The Nautical Almanac 2025

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The Nautical Almanac

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fair winds, clear skies & following seas
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Acknowledgment and Credits

Dr. Enno Rodegerdts

The Nautical Almanac *Daily Pages* and Sun Almanacs found on our site were originally created from PyAlmanac written by the great Norwegian sailor Enno Rodegerdts. PyAlmanac used PyEphem to generate the almanacs and LaTex provided the final formatting. Visit Dr. Rodegerdts site and learn of his voyages at https://sv-inua.net/

Without his work TheNauticalAlmanac.com wouldn't exist

Andrew Bauer

Mr. Bauer has taken the initial work of Dr. Rodegerdts and improved it to the excellence found in the following Daily Pages. Attending foremost to the accuracy of data and then formatting Mr. Bauer created SkyAlmanac which draws from Brandon Rhodes work *Ephem* and *Skyfield* and provides a clear arrangement of figures required for celestial navigation. He has also created the separate *Declination of the Sun and Planets* and *Local Mean Time of Meridian Passage* you'll find near the end of this almanac.

His work was determined, tireless and efficient. In our mutual writing across many lines of longitude he has always been pleasant, friendly and most affable.

As he has said, *"The art of celestial navigation should be promoted, not discouraged, even in the modern day".*

To both of these men we all owe a large debt of gratitude and thanks

Disclaimer and Warning

Prior to use verify the accuracy of The Nautical Almanac or data you download from our site. They SHOULD NOT and MUST NOT be relied upon for celestial navigation work of any sorts or any purpose whatsoever. You use them at your own risk or peril.

Errors & Corrections

Contact us if you find any significant errors and describe the correction that should be made.

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2025

January

wk	Su	M	Tu	W	Th	F	Sa
1				1	2	3	4
2	5	6	7	8	9	10	11
3	12	13	14	15	16	17	18
4	19	20	21	22	23	24	25
5	26	27	28	29	30	31	

February

wk	Su	M	Tu	W	Th	F	Sa
5							1
6	2	3	4	5	6	7	8
7	9	10	11	12	13	14	15
8	16	17	18	19	20	21	22
9	23	24	25	26	27	28	

March

wk	Su	M	Tu	W	Th	F	Sa
9							1
10	2	3	4	5	6	7	8
11	9	10	11	12	13	14	15
12	16	17	18	19	20	21	22
13	23	24	25	26	27	28	29
14	30	31					

April

wk	Su	M	Tu	W	Th	F	Sa
14			1	2	3	4	5
15	6	7	8	9	10	11	12
16	13	14	15	16	17	18	19
17	20	21	22	23	24	25	26
18	27	28	29	30			

May

wk	Su	M	Tu	W	Th	F	Sa
18					1	2	3
19	4	5	6	7	8	9	10
20	11	12	13	14	15	16	17
21	18	19	20	21	22	23	24
22	25	26	27	28	29	30	31

June

wk	Su	M	Tu	W	Th	F	Sa
23	1	2	3	4	5	6	7
24	8	9	10	11	12	13	14
25	15	16	17	18	19	20	21
26	22	23	24	25	26	27	28
27	29	30					

July

wk	Su	M	Tu	W	Th	F	Sa
27			1	2	3	4	5
28	6	7	8	9	10	11	12
29	13	14	15	16	17	18	19
30	20	21	22	23	24	25	26
31	27	28	29	30	31		

August

wk	Su	M	Tu	W	Th	F	Sa
31						1	2
32	3	4	5	6	7	8	9
33	10	11	12	13	14	15	16
34	17	18	19	20	21	22	23
35	24	25	26	27	28	29	30
36	31						

September

wk	Su	M	Tu	W	Th	F	Sa
36		1	2	3	4	5	6
37	7	8	9	10	11	12	13
38	14	15	16	17	18	19	20
39	21	22	23	24	25	26	27
40	28	29	30				

October

wk	Su	M	Tu	W	Th	F	Sa
40				1	2	3	4
41	5	6	7	8	9	10	11
42	12	13	14	15	16	17	18
43	19	20	21	22	23	24	25
44	26	27	28	29	30	31	

November

wk	Su	M	Tu	W	Th	F	Sa
44							1
45	2	3	4	5	6	7	8
46	9	10	11	12	13	14	15
47	16	17	18	19	20	21	22
48	23	24	25	26	27	28	29
49	30						

December

wk	Su	M	Tu	W	Th	F	Sa
49		1	2	3	4	5	6
50	7	8	9	10	11	12	13
51	14	15	16	17	18	19	20
52	21	22	23	24	25	26	27
1	28	29	30	31			

2025

Day of Week, Week Number, Day of Year, Remaining Days of Year

Day of Month	1 January			
	Day of Week	Day of Year	Days remaining	Week number
1	Wed	1	364	1
2	Thu	2	363	
3	Fri	3	362	
4	Sat	4	361	
5	Sun	5	360	2
6	Mon	6	359	
7	Tue	7	358	
8	Wed	8	357	
9	Thu	9	356	
10	Fri	10	355	
11	Sat	11	354	
12	Sun	12	353	3
13	Mon	13	352	
14	Tue	14	351	
15	Wed	15	350	
16	Thu	16	349	
17	Fri	17	348	
18	Sat	18	347	
19	Sun	19	346	4
20	Mon	20	345	
21	Tue	21	344	
22	Wed	22	343	
23	Thu	23	342	
24	Fri	24	341	
25	Sat	25	340	
26	Sun	26	339	5
27	Mon	27	338	
28	Tue	28	337	
29	Wed	29	336	
30	Thu	30	335	
31	Fri	31	334	

Day of Month	2 February			
	Day of Week	Day of Year	Days remaining	Week number
1	Sat	32	333	5
2	Sun	33	332	6
3	Mon	34	331	
4	Tue	35	330	
5	Wed	36	329	
6	Thu	37	328	
7	Fri	38	327	
8	Sat	39	326	
9	Sun	40	325	7
10	Mon	41	324	
11	Tue	42	323	
12	Wed	43	322	
13	Thu	44	321	
14	Fri	45	320	
15	Sat	46	319	
16	Sun	47	318	8
17	Mon	48	317	
18	Tue	49	316	
19	Wed	50	315	
20	Thu	51	314	
21	Fri	52	313	
22	Sat	53	312	
23	Sun	54	311	9
24	Mon	55	310	
25	Tue	56	309	
26	Wed	57	308	
27	Thu	58	307	
28	Fri	59	306	

Day of Month	3 March			
	Day of Week	Day of Year	Days remaining	Week number
1	Sat	60	305	9
2	Sun	61	304	10
3	Mon	62	303	
4	Tue	63	302	
5	Wed	64	301	
6	Thu	65	300	
7	Fri	66	299	
8	Sat	67	298	
9	Sun	68	297	11
10	Mon	69	296	
11	Tue	70	295	
12	Wed	71	294	
13	Thu	72	293	
14	Fri	73	292	
15	Sat	74	291	
16	Sun	75	290	12
17	Mon	76	289	
18	Tue	77	288	
19	Wed	78	287	
20	Thu	79	286	
21	Fri	80	285	
22	Sat	81	284	
23	Sun	82	283	13
24	Mon	83	282	
25	Tue	84	281	
26	Wed	85	280	
27	Thu	86	279	
28	Fri	87	278	
29	Sat	88	277	
30	Sun	89	276	14
31	Mon	90	275	

Day of Month	4 April			
	Day of Week	Day of Year	Days remaining	Week number
1	Tue	91	274	14
2	Wed	92	273	
3	Thu	93	272	
4	Fri	94	271	
5	Sat	95	270	
6	Sun	96	269	15
7	Mon	97	268	
8	Tue	98	267	
9	Wed	99	266	
10	Thu	100	265	
11	Fri	101	264	
12	Sat	102	263	
13	Sun	103	262	16
14	Mon	104	261	
15	Tue	105	260	
16	Wed	106	259	
17	Thu	107	258	
18	Fri	108	257	
19	Sat	109	256	
20	Sun	110	255	17
21	Mon	111	254	
22	Tue	112	253	
23	Wed	113	252	
24	Thu	114	251	
25	Fri	115	250	
26	Sat	116	249	
27	Sun	117	248	18
28	Mon	118	247	
29	Tue	119	246	
30	Wed	120	245	

Day of Month	5 May			
	Day of Week	Day of Year	Days remaining	Week number
1	Thu	121	244	18
2	Fri	122	243	
3	Sat	123	242	
4	Sun	124	241	19
5	Mon	125	240	
6	Tue	126	239	
7	Wed	127	238	
8	Thu	128	237	
9	Fri	129	236	
10	Sat	130	235	
11	Sun	131	234	20
12	Mon	132	233	
13	Tue	133	232	
14	Wed	134	231	
15	Thu	135	230	
16	Fri	136	229	
17	Sat	137	228	
18	Sun	138	227	21
19	Mon	139	226	
20	Tue	140	225	
21	Wed	141	224	
22	Thu	142	223	
23	Fri	143	222	
24	Sat	144	221	
25	Sun	145	220	22
26	Mon	146	219	
27	Tue	147	218	
28	Wed	148	217	
29	Thu	149	216	
30	Fri	150	215	
31	Sat	151	214	

Day of Month	6 June			
	Day of Week	Day of Year	Days remaining	Week number
1	Sun	152	213	23
2	Mon	153	212	
3	Tue	154	211	
4	Wed	155	210	
5	Thu	156	209	
6	Fri	157	208	
7	Sat	158	207	
8	Sun	159	206	24
9	Mon	160	205	
10	Tue	161	204	
11	Wed	162	203	
12	Thu	163	202	
13	Fri	164	201	
14	Sat	165	200	
15	Sun	166	199	25
16	Mon	167	198	
17	Tue	168	197	
18	Wed	169	196	
19	Thu	170	195	
20	Fri	171	194	
21	Sat	172	193	
22	Sun	173	192	26
23	Mon	174	191	
24	Tue	175	190	
25	Wed	176	189	
26	Thu	177	188	
27	Fri	178	187	
28	Sat	179	186	
29	Sun	180	185	27
30	Mon	181	184	

Day of Week, Week Number, Day of Year, Remaining Days of Year

Day of Month	7 July			
	Day of Week	Day of Year	Days remaining	Week number
1	Tue	182	183	27
2	Wed	183	182	
3	Thu	184	181	
4	Fri	185	180	
5	Sat	186	179	
6	Sun	187	178	28
7	Mon	188	177	
8	Tue	189	176	
9	Wed	190	175	
10	Thu	191	174	
11	Fri	192	173	
12	Sat	193	172	
13	Sun	194	171	29
14	Mon	195	170	
15	Tue	196	169	
16	Wed	197	168	
17	Thu	198	167	
18	Fri	199	166	
19	Sat	200	165	
20	Sun	201	164	30
21	Mon	202	163	
22	Tue	203	162	
23	Wed	204	161	
24	Thu	205	160	
25	Fri	206	159	
26	Sat	207	158	
27	Sun	208	157	31
28	Mon	209	156	
29	Tue	210	155	
30	Wed	211	154	
31	Thu	212	153	

Day of Month	8 August			
	Day of Week	Day of Year	Days remaining	Week number
1	Fri	213	152	31
2	Sat	214	151	
3	Sun	215	150	32
4	Mon	216	149	
5	Tue	217	148	
6	Wed	218	147	
7	Thu	219	146	
8	Fri	220	145	
9	Sat	221	144	
10	Sun	222	143	33
11	Mon	223	142	
12	Tue	224	141	
13	Wed	225	140	
14	Thu	226	139	
15	Fri	227	138	
16	Sat	228	137	
17	Sun	229	136	34
18	Mon	230	135	
19	Tue	231	134	
20	Wed	232	133	
21	Thu	233	132	
22	Fri	234	131	
23	Sat	235	130	
24	Sun	236	129	35
25	Mon	237	128	
26	Tue	238	127	
27	Wed	239	126	
28	Thu	240	125	
29	Fri	241	124	
30	Sat	242	123	
31	Sun	243	122	36

Day of Month	9 September			
	Day of Week	Day of Year	Days remaining	Week number
1	Mon	244	121	36
2	Tue	245	120	
3	Wed	246	119	
4	Thu	247	118	
5	Fri	248	117	
6	Sat	249	116	
7	Sun	250	115	37
8	Mon	251	114	
9	Tue	252	113	
10	Wed	253	112	
11	Thu	254	111	
12	Fri	255	110	
13	Sat	256	109	
14	Sun	257	108	38
15	Mon	258	107	
16	Tue	259	106	
17	Wed	260	105	
18	Thu	261	104	
19	Fri	262	103	
20	Sat	263	102	
21	Sun	264	101	39
22	Mon	265	100	
23	Tue	266	99	
24	Wed	267	98	
25	Thu	268	97	
26	Fri	269	96	
27	Sat	270	95	
28	Sun	271	94	40
29	Mon	272	93	
30	Tue	273	92	

Day of Month	10 October			
	Day of Week	Day of Year	Days remaining	Week number
1	Wed	274	91	40
2	Thu	275	90	
3	Fri	276	89	
4	Sat	277	88	
5	Sun	278	87	41
6	Mon	279	86	
7	Tue	280	85	
8	Wed	281	84	
9	Thu	282	83	
10	Fri	283	82	
11	Sat	284	81	
12	Sun	285	80	42
13	Mon	286	79	
14	Tue	287	78	
15	Wed	288	77	
16	Thu	289	76	
17	Fri	290	75	
18	Sat	291	74	
19	Sun	292	73	43
20	Mon	293	72	
21	Tue	294	71	
22	Wed	295	70	
23	Thu	296	69	
24	Fri	297	68	
25	Sat	298	67	
26	Sun	299	66	44
27	Mon	300	65	
28	Tue	301	64	
29	Wed	302	63	
30	Thu	303	62	
31	Fri	304	61	

Day of Month	11 November			
	Day of Week	Day of Year	Days remaining	Week number
1	Sat	305	60	44
2	Sun	306	59	45
3	Mon	307	58	
4	Tue	308	57	
5	Wed	309	56	
6	Thu	310	55	
7	Fri	311	54	
8	Sat	312	53	
9	Sun	313	52	46
10	Mon	314	51	
11	Tue	315	50	
12	Wed	316	49	
13	Thu	317	48	
14	Fri	318	47	
15	Sat	319	46	
16	Sun	320	45	47
17	Mon	321	44	
18	Tue	322	43	
19	Wed	323	42	
20	Thu	324	41	
21	Fri	325	40	
22	Sat	326	39	
23	Sun	327	38	48
24	Mon	328	37	
25	Tue	329	36	
26	Wed	330	35	
27	Thu	331	34	
28	Fri	332	33	
29	Sat	333	32	
30	Sun	334	31	49

Day of Month	12 December			
	Day of Week	Day of Year	Days remaining	Week number
1	Mon	335	30	49
2	Tue	336	29	
3	Wed	337	28	
4	Thu	338	27	
5	Fri	339	26	
6	Sat	340	25	
7	Sun	341	24	50
8	Mon	342	23	
9	Tue	343	22	
10	Wed	344	21	
11	Thu	345	20	
12	Fri	346	19	
13	Sat	347	18	
14	Sun	348	17	51
15	Mon	349	16	
16	Tue	350	15	
17	Wed	351	14	
18	Thu	352	13	
19	Fri	353	12	
20	Sat	354	11	
21	Sun	355	10	52
22	Mon	356	9	
23	Tue	357	8	
24	Wed	358	7	
25	Thu	359	6	
26	Fri	360	5	
27	Sat	361	4	
28	Sun	362	3	1
29	Mon	363	2	
30	Tue	364	1	
31	Wed	365	0	

Useful Information

Time Signals- by telephone

WWV 303-499-7111 **WWVH** 808-335-4363

CHU **English:** 613-745-1576 (CHU provides only Eastern time announcements)
French: 613-745-9426

Time signals- by Radio

WWV (Fort Collins, Colorado)	2.5, 5, 10, 15, 20 MHz (male voice)
WWVH (Kauai, Hawaii)	2.5, 5, 10, 15 MHz (female voice)
CHU (Ottawa, Canada)	3330, 7850, and 14,670 kHz (USB)

Bowditch *2024- The American Practical Navigator*

https://TheNauticalAlmanac.com/2024_Bowditch-_American_Practical_Navigator.html

Organized in a convenient and useful manner. Download the Chapters, Parts or Tables you want or the entire work.

Sight Reduction Tables

Pub. No. 249 Download individual Latitudes or Volumes

Epoch 2025 https://thenauticalalmanac.com/Pub_No_249_Epoch_2025.html

Epoch 2020 https://www.thenauticalalmanac.com/Pub_No_249_Epoch_2020.html

Pub. No. 229 Download individual Volumes covering a range of Latitudes

https://TheNauticalAlmanac.com/Pub_No_229.html

Sight Reduction Forms & Methods

https://www.TheNauticalAlmanac.com/Methods.html

Celestial Navigation

useful Formulas

About Calculators

The Casio *fx-300ES Plus* is an inexpensive calculator at about 11 USD. It features *natural input* so you enter a formula just as it would be written on paper. Entering degrees, minutes and seconds is very simple. The Casio *fx-300ES Plus* has 9 memory locations and you can review many of the previous entries you make using a special key on the calculator.

Determine Hc using a calculator

The formula

Hc = asin[sin(**Declination**)*sin(**Latitude**) + cos(**Latitude**)*cos(**Declination**)*cos(**LHA**)]

As it would be entered into the Casio calculator Note- Sin^{-1} is the arc-sin key

Sin^{-1}(Sin(**Ap Latitude**) x Sin(**Declination**) + Cos(**Ap Latitude)** x Cos(**Declination**) x Cos(**LHA**)

Declination is the declination of the Celestial body you're observing. When the heavenly body's declination is *Contrary name* to your Ap Latitude enter a negative sign before it.

Latitude "The AP latitude is chosen to be the nearest whole degree in latitude to the DR latitude." *from Bowditch 2019 Vol. 1 Chapter 19 section 1902 p. 310* Consider this to be where you are, think you are or where you would like to determine Hc for. Typically, you'll be using an *Assumed position Latitude* or *Ap Latitude* as it's called. *See Bowditch 2019 Vol. 1 Chapter 19 section 1902 p. 310*

About LHA determination

Assumed Position longitude (***a* λ**) "The AP longitude is that nearest the DR longitude resulting in a whole degree of LHA for the observed body." *From Bowditch 2019 Vol. 1 Chapter 19 section 1902 p. 310*

In Western Longitudes *see Bowditch 2019 Vol. 1 Chapter 19 section 1905 p. 313*

LHA is the Local Hour Angle derived by subtracting your Assumed Longitude (***a* λ**) whole degree value from the whole degree ***GHA*** (Greenwich Hour Angle) value. If GHA is less than the ***a* λ** than the add 360° to it then subtract the ***a* λ.** *Ignore the arc minutes* of GHA and ***a* λ.**

Example when GHA is less than ***a* λ** **GHA**= 43° 25.2' ***a* λ**= W 55° 15.1'

360° + 43° = 403° Then....403° – 55° = 348° (LHA)

In Eastern Longitudes *see Bowditch 2019 Vol. 1 Chapter 19 section 1905 p. 313*

LHA**, in **Eastern Longitudes, is determined by adding the entire GHA figure (degrees and minutes) to the whole degree figure of the Assumed longitude (***a* λ**) *plus* the amount of arc minutes required to get to the next degree of the GHA. If the resulting LHA figure is greater than 360° then subtract 360° from the figure to obtain the LHA.

Example- **GHA**= 58° 01.2' ***a* λ**= E 9° 10.1' (ignore the 10.1')

Step 1- *get GHA degree difference;* 59° - 58° 01.2' = 0° 58.8'

Step 2- add *a* λ degrees to *difference* found in step 1; 9° + 0°58.8' = 9° 58.8' *a* λ

Step 3- *get LHA;* 58° 01.2 + 9° 58.8' = 68° (LHA)

Why would you want to determine Hc using a calculator?

It's faster than looking up in Pub. No. 249 and Pub. No. 229, highly accurate and you don't need a lot of printed out pages of Latitudes from Pub. No. 249 and Pub. No. 229. Pub. No. 249 Vol. 2 & 3 don't cover any declination greater than 29 degrees so you'd have to use Pub. No. 229 which is extremely large.

Celestial Navigation

Determine Z

Z = acos[(sin(**Declination**) – sin(**Ap Latitude)** x sin(**Hc**)) ÷ (cos(**Ap Latitude**) x cos(**Hc**))]

As it would be entered into the Casio calculator... Note- Cos^{-1} is the arc-cosine key

Cos^{-1}((Sin(**Declination**) – Sin(**AP Latitude**) x Sin(**Hc**)) ÷ (Cos(**AP Latitude**) x Cos(**Hc**)

If the heavenly body's declination is *Contrary name* to the Ap Latitude enter a negative sign before it.

To obtain Zn see the rules below for Northern and Southern latitudes.

Determine Z independent of Hc

$$Z = \tan^{-1}\left(\frac{\sin \mathrm{LHA}}{(\cos \mathrm{L} \tan \mathrm{d}) - (\sin \mathrm{L} \cos \mathrm{LHA})}\right)$$

"L" is latitude and "*d"* is declination. When the heavenly body's declination is *Contrary name* to your Ap Latitude enter a negative sign before it.

As it would be entered into the Casio calculator... Note- $\tan^{-1}$ is the arc-tangent key

Z = $\tan^{-1}$ ((sin (**LHA**) ÷ (cos(**AP latitude**) x tan(**declination**) – (sin(**AP latitude**) x cos(**LHA**))

The sign convention used in the calculation of this azimuth formula is as follows:
from *Bowditch Chapter 22 CALCULATIONS AND CONVERSIONS, page 331*

1) If latitude and declination are of contrary name, declination is treated as a negative quantity;
2) If the local hour angle is greater than 180°, it is treated as a negative quantity. If the azimuth angle as calculated is negative, add 180° to obtain the desired value.

To obtain Zn apply the following rules

In Northern Latitudes	**In Southern Latitudes**
LHA greater than 180°....Zn=Z	LHA greater than 180°....Zn= 180° – Z
LHA less than 180°.....Zn=360° – Z	LHA less than 180°.....Zn= 180° + Z

Determine Refraction 0.96 ÷ Tan of (Ha)
Gives good results down to about 8° from the horizon but not less.

Refraction (good overall formula from 90° to below 8° from the horizon)

$$R_0 = \cot\left(H_a + \frac{7.31}{H_a + 4.4}\right)$$

As it would be entered into the Casio calculator...

1 ÷ Tan((Ha + (7.31 ÷ (Ha + 4.4))

Both refraction formulas use the standard pressure and temperature of;

1010 mb 10° C
29.83 in 53° F

Determine Dip using feet 0.97 x (Square Root of *He* (Height of Eye) in feet)

Determine Dip using meters 1.76 x (Square Root of *He* (Height of eye) in meters)

Rules to Calculate Latitude using the Sun- *Noon-Sight*

1- Latitude and declination *Same name* but latitude is greater than declination:

Latitude= (90° – Ho) + declination

2- Latitude and declination *Same name* but declination greater than latitude:

Latitude= Declination – (90° – Ho)

3- Latitude and declination *Contrary name*:

Latitude= (90° – Ho) – Declination

To get AP longitude (needed for plotting the LOP)

In Western longitudes

Combine the DR Longitude figure with only the minutes (of arc) of the total GHA figure. The Ap λ figure will be used when plotting the LOP on the UPS.

In Eastern longitudes

In Eastern longitudes the Ap λ is determined as follows;

DR longitude + (0°60' *minus* GHA minutes of arc)

Example- E 075° + (0°60' – 0° 02')= 75° 58' Ap longitude

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Formula Sheet added to NA.odt

Explanation of The Nautical Almanac *Daily Pages*

1	Date and Time based on GMT/UT
2	**Mer. pass**- meridian passage of Aries at the Prime Meridian- Greenwich- 0°. Time figure is GMT/UT.
3	Planet or Moon GHA **v** value and planet or Moon declination **d** value. **v**- "The change in hour angle arising from v of the body at the time of the sight observation is accounted for with the *v correction*." *Source- Bowditch 2017, Chapter 19- Sight Reduction p. 313.* The planet's **v** is positive unless preceeded by a minus sign which is sometimes the case with Venus. The sign of the Moon's **v** is positive. **d**- "The change in declination of the body at the time of the sight observation is accounted for with the *d correction*." *Source- Bowditch 2017, Chapter 19- Sight Reduction p. 313.* The sign of the Moon or planet's **d** correction is determined by the declination trend- positive if successive declination values increase and negative if they decrease. Corrections for both **v** and **d** are found in the Increments and Corrections pages of The Nautical Almanac. To find the correction for either **v** or **d** enter the Increments and Corrections pages for the minutes in time of the observation and find the value in the **v and d corr.** columns Find the **v**, or **d**, value in the left side of one of the three columns. To the right of that value is the **v**, or **d**, correction. Be sure to add or subtract the values depending upon the *sign* of the value as mentioned above.
	Example for v & d correction- June 10, 2020 GMT- 21:19:10 Body- Moon
	GHA= 247° 20.6' ***v =*** 12.1' GHA increment 4° 34.4' ***v-*** correction for 12.1' + 0° 03.9' GHA= 251° 58.9'
	Dec= S 17° 43.8' **d**= 8.9' **d-** correction for 8.9' – 0° 02.9' dec= S 17° 40.9' *declination trend is decreasing so the sign of d correction is negative*
4	**m**- is the *magnitude* or brightness of the planet. A bright planet will have a *minus* sign beside the figure. A fainter planet will have no sign beside its magnitude figure.
5	**Stars**- **SHA**, *Sidereal Hour Angle*, and **Declination**. 59 stars are listed. Typically, only 57 stars are used for navigational purposes in both Northern and Southern Hemispheres. Here you'll also find Polaris and Scheat. In the Northern Hemisphere Polaris is often used for determination of latitude.
6	**Mer. pass**- planet meridian passage time at the Prime Meridian- Greenwich- 0°. Time figure is GMT/UT.
7	**SHA**- planet SHA. Planet SHA is calculated by subtracting Aries GHA from planet GHA. If planet GHA figure is less than Aries GHA, add 360° to planet GHA and then subtract Aries GHA.
8	**Horizontal parallax**- for Venus and Mars. Horizontal parallax is the angle subtended by half the Earth's diameter as viewed from the planet in minutes of arc.
9	**SD**- Semi-diameter of the Sun in minutes of arc. One half of the angular width of the Sun as observed on earth.
10	**d**- the daily average change, per hour, in the Sun's declination in minutes of arc.

11	**SD**- Semi-diameter of the Moon in minutes of arc. Semi-diameter is one half of the angular width of the Moon, as observed on earth.
12	**HP**- the angle between two lines, one from the center of the Moon to the center of the Earth, the other from the center of the Moon to the edge of the Earth. This angle is about 56', but it changes slightly from day to day as the distance to the Moon changes along its elliptical path around the Earth. *Source- starpath.com*
13	**Sun- Eqn. of Time**- Basically the Equation of Time (EoT) is the difference between clock time and time seen on a sundial. This is comparing "clock time", as a mechanical measurement of time, and the sundial being time determined by the position of the Sun at any given moment. The figures listed are for 00^h and 12^h. Using the EoT you can get fairly accurate determination of when Meridian Passage (Local Apparent Noon) occurs at your position. Unshaded EoT values are subtracted from 12:00 to get Meridian Passage. Shaded EoT values are added to 12:00 to get Meridian Passage. An Equation of Time chart (as a curve) is provided in each almanac on TheNauticalAlmanac.com **Example**- Meridian Passage on May 30, 2020 equals 12:00 – EoT of 2 minutes 21 seconds MP= 11:57:39 *Local Apparent Noon* **Example**- Meridian Passage on August 25, 2020 equals 12:00 + EoT of 1 minute 59 seconds MP= 12:01:59 *Local Apparent Noon*
14	**Sun- Mer. Pass** just to the right of the **Eqn. of Time** is the approximate GMT/UT when the Sun crosses The Prime Meridian (at Greenwich) for that specific date.
15	**Moon- Mer. Pass**- is the approximate GMT/UT when the Moon crosses The Prime Meridian (at Greenwich) or the 180° line of longitude. **Upper** means the GMT/UT when the Moon crosses The Prime Meridian (Greenwich). **Lower** means the GMT/UT when the Moon crosses the 180° line of longitude.
16	**Moon- Age**- this is the number of days past a new Moon. Typically, there are 29 days in a lunar month. Moon- %- the amount of the Moon's illumination. 100% would be a full moon. 49% would be about ½ of the Moon is illuminated. A 3 day range percentage is provided but only one graphic for the phase.
17* see notes at bottom	**(morning) Twilight- Naut.**- the approximate GMT/UT when morning Nautical Twilight begins. Nautical twilight is the time when the center of the sun is 12° below the horizon and the horizon is visible enough to be used for marine sextant observations. First locate your approximate Latitude in the **Lat**. column and then follow across horizontally to the right to find the time.
17* see notes at bottom	**(morning) Twilight- Civil-** the approximate GMT/UT of morning civil twilight starts when the geometric center of the sun is 6° below the horizon. First locate your approximate Latitude in the **Lat**. column and then follow across horizontally to the right to find the time.
17* *see* notes *at bottom*	**Sunrise**- the approximate GMT/UT when the Sun is 0° 50' (semi-diameter plus refraction) below the horizon. First locate your approximate Latitude in the Lat. column and then follow across horizontally to the right to find the time.

17* see notes at bottom	**Sunset**- the approximate GMT/UT when the Sun is 0° 50' (semi-diameter plus refraction) below the horizon. First locate your approximate Latitude in the Lat. column and then follow across horizontally to the right to find the time.
17* see notes at bottom	**(evening) Twilight- Civil-** the approximate GMT/UT of evening civil twilight that ends when the geometric center of the sun is 6° below the horizon. First locate your approximate Latitude in the **Lat**. column and then follow across horizontally to the right to find the time.
17* see notes at bottom	**(evening) Twilight- Naut.**- the approximate GMT/UT of when evening Nautical Twilight ends. Nautical twilight is the time when the center of the sun is 12° below the horizon and the horizon is no longer visible enough to be used for sextant observations. First locate your approximate Latitude in the Lat. column and then follow across horizontally to the right to find the time.
18* see notes at bottom	**Moonrise**- the approximate GMT/UT when the Moon is about 0° 05' to 0° 10' below the horizon. First locate your approximate Latitude in the Lat. column and then follow across horizontally to the right to find the time under the specific day.
18* see notes at bottom	**Moonset**- the approximate GMT/UT when the Moon is about 0° 05' to 0° 10' below the horizon. First locate your approximate Latitude in the Lat. column and then follow across horizontally to the right to find the time under the specific day.

* Note-

▭ means the Sun or Moon remains continuously above the horizon on that day.

–:– can also mean twilight lasts all night

▬ means the Sun or Moon remains continuously below the horizon on that day.

–:– means Moon does not rise or set on that day but may have risen or set the previous day or following day.

* **Note**- Time of Sunrise, Sunset, Moonrise, Moonset and twilight is based on GMT/UT of the event at 0° (Greenwich) and can be condsidered as approximate LMT (Local Mean Time) with a tolerance of +/- 30 minutes depending on where you are within a time zone.

January 01, 02 ,03 (Fri., Sat., Sun.)

	Aries	Venus		Mars		Jupiter		Saturn	
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	100°32.5	181°58.1	S23°38.5	318°04.0	N18°45.1	131°37.2	S13°36.5	275°29.9	N00°18.5
1	115°35.0	196°57.1	38.4	333°06.8	45.4	146°39.2	36.4	290°32.3	18.5
2	130°37.4	211°56.1	38.3	348°09.6	45.6	161°41.2	36.2	305°34.7	18.5
3	145°39.9	226°55.1	·· 38.2	3°12.4	·· 45.8	176°43.2	·· 36.0	320°37.1	·· 18.5
4	160°42.4	241°54.2	38.1	18°15.2	46.0	191°45.1	35.8	335°39.5	18.5
5	175°44.8	256°53.2	38.0	33°18.1	46.2	206°47.1	35.7	350°41.9	18.5
6	190°47.3	271°52.2	S23°37.9	48°20.9	N18°46.5	221°49.1	S13°35.5	5°44.3	N00°18.5
7	205°49.8	286°51.3	37.8	63°23.7	46.7	236°51.1	35.3	20°46.7	18.5
8	220°52.2	301°50.3	37.7	78°26.5	46.9	251°53.0	35.1	35°49.2	18.5
9	235°54.7	316°49.3	·· 37.6	93°29.4	·· 47.1	266°55.0	·· 35.0	50°51.6	·· 18.4
10	250°57.2	331°48.4	37.5	108°32.2	47.3	281°57.0	34.8	65°54.0	18.4
11	265°59.6	346°47.4	37.4	123°35.0	47.6	296°59.0	34.6	80°56.4	18.4
12	281°02.1	1°46.4	S23°37.3	138°37.9	N18°47.8	312°00.9	S13°34.4	95°58.8	N00°18.4
13	296°04.5	16°45.5	37.2	153°40.7	48.0	327°02.9	34.3	111°01.2	18.4
14	311°07.0	31°44.5	37.1	168°43.5	48.2	342°04.9	34.1	126°03.6	18.4
15	326°09.5	46°43.5	·· 37.0	183°46.4	·· 48.5	357°06.8	·· 33.9	141°06.0	·· 18.4
16	341°11.9	61°42.6	36.9	198°49.2	48.7	12°08.8	33.7	156°08.4	18.4
17	356°14.4	76°41.6	36.8	213°52.0	48.9	27°10.8	33.6	171°10.8	18.4
18	11°16.9	91°40.6	S23°36.7	228°54.9	N18°49.1	42°12.8	S13°33.4	186°13.2	N00°18.3
19	26°19.3	106°39.6	36.5	243°57.7	49.4	57°14.7	33.2	201°15.7	18.3
20	41°21.8	121°38.7	36.4	259°00.6	49.6	72°16.7	33.0	216°18.1	18.3
21	56°24.3	136°37.7	·· 36.3	274°03.4	·· 49.8	87°18.7	·· 32.9	231°20.5	·· 18.3
22	71°26.7	151°36.7	36.2	289°06.3	50.0	102°20.7	32.7	246°22.9	18.3
23	86°29.2	166°35.8	36.1	304°09.1	50.3	117°22.6	32.5	261°25.3	18.3
Mer.pass.:17:14		v-1.0 d0.1 m-3.8		v2.8 d0.2 m-0.7		v2.0 d0.2 m-2.0		v2.4 d-0.0 m0.9	

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	101°31.7	181°34.8	S23°36.0	319°12.0	N18°50.5	132°24.6	S13°32.3	276°27.7	N00°18.3
1	116°34.1	196°33.8	35.8	334°14.8	50.7	147°26.6	32.2	291°30.1	18.3
2	131°36.6	211°32.9	35.7	349°17.7	51.0	162°28.6	32.0	306°32.5	18.3
3	146°39.0	226°31.9	·· 35.6	4°20.5	·· 51.2	177°30.5	·· 31.8	321°34.9	·· 18.3
4	161°41.5	241°30.9	35.5	19°23.4	51.4	192°32.5	31.6	336°37.3	18.2
5	176°44.0	256°30.0	35.3	34°26.2	51.6	207°34.5	31.5	351°39.8	18.2
6	191°46.4	271°29.0	S23°35.2	49°29.1	N18°51.9	222°36.4	S13°31.3	6°42.2	N00°18.2
7	206°48.9	286°28.0	35.1	64°31.9	52.1	237°38.4	31.1	21°44.6	18.2
8	221°51.4	301°27.1	34.9	79°34.8	52.3	252°40.4	30.9	36°47.0	18.2
9	236°53.8	316°26.1	·· 34.8	94°37.7	·· 52.6	267°42.4	·· 30.8	51°49.4	·· 18.2
10	251°56.3	331°25.1	34.7	109°40.5	52.8	282°44.3	30.6	66°51.8	18.2
11	266°58.8	346°24.2	34.5	124°43.4	53.0	297°46.3	30.4	81°54.2	18.2
12	282°01.2	1°23.2	S23°34.4	139°46.3	N18°53.3	312°48.3	S13°30.2	96°56.6	N00°18.2
13	297°03.7	16°22.2	34.3	154°49.1	53.5	327°50.2	30.1	111°59.1	18.2
14	312°06.1	31°21.3	34.1	169°52.0	53.7	342°52.2	29.9	127°01.5	18.2
15	327°08.6	46°20.3	·· 34.0	184°54.9	·· 54.0	357°54.2	·· 29.7	142°03.9	·· 18.1
16	342°11.1	61°19.3	33.8	199°57.7	54.2	12°56.2	29.5	157°06.3	18.1
17	357°13.5	76°18.4	33.7	215°00.6	54.4	27°58.1	29.3	172°08.7	18.1
18	12°16.0	91°17.4	S23°33.6	230°03.5	N18°54.7	43°00.1	S13°29.2	187°11.1	N00°18.1
19	27°18.5	106°16.5	33.4	245°06.4	54.9	58°02.1	29.0	202°13.5	18.1
20	42°20.9	121°15.5	33.3	260°09.3	55.1	73°04.0	28.8	217°16.0	18.1
21	57°23.4	136°14.5	·· 33.1	275°12.1	·· 55.4	88°06.0	·· 28.6	232°18.4	·· 18.1
22	72°25.9	151°13.6	33.0	290°15.0	55.6	103°08.0	28.5	247°20.8	18.1
23	87°28.3	166°12.6	32.8	305°17.9	55.9	118°09.9	28.3	262°23.2	18.1
Mer.pass.:17:11		v-1.0 d0.1 m-3.8		v2.9 d0.2 m-0.8		v2.0 d0.2 m-1.9		v2.4 d-0.0 m0.9	

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	102°30.8	181°11.6	S23°32.7	320°20.8	N18°56.1	133°11.9	S13°28.1	277°25.6	N00°18.1
1	117°33.3	196°10.7	32.5	335°23.7	56.3	148°13.9	27.9	292°28.0	18.1
2	132°35.7	211°09.7	32.4	350°26.6	56.6	163°15.9	27.8	307°30.4	18.1
3	147°38.2	226°08.7	·· 32.2	5°29.4	·· 56.8	178°17.8	·· 27.6	322°32.9	·· 18.0
4	162°40.6	241°07.8	32.0	20°32.3	57.0	193°19.8	27.4	337°35.3	18.0
5	177°43.1	256°06.8	31.9	35°35.2	57.3	208°21.8	27.2	352°37.7	18.0
6	192°45.6	271°05.8	S23°31.7	50°38.1	N18°57.5	223°23.7	S13°27.0	7°40.1	N00°18.0
7	207°48.0	286°04.9	31.6	65°41.0	57.8	238°25.7	26.9	22°42.5	18.0
8	222°50.5	301°03.9	31.4	80°43.9	58.0	253°27.7	26.7	37°44.9	18.0
9	237°53.0	316°03.0	·· 31.2	95°46.8	·· 58.2	268°29.6	·· 26.5	52°47.4	·· 18.0
10	252°55.4	331°02.0	31.1	110°49.7	58.5	283°31.6	26.3	67°49.8	18.0
11	267°57.9	346°01.0	30.9	125°52.6	58.7	298°33.6	26.2	82°52.2	18.0
12	283°00.4	1°00.1	S23°30.7	140°55.5	N18°59.0	313°35.5	S13°26.0	97°54.6	N00°18.0
13	298°02.8	15°59.1	30.6	155°58.4	59.2	328°37.5	25.8	112°57.0	18.0
14	313°05.3	30°58.1	30.4	171°01.3	59.5	343°39.5	25.6	127°59.4	18.0
15	328°07.8	45°57.2	·· 30.2	186°04.2	·· 59.7	358°41.4	·· 25.4	143°01.9	·· 18.0
16	343°10.2	60°56.2	30.1	201°07.1	18°59.9	13°43.4	25.3	158°04.3	17.9
17	358°12.7	75°55.3	29.9	216°10.0	19°00.2	28°45.4	25.1	173°06.7	17.9
18	13°15.1	90°54.3	S23°29.7	231°13.0	N19°00.4	43°47.3	S13°24.9	188°09.1	N00°17.9
19	28°17.6	105°53.3	29.5	246°15.9	00.7	58°49.3	24.7	203°11.5	17.9
20	43°20.1	120°52.4	29.4	261°18.8	00.9	73°51.3	24.6	218°13.9	17.9
21	58°22.5	135°51.4	·· 29.2	276°21.7	·· 01.2	88°53.3	·· 24.4	233°16.4	·· 17.9
22	73°25.0	150°50.4	29.0	291°24.6	01.4	103°55.2	24.2	248°18.8	17.9
23	88°27.5	165°49.5	28.8	306°27.5	01.7	118°57.2	24.0	263°21.2	17.9
Mer.pass.:17:07		v-1.0 d0.2 m-3.8		v2.9 d0.2 m-0.8		v2.0 d0.2 m-1.9		v2.4 d-0.0 m0.9	

Stars	SHA	Dec
Alpheratz	357°46.2	29°09.0
Ankaa	353°18.1	-42°15.2
Schedar	349°43.6	56°35.9
Diphda	348°58.3	-17°55.9
Achernar	335°28.3	-57°11.3
Hamal	328°03.5	23°30.8
Polaris	318°47.1	89°18.8
Akamar	315°19.9	-40°16.0
Menkar	314°17.5	4°07.8
Mirfak	308°43.7	49°54.0
Aldebaran	290°52.0	16°31.9
Rigel	281°14.1	-8°11.4
Capella	280°37.8	46°00.6
Bellatrix	278°34.4	6°21.5
Elnath	278°15.5	28°37.0
Alnilam	275°48.6	-1°11.7
Betelgeuse	271°03.7	7°24.5
Canopus	263°56.7	-52°42.1
Sirius	258°35.5	-16°43.6
Adara	255°14.1	-28°59.2
Procyon	245°01.9	5°12.0
Pollux	243°30.3	28°00.0
Avior	234°18.6	-59°32.4
Suhail	222°54.0	-43°28.3
Miaplacidus	221°39.7	-69°45.4
Alphard	217°58.3	-8°42.2
Regulus	207°45.9	11°54.9
Dubhe	193°54.2	61°41.4
Denebola	182°36.0	14°30.8
Gienah	175°54.9	-17°35.9
Acrux	173°12.3	-63°09.1
Gacrux	172°03.9	-57°10.0
Alioth	166°22.8	55°53.9
Spica	158°34.0	-11°12.9
Alcaid	153°00.9	49°15.4
Hadar	148°51.9	-60°25.1
Menkent	148°10.8	-36°25.1
Arcturus	145°58.0	19°07.9
Rigil Kent.	139°55.6	-60°52.4
Zubenelg.	137°08.4	-16°05.0
Kochab	137°20.2	74°06.5
Alphecca	126°13.4	26°40.7
Antares	112°29.7	-26°27.2
Atria	107°34.4	-69°02.6
Sabik	102°15.8	-15°44.3
Shaula	96°25.8	-37°06.6
Rasalhague	96°09.1	12°33.1
Eltanin	90°47.8	51°29.2
Kaus Aust.	83°47.5	-34°22.8
Vega	80°41.1	38°47.5
Nunki	76°01.8	-26°17.1
Altair	62°11.1	8°53.7
Peacock	53°23.6	-56°42.2
Deneb	49°33.7	45°19.1
Enif	33°49.9	9°55.4
Alnair	27°47.1	-46°54.8
Fomalhaut	15°26.9	-29°34.2
Scheat	13°56.1	28°08.4
Markab	13°41.0	15°15.7

Jan 01 Fri	SHA	Mer.pass
Venus	81°25.5	11:53
Mars	217°31.4	02:47
Jupiter	31°04.7	15:12
Saturn	174°57.4	05:37

Jan 02 Sat	SHA	Mer.pass
Venus	80°03.2	11:54
Mars	217°40.3	02:43
Jupiter	30°53.0	15:08
Saturn	174°56.1	05:33

Jan 03 Sun	SHA	Mer.pass
Venus	78°40.8	11:56
Mars	217°50.0	02:38
Jupiter	30°41.1	15:05
Saturn	174°54.8	05:29

Horizontal parallax	
Venus:	0.1
Mars:	0.2

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file date- June 16 2020

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2020 January 01 to Jan. 03

h	Sun		Moon				
Wed	GHA	Dec	GHA	v	Dec	d	HP
0	179° 13.7	S23° 03.5	110° 56.9	15.3′	S09° 58.5	10.7′	54.3′
1	194° 13.4	03.3	125° 31.3	15.4′	09° 47.8	10.7′	54.3′
2	209° 13.1	03.1	140° 05.7	15.4′	09° 37.1	10.7′	54.3′
3	224° 12.8	·· 03.0	154° 40.1	15.5′	09° 26.3	10.8′	54.3′
4	239° 12.5	02.8	169° 14.6	15.5′	09° 15.5	10.8′	54.3′
5	254° 12.2	02.6	183° 49.1	15.5′	09° 04.7	10.8′	54.2′
6	269° 11.9	S23° 02.4	198° 23.6	15.6′	S08° 53.8	10.9′	54.2′
7	284° 11.6	02.2	212° 58.2	15.6′	08° 42.9	10.9′	54.2′
8	299° 11.3	02.0	227° 32.8	15.6′	08° 32.0	10.9′	54.2′
9	314° 11.0	·· 01.8	242° 07.5	15.7′	08° 21.0	11.0′	54.2′
10	329° 10.7	01.6	256° 42.2	15.7′	08° 10.0	11.0′	54.2′
11	344° 10.4	01.4	271° 16.9	15.7′	07° 59.0	11.0′	54.2′
12	359° 10.1	S23° 01.2	285° 51.7	15.8′	S07° 48.0	11.1′	54.2′
13	14° 09.8	01.0	300° 26.4	15.8′	07° 36.9	11.1′	54.2′
14	29° 09.5	00.8	315° 01.2	15.8′	07° 25.8	11.1′	54.2′
15	44° 09.2	·· 00.6	329° 36.1	15.9′	07° 14.7	11.1′	54.2′
16	59° 08.9	00.4	344° 10.9	15.9′	07° 03.5	11.2′	54.2′
17	74° 08.6	00.2	358° 45.8	15.9′	06° 52.3	11.2′	54.2′
18	89° 08.3	S23° 00.0	13° 20.7	15.9′	S06° 41.1	11.2′	54.2′
19	104° 08.0	22° 59.7	27° 55.7	16.0′	06° 29.9	11.2′	54.2′
20	119° 07.7	59.5	42° 30.7	16.0′	06° 18.7	11.3′	54.2′
21	134° 07.5	·· 59.3	57° 05.6	16.0′	06° 07.4	11.3′	54.2′
22	149° 07.2	59.1	71° 40.6	16.0′	05° 56.1	11.3′	54.2′
23	164° 06.9	58.9	86° 15.7	16.0′	05° 44.8	11.3′	54.2′
	SD.=16.3	d=0.2	S.D.=14.8				

Thu	GHA	Dec	GHA	v	Dec	d	HP
0	179° 06.6	S22° 58.7	100° 50.7	16.1′	S05° 33.4	11.3′	54.2′
1	194° 06.3	58.5	115° 25.8	16.1′	05° 22.1	11.4′	54.2′
2	209° 06.0	58.3	130° 00.9	16.1′	05° 10.7	11.4′	54.2′
3	224° 05.7	·· 58.1	144° 36.0	16.1′	04° 59.3	11.4′	54.2′
4	239° 05.4	57.9	159° 11.1	16.1′	04° 47.9	11.4′	54.2′
5	254° 05.1	57.6	173° 46.3	16.1′	04° 36.5	11.4′	54.2′
6	269° 04.8	S22° 57.4	188° 21.4	16.2′	S04° 25.0	11.5′	54.2′
7	284° 04.5	57.2	202° 56.6	16.2′	04° 13.5	11.5′	54.2′
8	299° 04.2	57.0	217° 31.7	16.2′	04° 02.1	11.5′	54.2′
9	314° 03.9	·· 56.8	232° 06.9	16.2′	03° 50.6	11.5′	54.2′
10	329° 03.6	56.6	246° 42.1	16.2′	03° 39.0	11.5′	54.2′
11	344° 03.3	56.3	261° 17.3	16.2′	03° 27.5	11.5′	54.2′
12	359° 03.0	S22° 56.1	275° 52.6	16.2′	S03° 16.0	11.5′	54.2′
13	14° 02.8	55.9	290° 27.8	16.2′	03° 04.4	11.6′	54.2′
14	29° 02.5	55.7	305° 03.0	16.2′	02° 52.8	11.6′	54.2′
15	44° 02.2	·· 55.5	319° 38.3	16.2′	02° 41.3	11.6′	54.2′
16	59° 01.9	55.2	334° 13.5	16.2′	02° 29.7	11.6′	54.2′
17	74° 01.6	55.0	348° 48.8	16.3′	02° 18.1	11.6′	54.2′
18	89° 01.3	S22° 54.8	3° 24.0	16.3′	S02° 06.5	11.6′	54.2′
19	104° 01.0	54.6	17° 59.3	16.3′	01° 54.8	11.6′	54.2′
20	119° 00.7	54.3	32° 34.5	16.3′	01° 43.2	11.6′	54.2′
21	134° 00.4	·· 54.1	47° 09.8	16.3′	01° 31.6	11.6′	54.2′
22	149° 00.1	53.9	61° 45.0	16.3′	01° 19.9	11.7′	54.2′
23	163° 59.8	53.7	76° 20.3	16.3′	01° 08.2	11.7′	54.3′
	SD.=16.3	d=0.2	S.D.=14.8				

Fri	GHA	Dec	GHA	v	Dec	d	HP
0	178° 59.5	S22° 53.4	90° 55.5	16.2′	S00° 56.6	11.7′	54.3′
1	193° 59.3	53.2	105° 30.8	16.2′	00° 44.9	11.7′	54.3′
2	208° 59.0	53.0	120° 06.0	16.2′	00° 33.2	11.7′	54.3′
3	223° 58.7	·· 52.7	134° 41.3	16.2′	00° 21.5	11.7′	54.3′
4	238° 58.4	52.5	149° 16.5	16.2′	S00° 09.9	11.7′	54.3′
5	253° 58.1	52.3	163° 51.7	16.2′	N00° 01.8	11.7′	54.3′
6	268° 57.8	S22° 52.0	178° 26.9	16.2′	N00° 13.5	11.7′	54.3′
7	283° 57.5	51.8	193° 02.1	16.2′	00° 25.2	11.7′	54.3′
8	298° 57.2	51.6	207° 37.3	16.2′	00° 36.9	11.7′	54.3′
9	313° 56.9	·· 51.3	222° 12.5	16.2′	00° 48.6	11.7′	54.3′
10	328° 56.6	51.1	236° 47.7	16.2′	01° 00.3	11.7′	54.3′
11	343° 56.4	50.8	251° 22.8	16.1′	01° 12.0	11.7′	54.4′
12	358° 56.1	S22° 50.6	265° 58.0	16.1′	N01° 23.7	11.7′	54.4′
13	13° 55.8	50.4	280° 33.1	16.1′	01° 35.4	11.7′	54.4′
14	28° 55.5	50.1	295° 08.2	16.1′	01° 47.1	11.7′	54.4′
15	43° 55.2	·· 49.9	309° 43.3	16.1′	01° 58.8	11.7′	54.4′
16	58° 54.9	49.6	324° 18.4	16.1′	02° 10.5	11.7′	54.4′
17	73° 54.6	49.4	338° 53.4	16.0′	02° 22.2	11.7′	54.4′
18	88° 54.3	S22° 49.2	353° 28.4	16.0′	N02° 33.9	11.7′	54.4′
19	103° 54.0	48.9	8° 03.5	16.0′	02° 45.6	11.7′	54.4′
20	118° 53.8	48.7	22° 38.4	16.0′	02° 57.3	11.7′	54.5′
21	133° 53.5	·· 48.4	37° 13.4	16.0′	03° 09.0	11.7′	54.5′
22	148° 53.2	48.2	51° 48.4	15.9′	03° 20.6	11.7′	54.5′
23	163° 52.9	47.9	66° 23.3	15.9′	03° 32.3	11.7′	54.5′
	SD.=16.3	d=0.2	S.D.=14.8				

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	08:23	10:41	▬	▬	13:27	15:45
N 70°	08:05	09:49	▬	▬	14:19	16:03
68°	07:50	09:16	▬	▬	14:52	16:18
66°	07:37	08:53	10:27	13:41	15:15	16:31
64°	07:26	08:34	09:49	14:19	15:34	16:41
62°	07:17	08:18	09:23	14:45	15:49	16:51
60°	07:09	08:05	09:02	15:06	16:02	16:59
N 58°	07:02	07:54	08:45	15:23	16:14	17:06
56°	06:56	07:44	08:31	15:37	16:24	17:12
54°	06:50	07:35	08:19	15:49	16:32	17:18
52°	06:44	07:28	08:08	16:00	16:40	17:24
50°	06:39	07:20	07:58	16:09	16:47	17:29
45°	06:28	07:05	07:38	16:29	17:03	17:40
N 40°	06:18	06:52	07:22	16:46	17:16	17:50
35°	06:08	06:40	07:08	17:00	17:28	17:59
30°	06:00	06:30	06:56	17:12	17:38	18:08
20°	05:44	06:11	06:35	17:32	17:56	18:24
N 10°	05:28	05:54	06:17	17:50	18:13	18:40
0°	05:11	05:38	06:00	18:08	18:30	18:56
S 10°	04:53	05:20	05:43	18:25	18:48	19:15
20°	04:31	05:00	05:24	18:43	19:08	19:37
30°	04:02	04:35	05:03	19:05	19:32	20:05
35°	03:44	04:20	04:50	19:17	19:47	20:23
40°	03:21	04:03	04:35	19:32	20:05	20:46
45°	02:52	03:41	04:18	19:50	20:27	21:15
S 50°	02:08	03:12	03:56	20:11	20:55	21:59
52°	01:42	02:57	03:45	20:22	21:10	22:24
54°	01:02	02:40	03:33	20:34	21:27	23:03
56°	▭	02:19	03:20	20:47	21:48	▭
58°	▭	01:51	03:03	21:04	22:15	▭
S 60°	▭	01:08	02:44	21:23	22:58	▭

18

Lat.	Moonrise Wed	Moonrise Thu	Moonrise Fri	Moonset Wed	Moonset Thu	Moonset Fri
N 72°	12:37	12:18	12:00	21:58	23:43	–:–
N 70°	12:26	12:13	12:02	22:06	23:44	–:–
68°	12:17	12:10	12:03	22:14	23:45	–:–
66°	12:09	12:07	12:04	22:20	23:46	–:–
64°	12:02	12:04	12:05	22:25	23:47	–:–
62°	11:57	12:02	12:06	22:29	23:48	–:–
60°	11:52	12:00	12:07	22:33	23:49	–:–
N 58°	11:48	11:58	12:08	22:36	23:49	–:–
56°	11:44	11:56	12:08	22:39	23:50	–:–
54°	11:40	11:55	12:09	22:42	23:50	–:–
52°	11:37	11:54	12:10	22:44	23:51	–:–
50°	11:34	11:52	12:10	22:46	23:51	–:–
45°	11:28	11:50	12:11	22:51	23:52	–:–
N 40°	11:23	11:48	12:12	22:55	23:52	–:–
35°	11:18	11:46	12:13	22:58	23:53	–:–
30°	11:14	11:44	12:14	23:01	23:54	–:–
20°	11:07	11:41	12:15	23:06	23:54	–:–
N 10°	11:01	11:39	12:16	23:11	23:55	–:–
0°	10:55	11:36	12:17	23:15	23:56	–:–
S 10°	10:49	11:34	12:18	23:19	23:57	–:–
20°	10:43	11:31	12:19	23:24	23:57	–:–
30°	10:36	11:28	12:20	23:29	23:58	–:–
35°	10:32	11:26	12:21	23:31	23:59	–:–
40°	10:27	11:25	12:22	23:35	23:59	–:–
45°	10:21	11:22	12:23	23:38	–:–	00:00
S 50°	10:15	11:20	12:24	23:43	–:–	00:00
52°	10:12	11:18	12:25	23:45	–:–	00:01
54°	10:08	11:17	12:25	23:47	–:–	00:01
56°	10:05	11:15	12:26	23:49	–:–	00:01
58°	10:01	11:14	12:27	23:52	–:–	00:02
S 60°	09:56	11:12	12:28	23:55	–:–	00:02

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Age 6-8 34-53%
01	03:05	03:20	12:03	17:05	04:44	
02	03:34	03:48	12:04	17:46	05:26	
03	04:02	04:16	12:04	18:27	06:06	

9 10 3 11 3 12 13 14 15 16

file date- June 16 2020

Information in the data page footers

Information pertaining to the IERS EOP data has been added to the odd data page footers if using MiKTeX or TeX Live (2020 or later). The International Earth Rotation Service (IERS) provides accurate data (updated weekly) on the Earth Orientation Parameters (EOP).

Earth's speed of rotation is not constant, i.e. the day length fluctuates.[1] This is due to *internal torques* caused by relative movements and mass redistribution of Earth's core, mantle, oceans, atmosphere, and cryosphere. This has an immediate impact on the GHA values of all celestial objects.

The IERS monitors and measures several parameters taking the actual speed of Earth's rotation into account. Their measured data begins on 2nd Januaray 1973. Predictive data begins following the last day of (obtained) data and extends about 360 days into the future. (The IERS results are published with a delay of about 18-hours between the date of publication and the last available date with measured EOP.[2]) These Nautical Almanac daily pages take the (measured or predicted) UT1-UTC values into account providing highly accurate navigational data especially if the predictions are fairly recent.

As long as either measured or predicted data is available the footer will show:
IERS Earth Orientation data as of dd-mmm-yyyy
This indicates that IERS EOP data is in use - older dates are measured; newer dates are predictions.

If the final date of IERS prediction data is on the current data page, the footer shows:
IERS Earth Orientation predictions end dd-mmm-yyyy

Pages with dates beyond the final date of IERS prediction data have the following footer:
No IERS EOP prediction data available
Skyfield then defaults to using the ΔT and leap second files that ship with Skyfield internally.

The footers mentioned are only displayed as long as **'useIERS = True'** is set in *config.py* to enable use of IERS EOP data.

Brief historical overview

The story begins with the XEphem astronomical library, which is declared 'end of life' by its author, Elwood Charles Downey, as no further updates are planned. He generously gave permission for use of XEphem code in Ephem (also known as Pyephem), an astronomical library authored by Brandon Rhodes. Enno Rodegerdts (https://sv-inua.net/) created the original Nautical Almanac 'daily pages' in Pyalmanac using Python 2 and LaTeX. After contacting him I obtained permission for its future enhancement and maintenance. Pyalmanac uses Ephem.

Meanwhile Brandon Rhodes was working on a far more sophisticated astronomical library, Skyfield. This was 'state of the art' and clearly surpassed the 'Jean Meeus'-based Pyephem/Ephem. Skyfield uses NASA's NAIF (Navigation and Ancillary Information Facility) SPICE algorithms. The results agree with those from the HORIZONS System (*operated by NASA JPL (Jet Propulsion Laboratory) SSD (Solar System Dynamics) group, not by NAIF*). This in turn implies that celestial positions calculated by Skyfield agree with those generated by the United States Naval Observatory and their *Astronomical Almanac* to within 0.0005 arcseconds (half a milliarcsecond).

Pyephem was then in 'maintenance mode'. Clearly Pyalmanac needed adaptation to use Skyfield, and thus SFalmanac was born. However its performance was poor regarding the calculation of 'events' such as: sunrise, sunset, moonrise, moonset, civil twilight start/end and nautical twilight start/end. An interim (faster) solution was required.

A hybrid application, originally named Skyalmanac, was developed using Ephem to calculate 'events' and Skyfield for the rest. This was indeed much faster at the cost of poorer 'event time' data. It took a while to find a better solution: multiprocessing, which was built into SFalmanac. This now could compare to the execution times in Pyalmanac but with improved data.

New functionality was added to SFalmanac, e.g. lunar phase as a graphic; Lunar Distance tables and charts. The original Skyalmanac is deprecated and has now been replaced with the latest SFalmanac code, so Skyalmanac and SFalmanac are now identical apart from the name. Since April 2019 http://thenauticalalmanac.com has been publishing Celestial Navigation related material with software provided here.

[1] https://en.wikipedia.org/wiki/Day_length_fluctuations
[2] https://hpiers.obspm.fr/eoppc/bul/bulb/explanatory.html

January 01, 02, 03 UT (Wed., Thu., Fri.)

	Aries	Venus		Mars		Jupiter		Saturn	
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	100°54.0	130°30.3	S13°35.2	335°46.4	N23°32.7	29°01.0	N21°47.2	114°23.0	S07°55.0
1	115°56.4	145°30.2	34.1	350°49.7	33.0	44°03.8	47.2	129°25.3	54.9
2	130°58.9	160°30.2	33.0	5°53.1	33.3	59°06.5	47.2	144°27.6	54.8
3	146°01.4	175°30.1	·· 31.9	20°56.4	·· 33.5	74°09.3	·· 47.2	159°29.9	·· 54.8
4	161°03.8	190°30.0	30.8	35°59.7	33.8	89°12.0	47.1	174°32.2	54.7
5	176°06.3	205°30.0	29.7	51°03.0	34.1	104°14.8	47.1	189°34.4	54.6
6	191°08.8	220°29.9	S13°28.6	66°06.3	N23°34.4	119°17.5	N21°47.1	204°36.7	S07°54.5
7	206°11.2	235°29.9	27.5	81°09.6	34.6	134°20.3	47.1	219°39.0	54.5
8	221°13.7	250°29.8	26.4	96°13.0	34.9	149°23.0	47.0	234°41.3	54.4
9	236°16.2	265°29.7	·· 25.4	111°16.3	·· 35.2	164°25.8	·· 47.0	249°43.6	·· 54.3
10	251°18.6	280°29.7	24.3	126°19.6	35.5	179°28.5	47.0	264°45.9	54.2
11	266°21.1	295°29.6	23.2	141°22.9	35.7	194°31.3	47.0	279°48.2	54.1
12	281°23.5	310°29.6	S13°22.1	156°26.2	N23°36.0	209°34.0	N21°46.9	294°50.5	S07°54.1
13	296°26.0	325°29.5	21.0	171°29.6	36.3	224°36.8	46.9	309°52.8	54.0
14	311°28.5	340°29.5	19.9	186°32.9	36.6	239°39.5	46.9	324°55.0	53.9
15	326°30.9	355°29.4	·· 18.8	201°36.2	·· 36.8	254°42.3	·· 46.9	339°57.3	·· 53.8
16	341°33.4	10°29.4	17.7	216°39.5	37.1	269°45.0	46.9	354°59.6	53.7
17	356°35.9	25°29.3	16.6	231°42.9	37.4	284°47.7	46.8	10°01.9	53.7
18	11°38.3	40°29.3	S13°15.5	246°46.2	N23°37.7	299°50.5	N21°46.8	25°04.2	S07°53.6
19	26°40.8	55°29.2	14.4	261°49.5	37.9	314°53.2	46.8	40°06.5	53.5
20	41°43.3	70°29.2	13.3	276°52.9	38.2	329°56.0	46.8	55°08.8	53.4
21	56°45.7	85°29.1	·· 12.2	291°56.2	·· 38.5	344°58.7	·· 46.7	70°11.1	·· 53.4
22	71°48.2	100°29.1	11.1	306°59.5	38.8	0°01.5	46.7	85°13.4	53.3
23	86°50.7	115°29.1	10.0	322°02.9	39.0	15°04.2	46.7	100°15.6	53.2
Mer.pass. 17:14		ν -0.1′	d 1.1′	ν 3.3′	d 0.3′	m -1.21	ν 2.7′	d 0.0′	m -2.74	ν 2.3′	d 0.1′	m 1.05

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	101°53.1	130°29.0	S13°08.9	337°06.2	N23°39.3	30°07.0	N21°46.7	115°17.9	S07°53.1
1	116°55.6	145°29.0	07.8	352°09.6	39.6	45°09.7	46.6	130°20.2	53.0
2	131°58.0	160°28.9	06.7	7°12.9	39.9	60°12.4	46.6	145°22.5	53.0
3	147°00.5	175°28.9	·· 05.6	22°16.2	·· 40.1	75°15.2	·· 46.6	160°24.8	·· 52.9
4	162°03.0	190°28.9	04.5	37°19.6	40.4	90°17.9	46.6	175°27.1	52.8
5	177°05.4	205°28.8	03.4	52°22.9	40.7	105°20.7	46.5	190°29.4	52.7
6	192°07.9	220°28.8	S13°02.3	67°26.3	N23°41.0	120°23.4	N21°46.5	205°31.6	S07°52.6
7	207°10.4	235°28.7	01.2	82°29.6	41.3	135°26.2	46.5	220°33.9	52.6
8	222°12.8	250°28.7	13°00.1	97°33.0	41.5	150°28.9	46.5	235°36.2	52.5
9	237°15.3	265°28.7	12°59.0	112°36.3	·· 41.8	165°31.6	·· 46.4	250°38.5	·· 52.4
10	252°17.8	280°28.6	57.9	127°39.7	42.1	180°34.4	46.4	265°40.8	52.3
11	267°20.2	295°28.6	56.8	142°43.0	42.4	195°37.1	46.4	280°43.1	52.2
12	282°22.7	310°28.6	S12°55.7	157°46.4	N23°42.6	210°39.9	N21°46.4	295°45.4	S07°52.2
13	297°25.2	325°28.6	54.5	172°49.7	42.9	225°42.6	46.3	310°47.7	52.1
14	312°27.6	340°28.5	53.4	187°53.1	43.2	240°45.3	46.3	325°49.9	52.0
15	327°30.1	355°28.5	·· 52.3	202°56.4	·· 43.5	255°48.1	·· 46.3	340°52.2	·· 51.9
16	342°32.5	10°28.5	51.2	217°59.8	43.7	270°50.8	46.3	355°54.5	51.8
17	357°35.0	25°28.4	50.1	233°03.1	44.0	285°53.6	46.3	10°56.8	51.8
18	12°37.5	40°28.4	S12°49.0	248°06.5	N23°44.3	300°56.3	N21°46.2	25°59.1	S07°51.7
19	27°39.9	55°28.4	47.9	263°09.8	44.6	315°59.0	46.2	41°01.4	51.6
20	42°42.4	70°28.4	46.8	278°13.2	44.8	331°01.8	46.2	56°03.6	51.5
21	57°44.9	85°28.3	·· 45.7	293°16.6	·· 45.1	346°04.5	·· 46.2	71°05.9	·· 51.4
22	72°47.3	100°28.3	44.6	308°19.9	45.4	1°07.2	46.1	86°08.2	51.4
23	87°49.8	115°28.3	43.5	323°23.3	45.7	16°10.0	46.1	101°10.5	51.3
Mer.pass. 17:10		ν -0.0′	d 1.1′	m -4.46	ν 3.3′	d 0.3′	m -1.24	ν 2.7′	d 0.0′	m -2.74	ν 2.3′	d 0.1′	m 1.06

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	102°52.3	130°28.3	S12°42.4	338°26.6	N23°45.9	31°12.7	N21°46.1	116°12.8	S07°51.2
1	117°54.7	145°28.3	41.2	353°30.0	46.2	46°15.5	46.1	131°15.1	51.1
2	132°57.2	160°28.3	40.1	8°33.4	46.5	61°18.2	46.0	146°17.4	51.0
3	147°59.6	175°28.2	·· 39.0	23°36.7	·· 46.8	76°20.9	·· 46.0	161°19.6	·· 50.9
4	163°02.1	190°28.2	37.9	38°40.1	47.1	91°23.7	46.0	176°21.9	50.9
5	178°04.6	205°28.2	36.8	53°43.5	47.3	106°26.4	46.0	191°24.2	50.8
6	193°07.0	220°28.2	S12°35.7	68°46.8	N23°47.6	121°29.1	N21°45.9	206°26.5	S07°50.7
7	208°09.5	235°28.2	34.6	83°50.2	47.9	136°31.9	45.9	221°28.8	50.6
8	223°12.0	250°28.2	33.5	98°53.6	48.2	151°34.6	45.9	236°31.1	50.5
9	238°14.4	265°28.2	·· 32.3	113°57.0	·· 48.4	166°37.3	·· 45.9	251°33.3	·· 50.5
10	253°16.9	280°28.1	31.2	129°00.3	48.7	181°40.1	45.9	266°35.6	50.4
11	268°19.4	295°28.1	30.1	144°03.7	49.0	196°42.8	45.8	281°37.9	50.3
12	283°21.8	310°28.1	S12°29.0	159°07.1	N23°49.3	211°45.5	N21°45.8	296°40.2	S07°50.2
13	298°24.3	325°28.1	27.9	174°10.5	49.5	226°48.3	45.8	311°42.5	50.1
14	313°26.8	340°28.1	26.8	189°13.8	49.8	241°51.0	45.8	326°44.8	50.1
15	328°29.2	355°28.1	·· 25.7	204°17.2	·· 50.1	256°53.7	·· 45.7	341°47.0	·· 50.0
16	343°31.7	10°28.1	24.5	219°20.6	50.4	271°56.5	45.7	356°49.3	49.9
17	358°34.1	25°28.1	23.4	234°24.0	50.6	286°59.2	45.7	11°51.6	49.8
18	13°36.6	40°28.1	S12°22.3	249°27.4	N23°50.9	302°01.9	N21°45.7	26°53.9	S07°49.7
19	28°39.1	55°28.1	21.2	264°30.8	51.2	317°04.7	45.6	41°56.2	49.6
20	43°41.5	70°28.1	20.1	279°34.1	51.5	332°07.4	45.6	56°58.4	49.6
21	58°44.0	85°28.1	·· 19.0	294°37.5	·· 51.7	347°10.1	·· 45.6	72°00.7	·· 49.5
22	73°46.5	100°28.1	17.8	309°40.9	52.0	2°12.9	45.6	87°03.0	49.4
23	88°48.9	115°28.1	16.7	324°44.3	52.3	17°15.6	45.6	102°05.3	49.3
Mer.pass. 17:06		ν -0.0′	d 1.1′	m -4.47	ν 3.4′	d 0.3′	m -1.26	ν 2.7′	d 0.0′	m -2.73	ν 2.3′	d 0.1′	m 1.06

Stars

	SHA	Dec
Alpheratz	357°34.8	29°13.9
Ankaa	353°07.2	-42°10.4
Schedar	349°31.1	56°40.7
Diphda	348°47.3	-17°51.1
Achernar	335°20.0	-57°06.9
Hamal	327°51.1	23°34.9
Polaris	313°44.0	89°22.4
Acamar	315°11.5	-40°12.4
Menkar	314°06.0	4°11.3
Mirfak	308°27.9	49°57.2
Aldebaran	290°39.3	16°33.6
Rigel	281°03.6	-8°10.4
Capella	280°21.4	46°01.4
Bellatrix	278°22.6	6°22.3
Elnath	278°01.5	28°37.7
Alnilam	275°37.4	-1°11.2
Betelgeuse	270°51.8	7°24.7
Canopus	263°51.8	-52°42.5
Sirius	258°25.9	-16°45.0
Adhara	255°05.5	-29°00.3
Procyon	244°50.5	5°09.6
Pollux	243°16.9	27°57.9
Avior	234°14.1	-59°35.2
Suhail	222°46.0	-43°31.9
Miaplacidus	221°37.5	-69°48.9
Alphard	217°47.5	-8°46.0
Regulus	207°34.2	11°50.6
Dubhe	193°40.7	61°36.7
Denebola	182°24.9	14°25.8
Gienah	175°43.6	-17°40.8
Acrux	173°00.1	-63°14.0
Gacrux	171°51.7	-57°14.9
Alioth	166°13.0	55°49.1
Spica	158°22.4	-11°17.5
Alkaid	152°52.1	49°11.0
Hadar	148°36.3	-60°29.3
Menkent	147°57.8	-36°29.4
Arcturus	145°48.1	19°03.0
Rigil Kent.	139°40.7	-60°56.1
Kochab	137°20.4	74°02.8
Zuben'ubi	136°56.2	-16°08.7
Alphecca	126°04.0	26°37.7
Antares	112°16.2	-26°29.2
Atria	107°10.9	-69°04.2
Sabik	102°03.1	-15°45.4
Shaula	96°10.8	-37°07.3
Rasalhague	95°58.9	12°32.4
Eltanin	90°42.7	51°29.0
Kaus Aust.	83°32.9	-34°22.4
Vega	80°33.7	38°48.3
Nunki	75°48.2	-26°16.0
Altair	62°00.3	8°56.0
Peacock	53°06.3	-56°39.4
Deneb	49°26.2	45°22.2
Enif	33°39.1	9°59.4
Al Na'ir	27°33.2	-46°50.6
Fomalhaut	15°14.7	-29°29.6
Scheat	13°45.4	28°13.2
Markab	13°30.1	15°20.4

Jan 01 Wed	SHA	Mer.pass
Venus	29°36.3	15:18
Mars	234°52.5	01:37
Jupiter	288°07.1	22:00
Saturn	13°29.0	16:20

Jan 02 Thu	SHA	Mer.pass
Venus	28°35.9	15:18
Mars	235°13.1	01:31
Jupiter	288°13.8	21:56
Saturn	13°24.8	16:16

Jan 03 Fri	SHA	Mer.pass
Venus	27°36.0	15:18
Mars	235°34.4	01:26
Jupiter	288°20.5	21:51
Saturn	13°20.5	16:13

Horizontal parallax	
Venus:	0.2
Mars:	0.2

DUT1 = UT1-UTC = +0.0463 sec ΔT = TT-UT1 = +69.1377 sec

2025 January 01 to Jan. 03 UT

h	Sun		Moon				
Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°08.4	S22°59.9	164°13.2	7.1′	S25°51.6	7.2′	57.4′
1	194°08.1	59.7	178°39.2	7.1′	25°44.4	7.3′	57.4′
2	209°07.8	59.5	193°05.4	7.2′	25°37.1	7.6′	57.4′
3	224°07.5	·· 59.3	207°31.6	7.2′	25°29.5	7.6′	57.4′
4	239°07.2	59.1	221°57.8	7.3′	25°21.9	7.9′	57.5′
5	254°06.9	58.8	236°24.1	7.3′	25°14.0	7.9′	57.5′
6	269°06.6	S22°58.6	250°50.4	7.4′	S25°06.1	8.2′	57.5′
7	284°06.3	58.4	265°16.8	7.5′	24°57.9	8.2′	57.5′
8	299°06.0	58.2	279°43.3	7.5′	24°49.7	8.5′	57.5′
9	314°05.7	·· 58.0	294°09.8	7.6′	24°41.2	8.6′	57.6′
10	329°05.4	57.8	308°36.4	7.6′	24°32.6	8.7′	57.6′
11	344°05.1	57.6	323°03.0	7.7′	24°23.9	8.9′	57.6′
12	359°04.8	S22°57.4	337°29.7	7.8′	S24°15.0	9.0′	57.6′
13	14°04.5	57.1	351°56.5	7.8′	24°06.0	9.1′	57.6′
14	29°04.2	56.9	6°23.3	7.9′	23°56.9	9.3′	57.7′
15	44°03.9	·· 56.7	20°50.1	7.9′	23°47.6	9.5′	57.7′
16	59°03.7	56.5	35°17.1	8.0′	23°38.1	9.6′	57.7′
17	74°03.4	56.3	49°44.1	8.1′	23°28.5	9.7′	57.7′
18	89°03.1	S22°56.0	64°11.2	8.1′	S23°18.8	9.9′	57.7′
19	104°02.8	55.8	78°38.3	8.2′	23°08.9	10.0′	57.8′
20	119°02.5	55.6	93°05.5	8.3′	22°58.9	10.1′	57.8′
21	134°02.2	·· 55.4	107°32.8	8.3′	22°48.8	10.3′	57.8′
22	149°01.9	55.2	122°00.1	8.4′	22°38.5	10.4′	57.8′
23	164°01.6	54.9	136°27.5	8.5′	22°28.1	10.5′	57.8′
	SD = 16.3′	d = 0.2′	SD = 15.6′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°01.3	S22°54.7	150°55.0	8.5′	S22°17.6	10.7′	57.8′
1	194°01.0	54.5	165°22.5	8.6′	22°06.9	10.8′	57.9′
2	209°00.7	54.3	179°50.1	8.7′	21°56.1	11.0′	57.9′
3	224°00.4	·· 54.0	194°17.8	8.7′	21°45.1	11.0′	57.9′
4	239°00.1	53.8	208°45.5	8.8′	21°34.1	11.2′	57.9′
5	253°59.9	53.6	223°13.3	8.9′	21°22.9	11.3′	57.9′
6	268°59.6	S22°53.3	237°41.2	9.0′	S21°11.6	11.4′	58.0′
7	283°59.3	53.1	252°09.2	9.0′	21°00.2	11.6′	58.0′
8	298°59.0	52.9	266°37.2	9.1′	20°48.6	11.7′	58.0′
9	313°58.7	·· 52.6	281°05.3	9.2′	20°36.9	11.8′	58.0′
10	328°58.4	52.4	295°33.4	9.2′	20°25.1	11.9′	58.0′
11	343°58.1	52.2	310°01.7	9.3′	20°13.2	12.0′	58.0′
12	358°57.8	S22°51.9	324°30.0	9.4′	S20°01.2	12.2′	58.1′
13	13°57.5	51.7	338°58.3	9.4′	19°49.0	12.2′	58.1′
14	28°57.2	51.5	353°26.8	9.5′	19°36.8	12.4′	58.1′
15	43°56.9	·· 51.2	7°55.3	9.6′	19°24.4	12.5′	58.1′
16	58°56.7	51.0	22°23.9	9.7′	19°11.9	12.6′	58.1′
17	73°56.4	50.8	36°52.5	9.7′	18°59.3	12.7′	58.1′
18	88°56.1	S22°50.5	51°21.3	9.8′	S18°46.6	12.8′	58.2′
19	103°55.8	50.3	65°50.0	9.9′	18°33.8	12.9′	58.2′
20	118°55.5	50.0	80°18.9	9.9′	18°20.9	13.1′	58.2′
21	133°55.2	·· 49.8	94°47.8	10.0′	18°07.8	13.1′	58.2′
22	148°54.9	49.5	109°16.8	10.1′	17°54.7	13.2′	58.2′
23	163°54.6	49.3	123°45.9	10.1′	17°41.5	13.3′	58.2′
	SD = 16.3′	d = 0.2′	SD = 15.8′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°54.3	S22°49.1	138°15.0	10.2′	S17°28.2	13.5′	58.3′
1	193°54.1	48.8	152°44.2	10.3′	17°14.7	13.5′	58.3′
2	208°53.8	48.6	167°13.5	10.3′	17°01.2	13.6′	58.3′
3	223°53.5	·· 48.3	181°42.8	10.4′	16°47.6	13.7′	58.3′
4	238°53.2	48.1	196°12.2	10.5′	16°33.9	13.8′	58.3′
5	253°52.9	47.8	210°41.7	10.5′	16°20.1	13.9′	58.3′
6	268°52.6	S22°47.6	225°11.2	10.6′	S16°06.2	14.0′	58.3′
7	283°52.3	47.3	239°40.8	10.7′	15°52.2	14.1′	58.4′
8	298°52.0	47.1	254°10.4	10.7′	15°38.1	14.1′	58.4′
9	313°51.8	·· 46.8	268°40.1	10.8′	15°24.0	14.3′	58.4′
10	328°51.5	46.6	283°09.9	10.8′	15°09.7	14.3′	58.4′
11	343°51.2	46.3	297°39.8	10.9′	14°55.4	14.4′	58.4′
12	358°50.9	S22°46.1	312°09.6	11.0′	S14°41.0	14.5′	58.4′
13	13°50.6	45.8	326°39.6	11.0′	14°26.5	14.6′	58.4′
14	28°50.3	45.6	341°09.6	11.1′	14°11.9	14.7′	58.5′
15	43°50.0	·· 45.3	355°39.7	11.1′	13°57.2	14.7′	58.5′
16	58°49.7	45.0	10°09.8	11.2′	13°42.5	14.8′	58.5′
17	73°49.5	44.8	24°40.0	11.2′	13°27.7	14.9′	58.5′
18	88°49.2	S22°44.5	39°10.2	11.3′	S13°12.8	15.0′	58.5′
19	103°48.9	44.3	53°40.5	11.3′	12°57.8	15.0′	58.5′
20	118°48.6	44.0	68°10.9	11.4′	12°42.8	15.1′	58.5′
21	133°48.3	·· 43.7	82°41.3	11.4′	12°27.7	15.2′	58.5′
22	148°48.0	43.5	97°11.7	11.5′	12°12.5	15.2′	58.6′
23	163°47.8	43.2	111°42.2	11.5′	11°57.3	15.3′	58.6′
	SD = 16.3′	d = 0.2′	SD = 15.9′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	08:23	10:39	▬	▬	13:30	15:46
N 70°	08:04	09:47	▬	▬	14:21	16:05
68°	07:49	09:16	▬	▬	14:53	16:20
66°	07:37	08:52	10:25	13:43	15:17	16:32
64°	07:26	08:33	09:48	14:20	15:35	16:42
62°	07:17	08:18	09:22	14:47	15:50	16:52
60°	07:09	08:05	09:02	15:07	16:03	17:00
N 58°	07:02	07:54	08:45	15:24	16:15	17:07
56°	06:55	07:44	08:31	15:38	16:24	17:13
54°	06:50	07:35	08:19	15:50	16:33	17:19
52°	06:44	07:27	08:08	16:01	16:41	17:24
50°	06:39	07:20	07:58	16:10	16:48	17:29
45°	06:28	07:05	07:38	16:30	17:04	17:41
N 40°	06:18	06:52	07:22	16:46	17:17	17:51
35°	06:09	06:40	07:08	17:00	17:28	18:00
30°	06:00	06:30	06:56	17:12	17:38	18:08
20°	05:44	06:12	06:36	17:33	17:57	18:24
N 10°	05:28	05:55	06:17	17:51	18:14	18:40
0°	05:12	05:38	06:00	18:08	18:30	18:56
S 10°	04:53	05:20	05:43	18:25	18:48	19:15
20°	04:31	05:00	05:25	18:43	19:08	19:37
30°	04:03	04:36	05:03	19:05	19:32	20:05
35°	03:45	04:21	04:51	19:18	19:47	20:23
40°	03:22	04:03	04:36	19:32	20:05	20:46
45°	02:53	03:41	04:18	19:50	20:26	21:15
S 50°	02:09	03:13	03:57	20:11	20:55	21:58
52°	01:43	02:58	03:46	20:22	21:10	22:24
54°	01:04	02:41	03:34	20:34	21:27	23:02
56°	////	02:20	03:20	20:47	21:47	////
58°	////	01:52	03:04	21:03	22:15	////
S 60°	////	01:10	02:45	21:22	22:56	////

Lat.	**Moonrise** Wed	Thu	Fri	**Moonset** Wed	Thu	Fri
N 72°	▬	▬	12:47	▬	▬	18:17
N 70°	▬	13:51	12:17	▬	15:25	18:45
68°	▬	12:41	11:55	▬	16:33	19:05
66°	▬	12:04	11:38	▬	17:09	19:21
64°	12:03	11:38	11:23	15:16	17:34	19:34
62°	11:24	11:17	11:11	15:55	17:54	19:44
60°	10:57	11:00	11:01	16:21	18:09	19:54
N 58°	10:35	10:46	10:52	16:42	18:23	20:02
56°	10:18	10:33	10:43	16:59	18:34	20:09
54°	10:03	10:22	10:36	17:14	18:45	20:15
52°	09:50	10:13	10:30	17:26	18:53	20:20
50°	09:38	10:04	10:24	17:37	19:01	20:25
45°	09:14	09:46	10:11	18:00	19:18	20:36
N 40°	08:55	09:31	10:01	18:19	19:32	20:45
35°	08:39	09:18	09:52	18:34	19:44	20:53
30°	08:25	09:07	09:44	18:47	19:54	20:59
20°	08:01	08:47	09:30	19:09	20:11	21:11
N 10°	07:40	08:30	09:18	19:29	20:26	21:20
0°	07:20	08:15	09:06	19:47	20:40	21:30
S 10°	07:01	07:59	08:55	20:04	20:53	21:39
20°	06:40	07:42	08:42	20:23	21:08	21:48
30°	06:15	07:22	08:28	20:45	21:24	21:59
35°	06:01	07:10	08:20	20:58	21:34	22:05
40°	05:44	06:57	08:10	21:12	21:45	22:13
45°	05:24	06:41	07:59	21:29	21:57	22:21
S 50°	04:59	06:21	07:46	21:50	22:13	22:30
52°	04:46	06:12	07:39	22:00	22:20	22:35
54°	04:32	06:01	07:32	22:11	22:28	22:40
56°	04:16	05:50	07:24	22:24	22:36	22:45
58°	03:56	05:36	07:15	22:38	22:46	22:51
S 60°	03:31	05:19	07:05	22:56	22:58	22:58

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 2-4 1-11%
01	03:27	03:41	12:04	13:33	01:06	
02	03:55	04:09	12:04	14:27	02:01	
03	04:23	04:36	12:05	15:18	02:53	

January 04, 05, 06 UT (Sat., Sun., Mon.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	103°51.4	130°28.1	S12°15.6	339°47.7	N23°52.6	32°18.3	N21°45.5	117°07.6	S07°49.2
1	118°53.9	145°28.1	14.5	354°51.1	52.8	47°21.1	45.5	132°09.9	49.2
2	133°56.3	160°28.1	13.4	9°54.5	53.1	62°23.8	45.5	147°12.1	49.1
3	148°58.8	175°28.1	·· 12.2	24°57.9	·· 53.4	77°26.5	·· 45.5	162°14.4	·· 49.0
4	164°01.3	190°28.1	11.1	40°01.2	53.7	92°29.2	45.4	177°16.7	48.9
5	179°03.7	205°28.1	10.0	55°04.6	53.9	107°32.0	45.4	192°19.0	48.8
6	194°06.2	220°28.2	S12°08.9	70°08.0	N23°54.2	122°34.7	N21°45.4	207°21.3	S07°48.7
7	209°08.6	235°28.2	07.8	85°11.4	54.5	137°37.4	45.4	222°23.5	48.7
8	224°11.1	250°28.2	06.6	100°14.8	54.8	152°40.2	45.3	237°25.8	48.6
9	239°13.6	265°28.2	·· 05.5	115°18.2	·· 55.1	167°42.9	·· 45.3	252°28.1	·· 48.5
10	254°16.0	280°28.2	04.4	130°21.6	55.3	182°45.6	45.3	267°30.4	48.4
11	269°18.5	295°28.2	03.3	145°25.0	55.6	197°48.3	45.3	282°32.7	48.3
12	284°21.0	310°28.2	S12°02.1	160°28.4	N23°55.9	212°51.1	N21°45.3	297°34.9	S07°48.3
13	299°23.4	325°28.3	12°01.0	175°31.8	56.2	227°53.8	45.2	312°37.2	48.2
14	314°25.9	340°28.3	11°59.9	190°35.2	56.4	242°56.5	45.2	327°39.5	48.1
15	329°28.4	355°28.3	·· 58.8	205°38.6	·· 56.7	257°59.2	·· 45.2	342°41.8	·· 48.0
16	344°30.8	10°28.3	57.6	220°42.0	57.0	273°02.0	45.2	357°44.1	47.9
17	359°33.3	25°28.3	56.5	235°45.4	57.3	288°04.7	45.1	12°46.3	47.8
18	14°35.7	40°28.3	S11°55.4	250°48.8	N23°57.5	303°07.4	N21°45.1	27°48.6	S07°47.8
19	29°38.2	55°28.4	54.3	265°52.2	57.8	318°10.1	45.1	42°50.9	47.7
20	44°40.7	70°28.4	53.1	280°55.7	58.1	333°12.9	45.1	57°53.2	47.6
21	59°43.1	85°28.4	·· 52.0	295°59.1	·· 58.4	348°15.6	·· 45.1	72°55.5	·· 47.5
22	74°45.6	100°28.4	50.9	311°02.5	58.6	3°18.3	45.0	87°57.7	47.4
23	89°48.1	115°28.5	49.8	326°05.9	58.9	18°21.0	45.0	103°00.0	47.3
Mer.pass. 17:02		ν 0.0′	d 1.1′	m -4.48	ν 3.4′	d 0.3′	m -1.28	ν 2.7′	d 0.0′ m -2.72	ν 2.3′	d 0.1′ m 1.06

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	104°50.5	130°28.5	S11°48.6	341°09.3	N23°59.2	33°23.8	N21°45.0	118°02.3	S07°47.3
1	119°53.0	145°28.5	47.5	356°12.7	59.5	48°26.5	45.0	133°04.6	47.2
2	134°55.5	160°28.6	46.4	11°16.1	23°59.7	63°29.2	44.9	148°06.8	47.1
3	149°57.9	175°28.6	·· 45.2	26°19.5	24°00.0	78°31.9	·· 44.9	163°09.1	·· 47.0
4	165°00.4	190°28.6	44.1	41°22.9	00.3	93°34.7	44.9	178°11.4	46.9
5	180°02.9	205°28.6	43.0	56°26.4	00.5	108°37.4	44.9	193°13.7	46.8
6	195°05.3	220°28.7	S11°41.9	71°29.8	N24°00.8	123°40.1	N21°44.9	208°16.0	S07°46.8
7	210°07.8	235°28.7	40.7	86°33.2	01.1	138°42.8	44.8	223°18.2	46.7
8	225°10.2	250°28.7	39.6	101°36.6	01.4	153°45.5	44.8	238°20.5	46.6
9	240°12.7	265°28.8	·· 38.5	116°40.0	·· 01.6	168°48.3	·· 44.8	253°22.8	·· 46.5
10	255°15.2	280°28.8	37.3	131°43.5	01.9	183°51.0	44.8	268°25.1	46.4
11	270°17.6	295°28.9	36.2	146°46.9	02.2	198°53.7	44.8	283°27.3	46.3
12	285°20.1	310°28.9	S11°35.1	161°50.3	N24°02.5	213°56.4	N21°44.7	298°29.6	S07°46.3
13	300°22.6	325°28.9	33.9	176°53.7	02.7	228°59.1	44.7	313°31.9	46.2
14	315°25.0	340°29.0	32.8	191°57.1	03.0	244°01.9	44.7	328°34.2	46.1
15	330°27.5	355°29.0	·· 31.7	207°00.6	·· 03.3	259°04.6	·· 44.7	343°36.4	·· 46.0
16	345°30.0	10°29.1	30.5	222°04.0	03.6	274°07.3	44.6	358°38.7	45.9
17	0°32.4	25°29.1	29.4	237°07.4	03.8	289°10.0	44.6	13°41.0	45.8
18	15°34.9	40°29.2	S11°28.3	252°10.8	N24°04.1	304°12.7	N21°44.6	28°43.3	S07°45.8
19	30°37.4	55°29.2	27.1	267°14.3	04.4	319°15.5	44.6	43°45.6	45.7
20	45°39.8	70°29.2	26.0	282°17.7	04.7	334°18.2	44.6	58°47.8	45.6
21	60°42.3	85°29.3	·· 24.9	297°21.1	·· 04.9	349°20.9	·· 44.5	73°50.1	·· 45.5
22	75°44.7	100°29.3	23.7	312°24.6	05.2	4°23.6	44.5	88°52.4	45.4
23	90°47.2	115°29.4	22.6	327°28.0	05.5	19°26.3	44.5	103°54.7	45.3
Mer.pass. 16:58		ν 0.0′	d 1.1′	m -4.48	ν 3.4′	d 0.3′	m -1.30	ν 2.7′	d 0.0′ m -2.72	ν 2.3′	d 0.1′ m 1.06

Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	105°49.7	130°29.4	S11°21.5	342°31.4	N24°05.8	34°29.0	N21°44.5	118°56.9	S07°45.2
1	120°52.1	145°29.5	20.3	357°34.9	06.0	49°31.8	44.4	133°59.2	45.2
2	135°54.6	160°29.5	19.2	12°38.3	06.3	64°34.5	44.4	149°01.5	45.1
3	150°57.1	175°29.6	·· 18.1	27°41.7	·· 06.6	79°37.2	·· 44.4	164°03.8	·· 45.0
4	165°59.5	190°29.7	16.9	42°45.2	06.8	94°39.9	44.4	179°06.0	44.9
5	181°02.0	205°29.7	15.8	57°48.6	07.1	109°42.6	44.4	194°08.3	44.8
6	196°04.5	220°29.8	S11°14.6	72°52.0	N24°07.4	124°45.3	N21°44.3	209°10.6	S07°44.7
7	211°06.9	235°29.8	13.5	87°55.5	07.7	139°48.0	44.3	224°12.9	44.7
8	226°09.4	250°29.9	12.4	102°58.9	07.9	154°50.8	44.3	239°15.1	44.6
9	241°11.8	265°29.9	·· 11.2	118°02.4	·· 08.2	169°53.5	·· 44.3	254°17.4	·· 44.5
10	256°14.3	280°30.0	10.1	133°05.8	08.5	184°56.2	44.3	269°19.7	44.4
11	271°16.8	295°30.1	08.9	148°09.2	08.7	199°58.9	44.2	284°22.0	44.3
12	286°19.2	310°30.1	S11°07.8	163°12.7	N24°09.0	215°01.6	N21°44.2	299°24.2	S07°44.2
13	301°21.7	325°30.2	06.7	178°16.1	09.3	230°04.3	44.2	314°26.5	44.1
14	316°24.2	340°30.3	05.5	193°19.6	09.6	245°07.0	44.2	329°28.8	44.1
15	331°26.6	355°30.3	·· 04.4	208°23.0	·· 09.8	260°09.7	·· 44.2	344°31.0	·· 44.0
16	346°29.1	10°30.4	03.2	223°26.5	10.1	275°12.5	44.1	359°33.3	43.9
17	1°31.6	25°30.5	02.1	238°29.9	10.4	290°15.2	44.1	14°35.6	43.8
18	16°34.0	40°30.5	S11°01.0	253°33.4	N24°10.6	305°17.9	N21°44.1	29°37.9	S07°43.7
19	31°36.5	55°30.6	10°59.8	268°36.8	10.9	320°20.6	44.1	44°40.1	43.6
20	46°39.0	70°30.7	58.7	283°40.2	11.2	335°23.3	44.0	59°42.4	43.6
21	61°41.4	85°30.7	·· 57.5	298°43.7	·· 11.5	350°26.0	·· 44.0	74°44.7	·· 43.5
22	76°43.9	100°30.8	56.4	313°47.1	11.7	5°28.7	44.0	89°47.0	43.4
23	91°46.3	115°30.9	55.3	328°50.6	12.0	20°31.4	44.0	104°49.2	43.3
Mer.pass. 16:54		ν 0.1′	d 1.1′	m -4.49	ν 3.4′	d 0.3′	m -1.32	ν 2.7′	d 0.0′ m -2.71	ν 2.3′	d 0.1′ m 1.07

Stars

	SHA	Dec
Alpheratz	357°34.9	29°13.8
Ankaa	353°07.2	-42°10.4
Schedar	349°31.1	56°40.7
Diphda	348°47.3	-17°51.1
Achernar	335°20.0	-57°06.9
Hamal	327°51.1	23°34.9
Polaris	313°45.3	89°22.5
Acamar	315°11.5	-40°12.4
Menkar	314°06.0	4°11.3
Mirfak	308°27.9	49°57.2
Aldebaran	290°39.3	16°33.6
Rigel	281°03.6	-8°10.4
Capella	280°21.4	46°01.5
Bellatrix	278°22.6	6°22.3
Elnath	278°01.5	28°37.7
Alnilam	275°37.4	-1°11.2
Betelgeuse	270°51.8	7°24.7
Canopus	263°51.8	-52°42.5
Sirius	258°25.9	-16°45.0
Adhara	255°05.5	-29°00.3
Procyon	244°50.5	5°09.6
Pollux	243°16.9	27°57.9
Avior	234°14.1	-59°35.2
Suhail	222°45.9	-43°31.9
Miaplacidus	221°37.5	-69°49.0
Alphard	217°47.5	-8°46.0
Regulus	207°34.2	11°50.6
Dubhe	193°40.7	61°36.7
Denebola	182°24.9	14°25.8
Gienah	175°43.5	-17°40.8
Acrux	173°00.1	-63°14.0
Gacrux	171°51.6	-57°14.9
Alioth	166°12.9	55°49.1
Spica	158°22.4	-11°17.5
Alkaid	152°52.1	49°11.0
Hadar	148°36.3	-60°29.3
Menkent	147°57.8	-36°29.4
Arcturus	145°48.0	19°03.0
Rigil Kent.	139°40.6	-60°56.1
Kochab	137°20.4	74°02.8
Zuben'ubi	136°56.2	-16°08.7
Alphecca	126°04.0	26°37.6
Antares	112°16.2	-26°29.2
Atria	107°10.9	-69°04.2
Sabik	102°03.1	-15°45.4
Shaula	96°10.8	-37°07.3
Rasalhague	95°58.9	12°32.4
Eltanin	90°42.7	51°29.0
Kaus Aust.	83°32.9	-34°22.4
Vega	80°33.7	38°48.3
Nunki	75°48.1	-26°16.0
Altair	62°00.3	8°56.0
Peacock	53°06.3	-56°39.4
Deneb	49°26.3	45°22.2
Enif	33°39.1	9°59.4
Al Na'ir	27°33.2	-46°50.6
Fomalhaut	15°14.7	-29°29.6
Scheat	13°45.4	28°13.2
Markab	13°30.1	15°20.4

Jan 04 Sat	SHA	Mer.pass
Venus	26°36.7	15:18
Mars	235°56.3	01:21
Jupiter	288°26.9	21:47
Saturn	13°16.2	16:09

Jan 05 Sun	SHA	Mer.pass
Venus	25°38.0	15:18
Mars	236°18.8	01:15
Jupiter	288°33.2	21:42
Saturn	13°11.8	16:05

Jan 06 Mon	SHA	Mer.pass
Venus	24°39.8	15:18
Mars	236°41.8	01:10
Jupiter	288°39.4	21:38
Saturn	13°07.3	16:02

Horizontal parallax	
Venus:	0.2
Mars:	0.2

DUT1 = UT1-UTC = +0.0459 sec ΔT = TT-UT1 = +69.1381 sec

2025 January 04 to Jan. 06 UT

h	Sun		Moon				
Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°47.5	S22°43.0	126°12.8	11.6′	S11°42.0	15.4′	58.6′
1	193°47.2	42.7	140°43.4	11.6′	11°26.6	15.4′	58.6′
2	208°46.9	42.4	155°14.0	11.7′	11°11.2	15.5′	58.6′
3	223°46.6	·· 42.2	169°44.7	11.7′	10°55.7	15.5′	58.6′
4	238°46.3	41.9	184°15.4	11.8′	10°40.2	15.6′	58.6′
5	253°46.0	41.6	198°46.2	11.8′	10°24.6	15.7′	58.6′
6	268°45.8	S22°41.4	213°17.0	11.9′	S10°08.9	15.7′	58.7′
7	283°45.5	41.1	227°47.9	11.9′	09°53.2	15.8′	58.7′
8	298°45.2	40.8	242°18.8	11.9′	09°37.4	15.8′	58.7′
9	313°44.9	·· 40.6	256°49.8	12.0′	09°21.6	15.9′	58.7′
10	328°44.6	40.3	271°20.7	12.0′	09°05.7	15.9′	58.7′
11	343°44.4	40.0	285°51.8	12.1′	08°49.8	16.0′	58.7′
12	358°44.1	S22°39.7	300°22.8	12.1′	S08°33.8	16.0′	58.7′
13	13°43.8	39.5	314°53.9	12.1′	08°17.8	16.0′	58.7′
14	28°43.5	39.2	329°25.0	12.2′	08°01.8	16.2′	58.7′
15	43°43.2	·· 38.9	343°56.2	12.2′	07°45.6	16.1′	58.7′
16	58°42.9	38.6	358°27.4	12.2′	07°29.5	16.2′	58.8′
17	73°42.7	38.4	12°58.6	12.3′	07°13.3	16.2′	58.8′
18	88°42.4	S22°38.1	27°29.9	12.3′	S06°57.1	16.3′	58.8′
19	103°42.1	37.8	42°01.2	12.3′	06°40.8	16.3′	58.8′
20	118°41.8	37.5	56°32.5	12.3′	06°24.5	16.4′	58.8′
21	133°41.5	·· 37.3	71°03.8	12.4′	06°08.1	16.3′	58.8′
22	148°41.3	37.0	85°35.2	12.4′	05°51.8	16.5′	58.8′
23	163°41.0	36.7	100°06.5	12.4′	05°35.3	16.4′	58.8′
	SD = 16.3′	d = 0.3′	SD = 16.0′				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°40.7	S22°36.4	114°37.9	12.4′	S05°18.9	16.5′	58.8′
1	193°40.4	36.1	129°09.4	12.4′	05°02.4	16.5′	58.8′
2	208°40.1	35.8	143°40.8	12.5′	04°45.9	16.5′	58.8′
3	223°39.9	·· 35.6	158°12.3	12.5′	04°29.4	16.6′	58.9′
4	238°39.6	35.3	172°43.7	12.5′	04°12.8	16.5′	58.9′
5	253°39.3	35.0	187°15.2	12.5′	03°56.3	16.6′	58.9′
6	268°39.0	S22°34.7	201°46.7	12.5′	S03°39.7	16.7′	58.9′
7	283°38.8	34.4	216°18.2	12.5′	03°23.0	16.6′	58.9′
8	298°38.5	34.1	230°49.8	12.5′	03°06.4	16.7′	58.9′
9	313°38.2	·· 33.8	245°21.3	12.5′	02°49.7	16.7′	58.9′
10	328°37.9	33.5	259°52.9	12.6′	02°33.0	16.7′	58.9′
11	343°37.6	33.3	274°24.4	12.6′	02°16.3	16.7′	58.9′
12	358°37.4	S22°33.0	288°56.0	12.6′	S01°59.6	16.7′	58.9′
13	13°37.1	32.7	303°27.5	12.6′	01°42.9	16.7′	58.9′
14	28°36.8	32.4	317°59.1	12.6′	01°26.2	16.8′	58.9′
15	43°36.5	·· 32.1	332°30.7	12.6′	01°09.4	16.7′	58.9′
16	58°36.3	31.8	347°02.2	12.6′	00°52.7	16.8′	59.0′
17	73°36.0	31.5	1°33.8	12.6′	00°35.9	16.8′	59.0′
18	88°35.7	S22°31.2	16°05.4	12.6′	S00°19.1	16.7′	59.0′
19	103°35.4	30.9	30°36.9	12.6′	S00°02.4	16.8′	59.0′
20	118°35.2	30.6	45°08.5	12.5′	N00°14.4	16.8′	59.0′
21	133°34.9	·· 30.3	59°40.0	12.5′	00°31.2	16.8′	59.0′
22	148°34.6	30.0	74°11.5	12.5′	00°48.0	16.7′	59.0′
23	163°34.3	29.7	88°43.1	12.5′	01°04.7	16.8′	59.0′
	SD = 16.3′	d = 0.3′	SD = 16.0′				

Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°34.1	S22°29.4	103°14.6	12.5′	N01°21.5	16.8′	59.0′
1	193°33.8	29.1	117°46.1	12.5′	01°38.3	16.8′	59.0′
2	208°33.5	28.8	132°17.6	12.5′	01°55.1	16.7′	59.0′
3	223°33.2	·· 28.5	146°49.1	12.5′	02°11.8	16.8′	59.0′
4	238°33.0	28.2	161°20.5	12.4′	02°28.6	16.7′	59.0′
5	253°32.7	27.9	175°52.0	12.4′	02°45.3	16.8′	59.0′
6	268°32.4	S22°27.6	190°23.4	12.4′	N03°02.1	16.7′	59.0′
7	283°32.1	27.3	204°54.8	12.4′	03°18.8	16.7′	59.0′
8	298°31.9	27.0	219°26.2	12.4′	03°35.5	16.7′	59.1′
9	313°31.6	·· 26.7	233°57.5	12.3′	03°52.2	16.7′	59.1′
10	328°31.3	26.4	248°28.9	12.3′	04°08.9	16.6′	59.1′
11	343°31.0	26.1	263°00.2	12.3′	04°25.5	16.6′	59.1′
12	358°30.8	S22°25.7	277°31.5	12.2′	N04°42.1	16.7′	59.1′
13	13°30.5	25.4	292°02.7	12.2′	04°58.8	16.6′	59.1′
14	28°30.2	25.1	306°33.9	12.2′	05°15.4	16.5′	59.1′
15	43°30.0	·· 24.8	321°05.1	12.2′	05°31.9	16.6′	59.1′
16	58°29.7	24.5	335°36.3	12.1′	05°48.5	16.5′	59.1′
17	73°29.4	24.2	350°07.4	12.1′	06°05.0	16.5′	59.1′
18	88°29.1	S22°23.9	4°38.5	12.0′	N06°21.5	16.5′	59.1′
19	103°28.9	23.6	19°09.5	12.0′	06°38.0	16.4′	59.1′
20	118°28.6	23.2	33°40.5	12.0′	06°54.4	16.4′	59.1′
21	133°28.3	·· 22.9	48°11.5	11.9′	07°10.8	16.3′	59.1′
22	148°28.1	22.6	62°42.4	11.9′	07°27.1	16.4′	59.1′
23	163°27.8	22.3	77°13.3	11.8′	07°43.5	16.3′	59.1′
	SD = 16.3′	d = 0.3′	SD = 16.1′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	08:19	10:29	▬	▬	13:43	15:53
N 70°	08:01	09:42	▬	▬	14:29	16:10
68°	07:47	09:12	11:27	12:44	15:00	16:25
66°	07:35	08:49	10:19	13:52	15:22	16:37
64°	07:25	08:31	09:44	14:27	15:40	16:47
62°	07:16	08:16	09:19	14:52	15:55	16:56
60°	07:08	08:04	08:59	15:12	16:08	17:03
N 58°	07:01	07:53	08:43	15:28	16:19	17:10
56°	06:55	07:43	08:30	15:42	16:28	17:17
54°	06:49	07:35	08:18	15:54	16:37	17:22
52°	06:44	07:27	08:07	16:04	16:44	17:28
50°	06:39	07:20	07:58	16:13	16:51	17:32
45°	06:28	07:05	07:38	16:33	17:07	17:43
N 40°	06:18	06:52	07:22	16:49	17:19	17:53
35°	06:09	06:41	07:09	17:03	17:31	18:02
30°	06:01	06:31	06:57	17:14	17:41	18:10
20°	05:45	06:12	06:36	17:35	17:59	18:26
N 10°	05:30	05:56	06:19	17:53	18:15	18:41
0°	05:13	05:39	06:02	18:09	18:32	18:58
S 10°	04:55	05:22	05:45	18:26	18:49	19:16
20°	04:33	05:02	05:27	18:44	19:09	19:38
30°	04:05	04:38	05:06	19:05	19:32	20:05
35°	03:47	04:24	04:53	19:18	19:47	20:23
40°	03:25	04:06	04:39	19:32	20:04	20:45
45°	02:56	03:45	04:21	19:49	20:26	21:14
S 50°	02:14	03:16	04:00	20:11	20:54	21:56
52°	01:49	03:02	03:50	20:21	21:08	22:20
54°	01:14	02:46	03:38	20:32	21:24	22:55
56°	////	02:25	03:25	20:46	21:45	////
58°	////	01:59	03:09	21:01	22:10	////
S 60°	////	01:20	02:50	21:20	22:48	////

Lat.	**Moonrise** Sat	Sun	Mon	**Moonset** Sat	Sun	Mon
N 72°	11:51	11:12	10:36	20:56	23:18	·· ··
N 70°	11:39	11:09	10:41	21:06	23:17	·· ··
68°	11:28	11:06	10:46	21:13	23:15	·· ··
66°	11:20	11:04	10:50	21:20	23:14	·· ··
64°	11:12	11:02	10:53	21:25	23:14	·· ··
62°	11:06	11:01	10:56	21:30	23:13	·· ··
60°	11:00	10:59	10:58	21:34	23:12	·· ··
N 58°	10:55	10:58	11:01	21:37	23:12	·· ··
56°	10:51	10:57	11:03	21:40	23:11	·· ··
54°	10:47	10:56	11:05	21:43	23:11	·· ··
52°	10:43	10:55	11:06	21:46	23:10	·· ··
50°	10:40	10:54	11:08	21:48	23:10	·· ··
45°	10:33	10:52	11:11	21:53	23:09	·· ··
N 40°	10:27	10:51	11:14	21:57	23:08	·· ··
35°	10:22	10:49	11:17	22:00	23:08	·· ··
30°	10:17	10:48	11:19	22:04	23:07	·· ··
20°	10:09	10:46	11:23	22:09	23:06	·· ··
N 10°	10:02	10:44	11:26	22:13	23:05	23:58
0°	09:55	10:42	11:30	22:18	23:05	23:52
S 10°	09:48	10:41	11:33	22:22	23:04	23:46
20°	09:41	10:39	11:36	22:26	23:03	23:40
30°	09:33	10:37	11:41	22:31	23:02	23:33
35°	09:28	10:36	11:43	22:34	23:01	23:29
40°	09:23	10:34	11:46	22:37	23:01	23:25
45°	09:16	10:33	11:49	22:41	23:00	23:19
S 50°	09:09	10:31	11:53	22:45	22:59	23:13
52°	09:05	10:30	11:55	22:47	22:59	23:10
54°	09:01	10:29	11:57	22:49	22:58	23:07
56°	08:57	10:28	11:59	22:52	22:58	23:04
58°	08:52	10:27	12:01	22:54	22:57	23:00
S 60°	08:47	10:26	12:04	22:57	22:56	22:56

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 5-7 19-39%
04	04:50	05:04	12:05	16:06	03:42	
05	05:17	05:31	12:06	16:54	04:30	
06	05:44	05:57	12:06	17:41	05:17	

January 07, 08, 09 UT (Tue., Wed., Thu.)

	Aries	Venus		Mars		Jupiter		Saturn	
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	106°48.8	130°31.0	S10°54.1	343°54.1	N24°12.3	35°34.1	N21°44.0	119°51.5	S07°43.2
1	121°51.3	145°31.0	53.0	358°57.5	12.5	50°36.8	43.9	134°53.8	43.1
2	136°53.7	160°31.1	51.8	14°01.0	12.8	65°39.6	43.9	149°56.0	43.0
3	151°56.2	175°31.2	·· 50.7	29°04.4	·· 13.1	80°42.3	·· 43.9	164°58.3	·· 43.0
4	166°58.7	190°31.3	49.5	44°07.9	13.4	95°45.0	43.9	180°00.6	42.9
5	182°01.1	205°31.3	48.4	59°11.3	13.6	110°47.7	43.9	195°02.9	42.8
6	197°03.6	220°31.4	S10°47.3	74°14.8	N24°13.9	125°50.4	N21°43.8	210°05.1	S07°42.7
7	212°06.1	235°31.5	46.1	89°18.2	14.2	140°53.1	43.8	225°07.4	42.6
8	227°08.5	250°31.6	45.0	104°21.7	14.4	155°55.8	43.8	240°09.7	42.5
9	242°11.0	265°31.7	·· 43.8	119°25.2	·· 14.7	170°58.5	·· 43.8	255°11.9	·· 42.4
10	257°13.5	280°31.7	42.7	134°28.6	15.0	186°01.2	43.8	270°14.2	42.4
11	272°15.9	295°31.8	41.5	149°32.1	15.2	201°03.9	43.7	285°16.5	42.3
12	287°18.4	310°31.9	S10°40.4	164°35.5	N24°15.5	216°06.6	N21°43.7	300°18.8	S07°42.2
13	302°20.8	325°32.0	39.2	179°39.0	15.8	231°09.3	43.7	315°21.0	42.1
14	317°23.3	340°32.1	38.1	194°42.5	16.1	246°12.0	43.7	330°23.3	42.0
15	332°25.8	355°32.2	·· 36.9	209°45.9	·· 16.3	261°14.7	·· 43.7	345°25.6	·· 41.9
16	347°28.2	10°32.3	35.8	224°49.4	16.6	276°17.4	43.6	0°27.8	41.8
17	2°30.7	25°32.4	34.6	239°52.8	16.9	291°20.1	43.6	15°30.1	41.8
18	17°33.2	40°32.5	S10°33.5	254°56.3	N24°17.1	306°22.8	N21°43.6	30°32.4	S07°41.7
19	32°35.6	55°32.6	32.3	269°59.8	17.4	321°25.5	43.6	45°34.7	41.6
20	47°38.1	70°32.6	31.2	285°03.2	17.7	336°28.3	43.6	60°36.9	41.5
21	62°40.6	85°32.7	·· 30.0	300°06.7	·· 17.9	351°31.0	·· 43.5	75°39.2	·· 41.4
22	77°43.0	100°32.8	28.9	315°10.2	18.2	6°33.7	43.5	90°41.5	41.3
23	92°45.5	115°32.9	27.7	330°13.6	18.5	21°36.4	43.5	105°43.7	41.2
Mer.pass. 16:50		ν 0.1′	d 1.1′	m -4.50	ν 3.5′	d 0.3′	m -1.34	ν 2.7′	d 0.0′ m -2.71	ν 2.3′	d 0.1′ m 1.07

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	107°47.9	130°33.0	S10°26.6	345°17.1	N24°18.7	36°39.1	N21°43.5	120°46.0	S07°41.1
1	122°50.4	145°33.1	25.4	0°20.6	19.0	51°41.8	43.5	135°48.3	41.1
2	137°52.9	160°33.2	24.3	15°24.1	19.3	66°44.5	43.4	150°50.5	41.0
3	152°55.3	175°33.3	·· 23.1	30°27.5	·· 19.5	81°47.2	·· 43.4	165°52.8	·· 40.9
4	167°57.8	190°33.4	22.0	45°31.0	19.8	96°49.9	43.4	180°55.1	40.8
5	183°00.3	205°33.5	20.8	60°34.5	20.1	111°52.6	43.4	195°57.4	40.7
6	198°02.7	220°33.6	S10°19.7	75°37.9	N24°20.3	126°55.3	N21°43.4	210°59.6	S07°40.6
7	213°05.2	235°33.7	18.5	90°41.4	20.6	141°58.0	43.3	226°01.9	40.5
8	228°07.7	250°33.9	17.4	105°44.9	20.9	157°00.7	43.3	241°04.2	40.5
9	243°10.1	265°34.0	·· 16.2	120°48.4	·· 21.1	172°03.4	·· 43.3	256°06.4	·· 40.4
10	258°12.6	280°34.1	15.1	135°51.8	21.4	187°06.1	43.3	271°08.7	40.3
11	273°15.1	295°34.2	13.9	150°55.3	21.7	202°08.8	43.3	286°11.0	40.2
12	288°17.5	310°34.3	S10°12.8	165°58.8	N24°21.9	217°11.5	N21°43.2	301°13.2	S07°40.1
13	303°20.0	325°34.4	11.6	181°02.3	22.2	232°14.2	43.2	316°15.5	40.0
14	318°22.4	340°34.5	10.5	196°05.8	22.5	247°16.8	43.2	331°17.8	39.9
15	333°24.9	355°34.6	·· 09.3	211°09.2	·· 22.7	262°19.5	·· 43.2	346°20.0	·· 39.8
16	348°27.4	10°34.7	08.2	226°12.7	23.0	277°22.2	43.2	1°22.3	39.8
17	3°29.8	25°34.9	07.0	241°16.2	23.3	292°24.9	43.1	16°24.6	39.7
18	18°32.3	40°35.0	S10°05.9	256°19.7	N24°23.5	307°27.6	N21°43.1	31°26.8	S07°39.6
19	33°34.8	55°35.1	04.7	271°23.2	23.8	322°30.3	43.1	46°29.1	39.5
20	48°37.2	70°35.2	03.6	286°26.6	24.1	337°33.0	43.1	61°31.4	39.4
21	63°39.7	85°35.3	·· 02.4	301°30.1	·· 24.3	352°35.7	·· 43.1	76°33.6	·· 39.3
22	78°42.2	100°35.4	01.2	316°33.6	24.6	7°38.4	43.1	91°35.9	39.2
23	93°44.6	115°35.6	00.1	331°37.1	24.9	22°41.1	43.0	106°38.2	39.1
Mer.pass. 16:46		ν 0.1′	d 1.1′	m -4.51	ν 3.5′	d 0.3′	m -1.36	ν 2.7′	d 0.0′ m -2.70	ν 2.3′	d 0.1′ m 1.07

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	108°47.1	130°35.7	S09°58.9	346°40.6	N24°25.1	37°43.8	N21°43.0	121°40.4	S07°39.1
1	123°49.6	145°35.8	57.8	1°44.1	25.4	52°46.5	43.0	136°42.7	39.0
2	138°52.0	160°35.9	56.6	16°47.5	25.6	67°49.2	43.0	151°45.0	38.9
3	153°54.5	175°36.1	·· 55.5	31°51.0	·· 25.9	82°51.9	·· 43.0	166°47.2	·· 38.8
4	168°56.9	190°36.2	54.3	46°54.5	26.2	97°54.6	42.9	181°49.5	38.7
5	183°59.4	205°36.3	53.2	61°58.0	26.4	112°57.3	42.9	196°51.8	38.6
6	199°01.9	220°36.4	S09°52.0	77°01.5	N24°26.7	128°00.0	N21°42.9	211°54.0	S07°38.5
7	214°04.3	235°36.6	50.8	92°05.0	27.0	143°02.7	42.9	226°56.3	38.4
8	229°06.8	250°36.7	49.7	107°08.5	27.2	158°05.3	42.9	241°58.6	38.4
9	244°09.3	265°36.8	·· 48.5	122°12.0	·· 27.5	173°08.0	·· 42.8	257°00.8	·· 38.3
10	259°11.7	280°37.0	47.4	137°15.5	27.7	188°10.7	42.8	272°03.1	38.2
11	274°14.2	295°37.1	46.2	152°18.9	28.0	203°13.4	42.8	287°05.4	38.1
12	289°16.7	310°37.2	S09°45.0	167°22.4	N24°28.3	218°16.1	N21°42.8	302°07.6	S07°38.0
13	304°19.1	325°37.4	43.9	182°25.9	28.5	233°18.8	42.8	317°09.9	37.9
14	319°21.6	340°37.5	42.7	197°29.4	28.8	248°21.5	42.7	332°12.2	37.8
15	334°24.1	355°37.6	·· 41.6	212°32.9	·· 29.1	263°24.2	·· 42.7	347°14.4	·· 37.7
16	349°26.5	10°37.8	40.4	227°36.4	29.3	278°26.9	42.7	2°16.7	37.6
17	4°29.0	25°37.9	39.3	242°39.9	29.6	293°29.6	42.7	17°19.0	37.6
18	19°31.4	40°38.1	S09°38.1	257°43.4	N24°29.8	308°32.2	N21°42.7	32°21.2	S07°37.5
19	34°33.9	55°38.2	36.9	272°46.9	30.1	323°34.9	42.7	47°23.5	37.4
20	49°36.4	70°38.4	35.8	287°50.4	30.4	338°37.6	42.6	62°25.8	37.3
21	64°38.8	85°38.5	·· 34.6	302°53.9	·· 30.6	353°40.3	·· 42.6	77°28.0	·· 37.2
22	79°41.3	100°38.6	33.5	317°57.4	30.9	8°43.0	42.6	92°30.3	37.1
23	94°43.8	115°38.8	32.3	333°00.9	31.1	23°45.7	42.6	107°32.5	37.0
Mer.pass. 16:42		ν 0.1′	d 1.2′	m -4.52	ν 3.5′	d 0.3′	m -1.37	ν 2.7′	d 0.0′ m -2.69	ν 2.3′	d 0.1′ m 1.07

Stars

	SHA	Dec
Alpheratz	357°34.9	29°13.8
Ankaa	353°07.2	-42°10.4
Schedar	349°31.1	56°40.7
Diphda	348°47.3	-17°51.1
Achernar	335°20.1	-57°06.9
Hamal	327°51.1	23°34.9
Polaris	313°46.5	89°22.5
Acamar	315°11.5	-40°12.5
Menkar	314°06.0	4°11.3
Mirfak	308°28.0	49°57.2
Aldebaran	290°39.3	16°33.6
Rigel	281°03.6	-8°10.4
Capella	280°21.5	46°01.5
Bellatrix	278°22.6	6°22.3
Elnath	278°01.5	28°37.7
Alnilam	275°37.4	-1°11.2
Betelgeuse	270°51.8	7°24.7
Canopus	263°51.8	-52°42.5
Sirius	258°25.9	-16°45.0
Adhara	255°05.5	-29°00.4
Procyon	244°50.5	5°09.6
Pollux	243°16.9	27°57.9
Avior	234°14.1	-59°35.2
Suhail	222°45.9	-43°31.9
Miaplacidus	221°37.5	-69°49.0
Alphard	217°47.5	-8°46.0
Regulus	207°34.2	11°50.6
Dubhe	193°40.6	61°36.7
Denebola	182°24.8	14°25.8
Gienah	175°43.5	-17°40.8
Acrux	173°00.0	-63°14.0
Gacrux	171°51.6	-57°14.9
Alioth	166°12.9	55°49.1
Spica	158°22.3	-11°17.5
Alkaid	152°52.1	49°11.0
Hadar	148°36.2	-60°29.4
Menkent	147°57.7	-36°29.4
Arcturus	145°48.0	19°03.0
Rigil Kent.	139°40.6	-60°56.1
Kochab	137°20.3	74°02.8
Zuben'ubi	136°56.2	-16°08.7
Alphecca	126°04.0	26°37.6
Antares	112°16.1	-26°29.2
Atria	107°10.9	-69°04.2
Sabik	102°03.1	-15°45.4
Shaula	96°10.8	-37°07.3
Rasalhague	95°58.9	12°32.4
Eltanin	90°42.7	51°29.0
Kaus Aust.	83°32.9	-34°22.4
Vega	80°33.7	38°48.3
Nunki	75°48.1	-26°16.0
Altair	62°00.3	8°56.0
Peacock	53°06.3	-56°39.4
Deneb	49°26.3	45°22.2
Enif	33°39.1	9°59.4
Al Na'ir	27°33.2	-46°50.6
Fomalhaut	15°14.7	-29°29.6
Scheat	13°45.4	28°13.2
Markab	13°30.1	15°20.4

Jan 07 Tue	SHA	Mer.pass
Venus	23°42.1	15:18
Mars	237°05.2	01:04
Jupiter	288°45.3	21:34
Saturn	13°02.7	15:58

Jan 08 Wed	SHA	Mer.pass
Venus	22°45.1	15:18
Mars	237°29.2	00:59
Jupiter	288°51.1	21:30
Saturn	12°58.1	15:55

Jan 09 Thu	SHA	Mer.pass
Venus	21°48.6	15:17
Mars	237°53.5	00:53
Jupiter	288°56.7	21:25
Saturn	12°53.4	15:51

Horizontal parallax	
Venus:	0.2
Mars:	0.2

h	Sun		Moon				
Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°27.5	S22°22.0	91°44.1	11.8′	N07°59.8	16.2′	59.1′
1	193°27.3	21.6	106°14.9	11.7′	08°16.0	16.2′	59.1′
2	208°27.0	21.3	120°45.7	11.7′	08°32.2	16.2′	59.1′
3	223°26.7	·· 21.0	135°16.4	11.6′	08°48.4	16.1′	59.1′
4	238°26.4	20.7	149°47.0	11.6′	09°04.5	16.1′	59.1′
5	253°26.2	20.4	164°17.6	11.5′	09°20.6	16.1′	59.1′
6	268°25.9	S22°20.0	178°48.2	11.5′	N09°36.7	16.0′	59.1′
7	283°25.6	19.7	193°18.7	11.4′	09°52.7	15.9′	59.1′
8	298°25.4	19.4	207°49.1	11.4′	10°08.6	15.9′	59.1′
9	313°25.1	·· 19.1	222°19.5	11.3′	10°24.5	15.8′	59.1′
10	328°24.8	18.7	236°49.8	11.3′	10°40.3	15.8′	59.1′
11	343°24.6	18.4	251°20.1	11.2′	10°56.1	15.7′	59.1′
12	358°24.3	S22°18.1	265°50.3	11.1′	N11°11.8	15.7′	59.1′
13	13°24.0	17.8	280°20.4	11.1′	11°27.5	15.6′	59.1′
14	28°23.8	17.4	294°50.5	11.0′	11°43.1	15.6′	59.1′
15	43°23.5	·· 17.1	309°20.5	11.0′	11°58.7	15.5′	59.1′
16	58°23.2	16.8	323°50.5	10.9′	12°14.2	15.4′	59.2′
17	73°23.0	16.4	338°20.4	10.8′	12°29.6	15.4′	59.2′
18	88°22.7	S22°16.1	352°50.2	10.8′	N12°45.0	15.3′	59.2′
19	103°22.4	15.8	7°20.0	10.7′	13°00.3	15.2′	59.2′
20	118°22.2	15.4	21°49.7	10.6′	13°15.5	15.2′	59.2′
21	133°21.9	·· 15.1	36°19.3	10.5′	13°30.7	15.1′	59.2′
22	148°21.7	14.8	50°48.8	10.5′	13°45.8	15.0′	59.2′
23	163°21.4	14.4	65°18.3	10.4′	14°00.8	15.0′	59.2′
	SD = 16.3′	d = 0.3′	SD = 16.1′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°21.1	S22°14.1	79°47.7	10.3′	N14°15.8	14.8′	59.2′
1	193°20.9	13.8	94°17.0	10.3′	14°30.6	14.8′	59.2′
2	208°20.6	13.4	108°46.3	10.2′	14°45.4	14.7′	59.2′
3	223°20.3	·· 13.1	123°15.5	10.1′	15°00.1	14.7′	59.2′
4	238°20.1	12.7	137°44.6	10.0′	15°14.8	14.5′	59.2′
5	253°19.8	12.4	152°13.6	9.9′	15°29.3	14.5′	59.2′
6	268°19.5	S22°12.0	166°42.5	9.9′	N15°43.8	14.4′	59.2′
7	283°19.3	11.7	181°11.4	9.8′	15°58.2	14.3′	59.2′
8	298°19.0	11.4	195°40.2	9.7′	16°12.5	14.2′	59.2′
9	313°18.8	·· 11.0	210°08.9	9.6′	16°26.7	14.1′	59.1′
10	328°18.5	10.7	224°37.5	9.5′	16°40.8	14.0′	59.1′
11	343°18.2	10.3	239°06.0	9.5′	16°54.8	14.0′	59.1′
12	358°18.0	S22°10.0	253°34.5	9.4′	N17°08.8	13.8′	59.1′
13	13°17.7	09.6	268°02.9	9.3′	17°22.6	13.7′	59.1′
14	28°17.5	09.3	282°31.1	9.2′	17°36.3	13.7′	59.1′
15	43°17.2	·· 08.9	296°59.3	9.1′	17°50.0	13.5′	59.1′
16	58°16.9	08.6	311°27.4	9.0′	18°03.5	13.5′	59.1′
17	73°16.7	08.2	325°55.5	8.9′	18°17.0	13.3′	59.1′
18	88°16.4	S22°07.9	340°23.4	8.8′	N18°30.3	13.2′	59.1′
19	103°16.2	07.5	354°51.2	8.8′	18°43.5	13.1′	59.1′
20	118°15.9	07.2	9°19.0	8.7′	18°56.6	13.1′	59.1′
21	133°15.6	·· 06.8	23°46.7	8.6′	19°09.7	12.9′	59.1′
22	148°15.4	06.5	38°14.2	8.5′	19°22.6	12.8′	59.1′
23	163°15.1	06.1	52°41.7	8.4′	19°35.4	12.6′	59.1′
	SD = 16.3′	d = 0.3′	SD = 16.1′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°14.9	S22°05.8	67°09.1	8.3′	N19°48.0	12.6′	59.1′
1	193°14.6	05.4	81°36.4	8.2′	20°00.6	12.5′	59.1′
2	208°14.3	05.1	96°03.7	8.1′	20°13.1	12.3′	59.1′
3	223°14.1	·· 04.7	110°30.8	8.0′	20°25.4	12.2′	59.1′
4	238°13.8	04.3	124°57.8	7.9′	20°37.6	12.1′	59.1′
5	253°13.6	04.0	139°24.8	7.8′	20°49.7	11.9′	59.1′
6	268°13.3	S22°03.6	153°51.6	7.8′	N21°01.6	11.9′	59.1′
7	283°13.1	03.3	168°18.4	7.7′	21°13.5	11.7′	59.1′
8	298°12.8	02.9	182°45.0	7.6′	21°25.2	11.6′	59.1′
9	313°12.5	·· 02.5	197°11.6	7.5′	21°36.8	11.4′	59.1′
10	328°12.3	02.2	211°38.1	7.4′	21°48.2	11.3′	59.1′
11	343°12.0	01.8	226°04.5	7.3′	21°59.5	11.2′	59.1′
12	358°11.8	S22°01.5	240°30.8	7.2′	N22°10.7	11.1′	59.1′
13	13°11.5	01.1	254°57.0	7.1′	22°21.8	10.9′	59.1′
14	28°11.3	00.7	269°23.1	7.0′	22°32.7	10.8′	59.0′
15	43°11.0	·· 00.4	283°49.1	6.9′	22°43.5	10.6′	59.0′
16	58°10.8	22°00.0	298°15.0	6.8′	22°54.1	10.5′	59.0′
17	73°10.5	21°59.6	312°40.9	6.8′	23°04.6	10.4′	59.0′
18	88°10.2	S21°59.2	327°06.6	6.7′	N23°15.0	10.2′	59.0′
19	103°10.0	58.9	341°32.3	6.6′	23°25.2	10.0′	59.0′
20	118°09.7	58.5	355°57.9	6.5′	23°35.2	10.0′	59.0′
21	133°09.5	·· 58.1	10°23.4	6.4′	23°45.2	9.7′	59.0′
22	148°09.2	57.8	24°48.8	6.3′	23°54.9	9.6′	59.0′
23	163°09.0	57.4	39°14.1	6.2′	24°04.5	9.5′	59.0′
	SD = 16.3′	d = 0.4′	SD = 16.1′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	08:14	10:18	▬	▬	13:56	16:00
N 70°	07:57	09:36	▬	▬	14:39	16:17
68°	07:44	09:07	11:08	13:07	15:07	16:31
66°	07:32	08:45	10:12	14:02	15:29	16:42
64°	07:22	08:28	09:39	14:35	15:46	16:52
62°	07:14	08:14	09:15	14:59	16:00	17:00
60°	07:06	08:02	08:57	15:17	16:12	17:08
N 58°	07:00	07:51	08:41	15:33	16:23	17:14
56°	06:54	07:42	08:28	15:46	16:32	17:20
54°	06:48	07:33	08:16	15:58	16:40	17:26
52°	06:43	07:26	08:06	16:08	16:48	17:31
50°	06:38	07:19	07:57	16:17	16:55	17:36
45°	06:27	07:04	07:37	16:36	17:10	17:46
N 40°	06:18	06:52	07:22	16:52	17:22	17:56
35°	06:09	06:41	07:09	17:05	17:33	18:04
30°	06:01	06:31	06:57	17:17	17:43	18:12
20°	05:46	06:13	06:37	17:37	18:00	18:28
N 10°	05:31	05:57	06:20	17:54	18:17	18:43
0°	05:15	05:41	06:03	18:10	18:33	18:59
S 10°	04:57	05:24	05:47	18:27	18:50	19:17
20°	04:35	05:04	05:29	18:45	19:09	19:38
30°	04:08	04:41	05:08	19:05	19:33	20:05
35°	03:50	04:26	04:56	19:18	19:47	20:23
40°	03:29	04:09	04:42	19:32	20:04	20:44
45°	03:00	03:48	04:25	19:48	20:25	21:12
S 50°	02:20	03:21	04:04	20:09	20:52	21:53
52°	01:56	03:07	03:54	20:19	21:06	22:16
54°	01:23	02:51	03:42	20:30	21:22	22:48
56°	////	02:31	03:29	20:43	21:41	////
58°	////	02:06	03:14	20:58	22:06	////
S 60°	////	01:31	02:56	21:16	22:40	////

Lat.	**Moonrise** Tue	Wed	Thu	**Moonset** Tue	Wed	Thu
N 72°	09:54	08:44	▭	01:43	04:39	▭
N 70°	10:10	09:25	▭	01:30	04:00	▭
68°	10:23	09:53	08:46	01:19	03:34	06:33
66°	10:34	10:14	09:42	01:10	03:14	05:38
64°	10:43	10:31	10:15	01:03	02:58	05:06
62°	10:51	10:46	10:40	00:57	02:45	04:42
60°	10:58	10:58	11:00	00:52	02:34	04:23
N 58°	11:04	11:08	11:16	00:47	02:25	04:07
56°	11:09	11:18	11:30	00:43	02:17	03:54
54°	11:14	11:26	11:42	00:39	02:09	03:43
52°	11:19	11:33	11:53	00:35	02:03	03:33
50°	11:23	11:40	12:03	00:32	01:57	03:24
45°	11:31	11:55	12:23	00:26	01:44	03:05
N 40°	11:39	12:07	12:40	00:20	01:34	02:49
35°	11:45	12:17	12:54	00:16	01:25	02:36
30°	11:51	12:26	13:06	00:11	01:17	02:25
20°	12:01	12:42	13:27	00:04	01:04	02:06
N 10°	12:10	12:56	13:46	·· ··	00:52	01:50
0°	12:18	13:09	14:03	·· ··	00:42	01:34
S 10°	12:26	13:22	14:21	·· ··	00:31	01:19
20°	12:35	13:36	14:40	·· ··	00:19	01:02
30°	12:46	13:53	15:02	·· ··	00:06	00:44
35°	12:52	14:02	15:14	23:59	·· ··	00:33
40°	12:59	14:13	15:29	23:51	·· ··	00:21
45°	13:07	14:26	15:47	23:41	·· ··	00:06
S 50°	13:16	14:42	16:10	23:29	23:48	·· ··
52°	13:21	14:50	16:20	23:23	23:40	·· ··
54°	13:26	14:58	16:33	23:17	23:31	23:51
56°	13:32	15:08	16:47	23:11	23:21	23:36
58°	13:38	15:19	17:03	23:03	23:09	23:19
S 60°	13:45	15:31	17:23	22:55	22:55	22:58

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 8-10 50-72%
07	06:10	06:23	12:06	18:30	06:05	
08	06:36	06:48	12:07	19:21	06:55	
09	07:01	07:13	12:07	20:17	07:49	

January 10, 11, 12 UT (Fri., Sat., Sun.)

	Aries	Venus		Mars		Jupiter		Saturn	
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	109°46.2	130°38.9	S09°31.1	348°04.4	N24°31.4	38°48.4	N21°42.6	122°34.8	S07°36.9
1	124°48.7	145°39.1	30.0	3°07.9	31.7	53°51.1	42.5	137°37.1	36.8
2	139°51.2	160°39.2	28.8	18°11.4	31.9	68°53.7	42.5	152°39.3	36.8
3	154°53.6	175°39.4	·· 27.6	33°14.9	·· 32.2	83°56.4	·· 42.5	167°41.6	·· 36.7
4	169°56.1	190°39.5	26.5	48°18.4	32.4	98°59.1	42.5	182°43.9	36.6
5	184°58.5	205°39.7	25.3	63°21.9	32.7	114°01.8	42.5	197°46.1	36.5
6	200°01.0	220°39.8	S09°24.2	78°25.4	N24°33.0	129°04.5	N21°42.5	212°48.4	S07°36.4
7	215°03.5	235°40.0	23.0	93°28.9	33.2	144°07.2	42.4	227°50.7	36.3
8	230°05.9	250°40.1	21.8	108°32.4	33.5	159°09.8	42.4	242°52.9	36.2
9	245°08.4	265°40.3	·· 20.7	123°35.9	·· 33.7	174°12.5	·· 42.4	257°55.2	·· 36.1
10	260°10.9	280°40.5	19.5	138°39.4	34.0	189°15.2	42.4	272°57.4	36.0
11	275°13.3	295°40.6	18.3	153°42.9	34.2	204°17.9	42.4	287°59.7	36.0
12	290°15.8	310°40.8	S09°17.2	168°46.4	N24°34.5	219°20.6	N21°42.3	303°02.0	S07°35.9
13	305°18.3	325°40.9	16.0	183°49.9	34.8	234°23.3	42.3	318°04.2	35.8
14	320°20.7	340°41.1	14.9	198°53.4	35.0	249°25.9	42.3	333°06.5	35.7
15	335°23.2	355°41.3	·· 13.7	213°56.9	·· 35.3	264°28.6	·· 42.3	348°08.8	·· 35.6
16	350°25.7	10°41.4	12.5	229°00.4	35.5	279°31.3	42.3	3°11.0	35.5
17	5°28.1	25°41.6	11.4	244°03.9	35.8	294°34.0	42.3	18°13.3	35.4
18	20°30.6	40°41.8	S09°10.2	259°07.4	N24°36.0	309°36.7	N21°42.2	33°15.5	S07°35.3
19	35°33.0	55°41.9	09.0	274°11.0	36.3	324°39.3	42.2	48°17.8	35.2
20	50°35.5	70°42.1	07.9	289°14.5	36.6	339°42.0	42.2	63°20.1	35.2
21	65°38.0	85°42.3	·· 06.7	304°18.0	·· 36.8	354°44.7	·· 42.2	78°22.3	·· 35.1
22	80°40.4	100°42.4	05.5	319°21.5	37.1	9°47.4	42.2	93°24.6	35.0
23	95°42.9	115°42.6	04.4	334°25.0	37.3	24°50.1	42.2	108°26.9	34.9
Mer.pass. 16:38		ν 0.1′	d 1.2′	m -4.53	ν 3.5′	d 0.3′	m -1.39	ν 2.7′	d 0.0′ m -2.69	ν 2.3′	d 0.1′ m 1.08

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	110°45.4	130°42.8	S09°03.2	349°28.5	N24°37.6	39°52.7	N21°42.1	123°29.1	S07°34.8
1	125°47.8	145°42.9	02.0	4°32.0	37.8	54°55.4	42.1	138°31.4	34.7
2	140°50.3	160°43.1	09°00.9	19°35.5	38.1	69°58.1	42.1	153°33.6	34.6
3	155°52.8	175°43.3	08°59.7	34°39.0	·· 38.3	85°00.8	·· 42.1	168°35.9	·· 34.5
4	170°55.2	190°43.5	58.5	49°42.5	38.6	100°03.5	42.1	183°38.2	34.4
5	185°57.7	205°43.6	57.4	64°46.1	38.9	115°06.1	42.1	198°40.4	34.3
6	201°00.2	220°43.8	S08°56.2	79°49.6	N24°39.1	130°08.8	N21°42.0	213°42.7	S07°34.3
7	216°02.6	235°44.0	55.0	94°53.1	39.4	145°11.5	42.0	228°44.9	34.2
8	231°05.1	250°44.2	53.9	109°56.6	39.6	160°14.2	42.0	243°47.2	34.1
9	246°07.5	265°44.4	·· 52.7	125°00.1	·· 39.9	175°16.8	·· 42.0	258°49.5	·· 34.0
10	261°10.0	280°44.5	51.5	140°03.6	40.1	190°19.5	42.0	273°51.7	33.9
11	276°12.5	295°44.7	50.4	155°07.1	40.4	205°22.2	42.0	288°54.0	33.8
12	291°14.9	310°44.9	S08°49.2	170°10.7	N24°40.6	220°24.9	N21°41.9	303°56.2	S07°33.7
13	306°17.4	325°45.1	48.0	185°14.2	40.9	235°27.5	41.9	318°58.5	33.6
14	321°19.9	340°45.3	46.9	200°17.7	41.1	250°30.2	41.9	334°00.8	33.5
15	336°22.3	355°45.5	·· 45.7	215°21.2	·· 41.4	265°32.9	·· 41.9	349°03.0	·· 33.4
16	351°24.8	10°45.6	44.5	230°24.7	41.6	280°35.6	41.9	4°05.3	33.3
17	6°27.3	25°45.8	43.4	245°28.2	41.9	295°38.2	41.9	19°07.5	33.3
18	21°29.7	40°46.0	S08°42.2	260°31.8	N24°42.1	310°40.9	N21°41.8	34°09.8	S07°33.2
19	36°32.2	55°46.2	41.0	275°35.3	42.4	325°43.6	41.8	49°12.1	33.1
20	51°34.7	70°46.4	39.8	290°38.8	42.6	340°46.2	41.8	64°14.3	33.0
21	66°37.1	85°46.6	·· 38.7	305°42.3	·· 42.9	355°48.9	·· 41.8	79°16.6	·· 32.9
22	81°39.6	100°46.8	37.5	320°45.8	43.1	10°51.6	41.8	94°18.8	32.8
23	96°42.0	115°47.0	36.3	335°49.3	43.4	25°54.3	41.8	109°21.1	32.7
Mer.pass. 16:34		ν 0.2′	d 1.2′	m -4.54	ν 3.5′	d 0.3′	m -1.41	ν 2.7′	d 0.0′ m -2.68	ν 2.3′	d 0.1′ m 1.08

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	111°44.5	130°47.2	S08°35.2	350°52.9	N24°43.6	40°56.9	N21°41.7	124°23.4	S07°32.6
1	126°47.0	145°47.4	34.0	5°56.4	43.9	55°59.6	41.7	139°25.6	32.5
2	141°49.4	160°47.6	32.8	20°59.9	44.1	71°02.3	41.7	154°27.9	32.4
3	156°51.9	175°47.8	·· 31.7	36°03.4	·· 44.4	86°04.9	·· 41.7	169°30.1	·· 32.3
4	171°54.4	190°48.0	30.5	51°06.9	44.6	101°07.6	41.7	184°32.4	32.3
5	186°56.8	205°48.2	29.3	66°10.5	44.9	116°10.3	41.7	199°34.6	32.2
6	201°59.3	220°48.4	S08°28.1	81°14.0	N24°45.1	131°12.9	N21°41.6	214°36.9	S07°32.1
7	217°01.8	235°48.6	27.0	96°17.5	45.4	146°15.6	41.6	229°39.2	32.0
8	232°04.2	250°48.8	25.8	111°21.0	45.6	161°18.3	41.6	244°41.4	31.9
9	247°06.7	265°49.0	·· 24.6	126°24.6	·· 45.9	176°21.0	·· 41.6	259°43.7	·· 31.8
10	262°09.2	280°49.2	23.5	141°28.1	46.1	191°23.6	41.6	274°45.9	31.7
11	277°11.6	295°49.4	22.3	156°31.6	46.4	206°26.3	41.6	289°48.2	31.6
12	292°14.1	310°49.6	S08°21.1	171°35.1	N24°46.6	221°29.0	N21°41.5	304°50.4	S07°31.5
13	307°16.5	325°49.8	19.9	186°38.7	46.9	236°31.6	41.5	319°52.7	31.4
14	322°19.0	340°50.0	18.8	201°42.2	47.1	251°34.3	41.5	334°55.0	31.3
15	337°21.5	355°50.3	·· 17.6	216°45.7	·· 47.4	266°37.0	·· 41.5	349°57.2	·· 31.3
16	352°23.9	10°50.5	16.4	231°49.2	47.6	281°39.6	41.5	4°59.5	31.2
17	7°26.4	25°50.7	15.3	246°52.8	47.8	296°42.3	41.5	20°01.7	31.1
18	22°28.9	40°50.9	S08°14.1	261°56.3	N24°48.1	311°44.9	N21°41.4	35°04.0	S07°31.0
19	37°31.3	55°51.1	12.9	276°59.8	48.3	326°47.6	41.4	50°06.2	30.9
20	52°33.8	70°51.3	11.7	292°03.3	48.6	341°50.3	41.4	65°08.5	30.8
21	67°36.3	85°51.6	·· 10.6	307°06.9	·· 48.8	356°52.9	·· 41.4	80°10.8	·· 30.7
22	82°38.7	100°51.8	09.4	322°10.4	49.1	11°55.6	41.4	95°13.0	30.6
23	97°41.2	115°52.0	08.2	337°13.9	49.3	26°58.3	41.4	110°15.3	30.5
Mer.pass. 16:30		ν 0.2′	d 1.2′	m -4.55	ν 3.5′	d 0.2′	m -1.42	ν 2.7′	d 0.0′ m -2.67	ν 2.3′	d 0.1′ m 1.08

Stars

	SHA	Dec
Alpheratz	357°34.9	29°13.8
Ankaa	353°07.2	-42°10.4
Schedar	349°31.1	56°40.7
Diphda	348°47.3	-17°51.1
Achernar	335°20.1	-57°06.9
Hamal	327°51.1	23°34.9
Polaris	313°47.5	89°22.5
Acamar	315°11.6	-40°12.5
Menkar	314°06.0	4°11.3
Mirfak	308°28.0	49°57.2
Aldebaran	290°39.3	16°33.6
Rigel	281°03.6	-8°10.4
Capella	280°21.4	46°01.5
Bellatrix	278°22.6	6°22.3
Elnath	278°01.5	28°37.7
Alnilam	275°37.4	-1°11.2
Betelgeuse	270°51.8	7°24.7
Canopus	263°51.8	-52°42.6
Sirius	258°25.9	-16°45.1
Adhara	255°05.5	-29°00.4
Procyon	244°50.5	5°09.6
Pollux	243°16.9	27°57.9
Avior	234°14.1	-59°35.3
Suhail	222°45.9	-43°31.9
Miaplacidus	221°37.5	-69°49.0
Alphard	217°47.5	-8°46.0
Regulus	207°34.2	11°50.6
Dubhe	193°40.6	61°36.7
Denebola	182°24.8	14°25.8
Gienah	175°43.5	-17°40.8
Acrux	173°00.0	-63°14.0
Gacrux	171°51.5	-57°14.9
Alioth	166°12.9	55°49.1
Spica	158°22.3	-11°17.5
Alkaid	152°52.1	49°11.0
Hadar	148°36.2	-60°29.4
Menkent	147°57.7	-36°29.4
Arcturus	145°48.0	19°02.9
Rigil Kent.	139°40.5	-60°56.1
Kochab	137°20.2	74°02.8
Zuben'ubi	136°56.2	-16°08.7
Alphecca	126°03.9	26°37.6
Antares	112°16.1	-26°29.2
Atria	107°10.8	-69°04.2
Sabik	102°03.1	-15°45.4
Shaula	96°10.7	-37°07.3
Rasalhague	95°58.9	12°32.4
Eltanin	90°42.7	51°28.9
Kaus Aust.	83°32.9	-34°22.4
Vega	80°33.6	38°48.3
Nunki	75°48.1	-26°16.0
Altair	62°00.3	8°56.0
Peacock	53°06.3	-56°39.4
Deneb	49°26.3	45°22.2
Enif	33°39.1	9°59.4
Al Na'ir	27°33.2	-46°50.6
Fomalhaut	15°14.7	-29°29.6
Scheat	13°45.4	28°13.2
Markab	13°30.1	15°20.4

Jan 10 Fri	SHA	Mer.pass
Venus	20°52.7	15:17
Mars	238°18.2	00:48
Jupiter	289°02.1	21:21
Saturn	12°48.6	15:47

Jan 11 Sat	SHA	Mer.pass
Venus	19°57.4	15:17
Mars	238°43.1	00:42
Jupiter	289°07.4	21:17
Saturn	12°43.7	15:44

Jan 12 Sun	SHA	Mer.pass
Venus	19°02.7	15:17
Mars	239°08.4	00:36
Jupiter	289°12.4	21:12
Saturn	12°38.8	15:40

Horizontal parallax	
Venus:	0.2
Mars:	0.2

h	Sun		Moon				
Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°08.7	S21°57.0	53°39.3	6.1′	N24°14.0	9.3′	59.0′
1	193°08.5	56.6	68°04.5	6.1′	24°23.3	9.2′	59.0′
2	208°08.2	56.3	82°29.5	6.0′	24°32.5	9.0′	59.0′
3	223°08.0	·· 55.9	96°54.5	5.9′	24°41.5	8.8′	59.0′
4	238°07.7	55.5	111°19.4	5.8′	24°50.3	8.7′	58.9′
5	253°07.5	55.1	125°44.2	5.7′	24°59.0	8.5′	58.9′
6	268°07.2	S21°54.8	140°09.0	5.7′	N25°07.5	8.4′	58.9′
7	283°07.0	54.4	154°33.6	5.6′	25°15.9	8.2′	58.9′
8	298°06.7	54.0	168°58.2	5.5′	25°24.1	8.0′	58.9′
9	313°06.5	·· 53.6	183°22.7	5.4′	25°32.1	7.9′	58.9′
10	328°06.2	53.3	197°47.1	5.4′	25°40.0	7.7′	58.9′
11	343°06.0	52.9	212°11.5	5.3′	25°47.7	7.5′	58.9′
12	358°05.7	S21°52.5	226°35.8	5.2′	N25°55.2	7.4′	58.9′
13	13°05.5	52.1	241°00.0	5.1′	26°02.6	7.2′	58.9′
14	28°05.2	51.7	255°24.1	5.1′	26°09.8	7.0′	58.9′
15	43°05.0	·· 51.3	269°48.2	5.0′	26°16.8	6.9′	58.8′
16	58°04.7	51.0	284°12.2	4.9′	26°23.7	6.7′	58.8′
17	73°04.5	50.6	298°36.1	4.9′	26°30.4	6.5′	58.8′
18	88°04.2	S21°50.2	313°00.0	4.8′	N26°36.9	6.3′	58.8′
19	103°04.0	49.8	327°23.8	4.8′	26°43.2	6.1′	58.8′
20	118°03.7	49.4	341°47.6	4.7′	26°49.3	6.0′	58.8′
21	133°03.5	·· 49.0	356°11.3	4.7′	26°55.3	5.8′	58.8′
22	148°03.2	48.6	10°35.0	4.6′	27°01.1	5.6′	58.8′
23	163°03.0	48.2	24°58.6	4.5′	27°06.7	5.4′	58.8′
	SD = 16.3′	d = 0.4′	SD = 16.1′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°02.8	S21°47.8	39°22.1	4.5′	N27°12.1	5.3′	58.7′
1	193°02.5	47.5	53°45.6	4.5′	27°17.4	5.1′	58.7′
2	208°02.3	47.1	68°09.1	4.4′	27°22.5	4.8′	58.7′
3	223°02.0	·· 46.7	82°32.5	4.4′	27°27.3	4.7′	58.7′
4	238°01.8	46.3	96°55.8	4.3′	27°32.0	4.6′	58.7′
5	253°01.5	45.9	111°19.2	4.3′	27°36.6	4.3′	58.7′
6	268°01.3	S21°45.5	125°42.4	4.3′	N27°40.9	4.1′	58.7′
7	283°01.0	45.1	140°05.7	4.2′	27°45.0	4.0′	58.7′
8	298°00.8	44.7	154°28.9	4.2′	27°49.0	3.8′	58.6′
9	313°00.5	·· 44.3	168°52.1	4.2′	27°52.8	3.6′	58.6′
10	328°00.3	43.9	183°15.3	4.1′	27°56.4	3.4′	58.6′
11	343°00.1	43.5	197°38.4	4.1′	27°59.8	3.2′	58.6′
12	357°59.8	S21°43.1	212°01.5	4.1′	N28°03.0	3.0′	58.6′
13	12°59.6	42.7	226°24.6	4.1′	28°06.0	2.8′	58.6′
14	27°59.3	42.3	240°47.7	4.1′	28°08.8	2.7′	58.6′
15	42°59.1	·· 41.9	255°10.7	4.0′	28°11.5	2.4′	58.5′
16	57°58.8	41.5	269°33.8	4.0′	28°13.9	2.3′	58.5′
17	72°58.6	41.1	283°56.8	4.0′	28°16.2	2.0′	58.5′
18	87°58.4	S21°40.7	298°19.8	4.0′	N28°18.2	1.9′	58.5′
19	102°58.1	40.3	312°42.8	4.0′	28°20.1	1.7′	58.5′
20	117°57.9	39.9	327°05.8	4.0′	28°21.8	1.5′	58.5′
21	132°57.6	·· 39.5	341°28.8	4.0′	28°23.3	1.3′	58.4′
22	147°57.4	39.1	355°51.9	4.0′	28°24.6	1.1′	58.4′
23	162°57.2	38.7	10°14.9	4.0′	28°25.7	1.0′	58.4′
	SD = 16.3′	d = 0.4′	SD = 16.0′				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	177°56.9	S21°38.2	24°37.9	4.0′	N28°26.7	0.7′	58.4′
1	192°56.7	37.8	39°00.9	4.1′	28°27.4	0.5′	58.4′
2	207°56.4	37.4	53°24.0	4.1′	28°27.9	0.4′	58.4′
3	222°56.2	·· 37.0	67°47.1	4.1′	28°28.3	0.2′	58.3′
4	237°56.0	36.6	82°10.1	4.1′	28°28.5	0.0′	58.3′
5	252°55.7	36.2	96°33.3	4.1′	28°28.5	0.3′	58.3′
6	267°55.5	S21°35.8	110°56.4	4.2′	N28°28.2	0.4′	58.3′
7	282°55.3	35.4	125°19.5	4.2′	28°27.8	0.5′	58.3′
8	297°55.0	35.0	139°42.7	4.2′	28°27.3	0.8′	58.2′
9	312°54.8	·· 34.5	154°05.9	4.2′	28°26.5	1.0′	58.2′
10	327°54.5	34.1	168°29.2	4.3′	28°25.5	1.1′	58.2′
11	342°54.3	33.7	182°52.5	4.3′	28°24.4	1.4′	58.2′
12	357°54.1	S21°33.3	197°15.8	4.4′	N28°23.0	1.5′	58.2′
13	12°53.8	32.9	211°39.2	4.4′	28°21.5	1.7′	58.2′
14	27°53.6	32.5	226°02.6	4.5′	28°19.8	1.9′	58.1′
15	42°53.4	·· 32.0	240°26.0	4.5′	28°17.9	2.1′	58.1′
16	57°53.1	31.6	254°49.5	4.6′	28°15.8	2.2′	58.1′
17	72°52.9	31.2	269°13.1	4.6′	28°13.6	2.5′	58.1′
18	87°52.7	S21°30.8	283°36.7	4.7′	N28°11.1	2.6′	58.1′
19	102°52.4	30.4	298°00.4	4.7′	28°08.5	2.8′	58.0′
20	117°52.2	29.9	312°24.1	4.8′	28°05.7	3.0′	58.0′
21	132°51.9	·· 29.5	326°47.9	4.9′	28°02.7	3.1′	58.0′
22	147°51.7	29.1	341°11.7	4.9′	27°59.6	3.4′	58.0′
23	162°51.5	28.7	355°35.7	5.0′	27°56.2	3.5′	58.0′
	SD = 16.3′	d = 0.4′	SD = 15.9′				

Lat.	**Twilight** Naut.	**Twilight** Civil	**Sunrise**	**Sunset**	**Twilight** Civil	**Twilight** Naut.
N 72°	08:09	10:06	▬	▬	14:10	16:08
N 70°	07:53	09:28	▬	▬	14:49	16:24
68°	07:40	09:01	10:51	13:25	15:15	16:37
66°	07:29	08:41	10:04	14:13	15:36	16:48
64°	07:20	08:24	09:34	14:43	15:52	16:57
62°	07:11	08:11	09:11	15:05	16:06	17:05
60°	07:04	07:59	08:53	15:24	16:17	17:12
N 58°	06:58	07:49	08:38	15:39	16:28	17:19
56°	06:52	07:40	08:25	15:51	16:37	17:24
54°	06:47	07:32	08:14	16:02	16:45	17:30
52°	06:42	07:25	08:04	16:12	16:52	17:35
50°	06:37	07:18	07:55	16:21	16:59	17:39
45°	06:27	07:03	07:36	16:40	17:13	17:49
N 40°	06:18	06:51	07:21	16:55	17:25	17:59
35°	06:09	06:41	07:08	17:08	17:36	18:07
30°	06:01	06:31	06:57	17:19	17:45	18:15
20°	05:47	06:14	06:37	17:39	18:02	18:30
N 10°	05:32	05:58	06:20	17:56	18:18	18:44
0°	05:16	05:42	06:04	18:12	18:34	19:00
S 10°	04:59	05:25	05:48	18:28	18:51	19:17
20°	04:38	05:06	05:31	18:45	19:09	19:38
30°	04:11	04:43	05:10	19:05	19:32	20:05
35°	03:54	04:29	04:58	19:17	19:46	20:22
40°	03:32	04:13	04:45	19:31	20:03	20:43
45°	03:05	03:52	04:28	19:47	20:23	21:10
S 50°	02:26	03:25	04:08	20:08	20:50	21:49
52°	02:04	03:12	03:58	20:17	21:03	22:11
54°	01:33	02:56	03:47	20:28	21:18	22:40
56°	00:35	02:38	03:35	20:40	21:37	23:33
58°	////	02:14	03:20	20:55	22:00	////
S 60°	////	01:42	03:03	21:12	22:31	////

Lat.	**Moonrise** Fri	Sat	Sun	**Moonset** Fri	Sat	Sun
N 72°	▭	▭	▭	▭	▭	▭
N 70°	▭	▭	▭	▭	▭	▭
68°	▭	▭	▭	▭	▭	▭
66°	▭	▭	▭	▭	▭	▭
64°	09:38	▭	▭	07:43	▭	▭
62°	10:33	10:16	▭	06:48	09:12	▭
60°	11:06	11:25	12:18	06:16	08:03	09:20
N 58°	11:31	12:00	12:57	05:52	07:28	08:41
56°	11:51	12:26	13:24	05:32	07:03	08:14
54°	12:07	12:46	13:45	05:16	06:43	07:52
52°	12:22	13:03	14:03	05:02	06:26	07:34
50°	12:34	13:18	14:18	04:50	06:11	07:19
45°	13:00	13:48	14:49	04:25	05:42	06:48
N 40°	13:21	14:11	15:12	04:05	05:19	06:25
35°	13:38	14:31	15:32	03:49	05:00	06:05
30°	13:53	14:47	15:49	03:35	04:43	05:48
20°	14:19	15:16	16:17	03:11	04:16	05:19
N 10°	14:41	15:40	16:41	02:50	03:52	04:55
0°	15:02	16:03	17:04	02:31	03:30	04:32
S 10°	15:22	16:25	17:27	02:11	03:08	04:09
20°	15:45	16:50	17:51	01:51	02:45	03:44
30°	16:11	17:18	18:19	01:27	02:18	03:16
35°	16:27	17:35	18:36	01:13	02:02	02:59
40°	16:45	17:55	18:55	00:57	01:43	02:39
45°	17:07	18:19	19:19	00:38	01:20	02:15
S 50°	17:35	18:50	19:49	00:15	00:52	01:43
52°	17:48	19:05	20:04	00:03	00:38	01:28
54°	18:04	19:24	20:22	·· ··	00:21	01:10
56°	18:23	19:46	20:43	·· ··	00:02	00:48
58°	18:46	20:14	21:09	23:39	·· ··	00:19
S 60°	19:17	20:55	21:46	23:07	23:38	·· ··

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 11-13 82-95%
10	07:25	07:37	12:08	21:16	08:46	
11	07:49	08:01	12:08	22:17	09:46	
12	08:12	08:24	12:08	23:18	10:48	

January 13, 14, 15 UT (Mon., Tue., Wed.)

	Aries	Venus		Mars		Jupiter		Saturn	
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	112°43.7	130°52.2	S08°07.0	352°17.4	N24°49.6	42°00.9	N21°41.4	125°17.5	S07°30.4
1	127°46.1	145°52.4	05.9	7°21.0	49.8	57°03.6	41.3	140°19.8	30.3
2	142°48.6	160°52.7	04.7	22°24.5	50.0	72°06.3	41.3	155°22.0	30.2
3	157°51.0	175°52.9	·· 03.5	37°28.0	·· 50.3	87°08.9	·· 41.3	170°24.3	·· 30.1
4	172°53.5	190°53.1	02.3	52°31.6	50.5	102°11.6	41.3	185°26.6	30.1
5	187°56.0	205°53.3	01.2	67°35.1	50.8	117°14.2	41.3	200°28.8	30.0
6	202°58.4	220°53.6	S08°00.0	82°38.6	N24°51.0	132°16.9	N21°41.3	215°31.1	S07°29.9
7	218°00.9	235°53.8	07°58.8	97°42.1	51.3	147°19.6	41.2	230°33.3	29.8
8	233°03.4	250°54.0	57.7	112°45.7	51.5	162°22.2	41.2	245°35.6	29.7
9	248°05.8	265°54.3	·· 56.5	127°49.2	·· 51.7	177°24.9	·· 41.2	260°37.8	·· 29.6
10	263°08.3	280°54.5	55.3	142°52.7	52.0	192°27.5	41.2	275°40.1	29.5
11	278°10.8	295°54.7	54.1	157°56.3	52.2	207°30.2	41.2	290°42.3	29.4
12	293°13.2	310°55.0	S07°53.0	172°59.8	N24°52.5	222°32.9	N21°41.2	305°44.6	S07°29.3
13	308°15.7	325°55.2	51.8	188°03.3	52.7	237°35.5	41.2	320°46.8	29.2
14	323°18.2	340°55.4	50.6	203°06.8	52.9	252°38.2	41.1	335°49.1	29.1
15	338°20.6	355°55.7	·· 49.4	218°10.4	·· 53.2	267°40.8	·· 41.1	350°51.4	·· 29.0
16	353°23.1	10°55.9	48.2	233°13.9	53.4	282°43.5	41.1	5°53.6	28.9
17	8°25.5	25°56.1	47.1	248°17.4	53.7	297°46.1	41.1	20°55.9	28.9
18	23°28.0	40°56.4	S07°45.9	263°21.0	N24°53.9	312°48.8	N21°41.1	35°58.1	S07°28.8
19	38°30.5	55°56.6	44.7	278°24.5	54.1	327°51.5	41.1	51°00.4	28.7
20	53°32.9	70°56.9	43.5	293°28.0	54.4	342°54.1	41.0	66°02.6	28.6
21	68°35.4	85°57.1	·· 42.4	308°31.6	·· 54.6	357°56.8	·· 41.0	81°04.9	·· 28.5
22	83°37.9	100°57.4	41.2	323°35.1	54.9	12°59.4	41.0	96°07.1	28.4
23	98°40.3	115°57.6	40.0	338°38.6	55.1	28°02.1	41.0	111°09.4	28.3
Mer.pass. 16:26		ν 0.2′	d 1.2′	m -4.56	ν 3.5′	d 0.2′	m -1.43	ν 2.7′	d 0.0′ m -2.67	ν 2.3′	d 0.1′ m 1.08

Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	113°42.8	130°57.8	S07°38.8	353°42.2	N24°55.3	43°04.7	N21°41.0	126°11.6	S07°28.2
1	128°45.3	145°58.1	37.7	8°45.7	55.6	58°07.4	41.0	141°13.9	28.1
2	143°47.7	160°58.3	36.5	23°49.2	55.8	73°10.0	41.0	156°16.1	28.0
3	158°50.2	175°58.6	·· 35.3	38°52.8	·· 56.0	88°12.7	·· 40.9	171°18.4	·· 27.9
4	173°52.7	190°58.8	34.1	53°56.3	56.3	103°15.4	40.9	186°20.7	27.8
5	188°55.1	205°59.1	33.0	68°59.8	56.5	118°18.0	40.9	201°22.9	27.7
6	203°57.6	220°59.4	S07°31.8	84°03.4	N24°56.8	133°20.7	N21°40.9	216°25.2	S07°27.6
7	219°00.0	235°59.6	30.6	99°06.9	57.0	148°23.3	40.9	231°27.4	27.6
8	234°02.5	250°59.9	29.4	114°10.4	57.2	163°26.0	40.9	246°29.7	27.5
9	249°05.0	266°00.1	·· 28.2	129°14.0	·· 57.5	178°28.6	·· 40.9	261°31.9	·· 27.4
10	264°07.4	281°00.4	27.1	144°17.5	57.7	193°31.3	40.8	276°34.2	27.3
11	279°09.9	296°00.6	25.9	159°21.0	57.9	208°33.9	40.8	291°36.4	27.2
12	294°12.4	311°00.9	S07°24.7	174°24.6	N24°58.2	223°36.6	N21°40.8	306°38.7	S07°27.1
13	309°14.8	326°01.2	23.5	189°28.1	58.4	238°39.2	40.8	321°40.9	27.0
14	324°17.3	341°01.4	22.4	204°31.6	58.6	253°41.9	40.8	336°43.2	26.9
15	339°19.8	356°01.7	·· 21.2	219°35.2	·· 58.9	268°44.5	·· 40.8	351°45.4	·· 26.8
16	354°22.2	11°01.9	20.0	234°38.7	59.1	283°47.2	40.8	6°47.7	26.7
17	9°24.7	26°02.2	18.8	249°42.3	59.3	298°49.8	40.7	21°49.9	26.6
18	24°27.1	41°02.5	S07°17.6	264°45.8	N24°59.6	313°52.5	N21°40.7	36°52.2	S07°26.5
19	39°29.6	56°02.7	16.5	279°49.3	24°59.8	328°55.1	40.7	51°54.4	26.4
20	54°32.1	71°03.0	15.3	294°52.9	25°00.0	343°57.8	40.7	66°56.7	26.3
21	69°34.5	86°03.3	·· 14.1	309°56.4	·· 00.3	359°00.4	·· 40.7	81°58.9	·· 26.2
22	84°37.0	101°03.5	12.9	324°59.9	00.5	14°03.1	40.7	97°01.2	26.1
23	99°39.5	116°03.8	11.8	340°03.5	00.7	29°05.7	40.7	112°03.4	26.1
Mer.pass. 16:22		ν 0.2′	d 1.2′	m -4.57	ν 3.5′	d 0.2′	m -1.44	ν 2.7′	d 0.0′ m -2.66	ν 2.3′	d 0.1′ m 1.09

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	114°41.9	131°04.1	S07°10.6	355°07.0	N25°01.0	44°08.3	N21°40.7	127°05.7	S07°26.0
1	129°44.4	146°04.4	09.4	10°10.5	01.2	59°11.0	40.6	142°07.9	25.9
2	144°46.9	161°04.6	08.2	25°14.1	01.4	74°13.6	40.6	157°10.2	25.8
3	159°49.3	176°04.9	·· 07.0	40°17.6	·· 01.6	89°16.3	·· 40.6	172°12.4	·· 25.7
4	174°51.8	191°05.2	05.9	55°21.1	01.9	104°18.9	40.6	187°14.7	25.6
5	189°54.3	206°05.5	04.7	70°24.7	02.1	119°21.6	40.6	202°16.9	25.5
6	204°56.7	221°05.8	S07°03.5	85°28.2	N25°02.3	134°24.2	N21°40.6	217°19.2	S07°25.4
7	219°59.2	236°06.0	02.3	100°31.8	02.6	149°26.9	40.6	232°21.4	25.3
8	235°01.6	251°06.3	01.1	115°35.3	02.8	164°29.5	40.5	247°23.7	25.2
9	250°04.1	266°06.6	07°00.0	130°38.8	·· 03.0	179°32.2	·· 40.5	262°25.9	·· 25.1
10	265°06.6	281°06.9	06°58.8	145°42.4	03.2	194°34.8	40.5	277°28.2	25.0
11	280°09.0	296°07.2	57.6	160°45.9	03.5	209°37.4	40.5	292°30.4	24.9
12	295°11.5	311°07.4	S06°56.4	175°49.4	N25°03.7	224°40.1	N21°40.5	307°32.7	S07°24.8
13	310°14.0	326°07.7	55.2	190°53.0	03.9	239°42.7	40.5	322°34.9	24.7
14	325°16.4	341°08.0	54.1	205°56.5	04.2	254°45.4	40.5	337°37.2	24.6
15	340°18.9	356°08.3	·· 52.9	221°00.1	·· 04.4	269°48.0	·· 40.5	352°39.4	·· 24.5
16	355°21.4	11°08.6	51.7	236°03.6	04.6	284°50.6	40.4	7°41.7	24.5
17	10°23.8	26°08.9	50.5	251°07.1	04.8	299°53.3	40.4	22°43.9	24.4
18	25°26.3	41°09.2	S06°49.3	266°10.7	N25°05.1	314°55.9	N21°40.4	37°46.2	S07°24.3
19	40°28.8	56°09.5	48.2	281°14.2	05.3	329°58.6	40.4	52°48.4	24.2
20	55°31.2	71°09.8	47.0	296°17.7	05.5	345°01.2	40.4	67°50.7	24.1
21	70°33.7	86°10.1	·· 45.8	311°21.3	·· 05.7	0°03.8	·· 40.4	82°52.9	·· 24.0
22	85°36.1	101°10.4	44.6	326°24.8	06.0	15°06.5	40.4	97°55.2	23.9
23	100°38.6	116°10.7	43.4	341°28.4	06.2	30°09.1	40.4	112°57.4	23.8
Mer.pass. 16:19		ν 0.3′	d 1.2′	m -4.58	ν 3.5′	d 0.2′	m -1.45	ν 2.6′	d 0.0′ m -2.65	ν 2.3′	d 0.1′ m 1.09

Stars

	SHA	Dec
Alpheratz	357°34.9	29°13.8
Ankaa	353°07.2	-42°10.4
Schedar	349°31.2	56°40.7
Diphda	348°47.3	-17°51.1
Achernar	335°20.1	-57°06.9
Hamal	327°51.1	23°34.9
Polaris	313°48.5	89°22.5
Acamar	315°11.6	-40°12.5
Menkar	314°06.0	4°11.3
Mirfak	308°28.0	49°57.2
Aldebaran	290°39.3	16°33.6
Rigel	281°03.6	-8°10.4
Capella	280°21.4	46°01.5
Bellatrix	278°22.6	6°22.3
Elnath	278°01.5	28°37.7
Alnilam	275°37.4	-1°11.2
Betelgeuse	270°51.7	7°24.7
Canopus	263°51.8	-52°42.6
Sirius	258°25.9	-16°45.1
Adhara	255°05.5	-29°00.4
Procyon	244°50.5	5°09.6
Pollux	243°16.9	27°57.9
Avior	234°14.1	-59°35.3
Suhail	222°45.9	-43°31.9
Miaplacidus	221°37.4	-69°49.0
Alphard	217°47.4	-8°46.0
Regulus	207°34.2	11°50.6
Dubhe	193°40.5	61°36.7
Denebola	182°24.8	14°25.8
Gienah	175°43.5	-17°40.8
Acrux	172°59.9	-63°14.0
Gacrux	171°51.5	-57°15.0
Alioth	166°12.8	55°49.1
Spica	158°22.3	-11°17.5
Alkaid	152°52.0	49°11.0
Hadar	148°36.1	-60°29.4
Menkent	147°57.7	-36°29.4
Arcturus	145°48.0	19°02.9
Rigil Kent.	139°40.5	-60°56.1
Kochab	137°20.2	74°02.8
Zuben'ubi	136°56.1	-16°08.7
Alphecca	126°03.9	26°37.6
Antares	112°16.1	-26°29.2
Atria	107°10.7	-69°04.1
Sabik	102°03.0	-15°45.4
Shaula	96°10.7	-37°07.3
Rasalhague	95°58.8	12°32.4
Eltanin	90°42.7	51°28.9
Kaus Aust.	83°32.9	-34°22.4
Vega	80°33.6	38°48.3
Nunki	75°48.1	-26°16.0
Altair	62°00.3	8°56.0
Peacock	53°06.3	-56°39.4
Deneb	49°26.3	45°22.2
Enif	33°39.1	9°59.4
Al Na'ir	27°33.2	-46°50.6
Fomalhaut	15°14.7	-29°29.6
Scheat	13°45.4	28°13.2
Markab	13°30.1	15°20.4

Jan 13 Mon	SHA	Mer.pass
Venus	18°08.6	15:16
Mars	239°33.8	00:31
Jupiter	289°17.3	21:08
Saturn	12°33.9	15:36

Jan 14 Tue	SHA	Mer.pass
Venus	17°15.1	15:16
Mars	239°59.4	00:25
Jupiter	289°21.9	21:04
Saturn	12°28.8	15:33

Jan 15 Wed	SHA	Mer.pass
Venus	16°22.2	15:15
Mars	240°25.1	00:19
Jupiter	289°26.4	21:00
Saturn	12°23.8	15:29

Horizontal parallax	
Venus:	0.2
Mars:	0.2

DUT1 = UT1-UTC = +0.0435 sec ΔT = TT-UT1 = +69.1405 sec

2025 January 13 to Jan. 15 UT

h	Sun		Moon				
Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	177°51.2	S21°28.2	9°59.6	5.1′	N27°52.7	3.7′	57.9′
1	192°51.0	27.8	24°23.7	5.1′	27°49.0	3.8′	57.9′
2	207°50.8	27.4	38°47.8	5.2′	27°45.2	4.1′	57.9′
3	222°50.5	·· 27.0	53°12.0	5.3′	27°41.1	4.2′	57.9′
4	237°50.3	26.5	67°36.3	5.4′	27°36.9	4.4′	57.8′
5	252°50.1	26.1	82°00.6	5.4′	27°32.5	4.5′	57.8′
6	267°49.9	S21°25.7	96°25.1	5.5′	N27°28.0	4.7′	57.8′
7	282°49.6	25.2	110°49.6	5.6′	27°23.3	4.9′	57.8′
8	297°49.4	24.8	125°14.2	5.7′	27°18.4	5.1′	57.8′
9	312°49.2	·· 24.4	139°38.9	5.8′	27°13.3	5.2′	57.7′
10	327°48.9	23.9	154°03.6	5.9′	27°08.1	5.4′	57.7′
11	342°48.7	23.5	168°28.5	5.9′	27°02.7	5.5′	57.7′
12	357°48.5	S21°23.1	182°53.4	6.0′	N26°57.2	5.7′	57.7′
13	12°48.2	22.6	197°18.5	6.1′	26°51.5	5.9′	57.6′
14	27°48.0	22.2	211°43.6	6.2′	26°45.6	6.0′	57.6′
15	42°47.8	·· 21.8	226°08.8	6.3′	26°39.6	6.2′	57.6′
16	57°47.6	21.3	240°34.2	6.4′	26°33.4	6.3′	57.6′
17	72°47.3	20.9	254°59.6	6.5′	26°27.1	6.5′	57.5′
18	87°47.1	S21°20.5	269°25.1	6.6′	N26°20.6	6.7′	57.5′
19	102°46.9	20.0	283°50.7	6.7′	26°13.9	6.7′	57.5′
20	117°46.6	19.6	298°16.4	6.8′	26°07.2	7.0′	57.5′
21	132°46.4	·· 19.1	312°42.3	6.9′	26°00.2	7.1′	57.5′
22	147°46.2	18.7	327°08.2	7.0′	25°53.1	7.2′	57.4′
23	162°46.0	18.2	341°34.2	7.1′	25°45.9	7.4′	57.4′
	SD = 16.3′	d = 0.4′	SD = 15.8′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	177°45.7	S21°17.8	356°00.4	7.2′	N25°38.5	7.5′	57.4′
1	192°45.5	17.4	10°26.6	7.4′	25°31.0	7.7′	57.4′
2	207°45.3	16.9	24°53.0	7.5′	25°23.3	7.8′	57.3′
3	222°45.1	·· 16.5	39°19.4	7.6′	25°15.5	7.9′	57.3′
4	237°44.8	16.0	53°46.0	7.7′	25°07.6	8.1′	57.3′
5	252°44.6	15.6	68°12.7	7.8′	24°59.5	8.2′	57.3′
6	267°44.4	S21°15.1	82°39.5	7.9′	N24°51.3	8.4′	57.2′
7	282°44.2	14.7	97°06.4	8.0′	24°42.9	8.5′	57.2′
8	297°43.9	14.2	111°33.4	8.1′	24°34.4	8.6′	57.2′
9	312°43.7	·· 13.8	126°00.5	8.2′	24°25.8	8.7′	57.2′
10	327°43.5	13.3	140°27.7	8.4′	24°17.1	8.9′	57.1′
11	342°43.3	12.9	154°55.1	8.5′	24°08.2	9.0′	57.1′
12	357°43.0	S21°12.4	169°22.6	8.6′	N23°59.2	9.1′	57.1′
13	12°42.8	12.0	183°50.1	8.7′	23°50.1	9.3′	57.1′
14	27°42.6	11.5	198°17.8	8.8′	23°40.8	9.3′	57.0′
15	42°42.4	·· 11.1	212°45.7	8.9′	23°31.5	9.5′	57.0′
16	57°42.1	10.6	227°13.6	9.0′	23°22.0	9.6′	57.0′
17	72°41.9	10.2	241°41.6	9.2′	23°12.4	9.7′	57.0′
18	87°41.7	S21°09.7	256°09.8	9.3′	N23°02.7	9.9′	56.9′
19	102°41.5	09.3	270°38.0	9.4′	22°52.8	9.9′	56.9′
20	117°41.3	08.8	285°06.4	9.5′	22°42.9	10.1′	56.9′
21	132°41.0	·· 08.3	299°34.9	9.6′	22°32.8	10.1′	56.8′
22	147°40.8	07.9	314°03.5	9.7′	22°22.7	10.3′	56.8′
23	162°40.6	07.4	328°32.3	9.8′	22°12.4	10.4′	56.8′
	SD = 16.3′	d = 0.4′	SD = 15.6′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	177°40.4	S21°07.0	343°01.1	10.0′	N22°02.0	10.5′	56.8′
1	192°40.2	06.5	357°30.1	10.1′	21°51.5	10.6′	56.7′
2	207°39.9	06.0	11°59.1	10.2′	21°40.9	10.6′	56.7′
3	222°39.7	·· 05.6	26°28.3	10.3′	21°30.3	10.8′	56.7′
4	237°39.5	05.1	40°57.6	10.4′	21°19.5	10.9′	56.7′
5	252°39.3	04.7	55°27.0	10.5′	21°08.6	11.0′	56.6′
6	267°39.1	S21°04.2	69°56.6	10.6′	N20°57.6	11.1′	56.6′
7	282°38.8	03.7	84°26.2	10.8′	20°46.5	11.1′	56.6′
8	297°38.6	03.3	98°56.0	10.9′	20°35.4	11.3′	56.6′
9	312°38.4	·· 02.8	113°25.8	11.0′	20°24.1	11.3′	56.5′
10	327°38.2	02.3	127°55.8	11.1′	20°12.8	11.5′	56.5′
11	342°38.0	01.9	142°25.9	11.2′	20°01.3	11.5′	56.5′
12	357°37.8	S21°01.4	156°56.1	11.3′	N19°49.8	11.6′	56.5′
13	12°37.5	00.9	171°26.4	11.4′	19°38.2	11.7′	56.4′
14	27°37.3	00.5	185°56.8	11.5′	19°26.5	11.8′	56.4′
15	42°37.1	21°00.0	200°27.4	11.6′	19°14.7	11.8′	56.4′
16	57°36.9	20°59.5	214°58.0	11.7′	19°02.9	12.0′	56.3′
17	72°36.7	59.0	229°28.7	11.9′	18°50.9	12.0′	56.3′
18	87°36.5	S20°58.6	243°59.6	12.0′	N18°38.9	12.1′	56.3′
19	102°36.3	58.1	258°30.6	12.1′	18°26.8	12.1′	56.3′
20	117°36.0	57.6	273°01.6	12.2′	18°14.7	12.3′	56.2′
21	132°35.8	·· 57.2	287°32.8	12.3′	18°02.4	12.3′	56.2′
22	147°35.6	56.7	302°04.1	12.4′	17°50.1	12.4′	56.2′
23	162°35.4	56.2	316°35.4	12.5′	17°37.7	12.4′	56.2′
	SD = 16.3′	d = 0.5′	SD = 15.5′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	08:02	09:55	▬	▬	14:25	16:17
N 70°	07:47	09:20	▬	▬	14:59	16:32
68°	07:35	08:55	10:36	13:42	15:24	16:44
66°	07:25	08:36	09:55	14:24	15:43	16:54
64°	07:16	08:20	09:27	14:52	15:59	17:03
62°	07:08	08:07	09:06	15:13	16:12	17:10
60°	07:02	07:56	08:49	15:30	16:23	17:17
N 58°	06:56	07:46	08:34	15:44	16:33	17:23
56°	06:50	07:37	08:22	15:57	16:41	17:29
54°	06:45	07:30	08:11	16:07	16:49	17:34
52°	06:40	07:23	08:02	16:17	16:56	17:39
50°	06:36	07:16	07:53	16:25	17:02	17:43
45°	06:26	07:02	07:35	16:43	17:16	17:53
N 40°	06:17	06:51	07:20	16:58	17:28	18:01
35°	06:09	06:40	07:08	17:11	17:38	18:09
30°	06:01	06:31	06:57	17:22	17:48	18:17
20°	05:47	06:14	06:38	17:41	18:04	18:31
N 10°	05:33	05:59	06:21	17:57	18:20	18:46
0°	05:17	05:43	06:05	18:13	18:35	19:01
S 10°	05:00	05:27	05:50	18:29	18:51	19:18
20°	04:40	05:09	05:33	18:45	19:10	19:38
30°	04:14	04:46	05:13	19:05	19:32	20:04
35°	03:57	04:32	05:01	19:17	19:45	20:21
40°	03:36	04:16	04:48	19:30	20:02	20:41
45°	03:10	03:56	04:32	19:46	20:21	21:08
S 50°	02:32	03:30	04:12	20:05	20:47	21:45
52°	02:11	03:17	04:03	20:15	21:00	22:05
54°	01:44	03:03	03:52	20:25	21:14	22:32
56°	00:59	02:45	03:40	20:37	21:32	23:14
58°	////	02:23	03:26	20:51	21:54	////
S 60°	////	01:53	03:10	21:07	22:22	////

Lat.	**Moonrise** Mon	Tue	Wed	**Moonset** Mon	Tue	Wed
N 72°	▭	▭	▭	▭	▭	▭
N 70°	▭	▭	14:46	▭	▭	12:44
68°	▭	▭	15:46	▭	▭	11:43
66°	▭	13:28	16:20	▭	12:14	11:08
64°	▭	14:37	16:45	▭	11:04	10:42
62°	13:06	15:12	17:04	10:37	10:28	10:22
60°	13:51	15:37	17:20	09:51	10:02	10:05
N 58°	14:21	15:57	17:33	09:22	09:41	09:51
56°	14:44	16:14	17:44	08:59	09:24	09:39
54°	15:02	16:28	17:54	08:40	09:10	09:29
52°	15:18	16:40	18:03	08:24	08:57	09:19
50°	15:31	16:51	18:11	08:10	08:46	09:11
45°	15:59	17:13	18:27	07:42	08:22	08:53
N 40°	16:20	17:31	18:41	07:20	08:03	08:38
35°	16:38	17:46	18:52	07:01	07:47	08:25
30°	16:54	17:59	19:02	06:45	07:34	08:14
20°	17:20	18:21	19:19	06:18	07:10	07:55
N 10°	17:42	18:40	19:34	05:55	06:49	07:38
0°	18:03	18:58	19:48	05:33	06:30	07:22
S 10°	18:24	19:16	20:02	05:11	06:10	07:07
20°	18:46	19:34	20:16	04:47	05:50	06:50
30°	19:12	19:56	20:33	04:19	05:25	06:30
35°	19:27	20:09	20:43	04:03	05:11	06:18
40°	19:44	20:23	20:54	03:44	04:54	06:05
45°	20:05	20:40	21:07	03:21	04:34	05:49
S 50°	20:32	21:01	21:22	02:51	04:08	05:29
52°	20:45	21:11	21:30	02:36	03:56	05:20
54°	20:59	21:22	21:38	02:19	03:42	05:09
56°	21:16	21:35	21:47	01:58	03:25	04:57
58°	21:37	21:50	21:57	01:32	03:05	04:43
S 60°	22:02	22:07	22:08	00:55	02:40	04:26

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 14-16 99-99%
13	08:35	08:46	12:09	–:–	11:48	
14	08:57	09:08	12:09	00:17	12:44	
15	09:18	09:29	12:09	01:10	13:35	

January 16, 17, 18 UT (Thu., Fri., Sat.)

	Aries	Venus		Mars		Jupiter		Saturn	
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	115°41.1	131°11.0	S06°42.3	356°31.9	N25°06.4	45°11.8	N21°40.3	127°59.7	S07°23.7
1	130°43.5	146°11.3	41.1	11°35.4	06.6	60°14.4	40.3	143°01.9	23.6
2	145°46.0	161°11.6	39.9	26°39.0	06.8	75°17.0	40.3	158°04.2	23.5
3	160°48.5	176°11.9	·· 38.7	41°42.5	·· 07.1	90°19.7	·· 40.3	173°06.4	·· 23.4
4	175°50.9	191°12.2	37.5	56°46.0	07.3	105°22.3	40.3	188°08.7	23.3
5	190°53.4	206°12.5	36.3	71°49.6	07.5	120°24.9	40.3	203°10.9	23.2
6	205°55.9	221°12.8	S06°35.2	86°53.1	N25°07.7	135°27.6	N21°40.3	218°13.2	S07°23.1
7	220°58.3	236°13.1	34.0	101°56.7	08.0	150°30.2	40.3	233°15.4	23.0
8	236°00.8	251°13.4	32.8	117°00.2	08.2	165°32.9	40.2	248°17.7	22.9
9	251°03.3	266°13.7	·· 31.6	132°03.7	·· 08.4	180°35.5	·· 40.2	263°19.9	·· 22.8
10	266°05.7	281°14.0	30.4	147°07.3	08.6	195°38.1	40.2	278°22.2	22.7
11	281°08.2	296°14.3	29.3	162°10.8	08.8	210°40.8	40.2	293°24.4	22.6
12	296°10.6	311°14.6	S06°28.1	177°14.3	N25°09.1	225°43.4	N21°40.2	308°26.7	S07°22.5
13	311°13.1	326°14.9	26.9	192°17.9	09.3	240°46.0	40.2	323°28.9	22.5
14	326°15.6	341°15.3	25.7	207°21.4	09.5	255°48.7	40.2	338°31.1	22.4
15	341°18.0	356°15.6	·· 24.5	222°25.0	·· 09.7	270°51.3	·· 40.2	353°33.4	·· 22.3
16	356°20.5	11°15.9	23.4	237°28.5	09.9	285°53.9	40.1	8°35.6	22.2
17	11°23.0	26°16.2	22.2	252°32.0	10.2	300°56.6	40.1	23°37.9	22.1
18	26°25.4	41°16.5	S06°21.0	267°35.6	N25°10.4	315°59.2	N21°40.1	38°40.1	S07°22.0
19	41°27.9	56°16.8	19.8	282°39.1	10.6	331°01.8	40.1	53°42.4	21.9
20	56°30.4	71°17.2	18.6	297°42.6	10.8	346°04.5	40.1	68°44.6	21.8
21	71°32.8	86°17.5	·· 17.4	312°46.2	·· 11.0	1°07.1	·· 40.1	83°46.9	·· 21.7
22	86°35.3	101°17.8	16.3	327°49.7	11.2	16°09.7	40.1	98°49.1	21.6
23	101°37.7	116°18.1	15.1	342°53.3	11.5	31°12.3	40.1	113°51.4	21.5
Mer.pass. 16:15		ν 0.3′	d 1.2′	m -4.59	ν 3.5′	d 0.2′	m -1.45	ν 2.6′	d 0.0′ m -2.65	ν 2.2′	d 0.1′ m 1.09

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	116°40.2	131°18.5	S06°13.9	357°56.8	N25°11.7	46°15.0	N21°40.0	128°53.6	S07°21.4
1	131°42.7	146°18.8	12.7	13°00.3	11.9	61°17.6	40.0	143°55.9	21.3
2	146°45.1	161°19.1	11.5	28°03.9	12.1	76°20.2	40.0	158°58.1	21.2
3	161°47.6	176°19.4	·· 10.4	43°07.4	·· 12.3	91°22.9	·· 40.0	174°00.3	·· 21.1
4	176°50.1	191°19.8	09.2	58°10.9	12.5	106°25.5	40.0	189°02.6	21.0
5	191°52.5	206°20.1	08.0	73°14.5	12.7	121°28.1	40.0	204°04.8	20.9
6	206°55.0	221°20.4	S06°06.8	88°18.0	N25°13.0	136°30.7	N21°40.0	219°07.1	S07°20.8
7	221°57.5	236°20.8	05.6	103°21.5	13.2	151°33.4	40.0	234°09.3	20.7
8	236°59.9	251°21.1	04.4	118°25.1	13.4	166°36.0	40.0	249°11.6	20.6
9	252°02.4	266°21.4	·· 03.3	133°28.6	·· 13.6	181°38.6	·· 39.9	264°13.8	·· 20.5
10	267°04.9	281°21.8	02.1	148°32.2	13.8	196°41.3	39.9	279°16.1	20.4
11	282°07.3	296°22.1	06°00.9	163°35.7	14.0	211°43.9	39.9	294°18.3	20.3
12	297°09.8	311°22.4	S05°59.7	178°39.2	N25°14.2	226°46.5	N21°39.9	309°20.6	S07°20.2
13	312°12.2	326°22.8	58.5	193°42.8	14.5	241°49.1	39.9	324°22.8	20.2
14	327°14.7	341°23.1	57.3	208°46.3	14.7	256°51.8	39.9	339°25.0	20.1
15	342°17.2	356°23.5	·· 56.2	223°49.8	·· 14.9	271°54.4	·· 39.9	354°27.3	·· 20.0
16	357°19.6	11°23.8	55.0	238°53.4	15.1	286°57.0	39.9	9°29.5	19.9
17	12°22.1	26°24.1	53.8	253°56.9	15.3	301°59.6	39.9	24°31.8	19.8
18	27°24.6	41°24.5	S05°52.6	269°00.4	N25°15.5	317°02.3	N21°39.8	39°34.0	S07°19.7
19	42°27.0	56°24.8	51.4	284°04.0	15.7	332°04.9	39.8	54°36.3	19.6
20	57°29.5	71°25.2	50.2	299°07.5	15.9	347°07.5	39.8	69°38.5	19.5
21	72°32.0	86°25.5	·· 49.1	314°11.0	·· 16.1	2°10.1	·· 39.8	84°40.7	·· 19.4
22	87°34.4	101°25.9	47.9	329°14.6	16.3	17°12.7	39.8	99°43.0	19.3
23	102°36.9	116°26.2	46.7	344°18.1	16.5	32°15.4	39.8	114°45.2	19.2
Mer.pass. 16:11		ν 0.3′	d 1.2′	m -4.60	ν 3.5′	d 0.2′	m -1.44	ν 2.6′	d 0.0′ m -2.64	ν 2.2′	d 0.1′ m 1.09

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	117°39.4	131°26.6	S05°45.5	359°21.6	N25°16.8	47°18.0	N21°39.8	129°47.5	S07°19.1
1	132°41.8	146°26.9	44.3	14°25.2	17.0	62°20.6	39.8	144°49.7	19.0
2	147°44.3	161°27.3	43.2	29°28.7	17.2	77°23.2	39.8	159°52.0	18.9
3	162°46.7	176°27.6	·· 42.0	44°32.2	·· 17.4	92°25.9	·· 39.7	174°54.2	·· 18.8
4	177°49.2	191°28.0	40.8	59°35.8	17.6	107°28.5	39.7	189°56.5	18.7
5	192°51.7	206°28.4	39.6	74°39.3	17.8	122°31.1	39.7	204°58.7	18.6
6	207°54.1	221°28.7	S05°38.4	89°42.8	N25°18.0	137°33.7	N21°39.7	220°00.9	S07°18.5
7	222°56.6	236°29.1	37.2	104°46.4	18.2	152°36.3	39.7	235°03.2	18.4
8	237°59.1	251°29.4	36.1	119°49.9	18.4	167°38.9	39.7	250°05.4	18.3
9	253°01.5	266°29.8	·· 34.9	134°53.4	·· 18.6	182°41.6	·· 39.7	265°07.7	·· 18.2
10	268°04.0	281°30.2	33.7	149°57.0	18.8	197°44.2	39.7	280°09.9	18.1
11	283°06.5	296°30.5	32.5	165°00.5	19.0	212°46.8	39.7	295°12.2	18.0
12	298°08.9	311°30.9	S05°31.3	180°04.0	N25°19.2	227°49.4	N21°39.7	310°14.4	S07°17.9
13	313°11.4	326°31.3	30.1	195°07.6	19.4	242°52.0	39.6	325°16.6	17.8
14	328°13.8	341°31.6	29.0	210°11.1	19.6	257°54.7	39.6	340°18.9	17.7
15	343°16.3	356°32.0	·· 27.8	225°14.6	·· 19.8	272°57.3	·· 39.6	355°21.1	·· 17.6
16	358°18.8	11°32.4	26.6	240°18.2	20.0	287°59.9	39.6	10°23.4	17.5
17	13°21.2	26°32.7	25.4	255°21.7	20.2	303°02.5	39.6	25°25.6	17.4
18	28°23.7	41°33.1	S05°24.2	270°25.2	N25°20.4	318°05.1	N21°39.6	40°27.8	S07°17.3
19	43°26.2	56°33.5	23.0	285°28.7	20.6	333°07.7	39.6	55°30.1	17.2
20	58°28.6	71°33.9	21.9	300°32.3	20.8	348°10.3	39.6	70°32.3	17.1
21	73°31.1	86°34.2	·· 20.7	315°35.8	·· 21.0	3°13.0	·· 39.6	85°34.6	·· 17.0
22	88°33.6	101°34.6	19.5	330°39.3	21.2	18°15.6	39.6	100°36.8	16.9
23	103°36.0	116°35.0	18.3	345°42.9	21.4	33°18.2	39.5	115°39.1	16.8
Mer.pass. 16:07		ν 0.4′	d 1.2′	m -4.61	ν 3.5′	d 0.2′	m -1.42	ν 2.6′	d 0.0′ m -2.63	ν 2.2′	d 0.1′ m 1.09

Stars

	SHA	Dec
Alpheratz	357°34.9	29°13.8
Ankaa	353°07.2	-42°10.4
Schedar	349°31.2	56°40.7
Diphda	348°47.3	-17°51.1
Achernar	335°20.1	-57°06.9
Hamal	327°51.1	23°34.9
Polaris	313°50.0	89°22.5
Acamar	315°11.6	-40°12.5
Menkar	314°06.0	4°11.3
Mirfak	308°28.0	49°57.2
Aldebaran	290°39.3	16°33.6
Rigel	281°03.6	-8°10.4
Capella	280°21.4	46°01.5
Bellatrix	278°22.6	6°22.3
Elnath	278°01.5	28°37.8
Alnilam	275°37.4	-1°11.2
Betelgeuse	270°51.7	7°24.7
Canopus	263°51.9	-52°42.6
Sirius	258°25.9	-16°45.1
Adhara	255°05.5	-29°00.4
Procyon	244°50.5	5°09.6
Pollux	243°16.9	27°57.9
Avior	234°14.1	-59°35.3
Suhail	222°45.9	-43°31.9
Miaplacidus	221°37.4	-69°49.0
Alphard	217°47.4	-8°46.1
Regulus	207°34.1	11°50.6
Dubhe	193°40.5	61°36.7
Denebola	182°24.8	14°25.8
Gienah	175°43.4	-17°40.8
Acrux	172°59.9	-63°14.0
Gacrux	171°51.5	-57°15.0
Alioth	166°12.8	55°49.1
Spica	158°22.3	-11°17.5
Alkaid	152°52.0	49°11.0
Hadar	148°36.1	-60°29.4
Menkent	147°57.6	-36°29.5
Arcturus	145°47.9	19°02.9
Rigil Kent.	139°40.4	-60°56.1
Kochab	137°20.1	74°02.7
Zuben'ubi	136°56.1	-16°08.7
Alphecca	126°03.9	26°37.6
Antares	112°16.1	-26°29.2
Atria	107°10.7	-69°04.1
Sabik	102°03.0	-15°45.4
Shaula	96°10.7	-37°07.3
Rasalhague	95°58.8	12°32.4
Eltanin	90°42.7	51°28.9
Kaus Aust.	83°32.9	-34°22.4
Vega	80°33.6	38°48.2
Nunki	75°48.1	-26°16.0
Altair	62°00.3	8°56.0
Peacock	53°06.3	-56°39.4
Deneb	49°26.3	45°22.2
Enif	33°39.1	9°59.3
Al Na'ir	27°33.2	-46°50.6
Fomalhaut	15°14.7	-29°29.6
Scheat	13°45.4	28°13.2
Markab	13°30.1	15°20.4

Jan 16 Thu	SHA	Mer.pass
Venus	15°29.9	15:15
Mars	240°50.8	00:14
Jupiter	289°30.7	20:56
Saturn	12°18.6	15:26

Jan 17 Fri	SHA	Mer.pass
Venus	14°38.2	15:14
Mars	241°16.6	00:08
Jupiter	289°34.8	20:51
Saturn	12°13.4	15:22

Jan 18 Sat	SHA	Mer.pass
Venus	13°47.2	15:14
Mars	241°42.3	00:03
Jupiter	289°38.6	20:47
Saturn	12°08.1	15:19

Horizontal parallax	
Venus:	0.2
Mars:	0.2

h	Sun		Moon				
Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	177°35.2	S20°55.7	331°06.9	12.6′	N17°25.3	12.5′	56.1′
1	192°35.0	55.3	345°38.5	12.7′	17°12.8	12.6′	56.1′
2	207°34.8	54.8	0°10.2	12.8′	17°00.2	12.6′	56.1′
3	222°34.6	·· 54.3	14°41.9	12.9′	16°47.6	12.8′	56.1′
4	237°34.3	53.8	29°13.8	13.0′	16°34.8	12.7′	56.0′
5	252°34.1	53.3	43°45.8	13.1′	16°22.1	12.9′	56.0′
6	267°33.9	S20°52.9	58°17.9	13.2′	N16°09.2	12.8′	56.0′
7	282°33.7	52.4	72°50.0	13.3′	15°56.4	13.0′	56.0′
8	297°33.5	51.9	87°22.3	13.4′	15°43.4	13.0′	55.9′
9	312°33.3	·· 51.4	101°54.6	13.4′	15°30.4	13.1′	55.9′
10	327°33.1	50.9	116°27.1	13.5′	15°17.3	13.1′	55.9′
11	342°32.9	50.4	130°59.6	13.6′	15°04.2	13.1′	55.9′
12	357°32.7	S20°50.0	145°32.3	13.7′	N14°51.1	13.3′	55.8′
13	12°32.5	49.5	160°05.0	13.8′	14°37.8	13.2′	55.8′
14	27°32.2	49.0	174°37.8	13.9′	14°24.6	13.4′	55.8′
15	42°32.0	·· 48.5	189°10.7	14.0′	14°11.2	13.3′	55.8′
16	57°31.8	48.0	203°43.7	14.1′	13°57.9	13.4′	55.7′
17	72°31.6	47.5	218°16.8	14.2′	13°44.5	13.5′	55.7′
18	87°31.4	S20°47.0	232°49.9	14.2′	N13°31.0	13.5′	55.7′
19	102°31.2	46.5	247°23.1	14.3′	13°17.5	13.5′	55.7′
20	117°31.0	46.1	261°56.5	14.4′	13°04.0	13.6′	55.6′
21	132°30.8	·· 45.6	276°29.9	14.5′	12°50.4	13.6′	55.6′
22	147°30.6	45.1	291°03.4	14.6′	12°36.8	13.7′	55.6′
23	162°30.4	44.6	305°36.9	14.6′	12°23.1	13.7′	55.6′
	SD = 16.3′	d = 0.5′	SD = 15.3′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	177°30.2	S20°44.1	320°10.6	14.7′	N12°09.4	13.7′	55.5′
1	192°30.0	43.6	334°44.3	14.8′	11°55.7	13.8′	55.5′
2	207°29.8	43.1	349°18.1	14.9′	11°41.9	13.8′	55.5′
3	222°29.6	·· 42.6	3°51.9	14.9′	11°28.1	13.9′	55.5′
4	237°29.4	42.1	18°25.9	15.0′	11°14.2	13.9′	55.4′
5	252°29.1	41.6	32°59.9	15.1′	11°00.3	13.9′	55.4′
6	267°28.9	S20°41.1	47°34.0	15.2′	N10°46.4	13.9′	55.4′
7	282°28.7	40.6	62°08.1	15.2′	10°32.5	14.0′	55.4′
8	297°28.5	40.1	76°42.4	15.3′	10°18.5	14.0′	55.4′
9	312°28.3	·· 39.6	91°16.7	15.4′	10°04.5	14.0′	55.3′
10	327°28.1	39.1	105°51.0	15.4′	09°50.5	14.0′	55.3′
11	342°27.9	38.6	120°25.4	15.5′	09°36.5	14.1′	55.3′
12	357°27.7	S20°38.1	134°59.9	15.6′	N09°22.4	14.1′	55.3′
13	12°27.5	37.6	149°34.5	15.6′	09°08.3	14.1′	55.2′
14	27°27.3	37.1	164°09.1	15.7′	08°54.2	14.2′	55.2′
15	42°27.1	·· 36.6	178°43.8	15.7′	08°40.0	14.1′	55.2′
16	57°26.9	36.1	193°18.5	15.8′	08°25.9	14.2′	55.2′
17	72°26.7	35.6	207°53.3	15.8′	08°11.7	14.2′	55.2′
18	87°26.5	S20°35.1	222°28.1	15.9′	N07°57.5	14.2′	55.1′
19	102°26.3	34.6	237°03.0	16.0′	07°43.3	14.3′	55.1′
20	117°26.1	34.1	251°38.0	16.0′	07°29.0	14.2′	55.1′
21	132°25.9	·· 33.6	266°13.0	16.1′	07°14.8	14.3′	55.1′
22	147°25.7	33.1	280°48.1	16.1′	07°00.5	14.3′	55.0′
23	162°25.5	32.6	295°23.2	16.2′	06°46.2	14.3′	55.0′
	SD = 16.3′	d = 0.5′	SD = 15.1′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	177°25.3	S20°32.1	309°58.4	16.2′	N06°31.9	14.3′	55.0′
1	192°25.1	31.5	324°33.6	16.3′	06°17.6	14.3′	55.0′
2	207°24.9	31.0	339°08.8	16.3′	06°03.3	14.4′	55.0′
3	222°24.7	·· 30.5	353°44.1	16.4′	05°48.9	14.3′	54.9′
4	237°24.5	30.0	8°19.5	16.4′	05°34.6	14.4′	54.9′
5	252°24.3	29.5	22°54.9	16.4′	05°20.2	14.4′	54.9′
6	267°24.1	S20°29.0	37°30.3	16.5′	N05°05.8	14.3′	54.9′
7	282°23.9	28.5	52°05.8	16.5′	04°51.5	14.4′	54.9′
8	297°23.8	28.0	66°41.3	16.6′	04°37.1	14.4′	54.9′
9	312°23.6	·· 27.4	81°16.9	16.6′	04°22.7	14.4′	54.8′
10	327°23.4	26.9	95°52.5	16.6′	04°08.3	14.4′	54.8′
11	342°23.2	26.4	110°28.1	16.7′	03°53.9	14.4′	54.8′
12	357°23.0	S20°25.9	125°03.8	16.7′	N03°39.5	14.4′	54.8′
13	12°22.8	25.4	139°39.5	16.7′	03°25.1	14.4′	54.8′
14	27°22.6	24.9	154°15.2	16.8′	03°10.7	14.4′	54.7′
15	42°22.4	·· 24.3	168°51.0	16.8′	02°56.3	14.4′	54.7′
16	57°22.2	23.8	183°26.8	16.8′	02°41.9	14.4′	54.7′
17	72°22.0	23.3	198°02.6	16.9′	02°27.5	14.4′	54.7′
18	87°21.8	S20°22.8	212°38.5	16.9′	N02°13.1	14.4′	54.7′
19	102°21.6	22.3	227°14.4	16.9′	01°58.7	14.4′	54.7′
20	117°21.4	21.7	241°50.3	16.9′	01°44.3	14.4′	54.6′
21	132°21.2	·· 21.2	256°26.2	17.0′	01°29.9	14.4′	54.6′
22	147°21.0	20.7	271°02.1	17.0′	01°15.5	14.4′	54.6′
23	162°20.9	20.2	285°38.1	17.0′	01°01.1	14.4′	54.6′
	SD = 16.2′	d = 0.5′	SD = 15.0′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	07:55	09:42	▬	▬	14:39	16:26
N 70°	07:41	09:11	11:37	12:44	15:10	16:40
68°	07:30	08:48	10:22	13:59	15:33	16:51
66°	07:20	08:30	09:46	14:35	15:51	17:01
64°	07:12	08:15	09:20	15:01	16:06	17:09
62°	07:05	08:03	09:00	15:21	16:18	17:16
60°	06:58	07:52	08:44	15:37	16:29	17:23
N 58°	06:53	07:43	08:30	15:51	16:38	17:28
56°	06:47	07:34	08:19	16:02	16:46	17:33
54°	06:43	07:27	08:08	16:13	16:54	17:38
52°	06:38	07:20	07:59	16:22	17:00	17:43
50°	06:34	07:14	07:51	16:30	17:07	17:47
45°	06:25	07:01	07:33	16:47	17:20	17:56
N 40°	06:16	06:49	07:19	17:02	17:31	18:04
35°	06:08	06:39	07:07	17:14	17:41	18:12
30°	06:01	06:30	06:56	17:24	17:50	18:19
20°	05:47	06:14	06:38	17:43	18:06	18:33
N 10°	05:33	05:59	06:22	17:59	18:21	18:47
0°	05:19	05:44	06:07	18:14	18:36	19:02
S 10°	05:02	05:29	05:51	18:29	18:52	19:18
20°	04:42	05:11	05:35	18:45	19:09	19:38
30°	04:17	04:49	05:15	19:05	19:31	20:03
35°	04:00	04:36	05:04	19:16	19:44	20:19
40°	03:40	04:20	04:51	19:29	20:00	20:39
45°	03:15	04:00	04:36	19:44	20:19	21:04
S 50°	02:39	03:36	04:17	20:03	20:44	21:40
52°	02:19	03:23	04:08	20:12	20:56	21:59
54°	01:54	03:09	03:58	20:22	21:10	22:24
56°	01:16	02:52	03:46	20:33	21:27	22:59
58°	////	02:31	03:33	20:46	21:47	////
S 60°	////	02:04	03:17	21:02	22:13	////

Lat.	**Moonrise** Thu	Fri	Sat	**Moonset** Thu	Fri	Sat
N 72°	17:15	19:38	21:40	11:54	11:02	10:26
N 70°	17:44	19:49	21:42	11:24	10:48	10:21
68°	18:04	19:59	21:43	11:02	10:37	10:17
66°	18:21	20:06	21:44	10:44	10:27	10:13
64°	18:34	20:13	21:46	10:29	10:19	10:10
62°	18:45	20:18	21:46	10:17	10:12	10:07
60°	18:54	20:23	21:47	10:06	10:06	10:05
N 58°	19:03	20:27	21:48	09:57	10:00	10:02
56°	19:10	20:31	21:48	09:49	09:55	10:00
54°	19:16	20:34	21:49	09:42	09:51	09:59
52°	19:22	20:37	21:50	09:35	09:47	09:57
50°	19:27	20:40	21:50	09:29	09:44	09:56
45°	19:38	20:46	21:51	09:16	09:36	09:52
N 40°	19:47	20:51	21:52	09:06	09:29	09:50
35°	19:55	20:55	21:53	08:57	09:23	09:47
30°	20:02	20:59	21:53	08:48	09:18	09:45
20°	20:14	21:05	21:54	08:34	09:09	09:42
N 10°	20:24	21:11	21:55	08:22	09:02	09:39
0°	20:34	21:16	21:56	08:10	08:54	09:35
S 10°	20:43	21:21	21:57	07:59	08:47	09:32
20°	20:53	21:27	21:58	07:46	08:39	09:29
30°	21:05	21:33	21:59	07:31	08:30	09:25
35°	21:11	21:37	22:00	07:23	08:24	09:23
40°	21:19	21:41	22:01	07:13	08:18	09:20
45°	21:28	21:45	22:01	07:02	08:11	09:18
S 50°	21:38	21:51	22:02	06:48	08:03	09:14
52°	21:43	21:54	22:03	06:41	07:59	09:12
54°	21:48	21:56	22:03	06:34	07:54	09:11
56°	21:54	22:00	22:04	06:26	07:49	09:09
58°	22:01	22:03	22:05	06:16	07:44	09:06
S 60°	22:08	22:07	22:05	06:06	07:38	09:04

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 17-19 95-84%
16	09:39	09:49	12:10	01:59	14:22	
17	09:59	10:09	12:10	02:44	15:05	
18	10:19	10:28	12:10	03:26	15:46	

January 19, 20, 21 UT (Sun., Mon., Tue.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	118°38.5	131°35.4	S05°17.1	0°46.4	N25°21.6	48°20.8	N21°39.5	130°41.3	S07°16.7
1	133°41.0	146°35.7	16.0	15°49.9	21.8	63°23.4	39.5	145°43.5	16.7
2	148°43.4	161°36.1	14.8	30°53.4	22.0	78°26.0	39.5	160°45.8	16.6
3	163°45.9	176°36.5	·· 13.6	45°57.0	·· 22.2	93°28.6	·· 39.5	175°48.0	·· 16.5
4	178°48.3	191°36.9	12.4	61°00.5	22.4	108°31.2	39.5	190°50.3	16.4
5	193°50.8	206°37.3	11.2	76°04.0	22.6	123°33.9	39.5	205°52.5	16.3
6	208°53.3	221°37.7	S05°10.0	91°07.6	N25°22.8	138°36.5	N21°39.5	220°54.7	S07°16.2
7	223°55.7	236°38.0	08.9	106°11.1	23.0	153°39.1	39.5	235°57.0	16.1
8	238°58.2	251°38.4	07.7	121°14.6	23.2	168°41.7	39.5	250°59.2	16.0
9	254°00.7	266°38.8	·· 06.5	136°18.1	·· 23.4	183°44.3	·· 39.5	266°01.5	·· 15.9
10	269°03.1	281°39.2	05.3	151°21.7	23.6	198°46.9	39.4	281°03.7	15.8
11	284°05.6	296°39.6	04.1	166°25.2	23.8	213°49.5	39.4	296°05.9	15.7
12	299°08.1	311°40.0	S05°02.9	181°28.7	N25°24.0	228°52.1	N21°39.4	311°08.2	S07°15.6
13	314°10.5	326°40.4	01.8	196°32.2	24.2	243°54.7	39.4	326°10.4	15.5
14	329°13.0	341°40.8	05°00.6	211°35.8	24.4	258°57.3	39.4	341°12.7	15.4
15	344°15.4	356°41.2	04°59.4	226°39.3	·· 24.6	274°00.0	·· 39.4	356°14.9	·· 15.3
16	359°17.9	11°41.6	58.2	241°42.8	24.8	289°02.6	39.4	11°17.1	15.2
17	14°20.4	26°42.0	57.0	256°46.3	25.0	304°05.2	39.4	26°19.4	15.1
18	29°22.8	41°42.4	S04°55.8	271°49.9	N25°25.2	319°07.8	N21°39.4	41°21.6	S07°15.0
19	44°25.3	56°42.8	54.7	286°53.4	25.4	334°10.4	39.4	56°23.9	14.9
20	59°27.8	71°43.2	53.5	301°56.9	25.6	349°13.0	39.4	71°26.1	14.8
21	74°30.2	86°43.6	·· 52.3	317°00.4	·· 25.8	4°15.6	·· 39.3	86°28.3	·· 14.7
22	89°32.7	101°44.0	51.1	332°03.9	25.9	19°18.2	39.3	101°30.6	14.6
23	104°35.2	116°44.4	49.9	347°07.5	26.1	34°20.8	39.3	116°32.8	14.5
Mer.pass. 16:03		ν 0.4′	d 1.2′	m -4.62	ν 3.5′	d 0.2′	m -1.41	ν 2.6′	d 0.0′ m -2.62	ν 2.2′	d 0.1′ m 1.09

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	119°37.6	131°44.8	S04°48.8	2°11.0	N25°26.3	49°23.4	N21°39.3	131°35.1	S07°14.4
1	134°40.1	146°45.2	47.6	17°14.5	26.5	64°26.0	39.3	146°37.3	14.3
2	149°42.6	161°45.6	46.4	32°18.0	26.7	79°28.6	39.3	161°39.5	14.2
3	164°45.0	176°46.0	·· 45.2	47°21.6	·· 26.9	94°31.2	·· 39.3	176°41.8	·· 14.1
4	179°47.5	191°46.4	44.0	62°25.1	27.1	109°33.8	39.3	191°44.0	14.0
5	194°49.9	206°46.8	42.8	77°28.6	27.3	124°36.4	39.3	206°46.2	13.9
6	209°52.4	221°47.3	S04°41.7	92°32.1	N25°27.5	139°39.0	N21°39.3	221°48.5	S07°13.8
7	224°54.9	236°47.7	40.5	107°35.6	27.7	154°41.6	39.3	236°50.7	13.7
8	239°57.3	251°48.1	39.3	122°39.1	27.8	169°44.2	39.2	251°53.0	13.6
9	254°59.8	266°48.5	·· 38.1	137°42.7	·· 28.0	184°46.8	·· 39.2	266°55.2	·· 13.5
10	270°02.3	281°48.9	36.9	152°46.2	28.2	199°49.4	39.2	281°57.4	13.4
11	285°04.7	296°49.3	35.8	167°49.7	28.4	214°52.0	39.2	296°59.7	13.3
12	300°07.2	311°49.8	S04°34.6	182°53.2	N25°28.6	229°54.6	N21°39.2	312°01.9	S07°13.2
13	315°09.7	326°50.2	33.4	197°56.7	28.8	244°57.2	39.2	327°04.1	13.1
14	330°12.1	341°50.6	32.2	213°00.3	29.0	259°59.8	39.2	342°06.4	13.0
15	345°14.6	356°51.0	·· 31.0	228°03.8	·· 29.1	275°02.4	·· 39.2	357°08.6	·· 12.9
16	0°17.1	11°51.5	29.8	243°07.3	29.3	290°05.0	39.2	12°10.9	12.8
17	15°19.5	26°51.9	28.7	258°10.8	29.5	305°07.6	39.2	27°13.1	12.7
18	30°22.0	41°52.3	S04°27.5	273°14.3	N25°29.7	320°10.2	N21°39.2	42°15.3	S07°12.6
19	45°24.4	56°52.7	26.3	288°17.8	29.9	335°12.8	39.2	57°17.6	12.5
20	60°26.9	71°53.2	25.1	303°21.3	30.1	350°15.4	39.2	72°19.8	12.4
21	75°29.4	86°53.6	·· 23.9	318°24.9	·· 30.3	5°18.0	·· 39.1	87°22.0	·· 12.3
22	90°31.8	101°54.0	22.8	333°28.4	30.4	20°20.6	39.1	102°24.3	12.2
23	105°34.3	116°54.5	21.6	348°31.9	30.6	35°23.2	39.1	117°26.5	12.1
Mer.pass. 15:59		ν 0.4′	d 1.2′	m -4.63	ν 3.5′	d 0.2′	m -1.39	ν 2.6′	d 0.0′ m -2.62	ν 2.2′	d 0.1′ m 1.10

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	120°36.8	131°54.9	S04°20.4	3°35.4	N25°30.8	50°25.8	N21°39.1	132°28.8	S07°12.0
1	135°39.2	146°55.3	19.2	18°38.9	31.0	65°28.4	39.1	147°31.0	11.9
2	150°41.7	161°55.8	18.0	33°42.4	31.2	80°31.0	39.1	162°33.2	11.8
3	165°44.2	176°56.2	·· 16.9	48°45.9	·· 31.3	95°33.6	·· 39.1	177°35.5	·· 11.7
4	180°46.6	191°56.6	15.7	63°49.4	31.5	110°36.2	39.1	192°37.7	11.6
5	195°49.1	206°57.1	14.5	78°52.9	31.7	125°38.8	39.1	207°39.9	11.5
6	210°51.5	221°57.5	S04°13.3	93°56.5	N25°31.9	140°41.4	N21°39.1	222°42.2	S07°11.4
7	225°54.0	236°58.0	12.1	109°00.0	32.1	155°44.0	39.1	237°44.4	11.3
8	240°56.5	251°58.4	10.9	124°03.5	32.2	170°46.6	39.1	252°46.6	11.2
9	255°58.9	266°58.9	·· 09.8	139°07.0	·· 32.4	185°49.1	·· 39.1	267°48.9	·· 11.1
10	271°01.4	281°59.3	08.6	154°10.5	32.6	200°51.7	39.0	282°51.1	11.0
11	286°03.9	296°59.7	07.4	169°14.0	32.8	215°54.3	39.0	297°53.3	10.9
12	301°06.3	312°00.2	S04°06.2	184°17.5	N25°33.0	230°56.9	N21°39.0	312°55.6	S07°10.8
13	316°08.8	327°00.6	05.0	199°21.0	33.1	245°59.5	39.0	327°57.8	10.7
14	331°11.3	342°01.1	03.9	214°24.5	33.3	261°02.1	39.0	343°00.1	10.6
15	346°13.7	357°01.5	·· 02.7	229°28.0	·· 33.5	276°04.7	·· 39.0	358°02.3	·· 10.5
16	1°16.2	12°02.0	01.5	244°31.5	33.7	291°07.3	39.0	13°04.5	10.4
17	16°18.7	27°02.5	04°00.3	259°35.0	33.8	306°09.9	39.0	28°06.8	10.3
18	31°21.1	42°02.9	S03°59.1	274°38.5	N25°34.0	321°12.5	N21°39.0	43°09.0	S07°10.2
19	46°23.6	57°03.4	58.0	289°42.0	34.2	336°15.0	39.0	58°11.2	10.1
20	61°26.0	72°03.8	56.8	304°45.5	34.4	351°17.6	39.0	73°13.5	10.0
21	76°28.5	87°04.3	·· 55.6	319°49.0	·· 34.5	6°20.2	·· 39.0	88°15.7	·· 09.9
22	91°31.0	102°04.7	54.4	334°52.5	34.7	21°22.8	39.0	103°17.9	09.8
23	106°33.4	117°05.2	53.3	349°56.0	34.9	36°25.4	39.0	118°20.2	09.7
Mer.pass. 15:55		ν 0.4′	d 1.2′	m -4.64	ν 3.5′	d 0.2′	m -1.36	ν 2.6′	d 0.0′ m -2.61	ν 2.2′	d 0.1′ m 1.10

Stars

	SHA	**Dec**
Alpheratz	357°34.9	29°13.8
Ankaa	353°07.3	-42°10.4
Schedar	349°31.2	56°40.7
Diphda	348°47.4	-17°51.1
Achernar	335°20.2	-57°06.9
Hamal	327°51.1	23°34.9
Polaris	313°51.5	89°22.5
Acamar	315°11.6	-40°12.5
Menkar	314°06.0	4°11.3
Mirfak	308°28.0	49°57.2
Aldebaran	290°39.3	16°33.6
Rigel	281°03.6	-8°10.4
Capella	280°21.5	46°01.5
Bellatrix	278°22.6	6°22.3
Elnath	278°01.5	28°37.8
Alnilam	275°37.4	-1°11.2
Betelgeuse	270°51.7	7°24.7
Canopus	263°51.9	-52°42.6
Sirius	258°25.9	-16°45.1
Adhara	255°05.5	-29°00.4
Procyon	244°50.5	5°09.6
Pollux	243°16.9	27°57.9
Avior	234°14.1	-59°35.3
Suhail	222°45.9	-43°32.0
Miaplacidus	221°37.4	-69°49.1
Alphard	217°47.4	-8°46.1
Regulus	207°34.1	11°50.6
Dubhe	193°40.5	61°36.7
Denebola	182°24.7	14°25.8
Gienah	175°43.4	-17°40.8
Acrux	172°59.8	-63°14.0
Gacrux	171°51.4	-57°15.0
Alioth	166°12.8	55°49.1
Spica	158°22.2	-11°17.5
Alkaid	152°51.9	49°11.0
Hadar	148°36.0	-60°29.4
Menkent	147°57.6	-36°29.5
Arcturus	145°47.9	19°02.9
Rigil Kent.	139°40.4	-60°56.1
Kochab	137°20.1	74°02.7
Zuben'ubi	136°56.1	-16°08.7
Alphecca	126°03.9	26°37.6
Antares	112°16.0	-26°29.2
Atria	107°10.7	-69°04.1
Sabik	102°03.0	-15°45.4
Shaula	96°10.7	-37°07.3
Rasalhague	95°58.8	12°32.4
Eltanin	90°42.6	51°28.9
Kaus Aust.	83°32.8	-34°22.4
Vega	80°33.6	38°48.2
Nunki	75°48.1	-26°16.0
Altair	62°00.3	8°56.0
Peacock	53°06.3	-56°39.3
Deneb	49°26.3	45°22.1
Enif	33°39.1	9°59.3
Al Na'ir	27°33.3	-46°50.6
Fomalhaut	15°14.7	-29°29.6
Scheat	13°45.4	28°13.2
Markab	13°30.1	15°20.4

Jan 19 Sun	**SHA**	**Mer.pass**
Venus	12°56.9	15:13
Mars	242°07.9	23:51
Jupiter	289°42.3	20:43
Saturn	12°02.8	15:15

Jan 20 Mon	**SHA**	**Mer.pass**
Venus	12°07.2	15:13
Mars	242°33.4	23:46
Jupiter	289°45.8	20:39
Saturn	11°57.4	15:11

Jan 21 Tue	**SHA**	**Mer.pass**
Venus	11°18.1	15:12
Mars	242°58.6	23:40
Jupiter	289°49.0	20:35
Saturn	11°52.0	15:08

Horizontal parallax	
Venus:	0.2
Mars:	0.2

h	Sun		Moon				
Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	177°20.7	S20°19.6	300°14.1	17.0′	N00°46.7	14.4′	54.6′
1	192°20.5	19.1	314°50.1	17.0′	00°32.3	14.3′	54.6′
2	207°20.3	18.6	329°26.2	17.1′	00°18.0	14.4′	54.6′
3	222°20.1	·· 18.1	344°02.2	17.1′	N00°03.6	14.4′	54.5′
4	237°19.9	17.5	358°38.3	17.1′	S00°10.8	14.3′	54.5′
5	252°19.7	17.0	13°14.4	17.1′	00°25.1	14.3′	54.5′
6	267°19.5	S20°16.5	27°50.5	17.1′	S00°39.4	14.4′	54.5′
7	282°19.3	15.9	42°26.6	17.1′	00°53.8	14.3′	54.5′
8	297°19.1	15.4	57°02.7	17.1′	01°08.1	14.3′	54.5′
9	312°19.0	·· 14.9	71°38.9	17.1′	01°22.4	14.3′	54.5′
10	327°18.8	14.3	86°15.0	17.2′	01°36.7	14.3′	54.4′
11	342°18.6	13.8	100°51.2	17.2′	01°51.0	14.2′	54.4′
12	357°18.4	S20°13.3	115°27.3	17.2′	S02°05.2	14.3′	54.4′
13	12°18.2	12.7	130°03.5	17.2′	02°19.5	14.2′	54.4′
14	27°18.0	12.2	144°39.6	17.2′	02°33.7	14.2′	54.4′
15	42°17.8	·· 11.7	159°15.8	17.2′	02°47.9	14.2′	54.4′
16	57°17.6	11.1	173°52.0	17.2′	03°02.1	14.2′	54.4′
17	72°17.5	10.6	188°28.2	17.2′	03°16.3	14.2′	54.4′
18	87°17.3	S20°10.1	203°04.3	17.2′	S03°30.5	14.1′	54.4′
19	102°17.1	09.5	217°40.5	17.2′	03°44.6	14.2′	54.3′
20	117°16.9	09.0	232°16.7	17.2′	03°58.8	14.1′	54.3′
21	132°16.7	·· 08.4	246°52.8	17.2′	04°12.9	14.1′	54.3′
22	147°16.5	07.9	261°29.0	17.2′	04°27.0	14.1′	54.3′
23	162°16.4	07.4	276°05.1	17.1′	04°41.1	14.0′	54.3′
	SD = 16.2′	d = 0.5′	SD = 14.9′				

Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	177°16.2	S20°06.8	290°41.3	17.1′	S04°55.1	14.0′	54.3′
1	192°16.0	06.3	305°17.4	17.1′	05°09.1	14.0′	54.3′
2	207°15.8	05.7	319°53.6	17.1′	05°23.1	14.0′	54.3′
3	222°15.6	·· 05.2	334°29.7	17.1′	05°37.1	14.0′	54.3′
4	237°15.4	04.7	349°05.8	17.1′	05°51.1	13.9′	54.3′
5	252°15.3	04.1	3°41.9	17.1′	06°05.0	13.9′	54.3′
6	267°15.1	S20°03.6	18°17.9	17.1′	S06°18.9	13.9′	54.3′
7	282°14.9	03.0	32°54.0	17.0′	06°32.8	13.8′	54.2′
8	297°14.7	02.5	47°30.0	17.0′	06°46.6	13.9′	54.2′
9	312°14.5	·· 01.9	62°06.1	17.0′	07°00.5	13.7′	54.2′
10	327°14.4	01.4	76°42.1	17.0′	07°14.2	13.8′	54.2′
11	342°14.2	00.8	91°18.1	17.0′	07°28.0	13.8′	54.2′
12	357°14.0	S20°00.3	105°54.0	16.9′	S07°41.8	13.7′	54.2′
13	12°13.8	19°59.7	120°30.0	16.9′	07°55.5	13.6′	54.2′
14	27°13.6	59.2	135°05.9	16.9′	08°09.1	13.7′	54.2′
15	42°13.5	·· 58.6	149°41.8	16.9′	08°22.8	13.6′	54.2′
16	57°13.3	58.1	164°17.7	16.8′	08°36.4	13.6′	54.2′
17	72°13.1	57.5	178°53.5	16.8′	08°50.0	13.5′	54.2′
18	87°12.9	S19°57.0	193°29.3	16.8′	S09°03.5	13.5′	54.2′
19	102°12.7	56.4	208°05.1	16.8′	09°17.0	13.5′	54.2′
20	117°12.6	55.9	222°40.9	16.7′	09°30.5	13.4′	54.2′
21	132°12.4	·· 55.3	237°16.6	16.7′	09°43.9	13.5′	54.2′
22	147°12.2	54.8	251°52.3	16.7′	09°57.4	13.3′	54.2′
23	162°12.0	54.2	266°27.9	16.6′	10°10.7	13.3′	54.2′
	SD = 16.2′	d = 0.5′	SD = 14.8′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	177°11.9	S19°53.6	281°03.6	16.6′	S10°24.0	13.3′	54.2′
1	192°11.7	53.1	295°39.2	16.6′	10°37.3	13.3′	54.2′
2	207°11.5	52.5	310°14.7	16.5′	10°50.6	13.2′	54.2′
3	222°11.3	·· 52.0	324°50.2	16.5′	11°03.8	13.2′	54.2′
4	237°11.2	51.4	339°25.7	16.4′	11°17.0	13.1′	54.2′
5	252°11.0	50.8	354°01.1	16.4′	11°30.1	13.1′	54.2′
6	267°10.8	S19°50.3	8°36.5	16.3′	S11°43.2	13.0′	54.2′
7	282°10.6	49.7	23°11.9	16.3′	11°56.2	13.1′	54.2′
8	297°10.5	49.2	37°47.2	16.3′	12°09.3	12.9′	54.2′
9	312°10.3	·· 48.6	52°22.4	16.2′	12°22.2	12.9′	54.2′
10	327°10.1	48.0	66°57.7	16.2′	12°35.1	12.9′	54.2′
11	342°10.0	47.5	81°32.8	16.1′	12°48.0	12.8′	54.2′
12	357°09.8	S19°46.9	96°07.9	16.1′	S13°00.8	12.8′	54.2′
13	12°09.6	46.3	110°43.0	16.0′	13°13.6	12.7′	54.2′
14	27°09.4	45.8	125°18.0	16.0′	13°26.3	12.7′	54.2′
15	42°09.3	·· 45.2	139°53.0	15.9′	13°39.0	12.6′	54.2′
16	57°09.1	44.6	154°27.9	15.9′	13°51.6	12.6′	54.2′
17	72°08.9	44.1	169°02.8	15.8′	14°04.2	12.5′	54.2′
18	87°08.8	S19°43.5	183°37.6	15.8′	S14°16.7	12.5′	54.2′
19	102°08.6	42.9	198°12.4	15.7′	14°29.2	12.5′	54.2′
20	117°08.4	42.4	212°47.1	15.6′	14°41.7	12.3′	54.2′
21	132°08.3	·· 41.8	227°21.7	15.6′	14°54.0	12.4′	54.2′
22	147°08.1	41.2	241°56.3	15.5′	15°06.4	12.2′	54.2′
23	162°07.9	40.7	256°30.8	15.5′	15°18.6	12.2′	54.2′
	SD = 16.2′	d = 0.6′	SD = 14.8′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	07:47	09:30	▬	▬	14:54	16:36
N 70°	07:34	09:01	11:03	13:21	15:22	16:49
68°	07:24	08:40	10:09	14:14	15:43	16:59
66°	07:15	08:23	09:36	14:47	16:00	17:08
64°	07:07	08:09	09:13	15:10	16:13	17:16
62°	07:01	07:58	08:54	15:29	16:25	17:22
60°	06:55	07:48	08:39	15:44	16:35	17:28
N 58°	06:49	07:39	08:26	15:57	16:44	17:33
56°	06:44	07:31	08:15	16:08	16:52	17:38
54°	06:40	07:24	08:05	16:18	16:59	17:43
52°	06:36	07:18	07:56	16:27	17:05	17:47
50°	06:32	07:12	07:48	16:35	17:11	17:51
45°	06:23	06:59	07:31	16:51	17:24	18:00
N 40°	06:15	06:48	07:17	17:05	17:34	18:08
35°	06:08	06:39	07:06	17:17	17:44	18:15
30°	06:01	06:30	06:55	17:27	17:53	18:22
20°	05:47	06:14	06:38	17:45	18:08	18:35
N 10°	05:34	06:00	06:22	18:00	18:22	18:48
0°	05:20	05:45	06:07	18:15	18:37	19:02
S 10°	05:04	05:30	05:53	18:29	18:52	19:18
20°	04:44	05:13	05:37	18:45	19:09	19:37
30°	04:20	04:52	05:18	19:04	19:30	20:02
35°	04:04	04:39	05:07	19:14	19:43	20:18
40°	03:45	04:24	04:55	19:27	19:58	20:37
45°	03:20	04:05	04:40	19:42	20:16	21:01
S 50°	02:46	03:41	04:22	20:00	20:40	21:35
52°	02:28	03:29	04:13	20:08	20:52	21:53
54°	02:04	03:16	04:03	20:18	21:05	22:15
56°	01:32	03:00	03:52	20:29	21:21	22:46
58°	////	02:40	03:39	20:41	21:40	23:52
S 60°	////	02:15	03:24	20:56	22:04	////

Lat.	**Moonrise** Sun	Mon	Tue	**Moonset** Sun	Mon	Tue
N 72°	23:38	·· ··	01:44	09:54	09:21	08:40
N 70°	23:31	·· ··	01:25	09:56	09:31	09:01
68°	23:25	·· ··	01:10	09:58	09:39	09:18
66°	23:20	·· ··	00:58	10:00	09:46	09:31
64°	23:16	·· ··	00:48	10:01	09:52	09:42
62°	23:13	·· ··	00:40	10:02	09:57	09:52
60°	23:10	·· ··	00:32	10:03	10:02	10:00
N 58°	23:07	·· ··	00:26	10:04	10:06	10:08
56°	23:04	·· ··	00:21	10:05	10:09	10:14
54°	23:02	·· ··	00:16	10:06	10:12	10:20
52°	23:00	·· ··	00:11	10:06	10:15	10:25
50°	22:59	·· ··	00:07	10:07	10:18	10:30
45°	22:55	23:59	·· ··	10:08	10:24	10:41
N 40°	22:52	23:51	·· ··	10:09	10:29	10:49
35°	22:49	23:45	·· ··	10:10	10:33	10:57
30°	22:46	23:40	·· ··	10:11	10:37	11:03
20°	22:42	23:31	·· ··	10:13	10:43	11:15
N 10°	22:39	23:22	·· ··	10:14	10:49	11:25
0°	22:35	23:15	23:56	10:15	10:54	11:34
S 10°	22:32	23:07	23:44	10:16	11:00	11:44
20°	22:29	23:00	23:32	10:18	11:06	11:54
30°	22:25	22:51	23:18	10:19	11:12	12:06
35°	22:22	22:45	23:10	10:20	11:16	12:13
40°	22:20	22:40	23:01	10:21	11:20	12:21
45°	22:17	22:33	22:51	10:22	11:25	12:30
S 50°	22:13	22:25	22:38	10:23	11:32	12:41
52°	22:12	22:21	22:32	10:24	11:34	12:46
54°	22:10	22:17	22:26	10:24	11:38	12:52
56°	22:08	22:13	22:19	10:25	11:41	12:58
58°	22:06	22:08	22:11	10:26	11:45	13:05
S 60°	22:04	22:02	22:02	10:27	11:49	13:13

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 20-22 76-58%
19	10:37	10:46	12:11	04:06	16:25	
20	10:55	11:04	12:11	04:45	17:05	
21	11:13	11:21	12:11	05:25	17:45	

January 22, 23, 24 UT (Wed., Thu., Fri.)

	Aries	Venus		Mars		Jupiter		Saturn	
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	121°35.9	132°05.7	S03°52.1	4°59.5	N25°35.1	51°28.0	N21°39.0	133°22.4	S07°09.6
1	136°38.4	147°06.1	50.9	20°03.0	35.2	66°30.6	38.9	148°24.6	09.5
2	151°40.8	162°06.6	49.7	35°06.5	35.4	81°33.2	38.9	163°26.9	09.4
3	166°43.3	177°07.1	·· 48.5	50°10.0	·· 35.6	96°35.7	·· 38.9	178°29.1	·· 09.3
4	181°45.8	192°07.5	47.4	65°13.5	35.7	111°38.3	38.9	193°31.3	09.2
5	196°48.2	207°08.0	46.2	80°17.0	35.9	126°40.9	38.9	208°33.6	09.1
6	211°50.7	222°08.5	S03°45.0	95°20.5	N25°36.1	141°43.5	N21°38.9	223°35.8	S07°09.0
7	226°53.2	237°08.9	43.8	110°24.0	36.3	156°46.1	38.9	238°38.0	08.9
8	241°55.6	252°09.4	42.6	125°27.5	36.4	171°48.7	38.9	253°40.3	08.8
9	256°58.1	267°09.9	·· 41.5	140°31.0	·· 36.6	186°51.2	·· 38.9	268°42.5	·· 08.7
10	272°00.5	282°10.4	40.3	155°34.5	36.8	201°53.8	38.9	283°44.7	08.6
11	287°03.0	297°10.8	39.1	170°38.0	36.9	216°56.4	38.9	298°47.0	08.5
12	302°05.5	312°11.3	S03°37.9	185°41.5	N25°37.1	231°59.0	N21°38.9	313°49.2	S07°08.4
13	317°07.9	327°11.8	36.7	200°45.0	37.3	247°01.6	38.9	328°51.4	08.3
14	332°10.4	342°12.3	35.6	215°48.5	37.4	262°04.2	38.9	343°53.7	08.2
15	347°12.9	357°12.8	·· 34.4	230°52.0	·· 37.6	277°06.7	·· 38.9	358°55.9	·· 08.1
16	2°15.3	12°13.2	33.2	245°55.5	37.8	292°09.3	38.9	13°58.1	08.0
17	17°17.8	27°13.7	32.0	260°59.0	37.9	307°11.9	38.9	29°00.4	07.9
18	32°20.3	42°14.2	S03°30.9	276°02.5	N25°38.1	322°14.5	N21°38.8	44°02.6	S07°07.8
19	47°22.7	57°14.7	29.7	291°05.9	38.3	337°17.1	38.8	59°04.8	07.7
20	62°25.2	72°15.2	28.5	306°09.4	38.4	352°19.6	38.8	74°07.1	07.6
21	77°27.6	87°15.7	·· 27.3	321°12.9	·· 38.6	7°22.2	·· 38.8	89°09.3	·· 07.5
22	92°30.1	102°16.2	26.2	336°16.4	38.8	22°24.8	38.8	104°11.5	07.4
23	107°32.6	117°16.6	25.0	351°19.9	38.9	37°27.4	38.8	119°13.8	07.3
Mer.pass. 15:51		ν 0.5′	d 1.2′	m -4.65	ν 3.5′	d 0.2′	m -1.34	ν 2.6′	d 0.0′ m -2.60	ν 2.2′	d 0.1′ m 1.10

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	122°35.0	132°17.1	S03°23.8	6°23.4	N25°39.1	52°30.0	N21°38.8	134°16.0	S07°07.2
1	137°37.5	147°17.6	22.6	21°26.9	39.3	67°32.5	38.8	149°18.2	07.1
2	152°40.0	162°18.1	21.4	36°30.4	39.4	82°35.1	38.8	164°20.5	07.0
3	167°42.4	177°18.6	·· 20.3	51°33.8	·· 39.6	97°37.7	·· 38.8	179°22.7	·· 06.9
4	182°44.9	192°19.1	19.1	66°37.3	39.8	112°40.3	38.8	194°24.9	06.8
5	197°47.4	207°19.6	17.9	81°40.8	39.9	127°42.8	38.8	209°27.1	06.7
6	212°49.8	222°20.1	S03°16.7	96°44.3	N25°40.1	142°45.4	N21°38.8	224°29.4	S07°06.6
7	227°52.3	237°20.6	15.6	111°47.8	40.2	157°48.0	38.8	239°31.6	06.5
8	242°54.8	252°21.1	14.4	126°51.3	40.4	172°50.6	38.8	254°33.8	06.4
9	257°57.2	267°21.6	·· 13.2	141°54.7	·· 40.6	187°53.1	·· 38.8	269°36.1	·· 06.3
10	272°59.7	282°22.1	12.0	156°58.2	40.7	202°55.7	38.8	284°38.3	06.2
11	288°02.1	297°22.6	10.9	172°01.7	40.9	217°58.3	38.8	299°40.5	06.1
12	303°04.6	312°23.1	S03°09.7	187°05.2	N25°41.0	233°00.9	N21°38.8	314°42.8	S07°06.0
13	318°07.1	327°23.6	08.5	202°08.7	41.2	248°03.4	38.7	329°45.0	05.9
14	333°09.5	342°24.2	07.3	217°12.1	41.4	263°06.0	38.7	344°47.2	05.8
15	348°12.0	357°24.7	·· 06.2	232°15.6	·· 41.5	278°08.6	·· 38.7	359°49.5	·· 05.7
16	3°14.5	12°25.2	05.0	247°19.1	41.7	293°11.2	38.7	14°51.7	05.5
17	18°16.9	27°25.7	03.8	262°22.6	41.8	308°13.7	38.7	29°53.9	05.4
18	33°19.4	42°26.2	S03°02.6	277°26.0	N25°42.0	323°16.3	N21°38.7	44°56.1	S07°05.3
19	48°21.9	57°26.7	01.5	292°29.5	42.1	338°18.9	38.7	59°58.4	05.2
20	63°24.3	72°27.2	03°00.3	307°33.0	42.3	353°21.4	38.7	75°00.6	05.1
21	78°26.8	87°27.8	02°59.1	322°36.5	·· 42.5	8°24.0	·· 38.7	90°02.8	·· 05.0
22	93°29.3	102°28.3	57.9	337°39.9	42.6	23°26.6	38.7	105°05.1	04.9
23	108°31.7	117°28.8	56.8	352°43.4	42.8	38°29.2	38.7	120°07.3	04.8
Mer.pass. 15:47		ν 0.5′	d 1.2′	m -4.66	ν 3.5′	d 0.2′	m -1.32	ν 2.6′	d 0.0′ m -2.59	ν 2.2′	d 0.1′ m 1.10

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	123°34.2	132°29.3	S02°55.6	7°46.9	N25°42.9	53°31.7	N21°38.7	135°09.5	S07°04.7
1	138°36.6	147°29.8	54.4	22°50.3	43.1	68°34.3	38.7	150°11.8	04.6
2	153°39.1	162°30.4	53.2	37°53.8	43.2	83°36.9	38.7	165°14.0	04.5
3	168°41.6	177°30.9	·· 52.1	52°57.3	·· 43.4	98°39.4	·· 38.7	180°16.2	·· 04.4
4	183°44.0	192°31.4	50.9	68°00.8	43.5	113°42.0	38.7	195°18.4	04.3
5	198°46.5	207°31.9	49.7	83°04.2	43.7	128°44.6	38.7	210°20.7	04.2
6	213°49.0	222°32.5	S02°48.5	98°07.7	N25°43.8	143°47.1	N21°38.7	225°22.9	S07°04.1
7	228°51.4	237°33.0	47.4	113°11.2	44.0	158°49.7	38.7	240°25.1	04.0
8	243°53.9	252°33.5	46.2	128°14.6	44.1	173°52.3	38.7	255°27.4	03.9
9	258°56.4	267°34.1	·· 45.0	143°18.1	·· 44.3	188°54.8	·· 38.7	270°29.6	·· 03.8
10	273°58.8	282°34.6	43.9	158°21.6	44.4	203°57.4	38.7	285°31.8	03.7
11	289°01.3	297°35.1	42.7	173°25.0	44.6	219°00.0	38.7	300°34.1	03.6
12	304°03.8	312°35.7	S02°41.5	188°28.5	N25°44.7	234°02.5	N21°38.6	315°36.3	S07°03.5
13	319°06.2	327°36.2	40.3	203°31.9	44.9	249°05.1	38.6	330°38.5	03.4
14	334°08.7	342°36.7	39.2	218°35.4	45.0	264°07.7	38.6	345°40.7	03.3
15	349°11.1	357°37.3	·· 38.0	233°38.9	·· 45.2	279°10.2	·· 38.6	0°43.0	·· 03.2
16	4°13.6	12°37.8	36.8	248°42.3	45.3	294°12.8	38.6	15°45.2	03.1
17	19°16.1	27°38.4	35.7	263°45.8	45.5	309°15.3	38.6	30°47.4	03.0
18	34°18.5	42°38.9	S02°34.5	278°49.2	N25°45.6	324°17.9	N21°38.6	45°49.6	S07°02.9
19	49°21.0	57°39.5	33.3	293°52.7	45.8	339°20.5	38.6	60°51.9	02.8
20	64°23.5	72°40.0	32.1	308°56.2	45.9	354°23.0	38.6	75°54.1	02.7
21	79°25.9	87°40.6	·· 31.0	323°59.6	·· 46.1	9°25.6	·· 38.6	90°56.3	·· 02.6
22	94°28.4	102°41.1	29.8	339°03.1	46.2	24°28.2	38.6	105°58.6	02.5
23	109°30.9	117°41.7	28.6	354°06.5	46.4	39°30.7	38.6	121°00.8	02.4
Mer.pass. 15:43		ν 0.5′	d 1.2′	m -4.67	ν 3.5′	d 0.2′	m -1.29	ν 2.6′	d 0.0′ m -2.58	ν 2.2′	d 0.1′ m 1.10

Stars

	SHA	Dec
Alpheratz	357°34.9	29°13.8
Ankaa	353°07.3	-42°10.4
Schedar	349°31.2	56°40.7
Diphda	348°47.4	-17°51.1
Achernar	335°20.2	-57°06.9
Hamal	327°51.1	23°34.9
Polaris	313°52.8	89°22.5
Acamar	315°11.6	-40°12.5
Menkar	314°06.0	4°11.3
Mirfak	308°28.0	49°57.2
Aldebaran	290°39.4	16°33.6
Rigel	281°03.6	-8°10.4
Capella	280°21.5	46°01.5
Bellatrix	278°22.6	6°22.3
Elnath	278°01.5	28°37.8
Alnilam	275°37.4	-1°11.2
Betelgeuse	270°51.8	7°24.7
Canopus	263°51.9	-52°42.6
Sirius	258°25.9	-16°45.1
Adhara	255°05.5	-29°00.4
Procyon	244°50.5	5°09.6
Pollux	243°16.9	27°57.9
Avior	234°14.1	-59°35.3
Suhail	222°45.9	-43°32.0
Miaplacidus	221°37.4	-69°49.1
Alphard	217°47.4	-8°46.1
Regulus	207°34.1	11°50.6
Dubhe	193°40.4	61°36.7
Denebola	182°24.7	14°25.8
Gienah	175°43.4	-17°40.9
Acrux	172°59.8	-63°14.0
Gacrux	171°51.4	-57°15.0
Alioth	166°12.7	55°49.1
Spica	158°22.2	-11°17.6
Alkaid	152°51.9	49°11.0
Hadar	148°36.0	-60°29.4
Menkent	147°57.6	-36°29.5
Arcturus	145°47.9	19°02.9
Rigil Kent.	139°40.4	-60°56.1
Kochab	137°20.0	74°02.7
Zuben'ubi	136°56.0	-16°08.8
Alphecca	126°03.8	26°37.6
Antares	112°16.0	-26°29.2
Atria	107°10.6	-69°04.1
Sabik	102°03.0	-15°45.4
Shaula	96°10.6	-37°07.3
Rasalhague	95°58.8	12°32.4
Eltanin	90°42.6	51°28.9
Kaus Aust.	83°32.8	-34°22.3
Vega	80°33.6	38°48.2
Nunki	75°48.1	-26°16.0
Altair	62°00.3	8°56.0
Peacock	53°06.3	-56°39.3
Deneb	49°26.3	45°22.1
Enif	33°39.1	9°59.3
Al Na'ir	27°33.3	-46°50.6
Fomalhaut	15°14.7	-29°29.5
Scheat	13°45.4	28°13.2
Markab	13°30.1	15°20.4

Jan 22 Wed	SHA	Mer.pass
Venus	10°29.8	15:11
Mars	243°23.6	23:35
Jupiter	289°52.1	20:31
Saturn	11°46.5	15:04

Jan 23 Thu	SHA	Mer.pass
Venus	9°42.1	15:10
Mars	243°48.3	23:29
Jupiter	289°54.9	20:26
Saturn	11°40.9	15:01

Jan 24 Fri	SHA	Mer.pass
Venus	8°55.1	15:10
Mars	244°12.7	23:23
Jupiter	289°57.5	20:22
Saturn	11°35.3	14:57

Horizontal parallax	
Venus:	0.3
Mars:	0.2

h	Sun		Moon				
Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	177°07.7	S19°40.1	271°05.3	15.4′	S15°30.8	12.2′	54.2′
1	192°07.6	39.5	285°39.7	15.3′	15°43.0	12.1′	54.2′
2	207°07.4	38.9	300°14.0	15.3′	15°55.1	12.0′	54.2′
3	222°07.2	·· 38.4	314°48.3	15.2′	16°07.1	12.0′	54.2′
4	237°07.1	37.8	329°22.5	15.1′	16°19.1	11.9′	54.3′
5	252°06.9	37.2	343°56.7	15.1′	16°31.0	11.9′	54.3′
6	267°06.7	S19°36.6	358°30.8	15.0′	S16°42.9	11.8′	54.3′
7	282°06.6	36.1	13°04.8	14.9′	16°54.7	11.7′	54.3′
8	297°06.4	35.5	27°38.7	14.9′	17°06.4	11.7′	54.3′
9	312°06.2	·· 34.9	42°12.6	14.8′	17°18.1	11.6′	54.3′
10	327°06.1	34.3	56°46.4	14.7′	17°29.7	11.5′	54.3′
11	342°05.9	33.7	71°20.1	14.7′	17°41.2	11.5′	54.3′
12	357°05.8	S19°33.2	85°53.8	14.6′	S17°52.7	11.4′	54.3′
13	12°05.6	32.6	100°27.4	14.5′	18°04.1	11.4′	54.3′
14	27°05.4	32.0	115°00.9	14.4′	18°15.5	11.3′	54.3′
15	42°05.3	·· 31.4	129°34.4	14.4′	18°26.8	11.2′	54.4′
16	57°05.1	30.8	144°07.7	14.3′	18°38.0	11.1′	54.4′
17	72°04.9	30.3	158°41.0	14.2′	18°49.1	11.1′	54.4′
18	87°04.8	S19°29.7	173°14.2	14.1′	S19°00.2	11.0′	54.4′
19	102°04.6	29.1	187°47.4	14.1′	19°11.2	10.9′	54.4′
20	117°04.5	28.5	202°20.4	14.0′	19°22.1	10.9′	54.4′
21	132°04.3	·· 27.9	216°53.4	13.9′	19°33.0	10.7′	54.4′
22	147°04.1	27.3	231°26.3	13.8′	19°43.7	10.7′	54.4′
23	162°04.0	26.7	245°59.1	13.7′	19°54.4	10.6′	54.4′
	SD = 16.2′	d = 0.6′	SD = 14.8′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	177°03.8	S19°26.2	260°31.9	13.7′	S20°05.0	10.6′	54.5′
1	192°03.7	25.6	275°04.5	13.6′	20°15.6	10.5′	54.5′
2	207°03.5	25.0	289°37.1	13.5′	20°26.1	10.3′	54.5′
3	222°03.3	·· 24.4	304°09.6	13.4′	20°36.4	10.3′	54.5′
4	237°03.2	23.8	318°42.0	13.3′	20°46.7	10.3′	54.5′
5	252°03.0	23.2	333°14.3	13.2′	20°57.0	10.1′	54.5′
6	267°02.9	S19°22.6	347°46.5	13.1′	S21°07.1	10.1′	54.5′
7	282°02.7	22.0	2°18.7	13.1′	21°17.2	9.9′	54.6′
8	297°02.5	21.4	16°50.7	13.0′	21°27.1	9.9′	54.6′
9	312°02.4	·· 20.8	31°22.7	12.9′	21°37.0	9.8′	54.6′
10	327°02.2	20.3	45°54.6	12.8′	21°46.8	9.7′	54.6′
11	342°02.1	19.7	60°26.4	12.7′	21°56.5	9.7′	54.6′
12	357°01.9	S19°19.1	74°58.1	12.6′	S22°06.2	9.5′	54.6′
13	12°01.8	18.5	89°29.7	12.5′	22°15.7	9.4′	54.7′
14	27°01.6	17.9	104°01.2	12.4′	22°25.1	9.4′	54.7′
15	42°01.5	·· 17.3	118°32.6	12.3′	22°34.5	9.2′	54.7′
16	57°01.3	16.7	133°04.0	12.2′	22°43.7	9.2′	54.7′
17	72°01.1	16.1	147°35.2	12.2′	22°52.9	9.1′	54.7′
18	87°01.0	S19°15.5	162°06.4	12.1′	S23°02.0	8.9′	54.7′
19	102°00.8	14.9	176°37.4	12.0′	23°10.9	8.9′	54.8′
20	117°00.7	14.3	191°08.4	11.9′	23°19.8	8.8′	54.8′
21	132°00.5	·· 13.7	205°39.3	11.8′	23°28.6	8.7′	54.8′
22	147°00.4	13.1	220°10.1	11.7′	23°37.3	8.5′	54.8′
23	162°00.2	12.5	234°40.8	11.6′	23°45.8	8.5′	54.8′
	SD = 16.2′	d = 0.6′	SD = 14.9′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	177°00.1	S19°11.9	249°11.4	11.5′	S23°54.3	8.4′	54.9′
1	191°59.9	11.3	263°41.9	11.4′	24°02.7	8.2′	54.9′
2	206°59.8	10.7	278°12.3	11.3′	24°10.9	8.2′	54.9′
3	221°59.6	·· 10.1	292°42.6	11.2′	24°19.1	8.0′	54.9′
4	236°59.5	09.5	307°12.8	11.1′	24°27.1	8.0′	54.9′
5	251°59.3	08.9	321°42.9	11.0′	24°35.1	7.8′	55.0′
6	266°59.2	S19°08.2	336°12.9	10.9′	S24°42.9	7.7′	55.0′
7	281°59.0	07.6	350°42.9	10.8′	24°50.6	7.6′	55.0′
8	296°58.9	07.0	5°12.7	10.7′	24°58.2	7.5′	55.0′
9	311°58.7	·· 06.4	19°42.5	10.6′	25°05.7	7.4′	55.0′
10	326°58.6	05.8	34°12.1	10.6′	25°13.1	7.3′	55.1′
11	341°58.4	05.2	48°41.7	10.5′	25°20.4	7.1′	55.1′
12	356°58.3	S19°04.6	63°11.1	10.4′	S25°27.5	7.1′	55.1′
13	11°58.1	04.0	77°40.5	10.3′	25°34.6	6.9′	55.1′
14	26°58.0	03.4	92°09.7	10.2′	25°41.5	6.8′	55.2′
15	41°57.8	·· 02.8	106°38.9	10.1′	25°48.3	6.7′	55.2′
16	56°57.7	02.2	121°08.0	10.0′	25°55.0	6.5′	55.2′
17	71°57.5	01.5	135°37.0	9.9′	26°01.5	6.5′	55.2′
18	86°57.4	S19°00.9	150°05.9	9.8′	S26°08.0	6.3′	55.2′
19	101°57.2	19°00.3	164°34.7	9.7′	26°14.3	6.2′	55.3′
20	116°57.1	18°59.7	179°03.4	9.6′	26°20.5	6.0′	55.3′
21	131°57.0	·· 59.1	193°32.0	9.5′	26°26.5	5.9′	55.3′
22	146°56.8	58.5	208°00.5	9.4′	26°32.4	5.8′	55.3′
23	161°56.7	57.9	222°29.0	9.3′	26°38.2	5.7′	55.4′
	SD = 16.2′	d = 0.6′	SD = 15.0′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	07:38	09:17	▬	▬	15:08	16:47
N 70°	07:27	08:51	10:39	13:46	15:33	16:58
68°	07:17	08:32	09:55	14:29	15:53	17:08
66°	07:09	08:16	09:26	14:58	16:08	17:16
64°	07:02	08:03	09:05	15:20	16:21	17:22
62°	06:56	07:52	08:47	15:37	16:32	17:29
60°	06:51	07:43	08:33	15:51	16:42	17:34
N 58°	06:46	07:35	08:21	16:04	16:50	17:39
56°	06:41	07:27	08:10	16:14	16:57	17:43
54°	06:37	07:21	08:01	16:24	17:04	17:48
52°	06:33	07:14	07:52	16:32	17:10	17:51
50°	06:29	07:09	07:45	16:39	17:15	17:55
45°	06:21	06:57	07:29	16:55	17:27	18:03
N 40°	06:14	06:46	07:16	17:08	17:38	18:11
35°	06:07	06:37	07:04	17:20	17:47	18:17
30°	06:00	06:29	06:55	17:30	17:55	18:24
20°	05:47	06:14	06:37	17:46	18:10	18:37
N 10°	05:35	06:00	06:22	18:01	18:24	18:49
0°	05:21	05:46	06:08	18:15	18:37	19:03
S 10°	05:05	05:32	05:54	18:30	18:52	19:18
20°	04:47	05:15	05:39	18:45	19:09	19:37
30°	04:23	04:54	05:21	19:03	19:29	20:00
35°	04:08	04:42	05:10	19:13	19:41	20:15
40°	03:49	04:27	04:58	19:25	19:56	20:34
45°	03:25	04:09	04:44	19:39	20:13	20:57
S 50°	02:53	03:47	04:27	19:56	20:36	21:29
52°	02:36	03:35	04:18	20:05	20:47	21:46
54°	02:14	03:23	04:09	20:14	21:00	22:07
56°	01:46	03:07	03:58	20:24	21:15	22:34
58°	00:57	02:49	03:46	20:36	21:32	23:18
S 60°	////	02:27	03:32	20:50	21:54	////

Lat.	**Moonrise** Wed	Thu	Fri	**Moonset** Wed	Thu	Fri
N 72°	04:26	▬	▬	07:24	▬	▬
N 70°	03:36	▬	▬	08:16	▬	▬
68°	03:05	05:42	▬	08:48	07:44	▬
66°	02:43	04:45	▬	09:12	08:41	▬
64°	02:25	04:12	06:23	09:31	09:15	08:43
62°	02:10	03:48	05:35	09:47	09:40	09:32
60°	01:58	03:29	05:04	10:00	10:00	10:03
N 58°	01:48	03:13	04:42	10:11	10:16	10:27
56°	01:39	03:00	04:23	10:21	10:30	10:46
54°	01:31	02:48	04:07	10:30	10:43	11:02
52°	01:24	02:38	03:54	10:37	10:53	11:15
50°	01:17	02:29	03:42	10:44	11:03	11:27
45°	01:03	02:10	03:18	11:00	11:23	11:53
N 40°	00:52	01:55	02:59	11:12	11:39	12:13
35°	00:43	01:42	02:43	11:23	11:53	12:30
30°	00:34	01:31	02:29	11:32	12:06	12:44
20°	00:20	01:11	02:05	11:49	12:26	13:09
N 10°	00:07	00:55	01:45	12:03	12:45	13:30
0°	·· ··	00:39	01:27	12:17	13:02	13:51
S 10°	·· ··	00:24	01:08	12:30	13:19	14:11
20°	·· ··	00:08	00:48	12:45	13:37	14:32
30°	23:49	·· ··	00:25	13:01	13:58	14:58
35°	23:39	·· ··	00:12	13:11	14:11	15:12
40°	23:26	23:56	·· ··	13:22	14:25	15:30
45°	23:12	23:38	·· ··	13:35	14:43	15:51
S 50°	22:54	23:16	23:45	13:51	15:04	16:17
52°	22:46	23:05	23:32	13:59	15:14	16:30
54°	22:37	22:53	23:17	14:08	15:26	16:45
56°	22:27	22:39	22:59	14:17	15:39	17:02
58°	22:15	22:23	22:38	14:28	15:55	17:23
S 60°	22:02	22:04	22:10	14:41	16:13	17:50

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 23-25 49-30%
22	11:29	11:37	12:12	06:06	18:28	
23	11:45	11:52	12:12	06:50	19:14	
24	12:00	12:07	12:12	07:38	20:04	

January 25, 26, 27 UT (Sat., Sun., Mon.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	124°33.3	132°42.2	S02°27.5	9°10.0	N25°46.5	54°33.3	N21°38.6	136°03.0	S07°02.3
1	139°35.8	147°42.8	26.3	24°13.4	46.6	69°35.8	38.6	151°05.2	02.2
2	154°38.2	162°43.3	25.1	39°16.9	46.8	84°38.4	38.6	166°07.5	02.1
3	169°40.7	177°43.9	·· 23.9	54°20.3	·· 46.9	99°41.0	·· 38.6	181°09.7	·· 02.0
4	184°43.2	192°44.4	22.8	69°23.8	47.1	114°43.5	38.6	196°11.9	01.9
5	199°45.6	207°45.0	21.6	84°27.2	47.2	129°46.1	38.6	211°14.2	01.7
6	214°48.1	222°45.5	S02°20.4	99°30.7	N25°47.4	144°48.6	N21°38.6	226°16.4	S07°01.6
7	229°50.6	237°46.1	19.3	114°34.1	47.5	159°51.2	38.6	241°18.6	01.5
8	244°53.0	252°46.7	18.1	129°37.6	47.6	174°53.7	38.6	256°20.8	01.4
9	259°55.5	267°47.2	·· 16.9	144°41.0	·· 47.8	189°56.3	·· 38.6	271°23.1	·· 01.3
10	274°58.0	282°47.8	15.8	159°44.5	47.9	204°58.9	38.6	286°25.3	01.2
11	290°00.4	297°48.4	14.6	174°47.9	48.1	220°01.4	38.6	301°27.5	01.1
12	305°02.9	312°48.9	S02°13.4	189°51.4	N25°48.2	235°04.0	N21°38.6	316°29.7	S07°01.0
13	320°05.4	327°49.5	12.3	204°54.8	48.4	250°06.5	38.6	331°32.0	00.9
14	335°07.8	342°50.1	11.1	219°58.2	48.5	265°09.1	38.6	346°34.2	00.8
15	350°10.3	357°50.6	·· 09.9	235°01.7	·· 48.6	280°11.6	·· 38.6	1°36.4	·· 00.7
16	5°12.7	12°51.2	08.8	250°05.1	48.8	295°14.2	38.6	16°38.6	00.6
17	20°15.2	27°51.8	07.6	265°08.6	48.9	310°16.7	38.6	31°40.9	00.5
18	35°17.7	42°52.4	S02°06.4	280°12.0	N25°49.0	325°19.3	N21°38.6	46°43.1	S07°00.4
19	50°20.1	57°52.9	05.3	295°15.4	49.2	340°21.8	38.6	61°45.3	00.3
20	65°22.6	72°53.5	04.1	310°18.9	49.3	355°24.4	38.6	76°47.6	00.2
21	80°25.1	87°54.1	·· 02.9	325°22.3	·· 49.5	10°27.0	·· 38.6	91°49.8	·· 00.1
22	95°27.5	102°54.7	01.8	340°25.8	49.6	25°29.5	38.5	106°52.0	07°00.0
23	110°30.0	117°55.3	00.6	355°29.2	49.7	40°32.1	38.5	121°54.2	06°59.9
Mer.pass. 15:39		ν 0.6′	d 1.2′	m -4.68	ν 3.5′	d 0.1′	m -1.27	ν 2.6′	d 0.0′ m -2.58	ν 2.2′	d 0.1′ m 1.10

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	125°32.5	132°55.8	S01°59.4	10°32.6	N25°49.9	55°34.6	N21°38.5	136°56.5	S06°59.8
1	140°34.9	147°56.4	58.3	25°36.1	50.0	70°37.2	38.5	151°58.7	59.7
2	155°37.4	162°57.0	57.1	40°39.5	50.1	85°39.7	38.5	167°00.9	59.6
3	170°39.9	177°57.6	·· 55.9	55°42.9	·· 50.3	100°42.3	·· 38.5	182°03.1	·· 59.5
4	185°42.3	192°58.2	54.8	70°46.4	50.4	115°44.8	38.5	197°05.4	59.4
5	200°44.8	207°58.8	53.6	85°49.8	50.5	130°47.4	38.5	212°07.6	59.3
6	215°47.2	222°59.4	S01°52.4	100°53.2	N25°50.7	145°49.9	N21°38.5	227°09.8	S06°59.2
7	230°49.7	238°00.0	51.3	115°56.6	50.8	160°52.5	38.5	242°12.0	59.0
8	245°52.2	253°00.6	50.1	131°00.1	50.9	175°55.0	38.5	257°14.3	58.9
9	260°54.6	268°01.2	·· 48.9	146°03.5	·· 51.1	190°57.6	·· 38.5	272°16.5	·· 58.8
10	275°57.1	283°01.7	47.8	161°06.9	51.2	206°00.1	38.5	287°18.7	58.7
11	290°59.6	298°02.3	46.6	176°10.3	51.3	221°02.6	38.5	302°20.9	58.6
12	306°02.0	313°02.9	S01°45.4	191°13.8	N25°51.5	236°05.2	N21°38.5	317°23.2	S06°58.5
13	321°04.5	328°03.5	44.3	206°17.2	51.6	251°07.7	38.5	332°25.4	58.4
14	336°07.0	343°04.1	43.1	221°20.6	51.7	266°10.3	38.5	347°27.6	58.3
15	351°09.4	358°04.7	·· 42.0	236°24.0	·· 51.9	281°12.8	·· 38.5	2°29.8	·· 58.2
16	6°11.9	13°05.4	40.8	251°27.5	52.0	296°15.4	38.5	17°32.0	58.1
17	21°14.4	28°06.0	39.6	266°30.9	52.1	311°17.9	38.5	32°34.3	58.0
18	36°16.8	43°06.6	S01°38.5	281°34.3	N25°52.2	326°20.5	N21°38.5	47°36.5	S06°57.9
19	51°19.3	58°07.2	37.3	296°37.7	52.4	341°23.0	38.5	62°38.7	57.8
20	66°21.7	73°07.8	36.1	311°41.1	52.5	356°25.6	38.5	77°40.9	57.7
21	81°24.2	88°08.4	·· 35.0	326°44.5	·· 52.6	11°28.1	·· 38.5	92°43.2	·· 57.6
22	96°26.7	103°09.0	33.8	341°48.0	52.7	26°30.6	38.5	107°45.4	57.5
23	111°29.1	118°09.6	32.7	356°51.4	52.9	41°33.2	38.5	122°47.6	57.4
Mer.pass. 15:35		ν 0.6′	d 1.2′	m -4.69	ν 3.4′	d 0.1′	m -1.24	ν 2.6′	d 0.0′ m -2.57	ν 2.2′	d 0.1′ m 1.10

Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	126°31.6	133°10.2	S01°31.5	11°54.8	N25°53.0	56°35.7	N21°38.5	137°49.8	S06°57.3
1	141°34.1	148°10.9	30.3	26°58.2	53.1	71°38.3	38.5	152°52.1	57.2
2	156°36.5	163°11.5	29.2	42°01.6	53.2	86°40.8	38.5	167°54.3	57.1
3	171°39.0	178°12.1	·· 28.0	57°05.0	·· 53.4	101°43.3	·· 38.5	182°56.5	·· 57.0
4	186°41.5	193°12.7	26.9	72°08.4	53.5	116°45.9	38.5	197°58.7	56.9
5	201°43.9	208°13.3	25.7	87°11.8	53.6	131°48.4	38.5	213°01.0	56.7
6	216°46.4	223°14.0	S01°24.5	102°15.2	N25°53.7	146°51.0	N21°38.5	228°03.2	S06°56.6
7	231°48.9	238°14.6	23.4	117°18.6	53.9	161°53.5	38.5	243°05.4	56.5
8	246°51.3	253°15.2	22.2	132°22.1	54.0	176°56.0	38.5	258°07.6	56.4
9	261°53.8	268°15.8	·· 21.1	147°25.5	·· 54.1	191°58.6	·· 38.5	273°09.8	·· 56.3
10	276°56.2	283°16.5	19.9	162°28.9	54.2	207°01.1	38.5	288°12.1	56.2
11	291°58.7	298°17.1	18.7	177°32.3	54.4	222°03.7	38.5	303°14.3	56.1
12	307°01.2	313°17.7	S01°17.6	192°35.7	N25°54.5	237°06.2	N21°38.5	318°16.5	S06°56.0
13	322°03.6	328°18.4	16.4	207°39.1	54.6	252°08.7	38.5	333°18.7	55.9
14	337°06.1	343°19.0	15.3	222°42.5	54.7	267°11.3	38.5	348°21.0	55.8
15	352°08.6	358°19.6	·· 14.1	237°45.9	·· 54.8	282°13.8	·· 38.5	3°23.2	·· 55.7
16	7°11.0	13°20.3	13.0	252°49.3	55.0	297°16.3	38.5	18°25.4	55.6
17	22°13.5	28°20.9	11.8	267°52.7	55.1	312°18.9	38.5	33°27.6	55.5
18	37°16.0	43°21.5	S01°10.6	282°56.1	N25°55.2	327°21.4	N21°38.5	48°29.8	S06°55.4
19	52°18.4	58°22.2	09.5	297°59.5	55.3	342°24.0	38.5	63°32.1	55.3
20	67°20.9	73°22.8	08.3	313°02.8	55.4	357°26.5	38.5	78°34.3	55.2
21	82°23.4	88°23.5	·· 07.2	328°06.2	·· 55.6	12°29.0	·· 38.5	93°36.5	·· 55.1
22	97°25.8	103°24.1	06.0	343°09.6	55.7	27°31.6	38.5	108°38.7	55.0
23	112°28.3	118°24.8	04.9	358°13.0	55.8	42°34.1	38.5	123°41.0	54.9
Mer.pass. 15:31		ν 0.6′	d 1.2′	m -4.70	ν 3.4′	d 0.1′	m -1.21	ν 2.5′	d 0.0′ m -2.56	ν 2.2′	d 0.1′ m 1.11

Stars

	SHA	Dec
Alpheratz	357°34.9	29°13.8
Ankaa	353°07.3	-42°10.4
Schedar	349°31.2	56°40.7
Diphda	348°47.4	-17°51.1
Achernar	335°20.2	-57°06.9
Hamal	327°51.2	23°34.9
Polaris	313°54.0	89°22.5
Acamar	315°11.6	-40°12.5
Menkar	314°06.0	4°11.2
Mirfak	308°28.0	49°57.2
Aldebaran	290°39.4	16°33.6
Rigel	281°03.6	-8°10.4
Capella	280°21.5	46°01.5
Bellatrix	278°22.6	6°22.3
Elnath	278°01.5	28°37.8
Alnilam	275°37.4	-1°11.2
Betelgeuse	270°51.8	7°24.7
Canopus	263°51.9	-52°42.6
Sirius	258°25.9	-16°45.1
Adhara	255°05.5	-29°00.4
Procyon	244°50.5	5°09.6
Pollux	243°16.9	27°57.9
Avior	234°14.1	-59°35.4
Suhail	222°45.8	-43°32.0
Miaplacidus	221°37.4	-69°49.1
Alphard	217°47.4	-8°46.1
Regulus	207°34.1	11°50.6
Dubhe	193°40.4	61°36.7
Denebola	182°24.7	14°25.8
Gienah	175°43.4	-17°40.9
Acrux	172°59.8	-63°14.1
Gacrux	171°51.4	-57°15.0
Alioth	166°12.7	55°49.1
Spica	158°22.2	-11°17.6
Alkaid	152°51.9	49°10.9
Hadar	148°35.9	-60°29.4
Menkent	147°57.6	-36°29.5
Arcturus	145°47.9	19°02.9
Rigil Kent.	139°40.3	-60°56.1
Kochab	137°19.9	74°02.7
Zuben'ubi	136°56.0	-16°08.8
Alphecca	126°03.8	26°37.6
Antares	112°16.0	-26°29.2
Atria	107°10.6	-69°04.1
Sabik	102°03.0	-15°45.4
Shaula	96°10.6	-37°07.3
Rasalhague	95°58.8	12°32.3
Eltanin	90°42.6	51°28.9
Kaus Aust.	83°32.8	-34°22.3
Vega	80°33.6	38°48.2
Nunki	75°48.0	-26°16.0
Altair	62°00.2	8°56.0
Peacock	53°06.2	-56°39.3
Deneb	49°26.3	45°22.1
Enif	33°39.1	9°59.3
Al Na'ir	27°33.3	-46°50.5
Fomalhaut	15°14.7	-29°29.5
Scheat	13°45.4	28°13.2
Markab	13°30.1	15°20.4

Jan 25 Sat	SHA	Mer.pass
Venus	8°08.9	15:09
Mars	244°36.7	23:18
Jupiter	290°00.0	20:18
Saturn	11°29.7	14:54

Jan 26 Sun	SHA	Mer.pass
Venus	7°23.4	15:08
Mars	245°00.2	23:13
Jupiter	290°02.1	20:14
Saturn	11°24.0	14:50

Jan 27 Mon	SHA	Mer.pass
Venus	6°38.6	15:07
Mars	245°23.2	23:07
Jupiter	290°04.1	20:10
Saturn	11°18.2	14:46

Horizontal parallax	
Venus:	0.3
Mars:	0.2

h	Sun		Moon				
Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°56.5	S18°57.2	236°57.3	9.3′	S26°43.9	5.6′	55.4′
1	191°56.4	56.6	251°25.5	9.2′	26°49.5	5.4′	55.4′
2	206°56.2	56.0	265°53.7	9.1′	26°54.9	5.2′	55.4′
3	221°56.1	·· 55.4	280°21.8	9.0′	27°00.1	5.2′	55.5′
4	236°55.9	54.8	294°49.8	8.9′	27°05.3	5.0′	55.5′
5	251°55.8	54.1	309°17.7	8.8′	27°10.3	4.8′	55.5′
6	266°55.7	S18°53.5	323°45.5	8.7′	S27°15.1	4.8′	55.5′
7	281°55.5	52.9	338°13.2	8.6′	27°19.9	4.6′	55.6′
8	296°55.4	52.3	352°40.8	8.6′	27°24.5	4.4′	55.6′
9	311°55.2	·· 51.7	7°08.4	8.5′	27°28.9	4.3′	55.6′
10	326°55.1	51.0	21°35.9	8.4′	27°33.2	4.2′	55.7′
11	341°55.0	50.4	36°03.3	8.3′	27°37.4	4.0′	55.7′
12	356°54.8	S18°49.8	50°30.6	8.2′	S27°41.4	3.9′	55.7′
13	11°54.7	49.2	64°57.8	8.2′	27°45.3	3.7′	55.7′
14	26°54.5	48.5	79°25.0	8.1′	27°49.0	3.6′	55.8′
15	41°54.4	·· 47.9	93°52.0	8.0′	27°52.6	3.5′	55.8′
16	56°54.3	47.3	108°19.0	7.9′	27°56.1	3.3′	55.8′
17	71°54.1	46.7	122°45.9	7.8′	27°59.4	3.1′	55.8′
18	86°54.0	S18°46.0	137°12.8	7.8′	S28°02.5	3.0′	55.9′
19	101°53.8	45.4	151°39.6	7.7′	28°05.5	2.8′	55.9′
20	116°53.7	44.8	166°06.3	7.6′	28°08.3	2.7′	55.9′
21	131°53.6	·· 44.1	180°32.9	7.6′	28°11.0	2.6′	56.0′
22	146°53.4	43.5	194°59.5	7.5′	28°13.6	2.3′	56.0′
23	161°53.3	42.9	209°26.0	7.4′	28°15.9	2.3′	56.0′
	SD = 16.2′	d = 0.6′	SD = 15.1′				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°53.2	S18°42.2	223°52.4	7.4′	S28°18.2	2.0′	56.0′
1	191°53.0	41.6	238°18.7	7.3′	28°20.2	2.0′	56.1′
2	206°52.9	41.0	252°45.0	7.2′	28°22.2	1.7′	56.1′
3	221°52.8	·· 40.4	267°11.3	7.2′	28°23.9	1.6′	56.1′
4	236°52.6	39.7	281°37.5	7.1′	28°25.5	1.4′	56.2′
5	251°52.5	39.1	296°03.6	7.1′	28°26.9	1.3′	56.2′
6	266°52.4	S18°38.4	310°29.6	7.0′	S28°28.2	1.1′	56.2′
7	281°52.2	37.8	324°55.7	7.0′	28°29.3	1.0′	56.3′
8	296°52.1	37.2	339°21.6	6.9′	28°30.3	0.8′	56.3′
9	311°52.0	·· 36.5	353°47.5	6.9′	28°31.1	0.6′	56.3′
10	326°51.8	35.9	8°13.4	6.8′	28°31.7	0.5′	56.3′
11	341°51.7	35.3	22°39.2	6.8′	28°32.2	0.3′	56.4′
12	356°51.6	S18°34.6	37°04.9	6.7′	S28°32.5	0.1′	56.4′
13	11°51.4	34.0	51°30.6	6.7′	28°32.6	0.0′	56.4′
14	26°51.3	33.3	65°56.3	6.6′	28°32.6	0.2′	56.5′
15	41°51.2	·· 32.7	80°21.9	6.6′	28°32.4	0.3′	56.5′
16	56°51.0	32.1	94°47.5	6.5′	28°32.1	0.6′	56.5′
17	71°50.9	31.4	109°13.1	6.5′	28°31.5	0.7′	56.6′
18	86°50.8	S18°30.8	123°38.6	6.5′	S28°30.8	0.8′	56.6′
19	101°50.6	30.1	138°04.1	6.4′	28°30.0	1.0′	56.6′
20	116°50.5	29.5	152°29.5	6.4′	28°29.0	1.2′	56.6′
21	131°50.4	·· 28.9	166°54.9	6.4′	28°27.8	1.4′	56.7′
22	146°50.3	28.2	181°20.3	6.4′	28°26.4	1.5′	56.7′
23	161°50.1	27.6	195°45.7	6.3′	28°24.9	1.7′	56.7′
	SD = 16.2′	d = 0.6′	SD = 15.3′				

Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°50.0	S18°26.9	210°11.0	6.3′	S28°23.2	1.9′	56.8′
1	191°49.9	26.3	224°36.3	6.3′	28°21.3	2.1′	56.8′
2	206°49.8	25.6	239°01.6	6.3′	28°19.2	2.2′	56.8′
3	221°49.6	·· 25.0	253°26.9	6.3′	28°17.0	2.4′	56.9′
4	236°49.5	24.3	267°52.2	6.2′	28°14.6	2.5′	56.9′
5	251°49.4	23.7	282°17.4	6.2′	28°12.1	2.8′	56.9′
6	266°49.2	S18°23.0	296°42.7	6.2′	S28°09.3	2.9′	57.0′
7	281°49.1	22.4	311°07.9	6.2′	28°06.4	3.0′	57.0′
8	296°49.0	21.7	325°33.1	6.2′	28°03.4	3.3′	57.0′
9	311°48.9	·· 21.1	339°58.3	6.2′	28°00.1	3.4′	57.0′
10	326°48.8	20.4	354°23.5	6.2′	27°56.7	3.6′	57.1′
11	341°48.6	19.8	8°48.7	6.2′	27°53.1	3.8′	57.1′
12	356°48.5	S18°19.1	23°13.9	6.2′	S27°49.3	3.9′	57.1′
13	11°48.4	18.5	37°39.2	6.2′	27°45.4	4.1′	57.2′
14	26°48.3	17.8	52°04.4	6.2′	27°41.3	4.3′	57.2′
15	41°48.1	·· 17.2	66°29.6	6.2′	27°37.0	4.4′	57.2′
16	56°48.0	16.5	80°54.8	6.2′	27°32.6	4.6′	57.3′
17	71°47.9	15.9	95°20.0	6.2′	27°28.0	4.8′	57.3′
18	86°47.8	S18°15.2	109°45.3	6.3′	S27°23.2	5.0′	57.3′
19	101°47.6	14.5	124°10.5	6.3′	27°18.2	5.1′	57.3′
20	116°47.5	13.9	138°35.8	6.3′	27°13.1	5.3′	57.4′
21	131°47.4	·· 13.2	153°01.1	6.3′	27°07.8	5.5′	57.4′
22	146°47.3	12.6	167°26.4	6.3′	27°02.3	5.6′	57.4′
23	161°47.2	11.9	181°51.7	6.3′	26°56.7	5.8′	57.5′
	SD = 16.2′	d = 0.6′	SD = 15.5′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	07:29	09:04	11:33	12:53	15:23	16:58
N 70°	07:19	08:41	10:19	14:07	15:45	17:08
68°	07:10	08:23	09:42	14:44	16:03	17:16
66°	07:03	08:09	09:16	15:10	16:17	17:23
64°	06:57	07:57	08:56	15:30	16:29	17:30
62°	06:51	07:47	08:40	15:46	16:39	17:35
60°	06:46	07:38	08:27	15:59	16:48	17:40
N 58°	06:41	07:30	08:15	16:11	16:56	17:45
56°	06:37	07:23	08:05	16:21	17:03	17:49
54°	06:33	07:17	07:56	16:29	17:09	17:52
52°	06:30	07:11	07:48	16:37	17:15	17:56
50°	06:26	07:06	07:41	16:44	17:20	17:59
45°	06:19	06:54	07:26	17:00	17:31	18:07
N 40°	06:12	06:44	07:13	17:12	17:41	18:14
35°	06:05	06:36	07:03	17:23	17:50	18:20
30°	05:59	06:28	06:53	17:32	17:57	18:26
20°	05:47	06:14	06:37	17:48	18:12	18:38
N 10°	05:35	06:00	06:23	18:03	18:25	18:50
0°	05:22	05:47	06:09	18:16	18:38	19:03
S 10°	05:07	05:33	05:55	18:30	18:52	19:18
20°	04:49	05:17	05:41	18:44	19:08	19:36
30°	04:26	04:57	05:23	19:01	19:27	19:59
35°	04:11	04:45	05:13	19:11	19:39	20:13
40°	03:54	04:31	05:02	19:23	19:53	20:31
45°	03:31	04:14	04:48	19:36	20:10	20:53
S 50°	03:00	03:52	04:32	19:53	20:32	21:23
52°	02:44	03:42	04:24	20:00	20:42	21:39
54°	02:24	03:30	04:15	20:09	20:54	21:58
56°	01:59	03:15	04:05	20:19	21:08	22:23
58°	01:21	02:58	03:54	20:30	21:24	22:58
S 60°	////	02:38	03:40	20:43	21:45	////

Lat.	**Moonrise** Sat	Sun	Mon	**Moonset** Sat	Sun	Mon
N 72°						
N 70°						
68°						
66°						
64°						
62°	07:41			09:14		
60°	06:42	08:07	08:51	10:13	10:44	12:00
N 58°	06:09	07:24	08:14	10:46	11:26	12:37
56°	05:45	06:56	07:48	11:11	11:55	13:03
54°	05:25	06:34	07:27	11:31	12:17	13:24
52°	05:09	06:16	07:10	11:48	12:35	13:41
50°	04:54	06:00	06:55	12:02	12:51	13:56
45°	04:26	05:29	06:24	12:31	13:22	14:25
N 40°	04:03	05:05	06:01	12:54	13:46	14:49
35°	03:45	04:45	05:41	13:13	14:06	15:08
30°	03:29	04:28	05:25	13:30	14:23	15:24
20°	03:02	03:59	04:56	13:57	14:52	15:52
N 10°	02:39	03:35	04:32	14:21	15:17	16:15
0°	02:18	03:12	04:09	14:43	15:40	16:37
S 10°	01:56	02:50	03:47	15:06	16:02	16:59
20°	01:33	02:25	03:23	15:30	16:27	17:22
30°	01:07	01:57	02:54	15:57	16:55	17:50
35°	00:52	01:40	02:37	16:14	17:12	18:05
40°	00:34	01:21	02:18	16:33	17:32	18:24
45°	00:12	00:57	01:54	16:56	17:56	18:46
S 50°	·· ··	00:27	01:24	17:26	18:27	19:14
52°	·· ··	00:12	01:08	17:41	18:42	19:28
54°	23:54	·· ··	00:51	17:58	19:00	19:44
56°	23:33	·· ··	00:29	18:19	19:21	20:03
58°	23:07	·· ··	00:02	18:46	19:49	20:26
S 60°	22:30	23:23	·· ··	19:22	20:28	20:56

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 26-28 22-8%
25	12:14	12:21	12:12	08:30	20:58	
26	12:27	12:34	12:13	09:26	21:54	
27	12:40	12:46	12:13	10:23	22:52	

January 28, 29, 30 UT (Tue., Wed., Thu.)

	Aries	Venus		Mars		Jupiter		Saturn	
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	127°30.7	133°25.4	S01°03.7	13°16.4	N25°55.9	57°36.6	N21°38.5	138°43.2	S06°54.7
1	142°33.2	148°26.1	02.6	28°19.8	56.0	72°39.2	38.5	153°45.4	54.6
2	157°35.7	163°26.7	01.4	43°23.2	56.1	87°41.7	38.5	168°47.6	54.5
3	172°38.1	178°27.4	01°00.2	58°26.6	·· 56.2	102°44.2	·· 38.5	183°49.8	·· 54.4
4	187°40.6	193°28.0	00°59.1	73°30.0	56.4	117°46.8	38.5	198°52.1	54.3
5	202°43.1	208°28.7	57.9	88°33.3	56.5	132°49.3	38.5	213°54.3	54.2
6	217°45.5	223°29.3	S00°56.8	103°36.7	N25°56.6	147°51.8	N21°38.5	228°56.5	S06°54.1
7	232°48.0	238°30.0	55.6	118°40.1	56.7	162°54.3	38.5	243°58.7	54.0
8	247°50.5	253°30.6	54.5	133°43.5	56.8	177°56.9	38.5	259°00.9	53.9
9	262°52.9	268°31.3	·· 53.3	148°46.9	·· 56.9	192°59.4	·· 38.5	274°03.2	·· 53.8
10	277°55.4	283°32.0	52.2	163°50.3	57.0	208°01.9	38.5	289°05.4	53.7
11	292°57.9	298°32.6	51.0	178°53.6	57.2	223°04.5	38.5	304°07.6	53.6
12	308°00.3	313°33.3	S00°49.9	193°57.0	N25°57.3	238°07.0	N21°38.5	319°09.8	S06°53.5
13	323°02.8	328°33.9	48.7	209°00.4	57.4	253°09.5	38.5	334°12.0	53.4
14	338°05.2	343°34.6	47.6	224°03.8	57.5	268°12.1	38.5	349°14.3	53.3
15	353°07.7	358°35.3	·· 46.4	239°07.1	·· 57.6	283°14.6	·· 38.5	4°16.5	·· 53.2
16	8°10.2	13°36.0	45.3	254°10.5	57.7	298°17.1	38.5	19°18.7	53.1
17	23°12.6	28°36.6	44.1	269°13.9	57.8	313°19.6	38.5	34°20.9	52.9
18	38°15.1	43°37.3	S00°43.0	284°17.3	N25°57.9	328°22.2	N21°38.5	49°23.2	S06°52.8
19	53°17.6	58°38.0	41.8	299°20.6	58.0	343°24.7	38.5	64°25.4	52.7
20	68°20.0	73°38.7	40.7	314°24.0	58.1	358°27.2	38.5	79°27.6	52.6
21	83°22.5	88°39.3	·· 39.5	329°27.4	·· 58.3	13°29.7	·· 38.5	94°29.8	·· 52.5
22	98°25.0	103°40.0	38.4	344°30.7	58.4	28°32.3	38.5	109°32.0	52.4
23	113°27.4	118°40.7	37.2	359°34.1	58.5	43°34.8	38.5	124°34.2	52.3
Mer.pass. 15:27		ν 0.6′	d 1.2′	m -4.71	ν 3.4′	d 0.1′	m -1.19	ν 2.5′	d 0.0′ m -2.55	ν 2.2′	d 0.1′ m 1.11

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	128°29.9	133°41.4	S00°36.1	14°37.5	N25°58.6	58°37.3	N21°38.5	139°36.5	S06°52.2
1	143°32.3	148°42.1	34.9	29°40.8	58.7	73°39.8	38.5	154°38.7	52.1
2	158°34.8	163°42.7	33.8	44°44.2	58.8	88°42.4	38.5	169°40.9	52.0
3	173°37.3	178°43.4	·· 32.6	59°47.6	·· 58.9	103°44.9	·· 38.5	184°43.1	·· 51.9
4	188°39.7	193°44.1	31.5	74°50.9	59.0	118°47.4	38.5	199°45.3	51.8
5	203°42.2	208°44.8	30.3	89°54.3	59.1	133°49.9	38.5	214°47.6	51.7
6	218°44.7	223°45.5	S00°29.2	104°57.6	N25°59.2	148°52.4	N21°38.5	229°49.8	S06°51.6
7	233°47.1	238°46.2	28.0	120°01.0	59.3	163°55.0	38.5	244°52.0	51.5
8	248°49.6	253°46.9	26.9	135°04.3	59.4	178°57.5	38.5	259°54.2	51.3
9	263°52.1	268°47.6	·· 25.7	150°07.7	·· 59.5	194°00.0	·· 38.5	274°56.4	·· 51.2
10	278°54.5	283°48.3	24.6	165°11.1	59.6	209°02.5	38.5	289°58.7	51.1
11	293°57.0	298°49.0	23.4	180°14.4	59.7	224°05.1	38.5	305°00.9	51.0
12	308°59.5	313°49.7	S00°22.3	195°17.8	N25°59.8	239°07.6	N21°38.5	320°03.1	S06°50.9
13	324°01.9	328°50.4	21.1	210°21.1	25°59.9	254°10.1	38.6	335°05.3	50.8
14	339°04.4	343°51.1	20.0	225°24.5	26°00.0	269°12.6	38.6	350°07.5	50.7
15	354°06.8	358°51.8	·· 18.9	240°27.8	·· 00.1	284°15.1	·· 38.6	5°09.8	·· 50.6
16	9°09.3	13°52.5	17.7	255°31.2	00.2	299°17.6	38.6	20°12.0	50.5
17	24°11.8	28°53.2	16.6	270°34.5	00.3	314°20.2	38.6	35°14.2	50.4
18	39°14.2	43°53.9	S00°15.4	285°37.9	N26°00.4	329°22.7	N21°38.6	50°16.4	S06°50.3
19	54°16.7	58°54.6	14.3	300°41.2	00.5	344°25.2	38.6	65°18.6	50.2
20	69°19.2	73°55.3	13.1	315°44.5	00.6	359°27.7	38.6	80°20.8	50.1
21	84°21.6	88°56.0	·· 12.0	330°47.9	·· 00.7	14°30.2	·· 38.6	95°23.1	·· 50.0
22	99°24.1	103°56.7	10.9	345°51.2	00.8	29°32.7	38.6	110°25.3	49.9
23	114°26.6	118°57.4	09.7	0°54.6	00.9	44°35.3	38.6	125°27.5	49.7
Mer.pass. 15:23		ν 0.7′	d 1.1′	m -4.72	ν 3.4′	d 0.1′	m -1.16	ν 2.5′	d 0.0′ m -2.54	ν 2.2′	d 0.1′ m 1.11

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	129°29.0	133°58.2	S00°08.6	15°57.9	N26°01.0	59°37.8	N21°38.6	140°29.7	S06°49.6
1	144°31.5	148°58.9	07.4	31°01.2	01.1	74°40.3	38.6	155°31.9	49.5
2	159°34.0	163°59.6	06.3	46°04.6	01.2	89°42.8	38.6	170°34.1	49.4
3	174°36.4	179°00.3	·· 05.1	61°07.9	·· 01.3	104°45.3	·· 38.6	185°36.4	·· 49.3
4	189°38.9	194°01.0	04.0	76°11.2	01.4	119°47.8	38.6	200°38.6	49.2
5	204°41.3	209°01.8	02.9	91°14.6	01.5	134°50.3	38.6	215°40.8	49.1
6	219°43.8	224°02.5	S00°01.7	106°17.9	N26°01.6	149°52.9	N21°38.6	230°43.0	S06°49.0
7	234°46.3	239°03.2	S00°00.6	121°21.2	01.7	164°55.4	38.6	245°45.2	48.9
8	249°48.7	254°03.9	N00°00.5	136°24.6	01.8	179°57.9	38.6	260°47.5	48.8
9	264°51.2	269°04.7	·· 01.7	151°27.9	·· 01.9	195°00.4	·· 38.6	275°49.7	·· 48.7
10	279°53.7	284°05.4	02.8	166°31.2	02.0	210°02.9	38.6	290°51.9	48.6
11	294°56.1	299°06.1	04.0	181°34.6	02.1	225°05.4	38.6	305°54.1	48.5
12	309°58.6	314°06.9	N00°05.1	196°37.9	N26°02.2	240°07.9	N21°38.6	320°56.3	S06°48.4
13	325°01.1	329°07.6	06.2	211°41.2	02.3	255°10.4	38.6	335°58.5	48.2
14	340°03.5	344°08.3	07.4	226°44.5	02.3	270°12.9	38.6	351°00.8	48.1
15	355°06.0	359°09.1	·· 08.5	241°47.9	·· 02.4	285°15.5	·· 38.6	6°03.0	·· 48.0
16	10°08.5	14°09.8	09.7	256°51.2	02.5	300°18.0	38.6	21°05.2	47.9
17	25°10.9	29°10.6	10.8	271°54.5	02.6	315°20.5	38.6	36°07.4	47.8
18	40°13.4	44°11.3	N00°11.9	286°57.8	N26°02.7	330°23.0	N21°38.6	51°09.6	S06°47.7
19	55°15.8	59°12.0	13.1	302°01.1	02.8	345°25.5	38.6	66°11.8	47.6
20	70°18.3	74°12.8	14.2	317°04.4	02.9	0°28.0	38.6	81°14.0	47.5
21	85°20.8	89°13.5	·· 15.3	332°07.8	·· 03.0	15°30.5	·· 38.6	96°16.3	·· 47.4
22	100°23.2	104°14.3	16.5	347°11.1	03.1	30°33.0	38.6	111°18.5	47.3
23	115°25.7	119°15.0	17.6	2°14.4	03.2	45°35.5	38.7	126°20.7	47.2
Mer.pass. 15:20		ν 0.7′	d 1.1′	m -4.73	ν 3.3′	d 0.1′	m -1.13	ν 2.5′	d 0.0′ m -2.54	ν 2.2′	d 0.1′ m 1.11

Stars

	SHA	Dec
Alpheratz	357°34.9	29°13.8
Ankaa	353°07.3	-42°10.4
Schedar	349°31.3	56°40.7
Diphda	348°47.4	-17°51.1
Achernar	335°20.2	-57°06.9
Hamal	327°51.2	23°34.9
Polaris	313°55.3	89°22.5
Acamar	315°11.6	-40°12.5
Menkar	314°06.0	4°11.2
Mirfak	308°28.0	49°57.2
Aldebaran	290°39.4	16°33.6
Rigel	281°03.6	-8°10.4
Capella	280°21.5	46°01.5
Bellatrix	278°22.6	6°22.3
Elnath	278°01.5	28°37.8
Alnilam	275°37.4	-1°11.2
Betelgeuse	270°51.8	7°24.7
Canopus	263°51.9	-52°42.7
Sirius	258°25.9	-16°45.1
Adhara	255°05.5	-29°00.5
Procyon	244°50.4	5°09.6
Pollux	243°16.9	27°57.9
Avior	234°14.1	-59°35.4
Suhail	222°45.8	-43°32.0
Miaplacidus	221°37.4	-69°49.1
Alphard	217°47.4	-8°46.1
Regulus	207°34.1	11°50.6
Dubhe	193°40.4	61°36.7
Denebola	182°24.7	14°25.8
Gienah	175°43.3	-17°40.9
Acrux	172°59.7	-63°14.1
Gacrux	171°51.3	-57°15.0
Alioth	166°12.7	55°49.1
Spica	158°22.2	-11°17.6
Alkaid	152°51.8	49°10.9
Hadar	148°35.9	-60°29.4
Menkent	147°57.5	-36°29.5
Arcturus	145°47.8	19°02.9
Rigil Kent.	139°40.3	-60°56.1
Kochab	137°19.9	74°02.7
Zuben'ubi	136°56.0	-16°08.8
Alphecca	126°03.8	26°37.6
Antares	112°16.0	-26°29.2
Atria	107°10.5	-69°04.1
Sabik	102°02.9	-15°45.4
Shaula	96°10.6	-37°07.3
Rasalhague	95°58.7	12°32.3
Eltanin	90°42.6	51°28.8
Kaus Aust.	83°32.8	-34°22.3
Vega	80°33.6	38°48.2
Nunki	75°48.0	-26°16.0
Altair	62°00.2	8°56.0
Peacock	53°06.2	-56°39.3
Deneb	49°26.2	45°22.1
Enif	33°39.1	9°59.3
Al Na'ir	27°33.3	-46°50.5
Fomalhaut	15°14.7	-29°29.5
Scheat	13°45.4	28°13.2
Markab	13°30.1	15°20.4

Jan 28 Tue	SHA	Mer.pass
Venus	5°54.7	15:06
Mars	245°45.7	23:02
Jupiter	290°05.9	20:06
Saturn	11°12.4	14:43

Jan 29 Wed	SHA	Mer.pass
Venus	5°11.5	15:05
Mars	246°07.6	22:56
Jupiter	290°07.4	20:02
Saturn	11°06.6	14:39

Jan 30 Thu	SHA	Mer.pass
Venus	4°29.1	15:03
Mars	246°28.9	22:51
Jupiter	290°08.8	19:58
Saturn	11°00.7	14:36

Horizontal parallax	
Venus:	0.3
Mars:	0.2

h	Sun		Moon				
Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°47.0	S18°11.3	196°17.1	6.4′	S26°50.9	6.0′	57.5′
1	191°46.9	10.6	210°42.4	6.4′	26°44.9	6.1′	57.5′
2	206°46.8	09.9	225°07.8	6.4′	26°38.8	6.3′	57.6′
3	221°46.7	·· 09.3	239°33.3	6.5′	26°32.5	6.5′	57.6′
4	236°46.6	08.6	253°58.7	6.5′	26°26.0	6.6′	57.6′
5	251°46.5	08.0	268°24.2	6.5′	26°19.4	6.8′	57.6′
6	266°46.3	S18°07.3	282°49.7	6.5′	S26°12.6	7.0′	57.7′
7	281°46.2	06.6	297°15.2	6.6′	26°05.6	7.1′	57.7′
8	296°46.1	06.0	311°40.8	6.6′	25°58.5	7.3′	57.7′
9	311°46.0	·· 05.3	326°06.4	6.7′	25°51.2	7.5′	57.8′
10	326°45.9	04.6	340°32.1	6.7′	25°43.7	7.6′	57.8′
11	341°45.8	04.0	354°57.8	6.7′	25°36.1	7.8′	57.8′
12	356°45.6	S18°03.3	9°23.5	6.8′	S25°28.3	7.9′	57.9′
13	11°45.5	02.6	23°49.3	6.8′	25°20.4	8.1′	57.9′
14	26°45.4	02.0	38°15.1	6.9′	25°12.3	8.3′	57.9′
15	41°45.3	·· 01.3	52°41.0	6.9′	25°04.0	8.4′	57.9′
16	56°45.2	00.6	67°06.9	7.0′	24°55.6	8.6′	58.0′
17	71°45.1	18°00.0	81°32.9	7.0′	24°47.0	8.7′	58.0′
18	86°45.0	S17°59.3	95°58.9	7.1′	S24°38.3	8.9′	58.0′
19	101°44.9	58.6	110°24.9	7.1′	24°29.4	9.1′	58.1′
20	116°44.7	58.0	124°51.0	7.2′	24°20.3	9.2′	58.1′
21	131°44.6	·· 57.3	139°17.2	7.2′	24°11.1	9.3′	58.1′
22	146°44.5	56.6	153°43.4	7.3′	24°01.8	9.5′	58.1′
23	161°44.4	55.9	168°09.7	7.3′	23°52.3	9.7′	58.2′
	SD = 16.2′	d = 0.7′	SD = 15.7′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°44.3	S17°55.3	182°36.0	7.4′	S23°42.6	9.8′	58.2′
1	191°44.2	54.6	197°02.4	7.4′	23°32.8	9.9′	58.2′
2	206°44.1	53.9	211°28.8	7.5′	23°22.9	10.1′	58.2′
3	221°44.0	·· 53.2	225°55.3	7.5′	23°12.8	10.3′	58.3′
4	236°43.9	52.6	240°21.9	7.6′	23°02.5	10.4′	58.3′
5	251°43.7	51.9	254°48.5	7.7′	22°52.1	10.5′	58.3′
6	266°43.6	S17°51.2	269°15.1	7.7′	S22°41.6	10.7′	58.3′
7	281°43.5	50.5	283°41.9	7.8′	22°30.9	10.8′	58.4′
8	296°43.4	49.9	298°08.6	7.8′	22°20.1	11.0′	58.4′
9	311°43.3	·· 49.2	312°35.5	7.9′	22°09.1	11.1′	58.4′
10	326°43.2	48.5	327°02.4	8.0′	21°58.0	11.2′	58.4′
11	341°43.1	47.8	341°29.4	8.0′	21°46.8	11.3′	58.5′
12	356°43.0	S17°47.1	355°56.4	8.1′	S21°35.5	11.6′	58.5′
13	11°42.9	46.5	10°23.5	8.2′	21°23.9	11.6′	58.5′
14	26°42.8	45.8	24°50.7	8.2′	21°12.3	11.8′	58.5′
15	41°42.7	·· 45.1	39°17.9	8.3′	21°00.5	11.9′	58.6′
16	56°42.6	44.4	53°45.2	8.4′	20°48.6	12.0′	58.6′
17	71°42.5	43.7	68°12.6	8.4′	20°36.6	12.1′	58.6′
18	86°42.4	S17°43.1	82°40.0	8.5′	S20°24.5	12.3′	58.6′
19	101°42.3	42.4	97°07.5	8.6′	20°12.2	12.4′	58.7′
20	116°42.2	41.7	111°35.0	8.6′	19°59.8	12.6′	58.7′
21	131°42.0	·· 41.0	126°02.6	8.7′	19°47.2	12.6′	58.7′
22	146°41.9	40.3	140°30.3	8.8′	19°34.6	12.8′	58.7′
23	161°41.8	39.6	154°58.1	8.8′	19°21.8	12.9′	58.8′
	SD = 16.2′	d = 0.7′	SD = 15.9′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°41.7	S17°38.9	169°25.9	8.9′	S19°08.9	13.0′	58.8′
1	191°41.6	38.3	183°53.8	8.9′	18°55.9	13.1′	58.8′
2	206°41.5	37.6	198°21.7	9.0′	18°42.8	13.2′	58.8′
3	221°41.4	·· 36.9	212°49.7	9.1′	18°29.6	13.4′	58.8′
4	236°41.3	36.2	227°17.8	9.1′	18°16.2	13.5′	58.9′
5	251°41.2	35.5	241°46.0	9.2′	18°02.7	13.5′	58.9′
6	266°41.1	S17°34.8	256°14.2	9.3′	S17°49.2	13.7′	58.9′
7	281°41.0	34.1	270°42.4	9.3′	17°35.5	13.8′	58.9′
8	296°40.9	33.4	285°10.8	9.4′	17°21.7	13.9′	58.9′
9	311°40.8	·· 32.8	299°39.2	9.5′	17°07.8	14.0′	59.0′
10	326°40.7	32.1	314°07.6	9.5′	16°53.8	14.1′	59.0′
11	341°40.6	31.4	328°36.2	9.6′	16°39.7	14.2′	59.0′
12	356°40.5	S17°30.7	343°04.8	9.7′	S16°25.5	14.3′	59.0′
13	11°40.4	30.0	357°33.4	9.7′	16°11.2	14.4′	59.0′
14	26°40.3	29.3	12°02.1	9.8′	15°56.8	14.5′	59.1′
15	41°40.2	·· 28.6	26°30.9	9.8′	15°42.3	14.6′	59.1′
16	56°40.1	27.9	40°59.8	9.9′	15°27.7	14.7′	59.1′
17	71°40.1	27.2	55°28.7	10.0′	15°13.0	14.8′	59.1′
18	86°40.0	S17°26.5	69°57.6	10.0′	S14°58.2	14.8′	59.1′
19	101°39.9	25.8	84°26.6	10.1′	14°43.4	15.0′	59.1′
20	116°39.8	25.1	98°55.7	10.1′	14°28.4	15.0′	59.2′
21	131°39.7	·· 24.4	113°24.9	10.2′	14°13.4	15.2′	59.2′
22	146°39.6	23.7	127°54.1	10.3′	13°58.2	15.2′	59.2′
23	161°39.5	23.0	142°23.3	10.3′	13°43.0	15.3′	59.2′
	SD = 16.2′	d = 0.7′	SD = 16.0′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	07:19	08:51	10:53	13:35	15:37	17:09
N 70°	07:10	08:30	10:01	14:27	15:57	17:18
68°	07:02	08:14	09:29	14:58	16:13	17:25
66°	06:56	08:01	09:06	15:21	16:27	17:31
64°	06:50	07:50	08:48	15:40	16:37	17:37
62°	06:45	07:40	08:33	15:54	16:47	17:42
60°	06:41	07:32	08:20	16:07	16:55	17:46
N 58°	06:37	07:25	08:09	16:18	17:02	17:50
56°	06:33	07:18	08:00	16:27	17:09	17:54
54°	06:30	07:12	07:52	16:35	17:14	17:57
52°	06:26	07:07	07:44	16:43	17:20	18:01
50°	06:23	07:02	07:37	16:49	17:25	18:04
45°	06:16	06:51	07:23	17:04	17:35	18:11
N 40°	06:10	06:42	07:11	17:16	17:44	18:17
35°	06:04	06:34	07:01	17:26	17:53	18:23
30°	05:58	06:27	06:52	17:35	18:00	18:29
20°	05:47	06:13	06:36	17:50	18:13	18:40
N 10°	05:35	06:01	06:23	18:04	18:26	18:51
0°	05:23	05:48	06:10	18:17	18:38	19:04
S 10°	05:08	05:34	05:57	18:30	18:52	19:18
20°	04:51	05:19	05:42	18:44	19:07	19:35
30°	04:29	05:00	05:26	19:00	19:26	19:57
35°	04:15	04:49	05:17	19:09	19:37	20:10
40°	03:58	04:35	05:06	19:20	19:50	20:27
45°	03:36	04:19	04:53	19:33	20:06	20:49
S 50°	03:07	03:58	04:37	19:48	20:27	21:17
52°	02:52	03:48	04:29	19:56	20:37	21:32
54°	02:34	03:37	04:21	20:04	20:48	21:49
56°	02:12	03:23	04:12	20:13	21:01	22:12
58°	01:40	03:08	04:01	20:24	21:16	22:42
S 60°	00:31	02:49	03:49	20:36	21:35	23:37

Lat.	**Moonrise** Tue	Wed	Thu	**Moonset** Tue	Wed	Thu
N 72°	▬	▬	11:35	▬	▬	15:12
N 70°	▬	▬	10:50	▬	▬	15:55
68°	▬	11:42	10:20	▬	13:10	16:23
66°	▬	10:34	09:58	▬	14:17	16:44
64°	10:46	09:58	09:40	12:06	14:52	17:01
62°	09:41	09:31	09:25	13:11	15:17	17:15
60°	09:06	09:11	09:12	13:45	15:37	17:26
N 58°	08:40	08:54	09:01	14:10	15:53	17:36
56°	08:20	08:39	08:51	14:30	16:07	17:45
54°	08:03	08:27	08:43	14:47	16:19	17:52
52°	07:49	08:16	08:35	15:01	16:29	17:59
50°	07:36	08:06	08:28	15:13	16:38	18:05
45°	07:09	07:45	08:13	15:39	16:58	18:18
N 40°	06:49	07:28	08:01	15:59	17:13	18:29
35°	06:31	07:14	07:50	16:16	17:27	18:38
30°	06:16	07:01	07:41	16:30	17:38	18:46
20°	05:50	06:40	07:25	16:54	17:57	19:00
N 10°	05:28	06:21	07:11	17:15	18:14	19:11
0°	05:07	06:04	06:58	17:35	18:30	19:22
S 10°	04:46	05:46	06:44	17:54	18:45	19:33
20°	04:24	05:27	06:30	18:14	19:02	19:45
30°	03:58	05:05	06:14	18:38	19:20	19:58
35°	03:43	04:52	06:04	18:52	19:31	20:05
40°	03:25	04:38	05:53	19:08	19:44	20:14
45°	03:03	04:20	05:40	19:26	19:58	20:24
S 50°	02:36	03:58	05:24	19:50	20:16	20:35
52°	02:22	03:47	05:16	20:01	20:24	20:41
54°	02:06	03:35	05:08	20:14	20:33	20:47
56°	01:48	03:21	04:59	20:28	20:43	20:53
58°	01:25	03:05	04:48	20:45	20:55	21:01
S 60°	00:56	02:45	04:35	21:05	21:08	21:09

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 29-1 3-0%
28	12:52	12:57	12:13	11:21	23:49	
29	13:03	13:08	12:13	12:17	–:–	
30	13:13	13:18	12:13	13:10	00:44	

January 31, 01, 02 UT (Fri., Sat., Sun.)

	Aries	Venus		Mars		Jupiter		Saturn	
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	130°28.2	134°15.8	N00°18.7	17°17.7	N26°03.2	60°38.0	N21°38.7	141°22.9	S06°47.1
1	145°30.6	149°16.5	19.9	32°21.0	03.3	75°40.5	38.7	156°25.1	47.0
2	160°33.1	164°17.3	21.0	47°24.3	03.4	90°43.0	38.7	171°27.3	46.8
3	175°35.6	179°18.0	·· 22.1	62°27.6	·· 03.5	105°45.5	·· 38.7	186°29.6	·· 46.7
4	190°38.0	194°18.8	23.3	77°30.9	03.6	120°48.0	38.7	201°31.8	46.6
5	205°40.5	209°19.6	24.4	92°34.2	03.7	135°50.5	38.7	216°34.0	46.5
6	220°42.9	224°20.3	N00°25.5	107°37.5	N26°03.8	150°53.0	N21°38.7	231°36.2	S06°46.4
7	235°45.4	239°21.1	26.7	122°40.8	03.9	165°55.6	38.7	246°38.4	46.3
8	250°47.9	254°21.9	27.8	137°44.1	03.9	180°58.1	38.7	261°40.6	46.2
9	265°50.3	269°22.6	·· 28.9	152°47.4	·· 04.0	196°00.6	·· 38.7	276°42.9	·· 46.1
10	280°52.8	284°23.4	30.1	167°50.7	04.1	211°03.1	38.7	291°45.1	46.0
11	295°55.3	299°24.2	31.2	182°54.0	04.2	226°05.6	38.7	306°47.3	45.9
12	310°57.7	314°24.9	N00°32.3	197°57.3	N26°04.3	241°08.1	N21°38.7	321°49.5	S06°45.8
13	326°00.2	329°25.7	33.4	213°00.6	04.4	256°10.6	38.7	336°51.7	45.7
14	341°02.7	344°26.5	34.6	228°03.9	04.4	271°13.1	38.7	351°53.9	45.5
15	356°05.1	359°27.2	·· 35.7	243°07.2	·· 04.5	286°15.6	·· 38.7	6°56.1	·· 45.4
16	11°07.6	14°28.0	36.8	258°10.5	04.6	301°18.1	38.7	21°58.4	45.3
17	26°10.1	29°28.8	38.0	273°13.8	04.7	316°20.6	38.7	37°00.6	45.2
18	41°12.5	44°29.6	N00°39.1	288°17.1	N26°04.8	331°23.1	N21°38.7	52°02.8	S06°45.1
19	56°15.0	59°30.4	40.2	303°20.4	04.9	346°25.6	38.7	67°05.0	45.0
20	71°17.4	74°31.1	41.3	318°23.7	04.9	1°28.1	38.7	82°07.2	44.9
21	86°19.9	89°31.9	·· 42.5	333°27.0	·· 05.0	16°30.6	·· 38.7	97°09.4	·· 44.8
22	101°22.4	104°32.7	43.6	348°30.2	05.1	31°33.1	38.7	112°11.6	44.7
23	116°24.8	119°33.5	44.7	3°33.5	05.2	46°35.6	38.8	127°13.9	44.6
Mer.pass. 15:16		ν 0.8′	d 1.1′	m -4.74	ν 3.3′	d 0.1′	m -1.10	ν 2.5′	d 0.0′ m -2.53	ν 2.2′	d 0.1′ m 1.11

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	131°27.3	134°34.3	N00°45.8	18°36.8	N26°05.2	61°38.0	N21°38.8	142°16.1	S06°44.5
1	146°29.8	149°35.1	47.0	33°40.1	05.3	76°40.5	38.8	157°18.3	44.4
2	161°32.2	164°35.9	48.1	48°43.4	05.4	91°43.0	38.8	172°20.5	44.2
3	176°34.7	179°36.7	·· 49.2	63°46.6	·· 05.5	106°45.5	·· 38.8	187°22.7	·· 44.1
4	191°37.2	194°37.5	50.3	78°49.9	05.6	121°48.0	38.8	202°24.9	44.0
5	206°39.6	209°38.3	51.5	93°53.2	05.6	136°50.5	38.8	217°27.1	43.9
6	221°42.1	224°39.1	N00°52.6	108°56.5	N26°05.7	151°53.0	N21°38.8	232°29.4	S06°43.8
7	236°44.5	239°39.9	53.7	123°59.7	05.8	166°55.5	38.8	247°31.6	43.7
8	251°47.0	254°40.7	54.8	139°03.0	05.9	181°58.0	38.8	262°33.8	43.6
9	266°49.5	269°41.5	·· 55.9	154°06.3	·· 05.9	197°00.5	·· 38.8	277°36.0	·· 43.5
10	281°51.9	284°42.3	57.1	169°09.6	06.0	212°03.0	38.8	292°38.2	43.4
11	296°54.4	299°43.1	58.2	184°12.8	06.1	227°05.5	38.8	307°40.4	43.3
12	311°56.9	314°43.9	N00°59.3	199°16.1	N26°06.2	242°08.0	N21°38.8	322°42.6	S06°43.2
13	326°59.3	329°44.7	01°00.4	214°19.4	06.2	257°10.5	38.8	337°44.8	43.1
14	342°01.8	344°45.5	01.6	229°22.6	06.3	272°13.0	38.8	352°47.1	42.9
15	357°04.3	359°46.3	·· 02.7	244°25.9	·· 06.4	287°15.5	·· 38.8	7°49.3	·· 42.8
16	12°06.7	14°47.1	03.8	259°29.1	06.5	302°17.9	38.8	22°51.5	42.7
17	27°09.2	29°47.9	04.9	274°32.4	06.5	317°20.4	38.8	37°53.7	42.6
18	42°11.7	44°48.8	N01°06.0	289°35.7	N26°06.6	332°22.9	N21°38.9	52°55.9	S06°42.5
19	57°14.1	59°49.6	07.1	304°38.9	06.7	347°25.4	38.9	67°58.1	42.4
20	72°16.6	74°50.4	08.3	319°42.2	06.7	2°27.9	38.9	83°00.3	42.3
21	87°19.0	89°51.2	·· 09.4	334°45.4	·· 06.8	17°30.4	·· 38.9	98°02.5	·· 42.2
22	102°21.5	104°52.0	10.5	349°48.7	06.9	32°32.9	38.9	113°04.8	42.1
23	117°24.0	119°52.9	11.6	4°51.9	07.0	47°35.4	38.9	128°07.0	42.0
Mer.pass. 15:12		ν 0.8′	d 1.1′	m -4.75	ν 3.3′	d 0.1′	m -1.07	ν 2.5′	d 0.0′ m -2.52	ν 2.2′	d 0.1′ m 1.11

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	132°26.4	134°53.7	N01°12.7	19°55.2	N26°07.0	62°37.9	N21°38.9	143°09.2	S06°41.9
1	147°28.9	149°54.5	13.8	34°58.4	07.1	77°40.3	38.9	158°11.4	41.7
2	162°31.4	164°55.4	15.0	50°01.7	07.2	92°42.8	38.9	173°13.6	41.6
3	177°33.8	179°56.2	·· 16.1	65°04.9	·· 07.2	107°45.3	·· 38.9	188°15.8	·· 41.5
4	192°36.3	194°57.0	17.2	80°08.2	07.3	122°47.8	38.9	203°18.0	41.4
5	207°38.8	209°57.9	18.3	95°11.4	07.4	137°50.3	38.9	218°20.2	41.3
6	222°41.2	224°58.7	N01°19.4	110°14.7	N26°07.4	152°52.8	N21°38.9	233°22.5	S06°41.2
7	237°43.7	239°59.5	20.5	125°17.9	07.5	167°55.3	38.9	248°24.7	41.1
8	252°46.2	255°00.4	21.6	140°21.2	07.6	182°57.7	38.9	263°26.9	41.0
9	267°48.6	270°01.2	·· 22.8	155°24.4	·· 07.6	198°00.2	·· 38.9	278°29.1	·· 40.9
10	282°51.1	285°02.1	23.9	170°27.6	07.7	213°02.7	39.0	293°31.3	40.8
11	297°53.5	300°02.9	25.0	185°30.9	07.8	228°05.2	39.0	308°33.5	40.6
12	312°56.0	315°03.7	N01°26.1	200°34.1	N26°07.8	243°07.7	N21°39.0	323°35.7	S06°40.5
13	327°58.5	330°04.6	27.2	215°37.3	07.9	258°10.2	39.0	338°37.9	40.4
14	343°00.9	345°05.4	28.3	230°40.6	08.0	273°12.6	39.0	353°40.1	40.3
15	358°03.4	0°06.3	·· 29.4	245°43.8	·· 08.0	288°15.1	·· 39.0	8°42.4	·· 40.2
16	13°05.9	15°07.2	30.5	260°47.0	08.1	303°17.6	39.0	23°44.6	40.1
17	28°08.3	30°08.0	31.6	275°50.3	08.2	318°20.1	39.0	38°46.8	40.0
18	43°10.8	45°08.9	N01°32.7	290°53.5	N26°08.2	333°22.6	N21°39.0	53°49.0	S06°39.9
19	58°13.3	60°09.7	33.8	305°56.7	08.3	348°25.0	39.0	68°51.2	39.8
20	73°15.7	75°10.6	35.0	321°00.0	08.3	3°27.5	39.0	83°53.4	39.7
21	88°18.2	90°11.4	·· 36.1	336°03.2	·· 08.4	18°30.0	·· 39.0	98°55.6	·· 39.6
22	103°20.6	105°12.3	37.2	351°06.4	08.5	33°32.5	39.0	113°57.8	39.4
23	118°23.1	120°13.2	38.3	6°09.6	08.5	48°35.0	39.0	129°00.0	39.3
Mer.pass. 15:08		ν 0.8′	d 1.1′	m -4.76	ν 3.3′	d 0.1′	m -1.05	ν 2.5′	d 0.0′ m -2.51	ν 2.2′	d 0.1′ m 1.11

Stars

	SHA	Dec
Alpheratz	357°34.9	29°13.8
Ankaa	353°07.3	-42°10.4
Schedar	349°31.3	56°40.7
Diphda	348°47.4	-17°51.1
Achernar	335°20.3	-57°06.8
Hamal	327°51.2	23°34.9
Polaris	313°57.0	89°22.5
Acamar	315°11.7	-40°12.5
Menkar	314°06.0	4°11.2
Mirfak	308°28.1	49°57.2
Aldebaran	290°39.4	16°33.6
Rigel	281°03.6	-8°10.4
Capella	280°21.5	46°01.5
Bellatrix	278°22.6	6°22.3
Elnath	278°01.5	28°37.8
Alnilam	275°37.4	-1°11.2
Betelgeuse	270°51.8	7°24.7
Canopus	263°51.9	-52°42.7
Sirius	258°25.9	-16°45.1
Adhara	255°05.5	-29°00.5
Procyon	244°50.4	5°09.6
Pollux	243°16.9	27°57.9
Avior	234°14.1	-59°35.4
Suhail	222°45.8	-43°32.0
Miaplacidus	221°37.4	-69°49.1
Alphard	217°47.4	-8°46.1
Regulus	207°34.1	11°50.6
Dubhe	193°40.3	61°36.7
Denebola	182°24.6	14°25.8
Gienah	175°43.3	-17°40.9
Acrux	172°59.7	-63°14.1
Gacrux	171°51.3	-57°15.0
Alioth	166°12.6	55°49.1
Spica	158°22.1	-11°17.6
Alkaid	152°51.8	49°10.9
Hadar	148°35.8	-60°29.4
Menkent	147°57.5	-36°29.5
Arcturus	145°47.8	19°02.9
Rigil Kent.	139°40.2	-60°56.1
Kochab	137°19.8	74°02.7
Zuben'ubi	136°56.0	-16°08.8
Alphecca	126°03.8	26°37.5
Antares	112°15.9	-26°29.2
Atria	107°10.4	-69°04.1
Sabik	102°02.9	-15°45.4
Shaula	96°10.6	-37°07.3
Rasalhague	95°58.7	12°32.3
Eltanin	90°42.6	51°28.8
Kaus Aust.	83°32.8	-34°22.3
Vega	80°33.5	38°48.2
Nunki	75°48.0	-26°16.0
Altair	62°00.2	8°55.9
Peacock	53°06.2	-56°39.3
Deneb	49°26.2	45°22.1
Enif	33°39.1	9°59.3
Al Na'ir	27°33.2	-46°50.5
Fomalhaut	15°14.7	-29°29.5
Scheat	13°45.5	28°13.1
Markab	13°30.1	15°20.4

Jan 31 Fri	SHA	Mer.pass
Venus	3°47.6	15:02
Mars	246°49.5	22:46
Jupiter	290°09.9	19:54
Saturn	10°54.8	14:32

Feb 01 Sat	SHA	Mer.pass
Venus	3°07.0	15:01
Mars	247°09.5	22:41
Jupiter	290°10.7	19:50
Saturn	10°48.8	14:29

Feb 02 Sun	SHA	Mer.pass
Venus	2°27.3	15:00
Mars	247°28.8	22:35
Jupiter	290°11.4	19:46
Saturn	10°42.7	14:25

Horizontal parallax	
Venus:	0.3
Mars:	0.2

DUT1 = UT1-UTC = +0.0479 sec ΔT = TT-UT1 = +69.1361 sec

2025 January 31 to Feb. 02 UT

h	Sun		Moon				
Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°39.4	S17°22.3	156°52.6	10.4′	S13°27.7	15.3′	59.2′
1	191°39.3	21.6	171°22.0	10.4′	13°12.4	15.5′	59.2′
2	206°39.2	20.9	185°51.4	10.5′	12°56.9	15.5′	59.3′
3	221°39.1	·· 20.2	200°20.9	10.5′	12°41.4	15.6′	59.3′
4	236°39.0	19.5	214°50.4	10.6′	12°25.8	15.7′	59.3′
5	251°38.9	18.8	229°20.0	10.6′	12°10.1	15.7′	59.3′
6	266°38.8	S17°18.1	243°49.6	10.7′	S11°54.4	15.8′	59.3′
7	281°38.7	17.4	258°19.3	10.7′	11°38.6	15.9′	59.3′
8	296°38.7	16.7	272°49.0	10.8′	11°22.7	15.9′	59.3′
9	311°38.6	·· 16.0	287°18.8	10.8′	11°06.8	16.0′	59.3′
10	326°38.5	15.3	301°48.6	10.9′	10°50.8	16.1′	59.4′
11	341°38.4	14.6	316°18.5	10.9′	10°34.7	16.1′	59.4′
12	356°38.3	S17°13.9	330°48.4	11.0′	S10°18.6	16.2′	59.4′
13	11°38.2	13.2	345°18.4	11.0′	10°02.4	16.3′	59.4′
14	26°38.1	12.5	359°48.4	11.1′	09°46.1	16.3′	59.4′
15	41°38.0	·· 11.8	14°18.5	11.1′	09°29.8	16.4′	59.4′
16	56°37.9	11.1	28°48.6	11.1′	09°13.4	16.4′	59.4′
17	71°37.9	10.4	43°18.7	11.2′	08°57.0	16.4′	59.4′
18	86°37.8	S17°09.6	57°48.9	11.2′	S08°40.6	16.6′	59.4′
19	101°37.7	08.9	72°19.1	11.3′	08°24.0	16.5′	59.5′
20	116°37.6	08.2	86°49.4	11.3′	08°07.5	16.6′	59.5′
21	131°37.5	·· 07.5	101°19.7	11.3′	07°50.9	16.7′	59.5′
22	146°37.4	06.8	115°50.0	11.4′	07°34.2	16.7′	59.5′
23	161°37.3	06.1	130°20.3	11.4′	07°17.5	16.7′	59.5′
	SD = 16.2′	d = 0.7′	SD = 16.2′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°37.2	S17°05.4	144°50.7	11.4′	S07°00.8	16.8′	59.5′
1	191°37.2	04.7	159°21.2	11.5′	06°44.0	16.8′	59.5′
2	206°37.1	04.0	173°51.6	11.5′	06°27.2	16.9′	59.5′
3	221°37.0	·· 03.2	188°22.1	11.5′	06°10.3	16.9′	59.5′
4	236°36.9	02.5	202°52.6	11.5′	05°53.4	16.9′	59.5′
5	251°36.8	01.8	217°23.2	11.6′	05°36.5	16.9′	59.5′
6	266°36.7	S17°01.1	231°53.8	11.6′	S05°19.6	17.0′	59.5′
7	281°36.7	17°00.4	246°24.4	11.6′	05°02.6	17.0′	59.5′
8	296°36.6	16°59.7	260°55.0	11.6′	04°45.6	17.1′	59.5′
9	311°36.5	·· 59.0	275°25.6	11.7′	04°28.5	17.0′	59.6′
10	326°36.4	58.2	289°56.3	11.7′	04°11.5	17.1′	59.6′
11	341°36.3	57.5	304°27.0	11.7′	03°54.4	17.1′	59.6′
12	356°36.3	S16°56.8	318°57.7	11.7′	S03°37.3	17.2′	59.6′
13	11°36.2	56.1	333°28.4	11.7′	03°20.1	17.1′	59.6′
14	26°36.1	55.4	347°59.2	11.8′	03°03.0	17.2′	59.6′
15	41°36.0	·· 54.6	2°29.9	11.8′	02°45.8	17.1′	59.6′
16	56°35.9	53.9	17°00.7	11.8′	02°28.7	17.2′	59.6′
17	71°35.9	53.2	31°31.5	11.8′	02°11.5	17.2′	59.6′
18	86°35.8	S16°52.5	46°02.3	11.8′	S01°54.3	17.2′	59.6′
19	101°35.7	51.8	60°33.1	11.8′	01°37.1	17.3′	59.6′
20	116°35.6	51.0	75°03.9	11.8′	01°19.8	17.2′	59.6′
21	131°35.5	·· 50.3	89°34.7	11.8′	01°02.6	17.2′	59.6′
22	146°35.5	49.6	104°05.6	11.8′	00°45.4	17.2′	59.6′
23	161°35.4	48.9	118°36.4	11.8′	00°28.2	17.3′	59.6′
	SD = 16.2′	d = 0.7′	SD = 16.2′				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°35.3	S16°48.2	133°07.3	11.8′	S00°10.9	17.2′	59.6′
1	191°35.2	47.4	147°38.1	11.8′	N00°06.3	17.3′	59.6′
2	206°35.2	46.7	162°08.9	11.8′	00°23.6	17.2′	59.6′
3	221°35.1	·· 46.0	176°39.8	11.8′	00°40.8	17.2′	59.6′
4	236°35.0	45.2	191°10.6	11.8′	00°58.0	17.2′	59.6′
5	251°34.9	44.5	205°41.5	11.8′	01°15.2	17.2′	59.6′
6	266°34.9	S16°43.8	220°12.3	11.8′	N01°32.4	17.3′	59.6′
7	281°34.8	43.1	234°43.2	11.8′	01°49.7	17.1′	59.6′
8	296°34.7	42.3	249°14.0	11.8′	02°06.8	17.2′	59.6′
9	311°34.6	·· 41.6	263°44.8	11.8′	02°24.0	17.2′	59.6′
10	326°34.6	40.9	278°15.6	11.8′	02°41.2	17.1′	59.6′
11	341°34.5	40.2	292°46.4	11.8′	02°58.3	17.2′	59.6′
12	356°34.4	S16°39.4	307°17.2	11.8′	N03°15.5	17.1′	59.6′
13	11°34.3	38.7	321°48.0	11.8′	03°32.6	17.1′	59.6′
14	26°34.3	38.0	336°18.7	11.7′	03°49.7	17.1′	59.6′
15	41°34.2	·· 37.2	350°49.5	11.7′	04°06.8	17.0′	59.6′
16	56°34.1	36.5	5°20.2	11.7′	04°23.8	17.0′	59.6′
17	71°34.1	35.8	19°50.9	11.7′	04°40.8	17.0′	59.6′
18	86°34.0	S16°35.0	34°21.6	11.7′	N04°57.8	17.0′	59.6′
19	101°33.9	34.3	48°52.3	11.6′	05°14.8	16.9′	59.6′
20	116°33.9	33.6	63°22.9	11.6′	05°31.7	16.9′	59.6′
21	131°33.8	·· 32.8	77°53.6	11.6′	05°48.6	16.9′	59.6′
22	146°33.7	32.1	92°24.2	11.6′	06°05.5	16.8′	59.5′
23	161°33.7	31.4	106°54.7	11.5′	06°22.3	16.8′	59.5′
	SD = 16.2′	d = 0.7′	SD = 16.3′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	07:09	08:37	10:25	14:03	15:51	17:20
N 70°	07:01	08:19	09:44	14:44	16:10	17:28
68°	06:54	08:04	09:16	15:12	16:24	17:34
66°	06:49	07:52	08:55	15:33	16:36	17:40
64°	06:44	07:42	08:39	15:49	16:46	17:45
62°	06:39	07:34	08:25	16:03	16:54	17:49
60°	06:35	07:26	08:13	16:15	17:02	17:53
N 58°	06:32	07:19	08:03	16:25	17:09	17:56
56°	06:28	07:13	07:54	16:33	17:15	18:00
54°	06:25	07:08	07:47	16:41	17:20	18:03
52°	06:22	07:03	07:40	16:48	17:25	18:05
50°	06:20	06:58	07:33	16:55	17:29	18:08
45°	06:13	06:48	07:20	17:08	17:39	18:15
N 40°	06:07	06:40	07:08	17:19	17:48	18:20
35°	06:02	06:32	06:59	17:29	17:55	18:26
30°	05:57	06:25	06:50	17:37	18:02	18:31
20°	05:46	06:12	06:35	17:52	18:15	18:41
N 10°	05:35	06:00	06:22	18:05	18:27	18:52
0°	05:23	05:48	06:10	18:17	18:39	19:04
S 10°	05:10	05:36	05:58	18:29	18:51	19:17
20°	04:53	05:21	05:44	18:43	19:06	19:33
30°	04:32	05:03	05:29	18:58	19:24	19:54
35°	04:19	04:52	05:20	19:07	19:34	20:08
40°	04:03	04:39	05:09	19:17	19:47	20:24
45°	03:42	04:24	04:57	19:29	20:02	20:44
S 50°	03:15	04:04	04:42	19:44	20:22	21:11
52°	03:01	03:55	04:35	19:51	20:31	21:25
54°	02:44	03:44	04:27	19:59	20:42	21:41
56°	02:23	03:31	04:18	20:07	20:54	22:01
58°	01:56	03:17	04:08	20:17	21:08	22:27
S 60°	01:13	02:59	03:57	20:28	21:25	23:07

Lat.	**Moonrise** Fri	Sat	Sun	**Moonset** Fri	Sat	Sun
N 72°	10:19	09:35	08:57	18:16	20:46	23:12
N 70°	10:02	09:29	09:00	18:30	20:47	23:02
68°	09:48	09:24	09:03	18:42	20:49	22:54
66°	09:37	09:20	09:05	18:51	20:50	22:48
64°	09:27	09:17	09:07	18:59	20:51	22:43
62°	09:19	09:13	09:08	19:05	20:52	22:38
60°	09:12	09:11	09:10	19:11	20:53	22:34
N 58°	09:05	09:08	09:11	19:16	20:53	22:30
56°	09:00	09:06	09:12	19:20	20:54	22:27
54°	08:55	09:04	09:13	19:24	20:55	22:25
52°	08:50	09:02	09:14	19:28	20:55	22:22
50°	08:46	09:01	09:15	19:31	20:55	22:20
45°	08:37	08:57	09:17	19:38	20:56	22:15
N 40°	08:29	08:54	09:18	19:44	20:57	22:11
35°	08:22	08:51	09:19	19:48	20:58	22:07
30°	08:17	08:49	09:21	19:53	20:58	22:04
20°	08:06	08:45	09:23	20:00	20:59	21:59
N 10°	07:57	08:42	09:25	20:07	21:00	21:54
0°	07:49	08:38	09:27	20:12	21:01	21:49
S 10°	07:41	08:35	09:28	20:18	21:02	21:45
20°	07:31	08:31	09:30	20:25	21:03	21:40
30°	07:21	08:27	09:33	20:32	21:03	21:35
35°	07:15	08:25	09:34	20:36	21:04	21:32
40°	07:08	08:22	09:36	20:40	21:04	21:28
45°	07:00	08:19	09:37	20:45	21:05	21:25
S 50°	06:50	08:15	09:40	20:51	21:06	21:20
52°	06:46	08:14	09:41	20:54	21:06	21:18
54°	06:41	08:12	09:42	20:57	21:06	21:15
56°	06:35	08:10	09:43	21:01	21:07	21:13
58°	06:29	08:07	09:44	21:04	21:07	21:10
S 60°	06:22	08:05	09:46	21:09	21:08	21:07

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 2-4 3-15%
31	13:22	13:27	12:13	14:01	01:36	
01	13:31	13:35	12:14	14:50	02:25	
02	13:39	13:42	12:14	15:38	03:14	

February 03, 04, 05 UT (Mon., Tue., Wed.)

	Aries	Venus		Mars		Jupiter		Saturn	
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	133°25.6	135°14.0	N01°39.4	21°12.8	N26°08.6	63°37.4	N21°39.1	144°02.3	S06°39.2
1	148°28.0	150°14.9	40.5	36°16.1	08.7	78°39.9	39.1	159°04.5	39.1
2	163°30.5	165°15.8	41.6	51°19.3	08.7	93°42.4	39.1	174°06.7	39.0
3	178°33.0	180°16.6	·· 42.7	66°22.5	·· 08.8	108°44.9	·· 39.1	189°08.9	·· 38.9
4	193°35.4	195°17.5	43.8	81°25.7	08.8	123°47.4	39.1	204°11.1	38.8
5	208°37.9	210°18.4	44.9	96°28.9	08.9	138°49.8	39.1	219°13.3	38.7
6	223°40.4	225°19.3	N01°46.0	111°32.1	N26°09.0	153°52.3	N21°39.1	234°15.5	S06°38.6
7	238°42.8	240°20.2	47.1	126°35.3	09.0	168°54.8	39.1	249°17.7	38.5
8	253°45.3	255°21.0	48.2	141°38.6	09.1	183°57.3	39.1	264°19.9	38.3
9	268°47.8	270°21.9	·· 49.3	156°41.8	·· 09.1	198°59.7	·· 39.1	279°22.1	·· 38.2
10	283°50.2	285°22.8	50.4	171°45.0	09.2	214°02.2	39.1	294°24.4	38.1
11	298°52.7	300°23.7	51.5	186°48.2	09.2	229°04.7	39.1	309°26.6	38.0
12	313°55.1	315°24.6	N01°52.6	201°51.4	N26°09.3	244°07.2	N21°39.1	324°28.8	S06°37.9
13	328°57.6	330°25.5	53.7	216°54.6	09.4	259°09.6	39.1	339°31.0	37.8
14	344°00.1	345°26.3	54.8	231°57.8	09.4	274°12.1	39.2	354°33.2	37.7
15	359°02.5	0°27.2	·· 55.9	247°01.0	·· 09.5	289°14.6	·· 39.2	9°35.4	·· 37.6
16	14°05.0	15°28.1	57.0	262°04.2	09.5	304°17.0	39.2	24°37.6	37.5
17	29°07.5	30°29.0	58.1	277°07.4	09.6	319°19.5	39.2	39°39.8	37.4
18	44°09.9	45°29.9	N01°59.2	292°10.6	N26°09.6	334°22.0	N21°39.2	54°42.0	S06°37.2
19	59°12.4	60°30.8	02°00.3	307°13.8	09.7	349°24.5	39.2	69°44.2	37.1
20	74°14.9	75°31.7	01.4	322°17.0	09.7	4°26.9	39.2	84°46.4	37.0
21	89°17.3	90°32.6	·· 02.5	337°20.2	·· 09.8	19°29.4	·· 39.2	99°48.7	·· 36.9
22	104°19.8	105°33.5	03.6	352°23.3	09.8	34°31.9	39.2	114°50.9	36.8
23	119°22.2	120°34.4	04.7	7°26.5	09.9	49°34.3	39.2	129°53.1	36.7
Mer.pass. 15:04		ν 0.9′	d 1.1′	m -4.77	ν 3.2′	d 0.1′	m -1.02	ν 2.5′	d 0.0′ m -2.50	ν 2.2′	d 0.1′ m 1.11

Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	134°24.7	135°35.3	N02°05.8	22°29.7	N26°09.9	64°36.8	N21°39.2	144°55.3	S06°36.6
1	149°27.2	150°36.3	06.9	37°32.9	10.0	79°39.3	39.2	159°57.5	36.5
2	164°29.6	165°37.2	08.0	52°36.1	10.1	94°41.7	39.3	174°59.7	36.4
3	179°32.1	180°38.1	·· 09.1	67°39.3	·· 10.1	109°44.2	·· 39.3	190°01.9	·· 36.2
4	194°34.6	195°39.0	10.1	82°42.5	10.2	124°46.7	39.3	205°04.1	36.1
5	209°37.0	210°39.9	11.2	97°45.6	10.2	139°49.2	39.3	220°06.3	36.0
6	224°39.5	225°40.8	N02°12.3	112°48.8	N26°10.3	154°51.6	N21°39.3	235°08.5	S06°35.9
7	239°42.0	240°41.7	13.4	127°52.0	10.3	169°54.1	39.3	250°10.7	35.8
8	254°44.4	255°42.7	14.5	142°55.2	10.4	184°56.6	39.3	265°13.0	35.7
9	269°46.9	270°43.6	·· 15.6	157°58.3	·· 10.4	199°59.0	·· 39.3	280°15.2	·· 35.6
10	284°49.4	285°44.5	16.7	173°01.5	10.4	215°01.5	39.3	295°17.4	35.5
11	299°51.8	300°45.4	17.8	188°04.7	10.5	230°03.9	39.3	310°19.6	35.4
12	314°54.3	315°46.4	N02°18.9	203°07.9	N26°10.5	245°06.4	N21°39.3	325°21.8	S06°35.3
13	329°56.7	330°47.3	20.0	218°11.0	10.6	260°08.9	39.3	340°24.0	35.1
14	344°59.2	345°48.2	21.0	233°14.2	10.6	275°11.3	39.4	355°26.2	35.0
15	0°01.7	0°49.2	·· 22.1	248°17.4	·· 10.7	290°13.8	·· 39.4	10°28.4	·· 34.9
16	15°04.1	15°50.1	23.2	263°20.5	10.7	305°16.3	39.4	25°30.6	34.8
17	30°06.6	30°51.0	24.3	278°23.7	10.8	320°18.7	39.4	40°32.8	34.7
18	45°09.1	45°52.0	N02°25.4	293°26.9	N26°10.8	335°21.2	N21°39.4	55°35.0	S06°34.6
19	60°11.5	60°52.9	26.5	308°30.0	10.9	350°23.7	39.4	70°37.2	34.5
20	75°14.0	75°53.9	27.6	323°33.2	10.9	5°26.1	39.4	85°39.4	34.4
21	90°16.5	90°54.8	·· 28.6	338°36.3	·· 11.0	20°28.6	·· 39.4	100°41.7	·· 34.3
22	105°18.9	105°55.8	29.7	353°39.5	11.0	35°31.0	39.4	115°43.9	34.1
23	120°21.4	120°56.7	30.8	8°42.7	11.0	50°33.5	39.4	130°46.1	34.0
Mer.pass. 15:00		ν 0.9′	d 1.1′	m -4.78	ν 3.2′	d 0.1′	m -0.99	ν 2.5′	d 0.0′ m -2.50	ν 2.2′	d 0.1′ m 1.11

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	135°23.9	135°57.7	N02°31.9	23°45.8	N26°11.1	65°36.0	N21°39.5	145°48.3	S06°33.9
1	150°26.3	150°58.6	33.0	38°49.0	11.1	80°38.4	39.5	160°50.5	33.8
2	165°28.8	165°59.6	34.0	53°52.1	11.2	95°40.9	39.5	175°52.7	33.7
3	180°31.2	181°00.5	·· 35.1	68°55.3	·· 11.2	110°43.3	·· 39.5	190°54.9	·· 33.6
4	195°33.7	196°01.5	36.2	83°58.4	11.3	125°45.8	39.5	205°57.1	33.5
5	210°36.2	211°02.4	37.3	99°01.6	11.3	140°48.3	39.5	220°59.3	33.4
6	225°38.6	226°03.4	N02°38.4	114°04.7	N26°11.3	155°50.7	N21°39.5	236°01.5	S06°33.3
7	240°41.1	241°04.4	39.4	129°07.9	11.4	170°53.2	39.5	251°03.7	33.1
8	255°43.6	256°05.3	40.5	144°11.0	11.4	185°55.6	39.5	266°05.9	33.0
9	270°46.0	271°06.3	·· 41.6	159°14.1	·· 11.5	200°58.1	·· 39.5	281°08.1	·· 32.9
10	285°48.5	286°07.3	42.7	174°17.3	11.5	216°00.5	39.5	296°10.3	32.8
11	300°51.0	301°08.2	43.8	189°20.4	11.6	231°03.0	39.6	311°12.6	32.7
12	315°53.4	316°09.2	N02°44.8	204°23.6	N26°11.6	246°05.5	N21°39.6	326°14.8	S06°32.6
13	330°55.9	331°10.2	45.9	219°26.7	11.6	261°07.9	39.6	341°17.0	32.5
14	345°58.4	346°11.1	47.0	234°29.8	11.7	276°10.4	39.6	356°19.2	32.4
15	1°00.8	1°12.1	·· 48.1	249°33.0	·· 11.7	291°12.8	·· 39.6	11°21.4	·· 32.3
16	16°03.3	16°13.1	49.1	264°36.1	11.7	306°15.3	39.6	26°23.6	32.1
17	31°05.7	31°14.1	50.2	279°39.2	11.8	321°17.7	39.6	41°25.8	32.0
18	46°08.2	46°15.1	N02°51.3	294°42.3	N26°11.8	336°20.2	N21°39.6	56°28.0	S06°31.9
19	61°10.7	61°16.1	52.3	309°45.5	11.9	351°22.6	39.6	71°30.2	31.8
20	76°13.1	76°17.0	53.4	324°48.6	11.9	6°25.1	39.7	86°32.4	31.7
21	91°15.6	91°18.0	·· 54.5	339°51.7	·· 11.9	21°27.5	·· 39.7	101°34.6	·· 31.6
22	106°18.1	106°19.0	55.6	354°54.8	12.0	36°30.0	39.7	116°36.8	31.5
23	121°20.5	121°20.0	56.6	9°58.0	12.0	51°32.4	39.7	131°39.0	31.4
Mer.pass. 14:56		ν 1.0′	d 1.1′	m -4.79	ν 3.2′	d 0.0′	m -0.96	ν 2.5′	d 0.0′ m -2.49	ν 2.2′	d 0.1′ m 1.11

Stars

	SHA	Dec
Alpheratz	357°35.0	29°13.8
Ankaa	353°07.3	-42°10.4
Schedar	349°31.3	56°40.7
Diphda	348°47.4	-17°51.1
Achernar	335°20.3	-57°06.8
Hamal	327°51.2	23°34.9
Polaris	313°58.5	89°22.5
Acamar	315°11.7	-40°12.5
Menkar	314°06.1	4°11.2
Mirfak	308°28.1	49°57.2
Aldebaran	290°39.4	16°33.6
Rigel	281°03.6	-8°10.5
Capella	280°21.5	46°01.5
Bellatrix	278°22.6	6°22.3
Elnath	278°01.5	28°37.8
Alnilam	275°37.4	-1°11.2
Betelgeuse	270°51.8	7°24.7
Canopus	263°51.9	-52°42.7
Sirius	258°25.9	-16°45.1
Adhara	255°05.5	-29°00.5
Procyon	244°50.4	5°09.6
Pollux	243°16.9	27°57.9
Avior	234°14.1	-59°35.4
Suhail	222°45.8	-43°32.0
Miaplacidus	221°37.4	-69°49.2
Alphard	217°47.4	-8°46.1
Regulus	207°34.0	11°50.6
Dubhe	193°40.3	61°36.7
Denebola	182°24.6	14°25.7
Gienah	175°43.3	-17°40.9
Acrux	172°59.6	-63°14.1
Gacrux	171°51.3	-57°15.1
Alioth	166°12.6	55°49.1
Spica	158°22.1	-11°17.6
Alkaid	152°51.8	49°10.9
Hadar	148°35.8	-60°29.4
Menkent	147°57.5	-36°29.5
Arcturus	145°47.8	19°02.9
Rigil Kent.	139°40.2	-60°56.1
Kochab	137°19.7	74°02.7
Zuben'ubi	136°55.9	-16°08.8
Alphecca	126°03.7	26°37.5
Antares	112°15.9	-26°29.2
Atria	107°10.4	-69°04.1
Sabik	102°02.9	-15°45.4
Shaula	96°10.5	-37°07.3
Rasalhague	95°58.7	12°32.3
Eltanin	90°42.5	51°28.8
Kaus Aust.	83°32.7	-34°22.3
Vega	80°33.5	38°48.2
Nunki	75°48.0	-26°16.0
Altair	62°00.2	8°55.9
Peacock	53°06.2	-56°39.3
Deneb	49°26.2	45°22.1
Enif	33°39.1	9°59.3
Al Na'ir	27°33.3	-46°50.5
Fomalhaut	15°14.7	-29°29.5
Scheat	13°45.5	28°13.1
Markab	13°30.1	15°20.4

Feb 03 Mon	SHA	Mer.pass
Venus	1°48.5	14:58
Mars	247°47.3	22:30
Jupiter	290°11.9	19:42
Saturn	10°36.7	14:22

Feb 04 Tue	SHA	Mer.pass
Venus	1°10.6	14:57
Mars	248°05.0	22:25
Jupiter	290°12.1	19:38
Saturn	10°30.6	14:18

Feb 05 Wed	SHA	Mer.pass
Venus	0°33.8	14:55
Mars	248°22.0	22:20
Jupiter	290°12.1	19:34
Saturn	10°24.4	14:15

Horizontal parallax	
Venus:	0.3
Mars:	0.2

h	Sun		Moon				
Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°33.6	S16°30.6	121°25.3	11.5′	N06°39.1	16.8′	59.5′
1	191°33.5	29.9	135°55.8	11.5′	06°55.9	16.7′	59.5′
2	206°33.4	29.1	150°26.3	11.5′	07°12.6	16.7′	59.5′
3	221°33.4	·· 28.4	164°56.7	11.4′	07°29.3	16.6′	59.5′
4	236°33.3	27.7	179°27.2	11.4′	07°45.9	16.6′	59.5′
5	251°33.3	26.9	193°57.6	11.4′	08°02.5	16.6′	59.5′
6	266°33.2	S16°26.2	208°27.9	11.3′	N08°19.1	16.5′	59.5′
7	281°33.1	25.5	222°58.2	11.3′	08°35.6	16.4′	59.5′
8	296°33.1	24.7	237°28.5	11.2′	08°52.0	16.4′	59.5′
9	311°33.0	·· 24.0	251°58.8	11.2′	09°08.4	16.4′	59.5′
10	326°32.9	23.2	266°29.0	11.2′	09°24.8	16.3′	59.5′
11	341°32.9	22.5	280°59.1	11.1′	09°41.1	16.2′	59.5′
12	356°32.8	S16°21.7	295°29.3	11.1′	N09°57.3	16.2′	59.5′
13	11°32.7	21.0	309°59.3	11.0′	10°13.5	16.1′	59.4′
14	26°32.7	20.3	324°29.4	11.0′	10°29.6	16.1′	59.4′
15	41°32.6	·· 19.5	338°59.4	10.9′	10°45.7	16.0′	59.4′
16	56°32.5	18.8	353°29.3	10.9′	11°01.7	15.9′	59.4′
17	71°32.5	18.0	7°59.2	10.8′	11°17.6	15.9′	59.4′
18	86°32.4	S16°17.3	22°29.1	10.8′	N11°33.5	15.8′	59.4′
19	101°32.4	16.5	36°58.8	10.7′	11°49.3	15.8′	59.4′
20	116°32.3	15.8	51°28.6	10.7′	12°05.1	15.6′	59.4′
21	131°32.2	·· 15.0	65°58.3	10.6′	12°20.7	15.6′	59.4′
22	146°32.2	14.3	80°27.9	10.6′	12°36.3	15.6′	59.4′
23	161°32.1	13.6	94°57.5	10.5′	12°51.9	15.4′	59.4′
	SD = 16.2′	d = 0.7′	SD = 16.2′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°32.1	S16°12.8	109°27.0	10.5′	N13°07.3	15.4′	59.4′
1	191°32.0	12.1	123°56.5	10.4′	13°22.7	15.3′	59.3′
2	206°31.9	11.3	138°25.9	10.4′	13°38.0	15.2′	59.3′
3	221°31.9	·· 10.6	152°55.3	10.3′	13°53.2	15.2′	59.3′
4	236°31.8	09.8	167°24.6	10.2′	14°08.4	15.0′	59.3′
5	251°31.8	09.1	181°53.8	10.2′	14°23.4	15.0′	59.3′
6	266°31.7	S16°08.3	196°23.0	10.1′	N14°38.4	14.9′	59.3′
7	281°31.7	07.6	210°52.1	10.0′	14°53.3	14.8′	59.3′
8	296°31.6	06.8	225°21.1	10.0′	15°08.1	14.7′	59.3′
9	311°31.5	·· 06.1	239°50.1	9.9′	15°22.8	14.6′	59.3′
10	326°31.5	05.3	254°19.1	9.9′	15°37.4	14.6′	59.2′
11	341°31.4	04.5	268°47.9	9.8′	15°52.0	14.4′	59.2′
12	356°31.4	S16°03.8	283°16.7	9.7′	N16°06.4	14.4′	59.2′
13	11°31.3	03.0	297°45.4	9.7′	16°20.8	14.2′	59.2′
14	26°31.3	02.3	312°14.1	9.6′	16°35.0	14.2′	59.2′
15	41°31.2	·· 01.5	326°42.7	9.5′	16°49.2	14.1′	59.2′
16	56°31.2	00.8	341°11.2	9.4′	17°03.3	13.9′	59.2′
17	71°31.1	16°00.0	355°39.6	9.4′	17°17.2	13.9′	59.2′
18	86°31.1	S15°59.3	10°08.0	9.3′	N17°31.1	13.7′	59.2′
19	101°31.0	58.5	24°36.3	9.2′	17°44.8	13.7′	59.1′
20	116°31.0	57.7	39°04.5	9.2′	17°58.5	13.5′	59.1′
21	131°30.9	·· 57.0	53°32.7	9.1′	18°12.0	13.5′	59.1′
22	146°30.9	56.2	68°00.8	9.0′	18°25.5	13.3′	59.1′
23	161°30.8	55.5	82°28.8	8.9′	18°38.8	13.2′	59.1′
	SD = 16.2′	d = 0.7′	SD = 16.2′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°30.8	S15°54.7	96°56.7	8.9′	N18°52.0	13.1′	59.1′
1	191°30.7	54.0	111°24.6	8.8′	19°05.1	13.0′	59.1′
2	206°30.7	53.2	125°52.3	8.7′	19°18.1	12.9′	59.0′
3	221°30.6	·· 52.4	140°20.1	8.6′	19°31.0	12.7′	59.0′
4	236°30.6	51.7	154°47.7	8.6′	19°43.7	12.7′	59.0′
5	251°30.5	50.9	169°15.2	8.5′	19°56.4	12.5′	59.0′
6	266°30.5	S15°50.1	183°42.7	8.4′	N20°08.9	12.4′	59.0′
7	281°30.4	49.4	198°10.1	8.3′	20°21.3	12.3′	59.0′
8	296°30.4	48.6	212°37.5	8.3′	20°33.6	12.1′	59.0′
9	311°30.3	·· 47.9	227°04.7	8.2′	20°45.7	12.0′	59.0′
10	326°30.3	47.1	241°31.9	8.1′	20°57.7	11.9′	58.9′
11	341°30.2	46.3	255°59.0	8.0′	21°09.6	11.8′	58.9′
12	356°30.2	S15°45.6	270°26.0	7.9′	N21°21.4	11.6′	58.9′
13	11°30.1	44.8	284°52.9	7.9′	21°33.0	11.5′	58.9′
14	26°30.1	44.0	299°19.8	7.8′	21°44.5	11.4′	58.9′
15	41°30.0	·· 43.3	313°46.6	7.7′	21°55.9	11.3′	58.9′
16	56°30.0	42.5	328°13.3	7.6′	22°07.2	11.1′	58.9′
17	71°29.9	41.7	342°39.9	7.6′	22°18.3	10.9′	58.8′
18	86°29.9	S15°41.0	357°06.5	7.5′	N22°29.2	10.9′	58.8′
19	101°29.9	40.2	11°33.0	7.4′	22°40.1	10.7′	58.8′
20	116°29.8	39.4	25°59.4	7.3′	22°50.8	10.5′	58.8′
21	131°29.8	·· 38.7	40°25.7	7.2′	23°01.3	10.4′	58.8′
22	146°29.7	37.9	54°51.9	7.2′	23°11.7	10.3′	58.8′
23	161°29.7	37.1	69°18.1	7.1′	23°22.0	10.1′	58.7′
	SD = 16.2′	d = 0.8′	SD = 16.1′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	06:58	08:24	10:02	14:27	16:06	17:32
N 70°	06:51	08:07	09:28	15:01	16:22	17:38
68°	06:46	07:54	09:03	15:26	16:35	17:44
66°	06:41	07:44	08:45	15:44	16:45	17:48
64°	06:37	07:34	08:29	15:59	16:54	17:52
62°	06:33	07:27	08:17	16:12	17:02	17:56
60°	06:30	07:20	08:06	16:23	17:09	17:59
N 58°	06:26	07:14	07:57	16:32	17:15	18:02
56°	06:23	07:08	07:49	16:40	17:21	18:05
54°	06:21	07:03	07:41	16:47	17:26	18:08
52°	06:18	06:58	07:35	16:54	17:30	18:10
50°	06:16	06:54	07:29	17:00	17:34	18:13
45°	06:10	06:45	07:16	17:12	17:43	18:18
N 40°	06:05	06:37	07:05	17:23	17:51	18:24
35°	06:00	06:30	06:56	17:32	17:58	18:28
30°	05:55	06:23	06:48	17:40	18:05	18:33
20°	05:45	06:11	06:34	17:54	18:17	18:43
N 10°	05:35	06:00	06:22	18:06	18:28	18:53
0°	05:24	05:49	06:10	18:17	18:39	19:04
S 10°	05:11	05:37	05:59	18:29	18:51	19:17
20°	04:55	05:23	05:46	18:42	19:05	19:32
30°	04:35	05:06	05:31	18:56	19:22	19:52
35°	04:22	04:55	05:23	19:04	19:32	20:05
40°	04:07	04:43	05:13	19:14	19:44	20:20
45°	03:48	04:29	05:01	19:26	19:58	20:39
S 50°	03:22	04:10	04:47	19:39	20:17	21:04
52°	03:09	04:01	04:41	19:46	20:25	21:17
54°	02:53	03:51	04:33	19:53	20:35	21:32
56°	02:35	03:39	04:25	20:01	20:47	21:50
58°	02:11	03:26	04:16	20:10	21:00	22:13
S 60°	01:36	03:10	04:05	20:21	21:16	22:46

Lat.	**Moonrise** Mon	Tue	Wed	**Moonset** Mon	Tue	Wed
N 72°	08:17	07:19	▭	·· ··	01:56	▭
N 70°	08:30	07:50	05:55	·· ··	01:28	05:13
68°	08:40	08:12	07:23	·· ··	01:07	03:46
66°	08:49	08:30	08:03	·· ··	00:51	03:08
64°	08:57	08:45	08:30	·· ··	00:38	02:41
62°	09:03	08:58	08:52	·· ··	00:27	02:21
60°	09:09	09:08	09:09	·· ··	00:17	02:05
N 58°	09:14	09:18	09:24	·· ··	00:09	01:51
56°	09:18	09:26	09:37	·· ··	00:02	01:39
54°	09:22	09:33	09:48	23:56	·· ··	01:29
52°	09:26	09:40	09:58	23:50	·· ··	01:20
50°	09:29	09:46	10:06	23:45	·· ··	01:11
45°	09:36	09:59	10:25	23:34	·· ··	00:54
N 40°	09:43	10:09	10:41	23:25	·· ··	00:40
35°	09:48	10:19	10:54	23:17	·· ··	00:28
30°	09:53	10:27	11:05	23:10	·· ··	00:18
20°	10:01	10:41	11:25	22:59	·· ··	00:00
N 10°	10:08	10:54	11:43	22:48	23:45	·· ··
0°	10:15	11:06	11:59	22:39	23:31	·· ··
S 10°	10:22	11:18	12:15	22:29	23:16	·· ··
20°	10:30	11:30	12:33	22:19	23:01	23:47
30°	10:38	11:45	12:54	22:08	22:44	23:25
35°	10:44	11:54	13:06	22:01	22:34	23:12
40°	10:49	12:04	13:20	21:54	22:23	22:57
45°	10:56	12:16	13:36	21:45	22:09	22:39
S 50°	11:04	12:30	13:57	21:35	21:53	22:17
52°	11:08	12:37	14:07	21:30	21:46	22:06
54°	11:12	12:44	14:18	21:25	21:37	21:55
56°	11:17	12:53	14:31	21:19	21:28	21:41
58°	11:22	13:02	14:46	21:13	21:18	21:25
S 60°	11:28	13:13	15:04	21:06	21:05	21:07

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 5-7 25-46%
03	13:46	13:49	12:14	16:27	04:02	
04	13:52	13:54	12:14	17:18	04:52	
05	13:57	13:59	12:14	18:12	05:45	

February 06, 07, 08 UT (Thu., Fri., Sat.)

	Aries	Venus		Mars		Jupiter		Saturn	
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	136°23.0	136°21.0	N02°57.7	25°01.1	N26°12.0	66°34.9	N21°39.7	146°41.2	S06°31.2
1	151°25.5	151°22.0	58.8	40°04.2	12.1	81°37.3	39.7	161°43.4	31.1
2	166°27.9	166°23.0	02°59.8	55°07.3	12.1	96°39.8	39.7	176°45.6	31.0
3	181°30.4	181°24.0	03°00.9	70°10.4	·· 12.1	111°42.2	·· 39.7	191°47.8	·· 30.9
4	196°32.8	196°25.0	02.0	85°13.6	12.2	126°44.7	39.7	206°50.1	30.8
5	211°35.3	211°26.0	03.0	100°16.7	12.2	141°47.1	39.7	221°52.3	30.7
6	226°37.8	226°27.0	N03°04.1	115°19.8	N26°12.2	156°49.6	N21°39.8	236°54.5	S06°30.6
7	241°40.2	241°28.0	05.2	130°22.9	12.3	171°52.0	39.8	251°56.7	30.5
8	256°42.7	256°29.0	06.2	145°26.0	12.3	186°54.5	39.8	266°58.9	30.4
9	271°45.2	271°30.0	·· 07.3	160°29.1	·· 12.3	201°56.9	·· 39.8	282°01.1	·· 30.2
10	286°47.6	286°31.0	08.4	175°32.2	12.4	216°59.4	39.8	297°03.3	30.1
11	301°50.1	301°32.1	09.4	190°35.3	12.4	232°01.8	39.8	312°05.5	30.0
12	316°52.6	316°33.1	N03°10.5	205°38.4	N26°12.4	247°04.3	N21°39.8	327°07.7	S06°29.9
13	331°55.0	331°34.1	11.5	220°41.5	12.5	262°06.7	39.8	342°09.9	29.8
14	346°57.5	346°35.1	12.6	235°44.6	12.5	277°09.2	39.8	357°12.1	29.7
15	2°00.0	1°36.1	·· 13.7	250°47.7	·· 12.5	292°11.6	·· 39.9	12°14.3	·· 29.6
16	17°02.4	16°37.2	14.7	265°50.8	12.6	307°14.1	39.9	27°16.5	29.5
17	32°04.9	31°38.2	15.8	280°53.9	12.6	322°16.5	39.9	42°18.7	29.3
18	47°07.3	46°39.2	N03°16.8	295°57.0	N26°12.6	337°18.9	N21°39.9	57°20.9	S06°29.2
19	62°09.8	61°40.2	17.9	311°00.1	12.6	352°21.4	39.9	72°23.1	29.1
20	77°12.3	76°41.3	19.0	326°03.2	12.7	7°23.8	39.9	87°25.3	29.0
21	92°14.7	91°42.3	·· 20.0	341°06.3	·· 12.7	22°26.3	·· 39.9	102°27.5	·· 28.9
22	107°17.2	106°43.3	21.1	356°09.4	12.7	37°28.7	39.9	117°29.7	28.8
23	122°19.7	121°44.4	22.1	11°12.5	12.8	52°31.2	40.0	132°31.9	28.7
Mer.pass. 14:52		ν 1.0′	d 1.1′	m -4.79	ν 3.1′	d 0.0′	m -0.93	ν 2.5′	d 0.0′ m -2.48	ν 2.2′	d 0.1′ m 1.11

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	137°22.1	136°45.4	N03°23.2	26°15.5	N26°12.8	67°33.6	N21°40.0	147°34.2	S06°28.6
1	152°24.6	151°46.5	24.2	41°18.6	12.8	82°36.0	40.0	162°36.4	28.4
2	167°27.1	166°47.5	25.3	56°21.7	12.8	97°38.5	40.0	177°38.6	28.3
3	182°29.5	181°48.6	·· 26.3	71°24.8	·· 12.9	112°40.9	·· 40.0	192°40.8	·· 28.2
4	197°32.0	196°49.6	27.4	86°27.9	12.9	127°43.4	40.0	207°43.0	28.1
5	212°34.5	211°50.7	28.5	101°31.0	12.9	142°45.8	40.0	222°45.2	28.0
6	227°36.9	226°51.7	N03°29.5	116°34.0	N26°12.9	157°48.2	N21°40.0	237°47.4	S06°27.9
7	242°39.4	241°52.8	30.6	131°37.1	13.0	172°50.7	40.0	252°49.6	27.8
8	257°41.8	256°53.8	31.6	146°40.2	13.0	187°53.1	40.1	267°51.8	27.7
9	272°44.3	271°54.9	·· 32.7	161°43.3	·· 13.0	202°55.6	·· 40.1	282°54.0	·· 27.5
10	287°46.8	286°55.9	33.7	176°46.3	13.0	217°58.0	40.1	297°56.2	27.4
11	302°49.2	301°57.0	34.8	191°49.4	13.1	233°00.4	40.1	312°58.4	27.3
12	317°51.7	316°58.1	N03°35.8	206°52.5	N26°13.1	248°02.9	N21°40.1	328°00.6	S06°27.2
13	332°54.2	331°59.1	36.8	221°55.5	13.1	263°05.3	40.1	343°02.8	27.1
14	347°56.6	347°00.2	37.9	236°58.6	13.1	278°07.8	40.1	358°05.0	27.0
15	2°59.1	2°01.3	·· 38.9	252°01.7	·· 13.2	293°10.2	·· 40.1	13°07.2	·· 26.9
16	18°01.6	17°02.3	40.0	267°04.7	13.2	308°12.6	40.2	28°09.4	26.8
17	33°04.0	32°03.4	41.0	282°07.8	13.2	323°15.1	40.2	43°11.6	26.6
18	48°06.5	47°04.5	N03°42.1	297°10.8	N26°13.2	338°17.5	N21°40.2	58°13.8	S06°26.5
19	63°09.0	62°05.5	43.1	312°13.9	13.2	353°19.9	40.2	73°16.0	26.4
20	78°11.4	77°06.6	44.2	327°17.0	13.3	8°22.4	40.2	88°18.2	26.3
21	93°13.9	92°07.7	·· 45.2	342°20.0	·· 13.3	23°24.8	·· 40.2	103°20.4	·· 26.2
22	108°16.3	107°08.8	46.2	357°23.1	13.3	38°27.2	40.2	118°22.6	26.1
23	123°18.8	122°09.9	47.3	12°26.1	13.3	53°29.7	40.2	133°24.8	26.0
Mer.pass. 14:48		ν 1.0′	d 1.1′	m -4.80	ν 3.1′	d 0.0′	m -0.90	ν 2.4′	d 0.0′ m -2.47	ν 2.2′	d 0.1′ m 1.12

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	138°21.3	137°11.0	N03°48.3	27°29.2	N26°13.3	68°32.1	N21°40.3	148°27.0	S06°25.9
1	153°23.7	152°12.1	49.4	42°32.2	13.4	83°34.5	40.3	163°29.2	25.7
2	168°26.2	167°13.1	50.4	57°35.3	13.4	98°37.0	40.3	178°31.4	25.6
3	183°28.7	182°14.2	·· 51.4	72°38.3	·· 13.4	113°39.4	·· 40.3	193°33.6	·· 25.5
4	198°31.1	197°15.3	52.5	87°41.3	13.4	128°41.8	40.3	208°35.8	25.4
5	213°33.6	212°16.4	53.5	102°44.4	13.4	143°44.3	40.3	223°38.0	25.3
6	228°36.1	227°17.5	N03°54.6	117°47.4	N26°13.5	158°46.7	N21°40.3	238°40.2	S06°25.2
7	243°38.5	242°18.6	55.6	132°50.5	13.5	173°49.1	40.4	253°42.5	25.1
8	258°41.0	257°19.7	56.6	147°53.5	13.5	188°51.5	40.4	268°44.7	25.0
9	273°43.5	272°20.8	·· 57.7	162°56.6	·· 13.5	203°54.0	·· 40.4	283°46.9	·· 24.8
10	288°45.9	287°21.9	58.7	177°59.6	13.5	218°56.4	40.4	298°49.1	24.7
11	303°48.4	302°23.1	03°59.7	193°02.6	13.5	233°58.8	40.4	313°51.3	24.6
12	318°50.8	317°24.2	N04°00.8	208°05.7	N26°13.6	249°01.3	N21°40.4	328°53.5	S06°24.5
13	333°53.3	332°25.3	01.8	223°08.7	13.6	264°03.7	40.4	343°55.7	24.4
14	348°55.8	347°26.4	02.8	238°11.7	13.6	279°06.1	40.4	358°57.9	24.3
15	3°58.2	2°27.5	·· 03.9	253°14.7	·· 13.6	294°08.5	·· 40.5	14°00.1	·· 24.2
16	19°00.7	17°28.6	04.9	268°17.8	13.6	309°11.0	40.5	29°02.3	24.0
17	34°03.2	32°29.7	05.9	283°20.8	13.6	324°13.4	40.5	44°04.5	23.9
18	49°05.6	47°30.9	N04°06.9	298°23.8	N26°13.6	339°15.8	N21°40.5	59°06.7	S06°23.8
19	64°08.1	62°32.0	08.0	313°26.8	13.7	354°18.3	40.5	74°08.9	23.7
20	79°10.6	77°33.1	09.0	328°29.9	13.7	9°20.7	40.5	89°11.1	23.6
21	94°13.0	92°34.3	·· 10.0	343°32.9	·· 13.7	24°23.1	·· 40.5	104°13.3	·· 23.5
22	109°15.5	107°35.4	11.0	358°35.9	13.7	39°25.5	40.6	119°15.5	23.4
23	124°17.9	122°36.5	12.1	13°38.9	13.7	54°28.0	40.6	134°17.7	23.3
Mer.pass. 14:44		ν 1.1′	d 1.0′	m -4.81	ν 3.0′	d 0.0′	m -0.87	ν 2.4′	d 0.0′ m -2.46	ν 2.2′	d 0.1′ m 1.12

Stars

	SHA	Dec
Alpheratz	357°35.0	29°13.8
Ankaa	353°07.3	-42°10.4
Schedar	349°31.3	56°40.7
Diphda	348°47.4	-17°51.1
Achernar	335°20.3	-57°06.8
Hamal	327°51.2	23°34.9
Polaris	313°59.8	89°22.5
Acamar	315°11.7	-40°12.5
Menkar	314°06.1	4°11.2
Mirfak	308°28.1	49°57.2
Aldebaran	290°39.4	16°33.6
Rigel	281°03.6	-8°10.5
Capella	280°21.5	46°01.5
Bellatrix	278°22.6	6°22.3
Elnath	278°01.5	28°37.8
Alnilam	275°37.4	-1°11.2
Betelgeuse	270°51.8	7°24.7
Canopus	263°51.9	-52°42.7
Sirius	258°25.9	-16°45.1
Adhara	255°05.5	-29°00.5
Procyon	244°50.4	5°09.6
Pollux	243°16.9	27°57.9
Avior	234°14.1	-59°35.4
Suhail	222°45.8	-43°32.1
Miaplacidus	221°37.4	-69°49.2
Alphard	217°47.4	-8°46.1
Regulus	207°34.0	11°50.6
Dubhe	193°40.3	61°36.7
Denebola	182°24.6	14°25.7
Gienah	175°43.3	-17°40.9
Acrux	172°59.6	-63°14.1
Gacrux	171°51.2	-57°15.1
Alioth	166°12.6	55°49.1
Spica	158°22.1	-11°17.6
Alkaid	152°51.8	49°10.9
Hadar	148°35.8	-60°29.4
Menkent	147°57.4	-36°29.5
Arcturus	145°47.8	19°02.9
Rigil Kent.	139°40.1	-60°56.1
Kochab	137°19.7	74°02.7
Zuben'ubi	136°55.9	-16°08.8
Alphecca	126°03.7	26°37.5
Antares	112°15.9	-26°29.2
Atria	107°10.3	-69°04.1
Sabik	102°02.9	-15°45.4
Shaula	96°10.5	-37°07.3
Rasalhague	95°58.7	12°32.3
Eltanin	90°42.5	51°28.8
Kaus Aust.	83°32.7	-34°22.3
Vega	80°33.5	38°48.2
Nunki	75°48.0	-26°16.0
Altair	62°00.2	8°55.9
Peacock	53°06.2	-56°39.3
Deneb	49°26.2	45°22.1
Enif	33°39.0	9°59.3
Al Na'ir	27°33.3	-46°50.5
Fomalhaut	15°14.7	-29°29.5
Scheat	13°45.5	28°13.1
Markab	13°30.1	15°20.4

Feb 06 Thu	SHA	Mer.pass
Venus	359°58.0	14:54
Mars	248°38.1	22:15
Jupiter	290°11.9	19:30
Saturn	10°18.2	14:11

Feb 07 Fri	SHA	Mer.pass
Venus	359°23.3	14:52
Mars	248°53.4	22:10
Jupiter	290°11.5	19:27
Saturn	10°12.0	14:08

Feb 08 Sat	SHA	Mer.pass
Venus	358°49.7	14:50
Mars	249°07.9	22:06
Jupiter	290°10.8	19:23
Saturn	10°05.8	14:04

Horizontal parallax	
Venus:	0.3
Mars:	0.2

DUT1 = UT1-UTC = +0.0454 sec ΔT = TT-UT1 = +69.1386 sec

2025 February 06 to Feb. 08 UT

h	Sun		Moon				
Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°29.6	S15°36.3	83°44.2	7.0′	N23°32.1	10.0′	58.7′
1	191°29.6	35.6	98°10.2	6.9′	23°42.1	9.8′	58.7′
2	206°29.6	34.8	112°36.2	6.9′	23°51.9	9.7′	58.7′
3	221°29.5	·· 34.0	127°02.1	6.8′	24°01.6	9.5′	58.7′
4	236°29.5	33.3	141°27.9	6.7′	24°11.1	9.4′	58.7′
5	251°29.4	32.5	155°53.6	6.7′	24°20.5	9.2′	58.7′
6	266°29.4	S15°31.7	170°19.2	6.6′	N24°29.7	9.1′	58.6′
7	281°29.4	30.9	184°44.8	6.5′	24°38.8	8.9′	58.6′
8	296°29.3	30.2	199°10.4	6.4′	24°47.7	8.8′	58.6′
9	311°29.3	·· 29.4	213°35.8	6.4′	24°56.5	8.6′	58.6′
10	326°29.2	28.6	228°01.2	6.3′	25°05.1	8.4′	58.6′
11	341°29.2	27.8	242°26.5	6.2′	25°13.5	8.3′	58.6′
12	356°29.2	S15°27.1	256°51.7	6.2′	N25°21.8	8.1′	58.5′
13	11°29.1	26.3	271°16.9	6.1′	25°29.9	8.0′	58.5′
14	26°29.1	25.5	285°42.0	6.1′	25°37.9	7.8′	58.5′
15	41°29.1	·· 24.7	300°07.1	6.0′	25°45.7	7.6′	58.5′
16	56°29.0	24.0	314°32.1	5.9′	25°53.3	7.5′	58.5′
17	71°29.0	23.2	328°57.0	5.9′	26°00.8	7.3′	58.5′
18	86°29.0	S15°22.4	343°21.9	5.8′	N26°08.1	7.2′	58.4′
19	101°28.9	21.6	357°46.7	5.8′	26°15.3	6.9′	58.4′
20	116°28.9	20.8	12°11.5	5.7′	26°22.2	6.8′	58.4′
21	131°28.9	·· 20.1	26°36.2	5.6′	26°29.0	6.7′	58.4′
22	146°28.8	19.3	41°00.8	5.6′	26°35.7	6.4′	58.4′
23	161°28.8	18.5	55°25.4	5.5′	26°42.1	6.3′	58.4′
	SD = 16.2′	d = 0.8′	SD = 16.0′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°28.7	S15°17.7	69°49.9	5.5′	N26°48.4	6.2′	58.3′
1	191°28.7	16.9	84°14.4	5.4′	26°54.6	5.9′	58.3′
2	206°28.7	16.2	98°38.9	5.4′	27°00.5	5.8′	58.3′
3	221°28.7	·· 15.4	113°03.3	5.4′	27°06.3	5.6′	58.3′
4	236°28.6	14.6	127°27.6	5.3′	27°11.9	5.4′	58.3′
5	251°28.6	13.8	141°52.0	5.3′	27°17.3	5.3′	58.3′
6	266°28.6	S15°13.0	156°16.2	5.2′	N27°22.6	5.0′	58.2′
7	281°28.5	12.2	170°40.5	5.2′	27°27.6	4.9′	58.2′
8	296°28.5	11.4	185°04.6	5.2′	27°32.5	4.8′	58.2′
9	311°28.5	·· 10.7	199°28.8	5.1′	27°37.3	4.5′	58.2′
10	326°28.4	09.9	213°52.9	5.1′	27°41.8	4.4′	58.2′
11	341°28.4	09.1	228°17.0	5.1′	27°46.2	4.1′	58.2′
12	356°28.4	S15°08.3	242°41.1	5.0′	N27°50.3	4.0′	58.1′
13	11°28.3	07.5	257°05.1	5.0′	27°54.3	3.9′	58.1′
14	26°28.3	06.7	271°29.1	5.0′	27°58.2	3.6′	58.1′
15	41°28.3	·· 05.9	285°53.1	5.0′	28°01.8	3.5′	58.1′
16	56°28.3	05.2	300°17.1	4.9′	28°05.3	3.3′	58.1′
17	71°28.2	04.4	314°41.0	4.9′	28°08.6	3.1′	58.1′
18	86°28.2	S15°03.6	329°04.9	4.9′	N28°11.7	2.9′	58.0′
19	101°28.2	02.8	343°28.9	4.9′	28°14.6	2.7′	58.0′
20	116°28.2	02.0	357°52.7	4.9′	28°17.3	2.6′	58.0′
21	131°28.1	·· 01.2	12°16.6	4.9′	28°19.9	2.3′	58.0′
22	146°28.1	15°00.4	26°40.5	4.9′	28°22.2	2.2′	58.0′
23	161°28.1	14°59.6	41°04.4	4.9′	28°24.4	2.0′	58.0′
	SD = 16.2′	d = 0.8′	SD = 15.9′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°28.1	S14°58.8	55°28.2	4.9′	N28°26.4	1.9′	57.9′
1	191°28.0	58.0	69°52.1	4.9′	28°28.3	1.6′	57.9′
2	206°28.0	57.2	84°16.0	4.9′	28°29.9	1.5′	57.9′
3	221°28.0	·· 56.4	98°39.8	4.9′	28°31.4	1.2′	57.9′
4	236°28.0	55.7	113°03.7	4.9′	28°32.6	1.1′	57.9′
5	251°27.9	54.9	127°27.6	4.9′	28°33.7	1.0′	57.8′
6	266°27.9	S14°54.1	141°51.5	4.9′	N28°34.7	0.7′	57.8′
7	281°27.9	53.3	156°15.4	4.9′	28°35.4	0.5′	57.8′
8	296°27.9	52.5	170°39.3	4.9′	28°35.9	0.4′	57.8′
9	311°27.8	·· 51.7	185°03.2	4.9′	28°36.3	0.2′	57.8′
10	326°27.8	50.9	199°27.1	5.0′	28°36.5	0.0′	57.8′
11	341°27.8	50.1	213°51.1	5.0′	28°36.5	0.2′	57.7′
12	356°27.8	S14°49.3	228°15.1	5.0′	N28°36.3	0.4′	57.7′
13	11°27.8	48.5	242°39.1	5.0′	28°35.9	0.5′	57.7′
14	26°27.7	47.7	257°03.1	5.1′	28°35.4	0.7′	57.7′
15	41°27.7	·· 46.9	271°27.2	5.1′	28°34.7	0.9′	57.7′
16	56°27.7	46.1	285°51.3	5.1′	28°33.8	1.1′	57.6′
17	71°27.7	45.3	300°15.4	5.2′	28°32.7	1.3′	57.6′
18	86°27.7	S14°44.5	314°39.6	5.2′	N28°31.4	1.4′	57.6′
19	101°27.6	43.7	329°03.8	5.2′	28°30.0	1.6′	57.6′
20	116°27.6	42.9	343°28.0	5.3′	28°28.4	1.8′	57.6′
21	131°27.6	·· 42.1	357°52.3	5.3′	28°26.6	2.0′	57.5′
22	146°27.6	41.3	12°16.7	5.4′	28°24.6	2.1′	57.5′
23	161°27.6	40.5	26°41.0	5.4′	28°22.5	2.4′	57.5′
	SD = 16.2′	d = 0.8′	SD = 15.8′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	06:46	08:10	09:41	14:48	16:20	17:44
N 70°	06:41	07:56	09:12	15:17	16:34	17:49
68°	06:37	07:44	08:51	15:39	16:45	17:53
66°	06:33	07:35	08:34	15:56	16:55	17:57
64°	06:29	07:26	08:20	16:09	17:03	18:00
62°	06:26	07:19	08:08	16:21	17:10	18:03
60°	06:23	07:13	07:59	16:31	17:16	18:06
N 58°	06:21	07:07	07:50	16:39	17:22	18:09
56°	06:18	07:02	07:42	16:47	17:27	18:11
54°	06:16	06:58	07:36	16:53	17:31	18:13
52°	06:14	06:54	07:30	16:59	17:35	18:15
50°	06:12	06:50	07:24	17:05	17:39	18:17
45°	06:07	06:41	07:12	17:17	17:47	18:22
N 40°	06:02	06:34	07:02	17:26	17:55	18:27
35°	05:57	06:27	06:54	17:35	18:01	18:31
30°	05:53	06:21	06:46	17:42	18:07	18:36
20°	05:44	06:10	06:33	17:55	18:18	18:44
N 10°	05:35	06:00	06:22	18:07	18:28	18:54
0°	05:24	05:49	06:11	18:18	18:39	19:04
S 10°	05:12	05:38	06:00	18:28	18:50	19:16
20°	04:57	05:25	05:48	18:40	19:03	19:30
30°	04:38	05:09	05:34	18:54	19:19	19:49
35°	04:26	04:59	05:26	19:02	19:29	20:01
40°	04:11	04:47	05:17	19:11	19:40	20:16
45°	03:53	04:33	05:06	19:22	19:54	20:34
S 50°	03:29	04:16	04:53	19:34	20:11	20:58
52°	03:17	04:08	04:47	19:41	20:19	21:10
54°	03:02	03:58	04:40	19:47	20:29	21:23
56°	02:45	03:47	04:32	19:55	20:39	21:40
58°	02:24	03:35	04:23	20:03	20:51	22:01
S 60°	01:55	03:20	04:14	20:13	21:06	22:28

Lat.	**Moonrise** Thu	Fri	Sat	**Moonset** Thu	Fri	Sat
N 72°						
N 70°						
68°						
66°						
64°	08:02			05:05		
62°	08:44	08:30		04:24	06:41	
60°	09:13	09:25	10:02	03:56	05:46	07:15
N 58°	09:35	09:58	10:43	03:35	05:14	06:34
56°	09:54	10:22	11:11	03:17	04:50	06:06
54°	10:09	10:42	11:33	03:02	04:30	05:45
52°	10:22	10:59	11:51	02:49	04:14	05:27
50°	10:34	11:13	12:06	02:38	04:00	05:11
45°	10:59	11:42	12:37	02:14	03:31	04:40
N 40°	11:19	12:05	13:01	01:56	03:09	04:16
35°	11:35	12:24	13:21	01:40	02:51	03:56
30°	11:49	12:40	13:38	01:26	02:35	03:39
20°	12:14	13:08	14:07	01:04	02:08	03:11
N 10°	12:35	13:32	14:32	00:44	01:45	02:46
0°	12:55	13:54	14:55	00:25	01:23	02:23
S 10°	13:15	14:17	15:18	00:07	01:02	02:00
20°	13:37	14:41	15:42	·· ··	00:39	01:36
30°	14:02	15:09	16:11	·· ··	00:12	01:07
35°	14:17	15:26	16:28	23:57	·· ··	00:50
40°	14:35	15:46	16:48	23:39	·· ··	00:30
45°	14:56	16:09	17:12	23:17	·· ··	00:06
S 50°	15:22	16:40	17:43	22:49	23:35	·· ··
52°	15:35	16:55	17:59	22:36	23:20	·· ··
54°	15:50	17:13	18:17	22:21	23:02	·· ··
56°	16:08	17:35	18:39	22:03	22:40	23:41
58°	16:30	18:02	19:08	21:41	22:12	23:12
S 60°	16:57	18:42	19:49	21:13	21:32	22:31

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 8-10 58-78%
06	14:01	14:03	12:14	19:09	06:40	
07	14:05	14:06	12:14	20:09	07:39	
08	14:08	14:09	12:14	21:09	08:39	

February 09, 10, 11 UT (Sun., Monday., Tue.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	139°20.4	137°37.7	N04°13.1	28°41.9	N26°13.7	69°30.4	N21°40.6	149°19.9	S06°23.1
1	154°22.9	152°38.8	14.1	43°44.9	13.7	84°32.8	40.6	164°22.1	23.0
2	169°25.3	167°39.9	15.1	58°48.0	13.7	99°35.2	40.6	179°24.3	22.9
3	184°27.8	182°41.1	·· 16.2	73°51.0	·· 13.8	114°37.6	·· 40.6	194°26.5	·· 22.8
4	199°30.3	197°42.2	17.2	88°54.0	13.8	129°40.1	40.6	209°28.7	22.7
5	214°32.7	212°43.4	18.2	103°57.0	13.8	144°42.5	40.7	224°30.9	22.6
6	229°35.2	227°44.5	N04°19.2	119°00.0	N26°13.8	159°44.9	N21°40.7	239°33.1	S06°22.5
7	244°37.7	242°45.7	20.3	134°03.0	13.8	174°47.3	40.7	254°35.3	22.3
8	259°40.1	257°46.8	21.3	149°06.0	13.8	189°49.8	40.7	269°37.5	22.2
9	274°42.6	272°48.0	·· 22.3	164°09.0	·· 13.8	204°52.2	·· 40.7	284°39.7	·· 22.1
10	289°45.1	287°49.1	23.3	179°12.0	13.8	219°54.6	40.7	299°41.9	22.0
11	304°47.5	302°50.3	24.3	194°15.0	13.8	234°57.0	40.7	314°44.1	21.9
12	319°50.0	317°51.4	N04°25.3	209°18.0	N26°13.8	249°59.4	N21°40.8	329°46.3	S06°21.8
13	334°52.4	332°52.6	26.4	224°21.0	13.9	265°01.9	40.8	344°48.5	21.7
14	349°54.9	347°53.8	27.4	239°24.0	13.9	280°04.3	40.8	359°50.7	21.6
15	4°57.4	2°54.9	·· 28.4	254°27.0	·· 13.9	295°06.7	·· 40.8	14°52.9	·· 21.4
16	19°59.8	17°56.1	29.4	269°30.0	13.9	310°09.1	40.8	29°55.1	21.3
17	35°02.3	32°57.3	30.4	284°33.0	13.9	325°11.5	40.8	44°57.3	21.2
18	50°04.8	47°58.5	N04°31.4	299°35.9	N26°13.9	340°13.9	N21°40.8	59°59.5	S06°21.1
19	65°07.2	62°59.6	32.4	314°38.9	13.9	355°16.4	40.9	75°01.7	21.0
20	80°09.7	78°00.8	33.4	329°41.9	13.9	10°18.8	40.9	90°03.9	20.9
21	95°12.2	93°02.0	·· 34.5	344°44.9	·· 13.9	25°21.2	·· 40.9	105°06.1	·· 20.8
22	110°14.6	108°03.2	35.5	359°47.9	13.9	40°23.6	40.9	120°08.3	20.6
23	125°17.1	123°04.4	36.5	14°50.9	13.9	55°26.0	40.9	135°10.5	20.5
Mer.pass. 14:40		ν 1.1′	d 1.0′	m -4.82	ν 3.0′	d 0.0′	m -0.84	ν 2.4′	d 0.0′ m -2.46	ν 2.2′	d 0.1′ m 1.12

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	140°19.6	138°05.5	N04°37.5	29°53.8	N26°13.9	70°28.4	N21°40.9	150°12.7	S06°20.4
1	155°22.0	153°06.7	38.5	44°56.8	13.9	85°30.9	40.9	165°14.9	20.3
2	170°24.5	168°07.9	39.5	59°59.8	13.9	100°33.3	41.0	180°17.1	20.2
3	185°26.9	183°09.1	·· 40.5	75°02.8	·· 13.9	115°35.7	·· 41.0	195°19.3	·· 20.1
4	200°29.4	198°10.3	41.5	90°05.7	13.9	130°38.1	41.0	210°21.5	20.0
5	215°31.9	213°11.5	42.5	105°08.7	13.9	145°40.5	41.0	225°23.7	19.8
6	230°34.3	228°12.7	N04°43.5	120°11.7	N26°13.9	160°42.9	N21°41.0	240°25.9	S06°19.7
7	245°36.8	243°13.9	44.5	135°14.7	14.0	175°45.3	41.0	255°28.1	19.6
8	260°39.3	258°15.1	45.5	150°17.6	14.0	190°47.8	41.1	270°30.3	19.5
9	275°41.7	273°16.3	·· 46.5	165°20.6	·· 14.0	205°50.2	·· 41.1	285°32.5	·· 19.4
10	290°44.2	288°17.5	47.5	180°23.6	14.0	220°52.6	41.1	300°34.7	19.3
11	305°46.7	303°18.7	48.5	195°26.5	14.0	235°55.0	41.1	315°36.9	19.2
12	320°49.1	318°19.9	N04°49.5	210°29.5	N26°14.0	250°57.4	N21°41.1	330°39.1	S06°19.0
13	335°51.6	333°21.2	50.5	225°32.4	14.0	265°59.8	41.1	345°41.3	18.9
14	350°54.1	348°22.4	51.5	240°35.4	14.0	281°02.2	41.2	0°43.5	18.8
15	5°56.5	3°23.6	·· 52.5	255°38.3	·· 14.0	296°04.6	·· 41.2	15°45.7	·· 18.7
16	20°59.0	18°24.8	53.5	270°41.3	14.0	311°07.0	41.2	30°47.9	18.6
17	36°01.4	33°26.0	54.5	285°44.3	14.0	326°09.4	41.2	45°50.1	18.5
18	51°03.9	48°27.3	N04°55.5	300°47.2	N26°14.0	341°11.9	N21°41.2	60°52.3	S06°18.4
19	66°06.4	63°28.5	56.5	315°50.2	14.0	356°14.3	41.2	75°54.5	18.2
20	81°08.8	78°29.7	57.5	330°53.1	14.0	11°16.7	41.2	90°56.7	18.1
21	96°11.3	93°31.0	·· 58.5	345°56.1	·· 14.0	26°19.1	·· 41.3	105°58.9	·· 18.0
22	111°13.8	108°32.2	04°59.5	0°59.0	14.0	41°21.5	41.3	121°01.1	17.9
23	126°16.2	123°33.4	05°00.4	16°01.9	14.0	56°23.9	41.3	136°03.3	17.8
Mer.pass. 14:36		ν 1.2′	d 1.0′	m -4.82	ν 3.0′	d 0.0′	m -0.81	ν 2.4′	d 0.0′ m -2.45	ν 2.2′	d 0.1′ m 1.12

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	141°18.7	138°34.7	N05°01.4	31°04.9	N26°14.0	71°26.3	N21°41.3	151°05.5	S06°17.7
1	156°21.2	153°35.9	02.4	46°07.8	14.0	86°28.7	41.3	166°07.7	17.6
2	171°23.6	168°37.2	03.4	61°10.8	14.0	101°31.1	41.3	181°09.9	17.4
3	186°26.1	183°38.4	·· 04.4	76°13.7	·· 13.9	116°33.5	·· 41.4	196°12.1	·· 17.3
4	201°28.6	198°39.7	05.4	91°16.6	13.9	131°35.9	41.4	211°14.3	17.2
5	216°31.0	213°40.9	06.4	106°19.6	13.9	146°38.3	41.4	226°16.5	17.1
6	231°33.5	228°42.2	N05°07.4	121°22.5	N26°13.9	161°40.7	N21°41.4	241°18.7	S06°17.0
7	246°35.9	243°43.4	08.3	136°25.5	13.9	176°43.1	41.4	256°20.9	16.9
8	261°38.4	258°44.7	09.3	151°28.4	13.9	191°45.5	41.4	271°23.1	16.8
9	276°40.9	273°45.9	·· 10.3	166°31.3	·· 13.9	206°47.9	·· 41.5	286°25.3	·· 16.6
10	291°43.3	288°47.2	11.3	181°34.2	13.9	221°50.3	41.5	301°27.5	16.5
11	306°45.8	303°48.4	12.3	196°37.2	13.9	236°52.7	41.5	316°29.7	16.4
12	321°48.3	318°49.7	N05°13.3	211°40.1	N26°13.9	251°55.1	N21°41.5	331°31.9	S06°16.3
13	336°50.7	333°51.0	14.2	226°43.0	13.9	266°57.5	41.5	346°34.1	16.2
14	351°53.2	348°52.3	15.2	241°45.9	13.9	281°59.9	41.5	1°36.3	16.1
15	6°55.7	3°53.5	·· 16.2	256°48.9	·· 13.9	297°02.3	·· 41.6	16°38.5	·· 16.0
16	21°58.1	18°54.8	17.2	271°51.8	13.9	312°04.7	41.6	31°40.6	15.8
17	37°00.6	33°56.1	18.1	286°54.7	13.9	327°07.1	41.6	46°42.8	15.7
18	52°03.0	48°57.4	N05°19.1	301°57.6	N26°13.9	342°09.5	N21°41.6	61°45.0	S06°15.6
19	67°05.5	63°58.6	20.1	317°00.5	13.9	357°11.9	41.6	76°47.2	15.5
20	82°08.0	78°59.9	21.1	332°03.4	13.9	12°14.3	41.6	91°49.4	15.4
21	97°10.4	94°01.2	·· 22.0	347°06.3	·· 13.8	27°16.7	·· 41.7	106°51.6	·· 15.3
22	112°12.9	109°02.5	23.0	2°09.3	13.8	42°19.1	41.7	121°53.8	15.2
23	127°15.4	124°03.8	24.0	17°12.2	13.8	57°21.5	41.7	136°56.0	15.0
Mer.pass. 14:32		ν 1.2′	d 1.0′	m -4.83	ν 2.9′	d 0.0′	m -0.79	ν 2.4′	d 0.0′ m -2.44	ν 2.2′	d 0.1′ m 1.12

Stars

	SHA	**Dec**
Alpheratz	357°35.0	29°13.8
Ankaa	353°07.3	-42°10.4
Schedar	349°31.3	56°40.7
Diphda	348°47.4	-17°51.1
Achernar	335°20.3	-57°06.8
Hamal	327°51.2	23°34.9
Polaris	314°01.1	89°22.5
Acamar	315°11.7	-40°12.5
Menkar	314°06.1	4°11.2
Mirfak	308°28.1	49°57.2
Aldebaran	290°39.4	16°33.6
Rigel	281°03.6	-8°10.5
Capella	280°21.5	46°01.5
Bellatrix	278°22.6	6°22.3
Elnath	278°01.5	28°37.8
Alnilam	275°37.4	-1°11.2
Betelgeuse	270°51.8	7°24.7
Canopus	263°52.0	-52°42.7
Sirius	258°25.9	-16°45.2
Adhara	255°05.5	-29°00.5
Procyon	244°50.4	5°09.6
Pollux	243°16.9	27°57.9
Avior	234°14.1	-59°35.5
Suhail	222°45.8	-43°32.1
Miaplacidus	221°37.4	-69°49.2
Alphard	217°47.3	-8°46.1
Regulus	207°34.0	11°50.6
Dubhe	193°40.2	61°36.7
Denebola	182°24.6	14°25.7
Gienah	175°43.3	-17°40.9
Acrux	172°59.6	-63°14.1
Gacrux	171°51.2	-57°15.1
Alioth	166°12.5	55°49.1
Spica	158°22.1	-11°17.6
Alkaid	152°51.7	49°10.9
Hadar	148°35.7	-60°29.4
Menkent	147°57.4	-36°29.5
Arcturus	145°47.7	19°02.9
Rigil Kent.	139°40.1	-60°56.1
Kochab	137°19.6	74°02.7
Zuben'ubi	136°55.9	-16°08.8
Alphecca	126°03.7	26°37.5
Antares	112°15.8	-26°29.2
Atria	107°10.2	-69°04.1
Sabik	102°02.8	-15°45.4
Shaula	96°10.5	-37°07.3
Rasalhague	95°58.7	12°32.3
Eltanin	90°42.5	51°28.8
Kaus Aust.	83°32.7	-34°22.3
Vega	80°33.5	38°48.1
Nunki	75°47.9	-26°16.0
Altair	62°00.2	8°55.9
Peacock	53°06.1	-56°39.3
Deneb	49°26.2	45°22.0
Enif	33°39.0	9°59.3
Al Na'ir	27°33.2	-46°50.5
Fomalhaut	15°14.7	-29°29.5
Scheat	13°45.5	28°13.1
Markab	13°30.1	15°20.4

Feb 09 Sun	**SHA**	**Mer.pass**
Venus	358°17.2	14:48
Mars	249°21.5	22:01
Jupiter	290°10.0	19:19
Saturn	9°59.5	14:01

Feb 10 Mon	**SHA**	**Mer.pass**
Venus	357°46.0	14:46
Mars	249°34.3	21:56
Jupiter	290°08.9	19:15
Saturn	9°53.1	13:57

Feb 11 Tue	**SHA**	**Mer.pass**
Venus	357°16.0	14:44
Mars	249°46.2	21:51
Jupiter	290°07.6	19:11
Saturn	9°46.8	13:54

Horizontal parallax	
Venus:	0.3
Mars:	0.2

h	Sun		Moon				
Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°27.6	S14°39.7	41°05.5	5.5′	N28°20.1	2.5′	57.5′
1	191°27.5	38.9	55°29.9	5.5′	28°17.6	2.6′	57.5′
2	206°27.5	38.1	69°54.5	5.6′	28°15.0	2.9′	57.5′
3	221°27.5	·· 37.3	84°19.0	5.6′	28°12.1	3.0′	57.4′
4	236°27.5	36.5	98°43.7	5.7′	28°09.1	3.2′	57.4′
5	251°27.5	35.7	113°08.4	5.8′	28°05.9	3.3′	57.4′
6	266°27.5	S14°34.9	127°33.1	5.8′	N28°02.6	3.5′	57.4′
7	281°27.5	34.1	141°58.0	5.9′	27°59.1	3.7′	57.4′
8	296°27.4	33.3	156°22.9	6.0′	27°55.4	3.9′	57.3′
9	311°27.4	·· 32.4	170°47.8	6.0′	27°51.5	4.0′	57.3′
10	326°27.4	31.6	185°12.8	6.1′	27°47.5	4.2′	57.3′
11	341°27.4	30.8	199°37.9	6.2′	27°43.3	4.4′	57.3′
12	356°27.4	S14°30.0	214°03.1	6.2′	N27°38.9	4.5′	57.3′
13	11°27.4	29.2	228°28.3	6.3′	27°34.4	4.7′	57.2′
14	26°27.4	28.4	242°53.6	6.4′	27°29.7	4.8′	57.2′
15	41°27.4	·· 27.6	257°19.0	6.5′	27°24.9	5.0′	57.2′
16	56°27.3	26.8	271°44.5	6.5′	27°19.9	5.2′	57.2′
17	71°27.3	26.0	286°10.0	6.6′	27°14.7	5.3′	57.2′
18	86°27.3	S14°25.2	300°35.6	6.7′	N27°09.4	5.5′	57.1′
19	101°27.3	24.4	315°01.3	6.8′	27°03.9	5.7′	57.1′
20	116°27.3	23.6	329°27.1	6.9′	26°58.2	5.7′	57.1′
21	131°27.3	·· 22.7	343°53.0	7.0′	26°52.5	6.0′	57.1′
22	146°27.3	21.9	358°18.9	7.0′	26°46.5	6.1′	57.1′
23	161°27.3	21.1	12°45.0	7.1′	26°40.4	6.2′	57.0′
	SD = 16.2′	d = 0.8′	SD = 15.7′				

Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°27.3	S14°20.3	27°11.1	7.2′	N26°34.2	6.4′	57.0′
1	191°27.3	19.5	41°37.3	7.3′	26°27.8	6.6′	57.0′
2	206°27.2	18.7	56°03.6	7.4′	26°21.2	6.7′	57.0′
3	221°27.2	·· 17.9	70°30.0	7.5′	26°14.5	6.8′	57.0′
4	236°27.2	17.1	84°56.5	7.6′	26°07.7	7.0′	57.0′
5	251°27.2	16.2	99°23.1	7.7′	26°00.7	7.1′	56.9′
6	266°27.2	S14°15.4	113°49.8	7.8′	N25°53.6	7.3′	56.9′
7	281°27.2	14.6	128°16.5	7.9′	25°46.3	7.4′	56.9′
8	296°27.2	13.8	142°43.4	8.0′	25°38.9	7.5′	56.9′
9	311°27.2	·· 13.0	157°10.4	8.1′	25°31.4	7.7′	56.9′
10	326°27.2	12.2	171°37.5	8.2′	25°23.7	7.8′	56.8′
11	341°27.2	11.3	186°04.6	8.3′	25°15.9	8.0′	56.8′
12	356°27.2	S14°10.5	200°31.9	8.4′	N25°07.9	8.1′	56.8′
13	11°27.2	09.7	214°59.2	8.5′	24°59.8	8.2′	56.8′
14	26°27.2	08.9	229°26.7	8.6′	24°51.6	8.4′	56.8′
15	41°27.2	·· 08.1	243°54.3	8.7′	24°43.2	8.4′	56.7′
16	56°27.2	07.3	258°21.9	8.8′	24°34.8	8.6′	56.7′
17	71°27.2	06.4	272°49.7	8.9′	24°26.2	8.8′	56.7′
18	86°27.2	S14°05.6	287°17.6	9.0′	N24°17.4	8.8′	56.7′
19	101°27.2	04.8	301°45.5	9.1′	24°08.6	9.0′	56.7′
20	116°27.2	04.0	316°13.6	9.2′	23°59.6	9.1′	56.6′
21	131°27.2	·· 03.1	330°41.8	9.3′	23°50.5	9.2′	56.6′
22	146°27.2	02.3	345°10.1	9.4′	23°41.3	9.4′	56.6′
23	161°27.2	01.5	359°38.5	9.5′	23°31.9	9.4′	56.6′
	SD = 16.2′	d = 0.8′	SD = 15.6′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°27.2	S14°00.7	14°06.9	9.6′	N23°22.5	9.6′	56.5′
1	191°27.2	13°59.9	28°35.5	9.7′	23°12.9	9.7′	56.5′
2	206°27.2	59.0	43°04.2	9.8′	23°03.2	9.8′	56.5′
3	221°27.2	·· 58.2	57°33.0	9.9′	22°53.4	9.9′	56.5′
4	236°27.2	57.4	72°01.9	10.0′	22°43.5	10.0′	56.5′
5	251°27.2	56.6	86°31.0	10.1′	22°33.5	10.2′	56.4′
6	266°27.2	S13°55.7	101°00.1	10.2′	N22°23.3	10.2′	56.4′
7	281°27.2	54.9	115°29.3	10.3′	22°13.1	10.4′	56.4′
8	296°27.2	54.1	129°58.6	10.4′	22°02.7	10.4′	56.4′
9	311°27.2	·· 53.3	144°28.0	10.5′	21°52.3	10.6′	56.4′
10	326°27.2	52.4	158°57.6	10.6′	21°41.7	10.6′	56.3′
11	341°27.2	51.6	173°27.2	10.7′	21°31.1	10.8′	56.3′
12	356°27.2	S13°50.8	187°56.9	10.8′	N21°20.3	10.8′	56.3′
13	11°27.2	50.0	202°26.8	10.9′	21°09.5	11.0′	56.3′
14	26°27.2	49.1	216°56.7	11.0′	20°58.5	11.0′	56.3′
15	41°27.2	·· 48.3	231°26.7	11.1′	20°47.5	11.1′	56.2′
16	56°27.2	47.5	245°56.9	11.2′	20°36.4	11.3′	56.2′
17	71°27.2	46.6	260°27.1	11.3′	20°25.1	11.3′	56.2′
18	86°27.2	S13°45.8	274°57.5	11.4′	N20°13.8	11.4′	56.2′
19	101°27.2	45.0	289°27.9	11.5′	20°02.4	11.5′	56.2′
20	116°27.2	44.2	303°58.5	11.6′	19°50.9	11.6′	56.1′
21	131°27.2	·· 43.3	318°29.1	11.7′	19°39.3	11.6′	56.1′
22	146°27.2	42.5	332°59.9	11.8′	19°27.7	11.8′	56.1′
23	161°27.2	41.7	347°30.7	11.9′	19°15.9	11.8′	56.1′
	SD = 16.2′	d = 0.8′	SD = 15.4′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	06:34	07:56	09:22	15:08	16:34	17:56
N 70°	06:30	07:44	08:57	15:33	16:46	18:00
68°	06:27	07:34	08:38	15:52	16:56	18:03
66°	06:24	07:25	08:23	16:07	17:04	18:06
64°	06:21	07:18	08:10	16:19	17:12	18:08
62°	06:19	07:12	08:00	16:30	17:18	18:11
60°	06:17	07:06	07:51	16:38	17:23	18:13
N 58°	06:15	07:01	07:43	16:46	17:28	18:15
56°	06:13	06:57	07:36	16:53	17:33	18:17
54°	06:11	06:52	07:30	16:59	17:37	18:19
52°	06:09	06:49	07:24	17:05	17:40	18:20
50°	06:07	06:45	07:19	17:10	17:44	18:22
45°	06:03	06:37	07:08	17:21	17:52	18:26
N 40°	05:59	06:31	06:59	17:30	17:58	18:30
35°	05:55	06:25	06:51	17:38	18:04	18:34
30°	05:51	06:19	06:44	17:45	18:09	18:38
20°	05:43	06:09	06:32	17:57	18:20	18:46
N 10°	05:34	05:59	06:21	18:08	18:29	18:54
0°	05:25	05:49	06:11	18:18	18:39	19:04
S 10°	05:13	05:39	06:00	18:28	18:50	19:15
20°	04:59	05:26	05:49	18:39	19:02	19:29
30°	04:41	05:11	05:36	18:52	19:17	19:47
35°	04:30	05:02	05:29	18:59	19:26	19:58
40°	04:16	04:51	05:20	19:07	19:36	20:12
45°	03:59	04:38	05:10	19:17	19:49	20:29
S 50°	03:36	04:22	04:58	19:29	20:05	20:51
52°	03:25	04:14	04:52	19:35	20:13	21:02
54°	03:11	04:05	04:46	19:41	20:22	21:15
56°	02:56	03:55	04:39	19:48	20:31	21:30
58°	02:37	03:44	04:31	19:56	20:43	21:48
S 60°	02:12	03:30	04:22	20:05	20:56	22:12

Lat.	**Moonrise** Sun	Mon	Tue	**Moonset** Sun	Mon	Tue
N 72°						
N 70°						
68°			12:38			10:33
66°			13:34			09:36
64°		11:44	14:07		09:37	09:02
62°	10:20	12:35	14:31	09:02	08:44	08:37
60°	11:24	13:07	14:50	07:58	08:12	08:17
N 58°	11:58	13:30	15:06	07:24	07:48	08:00
56°	12:23	13:49	15:19	06:58	07:29	07:46
54°	12:43	14:05	15:31	06:38	07:12	07:34
52°	13:00	14:19	15:41	06:21	06:58	07:24
50°	13:14	14:31	15:50	06:06	06:46	07:14
45°	13:43	14:55	16:09	05:37	06:20	06:54
N 40°	14:06	15:15	16:24	05:14	06:00	06:37
35°	14:25	15:31	16:37	04:54	05:43	06:23
30°	14:41	15:45	16:49	04:38	05:28	06:11
20°	15:08	16:09	17:08	04:10	05:03	05:50
N 10°	15:32	16:30	17:25	03:46	04:41	05:31
0°	15:53	16:49	17:40	03:23	04:20	05:14
S 10°	16:15	17:08	17:55	03:00	04:00	04:56
20°	16:38	17:28	18:12	02:36	03:38	04:38
30°	17:05	17:52	18:31	02:08	03:12	04:16
35°	17:21	18:05	18:42	01:51	02:56	04:03
40°	17:40	18:21	18:54	01:31	02:38	03:48
45°	18:02	18:40	19:09	01:07	02:17	03:31
S 50°	18:30	19:03	19:26	00:36	01:49	03:08
52°	18:44	19:14	19:35	00:21	01:36	02:58
54°	19:00	19:27	19:44	00:03	01:20	02:46
56°	19:19	19:41	19:54	·· ··	01:02	02:32
58°	19:42	19:58	20:06	·· ··	00:39	02:16
S 60°	20:12	20:19	20:20	·· ··	00:10	01:56

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 11-13 86-97%
09	14:10	14:10	12:14	22:07	09:38	
10	14:11	14:11	12:14	23:01	10:35	
11	14:11	14:11	12:14	23:52	11:27	

February 12, 13, 14 UT (Wed., Thu., Fri.)

	Aries	Venus		Mars		Jupiter		Saturn	
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	142°17.8	139°05.1	N05°25.0	32°15.1	N26°13.8	72°23.9	N21°41.7	151°58.2	S06°14.9
1	157°20.3	154°06.4	25.9	47°18.0	13.8	87°26.3	41.7	167°00.4	14.8
2	172°22.8	169°07.7	26.9	62°20.9	13.8	102°28.7	41.8	182°02.6	14.7
3	187°25.2	184°09.0	·· 27.9	77°23.8	·· 13.8	117°31.1	·· 41.8	197°04.8	·· 14.6
4	202°27.7	199°10.3	28.8	92°26.7	13.8	132°33.5	41.8	212°07.0	14.5
5	217°30.2	214°11.6	29.8	107°29.6	13.8	147°35.9	41.8	227°09.2	14.3
6	232°32.6	229°12.9	N05°30.8	122°32.5	N26°13.8	162°38.3	N21°41.8	242°11.4	S06°14.2
7	247°35.1	244°14.2	31.7	137°35.4	13.8	177°40.7	41.8	257°13.6	14.1
8	262°37.5	259°15.5	32.7	152°38.3	13.7	192°43.1	41.9	272°15.8	14.0
9	277°40.0	274°16.8	·· 33.7	167°41.2	·· 13.7	207°45.5	·· 41.9	287°18.0	·· 13.9
10	292°42.5	289°18.1	34.6	182°44.1	13.7	222°47.9	41.9	302°20.2	13.8
11	307°44.9	304°19.5	35.6	197°46.9	13.7	237°50.3	41.9	317°22.4	13.7
12	322°47.4	319°20.8	N05°36.5	212°49.8	N26°13.7	252°52.7	N21°41.9	332°24.6	S06°13.5
13	337°49.9	334°22.1	37.5	227°52.7	13.7	267°55.1	41.9	347°26.8	13.4
14	352°52.3	349°23.4	38.5	242°55.6	13.7	282°57.5	42.0	2°29.0	13.3
15	7°54.8	4°24.8	·· 39.4	257°58.5	·· 13.7	297°59.9	·· 42.0	17°31.2	·· 13.2
16	22°57.3	19°26.1	40.4	273°01.4	13.6	313°02.2	42.0	32°33.4	13.1
17	37°59.7	34°27.4	41.3	288°04.3	13.6	328°04.6	42.0	47°35.6	13.0
18	53°02.2	49°28.8	N05°42.3	303°07.1	N26°13.6	343°07.0	N21°42.0	62°37.8	S06°12.9
19	68°04.7	64°30.1	43.2	318°10.0	13.6	358°09.4	42.1	77°40.0	12.7
20	83°07.1	79°31.4	44.2	333°12.9	13.6	13°11.8	42.1	92°42.2	12.6
21	98°09.6	94°32.8	·· 45.1	348°15.8	·· 13.6	28°14.2	·· 42.1	107°44.4	·· 12.5
22	113°12.0	109°34.1	46.1	3°18.6	13.6	43°16.6	42.1	122°46.6	12.4
23	128°14.5	124°35.5	47.0	18°21.5	13.5	58°19.0	42.1	137°48.8	12.3
Mer.pass. 14:28		ν 1.3′	d 1.0′	m -4.84	ν 2.9′	d 0.0′	m -0.76	ν 2.4′	d 0.0′ m -2.43	ν 2.2′	d 0.1′ m 1.12

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	143°17.0	139°36.8	N05°48.0	33°24.4	N26°13.5	73°21.4	N21°42.1	152°50.9	S06°12.2
1	158°19.4	154°38.2	48.9	48°27.3	13.5	88°23.7	42.2	167°53.1	12.0
2	173°21.9	169°39.5	49.9	63°30.1	13.5	103°26.1	42.2	182°55.3	11.9
3	188°24.4	184°40.9	·· 50.8	78°33.0	·· 13.5	118°28.5	·· 42.2	197°57.5	·· 11.8
4	203°26.8	199°42.3	51.8	93°35.8	13.5	133°30.9	42.2	212°59.7	11.7
5	218°29.3	214°43.6	52.7	108°38.7	13.4	148°33.3	42.2	228°01.9	11.6
6	233°31.8	229°45.0	N05°53.7	123°41.6	N26°13.4	163°35.7	N21°42.3	243°04.1	S06°11.5
7	248°34.2	244°46.3	54.6	138°44.4	13.4	178°38.1	42.3	258°06.3	11.4
8	263°36.7	259°47.7	55.6	153°47.3	13.4	193°40.5	42.3	273°08.5	11.2
9	278°39.1	274°49.1	·· 56.5	168°50.1	·· 13.4	208°42.8	·· 42.3	288°10.7	·· 11.1
10	293°41.6	289°50.5	57.5	183°53.0	13.4	223°45.2	42.3	303°12.9	11.0
11	308°44.1	304°51.8	58.4	198°55.9	13.3	238°47.6	42.4	318°15.1	10.9
12	323°46.5	319°53.2	N05°59.3	213°58.7	N26°13.3	253°50.0	N21°42.4	333°17.3	S06°10.8
13	338°49.0	334°54.6	06°00.3	229°01.6	13.3	268°52.4	42.4	348°19.5	10.7
14	353°51.5	349°56.0	01.2	244°04.4	13.3	283°54.8	42.4	3°21.7	10.5
15	8°53.9	4°57.4	·· 02.2	259°07.3	·· 13.3	298°57.1	·· 42.4	18°23.9	·· 10.4
16	23°56.4	19°58.8	03.1	274°10.1	13.2	313°59.5	42.4	33°26.1	10.3
17	38°58.9	35°00.1	04.0	289°12.9	13.2	329°01.9	42.5	48°28.3	10.2
18	54°01.3	50°01.5	N06°05.0	304°15.8	N26°13.2	344°04.3	N21°42.5	63°30.5	S06°10.1
19	69°03.8	65°02.9	05.9	319°18.6	13.2	359°06.7	42.5	78°32.7	10.0
20	84°06.3	80°04.3	06.8	334°21.5	13.2	14°09.1	42.5	93°34.9	09.9
21	99°08.7	95°05.7	·· 07.8	349°24.3	·· 13.1	29°11.4	·· 42.5	108°37.1	·· 09.7
22	114°11.2	110°07.1	08.7	4°27.1	13.1	44°13.8	42.6	123°39.2	09.6
23	129°13.6	125°08.5	09.6	19°30.0	13.1	59°16.2	42.6	138°41.4	09.5
Mer.pass. 14:25		ν 1.4′	d 0.9′	m -4.84	ν 2.9′	d 0.0′	m -0.73	ν 2.4′	d 0.0′ m -2.42	ν 2.2′	d 0.1′ m 1.12

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	144°16.1	140°09.9	N06°10.5	34°32.8	N26°13.1	74°18.6	N21°42.6	153°43.6	S06°09.4
1	159°18.6	155°11.4	11.5	49°35.7	13.1	89°21.0	42.6	168°45.8	09.3
2	174°21.0	170°12.8	12.4	64°38.5	13.0	104°23.3	42.6	183°48.0	09.2
3	189°23.5	185°14.2	·· 13.3	79°41.3	·· 13.0	119°25.7	·· 42.7	198°50.2	·· 09.0
4	204°26.0	200°15.6	14.3	94°44.1	13.0	134°28.1	42.7	213°52.4	08.9
5	219°28.4	215°17.0	15.2	109°47.0	13.0	149°30.5	42.7	228°54.6	08.8
6	234°30.9	230°18.4	N06°16.1	124°49.8	N26°12.9	164°32.8	N21°42.7	243°56.8	S06°08.7
7	249°33.4	245°19.9	17.0	139°52.6	12.9	179°35.2	42.7	258°59.0	08.6
8	264°35.8	260°21.3	17.9	154°55.4	12.9	194°37.6	42.8	274°01.2	08.5
9	279°38.3	275°22.7	·· 18.9	169°58.3	·· 12.9	209°40.0	·· 42.8	289°03.4	·· 08.3
10	294°40.8	290°24.2	19.8	185°01.1	12.8	224°42.4	42.8	304°05.6	08.2
11	309°43.2	305°25.6	20.7	200°03.9	12.8	239°44.7	42.8	319°07.8	08.1
12	324°45.7	320°27.0	N06°21.6	215°06.7	N26°12.8	254°47.1	N21°42.8	334°10.0	S06°08.0
13	339°48.1	335°28.5	22.5	230°09.5	12.8	269°49.5	42.9	349°12.2	07.9
14	354°50.6	350°29.9	23.5	245°12.3	12.7	284°51.9	42.9	4°14.4	07.8
15	9°53.1	5°31.4	·· 24.4	260°15.2	·· 12.7	299°54.2	·· 42.9	19°16.6	·· 07.7
16	24°55.5	20°32.8	25.3	275°18.0	12.7	314°56.6	42.9	34°18.8	07.5
17	39°58.0	35°34.3	26.2	290°20.8	12.7	329°59.0	42.9	49°20.9	07.4
18	55°00.5	50°35.7	N06°27.1	305°23.6	N26°12.6	345°01.4	N21°43.0	64°23.1	S06°07.3
19	70°02.9	65°37.2	28.0	320°26.4	12.6	0°03.7	43.0	79°25.3	07.2
20	85°05.4	80°38.6	28.9	335°29.2	12.6	15°06.1	43.0	94°27.5	07.1
21	100°07.9	95°40.1	·· 29.8	350°32.0	·· 12.6	30°08.5	·· 43.0	109°29.7	·· 07.0
22	115°10.3	110°41.6	30.8	5°34.8	12.5	45°10.8	43.0	124°31.9	06.8
23	130°12.8	125°43.0	31.7	20°37.6	12.5	60°13.2	43.1	139°34.1	06.7
Mer.pass. 14:21		ν 1.4′	d 0.9′	m -4.85	ν 2.8′	d 0.0′	m -0.70	ν 2.4′	d 0.0′ m -2.42	ν 2.2′	d 0.1′ m 1.12

Stars

	SHA	Dec
Alpheratz	357°35.0	29°13.8
Ankaa	353°07.3	-42°10.4
Schedar	349°31.4	56°40.7
Diphda	348°47.4	-17°51.1
Achernar	335°20.3	-57°06.8
Hamal	327°51.2	23°34.9
Polaris	314°02.6	89°22.5
Acamar	315°11.7	-40°12.5
Menkar	314°06.1	4°11.2
Mirfak	308°28.1	49°57.2
Aldebaran	290°39.4	16°33.6
Rigel	281°03.6	-8°10.5
Capella	280°21.5	46°01.5
Bellatrix	278°22.6	6°22.3
Elnath	278°01.6	28°37.8
Alnilam	275°37.5	-1°11.2
Betelgeuse	270°51.8	7°24.7
Canopus	263°52.0	-52°42.7
Sirius	258°25.9	-16°45.2
Adhara	255°05.5	-29°00.5
Procyon	244°50.4	5°09.6
Pollux	243°16.9	27°57.9
Avior	234°14.1	-59°35.5
Suhail	222°45.8	-43°32.1
Miaplacidus	221°37.4	-69°49.2
Alphard	217°47.3	-8°46.1
Regulus	207°34.0	11°50.5
Dubhe	193°40.2	61°36.8
Denebola	182°24.6	14°25.7
Gienah	175°43.2	-17°40.9
Acrux	172°59.5	-63°14.2
Gacrux	171°51.2	-57°15.1
Alioth	166°12.5	55°49.1
Spica	158°22.0	-11°17.6
Alkaid	152°51.7	49°10.9
Hadar	148°35.7	-60°29.4
Menkent	147°57.4	-36°29.5
Arcturus	145°47.7	19°02.9
Rigil Kent.	139°40.0	-60°56.1
Kochab	137°19.5	74°02.7
Zuben'ubi	136°55.9	-16°08.8
Alphecca	126°03.7	26°37.5
Antares	112°15.8	-26°29.2
Atria	107°10.2	-69°04.1
Sabik	102°02.8	-15°45.4
Shaula	96°10.5	-37°07.3
Rasalhague	95°58.6	12°32.3
Eltanin	90°42.5	51°28.8
Kaus Aust.	83°32.7	-34°22.3
Vega	80°33.5	38°48.1
Nunki	75°47.9	-26°16.0
Altair	62°00.2	8°55.9
Peacock	53°06.1	-56°39.2
Deneb	49°26.2	45°22.0
Enif	33°39.0	9°59.3
Al Na'ir	27°33.2	-46°50.5
Fomalhaut	15°14.7	-29°29.5
Scheat	13°45.5	28°13.1
Markab	13°30.1	15°20.4

Feb 12 Wed	SHA	Mer.pass
Venus	356°47.3	14:42
Mars	249°57.2	21:47
Jupiter	290°06.1	19:07
Saturn	9°40.4	13:50

Feb 13 Thu	SHA	Mer.pass
Venus	356°19.9	14:40
Mars	250°07.4	21:42
Jupiter	290°04.4	19:04
Saturn	9°34.0	13:47

Feb 14 Fri	SHA	Mer.pass
Venus	355°53.8	14:38
Mars	250°16.7	21:38
Jupiter	290°02.5	19:00
Saturn	9°27.5	13:43

Horizontal parallax	
Venus:	0.3
Mars:	0.2

h	Sun		Moon				
Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°27.3	S13°40.8	2°01.7	12.0′	N19°04.1	11.9′	56.1′
1	191°27.3	40.0	16°32.7	12.1′	18°52.2	12.0′	56.0′
2	206°27.3	39.2	31°03.8	12.2′	18°40.2	12.1′	56.0′
3	221°27.3	·· 38.3	45°35.1	12.3′	18°28.1	12.1′	56.0′
4	236°27.3	37.5	60°06.4	12.4′	18°16.0	12.3′	56.0′
5	251°27.3	36.7	74°37.8	12.5′	18°03.7	12.3′	56.0′
6	266°27.3	S13°35.8	89°09.3	12.6′	N17°51.4	12.3′	55.9′
7	281°27.3	35.0	103°41.0	12.7′	17°39.1	12.5′	55.9′
8	296°27.3	34.2	118°12.7	12.8′	17°26.6	12.5′	55.9′
9	311°27.3	·· 33.3	132°44.5	12.9′	17°14.1	12.6′	55.9′
10	326°27.3	32.5	147°16.3	13.0′	17°01.5	12.6′	55.9′
11	341°27.4	31.7	161°48.3	13.1′	16°48.9	12.7′	55.8′
12	356°27.4	S13°30.8	176°20.4	13.2′	N16°36.2	12.8′	55.8′
13	11°27.4	30.0	190°52.6	13.2′	16°23.4	12.8′	55.8′
14	26°27.4	29.2	205°24.8	13.3′	16°10.6	12.9′	55.8′
15	41°27.4	·· 28.3	219°57.1	13.4′	15°57.7	13.0′	55.8′
16	56°27.4	27.5	234°29.6	13.5′	15°44.7	13.0′	55.7′
17	71°27.4	26.6	249°02.1	13.6′	15°31.7	13.1′	55.7′
18	86°27.4	S13°25.8	263°34.7	13.7′	N15°18.6	13.1′	55.7′
19	101°27.5	25.0	278°07.3	13.8′	15°05.5	13.2′	55.7′
20	116°27.5	24.1	292°40.1	13.8′	14°52.3	13.2′	55.7′
21	131°27.5	·· 23.3	307°12.9	13.9′	14°39.1	13.3′	55.6′
22	146°27.5	22.4	321°45.9	14.0′	14°25.8	13.4′	55.6′
23	161°27.5	21.6	336°18.9	14.1′	14°12.4	13.4′	55.6′
	SD = 16.2′	d = 0.8′	SD = 15.3′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°27.5	S13°20.8	350°52.0	14.2′	N13°59.0	13.4′	55.6′
1	191°27.6	19.9	5°25.1	14.2′	13°45.6	13.5′	55.6′
2	206°27.6	19.1	19°58.4	14.3′	13°32.1	13.6′	55.5′
3	221°27.6	·· 18.2	34°31.7	14.4′	13°18.5	13.6′	55.5′
4	236°27.6	17.4	49°05.1	14.5′	13°04.9	13.6′	55.5′
5	251°27.6	16.6	63°38.5	14.5′	12°51.3	13.7′	55.5′
6	266°27.6	S13°15.7	78°12.1	14.6′	N12°37.6	13.7′	55.5′
7	281°27.7	14.9	92°45.7	14.7′	12°23.9	13.8′	55.4′
8	296°27.7	14.0	107°19.4	14.8′	12°10.1	13.8′	55.4′
9	311°27.7	·· 13.2	121°53.1	14.8′	11°56.3	13.8′	55.4′
10	326°27.7	12.3	136°26.9	14.9′	11°42.5	13.9′	55.4′
11	341°27.7	11.5	151°00.8	15.0′	11°28.6	13.9′	55.4′
12	356°27.7	S13°10.6	165°34.8	15.0′	N11°14.7	13.9′	55.3′
13	11°27.8	09.8	180°08.8	15.1′	11°00.8	14.0′	55.3′
14	26°27.8	08.9	194°42.9	15.2′	10°46.8	14.0′	55.3′
15	41°27.8	·· 08.1	209°17.1	15.2′	10°32.8	14.1′	55.3′
16	56°27.8	07.3	223°51.3	15.3′	10°18.7	14.0′	55.3′
17	71°27.8	06.4	238°25.6	15.3′	10°04.7	14.1′	55.2′
18	86°27.9	S13°05.6	252°59.9	15.4′	N09°50.6	14.2′	55.2′
19	101°27.9	04.7	267°34.3	15.5′	09°36.4	14.1′	55.2′
20	116°27.9	03.9	282°08.8	15.5′	09°22.3	14.2′	55.2′
21	131°27.9	·· 03.0	296°43.3	15.6′	09°08.1	14.3′	55.2′
22	146°28.0	02.2	311°17.9	15.6′	08°53.8	14.2′	55.2′
23	161°28.0	01.3	325°52.5	15.7′	08°39.6	14.3′	55.1′
	SD = 16.2′	d = 0.8′	SD = 15.2′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°28.0	S13°00.5	340°27.2	15.7′	N08°25.3	14.2′	55.1′
1	191°28.0	12°59.6	355°02.0	15.8′	08°11.1	14.3′	55.1′
2	206°28.1	58.8	9°36.8	15.8′	07°56.8	14.4′	55.1′
3	221°28.1	·· 57.9	24°11.6	15.9′	07°42.4	14.3′	55.1′
4	236°28.1	57.1	38°46.5	15.9′	07°28.1	14.4′	55.0′
5	251°28.1	56.2	53°21.5	16.0′	07°13.7	14.4′	55.0′
6	266°28.1	S12°55.4	67°56.5	16.0′	N06°59.3	14.4′	55.0′
7	281°28.2	54.5	82°31.5	16.1′	06°44.9	14.4′	55.0′
8	296°28.2	53.7	97°06.6	16.1′	06°30.5	14.4′	55.0′
9	311°28.2	·· 52.8	111°41.7	16.2′	06°16.1	14.5′	55.0′
10	326°28.3	51.9	126°16.9	16.2′	06°01.6	14.4′	54.9′
11	341°28.3	51.1	140°52.1	16.3′	05°47.2	14.5′	54.9′
12	356°28.3	S12°50.2	155°27.4	16.3′	N05°32.7	14.5′	54.9′
13	11°28.3	49.4	170°02.7	16.3′	05°18.2	14.5′	54.9′
14	26°28.4	48.5	184°38.1	16.4′	05°03.7	14.5′	54.9′
15	41°28.4	·· 47.7	199°13.4	16.4′	04°49.2	14.5′	54.9′
16	56°28.4	46.8	213°48.9	16.5′	04°34.7	14.5′	54.8′
17	71°28.4	46.0	228°24.3	16.5′	04°20.2	14.5′	54.8′
18	86°28.5	S12°45.1	242°59.8	16.5′	N04°05.7	14.5′	54.8′
19	101°28.5	44.3	257°35.3	16.6′	03°51.2	14.6′	54.8′
20	116°28.5	43.4	272°10.9	16.6′	03°36.6	14.5′	54.8′
21	131°28.6	·· 42.5	286°46.5	16.6′	03°22.1	14.6′	54.8′
22	146°28.6	41.7	301°22.1	16.7′	03°07.5	14.5′	54.7′
23	161°28.6	40.8	315°57.8	16.7′	02°53.0	14.5′	54.7′
	SD = 16.2′	d = 0.9′	SD = 15.0′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	06:22	07:43	09:04	15:26	16:47	18:08
N 70°	06:19	07:32	08:42	15:48	16:58	18:11
68°	06:17	07:23	08:25	16:04	17:07	18:13
66°	06:15	07:16	08:12	16:18	17:14	18:15
64°	06:13	07:09	08:01	16:29	17:20	18:16
62°	06:11	07:04	07:51	16:38	17:26	18:18
60°	06:10	06:59	07:43	16:46	17:31	18:20
N 58°	06:08	06:54	07:36	16:54	17:35	18:21
56°	06:07	06:50	07:29	17:00	17:39	18:23
54°	06:05	06:47	07:24	17:05	17:42	18:24
52°	06:04	06:43	07:18	17:11	17:46	18:25
50°	06:02	06:40	07:14	17:15	17:49	18:27
45°	05:59	06:33	07:04	17:25	17:56	18:30
N 40°	05:56	06:27	06:55	17:34	18:02	18:33
35°	05:52	06:22	06:48	17:41	18:07	18:37
30°	05:49	06:17	06:41	17:47	18:12	18:40
20°	05:42	06:08	06:30	17:58	18:21	18:47
N 10°	05:34	05:59	06:20	18:08	18:30	18:55
0°	05:25	05:50	06:11	18:18	18:39	19:03
S 10°	05:14	05:40	06:01	18:27	18:49	19:14
20°	05:01	05:28	05:51	18:37	19:00	19:27
30°	04:44	05:14	05:39	18:49	19:14	19:44
35°	04:33	05:05	05:32	18:56	19:22	19:54
40°	04:20	04:55	05:24	19:04	19:32	20:07
45°	04:04	04:43	05:15	19:13	19:44	20:23
S 50°	03:43	04:28	05:03	19:24	19:59	20:44
52°	03:32	04:20	04:58	19:29	20:07	20:54
54°	03:20	04:12	04:52	19:35	20:15	21:06
56°	03:06	04:03	04:46	19:41	20:24	21:20
58°	02:49	03:52	04:38	19:48	20:34	21:37
S 60°	02:27	03:40	04:30	19:56	20:46	21:58

Lat.	**Moonrise** Wed	Thu	Fri	**Moonset** Wed	Thu	Fri
N 72°	14:10	16:55	19:03	10:44	09:32	08:51
N 70°	14:55	17:12	19:09	09:58	09:13	08:43
68°	15:24	17:25	19:13	09:27	08:57	08:36
66°	15:45	17:36	19:17	09:04	08:45	08:30
64°	16:02	17:45	19:20	08:46	08:34	08:25
62°	16:16	17:52	19:23	08:31	08:25	08:20
60°	16:28	17:59	19:25	08:18	08:18	08:16
N 58°	16:38	18:05	19:27	08:07	08:11	08:13
56°	16:47	18:10	19:29	07:57	08:05	08:10
54°	16:54	18:14	19:31	07:49	07:59	08:07
52°	17:01	18:18	19:32	07:41	07:54	08:05
50°	17:08	18:22	19:33	07:34	07:49	08:02
45°	17:21	18:30	19:36	07:19	07:40	07:57
N 40°	17:32	18:37	19:39	07:07	07:31	07:53
35°	17:41	18:42	19:41	06:56	07:24	07:49
30°	17:49	18:47	19:43	06:47	07:18	07:46
20°	18:03	18:56	19:46	06:31	07:07	07:40
N 10°	18:16	19:03	19:49	06:16	06:57	07:35
0°	18:27	19:10	19:51	06:03	06:48	07:30
S 10°	18:38	19:17	19:54	05:50	06:39	07:25
20°	18:50	19:25	19:57	05:35	06:29	07:20
30°	19:04	19:33	20:00	05:18	06:18	07:14
35°	19:12	19:38	20:02	05:08	06:11	07:11
40°	19:21	19:44	20:04	04:57	06:03	07:07
45°	19:31	19:50	20:06	04:44	05:55	07:02
S 50°	19:44	19:57	20:09	04:28	05:44	06:57
52°	19:49	20:01	20:10	04:20	05:39	06:54
54°	19:56	20:05	20:12	04:11	05:33	06:51
56°	20:03	20:09	20:13	04:02	05:27	06:48
58°	20:11	20:13	20:15	03:50	05:20	06:45
S 60°	20:20	20:19	20:17	03:38	05:12	06:41

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 14-16 100-98%
12	14:11	14:11	12:14	–:–	12:15	
13	14:10	14:09	12:14	00:38	12:59	
14	14:08	14:07	12:14	01:20	13:41	

February 15, 16, 17 UT (Sat., Sun., Mon.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	145°15.2	140°44.5	N06°32.6	35°40.4	N26°12.5	75°15.6	N21°43.1	154°36.3	S06°06.6
1	160°17.7	155°46.0	33.5	50°43.2	12.5	90°18.0	43.1	169°38.5	06.5
2	175°20.2	170°47.4	34.4	65°46.0	12.4	105°20.3	43.1	184°40.7	06.4
3	190°22.6	185°48.9	·· 35.3	80°48.8	·· 12.4	120°22.7	·· 43.1	199°42.9	·· 06.3
4	205°25.1	200°50.4	36.2	95°51.6	12.4	135°25.1	43.2	214°45.1	06.1
5	220°27.6	215°51.9	37.1	110°54.4	12.3	150°27.4	43.2	229°47.3	06.0
6	235°30.0	230°53.4	N06°38.0	125°57.1	N26°12.3	165°29.8	N21°43.2	244°49.5	S06°05.9
7	250°32.5	245°54.8	38.9	140°59.9	12.3	180°32.2	43.2	259°51.7	05.8
8	265°35.0	260°56.3	39.8	156°02.7	12.2	195°34.5	43.2	274°53.9	05.7
9	280°37.4	275°57.8	·· 40.7	171°05.5	·· 12.2	210°36.9	·· 43.3	289°56.0	·· 05.6
10	295°39.9	290°59.3	41.6	186°08.3	12.2	225°39.3	43.3	304°58.2	05.4
11	310°42.4	306°00.8	42.5	201°11.1	12.2	240°41.6	43.3	320°00.4	05.3
12	325°44.8	321°02.3	N06°43.4	216°13.8	N26°12.1	255°44.0	N21°43.3	335°02.6	S06°05.2
13	340°47.3	336°03.8	44.3	231°16.6	12.1	270°46.4	43.4	350°04.8	05.1
14	355°49.7	351°05.3	45.2	246°19.4	12.1	285°48.7	43.4	5°07.0	05.0
15	10°52.2	6°06.8	·· 46.1	261°22.2	·· 12.0	300°51.1	·· 43.4	20°09.2	·· 04.9
16	25°54.7	21°08.3	46.9	276°24.9	12.0	315°53.5	43.4	35°11.4	04.7
17	40°57.1	36°09.9	47.8	291°27.7	12.0	330°55.8	43.4	50°13.6	04.6
18	55°59.6	51°11.4	N06°48.7	306°30.5	N26°11.9	345°58.2	N21°43.5	65°15.8	S06°04.5
19	71°02.1	66°12.9	49.6	321°33.3	11.9	1°00.6	43.5	80°18.0	04.4
20	86°04.5	81°14.4	50.5	336°36.0	11.9	16°02.9	43.5	95°20.2	04.3
21	101°07.0	96°15.9	·· 51.4	351°38.8	·· 11.8	31°05.3	·· 43.5	110°22.4	·· 04.2
22	116°09.5	111°17.5	52.3	6°41.6	11.8	46°07.7	43.5	125°24.6	04.0
23	131°11.9	126°19.0	53.2	21°44.3	11.8	61°10.0	43.6	140°26.7	03.9
Mer.pass. 14:17		ν 1.5′	d 0.9′	m -4.85	ν 2.8′	d 0.0′	m -0.67	ν 2.4′	d 0.0′ m -2.41	ν 2.2′	d 0.1′ m 1.12

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	146°14.4	141°20.5	N06°54.0	36°47.1	N26°11.7	76°12.4	N21°43.6	155°28.9	S06°03.8
1	161°16.8	156°22.1	54.9	51°49.8	11.7	91°14.7	43.6	170°31.1	03.7
2	176°19.3	171°23.6	55.8	66°52.6	11.7	106°17.1	43.6	185°33.3	03.6
3	191°21.8	186°25.1	·· 56.7	81°55.4	·· 11.6	121°19.5	·· 43.7	200°35.5	·· 03.5
4	206°24.2	201°26.7	57.6	96°58.1	11.6	136°21.8	43.7	215°37.7	03.3
5	221°26.7	216°28.2	58.4	112°00.9	11.6	151°24.2	43.7	230°39.9	03.2
6	236°29.2	231°29.8	N06°59.3	127°03.6	N26°11.5	166°26.5	N21°43.7	245°42.1	S06°03.1
7	251°31.6	246°31.3	07°00.2	142°06.4	11.5	181°28.9	43.7	260°44.3	03.0
8	266°34.1	261°32.9	01.1	157°09.1	11.5	196°31.3	43.8	275°46.5	02.9
9	281°36.6	276°34.4	·· 01.9	172°11.9	·· 11.4	211°33.6	·· 43.8	290°48.7	·· 02.8
10	296°39.0	291°36.0	02.8	187°14.6	11.4	226°36.0	43.8	305°50.9	02.6
11	311°41.5	306°37.5	03.7	202°17.4	11.4	241°38.3	43.8	320°53.1	02.5
12	326°44.0	321°39.1	N07°04.6	217°20.1	N26°11.3	256°40.7	N21°43.8	335°55.2	S06°02.4
13	341°46.4	336°40.7	05.4	232°22.8	11.3	271°43.1	43.9	350°57.4	02.3
14	356°48.9	351°42.2	06.3	247°25.6	11.2	286°45.4	43.9	5°59.6	02.2
15	11°51.3	6°43.8	·· 07.2	262°28.3	·· 11.2	301°47.8	·· 43.9	21°01.8	·· 02.1
16	26°53.8	21°45.4	08.0	277°31.1	11.2	316°50.1	43.9	36°04.0	01.9
17	41°56.3	36°47.0	08.9	292°33.8	11.1	331°52.5	44.0	51°06.2	01.8
18	56°58.7	51°48.5	N07°09.8	307°36.5	N26°11.1	346°54.8	N21°44.0	66°08.4	S06°01.7
19	72°01.2	66°50.1	10.6	322°39.3	11.1	1°57.2	44.0	81°10.6	01.6
20	87°03.7	81°51.7	11.5	337°42.0	11.0	16°59.6	44.0	96°12.8	01.5
21	102°06.1	96°53.3	·· 12.3	352°44.7	·· 11.0	32°01.9	·· 44.0	111°15.0	·· 01.4
22	117°08.6	111°54.9	13.2	7°47.5	10.9	47°04.3	44.1	126°17.2	01.2
23	132°11.1	126°56.5	14.1	22°50.2	10.9	62°06.6	44.1	141°19.4	01.1
Mer.pass. 14:13		ν 1.5′	d 0.9′	m -4.85	ν 2.8′	d 0.0′	m -0.64	ν 2.4′	d 0.0′ m -2.40	ν 2.2′	d 0.1′ m 1.12

Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	147°13.5	141°58.1	N07°14.9	37°52.9	N26°10.9	77°09.0	N21°44.1	156°21.5	S06°01.0
1	162°16.0	156°59.7	15.8	52°55.6	10.8	92°11.3	44.1	171°23.7	00.9
2	177°18.4	172°01.3	16.6	67°58.4	10.8	107°13.7	44.2	186°25.9	00.8
3	192°20.9	187°02.9	·· 17.5	83°01.1	·· 10.7	122°16.0	·· 44.2	201°28.1	·· 00.7
4	207°23.4	202°04.5	18.3	98°03.8	10.7	137°18.4	44.2	216°30.3	00.5
5	222°25.8	217°06.1	19.2	113°06.5	10.7	152°20.7	44.2	231°32.5	00.4
6	237°28.3	232°07.7	N07°20.0	128°09.2	N26°10.6	167°23.1	N21°44.3	246°34.7	S06°00.3
7	252°30.8	247°09.3	20.9	143°11.9	10.6	182°25.4	44.3	261°36.9	00.2
8	267°33.2	262°10.9	21.7	158°14.7	10.5	197°27.8	44.3	276°39.1	00.1
9	282°35.7	277°12.6	·· 22.6	173°17.4	·· 10.5	212°30.1	·· 44.3	291°41.3	06°00.0
10	297°38.2	292°14.2	23.4	188°20.1	10.5	227°32.5	44.3	306°43.5	05°59.8
11	312°40.6	307°15.8	24.3	203°22.8	10.4	242°34.8	44.4	321°45.7	59.7
12	327°43.1	322°17.4	N07°25.1	218°25.5	N26°10.4	257°37.2	N21°44.4	336°47.8	S05°59.6
13	342°45.6	337°19.1	26.0	233°28.2	10.3	272°39.5	44.4	351°50.0	59.5
14	357°48.0	352°20.7	26.8	248°30.9	10.3	287°41.9	44.4	6°52.2	59.4
15	12°50.5	7°22.3	·· 27.7	263°33.6	·· 10.2	302°44.2	·· 44.5	21°54.4	·· 59.3
16	27°52.9	22°24.0	28.5	278°36.3	10.2	317°46.6	44.5	36°56.6	59.1
17	42°55.4	37°25.6	29.3	293°39.0	10.2	332°48.9	44.5	51°58.8	59.0
18	57°57.9	52°27.3	N07°30.2	308°41.7	N26°10.1	347°51.3	N21°44.5	67°01.0	S05°58.9
19	73°00.3	67°28.9	31.0	323°44.4	10.1	2°53.6	44.6	82°03.2	58.8
20	88°02.8	82°30.6	31.8	338°47.1	10.0	17°56.0	44.6	97°05.4	58.7
21	103°05.3	97°32.2	·· 32.7	353°49.8	·· 10.0	32°58.3	·· 44.6	112°07.6	·· 58.6
22	118°07.7	112°33.9	33.5	8°52.5	09.9	48°00.7	44.6	127°09.7	58.4
23	133°10.2	127°35.5	34.3	23°55.2	09.9	63°03.0	44.6	142°11.9	58.3
Mer.pass. 14:09		ν 1.6′	d 0.9′	m -4.86	ν 2.7′	d 0.0′	m -0.61	ν 2.4′	d 0.0′ m -2.39	ν 2.2′	d 0.1′ m 1.12

Stars

	SHA	Dec
Alpheratz	357°35.0	29°13.8
Ankaa	353°07.3	-42°10.4
Schedar	349°31.4	56°40.7
Diphda	348°47.4	-17°51.1
Achernar	335°20.4	-57°06.8
Hamal	327°51.2	23°34.9
Polaris	314°04.3	89°22.5
Acamar	315°11.8	-40°12.5
Menkar	314°06.1	4°11.2
Mirfak	308°28.2	49°57.2
Aldebaran	290°39.4	16°33.6
Rigel	281°03.6	-8°10.5
Capella	280°21.6	46°01.5
Bellatrix	278°22.6	6°22.3
Elnath	278°01.6	28°37.8
Alnilam	275°37.5	-1°11.2
Betelgeuse	270°51.8	7°24.7
Canopus	263°52.0	-52°42.7
Sirius	258°25.9	-16°45.2
Adhara	255°05.5	-29°00.5
Procyon	244°50.5	5°09.6
Pollux	243°16.9	27°57.9
Avior	234°14.1	-59°35.5
Suhail	222°45.8	-43°32.1
Miaplacidus	221°37.4	-69°49.2
Alphard	217°47.3	-8°46.1
Regulus	207°34.0	11°50.5
Dubhe	193°40.2	61°36.8
Denebola	182°24.6	14°25.7
Gienah	175°43.2	-17°40.9
Acrux	172°59.5	-63°14.2
Gacrux	171°51.1	-57°15.1
Alioth	166°12.5	55°49.1
Spica	158°22.0	-11°17.6
Alkaid	152°51.7	49°10.9
Hadar	148°35.6	-60°29.5
Menkent	147°57.4	-36°29.5
Arcturus	145°47.7	19°02.8
Rigil Kent.	139°40.0	-60°56.2
Kochab	137°19.5	74°02.7
Zuben'ubi	136°55.8	-16°08.8
Alphecca	126°03.6	26°37.5
Antares	112°15.8	-26°29.2
Atria	107°10.1	-69°04.1
Sabik	102°02.8	-15°45.4
Shaula	96°10.4	-37°07.3
Rasalhague	95°58.6	12°32.3
Eltanin	90°42.4	51°28.8
Kaus Aust.	83°32.6	-34°22.3
Vega	80°33.4	38°48.1
Nunki	75°47.9	-26°16.0
Altair	62°00.2	8°55.9
Peacock	53°06.1	-56°39.2
Deneb	49°26.2	45°22.0
Enif	33°39.0	9°59.3
Al Na'ir	27°33.2	-46°50.5
Fomalhaut	15°14.7	-29°29.5
Scheat	13°45.5	28°13.1
Markab	13°30.1	15°20.3

Feb 15 Sat	SHA	Mer.pass
Venus	355°29.2	14:36
Mars	250°25.1	21:33
Jupiter	290°00.3	18:56
Saturn	9°21.1	13:40

Feb 16 Sun	SHA	Mer.pass
Venus	355°06.1	14:33
Mars	250°32.7	21:29
Jupiter	289°58.0	18:52
Saturn	9°14.6	13:36

Feb 17 Mon	SHA	Mer.pass
Venus	354°44.5	14:31
Mars	250°39.4	21:25
Jupiter	289°55.5	18:48
Saturn	9°08.0	13:33

Horizontal parallax	
Venus:	0.4
Mars:	0.2

h	Sun		Moon				
Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°28.7	S12°40.0	330°33.5	16.7′	N02°38.5	14.6′	54.7′
1	191°28.7	39.1	345°09.2	16.7′	02°23.9	14.5′	54.7′
2	206°28.7	38.2	359°44.9	16.8′	02°09.4	14.6′	54.7′
3	221°28.7	·· 37.4	14°20.7	16.8′	01°54.8	14.5′	54.7′
4	236°28.8	36.5	28°56.4	16.8′	01°40.3	14.6′	54.7′
5	251°28.8	35.7	43°32.3	16.8′	01°25.7	14.5′	54.6′
6	266°28.8	S12°34.8	58°08.1	16.9′	N01°11.2	14.5′	54.6′
7	281°28.9	33.9	72°43.9	16.9′	00°56.7	14.5′	54.6′
8	296°28.9	33.1	87°19.8	16.9′	00°42.2	14.6′	54.6′
9	311°28.9	·· 32.2	101°55.7	16.9′	00°27.6	14.5′	54.6′
10	326°29.0	31.4	116°31.6	16.9′	N00°13.1	14.5′	54.6′
11	341°29.0	30.5	131°07.5	16.9′	S00°01.4	14.5′	54.6′
12	356°29.0	S12°29.6	145°43.5	17.0′	S00°15.9	14.5′	54.5′
13	11°29.1	28.8	160°19.4	17.0′	00°30.4	14.4′	54.5′
14	26°29.1	27.9	174°55.4	17.0′	00°44.8	14.5′	54.5′
15	41°29.2	·· 27.0	189°31.4	17.0′	00°59.3	14.5′	54.5′
16	56°29.2	26.2	204°07.4	17.0′	01°13.8	14.4′	54.5′
17	71°29.2	25.3	218°43.4	17.0′	01°28.2	14.4′	54.5′
18	86°29.3	S12°24.5	233°19.4	17.0′	S01°42.6	14.4′	54.5′
19	101°29.3	23.6	247°55.4	17.0′	01°57.0	14.4′	54.5′
20	116°29.3	22.7	262°31.4	17.0′	02°11.4	14.4′	54.4′
21	131°29.4	·· 21.9	277°07.5	17.0′	02°25.8	14.4′	54.4′
22	146°29.4	21.0	291°43.5	17.0′	02°40.2	14.4′	54.4′
23	161°29.4	20.1	306°19.5	17.0′	02°54.6	14.3′	54.4′
	SD = 16.2′	d = 0.9′	SD = 14.9′				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°29.5	S12°19.3	320°55.6	17.0′	S03°08.9	14.3′	54.4′
1	191°29.5	18.4	335°31.6	17.0′	03°23.2	14.3′	54.4′
2	206°29.6	17.5	350°07.7	17.0′	03°37.5	14.3′	54.4′
3	221°29.6	·· 16.7	4°43.7	17.0′	03°51.8	14.2′	54.4′
4	236°29.6	15.8	19°19.8	17.0′	04°06.0	14.3′	54.3′
5	251°29.7	14.9	33°55.8	17.0′	04°20.3	14.2′	54.3′
6	266°29.7	S12°14.0	48°31.8	17.0′	S04°34.5	14.2′	54.3′
7	281°29.8	13.2	63°07.9	17.0′	04°48.7	14.2′	54.3′
8	296°29.8	12.3	77°43.9	17.0′	05°02.9	14.1′	54.3′
9	311°29.8	·· 11.4	92°19.9	17.0′	05°17.0	14.1′	54.3′
10	326°29.9	10.6	106°55.9	17.0′	05°31.1	14.1′	54.3′
11	341°29.9	09.7	121°31.9	17.0′	05°45.2	14.1′	54.3′
12	356°30.0	S12°08.8	136°07.9	17.0′	S05°59.3	14.0′	54.3′
13	11°30.0	08.0	150°43.9	17.0′	06°13.3	14.0′	54.3′
14	26°30.0	07.1	165°19.8	17.0′	06°27.3	14.0′	54.3′
15	41°30.1	·· 06.2	179°55.8	16.9′	06°41.3	14.0′	54.2′
16	56°30.1	05.3	194°31.7	16.9′	06°55.3	13.9′	54.2′
17	71°30.2	04.5	209°07.6	16.9′	07°09.2	13.9′	54.2′
18	86°30.2	S12°03.6	223°43.6	16.9′	S07°23.1	13.9′	54.2′
19	101°30.3	02.7	238°19.4	16.9′	07°37.0	13.8′	54.2′
20	116°30.3	01.8	252°55.3	16.8′	07°50.8	13.8′	54.2′
21	131°30.4	·· 01.0	267°31.2	16.8′	08°04.6	13.8′	54.2′
22	146°30.4	12°00.1	282°07.0	16.8′	08°18.4	13.7′	54.2′
23	161°30.4	11°59.2	296°42.8	16.8′	08°32.1	13.7′	54.2′
	SD = 16.2′	d = 0.9′	SD = 14.8′				

Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°30.5	S11°58.3	311°18.6	16.8′	S08°45.8	13.7′	54.2′
1	191°30.5	57.5	325°54.3	16.7′	08°59.5	13.6′	54.2′
2	206°30.6	56.6	340°30.1	16.7′	09°13.1	13.6′	54.2′
3	221°30.6	·· 55.7	355°05.8	16.7′	09°26.7	13.5′	54.2′
4	236°30.7	54.8	9°41.4	16.7′	09°40.2	13.5′	54.2′
5	251°30.7	54.0	24°17.1	16.6′	09°53.7	13.5′	54.1′
6	266°30.8	S11°53.1	38°52.7	16.6′	S10°07.2	13.4′	54.1′
7	281°30.8	52.2	53°28.3	16.6′	10°20.6	13.4′	54.1′
8	296°30.9	51.3	68°03.9	16.5′	10°34.0	13.4′	54.1′
9	311°30.9	·· 50.5	82°39.4	16.5′	10°47.4	13.3′	54.1′
10	326°31.0	49.6	97°14.9	16.5′	11°00.7	13.3′	54.1′
11	341°31.0	48.7	111°50.4	16.4′	11°14.0	13.2′	54.1′
12	356°31.1	S11°47.8	126°25.8	16.4′	S11°27.2	13.2′	54.1′
13	11°31.1	46.9	141°01.2	16.4′	11°40.4	13.1′	54.1′
14	26°31.2	46.1	155°36.5	16.3′	11°53.5	13.1′	54.1′
15	41°31.2	·· 45.2	170°11.9	16.3′	12°06.6	13.0′	54.1′
16	56°31.3	44.3	184°47.1	16.2′	12°19.6	13.0′	54.1′
17	71°31.3	43.4	199°22.4	16.2′	12°32.6	13.0′	54.1′
18	86°31.4	S11°42.5	213°57.6	16.2′	S12°45.6	12.9′	54.1′
19	101°31.4	41.7	228°32.7	16.1′	12°58.5	12.8′	54.1′
20	116°31.5	40.8	243°07.8	16.1′	13°11.3	12.8′	54.1′
21	131°31.5	·· 39.9	257°42.9	16.0′	13°24.1	12.8′	54.1′
22	146°31.6	39.0	272°17.9	16.0′	13°36.9	12.7′	54.1′
23	161°31.6	38.1	286°52.9	15.9′	13°49.6	12.6′	54.1′
	SD = 16.2′	d = 0.9′	SD = 14.8′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	06:09	07:29	08:46	15:43	17:01	18:21
N 70°	06:08	07:20	08:28	16:02	17:10	18:22
68°	06:07	07:12	08:13	16:17	17:17	18:23
66°	06:06	07:06	08:01	16:28	17:24	18:24
64°	06:05	07:00	07:51	16:38	17:29	18:25
62°	06:04	06:55	07:42	16:47	17:34	18:26
60°	06:03	06:51	07:35	16:54	17:38	18:27
N 58°	06:02	06:47	07:28	17:01	17:42	18:28
56°	06:01	06:44	07:23	17:06	17:45	18:29
54°	05:59	06:41	07:17	17:12	17:48	18:30
52°	05:58	06:38	07:13	17:16	17:51	18:30
50°	05:57	06:35	07:08	17:20	17:54	18:31
45°	05:55	06:29	06:59	17:30	18:00	18:34
N 40°	05:52	06:24	06:51	17:37	18:05	18:37
35°	05:49	06:19	06:45	17:44	18:10	18:39
30°	05:46	06:14	06:39	17:50	18:14	18:42
20°	05:40	06:06	06:28	18:00	18:22	18:48
N 10°	05:33	05:58	06:19	18:09	18:30	18:55
0°	05:25	05:49	06:11	18:17	18:39	19:03
S 10°	05:15	05:40	06:02	18:26	18:48	19:13
20°	05:03	05:30	05:52	18:35	18:58	19:25
30°	04:47	05:16	05:41	18:46	19:11	19:40
35°	04:37	05:08	05:35	18:53	19:19	19:50
40°	04:24	04:59	05:28	19:00	19:28	20:03
45°	04:09	04:48	05:19	19:08	19:39	20:18
S 50°	03:49	04:33	05:09	19:18	19:53	20:37
52°	03:40	04:27	05:04	19:23	20:00	20:47
54°	03:28	04:19	04:58	19:28	20:07	20:58
56°	03:15	04:10	04:52	19:34	20:16	21:10
58°	03:00	04:01	04:46	19:41	20:25	21:25
S 60°	02:41	03:49	04:38	19:48	20:36	21:44

Lat.	**Moonrise** Sat	Sun	Mon	**Moonset** Sat	Sun	Mon
N 72°	21:03	23:05	·· ··	08:18	07:45	07:08
N 70°	20:59	22:51	·· ··	08:17	07:52	07:24
68°	20:56	22:40	·· ··	08:16	07:58	07:37
66°	20:54	22:31	·· ··	08:16	08:02	07:48
64°	20:52	22:23	23:58	08:15	08:06	07:57
62°	20:50	22:17	23:46	08:15	08:10	08:05
60°	20:48	22:11	23:36	08:15	08:13	08:12
N 58°	20:47	22:07	23:27	08:14	08:16	08:18
56°	20:46	22:02	23:20	08:14	08:18	08:23
54°	20:45	21:58	23:13	08:14	08:21	08:28
52°	20:44	21:55	23:07	08:14	08:23	08:32
50°	20:43	21:52	23:01	08:14	08:25	08:36
45°	20:41	21:45	22:50	08:13	08:29	08:45
N 40°	20:39	21:39	22:40	08:13	08:32	08:52
35°	20:38	21:34	22:32	08:12	08:35	08:58
30°	20:37	21:30	22:24	08:12	08:38	09:04
20°	20:35	21:23	22:12	08:12	08:42	09:13
N 10°	20:33	21:17	22:01	08:11	08:46	09:22
0°	20:31	21:11	21:51	08:11	08:50	09:30
S 10°	20:29	21:05	21:41	08:10	08:54	09:38
20°	20:28	20:58	21:30	08:10	08:58	09:46
30°	20:26	20:51	21:18	08:09	09:03	09:56
35°	20:25	20:47	21:11	08:09	09:05	10:02
40°	20:23	20:43	21:04	08:08	09:08	10:08
45°	20:22	20:38	20:54	08:08	09:12	10:16
S 50°	20:20	20:31	20:44	08:07	09:16	10:25
52°	20:19	20:28	20:39	08:07	09:18	10:29
54°	20:19	20:25	20:33	08:06	09:20	10:34
56°	20:18	20:22	20:27	08:06	09:23	10:39
58°	20:17	20:18	20:20	08:06	09:25	10:45
S 60°	20:15	20:14	20:12	08:05	09:28	10:52

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 17-19 94-83%
15	14:05	14:04	12:14	02:01	14:21	
16	14:02	14:00	12:14	02:41	15:00	
17	13:58	13:56	12:14	03:20	15:40	

February 18, 19, 20 UT (Tue., Wed., Thu.)

	Aries	Venus		Mars		Jupiter		Saturn	
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	148°12.7	142°37.2	N07°35.2	38°57.9	N26°09.9	78°05.4	N21°44.7	157°14.1	S05°58.2
1	163°15.1	157°38.9	36.0	54°00.6	09.8	93°07.7	44.7	172°16.3	58.1
2	178°17.6	172°40.5	36.8	69°03.2	09.8	108°10.0	44.7	187°18.5	58.0
3	193°20.1	187°42.2	·· 37.7	84°05.9	·· 09.7	123°12.4	·· 44.7	202°20.7	·· 57.8
4	208°22.5	202°43.9	38.5	99°08.6	09.7	138°14.7	44.8	217°22.9	57.7
5	223°25.0	217°45.6	39.3	114°11.3	09.6	153°17.1	44.8	232°25.1	57.6
6	238°27.4	232°47.2	N07°40.1	129°14.0	N26°09.6	168°19.4	N21°44.8	247°27.3	S05°57.5
7	253°29.9	247°48.9	41.0	144°16.6	09.5	183°21.8	44.8	262°29.5	57.4
8	268°32.4	262°50.6	41.8	159°19.3	09.5	198°24.1	44.9	277°31.7	57.3
9	283°34.8	277°52.3	·· 42.6	174°22.0	·· 09.4	213°26.4	·· 44.9	292°33.8	·· 57.1
10	298°37.3	292°54.0	43.4	189°24.7	09.4	228°28.8	44.9	307°36.0	57.0
11	313°39.8	307°55.7	44.3	204°27.3	09.3	243°31.1	44.9	322°38.2	56.9
12	328°42.2	322°57.4	N07°45.1	219°30.0	N26°09.3	258°33.5	N21°45.0	337°40.4	S05°56.8
13	343°44.7	337°59.1	45.9	234°32.7	09.2	273°35.8	45.0	352°42.6	56.7
14	358°47.2	353°00.8	46.7	249°35.4	09.2	288°38.2	45.0	7°44.8	56.6
15	13°49.6	8°02.5	·· 47.5	264°38.0	·· 09.2	303°40.5	·· 45.0	22°47.0	·· 56.4
16	28°52.1	23°04.2	48.3	279°40.7	09.1	318°42.8	45.1	37°49.2	56.3
17	43°54.5	38°05.9	49.1	294°43.4	09.1	333°45.2	45.1	52°51.4	56.2
18	58°57.0	53°07.6	N07°50.0	309°46.0	N26°09.0	348°47.5	N21°45.1	67°53.6	S05°56.1
19	73°59.5	68°09.3	50.8	324°48.7	09.0	3°49.8	45.1	82°55.7	56.0
20	89°01.9	83°11.0	51.6	339°51.3	08.9	18°52.2	45.2	97°57.9	55.9
21	104°04.4	98°12.8	·· 52.4	354°54.0	·· 08.9	33°54.5	·· 45.2	113°00.1	·· 55.7
22	119°06.9	113°14.5	53.2	9°56.7	08.8	48°56.9	45.2	128°02.3	55.6
23	134°09.3	128°16.2	54.0	24°59.3	08.8	63°59.2	45.2	143°04.5	55.5
Mer.pass. 14:05		ν 1.7′	d 0.8′	m -4.86	ν 2.7′	d 0.0′	m -0.58	ν 2.3′	d 0.0′ m -2.38	ν 2.2′	d 0.1′ m 1.12

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	149°11.8	143°18.0	N07°54.8	40°02.0	N26°08.7	79°01.5	N21°45.2	158°06.7	S05°55.4
1	164°14.3	158°19.7	55.6	55°04.6	08.7	94°03.9	45.3	173°08.9	55.3
2	179°16.7	173°21.4	56.4	70°07.3	08.6	109°06.2	45.3	188°11.1	55.1
3	194°19.2	188°23.2	·· 57.2	85°09.9	·· 08.6	124°08.5	·· 45.3	203°13.3	·· 55.0
4	209°21.7	203°24.9	58.0	100°12.6	08.5	139°10.9	45.3	218°15.4	54.9
5	224°24.1	218°26.7	58.8	115°15.2	08.5	154°13.2	45.4	233°17.6	54.8
6	239°26.6	233°28.4	N07°59.6	130°17.8	N26°08.4	169°15.5	N21°45.4	248°19.8	S05°54.7
7	254°29.0	248°30.2	08°00.4	145°20.5	08.4	184°17.9	45.4	263°22.0	54.6
8	269°31.5	263°31.9	01.2	160°23.1	08.3	199°20.2	45.4	278°24.2	54.4
9	284°34.0	278°33.7	·· 02.0	175°25.8	·· 08.3	214°22.5	·· 45.5	293°26.4	·· 54.3
10	299°36.4	293°35.4	02.8	190°28.4	08.2	229°24.9	45.5	308°28.6	54.2
11	314°38.9	308°37.2	03.6	205°31.0	08.1	244°27.2	45.5	323°30.8	54.1
12	329°41.4	323°39.0	N08°04.3	220°33.7	N26°08.1	259°29.5	N21°45.5	338°33.0	S05°54.0
13	344°43.8	338°40.7	05.1	235°36.3	08.0	274°31.9	45.6	353°35.1	53.8
14	359°46.3	353°42.5	05.9	250°39.0	08.0	289°34.2	45.6	8°37.3	53.7
15	14°48.8	8°44.3	·· 06.7	265°41.6	·· 07.9	304°36.5	·· 45.6	23°39.5	·· 53.6
16	29°51.2	23°46.1	07.5	280°44.2	07.9	319°38.9	45.6	38°41.7	53.5
17	44°53.7	38°47.8	08.3	295°46.8	07.8	334°41.2	45.7	53°43.9	53.4
18	59°56.2	53°49.6	N08°09.1	310°49.5	N26°07.8	349°43.5	N21°45.7	68°46.1	S05°53.3
19	74°58.6	68°51.4	09.8	325°52.1	07.7	4°45.9	45.7	83°48.3	53.1
20	90°01.1	83°53.2	10.6	340°54.7	07.7	19°48.2	45.7	98°50.5	53.0
21	105°03.5	98°55.0	·· 11.4	355°57.3	·· 07.6	34°50.5	·· 45.8	113°52.7	·· 52.9
22	120°06.0	113°56.8	12.2	11°00.0	07.6	49°52.9	45.8	128°54.8	52.8
23	135°08.5	128°58.6	12.9	26°02.6	07.5	64°55.2	45.8	143°57.0	52.7
Mer.pass. 14:01		ν 1.7′	d 0.8′	m -4.86	ν 2.7′	d 0.1′	m -0.56	ν 2.3′	d 0.0′ m -2.38	ν 2.2′	d 0.1′ m 1.12

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	150°10.9	144°00.4	N08°13.7	41°05.2	N26°07.4	79°57.5	N21°45.9	158°59.2	S05°52.6
1	165°13.4	159°02.2	14.5	56°07.8	07.4	94°59.8	45.9	174°01.4	52.4
2	180°15.9	174°04.0	15.3	71°10.4	07.3	110°02.2	45.9	189°03.6	52.3
3	195°18.3	189°05.8	·· 16.0	86°13.0	·· 07.3	125°04.5	·· 45.9	204°05.8	·· 52.2
4	210°20.8	204°07.6	16.8	101°15.7	07.2	140°06.8	46.0	219°08.0	52.1
5	225°23.3	219°09.5	17.6	116°18.3	07.2	155°09.1	46.0	234°10.2	52.0
6	240°25.7	234°11.3	N08°18.3	131°20.9	N26°07.1	170°11.5	N21°46.0	249°12.4	S05°51.8
7	255°28.2	249°13.1	19.1	146°23.5	07.1	185°13.8	46.0	264°14.5	51.7
8	270°30.6	264°14.9	19.9	161°26.1	07.0	200°16.1	46.1	279°16.7	51.6
9	285°33.1	279°16.8	·· 20.6	176°28.7	·· 06.9	215°18.4	·· 46.1	294°18.9	·· 51.5
10	300°35.6	294°18.6	21.4	191°31.3	06.9	230°20.8	46.1	309°21.1	51.4
11	315°38.0	309°20.4	22.2	206°33.9	06.8	245°23.1	46.1	324°23.3	51.3
12	330°40.5	324°22.3	N08°22.9	221°36.5	N26°06.8	260°25.4	N21°46.2	339°25.5	S05°51.1
13	345°43.0	339°24.1	23.7	236°39.1	06.7	275°27.7	46.2	354°27.7	51.0
14	0°45.4	354°26.0	24.4	251°41.7	06.7	290°30.1	46.2	9°29.9	50.9
15	15°47.9	9°27.8	·· 25.2	266°44.3	·· 06.6	305°32.4	·· 46.2	24°32.0	·· 50.8
16	30°50.4	24°29.7	25.9	281°46.9	06.5	320°34.7	46.3	39°34.2	50.7
17	45°52.8	39°31.5	26.7	296°49.5	06.5	335°37.0	46.3	54°36.4	50.5
18	60°55.3	54°33.4	N08°27.4	311°52.1	N26°06.4	350°39.4	N21°46.3	69°38.6	S05°50.4
19	75°57.8	69°35.2	28.2	326°54.7	06.4	5°41.7	46.3	84°40.8	50.3
20	91°00.2	84°37.1	28.9	341°57.2	06.3	20°44.0	46.4	99°43.0	50.2
21	106°02.7	99°39.0	·· 29.7	356°59.8	·· 06.2	35°46.3	·· 46.4	114°45.2	·· 50.1
22	121°05.1	114°40.8	30.4	12°02.4	06.2	50°48.6	46.4	129°47.4	50.0
23	136°07.6	129°42.7	31.2	27°05.0	06.1	65°51.0	46.5	144°49.6	49.8
Mer.pass. 13:57		ν 1.8′	d 0.8′	m -4.86	ν 2.6′	d 0.1′	m -0.53	ν 2.3′	d 0.0′ m -2.37	ν 2.2′	d 0.1′ m 1.12

Stars

	SHA	Dec
Alpheratz	357°35.0	29°13.7
Ankaa	353°07.4	-42°10.4
Schedar	349°31.4	56°40.6
Diphda	348°47.4	-17°51.1
Achernar	335°20.4	-57°06.8
Hamal	327°51.2	23°34.9
Polaris	314°05.7	89°22.5
Acamar	315°11.8	-40°12.5
Menkar	314°06.1	4°11.2
Mirfak	308°28.2	49°57.2
Aldebaran	290°39.4	16°33.6
Rigel	281°03.7	-8°10.5
Capella	280°21.6	46°01.5
Bellatrix	278°22.6	6°22.3
Elnath	278°01.6	28°37.8
Alnilam	275°37.5	-1°11.2
Betelgeuse	270°51.8	7°24.7
Canopus	263°52.0	-52°42.7
Sirius	258°25.9	-16°45.2
Adhara	255°05.5	-29°00.5
Procyon	244°50.5	5°09.6
Pollux	243°16.9	27°57.9
Avior	234°14.1	-59°35.5
Suhail	222°45.8	-43°32.1
Miaplacidus	221°37.4	-69°49.3
Alphard	217°47.3	-8°46.2
Regulus	207°34.0	11°50.5
Dubhe	193°40.2	61°36.8
Denebola	182°24.6	14°25.7
Gienah	175°43.2	-17°41.0
Acrux	172°59.5	-63°14.2
Gacrux	171°51.1	-57°15.1
Alioth	166°12.4	55°49.1
Spica	158°22.0	-11°17.6
Alkaid	152°51.6	49°10.9
Hadar	148°35.6	-60°29.5
Menkent	147°57.3	-36°29.6
Arcturus	145°47.7	19°02.8
Rigil Kent.	139°40.0	-60°56.2
Kochab	137°19.4	74°02.7
Zuben'ubi	136°55.8	-16°08.8
Alphecca	126°03.6	26°37.5
Antares	112°15.8	-26°29.2
Atria	107°10.1	-69°04.1
Sabik	102°02.8	-15°45.4
Shaula	96°10.4	-37°07.3
Rasalhague	95°58.6	12°32.3
Eltanin	90°42.4	51°28.8
Kaus Aust.	83°32.6	-34°22.3
Vega	80°33.4	38°48.1
Nunki	75°47.9	-26°16.0
Altair	62°00.1	8°55.9
Peacock	53°06.1	-56°39.2
Deneb	49°26.2	45°22.0
Enif	33°39.0	9°59.3
Al Na'ir	27°33.2	-46°50.5
Fomalhaut	15°14.7	-29°29.5
Scheat	13°45.5	28°13.1
Markab	13°30.1	15°20.3

Feb 18 Tue	SHA	Mer.pass
Venus	354°24.5	14:28
Mars	250°45.2	21:20
Jupiter	289°52.7	18:45
Saturn	9°01.5	13:29

Feb 19 Wed	SHA	Mer.pass
Venus	354°06.2	14:25
Mars	250°50.2	21:16
Jupiter	289°49.7	18:41
Saturn	8°54.9	13:26

Feb 20 Thu	SHA	Mer.pass
Venus	353°49.5	14:22
Mars	250°54.3	21:12
Jupiter	289°46.6	18:37
Saturn	8°48.3	13:22

Horizontal parallax	
Venus:	0.4
Mars:	0.2

h	Sun		Moon				
Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°31.7	S11°37.3	301°27.8	15.9′	S14°02.2	12.6′	54.1′
1	191°31.7	36.4	316°02.7	15.8′	14°14.8	12.6′	54.1′
2	206°31.8	35.5	330°37.5	15.8′	14°27.4	12.5′	54.1′
3	221°31.8	·· 34.6	345°12.3	15.7′	14°39.9	12.4′	54.1′
4	236°31.9	33.7	359°47.0	15.7′	14°52.3	12.4′	54.1′
5	251°31.9	32.8	14°21.7	15.6′	15°04.7	12.3′	54.1′
6	266°32.0	S11°31.9	28°56.3	15.6′	S15°17.0	12.2′	54.1′
7	281°32.0	31.1	43°30.9	15.5′	15°29.2	12.2′	54.1′
8	296°32.1	30.2	58°05.4	15.5′	15°41.4	12.2′	54.1′
9	311°32.1	·· 29.3	72°39.9	15.4′	15°53.6	12.1′	54.1′
10	326°32.2	28.4	87°14.3	15.3′	16°05.7	12.0′	54.1′
11	341°32.3	27.5	101°48.6	15.3′	16°17.7	11.9′	54.1′
12	356°32.3	S11°26.6	116°22.9	15.2′	S16°29.6	11.9′	54.1′
13	11°32.4	25.7	130°57.1	15.2′	16°41.5	11.9′	54.1′
14	26°32.4	24.9	145°31.3	15.1′	16°53.4	11.7′	54.1′
15	41°32.5	·· 24.0	160°05.4	15.0′	17°05.1	11.7′	54.1′
16	56°32.5	23.1	174°39.5	15.0′	17°16.8	11.7′	54.1′
17	71°32.6	22.2	189°13.5	14.9′	17°28.5	11.5′	54.1′
18	86°32.7	S11°21.3	203°47.4	14.9′	S17°40.0	11.5′	54.1′
19	101°32.7	20.4	218°21.2	14.8′	17°51.5	11.5′	54.1′
20	116°32.8	19.5	232°55.0	14.7′	18°03.0	11.3′	54.1′
21	131°32.8	·· 18.6	247°28.7	14.7′	18°14.3	11.3′	54.1′
22	146°32.9	17.7	262°02.4	14.6′	18°25.6	11.3′	54.2′
23	161°32.9	16.9	276°36.0	14.5′	18°36.9	11.1′	54.2′
	SD = 16.2′	d = 0.9′	SD = 14.8′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°33.0	S11°16.0	291°09.5	14.5′	S18°48.0	11.1′	54.2′
1	191°33.1	15.1	305°43.0	14.4′	18°59.1	11.0′	54.2′
2	206°33.1	14.2	320°16.4	14.3′	19°10.1	11.0′	54.2′
3	221°33.2	·· 13.3	334°49.7	14.2′	19°21.1	10.8′	54.2′
4	236°33.2	12.4	349°22.9	14.2′	19°31.9	10.8′	54.2′
5	251°33.3	11.5	3°56.1	14.1′	19°42.7	10.7′	54.2′
6	266°33.4	S11°10.6	18°29.2	14.0′	S19°53.4	10.6′	54.2′
7	281°33.4	09.7	33°02.2	14.0′	20°04.0	10.6′	54.2′
8	296°33.5	08.8	47°35.2	13.9′	20°14.6	10.5′	54.2′
9	311°33.5	·· 07.9	62°08.0	13.8′	20°25.1	10.3′	54.2′
10	326°33.6	07.0	76°40.8	13.7′	20°35.4	10.4′	54.2′
11	341°33.7	06.2	91°13.6	13.6′	20°45.8	10.2′	54.3′
12	356°33.7	S11°05.3	105°46.2	13.6′	S20°56.0	10.1′	54.3′
13	11°33.8	04.4	120°18.8	13.5′	21°06.1	10.1′	54.3′
14	26°33.9	03.5	134°51.3	13.4′	21°16.2	10.0′	54.3′
15	41°33.9	·· 02.6	149°23.7	13.3′	21°26.2	9.9′	54.3′
16	56°34.0	01.7	163°56.0	13.3′	21°36.1	9.8′	54.3′
17	71°34.1	11°00.8	178°28.3	13.2′	21°45.9	9.7′	54.3′
18	86°34.1	S10°59.9	193°00.5	13.1′	S21°55.6	9.6′	54.3′
19	101°34.2	59.0	207°32.6	13.0′	22°05.2	9.5′	54.3′
20	116°34.2	58.1	222°04.6	12.9′	22°14.7	9.5′	54.4′
21	131°34.3	·· 57.2	236°36.5	12.8′	22°24.2	9.3′	54.4′
22	146°34.4	56.3	251°08.4	12.8′	22°33.5	9.3′	54.4′
23	161°34.4	55.4	265°40.1	12.7′	22°42.8	9.2′	54.4′
	SD = 16.2′	d = 0.9′	SD = 14.8′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°34.5	S10°54.5	280°11.8	12.6′	S22°52.0	9.0′	54.4′
1	191°34.6	53.6	294°43.4	12.5′	23°01.0	9.0′	54.4′
2	206°34.6	52.7	309°14.9	12.4′	23°10.0	8.9′	54.4′
3	221°34.7	·· 51.8	323°46.4	12.3′	23°18.9	8.8′	54.4′
4	236°34.8	50.9	338°17.7	12.3′	23°27.7	8.7′	54.5′
5	251°34.8	50.0	352°49.0	12.2′	23°36.4	8.5′	54.5′
6	266°34.9	S10°49.1	7°20.1	12.1′	S23°44.9	8.5′	54.5′
7	281°35.0	48.2	21°51.2	12.0′	23°53.4	8.4′	54.5′
8	296°35.0	47.3	36°22.2	11.9′	24°01.8	8.3′	54.5′
9	311°35.1	·· 46.4	50°53.2	11.8′	24°10.1	8.2′	54.5′
10	326°35.2	45.5	65°24.0	11.7′	24°18.3	8.0′	54.6′
11	341°35.3	44.6	79°54.7	11.7′	24°26.3	8.0′	54.6′
12	356°35.3	S10°43.7	94°25.4	11.6′	S24°34.3	7.9′	54.6′
13	11°35.4	42.8	108°56.0	11.5′	24°42.2	7.7′	54.6′
14	26°35.5	41.9	123°26.5	11.4′	24°49.9	7.7′	54.6′
15	41°35.5	·· 41.0	137°56.9	11.3′	24°57.6	7.5′	54.6′
16	56°35.6	40.1	152°27.2	11.2′	25°05.1	7.4′	54.7′
17	71°35.7	39.2	166°57.4	11.1′	25°12.5	7.3′	54.7′
18	86°35.7	S10°38.3	181°27.5	11.1′	S25°19.8	7.2′	54.7′
19	101°35.8	37.4	195°57.6	11.0′	25°27.0	7.1′	54.7′
20	116°35.9	36.5	210°27.5	10.9′	25°34.1	7.0′	54.7′
21	131°36.0	·· 35.6	224°57.4	10.8′	25°41.1	6.8′	54.8′
22	146°36.0	34.7	239°27.2	10.7′	25°47.9	6.8′	54.8′
23	161°36.1	33.8	253°56.9	10.6′	25°54.7	6.6′	54.8′
	SD = 16.2′	d = 0.9′	SD = 14.8′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	05:56	07:15	08:29	16:00	17:15	18:34
N 70°	05:56	07:07	08:13	16:16	17:22	18:33
68°	05:56	07:01	08:00	16:29	17:28	18:33
66°	05:56	06:56	07:50	16:39	17:33	18:33
64°	05:56	06:51	07:41	16:48	17:38	18:33
62°	05:55	06:47	07:33	16:56	17:42	18:33
60°	05:55	06:43	07:26	17:02	17:45	18:34
N 58°	05:55	06:40	07:21	17:08	17:48	18:34
56°	05:54	06:37	07:15	17:13	17:51	18:35
54°	05:53	06:35	07:11	17:18	17:54	18:35
52°	05:53	06:32	07:07	17:22	17:56	18:36
50°	05:52	06:30	07:03	17:26	17:59	18:36
45°	05:50	06:25	06:54	17:34	18:04	18:38
N 40°	05:48	06:20	06:47	17:41	18:08	18:40
35°	05:46	06:16	06:41	17:47	18:12	18:42
30°	05:44	06:12	06:36	17:52	18:16	18:44
20°	05:38	06:04	06:27	18:01	18:23	18:49
N 10°	05:32	05:57	06:18	18:09	18:31	18:55
0°	05:25	05:49	06:10	18:17	18:38	19:03
S 10°	05:16	05:41	06:02	18:25	18:46	19:11
20°	05:05	05:31	05:54	18:34	18:56	19:23
30°	04:50	05:19	05:44	18:43	19:08	19:37
35°	04:40	05:11	05:38	18:49	19:15	19:47
40°	04:29	05:03	05:31	18:56	19:24	19:58
45°	04:14	04:52	05:23	19:03	19:34	20:12
S 50°	03:56	04:39	05:14	19:13	19:47	20:30
52°	03:47	04:33	05:09	19:17	19:53	20:39
54°	03:37	04:26	05:05	19:22	20:00	20:49
56°	03:25	04:18	04:59	19:27	20:08	21:01
58°	03:10	04:09	04:53	19:33	20:17	21:14
S 60°	02:53	03:59	04:46	19:39	20:27	21:31

Lat.	**Moonrise** Tue	Wed	Thu	**Moonset** Tue	Wed	Thu
N 72°	01:26	▬	▬	06:12	▬	▬
N 70°	00:54	03:55	▬	06:46	05:15	▬
68°	00:31	02:42	▬	07:11	06:28	▬
66°	00:13	02:06	04:48	07:30	07:06	05:59
64°	·· ··	01:41	03:38	07:46	07:32	07:09
62°	·· ··	01:21	03:03	07:59	07:53	07:45
60°	·· ··	01:05	02:38	08:10	08:10	08:11
N 58°	·· ··	00:51	02:18	08:20	08:24	08:32
56°	·· ··	00:39	02:02	08:29	08:37	08:49
54°	·· ··	00:29	01:48	08:36	08:47	09:03
52°	·· ··	00:20	01:35	08:43	08:57	09:16
50°	·· ··	00:12	01:25	08:49	09:06	09:27
45°	23:55	·· ··	01:02	09:03	09:24	09:50
N 40°	23:42	·· ··	00:45	09:14	09:39	10:09
35°	23:30	·· ··	00:30	09:23	09:52	10:25
30°	23:20	·· ··	00:17	09:32	10:03	10:38
20°	23:02	23:55	·· ··	09:46	10:22	11:02
N 10°	22:47	23:36	·· ··	09:59	10:39	11:22
0°	22:33	23:18	·· ··	10:11	10:55	11:41
S 10°	22:19	23:01	23:46	10:23	11:10	12:00
20°	22:04	22:42	23:25	10:36	11:27	12:21
30°	21:48	22:21	23:00	10:51	11:47	12:45
35°	21:38	22:09	22:45	11:00	11:59	12:59
40°	21:27	21:54	22:28	11:09	12:12	13:15
45°	21:14	21:37	22:07	11:21	12:28	13:35
S 50°	20:58	21:17	21:42	11:35	12:47	13:59
52°	20:51	21:07	21:30	11:42	12:56	14:11
54°	20:43	20:56	21:16	11:49	13:07	14:25
56°	20:34	20:44	20:59	11:58	13:18	14:41
58°	20:23	20:29	20:40	12:07	13:32	15:00
S 60°	20:12	20:12	20:16	12:18	13:48	15:23

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 20-22 75-57%
18	13:53	13:51	12:14	04:01	16:22	
19	13:48	13:45	12:14	04:44	17:06	
20	13:42	13:39	12:14	05:30	17:54	

February 21, 22, 23 UT (Fri., Sat., Sun.)

	Aries	Venus		Mars		Jupiter		Saturn	
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	151°10.1	144°44.6	N08°31.9	42°07.6	N26°06.1	80°53.3	N21°46.5	159°51.7	S05°49.7
1	166°12.5	159°46.5	32.7	57°10.2	06.0	95°55.6	46.5	174°53.9	49.6
2	181°15.0	174°48.3	33.4	72°12.7	05.9	110°57.9	46.5	189°56.1	49.5
3	196°17.5	189°50.2	·· 34.2	87°15.3	·· 05.9	126°00.2	·· 46.6	204°58.3	·· 49.4
4	211°19.9	204°52.1	34.9	102°17.9	05.8	141°02.6	46.6	220°00.5	49.2
5	226°22.4	219°54.0	35.6	117°20.5	05.8	156°04.9	46.6	235°02.7	49.1
6	241°24.9	234°55.9	N08°36.4	132°23.1	N26°05.7	171°07.2	N21°46.6	250°04.9	S05°49.0
7	256°27.3	249°57.8	37.1	147°25.6	05.6	186°09.5	46.7	265°07.1	48.9
8	271°29.8	264°59.7	37.8	162°28.2	05.6	201°11.8	46.7	280°09.2	48.8
9	286°32.3	280°01.6	·· 38.6	177°30.8	·· 05.5	216°14.1	·· 46.7	295°11.4	·· 48.6
10	301°34.7	295°03.5	39.3	192°33.3	05.5	231°16.5	46.7	310°13.6	48.5
11	316°37.2	310°05.4	40.0	207°35.9	05.4	246°18.8	46.8	325°15.8	48.4
12	331°39.6	325°07.3	N08°40.8	222°38.5	N26°05.3	261°21.1	N21°46.8	340°18.0	S05°48.3
13	346°42.1	340°09.3	41.5	237°41.0	05.3	276°23.4	46.8	355°20.2	48.2
14	1°44.6	355°11.2	42.2	252°43.6	05.2	291°25.7	46.9	10°22.4	48.1
15	16°47.0	10°13.1	·· 42.9	267°46.2	·· 05.1	306°28.0	·· 46.9	25°24.5	·· 47.9
16	31°49.5	25°15.0	43.6	282°48.7	05.1	321°30.3	46.9	40°26.7	47.8
17	46°52.0	40°17.0	44.4	297°51.3	05.0	336°32.7	46.9	55°28.9	47.7
18	61°54.4	55°18.9	N08°45.1	312°53.8	N26°05.0	351°35.0	N21°47.0	70°31.1	S05°47.6
19	76°56.9	70°20.8	45.8	327°56.4	04.9	6°37.3	47.0	85°33.3	47.5
20	91°59.4	85°22.8	46.5	342°58.9	04.8	21°39.6	47.0	100°35.5	47.3
21	107°01.8	100°24.7	·· 47.2	358°01.5	·· 04.8	36°41.9	·· 47.0	115°37.7	·· 47.2
22	122°04.3	115°26.7	48.0	13°04.0	04.7	51°44.2	47.1	130°39.9	47.1
23	137°06.7	130°28.6	48.7	28°06.6	04.6	66°46.5	47.1	145°42.0	47.0
Mer.pass. 13:53		ν 1.9′	d 0.7′	m -4.85	ν 2.6′	d 0.1′	m -0.50	ν 2.3′	d 0.0′ m -2.36	ν 2.2′	d 0.1′ m 1.12

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	152°09.2	145°30.6	N08°49.4	43°09.1	N26°04.6	81°48.8	N21°47.1	160°44.2	S05°46.9
1	167°11.7	160°32.5	50.1	58°11.7	04.5	96°51.2	47.2	175°46.4	46.7
2	182°14.1	175°34.5	50.8	73°14.2	04.4	111°53.5	47.2	190°48.6	46.6
3	197°16.6	190°36.4	·· 51.5	88°16.8	·· 04.4	126°55.8	·· 47.2	205°50.8	·· 46.5
4	212°19.1	205°38.4	52.2	103°19.3	04.3	141°58.1	47.2	220°53.0	46.4
5	227°21.5	220°40.4	52.9	118°21.8	04.2	157°00.4	47.3	235°55.2	46.3
6	242°24.0	235°42.3	N08°53.6	133°24.4	N26°04.2	172°02.7	N21°47.3	250°57.4	S05°46.2
7	257°26.5	250°44.3	54.3	148°26.9	04.1	187°05.0	47.3	265°59.5	46.0
8	272°28.9	265°46.3	55.0	163°29.5	04.0	202°07.3	47.3	281°01.7	45.9
9	287°31.4	280°48.3	·· 55.7	178°32.0	·· 04.0	217°09.6	·· 47.4	296°03.9	·· 45.8
10	302°33.9	295°50.3	56.4	193°34.5	03.9	232°11.9	47.4	311°06.1	45.7
11	317°36.3	310°52.2	57.1	208°37.1	03.8	247°14.3	47.4	326°08.3	45.6
12	332°38.8	325°54.2	N08°57.8	223°39.6	N26°03.8	262°16.6	N21°47.5	341°10.5	S05°45.4
13	347°41.2	340°56.2	58.5	238°42.1	03.7	277°18.9	47.5	356°12.7	45.3
14	2°43.7	355°58.2	59.2	253°44.6	03.6	292°21.2	47.5	11°14.8	45.2
15	17°46.2	11°00.2	08°59.9	268°47.2	·· 03.6	307°23.5	·· 47.5	26°17.0	·· 45.1
16	32°48.6	26°02.2	09°00.6	283°49.7	03.5	322°25.8	47.6	41°19.2	45.0
17	47°51.1	41°04.2	01.3	298°52.2	03.4	337°28.1	47.6	56°21.4	44.8
18	62°53.6	56°06.2	N09°01.9	313°54.7	N26°03.4	352°30.4	N21°47.6	71°23.6	S05°44.7
19	77°56.0	71°08.3	02.6	328°57.3	03.3	7°32.7	47.7	86°25.8	44.6
20	92°58.5	86°10.3	03.3	343°59.8	03.2	22°35.0	47.7	101°28.0	44.5
21	108°01.0	101°12.3	·· 04.0	359°02.3	·· 03.2	37°37.3	·· 47.7	116°30.1	·· 44.4
22	123°03.4	116°14.3	04.7	14°04.8	03.1	52°39.6	47.7	131°32.3	44.3
23	138°05.9	131°16.3	05.3	29°07.3	03.0	67°41.9	47.8	146°34.5	44.1
Mer.pass. 13:49		ν 2.0′	d 0.7′	m -4.85	ν 2.5′	d 0.1′	m -0.47	ν 2.3′	d 0.0′ m -2.35	ν 2.2′	d 0.1′ m 1.12

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	153°08.4	146°18.4	N09°06.0	44°09.8	N26°03.0	82°44.2	N21°47.8	161°36.7	S05°44.0
1	168°10.8	161°20.4	06.7	59°12.3	02.9	97°46.5	47.8	176°38.9	43.9
2	183°13.3	176°22.4	07.4	74°14.9	02.8	112°48.8	47.9	191°41.1	43.8
3	198°15.7	191°24.5	·· 08.0	89°17.4	·· 02.8	127°51.1	·· 47.9	206°43.3	·· 43.7
4	213°18.2	206°26.5	08.7	104°19.9	02.7	142°53.4	47.9	221°45.4	43.5
5	228°20.7	221°28.6	09.4	119°22.4	02.6	157°55.7	47.9	236°47.6	43.4
6	243°23.1	236°30.6	N09°10.1	134°24.9	N26°02.5	172°58.0	N21°48.0	251°49.8	S05°43.3
7	258°25.6	251°32.7	10.7	149°27.4	02.5	188°00.3	48.0	266°52.0	43.2
8	273°28.1	266°34.7	11.4	164°29.9	02.4	203°02.6	48.0	281°54.2	43.1
9	288°30.5	281°36.8	·· 12.1	179°32.4	·· 02.3	218°04.9	·· 48.1	296°56.4	·· 42.9
10	303°33.0	296°38.9	12.7	194°34.9	02.3	233°07.2	48.1	311°58.6	42.8
11	318°35.5	311°40.9	13.4	209°37.4	02.2	248°09.5	48.1	327°00.7	42.7
12	333°37.9	326°43.0	N09°14.0	224°39.9	N26°02.1	263°11.8	N21°48.1	342°02.9	S05°42.6
13	348°40.4	341°45.1	14.7	239°42.4	02.0	278°14.1	48.2	357°05.1	42.5
14	3°42.9	356°47.1	15.3	254°44.9	02.0	293°16.4	48.2	12°07.3	42.3
15	18°45.3	11°49.2	·· 16.0	269°47.4	·· 01.9	308°18.7	·· 48.2	27°09.5	·· 42.2
16	33°47.8	26°51.3	16.7	284°49.8	01.8	323°21.0	48.3	42°11.7	42.1
17	48°50.2	41°53.4	17.3	299°52.3	01.8	338°23.3	48.3	57°13.9	42.0
18	63°52.7	56°55.5	N09°18.0	314°54.8	N26°01.7	353°25.6	N21°48.3	72°16.0	S05°41.9
19	78°55.2	71°57.6	18.6	329°57.3	01.6	8°27.9	48.3	87°18.2	41.8
20	93°57.6	86°59.7	19.3	344°59.8	01.5	23°30.2	48.4	102°20.4	41.6
21	109°00.1	102°01.8	·· 19.9	0°02.3	·· 01.5	38°32.5	·· 48.4	117°22.6	·· 41.5
22	124°02.6	117°03.9	20.5	15°04.8	01.4	53°34.8	48.4	132°24.8	41.4
23	139°05.0	132°06.0	21.2	30°07.2	01.3	68°37.1	48.5	147°27.0	41.3
Mer.pass. 13:45		ν 2.0′	d 0.7′	m -4.85	ν 2.5′	d 0.1′	m -0.44	ν 2.3′	d 0.0′ m -2.34	ν 2.2′	d 0.1′ m 1.12

Stars

	SHA	Dec
Alpheratz	357°35.0	29°13.7
Ankaa	353°07.4	-42°10.4
Schedar	349°31.4	56°40.6
Diphda	348°47.4	-17°51.1
Achernar	335°20.4	-57°06.8
Hamal	327°51.3	23°34.9
Polaris	314°07.0	89°22.5
Acamar	315°11.8	-40°12.5
Menkar	314°06.1	4°11.2
Mirfak	308°28.2	49°57.2
Aldebaran	290°39.4	16°33.6
Rigel	281°03.7	-8°10.5
Capella	280°21.6	46°01.5
Bellatrix	278°22.6	6°22.3
Elnath	278°01.6	28°37.8
Alnilam	275°37.5	-1°11.2
Betelgeuse	270°51.8	7°24.7
Canopus	263°52.0	-52°42.7
Sirius	258°25.9	-16°45.2
Adhara	255°05.5	-29°00.5
Procyon	244°50.5	5°09.6
Pollux	243°16.9	27°57.9
Avior	234°14.2	-59°35.5
Suhail	222°45.8	-43°32.1
Miaplacidus	221°37.4	-69°49.3
Alphard	217°47.3	-8°46.2
Regulus	207°34.0	11°50.5
Dubhe	193°40.2	61°36.8
Denebola	182°24.5	14°25.7
Gienah	175°43.2	-17°41.0
Acrux	172°59.5	-63°14.2
Gacrux	171°51.1	-57°15.2
Alioth	166°12.4	55°49.1
Spica	158°22.0	-11°17.6
Alkaid	152°51.6	49°10.9
Hadar	148°35.6	-60°29.5
Menkent	147°57.3	-36°29.6
Arcturus	145°47.6	19°02.8
Rigil Kent.	139°39.9	-60°56.2
Kochab	137°19.4	74°02.7
Zuben'ubi	136°55.8	-16°08.8
Alphecca	126°03.6	26°37.5
Antares	112°15.7	-26°29.3
Atria	107°10.0	-69°04.1
Sabik	102°02.8	-15°45.4
Shaula	96°10.4	-37°07.2
Rasalhague	95°58.6	12°32.3
Eltanin	90°42.4	51°28.8
Kaus Aust.	83°32.6	-34°22.3
Vega	80°33.4	38°48.1
Nunki	75°47.9	-26°15.9
Altair	62°00.1	8°55.9
Peacock	53°06.1	-56°39.2
Deneb	49°26.2	45°22.0
Enif	33°39.0	9°59.3
Al Na'ir	27°33.2	-46°50.4
Fomalhaut	15°14.7	-29°29.5
Scheat	13°45.5	28°13.1
Markab	13°30.1	15°20.3

Feb 21 Fri	SHA	Mer.pass
Venus	353°34.5	14:19
Mars	250°57.5	21:08
Jupiter	289°43.2	18:34
Saturn	8°41.7	13:19

Feb 22 Sat	SHA	Mer.pass
Venus	353°21.3	14:16
Mars	250°59.9	21:04
Jupiter	289°39.6	18:30
Saturn	8°35.0	13:15

Feb 23 Sun	SHA	Mer.pass
Venus	353°10.0	14:13
Mars	251°01.5	21:00
Jupiter	289°35.9	18:26
Saturn	8°28.3	13:12

Horizontal parallax	
Venus:	0.4
Mars:	0.2

DUT1 = UT1-UTC = +0.0459 sec ΔT = TT-UT1 = +69.1381 sec

2025 February 21 to Feb. 23 UT

h

	Sun		Moon				
Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°36.2	S10°32.9	268°26.5	10.5′	S26°01.3	6.5′	54.8′
1	191°36.2	32.0	282°56.1	10.4′	26°07.8	6.4′	54.8′
2	206°36.3	31.1	297°25.5	10.4′	26°14.2	6.2′	54.9′
3	221°36.4	·· 30.2	311°54.9	10.3′	26°20.4	6.2′	54.9′
4	236°36.5	29.2	326°24.1	10.2′	26°26.6	6.0′	54.9′
5	251°36.5	28.3	340°53.3	10.1′	26°32.6	5.9′	54.9′
6	266°36.6	S10°27.4	355°22.4	10.0′	S26°38.5	5.7′	54.9′
7	281°36.7	26.5	9°51.5	9.9′	26°44.2	5.7′	55.0′
8	296°36.8	25.6	24°20.4	9.9′	26°49.9	5.5′	55.0′
9	311°36.8	·· 24.7	38°49.2	9.8′	26°55.4	5.4′	55.0′
10	326°36.9	23.8	53°18.0	9.7′	27°00.8	5.2′	55.0′
11	341°37.0	22.9	67°46.7	9.6′	27°06.0	5.1′	55.1′
12	356°37.1	S10°22.0	82°15.3	9.5′	S27°11.1	5.0′	55.1′
13	11°37.1	21.1	96°43.8	9.4′	27°16.1	4.9′	55.1′
14	26°37.2	20.2	111°12.3	9.4′	27°21.0	4.7′	55.1′
15	41°37.3	·· 19.3	125°40.6	9.3′	27°25.7	4.6′	55.2′
16	56°37.4	18.4	140°08.9	9.2′	27°30.3	4.4′	55.2′
17	71°37.4	17.4	154°37.1	9.1′	27°34.7	4.4′	55.2′
18	86°37.5	S10°16.5	169°05.2	9.0′	S27°39.1	4.1′	55.2′
19	101°37.6	15.6	183°33.3	9.0′	27°43.2	4.1′	55.3′
20	116°37.7	14.7	198°01.2	8.9′	27°47.3	3.9′	55.3′
21	131°37.8	·· 13.8	212°29.1	8.8′	27°51.2	3.8′	55.3′
22	146°37.8	12.9	226°57.0	8.7′	27°55.0	3.6′	55.3′
23	161°37.9	12.0	241°24.7	8.7′	27°58.6	3.5′	55.4′
	SD = 16.2′	d = 0.9′	SD = 15.0′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°38.0	S10°11.1	255°52.4	8.6′	S28°02.1	3.3′	55.4′
1	191°38.1	10.2	270°20.0	8.5′	28°05.4	3.2′	55.4′
2	206°38.2	09.2	284°47.5	8.5′	28°08.6	3.0′	55.4′
3	221°38.2	·· 08.3	299°14.9	8.4′	28°11.6	2.9′	55.5′
4	236°38.3	07.4	313°42.3	8.3′	28°14.5	2.8′	55.5′
5	251°38.4	06.5	328°09.7	8.3′	28°17.3	2.6′	55.5′
6	266°38.5	S10°05.6	342°36.9	8.2′	S28°19.9	2.5′	55.6′
7	281°38.6	04.7	357°04.1	8.1′	28°22.4	2.3′	55.6′
8	296°38.6	03.8	11°31.2	8.1′	28°24.7	2.1′	55.6′
9	311°38.7	·· 02.9	25°58.3	8.0′	28°26.8	2.0′	55.6′
10	326°38.8	01.9	40°25.3	7.9′	28°28.8	1.9′	55.7′
11	341°38.9	01.0	54°52.2	7.9′	28°30.7	1.7′	55.7′
12	356°39.0	S10°00.1	69°19.1	7.8′	S28°32.4	1.6′	55.7′
13	11°39.0	09°59.2	83°45.9	7.8′	28°34.0	1.4′	55.8′
14	26°39.1	58.3	98°12.6	7.7′	28°35.4	1.2′	55.8′
15	41°39.2	·· 57.4	112°39.3	7.6′	28°36.6	1.1′	55.8′
16	56°39.3	56.5	127°06.0	7.6′	28°37.7	0.9′	55.9′
17	71°39.4	55.5	141°32.6	7.5′	28°38.6	0.8′	55.9′
18	86°39.5	S09°54.6	155°59.1	7.5′	S28°39.4	0.6′	55.9′
19	101°39.5	53.7	170°25.6	7.4′	28°40.0	0.5′	56.0′
20	116°39.6	52.8	184°52.0	7.4′	28°40.5	0.3′	56.0′
21	131°39.7	·· 51.9	199°18.4	7.3′	28°40.8	0.1′	56.0′
22	146°39.8	51.0	213°44.8	7.3′	28°40.9	0.0′	56.0′
23	161°39.9	50.0	228°11.1	7.3′	28°40.9	0.2′	56.1′
	SD = 16.2′	d = 0.9′	SD = 15.1′				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°40.0	S09°49.1	242°37.3	7.2′	S28°40.7	0.3′	56.1′
1	191°40.1	48.2	257°03.6	7.2′	28°40.4	0.5′	56.1′
2	206°40.1	47.3	271°29.7	7.1′	28°39.9	0.7′	56.2′
3	221°40.2	·· 46.4	285°55.9	7.1′	28°39.2	0.8′	56.2′
4	236°40.3	45.4	300°22.0	7.1′	28°38.4	1.0′	56.2′
5	251°40.4	44.5	314°48.0	7.0′	28°37.4	1.1′	56.3′
6	266°40.5	S09°43.6	329°14.1	7.0′	S28°36.3	1.3′	56.3′
7	281°40.6	42.7	343°40.1	7.0′	28°35.0	1.5′	56.3′
8	296°40.7	41.8	358°06.1	6.9′	28°33.5	1.7′	56.4′
9	311°40.7	·· 40.8	12°32.0	6.9′	28°31.8	1.8′	56.4′
10	326°40.8	39.9	26°57.9	6.9′	28°30.0	1.9′	56.4′
11	341°40.9	39.0	41°23.8	6.9′	28°28.1	2.2′	56.5′
12	356°41.0	S09°38.1	55°49.7	6.8′	S28°25.9	2.3′	56.5′
13	11°41.1	37.2	70°15.5	6.8′	28°23.6	2.5′	56.5′
14	26°41.2	36.2	84°41.4	6.8′	28°21.1	2.6′	56.6′
15	41°41.3	·· 35.3	99°07.2	6.8′	28°18.5	2.8′	56.6′
16	56°41.4	34.4	113°33.0	6.8′	28°15.7	3.0′	56.7′
17	71°41.5	33.5	127°58.7	6.8′	28°12.7	3.1′	56.7′
18	86°41.5	S09°32.5	142°24.5	6.8′	S28°09.6	3.3′	56.7′
19	101°41.6	31.6	156°50.2	6.7′	28°06.3	3.5′	56.8′
20	116°41.7	30.7	171°16.0	6.7′	28°02.8	3.7′	56.8′
21	131°41.8	·· 29.8	185°41.7	6.7′	27°59.1	3.8′	56.8′
22	146°41.9	28.9	200°07.5	6.7′	27°55.3	4.0′	56.9′
23	161°42.0	27.9	214°33.2	6.7′	27°51.3	4.1′	56.9′
	SD = 16.2′	d = 0.9′	SD = 15.3′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	05:42	07:00	08:13	16:16	17:28	18:47
N 70°	05:44	06:54	07:59	16:29	17:34	18:45
68°	05:45	06:49	07:48	16:41	17:39	18:44
66°	05:46	06:45	07:38	16:50	17:43	18:43
64°	05:47	06:42	07:31	16:57	17:47	18:42
62°	05:47	06:38	07:24	17:04	17:50	18:41
60°	05:47	06:35	07:18	17:10	17:53	18:41
N 58°	05:47	06:33	07:13	17:15	17:55	18:41
56°	05:47	06:30	07:08	17:19	17:57	18:41
54°	05:47	06:28	07:04	17:24	18:00	18:41
52°	05:47	06:26	07:00	17:27	18:02	18:41
50°	05:47	06:24	06:57	17:31	18:03	18:41
45°	05:46	06:20	06:50	17:38	18:08	18:42
N 40°	05:44	06:16	06:43	17:44	18:12	18:43
35°	05:43	06:12	06:38	17:49	18:15	18:44
30°	05:41	06:09	06:33	17:54	18:18	18:46
20°	05:37	06:02	06:25	18:02	18:25	18:50
N 10°	05:31	05:56	06:17	18:10	18:31	18:56
0°	05:25	05:49	06:10	18:17	18:38	19:02
S 10°	05:17	05:41	06:03	18:24	18:45	19:10
20°	05:06	05:32	05:55	18:32	18:54	19:20
30°	04:52	05:21	05:46	18:40	19:05	19:34
35°	04:43	05:14	05:41	18:46	19:12	19:43
40°	04:33	05:06	05:35	18:51	19:20	19:53
45°	04:19	04:57	05:28	18:58	19:29	20:06
S 50°	04:02	04:45	05:19	19:07	19:41	20:23
52°	03:54	04:39	05:15	19:11	19:46	20:31
54°	03:45	04:33	05:11	19:15	19:53	20:40
56°	03:34	04:25	05:06	19:20	20:00	20:51
58°	03:21	04:17	05:00	19:25	20:08	21:04
S 60°	03:05	04:08	04:54	19:31	20:17	21:19

Lat.	**Moonrise** Fri	Sat	Sun	**Moonset** Fri	Sat	Sun
N 72°	▬	▬	▬	▬	▬	▬
N 70°	▬	▬	▬	▬	▬	▬
68°	▬	▬	▬	▬	▬	▬
66°	▬	▬	▬	▬	▬	▬
64°	▬	▬	▬	▬	▬	▬
62°	04:59	▬	▬	07:32	▬	▬
60°	04:15	05:48	06:51	08:16	08:34	09:27
N 58°	03:46	05:07	06:08	08:46	09:14	10:09
56°	03:24	04:40	05:40	09:08	09:42	10:38
54°	03:05	04:18	05:18	09:27	10:04	11:00
52°	02:50	04:00	04:59	09:43	10:22	11:18
50°	02:37	03:45	04:44	09:56	10:37	11:34
45°	02:10	03:14	04:12	10:24	11:08	12:05
N 40°	01:48	02:50	03:48	10:46	11:32	12:29
35°	01:30	02:31	03:28	11:04	11:52	12:49
30°	01:15	02:14	03:11	11:20	12:09	13:06
20°	00:49	01:46	02:42	11:47	12:38	13:34
N 10°	00:27	01:22	02:17	12:10	13:02	13:59
0°	00:07	00:59	01:54	12:32	13:25	14:22
S 10°	·· ··	00:37	01:31	12:53	13:48	14:44
20°	·· ··	00:13	01:07	13:16	14:13	15:08
30°	23:45	·· ··	00:38	13:43	14:41	15:37
35°	23:29	·· ··	00:21	13:59	14:58	15:53
40°	23:09	·· ··	00:01	14:18	15:18	16:13
45°	22:46	23:37	·· ··	14:41	15:42	16:36
S 50°	22:17	23:06	·· ··	15:10	16:13	17:06
52°	22:03	22:50	23:55	15:24	16:29	17:21
54°	21:46	22:32	23:38	15:40	16:47	17:38
56°	21:26	22:10	23:18	16:00	17:09	17:59
58°	21:01	21:42	22:52	16:25	17:37	18:25
S 60°	20:27	21:01	22:17	16:58	18:19	19:00

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 23-25 48-28%
21	13:35	13:32	12:14	06:19	18:45	
22	13:28	13:24	12:13	07:12	19:40	
23	13:20	13:16	12:13	08:08	20:36	

February 24, 25, 26 UT (Mon., Tue., Wed.)

	Aries	Venus		Mars		Jupiter		Saturn	
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	154°07.5	147°08.1	N09°21.8	45°09.7	N26°01.2	83°39.4	N21°48.5	162°29.2	S05°41.2
1	169°10.0	162°10.2	22.5	60°12.2	01.2	98°41.7	48.5	177°31.3	41.0
2	184°12.4	177°12.3	23.1	75°14.7	01.1	113°44.0	48.6	192°33.5	40.9
3	199°14.9	192°14.4	·· 23.7	90°17.1	·· 01.0	128°46.3	·· 48.6	207°35.7	·· 40.8
4	214°17.4	207°16.6	24.4	105°19.6	00.9	143°48.6	48.6	222°37.9	40.7
5	229°19.8	222°18.7	25.0	120°22.1	00.9	158°50.9	48.6	237°40.1	40.6
6	244°22.3	237°20.8	N09°25.6	135°24.6	N26°00.8	173°53.1	N21°48.7	252°42.3	S05°40.4
7	259°24.7	252°23.0	26.3	150°27.0	00.7	188°55.4	48.7	267°44.5	40.3
8	274°27.2	267°25.1	26.9	165°29.5	00.6	203°57.7	48.7	282°46.6	40.2
9	289°29.7	282°27.2	·· 27.5	180°32.0	·· 00.6	219°00.0	·· 48.8	297°48.8	·· 40.1
10	304°32.1	297°29.4	28.2	195°34.4	00.5	234°02.3	48.8	312°51.0	40.0
11	319°34.6	312°31.5	28.8	210°36.9	00.4	249°04.6	48.8	327°53.2	39.8
12	334°37.1	327°33.7	N09°29.4	225°39.3	N26°00.3	264°06.9	N21°48.8	342°55.4	S05°39.7
13	349°39.5	342°35.8	30.0	240°41.8	00.3	279°09.2	48.9	357°57.6	39.6
14	4°42.0	357°38.0	30.6	255°44.3	00.2	294°11.5	48.9	12°59.7	39.5
15	19°44.5	12°40.1	·· 31.3	270°46.7	·· 00.1	309°13.8	·· 48.9	28°01.9	·· 39.4
16	34°46.9	27°42.3	31.9	285°49.2	00.0	324°16.1	49.0	43°04.1	39.2
17	49°49.4	42°44.5	32.5	300°51.6	26°00.0	339°18.3	49.0	58°06.3	39.1
18	64°51.8	57°46.7	N09°33.1	315°54.1	N25°59.9	354°20.6	N21°49.0	73°08.5	S05°39.0
19	79°54.3	72°48.8	33.7	330°56.5	59.8	9°22.9	49.1	88°10.7	38.9
20	94°56.8	87°51.0	34.3	345°59.0	59.7	24°25.2	49.1	103°12.9	38.8
21	109°59.2	102°53.2	·· 34.9	1°01.4	·· 59.7	39°27.5	·· 49.1	118°15.0	·· 38.7
22	125°01.7	117°55.4	35.5	16°03.9	59.6	54°29.8	49.2	133°17.2	38.5
23	140°04.2	132°57.6	36.1	31°06.3	59.5	69°32.1	49.2	148°19.4	38.4
Mer.pass. 13:41		ν 2.1′	d 0.6′	m -4.84	ν 2.5′	d 0.1′	m -0.42	ν 2.3′	d 0.0′ m -2.34	ν 2.2′	d 0.1′ m 1.12

Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	155°06.6	147°59.8	N09°36.8	46°08.8	N25°59.4	84°34.4	N21°49.2	163°21.6	S05°38.3
1	170°09.1	163°01.9	37.4	61°11.2	59.3	99°36.6	49.2	178°23.8	38.2
2	185°11.6	178°04.1	38.0	76°13.7	59.3	114°38.9	49.3	193°26.0	38.1
3	200°14.0	193°06.3	·· 38.6	91°16.1	·· 59.2	129°41.2	·· 49.3	208°28.1	·· 37.9
4	215°16.5	208°08.6	39.1	106°18.5	59.1	144°43.5	49.3	223°30.3	37.8
5	230°19.0	223°10.8	39.7	121°21.0	59.0	159°45.8	49.4	238°32.5	37.7
6	245°21.4	238°13.0	N09°40.3	136°23.4	N25°58.9	174°48.1	N21°49.4	253°34.7	S05°37.6
7	260°23.9	253°15.2	40.9	151°25.8	58.9	189°50.4	49.4	268°36.9	37.5
8	275°26.3	268°17.4	41.5	166°28.3	58.8	204°52.6	49.5	283°39.1	37.3
9	290°28.8	283°19.6	·· 42.1	181°30.7	·· 58.7	219°54.9	·· 49.5	298°41.2	·· 37.2
10	305°31.3	298°21.9	42.7	196°33.1	58.6	234°57.2	49.5	313°43.4	37.1
11	320°33.7	313°24.1	43.3	211°35.6	58.6	249°59.5	49.5	328°45.6	37.0
12	335°36.2	328°26.3	N09°43.9	226°38.0	N25°58.5	265°01.8	N21°49.6	343°47.8	S05°36.9
13	350°38.7	343°28.6	44.4	241°40.4	58.4	280°04.1	49.6	358°50.0	36.7
14	5°41.1	358°30.8	45.0	256°42.9	58.3	295°06.3	49.6	13°52.2	36.6
15	20°43.6	13°33.0	·· 45.6	271°45.3	·· 58.2	310°08.6	·· 49.7	28°54.4	·· 36.5
16	35°46.1	28°35.3	46.2	286°47.7	58.1	325°10.9	49.7	43°56.5	36.4
17	50°48.5	43°37.5	46.8	301°50.1	58.1	340°13.2	49.7	58°58.7	36.3
18	65°51.0	58°39.8	N09°47.3	316°52.5	N25°58.0	355°15.5	N21°49.8	74°00.9	S05°36.1
19	80°53.5	73°42.1	47.9	331°55.0	57.9	10°17.7	49.8	89°03.1	36.0
20	95°55.9	88°44.3	48.5	346°57.4	57.8	25°20.0	49.8	104°05.3	35.9
21	110°58.4	103°46.6	·· 49.0	1°59.8	·· 57.7	40°22.3	·· 49.9	119°07.5	·· 35.8
22	126°00.8	118°48.9	49.6	17°02.2	57.7	55°24.6	49.9	134°09.6	35.7
23	141°03.3	133°51.1	50.2	32°04.6	57.6	70°26.9	49.9	149°11.8	35.5
Mer.pass. 13:37		ν 2.2′	d 0.6′	m -4.83	ν 2.4′	d 0.1′	m -0.39	ν 2.3′	d 0.0′ m -2.33	ν 2.2′	d 0.1′ m 1.11

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	156°05.8	148°53.4	N09°50.7	47°07.0	N25°57.5	85°29.1	N21°50.0	164°14.0	S05°35.4
1	171°08.2	163°55.7	51.3	62°09.4	57.4	100°31.4	50.0	179°16.2	35.3
2	186°10.7	178°58.0	51.9	77°11.8	57.3	115°33.7	50.0	194°18.4	35.2
3	201°13.2	194°00.3	·· 52.4	92°14.2	·· 57.2	130°36.0	·· 50.0	209°20.6	·· 35.1
4	216°15.6	209°02.5	53.0	107°16.7	57.2	145°38.2	50.1	224°22.7	34.9
5	231°18.1	224°04.8	53.5	122°19.1	57.1	160°40.5	50.1	239°24.9	34.8
6	246°20.6	239°07.1	N09°54.1	137°21.5	N25°57.0	175°42.8	N21°50.1	254°27.1	S05°34.7
7	261°23.0	254°09.4	54.6	152°23.9	56.9	190°45.1	50.2	269°29.3	34.6
8	276°25.5	269°11.7	55.2	167°26.3	56.8	205°47.3	50.2	284°31.5	34.5
9	291°28.0	284°14.1	·· 55.7	182°28.7	·· 56.7	220°49.6	·· 50.2	299°33.7	·· 34.3
10	306°30.4	299°16.4	56.3	197°31.1	56.7	235°51.9	50.3	314°35.8	34.2
11	321°32.9	314°18.7	56.8	212°33.5	56.6	250°54.2	50.3	329°38.0	34.1
12	336°35.3	329°21.0	N09°57.4	227°35.8	N25°56.5	265°56.4	N21°50.3	344°40.2	S05°34.0
13	351°37.8	344°23.3	57.9	242°38.2	56.4	280°58.7	50.4	359°42.4	33.9
14	6°40.3	359°25.6	58.5	257°40.6	56.3	296°01.0	50.4	14°44.6	33.7
15	21°42.7	14°28.0	·· 59.0	272°43.0	·· 56.2	311°03.3	·· 50.4	29°46.8	·· 33.6
16	36°45.2	29°30.3	09°59.5	287°45.4	56.2	326°05.5	50.5	44°48.9	33.5
17	51°47.7	44°32.6	10°00.1	302°47.8	56.1	341°07.8	50.5	59°51.1	33.4
18	66°50.1	59°35.0	N10°00.6	317°50.2	N25°56.0	356°10.1	N21°50.5	74°53.3	S05°33.3
19	81°52.6	74°37.3	01.1	332°52.6	55.9	11°12.4	50.6	89°55.5	33.1
20	96°55.1	89°39.7	01.7	347°55.0	55.8	26°14.6	50.6	104°57.7	33.0
21	111°57.5	104°42.0	·· 02.2	2°57.3	·· 55.7	41°16.9	·· 50.6	119°59.9	·· 32.9
22	127°00.0	119°44.4	02.7	17°59.7	55.6	56°19.2	50.6	135°02.0	32.8
23	142°02.4	134°46.7	03.2	33°02.1	55.6	71°21.4	50.7	150°04.2	32.7
Mer.pass. 13:33		ν 2.3′	d 0.6′	m -4.82	ν 2.4′	d 0.1′	m -0.36	ν 2.3′	d 0.0′ m -2.32	ν 2.2′	d 0.1′ m 1.11

Stars

	SHA	Dec
Alpheratz	357°35.0	29°13.7
Ankaa	353°07.4	-42°10.3
Schedar	349°31.4	56°40.6
Diphda	348°47.4	-17°51.1
Achernar	335°20.4	-57°06.8
Hamal	327°51.3	23°34.9
Polaris	314°08.3	89°22.5
Acamar	315°11.8	-40°12.5
Menkar	314°06.1	4°11.2
Mirfak	308°28.2	49°57.2
Aldebaran	290°39.5	16°33.6
Rigel	281°03.7	-8°10.5
Capella	280°21.6	46°01.5
Bellatrix	278°22.7	6°22.3
Elnath	278°01.6	28°37.8
Alnilam	275°37.5	-1°11.2
Betelgeuse	270°51.8	7°24.7
Canopus	263°52.1	-52°42.8
Sirius	258°25.9	-16°45.2
Adhara	255°05.5	-29°00.5
Procyon	244°50.5	5°09.5
Pollux	243°16.9	27°57.9
Avior	234°14.2	-59°35.5
Suhail	222°45.8	-43°32.2
Miaplacidus	221°37.4	-69°49.3
Alphard	217°47.3	-8°46.2
Regulus	207°34.0	11°50.5
Dubhe	193°40.2	61°36.8
Denebola	182°24.5	14°25.7
Gienah	175°43.2	-17°41.0
Acrux	172°59.4	-63°14.2
Gacrux	171°51.1	-57°15.2
Alioth	166°12.4	55°49.1
Spica	158°22.0	-11°17.7
Alkaid	152°51.6	49°10.9
Hadar	148°35.5	-60°29.5
Menkent	147°57.3	-36°29.6
Arcturus	145°47.6	19°02.8
Rigil Kent.	139°39.9	-60°56.2
Kochab	137°19.3	74°02.7
Zuben'ubi	136°55.8	-16°08.8
Alphecca	126°03.6	26°37.5
Antares	112°15.7	-26°29.3
Atria	107°10.0	-69°04.1
Sabik	102°02.7	-15°45.4
Shaula	96°10.3	-37°07.3
Rasalhague	95°58.5	12°32.3
Eltanin	90°42.3	51°28.7
Kaus Aust.	83°32.6	-34°22.3
Vega	80°33.4	38°48.1
Nunki	75°47.8	-26°15.9
Altair	62°00.1	8°55.9
Peacock	53°06.0	-56°39.2
Deneb	49°26.2	45°22.0
Enif	33°39.0	9°59.3
Al Na'ir	27°33.2	-46°50.4
Fomalhaut	15°14.7	-29°29.5
Scheat	13°45.5	28°13.1
Markab	13°30.1	15°20.3

Feb 24 Mon	SHA	Mer.pass
Venus	353°00.6	14:09
Mars	251°02.2	20:56
Jupiter	289°31.9	18:23
Saturn	8°21.7	13:08

Feb 25 Tue	SHA	Mer.pass
Venus	352°53.1	14:06
Mars	251°02.1	20:52
Jupiter	289°27.7	18:19
Saturn	8°15.0	13:05

Feb 26 Wed	SHA	Mer.pass
Venus	352°47.6	14:02
Mars	251°01.2	20:48
Jupiter	289°23.4	18:15
Saturn	8°08.2	13:01

Horizontal parallax	
Venus:	0.4
Mars:	0.2

h	Sun		Moon				
Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°42.1	S09°27.0	228°58.9	6.7′	S27°47.2	4.3′	56.9′
1	191°42.2	26.1	243°24.6	6.7′	27°42.9	4.5′	57.0′
2	206°42.3	25.2	257°50.3	6.7′	27°38.4	4.7′	57.0′
3	221°42.4	·· 24.2	272°16.0	6.7′	27°33.7	4.8′	57.0′
4	236°42.5	23.3	286°41.8	6.7′	27°28.9	5.0′	57.1′
5	251°42.6	22.4	301°07.5	6.7′	27°23.9	5.1′	57.1′
6	266°42.6	S09°21.5	315°33.2	6.7′	S27°18.8	5.3′	57.2′
7	281°42.7	20.5	329°59.0	6.8′	27°13.5	5.5′	57.2′
8	296°42.8	19.6	344°24.7	6.8′	27°08.0	5.7′	57.2′
9	311°42.9	·· 18.7	358°50.5	6.8′	27°02.3	5.8′	57.3′
10	326°43.0	17.8	13°16.2	6.8′	26°56.5	6.0′	57.3′
11	341°43.1	16.8	27°42.0	6.8′	26°50.5	6.2′	57.3′
12	356°43.2	S09°15.9	42°07.8	6.8′	S26°44.3	6.3′	57.4′
13	11°43.3	15.0	56°33.7	6.8′	26°38.0	6.5′	57.4′
14	26°43.4	14.0	70°59.5	6.9′	26°31.5	6.6′	57.4′
15	41°43.5	·· 13.1	85°25.4	6.9′	26°24.9	6.8′	57.5′
16	56°43.6	12.2	99°51.2	6.9′	26°18.1	7.0′	57.5′
17	71°43.7	11.3	114°17.1	6.9′	26°11.1	7.1′	57.6′
18	86°43.8	S09°10.3	128°43.1	7.0′	S26°04.0	7.3′	57.6′
19	101°43.9	09.4	143°09.0	7.0′	25°56.7	7.5′	57.6′
20	116°44.0	08.5	157°35.0	7.0′	25°49.2	7.6′	57.7′
21	131°44.1	·· 07.5	172°01.0	7.0′	25°41.6	7.8′	57.7′
22	146°44.2	06.6	186°27.0	7.1′	25°33.8	8.0′	57.7′
23	161°44.3	05.7	200°53.1	7.1′	25°25.8	8.1′	57.8′
	SD = 16.2′	d = 0.9′	SD = 15.5′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°44.4	S09°04.8	215°19.2	7.1′	S25°17.7	8.3′	57.8′
1	191°44.5	03.8	229°45.3	7.2′	25°09.4	8.4′	57.9′
2	206°44.6	02.9	244°11.5	7.2′	25°01.0	8.6′	57.9′
3	221°44.7	·· 02.0	258°37.7	7.2′	24°52.4	8.7′	57.9′
4	236°44.8	01.0	273°03.9	7.3′	24°43.7	8.9′	58.0′
5	251°44.9	09°00.1	287°30.2	7.3′	24°34.8	9.1′	58.0′
6	266°45.0	S08°59.2	301°56.5	7.3′	S24°25.7	9.2′	58.0′
7	281°45.0	58.2	316°22.9	7.4′	24°16.5	9.4′	58.1′
8	296°45.1	57.3	330°49.3	7.4′	24°07.1	9.5′	58.1′
9	311°45.2	·· 56.4	345°15.7	7.5′	23°57.6	9.7′	58.1′
10	326°45.3	55.4	359°42.2	7.5′	23°47.9	9.8′	58.2′
11	341°45.4	54.5	14°08.7	7.6′	23°38.1	10.0′	58.2′
12	356°45.5	S08°53.6	28°35.2	7.6′	S23°28.1	10.1′	58.3′
13	11°45.6	52.6	43°01.8	7.6′	23°18.0	10.3′	58.3′
14	26°45.7	51.7	57°28.5	7.7′	23°07.7	10.4′	58.3′
15	41°45.9	·· 50.8	71°55.2	7.7′	22°57.3	10.6′	58.4′
16	56°46.0	49.8	86°21.9	7.8′	22°46.7	10.7′	58.4′
17	71°46.1	48.9	100°48.7	7.8′	22°36.0	10.9′	58.4′
18	86°46.2	S08°48.0	115°15.5	7.9′	S22°25.1	11.0′	58.5′
19	101°46.3	47.0	129°42.4	7.9′	22°14.1	11.2′	58.5′
20	116°46.4	46.1	144°09.3	8.0′	22°02.9	11.3′	58.5′
21	131°46.5	·· 45.2	158°36.3	8.0′	21°51.6	11.4′	58.6′
22	146°46.6	44.2	173°03.3	8.1′	21°40.2	11.6′	58.6′
23	161°46.7	43.3	187°30.4	8.1′	21°28.6	11.7′	58.6′
	SD = 16.2′	d = 0.9′	SD = 15.8′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°46.8	S08°42.4	201°57.6	8.2′	S21°16.9	11.8′	58.7′
1	191°46.9	41.4	216°24.7	8.2′	21°05.1	12.0′	58.7′
2	206°47.0	40.5	230°52.0	8.3′	20°53.1	12.2′	58.7′
3	221°47.1	·· 39.6	245°19.2	8.3′	20°40.9	12.2′	58.8′
4	236°47.2	38.6	259°46.6	8.4′	20°28.7	12.4′	58.8′
5	251°47.3	37.7	274°14.0	8.4′	20°16.3	12.5′	58.8′
6	266°47.4	S08°36.7	288°41.4	8.5′	S20°03.8	12.7′	58.9′
7	281°47.5	35.8	303°08.9	8.5′	19°51.1	12.8′	58.9′
8	296°47.6	34.9	317°36.4	8.6′	19°38.3	12.9′	58.9′
9	311°47.7	·· 33.9	332°04.0	8.6′	19°25.4	13.0′	59.0′
10	326°47.8	33.0	346°31.6	8.7′	19°12.4	13.2′	59.0′
11	341°47.9	32.1	0°59.3	8.7′	18°59.2	13.2′	59.0′
12	356°48.0	S08°31.1	15°27.1	8.8′	S18°46.0	13.4′	59.1′
13	11°48.1	30.2	29°54.9	8.9′	18°32.6	13.6′	59.1′
14	26°48.2	29.2	44°22.7	8.9′	18°19.0	13.6′	59.1′
15	41°48.3	·· 28.3	58°50.6	9.0′	18°05.4	13.8′	59.2′
16	56°48.5	27.4	73°18.6	9.0′	17°51.6	13.8′	59.2′
17	71°48.6	26.4	87°46.6	9.1′	17°37.8	14.0′	59.2′
18	86°48.7	S08°25.5	102°14.7	9.1′	S17°23.8	14.1′	59.3′
19	101°48.8	24.5	116°42.8	9.2′	17°09.7	14.3′	59.3′
20	116°48.9	23.6	131°10.9	9.2′	16°55.4	14.3′	59.3′
21	131°49.0	·· 22.7	145°39.1	9.3′	16°41.1	14.4′	59.4′
22	146°49.1	21.7	160°07.4	9.3′	16°26.7	14.6′	59.4′
23	161°49.2	20.8	174°35.7	9.4′	16°12.1	14.6′	59.4′
	SD = 16.1′	d = 0.9′	SD = 16.0′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	05:28	06:46	07:57	16:31	17:42	19:00
N 70°	05:31	06:42	07:45	16:43	17:46	18:57
68°	05:34	06:38	07:35	16:52	17:50	18:54
66°	05:36	06:35	07:27	17:00	17:53	18:52
64°	05:37	06:32	07:20	17:07	17:55	18:50
62°	05:38	06:29	07:15	17:13	17:58	18:49
60°	05:39	06:27	07:09	17:18	18:00	18:48
N 58°	05:40	06:25	07:05	17:22	18:02	18:47
56°	05:40	06:23	07:01	17:26	18:04	18:47
54°	05:41	06:22	06:57	17:30	18:05	18:46
52°	05:41	06:20	06:54	17:33	18:07	18:46
50°	05:41	06:18	06:51	17:36	18:08	18:46
45°	05:41	06:15	06:45	17:42	18:12	18:46
N 40°	05:40	06:12	06:39	17:47	18:15	18:46
35°	05:39	06:09	06:34	17:52	18:18	18:47
30°	05:38	06:06	06:30	17:56	18:20	18:48
20°	05:35	06:00	06:23	18:04	18:26	18:52
N 10°	05:30	05:55	06:16	18:10	18:31	18:56
0°	05:24	05:49	06:10	18:16	18:37	19:01
S 10°	05:17	05:42	06:03	18:23	18:44	19:09
20°	05:08	05:34	05:56	18:29	18:52	19:18
30°	04:55	05:24	05:48	18:37	19:02	19:30
35°	04:47	05:17	05:43	18:42	19:08	19:39
40°	04:37	05:10	05:38	18:47	19:15	19:48
45°	04:24	05:01	05:32	18:53	19:24	20:00
S 50°	04:09	04:50	05:24	19:01	19:34	20:16
52°	04:01	04:45	05:21	19:04	19:40	20:23
54°	03:52	04:39	05:17	19:08	19:45	20:32
56°	03:42	04:33	05:12	19:12	19:52	20:42
58°	03:30	04:25	05:08	19:17	19:59	20:53
S 60°	03:17	04:17	05:02	19:22	20:07	21:07

Lat.	**Moonrise** Mon	Tue	Wed	**Moonset** Mon	Tue	Wed
N 72°	▬	▬	▬	▬	▬	▬
N 70°	▬	▬	09:54	▬	▬	12:20
68°	▬	▬	08:58	▬	▬	13:14
66°	▬	09:48	08:25	▬	10:29	13:47
64°	▬	08:26	08:00	▬	11:50	14:10
62°	08:05	07:49	07:40	10:12	12:27	14:29
60°	07:15	07:22	07:24	11:02	12:53	14:44
N 58°	06:43	07:01	07:10	11:33	13:13	14:57
56°	06:20	06:44	06:58	11:56	13:30	15:08
54°	06:00	06:29	06:48	12:15	13:44	15:18
52°	05:44	06:16	06:38	12:31	13:56	15:26
50°	05:30	06:05	06:30	12:45	14:07	15:34
45°	05:01	05:41	06:12	13:13	14:30	15:50
N 40°	04:39	05:22	05:57	13:35	14:48	16:03
35°	04:20	05:06	05:45	13:53	15:03	16:14
30°	04:04	04:52	05:34	14:09	15:16	16:24
20°	03:37	04:28	05:15	14:35	15:38	16:41
N 10°	03:13	04:07	04:59	14:58	15:57	16:55
0°	02:51	03:48	04:43	15:18	16:14	17:09
S 10°	02:29	03:28	04:28	15:39	16:32	17:22
20°	02:06	03:08	04:11	16:01	16:51	17:36
30°	01:38	02:43	03:51	16:27	17:12	17:52
35°	01:22	02:29	03:40	16:42	17:24	18:01
40°	01:03	02:12	03:27	16:59	17:39	18:11
45°	00:40	01:53	03:12	17:20	17:55	18:24
S 50°	00:10	01:27	02:52	17:46	18:16	18:38
52°	·· ··	01:15	02:43	17:59	18:26	18:45
54°	·· ··	01:01	02:33	18:13	18:37	18:52
56°	·· ··	00:45	02:21	18:30	18:49	19:01
58°	·· ··	00:25	02:08	18:50	19:03	19:10
S 60°	·· ··	00:01	01:52	19:15	19:20	19:21

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 26-28 20-6%
24	13:12	13:07	12:13	09:05	21:33	
25	13:03	12:58	12:13	10:01	22:29	
26	12:53	12:48	12:13	10:56	23:22	

February 27, 28, 01 UT (Thu., Fri., Sat.)

	Aries	Venus		Mars		Jupiter		Saturn	
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	157°04.9	149°49.1	N10°03.8	48°04.5	N25°55.5	86°23.7	N21°50.7	165°06.4	S05°32.5
1	172°07.4	164°51.5	04.3	63°06.8	55.4	101°26.0	50.7	180°08.6	32.4
2	187°09.8	179°53.8	04.8	78°09.2	55.3	116°28.3	50.8	195°10.8	32.3
3	202°12.3	194°56.2	·· 05.3	93°11.6	·· 55.2	131°30.5	·· 50.8	210°13.0	·· 32.2
4	217°14.8	209°58.6	05.8	108°14.0	55.1	146°32.8	50.8	225°15.1	32.1
5	232°17.2	225°01.0	06.3	123°16.3	55.0	161°35.1	50.9	240°17.3	31.9
6	247°19.7	240°03.3	N10°06.9	138°18.7	N25°55.0	176°37.3	N21°50.9	255°19.5	S05°31.8
7	262°22.2	255°05.7	07.4	153°21.1	54.9	191°39.6	50.9	270°21.7	31.7
8	277°24.6	270°08.1	07.9	168°23.4	54.8	206°41.9	51.0	285°23.9	31.6
9	292°27.1	285°10.5	·· 08.4	183°25.8	·· 54.7	221°44.1	·· 51.0	300°26.1	·· 31.5
10	307°29.6	300°12.9	08.9	198°28.2	54.6	236°46.4	51.0	315°28.2	31.3
11	322°32.0	315°15.3	09.4	213°30.5	54.5	251°48.7	51.1	330°30.4	31.2
12	337°34.5	330°17.7	N10°09.9	228°32.9	N25°54.4	266°50.9	N21°51.1	345°32.6	S05°31.1
13	352°36.9	345°20.1	10.4	243°35.3	54.3	281°53.2	51.1	0°34.8	31.0
14	7°39.4	0°22.6	10.9	258°37.6	54.2	296°55.5	51.2	15°37.0	30.9
15	22°41.9	15°25.0	·· 11.4	273°40.0	·· 54.2	311°57.7	·· 51.2	30°39.2	·· 30.7
16	37°44.3	30°27.4	11.9	288°42.3	54.1	327°00.0	51.2	45°41.3	30.6
17	52°46.8	45°29.8	12.4	303°44.7	54.0	342°02.3	51.3	60°43.5	30.5
18	67°49.3	60°32.2	N10°12.9	318°47.0	N25°53.9	357°04.5	N21°51.3	75°45.7	S05°30.4
19	82°51.7	75°34.7	13.3	333°49.4	53.8	12°06.8	51.3	90°47.9	30.3
20	97°54.2	90°37.1	13.8	348°51.7	53.7	27°09.0	51.4	105°50.1	30.1
21	112°56.7	105°39.5	·· 14.3	3°54.1	·· 53.6	42°11.3	·· 51.4	120°52.2	·· 30.0
22	127°59.1	120°42.0	14.8	18°56.4	53.5	57°13.6	51.4	135°54.4	29.9
23	143°01.6	135°44.4	15.3	33°58.8	53.4	72°15.8	51.5	150°56.6	29.8
Mer.pass. 13:29		ν 2.4′	d 0.5′	ν 2.4′	d 0.1′	ν 2.3′	d 0.0′	ν 2.2′	d 0.1′
		m -4.81		m -0.33		m -2.31		m 1.11	

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	158°04.1	150°46.9	N10°15.8	49°01.1	N25°53.3	87°18.1	N21°51.5	165°58.8	S05°29.7
1	173°06.5	165°49.3	16.2	64°03.5	53.3	102°20.4	51.5	181°01.0	29.5
2	188°09.0	180°51.8	16.7	79°05.8	53.2	117°22.6	51.6	196°03.2	29.4
3	203°11.4	195°54.3	·· 17.2	94°08.2	·· 53.1	132°24.9	·· 51.6	211°05.3	·· 29.3
4	218°13.9	210°56.7	17.7	109°10.5	53.0	147°27.1	51.6	226°07.5	29.2
5	233°16.4	225°59.2	18.1	124°12.8	52.9	162°29.4	51.7	241°09.7	29.1
6	248°18.8	241°01.7	N10°18.6	139°15.2	N25°52.8	177°31.7	N21°51.7	256°11.9	S05°28.9
7	263°21.3	256°04.1	19.1	154°17.5	52.7	192°33.9	51.7	271°14.1	28.8
8	278°23.8	271°06.6	19.5	169°19.8	52.6	207°36.2	51.8	286°16.3	28.7
9	293°26.2	286°09.1	·· 20.0	184°22.2	·· 52.5	222°38.4	·· 51.8	301°18.4	·· 28.6
10	308°28.7	301°11.6	20.4	199°24.5	52.4	237°40.7	51.8	316°20.6	28.5
11	323°31.2	316°14.1	20.9	214°26.8	52.3	252°43.0	51.9	331°22.8	28.3
12	338°33.6	331°16.6	N10°21.4	229°29.2	N25°52.3	267°45.2	N21°51.9	346°25.0	S05°28.2
13	353°36.1	346°19.1	21.8	244°31.5	52.2	282°47.5	51.9	1°27.2	28.1
14	8°38.5	1°21.6	22.3	259°33.8	52.1	297°49.7	52.0	16°29.3	28.0
15	23°41.0	16°24.1	·· 22.7	274°36.1	·· 52.0	312°52.0	·· 52.0	31°31.5	·· 27.9
16	38°43.5	31°26.6	23.2	289°38.5	51.9	327°54.2	52.0	46°33.7	27.7
17	53°45.9	46°29.1	23.6	304°40.8	51.8	342°56.5	52.1	61°35.9	27.6
18	68°48.4	61°31.6	N10°24.1	319°43.1	N25°51.7	357°58.8	N21°52.1	76°38.1	S05°27.5
19	83°50.9	76°34.1	24.5	334°45.4	51.6	13°01.0	52.1	91°40.3	27.4
20	98°53.3	91°36.6	24.9	349°47.7	51.5	28°03.3	52.2	106°42.4	27.3
21	113°55.8	106°39.2	·· 25.4	4°50.1	·· 51.4	43°05.5	·· 52.2	121°44.6	·· 27.1
22	128°58.3	121°41.7	25.8	19°52.4	51.3	58°07.8	52.2	136°46.8	27.0
23	144°00.7	136°44.2	26.3	34°54.7	51.2	73°10.0	52.3	151°49.0	26.9
Mer.pass. 13:26		ν 2.5′	d 0.5′	ν 2.3′	d 0.1′	ν 2.3′	d 0.0′	ν 2.2′	d 0.1′
		m -4.80		m -0.31		m -2.31		m 1.11	

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	159°03.2	151°46.8	N10°26.7	49°57.0	N25°51.1	88°12.3	N21°52.3	166°51.2	S05°26.8
1	174°05.7	166°49.3	27.1	64°59.3	51.0	103°14.5	52.3	181°53.4	26.7
2	189°08.1	181°51.9	27.5	80°01.6	50.9	118°16.8	52.4	196°55.5	26.5
3	204°10.6	196°54.4	·· 28.0	95°03.9	·· 50.8	133°19.1	·· 52.4	211°57.7	·· 26.4
4	219°13.0	211°57.0	28.4	110°06.2	50.8	148°21.3	52.4	226°59.9	26.3
5	234°15.5	226°59.5	28.8	125°08.5	50.7	163°23.6	52.5	242°02.1	26.2
6	249°18.0	242°02.1	N10°29.2	140°10.9	N25°50.6	178°25.8	N21°52.5	257°04.3	S05°26.1
7	264°20.4	257°04.7	29.7	155°13.2	50.5	193°28.1	52.5	272°06.4	25.9
8	279°22.9	272°07.2	30.1	170°15.5	50.4	208°30.3	52.6	287°08.6	25.8
9	294°25.4	287°09.8	·· 30.5	185°17.8	·· 50.3	223°32.6	·· 52.6	302°10.8	·· 25.7
10	309°27.8	302°12.4	30.9	200°20.1	50.2	238°34.8	52.6	317°13.0	25.6
11	324°30.3	317°14.9	31.3	215°22.4	50.1	253°37.1	52.7	332°15.2	25.5
12	339°32.8	332°17.5	N10°31.7	230°24.7	N25°50.0	268°39.3	N21°52.7	347°17.4	S05°25.3
13	354°35.2	347°20.1	32.1	245°26.9	49.9	283°41.6	52.7	2°19.5	25.2
14	9°37.7	2°22.7	32.5	260°29.2	49.8	298°43.8	52.8	17°21.7	25.1
15	24°40.1	17°25.3	·· 32.9	275°31.5	·· 49.7	313°46.1	·· 52.8	32°23.9	·· 25.0
16	39°42.6	32°27.9	33.3	290°33.8	49.6	328°48.3	52.8	47°26.1	24.9
17	54°45.1	47°30.5	33.7	305°36.1	49.5	343°50.6	52.9	62°28.3	24.7
18	69°47.5	62°33.1	N10°34.1	320°38.4	N25°49.4	358°52.8	N21°52.9	77°30.4	S05°24.6
19	84°50.0	77°35.7	34.5	335°40.7	49.3	13°55.1	52.9	92°32.6	24.5
20	99°52.5	92°38.3	34.9	350°43.0	49.2	28°57.3	53.0	107°34.8	24.4
21	114°54.9	107°41.0	·· 35.3	5°45.3	·· 49.1	43°59.6	·· 53.0	122°37.0	·· 24.3
22	129°57.4	122°43.6	35.7	20°47.5	49.0	59°01.8	53.0	137°39.2	24.1
23	144°59.9	137°46.2	36.1	35°49.8	48.9	74°04.1	53.1	152°41.4	24.0
Mer.pass. 13:22		ν 2.5′	d 0.4′	ν 2.3′	d 0.1′	ν 2.3′	d 0.0′	ν 2.2′	d 0.1′
		m -4.78		m -0.28		m -2.30		m 1.11	

Stars

	SHA	Dec
Alpheratz	357°35.0	29°13.7
Ankaa	353°07.4	-42°10.3
Schedar	349°31.4	56°40.6
Diphda	348°47.4	-17°51.1
Achernar	335°20.4	-57°06.8
Hamal	327°51.3	23°34.9
Polaris	314°09.8	89°22.5
Acamar	315°11.8	-40°12.5
Menkar	314°06.1	4°11.2
Mirfak	308°28.2	49°57.2
Aldebaran	290°39.5	16°33.6
Rigel	281°03.7	-8°10.5
Capella	280°21.6	46°01.5
Bellatrix	278°22.7	6°22.3
Elnath	278°01.6	28°37.8
Alnilam	275°37.5	-1°11.2
Betelgeuse	270°51.8	7°24.7
Canopus	263°52.1	-52°42.8
Sirius	258°26.0	-16°45.2
Adhara	255°05.6	-29°00.6
Procyon	244°50.5	5°09.5
Pollux	243°16.9	27°57.9
Avior	234°14.2	-59°35.5
Suhail	222°45.8	-43°32.2
Miaplacidus	221°37.5	-69°49.3
Alphard	217°47.3	-8°46.2
Regulus	207°34.0	11°50.5
Dubhe	193°40.1	61°36.8
Denebola	182°24.5	14°25.7
Gienah	175°43.2	-17°41.0
Acrux	172°59.4	-63°14.2
Gacrux	171°51.1	-57°15.2
Alioth	166°12.4	55°49.1
Spica	158°21.9	-11°17.7
Alkaid	152°51.6	49°11.0
Hadar	148°35.5	-60°29.5
Menkent	147°57.3	-36°29.6
Arcturus	145°47.6	19°02.8
Rigil Kent.	139°39.8	-60°56.2
Kochab	137°19.2	74°02.7
Zuben'ubi	136°55.7	-16°08.9
Alphecca	126°03.5	26°37.5
Antares	112°15.7	-26°29.3
Atria	107°09.9	-69°04.1
Sabik	102°02.7	-15°45.4
Shaula	96°10.3	-37°07.3
Rasalhague	95°58.5	12°32.3
Eltanin	90°42.3	51°28.7
Kaus Aust.	83°32.5	-34°22.3
Vega	80°33.4	38°48.1
Nunki	75°47.8	-26°15.9
Altair	62°00.1	8°55.9
Peacock	53°06.0	-56°39.2
Deneb	49°26.1	45°22.0
Enif	33°39.0	9°59.3
Al Na'ir	27°33.2	-46°50.4
Fomalhaut	15°14.7	-29°29.5
Scheat	13°45.5	28°13.1
Markab	13°30.1	15°20.3

Feb 27 Thu	SHA	Mer.pass
Venus	352°44.2	13:59
Mars	250°59.6	20:44
Jupiter	289°18.8	18:12
Saturn	8°01.5	12:58

Feb 28 Fri	SHA	Mer.pass
Venus	352°42.8	13:55
Mars	250°57.1	20:41
Jupiter	289°14.0	18:08
Saturn	7°54.7	12:54

Mar 01 Sat	SHA	Mer.pass
Venus	352°43.6	13:51
Mars	250°53.8	20:37
Jupiter	289°09.1	18:04
Saturn	7°48.0	12:51

Horizontal parallax	
Venus:	0.4
Mars:	0.2

h	Sun		Moon				
Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°49.3	S08°19.8	189°04.1	9.4′	S15°57.5	14.8′	59.4′
1	191°49.4	18.9	203°32.5	9.5′	15°42.7	14.8′	59.5′
2	206°49.5	18.0	218°00.9	9.5′	15°27.9	15.0′	59.5′
3	221°49.6	·· 17.0	232°29.4	9.6′	15°12.9	15.0′	59.5′
4	236°49.8	16.1	246°58.0	9.6′	14°57.9	15.2′	59.6′
5	251°49.9	15.1	261°26.6	9.6′	14°42.7	15.2′	59.6′
6	266°50.0	S08°14.2	275°55.2	9.7′	S14°27.5	15.4′	59.6′
7	281°50.1	13.3	290°23.9	9.7′	14°12.1	15.4′	59.6′
8	296°50.2	12.3	304°52.7	9.8′	13°56.7	15.6′	59.7′
9	311°50.3	·· 11.4	319°21.5	9.8′	13°41.1	15.6′	59.7′
10	326°50.4	10.4	333°50.3	9.9′	13°25.5	15.7′	59.7′
11	341°50.5	09.5	348°19.2	9.9′	13°09.8	15.8′	59.7′
12	356°50.6	S08°08.5	2°48.1	10.0′	S12°54.0	15.9′	59.8′
13	11°50.8	07.6	17°17.0	10.0′	12°38.1	15.9′	59.8′
14	26°50.9	06.7	31°46.0	10.0′	12°22.2	16.1′	59.8′
15	41°51.0	·· 05.7	46°15.1	10.1′	12°06.1	16.1′	59.8′
16	56°51.1	04.8	60°44.1	10.1′	11°50.0	16.2′	59.9′
17	71°51.2	03.8	75°13.3	10.2′	11°33.8	16.3′	59.9′
18	86°51.3	S08°02.9	89°42.4	10.2′	S11°17.5	16.3′	59.9′
19	101°51.4	01.9	104°11.6	10.2′	11°01.2	16.5′	59.9′
20	116°51.5	01.0	118°40.8	10.3′	10°44.7	16.5′	60.0′
21	131°51.7	08°00.0	133°10.1	10.3′	10°28.2	16.5′	60.0′
22	146°51.8	07°59.1	147°39.4	10.3′	10°11.7	16.7′	60.0′
23	161°51.9	58.1	162°08.8	10.4′	09°55.0	16.7′	60.0′
	SD = 16.1′	d = 0.9′	SD = 16.2′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°52.0	S07°57.2	176°38.1	10.4′	S09°38.3	16.7′	60.0′
1	191°52.1	56.3	191°07.5	10.4′	09°21.6	16.8′	60.1′
2	206°52.2	55.3	205°37.0	10.5′	09°04.8	16.9′	60.1′
3	221°52.3	·· 54.4	220°06.4	10.5′	08°47.9	17.0′	60.1′
4	236°52.5	53.4	234°35.9	10.5′	08°30.9	17.0′	60.1′
5	251°52.6	52.5	249°05.4	10.5′	08°13.9	17.0′	60.1′
6	266°52.7	S07°51.5	263°35.0	10.6′	S07°56.9	17.1′	60.1′
7	281°52.8	50.6	278°04.6	10.6′	07°39.8	17.2′	60.2′
8	296°52.9	49.6	292°34.2	10.6′	07°22.6	17.2′	60.2′
9	311°53.0	·· 48.7	307°03.8	10.6′	07°05.4	17.3′	60.2′
10	326°53.2	47.7	321°33.4	10.7′	06°48.1	17.3′	60.2′
11	341°53.3	46.8	336°03.1	10.7′	06°30.8	17.3′	60.2′
12	356°53.4	S07°45.8	350°32.8	10.7′	S06°13.5	17.4′	60.2′
13	11°53.5	44.9	5°02.5	10.7′	05°56.1	17.5′	60.3′
14	26°53.6	43.9	19°32.2	10.7′	05°38.6	17.4′	60.3′
15	41°53.7	·· 43.0	34°02.0	10.8′	05°21.2	17.5′	60.3′
16	56°53.9	42.0	48°31.8	10.8′	05°03.7	17.6′	60.3′
17	71°54.0	41.1	63°01.5	10.8′	04°46.1	17.5′	60.3′
18	86°54.1	S07°40.1	77°31.3	10.8′	S04°28.6	17.7′	60.3′
19	101°54.2	39.2	92°01.2	10.8′	04°10.9	17.6′	60.3′
20	116°54.3	38.2	106°31.0	10.8′	03°53.3	17.7′	60.4′
21	131°54.5	·· 37.3	121°00.8	10.8′	03°35.6	17.6′	60.4′
22	146°54.6	36.3	135°30.7	10.9′	03°18.0	17.8′	60.4′
23	161°54.7	35.4	150°00.5	10.9′	03°00.2	17.7′	60.4′
	SD = 16.1′	d = 0.9′	SD = 16.4′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°54.8	S07°34.4	164°30.4	10.9′	S02°42.5	17.7′	60.4′
1	191°54.9	33.5	179°00.2	10.9′	02°24.8	17.8′	60.4′
2	206°55.1	32.5	193°30.1	10.9′	02°07.0	17.8′	60.4′
3	221°55.2	·· 31.6	208°00.0	10.9′	01°49.2	17.8′	60.4′
4	236°55.3	30.6	222°29.9	10.9′	01°31.4	17.8′	60.4′
5	251°55.4	29.7	236°59.8	10.9′	01°13.6	17.8′	60.4′
6	266°55.5	S07°28.7	251°29.6	10.9′	S00°55.8	17.9′	60.4′
7	281°55.7	27.8	265°59.5	10.9′	00°37.9	17.8′	60.5′
8	296°55.8	26.8	280°29.4	10.9′	00°20.1	17.9′	60.5′
9	311°55.9	·· 25.9	294°59.3	10.9′	S00°02.2	17.8′	60.5′
10	326°56.0	24.9	309°29.1	10.9′	N00°15.6	17.9′	60.5′
11	341°56.1	24.0	323°59.0	10.9′	00°33.5	17.8′	60.5′
12	356°56.3	S07°23.0	338°28.9	10.9′	N00°51.3	17.8′	60.5′
13	11°56.4	22.1	352°58.7	10.8′	01°09.1	17.9′	60.5′
14	26°56.5	21.1	7°28.6	10.8′	01°27.0	17.8′	60.5′
15	41°56.6	·· 20.2	21°58.4	10.8′	01°44.8	17.8′	60.5′
16	56°56.8	19.2	36°28.2	10.8′	02°02.6	17.9′	60.5′
17	71°56.9	18.3	50°58.0	10.8′	02°20.5	17.8′	60.5′
18	86°57.0	S07°17.3	65°27.8	10.8′	N02°38.3	17.7′	60.5′
19	101°57.1	16.3	79°57.6	10.8′	02°56.0	17.8′	60.5′
20	116°57.3	15.4	94°27.3	10.7′	03°13.8	17.8′	60.5′
21	131°57.4	·· 14.4	108°57.1	10.7′	03°31.6	17.7′	60.5′
22	146°57.5	13.5	123°26.8	10.7′	03°49.3	17.7′	60.5′
23	161°57.6	12.5	137°56.5	10.7′	04°07.0	17.7′	60.5′
	SD = 16.1′	d = 1.0′	SD = 16.5′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	05:14	06:32	07:41	16:46	17:56	19:14
N 70°	05:18	06:29	07:31	16:56	17:58	19:09
68°	05:22	06:26	07:23	17:04	18:01	19:05
66°	05:25	06:24	07:16	17:10	18:02	19:02
64°	05:27	06:22	07:10	17:16	18:04	18:59
62°	05:29	06:20	07:05	17:21	18:06	18:57
60°	05:31	06:19	07:01	17:25	18:07	18:55
N 58°	05:32	06:17	06:57	17:29	18:09	18:54
56°	05:33	06:16	06:54	17:32	18:10	18:53
54°	05:34	06:15	06:50	17:35	18:11	18:52
52°	05:35	06:14	06:48	17:38	18:12	18:51
50°	05:35	06:13	06:45	17:41	18:13	18:51
45°	05:36	06:10	06:39	17:46	18:16	18:50
N 40°	05:36	06:07	06:35	17:51	18:18	18:49
35°	05:36	06:05	06:31	17:55	18:20	18:50
30°	05:35	06:03	06:27	17:58	18:22	18:50
20°	05:33	05:58	06:20	18:05	18:27	18:53
N 10°	05:29	05:53	06:15	18:10	18:32	18:56
0°	05:24	05:48	06:09	18:16	18:37	19:01
S 10°	05:18	05:42	06:04	18:21	18:42	19:07
20°	05:09	05:35	05:57	18:27	18:49	19:16
30°	04:57	05:26	05:50	18:34	18:58	19:27
35°	04:50	05:20	05:46	18:38	19:04	19:34
40°	04:41	05:14	05:41	18:43	19:10	19:43
45°	04:29	05:06	05:36	18:48	19:18	19:54
S 50°	04:15	04:56	05:29	18:55	19:28	20:09
52°	04:08	04:51	05:26	18:58	19:33	20:16
54°	04:00	04:46	05:23	19:01	19:38	20:23
56°	03:50	04:40	05:19	19:04	19:44	20:32
58°	03:40	04:33	05:15	19:09	19:50	20:43
S 60°	03:27	04:25	05:10	19:13	19:58	20:55

Lat.	**Moonrise** Thu	Fri	Sat	**Moonset** Thu	Fri	Sat
N 72°	09:00	08:06	07:25	15:08	17:51	20:22
N 70°	08:34	07:55	07:24	15:31	17:58	20:17
68°	08:14	07:47	07:24	15:49	18:04	20:14
66°	07:58	07:39	07:23	16:03	18:08	20:10
64°	07:45	07:33	07:23	16:15	18:12	20:08
62°	07:33	07:28	07:22	16:25	18:16	20:06
60°	07:24	07:23	07:22	16:33	18:19	20:04
N 58°	07:15	07:19	07:21	16:40	18:21	20:02
56°	07:08	07:15	07:21	16:46	18:24	20:00
54°	07:01	07:12	07:21	16:52	18:26	19:59
52°	06:55	07:09	07:21	16:57	18:27	19:58
50°	06:50	07:06	07:20	17:02	18:29	19:56
45°	06:38	07:00	07:20	17:12	18:33	19:54
N 40°	06:28	06:54	07:19	17:20	18:36	19:52
35°	06:19	06:50	07:19	17:27	18:38	19:50
30°	06:12	06:46	07:19	17:33	18:41	19:48
20°	05:59	06:39	07:18	17:43	18:44	19:46
N 10°	05:47	06:33	07:18	17:52	18:48	19:43
0°	05:36	06:27	07:17	18:01	18:51	19:41
S 10°	05:25	06:21	07:17	18:09	18:54	19:39
20°	05:14	06:15	07:16	18:18	18:57	19:36
30°	05:00	06:08	07:16	18:28	19:01	19:33
35°	04:52	06:04	07:16	18:33	19:03	19:32
40°	04:43	06:00	07:16	18:40	19:05	19:30
45°	04:33	05:54	07:15	18:47	19:08	19:28
S 50°	04:20	05:48	07:15	18:56	19:11	19:25
52°	04:14	05:45	07:15	19:00	19:12	19:24
54°	04:07	05:41	07:15	19:04	19:14	19:23
56°	04:00	05:38	07:14	19:09	19:16	19:22
58°	03:52	05:34	07:14	19:15	19:18	19:20
S 60°	03:42	05:29	07:14	19:21	19:20	19:18

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 29-1 2-1%
27	12:43	12:37	12:13	11:48	–:–	
28	12:32	12:26	12:12	12:39	00:14	
01	12:21	12:15	12:12	13:29	01:04	

March 02, 03, 04 UT (Sun., Mon., Tue.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	160°02.3	152°48.8	N10°36.5	50°52.1	N25°48.8	89°06.3	N21°53.1	167°43.5	S05°23.9
1	175°04.8	167°51.5	36.9	65°54.4	48.7	104°08.5	53.1	182°45.7	23.8
2	190°07.3	182°54.1	37.3	80°56.7	48.6	119°10.8	53.2	197°47.9	23.7
3	205°09.7	197°56.7	·· 37.6	95°58.9	·· 48.5	134°13.0	·· 53.2	212°50.1	·· 23.5
4	220°12.2	212°59.4	38.0	111°01.2	48.4	149°15.3	53.2	227°52.3	23.4
5	235°14.6	228°02.0	38.4	126°03.5	48.3	164°17.5	53.3	242°54.4	23.3
6	250°17.1	243°04.7	N10°38.8	141°05.8	N25°48.2	179°19.8	N21°53.3	257°56.6	S05°23.2
7	265°19.6	258°07.3	39.1	156°08.0	48.1	194°22.0	53.3	272°58.8	23.1
8	280°22.0	273°10.0	39.5	171°10.3	48.0	209°24.3	53.4	288°01.0	22.9
9	295°24.5	288°12.7	·· 39.9	186°12.6	·· 47.9	224°26.5	·· 53.4	303°03.2	·· 22.8
10	310°27.0	303°15.3	40.2	201°14.9	47.8	239°28.7	53.5	318°05.3	22.7
11	325°29.4	318°18.0	40.6	216°17.1	47.7	254°31.0	53.5	333°07.5	22.6
12	340°31.9	333°20.7	N10°41.0	231°19.4	N25°47.6	269°33.2	N21°53.5	348°09.7	S05°22.5
13	355°34.4	348°23.3	41.3	246°21.6	47.5	284°35.5	53.6	3°11.9	22.3
14	10°36.8	3°26.0	41.7	261°23.9	47.4	299°37.7	53.6	18°14.1	22.2
15	25°39.3	18°28.7	·· 42.0	276°26.2	·· 47.3	314°40.0	·· 53.6	33°16.3	·· 22.1
16	40°41.7	33°31.4	42.4	291°28.4	47.2	329°42.2	53.7	48°18.4	22.0
17	55°44.2	48°34.1	42.7	306°30.7	47.1	344°44.4	53.7	63°20.6	21.9
18	70°46.7	63°36.8	N10°43.1	321°32.9	N25°47.0	359°46.7	N21°53.7	78°22.8	S05°21.7
19	85°49.1	78°39.5	43.4	336°35.2	46.9	14°48.9	53.8	93°25.0	21.6
20	100°51.6	93°42.2	43.8	351°37.5	46.8	29°51.2	53.8	108°27.2	21.5
21	115°54.1	108°44.9	·· 44.1	6°39.7	·· 46.7	44°53.4	·· 53.8	123°29.3	·· 21.4
22	130°56.5	123°47.6	44.5	21°42.0	46.6	59°55.6	53.9	138°31.5	21.3
23	145°59.0	138°50.3	44.8	36°44.2	46.5	74°57.9	53.9	153°33.7	21.1
Mer.pass. 13:18		ν 2.6′	d 0.4′	m -4.76	ν 2.3′	d 0.1′	m -0.25	ν 2.2′	d 0.1′ m 1.11

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	161°01.5	153°53.1	N10°45.1	51°46.5	N25°46.4	90°00.1	N21°53.9	168°35.9	S05°21.0
1	176°03.9	168°55.8	45.5	66°48.7	46.3	105°02.4	54.0	183°38.1	20.9
2	191°06.4	183°58.5	45.8	81°51.0	46.2	120°04.6	54.0	198°40.2	20.8
3	206°08.9	199°01.2	·· 46.1	96°53.2	·· 46.1	135°06.8	·· 54.0	213°42.4	·· 20.6
4	221°11.3	214°04.0	46.4	111°55.5	46.0	150°09.1	54.1	228°44.6	20.5
5	236°13.8	229°06.7	46.8	126°57.7	45.9	165°11.3	54.1	243°46.8	20.4
6	251°16.2	244°09.5	N10°47.1	141°59.9	N25°45.8	180°13.5	N21°54.2	258°49.0	S05°20.3
7	266°18.7	259°12.2	47.4	157°02.2	45.7	195°15.8	54.2	273°51.1	20.2
8	281°21.2	274°15.0	47.7	172°04.4	45.6	210°18.0	54.2	288°53.3	20.0
9	296°23.6	289°17.7	·· 48.1	187°06.7	·· 45.5	225°20.2	·· 54.3	303°55.5	·· 19.9
10	311°26.1	304°20.5	48.4	202°08.9	45.4	240°22.5	54.3	318°57.7	19.8
11	326°28.6	319°23.2	48.7	217°11.1	45.3	255°24.7	54.3	333°59.9	19.7
12	341°31.0	334°26.0	N10°49.0	232°13.4	N25°45.2	270°27.0	N21°54.4	349°02.1	S05°19.6
13	356°33.5	349°28.8	49.3	247°15.6	45.1	285°29.2	54.4	4°04.2	19.4
14	11°36.0	4°31.5	49.6	262°17.8	45.0	300°31.4	54.4	19°06.4	19.3
15	26°38.4	19°34.3	·· 49.9	277°20.1	·· 44.9	315°33.7	·· 54.5	34°08.6	·· 19.2
16	41°40.9	34°37.1	50.2	292°22.3	44.8	330°35.9	54.5	49°10.8	19.1
17	56°43.4	49°39.9	50.5	307°24.5	44.7	345°38.1	54.5	64°13.0	19.0
18	71°45.8	64°42.7	N10°50.8	322°26.7	N25°44.6	0°40.4	N21°54.6	79°15.1	S05°18.8
19	86°48.3	79°45.5	51.1	337°29.0	44.4	15°42.6	54.6	94°17.3	18.7
20	101°50.7	94°48.3	51.4	352°31.2	44.3	30°44.8	54.7	109°19.5	18.6
21	116°53.2	109°51.1	·· 51.7	7°33.4	·· 44.2	45°47.0	·· 54.7	124°21.7	·· 18.5
22	131°55.7	124°53.9	52.0	22°35.6	44.1	60°49.3	54.7	139°23.9	18.4
23	146°58.1	139°56.7	52.3	37°37.9	44.0	75°51.5	54.8	154°26.0	18.2
Mer.pass. 13:14		ν 2.7′	d 0.3′	m -4.74	ν 2.2′	d 0.1′	m -0.23	ν 2.2′	d 0.0′ m -2.29	ν 2.2′	d 0.1′ m 1.11

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	162°00.6	154°59.5	N10°52.5	52°40.1	N25°43.9	90°53.7	N21°54.8	169°28.2	S05°18.1
1	177°03.1	170°02.3	52.8	67°42.3	43.8	105°56.0	54.8	184°30.4	18.0
2	192°05.5	185°05.1	53.1	82°44.5	43.7	120°58.2	54.9	199°32.6	17.9
3	207°08.0	200°07.9	·· 53.4	97°46.7	·· 43.6	136°00.4	·· 54.9	214°34.8	·· 17.8
4	222°10.5	215°10.8	53.7	112°48.9	43.5	151°02.7	54.9	229°36.9	17.6
5	237°12.9	230°13.6	53.9	127°51.2	43.4	166°04.9	55.0	244°39.1	17.5
6	252°15.4	245°16.4	N10°54.2	142°53.4	N25°43.3	181°07.1	N21°55.0	259°41.3	S05°17.4
7	267°17.8	260°19.3	54.5	157°55.6	43.2	196°09.4	55.1	274°43.5	17.3
8	282°20.3	275°22.1	54.7	172°57.8	43.1	211°11.6	55.1	289°45.7	17.2
9	297°22.8	290°25.0	·· 55.0	188°00.0	·· 43.0	226°13.8	·· 55.1	304°47.8	·· 17.0
10	312°25.2	305°27.8	55.3	203°02.2	42.9	241°16.0	55.2	319°50.0	16.9
11	327°27.7	320°30.7	55.5	218°04.4	42.7	256°18.3	55.2	334°52.2	16.8
12	342°30.2	335°33.5	N10°55.8	233°06.6	N25°42.6	271°20.5	N21°55.2	349°54.4	S05°16.7
13	357°32.6	350°36.4	56.0	248°08.8	42.5	286°22.7	55.3	4°56.6	16.6
14	12°35.1	5°39.2	56.3	263°11.0	42.4	301°24.9	55.3	19°58.8	16.4
15	27°37.6	20°42.1	·· 56.5	278°13.2	·· 42.3	316°27.2	·· 55.3	35°00.9	·· 16.3
16	42°40.0	35°45.0	56.8	293°15.4	42.2	331°29.4	55.4	50°03.1	16.2
17	57°42.5	50°47.9	57.0	308°17.6	42.1	346°31.6	55.4	65°05.3	16.1
18	72°45.0	65°50.7	N10°57.3	323°19.8	N25°42.0	1°33.8	N21°55.5	80°07.5	S05°15.9
19	87°47.4	80°53.6	57.5	338°22.0	41.9	16°36.1	55.5	95°09.7	15.8
20	102°49.9	95°56.5	57.7	353°24.2	41.8	31°38.3	55.5	110°11.8	15.7
21	117°52.3	110°59.4	·· 58.0	8°26.4	·· 41.7	46°40.5	·· 55.6	125°14.0	·· 15.6
22	132°54.8	126°02.3	58.2	23°28.6	41.6	61°42.7	55.6	140°16.2	15.5
23	147°57.3	141°05.2	58.5	38°30.8	41.4	76°45.0	55.6	155°18.4	15.3
Mer.pass. 13:10		ν 2.8′	d 0.3′	m -4.72	ν 2.2′	d 0.1′	m -0.20	ν 2.2′	d 0.0′ m -2.28	ν 2.2′	d 0.1′ m 1.11

Stars

	SHA	**Dec**
Alpheratz	357°35.0	29°13.7
Ankaa	353°07.4	-42°10.3
Schedar	349°31.4	56°40.6
Diphda	348°47.4	-17°51.1
Achernar	335°20.5	-57°06.8
Hamal	327°51.3	23°34.9
Polaris	314°11.3	89°22.5
Acamar	315°11.8	-40°12.5
Menkar	314°06.2	4°11.2
Mirfak	308°28.3	49°57.2
Aldebaran	290°39.5	16°33.6
Rigel	281°03.7	-8°10.5
Capella	280°21.6	46°01.5
Bellatrix	278°22.7	6°22.3
Elnath	278°01.6	28°37.8
Alnilam	275°37.5	-1°11.2
Betelgeuse	270°51.8	7°24.7
Canopus	263°52.1	-52°42.8
Sirius	258°26.0	-16°45.2
Adhara	255°05.6	-29°00.6
Procyon	244°50.5	5°09.5
Pollux	243°16.9	27°57.9
Avior	234°14.2	-59°35.6
Suhail	222°45.8	-43°32.2
Miaplacidus	221°37.5	-69°49.3
Alphard	217°47.3	-8°46.2
Regulus	207°34.0	11°50.5
Dubhe	193°40.1	61°36.8
Denebola	182°24.5	14°25.7
Gienah	175°43.2	-17°41.0
Acrux	172°59.4	-63°14.3
Gacrux	171°51.0	-57°15.2
Alioth	166°12.3	55°49.2
Spica	158°21.9	-11°17.7
Alkaid	152°51.5	49°11.0
Hadar	148°35.5	-60°29.5
Menkent	147°57.2	-36°29.6
Arcturus	145°47.6	19°02.8
Rigil Kent.	139°39.8	-60°56.2
Kochab	137°19.2	74°02.7
Zuben'ubi	136°55.7	-16°08.9
Alphecca	126°03.5	26°37.5
Antares	112°15.7	-26°29.3
Atria	107°09.8	-69°04.1
Sabik	102°02.7	-15°45.4
Shaula	96°10.3	-37°07.3
Rasalhague	95°58.5	12°32.3
Eltanin	90°42.3	51°28.7
Kaus Aust.	83°32.5	-34°22.3
Vega	80°33.3	38°48.1
Nunki	75°47.8	-26°15.9
Altair	62°00.1	8°55.9
Peacock	53°06.0	-56°39.2
Deneb	49°26.1	45°22.0
Enif	33°39.0	9°59.3
Al Na'ir	27°33.2	-46°50.4
Fomalhaut	15°14.7	-29°29.5
Scheat	13°45.5	28°13.1
Markab	13°30.1	15°20.3

Mar 02 Sun	**SHA**	**Mer.pass**
Venus	352°46.5	13:46
Mars	250°49.8	20:33
Jupiter	289°04.0	18:01
Saturn	7°41.2	12:47

Mar 03 Mon	**SHA**	**Mer.pass**
Venus	352°51.6	13:42
Mars	250°45.0	20:30
Jupiter	288°58.7	17:57
Saturn	7°34.4	12:44

Mar 04 Tue	**SHA**	**Mer.pass**
Venus	352°58.9	13:37
Mars	250°39.5	20:26
Jupiter	288°53.1	17:54
Saturn	7°27.6	12:40

Horizontal parallax	
Venus:	0.4
Mars:	0.2

h — Sun — Moon

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	176°57.8	S07°11.6	152°26.2	10.7′	N04°24.7	17.7′	60.5′
1	191°57.9	10.6	166°55.9	10.6′	04°42.4	17.6′	60.5′
2	206°58.0	09.7	181°25.5	10.6′	05°00.0	17.6′	60.5′
3	221°58.1	·· 08.7	195°55.1	10.6′	05°17.6	17.6′	60.5′
4	236°58.3	07.8	210°24.7	10.6′	05°35.2	17.5′	60.5′
5	251°58.4	06.8	224°54.2	10.5′	05°52.7	17.5′	60.5′
6	266°58.5	S07°05.8	239°23.8	10.5′	N06°10.2	17.5′	60.5′
7	281°58.6	04.9	253°53.3	10.5′	06°27.7	17.4′	60.5′
8	296°58.8	03.9	268°22.7	10.4′	06°45.1	17.4′	60.5′
9	311°58.9	·· 03.0	282°52.2	10.4′	07°02.5	17.4′	60.5′
10	326°59.0	02.0	297°21.6	10.4′	07°19.9	17.3′	60.5′
11	341°59.1	01.1	311°50.9	10.3′	07°37.2	17.2′	60.5′
12	356°59.3	S07°00.1	326°20.3	10.3′	N07°54.4	17.2′	60.5′
13	11°59.4	06°59.1	340°49.6	10.3′	08°11.6	17.2′	60.4′
14	26°59.5	58.2	355°18.8	10.2′	08°28.8	17.1′	60.4′
15	41°59.7	·· 57.2	9°48.0	10.2′	08°45.9	17.0′	60.4′
16	56°59.8	56.3	24°17.2	10.1′	09°02.9	17.0′	60.4′
17	71°59.9	55.3	38°46.3	10.1′	09°19.9	17.0′	60.4′
18	87°00.0	S06°54.4	53°15.4	10.0′	N09°36.9	16.9′	60.4′
19	102°00.2	53.4	67°44.5	10.0′	09°53.8	16.8′	60.4′
20	117°00.3	52.4	82°13.5	10.0′	10°10.6	16.7′	60.4′
21	132°00.4	·· 51.5	96°42.4	9.9′	10°27.3	16.7′	60.4′
22	147°00.6	50.5	111°11.4	9.9′	10°44.0	16.6′	60.4′
23	162°00.7	49.6	125°40.2	9.8′	11°00.6	16.6′	60.4′
	SD = 16.1′	d = 1.0′		SD = 16.5′			

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	177°00.8	S06°48.6	140°09.0	9.8′	N11°17.2	16.5′	60.3′
1	192°00.9	47.6	154°37.8	9.7′	11°33.7	16.4′	60.3′
2	207°01.1	46.7	169°06.5	9.7′	11°50.1	16.3′	60.3′
3	222°01.2	·· 45.7	183°35.2	9.6′	12°06.4	16.3′	60.3′
4	237°01.3	44.8	198°03.8	9.6′	12°22.7	16.2′	60.3′
5	252°01.5	43.8	212°32.4	9.5′	12°38.9	16.1′	60.3′
6	267°01.6	S06°42.8	227°00.9	9.4′	N12°55.0	16.0′	60.3′
7	282°01.7	41.9	241°29.3	9.4′	13°11.0	15.9′	60.3′
8	297°01.9	40.9	255°57.7	9.3′	13°26.9	15.9′	60.2′
9	312°02.0	·· 40.0	270°26.0	9.3′	13°42.8	15.7′	60.2′
10	327°02.1	39.0	284°54.3	9.2′	13°58.5	15.7′	60.2′
11	342°02.3	38.0	299°22.5	9.2′	14°14.2	15.6′	60.2′
12	357°02.4	S06°37.1	313°50.7	9.1′	N14°29.8	15.5′	60.2′
13	12°02.5	36.1	328°18.8	9.0′	14°45.3	15.4′	60.2′
14	27°02.7	35.2	342°46.8	9.0′	15°00.7	15.3′	60.2′
15	42°02.8	·· 34.2	357°14.8	8.9′	15°16.0	15.2′	60.1′
16	57°02.9	33.2	11°42.7	8.9′	15°31.2	15.1′	60.1′
17	72°03.1	32.3	26°10.6	8.8′	15°46.3	15.0′	60.1′
18	87°03.2	S06°31.3	40°38.4	8.7′	N16°01.3	15.0′	60.1′
19	102°03.3	30.4	55°06.1	8.7′	16°16.3	14.8′	60.1′
20	117°03.5	29.4	69°33.7	8.6′	16°31.1	14.7′	60.1′
21	132°03.6	·· 28.4	84°01.3	8.5′	16°45.8	14.5′	60.0′
22	147°03.7	27.5	98°28.9	8.5′	17°00.3	14.5′	60.0′
23	162°03.9	26.5	112°56.3	8.4′	17°14.8	14.4′	60.0′
	SD = 16.1′	d = 1.0′		SD = 16.5′			

Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	177°04.0	S06°25.5	127°23.7	8.3′	N17°29.2	14.2′	60.0′
1	192°04.1	24.6	141°51.0	8.3′	17°43.4	14.2′	60.0′
2	207°04.3	23.6	156°18.3	8.2′	17°57.6	14.0′	59.9′
3	222°04.4	·· 22.7	170°45.5	8.1′	18°11.6	13.9′	59.9′
4	237°04.5	21.7	185°12.6	8.1′	18°25.5	13.8′	59.9′
5	252°04.7	20.7	199°39.7	8.0′	18°39.3	13.7′	59.9′
6	267°04.8	S06°19.8	214°06.6	7.9′	N18°53.0	13.5′	59.9′
7	282°05.0	18.8	228°33.6	7.8′	19°06.5	13.4′	59.8′
8	297°05.1	17.8	243°00.4	7.8′	19°19.9	13.3′	59.8′
9	312°05.2	·· 16.9	257°27.2	7.7′	19°33.2	13.2′	59.8′
10	327°05.4	15.9	271°53.9	7.6′	19°46.4	13.0′	59.8′
11	342°05.5	14.9	286°20.5	7.6′	19°59.4	12.9′	59.8′
12	357°05.6	S06°14.0	300°47.1	7.5′	N20°12.3	12.8′	59.7′
13	12°05.8	13.0	315°13.6	7.4′	20°25.1	12.7′	59.7′
14	27°05.9	12.0	329°40.0	7.4′	20°37.8	12.5′	59.7′
15	42°06.1	·· 11.1	344°06.4	7.3′	20°50.3	12.3′	59.7′
16	57°06.2	10.1	358°32.6	7.2′	21°02.6	12.3′	59.6′
17	72°06.3	09.2	12°58.9	7.1′	21°14.9	12.1′	59.6′
18	87°06.5	S06°08.2	27°25.0	7.1′	N21°27.0	11.9′	59.6′
19	102°06.6	07.2	41°51.1	7.0′	21°38.9	11.8′	59.6′
20	117°06.8	06.3	56°17.1	6.9′	21°50.7	11.7′	59.6′
21	132°06.9	·· 05.3	70°43.0	6.9′	22°02.4	11.5′	59.5′
22	147°07.0	04.3	85°08.9	6.8′	22°13.9	11.4′	59.5′
23	162°07.2	03.4	99°34.7	6.7′	22°25.3	11.2′	59.5′
	SD = 16.1′	d = 1.0′		SD = 16.4′			

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	04:59	06:17	07:25	17:01	18:09	19:28
N 70°	05:05	06:15	07:17	17:09	18:10	19:21
68°	05:10	06:14	07:10	17:15	18:11	19:16
66°	05:14	06:13	07:05	17:21	18:12	19:12
64°	05:17	06:12	07:00	17:25	18:13	19:08
62°	05:20	06:11	06:56	17:29	18:14	19:05
60°	05:22	06:10	06:52	17:33	18:15	19:03
N 58°	05:24	06:10	06:49	17:36	18:15	19:01
56°	05:26	06:09	06:46	17:39	18:16	18:59
54°	05:27	06:08	06:43	17:41	18:17	18:58
52°	05:28	06:07	06:41	17:44	18:17	18:56
50°	05:29	06:07	06:39	17:46	18:18	18:55
45°	05:31	06:05	06:34	17:50	18:20	18:54
N 40°	05:32	06:03	06:30	17:54	18:21	18:53
35°	05:32	06:01	06:27	17:58	18:23	18:52
30°	05:32	06:00	06:24	18:01	18:25	18:52
20°	05:30	05:56	06:18	18:06	18:28	18:54
N 10°	05:28	05:52	06:13	18:11	18:32	18:56
0°	05:24	05:48	06:09	18:15	18:36	19:00
S 10°	05:18	05:43	06:04	18:20	18:41	19:06
20°	05:10	05:36	05:59	18:25	18:47	19:13
30°	05:00	05:28	05:52	18:31	18:55	19:23
35°	04:53	05:23	05:49	18:34	19:00	19:30
40°	04:44	05:17	05:45	18:38	19:06	19:38
45°	04:34	05:10	05:40	18:43	19:13	19:49
S 50°	04:21	05:01	05:34	18:48	19:21	20:02
52°	04:14	04:57	05:32	18:51	19:26	20:08
54°	04:07	04:52	05:29	18:54	19:30	20:15
56°	03:59	04:47	05:26	18:57	19:35	20:23
58°	03:49	04:41	05:22	19:00	19:41	20:33
S 60°	03:38	04:34	05:18	19:04	19:48	20:44

Lat.	Moonrise Sun	Moonrise Mon	Moonrise Tue	Moonset Sun	Moonset Mon	Moonset Tue
N 72°	06:46	05:56		23:02		
N 70°	06:54	06:18	05:13	22:43	·· ··	01:40
68°	07:01	06:35	05:56	22:28	·· ··	00:59
66°	07:07	06:49	06:25	22:16	·· ··	00:31
64°	07:12	07:01	06:47	22:06	·· ··	00:10
62°	07:17	07:11	07:05	21:57	23:54	·· ··
60°	07:21	07:20	07:20	21:50	23:40	·· ··
N 58°	07:24	07:27	07:33	21:43	23:28	·· ··
56°	07:27	07:34	07:44	21:38	23:18	·· ··
54°	07:30	07:40	07:54	21:33	23:09	·· ··
52°	07:32	07:46	08:02	21:28	23:01	·· ··
50°	07:35	07:51	08:10	21:24	22:54	·· ··
45°	07:40	08:02	08:27	21:16	22:38	·· ··
N 40°	07:44	08:11	08:41	21:08	22:26	23:44
35°	07:48	08:19	08:53	21:02	22:15	23:29
30°	07:51	08:26	09:04	20:57	22:06	23:17
20°	07:57	08:38	09:22	20:47	21:51	22:55
N 10°	08:02	08:49	09:38	20:39	21:37	22:37
0°	08:07	08:59	09:53	20:32	21:24	22:19
S 10°	08:12	09:09	10:08	20:24	21:11	22:02
20°	08:18	09:20	10:24	20:16	20:58	21:44
30°	08:24	09:33	10:43	20:07	20:43	21:23
35°	08:28	09:40	10:54	20:01	20:34	21:11
40°	08:32	09:49	11:07	19:55	20:24	20:57
45°	08:37	09:59	11:22	19:49	20:12	20:40
S 50°	08:42	10:11	11:41	19:40	19:58	20:20
52°	08:45	10:17	11:50	19:37	19:51	20:10
54°	08:48	10:23	12:00	19:33	19:44	20:00
56°	08:51	10:30	12:11	19:28	19:36	19:47
58°	08:55	10:38	12:24	19:23	19:27	19:33
S 60°	08:59	10:47	12:40	19:17	19:17	19:17

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Age 2-4 6-21%
02	12:09	12:03	12:12	14:19	01:54	
03	11:57	11:50	12:12	15:11	02:45	
04	11:44	11:37	12:12	16:06	03:38	

March 05, 06, 07 UT (Wed., Thu., Fri.)

	Aries	Venus		Mars		Jupiter		Saturn	
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	162°59.7	156°08.1	N10°58.7	53°33.0	N25°41.3	91°47.2	N21°55.7	170°20.6	S05°15.2
1	178°02.2	171°11.0	58.9	68°35.2	41.2	106°49.4	55.7	185°22.7	15.1
2	193°04.7	186°13.9	59.1	83°37.3	41.1	121°51.6	55.7	200°24.9	15.0
3	208°07.1	201°16.8	·· 59.4	98°39.5	·· 41.0	136°53.9	·· 55.8	215°27.1	·· 14.9
4	223°09.6	216°19.8	59.6	113°41.7	40.9	151°56.1	55.8	230°29.3	14.7
5	238°12.1	231°22.7	10°59.8	128°43.9	40.8	166°58.3	55.9	245°31.5	14.6
6	253°14.5	246°25.6	N11°00.0	143°46.1	N25°40.7	182°00.5	N21°55.9	260°33.6	S05°14.5
7	268°17.0	261°28.5	00.2	158°48.3	40.6	197°02.7	55.9	275°35.8	14.4
8	283°19.5	276°31.5	00.4	173°50.4	40.5	212°05.0	56.0	290°38.0	14.3
9	298°21.9	291°34.4	·· 00.6	188°52.6	·· 40.3	227°07.2	·· 56.0	305°40.2	·· 14.1
10	313°24.4	306°37.4	00.9	203°54.8	40.2	242°09.4	56.0	320°42.4	14.0
11	328°26.8	321°40.3	01.1	218°57.0	40.1	257°11.6	56.1	335°44.5	13.9
12	343°29.3	336°43.2	N11°01.3	233°59.1	N25°40.0	272°13.8	N21°56.1	350°46.7	S05°13.8
13	358°31.8	351°46.2	01.5	249°01.3	39.9	287°16.1	56.2	5°48.9	13.7
14	13°34.2	6°49.2	01.7	264°03.5	39.8	302°18.3	56.2	20°51.1	13.5
15	28°36.7	21°52.1	·· 01.9	279°05.7	·· 39.7	317°20.5	·· 56.2	35°53.3	·· 13.4
16	43°39.2	36°55.1	02.0	294°07.8	39.6	332°22.7	56.3	50°55.4	13.3
17	58°41.6	51°58.1	02.2	309°10.0	39.5	347°24.9	56.3	65°57.6	13.2
18	73°44.1	67°01.0	N11°02.4	324°12.2	N25°39.3	2°27.2	N21°56.3	80°59.8	S05°13.1
19	88°46.6	82°04.0	02.6	339°14.3	39.2	17°29.4	56.4	96°02.0	12.9
20	103°49.0	97°07.0	02.8	354°16.5	39.1	32°31.6	56.4	111°04.2	12.8
21	118°51.5	112°10.0	·· 03.0	9°18.7	·· 39.0	47°33.8	·· 56.4	126°06.3	·· 12.7
22	133°53.9	127°12.9	03.2	24°20.8	38.9	62°36.0	56.5	141°08.5	12.6
23	148°56.4	142°15.9	03.3	39°23.0	38.8	77°38.2	56.5	156°10.7	12.4
Mer.pass. 13:06		ν 2.9′	d 0.2′	m -4.69	ν 2.2′	d 0.1′	m -0.17	ν 2.2′	d 0.0′ m -2.27	ν 2.2′	d 0.1′ m 1.11

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	163°58.9	157°18.9	N11°03.5	54°25.1	N25°38.7	92°40.5	N21°56.6	171°12.9	S05°12.3
1	179°01.3	172°21.9	03.7	69°27.3	38.6	107°42.7	56.6	186°15.1	12.2
2	194°03.8	187°24.9	03.8	84°29.5	38.4	122°44.9	56.6	201°17.2	12.1
3	209°06.3	202°27.9	·· 04.0	99°31.6	·· 38.3	137°47.1	·· 56.7	216°19.4	·· 12.0
4	224°08.7	217°31.0	04.2	114°33.8	38.2	152°49.3	56.7	231°21.6	11.8
5	239°11.2	232°34.0	04.3	129°35.9	38.1	167°51.5	56.7	246°23.8	11.7
6	254°13.7	247°37.0	N11°04.5	144°38.1	N25°38.0	182°53.7	N21°56.8	261°26.0	S05°11.6
7	269°16.1	262°40.0	04.7	159°40.2	37.9	197°56.0	56.8	276°28.1	11.5
8	284°18.6	277°43.0	04.8	174°42.4	37.8	212°58.2	56.9	291°30.3	11.4
9	299°21.1	292°46.1	·· 05.0	189°44.5	·· 37.6	228°00.4	·· 56.9	306°32.5	·· 11.2
10	314°23.5	307°49.1	05.1	204°46.7	37.5	243°02.6	56.9	321°34.7	11.1
11	329°26.0	322°52.1	05.3	219°48.8	37.4	258°04.8	57.0	336°36.9	11.0
12	344°28.4	337°55.2	N11°05.4	234°51.0	N25°37.3	273°07.0	N21°57.0	351°39.0	S05°10.9
13	359°30.9	352°58.2	05.6	249°53.1	37.2	288°09.2	57.0	6°41.2	10.8
14	14°33.4	8°01.3	05.7	264°55.2	37.1	303°11.4	57.1	21°43.4	10.6
15	29°35.8	23°04.3	·· 05.8	279°57.4	·· 37.0	318°13.6	·· 57.1	36°45.6	·· 10.5
16	44°38.3	38°07.4	06.0	294°59.5	36.8	333°15.9	57.2	51°47.8	10.4
17	59°40.8	53°10.4	06.1	310°01.7	36.7	348°18.1	57.2	66°49.9	10.3
18	74°43.2	68°13.5	N11°06.2	325°03.8	N25°36.6	3°20.3	N21°57.2	81°52.1	S05°10.2
19	89°45.7	83°16.6	06.4	340°05.9	36.5	18°22.5	57.3	96°54.3	10.0
20	104°48.2	98°19.6	06.5	355°08.1	36.4	33°24.7	57.3	111°56.5	09.9
21	119°50.6	113°22.7	·· 06.6	10°10.2	·· 36.3	48°26.9	·· 57.4	126°58.7	·· 09.8
22	134°53.1	128°25.8	06.7	25°12.4	36.1	63°29.1	57.4	142°00.8	09.7
23	149°55.6	143°28.9	06.9	40°14.5	36.0	78°31.3	57.4	157°03.0	09.6
Mer.pass. 13:02		ν 3.0′	d 0.2′	m -4.66	ν 2.2′	d 0.1′	m -0.15	ν 2.2′	d 0.0′ m -2.26	ν 2.2′	d 0.1′ m 1.11

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	164°58.0	158°31.9	N11°07.0	55°16.6	N25°35.9	93°33.5	N21°57.5	172°05.2	S05°09.4
1	180°00.5	173°35.0	07.1	70°18.7	35.8	108°35.7	57.5	187°07.4	09.3
2	195°02.9	188°38.1	07.2	85°20.9	35.7	123°38.0	57.5	202°09.6	09.2
3	210°05.4	203°41.2	·· 07.3	100°23.0	·· 35.6	138°40.2	·· 57.6	217°11.7	·· 09.1
4	225°07.9	218°44.3	07.4	115°25.1	35.4	153°42.4	57.6	232°13.9	08.9
5	240°10.3	233°47.4	07.5	130°27.3	35.3	168°44.6	57.7	247°16.1	08.8
6	255°12.8	248°50.5	N11°07.6	145°29.4	N25°35.2	183°46.8	N21°57.7	262°18.3	S05°08.7
7	270°15.3	263°53.6	07.7	160°31.5	35.1	198°49.0	57.7	277°20.5	08.6
8	285°17.7	278°56.8	07.8	175°33.6	35.0	213°51.2	57.8	292°22.6	08.5
9	300°20.2	293°59.9	·· 07.9	190°35.7	·· 34.9	228°53.4	·· 57.8	307°24.8	·· 08.3
10	315°22.7	309°03.0	08.0	205°37.9	34.7	243°55.6	57.8	322°27.0	08.2
11	330°25.1	324°06.1	08.1	220°40.0	34.6	258°57.8	57.9	337°29.2	08.1
12	345°27.6	339°09.3	N11°08.2	235°42.1	N25°34.5	274°00.0	N21°57.9	352°31.4	S05°08.0
13	0°30.1	354°12.4	08.3	250°44.2	34.4	289°02.2	58.0	7°33.5	07.9
14	15°32.5	9°15.5	08.3	265°46.3	34.3	304°04.4	58.0	22°35.7	07.7
15	30°35.0	24°18.7	·· 08.4	280°48.4	·· 34.1	319°06.6	·· 58.0	37°37.9	·· 07.6
16	45°37.4	39°21.8	08.5	295°50.6	34.0	334°08.8	58.1	52°40.1	07.5
17	60°39.9	54°25.0	08.6	310°52.7	33.9	349°11.0	58.1	67°42.2	07.4
18	75°42.4	69°28.1	N11°08.7	325°54.8	N25°33.8	4°13.2	N21°58.2	82°44.4	S05°07.3
19	90°44.8	84°31.3	08.7	340°56.9	33.7	19°15.4	58.2	97°46.6	07.1
20	105°47.3	99°34.4	08.8	355°59.0	33.5	34°17.6	58.2	112°48.8	07.0
21	120°49.8	114°37.6	·· 08.9	11°01.1	·· 33.4	49°19.8	·· 58.3	127°51.0	·· 06.9
22	135°52.2	129°40.8	08.9	26°03.2	33.3	64°22.0	58.3	142°53.1	06.8
23	150°54.7	144°43.9	09.0	41°05.3	33.2	79°24.2	58.3	157°55.3	06.7
Mer.pass. 12:58		ν 3.1′	d 0.1′	m -4.63	ν 2.1′	d 0.1′	m -0.12	ν 2.2′	d 0.0′ m -2.26	ν 2.2′	d 0.1′ m 1.11

Stars

	SHA	Dec
Alpheratz	357°35.0	29°13.7
Ankaa	353°07.4	-42°10.3
Schedar	349°31.4	56°40.6
Diphda	348°47.4	-17°51.1
Achernar	335°20.5	-57°06.7
Hamal	327°51.3	23°34.9
Polaris	314°12.4	89°22.5
Acamar	315°11.9	-40°12.5
Menkar	314°06.2	4°11.2
Mirfak	308°28.3	49°57.2
Aldebaran	290°39.5	16°33.6
Rigel	281°03.7	-8°10.5
Capella	280°21.7	46°01.5
Bellatrix	278°22.7	6°22.3
Elnath	278°01.7	28°37.8
Alnilam	275°37.5	-1°11.2
Betelgeuse	270°51.9	7°24.6
Canopus	263°52.1	-52°42.8
Sirius	258°26.0	-16°45.2
Adhara	255°05.6	-29°00.6
Procyon	244°50.5	5°09.5
Pollux	243°16.9	27°57.9
Avior	234°14.2	-59°35.6
Suhail	222°45.9	-43°32.2
Miaplacidus	221°37.5	-69°49.3
Alphard	217°47.3	-8°46.2
Regulus	207°34.0	11°50.5
Dubhe	193°40.1	61°36.8
Denebola	182°24.5	14°25.7
Gienah	175°43.2	-17°41.0
Acrux	172°59.4	-63°14.3
Gacrux	171°51.0	-57°15.2
Alioth	166°12.3	55°49.2
Spica	158°21.9	-11°17.7
Alkaid	152°51.5	49°11.0
Hadar	148°35.4	-60°29.5
Menkent	147°57.2	-36°29.6
Arcturus	145°47.6	19°02.8
Rigil Kent.	139°39.8	-60°56.2
Kochab	137°19.1	74°02.7
Zuben'ubi	136°55.7	-16°08.9
Alphecca	126°03.5	26°37.5
Antares	112°15.6	-26°29.3
Atria	107°09.8	-69°04.1
Sabik	102°02.7	-15°45.4
Shaula	96°10.3	-37°07.3
Rasalhague	95°58.5	12°32.3
Eltanin	90°42.3	51°28.7
Kaus Aust.	83°32.5	-34°22.3
Vega	80°33.3	38°48.1
Nunki	75°47.8	-26°15.9
Altair	62°00.1	8°55.9
Peacock	53°05.9	-56°39.2
Deneb	49°26.1	45°21.9
Enif	33°39.0	9°59.3
Al Na'ir	27°33.2	-46°50.4
Fomalhaut	15°14.7	-29°29.4
Scheat	13°45.4	28°13.0
Markab	13°30.1	15°20.3

Mar 05 Wed	SHA	Mer.pass
Venus	353°08.4	13:33
Mars	250°33.2	20:23
Jupiter	288°47.5	17:50
Saturn	7°20.8	12:37

Mar 06 Thu	SHA	Mer.pass
Venus	353°20.1	13:28
Mars	250°26.3	20:19
Jupiter	288°41.6	17:47
Saturn	7°14.0	12:33

Mar 07 Fri	SHA	Mer.pass
Venus	353°33.9	13:23
Mars	250°18.6	20:16
Jupiter	288°35.5	17:43
Saturn	7°07.2	12:30

Horizontal parallax	
Venus:	0.5
Mars:	0.2

DUT1 = UT1-UTC = +0.0431 sec ΔT = TT-UT1 = +69.1409 sec

2025 March 05 to Mar. 07 UT

h — Sun — Moon

Wed	GHA	Dec	GHA	ν	Dec	d	HP
0	177°07.3	S06°02.4	114°00.4	6.7′	N22°36.5	11.1′	59.5′
1	192°07.4	01.4	128°26.1	6.6′	22°47.6	10.9′	59.4′
2	207°07.6	06°00.5	142°51.7	6.5′	22°58.5	10.8′	59.4′
3	222°07.7	05°59.5	157°17.2	6.5′	23°09.3	10.6′	59.4′
4	237°07.9	58.5	171°42.7	6.4′	23°19.9	10.5′	59.4′
5	252°08.0	57.6	186°08.1	6.3′	23°30.4	10.3′	59.3′
6	267°08.2	S05°56.6	200°33.4	6.3′	N23°40.7	10.2′	59.3′
7	282°08.3	55.6	214°58.7	6.2′	23°50.9	10.0′	59.3′
8	297°08.4	54.7	229°23.9	6.1′	24°00.9	9.8′	59.3′
9	312°08.6	·· 53.7	243°49.0	6.1′	24°10.7	9.7′	59.2′
10	327°08.7	52.7	258°14.1	6.0′	24°20.4	9.5′	59.2′
11	342°08.9	51.8	272°39.1	6.0′	24°29.9	9.4′	59.2′
12	357°09.0	S05°50.8	287°04.1	5.9′	N24°39.3	9.2′	59.2′
13	12°09.1	49.8	301°29.0	5.8′	24°48.5	9.0′	59.1′
14	27°09.3	48.8	315°53.8	5.8′	24°57.5	8.8′	59.1′
15	42°09.4	·· 47.9	330°18.6	5.7′	25°06.3	8.7′	59.1′
16	57°09.6	46.9	344°43.4	5.7′	25°15.0	8.6′	59.1′
17	72°09.7	45.9	359°08.0	5.6′	25°23.6	8.3′	59.0′
18	87°09.9	S05°45.0	13°32.7	5.6′	N25°31.9	8.2′	59.0′
19	102°10.0	44.0	27°57.2	5.5′	25°40.1	8.0′	59.0′
20	117°10.1	43.0	42°21.8	5.5′	25°48.1	7.9′	58.9′
21	132°10.3	·· 42.1	56°46.2	5.4′	25°56.0	7.6′	58.9′
22	147°10.4	41.1	71°10.7	5.4′	26°03.6	7.5′	58.9′
23	162°10.6	40.1	85°35.0	5.3′	26°11.1	7.4′	58.9′
	SD = 16.1′	d = 1.0′	SD = 16.2′				

Thu	GHA	Dec	GHA	ν	Dec	d	HP
0	177°10.7	S05°39.2	99°59.4	5.3′	N26°18.5	7.1′	58.8′
1	192°10.9	38.2	114°23.7	5.2′	26°25.6	7.0′	58.8′
2	207°11.0	37.2	128°47.9	5.2′	26°32.6	6.8′	58.8′
3	222°11.2	·· 36.2	143°12.1	5.2′	26°39.4	6.6′	58.8′
4	237°11.3	35.3	157°36.3	5.1′	26°46.0	6.4′	58.7′
5	252°11.4	34.3	172°00.4	5.1′	26°52.4	6.3′	58.7′
6	267°11.6	S05°33.3	186°24.5	5.1′	N26°58.7	6.1′	58.7′
7	282°11.7	32.4	200°48.5	5.0′	27°04.8	5.9′	58.7′
8	297°11.9	31.4	215°12.6	5.0′	27°10.7	5.7′	58.6′
9	312°12.0	·· 30.4	229°36.6	5.0′	27°16.4	5.6′	58.6′
10	327°12.2	29.5	244°00.5	4.9′	27°22.0	5.3′	58.6′
11	342°12.3	28.5	258°24.5	4.9′	27°27.3	5.2′	58.5′
12	357°12.5	S05°27.5	272°48.4	4.9′	N27°32.5	5.0′	58.5′
13	12°12.6	26.5	287°12.3	4.9′	27°37.5	4.8′	58.5′
14	27°12.8	25.6	301°36.2	4.8′	27°42.3	4.7′	58.5′
15	42°12.9	·· 24.6	316°00.0	4.8′	27°47.0	4.4′	58.4′
16	57°13.1	23.6	330°23.8	4.8′	27°51.4	4.3′	58.4′
17	72°13.2	22.7	344°47.6	4.8′	27°55.7	4.1′	58.4′
18	87°13.4	S05°21.7	359°11.5	4.8′	N27°59.8	3.9′	58.4′
19	102°13.5	20.7	13°35.2	4.8′	28°03.7	3.7′	58.3′
20	117°13.7	19.7	27°59.0	4.8′	28°07.4	3.5′	58.3′
21	132°13.8	·· 18.8	42°22.8	4.8′	28°10.9	3.4′	58.3′
22	147°14.0	17.8	56°46.6	4.8′	28°14.3	3.1′	58.2′
23	162°14.1	16.8	71°10.3	4.8′	28°17.4	3.0′	58.2′
	SD = 16.1′	d = 1.0′	SD = 16.0′				

Fri	GHA	Dec	GHA	ν	Dec	d	HP
0	177°14.2	S05°15.9	85°34.1	4.8′	N28°20.4	2.8′	58.2′
1	192°14.4	14.9	99°57.9	4.8′	28°23.2	2.6′	58.2′
2	207°14.5	13.9	114°21.6	4.8′	28°25.8	2.4′	58.1′
3	222°14.7	·· 12.9	128°45.4	4.8′	28°28.2	2.3′	58.1′
4	237°14.8	12.0	143°09.2	4.8′	28°30.5	2.0′	58.1′
5	252°15.0	11.0	157°33.0	4.8′	28°32.5	1.9′	58.1′
6	267°15.1	S05°10.0	171°56.8	4.8′	N28°34.4	1.7′	58.0′
7	282°15.3	09.0	186°20.6	4.8′	28°36.1	1.5′	58.0′
8	297°15.4	08.1	200°44.4	4.8′	28°37.6	1.3′	58.0′
9	312°15.6	·· 07.1	215°08.3	4.9′	28°38.9	1.1′	57.9′
10	327°15.7	06.1	229°32.1	4.9′	28°40.0	1.0′	57.9′
11	342°15.9	05.1	243°56.0	4.9′	28°41.0	0.7′	57.9′
12	357°16.0	S05°04.2	258°19.9	4.9′	N28°41.7	0.6′	57.9′
13	12°16.2	03.2	272°43.9	5.0′	28°42.3	0.4′	57.8′
14	27°16.4	02.2	287°07.9	5.0′	28°42.7	0.3′	57.8′
15	42°16.5	·· 01.2	301°31.9	5.0′	28°43.0	0.0′	57.8′
16	57°16.7	05°00.3	315°55.9	5.1′	28°43.0	0.1′	57.8′
17	72°16.8	04°59.3	330°20.0	5.1′	28°42.9	0.4′	57.7′
18	87°17.0	S04°58.3	344°44.1	5.1′	N28°42.5	0.5′	57.7′
19	102°17.1	57.4	359°08.2	5.2′	28°42.0	0.6′	57.7′
20	117°17.3	56.4	13°32.4	5.2′	28°41.4	0.9′	57.6′
21	132°17.4	·· 55.4	27°56.6	5.3′	28°40.5	1.0′	57.6′
22	147°17.6	54.4	42°20.9	5.3′	28°39.5	1.3′	57.6′
23	162°17.7	53.5	56°45.2	5.4′	28°38.2	1.3′	57.6′
	SD = 16.1′	d = 1.0′	SD = 15.9′				

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	04:43	06:02	07:09	17:15	18:23	19:42
N 70°	04:51	06:02	07:03	17:21	18:22	19:34
68°	04:58	06:02	06:58	17:26	18:22	19:27
66°	05:03	06:02	06:53	17:31	18:22	19:22
64°	05:07	06:02	06:49	17:34	18:22	19:17
62°	05:11	06:02	06:46	17:38	18:22	19:13
60°	05:14	06:02	06:43	17:40	18:22	19:10
N 58°	05:16	06:01	06:41	17:43	18:22	19:08
56°	05:18	06:01	06:38	17:45	18:22	19:05
54°	05:20	06:01	06:36	17:47	18:22	19:03
52°	05:22	06:01	06:34	17:49	18:23	19:02
50°	05:23	06:00	06:33	17:51	18:23	19:00
45°	05:26	05:59	06:29	17:54	18:24	18:58
N 40°	05:27	05:59	06:26	17:57	18:24	18:56
35°	05:28	05:57	06:23	18:00	18:25	18:55
30°	05:29	05:56	06:20	18:03	18:26	18:54
20°	05:28	05:54	06:16	18:07	18:29	18:54
N 10°	05:26	05:51	06:12	18:11	18:32	18:56
0°	05:23	05:47	06:08	18:14	18:35	18:59
S 10°	05:18	05:43	06:04	18:18	18:39	19:04
20°	05:11	05:37	06:00	18:22	18:45	19:10
30°	05:02	05:30	05:54	18:27	18:51	19:20
35°	04:56	05:26	05:52	18:30	18:56	19:26
40°	04:48	05:21	05:48	18:34	19:01	19:33
45°	04:39	05:14	05:44	18:37	19:07	19:43
S 50°	04:26	05:06	05:39	18:42	19:15	19:54
52°	04:21	05:03	05:37	18:44	19:19	20:00
54°	04:14	04:58	05:35	18:46	19:23	20:07
56°	04:06	04:54	05:32	18:49	19:27	20:14
58°	03:58	04:48	05:29	18:52	19:32	20:23
S 60°	03:47	04:42	05:26	18:55	19:38	20:33

Lat.	Moonrise Wed	Moonrise Thu	Moonrise Fri	Moonset Wed	Moonset Thu	Moonset Fri
N 72°						
N 70°						
68°						
66°	05:29			03:24		
64°	06:24			02:30		
62°	06:58	06:46		01:58	04:13	
60°	07:22	07:31	07:57	01:34	03:28	05:08
N 58°	07:42	08:00	08:37	01:15	02:59	04:28
56°	07:59	08:23	09:05	00:59	02:36	04:00
54°	08:13	08:42	09:27	00:45	02:18	03:38
52°	08:25	08:58	09:45	00:34	02:03	03:20
50°	08:36	09:12	10:00	00:23	01:49	03:05
45°	08:59	09:40	10:32	00:01	01:22	02:34
N 40°	09:18	10:02	10:56	·· ··	01:00	02:10
35°	09:33	10:21	11:16	·· ··	00:42	01:50
30°	09:47	10:36	11:33	·· ··	00:27	01:34
20°	10:10	11:04	12:01	·· ··	00:01	01:05
N 10°	10:31	11:27	12:26	23:38	·· ··	00:41
0°	10:50	11:49	12:49	23:18	·· ··	00:18
S 10°	11:09	12:11	13:12	22:57	23:55	·· ··
20°	11:30	12:35	13:37	22:35	23:31	·· ··
30°	11:54	13:02	14:06	22:09	23:02	·· ··
35°	12:08	13:19	14:23	21:54	22:45	23:44
40°	12:25	13:38	14:44	21:37	22:26	23:24
45°	12:44	14:01	15:08	21:16	22:02	23:00
S 50°	13:10	14:31	15:40	20:50	21:32	22:28
52°	13:22	14:46	15:56	20:37	21:16	22:12
54°	13:36	15:04	16:14	20:23	20:59	21:54
56°	13:52	15:25	16:37	20:06	20:38	21:31
58°	14:12	15:51	17:06	19:46	20:11	21:02
S 60°	14:36	16:29	17:51	19:21	19:33	20:17

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 5-7 31-54%
05	11:31	11:24	12:11	17:04	04:34	
06	11:17	11:10	12:11	18:03	05:33	
07	11:03	10:56	12:11	19:04	06:34	

March 08, 09, 10 UT (Sat., Sun., Mon.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	165°57.2	159°47.1	N11°09.0	56°07.4	N25°33.1	94°26.4	N21°58.4	172°57.5	S05°06.5
1	180°59.6	174°50.3	09.1	71°09.5	32.9	109°28.6	58.4	187°59.7	06.4
2	196°02.1	189°53.5	09.1	86°11.6	32.8	124°30.8	58.5	203°01.9	06.3
3	211°04.6	204°56.6	·· 09.2	101°13.7	·· 32.7	139°33.0	·· 58.5	218°04.0	·· 06.2
4	226°07.0	219°59.8	09.2	116°15.8	32.6	154°35.2	58.5	233°06.2	06.1
5	241°09.5	235°03.0	09.3	131°17.9	32.5	169°37.4	58.6	248°08.4	05.9
6	256°11.9	250°06.2	N11°09.3	146°20.0	N25°32.3	184°39.6	N21°58.6	263°10.6	S05°05.8
7	271°14.4	265°09.4	09.4	161°22.1	32.2	199°41.8	58.7	278°12.8	05.7
8	286°16.9	280°12.6	09.4	176°24.2	32.1	214°44.0	58.7	293°14.9	05.6
9	301°19.3	295°15.8	·· 09.4	191°26.3	·· 32.0	229°46.2	·· 58.7	308°17.1	·· 05.4
10	316°21.8	310°19.0	09.5	206°28.4	31.9	244°48.4	58.8	323°19.3	05.3
11	331°24.3	325°22.3	09.5	221°30.5	31.7	259°50.6	58.8	338°21.5	05.2
12	346°26.7	340°25.5	N11°09.5	236°32.6	N25°31.6	274°52.8	N21°58.9	353°23.7	S05°05.1
13	1°29.2	355°28.7	09.6	251°34.6	31.5	289°55.0	58.9	8°25.8	05.0
14	16°31.7	10°31.9	09.6	266°36.7	31.4	304°57.2	58.9	23°28.0	04.8
15	31°34.1	25°35.1	·· 09.6	281°38.8	·· 31.3	319°59.4	·· 59.0	38°30.2	·· 04.7
16	46°36.6	40°38.4	09.6	296°40.9	31.1	335°01.6	59.0	53°32.4	04.6
17	61°39.0	55°41.6	09.6	311°43.0	31.0	350°03.8	59.1	68°34.6	04.5
18	76°41.5	70°44.8	N11°09.6	326°45.1	N25°30.9	5°06.0	N21°59.1	83°36.7	S05°04.4
19	91°44.0	85°48.1	09.6	341°47.1	30.8	20°08.2	59.1	98°38.9	04.2
20	106°46.4	100°51.3	09.7	356°49.2	30.6	35°10.4	59.2	113°41.1	04.1
21	121°48.9	115°54.6	·· 09.7	11°51.3	·· 30.5	50°12.6	·· 59.2	128°43.3	·· 04.0
22	136°51.4	130°57.8	09.7	26°53.4	30.4	65°14.8	59.2	143°45.5	03.9
23	151°53.8	146°01.1	09.7	41°55.5	30.3	80°17.0	59.3	158°47.6	03.8
Mer.pass. 12:54		ν 3.2′	d 0.1′	m -4.59	ν 2.1′	d 0.1′	m -0.10	ν 2.2′	d 0.1′ m 1.10

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	166°56.3	161°04.4	N11°09.7	56°57.5	N25°30.1	95°19.2	N21°59.3	173°49.8	S05°03.6
1	181°58.8	176°07.6	09.7	71°59.6	30.0	110°21.4	59.4	188°52.0	03.5
2	197°01.2	191°10.9	09.6	87°01.7	29.9	125°23.6	59.4	203°54.2	03.4
3	212°03.7	206°14.2	·· 09.6	102°03.8	·· 29.8	140°25.7	·· 59.4	218°56.4	·· 03.3
4	227°06.2	221°17.4	09.6	117°05.8	29.7	155°27.9	59.5	233°58.5	03.2
5	242°08.6	236°20.7	09.6	132°07.9	29.5	170°30.1	59.5	249°00.7	03.0
6	257°11.1	251°24.0	N11°09.6	147°10.0	N25°29.4	185°32.3	N21°59.6	264°02.9	S05°02.9
7	272°13.5	266°27.3	09.6	162°12.0	29.3	200°34.5	59.6	279°05.1	02.8
8	287°16.0	281°30.6	09.5	177°14.1	29.2	215°36.7	59.6	294°07.2	02.7
9	302°18.5	296°33.9	·· 09.5	192°16.2	·· 29.0	230°38.9	·· 59.7	309°09.4	·· 02.6
10	317°20.9	311°37.2	09.5	207°18.2	28.9	245°41.1	59.7	324°11.6	02.4
11	332°23.4	326°40.4	09.5	222°20.3	28.8	260°43.3	59.8	339°13.8	02.3
12	347°25.9	341°43.8	N11°09.4	237°22.4	N25°28.7	275°45.5	N21°59.8	354°16.0	S05°02.2
13	2°28.3	356°47.1	09.4	252°24.4	28.5	290°47.7	59.8	9°18.1	02.1
14	17°30.8	11°50.4	09.3	267°26.5	28.4	305°49.8	59.9	24°20.3	01.9
15	32°33.3	26°53.7	·· 09.3	282°28.5	·· 28.3	320°52.0	21°59.9	39°22.5	·· 01.8
16	47°35.7	41°57.0	09.3	297°30.6	28.2	335°54.2	22°00.0	54°24.7	01.7
17	62°38.2	57°00.3	09.2	312°32.7	28.0	350°56.4	00.0	69°26.9	01.6
18	77°40.7	72°03.6	N11°09.2	327°34.7	N25°27.9	5°58.6	N22°00.0	84°29.0	S05°01.5
19	92°43.1	87°07.0	09.1	342°36.8	27.8	21°00.8	00.1	99°31.2	01.3
20	107°45.6	102°10.3	09.1	357°38.8	27.6	36°03.0	00.1	114°33.4	01.2
21	122°48.0	117°13.6	·· 09.0	12°40.9	·· 27.5	51°05.2	·· 00.2	129°35.6	·· 01.1
22	137°50.5	132°17.0	08.9	27°42.9	27.4	66°07.4	00.2	144°37.8	01.0
23	152°53.0	147°20.3	08.9	42°45.0	27.3	81°09.5	00.2	159°39.9	00.9
Mer.pass. 12:50		ν 3.3′	d 0.0′	m -4.55	ν 2.1′	d 0.1′	m -0.07	ν 2.2′	d 0.1′ m 1.10

Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	167°55.4	162°23.6	N11°08.8	57°47.0	N25°27.1	96°11.7	N22°00.3	174°42.1	S05°00.7
1	182°57.9	177°27.0	08.7	72°49.1	27.0	111°13.9	00.3	189°44.3	00.6
2	198°00.4	192°30.3	08.7	87°51.1	26.9	126°16.1	00.4	204°46.5	00.5
3	213°02.8	207°33.7	·· 08.6	102°53.2	·· 26.8	141°18.3	·· 00.4	219°48.7	·· 00.4
4	228°05.3	222°37.1	08.5	117°55.2	26.6	156°20.5	00.4	234°50.8	00.3
5	243°07.8	237°40.4	08.4	132°57.2	26.5	171°22.7	00.5	249°53.0	00.1
6	258°10.2	252°43.8	N11°08.4	147°59.3	N25°26.4	186°24.8	N22°00.5	264°55.2	S05°00.0
7	273°12.7	267°47.1	08.3	163°01.3	26.2	201°27.0	00.6	279°57.4	04°59.9
8	288°15.2	282°50.5	08.2	178°03.4	26.1	216°29.2	00.6	294°59.5	59.8
9	303°17.6	297°53.9	·· 08.1	193°05.4	·· 26.0	231°31.4	·· 00.6	310°01.7	·· 59.7
10	318°20.1	312°57.3	08.0	208°07.4	25.9	246°33.6	00.7	325°03.9	59.5
11	333°22.5	328°00.6	07.9	223°09.5	25.7	261°35.8	00.7	340°06.1	59.4
12	348°25.0	343°04.0	N11°07.8	238°11.5	N25°25.6	276°37.9	N22°00.8	355°08.3	S04°59.3
13	3°27.5	358°07.4	07.7	253°13.6	25.5	291°40.1	00.8	10°10.4	59.2
14	18°29.9	13°10.8	07.6	268°15.6	25.3	306°42.3	00.8	25°12.6	59.1
15	33°32.4	28°14.2	·· 07.5	283°17.6	·· 25.2	321°44.5	·· 00.9	40°14.8	·· 58.9
16	48°34.9	43°17.6	07.4	298°19.6	25.1	336°46.7	00.9	55°17.0	58.8
17	63°37.3	58°21.0	07.3	313°21.7	25.0	351°48.9	01.0	70°19.2	58.7
18	78°39.8	73°24.4	N11°07.2	328°23.7	N25°24.8	6°51.0	N22°01.0	85°21.3	S04°58.6
19	93°42.3	88°27.8	07.1	343°25.7	24.7	21°53.2	01.0	100°23.5	58.4
20	108°44.7	103°31.2	07.0	358°27.8	24.6	36°55.4	01.1	115°25.7	58.3
21	123°47.2	118°34.6	·· 06.8	13°29.8	·· 24.4	51°57.6	·· 01.1	130°27.9	·· 58.2
22	138°49.6	133°38.1	06.7	28°31.8	24.3	66°59.8	01.2	145°30.1	58.1
23	153°52.1	148°41.5	06.6	43°33.8	24.2	82°01.9	01.2	160°32.2	58.0
Mer.pass. 12:46		ν 3.3′	d 0.1′	m -4.50	ν 2.0′	d 0.1′	m -0.05	ν 2.2′	d 0.1′ m 1.10

Stars

	SHA	Dec
Alpheratz	357°35.0	29°13.7
Ankaa	353°07.4	-42°10.3
Schedar	349°31.4	56°40.6
Diphda	348°47.4	-17°51.1
Achernar	335°20.5	-57°06.7
Hamal	327°51.3	23°34.9
Polaris	314°13.5	89°22.5
Acamar	315°11.9	-40°12.4
Menkar	314°06.2	4°11.2
Mirfak	308°28.3	49°57.2
Aldebaran	290°39.5	16°33.6
Rigel	281°03.7	-8°10.5
Capella	280°21.7	46°01.5
Bellatrix	278°22.7	6°22.3
Elnath	278°01.7	28°37.8
Alnilam	275°37.5	-1°11.2
Betelgeuse	270°51.9	7°24.6
Canopus	263°52.2	-52°42.8
Sirius	258°26.0	-16°45.2
Adhara	255°05.6	-29°00.6
Procyon	244°50.5	5°09.5
Pollux	243°16.9	27°57.9
Avior	234°14.2	-59°35.6
Suhail	222°45.9	-43°32.2
Miaplacidus	221°37.5	-69°49.4
Alphard	217°47.3	-8°46.2
Regulus	207°34.0	11°50.5
Dubhe	193°40.1	61°36.8
Denebola	182°24.5	14°25.7
Gienah	175°43.1	-17°41.0
Acrux	172°59.3	-63°14.3
Gacrux	171°51.0	-57°15.2
Alioth	166°12.3	55°49.2
Spica	158°21.9	-11°17.7
Alkaid	152°51.5	49°11.0
Hadar	148°35.4	-60°29.6
Menkent	147°57.2	-36°29.6
Arcturus	145°47.5	19°02.8
Rigil Kent.	139°39.7	-60°56.2
Kochab	137°19.1	74°02.7
Zuben'ubi	136°55.7	-16°08.9
Alphecca	126°03.5	26°37.5
Antares	112°15.6	-26°29.3
Atria	107°09.7	-69°04.1
Sabik	102°02.6	-15°45.4
Shaula	96°10.2	-37°07.3
Rasalhague	95°58.5	12°32.3
Eltanin	90°42.2	51°28.7
Kaus Aust.	83°32.4	-34°22.3
Vega	80°33.3	38°48.1
Nunki	75°47.7	-26°15.9
Altair	62°00.0	8°55.9
Peacock	53°05.9	-56°39.1
Deneb	49°26.1	45°21.9
Enif	33°39.0	9°59.3
Al Na'ir	27°33.2	-46°50.4
Fomalhaut	15°14.7	-29°29.4
Scheat	13°45.4	28°13.0
Markab	13°30.1	15°20.3

Mar 08 Sat	SHA	Mer.pass
Venus	353°49.9	13:18
Mars	250°10.3	20:13
Jupiter	288°29.3	17:40
Saturn	7°00.3	12:26

Mar 09 Sun	SHA	Mer.pass
Venus	354°08.1	13:13
Mars	250°01.2	20:09
Jupiter	288°22.9	17:36
Saturn	6°53.5	12:23

Mar 10 Mon	SHA	Mer.pass
Venus	354°28.2	13:07
Mars	249°51.6	20:06
Jupiter	288°16.3	17:33
Saturn	6°46.7	12:19

Horizontal parallax	
Venus:	0.5
Mars:	0.2

h	Sun		Moon				
Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	177°17.9	S04°52.5	71°09.6	5.4′	N28°36.9	1.6′	57.5′
1	192°18.0	51.5	85°34.0	5.5′	28°35.3	1.8′	57.5′
2	207°18.2	50.5	99°58.5	5.5′	28°33.5	1.9′	57.5′
3	222°18.3	·· 49.6	114°23.0	5.6′	28°31.6	2.1′	57.5′
4	237°18.5	48.6	128°47.6	5.6′	28°29.5	2.2′	57.4′
5	252°18.6	47.6	143°12.2	5.7′	28°27.3	2.5′	57.4′
6	267°18.8	S04°46.6	157°37.0	5.8′	N28°24.8	2.6′	57.4′
7	282°19.0	45.6	172°01.7	5.8′	28°22.2	2.7′	57.4′
8	297°19.1	44.7	186°26.6	5.9′	28°19.5	3.0′	57.3′
9	312°19.3	·· 43.7	200°51.4	6.0′	28°16.5	3.1′	57.3′
10	327°19.4	42.7	215°16.4	6.0′	28°13.4	3.3′	57.3′
11	342°19.6	41.7	229°41.4	6.1′	28°10.1	3.4′	57.3′
12	357°19.7	S04°40.8	244°06.6	6.2′	N28°06.7	3.6′	57.2′
13	12°19.9	39.8	258°31.7	6.3′	28°03.1	3.8′	57.2′
14	27°20.0	38.8	272°57.0	6.3′	27°59.3	4.0′	57.2′
15	42°20.2	·· 37.8	287°22.3	6.4′	27°55.3	4.1′	57.2′
16	57°20.3	36.9	301°47.7	6.5′	27°51.2	4.2′	57.1′
17	72°20.5	35.9	316°13.2	6.6′	27°47.0	4.5′	57.1′
18	87°20.7	S04°34.9	330°38.7	6.6′	N27°42.5	4.5′	57.1′
19	102°20.8	33.9	345°04.4	6.7′	27°38.0	4.8′	57.1′
20	117°21.0	33.0	359°30.1	6.8′	27°33.2	4.9′	57.0′
21	132°21.1	·· 32.0	13°55.9	6.9′	27°28.3	5.0′	57.0′
22	147°21.3	31.0	28°21.8	7.0′	27°23.3	5.3′	57.0′
23	162°21.4	30.0	42°47.8	7.1′	27°18.0	5.3′	57.0′
	SD = 16.1′	d = 1.0′	SD = 15.7′				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	177°21.6	S04°29.0	57°13.8	7.2′	N27°12.7	5.5′	56.9′
1	192°21.8	28.1	71°40.0	7.2′	27°07.2	5.7′	56.9′
2	207°21.9	27.1	86°06.2	7.3′	27°01.5	5.8′	56.9′
3	222°22.1	·· 26.1	100°32.6	7.4′	26°55.7	6.0′	56.9′
4	237°22.2	25.1	114°59.0	7.5′	26°49.7	6.1′	56.8′
5	252°22.4	24.2	129°25.5	7.6′	26°43.6	6.2′	56.8′
6	267°22.5	S04°23.2	143°52.1	7.7′	N26°37.4	6.4′	56.8′
7	282°22.7	22.2	158°18.8	7.8′	26°31.0	6.6′	56.8′
8	297°22.9	21.2	172°45.6	7.9′	26°24.4	6.7′	56.7′
9	312°23.0	·· 20.2	187°12.5	8.0′	26°17.7	6.8′	56.7′
10	327°23.2	19.3	201°39.5	8.1′	26°10.9	7.0′	56.7′
11	342°23.3	18.3	216°06.6	8.2′	26°03.9	7.1′	56.7′
12	357°23.5	S04°17.3	230°33.7	8.3′	N25°56.8	7.2′	56.6′
13	12°23.7	16.3	245°01.0	8.4′	25°49.6	7.4′	56.6′
14	27°23.8	15.3	259°28.4	8.5′	25°42.2	7.5′	56.6′
15	42°24.0	·· 14.4	273°55.9	8.6′	25°34.7	7.6′	56.6′
16	57°24.1	13.4	288°23.5	8.7′	25°27.1	7.8′	56.5′
17	72°24.3	12.4	302°51.1	8.8′	25°19.3	7.9′	56.5′
18	87°24.5	S04°11.4	317°18.9	8.9′	N25°11.4	8.1′	56.5′
19	102°24.6	10.4	331°46.8	9.0′	25°03.3	8.1′	56.5′
20	117°24.8	09.5	346°14.8	9.1′	24°55.2	8.3′	56.5′
21	132°24.9	·· 08.5	0°42.9	9.2′	24°46.9	8.4′	56.4′
22	147°25.1	07.5	15°11.0	9.3′	24°38.5	8.5′	56.4′
23	162°25.3	06.5	29°39.3	9.4′	24°30.0	8.7′	56.4′
	SD = 16.1′	d = 1.0′	SD = 15.5′				

Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	177°25.4	S04°05.6	44°07.7	9.5′	N24°21.3	8.8′	56.4′
1	192°25.6	04.6	58°36.2	9.6′	24°12.5	8.9′	56.3′
2	207°25.7	03.6	73°04.8	9.7′	24°03.6	9.0′	56.3′
3	222°25.9	·· 02.6	87°33.5	9.8′	23°54.6	9.1′	56.3′
4	237°26.1	01.6	102°02.3	9.9′	23°45.5	9.3′	56.3′
5	252°26.2	04°00.7	116°31.2	10.0′	23°36.2	9.3′	56.3′
6	267°26.4	S03°59.7	131°00.2	10.1′	N23°26.9	9.5′	56.2′
7	282°26.5	58.7	145°29.3	10.2′	23°17.4	9.6′	56.2′
8	297°26.7	57.7	159°58.5	10.3′	23°07.8	9.6′	56.2′
9	312°26.9	·· 56.7	174°27.8	10.4′	22°58.2	9.8′	56.2′
10	327°27.0	55.7	188°57.2	10.5′	22°48.4	9.9′	56.1′
11	342°27.2	54.8	203°26.8	10.6′	22°38.5	10.1′	56.1′
12	357°27.4	S03°53.8	217°56.4	10.7′	N22°28.4	10.1′	56.1′
13	12°27.5	52.8	232°26.1	10.8′	22°18.3	10.2′	56.1′
14	27°27.7	51.8	246°55.9	10.9′	22°08.1	10.3′	56.1′
15	42°27.8	·· 50.8	261°25.8	11.0′	21°57.8	10.4′	56.0′
16	57°28.0	49.9	275°55.9	11.1′	21°47.4	10.5′	56.0′
17	72°28.2	48.9	290°26.0	11.2′	21°36.9	10.6′	56.0′
18	87°28.3	S03°47.9	304°56.2	11.3′	N21°26.3	10.7′	56.0′
19	102°28.5	46.9	319°26.5	11.4′	21°15.6	10.8′	56.0′
20	117°28.7	45.9	333°57.0	11.5′	21°04.8	10.9′	55.9′
21	132°28.8	·· 45.0	348°27.5	11.6′	20°53.9	11.0′	55.9′
22	147°29.0	44.0	2°58.1	11.7′	20°42.9	11.1′	55.9′
23	162°29.2	43.0	17°28.8	11.8′	20°31.8	11.1′	55.9′
	SD = 16.1′	d = 1.0′	SD = 15.4′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	04:27	05:47	06:54	17:29	18:37	19:58
N 70°	04:37	05:49	06:49	17:34	18:35	19:47
68°	04:45	05:50	06:45	17:38	18:33	19:39
66°	04:51	05:51	06:42	17:41	18:32	19:32
64°	04:56	05:52	06:39	17:43	18:31	19:26
62°	05:01	05:52	06:36	17:46	18:30	19:22
60°	05:05	05:53	06:34	17:48	18:29	19:18
N 58°	05:08	05:53	06:32	17:50	18:29	19:15
56°	05:11	05:54	06:31	17:51	18:28	19:12
54°	05:13	05:54	06:29	17:53	18:28	19:09
52°	05:15	05:54	06:28	17:54	18:28	19:07
50°	05:17	05:54	06:26	17:56	18:28	19:05
45°	05:20	05:54	06:23	17:58	18:28	19:02
N 40°	05:23	05:54	06:21	18:01	18:28	18:59
35°	05:24	05:53	06:19	18:03	18:28	18:57
30°	05:25	05:53	06:17	18:05	18:28	18:56
20°	05:26	05:51	06:13	18:08	18:30	18:55
N 10°	05:25	05:49	06:10	18:11	18:32	18:56
0°	05:22	05:46	06:07	18:14	18:34	18:58
S 10°	05:18	05:43	06:04	18:17	18:38	19:02
20°	05:13	05:38	06:01	18:20	18:42	19:08
30°	05:04	05:32	05:56	18:24	18:48	19:16
35°	04:59	05:29	05:54	18:26	18:52	19:22
40°	04:52	05:24	05:51	18:29	18:56	19:28
45°	04:43	05:18	05:48	18:32	19:01	19:37
S 50°	04:32	05:11	05:44	18:36	19:08	19:47
52°	04:27	05:08	05:42	18:37	19:11	19:53
54°	04:21	05:04	05:41	18:39	19:15	19:59
56°	04:14	05:00	05:38	18:41	19:19	20:05
58°	04:06	04:56	05:36	18:44	19:24	20:13
S 60°	03:57	04:50	05:33	18:46	19:29	20:22

Lat.	**Moonrise** Sat	Sun	Mon	**Moonset** Sat	Sun	Mon
N 72°						
N 70°						
68°						
66°			10:50			08:10
64°			11:36			07:23
62°		10:06	12:06		07:03	06:53
60°	09:05	10:45	12:28	06:05	06:24	06:29
N 58°	09:43	11:12	12:46	05:26	05:56	06:11
56°	10:10	11:33	13:02	04:59	05:35	05:55
54°	10:31	11:50	13:15	04:38	05:17	05:41
52°	10:49	12:05	13:26	04:20	05:02	05:29
50°	11:04	12:18	13:36	04:05	04:48	05:19
45°	11:34	12:44	13:57	03:34	04:21	04:57
N 40°	11:58	13:05	14:14	03:11	04:00	04:39
35°	12:17	13:22	14:28	02:51	03:42	04:24
30°	12:34	13:37	14:40	02:34	03:26	04:10
20°	13:02	14:02	15:01	02:05	03:00	03:48
N 10°	13:26	14:24	15:19	01:41	02:37	03:28
0°	13:48	14:44	15:36	01:18	02:16	03:10
S 10°	14:11	15:04	15:53	00:55	01:54	02:51
20°	14:35	15:26	16:11	00:30	01:31	02:31
30°	15:03	15:51	16:31	00:01	01:04	02:08
35°	15:19	16:05	16:43	·· ··	00:48	01:54
40°	15:38	16:22	16:57	·· ··	00:29	01:38
45°	16:01	16:42	17:13	·· ··	00:07	01:19
S 50°	16:31	17:07	17:32	23:38	·· ··	00:55
52°	16:46	17:19	17:42	23:23	·· ··	00:43
54°	17:03	17:33	17:52	23:07	·· ··	00:30
56°	17:23	17:49	18:04	22:47	·· ··	00:14
58°	17:48	18:08	18:17	22:22	23:56	·· ··
S 60°	18:22	18:31	18:33	21:48	23:34	·· ··

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 8-10 64-83%
08	10:49	10:41	12:11	20:02	07:33	
09	10:34	10:26	12:10	20:57	08:30	
10	10:18	10:11	12:10	21:48	09:23	

March 11, 12, 13 UT (Tue., Wed., Thu.)

	Aries	Venus		Mars		Jupiter		Saturn	
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	168°54.6	163°44.9	N11°06.5	58°35.9	N25°24.1	97°04.1	N22°01.2	175°34.4	S04°57.8
1	183°57.0	178°48.3	06.3	73°37.9	23.9	112°06.3	01.3	190°36.6	57.7
2	198°59.5	193°51.7	06.2	88°39.9	23.8	127°08.5	01.3	205°38.8	57.6
3	214°02.0	208°55.2	·· 06.1	103°41.9	·· 23.7	142°10.6	·· 01.4	220°41.0	·· 57.5
4	229°04.4	223°58.6	05.9	118°43.9	23.5	157°12.8	01.4	235°43.1	57.4
5	244°06.9	239°02.1	05.8	133°46.0	23.4	172°15.0	01.4	250°45.3	57.2
6	259°09.4	254°05.5	N11°05.6	148°48.0	N25°23.3	187°17.2	N22°01.5	265°47.5	S04°57.1
7	274°11.8	269°08.9	05.5	163°50.0	23.1	202°19.4	01.5	280°49.7	57.0
8	289°14.3	284°12.4	05.4	178°52.0	23.0	217°21.5	01.6	295°51.8	56.9
9	304°16.8	299°15.8	·· 05.2	193°54.0	·· 22.9	232°23.7	·· 01.6	310°54.0	·· 56.8
10	319°19.2	314°19.3	05.0	208°56.0	22.7	247°25.9	01.7	325°56.2	56.6
11	334°21.7	329°22.8	04.9	223°58.0	22.6	262°28.1	01.7	340°58.4	56.5
12	349°24.1	344°26.2	N11°04.7	239°00.0	N25°22.5	277°30.2	N22°01.7	356°00.6	S04°56.4
13	4°26.6	359°29.7	04.6	254°02.1	22.3	292°32.4	01.8	11°02.7	56.3
14	19°29.1	14°33.2	04.4	269°04.1	22.2	307°34.6	01.8	26°04.9	56.2
15	34°31.5	29°36.6	·· 04.2	284°06.1	·· 22.1	322°36.8	·· 01.9	41°07.1	·· 56.0
16	49°34.0	44°40.1	04.1	299°08.1	21.9	337°38.9	01.9	56°09.3	55.9
17	64°36.5	59°43.6	03.9	314°10.1	21.8	352°41.1	01.9	71°11.5	55.8
18	79°38.9	74°47.1	N11°03.7	329°12.1	N25°21.7	7°43.3	N22°02.0	86°13.6	S04°55.7
19	94°41.4	89°50.5	03.5	344°14.1	21.5	22°45.5	02.0	101°15.8	55.6
20	109°43.9	104°54.0	03.4	359°16.1	21.4	37°47.6	02.1	116°18.0	55.4
21	124°46.3	119°57.5	·· 03.2	14°18.1	·· 21.3	52°49.8	·· 02.1	131°20.2	·· 55.3
22	139°48.8	135°01.0	03.0	29°20.1	21.1	67°52.0	02.1	146°22.4	55.2
23	154°51.3	150°04.5	02.8	44°22.1	21.0	82°54.2	02.2	161°24.5	55.1
Mer.pass. 12:42		ν 3.4′	d 0.1′	m -4.45	ν 2.0′	d 0.1′	m -0.02	ν 2.2′	d 0.0′ m -2.23	ν 2.2′	d 0.1′ m 1.10

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	169°53.7	165°08.0	N11°02.6	59°24.1	N25°20.9	97°56.3	N22°02.2	176°26.7	S04°55.0
1	184°56.2	180°11.5	02.4	74°26.1	20.7	112°58.5	02.3	191°28.9	54.8
2	199°58.6	195°15.0	02.2	89°28.1	20.6	128°00.7	02.3	206°31.1	54.7
3	215°01.1	210°18.5	·· 02.0	104°30.1	·· 20.5	143°02.8	·· 02.3	221°33.3	·· 54.6
4	230°03.6	225°22.0	01.8	119°32.1	20.3	158°05.0	02.4	236°35.4	54.5
5	245°06.0	240°25.5	01.6	134°34.1	20.2	173°07.2	02.4	251°37.6	54.4
6	260°08.5	255°29.0	N11°01.4	149°36.0	N25°20.1	188°09.4	N22°02.5	266°39.8	S04°54.2
7	275°11.0	270°32.6	01.2	164°38.0	19.9	203°11.5	02.5	281°42.0	54.1
8	290°13.4	285°36.1	01.0	179°40.0	19.8	218°13.7	02.6	296°44.1	54.0
9	305°15.9	300°39.6	·· 00.8	194°42.0	·· 19.7	233°15.9	·· 02.6	311°46.3	·· 53.9
10	320°18.4	315°43.1	00.6	209°44.0	19.5	248°18.0	02.6	326°48.5	53.7
11	335°20.8	330°46.7	00.3	224°46.0	19.4	263°20.2	02.7	341°50.7	53.6
12	350°23.3	345°50.2	N11°00.1	239°48.0	N25°19.3	278°22.4	N22°02.7	356°52.9	S04°53.5
13	5°25.7	0°53.7	10°59.9	254°50.0	19.1	293°24.5	02.8	11°55.0	53.4
14	20°28.2	15°57.3	59.7	269°51.9	19.0	308°26.7	02.8	26°57.2	53.3
15	35°30.7	31°00.8	·· 59.4	284°53.9	·· 18.9	323°28.9	·· 02.8	41°59.4	·· 53.1
16	50°33.1	46°04.4	59.2	299°55.9	18.7	338°31.0	02.9	57°01.6	53.0
17	65°35.6	61°07.9	59.0	314°57.9	18.6	353°33.2	02.9	72°03.8	52.9
18	80°38.1	76°11.5	N10°58.7	329°59.9	N25°18.4	8°35.4	N22°03.0	87°05.9	S04°52.8
19	95°40.5	91°15.0	58.5	345°01.8	18.3	23°37.5	03.0	102°08.1	52.7
20	110°43.0	106°18.6	58.3	0°03.8	18.2	38°39.7	03.0	117°10.3	52.5
21	125°45.5	121°22.1	·· 58.0	15°05.8	·· 18.0	53°41.9	·· 03.1	132°12.5	·· 52.4
22	140°47.9	136°25.7	57.8	30°07.8	17.9	68°44.0	03.1	147°14.7	52.3
23	155°50.4	151°29.3	57.5	45°09.7	17.8	83°46.2	03.2	162°16.8	52.2
Mer.pass. 12:38		ν 3.5′	d 0.2′	m -4.40	ν 2.0′	d 0.1′	m 0.00	ν 2.2′	d 0.0′ m -2.22	ν 2.2′	d 0.1′ m 1.10

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	170°52.9	166°32.8	N10°57.3	60°11.7	N25°17.6	98°48.4	N22°03.2	177°19.0	S04°52.1
1	185°55.3	181°36.4	57.0	75°13.7	17.5	113°50.5	03.3	192°21.2	51.9
2	200°57.8	196°40.0	56.7	90°15.6	17.4	128°52.7	03.3	207°23.4	51.8
3	216°00.2	211°43.5	·· 56.5	105°17.6	·· 17.2	143°54.9	·· 03.3	222°25.6	·· 51.7
4	231°02.7	226°47.1	56.2	120°19.6	17.1	158°57.0	03.4	237°27.7	51.6
5	246°05.2	241°50.7	55.9	135°21.6	16.9	173°59.2	03.4	252°29.9	51.5
6	261°07.6	256°54.3	N10°55.7	150°23.5	N25°16.8	189°01.4	N22°03.5	267°32.1	S04°51.3
7	276°10.1	271°57.9	55.4	165°25.5	16.7	204°03.5	03.5	282°34.3	51.2
8	291°12.6	287°01.5	55.1	180°27.4	16.5	219°05.7	03.5	297°36.4	51.1
9	306°15.0	302°05.1	·· 54.9	195°29.4	·· 16.4	234°07.9	·· 03.6	312°38.6	·· 51.0
10	321°17.5	317°08.7	54.6	210°31.4	16.2	249°10.0	03.6	327°40.8	50.9
11	336°20.0	332°12.3	54.3	225°33.3	16.1	264°12.2	03.7	342°43.0	50.7
12	351°22.4	347°15.9	N10°54.0	240°35.3	N25°16.0	279°14.3	N22°03.7	357°45.2	S04°50.6
13	6°24.9	2°19.5	53.7	255°37.3	15.8	294°16.5	03.8	12°47.3	50.5
14	21°27.3	17°23.1	53.4	270°39.2	15.7	309°18.7	03.8	27°49.5	50.4
15	36°29.8	32°26.7	·· 53.1	285°41.2	·· 15.6	324°20.8	·· 03.8	42°51.7	·· 50.3
16	51°32.3	47°30.3	52.8	300°43.1	15.4	339°23.0	03.9	57°53.9	50.1
17	66°34.7	62°33.9	52.5	315°45.1	15.3	354°25.1	03.9	72°56.1	50.0
18	81°37.2	77°37.5	N10°52.2	330°47.0	N25°15.1	9°27.3	N22°04.0	87°58.2	S04°49.9
19	96°39.7	92°41.1	51.9	345°49.0	15.0	24°29.5	04.0	103°00.4	49.8
20	111°42.1	107°44.7	51.6	0°50.9	14.9	39°31.6	04.1	118°02.6	49.7
21	126°44.6	122°48.4	·· 51.3	15°52.9	·· 14.7	54°33.8	·· 04.1	133°04.8	·· 49.5
22	141°47.1	137°52.0	51.0	30°54.8	14.6	69°35.9	04.1	148°07.0	49.4
23	156°49.5	152°55.6	50.7	45°56.8	14.4	84°38.1	04.2	163°09.1	49.3
Mer.pass. 12:34		ν 3.6′	d 0.3′	m -4.34	ν 2.0′	d 0.1′	m 0.03	ν 2.2′	d 0.0′ m -2.22	ν 2.2′	d 0.1′ m 1.11

Stars

	SHA	Dec
Alpheratz	357°35.0	29°13.7
Ankaa	353°07.4	-42°10.3
Schedar	349°31.5	56°40.6
Diphda	348°47.4	-17°51.0
Achernar	335°20.5	-57°06.7
Hamal	327°51.3	23°34.9
Polaris	314°14.8	89°22.5
Acamar	315°11.9	-40°12.4
Menkar	314°06.2	4°11.2
Mirfak	308°28.3	49°57.2
Aldebaran	290°39.5	16°33.6
Rigel	281°03.7	-8°10.5
Capella	280°21.7	46°01.5
Bellatrix	278°22.7	6°22.3
Elnath	278°01.7	28°37.8
Alnilam	275°37.6	-1°11.2
Betelgeuse	270°51.9	7°24.6
Canopus	263°52.2	-52°42.8
Sirius	258°26.0	-16°45.2
Adhara	255°05.6	-29°00.6
Procyon	244°50.5	5°09.5
Pollux	243°16.9	27°57.9
Avior	234°14.3	-59°35.6
Suhail	222°45.9	-43°32.2
Miaplacidus	221°37.6	-69°49.4
Alphard	217°47.3	-8°46.2
Regulus	207°34.0	11°50.5
Dubhe	193°40.1	61°36.9
Denebola	182°24.5	14°25.7
Gienah	175°43.1	-17°41.0
Acrux	172°59.3	-63°14.3
Gacrux	171°51.0	-57°15.3
Alioth	166°12.3	55°49.2
Spica	158°21.9	-11°17.7
Alkaid	152°51.5	49°11.0
Hadar	148°35.4	-60°29.6
Menkent	147°57.2	-36°29.6
Arcturus	145°47.5	19°02.8
Rigil Kent.	139°39.7	-60°56.2
Kochab	137°19.0	74°02.8
Zuben'ubi	136°55.7	-16°08.9
Alphecca	126°03.4	26°37.5
Antares	112°15.6	-26°29.3
Atria	107°09.6	-69°04.1
Sabik	102°02.6	-15°45.4
Shaula	96°10.2	-37°07.3
Rasalhague	95°58.4	12°32.2
Eltanin	90°42.2	51°28.7
Kaus Aust.	83°32.4	-34°22.3
Vega	80°33.3	38°48.1
Nunki	75°47.7	-26°15.9
Altair	62°00.0	8°55.9
Peacock	53°05.9	-56°39.1
Deneb	49°26.1	45°21.9
Enif	33°38.9	9°59.3
Al Na'ir	27°33.1	-46°50.4
Fomalhaut	15°14.7	-29°29.4
Scheat	13°45.4	28°13.0
Markab	13°30.1	15°20.3

Mar 11 Tue	SHA	Mer.pass
Venus	354°50.3	13:02
Mars	249°41.3	20:03
Jupiter	288°09.5	17:29
Saturn	6°39.8	12:16

Mar 12 Wed	SHA	Mer.pass
Venus	355°14.3	12:56
Mars	249°30.4	20:00
Jupiter	288°02.6	17:26
Saturn	6°33.0	12:12

Mar 13 Thu	SHA	Mer.pass
Venus	355°40.0	12:51
Mars	249°18.9	19:57
Jupiter	287°55.5	17:22
Saturn	6°26.2	12:09

Horizontal parallax	
Venus:	0.5
Mars:	0.2

h	Sun		Moon				
Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	177°29.3	S03°42.0	31°59.6	11.9′	N20°20.7	11.3′	55.9′
1	192°29.5	41.0	46°30.5	12.0′	20°09.4	11.3′	55.8′
2	207°29.6	40.0	61°01.6	12.1′	19°58.1	11.5′	55.8′
3	222°29.8	·· 39.1	75°32.7	12.2′	19°46.6	11.5′	55.8′
4	237°30.0	38.1	90°03.9	12.3′	19°35.1	11.5′	55.8′
5	252°30.1	37.1	104°35.2	12.4′	19°23.6	11.7′	55.8′
6	267°30.3	S03°36.1	119°06.5	12.5′	N19°11.9	11.8′	55.7′
7	282°30.5	35.1	133°38.0	12.6′	19°00.1	11.8′	55.7′
8	297°30.6	34.2	148°09.6	12.7′	18°48.3	11.9′	55.7′
9	312°30.8	·· 33.2	162°41.3	12.8′	18°36.4	12.0′	55.7′
10	327°31.0	32.2	177°13.0	12.8′	18°24.4	12.0′	55.7′
11	342°31.1	31.2	191°44.9	12.9′	18°12.4	12.1′	55.6′
12	357°31.3	S03°30.2	206°16.8	13.0′	N18°00.3	12.2′	55.6′
13	12°31.5	29.2	220°48.8	13.1′	17°48.1	12.3′	55.6′
14	27°31.6	28.3	235°20.9	13.2′	17°35.8	12.4′	55.6′
15	42°31.8	·· 27.3	249°53.1	13.3′	17°23.4	12.4′	55.6′
16	57°32.0	26.3	264°25.4	13.4′	17°11.0	12.4′	55.5′
17	72°32.1	25.3	278°57.8	13.5′	16°58.6	12.6′	55.5′
18	87°32.3	S03°24.3	293°30.2	13.5′	N16°46.0	12.6′	55.5′
19	102°32.5	23.3	308°02.8	13.6′	16°33.4	12.6′	55.5′
20	117°32.6	22.4	322°35.4	13.7′	16°20.8	12.8′	55.5′
21	132°32.8	·· 21.4	337°08.1	13.8′	16°08.0	12.8′	55.4′
22	147°33.0	20.4	351°40.9	13.9′	15°55.2	12.8′	55.4′
23	162°33.1	19.4	6°13.8	13.9′	15°42.4	12.9′	55.4′
	SD = 16.1′	d = 1.0′	SD = 15.2′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	177°33.3	S03°18.4	20°46.7	14.0′	N15°29.5	13.0′	55.4′
1	192°33.5	17.4	35°19.7	14.1′	15°16.5	13.0′	55.4′
2	207°33.6	16.5	49°52.8	14.2′	15°03.5	13.1′	55.4′
3	222°33.8	·· 15.5	64°26.0	14.3′	14°50.4	13.1′	55.3′
4	237°34.0	14.5	78°59.3	14.3′	14°37.3	13.2′	55.3′
5	252°34.1	13.5	93°32.6	14.4′	14°24.1	13.3′	55.3′
6	267°34.3	S03°12.5	108°06.0	14.5′	N14°10.8	13.3′	55.3′
7	282°34.5	11.5	122°39.5	14.6′	13°57.5	13.3′	55.3′
8	297°34.6	10.6	137°13.1	14.6′	13°44.2	13.4′	55.3′
9	312°34.8	·· 09.6	151°46.7	14.7′	13°30.8	13.4′	55.2′
10	327°35.0	08.6	166°20.4	14.8′	13°17.4	13.5′	55.2′
11	342°35.1	07.6	180°54.1	14.8′	13°03.9	13.5′	55.2′
12	357°35.3	S03°06.6	195°28.0	14.9′	N12°50.4	13.6′	55.2′
13	12°35.5	05.6	210°01.9	15.0′	12°36.8	13.6′	55.2′
14	27°35.7	04.7	224°35.8	15.0′	12°23.2	13.7′	55.1′
15	42°35.8	·· 03.7	239°09.9	15.1′	12°09.5	13.6′	55.1′
16	57°36.0	02.7	253°44.0	15.2′	11°55.9	13.8′	55.1′
17	72°36.2	01.7	268°18.1	15.2′	11°42.1	13.8′	55.1′
18	87°36.3	S03°00.7	282°52.3	15.3′	N11°28.3	13.8′	55.1′
19	102°36.5	02°59.7	297°26.6	15.3′	11°14.5	13.8′	55.1′
20	117°36.7	58.8	312°01.0	15.4′	11°00.7	13.9′	55.1′
21	132°36.8	·· 57.8	326°35.4	15.5′	10°46.8	13.9′	55.0′
22	147°37.0	56.8	341°09.8	15.5′	10°32.9	14.0′	55.0′
23	162°37.2	55.8	355°44.3	15.6′	10°18.9	13.9′	55.0′
	SD = 16.1′	d = 1.0′	SD = 15.1′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	177°37.4	S02°54.8	10°18.9	15.6′	N10°05.0	14.1′	55.0′
1	192°37.5	53.8	24°53.5	15.7′	09°50.9	14.0′	55.0′
2	207°37.7	52.8	39°28.2	15.7′	09°36.9	14.1′	55.0′
3	222°37.9	·· 51.9	54°03.0	15.8′	09°22.8	14.1′	54.9′
4	237°38.0	50.9	68°37.8	15.8′	09°08.7	14.1′	54.9′
5	252°38.2	49.9	83°12.6	15.9′	08°54.6	14.2′	54.9′
6	267°38.4	S02°48.9	97°47.5	15.9′	N08°40.4	14.2′	54.9′
7	282°38.6	47.9	112°22.4	16.0′	08°26.2	14.2′	54.9′
8	297°38.7	46.9	126°57.4	16.0′	08°12.0	14.2′	54.9′
9	312°38.9	·· 45.9	141°32.4	16.1′	07°57.8	14.3′	54.8′
10	327°39.1	45.0	156°07.5	16.1′	07°43.5	14.2′	54.8′
11	342°39.2	44.0	170°42.6	16.2′	07°29.3	14.3′	54.8′
12	357°39.4	S02°43.0	185°17.8	16.2′	N07°15.0	14.3′	54.8′
13	12°39.6	42.0	199°53.0	16.3′	07°00.7	14.4′	54.8′
14	27°39.8	41.0	214°28.3	16.3′	06°46.3	14.3′	54.8′
15	42°39.9	·· 40.0	229°03.6	16.3′	06°32.0	14.4′	54.8′
16	57°40.1	39.0	243°38.9	16.4′	06°17.6	14.4′	54.7′
17	72°40.3	38.1	258°14.3	16.4′	06°03.2	14.4′	54.7′
18	87°40.4	S02°37.1	272°49.7	16.4′	N05°48.8	14.4′	54.7′
19	102°40.6	36.1	287°25.1	16.5′	05°34.4	14.4′	54.7′
20	117°40.8	35.1	302°00.6	16.5′	05°20.0	14.5′	54.7′
21	132°41.0	·· 34.1	316°36.1	16.5′	05°05.5	14.4′	54.7′
22	147°41.1	33.1	331°11.7	16.6′	04°51.1	14.5′	54.7′
23	162°41.3	32.1	345°47.3	16.6′	04°36.6	14.5′	54.6′
	SD = 16.1′	d = 1.0′	SD = 15.0′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	04:10	05:32	06:38	17:43	18:50	20:13
N 70°	04:22	05:35	06:35	17:46	18:47	20:01
68°	04:31	05:37	06:33	17:49	18:44	19:51
66°	04:39	05:40	06:30	17:51	18:42	19:43
64°	04:46	05:41	06:28	17:52	18:40	19:36
62°	04:51	05:43	06:27	17:54	18:38	19:30
60°	04:55	05:44	06:25	17:55	18:37	19:26
N 58°	04:59	05:45	06:24	17:57	18:36	19:22
56°	05:03	05:46	06:23	17:58	18:35	19:18
54°	05:05	05:47	06:22	17:59	18:34	19:15
52°	05:08	05:47	06:21	18:00	18:33	19:13
50°	05:10	05:48	06:20	18:00	18:33	19:10
45°	05:15	05:49	06:18	18:02	18:31	19:06
N 40°	05:18	05:49	06:16	18:04	18:31	19:02
35°	05:20	05:49	06:15	18:05	18:30	19:00
30°	05:22	05:49	06:13	18:06	18:30	18:58
20°	05:23	05:49	06:11	18:09	18:31	18:56
N 10°	05:23	05:48	06:09	18:11	18:32	18:56
0°	05:22	05:46	06:06	18:13	18:34	18:58
S 10°	05:19	05:43	06:04	18:15	18:36	19:01
20°	05:14	05:39	06:01	18:17	18:40	19:05
30°	05:06	05:34	05:58	18:20	18:44	19:12
35°	05:01	05:31	05:57	18:22	18:47	19:17
40°	04:55	05:27	05:55	18:24	18:51	19:23
45°	04:48	05:23	05:52	18:26	18:56	19:31
S 50°	04:38	05:17	05:49	18:29	19:02	19:40
52°	04:33	05:14	05:48	18:30	19:04	19:45
54°	04:27	05:11	05:46	18:32	19:07	19:50
56°	04:21	05:07	05:45	18:33	19:11	19:56
58°	04:14	05:03	05:43	18:35	19:15	20:03
S 60°	04:06	04:58	05:41	18:37	19:19	20:11

Lat.	**Moonrise** Tue	Wed	Thu	**Moonset** Tue	Wed	Thu
N 72°		14:15	16:30		08:04	07:17
N 70°	12:05	14:38	16:39	08:38	07:39	07:05
68°	12:47	14:55	16:46	07:55	07:19	06:56
66°	13:15	15:09	16:52	07:26	07:04	06:47
64°	13:36	15:21	16:58	07:04	06:51	06:41
62°	13:53	15:31	17:02	06:46	06:40	06:35
60°	14:07	15:39	17:06	06:31	06:30	06:29
N 58°	14:19	15:46	17:09	06:18	06:22	06:25
56°	14:29	15:52	17:12	06:07	06:15	06:20
54°	14:38	15:58	17:15	05:57	06:08	06:17
52°	14:46	16:03	17:17	05:48	06:02	06:13
50°	14:53	16:08	17:20	05:41	05:57	06:10
45°	15:09	16:18	17:24	05:24	05:45	06:03
N 40°	15:21	16:26	17:28	05:10	05:36	05:58
35°	15:32	16:33	17:32	04:58	05:27	05:53
30°	15:41	16:39	17:35	04:48	05:20	05:48
20°	15:57	16:50	17:40	04:30	05:07	05:41
N 10°	16:11	16:59	17:45	04:14	04:56	05:34
0°	16:23	17:07	17:49	03:59	04:45	05:28
S 10°	16:36	17:16	17:53	03:44	04:34	05:21
20°	16:50	17:25	17:58	03:28	04:23	05:14
30°	17:05	17:35	18:03	03:10	04:09	05:06
35°	17:14	17:41	18:06	02:59	04:01	05:02
40°	17:25	17:48	18:09	02:46	03:53	04:56
45°	17:36	17:56	18:13	02:31	03:42	04:50
S 50°	17:51	18:05	18:17	02:13	03:29	04:43
52°	17:57	18:09	18:19	02:04	03:23	04:39
54°	18:05	18:14	18:22	01:55	03:17	04:35
56°	18:13	18:19	18:24	01:44	03:09	04:31
58°	18:22	18:25	18:27	01:31	03:01	04:26
S 60°	18:33	18:32	18:30	01:16	02:52	04:21

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 11-13 90-98%
11	10:03	09:55	12:10	22:34	10:11	
12	09:47	09:39	12:10	23:18	10:56	
13	09:31	09:22	12:09	23:58	11:38	

March 14, 15, 16 UT (Fri., Sat., Sun.)

	Aries	Venus		Mars		Jupiter		Saturn	
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	171°52.0	167°59.3	N10°50.4	60°58.7	N25°14.3	99°40.3	N22°04.2	178°11.3	S04°49.2
1	186°54.5	183°02.9	50.1	76°00.7	14.2	114°42.4	04.3	193°13.5	49.1
2	201°56.9	198°06.5	49.7	91°02.6	14.0	129°44.6	04.3	208°15.7	48.9
3	216°59.4	213°10.2	·· 49.4	106°04.6	·· 13.9	144°46.7	·· 04.3	223°17.9	·· 48.8
4	232°01.8	228°13.8	49.1	121°06.5	13.7	159°48.9	04.4	238°20.0	48.7
5	247°04.3	243°17.5	48.8	136°08.5	13.6	174°51.0	04.4	253°22.2	48.6
6	262°06.8	258°21.1	N10°48.4	151°10.4	N25°13.5	189°53.2	N22°04.5	268°24.4	S04°48.4
7	277°09.2	273°24.7	48.1	166°12.3	13.3	204°55.4	04.5	283°26.6	48.3
8	292°11.7	288°28.4	47.8	181°14.3	13.2	219°57.5	04.6	298°28.7	48.2
9	307°14.2	303°32.1	·· 47.4	196°16.2	·· 13.0	234°59.7	·· 04.6	313°30.9	·· 48.1
10	322°16.6	318°35.7	47.1	211°18.2	12.9	250°01.8	04.6	328°33.1	48.0
11	337°19.1	333°39.4	46.7	226°20.1	12.7	265°04.0	04.7	343°35.3	47.8
12	352°21.6	348°43.0	N10°46.4	241°22.0	N25°12.6	280°06.1	N22°04.7	358°37.5	S04°47.7
13	7°24.0	3°46.7	46.0	256°24.0	12.5	295°08.3	04.8	13°39.6	47.6
14	22°26.5	18°50.4	45.7	271°25.9	12.3	310°10.5	04.8	28°41.8	47.5
15	37°28.9	33°54.0	·· 45.3	286°27.8	·· 12.2	325°12.6	·· 04.9	43°44.0	·· 47.4
16	52°31.4	48°57.7	45.0	301°29.8	12.0	340°14.8	04.9	58°46.2	47.2
17	67°33.9	64°01.4	44.6	316°31.7	11.9	355°16.9	04.9	73°48.4	47.1
18	82°36.3	79°05.0	N10°44.2	331°33.6	N25°11.7	10°19.1	N22°05.0	88°50.5	S04°47.0
19	97°38.8	94°08.7	43.9	346°35.6	11.6	25°21.2	05.0	103°52.7	46.9
20	112°41.3	109°12.4	43.5	1°37.5	11.5	40°23.4	05.1	118°54.9	46.8
21	127°43.7	124°16.1	·· 43.1	16°39.4	·· 11.3	55°25.5	·· 05.1	133°57.1	·· 46.6
22	142°46.2	139°19.8	42.8	31°41.3	11.2	70°27.7	05.2	148°59.3	46.5
23	157°48.7	154°23.4	42.4	46°43.3	11.0	85°29.8	05.2	164°01.4	46.4
Mer.pass. 12:30		ν 3.6′	d 0.3′	m -4.28	ν 1.9′	d 0.1′	m 0.05	ν 2.2′	d 0.0′ m -2.21	ν 2.2′	d 0.1′ m 1.11

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	172°51.1	169°27.1	N10°42.0	61°45.2	N25°10.9	100°32.0	N22°05.2	179°03.6	S04°46.3
1	187°53.6	184°30.8	41.6	76°47.1	10.7	115°34.1	05.3	194°05.8	46.2
2	202°56.1	199°34.5	41.2	91°49.0	10.6	130°36.3	05.3	209°08.0	46.0
3	217°58.5	214°38.2	·· 40.9	106°51.0	·· 10.4	145°38.4	·· 05.4	224°10.2	·· 45.9
4	233°01.0	229°41.9	40.5	121°52.9	10.3	160°40.6	05.4	239°12.3	45.8
5	248°03.4	244°45.6	40.1	136°54.8	10.2	175°42.7	05.4	254°14.5	45.7
6	263°05.9	259°49.3	N10°39.7	151°56.7	N25°10.0	190°44.9	N22°05.5	269°16.7	S04°45.6
7	278°08.4	274°53.0	39.3	166°58.6	09.9	205°47.0	05.5	284°18.9	45.4
8	293°10.8	289°56.7	38.9	182°00.5	09.7	220°49.2	05.6	299°21.1	45.3
9	308°13.3	305°00.4	·· 38.5	197°02.5	·· 09.6	235°51.3	·· 05.6	314°23.2	·· 45.2
10	323°15.8	320°04.1	38.1	212°04.4	09.4	250°53.5	05.7	329°25.4	45.1
11	338°18.2	335°07.8	37.7	227°06.3	09.3	265°55.6	05.7	344°27.6	45.0
12	353°20.7	350°11.6	N10°37.3	242°08.2	N25°09.1	280°57.8	N22°05.7	359°29.8	S04°44.8
13	8°23.2	5°15.3	36.9	257°10.1	09.0	295°59.9	05.8	14°31.9	44.7
14	23°25.6	20°19.0	36.4	272°12.0	08.9	311°02.1	05.8	29°34.1	44.6
15	38°28.1	35°22.7	·· 36.0	287°13.9	·· 08.7	326°04.2	·· 05.9	44°36.3	·· 44.5
16	53°30.5	50°26.4	35.6	302°15.8	08.6	341°06.4	05.9	59°38.5	44.4
17	68°33.0	65°30.2	35.2	317°17.8	08.4	356°08.5	06.0	74°40.7	44.2
18	83°35.5	80°33.9	N10°34.8	332°19.7	N25°08.3	11°10.7	N22°06.0	89°42.8	S04°44.1
19	98°37.9	95°37.6	34.3	347°21.6	08.1	26°12.8	06.0	104°45.0	44.0
20	113°40.4	110°41.3	33.9	2°23.5	08.0	41°15.0	06.1	119°47.2	43.9
21	128°42.9	125°45.1	·· 33.5	17°25.4	·· 07.8	56°17.1	·· 06.1	134°49.4	·· 43.8
22	143°45.3	140°48.8	33.0	32°27.3	07.7	71°19.2	06.2	149°51.6	43.6
23	158°47.8	155°52.5	32.6	47°29.2	07.5	86°21.4	06.2	164°53.7	43.5
Mer.pass. 12:27		ν 3.7′	d 0.4′	m -4.22	ν 1.9′	d 0.1′	m 0.07	ν 2.2′	d 0.0′ m -2.20	ν 2.2′	d 0.1′ m 1.11

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	173°50.3	170°56.3	N10°32.2	62°31.1	N25°07.4	101°23.5	N22°06.3	179°55.9	S04°43.4
1	188°52.7	186°00.0	31.7	77°33.0	07.2	116°25.7	06.3	194°58.1	43.3
2	203°55.2	201°03.8	31.3	92°34.9	07.1	131°27.8	06.3	210°00.3	43.2
3	218°57.7	216°07.5	·· 30.8	107°36.8	·· 06.9	146°30.0	·· 06.4	225°02.5	·· 43.0
4	234°00.1	231°11.3	30.4	122°38.7	06.8	161°32.1	06.4	240°04.6	42.9
5	249°02.6	246°15.0	29.9	137°40.6	06.6	176°34.3	06.5	255°06.8	42.8
6	264°05.0	261°18.7	N10°29.5	152°42.5	N25°06.5	191°36.4	N22°06.5	270°09.0	S04°42.7
7	279°07.5	276°22.5	29.0	167°44.4	06.4	206°38.5	06.6	285°11.2	42.6
8	294°10.0	291°26.3	28.6	182°46.3	06.2	221°40.7	06.6	300°13.4	42.4
9	309°12.4	306°30.0	·· 28.1	197°48.1	·· 06.1	236°42.8	·· 06.6	315°15.5	·· 42.3
10	324°14.9	321°33.8	27.6	212°50.0	05.9	251°45.0	06.7	330°17.7	42.2
11	339°17.4	336°37.5	27.2	227°51.9	05.8	266°47.1	06.7	345°19.9	42.1
12	354°19.8	351°41.3	N10°26.7	242°53.8	N25°05.6	281°49.3	N22°06.8	0°22.1	S04°42.0
13	9°22.3	6°45.0	26.2	257°55.7	05.5	296°51.4	06.8	15°24.3	41.8
14	24°24.8	21°48.8	25.8	272°57.6	05.3	311°53.5	06.9	30°26.4	41.7
15	39°27.2	36°52.6	·· 25.3	287°59.5	·· 05.2	326°55.7	·· 06.9	45°28.6	·· 41.6
16	54°29.7	51°56.3	24.8	303°01.4	05.0	341°57.8	07.0	60°30.8	41.5
17	69°32.2	67°00.1	24.3	318°03.3	04.9	357°00.0	07.0	75°33.0	41.4
18	84°34.6	82°03.9	N10°23.8	333°05.1	N25°04.7	12°02.1	N22°07.0	90°35.1	S04°41.2
19	99°37.1	97°07.6	23.4	348°07.0	04.6	27°04.2	07.1	105°37.3	41.1
20	114°39.5	112°11.4	22.9	3°08.9	04.4	42°06.4	07.1	120°39.5	41.0
21	129°42.0	127°15.2	·· 22.4	18°10.8	·· 04.3	57°08.5	·· 07.2	135°41.7	·· 40.9
22	144°44.5	142°19.0	21.9	33°12.7	04.1	72°10.7	07.2	150°43.9	40.8
23	159°46.9	157°22.7	21.4	48°14.5	04.0	87°12.8	07.3	165°46.0	40.6
Mer.pass. 12:23		ν 3.7′	d 0.4′	m -4.16	ν 1.9′	d 0.1′	m 0.10	ν 2.1′	d 0.0′ m -2.20	ν 2.2′	d 0.1′ m 1.12

Stars

	SHA	Dec
Alpheratz	357°35.0	29°13.7
Ankaa	353°07.4	-42°10.3
Schedar	349°31.5	56°40.5
Diphda	348°47.5	-17°51.0
Achernar	335°20.5	-57°06.7
Hamal	327°51.3	23°34.9
Polaris	314°16.1	89°22.5
Acamar	315°11.9	-40°12.4
Menkar	314°06.2	4°11.2
Mirfak	308°28.3	49°57.2
Aldebaran	290°39.5	16°33.6
Rigel	281°03.7	-8°10.5
Capella	280°21.7	46°01.5
Bellatrix	278°22.7	6°22.3
Elnath	278°01.7	28°37.8
Alnilam	275°37.6	-1°11.2
Betelgeuse	270°51.9	7°24.6
Canopus	263°52.2	-52°42.8
Sirius	258°26.0	-16°45.2
Adhara	255°05.6	-29°00.6
Procyon	244°50.5	5°09.5
Pollux	243°16.9	27°57.9
Avior	234°14.3	-59°35.6
Suhail	222°45.9	-43°32.2
Miaplacidus	221°37.6	-69°49.4
Alphard	217°47.3	-8°46.2
Regulus	207°34.0	11°50.5
Dubhe	193°40.1	61°36.9
Denebola	182°24.5	14°25.7
Gienah	175°43.1	-17°41.0
Acrux	172°59.3	-63°14.3
Gacrux	171°51.0	-57°15.3
Alioth	166°12.3	55°49.2
Spica	158°21.9	-11°17.7
Alkaid	152°51.5	49°11.0
Hadar	148°35.3	-60°29.6
Menkent	147°57.2	-36°29.6
Arcturus	145°47.5	19°02.8
Rigil Kent.	139°39.7	-60°56.3
Kochab	137°19.0	74°02.8
Zuben'ubi	136°55.6	-16°08.9
Alphecca	126°03.4	26°37.5
Antares	112°15.6	-26°29.3
Atria	107°09.6	-69°04.1
Sabik	102°02.6	-15°45.4
Shaula	96°10.2	-37°07.3
Rasalhague	95°58.4	12°32.2
Eltanin	90°42.2	51°28.7
Kaus Aust.	83°32.4	-34°22.3
Vega	80°33.2	38°48.1
Nunki	75°47.7	-26°15.9
Altair	62°00.0	8°55.9
Peacock	53°05.9	-56°39.1
Deneb	49°26.1	45°21.9
Enif	33°38.9	9°59.3
Al Na'ir	27°33.1	-46°50.4
Fomalhaut	15°14.7	-29°29.4
Scheat	13°45.4	28°13.0
Markab	13°30.1	15°20.3

Mar 14 Fri	SHA	Mer.pass
Venus	356°07.3	12:45
Mars	249°06.7	19:54
Jupiter	287°48.3	17:19
Saturn	6°19.3	12:05

Mar 15 Sat	SHA	Mer.pass
Venus	356°36.0	12:39
Mars	248°54.1	19:50
Jupiter	287°40.9	17:15
Saturn	6°12.5	12:02

Mar 16 Sun	SHA	Mer.pass
Venus	357°06.0	12:33
Mars	248°40.8	19:47
Jupiter	287°33.3	17:12
Saturn	6°05.7	11:59

Horizontal parallax	
Venus:	0.5
Mars:	0.1

DUT1 = UT1-UTC = +0.0434 sec ΔT = TT-UT1 = +69.1406 sec

2025 March 14 to Mar. 16 UT

h	Sun		Moon				
Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	177°41.5	S02°31.2	0°22.9	16.6′	N04°22.1	14.4′	54.6′
1	192°41.7	30.2	14°58.5	16.7′	04°07.7	14.5′	54.6′
2	207°41.8	29.2	29°34.2	16.7′	03°53.2	14.5′	54.6′
3	222°42.0	·· 28.2	44°09.9	16.7′	03°38.7	14.5′	54.6′
4	237°42.2	27.2	58°45.6	16.8′	03°24.2	14.6′	54.6′
5	252°42.4	26.2	73°21.4	16.8′	03°09.6	14.5′	54.6′
6	267°42.5	S02°25.2	87°57.1	16.8′	N02°55.1	14.5′	54.6′
7	282°42.7	24.3	102°32.9	16.8′	02°40.6	14.5′	54.5′
8	297°42.9	23.3	117°08.8	16.8′	02°26.1	14.5′	54.5′
9	312°43.0	·· 22.3	131°44.6	16.9′	02°11.6	14.6′	54.5′
10	327°43.2	21.3	146°20.5	16.9′	01°57.0	14.5′	54.5′
11	342°43.4	20.3	160°56.4	16.9′	01°42.5	14.5′	54.5′
12	357°43.6	S02°19.3	175°32.3	16.9′	N01°28.0	14.5′	54.5′
13	12°43.7	18.3	190°08.2	16.9′	01°13.5	14.5′	54.5′
14	27°43.9	17.4	204°44.1	17.0′	00°59.0	14.6′	54.5′
15	42°44.1	·· 16.4	219°20.1	17.0′	00°44.4	14.5′	54.4′
16	57°44.3	15.4	233°56.1	17.0′	00°29.9	14.5′	54.4′
17	72°44.4	14.4	248°32.1	17.0′	00°15.4	14.5′	54.4′
18	87°44.6	S02°13.4	263°08.1	17.0′	N00°00.9	14.5′	54.4′
19	102°44.8	12.4	277°44.1	17.0′	S00°13.6	14.5′	54.4′
20	117°45.0	11.4	292°20.1	17.0′	00°28.1	14.5′	54.4′
21	132°45.1	·· 10.4	306°56.1	17.0′	00°42.6	14.4′	54.4′
22	147°45.3	09.5	321°32.2	17.0′	00°57.0	14.5′	54.4′
23	162°45.5	08.5	336°08.2	17.1′	01°11.5	14.5′	54.4′
	SD = 16.1′	d = 1.0′	SD = 14.9′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	177°45.7	S02°07.5	350°44.3	17.1′	S01°26.0	14.4′	54.3′
1	192°45.9	06.5	5°20.3	17.1′	01°40.4	14.4′	54.3′
2	207°46.0	05.5	19°56.4	17.1′	01°54.8	14.5′	54.3′
3	222°46.2	·· 04.5	34°32.4	17.1′	02°09.3	14.4′	54.3′
4	237°46.4	03.5	49°08.5	17.1′	02°23.7	14.4′	54.3′
5	252°46.6	02.6	63°44.6	17.1′	02°38.1	14.3′	54.3′
6	267°46.7	S02°01.6	78°20.6	17.1′	S02°52.4	14.4′	54.3′
7	282°46.9	02°00.6	92°56.7	17.1′	03°06.8	14.3′	54.3′
8	297°47.1	01°59.6	107°32.8	17.1′	03°21.1	14.4′	54.3′
9	312°47.3	·· 58.6	122°08.8	17.1′	03°35.5	14.3′	54.3′
10	327°47.4	57.6	136°44.9	17.1′	03°49.8	14.3′	54.2′
11	342°47.6	56.6	151°21.0	17.1′	04°04.1	14.2′	54.2′
12	357°47.8	S01°55.6	165°57.0	17.0′	S04°18.3	14.3′	54.2′
13	12°48.0	54.7	180°33.1	17.0′	04°32.6	14.2′	54.2′
14	27°48.1	53.7	195°09.1	17.0′	04°46.8	14.2′	54.2′
15	42°48.3	·· 52.7	209°45.1	17.0′	05°01.0	14.2′	54.2′
16	57°48.5	51.7	224°21.1	17.0′	05°15.2	14.2′	54.2′
17	72°48.7	50.7	238°57.1	17.0′	05°29.4	14.1′	54.2′
18	87°48.9	S01°49.7	253°33.1	17.0′	S05°43.5	14.1′	54.2′
19	102°49.0	48.7	268°09.1	17.0′	05°57.6	14.1′	54.2′
20	117°49.2	47.7	282°45.1	17.0′	06°11.7	14.0′	54.2′
21	132°49.4	·· 46.8	297°21.0	16.9′	06°25.7	14.1′	54.2′
22	147°49.6	45.8	311°57.0	16.9′	06°39.8	14.0′	54.1′
23	162°49.7	44.8	326°32.9	16.9′	06°53.8	14.0′	54.1′
	SD = 16.1′	d = 1.0′	SD = 14.8′				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	177°49.9	S01°43.8	341°08.8	16.9′	S07°07.8	13.9′	54.1′
1	192°50.1	42.8	355°44.7	16.9′	07°21.7	13.9′	54.1′
2	207°50.3	41.8	10°20.6	16.8′	07°35.6	13.9′	54.1′
3	222°50.5	·· 40.8	24°56.4	16.8′	07°49.5	13.8′	54.1′
4	237°50.6	39.8	39°32.2	16.8′	08°03.3	13.9′	54.1′
5	252°50.8	38.9	54°08.0	16.8′	08°17.2	13.7′	54.1′
6	267°51.0	S01°37.9	68°43.8	16.8′	S08°30.9	13.8′	54.1′
7	282°51.2	36.9	83°19.6	16.7′	08°44.7	13.7′	54.1′
8	297°51.4	35.9	97°55.3	16.7′	08°58.4	13.7′	54.1′
9	312°51.5	·· 34.9	112°31.0	16.7′	09°12.1	13.6′	54.1′
10	327°51.7	33.9	127°06.7	16.7′	09°25.7	13.6′	54.1′
11	342°51.9	32.9	141°42.4	16.6′	09°39.3	13.6′	54.1′
12	357°52.1	S01°31.9	156°18.0	16.6′	S09°52.9	13.5′	54.1′
13	12°52.2	31.0	170°53.6	16.6′	10°06.4	13.5′	54.1′
14	27°52.4	30.0	185°29.1	16.5′	10°19.9	13.4′	54.0′
15	42°52.6	·· 29.0	200°04.7	16.5′	10°33.3	13.4′	54.0′
16	57°52.8	28.0	214°40.2	16.5′	10°46.7	13.4′	54.0′
17	72°53.0	27.0	229°15.6	16.4′	11°00.1	13.3′	54.0′
18	87°53.1	S01°26.0	243°51.1	16.4′	S11°13.4	13.3′	54.0′
19	102°53.3	25.0	258°26.5	16.4′	11°26.7	13.2′	54.0′
20	117°53.5	24.0	273°01.8	16.3′	11°39.9	13.2′	54.0′
21	132°53.7	·· 23.0	287°37.1	16.3′	11°53.1	13.1′	54.0′
22	147°53.9	22.1	302°12.4	16.2′	12°06.2	13.1′	54.0′
23	162°54.0	21.1	316°47.7	16.2′	12°19.3	13.1′	54.0′
	SD = 16.1′	d = 1.0′	SD = 14.8′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	03:52	05:16	06:23	17:57	19:05	20:30
N 70°	04:06	05:21	06:21	17:58	18:59	20:15
68°	04:18	05:25	06:20	18:00	18:55	20:03
66°	04:27	05:28	06:19	18:00	18:52	19:53
64°	04:34	05:31	06:18	18:01	18:49	19:46
62°	04:41	05:33	06:17	18:02	18:46	19:39
60°	04:46	05:35	06:16	18:03	18:44	19:33
N 58°	04:51	05:37	06:16	18:03	18:42	19:29
56°	04:54	05:38	06:15	18:04	18:41	19:25
54°	04:58	05:39	06:14	18:04	18:40	19:21
52°	05:01	05:40	06:14	18:05	18:38	19:18
50°	05:04	05:41	06:13	18:05	18:37	19:15
45°	05:09	05:43	06:12	18:06	18:35	19:10
N 40°	05:13	05:44	06:11	18:07	18:34	19:05
35°	05:16	05:45	06:10	18:08	18:33	19:02
30°	05:18	05:46	06:10	18:08	18:32	19:00
20°	05:21	05:46	06:08	18:10	18:32	18:57
N 10°	05:22	05:46	06:07	18:11	18:32	18:56
0°	05:21	05:45	06:06	18:12	18:33	18:57
S 10°	05:19	05:43	06:04	18:13	18:34	18:59
20°	05:15	05:40	06:02	18:15	18:37	19:03
30°	05:08	05:36	06:00	18:17	18:41	19:09
35°	05:04	05:34	05:59	18:18	18:43	19:13
40°	04:59	05:31	05:58	18:19	18:46	19:18
45°	04:52	05:27	05:56	18:21	18:50	19:25
S 50°	04:43	05:22	05:54	18:23	18:55	19:33
52°	04:39	05:19	05:53	18:23	18:57	19:38
54°	04:34	05:16	05:52	18:24	19:00	19:42
56°	04:28	05:13	05:51	18:26	19:03	19:48
58°	04:22	05:10	05:50	18:27	19:06	19:54
S 60°	04:15	05:06	05:48	18:28	19:10	20:01

Lat.	**Moonrise** Fri	Sat	Sun	**Moonset** Fri	Sat	Sun
N 72°	18:31	20:31	22:42	06:42	06:10	05:35
N 70°	18:31	20:21	22:18	06:39	06:14	05:47
68°	18:30	20:13	22:01	06:36	06:17	05:57
66°	18:30	20:07	21:46	06:33	06:20	06:05
64°	18:30	20:01	21:35	06:31	06:22	06:13
62°	18:30	19:57	21:25	06:29	06:24	06:19
60°	18:30	19:53	21:17	06:28	06:26	06:24
N 58°	18:30	19:49	21:09	06:26	06:28	06:29
56°	18:30	19:46	21:03	06:25	06:29	06:33
54°	18:29	19:43	20:57	06:24	06:30	06:37
52°	18:29	19:41	20:52	06:23	06:31	06:41
50°	18:29	19:38	20:48	06:22	06:33	06:44
45°	18:29	19:33	20:38	06:20	06:35	06:51
N 40°	18:29	19:29	20:29	06:18	06:37	06:57
35°	18:29	19:26	20:22	06:16	06:39	07:02
30°	18:29	19:22	20:16	06:15	06:40	07:06
20°	18:29	19:17	20:06	06:12	06:43	07:14
N 10°	18:29	19:12	19:56	06:10	06:45	07:21
0°	18:29	19:08	19:48	06:08	06:48	07:27
S 10°	18:29	19:04	19:39	06:06	06:50	07:34
20°	18:28	18:59	19:30	06:04	06:52	07:40
30°	18:28	18:54	19:20	06:01	06:55	07:48
35°	18:28	18:51	19:14	06:00	06:56	07:53
40°	18:28	18:48	19:08	05:58	06:58	07:58
45°	18:28	18:44	19:00	05:56	07:00	08:04
S 50°	18:28	18:39	18:51	05:53	07:03	08:12
52°	18:28	18:37	18:47	05:52	07:04	08:15
54°	18:28	18:35	18:42	05:51	07:05	08:19
56°	18:28	18:32	18:37	05:50	07:06	08:23
58°	18:28	18:30	18:31	05:48	07:08	08:28
S 60°	18:28	18:26	18:25	05:46	07:10	08:33

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 14-16 100-97%
14	09:14	09:06	12:09	–:–	12:18	
15	08:57	08:49	12:09	00:38	12:58	
16	08:40	08:32	12:09	01:17	13:37	

March 17, 18, 19 UT (Mon., Tue., Wed.)

	Aries	Venus		Mars		Jupiter		Saturn	
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	174°49.4	172°26.5	N10°20.9	63°16.4	N25°03.8	102°14.9	N22°07.3	180°48.2	S04°40.5
1	189°51.9	187°30.3	20.4	78°18.3	03.7	117°17.1	07.3	195°50.4	40.4
2	204°54.3	202°34.1	19.9	93°20.2	03.5	132°19.2	07.4	210°52.6	40.3
3	219°56.8	217°37.9	·· 19.4	108°22.1	·· 03.4	147°21.4	·· 07.4	225°54.8	·· 40.2
4	234°59.3	232°41.7	18.9	123°23.9	03.2	162°23.5	07.5	240°56.9	40.0
5	250°01.7	247°45.4	18.4	138°25.8	03.1	177°25.6	07.5	255°59.1	39.9
6	265°04.2	262°49.2	N10°17.9	153°27.7	N25°02.9	192°27.8	N22°07.6	271°01.3	S04°39.8
7	280°06.6	277°53.0	17.3	168°29.5	02.8	207°29.9	07.6	286°03.5	39.7
8	295°09.1	292°56.8	16.8	183°31.4	02.6	222°32.0	07.6	301°05.7	39.6
9	310°11.6	308°00.6	·· 16.3	198°33.3	·· 02.4	237°34.2	·· 07.7	316°07.8	·· 39.4
10	325°14.0	323°04.4	15.8	213°35.2	02.3	252°36.3	07.7	331°10.0	39.3
11	340°16.5	338°08.2	15.3	228°37.0	02.1	267°38.4	07.8	346°12.2	39.2
12	355°19.0	353°12.0	N10°14.7	243°38.9	N25°02.0	282°40.6	N22°07.8	1°14.4	S04°39.1
13	10°21.4	8°15.8	14.2	258°40.8	01.8	297°42.7	07.9	16°16.6	39.0
14	25°23.9	23°19.6	13.7	273°42.6	01.7	312°44.8	07.9	31°18.7	38.8
15	40°26.4	38°23.4	·· 13.1	288°44.5	·· 01.5	327°47.0	·· 07.9	46°20.9	·· 38.7
16	55°28.8	53°27.2	12.6	303°46.4	01.4	342°49.1	08.0	61°23.1	38.6
17	70°31.3	68°31.0	12.1	318°48.2	01.2	357°51.3	08.0	76°25.3	38.5
18	85°33.8	83°34.8	N10°11.5	333°50.1	N25°01.1	12°53.4	N22°08.1	91°27.5	S04°38.4
19	100°36.2	98°38.6	11.0	348°51.9	00.9	27°55.5	08.1	106°29.6	38.2
20	115°38.7	113°42.4	10.4	3°53.8	00.8	42°57.7	08.2	121°31.8	38.1
21	130°41.1	128°46.2	·· 09.9	18°55.7	·· 00.6	57°59.8	·· 08.2	136°34.0	·· 38.0
22	145°43.6	143°50.0	09.3	33°57.5	00.5	73°01.9	08.3	151°36.2	37.9
23	160°46.1	158°53.8	08.8	48°59.4	00.3	88°04.0	08.3	166°38.4	37.8
Mer.pass. 12:19		ν 3.8′	d 0.5′	m -4.09	ν 1.9′	d 0.2′	m 0.12	ν 2.1′	d 0.0′ m -2.19	ν 2.2′	d 0.1′ m 1.12

Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	175°48.5	173°57.6	N10°08.2	64°01.2	N25°00.2	103°06.2	N22°08.3	181°40.5	S04°37.6
1	190°51.0	189°01.5	07.7	79°03.1	25°00.0	118°08.3	08.4	196°42.7	37.5
2	205°53.5	204°05.3	07.1	94°04.9	24°59.8	133°10.4	08.4	211°44.9	37.4
3	220°55.9	219°09.1	·· 06.6	109°06.8	·· 59.7	148°12.6	·· 08.5	226°47.1	·· 37.3
4	235°58.4	234°12.9	06.0	124°08.6	59.5	163°14.7	08.5	241°49.3	37.2
5	251°00.9	249°16.7	05.4	139°10.5	59.4	178°16.8	08.6	256°51.4	37.0
6	266°03.3	264°20.5	N10°04.9	154°12.3	N24°59.2	193°19.0	N22°08.6	271°53.6	S04°36.9
7	281°05.8	279°24.4	04.3	169°14.2	59.1	208°21.1	08.6	286°55.8	36.8
8	296°08.2	294°28.2	03.7	184°16.0	58.9	223°23.2	08.7	301°58.0	36.7
9	311°10.7	309°32.0	·· 03.1	199°17.9	·· 58.8	238°25.4	·· 08.7	317°00.2	·· 36.6
10	326°13.2	324°35.8	02.6	214°19.7	58.6	253°27.5	08.8	332°02.3	36.4
11	341°15.6	339°39.7	02.0	229°21.6	58.4	268°29.6	08.8	347°04.5	36.3
12	356°18.1	354°43.5	N10°01.4	244°23.4	N24°58.3	283°31.7	N22°08.9	2°06.7	S04°36.2
13	11°20.6	9°47.3	00.8	259°25.3	58.1	298°33.9	08.9	17°08.9	36.1
14	26°23.0	24°51.1	10°00.2	274°27.1	58.0	313°36.0	09.0	32°11.1	36.0
15	41°25.5	39°55.0	09°59.7	289°29.0	·· 57.8	328°38.1	·· 09.0	47°13.2	·· 35.8
16	56°28.0	54°58.8	59.1	304°30.8	57.7	343°40.3	09.0	62°15.4	35.7
17	71°30.4	70°02.6	58.5	319°32.6	57.5	358°42.4	09.1	77°17.6	35.6
18	86°32.9	85°06.5	N09°57.9	334°34.5	N24°57.4	13°44.5	N22°09.1	92°19.8	S04°35.5
19	101°35.4	100°10.3	57.3	349°36.3	57.2	28°46.6	09.2	107°21.9	35.4
20	116°37.8	115°14.1	56.7	4°38.2	57.0	43°48.8	09.2	122°24.1	35.2
21	131°40.3	130°17.9	·· 56.1	19°40.0	·· 56.9	58°50.9	·· 09.3	137°26.3	·· 35.1
22	146°42.7	145°21.8	55.5	34°41.8	56.7	73°53.0	09.3	152°28.5	35.0
23	161°45.2	160°25.6	54.9	49°43.7	56.6	88°55.1	09.4	167°30.7	34.9
Mer.pass. 12:15		ν 3.8′	d 0.6′	m -4.04	ν 1.9′	d 0.2′	m 0.14	ν 2.1′	d 0.0′ m -2.19	ν 2.2′	d 0.1′ m 1.12

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	176°47.7	175°29.5	N09°54.3	64°45.5	N24°56.4	103°57.3	N22°09.4	182°32.8	S04°34.8
1	191°50.1	190°33.3	53.7	79°47.3	56.3	118°59.4	09.4	197°35.0	34.6
2	206°52.6	205°37.1	53.0	94°49.2	56.1	134°01.5	09.5	212°37.2	34.5
3	221°55.1	220°41.0	·· 52.4	109°51.0	·· 55.9	149°03.6	·· 09.5	227°39.4	·· 34.4
4	236°57.5	235°44.8	51.8	124°52.8	55.8	164°05.8	09.6	242°41.6	34.3
5	252°00.0	250°48.6	51.2	139°54.7	55.6	179°07.9	09.6	257°43.7	34.2
6	267°02.5	265°52.5	N09°50.6	154°56.5	N24°55.5	194°10.0	N22°09.7	272°45.9	S04°34.0
7	282°04.9	280°56.3	50.0	169°58.3	55.3	209°12.1	09.7	287°48.1	33.9
8	297°07.4	296°00.2	49.3	185°00.2	55.1	224°14.3	09.8	302°50.3	33.8
9	312°09.9	311°04.0	·· 48.7	200°02.0	·· 55.0	239°16.4	·· 09.8	317°52.5	·· 33.7
10	327°12.3	326°07.9	48.1	215°03.8	54.8	254°18.5	09.8	332°54.6	33.6
11	342°14.8	341°11.7	47.4	230°05.6	54.7	269°20.6	09.9	347°56.8	33.4
12	357°17.2	356°15.5	N09°46.8	245°07.5	N24°54.5	284°22.8	N22°09.9	2°59.0	S04°33.3
13	12°19.7	11°19.4	46.2	260°09.3	54.4	299°24.9	10.0	18°01.2	33.2
14	27°22.2	26°23.2	45.5	275°11.1	54.2	314°27.0	10.0	33°03.4	33.1
15	42°24.6	41°27.1	·· 44.9	290°12.9	·· 54.0	329°29.1	·· 10.1	48°05.5	·· 33.0
16	57°27.1	56°30.9	44.3	305°14.7	53.9	344°31.2	10.1	63°07.7	32.8
17	72°29.6	71°34.8	43.6	320°16.6	53.7	359°33.4	10.2	78°09.9	32.7
18	87°32.0	86°38.6	N09°43.0	335°18.4	N24°53.6	14°35.5	N22°10.2	93°12.1	S04°32.6
19	102°34.5	101°42.5	42.3	350°20.2	53.4	29°37.6	10.2	108°14.3	32.5
20	117°37.0	116°46.3	41.7	5°22.0	53.2	44°39.7	10.3	123°16.4	32.4
21	132°39.4	131°50.2	·· 41.0	20°23.8	·· 53.1	59°41.8	·· 10.3	138°18.6	·· 32.3
22	147°41.9	146°54.0	40.4	35°25.7	52.9	74°44.0	10.4	153°20.8	32.1
23	162°44.3	161°57.9	39.7	50°27.5	52.8	89°46.1	10.4	168°23.0	32.0
Mer.pass. 12:11		ν 3.8′	d 0.6′	m -4.13	ν 1.8′	d 0.2′	m 0.17	ν 2.1′	d 0.0′ m -2.18	ν 2.2′	d 0.1′ m 1.13

Stars

	SHA	Dec
Alpheratz	357°35.0	29°13.7
Ankaa	353°07.4	-42°10.3
Schedar	349°31.5	56°40.5
Diphda	348°47.5	-17°51.0
Achernar	335°20.5	-57°06.7
Hamal	327°51.3	23°34.9
Polaris	314°17.2	89°22.5
Acamar	315°11.9	-40°12.4
Menkar	314°06.2	4°11.2
Mirfak	308°28.3	49°57.2
Aldebaran	290°39.5	16°33.6
Rigel	281°03.8	-8°10.5
Capella	280°21.7	46°01.5
Bellatrix	278°22.7	6°22.3
Elnath	278°01.7	28°37.8
Alnilam	275°37.6	-1°11.2
Betelgeuse	270°51.9	7°24.6
Canopus	263°52.3	-52°42.8
Sirius	258°26.0	-16°45.2
Adhara	255°05.6	-29°00.6
Procyon	244°50.5	5°09.5
Pollux	243°16.9	27°57.9
Avior	234°14.3	-59°35.6
Suhail	222°45.9	-43°32.2
Miaplacidus	221°37.6	-69°49.4
Alphard	217°47.4	-8°46.2
Regulus	207°34.0	11°50.5
Dubhe	193°40.1	61°36.9
Denebola	182°24.5	14°25.7
Gienah	175°43.1	-17°41.0
Acrux	172°59.3	-63°14.3
Gacrux	171°51.0	-57°15.3
Alioth	166°12.3	55°49.2
Spica	158°21.9	-11°17.7
Alkaid	152°51.4	49°11.0
Hadar	148°35.3	-60°29.6
Menkent	147°57.1	-36°29.7
Arcturus	145°47.5	19°02.8
Rigil Kent.	139°39.7	-60°56.3
Kochab	137°18.9	74°02.8
Zuben'ubi	136°55.6	-16°08.9
Alphecca	126°03.4	26°37.5
Antares	112°15.5	-26°29.3
Atria	107°09.5	-69°04.1
Sabik	102°02.6	-15°45.4
Shaula	96°10.1	-37°07.3
Rasalhague	95°58.4	12°32.2
Eltanin	90°42.1	51°28.7
Kaus Aust.	83°32.4	-34°22.3
Vega	80°33.2	38°48.1
Nunki	75°47.7	-26°15.9
Altair	62°00.0	8°55.9
Peacock	53°05.8	-56°39.1
Deneb	49°26.0	45°21.9
Enif	33°38.9	9°59.3
Al Na'ir	27°33.1	-46°50.3
Fomalhaut	15°14.7	-29°29.4
Scheat	13°45.4	28°13.0
Markab	13°30.1	15°20.3

Mar 17 Mon	SHA	Mer.pass
Venus	357°37.1	12:27
Mars	248°27.0	19:44
Jupiter	287°25.5	17:09
Saturn	5°58.8	11:55

Mar 18 Tue	SHA	Mer.pass
Venus	358°09.1	12:21
Mars	248°12.7	19:41
Jupiter	287°17.6	17:05
Saturn	5°52.0	11:52

Mar 19 Wed	SHA	Mer.pass
Venus	358°41.8	12:15
Mars	247°57.8	19:39
Jupiter	287°09.6	17:02
Saturn	5°45.2	11:48

Horizontal parallax	
Venus:	0.5
Mars:	0.1

h	Sun		Moon				
Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	177°54.2	S01°20.1	331°22.9	16.2′	S12°32.4	13.0′	54.0′
1	192°54.4	19.1	345°58.0	16.1′	12°45.4	12.9′	54.0′
2	207°54.6	18.1	0°33.2	16.1′	12°58.3	12.9′	54.0′
3	222°54.8	·· 17.1	15°08.3	16.0′	13°11.2	12.9′	54.0′
4	237°54.9	16.1	29°43.3	16.0′	13°24.1	12.8′	54.0′
5	252°55.1	15.1	44°18.3	15.9′	13°36.9	12.7′	54.0′
6	267°55.3	S01°14.2	58°53.2	15.9′	S13°49.6	12.7′	54.0′
7	282°55.5	13.2	73°28.1	15.9′	14°02.3	12.6′	54.0′
8	297°55.7	12.2	88°03.0	15.8′	14°14.9	12.6′	54.0′
9	312°55.8	·· 11.2	102°37.8	15.8′	14°27.5	12.5′	54.0′
10	327°56.0	10.2	117°12.6	15.7′	14°40.0	12.5′	54.0′
11	342°56.2	09.2	131°47.3	15.7′	14°52.5	12.4′	54.0′
12	357°56.4	S01°08.2	146°21.9	15.6′	S15°04.9	12.4′	54.0′
13	12°56.6	07.2	160°56.6	15.6′	15°17.3	12.2′	54.0′
14	27°56.8	06.2	175°31.1	15.5′	15°29.5	12.3′	54.0′
15	42°56.9	·· 05.3	190°05.6	15.5′	15°41.8	12.2′	54.0′
16	57°57.1	04.3	204°40.1	15.4′	15°54.0	12.1′	54.0′
17	72°57.3	03.3	219°14.5	15.3′	16°06.1	12.0′	54.0′
18	87°57.5	S01°02.3	233°48.8	15.3′	S16°18.1	12.0′	54.0′
19	102°57.7	01.3	248°23.1	15.2′	16°30.1	11.9′	54.0′
20	117°57.8	01°00.3	262°57.4	15.2′	16°42.0	11.9′	54.0′
21	132°58.0	00°59.3	277°31.5	15.1′	16°53.9	11.8′	54.0′
22	147°58.2	58.3	292°05.7	15.1′	17°05.7	11.7′	54.0′
23	162°58.4	57.4	306°39.7	15.0′	17°17.4	11.7′	54.0′
	SD = 16.1′	d = 1.0′	SD = 14.7′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	177°58.6	S00°56.4	321°13.7	14.9′	S17°29.1	11.5′	54.0′
1	192°58.8	55.4	335°47.7	14.9′	17°40.6	11.6′	54.0′
2	207°58.9	54.4	350°21.6	14.8′	17°52.2	11.4′	54.0′
3	222°59.1	·· 53.4	4°55.4	14.8′	18°03.6	11.4′	54.0′
4	237°59.3	52.4	19°29.1	14.7′	18°15.0	11.3′	54.0′
5	252°59.5	51.4	34°02.8	14.6′	18°26.3	11.2′	54.0′
6	267°59.7	S00°50.4	48°36.5	14.6′	S18°37.5	11.2′	54.0′
7	282°59.8	49.4	63°10.0	14.5′	18°48.7	11.1′	54.0′
8	298°00.0	48.5	77°43.5	14.4′	18°59.8	11.0′	54.0′
9	313°00.2	·· 47.5	92°17.0	14.4′	19°10.8	11.0′	54.0′
10	328°00.4	46.5	106°50.4	14.3′	19°21.8	10.8′	54.0′
11	343°00.6	45.5	121°23.7	14.2′	19°32.6	10.8′	54.0′
12	358°00.8	S00°44.5	135°56.9	14.2′	S19°43.4	10.7′	54.0′
13	13°00.9	43.5	150°30.1	14.1′	19°54.1	10.6′	54.0′
14	28°01.1	42.5	165°03.2	14.0′	20°04.7	10.6′	54.0′
15	43°01.3	·· 41.5	179°36.2	14.0′	20°15.3	10.5′	54.0′
16	58°01.5	40.6	194°09.2	13.9′	20°25.8	10.3′	54.0′
17	73°01.7	39.6	208°42.1	13.8′	20°36.1	10.3′	54.0′
18	88°01.9	S00°38.6	223°14.9	13.8′	S20°46.4	10.3′	54.0′
19	103°02.0	37.6	237°47.7	13.7′	20°56.7	10.1′	54.1′
20	118°02.2	36.6	252°20.4	13.6′	21°06.8	10.0′	54.1′
21	133°02.4	·· 35.6	266°53.0	13.5′	21°16.8	10.0′	54.1′
22	148°02.6	34.6	281°25.5	13.5′	21°26.8	9.9′	54.1′
23	163°02.8	33.6	295°58.0	13.4′	21°36.7	9.8′	54.1′
	SD = 16.1′	d = 1.0′	SD = 14.7′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°03.0	S00°32.6	310°30.4	13.3′	S21°46.5	9.7′	54.1′
1	193°03.1	31.7	325°02.7	13.2′	21°56.2	9.6′	54.1′
2	208°03.3	30.7	339°35.0	13.2′	22°05.8	9.5′	54.1′
3	223°03.5	·· 29.7	354°07.1	13.1′	22°15.3	9.4′	54.1′
4	238°03.7	28.7	8°39.3	13.0′	22°24.7	9.4′	54.1′
5	253°03.9	27.7	23°11.3	13.0′	22°34.1	9.2′	54.1′
6	268°04.1	S00°26.7	37°43.2	12.9′	S22°43.3	9.1′	54.1′
7	283°04.2	25.7	52°15.1	12.8′	22°52.4	9.1′	54.1′
8	298°04.4	24.7	66°46.9	12.7′	23°01.5	8.9′	54.2′
9	313°04.6	·· 23.8	81°18.6	12.6′	23°10.4	8.9′	54.2′
10	328°04.8	22.8	95°50.3	12.6′	23°19.3	8.7′	54.2′
11	343°05.0	21.8	110°21.8	12.5′	23°28.0	8.7′	54.2′
12	358°05.2	S00°20.8	124°53.3	12.4′	S23°36.7	8.6′	54.2′
13	13°05.3	19.8	139°24.8	12.3′	23°45.3	8.4′	54.2′
14	28°05.5	18.8	153°56.1	12.3′	23°53.7	8.4′	54.2′
15	43°05.7	·· 17.8	168°27.4	12.2′	24°02.1	8.2′	54.2′
16	58°05.9	16.8	182°58.5	12.1′	24°10.3	8.2′	54.2′
17	73°06.1	15.8	197°29.7	12.0′	24°18.5	8.0′	54.2′
18	88°06.3	S00°14.9	212°00.7	12.0′	S24°26.5	7.9′	54.3′
19	103°06.5	13.9	226°31.6	11.9′	24°34.4	7.9′	54.3′
20	118°06.6	12.9	241°02.5	11.8′	24°42.3	7.7′	54.3′
21	133°06.8	·· 11.9	255°33.3	11.7′	24°50.0	7.6′	54.3′
22	148°07.0	10.9	270°04.0	11.6′	24°57.6	7.5′	54.3′
23	163°07.2	09.9	284°34.7	11.6′	25°05.1	7.4′	54.3′
	SD = 16.1′	d = 1.0′	SD = 14.8′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	03:33	05:00	06:08	18:11	19:19	20:47
N 70°	03:50	05:07	06:08	18:11	19:12	20:29
68°	04:03	05:12	06:07	18:10	19:06	20:16
66°	04:14	05:16	06:07	18:10	19:02	20:04
64°	04:23	05:20	06:07	18:10	18:58	19:55
62°	04:30	05:23	06:07	18:10	18:54	19:48
60°	04:36	05:26	06:07	18:10	18:52	19:41
N 58°	04:42	05:28	06:07	18:10	18:49	19:36
56°	04:46	05:30	06:07	18:10	18:47	19:31
54°	04:50	05:32	06:07	18:10	18:45	19:27
52°	04:54	05:33	06:07	18:10	18:44	19:23
50°	04:57	05:35	06:07	18:10	18:42	19:20
45°	05:03	05:37	06:07	18:10	18:39	19:14
N 40°	05:08	05:40	06:06	18:10	18:37	19:09
35°	05:12	05:41	06:06	18:10	18:35	19:05
30°	05:14	05:42	06:06	18:10	18:34	19:02
20°	05:18	05:44	06:06	18:10	18:32	18:58
N 10°	05:20	05:44	06:05	18:11	18:32	18:56
0°	05:20	05:44	06:05	18:11	18:32	18:56
S 10°	05:19	05:43	06:04	18:12	18:33	18:57
20°	05:16	05:41	06:03	18:12	18:34	19:00
30°	05:10	05:38	06:02	18:13	18:37	19:05
35°	05:07	05:36	06:02	18:14	18:39	19:08
40°	05:02	05:34	06:01	18:14	18:41	19:13
45°	04:56	05:31	06:00	18:15	18:44	19:19
S 50°	04:48	05:26	05:59	18:16	18:48	19:26
52°	04:44	05:25	05:58	18:17	18:50	19:30
54°	04:40	05:22	05:58	18:17	18:52	19:34
56°	04:35	05:20	05:57	18:18	18:55	19:39
58°	04:30	05:17	05:56	18:18	18:57	19:45
S 60°	04:23	05:14	05:56	18:19	19:01	19:51

Lat.	**Moonrise** Mon	Tue	Wed	**Moonset** Mon	Tue	Wed
N 72°	▬	▬	▬	04:49	▬	▬
N 70°	·· ··	00:41	▬	05:14	04:19	▬
68°	·· ··	00:02	▬	05:34	05:00	▬
66°	23:35	·· ··	01:46	05:49	05:28	04:49
64°	23:14	·· ··	01:04	06:02	05:50	05:31
62°	22:57	·· ··	00:36	06:13	06:07	06:00
60°	22:44	·· ··	00:15	06:23	06:22	06:22
N 58°	22:32	23:58	·· ··	06:31	06:34	06:40
56°	22:22	23:43	·· ··	06:38	06:45	06:55
54°	22:13	23:31	·· ··	06:45	06:55	07:08
52°	22:05	23:20	·· ··	06:51	07:03	07:20
50°	21:58	23:10	·· ··	06:56	07:11	07:30
45°	21:43	22:50	23:56	07:08	07:28	07:52
N 40°	21:31	22:33	23:36	07:17	07:41	08:09
35°	21:20	22:19	23:20	07:26	07:53	08:24
30°	21:11	22:07	23:05	07:33	08:03	08:36
20°	20:56	21:47	22:41	07:46	08:20	08:58
N 10°	20:42	21:30	22:20	07:57	08:36	09:18
0°	20:29	21:13	22:00	08:08	08:50	09:35
S 10°	20:17	20:57	21:41	08:18	09:05	09:53
20°	20:04	20:40	21:20	08:30	09:20	10:13
30°	19:48	20:20	20:56	08:43	09:38	10:35
35°	19:40	20:09	20:42	08:50	09:49	10:48
40°	19:30	19:55	20:26	08:59	10:01	11:04
45°	19:18	19:40	20:07	09:09	10:15	11:22
S 50°	19:04	19:21	19:43	09:21	10:33	11:45
52°	18:58	19:12	19:32	09:27	10:41	11:56
54°	18:51	19:02	19:19	09:34	10:50	12:08
56°	18:43	18:51	19:04	09:41	11:01	12:22
58°	18:34	18:39	18:47	09:49	11:13	12:39
S 60°	18:24	18:24	18:26	09:58	11:27	13:00

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 17-19 93-81%
17	08:23	08:14	12:08	01:58	14:18	
18	08:06	07:57	12:08	02:40	15:02	
19	07:48	07:39	12:08	03:24	15:48	

March 20, 21, 22 UT (Thu., Fri., Sat.)

	Aries	Venus		Mars		Jupiter		Saturn	
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	177°46.8	177°01.7	N09°39.1	65°29.3	N24°52.6	104°48.2	N22°10.5	183°25.2	S04°31.9
1	192°49.3	192°05.6	38.4	80°31.1	52.4	119°50.3	10.5	198°27.3	31.8
2	207°51.7	207°09.4	37.7	95°32.9	52.3	134°52.4	10.6	213°29.5	31.7
3	222°54.2	222°13.3	·· 37.1	110°34.7	·· 52.1	149°54.6	·· 10.6	228°31.7	·· 31.5
4	237°56.7	237°17.1	36.4	125°36.5	51.9	164°56.7	10.6	243°33.9	31.4
5	252°59.1	252°21.0	35.7	140°38.3	51.8	179°58.8	10.7	258°36.1	31.3
6	268°01.6	267°24.8	N09°35.1	155°40.1	N24°51.6	195°00.9	N22°10.7	273°38.2	S04°31.2
7	283°04.1	282°28.7	34.4	170°42.0	51.5	210°03.0	10.8	288°40.4	31.1
8	298°06.5	297°32.5	33.7	185°43.8	51.3	225°05.1	10.8	303°42.6	30.9
9	313°09.0	312°36.4	·· 33.0	200°45.6	·· 51.1	240°07.3	·· 10.9	318°44.8	·· 30.8
10	328°11.5	327°40.2	32.4	215°47.4	51.0	255°09.4	10.9	333°47.0	30.7
11	343°13.9	342°44.1	31.7	230°49.2	50.8	270°11.5	11.0	348°49.2	30.6
12	358°16.4	357°48.0	N09°31.0	245°51.0	N24°50.7	285°13.6	N22°11.0	3°51.3	S04°30.5
13	13°18.8	12°51.8	30.3	260°52.8	50.5	300°15.7	11.0	18°53.5	30.3
14	28°21.3	27°55.7	29.6	275°54.6	50.3	315°17.8	11.1	33°55.7	30.2
15	43°23.8	42°59.5	·· 29.0	290°56.4	·· 50.2	330°20.0	·· 11.1	48°57.9	·· 30.1
16	58°26.2	58°03.4	28.3	305°58.2	50.0	345°22.1	11.2	64°00.1	30.0
17	73°28.7	73°07.2	27.6	321°00.0	49.8	0°24.2	11.2	79°02.2	29.9
18	88°31.2	88°11.1	N09°26.9	336°01.8	N24°49.7	15°26.3	N22°11.3	94°04.4	S04°29.7
19	103°33.6	103°14.9	26.2	351°03.6	49.5	30°28.4	11.3	109°06.6	29.6
20	118°36.1	118°18.8	25.5	6°05.4	49.3	45°30.5	11.4	124°08.8	29.5
21	133°38.6	133°22.7	·· 24.8	21°07.2	·· 49.2	60°32.6	·· 11.4	139°11.0	·· 29.4
22	148°41.0	148°26.5	24.1	36°09.0	49.0	75°34.8	11.4	154°13.1	29.3
23	163°43.5	163°30.4	23.4	51°10.8	48.9	90°36.9	11.5	169°15.3	29.1
Mer.pass. 12:07		ν 3.9′ d 0.7′	m -4.18	ν 1.8′ d 0.2′	m 0.19	ν 2.1′ d 0.0′	m -2.17	ν 2.2′ d 0.1′	m 1.13

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	178°46.0	178°34.2	N09°22.7	66°12.6	N24°48.7	105°39.0	N22°11.5	184°17.5	S04°29.0
1	193°48.4	193°38.1	22.0	81°14.3	48.5	120°41.1	11.6	199°19.7	28.9
2	208°50.9	208°41.9	21.3	96°16.1	48.4	135°43.2	11.6	214°21.9	28.8
3	223°53.3	223°45.8	·· 20.6	111°17.9	·· 48.2	150°45.3	·· 11.7	229°24.0	·· 28.7
4	238°55.8	238°49.6	19.9	126°19.7	48.0	165°47.4	11.7	244°26.2	28.6
5	253°58.3	253°53.5	19.1	141°21.5	47.9	180°49.5	11.8	259°28.4	28.4
6	269°00.7	268°57.4	N09°18.4	156°23.3	N24°47.7	195°51.6	N22°11.8	274°30.6	S04°28.3
7	284°03.2	284°01.2	17.7	171°25.1	47.5	210°53.8	11.8	289°32.8	28.2
8	299°05.7	299°05.1	17.0	186°26.9	47.4	225°55.9	11.9	304°34.9	28.1
9	314°08.1	314°08.9	·· 16.3	201°28.7	·· 47.2	240°58.0	·· 11.9	319°37.1	·· 28.0
10	329°10.6	329°12.8	15.5	216°30.4	47.0	256°00.1	12.0	334°39.3	27.8
11	344°13.1	344°16.6	14.8	231°32.2	46.9	271°02.2	12.0	349°41.5	27.7
12	359°15.5	359°20.5	N09°14.1	246°34.0	N24°46.7	286°04.3	N22°12.1	4°43.7	S04°27.6
13	14°18.0	14°24.3	13.4	261°35.8	46.5	301°06.4	12.1	19°45.8	27.5
14	29°20.5	29°28.2	12.6	276°37.6	46.4	316°08.5	12.2	34°48.0	27.4
15	44°22.9	44°32.1	·· 11.9	291°39.3	·· 46.2	331°10.6	·· 12.2	49°50.2	·· 27.2
16	59°25.4	59°35.9	11.2	306°41.1	46.0	346°12.7	12.3	64°52.4	27.1
17	74°27.8	74°39.8	10.4	321°42.9	45.9	1°14.9	12.3	79°54.6	27.0
18	89°30.3	89°43.6	N09°09.7	336°44.7	N24°45.7	16°17.0	N22°12.3	94°56.7	S04°26.9
19	104°32.8	104°47.5	09.0	351°46.5	45.5	31°19.1	12.4	109°58.9	26.8
20	119°35.2	119°51.3	08.2	6°48.2	45.4	46°21.2	12.4	125°01.1	26.6
21	134°37.7	134°55.2	·· 07.5	21°50.0	·· 45.2	61°23.3	·· 12.5	140°03.3	·· 26.5
22	149°40.2	149°59.0	06.8	36°51.8	45.0	76°25.4	12.5	155°05.5	26.4
23	164°42.6	165°02.9	06.0	51°53.6	44.9	91°27.5	12.6	170°07.7	26.3
Mer.pass. 12:03		ν 3.9′ d 0.7′	m -4.20	ν 1.8′ d 0.2′	m 0.21	ν 2.1′ d 0.0′	m -2.17	ν 2.2′ d 0.1′	m 1.13

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	179°45.1	180°06.7	N09°05.3	66°55.3	N24°44.7	106°29.6	N22°12.6	185°09.8	S04°26.2
1	194°47.6	195°10.6	04.5	81°57.1	44.5	121°31.7	12.7	200°12.0	26.1
2	209°50.0	210°14.4	03.8	96°58.9	44.4	136°33.8	12.7	215°14.2	25.9
3	224°52.5	225°18.3	·· 03.0	112°00.7	·· 44.2	151°35.9	·· 12.7	230°16.4	·· 25.8
4	239°54.9	240°22.1	02.3	127°02.4	44.0	166°38.0	12.8	245°18.6	25.7
5	254°57.4	255°26.0	01.5	142°04.2	43.9	181°40.1	12.8	260°20.7	25.6
6	269°59.9	270°29.8	N09°00.8	157°06.0	N24°43.7	196°42.2	N22°12.9	275°22.9	S04°25.5
7	285°02.3	285°33.7	09°00.0	172°07.7	43.5	211°44.3	12.9	290°25.1	25.3
8	300°04.8	300°37.5	08°59.2	187°09.5	43.4	226°46.4	13.0	305°27.3	25.2
9	315°07.3	315°41.4	·· 58.5	202°11.3	·· 43.2	241°48.6	·· 13.0	320°29.5	·· 25.1
10	330°09.7	330°45.2	57.7	217°13.0	43.0	256°50.7	13.1	335°31.6	25.0
11	345°12.2	345°49.1	57.0	232°14.8	42.8	271°52.8	13.1	350°33.8	24.9
12	0°14.7	0°52.9	N08°56.2	247°16.5	N24°42.7	286°54.9	N22°13.2	5°36.0	S04°24.7
13	15°17.1	15°56.8	55.4	262°18.3	42.5	301°57.0	13.2	20°38.2	24.6
14	30°19.6	31°00.6	54.7	277°20.1	42.3	316°59.1	13.2	35°40.4	24.5
15	45°22.1	46°04.4	·· 53.9	292°21.8	·· 42.2	332°01.2	·· 13.3	50°42.5	·· 24.4
16	60°24.5	61°08.3	53.1	307°23.6	42.0	347°03.3	13.3	65°44.7	24.3
17	75°27.0	76°12.1	52.3	322°25.4	41.8	2°05.4	13.4	80°46.9	24.1
18	90°29.4	91°16.0	N08°51.6	337°27.1	N24°41.7	17°07.5	N22°13.4	95°49.1	S04°24.0
19	105°31.9	106°19.8	50.8	352°28.9	41.5	32°09.6	13.5	110°51.3	23.9
20	120°34.4	121°23.7	50.0	7°30.6	41.3	47°11.7	13.5	125°53.5	23.8
21	135°36.8	136°27.5	·· 49.2	22°32.4	·· 41.1	62°13.8	·· 13.6	140°55.6	·· 23.7
22	150°39.3	151°31.3	48.5	37°34.1	41.0	77°15.9	13.6	155°57.8	23.6
23	165°41.8	166°35.2	47.7	52°35.9	40.8	92°18.0	13.7	171°00.0	23.4
Mer.pass. 11:59		ν 3.9′ d 0.7′	m -4.20	ν 1.8′ d 0.2′	m 0.23	ν 2.1′ d 0.0′	m -2.16	ν 2.2′ d 0.1′	m 1.14

Stars

	SHA	Dec
Alpheratz	357°35.0	29°13.7
Ankaa	353°07.4	-42°10.2
Schedar	349°31.5	56°40.5
Diphda	348°47.5	-17°51.0
Achernar	335°20.6	-57°06.7
Hamal	327°51.3	23°34.9
Polaris	314°18.1	89°22.5
Acamar	315°11.9	-40°12.4
Menkar	314°06.2	4°11.2
Mirfak	308°28.4	49°57.2
Aldebaran	290°39.6	16°33.6
Rigel	281°03.8	-8°10.5
Capella	280°21.7	46°01.5
Bellatrix	278°22.8	6°22.3
Elnath	278°01.7	28°37.8
Alnilam	275°37.6	-1°11.3
Betelgeuse	270°51.9	7°24.6
Canopus	263°52.3	-52°42.8
Sirius	258°26.0	-16°45.2
Adhara	255°05.7	-29°00.6
Procyon	244°50.5	5°09.5
Pollux	243°17.0	27°57.9
Avior	234°14.4	-59°35.6
Suhail	222°45.9	-43°32.3
Miaplacidus	221°37.6	-69°49.4
Alphard	217°47.4	-8°46.2
Regulus	207°34.0	11°50.5
Dubhe	193°40.1	61°36.9
Denebola	182°24.5	14°25.7
Gienah	175°43.1	-17°41.0
Acrux	172°59.3	-63°14.4
Gacrux	171°51.0	-57°15.3
Alioth	166°12.2	55°49.2
Spica	158°21.8	-11°17.7
Alkaid	152°51.4	49°11.0
Hadar	148°35.3	-60°29.6
Menkent	147°57.1	-36°29.7
Arcturus	145°47.5	19°02.8
Rigil Kent.	139°39.6	-60°56.3
Kochab	137°18.9	74°02.8
Zuben'ubi	136°55.6	-16°08.9
Alphecca	126°03.4	26°37.5
Antares	112°15.5	-26°29.3
Atria	107°09.5	-69°04.1
Sabik	102°02.5	-15°45.4
Shaula	96°10.1	-37°07.3
Rasalhague	95°58.4	12°32.3
Eltanin	90°42.1	51°28.7
Kaus Aust.	83°32.3	-34°22.3
Vega	80°33.2	38°48.1
Nunki	75°47.6	-26°15.9
Altair	62°00.0	8°55.9
Peacock	53°05.8	-56°39.1
Deneb	49°26.0	45°21.9
Enif	33°38.9	9°59.3
Al Na'ir	27°33.1	-46°50.3
Fomalhaut	15°14.7	-29°29.4
Scheat	13°45.4	28°13.0
Markab	13°30.1	15°20.3

Mar 20 Thu	SHA	Mer.pass
Venus	359°14.9	12:09
Mars	247°42.5	19:36
Jupiter	287°01.4	16:58
Saturn	5°38.4	11:45

Mar 21 Fri	SHA	Mer.pass
Venus	359°48.3	12:03
Mars	247°26.6	19:33
Jupiter	286°53.0	16:55
Saturn	5°31.5	11:41

Mar 22 Sat	SHA	Mer.pass
Venus	0°21.6	11:56
Mars	247°10.2	19:30
Jupiter	286°44.5	16:52
Saturn	5°24.7	11:38

Horizontal parallax	
Venus:	0.5
Mars:	0.1

h	Sun		Moon				
Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°07.4	S00°08.9	299°05.2	11.5′	S25°12.5	7.3′	54.3′
1	193°07.6	07.9	313°35.7	11.4′	25°19.8	7.2′	54.3′
2	208°07.7	07.0	328°06.1	11.3′	25°27.0	7.0′	54.4′
3	223°07.9	·· 06.0	342°36.5	11.3′	25°34.0	7.0′	54.4′
4	238°08.1	05.0	357°06.7	11.2′	25°41.0	6.8′	54.4′
5	253°08.3	04.0	11°36.9	11.1′	25°47.8	6.7′	54.4′
6	268°08.5	S00°03.0	26°07.0	11.0′	S25°54.5	6.6′	54.4′
7	283°08.7	02.0	40°37.0	10.9′	26°01.1	6.5′	54.4′
8	298°08.9	01.0	55°07.0	10.9′	26°07.6	6.3′	54.4′
9	313°09.0	S00°00.0	69°36.9	10.8′	26°13.9	6.3′	54.5′
10	328°09.2	N00°01.0	84°06.7	10.7′	26°20.2	6.1′	54.5′
11	343°09.4	01.9	98°36.4	10.6′	26°26.3	6.0′	54.5′
12	358°09.6	N00°02.9	113°06.0	10.6′	S26°32.3	5.9′	54.5′
13	13°09.8	03.9	127°35.6	10.5′	26°38.2	5.7′	54.5′
14	28°10.0	04.9	142°05.1	10.4′	26°43.9	5.6′	54.5′
15	43°10.2	·· 05.9	156°34.5	10.4′	26°49.5	5.5′	54.6′
16	58°10.3	06.9	171°03.9	10.3′	26°55.0	5.4′	54.6′
17	73°10.5	07.9	185°33.2	10.2′	27°00.4	5.3′	54.6′
18	88°10.7	N00°08.9	200°02.4	10.1′	S27°05.7	5.1′	54.6′
19	103°10.9	09.8	214°31.5	10.1′	27°10.8	5.0′	54.6′
20	118°11.1	10.8	229°00.6	10.0′	27°15.8	4.9′	54.7′
21	133°11.3	·· 11.8	243°29.6	9.9′	27°20.7	4.7′	54.7′
22	148°11.5	12.8	257°58.5	9.9′	27°25.4	4.6′	54.7′
23	163°11.6	13.8	272°27.3	9.8′	27°30.0	4.5′	54.7′
	SD = 16.1′	d = 1.0′	SD = 14.8′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°11.8	N00°14.8	286°56.1	9.7′	S27°34.5	4.3′	54.7′
1	193°12.0	15.8	301°24.8	9.7′	27°38.8	4.2′	54.7′
2	208°12.2	16.8	315°53.5	9.6′	27°43.0	4.1′	54.8′
3	223°12.4	·· 17.7	330°22.1	9.5′	27°47.1	3.9′	54.8′
4	238°12.6	18.7	344°50.6	9.5′	27°51.0	3.8′	54.8′
5	253°12.8	19.7	359°19.0	9.4′	27°54.8	3.7′	54.8′
6	268°12.9	N00°20.7	13°47.4	9.3′	S27°58.5	3.5′	54.9′
7	283°13.1	21.7	28°15.8	9.3′	28°02.0	3.4′	54.9′
8	298°13.3	22.7	42°44.0	9.2′	28°05.4	3.2′	54.9′
9	313°13.5	·· 23.7	57°12.2	9.1′	28°08.6	3.2′	54.9′
10	328°13.7	24.7	71°40.4	9.1′	28°11.8	2.9′	54.9′
11	343°13.9	25.6	86°08.5	9.0′	28°14.7	2.8′	55.0′
12	358°14.1	N00°26.6	100°36.5	9.0′	S28°17.5	2.7′	55.0′
13	13°14.2	27.6	115°04.4	8.9′	28°20.2	2.6′	55.0′
14	28°14.4	28.6	129°32.4	8.9′	28°22.8	2.4′	55.0′
15	43°14.6	·· 29.6	144°00.2	8.8′	28°25.2	2.2′	55.1′
16	58°14.8	30.6	158°28.0	8.7′	28°27.4	2.1′	55.1′
17	73°15.0	31.6	172°55.8	8.7′	28°29.5	2.0′	55.1′
18	88°15.2	N00°32.6	187°23.4	8.6′	S28°31.5	1.8′	55.1′
19	103°15.4	33.5	201°51.1	8.6′	28°33.3	1.7′	55.2′
20	118°15.6	34.5	216°18.7	8.5′	28°35.0	1.5′	55.2′
21	133°15.7	·· 35.5	230°46.2	8.5′	28°36.5	1.4′	55.2′
22	148°15.9	36.5	245°13.7	8.4′	28°37.9	1.2′	55.2′
23	163°16.1	37.5	259°41.2	8.4′	28°39.1	1.1′	55.3′
	SD = 16.1′	d = 1.0′	SD = 14.9′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°16.3	N00°38.5	274°08.6	8.4′	S28°40.2	0.9′	55.3′
1	193°16.5	39.5	288°35.9	8.3′	28°41.1	0.8′	55.3′
2	208°16.7	40.4	303°03.3	8.3′	28°41.9	0.6′	55.3′
3	223°16.9	·· 41.4	317°30.5	8.2′	28°42.5	0.5′	55.4′
4	238°17.0	42.4	331°57.8	8.2′	28°43.0	0.3′	55.4′
5	253°17.2	43.4	346°25.0	8.2′	28°43.3	0.2′	55.4′
6	268°17.4	N00°44.4	0°52.1	8.1′	S28°43.5	0.0′	55.4′
7	283°17.6	45.4	15°19.2	8.1′	28°43.5	0.1′	55.5′
8	298°17.8	46.4	29°46.3	8.1′	28°43.4	0.3′	55.5′
9	313°18.0	·· 47.4	44°13.4	8.0′	28°43.1	0.4′	55.5′
10	328°18.2	48.3	58°40.4	8.0′	28°42.7	0.6′	55.6′
11	343°18.4	49.3	73°07.4	8.0′	28°42.1	0.8′	55.6′
12	358°18.5	N00°50.3	87°34.3	7.9′	S28°41.3	0.9′	55.6′
13	13°18.7	51.3	102°01.3	7.9′	28°40.4	1.1′	55.6′
14	28°18.9	52.3	116°28.2	7.9′	28°39.3	1.2′	55.7′
15	43°19.1	·· 53.3	130°55.1	7.9′	28°38.1	1.3′	55.7′
16	58°19.3	54.3	145°21.9	7.8′	28°36.8	1.6′	55.7′
17	73°19.5	55.2	159°48.8	7.8′	28°35.2	1.7′	55.8′
18	88°19.7	N00°56.2	174°15.6	7.8′	S28°33.5	1.8′	55.8′
19	103°19.9	57.2	188°42.4	7.8′	28°31.7	2.0′	55.8′
20	118°20.0	58.2	203°09.1	7.8′	28°29.7	2.2′	55.9′
21	133°20.2	00°59.2	217°35.9	7.7′	28°27.5	2.3′	55.9′
22	148°20.4	01°00.2	232°02.6	7.7′	28°25.2	2.5′	55.9′
23	163°20.6	01.2	246°29.3	7.7′	28°22.7	2.6′	56.0′
	SD = 16.0′	d = 1.0′	SD = 15.1′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	03:13	04:44	05:52	18:25	19:34	21:06
N 70°	03:33	04:52	05:54	18:23	19:25	20:45
68°	03:49	04:59	05:55	18:21	19:18	20:29
66°	04:01	05:05	05:56	18:20	19:12	20:16
64°	04:11	05:09	05:57	18:19	19:07	20:06
62°	04:19	05:13	05:57	18:18	19:03	19:57
60°	04:26	05:17	05:58	18:17	18:59	19:50
N 58°	04:33	05:19	05:59	18:17	18:56	19:43
56°	04:38	05:22	05:59	18:16	18:53	19:38
54°	04:42	05:24	06:00	18:16	18:51	19:33
52°	04:46	05:26	06:00	18:15	18:49	19:29
50°	04:50	05:28	06:00	18:15	18:47	19:25
45°	04:57	05:32	06:01	18:14	18:43	19:18
N 40°	05:03	05:35	06:02	18:13	18:40	19:12
35°	05:07	05:37	06:02	18:13	18:38	19:07
30°	05:11	05:39	06:03	18:12	18:36	19:04
20°	05:16	05:41	06:03	18:11	18:33	18:59
N 10°	05:18	05:43	06:04	18:11	18:32	18:56
0°	05:19	05:43	06:04	18:10	18:31	18:55
S 10°	05:19	05:43	06:04	18:10	18:31	18:55
20°	05:17	05:42	06:04	18:10	18:32	18:57
30°	05:12	05:40	06:04	18:10	18:33	19:01
35°	05:09	05:39	06:04	18:10	18:35	19:04
40°	05:05	05:37	06:04	18:09	18:36	19:08
45°	05:00	05:35	06:04	18:10	18:39	19:13
S 50°	04:53	05:31	06:04	18:10	18:42	19:20
52°	04:50	05:30	06:04	18:10	18:43	19:23
54°	04:46	05:28	06:03	18:10	18:45	19:26
56°	04:42	05:26	06:03	18:10	18:47	19:31
58°	04:37	05:24	06:03	18:10	18:49	19:35
S 60°	04:31	05:21	06:03	18:10	18:51	19:41

Lat.	**Moonrise** Thu	Fri	Sat	**Moonset** Thu	Fri	Sat
N 72°	▬	▬	▬	▬	▬	▬
N 70°	▬	▬	▬	▬	▬	▬
68°	▬	▬	▬	▬	▬	▬
66°	▬	▬	▬	▬	▬	▬
64°	03:35	▬	▬	04:39	▬	▬
62°	02:25	▬	▬	05:49	▬	▬
60°	01:50	03:26	04:43	06:25	06:35	07:09
N 58°	01:25	02:49	03:59	06:51	07:12	07:54
56°	01:05	02:23	03:30	07:11	07:38	08:23
54°	00:49	02:03	03:07	07:28	07:59	08:46
52°	00:34	01:46	02:49	07:43	08:16	09:04
50°	00:22	01:31	02:33	07:56	08:31	09:20
45°	·· ··	01:01	02:01	08:22	09:01	09:51
N 40°	·· ··	00:38	01:37	08:43	09:25	10:16
35°	·· ··	00:19	01:17	09:00	09:44	10:36
30°	·· ··	00:03	01:00	09:15	10:01	10:53
20°	23:36	·· ··	00:31	09:41	10:29	11:22
N 10°	23:12	·· ··	00:06	10:03	10:53	11:47
0°	22:50	23:43	·· ··	10:24	11:16	12:10
S 10°	22:29	23:20	·· ··	10:45	11:38	12:33
20°	22:05	22:56	23:51	11:07	12:02	12:57
30°	21:38	22:27	23:23	11:33	12:31	13:26
35°	21:22	22:10	23:06	11:48	12:47	13:43
40°	21:04	21:50	22:46	12:06	13:07	14:03
45°	20:42	21:26	22:23	12:28	13:31	14:27
S 50°	20:14	20:56	21:52	12:55	14:01	14:58
52°	20:00	20:40	21:37	13:09	14:17	15:13
54°	19:44	20:22	21:19	13:24	14:34	15:31
56°	19:25	20:01	20:57	13:43	14:56	15:53
58°	19:02	19:33	20:29	14:05	15:23	16:20
S 60°	18:32	18:53	19:49	14:35	16:03	17:01

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 20-22 73-55%
20	07:30	07:22	12:07	04:12	16:37	
21	07:13	07:04	12:07	05:03	17:29	
22	06:55	06:46	12:07	05:56	18:24	

March 23, 24, 25 UT (Sun., Mon., Tue.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	180°44.2	181°39.0	N08°46.9	67°37.6	N24°40.6	107°20.1	N22°13.7	186°02.2	S04°23.3
1	195°46.7	196°42.9	46.1	82°39.4	40.5	122°22.2	13.7	201°04.4	23.2
2	210°49.2	211°46.7	45.3	97°41.1	40.3	137°24.3	13.8	216°06.5	23.1
3	225°51.6	226°50.5	·· 44.5	112°42.9	·· 40.1	152°26.4	·· 13.8	231°08.7	·· 23.0
4	240°54.1	241°54.4	43.7	127°44.6	39.9	167°28.5	13.9	246°10.9	22.8
5	255°56.6	256°58.2	43.0	142°46.4	39.8	182°30.6	13.9	261°13.1	22.7
6	270°59.0	272°02.0	N08°42.2	157°48.1	N24°39.6	197°32.7	N22°14.0	276°15.3	S04°22.6
7	286°01.5	287°05.9	41.4	172°49.9	39.4	212°34.8	14.0	291°17.4	22.5
8	301°03.9	302°09.7	40.6	187°51.6	39.3	227°36.9	14.1	306°19.6	22.4
9	316°06.4	317°13.5	·· 39.8	202°53.4	·· 39.1	242°39.0	·· 14.1	321°21.8	·· 22.2
10	331°08.9	332°17.3	39.0	217°55.1	38.9	257°41.1	14.2	336°24.0	22.1
11	346°11.3	347°21.2	38.2	232°56.9	38.7	272°43.2	14.2	351°26.2	22.0
12	1°13.8	2°25.0	N08°37.4	247°58.6	N24°38.6	287°45.3	N22°14.2	6°28.4	S04°21.9
13	16°16.3	17°28.8	36.6	263°00.4	38.4	302°47.4	14.3	21°30.5	21.8
14	31°18.7	32°32.7	35.8	278°02.1	38.2	317°49.5	14.3	36°32.7	21.7
15	46°21.2	47°36.5	·· 35.0	293°03.8	·· 38.0	332°51.6	·· 14.4	51°34.9	·· 21.5
16	61°23.7	62°40.3	34.2	308°05.6	37.9	347°53.7	14.4	66°37.1	21.4
17	76°26.1	77°44.1	33.4	323°07.3	37.7	2°55.8	14.5	81°39.3	21.3
18	91°28.6	92°47.9	N08°32.6	338°09.1	N24°37.5	17°57.8	N22°14.5	96°41.4	S04°21.2
19	106°31.1	107°51.8	31.7	353°10.8	37.3	32°59.9	14.6	111°43.6	21.1
20	121°33.5	122°55.6	30.9	8°12.5	37.2	48°02.0	14.6	126°45.8	20.9
21	136°36.0	137°59.4	·· 30.1	23°14.3	·· 37.0	63°04.1	·· 14.7	141°48.0	·· 20.8
22	151°38.4	153°03.2	29.3	38°16.0	36.8	78°06.2	14.7	156°50.2	20.7
23	166°40.9	168°07.0	28.5	53°17.8	36.7	93°08.3	14.7	171°52.3	20.6
Mer.pass. 11:55		ν 3.8′	d 0.8′	ν 1.8′	d 0.2′	ν 2.1′	d 0.0′	ν 2.2′	d 0.1′
		m -4.20		m 0.25		m -2.16		m 1.14	

Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	181°43.4	183°10.9	N08°27.7	68°19.5	N24°36.5	108°10.4	N22°14.8	186°54.5	S04°20.5
1	196°45.8	198°14.7	26.9	83°21.2	36.3	123°12.5	14.8	201°56.7	20.3
2	211°48.3	213°18.5	26.0	98°23.0	36.1	138°14.6	14.9	216°58.9	20.2
3	226°50.8	228°22.3	·· 25.2	113°24.7	·· 36.0	153°16.7	·· 14.9	232°01.1	·· 20.1
4	241°53.2	243°26.1	24.4	128°26.4	35.8	168°18.8	15.0	247°03.3	20.0
5	256°55.7	258°29.9	23.6	143°28.1	35.6	183°20.9	15.0	262°05.4	19.9
6	271°58.2	273°33.7	N08°22.8	158°29.9	N24°35.4	198°23.0	N22°15.1	277°07.6	S04°19.8
7	287°00.6	288°37.5	21.9	173°31.6	35.2	213°25.1	15.1	292°09.8	19.6
8	302°03.1	303°41.3	21.1	188°33.3	35.1	228°27.2	15.2	307°12.0	19.5
9	317°05.5	318°45.1	·· 20.3	203°35.1	·· 34.9	243°29.3	·· 15.2	322°14.2	·· 19.4
10	332°08.0	333°48.9	19.5	218°36.8	34.7	258°31.3	15.3	337°16.3	19.3
11	347°10.5	348°52.7	18.6	233°38.5	34.5	273°33.4	15.3	352°18.5	19.2
12	2°12.9	3°56.5	N08°17.8	248°40.2	N24°34.4	288°35.5	N22°15.3	7°20.7	S04°19.0
13	17°15.4	19°00.3	17.0	263°42.0	34.2	303°37.6	15.4	22°22.9	18.9
14	32°17.9	34°04.1	16.1	278°43.7	34.0	318°39.7	15.4	37°25.1	18.8
15	47°20.3	49°07.9	·· 15.3	293°45.4	·· 33.8	333°41.8	·· 15.5	52°27.3	·· 18.7
16	62°22.8	64°11.7	14.5	308°47.1	33.7	348°43.9	15.5	67°29.4	18.6
17	77°25.3	79°15.5	13.6	323°48.9	33.5	3°46.0	15.6	82°31.6	18.5
18	92°27.7	94°19.3	N08°12.8	338°50.6	N24°33.3	18°48.1	N22°15.6	97°33.8	S04°18.3
19	107°30.2	109°23.1	12.0	353°52.3	33.1	33°50.2	15.7	112°36.0	18.2
20	122°32.7	124°26.9	11.1	8°54.0	32.9	48°52.2	15.7	127°38.2	18.1
21	137°35.1	139°30.7	·· 10.3	23°55.7	·· 32.8	63°54.3	·· 15.8	142°40.3	·· 18.0
22	152°37.6	154°34.5	09.4	38°57.4	32.6	78°56.4	15.8	157°42.5	17.9
23	167°40.0	169°38.2	08.6	53°59.2	32.4	93°58.5	15.8	172°44.7	17.7
Mer.pass. 11:51		ν 3.8′	d 0.8′	ν 1.7′	d 0.2′	ν 2.1′	d 0.0′	ν 2.2′	d 0.1′
		m -4.20		m 0.28		m -2.15		m 1.15	

Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	182°42.5	184°42.0	N08°07.8	69°00.9	N24°32.2	109°00.6	N22°15.9	187°46.9	S04°17.6
1	197°45.0	199°45.8	06.9	84°02.6	32.1	124°02.7	15.9	202°49.1	17.5
2	212°47.4	214°49.6	06.1	99°04.3	31.9	139°04.8	16.0	217°51.3	17.4
3	227°49.9	229°53.4	·· 05.2	114°06.0	·· 31.7	154°06.9	·· 16.0	232°53.4	·· 17.3
4	242°52.4	244°57.1	04.4	129°07.7	31.5	169°09.0	16.1	247°55.6	17.2
5	257°54.8	260°00.9	03.5	144°09.4	31.3	184°11.0	16.1	262°57.8	17.0
6	272°57.3	275°04.7	N08°02.7	159°11.2	N24°31.2	199°13.1	N22°16.2	278°00.0	S04°16.9
7	287°59.8	290°08.5	01.8	174°12.9	31.0	214°15.2	16.2	293°02.2	16.8
8	303°02.2	305°12.2	01.0	189°14.6	30.8	229°17.3	16.3	308°04.4	16.7
9	318°04.7	320°16.0	08°00.1	204°16.3	·· 30.6	244°19.4	·· 16.3	323°06.5	·· 16.6
10	333°07.2	335°19.8	07°59.3	219°18.0	30.4	259°21.5	16.4	338°08.7	16.4
11	348°09.6	350°23.5	58.4	234°19.7	30.3	274°23.6	16.4	353°10.9	16.3
12	3°12.1	5°27.3	N07°57.6	249°21.4	N24°30.1	289°25.6	N22°16.4	8°13.1	S04°16.2
13	18°14.5	20°31.1	56.7	264°23.1	29.9	304°27.7	16.5	23°15.3	16.1
14	33°17.0	35°34.8	55.9	279°24.8	29.7	319°29.8	16.5	38°17.4	16.0
15	48°19.5	50°38.6	·· 55.0	294°26.5	·· 29.5	334°31.9	·· 16.6	53°19.6	·· 15.9
16	63°21.9	65°42.3	54.2	309°28.2	29.4	349°34.0	16.6	68°21.8	15.7
17	78°24.4	80°46.1	53.3	324°29.9	29.2	4°36.1	16.7	83°24.0	15.6
18	93°26.9	95°49.8	N07°52.4	339°31.6	N24°29.0	19°38.2	N22°16.7	98°26.2	S04°15.5
19	108°29.3	110°53.6	51.6	354°33.3	28.8	34°40.2	16.8	113°28.4	15.4
20	123°31.8	125°57.3	50.7	9°35.0	28.6	49°42.3	16.8	128°30.5	15.3
21	138°34.3	141°01.1	·· 49.9	24°36.7	·· 28.5	64°44.4	·· 16.9	143°32.7	·· 15.1
22	153°36.7	156°04.8	49.0	39°38.4	28.3	79°46.5	16.9	158°34.9	15.0
23	168°39.2	171°08.6	48.1	54°40.1	28.1	94°48.6	17.0	173°37.1	14.9
Mer.pass. 11:47		ν 3.8′	d 0.8′	ν 1.7′	d 0.2′	ν 2.1′	d 0.0′	ν 2.2′	d 0.1′
		m -4.20		m 0.30		m -2.14		m 1.15	

Stars

	SHA	Dec
Alpheratz	357°35.0	29°13.7
Ankaa	353°07.4	-42°10.2
Schedar	349°31.5	56°40.5
Diphda	348°47.4	-17°51.0
Achernar	335°20.6	-57°06.7
Hamal	327°51.3	23°34.9
Polaris	314°19.0	89°22.4
Acamar	315°11.9	-40°12.4
Menkar	314°06.2	4°11.2
Mirfak	308°28.4	49°57.1
Aldebaran	290°39.6	16°33.6
Rigel	281°03.8	-8°10.5
Capella	280°21.8	46°01.5
Bellatrix	278°22.8	6°22.3
Elnath	278°01.7	28°37.8
Alnilam	275°37.6	-1°11.2
Betelgeuse	270°51.9	7°24.6
Canopus	263°52.3	-52°42.8
Sirius	258°26.1	-16°45.2
Adhara	255°05.7	-29°00.6
Procyon	244°50.6	5°09.5
Pollux	243°17.0	27°57.9
Avior	234°14.4	-59°35.6
Suhail	222°45.9	-43°32.3
Miaplacidus	221°37.7	-69°49.4
Alphard	217°47.4	-8°46.2
Regulus	207°34.0	11°50.5
Dubhe	193°40.1	61°36.9
Denebola	182°24.5	14°25.7
Gienah	175°43.1	-17°41.1
Acrux	172°59.3	-63°14.4
Gacrux	171°50.9	-57°15.3
Alioth	166°12.2	55°49.2
Spica	158°21.8	-11°17.7
Alkaid	152°51.4	49°11.0
Hadar	148°35.3	-60°29.6
Menkent	147°57.1	-36°29.7
Arcturus	145°47.5	19°02.8
Rigil Kent.	139°39.6	-60°56.3
Kochab	137°18.8	74°02.8
Zuben'ubi	136°55.6	-16°08.9
Alphecca	126°03.4	26°37.5
Antares	112°15.5	-26°29.3
Atria	107°09.4	-69°04.1
Sabik	102°02.5	-15°45.4
Shaula	96°10.1	-37°07.3
Rasalhague	95°58.3	12°32.3
Eltanin	90°42.1	51°28.7
Kaus Aust.	83°32.3	-34°22.3
Vega	80°33.2	38°48.1
Nunki	75°47.6	-26°15.9
Altair	61°59.9	8°55.9
Peacock	53°05.8	-56°39.1
Deneb	49°26.0	45°21.9
Enif	33°38.9	9°59.3
Al Na'ir	27°33.1	-46°50.3
Fomalhaut	15°14.7	-29°29.4
Scheat	13°45.4	28°13.0
Markab	13°30.1	15°20.3

Mar 23 Sun	SHA	Mer.pass
Venus	0°54.8	11:50
Mars	246°53.4	19:27
Jupiter	286°35.9	16:48
Saturn	5°17.9	11:34

Mar 24 Mon	SHA	Mer.pass
Venus	1°27.5	11:44
Mars	246°36.1	19:24
Jupiter	286°27.0	16:45
Saturn	5°11.2	11:31

Mar 25 Tue	SHA	Mer.pass
Venus	1°59.5	11:38
Mars	246°18.4	19:22
Jupiter	286°18.1	16:42
Saturn	5°04.4	11:27

Horizontal parallax	
Venus:	0.5
Mars:	0.1

h

Sun	Sun		Moon				
Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°20.8	N01°02.1	260°56.1	7.7′	S28°20.1	2.8′	56.0′
1	193°21.0	03.1	275°22.8	7.7′	28°17.3	3.0′	56.0′
2	208°21.2	04.1	289°49.5	7.7′	28°14.3	3.1′	56.1′
3	223°21.4	·· 05.1	304°16.1	7.7′	28°11.2	3.3′	56.1′
4	238°21.5	06.1	318°42.8	7.7′	28°07.9	3.4′	56.1′
5	253°21.7	07.1	333°09.5	7.7′	28°04.5	3.6′	56.2′
6	268°21.9	N01°08.1	347°36.1	7.7′	S28°00.9	3.7′	56.2′
7	283°22.1	09.0	2°02.8	7.7′	27°57.2	3.9′	56.2′
8	298°22.3	10.0	16°29.5	7.7′	27°53.3	4.1′	56.3′
9	313°22.5	·· 11.0	30°56.1	7.7′	27°49.2	4.2′	56.3′
10	328°22.7	12.0	45°22.8	7.7′	27°45.0	4.4′	56.3′
11	343°22.9	13.0	59°49.4	7.7′	27°40.6	4.6′	56.4′
12	358°23.0	N01°14.0	74°16.1	7.7′	S27°36.0	4.7′	56.4′
13	13°23.2	15.0	88°42.8	7.7′	27°31.3	4.8′	56.4′
14	28°23.4	15.9	103°09.4	7.7′	27°26.5	5.0′	56.5′
15	43°23.6	·· 16.9	117°36.1	7.7′	27°21.5	5.2′	56.5′
16	58°23.8	17.9	132°02.8	7.7′	27°16.3	5.4′	56.5′
17	73°24.0	18.9	146°29.5	7.7′	27°10.9	5.5′	56.6′
18	88°24.2	N01°19.9	160°56.2	7.7′	S27°05.4	5.6′	56.6′
19	103°24.4	20.9	175°23.0	7.7′	26°59.8	5.8′	56.6′
20	118°24.5	21.9	189°49.7	7.8′	26°54.0	6.0′	56.7′
21	133°24.7	·· 22.8	204°16.5	7.8′	26°48.0	6.1′	56.7′
22	148°24.9	23.8	218°43.2	7.8′	26°41.9	6.3′	56.8′
23	163°25.1	24.8	233°10.0	7.8′	26°35.6	6.4′	56.8′
	SD = 16.0′	d = 1.0′	SD = 15.3′				

Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°25.3	N01°25.8	247°36.8	7.8′	S26°29.2	6.6′	56.8′
1	193°25.5	26.8	262°03.6	7.8′	26°22.6	6.8′	56.9′
2	208°25.7	27.8	276°30.5	7.9′	26°15.8	6.9′	56.9′
3	223°25.9	·· 28.7	290°57.3	7.9′	26°08.9	7.1′	56.9′
4	238°26.1	29.7	305°24.2	7.9′	26°01.8	7.2′	57.0′
5	253°26.2	30.7	319°51.1	7.9′	25°54.6	7.4′	57.0′
6	268°26.4	N01°31.7	334°18.1	8.0′	S25°47.2	7.5′	57.1′
7	283°26.6	32.7	348°45.0	8.0′	25°39.7	7.7′	57.1′
8	298°26.8	33.7	3°12.0	8.0′	25°32.0	7.8′	57.1′
9	313°27.0	·· 34.7	17°39.0	8.0′	25°24.2	8.0′	57.2′
10	328°27.2	35.6	32°06.1	8.1′	25°16.2	8.1′	57.2′
11	343°27.4	36.6	46°33.1	8.1′	25°08.1	8.3′	57.2′
12	358°27.6	N01°37.6	61°00.2	8.1′	S24°59.8	8.5′	57.3′
13	13°27.7	38.6	75°27.4	8.2′	24°51.3	8.6′	57.3′
14	28°27.9	39.6	89°54.5	8.2′	24°42.7	8.7′	57.4′
15	43°28.1	·· 40.6	104°21.7	8.2′	24°34.0	8.9′	57.4′
16	58°28.3	41.5	118°48.9	8.3′	24°25.1	9.0′	57.4′
17	73°28.5	42.5	133°16.2	8.3′	24°16.1	9.2′	57.5′
18	88°28.7	N01°43.5	147°43.5	8.3′	S24°06.9	9.3′	57.5′
19	103°28.9	44.5	162°10.8	8.4′	23°57.6	9.5′	57.6′
20	118°29.1	45.5	176°38.2	8.4′	23°48.1	9.7′	57.6′
21	133°29.2	·· 46.5	191°05.5	8.4′	23°38.4	9.7′	57.6′
22	148°29.4	47.4	205°33.0	8.5′	23°28.7	9.9′	57.7′
23	163°29.6	48.4	220°00.4	8.5′	23°18.8	10.1′	57.7′
	SD = 16.0′	d = 1.0′	SD = 15.5′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°29.8	N01°49.4	234°27.9	8.5′	S23°08.7	10.2′	57.8′
1	193°30.0	50.4	248°55.5	8.6′	22°58.5	10.4′	57.8′
2	208°30.2	51.4	263°23.1	8.6′	22°48.1	10.4′	57.8′
3	223°30.4	·· 52.4	277°50.7	8.7′	22°37.7	10.7′	57.9′
4	238°30.6	53.3	292°18.3	8.7′	22°27.0	10.7′	57.9′
5	253°30.8	54.3	306°46.0	8.7′	22°16.3	11.0′	58.0′
6	268°30.9	N01°55.3	321°13.8	8.8′	S22°05.3	11.0′	58.0′
7	283°31.1	56.3	335°41.5	8.8′	21°54.3	11.2′	58.0′
8	298°31.3	57.3	350°09.4	8.9′	21°43.1	11.3′	58.1′
9	313°31.5	·· 58.3	4°37.2	8.9′	21°31.8	11.4′	58.1′
10	328°31.7	01°59.2	19°05.1	8.9′	21°20.4	11.6′	58.2′
11	343°31.9	02°00.2	33°33.0	9.0′	21°08.8	11.8′	58.2′
12	358°32.1	N02°01.2	48°01.0	9.0′	S20°57.0	11.8′	58.2′
13	13°32.3	02.2	62°29.0	9.1′	20°45.2	12.0′	58.3′
14	28°32.4	03.2	76°57.1	9.1′	20°33.2	12.1′	58.3′
15	43°32.6	·· 04.1	91°25.2	9.1′	20°21.1	12.3′	58.4′
16	58°32.8	05.1	105°53.3	9.2′	20°08.8	12.3′	58.4′
17	73°33.0	06.1	120°21.5	9.2′	19°56.5	12.5′	58.4′
18	88°33.2	N02°07.1	134°49.7	9.3′	S19°44.0	12.7′	58.5′
19	103°33.4	08.1	149°18.0	9.3′	19°31.3	12.7′	58.5′
20	118°33.6	09.1	163°46.3	9.3′	19°18.6	12.9′	58.6′
21	133°33.8	·· 10.0	178°14.6	9.4′	19°05.7	13.0′	58.6′
22	148°34.0	11.0	192°43.0	9.4′	18°52.7	13.1′	58.6′
23	163°34.1	12.0	207°11.4	9.5′	18°39.6	13.3′	58.7′
	SD = 16.0′	d = 1.0′	SD = 15.8′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	02:51	04:27	05:37	18:38	19:49	21:27
N 70°	03:15	04:37	05:40	18:35	19:38	21:02
68°	03:33	04:46	05:42	18:32	19:29	20:43
66°	03:47	04:53	05:44	18:30	19:22	20:28
64°	03:59	04:58	05:46	18:28	19:16	20:16
62°	04:08	05:03	05:48	18:26	19:11	20:06
60°	04:16	05:07	05:49	18:25	19:07	19:58
N 58°	04:23	05:11	05:50	18:23	19:03	19:51
56°	04:29	05:14	05:51	18:22	19:00	19:45
54°	04:34	05:17	05:52	18:21	18:57	19:39
52°	04:39	05:19	05:53	18:20	18:54	19:35
50°	04:43	05:21	05:54	18:20	18:52	19:30
45°	04:51	05:26	05:55	18:18	18:47	19:22
N 40°	04:58	05:30	05:57	18:16	18:43	19:15
35°	05:03	05:33	05:58	18:15	18:40	19:10
30°	05:07	05:35	05:59	18:14	18:38	19:06
20°	05:13	05:38	06:00	18:12	18:34	19:00
N 10°	05:16	05:41	06:02	18:11	18:32	18:56
0°	05:18	05:42	06:03	18:09	18:30	18:54
S 10°	05:19	05:43	06:04	18:08	18:29	18:54
20°	05:17	05:43	06:05	18:07	18:29	18:55
30°	05:14	05:42	06:06	18:06	18:30	18:58
35°	05:12	05:41	06:06	18:05	18:31	19:00
40°	05:09	05:40	06:07	18:05	18:32	19:03
45°	05:04	05:38	06:08	18:04	18:33	19:07
S 50°	04:58	05:36	06:08	18:03	18:35	19:13
52°	04:55	05:35	06:09	18:03	18:36	19:16
54°	04:52	05:34	06:09	18:02	18:37	19:19
56°	04:48	05:32	06:09	18:02	18:39	19:22
58°	04:44	05:31	06:10	18:01	18:40	19:26
S 60°	04:39	05:29	06:10	18:01	18:42	19:31

Lat.	**Moonrise** Sun	Mon	Tue	**Moonset** Sun	Mon	Tue
N 72°	▬	▬	▬	▬	▬	▬
N 70°	▬	▬	▬	▬	▬	▬
68°	▬	▬	08:09	▬	▬	09:30
66°	▬	▬	06:59	▬	▬	10:39
64°	▬	07:12	06:22	▬	08:32	11:15
62°	▬	06:07	05:56	▬	09:37	11:40
60°	05:20	05:32	05:35	08:27	10:11	12:00
N 58°	04:43	05:06	05:18	09:04	10:36	12:16
56°	04:17	04:46	05:04	09:30	10:56	12:30
54°	03:56	04:29	04:51	09:51	11:12	12:42
52°	03:38	04:15	04:40	10:08	11:26	12:52
50°	03:23	04:02	04:30	10:23	11:39	13:02
45°	02:53	03:36	04:09	10:53	12:04	13:21
N 40°	02:30	03:15	03:53	11:16	12:24	13:37
35°	02:10	02:57	03:38	11:35	12:41	13:50
30°	01:53	02:42	03:26	11:52	12:55	14:02
20°	01:25	02:16	03:04	12:19	13:20	14:21
N 10°	01:01	01:54	02:46	12:43	13:40	14:38
0°	00:38	01:34	02:28	13:05	14:00	14:53
S 10°	00:16	01:13	02:10	13:27	14:19	15:09
20°	·· ··	00:50	01:52	13:50	14:40	15:25
30°	·· ··	00:24	01:30	14:17	15:03	15:44
35°	·· ··	00:09	01:17	14:33	15:17	15:55
40°	23:51	·· ··	01:02	14:51	15:33	16:07
45°	23:29	·· ··	00:44	15:14	15:52	16:22
S 50°	23:02	·· ··	00:22	15:42	16:15	16:40
52°	22:49	·· ··	00:11	15:56	16:26	16:48
54°	22:33	23:59	·· ··	16:12	16:39	16:57
56°	22:15	23:45	·· ··	16:30	16:53	17:08
58°	21:52	23:29	·· ··	16:53	17:10	17:19
S 60°	21:22	23:09	·· ··	17:23	17:31	17:33

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 23-25 45-25%
23	06:37	06:28	12:06	06:51	19:19	
24	06:19	06:10	12:06	07:47	20:14	
25	06:01	05:52	12:06	08:41	21:07	

March 26, 27, 28 UT (Wed., Thu., Fri.)

	Aries	Venus		Mars		Jupiter		Saturn	
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	183°41.7	186°12.3	N07°47.3	69°41.8	N24°27.9	109°50.6	N22°17.0	188°39.3	S04°14.8
1	198°44.1	201°16.1	46.4	84°43.5	27.7	124°52.7	17.0	203°41.5	14.7
2	213°46.6	216°19.8	45.5	99°45.2	27.5	139°54.8	17.1	218°43.6	14.6
3	228°49.0	231°23.5	·· 44.7	114°46.9	·· 27.4	154°56.9	·· 17.1	233°45.8	·· 14.4
4	243°51.5	246°27.3	43.8	129°48.6	27.2	169°59.0	17.2	248°48.0	14.3
5	258°54.0	261°31.0	42.9	144°50.3	27.0	185°01.1	17.2	263°50.2	14.2
6	273°56.4	276°34.7	N07°42.1	159°52.0	N24°26.8	200°03.1	N22°17.3	278°52.4	S04°14.1
7	288°58.9	291°38.5	41.2	174°53.7	26.6	215°05.2	17.3	293°54.5	14.0
8	304°01.4	306°42.2	40.3	189°55.4	26.4	230°07.3	17.4	308°56.7	13.9
9	319°03.8	321°45.9	·· 39.4	204°57.1	·· 26.3	245°09.4	·· 17.4	323°58.9	·· 13.7
10	334°06.3	336°49.6	38.6	219°58.8	26.1	260°11.5	17.5	339°01.1	13.6
11	349°08.8	351°53.3	37.7	235°00.4	25.9	275°13.5	17.5	354°03.3	13.5
12	4°11.2	6°57.1	N07°36.8	250°02.1	N24°25.7	290°15.6	N22°17.6	9°05.5	S04°13.4
13	19°13.7	22°00.8	36.0	265°03.8	25.5	305°17.7	17.6	24°07.6	13.3
14	34°16.1	37°04.5	35.1	280°05.5	25.3	320°19.8	17.6	39°09.8	13.1
15	49°18.6	52°08.2	·· 34.2	295°07.2	·· 25.2	335°21.9	·· 17.7	54°12.0	·· 13.0
16	64°21.1	67°11.9	33.3	310°08.9	25.0	350°23.9	17.7	69°14.2	12.9
17	79°23.5	82°15.6	32.5	325°10.6	24.8	5°26.0	17.8	84°16.4	12.8
18	94°26.0	97°19.3	N07°31.6	340°12.2	N24°24.6	20°28.1	N22°17.8	99°18.6	S04°12.7
19	109°28.5	112°23.0	30.7	355°13.9	24.4	35°30.2	17.9	114°20.7	12.6
20	124°30.9	127°26.7	29.8	10°15.6	24.2	50°32.2	17.9	129°22.9	12.4
21	139°33.4	142°30.4	·· 28.9	25°17.3	·· 24.1	65°34.3	·· 18.0	144°25.1	·· 12.3
22	154°35.9	157°34.1	28.1	40°19.0	23.9	80°36.4	18.0	159°27.3	12.2
23	169°38.3	172°37.8	27.2	55°20.7	23.7	95°38.5	18.1	174°29.5	12.1
Mer.pass. 11:43		ν 3.7′	d 0.9′	m -4.18	ν 1.7′	d 0.2′	m 0.32	ν 2.1′	d 0.0′ m -2.14	ν 2.2′	d 0.1′ m 1.15

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	184°40.8	187°41.5	N07°26.3	70°22.3	N24°23.5	110°40.6	N22°18.1	189°31.7	S04°12.0
1	199°43.3	202°45.2	25.4	85°24.0	23.3	125°42.6	18.2	204°33.8	11.9
2	214°45.7	217°48.9	24.5	100°25.7	23.1	140°44.7	18.2	219°36.0	11.7
3	229°48.2	232°52.6	·· 23.7	115°27.4	·· 22.9	155°46.8	·· 18.2	234°38.2	·· 11.6
4	244°50.6	247°56.3	22.8	130°29.0	22.8	170°48.9	18.3	249°40.4	11.5
5	259°53.1	263°00.0	21.9	145°30.7	22.6	185°50.9	18.3	264°42.6	11.4
6	274°55.6	278°03.6	N07°21.0	160°32.4	N24°22.4	200°53.0	N22°18.4	279°44.8	S04°11.3
7	289°58.0	293°07.3	20.1	175°34.1	22.2	215°55.1	18.4	294°46.9	11.1
8	305°00.5	308°11.0	19.2	190°35.7	22.0	230°57.2	18.5	309°49.1	11.0
9	320°03.0	323°14.7	·· 18.3	205°37.4	·· 21.8	245°59.2	·· 18.5	324°51.3	·· 10.9
10	335°05.4	338°18.3	17.5	220°39.1	21.6	261°01.3	18.6	339°53.5	10.8
11	350°07.9	353°22.0	16.6	235°40.8	21.4	276°03.4	18.6	354°55.7	10.7
12	5°10.4	8°25.7	N07°15.7	250°42.4	N24°21.3	291°05.4	N22°18.7	9°57.9	S04°10.6
13	20°12.8	23°29.3	14.8	265°44.1	21.1	306°07.5	18.7	25°00.0	10.4
14	35°15.3	38°33.0	13.9	280°45.8	20.9	321°09.6	18.8	40°02.2	10.3
15	50°17.7	53°36.6	·· 13.0	295°47.4	·· 20.7	336°11.7	·· 18.8	55°04.4	·· 10.2
16	65°20.2	68°40.3	12.1	310°49.1	20.5	351°13.7	18.9	70°06.6	10.1
17	80°22.7	83°44.0	11.2	325°50.8	20.3	6°15.8	18.9	85°08.8	10.0
18	95°25.1	98°47.6	N07°10.4	340°52.4	N24°20.1	21°17.9	N22°18.9	100°11.0	S04°09.9
19	110°27.6	113°51.3	09.5	355°54.1	19.9	36°20.0	19.0	115°13.1	09.7
20	125°30.1	128°54.9	08.6	10°55.8	19.8	51°22.0	19.0	130°15.3	09.6
21	140°32.5	143°58.6	·· 07.7	25°57.4	·· 19.6	66°24.1	·· 19.1	145°17.5	·· 09.5
22	155°35.0	159°02.2	06.8	40°59.1	19.4	81°26.2	19.1	160°19.7	09.4
23	170°37.5	174°05.8	05.9	56°00.8	19.2	96°28.2	19.2	175°21.9	09.3
Mer.pass. 11:39		ν 3.7′	d 0.9′	m -4.13	ν 1.7′	d 0.2′	m 0.34	ν 2.1′	d 0.0′ m -2.13	ν 2.2′	d 0.1′ m 1.15

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	185°39.9	189°09.5	N07°05.0	71°02.4	N24°19.0	111°30.3	N22°19.2	190°24.1	S04°09.2
1	200°42.4	204°13.1	04.1	86°04.1	18.8	126°32.4	19.3	205°26.2	09.0
2	215°44.9	219°16.7	03.2	101°05.7	18.6	141°34.5	19.3	220°28.4	08.9
3	230°47.3	234°20.4	·· 02.3	116°07.4	·· 18.4	156°36.5	·· 19.4	235°30.6	·· 08.8
4	245°49.8	249°24.0	01.4	131°09.1	18.2	171°38.6	19.4	250°32.8	08.7
5	260°52.2	264°27.6	07°00.5	146°10.7	18.0	186°40.7	19.5	265°35.0	08.6
6	275°54.7	279°31.2	N06°59.7	161°12.4	N24°17.9	201°42.7	N22°19.5	280°37.2	S04°08.5
7	290°57.2	294°34.9	58.8	176°14.0	17.7	216°44.8	19.5	295°39.3	08.3
8	305°59.6	309°38.5	57.9	191°15.7	17.5	231°46.9	19.6	310°41.5	08.2
9	321°02.1	324°42.1	·· 57.0	206°17.3	·· 17.3	246°48.9	·· 19.6	325°43.7	·· 08.1
10	336°04.6	339°45.7	56.1	221°19.0	17.1	261°51.0	19.7	340°45.9	08.0
11	351°07.0	354°49.3	55.2	236°20.7	16.9	276°53.1	19.7	355°48.1	07.9
12	6°09.5	9°52.9	N06°54.3	251°22.3	N24°16.7	291°55.1	N22°19.8	10°50.3	S04°07.7
13	21°12.0	24°56.5	53.4	266°24.0	16.5	306°57.2	19.8	25°52.5	07.6
14	36°14.4	40°00.1	52.5	281°25.6	16.3	321°59.3	19.9	40°54.6	07.5
15	51°16.9	55°03.7	·· 51.6	296°27.3	·· 16.1	337°01.3	·· 19.9	55°56.8	·· 07.4
16	66°19.3	70°07.3	50.7	311°28.9	15.9	352°03.4	20.0	70°59.0	07.3
17	81°21.8	85°10.9	49.8	326°30.6	15.8	7°05.5	20.0	86°01.2	07.2
18	96°24.3	100°14.5	N06°48.9	341°32.2	N24°15.6	22°07.5	N22°20.1	101°03.4	S04°07.0
19	111°26.7	115°18.1	48.0	356°33.9	15.4	37°09.6	20.1	116°05.6	06.9
20	126°29.2	130°21.7	47.1	11°35.5	15.2	52°11.7	20.2	131°07.7	06.8
21	141°31.7	145°25.2	·· 46.2	26°37.2	·· 15.0	67°13.7	·· 20.2	146°09.9	·· 06.7
22	156°34.1	160°28.8	45.3	41°38.8	14.8	82°15.8	20.2	161°12.1	06.6
23	171°36.6	175°32.4	44.4	56°40.4	14.6	97°17.9	20.3	176°14.3	06.5
Mer.pass. 11:35		ν 3.6′	d 0.9′	m -4.05	ν 1.7′	d 0.2′	m 0.36	ν 2.1′	d 0.0′ m -2.13	ν 2.2′	d 0.1′ m 1.16

Stars

	SHA	Dec
Alpheratz	357°35.0	29°13.7
Ankaa	353°07.4	-42°10.2
Schedar	349°31.5	56°40.5
Diphda	348°47.4	-17°51.0
Achernar	335°20.6	-57°06.6
Hamal	327°51.3	23°34.9
Polaris	314°20.0	89°22.4
Acamar	315°11.9	-40°12.4
Menkar	314°06.2	4°11.2
Mirfak	308°28.4	49°57.1
Aldebaran	290°39.6	16°33.6
Rigel	281°03.8	-8°10.5
Capella	280°21.8	46°01.5
Bellatrix	278°22.8	6°22.3
Elnath	278°01.7	28°37.8
Alnilam	275°37.6	-1°11.2
Betelgeuse	270°51.9	7°24.6
Canopus	263°52.3	-52°42.8
Sirius	258°26.1	-16°45.2
Adhara	255°05.7	-29°00.6
Procyon	244°50.6	5°09.5
Pollux	243°17.0	27°58.0
Avior	234°14.4	-59°35.7
Suhail	222°45.9	-43°32.3
Miaplacidus	221°37.7	-69°49.4
Alphard	217°47.4	-8°46.2
Regulus	207°34.0	11°50.5
Dubhe	193°40.1	61°36.9
Denebola	182°24.4	14°25.7
Gienah	175°43.1	-17°41.1
Acrux	172°59.3	-63°14.4
Gacrux	171°50.9	-57°15.3
Alioth	166°12.2	55°49.2
Spica	158°21.8	-11°17.7
Alkaid	152°51.4	49°11.0
Hadar	148°35.2	-60°29.6
Menkent	147°57.1	-36°29.7
Arcturus	145°47.5	19°02.8
Rigil Kent.	139°39.6	-60°56.3
Kochab	137°18.8	74°02.8
Zuben'ubi	136°55.6	-16°08.9
Alphecca	126°03.3	26°37.5
Antares	112°15.5	-26°29.3
Atria	107°09.4	-69°04.1
Sabik	102°02.5	-15°45.4
Shaula	96°10.0	-37°07.3
Rasalhague	95°58.3	12°32.2
Eltanin	90°42.0	51°28.7
Kaus Aust.	83°32.3	-34°22.3
Vega	80°33.1	38°48.0
Nunki	75°47.6	-26°15.9
Altair	61°59.9	8°55.9
Peacock	53°05.7	-56°39.1
Deneb	49°26.0	45°21.9
Enif	33°38.9	9°59.3
Al Na'ir	27°33.0	-46°50.3
Fomalhaut	15°14.6	-29°29.4
Scheat	13°45.4	28°13.0
Markab	13°30.0	15°20.3

Mar 26 Wed	SHA	Mer.pass
Venus	2°30.7	11:32
Mars	246°00.2	19:19
Jupiter	286°09.0	16:38
Saturn	4°57.6	11:24

Mar 27 Thu	SHA	Mer.pass
Venus	3°00.7	11:26
Mars	245°41.5	19:16
Jupiter	285°59.8	16:35
Saturn	4°50.9	11:20

Mar 28 Fri	SHA	Mer.pass
Venus	3°29.5	11:21
Mars	245°22.5	19:14
Jupiter	285°50.4	16:32
Saturn	4°44.1	11:17

Horizontal parallax	
Venus:	0.5
Mars:	0.1

h — Sun — Moon

Wed	GHA	Dec	GHA	ν	Dec	d	HP
0	178°34.3	N02°13.0	221°39.9	9.5′	S18°26.3	13.3′	58.7′
1	193°34.5	14.0	236°08.4	9.5′	18°13.0	13.5′	58.8′
2	208°34.7	14.9	250°36.9	9.6′	17°59.5	13.6′	58.8′
3	223°34.9	·· 15.9	265°05.5	9.6′	17°45.9	13.7′	58.8′
4	238°35.1	16.9	279°34.1	9.7′	17°32.2	13.8′	58.9′
5	253°35.3	17.9	294°02.8	9.7′	17°18.4	14.0′	58.9′
6	268°35.5	N02°18.9	308°31.4	9.7′	S17°04.4	14.0′	58.9′
7	283°35.6	19.9	323°00.2	9.8′	16°50.4	14.2′	59.0′
8	298°35.8	20.8	337°28.9	9.8′	16°36.2	14.3′	59.0′
9	313°36.0	·· 21.8	351°57.7	9.8′	16°21.9	14.4′	59.1′
10	328°36.2	22.8	6°26.6	9.9′	16°07.5	14.5′	59.1′
11	343°36.4	23.8	20°55.5	9.9′	15°53.0	14.6′	59.1′
12	358°36.6	N02°24.8	35°24.4	9.9′	S15°38.4	14.7′	59.2′
13	13°36.8	25.7	49°53.3	10.0′	15°23.7	14.8′	59.2′
14	28°37.0	26.7	64°22.3	10.0′	15°08.9	14.9′	59.3′
15	43°37.2	·· 27.7	78°51.3	10.0′	14°54.0	15.0′	59.3′
16	58°37.3	28.7	93°20.3	10.1′	14°39.0	15.1′	59.3′
17	73°37.5	29.7	107°49.4	10.1′	14°23.9	15.2′	59.4′
18	88°37.7	N02°30.6	122°18.5	10.1′	S14°08.7	15.3′	59.4′
19	103°37.9	31.6	136°47.7	10.2′	13°53.4	15.4′	59.4′
20	118°38.1	32.6	151°16.8	10.2′	13°38.0	15.5′	59.5′
21	133°38.3	·· 33.6	165°46.0	10.2′	13°22.5	15.6′	59.5′
22	148°38.5	34.6	180°15.2	10.3′	13°06.9	15.7′	59.5′
23	163°38.7	35.5	194°44.5	10.3′	12°51.2	15.7′	59.6′
	SD = 16.0′	d = 1.0′	SD = 16.0′				

Thu	GHA	Dec	GHA	ν	Dec	d	HP
0	178°38.8	N02°36.5	209°13.8	10.3′	S12°35.5	15.9′	59.6′
1	193°39.0	37.5	223°43.1	10.3′	12°19.6	15.9′	59.7′
2	208°39.2	38.5	238°12.4	10.4′	12°03.7	16.0′	59.7′
3	223°39.4	·· 39.4	252°41.8	10.4′	11°47.7	16.2′	59.7′
4	238°39.6	40.4	267°11.2	10.4′	11°31.5	16.1′	59.8′
5	253°39.8	41.4	281°40.6	10.4′	11°15.4	16.3′	59.8′
6	268°40.0	N02°42.4	296°10.0	10.4′	S10°59.1	16.4′	59.8′
7	283°40.2	43.4	310°39.4	10.5′	10°42.7	16.4′	59.9′
8	298°40.3	44.3	325°08.9	10.5′	10°26.3	16.5′	59.9′
9	313°40.5	·· 45.3	339°38.4	10.5′	10°09.8	16.6′	59.9′
10	328°40.7	46.3	354°07.9	10.5′	09°53.2	16.6′	60.0′
11	343°40.9	47.3	8°37.4	10.5′	09°36.6	16.7′	60.0′
12	358°41.1	N02°48.3	23°07.0	10.6′	S09°19.9	16.8′	60.0′
13	13°41.3	49.2	37°36.5	10.6′	09°03.1	16.9′	60.1′
14	28°41.5	50.2	52°06.1	10.6′	08°46.2	16.9′	60.1′
15	43°41.7	·· 51.2	66°35.7	10.6′	08°29.3	17.0′	60.1′
16	58°41.9	52.2	81°05.3	10.6′	08°12.3	17.0′	60.1′
17	73°42.0	53.1	95°34.9	10.6′	07°55.3	17.1′	60.2′
18	88°42.2	N02°54.1	110°04.5	10.6′	S07°38.2	17.2′	60.2′
19	103°42.4	55.1	124°34.1	10.6′	07°21.0	17.2′	60.2′
20	118°42.6	56.1	139°03.8	10.6′	07°03.8	17.3′	60.3′
21	133°42.8	·· 57.1	153°33.4	10.7′	06°46.5	17.4′	60.3′
22	148°43.0	58.0	168°03.1	10.7′	06°29.1	17.3′	60.3′
23	163°43.2	59.0	182°32.7	10.7′	06°11.8	17.5′	60.4′
	SD = 16.0′	d = 1.0′	SD = 16.3′				

Fri	GHA	Dec	GHA	ν	Dec	d	HP
0	178°43.4	N03°00.0	197°02.4	10.7′	S05°54.3	17.5′	60.4′
1	193°43.5	01.0	211°32.1	10.7′	05°36.8	17.5′	60.4′
2	208°43.7	01.9	226°01.7	10.7′	05°19.3	17.6′	60.4′
3	223°43.9	·· 02.9	240°31.4	10.7′	05°01.7	17.6′	60.5′
4	238°44.1	03.9	255°01.0	10.7′	04°44.1	17.7′	60.5′
5	253°44.3	04.9	269°30.7	10.7′	04°26.4	17.7′	60.5′
6	268°44.5	N03°05.8	284°00.4	10.7′	S04°08.7	17.7′	60.5′
7	283°44.7	06.8	298°30.0	10.7′	03°51.0	17.8′	60.6′
8	298°44.9	07.8	312°59.7	10.6′	03°33.2	17.8′	60.6′
9	313°45.0	·· 08.8	327°29.3	10.6′	03°15.4	17.8′	60.6′
10	328°45.2	09.8	341°59.0	10.6′	02°57.6	17.9′	60.6′
11	343°45.4	10.7	356°28.6	10.6′	02°39.7	17.9′	60.7′
12	358°45.6	N03°11.7	10°58.2	10.6′	S02°21.8	17.9′	60.7′
13	13°45.8	12.7	25°27.8	10.6′	02°03.9	18.0′	60.7′
14	28°46.0	13.7	39°57.4	10.6′	01°45.9	18.0′	60.7′
15	43°46.2	·· 14.6	54°27.0	10.6′	01°27.9	18.0′	60.7′
16	58°46.4	15.6	68°56.6	10.6′	01°09.9	18.0′	60.8′
17	73°46.5	16.6	83°26.1	10.5′	00°51.9	18.0′	60.8′
18	88°46.7	N03°17.6	97°55.7	10.5′	S00°33.9	18.1′	60.8′
19	103°46.9	18.5	112°25.2	10.5′	S00°15.8	18.0′	60.8′
20	118°47.1	19.5	126°54.7	10.5′	N00°02.2	18.1′	60.8′
21	133°47.3	·· 20.5	141°24.2	10.5′	00°20.3	18.1′	60.9′
22	148°47.5	21.5	155°53.6	10.4′	00°38.4	18.1′	60.9′
23	163°47.7	22.4	170°23.0	10.4′	00°56.5	18.1′	60.9′
	SD = 16.0′	d = 1.0′	SD = 16.5′				

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	02:27	04:10	05:21	18:52	20:04	21:51
N 70°	02:56	04:22	05:26	18:47	19:51	21:20
68°	03:17	04:32	05:30	18:43	19:41	20:58
66°	03:33	04:40	05:33	18:40	19:33	20:41
64°	03:46	04:47	05:36	18:37	19:26	20:27
62°	03:57	04:53	05:38	18:34	19:20	20:16
60°	04:06	04:58	05:40	18:32	19:14	20:07
N 58°	04:14	05:02	05:42	18:30	19:10	19:59
56°	04:21	05:06	05:43	18:28	19:06	19:52
54°	04:26	05:09	05:45	18:27	19:03	19:46
52°	04:32	05:12	05:46	18:26	19:00	19:40
50°	04:36	05:15	05:47	18:24	18:57	19:36
45°	04:46	05:20	05:50	18:22	18:51	19:26
N 40°	04:53	05:25	05:52	18:19	18:46	19:19
35°	04:59	05:28	05:54	18:17	18:43	19:13
30°	05:03	05:31	05:55	18:16	18:40	19:08
20°	05:10	05:36	05:58	18:13	18:35	19:01
N 10°	05:15	05:39	06:00	18:11	18:32	18:56
0°	05:17	05:41	06:02	18:09	18:29	18:53
S 10°	05:18	05:43	06:04	18:07	18:28	18:52
20°	05:18	05:44	06:06	18:04	18:26	18:52
30°	05:16	05:44	06:08	18:02	18:26	18:54
35°	05:14	05:44	06:09	18:01	18:26	18:56
40°	05:12	05:43	06:10	18:00	18:27	18:58
45°	05:08	05:42	06:11	17:58	18:27	19:02
S 50°	05:03	05:41	06:13	17:57	18:29	19:06
52°	05:01	05:40	06:14	17:56	18:29	19:08
54°	04:58	05:39	06:15	17:55	18:30	19:11
56°	04:55	05:38	06:15	17:54	18:31	19:14
58°	04:51	05:37	06:16	17:53	18:32	19:18
S 60°	04:47	05:36	06:17	17:52	18:33	19:22

Lat.	Moonrise Wed	Moonrise Thu	Moonrise Fri	Moonset Wed	Moonset Thu	Moonset Fri
N 72°	08:01	06:43	05:58	11:32	14:40	17:15
N 70°	07:15	06:26	05:52	12:16	14:54	17:16
68°	06:45	06:12	05:47	12:45	15:06	17:17
66°	06:22	06:00	05:43	13:06	15:15	17:18
64°	06:04	05:51	05:40	13:23	15:22	17:19
62°	05:49	05:43	05:37	13:37	15:29	17:20
60°	05:36	05:35	05:34	13:48	15:35	17:20
N 58°	05:25	05:29	05:32	13:58	15:40	17:21
56°	05:15	05:23	05:30	14:07	15:44	17:21
54°	05:07	05:18	05:28	14:15	15:48	17:22
52°	04:59	05:14	05:26	14:22	15:52	17:22
50°	04:52	05:09	05:24	14:28	15:55	17:22
45°	04:37	05:00	05:21	14:41	16:02	17:23
N 40°	04:25	04:52	05:18	14:52	16:07	17:24
35°	04:14	04:46	05:16	15:01	16:12	17:24
30°	04:05	04:40	05:13	15:09	16:17	17:25
20°	03:48	04:30	05:09	15:23	16:24	17:25
N 10°	03:34	04:21	05:06	15:34	16:30	17:26
0°	03:21	04:12	05:03	15:46	16:36	17:26
S 10°	03:08	04:04	04:59	15:56	16:42	17:27
20°	02:53	03:55	04:56	16:08	16:48	17:28
30°	02:37	03:44	04:52	16:21	16:55	17:28
35°	02:27	03:38	04:50	16:29	16:59	17:28
40°	02:16	03:31	04:47	16:37	17:04	17:29
45°	02:03	03:23	04:44	16:47	17:09	17:29
S 50°	01:47	03:13	04:41	16:59	17:15	17:30
52°	01:39	03:09	04:39	17:04	17:18	17:30
54°	01:31	03:04	04:37	17:10	17:21	17:30
56°	01:21	02:58	04:35	17:17	17:24	17:30
58°	01:10	02:52	04:33	17:25	17:28	17:31
S 60°	00:58	02:45	04:30	17:33	17:32	17:31

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 26-28 16-3%
26	05:43	05:34	12:06	09:33	21:59	
27	05:25	05:16	12:05	10:24	22:49	
28	05:07	04:58	12:05	11:15	23:40	

March 29, 30, 31 UT (Sat., Sun., Mon.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	186°39.1	190°36.0	N06°43.5	71°42.1	N24°14.4	112°19.9	N22°20.3	191°16.5	S04°06.3
1	201°41.5	205°39.5	42.6	86°43.7	14.2	127°22.0	20.4	206°18.7	06.2
2	216°44.0	220°43.1	41.7	101°45.4	14.0	142°24.1	20.4	221°20.9	06.1
3	231°46.5	235°46.7	·· 40.8	116°47.0	·· 13.8	157°26.1	·· 20.5	236°23.0	·· 06.0
4	246°48.9	250°50.2	39.9	131°48.7	13.6	172°28.2	20.5	251°25.2	05.9
5	261°51.4	265°53.8	39.0	146°50.3	13.4	187°30.3	20.6	266°27.4	05.8
6	276°53.8	280°57.4	N06°38.1	161°51.9	N24°13.2	202°32.3	N22°20.6	281°29.6	S04°05.6
7	291°56.3	296°00.9	37.2	176°53.6	13.0	217°34.4	20.7	296°31.8	05.5
8	306°58.8	311°04.5	36.3	191°55.2	12.9	232°36.4	20.7	311°34.0	05.4
9	322°01.2	326°08.0	·· 35.4	206°56.9	·· 12.7	247°38.5	·· 20.8	326°36.1	·· 05.3
10	337°03.7	341°11.6	34.5	221°58.5	12.5	262°40.6	20.8	341°38.3	05.2
11	352°06.2	356°15.1	33.6	237°00.1	12.3	277°42.6	20.9	356°40.5	05.1
12	7°08.6	11°18.6	N06°32.8	252°01.8	N24°12.1	292°44.7	N22°20.9	11°42.7	S04°04.9
13	22°11.1	26°22.2	31.9	267°03.4	11.9	307°46.8	20.9	26°44.9	04.8
14	37°13.6	41°25.7	31.0	282°05.1	11.7	322°48.8	21.0	41°47.1	04.7
15	52°16.0	56°29.2	·· 30.1	297°06.7	·· 11.5	337°50.9	·· 21.0	56°49.3	·· 04.6
16	67°18.5	71°32.8	29.2	312°08.3	11.3	352°52.9	21.1	71°51.4	04.5
17	82°21.0	86°36.3	28.3	327°10.0	11.1	7°55.0	21.1	86°53.6	04.4
18	97°23.4	101°39.8	N06°27.4	342°11.6	N24°10.9	22°57.1	N22°21.2	101°55.8	S04°04.2
19	112°25.9	116°43.3	26.5	357°13.2	10.7	37°59.1	21.2	116°58.0	04.1
20	127°28.3	131°46.9	25.6	12°14.8	10.5	53°01.2	21.3	132°00.2	04.0
21	142°30.8	146°50.4	·· 24.7	27°16.5	·· 10.3	68°03.2	·· 21.3	147°02.4	·· 03.9
22	157°33.3	161°53.9	23.8	42°18.1	10.1	83°05.3	21.4	162°04.5	03.8
23	172°35.7	176°57.4	22.9	57°19.7	09.9	98°07.4	21.4	177°06.7	03.7
Mer.pass. 11:32		ν 3.6′	d 0.9′	m -4.06	ν 1.6′	d 0.2′	m 0.38	ν 2.1′	d 0.0′ m -2.12	ν 2.2′	d 0.1′ m 1.16

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	187°38.2	192°00.9	N06°22.0	72°21.4	N24°09.7	113°09.4	N22°21.5	192°08.9	S04°03.5
1	202°40.7	207°04.4	21.1	87°23.0	09.5	128°11.5	21.5	207°11.1	03.4
2	217°43.1	222°07.9	20.2	102°24.6	09.3	143°13.5	21.6	222°13.3	03.3
3	232°45.6	237°11.4	·· 19.3	117°26.2	·· 09.1	158°15.6	·· 21.6	237°15.5	·· 03.2
4	247°48.1	252°14.9	18.4	132°27.9	08.9	173°17.7	21.6	252°17.7	03.1
5	262°50.5	267°18.4	17.5	147°29.5	08.7	188°19.7	21.7	267°19.8	03.0
6	277°53.0	282°21.9	N06°16.6	162°31.1	N24°08.5	203°21.8	N22°21.7	282°22.0	S04°02.9
7	292°55.4	297°25.3	15.7	177°32.7	08.3	218°23.8	21.8	297°24.2	02.7
8	307°57.9	312°28.8	14.8	192°34.4	08.1	233°25.9	21.8	312°26.4	02.6
9	323°00.4	327°32.3	·· 13.9	207°36.0	·· 07.9	248°28.0	·· 21.9	327°28.6	·· 02.5
10	338°02.8	342°35.8	13.0	222°37.6	07.7	263°30.0	21.9	342°30.8	02.4
11	353°05.3	357°39.2	12.1	237°39.2	07.5	278°32.1	22.0	357°33.0	02.3
12	8°07.8	12°42.7	N06°11.2	252°40.9	N24°07.3	293°34.1	N22°22.0	12°35.1	S04°02.2
13	23°10.2	27°46.2	10.3	267°42.5	07.1	308°36.2	22.1	27°37.3	02.0
14	38°12.7	42°49.6	09.4	282°44.1	06.9	323°38.2	22.1	42°39.5	01.9
15	53°15.2	57°53.1	·· 08.5	297°45.7	·· 06.7	338°40.3	·· 22.2	57°41.7	·· 01.8
16	68°17.6	72°56.6	07.6	312°47.3	06.5	353°42.3	22.2	72°43.9	01.7
17	83°20.1	88°00.0	06.7	327°48.9	06.3	8°44.4	22.3	87°46.1	01.6
18	98°22.6	103°03.5	N06°05.8	342°50.6	N24°06.1	23°46.5	N22°22.3	102°48.3	S04°01.5
19	113°25.0	118°06.9	04.9	357°52.2	05.9	38°48.5	22.3	117°50.4	01.3
20	128°27.5	133°10.3	04.0	12°53.8	05.7	53°50.6	22.4	132°52.6	01.2
21	143°29.9	148°13.8	·· 03.1	27°55.4	·· 05.5	68°52.6	·· 22.4	147°54.8	·· 01.1
22	158°32.4	163°17.2	02.3	42°57.0	05.3	83°54.7	22.5	162°57.0	01.0
23	173°34.9	178°20.6	01.4	57°58.6	05.1	98°56.7	22.5	177°59.2	00.9
Mer.pass. 11:28		ν 3.5′	d 0.9′	m -4.12	ν 1.6′	d 0.2′	m 0.40	ν 2.1′	d 0.0′ m -2.12	ν 2.2′	d 0.1′ m 1.16

Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	188°37.3	193°24.1	N06°00.5	73°00.2	N24°04.9	113°58.8	N22°22.6	193°01.4	S04°00.8
1	203°39.8	208°27.5	05°59.6	88°01.9	04.7	129°00.8	22.6	208°03.6	00.6
2	218°42.3	223°30.9	58.7	103°03.5	04.5	144°02.9	22.7	223°05.7	00.5
3	233°44.7	238°34.3	·· 57.8	118°05.1	·· 04.3	159°04.9	·· 22.7	238°07.9	·· 00.4
4	248°47.2	253°37.8	56.9	133°06.7	04.1	174°07.0	22.8	253°10.1	00.3
5	263°49.7	268°41.2	56.0	148°08.3	03.9	189°09.0	22.8	268°12.3	00.2
6	278°52.1	283°44.6	N05°55.1	163°09.9	N24°03.7	204°11.1	N22°22.9	283°14.5	S04°00.1
7	293°54.6	298°48.0	54.2	178°11.5	03.5	219°13.2	22.9	298°16.7	03°59.9
8	308°57.0	313°51.4	53.3	193°13.1	03.3	234°15.2	23.0	313°18.9	59.8
9	323°59.5	328°54.8	·· 52.4	208°14.7	·· 03.1	249°17.3	·· 23.0	328°21.0	·· 59.7
10	339°02.0	343°58.2	51.5	223°16.3	02.9	264°19.3	23.0	343°23.2	59.6
11	354°04.4	359°01.6	50.7	238°17.9	02.7	279°21.4	23.1	358°25.4	59.5
12	9°06.9	14°05.0	N05°49.8	253°19.5	N24°02.5	294°23.4	N22°23.1	13°27.6	S03°59.4
13	24°09.4	29°08.4	48.9	268°21.1	02.3	309°25.5	23.2	28°29.8	59.3
14	39°11.8	44°11.8	48.0	283°22.7	02.1	324°27.5	23.2	43°32.0	59.1
15	54°14.3	59°15.1	·· 47.1	298°24.3	·· 01.9	339°29.6	·· 23.3	58°34.2	·· 59.0
16	69°16.8	74°18.5	46.2	313°25.9	01.7	354°31.6	23.3	73°36.3	58.9
17	84°19.2	89°21.9	45.3	328°27.6	01.5	9°33.7	23.4	88°38.5	58.8
18	99°21.7	104°25.3	N05°44.4	343°29.2	N24°01.3	24°35.7	N22°23.4	103°40.7	S03°58.7
19	114°24.2	119°28.6	43.5	358°30.8	01.1	39°37.8	23.5	118°42.9	58.6
20	129°26.6	134°32.0	42.7	13°32.4	00.9	54°39.8	23.5	133°45.1	58.4
21	144°29.1	149°35.3	·· 41.8	28°33.9	·· 00.7	69°41.9	·· 23.6	148°47.3	·· 58.3
22	159°31.5	164°38.7	40.9	43°35.5	00.5	84°43.9	23.6	163°49.5	58.2
23	174°34.0	179°42.1	40.0	58°37.1	00.3	99°46.0	23.7	178°51.7	58.1
Mer.pass. 11:24		ν 3.4′	d 0.9′	m -4.18	ν 1.6′	d 0.2′	m 0.42	ν 2.1′	d 0.0′ m -2.11	ν 2.2′	d 0.1′ m 1.16

Stars

	SHA	Dec
Alpheratz	357°35.0	29°13.7
Ankaa	353°07.4	-42°10.2
Schedar	349°31.5	56°40.5
Diphda	348°47.4	-17°51.0
Achernar	335°20.6	-57°06.6
Hamal	327°51.3	23°34.9
Polaris	314°21.1	89°22.4
Acamar	315°12.0	-40°12.4
Menkar	314°06.2	4°11.2
Mirfak	308°28.4	49°57.1
Aldebaran	290°39.6	16°33.6
Rigel	281°03.8	-8°10.5
Capella	280°21.8	46°01.5
Bellatrix	278°22.8	6°22.3
Elnath	278°01.8	28°37.8
Alnilam	275°37.6	-1°11.2
Betelgeuse	270°52.0	7°24.6
Canopus	263°52.4	-52°42.8
Sirius	258°26.1	-16°45.2
Adhara	255°05.7	-29°00.6
Procyon	244°50.6	5°09.5
Pollux	243°17.0	27°58.0
Avior	234°14.4	-59°35.7
Suhail	222°46.0	-43°32.3
Miaplacidus	221°37.8	-69°49.5
Alphard	217°47.4	-8°46.2
Regulus	207°34.0	11°50.6
Dubhe	193°40.1	61°36.9
Denebola	182°24.5	14°25.7
Gienah	175°43.1	-17°41.1
Acrux	172°59.3	-63°14.4
Gacrux	171°50.9	-57°15.4
Alioth	166°12.2	55°49.3
Spica	158°21.8	-11°17.7
Alkaid	152°51.4	49°11.0
Hadar	148°35.2	-60°29.7
Menkent	147°57.1	-36°29.7
Arcturus	145°47.4	19°02.9
Rigil Kent.	139°39.5	-60°56.3
Kochab	137°18.8	74°02.8
Zuben'ubi	136°55.6	-16°08.9
Alphecca	126°03.3	26°37.5
Antares	112°15.4	-26°29.3
Atria	107°09.3	-69°04.2
Sabik	102°02.5	-15°45.4
Shaula	96°10.0	-37°07.3
Rasalhague	95°58.3	12°32.3
Eltanin	90°42.0	51°28.7
Kaus Aust.	83°32.3	-34°22.3
Vega	80°33.1	38°48.0
Nunki	75°47.6	-26°15.9
Altair	61°59.9	8°55.9
Peacock	53°05.7	-56°39.1
Deneb	49°25.9	45°21.9
Enif	33°38.9	9°59.3
Al Na'ir	27°33.0	-46°50.3
Fomalhaut	15°14.6	-29°29.4
Scheat	13°45.4	28°13.0
Markab	13°30.0	15°20.3

Mar 29 Sat	SHA	Mer.pass
Venus	3°56.9	11:15
Mars	245°03.0	19:11
Jupiter	285°40.9	16:28
Saturn	4°37.4	11:13

Mar 30 Sun	SHA	Mer.pass
Venus	4°22.7	11:09
Mars	244°43.2	19:09
Jupiter	285°31.2	16:25
Saturn	4°30.7	11:10

Mar 31 Mon	SHA	Mer.pass
Venus	4°46.7	11:04
Mars	244°22.9	19:06
Jupiter	285°21.4	16:22
Saturn	4°24.0	11:06

Horizontal parallax	
Venus:	0.5
Mars:	0.1

h

	Sun		Moon				
Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°47.9	N03°23.4	184°52.5	10.4′	N01°14.6	18.1′	60.9′
1	193°48.0	24.4	199°21.8	10.4′	01°32.7	18.1′	60.9′
2	208°48.2	25.4	213°51.2	10.3′	01°50.8	18.1′	60.9′
3	223°48.4	·· 26.3	228°20.5	10.3′	02°08.9	18.0′	61.0′
4	238°48.6	27.3	242°49.8	10.3′	02°26.9	18.1′	61.0′
5	253°48.8	28.3	257°19.1	10.2′	02°45.0	18.1′	61.0′
6	268°49.0	N03°29.3	271°48.3	10.2′	N03°03.1	18.1′	61.0′
7	283°49.2	30.2	286°17.5	10.2′	03°21.2	18.0′	61.0′
8	298°49.4	31.2	300°46.7	10.1′	03°39.2	18.1′	61.0′
9	313°49.5	·· 32.2	315°15.8	10.1′	03°57.3	18.0′	61.0′
10	328°49.7	33.1	329°44.9	10.1′	04°15.3	18.0′	61.0′
11	343°49.9	34.1	344°14.0	10.0′	04°33.3	18.0′	61.1′
12	358°50.1	N03°35.1	358°43.0	10.0′	N04°51.3	18.0′	61.1′
13	13°50.3	36.1	13°12.0	9.9′	05°09.3	17.9′	61.1′
14	28°50.5	37.0	27°40.9	9.9′	05°27.2	18.0′	61.1′
15	43°50.7	·· 38.0	42°09.8	9.8′	05°45.2	17.9′	61.1′
16	58°50.8	39.0	56°38.6	9.8′	06°03.1	17.8′	61.1′
17	73°51.0	40.0	71°07.4	9.8′	06°20.9	17.9′	61.1′
18	88°51.2	N03°40.9	85°36.2	9.7′	N06°38.8	17.8′	61.1′
19	103°51.4	41.9	100°04.9	9.7′	06°56.6	17.7′	61.1′
20	118°51.6	42.9	114°33.6	9.6′	07°14.3	17.7′	61.1′
21	133°51.8	·· 43.8	129°02.2	9.6′	07°32.0	17.7′	61.1′
22	148°52.0	44.8	143°30.7	9.5′	07°49.7	17.6′	61.1′
23	163°52.2	45.8	157°59.2	9.5′	08°07.3	17.6′	61.1′
	SD = 16.0′	d = 1.0′	SD = 16.6′				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°52.3	N03°46.8	172°27.7	9.4′	N08°24.9	17.6′	61.1′
1	193°52.5	47.7	186°56.1	9.3′	08°42.5	17.5′	61.1′
2	208°52.7	48.7	201°24.4	9.3′	09°00.0	17.4′	61.1′
3	223°52.9	·· 49.7	215°52.7	9.2′	09°17.4	17.4′	61.1′
4	238°53.1	50.6	230°20.9	9.2′	09°34.8	17.3′	61.1′
5	253°53.3	51.6	244°49.1	9.1′	09°52.1	17.3′	61.1′
6	268°53.5	N03°52.6	259°17.2	9.1′	N10°09.4	17.2′	61.1′
7	283°53.6	53.6	273°45.3	9.0′	10°26.6	17.2′	61.1′
8	298°53.8	54.5	288°13.3	8.9′	10°43.8	17.1′	61.1′
9	313°54.0	·· 55.5	302°41.2	8.9′	11°00.9	17.0′	61.1′
10	328°54.2	56.5	317°09.1	8.8′	11°17.9	16.9′	61.1′
11	343°54.4	57.4	331°36.9	8.7′	11°34.8	16.9′	61.1′
12	358°54.6	N03°58.4	346°04.6	8.7′	N11°51.7	16.8′	61.1′
13	13°54.8	03°59.4	0°32.3	8.6′	12°08.5	16.7′	61.1′
14	28°55.0	04°00.4	14°59.9	8.5′	12°25.2	16.7′	61.1′
15	43°55.1	·· 01.3	29°27.4	8.5′	12°41.9	16.6′	61.1′
16	58°55.3	02.3	43°54.9	8.4′	12°58.5	16.5′	61.1′
17	73°55.5	03.3	58°22.3	8.3′	13°15.0	16.4′	61.1′
18	88°55.7	N04°04.2	72°49.6	8.3′	N13°31.4	16.3′	61.1′
19	103°55.9	05.2	87°16.8	8.2′	13°47.7	16.2′	61.1′
20	118°56.1	06.2	101°44.0	8.1′	14°03.9	16.1′	61.1′
21	133°56.3	·· 07.1	116°11.1	8.0′	14°20.0	16.1′	61.1′
22	148°56.4	08.1	130°38.2	8.0′	14°36.1	16.0′	61.1′
23	163°56.6	09.1	145°05.1	7.9′	14°52.1	15.8′	61.1′
	SD = 16.0′	d = 1.0′	SD = 16.7′				

Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°56.8	N04°10.0	159°32.0	7.8′	N15°07.9	15.8′	61.1′
1	193°57.0	11.0	173°58.8	7.7′	15°23.7	15.6′	61.0′
2	208°57.2	12.0	188°25.6	7.7′	15°39.3	15.6′	61.0′
3	223°57.4	·· 13.0	202°52.2	7.6′	15°54.9	15.4′	61.0′
4	238°57.6	13.9	217°18.8	7.5′	16°10.3	15.4′	61.0′
5	253°57.7	14.9	231°45.3	7.4′	16°25.7	15.2′	61.0′
6	268°57.9	N04°15.9	246°11.8	7.4′	N16°40.9	15.1′	61.0′
7	283°58.1	16.8	260°38.1	7.3′	16°56.0	15.0′	61.0′
8	298°58.3	17.8	275°04.4	7.2′	17°11.0	14.9′	61.0′
9	313°58.5	·· 18.8	289°30.6	7.1′	17°25.9	14.8′	60.9′
10	328°58.7	19.7	303°56.7	7.0′	17°40.7	14.6′	60.9′
11	343°58.9	20.7	318°22.7	7.0′	17°55.3	14.5′	60.9′
12	358°59.0	N04°21.7	332°48.7	6.9′	N18°09.8	14.5′	60.9′
13	13°59.2	22.6	347°14.6	6.8′	18°24.3	14.2′	60.9′
14	28°59.4	23.6	1°40.4	6.7′	18°38.5	14.2′	60.9′
15	43°59.6	·· 24.6	16°06.1	6.6′	18°52.7	14.0′	60.8′
16	58°59.8	25.5	30°31.7	6.6′	19°06.7	13.9′	60.8′
17	74°00.0	26.5	44°57.3	6.5′	19°20.6	13.8′	60.8′
18	89°00.2	N04°27.5	59°22.8	6.4′	N19°34.4	13.6′	60.8′
19	104°00.3	28.4	73°48.2	6.3′	19°48.0	13.5′	60.8′
20	119°00.5	29.4	88°13.5	6.2′	20°01.5	13.3′	60.7′
21	134°00.7	·· 30.4	102°38.7	6.2′	20°14.8	13.2′	60.7′
22	149°00.9	31.3	117°03.9	6.1′	20°28.0	13.1′	60.7′
23	164°01.1	32.3	131°29.0	6.0′	20°41.1	12.9′	60.7′
	SD = 16.0′	d = 1.0′	SD = 16.7′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	01:58	03:52	05:05	19:06	20:20	22:19
N 70°	02:35	04:07	05:12	19:00	20:05	21:40
68°	03:00	04:18	05:17	18:54	19:53	21:13
66°	03:18	04:28	05:21	18:50	19:43	20:54
64°	03:33	04:36	05:25	18:46	19:35	20:38
62°	03:45	04:43	05:28	18:42	19:28	20:26
60°	03:56	04:48	05:31	18:39	19:22	20:15
N 58°	04:04	04:53	05:33	18:37	19:17	20:06
56°	04:12	04:58	05:35	18:35	19:13	19:59
54°	04:18	05:02	05:37	18:33	19:09	19:52
52°	04:24	05:05	05:39	18:31	19:05	19:46
50°	04:29	05:08	05:41	18:29	19:02	19:41
45°	04:40	05:15	05:44	18:25	18:55	19:30
N 40°	04:48	05:20	05:47	18:22	18:50	19:22
35°	04:54	05:24	05:49	18:20	18:45	19:15
30°	05:00	05:28	05:52	18:18	18:42	19:10
20°	05:07	05:33	05:55	18:14	18:36	19:02
N 10°	05:13	05:37	05:58	18:11	18:32	18:56
0°	05:16	05:40	06:01	18:08	18:28	18:52
S 10°	05:18	05:43	06:04	18:05	18:26	18:50
20°	05:19	05:45	06:07	18:02	18:24	18:49
30°	05:18	05:46	06:10	17:59	18:23	18:50
35°	05:17	05:46	06:11	17:57	18:22	18:51
40°	05:15	05:46	06:13	17:55	18:22	18:53
45°	05:12	05:46	06:15	17:53	18:22	18:56
S 50°	05:08	05:46	06:18	17:50	18:22	19:00
52°	05:06	05:45	06:19	17:49	18:22	19:01
54°	05:04	05:45	06:20	17:48	18:23	19:04
56°	05:01	05:44	06:22	17:46	18:23	19:06
58°	04:58	05:44	06:23	17:44	18:23	19:09
S 60°	04:55	05:43	06:25	17:43	18:24	19:12

Lat.	**Moonrise** Sat	Sun	Mon	**Moonset** Sat	Sun	Mon
N 72°	05:18	04:35	03:26	19:50	22:54	▭
N 70°	05:22	04:49	04:03	19:39	22:19	▭
68°	05:25	05:01	04:29	19:31	21:55	·· ··
66°	05:27	05:10	04:50	19:23	21:36	·· ··
64°	05:29	05:19	05:06	19:17	21:22	23:38
62°	05:31	05:26	05:20	19:12	21:09	23:14
60°	05:33	05:32	05:32	19:07	20:59	22:55
N 58°	05:34	05:38	05:42	19:04	20:50	22:40
56°	05:36	05:42	05:51	19:00	20:42	22:26
54°	05:37	05:47	05:59	18:57	20:35	22:15
52°	05:38	05:51	06:06	18:54	20:28	22:05
50°	05:39	05:55	06:13	18:51	20:23	21:56
45°	05:41	06:03	06:27	18:46	20:11	21:37
N 40°	05:43	06:09	06:39	18:41	20:01	21:22
35°	05:45	06:15	06:49	18:37	19:52	21:09
30°	05:46	06:20	06:58	18:34	19:45	20:58
20°	05:49	06:29	07:13	18:28	19:32	20:39
N 10°	05:51	06:38	07:27	18:22	19:21	20:22
0°	05:53	06:45	07:40	18:17	19:11	20:07
S 10°	05:55	06:53	07:53	18:13	19:00	19:51
20°	05:58	07:01	08:07	18:07	18:49	19:35
30°	06:01	07:11	08:23	18:01	18:37	19:16
35°	06:02	07:16	08:32	17:58	18:30	19:06
40°	06:04	07:23	08:43	17:54	18:22	18:53
45°	06:06	07:30	08:56	17:50	18:12	18:39
S 50°	06:09	07:39	09:12	17:44	18:01	18:21
52°	06:10	07:43	09:19	17:42	17:56	18:13
54°	06:11	07:48	09:28	17:39	17:50	18:04
56°	06:13	07:53	09:37	17:36	17:44	17:54
58°	06:15	07:59	09:48	17:33	17:37	17:42
S 60°	06:16	08:06	10:00	17:30	17:29	17:29

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 0-2 0-4%
29	04:49	04:40	12:05	12:05	–:–	
30	04:31	04:22	12:04	12:58	00:31	
31	04:13	04:04	12:04	13:53	01:25	

April 01, 02, 03 UT (Tue., Wed., Thu.)

	Aries	Venus		Mars		Jupiter		Saturn	
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	189°36.5	194°45.4	N05°39.1	73°38.7	N24°00.1	114°48.0	N22°23.7	193°53.8	S03°58.0
1	204°38.9	209°48.8	38.2	88°40.3	23°59.9	129°50.1	23.7	208°56.0	57.9
2	219°41.4	224°52.1	37.4	103°41.9	59.7	144°52.1	23.8	223°58.2	57.8
3	234°43.9	239°55.4	·· 36.5	118°43.5	·· 59.5	159°54.1	·· 23.8	239°00.4	·· 57.6
4	249°46.3	254°58.8	35.6	133°45.1	59.3	174°56.2	23.9	254°02.6	57.5
5	264°48.8	270°02.1	34.7	148°46.7	59.1	189°58.2	23.9	269°04.8	57.4
6	279°51.3	285°05.4	N05°33.8	163°48.3	N23°58.8	205°00.3	N22°24.0	284°07.0	S03°57.3
7	294°53.7	300°08.8	32.9	178°49.9	58.6	220°02.3	24.0	299°09.1	57.2
8	309°56.2	315°12.1	32.1	193°51.5	58.4	235°04.4	24.1	314°11.3	57.1
9	324°58.7	330°15.4	·· 31.2	208°53.1	·· 58.2	250°06.4	·· 24.1	329°13.5	·· 56.9
10	340°01.1	345°18.7	30.3	223°54.7	58.0	265°08.5	24.2	344°15.7	56.8
11	355°03.6	0°22.0	29.4	238°56.3	57.8	280°10.5	24.2	359°17.9	56.7
12	10°06.0	15°25.3	N05°28.5	253°57.8	N23°57.6	295°12.6	N22°24.3	14°20.1	S03°56.6
13	25°08.5	30°28.6	27.7	268°59.4	57.4	310°14.6	24.3	29°22.3	56.5
14	40°11.0	45°32.0	26.8	284°01.0	57.2	325°16.7	24.4	44°24.5	56.4
15	55°13.4	60°35.2	·· 25.9	299°02.6	·· 57.0	340°18.7	·· 24.4	59°26.6	·· 56.2
16	70°15.9	75°38.5	25.0	314°04.2	56.8	355°20.7	24.4	74°28.8	56.1
17	85°18.4	90°41.8	24.2	329°05.8	56.6	10°22.8	24.5	89°31.0	56.0
18	100°20.8	105°45.1	N05°23.3	344°07.4	N23°56.4	25°24.8	N22°24.5	104°33.2	S03°55.9
19	115°23.3	120°48.4	22.4	359°09.0	56.2	40°26.9	24.6	119°35.4	55.8
20	130°25.8	135°51.7	21.5	14°10.5	55.9	55°28.9	24.6	134°37.6	55.7
21	145°28.2	150°55.0	·· 20.7	29°12.1	·· 55.7	70°31.0	·· 24.7	149°39.8	·· 55.6
22	160°30.7	165°58.2	19.8	44°13.7	55.5	85°33.0	24.7	164°42.0	55.4
23	175°33.1	181°01.5	18.9	59°15.3	55.3	100°35.1	24.8	179°44.1	55.3
Mer.pass. 11:20		ν 3.3′	d 0.9′	m -4.24	ν 1.6′	d 0.2′	m 0.44	ν 2.0′	d 0.0′ m -2.11	ν 2.2′	d 0.1′ m 1.16

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	190°35.6	196°04.8	N05°18.1	74°16.9	N23°55.1	115°37.1	N22°24.8	194°46.3	S03°55.2
1	205°38.1	211°08.0	17.2	89°18.4	54.9	130°39.1	24.9	209°48.5	55.1
2	220°40.5	226°11.3	16.3	104°20.0	54.7	145°41.2	24.9	224°50.7	55.0
3	235°43.0	241°14.6	·· 15.5	119°21.6	·· 54.5	160°43.2	·· 25.0	239°52.9	·· 54.9
4	250°45.5	256°17.8	14.6	134°23.2	54.3	175°45.3	25.0	254°55.1	54.8
5	265°47.9	271°21.1	13.7	149°24.8	54.1	190°47.3	25.1	269°57.3	54.6
6	280°50.4	286°24.3	N05°12.8	164°26.3	N23°53.9	205°49.4	N22°25.1	284°59.5	S03°54.5
7	295°52.9	301°27.5	12.0	179°27.9	53.7	220°51.4	25.1	300°01.6	54.4
8	310°55.3	316°30.8	11.1	194°29.5	53.4	235°53.4	25.2	315°03.8	54.3
9	325°57.8	331°34.0	·· 10.3	209°31.1	·· 53.2	250°55.5	·· 25.2	330°06.0	·· 54.2
10	341°00.3	346°37.2	09.4	224°32.6	53.0	265°57.5	25.3	345°08.2	54.1
11	356°02.7	1°40.5	08.5	239°34.2	52.8	280°59.6	25.3	0°10.4	53.9
12	11°05.2	16°43.7	N05°07.7	254°35.8	N23°52.6	296°01.6	N22°25.4	15°12.6	S03°53.8
13	26°07.6	31°46.9	06.8	269°37.4	52.4	311°03.6	25.4	30°14.8	53.7
14	41°10.1	46°50.1	05.9	284°38.9	52.2	326°05.7	25.5	45°17.0	53.6
15	56°12.6	61°53.3	·· 05.1	299°40.5	·· 52.0	341°07.7	·· 25.5	60°19.1	·· 53.5
16	71°15.0	76°56.6	04.2	314°42.1	51.8	356°09.8	25.6	75°21.3	53.4
17	86°17.5	91°59.8	03.4	329°43.7	51.5	11°11.8	25.6	90°23.5	53.3
18	101°20.0	107°03.0	N05°02.5	344°45.2	N23°51.3	26°13.8	N22°25.7	105°25.7	S03°53.1
19	116°22.4	122°06.2	01.7	359°46.8	51.1	41°15.9	25.7	120°27.9	53.0
20	131°24.9	137°09.4	05°00.8	14°48.4	50.9	56°17.9	25.8	135°30.1	52.9
21	146°27.4	152°12.5	04°59.9	29°49.9	·· 50.7	71°19.9	·· 25.8	150°32.3	·· 52.8
22	161°29.8	167°15.7	59.1	44°51.5	50.5	86°22.0	25.8	165°34.5	52.7
23	176°32.3	182°18.9	58.2	59°53.1	50.3	101°24.0	25.9	180°36.7	52.6
Mer.pass. 11:16		ν 3.3′	d 0.9′	m -4.30	ν 1.6′	d 0.2′	m 0.46	ν 2.0′	d 0.0′ m -2.10	ν 2.2′	d 0.1′ m 1.16

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	191°34.8	197°22.1	N04°57.4	74°54.6	N23°50.1	116°26.1	N22°25.9	195°38.8	S03°52.5
1	206°37.2	212°25.3	56.5	89°56.2	49.8	131°28.1	26.0	210°41.0	52.3
2	221°39.7	227°28.4	55.7	104°57.8	49.6	146°30.1	26.0	225°43.2	52.2
3	236°42.1	242°31.6	·· 54.8	119°59.3	·· 49.4	161°32.2	·· 26.1	240°45.4	·· 52.1
4	251°44.6	257°34.8	54.0	135°00.9	49.2	176°34.2	26.1	255°47.6	52.0
5	266°47.1	272°37.9	53.1	150°02.5	49.0	191°36.2	26.2	270°49.8	51.9
6	281°49.5	287°41.1	N04°52.3	165°04.0	N23°48.8	206°38.3	N22°26.2	285°52.0	S03°51.8
7	296°52.0	302°44.2	51.4	180°05.6	48.6	221°40.3	26.3	300°54.2	51.7
8	311°54.5	317°47.4	50.6	195°07.1	48.4	236°42.4	26.3	315°56.4	51.5
9	326°56.9	332°50.5	·· 49.7	210°08.7	·· 48.1	251°44.4	·· 26.4	330°58.5	·· 51.4
10	341°59.4	347°53.7	48.9	225°10.3	47.9	266°46.4	26.4	346°00.7	51.3
11	357°01.9	2°56.8	48.1	240°11.8	47.7	281°48.5	26.5	1°02.9	51.2
12	12°04.3	18°00.0	N04°47.2	255°13.4	N23°47.5	296°50.5	N22°26.5	16°05.1	S03°51.1
13	27°06.8	33°03.1	46.4	270°14.9	47.3	311°52.5	26.6	31°07.3	51.0
14	42°09.3	48°06.2	45.5	285°16.5	47.1	326°54.6	26.6	46°09.5	50.9
15	57°11.7	63°09.3	·· 44.7	300°18.1	·· 46.9	341°56.6	·· 26.6	61°11.7	·· 50.7
16	72°14.2	78°12.5	43.9	315°19.6	46.6	356°58.6	26.7	76°13.9	50.6
17	87°16.6	93°15.6	43.0	330°21.2	46.4	12°00.7	26.7	91°16.1	50.5
18	102°19.1	108°18.7	N04°42.2	345°22.7	N23°46.2	27°02.7	N22°26.8	106°18.2	S03°50.4
19	117°21.6	123°21.8	41.3	0°24.3	46.0	42°04.7	26.8	121°20.4	50.3
20	132°24.0	138°24.9	40.5	15°25.8	45.8	57°06.8	26.9	136°22.6	50.2
21	147°26.5	153°28.0	·· 39.7	30°27.4	·· 45.6	72°08.8	·· 26.9	151°24.8	·· 50.1
22	162°29.0	168°31.1	38.8	45°28.9	45.3	87°10.8	27.0	166°27.0	49.9
23	177°31.4	183°34.2	38.0	60°30.5	45.1	102°12.9	27.0	181°29.2	49.8
Mer.pass. 11:12		ν 3.2′	d 0.9′	m -4.35	ν 1.6′	d 0.2′	m 0.48	ν 2.0′	d 0.0′ m -2.10	ν 2.2′	d 0.1′ m 1.16

Stars

	SHA	Dec
Alpheratz	357°35.0	29°13.7
Ankaa	353°07.4	-42°10.2
Schedar	349°31.5	56°40.5
Diphda	348°47.4	-17°51.0
Achernar	335°20.6	-57°06.6
Hamal	327°51.3	23°34.8
Polaris	314°21.6	89°22.4
Acamar	315°12.0	-40°12.4
Menkar	314°06.2	4°11.2
Mirfak	308°28.4	49°57.1
Aldebaran	290°39.6	16°33.6
Rigel	281°03.8	-8°10.5
Capella	280°21.8	46°01.5
Bellatrix	278°22.8	6°22.3
Elnath	278°01.8	28°37.8
Alnilam	275°37.7	-1°11.2
Betelgeuse	270°52.0	7°24.6
Canopus	263°52.4	-52°42.8
Sirius	258°26.1	-16°45.2
Adhara	255°05.7	-29°00.6
Procyon	244°50.6	5°09.5
Pollux	243°17.0	27°58.0
Avior	234°14.5	-59°35.7
Suhail	222°46.0	-43°32.3
Miaplacidus	221°37.8	-69°49.5
Alphard	217°47.4	-8°46.2
Regulus	207°34.0	11°50.6
Dubhe	193°40.2	61°37.0
Denebola	182°24.5	14°25.7
Gienah	175°43.1	-17°41.1
Acrux	172°59.3	-63°14.4
Gacrux	171°50.9	-57°15.4
Alioth	166°12.2	55°49.3
Spica	158°21.8	-11°17.7
Alkaid	152°51.4	49°11.1
Hadar	148°35.2	-60°29.7
Menkent	147°57.1	-36°29.7
Arcturus	145°47.4	19°02.9
Rigil Kent.	139°39.5	-60°56.3
Kochab	137°18.7	74°02.8
Zuben'ubi	136°55.5	-16°08.9
Alphecca	126°03.3	26°37.5
Antares	112°15.4	-26°29.3
Atria	107°09.3	-69°04.2
Sabik	102°02.4	-15°45.4
Shaula	96°10.0	-37°07.3
Rasalhague	95°58.3	12°32.3
Eltanin	90°42.0	51°28.7
Kaus Aust.	83°32.2	-34°22.3
Vega	80°33.1	38°48.1
Nunki	75°47.5	-26°15.9
Altair	61°59.9	8°55.9
Peacock	53°05.7	-56°39.1
Deneb	49°25.9	45°21.9
Enif	33°38.8	9°59.3
Al Na'ir	27°33.0	-46°50.3
Fomalhaut	15°14.6	-29°29.4
Scheat	13°45.4	28°13.0
Markab	13°30.0	15°20.3

Apr 01 Tue	SHA	Mer.pass
Venus	5°08.9	10:59
Mars	244°02.3	19:03
Jupiter	285°11.5	16:19
Saturn	4°17.4	11:03

Apr 02 Wed	SHA	Mer.pass
Venus	5°29.2	10:53
Mars	243°41.3	19:01
Jupiter	285°01.5	16:15
Saturn	4°10.7	10:59

Apr 03 Thu	SHA	Mer.pass
Venus	5°47.3	10:48
Mars	243°19.9	18:58
Jupiter	284°51.3	16:12
Saturn	4°04.1	10:56

Horizontal parallax	
Venus:	0.5
Mars:	0.1

DUT1 = UT1-UTC = +0.0369 sec ΔT = TT-UT1 = +69.1471 sec

2025 April 01 to Apr. 03 UT

h	Sun		Moon				
Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°01.3	N04°33.3	145°54.0	5.9′	N20°54.0	12.8′	60.7′
1	194°01.4	34.2	160°18.9	5.9′	21°06.8	12.6′	60.6′
2	209°01.6	35.2	174°43.8	5.8′	21°19.4	12.5′	60.6′
3	224°01.8	·· 36.1	189°08.6	5.7′	21°31.9	12.3′	60.6′
4	239°02.0	37.1	203°33.3	5.6′	21°44.2	12.2′	60.6′
5	254°02.2	38.1	217°57.9	5.5′	21°56.4	12.0′	60.6′
6	269°02.4	N04°39.0	232°22.4	5.5′	N22°08.4	11.8′	60.5′
7	284°02.6	40.0	246°46.9	5.4′	22°20.2	11.7′	60.5′
8	299°02.7	41.0	261°11.3	5.3′	22°31.9	11.6′	60.5′
9	314°02.9	·· 41.9	275°35.7	5.3′	22°43.5	11.3′	60.5′
10	329°03.1	42.9	289°59.9	5.2′	22°54.8	11.3′	60.4′
11	344°03.3	43.9	304°24.1	5.1′	23°06.1	11.0′	60.4′
12	359°03.5	N04°44.8	318°48.2	5.0′	N23°17.1	10.9′	60.4′
13	14°03.7	45.8	333°12.3	5.0′	23°28.0	10.7′	60.4′
14	29°03.8	46.8	347°36.2	4.9′	23°38.7	10.5′	60.3′
15	44°04.0	·· 47.7	2°00.1	4.8′	23°49.2	10.4′	60.3′
16	59°04.2	48.7	16°24.0	4.8′	23°59.6	10.2′	60.3′
17	74°04.4	49.6	30°47.8	4.7′	24°09.8	10.1′	60.2′
18	89°04.6	N04°50.6	45°11.5	4.7′	N24°19.9	9.8′	60.2′
19	104°04.8	51.6	59°35.1	4.6′	24°29.7	9.7′	60.2′
20	119°05.0	52.5	73°58.7	4.5′	24°39.4	9.5′	60.2′
21	134°05.1	·· 53.5	88°22.2	4.5′	24°48.9	9.3′	60.1′
22	149°05.3	54.5	102°45.7	4.4′	24°58.2	9.2′	60.1′
23	164°05.5	55.4	117°09.1	4.4′	25°07.4	9.0′	60.1′
	SD = 16.0′	d = 1.0′	SD = 16.5′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°05.7	N04°56.4	131°32.5	4.3′	N25°16.4	8.7′	60.0′
1	194°05.9	57.3	145°55.8	4.3′	25°25.1	8.6′	60.0′
2	209°06.1	58.3	160°19.0	4.2′	25°33.7	8.5′	60.0′
3	224°06.2	04°59.3	174°42.2	4.2′	25°42.2	8.2′	60.0′
4	239°06.4	05°00.2	189°05.4	4.1′	25°50.4	8.1′	59.9′
5	254°06.6	01.2	203°28.5	4.1′	25°58.5	7.8′	59.9′
6	269°06.8	N05°02.1	217°51.6	4.0′	N26°06.3	7.7′	59.9′
7	284°07.0	03.1	232°14.6	4.0′	26°14.0	7.5′	59.8′
8	299°07.2	04.1	246°37.6	3.9′	26°21.5	7.3′	59.8′
9	314°07.3	·· 05.0	261°00.5	3.9′	26°28.8	7.1′	59.8′
10	329°07.5	06.0	275°23.4	3.9′	26°35.9	6.9′	59.7′
11	344°07.7	06.9	289°46.3	3.8′	26°42.8	6.7′	59.7′
12	359°07.9	N05°07.9	304°09.1	3.8′	N26°49.5	6.6′	59.7′
13	14°08.1	08.9	318°31.9	3.8′	26°56.1	6.3′	59.6′
14	29°08.3	09.8	332°54.7	3.7′	27°02.4	6.2′	59.6′
15	44°08.4	·· 10.8	347°17.4	3.7′	27°08.6	5.9′	59.6′
16	59°08.6	11.7	1°40.1	3.7′	27°14.5	5.8′	59.5′
17	74°08.8	12.7	16°02.8	3.7′	27°20.3	5.6′	59.5′
18	89°09.0	N05°13.7	30°25.5	3.7′	N27°25.9	5.3′	59.5′
19	104°09.2	14.6	44°48.2	3.6′	27°31.2	5.2′	59.4′
20	119°09.4	15.6	59°10.8	3.6′	27°36.4	5.0′	59.4′
21	134°09.5	·· 16.5	73°33.4	3.6′	27°41.4	4.8′	59.4′
22	149°09.7	17.5	87°56.0	3.6′	27°46.2	4.6′	59.3′
23	164°09.9	18.5	102°18.6	3.6′	27°50.8	4.4′	59.3′
	SD = 16.0′	d = 1.0′	SD = 16.4′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°10.1	N05°19.4	116°41.2	3.6′	N27°55.2	4.1′	59.3′
1	194°10.3	20.4	131°03.8	3.6′	27°59.3	4.0′	59.2′
2	209°10.4	21.3	145°26.4	3.6′	28°03.3	3.8′	59.2′
3	224°10.6	·· 22.3	159°49.0	3.6′	28°07.1	3.7′	59.2′
4	239°10.8	23.2	174°11.6	3.6′	28°10.8	3.4′	59.1′
5	254°11.0	24.2	188°34.2	3.6′	28°14.2	3.2′	59.1′
6	269°11.2	N05°25.2	202°56.8	3.6′	N28°17.4	3.0′	59.1′
7	284°11.4	26.1	217°19.5	3.6′	28°20.4	2.8′	59.0′
8	299°11.5	27.1	231°42.1	3.7′	28°23.2	2.6′	59.0′
9	314°11.7	·· 28.0	246°04.8	3.7′	28°25.8	2.5′	58.9′
10	329°11.9	29.0	260°27.4	3.7′	28°28.3	2.2′	58.9′
11	344°12.1	29.9	274°50.1	3.7′	28°30.5	2.0′	58.9′
12	359°12.3	N05°30.9	289°12.8	3.7′	N28°32.5	1.9′	58.8′
13	14°12.5	31.8	303°35.6	3.8′	28°34.4	1.6′	58.8′
14	29°12.6	32.8	317°58.3	3.8′	28°36.0	1.5′	58.8′
15	44°12.8	·· 33.8	332°21.1	3.8′	28°37.5	1.2′	58.7′
16	59°13.0	34.7	346°44.0	3.9′	28°38.7	1.1′	58.7′
17	74°13.2	35.7	1°06.8	3.9′	28°39.8	0.9′	58.7′
18	89°13.4	N05°36.6	15°29.7	3.9′	N28°40.7	0.6′	58.6′
19	104°13.5	37.6	29°52.7	4.0′	28°41.3	0.5′	58.6′
20	119°13.7	38.5	44°15.7	4.0′	28°41.8	0.3′	58.6′
21	134°13.9	·· 39.5	58°38.7	4.1′	28°42.1	0.1′	58.5′
22	149°14.1	40.4	73°01.8	4.1′	28°42.2	0.1′	58.5′
23	164°14.3	41.4	87°24.9	4.2′	28°42.1	0.2′	58.5′
	SD = 16.0′	d = 1.0′	SD = 16.2′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	01:22	03:34	04:50	19:20	20:38	23:00
N 70°	02:11	03:51	04:58	19:12	20:20	22:03
68°	02:41	04:04	05:04	19:05	20:06	21:31
66°	03:03	04:15	05:10	18:59	19:54	21:08
64°	03:20	04:24	05:14	18:55	19:45	20:50
62°	03:34	04:32	05:18	18:50	19:37	20:36
60°	03:45	04:39	05:22	18:47	19:30	20:24
N 58°	03:55	04:44	05:25	18:44	19:24	20:14
56°	04:03	04:49	05:28	18:41	19:19	20:06
54°	04:10	04:54	05:30	18:38	19:14	19:59
52°	04:16	04:58	05:32	18:36	19:10	19:52
50°	04:22	05:01	05:34	18:34	19:07	19:46
45°	04:34	05:09	05:39	18:29	18:59	19:34
N 40°	04:43	05:15	05:42	18:25	18:53	19:25
35°	04:50	05:20	05:45	18:22	18:48	19:18
30°	04:56	05:24	05:48	18:19	18:43	19:12
20°	05:05	05:31	05:53	18:15	18:37	19:03
N 10°	05:11	05:36	05:57	18:10	18:32	18:56
0°	05:15	05:39	06:00	18:07	18:27	18:52
S 10°	05:18	05:43	06:04	18:03	18:24	18:49
20°	05:20	05:45	06:07	17:59	18:21	18:47
30°	05:20	05:47	06:11	17:55	18:19	18:47
35°	05:19	05:48	06:14	17:53	18:18	18:47
40°	05:18	05:49	06:16	17:50	18:17	18:48
45°	05:16	05:50	06:19	17:47	18:16	18:50
S 50°	05:13	05:50	06:22	17:44	18:16	18:53
52°	05:11	05:50	06:24	17:42	18:16	18:55
54°	05:09	05:50	06:26	17:40	18:15	18:56
56°	05:07	05:50	06:28	17:38	18:15	18:58
58°	05:05	05:50	06:30	17:36	18:15	19:01
S 60°	05:02	05:50	06:32	17:34	18:15	19:03

Lat.	**Moonrise** Tue	Wed	Thu	**Moonset** Tue	Wed	Thu
N 72°	▭	▭	▭	▭	▭	▭
N 70°	▭	▭	▭	▭	▭	▭
68°	03:19	▭	▭	01:05	▭	▭
66°	04:15	▭	▭	00:10	▭	▭
64°	04:49	04:02	▭	·· ··	02:30	▭
62°	05:13	05:04	▭	·· ··	01:29	▭
60°	05:33	05:39	05:57	·· ··	00:55	02:47
N 58°	05:50	06:04	06:34	·· ··	00:30	02:11
56°	06:04	06:24	07:00	·· ··	00:10	01:44
54°	06:16	06:41	07:21	23:54	·· ··	01:23
52°	06:27	06:56	07:39	23:40	·· ··	01:06
50°	06:36	07:09	07:54	23:28	·· ··	00:51
45°	06:57	07:35	08:24	23:02	·· ··	00:21
N 40°	07:14	07:56	08:48	22:42	23:58	·· ··
35°	07:28	08:14	09:08	22:25	23:38	·· ··
30°	07:40	08:29	09:25	22:11	23:22	·· ··
20°	08:01	08:55	09:53	21:47	22:54	23:58
N 10°	08:20	09:17	10:18	21:26	22:30	23:33
0°	08:37	09:38	10:41	21:06	22:08	23:10
S 10°	08:55	09:59	11:03	20:47	21:46	22:47
20°	09:14	10:22	11:28	20:26	21:22	22:22
30°	09:36	10:49	11:57	20:02	20:54	21:53
35°	09:49	11:05	12:14	19:48	20:38	21:36
40°	10:04	11:23	12:34	19:32	20:19	21:16
45°	10:22	11:45	12:59	19:12	19:56	20:51
S 50°	10:45	12:14	13:30	18:49	19:27	20:20
52°	10:56	12:28	13:46	18:37	19:12	20:04
54°	11:08	12:44	14:05	18:24	18:56	19:45
56°	11:22	13:03	14:27	18:09	18:36	19:22
58°	11:39	13:28	14:56	17:52	18:12	18:53
S 60°	12:00	14:00	15:41	17:31	17:39	18:09

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 3-5 10-28%
01	03:55	03:46	12:04	14:52	02:22	
02	03:37	03:28	12:03	15:53	03:22	
03	03:20	03:11	12:03	16:55	04:24	

April 04, 05, 06 UT (Fri., Sat., Sun.)

	Aries	Venus		Mars		Jupiter		Saturn	
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	192°33.9	198°37.3	N04°37.2	75°32.0	N23°44.9	117°14.9	N22°27.1	196°31.4	S03°49.7
1	207°36.4	213°40.4	36.3	90°33.6	44.7	132°16.9	27.1	211°33.6	49.6
2	222°38.8	228°43.5	35.5	105°35.1	44.5	147°19.0	27.2	226°35.8	49.5
3	237°41.3	243°46.5	·· 34.7	120°36.7	·· 44.3	162°21.0	·· 27.2	241°37.9	·· 49.4
4	252°43.8	258°49.6	33.9	135°38.2	44.0	177°23.0	27.3	256°40.1	49.3
5	267°46.2	273°52.7	33.0	150°39.8	43.8	192°25.1	27.3	271°42.3	49.1
6	282°48.7	288°55.7	N04°32.2	165°41.3	N23°43.6	207°27.1	N22°27.3	286°44.5	S03°49.0
7	297°51.1	303°58.8	31.4	180°42.9	43.4	222°29.1	27.4	301°46.7	48.9
8	312°53.6	319°01.9	30.6	195°44.4	43.2	237°31.2	27.4	316°48.9	48.8
9	327°56.1	334°04.9	·· 29.7	210°46.0	·· 43.0	252°33.2	·· 27.5	331°51.1	·· 48.7
10	342°58.5	349°08.0	28.9	225°47.5	42.7	267°35.2	27.5	346°53.3	48.6
11	358°01.0	4°11.0	28.1	240°49.1	42.5	282°37.2	27.6	1°55.5	48.5
12	13°03.5	19°14.1	N04°27.3	255°50.6	N23°42.3	297°39.3	N22°27.6	16°57.7	S03°48.3
13	28°05.9	34°17.1	26.5	270°52.2	42.1	312°41.3	27.7	31°59.8	48.2
14	43°08.4	49°20.1	25.6	285°53.7	41.9	327°43.3	27.7	47°02.0	48.1
15	58°10.9	64°23.2	·· 24.8	300°55.3	·· 41.6	342°45.4	·· 27.8	62°04.2	·· 48.0
16	73°13.3	79°26.2	24.0	315°56.8	41.4	357°47.4	27.8	77°06.4	47.9
17	88°15.8	94°29.2	23.2	330°58.3	41.2	12°49.4	27.9	92°08.6	47.8
18	103°18.3	109°32.2	N04°22.4	345°59.9	N23°41.0	27°51.5	N22°27.9	107°10.8	S03°47.7
19	118°20.7	124°35.3	21.6	1°01.4	40.8	42°53.5	28.0	122°13.0	47.5
20	133°23.2	139°38.3	20.8	16°03.0	40.6	57°55.5	28.0	137°15.2	47.4
21	148°25.6	154°41.3	·· 20.0	31°04.5	·· 40.3	72°57.5	·· 28.0	152°17.4	·· 47.3
22	163°28.1	169°44.3	19.2	46°06.0	40.1	87°59.6	28.1	167°19.6	47.2
23	178°30.6	184°47.3	18.3	61°07.6	39.9	103°01.6	28.1	182°21.7	47.1
Mer.pass. 11:08		ν 3.1′	d 0.8′	m -4.40	ν 1.6′	d 0.2′	m 0.50	ν 2.0′	d 0.0′ m -2.09	ν 2.2′	d 0.1′ m 1.16

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	193°33.0	199°50.3	N04°17.5	76°09.1	N23°39.7	118°03.6	N22°28.2	197°23.9	S03°47.0
1	208°35.5	214°53.3	16.7	91°10.7	39.5	133°05.6	28.2	212°26.1	46.9
2	223°38.0	229°56.3	15.9	106°12.2	39.2	148°07.7	28.3	227°28.3	46.7
3	238°40.4	244°59.3	·· 15.1	121°13.7	·· 39.0	163°09.7	·· 28.3	242°30.5	·· 46.6
4	253°42.9	260°02.2	14.3	136°15.3	38.8	178°11.7	28.4	257°32.7	46.5
5	268°45.4	275°05.2	13.5	151°16.8	38.6	193°13.8	28.4	272°34.9	46.4
6	283°47.8	290°08.2	N04°12.7	166°18.3	N23°38.3	208°15.8	N22°28.5	287°37.1	S03°46.3
7	298°50.3	305°11.2	11.9	181°19.9	38.1	223°17.8	28.5	302°39.3	46.2
8	313°52.7	320°14.1	11.1	196°21.4	37.9	238°19.8	28.6	317°41.5	46.1
9	328°55.2	335°17.1	·· 10.3	211°22.9	·· 37.7	253°21.9	·· 28.6	332°43.6	·· 46.0
10	343°57.7	350°20.1	09.5	226°24.5	37.5	268°23.9	28.7	347°45.8	45.8
11	359°00.1	5°23.0	08.8	241°26.0	37.2	283°25.9	28.7	2°48.0	45.7
12	14°02.6	20°26.0	N04°08.0	256°27.5	N23°37.0	298°27.9	N22°28.7	17°50.2	S03°45.6
13	29°05.1	35°28.9	07.2	271°29.1	36.8	313°30.0	28.8	32°52.4	45.5
14	44°07.5	50°31.8	06.4	286°30.6	36.6	328°32.0	28.8	47°54.6	45.4
15	59°10.0	65°34.8	·· 05.6	301°32.1	·· 36.3	343°34.0	·· 28.9	62°56.8	·· 45.3
16	74°12.5	80°37.7	04.8	316°33.7	36.1	358°36.0	28.9	77°59.0	45.2
17	89°14.9	95°40.7	04.0	331°35.2	35.9	13°38.1	29.0	93°01.2	45.0
18	104°17.4	110°43.6	N04°03.2	346°36.7	N23°35.7	28°40.1	N22°29.0	108°03.4	S03°44.9
19	119°19.9	125°46.5	02.4	1°38.2	35.5	43°42.1	29.1	123°05.6	44.8
20	134°22.3	140°49.4	01.7	16°39.8	35.2	58°44.1	29.1	138°07.7	44.7
21	149°24.8	155°52.3	·· 00.9	31°41.3	·· 35.0	73°46.2	·· 29.2	153°09.9	·· 44.6
22	164°27.2	170°55.3	04°00.1	46°42.8	34.8	88°48.2	29.2	168°12.1	44.5
23	179°29.7	185°58.2	03°59.3	61°44.3	34.6	103°50.2	29.3	183°14.3	44.4
Mer.pass. 11:04		ν 3.0′	d 0.8′	m -4.45	ν 1.5′	d 0.2′	m 0.52	ν 2.0′	d 0.0′ m -2.09	ν 2.2′	d 0.1′ m 1.16

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	194°32.2	201°01.1	N03°58.6	76°45.9	N23°34.3	118°52.2	N22°29.3	198°16.5	S03°44.3
1	209°34.6	216°04.0	57.8	91°47.4	34.1	133°54.2	29.4	213°18.7	44.1
2	224°37.1	231°06.9	57.0	106°48.9	33.9	148°56.3	29.4	228°20.9	44.0
3	239°39.6	246°09.8	·· 56.2	121°50.4	·· 33.7	163°58.3	·· 29.4	243°23.1	·· 43.9
4	254°42.0	261°12.6	55.5	136°52.0	33.4	179°00.3	29.5	258°25.3	43.8
5	269°44.5	276°15.5	54.7	151°53.5	33.2	194°02.3	29.5	273°27.5	43.7
6	284°47.0	291°18.4	N03°53.9	166°55.0	N23°33.0	209°04.3	N22°29.6	288°29.7	S03°43.6
7	299°49.4	306°21.3	53.1	181°56.5	32.8	224°06.4	29.6	303°31.9	43.5
8	314°51.9	321°24.2	52.4	196°58.0	32.5	239°08.4	29.7	318°34.0	43.4
9	329°54.4	336°27.0	·· 51.6	211°59.6	·· 32.3	254°10.4	·· 29.7	333°36.2	·· 43.2
10	344°56.8	351°29.9	50.8	227°01.1	32.1	269°12.4	29.8	348°38.4	43.1
11	359°59.3	6°32.8	50.1	242°02.6	31.9	284°14.5	29.8	3°40.6	43.0
12	15°01.7	21°35.6	N03°49.3	257°04.1	N23°31.6	299°16.5	N22°29.9	18°42.8	S03°42.9
13	30°04.2	36°38.5	48.6	272°05.6	31.4	314°18.5	29.9	33°45.0	42.8
14	45°06.7	51°41.3	47.8	287°07.2	31.2	329°20.5	30.0	48°47.2	42.7
15	60°09.1	66°44.2	·· 47.0	302°08.7	·· 31.0	344°22.5	·· 30.0	63°49.4	·· 42.6
16	75°11.6	81°47.0	46.3	317°10.2	30.7	359°24.6	30.1	78°51.6	42.4
17	90°14.1	96°49.8	45.5	332°11.7	30.5	14°26.6	30.1	93°53.8	42.3
18	105°16.5	111°52.7	N03°44.8	347°13.2	N23°30.3	29°28.6	N22°30.1	108°56.0	S03°42.2
19	120°19.0	126°55.5	44.0	2°14.7	30.0	44°30.6	30.2	123°58.2	42.1
20	135°21.5	141°58.3	43.3	17°16.2	29.8	59°32.6	30.2	139°00.3	42.0
21	150°23.9	157°01.1	·· 42.5	32°17.8	·· 29.6	74°34.6	·· 30.3	154°02.5	·· 41.9
22	165°26.4	172°04.0	41.8	47°19.3	29.4	89°36.7	30.3	169°04.7	41.8
23	180°28.9	187°06.8	41.0	62°20.8	29.1	104°38.7	30.4	184°06.9	41.7
Mer.pass. 11:00		ν 2.9′	d 0.8′	m -4.49	ν 1.5′	d 0.2′	m 0.54	ν 2.0′	d 0.0′ m -2.08	ν 2.2′	d 0.1′ m 1.17

Stars

	SHA	Dec
Alpheratz	357°34.9	29°13.6
Ankaa	353°07.4	-42°10.2
Schedar	349°31.4	56°40.5
Diphda	348°47.4	-17°51.0
Achernar	335°20.6	-57°06.6
Hamal	327°51.3	23°34.8
Polaris	314°22.1	89°22.4
Acamar	315°12.0	-40°12.4
Menkar	314°06.2	4°11.2
Mirfak	308°28.4	49°57.1
Aldebaran	290°39.6	16°33.6
Rigel	281°03.8	-8°10.5
Capella	280°21.8	46°01.5
Bellatrix	278°22.8	6°22.3
Elnath	278°01.8	28°37.8
Alnilam	275°37.7	-1°11.2
Betelgeuse	270°52.0	7°24.6
Canopus	263°52.4	-52°42.8
Sirius	258°26.1	-16°45.2
Adhara	255°05.7	-29°00.6
Procyon	244°50.6	5°09.5
Pollux	243°17.0	27°58.0
Avior	234°14.5	-59°35.7
Suhail	222°46.0	-43°32.3
Miaplacidus	221°37.8	-69°49.5
Alphard	217°47.4	-8°46.2
Regulus	207°34.0	11°50.6
Dubhe	193°40.2	61°37.0
Denebola	182°24.4	14°25.7
Gienah	175°43.1	-17°41.1
Acrux	172°59.3	-63°14.5
Gacrux	171°50.9	-57°15.4
Alioth	166°12.2	55°49.3
Spica	158°21.8	-11°17.7
Alkaid	152°51.4	49°11.1
Hadar	148°35.2	-60°29.7
Menkent	147°57.0	-36°29.7
Arcturus	145°47.4	19°02.9
Rigil Kent.	139°39.5	-60°56.4
Kochab	137°18.7	74°02.8
Zuben'ubi	136°55.5	-16°08.9
Alphecca	126°03.3	26°37.5
Antares	112°15.4	-26°29.3
Atria	107°09.2	-69°04.2
Sabik	102°02.4	-15°45.4
Shaula	96°10.0	-37°07.3
Rasalhague	95°58.3	12°32.3
Eltanin	90°41.9	51°28.7
Kaus Aust.	83°32.2	-34°22.3
Vega	80°33.0	38°48.1
Nunki	75°47.5	-26°15.9
Altair	61°59.8	8°55.9
Peacock	53°05.6	-56°39.1
Deneb	49°25.9	45°21.9
Enif	33°38.8	9°59.3
Al Na'ir	27°33.0	-46°50.3
Fomalhaut	15°14.6	-29°29.3
Scheat	13°45.3	28°13.0
Markab	13°30.0	15°20.3

Apr 04 Fri	SHA	Mer.pass
Venus	6°03.4	10:43
Mars	242°58.1	18:56
Jupiter	284°41.0	16:09
Saturn	3°57.5	10:52

Apr 05 Sat	SHA	Mer.pass
Venus	6°17.3	10:39
Mars	242°36.1	18:53
Jupiter	284°30.6	16:06
Saturn	3°50.9	10:49

Apr 06 Sun	SHA	Mer.pass
Venus	6°28.9	10:34
Mars	242°13.7	18:51
Jupiter	284°20.0	16:02
Saturn	3°44.3	10:45

Horizontal parallax	
Venus:	0.5
Mars:	0.1

h — Sun — Moon

Fri	GHA	Dec	GHA	ν	Dec	d	HP
0	179°14.4	N05°42.3	101°48.1	4.2′	N28°41.9	0.5′	58.4′
1	194°14.6	43.3	116°11.3	4.3′	28°41.4	0.7′	58.4′
2	209°14.8	44.3	130°34.6	4.3′	28°40.7	0.8′	58.3′
3	224°15.0	·· 45.2	144°57.9	4.4′	28°39.9	1.0′	58.3′
4	239°15.2	46.2	159°21.3	4.5′	28°38.9	1.2′	58.3′
5	254°15.4	47.1	173°44.8	4.5′	28°37.7	1.4′	58.2′
6	269°15.5	N05°48.1	188°08.4	4.6′	N28°36.3	1.6′	58.2′
7	284°15.7	49.0	202°32.0	4.7′	28°34.7	1.8′	58.2′
8	299°15.9	50.0	216°55.6	4.7′	28°32.9	1.9′	58.1′
9	314°16.1	·· 50.9	231°19.4	4.8′	28°31.0	2.1′	58.1′
10	329°16.3	51.9	245°43.2	4.9′	28°28.9	2.3′	58.1′
11	344°16.4	52.8	260°07.1	5.0′	28°26.6	2.5′	58.0′
12	359°16.6	N05°53.8	274°31.0	5.0′	N28°24.1	2.7′	58.0′
13	14°16.8	54.7	288°55.1	5.1′	28°21.4	2.8′	58.0′
14	29°17.0	55.7	303°19.2	5.2′	28°18.6	3.0′	57.9′
15	44°17.2	·· 56.6	317°43.4	5.3′	28°15.6	3.2′	57.9′
16	59°17.3	57.6	332°07.7	5.4′	28°12.4	3.3′	57.8′
17	74°17.5	58.5	346°32.1	5.5′	28°09.1	3.5′	57.8′
18	89°17.7	N05°59.5	0°56.6	5.6′	N28°05.6	3.7′	57.8′
19	104°17.9	06°00.4	15°21.1	5.6′	28°01.9	3.9′	57.7′
20	119°18.1	01.4	29°45.8	5.7′	27°58.0	4.0′	57.7′
21	134°18.2	·· 02.3	44°10.5	5.8′	27°54.0	4.2′	57.7′
22	149°18.4	03.3	58°35.3	5.9′	27°49.8	4.4′	57.6′
23	164°18.6	04.2	73°00.3	6.0′	27°45.4	4.5′	57.6′
	SD = 16.0′	d = 1.0′	SD = 15.9′				

Sat	GHA	Dec	GHA	ν	Dec	d	HP
0	179°18.8	N06°05.2	87°25.3	6.1′	N27°40.9	4.7′	57.6′
1	194°19.0	06.1	101°50.4	6.2′	27°36.2	4.8′	57.5′
2	209°19.1	07.1	116°15.6	6.3′	27°31.4	5.0′	57.5′
3	224°19.3	·· 08.0	130°40.9	6.4′	27°26.4	5.2′	57.5′
4	239°19.5	09.0	145°06.3	6.5′	27°21.2	5.3′	57.4′
5	254°19.7	09.9	159°31.9	6.6′	27°15.9	5.4′	57.4′
6	269°19.8	N06°10.9	173°57.5	6.7′	N27°10.5	5.7′	57.4′
7	284°20.0	11.8	188°23.2	6.8′	27°04.8	5.7′	57.3′
8	299°20.2	12.8	202°49.0	6.9′	26°59.1	6.0′	57.3′
9	314°20.4	·· 13.7	217°15.0	7.0′	26°53.1	6.0′	57.3′
10	329°20.6	14.7	231°41.0	7.2′	26°47.1	6.3′	57.2′
11	344°20.7	15.6	246°07.2	7.3′	26°40.8	6.3′	57.2′
12	359°20.9	N06°16.6	260°33.4	7.4′	N26°34.5	6.5′	57.2′
13	14°21.1	17.5	274°59.8	7.5′	26°28.0	6.7′	57.1′
14	29°21.3	18.5	289°26.3	7.6′	26°21.3	6.8′	57.1′
15	44°21.5	·· 19.4	303°52.9	7.7′	26°14.5	6.9′	57.1′
16	59°21.6	20.3	318°19.6	7.8′	26°07.6	7.1′	57.0′
17	74°21.8	21.3	332°46.4	7.9′	26°00.5	7.2′	57.0′
18	89°22.0	N06°22.2	347°13.3	8.0′	N25°53.3	7.4′	57.0′
19	104°22.2	23.2	1°40.3	8.1′	25°45.9	7.5′	56.9′
20	119°22.3	24.1	16°07.5	8.3′	25°38.4	7.6′	56.9′
21	134°22.5	·· 25.1	30°34.8	8.4′	25°30.8	7.7′	56.9′
22	149°22.7	26.0	45°02.1	8.5′	25°23.1	7.9′	56.8′
23	164°22.9	27.0	59°29.6	8.6′	25°15.2	8.0′	56.8′
	SD = 16.0′	d = 0.9′	SD = 15.7′				

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	179°23.1	N06°27.9	73°57.2	8.7′	N25°07.2	8.1′	56.8′
1	194°23.2	28.9	88°24.9	8.8′	24°59.1	8.3′	56.7′
2	209°23.4	29.8	102°52.8	8.9′	24°50.8	8.4′	56.7′
3	224°23.6	·· 30.7	117°20.7	9.1′	24°42.4	8.5′	56.7′
4	239°23.8	31.7	131°48.8	9.2′	24°33.9	8.6′	56.7′
5	254°23.9	32.6	146°17.0	9.3′	24°25.3	8.7′	56.6′
6	269°24.1	N06°33.6	160°45.2	9.4′	N24°16.6	8.9′	56.6′
7	284°24.3	34.5	175°13.6	9.5′	24°07.7	9.0′	56.6′
8	299°24.5	35.5	189°42.2	9.6′	23°58.7	9.1′	56.5′
9	314°24.7	·· 36.4	204°10.8	9.7′	23°49.6	9.2′	56.5′
10	329°24.8	37.3	218°39.5	9.9′	23°40.4	9.3′	56.5′
11	344°25.0	38.3	233°08.4	10.0′	23°31.1	9.4′	56.4′
12	359°25.2	N06°39.2	247°37.4	10.1′	N23°21.7	9.6′	56.4′
13	14°25.4	40.2	262°06.5	10.2′	23°12.1	9.6′	56.4′
14	29°25.5	41.1	276°35.7	10.3′	23°02.5	9.8′	56.4′
15	44°25.7	·· 42.1	291°05.0	10.4′	22°52.7	9.8′	56.3′
16	59°25.9	43.0	305°34.4	10.5′	22°42.9	10.0′	56.3′
17	74°26.1	43.9	320°03.9	10.6′	22°32.9	10.0′	56.3′
18	89°26.2	N06°44.9	334°33.6	10.8′	N22°22.9	10.2′	56.2′
19	104°26.4	45.8	349°03.3	10.9′	22°12.7	10.3′	56.2′
20	119°26.6	46.8	3°33.2	11.0′	22°02.4	10.3′	56.2′
21	134°26.8	·· 47.7	18°03.2	11.1′	21°52.1	10.5′	56.2′
22	149°26.9	48.6	32°33.2	11.2′	21°41.6	10.5′	56.1′
23	164°27.1	49.6	47°03.4	11.3′	21°31.1	10.7′	56.1′
	SD = 16.0′	d = 0.9′	SD = 15.5′				

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	////	03:14	04:34	19:35	20:56	////
N 70°	01:43	03:34	04:43	19:25	20:35	22:31
68°	02:21	03:50	04:51	19:16	20:18	21:50
66°	02:47	04:03	04:58	19:09	20:05	21:23
64°	03:06	04:13	05:04	19:03	19:55	21:03
62°	03:21	04:22	05:08	18:58	19:46	20:47
60°	03:34	04:29	05:13	18:54	19:38	20:34
N 58°	03:45	04:36	05:16	18:50	19:31	20:23
56°	03:54	04:41	05:20	18:47	19:25	20:13
54°	04:02	04:46	05:23	18:44	19:20	20:05
52°	04:09	04:51	05:25	18:41	19:16	19:58
50°	04:15	04:55	05:28	18:38	19:12	19:52
45°	04:27	05:03	05:33	18:33	19:03	19:39
N 40°	04:37	05:10	05:37	18:28	18:56	19:29
35°	04:45	05:16	05:41	18:25	18:50	19:21
30°	04:52	05:20	05:44	18:21	18:45	19:14
20°	05:02	05:28	05:50	18:15	18:38	19:04
N 10°	05:09	05:34	05:55	18:10	18:32	18:56
0°	05:14	05:39	05:59	18:06	18:27	18:51
S 10°	05:18	05:43	06:04	18:01	18:23	18:47
20°	05:20	05:46	06:08	17:57	18:19	18:44
30°	05:21	05:49	06:13	17:52	18:16	18:43
35°	05:21	05:51	06:16	17:49	18:14	18:43
40°	05:21	05:52	06:19	17:45	18:13	18:44
45°	05:19	05:53	06:23	17:42	18:11	18:45
S 50°	05:17	05:55	06:27	17:37	18:10	18:47
52°	05:16	05:55	06:29	17:35	18:09	18:48
54°	05:15	05:56	06:31	17:33	18:08	18:49
56°	05:13	05:56	06:34	17:31	18:08	18:51
58°	05:11	05:57	06:36	17:28	18:07	18:52
S 60°	05:09	05:57	06:39	17:25	18:06	18:54

Lat.	Moonrise Fri	Moonrise Sat	Moonrise Sun	Moonset Fri	Moonset Sat	Moonset Sun
N 72°						
N 70°						
68°						
66°			07:42			07:11
64°			09:07			05:45
62°		07:38	09:44		05:20	05:07
60°	06:50	08:25	10:10	04:03	04:32	04:41
N 58°	07:31	08:56	10:30	03:23	04:01	04:20
56°	07:59	09:19	10:47	02:55	03:38	04:02
54°	08:21	09:37	11:01	02:33	03:19	03:47
52°	08:39	09:53	11:14	02:15	03:03	03:34
50°	08:54	10:07	11:25	01:59	02:49	03:23
45°	09:25	10:35	11:47	01:28	02:20	02:59
N 40°	09:49	10:56	12:05	01:04	01:58	02:40
35°	10:09	11:14	12:21	00:44	01:39	02:24
30°	10:26	11:30	12:34	00:27	01:23	02:10
20°	10:54	11:56	12:56	·· ··	00:56	01:46
N 10°	11:19	12:19	13:15	·· ··	00:32	01:25
0°	11:42	12:40	13:33	·· ··	00:10	01:06
S 10°	12:05	13:01	13:51	23:48	·· ··	00:46
20°	12:29	13:23	14:10	23:24	·· ··	00:25
30°	12:58	13:49	14:32	22:56	·· ··	00:01
35°	13:14	14:04	14:45	22:40	23:46	·· ··
40°	13:34	14:22	14:59	22:21	23:29	·· ··
45°	13:58	14:43	15:17	21:57	23:09	·· ··
S 50°	14:29	15:10	15:38	21:27	22:43	·· ··
52°	14:44	15:23	15:48	21:12	22:31	23:52
54°	15:02	15:37	15:59	20:54	22:16	23:42
56°	15:23	15:55	16:12	20:33	22:00	23:29
58°	15:50	16:15	16:27	20:06	21:39	23:15
S 60°	16:28	16:42	16:45	19:28	21:14	22:58

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 6-8 38-60%
04	03:02	02:54	12:03	17:56	05:26	
05	02:45	02:36	12:03	18:53	06:25	
06	02:28	02:19	12:02	19:45	07:20	

April 07, 08, 09 UT (Mon., Tue., Wed.)

	Aries	Venus		Mars		Jupiter		Saturn	
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	195°31.3	202°09.6	N03°40.3	77°22.3	N23°28.9	119°40.7	N22°30.4	199°09.1	S03°41.5
1	210°33.8	217°12.4	39.5	92°23.8	28.7	134°42.7	30.5	214°11.3	41.4
2	225°36.2	232°15.2	38.8	107°25.3	28.4	149°44.7	30.5	229°13.5	41.3
3	240°38.7	247°18.0	·· 38.1	122°26.8	·· 28.2	164°46.7	·· 30.6	244°15.7	·· 41.2
4	255°41.2	262°20.8	37.3	137°28.3	28.0	179°48.8	30.6	259°17.9	41.1
5	270°43.6	277°23.6	36.6	152°29.8	27.8	194°50.8	30.7	274°20.1	41.0
6	285°46.1	292°26.4	N03°35.8	167°31.4	N23°27.5	209°52.8	N22°30.7	289°22.3	S03°40.9
7	300°48.6	307°29.1	35.1	182°32.9	27.3	224°54.8	30.8	304°24.5	40.8
8	315°51.0	322°31.9	34.4	197°34.4	27.1	239°56.8	30.8	319°26.7	40.6
9	330°53.5	337°34.7	·· 33.6	212°35.9	·· 26.8	254°58.8	·· 30.8	334°28.8	·· 40.5
10	345°56.0	352°37.5	32.9	227°37.4	26.6	270°00.9	30.9	349°31.0	40.4
11	0°58.4	7°40.2	32.2	242°38.9	26.4	285°02.9	30.9	4°33.2	40.3
12	16°00.9	22°43.0	N03°31.4	257°40.4	N23°26.2	300°04.9	N22°31.0	19°35.4	S03°40.2
13	31°03.3	37°45.7	30.7	272°41.9	25.9	315°06.9	31.0	34°37.6	40.1
14	46°05.8	52°48.5	30.0	287°43.4	25.7	330°08.9	31.1	49°39.8	40.0
15	61°08.3	67°51.2	·· 29.3	302°44.9	·· 25.5	345°10.9	·· 31.1	64°42.0	·· 39.9
16	76°10.7	82°54.0	28.5	317°46.4	25.2	0°13.0	31.2	79°44.2	39.8
17	91°13.2	97°56.7	27.8	332°47.9	25.0	15°15.0	31.2	94°46.4	39.6
18	106°15.7	112°59.5	N03°27.1	347°49.4	N23°24.8	30°17.0	N22°31.3	109°48.6	S03°39.5
19	121°18.1	128°02.2	26.4	2°50.9	24.5	45°19.0	31.3	124°50.8	39.4
20	136°20.6	143°04.9	25.7	17°52.4	24.3	60°21.0	31.4	139°53.0	39.3
21	151°23.1	158°07.7	·· 24.9	32°53.9	·· 24.1	75°23.0	·· 31.4	154°55.2	·· 39.2
22	166°25.5	173°10.4	24.2	47°55.4	23.8	90°25.0	31.4	169°57.4	39.1
23	181°28.0	188°13.1	23.5	62°56.9	23.6	105°27.0	31.5	184°59.6	39.0
Mer.pass. 10:56		ν 2.8′	d 0.7′	m -4.53	ν 1.5′	d 0.2′	m 0.55	ν 2.0′	d 0.0′ m -2.08	ν 2.2′	d 0.1′ m 1.17

Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	196°30.5	203°15.8	N03°22.8	77°58.4	N23°23.4	120°29.1	N22°31.5	200°01.7	S03°38.9
1	211°32.9	218°18.5	22.1	92°59.9	23.1	135°31.1	31.6	215°03.9	38.7
2	226°35.4	233°21.2	21.4	108°01.4	22.9	150°33.1	31.6	230°06.1	38.6
3	241°37.8	248°23.9	·· 20.7	123°02.9	·· 22.7	165°35.1	·· 31.7	245°08.3	·· 38.5
4	256°40.3	263°26.6	20.0	138°04.4	22.4	180°37.1	31.7	260°10.5	38.4
5	271°42.8	278°29.3	19.3	153°05.9	22.2	195°39.1	31.8	275°12.7	38.3
6	286°45.2	293°32.0	N03°18.6	168°07.4	N23°22.0	210°41.1	N22°31.8	290°14.9	S03°38.2
7	301°47.7	308°34.7	17.9	183°08.9	21.7	225°43.1	31.9	305°17.1	38.1
8	316°50.2	323°37.4	17.2	198°10.4	21.5	240°45.2	31.9	320°19.3	38.0
9	331°52.6	338°40.1	·· 16.5	213°11.9	·· 21.3	255°47.2	·· 32.0	335°21.5	·· 37.8
10	346°55.1	353°42.7	15.8	228°13.4	21.0	270°49.2	32.0	350°23.7	37.7
11	1°57.6	8°45.4	15.1	243°14.9	20.8	285°51.2	32.0	5°25.9	37.6
12	17°00.0	23°48.1	N03°14.4	258°16.4	N23°20.6	300°53.2	N22°32.1	20°28.1	S03°37.5
13	32°02.5	38°50.7	13.7	273°17.9	20.3	315°55.2	32.1	35°30.3	37.4
14	47°04.9	53°53.4	13.0	288°19.3	20.1	330°57.2	32.2	50°32.5	37.3
15	62°07.4	68°56.1	·· 12.3	303°20.8	·· 19.9	345°59.2	·· 32.2	65°34.7	·· 37.2
16	77°09.9	83°58.7	11.6	318°22.3	19.6	1°01.2	32.3	80°36.8	37.1
17	92°12.3	99°01.4	10.9	333°23.8	19.4	16°03.2	32.3	95°39.0	37.0
18	107°14.8	114°04.0	N03°10.2	348°25.3	N23°19.2	31°05.3	N22°32.4	110°41.2	S03°36.8
19	122°17.3	129°06.6	09.6	3°26.8	18.9	46°07.3	32.4	125°43.4	36.7
20	137°19.7	144°09.3	08.9	18°28.3	18.7	61°09.3	32.5	140°45.6	36.6
21	152°22.2	159°11.9	·· 08.2	33°29.8	·· 18.5	76°11.3	·· 32.5	155°47.8	·· 36.5
22	167°24.7	174°14.5	07.5	48°31.3	18.2	91°13.3	32.6	170°50.0	36.4
23	182°27.1	189°17.1	06.8	63°32.7	18.0	106°15.3	32.6	185°52.2	36.3
Mer.pass. 10:52		ν 2.7′	d 0.7′	m -4.56	ν 1.5′	d 0.2′	m 0.57	ν 2.0′	d 0.0′ m -2.07	ν 2.2′	d 0.1′ m 1.17

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	197°29.6	204°19.8	N03°06.2	78°34.2	N23°17.7	121°17.3	N22°32.7	200°54.4	S03°36.2
1	212°32.1	219°22.4	05.5	93°35.7	17.5	136°19.3	32.7	215°56.6	36.1
2	227°34.5	234°25.0	04.8	108°37.2	17.3	151°21.3	32.7	230°58.8	36.0
3	242°37.0	249°27.6	·· 04.1	123°38.7	·· 17.0	166°23.3	·· 32.8	246°01.0	·· 35.8
4	257°39.4	264°30.2	03.5	138°40.2	16.8	181°25.3	32.8	261°03.2	35.7
5	272°41.9	279°32.8	02.8	153°41.7	16.6	196°27.3	32.9	276°05.4	35.6
6	287°44.4	294°35.4	N03°02.1	168°43.1	N23°16.3	211°29.4	N22°32.9	291°07.6	S03°35.5
7	302°46.8	309°38.0	01.5	183°44.6	16.1	226°31.4	33.0	306°09.8	35.4
8	317°49.3	324°40.6	00.8	198°46.1	15.9	241°33.4	33.0	321°12.0	35.3
9	332°51.8	339°43.2	03°00.1	213°47.6	·· 15.6	256°35.4	·· 33.1	336°14.2	·· 35.2
10	347°54.2	354°45.7	02°59.5	228°49.1	15.4	271°37.4	33.1	351°16.3	35.1
11	2°56.7	9°48.3	58.8	243°50.6	15.1	286°39.4	33.2	6°18.5	35.0
12	17°59.2	24°50.9	N02°58.2	258°52.0	N23°14.9	301°41.4	N22°33.2	21°20.7	S03°34.8
13	33°01.6	39°53.5	57.5	273°53.5	14.7	316°43.4	33.3	36°22.9	34.7
14	48°04.1	54°56.0	56.9	288°55.0	14.4	331°45.4	33.3	51°25.1	34.6
15	63°06.6	69°58.6	·· 56.2	303°56.5	·· 14.2	346°47.4	·· 33.3	66°27.3	·· 34.5
16	78°09.0	85°01.1	55.5	318°58.0	13.9	1°49.4	33.4	81°29.5	34.4
17	93°11.5	100°03.7	54.9	333°59.4	13.7	16°51.4	33.4	96°31.7	34.3
18	108°13.9	115°06.2	N02°54.3	349°00.9	N23°13.5	31°53.4	N22°33.5	111°33.9	S03°34.2
19	123°16.4	130°08.8	53.6	4°02.4	13.2	46°55.4	33.5	126°36.1	34.1
20	138°18.9	145°11.3	53.0	19°03.9	13.0	61°57.4	33.6	141°38.3	34.0
21	153°21.3	160°13.9	·· 52.3	34°05.3	·· 12.7	76°59.4	·· 33.6	156°40.5	·· 33.8
22	168°23.8	175°16.4	51.7	49°06.8	12.5	92°01.4	33.7	171°42.7	33.7
23	183°26.3	190°18.9	51.0	64°08.3	12.3	107°03.4	33.7	186°44.9	33.6
Mer.pass. 10:48		ν 2.6′	d 0.7′	m -4.59	ν 1.5′	d 0.2′	m 0.59	ν 2.0′	d 0.0′ m -2.07	ν 2.2′	d 0.1′ m 1.17

Stars

	SHA	Dec
Alpheratz	357°34.9	29°13.6
Ankaa	353°07.3	-42°10.2
Schedar	349°31.4	56°40.5
Diphda	348°47.4	-17°51.0
Achernar	335°20.6	-57°06.6
Hamal	327°51.3	23°34.8
Polaris	314°22.8	89°22.4
Acamar	315°12.0	-40°12.3
Menkar	314°06.2	4°11.2
Mirfak	308°28.4	49°57.1
Aldebaran	290°39.6	16°33.6
Rigel	281°03.8	-8°10.5
Capella	280°21.8	46°01.5
Bellatrix	278°22.8	6°22.3
Elnath	278°01.8	28°37.8
Alnilam	275°37.7	-1°11.2
Betelgeuse	270°52.0	7°24.7
Canopus	263°52.4	-52°42.8
Sirius	258°26.1	-16°45.2
Adhara	255°05.7	-29°00.6
Procyon	244°50.6	5°09.5
Pollux	243°17.0	27°58.0
Avior	234°14.5	-59°35.7
Suhail	222°46.0	-43°32.3
Miaplacidus	221°37.9	-69°49.5
Alphard	217°47.4	-8°46.2
Regulus	207°34.0	11°50.6
Dubhe	193°40.2	61°37.0
Denebola	182°24.4	14°25.8
Gienah	175°43.1	-17°41.1
Acrux	172°59.3	-63°14.5
Gacrux	171°50.9	-57°15.4
Alioth	166°12.2	55°49.3
Spica	158°21.8	-11°17.7
Alkaid	152°51.3	49°11.1
Hadar	148°35.2	-60°29.7
Menkent	147°57.0	-36°29.7
Arcturus	145°47.4	19°02.9
Rigil Kent.	139°39.5	-60°56.4
Kochab	137°18.7	74°02.9
Zuben'ubi	136°55.5	-16°08.9
Alphecca	126°03.3	26°37.5
Antares	112°15.4	-26°29.3
Atria	107°09.1	-69°04.2
Sabik	102°02.4	-15°45.4
Shaula	96°09.9	-37°07.3
Rasalhague	95°58.2	12°32.3
Eltanin	90°41.9	51°28.7
Kaus Aust.	83°32.2	-34°22.3
Vega	80°33.0	38°48.1
Nunki	75°47.5	-26°15.9
Altair	61°59.8	8°55.9
Peacock	53°05.6	-56°39.0
Deneb	49°25.9	45°21.9
Enif	33°38.8	9°59.3
Al Na'ir	27°33.0	-46°50.2
Fomalhaut	15°14.6	-29°29.3
Scheat	13°45.3	28°13.0
Markab	13°30.0	15°20.3

Apr 07 Mon	SHA	Mer.pass
Venus	6°38.3	10:29
Mars	241°51.0	18:49
Jupiter	284°09.4	15:59
Saturn	3°37.8	10:42

Apr 08 Tue	SHA	Mer.pass
Venus	6°45.4	10:25
Mars	241°28.0	18:46
Jupiter	283°58.6	15:56
Saturn	3°31.3	10:38

Apr 09 Wed	SHA	Mer.pass
Venus	6°50.2	10:21
Mars	241°04.6	18:44
Jupiter	283°47.7	15:53
Saturn	3°24.8	10:35

Horizontal parallax	
Venus:	0.5
Mars:	0.1

DUT1 = UT1-UTC = +0.0373 sec ΔT = TT-UT1 = +69.1467 sec

2025 April 07 to Apr. 09 UT

h

Mon	Sun GHA	Sun Dec	Moon GHA	Moon ν	Moon Dec	Moon d	Moon HP
0	179°27.3	N06°50.5	61°33.7	11.4′	N21°20.4	10.7′	56.1′
1	194°27.5	51.5	76°04.1	11.5′	21°09.7	10.8′	56.0′
2	209°27.6	52.4	90°34.7	11.6′	20°58.9	10.9′	56.0′
3	224°27.8	·· 53.3	105°05.3	11.7′	20°48.0	11.0′	56.0′
4	239°28.0	54.3	119°36.0	11.8′	20°37.0	11.1′	56.0′
5	254°28.2	55.2	134°06.8	11.9′	20°25.9	11.2′	55.9′
6	269°28.3	N06°56.2	148°37.8	12.0′	N20°14.7	11.2′	55.9′
7	284°28.5	57.1	163°08.8	12.1′	20°03.5	11.4′	55.9′
8	299°28.7	58.0	177°39.9	12.2′	19°52.1	11.4′	55.9′
9	314°28.9	·· 59.0	192°11.2	12.3′	19°40.7	11.5′	55.8′
10	329°29.0	06°59.9	206°42.5	12.4′	19°29.2	11.5′	55.8′
11	344°29.2	07°00.9	221°14.0	12.5′	19°17.7	11.7′	55.8′
12	359°29.4	N07°01.8	235°45.5	12.6′	N19°06.0	11.7′	55.8′
13	14°29.6	02.7	250°17.2	12.7′	18°54.3	11.8′	55.7′
14	29°29.7	03.7	264°48.9	12.8′	18°42.5	11.9′	55.7′
15	44°29.9	·· 04.6	279°20.7	12.9′	18°30.6	12.0′	55.7′
16	59°30.1	05.5	293°52.7	13.0′	18°18.6	12.0′	55.7′
17	74°30.3	06.5	308°24.7	13.1′	18°06.6	12.1′	55.6′
18	89°30.4	N07°07.4	322°56.8	13.2′	N17°54.5	12.1′	55.6′
19	104°30.6	08.3	337°29.0	13.3′	17°42.4	12.3′	55.6′
20	119°30.8	09.3	352°01.3	13.4′	17°30.1	12.2′	55.6′
21	134°31.0	·· 10.2	6°33.7	13.5′	17°17.9	12.4′	55.5′
22	149°31.1	11.2	21°06.2	13.6′	17°05.5	12.4′	55.5′
23	164°31.3	12.1	35°38.8	13.7′	16°53.1	12.5′	55.5′
	SD = 16.0′	d = 0.9′	SD = 15.3′				

Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	179°31.5	N07°13.0	50°11.4	13.8′	N16°40.6	12.5′	55.5′
1	194°31.7	14.0	64°44.2	13.8′	16°28.1	12.6′	55.4′
2	209°31.8	14.9	79°17.0	13.9′	16°15.5	12.7′	55.4′
3	224°32.0	·· 15.8	93°50.0	14.0′	16°02.8	12.7′	55.4′
4	239°32.2	16.8	108°23.0	14.1′	15°50.1	12.8′	55.4′
5	254°32.3	17.7	122°56.0	14.2′	15°37.3	12.8′	55.4′
6	269°32.5	N07°18.6	137°29.2	14.3′	N15°24.5	12.9′	55.3′
7	284°32.7	19.6	152°02.5	14.3′	15°11.6	13.0′	55.3′
8	299°32.9	20.5	166°35.8	14.4′	14°58.6	13.0′	55.3′
9	314°33.0	·· 21.4	181°09.2	14.5′	14°45.6	13.0′	55.3′
10	329°33.2	22.4	195°42.7	14.6′	14°32.6	13.1′	55.2′
11	344°33.4	23.3	210°16.3	14.6′	14°19.5	13.1′	55.2′
12	359°33.6	N07°24.2	224°49.9	14.7′	N14°06.4	13.2′	55.2′
13	14°33.7	25.2	239°23.6	14.8′	13°53.2	13.3′	55.2′
14	29°33.9	26.1	253°57.4	14.9′	13°39.9	13.3′	55.2′
15	44°34.1	·· 27.0	268°31.3	14.9′	13°26.6	13.3′	55.1′
16	59°34.2	27.9	283°05.2	15.0′	13°13.3	13.4′	55.1′
17	74°34.4	28.9	297°39.2	15.1′	12°59.9	13.4′	55.1′
18	89°34.6	N07°29.8	312°13.3	15.1′	N12°46.5	13.4′	55.1′
19	104°34.8	30.7	326°47.4	15.2′	12°33.1	13.5′	55.1′
20	119°34.9	31.7	341°21.6	15.3′	12°19.6	13.6′	55.0′
21	134°35.1	·· 32.6	355°55.9	15.3′	12°06.0	13.6′	55.0′
22	149°35.3	33.5	10°30.2	15.4′	11°52.4	13.6′	55.0′
23	164°35.4	34.5	25°04.6	15.5′	11°38.8	13.6′	55.0′
	SD = 16.0′	d = 0.9′	SD = 15.1′				

Wed	GHA	Dec	GHA	ν	Dec	d	HP
0	179°35.6	N07°35.4	39°39.1	15.5′	N11°25.2	13.7′	55.0′
1	194°35.8	36.3	54°13.6	15.6′	11°11.5	13.7′	55.0′
2	209°36.0	37.3	68°48.2	15.6′	10°57.8	13.8′	54.9′
3	224°36.1	·· 38.2	83°22.9	15.7′	10°44.0	13.8′	54.9′
4	239°36.3	39.1	97°57.6	15.8′	10°30.2	13.8′	54.9′
5	254°36.5	40.0	112°32.3	15.8′	10°16.4	13.9′	54.9′
6	269°36.6	N07°41.0	127°07.1	15.9′	N10°02.5	13.9′	54.9′
7	284°36.8	41.9	141°42.0	15.9′	09°48.6	13.9′	54.8′
8	299°37.0	42.8	156°16.9	16.0′	09°34.7	13.9′	54.8′
9	314°37.1	·· 43.7	170°51.9	16.0′	09°20.8	14.0′	54.8′
10	329°37.3	44.7	185°26.9	16.1′	09°06.8	14.0′	54.8′
11	344°37.5	45.6	200°02.0	16.1′	08°52.8	14.0′	54.8′
12	359°37.7	N07°46.5	214°37.1	16.2′	N08°38.8	14.1′	54.8′
13	14°37.8	47.5	229°12.3	16.2′	08°24.7	14.0′	54.7′
14	29°38.0	48.4	243°47.5	16.3′	08°10.7	14.1′	54.7′
15	44°38.2	·· 49.3	258°22.8	16.3′	07°56.6	14.1′	54.7′
16	59°38.3	50.2	272°58.1	16.4′	07°42.5	14.2′	54.7′
17	74°38.5	51.2	287°33.5	16.4′	07°28.3	14.1′	54.7′
18	89°38.7	N07°52.1	302°08.9	16.4′	N07°14.2	14.2′	54.7′
19	104°38.8	53.0	316°44.3	16.5′	07°00.0	14.2′	54.6′
20	119°39.0	53.9	331°19.8	16.5′	06°45.8	14.2′	54.6′
21	134°39.2	·· 54.9	345°55.3	16.6′	06°31.6	14.3′	54.6′
22	149°39.3	55.8	0°30.9	16.6′	06°17.3	14.2′	54.6′
23	164°39.5	56.7	15°06.4	16.6′	06°03.1	14.3′	54.6′
	SD = 16.0′	d = 0.9′	SD = 15.0′				

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	////	02:53	04:17	19:50	21:16	////
N 70°	01:06	03:17	04:29	19:37	20:51	23:14
68°	01:58	03:35	04:39	19:27	20:32	22:12
66°	02:29	03:50	04:46	19:19	20:17	21:39
64°	02:51	04:01	04:53	19:12	20:05	21:16
62°	03:09	04:11	04:59	19:07	19:55	20:58
60°	03:23	04:19	05:04	19:01	19:46	20:43
N 58°	03:34	04:27	05:08	18:57	19:39	20:31
56°	03:45	04:33	05:12	18:53	19:32	20:21
54°	03:53	04:39	05:15	18:49	19:26	20:12
52°	04:01	04:44	05:19	18:46	19:21	20:04
50°	04:08	04:48	05:21	18:43	19:17	19:57
45°	04:21	04:58	05:28	18:37	19:07	19:43
N 40°	04:32	05:05	05:33	18:31	18:59	19:32
35°	04:41	05:11	05:37	18:27	18:53	19:23
30°	04:48	05:17	05:41	18:23	18:47	19:16
20°	04:59	05:25	05:48	18:16	18:39	19:05
N 10°	05:07	05:32	05:53	18:10	18:32	18:56
0°	05:13	05:38	05:58	18:05	18:26	18:50
S 10°	05:18	05:42	06:04	18:00	18:21	18:45
20°	05:21	05:47	06:09	17:54	18:16	18:42
30°	05:23	05:51	06:15	17:48	18:12	18:40
35°	05:24	05:53	06:18	17:45	18:10	18:39
40°	05:24	05:55	06:22	17:41	18:08	18:39
45°	05:23	05:57	06:27	17:36	18:06	18:40
S 50°	05:22	05:59	06:32	17:31	18:03	18:41
52°	05:21	06:00	06:34	17:28	18:02	18:41
54°	05:20	06:01	06:37	17:26	18:01	18:42
56°	05:19	06:02	06:40	17:23	18:00	18:43
58°	05:18	06:03	06:43	17:20	17:59	18:44
S 60°	05:16	06:04	06:46	17:16	17:58	18:46

Lat.	Moonrise Mon	Moonrise Tue	Moonrise Wed	Moonset Mon	Moonset Tue	Moonset Wed
N 72°	▭	11:38	14:01	▭	06:37	05:43
N 70°	09:01	12:08	14:14	07:38	06:05	05:27
68°	10:12	12:31	14:24	06:25	05:41	05:15
66°	10:49	12:48	14:33	05:47	05:22	05:05
64°	11:14	13:02	14:40	05:21	05:07	04:56
62°	11:34	13:13	14:46	05:00	04:54	04:49
60°	11:50	13:23	14:51	04:43	04:43	04:42
N 58°	12:04	13:32	14:55	04:29	04:34	04:36
56°	12:15	13:39	14:59	04:16	04:25	04:31
54°	12:25	13:46	15:03	04:05	04:18	04:27
52°	12:34	13:52	15:06	03:56	04:11	04:23
50°	12:42	13:57	15:09	03:47	04:05	04:19
45°	12:59	14:09	15:16	03:29	03:52	04:10
N 40°	13:13	14:18	15:21	03:14	03:41	04:03
35°	13:25	14:27	15:26	03:01	03:31	03:57
30°	13:35	14:34	15:30	02:49	03:23	03:52
20°	13:53	14:46	15:36	02:30	03:08	03:43
N 10°	14:08	14:57	15:43	02:13	02:56	03:35
0°	14:22	15:07	15:48	01:57	02:44	03:27
S 10°	14:36	15:16	15:54	01:41	02:32	03:19
20°	14:51	15:27	16:00	01:24	02:19	03:11
30°	15:08	15:39	16:07	01:04	02:04	03:01
35°	15:18	15:46	16:11	00:52	01:55	02:55
40°	15:29	15:54	16:15	00:38	01:45	02:49
45°	15:42	16:03	16:20	00:22	01:33	02:41
S 50°	15:58	16:13	16:26	00:02	01:19	02:32
52°	16:06	16:19	16:29	·· ··	01:12	02:28
54°	16:14	16:24	16:32	·· ··	01:04	02:23
56°	16:23	16:30	16:35	·· ··	00:56	02:18
58°	16:34	16:37	16:39	·· ··	00:46	02:12
S 60°	16:45	16:45	16:43	·· ··	00:35	02:06

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 9-11 70-86%
07	02:11	02:02	12:02	20:33	08:10	
08	01:54	01:46	12:02	21:17	08:55	
09	01:38	01:29	12:01	21:58	09:38	

April 10, 11, 12 UT (Thu., Fri., Sat.)

	Aries	Venus		Mars		Jupiter		Saturn	
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	198°28.7	205°21.4	N02°50.4	79°09.8	N23°12.0	122°05.4	N22°33.8	201°47.1	S03°33.5
1	213°31.2	220°24.0	49.8	94°11.2	11.8	137°07.4	33.8	216°49.3	33.4
2	228°33.7	235°26.5	49.1	109°12.7	11.5	152°09.4	33.9	231°51.5	33.3
3	243°36.1	250°29.0	·· 48.5	124°14.2	·· 11.3	167°11.5	·· 33.9	246°53.7	·· 33.2
4	258°38.6	265°31.5	47.9	139°15.7	11.1	182°13.5	33.9	261°55.9	33.1
5	273°41.0	280°34.0	47.2	154°17.1	10.8	197°15.5	34.0	276°58.1	33.0
6	288°43.5	295°36.5	N02°46.6	169°18.6	N23°10.6	212°17.5	N22°34.0	292°00.3	S03°32.8
7	303°46.0	310°39.0	46.0	184°20.1	10.3	227°19.5	34.1	307°02.5	32.7
8	318°48.4	325°41.5	45.3	199°21.5	10.1	242°21.5	34.1	322°04.7	32.6
9	333°50.9	340°44.0	·· 44.7	214°23.0	·· 09.9	257°23.5	·· 34.2	337°06.8	·· 32.5
10	348°53.4	355°46.5	44.1	229°24.5	09.6	272°25.5	34.2	352°09.0	32.4
11	3°55.8	10°49.0	43.5	244°26.0	09.4	287°27.5	34.3	7°11.2	32.3
12	18°58.3	25°51.4	N02°42.9	259°27.4	N23°09.1	302°29.5	N22°34.3	22°13.4	S03°32.2
13	34°00.8	40°53.9	42.2	274°28.9	08.9	317°31.5	34.4	37°15.6	32.1
14	49°03.2	55°56.4	41.6	289°30.4	08.6	332°33.5	34.4	52°17.8	32.0
15	64°05.7	70°58.8	·· 41.0	304°31.8	·· 08.4	347°35.5	·· 34.4	67°20.0	·· 31.9
16	79°08.2	86°01.3	40.4	319°33.3	08.2	2°37.5	34.5	82°22.2	31.7
17	94°10.6	101°03.8	39.8	334°34.8	07.9	17°39.5	34.5	97°24.4	31.6
18	109°13.1	116°06.2	N02°39.2	349°36.2	N23°07.7	32°41.5	N22°34.6	112°26.6	S03°31.5
19	124°15.5	131°08.7	38.6	4°37.7	07.4	47°43.5	34.6	127°28.8	31.4
20	139°18.0	146°11.1	38.0	19°39.2	07.2	62°45.5	34.7	142°31.0	31.3
21	154°20.5	161°13.6	·· 37.4	34°40.6	·· 06.9	77°47.5	·· 34.7	157°33.2	·· 31.2
22	169°22.9	176°16.0	36.8	49°42.1	06.7	92°49.5	34.8	172°35.4	31.1
23	184°25.4	191°18.4	36.2	64°43.6	06.5	107°51.5	34.8	187°37.6	31.0
Mer.pass. 10:44		ν 2.5′	d 0.6′	m -4.62	ν 1.5′	d 0.2′	m 0.61	ν 2.0′	d 0.0′ m -2.06	ν 2.2′	d 0.1′ m 1.17

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	199°27.9	206°20.9	N02°35.6	79°45.0	N23°06.2	122°53.5	N22°34.9	202°39.8	S03°30.9
1	214°30.3	221°23.3	35.0	94°46.5	06.0	137°55.5	34.9	217°42.0	30.7
2	229°32.8	236°25.7	34.4	109°47.9	05.7	152°57.5	35.0	232°44.2	30.6
3	244°35.3	251°28.1	·· 33.8	124°49.4	·· 05.5	167°59.5	·· 35.0	247°46.4	·· 30.5
4	259°37.7	266°30.5	33.2	139°50.9	05.2	183°01.5	35.0	262°48.6	30.4
5	274°40.2	281°33.0	32.6	154°52.3	05.0	198°03.5	35.1	277°50.8	30.3
6	289°42.6	296°35.4	N02°32.0	169°53.8	N23°04.7	213°05.5	N22°35.1	292°53.0	S03°30.2
7	304°45.1	311°37.8	31.4	184°55.2	04.5	228°07.5	35.2	307°55.2	30.1
8	319°47.6	326°40.2	30.8	199°56.7	04.2	243°09.4	35.2	322°57.4	30.0
9	334°50.0	341°42.6	·· 30.2	214°58.2	·· 04.0	258°11.4	·· 35.3	337°59.6	·· 29.9
10	349°52.5	356°45.0	29.7	229°59.6	03.8	273°13.4	35.3	353°01.8	29.8
11	4°55.0	11°47.3	29.1	245°01.1	03.5	288°15.4	35.4	8°04.0	29.6
12	19°57.4	26°49.7	N02°28.5	260°02.5	N23°03.3	303°17.4	N22°35.4	23°06.2	S03°29.5
13	34°59.9	41°52.1	27.9	275°04.0	03.0	318°19.4	35.5	38°08.4	29.4
14	50°02.4	56°54.5	27.4	290°05.5	02.8	333°21.4	35.5	53°10.6	29.3
15	65°04.8	71°56.9	·· 26.8	305°06.9	·· 02.5	348°23.4	·· 35.5	68°12.8	·· 29.2
16	80°07.3	86°59.2	26.2	320°08.4	02.3	3°25.4	35.6	83°15.0	29.1
17	95°09.8	102°01.6	25.6	335°09.8	02.0	18°27.4	35.6	98°17.2	29.0
18	110°12.2	117°04.0	N02°25.1	350°11.3	N23°01.8	33°29.4	N22°35.7	113°19.3	S03°28.9
19	125°14.7	132°06.3	24.5	5°12.7	01.5	48°31.4	35.7	128°21.5	28.8
20	140°17.1	147°08.7	23.9	20°14.2	01.3	63°33.4	35.8	143°23.7	28.7
21	155°19.6	162°11.0	·· 23.4	35°15.6	·· 01.0	78°35.4	·· 35.8	158°25.9	·· 28.6
22	170°22.1	177°13.4	22.8	50°17.1	00.8	93°37.4	35.9	173°28.1	28.4
23	185°24.5	192°15.7	22.2	65°18.5	00.5	108°39.4	35.9	188°30.3	28.3
Mer.pass. 10:40		ν 2.4′	d 0.6′	m -4.65	ν 1.5′	d 0.2′	m 0.63	ν 2.0′	d 0.0′ m -2.06	ν 2.2′	d 0.1′ m 1.17

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	200°27.0	207°18.0	N02°21.7	80°20.0	N23°00.3	123°41.4	N22°36.0	203°32.5	S03°28.2
1	215°29.5	222°20.4	21.1	95°21.4	23°00.0	138°43.4	36.0	218°34.7	28.1
2	230°31.9	237°22.7	20.6	110°22.9	22°59.8	153°45.4	36.1	233°36.9	28.0
3	245°34.4	252°25.0	·· 20.0	125°24.4	·· 59.5	168°47.4	·· 36.1	248°39.1	·· 27.9
4	260°36.9	267°27.4	19.5	140°25.8	59.3	183°49.4	36.1	263°41.3	27.8
5	275°39.3	282°29.7	18.9	155°27.3	59.0	198°51.3	36.2	278°43.5	27.7
6	290°41.8	297°32.0	N02°18.4	170°28.7	N22°58.8	213°53.3	N22°36.2	293°45.7	S03°27.6
7	305°44.2	312°34.3	17.8	185°30.1	58.5	228°55.3	36.3	308°47.9	27.5
8	320°46.7	327°36.6	17.3	200°31.6	58.3	243°57.3	36.3	323°50.1	27.3
9	335°49.2	342°38.9	·· 16.7	215°33.0	·· 58.0	258°59.3	·· 36.4	338°52.3	·· 27.2
10	350°51.6	357°41.2	16.2	230°34.5	57.8	274°01.3	36.4	353°54.5	27.1
11	5°54.1	12°43.5	15.7	245°35.9	57.5	289°03.3	36.5	8°56.7	27.0
12	20°56.6	27°45.8	N02°15.1	260°37.4	N22°57.3	304°05.3	N22°36.5	23°58.9	S03°26.9
13	35°59.0	42°48.1	14.6	275°38.8	57.0	319°07.3	36.6	39°01.1	26.8
14	51°01.5	57°50.4	14.0	290°40.3	56.8	334°09.3	36.6	54°03.3	26.7
15	66°04.0	72°52.7	·· 13.5	305°41.7	·· 56.5	349°11.3	·· 36.6	69°05.5	·· 26.6
16	81°06.4	87°54.9	13.0	320°43.2	56.3	4°13.3	36.7	84°07.7	26.5
17	96°08.9	102°57.2	12.5	335°44.6	56.0	19°15.3	36.7	99°09.9	26.4
18	111°11.4	117°59.5	N02°11.9	350°46.1	N22°55.8	34°17.2	N22°36.8	114°12.1	S03°26.3
19	126°13.8	133°01.8	11.4	5°47.5	55.5	49°19.2	36.8	129°14.3	26.1
20	141°16.3	148°04.0	10.9	20°48.9	55.3	64°21.2	36.9	144°16.5	26.0
21	156°18.7	163°06.3	·· 10.4	35°50.4	·· 55.0	79°23.2	·· 36.9	159°18.7	·· 25.9
22	171°21.2	178°08.5	09.8	50°51.8	54.8	94°25.2	37.0	174°20.9	25.8
23	186°23.7	193°10.8	09.3	65°53.3	54.5	109°27.2	37.0	189°23.1	25.7
Mer.pass. 10:36		ν 2.3′	d 0.6′	m -4.67	ν 1.5′	d 0.2′	m 0.64	ν 2.0′	d 0.0′ m -2.05	ν 2.2′	d 0.1′ m 1.17

Stars

	SHA	Dec
Alpheratz	357°34.9	29°13.6
Ankaa	353°07.3	-42°10.1
Schedar	349°31.4	56°40.4
Diphda	348°47.4	-17°51.0
Achernar	335°20.6	-57°06.6
Hamal	327°51.3	23°34.8
Polaris	314°23.5	89°22.4
Acamar	315°12.0	-40°12.3
Menkar	314°06.2	4°11.2
Mirfak	308°28.4	49°57.1
Aldebaran	290°39.6	16°33.6
Rigel	281°03.9	-8°10.5
Capella	280°21.9	46°01.5
Bellatrix	278°22.8	6°22.3
Elnath	278°01.8	28°37.8
Alnilam	275°37.7	-1°11.2
Betelgeuse	270°52.0	7°24.7
Canopus	263°52.5	-52°42.8
Sirius	258°26.1	-16°45.2
Adhara	255°05.8	-29°00.6
Procyon	244°50.6	5°09.5
Pollux	243°17.0	27°58.0
Avior	234°14.6	-59°35.7
Suhail	222°46.0	-43°32.3
Miaplacidus	221°37.9	-69°49.5
Alphard	217°47.4	-8°46.2
Regulus	207°34.0	11°50.6
Dubhe	193°40.2	61°37.0
Denebola	182°24.5	14°25.8
Gienah	175°43.1	-17°41.1
Acrux	172°59.3	-63°14.5
Gacrux	171°50.9	-57°15.4
Alioth	166°12.2	55°49.3
Spica	158°21.8	-11°17.7
Alkaid	152°51.3	49°11.1
Hadar	148°35.1	-60°29.7
Menkent	147°57.0	-36°29.7
Arcturus	145°47.4	19°02.9
Rigil Kent.	139°39.4	-60°56.4
Kochab	137°18.6	74°02.9
Zuben'ubi	136°55.5	-16°08.9
Alphecca	126°03.3	26°37.5
Antares	112°15.4	-26°29.3
Atria	107°09.1	-69°04.2
Sabik	102°02.4	-15°45.4
Shaula	96°09.9	-37°07.3
Rasalhague	95°58.2	12°32.3
Eltanin	90°41.9	51°28.7
Kaus Aust.	83°32.1	-34°22.3
Vega	80°33.0	38°48.1
Nunki	75°47.5	-26°15.9
Altair	61°59.8	8°55.9
Peacock	53°05.5	-56°39.0
Deneb	49°25.8	45°21.9
Enif	33°38.8	9°59.3
Al Na'ir	27°32.9	-46°50.2
Fomalhaut	15°14.6	-29°29.3
Scheat	13°45.3	28°13.0
Markab	13°30.0	15°20.3

Apr 10 Thu	SHA	Mer.pass
Venus	6°52.7	10:17
Mars	240°41.0	18:42
Jupiter	283°36.7	15:50
Saturn	3°18.4	10:31

Apr 11 Fri	SHA	Mer.pass
Venus	6°53.0	10:13
Mars	240°17.2	18:39
Jupiter	283°25.6	15:46
Saturn	3°11.9	10:28

Apr 12 Sat	SHA	Mer.pass
Venus	6°51.0	10:09
Mars	239°53.0	18:37
Jupiter	283°14.4	15:43
Saturn	3°05.5	10:24

Horizontal parallax	
Venus:	0.4
Mars:	0.1

h — Sun — Moon

Thu	GHA	Dec	GHA	ν	Dec	d	HP
0	179°39.7	N07°57.6	29°42.1	16.7′	N05°48.8	14.3′	54.6′
1	194°39.9	58.6	44°17.7	16.7′	05°34.5	14.2′	54.6′
2	209°40.0	07°59.5	58°53.4	16.7′	05°20.3	14.4′	54.5′
3	224°40.2	08°00.4	73°29.2	16.8′	05°05.9	14.3′	54.5′
4	239°40.4	01.3	88°04.9	16.8′	04°51.6	14.3′	54.5′
5	254°40.5	02.2	102°40.7	16.8′	04°37.3	14.3′	54.5′
6	269°40.7	N08°03.2	117°16.5	16.8′	N04°23.0	14.4′	54.5′
7	284°40.9	04.1	131°52.4	16.9′	04°08.6	14.3′	54.5′
8	299°41.0	05.0	146°28.3	16.9′	03°54.3	14.4′	54.5′
9	314°41.2	·· 05.9	161°04.2	16.9′	03°39.9	14.4′	54.5′
10	329°41.4	06.9	175°40.1	17.0′	03°25.5	14.4′	54.4′
11	344°41.5	07.8	190°16.0	17.0′	03°11.1	14.3′	54.4′
12	359°41.7	N08°08.7	204°52.0	17.0′	N02°56.8	14.4′	54.4′
13	14°41.9	09.6	219°28.0	17.0′	02°42.4	14.4′	54.4′
14	29°42.0	10.5	234°04.0	17.0′	02°28.0	14.4′	54.4′
15	44°42.2	·· 11.5	248°40.1	17.1′	02°13.6	14.4′	54.4′
16	59°42.4	12.4	263°16.1	17.1′	01°59.2	14.4′	54.4′
17	74°42.5	13.3	277°52.2	17.1′	01°44.8	14.4′	54.4′
18	89°42.7	N08°14.2	292°28.3	17.1′	N01°30.4	14.4′	54.3′
19	104°42.9	15.1	307°04.4	17.1′	01°16.0	14.4′	54.3′
20	119°43.0	16.1	321°40.5	17.1′	01°01.6	14.4′	54.3′
21	134°43.2	·· 17.0	336°16.6	17.1′	00°47.2	14.4′	54.3′
22	149°43.4	17.9	350°52.8	17.2′	00°32.8	14.4′	54.3′
23	164°43.5	18.8	5°28.9	17.2′	00°18.4	14.4′	54.3′
	SD = 16.0′	d = 0.9′	SD = 14.9′				

Fri	GHA	Dec	GHA	ν	Dec	d	HP
0	179°43.7	N08°19.7	20°05.1	17.2′	N00°04.0	14.4′	54.3′
1	194°43.9	20.7	34°41.2	17.2′	S00°10.4	14.4′	54.3′
2	209°44.0	21.6	49°17.4	17.2′	00°24.8	14.3′	54.3′
3	224°44.2	·· 22.5	63°53.6	17.2′	00°39.1	14.4′	54.2′
4	239°44.4	23.4	78°29.8	17.2′	00°53.5	14.3′	54.2′
5	254°44.5	24.3	93°06.0	17.2′	01°07.8	14.4′	54.2′
6	269°44.7	N08°25.2	107°42.2	17.2′	S01°22.2	14.3′	54.2′
7	284°44.8	26.2	122°18.4	17.2′	01°36.5	14.4′	54.2′
8	299°45.0	27.1	136°54.6	17.2′	01°50.9	14.3′	54.2′
9	314°45.2	·· 28.0	151°30.8	17.2′	02°05.2	14.3′	54.2′
10	329°45.3	28.9	166°07.0	17.2′	02°19.5	14.3′	54.2′
11	344°45.5	29.8	180°43.2	17.2′	02°33.8	14.3′	54.2′
12	359°45.7	N08°30.7	195°19.4	17.2′	S02°48.1	14.2′	54.2′
13	14°45.8	31.7	209°55.6	17.2′	03°02.3	14.3′	54.2′
14	29°46.0	32.6	224°31.8	17.2′	03°16.6	14.2′	54.1′
15	44°46.2	·· 33.5	239°08.0	17.2′	03°30.8	14.3′	54.1′
16	59°46.3	34.4	253°44.2	17.2′	03°45.1	14.2′	54.1′
17	74°46.5	35.3	268°20.3	17.2′	03°59.3	14.1′	54.1′
18	89°46.6	N08°36.2	282°56.5	17.2′	S04°13.4	14.2′	54.1′
19	104°46.8	37.1	297°32.6	17.1′	04°27.6	14.2′	54.1′
20	119°47.0	38.1	312°08.8	17.1′	04°41.8	14.1′	54.1′
21	134°47.1	·· 39.0	326°44.9	17.1′	04°55.9	14.1′	54.1′
22	149°47.3	39.9	341°21.0	17.1′	05°10.0	14.1′	54.1′
23	164°47.5	40.8	355°57.1	17.1′	05°24.1	14.0′	54.1′
	SD = 16.0′	d = 0.9′	SD = 14.8′				

Sat	GHA	Dec	GHA	ν	Dec	d	HP
0	179°47.6	N08°41.7	10°33.2	17.1′	S05°38.1	14.1′	54.1′
1	194°47.8	42.6	25°09.3	17.1′	05°52.2	14.0′	54.1′
2	209°47.9	43.5	39°45.4	17.0′	06°06.2	14.0′	54.1′
3	224°48.1	·· 44.4	54°21.4	17.0′	06°20.2	14.0′	54.0′
4	239°48.3	45.4	68°57.4	17.0′	06°34.2	13.9′	54.0′
5	254°48.4	46.3	83°33.4	17.0′	06°48.1	13.9′	54.0′
6	269°48.6	N08°47.2	98°09.4	17.0′	S07°02.0	13.9′	54.0′
7	284°48.8	48.1	112°45.4	16.9′	07°15.9	13.9′	54.0′
8	299°48.9	49.0	127°21.3	16.9′	07°29.8	13.8′	54.0′
9	314°49.1	·· 49.9	141°57.3	16.9′	07°43.6	13.8′	54.0′
10	329°49.2	50.8	156°33.1	16.9′	07°57.4	13.8′	54.0′
11	344°49.4	51.7	171°09.0	16.8′	08°11.2	13.7′	54.0′
12	359°49.6	N08°52.6	185°44.9	16.8′	S08°24.9	13.7′	54.0′
13	14°49.7	53.5	200°20.7	16.8′	08°38.6	13.7′	54.0′
14	29°49.9	54.5	214°56.5	16.8′	08°52.3	13.6′	54.0′
15	44°50.0	·· 55.4	229°32.2	16.7′	09°05.9	13.6′	54.0′
16	59°50.2	56.3	244°08.0	16.7′	09°19.5	13.6′	54.0′
17	74°50.4	57.2	258°43.7	16.7′	09°33.1	13.5′	54.0′
18	89°50.5	N08°58.1	273°19.3	16.6′	S09°46.6	13.5′	54.0′
19	104°50.7	59.0	287°55.0	16.6′	10°00.1	13.4′	54.0′
20	119°50.8	08°59.9	302°30.6	16.6′	10°13.5	13.5′	54.0′
21	134°51.0	09°00.8	317°06.1	16.5′	10°27.0	13.3′	54.0′
22	149°51.2	01.7	331°41.7	16.5′	10°40.3	13.4′	53.9′
23	164°51.3	02.6	346°17.2	16.5′	10°53.7	13.3′	53.9′
	SD = 16.0′	d = 0.9′	SD = 14.7′				

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	////	02:31	04:01	20:05	21:38	////
N 70°	////	02:59	04:15	19:50	21:07	////
68°	01:31	03:20	04:26	19:39	20:46	22:40
66°	02:10	03:36	04:35	19:29	20:29	21:58
64°	02:36	03:49	04:42	19:21	20:15	21:30
62°	02:55	04:00	04:49	19:15	20:04	21:10
60°	03:11	04:10	04:55	19:09	19:54	20:53
N 58°	03:24	04:18	05:00	19:04	19:46	20:40
56°	03:35	04:25	05:04	18:59	19:39	20:29
54°	03:45	04:31	05:08	18:55	19:32	20:19
52°	03:53	04:37	05:12	18:51	19:27	20:10
50°	04:00	04:41	05:15	18:48	19:22	20:03
45°	04:15	04:52	05:22	18:41	19:11	19:48
N 40°	04:27	05:00	05:28	18:35	19:02	19:36
35°	04:37	05:07	05:33	18:29	18:55	19:26
30°	04:44	05:13	05:38	18:25	18:49	19:18
20°	04:57	05:23	05:45	18:17	18:39	19:06
N 10°	05:06	05:30	05:52	18:10	18:32	18:56
0°	05:13	05:37	05:58	18:04	18:25	18:49
S 10°	05:18	05:42	06:04	17:58	18:19	18:44
20°	05:22	05:48	06:10	17:52	18:14	18:40
30°	05:25	05:53	06:17	17:45	18:09	18:37
35°	05:26	05:55	06:21	17:41	18:06	18:36
40°	05:26	05:58	06:25	17:36	18:03	18:35
45°	05:27	06:01	06:30	17:31	18:00	18:34
S 50°	05:26	06:04	06:36	17:25	17:57	18:35
52°	05:26	06:05	06:39	17:22	17:56	18:35
54°	05:26	06:07	06:42	17:19	17:54	18:35
56°	05:25	06:08	06:46	17:15	17:53	18:36
58°	05:24	06:10	06:49	17:11	17:51	18:36
S 60°	05:23	06:11	06:54	17:07	17:49	18:37

Lat.	Moonrise Thu	Moonrise Fri	Moonrise Sat	Moonset Thu	Moonset Fri	Moonset Sat
N 72°	16:04	18:02	20:07	05:06	04:33	04:00
N 70°	16:07	17:56	19:49	05:00	04:35	04:09
68°	16:09	17:51	19:35	04:55	04:36	04:17
66°	16:11	17:46	19:24	04:50	04:37	04:23
64°	16:12	17:43	19:15	04:47	04:38	04:29
62°	16:14	17:40	19:07	04:44	04:38	04:33
60°	16:15	17:37	19:00	04:41	04:39	04:37
N 58°	16:16	17:35	18:54	04:38	04:40	04:41
56°	16:17	17:33	18:49	04:36	04:40	04:44
54°	16:17	17:31	18:44	04:34	04:41	04:47
52°	16:18	17:29	18:40	04:32	04:41	04:50
50°	16:19	17:28	18:36	04:31	04:42	04:52
45°	16:20	17:24	18:28	04:27	04:42	04:58
N 40°	16:22	17:21	18:21	04:24	04:43	05:02
35°	16:23	17:19	18:15	04:21	04:44	05:06
30°	16:24	17:17	18:10	04:19	04:44	05:10
20°	16:25	17:13	18:02	04:15	04:45	05:16
N 10°	16:27	17:10	17:54	04:11	04:46	05:21
0°	16:28	17:07	17:47	04:07	04:47	05:26
S 10°	16:29	17:04	17:40	04:04	04:48	05:31
20°	16:31	17:01	17:32	04:00	04:48	05:37
30°	16:33	16:58	17:24	03:56	04:49	05:43
35°	16:33	16:56	17:19	03:53	04:50	05:46
40°	16:35	16:54	17:13	03:50	04:51	05:50
45°	16:36	16:51	17:07	03:47	04:51	05:55
S 50°	16:37	16:48	16:59	03:43	04:52	06:01
52°	16:38	16:47	16:56	03:41	04:52	06:03
54°	16:39	16:45	16:52	03:39	04:53	06:06
56°	16:39	16:44	16:48	03:37	04:53	06:09
58°	16:40	16:42	16:43	03:34	04:54	06:13
S 60°	16:41	16:40	16:38	03:31	04:54	06:17

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 12-14 92-99%
10	01:21	01:13	12:01	22:37	10:18	
11	01:05	00:57	12:01	23:17	10:57	
12	00:50	00:42	12:01	23:56	11:36	

April 13, 14, 15 UT (Sun., Mon., Tue.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	201°26.1	208°13.0	N02°08.8	80°54.7	N22°54.3	124°29.2	N22°37.1	204°25.3	S03°25.6
1	216°28.6	223°15.3	08.3	95°56.2	54.0	139°31.2	37.1	219°27.5	25.5
2	231°31.1	238°17.5	07.8	110°57.6	53.8	154°33.2	37.1	234°29.7	25.4
3	246°33.5	253°19.7	·· 07.3	125°59.0	·· 53.5	169°35.2	·· 37.2	249°31.9	·· 25.3
4	261°36.0	268°22.0	06.7	141°00.5	53.3	184°37.1	37.2	264°34.1	25.2
5	276°38.5	283°24.2	06.2	156°01.9	53.0	199°39.1	37.3	279°36.3	25.1
6	291°40.9	298°26.4	N02°05.7	171°03.4	N22°52.7	214°41.1	N22°37.3	294°38.5	S03°25.0
7	306°43.4	313°28.7	05.2	186°04.8	52.5	229°43.1	37.4	309°40.7	24.8
8	321°45.9	328°30.9	04.7	201°06.2	52.2	244°45.1	37.4	324°42.9	24.7
9	336°48.3	343°33.1	·· 04.2	216°07.7	·· 52.0	259°47.1	·· 37.5	339°45.1	·· 24.6
10	351°50.8	358°35.3	03.7	231°09.1	51.7	274°49.1	37.5	354°47.3	24.5
11	6°53.2	13°37.5	03.2	246°10.5	51.5	289°51.1	37.5	9°49.5	24.4
12	21°55.7	28°39.7	N02°02.7	261°12.0	N22°51.2	304°53.1	N22°37.6	24°51.7	S03°24.3
13	36°58.2	43°41.9	02.2	276°13.4	51.0	319°55.0	37.6	39°53.9	24.2
14	52°00.6	58°44.1	01.7	291°14.8	50.7	334°57.0	37.7	54°56.1	24.1
15	67°03.1	73°46.3	·· 01.2	306°16.3	·· 50.5	349°59.0	·· 37.7	69°58.3	·· 24.0
16	82°05.6	88°48.5	00.8	321°17.7	50.2	5°01.0	37.8	85°00.5	23.9
17	97°08.0	103°50.7	02°00.3	336°19.1	49.9	20°03.0	37.8	100°02.7	23.8
18	112°10.5	118°52.8	N01°59.8	351°20.6	N22°49.7	35°05.0	N22°37.9	115°04.9	S03°23.6
19	127°13.0	133°55.0	59.3	6°22.0	49.4	50°07.0	37.9	130°07.1	23.5
20	142°15.4	148°57.2	58.8	21°23.4	49.2	65°08.9	38.0	145°09.3	23.4
21	157°17.9	163°59.4	·· 58.3	36°24.9	·· 48.9	80°10.9	·· 38.0	160°11.5	·· 23.3
22	172°20.3	179°01.5	57.9	51°26.3	48.7	95°12.9	38.0	175°13.7	23.2
23	187°22.8	194°03.7	57.4	66°27.7	48.4	110°14.9	38.1	190°15.9	23.1
Mer.pass. 10:33		ν 2.2′ d 0.5′	m -4.69	ν 1.4′ d 0.3′	m 0.66	ν 2.0′ d 0.0′	m -2.05	ν 2.2′ d 0.1′	m 1.17

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	202°25.3	209°05.9	N01°56.9	81°29.2	N22°48.2	125°16.9	N22°38.1	205°18.1	S03°23.0
1	217°27.7	224°08.0	56.4	96°30.6	47.9	140°18.9	38.2	220°20.3	22.9
2	232°30.2	239°10.2	56.0	111°32.0	47.6	155°20.9	38.2	235°22.5	22.8
3	247°32.7	254°12.3	·· 55.5	126°33.5	·· 47.4	170°22.8	·· 38.3	250°24.7	·· 22.7
4	262°35.1	269°14.4	55.0	141°34.9	47.1	185°24.8	38.3	265°26.9	22.6
5	277°37.6	284°16.6	54.6	156°36.3	46.9	200°26.8	38.4	280°29.1	22.5
6	292°40.1	299°18.7	N01°54.1	171°37.7	N22°46.6	215°28.8	N22°38.4	295°31.3	S03°22.3
7	307°42.5	314°20.9	53.6	186°39.2	46.3	230°30.8	38.5	310°33.5	22.2
8	322°45.0	329°23.0	53.2	201°40.6	46.1	245°32.8	38.5	325°35.7	22.1
9	337°47.5	344°25.1	·· 52.7	216°42.0	·· 45.8	260°34.8	·· 38.5	340°37.9	·· 22.0
10	352°49.9	359°27.2	52.2	231°43.5	45.6	275°36.7	38.6	355°40.1	21.9
11	7°52.4	14°29.4	51.8	246°44.9	45.3	290°38.7	38.6	10°42.3	21.8
12	22°54.8	29°31.5	N01°51.3	261°46.3	N22°45.1	305°40.7	N22°38.7	25°44.5	S03°21.7
13	37°57.3	44°33.6	50.9	276°47.7	44.8	320°42.7	38.7	40°46.7	21.6
14	52°59.8	59°35.7	50.4	291°49.2	44.5	335°44.7	38.8	55°48.9	21.5
15	68°02.2	74°37.8	·· 50.0	306°50.6	·· 44.3	350°46.6	·· 38.8	70°51.1	·· 21.4
16	83°04.7	89°39.9	49.5	321°52.0	44.0	5°48.6	38.9	85°53.3	21.3
17	98°07.2	104°42.0	49.1	336°53.4	43.8	20°50.6	38.9	100°55.5	21.2
18	113°09.6	119°44.1	N01°48.6	351°54.8	N22°43.5	35°52.6	N22°38.9	115°57.7	S03°21.1
19	128°12.1	134°46.2	48.2	6°56.3	43.2	50°54.6	39.0	130°59.9	20.9
20	143°14.6	149°48.3	47.8	21°57.7	43.0	65°56.6	39.0	146°02.1	20.8
21	158°17.0	164°50.3	·· 47.3	36°59.1	·· 42.7	80°58.5	·· 39.1	161°04.3	·· 20.7
22	173°19.5	179°52.4	46.9	52°00.5	42.5	96°00.5	39.1	176°06.5	20.6
23	188°21.9	194°54.5	46.5	67°02.0	42.2	111°02.5	39.2	191°08.7	20.5
Mer.pass. 10:29		ν 2.2′ d 0.5′	m -4.70	ν 1.4′ d 0.3′	m 0.68	ν 2.0′ d 0.0′	m -2.05	ν 2.2′ d 0.1′	m 1.17

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	203°24.4	209°56.6	N01°46.0	82°03.4	N22°41.9	126°04.5	N22°39.2	206°10.9	S03°20.4
1	218°26.9	224°58.6	45.6	97°04.8	41.7	141°06.5	39.3	221°13.1	20.3
2	233°29.3	240°00.7	45.2	112°06.2	41.4	156°08.4	39.3	236°15.3	20.2
3	248°31.8	255°02.8	·· 44.7	127°07.6	·· 41.1	171°10.4	·· 39.3	251°17.5	·· 20.1
4	263°34.3	270°04.8	44.3	142°09.1	40.9	186°12.4	39.4	266°19.7	20.0
5	278°36.7	285°06.9	43.9	157°10.5	40.6	201°14.4	39.4	281°21.9	19.9
6	293°39.2	300°08.9	N01°43.5	172°11.9	N22°40.4	216°16.4	N22°39.5	296°24.2	S03°19.8
7	308°41.7	315°11.0	43.0	187°13.3	40.1	231°18.3	39.5	311°26.4	19.7
8	323°44.1	330°13.0	42.6	202°14.7	39.8	246°20.3	39.6	326°28.6	19.5
9	338°46.6	345°15.0	·· 42.2	217°16.1	·· 39.6	261°22.3	·· 39.6	341°30.8	·· 19.4
10	353°49.1	0°17.1	41.8	232°17.6	39.3	276°24.3	39.7	356°33.0	19.3
11	8°51.5	15°19.1	41.4	247°19.0	39.0	291°26.3	39.7	11°35.2	19.2
12	23°54.0	30°21.1	N01°41.0	262°20.4	N22°38.8	306°28.2	N22°39.8	26°37.4	S03°19.1
13	38°56.4	45°23.2	40.6	277°21.8	38.5	321°30.2	39.8	41°39.6	19.0
14	53°58.9	60°25.2	40.1	292°23.2	38.3	336°32.2	39.8	56°41.8	18.9
15	69°01.4	75°27.2	·· 39.7	307°24.6	·· 38.0	351°34.2	·· 39.9	71°44.0	·· 18.8
16	84°03.8	90°29.2	39.3	322°26.0	37.7	6°36.2	39.9	86°46.2	18.7
17	99°06.3	105°31.2	38.9	337°27.5	37.5	21°38.1	40.0	101°48.4	18.6
18	114°08.8	120°33.2	N01°38.5	352°28.9	N22°37.2	36°40.1	N22°40.0	116°50.6	S03°18.5
19	129°11.2	135°35.2	38.1	7°30.3	36.9	51°42.1	40.1	131°52.8	18.4
20	144°13.7	150°37.2	37.7	22°31.7	36.7	66°44.1	40.1	146°55.0	18.3
21	159°16.2	165°39.2	·· 37.3	37°33.1	·· 36.4	81°46.1	·· 40.2	161°57.2	·· 18.2
22	174°18.6	180°41.2	36.9	52°34.5	36.1	96°48.0	40.2	176°59.4	18.1
23	189°21.1	195°43.2	36.5	67°35.9	35.9	111°50.0	40.2	192°01.6	17.9
Mer.pass. 10:25		ν 2.1′ d 0.4′	m -4.72	ν 1.4′ d 0.3′	m 0.70	ν 2.0′ d 0.0′	m -2.04	ν 2.2′ d 0.1′	m 1.17

Stars

	SHA	**Dec**
Alpheratz	357°34.9	29°13.6
Ankaa	353°07.3	-42°10.1
Schedar	349°31.4	56°40.4
Diphda	348°47.4	-17°51.0
Achernar	335°20.6	-57°06.5
Hamal	327°51.3	23°34.8
Polaris	314°24.0	89°22.3
Acamar	315°12.0	-40°12.3
Menkar	314°06.2	4°11.2
Mirfak	308°28.4	49°57.1
Aldebaran	290°39.6	16°33.6
Rigel	281°03.9	-8°10.5
Capella	280°21.9	46°01.5
Bellatrix	278°22.8	6°22.3
Elnath	278°01.8	28°37.8
Alnilam	275°37.7	-1°11.2
Betelgeuse	270°52.0	7°24.7
Canopus	263°52.5	-52°42.8
Sirius	258°26.2	-16°45.2
Adhara	255°05.8	-29°00.6
Procyon	244°50.6	5°09.5
Pollux	243°17.1	27°58.0
Avior	234°14.6	-59°35.7
Suhail	222°46.0	-43°32.3
Miaplacidus	221°38.0	-69°49.5
Alphard	217°47.4	-8°46.2
Regulus	207°34.0	11°50.6
Dubhe	193°40.2	61°37.0
Denebola	182°24.5	14°25.8
Gienah	175°43.1	-17°41.1
Acrux	172°59.3	-63°14.5
Gacrux	171°50.9	-57°15.4
Alioth	166°12.2	55°49.3
Spica	158°21.8	-11°17.7
Alkaid	152°51.3	49°11.1
Hadar	148°35.1	-60°29.7
Menkent	147°57.0	-36°29.8
Arcturus	145°47.4	19°02.9
Rigil Kent.	139°39.4	-60°56.4
Kochab	137°18.6	74°02.9
Zuben'ubi	136°55.5	-16°08.9
Alphecca	126°03.3	26°37.5
Antares	112°15.3	-26°29.3
Atria	107°09.1	-69°04.2
Sabik	102°02.4	-15°45.4
Shaula	96°09.9	-37°07.3
Rasalhague	95°58.2	12°32.3
Eltanin	90°41.9	51°28.8
Kaus Aust.	83°32.1	-34°22.3
Vega	80°33.0	38°48.1
Nunki	75°47.4	-26°15.9
Altair	61°59.8	8°55.9
Peacock	53°05.5	-56°39.0
Deneb	49°25.8	45°21.9
Enif	33°38.8	9°59.3
Al Na'ir	27°32.9	-46°50.2
Fomalhaut	15°14.6	-29°29.3
Scheat	13°45.3	28°13.0
Markab	13°30.0	15°20.3

Apr 13 Sun	**SHA**	**Mer.pass**
Venus	6°46.9	10:06
Mars	239°28.6	18:35
Jupiter	283°03.0	15:40
Saturn	2°59.2	10:21

Apr 14 Mon	**SHA**	**Mer.pass**
Venus	6°40.6	10:02
Mars	239°03.9	18:32
Jupiter	282°51.6	15:37
Saturn	2°52.8	10:17

Apr 15 Tue	**SHA**	**Mer.pass**
Venus	6°32.1	09:59
Mars	238°39.0	18:30
Jupiter	282°40.1	15:34
Saturn	2°46.5	10:14

Horizontal parallax	
Venus:	0.4
Mars:	0.1

h — Sun — Moon

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	179°51.5	N09°03.5	0°52.6	16.4′	S11°07.0	13.2′	53.9′
1	194°51.6	04.4	15°28.0	16.4′	11°20.2	13.2′	53.9′
2	209°51.8	05.3	30°03.4	16.3′	11°33.4	13.2′	53.9′
3	224°52.0	·· 06.2	44°38.8	16.3′	11°46.6	13.1′	53.9′
4	239°52.1	07.1	59°14.1	16.3′	11°59.7	13.1′	53.9′
5	254°52.3	08.1	73°49.3	16.2′	12°12.8	13.0′	53.9′
6	269°52.4	N09°09.0	88°24.6	16.2′	S12°25.8	13.0′	53.9′
7	284°52.6	09.9	102°59.7	16.1′	12°38.8	12.9′	53.9′
8	299°52.7	10.8	117°34.9	16.1′	12°51.7	12.9′	53.9′
9	314°52.9	·· 11.7	132°10.0	16.0′	13°04.6	12.8′	53.9′
10	329°53.1	12.6	146°45.0	16.0′	13°17.4	12.8′	53.9′
11	344°53.2	13.5	161°20.0	16.0′	13°30.2	12.8′	53.9′
12	359°53.4	N09°14.4	175°55.0	15.9′	S13°43.0	12.6′	53.9′
13	14°53.5	15.3	190°29.9	15.9′	13°55.6	12.7′	53.9′
14	29°53.7	16.2	205°04.7	15.8′	14°08.3	12.5′	53.9′
15	44°53.9	·· 17.1	219°39.5	15.8′	14°20.8	12.6′	53.9′
16	59°54.0	18.0	234°14.3	15.7′	14°33.4	12.4′	53.9′
17	74°54.2	18.9	248°49.0	15.7′	14°45.8	12.4′	53.9′
18	89°54.3	N09°19.8	263°23.7	15.6′	S14°58.2	12.4′	53.9′
19	104°54.5	20.7	277°58.3	15.6′	15°10.6	12.3′	53.9′
20	119°54.6	21.6	292°32.8	15.5′	15°22.9	12.2′	53.9′
21	134°54.8	·· 22.5	307°07.3	15.4′	15°35.1	12.2′	53.9′
22	149°54.9	23.4	321°41.8	15.4′	15°47.3	12.1′	53.9′
23	164°55.1	24.3	336°16.1	15.3′	15°59.4	12.1′	53.9′
	SD = 15.9′	d = 0.9′		SD = 14.7′			

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	179°55.3	N09°25.2	350°50.5	15.3′	S16°11.5	12.0′	53.9′
1	194°55.4	26.1	5°24.7	15.2′	16°23.5	11.9′	53.9′
2	209°55.6	27.0	19°59.0	15.2′	16°35.4	11.9′	53.9′
3	224°55.7	·· 27.9	34°33.1	15.1′	16°47.3	11.8′	53.9′
4	239°55.9	28.8	49°07.2	15.0′	16°59.1	11.7′	53.9′
5	254°56.0	29.7	63°41.3	15.0′	17°10.8	11.7′	53.9′
6	269°56.2	N09°30.6	78°15.3	14.9′	S17°22.5	11.6′	53.9′
7	284°56.3	31.5	92°49.2	14.9′	17°34.1	11.5′	53.9′
8	299°56.5	32.4	107°23.0	14.8′	17°45.6	11.5′	53.9′
9	314°56.7	·· 33.3	121°56.8	14.7′	17°57.1	11.3′	53.9′
10	329°56.8	34.2	136°30.6	14.7′	18°08.4	11.4′	53.9′
11	344°57.0	35.1	151°04.2	14.6′	18°19.8	11.2′	53.9′
12	359°57.1	N09°36.0	165°37.9	14.5′	S18°31.0	11.2′	53.9′
13	14°57.3	36.9	180°11.4	14.5′	18°42.2	11.1′	53.9′
14	29°57.4	37.8	194°44.9	14.4′	18°53.3	11.0′	53.9′
15	44°57.6	·· 38.7	209°18.3	14.4′	19°04.3	11.0′	53.9′
16	59°57.7	39.6	223°51.6	14.3′	19°15.3	10.8′	53.9′
17	74°57.9	40.5	238°24.9	14.2′	19°26.1	10.8′	53.9′
18	89°58.0	N09°41.3	252°58.1	14.2′	S19°36.9	10.8′	53.9′
19	104°58.2	42.2	267°31.3	14.1′	19°47.7	10.6′	53.9′
20	119°58.3	43.1	282°04.4	14.0′	19°58.3	10.6′	53.9′
21	134°58.5	·· 44.0	296°37.4	13.9′	20°08.9	10.4′	53.9′
22	149°58.6	44.9	311°10.3	13.9′	20°19.3	10.4′	53.9′
23	164°58.8	45.8	325°43.2	13.8′	20°29.7	10.3′	54.0′
	SD = 15.9′	d = 0.9′		SD = 14.7′			

Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	179°59.0	N09°46.7	340°16.0	13.7′	S20°40.0	10.3′	54.0′
1	194°59.1	47.6	354°48.8	13.7′	20°50.3	10.1′	54.0′
2	209°59.3	48.5	9°21.4	13.6′	21°00.4	10.1′	54.0′
3	224°59.4	·· 49.4	23°54.0	13.5′	21°10.5	9.9′	54.0′
4	239°59.6	50.3	38°26.6	13.5′	21°20.4	9.9′	54.0′
5	254°59.7	51.2	52°59.0	13.4′	21°30.3	9.8′	54.0′
6	269°59.9	N09°52.1	67°31.4	13.3′	S21°40.1	9.7′	54.0′
7	285°00.0	53.0	82°03.7	13.2′	21°49.8	9.6′	54.0′
8	300°00.2	53.8	96°36.0	13.2′	21°59.4	9.6′	54.0′
9	315°00.3	·· 54.7	111°08.1	13.1′	22°09.0	9.4′	54.0′
10	330°00.5	55.6	125°40.2	13.0′	22°18.4	9.3′	54.0′
11	345°00.6	56.5	140°12.2	13.0′	22°27.7	9.3′	54.0′
12	0°00.8	N09°57.4	154°44.2	12.9′	S22°37.0	9.1′	54.0′
13	15°00.9	58.3	169°16.1	12.8′	22°46.1	9.1′	54.0′
14	30°01.1	09°59.2	183°47.9	12.7′	22°55.2	8.9′	54.0′
15	45°01.2	10°00.1	198°19.6	12.7′	23°04.1	8.9′	54.0′
16	60°01.4	01.0	212°51.3	12.6′	23°13.0	8.8′	54.0′
17	75°01.5	01.9	227°22.8	12.5′	23°21.8	8.6′	54.1′
18	90°01.7	N10°02.7	241°54.4	12.4′	S23°30.4	8.6′	54.1′
19	105°01.8	03.6	256°25.8	12.4′	23°39.0	8.4′	54.1′
20	120°02.0	04.5	270°57.2	12.3′	23°47.4	8.4′	54.1′
21	135°02.1	·· 05.4	285°28.4	12.2′	23°55.8	8.2′	54.1′
22	150°02.3	06.3	299°59.7	12.1′	24°04.0	8.2′	54.1′
23	165°02.4	07.2	314°30.8	12.1′	24°12.2	8.0′	54.1′
	SD = 15.9′	d = 0.9′		SD = 14.7′			

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	////	02:05	03:44	20:21	22:03	////
N 70°	////	02:40	04:00	20:04	21:26	////
68°	00:53	03:04	04:13	19:50	21:00	23:26
66°	01:48	03:23	04:23	19:40	20:41	22:19
64°	02:19	03:37	04:32	19:31	20:26	21:46
62°	02:42	03:50	04:39	19:23	20:13	21:22
60°	02:59	04:00	04:46	19:16	20:02	21:04
N 58°	03:14	04:09	04:52	19:10	19:53	20:49
56°	03:26	04:17	04:57	19:05	19:45	20:37
54°	03:36	04:23	05:01	19:00	19:38	20:26
52°	03:45	04:29	05:05	18:56	19:32	20:17
50°	03:53	04:35	05:09	18:53	19:27	20:09
45°	04:09	04:46	05:17	18:44	19:15	19:52
N 40°	04:22	04:56	05:24	18:38	19:06	19:39
35°	04:32	05:03	05:29	18:32	18:58	19:29
30°	04:41	05:10	05:34	18:27	18:51	19:20
20°	04:54	05:20	05:43	18:18	18:40	19:07
N 10°	05:04	05:29	05:50	18:10	18:32	18:57
0°	05:12	05:36	05:57	18:04	18:24	18:49
S 10°	05:18	05:42	06:04	17:57	18:18	18:43
20°	05:23	05:48	06:11	17:49	18:12	18:37
30°	05:27	05:54	06:19	17:41	18:06	18:33
35°	05:28	05:57	06:23	17:37	18:02	18:32
40°	05:29	06:01	06:28	17:32	17:59	18:30
45°	05:30	06:04	06:34	17:26	17:55	18:29
S 50°	05:31	06:08	06:41	17:19	17:51	18:29
52°	05:31	06:10	06:44	17:15	17:50	18:29
54°	05:31	06:12	06:48	17:12	17:48	18:29
56°	05:31	06:14	06:52	17:08	17:46	18:29
58°	05:30	06:16	06:56	17:03	17:43	18:29
S 60°	05:30	06:18	07:01	16:58	17:41	18:29

Lat.	Moonrise Sun	Moonrise Mon	Moonrise Tue	Moonset Sun	Moonset Mon	Moonset Tue
N 72°	22:43	▬	▬	03:20	02:10	▬
N 70°	21:59	▬	▬	03:39	02:56	▬
68°	21:30	23:57	▬	03:55	03:26	02:29
66°	21:08	23:08	▬	04:08	03:49	03:20
64°	20:51	22:37	·· ··	04:19	04:07	03:52
62°	20:38	22:14	23:58	04:28	04:22	04:16
60°	20:26	21:56	23:30	04:36	04:35	04:35
N 58°	20:16	21:40	23:07	04:43	04:46	04:51
56°	20:07	21:28	22:49	04:49	04:55	05:04
54°	19:59	21:16	22:34	04:55	05:04	05:16
52°	19:53	21:07	22:21	05:00	05:11	05:27
50°	19:46	20:58	22:10	05:04	05:18	05:36
45°	19:33	20:39	21:46	05:14	05:33	05:56
N 40°	19:22	20:24	21:27	05:23	05:45	06:12
35°	19:13	20:12	21:11	05:30	05:56	06:25
30°	19:05	20:01	20:58	05:36	06:05	06:37
20°	18:51	19:42	20:35	05:47	06:21	06:58
N 10°	18:39	19:26	20:15	05:57	06:35	07:16
0°	18:28	19:11	19:56	06:06	06:48	07:32
S 10°	18:16	18:56	19:38	06:15	07:01	07:49
20°	18:05	18:40	19:19	06:25	07:15	08:07
30°	17:51	18:22	18:56	06:37	07:32	08:28
35°	17:43	18:11	18:43	06:43	07:41	08:40
40°	17:35	17:59	18:28	06:51	07:52	08:55
45°	17:24	17:45	18:10	06:59	08:05	09:11
S 50°	17:12	17:28	17:48	07:10	08:21	09:32
52°	17:07	17:20	17:37	07:15	08:28	09:42
54°	17:00	17:11	17:26	07:20	08:36	09:54
56°	16:53	17:01	17:12	07:26	08:46	10:07
58°	16:46	16:50	16:57	07:33	08:56	10:22
S 60°	16:37	16:37	16:38	07:41	09:08	10:40

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 15-17 100-96%
13	00:34	00:26	12:00	–:–	12:17	
14	00:19	00:12	12:00	00:38	12:59	
15	00:04	00:03	12:00	01:21	13:44	

April 16, 17, 18 UT (Wed., Thu., Fri.)

	Aries	Venus		Mars		Jupiter		Saturn	
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	204°23.6	210°45.2	N01°36.2	82°37.3	N22°35.6	126°52.0	N22°40.3	207°03.8	S03°17.8
1	219°26.0	225°47.2	35.8	97°38.8	35.3	141°54.0	40.3	222°06.0	17.7
2	234°28.5	240°49.2	35.4	112°40.2	35.1	156°55.9	40.4	237°08.2	17.6
3	249°30.9	255°51.1	·· 35.0	127°41.6	·· 34.8	171°57.9	·· 40.4	252°10.4	·· 17.5
4	264°33.4	270°53.1	34.6	142°43.0	34.5	186°59.9	40.5	267°12.6	17.4
5	279°35.9	285°55.1	34.2	157°44.4	34.3	202°01.9	40.5	282°14.8	17.3
6	294°38.3	300°57.0	N01°33.9	172°45.8	N22°34.0	217°03.8	N22°40.6	297°17.0	S03°17.2
7	309°40.8	315°59.0	33.5	187°47.2	33.8	232°05.8	40.6	312°19.2	17.1
8	324°43.3	331°01.0	33.1	202°48.6	33.5	247°07.8	40.6	327°21.4	17.0
9	339°45.7	346°02.9	·· 32.7	217°50.0	·· 33.2	262°09.8	·· 40.7	342°23.6	·· 16.9
10	354°48.2	1°04.9	32.3	232°51.4	33.0	277°11.7	40.7	357°25.8	16.8
11	9°50.7	16°06.8	32.0	247°52.8	32.7	292°13.7	40.8	12°28.0	16.7
12	24°53.1	31°08.8	N01°31.6	262°54.2	N22°32.4	307°15.7	N22°40.8	27°30.2	S03°16.6
13	39°55.6	46°10.7	31.2	277°55.6	32.1	322°17.7	40.9	42°32.5	16.4
14	54°58.1	61°12.6	30.9	292°57.0	31.9	337°19.6	40.9	57°34.7	16.3
15	70°00.5	76°14.6	·· 30.5	307°58.5	·· 31.6	352°21.6	·· 41.0	72°36.9	·· 16.2
16	85°03.0	91°16.5	30.1	322°59.9	31.3	7°23.6	41.0	87°39.1	16.1
17	100°05.4	106°18.4	29.8	338°01.3	31.1	22°25.6	41.0	102°41.3	16.0
18	115°07.9	121°20.4	N01°29.4	353°02.7	N22°30.8	37°27.5	N22°41.1	117°43.5	S03°15.9
19	130°10.4	136°22.3	29.1	8°04.1	30.5	52°29.5	41.1	132°45.7	15.8
20	145°12.8	151°24.2	28.7	23°05.5	30.3	67°31.5	41.2	147°47.9	15.7
21	160°15.3	166°26.1	·· 28.4	38°06.9	·· 30.0	82°33.5	·· 41.2	162°50.1	·· 15.6
22	175°17.8	181°28.0	28.0	53°08.3	29.7	97°35.4	41.3	177°52.3	15.5
23	190°20.2	196°29.9	27.7	68°09.7	29.5	112°37.4	41.3	192°54.5	15.4
Mer.pass. 10:21		ν 2.0′	d 0.4′	ν 1.4′	d 0.3′	ν 2.0′	d 0.0′	ν 2.2′	d 0.1′
		m -4.73		m 0.71		m -2.04		m 1.17	

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	205°22.7	211°31.8	N01°27.3	83°11.1	N22°29.2	127°39.4	N22°41.4	207°56.7	S03°15.3
1	220°25.2	226°33.7	27.0	98°12.5	28.9	142°41.3	41.4	222°58.9	15.2
2	235°27.6	241°35.6	26.6	113°13.9	28.7	157°43.3	41.4	238°01.1	15.1
3	250°30.1	256°37.5	·· 26.3	128°15.3	·· 28.4	172°45.3	·· 41.5	253°03.3	·· 15.0
4	265°32.5	271°39.4	25.9	143°16.7	28.1	187°47.3	41.5	268°05.5	14.9
5	280°35.0	286°41.3	25.6	158°18.1	27.8	202°49.2	41.6	283°07.7	14.7
6	295°37.5	301°43.2	N01°25.3	173°19.5	N22°27.6	217°51.2	N22°41.6	298°09.9	S03°14.6
7	310°39.9	316°45.1	24.9	188°20.9	27.3	232°53.2	41.7	313°12.1	14.5
8	325°42.4	331°46.9	24.6	203°22.3	27.0	247°55.2	41.7	328°14.3	14.4
9	340°44.9	346°48.8	·· 24.3	218°23.7	·· 26.8	262°57.1	·· 41.7	343°16.5	·· 14.3
10	355°47.3	1°50.7	23.9	233°25.1	26.5	277°59.1	41.8	358°18.8	14.2
11	10°49.8	16°52.6	23.6	248°26.5	26.2	293°01.1	41.8	13°21.0	14.1
12	25°52.3	31°54.4	N01°23.3	263°27.9	N22°25.9	308°03.0	N22°41.9	28°23.2	S03°14.0
13	40°54.7	46°56.3	23.0	278°29.2	25.7	323°05.0	41.9	43°25.4	13.9
14	55°57.2	61°58.1	22.6	293°30.6	25.4	338°07.0	42.0	58°27.6	13.8
15	70°59.7	77°00.0	·· 22.3	308°32.0	·· 25.1	353°08.9	·· 42.0	73°29.8	·· 13.7
16	86°02.1	92°01.8	22.0	323°33.4	24.9	8°10.9	42.1	88°32.0	13.6
17	101°04.6	107°03.7	21.7	338°34.8	24.6	23°12.9	42.1	103°34.2	13.5
18	116°07.0	122°05.5	N01°21.4	353°36.2	N22°24.3	38°14.9	N22°42.1	118°36.4	S03°13.4
19	131°09.5	137°07.4	21.0	8°37.6	24.0	53°16.8	42.2	133°38.6	13.3
20	146°12.0	152°09.2	20.7	23°39.0	23.8	68°18.8	42.2	148°40.8	13.2
21	161°14.4	167°11.0	·· 20.4	38°40.4	·· 23.5	83°20.8	·· 42.3	163°43.0	·· 13.1
22	176°16.9	182°12.9	20.1	53°41.8	23.2	98°22.7	42.3	178°45.2	13.0
23	191°19.4	197°14.7	19.8	68°43.2	22.9	113°24.7	42.4	193°47.4	12.8
Mer.pass. 10:17		ν 1.9′	d 0.3′	ν 1.4′	d 0.3′	ν 2.0′	d 0.0′	ν 2.2′	d 0.1′
		m -4.74		m 0.73		m -2.03		m 1.17	

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	206°21.8	212°16.5	N01°19.5	83°44.6	N22°22.7	128°26.7	N22°42.4	208°49.6	S03°12.7
1	221°24.3	227°18.3	19.2	98°46.0	22.4	143°28.6	42.5	223°51.8	12.6
2	236°26.8	242°20.2	18.9	113°47.4	22.1	158°30.6	42.5	238°54.0	12.5
3	251°29.2	257°22.0	·· 18.6	128°48.7	·· 21.8	173°32.6	·· 42.5	253°56.3	·· 12.4
4	266°31.7	272°23.8	18.3	143°50.1	21.6	188°34.5	42.6	268°58.5	12.3
5	281°34.2	287°25.6	18.0	158°51.5	21.3	203°36.5	42.6	284°00.7	12.2
6	296°36.6	302°27.4	N01°17.7	173°52.9	N22°21.0	218°38.5	N22°42.7	299°02.9	S03°12.1
7	311°39.1	317°29.2	17.4	188°54.3	20.7	233°40.4	42.7	314°05.1	12.0
8	326°41.5	332°31.0	17.1	203°55.7	20.5	248°42.4	42.8	329°07.3	11.9
9	341°44.0	347°32.8	·· 16.8	218°57.1	·· 20.2	263°44.4	·· 42.8	344°09.5	·· 11.8
10	356°46.5	2°34.6	16.5	233°58.5	19.9	278°46.3	42.8	359°11.7	11.7
11	11°48.9	17°36.4	16.2	248°59.9	19.6	293°48.3	42.9	14°13.9	11.6
12	26°51.4	32°38.2	N01°16.0	264°01.2	N22°19.4	308°50.3	N22°42.9	29°16.1	S03°11.5
13	41°53.9	47°39.9	15.7	279°02.6	19.1	323°52.2	43.0	44°18.3	11.4
14	56°56.3	62°41.7	15.4	294°04.0	18.8	338°54.2	43.0	59°20.5	11.3
15	71°58.8	77°43.5	·· 15.1	309°05.4	·· 18.5	353°56.2	·· 43.1	74°22.7	·· 11.2
16	87°01.3	92°45.3	14.8	324°06.8	18.3	8°58.1	43.1	89°24.9	11.1
17	102°03.7	107°47.0	14.6	339°08.2	18.0	24°00.1	43.2	104°27.1	11.0
18	117°06.2	122°48.8	N01°14.3	354°09.6	N22°17.7	39°02.1	N22°43.2	119°29.4	S03°10.8
19	132°08.7	137°50.6	14.0	9°10.9	17.4	54°04.0	43.2	134°31.6	10.7
20	147°11.1	152°52.3	13.7	24°12.3	17.2	69°06.0	43.3	149°33.8	10.6
21	162°13.6	167°54.1	·· 13.5	39°13.7	·· 16.9	84°08.0	·· 43.3	164°36.0	·· 10.5
22	177°16.0	182°55.8	13.2	54°15.1	16.6	99°09.9	43.4	179°38.2	10.4
23	192°18.5	197°57.6	12.9	69°16.5	16.3	114°11.9	43.4	194°40.4	10.3
Mer.pass. 10:13		ν 1.8′	d 0.3′	ν 1.4′	d 0.3′	ν 2.0′	d 0.0′	ν 2.2′	d 0.1′
		m -4.74		m 0.74		m -2.03		m 1.17	

Stars

	SHA	Dec
Alpheratz	357°34.9	29°13.6
Ankaa	353°07.3	-42°10.1
Schedar	349°31.4	56°40.4
Diphda	348°47.4	-17°50.9
Achernar	335°20.6	-57°06.5
Hamal	327°51.3	23°34.8
Polaris	314°24.2	89°22.3
Acamar	315°12.0	-40°12.3
Menkar	314°06.2	4°11.2
Mirfak	308°28.4	49°57.1
Aldebaran	290°39.6	16°33.6
Rigel	281°03.9	-8°10.5
Capella	280°21.9	46°01.5
Bellatrix	278°22.9	6°22.3
Elnath	278°01.8	28°37.8
Alnilam	275°37.7	-1°11.2
Betelgeuse	270°52.0	7°24.7
Canopus	263°52.5	-52°42.8
Sirius	258°26.2	-16°45.2
Adhara	255°05.8	-29°00.6
Procyon	244°50.7	5°09.5
Pollux	243°17.1	27°58.0
Avior	234°14.6	-59°35.7
Suhail	222°46.0	-43°32.3
Miaplacidus	221°38.0	-69°49.5
Alphard	217°47.4	-8°46.2
Regulus	207°34.0	11°50.6
Dubhe	193°40.2	61°37.0
Denebola	182°24.5	14°25.8
Gienah	175°43.1	-17°41.1
Acrux	172°59.3	-63°14.5
Gacrux	171°50.9	-57°15.5
Alioth	166°12.2	55°49.3
Spica	158°21.8	-11°17.7
Alkaid	152°51.3	49°11.1
Hadar	148°35.1	-60°29.7
Menkent	147°57.0	-36°29.8
Arcturus	145°47.4	19°02.9
Rigil Kent.	139°39.4	-60°56.4
Kochab	137°18.6	74°02.9
Zuben'ubi	136°55.5	-16°08.9
Alphecca	126°03.2	26°37.6
Antares	112°15.3	-26°29.3
Atria	107°09.0	-69°04.2
Sabik	102°02.3	-15°45.4
Shaula	96°09.9	-37°07.3
Rasalhague	95°58.2	12°32.3
Eltanin	90°41.8	51°28.8
Kaus Aust.	83°32.1	-34°22.3
Vega	80°33.0	38°48.1
Nunki	75°47.4	-26°15.9
Altair	61°59.8	8°55.9
Peacock	53°05.5	-56°39.0
Deneb	49°25.8	45°21.9
Enif	33°38.8	9°59.3
Al Na'ir	27°32.9	-46°50.2
Fomalhaut	15°14.5	-29°29.3
Scheat	13°45.3	28°13.0
Markab	13°29.9	15°20.3

Apr 16 Wed	SHA	Mer.pass
Venus	6°21.7	09:56
Mars	238°13.8	18:28
Jupiter	282°28.4	15:30
Saturn	2°40.3	10:10

Apr 17 Thu	SHA	Mer.pass
Venus	6°09.1	09:53
Mars	237°48.4	18:26
Jupiter	282°16.7	15:27
Saturn	2°34.0	10:07

Apr 18 Fri	SHA	Mer.pass
Venus	5°54.7	09:50
Mars	237°22.7	18:23
Jupiter	282°04.8	15:24
Saturn	2°27.8	10:03

Horizontal parallax	
Venus:	0.4
Mars:	0.1

h — Sun — Moon

Wed	GHA	Dec	GHA	ν	Dec	d	HP
0	180°02.6	N10°08.1	329°01.9	12.0′	S24°20.2	8.0′	54.1′
1	195°02.7	09.0	343°32.9	11.9′	24°28.2	7.8′	54.1′
2	210°02.8	09.8	358°03.8	11.8′	24°36.0	7.7′	54.1′
3	225°03.0	·· 10.7	12°34.6	11.8′	24°43.7	7.6′	54.1′
4	240°03.1	11.6	27°05.4	11.7′	24°51.3	7.5′	54.1′
5	255°03.3	12.5	41°36.1	11.6′	24°58.8	7.4′	54.1′
6	270°03.4	N10°13.4	56°06.8	11.6′	S25°06.2	7.3′	54.2′
7	285°03.6	14.3	70°37.3	11.5′	25°13.5	7.2′	54.2′
8	300°03.7	15.1	85°07.8	11.4′	25°20.7	7.0′	54.2′
9	315°03.9	·· 16.0	99°38.2	11.3′	25°27.7	7.0′	54.2′
10	330°04.0	16.9	114°08.6	11.3′	25°34.7	6.8′	54.2′
11	345°04.2	17.8	128°38.8	11.2′	25°41.5	6.7′	54.2′
12	0°04.3	N10°18.7	143°09.0	11.1′	S25°48.2	6.6′	54.2′
13	15°04.5	19.6	157°39.2	11.1′	25°54.8	6.5′	54.2′
14	30°04.6	20.4	172°09.2	11.0′	26°01.3	6.3′	54.2′
15	45°04.8	·· 21.3	186°39.2	10.9′	26°07.6	6.2′	54.3′
16	60°04.9	22.2	201°09.1	10.9′	26°13.8	6.2′	54.3′
17	75°05.0	23.1	215°39.0	10.8′	26°20.0	5.9′	54.3′
18	90°05.2	N10°24.0	230°08.8	10.7′	S26°25.9	5.9′	54.3′
19	105°05.3	24.9	244°38.5	10.6′	26°31.8	5.8′	54.3′
20	120°05.5	25.7	259°08.1	10.6′	26°37.6	5.6′	54.3′
21	135°05.6	·· 26.6	273°37.7	10.5′	26°43.2	5.5′	54.3′
22	150°05.8	27.5	288°07.2	10.5′	26°48.7	5.4′	54.3′
23	165°05.9	28.4	302°36.7	10.4′	26°54.1	5.2′	54.4′
	SD = 15.9′	d = 0.9′		SD = 14.8′			

Thu	GHA	Dec	GHA	ν	Dec	d	HP
0	180°06.1	N10°29.3	317°06.1	10.3′	S26°59.3	5.1′	54.4′
1	195°06.2	30.1	331°35.4	10.3′	27°04.4	5.0′	54.4′
2	210°06.3	31.0	346°04.6	10.2′	27°09.4	4.9′	54.4′
3	225°06.5	·· 31.9	0°33.8	10.1′	27°14.3	4.7′	54.4′
4	240°06.6	32.8	15°03.0	10.1′	27°19.0	4.6′	54.4′
5	255°06.8	33.6	29°32.0	10.0′	27°23.6	4.5′	54.4′
6	270°06.9	N10°34.5	44°01.0	10.0′	S27°28.1	4.3′	54.4′
7	285°07.1	35.4	58°30.0	9.9′	27°32.4	4.2′	54.5′
8	300°07.2	36.3	72°58.9	9.8′	27°36.6	4.1′	54.5′
9	315°07.4	·· 37.2	87°27.7	9.8′	27°40.7	4.0′	54.5′
10	330°07.5	38.0	101°56.5	9.7′	27°44.7	3.8′	54.5′
11	345°07.6	38.9	116°25.2	9.7′	27°48.5	3.6′	54.5′
12	0°07.8	N10°39.8	130°53.9	9.6′	S27°52.1	3.6′	54.5′
13	15°07.9	40.7	145°22.5	9.6′	27°55.7	3.4′	54.6′
14	30°08.1	41.5	159°51.1	9.5′	27°59.1	3.2′	54.6′
15	45°08.2	·· 42.4	174°19.6	9.5′	28°02.3	3.2′	54.6′
16	60°08.3	43.3	188°48.0	9.4′	28°05.5	2.9′	54.6′
17	75°08.5	44.2	203°16.4	9.4′	28°08.4	2.9′	54.6′
18	90°08.6	N10°45.0	217°44.8	9.3′	S28°11.3	2.7′	54.6′
19	105°08.8	45.9	232°13.1	9.3′	28°14.0	2.6′	54.7′
20	120°08.9	46.8	246°41.4	9.2′	28°16.6	2.4′	54.7′
21	135°09.1	·· 47.7	261°09.6	9.2′	28°19.0	2.3′	54.7′
22	150°09.2	48.5	275°37.7	9.1′	28°21.3	2.1′	54.7′
23	165°09.3	49.4	290°05.9	9.1′	28°23.4	2.0′	54.7′
	SD = 15.9′	d = 0.9′		SD = 14.8′			

Fri	GHA	Dec	GHA	ν	Dec	d	HP
0	180°09.5	N10°50.3	304°34.0	9.0′	S28°25.4	1.9′	54.7′
1	195°09.6	51.1	319°02.0	9.0′	28°27.3	1.7′	54.8′
2	210°09.8	52.0	333°30.0	9.0′	28°29.0	1.5′	54.8′
3	225°09.9	·· 52.9	347°58.0	8.9′	28°30.5	1.5′	54.8′
4	240°10.0	53.8	2°25.9	8.9′	28°32.0	1.3′	54.8′
5	255°10.2	54.6	16°53.8	8.9′	28°33.3	1.1′	54.8′
6	270°10.3	N10°55.5	31°21.6	8.8′	S28°34.4	1.0′	54.9′
7	285°10.4	56.4	45°49.5	8.8′	28°35.4	0.8′	54.9′
8	300°10.6	57.2	60°17.2	8.8′	28°36.2	0.7′	54.9′
9	315°10.7	·· 58.1	74°45.0	8.7′	28°36.9	0.6′	54.9′
10	330°10.9	59.0	89°12.7	8.7′	28°37.5	0.4′	54.9′
11	345°11.0	10°59.8	103°40.4	8.7′	28°37.9	0.2′	55.0′
12	0°11.1	N11°00.7	118°08.1	8.6′	S28°38.1	0.1′	55.0′
13	15°11.3	01.6	132°35.7	8.6′	28°38.2	0.0′	55.0′
14	30°11.4	02.5	147°03.3	8.6′	28°38.2	0.2′	55.0′
15	45°11.6	·· 03.3	161°30.9	8.6′	28°38.0	0.4′	55.0′
16	60°11.7	04.2	175°58.5	8.6′	28°37.6	0.5′	55.1′
17	75°11.8	05.1	190°26.1	8.5′	28°37.1	0.6′	55.1′
18	90°12.0	N11°05.9	204°53.6	8.5′	S28°36.5	0.8′	55.1′
19	105°12.1	06.8	219°21.1	8.5′	28°35.7	0.9′	55.1′
20	120°12.2	07.7	233°48.6	8.5′	28°34.8	1.1′	55.2′
21	135°12.4	·· 08.5	248°16.1	8.5′	28°33.7	1.3′	55.2′
22	150°12.5	09.4	262°43.5	8.5′	28°32.4	1.4′	55.2′
23	165°12.6	10.2	277°11.0	8.4′	28°31.0	1.5′	55.2′
	SD = 15.9′	d = 0.9′		SD = 14.9′			

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	////	01:35	03:26	20:37	22:35	////
N 70°	////	02:19	03:45	20:17	21:46	////
68°	////	02:47	04:00	20:02	21:16	////
66°	01:22	03:09	04:11	19:50	20:54	22:46
64°	02:01	03:25	04:21	19:40	20:37	22:03
62°	02:27	03:39	04:30	19:31	20:23	21:36
60°	02:47	03:50	04:37	19:24	20:11	21:15
N 58°	03:03	04:00	04:43	19:17	20:01	20:59
56°	03:16	04:08	04:49	19:11	19:52	20:45
54°	03:28	04:16	04:54	19:06	19:45	20:33
52°	03:37	04:22	04:59	19:01	19:38	20:23
50°	03:46	04:28	05:03	18:57	19:32	20:15
45°	04:03	04:41	05:12	18:48	19:19	19:57
N 40°	04:17	04:51	05:19	18:41	19:09	19:43
35°	04:28	04:59	05:25	18:34	19:00	19:32
30°	04:37	05:06	05:31	18:29	18:53	19:22
20°	04:51	05:18	05:40	18:19	18:41	19:08
N 10°	05:02	05:27	05:49	18:11	18:32	18:57
0°	05:11	05:35	05:56	18:03	18:24	18:48
S 10°	05:18	05:42	06:04	17:55	18:17	18:41
20°	05:23	05:49	06:12	17:47	18:10	18:35
30°	05:28	05:56	06:20	17:38	18:02	18:30
35°	05:30	06:00	06:25	17:33	17:59	18:28
40°	05:32	06:04	06:31	17:27	17:55	18:26
45°	05:34	06:08	06:38	17:21	17:50	18:25
S 50°	05:35	06:13	06:46	17:13	17:45	18:23
52°	05:36	06:15	06:49	17:09	17:43	18:23
54°	05:36	06:17	06:53	17:05	17:41	18:22
56°	05:36	06:19	06:58	17:00	17:39	18:22
58°	05:36	06:22	07:03	16:55	17:36	18:21
S 60°	05:37	06:25	07:08	16:50	17:33	18:21

Lat.	Moonrise Wed	Moonrise Thu	Moonrise Fri	Moonset Wed	Moonset Thu	Moonset Fri
N 72°	▬	▬	▬	▬	▬	▬
N 70°	▬	▬	▬	▬	▬	▬
68°	▬	▬	▬	▬	▬	▬
66°	▬	▬	▬	▬	▬	▬
64°	00:42	▬	▬	03:23	▬	▬
62°	·· ··	01:58	▬	04:07	03:51	▬
60°	·· ··	01:05	02:30	04:37	04:44	05:08
N 58°	·· ··	00:33	01:48	05:00	05:17	05:50
56°	·· ··	00:09	01:20	05:18	05:41	06:18
54°	23:50	·· ··	00:58	05:34	06:00	06:41
52°	23:34	·· ··	00:40	05:47	06:17	06:59
50°	23:20	·· ··	00:24	05:59	06:31	07:14
45°	22:52	23:53	·· ··	06:24	07:00	07:45
N 40°	22:30	23:29	·· ··	06:43	07:22	08:10
35°	22:11	23:10	·· ··	07:00	07:41	08:30
30°	21:56	22:53	23:47	07:14	07:57	08:47
20°	21:29	22:24	23:18	07:39	08:25	09:15
N 10°	21:07	22:00	22:54	08:00	08:48	09:40
0°	20:45	21:37	22:31	08:20	09:10	10:03
S 10°	20:24	21:15	22:08	08:40	09:32	10:26
20°	20:02	20:50	21:43	09:01	09:56	10:50
30°	19:36	20:22	21:15	09:26	10:23	11:19
35°	19:21	20:05	20:58	09:40	10:40	11:36
40°	19:03	19:46	20:38	09:57	10:59	11:56
45°	18:42	19:23	20:14	10:18	11:22	12:20
S 50°	18:15	18:53	19:43	10:44	11:51	12:51
52°	18:02	18:38	19:28	10:56	12:06	13:06
54°	17:47	18:21	19:10	11:11	12:23	13:24
56°	17:30	18:00	18:48	11:28	12:44	13:46
58°	17:09	17:34	18:20	11:48	13:10	14:14
S 60°	16:43	16:58	17:39	12:14	13:46	14:55

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 18-20 92-79%
16	00:10	00:17	12:00	02:08	14:32	
17	00:24	00:31	11:59	02:58	15:24	
18	00:38	00:45	11:59	03:50	16:17	

April 19, 20, 21 UT (Sat., Sun., Mon.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	207°21.0	212°59.3	N01°12.7	84°17.9	N22°16.0	129°13.9	N22°43.5	209°42.6	S03°10.2
1	222°23.4	228°01.1	12.4	99°19.2	15.8	144°15.8	43.5	224°44.8	10.1
2	237°25.9	243°02.8	12.2	114°20.6	15.5	159°17.8	43.5	239°47.0	10.0
3	252°28.4	258°04.5	·· 11.9	129°22.0	·· 15.2	174°19.8	·· 43.6	254°49.2	·· 09.9
4	267°30.8	273°06.3	11.6	144°23.4	14.9	189°21.7	43.6	269°51.4	09.8
5	282°33.3	288°08.0	11.4	159°24.8	14.7	204°23.7	43.7	284°53.6	09.7
6	297°35.8	303°09.7	N01°11.1	174°26.1	N22°14.4	219°25.7	N22°43.7	299°55.8	S03°09.6
7	312°38.2	318°11.5	10.9	189°27.5	14.1	234°27.6	43.8	314°58.1	09.5
8	327°40.7	333°13.2	10.6	204°28.9	13.8	249°29.6	43.8	330°00.3	09.4
9	342°43.1	348°14.9	·· 10.4	219°30.3	·· 13.5	264°31.5	·· 43.8	345°02.5	·· 09.3
10	357°45.6	3°16.6	10.1	234°31.7	13.3	279°33.5	43.9	0°04.7	09.2
11	12°48.1	18°18.3	09.9	249°33.0	13.0	294°35.5	43.9	15°06.9	09.1
12	27°50.5	33°20.0	N01°09.6	264°34.4	N22°12.7	309°37.4	N22°44.0	30°09.1	S03°09.0
13	42°53.0	48°21.7	09.4	279°35.8	12.4	324°39.4	44.0	45°11.3	08.9
14	57°55.5	63°23.4	09.2	294°37.2	12.1	339°41.4	44.1	60°13.5	08.8
15	72°57.9	78°25.1	·· 08.9	309°38.5	·· 11.9	354°43.3	·· 44.1	75°15.7	·· 08.7
16	88°00.4	93°26.8	08.7	324°39.9	11.6	9°45.3	44.2	90°17.9	08.5
17	103°02.9	108°28.5	08.5	339°41.3	11.3	24°47.2	44.2	105°20.1	08.4
18	118°05.3	123°30.2	N01°08.2	354°42.7	N22°11.0	39°49.2	N22°44.2	120°22.4	S03°08.3
19	133°07.8	138°31.9	08.0	9°44.0	10.7	54°51.2	44.3	135°24.6	08.2
20	148°10.3	153°33.6	07.8	24°45.4	10.4	69°53.1	44.3	150°26.8	08.1
21	163°12.7	168°35.3	·· 07.5	39°46.8	·· 10.2	84°55.1	·· 44.4	165°29.0	·· 08.0
22	178°15.2	183°36.9	07.3	54°48.2	09.9	99°57.0	44.4	180°31.2	07.9
23	193°17.6	198°38.6	07.1	69°49.5	09.6	114°59.0	44.5	195°33.4	07.8
Mer.pass. 10:09		ν 1.7′ d 0.3′ m -4.75		ν 1.4′ d 0.3′ m 0.76		ν 2.0′ d 0.0′ m -2.03		ν 2.2′ d 0.1′ m 1.17	

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	208°20.1	213°40.3	N01°06.9	84°50.9	N22°09.3	130°01.0	N22°44.5	210°35.6	S03°07.7
1	223°22.6	228°42.0	06.6	99°52.3	09.0	145°02.9	44.5	225°37.8	07.6
2	238°25.0	243°43.6	06.4	114°53.7	08.8	160°04.9	44.6	240°40.0	07.5
3	253°27.5	258°45.3	·· 06.2	129°55.0	·· 08.5	175°06.9	·· 44.6	255°42.2	·· 07.4
4	268°30.0	273°46.9	06.0	144°56.4	08.2	190°08.8	44.7	270°44.4	07.3
5	283°32.4	288°48.6	05.8	159°57.8	07.9	205°10.8	44.7	285°46.7	07.2
6	298°34.9	303°50.3	N01°05.6	174°59.1	N22°07.6	220°12.7	N22°44.8	300°48.9	S03°07.1
7	313°37.4	318°51.9	05.4	190°00.5	07.3	235°14.7	44.8	315°51.1	07.0
8	328°39.8	333°53.6	05.1	205°01.9	07.1	250°16.7	44.8	330°53.3	06.9
9	343°42.3	348°55.2	·· 04.9	220°03.3	·· 06.8	265°18.6	·· 44.9	345°55.5	·· 06.8
10	358°44.8	3°56.8	04.7	235°04.6	06.5	280°20.6	44.9	0°57.7	06.7
11	13°47.2	18°58.5	04.5	250°06.0	06.2	295°22.5	45.0	15°59.9	06.6
12	28°49.7	34°00.1	N01°04.3	265°07.4	N22°05.9	310°24.5	N22°45.0	31°02.1	S03°06.5
13	43°52.1	49°01.7	04.1	280°08.7	05.6	325°26.4	45.1	46°04.3	06.4
14	58°54.6	64°03.4	03.9	295°10.1	05.3	340°28.4	45.1	61°06.5	06.3
15	73°57.1	79°05.0	·· 03.7	310°11.5	·· 05.1	355°30.4	·· 45.1	76°08.8	·· 06.2
16	88°59.5	94°06.6	03.5	325°12.8	04.8	10°32.3	45.2	91°11.0	06.1
17	104°02.0	109°08.2	03.3	340°14.2	04.5	25°34.3	45.2	106°13.2	06.0
18	119°04.5	124°09.9	N01°03.2	355°15.6	N22°04.2	40°36.2	N22°45.3	121°15.4	S03°05.8
19	134°06.9	139°11.5	03.0	10°16.9	03.9	55°38.2	45.3	136°17.6	05.7
20	149°09.4	154°13.1	02.8	25°18.3	03.6	70°40.2	45.4	151°19.8	05.6
21	164°11.9	169°14.7	·· 02.6	40°19.7	·· 03.3	85°42.1	·· 45.4	166°22.0	·· 05.5
22	179°14.3	184°16.3	02.4	55°21.0	03.1	100°44.1	45.4	181°24.2	05.4
23	194°16.8	199°17.9	02.2	70°22.4	02.8	115°46.0	45.5	196°26.4	05.3
Mer.pass. 10:05		ν 1.7′ d 0.2′ m -4.75		ν 1.4′ d 0.3′ m 0.78		ν 2.0′ d 0.0′ m -2.02		ν 2.2′ d 0.1′ m 1.17	

Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	209°19.3	214°19.5	N01°02.0	85°23.8	N22°02.5	130°48.0	N22°45.5	211°28.6	S03°05.2
1	224°21.7	229°21.1	01.9	100°25.1	02.2	145°49.9	45.6	226°30.9	05.1
2	239°24.2	244°22.7	01.7	115°26.5	01.9	160°51.9	45.6	241°33.1	05.0
3	254°26.6	259°24.3	·· 01.5	130°27.9	·· 01.6	175°53.8	·· 45.7	256°35.3	·· 04.9
4	269°29.1	274°25.9	01.3	145°29.2	01.3	190°55.8	45.7	271°37.5	04.8
5	284°31.6	289°27.4	01.2	160°30.6	01.1	205°57.8	45.7	286°39.7	04.7
6	299°34.0	304°29.0	N01°01.0	175°31.9	N22°00.8	220°59.7	N22°45.8	301°41.9	S03°04.6
7	314°36.5	319°30.6	00.8	190°33.3	00.5	236°01.7	45.8	316°44.1	04.5
8	329°39.0	334°32.2	00.7	205°34.7	22°00.2	251°03.6	45.9	331°46.3	04.4
9	344°41.4	349°33.8	·· 00.5	220°36.0	21°59.9	266°05.6	·· 45.9	346°48.5	·· 04.3
10	359°43.9	4°35.3	00.3	235°37.4	59.6	281°07.5	46.0	1°50.8	04.2
11	14°46.4	19°36.9	00.2	250°38.8	59.3	296°09.5	46.0	16°53.0	04.1
12	29°48.8	34°38.5	N01°00.0	265°40.1	N21°59.0	311°11.4	N22°46.0	31°55.2	S03°04.0
13	44°51.3	49°40.0	00°59.8	280°41.5	58.7	326°13.4	46.1	46°57.4	03.9
14	59°53.7	64°41.6	59.7	295°42.8	58.5	341°15.4	46.1	61°59.6	03.8
15	74°56.2	79°43.1	·· 59.5	310°44.2	·· 58.2	356°17.3	·· 46.2	77°01.8	·· 03.7
16	89°58.7	94°44.7	59.4	325°45.5	57.9	11°19.3	46.2	92°04.0	03.6
17	105°01.1	109°46.2	59.2	340°46.9	57.6	26°21.2	46.3	107°06.2	03.5
18	120°03.6	124°47.8	N00°59.1	355°48.3	N21°57.3	41°23.2	N22°46.3	122°08.5	S03°03.4
19	135°06.1	139°49.3	58.9	10°49.6	57.0	56°25.1	46.3	137°10.7	03.3
20	150°08.5	154°50.9	58.8	25°51.0	56.7	71°27.1	46.4	152°12.9	03.2
21	165°11.0	169°52.4	·· 58.6	40°52.3	·· 56.4	86°29.0	·· 46.4	167°15.1	·· 03.1
22	180°13.5	184°53.9	58.5	55°53.7	56.1	101°31.0	46.5	182°17.3	03.0
23	195°15.9	199°55.5	58.3	70°55.1	55.8	116°32.9	46.5	197°19.5	02.9
Mer.pass. 10:01		ν 1.6′ d 0.2′ m -4.76		ν 1.4′ d 0.3′ m 0.79		ν 2.0′ d 0.0′ m -2.02		ν 2.2′ d 0.1′ m 1.17	

Stars

	SHA	Dec
Alpheratz	357°34.9	29°13.6
Ankaa	353°07.3	-42°10.1
Schedar	349°31.4	56°40.4
Diphda	348°47.4	-17°50.9
Achernar	335°20.6	-57°06.5
Hamal	327°51.3	23°34.8
Polaris	314°24.4	89°22.3
Acamar	315°12.0	-40°12.3
Menkar	314°06.2	4°11.2
Mirfak	308°28.4	49°57.1
Aldebaran	290°39.6	16°33.6
Rigel	281°03.9	-8°10.5
Capella	280°21.9	46°01.5
Bellatrix	278°22.9	6°22.3
Elnath	278°01.8	28°37.8
Alnilam	275°37.7	-1°11.2
Betelgeuse	270°52.0	7°24.7
Canopus	263°52.5	-52°42.8
Sirius	258°26.2	-16°45.2
Adhara	255°05.8	-29°00.6
Procyon	244°50.7	5°09.5
Pollux	243°17.1	27°58.0
Avior	234°14.6	-59°35.7
Suhail	222°46.1	-43°32.3
Miaplacidus	221°38.0	-69°49.5
Alphard	217°47.4	-8°46.2
Regulus	207°34.1	11°50.6
Dubhe	193°40.2	61°37.0
Denebola	182°24.5	14°25.8
Gienah	175°43.1	-17°41.1
Acrux	172°59.3	-63°14.5
Gacrux	171°50.9	-57°15.5
Alioth	166°12.2	55°49.3
Spica	158°21.8	-11°17.7
Alkaid	152°51.3	49°11.1
Hadar	148°35.1	-60°29.8
Menkent	147°57.0	-36°29.8
Arcturus	145°47.4	19°02.9
Rigil Kent.	139°39.4	-60°56.4
Kochab	137°18.6	74°02.9
Zuben'ubi	136°55.5	-16°08.9
Alphecca	126°03.2	26°37.6
Antares	112°15.3	-26°29.3
Atria	107°08.9	-69°04.2
Sabik	102°02.3	-15°45.4
Shaula	96°09.8	-37°07.3
Rasalhague	95°58.1	12°32.3
Eltanin	90°41.8	51°28.8
Kaus Aust.	83°32.1	-34°22.3
Vega	80°32.9	38°48.1
Nunki	75°47.4	-26°15.9
Altair	61°59.7	8°55.9
Peacock	53°05.4	-56°39.0
Deneb	49°25.7	45°21.9
Enif	33°38.7	9°59.3
Al Na'ir	27°32.9	-46°50.2
Fomalhaut	15°14.5	-29°29.3
Scheat	13°45.3	28°13.0
Markab	13°29.9	15°20.3

Apr 19 Sat	SHA	Mer.pass
Venus	5°38.4	09:47
Mars	236°56.9	18:21
Jupiter	281°52.9	15:21
Saturn	2°21.6	10:00

Apr 20 Sun	SHA	Mer.pass
Venus	5°20.2	09:44
Mars	236°30.8	18:19
Jupiter	281°40.9	15:18
Saturn	2°15.5	09:56

Apr 21 Mon	SHA	Mer.pass
Venus	5°00.2	09:42
Mars	236°04.5	18:17
Jupiter	281°28.7	15:15
Saturn	2°09.4	09:53

Horizontal parallax	
Venus:	0.4
Mars:	0.1

h

Sat	Sun GHA	Sun Dec	Moon GHA	Moon ν	Moon Dec	Moon d	Moon HP
0	180°12.8	N11°11.1	291°38.4	8.4′	S28°29.5	1.7′	55.3′
1	195°12.9	12.0	306°05.9	8.4′	28°27.8	1.9′	55.3′
2	210°13.1	12.8	320°33.3	8.4′	28°25.9	2.0′	55.3′
3	225°13.2	·· 13.7	335°00.7	8.4′	28°23.9	2.1′	55.3′
4	240°13.3	14.6	349°28.1	8.4′	28°21.8	2.3′	55.4′
5	255°13.5	15.4	3°55.5	8.4′	28°19.5	2.5′	55.4′
6	270°13.6	N11°16.3	18°22.9	8.4′	S28°17.0	2.6′	55.4′
7	285°13.7	17.2	32°50.3	8.4′	28°14.4	2.7′	55.4′
8	300°13.9	18.0	47°17.7	8.4′	28°11.7	2.9′	55.5′
9	315°14.0	·· 18.9	61°45.1	8.4′	28°08.8	3.1′	55.5′
10	330°14.1	19.7	76°12.5	8.4′	28°05.7	3.2′	55.5′
11	345°14.3	20.6	90°39.9	8.4′	28°02.5	3.4′	55.5′
12	0°14.4	N11°21.5	105°07.3	8.4′	S27°59.1	3.5′	55.6′
13	15°14.5	22.3	119°34.7	8.4′	27°55.6	3.6′	55.6′
14	30°14.7	23.2	134°02.1	8.4′	27°52.0	3.8′	55.6′
15	45°14.8	·· 24.0	148°29.5	8.4′	27°48.2	4.0′	55.6′
16	60°14.9	24.9	162°57.0	8.4′	27°44.2	4.1′	55.7′
17	75°15.1	25.8	177°24.4	8.5′	27°40.1	4.3′	55.7′
18	90°15.2	N11°26.6	191°51.9	8.5′	S27°35.8	4.4′	55.7′
19	105°15.3	27.5	206°19.3	8.5′	27°31.4	4.6′	55.8′
20	120°15.5	28.3	220°46.8	8.5′	27°26.8	4.7′	55.8′
21	135°15.6	·· 29.2	235°14.3	8.5′	27°22.1	4.9′	55.8′
22	150°15.7	30.1	249°41.8	8.5′	27°17.2	5.0′	55.8′
23	165°15.8	30.9	264°09.3	8.5′	27°12.2	5.2′	55.9′
	SD = 15.9′	d = 0.9′		SD = 15.1′			

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	180°16.0	N11°31.8	278°36.9	8.6′	S27°07.0	5.3′	55.9′
1	195°16.1	32.6	293°04.4	8.6′	27°01.7	5.5′	55.9′
2	210°16.2	33.5	307°32.0	8.6′	26°56.2	5.6′	56.0′
3	225°16.4	·· 34.3	321°59.6	8.6′	26°50.6	5.7′	56.0′
4	240°16.5	35.2	336°27.3	8.6′	26°44.9	5.9′	56.0′
5	255°16.6	36.1	350°54.9	8.7′	26°39.0	6.1′	56.0′
6	270°16.8	N11°36.9	5°22.6	8.7′	S26°32.9	6.2′	56.1′
7	285°16.9	37.8	19°50.3	8.7′	26°26.7	6.4′	56.1′
8	300°17.0	38.6	34°18.0	8.7′	26°20.3	6.5′	56.1′
9	315°17.2	·· 39.5	48°45.7	8.8′	26°13.8	6.6′	56.2′
10	330°17.3	40.3	63°13.5	8.8′	26°07.2	6.8′	56.2′
11	345°17.4	41.2	77°41.3	8.8′	26°00.4	6.9′	56.2′
12	0°17.5	N11°42.0	92°09.2	8.9′	S25°53.5	7.1′	56.3′
13	15°17.7	42.9	106°37.0	8.9′	25°46.4	7.3′	56.3′
14	30°17.8	43.7	121°04.9	8.9′	25°39.1	7.3′	56.3′
15	45°17.9	·· 44.6	135°32.8	9.0′	25°31.8	7.5′	56.4′
16	60°18.1	45.4	150°00.8	9.0′	25°24.3	7.7′	56.4′
17	75°18.2	46.3	164°28.8	9.0′	25°16.6	7.8′	56.4′
18	90°18.3	N11°47.1	178°56.8	9.1′	S25°08.8	7.9′	56.5′
19	105°18.4	48.0	193°24.9	9.1′	25°00.9	8.1′	56.5′
20	120°18.6	48.8	207°53.0	9.1′	24°52.8	8.2′	56.5′
21	135°18.7	·· 49.7	222°21.1	9.2′	24°44.6	8.4′	56.6′
22	150°18.8	50.5	236°49.3	9.2′	24°36.2	8.5′	56.6′
23	165°18.9	51.4	251°17.5	9.2′	24°27.7	8.6′	56.6′
	SD = 15.9′	d = 0.9′		SD = 15.2′			

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	180°19.1	N11°52.2	265°45.7	9.3′	S24°19.1	8.8′	56.7′
1	195°19.2	53.1	280°14.0	9.3′	24°10.3	8.9′	56.7′
2	210°19.3	53.9	294°42.3	9.3′	24°01.4	9.1′	56.7′
3	225°19.5	·· 54.8	309°10.6	9.4′	23°52.3	9.2′	56.8′
4	240°19.6	55.6	323°39.0	9.4′	23°43.1	9.3′	56.8′
5	255°19.7	56.5	338°07.4	9.5′	23°33.8	9.5′	56.8′
6	270°19.8	N11°57.3	352°35.9	9.5′	S23°24.3	9.6′	56.9′
7	285°20.0	58.2	7°04.4	9.5′	23°14.7	9.7′	56.9′
8	300°20.1	59.0	21°32.9	9.6′	23°05.0	9.9′	56.9′
9	315°20.2	11°59.9	36°01.5	9.6′	22°55.1	9.9′	57.0′
10	330°20.3	12°00.7	50°30.1	9.7′	22°45.2	10.2′	57.0′
11	345°20.5	01.6	64°58.8	9.7′	22°35.0	10.2′	57.1′
12	0°20.6	N12°02.4	79°27.5	9.7′	S22°24.8	10.4′	57.1′
13	15°20.7	03.3	93°56.2	9.8′	22°14.4	10.5′	57.1′
14	30°20.8	04.1	108°25.0	9.8′	22°03.9	10.7′	57.2′
15	45°20.9	·· 04.9	122°53.9	9.9′	21°53.2	10.7′	57.2′
16	60°21.1	05.8	137°22.7	9.9′	21°42.5	10.9′	57.2′
17	75°21.2	06.6	151°51.6	9.9′	21°31.6	11.1′	57.3′
18	90°21.3	N12°07.5	166°20.6	10.0′	S21°20.5	11.1′	57.3′
19	105°21.4	08.3	180°49.5	10.0′	21°09.4	11.3′	57.3′
20	120°21.6	09.2	195°18.6	10.1′	20°58.1	11.4′	57.4′
21	135°21.7	·· 10.0	209°47.6	10.1′	20°46.7	11.5′	57.4′
22	150°21.8	10.8	224°16.7	10.1′	20°35.2	11.7′	57.5′
23	165°21.9	11.7	238°45.9	10.2′	20°23.5	11.7′	57.5′
	SD = 15.9′	d = 0.8′		SD = 15.5′			

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	////	00:52	03:08	20:54	23:30	////
N 70°	////	01:55	03:30	20:32	22:09	////
68°	////	02:30	03:46	20:14	21:33	////
66°	00:45	02:54	04:00	20:00	21:07	23:34
64°	01:41	03:13	04:11	19:49	20:48	22:23
62°	02:12	03:28	04:20	19:39	20:32	21:50
60°	02:34	03:40	04:28	19:31	20:19	21:27
N 58°	02:52	03:51	04:35	19:24	20:08	21:08
56°	03:07	04:00	04:42	19:17	19:59	20:53
54°	03:19	04:08	04:47	19:12	19:51	20:41
52°	03:29	04:16	04:52	19:07	19:43	20:30
50°	03:39	04:22	04:57	19:02	19:37	20:20
45°	03:58	04:35	05:07	18:52	19:23	20:01
N 40°	04:12	04:46	05:15	18:44	19:12	19:46
35°	04:24	04:55	05:22	18:37	19:03	19:34
30°	04:34	05:03	05:28	18:30	18:55	19:25
20°	04:49	05:15	05:38	18:20	18:42	19:09
N 10°	05:01	05:26	05:47	18:11	18:32	18:57
0°	05:10	05:34	05:55	18:02	18:23	18:48
S 10°	05:18	05:42	06:04	17:54	18:15	18:40
20°	05:24	05:50	06:12	17:45	18:07	18:33
30°	05:30	05:58	06:22	17:35	17:59	18:27
35°	05:32	06:02	06:28	17:29	17:55	18:25
40°	05:35	06:07	06:34	17:23	17:51	18:22
45°	05:37	06:11	06:41	17:16	17:46	18:20
S 50°	05:39	06:17	06:50	17:07	17:40	18:18
52°	05:40	06:20	06:54	17:03	17:37	18:17
54°	05:41	06:22	06:59	16:58	17:35	18:16
56°	05:42	06:25	07:04	16:53	17:32	18:15
58°	05:42	06:28	07:09	16:48	17:28	18:14
S 60°	05:43	06:32	07:15	16:41	17:25	18:13

Lat.	Moonrise Sat	Moonrise Sun	Moonrise Mon	Moonset Sat	Moonset Sun	Moonset Mon
N 72°	▬	▬	▬	▬	▬	▬
N 70°	▬	▬	▬	▬	▬	▬
68°	▬	▬	▬	▬	▬	▬
66°	▬	▬	05:43	▬	▬	07:32
64°	▬	▬	04:44	▬	▬	08:30
62°	▬	04:23	04:10	▬	07:00	09:04
60°	03:21	03:39	03:45	06:09	07:44	09:28
N 58°	02:41	03:10	03:25	06:49	08:12	09:47
56°	02:13	02:48	03:09	07:17	08:35	10:03
54°	01:51	02:29	02:54	07:38	08:53	10:17
52°	01:33	02:14	02:42	07:56	09:08	10:29
50°	01:18	02:00	02:31	08:12	09:21	10:39
45°	00:47	01:32	02:08	08:42	09:48	11:01
N 40°	00:23	01:10	01:50	09:06	10:10	11:18
35°	00:04	00:52	01:34	09:25	10:27	11:33
30°	·· ··	00:36	01:20	09:42	10:42	11:46
20°	·· ··	00:09	00:57	10:10	11:08	12:07
N 10°	23:46	·· ··	00:37	10:34	11:30	12:26
0°	23:25	·· ··	00:18	10:57	11:51	12:43
S 10°	23:03	23:59	·· ··	11:19	12:11	13:00
20°	22:40	23:39	·· ··	11:43	12:33	13:18
30°	22:13	23:15	·· ··	12:11	12:58	13:39
35°	21:57	23:01	·· ··	12:27	13:12	13:51
40°	21:38	22:45	23:56	12:46	13:29	14:05
45°	21:16	22:26	23:41	13:09	13:49	14:22
S 50°	20:47	22:01	23:22	13:39	14:15	14:42
52°	20:33	21:50	23:13	13:53	14:27	14:51
54°	20:16	21:36	23:03	14:10	14:41	15:02
56°	19:57	21:21	22:52	14:30	14:57	15:14
58°	19:32	21:02	22:39	14:54	15:16	15:27
S 60°	18:59	20:39	22:24	15:28	15:39	15:43

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 21-23 70-51%
19	00:51	00:58	11:59	04:44	17:11	
20	01:04	01:10	11:59	05:38	18:04	
21	01:16	01:22	11:59	06:31	18:57	

April 22, 23, 24 UT (Tue., Wed., Thu.)

	Aries	Venus		Mars		Jupiter		Saturn	
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	210°18.4	214°57.0	N00°58.2	85°56.4	N21°55.6	131°34.9	N22°46.6	212°21.7	S03°02.8
1	225°20.9	229°58.5	58.1	100°57.8	55.3	146°36.8	46.6	227°23.9	02.7
2	240°23.3	245°00.0	57.9	115°59.1	55.0	161°38.8	46.6	242°26.1	02.6
3	255°25.8	260°01.6	·· 57.8	131°00.5	·· 54.7	176°40.8	·· 46.7	257°28.4	·· 02.5
4	270°28.2	275°03.1	57.6	146°01.8	54.4	191°42.7	46.7	272°30.6	02.4
5	285°30.7	290°04.6	57.5	161°03.2	54.1	206°44.7	46.8	287°32.8	02.3
6	300°33.2	305°06.1	N00°57.4	176°04.5	N21°53.8	221°46.6	N22°46.8	302°35.0	S03°02.2
7	315°35.6	320°07.6	57.3	191°05.9	53.5	236°48.6	46.8	317°37.2	02.0
8	330°38.1	335°09.1	57.1	206°07.2	53.2	251°50.5	46.9	332°39.4	01.9
9	345°40.6	350°10.6	·· 57.0	221°08.6	·· 52.9	266°52.5	·· 46.9	347°41.6	·· 01.8
10	0°43.0	5°12.1	56.9	236°10.0	52.6	281°54.4	47.0	2°43.9	01.7
11	15°45.5	20°13.6	56.7	251°11.3	52.3	296°56.4	47.0	17°46.1	01.6
12	30°48.0	35°15.1	N00°56.6	266°12.7	N21°52.0	311°58.3	N22°47.1	32°48.3	S03°01.5
13	45°50.4	50°16.6	56.5	281°14.0	51.8	327°00.3	47.1	47°50.5	01.4
14	60°52.9	65°18.1	56.4	296°15.4	51.5	342°02.2	47.1	62°52.7	01.3
15	75°55.4	80°19.6	·· 56.3	311°16.7	·· 51.2	357°04.2	·· 47.2	77°54.9	·· 01.2
16	90°57.8	95°21.1	56.2	326°18.1	50.9	12°06.1	47.2	92°57.1	01.1
17	106°00.3	110°22.6	56.0	341°19.4	50.6	27°08.1	47.3	107°59.3	01.0
18	121°02.7	125°24.0	N00°55.9	356°20.8	N21°50.3	42°10.0	N22°47.3	123°01.6	S03°00.9
19	136°05.2	140°25.5	55.8	11°22.1	50.0	57°12.0	47.4	138°03.8	00.8
20	151°07.7	155°27.0	55.7	26°23.5	49.7	72°13.9	47.4	153°06.0	00.7
21	166°10.1	170°28.5	·· 55.6	41°24.8	·· 49.4	87°15.9	·· 47.4	168°08.2	·· 00.6
22	181°12.6	185°29.9	55.5	56°26.2	49.1	102°17.8	47.5	183°10.4	00.5
23	196°15.1	200°31.4	55.4	71°27.5	48.8	117°19.8	47.5	198°12.6	00.4
Mer.pass. 09:57		ν 1.5′	d 0.1′	m -4.76	ν 1.4′	d 0.3′	m 0.81	ν 2.0′	d 0.0′ m -2.01	ν 2.2′	d 0.1′ m 1.17

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	211°17.5	215°32.9	N00°55.3	86°28.9	N21°48.5	132°21.7	N22°47.6	213°14.8	S03°00.3
1	226°20.0	230°34.3	55.2	101°30.2	48.2	147°23.7	47.6	228°17.1	00.2
2	241°22.5	245°35.8	55.1	116°31.5	47.9	162°25.6	47.6	243°19.3	00.1
3	256°24.9	260°37.2	·· 55.0	131°32.9	·· 47.6	177°27.6	·· 47.7	258°21.5	03°00.0
4	271°27.4	275°38.7	54.9	146°34.2	47.3	192°29.5	47.7	273°23.7	02°59.9
5	286°29.9	290°40.1	54.8	161°35.6	47.0	207°31.5	47.8	288°25.9	59.8
6	301°32.3	305°41.6	N00°54.7	176°36.9	N21°46.7	222°33.4	N22°47.8	303°28.1	S02°59.7
7	316°34.8	320°43.0	54.6	191°38.3	46.4	237°35.4	47.9	318°30.3	59.6
8	331°37.2	335°44.5	54.5	206°39.6	46.1	252°37.3	47.9	333°32.6	59.5
9	346°39.7	350°45.9	·· 54.5	221°41.0	·· 45.8	267°39.3	·· 47.9	348°34.8	·· 59.4
10	1°42.2	5°47.3	54.4	236°42.3	45.6	282°41.2	48.0	3°37.0	59.3
11	16°44.6	20°48.8	54.3	251°43.7	45.3	297°43.1	48.0	18°39.2	59.2
12	31°47.1	35°50.2	N00°54.2	266°45.0	N21°45.0	312°45.1	N22°48.1	33°41.4	S02°59.1
13	46°49.6	50°51.6	54.1	281°46.3	44.7	327°47.0	48.1	48°43.6	59.0
14	61°52.0	65°53.0	54.0	296°47.7	44.4	342°49.0	48.1	63°45.8	58.9
15	76°54.5	80°54.5	·· 54.0	311°49.0	·· 44.1	357°50.9	·· 48.2	78°48.1	·· 58.8
16	91°57.0	95°55.9	53.9	326°50.4	43.8	12°52.9	48.2	93°50.3	58.7
17	106°59.4	110°57.3	53.8	341°51.7	43.5	27°54.8	48.3	108°52.5	58.6
18	122°01.9	125°58.7	N00°53.7	356°53.1	N21°43.2	42°56.8	N22°48.3	123°54.7	S02°58.5
19	137°04.3	141°00.1	53.7	11°54.4	42.9	57°58.7	48.4	138°56.9	58.4
20	152°06.8	156°01.5	53.6	26°55.7	42.6	73°00.7	48.4	153°59.1	58.3
21	167°09.3	171°02.9	·· 53.5	41°57.1	·· 42.3	88°02.6	·· 48.4	169°01.4	·· 58.2
22	182°11.7	186°04.3	53.5	56°58.4	42.0	103°04.6	48.5	184°03.6	58.1
23	197°14.2	201°05.7	53.4	71°59.8	41.7	118°06.5	48.5	199°05.8	58.0
Mer.pass. 09:53		ν 1.5′	d 0.1′	m -4.76	ν 1.3′	d 0.3′	m 0.82	ν 1.9′	d 0.0′ m -2.01	ν 2.2′	d 0.1′ m 1.17

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	212°16.7	216°07.1	N00°53.3	87°01.1	N21°41.4	133°08.5	N22°48.6	214°08.0	S02°57.9
1	227°19.1	231°08.5	53.3	102°02.4	41.1	148°10.4	48.6	229°10.2	57.8
2	242°21.6	246°09.9	53.2	117°03.8	40.8	163°12.3	48.6	244°12.4	57.7
3	257°24.1	261°11.3	·· 53.2	132°05.1	·· 40.5	178°14.3	·· 48.7	259°14.6	·· 57.6
4	272°26.5	276°12.7	53.1	147°06.5	40.2	193°16.2	48.7	274°16.9	57.5
5	287°29.0	291°14.1	53.1	162°07.8	39.9	208°18.2	48.8	289°19.1	57.4
6	302°31.5	306°15.5	N00°53.0	177°09.1	N21°39.6	223°20.1	N22°48.8	304°21.3	S02°57.3
7	317°33.9	321°16.9	52.9	192°10.5	39.3	238°22.1	48.9	319°23.5	57.2
8	332°36.4	336°18.2	52.9	207°11.8	39.0	253°24.0	48.9	334°25.7	57.1
9	347°38.8	351°19.6	·· 52.8	222°13.1	·· 38.7	268°26.0	·· 48.9	349°27.9	·· 57.0
10	2°41.3	6°21.0	52.8	237°14.5	38.4	283°27.9	49.0	4°30.2	56.9
11	17°43.8	21°22.3	52.8	252°15.8	38.1	298°29.8	49.0	19°32.4	56.8
12	32°46.2	36°23.7	N00°52.7	267°17.2	N21°37.8	313°31.8	N22°49.1	34°34.6	S02°56.7
13	47°48.7	51°25.1	52.7	282°18.5	37.5	328°33.7	49.1	49°36.8	56.6
14	62°51.2	66°26.4	52.6	297°19.8	37.2	343°35.7	49.1	64°39.0	56.5
15	77°53.6	81°27.8	·· 52.6	312°21.2	·· 36.9	358°37.6	·· 49.2	79°41.2	·· 56.4
16	92°56.1	96°29.2	52.6	327°22.5	36.5	13°39.6	49.2	94°43.5	56.3
17	107°58.6	111°30.5	52.5	342°23.8	36.2	28°41.5	49.3	109°45.7	56.2
18	123°01.0	126°31.9	N00°52.5	357°25.2	N21°35.9	43°43.4	N22°49.3	124°47.9	S02°56.1
19	138°03.5	141°33.2	52.4	12°26.5	35.6	58°45.4	49.3	139°50.1	56.0
20	153°05.9	156°34.6	52.4	27°27.8	35.3	73°47.3	49.4	154°52.3	55.9
21	168°08.4	171°35.9	·· 52.4	42°29.2	·· 35.0	88°49.3	·· 49.4	169°54.5	·· 55.8
22	183°10.9	186°37.2	52.4	57°30.5	34.7	103°51.2	49.5	184°56.8	55.7
23	198°13.3	201°38.6	52.3	72°31.8	34.4	118°53.2	49.5	199°59.0	55.6
Mer.pass. 09:49		ν 1.4′	d 0.1′	m -4.75	ν 1.3′	d 0.3′	m 0.84	ν 1.9′	d 0.0′ m -2.01	ν 2.2′	d 0.1′ m 1.17

Stars

	SHA	Dec
Alpheratz	357°34.9	29°13.6
Ankaa	353°07.3	-42°10.1
Schedar	349°31.4	56°40.4
Diphda	348°47.4	-17°50.9
Achernar	335°20.6	-57°06.5
Hamal	327°51.3	23°34.8
Polaris	314°24.7	89°22.3
Acamar	315°12.0	-40°12.3
Menkar	314°06.2	4°11.3
Mirfak	308°28.4	49°57.1
Aldebaran	290°39.6	16°33.6
Rigel	281°03.9	-8°10.4
Capella	280°21.9	46°01.5
Bellatrix	278°22.9	6°22.3
Elnath	278°01.8	28°37.8
Alnilam	275°37.7	-1°11.2
Betelgeuse	270°52.0	7°24.7
Canopus	263°52.6	-52°42.8
Sirius	258°26.2	-16°45.2
Adhara	255°05.8	-29°00.6
Procyon	244°50.7	5°09.5
Pollux	243°17.1	27°58.0
Avior	234°14.7	-59°35.7
Suhail	222°46.1	-43°32.3
Miaplacidus	221°38.1	-69°49.5
Alphard	217°47.5	-8°46.2
Regulus	207°34.1	11°50.6
Dubhe	193°40.3	61°37.0
Denebola	182°24.5	14°25.8
Gienah	175°43.1	-17°41.1
Acrux	172°59.3	-63°14.5
Gacrux	171°50.9	-57°15.5
Alioth	166°12.2	55°49.4
Spica	158°21.8	-11°17.7
Alkaid	152°51.3	49°11.1
Hadar	148°35.1	-60°29.8
Menkent	147°57.0	-36°29.8
Arcturus	145°47.4	19°02.9
Rigil Kent.	139°39.4	-60°56.4
Kochab	137°18.6	74°02.9
Zuben'ubi	136°55.4	-16°08.9
Alphecca	126°03.2	26°37.6
Antares	112°15.3	-26°29.3
Atria	107°08.9	-69°04.2
Sabik	102°02.3	-15°45.4
Shaula	96°09.8	-37°07.3
Rasalhague	95°58.1	12°32.3
Eltanin	90°41.8	51°28.8
Kaus Aust.	83°32.0	-34°22.3
Vega	80°32.9	38°48.1
Nunki	75°47.4	-26°15.9
Altair	61°59.7	8°55.9
Peacock	53°05.4	-56°39.0
Deneb	49°25.7	45°21.9
Enif	33°38.7	9°59.3
Al Na'ir	27°32.8	-46°50.2
Fomalhaut	15°14.5	-29°29.3
Scheat	13°45.2	28°13.0
Markab	13°29.9	15°20.3

Apr 22 Tue	SHA	Mer.pass
Venus	4°38.6	09:39
Mars	235°38.0	18:15
Jupiter	281°16.5	15:12
Saturn	2°03.3	09:49

Apr 23 Wed	SHA	Mer.pass
Venus	4°15.3	09:37
Mars	235°11.3	18:12
Jupiter	281°04.2	15:09
Saturn	1°57.3	09:46

Apr 24 Thu	SHA	Mer.pass
Venus	3°50.5	09:35
Mars	234°44.4	18:10
Jupiter	280°51.8	15:05
Saturn	1°51.3	09:42

Horizontal parallax	
Venus:	0.4
Mars:	0.1

h	Sun		Moon				
Tue	**GHA**	**Dec**	**GHA**	*ν*	**Dec**	*d*	**HP**
0	180°22.0	N12°12.5	253°15.1	10.2′	S20°11.8	11.9′	57.5′
1	195°22.2	13.4	267°44.3	10.3′	19°59.9	12.0′	57.6′
2	210°22.3	14.2	282°13.5	10.3′	19°47.9	12.1′	57.6′
3	225°22.4	·· 15.0	296°42.8	10.3′	19°35.8	12.3′	57.6′
4	240°22.5	15.9	311°12.2	10.4′	19°23.5	12.3′	57.7′
5	255°22.7	16.7	325°41.6	10.4′	19°11.2	12.5′	57.7′
6	270°22.8	N12°17.6	340°11.0	10.5′	S18°58.7	12.6′	57.8′
7	285°22.9	18.4	354°40.4	10.5′	18°46.1	12.7′	57.8′
8	300°23.0	19.2	9°09.9	10.5′	18°33.4	12.8′	57.8′
9	315°23.1	·· 20.1	23°39.5	10.6′	18°20.6	12.9′	57.9′
10	330°23.3	20.9	38°09.0	10.6′	18°07.7	13.0′	57.9′
11	345°23.4	21.7	52°38.6	10.6′	17°54.7	13.2′	58.0′
12	0°23.5	N12°22.6	67°08.3	10.7′	S17°41.5	13.2′	58.0′
13	15°23.6	23.4	81°37.9	10.7′	17°28.3	13.4′	58.0′
14	30°23.7	24.3	96°07.6	10.7′	17°14.9	13.5′	58.1′
15	45°23.9	·· 25.1	110°37.4	10.8′	17°01.4	13.5′	58.1′
16	60°24.0	25.9	125°07.1	10.8′	16°47.9	13.7′	58.1′
17	75°24.1	26.8	139°37.0	10.8′	16°34.2	13.8′	58.2′
18	90°24.2	N12°27.6	154°06.8	10.9′	S16°20.4	13.9′	58.2′
19	105°24.3	28.4	168°36.7	10.9′	16°06.5	14.0′	58.3′
20	120°24.4	29.3	183°06.6	10.9′	15°52.5	14.0′	58.3′
21	135°24.6	·· 30.1	197°36.5	11.0′	15°38.5	14.2′	58.3′
22	150°24.7	30.9	212°06.5	11.0′	15°24.3	14.3′	58.4′
23	165°24.8	31.8	226°36.4	11.0′	15°10.0	14.4′	58.4′
	SD = 15.9′	*d* = 0.8′	SD = 15.7′				

Wed	**GHA**	**Dec**	**GHA**	*ν*	**Dec**	*d*	**HP**
0	180°24.9	N12°32.6	241°06.5	11.0′	S14°55.6	14.5′	58.5′
1	195°25.0	33.4	255°36.5	11.1′	14°41.1	14.5′	58.5′
2	210°25.1	34.3	270°06.6	11.1′	14°26.6	14.7′	58.5′
3	225°25.3	·· 35.1	284°36.7	11.1′	14°11.9	14.8′	58.6′
4	240°25.4	35.9	299°06.8	11.1′	13°57.1	14.8′	58.6′
5	255°25.5	36.8	313°36.9	11.2′	13°42.3	15.0′	58.7′
6	270°25.6	N12°37.6	328°07.1	11.2′	S13°27.3	15.0′	58.7′
7	285°25.7	38.4	342°37.3	11.2′	13°12.3	15.1′	58.7′
8	300°25.8	39.2	357°07.5	11.2′	12°57.2	15.2′	58.8′
9	315°26.0	·· 40.1	11°37.8	11.3′	12°42.0	15.3′	58.8′
10	330°26.1	40.9	26°08.0	11.3′	12°26.7	15.4′	58.9′
11	345°26.2	41.7	40°38.3	11.3′	12°11.3	15.4′	58.9′
12	0°26.3	N12°42.6	55°08.6	11.3′	S11°55.9	15.6′	58.9′
13	15°26.4	43.4	69°38.9	11.3′	11°40.3	15.6′	59.0′
14	30°26.5	44.2	84°09.2	11.3′	11°24.7	15.7′	59.0′
15	45°26.6	·· 45.0	98°39.6	11.4′	11°09.0	15.8′	59.0′
16	60°26.7	45.9	113°09.9	11.4′	10°53.2	15.8′	59.1′
17	75°26.9	46.7	127°40.3	11.4′	10°37.4	16.0′	59.1′
18	90°27.0	N12°47.5	142°10.7	11.4′	S10°21.4	16.0′	59.2′
19	105°27.1	48.3	156°41.0	11.4′	10°05.4	16.0′	59.2′
20	120°27.2	49.2	171°11.4	11.4′	09°49.4	16.2′	59.2′
21	135°27.3	·· 50.0	185°41.9	11.4′	09°33.2	16.2′	59.3′
22	150°27.4	50.8	200°12.3	11.4′	09°17.0	16.3′	59.3′
23	165°27.5	51.6	214°42.7	11.4′	09°00.7	16.4′	59.3′
	SD = 15.9′	*d* = 0.8′	SD = 15.9′				

Thu	**GHA**	**Dec**	**GHA**	*ν*	**Dec**	*d*	**HP**
0	180°27.6	N12°52.5	229°13.1	11.4′	S08°44.3	16.4′	59.4′
1	195°27.8	53.3	243°43.6	11.4′	08°27.9	16.5′	59.4′
2	210°27.9	54.1	258°14.0	11.4′	08°11.4	16.5′	59.5′
3	225°28.0	·· 54.9	272°44.4	11.4′	07°54.9	16.7′	59.5′
4	240°28.1	55.8	287°14.9	11.4′	07°38.2	16.6′	59.5′
5	255°28.2	56.6	301°45.3	11.4′	07°21.6	16.8′	59.6′
6	270°28.3	N12°57.4	316°15.8	11.4′	S07°04.8	16.8′	59.6′
7	285°28.4	58.2	330°46.2	11.4′	06°48.0	16.8′	59.6′
8	300°28.5	59.0	345°16.6	11.4′	06°31.2	16.9′	59.7′
9	315°28.6	12°59.9	359°47.1	11.4′	06°14.3	17.0′	59.7′
10	330°28.8	13°00.7	14°17.5	11.4′	05°57.3	17.0′	59.7′
11	345°28.9	01.5	28°47.9	11.4′	05°40.3	17.0′	59.8′
12	0°29.0	N13°02.3	43°18.3	11.4′	S05°23.3	17.1′	59.8′
13	15°29.1	03.1	57°48.7	11.4′	05°06.2	17.2′	59.9′
14	30°29.2	04.0	72°19.1	11.4′	04°49.0	17.2′	59.9′
15	45°29.3	·· 04.8	86°49.5	11.4′	04°31.8	17.3′	59.9′
16	60°29.4	05.6	101°19.8	11.3′	04°14.5	17.2′	60.0′
17	75°29.5	06.4	115°50.2	11.3′	03°57.3	17.4′	60.0′
18	90°29.6	N13°07.2	130°20.5	11.3′	S03°39.9	17.3′	60.0′
19	105°29.7	08.1	144°50.8	11.3′	03°22.6	17.4′	60.1′
20	120°29.8	08.9	159°21.1	11.3′	03°05.2	17.5′	60.1′
21	135°29.9	·· 09.7	173°51.4	11.3′	02°47.7	17.5′	60.1′
22	150°30.1	10.5	188°21.6	11.2′	02°30.2	17.5′	60.2′
23	165°30.2	11.3	202°51.9	11.2′	02°12.7	17.5′	60.2′
	SD = 15.9′	*d* = 0.8′	SD = 16.2′				

Lat.	**Twilight** Naut.	**Twilight** Civil	**Sunrise**	**Sunset**	**Twilight** Civil	**Twilight** Naut.
N 72°	////	////	02:49	21:12	////	////
N 70°	////	01:27	03:14	20:46	22:39	////
68°	////	02:11	03:33	20:27	21:51	////
66°	////	02:39	03:48	20:11	21:22	////
64°	01:16	03:00	04:00	19:58	21:00	22:49
62°	01:55	03:17	04:11	19:48	20:42	22:06
60°	02:21	03:31	04:20	19:38	20:28	21:39
N 58°	02:41	03:42	04:28	19:31	20:16	21:19
56°	02:57	03:52	04:34	19:24	20:06	21:02
54°	03:10	04:01	04:40	19:17	19:57	20:48
52°	03:22	04:09	04:46	19:12	19:49	20:37
50°	03:32	04:16	04:51	19:07	19:42	20:27
45°	03:52	04:30	05:02	18:56	19:27	20:06
N 40°	04:07	04:42	05:10	18:47	19:15	19:50
35°	04:20	04:52	05:18	18:39	19:06	19:37
30°	04:30	05:00	05:25	18:32	18:57	19:27
20°	04:47	05:13	05:36	18:21	18:44	19:10
N 10°	04:59	05:24	05:46	18:11	18:32	18:58
0°	05:09	05:34	05:55	18:02	18:23	18:47
S 10°	05:18	05:42	06:04	17:52	18:14	18:39
20°	05:25	05:51	06:13	17:43	18:05	18:31
30°	05:31	06:00	06:24	17:32	17:57	18:25
35°	05:35	06:04	06:30	17:26	17:52	18:21
40°	05:38	06:09	06:37	17:19	17:47	18:18
45°	05:41	06:15	06:45	17:11	17:41	18:15
S 50°	05:43	06:21	06:55	17:01	17:34	18:12
52°	05:45	06:24	06:59	16:56	17:31	18:11
54°	05:46	06:27	07:04	16:52	17:28	18:10
56°	05:47	06:31	07:10	16:46	17:25	18:08
58°	05:48	06:34	07:16	16:40	17:21	18:07
S 60°	05:50	06:38	07:22	16:33	17:17	18:06

Lat.	**Moonrise** Tue	Wed	Thu	**Moonset** Tue	Wed	Thu
N 72°	▬	05:22	04:30	▬	11:32	14:09
N 70°	06:07	04:56	04:19	08:59	11:55	14:17
68°	05:17	04:37	04:10	09:47	12:12	14:23
66°	04:45	04:21	04:03	10:18	12:27	14:28
64°	04:22	04:08	03:56	10:40	12:38	14:32
62°	04:03	03:56	03:51	10:58	12:48	14:35
60°	03:47	03:47	03:46	11:13	12:56	14:38
N 58°	03:33	03:38	03:42	11:25	13:03	14:41
56°	03:22	03:31	03:38	11:36	13:10	14:44
54°	03:12	03:24	03:34	11:45	13:15	14:46
52°	03:03	03:18	03:31	11:54	13:20	14:48
50°	02:54	03:13	03:28	12:01	13:25	14:49
45°	02:37	03:01	03:22	12:17	13:35	14:53
N 40°	02:23	02:51	03:17	12:30	13:43	14:56
35°	02:10	02:43	03:12	12:41	13:50	14:59
30°	02:00	02:35	03:08	12:51	13:56	15:02
20°	01:41	02:22	03:01	13:07	14:06	15:06
N 10°	01:25	02:11	02:55	13:21	14:15	15:09
0°	01:10	02:00	02:49	13:34	14:24	15:12
S 10°	00:55	01:49	02:43	13:47	14:32	15:16
20°	00:38	01:38	02:37	14:01	14:41	15:19
30°	00:19	01:24	02:30	14:17	14:51	15:23
35°	00:08	01:17	02:26	14:26	14:56	15:25
40°	·· ··	01:08	02:21	14:36	15:03	15:28
45°	·· ··	00:58	02:16	14:48	15:10	15:30
S 50°	·· ··	00:45	02:09	15:02	15:19	15:34
52°	·· ··	00:39	02:06	15:09	15:23	15:35
54°	·· ··	00:32	02:03	15:16	15:27	15:37
56°	·· ··	00:25	01:59	15:25	15:32	15:39
58°	·· ··	00:17	01:55	15:34	15:38	15:41
S 60°	·· ··	00:07	01:50	15:44	15:44	15:43

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 24-26 40-20%
22	01:28	01:34	11:58	07:22	19:47	
23	01:40	01:45	11:58	08:12	20:36	
24	01:51	01:56	11:58	09:01	21:25	

April 25, 26, 27 UT (Fri., Sat., Sun.)

	Aries	Venus		Mars		Jupiter		Saturn	
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	213°15.8	216°39.9	N00°52.3	87°33.2	N21°34.1	133°55.1	N22°49.6	215°01.2	S02°55.5
1	228°18.3	231°41.3	52.3	102°34.5	33.8	148°57.0	49.6	230°03.4	55.4
2	243°20.7	246°42.6	52.3	117°35.8	33.5	163°59.0	49.6	245°05.6	55.3
3	258°23.2	261°43.9	·· 52.2	132°37.2	·· 33.2	179°00.9	·· 49.7	260°07.9	·· 55.2
4	273°25.7	276°45.2	52.2	147°38.5	32.9	194°02.9	49.7	275°10.1	55.1
5	288°28.1	291°46.6	52.2	162°39.8	32.6	209°04.8	49.8	290°12.3	55.0
6	303°30.6	306°47.9	N00°52.2	177°41.1	N21°32.3	224°06.7	N22°49.8	305°14.5	S02°54.9
7	318°33.1	321°49.2	52.2	192°42.5	32.0	239°08.7	49.8	320°16.7	54.8
8	333°35.5	336°50.5	52.2	207°43.8	31.7	254°10.6	49.9	335°18.9	54.7
9	348°38.0	351°51.8	·· 52.1	222°45.1	·· 31.4	269°12.6	·· 49.9	350°21.2	·· 54.6
10	3°40.4	6°53.1	52.1	237°46.5	31.1	284°14.5	50.0	5°23.4	54.5
11	18°42.9	21°54.5	52.1	252°47.8	30.8	299°16.5	50.0	20°25.6	54.4
12	33°45.4	36°55.8	N00°52.1	267°49.1	N21°30.5	314°18.4	N22°50.0	35°27.8	S02°54.3
13	48°47.8	51°57.1	52.1	282°50.4	30.1	329°20.3	50.1	50°30.0	54.2
14	63°50.3	66°58.4	52.1	297°51.8	29.8	344°22.3	50.1	65°32.3	54.1
15	78°52.8	81°59.7	·· 52.1	312°53.1	·· 29.5	359°24.2	·· 50.2	80°34.5	·· 54.0
16	93°55.2	97°01.0	52.1	327°54.4	29.2	14°26.1	50.2	95°36.7	53.9
17	108°57.7	112°02.3	52.1	342°55.8	28.9	29°28.1	50.2	110°38.9	53.8
18	124°00.2	127°03.5	N00°52.1	357°57.1	N21°28.6	44°30.0	N22°50.3	125°41.1	S02°53.7
19	139°02.6	142°04.8	52.1	12°58.4	28.3	59°32.0	50.3	140°43.3	53.6
20	154°05.1	157°06.1	52.1	27°59.7	28.0	74°33.9	50.4	155°45.6	53.5
21	169°07.5	172°07.4	·· 52.1	43°01.1	·· 27.7	89°35.8	·· 50.4	170°47.8	·· 53.4
22	184°10.0	187°08.7	52.1	58°02.4	27.4	104°37.8	50.4	185°50.0	53.3
23	199°12.5	202°10.0	52.2	73°03.7	27.1	119°39.7	50.5	200°52.2	53.2
Mer.pass. 09:45		ν 1.3′	d 0.0′	m -4.75	ν 1.3′	d 0.3′	m 0.85	ν 1.9′	d 0.0′ m -2.00	ν 2.2′	d 0.1′ m 1.17

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	214°14.9	217°11.2	N00°52.2	88°05.0	N21°26.8	134°41.7	N22°50.5	215°54.4	S02°53.1
1	229°17.4	232°12.5	52.2	103°06.4	26.5	149°43.6	50.6	230°56.7	53.0
2	244°19.9	247°13.8	52.2	118°07.7	26.1	164°45.5	50.6	245°58.9	52.9
3	259°22.3	262°15.1	·· 52.2	133°09.0	·· 25.8	179°47.5	·· 50.6	261°01.1	·· 52.8
4	274°24.8	277°16.3	52.2	148°10.3	25.5	194°49.4	50.7	276°03.3	52.7
5	289°27.3	292°17.6	52.2	163°11.7	25.2	209°51.3	50.7	291°05.5	52.6
6	304°29.7	307°18.9	N00°52.3	178°13.0	N21°24.9	224°53.3	N22°50.8	306°07.8	S02°52.5
7	319°32.2	322°20.1	52.3	193°14.3	24.6	239°55.2	50.8	321°10.0	52.4
8	334°34.7	337°21.4	52.3	208°15.6	24.3	254°57.2	50.9	336°12.2	52.3
9	349°37.1	352°22.6	·· 52.3	223°16.9	·· 24.0	269°59.1	·· 50.9	351°14.4	·· 52.2
10	4°39.6	7°23.9	52.4	238°18.3	23.7	285°01.0	50.9	6°16.6	52.1
11	19°42.0	22°25.1	52.4	253°19.6	23.4	300°03.0	51.0	21°18.9	52.0
12	34°44.5	37°26.4	N00°52.4	268°20.9	N21°23.0	315°04.9	N22°51.0	36°21.1	S02°51.9
13	49°47.0	52°27.6	52.5	283°22.2	22.7	330°06.8	51.1	51°23.3	51.8
14	64°49.4	67°28.9	52.5	298°23.5	22.4	345°08.8	51.1	66°25.5	51.7
15	79°51.9	82°30.1	·· 52.5	313°24.9	·· 22.1	0°10.7	·· 51.1	81°27.7	·· 51.6
16	94°54.4	97°31.4	52.6	328°26.2	21.8	15°12.7	51.2	96°30.0	51.5
17	109°56.8	112°32.6	52.6	343°27.5	21.5	30°14.6	51.2	111°32.2	51.4
18	124°59.3	127°33.8	N00°52.6	358°28.8	N21°21.2	45°16.5	N22°51.3	126°34.4	S02°51.3
19	140°01.8	142°35.1	52.7	13°30.1	20.9	60°18.5	51.3	141°36.6	51.2
20	155°04.2	157°36.3	52.7	28°31.5	20.5	75°20.4	51.3	156°38.8	51.1
21	170°06.7	172°37.5	·· 52.8	43°32.8	·· 20.2	90°22.3	·· 51.4	171°41.1	·· 51.0
22	185°09.2	187°38.7	52.8	58°34.1	19.9	105°24.3	51.4	186°43.3	50.9
23	200°11.6	202°40.0	52.8	73°35.4	19.6	120°26.2	51.5	201°45.5	50.8
Mer.pass. 09:41		ν 1.3′	d 0.0′	m -4.75	ν 1.3′	d 0.3′	m 0.87	ν 1.9′	d 0.0′ m -2.00	ν 2.2′	d 0.1′ m 1.17

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	215°14.1	217°41.2	N00°52.9	88°36.7	N21°19.3	135°28.1	N22°51.5	216°47.7	S02°50.7
1	230°16.5	232°42.4	52.9	103°38.0	19.0	150°30.1	51.5	231°49.9	50.6
2	245°19.0	247°43.6	53.0	118°39.4	18.7	165°32.0	51.6	246°52.2	50.5
3	260°21.5	262°44.8	·· 53.0	133°40.7	·· 18.4	180°33.9	·· 51.6	261°54.4	·· 50.4
4	275°23.9	277°46.0	53.1	148°42.0	18.0	195°35.9	51.7	276°56.6	50.3
5	290°26.4	292°47.3	53.2	163°43.3	17.7	210°37.8	51.7	291°58.8	50.2
6	305°28.9	307°48.5	N00°53.2	178°44.6	N21°17.4	225°39.7	N22°51.7	307°01.1	S02°50.2
7	320°31.3	322°49.7	53.3	193°45.9	17.1	240°41.7	51.8	322°03.3	50.1
8	335°33.8	337°50.9	53.3	208°47.3	16.8	255°43.6	51.8	337°05.5	50.0
9	350°36.3	352°52.1	·· 53.4	223°48.6	·· 16.5	270°45.5	·· 51.9	352°07.7	·· 49.9
10	5°38.7	7°53.3	53.4	238°49.9	16.2	285°47.5	51.9	7°09.9	49.8
11	20°41.2	22°54.5	53.5	253°51.2	15.8	300°49.4	51.9	22°12.2	49.7
12	35°43.6	37°55.7	N00°53.6	268°52.5	N21°15.5	315°51.3	N22°52.0	37°14.4	S02°49.6
13	50°46.1	52°56.8	53.6	283°53.8	15.2	330°53.3	52.0	52°16.6	49.5
14	65°48.6	67°58.0	53.7	298°55.1	14.9	345°55.2	52.0	67°18.8	49.4
15	80°51.0	82°59.2	·· 53.8	313°56.4	·· 14.6	0°57.1	·· 52.1	82°21.0	·· 49.3
16	95°53.5	98°00.4	53.9	328°57.8	14.3	15°59.1	52.1	97°23.3	49.2
17	110°56.0	113°01.6	53.9	343°59.1	13.9	31°01.0	52.2	112°25.5	49.1
18	125°58.4	128°02.8	N00°54.0	359°00.4	N21°13.6	46°02.9	N22°52.2	127°27.7	S02°49.0
19	141°00.9	143°03.9	54.1	14°01.7	13.3	61°04.9	52.2	142°29.9	48.9
20	156°03.4	158°05.1	54.2	29°03.0	13.0	76°06.8	52.3	157°32.2	48.8
21	171°05.8	173°06.3	·· 54.2	44°04.3	·· 12.7	91°08.7	·· 52.3	172°34.4	·· 48.7
22	186°08.3	188°07.5	54.3	59°05.6	12.4	106°10.7	52.4	187°36.6	48.6
23	201°10.8	203°08.6	54.4	74°06.9	12.0	121°12.6	52.4	202°38.8	48.5
Mer.pass. 09:37		ν 1.2′	d 0.0′	m -4.74	ν 1.3′	d 0.3′	m 0.88	ν 1.9′	d 0.0′ m -2.00	ν 2.2′	d 0.1′ m 1.17

Stars	SHA	Dec
Alpheratz	357°34.9	29°13.6
Ankaa	353°07.3	-42°10.1
Schedar	349°31.3	56°40.4
Diphda	348°47.4	-17°50.9
Achernar	335°20.6	-57°06.5
Hamal	327°51.3	23°34.8
Polaris	314°25.0	89°22.3
Acamar	315°12.0	-40°12.3
Menkar	314°06.2	4°11.3
Mirfak	308°28.4	49°57.1
Aldebaran	290°39.7	16°33.6
Rigel	281°03.9	-8°10.4
Capella	280°21.9	46°01.5
Bellatrix	278°22.9	6°22.3
Elnath	278°01.9	28°37.7
Alnilam	275°37.7	-1°11.2
Betelgeuse	270°52.1	7°24.7
Canopus	263°52.6	-52°42.8
Sirius	258°26.2	-16°45.2
Adhara	255°05.8	-29°00.6
Procyon	244°50.7	5°09.6
Pollux	243°17.1	27°58.0
Avior	234°14.7	-59°35.7
Suhail	222°46.1	-43°32.3
Miaplacidus	221°38.1	-69°49.5
Alphard	217°47.5	-8°46.2
Regulus	207°34.1	11°50.6
Dubhe	193°40.3	61°37.0
Denebola	182°24.5	14°25.8
Gienah	175°43.1	-17°41.1
Acrux	172°59.3	-63°14.6
Gacrux	171°50.9	-57°15.5
Alioth	166°12.2	55°49.4
Spica	158°21.8	-11°17.7
Alkaid	152°51.3	49°11.2
Hadar	148°35.1	-60°29.8
Menkent	147°57.0	-36°29.8
Arcturus	145°47.4	19°02.9
Rigil Kent.	139°39.4	-60°56.5
Kochab	137°18.6	74°03.0
Zuben'ubi	136°55.4	-16°08.9
Alphecca	126°03.2	26°37.6
Antares	112°15.3	-26°29.3
Atria	107°08.9	-69°04.2
Sabik	102°02.3	-15°45.4
Shaula	96°09.8	-37°07.3
Rasalhague	95°58.1	12°32.3
Eltanin	90°41.8	51°28.8
Kaus Aust.	83°32.0	-34°22.3
Vega	80°32.9	38°48.1
Nunki	75°47.3	-26°15.9
Altair	61°59.7	8°55.9
Peacock	53°05.3	-56°39.0
Deneb	49°25.7	45°21.9
Enif	33°38.7	9°59.3
Al Na'ir	27°32.8	-46°50.2
Fomalhaut	15°14.5	-29°29.3
Scheat	13°45.2	28°13.0
Markab	13°29.9	15°20.3

Apr 25 Fri	SHA	Mer.pass
Venus	3°24.1	09:32
Mars	234°17.4	18:08
Jupiter	280°39.3	15:02
Saturn	1°45.4	09:38

Apr 26 Sat	SHA	Mer.pass
Venus	2°56.3	09:30
Mars	233°50.1	18:06
Jupiter	280°26.7	14:59
Saturn	1°39.5	09:35

Apr 27 Sun	SHA	Mer.pass
Venus	2°27.1	09:28
Mars	233°22.6	18:04
Jupiter	280°14.1	14:56
Saturn	1°33.6	09:31

Horizontal parallax	
Venus:	0.3
Mars:	0.1

h	Sun		Moon				
Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°30.3	N13°12.1	217°22.1	11.2′	S01°55.2	17.6′	60.2′
1	195°30.4	12.9	231°52.2	11.2′	01°37.6	17.6′	60.2′
2	210°30.5	13.8	246°22.4	11.1′	01°20.0	17.6′	60.3′
3	225°30.6	·· 14.6	260°52.5	11.1′	01°02.4	17.7′	60.3′
4	240°30.7	15.4	275°22.6	11.1′	00°44.7	17.6′	60.3′
5	255°30.8	16.2	289°52.7	11.0′	00°27.1	17.7′	60.4′
6	270°30.9	N13°17.0	304°22.7	11.0′	S00°09.4	17.8′	60.4′
7	285°31.0	17.8	318°52.7	11.0′	N00°08.4	17.7′	60.4′
8	300°31.1	18.6	333°22.7	10.9′	00°26.1	17.7′	60.5′
9	315°31.2	·· 19.5	347°52.6	10.9′	00°43.8	17.8′	60.5′
10	330°31.3	20.3	2°22.5	10.9′	01°01.6	17.8′	60.5′
11	345°31.4	21.1	16°52.4	10.8′	01°19.4	17.7′	60.5′
12	0°31.5	N13°21.9	31°22.2	10.8′	N01°37.1	17.8′	60.6′
13	15°31.6	22.7	45°52.0	10.7′	01°54.9	17.8′	60.6′
14	30°31.7	23.5	60°21.7	10.7′	02°12.7	17.8′	60.6′
15	45°31.8	·· 24.3	74°51.4	10.6′	02°30.5	17.8′	60.6′
16	60°31.9	25.1	89°21.0	10.6′	02°48.3	17.8′	60.7′
17	75°32.0	25.9	103°50.6	10.5′	03°06.1	17.8′	60.7′
18	90°32.1	N13°26.7	118°20.2	10.5′	N03°23.9	17.8′	60.7′
19	105°32.3	27.5	132°49.7	10.4′	03°41.7	17.8′	60.7′
20	120°32.4	28.4	147°19.1	10.4′	03°59.5	17.8′	60.8′
21	135°32.5	·· 29.2	161°48.5	10.3′	04°17.3	17.8′	60.8′
22	150°32.6	30.0	176°17.9	10.3′	04°35.1	17.8′	60.8′
23	165°32.7	30.8	190°47.2	10.2′	04°52.9	17.7′	60.8′
	SD = 15.9′	d = 0.8′	SD = 16.4′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°32.8	N13°31.6	205°16.4	10.2′	N05°10.6	17.8′	60.9′
1	195°32.9	32.4	219°45.6	10.1′	05°28.4	17.7′	60.9′
2	210°33.0	33.2	234°14.7	10.1′	05°46.1	17.7′	60.9′
3	225°33.1	·· 34.0	248°43.8	10.0′	06°03.8	17.7′	60.9′
4	240°33.2	34.8	263°12.7	9.9′	06°21.5	17.6′	60.9′
5	255°33.3	35.6	277°41.7	9.9′	06°39.1	17.6′	61.0′
6	270°33.4	N13°36.4	292°10.6	9.8′	N06°56.7	17.6′	61.0′
7	285°33.5	37.2	306°39.4	9.7′	07°14.3	17.6′	61.0′
8	300°33.6	38.0	321°08.1	9.7′	07°31.9	17.6′	61.0′
9	315°33.7	·· 38.8	335°36.8	9.6′	07°49.5	17.5′	61.0′
10	330°33.8	39.6	350°05.4	9.5′	08°07.0	17.4′	61.1′
11	345°33.9	40.4	4°33.9	9.5′	08°24.4	17.5′	61.1′
12	0°34.0	N13°41.2	19°02.4	9.4′	N08°41.9	17.3′	61.1′
13	15°34.1	42.0	33°30.8	9.3′	08°59.2	17.4′	61.1′
14	30°34.2	42.8	47°59.1	9.2′	09°16.6	17.3′	61.1′
15	45°34.3	·· 43.6	62°27.3	9.2′	09°33.9	17.3′	61.1′
16	60°34.4	44.4	76°55.5	9.1′	09°51.2	17.2′	61.2′
17	75°34.5	45.2	91°23.6	9.0′	10°08.4	17.1′	61.2′
18	90°34.5	N13°46.0	105°51.6	8.9′	N10°25.5	17.1′	61.2′
19	105°34.6	46.8	120°19.5	8.9′	10°42.6	17.1′	61.2′
20	120°34.7	47.6	134°47.4	8.8′	10°59.7	16.9′	61.2′
21	135°34.8	·· 48.4	149°15.2	8.7′	11°16.6	17.0′	61.2′
22	150°34.9	49.2	163°42.9	8.6′	11°33.6	16.8′	61.2′
23	165°35.0	50.0	178°10.5	8.5′	11°50.4	16.8′	61.2′
	SD = 15.9′	d = 0.8′	SD = 16.6′				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°35.1	N13°50.8	192°38.0	8.4′	N12°07.2	16.7′	61.2′
1	195°35.2	51.6	207°05.4	8.4′	12°23.9	16.7′	61.3′
2	210°35.3	52.4	221°32.8	8.3′	12°40.6	16.6′	61.3′
3	225°35.4	·· 53.2	236°00.1	8.2′	12°57.2	16.5′	61.3′
4	240°35.5	54.0	250°27.2	8.1′	13°13.7	16.4′	61.3′
5	255°35.6	54.8	264°54.3	8.0′	13°30.1	16.4′	61.3′
6	270°35.7	N13°55.6	279°21.3	7.9′	N13°46.5	16.3′	61.3′
7	285°35.8	56.4	293°48.2	7.8′	14°02.8	16.1′	61.3′
8	300°35.9	57.2	308°15.0	7.7′	14°18.9	16.1′	61.3′
9	315°36.0	·· 58.0	322°41.8	7.6′	14°35.0	16.1′	61.3′
10	330°36.1	58.7	337°08.4	7.5′	14°51.1	15.9′	61.3′
11	345°36.2	13°59.5	351°34.9	7.4′	15°07.0	15.8′	61.3′
12	0°36.3	N14°00.3	6°01.4	7.4′	N15°22.8	15.7′	61.3′
13	15°36.4	01.1	20°27.7	7.3′	15°38.5	15.7′	61.3′
14	30°36.4	01.9	34°54.0	7.2′	15°54.2	15.5′	61.3′
15	45°36.5	·· 02.7	49°20.2	7.1′	16°09.7	15.5′	61.3′
16	60°36.6	03.5	63°46.2	7.0′	16°25.2	15.3′	61.3′
17	75°36.7	04.3	78°12.2	6.9′	16°40.5	15.2′	61.3′
18	90°36.8	N14°05.1	92°38.1	6.8′	N16°55.7	15.1′	61.3′
19	105°36.9	05.9	107°03.8	6.7′	17°10.8	15.0′	61.3′
20	120°37.0	06.6	121°29.5	6.6′	17°25.8	14.9′	61.3′
21	135°37.1	·· 07.4	135°55.1	6.5′	17°40.7	14.8′	61.3′
22	150°37.2	08.2	150°20.6	6.4′	17°55.5	14.6′	61.3′
23	165°37.3	09.0	164°45.9	6.3′	18°10.1	14.5′	61.3′
	SD = 15.9′	d = 0.8′	SD = 16.7′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	////	////	02:29	21:32	////	////
N 70°	////	00:48	02:58	21:02	23:28	////
68°	////	01:50	03:19	20:39	22:12	////
66°	////	02:23	03:36	20:22	21:37	////
64°	00:42	02:47	03:50	20:08	21:12	23:32
62°	01:37	03:06	04:01	19:56	20:53	22:25
60°	02:07	03:21	04:11	19:46	20:37	21:52
N 58°	02:29	03:33	04:20	19:37	20:24	21:29
56°	02:47	03:44	04:27	19:30	20:13	21:11
54°	03:01	03:54	04:34	19:23	20:03	20:56
52°	03:14	04:02	04:40	19:17	19:55	20:44
50°	03:24	04:09	04:45	19:11	19:47	20:33
45°	03:46	04:25	04:57	18:59	19:31	20:11
N 40°	04:03	04:38	05:06	18:50	19:19	19:54
35°	04:16	04:48	05:15	18:41	19:08	19:40
30°	04:27	04:57	05:22	18:34	18:59	19:29
20°	04:44	05:11	05:34	18:22	18:45	19:12
N 10°	04:58	05:23	05:45	18:11	18:33	18:58
0°	05:08	05:33	05:54	18:01	18:22	18:47
S 10°	05:18	05:43	06:04	17:51	18:13	18:38
20°	05:26	05:52	06:14	17:41	18:03	18:30
30°	05:33	06:01	06:26	17:29	17:54	18:22
35°	05:37	06:07	06:33	17:22	17:48	18:18
40°	05:40	06:12	06:40	17:15	17:43	18:15
45°	05:44	06:18	06:49	17:06	17:36	18:11
S 50°	05:48	06:26	06:59	16:55	17:29	18:07
52°	05:49	06:29	07:04	16:51	17:26	18:05
54°	05:51	06:32	07:10	16:45	17:22	18:04
56°	05:52	06:36	07:15	16:39	17:18	18:02
58°	05:54	06:40	07:22	16:32	17:14	18:00
S 60°	05:56	06:45	07:30	16:25	17:09	17:59

Lat.	**Moonrise** Fri	Sat	Sun	**Moonset** Fri	Sat	Sun
N 72°	03:50	03:11	02:21	16:39	19:21	
N 70°	03:49	03:19	02:42	16:35	19:02	22:06
68°	03:48	03:26	03:00	16:31	18:47	21:24
66°	03:47	03:31	03:13	16:28	18:35	20:56
64°	03:46	03:36	03:25	16:26	18:25	20:35
62°	03:46	03:40	03:35	16:24	18:17	20:18
60°	03:45	03:44	03:44	16:22	18:10	20:04
N 58°	03:44	03:47	03:51	16:21	18:04	19:53
56°	03:44	03:50	03:58	16:19	17:58	19:42
54°	03:44	03:53	04:04	16:18	17:54	19:33
52°	03:43	03:55	04:09	16:17	17:49	19:25
50°	03:43	03:58	04:14	16:16	17:45	19:18
45°	03:42	04:03	04:25	16:14	17:37	19:03
N 40°	03:42	04:07	04:34	16:12	17:30	18:50
35°	03:41	04:10	04:42	16:10	17:23	18:40
30°	03:41	04:14	04:49	16:09	17:18	18:31
20°	03:40	04:19	05:01	16:06	17:09	18:15
N 10°	03:39	04:24	05:12	16:04	17:01	18:01
0°	03:38	04:29	05:22	16:02	16:53	17:48
S 10°	03:38	04:34	05:32	16:00	16:46	17:36
20°	03:37	04:39	05:43	15:58	16:38	17:22
30°	03:36	04:45	05:56	15:55	16:29	17:07
35°	03:36	04:48	06:03	15:54	16:24	16:58
40°	03:36	04:52	06:12	15:52	16:18	16:48
45°	03:35	04:57	06:22	15:50	16:11	16:36
S 50°	03:35	05:02	06:34	15:48	16:03	16:22
52°	03:34	05:05	06:39	15:47	16:00	16:15
54°	03:34	05:08	06:46	15:46	15:56	16:08
56°	03:34	05:11	06:53	15:45	15:51	16:00
58°	03:33	05:15	07:01	15:43	15:46	15:51
S 60°	03:33	05:19	07:10	15:42	15:41	15:40

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 27-0 12-1%
25	02:01	02:06	11:58	09:50	22:15	
26	02:11	02:16	11:58	10:41	23:08	
27	02:21	02:25	11:58	11:35	–:–	

April 28, 29, 30 UT (Mon., Tue., Wed.)

	Aries	Venus		Mars		Jupiter		Saturn	
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	216°13.2	218°09.8	N00°54.5	89°08.2	N21°11.7	136°14.5	N22°52.4	217°41.1	S02°48.4
1	231°15.7	233°11.0	54.6	104°09.6	11.4	151°16.5	52.5	232°43.3	48.3
2	246°18.1	248°12.1	54.6	119°10.9	11.1	166°18.4	52.5	247°45.5	48.2
3	261°20.6	263°13.3	·· 54.7	134°12.2	·· 10.8	181°20.3	·· 52.6	262°47.7	·· 48.1
4	276°23.1	278°14.4	54.8	149°13.5	10.5	196°22.3	52.6	277°49.9	48.0
5	291°25.5	293°15.6	54.9	164°14.8	10.1	211°24.2	52.6	292°52.2	47.9
6	306°28.0	308°16.7	N00°55.0	179°16.1	N21°09.8	226°26.1	N22°52.7	307°54.4	S02°47.8
7	321°30.5	323°17.9	55.1	194°17.4	09.5	241°28.0	52.7	322°56.6	47.7
8	336°32.9	338°19.0	55.2	209°18.7	09.2	256°30.0	52.8	337°58.8	47.6
9	351°35.4	353°20.2	·· 55.3	224°20.0	·· 08.9	271°31.9	·· 52.8	353°01.1	·· 47.5
10	6°37.9	8°21.3	55.4	239°21.3	08.5	286°33.8	52.8	8°03.3	47.4
11	21°40.3	23°22.5	55.5	254°22.6	08.2	301°35.8	52.9	23°05.5	47.3
12	36°42.8	38°23.6	N00°55.6	269°23.9	N21°07.9	316°37.7	N22°52.9	38°07.7	S02°47.2
13	51°45.3	53°24.8	55.7	284°25.2	07.6	331°39.6	53.0	53°10.0	47.1
14	66°47.7	68°25.9	55.8	299°26.6	07.3	346°41.6	53.0	68°12.2	47.0
15	81°50.2	83°27.0	·· 55.9	314°27.9	·· 06.9	1°43.5	·· 53.0	83°14.4	·· 46.9
16	96°52.6	98°28.2	56.0	329°29.2	06.6	16°45.4	53.1	98°16.6	46.8
17	111°55.1	113°29.3	56.1	344°30.5	06.3	31°47.3	53.1	113°18.9	46.7
18	126°57.6	128°30.4	N00°56.2	359°31.8	N21°06.0	46°49.3	N22°53.1	128°21.1	S02°46.7
19	142°00.0	143°31.5	56.3	14°33.1	05.7	61°51.2	53.2	143°23.3	46.6
20	157°02.5	158°32.7	56.4	29°34.4	05.3	76°53.1	53.2	158°25.5	46.5
21	172°05.0	173°33.8	·· 56.5	44°35.7	·· 05.0	91°55.1	·· 53.3	173°27.8	·· 46.4
22	187°07.4	188°34.9	56.6	59°37.0	04.7	106°57.0	53.3	188°30.0	46.3
23	202°09.9	203°36.0	56.8	74°38.3	04.4	121°58.9	53.3	203°32.2	46.2
Mer.pass. 09:34		ν 1.2′	d 0.1′	m -4.74	ν 1.3′	d 0.3′	m 0.90	ν 1.9′	d 0.0′ m -1.99	ν 2.2′	d 0.1′ m 1.17

Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	217°12.4	218°37.1	N00°56.9	89°39.6	N21°04.0	137°00.8	N22°53.4	218°34.4	S02°46.1
1	232°14.8	233°38.2	57.0	104°40.9	03.7	152°02.8	53.4	233°36.7	46.0
2	247°17.3	248°39.3	57.1	119°42.2	03.4	167°04.7	53.5	248°38.9	45.9
3	262°19.7	263°40.5	·· 57.2	134°43.5	·· 03.1	182°06.6	·· 53.5	263°41.1	·· 45.8
4	277°22.2	278°41.6	57.4	149°44.8	02.8	197°08.5	53.5	278°43.3	45.7
5	292°24.7	293°42.7	57.5	164°46.1	02.4	212°10.5	53.6	293°45.6	45.6
6	307°27.1	308°43.8	N00°57.6	179°47.4	N21°02.1	227°12.4	N22°53.6	308°47.8	S02°45.5
7	322°29.6	323°44.9	57.7	194°48.7	01.8	242°14.3	53.7	323°50.0	45.4
8	337°32.1	338°46.0	57.9	209°50.0	01.5	257°16.3	53.7	338°52.2	45.3
9	352°34.5	353°47.1	·· 58.0	224°51.3	·· 01.1	272°18.2	·· 53.7	353°54.5	·· 45.2
10	7°37.0	8°48.2	58.1	239°52.6	00.8	287°20.1	53.8	8°56.7	45.1
11	22°39.5	23°49.2	58.2	254°53.9	00.5	302°22.0	53.8	23°58.9	45.0
12	37°41.9	38°50.3	N00°58.4	269°55.2	N21°00.2	317°24.0	N22°53.8	39°01.1	S02°44.9
13	52°44.4	53°51.4	58.5	284°56.5	20°59.8	332°25.9	53.9	54°03.4	44.8
14	67°46.9	68°52.5	58.7	299°57.8	59.5	347°27.8	53.9	69°05.6	44.7
15	82°49.3	83°53.6	·· 58.8	314°59.1	·· 59.2	2°29.7	·· 54.0	84°07.8	·· 44.6
16	97°51.8	98°54.7	58.9	330°00.4	58.9	17°31.7	54.0	99°10.0	44.5
17	112°54.2	113°55.7	59.1	345°01.7	58.5	32°33.6	54.0	114°12.3	44.4
18	127°56.7	128°56.8	N00°59.2	0°03.0	N20°58.2	47°35.5	N22°54.1	129°14.5	S02°44.3
19	142°59.2	143°57.9	59.4	15°04.3	57.9	62°37.4	54.1	144°16.7	44.3
20	158°01.6	158°59.0	59.5	30°05.6	57.6	77°39.4	54.2	159°18.9	44.2
21	173°04.1	174°00.0	·· 59.6	45°06.9	·· 57.2	92°41.3	·· 54.2	174°21.2	·· 44.1
22	188°06.6	189°01.1	59.8	60°08.2	56.9	107°43.2	54.2	189°23.4	44.0
23	203°09.0	204°02.2	59.9	75°09.5	56.6	122°45.1	54.3	204°25.6	43.9
Mer.pass. 09:30		ν 1.1′	d 0.1′	m -4.73	ν 1.3′	d 0.3′	m 0.91	ν 1.9′	d 0.0′ m -1.99	ν 2.2′	d 0.1′ m 1.17

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	218°11.5	219°03.2	N01°00.1	90°10.8	N20°56.3	137°47.1	N22°54.3	219°27.8	S02°43.8
1	233°14.0	234°04.3	00.2	105°12.1	55.9	152°49.0	54.3	234°30.1	43.7
2	248°16.4	249°05.4	00.4	120°13.4	55.6	167°50.9	54.4	249°32.3	43.6
3	263°18.9	264°06.4	·· 00.5	135°14.7	·· 55.3	182°52.8	·· 54.4	264°34.5	·· 43.5
4	278°21.4	279°07.5	00.7	150°16.0	54.9	197°54.8	54.5	279°36.8	43.4
5	293°23.8	294°08.5	00.9	165°17.3	54.6	212°56.7	54.5	294°39.0	43.3
6	308°26.3	309°09.6	N01°01.0	180°18.5	N20°54.3	227°58.6	N22°54.5	309°41.2	S02°43.2
7	323°28.7	324°10.6	01.2	195°19.8	54.0	243°00.5	54.6	324°43.4	43.1
8	338°31.2	339°11.7	01.3	210°21.1	53.6	258°02.5	54.6	339°45.7	43.0
9	353°33.7	354°12.7	·· 01.5	225°22.4	·· 53.3	273°04.4	·· 54.6	354°47.9	·· 42.9
10	8°36.1	9°13.8	01.7	240°23.7	53.0	288°06.3	54.7	9°50.1	42.8
11	23°38.6	24°14.8	01.8	255°25.0	52.6	303°08.2	54.7	24°52.3	42.7
12	38°41.1	39°15.9	N01°02.0	270°26.3	N20°52.3	318°10.2	N22°54.8	39°54.6	S02°42.6
13	53°43.5	54°16.9	02.1	285°27.6	52.0	333°12.1	54.8	54°56.8	42.5
14	68°46.0	69°17.9	02.3	300°28.9	51.7	348°14.0	54.8	69°59.0	42.4
15	83°48.5	84°19.0	·· 02.5	315°30.2	·· 51.3	3°15.9	·· 54.9	85°01.3	·· 42.4
16	98°50.9	99°20.0	02.7	330°31.5	51.0	18°17.8	54.9	100°03.5	42.3
17	113°53.4	114°21.0	02.8	345°32.8	50.7	33°19.8	55.0	115°05.7	42.2
18	128°55.9	129°22.1	N01°03.0	0°34.1	N20°50.3	48°21.7	N22°55.0	130°07.9	S02°42.1
19	143°58.3	144°23.1	03.2	15°35.3	50.0	63°23.6	55.0	145°10.2	42.0
20	159°00.8	159°24.1	03.4	30°36.6	49.7	78°25.5	55.1	160°12.4	41.9
21	174°03.2	174°25.1	·· 03.5	45°37.9	·· 49.3	93°27.5	·· 55.1	175°14.6	·· 41.8
22	189°05.7	189°26.2	03.7	60°39.2	49.0	108°29.4	55.1	190°16.9	41.7
23	204°08.2	204°27.2	03.9	75°40.5	48.7	123°31.3	55.2	205°19.1	41.6
Mer.pass. 09:26		ν 1.1′	d 0.2′	m -4.72	ν 1.3′	d 0.3′	m 0.92	ν 1.9′	d 0.0′ m -1.99	ν 2.2′	d 0.1′ m 1.17

Stars

	SHA	Dec
Alpheratz	357°34.8	29°13.6
Ankaa	353°07.3	-42°10.0
Schedar	349°31.3	56°40.4
Diphda	348°47.4	-17°50.9
Achernar	335°20.6	-57°06.4
Hamal	327°51.3	23°34.8
Polaris	314°24.9	89°22.3
Acamar	315°12.0	-40°12.2
Menkar	314°06.2	4°11.3
Mirfak	308°28.4	49°57.0
Aldebaran	290°39.7	16°33.6
Rigel	281°03.9	-8°10.4
Capella	280°21.9	46°01.5
Bellatrix	278°22.9	6°22.3
Elnath	278°01.9	28°37.7
Alnilam	275°37.7	-1°11.2
Betelgeuse	270°52.1	7°24.7
Canopus	263°52.6	-52°42.7
Sirius	258°26.2	-16°45.2
Adhara	255°05.9	-29°00.6
Procyon	244°50.7	5°09.6
Pollux	243°17.1	27°58.0
Avior	234°14.7	-59°35.7
Suhail	222°46.1	-43°32.3
Miaplacidus	221°38.2	-69°49.5
Alphard	217°47.5	-8°46.2
Regulus	207°34.1	11°50.6
Dubhe	193°40.3	61°37.1
Denebola	182°24.5	14°25.8
Gienah	175°43.1	-17°41.1
Acrux	172°59.3	-63°14.6
Gacrux	171°50.9	-57°15.5
Alioth	166°12.2	55°49.4
Spica	158°21.8	-11°17.7
Alkaid	152°51.3	49°11.2
Hadar	148°35.1	-60°29.8
Menkent	147°57.0	-36°29.8
Arcturus	145°47.4	19°02.9
Rigil Kent.	139°39.4	-60°56.5
Kochab	137°18.6	74°03.0
Zuben'ubi	136°55.4	-16°08.9
Alphecca	126°03.2	26°37.6
Antares	112°15.2	-26°29.3
Atria	107°08.8	-69°04.2
Sabik	102°02.3	-15°45.4
Shaula	96°09.8	-37°07.3
Rasalhague	95°58.1	12°32.3
Eltanin	90°41.7	51°28.8
Kaus Aust.	83°32.0	-34°22.3
Vega	80°32.9	38°48.1
Nunki	75°47.3	-26°15.9
Altair	61°59.7	8°55.9
Peacock	53°05.3	-56°39.0
Deneb	49°25.7	45°21.9
Enif	33°38.7	9°59.3
Al Na'ir	27°32.8	-46°50.2
Fomalhaut	15°14.5	-29°29.2
Scheat	13°45.2	28°13.0
Markab	13°29.9	15°20.3

Apr 28 Mon	SHA	Mer.pass
Venus	1°56.6	09:27
Mars	232°55.0	18:02
Jupiter	280°01.3	14:53
Saturn	1°27.8	09:28

Apr 29 Tue	SHA	Mer.pass
Venus	1°24.8	09:25
Mars	232°27.2	18:00
Jupiter	279°48.5	14:50
Saturn	1°22.1	09:24

Apr 30 Wed	SHA	Mer.pass
Venus	0°51.7	09:23
Mars	231°59.3	17:58
Jupiter	279°35.6	14:47
Saturn	1°16.3	09:21

Horizontal parallax	
Venus:	0.3
Mars:	0.1

h

Mon	Sun GHA	Sun Dec	Moon GHA	ν	Moon Dec	d	HP
0	180°37.4	N14°09.8	179°11.2	6.2′	N18°24.6	14.5′	61.3′
1	195°37.5	10.6	193°36.4	6.1′	18°39.1	14.2′	61.3′
2	210°37.5	11.4	208°01.5	6.0′	18°53.3	14.2′	61.3′
3	225°37.6	·· 12.2	222°26.5	5.9′	19°07.5	14.0′	61.3′
4	240°37.7	12.9	236°51.4	5.8′	19°21.5	13.9′	61.3′
5	255°37.8	13.7	251°16.2	5.7′	19°35.4	13.8′	61.3′
6	270°37.9	N14°14.5	265°40.8	5.6′	N19°49.2	13.6′	61.3′
7	285°38.0	15.3	280°05.4	5.5′	20°02.8	13.5′	61.3′
8	300°38.1	16.1	294°29.9	5.4′	20°16.3	13.3′	61.2′
9	315°38.2	·· 16.9	308°54.3	5.3′	20°29.6	13.2′	61.2′
10	330°38.3	17.6	323°18.6	5.2′	20°42.8	13.0′	61.2′
11	345°38.4	18.4	337°42.8	5.1′	20°55.8	12.9′	61.2′
12	0°38.4	N14°19.2	352°06.9	5.0′	N21°08.7	12.8′	61.2′
13	15°38.5	20.0	6°31.0	4.9′	21°21.5	12.6′	61.2′
14	30°38.6	20.8	20°54.9	4.8′	21°34.1	12.4′	61.2′
15	45°38.7	·· 21.6	35°18.7	4.7′	21°46.5	12.3′	61.2′
16	60°38.8	22.3	49°42.4	4.6′	21°58.8	12.2′	61.2′
17	75°38.9	23.1	64°06.1	4.5′	22°11.0	11.9′	61.1′
18	90°39.0	N14°23.9	78°29.6	4.5′	N22°22.9	11.8′	61.1′
19	105°39.0	24.7	92°53.1	4.4′	22°34.7	11.7′	61.1′
20	120°39.1	25.4	107°16.4	4.3′	22°46.4	11.5′	61.1′
21	135°39.2	·· 26.2	121°39.7	4.2′	22°57.9	11.3′	61.1′
22	150°39.3	27.0	136°02.9	4.1′	23°09.2	11.1′	61.1′
23	165°39.4	27.8	150°26.0	4.0′	23°20.3	11.0′	61.0′
	SD = 15.9′	d = 0.8′	SD = 16.7′				

Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	180°39.5	N14°28.6	164°49.0	3.9′	N23°31.3	10.8′	61.0′
1	195°39.6	29.3	179°11.9	3.8′	23°42.1	10.6′	61.0′
2	210°39.6	30.1	193°34.8	3.8′	23°52.7	10.5′	61.0′
3	225°39.7	·· 30.9	207°57.5	3.7′	24°03.2	10.2′	61.0′
4	240°39.8	31.7	222°20.2	3.6′	24°13.4	10.1′	61.0′
5	255°39.9	32.4	236°42.8	3.5′	24°23.5	9.9′	60.9′
6	270°40.0	N14°33.2	251°05.3	3.5′	N24°33.4	9.8′	60.9′
7	285°40.1	34.0	265°27.8	3.4′	24°43.2	9.5′	60.9′
8	300°40.2	34.8	279°50.2	3.3′	24°52.7	9.4′	60.9′
9	315°40.2	·· 35.5	294°12.5	3.2′	25°02.1	9.1′	60.8′
10	330°40.3	36.3	308°34.7	3.2′	25°11.2	9.0′	60.8′
11	345°40.4	37.1	322°56.9	3.1′	25°20.2	8.8′	60.8′
12	0°40.5	N14°37.9	337°19.0	3.0′	N25°29.0	8.6′	60.8′
13	15°40.6	38.6	351°41.1	3.0′	25°37.6	8.4′	60.8′
14	30°40.7	39.4	6°03.0	2.9′	25°46.0	8.2′	60.7′
15	45°40.7	·· 40.2	20°25.0	2.9′	25°54.2	8.0′	60.7′
16	60°40.8	40.9	34°46.8	2.8′	26°02.2	7.8′	60.7′
17	75°40.9	41.7	49°08.6	2.8′	26°10.0	7.6′	60.7′
18	90°41.0	N14°42.5	63°30.4	2.7′	N26°17.6	7.4′	60.6′
19	105°41.1	43.2	77°52.1	2.7′	26°25.0	7.3′	60.6′
20	120°41.1	44.0	92°13.8	2.6′	26°32.3	7.0′	60.6′
21	135°41.2	·· 44.8	106°35.4	2.6′	26°39.3	6.8′	60.5′
22	150°41.3	45.5	120°56.9	2.5′	26°46.1	6.6′	60.5′
23	165°41.4	46.3	135°18.5	2.5′	26°52.7	6.4′	60.5′
	SD = 15.9′	d = 0.8′	SD = 16.6′				

Wed	GHA	Dec	GHA	ν	Dec	d	HP
0	180°41.5	N14°47.1	149°40.0	2.5′	N26°59.1	6.2′	60.5′
1	195°41.5	47.8	164°01.4	2.4′	27°05.3	6.0′	60.4′
2	210°41.6	48.6	178°22.9	2.4′	27°11.3	5.8′	60.4′
3	225°41.7	·· 49.4	192°44.3	2.4′	27°17.1	5.6′	60.4′
4	240°41.8	50.1	207°05.6	2.3′	27°22.7	5.4′	60.3′
5	255°41.9	50.9	221°27.0	2.3′	27°28.1	5.2′	60.3′
6	270°41.9	N14°51.7	235°48.3	2.3′	N27°33.3	4.9′	60.3′
7	285°42.0	52.4	250°09.6	2.3′	27°38.2	4.8′	60.2′
8	300°42.1	53.2	264°30.9	2.3′	27°43.0	4.5′	60.2′
9	315°42.2	·· 54.0	278°52.2	2.3′	27°47.5	4.4′	60.2′
10	330°42.2	54.7	293°13.4	2.3′	27°51.9	4.1′	60.2′
11	345°42.3	55.5	307°34.7	2.3′	27°56.0	3.9′	60.1′
12	0°42.4	N14°56.3	321°56.0	2.3′	N27°59.9	3.7′	60.1′
13	15°42.5	57.0	336°17.2	2.3′	28°03.6	3.5′	60.1′
14	30°42.6	57.8	350°38.5	2.3′	28°07.1	3.3′	60.0′
15	45°42.6	·· 58.5	4°59.8	2.3′	28°10.4	3.1′	60.0′
16	60°42.7	14°59.3	19°21.0	2.3′	28°13.5	2.9′	60.0′
17	75°42.8	15°00.1	33°42.3	2.3′	28°16.4	2.7′	59.9′
18	90°42.9	N15°00.8	48°03.6	2.3′	N28°19.1	2.4′	59.9′
19	105°42.9	01.6	62°24.9	2.3′	28°21.5	2.3′	59.8′
20	120°43.0	02.3	76°46.3	2.4′	28°23.8	2.0′	59.8′
21	135°43.1	·· 03.1	91°07.6	2.4′	28°25.8	1.8′	59.8′
22	150°43.2	03.8	105°29.0	2.4′	28°27.6	1.6′	59.7′
23	165°43.2	04.6	119°50.4	2.5′	28°29.2	1.5′	59.7′
	SD = 15.9′	d = 0.8′	SD = 16.5′				

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	////	////	02:07	21:54	////	////
N 70°	////	////	02:41	21:18	////	////
68°	////	01:25	03:06	20:52	22:38	////
66°	////	02:06	03:25	20:33	21:53	////
64°	////	02:33	03:40	20:17	21:25	////
62°	01:15	02:54	03:52	20:04	21:03	22:47
60°	01:52	03:11	04:03	19:53	20:46	22:07
N 58°	02:17	03:25	04:12	19:44	20:32	21:40
56°	02:37	03:36	04:20	19:36	20:20	21:20
54°	02:53	03:47	04:27	19:28	20:10	21:04
52°	03:06	03:55	04:34	19:22	20:00	20:51
50°	03:17	04:03	04:40	19:16	19:52	20:39
45°	03:40	04:20	04:52	19:03	19:36	20:15
N 40°	03:58	04:33	05:02	18:53	19:22	19:58
35°	04:12	04:44	05:11	18:44	19:11	19:43
30°	04:24	04:54	05:19	18:36	19:01	19:32
20°	04:42	05:09	05:32	18:23	18:46	19:13
N 10°	04:56	05:22	05:43	18:11	18:33	18:59
0°	05:08	05:33	05:54	18:01	18:22	18:47
S 10°	05:18	05:43	06:04	17:50	18:12	18:37
20°	05:27	05:53	06:15	17:39	18:02	18:28
30°	05:35	06:03	06:28	17:26	17:51	18:19
35°	05:39	06:09	06:35	17:19	17:45	18:15
40°	05:43	06:15	06:43	17:11	17:39	18:11
45°	05:47	06:22	06:53	17:01	17:32	18:07
S 50°	05:52	06:30	07:04	16:50	17:24	18:02
52°	05:54	06:33	07:09	16:45	17:20	18:00
54°	05:55	06:37	07:15	16:39	17:16	17:58
56°	05:58	06:42	07:21	16:32	17:12	17:56
58°	06:00	06:46	07:29	16:25	17:07	17:54
S 60°	06:02	06:51	07:37	16:17	17:02	17:52

Lat.	Moonrise Mon	Moonrise Tue	Moonrise Wed	Moonset Mon	Moonset Tue	Moonset Wed
N 72°	▭	▭	▭	▭	▭	▭
N 70°	01:36	▭	▭	▭	▭	▭
68°	02:19	▭	▭	▭	▭	▭
66°	02:49	01:46	▭	·· ··	00:05	▭
64°	03:11	02:48	▭	23:04	▭	▭
62°	03:29	03:23	03:11	22:30	·· ··	00:54
60°	03:44	03:48	04:00	22:05	·· ··	00:06
N 58°	03:57	04:09	04:31	21:46	23:36	·· ··
56°	04:09	04:25	04:54	21:29	23:12	·· ··
54°	04:19	04:40	05:14	21:16	22:54	·· ··
52°	04:27	04:53	05:30	21:04	22:38	23:58
50°	04:35	05:04	05:44	20:53	22:24	23:42
45°	04:53	05:27	06:13	20:31	21:56	23:11
N 40°	05:07	05:46	06:35	20:13	21:34	22:47
35°	05:19	06:02	06:54	19:58	21:16	22:28
30°	05:29	06:16	07:10	19:45	21:00	22:11
20°	05:48	06:40	07:38	19:24	20:34	21:42
N 10°	06:04	07:00	08:02	19:05	20:11	21:17
0°	06:19	07:20	08:24	18:47	19:50	20:55
S 10°	06:34	07:39	08:46	18:30	19:29	20:32
20°	06:51	08:00	09:10	18:11	19:06	20:07
30°	07:10	08:25	09:38	17:50	18:40	19:38
35°	07:21	08:39	09:55	17:37	18:25	19:21
40°	07:34	08:56	10:14	17:23	18:07	19:02
45°	07:49	09:17	10:38	17:06	17:46	18:38
S 50°	08:08	09:42	11:08	16:46	17:19	18:07
52°	08:17	09:55	11:24	16:36	17:06	17:51
54°	08:28	10:09	11:41	16:25	16:51	17:34
56°	08:39	10:26	12:03	16:13	16:34	17:12
58°	08:53	10:46	12:30	15:58	16:13	16:44
S 60°	09:08	11:12	13:09	15:42	15:47	16:05

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 1-3 0-7%
28	02:29	02:34	11:57	12:33	00:03	
29	02:38	02:42	11:57	13:35	01:03	
30	02:46	02:50	11:57	14:39	02:07	

May 01, 02, 03 UT (Thu., Fri., Sat.)

	Aries	Venus		Mars		Jupiter		Saturn	
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	219°10.6	219°28.2	N01°04.1	90°41.8	N20°48.4	138°33.2	N22°55.2	220°21.3	S02°41.5
1	234°13.1	234°29.2	04.3	105°43.1	48.0	153°35.1	55.3	235°23.5	41.4
2	249°15.6	249°30.2	04.4	120°44.4	47.7	168°37.1	55.3	250°25.8	41.3
3	264°18.0	264°31.2	·· 04.6	135°45.7	·· 47.4	183°39.0	·· 55.3	265°28.0	·· 41.2
4	279°20.5	279°32.2	04.8	150°47.0	47.0	198°40.9	55.4	280°30.2	41.1
5	294°23.0	294°33.2	05.0	165°48.2	46.7	213°42.8	55.4	295°32.5	41.0
6	309°25.4	309°34.3	N01°05.2	180°49.5	N20°46.4	228°44.8	N22°55.4	310°34.7	S02°40.9
7	324°27.9	324°35.3	05.4	195°50.8	46.0	243°46.7	55.5	325°36.9	40.8
8	339°30.4	339°36.3	05.6	210°52.1	45.7	258°48.6	55.5	340°39.1	40.7
9	354°32.8	354°37.3	·· 05.8	225°53.4	·· 45.4	273°50.5	·· 55.6	355°41.4	·· 40.7
10	9°35.3	9°38.3	06.0	240°54.7	45.0	288°52.4	55.6	10°43.6	40.6
11	24°37.7	24°39.2	06.2	255°56.0	44.7	303°54.4	55.6	25°45.8	40.5
12	39°40.2	39°40.2	N01°06.3	270°57.3	N20°44.4	318°56.3	N22°55.7	40°48.1	S02°40.4
13	54°42.7	54°41.2	06.5	285°58.5	44.0	333°58.2	55.7	55°50.3	40.3
14	69°45.1	69°42.2	06.7	300°59.8	43.7	349°00.1	55.7	70°52.5	40.2
15	84°47.6	84°43.2	·· 06.9	316°01.1	·· 43.4	4°02.0	·· 55.8	85°54.8	·· 40.1
16	99°50.1	99°44.2	07.1	331°02.4	43.0	19°04.0	55.8	100°57.0	40.0
17	114°52.5	114°45.2	07.4	346°03.7	42.7	34°05.9	55.9	115°59.2	39.9
18	129°55.0	129°46.2	N01°07.6	1°05.0	N20°42.4	49°07.8	N22°55.9	131°01.4	S02°39.8
19	144°57.5	144°47.1	07.8	16°06.3	42.0	64°09.7	55.9	146°03.7	39.7
20	159°59.9	159°48.1	08.0	31°07.5	41.7	79°11.6	56.0	161°05.9	39.6
21	175°02.4	174°49.1	·· 08.2	46°08.8	·· 41.4	94°13.5	·· 56.0	176°08.1	·· 39.5
22	190°04.9	189°50.1	08.4	61°10.1	41.0	109°15.5	56.0	191°10.4	39.4
23	205°07.3	204°51.0	08.6	76°11.4	40.7	124°17.4	56.1	206°12.6	39.3
Mer.pass. 09:22		ν 1.0′	d 0.2′	m -4.72	ν 1.3′	d 0.3′	m 0.94	ν 1.9′	d 0.0′ m -1.98	ν 2.2′	d 0.1′ m 1.17

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	220°09.8	219°52.0	N01°08.8	91°12.7	N20°40.4	139°19.3	N22°56.1	221°14.8	S02°39.2
1	235°12.2	234°53.0	09.0	106°14.0	40.0	154°21.2	56.1	236°17.1	39.2
2	250°14.7	249°54.0	09.2	121°15.2	39.7	169°23.1	56.2	251°19.3	39.1
3	265°17.2	264°54.9	·· 09.5	136°16.5	·· 39.3	184°25.1	·· 56.2	266°21.5	·· 39.0
4	280°19.6	279°55.9	09.7	151°17.8	39.0	199°27.0	56.3	281°23.8	38.9
5	295°22.1	294°56.8	09.9	166°19.1	38.7	214°28.9	56.3	296°26.0	38.8
6	310°24.6	309°57.8	N01°10.1	181°20.4	N20°38.3	229°30.8	N22°56.3	311°28.2	S02°38.7
7	325°27.0	324°58.8	10.3	196°21.6	38.0	244°32.7	56.4	326°30.4	38.6
8	340°29.5	339°59.7	10.6	211°22.9	37.7	259°34.6	56.4	341°32.7	38.5
9	355°32.0	355°00.7	·· 10.8	226°24.2	·· 37.3	274°36.6	·· 56.4	356°34.9	·· 38.4
10	10°34.4	10°01.6	11.0	241°25.5	37.0	289°38.5	56.5	11°37.1	38.3
11	25°36.9	25°02.6	11.2	256°26.8	36.6	304°40.4	56.5	26°39.4	38.2
12	40°39.4	40°03.5	N01°11.5	271°28.0	N20°36.3	319°42.3	N22°56.6	41°41.6	S02°38.1
13	55°41.8	55°04.5	11.7	286°29.3	36.0	334°44.2	56.6	56°43.8	38.0
14	70°44.3	70°05.4	11.9	301°30.6	35.6	349°46.2	56.6	71°46.1	37.9
15	85°46.7	85°06.4	·· 12.2	316°31.9	·· 35.3	4°48.1	·· 56.7	86°48.3	·· 37.9
16	100°49.2	100°07.3	12.4	331°33.2	35.0	19°50.0	56.7	101°50.5	37.8
17	115°51.7	115°08.2	12.6	346°34.4	34.6	34°51.9	56.7	116°52.8	37.7
18	130°54.1	130°09.2	N01°12.9	1°35.7	N20°34.3	49°53.8	N22°56.8	131°55.0	S02°37.6
19	145°56.6	145°10.1	13.1	16°37.0	33.9	64°55.7	56.8	146°57.2	37.5
20	160°59.1	160°11.1	13.3	31°38.3	33.6	79°57.6	56.8	161°59.5	37.4
21	176°01.5	175°12.0	·· 13.6	46°39.6	·· 33.3	94°59.6	·· 56.9	177°01.7	·· 37.3
22	191°04.0	190°12.9	13.8	61°40.8	32.9	110°01.5	56.9	192°03.9	37.2
23	206°06.5	205°13.8	14.0	76°42.1	32.6	125°03.4	57.0	207°06.2	37.1
Mer.pass. 09:18		ν 1.0′	d 0.2′	m -4.71	ν 1.3′	d 0.3′	m 0.95	ν 1.9′	d 0.0′ m -1.98	ν 2.2′	d 0.1′ m 1.17

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	221°08.9	220°14.8	N01°14.3	91°43.4	N20°32.2	140°05.3	N22°57.0	222°08.4	S02°37.0
1	236°11.4	235°15.7	14.5	106°44.7	31.9	155°07.2	57.0	237°10.6	36.9
2	251°13.8	250°16.6	14.8	121°45.9	31.6	170°09.1	57.1	252°12.9	36.8
3	266°16.3	265°17.5	·· 15.0	136°47.2	·· 31.2	185°11.1	·· 57.1	267°15.1	·· 36.7
4	281°18.8	280°18.5	15.3	151°48.5	30.9	200°13.0	57.1	282°17.3	36.7
5	296°21.2	295°19.4	15.5	166°49.8	30.5	215°14.9	57.2	297°19.6	36.6
6	311°23.7	310°20.3	N01°15.8	181°51.1	N20°30.2	230°16.8	N22°57.2	312°21.8	S02°36.5
7	326°26.2	325°21.2	16.0	196°52.3	29.9	245°18.7	57.2	327°24.0	36.4
8	341°28.6	340°22.1	16.3	211°53.6	29.5	260°20.6	57.3	342°26.3	36.3
9	356°31.1	355°23.0	·· 16.5	226°54.9	·· 29.2	275°22.5	·· 57.3	357°28.5	·· 36.2
10	11°33.6	10°24.0	16.8	241°56.2	28.8	290°24.5	57.4	12°30.7	36.1
11	26°36.0	25°24.9	17.0	256°57.4	28.5	305°26.4	57.4	27°33.0	36.0
12	41°38.5	40°25.8	N01°17.3	271°58.7	N20°28.1	320°28.3	N22°57.4	42°35.2	S02°35.9
13	56°41.0	55°26.7	17.6	287°00.0	27.8	335°30.2	57.5	57°37.4	35.8
14	71°43.4	70°27.6	17.8	302°01.2	27.5	350°32.1	57.5	72°39.7	35.7
15	86°45.9	85°28.5	·· 18.1	317°02.5	·· 27.1	5°34.0	·· 57.5	87°41.9	·· 35.6
16	101°48.3	100°29.4	18.3	332°03.8	26.8	20°35.9	57.6	102°44.1	35.6
17	116°50.8	115°30.3	18.6	347°05.1	26.4	35°37.9	57.6	117°46.4	35.5
18	131°53.3	130°31.2	N01°18.9	2°06.3	N20°26.1	50°39.8	N22°57.6	132°48.6	S02°35.4
19	146°55.7	145°32.1	19.1	17°07.6	25.7	65°41.7	57.7	147°50.8	35.3
20	161°58.2	160°33.0	19.4	32°08.9	25.4	80°43.6	57.7	162°53.1	35.2
21	177°00.7	175°33.8	·· 19.7	47°10.2	·· 25.1	95°45.5	·· 57.8	177°55.3	·· 35.1
22	192°03.1	190°34.7	19.9	62°11.4	24.7	110°47.4	57.8	192°57.5	35.0
23	207°05.6	205°35.6	20.2	77°12.7	24.4	125°49.3	57.8	207°59.8	34.9
Mer.pass. 09:14		ν 0.9′	d 0.2′	m -4.70	ν 1.3′	d 0.3′	m 0.97	ν 1.9′	d 0.0′ m -1.98	ν 2.2′	d 0.1′ m 1.17

Stars

	SHA	Dec
Alpheratz	357°34.8	29°13.6
Ankaa	353°07.2	-42°10.0
Schedar	349°31.3	56°40.4
Diphda	348°47.3	-17°50.9
Achernar	335°20.5	-57°06.4
Hamal	327°51.3	23°34.8
Polaris	314°24.6	89°22.3
Acamar	315°12.0	-40°12.2
Menkar	314°06.2	4°11.3
Mirfak	308°28.4	49°57.0
Aldebaran	290°39.7	16°33.6
Rigel	281°03.9	-8°10.4
Capella	280°21.9	46°01.5
Bellatrix	278°22.9	6°22.3
Elnath	278°01.9	28°37.7
Alnilam	275°37.7	-1°11.2
Betelgeuse	270°52.1	7°24.7
Canopus	263°52.6	-52°42.7
Sirius	258°26.2	-16°45.2
Adhara	255°05.9	-29°00.6
Procyon	244°50.7	5°09.6
Pollux	243°17.1	27°58.0
Avior	234°14.8	-59°35.7
Suhail	222°46.1	-43°32.3
Miaplacidus	221°38.2	-69°49.5
Alphard	217°47.5	-8°46.2
Regulus	207°34.1	11°50.6
Dubhe	193°40.3	61°37.1
Denebola	182°24.5	14°25.8
Gienah	175°43.1	-17°41.1
Acrux	172°59.3	-63°14.6
Gacrux	171°50.9	-57°15.5
Alioth	166°12.2	55°49.4
Spica	158°21.7	-11°17.7
Alkaid	152°51.3	49°11.2
Hadar	148°35.1	-60°29.8
Menkent	147°57.0	-36°29.8
Arcturus	145°47.4	19°02.9
Rigil Kent.	139°39.3	-60°56.5
Kochab	137°18.6	74°03.0
Zuben'ubi	136°55.4	-16°08.9
Alphecca	126°03.2	26°37.6
Antares	112°15.2	-26°29.3
Atria	107°08.8	-69°04.3
Sabik	102°02.2	-15°45.4
Shaula	96°09.7	-37°07.3
Rasalhague	95°58.1	12°32.3
Eltanin	90°41.7	51°28.8
Kaus Aust.	83°32.0	-34°22.3
Vega	80°32.8	38°48.1
Nunki	75°47.3	-26°15.9
Altair	61°59.6	8°55.9
Peacock	53°05.3	-56°39.0
Deneb	49°25.6	45°21.9
Enif	33°38.6	9°59.3
Al Na'ir	27°32.7	-46°50.1
Fomalhaut	15°14.4	-29°29.2
Scheat	13°45.2	28°13.0
Markab	13°29.8	15°20.3

May 01 Thu	SHA	Mer.pass
Venus	0°17.6	09:21
Mars	231°31.2	17:56
Jupiter	279°22.6	14:44
Saturn	1°10.7	09:17

May 02 Fri	SHA	Mer.pass
Venus	359°42.2	09:20
Mars	231°02.9	17:54
Jupiter	279°09.5	14:41
Saturn	1°05.1	09:14

May 03 Sat	SHA	Mer.pass
Venus	359°05.9	09:18
Mars	230°34.5	17:52
Jupiter	278°56.4	14:38
Saturn	0°59.5	09:10

Horizontal parallax	
Venus:	0.3
Mars:	0.1

h

	Sun		Moon				
Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°43.3	N15°05.4	134°11.9	2.5′	N28°30.7	1.2′	59.7′
1	195°43.4	06.1	148°33.4	2.5′	28°31.9	1.0′	59.6′
2	210°43.5	06.9	162°54.9	2.6′	28°32.9	0.8′	59.6′
3	225°43.5	·· 07.6	177°16.5	2.6′	28°33.7	0.6′	59.6′
4	240°43.6	08.4	191°38.1	2.7′	28°34.3	0.3′	59.5′
5	255°43.7	09.1	205°59.7	2.7′	28°34.6	0.2′	59.5′
6	270°43.8	N15°09.9	220°21.5	2.8′	N28°34.8	0.0′	59.5′
7	285°43.8	10.6	234°43.2	2.8′	28°34.8	0.2′	59.4′
8	300°43.9	11.4	249°05.0	2.9′	28°34.6	0.4′	59.4′
9	315°44.0	·· 12.1	263°26.9	2.9′	28°34.2	0.7′	59.3′
10	330°44.0	12.9	277°48.9	3.0′	28°33.5	0.8′	59.3′
11	345°44.1	13.7	292°10.9	3.1′	28°32.7	1.0′	59.3′
12	0°44.2	N15°14.4	306°32.9	3.1′	N28°31.7	1.2′	59.2′
13	15°44.3	15.2	320°55.1	3.2′	28°30.5	1.5′	59.2′
14	30°44.3	15.9	335°17.3	3.3′	28°29.0	1.6′	59.1′
15	45°44.4	·· 16.7	349°39.6	3.4′	28°27.4	1.8′	59.1′
16	60°44.5	17.4	4°01.9	3.4′	28°25.6	2.0′	59.1′
17	75°44.5	18.2	18°24.4	3.5′	28°23.6	2.2′	59.0′
18	90°44.6	N15°18.9	32°46.9	3.6′	N28°21.4	2.3′	59.0′
19	105°44.7	19.6	47°09.5	3.7′	28°19.1	2.6′	59.0′
20	120°44.8	20.4	61°32.2	3.8′	28°16.5	2.8′	58.9′
21	135°44.8	·· 21.1	75°55.0	3.9′	28°13.7	2.9′	58.9′
22	150°44.9	21.9	90°17.8	4.0′	28°10.8	3.2′	58.8′
23	165°45.0	22.6	104°40.8	4.1′	28°07.6	3.3′	58.8′
	SD = 15.9′	d = 0.8′	SD = 16.3′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°45.0	N15°23.4	119°03.9	4.2′	N28°04.3	3.5′	58.8′
1	195°45.1	24.1	133°27.0	4.3′	28°00.8	3.6′	58.7′
2	210°45.2	24.9	147°50.3	4.4′	27°57.2	3.9′	58.7′
3	225°45.2	·· 25.6	162°13.6	4.5′	27°53.3	4.0′	58.6′
4	240°45.3	26.4	176°37.1	4.6′	27°49.3	4.3′	58.6′
5	255°45.4	27.1	191°00.6	4.7′	27°45.0	4.3′	58.6′
6	270°45.4	N15°27.8	205°24.3	4.8′	N27°40.7	4.6′	58.5′
7	285°45.5	28.6	219°48.1	4.9′	27°36.1	4.7′	58.5′
8	300°45.6	29.3	234°12.0	5.0′	27°31.4	4.9′	58.4′
9	315°45.6	·· 30.1	248°36.0	5.1′	27°26.5	5.1′	58.4′
10	330°45.7	30.8	263°00.1	5.2′	27°21.4	5.3′	58.4′
11	345°45.8	31.6	277°24.3	5.3′	27°16.1	5.4′	58.3′
12	0°45.8	N15°32.3	291°48.7	5.5′	N27°10.7	5.5′	58.3′
13	15°45.9	33.0	306°13.1	5.6′	27°05.2	5.8′	58.2′
14	30°46.0	33.8	320°37.7	5.7′	26°59.4	5.8′	58.2′
15	45°46.0	·· 34.5	335°02.4	5.8′	26°53.6	6.1′	58.2′
16	60°46.1	35.3	349°27.2	5.9′	26°47.5	6.2′	58.1′
17	75°46.2	36.0	3°52.1	6.1′	26°41.3	6.4′	58.1′
18	90°46.2	N15°36.7	18°17.2	6.2′	N26°34.9	6.5′	58.0′
19	105°46.3	37.5	32°42.4	6.3′	26°28.4	6.6′	58.0′
20	120°46.4	38.2	47°07.7	6.4′	26°21.8	6.8′	58.0′
21	135°46.4	·· 38.9	61°33.1	6.6′	26°15.0	7.0′	57.9′
22	150°46.5	39.7	75°58.6	6.7′	26°08.0	7.1′	57.9′
23	165°46.6	40.4	90°24.3	6.8′	26°00.9	7.3′	57.8′
	SD = 15.9′	d = 0.7′	SD = 16.0′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°46.6	N15°41.2	104°50.1	6.9′	N25°53.6	7.4′	57.8′
1	195°46.7	41.9	119°16.1	7.1′	25°46.2	7.5′	57.8′
2	210°46.7	42.6	133°42.1	7.2′	25°38.7	7.7′	57.7′
3	225°46.8	·· 43.4	148°08.3	7.3′	25°31.0	7.8′	57.7′
4	240°46.9	44.1	162°34.6	7.4′	25°23.2	8.0′	57.7′
5	255°46.9	44.8	177°01.1	7.6′	25°15.2	8.0′	57.6′
6	270°47.0	N15°45.6	191°27.6	7.7′	N25°07.2	8.3′	57.6′
7	285°47.1	46.3	205°54.3	7.8′	24°58.9	8.3′	57.5′
8	300°47.1	47.0	220°21.2	8.0′	24°50.6	8.5′	57.5′
9	315°47.2	·· 47.7	234°48.1	8.1′	24°42.1	8.6′	57.5′
10	330°47.2	48.5	249°15.2	8.2′	24°33.5	8.7′	57.4′
11	345°47.3	49.2	263°42.4	8.4′	24°24.8	8.9′	57.4′
12	0°47.4	N15°49.9	278°09.8	8.5′	N24°15.9	8.9′	57.3′
13	15°47.4	50.7	292°37.3	8.6′	24°07.0	9.1′	57.3′
14	30°47.5	51.4	307°04.9	8.7′	23°57.9	9.3′	57.3′
15	45°47.5	·· 52.1	321°32.6	8.9′	23°48.6	9.3′	57.2′
16	60°47.6	52.9	336°00.5	9.0′	23°39.3	9.4′	57.2′
17	75°47.7	53.6	350°28.5	9.1′	23°29.9	9.6′	57.2′
18	90°47.7	N15°54.3	4°56.6	9.3′	N23°20.3	9.7′	57.1′
19	105°47.8	55.0	19°24.9	9.4′	23°10.6	9.7′	57.1′
20	120°47.8	55.8	33°53.3	9.5′	23°00.9	9.9′	57.0′
21	135°47.9	·· 56.5	48°21.8	9.6′	22°51.0	10.0′	57.0′
22	150°48.0	57.2	62°50.4	9.8′	22°41.0	10.1′	57.0′
23	165°48.0	57.9	77°19.2	9.9′	22°30.9	10.2′	56.9′
	SD = 15.9′	d = 0.7′	SD = 15.8′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	////	////	01:42	22:20	////	////
N 70°	////	////	02:24	21:35	////	////
68°	////	00:52	02:52	21:06	23:16	////
66°	////	01:48	03:13	20:44	22:12	////
64°	////	02:20	03:29	20:27	21:38	////
62°	00:46	02:43	03:43	20:13	21:14	23:21
60°	01:36	03:01	03:55	20:01	20:55	22:23
N 58°	02:05	03:16	04:05	19:51	20:40	21:52
56°	02:27	03:29	04:13	19:42	20:27	21:30
54°	02:44	03:40	04:21	19:34	20:16	21:12
52°	02:58	03:49	04:28	19:27	20:06	20:58
50°	03:10	03:58	04:34	19:21	19:58	20:45
45°	03:35	04:15	04:48	19:07	19:40	20:20
N 40°	03:53	04:29	04:59	18:56	19:25	20:01
35°	04:08	04:41	05:08	18:46	19:14	19:46
30°	04:21	04:51	05:16	18:38	19:04	19:34
20°	04:40	05:07	05:30	18:24	18:47	19:14
N 10°	04:55	05:20	05:42	18:12	18:34	18:59
0°	05:07	05:32	05:54	18:00	18:22	18:47
S 10°	05:18	05:43	06:05	17:49	18:11	18:36
20°	05:27	05:54	06:16	17:37	18:00	18:26
30°	05:36	06:05	06:30	17:24	17:49	18:17
35°	05:41	06:11	06:37	17:16	17:42	18:12
40°	05:46	06:18	06:46	17:07	17:36	18:08
45°	05:50	06:25	06:56	16:57	17:28	18:03
S 50°	05:56	06:34	07:08	16:45	17:19	17:58
52°	05:58	06:38	07:14	16:39	17:15	17:55
54°	06:00	06:42	07:20	16:33	17:11	17:53
56°	06:03	06:47	07:27	16:26	17:06	17:50
58°	06:05	06:52	07:35	16:18	17:01	17:48
S 60°	06:08	06:58	07:44	16:09	16:55	17:45

Lat.	**Moonrise** Thu	Fri	Sat	**Moonset** Thu	Fri	Sat
N 72°						
N 70°						
68°						
66°						
64°			06:26			04:10
62°		04:57	07:15		03:36	03:20
60°	04:37	06:00	07:46	01:45	02:33	02:48
N 58°	05:17	06:34	08:10	01:05	01:59	02:25
56°	05:45	06:59	08:28	00:37	01:34	02:05
54°	06:06	07:19	08:44	00:16	01:13	01:49
52°	06:24	07:36	08:58	·· ··	00:56	01:35
50°	06:40	07:50	09:09	·· ··	00:42	01:23
45°	07:11	08:20	09:34	·· ··	00:12	00:57
N 40°	07:35	08:42	09:53	23:49	·· ··	00:37
35°	07:55	09:01	10:10	23:29	·· ··	00:20
30°	08:12	09:17	10:23	23:13	·· ··	00:05
20°	08:40	09:45	10:47	22:45	23:40	·· ··
N 10°	09:05	10:08	11:08	22:21	23:18	·· ··
0°	09:28	10:30	11:27	21:58	22:58	23:52
S 10°	09:51	10:52	11:46	21:35	22:37	23:35
20°	10:16	11:15	12:06	21:11	22:15	23:16
30°	10:45	11:42	12:29	20:43	21:49	22:54
35°	11:02	11:58	12:43	20:26	21:34	22:42
40°	11:22	12:16	12:59	20:06	21:16	22:27
45°	11:46	12:39	13:17	19:42	20:54	22:09
S 50°	12:17	13:07	13:40	19:11	20:27	21:48
52°	12:33	13:21	13:51	18:55	20:13	21:37
54°	12:51	13:36	14:04	18:37	19:58	21:25
56°	13:13	13:55	14:18	18:15	19:40	21:11
58°	13:42	14:18	14:35	17:47	19:17	20:55
S 60°	14:24	14:48	14:55	17:05	18:47	20:36

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 4-6 15-34%
01	02:53	02:57	11:57	15:43	03:11	
02	03:00	03:03	11:57	16:44	04:14	
03	03:06	03:09	11:57	17:39	05:12	

May 04, 05, 06 UT (Sun., Mon., Tue.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	222°08.1	220°36.5	N01°20.5	92°14.0	N20°24.0	140°51.2	N22°57.9	223°02.0	S02°34.8
1	237°10.5	235°37.4	20.7	107°15.2	23.7	155°53.2	57.9	238°04.2	34.7
2	252°13.0	250°38.3	21.0	122°16.5	23.3	170°55.1	57.9	253°06.5	34.6
3	267°15.5	265°39.1	·· 21.3	137°17.8	·· 23.0	185°57.0	·· 58.0	268°08.7	·· 34.5
4	282°17.9	280°40.0	21.6	152°19.1	22.6	200°58.9	58.0	283°11.0	34.5
5	297°20.4	295°40.9	21.9	167°20.3	22.3	216°00.8	58.0	298°13.2	34.4
6	312°22.8	310°41.8	N01°22.1	182°21.6	N20°21.9	231°02.7	N22°58.1	313°15.4	S02°34.3
7	327°25.3	325°42.7	22.4	197°22.9	21.6	246°04.6	58.1	328°17.7	34.2
8	342°27.8	340°43.5	22.7	212°24.1	21.3	261°06.5	58.1	343°19.9	34.1
9	357°30.2	355°44.4	·· 23.0	227°25.4	·· 20.9	276°08.5	·· 58.2	358°22.1	·· 34.0
10	12°32.7	10°45.3	23.3	242°26.7	20.6	291°10.4	58.2	13°24.4	33.9
11	27°35.2	25°46.1	23.5	257°27.9	20.2	306°12.3	58.3	28°26.6	33.8
12	42°37.6	40°47.0	N01°23.8	272°29.2	N20°19.9	321°14.2	N22°58.3	43°28.8	S02°33.7
13	57°40.1	55°47.9	24.1	287°30.5	19.5	336°16.1	58.3	58°31.1	33.6
14	72°42.6	70°48.7	24.4	302°31.8	19.2	351°18.0	58.4	73°33.3	33.5
15	87°45.0	85°49.6	·· 24.7	317°33.0	·· 18.8	6°19.9	·· 58.4	88°35.5	·· 33.5
16	102°47.5	100°50.4	25.0	332°34.3	18.5	21°21.8	58.4	103°37.8	33.4
17	117°50.0	115°51.3	25.3	347°35.6	18.1	36°23.7	58.5	118°40.0	33.3
18	132°52.4	130°52.1	N01°25.6	2°36.8	N20°17.8	51°25.7	N22°58.5	133°42.3	S02°33.2
19	147°54.9	145°53.0	25.9	17°38.1	17.4	66°27.6	58.5	148°44.5	33.1
20	162°57.3	160°53.9	26.2	32°39.4	17.1	81°29.5	58.6	163°46.7	33.0
21	177°59.8	175°54.7	·· 26.5	47°40.6	·· 16.7	96°31.4	·· 58.6	178°49.0	·· 32.9
22	193°02.3	190°55.5	26.8	62°41.9	16.4	111°33.3	58.6	193°51.2	32.8
23	208°04.7	205°56.4	27.1	77°43.2	16.0	126°35.2	58.7	208°53.4	32.7
Mer.pass. 09:10		ν 0.9′	d 0.3′	m -4.69	ν 1.3′	d 0.3′	m 0.98	ν 1.9′	d 0.0′ m -1.97	ν 2.2′	d 0.1′ m 1.17

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	223°07.2	220°57.2	N01°27.4	92°44.4	N20°15.7	141°37.1	N22°58.7	223°55.7	S02°32.6
1	238°09.7	235°58.1	27.7	107°45.7	15.3	156°39.0	58.7	238°57.9	32.6
2	253°12.1	250°58.9	28.0	122°47.0	15.0	171°40.9	58.8	254°00.2	32.5
3	268°14.6	265°59.8	·· 28.3	137°48.2	·· 14.6	186°42.8	·· 58.8	269°02.4	·· 32.4
4	283°17.1	281°00.6	28.6	152°49.5	14.3	201°44.8	58.9	284°04.6	32.3
5	298°19.5	296°01.4	28.9	167°50.7	13.9	216°46.7	58.9	299°06.9	32.2
6	313°22.0	311°02.3	N01°29.2	182°52.0	N20°13.6	231°48.6	N22°58.9	314°09.1	S02°32.1
7	328°24.4	326°03.1	29.5	197°53.3	13.2	246°50.5	59.0	329°11.3	32.0
8	343°26.9	341°03.9	29.8	212°54.5	12.9	261°52.4	59.0	344°13.6	31.9
9	358°29.4	356°04.8	·· 30.1	227°55.8	·· 12.5	276°54.3	·· 59.0	359°15.8	·· 31.8
10	13°31.8	11°05.6	30.4	242°57.1	12.2	291°56.2	59.1	14°18.1	31.7
11	28°34.3	26°06.4	30.7	257°58.3	11.8	306°58.1	59.1	29°20.3	31.7
12	43°36.8	41°07.3	N01°31.0	272°59.6	N20°11.5	322°00.0	N22°59.1	44°22.5	S02°31.6
13	58°39.2	56°08.1	31.4	288°00.9	11.1	337°01.9	59.2	59°24.8	31.5
14	73°41.7	71°08.9	31.7	303°02.1	10.8	352°03.8	59.2	74°27.0	31.4
15	88°44.2	86°09.7	·· 32.0	318°03.4	·· 10.4	7°05.7	·· 59.2	89°29.2	·· 31.3
16	103°46.6	101°10.5	32.3	333°04.6	10.1	22°07.7	59.3	104°31.5	31.2
17	118°49.1	116°11.4	32.6	348°05.9	09.7	37°09.6	59.3	119°33.7	31.1
18	133°51.6	131°12.2	N01°33.0	3°07.2	N20°09.4	52°11.5	N22°59.3	134°36.0	S02°31.0
19	148°54.0	146°13.0	33.3	18°08.4	09.0	67°13.4	59.4	149°38.2	30.9
20	163°56.5	161°13.8	33.6	33°09.7	08.7	82°15.3	59.4	164°40.4	30.8
21	178°58.9	176°14.6	·· 33.9	48°11.0	·· 08.3	97°17.2	·· 59.4	179°42.7	·· 30.8
22	194°01.4	191°15.4	34.2	63°12.2	08.0	112°19.1	59.5	194°44.9	30.7
23	209°03.9	206°16.2	34.6	78°13.5	07.6	127°21.0	59.5	209°47.2	30.6
Mer.pass. 09:06		ν 0.8′	d 0.3′	m -4.68	ν 1.3′	d 0.3′	m 0.99	ν 1.9′	d 0.0′ m -1.97	ν 2.2′	d 0.1′ m 1.16

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	224°06.3	221°17.0	N01°34.9	93°14.7	N20°07.3	142°22.9	N22°59.5	224°49.4	S02°30.5
1	239°08.8	236°17.8	35.2	108°16.0	06.9	157°24.8	59.6	239°51.6	30.4
2	254°11.3	251°18.6	35.6	123°17.3	06.6	172°26.7	59.6	254°53.9	30.3
3	269°13.7	266°19.4	·· 35.9	138°18.5	·· 06.2	187°28.6	·· 59.7	269°56.1	·· 30.2
4	284°16.2	281°20.2	36.2	153°19.8	05.8	202°30.5	59.7	284°58.4	30.1
5	299°18.7	296°21.0	36.6	168°21.0	05.5	217°32.4	59.7	300°00.6	30.0
6	314°21.1	311°21.8	N01°36.9	183°22.3	N20°05.1	232°34.4	N22°59.8	315°02.8	S02°30.0
7	329°23.6	326°22.6	37.2	198°23.6	04.8	247°36.3	59.8	330°05.1	29.9
8	344°26.1	341°23.4	37.6	213°24.8	04.4	262°38.2	59.8	345°07.3	29.8
9	359°28.5	356°24.2	·· 37.9	228°26.1	·· 04.1	277°40.1	·· 59.9	0°09.6	·· 29.7
10	14°31.0	11°25.0	38.2	243°27.3	03.7	292°42.0	59.9	15°11.8	29.6
11	29°33.4	26°25.8	38.6	258°28.6	03.4	307°43.9	22°59.9	30°14.0	29.5
12	44°35.9	41°26.6	N01°38.9	273°29.8	N20°03.0	322°45.8	N23°00.0	45°16.3	S02°29.4
13	59°38.4	56°27.4	39.3	288°31.1	02.6	337°47.7	00.0	60°18.5	29.3
14	74°40.8	71°28.2	39.6	303°32.4	02.3	352°49.6	00.0	75°20.8	29.2
15	89°43.3	86°28.9	·· 39.9	318°33.6	·· 01.9	7°51.5	·· 00.1	90°23.0	·· 29.2
16	104°45.8	101°29.7	40.3	333°34.9	01.6	22°53.4	00.1	105°25.2	29.1
17	119°48.2	116°30.5	40.6	348°36.1	01.2	37°55.3	00.1	120°27.5	29.0
18	134°50.7	131°31.3	N01°41.0	3°37.4	N20°00.9	52°57.2	N23°00.2	135°29.7	S02°28.9
19	149°53.2	146°32.0	41.3	18°38.6	00.5	67°59.1	00.2	150°32.0	28.8
20	164°55.6	161°32.8	41.7	33°39.9	20°00.2	83°01.0	00.2	165°34.2	28.7
21	179°58.1	176°33.6	·· 42.0	48°41.2	19°59.8	98°02.9	·· 00.3	180°36.4	·· 28.6
22	195°00.5	191°34.4	42.4	63°42.4	59.4	113°04.8	00.3	195°38.7	28.5
23	210°03.0	206°35.1	42.7	78°43.7	59.1	128°06.7	00.3	210°40.9	28.4
Mer.pass. 09:02		ν 0.8′	d 0.3′	m -4.67	ν 1.3′	d 0.4′	m 1.00	ν 1.9′	d 0.0′ m -1.97	ν 2.2′	d 0.1′ m 1.16

Stars

	SHA	**Dec**
Alpheratz	357°34.8	29°13.6
Ankaa	353°07.2	-42°10.0
Schedar	349°31.3	56°40.4
Diphda	348°47.3	-17°50.9
Achernar	335°20.5	-57°06.4
Hamal	327°51.3	23°34.8
Polaris	314°24.5	89°22.2
Acamar	315°12.0	-40°12.2
Menkar	314°06.2	4°11.3
Mirfak	308°28.4	49°57.0
Aldebaran	290°39.7	16°33.6
Rigel	281°03.9	-8°10.4
Capella	280°21.9	46°01.5
Bellatrix	278°22.9	6°22.3
Elnath	278°01.9	28°37.7
Alnilam	275°37.7	-1°11.2
Betelgeuse	270°52.1	7°24.7
Canopus	263°52.6	-52°42.7
Sirius	258°26.2	-16°45.2
Adhara	255°05.9	-29°00.6
Procyon	244°50.7	5°09.6
Pollux	243°17.1	27°58.0
Avior	234°14.8	-59°35.7
Suhail	222°46.1	-43°32.3
Miaplacidus	221°38.3	-69°49.5
Alphard	217°47.5	-8°46.2
Regulus	207°34.1	11°50.6
Dubhe	193°40.3	61°37.1
Denebola	182°24.5	14°25.8
Gienah	175°43.1	-17°41.1
Acrux	172°59.3	-63°14.6
Gacrux	171°50.9	-57°15.5
Alioth	166°12.2	55°49.4
Spica	158°21.7	-11°17.8
Alkaid	152°51.3	49°11.2
Hadar	148°35.1	-60°29.8
Menkent	147°56.9	-36°29.8
Arcturus	145°47.3	19°02.9
Rigil Kent.	139°39.3	-60°56.5
Kochab	137°18.6	74°03.0
Zuben'ubi	136°55.4	-16°08.9
Alphecca	126°03.2	26°37.6
Antares	112°15.2	-26°29.3
Atria	107°08.7	-69°04.3
Sabik	102°02.2	-15°45.4
Shaula	96°09.7	-37°07.3
Rasalhague	95°58.1	12°32.3
Eltanin	90°41.7	51°28.8
Kaus Aust.	83°31.9	-34°22.3
Vega	80°32.8	38°48.1
Nunki	75°47.3	-26°15.9
Altair	61°59.6	8°55.9
Peacock	53°05.2	-56°39.0
Deneb	49°25.6	45°21.9
Enif	33°38.6	9°59.3
Al Na'ir	27°32.7	-46°50.1
Fomalhaut	15°14.4	-29°29.2
Scheat	13°45.2	28°13.0
Markab	13°29.8	15°20.3

May 04 Sun	**SHA**	**Mer.pass**
Venus	358°28.4	09:17
Mars	230°05.9	17:50
Jupiter	278°43.2	14:35
Saturn	0°54.0	09:07

May 05 Mon	**SHA**	**Mer.pass**
Venus	357°50.0	09:16
Mars	229°37.2	17:48
Jupiter	278°29.9	14:32
Saturn	0°48.5	09:03

May 06 Tue	**SHA**	**Mer.pass**
Venus	357°10.7	09:14
Mars	229°08.4	17:46
Jupiter	278°16.6	14:29
Saturn	0°43.1	08:59

Horizontal parallax	
Venus:	0.3
Mars:	0.1

h	Sun		Moon				
Sun	**GHA**	**Dec**	**GHA**	*ν*	**Dec**	*d*	**HP**
0	180°48.1	N15°58.7	91°48.1	10.0′	N22°20.7	10.3′	56.9′
1	195°48.1	15°59.4	106°17.1	10.1′	22°10.4	10.4′	56.9′
2	210°48.2	16°00.1	120°46.2	10.3′	22°00.0	10.5′	56.8′
3	225°48.3	·· 00.8	135°15.5	10.4′	21°49.5	10.6′	56.8′
4	240°48.3	01.6	149°44.9	10.5′	21°38.9	10.7′	56.8′
5	255°48.4	02.3	164°14.4	10.6′	21°28.2	10.8′	56.7′
6	270°48.4	N16°03.0	178°44.0	10.8′	N21°17.4	10.9′	56.7′
7	285°48.5	03.7	193°13.8	10.9′	21°06.5	11.0′	56.6′
8	300°48.5	04.4	207°43.7	11.0′	20°55.5	11.0′	56.6′
9	315°48.6	·· 05.2	222°13.7	11.1′	20°44.5	11.2′	56.6′
10	330°48.6	05.9	236°43.8	11.2′	20°33.3	11.2′	56.5′
11	345°48.7	06.6	251°14.0	11.4′	20°22.1	11.3′	56.5′
12	0°48.8	N16°07.3	265°44.4	11.5′	N20°10.8	11.4′	56.5′
13	15°48.8	08.0	280°14.8	11.6′	19°59.4	11.5′	56.4′
14	30°48.9	08.7	294°45.4	11.7′	19°47.9	11.6′	56.4′
15	45°48.9	·· 09.5	309°16.1	11.8′	19°36.3	11.6′	56.4′
16	60°49.0	10.2	323°46.9	11.9′	19°24.7	11.7′	56.3′
17	75°49.0	10.9	338°17.9	12.0′	19°13.0	11.8′	56.3′
18	90°49.1	N16°11.6	352°48.9	12.2′	N19°01.2	11.9′	56.3′
19	105°49.1	12.3	7°20.1	12.3′	18°49.3	11.9′	56.2′
20	120°49.2	13.0	21°51.3	12.4′	18°37.4	12.0′	56.2′
21	135°49.2	·· 13.8	36°22.7	12.5′	18°25.4	12.1′	56.2′
22	150°49.3	14.5	50°54.2	12.6′	18°13.3	12.2′	56.1′
23	165°49.4	15.2	65°25.7	12.7′	18°01.1	12.2′	56.1′
	SD = 15.9′	*d* = 0.7′	SD = 15.5′				

Mon	**GHA**	**Dec**	**GHA**	*ν*	**Dec**	*d*	**HP**
0	180°49.4	N16°15.9	79°57.4	12.8′	N17°48.9	12.3′	56.1′
1	195°49.5	16.6	94°29.2	12.9′	17°36.6	12.3′	56.0′
2	210°49.5	17.3	109°01.1	13.0′	17°24.3	12.4′	56.0′
3	225°49.6	·· 18.0	123°33.1	13.1′	17°11.9	12.5′	56.0′
4	240°49.6	18.7	138°05.2	13.2′	16°59.4	12.5′	56.0′
5	255°49.7	19.5	152°37.4	13.3′	16°46.9	12.6′	55.9′
6	270°49.7	N16°20.2	167°09.7	13.4′	N16°34.3	12.7′	55.9′
7	285°49.8	20.9	181°42.1	13.5′	16°21.6	12.7′	55.9′
8	300°49.8	21.6	196°14.6	13.6′	16°08.9	12.8′	55.8′
9	315°49.9	·· 22.3	210°47.2	13.7′	15°56.1	12.8′	55.8′
10	330°49.9	23.0	225°19.9	13.8′	15°43.3	12.9′	55.8′
11	345°50.0	23.7	239°52.7	13.9′	15°30.4	12.9′	55.7′
12	0°50.0	N16°24.4	254°25.6	14.0′	N15°17.5	13.0′	55.7′
13	15°50.1	25.1	268°58.5	14.1′	15°04.5	13.0′	55.7′
14	30°50.1	25.8	283°31.6	14.1′	14°51.5	13.1′	55.7′
15	45°50.2	·· 26.5	298°04.7	14.2′	14°38.4	13.1′	55.6′
16	60°50.2	27.2	312°37.9	14.3′	14°25.3	13.2′	55.6′
17	75°50.3	27.9	327°11.2	14.4′	14°12.1	13.2′	55.6′
18	90°50.3	N16°28.6	341°44.6	14.5′	N13°58.9	13.3′	55.5′
19	105°50.4	29.4	356°18.1	14.6′	13°45.6	13.3′	55.5′
20	120°50.4	30.1	10°51.7	14.6′	13°32.3	13.4′	55.5′
21	135°50.4	·· 30.8	25°25.3	14.7′	13°18.9	13.4′	55.5′
22	150°50.5	31.5	39°59.1	14.8′	13°05.5	13.4′	55.4′
23	165°50.5	32.2	54°32.9	14.9′	12°52.1	13.5′	55.4′
	SD = 15.9′	*d* = 0.7′	SD = 15.3′				

Tue	**GHA**	**Dec**	**GHA**	*ν*	**Dec**	*d*	**HP**
0	180°50.6	N16°32.9	69°06.7	15.0′	N12°38.6	13.5′	55.4′
1	195°50.6	33.6	83°40.7	15.0′	12°25.1	13.5′	55.4′
2	210°50.7	34.3	98°14.7	15.1′	12°11.6	13.6′	55.3′
3	225°50.7	·· 35.0	112°48.8	15.2′	11°58.0	13.6′	55.3′
4	240°50.8	35.7	127°23.0	15.2′	11°44.4	13.7′	55.3′
5	255°50.8	36.4	141°57.2	15.3′	11°30.7	13.7′	55.3′
6	270°50.9	N16°37.1	156°31.6	15.4′	N11°17.0	13.7′	55.2′
7	285°50.9	37.8	171°05.9	15.5′	11°03.3	13.8′	55.2′
8	300°51.0	38.5	185°40.4	15.5′	10°49.5	13.7′	55.2′
9	315°51.0	·· 39.2	200°14.9	15.6′	10°35.8	13.9′	55.2′
10	330°51.0	39.9	214°49.5	15.6′	10°21.9	13.8′	55.1′
11	345°51.1	40.6	229°24.1	15.7′	10°08.1	13.9′	55.1′
12	0°51.1	N16°41.2	243°58.9	15.8′	N09°54.2	13.9′	55.1′
13	15°51.2	41.9	258°33.6	15.8′	09°40.3	13.9′	55.1′
14	30°51.2	42.6	273°08.4	15.9′	09°26.4	13.9′	55.0′
15	45°51.3	·· 43.3	287°43.3	15.9′	09°12.5	14.0′	55.0′
16	60°51.3	44.0	302°18.3	16.0′	08°58.5	14.0′	55.0′
17	75°51.3	44.7	316°53.3	16.1′	08°44.5	14.0′	55.0′
18	90°51.4	N16°45.4	331°28.3	16.1′	N08°30.5	14.1′	54.9′
19	105°51.4	46.1	346°03.4	16.2′	08°16.4	14.0′	54.9′
20	120°51.5	46.8	0°38.6	16.2′	08°02.4	14.1′	54.9′
21	135°51.5	·· 47.5	15°13.8	16.3′	07°48.3	14.1′	54.9′
22	150°51.6	48.2	29°49.1	16.3′	07°34.2	14.1′	54.9′
23	165°51.6	48.9	44°24.4	16.4′	07°20.1	14.2′	54.8′
	SD = 15.8′	*d* = 0.7′	SD = 15.1′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	////	////	01:11	22:54	////	////
N 70°	////	////	02:05	21:54	////	////
68°	////	////	02:37	21:20	////	////
66°	////	01:27	03:01	20:55	22:33	////
64°	////	02:05	03:19	20:36	21:52	////
62°	////	02:31	03:34	20:21	21:25	////
60°	01:17	02:51	03:47	20:08	21:05	22:42
N 58°	01:52	03:07	03:58	19:57	20:48	22:05
56°	02:16	03:21	04:07	19:48	20:34	21:40
54°	02:35	03:33	04:15	19:39	20:22	21:21
52°	02:50	03:43	04:23	19:32	20:12	21:05
50°	03:04	03:52	04:29	19:25	20:03	20:51
45°	03:30	04:11	04:43	19:11	19:44	20:25
N 40°	03:49	04:25	04:55	18:59	19:29	20:05
35°	04:05	04:38	05:05	18:49	19:16	19:49
30°	04:18	04:48	05:14	18:40	19:06	19:36
20°	04:38	05:05	05:28	18:25	18:48	19:16
N 10°	04:54	05:19	05:41	18:12	18:34	19:00
0°	05:07	05:32	05:53	18:00	18:22	18:47
S 10°	05:18	05:43	06:05	17:48	18:10	18:35
20°	05:28	05:55	06:17	17:36	17:59	18:25
30°	05:38	06:07	06:32	17:21	17:46	18:15
35°	05:43	06:13	06:40	17:13	17:40	18:10
40°	05:48	06:21	06:49	17:04	17:32	18:05
45°	05:54	06:29	07:00	16:53	17:24	17:59
S 50°	06:00	06:38	07:13	16:40	17:15	17:53
52°	06:02	06:42	07:19	16:34	17:10	17:51
54°	06:05	06:47	07:26	16:27	17:05	17:48
56°	06:08	06:52	07:33	16:20	17:00	17:45
58°	06:11	06:58	07:41	16:11	16:55	17:42
S 60°	06:14	07:04	07:51	16:02	16:48	17:39

Lat.	**Moonrise** Sun	Mon	Tue	**Moonset** Sun	Mon	Tue
N 72°	▭	08:53	11:33	▭	05:17	04:07
N 70°	▭	09:36	11:50	▭	04:32	03:49
68°	07:24	10:04	12:03	05:04	04:02	03:33
66°	08:16	10:25	12:14	04:10	03:40	03:21
64°	08:48	10:42	12:23	03:37	03:22	03:11
62°	09:12	10:55	12:30	03:13	03:07	03:02
60°	09:30	11:07	12:37	02:53	02:54	02:54
N 58°	09:46	11:17	12:42	02:37	02:43	02:47
56°	09:59	11:26	12:47	02:23	02:34	02:41
54°	10:10	11:33	12:52	02:11	02:25	02:36
52°	10:20	11:40	12:56	02:00	02:18	02:31
50°	10:29	11:46	13:00	01:51	02:11	02:26
45°	10:48	11:59	13:07	01:31	01:56	02:17
N 40°	11:03	12:10	13:14	01:14	01:44	02:08
35°	11:16	12:20	13:20	01:01	01:34	02:01
30°	11:27	12:28	13:25	00:48	01:24	01:55
20°	11:46	12:41	13:33	00:27	01:08	01:44
N 10°	12:03	12:53	13:41	00:09	00:54	01:35
0°	12:18	13:05	13:47	·· ··	00:41	01:26
S 10°	12:33	13:16	13:54	·· ··	00:28	01:16
20°	12:50	13:28	14:02	·· ··	00:13	01:07
30°	13:08	13:41	14:10	23:57	·· ··	00:55
35°	13:19	13:49	14:15	23:47	·· ··	00:49
40°	13:31	13:58	14:20	23:36	·· ··	00:41
45°	13:46	14:08	14:27	23:23	·· ··	00:33
S 50°	14:03	14:21	14:34	23:07	·· ··	00:22
52°	14:12	14:26	14:38	22:59	·· ··	00:17
54°	14:21	14:33	14:41	22:50	·· ··	00:11
56°	14:31	14:40	14:45	22:41	·· ··	00:05
58°	14:43	14:47	14:50	22:30	23:58	·· ··
S 60°	14:57	14:56	14:55	22:17	23:51	·· ··

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 7-9 44-64%
04	03:12	03:15	11:57	18:30	06:05	
05	03:18	03:20	11:57	19:15	06:53	
06	03:22	03:25	11:57	19:57	07:37	

May 07, 08, 09 UT (Wed., Thu., Fri.)

	Aries	Venus		Mars		Jupiter		Saturn	
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	225°05.5	221°35.9	N01°43.1	93°44.9	N19°58.7	143°08.6	N23°00.4	225°43.2	S02°28.4
1	240°07.9	236°36.7	43.4	108°46.2	58.4	158°10.5	00.4	240°45.4	28.3
2	255°10.4	251°37.4	43.8	123°47.4	58.0	173°12.5	00.4	255°47.6	28.2
3	270°12.9	266°38.2	·· 44.2	138°48.7	·· 57.6	188°14.4	·· 00.5	270°49.9	·· 28.1
4	285°15.3	281°39.0	44.5	153°49.9	57.3	203°16.3	00.5	285°52.1	28.0
5	300°17.8	296°39.7	44.9	168°51.2	56.9	218°18.2	00.5	300°54.4	27.9
6	315°20.3	311°40.5	N01°45.2	183°52.4	N19°56.6	233°20.1	N23°00.6	315°56.6	S02°27.8
7	330°22.7	326°41.2	45.6	198°53.7	56.2	248°22.0	00.6	330°58.9	27.7
8	345°25.2	341°42.0	46.0	213°55.0	55.9	263°23.9	00.6	346°01.1	27.7
9	0°27.7	356°42.8	·· 46.3	228°56.2	·· 55.5	278°25.8	·· 00.7	1°03.3	·· 27.6
10	15°30.1	11°43.5	46.7	243°57.5	55.1	293°27.7	00.7	16°05.6	27.5
11	30°32.6	26°44.3	47.1	258°58.7	54.8	308°29.6	00.7	31°07.8	27.4
12	45°35.0	41°45.0	N01°47.4	274°00.0	N19°54.4	323°31.5	N23°00.8	46°10.1	S02°27.3
13	60°37.5	56°45.8	47.8	289°01.2	54.1	338°33.4	00.8	61°12.3	27.2
14	75°40.0	71°46.5	48.2	304°02.5	53.7	353°35.3	00.8	76°14.6	27.1
15	90°42.4	86°47.3	·· 48.5	319°03.7	·· 53.3	8°37.2	·· 00.9	91°16.8	·· 27.0
16	105°44.9	101°48.0	48.9	334°05.0	53.0	23°39.1	00.9	106°19.0	27.0
17	120°47.4	116°48.7	49.3	349°06.2	52.6	38°41.0	00.9	121°21.3	26.9
18	135°49.8	131°49.5	N01°49.6	4°07.5	N19°52.2	53°42.9	N23°01.0	136°23.5	S02°26.8
19	150°52.3	146°50.2	50.0	19°08.7	51.9	68°44.8	01.0	151°25.8	26.7
20	165°54.8	161°51.0	50.4	34°10.0	51.5	83°46.7	01.0	166°28.0	26.6
21	180°57.2	176°51.7	·· 50.8	49°11.2	·· 51.2	98°48.6	·· 01.1	181°30.3	·· 26.5
22	195°59.7	191°52.4	51.2	64°12.5	50.8	113°50.5	01.1	196°32.5	26.4
23	211°02.1	206°53.2	51.5	79°13.7	50.4	128°52.4	01.1	211°34.7	26.3
Mer.pass. 08:58		ν 0.8′	d 0.4′	m -4.66	ν 1.3′	d 0.4′	m 1.02	ν 1.9′	d 0.0′ m -1.97	ν 2.2′	d 0.1′ m 1.16

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	226°04.6	221°53.9	N01°51.9	94°15.0	N19°50.1	143°54.3	N23°01.2	226°37.0	S02°26.3
1	241°07.1	236°54.6	52.3	109°16.2	49.7	158°56.2	01.2	241°39.2	26.2
2	256°09.5	251°55.4	52.7	124°17.5	49.4	173°58.1	01.2	256°41.5	26.1
3	271°12.0	266°56.1	·· 53.1	139°18.7	·· 49.0	189°00.0	·· 01.3	271°43.7	·· 26.0
4	286°14.5	281°56.8	53.4	154°20.0	48.6	204°01.9	01.3	286°46.0	25.9
5	301°16.9	296°57.6	53.8	169°21.2	48.3	219°03.8	01.3	301°48.2	25.8
6	316°19.4	311°58.3	N01°54.2	184°22.5	N19°47.9	234°05.7	N23°01.4	316°50.5	S02°25.7
7	331°21.9	326°59.0	54.6	199°23.7	47.5	249°07.6	01.4	331°52.7	25.6
8	346°24.3	341°59.7	55.0	214°25.0	47.2	264°09.5	01.4	346°54.9	25.6
9	1°26.8	357°00.4	·· 55.4	229°26.2	·· 46.8	279°11.4	·· 01.5	1°57.2	·· 25.5
10	16°29.3	12°01.2	55.8	244°27.5	46.4	294°13.3	01.5	16°59.4	25.4
11	31°31.7	27°01.9	56.2	259°28.7	46.1	309°15.2	01.5	32°01.7	25.3
12	46°34.2	42°02.6	N01°56.5	274°30.0	N19°45.7	324°17.1	N23°01.6	47°03.9	S02°25.2
13	61°36.6	57°03.3	56.9	289°31.2	45.3	339°19.0	01.6	62°06.2	25.1
14	76°39.1	72°04.0	57.3	304°32.5	45.0	354°20.9	01.6	77°08.4	25.0
15	91°41.6	87°04.7	·· 57.7	319°33.7	·· 44.6	9°22.8	·· 01.7	92°10.7	·· 25.0
16	106°44.0	102°05.4	58.1	334°35.0	44.3	24°24.7	01.7	107°12.9	24.9
17	121°46.5	117°06.2	58.5	349°36.2	43.9	39°26.6	01.7	122°15.1	24.8
18	136°49.0	132°06.9	N01°58.9	4°37.5	N19°43.5	54°28.5	N23°01.8	137°17.4	S02°24.7
19	151°51.4	147°07.6	59.3	19°38.7	43.2	69°30.4	01.8	152°19.6	24.6
20	166°53.9	162°08.3	01°59.7	34°40.0	42.8	84°32.3	01.8	167°21.9	24.5
21	181°56.4	177°09.0	02°00.1	49°41.2	·· 42.4	99°34.2	·· 01.9	182°24.1	·· 24.4
22	196°58.8	192°09.7	00.5	64°42.4	42.1	114°36.1	01.9	197°26.4	24.4
23	212°01.3	207°10.4	00.9	79°43.7	41.7	129°38.0	01.9	212°28.6	24.3
Mer.pass. 08:54		ν 0.7′	d 0.4′	m -4.65	ν 1.3′	d 0.4′	m 1.03	ν 1.9′	d 0.0′ m -1.96	ν 2.2′	d 0.1′ m 1.16

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	227°03.8	222°11.1	N02°01.3	94°44.9	N19°41.3	144°39.9	N23°02.0	227°30.9	S02°24.2
1	242°06.2	237°11.8	01.7	109°46.2	41.0	159°41.8	02.0	242°33.1	24.1
2	257°08.7	252°12.5	02.1	124°47.4	40.6	174°43.7	02.0	257°35.4	24.0
3	272°11.1	267°13.2	·· 02.6	139°48.7	·· 40.2	189°45.6	·· 02.1	272°37.6	·· 23.9
4	287°13.6	282°13.9	03.0	154°49.9	39.9	204°47.5	02.1	287°39.9	23.8
5	302°16.1	297°14.5	03.4	169°51.2	39.5	219°49.4	02.1	302°42.1	23.8
6	317°18.5	312°15.2	N02°03.8	184°52.4	N19°39.1	234°51.3	N23°02.1	317°44.3	S02°23.7
7	332°21.0	327°15.9	04.2	199°53.6	38.8	249°53.2	02.2	332°46.6	23.6
8	347°23.5	342°16.6	04.6	214°54.9	38.4	264°55.1	02.2	347°48.8	23.5
9	2°25.9	357°17.3	·· 05.0	229°56.1	·· 38.0	279°57.0	·· 02.2	2°51.1	·· 23.4
10	17°28.4	12°18.0	05.4	244°57.4	37.6	294°58.9	02.3	17°53.3	23.3
11	32°30.9	27°18.7	05.8	259°58.6	37.3	310°00.8	02.3	32°55.6	23.2
12	47°33.3	42°19.3	N02°06.3	274°59.9	N19°36.9	325°02.7	N23°02.3	47°57.8	S02°23.2
13	62°35.8	57°20.0	06.7	290°01.1	36.5	340°04.6	02.4	63°00.1	23.1
14	77°38.2	72°20.7	07.1	305°02.4	36.2	355°06.5	02.4	78°02.3	23.0
15	92°40.7	87°21.4	·· 07.5	320°03.6	·· 35.8	10°08.4	·· 02.4	93°04.6	·· 22.9
16	107°43.2	102°22.1	07.9	335°04.8	35.4	25°10.3	02.5	108°06.8	22.8
17	122°45.6	117°22.7	08.4	350°06.1	35.1	40°12.2	02.5	123°09.1	22.7
18	137°48.1	132°23.4	N02°08.8	5°07.3	N19°34.7	55°14.1	N23°02.5	138°11.3	S02°22.6
19	152°50.6	147°24.1	09.2	20°08.6	34.3	70°16.0	02.6	153°13.6	22.6
20	167°53.0	162°24.8	09.6	35°09.8	33.9	85°17.9	02.6	168°15.8	22.5
21	182°55.5	177°25.4	·· 10.1	50°11.0	·· 33.6	100°19.8	·· 02.6	183°18.1	·· 22.4
22	197°58.0	192°26.1	10.5	65°12.3	33.2	115°21.7	02.7	198°20.3	22.3
23	213°00.4	207°26.8	10.9	80°13.5	32.8	130°23.6	02.7	213°22.6	22.2
Mer.pass. 08:50		ν 0.7′	d 0.4′	m -4.64	ν 1.2′	d 0.4′	m 1.04	ν 1.9′	d 0.0′ m -1.96	ν 2.2′	d 0.1′ m 1.15

Stars

	SHA	Dec
Alpheratz	357°34.8	29°13.6
Ankaa	353°07.2	-42°10.0
Schedar	349°31.2	56°40.4
Diphda	348°47.3	-17°50.9
Achernar	335°20.5	-57°06.4
Hamal	327°51.3	23°34.8
Polaris	314°24.5	89°22.2
Acamar	315°12.0	-40°12.2
Menkar	314°06.2	4°11.3
Mirfak	308°28.4	49°57.0
Aldebaran	290°39.7	16°33.6
Rigel	281°03.9	-8°10.4
Capella	280°21.9	46°01.5
Bellatrix	278°22.9	6°22.3
Elnath	278°01.9	28°37.7
Alnilam	275°37.7	-1°11.2
Betelgeuse	270°52.1	7°24.7
Canopus	263°52.7	-52°42.7
Sirius	258°26.2	-16°45.2
Adhara	255°05.9	-29°00.5
Procyon	244°50.7	5°09.6
Pollux	243°17.1	27°58.0
Avior	234°14.8	-59°35.7
Suhail	222°46.2	-43°32.3
Miaplacidus	221°38.3	-69°49.5
Alphard	217°47.5	-8°46.2
Regulus	207°34.1	11°50.6
Dubhe	193°40.4	61°37.1
Denebola	182°24.5	14°25.8
Gienah	175°43.1	-17°41.1
Acrux	172°59.3	-63°14.6
Gacrux	171°51.0	-57°15.5
Alioth	166°12.2	55°49.4
Spica	158°21.7	-11°17.8
Alkaid	152°51.3	49°11.2
Hadar	148°35.1	-60°29.9
Menkent	147°57.0	-36°29.8
Arcturus	145°47.3	19°02.9
Rigil Kent.	139°39.3	-60°56.5
Kochab	137°18.6	74°03.0
Zuben'ubi	136°55.4	-16°08.9
Alphecca	126°03.2	26°37.6
Antares	112°15.2	-26°29.3
Atria	107°08.7	-69°04.3
Sabik	102°02.2	-15°45.4
Shaula	96°09.7	-37°07.3
Rasalhague	95°58.0	12°32.3
Eltanin	90°41.7	51°28.8
Kaus Aust.	83°31.9	-34°22.3
Vega	80°32.8	38°48.1
Nunki	75°47.2	-26°15.9
Altair	61°59.6	8°55.9
Peacock	53°05.2	-56°39.0
Deneb	49°25.6	45°21.9
Enif	33°38.6	9°59.3
Al Na'ir	27°32.7	-46°50.1
Fomalhaut	15°14.4	-29°29.2
Scheat	13°45.1	28°13.0
Markab	13°29.8	15°20.3

May 07 Wed	SHA	Mer.pass
Venus	356°30.4	09:13
Mars	228°39.4	17:44
Jupiter	278°03.2	14:26
Saturn	0°37.7	08:56

May 08 Thu	SHA	Mer.pass
Venus	355°49.3	09:12
Mars	228°10.4	17:42
Jupiter	277°49.7	14:23
Saturn	0°32.4	08:52

May 09 Fri	SHA	Mer.pass
Venus	355°07.3	09:11
Mars	227°41.2	17:40
Jupiter	277°36.2	14:20
Saturn	0°27.1	08:49

Horizontal parallax	
Venus:	0.3
Mars:	0.1

DUT1 = UT1-UTC = +0.0297 sec ΔT = TT-UT1 = +69.1543 sec

2025 May 07 to May. 09 UT

h	Sun		Moon				
Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°51.6	N16°49.6	58°59.7	16.4′	N07°05.9	14.1′	54.8′
1	195°51.7	50.2	73°35.1	16.4′	06°51.8	14.2′	54.8′
2	210°51.7	50.9	88°10.6	16.5′	06°37.6	14.2′	54.8′
3	225°51.8	·· 51.6	102°46.1	16.5′	06°23.4	14.2′	54.8′
4	240°51.8	52.3	117°21.6	16.6′	06°09.2	14.2′	54.7′
5	255°51.8	53.0	131°57.2	16.6′	05°55.0	14.2′	54.7′
6	270°51.9	N16°53.7	146°32.8	16.6′	N05°40.8	14.2′	54.7′
7	285°51.9	54.4	161°08.4	16.7′	05°26.6	14.3′	54.7′
8	300°52.0	55.1	175°44.1	16.7′	05°12.3	14.2′	54.7′
9	315°52.0	·· 55.7	190°19.8	16.8′	04°58.1	14.3′	54.7′
10	330°52.0	56.4	204°55.6	16.8′	04°43.8	14.3′	54.6′
11	345°52.1	57.1	219°31.4	16.8′	04°29.5	14.2′	54.6′
12	0°52.1	N16°57.8	234°07.2	16.9′	N04°15.3	14.3′	54.6′
13	15°52.2	58.5	248°43.1	16.9′	04°01.0	14.3′	54.6′
14	30°52.2	59.2	263°18.9	16.9′	03°46.7	14.3′	54.6′
15	45°52.2	16°59.8	277°54.9	16.9′	03°32.4	14.3′	54.5′
16	60°52.3	17°00.5	292°30.8	17.0′	03°18.1	14.3′	54.5′
17	75°52.3	01.2	307°06.8	17.0′	03°03.8	14.3′	54.5′
18	90°52.3	N17°01.9	321°42.8	17.0′	N02°49.5	14.4′	54.5′
19	105°52.4	02.6	336°18.8	17.0′	02°35.1	14.3′	54.5′
20	120°52.4	03.2	350°54.8	17.1′	02°20.8	14.3′	54.5′
21	135°52.4	·· 03.9	5°30.9	17.1′	02°06.5	14.3′	54.5′
22	150°52.5	04.6	20°07.0	17.1′	01°52.2	14.3′	54.4′
23	165°52.5	05.3	34°43.1	17.1′	01°37.9	14.3′	54.4′
	SD = 15.8′	d = 0.7′	SD = 15.0′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°52.6	N17°06.0	49°19.2	17.1′	N01°23.6	14.4′	54.4′
1	195°52.6	06.6	63°55.3	17.2′	01°09.2	14.3′	54.4′
2	210°52.6	07.3	78°31.5	17.2′	00°54.9	14.3′	54.4′
3	225°52.7	·· 08.0	93°07.7	17.2′	00°40.6	14.3′	54.4′
4	240°52.7	08.7	107°43.8	17.2′	00°26.3	14.3′	54.3′
5	255°52.7	09.3	122°20.0	17.2′	N00°12.0	14.3′	54.3′
6	270°52.8	N17°10.0	136°56.2	17.2′	S00°02.3	14.3′	54.3′
7	285°52.8	10.7	151°32.5	17.2′	00°16.6	14.3′	54.3′
8	300°52.8	11.4	166°08.7	17.2′	00°30.9	14.2′	54.3′
9	315°52.9	·· 12.0	180°44.9	17.2′	00°45.1	14.3′	54.3′
10	330°52.9	12.7	195°21.2	17.2′	00°59.4	14.3′	54.3′
11	345°52.9	13.4	209°57.4	17.3′	01°13.7	14.2′	54.3′
12	0°53.0	N17°14.1	224°33.7	17.3′	S01°27.9	14.2′	54.2′
13	15°53.0	14.7	239°09.9	17.3′	01°42.1	14.3′	54.2′
14	30°53.0	15.4	253°46.2	17.3′	01°56.4	14.2′	54.2′
15	45°53.1	·· 16.1	268°22.4	17.3′	02°10.6	14.2′	54.2′
16	60°53.1	16.7	282°58.7	17.3′	02°24.8	14.2′	54.2′
17	75°53.1	17.4	297°34.9	17.3′	02°39.0	14.1′	54.2′
18	90°53.1	N17°18.1	312°11.2	17.3′	S02°53.1	14.2′	54.2′
19	105°53.2	18.8	326°47.5	17.2′	03°07.3	14.2′	54.2′
20	120°53.2	19.4	341°23.7	17.2′	03°21.5	14.1′	54.2′
21	135°53.2	·· 20.1	355°59.9	17.2′	03°35.6	14.1′	54.2′
22	150°53.3	20.8	10°36.2	17.2′	03°49.7	14.1′	54.1′
23	165°53.3	21.4	25°12.4	17.2′	04°03.8	14.1′	54.1′
	SD = 15.8′	d = 0.7′	SD = 14.8′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°53.3	N17°22.1	39°48.6	17.2′	S04°17.9	14.0′	54.1′
1	195°53.4	22.8	54°24.9	17.2′	04°31.9	14.1′	54.1′
2	210°53.4	23.4	69°01.1	17.2′	04°46.0	14.0′	54.1′
3	225°53.4	·· 24.1	83°37.2	17.2′	05°00.0	14.0′	54.1′
4	240°53.4	24.7	98°13.4	17.2′	05°14.0	14.0′	54.1′
5	255°53.5	25.4	112°49.6	17.1′	05°28.0	13.9′	54.1′
6	270°53.5	N17°26.1	127°25.7	17.1′	S05°41.9	13.9′	54.1′
7	285°53.5	26.7	142°01.9	17.1′	05°55.8	13.9′	54.1′
8	300°53.6	27.4	156°38.0	17.1′	06°09.7	13.9′	54.1′
9	315°53.6	·· 28.1	171°14.1	17.1′	06°23.6	13.9′	54.0′
10	330°53.6	28.7	185°50.2	17.1′	06°37.5	13.8′	54.0′
11	345°53.6	29.4	200°26.2	17.0′	06°51.3	13.8′	54.0′
12	0°53.7	N17°30.0	215°02.3	17.0′	S07°05.1	13.8′	54.0′
13	15°53.7	30.7	229°38.3	17.0′	07°18.9	13.7′	54.0′
14	30°53.7	31.4	244°14.3	17.0′	07°32.6	13.8′	54.0′
15	45°53.7	·· 32.0	258°50.2	16.9′	07°46.4	13.7′	54.0′
16	60°53.8	32.7	273°26.2	16.9′	08°00.1	13.6′	54.0′
17	75°53.8	33.3	288°02.1	16.9′	08°13.7	13.6′	54.0′
18	90°53.8	N17°34.0	302°38.0	16.9′	S08°27.3	13.6′	54.0′
19	105°53.8	34.6	317°13.8	16.8′	08°40.9	13.6′	54.0′
20	120°53.9	35.3	331°49.7	16.8′	08°54.5	13.5′	54.0′
21	135°53.9	·· 36.0	346°25.5	16.8′	09°08.0	13.5′	54.0′
22	150°53.9	36.6	1°01.3	16.7′	09°21.5	13.5′	54.0′
23	165°53.9	37.3	15°37.0	16.7′	09°35.0	13.4′	54.0′
	SD = 15.8′	d = 0.7′	SD = 14.8′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	////	////	00:17	////	////	////
N 70°	////	////	01:45	22:15	////	////
68°	////	////	02:23	21:34	////	////
66°	////	01:01	02:49	21:07	23:01	////
64°	////	01:49	03:09	20:46	22:08	////
62°	////	02:19	03:25	20:29	21:37	////
60°	00:54	02:41	03:39	20:16	21:14	23:07
N 58°	01:38	02:59	03:51	20:04	20:56	22:19
56°	02:05	03:14	04:01	19:54	20:41	21:50
54°	02:26	03:26	04:09	19:45	20:28	21:29
52°	02:43	03:37	04:17	19:37	20:17	21:12
50°	02:57	03:46	04:24	19:30	20:08	20:58
45°	03:24	04:06	04:39	19:14	19:48	20:30
N 40°	03:45	04:22	04:52	19:02	19:32	20:09
35°	04:01	04:35	05:02	18:51	19:19	19:52
30°	04:15	04:46	05:11	18:42	19:08	19:39
20°	04:36	05:04	05:27	18:26	18:50	19:17
N 10°	04:53	05:18	05:40	18:13	18:35	19:01
0°	05:06	05:31	05:53	18:00	18:22	18:47
S 10°	05:18	05:44	06:05	17:47	18:09	18:35
20°	05:29	05:56	06:19	17:34	17:57	18:24
30°	05:40	06:08	06:34	17:19	17:44	18:13
35°	05:45	06:15	06:42	17:10	17:37	18:07
40°	05:51	06:23	06:52	17:01	17:29	18:02
45°	05:57	06:32	07:03	16:49	17:20	17:56
S 50°	06:03	06:42	07:17	16:35	17:10	17:49
52°	06:06	06:47	07:24	16:29	17:05	17:46
54°	06:09	06:52	07:31	16:22	17:00	17:43
56°	06:12	06:57	07:39	16:14	16:55	17:40
58°	06:16	07:04	07:48	16:05	16:49	17:36
S 60°	06:19	07:10	07:58	15:54	16:42	17:33

Lat.	**Moonrise** Wed	Thu	Fri	**Moonset** Wed	Thu	Fri
N 72°	13:39	15:37	17:38	03:28	02:55	02:23
N 70°	13:45	15:34	17:24	03:19	02:54	02:29
68°	13:49	15:31	17:14	03:12	02:53	02:35
66°	13:53	15:29	17:05	03:06	02:53	02:39
64°	13:56	15:27	16:58	03:01	02:52	02:43
62°	13:59	15:25	16:51	02:57	02:52	02:47
60°	14:01	15:24	16:46	02:53	02:51	02:50
N 58°	14:03	15:22	16:41	02:49	02:51	02:53
56°	14:05	15:21	16:37	02:46	02:51	02:55
54°	14:07	15:20	16:33	02:44	02:51	02:57
52°	14:08	15:19	16:30	02:41	02:50	02:59
50°	14:10	15:18	16:27	02:39	02:50	03:01
45°	14:13	15:16	16:20	02:34	02:50	03:05
N 40°	14:15	15:15	16:14	02:30	02:49	03:08
35°	14:17	15:14	16:10	02:26	02:49	03:11
30°	14:19	15:12	16:05	02:23	02:48	03:14
20°	14:22	15:10	15:58	02:17	02:48	03:18
N 10°	14:25	15:09	15:52	02:12	02:47	03:22
0°	14:28	15:07	15:46	02:07	02:47	03:26
S 10°	14:31	15:05	15:40	02:02	02:46	03:30
20°	14:33	15:04	15:34	01:57	02:46	03:34
30°	14:37	15:02	15:27	01:51	02:45	03:38
35°	14:38	15:01	15:24	01:48	02:45	03:41
40°	14:40	15:00	15:19	01:44	02:44	03:44
45°	14:43	14:58	15:14	01:39	02:44	03:47
S 50°	14:46	14:57	15:08	01:34	02:43	03:51
52°	14:47	14:56	15:05	01:31	02:43	03:53
54°	14:48	14:55	15:02	01:28	02:42	03:55
56°	14:50	14:54	14:59	01:25	02:42	03:58
58°	14:52	14:53	14:55	01:22	02:42	04:00
S 60°	14:54	14:52	14:51	01:18	02:41	04:03

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 10-12 73-88%
07	03:27	03:28	11:57	20:37	08:18	
08	03:30	03:32	11:56	21:16	08:57	
09	03:33	03:35	11:56	21:56	09:36	

May 10, 11, 12 UT (Sat., Sun., Mon.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	228°02.9	222°27.4	N02°11.3	95°14.8	N19°32.5	145°25.5	N23°02.7	228°24.8	S02°22.1
1	243°05.4	237°28.1	11.8	110°16.0	32.1	160°27.4	02.8	243°27.0	22.0
2	258°07.8	252°28.8	12.2	125°17.3	31.7	175°29.2	02.8	258°29.3	22.0
3	273°10.3	267°29.4	·· 12.6	140°18.5	·· 31.3	190°31.1	·· 02.8	273°31.5	·· 21.9
4	288°12.7	282°30.1	13.1	155°19.7	31.0	205°33.0	02.8	288°33.8	21.8
5	303°15.2	297°30.7	13.5	170°21.0	30.6	220°34.9	02.9	303°36.0	21.7
6	318°17.7	312°31.4	N02°13.9	185°22.2	N19°30.2	235°36.8	N23°02.9	318°38.3	S02°21.6
7	333°20.1	327°32.0	14.4	200°23.4	29.9	250°38.7	02.9	333°40.5	21.5
8	348°22.6	342°32.7	14.8	215°24.7	29.5	265°40.6	03.0	348°42.8	21.5
9	3°25.1	357°33.4	·· 15.2	230°25.9	·· 29.1	280°42.5	·· 03.0	3°45.0	·· 21.4
10	18°27.5	12°34.0	15.7	245°27.2	28.7	295°44.4	03.0	18°47.3	21.3
11	33°30.0	27°34.7	16.1	260°28.4	28.4	310°46.3	03.1	33°49.5	21.2
12	48°32.5	42°35.3	N02°16.6	275°29.6	N19°28.0	325°48.2	N23°03.1	48°51.8	S02°21.1
13	63°34.9	57°36.0	17.0	290°30.9	27.6	340°50.1	03.1	63°54.0	21.0
14	78°37.4	72°36.6	17.4	305°32.1	27.2	355°52.0	03.2	78°56.3	20.9
15	93°39.8	87°37.2	·· 17.9	320°33.4	·· 26.9	10°53.9	·· 03.2	93°58.5	·· 20.9
16	108°42.3	102°37.9	18.3	335°34.6	26.5	25°55.8	03.2	109°00.8	20.8
17	123°44.8	117°38.5	18.8	350°35.8	26.1	40°57.7	03.3	124°03.0	20.7
18	138°47.2	132°39.2	N02°19.2	5°37.1	N19°25.8	55°59.6	N23°03.3	139°05.3	S02°20.6
19	153°49.7	147°39.8	19.7	20°38.3	25.4	71°01.5	03.3	154°07.5	20.5
20	168°52.2	162°40.5	20.1	35°39.5	25.0	86°03.4	03.3	169°09.8	20.4
21	183°54.6	177°41.1	·· 20.6	50°40.8	·· 24.6	101°05.3	·· 03.4	184°12.0	·· 20.4
22	198°57.1	192°41.7	21.0	65°42.0	24.3	116°07.2	03.4	199°14.3	20.3
23	213°59.6	207°42.4	21.5	80°43.3	23.9	131°09.0	03.4	214°16.5	20.2
Mer.pass. 08:46		ν 0.7′	d 0.4′	m -4.63	ν 1.2′	d 0.4′	m 1.05	ν 1.9′	d 0.0′ m -1.96	ν 2.2′	d 0.1′ m 1.15

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	229°02.0	222°43.0	N02°21.9	95°44.5	N19°23.5	146°10.9	N23°03.5	229°18.8	S02°20.1
1	244°04.5	237°43.6	22.4	110°45.7	23.1	161°12.8	03.5	244°21.0	20.0
2	259°07.0	252°44.3	22.8	125°47.0	22.7	176°14.7	03.5	259°23.3	19.9
3	274°09.4	267°44.9	·· 23.3	140°48.2	·· 22.4	191°16.6	·· 03.6	274°25.5	·· 19.9
4	289°11.9	282°45.5	23.7	155°49.4	22.0	206°18.5	03.6	289°27.8	19.8
5	304°14.3	297°46.1	24.2	170°50.7	21.6	221°20.4	03.6	304°30.0	19.7
6	319°16.8	312°46.8	N02°24.6	185°51.9	N19°21.2	236°22.3	N23°03.7	319°32.3	S02°19.6
7	334°19.3	327°47.4	25.1	200°53.1	20.9	251°24.2	03.7	334°34.5	19.5
8	349°21.7	342°48.0	25.6	215°54.4	20.5	266°26.1	03.7	349°36.8	19.4
9	4°24.2	357°48.6	·· 26.0	230°55.6	·· 20.1	281°28.0	·· 03.7	4°39.0	·· 19.4
10	19°26.7	12°49.3	26.5	245°56.8	19.7	296°29.9	03.8	19°41.3	19.3
11	34°29.1	27°49.9	26.9	260°58.1	19.4	311°31.8	03.8	34°43.6	19.2
12	49°31.6	42°50.5	N02°27.4	275°59.3	N19°19.0	326°33.7	N23°03.8	49°45.8	S02°19.1
13	64°34.1	57°51.1	27.9	291°00.5	18.6	341°35.6	03.9	64°48.1	19.0
14	79°36.5	72°51.7	28.3	306°01.8	18.2	356°37.4	03.9	79°50.3	18.9
15	94°39.0	87°52.3	·· 28.8	321°03.0	·· 17.8	11°39.3	·· 03.9	94°52.6	·· 18.9
16	109°41.5	102°53.0	29.3	336°04.3	17.5	26°41.2	04.0	109°54.8	18.8
17	124°43.9	117°53.6	29.7	351°05.5	17.1	41°43.1	04.0	124°57.1	18.7
18	139°46.4	132°54.2	N02°30.2	6°06.7	N19°16.7	56°45.0	N23°04.0	139°59.3	S02°18.6
19	154°48.8	147°54.8	30.7	21°07.9	16.3	71°46.9	04.1	155°01.6	18.5
20	169°51.3	162°55.4	31.1	36°09.2	15.9	86°48.8	04.1	170°03.8	18.4
21	184°53.8	177°56.0	·· 31.6	51°10.4	·· 15.6	101°50.7	·· 04.1	185°06.1	·· 18.4
22	199°56.2	192°56.6	32.1	66°11.6	15.2	116°52.6	04.1	200°08.3	18.3
23	214°58.7	207°57.2	32.5	81°12.9	14.8	131°54.5	04.2	215°10.6	18.2
Mer.pass. 08:42		ν 0.6′	d 0.5′	m -4.62	ν 1.2′	d 0.4′	m 1.07	ν 1.9′	d 0.0′ m -1.96	ν 2.3′	d 0.1′ m 1.15

Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	230°01.2	222°57.8	N02°33.0	96°14.1	N19°14.4	146°56.4	N23°04.2	230°12.8	S02°18.1
1	245°03.6	237°58.4	33.5	111°15.3	14.0	161°58.3	04.2	245°15.1	18.0
2	260°06.1	252°59.0	34.0	126°16.6	13.7	177°00.1	04.3	260°17.3	17.9
3	275°08.6	267°59.6	·· 34.4	141°17.8	·· 13.3	192°02.0	·· 04.3	275°19.6	·· 17.9
4	290°11.0	283°00.2	34.9	156°19.0	12.9	207°03.9	04.3	290°21.8	17.8
5	305°13.5	298°00.8	35.4	171°20.3	12.5	222°05.8	04.4	305°24.1	17.7
6	320°15.9	313°01.4	N02°35.9	186°21.5	N19°12.1	237°07.7	N23°04.4	320°26.4	S02°17.6
7	335°18.4	328°02.0	36.4	201°22.7	11.8	252°09.6	04.4	335°28.6	17.5
8	350°20.9	343°02.6	36.8	216°24.0	11.4	267°11.5	04.4	350°30.9	17.5
9	5°23.3	358°03.2	·· 37.3	231°25.2	·· 11.0	282°13.4	·· 04.5	5°33.1	·· 17.4
10	20°25.8	13°03.8	37.8	246°26.4	10.6	297°15.3	04.5	20°35.4	17.3
11	35°28.3	28°04.4	38.3	261°27.7	10.2	312°17.2	04.5	35°37.6	17.2
12	50°30.7	43°05.0	N02°38.8	276°28.9	N19°09.9	327°19.1	N23°04.6	50°39.9	S02°17.1
13	65°33.2	58°05.5	39.3	291°30.1	09.5	342°20.9	04.6	65°42.1	17.0
14	80°35.7	73°06.1	39.7	306°31.3	09.1	357°22.8	04.6	80°44.4	17.0
15	95°38.1	88°06.7	·· 40.2	321°32.6	·· 08.7	12°24.7	·· 04.7	95°46.6	·· 16.9
16	110°40.6	103°07.3	40.7	336°33.8	08.3	27°26.6	04.7	110°48.9	16.8
17	125°43.1	118°07.9	41.2	351°35.0	07.9	42°28.5	04.7	125°51.1	16.7
18	140°45.5	133°08.5	N02°41.7	6°36.3	N19°07.6	57°30.4	N23°04.7	140°53.4	S02°16.6
19	155°48.0	148°09.0	42.2	21°37.5	07.2	72°32.3	04.8	155°55.7	16.6
20	170°50.4	163°09.6	42.7	36°38.7	06.8	87°34.2	04.8	170°57.9	16.5
21	185°52.9	178°10.2	·· 43.2	51°39.9	·· 06.4	102°36.1	·· 04.8	186°00.2	·· 16.4
22	200°55.4	193°10.8	43.7	66°41.2	06.0	117°38.0	04.9	201°02.4	16.3
23	215°57.8	208°11.4	44.2	81°42.4	05.6	132°39.8	04.9	216°04.7	16.2
Mer.pass. 08:39		ν 0.6′	d 0.5′	m -4.61	ν 1.2′	d 0.4′	m 1.08	ν 1.9′	d 0.0′ m -1.95	ν 2.3′	d 0.1′ m 1.14

Stars

	SHA	Dec
Alpheratz	357°34.8	29°13.6
Ankaa	353°07.2	-42°10.0
Schedar	349°31.2	56°40.4
Diphda	348°47.3	-17°50.9
Achernar	335°20.5	-57°06.4
Hamal	327°51.3	23°34.8
Polaris	314°24.3	89°22.2
Acamar	315°12.0	-40°12.2
Menkar	314°06.2	4°11.3
Mirfak	308°28.4	49°57.0
Aldebaran	290°39.7	16°33.6
Rigel	281°03.9	-8°10.4
Capella	280°21.9	46°01.5
Bellatrix	278°22.9	6°22.3
Elnath	278°01.9	28°37.7
Alnilam	275°37.8	-1°11.2
Betelgeuse	270°52.1	7°24.7
Canopus	263°52.7	-52°42.7
Sirius	258°26.2	-16°45.2
Adhara	255°05.9	-29°00.5
Procyon	244°50.7	5°09.6
Pollux	243°17.2	27°58.0
Avior	234°14.9	-59°35.7
Suhail	222°46.2	-43°32.3
Miaplacidus	221°38.4	-69°49.6
Alphard	217°47.5	-8°46.2
Regulus	207°34.1	11°50.6
Dubhe	193°40.4	61°37.1
Denebola	182°24.5	14°25.8
Gienah	175°43.1	-17°41.1
Acrux	172°59.4	-63°14.6
Gacrux	171°51.0	-57°15.6
Alioth	166°12.3	55°49.4
Spica	158°21.8	-11°17.7
Alkaid	152°51.3	49°11.2
Hadar	148°35.1	-60°29.9
Menkent	147°57.0	-36°29.8
Arcturus	145°47.3	19°02.9
Rigil Kent.	139°39.3	-60°56.5
Kochab	137°18.6	74°03.0
Zuben'ubi	136°55.4	-16°08.9
Alphecca	126°03.2	26°37.6
Antares	112°15.2	-26°29.3
Atria	107°08.7	-69°04.3
Sabik	102°02.2	-15°45.4
Shaula	96°09.7	-37°07.3
Rasalhague	95°58.0	12°32.3
Eltanin	90°41.6	51°28.9
Kaus Aust.	83°31.9	-34°22.3
Vega	80°32.8	38°48.2
Nunki	75°47.2	-26°15.9
Altair	61°59.6	8°56.0
Peacock	53°05.1	-56°39.0
Deneb	49°25.5	45°21.9
Enif	33°38.6	9°59.3
Al Na'ir	27°32.7	-46°50.1
Fomalhaut	15°14.4	-29°29.2
Scheat	13°45.1	28°13.0
Markab	13°29.8	15°20.3

May 10 Sat	SHA	Mer.pass
Venus	354°24.5	09:10
Mars	227°11.9	17:38
Jupiter	277°22.6	14:16
Saturn	0°21.9	08:45

May 11 Sun	SHA	Mer.pass
Venus	353°41.0	09:09
Mars	226°42.5	17:36
Jupiter	277°08.9	14:13
Saturn	0°16.8	08:41

May 12 Mon	SHA	Mer.pass
Venus	352°56.7	09:08
Mars	226°12.9	17:34
Jupiter	276°55.2	14:10
Saturn	0°11.7	08:38

Horizontal parallax	
Venus:	0.3
Mars:	0.1

h	Sun		Moon				
Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°54.0	N17°37.9	30°12.7	16.7′	S09°48.4	13.4′	54.0′
1	195°54.0	38.6	44°48.4	16.6′	10°01.8	13.4′	54.0′
2	210°54.0	39.2	59°24.0	16.6′	10°15.2	13.3′	54.0′
3	225°54.0	·· 39.9	73°59.6	16.6′	10°28.5	13.2′	53.9′
4	240°54.1	40.5	88°35.2	16.5′	10°41.7	13.3′	53.9′
5	255°54.1	41.2	103°10.7	16.5′	10°55.0	13.2′	53.9′
6	270°54.1	N17°41.8	117°46.2	16.5′	S11°08.2	13.1′	53.9′
7	285°54.1	42.5	132°21.7	16.4′	11°21.3	13.1′	53.9′
8	300°54.1	43.1	146°57.1	16.4′	11°34.4	13.1′	53.9′
9	315°54.2	·· 43.8	161°32.4	16.3′	11°47.5	13.0′	53.9′
10	330°54.2	44.4	176°07.8	16.3′	12°00.5	13.0′	53.9′
11	345°54.2	45.1	190°43.1	16.2′	12°13.5	12.9′	53.9′
12	0°54.2	N17°45.7	205°18.3	16.2′	S12°26.4	12.9′	53.9′
13	15°54.2	46.4	219°53.5	16.2′	12°39.3	12.9′	53.9′
14	30°54.3	47.0	234°28.6	16.1′	12°52.2	12.8′	53.9′
15	45°54.3	·· 47.7	249°03.7	16.1′	13°05.0	12.7′	53.9′
16	60°54.3	48.3	263°38.8	16.0′	13°17.7	12.7′	53.9′
17	75°54.3	49.0	278°13.8	16.0′	13°30.4	12.7′	53.9′
18	90°54.3	N17°49.6	292°48.8	15.9′	S13°43.1	12.6′	53.9′
19	105°54.4	50.2	307°23.7	15.9′	13°55.7	12.5′	53.9′
20	120°54.4	50.9	321°58.5	15.8′	14°08.2	12.5′	53.9′
21	135°54.4	·· 51.5	336°33.3	15.8′	14°20.7	12.4′	53.9′
22	150°54.4	52.2	351°08.1	15.7′	14°33.1	12.4′	53.9′
23	165°54.4	52.8	5°42.8	15.6′	14°45.5	12.3′	53.9′
	SD = 15.8′	d = 0.7′	SD = 14.7′				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°54.5	N17°53.5	20°17.5	15.6′	S14°57.8	12.3′	53.9′
1	195°54.5	54.1	34°52.0	15.5′	15°10.1	12.2′	53.9′
2	210°54.5	54.7	49°26.6	15.5′	15°22.3	12.2′	53.9′
3	225°54.5	·· 55.4	64°01.1	15.4′	15°34.5	12.1′	53.9′
4	240°54.5	56.0	78°35.5	15.4′	15°46.6	12.0′	53.9′
5	255°54.5	56.6	93°09.9	15.3′	15°58.6	12.0′	53.9′
6	270°54.6	N17°57.3	107°44.2	15.2′	S16°10.6	11.9′	53.9′
7	285°54.6	57.9	122°18.4	15.2′	16°22.5	11.9′	53.9′
8	300°54.6	58.6	136°52.6	15.1′	16°34.4	11.8′	53.9′
9	315°54.6	·· 59.2	151°26.7	15.1′	16°46.2	11.7′	53.9′
10	330°54.6	17°59.8	166°00.8	15.0′	16°57.9	11.7′	53.9′
11	345°54.6	18°00.5	180°34.8	14.9′	17°09.6	11.6′	53.9′
12	0°54.6	N18°01.1	195°08.7	14.9′	S17°21.2	11.5′	53.9′
13	15°54.7	01.7	209°42.6	14.8′	17°32.7	11.5′	53.9′
14	30°54.7	02.4	224°16.4	14.8′	17°44.2	11.4′	53.9′
15	45°54.7	·· 03.0	238°50.2	14.7′	17°55.6	11.3′	53.9′
16	60°54.7	03.6	253°23.9	14.6′	18°06.9	11.3′	53.9′
17	75°54.7	04.3	267°57.5	14.6′	18°18.2	11.1′	53.9′
18	90°54.7	N18°04.9	282°31.1	14.5′	S18°29.3	11.2′	53.9′
19	105°54.7	05.5	297°04.5	14.4′	18°40.5	11.0′	53.9′
20	120°54.8	06.2	311°38.0	14.4′	18°51.5	11.0′	53.9′
21	135°54.8	·· 06.8	326°11.3	14.3′	19°02.5	10.9′	53.9′
22	150°54.8	07.4	340°44.6	14.2′	19°13.4	10.8′	53.9′
23	165°54.8	08.1	355°17.8	14.1′	19°24.2	10.7′	53.9′
	SD = 15.8′	d = 0.6′	SD = 14.7′				

Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°54.8	N18°08.7	9°51.0	14.1′	S19°34.9	10.7′	54.0′
1	195°54.8	09.3	24°24.0	14.0′	19°45.6	10.6′	54.0′
2	210°54.8	09.9	38°57.0	13.9′	19°56.2	10.5′	54.0′
3	225°54.8	·· 10.6	53°30.0	13.9′	20°06.7	10.4′	54.0′
4	240°54.8	11.2	68°02.8	13.8′	20°17.1	10.3′	54.0′
5	255°54.9	11.8	82°35.6	13.7′	20°27.4	10.3′	54.0′
6	270°54.9	N18°12.4	97°08.4	13.6′	S20°37.7	10.1′	54.0′
7	285°54.9	13.1	111°41.0	13.6′	20°47.8	10.1′	54.0′
8	300°54.9	13.7	126°13.6	13.5′	20°57.9	10.0′	54.0′
9	315°54.9	·· 14.3	140°46.1	13.4′	21°07.9	10.0′	54.0′
10	330°54.9	14.9	155°18.5	13.4′	21°17.9	9.8′	54.0′
11	345°54.9	15.6	169°50.9	13.3′	21°27.7	9.7′	54.0′
12	0°54.9	N18°16.2	184°23.1	13.2′	S21°37.4	9.7′	54.0′
13	15°54.9	16.8	198°55.4	13.1′	21°47.1	9.6′	54.0′
14	30°54.9	17.4	213°27.5	13.1′	21°56.7	9.4′	54.0′
15	45°55.0	·· 18.1	227°59.5	13.0′	22°06.1	9.4′	54.0′
16	60°55.0	18.7	242°31.5	12.9′	22°15.5	9.3′	54.0′
17	75°55.0	19.3	257°03.4	12.8′	22°24.8	9.2′	54.0′
18	90°55.0	N18°19.9	271°35.3	12.8′	S22°34.0	9.1′	54.0′
19	105°55.0	20.5	286°07.0	12.7′	22°43.1	9.0′	54.1′
20	120°55.0	21.1	300°38.7	12.6′	22°52.1	8.9′	54.1′
21	135°55.0	·· 21.8	315°10.3	12.5′	23°01.0	8.8′	54.1′
22	150°55.0	22.4	329°41.9	12.5′	23°09.8	8.7′	54.1′
23	165°55.0	23.0	344°13.3	12.4′	23°18.5	8.6′	54.1′
	SD = 15.8′	d = 0.6′	SD = 14.7′				

Lat.	**Twilight** Naut.	**Twilight** Civil	**Sunrise**	**Sunset**	**Twilight** Civil	**Twilight** Naut.
N 72°	▭	▭	▭	▭	▭	▭
N 70°	////	////	01:21	22:39	////	////
68°	////	////	02:07	21:50	////	////
66°	////	00:19	02:37	21:19	////	////
64°	////	01:33	02:59	20:56	22:25	////
62°	////	02:07	03:17	20:38	21:49	////
60°	00:17	02:31	03:31	20:23	21:24	////
N 58°	01:23	02:51	03:44	20:10	21:04	22:34
56°	01:55	03:06	03:54	20:00	20:48	22:01
54°	02:17	03:20	04:04	19:50	20:35	21:38
52°	02:35	03:31	04:12	19:42	20:23	21:19
50°	02:50	03:41	04:20	19:34	20:13	21:04
45°	03:19	04:02	04:36	19:18	19:52	20:34
N 40°	03:41	04:18	04:49	19:05	19:35	20:13
35°	03:58	04:32	05:00	18:54	19:21	19:55
30°	04:12	04:43	05:09	18:44	19:10	19:41
20°	04:34	05:02	05:26	18:27	18:51	19:19
N 10°	04:52	05:18	05:40	18:13	18:35	19:01
0°	05:06	05:31	05:53	18:00	18:22	18:47
S 10°	05:18	05:44	06:06	17:47	18:09	18:34
20°	05:30	05:57	06:20	17:33	17:56	18:22
30°	05:41	06:10	06:35	17:17	17:42	18:11
35°	05:47	06:18	06:44	17:08	17:35	18:05
40°	05:53	06:26	06:55	16:58	17:26	17:59
45°	06:00	06:35	07:07	16:45	17:17	17:52
S 50°	06:07	06:46	07:21	16:31	17:06	17:45
52°	06:10	06:51	07:28	16:24	17:01	17:42
54°	06:13	06:57	07:36	16:16	16:56	17:39
56°	06:17	07:02	07:44	16:08	16:50	17:35
58°	06:21	07:09	07:54	15:58	16:43	17:31
S 60°	06:25	07:16	08:05	15:47	16:36	17:27

Lat.	**Moonrise** Sat	**Moonrise** Sun	**Moonrise** Mon	**Moonset** Sat	**Moonset** Sun	**Moonset** Mon
N 72°	19:57	▬	▬	01:46	00:53	▬
N 70°	19:26	22:17	▬	02:02	01:26	00:04
68°	19:03	21:13	▬	02:15	01:50	01:09
66°	18:46	20:38	23:10	02:25	02:08	01:45
64°	18:32	20:13	22:09	02:34	02:24	02:11
62°	18:20	19:54	21:35	02:42	02:37	02:31
60°	18:10	19:38	21:11	02:49	02:48	02:48
N 58°	18:02	19:25	20:51	02:54	02:57	03:02
56°	17:54	19:13	20:35	03:00	03:06	03:14
54°	17:47	19:03	20:21	03:04	03:13	03:24
52°	17:41	18:55	20:09	03:09	03:20	03:34
50°	17:36	18:47	19:59	03:13	03:26	03:42
45°	17:24	18:30	19:37	03:21	03:39	04:00
N 40°	17:15	18:16	19:19	03:28	03:50	04:15
35°	17:07	18:05	19:04	03:34	04:00	04:28
30°	16:59	17:55	18:52	03:40	04:08	04:39
20°	16:47	17:38	18:30	03:49	04:22	04:58
N 10°	16:36	17:23	18:11	03:58	04:35	05:15
0°	16:27	17:09	17:54	04:05	04:47	05:30
S 10°	16:17	16:55	17:37	04:13	04:59	05:46
20°	16:06	16:40	17:18	04:22	05:11	06:03
30°	15:54	16:24	16:57	04:31	05:26	06:22
35°	15:48	16:14	16:45	04:37	05:34	06:33
40°	15:40	16:03	16:31	04:43	05:44	06:47
45°	15:31	15:50	16:14	04:51	05:56	07:02
S 50°	15:20	15:35	15:54	05:00	06:10	07:21
52°	15:15	15:28	15:44	05:04	06:16	07:30
54°	15:10	15:20	15:33	05:09	06:24	07:41
56°	15:04	15:11	15:21	05:14	06:32	07:52
58°	14:57	15:01	15:07	05:20	06:41	08:06
S 60°	14:50	14:49	14:50	05:26	06:52	08:22

Day	**Sun** Eqn.of Time 00^h mm:ss	**Sun** Eqn.of Time 12^h mm:ss	**Sun** Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	**Moon** Mer.Pass. Lower hh:mm	**Moon** Age 13-15 94-99%
10	03:36	03:37	11:56	22:36	10:16	
11	03:38	03:39	11:56	23:19	10:58	
12	03:39	03:40	11:56	–:–	11:42	

May 13, 14, 15 UT (Tue., Wed., Thu.)

	Aries	Venus		Mars		Jupiter		Saturn	
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	231°00.3	223°11.9	N02°44.7	96°43.6	N19°05.3	147°41.7	N23°04.9	231°06.9	S02°16.1
1	246°02.8	238°12.5	45.2	111°44.9	04.9	162°43.6	04.9	246°09.2	16.1
2	261°05.2	253°13.1	45.7	126°46.1	04.5	177°45.5	05.0	261°11.4	16.0
3	276°07.7	268°13.6	·· 46.1	141°47.3	·· 04.1	192°47.4	·· 05.0	276°13.7	·· 15.9
4	291°10.2	283°14.2	46.6	156°48.5	03.7	207°49.3	05.0	291°16.0	15.8
5	306°12.6	298°14.8	47.1	171°49.8	03.3	222°51.2	05.1	306°18.2	15.7
6	321°15.1	313°15.3	N02°47.6	186°51.0	N19°02.9	237°53.1	N23°05.1	321°20.5	S02°15.7
7	336°17.6	328°15.9	48.1	201°52.2	02.6	252°54.9	05.1	336°22.7	15.6
8	351°20.0	343°16.5	48.6	216°53.4	02.2	267°56.8	05.1	351°25.0	15.5
9	6°22.5	358°17.0	·· 49.2	231°54.7	·· 01.8	282°58.7	·· 05.2	6°27.2	·· 15.4
10	21°24.9	13°17.6	49.7	246°55.9	01.4	298°00.6	05.2	21°29.5	15.3
11	36°27.4	28°18.2	50.2	261°57.1	01.0	313°02.5	05.2	36°31.8	15.2
12	51°29.9	43°18.7	N02°50.7	276°58.3	N19°00.6	328°04.4	N23°05.3	51°34.0	S02°15.2
13	66°32.3	58°19.3	51.2	291°59.6	19°00.2	343°06.3	05.3	66°36.3	15.1
14	81°34.8	73°19.8	51.7	307°00.8	18°59.9	358°08.2	05.3	81°38.5	15.0
15	96°37.3	88°20.4	·· 52.2	322°02.0	·· 59.5	13°10.1	·· 05.4	96°40.8	·· 14.9
16	111°39.7	103°20.9	52.7	337°03.2	59.1	28°11.9	05.4	111°43.0	14.8
17	126°42.2	118°21.5	53.2	352°04.5	58.7	43°13.8	05.4	126°45.3	14.8
18	141°44.7	133°22.0	N02°53.7	7°05.7	N18°58.3	58°15.7	N23°05.4	141°47.5	S02°14.7
19	156°47.1	148°22.6	54.2	22°06.9	57.9	73°17.6	05.5	156°49.8	14.6
20	171°49.6	163°23.1	54.7	37°08.1	57.5	88°19.5	05.5	171°52.1	14.5
21	186°52.1	178°23.7	·· 55.3	52°09.4	·· 57.1	103°21.4	·· 05.5	186°54.3	·· 14.4
22	201°54.5	193°24.2	55.8	67°10.6	56.8	118°23.3	05.6	201°56.6	14.4
23	216°57.0	208°24.8	56.3	82°11.8	56.4	133°25.2	05.6	216°58.8	14.3
Mer.pass. 08:35		ν 0.6′	d 0.5′	m -4.60	ν 1.2′	d 0.4′	m 1.09	ν 1.9′	d 0.0′ m -1.95	ν 2.3′	d 0.1′ m 1.14

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	231°59.4	223°25.3	N02°56.8	97°13.0	N18°56.0	148°27.0	N23°05.6	232°01.1	S02°14.2
1	247°01.9	238°25.9	57.3	112°14.3	55.6	163°28.9	05.6	247°03.4	14.1
2	262°04.4	253°26.4	57.8	127°15.5	55.2	178°30.8	05.7	262°05.6	14.0
3	277°06.8	268°27.0	·· 58.3	142°16.7	·· 54.8	193°32.7	·· 05.7	277°07.9	·· 14.0
4	292°09.3	283°27.5	58.9	157°17.9	54.4	208°34.6	05.7	292°10.1	13.9
5	307°11.8	298°28.0	59.4	172°19.2	54.0	223°36.5	05.8	307°12.4	13.8
6	322°14.2	313°28.6	N02°59.9	187°20.4	N18°53.6	238°38.4	N23°05.8	322°14.6	S02°13.7
7	337°16.7	328°29.1	03°00.4	202°21.6	53.2	253°40.2	05.8	337°16.9	13.6
8	352°19.2	343°29.6	00.9	217°22.8	52.9	268°42.1	05.8	352°19.2	13.6
9	7°21.6	358°30.2	·· 01.5	232°24.0	·· 52.5	283°44.0	·· 05.9	7°21.4	·· 13.5
10	22°24.1	13°30.7	02.0	247°25.3	52.1	298°45.9	05.9	22°23.7	13.4
11	37°26.5	28°31.2	02.5	262°26.5	51.7	313°47.8	05.9	37°25.9	13.3
12	52°29.0	43°31.8	N03°03.0	277°27.7	N18°51.3	328°49.7	N23°06.0	52°28.2	S02°13.2
13	67°31.5	58°32.3	03.6	292°28.9	50.9	343°51.6	06.0	67°30.5	13.2
14	82°33.9	73°32.8	04.1	307°30.2	50.5	358°53.4	06.0	82°32.7	13.1
15	97°36.4	88°33.4	·· 04.6	322°31.4	·· 50.1	13°55.3	·· 06.0	97°35.0	·· 13.0
16	112°38.9	103°33.9	05.2	337°32.6	49.7	28°57.2	06.1	112°37.2	12.9
17	127°41.3	118°34.4	05.7	352°33.8	49.3	43°59.1	06.1	127°39.5	12.8
18	142°43.8	133°34.9	N03°06.2	7°35.0	N18°48.9	59°01.0	N23°06.1	142°41.8	S02°12.8
19	157°46.3	148°35.5	06.7	22°36.3	48.6	74°02.9	06.1	157°44.0	12.7
20	172°48.7	163°36.0	07.3	37°37.5	48.2	89°04.8	06.2	172°46.3	12.6
21	187°51.2	178°36.5	·· 07.8	52°38.7	·· 47.8	104°06.6	·· 06.2	187°48.5	·· 12.5
22	202°53.7	193°37.0	08.3	67°39.9	47.4	119°08.5	06.2	202°50.8	12.4
23	217°56.1	208°37.5	08.9	82°41.1	47.0	134°10.4	06.3	217°53.1	12.4
Mer.pass. 08:31		ν 0.5′	d 0.5′	m -4.59	ν 1.2′	d 0.4′	m 1.10	ν 1.9′	d 0.0′ m -1.95	ν 2.3′	d 0.1′ m 1.14

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	232°58.6	223°38.1	N03°09.4	97°42.4	N18°46.6	149°12.3	N23°06.3	232°55.3	S02°12.3
1	248°01.0	238°38.6	10.0	112°43.6	46.2	164°14.2	06.3	247°57.6	12.2
2	263°03.5	253°39.1	10.5	127°44.8	45.8	179°16.1	06.3	262°59.8	12.1
3	278°06.0	268°39.6	·· 11.0	142°46.0	·· 45.4	194°17.9	·· 06.4	278°02.1	·· 12.0
4	293°08.4	283°40.1	11.6	157°47.2	45.0	209°19.8	06.4	293°04.4	12.0
5	308°10.9	298°40.6	12.1	172°48.5	44.6	224°21.7	06.4	308°06.6	11.9
6	323°13.4	313°41.1	N03°12.6	187°49.7	N18°44.2	239°23.6	N23°06.5	323°08.9	S02°11.8
7	338°15.8	328°41.7	13.2	202°50.9	43.8	254°25.5	06.5	338°11.1	11.7
8	353°18.3	343°42.2	13.7	217°52.1	43.4	269°27.4	06.5	353°13.4	11.7
9	8°20.8	358°42.7	·· 14.3	232°53.3	·· 43.0	284°29.3	·· 06.5	8°15.7	·· 11.6
10	23°23.2	13°43.2	14.8	247°54.5	42.6	299°31.1	06.6	23°17.9	11.5
11	38°25.7	28°43.7	15.4	262°55.8	42.3	314°33.0	06.6	38°20.2	11.4
12	53°28.2	43°44.2	N03°15.9	277°57.0	N18°41.9	329°34.9	N23°06.6	53°22.4	S02°11.3
13	68°30.6	58°44.7	16.4	292°58.2	41.5	344°36.8	06.6	68°24.7	11.3
14	83°33.1	73°45.2	17.0	307°59.4	41.1	359°38.7	06.7	83°27.0	11.2
15	98°35.5	88°45.7	·· 17.5	323°00.6	·· 40.7	14°40.6	·· 06.7	98°29.2	·· 11.1
16	113°38.0	103°46.2	18.1	338°01.9	40.3	29°42.4	06.7	113°31.5	11.0
17	128°40.5	118°46.7	18.6	353°03.1	39.9	44°44.3	06.8	128°33.8	10.9
18	143°42.9	133°47.2	N03°19.2	8°04.3	N18°39.5	59°46.2	N23°06.8	143°36.0	S02°10.9
19	158°45.4	148°47.7	19.7	23°05.5	39.1	74°48.1	06.8	158°38.3	10.8
20	173°47.9	163°48.2	20.3	38°06.7	38.7	89°50.0	06.8	173°40.5	10.7
21	188°50.3	178°48.7	·· 20.8	53°07.9	·· 38.3	104°51.8	·· 06.9	188°42.8	·· 10.6
22	203°52.8	193°49.2	21.4	68°09.2	37.9	119°53.7	06.9	203°45.1	10.6
23	218°55.3	208°49.7	21.9	83°10.4	37.5	134°55.6	06.9	218°47.3	10.5
Mer.pass. 08:27		ν 0.5′	d 0.5′	m -4.58	ν 1.2′	d 0.4′	m 1.11	ν 1.9′	d 0.0′ m -1.95	ν 2.3′	d 0.1′ m 1.14

Stars

	SHA	Dec
Alpheratz	357°34.7	29°13.6
Ankaa	353°07.2	-42°10.0
Schedar	349°31.2	56°40.4
Diphda	348°47.3	-17°50.8
Achernar	335°20.5	-57°06.4
Hamal	327°51.2	23°34.8
Polaris	314°23.7	89°22.2
Acamar	315°12.0	-40°12.2
Menkar	314°06.2	4°11.3
Mirfak	308°28.4	49°57.0
Aldebaran	290°39.7	16°33.6
Rigel	281°03.9	-8°10.4
Capella	280°21.9	46°01.4
Bellatrix	278°22.9	6°22.3
Elnath	278°01.9	28°37.7
Alnilam	275°37.8	-1°11.2
Betelgeuse	270°52.1	7°24.7
Canopus	263°52.7	-52°42.7
Sirius	258°26.3	-16°45.2
Adhara	255°05.9	-29°00.5
Procyon	244°50.7	5°09.6
Pollux	243°17.2	27°58.0
Avior	234°14.9	-59°35.7
Suhail	222°46.2	-43°32.3
Miaplacidus	221°38.4	-69°49.6
Alphard	217°47.5	-8°46.2
Regulus	207°34.1	11°50.6
Dubhe	193°40.4	61°37.1
Denebola	182°24.5	14°25.8
Gienah	175°43.1	-17°41.1
Acrux	172°59.4	-63°14.6
Gacrux	171°51.0	-57°15.6
Alioth	166°12.3	55°49.4
Spica	158°21.8	-11°17.7
Alkaid	152°51.3	49°11.2
Hadar	148°35.1	-60°29.9
Menkent	147°56.9	-36°29.8
Arcturus	145°47.3	19°03.0
Rigil Kent.	139°39.3	-60°56.5
Kochab	137°18.6	74°03.1
Zuben'ubi	136°55.4	-16°08.9
Alphecca	126°03.1	26°37.7
Antares	112°15.2	-26°29.3
Atria	107°08.6	-69°04.3
Sabik	102°02.2	-15°45.4
Shaula	96°09.7	-37°07.3
Rasalhague	95°58.0	12°32.3
Eltanin	90°41.6	51°28.9
Kaus Aust.	83°31.9	-34°22.3
Vega	80°32.7	38°48.2
Nunki	75°47.2	-26°15.9
Altair	61°59.5	8°56.0
Peacock	53°05.1	-56°39.0
Deneb	49°25.5	45°21.9
Enif	33°38.5	9°59.3
Al Na'ir	27°32.6	-46°50.1
Fomalhaut	15°14.3	-29°29.2
Scheat	13°45.1	28°13.0
Markab	13°29.8	15°20.3

May 13 Tue	SHA	Mer.pass
Venus	352°11.6	09:07
Mars	225°43.3	17:32
Jupiter	276°41.4	14:07
Saturn	0°06.6	08:34

May 14 Wed	SHA	Mer.pass
Venus	351°25.9	09:06
Mars	225°13.6	17:30
Jupiter	276°27.6	14:04
Saturn	0°01.7	08:31

May 15 Thu	SHA	Mer.pass
Venus	350°39.5	09:05
Mars	224°43.8	17:28
Jupiter	276°13.7	14:01
Saturn	359°56.7	08:27

Horizontal parallax	
Venus:	0.3
Mars:	0.1

h	Sun		Moon				
Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°55.0	N18°23.6	358°44.7	12.3′	S23°27.1	8.5′	54.1′
1	195°55.0	24.2	13°16.0	12.2′	23°35.6	8.4′	54.1′
2	210°55.0	24.8	27°47.2	12.2′	23°44.0	8.3′	54.1′
3	225°55.0	·· 25.5	42°18.4	12.1′	23°52.3	8.2′	54.1′
4	240°55.0	26.1	56°49.5	12.0′	24°00.5	8.1′	54.1′
5	255°55.0	26.7	71°20.5	11.9′	24°08.6	8.0′	54.1′
6	270°55.0	N18°27.3	85°51.4	11.9′	S24°16.6	7.9′	54.1′
7	285°55.0	27.9	100°22.3	11.8′	24°24.5	7.7′	54.1′
8	300°55.1	28.5	114°53.1	11.7′	24°32.2	7.7′	54.1′
9	315°55.1	·· 29.1	129°23.8	11.6′	24°39.9	7.6′	54.2′
10	330°55.1	29.7	143°54.4	11.6′	24°47.5	7.4′	54.2′
11	345°55.1	30.4	158°25.0	11.5′	24°54.9	7.3′	54.2′
12	0°55.1	N18°31.0	172°55.4	11.4′	S25°02.2	7.2′	54.2′
13	15°55.1	31.6	187°25.9	11.3′	25°09.4	7.1′	54.2′
14	30°55.1	32.2	201°56.2	11.3′	25°16.5	7.0′	54.2′
15	45°55.1	·· 32.8	216°26.5	11.2′	25°23.5	6.9′	54.2′
16	60°55.1	33.4	230°56.7	11.1′	25°30.4	6.8′	54.2′
17	75°55.1	34.0	245°26.8	11.1′	25°37.2	6.6′	54.2′
18	90°55.1	N18°34.6	259°56.8	11.0′	S25°43.8	6.5′	54.2′
19	105°55.1	35.2	274°26.8	10.9′	25°50.3	6.4′	54.2′
20	120°55.1	35.8	288°56.7	10.8′	25°56.7	6.3′	54.3′
21	135°55.1	·· 36.4	303°26.6	10.8′	26°03.0	6.2′	54.3′
22	150°55.1	37.0	317°56.4	10.7′	26°09.2	6.0′	54.3′
23	165°55.1	37.6	332°26.1	10.6′	26°15.2	6.0′	54.3′
	SD = 15.8′	d = 0.6′	SD = 14.8′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°55.1	N18°38.2	346°55.7	10.6′	S26°21.2	5.8′	54.3′
1	195°55.1	38.8	1°25.3	10.5′	26°27.0	5.6′	54.3′
2	210°55.1	39.4	15°54.8	10.4′	26°32.6	5.6′	54.3′
3	225°55.1	·· 40.0	30°24.2	10.4′	26°38.2	5.4′	54.3′
4	240°55.1	40.6	44°53.6	10.3′	26°43.6	5.3′	54.3′
5	255°55.1	41.2	59°22.9	10.2′	26°48.9	5.2′	54.4′
6	270°55.1	N18°41.8	73°52.1	10.2′	S26°54.1	5.0′	54.4′
7	285°55.1	42.4	88°21.3	10.1′	26°59.1	4.9′	54.4′
8	300°55.1	43.0	102°50.4	10.1′	27°04.0	4.8′	54.4′
9	315°55.1	·· 43.6	117°19.5	10.0′	27°08.8	4.7′	54.4′
10	330°55.1	44.2	131°48.5	9.9′	27°13.5	4.5′	54.4′
11	345°55.1	44.8	146°17.4	9.9′	27°18.0	4.4′	54.4′
12	0°55.1	N18°45.4	160°46.3	9.8′	S27°22.4	4.2′	54.4′
13	15°55.1	46.0	175°15.1	9.8′	27°26.6	4.1′	54.5′
14	30°55.0	46.6	189°43.9	9.7′	27°30.7	4.0′	54.5′
15	45°55.0	·· 47.2	204°12.6	9.7′	27°34.7	3.9′	54.5′
16	60°55.0	47.8	218°41.3	9.6′	27°38.6	3.7′	54.5′
17	75°55.0	48.4	233°09.9	9.6′	27°42.3	3.6′	54.5′
18	90°55.0	N18°49.0	247°38.4	9.5′	S27°45.9	3.4′	54.5′
19	105°55.0	49.6	262°06.9	9.5′	27°49.3	3.3′	54.5′
20	120°55.0	50.2	276°35.4	9.4′	27°52.6	3.2′	54.5′
21	135°55.0	·· 50.8	291°03.8	9.4′	27°55.8	3.0′	54.6′
22	150°55.0	51.4	305°32.2	9.3′	27°58.8	2.9′	54.6′
23	165°55.0	52.0	320°00.5	9.3′	28°01.7	2.8′	54.6′
	SD = 15.8′	d = 0.6′	SD = 14.8′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°55.0	N18°52.5	334°28.7	9.2′	S28°04.5	2.6′	54.6′
1	195°55.0	53.1	348°57.0	9.2′	28°07.1	2.5′	54.6′
2	210°55.0	53.7	3°25.1	9.1′	28°09.6	2.3′	54.6′
3	225°55.0	·· 54.3	17°53.3	9.1′	28°11.9	2.2′	54.6′
4	240°55.0	54.9	32°21.4	9.1′	28°14.1	2.0′	54.7′
5	255°55.0	55.5	46°49.4	9.0′	28°16.1	1.9′	54.7′
6	270°55.0	N18°56.1	61°17.4	9.0′	S28°18.0	1.8′	54.7′
7	285°55.0	56.7	75°45.4	8.9′	28°19.8	1.6′	54.7′
8	300°54.9	57.2	90°13.4	8.9′	28°21.4	1.4′	54.7′
9	315°54.9	·· 57.8	104°41.3	8.9′	28°22.8	1.4′	54.7′
10	330°54.9	58.4	119°09.2	8.9′	28°24.2	1.1′	54.8′
11	345°54.9	59.0	133°37.0	8.8′	28°25.3	1.1′	54.8′
12	0°54.9	N18°59.6	148°04.8	8.8′	S28°26.4	0.9′	54.8′
13	15°54.9	19°00.2	162°32.6	8.8′	28°27.3	0.7′	54.8′
14	30°54.9	00.7	177°00.4	8.7′	28°28.0	0.6′	54.8′
15	45°54.9	·· 01.3	191°28.1	8.7′	28°28.6	0.4′	54.8′
16	60°54.9	01.9	205°55.9	8.7′	28°29.0	0.3′	54.8′
17	75°54.9	02.5	220°23.5	8.7′	28°29.3	0.2′	54.9′
18	90°54.8	N19°03.1	234°51.2	8.7′	S28°29.5	0.0′	54.9′
19	105°54.8	03.6	249°18.9	8.6′	28°29.5	0.2′	54.9′
20	120°54.8	04.2	263°46.5	8.6′	28°29.3	0.3′	54.9′
21	135°54.8	·· 04.8	278°14.1	8.6′	28°29.0	0.4′	54.9′
22	150°54.8	05.4	292°41.7	8.6′	28°28.6	0.6′	54.9′
23	165°54.8	06.0	307°09.3	8.6′	28°28.0	0.8′	55.0′
	SD = 15.8′	d = 0.6′	SD = 14.9′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°						
N 70°	////	////	00:51	23:15	////	////
68°	////	////	01:51	22:06	////	////
66°	////	////	02:25	21:31	////	////
64°	////	01:14	02:50	21:05	22:45	////
62°	////	01:55	03:09	20:46	22:02	////
60°	////	02:22	03:24	20:30	21:34	////
N 58°	01:06	02:42	03:37	20:17	21:12	22:52
56°	01:43	02:59	03:49	20:05	20:55	22:13
54°	02:09	03:13	03:59	19:55	20:41	21:46
52°	02:28	03:25	04:07	19:46	20:28	21:26
50°	02:44	03:36	04:15	19:38	20:18	21:10
45°	03:15	03:58	04:32	19:21	19:56	20:39
N 40°	03:37	04:15	04:46	19:08	19:38	20:16
35°	03:55	04:29	04:57	18:56	19:24	19:58
30°	04:10	04:41	05:07	18:46	19:12	19:43
20°	04:33	05:01	05:24	18:29	18:52	19:20
N 10°	04:51	05:17	05:39	18:14	18:36	19:02
0°	05:06	05:31	05:53	18:00	18:22	18:47
S 10°	05:19	05:44	06:06	17:46	18:08	18:34
20°	05:31	05:58	06:21	17:32	17:55	18:22
30°	05:43	06:12	06:37	17:15	17:40	18:09
35°	05:49	06:20	06:47	17:06	17:33	18:03
40°	05:56	06:29	06:58	16:55	17:24	17:57
45°	06:03	06:38	07:10	16:42	17:14	17:49
S 50°	06:11	06:50	07:26	16:27	17:02	17:42
52°	06:14	06:55	07:33	16:19	16:57	17:38
54°	06:18	07:01	07:41	16:11	16:51	17:34
56°	06:21	07:07	07:50	16:02	16:45	17:31
58°	06:26	07:14	08:00	15:52	16:38	17:26
S 60°	06:30	07:22	08:12	15:40	16:30	17:22

Lat.	**Moonrise** Tue	Wed	Thu	**Moonset** Tue	Wed	Thu
N 72°						
N 70°						
68°						
66°				00:48		
64°				01:50		
62°	23:27			02:24	02:14	
60°	22:46	·· ··	00:15	02:49	02:55	03:13
N 58°	22:18	23:37	·· ··	03:09	03:24	03:52
56°	21:56	23:10	·· ··	03:26	03:46	04:19
54°	21:38	22:49	23:47	03:40	04:04	04:40
52°	21:23	22:32	23:29	03:53	04:19	04:58
50°	21:10	22:17	23:14	04:04	04:33	05:13
45°	20:43	21:46	22:43	04:27	05:00	05:43
N 40°	20:22	21:23	22:19	04:45	05:22	06:07
35°	20:05	21:04	21:59	05:01	05:40	06:27
30°	19:50	20:47	21:42	05:15	05:56	06:43
20°	19:24	20:19	21:14	05:38	06:22	07:12
N 10°	19:02	19:55	20:49	05:58	06:45	07:36
0°	18:42	19:33	20:26	06:17	07:06	07:59
S 10°	18:22	19:11	20:04	06:36	07:28	08:21
20°	18:00	18:47	19:39	06:56	07:51	08:46
30°	17:35	18:20	19:11	07:20	08:17	09:14
35°	17:21	18:04	18:54	07:33	08:33	09:31
40°	17:04	17:45	18:34	07:50	08:52	09:50
45°	16:44	17:22	18:10	08:09	09:14	10:14
S 50°	16:19	16:53	17:40	08:33	09:42	10:45
52°	16:07	16:39	17:24	08:45	09:56	11:00
54°	15:53	16:22	17:06	08:58	10:13	11:18
56°	15:37	16:03	16:45	09:14	10:32	11:39
58°	15:18	15:38	16:17	09:32	10:56	12:07
S 60°	14:54	15:06	15:38	09:55	11:28	12:46

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 16-18 100-95%
13	03:40	03:40	11:56	00:05	12:29	
14	03:40	03:40	11:56	00:54	13:20	
15	03:40	03:40	11:56	01:46	14:12	

May 16, 17, 18 UT (Fri., Sat., Sun.)

	Aries	Venus		Mars		Jupiter		Saturn	
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	233°57.7	223°50.2	N03°22.5	98°11.6	N18°37.1	149°57.5	N23°06.9	233°49.6	S02°10.4
1	249°00.2	238°50.6	23.1	113°12.8	36.7	164°59.4	07.0	248°51.9	10.3
2	264°02.7	253°51.1	23.6	128°14.0	36.3	180°01.3	07.0	263°54.1	10.2
3	279°05.1	268°51.6	·· 24.2	143°15.2	·· 35.9	195°03.1	·· 07.0	278°56.4	·· 10.2
4	294°07.6	283°52.1	24.7	158°16.4	35.5	210°05.0	07.1	293°58.6	10.1
5	309°10.0	298°52.6	25.3	173°17.7	35.1	225°06.9	07.1	309°00.9	10.0
6	324°12.5	313°53.1	N03°25.8	188°18.9	N18°34.7	240°08.8	N23°07.1	324°03.2	S02°09.9
7	339°15.0	328°53.6	26.4	203°20.1	34.3	255°10.7	07.1	339°05.4	09.9
8	354°17.4	343°54.0	27.0	218°21.3	33.9	270°12.6	07.2	354°07.7	09.8
9	9°19.9	358°54.5	·· 27.5	233°22.5	·· 33.5	285°14.4	·· 07.2	9°10.0	·· 09.7
10	24°22.4	13°55.0	28.1	248°23.7	33.1	300°16.3	07.2	24°12.2	09.6
11	39°24.8	28°55.5	28.6	263°25.0	32.7	315°18.2	07.2	39°14.5	09.5
12	54°27.3	43°56.0	N03°29.2	278°26.2	N18°32.3	330°20.1	N23°07.3	54°16.8	S02°09.5
13	69°29.8	58°56.4	29.8	293°27.4	31.9	345°22.0	07.3	69°19.0	09.4
14	84°32.2	73°56.9	30.3	308°28.6	31.5	0°23.8	07.3	84°21.3	09.3
15	99°34.7	88°57.4	·· 30.9	323°29.8	·· 31.1	15°25.7	·· 07.3	99°23.5	·· 09.2
16	114°37.2	103°57.9	31.5	338°31.0	30.7	30°27.6	07.4	114°25.8	09.2
17	129°39.6	118°58.3	32.0	353°32.2	30.3	45°29.5	07.4	129°28.1	09.1
18	144°42.1	133°58.8	N03°32.6	8°33.4	N18°29.9	60°31.4	N23°07.4	144°30.3	S02°09.0
19	159°44.5	148°59.3	33.2	23°34.7	29.5	75°33.2	07.5	159°32.6	08.9
20	174°47.0	163°59.7	33.7	38°35.9	29.1	90°35.1	07.5	174°34.9	08.9
21	189°49.5	179°00.2	·· 34.3	53°37.1	·· 28.7	105°37.0	·· 07.5	189°37.1	·· 08.8
22	204°51.9	194°00.7	34.9	68°38.3	28.3	120°38.9	07.5	204°39.4	08.7
23	219°54.4	209°01.2	35.5	83°39.5	27.9	135°40.8	07.6	219°41.7	08.6
Mer.pass. 08:23		ν 0.5′	d 0.6′	m -4.57	ν 1.2′	d 0.4′	m 1.12	ν 1.9′	d 0.0′ m -1.94	ν 2.3′	d 0.1′ m 1.13

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	234°56.9	224°01.6	N03°36.0	98°40.7	N18°27.5	150°42.6	N23°07.6	234°43.9	S02°08.5
1	249°59.3	239°02.1	36.6	113°41.9	27.1	165°44.5	07.6	249°46.2	08.5
2	265°01.8	254°02.5	37.2	128°43.1	26.7	180°46.4	07.6	264°48.5	08.4
3	280°04.3	269°03.0	·· 37.7	143°44.4	·· 26.3	195°48.3	·· 07.7	279°50.7	·· 08.3
4	295°06.7	284°03.5	38.3	158°45.6	25.9	210°50.2	07.7	294°53.0	08.2
5	310°09.2	299°03.9	38.9	173°46.8	25.5	225°52.0	07.7	309°55.3	08.2
6	325°11.7	314°04.4	N03°39.5	188°48.0	N18°25.1	240°53.9	N23°07.7	324°57.5	S02°08.1
7	340°14.1	329°04.8	40.0	203°49.2	24.7	255°55.8	07.8	339°59.8	08.0
8	355°16.6	344°05.3	40.6	218°50.4	24.3	270°57.7	07.8	355°02.1	07.9
9	10°19.0	359°05.8	·· 41.2	233°51.6	·· 23.9	285°59.6	·· 07.8	10°04.3	·· 07.9
10	25°21.5	14°06.2	41.8	248°52.8	23.5	301°01.4	07.8	25°06.6	07.8
11	40°24.0	29°06.7	42.4	263°54.0	23.1	316°03.3	07.9	40°08.9	07.7
12	55°26.4	44°07.1	N03°42.9	278°55.3	N18°22.7	331°05.2	N23°07.9	55°11.1	S02°07.6
13	70°28.9	59°07.6	43.5	293°56.5	22.3	346°07.1	07.9	70°13.4	07.5
14	85°31.4	74°08.0	44.1	308°57.7	21.9	1°09.0	07.9	85°15.7	07.5
15	100°33.8	89°08.5	·· 44.7	323°58.9	·· 21.5	16°10.8	·· 08.0	100°17.9	·· 07.4
16	115°36.3	104°08.9	45.3	339°00.1	21.1	31°12.7	08.0	115°20.2	07.3
17	130°38.8	119°09.4	45.9	354°01.3	20.6	46°14.6	08.0	130°22.5	07.2
18	145°41.2	134°09.8	N03°46.4	9°02.5	N18°20.2	61°16.5	N23°08.0	145°24.7	S02°07.2
19	160°43.7	149°10.3	47.0	24°03.7	19.8	76°18.4	08.1	160°27.0	07.1
20	175°46.1	164°10.7	47.6	39°04.9	19.4	91°20.2	08.1	175°29.3	07.0
21	190°48.6	179°11.1	·· 48.2	54°06.1	·· 19.0	106°22.1	·· 08.1	190°31.5	·· 06.9
22	205°51.1	194°11.6	48.8	69°07.4	18.6	121°24.0	08.2	205°33.8	06.9
23	220°53.5	209°12.0	49.4	84°08.6	18.2	136°25.9	08.2	220°36.1	06.8
Mer.pass. 08:19		ν 0.5′	d 0.6′	m -4.55	ν 1.2′	d 0.4′	m 1.14	ν 1.9′	d 0.0′ m -1.94	ν 2.3′	d 0.1′ m 1.13

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	235°56.0	224°12.5	N03°50.0	99°09.8	N18°17.8	151°27.7	N23°08.2	235°38.3	S02°06.7
1	250°58.5	239°12.9	50.6	114°11.0	17.4	166°29.6	08.2	250°40.6	06.6
2	266°00.9	254°13.4	51.2	129°12.2	17.0	181°31.5	08.3	265°42.9	06.6
3	281°03.4	269°13.8	·· 51.7	144°13.4	·· 16.6	196°33.4	·· 08.3	280°45.1	·· 06.5
4	296°05.9	284°14.2	52.3	159°14.6	16.2	211°35.3	08.3	295°47.4	06.4
5	311°08.3	299°14.7	52.9	174°15.8	15.8	226°37.1	08.3	310°49.7	06.3
6	326°10.8	314°15.1	N03°53.5	189°17.0	N18°15.4	241°39.0	N23°08.4	325°51.9	S02°06.3
7	341°13.3	329°15.5	54.1	204°18.2	15.0	256°40.9	08.4	340°54.2	06.2
8	356°15.7	344°16.0	54.7	219°19.4	14.6	271°42.8	08.4	355°56.5	06.1
9	11°18.2	359°16.4	·· 55.3	234°20.6	·· 14.1	286°44.6	·· 08.4	10°58.8	·· 06.0
10	26°20.6	14°16.8	55.9	249°21.8	13.7	301°46.5	08.5	26°01.0	06.0
11	41°23.1	29°17.3	56.5	264°23.1	13.3	316°48.4	08.5	41°03.3	05.9
12	56°25.6	44°17.7	N03°57.1	279°24.3	N18°12.9	331°50.3	N23°08.5	56°05.6	S02°05.8
13	71°28.0	59°18.1	57.7	294°25.5	12.5	346°52.2	08.5	71°07.8	05.7
14	86°30.5	74°18.5	58.3	309°26.7	12.1	1°54.0	08.6	86°10.1	05.7
15	101°33.0	89°19.0	·· 58.9	324°27.9	·· 11.7	16°55.9	·· 08.6	101°12.4	·· 05.6
16	116°35.4	104°19.4	03°59.5	339°29.1	11.3	31°57.8	08.6	116°14.6	05.5
17	131°37.9	119°19.8	04°00.1	354°30.3	10.9	46°59.7	08.6	131°16.9	05.4
18	146°40.4	134°20.2	N04°00.7	9°31.5	N18°10.5	62°01.5	N23°08.7	146°19.2	S02°05.4
19	161°42.8	149°20.7	01.3	24°32.7	10.1	77°03.4	08.7	161°21.4	05.3
20	176°45.3	164°21.1	01.9	39°33.9	09.6	92°05.3	08.7	176°23.7	05.2
21	191°47.8	179°21.5	·· 02.5	54°35.1	·· 09.2	107°07.2	·· 08.7	191°26.0	·· 05.1
22	206°50.2	194°21.9	03.1	69°36.3	08.8	122°09.0	08.8	206°28.3	05.1
23	221°52.7	209°22.3	03.7	84°37.5	08.4	137°10.9	08.8	221°30.5	05.0
Mer.pass. 08:15		ν 0.4′	d 0.6′	m -4.54	ν 1.2′	d 0.4′	m 1.15	ν 1.9′	d 0.0′ m -1.94	ν 2.3′	d 0.1′ m 1.13

Stars

	SHA	Dec
Alpheratz	357°34.7	29°13.6
Ankaa	353°07.1	-42°10.0
Schedar	349°31.2	56°40.4
Diphda	348°47.3	-17°50.8
Achernar	335°20.5	-57°06.3
Hamal	327°51.2	23°34.8
Polaris	314°23.1	89°22.2
Acamar	315°12.0	-40°12.1
Menkar	314°06.2	4°11.3
Mirfak	308°28.4	49°57.0
Aldebaran	290°39.6	16°33.6
Rigel	281°03.9	-8°10.4
Capella	280°21.9	46°01.4
Bellatrix	278°22.9	6°22.3
Elnath	278°01.9	28°37.7
Alnilam	275°37.8	-1°11.2
Betelgeuse	270°52.1	7°24.7
Canopus	263°52.7	-52°42.7
Sirius	258°26.3	-16°45.2
Adhara	255°05.9	-29°00.5
Procyon	244°50.7	5°09.6
Pollux	243°17.2	27°58.0
Avior	234°14.9	-59°35.7
Suhail	222°46.2	-43°32.3
Miaplacidus	221°38.4	-69°49.6
Alphard	217°47.5	-8°46.2
Regulus	207°34.1	11°50.6
Dubhe	193°40.4	61°37.1
Denebola	182°24.5	14°25.8
Gienah	175°43.1	-17°41.1
Acrux	172°59.4	-63°14.7
Gacrux	171°51.0	-57°15.6
Alioth	166°12.3	55°49.5
Spica	158°21.7	-11°17.7
Alkaid	152°51.3	49°11.2
Hadar	148°35.0	-60°29.9
Menkent	147°56.9	-36°29.8
Arcturus	145°47.3	19°03.0
Rigil Kent.	139°39.3	-60°56.5
Kochab	137°18.6	74°03.1
Zuben'ubi	136°55.4	-16°08.9
Alphecca	126°03.1	26°37.7
Antares	112°15.1	-26°29.3
Atria	107°08.6	-69°04.3
Sabik	102°02.1	-15°45.4
Shaula	96°09.6	-37°07.3
Rasalhague	95°58.0	12°32.4
Eltanin	90°41.6	51°28.9
Kaus Aust.	83°31.8	-34°22.3
Vega	80°32.7	38°48.2
Nunki	75°47.2	-26°15.9
Altair	61°59.5	8°56.0
Peacock	53°05.1	-56°39.0
Deneb	49°25.5	45°21.9
Enif	33°38.5	9°59.3
Al Na'ir	27°32.6	-46°50.1
Fomalhaut	15°14.3	-29°29.2
Scheat	13°45.1	28°13.0
Markab	13°29.7	15°20.3

May 16 Fri	SHA	Mer.pass
Venus	349°52.4	09:04
Mars	224°13.9	17:26
Jupiter	275°59.8	13:58
Saturn	359°51.9	08:23

May 17 Sat	SHA	Mer.pass
Venus	349°04.8	09:04
Mars	223°43.9	17:24
Jupiter	275°45.8	13:55
Saturn	359°47.1	08:20

May 18 Sun	SHA	Mer.pass
Venus	348°16.5	09:03
Mars	223°13.8	17:22
Jupiter	275°31.7	13:52
Saturn	359°42.3	08:16

Horizontal parallax	
Venus:	0.2
Mars:	0.1

h	Sun		Moon				
Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°54.8	N19°06.5	321°36.9	8.6′	S28°27.2	0.9′	55.0′
1	195°54.8	07.1	336°04.5	8.6′	28°26.3	1.0′	55.0′
2	210°54.8	07.7	350°32.0	8.6′	28°25.3	1.2′	55.0′
3	225°54.7	·· 08.3	4°59.6	8.5′	28°24.1	1.3′	55.0′
4	240°54.7	08.8	19°27.1	8.5′	28°22.8	1.5′	55.1′
5	255°54.7	09.4	33°54.7	8.5′	28°21.3	1.7′	55.1′
6	270°54.7	N19°10.0	48°22.2	8.5′	S28°19.6	1.7′	55.1′
7	285°54.7	10.6	62°49.7	8.5′	28°17.9	2.0′	55.1′
8	300°54.7	11.1	77°17.3	8.5′	28°15.9	2.1′	55.1′
9	315°54.7	·· 11.7	91°44.8	8.5′	28°13.8	2.2′	55.2′
10	330°54.6	12.3	106°12.3	8.5′	28°11.6	2.4′	55.2′
11	345°54.6	12.8	120°39.9	8.5′	28°09.2	2.5′	55.2′
12	0°54.6	N19°13.4	135°07.4	8.6′	S28°06.7	2.7′	55.2′
13	15°54.6	14.0	149°35.0	8.6′	28°04.0	2.8′	55.2′
14	30°54.6	14.5	164°02.5	8.6′	28°01.2	3.0′	55.2′
15	45°54.6	·· 15.1	178°30.1	8.6′	27°58.2	3.2′	55.3′
16	60°54.6	15.7	192°57.7	8.6′	27°55.0	3.2′	55.3′
17	75°54.5	16.2	207°25.3	8.6′	27°51.8	3.5′	55.3′
18	90°54.5	N19°16.8	221°52.9	8.6′	S27°48.3	3.6′	55.3′
19	105°54.5	17.4	236°20.5	8.6′	27°44.7	3.7′	55.4′
20	120°54.5	17.9	250°48.1	8.6′	27°41.0	3.9′	55.4′
21	135°54.5	·· 18.5	265°15.8	8.7′	27°37.1	4.0′	55.4′
22	150°54.5	19.1	279°43.4	8.7′	27°33.1	4.1′	55.4′
23	165°54.4	19.6	294°11.1	8.7′	27°29.0	4.4′	55.4′
	SD = 15.8′	d = 0.6′	SD = 15.0′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°54.4	N19°20.2	308°38.8	8.7′	S27°24.6	4.4′	55.5′
1	195°54.4	20.8	323°06.5	8.8′	27°20.2	4.6′	55.5′
2	210°54.4	21.3	337°34.3	8.8′	27°15.6	4.8′	55.5′
3	225°54.4	·· 21.9	352°02.1	8.8′	27°10.8	4.9′	55.5′
4	240°54.3	22.4	6°29.9	8.8′	27°05.9	5.0′	55.5′
5	255°54.3	23.0	20°57.7	8.9′	27°00.9	5.2′	55.6′
6	270°54.3	N19°23.6	35°25.6	8.9′	S26°55.7	5.4′	55.6′
7	285°54.3	24.1	49°53.4	8.9′	26°50.3	5.5′	55.6′
8	300°54.3	24.7	64°21.4	8.9′	26°44.8	5.6′	55.6′
9	315°54.2	·· 25.2	78°49.3	9.0′	26°39.2	5.8′	55.7′
10	330°54.2	25.8	93°17.3	9.0′	26°33.4	5.9′	55.7′
11	345°54.2	26.4	107°45.3	9.0′	26°27.5	6.0′	55.7′
12	0°54.2	N19°26.9	122°13.3	9.1′	S26°21.5	6.2′	55.7′
13	15°54.2	27.5	136°41.4	9.1′	26°15.3	6.4′	55.8′
14	30°54.1	28.0	151°09.5	9.1′	26°08.9	6.4′	55.8′
15	45°54.1	·· 28.6	165°37.7	9.2′	26°02.5	6.6′	55.8′
16	60°54.1	29.1	180°05.8	9.2′	25°55.9	6.8′	55.8′
17	75°54.1	29.7	194°34.1	9.3′	25°49.1	6.9′	55.8′
18	90°54.0	N19°30.2	209°02.3	9.3′	S25°42.2	7.0′	55.9′
19	105°54.0	30.8	223°30.6	9.3′	25°35.2	7.2′	55.9′
20	120°54.0	31.3	237°59.0	9.4′	25°28.0	7.3′	55.9′
21	135°54.0	·· 31.9	252°27.3	9.4′	25°20.7	7.5′	55.9′
22	150°54.0	32.4	266°55.8	9.5′	25°13.2	7.6′	56.0′
23	165°53.9	33.0	281°24.2	9.5′	25°05.6	7.7′	56.0′
	SD = 15.8′	d = 0.6′	SD = 15.1′				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°53.9	N19°33.5	295°52.7	9.5′	S24°57.9	7.8′	56.0′
1	195°53.9	34.1	310°21.3	9.6′	24°50.1	8.0′	56.0′
2	210°53.9	34.6	324°49.9	9.6′	24°42.1	8.2′	56.1′
3	225°53.8	·· 35.2	339°18.5	9.7′	24°33.9	8.2′	56.1′
4	240°53.8	35.7	353°47.2	9.7′	24°25.7	8.4′	56.1′
5	255°53.8	36.3	8°15.9	9.8′	24°17.3	8.5′	56.2′
6	270°53.8	N19°36.8	22°44.7	9.8′	S24°08.8	8.7′	56.2′
7	285°53.7	37.4	37°13.5	9.9′	24°00.1	8.7′	56.2′
8	300°53.7	37.9	51°42.4	9.9′	23°51.4	9.0′	56.2′
9	315°53.7	·· 38.5	66°11.3	10.0′	23°42.4	9.0′	56.3′
10	330°53.7	39.0	80°40.3	10.0′	23°33.4	9.2′	56.3′
11	345°53.6	39.5	95°09.3	10.1′	23°24.2	9.3′	56.3′
12	0°53.6	N19°40.1	109°38.3	10.1′	S23°14.9	9.4′	56.3′
13	15°53.6	40.6	124°07.4	10.1′	23°05.5	9.5′	56.4′
14	30°53.5	41.2	138°36.6	10.2′	22°56.0	9.7′	56.4′
15	45°53.5	·· 41.7	153°05.8	10.2′	22°46.3	9.8′	56.4′
16	60°53.5	42.3	167°35.0	10.3′	22°36.5	9.9′	56.5′
17	75°53.5	42.8	182°04.3	10.3′	22°26.6	10.0′	56.5′
18	90°53.4	N19°43.3	196°33.6	10.4′	S22°16.6	10.2′	56.5′
19	105°53.4	43.9	211°03.0	10.4′	22°06.4	10.3′	56.5′
20	120°53.4	44.4	225°32.5	10.5′	21°56.1	10.4′	56.6′
21	135°53.3	·· 44.9	240°02.0	10.5′	21°45.7	10.5′	56.6′
22	150°53.3	45.5	254°31.5	10.6′	21°35.2	10.6′	56.6′
23	165°53.3	46.0	269°01.1	10.6′	21°24.6	10.8′	56.7′
	SD = 15.8′	d = 0.5′	SD = 15.3′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	▭	▭	▭	▭	▭	▭
N 70°	▭	▭	▭	▭	▭	▭
68°	////	////	01:34	22:24	////	////
66°	////	////	02:13	21:43	////	////
64°	////	00:50	02:40	21:15	23:12	////
62°	////	01:42	03:01	20:54	22:15	////
60°	////	02:12	03:17	20:37	21:43	////
N 58°	00:45	02:34	03:31	20:23	21:20	23:16
56°	01:32	02:52	03:43	20:11	21:02	22:25
54°	02:00	03:07	03:54	20:00	20:47	21:55
52°	02:21	03:20	04:03	19:51	20:34	21:34
50°	02:38	03:31	04:11	19:42	20:22	21:16
45°	03:10	03:54	04:29	19:25	19:59	20:44
N 40°	03:34	04:12	04:43	19:10	19:41	20:20
35°	03:52	04:27	04:55	18:58	19:27	20:01
30°	04:07	04:39	05:05	18:48	19:14	19:46
20°	04:31	04:59	05:23	18:30	18:54	19:22
N 10°	04:50	05:16	05:39	18:14	18:37	19:03
0°	05:05	05:31	05:53	18:00	18:22	18:47
S 10°	05:19	05:45	06:07	17:46	18:08	18:34
20°	05:32	05:59	06:22	17:31	17:54	18:21
30°	05:45	06:14	06:39	17:13	17:39	18:08
35°	05:51	06:22	06:49	17:03	17:31	18:01
40°	05:58	06:31	07:00	16:52	17:21	17:54
45°	06:06	06:41	07:14	16:39	17:11	17:47
S 50°	06:14	06:54	07:30	16:23	16:59	17:38
52°	06:18	06:59	07:37	16:15	16:53	17:35
54°	06:22	07:05	07:46	16:07	16:47	17:31
56°	06:26	07:12	07:55	15:57	16:40	17:26
58°	06:30	07:19	08:06	15:46	16:33	17:22
S 60°	06:35	07:28	08:18	15:34	16:24	17:17

Lat.	**Moonrise** Fri	Sat	Sun	**Moonset** Fri	Sat	Sun
N 72°	▬	▬	▬	▬	▬	▬
N 70°	▬	▬	▬	▬	▬	▬
68°	▬	▬	▬	▬	▬	▬
66°	▬	▬	▬	▬	▬	▬
64°	▬	▬	03:04	▬	▬	05:59
62°	▬	02:36	02:22	▬	04:36	06:40
60°	01:18	01:44	01:54	04:02	05:28	07:08
N 58°	00:37	01:13	01:31	04:43	05:59	07:30
56°	00:09	00:49	01:13	05:11	06:23	07:47
54°	·· ··	00:29	00:58	05:33	06:42	08:02
52°	·· ··	00:13	00:45	05:51	06:58	08:15
50°	23:59	·· ··	00:33	06:06	07:12	08:26
45°	23:30	·· ··	00:08	06:37	07:40	08:50
N 40°	23:08	23:49	·· ··	07:01	08:02	09:08
35°	22:49	23:32	·· ··	07:20	08:20	09:24
30°	22:33	23:18	23:58	07:37	08:36	09:37
20°	22:06	22:54	23:38	08:05	09:02	10:00
N 10°	21:42	22:33	23:21	08:30	09:25	10:20
0°	21:20	22:13	23:05	08:52	09:46	10:38
S 10°	20:58	21:53	22:48	09:15	10:07	10:56
20°	20:35	21:32	22:31	09:39	10:29	11:16
30°	20:07	21:08	22:10	10:07	10:55	11:38
35°	19:51	20:53	21:58	10:24	11:10	11:51
40°	19:32	20:36	21:44	10:43	11:28	12:05
45°	19:09	20:16	21:28	11:06	11:49	12:23
S 50°	18:39	19:50	21:08	11:36	12:15	12:44
52°	18:25	19:38	20:58	11:51	12:28	12:55
54°	18:08	19:23	20:47	12:08	12:43	13:06
56°	17:47	19:07	20:34	12:28	13:00	13:19
58°	17:22	18:47	20:20	12:54	13:21	13:35
S 60°	16:47	18:21	20:03	13:30	13:46	13:53

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 19-21 90-75%
16	03:39	03:38	11:56	02:39	15:06	
17	03:38	03:37	11:56	03:33	16:00	
18	03:36	03:34	11:56	04:26	16:51	

May 19, 20, 21 UT (Mon., Tue., Wed.)

	Aries	Venus		Mars		Jupiter		Saturn	
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	236°55.1	224°22.8	N04°04.3	99°38.7	N18°08.0	152°12.8	N23°08.8	236°32.8	S02°04.9
1	251°57.6	239°23.2	04.9	114°39.9	07.6	167°14.7	08.8	251°35.1	04.8
2	267°00.1	254°23.6	05.5	129°41.1	07.2	182°16.5	08.9	266°37.3	04.8
3	282°02.5	269°24.0	·· 06.1	144°42.3	·· 06.8	197°18.4	·· 08.9	281°39.6	·· 04.7
4	297°05.0	284°24.4	06.8	159°43.5	06.4	212°20.3	08.9	296°41.9	04.6
5	312°07.5	299°24.8	07.4	174°44.7	06.0	227°22.2	08.9	311°44.2	04.5
6	327°09.9	314°25.2	N04°08.0	189°46.0	N18°05.5	242°24.1	N23°08.9	326°46.4	S02°04.5
7	342°12.4	329°25.6	08.6	204°47.2	05.1	257°25.9	09.0	341°48.7	04.4
8	357°14.9	344°26.0	09.2	219°48.4	04.7	272°27.8	09.0	356°51.0	04.3
9	12°17.3	359°26.5	·· 09.8	234°49.6	·· 04.3	287°29.7	·· 09.0	11°53.2	·· 04.2
10	27°19.8	14°26.9	10.4	249°50.8	03.9	302°31.6	09.0	26°55.5	04.2
11	42°22.3	29°27.3	11.0	264°52.0	03.5	317°33.4	09.1	41°57.8	04.1
12	57°24.7	44°27.7	N04°11.6	279°53.2	N18°03.1	332°35.3	N23°09.1	57°00.1	S02°04.0
13	72°27.2	59°28.1	12.3	294°54.4	02.7	347°37.2	09.1	72°02.3	04.0
14	87°29.6	74°28.5	12.9	309°55.6	02.2	2°39.1	09.1	87°04.6	03.9
15	102°32.1	89°28.9	·· 13.5	324°56.8	·· 01.8	17°40.9	·· 09.2	102°06.9	·· 03.8
16	117°34.6	104°29.3	14.1	339°58.0	01.4	32°42.8	09.2	117°09.1	03.7
17	132°37.0	119°29.7	14.7	354°59.2	01.0	47°44.7	09.2	132°11.4	03.7
18	147°39.5	134°30.1	N04°15.3	10°00.4	N18°00.6	62°46.6	N23°09.2	147°13.7	S02°03.6
19	162°42.0	149°30.5	16.0	25°01.6	18°00.2	77°48.4	09.3	162°16.0	03.5
20	177°44.4	164°30.9	16.6	40°02.8	17°59.8	92°50.3	09.3	177°18.2	03.4
21	192°46.9	179°31.3	·· 17.2	55°04.0	·· 59.3	107°52.2	·· 09.3	192°20.5	·· 03.4
22	207°49.4	194°31.7	17.8	70°05.2	58.9	122°54.1	09.3	207°22.8	03.3
23	222°51.8	209°32.1	18.4	85°06.4	58.5	137°55.9	09.4	222°25.1	03.2
Mer.pass. 08:11		ν 0.4′	d 0.6′	m -4.53	ν 1.2′	d 0.4′	m 1.16	ν 1.9′	d 0.0′ m -1.94	ν 2.3′	d 0.1′ m 1.12

Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	237°54.3	224°32.5	N04°19.1	100°07.6	N17°58.1	152°57.8	N23°09.4	237°27.3	S02°03.1
1	252°56.7	239°32.9	19.7	115°08.8	57.7	167°59.7	09.4	252°29.6	03.1
2	267°59.2	254°33.2	20.3	130°10.0	57.3	183°01.5	09.4	267°31.9	03.0
3	283°01.7	269°33.6	·· 20.9	145°11.2	·· 56.9	198°03.4	·· 09.5	282°34.1	·· 02.9
4	298°04.1	284°34.0	21.5	160°12.4	56.4	213°05.3	09.5	297°36.4	02.9
5	313°06.6	299°34.4	22.2	175°13.6	56.0	228°07.2	09.5	312°38.7	02.8
6	328°09.1	314°34.8	N04°22.8	190°14.8	N17°55.6	243°09.0	N23°09.5	327°41.0	S02°02.7
7	343°11.5	329°35.2	23.4	205°16.0	55.2	258°10.9	09.5	342°43.2	02.6
8	358°14.0	344°35.6	24.0	220°17.2	54.8	273°12.8	09.6	357°45.5	02.6
9	13°16.5	359°36.0	·· 24.7	235°18.4	·· 54.4	288°14.7	·· 09.6	12°47.8	·· 02.5
10	28°18.9	14°36.3	25.3	250°19.6	53.9	303°16.5	09.6	27°50.1	02.4
11	43°21.4	29°36.7	25.9	265°20.8	53.5	318°18.4	09.6	42°52.3	02.3
12	58°23.9	44°37.1	N04°26.6	280°22.0	N17°53.1	333°20.3	N23°09.7	57°54.6	S02°02.3
13	73°26.3	59°37.5	27.2	295°23.2	52.7	348°22.2	09.7	72°56.9	02.2
14	88°28.8	74°37.9	27.8	310°24.4	52.3	3°24.0	09.7	87°59.2	02.1
15	103°31.2	89°38.3	·· 28.5	325°25.6	·· 51.9	18°25.9	·· 09.7	103°01.4	·· 02.1
16	118°33.7	104°38.6	29.1	340°26.8	51.4	33°27.8	09.8	118°03.7	02.0
17	133°36.2	119°39.0	29.7	355°28.0	51.0	48°29.6	09.8	133°06.0	01.9
18	148°38.6	134°39.4	N04°30.3	10°29.2	N17°50.6	63°31.5	N23°09.8	148°08.3	S02°01.8
19	163°41.1	149°39.8	31.0	25°30.4	50.2	78°33.4	09.8	163°10.5	01.8
20	178°43.6	164°40.1	31.6	40°31.6	49.8	93°35.3	09.8	178°12.8	01.7
21	193°46.0	179°40.5	·· 32.2	55°32.8	·· 49.3	108°37.1	·· 09.9	193°15.1	·· 01.6
22	208°48.5	194°40.9	32.9	70°34.0	48.9	123°39.0	09.9	208°17.4	01.6
23	223°51.0	209°41.3	33.5	85°35.2	48.5	138°40.9	09.9	223°19.6	01.5
Mer.pass. 08:07		ν 0.4′	d 0.6′	m -4.52	ν 1.2′	d 0.4′	m 1.17	ν 1.9′	d 0.0′ m -1.94	ν 2.3′	d 0.1′ m 1.12

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	238°53.4	224°41.6	N04°34.2	100°36.4	N17°48.1	153°42.8	N23°09.9	238°21.9	S02°01.4
1	253°55.9	239°42.0	34.8	115°37.6	47.7	168°44.6	10.0	253°24.2	01.3
2	268°58.4	254°42.4	35.4	130°38.8	47.3	183°46.5	10.0	268°26.5	01.3
3	284°00.8	269°42.7	·· 36.1	145°40.0	·· 46.8	198°48.4	·· 10.0	283°28.7	·· 01.2
4	299°03.3	284°43.1	36.7	160°41.2	46.4	213°50.2	10.0	298°31.0	01.1
5	314°05.7	299°43.5	37.3	175°42.4	46.0	228°52.1	10.1	313°33.3	01.0
6	329°08.2	314°43.8	N04°38.0	190°43.6	N17°45.6	243°54.0	N23°10.1	328°35.6	S02°01.0
7	344°10.7	329°44.2	38.6	205°44.8	45.2	258°55.9	10.1	343°37.8	00.9
8	359°13.1	344°44.6	39.3	220°46.0	44.7	273°57.7	10.1	358°40.1	00.8
9	14°15.6	359°44.9	·· 39.9	235°47.2	·· 44.3	288°59.6	·· 10.1	13°42.4	·· 00.8
10	29°18.1	14°45.3	40.5	250°48.4	43.9	304°01.5	10.2	28°44.7	00.7
11	44°20.5	29°45.6	41.2	265°49.6	43.5	319°03.3	10.2	43°47.0	00.6
12	59°23.0	44°46.0	N04°41.8	280°50.8	N17°43.0	334°05.2	N23°10.2	58°49.2	S02°00.5
13	74°25.5	59°46.4	42.5	295°52.0	42.6	349°07.1	10.2	73°51.5	00.5
14	89°27.9	74°46.7	43.1	310°53.2	42.2	4°09.0	10.3	88°53.8	00.4
15	104°30.4	89°47.1	·· 43.8	325°54.4	·· 41.8	19°10.8	·· 10.3	103°56.1	·· 00.3
16	119°32.8	104°47.4	44.4	340°55.5	41.4	34°12.7	10.3	118°58.3	00.3
17	134°35.3	119°47.8	45.1	355°56.7	40.9	49°14.6	10.3	134°00.6	00.2
18	149°37.8	134°48.2	N04°45.7	10°57.9	N17°40.5	64°16.4	N23°10.3	149°02.9	S02°00.1
19	164°40.2	149°48.5	46.4	25°59.1	40.1	79°18.3	10.4	164°05.2	00.1
20	179°42.7	164°48.9	47.0	41°00.3	39.7	94°20.2	10.4	179°07.5	02°00.0
21	194°45.2	179°49.2	·· 47.7	56°01.5	·· 39.2	109°22.1	·· 10.4	194°09.7	01°59.9
22	209°47.6	194°49.6	48.3	71°02.7	38.8	124°23.9	10.4	209°12.0	59.8
23	224°50.1	209°49.9	48.9	86°03.9	38.4	139°25.8	10.5	224°14.3	59.8
Mer.pass. 08:03		ν 0.4′	d 0.6′	m -4.51	ν 1.2′	d 0.4′	m 1.18	ν 1.9′	d 0.0′ m -1.93	ν 2.3′	d 0.1′ m 1.12

Stars

	SHA	Dec
Alpheratz	357°34.7	29°13.6
Ankaa	353°07.1	-42°09.9
Schedar	349°31.1	56°40.3
Diphda	348°47.2	-17°50.8
Achernar	335°20.4	-57°06.3
Hamal	327°51.2	23°34.8
Polaris	314°22.7	89°22.2
Acamar	315°12.0	-40°12.1
Menkar	314°06.2	4°11.3
Mirfak	308°28.4	49°57.0
Aldebaran	290°39.6	16°33.6
Rigel	281°03.9	-8°10.4
Capella	280°21.9	46°01.4
Bellatrix	278°22.9	6°22.3
Elnath	278°01.9	28°37.7
Alnilam	275°37.7	-1°11.2
Betelgeuse	270°52.1	7°24.7
Canopus	263°52.7	-52°42.7
Sirius	258°26.3	-16°45.1
Adhara	255°05.9	-29°00.5
Procyon	244°50.7	5°09.6
Pollux	243°17.2	27°58.0
Avior	234°14.9	-59°35.7
Suhail	222°46.2	-43°32.3
Miaplacidus	221°38.5	-69°49.6
Alphard	217°47.5	-8°46.2
Regulus	207°34.1	11°50.6
Dubhe	193°40.5	61°37.1
Denebola	182°24.5	14°25.8
Gienah	175°43.1	-17°41.1
Acrux	172°59.4	-63°14.7
Gacrux	171°51.0	-57°15.6
Alioth	166°12.3	55°49.5
Spica	158°21.7	-11°17.8
Alkaid	152°51.3	49°11.3
Hadar	148°35.0	-60°29.9
Menkent	147°56.9	-36°29.9
Arcturus	145°47.3	19°03.0
Rigil Kent.	139°39.3	-60°56.6
Kochab	137°18.6	74°03.1
Zuben'ubi	136°55.4	-16°08.9
Alphecca	126°03.1	26°37.7
Antares	112°15.1	-26°29.4
Atria	107°08.6	-69°04.3
Sabik	102°02.1	-15°45.4
Shaula	96°09.6	-37°07.3
Rasalhague	95°58.0	12°32.4
Eltanin	90°41.6	51°28.9
Kaus Aust.	83°31.8	-34°22.3
Vega	80°32.7	38°48.2
Nunki	75°47.1	-26°15.9
Altair	61°59.5	8°56.0
Peacock	53°05.0	-56°39.0
Deneb	49°25.5	45°21.9
Enif	33°38.5	9°59.3
Al Na'ir	27°32.6	-46°50.1
Fomalhaut	15°14.3	-29°29.2
Scheat	13°45.0	28°13.0
Markab	13°29.7	15°20.4

May 19 Mon	SHA	Mer.pass
Venus	347°27.6	09:02
Mars	222°43.6	17:20
Jupiter	275°17.7	13:49
Saturn	359°37.7	08:13

May 20 Tue	SHA	Mer.pass
Venus	346°38.2	09:02
Mars	222°13.3	17:18
Jupiter	275°03.5	13:46
Saturn	359°33.0	08:09

May 21 Wed	SHA	Mer.pass
Venus	345°48.2	09:01
Mars	221°43.0	17:16
Jupiter	274°49.3	13:43
Saturn	359°28.5	08:05

Horizontal parallax	
Venus:	0.2
Mars:	0.1

h	Sun		Moon				
Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°53.3	N19°46.5	283°30.7	10.7′	S21°13.8	10.9′	56.7′
1	195°53.2	47.1	298°00.4	10.7′	21°02.9	11.0′	56.7′
2	210°53.2	47.6	312°30.1	10.8′	20°51.9	11.1′	56.7′
3	225°53.2	·· 48.2	326°59.9	10.8′	20°40.8	11.2′	56.8′
4	240°53.1	48.7	341°29.7	10.9′	20°29.6	11.3′	56.8′
5	255°53.1	49.2	355°59.6	10.9′	20°18.3	11.4′	56.8′
6	270°53.1	N19°49.7	10°29.5	11.0′	S20°06.9	11.6′	56.9′
7	285°53.0	50.3	24°59.5	11.0′	19°55.3	11.7′	56.9′
8	300°53.0	50.8	39°29.5	11.1′	19°43.6	11.7′	56.9′
9	315°53.0	·· 51.3	53°59.5	11.1′	19°31.9	11.9′	56.9′
10	330°52.9	51.9	68°29.6	11.1′	19°20.0	12.0′	57.0′
11	345°52.9	52.4	82°59.8	11.2′	19°08.0	12.1′	57.0′
12	0°52.9	N19°52.9	97°30.0	11.2′	S18°55.9	12.2′	57.0′
13	15°52.8	53.5	112°00.2	11.3′	18°43.7	12.3′	57.1′
14	30°52.8	54.0	126°30.5	11.3′	18°31.4	12.4′	57.1′
15	45°52.8	·· 54.5	141°00.8	11.4′	18°19.0	12.5′	57.1′
16	60°52.7	55.0	155°31.2	11.4′	18°06.5	12.6′	57.2′
17	75°52.7	55.6	170°01.6	11.5′	17°53.9	12.7′	57.2′
18	90°52.7	N19°56.1	184°32.1	11.5′	S17°41.2	12.9′	57.2′
19	105°52.6	56.6	199°02.6	11.5′	17°28.3	12.9′	57.3′
20	120°52.6	57.1	213°33.1	11.6′	17°15.4	13.0′	57.3′
21	135°52.6	·· 57.7	228°03.7	11.6′	17°02.4	13.1′	57.3′
22	150°52.5	58.2	242°34.3	11.7′	16°49.3	13.2′	57.4′
23	165°52.5	58.7	257°04.9	11.7′	16°36.1	13.3′	57.4′
	SD = 15.8′	d = 0.5′	SD = 15.5′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°52.5	N19°59.2	271°35.6	11.7′	S16°22.8	13.4′	57.4′
1	195°52.4	19°59.7	286°06.4	11.8′	16°09.4	13.5′	57.4′
2	210°52.4	20°00.3	300°37.1	11.8′	15°55.9	13.5′	57.5′
3	225°52.4	·· 00.8	315°07.9	11.8′	15°42.4	13.7′	57.5′
4	240°52.3	01.3	329°38.8	11.9′	15°28.7	13.8′	57.5′
5	255°52.3	01.8	344°09.6	11.9′	15°14.9	13.8′	57.6′
6	270°52.2	N20°02.3	358°40.5	11.9′	S15°01.1	14.0′	57.6′
7	285°52.2	02.9	13°11.5	12.0′	14°47.1	14.0′	57.6′
8	300°52.2	03.4	27°42.5	12.0′	14°33.1	14.1′	57.7′
9	315°52.1	·· 03.9	42°13.5	12.0′	14°19.0	14.2′	57.7′
10	330°52.1	04.4	56°44.5	12.1′	14°04.8	14.3′	57.7′
11	345°52.1	04.9	71°15.6	12.1′	13°50.5	14.3′	57.8′
12	0°52.0	N20°05.4	85°46.7	12.1′	S13°36.2	14.5′	57.8′
13	15°52.0	05.9	100°17.8	12.1′	13°21.7	14.5′	57.8′
14	30°51.9	06.5	114°48.9	12.2′	13°07.2	14.6′	57.9′
15	45°51.9	·· 07.0	129°20.1	12.2′	12°52.6	14.7′	57.9′
16	60°51.9	07.5	143°51.3	12.2′	12°37.9	14.7′	57.9′
17	75°51.8	08.0	158°22.5	12.2′	12°23.2	14.9′	58.0′
18	90°51.8	N20°08.5	172°53.8	12.3′	S12°08.3	14.9′	58.0′
19	105°51.7	09.0	187°25.0	12.3′	11°53.4	15.0′	58.0′
20	120°51.7	09.5	201°56.3	12.3′	11°38.4	15.0′	58.1′
21	135°51.7	·· 10.0	216°27.6	12.3′	11°23.4	15.1′	58.1′
22	150°51.6	10.5	230°58.9	12.3′	11°08.3	15.2′	58.1′
23	165°51.6	11.0	245°30.3	12.4′	10°53.1	15.3′	58.2′
	SD = 15.8′	d = 0.5′	SD = 15.7′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°51.5	N20°11.6	260°01.6	12.4′	S10°37.8	15.4′	58.2′
1	195°51.5	12.1	274°33.0	12.4′	10°22.4	15.4′	58.2′
2	210°51.5	12.6	289°04.4	12.4′	10°07.0	15.4′	58.3′
3	225°51.4	·· 13.1	303°35.8	12.4′	09°51.6	15.6′	58.3′
4	240°51.4	13.6	318°07.2	12.4′	09°36.0	15.6′	58.3′
5	255°51.3	14.1	332°38.7	12.4′	09°20.4	15.7′	58.4′
6	270°51.3	N20°14.6	347°10.1	12.4′	S09°04.7	15.7′	58.4′
7	285°51.2	15.1	1°41.5	12.5′	08°49.0	15.8′	58.4′
8	300°51.2	15.6	16°13.0	12.5′	08°33.2	15.8′	58.5′
9	315°51.2	·· 16.1	30°44.5	12.5′	08°17.4	15.9′	58.5′
10	330°51.1	16.6	45°15.9	12.5′	08°01.5	16.0′	58.5′
11	345°51.1	17.1	59°47.4	12.5′	07°45.5	16.0′	58.6′
12	0°51.0	N20°17.6	74°18.9	12.5′	S07°29.5	16.1′	58.6′
13	15°51.0	18.1	88°50.3	12.5′	07°13.4	16.1′	58.6′
14	30°50.9	18.6	103°21.8	12.5′	06°57.3	16.2′	58.7′
15	45°50.9	·· 19.1	117°53.3	12.5′	06°41.1	16.3′	58.7′
16	60°50.8	19.6	132°24.7	12.5′	06°24.8	16.2′	58.7′
17	75°50.8	20.1	146°56.2	12.5′	06°08.6	16.4′	58.8′
18	90°50.7	N20°20.6	161°27.7	12.5′	S05°52.2	16.4′	58.8′
19	105°50.7	21.1	175°59.1	12.4′	05°35.8	16.4′	58.8′
20	120°50.7	21.6	190°30.6	12.4′	05°19.4	16.5′	58.9′
21	135°50.6	·· 22.1	205°02.0	12.4′	05°02.9	16.5′	58.9′
22	150°50.6	22.6	219°33.4	12.4′	04°46.4	16.5′	58.9′
23	165°50.5	23.1	234°04.9	12.4′	04°29.9	16.6′	59.0′
	SD = 15.8′	d = 0.5′	SD = 15.9′				

Lat.	**Twilight** Naut.	**Twilight** Civil	**Sunrise**	**Sunset**	**Twilight** Civil	**Twilight** Naut.
N 72°	▭	▭	▭	▭	▭	▭
N 70°	▭	▭	▭	▭	▭	▭
68°	////	////	01:15	22:45	////	////
66°	////	////	02:01	21:55	////	////
64°	////	00:05	02:31	21:25	////	////
62°	////	01:28	02:53	21:02	22:29	////
60°	////	02:02	03:11	20:44	21:53	////
N 58°	00:04	02:27	03:26	20:29	21:28	////
56°	01:19	02:46	03:38	20:16	21:09	22:37
54°	01:51	03:02	03:49	20:05	20:53	22:04
52°	02:14	03:15	03:59	19:55	20:39	21:41
50°	02:32	03:27	04:07	19:46	20:27	21:22
45°	03:06	03:51	04:26	19:28	20:03	20:48
N 40°	03:31	04:09	04:40	19:13	19:44	20:23
35°	03:50	04:24	04:53	19:01	19:29	20:04
30°	04:05	04:37	05:04	18:50	19:16	19:48
20°	04:30	04:58	05:22	18:31	18:55	19:23
N 10°	04:49	05:16	05:38	18:15	18:37	19:04
0°	05:05	05:31	05:53	18:00	18:22	18:48
S 10°	05:20	05:45	06:08	17:45	18:08	18:33
20°	05:33	06:00	06:23	17:30	17:53	18:20
30°	05:46	06:15	06:41	17:12	17:37	18:07
35°	05:53	06:24	06:51	17:02	17:29	18:00
40°	06:00	06:34	07:03	16:50	17:19	17:52
45°	06:08	06:44	07:17	16:36	17:08	17:44
S 50°	06:17	06:57	07:34	16:19	16:55	17:35
52°	06:21	07:03	07:41	16:11	16:49	17:31
54°	06:25	07:09	07:50	16:02	16:43	17:27
56°	06:30	07:17	08:00	15:52	16:36	17:23
58°	06:35	07:24	08:11	15:41	16:28	17:18
S 60°	06:40	07:33	08:24	15:28	16:19	17:12

Lat.	**Moonrise** Mon	Tue	Wed	**Moonset** Mon	Tue	Wed
N 72°	▬	03:59	02:57	▬	08:39	11:22
N 70°	▬	03:23	02:42	▬	09:12	11:34
68°	03:49	02:58	02:30	07:02	09:36	11:44
66°	03:06	02:38	02:19	07:44	09:54	11:52
64°	02:37	02:22	02:11	08:12	10:08	11:59
62°	02:15	02:09	02:03	08:33	10:21	12:05
60°	01:57	01:57	01:57	08:50	10:31	12:10
N 58°	01:41	01:47	01:51	09:05	10:40	12:14
56°	01:28	01:39	01:46	09:17	10:47	12:18
54°	01:17	01:31	01:41	09:28	10:54	12:21
52°	01:07	01:24	01:37	09:37	11:01	12:24
50°	00:58	01:17	01:33	09:46	11:06	12:27
45°	00:39	01:04	01:25	10:03	11:18	12:33
N 40°	00:23	00:52	01:18	10:18	11:28	12:38
35°	00:10	00:43	01:12	10:30	11:36	12:43
30°	·· ··	00:34	01:07	10:40	11:43	12:47
20°	·· ··	00:19	00:58	10:58	11:56	12:53
N 10°	·· ··	00:06	00:49	11:14	12:07	12:59
0°	23:54	·· ··	00:42	11:28	12:17	13:04
S 10°	23:42	·· ··	00:34	11:43	12:27	13:09
20°	23:28	·· ··	00:26	11:58	12:37	13:15
30°	23:13	·· ··	00:16	12:15	12:49	13:21
35°	23:04	·· ··	00:11	12:25	12:56	13:25
40°	22:54	·· ··	00:05	12:37	13:04	13:29
45°	22:42	23:57	·· ··	12:50	13:13	13:33
S 50°	22:28	23:48	·· ··	13:07	13:24	13:39
52°	22:21	23:44	·· ··	13:14	13:29	13:41
54°	22:13	23:40	·· ··	13:22	13:34	13:44
56°	22:05	23:35	·· ··	13:32	13:40	13:47
58°	21:55	23:29	·· ··	13:42	13:47	13:50
S 60°	21:44	23:23	·· ··	13:55	13:55	13:54

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 22-24 66-45%
19	03:33	03:32	11:56	05:17	17:41	
20	03:30	03:28	11:57	06:05	18:29	
21	03:26	03:24	11:57	06:53	19:17	

May 22, 23, 24 UT (Thu., Fri., Sat.)

	Aries	Venus		Mars		Jupiter		Saturn	
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	239°52.6	224°50.3	N04°49.6	101°05.1	N17°38.0	154°27.7	N23°10.5	239°16.6	S01°59.7
1	254°55.0	239°50.6	50.3	116°06.3	37.6	169°29.5	10.5	254°18.9	59.6
2	269°57.5	254°51.0	50.9	131°07.5	37.1	184°31.4	10.5	269°21.1	59.6
3	285°00.0	269°51.3	·· 51.6	146°08.7	·· 36.7	199°33.3	·· 10.5	284°23.4	·· 59.5
4	300°02.4	284°51.6	52.2	161°09.9	36.3	214°35.1	10.6	299°25.7	59.4
5	315°04.9	299°52.0	52.9	176°11.1	35.9	229°37.0	10.6	314°28.0	59.3
6	330°07.3	314°52.3	N04°53.5	191°12.3	N17°35.4	244°38.9	N23°10.6	329°30.2	S01°59.3
7	345°09.8	329°52.7	54.2	206°13.5	35.0	259°40.8	10.6	344°32.5	59.2
8	0°12.3	344°53.0	54.8	221°14.7	34.6	274°42.6	10.7	359°34.8	59.1
9	15°14.7	359°53.4	·· 55.5	236°15.9	·· 34.2	289°44.5	·· 10.7	14°37.1	·· 59.1
10	30°17.2	14°53.7	56.1	251°17.1	33.7	304°46.4	10.7	29°39.4	59.0
11	45°19.7	29°54.0	56.8	266°18.2	33.3	319°48.2	10.7	44°41.6	58.9
12	60°22.1	44°54.4	N04°57.4	281°19.4	N17°32.9	334°50.1	N23°10.7	59°43.9	S01°58.9
13	75°24.6	59°54.7	58.1	296°20.6	32.5	349°52.0	10.8	74°46.2	58.8
14	90°27.1	74°55.1	58.8	311°21.8	32.0	4°53.8	10.8	89°48.5	58.7
15	105°29.5	89°55.4	04°59.4	326°23.0	·· 31.6	19°55.7	·· 10.8	104°50.8	·· 58.6
16	120°32.0	104°55.7	05°00.1	341°24.2	31.2	34°57.6	10.8	119°53.0	58.6
17	135°34.5	119°56.1	00.7	356°25.4	30.8	49°59.5	10.8	134°55.3	58.5
18	150°36.9	134°56.4	N05°01.4	11°26.6	N17°30.3	65°01.3	N23°10.9	149°57.6	S01°58.4
19	165°39.4	149°56.7	02.1	26°27.8	29.9	80°03.2	10.9	164°59.9	58.4
20	180°41.8	164°57.1	02.7	41°29.0	29.5	95°05.1	10.9	180°02.2	58.3
21	195°44.3	179°57.4	·· 03.4	56°30.2	·· 29.0	110°06.9	·· 10.9	195°04.4	·· 58.2
22	210°46.8	194°57.7	04.0	71°31.4	28.6	125°08.8	11.0	210°06.7	58.2
23	225°49.2	209°58.1	04.7	86°32.6	28.2	140°10.7	11.0	225°09.0	58.1
Mer.pass. 07:59		ν 0.3′	d 0.7′	m -4.50	ν 1.2′	d 0.4′	m 1.19	ν 1.9′	d 0.0′ m -1.93	ν 2.3′	d 0.1′ m 1.11

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	240°51.7	224°58.4	N05°05.4	101°33.7	N17°27.8	155°12.5	N23°11.0	240°11.3	S01°58.0
1	255°54.2	239°58.7	06.0	116°34.9	27.3	170°14.4	11.0	255°13.6	58.0
2	270°56.6	254°59.0	06.7	131°36.1	26.9	185°16.3	11.0	270°15.9	57.9
3	285°59.1	269°59.4	·· 07.4	146°37.3	·· 26.5	200°18.1	·· 11.1	285°18.1	·· 57.8
4	301°01.6	284°59.7	08.0	161°38.5	26.1	215°20.0	11.1	300°20.4	57.7
5	316°04.0	300°00.0	08.7	176°39.7	25.6	230°21.9	11.1	315°22.7	57.7
6	331°06.5	315°00.3	N05°09.4	191°40.9	N17°25.2	245°23.7	N23°11.1	330°25.0	S01°57.6
7	346°08.9	330°00.7	10.0	206°42.1	24.8	260°25.6	11.1	345°27.3	57.5
8	1°11.4	345°01.0	10.7	221°43.3	24.3	275°27.5	11.2	0°29.5	57.5
9	16°13.9	0°01.3	·· 11.4	236°44.5	·· 23.9	290°29.3	·· 11.2	15°31.8	·· 57.4
10	31°16.3	15°01.6	12.0	251°45.7	23.5	305°31.2	11.2	30°34.1	57.3
11	46°18.8	30°01.9	12.7	266°46.8	23.0	320°33.1	11.2	45°36.4	57.3
12	61°21.3	45°02.3	N05°13.4	281°48.0	N17°22.6	335°35.0	N23°11.2	60°38.7	S01°57.2
13	76°23.7	60°02.6	14.0	296°49.2	22.2	350°36.8	11.3	75°41.0	57.1
14	91°26.2	75°02.9	14.7	311°50.4	21.8	5°38.7	11.3	90°43.2	57.1
15	106°28.7	90°03.2	·· 15.4	326°51.6	·· 21.3	20°40.6	·· 11.3	105°45.5	·· 57.0
16	121°31.1	105°03.5	16.1	341°52.8	20.9	35°42.4	11.3	120°47.8	56.9
17	136°33.6	120°03.8	16.7	356°54.0	20.5	50°44.3	11.3	135°50.1	56.9
18	151°36.1	135°04.1	N05°17.4	11°55.2	N17°20.0	65°46.2	N23°11.4	150°52.4	S01°56.8
19	166°38.5	150°04.5	18.1	26°56.4	19.6	80°48.0	11.4	165°54.7	56.7
20	181°41.0	165°04.8	18.7	41°57.5	19.2	95°49.9	11.4	180°56.9	56.7
21	196°43.4	180°05.1	·· 19.4	56°58.7	·· 18.7	110°51.8	·· 11.4	195°59.2	·· 56.6
22	211°45.9	195°05.4	20.1	71°59.9	18.3	125°53.6	11.5	211°01.5	56.5
23	226°48.4	210°05.7	20.8	87°01.1	17.9	140°55.5	11.5	226°03.8	56.4
Mer.pass. 07:55		ν 0.3′	d 0.7′	m -4.49	ν 1.2′	d 0.4′	m 1.20	ν 1.9′	d 0.0′ m -1.93	ν 2.3′	d 0.1′ m 1.11

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	241°50.8	225°06.0	N05°21.4	102°02.3	N17°17.4	155°57.4	N23°11.5	241°06.1	S01°56.4
1	256°53.3	240°06.3	22.1	117°03.5	17.0	170°59.2	11.5	256°08.4	56.3
2	271°55.8	255°06.6	22.8	132°04.7	16.6	186°01.1	11.5	271°10.7	56.2
3	286°58.2	270°06.9	·· 23.5	147°05.9	·· 16.1	201°03.0	·· 11.6	286°12.9	·· 56.2
4	302°00.7	285°07.2	24.2	162°07.1	15.7	216°04.8	11.6	301°15.2	56.1
5	317°03.2	300°07.5	24.8	177°08.2	15.3	231°06.7	11.6	316°17.5	56.0
6	332°05.6	315°07.8	N05°25.5	192°09.4	N17°14.8	246°08.6	N23°11.6	331°19.8	S01°56.0
7	347°08.1	330°08.1	26.2	207°10.6	14.4	261°10.4	11.6	346°22.1	55.9
8	2°10.5	345°08.4	26.9	222°11.8	14.0	276°12.3	11.7	1°24.4	55.8
9	17°13.0	0°08.7	·· 27.6	237°13.0	·· 13.5	291°14.2	·· 11.7	16°26.6	·· 55.8
10	32°15.5	15°09.0	28.2	252°14.2	13.1	306°16.0	11.7	31°28.9	55.7
11	47°17.9	30°09.3	28.9	267°15.4	12.7	321°17.9	11.7	46°31.2	55.6
12	62°20.4	45°09.6	N05°29.6	282°16.6	N17°12.2	336°19.8	N23°11.7	61°33.5	S01°55.6
13	77°22.9	60°09.9	30.3	297°17.7	11.8	351°21.6	11.7	76°35.8	55.5
14	92°25.3	75°10.2	31.0	312°18.9	11.4	6°23.5	11.8	91°38.1	55.4
15	107°27.8	90°10.5	·· 31.6	327°20.1	·· 10.9	21°25.4	·· 11.8	106°40.4	·· 55.4
16	122°30.3	105°10.8	32.3	342°21.3	10.5	36°27.2	11.8	121°42.6	55.3
17	137°32.7	120°11.1	33.0	357°22.5	10.1	51°29.1	11.8	136°44.9	55.2
18	152°35.2	135°11.4	N05°33.7	12°23.7	N17°09.6	66°30.9	N23°11.8	151°47.2	S01°55.2
19	167°37.7	150°11.7	34.4	27°24.9	09.2	81°32.8	11.9	166°49.5	55.1
20	182°40.1	165°12.0	35.1	42°26.0	08.8	96°34.7	11.9	181°51.8	55.0
21	197°42.6	180°12.3	·· 35.8	57°27.2	·· 08.3	111°36.5	·· 11.9	196°54.1	·· 55.0
22	212°45.0	195°12.6	36.4	72°28.4	07.9	126°38.4	11.9	211°56.4	54.9
23	227°47.5	210°12.9	37.1	87°29.6	07.5	141°40.3	11.9	226°58.7	54.8
Mer.pass. 07:51		ν 0.3′	d 0.7′	m -4.48	ν 1.2′	d 0.4′	m 1.21	ν 1.9′	d 0.0′ m -1.93	ν 2.3′	d 0.1′ m 1.11

Stars

	SHA	Dec
Alpheratz	357°34.7	29°13.6
Ankaa	353°07.1	-42°09.9
Schedar	349°31.1	56°40.3
Diphda	348°47.2	-17°50.8
Achernar	335°20.4	-57°06.3
Hamal	327°51.2	23°34.8
Polaris	314°22.3	89°22.2
Acamar	315°12.0	-40°12.1
Menkar	314°06.2	4°11.3
Mirfak	308°28.4	49°57.0
Aldebaran	290°39.6	16°33.6
Rigel	281°03.9	-8°10.4
Capella	280°21.9	46°01.4
Bellatrix	278°22.9	6°22.3
Elnath	278°01.9	28°37.7
Alnilam	275°37.8	-1°11.2
Betelgeuse	270°52.1	7°24.7
Canopus	263°52.7	-52°42.7
Sirius	258°26.3	-16°45.1
Adhara	255°05.9	-29°00.5
Procyon	244°50.8	5°09.6
Pollux	243°17.2	27°58.0
Avior	234°15.0	-59°35.7
Suhail	222°46.3	-43°32.3
Miaplacidus	221°38.5	-69°49.5
Alphard	217°47.6	-8°46.2
Regulus	207°34.1	11°50.6
Dubhe	193°40.5	61°37.1
Denebola	182°24.5	14°25.8
Gienah	175°43.1	-17°41.1
Acrux	172°59.4	-63°14.7
Gacrux	171°51.0	-57°15.6
Alioth	166°12.3	55°49.5
Spica	158°21.8	-11°17.7
Alkaid	152°51.4	49°11.3
Hadar	148°35.1	-60°29.9
Menkent	147°56.9	-36°29.9
Arcturus	145°47.3	19°03.0
Rigil Kent.	139°39.3	-60°56.6
Kochab	137°18.6	74°03.1
Zuben'ubi	136°55.4	-16°08.9
Alphecca	126°03.1	26°37.7
Antares	112°15.1	-26°29.4
Atria	107°08.5	-69°04.3
Sabik	102°02.1	-15°45.4
Shaula	96°09.6	-37°07.3
Rasalhague	95°58.0	12°32.4
Eltanin	90°41.6	51°28.9
Kaus Aust.	83°31.8	-34°22.3
Vega	80°32.7	38°48.2
Nunki	75°47.1	-26°15.9
Altair	61°59.5	8°56.0
Peacock	53°05.0	-56°39.0
Deneb	49°25.4	45°22.0
Enif	33°38.5	9°59.4
Al Na'ir	27°32.5	-46°50.1
Fomalhaut	15°14.3	-29°29.2
Scheat	13°45.0	28°13.0
Markab	13°29.7	15°20.4

May 22 Thu	SHA	Mer.pass
Venus	344°57.7	09:00
Mars	221°12.5	17:14
Jupiter	274°35.1	13:40
Saturn	359°24.0	08:02

May 23 Fri	SHA	Mer.pass
Venus	344°06.7	09:00
Mars	220°42.0	17:12
Jupiter	274°20.8	13:37
Saturn	359°19.6	07:58

May 24 Sat	SHA	Mer.pass
Venus	343°15.2	08:59
Mars	220°11.5	17:10
Jupiter	274°06.5	13:34
Saturn	359°15.2	07:54

Horizontal parallax	
Venus:	0.2
Mars:	0.1

h	Sun		Moon				
Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°50.5	N20°23.5	248°36.3	12.4′	S04°13.3	16.7′	59.0′
1	195°50.4	24.0	263°07.7	12.4′	03°56.6	16.6′	59.0′
2	210°50.4	24.5	277°39.0	12.4′	03°40.0	16.8′	59.1′
3	225°50.3	· · 25.0	292°10.4	12.3′	03°23.2	16.7′	59.1′
4	240°50.3	25.5	306°41.7	12.3′	03°06.5	16.8′	59.1′
5	255°50.2	26.0	321°13.1	12.3′	02°49.7	16.8′	59.2′
6	270°50.2	N20°26.5	335°44.4	12.3′	S02°32.9	16.9′	59.2′
7	285°50.1	27.0	350°15.6	12.3′	02°16.0	16.9′	59.2′
8	300°50.1	27.5	4°46.9	12.2′	01°59.1	16.9′	59.3′
9	315°50.0	· · 28.0	19°18.1	12.2′	01°42.2	16.9′	59.3′
10	330°50.0	28.4	33°49.3	12.2′	01°25.3	17.0′	59.3′
11	345°49.9	28.9	48°20.5	12.1′	01°08.3	17.0′	59.4′
12	0°49.9	N20°29.4	62°51.7	12.1′	S00°51.3	17.0′	59.4′
13	15°49.8	29.9	77°22.8	12.1′	00°34.3	17.0′	59.4′
14	30°49.8	30.4	91°53.9	12.1′	00°17.3	17.0′	59.5′
15	45°49.7	· · 30.9	106°24.9	12.0′	S00°00.3	17.1′	59.5′
16	60°49.7	31.3	120°55.9	12.0′	N00°16.8	17.1′	59.5′
17	75°49.6	31.8	135°26.9	11.9′	00°33.9	17.1′	59.6′
18	90°49.6	N20°32.3	149°57.8	11.9′	N00°51.0	17.1′	59.6′
19	105°49.5	32.8	164°28.7	11.9′	01°08.1	17.2′	59.6′
20	120°49.5	33.3	178°59.6	11.8′	01°25.3	17.1′	59.6′
21	135°49.4	· · 33.7	193°30.4	11.8′	01°42.4	17.2′	59.7′
22	150°49.4	34.2	208°01.2	11.7′	01°59.6	17.1′	59.7′
23	165°49.3	34.7	222°31.9	11.7′	02°16.7	17.2′	59.7′
	SD = 15.8′	d = 0.5′	SD = 16.1′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°49.3	N20°35.2	237°02.6	11.6′	N02°33.9	17.2′	59.8′
1	195°49.2	35.7	251°33.3	11.6′	02°51.1	17.1′	59.8′
2	210°49.2	36.1	266°03.9	11.5′	03°08.2	17.2′	59.8′
3	225°49.1	· · 36.6	280°34.4	11.5′	03°25.4	17.2′	59.9′
4	240°49.0	37.1	295°04.9	11.4′	03°42.6	17.2′	59.9′
5	255°49.0	37.6	309°35.3	11.4′	03°59.8	17.1′	59.9′
6	270°48.9	N20°38.0	324°05.7	11.3′	N04°16.9	17.2′	59.9′
7	285°48.9	38.5	338°36.0	11.3′	04°34.1	17.1′	60.0′
8	300°48.8	39.0	353°06.3	11.2′	04°51.2	17.2′	60.0′
9	315°48.8	· · 39.5	7°36.5	11.1′	05°08.4	17.1′	60.0′
10	330°48.7	39.9	22°06.6	11.1′	05°25.5	17.2′	60.0′
11	345°48.7	40.4	36°36.7	11.0′	05°42.7	17.1′	60.1′
12	0°48.6	N20°40.9	51°06.7	11.0′	N05°59.8	17.1′	60.1′
13	15°48.6	41.3	65°36.7	10.9′	06°16.9	17.0′	60.1′
14	30°48.5	41.8	80°06.5	10.8′	06°33.9	17.1′	60.2′
15	45°48.4	· · 42.3	94°36.4	10.7′	06°51.0	17.0′	60.2′
16	60°48.4	42.7	109°06.1	10.7′	07°08.0	17.1′	60.2′
17	75°48.3	43.2	123°35.8	10.6′	07°25.1	17.0′	60.2′
18	90°48.3	N20°43.7	138°05.4	10.5′	N07°42.1	16.9′	60.3′
19	105°48.2	44.1	152°34.9	10.5′	07°59.0	16.9′	60.3′
20	120°48.2	44.6	167°04.4	10.4′	08°15.9	17.0′	60.3′
21	135°48.1	· · 45.1	181°33.8	10.3′	08°32.9	16.8′	60.3′
22	150°48.0	45.5	196°03.1	10.2′	08°49.7	16.9′	60.4′
23	165°48.0	46.0	210°32.3	10.1′	09°06.6	16.8′	60.4′
	SD = 15.8′	d = 0.5′	SD = 16.3′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°47.9	N20°46.5	225°01.4	10.1′	N09°23.4	16.7′	60.4′
1	195°47.9	46.9	239°30.5	10.0′	09°40.1	16.7′	60.4′
2	210°47.8	47.4	253°59.5	9.9′	09°56.8	16.7′	60.4′
3	225°47.7	· · 47.9	268°28.4	9.8′	10°13.5	16.7′	60.5′
4	240°47.7	48.3	282°57.2	9.7′	10°30.2	16.5′	60.5′
5	255°47.6	48.8	297°25.9	9.6′	10°46.7	16.6′	60.5′
6	270°47.6	N20°49.2	311°54.6	9.5′	N11°03.3	16.5′	60.5′
7	285°47.5	49.7	326°23.1	9.5′	11°19.8	16.4′	60.5′
8	300°47.4	50.2	340°51.6	9.4′	11°36.2	16.4′	60.6′
9	315°47.4	· · 50.6	355°19.9	9.3′	11°52.6	16.3′	60.6′
10	330°47.3	51.1	9°48.2	9.2′	12°08.9	16.3′	60.6′
11	345°47.3	51.5	24°16.4	9.1′	12°25.2	16.2′	60.6′
12	0°47.2	N20°52.0	38°44.5	9.0′	N12°41.4	16.1′	60.6′
13	15°47.1	52.4	53°12.5	8.9′	12°57.5	16.1′	60.7′
14	30°47.1	52.9	67°40.3	8.8′	13°13.6	16.0′	60.7′
15	45°47.0	· · 53.3	82°08.1	8.7′	13°29.6	15.9′	60.7′
16	60°47.0	53.8	96°35.8	8.6′	13°45.5	15.9′	60.7′
17	75°46.9	54.2	111°03.4	8.5′	14°01.4	15.8′	60.7′
18	90°46.8	N20°54.7	125°30.9	8.4′	N14°17.2	15.7′	60.7′
19	105°46.8	55.2	139°58.3	8.3′	14°32.9	15.6′	60.8′
20	120°46.7	55.6	154°25.6	8.2′	14°48.5	15.6′	60.8′
21	135°46.6	· · 56.1	168°52.8	8.1′	15°04.1	15.4′	60.8′
22	150°46.6	56.5	183°19.9	8.0′	15°19.5	15.4′	60.8′
23	165°46.5	57.0	197°46.8	7.9′	15°34.9	15.3′	60.8′
	SD = 15.8′	d = 0.5′	SD = 16.5′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	▭	▭	▭	▭	▭	▭
N 70°	▭	▭	▭	▭	▭	▭
68°	////	////	00:52	23:11	////	////
66°	////	////	01:49	22:08	////	////
64°	////	////	02:22	21:34	////	////
62°	////	01:13	02:46	21:10	22:45	////
60°	////	01:53	03:05	20:50	22:03	////
N 58°	////	02:19	03:20	20:35	21:36	////
56°	01:06	02:40	03:33	20:21	21:15	22:52
54°	01:43	02:57	03:45	20:10	20:58	22:13
52°	02:07	03:11	03:55	19:59	20:44	21:48
50°	02:27	03:23	04:04	19:50	20:32	21:28
45°	03:02	03:48	04:23	19:31	20:07	20:52
N 40°	03:28	04:07	04:38	19:16	19:47	20:27
35°	03:47	04:22	04:51	19:03	19:31	20:07
30°	04:04	04:36	05:02	18:51	19:18	19:50
20°	04:29	04:57	05:21	18:32	18:56	19:25
N 10°	04:49	05:15	05:38	18:16	18:38	19:05
0°	05:05	05:31	05:53	18:00	18:22	18:48
S 10°	05:20	05:46	06:08	17:45	18:07	18:33
20°	05:34	06:01	06:24	17:29	17:52	18:19
30°	05:48	06:17	06:43	17:11	17:36	18:06
35°	05:55	06:26	06:53	17:00	17:27	17:58
40°	06:03	06:36	07:06	16:48	17:17	17:51
45°	06:11	06:47	07:20	16:33	17:06	17:42
S 50°	06:20	07:01	07:37	16:16	16:52	17:33
52°	06:25	07:07	07:46	16:08	16:46	17:28
54°	06:29	07:13	07:55	15:58	16:40	17:24
56°	06:34	07:21	08:05	15:48	16:32	17:19
58°	06:39	07:29	08:17	15:36	16:24	17:14
S 60°	06:45	07:38	08:31	15:22	16:15	17:08

Lat.	**Moonrise** Thu	Fri	Sat	**Moonset** Thu	Fri	Sat
N 72°	02:16	01:39	00:58 23:53	13:46	16:13	19:10
N 70°	02:11	01:43	01:12	13:46	16:02	18:37
68°	02:07	01:46	01:24	13:47	15:53	18:13
66°	02:04	01:49	01:33	13:47	15:46	17:55
64°	02:01	01:51	01:41	13:48	15:40	17:40
62°	01:58	01:53	01:49	13:48	15:35	17:28
60°	01:56	01:55	01:55	13:48	15:30	17:18
N 58°	01:54	01:57	02:00	13:49	15:26	17:09
56°	01:52	01:58	02:05	13:49	15:23	17:01
54°	01:51	02:00	02:09	13:49	15:20	16:55
52°	01:49	02:01	02:13	13:49	15:17	16:48
50°	01:48	02:02	02:17	13:50	15:14	16:43
45°	01:45	02:04	02:25	13:50	15:09	16:31
N 40°	01:42	02:06	02:32	13:50	15:04	16:21
35°	01:40	02:08	02:37	13:50	15:00	16:13
30°	01:38	02:09	02:43	13:51	14:57	16:06
20°	01:35	02:12	02:52	13:51	14:51	15:53
N 10°	01:32	02:15	02:59	13:51	14:45	15:42
0°	01:29	02:17	03:07	13:52	14:40	15:32
S 10°	01:26	02:19	03:15	13:52	14:35	15:22
20°	01:23	02:22	03:23	13:52	14:30	15:11
30°	01:20	02:25	03:32	13:52	14:24	14:59
35°	01:18	02:27	03:38	13:52	14:21	14:52
40°	01:16	02:29	03:44	13:52	14:17	14:44
45°	01:13	02:31	03:51	13:53	14:12	14:34
S 50°	01:10	02:34	04:00	13:53	14:07	14:23
52°	01:09	02:35	04:04	13:53	14:05	14:18
54°	01:07	02:36	04:09	13:53	14:02	14:13
56°	01:05	02:38	04:14	13:53	13:59	14:06
58°	01:03	02:40	04:20	13:53	13:56	14:00
S 60°	01:01	02:42	04:26	13:53	13:52	13:52

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 25-27 34-14%
22	03:22	03:20	11:57	07:40	20:04	
23	03:17	03:14	11:57	08:29	20:54	
24	03:12	03:09	11:57	09:19	21:46	

May 25, 26, 27 UT (Sun., Mon., Tue.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	242°50.0	225°13.2	N05°37.8	102°30.8	N17°07.0	156°42.1	N23°12.0	242°00.9	S01°54.8
1	257°52.4	240°13.4	38.5	117°32.0	06.6	171°44.0	12.0	257°03.2	54.7
2	272°54.9	255°13.7	39.2	132°33.2	06.1	186°45.9	12.0	272°05.5	54.6
3	287°57.4	270°14.0	·· 39.9	147°34.3	·· 05.7	201°47.7	·· 12.0	287°07.8	·· 54.6
4	302°59.8	285°14.3	40.6	162°35.5	05.3	216°49.6	12.0	302°10.1	54.5
5	318°02.3	300°14.6	41.3	177°36.7	04.8	231°51.5	12.1	317°12.4	54.4
6	333°04.8	315°14.9	N05°41.9	192°37.9	N17°04.4	246°53.3	N23°12.1	332°14.7	S01°54.4
7	348°07.2	330°15.1	42.6	207°39.1	04.0	261°55.2	12.1	347°17.0	54.3
8	3°09.7	345°15.4	43.3	222°40.3	03.5	276°57.1	12.1	2°19.2	54.2
9	18°12.2	0°15.7	·· 44.0	237°41.5	·· 03.1	291°58.9	·· 12.1	17°21.5	·· 54.2
10	33°14.6	15°16.0	44.7	252°42.6	02.6	307°00.8	12.2	32°23.8	54.1
11	48°17.1	30°16.3	45.4	267°43.8	02.2	322°02.7	12.2	47°26.1	54.0
12	63°19.5	45°16.5	N05°46.1	282°45.0	N17°01.8	337°04.5	N23°12.2	62°28.4	S01°54.0
13	78°22.0	60°16.8	46.8	297°46.2	01.3	352°06.4	12.2	77°30.7	53.9
14	93°24.5	75°17.1	47.5	312°47.4	00.9	7°08.2	12.2	92°33.0	53.8
15	108°26.9	90°17.4	·· 48.2	327°48.6	·· 00.5	22°10.1	·· 12.2	107°35.3	·· 53.8
16	123°29.4	105°17.7	48.9	342°49.7	17°00.0	37°12.0	12.3	122°37.6	53.7
17	138°31.9	120°17.9	49.6	357°50.9	16°59.6	52°13.8	12.3	137°39.8	53.6
18	153°34.3	135°18.2	N05°50.3	12°52.1	N16°59.1	67°15.7	N23°12.3	152°42.1	S01°53.6
19	168°36.8	150°18.5	51.0	27°53.3	58.7	82°17.6	12.3	167°44.4	53.5
20	183°39.3	165°18.7	51.7	42°54.5	58.3	97°19.4	12.3	182°46.7	53.4
21	198°41.7	180°19.0	·· 52.4	57°55.7	·· 57.8	112°21.3	·· 12.4	197°49.0	·· 53.4
22	213°44.2	195°19.3	53.1	72°56.8	57.4	127°23.2	12.4	212°51.3	53.3
23	228°46.7	210°19.6	53.8	87°58.0	56.9	142°25.0	12.4	227°53.6	53.2
Mer.pass. 07:47		ν 0.3′	d 0.7′	m -4.47	ν 1.2′	d 0.4′	m 1.22	ν 1.9′	d 0.0′ m -1.93	ν 2.3′	d 0.1′ m 1.11

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	243°49.1	225°19.8	N05°54.5	102°59.2	N16°56.5	157°26.9	N23°12.4	242°55.9	S01°53.2
1	258°51.6	240°20.1	55.2	118°00.4	56.1	172°28.7	12.4	257°58.2	53.1
2	273°54.0	255°20.4	55.9	133°01.6	55.6	187°30.6	12.5	273°00.4	53.1
3	288°56.5	270°20.6	·· 56.6	148°02.7	·· 55.2	202°32.5	·· 12.5	288°02.7	·· 53.0
4	303°59.0	285°20.9	57.3	163°03.9	54.7	217°34.3	12.5	303°05.0	52.9
5	319°01.4	300°21.2	58.0	178°05.1	54.3	232°36.2	12.5	318°07.3	52.9
6	334°03.9	315°21.4	N05°58.7	193°06.3	N16°53.8	247°38.1	N23°12.5	333°09.6	S01°52.8
7	349°06.4	330°21.7	05°59.4	208°07.5	53.4	262°39.9	12.5	348°11.9	52.7
8	4°08.8	345°22.0	06°00.1	223°08.7	53.0	277°41.8	12.6	3°14.2	52.7
9	19°11.3	0°22.2	·· 00.8	238°09.8	·· 52.5	292°43.7	·· 12.6	18°16.5	·· 52.6
10	34°13.8	15°22.5	01.5	253°11.0	52.1	307°45.5	12.6	33°18.8	52.5
11	49°16.2	30°22.7	02.2	268°12.2	51.6	322°47.4	12.6	48°21.1	52.5
12	64°18.7	45°23.0	N06°02.9	283°13.4	N16°51.2	337°49.2	N23°12.6	63°23.4	S01°52.4
13	79°21.1	60°23.3	03.6	298°14.6	50.7	352°51.1	12.7	78°25.6	52.3
14	94°23.6	75°23.5	04.3	313°15.7	50.3	7°53.0	12.7	93°27.9	52.3
15	109°26.1	90°23.8	·· 05.0	328°16.9	·· 49.9	22°54.8	·· 12.7	108°30.2	·· 52.2
16	124°28.5	105°24.0	05.7	343°18.1	49.4	37°56.7	12.7	123°32.5	52.1
17	139°31.0	120°24.3	06.4	358°19.3	49.0	52°58.6	12.7	138°34.8	52.1
18	154°33.5	135°24.5	N06°07.1	13°20.5	N16°48.5	68°00.4	N23°12.7	153°37.1	S01°52.0
19	169°35.9	150°24.8	07.8	28°21.6	48.1	83°02.3	12.8	168°39.4	52.0
20	184°38.4	165°25.0	08.5	43°22.8	47.6	98°04.1	12.8	183°41.7	51.9
21	199°40.9	180°25.3	·· 09.2	58°24.0	·· 47.2	113°06.0	·· 12.8	198°44.0	·· 51.8
22	214°43.3	195°25.6	09.9	73°25.2	46.8	128°07.9	12.8	213°46.3	51.8
23	229°45.8	210°25.8	10.6	88°26.4	46.3	143°09.7	12.8	228°48.6	51.7
Mer.pass. 07:43		ν 0.3′	d 0.7′	m -4.45	ν 1.2′	d 0.4′	m 1.23	ν 1.9′	d 0.0′ m -1.92	ν 2.3′	d 0.1′ m 1.10

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	244°48.3	225°26.1	N06°11.3	103°27.5	N16°45.9	158°11.6	N23°12.8	243°50.9	S01°51.6
1	259°50.7	240°26.3	12.1	118°28.7	45.4	173°13.4	12.9	258°53.2	51.6
2	274°53.2	255°26.6	12.8	133°29.9	45.0	188°15.3	12.9	273°55.4	51.5
3	289°55.6	270°26.8	·· 13.5	148°31.1	·· 44.5	203°17.2	·· 12.9	288°57.7	·· 51.4
4	304°58.1	285°27.0	14.2	163°32.3	44.1	218°19.0	12.9	304°00.0	51.4
5	320°00.6	300°27.3	14.9	178°33.4	43.6	233°20.9	12.9	319°02.3	51.3
6	335°03.0	315°27.5	N06°15.6	193°34.6	N16°43.2	248°22.8	N23°12.9	334°04.6	S01°51.2
7	350°05.5	330°27.8	16.3	208°35.8	42.7	263°24.6	13.0	349°06.9	51.2
8	5°08.0	345°28.0	17.0	223°37.0	42.3	278°26.5	13.0	4°09.2	51.1
9	20°10.4	0°28.3	·· 17.7	238°38.2	·· 41.9	293°28.3	·· 13.0	19°11.5	·· 51.1
10	35°12.9	15°28.5	18.5	253°39.3	41.4	308°30.2	13.0	34°13.8	51.0
11	50°15.4	30°28.8	19.2	268°40.5	41.0	323°32.1	13.0	49°16.1	50.9
12	65°17.8	45°29.0	N06°19.9	283°41.7	N16°40.5	338°33.9	N23°13.1	64°18.4	S01°50.9
13	80°20.3	60°29.2	20.6	298°42.9	40.1	353°35.8	13.1	79°20.7	50.8
14	95°22.8	75°29.5	21.3	313°44.0	39.6	8°37.6	13.1	94°23.0	50.7
15	110°25.2	90°29.7	·· 22.0	328°45.2	·· 39.2	23°39.5	·· 13.1	109°25.3	·· 50.7
16	125°27.7	105°30.0	22.7	343°46.4	38.7	38°41.4	13.1	124°27.6	50.6
17	140°30.1	120°30.2	23.5	358°47.6	38.3	53°43.2	13.1	139°29.9	50.6
18	155°32.6	135°30.4	N06°24.2	13°48.8	N16°37.8	68°45.1	N23°13.2	154°32.2	S01°50.5
19	170°35.1	150°30.7	24.9	28°49.9	37.4	83°47.0	13.2	169°34.5	50.4
20	185°37.5	165°30.9	25.6	43°51.1	36.9	98°48.8	13.2	184°36.7	50.4
21	200°40.0	180°31.1	·· 26.3	58°52.3	·· 36.5	113°50.7	·· 13.2	199°39.0	·· 50.3
22	215°42.5	195°31.4	27.0	73°53.5	36.0	128°52.5	13.2	214°41.3	50.2
23	230°44.9	210°31.6	27.8	88°54.6	35.6	143°54.4	13.2	229°43.6	50.2
Mer.pass. 07:40		ν 0.2′	d 0.7′	m -4.44	ν 1.2′	d 0.4′	m 1.24	ν 1.9′	d 0.0′ m -1.92	ν 2.3′	d 0.1′ m 1.10

Stars

	SHA	**Dec**
Alpheratz	357°34.6	29°13.6
Ankaa	353°07.1	-42°09.9
Schedar	349°31.1	56°40.3
Diphda	348°47.2	-17°50.8
Achernar	335°20.4	-57°06.3
Hamal	327°51.2	23°34.8
Polaris	314°21.6	89°22.1
Acamar	315°11.9	-40°12.1
Menkar	314°06.2	4°11.3
Mirfak	308°28.3	49°57.0
Aldebaran	290°39.6	16°33.6
Rigel	281°03.9	-8°10.4
Capella	280°21.9	46°01.4
Bellatrix	278°22.9	6°22.3
Elnath	278°01.9	28°37.7
Alnilam	275°37.8	-1°11.2
Betelgeuse	270°52.1	7°24.7
Canopus	263°52.8	-52°42.6
Sirius	258°26.3	-16°45.1
Adhara	255°05.9	-29°00.5
Procyon	244°50.8	5°09.6
Pollux	243°17.2	27°58.0
Avior	234°15.0	-59°35.7
Suhail	222°46.3	-43°32.3
Miaplacidus	221°38.6	-69°49.5
Alphard	217°47.6	-8°46.2
Regulus	207°34.2	11°50.6
Dubhe	193°40.5	61°37.1
Denebola	182°24.5	14°25.8
Gienah	175°43.1	-17°41.1
Acrux	172°59.4	-63°14.7
Gacrux	171°51.0	-57°15.6
Alioth	166°12.3	55°49.5
Spica	158°21.8	-11°17.7
Alkaid	152°51.4	49°11.3
Hadar	148°35.1	-60°29.9
Menkent	147°56.9	-36°29.9
Arcturus	145°47.3	19°03.0
Rigil Kent.	139°39.3	-60°56.6
Kochab	137°18.7	74°03.1
Zuben'ubi	136°55.4	-16°08.9
Alphecca	126°03.1	26°37.7
Antares	112°15.1	-26°29.4
Atria	107°08.5	-69°04.4
Sabik	102°02.1	-15°45.4
Shaula	96°09.6	-37°07.3
Rasalhague	95°58.0	12°32.4
Eltanin	90°41.5	51°28.9
Kaus Aust.	83°31.8	-34°22.3
Vega	80°32.7	38°48.2
Nunki	75°47.1	-26°15.9
Altair	61°59.5	8°56.0
Peacock	53°05.0	-56°39.0
Deneb	49°25.4	45°22.0
Enif	33°38.5	9°59.4
Al Na'ir	27°32.5	-46°50.1
Fomalhaut	15°14.2	-29°29.1
Scheat	13°45.0	28°13.0
Markab	13°29.7	15°20.4

May 25 Sun	**SHA**	**Mer.pass**
Venus	342°23.2	08:59
Mars	219°40.8	17:09
Jupiter	273°52.2	13:32
Saturn	359°11.0	07:51

May 26 Mon	**SHA**	**Mer.pass**
Venus	341°30.7	08:59
Mars	219°10.1	17:07
Jupiter	273°37.8	13:29
Saturn	359°06.8	07:47

May 27 Tue	**SHA**	**Mer.pass**
Venus	340°37.8	08:58
Mars	218°39.3	17:05
Jupiter	273°23.3	13:26
Saturn	359°02.6	07:43

Horizontal parallax	
Venus:	0.2
Mars:	0.1

DUT1 = UT1-UTC = +0.0279 sec ΔT = TT-UT1 = +69.1561 sec

2025 May 25 to May. 27 UT

h	Sun		Moon				
Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°46.5	N20°57.4	212°13.7	7.8′	N15°50.2	15.2′	60.8′
1	195°46.4	57.8	226°40.5	7.7′	16°05.4	15.1′	60.8′
2	210°46.3	58.3	241°07.1	7.5′	16°20.5	15.1′	60.9′
3	225°46.3	·· 58.7	255°33.7	7.4′	16°35.6	14.9′	60.9′
4	240°46.2	59.2	270°00.1	7.3′	16°50.5	14.8′	60.9′
5	255°46.1	20°59.6	284°26.4	7.2′	17°05.3	14.7′	60.9′
6	270°46.1	N21°00.1	298°52.6	7.1′	N17°20.0	14.6′	60.9′
7	285°46.0	00.5	313°18.7	7.0′	17°34.6	14.6′	60.9′
8	300°45.9	01.0	327°44.7	6.9′	17°49.2	14.4′	60.9′
9	315°45.9	·· 01.4	342°10.6	6.8′	18°03.6	14.3′	60.9′
10	330°45.8	01.8	356°36.4	6.7′	18°17.9	14.1′	60.9′
11	345°45.7	02.3	11°02.0	6.5′	18°32.0	14.1′	60.9′
12	0°45.7	N21°02.7	25°27.6	6.4′	N18°46.1	13.9′	61.0′
13	15°45.6	03.2	39°53.0	6.3′	19°00.0	13.9′	61.0′
14	30°45.5	03.6	54°18.3	6.2′	19°13.9	13.7′	61.0′
15	45°45.5	·· 04.0	68°43.5	6.1′	19°27.6	13.6′	61.0′
16	60°45.4	04.5	83°08.6	6.0′	19°41.2	13.4′	61.0′
17	75°45.3	04.9	97°33.6	5.9′	19°54.6	13.3′	61.0′
18	90°45.3	N21°05.4	111°58.5	5.8′	N20°07.9	13.2′	61.0′
19	105°45.2	05.8	126°23.2	5.6′	20°21.1	13.1′	61.0′
20	120°45.1	06.2	140°47.9	5.5′	20°34.2	12.9′	61.0′
21	135°45.1	·· 06.7	155°12.4	5.4′	20°47.1	12.8′	61.0′
22	150°45.0	07.1	169°36.8	5.3′	20°59.9	12.6′	61.0′
23	165°44.9	07.5	184°01.1	5.2′	21°12.5	12.6′	61.0′
	SD = 15.8′	d = 0.4′	SD = 16.6′				

Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°44.9	N21°08.0	198°25.3	5.1′	N21°25.1	12.3′	61.0′
1	195°44.8	08.4	212°49.4	5.0′	21°37.4	12.2′	61.0′
2	210°44.7	08.8	227°13.3	4.9′	21°49.6	12.1′	61.0′
3	225°44.6	·· 09.3	241°37.2	4.7′	22°01.7	11.9′	61.0′
4	240°44.6	09.7	256°00.9	4.6′	22°13.6	11.7′	61.0′
5	255°44.5	10.1	270°24.6	4.5′	22°25.3	11.6′	61.0′
6	270°44.4	N21°10.6	284°48.1	4.4′	N22°36.9	11.5′	61.0′
7	285°44.4	11.0	299°11.5	4.3′	22°48.4	11.3′	61.0′
8	300°44.3	11.4	313°34.8	4.2′	22°59.7	11.1′	61.0′
9	315°44.2	·· 11.8	327°58.1	4.1′	23°10.8	10.9′	61.0′
10	330°44.2	12.3	342°21.2	4.0′	23°21.7	10.8′	61.0′
11	345°44.1	12.7	356°44.2	3.9′	23°32.5	10.7′	61.0′
12	0°44.0	N21°13.1	11°07.1	3.8′	N23°43.2	10.4′	61.0′
13	15°43.9	13.5	25°29.9	3.7′	23°53.6	10.3′	61.0′
14	30°43.9	14.0	39°52.6	3.6′	24°03.9	10.1′	61.0′
15	45°43.8	·· 14.4	54°15.2	3.5′	24°14.0	9.9′	61.0′
16	60°43.7	14.8	68°37.7	3.4′	24°23.9	9.8′	60.9′
17	75°43.7	15.2	83°00.1	3.3′	24°33.7	9.5′	60.9′
18	90°43.6	N21°15.7	97°22.5	3.2′	N24°43.2	9.4′	60.9′
19	105°43.5	16.1	111°44.7	3.1′	24°52.6	9.2′	60.9′
20	120°43.4	16.5	126°06.8	3.1′	25°01.8	9.1′	60.9′
21	135°43.4	·· 16.9	140°28.9	3.0′	25°10.9	8.8′	60.9′
22	150°43.3	17.3	154°50.9	2.9′	25°19.7	8.7′	60.9′
23	165°43.2	17.8	169°12.7	2.8′	25°28.4	8.4′	60.9′
	SD = 15.8′	d = 0.4′	SD = 16.6′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°43.1	N21°18.2	183°34.5	2.7′	N25°36.8	8.3′	60.9′
1	195°43.1	18.6	197°56.3	2.6′	25°45.1	8.0′	60.9′
2	210°43.0	19.0	212°17.9	2.6′	25°53.1	7.9′	60.8′
3	225°42.9	·· 19.4	226°39.5	2.5′	26°01.0	7.7′	60.8′
4	240°42.8	19.8	241°01.0	2.4′	26°08.7	7.5′	60.8′
5	255°42.8	20.2	255°22.4	2.4′	26°16.2	7.3′	60.8′
6	270°42.7	N21°20.7	269°43.8	2.3′	N26°23.5	7.1′	60.8′
7	285°42.6	21.1	284°05.1	2.2′	26°30.6	6.9′	60.8′
8	300°42.5	21.5	298°26.3	2.2′	26°37.5	6.6′	60.8′
9	315°42.5	·· 21.9	312°47.5	2.1′	26°44.1	6.5′	60.7′
10	330°42.4	22.3	327°08.6	2.1′	26°50.6	6.3′	60.7′
11	345°42.3	22.7	341°29.7	2.0′	26°56.9	6.1′	60.7′
12	0°42.2	N21°23.1	355°50.7	2.0′	N27°03.0	5.8′	60.7′
13	15°42.2	23.5	10°11.7	1.9′	27°08.8	5.7′	60.7′
14	30°42.1	24.0	24°32.6	1.9′	27°14.5	5.4′	60.6′
15	45°42.0	·· 24.4	38°53.5	1.8′	27°19.9	5.3′	60.6′
16	60°41.9	24.8	53°14.3	1.8′	27°25.2	5.0′	60.6′
17	75°41.8	25.2	67°35.1	1.8′	27°30.2	4.8′	60.6′
18	90°41.8	N21°25.6	81°55.9	1.7′	N27°35.0	4.6′	60.6′
19	105°41.7	26.0	96°16.6	1.7′	27°39.6	4.4′	60.5′
20	120°41.6	26.4	110°37.3	1.7′	27°44.0	4.2′	60.5′
21	135°41.5	·· 26.8	124°58.0	1.7′	27°48.2	3.9′	60.5′
22	150°41.5	27.2	139°18.7	1.6′	27°52.1	3.8′	60.5′
23	165°41.4	27.6	153°39.4	1.6′	27°55.9	3.5′	60.5′
	SD = 15.8′	d = 0.4′	SD = 16.6′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	▭	▭	▭	▭	▭	▭
N 70°	▭	▭	▭	▭	▭	▭
68°	////	////	00:11	////	////	////
66°	////	////	01:37	22:21	////	////
64°	////	////	02:13	21:43	////	////
62°	////	00:57	02:39	21:17	23:03	////
60°	////	01:44	02:59	20:57	22:13	////
N 58°	////	02:12	03:15	20:40	21:44	////
56°	00:52	02:34	03:29	20:26	21:21	23:08
54°	01:34	02:52	03:41	20:14	21:04	22:22
52°	02:01	03:06	03:52	20:03	20:49	21:55
50°	02:21	03:19	04:01	19:54	20:36	21:34
45°	02:59	03:45	04:20	19:34	20:10	20:56
N 40°	03:25	04:05	04:36	19:18	19:50	20:30
35°	03:45	04:21	04:50	19:05	19:34	20:09
30°	04:02	04:34	05:01	18:53	19:20	19:52
20°	04:28	04:57	05:21	18:34	18:58	19:26
N 10°	04:48	05:15	05:38	18:16	18:39	19:06
0°	05:06	05:31	05:53	18:01	18:23	18:49
S 10°	05:21	05:47	06:09	17:45	18:07	18:33
20°	05:35	06:02	06:26	17:28	17:52	18:19
30°	05:49	06:19	06:45	17:09	17:35	18:05
35°	05:57	06:28	06:56	16:58	17:26	17:57
40°	06:05	06:38	07:08	16:46	17:16	17:49
45°	06:14	06:50	07:23	16:31	17:04	17:40
S 50°	06:23	07:04	07:41	16:13	16:50	17:30
52°	06:28	07:10	07:49	16:04	16:43	17:26
54°	06:32	07:17	07:59	15:55	16:36	17:21
56°	06:38	07:25	08:10	15:44	16:29	17:16
58°	06:43	07:34	08:22	15:32	16:20	17:11
S 60°	06:49	07:43	08:36	15:17	16:10	17:04

Lat.	**Moonrise** Sun	Mon	Tue	**Moonset** Sun	Mon	Tue
N 72°	▭	▭	▭	▭	▭	▭
N 70°	00:28	▭	▭	▭	▭	▭
68°	00:54 23:50	▭	▭	21:16	▭	▭
66°	01:14	00:42	▭	20:26	▭	▭
64°	01:30	01:14	00:34	19:55	22:44	▭
62°	01:44	01:38	01:31	19:32	21:48	·· ··
60°	01:55	01:57	02:05	19:13	21:15	23:09
N 58°	02:05	02:14	02:30	18:58	20:50	22:33
56°	02:14	02:27	02:50	18:45	20:31	22:08
54°	02:22	02:39	03:06	18:34	20:15	21:47
52°	02:29	02:50	03:21	18:24	20:01	21:30
50°	02:35	03:00	03:33	18:15	19:49	21:15
45°	02:49	03:20	04:00	17:57	19:24	20:45
N 40°	03:01	03:36	04:20	17:42	19:04	20:22
35°	03:11	03:50	04:38	17:29	18:47	20:03
30°	03:19	04:02	04:53	17:18	18:33	19:47
20°	03:35	04:23	05:19	16:59	18:09	19:19
N 10°	03:48	04:42	05:41	16:43	17:48	18:55
0°	04:01	04:59	06:02	16:28	17:28	18:33
S 10°	04:14	05:17	06:23	16:13	17:09	18:11
20°	04:27	05:35	06:46	15:57	16:48	17:47
30°	04:43	05:57	07:12	15:38	16:25	17:20
35°	04:52	06:10	07:28	15:28	16:11	17:03
40°	05:03	06:25	07:46	15:15	15:55	16:44
45°	05:16	06:43	08:08	15:01	15:36	16:22
S 50°	05:31	07:05	08:37	14:44	15:12	15:53
52°	05:39	07:16	08:50	14:36	15:01	15:38
54°	05:47	07:28	09:07	14:27	14:48	15:22
56°	05:56	07:42	09:26	14:17	14:33	15:02
58°	06:06	07:59	09:50	14:05	14:16	14:38
S 60°	06:18	08:19	10:21	13:52	13:55	14:06

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 28-0 7-0%
25	03:06	03:03	11:57	10:14	22:43	
26	02:59	02:56	11:57	11:14	23:45	
27	02:53	02:49	11:57	12:17	–:–	

May 28, 29, 30 UT (Wed., Thu., Fri.)

	Aries	Venus		Mars		Jupiter		Saturn	
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	245°47.4	225°31.8	N06°28.5	103°55.8	N16°35.1	158°56.3	N23°13.3	244°45.9	S01°50.1
1	260°49.9	240°32.1	29.2	118°57.0	34.7	173°58.1	13.3	259°48.2	50.1
2	275°52.3	255°32.3	29.9	133°58.2	34.2	189°00.0	13.3	274°50.5	50.0
3	290°54.8	270°32.5	·· 30.6	148°59.3	·· 33.8	204°01.8	·· 13.3	289°52.8	·· 49.9
4	305°57.3	285°32.8	31.3	164°00.5	33.3	219°03.7	13.3	304°55.1	49.9
5	320°59.7	300°33.0	32.1	179°01.7	32.9	234°05.6	13.3	319°57.4	49.8
6	336°02.2	315°33.2	N06°32.8	194°02.9	N16°32.4	249°07.4	N23°13.4	334°59.7	S01°49.7
7	351°04.6	330°33.4	33.5	209°04.0	32.0	264°09.3	13.4	350°02.0	49.7
8	6°07.1	345°33.7	34.2	224°05.2	31.5	279°11.1	13.4	5°04.3	49.6
9	21°09.6	0°33.9	·· 35.0	239°06.4	·· 31.1	294°13.0	·· 13.4	20°06.6	·· 49.6
10	36°12.0	15°34.1	35.7	254°07.6	30.6	309°14.9	13.4	35°08.9	49.5
11	51°14.5	30°34.3	36.4	269°08.7	30.2	324°16.7	13.4	50°11.2	49.4
12	66°17.0	45°34.6	N06°37.1	284°09.9	N16°29.7	339°18.6	N23°13.4	65°13.5	S01°49.4
13	81°19.4	60°34.8	37.8	299°11.1	29.3	354°20.4	13.5	80°15.8	49.3
14	96°21.9	75°35.0	38.6	314°12.3	28.8	9°22.3	13.5	95°18.1	49.2
15	111°24.4	90°35.2	·· 39.3	329°13.4	·· 28.4	24°24.2	·· 13.5	110°20.4	·· 49.2
16	126°26.8	105°35.4	40.0	344°14.6	27.9	39°26.0	13.5	125°22.7	49.1
17	141°29.3	120°35.7	40.7	359°15.8	27.5	54°27.9	13.5	140°25.0	49.1
18	156°31.8	135°35.9	N06°41.5	14°17.0	N16°27.0	69°29.7	N23°13.5	155°27.3	S01°49.0
19	171°34.2	150°36.1	42.2	29°18.1	26.6	84°31.6	13.6	170°29.6	48.9
20	186°36.7	165°36.3	42.9	44°19.3	26.1	99°33.5	13.6	185°31.9	48.9
21	201°39.1	180°36.5	·· 43.6	59°20.5	·· 25.7	114°35.3	·· 13.6	200°34.2	·· 48.8
22	216°41.6	195°36.7	44.4	74°21.7	25.2	129°37.2	13.6	215°36.5	48.8
23	231°44.1	210°37.0	45.1	89°22.8	24.8	144°39.0	13.6	230°38.8	48.7
Mer.pass. 07:36		ν 0.2′	d 0.7′	m -4.43	ν 1.2′	d 0.4′	m 1.25	ν 1.9′	d 0.0′ m -1.92	ν 2.3′	d 0.1′ m 1.10

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	246°46.5	225°37.2	N06°45.8	104°24.0	N16°24.3	159°40.9	N23°13.6	245°41.1	S01°48.6
1	261°49.0	240°37.4	46.5	119°25.2	23.8	174°42.7	13.7	260°43.4	48.6
2	276°51.5	255°37.6	47.3	134°26.4	23.4	189°44.6	13.7	275°45.7	48.5
3	291°53.9	270°37.8	·· 48.0	149°27.5	·· 22.9	204°46.5	·· 13.7	290°48.0	·· 48.4
4	306°56.4	285°38.0	48.7	164°28.7	22.5	219°48.3	13.7	305°50.3	48.4
5	321°58.9	300°38.2	49.5	179°29.9	22.0	234°50.2	13.7	320°52.6	48.3
6	337°01.3	315°38.4	N06°50.2	194°31.1	N16°21.6	249°52.0	N23°13.7	335°54.9	S01°48.3
7	352°03.8	330°38.7	50.9	209°32.2	21.1	264°53.9	13.7	350°57.2	48.2
8	7°06.3	345°38.9	51.6	224°33.4	20.7	279°55.8	13.8	5°59.5	48.1
9	22°08.7	0°39.1	·· 52.4	239°34.6	·· 20.2	294°57.6	·· 13.8	21°01.8	·· 48.1
10	37°11.2	15°39.3	53.1	254°35.8	19.8	309°59.5	13.8	36°04.1	48.0
11	52°13.6	30°39.5	53.8	269°36.9	19.3	325°01.3	13.8	51°06.4	48.0
12	67°16.1	45°39.7	N06°54.6	284°38.1	N16°18.8	340°03.2	N23°13.8	66°08.7	S01°47.9
13	82°18.6	60°39.9	55.3	299°39.3	18.4	355°05.1	13.8	81°11.0	47.8
14	97°21.0	75°40.1	56.0	314°40.4	17.9	10°06.9	13.9	96°13.3	47.8
15	112°23.5	90°40.3	·· 56.8	329°41.6	·· 17.5	25°08.8	·· 13.9	111°15.6	·· 47.7
16	127°26.0	105°40.5	57.5	344°42.8	17.0	40°10.6	13.9	126°17.9	47.7
17	142°28.4	120°40.7	58.2	359°44.0	16.6	55°12.5	13.9	141°20.2	47.6
18	157°30.9	135°40.9	N06°59.0	14°45.1	N16°16.1	70°14.3	N23°13.9	156°22.5	S01°47.5
19	172°33.4	150°41.1	06°59.7	29°46.3	15.7	85°16.2	13.9	171°24.8	47.5
20	187°35.8	165°41.3	07°00.4	44°47.5	15.2	100°18.1	13.9	186°27.1	47.4
21	202°38.3	180°41.5	·· 01.2	59°48.6	·· 14.7	115°19.9	·· 14.0	201°29.4	·· 47.4
22	217°40.8	195°41.7	01.9	74°49.8	14.3	130°21.8	14.0	216°31.7	47.3
23	232°43.2	210°41.9	02.6	89°51.0	13.8	145°23.6	14.0	231°34.0	47.2
Mer.pass. 07:32		ν 0.2′	d 0.7′	m -4.42	ν 1.2′	d 0.5′	m 1.26	ν 1.9′	d 0.0′ m -1.92	ν 2.3′	d 0.1′ m 1.09

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	247°45.7	225°42.1	N07°03.4	104°52.2	N16°13.4	160°25.5	N23°14.0	246°36.3	S01°47.2
1	262°48.1	240°42.3	04.1	119°53.3	12.9	175°27.4	14.0	261°38.6	47.1
2	277°50.6	255°42.5	04.8	134°54.5	12.5	190°29.2	14.0	276°40.9	47.1
3	292°53.1	270°42.7	·· 05.6	149°55.7	·· 12.0	205°31.1	·· 14.0	291°43.2	·· 47.0
4	307°55.5	285°42.9	06.3	164°56.8	11.5	220°32.9	14.1	306°45.5	46.9
5	322°58.0	300°43.1	07.0	179°58.0	11.1	235°34.8	14.1	321°47.8	46.9
6	338°00.5	315°43.3	N07°07.8	194°59.2	N16°10.6	250°36.6	N23°14.1	336°50.1	S01°46.8
7	353°02.9	330°43.5	08.5	210°00.4	10.2	265°38.5	14.1	351°52.4	46.8
8	8°05.4	345°43.6	09.3	225°01.5	09.7	280°40.4	14.1	6°54.7	46.7
9	23°07.9	0°43.8	·· 10.0	240°02.7	·· 09.2	295°42.2	·· 14.1	21°57.0	·· 46.6
10	38°10.3	15°44.0	10.7	255°03.9	08.8	310°44.1	14.1	36°59.3	46.6
11	53°12.8	30°44.2	11.5	270°05.0	08.3	325°45.9	14.2	52°01.6	46.5
12	68°15.3	45°44.4	N07°12.2	285°06.2	N16°07.9	340°47.8	N23°14.2	67°03.9	S01°46.5
13	83°17.7	60°44.6	12.9	300°07.4	07.4	355°49.6	14.2	82°06.2	46.4
14	98°20.2	75°44.8	13.7	315°08.5	06.9	10°51.5	14.2	97°08.5	46.3
15	113°22.6	90°45.0	·· 14.4	330°09.7	·· 06.5	25°53.4	·· 14.2	112°10.8	·· 46.3
16	128°25.1	105°45.2	15.2	345°10.9	06.0	40°55.2	14.2	127°13.1	46.2
17	143°27.6	120°45.3	15.9	0°12.1	05.6	55°57.1	14.2	142°15.4	46.2
18	158°30.0	135°45.5	N07°16.6	15°13.2	N16°05.1	70°58.9	N23°14.3	157°17.7	S01°46.1
19	173°32.5	150°45.7	17.4	30°14.4	04.6	86°00.8	14.3	172°20.0	46.1
20	188°35.0	165°45.9	18.1	45°15.6	04.2	101°02.6	14.3	187°22.3	46.0
21	203°37.4	180°46.1	·· 18.9	60°16.7	·· 03.7	116°04.5	·· 14.3	202°24.6	·· 45.9
22	218°39.9	195°46.2	19.6	75°17.9	03.3	131°06.3	14.3	217°27.0	45.9
23	233°42.4	210°46.4	20.4	90°19.1	02.8	146°08.2	14.3	232°29.3	45.8
Mer.pass. 07:28		ν 0.2′	d 0.7′	m -4.41	ν 1.2′	d 0.5′	m 1.27	ν 1.9′	d 0.0′ m -1.92	ν 2.3′	d 0.1′ m 1.09

Stars

	SHA	Dec
Alpheratz	357°34.6	29°13.7
Ankaa	353°07.0	-42°09.9
Schedar	349°31.0	56°40.3
Diphda	348°47.2	-17°50.8
Achernar	335°20.4	-57°06.3
Hamal	327°51.1	23°34.8
Polaris	314°20.5	89°22.1
Acamar	315°11.9	-40°12.1
Menkar	314°06.1	4°11.3
Mirfak	308°28.3	49°57.0
Aldebaran	290°39.6	16°33.6
Rigel	281°03.9	-8°10.4
Capella	280°21.9	46°01.4
Bellatrix	278°22.9	6°22.3
Elnath	278°01.9	28°37.7
Alnilam	275°37.7	-1°11.2
Betelgeuse	270°52.1	7°24.7
Canopus	263°52.8	-52°42.6
Sirius	258°26.3	-16°45.1
Adhara	255°05.9	-29°00.5
Procyon	244°50.8	5°09.6
Pollux	243°17.2	27°58.0
Avior	234°15.0	-59°35.7
Suhail	222°46.3	-43°32.3
Miaplacidus	221°38.6	-69°49.5
Alphard	217°47.6	-8°46.2
Regulus	207°34.2	11°50.6
Dubhe	193°40.5	61°37.1
Denebola	182°24.5	14°25.8
Gienah	175°43.1	-17°41.1
Acrux	172°59.4	-63°14.7
Gacrux	171°51.0	-57°15.6
Alioth	166°12.3	55°49.5
Spica	158°21.8	-11°17.7
Alkaid	152°51.4	49°11.3
Hadar	148°35.1	-60°29.9
Menkent	147°56.9	-36°29.9
Arcturus	145°47.3	19°03.0
Rigil Kent.	139°39.3	-60°56.6
Kochab	137°18.7	74°03.1
Zuben'ubi	136°55.4	-16°08.9
Alphecca	126°03.1	26°37.7
Antares	112°15.1	-26°29.4
Atria	107°08.5	-69°04.4
Sabik	102°02.1	-15°45.4
Shaula	96°09.5	-37°07.3
Rasalhague	95°57.9	12°32.4
Eltanin	90°41.5	51°28.9
Kaus Aust.	83°31.7	-34°22.3
Vega	80°32.6	38°48.2
Nunki	75°47.1	-26°15.9
Altair	61°59.4	8°56.0
Peacock	53°04.9	-56°39.0
Deneb	49°25.4	45°22.0
Enif	33°38.4	9°59.4
Al Na'ir	27°32.5	-46°50.1
Fomalhaut	15°14.2	-29°29.1
Scheat	13°45.0	28°13.0
Markab	13°29.6	15°20.4

May 28 Wed	SHA	Mer.pass
Venus	339°44.4	08:58
Mars	218°08.4	17:03
Jupiter	273°08.9	13:23
Saturn	358°58.5	07:40

May 29 Thu	SHA	Mer.pass
Venus	338°50.6	08:57
Mars	217°37.5	17:01
Jupiter	272°54.4	13:20
Saturn	358°54.5	07:36

May 30 Fri	SHA	Mer.pass
Venus	337°56.4	08:57
Mars	217°06.5	16:59
Jupiter	272°39.8	13:17
Saturn	358°50.6	07:32

Horizontal parallax	
Venus:	0.2
Mars:	0.1

h	Sun		Moon				
Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°41.3	N21°28.0	168°00.0	1.6′	N27°59.4	3.4′	60.4′
1	195°41.2	28.4	182°20.6	1.6′	28°02.8	3.1′	60.4′
2	210°41.1	28.8	196°41.2	1.6′	28°05.9	2.9′	60.4′
3	225°41.1	·· 29.2	211°01.8	1.6′	28°08.8	2.7′	60.4′
4	240°41.0	29.6	225°22.5	1.6′	28°11.5	2.4′	60.3′
5	255°40.9	30.0	239°43.1	1.6′	28°13.9	2.3′	60.3′
6	270°40.8	N21°30.4	254°03.7	1.6′	N28°16.2	2.0′	60.3′
7	285°40.7	30.8	268°24.3	1.6′	28°18.2	1.8′	60.3′
8	300°40.7	31.2	282°45.0	1.7′	28°20.0	1.6′	60.2′
9	315°40.6	·· 31.6	297°05.6	1.7′	28°21.6	1.4′	60.2′
10	330°40.5	32.0	311°26.3	1.7′	28°23.0	1.2′	60.2′
11	345°40.4	32.4	325°47.0	1.7′	28°24.2	1.0′	60.2′
12	0°40.3	N21°32.8	340°07.7	1.8′	N28°25.2	0.7′	60.1′
13	15°40.3	33.2	354°28.5	1.8′	28°25.9	0.6′	60.1′
14	30°40.2	33.6	8°49.3	1.8′	28°26.5	0.3′	60.1′
15	45°40.1	·· 34.0	23°10.1	1.9′	28°26.8	0.1′	60.0′
16	60°40.0	34.4	37°31.0	1.9′	28°26.9	0.1′	60.0′
17	75°39.9	34.7	51°51.9	2.0′	28°26.8	0.3′	60.0′
18	90°39.9	N21°35.1	66°12.9	2.0′	N28°26.5	0.5′	59.9′
19	105°39.8	35.5	80°33.9	2.1′	28°26.0	0.7′	59.9′
20	120°39.7	35.9	94°54.9	2.1′	28°25.3	0.9′	59.9′
21	135°39.6	·· 36.3	109°16.0	2.2′	28°24.4	1.2′	59.9′
22	150°39.5	36.7	123°37.2	2.2′	28°23.2	1.3′	59.8′
23	165°39.4	37.1	137°58.5	2.3′	28°21.9	1.6′	59.8′
	SD = 15.8′	d = 0.4′	SD = 16.5′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°39.4	N21°37.5	152°19.8	2.4′	N28°20.3	1.7′	59.8′
1	195°39.3	37.9	166°41.1	2.4′	28°18.6	2.0′	59.7′
2	210°39.2	38.2	181°02.6	2.5′	28°16.6	2.1′	59.7′
3	225°39.1	·· 38.6	195°24.1	2.6′	28°14.5	2.4′	59.7′
4	240°39.0	39.0	209°45.7	2.7′	28°12.1	2.5′	59.6′
5	255°38.9	39.4	224°07.3	2.8′	28°09.6	2.8′	59.6′
6	270°38.8	N21°39.8	238°29.1	2.8′	N28°06.8	3.0′	59.6′
7	285°38.8	40.2	252°50.9	2.9′	28°03.8	3.1′	59.5′
8	300°38.7	40.5	267°12.9	3.0′	28°00.7	3.3′	59.5′
9	315°38.6	·· 40.9	281°34.9	3.1′	27°57.4	3.6′	59.5′
10	330°38.5	41.3	295°57.0	3.2′	27°53.8	3.7′	59.4′
11	345°38.4	41.7	310°19.2	3.3′	27°50.1	3.9′	59.4′
12	0°38.3	N21°42.1	324°41.5	3.4′	N27°46.2	4.1′	59.3′
13	15°38.3	42.4	339°03.9	3.5′	27°42.1	4.3′	59.3′
14	30°38.2	42.8	353°26.4	3.6′	27°37.8	4.5′	59.3′
15	45°38.1	·· 43.2	7°49.0	3.7′	27°33.3	4.7′	59.2′
16	60°38.0	43.6	22°11.7	3.8′	27°28.6	4.8′	59.2′
17	75°37.9	43.9	36°34.5	3.9′	27°23.8	5.0′	59.2′
18	90°37.8	N21°44.3	50°57.5	4.0′	N27°18.8	5.2′	59.1′
19	105°37.7	44.7	65°20.5	4.2′	27°13.6	5.4′	59.1′
20	120°37.6	45.1	79°43.7	4.3′	27°08.2	5.6′	59.1′
21	135°37.6	·· 45.4	94°06.9	4.4′	27°02.6	5.7′	59.0′
22	150°37.5	45.8	108°30.3	4.5′	26°56.9	5.9′	59.0′
23	165°37.4	46.2	122°53.8	4.6′	26°51.0	6.0′	58.9′
	SD = 15.8′	d = 0.4′	SD = 16.3′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°37.3	N21°46.6	137°17.5	4.8′	N26°45.0	6.3′	58.9′
1	195°37.2	46.9	151°41.2	4.9′	26°38.7	6.4′	58.9′
2	210°37.1	47.3	166°05.1	5.0′	26°32.3	6.5′	58.8′
3	225°37.0	·· 47.7	180°29.1	5.1′	26°25.8	6.8′	58.8′
4	240°36.9	48.0	194°53.2	5.3′	26°19.0	6.9′	58.8′
5	255°36.9	48.4	209°17.5	5.4′	26°12.1	7.0′	58.7′
6	270°36.8	N21°48.8	223°41.9	5.5′	N26°05.1	7.2′	58.7′
7	285°36.7	49.1	238°06.4	5.6′	25°57.9	7.4′	58.6′
8	300°36.6	49.5	252°31.0	5.8′	25°50.5	7.5′	58.6′
9	315°36.5	·· 49.9	266°55.8	5.9′	25°43.0	7.6′	58.6′
10	330°36.4	50.2	281°20.7	6.0′	25°35.4	7.8′	58.5′
11	345°36.3	50.6	295°45.8	6.2′	25°27.6	8.0′	58.5′
12	0°36.2	N21°51.0	310°10.9	6.3′	N25°19.6	8.1′	58.5′
13	15°36.1	51.3	324°36.2	6.4′	25°11.5	8.2′	58.4′
14	30°36.0	51.7	339°01.7	6.6′	25°03.3	8.4′	58.4′
15	45°36.0	·· 52.0	353°27.3	6.7′	24°54.9	8.6′	58.3′
16	60°35.9	52.4	7°53.0	6.9′	24°46.3	8.6′	58.3′
17	75°35.8	52.8	22°18.8	7.0′	24°37.7	8.8′	58.3′
18	90°35.7	N21°53.1	36°44.8	7.1′	N24°28.9	8.9′	58.2′
19	105°35.6	53.5	51°10.9	7.3′	24°20.0	9.1′	58.2′
20	120°35.5	53.8	65°37.2	7.4′	24°10.9	9.2′	58.1′
21	135°35.4	·· 54.2	80°03.6	7.5′	24°01.7	9.3′	58.1′
22	150°35.3	54.5	94°30.2	7.7′	23°52.4	9.4′	58.1′
23	165°35.2	54.9	108°56.8	7.8′	23°43.0	9.6′	58.0′
	SD = 15.8′	d = 0.4′	SD = 16.1′				

Lat.	**Twilight** Naut.	**Twilight** Civil	**Sunrise**	**Sunset**	**Twilight** Civil	**Twilight** Naut.
N 72°	▭	▭	▭	▭	▭	▭
N 70°	▭	▭	▭	▭	▭	▭
68°	▭	▭	▭	▭	▭	▭
66°	////	////	01:24	22:35	////	////
64°	////	////	02:05	21:52	////	////
62°	////	00:37	02:33	21:24	23:26	////
60°	////	01:34	02:54	21:03	22:23	////
N 58°	////	02:06	03:11	20:45	21:51	////
56°	00:33	02:29	03:25	20:31	21:27	23:29
54°	01:26	02:47	03:38	20:18	21:09	22:31
52°	01:55	03:03	03:48	20:07	20:53	22:01
50°	02:17	03:16	03:58	19:57	20:40	21:39
45°	02:55	03:42	04:18	19:37	20:13	21:00
N 40°	03:23	04:03	04:35	19:21	19:53	20:33
35°	03:44	04:19	04:48	19:07	19:36	20:12
30°	04:01	04:33	05:00	18:55	19:22	19:55
20°	04:27	04:56	05:20	18:35	18:59	19:28
N 10°	04:48	05:15	05:38	18:17	18:40	19:07
0°	05:06	05:32	05:54	18:01	18:23	18:49
S 10°	05:21	05:47	06:10	17:45	18:08	18:34
20°	05:36	06:03	06:27	17:28	17:52	18:19
30°	05:51	06:20	06:46	17:08	17:34	18:04
35°	05:59	06:30	06:57	16:57	17:25	17:56
40°	06:07	06:40	07:10	16:44	17:14	17:48
45°	06:16	06:53	07:26	16:29	17:02	17:39
S 50°	06:26	07:07	07:44	16:10	16:48	17:28
52°	06:31	07:14	07:53	16:02	16:41	17:24
54°	06:36	07:21	08:03	15:52	16:34	17:19
56°	06:41	07:29	08:14	15:40	16:26	17:13
58°	06:47	07:38	08:27	15:28	16:17	17:08
S 60°	06:53	07:48	08:42	15:13	16:07	17:01

Lat.	**Moonrise** Wed	**Moonrise** Thu	**Moonrise** Fri	**Moonset** Wed	**Moonset** Thu	**Moonset** Fri
N 72°	▭	▭	▭	▭	▭	▭
N 70°	▭	▭	▭	▭	▭	▭
68°	▭	▭	▭	▭	▭	▭
66°	▭	▭	▭	▭	▭	▭
64°	▭	▭	▭	▭	▭	▭
62°	01:13	▭	04:33	00:23	▭	01:32
60°	02:27	03:30	05:12	·· ··	00:24	00:52
N 58°	03:03	04:07	05:40	23:46	·· ··	00:24
56°	03:29	04:34	06:01	23:19	·· ··	00:03
54°	03:50	04:55	06:18	22:58	23:45	·· ··
52°	04:07	05:13	06:33	22:41	23:29	·· ··
50°	04:22	05:28	06:46	22:25	23:16	23:50
45°	04:52	05:58	07:13	21:55	22:49	23:28
N 40°	05:16	06:22	07:34	21:31	22:27	23:10
35°	05:35	06:41	07:51	21:11	22:09	22:55
30°	05:52	06:58	08:06	20:55	21:53	22:42
20°	06:20	07:26	08:31	20:26	21:27	22:19
N 10°	06:45	07:50	08:53	20:02	21:04	21:59
0°	07:07	08:12	09:13	19:39	20:42	21:41
S 10°	07:30	08:35	09:34	19:16	20:21	21:22
20°	07:55	08:59	09:55	18:51	19:57	21:02
30°	08:24	09:27	10:20	18:22	19:30	20:38
35°	08:41	09:44	10:35	18:05	19:14	20:25
40°	09:00	10:03	10:52	17:45	18:55	20:09
45°	09:25	10:26	11:12	17:21	18:32	19:49
S 50°	09:56	10:56	11:37	16:50	18:03	19:25
52°	10:11	11:11	11:49	16:34	17:49	19:13
54°	10:30	11:28	12:03	16:16	17:32	19:00
56°	10:52	11:48	12:19	15:54	17:12	18:44
58°	11:20	12:14	12:38	15:25	16:46	18:26
S 60°	12:02	12:49	13:02	14:43	16:12	18:03

Day	**Sun** Eqn.of Time 00^h mm:ss	**Sun** Eqn.of Time 12^h mm:ss	**Sun** Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	**Moon** Mer.Pass. Lower hh:mm	**Moon** Age 1-3 1-12%
28	02:45	02:41	11:57	13:23	00:50	
29	02:37	02:33	11:57	14:27	01:56	
30	02:29	02:25	11:58	15:27	02:58	

May 31, 01, 02 UT (Sat., Sun., Mon.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	248°44.8	225°46.6	N07°21.1	105°20.2	N16°02.3	161°10.1	N23°14.3	247°31.6	S01°45.8
1	263°47.3	240°46.8	21.8	120°21.4	01.9	176°11.9	14.4	262°33.9	45.7
2	278°49.8	255°47.0	22.6	135°22.6	01.4	191°13.8	14.4	277°36.2	45.6
3	293°52.2	270°47.1	·· 23.3	150°23.7	·· 01.0	206°15.6	·· 14.4	292°38.5	·· 45.6
4	308°54.7	285°47.3	24.1	165°24.9	00.5	221°17.5	14.4	307°40.8	45.5
5	323°57.1	300°47.5	24.8	180°26.1	16°00.0	236°19.3	14.4	322°43.1	45.5
6	338°59.6	315°47.7	N07°25.6	195°27.3	N15°59.6	251°21.2	N23°14.4	337°45.4	S01°45.4
7	354°02.1	330°47.8	26.3	210°28.4	59.1	266°23.1	14.4	352°47.7	45.4
8	9°04.5	345°48.0	27.0	225°29.6	58.6	281°24.9	14.5	7°50.0	45.3
9	24°07.0	0°48.2	·· 27.8	240°30.8	·· 58.2	296°26.8	·· 14.5	22°52.3	·· 45.2
10	39°09.5	15°48.4	28.5	255°31.9	57.7	311°28.6	14.5	37°54.6	45.2
11	54°11.9	30°48.5	29.3	270°33.1	57.3	326°30.5	14.5	52°56.9	45.1
12	69°14.4	45°48.7	N07°30.0	285°34.3	N15°56.8	341°32.3	N23°14.5	67°59.2	S01°45.1
13	84°16.9	60°48.9	30.8	300°35.4	56.3	356°34.2	14.5	83°01.5	45.0
14	99°19.3	75°49.0	31.5	315°36.6	55.9	11°36.0	14.5	98°03.8	45.0
15	114°21.8	90°49.2	·· 32.3	330°37.8	·· 55.4	26°37.9	·· 14.5	113°06.2	·· 44.9
16	129°24.2	105°49.4	33.0	345°38.9	54.9	41°39.8	14.6	128°08.5	44.8
17	144°26.7	120°49.6	33.8	0°40.1	54.5	56°41.6	14.6	143°10.8	44.8
18	159°29.2	135°49.7	N07°34.5	15°41.3	N15°54.0	71°43.5	N23°14.6	158°13.1	S01°44.7
19	174°31.6	150°49.9	35.3	30°42.4	53.5	86°45.3	14.6	173°15.4	44.7
20	189°34.1	165°50.1	36.0	45°43.6	53.1	101°47.2	14.6	188°17.7	44.6
21	204°36.6	180°50.2	·· 36.8	60°44.8	·· 52.6	116°49.0	·· 14.6	203°20.0	·· 44.6
22	219°39.0	195°50.4	37.5	75°45.9	52.1	131°50.9	14.6	218°22.3	44.5
23	234°41.5	210°50.5	38.2	90°47.1	51.7	146°52.7	14.7	233°24.6	44.4
Mer.pass. 07:24		ν 0.2′	d 0.7′	m -4.40	ν 1.2′	d 0.5′	m 1.28	ν 1.9′	d 0.0′ m -1.92	ν 2.3′	d 0.1′ m 1.09

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	249°44.0	225°50.7	N07°39.0	105°48.3	N15°51.2	161°54.6	N23°14.7	248°26.9	S01°44.4
1	264°46.4	240°50.9	39.7	120°49.4	50.7	176°56.5	14.7	263°29.2	44.3
2	279°48.9	255°51.0	40.5	135°50.6	50.3	191°58.3	14.7	278°31.5	44.3
3	294°51.4	270°51.2	·· 41.2	150°51.8	·· 49.8	207°00.2	·· 14.7	293°33.8	·· 44.2
4	309°53.8	285°51.3	42.0	165°52.9	49.3	222°02.0	14.7	308°36.2	44.2
5	324°56.3	300°51.5	42.7	180°54.1	48.9	237°03.9	14.7	323°38.5	44.1
6	339°58.7	315°51.7	N07°43.5	195°55.3	N15°48.4	252°05.7	N23°14.7	338°40.8	S01°44.0
7	355°01.2	330°51.8	44.2	210°56.4	47.9	267°07.6	14.8	353°43.1	44.0
8	10°03.7	345°52.0	45.0	225°57.6	47.5	282°09.4	14.8	8°45.4	43.9
9	25°06.1	0°52.1	·· 45.8	240°58.8	·· 47.0	297°11.3	·· 14.8	23°47.7	·· 43.9
10	40°08.6	15°52.3	46.5	255°59.9	46.5	312°13.2	14.8	38°50.0	43.8
11	55°11.1	30°52.4	47.3	271°01.1	46.1	327°15.0	14.8	53°52.3	43.8
12	70°13.5	45°52.6	N07°48.0	286°02.3	N15°45.6	342°16.9	N23°14.8	68°54.6	S01°43.7
13	85°16.0	60°52.8	48.8	301°03.4	45.1	357°18.7	14.8	83°56.9	43.6
14	100°18.5	75°52.9	49.5	316°04.6	44.7	12°20.6	14.8	98°59.2	43.6
15	115°20.9	90°53.1	·· 50.3	331°05.8	·· 44.2	27°22.4	·· 14.9	114°01.6	·· 43.5
16	130°23.4	105°53.2	51.0	346°06.9	43.7	42°24.3	14.9	129°03.9	43.5
17	145°25.9	120°53.4	51.8	1°08.1	43.3	57°26.1	14.9	144°06.2	43.4
18	160°28.3	135°53.5	N07°52.5	16°09.2	N15°42.8	72°28.0	N23°14.9	159°08.5	S01°43.4
19	175°30.8	150°53.7	53.3	31°10.4	42.3	87°29.8	14.9	174°10.8	43.3
20	190°33.2	165°53.8	54.0	46°11.6	41.9	102°31.7	14.9	189°13.1	43.3
21	205°35.7	180°54.0	·· 54.8	61°12.7	·· 41.4	117°33.6	·· 14.9	204°15.4	·· 43.2
22	220°38.2	195°54.1	55.5	76°13.9	40.9	132°35.4	14.9	219°17.7	43.1
23	235°40.6	210°54.3	56.3	91°15.1	40.5	147°37.3	15.0	234°20.0	43.1
Mer.pass. 07:20		ν 0.2′	d 0.7′	m -4.39	ν 1.2′	d 0.5′	m 1.29	ν 1.9′	d 0.0′ m -1.91	ν 2.3′	d 0.1′ m 1.08

Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	250°43.1	225°54.4	N07°57.1	106°16.2	N15°40.0	162°39.1	N23°15.0	249°22.4	S01°43.0
1	265°45.6	240°54.5	57.8	121°17.4	39.5	177°41.0	15.0	264°24.7	43.0
2	280°48.0	255°54.7	58.6	136°18.6	39.0	192°42.8	15.0	279°27.0	42.9
3	295°50.5	270°54.8	07°59.3	151°19.7	·· 38.6	207°44.7	·· 15.0	294°29.3	·· 42.9
4	310°53.0	285°55.0	08°00.1	166°20.9	38.1	222°46.5	15.0	309°31.6	42.8
5	325°55.4	300°55.1	00.8	181°22.1	37.6	237°48.4	15.0	324°33.9	42.8
6	340°57.9	315°55.3	N08°01.6	196°23.2	N15°37.2	252°50.2	N23°15.0	339°36.2	S01°42.7
7	356°00.3	330°55.4	02.3	211°24.4	36.7	267°52.1	15.0	354°38.5	42.6
8	11°02.8	345°55.5	03.1	226°25.5	36.2	282°53.9	15.1	9°40.8	42.6
9	26°05.3	0°55.7	·· 03.9	241°26.7	·· 35.8	297°55.8	·· 15.1	24°43.2	·· 42.5
10	41°07.7	15°55.8	04.6	256°27.9	35.3	312°57.7	15.1	39°45.5	42.5
11	56°10.2	30°56.0	05.4	271°29.0	34.8	327°59.5	15.1	54°47.8	42.4
12	71°12.7	45°56.1	N08°06.1	286°30.2	N15°34.3	343°01.4	N23°15.1	69°50.1	S01°42.4
13	86°15.1	60°56.2	06.9	301°31.4	33.9	358°03.2	15.1	84°52.4	42.3
14	101°17.6	75°56.4	07.6	316°32.5	33.4	13°05.1	15.1	99°54.7	42.3
15	116°20.1	90°56.5	·· 08.4	331°33.7	·· 32.9	28°06.9	·· 15.1	114°57.0	·· 42.2
16	131°22.5	105°56.6	09.2	346°34.9	32.5	43°08.8	15.1	129°59.4	42.2
17	146°25.0	120°56.8	09.9	1°36.0	32.0	58°10.6	15.2	145°01.7	42.1
18	161°27.5	135°56.9	N08°10.7	16°37.2	N15°31.5	73°12.5	N23°15.2	160°04.0	S01°42.0
19	176°29.9	150°57.0	11.4	31°38.3	31.0	88°14.3	15.2	175°06.3	42.0
20	191°32.4	165°57.2	12.2	46°39.5	30.6	103°16.2	15.2	190°08.6	41.9
21	206°34.8	180°57.3	·· 13.0	61°40.7	·· 30.1	118°18.0	·· 15.2	205°10.9	·· 41.9
22	221°37.3	195°57.4	13.7	76°41.8	29.6	133°19.9	15.2	220°13.2	41.8
23	236°39.8	210°57.6	14.5	91°43.0	29.1	148°21.8	15.2	235°15.5	41.8
Mer.pass. 07:16		ν 0.1′	d 0.8′	m -4.38	ν 1.2′	d 0.5′	m 1.29	ν 1.9′	d 0.0′ m -1.91	ν 2.3′	d 0.1′ m 1.08

Stars

	SHA	Dec
Alpheratz	357°34.6	29°13.7
Ankaa	353°07.0	-42°09.9
Schedar	349°31.0	56°40.3
Diphda	348°47.1	-17°50.8
Achernar	335°20.3	-57°06.3
Hamal	327°51.1	23°34.8
Polaris	314°19.7	89°22.1
Acamar	315°11.9	-40°12.1
Menkar	314°06.1	4°11.3
Mirfak	308°28.3	49°57.0
Aldebaran	290°39.6	16°33.6
Rigel	281°03.9	-8°10.4
Capella	280°21.9	46°01.4
Bellatrix	278°22.9	6°22.3
Elnath	278°01.8	28°37.7
Alnilam	275°37.7	-1°11.2
Betelgeuse	270°52.1	7°24.7
Canopus	263°52.8	-52°42.6
Sirius	258°26.3	-16°45.1
Adhara	255°05.9	-29°00.5
Procyon	244°50.8	5°09.6
Pollux	243°17.2	27°58.0
Avior	234°15.0	-59°35.7
Suhail	222°46.3	-43°32.3
Miaplacidus	221°38.6	-69°49.5
Alphard	217°47.6	-8°46.2
Regulus	207°34.2	11°50.6
Dubhe	193°40.5	61°37.1
Denebola	182°24.5	14°25.8
Gienah	175°43.1	-17°41.1
Acrux	172°59.5	-63°14.7
Gacrux	171°51.0	-57°15.6
Alioth	166°12.4	55°49.5
Spica	158°21.8	-11°17.7
Alkaid	152°51.4	49°11.3
Hadar	148°35.1	-60°29.9
Menkent	147°56.9	-36°29.9
Arcturus	145°47.3	19°03.0
Rigil Kent.	139°39.3	-60°56.6
Kochab	137°18.7	74°03.1
Zuben'ubi	136°55.4	-16°08.9
Alphecca	126°03.1	26°37.7
Antares	112°15.1	-26°29.4
Atria	107°08.4	-69°04.4
Sabik	102°02.1	-15°45.4
Shaula	96°09.5	-37°07.3
Rasalhague	95°57.9	12°32.4
Eltanin	90°41.5	51°29.0
Kaus Aust.	83°31.7	-34°22.3
Vega	80°32.6	38°48.3
Nunki	75°47.0	-26°15.9
Altair	61°59.4	8°56.0
Peacock	53°04.9	-56°39.0
Deneb	49°25.3	45°22.0
Enif	33°38.4	9°59.4
Al Na'ir	27°32.4	-46°50.1
Fomalhaut	15°14.2	-29°29.1
Scheat	13°44.9	28°13.0
Markab	13°29.6	15°20.4

May 31 Sat	SHA	Mer.pass
Venus	337°01.8	08:57
Mars	216°35.4	16:57
Jupiter	272°25.2	13:14
Saturn	358°46.7	07:29

Jun 01 Sun	SHA	Mer.pass
Venus	336°06.7	08:57
Mars	216°04.3	16:55
Jupiter	272°10.6	13:11
Saturn	358°43.0	07:25

Jun 02 Mon	SHA	Mer.pass
Venus	335°11.3	08:56
Mars	215°33.1	16:54
Jupiter	271°56.0	13:08
Saturn	358°39.3	07:21

Horizontal parallax	
Venus:	0.2
Mars:	0.1

DUT1 = UT1-UTC = +0.0288 sec ΔT = TT-UT1 = +69.1552 sec

2025 May 31 to Jun. 02 UT

h	Sun		Moon				
Sat	**GHA**	**Dec**	**GHA**	*ν*	**Dec**	*d*	**HP**
0	180°35.1	N21°55.3	123°23.6	8.0′	N23°33.4	9.7′	58.0′
1	195°35.0	55.6	137°50.6	8.1′	23°23.7	9.8′	57.9′
2	210°34.9	56.0	152°17.7	8.2′	23°13.9	9.9′	57.9′
3	225°34.9	·· 56.3	166°44.9	8.4′	23°04.0	10.1′	57.9′
4	240°34.8	56.7	181°12.3	8.5′	22°53.9	10.1′	57.8′
5	255°34.7	57.0	195°39.8	8.6′	22°43.8	10.3′	57.8′
6	270°34.6	N21°57.4	210°07.4	8.8′	N22°33.5	10.4′	57.7′
7	285°34.5	57.7	224°35.2	8.9′	22°23.1	10.4′	57.7′
8	300°34.4	58.1	239°03.1	9.0′	22°12.7	10.6′	57.7′
9	315°34.3	·· 58.4	253°31.1	9.2′	22°02.1	10.7′	57.6′
10	330°34.2	58.8	267°59.3	9.3′	21°51.4	10.8′	57.6′
11	345°34.1	59.1	282°27.6	9.4′	21°40.6	10.9′	57.6′
12	0°34.0	N21°59.5	296°56.1	9.6′	N21°29.7	11.0′	57.5′
13	15°33.9	21°59.8	311°24.7	9.7′	21°18.7	11.1′	57.5′
14	30°33.8	22°00.2	325°53.4	9.8′	21°07.6	11.2′	57.4′
15	45°33.7	·· 00.5	340°22.2	10.0′	20°56.4	11.3′	57.4′
16	60°33.6	00.8	354°51.2	10.1′	20°45.1	11.4′	57.4′
17	75°33.5	01.2	9°20.3	10.2′	20°33.7	11.4′	57.3′
18	90°33.4	N22°01.5	23°49.5	10.4′	N20°22.3	11.6′	57.3′
19	105°33.4	01.9	38°18.9	10.5′	20°10.7	11.6′	57.2′
20	120°33.3	02.2	52°48.4	10.6′	19°59.1	11.7′	57.2′
21	135°33.2	·· 02.6	67°18.0	10.7′	19°47.4	11.9′	57.2′
22	150°33.1	02.9	81°47.8	10.9′	19°35.5	11.8′	57.1′
23	165°33.0	03.2	96°17.6	11.0′	19°23.7	12.0′	57.1′
	SD = 15.8′	*d* = 0.4′	SD = 15.8′				

Sun	**GHA**	**Dec**	**GHA**	*ν*	**Dec**	*d*	**HP**
0	180°32.9	N22°03.6	110°47.6	11.1′	N19°11.7	12.1′	57.1′
1	195°32.8	03.9	125°17.8	11.2′	18°59.6	12.1′	57.0′
2	210°32.7	04.3	139°48.0	11.4′	18°47.5	12.2′	57.0′
3	225°32.6	·· 04.6	154°18.4	11.5′	18°35.3	12.3′	56.9′
4	240°32.5	04.9	168°48.8	11.6′	18°23.0	12.3′	56.9′
5	255°32.4	05.3	183°19.5	11.7′	18°10.7	12.4′	56.9′
6	270°32.3	N22°05.6	197°50.2	11.8′	N17°58.3	12.5′	56.8′
7	285°32.2	05.9	212°21.0	12.0′	17°45.8	12.6′	56.8′
8	300°32.1	06.3	226°52.0	12.1′	17°33.2	12.6′	56.8′
9	315°32.0	·· 06.6	241°23.0	12.2′	17°20.6	12.7′	56.7′
10	330°31.9	06.9	255°54.2	12.3′	17°07.9	12.7′	56.7′
11	345°31.8	07.3	270°25.5	12.4′	16°55.2	12.8′	56.6′
12	0°31.7	N22°07.6	284°56.9	12.5′	N16°42.4	12.9′	56.6′
13	15°31.6	07.9	299°28.5	12.6′	16°29.5	12.9′	56.6′
14	30°31.5	08.3	314°00.1	12.7′	16°16.6	13.0′	56.5′
15	45°31.4	·· 08.6	328°31.8	12.8′	16°03.6	13.1′	56.5′
16	60°31.3	08.9	343°03.7	12.9′	15°50.5	13.1′	56.5′
17	75°31.2	09.2	357°35.6	13.1′	15°37.4	13.1′	56.4′
18	90°31.1	N22°09.6	12°07.7	13.2′	N15°24.3	13.2′	56.4′
19	105°31.0	09.9	26°39.8	13.3′	15°11.1	13.3′	56.4′
20	120°30.9	10.2	41°12.1	13.4′	14°57.8	13.3′	56.3′
21	135°30.8	·· 10.5	55°44.4	13.5′	14°44.5	13.3′	56.3′
22	150°30.7	10.9	70°16.9	13.6′	14°31.2	13.4′	56.3′
23	165°30.6	11.2	84°49.4	13.7′	14°17.8	13.5′	56.2′
	SD = 15.8′	*d* = 0.3′	SD = 15.6′				

Mon	**GHA**	**Dec**	**GHA**	*ν*	**Dec**	*d*	**HP**
0	180°30.5	N22°11.5	99°22.1	13.7′	N14°04.3	13.5′	56.2′
1	195°30.4	11.8	113°54.8	13.8′	13°50.8	13.5′	56.2′
2	210°30.3	12.2	128°27.7	13.9′	13°37.3	13.6′	56.1′
3	225°30.2	·· 12.5	143°00.6	14.0′	13°23.7	13.6′	56.1′
4	240°30.1	12.8	157°33.6	14.1′	13°10.1	13.6′	56.1′
5	255°30.0	13.1	172°06.8	14.2′	12°56.5	13.7′	56.0′
6	270°29.9	N22°13.4	186°40.0	14.3′	N12°42.8	13.7′	56.0′
7	285°29.8	13.8	201°13.2	14.4′	12°29.1	13.8′	56.0′
8	300°29.7	14.1	215°46.6	14.5′	12°15.3	13.8′	55.9′
9	315°29.6	·· 14.4	230°20.1	14.5′	12°01.5	13.8′	55.9′
10	330°29.5	14.7	244°53.6	14.6′	11°47.7	13.9′	55.9′
11	345°29.4	15.0	259°27.2	14.7′	11°33.8	13.9′	55.8′
12	0°29.3	N22°15.3	274°01.0	14.8′	N11°19.9	13.9′	55.8′
13	15°29.2	15.7	288°34.7	14.9′	11°06.0	14.0′	55.8′
14	30°29.1	16.0	303°08.6	14.9′	10°52.0	14.0′	55.7′
15	45°29.0	·· 16.3	317°42.5	15.0′	10°38.0	14.0′	55.7′
16	60°28.9	16.6	332°16.5	15.1′	10°24.0	14.0′	55.7′
17	75°28.8	16.9	346°50.6	15.2′	10°10.0	14.1′	55.7′
18	90°28.7	N22°17.2	1°24.8	15.2′	N09°55.9	14.1′	55.6′
19	105°28.6	17.5	15°59.0	15.3′	09°41.8	14.1′	55.6′
20	120°28.5	17.8	30°33.3	15.4′	09°27.7	14.1′	55.6′
21	135°28.4	·· 18.1	45°07.7	15.4′	09°13.6	14.2′	55.5′
22	150°28.3	18.5	59°42.1	15.5′	08°59.4	14.2′	55.5′
23	165°28.2	18.8	74°16.6	15.6′	08°45.2	14.2′	55.5′
	SD = 15.8′	*d* = 0.3′	SD = 15.3′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	▭	▭	▭	▭	▭	▭
N 70°	▭	▭	▭	▭	▭	▭
68°	▭	▭	▭	▭	▭	▭
66°	////	////	01:11	22:49	////	////
64°	////	////	01:57	22:01	////	////
62°	////	////	02:27	21:30	////	////
60°	////	01:26	02:49	21:08	22:33	////
N 58°	////	02:00	03:07	20:50	21:58	////
56°	////	02:24	03:22	20:35	21:33	////
54°	01:18	02:43	03:35	20:22	21:13	22:40
52°	01:50	02:59	03:46	20:11	20:57	22:08
50°	02:13	03:13	03:56	20:01	20:44	21:44
45°	02:53	03:40	04:17	19:40	20:16	21:04
N 40°	03:21	04:01	04:33	19:23	19:55	20:36
35°	03:42	04:18	04:47	19:09	19:38	20:14
30°	04:00	04:32	04:59	18:57	19:24	19:56
20°	04:27	04:56	05:20	18:36	19:00	19:29
N 10°	04:48	05:15	05:38	18:18	18:41	19:08
0°	05:06	05:32	05:54	18:02	18:24	18:50
S 10°	05:22	05:48	06:11	17:45	18:08	18:34
20°	05:37	06:04	06:28	17:28	17:51	18:19
30°	05:52	06:22	06:48	17:08	17:34	18:03
35°	06:00	06:32	06:59	16:56	17:24	17:55
40°	06:09	06:42	07:13	16:43	17:13	17:47
45°	06:18	06:55	07:28	16:27	17:01	17:37
S 50°	06:29	07:10	07:47	16:08	16:46	17:27
52°	06:34	07:17	07:56	15:59	16:39	17:22
54°	06:39	07:24	08:07	15:49	16:31	17:17
56°	06:44	07:32	08:18	15:37	16:23	17:11
58°	06:50	07:42	08:31	15:24	16:14	17:05
S 60°	06:57	07:52	08:47	15:09	16:03	16:59

Lat.	**Moonrise** Sat	Sun	Mon	**Moonset** Sat	Sun	Mon
N 72°	▭	▭	08:56	▭	▭	02:35
N 70°	▭	06:45	09:19	▭	03:08	02:11
68°	▭	07:25	09:35	▭	02:27	01:52
66°	05:23	07:53	09:49	02:41	01:58	01:37
64°	06:09	08:13	10:00	01:55	01:36	01:24
62°	06:39	08:30	10:10	01:24	01:19	01:14
60°	07:01	08:44	10:18	01:01	01:04	01:04
N 58°	07:19	08:55	10:25	00:42	00:51	00:56
56°	07:35	09:05	10:31	00:26	00:40	00:49
54°	07:47	09:14	10:36	00:13	00:31	00:43
52°	07:59	09:22	10:41	00:01	00:22	00:37
50°	08:09	09:29	10:46	·· ··	00:14	00:32
45°	08:30	09:45	10:55	23:57	·· ··	00:20
N 40°	08:47	09:57	11:03	23:44	·· ··	00:11
35°	09:01	10:07	11:10	23:32	·· ··	00:02
30°	09:13	10:17	11:16	23:22	23:55	·· ··
20°	09:34	10:32	11:27	23:04	23:43	·· ··
N 10°	09:52	10:46	11:36	22:48	23:31	·· ··
0°	10:09	10:59	11:44	22:33	23:21	·· ··
S 10°	10:26	11:11	11:52	22:19	23:10	23:58
20°	10:44	11:25	12:01	22:03	22:59	23:51
30°	11:04	11:40	12:11	21:44	22:46	23:44
35°	11:16	11:49	12:17	21:33	22:38	23:39
40°	11:30	11:59	12:24	21:21	22:29	23:34
45°	11:46	12:11	12:31	21:06	22:19	23:28
S 50°	12:05	12:25	12:40	20:48	22:07	23:21
52°	12:15	12:32	12:44	20:39	22:01	23:18
54°	12:25	12:39	12:49	20:29	21:54	23:14
56°	12:37	12:47	12:54	20:18	21:47	23:10
58°	12:50	12:56	13:00	20:06	21:39	23:05
S 60°	13:06	13:07	13:06	19:51	21:29	23:00

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 4-6 20-39%
31	02:21	02:16	11:58	16:21	03:55	
01	02:11	02:07	11:58	17:10	04:46	
02	02:02	01:57	11:58	17:54	05:33	

June 03, 04, 05 UT (Tue., Wed., Thu.)

	Aries	Venus		Mars		Jupiter		Saturn	
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	251°42.2	225°57.7	N08°15.2	106°44.1	N15°28.7	163°23.6	N23°15.2	250°17.9	S01°41.7
1	266°44.7	240°57.8	16.0	121°45.3	28.2	178°25.5	15.2	265°20.2	41.7
2	281°47.2	255°58.0	16.8	136°46.5	27.7	193°27.3	15.3	280°22.5	41.6
3	296°49.6	270°58.1	·· 17.5	151°47.6	·· 27.2	208°29.2	·· 15.3	295°24.8	·· 41.6
4	311°52.1	285°58.2	18.3	166°48.8	26.8	223°31.0	15.3	310°27.1	41.5
5	326°54.6	300°58.3	19.1	181°50.0	26.3	238°32.9	15.3	325°29.4	41.5
6	341°57.0	315°58.5	N08°19.8	196°51.1	N15°25.8	253°34.7	N23°15.3	340°31.7	S01°41.4
7	356°59.5	330°58.6	20.6	211°52.3	25.3	268°36.6	15.3	355°34.1	41.3
8	12°02.0	345°58.7	21.3	226°53.4	24.9	283°38.4	15.3	10°36.4	41.3
9	27°04.4	0°58.8	·· 22.1	241°54.6	·· 24.4	298°40.3	·· 15.3	25°38.7	·· 41.2
10	42°06.9	15°59.0	22.9	256°55.8	23.9	313°42.1	15.3	40°41.0	41.2
11	57°09.3	30°59.1	23.6	271°56.9	23.4	328°44.0	15.4	55°43.3	41.1
12	72°11.8	45°59.2	N08°24.4	286°58.1	N15°23.0	343°45.8	N23°15.4	70°45.6	S01°41.1
13	87°14.3	60°59.3	25.2	301°59.2	22.5	358°47.7	15.4	85°48.0	41.0
14	102°16.7	75°59.4	25.9	317°00.4	22.0	13°49.5	15.4	100°50.3	41.0
15	117°19.2	90°59.6	·· 26.7	332°01.6	·· 21.5	28°51.4	·· 15.4	115°52.6	·· 40.9
16	132°21.7	105°59.7	27.4	347°02.7	21.1	43°53.2	15.4	130°54.9	40.9
17	147°24.1	120°59.8	28.2	2°03.9	20.6	58°55.1	15.4	145°57.2	40.8
18	162°26.6	135°59.9	N08°29.0	17°05.1	N15°20.1	73°57.0	N23°15.4	160°59.5	S01°40.8
19	177°29.1	151°00.0	29.7	32°06.2	19.6	88°58.8	15.4	176°01.9	40.7
20	192°31.5	166°00.2	30.5	47°07.4	19.2	104°00.7	15.4	191°04.2	40.7
21	207°34.0	181°00.3	·· 31.3	62°08.5	·· 18.7	119°02.5	·· 15.5	206°06.5	·· 40.6
22	222°36.4	196°00.4	32.0	77°09.7	18.2	134°04.4	15.5	221°08.8	40.5
23	237°38.9	211°00.5	32.8	92°10.9	17.7	149°06.2	15.5	236°11.1	40.5
Mer.pass. 07:12		ν 0.1′	d 0.8′	m -4.37	ν 1.2′	d 0.5′	m 1.30	ν 1.9′	d 0.0′ m -1.91	ν 2.3′	d 0.1′ m 1.08

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	252°41.4	226°00.6	N08°33.6	107°12.0	N15°17.3	164°08.1	N23°15.5	251°13.4	S01°40.4
1	267°43.8	241°00.7	34.3	122°13.2	16.8	179°09.9	15.5	266°15.8	40.4
2	282°46.3	256°00.8	35.1	137°14.3	16.3	194°11.8	15.5	281°18.1	40.3
3	297°48.8	271°00.9	·· 35.9	152°15.5	·· 15.8	209°13.6	·· 15.5	296°20.4	·· 40.3
4	312°51.2	286°01.1	36.6	167°16.7	15.3	224°15.5	15.5	311°22.7	40.2
5	327°53.7	301°01.2	37.4	182°17.8	14.9	239°17.3	15.5	326°25.0	40.2
6	342°56.2	316°01.3	N08°38.2	197°19.0	N15°14.4	254°19.2	N23°15.5	341°27.4	S01°40.1
7	357°58.6	331°01.4	38.9	212°20.1	13.9	269°21.0	15.6	356°29.7	40.1
8	13°01.1	346°01.5	39.7	227°21.3	13.4	284°22.9	15.6	11°32.0	40.0
9	28°03.6	1°01.6	·· 40.5	242°22.4	·· 12.9	299°24.7	·· 15.6	26°34.3	·· 40.0
10	43°06.0	16°01.7	41.2	257°23.6	12.5	314°26.6	15.6	41°36.6	39.9
11	58°08.5	31°01.8	42.0	272°24.8	12.0	329°28.4	15.6	56°38.9	39.9
12	73°10.9	46°01.9	N08°42.8	287°25.9	N15°11.5	344°30.3	N23°15.6	71°41.3	S01°39.8
13	88°13.4	61°02.0	43.5	302°27.1	11.0	359°32.1	15.6	86°43.6	39.8
14	103°15.9	76°02.1	44.3	317°28.2	10.5	14°34.0	15.6	101°45.9	39.7
15	118°18.3	91°02.2	·· 45.1	332°29.4	·· 10.1	29°35.8	·· 15.6	116°48.2	·· 39.7
16	133°20.8	106°02.3	45.8	347°30.6	09.6	44°37.7	15.6	131°50.5	39.6
17	148°23.3	121°02.4	46.6	2°31.7	09.1	59°39.5	15.6	146°52.9	39.6
18	163°25.7	136°02.5	N08°47.4	17°32.9	N15°08.6	74°41.4	N23°15.7	161°55.2	S01°39.5
19	178°28.2	151°02.6	48.1	32°34.0	08.1	89°43.2	15.7	176°57.5	39.5
20	193°30.7	166°02.7	48.9	47°35.2	07.7	104°45.1	15.7	191°59.8	39.4
21	208°33.1	181°02.8	·· 49.7	62°36.4	·· 07.2	119°46.9	·· 15.7	207°02.1	·· 39.4
22	223°35.6	196°02.9	50.5	77°37.5	06.7	134°48.8	15.7	222°04.5	39.3
23	238°38.1	211°03.0	51.2	92°38.7	06.2	149°50.7	15.7	237°06.8	39.3
Mer.pass. 07:08		ν 0.1′	d 0.8′	m -4.36	ν 1.2′	d 0.5′	m 1.31	ν 1.9′	d 0.0′ m -1.91	ν 2.3′	d 0.1′ m 1.07

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	253°40.5	226°03.1	N08°52.0	107°39.8	N15°05.7	164°52.5	N23°15.7	252°09.1	S01°39.2
1	268°43.0	241°03.2	52.8	122°41.0	05.3	179°54.4	15.7	267°11.4	39.2
2	283°45.4	256°03.3	53.5	137°42.1	04.8	194°56.2	15.7	282°13.7	39.1
3	298°47.9	271°03.4	·· 54.3	152°43.3	·· 04.3	209°58.1	·· 15.7	297°16.1	·· 39.0
4	313°50.4	286°03.5	55.1	167°44.5	03.8	224°59.9	15.7	312°18.4	39.0
5	328°52.8	301°03.6	55.8	182°45.6	03.3	240°01.8	15.8	327°20.7	38.9
6	343°55.3	316°03.7	N08°56.6	197°46.8	N15°02.8	255°03.6	N23°15.8	342°23.0	S01°38.9
7	358°57.8	331°03.8	57.4	212°47.9	02.4	270°05.5	15.8	357°25.4	38.8
8	14°00.2	346°03.9	58.2	227°49.1	01.9	285°07.3	15.8	12°27.7	38.8
9	29°02.7	1°04.0	·· 58.9	242°50.2	·· 01.4	300°09.2	·· 15.8	27°30.0	·· 38.7
10	44°05.2	16°04.1	08°59.7	257°51.4	00.9	315°11.0	15.8	42°32.3	38.7
11	59°07.6	31°04.2	09°00.5	272°52.6	15°00.4	330°12.9	15.8	57°34.6	38.6
12	74°10.1	46°04.2	N09°01.2	287°53.7	N14°59.9	345°14.7	N23°15.8	72°37.0	S01°38.6
13	89°12.5	61°04.3	02.0	302°54.9	59.5	0°16.6	15.8	87°39.3	38.5
14	104°15.0	76°04.4	02.8	317°56.0	59.0	15°18.4	15.8	102°41.6	38.5
15	119°17.5	91°04.5	·· 03.6	332°57.2	·· 58.5	30°20.3	·· 15.8	117°43.9	·· 38.4
16	134°19.9	106°04.6	04.3	347°58.3	58.0	45°22.1	15.9	132°46.3	38.4
17	149°22.4	121°04.7	05.1	2°59.5	57.5	60°24.0	15.9	147°48.6	38.3
18	164°24.9	136°04.8	N09°05.9	18°00.7	N14°57.0	75°25.8	N23°15.9	162°50.9	S01°38.3
19	179°27.3	151°04.8	06.6	33°01.8	56.6	90°27.7	15.9	177°53.2	38.2
20	194°29.8	166°04.9	07.4	48°03.0	56.1	105°29.5	15.9	192°55.5	38.2
21	209°32.3	181°05.0	·· 08.2	63°04.1	·· 55.6	120°31.4	·· 15.9	207°57.9	·· 38.1
22	224°34.7	196°05.1	09.0	78°05.3	55.1	135°33.2	15.9	223°00.2	38.1
23	239°37.2	211°05.2	09.7	93°06.4	54.6	150°35.1	15.9	238°02.5	38.0
Mer.pass. 07:04		ν 0.1′	d 0.8′	m -4.35	ν 1.2′	d 0.5′	m 1.32	ν 1.9′	d 0.0′ m -1.91	ν 2.3′	d 0.1′ m 1.07

Stars

	SHA	Dec
Alpheratz	357°34.6	29°13.7
Ankaa	353°07.0	-42°09.9
Schedar	349°31.0	56°40.3
Diphda	348°47.1	-17°50.8
Achernar	335°20.3	-57°06.2
Hamal	327°51.1	23°34.8
Polaris	314°19.0	89°22.1
Acamar	315°11.9	-40°12.0
Menkar	314°06.1	4°11.3
Mirfak	308°28.3	49°57.0
Aldebaran	290°39.6	16°33.6
Rigel	281°03.9	-8°10.3
Capella	280°21.9	46°01.4
Bellatrix	278°22.9	6°22.3
Elnath	278°01.8	28°37.7
Alnilam	275°37.7	-1°11.2
Betelgeuse	270°52.1	7°24.7
Canopus	263°52.8	-52°42.6
Sirius	258°26.3	-16°45.1
Adhara	255°06.0	-29°00.5
Procyon	244°50.8	5°09.6
Pollux	243°17.2	27°58.0
Avior	234°15.0	-59°35.6
Suhail	222°46.3	-43°32.3
Miaplacidus	221°38.7	-69°49.5
Alphard	217°47.6	-8°46.2
Regulus	207°34.2	11°50.6
Dubhe	193°40.6	61°37.1
Denebola	182°24.5	14°25.8
Gienah	175°43.1	-17°41.1
Acrux	172°59.5	-63°14.7
Gacrux	171°51.1	-57°15.6
Alioth	166°12.4	55°49.5
Spica	158°21.8	-11°17.7
Alkaid	152°51.4	49°11.3
Hadar	148°35.1	-60°30.0
Menkent	147°56.9	-36°29.9
Arcturus	145°47.3	19°03.0
Rigil Kent.	139°39.3	-60°56.6
Kochab	137°18.7	74°03.1
Zuben'ubi	136°55.4	-16°08.9
Alphecca	126°03.1	26°37.7
Antares	112°15.1	-26°29.4
Atria	107°08.4	-69°04.4
Sabik	102°02.1	-15°45.4
Shaula	96°09.5	-37°07.3
Rasalhague	95°57.9	12°32.4
Eltanin	90°41.5	51°29.0
Kaus Aust.	83°31.7	-34°22.3
Vega	80°32.6	38°48.3
Nunki	75°47.0	-26°15.9
Altair	61°59.4	8°56.0
Peacock	53°04.8	-56°39.0
Deneb	49°25.3	45°22.0
Enif	33°38.4	9°59.4
Al Na'ir	27°32.4	-46°50.1
Fomalhaut	15°14.2	-29°29.1
Scheat	13°44.9	28°13.1
Markab	13°29.6	15°20.4

Jun 03 Tue	SHA	Mer.pass
Venus	334°15.5	08:56
Mars	215°01.9	16:52
Jupiter	271°41.4	13:05
Saturn	358°35.6	07:18

Jun 04 Wed	SHA	Mer.pass
Venus	333°19.2	08:56
Mars	214°30.6	16:50
Jupiter	271°26.7	13:02
Saturn	358°32.1	07:14

Jun 05 Thu	SHA	Mer.pass
Venus	332°22.6	08:56
Mars	213°59.3	16:48
Jupiter	271°12.0	12:59
Saturn	358°28.6	07:10

Horizontal parallax	
Venus:	0.2
Mars:	0.1

h — Sun — Moon

Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	180°28.1	N22°19.1	88°51.2	15.6′	N08°31.0	14.2′	55.5′
1	195°28.0	19.4	103°25.8	15.7′	08°16.8	14.2′	55.4′
2	210°27.9	19.7	118°00.5	15.7′	08°02.6	14.3′	55.4′
3	225°27.8	·· 20.0	132°35.2	15.8′	07°48.3	14.2′	55.4′
4	240°27.7	20.3	147°10.1	15.9′	07°34.1	14.3′	55.3′
5	255°27.6	20.6	161°44.9	15.9′	07°19.8	14.3′	55.3′
6	270°27.4	N22°20.9	176°19.8	16.0′	N07°05.5	14.3′	55.3′
7	285°27.3	21.2	190°54.8	16.0′	06°51.2	14.3′	55.3′
8	300°27.2	21.5	205°29.8	16.1′	06°36.9	14.4′	55.2′
9	315°27.1	·· 21.8	220°04.9	16.1′	06°22.5	14.3′	55.2′
10	330°27.0	22.1	234°40.1	16.2′	06°08.2	14.4′	55.2′
11	345°26.9	22.4	249°15.2	16.2′	05°53.8	14.3′	55.2′
12	0°26.8	N22°22.7	263°50.5	16.3′	N05°39.5	14.4′	55.1′
13	15°26.7	23.0	278°25.7	16.3′	05°25.1	14.4′	55.1′
14	30°26.6	23.3	293°01.1	16.4′	05°10.7	14.4′	55.1′
15	45°26.5	·· 23.6	307°36.4	16.4′	04°56.3	14.3′	55.1′
16	60°26.4	23.9	322°11.8	16.4′	04°42.0	14.4′	55.0′
17	75°26.3	24.2	336°47.3	16.5′	04°27.6	14.4′	55.0′
18	90°26.2	N22°24.5	351°22.8	16.5′	N04°13.2	14.4′	55.0′
19	105°26.1	24.8	5°58.3	16.6′	03°58.8	14.5′	55.0′
20	120°26.0	25.1	20°33.9	16.6′	03°44.3	14.4′	54.9′
21	135°25.9	·· 25.3	35°09.5	16.6′	03°29.9	14.4′	54.9′
22	150°25.8	25.6	49°45.1	16.7′	03°15.5	14.4′	54.9′
23	165°25.6	25.9	64°20.8	16.7′	03°01.1	14.4′	54.9′
	SD = 15.8′	d = 0.3′		SD = 15.1′			

Wed	GHA	Dec	GHA	ν	Dec	d	HP
0	180°25.5	N22°26.2	78°56.5	16.7′	N02°46.7	14.4′	54.9′
1	195°25.4	26.5	93°32.2	16.8′	02°32.3	14.4′	54.8′
2	210°25.3	26.8	108°08.0	16.8′	02°17.9	14.4′	54.8′
3	225°25.2	·· 27.1	122°43.8	16.8′	02°03.5	14.4′	54.8′
4	240°25.1	27.4	137°19.6	16.8′	01°49.1	14.4′	54.8′
5	255°25.0	27.7	151°55.5	16.9′	01°34.7	14.4′	54.8′
6	270°24.9	N22°27.9	166°31.3	16.9′	N01°20.3	14.4′	54.7′
7	285°24.8	28.2	181°07.2	16.9′	01°05.9	14.4′	54.7′
8	300°24.7	28.5	195°43.1	16.9′	00°51.5	14.4′	54.7′
9	315°24.6	·· 28.8	210°19.1	17.0′	00°37.1	14.3′	54.7′
10	330°24.5	29.1	224°55.0	17.0′	00°22.8	14.4′	54.7′
11	345°24.4	29.4	239°31.0	17.0′	N00°08.4	14.3′	54.6′
12	0°24.2	N22°29.7	254°07.0	17.0′	S00°05.9	14.4′	54.6′
13	15°24.1	29.9	268°43.0	17.0′	00°20.3	14.3′	54.6′
14	30°24.0	30.2	283°19.1	17.0′	00°34.6	14.3′	54.6′
15	45°23.9	·· 30.5	297°55.1	17.1′	00°48.9	14.3′	54.6′
16	60°23.8	30.8	312°31.1	17.1′	01°03.2	14.3′	54.5′
17	75°23.7	31.1	327°07.2	17.1′	01°17.5	14.3′	54.5′
18	90°23.6	N22°31.3	341°43.3	17.1′	S01°31.8	14.3′	54.5′
19	105°23.5	31.6	356°19.4	17.1′	01°46.1	14.2′	54.5′
20	120°23.4	31.9	10°55.5	17.1′	02°00.3	14.3′	54.5′
21	135°23.3	·· 32.2	25°31.6	17.1′	02°14.6	14.2′	54.5′
22	150°23.2	32.4	40°07.7	17.1′	02°28.8	14.2′	54.4′
23	165°23.0	32.7	54°43.8	17.1′	02°43.0	14.2′	54.4′
	SD = 15.8′	d = 0.3′		SD = 15.0′			

Thu	GHA	Dec	GHA	ν	Dec	d	HP
0	180°22.9	N22°33.0	69°19.9	17.1′	S02°57.2	14.2′	54.4′
1	195°22.8	33.3	83°56.0	17.1′	03°11.4	14.1′	54.4′
2	210°22.7	33.5	98°32.1	17.1′	03°25.5	14.2′	54.4′
3	225°22.6	·· 33.8	113°08.2	17.1′	03°39.7	14.1′	54.4′
4	240°22.5	34.1	127°44.3	17.1′	03°53.8	14.1′	54.4′
5	255°22.4	34.3	142°20.4	17.1′	04°07.9	14.1′	54.3′
6	270°22.3	N22°34.6	156°56.5	17.1′	S04°22.0	14.0′	54.3′
7	285°22.2	34.9	171°32.6	17.1′	04°36.0	14.1′	54.3′
8	300°22.0	35.2	186°08.7	17.1′	04°50.1	14.0′	54.3′
9	315°21.9	·· 35.4	200°44.8	17.1′	05°04.1	14.0′	54.3′
10	330°21.8	35.7	215°20.9	17.1′	05°18.1	13.9′	54.3′
11	345°21.7	36.0	229°56.9	17.1′	05°32.0	14.0′	54.3′
12	0°21.6	N22°36.2	244°33.0	17.0′	S05°46.0	13.9′	54.3′
13	15°21.5	36.5	259°09.0	17.0′	05°59.9	13.9′	54.2′
14	30°21.4	36.7	273°45.1	17.0′	06°13.8	13.8′	54.2′
15	45°21.3	·· 37.0	288°21.1	17.0′	06°27.6	13.9′	54.2′
16	60°21.1	37.3	302°57.1	17.0′	06°41.5	13.8′	54.2′
17	75°21.0	37.5	317°33.1	17.0′	06°55.3	13.7′	54.2′
18	90°20.9	N22°37.8	332°09.0	16.9′	S07°09.0	13.8′	54.2′
19	105°20.8	38.1	346°45.0	16.9′	07°22.8	13.7′	54.2′
20	120°20.7	38.3	1°20.9	16.9′	07°36.5	13.7′	54.2′
21	135°20.6	·· 38.6	15°56.8	16.9′	07°50.2	13.6′	54.2′
22	150°20.5	38.8	30°32.7	16.9′	08°03.8	13.7′	54.2′
23	165°20.4	39.1	45°08.5	16.8′	08°17.5	13.6′	54.1′
	SD = 15.8′	d = 0.3′		SD = 14.8′			

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	▭	▭	▭	▭	▭	▭
N 70°	▭	▭	▭	▭	▭	▭
68°	▭	▭	▭	▭	▭	▭
66°	////	////	00:58	23:03	////	////
64°	////	////	01:50	22:08	////	////
62°	////	////	02:22	21:36	////	////
60°	////	01:17	02:45	21:13	22:42	////
N 58°	////	01:54	03:04	20:54	22:04	////
56°	////	02:20	03:19	20:39	21:38	////
54°	01:10	02:40	03:32	20:25	21:18	22:49
52°	01:45	02:57	03:44	20:14	21:01	22:13
50°	02:09	03:11	03:54	20:03	20:47	21:49
45°	02:50	03:38	04:15	19:42	20:19	21:07
N 40°	03:19	04:00	04:32	19:25	19:57	20:38
35°	03:41	04:17	04:46	19:11	19:40	20:16
30°	03:59	04:32	04:59	18:58	19:25	19:58
20°	04:27	04:55	05:20	18:37	19:01	19:30
N 10°	04:48	05:15	05:38	18:19	18:42	19:09
0°	05:06	05:32	05:55	18:02	18:24	18:50
S 10°	05:23	05:49	06:11	17:45	18:08	18:34
20°	05:38	06:05	06:29	17:28	17:51	18:19
30°	05:54	06:23	06:49	17:07	17:33	18:03
35°	06:02	06:33	07:01	16:55	17:23	17:55
40°	06:11	06:44	07:15	16:42	17:12	17:46
45°	06:20	06:57	07:31	16:26	16:59	17:36
S 50°	06:31	07:12	07:50	16:06	16:44	17:25
52°	06:36	07:19	07:59	15:57	16:37	17:20
54°	06:41	07:27	08:10	15:47	16:30	17:15
56°	06:47	07:35	08:22	15:35	16:21	17:09
58°	06:53	07:45	08:35	15:21	16:11	17:03
S 60°	07:00	07:56	08:51	15:05	16:01	16:56

Lat.	Moonrise Tue	Moonrise Wed	Moonrise Thu	Moonset Tue	Moonset Wed	Moonset Thu
N 72°	11:11	13:11	15:10	01:50	01:16	00:44
N 70°	11:20	13:11	15:00	01:38	01:12	00:48
68°	11:27	13:10	14:52	01:29	01:10	00:52
66°	11:32	13:10	14:46	01:21	01:08	00:55
64°	11:37	13:09	14:40	01:15	01:06	00:57
62°	11:41	13:09	14:35	01:09	01:04	00:59
60°	11:45	13:09	14:31	01:04	01:03	01:01
N 58°	11:48	13:08	14:27	00:59	01:01	01:03
56°	11:51	13:08	14:24	00:55	01:00	01:05
54°	11:54	13:08	14:21	00:52	00:59	01:06
52°	11:56	13:08	14:19	00:48	00:58	01:07
50°	11:58	13:08	14:16	00:45	00:57	01:09
45°	12:03	13:07	14:11	00:39	00:55	01:11
N 40°	12:06	13:07	14:07	00:33	00:54	01:13
35°	12:10	13:07	14:03	00:29	00:52	01:15
30°	12:12	13:07	14:00	00:24	00:51	01:17
20°	12:17	13:06	13:54	00:17	00:49	01:20
N 10°	12:22	13:06	13:49	00:10	00:47	01:22
0°	12:26	13:06	13:45	00:04	00:45	01:25
S 10°	12:30	13:05	13:40	·· ··	00:43	01:27
20°	12:34	13:05	13:36	·· ··	00:41	01:29
30°	12:39	13:05	13:30	·· ··	00:39	01:32
35°	12:42	13:05	13:27	·· ··	00:37	01:34
40°	12:45	13:05	13:24	·· ··	00:36	01:36
45°	12:49	13:04	13:20	·· ··	00:34	01:38
S 50°	12:53	13:04	13:15	·· ··	00:32	01:41
52°	12:55	13:04	13:13	·· ··	00:31	01:42
54°	12:57	13:04	13:11	·· ··	00:30	01:43
56°	12:59	13:04	13:08	·· ··	00:28	01:45
58°	13:02	13:04	13:05	·· ··	00:27	01:46
S 60°	13:05	13:04	13:02	·· ··	00:26	01:48

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 7-9 49-68%
03	01:52	01:47	11:58	18:35	06:15	
04	01:42	01:37	11:58	19:15	06:55	
05	01:32	01:26	11:59	19:54	07:35	

June 06, 07, 08 UT (Fri., Sat., Sun.)

	Aries	Venus		Mars		Jupiter		Saturn	
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	254°39.7	226°05.3	N09°10.5	108°07.6	N14°54.1	165°36.9	N23°15.9	253°04.8	S01°38.0
1	269°42.1	241°05.3	11.3	123°08.7	53.6	180°38.8	15.9	268°07.2	37.9
2	284°44.6	256°05.4	12.1	138°09.9	53.2	195°40.6	15.9	283°09.5	37.9
3	299°47.0	271°05.5	·· 12.8	153°11.1	·· 52.7	210°42.5	·· 15.9	298°11.8	·· 37.8
4	314°49.5	286°05.6	13.6	168°12.2	52.2	225°44.3	15.9	313°14.1	37.8
5	329°52.0	301°05.7	14.4	183°13.4	51.7	240°46.2	16.0	328°16.5	37.7
6	344°54.4	316°05.7	N09°15.2	198°14.5	N14°51.2	255°48.0	N23°16.0	343°18.8	S01°37.7
7	359°56.9	331°05.8	15.9	213°15.7	50.7	270°49.9	16.0	358°21.1	37.6
8	14°59.4	346°05.9	16.7	228°16.8	50.2	285°51.7	16.0	13°23.4	37.6
9	30°01.8	1°06.0	·· 17.5	243°18.0	·· 49.8	300°53.6	·· 16.0	28°25.8	·· 37.6
10	45°04.3	16°06.0	18.3	258°19.1	49.3	315°55.4	16.0	43°28.1	37.5
11	60°06.8	31°06.1	19.0	273°20.3	48.8	330°57.3	16.0	58°30.4	37.5
12	75°09.2	46°06.2	N09°19.8	288°21.5	N14°48.3	345°59.1	N23°16.0	73°32.7	S01°37.4
13	90°11.7	61°06.3	20.6	303°22.6	47.8	1°01.0	16.0	88°35.1	37.4
14	105°14.2	76°06.3	21.4	318°23.8	47.3	16°02.8	16.0	103°37.4	37.3
15	120°16.6	91°06.4	·· 22.1	333°24.9	·· 46.8	31°04.7	·· 16.0	118°39.7	·· 37.3
16	135°19.1	106°06.5	22.9	348°26.1	46.3	46°06.5	16.0	133°42.0	37.2
17	150°21.5	121°06.5	23.7	3°27.2	45.9	61°08.4	16.0	148°44.4	37.2
18	165°24.0	136°06.6	N09°24.5	18°28.4	N14°45.4	76°10.2	N23°16.1	163°46.7	S01°37.1
19	180°26.5	151°06.7	25.2	33°29.5	44.9	91°12.1	16.1	178°49.0	37.1
20	195°28.9	166°06.7	26.0	48°30.7	44.4	106°13.9	16.1	193°51.3	37.0
21	210°31.4	181°06.8	·· 26.8	63°31.8	·· 43.9	121°15.8	·· 16.1	208°53.7	·· 37.0
22	225°33.9	196°06.9	27.6	78°33.0	43.4	136°17.6	16.1	223°56.0	36.9
23	240°36.3	211°06.9	28.3	93°34.2	42.9	151°19.5	16.1	238°58.3	36.9
Mer.pass. 07:00		ν 0.1′ d 0.8′	m -4.34	ν 1.2′ d 0.5′	m 1.33	ν 1.9′ d 0.0′	m -1.91	ν 2.3′ d 0.0′	m 1.06

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	255°38.8	226°07.0	N09°29.1	108°35.3	N14°42.4	166°21.3	N23°16.1	254°00.7	S01°36.8
1	270°41.3	241°07.1	29.9	123°36.5	41.9	181°23.2	16.1	269°03.0	36.8
2	285°43.7	256°07.1	30.7	138°37.6	41.5	196°25.0	16.1	284°05.3	36.7
3	300°46.2	271°07.2	·· 31.4	153°38.8	·· 41.0	211°26.9	·· 16.1	299°07.6	·· 36.7
4	315°48.6	286°07.3	32.2	168°39.9	40.5	226°28.7	16.1	314°10.0	36.6
5	330°51.1	301°07.3	33.0	183°41.1	40.0	241°30.6	16.1	329°12.3	36.6
6	345°53.6	316°07.4	N09°33.8	198°42.2	N14°39.5	256°32.4	N23°16.1	344°14.6	S01°36.5
7	0°56.0	331°07.5	34.6	213°43.4	39.0	271°34.3	16.1	359°16.9	36.5
8	15°58.5	346°07.5	35.3	228°44.5	38.5	286°36.1	16.1	14°19.3	36.4
9	31°01.0	1°07.6	·· 36.1	243°45.7	·· 38.0	301°38.0	·· 16.2	29°21.6	·· 36.4
10	46°03.4	16°07.6	36.9	258°46.8	37.5	316°39.8	16.2	44°23.9	36.3
11	61°05.9	31°07.7	37.7	273°48.0	37.0	331°41.7	16.2	59°26.3	36.3
12	76°08.4	46°07.7	N09°38.4	288°49.2	N14°36.5	346°43.5	N23°16.2	74°28.6	S01°36.2
13	91°10.8	61°07.8	39.2	303°50.3	36.1	1°45.4	16.2	89°30.9	36.2
14	106°13.3	76°07.9	40.0	318°51.5	35.6	16°47.2	16.2	104°33.3	36.2
15	121°15.8	91°07.9	·· 40.8	333°52.6	·· 35.1	31°49.0	·· 16.2	119°35.6	·· 36.1
16	136°18.2	106°08.0	41.6	348°53.8	34.6	46°50.9	16.2	134°37.9	36.1
17	151°20.7	121°08.0	42.3	3°54.9	34.1	61°52.7	16.2	149°40.2	36.0
18	166°23.1	136°08.1	N09°43.1	18°56.1	N14°33.6	76°54.6	N23°16.2	164°42.6	S01°36.0
19	181°25.6	151°08.1	43.9	33°57.2	33.1	91°56.4	16.2	179°44.9	35.9
20	196°28.1	166°08.2	44.7	48°58.4	32.6	106°58.3	16.2	194°47.2	35.9
21	211°30.5	181°08.2	·· 45.4	63°59.5	·· 32.1	122°00.1	·· 16.2	209°49.6	·· 35.8
22	226°33.0	196°08.3	46.2	79°00.7	31.6	137°02.0	16.2	224°51.9	35.8
23	241°35.5	211°08.3	47.0	94°01.8	31.1	152°03.8	16.2	239°54.2	35.7
Mer.pass. 06:56		ν 0.1′ d 0.8′	m -4.33	ν 1.2′ d 0.5′	m 1.34	ν 1.8′ d 0.0′	m -1.91	ν 2.3′ d 0.0′	m 1.06

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	256°37.9	226°08.4	N09°47.8	109°03.0	N14°30.6	167°05.7	N23°16.3	254°56.5	S01°35.7
1	271°40.4	241°08.4	48.6	124°04.1	30.1	182°07.5	16.3	269°58.9	35.6
2	286°42.9	256°08.5	49.3	139°05.3	29.7	197°09.4	16.3	285°01.2	35.6
3	301°45.3	271°08.5	·· 50.1	154°06.4	·· 29.2	212°11.2	·· 16.3	300°03.5	·· 35.5
4	316°47.8	286°08.6	50.9	169°07.6	28.7	227°13.1	16.3	315°05.9	35.5
5	331°50.3	301°08.6	51.7	184°08.7	28.2	242°14.9	16.3	330°08.2	35.5
6	346°52.7	316°08.7	N09°52.5	199°09.9	N14°27.7	257°16.8	N23°16.3	345°10.5	S01°35.4
7	1°55.2	331°08.7	53.2	214°11.0	27.2	272°18.6	16.3	0°12.9	35.4
8	16°57.6	346°08.8	54.0	229°12.2	26.7	287°20.5	16.3	15°15.2	35.3
9	32°00.1	1°08.8	·· 54.8	244°13.3	·· 26.2	302°22.3	·· 16.3	30°17.5	·· 35.3
10	47°02.6	16°08.8	55.6	259°14.5	25.7	317°24.2	16.3	45°19.9	35.2
11	62°05.0	31°08.9	56.4	274°15.7	25.2	332°26.0	16.3	60°22.2	35.2
12	77°07.5	46°08.9	N09°57.1	289°16.8	N14°24.7	347°27.9	N23°16.3	75°24.5	S01°35.1
13	92°10.0	61°09.0	57.9	304°18.0	24.2	2°29.7	16.3	90°26.9	35.1
14	107°12.4	76°09.0	58.7	319°19.1	23.7	17°31.6	16.3	105°29.2	35.0
15	122°14.9	91°09.1	09°59.5	334°20.3	·· 23.2	32°33.4	·· 16.3	120°31.5	·· 35.0
16	137°17.4	106°09.1	10°00.3	349°21.4	22.7	47°35.3	16.3	135°33.9	34.9
17	152°19.8	121°09.1	01.0	4°22.6	22.2	62°37.1	16.3	150°36.2	34.9
18	167°22.3	136°09.2	N10°01.8	19°23.7	N14°21.7	77°39.0	N23°16.4	165°38.5	S01°34.9
19	182°24.7	151°09.2	02.6	34°24.9	21.2	92°40.8	16.4	180°40.9	34.8
20	197°27.2	166°09.2	03.4	49°26.0	20.7	107°42.7	16.4	195°43.2	34.8
21	212°29.7	181°09.3	·· 04.2	64°27.2	·· 20.3	122°44.5	·· 16.4	210°45.5	·· 34.7
22	227°32.1	196°09.3	04.9	79°28.3	19.8	137°46.3	16.4	225°47.9	34.7
23	242°34.6	211°09.3	05.7	94°29.5	19.3	152°48.2	16.4	240°50.2	34.6
Mer.pass. 06:52		ν 0.0′ d 0.8′	m -4.32	ν 1.2′ d 0.5′	m 1.34	ν 1.8′ d 0.0′	m -1.91	ν 2.3′ d 0.0′	m 1.06

Stars

	SHA	Dec
Alpheratz	357°34.5	29°13.7
Ankaa	353°07.0	-42°09.9
Schedar	349°30.9	56°40.3
Diphda	348°47.1	-17°50.7
Achernar	335°20.3	-57°06.2
Hamal	327°51.1	23°34.8
Polaris	314°18.1	89°22.1
Acamar	315°11.9	-40°12.0
Menkar	314°06.1	4°11.3
Mirfak	308°28.3	49°57.0
Aldebaran	290°39.6	16°33.6
Rigel	281°03.9	-8°10.3
Capella	280°21.9	46°01.4
Bellatrix	278°22.9	6°22.4
Elnath	278°01.8	28°37.7
Alnilam	275°37.7	-1°11.1
Betelgeuse	270°52.1	7°24.7
Canopus	263°52.8	-52°42.6
Sirius	258°26.3	-16°45.1
Adhara	255°06.0	-29°00.5
Procyon	244°50.8	5°09.6
Pollux	243°17.2	27°58.0
Avior	234°15.1	-59°35.6
Suhail	222°46.3	-43°32.3
Miaplacidus	221°38.7	-69°49.5
Alphard	217°47.6	-8°46.2
Regulus	207°34.2	11°50.6
Dubhe	193°40.6	61°37.1
Denebola	182°24.6	14°25.8
Gienah	175°43.2	-17°41.1
Acrux	172°59.5	-63°14.7
Gacrux	171°51.1	-57°15.6
Alioth	166°12.4	55°49.5
Spica	158°21.8	-11°17.7
Alkaid	152°51.4	49°11.3
Hadar	148°35.1	-60°30.0
Menkent	147°57.0	-36°29.9
Arcturus	145°47.4	19°03.0
Rigil Kent.	139°39.3	-60°56.6
Kochab	137°18.8	74°03.2
Zuben'ubi	136°55.4	-16°08.9
Alphecca	126°03.1	26°37.7
Antares	112°15.1	-26°29.4
Atria	107°08.4	-69°04.4
Sabik	102°02.1	-15°45.4
Shaula	96°09.5	-37°07.3
Rasalhague	95°57.9	12°32.4
Eltanin	90°41.5	51°29.0
Kaus Aust.	83°31.7	-34°22.3
Vega	80°32.6	38°48.3
Nunki	75°47.0	-26°15.9
Altair	61°59.4	8°56.0
Peacock	53°04.8	-56°39.0
Deneb	49°25.3	45°22.0
Enif	33°38.4	9°59.4
Al Na'ir	27°32.4	-46°50.0
Fomalhaut	15°14.1	-29°29.1
Scheat	13°44.9	28°13.1
Markab	13°29.6	15°20.4

Jun 06 Fri	SHA	Mer.pass
Venus	331°25.6	08:56
Mars	213°27.9	16:46
Jupiter	270°57.3	12:56
Saturn	358°25.2	07:07

Jun 07 Sat	SHA	Mer.pass
Venus	330°28.2	08:55
Mars	212°56.5	16:44
Jupiter	270°42.5	12:53
Saturn	358°21.9	07:03

Jun 08 Sun	SHA	Mer.pass
Venus	329°30.5	08:55
Mars	212°25.1	16:43
Jupiter	270°27.8	12:50
Saturn	358°18.6	06:59

Horizontal parallax	
Venus:	0.2
Mars:	0.1

DUT1 = UT1-UTC = +0.0287 sec ΔT = TT-UT1 = +69.1553 sec

2025 June 06 to Jun. 08 UT

h	Sun		Moon				
Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°20.2	N22°39.4	59°44.4	16.8′	S08°31.1	13.5′	54.1′
1	195°20.1	39.6	74°20.2	16.8′	08°44.6	13.5′	54.1′
2	210°20.0	39.9	88°56.0	16.8′	08°58.1	13.5′	54.1′
3	225°19.9	·· 40.1	103°31.7	16.7′	09°11.6	13.5′	54.1′
4	240°19.8	40.4	118°07.5	16.7′	09°25.1	13.4′	54.1′
5	255°19.7	40.6	132°43.1	16.7′	09°38.5	13.3′	54.1′
6	270°19.6	N22°40.9	147°18.8	16.6′	S09°51.8	13.4′	54.1′
7	285°19.4	41.1	161°54.5	16.6′	10°05.2	13.3′	54.1′
8	300°19.3	41.4	176°30.1	16.6′	10°18.5	13.2′	54.1′
9	315°19.2	·· 41.6	191°05.6	16.5′	10°31.7	13.3′	54.1′
10	330°19.1	41.9	205°41.2	16.5′	10°45.0	13.1′	54.1′
11	345°19.0	42.1	220°16.7	16.5′	10°58.1	13.2′	54.1′
12	0°18.9	N22°42.4	234°52.1	16.4′	S11°11.3	13.1′	54.1′
13	15°18.8	42.6	249°27.5	16.4′	11°24.4	13.0′	54.1′
14	30°18.6	42.9	264°02.9	16.3′	11°37.4	13.0′	54.0′
15	45°18.5	·· 43.1	278°38.3	16.3′	11°50.4	13.0′	54.0′
16	60°18.4	43.4	293°13.6	16.3′	12°03.4	12.9′	54.0′
17	75°18.3	43.6	307°48.8	16.2′	12°16.3	12.9′	54.0′
18	90°18.2	N22°43.9	322°24.1	16.2′	S12°29.2	12.8′	54.0′
19	105°18.1	44.1	336°59.2	16.1′	12°42.0	12.8′	54.0′
20	120°17.9	44.4	351°34.4	16.1′	12°54.8	12.7′	54.0′
21	135°17.8	·· 44.6	6°09.5	16.0′	13°07.5	12.7′	54.0′
22	150°17.7	44.8	20°44.5	16.0′	13°20.2	12.6′	54.0′
23	165°17.6	45.1	35°19.5	15.9′	13°32.8	12.6′	54.0′
	SD = 15.8′	d = 0.3′	SD = 14.8′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°17.5	N22°45.3	49°54.4	15.9′	S13°45.4	12.6′	54.0′
1	195°17.4	45.6	64°29.3	15.8′	13°58.0	12.4′	54.0′
2	210°17.2	45.8	79°04.2	15.8′	14°10.4	12.5′	54.0′
3	225°17.1	·· 46.0	93°39.0	15.7′	14°22.9	12.3′	54.0′
4	240°17.0	46.3	108°13.7	15.7′	14°35.2	12.3′	54.0′
5	255°16.9	46.5	122°48.4	15.6′	14°47.5	12.3′	54.0′
6	270°16.8	N22°46.8	137°23.1	15.6′	S14°59.8	12.2′	54.0′
7	285°16.7	47.0	151°57.6	15.5′	15°12.0	12.2′	54.0′
8	300°16.5	47.2	166°32.2	15.5′	15°24.2	12.1′	54.0′
9	315°16.4	·· 47.5	181°06.6	15.4′	15°36.3	12.0′	54.0′
10	330°16.3	47.7	195°41.1	15.4′	15°48.3	12.0′	54.0′
11	345°16.2	47.9	210°15.4	15.3′	16°00.3	11.9′	54.0′
12	0°16.1	N22°48.2	224°49.7	15.2′	S16°12.2	11.8′	54.0′
13	15°16.0	48.4	239°23.9	15.2′	16°24.0	11.8′	54.0′
14	30°15.8	48.6	253°58.1	15.1′	16°35.8	11.7′	54.0′
15	45°15.7	·· 48.9	268°32.2	15.1′	16°47.5	11.7′	54.0′
16	60°15.6	49.1	283°06.3	15.0′	16°59.2	11.6′	54.0′
17	75°15.5	49.3	297°40.3	14.9′	17°10.8	11.5′	54.0′
18	90°15.4	N22°49.5	312°14.2	14.9′	S17°22.3	11.5′	54.0′
19	105°15.2	49.8	326°48.1	14.8′	17°33.8	11.4′	54.0′
20	120°15.1	50.0	341°21.9	14.7′	17°45.2	11.3′	54.0′
21	135°15.0	·· 50.2	355°55.6	14.7′	17°56.5	11.3′	54.0′
22	150°14.9	50.4	10°29.3	14.6′	18°07.8	11.2′	54.0′
23	165°14.8	50.7	25°02.9	14.5′	18°19.0	11.1′	54.0′
	SD = 15.8′	d = 0.2′	SD = 14.7′				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°14.7	N22°50.9	39°36.4	14.5′	S18°30.1	11.0′	54.0′
1	195°14.5	51.1	54°09.9	14.4′	18°41.1	11.0′	54.0′
2	210°14.4	51.3	68°43.3	14.3′	18°52.1	10.9′	54.0′
3	225°14.3	·· 51.6	83°16.6	14.3′	19°03.0	10.9′	54.0′
4	240°14.2	51.8	97°49.9	14.2′	19°13.9	10.7′	54.0′
5	255°14.1	52.0	112°23.1	14.1′	19°24.6	10.7′	54.0′
6	270°13.9	N22°52.2	126°56.2	14.0′	S19°35.3	10.6′	54.0′
7	285°13.8	52.4	141°29.2	14.0′	19°45.9	10.5′	54.0′
8	300°13.7	52.7	156°02.2	13.9′	19°56.4	10.5′	54.0′
9	315°13.6	·· 52.9	170°35.1	13.8′	20°06.9	10.3′	54.1′
10	330°13.5	53.1	185°07.9	13.8′	20°17.2	10.3′	54.1′
11	345°13.3	53.3	199°40.7	13.7′	20°27.5	10.2′	54.1′
12	0°13.2	N22°53.5	214°13.4	13.6′	S20°37.7	10.1′	54.1′
13	15°13.1	53.7	228°46.0	13.5′	20°47.8	10.1′	54.1′
14	30°13.0	54.0	243°18.5	13.5′	20°57.9	9.9′	54.1′
15	45°12.9	·· 54.2	257°51.0	13.4′	21°07.8	9.9′	54.1′
16	60°12.7	54.4	272°23.3	13.3′	21°17.7	9.7′	54.1′
17	75°12.6	54.6	286°55.6	13.2′	21°27.4	9.7′	54.1′
18	90°12.5	N22°54.8	301°27.9	13.2′	S21°37.1	9.6′	54.1′
19	105°12.4	55.0	316°00.0	13.1′	21°46.7	9.5′	54.1′
20	120°12.2	55.2	330°32.1	13.0′	21°56.2	9.5′	54.1′
21	135°12.1	·· 55.4	345°04.1	12.9′	22°05.7	9.3′	54.1′
22	150°12.0	55.6	359°36.0	12.8′	22°15.0	9.2′	54.1′
23	165°11.9	55.9	14°07.9	12.8′	22°24.2	9.2′	54.1′
	SD = 15.8′	d = 0.2′	SD = 14.7′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	▭	▭	▭	▭	▭	▭
N 70°	▭	▭	▭	▭	▭	▭
68°	▭	▭	▭	▭	▭	▭
66°	////	////	00:44	23:19	////	////
64°	////	////	01:44	22:15	////	////
62°	////	////	02:17	21:42	////	////
60°	////	01:09	02:42	21:17	22:51	////
N 58°	////	01:50	03:01	20:58	22:10	////
56°	////	02:17	03:17	20:42	21:42	////
54°	01:03	02:37	03:30	20:28	21:21	22:57
52°	01:41	02:54	03:42	20:16	21:04	22:19
50°	02:06	03:09	03:52	20:06	20:50	21:53
45°	02:48	03:37	04:14	19:44	20:21	21:10
N 40°	03:18	03:59	04:31	19:27	19:59	20:40
35°	03:40	04:16	04:46	19:12	19:42	20:18
30°	03:58	04:31	04:58	19:00	19:27	20:00
20°	04:26	04:55	05:20	18:38	19:03	19:32
N 10°	04:48	05:15	05:38	18:20	18:43	19:10
0°	05:07	05:33	05:55	18:03	18:25	18:51
S 10°	05:23	05:49	06:12	17:46	18:08	18:35
20°	05:39	06:06	06:30	17:28	17:52	18:19
30°	05:55	06:25	06:51	17:07	17:33	18:03
35°	06:03	06:35	07:03	16:55	17:23	17:55
40°	06:12	06:46	07:16	16:41	17:12	17:46
45°	06:22	06:59	07:33	16:25	16:59	17:36
S 50°	06:33	07:15	07:53	16:05	16:43	17:24
52°	06:38	07:22	08:02	15:56	16:36	17:19
54°	06:44	07:30	08:13	15:45	16:28	17:14
56°	06:50	07:38	08:25	15:33	16:19	17:08
58°	06:56	07:48	08:39	15:19	16:10	17:02
S 60°	07:03	07:59	08:55	15:02	15:58	16:54

Lat.	**Moonrise** Fri	Sat	Sun	**Moonset** Fri	Sat	Sun
N 72°	17:20	▬	▬	00:10 23:25	▬	▬
N 70°	16:57	19:19	▬	00:22 23:50	22:56	▬
68°	16:39	18:39	▬	00:33	00:10 23:37	▬
66°	16:24	18:12	20:21	00:41	00:26	00:05 23:29
64°	16:13	17:51	19:41	00:48	00:39	00:27
62°	16:03	17:35	19:13	00:55	00:50	00:44
60°	15:54	17:21	18:52	01:00	00:59	00:59
N 58°	15:47	17:09	18:34	01:05	01:08	01:11
56°	15:41	16:59	18:20	01:09	01:15	01:22
54°	15:35	16:50	18:08	01:13	01:21	01:32
52°	15:30	16:42	17:57	01:17	01:27	01:40
50°	15:25	16:35	17:47	01:20	01:33	01:48
45°	15:15	16:20	17:27	01:27	01:44	02:05
N 40°	15:07	16:08	17:10	01:33	01:54	02:18
35°	15:00	15:57	16:57	01:38	02:03	02:30
30°	14:53	15:48	16:45	01:43	02:10	02:40
20°	14:43	15:33	16:24	01:51	02:23	02:58
N 10°	14:33	15:19	16:07	01:57	02:34	03:13
0°	14:25	15:06	15:51	02:04	02:45	03:27
S 10°	14:16	14:54	15:34	02:11	02:55	03:42
20°	14:07	14:41	15:17	02:18	03:07	03:57
30°	13:57	14:25	14:57	02:26	03:20	04:15
35°	13:51	14:17	14:46	02:30	03:27	04:26
40°	13:44	14:07	14:33	02:36	03:36	04:38
45°	13:37	13:55	14:18	02:42	03:46	04:52
S 50°	13:27	13:41	13:59	02:49	03:59	05:10
52°	13:23	13:35	13:50	02:53	04:05	05:18
54°	13:18	13:28	13:40	02:57	04:11	05:27
56°	13:13	13:20	13:29	03:01	04:18	05:38
58°	13:08	13:11	13:16	03:06	04:26	05:50
S 60°	13:01	13:01	13:01	03:11	04:35	06:04

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 10-12 76-90%
06	01:21	01:15	11:59	20:35	08:14	
07	01:10	01:04	11:59	21:17	08:55	
08	00:59	00:53	11:59	22:02	09:39	

June 09, 10, 11 UT (Mon., Tue., Wed.)

	Aries	Venus		Mars		Jupiter		Saturn	
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	257°37.1	226°09.4	N10°06.5	109°30.6	N14°18.8	167°50.0	N23°16.4	255°52.5	S01°34.6
1	272°39.5	241°09.4	07.3	124°31.8	18.3	182°51.9	16.4	270°54.9	34.5
2	287°42.0	256°09.4	08.1	139°32.9	17.8	197°53.7	16.4	285°57.2	34.5
3	302°44.5	271°09.5	·· 08.8	154°34.1	·· 17.3	212°55.6	·· 16.4	300°59.5	·· 34.5
4	317°46.9	286°09.5	09.6	169°35.2	16.8	227°57.4	16.4	316°01.9	34.4
5	332°49.4	301°09.5	10.4	184°36.4	16.3	242°59.3	16.4	331°04.2	34.4
6	347°51.9	316°09.6	N10°11.2	199°37.5	N14°15.8	258°01.1	N23°16.4	346°06.5	S01°34.3
7	2°54.3	331°09.6	12.0	214°38.7	15.3	273°03.0	16.4	1°08.9	34.3
8	17°56.8	346°09.6	12.7	229°39.8	14.8	288°04.8	16.4	16°11.2	34.2
9	32°59.2	1°09.7	·· 13.5	244°41.0	·· 14.3	303°06.7	·· 16.4	31°13.5	·· 34.2
10	48°01.7	16°09.7	14.3	259°42.1	13.8	318°08.5	16.4	46°15.9	34.1
11	63°04.2	31°09.7	15.1	274°43.3	13.3	333°10.4	16.4	61°18.2	34.1
12	78°06.6	46°09.7	N10°15.9	289°44.4	N14°12.8	348°12.2	N23°16.4	76°20.5	S01°34.0
13	93°09.1	61°09.8	16.7	304°45.6	12.3	3°14.1	16.4	91°22.9	34.0
14	108°11.6	76°09.8	17.4	319°46.7	11.8	18°15.9	16.4	106°25.2	34.0
15	123°14.0	91°09.8	·· 18.2	334°47.9	·· 11.3	33°17.8	·· 16.5	121°27.5	·· 33.9
16	138°16.5	106°09.8	19.0	349°49.0	10.8	48°19.6	16.5	136°29.9	33.9
17	153°19.0	121°09.9	19.8	4°50.2	10.3	63°21.5	16.5	151°32.2	33.8
18	168°21.4	136°09.9	N10°20.6	19°51.3	N14°09.8	78°23.3	N23°16.5	166°34.6	S01°33.8
19	183°23.9	151°09.9	21.3	34°52.5	09.3	93°25.1	16.5	181°36.9	33.7
20	198°26.4	166°09.9	22.1	49°53.6	08.8	108°27.0	16.5	196°39.2	33.7
21	213°28.8	181°09.9	·· 22.9	64°54.8	·· 08.3	123°28.8	·· 16.5	211°41.6	·· 33.7
22	228°31.3	196°10.0	23.7	79°55.9	07.8	138°30.7	16.5	226°43.9	33.6
23	243°33.7	211°10.0	24.5	94°57.1	07.3	153°32.5	16.5	241°46.2	33.6
Mer.pass. 06:48		ν 0.0′	d 0.8′	m -4.31	ν 1.2′	d 0.5′	m 1.35	ν 1.8′	d 0.0′ m -1.90	ν 2.3′	d 0.0′ m 1.05

Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	258°36.2	226°10.0	N10°25.2	109°58.2	N14°06.8	168°34.4	N23°16.5	256°48.6	S01°33.5
1	273°38.7	241°10.0	26.0	124°59.3	06.3	183°36.2	16.5	271°50.9	33.5
2	288°41.1	256°10.0	26.8	140°00.5	05.8	198°38.1	16.5	286°53.2	33.4
3	303°43.6	271°10.1	·· 27.6	155°01.6	·· 05.3	213°39.9	·· 16.5	301°55.6	·· 33.4
4	318°46.1	286°10.1	28.4	170°02.8	04.8	228°41.8	16.5	316°57.9	33.3
5	333°48.5	301°10.1	29.2	185°03.9	04.3	243°43.6	16.5	332°00.3	33.3
6	348°51.0	316°10.1	N10°29.9	200°05.1	N14°03.8	258°45.5	N23°16.5	347°02.6	S01°33.3
7	3°53.5	331°10.1	30.7	215°06.2	03.3	273°47.3	16.5	2°04.9	33.2
8	18°55.9	346°10.1	31.5	230°07.4	02.8	288°49.2	16.5	17°07.3	33.2
9	33°58.4	1°10.1	·· 32.3	245°08.5	·· 02.3	303°51.0	·· 16.5	32°09.6	·· 33.1
10	49°00.9	16°10.1	33.1	260°09.7	01.8	318°52.9	16.5	47°12.0	33.1
11	64°03.3	31°10.2	33.9	275°10.8	01.3	333°54.7	16.5	62°14.3	33.0
12	79°05.8	46°10.2	N10°34.6	290°12.0	N14°00.8	348°56.5	N23°16.5	77°16.6	S01°33.0
13	94°08.2	61°10.2	35.4	305°13.1	14°00.3	3°58.4	16.5	92°19.0	33.0
14	109°10.7	76°10.2	36.2	320°14.3	13°59.8	19°00.2	16.5	107°21.3	32.9
15	124°13.2	91°10.2	·· 37.0	335°15.4	·· 59.3	34°02.1	·· 16.5	122°23.6	·· 32.9
16	139°15.6	106°10.2	37.8	350°16.6	58.8	49°03.9	16.6	137°26.0	32.8
17	154°18.1	121°10.2	38.5	5°17.7	58.3	64°05.8	16.6	152°28.3	32.8
18	169°20.6	136°10.2	N10°39.3	20°18.9	N13°57.7	79°07.6	N23°16.6	167°30.7	S01°32.7
19	184°23.0	151°10.2	40.1	35°20.0	57.2	94°09.5	16.6	182°33.0	32.7
20	199°25.5	166°10.2	40.9	50°21.2	56.7	109°11.3	16.6	197°35.3	32.7
21	214°28.0	181°10.2	·· 41.7	65°22.3	·· 56.2	124°13.2	·· 16.6	212°37.7	·· 32.6
22	229°30.4	196°10.2	42.5	80°23.5	55.7	139°15.0	16.6	227°40.0	32.6
23	244°32.9	211°10.2	43.2	95°24.6	55.2	154°16.9	16.6	242°42.4	32.5
Mer.pass. 06:44		ν 0.0′	d 0.8′	m -4.30	ν 1.1′	d 0.5′	m 1.36	ν 1.8′	d 0.0′ m -1.90	ν 2.3′	d 0.0′ m 1.05

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	259°35.4	226°10.2	N10°44.0	110°25.7	N13°54.7	169°18.7	N23°16.6	257°44.7	S01°32.5
1	274°37.8	241°10.2	44.8	125°26.9	54.2	184°20.5	16.6	272°47.0	32.4
2	289°40.3	256°10.3	45.6	140°28.0	53.7	199°22.4	16.6	287°49.4	32.4
3	304°42.7	271°10.3	·· 46.4	155°29.2	·· 53.2	214°24.2	·· 16.6	302°51.7	·· 32.4
4	319°45.2	286°10.3	47.2	170°30.3	52.7	229°26.1	16.6	317°54.1	32.3
5	334°47.7	301°10.3	47.9	185°31.5	52.2	244°27.9	16.6	332°56.4	32.3
6	349°50.1	316°10.3	N10°48.7	200°32.6	N13°51.7	259°29.8	N23°16.6	347°58.8	S01°32.2
7	4°52.6	331°10.2	49.5	215°33.8	51.2	274°31.6	16.6	3°01.1	32.2
8	19°55.1	346°10.2	50.3	230°34.9	50.7	289°33.5	16.6	18°03.4	32.2
9	34°57.5	1°10.2	·· 51.1	245°36.1	·· 50.2	304°35.3	·· 16.6	33°05.8	·· 32.1
10	50°00.0	16°10.2	51.9	260°37.2	49.7	319°37.2	16.6	48°08.1	32.1
11	65°02.5	31°10.2	52.6	275°38.4	49.2	334°39.0	16.6	63°10.5	32.0
12	80°04.9	46°10.2	N10°53.4	290°39.5	N13°48.7	349°40.9	N23°16.6	78°12.8	S01°32.0
13	95°07.4	61°10.2	54.2	305°40.7	48.2	4°42.7	16.6	93°15.1	31.9
14	110°09.8	76°10.2	55.0	320°41.8	47.6	19°44.6	16.6	108°17.5	31.9
15	125°12.3	91°10.2	·· 55.8	335°42.9	·· 47.1	34°46.4	·· 16.6	123°19.8	·· 31.9
16	140°14.8	106°10.2	56.5	350°44.1	46.6	49°48.2	16.6	138°22.2	31.8
17	155°17.2	121°10.2	57.3	5°45.2	46.1	64°50.1	16.6	153°24.5	31.8
18	170°19.7	136°10.2	N10°58.1	20°46.4	N13°45.6	79°51.9	N23°16.6	168°26.9	S01°31.7
19	185°22.2	151°10.2	58.9	35°47.5	45.1	94°53.8	16.6	183°29.2	31.7
20	200°24.6	166°10.2	10°59.7	50°48.7	44.6	109°55.6	16.6	198°31.5	31.7
21	215°27.1	181°10.2	11°00.5	65°49.8	·· 44.1	124°57.5	·· 16.6	213°33.9	·· 31.6
22	230°29.6	196°10.1	01.2	80°51.0	43.6	139°59.3	16.6	228°36.2	31.6
23	245°32.0	211°10.1	02.0	95°52.1	43.1	155°01.2	16.6	243°38.6	31.5
Mer.pass. 06:41		ν 0.0′	d 0.8′	m -4.29	ν 1.1′	d 0.5′	m 1.37	ν 1.8′	d 0.0′ m -1.90	ν 2.3′	d 0.0′ m 1.04

Stars

	SHA	Dec
Alpheratz	357°34.5	29°13.7
Ankaa	353°06.9	-42°09.8
Schedar	349°30.9	56°40.3
Diphda	348°47.1	-17°50.7
Achernar	335°20.3	-57°06.2
Hamal	327°51.1	23°34.9
Polaris	314°17.0	89°22.1
Acamar	315°11.9	-40°12.0
Menkar	314°06.1	4°11.3
Mirfak	308°28.2	49°56.9
Aldebaran	290°39.6	16°33.6
Rigel	281°03.9	-8°10.3
Capella	280°21.9	46°01.4
Bellatrix	278°22.9	6°22.4
Elnath	278°01.8	28°37.7
Alnilam	275°37.7	-1°11.1
Betelgeuse	270°52.1	7°24.7
Canopus	263°52.8	-52°42.6
Sirius	258°26.3	-16°45.1
Adhara	255°06.0	-29°00.4
Procyon	244°50.8	5°09.6
Pollux	243°17.2	27°58.0
Avior	234°15.1	-59°35.6
Suhail	222°46.3	-43°32.3
Miaplacidus	221°38.8	-69°49.5
Alphard	217°47.6	-8°46.2
Regulus	207°34.2	11°50.6
Dubhe	193°40.6	61°37.1
Denebola	182°24.6	14°25.8
Gienah	175°43.2	-17°41.1
Acrux	172°59.5	-63°14.7
Gacrux	171°51.1	-57°15.6
Alioth	166°12.4	55°49.5
Spica	158°21.8	-11°17.7
Alkaid	152°51.4	49°11.3
Hadar	148°35.1	-60°30.0
Menkent	147°57.0	-36°29.9
Arcturus	145°47.4	19°03.0
Rigil Kent.	139°39.3	-60°56.6
Kochab	137°18.8	74°03.2
Zuben'ubi	136°55.4	-16°08.9
Alphecca	126°03.1	26°37.8
Antares	112°15.1	-26°29.4
Atria	107°08.4	-69°04.4
Sabik	102°02.0	-15°45.4
Shaula	96°09.5	-37°07.3
Rasalhague	95°57.9	12°32.4
Eltanin	90°41.5	51°29.0
Kaus Aust.	83°31.7	-34°22.3
Vega	80°32.6	38°48.3
Nunki	75°47.0	-26°15.9
Altair	61°59.4	8°56.1
Peacock	53°04.8	-56°39.0
Deneb	49°25.3	45°22.0
Enif	33°38.3	9°59.4
Al Na'ir	27°32.3	-46°50.0
Fomalhaut	15°14.1	-29°29.1
Scheat	13°44.9	28°13.1
Markab	13°29.5	15°20.4

Jun 09 Mon	SHA	Mer.pass
Venus	328°32.3	08:55
Mars	211°53.5	16:41
Jupiter	270°13.0	12:47
Saturn	358°15.5	06:55

Jun 10 Tue	SHA	Mer.pass
Venus	327°33.8	08:55
Mars	211°22.0	16:39
Jupiter	269°58.2	12:44
Saturn	358°12.4	06:52

Jun 11 Wed	SHA	Mer.pass
Venus	326°34.9	08:55
Mars	210°50.4	16:37
Jupiter	269°43.4	12:41
Saturn	358°09.4	06:48

Horizontal parallax	
Venus:	0.2
Mars:	0.1

h	Sun		Moon				
Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°11.8	N22°56.1	28°39.6	12.7′	S22°33.4	9.0′	54.1′
1	195°11.6	56.3	43°11.3	12.6′	22°42.4	8.9′	54.1′
2	210°11.5	56.5	57°42.9	12.5′	22°51.3	8.9′	54.2′
3	225°11.4	·· 56.7	72°14.4	12.5′	23°00.2	8.8′	54.2′
4	240°11.3	56.9	86°45.9	12.4′	23°09.0	8.6′	54.2′
5	255°11.2	57.1	101°17.3	12.3′	23°17.6	8.6′	54.2′
6	270°11.0	N22°57.3	115°48.6	12.2′	S23°26.2	8.4′	54.2′
7	285°10.9	57.5	130°19.8	12.1′	23°34.6	8.4′	54.2′
8	300°10.8	57.7	144°50.9	12.1′	23°43.0	8.2′	54.2′
9	315°10.7	·· 57.9	159°22.0	12.0′	23°51.2	8.2′	54.2′
10	330°10.5	58.1	173°53.0	11.9′	23°59.4	8.0′	54.2′
11	345°10.4	58.3	188°23.9	11.8′	24°07.4	8.0′	54.2′
12	0°10.3	N22°58.5	202°54.7	11.7′	S24°15.4	7.8′	54.2′
13	15°10.2	58.7	217°25.4	11.7′	24°23.2	7.7′	54.3′
14	30°10.0	58.9	231°56.1	11.6′	24°30.9	7.6′	54.3′
15	45°09.9	·· 59.1	246°26.7	11.5′	24°38.5	7.6′	54.3′
16	60°09.8	59.3	260°57.2	11.4′	24°46.1	7.3′	54.3′
17	75°09.7	59.5	275°27.6	11.4′	24°53.4	7.3′	54.3′
18	90°09.6	N22°59.7	289°58.0	11.3′	S25°00.7	7.2′	54.3′
19	105°09.4	22°59.9	304°28.3	11.2′	25°07.9	7.1′	54.3′
20	120°09.3	23°00.1	318°58.5	11.1′	25°15.0	6.9′	54.3′
21	135°09.2	·· 00.3	333°28.6	11.1′	25°21.9	6.8′	54.3′
22	150°09.1	00.4	347°58.6	11.0′	25°28.7	6.8′	54.3′
23	165°08.9	00.6	2°28.6	10.9′	25°35.5	6.5′	54.4′
	SD = 15.8′	d = 0.2′	SD = 14.8′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°08.8	N23°00.8	16°58.5	10.8′	S25°42.0	6.5′	54.4′
1	195°08.7	01.0	31°28.3	10.8′	25°48.5	6.4′	54.4′
2	210°08.6	01.2	45°58.1	10.7′	25°54.9	6.2′	54.4′
3	225°08.4	·· 01.4	60°27.8	10.6′	26°01.1	6.1′	54.4′
4	240°08.3	01.6	74°57.4	10.5′	26°07.2	6.0′	54.4′
5	255°08.2	01.8	89°26.9	10.5′	26°13.2	5.9′	54.4′
6	270°08.1	N23°02.0	103°56.4	10.4′	S26°19.1	5.7′	54.4′
7	285°07.9	02.1	118°25.8	10.3′	26°24.8	5.7′	54.4′
8	300°07.8	02.3	132°55.1	10.3′	26°30.5	5.5′	54.5′
9	315°07.7	·· 02.5	147°24.3	10.2′	26°36.0	5.3′	54.5′
10	330°07.6	02.7	161°53.5	10.1′	26°41.3	5.3′	54.5′
11	345°07.4	02.9	176°22.6	10.0′	26°46.6	5.1′	54.5′
12	0°07.3	N23°03.1	190°51.7	10.0′	S26°51.7	5.0′	54.5′
13	15°07.2	03.2	205°20.7	9.9′	26°56.7	4.8′	54.5′
14	30°07.1	03.4	219°49.6	9.9′	27°01.5	4.8′	54.5′
15	45°06.9	·· 03.6	234°18.4	9.8′	27°06.3	4.6′	54.5′
16	60°06.8	03.8	248°47.2	9.7′	27°10.9	4.4′	54.6′
17	75°06.7	04.0	263°15.9	9.7′	27°15.3	4.3′	54.6′
18	90°06.6	N23°04.1	277°44.6	9.6′	S27°19.6	4.2′	54.6′
19	105°06.4	04.3	292°13.2	9.5′	27°23.8	4.1′	54.6′
20	120°06.3	04.5	306°41.7	9.5′	27°27.9	3.9′	54.6′
21	135°06.2	·· 04.7	321°10.2	9.4′	27°31.8	3.8′	54.6′
22	150°06.1	04.8	335°38.6	9.4′	27°35.6	3.7′	54.6′
23	165°05.9	05.0	350°07.0	9.3′	27°39.3	3.5′	54.7′
	SD = 15.7′	d = 0.2′	SD = 14.8′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°05.8	N23°05.2	4°35.3	9.3′	S27°42.8	3.3′	54.7′
1	195°05.7	05.4	19°03.6	9.2′	27°46.1	3.3′	54.7′
2	210°05.6	05.5	33°31.8	9.2′	27°49.4	3.1′	54.7′
3	225°05.4	·· 05.7	48°00.0	9.1′	27°52.5	2.9′	54.7′
4	240°05.3	05.9	62°28.1	9.1′	27°55.4	2.8′	54.7′
5	255°05.2	06.0	76°56.1	9.0′	27°58.2	2.7′	54.7′
6	270°05.0	N23°06.2	91°24.1	9.0′	S28°00.9	2.5′	54.8′
7	285°04.9	06.4	105°52.1	8.9′	28°03.4	2.4′	54.8′
8	300°04.8	06.6	120°20.0	8.9′	28°05.8	2.3′	54.8′
9	315°04.7	·· 06.7	134°47.9	8.8′	28°08.1	2.1′	54.8′
10	330°04.5	06.9	149°15.7	8.8′	28°10.2	1.9′	54.8′
11	345°04.4	07.1	163°43.5	8.7′	28°12.1	1.8′	54.8′
12	0°04.3	N23°07.2	178°11.2	8.7′	S28°13.9	1.7′	54.9′
13	15°04.2	07.4	192°38.9	8.7′	28°15.6	1.5′	54.9′
14	30°04.0	07.5	207°06.6	8.6′	28°17.1	1.4′	54.9′
15	45°03.9	·· 07.7	221°34.3	8.6′	28°18.5	1.2′	54.9′
16	60°03.8	07.9	236°01.9	8.6′	28°19.7	1.1′	54.9′
17	75°03.6	08.0	250°29.4	8.5′	28°20.8	0.9′	54.9′
18	90°03.5	N23°08.2	264°57.0	8.5′	S28°21.7	0.8′	54.9′
19	105°03.4	08.4	279°24.5	8.5′	28°22.5	0.6′	55.0′
20	120°03.3	08.5	293°52.0	8.5′	28°23.1	0.5′	55.0′
21	135°03.1	·· 08.7	308°19.4	8.4′	28°23.6	0.3′	55.0′
22	150°03.0	08.8	322°46.9	8.4′	28°23.9	0.2′	55.0′
23	165°02.9	09.0	337°14.3	8.4′	28°24.1	0.0′	55.0′
	SD = 15.7′	d = 0.2′	SD = 14.9′				

Lat.	**Twilight** Naut.	**Twilight** Civil	**Sunrise**	**Sunset**	**Twilight** Civil	**Twilight** Naut.
N 72°						
N 70°						
68°						
66°	////	////	00:27	23:39	////	////
64°	////	////	01:39	22:21	////	////
62°	////	////	02:14	21:46	////	////
60°	////	01:02	02:39	21:21	22:59	////
N 58°	////	01:46	02:59	21:01	22:14	////
56°	////	02:14	03:15	20:45	21:46	////
54°	00:57	02:35	03:29	20:31	21:25	23:04
52°	01:37	02:52	03:41	20:19	21:07	22:23
50°	02:03	03:07	03:51	20:08	20:52	21:57
45°	02:47	03:36	04:13	19:46	20:23	21:12
N 40°	03:17	03:58	04:31	19:28	20:01	20:42
35°	03:40	04:16	04:46	19:14	19:43	20:20
30°	03:58	04:31	04:58	19:01	19:28	20:01
20°	04:26	04:55	05:20	18:39	19:04	19:33
N 10°	04:49	05:16	05:39	18:20	18:43	19:10
0°	05:07	05:33	05:56	18:03	18:26	18:52
S 10°	05:24	05:50	06:13	17:46	18:09	18:35
20°	05:40	06:07	06:31	17:28	17:52	18:19
30°	05:56	06:26	06:52	17:07	17:33	18:03
35°	06:04	06:36	07:04	16:55	17:23	17:54
40°	06:14	06:48	07:18	16:41	17:11	17:45
45°	06:24	07:01	07:35	16:24	16:58	17:35
S 50°	06:35	07:17	07:55	16:04	16:42	17:24
52°	06:40	07:24	08:04	15:54	16:35	17:19
54°	06:46	07:32	08:15	15:44	16:27	17:13
56°	06:52	07:41	08:28	15:31	16:18	17:07
58°	06:58	07:51	08:42	15:17	16:08	17:00
S 60°	07:06	08:02	08:59	15:00	15:57	16:53

Lat.	**Moonrise** Mon	Tue	Wed	**Moonset** Mon	Tue	Wed
N 72°						
N 70°						
68°						
66°						
64°	22:04			00:10 23:26		
62°	21:00	23:07		00:38	00:30	00:10
60°	20:26	21:59	23:12	01:00	01:05	01:19
N 58°	20:01	21:24	22:31	01:18	01:30	01:54
56°	19:42	20:59	22:03	01:33	01:51	02:19
54°	19:25	20:39	21:42	01:46	02:07	02:40
52°	19:11	20:22	21:24	01:58	02:22	02:57
50°	18:59	20:08	21:08	02:08	02:35	03:11
45°	18:34	19:38	20:38	02:29	03:01	03:41
N 40°	18:13	19:15	20:14	02:47	03:21	04:04
35°	17:57	18:57	19:54	03:01	03:39	04:23
30°	17:42	18:41	19:37	03:14	03:54	04:40
20°	17:18	18:13	19:09	03:36	04:19	05:07
N 10°	16:57	17:50	18:44	03:55	04:41	05:31
0°	16:38	17:28	18:21	04:13	05:02	05:54
S 10°	16:19	17:07	17:59	04:31	05:23	06:16
20°	15:58	16:44	17:34	04:50	05:45	06:40
30°	15:34	16:17	17:06	05:12	06:11	07:08
35°	15:20	16:01	16:49	05:26	06:26	07:25
40°	15:04	15:43	16:30	05:41	06:44	07:44
45°	14:45	15:21	16:06	05:59	07:05	08:07
S 50°	14:22	14:53	15:36	06:21	07:32	08:37
52°	14:10	14:39	15:21	06:32	07:45	08:52
54°	13:58	14:24	15:04	06:45	08:01	09:10
56°	13:43	14:05	14:43	06:59	08:19	09:31
58°	13:26	13:43	14:16	07:16	08:41	09:57
S 60°	13:05	13:14	13:38	07:36	09:10	10:35

Day	**Sun** Eqn.of Time 00^h mm:ss	Eqn.of Time 12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Mer.Pass. Lower hh:mm	Age 13-15 95-100%
09	00:47	00:41	11:59	22:50	10:25	
10	00:35	00:29	12:00	23:41	11:15	
11	00:23	00:17	12:00	–:–	12:08	

June 12, 13, 14 UT (Thu., Fri., Sat.)

	Aries	Venus		Mars		Jupiter		Saturn	
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	260°34.5	226°10.1	N11°02.8	110°53.3	N13°42.6	170°03.0	N23°16.6	258°40.9	S01°31.5
1	275°37.0	241°10.1	03.6	125°54.4	42.1	185°04.9	16.6	273°43.3	31.5
2	290°39.4	256°10.1	04.4	140°55.5	41.6	200°06.7	16.6	288°45.6	31.4
3	305°41.9	271°10.1	·· 05.2	155°56.7	·· 41.0	215°08.5	·· 16.6	303°47.9	·· 31.4
4	320°44.3	286°10.1	05.9	170°57.8	40.5	230°10.4	16.6	318°50.3	31.3
5	335°46.8	301°10.0	06.7	185°59.0	40.0	245°12.2	16.6	333°52.6	31.3
6	350°49.3	316°10.0	N11°07.5	201°00.1	N13°39.5	260°14.1	N23°16.7	348°55.0	S01°31.3
7	5°51.7	331°10.0	08.3	216°01.3	39.0	275°15.9	16.7	3°57.3	31.2
8	20°54.2	346°10.0	09.1	231°02.4	38.5	290°17.8	16.7	18°59.7	31.2
9	35°56.7	1°10.0	·· 09.8	246°03.6	·· 38.0	305°19.6	·· 16.7	34°02.0	·· 31.1
10	50°59.1	16°10.0	10.6	261°04.7	37.5	320°21.5	16.7	49°04.4	31.1
11	66°01.6	31°09.9	11.4	276°05.8	37.0	335°23.3	16.7	64°06.7	31.1
12	81°04.1	46°09.9	N11°12.2	291°07.0	N13°36.5	350°25.2	N23°16.7	79°09.1	S01°31.0
13	96°06.5	61°09.9	13.0	306°08.1	36.0	5°27.0	16.7	94°11.4	31.0
14	111°09.0	76°09.9	13.8	321°09.3	35.4	20°28.8	16.7	109°13.7	30.9
15	126°11.5	91°09.9	·· 14.5	336°10.4	·· 34.9	35°30.7	·· 16.7	124°16.1	·· 30.9
16	141°13.9	106°09.8	15.3	351°11.6	34.4	50°32.5	16.7	139°18.4	30.9
17	156°16.4	121°09.8	16.1	6°12.7	33.9	65°34.4	16.7	154°20.8	30.8
18	171°18.8	136°09.8	N11°16.9	21°13.9	N13°33.4	80°36.2	N23°16.7	169°23.1	S01°30.8
19	186°21.3	151°09.8	17.7	36°15.0	32.9	95°38.1	16.7	184°25.5	30.7
20	201°23.8	166°09.7	18.5	51°16.1	32.4	110°39.9	16.7	199°27.8	30.7
21	216°26.2	181°09.7	·· 19.2	66°17.3	·· 31.9	125°41.8	·· 16.7	214°30.2	·· 30.7
22	231°28.7	196°09.7	20.0	81°18.4	31.4	140°43.6	16.7	229°32.5	30.6
23	246°31.2	211°09.7	20.8	96°19.6	30.8	155°45.5	16.7	244°34.9	30.6
Mer.pass. 06:37		ν -0.0′	d 0.8′	ν 1.1′	d 0.5′	ν 1.8′	d 0.0′	ν 2.3′	d 0.0′
		m -4.29		m 1.37		m -1.90		m 1.04	

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	261°33.6	226°09.6	N11°21.6	111°20.7	N13°30.3	170°47.3	N23°16.7	259°37.2	S01°30.5
1	276°36.1	241°09.6	22.4	126°21.9	29.8	185°49.1	16.7	274°39.6	30.5
2	291°38.6	256°09.6	23.1	141°23.0	29.3	200°51.0	16.7	289°41.9	30.5
3	306°41.0	271°09.5	·· 23.9	156°24.1	·· 28.8	215°52.8	·· 16.7	304°44.3	·· 30.4
4	321°43.5	286°09.5	24.7	171°25.3	28.3	230°54.7	16.7	319°46.6	30.4
5	336°46.0	301°09.5	25.5	186°26.4	27.8	245°56.5	16.7	334°48.9	30.3
6	351°48.4	316°09.4	N11°26.3	201°27.6	N13°27.3	260°58.4	N23°16.7	349°51.3	S01°30.3
7	6°50.9	331°09.4	27.1	216°28.7	26.7	276°00.2	16.7	4°53.6	30.3
8	21°53.3	346°09.4	27.8	231°29.9	26.2	291°02.1	16.7	19°56.0	30.2
9	36°55.8	1°09.3	·· 28.6	246°31.0	·· 25.7	306°03.9	·· 16.7	34°58.3	·· 30.2
10	51°58.3	16°09.3	29.4	261°32.2	25.2	321°05.8	16.7	50°00.7	30.2
11	67°00.7	31°09.3	30.2	276°33.3	24.7	336°07.6	16.7	65°03.0	30.1
12	82°03.2	46°09.2	N11°31.0	291°34.4	N13°24.2	351°09.4	N23°16.7	80°05.4	S01°30.1
13	97°05.7	61°09.2	31.7	306°35.6	23.7	6°11.3	16.7	95°07.7	30.0
14	112°08.1	76°09.2	32.5	321°36.7	23.2	21°13.1	16.7	110°10.1	30.0
15	127°10.6	91°09.1	·· 33.3	336°37.9	·· 22.6	36°15.0	·· 16.7	125°12.4	·· 30.0
16	142°13.1	106°09.1	34.1	351°39.0	22.1	51°16.8	16.7	140°14.8	29.9
17	157°15.5	121°09.0	34.9	6°40.1	21.6	66°18.7	16.7	155°17.1	29.9
18	172°18.0	136°09.0	N11°35.7	21°41.3	N13°21.1	81°20.5	N23°16.7	170°19.5	S01°29.9
19	187°20.5	151°09.0	36.4	36°42.4	20.6	96°22.4	16.7	185°21.8	29.8
20	202°22.9	166°08.9	37.2	51°43.6	20.1	111°24.2	16.7	200°24.2	29.8
21	217°25.4	181°08.9	·· 38.0	66°44.7	·· 19.6	126°26.0	·· 16.7	215°26.5	·· 29.7
22	232°27.8	196°08.8	38.8	81°45.9	19.0	141°27.9	16.7	230°28.9	29.7
23	247°30.3	211°08.8	39.6	96°47.0	18.5	156°29.7	16.7	245°31.2	29.7
Mer.pass. 06:33		ν -0.0′	d 0.8′	ν 1.1′	d 0.5′	ν 1.8′	d 0.0′	ν 2.3′	d 0.0′
		m -4.28		m 1.38		m -1.90		m 1.04	

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	262°32.8	226°08.8	N11°40.3	111°48.1	N13°18.0	171°31.6	N23°16.7	260°33.6	S01°29.6
1	277°35.2	241°08.7	41.1	126°49.3	17.5	186°33.4	16.7	275°35.9	29.6
2	292°37.7	256°08.7	41.9	141°50.4	17.0	201°35.3	16.7	290°38.3	29.6
3	307°40.2	271°08.6	·· 42.7	156°51.6	·· 16.5	216°37.1	·· 16.7	305°40.6	·· 29.5
4	322°42.6	286°08.6	43.5	171°52.7	15.9	231°39.0	16.7	320°43.0	29.5
5	337°45.1	301°08.5	44.2	186°53.9	15.4	246°40.8	16.7	335°45.3	29.4
6	352°47.6	316°08.5	N11°45.0	201°55.0	N13°14.9	261°42.7	N23°16.7	350°47.7	S01°29.4
7	7°50.0	331°08.4	45.8	216°56.1	14.4	276°44.5	16.7	5°50.0	29.4
8	22°52.5	346°08.4	46.6	231°57.3	13.9	291°46.3	16.7	20°52.4	29.3
9	37°55.0	1°08.3	·· 47.4	246°58.4	·· 13.4	306°48.2	·· 16.7	35°54.7	·· 29.3
10	52°57.4	16°08.3	48.1	261°59.6	12.8	321°50.0	16.7	50°57.1	29.3
11	67°59.9	31°08.2	48.9	277°00.7	12.3	336°51.9	16.7	65°59.5	29.2
12	83°02.3	46°08.2	N11°49.7	292°01.8	N13°11.8	351°53.7	N23°16.7	81°01.8	S01°29.2
13	98°04.8	61°08.1	50.5	307°03.0	11.3	6°55.6	16.7	96°04.2	29.1
14	113°07.3	76°08.1	51.3	322°04.1	10.8	21°57.4	16.7	111°06.5	29.1
15	128°09.7	91°08.0	·· 52.0	337°05.3	·· 10.3	36°59.3	·· 16.7	126°08.9	·· 29.1
16	143°12.2	106°08.0	52.8	352°06.4	09.7	52°01.1	16.7	141°11.2	29.0
17	158°14.7	121°07.9	53.6	7°07.5	09.2	67°02.9	16.7	156°13.6	29.0
18	173°17.1	136°07.9	N11°54.4	22°08.7	N13°08.7	82°04.8	N23°16.7	171°15.9	S01°29.0
19	188°19.6	151°07.8	55.2	37°09.8	08.2	97°06.6	16.7	186°18.3	28.9
20	203°22.1	166°07.8	55.9	52°11.0	07.7	112°08.5	16.7	201°20.6	28.9
21	218°24.5	181°07.7	·· 56.7	67°12.1	·· 07.1	127°10.3	·· 16.7	216°23.0	·· 28.9
22	233°27.0	196°07.6	57.5	82°13.3	06.6	142°12.2	16.7	231°25.3	28.8
23	248°29.4	211°07.6	58.3	97°14.4	06.1	157°14.0	16.7	246°27.7	28.8
Mer.pass. 06:29		ν -0.0′	d 0.8′	ν 1.1′	d 0.5′	ν 1.8′	d 0.0′	ν 2.4′	d 0.0′
		m -4.27		m 1.39		m -1.90		m 1.03	

Stars

	SHA	Dec
Alpheratz	357°34.5	29°13.7
Ankaa	353°06.9	-42°09.8
Schedar	349°30.8	56°40.3
Diphda	348°47.1	-17°50.7
Achernar	335°20.2	-57°06.2
Hamal	327°51.0	23°34.9
Polaris	314°15.8	89°22.1
Acamar	315°11.9	-40°12.0
Menkar	314°06.1	4°11.4
Mirfak	308°28.2	49°56.9
Aldebaran	290°39.6	16°33.6
Rigel	281°03.9	-8°10.3
Capella	280°21.9	46°01.4
Bellatrix	278°22.8	6°22.4
Elnath	278°01.8	28°37.7
Alnilam	275°37.7	-1°11.1
Betelgeuse	270°52.1	7°24.7
Canopus	263°52.8	-52°42.6
Sirius	258°26.3	-16°45.1
Adhara	255°06.0	-29°00.4
Procyon	244°50.8	5°09.6
Pollux	243°17.2	27°57.9
Avior	234°15.1	-59°35.6
Suhail	222°46.3	-43°32.3
Miaplacidus	221°38.8	-69°49.5
Alphard	217°47.6	-8°46.2
Regulus	207°34.2	11°50.6
Dubhe	193°40.7	61°37.1
Denebola	182°24.6	14°25.8
Gienah	175°43.2	-17°41.1
Acrux	172°59.6	-63°14.7
Gacrux	171°51.1	-57°15.6
Alioth	166°12.4	55°49.5
Spica	158°21.8	-11°17.7
Alkaid	152°51.4	49°11.3
Hadar	148°35.1	-60°30.0
Menkent	147°57.0	-36°29.9
Arcturus	145°47.4	19°03.0
Rigil Kent.	139°39.3	-60°56.6
Kochab	137°18.8	74°03.2
Zuben'ubi	136°55.4	-16°08.9
Alphecca	126°03.1	26°37.8
Antares	112°15.0	-26°29.4
Atria	107°08.4	-69°04.4
Sabik	102°02.0	-15°45.4
Shaula	96°09.5	-37°07.3
Rasalhague	95°57.9	12°32.4
Eltanin	90°41.5	51°29.0
Kaus Aust.	83°31.7	-34°22.3
Vega	80°32.6	38°48.3
Nunki	75°47.0	-26°15.9
Altair	61°59.3	8°56.1
Peacock	53°04.7	-56°39.0
Deneb	49°25.3	45°22.0
Enif	33°38.3	9°59.4
Al Na'ir	27°32.3	-46°50.0
Fomalhaut	15°14.1	-29°29.1
Scheat	13°44.8	28°13.1
Markab	13°29.5	15°20.4

Jun 12 Thu	SHA	Mer.pass
Venus	325°35.6	08:55
Mars	210°18.8	16:35
Jupiter	269°28.5	12:38
Saturn	358°06.4	06:44

Jun 13 Fri	SHA	Mer.pass
Venus	324°36.0	08:55
Mars	209°47.1	16:33
Jupiter	269°13.7	12:35
Saturn	358°03.6	06:40

Jun 14 Sat	SHA	Mer.pass
Venus	323°36.0	08:55
Mars	209°15.4	16:32
Jupiter	268°58.8	12:32
Saturn	358°00.8	06:37

Horizontal parallax	
Venus:	0.2
Mars:	0.1

h	Sun		Moon				
Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°02.7	N23°09.1	351°41.7	8.4′	S28°24.1	0.1′	55.0′
1	195°02.6	09.3	6°09.0	8.4′	28°24.0	0.3′	55.1′
2	210°02.5	09.5	20°36.4	8.3′	28°23.7	0.4′	55.1′
3	225°02.4	·· 09.6	35°03.7	8.3′	28°23.3	0.6′	55.1′
4	240°02.2	09.8	49°31.0	8.3′	28°22.7	0.7′	55.1′
5	255°02.1	09.9	63°58.4	8.3′	28°22.0	0.9′	55.1′
6	270°02.0	N23°10.1	78°25.6	8.3′	S28°21.1	1.0′	55.1′
7	285°01.8	10.2	92°52.9	8.3′	28°20.1	1.2′	55.2′
8	300°01.7	10.4	107°20.2	8.3′	28°18.9	1.3′	55.2′
9	315°01.6	·· 10.5	121°47.5	8.3′	28°17.6	1.5′	55.2′
10	330°01.5	10.7	136°14.7	8.3′	28°16.1	1.6′	55.2′
11	345°01.3	10.8	150°42.0	8.3′	28°14.5	1.8′	55.2′
12	0°01.2	N23°11.0	165°09.2	8.3′	S28°12.7	1.9′	55.3′
13	15°01.1	11.1	179°36.5	8.3′	28°10.8	2.1′	55.3′
14	30°00.9	11.3	194°03.8	8.3′	28°08.7	2.2′	55.3′
15	45°00.8	·· 11.4	208°31.0	8.3′	28°06.5	2.4′	55.3′
16	60°00.7	11.6	222°58.3	8.3′	28°04.1	2.6′	55.3′
17	75°00.6	11.7	237°25.5	8.3′	28°01.5	2.7′	55.3′
18	90°00.4	N23°11.8	251°52.8	8.3′	S27°58.8	2.8′	55.4′
19	105°00.3	12.0	266°20.1	8.3′	27°56.0	3.0′	55.4′
20	120°00.2	12.1	280°47.4	8.3′	27°53.0	3.2′	55.4′
21	135°00.0	·· 12.3	295°14.7	8.3′	27°49.8	3.2′	55.4′
22	149°59.9	12.4	309°42.0	8.3′	27°46.6	3.5′	55.4′
23	164°59.8	12.6	324°09.3	8.3′	27°43.1	3.6′	55.5′
	SD = 15.7′	d = 0.2′	SD = 15.0′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°59.6	N23°12.7	338°36.7	8.4′	S27°39.5	3.7′	55.5′
1	194°59.5	12.8	353°04.1	8.4′	27°35.8	3.9′	55.5′
2	209°59.4	13.0	7°31.4	8.4′	27°31.9	4.1′	55.5′
3	224°59.3	·· 13.1	21°58.8	8.4′	27°27.8	4.2′	55.5′
4	239°59.1	13.2	36°26.3	8.4′	27°23.6	4.3′	55.5′
5	254°59.0	13.4	50°53.7	8.5′	27°19.3	4.5′	55.6′
6	269°58.9	N23°13.5	65°21.2	8.5′	S27°14.8	4.7′	55.6′
7	284°58.7	13.7	79°48.7	8.5′	27°10.1	4.8′	55.6′
8	299°58.6	13.8	94°16.2	8.6′	27°05.3	4.9′	55.6′
9	314°58.5	·· 13.9	108°43.8	8.6′	27°00.4	5.1′	55.6′
10	329°58.3	14.1	123°11.4	8.6′	26°55.3	5.2′	55.7′
11	344°58.2	14.2	137°39.0	8.6′	26°50.1	5.4′	55.7′
12	359°58.1	N23°14.3	152°06.6	8.7′	S26°44.7	5.5′	55.7′
13	14°57.9	14.4	166°34.3	8.7′	26°39.2	5.7′	55.7′
14	29°57.8	14.6	181°02.0	8.8′	26°33.5	5.8′	55.7′
15	44°57.7	·· 14.7	195°29.8	8.8′	26°27.7	6.0′	55.8′
16	59°57.6	14.8	209°57.6	8.8′	26°21.7	6.1′	55.8′
17	74°57.4	15.0	224°25.4	8.9′	26°15.6	6.2′	55.8′
18	89°57.3	N23°15.1	238°53.3	8.9′	S26°09.4	6.4′	55.8′
19	104°57.2	15.2	253°21.2	8.9′	26°03.0	6.5′	55.8′
20	119°57.0	15.3	267°49.1	9.0′	25°56.5	6.7′	55.9′
21	134°56.9	·· 15.5	282°17.1	9.0′	25°49.8	6.8′	55.9′
22	149°56.8	15.6	296°45.1	9.1′	25°43.0	6.9′	55.9′
23	164°56.6	15.7	311°13.2	9.1′	25°36.1	7.1′	55.9′
	SD = 15.7′	d = 0.1′	SD = 15.1′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°56.5	N23°15.8	325°41.3	9.2′	S25°29.0	7.2′	55.9′
1	194°56.4	16.0	340°09.5	9.2′	25°21.8	7.4′	56.0′
2	209°56.2	16.1	354°37.7	9.3′	25°14.4	7.5′	56.0′
3	224°56.1	·· 16.2	9°05.9	9.3′	25°06.9	7.6′	56.0′
4	239°56.0	16.3	23°34.3	9.4′	24°59.3	7.8′	56.0′
5	254°55.8	16.4	38°02.6	9.4′	24°51.5	7.9′	56.0′
6	269°55.7	N23°16.6	52°31.0	9.5′	S24°43.6	8.0′	56.1′
7	284°55.6	16.7	66°59.5	9.5′	24°35.6	8.2′	56.1′
8	299°55.4	16.8	81°28.0	9.6′	24°27.4	8.3′	56.1′
9	314°55.3	·· 16.9	95°56.5	9.6′	24°19.1	8.4′	56.1′
10	329°55.2	17.0	110°25.1	9.7′	24°10.7	8.6′	56.1′
11	344°55.1	17.1	124°53.8	9.7′	24°02.1	8.7′	56.2′
12	359°54.9	N23°17.3	139°22.5	9.8′	S23°53.4	8.8′	56.2′
13	14°54.8	17.4	153°51.3	9.8′	23°44.6	9.0′	56.2′
14	29°54.7	17.5	168°20.1	9.9′	23°35.6	9.0′	56.2′
15	44°54.5	·· 17.6	182°49.0	9.9′	23°26.6	9.3′	56.3′
16	59°54.4	17.7	197°17.9	10.0′	23°17.3	9.3′	56.3′
17	74°54.3	17.8	211°46.9	10.0′	23°08.0	9.4′	56.3′
18	89°54.1	N23°17.9	226°15.9	10.1′	S22°58.6	9.6′	56.3′
19	104°54.0	18.0	240°45.0	10.1′	22°49.0	9.7′	56.3′
20	119°53.9	18.1	255°14.1	10.2′	22°39.3	9.8′	56.4′
21	134°53.7	·· 18.2	269°43.3	10.3′	22°29.5	10.0′	56.4′
22	149°53.6	18.4	284°12.6	10.3′	22°19.5	10.0′	56.4′
23	164°53.5	18.5	298°41.9	10.4′	22°09.5	10.2′	56.4′
	SD = 15.7′	d = 0.1′	SD = 15.3′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°						
N 70°						
68°						
66°						
64°	////	////	01:35	22:26	////	////
62°	////	////	02:11	21:50	////	////
60°	////	00:56	02:37	21:24	23:06	////
N 58°	////	01:43	02:57	21:04	22:18	////
56°	////	02:12	03:14	20:47	21:49	////
54°	00:51	02:34	03:28	20:33	21:27	23:11
52°	01:34	02:51	03:40	20:21	21:09	22:27
50°	02:01	03:06	03:50	20:10	20:54	21:59
45°	02:46	03:35	04:13	19:48	20:25	21:14
N 40°	03:16	03:58	04:31	19:30	20:03	20:44
35°	03:39	04:16	04:45	19:15	19:45	20:21
30°	03:58	04:31	04:58	19:02	19:29	20:03
20°	04:27	04:56	05:20	18:40	19:05	19:34
N 10°	04:49	05:16	05:39	18:21	18:44	19:11
0°	05:08	05:34	05:56	18:04	18:26	18:52
S 10°	05:25	05:51	06:14	17:46	18:09	18:36
20°	05:41	06:08	06:32	17:28	17:52	18:20
30°	05:57	06:27	06:53	17:07	17:33	18:03
35°	06:06	06:37	07:05	16:55	17:23	17:55
40°	06:15	06:49	07:19	16:41	17:11	17:45
45°	06:25	07:02	07:36	16:24	16:58	17:35
S 50°	06:37	07:18	07:57	16:03	16:42	17:23
52°	06:42	07:26	08:06	15:54	16:35	17:18
54°	06:48	07:34	08:17	15:43	16:26	17:13
56°	06:54	07:43	08:30	15:30	16:17	17:06
58°	07:00	07:53	08:44	15:16	16:07	17:00
S 60°	07:08	08:04	09:02	14:58	15:56	16:52

Lat.	**Moonrise** Thu	Fri	Sat	**Moonset** Thu	Fri	Sat
N 72°						
N 70°						
68°						
66°						
64°			01:28			03:27
62°		00:52	00:34		02:11	04:20
60°	23:48	·· ··	00:02	01:57	03:14	04:52
N 58°	23:14	23:37	23:49	02:38	03:48	05:16
56°	22:49	23:18	23:35	03:06	04:13	05:35
54°	22:29	23:01	23:23	03:27	04:33	05:51
52°	22:12	22:47	23:12	03:45	04:49	06:05
50°	21:58	22:35	23:02	04:01	05:04	06:17
45°	21:28	22:09	22:42	04:32	05:33	06:41
N 40°	21:05	21:49	22:25	04:56	05:55	07:01
35°	20:46	21:32	22:11	05:15	06:14	07:17
30°	20:30	21:17	21:59	05:32	06:30	07:31
20°	20:02	20:52	21:37	06:00	06:57	07:55
N 10°	19:38	20:30	21:19	06:25	07:20	08:16
0°	19:16	20:10	21:02	06:48	07:42	08:35
S 10°	18:53	19:49	20:44	07:10	08:03	08:54
20°	18:30	19:27	20:26	07:34	08:26	09:14
30°	18:02	19:02	20:04	08:03	08:53	09:37
35°	17:45	18:47	19:51	08:19	09:08	09:51
40°	17:26	18:29	19:37	08:39	09:26	10:06
45°	17:03	18:08	19:19	09:02	09:48	10:25
S 50°	16:33	17:41	18:57	09:33	10:16	10:48
52°	16:18	17:28	18:47	09:48	10:29	10:59
54°	16:00	17:13	18:35	10:05	10:44	11:11
56°	15:40	16:55	18:22	10:26	11:03	11:25
58°	15:13	16:34	18:06	10:52	11:24	11:42
S 60°	14:36	16:06	17:47	11:29	11:53	12:01

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 16-18 99-93%
12	00:11	00:05	12:00	00:34	13:02	
13	00:01	00:08	12:00	01:29	13:56	
14	00:14	00:20	12:00	02:22	14:48	

June 15, 16, 17 UT (Sun., Mon., Tue.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	263°31.9	226°07.5	N11°59.1	112°15.5	N13°05.6	172°15.9	N23°16.7	261°30.0	S01°28.7
1	278°34.4	241°07.5	11°59.8	127°16.7	05.1	187°17.7	16.7	276°32.4	28.7
2	293°36.8	256°07.4	12°00.6	142°17.8	04.6	202°19.5	16.7	291°34.8	28.7
3	308°39.3	271°07.3	·· 01.4	157°19.0	·· 04.0	217°21.4	·· 16.7	306°37.1	·· 28.6
4	323°41.8	286°07.3	02.2	172°20.1	03.5	232°23.2	16.7	321°39.5	28.6
5	338°44.2	301°07.2	02.9	187°21.2	03.0	247°25.1	16.7	336°41.8	28.6
6	353°46.7	316°07.2	N12°03.7	202°22.4	N13°02.5	262°26.9	N23°16.7	351°44.2	S01°28.5
7	8°49.2	331°07.1	04.5	217°23.5	02.0	277°28.8	16.7	6°46.5	28.5
8	23°51.6	346°07.0	05.3	232°24.7	01.4	292°30.6	16.7	21°48.9	28.5
9	38°54.1	1°07.0	·· 06.1	247°25.8	·· 00.9	307°32.5	·· 16.7	36°51.2	·· 28.4
10	53°56.6	16°06.9	06.8	262°26.9	13°00.4	322°34.3	16.7	51°53.6	28.4
11	68°59.0	31°06.8	07.6	277°28.1	12°59.9	337°36.1	16.7	66°56.0	28.4
12	84°01.5	46°06.8	N12°08.4	292°29.2	N12°59.4	352°38.0	N23°16.7	81°58.3	S01°28.3
13	99°03.9	61°06.7	09.2	307°30.4	58.8	7°39.8	16.7	97°00.7	28.3
14	114°06.4	76°06.6	10.0	322°31.5	58.3	22°41.7	16.7	112°03.0	28.2
15	129°08.9	91°06.6	·· 10.7	337°32.6	·· 57.8	37°43.5	·· 16.7	127°05.4	·· 28.2
16	144°11.3	106°06.5	11.5	352°33.8	57.3	52°45.4	16.7	142°07.7	28.2
17	159°13.8	121°06.4	12.3	7°34.9	56.7	67°47.2	16.7	157°10.1	28.1
18	174°16.3	136°06.4	N12°13.1	22°36.0	N12°56.2	82°49.0	N23°16.7	172°12.4	S01°28.1
19	189°18.7	151°06.3	13.8	37°37.2	55.7	97°50.9	16.7	187°14.8	28.1
20	204°21.2	166°06.2	14.6	52°38.3	55.2	112°52.7	16.7	202°17.2	28.0
21	219°23.7	181°06.1	·· 15.4	67°39.5	·· 54.7	127°54.6	·· 16.7	217°19.5	·· 28.0
22	234°26.1	196°06.1	16.2	82°40.6	54.1	142°56.4	16.7	232°21.9	28.0
23	249°28.6	211°06.0	16.9	97°41.7	53.6	157°58.3	16.7	247°24.2	27.9
Mer.pass. 06:25		ν -0.1′	d 0.8′	m -4.26	ν 1.1′	d 0.5′	m 1.40	ν 1.8′	d 0.0′ m -1.90	ν 2.4′	d 0.0′ m 1.03

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	264°31.1	226°05.9	N12°17.7	112°42.9	N12°53.1	173°00.1	N23°16.7	262°26.6	S01°27.9
1	279°33.5	241°05.8	18.5	127°44.0	52.6	188°02.0	16.7	277°28.9	27.9
2	294°36.0	256°05.8	19.3	142°45.2	52.0	203°03.8	16.6	292°31.3	27.8
3	309°38.4	271°05.7	·· 20.1	157°46.3	·· 51.5	218°05.6	·· 16.6	307°33.7	·· 27.8
4	324°40.9	286°05.6	20.8	172°47.4	51.0	233°07.5	16.6	322°36.0	27.8
5	339°43.4	301°05.5	21.6	187°48.6	50.5	248°09.3	16.6	337°38.4	27.7
6	354°45.8	316°05.5	N12°22.4	202°49.7	N12°50.0	263°11.2	N23°16.6	352°40.7	S01°27.7
7	9°48.3	331°05.4	23.2	217°50.9	49.4	278°13.0	16.6	7°43.1	27.7
8	24°50.8	346°05.3	23.9	232°52.0	48.9	293°14.9	16.6	22°45.5	27.6
9	39°53.2	1°05.2	·· 24.7	247°53.1	·· 48.4	308°16.7	·· 16.6	37°47.8	·· 27.6
10	54°55.7	16°05.1	25.5	262°54.3	47.9	323°18.6	16.6	52°50.2	27.6
11	69°58.2	31°05.1	26.3	277°55.4	47.3	338°20.4	16.6	67°52.5	27.5
12	85°00.6	46°05.0	N12°27.0	292°56.5	N12°46.8	353°22.2	N23°16.6	82°54.9	S01°27.5
13	100°03.1	61°04.9	27.8	307°57.7	46.3	8°24.1	16.6	97°57.2	27.5
14	115°05.6	76°04.8	28.6	322°58.8	45.8	23°25.9	16.6	112°59.6	27.4
15	130°08.0	91°04.7	·· 29.4	338°00.0	·· 45.2	38°27.8	·· 16.6	128°02.0	·· 27.4
16	145°10.5	106°04.6	30.1	353°01.1	44.7	53°29.6	16.6	143°04.3	27.4
17	160°12.9	121°04.6	30.9	8°02.2	44.2	68°31.5	16.6	158°06.7	27.3
18	175°15.4	136°04.5	N12°31.7	23°03.4	N12°43.7	83°33.3	N23°16.6	173°09.0	S01°27.3
19	190°17.9	151°04.4	32.5	38°04.5	43.1	98°35.1	16.6	188°11.4	27.3
20	205°20.3	166°04.3	33.2	53°05.6	42.6	113°37.0	16.6	203°13.8	27.2
21	220°22.8	181°04.2	·· 34.0	68°06.8	·· 42.1	128°38.8	·· 16.6	218°16.1	·· 27.2
22	235°25.3	196°04.1	34.8	83°07.9	41.6	143°40.7	16.6	233°18.5	27.2
23	250°27.7	211°04.0	35.6	98°09.1	41.0	158°42.5	16.6	248°20.9	27.1
Mer.pass. 06:21		ν -0.1′	d 0.8′	m -4.25	ν 1.1′	d 0.5′	m 1.40	ν 1.8′	d 0.0′ m -1.90	ν 2.4′	d 0.0′ m 1.02

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	265°30.2	226°03.9	N12°36.3	113°10.2	N12°40.5	173°44.4	N23°16.6	263°23.2	S01°27.1
1	280°32.7	241°03.9	37.1	128°11.3	40.0	188°46.2	16.6	278°25.6	27.1
2	295°35.1	256°03.8	37.9	143°12.5	39.5	203°48.0	16.6	293°27.9	27.0
3	310°37.6	271°03.7	·· 38.6	158°13.6	·· 38.9	218°49.9	·· 16.6	308°30.3	·· 27.0
4	325°40.0	286°03.6	39.4	173°14.7	38.4	233°51.7	16.6	323°32.7	27.0
5	340°42.5	301°03.5	40.2	188°15.9	37.9	248°53.6	16.6	338°35.0	26.9
6	355°45.0	316°03.4	N12°41.0	203°17.0	N12°37.4	263°55.4	N23°16.6	353°37.4	S01°26.9
7	10°47.4	331°03.3	41.7	218°18.1	36.8	278°57.3	16.6	8°39.7	26.9
8	25°49.9	346°03.2	42.5	233°19.3	36.3	293°59.1	16.6	23°42.1	26.8
9	40°52.4	1°03.1	·· 43.3	248°20.4	·· 35.8	309°01.0	·· 16.6	38°44.5	·· 26.8
10	55°54.8	16°03.0	44.1	263°21.6	35.2	324°02.8	16.6	53°46.8	26.8
11	70°57.3	31°02.9	44.8	278°22.7	34.7	339°04.6	16.6	68°49.2	26.7
12	85°59.8	46°02.8	N12°45.6	293°23.8	N12°34.2	354°06.5	N23°16.6	83°51.6	S01°26.7
13	101°02.2	61°02.7	46.4	308°25.0	33.7	9°08.3	16.6	98°53.9	26.7
14	116°04.7	76°02.6	47.1	323°26.1	33.1	24°10.2	16.6	113°56.3	26.6
15	131°07.2	91°02.5	·· 47.9	338°27.2	·· 32.6	39°12.0	·· 16.5	128°58.6	·· 26.6
16	146°09.6	106°02.4	48.7	353°28.4	32.1	54°13.9	16.5	144°01.0	26.6
17	161°12.1	121°02.3	49.5	8°29.5	31.5	69°15.7	16.5	159°03.4	26.5
18	176°14.5	136°02.2	N12°50.2	23°30.6	N12°31.0	84°17.5	N23°16.5	174°05.7	S01°26.5
19	191°17.0	151°02.1	51.0	38°31.8	30.5	99°19.4	16.5	189°08.1	26.5
20	206°19.5	166°02.0	51.8	53°32.9	30.0	114°21.2	16.5	204°10.5	26.5
21	221°21.9	181°01.9	·· 52.5	68°34.1	·· 29.4	129°23.1	·· 16.5	219°12.8	·· 26.4
22	236°24.4	196°01.8	53.3	83°35.2	28.9	144°24.9	16.5	234°15.2	26.4
23	251°26.9	211°01.7	54.1	98°36.3	28.4	159°26.8	16.5	249°17.6	26.4
Mer.pass. 06:17		ν -0.1′	d 0.8′	m -4.24	ν 1.1′	d 0.5′	m 1.41	ν 1.8′	d 0.0′ m -1.90	ν 2.4′	d 0.0′ m 1.02

Stars

	SHA	**Dec**
Alpheratz	357°34.5	29°13.7
Ankaa	353°06.9	-42°09.8
Schedar	349°30.8	56°40.4
Diphda	348°47.0	-17°50.7
Achernar	335°20.2	-57°06.2
Hamal	327°51.0	23°34.9
Polaris	314°14.7	89°22.1
Acamar	315°11.8	-40°12.0
Menkar	314°06.0	4°11.4
Mirfak	308°28.2	49°56.9
Aldebaran	290°39.6	16°33.6
Rigel	281°03.9	-8°10.3
Capella	280°21.8	46°01.4
Bellatrix	278°22.8	6°22.4
Elnath	278°01.8	28°37.7
Alnilam	275°37.7	-1°11.1
Betelgeuse	270°52.0	7°24.7
Canopus	263°52.8	-52°42.5
Sirius	258°26.3	-16°45.1
Adhara	255°06.0	-29°00.4
Procyon	244°50.8	5°09.6
Pollux	243°17.2	27°57.9
Avior	234°15.1	-59°35.6
Suhail	222°46.4	-43°32.3
Miaplacidus	221°38.8	-69°49.5
Alphard	217°47.6	-8°46.2
Regulus	207°34.2	11°50.6
Dubhe	193°40.7	61°37.1
Denebola	182°24.6	14°25.8
Gienah	175°43.2	-17°41.1
Acrux	172°59.6	-63°14.7
Gacrux	171°51.1	-57°15.6
Alioth	166°12.5	55°49.5
Spica	158°21.8	-11°17.7
Alkaid	152°51.4	49°11.3
Hadar	148°35.1	-60°30.0
Menkent	147°57.0	-36°29.9
Arcturus	145°47.4	19°03.0
Rigil Kent.	139°39.3	-60°56.7
Kochab	137°18.9	74°03.2
Zuben'ubi	136°55.4	-16°08.9
Alphecca	126°03.1	26°37.8
Antares	112°15.0	-26°29.4
Atria	107°08.4	-69°04.4
Sabik	102°02.0	-15°45.4
Shaula	96°09.5	-37°07.3
Rasalhague	95°57.9	12°32.4
Eltanin	90°41.5	51°29.0
Kaus Aust.	83°31.6	-34°22.3
Vega	80°32.6	38°48.3
Nunki	75°47.0	-26°15.9
Altair	61°59.3	8°56.1
Peacock	53°04.7	-56°39.0
Deneb	49°25.2	45°22.1
Enif	33°38.3	9°59.4
Al Na'ir	27°32.3	-46°50.0
Fomalhaut	15°14.0	-29°29.1
Scheat	13°44.8	28°13.1
Markab	13°29.5	15°20.4

Jun 15 Sun	**SHA**	**Mer.pass**
Venus	322°35.6	08:56
Mars	208°43.6	16:30
Jupiter	268°43.9	12:29
Saturn	357°58.1	06:33

Jun 16 Mon	**SHA**	**Mer.pass**
Venus	321°34.9	08:56
Mars	208°11.8	16:28
Jupiter	268°29.1	12:26
Saturn	357°55.5	06:29

Jun 17 Tue	**SHA**	**Mer.pass**
Venus	320°33.8	08:56
Mars	207°40.0	16:26
Jupiter	268°14.2	12:24
Saturn	357°53.0	06:25

Horizontal parallax	
Venus:	0.2
Mars:	0.1

h

Sun	Sun GHA	Sun Dec	Moon GHA	Moon ν	Moon Dec	Moon d	Moon HP
0	179°53.3	N23°18.6	313°11.3	10.4′	S21°59.3	10.3′	56.5′
1	194°53.2	18.7	327°40.7	10.5′	21°49.0	10.4′	56.5′
2	209°53.1	18.8	342°10.2	10.5′	21°38.6	10.6′	56.5′
3	224°52.9	·· 18.9	356°39.7	10.6′	21°28.0	10.6′	56.5′
4	239°52.8	19.0	11°09.3	10.7′	21°17.4	10.8′	56.5′
5	254°52.7	19.1	25°39.0	10.7′	21°06.6	10.8′	56.6′
6	269°52.5	N23°19.2	40°08.7	10.8′	S20°55.8	11.0′	56.6′
7	284°52.4	19.3	54°38.5	10.8′	20°44.8	11.1′	56.6′
8	299°52.3	19.4	69°08.3	10.9′	20°33.7	11.2′	56.6′
9	314°52.1	·· 19.5	83°38.2	10.9′	20°22.5	11.4′	56.7′
10	329°52.0	19.6	98°08.1	11.0′	20°11.1	11.4′	56.7′
11	344°51.9	19.7	112°38.1	11.0′	19°59.7	11.5′	56.7′
12	359°51.7	N23°19.8	127°08.1	11.1′	S19°48.2	11.6′	56.7′
13	14°51.6	19.9	141°38.2	11.2′	19°36.6	11.8′	56.7′
14	29°51.5	20.0	156°08.4	11.2′	19°24.8	11.8′	56.8′
15	44°51.3	·· 20.1	170°38.6	11.3′	19°13.0	12.0′	56.8′
16	59°51.2	20.2	185°08.9	11.3′	19°01.0	12.0′	56.8′
17	74°51.1	20.3	199°39.2	11.4′	18°49.0	12.2′	56.8′
18	89°50.9	N23°20.3	214°09.6	11.4′	S18°36.8	12.2′	56.9′
19	104°50.8	20.4	228°40.0	11.5′	18°24.6	12.4′	56.9′
20	119°50.7	20.5	243°10.5	11.5′	18°12.2	12.4′	56.9′
21	134°50.5	·· 20.6	257°41.0	11.6′	17°59.8	12.6′	56.9′
22	149°50.4	20.7	272°11.6	11.6′	17°47.2	12.6′	57.0′
23	164°50.3	20.8	286°42.2	11.7′	17°34.6	12.8′	57.0′
	SD = 15.7′	d = 0.1′		SD = 15.4′			

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	179°50.1	N23°20.9	301°12.9	11.7′	S17°21.8	12.8′	57.0′
1	194°50.0	21.0	315°43.6	11.8′	17°09.0	12.9′	57.0′
2	209°49.8	21.1	330°14.4	11.8′	16°56.1	13.0′	57.0′
3	224°49.7	·· 21.1	344°45.2	11.9′	16°43.1	13.1′	57.1′
4	239°49.6	21.2	359°16.1	11.9′	16°30.0	13.2′	57.1′
5	254°49.4	21.3	13°47.0	12.0′	16°16.8	13.3′	57.1′
6	269°49.3	N23°21.4	28°18.0	12.0′	S16°03.5	13.4′	57.1′
7	284°49.2	21.5	42°49.0	12.1′	15°50.1	13.4′	57.2′
8	299°49.0	21.6	57°20.1	12.1′	15°36.7	13.5′	57.2′
9	314°48.9	·· 21.7	71°51.2	12.2′	15°23.2	13.7′	57.2′
10	329°48.8	21.7	86°22.4	12.2′	15°09.5	13.7′	57.2′
11	344°48.6	21.8	100°53.6	12.2′	14°55.8	13.8′	57.3′
12	359°48.5	N23°21.9	115°24.8	12.3′	S14°42.0	13.8′	57.3′
13	14°48.4	22.0	129°56.1	12.3′	14°28.2	14.0′	57.3′
14	29°48.2	22.0	144°27.4	12.4′	14°14.2	14.0′	57.3′
15	44°48.1	·· 22.1	158°58.8	12.4′	14°00.2	14.1′	57.4′
16	59°48.0	22.2	173°30.2	12.4′	13°46.1	14.2′	57.4′
17	74°47.8	22.3	188°01.6	12.5′	13°31.9	14.2′	57.4′
18	89°47.7	N23°22.4	202°33.1	12.5′	S13°17.7	14.3′	57.4′
19	104°47.6	22.4	217°04.6	12.5′	13°03.4	14.4′	57.5′
20	119°47.4	22.5	231°36.1	12.6′	12°49.0	14.5′	57.5′
21	134°47.3	·· 22.6	246°07.7	12.6′	12°34.5	14.5′	57.5′
22	149°47.2	22.7	260°39.3	12.6′	12°20.0	14.7′	57.5′
23	164°47.0	22.7	275°11.0	12.7′	12°05.3	14.6′	57.6′
	SD = 15.7′	d = 0.1′		SD = 15.5′			

Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	179°46.9	N23°22.8	289°42.7	12.7′	S11°50.7	14.8′	57.6′
1	194°46.7	22.9	304°14.4	12.7′	11°35.9	14.8′	57.6′
2	209°46.6	22.9	318°46.1	12.8′	11°21.1	14.9′	57.6′
3	224°46.5	·· 23.0	333°17.9	12.8′	11°06.2	14.9′	57.7′
4	239°46.3	23.1	347°49.7	12.8′	10°51.3	15.0′	57.7′
5	254°46.2	23.1	2°21.5	12.8′	10°36.3	15.1′	57.7′
6	269°46.1	N23°23.2	16°53.4	12.9′	S10°21.2	15.1′	57.7′
7	284°45.9	23.3	31°25.2	12.9′	10°06.1	15.2′	57.8′
8	299°45.8	23.3	45°57.1	12.9′	09°50.9	15.2′	57.8′
9	314°45.7	·· 23.4	60°29.0	12.9′	09°35.7	15.3′	57.8′
10	329°45.5	23.5	75°01.0	13.0′	09°20.4	15.4′	57.8′
11	344°45.4	23.5	89°32.9	13.0′	09°05.0	15.4′	57.9′
12	359°45.3	N23°23.6	104°04.9	13.0′	S08°49.6	15.5′	57.9′
13	14°45.1	23.7	118°36.9	13.0′	08°34.1	15.5′	57.9′
14	29°45.0	23.7	133°08.9	13.0′	08°18.6	15.5′	57.9′
15	44°44.8	·· 23.8	147°41.0	13.0′	08°03.1	15.7′	58.0′
16	59°44.7	23.8	162°13.0	13.1′	07°47.4	15.6′	58.0′
17	74°44.6	23.9	176°45.1	13.1′	07°31.8	15.8′	58.0′
18	89°44.4	N23°24.0	191°17.1	13.1′	S07°16.0	15.7′	58.0′
19	104°44.3	24.0	205°49.2	13.1′	07°00.3	15.8′	58.1′
20	119°44.2	24.1	220°21.3	13.1′	06°44.5	15.9′	58.1′
21	134°44.0	·· 24.1	234°53.4	13.1′	06°28.6	15.9′	58.1′
22	149°43.9	24.2	249°25.5	13.1′	06°12.7	15.9′	58.1′
23	164°43.8	24.2	263°57.6	13.1′	05°56.8	16.0′	58.2′
	SD = 15.7′	d = 0.1′		SD = 15.7′			

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	▭	▭	▭	▭	▭	▭
N 70°	▭	▭	▭	▭	▭	▭
68°	▭	▭	▭	▭	▭	▭
66°	▭	▭	▭	▭	▭	▭
64°	////	////	01:32	22:30	////	////
62°	////	////	02:10	21:52	////	////
60°	////	00:52	02:36	21:26	23:11	////
N 58°	////	01:41	02:56	21:06	22:21	////
56°	////	02:11	03:13	20:49	21:51	////
54°	00:47	02:33	03:27	20:35	21:29	23:15
52°	01:33	02:51	03:39	20:22	21:11	22:29
50°	02:00	03:06	03:50	20:11	20:56	22:02
45°	02:46	03:35	04:13	19:49	20:26	21:16
N 40°	03:16	03:58	04:31	19:31	20:04	20:46
35°	03:39	04:16	04:46	19:16	19:46	20:22
30°	03:58	04:31	04:59	19:03	19:30	20:04
20°	04:27	04:56	05:21	18:41	19:05	19:35
N 10°	04:49	05:16	05:40	18:22	18:45	19:12
0°	05:08	05:35	05:57	18:04	18:27	18:53
S 10°	05:25	05:52	06:14	17:47	18:10	18:36
20°	05:41	06:09	06:33	17:29	17:53	18:20
30°	05:58	06:28	06:54	17:07	17:34	18:04
35°	06:07	06:38	07:07	16:55	17:23	17:55
40°	06:16	06:50	07:21	16:41	17:11	17:45
45°	06:26	07:04	07:37	16:24	16:58	17:35
S 50°	06:38	07:20	07:58	16:03	16:42	17:23
52°	06:43	07:27	08:08	15:53	16:34	17:18
54°	06:49	07:35	08:19	15:42	16:26	17:12
56°	06:55	07:44	08:32	15:30	16:17	17:06
58°	07:02	07:55	08:46	15:15	16:07	17:00
S 60°	07:09	08:06	09:04	14:58	15:55	16:52

Lat.	Moonrise Sun	Moonrise Mon	Moonrise Tue	Moonset Sun	Moonset Mon	Moonset Tue
N 72°	▬	02:38	01:21	▬	05:53	08:50
N 70°	▬	01:49	01:02	▬	06:39	09:06
68°	02:31	01:18	00:47	04:14	07:09	09:19
66°	01:27	00:54	00:35	05:16	07:31	09:30
64°	00:52	00:36	00:24	05:50	07:49	09:38
62°	00:26	00:20	00:15	06:15	08:03	09:46
60°	00:06	00:08	00:07	06:34	08:15	09:52
N 58°	23:56	·· ··	00:01	06:50	08:25	09:58
56°	23:47	23:55	·· ··	07:04	08:34	10:03
54°	23:38	23:49	23:58	07:16	08:42	10:07
52°	23:30	23:44	23:56	07:26	08:49	10:11
50°	23:23	23:40	23:54	07:35	08:55	10:15
45°	23:08	23:30	23:50	07:54	09:08	10:22
N 40°	22:55	23:22	23:46	08:10	09:19	10:29
35°	22:45	23:15	23:42	08:23	09:29	10:34
30°	22:35	23:08	23:39	08:34	09:37	10:39
20°	22:19	22:58	23:34	08:54	09:51	10:47
N 10°	22:05	22:48	23:30	09:10	10:03	10:55
0°	21:51	22:39	23:26	09:26	10:14	11:01
S 10°	21:38	22:30	23:21	09:41	10:26	11:08
20°	21:24	22:20	23:17	09:58	10:38	11:15
30°	21:07	22:09	23:11	10:16	10:51	11:23
35°	20:57	22:03	23:08	10:27	10:59	11:27
40°	20:46	21:56	23:05	10:39	11:08	11:32
45°	20:33	21:47	23:01	10:54	11:18	11:38
S 50°	20:17	21:37	22:56	11:12	11:30	11:45
52°	20:09	21:32	22:54	11:20	11:36	11:49
54°	20:01	21:26	22:52	11:29	11:42	11:52
56°	19:51	21:20	22:49	11:39	11:49	11:56
58°	19:40	21:14	22:46	11:51	11:57	12:00
S 60°	19:28	21:06	22:43	12:05	12:05	12:05

Day	Sun Eqn.of Time 00h	Sun Eqn.of Time 12h	Sun Mer. Pass	Moon Mer.Pass. Upper	Moon Mer.Pass. Lower	Age 19-21 87-69%
	mm:ss	mm:ss	hh:mm	hh:mm	hh:mm	
15	00:27	00:33	12:01	03:14	15:39	
16	00:40	00:46	12:01	04:03	16:27	
17	00:52	00:59	12:01	04:50	17:13	

June 18, 19, 20 UT (Wed., Thu., Fri.)

	Aries	Venus		Mars		Jupiter		Saturn	
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	266°29.3	226°01.6	N12°54.9	113°37.5	N12°27.8	174°28.6	N23°16.5	264°19.9	S01°26.3
1	281°31.8	241°01.5	55.6	128°38.6	27.3	189°30.4	16.5	279°22.3	26.3
2	296°34.3	256°01.4	56.4	143°39.7	26.8	204°32.3	16.5	294°24.7	26.3
3	311°36.7	271°01.3	·· 57.2	158°40.9	·· 26.3	219°34.1	·· 16.5	309°27.0	·· 26.2
4	326°39.2	286°01.2	57.9	173°42.0	25.7	234°36.0	16.5	324°29.4	26.2
5	341°41.7	301°01.1	58.7	188°43.1	25.2	249°37.8	16.5	339°31.8	26.2
6	356°44.1	316°01.0	N12°59.5	203°44.3	N12°24.7	264°39.7	N23°16.5	354°34.1	S01°26.1
7	11°46.6	331°00.9	13°00.2	218°45.4	24.1	279°41.5	16.5	9°36.5	26.1
8	26°49.0	346°00.8	01.0	233°46.5	23.6	294°43.3	16.5	24°38.8	26.1
9	41°51.5	1°00.6	·· 01.8	248°47.7	·· 23.1	309°45.2	·· 16.5	39°41.2	·· 26.1
10	56°54.0	16°00.5	02.5	263°48.8	22.5	324°47.0	16.5	54°43.6	26.0
11	71°56.4	31°00.4	03.3	278°49.9	22.0	339°48.9	16.5	69°45.9	26.0
12	86°58.9	46°00.3	N13°04.1	293°51.1	N12°21.5	354°50.7	N23°16.5	84°48.3	S01°26.0
13	102°01.4	61°00.2	04.8	308°52.2	20.9	9°52.6	16.5	99°50.7	25.9
14	117°03.8	76°00.1	05.6	323°53.4	20.4	24°54.4	16.5	114°53.0	25.9
15	132°06.3	91°00.0	·· 06.4	338°54.5	·· 19.9	39°56.3	·· 16.5	129°55.4	·· 25.9
16	147°08.8	105°59.9	07.1	353°55.6	19.4	54°58.1	16.4	144°57.8	25.8
17	162°11.2	120°59.7	07.9	8°56.8	18.8	69°59.9	16.4	160°00.1	25.8
18	177°13.7	135°59.6	N13°08.7	23°57.9	N12°18.3	85°01.8	N23°16.4	175°02.5	S01°25.8
19	192°16.1	150°59.5	09.5	38°59.0	17.8	100°03.6	16.4	190°04.9	25.8
20	207°18.6	165°59.4	10.2	54°00.2	17.2	115°05.5	16.4	205°07.2	25.7
21	222°21.1	180°59.3	·· 11.0	69°01.3	·· 16.7	130°07.3	·· 16.4	220°09.6	·· 25.7
22	237°23.5	195°59.2	11.8	84°02.4	16.2	145°09.2	16.4	235°12.0	25.7
23	252°26.0	210°59.0	12.5	99°03.6	15.6	160°11.0	16.4	250°14.4	25.6
Mer.pass. 06:13		ν -0.1′	d 0.8′	m -4.23	ν 1.1′	d 0.5′	m 1.42	ν 1.8′	d 0.0′ m -1.90	ν 2.4′	d 0.0′ m 1.02

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	267°28.5	225°58.9	N13°13.3	114°04.7	N12°15.1	175°12.8	N23°16.4	265°16.7	S01°25.6
1	282°30.9	240°58.8	14.0	129°05.8	14.6	190°14.7	16.4	280°19.1	25.6
2	297°33.4	255°58.7	14.8	144°07.0	14.0	205°16.5	16.4	295°21.5	25.5
3	312°35.9	270°58.6	·· 15.6	159°08.1	·· 13.5	220°18.4	·· 16.4	310°23.8	·· 25.5
4	327°38.3	285°58.4	16.3	174°09.2	13.0	235°20.2	16.4	325°26.2	25.5
5	342°40.8	300°58.3	17.1	189°10.4	12.4	250°22.1	16.4	340°28.6	25.5
6	357°43.3	315°58.2	N13°17.9	204°11.5	N12°11.9	265°23.9	N23°16.4	355°30.9	S01°25.4
7	12°45.7	330°58.1	18.6	219°12.6	11.4	280°25.7	16.4	10°33.3	25.4
8	27°48.2	345°57.9	19.4	234°13.8	10.8	295°27.6	16.4	25°35.7	25.4
9	42°50.6	0°57.8	·· 20.2	249°14.9	·· 10.3	310°29.4	·· 16.4	40°38.0	·· 25.3
10	57°53.1	15°57.7	20.9	264°16.0	09.8	325°31.3	16.4	55°40.4	25.3
11	72°55.6	30°57.6	21.7	279°17.2	09.2	340°33.1	16.4	70°42.8	25.3
12	87°58.0	45°57.4	N13°22.5	294°18.3	N12°08.7	355°35.0	N23°16.3	85°45.2	S01°25.3
13	103°00.5	60°57.3	23.2	309°19.4	08.1	10°36.8	16.3	100°47.5	25.2
14	118°03.0	75°57.2	24.0	324°20.6	07.6	25°38.6	16.3	115°49.9	25.2
15	133°05.4	90°57.0	·· 24.7	339°21.7	·· 07.1	40°40.5	·· 16.3	130°52.3	·· 25.2
16	148°07.9	105°56.9	25.5	354°22.8	06.5	55°42.3	16.3	145°54.6	25.1
17	163°10.4	120°56.8	26.3	9°24.0	06.0	70°44.2	16.3	160°57.0	25.1
18	178°12.8	135°56.7	N13°27.0	24°25.1	N12°05.5	85°46.0	N23°16.3	175°59.4	S01°25.1
19	193°15.3	150°56.5	27.8	39°26.2	04.9	100°47.9	16.3	191°01.7	25.1
20	208°17.8	165°56.4	28.6	54°27.4	04.4	115°49.7	16.3	206°04.1	25.0
21	223°20.2	180°56.3	·· 29.3	69°28.5	·· 03.9	130°51.5	·· 16.3	221°06.5	·· 25.0
22	238°22.7	195°56.1	30.1	84°29.6	03.3	145°53.4	16.3	236°08.9	25.0
23	253°25.1	210°56.0	30.8	99°30.8	02.8	160°55.2	16.3	251°11.2	24.9
Mer.pass. 06:09		ν -0.1′	d 0.8′	m -4.23	ν 1.1′	d 0.5′	m 1.42	ν 1.8′	d 0.0′ m -1.90	ν 2.4′	d 0.0′ m 1.01

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	268°27.6	225°55.9	N13°31.6	114°31.9	N12°02.3	175°57.1	N23°16.3	266°13.6	S01°24.9
1	283°30.1	240°55.7	32.4	129°33.0	01.7	190°58.9	16.3	281°16.0	24.9
2	298°32.5	255°55.6	33.1	144°34.2	01.2	206°00.8	16.3	296°18.3	24.9
3	313°35.0	270°55.4	·· 33.9	159°35.3	·· 00.6	221°02.6	·· 16.3	311°20.7	·· 24.8
4	328°37.5	285°55.3	34.6	174°36.4	12°00.1	236°04.4	16.3	326°23.1	24.8
5	343°39.9	300°55.2	35.4	189°37.6	11°59.6	251°06.3	16.3	341°25.5	24.8
6	358°42.4	315°55.0	N13°36.2	204°38.7	N11°59.0	266°08.1	N23°16.2	356°27.8	S01°24.7
7	13°44.9	330°54.9	36.9	219°39.8	58.5	281°10.0	16.2	11°30.2	24.7
8	28°47.3	345°54.8	37.7	234°40.9	58.0	296°11.8	16.2	26°32.6	24.7
9	43°49.8	0°54.6	·· 38.4	249°42.1	·· 57.4	311°13.7	·· 16.2	41°35.0	·· 24.7
10	58°52.2	15°54.5	39.2	264°43.2	56.9	326°15.5	16.2	56°37.3	24.6
11	73°54.7	30°54.3	40.0	279°44.3	56.3	341°17.3	16.2	71°39.7	24.6
12	88°57.2	45°54.2	N13°40.7	294°45.5	N11°55.8	356°19.2	N23°16.2	86°42.1	S01°24.6
13	103°59.6	60°54.0	41.5	309°46.6	55.3	11°21.0	16.2	101°44.5	24.6
14	119°02.1	75°53.9	42.2	324°47.7	54.7	26°22.9	16.2	116°46.8	24.5
15	134°04.6	90°53.8	·· 43.0	339°48.9	·· 54.2	41°24.7	·· 16.2	131°49.2	·· 24.5
16	149°07.0	105°53.6	43.8	354°50.0	53.7	56°26.6	16.2	146°51.6	24.5
17	164°09.5	120°53.5	44.5	9°51.1	53.1	71°28.4	16.2	161°53.9	24.4
18	179°12.0	135°53.3	N13°45.3	24°52.3	N11°52.6	86°30.2	N23°16.2	176°56.3	S01°24.4
19	194°14.4	150°53.2	46.0	39°53.4	52.0	101°32.1	16.2	191°58.7	24.4
20	209°16.9	165°53.0	46.8	54°54.5	51.5	116°33.9	16.2	207°01.1	24.4
21	224°19.4	180°52.9	·· 47.5	69°55.7	·· 51.0	131°35.8	·· 16.1	222°03.4	·· 24.3
22	239°21.8	195°52.7	48.3	84°56.8	50.4	146°37.6	16.1	237°05.8	24.3
23	254°24.3	210°52.6	49.0	99°57.9	49.9	161°39.5	16.1	252°08.2	24.3
Mer.pass. 06:05		ν -0.1′	d 0.8′	m -4.22	ν 1.1′	d 0.5′	m 1.43	ν 1.8′	d 0.0′ m -1.90	ν 2.4′	d 0.0′ m 1.01

Stars

	SHA	Dec
Alpheratz	357°34.4	29°13.7
Ankaa	353°06.8	-42°09.8
Schedar	349°30.8	56°40.4
Diphda	348°47.0	-17°50.7
Achernar	335°20.2	-57°06.2
Hamal	327°51.0	23°34.9
Polaris	314°13.7	89°22.1
Acamar	315°11.8	-40°12.0
Menkar	314°06.0	4°11.4
Mirfak	308°28.2	49°56.9
Aldebaran	290°39.5	16°33.6
Rigel	281°03.9	-8°10.3
Capella	280°21.8	46°01.4
Bellatrix	278°22.8	6°22.4
Elnath	278°01.8	28°37.7
Alnilam	275°37.7	-1°11.1
Betelgeuse	270°52.0	7°24.7
Canopus	263°52.8	-52°42.5
Sirius	258°26.3	-16°45.1
Adhara	255°06.0	-29°00.4
Procyon	244°50.8	5°09.6
Pollux	243°17.2	27°57.9
Avior	234°15.1	-59°35.6
Suhail	222°46.4	-43°32.3
Miaplacidus	221°38.9	-69°49.5
Alphard	217°47.6	-8°46.2
Regulus	207°34.2	11°50.6
Dubhe	193°40.7	61°37.1
Denebola	182°24.6	14°25.9
Gienah	175°43.2	-17°41.1
Acrux	172°59.6	-63°14.7
Gacrux	171°51.2	-57°15.6
Alioth	166°12.5	55°49.5
Spica	158°21.8	-11°17.7
Alkaid	152°51.5	49°11.4
Hadar	148°35.1	-60°30.0
Menkent	147°57.0	-36°29.9
Arcturus	145°47.4	19°03.0
Rigil Kent.	139°39.4	-60°56.7
Kochab	137°18.9	74°03.2
Zuben'ubi	136°55.4	-16°08.9
Alphecca	126°03.1	26°37.8
Antares	112°15.0	-26°29.4
Atria	107°08.4	-69°04.5
Sabik	102°02.0	-15°45.4
Shaula	96°09.5	-37°07.3
Rasalhague	95°57.9	12°32.5
Eltanin	90°41.5	51°29.1
Kaus Aust.	83°31.6	-34°22.3
Vega	80°32.6	38°48.3
Nunki	75°46.9	-26°15.9
Altair	61°59.3	8°56.1
Peacock	53°04.7	-56°39.0
Deneb	49°25.2	45°22.1
Enif	33°38.3	9°59.4
Al Na'ir	27°32.2	-46°50.0
Fomalhaut	15°14.0	-29°29.1
Scheat	13°44.8	28°13.1
Markab	13°29.5	15°20.4

Jun 18 Wed	SHA	Mer.pass
Venus	319°32.3	08:56
Mars	207°08.1	16:24
Jupiter	267°59.3	12:21
Saturn	357°50.6	06:22

Jun 19 Thu	SHA	Mer.pass
Venus	318°30.4	08:56
Mars	206°36.2	16:22
Jupiter	267°44.4	12:18
Saturn	357°48.3	06:18

Jun 20 Fri	SHA	Mer.pass
Venus	317°28.2	08:56
Mars	206°04.3	16:21
Jupiter	267°29.5	12:15
Saturn	357°46.0	06:14

Horizontal parallax	
Venus:	0.2
Mars:	0.1

h — Sun — Moon

Wed	GHA	Dec	GHA	ν	Dec	d	HP
0	179°43.6	N23°24.3	278°29.7	13.1′	S05°40.8	16.0′	58.2′
1	194°43.5	24.3	293°01.8	13.1′	05°24.8	16.1′	58.2′
2	209°43.4	24.4	307°33.9	13.1′	05°08.7	16.1′	58.2′
3	224°43.2	·· 24.4	322°06.0	13.1′	04°52.6	16.1′	58.3′
4	239°43.1	24.5	336°38.1	13.1′	04°36.5	16.2′	58.3′
5	254°42.9	24.6	351°10.3	13.1′	04°20.3	16.2′	58.3′
6	269°42.8	N23°24.6	5°42.4	13.1′	S04°04.1	16.2′	58.3′
7	284°42.7	24.6	20°14.5	13.1′	03°47.9	16.3′	58.4′
8	299°42.5	24.7	34°46.6	13.1′	03°31.6	16.3′	58.4′
9	314°42.4	·· 24.7	49°18.6	13.1′	03°15.3	16.3′	58.4′
10	329°42.3	24.8	63°50.7	13.1′	02°59.0	16.3′	58.4′
11	344°42.1	24.8	78°22.8	13.1′	02°42.7	16.4′	58.5′
12	359°42.0	N23°24.9	92°54.8	13.0′	S02°26.3	16.4′	58.5′
13	14°41.9	24.9	107°26.9	13.0′	02°09.9	16.5′	58.5′
14	29°41.7	25.0	121°58.9	13.0′	01°53.4	16.4′	58.5′
15	44°41.6	·· 25.0	136°30.9	13.0′	01°37.0	16.5′	58.6′
16	59°41.4	25.1	151°02.9	13.0′	01°20.5	16.5′	58.6′
17	74°41.3	25.1	165°34.9	13.0′	01°04.0	16.5′	58.6′
18	89°41.2	N23°25.1	180°06.9	12.9′	S00°47.5	16.5′	58.6′
19	104°41.0	25.2	194°38.8	12.9′	00°31.0	16.6′	58.6′
20	119°40.9	25.2	209°10.7	12.9′	S00°14.4	16.5′	58.7′
21	134°40.8	·· 25.3	223°42.6	12.9′	N00°02.1	16.6′	58.7′
22	149°40.6	25.3	238°14.5	12.8′	00°18.7	16.6′	58.7′
23	164°40.5	25.3	252°46.3	12.8′	00°35.3	16.6′	58.7′
	SD = 15.7′	d = 0.1′		SD = 15.9′			

Thu	GHA	Dec	GHA	ν	Dec	d	HP
0	179°40.3	N23°25.4	267°18.1	12.8′	N00°51.9	16.6′	58.8′
1	194°40.2	25.4	281°49.9	12.7′	01°08.5	16.6′	58.8′
2	209°40.1	25.4	296°21.6	12.7′	01°25.1	16.6′	58.8′
3	224°39.9	·· 25.5	310°53.3	12.7′	01°41.7	16.6′	58.8′
4	239°39.8	25.5	325°25.0	12.6′	01°58.3	16.7′	58.9′
5	254°39.7	25.5	339°56.6	12.6′	02°15.0	16.6′	58.9′
6	269°39.5	N23°25.6	354°28.2	12.6′	N02°31.6	16.6′	58.9′
7	284°39.4	25.6	8°59.8	12.5′	02°48.2	16.7′	58.9′
8	299°39.3	25.6	23°31.3	12.5′	03°04.9	16.6′	59.0′
9	314°39.1	·· 25.7	38°02.8	12.4′	03°21.5	16.7′	59.0′
10	329°39.0	25.7	52°34.3	12.4′	03°38.2	16.6′	59.0′
11	344°38.8	25.7	67°05.6	12.3′	03°54.8	16.6′	59.0′
12	359°38.7	N23°25.8	81°37.0	12.3′	N04°11.4	16.6′	59.1′
13	14°38.6	25.8	96°08.3	12.3′	04°28.0	16.6′	59.1′
14	29°38.4	25.8	110°39.6	12.2′	04°44.6	16.6′	59.1′
15	44°38.3	·· 25.8	125°10.8	12.2′	05°01.2	16.6′	59.1′
16	59°38.2	25.9	139°41.9	12.1′	05°17.8	16.6′	59.2′
17	74°38.0	25.9	154°13.0	12.0′	05°34.4	16.5′	59.2′
18	89°37.9	N23°25.9	168°44.0	12.0′	N05°50.9	16.6′	59.2′
19	104°37.8	25.9	183°15.0	11.9′	06°07.5	16.5′	59.2′
20	119°37.6	26.0	197°46.0	11.9′	06°24.0	16.5′	59.2′
21	134°37.5	·· 26.0	212°16.8	11.8′	06°40.5	16.5′	59.3′
22	149°37.3	26.0	226°47.6	11.7′	06°57.0	16.5′	59.3′
23	164°37.2	26.0	241°18.4	11.7′	07°13.5	16.4′	59.3′
	SD = 15.7′	d = 0.0′		SD = 16.0′			

Fri	GHA	Dec	GHA	ν	Dec	d	HP
0	179°37.1	N23°26.0	255°49.1	11.6′	N07°29.9	16.4′	59.3′
1	194°36.9	26.1	270°19.7	11.6′	07°46.3	16.4′	59.4′
2	209°36.8	26.1	284°50.3	11.5′	08°02.7	16.4′	59.4′
3	224°36.7	·· 26.1	299°20.7	11.4′	08°19.1	16.3′	59.4′
4	239°36.5	26.1	313°51.2	11.3′	08°35.4	16.3′	59.4′
5	254°36.4	26.1	328°21.5	11.3′	08°51.7	16.2′	59.4′
6	269°36.2	N23°26.1	342°51.8	11.2′	N09°07.9	16.3′	59.5′
7	284°36.1	26.2	357°22.0	11.1′	09°24.2	16.1′	59.5′
8	299°36.0	26.2	11°52.1	11.1′	09°40.3	16.2′	59.5′
9	314°35.8	·· 26.2	26°22.2	11.0′	09°56.5	16.1′	59.5′
10	329°35.7	26.2	40°52.1	10.9′	10°12.6	16.1′	59.5′
11	344°35.6	26.2	55°22.0	10.8′	10°28.7	16.0′	59.6′
12	359°35.4	N23°26.2	69°51.8	10.7′	N10°44.7	16.0′	59.6′
13	14°35.3	26.2	84°21.6	10.7′	11°00.7	15.9′	59.6′
14	29°35.1	26.2	98°51.2	10.6′	11°16.6	15.9′	59.6′
15	44°35.0	·· 26.3	113°20.8	10.5′	11°32.5	15.8′	59.6′
16	59°34.9	26.3	127°50.3	10.4′	11°48.3	15.8′	59.7′
17	74°34.7	26.3	142°19.7	10.3′	12°04.1	15.7′	59.7′
18	89°34.6	N23°26.3	156°49.0	10.2′	N12°19.8	15.7′	59.7′
19	104°34.5	26.3	171°18.2	10.1′	12°35.5	15.6′	59.7′
20	119°34.3	26.3	185°47.3	10.0′	12°51.1	15.6′	59.7′
21	134°34.2	·· 26.3	200°16.4	9.9′	13°06.7	15.4′	59.8′
22	149°34.1	26.3	214°45.3	9.9′	13°22.1	15.5′	59.8′
23	164°33.9	26.3	229°14.2	9.8′	13°37.6	15.3′	59.8′
	SD = 15.7′	d = 0.0′		SD = 16.2′			

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	▭	▭	▭	▭	▭	▭
N 70°	▭	▭	▭	▭	▭	▭
68°	▭	▭	▭	▭	▭	▭
66°	▭	▭	▭	▭	▭	▭
64°	////	////	01:31	22:32	////	////
62°	////	////	02:09	21:54	////	////
60°	////	00:49	02:36	21:27	23:14	////
N 58°	////	01:40	02:56	21:07	22:23	////
56°	////	02:10	03:13	20:50	21:53	////
54°	00:45	02:33	03:27	20:36	21:30	23:18
52°	01:32	02:51	03:39	20:23	21:12	22:31
50°	02:00	03:06	03:50	20:13	20:57	22:03
45°	02:46	03:35	04:13	19:50	20:27	21:17
N 40°	03:16	03:58	04:31	19:32	20:05	20:47
35°	03:40	04:16	04:46	19:17	19:47	20:23
30°	03:58	04:32	04:59	19:04	19:31	20:05
20°	04:27	04:57	05:21	18:42	19:06	19:36
N 10°	04:50	05:17	05:40	18:23	18:46	19:13
0°	05:09	05:35	05:58	18:05	18:28	18:54
S 10°	05:26	05:52	06:15	17:48	18:10	18:37
20°	05:42	06:10	06:34	17:29	17:53	18:21
30°	05:59	06:29	06:55	17:08	17:34	18:04
35°	06:08	06:39	07:07	16:55	17:24	17:55
40°	06:17	06:51	07:22	16:41	17:12	17:46
45°	06:27	07:05	07:38	16:24	16:58	17:36
S 50°	06:39	07:21	07:59	16:04	16:42	17:24
52°	06:44	07:28	08:09	15:54	16:35	17:18
54°	06:50	07:36	08:20	15:43	16:26	17:13
56°	06:56	07:45	08:33	15:30	16:17	17:07
58°	07:03	07:56	08:48	15:15	16:07	17:00
S 60°	07:11	08:07	09:05	14:58	15:55	16:52

Lat.	Moonrise Wed	Moonrise Thu	Moonrise Fri	Moonset Wed	Moonset Thu	Moonset Fri
N 72°	00:38	00:02 23:24	22:34	11:12	13:32	16:07
N 70°	00:30	00:03 23:34	22:59	11:16	13:25	15:45
68°	00:24	00:04 23:43	23:17	11:20	13:20	15:29
66°	00:19	00:04 23:50	23:33	11:22	13:16	15:15
64°	00:14	00:05 23:56	23:45	11:25	13:12	15:04
62°	00:10	00:05	00:01 23:56	11:27	13:09	14:55
60°	00:07	00:06	00:05	11:28	13:06	14:47
N 58°	00:04	00:06	00:09	11:30	13:03	14:40
56°	00:01	00:07	00:13	11:31	13:01	14:34
54°	·· ··	00:07	00:16	11:32	12:59	14:29
52°	·· ··	00:07	00:19	11:33	12:57	14:24
50°	·· ··	00:08	00:22	11:34	12:56	14:20
45°	·· ··	00:08	00:28	11:37	12:52	14:10
N 40°	·· ··	00:09	00:33	11:38	12:49	14:02
35°	·· ··	00:09	00:37	11:40	12:47	13:56
30°	·· ··	00:10	00:41	11:41	12:44	13:50
20°	·· ··	00:10	00:48	11:44	12:41	13:40
N 10°	·· ··	00:11	00:54	11:46	12:37	13:31
0°	·· ··	00:12	00:59	11:47	12:34	13:23
S 10°	·· ··	00:12	01:05	11:49	12:31	13:14
20°	·· ··	00:13	01:11	11:51	12:27	13:06
30°	·· ··	00:14	01:18	11:53	12:24	12:56
35°	·· ··	00:15	01:22	11:54	12:21	12:50
40°	·· ··	00:15	01:27	11:56	12:19	12:44
45°	·· ··	00:16	01:33	11:57	12:16	12:36
S 50°	·· ··	00:17	01:39	11:59	12:13	12:28
52°	·· ··	00:17	01:42	12:00	12:11	12:23
54°	·· ··	00:18	01:46	12:01	12:09	12:19
56°	·· ··	00:18	01:50	12:02	12:08	12:14
58°	·· ··	00:19	01:54	12:03	12:05	12:09
S 60°	·· ··	00:19	01:58	12:04	12:03	12:02

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 22-24 59-37%
18	01:06	01:12	12:01	05:36	18:00	
19	01:19	01:25	12:01	06:23	18:47	
20	01:32	01:38	12:02	07:11	19:36	

June 21, 22, 23 UT (Sat., Sun., Mon.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	269°26.7	225°52.4	N13°49.8	114°59.0	N11°49.3	176°41.3	N23°16.1	267°10.6	S01°24.3
1	284°29.2	240°52.3	50.6	130°00.2	48.8	191°43.1	16.1	282°12.9	24.2
2	299°31.7	255°52.1	51.3	145°01.3	48.3	206°45.0	16.1	297°15.3	24.2
3	314°34.1	270°52.0	·· 52.1	160°02.4	·· 47.7	221°46.8	·· 16.1	312°17.7	·· 24.2
4	329°36.6	285°51.8	52.8	175°03.6	47.2	236°48.7	16.1	327°20.1	24.2
5	344°39.1	300°51.7	53.6	190°04.7	46.6	251°50.5	16.1	342°22.5	24.1
6	359°41.5	315°51.5	N13°54.3	205°05.8	N11°46.1	266°52.3	N23°16.1	357°24.8	S01°24.1
7	14°44.0	330°51.4	55.1	220°07.0	45.6	281°54.2	16.1	12°27.2	24.1
8	29°46.5	345°51.2	55.8	235°08.1	45.0	296°56.0	16.1	27°29.6	24.1
9	44°48.9	0°51.1	·· 56.6	250°09.2	·· 44.5	311°57.9	·· 16.1	42°32.0	·· 24.0
10	59°51.4	15°50.9	57.3	265°10.4	43.9	326°59.7	16.1	57°34.3	24.0
11	74°53.9	30°50.7	58.1	280°11.5	43.4	342°01.6	16.0	72°36.7	24.0
12	89°56.3	45°50.6	N13°58.9	295°12.6	N11°42.8	357°03.4	N23°16.0	87°39.1	S01°23.9
13	104°58.8	60°50.4	13°59.6	310°13.7	42.3	12°05.2	16.0	102°41.5	23.9
14	120°01.2	75°50.3	14°00.4	325°14.9	41.8	27°07.1	16.0	117°43.8	23.9
15	135°03.7	90°50.1	·· 01.1	340°16.0	·· 41.2	42°08.9	·· 16.0	132°46.2	·· 23.9
16	150°06.2	105°49.9	01.9	355°17.1	40.7	57°10.8	16.0	147°48.6	23.8
17	165°08.6	120°49.8	02.6	10°18.3	40.1	72°12.6	16.0	162°51.0	23.8
18	180°11.1	135°49.6	N14°03.4	25°19.4	N11°39.6	87°14.5	N23°16.0	177°53.4	S01°23.8
19	195°13.6	150°49.5	04.1	40°20.5	39.1	102°16.3	16.0	192°55.7	23.8
20	210°16.0	165°49.3	04.9	55°21.6	38.5	117°18.1	16.0	207°58.1	23.7
21	225°18.5	180°49.1	·· 05.6	70°22.8	·· 38.0	132°20.0	·· 16.0	223°00.5	·· 23.7
22	240°21.0	195°49.0	06.4	85°23.9	37.4	147°21.8	16.0	238°02.9	23.7
23	255°23.4	210°48.8	07.1	100°25.0	36.9	162°23.7	16.0	253°05.2	23.7
Mer.pass. 06:01		ν -0.2′	d 0.8′	ν 1.1′	d 0.5′	ν 1.8′	d 0.0′	ν 2.4′	d 0.0′
		m -4.21		m 1.44		m -1.90		m 1.00	

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	270°25.9	225°48.6	N14°07.9	115°26.2	N11°36.3	177°25.5	N23°16.0	268°07.6	S01°23.6
1	285°28.3	240°48.5	08.6	130°27.3	35.8	192°27.4	15.9	283°10.0	23.6
2	300°30.8	255°48.3	09.4	145°28.4	35.2	207°29.2	15.9	298°12.4	23.6
3	315°33.3	270°48.1	·· 10.1	160°29.6	·· 34.7	222°31.0	·· 15.9	313°14.8	·· 23.6
4	330°35.7	285°48.0	10.9	175°30.7	34.2	237°32.9	15.9	328°17.1	23.5
5	345°38.2	300°47.8	11.6	190°31.8	33.6	252°34.7	15.9	343°19.5	23.5
6	0°40.7	315°47.6	N14°12.4	205°32.9	N11°33.1	267°36.6	N23°15.9	358°21.9	S01°23.5
7	15°43.1	330°47.5	13.1	220°34.1	32.5	282°38.4	15.9	13°24.3	23.5
8	30°45.6	345°47.3	13.9	235°35.2	32.0	297°40.3	15.9	28°26.7	23.5
9	45°48.1	0°47.1	·· 14.6	250°36.3	·· 31.4	312°42.1	·· 15.9	43°29.0	·· 23.4
10	60°50.5	15°47.0	15.4	265°37.5	30.9	327°43.9	15.9	58°31.4	23.4
11	75°53.0	30°46.8	16.1	280°38.6	30.3	342°45.8	15.9	73°33.8	23.4
12	90°55.5	45°46.6	N14°16.8	295°39.7	N11°29.8	357°47.6	N23°15.9	88°36.2	S01°23.4
13	105°57.9	60°46.4	17.6	310°40.8	29.3	12°49.5	15.8	103°38.6	23.3
14	121°00.4	75°46.3	18.3	325°42.0	28.7	27°51.3	15.8	118°41.0	23.3
15	136°02.8	90°46.1	·· 19.1	340°43.1	·· 28.2	42°53.2	·· 15.8	133°43.3	·· 23.3
16	151°05.3	105°45.9	19.8	355°44.2	27.6	57°55.0	15.8	148°45.7	23.3
17	166°07.8	120°45.7	20.6	10°45.4	27.1	72°56.8	15.8	163°48.1	23.2
18	181°10.2	135°45.6	N14°21.3	25°46.5	N11°26.5	87°58.7	N23°15.8	178°50.5	S01°23.2
19	196°12.7	150°45.4	22.1	40°47.6	26.0	103°00.5	15.8	193°52.9	23.2
20	211°15.2	165°45.2	22.8	55°48.7	25.4	118°02.4	15.8	208°55.2	23.2
21	226°17.6	180°45.0	·· 23.6	70°49.9	·· 24.9	133°04.2	·· 15.8	223°57.6	·· 23.1
22	241°20.1	195°44.9	24.3	85°51.0	24.3	148°06.0	15.8	239°00.0	23.1
23	256°22.6	210°44.7	25.0	100°52.1	23.8	163°07.9	15.8	254°02.4	23.1
Mer.pass. 05:57		ν -0.2′	d 0.7′	ν 1.1′	d 0.5′	ν 1.8′	d 0.0′	ν 2.4′	d 0.0′
		m -4.20		m 1.44		m -1.89		m 1.00	

Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	271°25.0	225°44.5	N14°25.8	115°53.2	N11°23.3	178°09.7	N23°15.7	269°04.8	S01°23.1
1	286°27.5	240°44.3	26.5	130°54.4	22.7	193°11.6	15.7	284°07.2	23.1
2	301°30.0	255°44.1	27.3	145°55.5	22.2	208°13.4	15.7	299°09.5	23.0
3	316°32.4	270°44.0	·· 28.0	160°56.6	·· 21.6	223°15.3	·· 15.7	314°11.9	·· 23.0
4	331°34.9	285°43.8	28.8	175°57.8	21.1	238°17.1	15.7	329°14.3	23.0
5	346°37.3	300°43.6	29.5	190°58.9	20.5	253°18.9	15.7	344°16.7	23.0
6	1°39.8	315°43.4	N14°30.2	206°00.0	N11°20.0	268°20.8	N23°15.7	359°19.1	S01°22.9
7	16°42.3	330°43.2	31.0	221°01.1	19.4	283°22.6	15.7	14°21.5	22.9
8	31°44.7	345°43.0	31.7	236°02.3	18.9	298°24.5	15.7	29°23.8	22.9
9	46°47.2	0°42.9	·· 32.5	251°03.4	·· 18.3	313°26.3	·· 15.7	44°26.2	·· 22.9
10	61°49.7	15°42.7	33.2	266°04.5	17.8	328°28.2	15.7	59°28.6	22.8
11	76°52.1	30°42.5	33.9	281°05.6	17.2	343°30.0	15.6	74°31.0	22.8
12	91°54.6	45°42.3	N14°34.7	296°06.8	N11°16.7	358°31.8	N23°15.6	89°33.4	S01°22.8
13	106°57.1	60°42.1	35.4	311°07.9	16.1	13°33.7	15.6	104°35.8	22.8
14	121°59.5	75°41.9	36.2	326°09.0	15.6	28°35.5	15.6	119°38.1	22.8
15	137°02.0	90°41.7	·· 36.9	341°10.2	·· 15.0	43°37.4	·· 15.6	134°40.5	·· 22.7
16	152°04.5	105°41.5	37.6	356°11.3	14.5	58°39.2	15.6	149°42.9	22.7
17	167°06.9	120°41.4	38.4	11°12.4	13.9	73°41.1	15.6	164°45.3	22.7
18	182°09.4	135°41.2	N14°39.1	26°13.5	N11°13.4	88°42.9	N23°15.6	179°47.7	S01°22.7
19	197°11.8	150°41.0	39.8	41°14.7	12.8	103°44.7	15.6	194°50.1	22.6
20	212°14.3	165°40.8	40.6	56°15.8	12.3	118°46.6	15.6	209°52.5	22.6
21	227°16.8	180°40.6	·· 41.3	71°16.9	·· 11.7	133°48.4	·· 15.5	224°54.8	·· 22.6
22	242°19.2	195°40.4	42.1	86°18.0	11.2	148°50.3	15.5	239°57.2	22.6
23	257°21.7	210°40.2	42.8	101°19.2	10.6	163°52.1	15.5	254°59.6	22.6
Mer.pass. 05:53		ν -0.2′	d 0.7′	ν 1.1′	d 0.5′	ν 1.8′	d 0.0′	ν 2.4′	d 0.0′
		m -4.20		m 1.45		m -1.89		m 0.99	

Stars

	SHA	Dec
Alpheratz	357°34.4	29°13.7
Ankaa	353°06.8	-42°09.8
Schedar	349°30.7	56°40.4
Diphda	348°47.0	-17°50.7
Achernar	335°20.1	-57°06.2
Hamal	327°51.0	23°34.9
Polaris	314°12.5	89°22.0
Acamar	315°11.8	-40°12.0
Menkar	314°06.0	4°11.4
Mirfak	308°28.1	49°56.9
Aldebaran	290°39.5	16°33.6
Rigel	281°03.9	-8°10.3
Capella	280°21.8	46°01.4
Bellatrix	278°22.8	6°22.4
Elnath	278°01.8	28°37.7
Alnilam	275°37.7	-1°11.1
Betelgeuse	270°52.0	7°24.7
Canopus	263°52.8	-52°42.5
Sirius	258°26.3	-16°45.0
Adhara	255°06.0	-29°00.4
Procyon	244°50.8	5°09.6
Pollux	243°17.2	27°57.9
Avior	234°15.2	-59°35.6
Suhail	222°46.4	-43°32.3
Miaplacidus	221°38.9	-69°49.5
Alphard	217°47.6	-8°46.2
Regulus	207°34.2	11°50.6
Dubhe	193°40.7	61°37.1
Denebola	182°24.6	14°25.9
Gienah	175°43.2	-17°41.1
Acrux	172°59.6	-63°14.7
Gacrux	171°51.2	-57°15.6
Alioth	166°12.5	55°49.5
Spica	158°21.8	-11°17.7
Alkaid	152°51.5	49°11.4
Hadar	148°35.2	-60°30.0
Menkent	147°57.0	-36°29.9
Arcturus	145°47.4	19°03.1
Rigil Kent.	139°39.4	-60°56.7
Kochab	137°19.0	74°03.2
Zuben'ubi	136°55.4	-16°08.9
Alphecca	126°03.1	26°37.8
Antares	112°15.0	-26°29.4
Atria	107°08.4	-69°04.5
Sabik	102°02.0	-15°45.4
Shaula	96°09.4	-37°07.4
Rasalhague	95°57.9	12°32.5
Eltanin	90°41.5	51°29.1
Kaus Aust.	83°31.6	-34°22.3
Vega	80°32.5	38°48.4
Nunki	75°46.9	-26°15.9
Altair	61°59.3	8°56.1
Peacock	53°04.6	-56°39.0
Deneb	49°25.2	45°22.1
Enif	33°38.2	9°59.5
Al Na'ir	27°32.2	-46°50.0
Fomalhaut	15°14.0	-29°29.1
Scheat	13°44.8	28°13.1
Markab	13°29.4	15°20.5

Jun 21 Sat	SHA	Mer.pass
Venus	316°25.7	08:57
Mars	205°32.3	16:19
Jupiter	267°14.5	12:12
Saturn	357°43.8	06:10

Jun 22 Sun	SHA	Mer.pass
Venus	315°22.8	08:57
Mars	205°00.3	16:17
Jupiter	266°59.6	12:09
Saturn	357°41.7	06:07

Jun 23 Mon	SHA	Mer.pass
Venus	314°19.5	08:57
Mars	204°28.2	16:15
Jupiter	266°44.7	12:06
Saturn	357°39.7	06:03

Horizontal parallax	
Venus:	0.2
Mars:	0.1

h

Sat	Sun GHA	Sun Dec	Moon GHA	ν	Moon Dec	d	HP
0	179°33.8	N23°26.3	243°42.9	9.7′	N13°52.9	15.3′	59.8′
1	194°33.6	26.3	258°11.6	9.6′	14°08.2	15.2′	59.8′
2	209°33.5	26.3	272°40.1	9.5′	14°23.4	15.2′	59.8′
3	224°33.4	·· 26.3	287°08.6	9.4′	14°38.6	15.1′	59.9′
4	239°33.2	26.3	301°37.0	9.3′	14°53.7	15.0′	59.9′
5	254°33.1	26.3	316°05.2	9.2′	15°08.7	14.9′	59.9′
6	269°33.0	N23°26.3	330°33.4	9.1′	N15°23.6	14.8′	59.9′
7	284°32.8	26.3	345°01.5	9.0′	15°38.4	14.8′	59.9′
8	299°32.7	26.3	359°29.4	8.9′	15°53.2	14.7′	59.9′
9	314°32.5	·· 26.3	13°57.3	8.7′	16°07.9	14.6′	60.0′
10	329°32.4	26.3	28°25.0	8.6′	16°22.5	14.5′	60.0′
11	344°32.3	26.3	42°52.7	8.5′	16°37.0	14.4′	60.0′
12	359°32.1	N23°26.3	57°20.2	8.4′	N16°51.4	14.3′	60.0′
13	14°32.0	26.3	71°47.6	8.3′	17°05.7	14.3′	60.0′
14	29°31.9	26.3	86°14.9	8.2′	17°20.0	14.1′	60.0′
15	44°31.7	·· 26.2	100°42.1	8.1′	17°34.1	14.0′	60.0′
16	59°31.6	26.2	115°09.2	8.0′	17°48.1	14.0′	60.1′
17	74°31.5	26.2	129°36.2	7.9′	18°02.1	13.8′	60.1′
18	89°31.3	N23°26.2	144°03.1	7.8′	N18°15.9	13.8′	60.1′
19	104°31.2	26.2	158°29.9	7.7′	18°29.7	13.6′	60.1′
20	119°31.0	26.2	172°56.5	7.5′	18°43.3	13.5′	60.1′
21	134°30.9	·· 26.2	187°23.1	7.4′	18°56.8	13.4′	60.1′
22	149°30.8	26.2	201°49.5	7.3′	19°10.2	13.3′	60.1′
23	164°30.6	26.2	216°15.8	7.2′	19°23.5	13.2′	60.1′
	SD = 15.7′	d = 0.0′		SD = 16.3′			

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	179°30.5	N23°26.1	230°42.0	7.1′	N19°36.7	13.1′	60.1′
1	194°30.4	26.1	245°08.1	7.0′	19°49.8	12.9′	60.2′
2	209°30.2	26.1	259°34.1	6.9′	20°02.7	12.9′	60.2′
3	224°30.1	·· 26.1	273°59.9	6.7′	20°15.6	12.7′	60.2′
4	239°29.9	26.1	288°25.7	6.6′	20°28.3	12.6′	60.2′
5	254°29.8	26.1	302°51.3	6.5′	20°40.9	12.4′	60.2′
6	269°29.7	N23°26.0	317°16.8	6.4′	N20°53.3	12.4′	60.2′
7	284°29.5	26.0	331°42.2	6.3′	21°05.7	12.2′	60.2′
8	299°29.4	26.0	346°07.5	6.2′	21°17.9	12.0′	60.2′
9	314°29.3	·· 26.0	0°32.6	6.1′	21°29.9	12.0′	60.2′
10	329°29.1	25.9	14°57.7	5.9′	21°41.9	11.8′	60.2′
11	344°29.0	25.9	29°22.6	5.8′	21°53.7	11.6′	60.2′
12	359°28.9	N23°25.9	43°47.5	5.7′	N22°05.3	11.5′	60.2′
13	14°28.7	25.9	58°12.2	5.6′	22°16.8	11.4′	60.3′
14	29°28.6	25.9	72°36.8	5.5′	22°28.2	11.2′	60.3′
15	44°28.4	·· 25.8	87°01.2	5.4′	22°39.4	11.1′	60.3′
16	59°28.3	25.8	101°25.6	5.3′	22°50.5	10.9′	60.3′
17	74°28.2	25.8	115°49.9	5.1′	23°01.4	10.8′	60.3′
18	89°28.0	N23°25.7	130°14.0	5.0′	N23°12.2	10.6′	60.3′
19	104°27.9	25.7	144°38.1	4.9′	23°22.8	10.5′	60.3′
20	119°27.8	25.7	159°02.0	4.8′	23°33.3	10.3′	60.3′
21	134°27.6	·· 25.7	173°25.8	4.7′	23°43.6	10.2′	60.3′
22	149°27.5	25.6	187°49.5	4.6′	23°53.8	10.0′	60.3′
23	164°27.4	25.6	202°13.1	4.5′	24°03.8	9.8′	60.3′
	SD = 15.7′	d = 0.0′		SD = 16.4′			

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	179°27.2	N23°25.6	216°36.6	4.4′	N24°13.6	9.7′	60.3′
1	194°27.1	25.5	231°00.0	4.3′	24°23.3	9.5′	60.3′
2	209°26.9	25.5	245°23.3	4.2′	24°32.8	9.3′	60.3′
3	224°26.8	·· 25.5	259°46.5	4.1′	24°42.1	9.2′	60.3′
4	239°26.7	25.4	274°09.6	4.0′	24°51.3	9.0′	60.3′
5	254°26.5	25.4	288°32.6	3.9′	25°00.3	8.8′	60.3′
6	269°26.4	N23°25.4	302°55.5	3.8′	N25°09.1	8.6′	60.3′
7	284°26.3	25.3	317°18.2	3.7′	25°17.7	8.5′	60.3′
8	299°26.1	25.3	331°40.9	3.6′	25°26.2	8.2′	60.3′
9	314°26.0	·· 25.2	346°03.6	3.5′	25°34.4	8.2′	60.3′
10	329°25.9	25.2	0°26.1	3.4′	25°42.6	7.9′	60.3′
11	344°25.7	25.2	14°48.5	3.3′	25°50.5	7.7′	60.3′
12	359°25.6	N23°25.1	29°10.8	3.3′	N25°58.2	7.6′	60.3′
13	14°25.4	25.1	43°33.1	3.2′	26°05.8	7.3′	60.3′
14	29°25.3	25.0	57°55.3	3.1′	26°13.1	7.2′	60.3′
15	44°25.2	·· 25.0	72°17.3	3.0′	26°20.3	7.0′	60.3′
16	59°25.0	25.0	86°39.4	2.9′	26°27.3	6.8′	60.3′
17	74°24.9	24.9	101°01.3	2.9′	26°34.1	6.6′	60.3′
18	89°24.8	N23°24.9	115°23.2	2.8′	N26°40.7	6.4′	60.3′
19	104°24.6	24.8	129°44.9	2.7′	26°47.1	6.2′	60.3′
20	119°24.5	24.8	144°06.7	2.7′	26°53.3	6.0′	60.3′
21	134°24.4	·· 24.7	158°28.3	2.6′	26°59.3	5.8′	60.2′
22	149°24.2	24.7	172°49.9	2.5′	27°05.1	5.6′	60.2′
23	164°24.1	24.6	187°11.4	2.5′	27°10.7	5.5′	60.2′
	SD = 15.7′	d = 0.0′		SD = 16.4′			

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	▭	▭	▭	▭	▭	▭
N 70°	▭	▭	▭	▭	▭	▭
68°	▭	▭	▭	▭	▭	▭
66°	▭	▭	▭	▭	▭	▭
64°	////	////	01:31	22:33	////	////
62°	////	////	02:10	21:54	////	////
60°	////	00:50	02:36	21:28	23:14	////
N 58°	////	01:41	02:57	21:07	22:23	////
56°	////	02:11	03:13	20:51	21:53	////
54°	00:45	02:33	03:28	20:36	21:31	23:18
52°	01:33	02:51	03:40	20:24	21:13	22:31
50°	02:01	03:06	03:51	20:13	20:58	22:03
45°	02:46	03:36	04:14	19:51	20:28	21:18
N 40°	03:17	03:59	04:32	19:33	20:05	20:47
35°	03:40	04:17	04:47	19:17	19:47	20:24
30°	03:59	04:32	05:00	19:04	19:32	20:05
20°	04:28	04:57	05:22	18:42	19:07	19:36
N 10°	04:51	05:18	05:41	18:23	18:46	19:14
0°	05:10	05:36	05:58	18:06	18:28	18:55
S 10°	05:27	05:53	06:16	17:48	18:11	18:37
20°	05:43	06:10	06:34	17:30	17:54	18:21
30°	05:59	06:29	06:56	17:08	17:35	18:05
35°	06:08	06:40	07:08	16:56	17:24	17:56
40°	06:18	06:52	07:22	16:42	17:12	17:47
45°	06:28	07:05	07:39	16:25	16:59	17:36
S 50°	06:40	07:21	08:00	16:04	16:43	17:24
52°	06:45	07:29	08:10	15:54	16:35	17:19
54°	06:51	07:37	08:21	15:43	16:27	17:13
56°	06:57	07:46	08:34	15:31	16:18	17:07
58°	07:04	07:56	08:48	15:16	16:08	17:00
S 60°	07:11	08:08	09:06	14:58	15:56	16:53

Lat.	Moonrise Sat	Moonrise Sun	Moonrise Mon	Moonset Sat	Moonset Sun	Moonset Mon
N 72°	▭	▭	▭	▭	▭	▭
N 70°	21:49	▭	▭	18:46	▭	▭
68°	22:37	▭	▭	18:00	▭	▭
66°	23:09	22:04	▭	17:30	20:35	▭
64°	23:32	23:10	▭	17:08	19:31	▭
62°	23:51	23:45	23:37	16:50	18:56	21:16
60°	00:05	00:07	00:11	16:35	18:31	20:28
N 58°	00:13	00:20	00:32	16:23	18:11	19:58
56°	00:21	00:31	00:49	16:13	17:55	19:35
54°	00:27	00:42	01:03	16:03	17:41	19:16
52°	00:33	00:51	01:16	15:55	17:29	19:00
50°	00:38	00:59	01:27	15:48	17:18	18:47
45°	00:50	01:16	01:51	15:32	16:56	18:19
N 40°	00:59	01:31	02:10	15:19	16:38	17:57
35°	01:08	01:43	02:26	15:08	16:23	17:39
30°	01:15	01:54	02:39	14:58	16:10	17:23
20°	01:28	02:12	03:03	14:42	15:48	16:57
N 10°	01:39	02:29	03:24	14:28	15:29	16:34
0°	01:50	02:44	03:43	14:15	15:12	16:13
S 10°	02:00	03:00	04:03	14:02	14:54	15:52
20°	02:12	03:16	04:24	13:48	14:35	15:30
30°	02:25	03:36	04:49	13:32	14:14	15:04
35°	02:33	03:47	05:03	13:23	14:01	14:48
40°	02:42	04:00	05:20	13:12	13:47	14:31
45°	02:53	04:16	05:40	13:00	13:30	14:09
S 50°	03:05	04:35	06:06	12:45	13:09	13:43
52°	03:11	04:44	06:19	12:39	12:59	13:30
54°	03:18	04:55	06:33	12:31	12:48	13:15
56°	03:25	05:07	06:50	12:23	12:36	12:58
58°	03:34	05:20	07:10	12:13	12:21	12:37
S 60°	03:44	05:36	07:36	12:02	12:04	12:11

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Age 25-27 26-9%
21	01:45	01:51	12:02	08:02	20:29	
22	01:58	02:05	12:02	08:58	21:27	
23	02:11	02:18	12:02	09:58	22:30	

June 24, 25, 26 UT (Tue., Wed., Thu.)

	Aries	Venus		Mars		Jupiter		Saturn	
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	272°24.2	225°40.0	N14°43.5	116°20.3	N11°10.1	178°53.9	N23°15.5	270°02.0	S01°22.5
1	287°26.6	240°39.8	44.3	131°21.4	09.5	193°55.8	15.5	285°04.4	22.5
2	302°29.1	255°39.6	45.0	146°22.5	09.0	208°57.6	15.5	300°06.8	22.5
3	317°31.6	270°39.4	·· 45.7	161°23.7	·· 08.4	223°59.5	·· 15.5	315°09.2	·· 22.5
4	332°34.0	285°39.2	46.5	176°24.8	07.9	239°01.3	15.5	330°11.6	22.5
5	347°36.5	300°39.0	47.2	191°25.9	07.3	254°03.2	15.5	345°13.9	22.4
6	2°39.0	315°38.8	N14°47.9	206°27.0	N11°06.8	269°05.0	N23°15.5	0°16.3	S01°22.4
7	17°41.4	330°38.6	48.7	221°28.2	06.2	284°06.8	15.4	15°18.7	22.4
8	32°43.9	345°38.4	49.4	236°29.3	05.7	299°08.7	15.4	30°21.1	22.4
9	47°46.3	0°38.2	·· 50.1	251°30.4	·· 05.1	314°10.5	·· 15.4	45°23.5	·· 22.3
10	62°48.8	15°38.0	50.9	266°31.5	04.6	329°12.4	15.4	60°25.9	22.3
11	77°51.3	30°37.8	51.6	281°32.7	04.0	344°14.2	15.4	75°28.3	22.3
12	92°53.7	45°37.6	N14°52.3	296°33.8	N11°03.5	359°16.0	N23°15.4	90°30.7	S01°22.3
13	107°56.2	60°37.4	53.1	311°34.9	02.9	14°17.9	15.4	105°33.0	22.3
14	122°58.7	75°37.2	53.8	326°36.0	02.4	29°19.7	15.3	120°35.4	22.2
15	138°01.1	90°37.0	·· 54.5	341°37.2	·· 01.8	44°21.6	·· 15.3	135°37.8	·· 22.2
16	153°03.6	105°36.8	55.3	356°38.3	01.3	59°23.4	15.3	150°40.2	22.2
17	168°06.1	120°36.6	56.0	11°39.4	00.7	74°25.3	15.3	165°42.6	22.2
18	183°08.5	135°36.4	N14°56.7	26°40.5	N11°00.2	89°27.1	N23°15.3	180°45.0	S01°22.2
19	198°11.0	150°36.2	57.5	41°41.7	10°59.6	104°29.0	15.3	195°47.4	22.1
20	213°13.5	165°36.0	58.2	56°42.8	59.1	119°30.8	15.3	210°49.8	22.1
21	228°15.9	180°35.8	·· 58.9	71°43.9	·· 58.5	134°32.7	·· 15.3	225°52.2	·· 22.1
22	243°18.4	195°35.6	14°59.6	86°45.0	58.0	149°34.5	15.3	240°54.5	22.1
23	258°20.8	210°35.4	15°00.4	101°46.2	57.4	164°36.4	15.3	255°56.9	22.1
Mer.pass. 05:49		ν -0.2′	d 0.7′	m -4.19	ν 1.1′	d 0.6′	m 1.45	ν 1.8′	d 0.0′ m -1.89	ν 2.4′	d 0.0′ m 0.99

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	273°23.3	225°35.2	N15°01.1	116°47.3	N10°56.8	179°38.2	N23°15.3	270°59.3	S01°22.0
1	288°25.8	240°34.9	01.8	131°48.4	56.3	194°40.0	15.3	286°01.7	22.0
2	303°28.2	255°34.7	02.6	146°49.5	55.7	209°41.9	15.2	301°04.1	22.0
3	318°30.7	270°34.5	·· 03.3	161°50.7	·· 55.2	224°43.7	·· 15.2	316°06.5	·· 22.0
4	333°33.2	285°34.3	04.0	176°51.8	54.6	239°45.6	15.2	331°08.9	22.0
5	348°35.6	300°34.1	04.7	191°52.9	54.1	254°47.4	15.2	346°11.3	21.9
6	3°38.1	315°33.9	N15°05.5	206°54.0	N10°53.5	269°49.3	N23°15.2	1°13.7	S01°21.9
7	18°40.6	330°33.7	06.2	221°55.2	53.0	284°51.1	15.2	16°16.1	21.9
8	33°43.0	345°33.5	06.9	236°56.3	52.4	299°52.9	15.2	31°18.5	21.9
9	48°45.5	0°33.2	·· 07.6	251°57.4	·· 51.9	314°54.8	·· 15.2	46°20.8	·· 21.9
10	63°48.0	15°33.0	08.4	266°58.5	51.3	329°56.6	15.2	61°23.2	21.8
11	78°50.4	30°32.8	09.1	281°59.7	50.8	344°58.5	15.1	76°25.6	21.8
12	93°52.9	45°32.6	N15°09.8	297°00.8	N10°50.2	0°00.3	N23°15.1	91°28.0	S01°21.8
13	108°55.3	60°32.4	10.5	312°01.9	49.6	15°02.1	15.1	106°30.4	21.8
14	123°57.8	75°32.2	11.3	327°03.0	49.1	30°04.0	15.1	121°32.8	21.8
15	139°00.3	90°31.9	·· 12.0	342°04.1	·· 48.5	45°05.8	·· 15.1	136°35.2	·· 21.8
16	154°02.7	105°31.7	12.7	357°05.3	48.0	60°07.7	15.1	151°37.6	21.7
17	169°05.2	120°31.5	13.4	12°06.4	47.4	75°09.5	15.1	166°40.0	21.7
18	184°07.7	135°31.3	N15°14.2	27°07.5	N10°46.9	90°11.4	N23°15.1	181°42.4	S01°21.7
19	199°10.1	150°31.1	14.9	42°08.6	46.3	105°13.2	15.1	196°44.8	21.7
20	214°12.6	165°30.8	15.6	57°09.8	45.8	120°15.0	15.0	211°47.2	21.7
21	229°15.1	180°30.6	·· 16.3	72°10.9	·· 45.2	135°16.9	·· 15.0	226°49.6	·· 21.6
22	244°17.5	195°30.4	17.0	87°12.0	44.6	150°18.7	15.0	241°51.9	21.6
23	259°20.0	210°30.2	17.8	102°13.1	44.1	165°20.6	15.0	256°54.3	21.6
Mer.pass. 05:45		ν -0.2′	d 0.7′	m -4.18	ν 1.1′	d 0.6′	m 1.46	ν 1.8′	d 0.0′ m -1.89	ν 2.4′	d 0.0′ m 0.99

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	274°22.5	225°30.0	N15°18.5	117°14.3	N10°43.5	180°22.4	N23°15.0	271°56.7	S01°21.6
1	289°24.9	240°29.7	19.2	132°15.4	43.0	195°24.3	15.0	286°59.1	21.6
2	304°27.4	255°29.5	19.9	147°16.5	42.4	210°26.1	15.0	302°01.5	21.6
3	319°29.8	270°29.3	·· 20.6	162°17.6	·· 41.9	225°27.9	·· 15.0	317°03.9	·· 21.5
4	334°32.3	285°29.1	21.4	177°18.7	41.3	240°29.8	15.0	332°06.3	21.5
5	349°34.8	300°28.8	22.1	192°19.9	40.7	255°31.6	14.9	347°08.7	21.5
6	4°37.2	315°28.6	N15°22.8	207°21.0	N10°40.2	270°33.5	N23°14.9	2°11.1	S01°21.5
7	19°39.7	330°28.4	23.5	222°22.1	39.6	285°35.3	14.9	17°13.5	21.5
8	34°42.2	345°28.1	24.2	237°23.2	39.1	300°37.2	14.9	32°15.9	21.4
9	49°44.6	0°27.9	·· 25.0	252°24.4	·· 38.5	315°39.0	·· 14.9	47°18.3	·· 21.4
10	64°47.1	15°27.7	25.7	267°25.5	38.0	330°40.8	14.9	62°20.7	21.4
11	79°49.6	30°27.5	26.4	282°26.6	37.4	345°42.7	14.9	77°23.1	21.4
12	94°52.0	45°27.2	N15°27.1	297°27.7	N10°36.8	0°44.5	N23°14.9	92°25.5	S01°21.4
13	109°54.5	60°27.0	27.8	312°28.8	36.3	15°46.4	14.8	107°27.9	21.4
14	124°56.9	75°26.8	28.5	327°30.0	35.7	30°48.2	14.8	122°30.3	21.3
15	139°59.4	90°26.5	·· 29.2	342°31.1	·· 35.2	45°50.1	·· 14.8	137°32.7	·· 21.3
16	155°01.9	105°26.3	30.0	357°32.2	34.6	60°51.9	14.8	152°35.1	21.3
17	170°04.3	120°26.1	30.7	12°33.3	34.0	75°53.7	14.8	167°37.5	21.3
18	185°06.8	135°25.8	N15°31.4	27°34.5	N10°33.5	90°55.6	N23°14.8	182°39.9	S01°21.3
19	200°09.3	150°25.6	32.1	42°35.6	32.9	105°57.4	14.8	197°42.3	21.3
20	215°11.7	165°25.4	32.8	57°36.7	32.4	120°59.3	14.8	212°44.6	21.2
21	230°14.2	180°25.1	·· 33.5	72°37.8	·· 31.8	136°01.1	·· 14.7	227°47.0	·· 21.2
22	245°16.7	195°24.9	34.2	87°38.9	31.2	151°03.0	14.7	242°49.4	21.2
23	260°19.1	210°24.6	34.9	102°40.1	30.7	166°04.8	14.7	257°51.8	21.2
Mer.pass. 05:42		ν -0.2′	d 0.7′	m -4.17	ν 1.1′	d 0.6′	m 1.47	ν 1.8′	d 0.0′ m -1.89	ν 2.4′	d 0.0′ m 0.98

Stars

	SHA	Dec
Alpheratz	357°34.4	29°13.7
Ankaa	353°06.8	-42°09.8
Schedar	349°30.7	56°40.4
Diphda	348°47.0	-17°50.7
Achernar	335°20.1	-57°06.1
Hamal	327°50.9	23°34.9
Polaris	314°10.9	89°22.0
Acamar	315°11.8	-40°11.9
Menkar	314°06.0	4°11.4
Mirfak	308°28.1	49°56.9
Aldebaran	290°39.5	16°33.6
Rigel	281°03.8	-8°10.3
Capella	280°21.8	46°01.4
Bellatrix	278°22.8	6°22.4
Elnath	278°01.8	28°37.7
Alnilam	275°37.7	-1°11.1
Betelgeuse	270°52.0	7°24.7
Canopus	263°52.8	-52°42.5
Sirius	258°26.3	-16°45.0
Adhara	255°06.0	-29°00.4
Procyon	244°50.8	5°09.6
Pollux	243°17.2	27°57.9
Avior	234°15.2	-59°35.6
Suhail	222°46.4	-43°32.3
Miaplacidus	221°38.9	-69°49.5
Alphard	217°47.6	-8°46.2
Regulus	207°34.2	11°50.6
Dubhe	193°40.7	61°37.1
Denebola	182°24.6	14°25.9
Gienah	175°43.2	-17°41.1
Acrux	172°59.7	-63°14.7
Gacrux	171°51.2	-57°15.6
Alioth	166°12.5	55°49.5
Spica	158°21.8	-11°17.7
Alkaid	152°51.5	49°11.4
Hadar	148°35.2	-60°30.0
Menkent	147°57.0	-36°29.9
Arcturus	145°47.4	19°03.1
Rigil Kent.	139°39.4	-60°56.7
Kochab	137°19.0	74°03.2
Zuben'ubi	136°55.4	-16°08.9
Alphecca	126°03.1	26°37.8
Antares	112°15.0	-26°29.4
Atria	107°08.4	-69°04.5
Sabik	102°02.0	-15°45.4
Shaula	96°09.4	-37°07.4
Rasalhague	95°57.9	12°32.5
Eltanin	90°41.5	51°29.1
Kaus Aust.	83°31.6	-34°22.3
Vega	80°32.5	38°48.4
Nunki	75°46.9	-26°15.9
Altair	61°59.3	8°56.1
Peacock	53°04.6	-56°39.0
Deneb	49°25.2	45°22.1
Enif	33°38.2	9°59.5
Al Na'ir	27°32.2	-46°50.0
Fomalhaut	15°14.0	-29°29.1
Scheat	13°44.7	28°13.1
Markab	13°29.4	15°20.5

Jun 24 Tue	SHA	Mer.pass
Venus	313°15.8	08:57
Mars	203°56.1	16:13
Jupiter	266°29.8	12:03
Saturn	357°37.8	05:59

Jun 25 Wed	SHA	Mer.pass
Venus	312°11.8	08:58
Mars	203°24.0	16:12
Jupiter	266°14.9	12:00
Saturn	357°36.0	05:55

Jun 26 Thu	SHA	Mer.pass
Venus	311°07.5	08:58
Mars	202°51.8	16:10
Jupiter	266°00.0	11:57
Saturn	357°34.3	05:51

Horizontal parallax	
Venus:	0.2
Mars:	0.1

h	Sun		Moon				
Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°24.0	N23°24.6	201°32.9	2.4′	N27°16.2	5.2′	60.2′
1	194°23.8	24.5	215°54.3	2.4′	27°21.4	5.0′	60.2′
2	209°23.7	24.5	230°15.6	2.3′	27°26.4	4.8′	60.2′
3	224°23.6	·· 24.4	244°37.0	2.3′	27°31.2	4.6′	60.2′
4	239°23.4	24.4	258°58.2	2.2′	27°35.8	4.4′	60.2′
5	254°23.3	24.3	273°19.4	2.2′	27°40.2	4.2′	60.2′
6	269°23.1	N23°24.3	287°40.6	2.1′	N27°44.4	4.0′	60.2′
7	284°23.0	24.2	302°01.7	2.1′	27°48.4	3.8′	60.2′
8	299°22.9	24.2	316°22.8	2.1′	27°52.2	3.6′	60.1′
9	314°22.7	·· 24.1	330°43.9	2.0′	27°55.8	3.3′	60.1′
10	329°22.6	24.0	345°04.9	2.0′	27°59.1	3.2′	60.1′
11	344°22.5	24.0	359°25.9	2.0′	28°02.3	2.9′	60.1′
12	359°22.3	N23°23.9	13°46.9	2.0′	N28°05.2	2.8′	60.1′
13	14°22.2	23.9	28°07.9	1.9′	28°08.0	2.5′	60.1′
14	29°22.1	23.8	42°28.8	1.9′	28°10.5	2.3′	60.1′
15	44°21.9	·· 23.8	56°49.7	1.9′	28°12.8	2.2′	60.1′
16	59°21.8	23.7	71°10.7	1.9′	28°15.0	1.9′	60.0′
17	74°21.7	23.6	85°31.6	1.9′	28°16.9	1.6′	60.0′
18	89°21.5	N23°23.6	99°52.5	1.9′	N28°18.5	1.5′	60.0′
19	104°21.4	23.5	114°13.4	1.9′	28°20.0	1.3′	60.0′
20	119°21.3	23.4	128°34.3	1.9′	28°21.3	1.0′	60.0′
21	134°21.1	·· 23.4	142°55.2	1.9′	28°22.3	0.9′	60.0′
22	149°21.0	23.3	157°16.2	1.9′	28°23.2	0.6′	59.9′
23	164°20.9	23.2	171°37.1	2.0′	28°23.8	0.5′	59.9′
	SD = 15.7′	d = 0.1′	SD = 16.4′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°20.7	N23°23.2	185°58.1	2.0′	N28°24.3	0.2′	59.9′
1	194°20.6	23.1	200°19.0	2.0′	28°24.5	0.0′	59.9′
2	209°20.5	23.0	214°40.0	2.0′	28°24.5	0.2′	59.9′
3	224°20.3	·· 23.0	229°01.1	2.1′	28°24.3	0.4′	59.9′
4	239°20.2	22.9	243°22.1	2.1′	28°23.9	0.7′	59.8′
5	254°20.0	22.8	257°43.2	2.1′	28°23.2	0.8′	59.8′
6	269°19.9	N23°22.8	272°04.3	2.2′	N28°22.4	1.0′	59.8′
7	284°19.8	22.7	286°25.5	2.2′	28°21.4	1.3′	59.8′
8	299°19.6	22.6	300°46.7	2.3′	28°20.1	1.4′	59.8′
9	314°19.5	·· 22.5	315°08.0	2.3′	28°18.7	1.7′	59.7′
10	329°19.4	22.5	329°29.3	2.4′	28°17.0	1.8′	59.7′
11	344°19.2	22.4	343°50.6	2.4′	28°15.2	2.1′	59.7′
12	359°19.1	N23°22.3	358°12.1	2.5′	N28°13.1	2.3′	59.7′
13	14°19.0	22.2	12°33.5	2.5′	28°10.8	2.4′	59.7′
14	29°18.8	22.2	26°55.1	2.6′	28°08.4	2.7′	59.6′
15	44°18.7	·· 22.1	41°16.7	2.7′	28°05.7	2.9′	59.6′
16	59°18.6	22.0	55°38.3	2.7′	28°02.8	3.1′	59.6′
17	74°18.4	21.9	70°00.0	2.8′	27°59.7	3.2′	59.6′
18	89°18.3	N23°21.9	84°21.9	2.9′	N27°56.5	3.5′	59.5′
19	104°18.2	21.8	98°43.7	3.0′	27°53.0	3.6′	59.5′
20	119°18.0	21.7	113°05.7	3.0′	27°49.4	3.9′	59.5′
21	134°17.9	·· 21.6	127°27.7	3.1′	27°45.5	4.0′	59.5′
22	149°17.8	21.5	141°49.9	3.2′	27°41.5	4.3′	59.4′
23	164°17.6	21.4	156°12.1	3.3′	27°37.2	4.4′	59.4′
	SD = 15.7′	d = 0.1′	SD = 16.3′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°17.5	N23°21.4	170°34.4	3.4′	N27°32.8	4.6′	59.4′
1	194°17.4	21.3	184°56.8	3.5′	27°28.2	4.8′	59.4′
2	209°17.2	21.2	199°19.2	3.6′	27°23.4	5.0′	59.3′
3	224°17.1	·· 21.1	213°41.8	3.7′	27°18.4	5.2′	59.3′
4	239°17.0	21.0	228°04.5	3.8′	27°13.2	5.3′	59.3′
5	254°16.9	20.9	242°27.3	3.9′	27°07.9	5.5′	59.2′
6	269°16.7	N23°20.8	256°50.2	4.0′	N27°02.4	5.7′	59.2′
7	284°16.6	20.8	271°13.1	4.1′	26°56.7	5.9′	59.2′
8	299°16.5	20.7	285°36.2	4.2′	26°50.8	6.1′	59.2′
9	314°16.3	·· 20.6	299°59.4	4.3′	26°44.7	6.2′	59.1′
10	329°16.2	20.5	314°22.7	4.4′	26°38.5	6.4′	59.1′
11	344°16.1	20.4	328°46.1	4.5′	26°32.1	6.6′	59.1′
12	359°15.9	N23°20.3	343°09.7	4.6′	N26°25.5	6.8′	59.1′
13	14°15.8	20.2	357°33.3	4.8′	26°18.7	6.9′	59.0′
14	29°15.7	20.1	11°57.1	4.9′	26°11.8	7.1′	59.0′
15	44°15.5	·· 20.0	26°21.0	5.0′	26°04.7	7.2′	59.0′
16	59°15.4	19.9	40°45.0	5.1′	25°57.5	7.4′	58.9′
17	74°15.3	19.8	55°09.1	5.2′	25°50.1	7.6′	58.9′
18	89°15.1	N23°19.7	69°33.3	5.4′	N25°42.5	7.7′	58.9′
19	104°15.0	19.6	83°57.7	5.5′	25°34.8	7.9′	58.8′
20	119°14.9	19.5	98°22.2	5.6′	25°26.9	8.0′	58.8′
21	134°14.7	·· 19.4	112°46.8	5.7′	25°18.9	8.2′	58.8′
22	149°14.6	19.3	127°11.6	5.9′	25°10.7	8.4′	58.7′
23	164°14.5	19.2	141°36.4	6.0′	25°02.3	8.4′	58.7′
	SD = 15.7′	d = 0.1′	SD = 16.2′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	▭	▭	▭	▭	▭	▭
N 70°	▭	▭	▭	▭	▭	▭
68°	▭	▭	▭	▭	▭	▭
66°	▭	▭	▭	▭	▭	▭
64°	////	////	01:33	22:31	////	////
62°	////	////	02:11	21:54	////	////
60°	////	00:52	02:37	21:28	23:12	////
N 58°	////	01:42	02:58	21:07	22:23	////
56°	////	02:12	03:15	20:51	21:53	////
54°	00:48	02:34	03:29	20:36	21:31	23:16
52°	01:34	02:52	03:41	20:24	21:13	22:31
50°	02:02	03:07	03:52	20:13	20:58	22:03
45°	02:47	03:37	04:14	19:51	20:28	21:18
N 40°	03:18	04:00	04:32	19:33	20:06	20:47
35°	03:41	04:18	04:48	19:18	19:48	20:24
30°	04:00	04:33	05:01	19:05	19:32	20:06
20°	04:29	04:58	05:23	18:43	19:07	19:37
N 10°	04:51	05:18	05:41	18:24	18:47	19:14
0°	05:10	05:37	05:59	18:06	18:29	18:55
S 10°	05:27	05:54	06:16	17:49	18:12	18:38
20°	05:43	06:11	06:35	17:30	17:55	18:22
30°	06:00	06:30	06:56	17:09	17:36	18:06
35°	06:09	06:40	07:09	16:57	17:25	17:57
40°	06:18	06:52	07:23	16:43	17:13	17:47
45°	06:28	07:06	07:39	16:26	17:00	17:37
S 50°	06:40	07:22	08:00	16:05	16:44	17:25
52°	06:45	07:29	08:10	15:55	16:36	17:20
54°	06:51	07:37	08:21	15:44	16:28	17:14
56°	06:57	07:46	08:34	15:32	16:19	17:08
58°	07:04	07:57	08:48	15:17	16:09	17:02
S 60°	07:12	08:08	09:06	15:00	15:57	16:54

Lat.	**Moonrise** Tue	Wed	Thu	**Moonset** Tue	Wed	Thu
N 72°	▭	▭	▭	▭	▭	▭
N 70°	▭	▭	▭	▭	▭	▭
68°	▭	▭	▭	▭	▭	▭
66°	▭	▭	▭	▭	▭	▭
64°	▭	▭	▭	▭	▭	▭
62°	▭	▭	01:39	▭	23:46	23:37
60°	00:24	01:05	02:33	22:05	22:52	23:08
N 58°	00:55	01:44	03:05	21:26	22:19	22:45
56°	01:19	02:11	03:29	20:59	21:55	22:27
54°	01:38	02:32	03:48	20:38	21:35	22:11
52°	01:54	02:50	04:05	20:20	21:19	21:58
50°	02:08	03:05	04:19	20:05	21:04	21:46
45°	02:36	03:36	04:47	19:34	20:35	21:21
N 40°	02:59	04:00	05:10	19:10	20:12	21:02
35°	03:18	04:19	05:28	18:50	19:53	20:45
30°	03:34	04:36	05:44	18:34	19:37	20:31
20°	04:01	05:05	06:11	18:05	19:09	20:06
N 10°	04:25	05:29	06:34	17:41	18:45	19:45
0°	04:47	05:52	06:56	17:18	18:23	19:24
S 10°	05:09	06:15	07:17	16:55	18:00	19:04
20°	05:33	06:40	07:40	16:31	17:36	18:43
30°	06:01	07:08	08:07	16:02	17:08	18:17
35°	06:18	07:25	08:22	15:45	16:51	18:02
40°	06:37	07:45	08:40	15:26	16:32	17:45
45°	07:00	08:09	09:02	15:02	16:08	17:24
S 50°	07:31	08:40	09:30	14:31	15:37	16:57
52°	07:46	08:55	09:43	14:16	15:22	16:44
54°	08:03	09:13	09:59	13:58	15:04	16:29
56°	08:24	09:35	10:17	13:37	14:43	16:11
58°	08:51	10:03	10:39	13:10	14:15	15:50
S 60°	09:29	10:42	11:07	12:31	13:36	15:22

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 28-1 3-1%
24	02:24	02:31	12:03	11:02	23:35	
25	02:37	02:44	12:03	12:08	–:–	
26	02:50	02:56	12:03	13:10	00:39	

June 27, 28, 29 UT (Fri., Sat., Sun.)

	Aries	Venus		Mars		Jupiter		Saturn	
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	275°21.6	225°24.4	N15°35.7	117°41.2	N10°30.1	181°06.6	N23°14.7	272°54.2	S01°21.2
1	290°24.1	240°24.2	36.4	132°42.3	29.6	196°08.5	14.7	287°56.6	21.2
2	305°26.5	255°23.9	37.1	147°43.4	29.0	211°10.3	14.7	302°59.0	21.1
3	320°29.0	270°23.7	·· 37.8	162°44.5	·· 28.4	226°12.2	·· 14.7	318°01.4	·· 21.1
4	335°31.4	285°23.4	38.5	177°45.7	27.9	241°14.0	14.7	333°03.8	21.1
5	350°33.9	300°23.2	39.2	192°46.8	27.3	256°15.9	14.6	348°06.2	21.1
6	5°36.4	315°23.0	N15°39.9	207°47.9	N10°26.8	271°17.7	N23°14.6	3°08.6	S01°21.1
7	20°38.8	330°22.7	40.6	222°49.0	26.2	286°19.5	14.6	18°11.0	21.1
8	35°41.3	345°22.5	41.3	237°50.2	25.6	301°21.4	14.6	33°13.4	21.0
9	50°43.8	0°22.2	·· 42.0	252°51.3	·· 25.1	316°23.2	·· 14.6	48°15.8	·· 21.0
10	65°46.2	15°22.0	42.8	267°52.4	24.5	331°25.1	14.6	63°18.2	21.0
11	80°48.7	30°21.7	43.5	282°53.5	24.0	346°26.9	14.6	78°20.6	21.0
12	95°51.2	45°21.5	N15°44.2	297°54.6	N10°23.4	1°28.8	N23°14.5	93°23.0	S01°21.0
13	110°53.6	60°21.3	44.9	312°55.8	22.8	16°30.6	14.5	108°25.4	21.0
14	125°56.1	75°21.0	45.6	327°56.9	22.3	31°32.4	14.5	123°27.8	20.9
15	140°58.6	90°20.8	·· 46.3	342°58.0	·· 21.7	46°34.3	·· 14.5	138°30.2	·· 20.9
16	156°01.0	105°20.5	47.0	357°59.1	21.2	61°36.1	14.5	153°32.6	20.9
17	171°03.5	120°20.3	47.7	13°00.2	20.6	76°38.0	14.5	168°35.0	20.9
18	186°05.9	135°20.0	N15°48.4	28°01.4	N10°20.0	91°39.8	N23°14.5	183°37.4	S01°20.9
19	201°08.4	150°19.8	49.1	43°02.5	19.5	106°41.7	14.5	198°39.8	20.9
20	216°10.9	165°19.5	49.8	58°03.6	18.9	121°43.5	14.4	213°42.2	20.9
21	231°13.3	180°19.3	·· 50.5	73°04.7	·· 18.3	136°45.3	·· 14.4	228°44.6	·· 20.8
22	246°15.8	195°19.0	51.2	88°05.8	17.8	151°47.2	14.4	243°47.0	20.8
23	261°18.3	210°18.8	51.9	103°07.0	17.2	166°49.0	14.4	258°49.4	20.8
Mer.pass. 05:38		ν -0.2′	d 0.7′	m -4.17	ν 1.1′	d 0.6′	m 1.47	ν 1.8′	d 0.0′ m -1.89	ν 2.4′	d 0.0′ m 0.98

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	276°20.7	225°18.5	N15°52.6	118°08.1	N10°16.7	181°50.9	N23°14.4	273°51.8	S01°20.8
1	291°23.2	240°18.3	53.3	133°09.2	16.1	196°52.7	14.4	288°54.2	20.8
2	306°25.7	255°18.0	54.0	148°10.3	15.5	211°54.6	14.4	303°56.6	20.8
3	321°28.1	270°17.7	·· 54.7	163°11.4	·· 15.0	226°56.4	·· 14.3	318°59.0	·· 20.8
4	336°30.6	285°17.5	55.4	178°12.6	14.4	241°58.3	14.3	334°01.4	20.7
5	351°33.1	300°17.2	56.1	193°13.7	13.8	257°00.1	14.3	349°03.8	20.7
6	6°35.5	315°17.0	N15°56.8	208°14.8	N10°13.3	272°01.9	N23°14.3	4°06.2	S01°20.7
7	21°38.0	330°16.7	57.5	223°15.9	12.7	287°03.8	14.3	19°08.6	20.7
8	36°40.4	345°16.5	58.2	238°17.0	12.1	302°05.6	14.3	34°11.0	20.7
9	51°42.9	0°16.2	·· 58.9	253°18.2	·· 11.6	317°07.5	·· 14.3	49°13.4	·· 20.7
10	66°45.4	15°15.9	15°59.6	268°19.3	11.0	332°09.3	14.2	64°15.9	20.7
11	81°47.8	30°15.7	16°00.3	283°20.4	10.5	347°11.2	14.2	79°18.3	20.6
12	96°50.3	45°15.4	N16°01.0	298°21.5	N10°09.9	2°13.0	N23°14.2	94°20.7	S01°20.6
13	111°52.8	60°15.2	01.7	313°22.6	09.3	17°14.8	14.2	109°23.1	20.6
14	126°55.2	75°14.9	02.4	328°23.7	08.8	32°16.7	14.2	124°25.5	20.6
15	141°57.7	90°14.6	·· 03.1	343°24.9	·· 08.2	47°18.5	·· 14.2	139°27.9	·· 20.6
16	157°00.2	105°14.4	03.8	358°26.0	07.6	62°20.4	14.2	154°30.3	20.6
17	172°02.6	120°14.1	04.5	13°27.1	07.1	77°22.2	14.1	169°32.7	20.6
18	187°05.1	135°13.9	N16°05.2	28°28.2	N10°06.5	92°24.1	N23°14.1	184°35.1	S01°20.5
19	202°07.6	150°13.6	05.9	43°29.3	05.9	107°25.9	14.1	199°37.5	20.5
20	217°10.0	165°13.3	06.6	58°30.5	05.4	122°27.7	14.1	214°39.9	20.5
21	232°12.5	180°13.1	·· 07.3	73°31.6	·· 04.8	137°29.6	·· 14.1	229°42.3	·· 20.5
22	247°14.9	195°12.8	08.0	88°32.7	04.2	152°31.4	14.1	244°44.7	20.5
23	262°17.4	210°12.5	08.7	103°33.8	03.7	167°33.3	14.1	259°47.1	20.5
Mer.pass. 05:34		ν -0.3′	d 0.7′	m -4.16	ν 1.1′	d 0.6′	m 1.48	ν 1.8′	d 0.0′ m -1.89	ν 2.4′	d 0.0′ m 0.97

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	277°19.9	225°12.3	N16°09.3	118°34.9	N10°03.1	182°35.1	N23°14.0	274°49.5	S01°20.5
1	292°22.3	240°12.0	10.0	133°36.1	02.5	197°37.0	14.0	289°51.9	20.4
2	307°24.8	255°11.7	10.7	148°37.2	02.0	212°38.8	14.0	304°54.3	20.4
3	322°27.3	270°11.5	·· 11.4	163°38.3	·· 01.4	227°40.7	·· 14.0	319°56.7	·· 20.4
4	337°29.7	285°11.2	12.1	178°39.4	00.8	242°42.5	14.0	334°59.1	20.4
5	352°32.2	300°10.9	12.8	193°40.5	10°00.3	257°44.3	14.0	350°01.5	20.4
6	7°34.7	315°10.6	N16°13.5	208°41.6	N09°59.7	272°46.2	N23°14.0	5°03.9	S01°20.4
7	22°37.1	330°10.4	14.2	223°42.8	59.1	287°48.0	13.9	20°06.4	20.4
8	37°39.6	345°10.1	14.9	238°43.9	58.6	302°49.9	13.9	35°08.8	20.4
9	52°42.0	0°09.8	·· 15.6	253°45.0	·· 58.0	317°51.7	·· 13.9	50°11.2	·· 20.3
10	67°44.5	15°09.6	16.2	268°46.1	57.4	332°53.6	13.9	65°13.6	20.3
11	82°47.0	30°09.3	16.9	283°47.2	56.9	347°55.4	13.9	80°16.0	20.3
12	97°49.4	45°09.0	N16°17.6	298°48.4	N09°56.3	2°57.2	N23°13.9	95°18.4	S01°20.3
13	112°51.9	60°08.7	18.3	313°49.5	55.7	17°59.1	13.8	110°20.8	20.3
14	127°54.4	75°08.5	19.0	328°50.6	55.2	33°00.9	13.8	125°23.2	20.3
15	142°56.8	90°08.2	·· 19.7	343°51.7	·· 54.6	48°02.8	·· 13.8	140°25.6	·· 20.3
16	157°59.3	105°07.9	20.4	358°52.8	54.0	63°04.6	13.8	155°28.0	20.3
17	173°01.8	120°07.6	21.0	13°53.9	53.5	78°06.5	13.8	170°30.4	20.2
18	188°04.2	135°07.4	N16°21.7	28°55.1	N09°52.9	93°08.3	N23°13.8	185°32.8	S01°20.2
19	203°06.7	150°07.1	22.4	43°56.2	52.3	108°10.2	13.8	200°35.2	20.2
20	218°09.2	165°06.8	23.1	58°57.3	51.8	123°12.0	13.7	215°37.6	20.2
21	233°11.6	180°06.5	·· 23.8	73°58.4	·· 51.2	138°13.8	·· 13.7	230°40.1	·· 20.2
22	248°14.1	195°06.2	24.5	88°59.5	50.6	153°15.7	13.7	245°42.5	20.2
23	263°16.5	210°06.0	25.1	104°00.6	50.1	168°17.5	13.7	260°44.9	20.2
Mer.pass. 05:30		ν -0.3′	d 0.7′	m -4.15	ν 1.1′	d 0.6′	m 1.48	ν 1.8′	d 0.0′ m -1.89	ν 2.4′	d 0.0′ m 0.97

Stars

	SHA	Dec
Alpheratz	357°34.3	29°13.7
Ankaa	353°06.8	-42°09.8
Schedar	349°30.7	56°40.4
Diphda	348°46.9	-17°50.7
Achernar	335°20.1	-57°06.1
Hamal	327°50.9	23°34.9
Polaris	314°09.5	89°22.0
Acamar	315°11.7	-40°11.9
Menkar	314°06.0	4°11.4
Mirfak	308°28.1	49°56.9
Aldebaran	290°39.5	16°33.6
Rigel	281°03.8	-8°10.3
Capella	280°21.8	46°01.3
Bellatrix	278°22.8	6°22.4
Elnath	278°01.7	28°37.7
Alnilam	275°37.7	-1°11.1
Betelgeuse	270°52.0	7°24.7
Canopus	263°52.8	-52°42.5
Sirius	258°26.2	-16°45.0
Adhara	255°05.9	-29°00.4
Procyon	244°50.7	5°09.6
Pollux	243°17.2	27°57.9
Avior	234°15.2	-59°35.6
Suhail	222°46.4	-43°32.2
Miaplacidus	221°39.0	-69°49.5
Alphard	217°47.6	-8°46.2
Regulus	207°34.2	11°50.6
Dubhe	193°40.8	61°37.1
Denebola	182°24.6	14°25.9
Gienah	175°43.2	-17°41.1
Acrux	172°59.7	-63°14.7
Gacrux	171°51.2	-57°15.6
Alioth	166°12.5	55°49.5
Spica	158°21.8	-11°17.7
Alkaid	152°51.5	49°11.4
Hadar	148°35.2	-60°30.0
Menkent	147°57.0	-36°29.9
Arcturus	145°47.4	19°03.1
Rigil Kent.	139°39.4	-60°56.7
Kochab	137°19.0	74°03.2
Zuben'ubi	136°55.4	-16°08.9
Alphecca	126°03.1	26°37.8
Antares	112°15.0	-26°29.4
Atria	107°08.4	-69°04.5
Sabik	102°02.0	-15°45.4
Shaula	96°09.4	-37°07.4
Rasalhague	95°57.8	12°32.5
Eltanin	90°41.5	51°29.1
Kaus Aust.	83°31.6	-34°22.3
Vega	80°32.5	38°48.4
Nunki	75°46.9	-26°15.9
Altair	61°59.3	8°56.1
Peacock	53°04.6	-56°39.0
Deneb	49°25.1	45°22.1
Enif	33°38.2	9°59.5
Al Na'ir	27°32.1	-46°50.0
Fomalhaut	15°13.9	-29°29.0
Scheat	13°44.7	28°13.1
Markab	13°29.4	15°20.5

Jun 27 Fri	SHA	Mer.pass
Venus	310°02.8	08:59
Mars	202°19.6	16:08
Jupiter	265°45.0	11:54
Saturn	357°32.6	05:47

Jun 28 Sat	SHA	Mer.pass
Venus	308°57.8	08:59
Mars	201°47.3	16:06
Jupiter	265°30.1	11:51
Saturn	357°31.1	05:44

Jun 29 Sun	SHA	Mer.pass
Venus	307°52.4	08:59
Mars	201°15.1	16:04
Jupiter	265°15.2	11:48
Saturn	357°29.6	05:40

Horizontal parallax	
Venus:	0.2
Mars:	0.1

h	Sun		Moon				
Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°14.3	N23°19.1	156°01.4	6.1′	N24°53.9	8.7′	58.7′
1	194°14.2	19.0	170°26.6	6.3′	24°45.2	8.7′	58.6′
2	209°14.1	18.9	184°51.8	6.4′	24°36.5	9.0′	58.6′
3	224°14.0	·· 18.8	199°17.2	6.5′	24°27.5	9.0′	58.6′
4	239°13.8	18.7	213°42.7	6.7′	24°18.5	9.2′	58.6′
5	254°13.7	18.6	228°08.4	6.8′	24°09.3	9.3′	58.5′
6	269°13.6	N23°18.5	242°34.2	6.9′	N24°00.0	9.5′	58.5′
7	284°13.4	18.4	257°00.1	7.0′	23°50.5	9.6′	58.5′
8	299°13.3	18.3	271°26.1	7.2′	23°40.9	9.7′	58.4′
9	314°13.2	·· 18.2	285°52.3	7.3′	23°31.2	9.9′	58.4′
10	329°13.0	18.1	300°18.6	7.4′	23°21.3	10.0′	58.4′
11	344°12.9	18.0	314°45.1	7.6′	23°11.3	10.1′	58.3′
12	359°12.8	N23°17.9	329°11.6	7.7′	N23°01.2	10.2′	58.3′
13	14°12.6	17.8	343°38.4	7.8′	22°51.0	10.3′	58.3′
14	29°12.5	17.7	358°05.2	8.0′	22°40.7	10.5′	58.2′
15	44°12.4	·· 17.5	12°32.2	8.1′	22°30.2	10.6′	58.2′
16	59°12.3	17.4	26°59.3	8.3′	22°19.6	10.7′	58.1′
17	74°12.1	17.3	41°26.6	8.4′	22°08.9	10.8′	58.1′
18	89°12.0	N23°17.2	55°53.9	8.5′	N21°58.1	10.9′	58.1′
19	104°11.9	17.1	70°21.5	8.6′	21°47.2	11.0′	58.0′
20	119°11.7	17.0	84°49.1	8.8′	21°36.2	11.2′	58.0′
21	134°11.6	·· 16.9	99°16.9	8.9′	21°25.0	11.2′	58.0′
22	149°11.5	16.7	113°44.8	9.0′	21°13.8	11.4′	57.9′
23	164°11.4	16.6	128°12.8	9.2′	21°02.4	11.4′	57.9′
	SD = 15.7′	d = 0.1′	SD = 16.0′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°11.2	N23°16.5	142°41.0	9.3′	N20°51.0	11.5′	57.9′
1	194°11.1	16.4	157°09.3	9.4′	20°39.5	11.7′	57.8′
2	209°11.0	16.3	171°37.8	9.6′	20°27.8	11.7′	57.8′
3	224°10.8	·· 16.2	186°06.3	9.7′	20°16.1	11.8′	57.8′
4	239°10.7	16.0	200°35.0	9.8′	20°04.3	12.0′	57.7′
5	254°10.6	15.9	215°03.9	10.0′	19°52.3	12.0′	57.7′
6	269°10.4	N23°15.8	229°32.8	10.1′	N19°40.3	12.1′	57.7′
7	284°10.3	15.7	244°01.9	10.2′	19°28.2	12.1′	57.6′
8	299°10.2	15.5	258°31.1	10.3′	19°16.1	12.3′	57.6′
9	314°10.1	·· 15.4	273°00.4	10.5′	19°03.8	12.4′	57.6′
10	329°09.9	15.3	287°29.9	10.6′	18°51.4	12.4′	57.5′
11	344°09.8	15.2	301°59.5	10.7′	18°39.0	12.5′	57.5′
12	359°09.7	N23°15.0	316°29.2	10.8′	N18°26.5	12.6′	57.5′
13	14°09.6	14.9	330°59.0	10.9′	18°13.9	12.7′	57.4′
14	29°09.4	14.8	345°28.9	11.1′	18°01.2	12.7′	57.4′
15	44°09.3	·· 14.7	359°59.0	11.2′	17°48.5	12.8′	57.3′
16	59°09.2	14.5	14°29.2	11.3′	17°35.7	12.9′	57.3′
17	74°09.0	14.4	28°59.5	11.4′	17°22.8	12.9′	57.3′
18	89°08.9	N23°14.3	43°29.9	11.5′	N17°09.9	13.1′	57.2′
19	104°08.8	14.1	58°00.5	11.7′	16°56.8	13.0′	57.2′
20	119°08.7	14.0	72°31.1	11.8′	16°43.8	13.2′	57.2′
21	134°08.5	·· 13.9	87°01.9	11.9′	16°30.6	13.2′	57.1′
22	149°08.4	13.7	101°32.8	12.0′	16°17.4	13.3′	57.1′
23	164°08.3	13.6	116°03.8	12.1′	16°04.1	13.3′	57.1′
	SD = 15.7′	d = 0.1′	SD = 15.8′				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°08.1	N23°13.5	130°34.9	12.2′	N15°50.8	13.4′	57.0′
1	194°08.0	13.3	145°06.1	12.3′	15°37.4	13.4′	57.0′
2	209°07.9	13.2	159°37.4	12.4′	15°24.0	13.5′	57.0′
3	224°07.8	·· 13.1	174°08.8	12.5′	15°10.5	13.6′	56.9′
4	239°07.6	12.9	188°40.4	12.6′	14°56.9	13.6′	56.9′
5	254°07.5	12.8	203°12.0	12.7′	14°43.3	13.6′	56.9′
6	269°07.4	N23°12.6	217°43.8	12.8′	N14°29.7	13.7′	56.8′
7	284°07.3	12.5	232°15.6	12.9′	14°16.0	13.8′	56.8′
8	299°07.1	12.4	246°47.6	13.1′	14°02.2	13.8′	56.8′
9	314°07.0	·· 12.2	261°19.6	13.1′	13°48.4	13.8′	56.7′
10	329°06.9	12.1	275°51.8	13.2′	13°34.6	13.9′	56.7′
11	344°06.8	11.9	290°24.0	13.3′	13°20.7	13.9′	56.7′
12	359°06.6	N23°11.8	304°56.4	13.4′	N13°06.8	14.0′	56.6′
13	14°06.5	11.6	319°28.8	13.5′	12°52.8	14.0′	56.6′
14	29°06.4	11.5	334°01.3	13.6′	12°38.8	14.0′	56.6′
15	44°06.3	·· 11.4	348°34.0	13.7′	12°24.8	14.1′	56.5′
16	59°06.1	11.2	3°06.7	13.8′	12°10.7	14.1′	56.5′
17	74°06.0	11.1	17°39.5	13.9′	11°56.6	14.2′	56.5′
18	89°05.9	N23°10.9	32°12.4	14.0′	N11°42.4	14.2′	56.4′
19	104°05.8	10.8	46°45.4	14.1′	11°28.2	14.2′	56.4′
20	119°05.6	10.6	61°18.4	14.2′	11°14.0	14.2′	56.4′
21	134°05.5	·· 10.5	75°51.6	14.2′	10°59.8	14.3′	56.3′
22	149°05.4	10.3	90°24.8	14.3′	10°45.5	14.3′	56.3′
23	164°05.3	10.2	104°58.1	14.4′	10°31.2	14.3′	56.3′
	SD = 15.7′	d = 0.1′	SD = 15.6′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	▭	▭	▭	▭	▭	▭
N 70°	▭	▭	▭	▭	▭	▭
68°	▭	▭	▭	▭	▭	▭
66°	▭	▭	▭	▭	▭	▭
64°	////	////	01:37	22:29	////	////
62°	////	////	02:14	21:52	////	////
60°	////	00:57	02:40	21:27	23:08	////
N 58°	////	01:45	03:00	21:07	22:21	////
56°	////	02:14	03:16	20:50	21:52	////
54°	00:53	02:36	03:30	20:36	21:30	23:13
52°	01:37	02:54	03:43	20:24	21:12	22:29
50°	02:04	03:09	03:53	20:13	20:57	22:02
45°	02:49	03:38	04:16	19:51	20:28	21:17
N 40°	03:19	04:01	04:34	19:33	20:06	20:47
35°	03:42	04:19	04:49	19:18	19:48	20:24
30°	04:01	04:34	05:01	19:05	19:33	20:06
20°	04:30	04:59	05:23	18:43	19:08	19:37
N 10°	04:52	05:19	05:42	18:24	18:47	19:15
0°	05:11	05:37	06:00	18:07	18:30	18:56
S 10°	05:28	05:54	06:17	17:50	18:13	18:39
20°	05:44	06:11	06:35	17:31	17:55	18:23
30°	06:00	06:30	06:56	17:10	17:37	18:06
35°	06:09	06:41	07:09	16:58	17:26	17:58
40°	06:18	06:52	07:23	16:44	17:14	17:49
45°	06:29	07:06	07:40	16:27	17:01	17:38
S 50°	06:40	07:22	08:00	16:07	16:45	17:27
52°	06:45	07:29	08:10	15:57	16:38	17:21
54°	06:51	07:37	08:21	15:46	16:30	17:16
56°	06:57	07:46	08:33	15:33	16:21	17:10
58°	07:04	07:56	08:48	15:19	16:11	17:03
S 60°	07:11	08:08	09:05	15:02	15:59	16:56

Lat.	**Moonrise** Fri	Sat	Sun	**Moonset** Fri	Sat	Sun
N 72°	▭	▭	06:01	▭	▭	01:13
N 70°	▭	▭	06:33	▭	▭	00:39
68°	▭	04:25	06:56	▭	01:03	00:14 23:47
66°	▭	05:05	07:14	▭	00:21 23:55	23:37
64°	03:13	05:33	07:29	00:19 23:53	23:39	23:28
62°	03:55	05:54	07:41	23:31	23:26	23:21
60°	04:23	06:11	07:51	23:13	23:14	23:14
N 58°	04:45	06:25	07:59	22:58	23:04	23:08
56°	05:02	06:37	08:07	22:45	22:56	23:03
54°	05:17	06:48	08:14	22:34	22:48	22:59
52°	05:30	06:57	08:20	22:24	22:41	22:54
50°	05:42	07:05	08:26	22:15	22:35	22:50
45°	06:05	07:23	08:37	21:55	22:21	22:42
N 40°	06:24	07:37	08:47	21:40	22:10	22:35
35°	06:40	07:49	08:55	21:27	22:00	22:29
30°	06:53	08:00	09:03	21:15	21:52	22:23
20°	07:16	08:18	09:15	20:55	21:37	22:14
N 10°	07:36	08:34	09:26	20:37	21:24	22:06
0°	07:55	08:48	09:36	20:21	21:12	21:58
S 10°	08:13	09:03	09:46	20:04	20:59	21:50
20°	08:33	09:18	09:57	19:46	20:46	21:41
30°	08:55	09:36	10:09	19:26	20:31	21:31
35°	09:09	09:46	10:16	19:13	20:22	21:26
40°	09:24	09:57	10:24	18:59	20:11	21:19
45°	09:42	10:11	10:34	18:43	19:59	21:12
S 50°	10:04	10:27	10:45	18:22	19:44	21:02
52°	10:14	10:35	10:50	18:12	19:37	20:58
54°	10:26	10:44	10:55	18:00	19:29	20:53
56°	10:40	10:53	11:02	17:47	19:21	20:48
58°	10:56	11:04	11:09	17:32	19:11	20:42
S 60°	11:14	11:16	11:17	17:14	18:59	20:35

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 2-4 3-15%
27	03:03	03:09	12:03	14:08	01:40	
28	03:15	03:21	12:03	15:00	02:35	
29	03:27	03:33	12:04	15:47	03:24	

June 30, 01, 02 UT (Mon., Tue., Wed.)

	Aries	Venus		Mars		Jupiter		Saturn	
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	278°19.0	225°05.7	N16°25.8	119°01.8	N09°49.5	183°19.4	N23°13.7	275°47.3	S01°20.2
1	293°21.5	240°05.4	26.5	134°02.9	48.9	198°21.2	13.7	290°49.7	20.2
2	308°23.9	255°05.1	27.2	149°04.0	48.3	213°23.1	13.6	305°52.1	20.1
3	323°26.4	270°04.8	·· 27.9	164°05.1	·· 47.8	228°24.9	·· 13.6	320°54.5	·· 20.1
4	338°28.9	285°04.5	28.5	179°06.2	47.2	243°26.8	13.6	335°56.9	20.1
5	353°31.3	300°04.3	29.2	194°07.3	46.6	258°28.6	13.6	350°59.3	20.1
6	8°33.8	315°04.0	N16°29.9	209°08.5	N09°46.1	273°30.4	N23°13.6	6°01.7	S01°20.1
7	23°36.3	330°03.7	30.6	224°09.6	45.5	288°32.3	13.6	21°04.2	20.1
8	38°38.7	345°03.4	31.3	239°10.7	44.9	303°34.1	13.5	36°06.6	20.1
9	53°41.2	0°03.1	·· 31.9	254°11.8	·· 44.4	318°36.0	·· 13.5	51°09.0	·· 20.1
10	68°43.7	15°02.8	32.6	269°12.9	43.8	333°37.8	13.5	66°11.4	20.1
11	83°46.1	30°02.5	33.3	284°14.0	43.2	348°39.7	13.5	81°13.8	20.0
12	98°48.6	45°02.2	N16°34.0	299°15.2	N09°42.7	3°41.5	N23°13.5	96°16.2	S01°20.0
13	113°51.0	60°02.0	34.6	314°16.3	42.1	18°43.3	13.5	111°18.6	20.0
14	128°53.5	75°01.7	35.3	329°17.4	41.5	33°45.2	13.4	126°21.0	20.0
15	143°56.0	90°01.4	·· 36.0	344°18.5	·· 40.9	48°47.0	·· 13.4	141°23.4	·· 20.0
16	158°58.4	105°01.1	36.7	359°19.6	40.4	63°48.9	13.4	156°25.9	20.0
17	174°00.9	120°00.8	37.3	14°20.7	39.8	78°50.7	13.4	171°28.3	20.0
18	189°03.4	135°00.5	N16°38.0	29°21.9	N09°39.2	93°52.6	N23°13.4	186°30.7	S01°20.0
19	204°05.8	150°00.2	38.7	44°23.0	38.7	108°54.4	13.4	201°33.1	20.0
20	219°08.3	164°59.9	39.4	59°24.1	38.1	123°56.3	13.4	216°35.5	20.0
21	234°10.8	179°59.6	·· 40.0	74°25.2	·· 37.5	138°58.1	·· 13.3	231°37.9	·· 19.9
22	249°13.2	194°59.3	40.7	89°26.3	36.9	154°00.0	13.3	246°40.3	19.9
23	264°15.7	209°59.0	41.4	104°27.4	36.4	169°01.8	13.3	261°42.7	19.9
Mer.pass. 05:26		ν -0.3′	d 0.7′	m -4.15	ν 1.1′	d 0.6′	m 1.49	ν 1.8′	d 0.0′ m -1.89	ν 2.4′	d 0.0′ m 0.96

Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	279°18.1	224°58.7	N16°42.1	119°28.5	N09°35.8	184°03.6	N23°13.3	276°45.1	S01°19.9
1	294°20.6	239°58.4	42.7	134°29.7	35.2	199°05.5	13.3	291°47.6	19.9
2	309°23.1	254°58.1	43.4	149°30.8	34.7	214°07.3	13.3	306°50.0	19.9
3	324°25.5	269°57.8	·· 44.1	164°31.9	·· 34.1	229°09.2	·· 13.2	321°52.4	·· 19.9
4	339°28.0	284°57.5	44.7	179°33.0	33.5	244°11.0	13.2	336°54.8	19.9
5	354°30.5	299°57.2	45.4	194°34.1	32.9	259°12.9	13.2	351°57.2	19.9
6	9°32.9	314°56.9	N16°46.1	209°35.2	N09°32.4	274°14.7	N23°13.2	6°59.6	S01°19.9
7	24°35.4	329°56.6	46.7	224°36.4	31.8	289°16.6	13.2	22°02.0	19.8
8	39°37.9	344°56.3	47.4	239°37.5	31.2	304°18.4	13.1	37°04.5	19.8
9	54°40.3	359°56.0	·· 48.1	254°38.6	·· 30.6	319°20.2	·· 13.1	52°06.9	·· 19.8
10	69°42.8	14°55.7	48.7	269°39.7	30.1	334°22.1	13.1	67°09.3	19.8
11	84°45.3	29°55.4	49.4	284°40.8	29.5	349°23.9	13.1	82°11.7	19.8
12	99°47.7	44°55.1	N16°50.1	299°41.9	N09°28.9	4°25.8	N23°13.1	97°14.1	S01°19.8
13	114°50.2	59°54.8	50.7	314°43.0	28.4	19°27.6	13.1	112°16.5	19.8
14	129°52.6	74°54.5	51.4	329°44.2	27.8	34°29.5	13.0	127°18.9	19.8
15	144°55.1	89°54.2	·· 52.1	344°45.3	·· 27.2	49°31.3	·· 13.0	142°21.4	·· 19.8
16	159°57.6	104°53.9	52.7	359°46.4	26.6	64°33.2	13.0	157°23.8	19.8
17	175°00.0	119°53.6	53.4	14°47.5	26.1	79°35.0	13.0	172°26.2	19.8
18	190°02.5	134°53.3	N16°54.0	29°48.6	N09°25.5	94°36.8	N23°13.0	187°28.6	S01°19.7
19	205°05.0	149°53.0	54.7	44°49.7	24.9	109°38.7	13.0	202°31.0	19.7
20	220°07.4	164°52.7	55.4	59°50.8	24.3	124°40.5	12.9	217°33.4	19.7
21	235°09.9	179°52.4	·· 56.0	74°52.0	·· 23.8	139°42.4	·· 12.9	232°35.9	·· 19.7
22	250°12.4	194°52.1	56.7	89°53.1	23.2	154°44.2	12.9	247°38.3	19.7
23	265°14.8	209°51.8	57.4	104°54.2	22.6	169°46.1	12.9	262°40.7	19.7
Mer.pass. 05:22		ν -0.3′	d 0.7′	m -4.14	ν 1.1′	d 0.6′	m 1.49	ν 1.8′	d 0.0′ m -1.89	ν 2.4′	d 0.0′ m 0.96

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	280°17.3	224°51.5	N16°58.0	119°55.3	N09°22.0	184°47.9	N23°12.9	277°43.1	S01°19.7
1	295°19.8	239°51.1	58.7	134°56.4	21.5	199°49.8	12.9	292°45.5	19.7
2	310°22.2	254°50.8	16°59.3	149°57.5	20.9	214°51.6	12.8	307°47.9	19.7
3	325°24.7	269°50.5	17°00.0	164°58.6	·· 20.3	229°53.5	·· 12.8	322°50.4	·· 19.7
4	340°27.1	284°50.2	00.6	179°59.8	19.7	244°55.3	12.8	337°52.8	19.7
5	355°29.6	299°49.9	01.3	195°00.9	19.2	259°57.1	12.8	352°55.2	19.7
6	10°32.1	314°49.6	N17°02.0	210°02.0	N09°18.6	274°59.0	N23°12.8	7°57.6	S01°19.7
7	25°34.5	329°49.3	02.6	225°03.1	18.0	290°00.8	12.7	23°00.0	19.6
8	40°37.0	344°48.9	03.3	240°04.2	17.4	305°02.7	12.7	38°02.4	19.6
9	55°39.5	359°48.6	·· 03.9	255°05.3	·· 16.9	320°04.5	·· 12.7	53°04.9	·· 19.6
10	70°41.9	14°48.3	04.6	270°06.4	16.3	335°06.4	12.7	68°07.3	19.6
11	85°44.4	29°48.0	05.2	285°07.6	15.7	350°08.2	12.7	83°09.7	19.6
12	100°46.9	44°47.7	N17°05.9	300°08.7	N09°15.1	5°10.1	N23°12.7	98°12.1	S01°19.6
13	115°49.3	59°47.4	06.5	315°09.8	14.6	20°11.9	12.6	113°14.5	19.6
14	130°51.8	74°47.0	07.2	330°10.9	14.0	35°13.8	12.6	128°17.0	19.6
15	145°54.2	89°46.7	·· 07.8	345°12.0	·· 13.4	50°15.6	·· 12.6	143°19.4	·· 19.6
16	160°56.7	104°46.4	08.5	0°13.1	12.8	65°17.4	12.6	158°21.8	19.6
17	175°59.2	119°46.1	09.1	15°14.2	12.2	80°19.3	12.6	173°24.2	19.6
18	191°01.6	134°45.8	N17°09.8	30°15.3	N09°11.7	95°21.1	N23°12.5	188°26.6	S01°19.6
19	206°04.1	149°45.4	10.4	45°16.5	11.1	110°23.0	12.5	203°29.1	19.6
20	221°06.6	164°45.1	11.1	60°17.6	10.5	125°24.8	12.5	218°31.5	19.5
21	236°09.0	179°44.8	·· 11.7	75°18.7	·· 09.9	140°26.7	·· 12.5	233°33.9	·· 19.5
22	251°11.5	194°44.5	12.4	90°19.8	09.4	155°28.5	12.5	248°36.3	19.5
23	266°14.0	209°44.2	13.0	105°20.9	08.8	170°30.4	12.5	263°38.7	19.5
Mer.pass. 05:18		ν -0.3′	d 0.7′	m -4.13	ν 1.1′	d 0.6′	m 1.50	ν 1.8′	d 0.0′ m -1.89	ν 2.4′	d 0.0′ m 0.95

Stars

	SHA	Dec
Alpheratz	357°34.3	29°13.7
Ankaa	353°06.7	-42°09.8
Schedar	349°30.6	56°40.4
Diphda	348°46.9	-17°50.7
Achernar	335°20.0	-57°06.1
Hamal	327°50.9	23°34.9
Polaris	314°08.3	89°22.0
Acamar	315°11.7	-40°11.9
Menkar	314°05.9	4°11.4
Mirfak	308°28.0	49°56.9
Aldebaran	290°39.5	16°33.6
Rigel	281°03.8	-8°10.3
Capella	280°21.8	46°01.3
Bellatrix	278°22.8	6°22.4
Elnath	278°01.7	28°37.7
Alnilam	275°37.7	-1°11.1
Betelgeuse	270°52.0	7°24.7
Canopus	263°52.8	-52°42.5
Sirius	258°26.2	-16°45.0
Adhara	255°05.9	-29°00.4
Procyon	244°50.7	5°09.6
Pollux	243°17.2	27°57.9
Avior	234°15.2	-59°35.5
Suhail	222°46.4	-43°32.2
Miaplacidus	221°39.0	-69°49.5
Alphard	217°47.6	-8°46.2
Regulus	207°34.2	11°50.6
Dubhe	193°40.8	61°37.1
Denebola	182°24.6	14°25.9
Gienah	175°43.2	-17°41.1
Acrux	172°59.7	-63°14.7
Gacrux	171°51.2	-57°15.6
Alioth	166°12.5	55°49.5
Spica	158°21.8	-11°17.7
Alkaid	152°51.5	49°11.4
Hadar	148°35.2	-60°30.0
Menkent	147°57.0	-36°29.9
Arcturus	145°47.4	19°03.1
Rigil Kent.	139°39.4	-60°56.7
Kochab	137°19.1	74°03.2
Zuben'ubi	136°55.4	-16°08.9
Alphecca	126°03.1	26°37.8
Antares	112°15.0	-26°29.4
Atria	107°08.4	-69°04.5
Sabik	102°02.0	-15°45.4
Shaula	96°09.4	-37°07.4
Rasalhague	95°57.8	12°32.5
Eltanin	90°41.5	51°29.1
Kaus Aust.	83°31.6	-34°22.3
Vega	80°32.5	38°48.4
Nunki	75°46.9	-26°15.9
Altair	61°59.2	8°56.1
Peacock	53°04.5	-56°39.0
Deneb	49°25.1	45°22.1
Enif	33°38.2	9°59.5
Al Na'ir	27°32.1	-46°50.0
Fomalhaut	15°13.9	-29°29.0
Scheat	13°44.7	28°13.1
Markab	13°29.4	15°20.5

Jun 30 Mon	SHA	Mer.pass
Venus	306°46.7	09:00
Mars	200°42.7	16:03
Jupiter	265°00.4	11:45
Saturn	357°28.3	05:36

Jul 01 Tue	SHA	Mer.pass
Venus	305°40.6	09:00
Mars	200°10.4	16:01
Jupiter	264°45.5	11:42
Saturn	357°27.0	05:32

Jul 02 Wed	SHA	Mer.pass
Venus	304°34.2	09:01
Mars	199°38.0	15:59
Jupiter	264°30.6	11:39
Saturn	357°25.8	05:28

Horizontal parallax	
Venus:	0.2
Mars:	0.1

h	Sun		Moon				
Mon	**GHA**	**Dec**	**GHA**	*ν*	**Dec**	*d*	**HP**
0	179°05.1	N23°10.0	119°31.5	14.5′	N10°16.9	14.4′	56.2′
1	194°05.0	09.9	134°05.0	14.6′	10°02.5	14.4′	56.2′
2	209°04.9	09.7	148°38.5	14.6′	09°48.1	14.4′	56.2′
3	224°04.8	·· 09.6	163°12.2	14.7′	09°33.7	14.4′	56.1′
4	239°04.6	09.4	177°45.9	14.8′	09°19.3	14.5′	56.1′
5	254°04.5	09.2	192°19.7	14.9′	09°04.8	14.4′	56.1′
6	269°04.4	N23°09.1	206°53.5	14.9′	N08°50.4	14.5′	56.0′
7	284°04.3	08.9	221°27.4	15.0′	08°35.9	14.5′	56.0′
8	299°04.1	08.8	236°01.4	15.1′	08°21.4	14.6′	56.0′
9	314°04.0	·· 08.6	250°35.5	15.1′	08°06.8	14.5′	55.9′
10	329°03.9	08.5	265°09.6	15.2′	07°52.3	14.6′	55.9′
11	344°03.8	08.3	279°43.8	15.3′	07°37.7	14.5′	55.9′
12	359°03.7	N23°08.1	294°18.1	15.3′	N07°23.2	14.6′	55.8′
13	14°03.5	08.0	308°52.4	15.4′	07°08.6	14.6′	55.8′
14	29°03.4	07.8	323°26.8	15.4′	06°54.0	14.6′	55.8′
15	44°03.3	·· 07.7	338°01.2	15.5′	06°39.4	14.6′	55.8′
16	59°03.2	07.5	352°35.7	15.6′	06°24.8	14.6′	55.7′
17	74°03.0	07.3	7°10.3	15.6′	06°10.2	14.7′	55.7′
18	89°02.9	N23°07.2	21°44.9	15.7′	N05°55.5	14.6′	55.7′
19	104°02.8	07.0	36°19.6	15.7′	05°40.9	14.7′	55.6′
20	119°02.7	06.8	50°54.3	15.8′	05°26.2	14.6′	55.6′
21	134°02.5	·· 06.7	65°29.1	15.8′	05°11.6	14.7′	55.6′
22	149°02.4	06.5	80°03.9	15.9′	04°56.9	14.6′	55.6′
23	164°02.3	06.3	94°38.8	15.9′	04°42.3	14.7′	55.5′
	SD = 15.7′	*d* = 0.2′	SD = 15.3′				

Tue	**GHA**	**Dec**	**GHA**	*ν*	**Dec**	*d*	**HP**
0	179°02.2	N23°06.2	109°13.7	16.0′	N04°27.6	14.7′	55.5′
1	194°02.1	06.0	123°48.7	16.0′	04°12.9	14.6′	55.5′
2	209°01.9	05.8	138°23.7	16.1′	03°58.3	14.7′	55.4′
3	224°01.8	·· 05.7	152°58.8	16.1′	03°43.6	14.6′	55.4′
4	239°01.7	05.5	167°33.9	16.1′	03°29.0	14.7′	55.4′
5	254°01.6	05.3	182°09.0	16.2′	03°14.3	14.7′	55.4′
6	269°01.5	N23°05.1	196°44.2	16.2′	N02°59.6	14.6′	55.3′
7	284°01.3	05.0	211°19.5	16.3′	02°45.0	14.7′	55.3′
8	299°01.2	04.8	225°54.7	16.3′	02°30.3	14.6′	55.3′
9	314°01.1	·· 04.6	240°30.0	16.3′	02°15.7	14.7′	55.3′
10	329°01.0	04.4	255°05.4	16.4′	02°01.0	14.6′	55.2′
11	344°00.9	04.3	269°40.7	16.4′	01°46.4	14.7′	55.2′
12	359°00.7	N23°04.1	284°16.1	16.4′	N01°31.7	14.6′	55.2′
13	14°00.6	03.9	298°51.6	16.5′	01°17.1	14.6′	55.2′
14	29°00.5	03.7	313°27.1	16.5′	01°02.5	14.6′	55.1′
15	44°00.4	·· 03.5	328°02.5	16.5′	00°47.9	14.6′	55.1′
16	59°00.3	03.4	342°38.1	16.5′	00°33.3	14.6′	55.1′
17	74°00.1	03.2	357°13.6	16.6′	00°18.7	14.5′	55.1′
18	89°00.0	N23°03.0	11°49.2	16.6′	N00°04.2	14.6′	55.0′
19	103°59.9	02.8	26°24.8	16.6′	S00°10.4	14.6′	55.0′
20	118°59.8	02.6	41°00.4	16.6′	00°25.0	14.5′	55.0′
21	133°59.7	·· 02.5	55°36.1	16.7′	00°39.5	14.5′	55.0′
22	148°59.5	02.3	70°11.7	16.7′	00°54.0	14.5′	55.0′
23	163°59.4	02.1	84°47.4	16.7′	01°08.5	14.5′	54.9′
	SD = 15.7′	*d* = 0.2′	SD = 15.1′				

Wed	**GHA**	**Dec**	**GHA**	*ν*	**Dec**	*d*	**HP**
0	178°59.3	N23°01.9	99°23.1	16.7′	S01°23.0	14.5′	54.9′
1	193°59.2	01.7	113°58.8	16.7′	01°37.5	14.4′	54.9′
2	208°59.1	01.5	128°34.5	16.7′	01°51.9	14.5′	54.9′
3	223°58.9	·· 01.3	143°10.3	16.8′	02°06.4	14.4′	54.9′
4	238°58.8	01.2	157°46.0	16.8′	02°20.8	14.4′	54.8′
5	253°58.7	01.0	172°21.8	16.8′	02°35.2	14.4′	54.8′
6	268°58.6	N23°00.8	186°57.6	16.8′	S02°49.6	14.3′	54.8′
7	283°58.5	00.6	201°33.3	16.8′	03°03.9	14.3′	54.8′
8	298°58.4	00.4	216°09.1	16.8′	03°18.2	14.4′	54.8′
9	313°58.2	·· 00.2	230°44.9	16.8′	03°32.6	14.3′	54.7′
10	328°58.1	23°00.0	245°20.7	16.8′	03°46.9	14.2′	54.7′
11	343°58.0	22°59.8	259°56.5	16.8′	04°01.1	14.3′	54.7′
12	358°57.9	N22°59.6	274°32.4	16.8′	S04°15.4	14.2′	54.7′
13	13°57.8	59.4	289°08.2	16.8′	04°29.6	14.2′	54.7′
14	28°57.7	59.2	303°44.0	16.8′	04°43.8	14.1′	54.6′
15	43°57.5	·· 59.0	318°19.8	16.8′	04°57.9	14.2′	54.6′
16	58°57.4	58.8	332°55.6	16.8′	05°12.1	14.1′	54.6′
17	73°57.3	58.6	347°31.4	16.8′	05°26.2	14.1′	54.6′
18	88°57.2	N22°58.4	2°07.2	16.8′	S05°40.3	14.0′	54.6′
19	103°57.1	58.2	16°43.0	16.8′	05°54.3	14.1′	54.6′
20	118°57.0	58.0	31°18.8	16.8′	06°08.4	14.0′	54.5′
21	133°56.8	·· 57.8	45°54.6	16.8′	06°22.4	13.9′	54.5′
22	148°56.7	57.6	60°30.3	16.8′	06°36.3	14.0′	54.5′
23	163°56.6	57.4	75°06.1	16.7′	06°50.3	13.9′	54.5′
	SD = 15.7′	*d* = 0.2′	SD = 15.0′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°						
N 70°						
68°						
66°	////	////	00:22	23:38	////	////
64°	////	////	01:42	22:25	////	////
62°	////	////	02:17	21:50	////	////
60°	////	01:04	02:42	21:25	23:02	////
N 58°	////	01:49	03:02	21:05	22:18	////
56°	////	02:17	03:19	20:49	21:50	////
54°	00:59	02:39	03:32	20:35	21:29	23:07
52°	01:40	02:56	03:45	20:23	21:11	22:27
50°	02:07	03:11	03:55	20:12	20:57	22:00
45°	02:51	03:40	04:17	19:50	20:27	21:17
N 40°	03:21	04:02	04:35	19:33	20:05	20:47
35°	03:44	04:20	04:50	19:18	19:48	20:24
30°	04:02	04:35	05:03	19:05	19:33	20:06
20°	04:31	05:00	05:24	18:44	19:08	19:37
N 10°	04:53	05:20	05:43	18:25	18:48	19:15
0°	05:12	05:38	06:00	18:08	18:30	18:56
S 10°	05:28	05:55	06:17	17:50	18:13	18:40
20°	05:44	06:12	06:36	17:32	17:56	18:24
30°	06:01	06:30	06:57	17:11	17:38	18:07
35°	06:09	06:41	07:09	16:59	17:27	17:59
40°	06:18	06:52	07:23	16:45	17:16	17:50
45°	06:28	07:06	07:39	16:29	17:03	17:40
S 50°	06:40	07:21	08:00	16:09	16:47	17:28
52°	06:45	07:29	08:09	15:59	16:40	17:23
54°	06:51	07:37	08:20	15:48	16:32	17:18
56°	06:57	07:45	08:32	15:36	16:23	17:12
58°	07:03	07:55	08:47	15:21	16:13	17:05
S 60°	07:10	08:07	09:04	15:04	16:01	16:58

Lat.	**Moonrise** Mon	Tue	Wed	**Moonset** Mon	Tue	Wed
N 72°	08:33	10:39	12:39	00:15 23:38	23:05	22:32
N 70°	08:46	10:42	12:32	00:00 23:32	23:07	22:42
68°	08:56	10:44	12:27	23:27	23:08	22:50
66°	09:04	10:45	12:23	23:23	23:10	22:56
64°	09:11	10:47	12:19	23:19	23:11	23:02
62°	09:17	10:48	12:16	23:16	23:11	23:07
60°	09:23	10:49	12:13	23:13	23:12	23:11
N 58°	09:27	10:50	12:10	23:11	23:13	23:15
56°	09:31	10:51	12:08	23:09	23:13	23:18
54°	09:35	10:52	12:06	23:07	23:14	23:21
52°	09:38	10:53	12:05	23:05	23:14	23:24
50°	09:41	10:53	12:03	23:03	23:15	23:26
45°	09:48	10:55	11:59	23:00	23:16	23:32
N 40°	09:53	10:56	11:57	22:57	23:17	23:37
35°	09:58	10:57	11:54	22:54	23:17	23:41
30°	10:02	10:58	11:52	22:52	23:18	23:44
20°	10:09	10:59	11:48	22:48	23:19	23:50
N 10°	10:15	11:00	11:45	22:44	23:20	23:56
0°	10:20	11:02	11:42	22:40	23:21	·· ··
S 10°	10:26	11:03	11:39	22:37	23:22	·· ··
20°	10:32	11:04	11:36	22:33	23:23	·· ··
30°	10:39	11:06	11:32	22:29	23:24	·· ··
35°	10:43	11:07	11:30	22:26	23:24	·· ··
40°	10:47	11:08	11:28	22:24	23:25	·· ··
45°	10:52	11:09	11:25	22:20	23:26	·· ··
S 50°	10:59	11:10	11:22	22:16	23:27	·· ··
52°	11:01	11:11	11:20	22:14	23:27	·· ··
54°	11:04	11:12	11:19	22:12	23:28	·· ··
56°	11:08	11:13	11:17	22:10	23:28	·· ··
58°	11:11	11:13	11:15	22:07	23:29	·· ··
S 60°	11:16	11:14	11:13	22:05	23:30	·· ··

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 5-7 24-42%
30	03:39	03:45	12:04	16:30	04:09	
01	03:51	03:57	12:04	17:11	04:51	
02	04:03	04:08	12:04	17:51	05:31	

July 03, 04, 05 UT (Thu., Fri., Sat.)

	Aries	Venus		Mars		Jupiter		Saturn	
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	281°16.4	224°43.8	N17°13.7	120°22.0	N09°08.2	185°32.2	N23°12.4	278°41.2	S01°19.5
1	296°18.9	239°43.5	14.3	135°23.1	07.6	200°34.1	12.4	293°43.6	19.5
2	311°21.4	254°43.2	15.0	150°24.2	07.0	215°35.9	12.4	308°46.0	19.5
3	326°23.8	269°42.8	·· 15.6	165°25.4	·· 06.5	230°37.7	·· 12.4	323°48.4	·· 19.5
4	341°26.3	284°42.5	16.3	180°26.5	05.9	245°39.6	12.4	338°50.8	19.5
5	356°28.7	299°42.2	16.9	195°27.6	05.3	260°41.4	12.3	353°53.3	19.5
6	11°31.2	314°41.9	N17°17.6	210°28.7	N09°04.7	275°43.3	N23°12.3	8°55.7	S01°19.5
7	26°33.7	329°41.5	18.2	225°29.8	04.2	290°45.1	12.3	23°58.1	19.5
8	41°36.1	344°41.2	18.8	240°30.9	03.6	305°47.0	12.3	39°00.5	19.5
9	56°38.6	359°40.9	·· 19.5	255°32.0	·· 03.0	320°48.8	·· 12.3	54°02.9	·· 19.5
10	71°41.1	14°40.5	20.1	270°33.1	02.4	335°50.7	12.2	69°05.4	19.5
11	86°43.5	29°40.2	20.8	285°34.3	01.8	350°52.5	12.2	84°07.8	19.5
12	101°46.0	44°39.9	N17°21.4	300°35.4	N09°01.3	5°54.4	N23°12.2	99°10.2	S01°19.5
13	116°48.5	59°39.6	22.1	315°36.5	00.7	20°56.2	12.2	114°12.6	19.4
14	131°50.9	74°39.2	22.7	330°37.6	09°00.1	35°58.0	12.2	129°15.1	19.4
15	146°53.4	89°38.9	·· 23.3	345°38.7	08°59.5	50°59.9	·· 12.1	144°17.5	·· 19.4
16	161°55.9	104°38.6	24.0	0°39.8	58.9	66°01.7	12.1	159°19.9	19.4
17	176°58.3	119°38.2	24.6	15°40.9	58.4	81°03.6	12.1	174°22.3	19.4
18	192°00.8	134°37.9	N17°25.3	30°42.0	N08°57.8	96°05.4	N23°12.1	189°24.7	S01°19.4
19	207°03.2	149°37.5	25.9	45°43.2	57.2	111°07.3	12.1	204°27.2	19.4
20	222°05.7	164°37.2	26.5	60°44.3	56.6	126°09.1	12.1	219°29.6	19.4
21	237°08.2	179°36.9	·· 27.2	75°45.4	·· 56.0	141°11.0	·· 12.0	234°32.0	·· 19.4
22	252°10.6	194°36.5	27.8	90°46.5	55.5	156°12.8	12.0	249°34.4	19.4
23	267°13.1	209°36.2	28.4	105°47.6	54.9	171°14.7	12.0	264°36.9	19.4
Mer.pass. 05:14		ν -0.3′	d 0.6′	m -4.13	ν 1.1′	d 0.6′	m 1.50	ν 1.8′	d 0.0′ m -1.89	ν 2.4′	d 0.0′ m 0.95

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	282°15.6	224°35.9	N17°29.1	120°48.7	N08°54.3	186°16.5	N23°12.0	279°39.3	S01°19.4
1	297°18.0	239°35.5	29.7	135°49.8	53.7	201°18.4	12.0	294°41.7	19.4
2	312°20.5	254°35.2	30.3	150°50.9	53.1	216°20.2	11.9	309°44.1	19.4
3	327°23.0	269°34.8	·· 31.0	165°52.0	·· 52.6	231°22.1	·· 11.9	324°46.6	·· 19.4
4	342°25.4	284°34.5	31.6	180°53.2	52.0	246°23.9	11.9	339°49.0	19.4
5	357°27.9	299°34.2	32.2	195°54.3	51.4	261°25.7	11.9	354°51.4	19.4
6	12°30.3	314°33.8	N17°32.9	210°55.4	N08°50.8	276°27.6	N23°11.9	9°53.8	S01°19.4
7	27°32.8	329°33.5	33.5	225°56.5	50.2	291°29.4	11.8	24°56.3	19.4
8	42°35.3	344°33.1	34.1	240°57.6	49.7	306°31.3	11.8	39°58.7	19.4
9	57°37.7	359°32.8	·· 34.8	255°58.7	·· 49.1	321°33.1	·· 11.8	55°01.1	·· 19.3
10	72°40.2	14°32.4	35.4	270°59.8	48.5	336°35.0	11.8	70°03.5	19.3
11	87°42.7	29°32.1	36.0	286°00.9	47.9	351°36.8	11.8	85°06.0	19.3
12	102°45.1	44°31.7	N17°36.6	301°02.0	N08°47.3	6°38.7	N23°11.7	100°08.4	S01°19.3
13	117°47.6	59°31.4	37.3	316°03.2	46.7	21°40.5	11.7	115°10.8	19.3
14	132°50.1	74°31.1	37.9	331°04.3	46.2	36°42.4	11.7	130°13.2	19.3
15	147°52.5	89°30.7	·· 38.5	346°05.4	·· 45.6	51°44.2	·· 11.7	145°15.7	·· 19.3
16	162°55.0	104°30.4	39.2	1°06.5	45.0	66°46.1	11.7	160°18.1	19.3
17	177°57.5	119°30.0	39.8	16°07.6	44.4	81°47.9	11.6	175°20.5	19.3
18	192°59.9	134°29.7	N17°40.4	31°08.7	N08°43.8	96°49.8	N23°11.6	190°23.0	S01°19.3
19	208°02.4	149°29.3	41.0	46°09.8	43.3	111°51.6	11.6	205°25.4	19.3
20	223°04.8	164°29.0	41.7	61°10.9	42.7	126°53.4	11.6	220°27.8	19.3
21	238°07.3	179°28.6	·· 42.3	76°12.0	·· 42.1	141°55.3	·· 11.5	235°30.2	·· 19.3
22	253°09.8	194°28.3	42.9	91°13.1	41.5	156°57.1	11.5	250°32.7	19.3
23	268°12.2	209°27.9	43.5	106°14.3	40.9	171°59.0	11.5	265°35.1	19.3
Mer.pass. 05:10		ν -0.3′	d 0.6′	m -4.12	ν 1.1′	d 0.6′	m 1.51	ν 1.8′	d 0.0′ m -1.89	ν 2.4′	d 0.0′ m 0.94

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	283°14.7	224°27.6	N17°44.1	121°15.4	N08°40.3	187°00.8	N23°11.5	280°37.5	S01°19.3
1	298°17.2	239°27.2	44.8	136°16.5	39.8	202°02.7	11.5	295°39.9	19.3
2	313°19.6	254°26.8	45.4	151°17.6	39.2	217°04.5	11.4	310°42.4	19.3
3	328°22.1	269°26.5	·· 46.0	166°18.7	·· 38.6	232°06.4	·· 11.4	325°44.8	·· 19.3
4	343°24.6	284°26.1	46.6	181°19.8	38.0	247°08.2	11.4	340°47.2	19.3
5	358°27.0	299°25.8	47.2	196°20.9	37.4	262°10.1	11.4	355°49.7	19.3
6	13°29.5	314°25.4	N17°47.9	211°22.0	N08°36.8	277°11.9	N23°11.4	10°52.1	S01°19.3
7	28°32.0	329°25.1	48.5	226°23.1	36.2	292°13.8	11.3	25°54.5	19.3
8	43°34.4	344°24.7	49.1	241°24.2	35.7	307°15.6	11.3	40°57.0	19.3
9	58°36.9	359°24.3	·· 49.7	256°25.4	·· 35.1	322°17.5	·· 11.3	55°59.4	·· 19.3
10	73°39.3	14°24.0	50.3	271°26.5	34.5	337°19.3	11.3	71°01.8	19.3
11	88°41.8	29°23.6	51.0	286°27.6	33.9	352°21.2	11.3	86°04.2	19.3
12	103°44.3	44°23.3	N17°51.6	301°28.7	N08°33.3	7°23.0	N23°11.2	101°06.7	S01°19.3
13	118°46.7	59°22.9	52.2	316°29.8	32.7	22°24.8	11.2	116°09.1	19.3
14	133°49.2	74°22.5	52.8	331°30.9	32.2	37°26.7	11.2	131°11.5	19.3
15	148°51.7	89°22.2	·· 53.4	346°32.0	·· 31.6	52°28.5	·· 11.2	146°14.0	·· 19.3
16	163°54.1	104°21.8	54.0	1°33.1	31.0	67°30.4	11.2	161°16.4	19.3
17	178°56.6	119°21.5	54.6	16°34.2	30.4	82°32.2	11.1	176°18.8	19.3
18	193°59.1	134°21.1	N17°55.2	31°35.3	N08°29.8	97°34.1	N23°11.1	191°21.3	S01°19.2
19	209°01.5	149°20.7	55.9	46°36.4	29.2	112°35.9	11.1	206°23.7	19.2
20	224°04.0	164°20.4	56.5	61°37.6	28.6	127°37.8	11.1	221°26.1	19.2
21	239°06.4	179°20.0	·· 57.1	76°38.7	·· 28.1	142°39.6	·· 11.0	236°28.5	·· 19.2
22	254°08.9	194°19.6	57.7	91°39.8	27.5	157°41.5	11.0	251°31.0	19.2
23	269°11.4	209°19.3	58.3	106°40.9	26.9	172°43.3	11.0	266°33.4	19.2
Mer.pass. 05:06		ν -0.4′	d 0.6′	m -4.12	ν 1.1′	d 0.6′	m 1.51	ν 1.8′	d 0.0′ m -1.89	ν 2.4′	d 0.0′ m 0.94

Stars

	SHA	Dec
Alpheratz	357°34.3	29°13.8
Ankaa	353°06.7	-42°09.8
Schedar	349°30.6	56°40.4
Diphda	348°46.9	-17°50.6
Achernar	335°20.0	-57°06.1
Hamal	327°50.9	23°34.9
Polaris	314°07.0	89°22.0
Acamar	315°11.7	-40°11.9
Menkar	314°05.9	4°11.4
Mirfak	308°28.0	49°56.9
Aldebaran	290°39.5	16°33.6
Rigel	281°03.8	-8°10.3
Capella	280°21.7	46°01.3
Bellatrix	278°22.8	6°22.4
Elnath	278°01.7	28°37.7
Alnilam	275°37.6	-1°11.1
Betelgeuse	270°52.0	7°24.7
Canopus	263°52.8	-52°42.4
Sirius	258°26.2	-16°45.0
Adhara	255°05.9	-29°00.3
Procyon	244°50.7	5°09.6
Pollux	243°17.2	27°57.9
Avior	234°15.2	-59°35.5
Suhail	222°46.4	-43°32.2
Miaplacidus	221°39.0	-69°49.4
Alphard	217°47.6	-8°46.2
Regulus	207°34.2	11°50.6
Dubhe	193°40.8	61°37.1
Denebola	182°24.6	14°25.9
Gienah	175°43.2	-17°41.1
Acrux	172°59.7	-63°14.7
Gacrux	171°51.3	-57°15.6
Alioth	166°12.6	55°49.5
Spica	158°21.8	-11°17.7
Alkaid	152°51.5	49°11.4
Hadar	148°35.2	-60°30.0
Menkent	147°57.0	-36°29.9
Arcturus	145°47.4	19°03.1
Rigil Kent.	139°39.4	-60°56.7
Kochab	137°19.1	74°03.2
Zuben'ubi	136°55.4	-16°08.9
Alphecca	126°03.1	26°37.8
Antares	112°15.0	-26°29.4
Atria	107°08.4	-69°04.5
Sabik	102°02.0	-15°45.4
Shaula	96°09.4	-37°07.4
Rasalhague	95°57.8	12°32.5
Eltanin	90°41.5	51°29.1
Kaus Aust.	83°31.6	-34°22.3
Vega	80°32.5	38°48.4
Nunki	75°46.9	-26°15.9
Altair	61°59.2	8°56.1
Peacock	53°04.5	-56°39.0
Deneb	49°25.1	45°22.2
Enif	33°38.2	9°59.5
Al Na'ir	27°32.1	-46°50.0
Fomalhaut	15°13.9	-29°29.0
Scheat	13°44.7	28°13.2
Markab	13°29.4	15°20.5

Jul 03 Thu	SHA	Mer.pass
Venus	303°27.4	09:01
Mars	199°05.6	15:57
Jupiter	264°15.8	11:36
Saturn	357°24.7	05:24

Jul 04 Fri	SHA	Mer.pass
Venus	302°20.3	09:02
Mars	198°33.1	15:56
Jupiter	264°00.9	11:33
Saturn	357°23.7	05:21

Jul 05 Sat	SHA	Mer.pass
Venus	301°12.9	09:02
Mars	198°00.7	15:54
Jupiter	263°46.1	11:31
Saturn	357°22.8	05:17

Horizontal parallax	
Venus:	0.2
Mars:	0.1

h	Sun		Moon				
Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°56.5	N22°57.2	89°41.8	16.7′	S07°04.2	13.8′	54.5′
1	193°56.4	57.0	104°17.6	16.7′	07°18.0	13.9′	54.5′
2	208°56.3	56.8	118°53.3	16.7′	07°31.9	13.8′	54.5′
3	223°56.2	·· 56.6	133°29.0	16.7′	07°45.7	13.7′	54.4′
4	238°56.0	56.4	148°04.7	16.7′	07°59.4	13.8′	54.4′
5	253°55.9	56.2	162°40.4	16.7′	08°13.2	13.7′	54.4′
6	268°55.8	N22°56.0	177°16.0	16.6′	S08°26.9	13.6′	54.4′
7	283°55.7	55.8	191°51.7	16.6′	08°40.5	13.6′	54.4′
8	298°55.6	55.6	206°27.3	16.6′	08°54.1	13.6′	54.4′
9	313°55.5	·· 55.4	221°02.9	16.6′	09°07.7	13.6′	54.4′
10	328°55.4	55.2	235°38.4	16.5′	09°21.3	13.5′	54.4′
11	343°55.2	55.0	250°14.0	16.5′	09°34.8	13.4′	54.3′
12	358°55.1	N22°54.8	264°49.5	16.5′	S09°48.2	13.5′	54.3′
13	13°55.0	54.5	279°25.0	16.5′	10°01.7	13.3′	54.3′
14	28°54.9	54.3	294°00.5	16.4′	10°15.0	13.4′	54.3′
15	43°54.8	·· 54.1	308°35.9	16.4′	10°28.4	13.3′	54.3′
16	58°54.7	53.9	323°11.3	16.4′	10°41.7	13.2′	54.3′
17	73°54.6	53.7	337°46.7	16.3′	10°54.9	13.2′	54.3′
18	88°54.4	N22°53.5	352°22.1	16.3′	S11°08.1	13.2′	54.3′
19	103°54.3	53.3	6°57.4	16.3′	11°21.3	13.1′	54.3′
20	118°54.2	53.0	21°32.7	16.2′	11°34.4	13.1′	54.3′
21	133°54.1	·· 52.8	36°07.9	16.2′	11°47.5	13.0′	54.2′
22	148°54.0	52.6	50°43.1	16.2′	12°00.5	13.0′	54.2′
23	163°53.9	52.4	65°18.3	16.1′	12°13.5	13.0′	54.2′
	SD = 15.7′	d = 0.2′	SD = 14.9′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°53.8	N22°52.2	79°53.4	16.1′	S12°26.5	12.8′	54.2′
1	193°53.7	52.0	94°28.5	16.1′	12°39.3	12.9′	54.2′
2	208°53.5	51.7	109°03.6	16.0′	12°52.2	12.8′	54.2′
3	223°53.4	·· 51.5	123°38.6	16.0′	13°05.0	12.7′	54.2′
4	238°53.3	51.3	138°13.6	15.9′	13°17.7	12.7′	54.2′
5	253°53.2	51.1	152°48.5	15.9′	13°30.4	12.6′	54.2′
6	268°53.1	N22°50.8	167°23.4	15.8′	S13°43.0	12.6′	54.2′
7	283°53.0	50.6	181°58.3	15.8′	13°55.6	12.5′	54.2′
8	298°52.9	50.4	196°33.1	15.8′	14°08.1	12.5′	54.2′
9	313°52.8	·· 50.2	211°07.8	15.7′	14°20.6	12.4′	54.2′
10	328°52.7	50.0	225°42.5	15.7′	14°33.0	12.3′	54.2′
11	343°52.5	49.7	240°17.2	15.6′	14°45.3	12.3′	54.2′
12	358°52.4	N22°49.5	254°51.8	15.6′	S14°57.6	12.3′	54.1′
13	13°52.3	49.3	269°26.3	15.5′	15°09.9	12.1′	54.1′
14	28°52.2	49.0	284°00.9	15.5′	15°22.0	12.2′	54.1′
15	43°52.1	·· 48.8	298°35.3	15.4′	15°34.2	12.0′	54.1′
16	58°52.0	48.6	313°09.7	15.3′	15°46.2	12.0′	54.1′
17	73°51.9	48.4	327°44.1	15.3′	15°58.2	12.0′	54.1′
18	88°51.8	N22°48.1	342°18.3	15.2′	S16°10.2	11.8′	54.1′
19	103°51.7	47.9	356°52.6	15.2′	16°22.0	11.8′	54.1′
20	118°51.6	47.7	11°26.8	15.1′	16°33.8	11.8′	54.1′
21	133°51.5	·· 47.4	26°00.9	15.1′	16°45.6	11.7′	54.1′
22	148°51.3	47.2	40°34.9	15.0′	16°57.3	11.6′	54.1′
23	163°51.2	47.0	55°08.9	14.9′	17°08.9	11.5′	54.1′
	SD = 15.7′	d = 0.2′	SD = 14.8′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°51.1	N22°46.7	69°42.9	14.9′	S17°20.4	11.5′	54.1′
1	193°51.0	46.5	84°16.8	14.8′	17°31.9	11.5′	54.1′
2	208°50.9	46.2	98°50.6	14.8′	17°43.4	11.3′	54.1′
3	223°50.8	·· 46.0	113°24.4	14.7′	17°54.7	11.3′	54.1′
4	238°50.7	45.8	127°58.1	14.6′	18°06.0	11.2′	54.1′
5	253°50.6	45.5	142°31.7	14.6′	18°17.2	11.1′	54.1′
6	268°50.5	N22°45.3	157°05.3	14.5′	S18°28.3	11.1′	54.1′
7	283°50.4	45.1	171°38.8	14.4′	18°39.4	11.0′	54.1′
8	298°50.3	44.8	186°12.2	14.4′	18°50.4	10.9′	54.1′
9	313°50.2	·· 44.6	200°45.6	14.3′	19°01.3	10.8′	54.1′
10	328°50.1	44.3	215°18.9	14.2′	19°12.1	10.8′	54.1′
11	343°49.9	44.1	229°52.1	14.2′	19°22.9	10.7′	54.1′
12	358°49.8	N22°43.8	244°25.3	14.1′	S19°33.6	10.6′	54.1′
13	13°49.7	43.6	258°58.3	14.0′	19°44.2	10.6′	54.1′
14	28°49.6	43.4	273°31.4	14.0′	19°54.8	10.4′	54.1′
15	43°49.5	·· 43.1	288°04.3	13.9′	20°05.2	10.4′	54.1′
16	58°49.4	42.9	302°37.2	13.8′	20°15.6	10.3′	54.1′
17	73°49.3	42.6	317°10.0	13.7′	20°25.9	10.2′	54.1′
18	88°49.2	N22°42.4	331°42.8	13.7′	S20°36.1	10.1′	54.2′
19	103°49.1	42.1	346°15.4	13.6′	20°46.2	10.1′	54.2′
20	118°49.0	41.9	0°48.0	13.5′	20°56.3	9.9′	54.2′
21	133°48.9	·· 41.6	15°20.5	13.4′	21°06.2	9.9′	54.2′
22	148°48.8	41.4	29°53.0	13.4′	21°16.1	9.8′	54.2′
23	163°48.7	41.1	44°25.3	13.3′	21°25.9	9.7′	54.2′
	SD = 15.7′	d = 0.2′	SD = 14.8′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	▭	▭	▭	▭	▭	▭
N 70°	▭	▭	▭	▭	▭	▭
68°	▭	▭	▭	▭	▭	▭
66°	////	////	00:43	23:21	////	////
64°	////	////	01:48	22:20	////	////
62°	////	////	02:21	21:46	////	////
60°	////	01:12	02:46	21:22	22:55	////
N 58°	////	01:54	03:05	21:03	22:14	////
56°	////	02:21	03:21	20:47	21:47	////
54°	01:06	02:42	03:35	20:34	21:26	23:01
52°	01:45	02:59	03:47	20:22	21:09	22:23
50°	02:10	03:13	03:57	20:11	20:55	21:58
45°	02:53	03:42	04:19	19:50	20:27	21:15
N 40°	03:23	04:04	04:37	19:32	20:05	20:46
35°	03:45	04:22	04:51	19:18	19:47	20:23
30°	04:03	04:37	05:04	19:05	19:32	20:05
20°	04:32	05:01	05:25	18:44	19:08	19:37
N 10°	04:54	05:21	05:44	18:25	18:48	19:15
0°	05:12	05:38	06:01	18:08	18:31	18:57
S 10°	05:29	05:55	06:18	17:51	18:14	18:40
20°	05:45	06:12	06:36	17:33	17:57	18:25
30°	06:01	06:30	06:56	17:13	17:39	18:09
35°	06:09	06:40	07:08	17:01	17:29	18:00
40°	06:18	06:52	07:22	16:47	17:17	17:51
45°	06:28	07:05	07:39	16:31	17:04	17:41
S 50°	06:39	07:20	07:59	16:11	16:49	17:30
52°	06:44	07:28	08:08	16:01	16:42	17:25
54°	06:50	07:36	08:19	15:50	16:34	17:20
56°	06:56	07:44	08:31	15:38	16:25	17:14
58°	07:02	07:54	08:45	15:24	16:15	17:07
S 60°	07:09	08:05	09:02	15:08	16:04	17:00

Lat.	**Moonrise** Thu	Fri	Sat	**Moonset** Thu	Fri	Sat
N 72°	14:44	17:21	▬	21:52	20:43	▬
N 70°	14:26	16:36	▬	22:12	21:29	▬
68°	14:12	16:07	18:34	22:28	22:00	21:04
66°	14:01	15:45	17:44	22:41	22:23	21:55
64°	13:51	15:28	17:13	22:52	22:41	22:27
62°	13:43	15:14	16:50	23:02	22:57	22:51
60°	13:36	15:02	16:31	23:10	23:09	23:10
N 58°	13:30	14:52	16:16	23:17	23:20	23:26
56°	13:25	14:43	16:03	23:23	23:30	23:39
54°	13:20	14:35	15:52	23:29	23:38	23:51
52°	13:16	14:28	15:42	23:34	23:46	·· ··
50°	13:12	14:22	15:33	23:39	23:53	·· ··
45°	13:04	14:09	15:15	23:49	·· ··	00:08
N 40°	12:57	13:58	15:00	23:57	·· ··	00:20
35°	12:51	13:48	14:47	·· ··	00:05	00:31
30°	12:46	13:40	14:36	·· ··	00:11	00:40
20°	12:37	13:26	14:17	·· ··	00:22	00:56
N 10°	12:29	13:14	14:01	·· ··	00:32	01:10
0°	12:22	13:03	13:46	00:01	00:41	01:23
S 10°	12:14	12:51	13:31	00:06	00:51	01:36
20°	12:07	12:40	13:15	00:12	01:00	01:51
30°	11:58	12:26	12:57	00:18	01:12	02:07
35°	11:53	12:18	12:46	00:21	01:19	02:17
40°	11:48	12:09	12:34	00:26	01:26	02:27
45°	11:41	11:59	12:20	00:30	01:35	02:40
S 50°	11:34	11:47	12:03	00:36	01:46	02:56
52°	11:30	11:41	11:55	00:39	01:51	03:04
54°	11:26	11:35	11:46	00:42	01:56	03:12
56°	11:22	11:28	11:36	00:45	02:02	03:21
58°	11:17	11:20	11:24	00:49	02:09	03:32
S 60°	11:12	11:11	11:11	00:53	02:17	03:44

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 8-10 52-70%
03	04:14	04:20	12:04	18:31	06:11	
04	04:25	04:30	12:05	19:13	06:52	
05	04:35	04:41	12:05	19:57	07:34	

July 06, 07, 08 UT (Sun., Mon., Tue.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	284°13.8	224°18.9	N17°58.9	121°42.0	N08°26.3	187°45.2	N23°11.0	281°35.8	S01°19.2
1	299°16.3	239°18.5	17°59.5	136°43.1	25.7	202°47.0	11.0	296°38.3	19.2
2	314°18.8	254°18.2	18°00.1	151°44.2	25.1	217°48.9	10.9	311°40.7	19.2
3	329°21.2	269°17.8	·· 00.7	166°45.3	·· 24.5	232°50.7	·· 10.9	326°43.1	·· 19.2
4	344°23.7	284°17.4	01.3	181°46.4	24.0	247°52.6	10.9	341°45.6	19.2
5	359°26.2	299°17.1	01.9	196°47.5	23.4	262°54.4	10.9	356°48.0	19.2
6	14°28.6	314°16.7	N18°02.5	211°48.6	N08°22.8	277°56.3	N23°10.9	11°50.4	S01°19.2
7	29°31.1	329°16.3	03.2	226°49.7	22.2	292°58.1	10.8	26°52.9	19.2
8	44°33.6	344°15.9	03.8	241°50.9	21.6	308°00.0	10.8	41°55.3	19.2
9	59°36.0	359°15.6	·· 04.4	256°52.0	·· 21.0	323°01.8	·· 10.8	56°57.7	·· 19.2
10	74°38.5	14°15.2	05.0	271°53.1	20.4	338°03.6	10.8	72°00.2	19.2
11	89°40.9	29°14.8	05.6	286°54.2	19.9	353°05.5	10.7	87°02.6	19.2
12	104°43.4	44°14.5	N18°06.2	301°55.3	N08°19.3	8°07.3	N23°10.7	102°05.0	S01°19.2
13	119°45.9	59°14.1	06.8	316°56.4	18.7	23°09.2	10.7	117°07.5	19.2
14	134°48.3	74°13.7	07.4	331°57.5	18.1	38°11.0	10.7	132°09.9	19.2
15	149°50.8	89°13.3	·· 08.0	346°58.6	·· 17.5	53°12.9	·· 10.7	147°12.3	·· 19.2
16	164°53.3	104°13.0	08.6	1°59.7	16.9	68°14.7	10.6	162°14.8	19.2
17	179°55.7	119°12.6	09.2	17°00.8	16.3	83°16.6	10.6	177°17.2	19.2
18	194°58.2	134°12.2	N18°09.8	32°01.9	N08°15.7	98°18.4	N23°10.6	192°19.6	S01°19.2
19	210°00.7	149°11.8	10.4	47°03.0	15.1	113°20.3	10.6	207°22.1	19.2
20	225°03.1	164°11.4	11.0	62°04.1	14.6	128°22.1	10.5	222°24.5	19.2
21	240°05.6	179°11.1	·· 11.6	77°05.3	·· 14.0	143°24.0	·· 10.5	237°26.9	·· 19.2
22	255°08.1	194°10.7	12.1	92°06.4	13.4	158°25.8	10.5	252°29.4	19.2
23	270°10.5	209°10.3	12.7	107°07.5	12.8	173°27.7	10.5	267°31.8	19.2
Mer.pass. 05:02		ν -0.4′	d 0.6′	m -4.11	ν 1.1′	d 0.6′	m 1.52	ν 1.8′	d 0.0′ m -1.89	ν 2.4′	d 0.0′ m 0.93

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	285°13.0	224°09.9	N18°13.3	122°08.6	N08°12.2	188°29.5	N23°10.5	282°34.3	S01°19.2
1	300°15.4	239°09.5	13.9	137°09.7	11.6	203°31.4	10.4	297°36.7	19.2
2	315°17.9	254°09.2	14.5	152°10.8	11.0	218°33.2	10.4	312°39.1	19.2
3	330°20.4	269°08.8	·· 15.1	167°11.9	·· 10.4	233°35.1	·· 10.4	327°41.6	·· 19.2
4	345°22.8	284°08.4	15.7	182°13.0	09.9	248°36.9	10.4	342°44.0	19.2
5	0°25.3	299°08.0	16.3	197°14.1	09.3	263°38.8	10.3	357°46.4	19.2
6	15°27.8	314°07.6	N18°16.9	212°15.2	N08°08.7	278°40.6	N23°10.3	12°48.9	S01°19.2
7	30°30.2	329°07.2	17.5	227°16.3	08.1	293°42.5	10.3	27°51.3	19.2
8	45°32.7	344°06.9	18.1	242°17.4	07.5	308°44.3	10.3	42°53.7	19.2
9	60°35.2	359°06.5	·· 18.7	257°18.5	·· 06.9	323°46.2	·· 10.2	57°56.2	·· 19.2
10	75°37.6	14°06.1	19.3	272°19.6	06.3	338°48.0	10.2	72°58.6	19.2
11	90°40.1	29°05.7	19.8	287°20.8	05.7	353°49.9	10.2	88°01.1	19.2
12	105°42.6	44°05.3	N18°20.4	302°21.9	N08°05.1	8°51.7	N23°10.2	103°03.5	S01°19.2
13	120°45.0	59°04.9	21.0	317°23.0	04.5	23°53.6	10.2	118°05.9	19.2
14	135°47.5	74°04.5	21.6	332°24.1	04.0	38°55.4	10.1	133°08.4	19.2
15	150°49.9	89°04.1	·· 22.2	347°25.2	·· 03.4	53°57.3	·· 10.1	148°10.8	·· 19.2
16	165°52.4	104°03.7	22.8	2°26.3	02.8	68°59.1	10.1	163°13.3	19.2
17	180°54.9	119°03.4	23.4	17°27.4	02.2	84°01.0	10.1	178°15.7	19.2
18	195°57.3	134°03.0	N18°23.9	32°28.5	N08°01.6	99°02.8	N23°10.0	193°18.1	S01°19.2
19	210°59.8	149°02.6	24.5	47°29.6	01.0	114°04.7	10.0	208°20.6	19.2
20	226°02.3	164°02.2	25.1	62°30.7	08°00.4	129°06.5	10.0	223°23.0	19.2
21	241°04.7	179°01.8	·· 25.7	77°31.8	07°59.8	144°08.4	·· 10.0	238°25.4	·· 19.2
22	256°07.2	194°01.4	26.3	92°32.9	59.2	159°10.2	09.9	253°27.9	19.2
23	271°09.7	209°01.0	26.8	107°34.0	58.6	174°12.1	09.9	268°30.3	19.2
Mer.pass. 04:58		ν -0.4′	d 0.6′	m -4.11	ν 1.1′	d 0.6′	m 1.52	ν 1.8′	d 0.0′ m -1.89	ν 2.4′	d 0.0′ m 0.93

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	286°12.1	224°00.6	N18°27.4	122°35.1	N07°58.0	189°13.9	N23°09.9	283°32.8	S01°19.2
1	301°14.6	239°00.2	28.0	137°36.2	57.5	204°15.8	09.9	298°35.2	19.2
2	316°17.0	253°59.8	28.6	152°37.3	56.9	219°17.6	09.9	313°37.6	19.3
3	331°19.5	268°59.4	·· 29.2	167°38.5	·· 56.3	234°19.5	·· 09.8	328°40.1	·· 19.3
4	346°22.0	283°59.0	29.7	182°39.6	55.7	249°21.3	09.8	343°42.5	19.3
5	1°24.4	298°58.6	30.3	197°40.7	55.1	264°23.1	09.8	358°45.0	19.3
6	16°26.9	313°58.2	N18°30.9	212°41.8	N07°54.5	279°25.0	N23°09.8	13°47.4	S01°19.3
7	31°29.4	328°57.8	31.5	227°42.9	53.9	294°26.8	09.7	28°49.8	19.3
8	46°31.8	343°57.4	32.0	242°44.0	53.3	309°28.7	09.7	43°52.3	19.3
9	61°34.3	358°57.0	·· 32.6	257°45.1	·· 52.7	324°30.5	·· 09.7	58°54.7	·· 19.3
10	76°36.8	13°56.6	33.2	272°46.2	52.1	339°32.4	09.7	73°57.2	19.3
11	91°39.2	28°56.2	33.8	287°47.3	51.5	354°34.2	09.6	88°59.6	19.3
12	106°41.7	43°55.8	N18°34.3	302°48.4	N07°50.9	9°36.1	N23°09.6	104°02.1	S01°19.3
13	121°44.2	58°55.4	34.9	317°49.5	50.4	24°37.9	09.6	119°04.5	19.3
14	136°46.6	73°55.0	35.5	332°50.6	49.8	39°39.8	09.6	134°06.9	19.3
15	151°49.1	88°54.6	·· 36.1	347°51.7	·· 49.2	54°41.6	·· 09.5	149°09.4	·· 19.3
16	166°51.5	103°54.2	36.6	2°52.8	48.6	69°43.5	09.5	164°11.8	19.3
17	181°54.0	118°53.8	37.2	17°53.9	48.0	84°45.3	09.5	179°14.3	19.3
18	196°56.5	133°53.4	N18°37.8	32°55.0	N07°47.4	99°47.2	N23°09.5	194°16.7	S01°19.3
19	211°58.9	148°53.0	38.3	47°56.1	46.8	114°49.0	09.4	209°19.1	19.3
20	227°01.4	163°52.6	38.9	62°57.2	46.2	129°50.9	09.4	224°21.6	19.3
21	242°03.9	178°52.2	·· 39.5	77°58.3	·· 45.6	144°52.7	·· 09.4	239°24.0	·· 19.3
22	257°06.3	193°51.8	40.0	92°59.4	45.0	159°54.6	09.4	254°26.5	19.3
23	272°08.8	208°51.4	40.6	108°00.6	44.4	174°56.4	09.4	269°28.9	19.3
Mer.pass. 04:54		ν -0.4′	d 0.6′	m -4.10	ν 1.1′	d 0.6′	m 1.53	ν 1.8′	d 0.0′ m -1.89	ν 2.4′	d 0.0′ m 0.92

Stars

	SHA	**Dec**
Alpheratz	357°34.3	29°13.8
Ankaa	353°06.7	-42°09.8
Schedar	349°30.5	56°40.4
Diphda	348°46.9	-17°50.6
Achernar	335°20.0	-57°06.1
Hamal	327°50.8	23°34.9
Polaris	314°05.5	89°22.0
Acamar	315°11.7	-40°11.9
Menkar	314°05.9	4°11.4
Mirfak	308°28.0	49°56.9
Aldebaran	290°39.4	16°33.6
Rigel	281°03.8	-8°10.2
Capella	280°21.7	46°01.3
Bellatrix	278°22.8	6°22.4
Elnath	278°01.7	28°37.7
Alnilam	275°37.6	-1°11.1
Betelgeuse	270°52.0	7°24.7
Canopus	263°52.8	-52°42.4
Sirius	258°26.2	-16°45.0
Adhara	255°05.9	-29°00.3
Procyon	244°50.7	5°09.6
Pollux	243°17.2	27°57.9
Avior	234°15.2	-59°35.5
Suhail	222°46.4	-43°32.2
Miaplacidus	221°39.0	-69°49.4
Alphard	217°47.6	-8°46.1
Regulus	207°34.2	11°50.6
Dubhe	193°40.8	61°37.1
Denebola	182°24.6	14°25.9
Gienah	175°43.2	-17°41.1
Acrux	172°59.8	-63°14.7
Gacrux	171°51.3	-57°15.6
Alioth	166°12.6	55°49.5
Spica	158°21.8	-11°17.7
Alkaid	152°51.6	49°11.4
Hadar	148°35.2	-60°30.0
Menkent	147°57.0	-36°29.9
Arcturus	145°47.4	19°03.1
Rigil Kent.	139°39.5	-60°56.7
Kochab	137°19.2	74°03.3
Zuben'ubi	136°55.4	-16°08.9
Alphecca	126°03.1	26°37.8
Antares	112°15.0	-26°29.4
Atria	107°08.4	-69°04.5
Sabik	102°02.0	-15°45.4
Shaula	96°09.4	-37°07.4
Rasalhague	95°57.8	12°32.5
Eltanin	90°41.5	51°29.2
Kaus Aust.	83°31.6	-34°22.3
Vega	80°32.5	38°48.4
Nunki	75°46.9	-26°15.9
Altair	61°59.2	8°56.2
Peacock	53°04.5	-56°39.0
Deneb	49°25.1	45°22.2
Enif	33°38.1	9°59.5
Al Na'ir	27°32.1	-46°50.0
Fomalhaut	15°13.9	-29°29.0
Scheat	13°44.6	28°13.2
Markab	13°29.3	15°20.5

Jul 06 Sun	**SHA**	**Mer.pass**
Venus	300°05.1	09:03
Mars	197°28.1	15:52
Jupiter	263°31.3	11:28
Saturn	357°22.0	05:13

Jul 07 Mon	**SHA**	**Mer.pass**
Venus	298°56.9	09:04
Mars	196°55.6	15:50
Jupiter	263°16.5	11:25
Saturn	357°21.3	05:09

Jul 08 Tue	**SHA**	**Mer.pass**
Venus	297°48.5	09:04
Mars	196°23.0	15:48
Jupiter	263°01.8	11:22
Saturn	357°20.6	05:05

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°48.6	N22°40.9	58°57.6	13.2′	S21°35.6	9.6′	54.2′
1	193°48.5	40.6	73°29.8	13.1′	21°45.2	9.5′	54.2′
2	208°48.4	40.4	88°02.0	13.1′	21°54.7	9.5′	54.2′
3	223°48.3	·· 40.1	102°34.0	13.0′	22°04.2	9.3′	54.2′
4	238°48.2	39.8	117°06.0	12.9′	22°13.5	9.3′	54.2′
5	253°48.1	39.6	131°37.9	12.8′	22°22.8	9.1′	54.2′
6	268°48.0	N22°39.3	146°09.8	12.8′	S22°31.9	9.1′	54.2′
7	283°47.9	39.1	160°41.5	12.7′	22°41.0	9.0′	54.2′
8	298°47.7	38.8	175°13.2	12.6′	22°50.0	8.9′	54.2′
9	313°47.6	·· 38.6	189°44.8	12.5′	22°58.9	8.7′	54.2′
10	328°47.5	38.3	204°16.3	12.4′	23°07.6	8.7′	54.3′
11	343°47.4	38.0	218°47.7	12.4′	23°16.3	8.6′	54.3′
12	358°47.3	N22°37.8	233°19.1	12.3′	S23°24.9	8.5′	54.3′
13	13°47.2	37.5	247°50.4	12.2′	23°33.4	8.4′	54.3′
14	28°47.1	37.3	262°21.6	12.1′	23°41.8	8.2′	54.3′
15	43°47.0	·· 37.0	276°52.7	12.0′	23°50.0	8.2′	54.3′
16	58°46.9	36.7	291°23.7	12.0′	23°58.2	8.1′	54.3′
17	73°46.8	36.5	305°54.7	11.9′	24°06.3	7.9′	54.3′
18	88°46.7	N22°36.2	320°25.6	11.8′	S24°14.2	7.9′	54.3′
19	103°46.6	35.9	334°56.4	11.7′	24°22.1	7.8′	54.3′
20	118°46.5	35.7	349°27.1	11.6′	24°29.9	7.6′	54.3′
21	133°46.4	·· 35.4	3°57.7	11.6′	24°37.5	7.6′	54.4′
22	148°46.3	35.2	18°28.3	11.5′	24°45.1	7.4′	54.4′
23	163°46.2	34.9	32°58.8	11.4′	24°52.5	7.3′	54.4′
	SD = 15.7′	d = 0.3′	SD = 14.8′				

Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°46.1	N22°34.6	47°29.2	11.3′	S24°59.8	7.2′	54.4′
1	193°46.0	34.3	61°59.5	11.2′	25°07.0	7.1′	54.4′
2	208°45.9	34.1	76°29.7	11.2′	25°14.1	7.0′	54.4′
3	223°45.8	·· 33.8	90°59.9	11.1′	25°21.1	6.9′	54.4′
4	238°45.7	33.5	105°30.0	11.0′	25°28.0	6.7′	54.4′
5	253°45.6	33.3	120°00.0	10.9′	25°34.7	6.6′	54.4′
6	268°45.5	N22°33.0	134°29.9	10.9′	S25°41.3	6.6′	54.5′
7	283°45.4	32.7	148°59.8	10.8′	25°47.9	6.4′	54.5′
8	298°45.3	32.4	163°29.6	10.7′	25°54.3	6.2′	54.5′
9	313°45.2	·· 32.2	177°59.3	10.6′	26°00.5	6.2′	54.5′
10	328°45.1	31.9	192°28.9	10.5′	26°06.7	6.0′	54.5′
11	343°45.0	31.6	206°58.4	10.5′	26°12.7	6.0′	54.5′
12	358°44.9	N22°31.3	221°27.9	10.4′	S26°18.7	5.8′	54.5′
13	13°44.8	31.1	235°57.3	10.3′	26°24.5	5.6′	54.5′
14	28°44.7	30.8	250°26.6	10.3′	26°30.1	5.6′	54.6′
15	43°44.6	·· 30.5	264°55.9	10.2′	26°35.7	5.4′	54.6′
16	58°44.5	30.2	279°25.1	10.1′	26°41.1	5.3′	54.6′
17	73°44.4	30.0	293°54.2	10.0′	26°46.4	5.2′	54.6′
18	88°44.3	N22°29.7	308°23.2	10.0′	S26°51.6	5.0′	54.6′
19	103°44.2	29.4	322°52.2	9.9′	26°56.6	4.9′	54.6′
20	118°44.1	29.1	337°21.0	9.8′	27°01.5	4.8′	54.6′
21	133°44.1	·· 28.8	351°49.9	9.8′	27°06.3	4.6′	54.7′
22	148°44.0	28.5	6°18.6	9.7′	27°10.9	4.5′	54.7′
23	163°43.9	28.3	20°47.3	9.6′	27°15.4	4.4′	54.7′
	SD = 15.7′	d = 0.3′	SD = 14.8′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°43.8	N22°28.0	35°15.9	9.6′	S27°19.8	4.3′	54.7′
1	193°43.7	27.7	49°44.5	9.5′	27°24.1	4.1′	54.7′
2	208°43.6	27.4	64°13.0	9.4′	27°28.2	4.0′	54.7′
3	223°43.5	·· 27.1	78°41.4	9.4′	27°32.2	3.8′	54.8′
4	238°43.4	26.8	93°09.8	9.3′	27°36.0	3.7′	54.8′
5	253°43.3	26.5	107°38.1	9.2′	27°39.7	3.6′	54.8′
6	268°43.2	N22°26.3	122°06.3	9.2′	S27°43.3	3.4′	54.8′
7	283°43.1	26.0	136°34.5	9.1′	27°46.7	3.3′	54.8′
8	298°43.0	25.7	151°02.6	9.1′	27°50.0	3.1′	54.8′
9	313°42.9	·· 25.4	165°30.7	9.0′	27°53.1	3.0′	54.9′
10	328°42.8	25.1	179°58.7	9.0′	27°56.1	2.9′	54.9′
11	343°42.7	24.8	194°26.6	8.9′	27°59.0	2.7′	54.9′
12	358°42.6	N22°24.5	208°54.5	8.8′	S28°01.7	2.6′	54.9′
13	13°42.5	24.2	223°22.4	8.8′	28°04.3	2.5′	54.9′
14	28°42.4	23.9	237°50.2	8.7′	28°06.8	2.2′	54.9′
15	43°42.3	·· 23.6	252°17.9	8.7′	28°09.0	2.2′	55.0′
16	58°42.2	23.3	266°45.6	8.6′	28°11.2	2.0′	55.0′
17	73°42.2	23.0	281°13.3	8.6′	28°13.2	1.9′	55.0′
18	88°42.1	N22°22.7	295°40.9	8.6′	S28°15.1	1.7′	55.0′
19	103°42.0	22.4	310°08.4	8.5′	28°16.8	1.5′	55.0′
20	118°41.9	22.2	324°35.9	8.5′	28°18.3	1.4′	55.1′
21	133°41.8	·· 21.9	339°03.4	8.4′	28°19.7	1.3′	55.1′
22	148°41.7	21.6	353°30.8	8.4′	28°21.0	1.1′	55.1′
23	163°41.6	21.3	7°58.2	8.4′	28°22.1	1.0′	55.1′
	SD = 15.7′	d = 0.3′	SD = 14.9′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	▭	▭	▭	▭	▭	▭
N 70°	▭	▭	▭	▭	▭	▭
68°	▭	▭	▭	▭	▭	▭
66°	////	////	00:59	23:07	////	////
64°	////	////	01:54	22:14	////	////
62°	////	////	02:27	21:42	////	////
60°	////	01:20	02:50	21:19	22:47	////
N 58°	////	01:59	03:09	21:00	22:09	////
56°	////	02:25	03:25	20:45	21:44	////
54°	01:14	02:46	03:38	20:31	21:24	22:54
52°	01:50	03:02	03:49	20:20	21:07	22:19
50°	02:14	03:16	04:00	20:10	20:53	21:55
45°	02:56	03:44	04:21	19:48	20:25	21:13
N 40°	03:25	04:06	04:38	19:31	20:04	20:45
35°	03:47	04:23	04:53	19:17	19:46	20:23
30°	04:05	04:38	05:05	19:05	19:32	20:05
20°	04:33	05:02	05:26	18:44	19:08	19:37
N 10°	04:55	05:22	05:45	18:25	18:48	19:15
0°	05:13	05:39	06:01	18:09	18:31	18:57
S 10°	05:29	05:55	06:18	17:52	18:15	18:41
20°	05:45	06:12	06:36	17:34	17:58	18:25
30°	06:00	06:30	06:56	17:14	17:40	18:10
35°	06:09	06:40	07:08	17:02	17:30	18:02
40°	06:17	06:51	07:22	16:49	17:19	17:53
45°	06:27	07:04	07:38	16:33	17:06	17:43
S 50°	06:38	07:19	07:57	16:13	16:51	17:32
52°	06:43	07:26	08:06	16:04	16:44	17:27
54°	06:48	07:34	08:17	15:53	16:36	17:22
56°	06:54	07:43	08:29	15:41	16:28	17:16
58°	07:00	07:52	08:43	15:28	16:18	17:10
S 60°	07:07	08:03	08:59	15:12	16:07	17:03

Lat.	**Moonrise** Sun	Mon	Tue	**Moonset** Sun	Mon	Tue
N 72°	▬	▬	▬	▬	▬	▬
N 70°	▬	▬	▬	▬	▬	▬
68°	▬	▬	▬	▬	▬	▬
66°	▬	▬	▬	▬	▬	▬
64°	19:17	▬	▬	21:59	▬	▬
62°	18:34	20:31	▬	22:44	22:31	▬
60°	18:05	19:39	21:03	23:13	23:22	23:50
N 58°	17:43	19:08	20:22	23:36	23:54	·· ··
56°	17:25	18:45	19:55	23:54	·· ··	00:18
54°	17:10	18:25	19:33	·· ··	00:10	00:37
52°	16:57	18:09	19:15	00:02	00:23	00:54
50°	16:45	17:56	19:00	00:11	00:35	01:08
45°	16:22	17:27	18:29	00:31	01:00	01:36
N 40°	16:03	17:05	18:05	00:47	01:19	01:59
35°	15:47	16:47	17:46	01:01	01:36	02:18
30°	15:33	16:32	17:29	01:13	01:50	02:34
20°	15:10	16:05	17:01	01:33	02:14	03:01
N 10°	14:50	15:42	16:36	01:51	02:36	03:25
0°	14:32	15:21	16:14	02:08	02:55	03:46
S 10°	14:14	15:00	15:51	02:25	03:15	04:08
20°	13:54	14:38	15:27	02:43	03:37	04:32
30°	13:32	14:12	14:59	03:04	04:01	04:59
35°	13:18	13:57	14:43	03:16	04:16	05:16
40°	13:03	13:39	14:24	03:30	04:33	05:35
45°	12:46	13:18	14:00	03:47	04:53	05:58
S 50°	12:24	12:52	13:30	04:08	05:19	06:27
52°	12:13	12:39	13:16	04:18	05:32	06:42
54°	12:01	12:24	12:59	04:29	05:46	06:58
56°	11:48	12:07	12:38	04:42	06:03	07:19
58°	11:32	11:46	12:13	04:57	06:23	07:44
S 60°	11:13	11:20	11:37	05:15	06:49	08:19

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 11-13 79-92%
06	04:46	04:51	12:05	20:44	08:20	
07	04:56	05:00	12:05	21:34	09:08	
08	05:05	05:10	12:05	22:27	10:00	

July 09, 10, 11 UT (Wed., Thu., Fri.)

	Aries	Venus		Mars		Jupiter		Saturn	
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	287°11.3	223°50.9	N18°41.2	123°01.7	N07°43.8	189°58.3	N23°09.3	284°31.4	S01°19.3
1	302°13.7	238°50.5	41.7	138°02.8	43.2	205°00.1	09.3	299°33.8	19.3
2	317°16.2	253°50.1	42.3	153°03.9	42.6	220°02.0	09.3	314°36.2	19.3
3	332°18.7	268°49.7	·· 42.9	168°05.0	·· 42.0	235°03.8	·· 09.3	329°38.7	·· 19.3
4	347°21.1	283°49.3	43.4	183°06.1	41.4	250°05.7	09.2	344°41.1	19.3
5	2°23.6	298°48.9	44.0	198°07.2	40.9	265°07.5	09.2	359°43.6	19.3
6	17°26.0	313°48.5	N18°44.5	213°08.3	N07°40.3	280°09.4	N23°09.2	14°46.0	S01°19.3
7	32°28.5	328°48.1	45.1	228°09.4	39.7	295°11.3	09.2	29°48.5	19.3
8	47°31.0	343°47.7	45.7	243°10.5	39.1	310°13.1	09.1	44°50.9	19.3
9	62°33.4	358°47.2	·· 46.2	258°11.6	·· 38.5	325°15.0	·· 09.1	59°53.4	·· 19.3
10	77°35.9	13°46.8	46.8	273°12.7	37.9	340°16.8	09.1	74°55.8	19.3
11	92°38.4	28°46.4	47.3	288°13.8	37.3	355°18.7	09.1	89°58.3	19.4
12	107°40.8	43°46.0	N18°47.9	303°14.9	N07°36.7	10°20.5	N23°09.0	105°00.7	S01°19.4
13	122°43.3	58°45.6	48.5	318°16.0	36.1	25°22.4	09.0	120°03.1	19.4
14	137°45.8	73°45.2	49.0	333°17.1	35.5	40°24.2	09.0	135°05.6	19.4
15	152°48.2	88°44.7	·· 49.6	348°18.2	·· 34.9	55°26.1	·· 09.0	150°08.0	·· 19.4
16	167°50.7	103°44.3	50.1	3°19.3	34.3	70°27.9	08.9	165°10.5	19.4
17	182°53.2	118°43.9	50.7	18°20.4	33.7	85°29.8	08.9	180°12.9	19.4
18	197°55.6	133°43.5	N18°51.2	33°21.5	N07°33.1	100°31.6	N23°08.9	195°15.4	S01°19.4
19	212°58.1	148°43.1	51.8	48°22.6	32.5	115°33.5	08.9	210°17.8	19.4
20	228°00.5	163°42.7	52.3	63°23.7	31.9	130°35.3	08.8	225°20.3	19.4
21	243°03.0	178°42.2	·· 52.9	78°24.8	·· 31.3	145°37.2	·· 08.8	240°22.7	·· 19.4
22	258°05.5	193°41.8	53.4	93°25.9	30.7	160°39.0	08.8	255°25.2	19.4
23	273°07.9	208°41.4	54.0	108°27.0	30.1	175°40.9	08.8	270°27.6	19.4
Mer.pass. 04:50		ν -0.4′	d 0.6′	m -4.09	ν 1.1′	d 0.6′	m 1.53	ν 1.9′	d 0.0′ m -1.89	ν 2.4′	d 0.0′ m 0.92

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	288°10.4	223°41.0	N18°54.5	123°28.1	N07°29.5	190°42.7	N23°08.7	285°30.1	S01°19.4
1	303°12.9	238°40.5	55.1	138°29.2	28.9	205°44.6	08.7	300°32.5	19.4
2	318°15.3	253°40.1	55.6	153°30.3	28.3	220°46.4	08.7	315°34.9	19.4
3	333°17.8	268°39.7	·· 56.2	168°31.5	·· 27.8	235°48.3	·· 08.7	330°37.4	·· 19.4
4	348°20.3	283°39.3	56.7	183°32.6	27.2	250°50.1	08.6	345°39.8	19.4
5	3°22.7	298°38.8	57.3	198°33.7	26.6	265°52.0	08.6	0°42.3	19.4
6	18°25.2	313°38.4	N18°57.8	213°34.8	N07°26.0	280°53.8	N23°08.6	15°44.7	S01°19.4
7	33°27.7	328°38.0	58.4	228°35.9	25.4	295°55.7	08.6	30°47.2	19.5
8	48°30.1	343°37.6	58.9	243°37.0	24.8	310°57.5	08.5	45°49.6	19.5
9	63°32.6	358°37.1	18°59.5	258°38.1	·· 24.2	325°59.4	·· 08.5	60°52.1	·· 19.5
10	78°35.0	13°36.7	19°00.0	273°39.2	23.6	341°01.2	08.5	75°54.5	19.5
11	93°37.5	28°36.3	00.5	288°40.3	23.0	356°03.1	08.5	90°57.0	19.5
12	108°40.0	43°35.9	N19°01.1	303°41.4	N07°22.4	11°04.9	N23°08.4	105°59.4	S01°19.5
13	123°42.4	58°35.4	01.6	318°42.5	21.8	26°06.8	08.4	121°01.9	19.5
14	138°44.9	73°35.0	02.2	333°43.6	21.2	41°08.6	08.4	136°04.3	19.5
15	153°47.4	88°34.6	·· 02.7	348°44.7	·· 20.6	56°10.5	·· 08.3	151°06.8	·· 19.5
16	168°49.8	103°34.1	03.2	3°45.8	20.0	71°12.3	08.3	166°09.2	19.5
17	183°52.3	118°33.7	03.8	18°46.9	19.4	86°14.2	08.3	181°11.7	19.5
18	198°54.8	133°33.3	N19°04.3	33°48.0	N07°18.8	101°16.0	N23°08.3	196°14.1	S01°19.5
19	213°57.2	148°32.8	04.9	48°49.1	18.2	116°17.9	08.2	211°16.6	19.5
20	228°59.7	163°32.4	05.4	63°50.2	17.6	131°19.7	08.2	226°19.0	19.5
21	244°02.2	178°32.0	·· 05.9	78°51.3	·· 17.0	146°21.6	·· 08.2	241°21.5	·· 19.5
22	259°04.6	193°31.5	06.5	93°52.4	16.4	161°23.5	08.2	256°23.9	19.5
23	274°07.1	208°31.1	07.0	108°53.5	15.8	176°25.3	08.1	271°26.4	19.6
Mer.pass. 04:47		ν -0.4′	d 0.5′	m -4.09	ν 1.1′	d 0.6′	m 1.53	ν 1.9′	d 0.0′ m -1.90	ν 2.4′	d 0.0′ m 0.91

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	289°09.5	223°30.7	N19°07.5	123°54.6	N07°15.2	191°27.2	N23°08.1	286°28.8	S01°19.6
1	304°12.0	238°30.2	08.1	138°55.7	14.6	206°29.0	08.1	301°31.3	19.6
2	319°14.5	253°29.8	08.6	153°56.8	14.0	221°30.9	08.1	316°33.7	19.6
3	334°16.9	268°29.3	·· 09.1	168°57.9	·· 13.4	236°32.7	·· 08.0	331°36.2	·· 19.6
4	349°19.4	283°28.9	09.7	183°59.0	12.8	251°34.6	08.0	346°38.6	19.6
5	4°21.9	298°28.5	10.2	199°00.1	12.2	266°36.4	08.0	1°41.1	19.6
6	19°24.3	313°28.0	N19°10.7	214°01.2	N07°11.6	281°38.3	N23°08.0	16°43.5	S01°19.6
7	34°26.8	328°27.6	11.3	229°02.3	11.0	296°40.1	07.9	31°46.0	19.6
8	49°29.3	343°27.1	11.8	244°03.4	10.4	311°42.0	07.9	46°48.5	19.6
9	64°31.7	358°26.7	·· 12.3	259°04.5	·· 09.8	326°43.8	·· 07.9	61°50.9	·· 19.6
10	79°34.2	13°26.3	12.8	274°05.6	09.2	341°45.7	07.9	76°53.4	19.6
11	94°36.7	28°25.8	13.4	289°06.7	08.6	356°47.5	07.8	91°55.8	19.6
12	109°39.1	43°25.4	N19°13.9	304°07.8	N07°08.0	11°49.4	N23°07.8	106°58.3	S01°19.6
13	124°41.6	58°24.9	14.4	319°08.9	07.4	26°51.2	07.8	122°00.7	19.7
14	139°44.0	73°24.5	14.9	334°10.0	06.8	41°53.1	07.7	137°03.2	19.7
15	154°46.5	88°24.0	·· 15.5	349°11.1	·· 06.2	56°54.9	·· 07.7	152°05.6	·· 19.7
16	169°49.0	103°23.6	16.0	4°12.2	05.6	71°56.8	07.7	167°08.1	19.7
17	184°51.4	118°23.2	16.5	19°13.3	05.0	86°58.6	07.7	182°10.5	19.7
18	199°53.9	133°22.7	N19°17.0	34°14.4	N07°04.4	102°00.5	N23°07.6	197°13.0	S01°19.7
19	214°56.4	148°22.3	17.6	49°15.5	03.8	117°02.4	07.6	212°15.4	19.7
20	229°58.8	163°21.8	18.1	64°16.6	03.2	132°04.2	07.6	227°17.9	19.7
21	245°01.3	178°21.4	·· 18.6	79°17.7	·· 02.6	147°06.1	·· 07.6	242°20.3	·· 19.7
22	260°03.8	193°20.9	19.1	94°18.8	02.0	162°07.9	07.5	257°22.8	19.7
23	275°06.2	208°20.5	19.6	109°19.9	01.4	177°09.8	07.5	272°25.3	19.7
Mer.pass. 04:43		ν -0.4′	d 0.5′	m -4.08	ν 1.1′	d 0.6′	m 1.54	ν 1.9′	d 0.0′ m -1.90	ν 2.5′	d 0.0′ m 0.91

Stars

	SHA	Dec
Alpheratz	357°34.2	29°13.8
Ankaa	353°06.6	-42°09.8
Schedar	349°30.5	56°40.4
Diphda	348°46.8	-17°50.6
Achernar	335°19.9	-57°06.1
Hamal	327°50.8	23°34.9
Polaris	314°03.8	89°22.0
Acamar	315°11.7	-40°11.9
Menkar	314°05.9	4°11.4
Mirfak	308°27.9	49°56.9
Aldebaran	290°39.4	16°33.6
Rigel	281°03.8	-8°10.2
Capella	280°21.7	46°01.3
Bellatrix	278°22.7	6°22.4
Elnath	278°01.7	28°37.7
Alnilam	275°37.6	-1°11.1
Betelgeuse	270°52.0	7°24.8
Canopus	263°52.8	-52°42.4
Sirius	258°26.2	-16°45.0
Adhara	255°05.9	-29°00.3
Procyon	244°50.7	5°09.6
Pollux	243°17.2	27°57.9
Avior	234°15.2	-59°35.5
Suhail	222°46.4	-43°32.2
Miaplacidus	221°39.1	-69°49.4
Alphard	217°47.6	-8°46.1
Regulus	207°34.2	11°50.6
Dubhe	193°40.8	61°37.1
Denebola	182°24.6	14°25.9
Gienah	175°43.2	-17°41.1
Acrux	172°59.8	-63°14.7
Gacrux	171°51.3	-57°15.6
Alioth	166°12.6	55°49.5
Spica	158°21.8	-11°17.7
Alkaid	152°51.6	49°11.4
Hadar	148°35.2	-60°30.0
Menkent	147°57.0	-36°29.9
Arcturus	145°47.4	19°03.1
Rigil Kent.	139°39.5	-60°56.7
Kochab	137°19.2	74°03.3
Zuben'ubi	136°55.4	-16°08.9
Alphecca	126°03.2	26°37.8
Antares	112°15.0	-26°29.4
Atria	107°08.4	-69°04.5
Sabik	102°02.0	-15°45.4
Shaula	96°09.4	-37°07.4
Rasalhague	95°57.8	12°32.5
Eltanin	90°41.5	51°29.2
Kaus Aust.	83°31.6	-34°22.3
Vega	80°32.5	38°48.5
Nunki	75°46.9	-26°15.9
Altair	61°59.2	8°56.2
Peacock	53°04.5	-56°39.0
Deneb	49°25.1	45°22.2
Enif	33°38.1	9°59.5
Al Na'ir	27°32.0	-46°50.0
Fomalhaut	15°13.8	-29°29.0
Scheat	13°44.6	28°13.2
Markab	13°29.3	15°20.5

Jul 09 Wed	SHA	Mer.pass
Venus	296°39.7	09:05
Mars	195°50.4	15:47
Jupiter	262°47.0	11:19
Saturn	357°20.1	05:01

Jul 10 Thu	SHA	Mer.pass
Venus	295°30.6	09:06
Mars	195°17.7	15:45
Jupiter	262°32.3	11:16
Saturn	357°19.7	04:57

Jul 11 Fri	SHA	Mer.pass
Venus	294°21.1	09:06
Mars	194°45.1	15:43
Jupiter	262°17.6	11:13
Saturn	357°19.3	04:53

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°41.5	N22°21.0	22°25.6	8.3′	S28°23.1	0.8′	55.1′
1	193°41.4	20.7	36°52.9	8.3′	28°23.9	0.7′	55.1′
2	208°41.3	20.4	51°20.2	8.3′	28°24.6	0.5′	55.2′
3	223°41.2	·· 20.0	65°47.4	8.2′	28°25.1	0.4′	55.2′
4	238°41.1	19.7	80°14.7	8.2′	28°25.5	0.2′	55.2′
5	253°41.0	19.4	94°41.8	8.2′	28°25.7	0.1′	55.2′
6	268°41.0	N22°19.1	109°09.0	8.1′	S28°25.8	0.1′	55.2′
7	283°40.9	18.8	123°36.1	8.1′	28°25.7	0.3′	55.3′
8	298°40.8	18.5	138°03.3	8.1′	28°25.4	0.4′	55.3′
9	313°40.7	·· 18.2	152°30.3	8.1′	28°25.0	0.5′	55.3′
10	328°40.6	17.9	166°57.4	8.0′	28°24.5	0.7′	55.3′
11	343°40.5	17.6	181°24.5	8.0′	28°23.8	0.9′	55.3′
12	358°40.4	N22°17.3	195°51.5	8.0′	S28°22.9	1.0′	55.4′
13	13°40.3	17.0	210°18.5	8.0′	28°21.9	1.1′	55.4′
14	28°40.2	16.7	224°45.5	8.0′	28°20.8	1.4′	55.4′
15	43°40.1	·· 16.4	239°12.5	8.0′	28°19.4	1.4′	55.4′
16	58°40.1	16.1	253°39.5	8.0′	28°18.0	1.6′	55.4′
17	73°40.0	15.7	268°06.4	8.0′	28°16.4	1.8′	55.5′
18	88°39.9	N22°15.4	282°33.4	7.9′	S28°14.6	2.0′	55.5′
19	103°39.8	15.1	297°00.3	7.9′	28°12.6	2.1′	55.5′
20	118°39.7	14.8	311°27.3	7.9′	28°10.5	2.2′	55.5′
21	133°39.6	·· 14.5	325°54.2	7.9′	28°08.3	2.4′	55.5′
22	148°39.5	14.2	340°21.1	7.9′	28°05.9	2.6′	55.6′
23	163°39.4	13.9	354°48.1	7.9′	28°03.3	2.7′	55.6′
	SD = 15.7′	d = 0.3′	SD = 15.0′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°39.4	N22°13.5	9°15.0	7.9′	S28°00.6	2.8′	55.6′
1	193°39.3	13.2	23°41.9	7.9′	27°57.8	3.0′	55.6′
2	208°39.2	12.9	38°08.9	7.9′	27°54.8	3.2′	55.6′
3	223°39.1	·· 12.6	52°35.8	8.0′	27°51.6	3.3′	55.7′
4	238°39.0	12.3	67°02.8	8.0′	27°48.3	3.5′	55.7′
5	253°38.9	12.0	81°29.8	8.0′	27°44.8	3.7′	55.7′
6	268°38.8	N22°11.6	95°56.7	8.0′	S27°41.1	3.8′	55.7′
7	283°38.7	11.3	110°23.7	8.0′	27°37.3	3.9′	55.8′
8	298°38.7	11.0	124°50.7	8.0′	27°33.4	4.1′	55.8′
9	313°38.6	·· 10.7	139°17.7	8.0′	27°29.3	4.2′	55.8′
10	328°38.5	10.3	153°44.8	8.1′	27°25.1	4.4′	55.8′
11	343°38.4	10.0	168°11.8	8.1′	27°20.7	4.6′	55.8′
12	358°38.3	N22°09.7	182°38.9	8.1′	S27°16.1	4.7′	55.9′
13	13°38.2	09.4	197°06.0	8.1′	27°11.4	4.9′	55.9′
14	28°38.1	09.0	211°33.1	8.1′	27°06.5	5.0′	55.9′
15	43°38.1	·· 08.7	226°00.3	8.2′	27°01.5	5.1′	55.9′
16	58°38.0	08.4	240°27.4	8.2′	26°56.4	5.4′	55.9′
17	73°37.9	08.1	254°54.6	8.2′	26°51.0	5.4′	56.0′
18	88°37.8	N22°07.7	269°21.9	8.3′	S26°45.6	5.6′	56.0′
19	103°37.7	07.4	283°49.1	8.3′	26°40.0	5.8′	56.0′
20	118°37.6	07.1	298°16.4	8.3′	26°34.2	5.9′	56.0′
21	133°37.6	·· 06.8	312°43.7	8.4′	26°28.3	6.1′	56.1′
22	148°37.5	06.4	327°11.1	8.4′	26°22.2	6.2′	56.1′
23	163°37.4	06.1	341°38.5	8.4′	26°16.0	6.3′	56.1′
	SD = 15.7′	d = 0.3′	SD = 15.2′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°37.3	N22°05.8	356°05.9	8.5′	S26°09.7	6.5′	56.1′
1	193°37.2	05.4	10°33.4	8.5′	26°03.2	6.7′	56.1′
2	208°37.1	05.1	25°00.9	8.5′	25°56.5	6.8′	56.2′
3	223°37.1	·· 04.8	39°28.4	8.6′	25°49.7	6.9′	56.2′
4	238°37.0	04.4	53°56.0	8.6′	25°42.8	7.1′	56.2′
5	253°36.9	04.1	68°23.6	8.7′	25°35.7	7.2′	56.2′
6	268°36.8	N22°03.7	82°51.3	8.7′	S25°28.5	7.4′	56.3′
7	283°36.7	03.4	97°19.0	8.8′	25°21.1	7.5′	56.3′
8	298°36.7	03.1	111°46.7	8.8′	25°13.6	7.6′	56.3′
9	313°36.6	·· 02.7	126°14.5	8.8′	25°06.0	7.8′	56.3′
10	328°36.5	02.4	140°42.4	8.9′	24°58.2	8.0′	56.3′
11	343°36.4	02.1	155°10.3	8.9′	24°50.2	8.0′	56.4′
12	358°36.3	N22°01.7	169°38.2	9.0′	S24°42.2	8.2′	56.4′
13	13°36.2	01.4	184°06.2	9.0′	24°34.0	8.4′	56.4′
14	28°36.2	01.0	198°34.3	9.1′	24°25.6	8.5′	56.4′
15	43°36.1	·· 00.7	213°02.4	9.1′	24°17.1	8.6′	56.5′
16	58°36.0	00.4	227°30.5	9.2′	24°08.5	8.7′	56.5′
17	73°35.9	22°00.0	241°58.7	9.2′	23°59.8	8.9′	56.5′
18	88°35.8	N21°59.7	256°26.9	9.3′	S23°50.9	9.0′	56.5′
19	103°35.8	59.3	270°55.3	9.4′	23°41.9	9.2′	56.5′
20	118°35.7	59.0	285°23.6	9.4′	23°32.7	9.2′	56.6′
21	133°35.6	·· 58.6	299°52.0	9.5′	23°23.5	9.5′	56.6′
22	148°35.5	58.3	314°20.5	9.5′	23°14.0	9.5′	56.6′
23	163°35.5	57.9	328°49.0	9.6′	23°04.5	9.7′	56.6′
	SD = 15.7′	d = 0.3′	SD = 15.3′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	▭	▭	▭	▭	▭	▭
N 70°	▭	▭	▭	▭	▭	▭
68°	▭	▭	▭	▭	▭	▭
66°	////	////	01:14	22:53	////	////
64°	////	////	02:02	22:07	////	////
62°	////	////	02:32	21:37	////	////
60°	////	01:30	02:55	21:15	22:39	////
N 58°	////	02:05	03:13	20:57	22:04	////
56°	////	02:30	03:28	20:42	21:40	////
54°	01:22	02:50	03:41	20:29	21:20	22:46
52°	01:55	03:06	03:53	20:18	21:04	22:14
50°	02:19	03:20	04:03	20:08	20:51	21:51
45°	02:59	03:47	04:23	19:47	20:23	21:11
N 40°	03:28	04:08	04:40	19:30	20:02	20:43
35°	03:49	04:25	04:54	19:16	19:45	20:21
30°	04:07	04:40	05:07	19:04	19:31	20:04
20°	04:34	05:03	05:27	18:43	19:08	19:36
N 10°	04:56	05:22	05:45	18:26	18:48	19:15
0°	05:14	05:39	06:02	18:09	18:31	18:57
S 10°	05:30	05:56	06:18	17:53	18:15	18:41
20°	05:45	06:12	06:36	17:35	17:59	18:26
30°	06:00	06:30	06:56	17:15	17:41	18:11
35°	06:08	06:39	07:07	17:04	17:32	18:03
40°	06:17	06:50	07:20	16:51	17:21	17:54
45°	06:26	07:03	07:36	16:35	17:08	17:45
S 50°	06:37	07:18	07:55	16:16	16:53	17:34
52°	06:42	07:25	08:04	16:07	16:47	17:30
54°	06:47	07:32	08:15	15:57	16:39	17:24
56°	06:52	07:40	08:26	15:45	16:31	17:19
58°	06:58	07:50	08:40	15:32	16:22	17:13
S 60°	07:05	08:00	08:55	15:16	16:11	17:06

Lat.	**Moonrise** Wed	Thu	Fri	**Moonset** Wed	Thu	Fri
N 72°	▬	▬	▬	▬	▬	▬
N 70°	▬	▬	▬	▬	▬	▬
68°	▬	▬	▬	▬	▬	▬
66°	▬	▬	23:58	▬	▬	▬
64°	▬	▬	23:10	▬	▬	▬
62°	▬	22:49	22:40	▬	▬	01:52
60°	21:52	22:10	22:16	·· ··	00:55	02:30
N 58°	21:14	21:43	21:58	00:30	01:32	02:57
56°	20:47	21:21	21:42	00:58	01:59	03:18
54°	20:26	21:03	21:28	01:20	02:20	03:36
52°	20:09	20:48	21:16	01:38	02:37	03:51
50°	19:54	20:35	21:06	01:53	02:52	04:03
45°	19:23	20:08	20:44	02:24	03:22	04:30
N 40°	19:00	19:46	20:26	02:48	03:45	04:50
35°	18:40	19:29	20:10	03:07	04:05	05:08
30°	18:23	19:13	19:57	03:24	04:21	05:23
20°	17:55	18:47	19:35	03:53	04:49	05:48
N 10°	17:31	18:24	19:15	04:17	05:13	06:09
0°	17:08	18:03	18:57	04:40	05:35	06:29
S 10°	16:46	17:42	18:38	05:03	05:57	06:49
20°	16:21	17:19	18:18	05:27	06:20	07:10
30°	15:53	16:53	17:55	05:56	06:48	07:35
35°	15:37	16:37	17:42	06:12	07:04	07:49
40°	15:17	16:19	17:26	06:32	07:23	08:05
45°	14:53	15:57	17:08	06:56	07:45	08:25
S 50°	14:23	15:29	16:44	07:26	08:14	08:50
52°	14:08	15:15	16:33	07:41	08:28	09:01
54°	13:50	14:59	16:20	07:59	08:44	09:15
56°	13:29	14:40	16:05	08:21	09:03	09:30
58°	13:01	14:16	15:47	08:48	09:27	09:48
S 60°	12:23	13:45	15:26	09:27	09:59	10:11

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 14-16 96-100%
09	05:14	05:18	12:05	23:22	10:54	
10	05:23	05:27	12:05	–:–	11:49	
11	05:31	05:35	12:06	00:16	12:43	

July 12, 13, 14 UT (Sat., Sun., Mon.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	290°08.7	223°20.0	N19°20.1	124°21.0	N07°00.8	192°11.6	N23°07.5	287°27.7	S01°19.7
1	305°11.1	238°19.6	20.7	139°22.1	07°00.2	207°13.5	07.4	302°30.2	19.7
2	320°13.6	253°19.1	21.2	154°23.2	06°59.6	222°15.3	07.4	317°32.6	19.8
3	335°16.1	268°18.7	·· 21.7	169°24.3	·· 59.0	237°17.2	·· 07.4	332°35.1	·· 19.8
4	350°18.5	283°18.2	22.2	184°25.4	58.4	252°19.0	07.4	347°37.5	19.8
5	5°21.0	298°17.8	22.7	199°26.5	57.8	267°20.9	07.3	2°40.0	19.8
6	20°23.5	313°17.3	N19°23.2	214°27.6	N06°57.2	282°22.7	N23°07.3	17°42.4	S01°19.8
7	35°25.9	328°16.9	23.8	229°28.7	56.6	297°24.6	07.3	32°44.9	19.8
8	50°28.4	343°16.4	24.3	244°29.8	56.0	312°26.4	07.3	47°47.4	19.8
9	65°30.9	358°15.9	·· 24.8	259°30.9	·· 55.4	327°28.3	·· 07.2	62°49.8	·· 19.8
10	80°33.3	13°15.5	25.3	274°32.0	54.8	342°30.2	07.2	77°52.3	19.8
11	95°35.8	28°15.0	25.8	289°33.1	54.2	357°32.0	07.2	92°54.7	19.8
12	110°38.3	43°14.6	N19°26.3	304°34.2	N06°53.6	12°33.9	N23°07.1	107°57.2	S01°19.8
13	125°40.7	58°14.1	26.8	319°35.3	53.0	27°35.7	07.1	122°59.6	19.9
14	140°43.2	73°13.7	27.3	334°36.4	52.4	42°37.6	07.1	138°02.1	19.9
15	155°45.6	88°13.2	·· 27.8	349°37.5	·· 51.8	57°39.4	·· 07.1	153°04.6	·· 19.9
16	170°48.1	103°12.8	28.3	4°38.6	51.2	72°41.3	07.0	168°07.0	19.9
17	185°50.6	118°12.3	28.8	19°39.7	50.6	87°43.1	07.0	183°09.5	19.9
18	200°53.0	133°11.8	N19°29.3	34°40.8	N06°50.0	102°45.0	N23°07.0	198°11.9	S01°19.9
19	215°55.5	148°11.4	29.9	49°41.9	49.4	117°46.8	07.0	213°14.4	19.9
20	230°58.0	163°10.9	30.4	64°43.0	48.8	132°48.7	06.9	228°16.8	19.9
21	246°00.4	178°10.5	·· 30.9	79°44.1	·· 48.2	147°50.5	·· 06.9	243°19.3	·· 19.9
22	261°02.9	193°10.0	31.4	94°45.2	47.5	162°52.4	06.9	258°21.8	19.9
23	276°05.4	208°09.5	31.9	109°46.3	46.9	177°54.3	06.8	273°24.2	20.0
Mer.pass. 04:39		ν -0.5′ d 0.5′		m -4.08	ν 1.1′ d 0.6′		m 1.54	ν 1.9′ d 0.0′	m -1.90
								ν 2.5′ d 0.0′	m 0.90

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	291°07.8	223°09.1	N19°32.4	124°47.4	N06°46.3	192°56.1	N23°06.8	288°26.7	S01°20.0
1	306°10.3	238°08.6	32.9	139°48.5	45.7	207°58.0	06.8	303°29.1	20.0
2	321°12.8	253°08.1	33.4	154°49.6	45.1	222°59.8	06.8	318°31.6	20.0
3	336°15.2	268°07.7	·· 33.9	169°50.7	·· 44.5	238°01.7	·· 06.7	333°34.1	·· 20.0
4	351°17.7	283°07.2	34.4	184°51.8	43.9	253°03.5	06.7	348°36.5	20.0
5	6°20.1	298°06.7	34.9	199°52.9	43.3	268°05.4	06.7	3°39.0	20.0
6	21°22.6	313°06.3	N19°35.4	214°54.0	N06°42.7	283°07.2	N23°06.6	18°41.4	S01°20.0
7	36°25.1	328°05.8	35.8	229°55.1	42.1	298°09.1	06.6	33°43.9	20.0
8	51°27.5	343°05.3	36.3	244°56.2	41.5	313°10.9	06.6	48°46.4	20.0
9	66°30.0	358°04.9	·· 36.8	259°57.3	·· 40.9	328°12.8	·· 06.6	63°48.8	·· 20.1
10	81°32.5	13°04.4	37.3	274°58.4	40.3	343°14.7	06.5	78°51.3	20.1
11	96°34.9	28°03.9	37.8	289°59.5	39.7	358°16.5	06.5	93°53.7	20.1
12	111°37.4	43°03.5	N19°38.3	305°00.6	N06°39.1	13°18.4	N23°06.5	108°56.2	S01°20.1
13	126°39.9	58°03.0	38.8	320°01.7	38.5	28°20.2	06.5	123°58.7	20.1
14	141°42.3	73°02.5	39.3	335°02.8	37.9	43°22.1	06.4	139°01.1	20.1
15	156°44.8	88°02.1	·· 39.8	350°03.9	·· 37.3	58°23.9	·· 06.4	154°03.6	·· 20.1
16	171°47.3	103°01.6	40.3	5°05.0	36.7	73°25.8	06.4	169°06.0	20.1
17	186°49.7	118°01.1	40.8	20°06.1	36.1	88°27.6	06.3	184°08.5	20.1
18	201°52.2	133°00.6	N19°41.3	35°07.2	N06°35.5	103°29.5	N23°06.3	199°11.0	S01°20.2
19	216°54.6	148°00.2	41.7	50°08.3	34.9	118°31.4	06.3	214°13.4	20.2
20	231°57.1	162°59.7	42.2	65°09.4	34.2	133°33.2	06.3	229°15.9	20.2
21	246°59.6	177°59.2	·· 42.7	80°10.4	·· 33.6	148°35.1	·· 06.2	244°18.4	·· 20.2
22	262°02.0	192°58.7	43.2	95°11.5	33.0	163°36.9	06.2	259°20.8	20.2
23	277°04.5	207°58.3	43.7	110°12.6	32.4	178°38.8	06.2	274°23.3	20.2
Mer.pass. 04:35		ν -0.5′ d 0.5′		m -4.07	ν 1.1′ d 0.6′		m 1.55	ν 1.9′ d 0.0′	m -1.90
								ν 2.5′ d 0.0′	m 0.90

Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	292°07.0	222°57.8	N19°44.2	125°13.7	N06°31.8	193°40.6	N23°06.1	289°25.7	S01°20.2
1	307°09.4	237°57.3	44.6	140°14.8	31.2	208°42.5	06.1	304°28.2	20.2
2	322°11.9	252°56.8	45.1	155°15.9	30.6	223°44.3	06.1	319°30.7	20.3
3	337°14.4	267°56.4	·· 45.6	170°17.0	·· 30.0	238°46.2	·· 06.0	334°33.1	·· 20.3
4	352°16.8	282°55.9	46.1	185°18.1	29.4	253°48.1	06.0	349°35.6	20.3
5	7°19.3	297°55.4	46.6	200°19.2	28.8	268°49.9	06.0	4°38.1	20.3
6	22°21.7	312°54.9	N19°47.0	215°20.3	N06°28.2	283°51.8	N23°06.0	19°40.5	S01°20.3
7	37°24.2	327°54.4	47.5	230°21.4	27.6	298°53.6	05.9	34°43.0	20.3
8	52°26.7	342°54.0	48.0	245°22.5	27.0	313°55.5	05.9	49°45.5	20.3
9	67°29.1	357°53.5	·· 48.5	260°23.6	·· 26.4	328°57.3	·· 05.9	64°47.9	·· 20.3
10	82°31.6	12°53.0	49.0	275°24.7	25.8	343°59.2	05.8	79°50.4	20.3
11	97°34.1	27°52.5	49.4	290°25.8	25.2	359°01.0	05.8	94°52.8	20.4
12	112°36.5	42°52.0	N19°49.9	305°26.9	N06°24.5	14°02.9	N23°05.8	109°55.3	S01°20.4
13	127°39.0	57°51.6	50.4	320°28.0	23.9	29°04.8	05.8	124°57.8	20.4
14	142°41.5	72°51.1	50.9	335°29.1	23.3	44°06.6	05.7	140°00.2	20.4
15	157°43.9	87°50.6	·· 51.3	350°30.2	·· 22.7	59°08.5	·· 05.7	155°02.7	·· 20.4
16	172°46.4	102°50.1	51.8	5°31.3	22.1	74°10.3	05.7	170°05.2	20.4
17	187°48.9	117°49.6	52.3	20°32.4	21.5	89°12.2	05.6	185°07.6	20.4
18	202°51.3	132°49.1	N19°52.7	35°33.5	N06°20.9	104°14.0	N23°05.6	200°10.1	S01°20.5
19	217°53.8	147°48.7	53.2	50°34.6	20.3	119°15.9	05.6	215°12.6	20.5
20	232°56.2	162°48.2	53.7	65°35.7	19.7	134°17.7	05.6	230°15.0	20.5
21	247°58.7	177°47.7	·· 54.1	80°36.8	·· 19.1	149°19.6	·· 05.5	245°17.5	·· 20.5
22	263°01.2	192°47.2	54.6	95°37.9	18.5	164°21.5	05.5	260°20.0	20.5
23	278°03.6	207°46.7	55.1	110°38.9	17.9	179°23.3	05.5	275°22.4	20.5
Mer.pass. 04:31		ν -0.5′ d 0.5′		m -4.07	ν 1.1′ d 0.6′		m 1.55	ν 1.9′ d 0.0′	m -1.90
								ν 2.5′ d 0.0′	m 0.89

Stars

	SHA	Dec
Alpheratz	357°34.2	29°13.8
Ankaa	353°06.6	-42°09.7
Schedar	349°30.5	56°40.4
Diphda	348°46.8	-17°50.6
Achernar	335°19.9	-57°06.1
Hamal	327°50.8	23°34.9
Polaris	314°02.4	89°22.0
Acamar	315°11.6	-40°11.9
Menkar	314°05.8	4°11.4
Mirfak	308°27.9	49°56.9
Aldebaran	290°39.4	16°33.6
Rigel	281°03.7	-8°10.2
Capella	280°21.7	46°01.3
Bellatrix	278°22.7	6°22.4
Elnath	278°01.7	28°37.7
Alnilam	275°37.6	-1°11.1
Betelgeuse	270°51.9	7°24.8
Canopus	263°52.7	-52°42.4
Sirius	258°26.2	-16°45.0
Adhara	255°05.9	-29°00.3
Procyon	244°50.7	5°09.6
Pollux	243°17.2	27°57.9
Avior	234°15.2	-59°35.5
Suhail	222°46.4	-43°32.2
Miaplacidus	221°39.1	-69°49.4
Alphard	217°47.6	-8°46.1
Regulus	207°34.2	11°50.6
Dubhe	193°40.8	61°37.0
Denebola	182°24.6	14°25.9
Gienah	175°43.2	-17°41.1
Acrux	172°59.8	-63°14.7
Gacrux	171°51.3	-57°15.6
Alioth	166°12.6	55°49.5
Spica	158°21.8	-11°17.7
Alkaid	152°51.6	49°11.4
Hadar	148°35.3	-60°30.0
Menkent	147°57.0	-36°29.9
Arcturus	145°47.4	19°03.1
Rigil Kent.	139°39.5	-60°56.7
Kochab	137°19.3	74°03.3
Zuben'ubi	136°55.4	-16°08.9
Alphecca	126°03.2	26°37.8
Antares	112°15.0	-26°29.4
Atria	107°08.4	-69°04.6
Sabik	102°02.0	-15°45.4
Shaula	96°09.4	-37°07.4
Rasalhague	95°57.8	12°32.5
Eltanin	90°41.5	51°29.2
Kaus Aust.	83°31.5	-34°22.3
Vega	80°32.5	38°48.5
Nunki	75°46.8	-26°15.9
Altair	61°59.2	8°56.2
Peacock	53°04.5	-56°39.0
Deneb	49°25.1	45°22.2
Enif	33°38.1	9°59.5
Al Na'ir	27°32.0	-46°50.0
Fomalhaut	15°13.8	-29°29.0
Scheat	13°44.6	28°13.2
Markab	13°29.3	15°20.5

Jul 12 Sat	SHA	Mer.pass
Venus	293°11.3	09:07
Mars	194°12.3	15:41
Jupiter	262°02.9	11:10
Saturn	357°19.0	04:49

Jul 13 Sun	SHA	Mer.pass
Venus	292°01.2	09:08
Mars	193°39.6	15:40
Jupiter	261°48.3	11:07
Saturn	357°18.9	04:45

Jul 14 Mon	SHA	Mer.pass
Venus	290°50.8	09:08
Mars	193°06.8	15:38
Jupiter	261°33.7	11:04
Saturn	357°18.8	04:42

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h

Sat	Sun GHA	Sun Dec	Moon GHA	Moon ν	Moon Dec	Moon d	Moon HP
0	178°35.4	N21°57.6	343°17.6	9.6′	S22°54.8	9.8′	56.6′
1	193°35.3	57.2	357°46.2	9.7′	22°45.0	9.9′	56.7′
2	208°35.2	56.9	12°14.9	9.7′	22°35.1	10.0′	56.7′
3	223°35.1	·· 56.5	26°43.7	9.8′	22°25.1	10.2′	56.7′
4	238°35.1	56.2	41°12.5	9.9′	22°14.9	10.3′	56.7′
5	253°35.0	55.8	55°41.3	9.9′	22°04.6	10.4′	56.8′
6	268°34.9	N21°55.5	70°10.3	10.0′	S21°54.2	10.5′	56.8′
7	283°34.8	55.1	84°39.2	10.0′	21°43.7	10.7′	56.8′
8	298°34.8	54.8	99°08.3	10.1′	21°33.0	10.7′	56.8′
9	313°34.7	·· 54.4	113°37.4	10.2′	21°22.3	10.9′	56.8′
10	328°34.6	54.1	128°06.5	10.2′	21°11.4	11.0′	56.9′
11	343°34.5	53.7	142°35.7	10.3′	21°00.4	11.2′	56.9′
12	358°34.5	N21°53.4	157°05.0	10.3′	S20°49.2	11.2′	56.9′
13	13°34.4	53.0	171°34.3	10.4′	20°38.0	11.3′	56.9′
14	28°34.3	52.6	186°03.7	10.5′	20°26.7	11.5′	56.9′
15	43°34.2	·· 52.3	200°33.2	10.5′	20°15.2	11.6′	57.0′
16	58°34.2	51.9	215°02.7	10.6′	20°03.6	11.7′	57.0′
17	73°34.1	51.6	229°32.3	10.6′	19°51.9	11.8′	57.0′
18	88°34.0	N21°51.2	244°01.9	10.7′	S19°40.1	11.9′	57.0′
19	103°33.9	50.9	258°31.6	10.7′	19°28.2	12.0′	57.1′
20	118°33.9	50.5	273°01.3	10.8′	19°16.2	12.1′	57.1′
21	133°33.8	·· 50.1	287°31.1	10.9′	19°04.1	12.2′	57.1′
22	148°33.7	49.8	302°01.0	10.9′	18°51.9	12.3′	57.1′
23	163°33.6	49.4	316°30.9	11.0′	18°39.6	12.4′	57.1′
	SD = 15.7′	d = 0.3′		SD = 15.4′			

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	178°33.6	N21°49.0	331°00.9	11.0′	S18°27.2	12.6′	57.2′
1	193°33.5	48.7	345°30.9	11.1′	18°14.6	12.6′	57.2′
2	208°33.4	48.3	0°01.0	11.1′	18°02.0	12.7′	57.2′
3	223°33.3	·· 47.9	14°31.1	11.2′	17°49.3	12.8′	57.2′
4	238°33.3	47.6	29°01.3	11.3′	17°36.5	12.9′	57.2′
5	253°33.2	47.2	43°31.6	11.3′	17°23.6	13.0′	57.3′
6	268°33.1	N21°46.8	58°01.9	11.4′	S17°10.6	13.1′	57.3′
7	283°33.0	46.5	72°32.3	11.4′	16°57.5	13.2′	57.3′
8	298°33.0	46.1	87°02.7	11.5′	16°44.3	13.3′	57.3′
9	313°32.9	·· 45.7	101°33.2	11.5′	16°31.0	13.4′	57.3′
10	328°32.8	45.4	116°03.7	11.6′	16°17.6	13.4′	57.4′
11	343°32.8	45.0	130°34.3	11.6′	16°04.2	13.6′	57.4′
12	358°32.7	N21°44.6	145°04.9	11.7′	S15°50.6	13.6′	57.4′
13	13°32.6	44.3	159°35.6	11.7′	15°37.0	13.7′	57.4′
14	28°32.6	43.9	174°06.3	11.8′	15°23.3	13.8′	57.4′
15	43°32.5	·· 43.5	188°37.1	11.8′	15°09.5	13.9′	57.5′
16	58°32.4	43.1	203°07.9	11.9′	14°55.6	14.0′	57.5′
17	73°32.3	42.8	217°38.8	11.9′	14°41.6	14.1′	57.5′
18	88°32.3	N21°42.4	232°09.8	12.0′	S14°27.5	14.1′	57.5′
19	103°32.2	42.0	246°40.7	12.0′	14°13.4	14.2′	57.5′
20	118°32.1	41.6	261°11.8	12.1′	13°59.2	14.3′	57.6′
21	133°32.1	·· 41.3	275°42.8	12.1′	13°44.9	14.3′	57.6′
22	148°32.0	40.9	290°13.9	12.2′	13°30.6	14.4′	57.6′
23	163°31.9	40.5	304°45.1	12.2′	13°16.2	14.6′	57.6′
	SD = 15.7′	d = 0.4′		SD = 15.6′			

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	178°31.9	N21°40.1	319°16.3	12.2′	S13°01.6	14.5′	57.6′
1	193°31.8	39.7	333°47.5	12.3′	12°47.1	14.7′	57.7′
2	208°31.7	39.4	348°18.8	12.3′	12°32.4	14.7′	57.7′
3	223°31.7	·· 39.0	2°50.2	12.4′	12°17.7	14.8′	57.7′
4	238°31.6	38.6	17°21.5	12.4′	12°02.9	14.8′	57.7′
5	253°31.5	38.2	31°52.9	12.4′	11°48.1	14.9′	57.7′
6	268°31.5	N21°37.8	46°24.4	12.5′	S11°33.2	15.0′	57.8′
7	283°31.4	37.5	60°55.9	12.5′	11°18.2	15.0′	57.8′
8	298°31.3	37.1	75°27.4	12.6′	11°03.2	15.1′	57.8′
9	313°31.3	·· 36.7	89°58.9	12.6′	10°48.1	15.2′	57.8′
10	328°31.2	36.3	104°30.5	12.6′	10°32.9	15.2′	57.8′
11	343°31.1	35.9	119°02.1	12.7′	10°17.7	15.3′	57.8′
12	358°31.1	N21°35.5	133°33.8	12.7′	S10°02.4	15.3′	57.9′
13	13°31.0	35.1	148°05.5	12.7′	09°47.1	15.4′	57.9′
14	28°30.9	34.8	162°37.2	12.7′	09°31.7	15.4′	57.9′
15	43°30.9	·· 34.4	177°08.9	12.8′	09°16.3	15.5′	57.9′
16	58°30.8	34.0	191°40.7	12.8′	09°00.8	15.6′	57.9′
17	73°30.7	33.6	206°12.5	12.8′	08°45.2	15.6′	58.0′
18	88°30.7	N21°33.2	220°44.3	12.8′	S08°29.6	15.6′	58.0′
19	103°30.6	32.8	235°16.2	12.9′	08°14.0	15.7′	58.0′
20	118°30.5	32.4	249°48.0	12.9′	07°58.3	15.7′	58.0′
21	133°30.5	·· 32.0	264°19.9	12.9′	07°42.6	15.8′	58.0′
22	148°30.4	31.6	278°51.8	12.9′	07°26.8	15.9′	58.1′
23	163°30.3	31.2	293°23.8	13.0′	07°10.9	15.8′	58.1′
	SD = 15.7′	d = 0.4′		SD = 15.7′			

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	▭	▭	▭	▭	▭	▭
N 70°	▭	▭	▭	▭	▭	▭
68°	▭	▭	▭	▭	▭	▭
66°	////	////	01:27	22:40	////	////
64°	////	////	02:10	21:59	////	////
62°	////	00:34	02:39	21:31	23:29	////
60°	////	01:39	03:00	21:10	22:30	////
N 58°	////	02:12	03:18	20:53	21:58	////
56°	00:31	02:35	03:32	20:38	21:35	23:32
54°	01:31	02:54	03:45	20:26	21:16	22:38
52°	02:01	03:10	03:56	20:15	21:01	22:09
50°	02:23	03:23	04:06	20:05	20:48	21:47
45°	03:03	03:50	04:26	19:45	20:21	21:08
N 40°	03:30	04:10	04:42	19:29	20:01	20:41
35°	03:51	04:27	04:56	19:15	19:44	20:20
30°	04:09	04:41	05:08	19:03	19:30	20:03
20°	04:36	05:04	05:28	18:43	19:07	19:36
N 10°	04:56	05:23	05:46	18:26	18:48	19:15
0°	05:14	05:40	06:02	18:09	18:32	18:58
S 10°	05:30	05:56	06:18	17:53	18:16	18:42
20°	05:44	06:12	06:35	17:36	18:00	18:27
30°	05:59	06:29	06:55	17:17	17:43	18:12
35°	06:07	06:39	07:06	17:06	17:33	18:05
40°	06:16	06:49	07:19	16:53	17:23	17:56
45°	06:25	07:01	07:34	16:37	17:11	17:47
S 50°	06:35	07:16	07:53	16:19	16:56	17:37
52°	06:40	07:23	08:02	16:10	16:49	17:32
54°	06:45	07:30	08:12	16:00	16:42	17:27
56°	06:50	07:38	08:23	15:49	16:34	17:22
58°	06:56	07:47	08:36	15:36	16:25	17:16
S 60°	07:02	07:57	08:51	15:21	16:15	17:10

Lat.	Moonrise Sat	Moonrise Sun	Moonrise Mon	Moonset Sat	Moonset Sun	Moonset Mon
N 72°	▬	23:48	23:00	▬	▬	06:18
N 70°	▬	00:24 23:24	22:49	▬	03:58	06:39
68°	23:42	23:05	22:41	▬	04:38	06:56
66°	23:13	22:51	22:34	02:35	05:06	07:09
64°	22:51	22:38	22:28	03:22	05:26	07:20
62°	22:33	22:28	22:23	03:52	05:43	07:29
60°	22:18	22:19	22:18	04:14	05:57	07:36
N 58°	22:06	22:11	22:14	04:32	06:09	07:43
56°	21:55	22:04	22:10	04:47	06:19	07:49
54°	21:45	21:57	22:07	05:00	06:28	07:55
52°	21:36	21:52	22:04	05:12	06:36	07:59
50°	21:29	21:46	22:01	05:22	06:43	08:04
45°	21:12	21:35	21:55	05:43	06:58	08:13
N 40°	20:58	21:26	21:50	06:00	07:10	08:21
35°	20:46	21:18	21:46	06:14	07:21	08:27
30°	20:36	21:10	21:42	06:26	07:30	08:33
20°	20:18	20:58	21:35	06:47	07:46	08:43
N 10°	20:03	20:47	21:30	07:05	07:59	08:52
0°	19:48	20:37	21:24	07:22	08:12	09:00
S 10°	19:33	20:27	21:18	07:38	08:24	09:07
20°	19:18	20:16	21:12	07:56	08:37	09:16
30°	18:59	20:03	21:06	08:16	08:52	09:25
35°	18:49	19:56	21:02	08:28	09:01	09:31
40°	18:36	19:47	20:57	08:41	09:11	09:37
45°	18:22	19:37	20:52	08:57	09:22	09:44
S 50°	18:04	19:25	20:46	09:16	09:36	09:52
52°	17:56	19:20	20:43	09:25	09:43	09:56
54°	17:46	19:13	20:40	09:35	09:50	10:00
56°	17:36	19:06	20:36	09:47	09:57	10:05
58°	17:23	18:59	20:32	10:00	10:06	10:10
S 60°	17:09	18:50	20:28	10:15	10:16	10:16

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 17-19 98-89%
12	05:38	05:42	12:06	01:09	13:35	
13	05:46	05:49	12:06	02:00	14:24	
14	05:53	05:56	12:06	02:48	15:12	

July 15, 16, 17 UT (Tue., Wed., Thu.)

	Aries	Venus		Mars		Jupiter		Saturn	
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	293°06.1	222°46.2	N19°55.5	125°40.0	N06°17.3	194°25.2	N23°05.4	290°24.9	S01°20.5
1	308°08.6	237°45.7	56.0	140°41.1	16.6	209°27.0	05.4	305°27.4	20.5
2	323°11.0	252°45.2	56.5	155°42.2	16.0	224°28.9	05.4	320°29.8	20.6
3	338°13.5	267°44.7	·· 56.9	170°43.3	·· 15.4	239°30.7	·· 05.3	335°32.3	·· 20.6
4	353°16.0	282°44.3	57.4	185°44.4	14.8	254°32.6	05.3	350°34.8	20.6
5	8°18.4	297°43.8	57.9	200°45.5	14.2	269°34.5	05.3	5°37.2	20.6
6	23°20.9	312°43.3	N19°58.3	215°46.6	N06°13.6	284°36.3	N23°05.3	20°39.7	S01°20.6
7	38°23.4	327°42.8	58.8	230°47.7	13.0	299°38.2	05.2	35°42.2	20.6
8	53°25.8	342°42.3	59.2	245°48.8	12.4	314°40.0	05.2	50°44.6	20.6
9	68°28.3	357°41.8	19°59.7	260°49.9	·· 11.8	329°41.9	·· 05.2	65°47.1	·· 20.7
10	83°30.7	12°41.3	20°00.2	275°51.0	11.2	344°43.7	05.1	80°49.6	20.7
11	98°33.2	27°40.8	00.6	290°52.1	10.6	359°45.6	05.1	95°52.0	20.7
12	113°35.7	42°40.3	N20°01.1	305°53.2	N06°10.0	14°47.5	N23°05.1	110°54.5	S01°20.7
13	128°38.1	57°39.8	01.5	320°54.3	09.3	29°49.3	05.0	125°57.0	20.7
14	143°40.6	72°39.3	02.0	335°55.4	08.7	44°51.2	05.0	140°59.4	20.7
15	158°43.1	87°38.8	·· 02.4	350°56.5	·· 08.1	59°53.0	·· 05.0	156°01.9	·· 20.7
16	173°45.5	102°38.3	02.9	5°57.6	07.5	74°54.9	05.0	171°04.4	20.8
17	188°48.0	117°37.8	03.3	20°58.7	06.9	89°56.7	04.9	186°06.9	20.8
18	203°50.5	132°37.3	N20°03.8	35°59.7	N06°06.3	104°58.6	N23°04.9	201°09.3	S01°20.8
19	218°52.9	147°36.8	04.3	51°00.8	05.7	120°00.5	04.9	216°11.8	20.8
20	233°55.4	162°36.3	04.7	66°01.9	05.1	135°02.3	04.8	231°14.3	20.8
21	248°57.8	177°35.8	·· 05.2	81°03.0	·· 04.5	150°04.2	·· 04.8	246°16.7	·· 20.8
22	264°00.3	192°35.3	05.6	96°04.1	03.9	165°06.0	04.8	261°19.2	20.8
23	279°02.8	207°34.8	06.0	111°05.2	03.2	180°07.9	04.7	276°21.7	20.9
Mer.pass. 04:27		ν -0.5′	d 0.5′	m -4.07	ν 1.1′	d 0.6′	m 1.55	ν 1.9′	d 0.0′ m -1.90	ν 2.5′	d 0.0′ m 0.89

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	294°05.2	222°34.3	N20°06.5	126°06.3	N06°02.6	195°09.7	N23°04.7	291°24.1	S01°20.9
1	309°07.7	237°33.8	06.9	141°07.4	02.0	210°11.6	04.7	306°26.6	20.9
2	324°10.2	252°33.3	07.4	156°08.5	01.4	225°13.5	04.6	321°29.1	20.9
3	339°12.6	267°32.8	·· 07.8	171°09.6	·· 00.8	240°15.3	·· 04.6	336°31.6	·· 20.9
4	354°15.1	282°32.3	08.3	186°10.7	06°00.2	255°17.2	04.6	351°34.0	20.9
5	9°17.6	297°31.8	08.7	201°11.8	05°59.6	270°19.0	04.6	6°36.5	20.9
6	24°20.0	312°31.3	N20°09.2	216°12.9	N05°59.0	285°20.9	N23°04.5	21°39.0	S01°21.0
7	39°22.5	327°30.8	09.6	231°14.0	58.4	300°22.8	04.5	36°41.4	21.0
8	54°25.0	342°30.3	10.0	246°15.1	57.7	315°24.6	04.5	51°43.9	21.0
9	69°27.4	357°29.8	·· 10.5	261°16.2	·· 57.1	330°26.5	·· 04.4	66°46.4	·· 21.0
10	84°29.9	12°29.3	10.9	276°17.2	56.5	345°28.3	04.4	81°48.9	21.0
11	99°32.3	27°28.8	11.4	291°18.3	55.9	0°30.2	04.4	96°51.3	21.0
12	114°34.8	42°28.3	N20°11.8	306°19.4	N05°55.3	15°32.0	N23°04.3	111°53.8	S01°21.1
13	129°37.3	57°27.8	12.2	321°20.5	54.7	30°33.9	04.3	126°56.3	21.1
14	144°39.7	72°27.3	12.7	336°21.6	54.1	45°35.8	04.3	141°58.7	21.1
15	159°42.2	87°26.7	·· 13.1	351°22.7	·· 53.5	60°37.6	·· 04.2	157°01.2	·· 21.1
16	174°44.7	102°26.2	13.5	6°23.8	52.9	75°39.5	04.2	172°03.7	21.1
17	189°47.1	117°25.7	14.0	21°24.9	52.2	90°41.3	04.2	187°06.2	21.1
18	204°49.6	132°25.2	N20°14.4	36°26.0	N05°51.6	105°43.2	N23°04.2	202°08.6	S01°21.2
19	219°52.1	147°24.7	14.8	51°27.1	51.0	120°45.1	04.1	217°11.1	21.2
20	234°54.5	162°24.2	15.3	66°28.2	50.4	135°46.9	04.1	232°13.6	21.2
21	249°57.0	177°23.7	·· 15.7	81°29.3	·· 49.8	150°48.8	·· 04.1	247°16.1	·· 21.2
22	264°59.4	192°23.2	16.1	96°30.4	49.2	165°50.6	04.0	262°18.5	21.2
23	280°01.9	207°22.6	16.6	111°31.4	48.6	180°52.5	04.0	277°21.0	21.2
Mer.pass. 04:23		ν -0.5′	d 0.4′	m -4.06	ν 1.1′	d 0.6′	m 1.56	ν 1.9′	d 0.0′ m -1.90	ν 2.5′	d 0.0′ m 0.88

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	295°04.4	222°22.1	N20°17.0	126°32.5	N05°48.0	195°54.3	N23°04.0	292°23.5	S01°21.3
1	310°06.8	237°21.6	17.4	141°33.6	47.3	210°56.2	03.9	307°26.0	21.3
2	325°09.3	252°21.1	17.9	156°34.7	46.7	225°58.1	03.9	322°28.4	21.3
3	340°11.8	267°20.6	·· 18.3	171°35.8	·· 46.1	240°59.9	·· 03.9	337°30.9	·· 21.3
4	355°14.2	282°20.1	18.7	186°36.9	45.5	256°01.8	03.8	352°33.4	21.3
5	10°16.7	297°19.6	19.1	201°38.0	44.9	271°03.6	03.8	7°35.9	21.3
6	25°19.2	312°19.0	N20°19.6	216°39.1	N05°44.3	286°05.5	N23°03.8	22°38.3	S01°21.4
7	40°21.6	327°18.5	20.0	231°40.2	43.7	301°07.4	03.7	37°40.8	21.4
8	55°24.1	342°18.0	20.4	246°41.3	43.0	316°09.2	03.7	52°43.3	21.4
9	70°26.6	357°17.5	·· 20.8	261°42.4	·· 42.4	331°11.1	·· 03.7	67°45.8	·· 21.4
10	85°29.0	12°17.0	21.2	276°43.5	41.8	346°12.9	03.6	82°48.2	21.4
11	100°31.5	27°16.5	21.7	291°44.5	41.2	1°14.8	03.6	97°50.7	21.4
12	115°33.9	42°15.9	N20°22.1	306°45.6	N05°40.6	16°16.7	N23°03.6	112°53.2	S01°21.5
13	130°36.4	57°15.4	22.5	321°46.7	40.0	31°18.5	03.6	127°55.7	21.5
14	145°38.9	72°14.9	22.9	336°47.8	39.4	46°20.4	03.5	142°58.1	21.5
15	160°41.3	87°14.4	·· 23.3	351°48.9	·· 38.8	61°22.2	·· 03.5	158°00.6	·· 21.5
16	175°43.8	102°13.8	23.8	6°50.0	38.1	76°24.1	03.5	173°03.1	21.5
17	190°46.3	117°13.3	24.2	21°51.1	37.5	91°26.0	03.4	188°05.6	21.5
18	205°48.7	132°12.8	N20°24.6	36°52.2	N05°36.9	106°27.8	N23°03.4	203°08.0	S01°21.6
19	220°51.2	147°12.3	25.0	51°53.3	36.3	121°29.7	03.4	218°10.5	21.6
20	235°53.7	162°11.8	25.4	66°54.4	35.7	136°31.5	03.3	233°13.0	21.6
21	250°56.1	177°11.2	·· 25.8	81°55.5	·· 35.1	151°33.4	·· 03.3	248°15.5	·· 21.6
22	265°58.6	192°10.7	26.2	96°56.5	34.5	166°35.3	03.3	263°18.0	21.6
23	281°01.1	207°10.2	26.6	111°57.6	33.8	181°37.1	03.2	278°20.4	21.7
Mer.pass. 04:19		ν -0.5′	d 0.4′	m -4.06	ν 1.1′	d 0.6′	m 1.56	ν 1.9′	d 0.0′ m -1.90	ν 2.5′	d 0.0′ m 0.88

Stars

	SHA	Dec
Alpheratz	357°34.2	29°13.8
Ankaa	353°06.6	-42°09.7
Schedar	349°30.4	56°40.4
Diphda	348°46.8	-17°50.6
Achernar	335°19.9	-57°06.1
Hamal	327°50.8	23°34.9
Polaris	314°01.1	89°22.0
Acamar	315°11.6	-40°11.8
Menkar	314°05.8	4°11.5
Mirfak	308°27.9	49°56.9
Aldebaran	290°39.4	16°33.6
Rigel	281°03.7	-8°10.2
Capella	280°21.6	46°01.3
Bellatrix	278°22.7	6°22.4
Elnath	278°01.6	28°37.7
Alnilam	275°37.6	-1°11.1
Betelgeuse	270°51.9	7°24.8
Canopus	263°52.7	-52°42.4
Sirius	258°26.2	-16°45.0
Adhara	255°05.9	-29°00.3
Procyon	244°50.7	5°09.6
Pollux	243°17.2	27°57.9
Avior	234°15.2	-59°35.5
Suhail	222°46.4	-43°32.2
Miaplacidus	221°39.1	-69°49.4
Alphard	217°47.6	-8°46.1
Regulus	207°34.2	11°50.6
Dubhe	193°40.9	61°37.0
Denebola	182°24.6	14°25.9
Gienah	175°43.3	-17°41.1
Acrux	172°59.8	-63°14.7
Gacrux	171°51.3	-57°15.6
Alioth	166°12.6	55°49.5
Spica	158°21.8	-11°17.7
Alkaid	152°51.6	49°11.4
Hadar	148°35.3	-60°30.0
Menkent	147°57.0	-36°29.9
Arcturus	145°47.4	19°03.1
Rigil Kent.	139°39.5	-60°56.7
Kochab	137°19.3	74°03.3
Zuben'ubi	136°55.4	-16°08.9
Alphecca	126°03.2	26°37.9
Antares	112°15.0	-26°29.4
Atria	107°08.4	-69°04.6
Sabik	102°02.0	-15°45.4
Shaula	96°09.4	-37°07.4
Rasalhague	95°57.8	12°32.5
Eltanin	90°41.5	51°29.2
Kaus Aust.	83°31.5	-34°22.3
Vega	80°32.5	38°48.5
Nunki	75°46.8	-26°15.9
Altair	61°59.2	8°56.2
Peacock	53°04.4	-56°39.1
Deneb	49°25.1	45°22.2
Enif	33°38.1	9°59.5
Al Na'ir	27°32.0	-46°50.0
Fomalhaut	15°13.8	-29°29.0
Scheat	13°44.6	28°13.2
Markab	13°29.3	15°20.6

Jul 15 Tue	SHA	Mer.pass
Venus	289°40.1	09:09
Mars	192°33.9	15:36
Jupiter	261°19.1	11:01
Saturn	357°18.8	04:38

Jul 16 Wed	SHA	Mer.pass
Venus	288°29.1	09:10
Mars	192°01.1	15:34
Jupiter	261°04.5	10:58
Saturn	357°18.9	04:34

Jul 17 Thu	SHA	Mer.pass
Venus	287°17.8	09:11
Mars	191°28.2	15:33
Jupiter	260°50.0	10:55
Saturn	357°19.1	04:30

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°30.3	N21°30.8	307°55.7	13.0′	S06°55.1	15.9′	58.1′
1	193°30.2	30.4	322°27.7	13.0′	06°39.2	16.0′	58.1′
2	208°30.2	30.0	336°59.7	13.0′	06°23.2	16.0′	58.1′
3	223°30.1	·· 29.7	351°31.7	13.0′	06°07.2	16.0′	58.1′
4	238°30.0	29.3	6°03.7	13.0′	05°51.2	16.1′	58.2′
5	253°30.0	28.9	20°35.8	13.0′	05°35.1	16.1′	58.2′
6	268°29.9	N21°28.5	35°07.8	13.1′	S05°19.0	16.1′	58.2′
7	283°29.8	28.1	49°39.9	13.1′	05°02.9	16.1′	58.2′
8	298°29.8	27.7	64°11.9	13.1′	04°46.8	16.2′	58.2′
9	313°29.7	·· 27.3	78°44.0	13.1′	04°30.6	16.3′	58.2′
10	328°29.7	26.9	93°16.1	13.1′	04°14.3	16.2′	58.3′
11	343°29.6	26.5	107°48.2	13.1′	03°58.1	16.3′	58.3′
12	358°29.5	N21°26.1	122°20.3	13.1′	S03°41.8	16.3′	58.3′
13	13°29.5	25.7	136°52.3	13.1′	03°25.5	16.3′	58.3′
14	28°29.4	25.3	151°24.4	13.1′	03°09.2	16.4′	58.3′
15	43°29.4	·· 24.8	165°56.5	13.1′	02°52.8	16.3′	58.3′
16	58°29.3	24.4	180°28.6	13.1′	02°36.5	16.4′	58.4′
17	73°29.2	24.0	195°00.7	13.1′	02°20.1	16.4′	58.4′
18	88°29.2	N21°23.6	209°32.8	13.1′	S02°03.7	16.5′	58.4′
19	103°29.1	23.2	224°04.9	13.1′	01°47.2	16.4′	58.4′
20	118°29.1	22.8	238°37.0	13.1′	01°30.8	16.5′	58.4′
21	133°29.0	·· 22.4	253°09.1	13.1′	01°14.3	16.4′	58.4′
22	148°28.9	22.0	267°41.1	13.1′	00°57.9	16.5′	58.5′
23	163°28.9	21.6	282°13.2	13.0′	00°41.4	16.5′	58.5′
	SD = 15.7′	d = 0.4′	SD = 15.8′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°28.8	N21°21.2	296°45.2	13.0′	S00°24.9	16.5′	58.5′
1	193°28.8	20.8	311°17.3	13.0′	S00°08.4	16.6′	58.5′
2	208°28.7	20.4	325°49.3	13.0′	N00°08.2	16.5′	58.5′
3	223°28.6	·· 20.0	340°21.3	13.0′	00°24.7	16.5′	58.5′
4	238°28.6	19.5	354°53.3	13.0′	00°41.2	16.6′	58.6′
5	253°28.5	19.1	9°25.2	12.9′	00°57.8	16.5′	58.6′
6	268°28.5	N21°18.7	23°57.2	12.9′	N01°14.3	16.5′	58.6′
7	283°28.4	18.3	38°29.1	12.9′	01°30.8	16.6′	58.6′
8	298°28.4	17.9	53°01.0	12.9′	01°47.4	16.5′	58.6′
9	313°28.3	·· 17.5	67°32.9	12.9′	02°03.9	16.6′	58.6′
10	328°28.2	17.1	82°04.8	12.8′	02°20.5	16.5′	58.6′
11	343°28.2	16.6	96°36.6	12.8′	02°37.0	16.5′	58.7′
12	358°28.1	N21°16.2	111°08.4	12.8′	N02°53.5	16.6′	58.7′
13	13°28.1	15.8	125°40.2	12.7′	03°10.1	16.5′	58.7′
14	28°28.0	15.4	140°11.9	12.7′	03°26.6	16.5′	58.7′
15	43°28.0	·· 15.0	154°43.6	12.7′	03°43.1	16.5′	58.7′
16	58°27.9	14.5	169°15.3	12.6′	03°59.6	16.5′	58.7′
17	73°27.9	14.1	183°47.0	12.6′	04°16.1	16.4′	58.7′
18	88°27.8	N21°13.7	198°18.6	12.6′	N04°32.5	16.5′	58.8′
19	103°27.8	13.3	212°50.2	12.5′	04°49.0	16.4′	58.8′
20	118°27.7	12.9	227°21.7	12.5′	05°05.4	16.5′	58.8′
21	133°27.6	·· 12.4	241°53.2	12.5′	05°21.9	16.4′	58.8′
22	148°27.6	12.0	256°24.6	12.4′	05°38.3	16.4′	58.8′
23	163°27.5	11.6	270°56.0	12.4′	05°54.7	16.3′	58.8′
	SD = 15.7′	d = 0.4′	SD = 16.0′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°27.5	N21°11.2	285°27.4	12.3′	N06°11.0	16.4′	58.8′
1	193°27.4	10.7	299°58.7	12.3′	06°27.4	16.3′	58.9′
2	208°27.4	10.3	314°30.0	12.2′	06°43.7	16.3′	58.9′
3	223°27.3	·· 09.9	329°01.2	12.2′	07°00.0	16.2′	58.9′
4	238°27.3	09.5	343°32.4	12.1′	07°16.2	16.3′	58.9′
5	253°27.2	09.0	358°03.5	12.1′	07°32.5	16.2′	58.9′
6	268°27.2	N21°08.6	12°34.6	12.0′	N07°48.7	16.2′	58.9′
7	283°27.1	08.2	27°05.6	12.0′	08°04.9	16.1′	58.9′
8	298°27.1	07.7	41°36.6	11.9′	08°21.0	16.1′	58.9′
9	313°27.0	·· 07.3	56°07.5	11.9′	08°37.1	16.1′	59.0′
10	328°27.0	06.9	70°38.4	11.8′	08°53.2	16.0′	59.0′
11	343°26.9	06.5	85°09.2	11.7′	09°09.2	16.0′	59.0′
12	358°26.9	N21°06.0	99°39.9	11.7′	N09°25.2	16.0′	59.0′
13	13°26.8	05.6	114°10.6	11.6′	09°41.2	15.9′	59.0′
14	28°26.8	05.2	128°41.2	11.5′	09°57.1	15.8′	59.0′
15	43°26.7	·· 04.7	143°11.7	11.5′	10°12.9	15.8′	59.0′
16	58°26.7	04.3	157°42.2	11.4′	10°28.7	15.8′	59.0′
17	73°26.6	03.9	172°12.6	11.3′	10°44.5	15.7′	59.1′
18	88°26.6	N21°03.4	186°43.0	11.3′	N11°00.2	15.7′	59.1′
19	103°26.5	03.0	201°13.2	11.2′	11°15.9	15.6′	59.1′
20	118°26.5	02.5	215°43.4	11.1′	11°31.5	15.6′	59.1′
21	133°26.4	·· 02.1	230°13.6	11.1′	11°47.1	15.5′	59.1′
22	148°26.4	01.7	244°43.6	11.0′	12°02.6	15.5′	59.1′
23	163°26.3	01.2	259°13.6	10.9′	12°18.1	15.4′	59.1′
	SD = 15.7′	d = 0.4′	SD = 16.0′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	▭	▭	▭	▭	▭	▭
N 70°	▭	▭	▭	▭	▭	▭
68°	▭	▭	▭	▭	▭	▭
66°	////	////	01:41	22:28	////	////
64°	////	////	02:19	21:51	////	////
62°	////	00:58	02:45	21:25	23:08	////
60°	////	01:49	03:06	21:05	22:21	////
N 58°	////	02:19	03:23	20:48	21:51	////
56°	00:54	02:41	03:37	20:35	21:30	23:13
54°	01:40	02:59	03:49	20:23	21:12	22:30
52°	02:08	03:14	03:59	20:12	20:57	22:03
50°	02:29	03:27	04:09	20:03	20:44	21:42
45°	03:06	03:53	04:29	19:43	20:19	21:05
N 40°	03:33	04:13	04:45	19:27	19:59	20:38
35°	03:54	04:29	04:58	19:14	19:43	20:18
30°	04:11	04:43	05:10	19:02	19:29	20:01
20°	04:37	05:05	05:30	18:42	19:07	19:35
N 10°	04:57	05:24	05:47	18:25	18:48	19:15
0°	05:15	05:40	06:03	18:10	18:32	18:58
S 10°	05:30	05:56	06:18	17:54	18:17	18:43
20°	05:44	06:11	06:35	17:37	18:01	18:28
30°	05:59	06:28	06:54	17:19	17:44	18:14
35°	06:06	06:37	07:05	17:08	17:35	18:06
40°	06:14	06:48	07:18	16:55	17:25	17:58
45°	06:23	07:00	07:32	16:40	17:13	17:49
S 50°	06:33	07:14	07:51	16:22	16:59	17:39
52°	06:38	07:20	07:59	16:13	16:53	17:35
54°	06:42	07:27	08:09	16:04	16:46	17:30
56°	06:47	07:35	08:20	15:53	16:38	17:25
58°	06:53	07:44	08:32	15:41	16:29	17:20
S 60°	06:59	07:53	08:46	15:26	16:19	17:14

Lat.	**Moonrise** Tue	Wed	Thu	**Moonset** Tue	Wed	Thu
N 72°	22:22	21:46	21:02	08:46	11:04	13:31
N 70°	22:21	21:53	21:21	08:53	11:01	13:14
68°	22:20	21:59	21:36	08:58	10:58	13:02
66°	22:19	22:05	21:48	09:03	10:55	12:51
64°	22:18	22:09	21:59	09:07	10:53	12:43
62°	22:18	22:13	22:08	09:10	10:52	12:35
60°	22:17	22:16	22:16	09:13	10:50	12:29
N 58°	22:17	22:19	22:23	09:16	10:49	12:23
56°	22:16	22:22	22:29	09:18	10:47	12:18
54°	22:16	22:24	22:34	09:20	10:46	12:14
52°	22:15	22:26	22:39	09:22	10:45	12:10
50°	22:15	22:29	22:44	09:24	10:44	12:06
45°	22:14	22:33	22:54	09:28	10:42	11:59
N 40°	22:13	22:37	23:02	09:31	10:41	11:52
35°	22:13	22:40	23:09	09:33	10:39	11:47
30°	22:12	22:43	23:15	09:35	10:38	11:42
20°	22:12	22:48	23:26	09:39	10:36	11:34
N 10°	22:11	22:52	23:36	09:43	10:34	11:26
0°	22:10	22:57	23:45	09:46	10:32	11:19
S 10°	22:09	23:01	23:55	09:49	10:30	11:13
20°	22:09	23:06	·· ··	09:52	10:28	11:05
30°	22:08	23:11	·· ··	09:56	10:26	10:57
35°	22:08	23:14	·· ··	09:58	10:25	10:53
40°	22:07	23:18	·· ··	10:00	10:23	10:47
45°	22:07	23:22	·· ··	10:03	10:22	10:41
S 50°	22:06	23:27	·· ··	10:06	10:20	10:34
52°	22:06	23:29	·· ··	10:08	10:19	10:31
54°	22:05	23:32	·· ··	10:09	10:18	10:27
56°	22:05	23:35	·· ··	10:11	10:17	10:23
58°	22:04	23:38	·· ··	10:13	10:16	10:18
S 60°	22:04	23:41	·· ··	10:15	10:14	10:13

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 20-22 82-62%
15	05:59	06:02	12:06	03:35	15:58	
16	06:05	06:07	12:06	04:21	16:44	
17	06:10	06:13	12:06	05:08	17:32	

July 18, 19, 20 UT (Fri., Sat., Sun.)

	Aries	Venus		Mars		Jupiter		Saturn	
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	296°03.5	222°09.7	N20°27.1	126°58.7	N05°33.2	196°39.0	N23°03.2	293°22.9	S01°21.7
1	311°06.0	237°09.1	27.5	141°59.8	32.6	211°40.8	03.2	308°25.4	21.7
2	326°08.4	252°08.6	27.9	157°00.9	32.0	226°42.7	03.1	323°27.9	21.7
3	341°10.9	267°08.1	·· 28.3	172°02.0	·· 31.4	241°44.6	·· 03.1	338°30.4	·· 21.7
4	356°13.4	282°07.5	28.7	187°03.1	30.8	256°46.4	03.1	353°32.8	21.8
5	11°15.8	297°07.0	29.1	202°04.2	30.1	271°48.3	03.0	8°35.3	21.8
6	26°18.3	312°06.5	N20°29.5	217°05.3	N05°29.5	286°50.1	N23°03.0	23°37.8	S01°21.8
7	41°20.8	327°06.0	29.9	232°06.4	28.9	301°52.0	03.0	38°40.3	21.8
8	56°23.2	342°05.4	30.3	247°07.4	28.3	316°53.9	02.9	53°42.7	21.8
9	71°25.7	357°04.9	·· 30.7	262°08.5	·· 27.7	331°55.7	·· 02.9	68°45.2	·· 21.8
10	86°28.2	12°04.4	31.1	277°09.6	27.1	346°57.6	02.9	83°47.7	21.9
11	101°30.6	27°03.8	31.5	292°10.7	26.5	1°59.4	02.8	98°50.2	21.9
12	116°33.1	42°03.3	N20°31.9	307°11.8	N05°25.8	17°01.3	N23°02.8	113°52.7	S01°21.9
13	131°35.5	57°02.8	32.3	322°12.9	25.2	32°03.2	02.8	128°55.1	21.9
14	146°38.0	72°02.2	32.7	337°14.0	24.6	47°05.0	02.7	143°57.6	21.9
15	161°40.5	87°01.7	·· 33.1	352°15.1	·· 24.0	62°06.9	·· 02.7	159°00.1	·· 22.0
16	176°42.9	102°01.2	33.5	7°16.2	23.4	77°08.8	02.7	174°02.6	22.0
17	191°45.4	117°00.6	33.9	22°17.2	22.8	92°10.6	02.6	189°05.1	22.0
18	206°47.9	132°00.1	N20°34.3	37°18.3	N05°22.1	107°12.5	N23°02.6	204°07.6	S01°22.0
19	221°50.3	146°59.6	34.7	52°19.4	21.5	122°14.3	02.6	219°10.0	22.0
20	236°52.8	161°59.0	35.1	67°20.5	20.9	137°16.2	02.5	234°12.5	22.1
21	251°55.3	176°58.5	·· 35.5	82°21.6	·· 20.3	152°18.1	·· 02.5	249°15.0	·· 22.1
22	266°57.7	191°58.0	35.9	97°22.7	19.7	167°19.9	02.5	264°17.5	22.1
23	282°00.2	206°57.4	36.3	112°23.8	19.1	182°21.8	02.4	279°20.0	22.1
Mer.pass. 04:15		ν -0.5′ d 0.4′		m -4.05	ν 1.1′ d 0.6′		m 1.56	ν 1.9′ d 0.0′	m -1.90	ν 2.5′ d 0.0′	m 0.87

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	297°02.7	221°56.9	N20°36.6	127°24.9	N05°18.4	197°23.6	N23°02.4	294°22.4	S01°22.1
1	312°05.1	236°56.3	37.0	142°26.0	17.8	212°25.5	02.4	309°24.9	22.2
2	327°07.6	251°55.8	37.4	157°27.0	17.2	227°27.4	02.3	324°27.4	22.2
3	342°10.0	266°55.3	·· 37.8	172°28.1	·· 16.6	242°29.2	·· 02.3	339°29.9	·· 22.2
4	357°12.5	281°54.7	38.2	187°29.2	16.0	257°31.1	02.3	354°32.4	22.2
5	12°15.0	296°54.2	38.6	202°30.3	15.4	272°33.0	02.2	9°34.9	22.2
6	27°17.4	311°53.7	N20°39.0	217°31.4	N05°14.7	287°34.8	N23°02.2	24°37.3	S01°22.3
7	42°19.9	326°53.1	39.4	232°32.5	14.1	302°36.7	02.2	39°39.8	22.3
8	57°22.4	341°52.6	39.7	247°33.6	13.5	317°38.5	02.1	54°42.3	22.3
9	72°24.8	356°52.0	·· 40.1	262°34.7	·· 12.9	332°40.4	·· 02.1	69°44.8	·· 22.3
10	87°27.3	11°51.5	40.5	277°35.7	12.3	347°42.3	02.1	84°47.3	22.3
11	102°29.8	26°50.9	40.9	292°36.8	11.6	2°44.1	02.0	99°49.8	22.4
12	117°32.2	41°50.4	N20°41.3	307°37.9	N05°11.0	17°46.0	N23°02.0	114°52.2	S01°22.4
13	132°34.7	56°49.9	41.6	322°39.0	10.4	32°47.9	02.0	129°54.7	22.4
14	147°37.2	71°49.3	42.0	337°40.1	09.8	47°49.7	01.9	144°57.2	22.4
15	162°39.6	86°48.8	·· 42.4	352°41.2	·· 09.2	62°51.6	·· 01.9	159°59.7	·· 22.4
16	177°42.1	101°48.2	42.8	7°42.3	08.6	77°53.4	01.9	175°02.2	22.5
17	192°44.5	116°47.7	43.2	22°43.4	07.9	92°55.3	01.8	190°04.7	22.5
18	207°47.0	131°47.1	N20°43.5	37°44.4	N05°07.3	107°57.2	N23°01.8	205°07.1	S01°22.5
19	222°49.5	146°46.6	43.9	52°45.5	06.7	122°59.0	01.8	220°09.6	22.5
20	237°51.9	161°46.0	44.3	67°46.6	06.1	138°00.9	01.7	235°12.1	22.6
21	252°54.4	176°45.5	·· 44.6	82°47.7	·· 05.5	153°02.8	·· 01.7	250°14.6	·· 22.6
22	267°56.9	191°44.9	45.0	97°48.8	04.8	168°04.6	01.7	265°17.1	22.6
23	282°59.3	206°44.4	45.4	112°49.9	04.2	183°06.5	01.6	280°19.6	22.6
Mer.pass. 04:11		ν -0.5′ d 0.4′		m -4.05	ν 1.1′ d 0.6′		m 1.57	ν 1.9′ d 0.0′	m -1.90	ν 2.5′ d 0.0′	m 0.87

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	298°01.8	221°43.8	N20°45.8	127°51.0	N05°03.6	198°08.3	N23°01.6	295°22.1	S01°22.6
1	313°04.3	236°43.3	46.1	142°52.1	03.0	213°10.2	01.6	310°24.5	22.7
2	328°06.7	251°42.7	46.5	157°53.1	02.4	228°12.1	01.5	325°27.0	22.7
3	343°09.2	266°42.2	·· 46.9	172°54.2	·· 01.7	243°13.9	·· 01.5	340°29.5	·· 22.7
4	358°11.7	281°41.6	47.2	187°55.3	01.1	258°15.8	01.5	355°32.0	22.7
5	13°14.1	296°41.1	47.6	202°56.4	05°00.5	273°17.7	01.4	10°34.5	22.7
6	28°16.6	311°40.5	N20°48.0	217°57.5	N04°59.9	288°19.5	N23°01.4	25°37.0	S01°22.8
7	43°19.0	326°40.0	48.3	232°58.6	59.3	303°21.4	01.4	40°39.5	22.8
8	58°21.5	341°39.4	48.7	247°59.7	58.6	318°23.3	01.3	55°42.0	22.8
9	73°24.0	356°38.9	·· 49.1	263°00.7	·· 58.0	333°25.1	·· 01.3	70°44.4	·· 22.8
10	88°26.4	11°38.3	49.4	278°01.8	57.4	348°27.0	01.3	85°46.9	22.9
11	103°28.9	26°37.8	49.8	293°02.9	56.8	3°28.8	01.2	100°49.4	22.9
12	118°31.4	41°37.2	N20°50.1	308°04.0	N04°56.2	18°30.7	N23°01.2	115°51.9	S01°22.9
13	133°33.8	56°36.7	50.5	323°05.1	55.5	33°32.6	01.2	130°54.4	22.9
14	148°36.3	71°36.1	50.9	338°06.2	54.9	48°34.4	01.1	145°56.9	22.9
15	163°38.8	86°35.6	·· 51.2	353°07.3	·· 54.3	63°36.3	·· 01.1	160°59.4	·· 23.0
16	178°41.2	101°35.0	51.6	8°08.3	53.7	78°38.2	01.1	176°01.9	23.0
17	193°43.7	116°34.4	51.9	23°09.4	53.1	93°40.0	01.0	191°04.3	23.0
18	208°46.1	131°33.9	N20°52.3	38°10.5	N04°52.4	108°41.9	N23°01.0	206°06.8	S01°23.0
19	223°48.6	146°33.3	52.6	53°11.6	51.8	123°43.8	01.0	221°09.3	23.1
20	238°51.1	161°32.8	53.0	68°12.7	51.2	138°45.6	00.9	236°11.8	23.1
21	253°53.5	176°32.2	·· 53.3	83°13.8	·· 50.6	153°47.5	·· 00.9	251°14.3	·· 23.1
22	268°56.0	191°31.6	53.7	98°14.9	50.0	168°49.4	00.8	266°16.8	23.1
23	283°58.5	206°31.1	54.0	113°15.9	49.3	183°51.2	00.8	281°19.3	23.2
Mer.pass. 04:07		ν -0.5′ d 0.4′		m -4.04	ν 1.1′ d 0.6′		m 1.57	ν 1.9′ d 0.0′	m -1.90	ν 2.5′ d 0.0′	m 0.86

Stars	SHA	Dec
Alpheratz	357°34.2	29°13.8
Ankaa	353°06.6	-42°09.7
Schedar	349°30.4	56°40.4
Diphda	348°46.8	-17°50.6
Achernar	335°19.8	-57°06.1
Hamal	327°50.7	23°34.9
Polaris	313°59.5	89°22.0
Acamar	315°11.6	-40°11.8
Menkar	314°05.8	4°11.5
Mirfak	308°27.9	49°56.9
Aldebaran	290°39.4	16°33.6
Rigel	281°03.7	-8°10.2
Capella	280°21.6	46°01.3
Bellatrix	278°22.7	6°22.4
Elnath	278°01.6	28°37.7
Alnilam	275°37.6	-1°11.0
Betelgeuse	270°51.9	7°24.8
Canopus	263°52.7	-52°42.4
Sirius	258°26.2	-16°45.0
Adhara	255°05.9	-29°00.3
Procyon	244°50.7	5°09.6
Pollux	243°17.1	27°57.9
Avior	234°15.2	-59°35.5
Suhail	222°46.4	-43°32.2
Miaplacidus	221°39.1	-69°49.4
Alphard	217°47.6	-8°46.1
Regulus	207°34.2	11°50.6
Dubhe	193°40.9	61°37.0
Denebola	182°24.7	14°25.9
Gienah	175°43.3	-17°41.1
Acrux	172°59.9	-63°14.7
Gacrux	171°51.4	-57°15.6
Alioth	166°12.7	55°49.5
Spica	158°21.9	-11°17.7
Alkaid	152°51.6	49°11.4
Hadar	148°35.3	-60°30.0
Menkent	147°57.1	-36°29.9
Arcturus	145°47.4	19°03.1
Rigil Kent.	139°39.5	-60°56.7
Kochab	137°19.4	74°03.3
Zuben'ubi	136°55.4	-16°08.9
Alphecca	126°03.2	26°37.9
Antares	112°15.0	-26°29.4
Atria	107°08.4	-69°04.6
Sabik	102°02.0	-15°45.4
Shaula	96°09.4	-37°07.4
Rasalhague	95°57.8	12°32.5
Eltanin	90°41.5	51°29.2
Kaus Aust.	83°31.5	-34°22.4
Vega	80°32.5	38°48.5
Nunki	75°46.8	-26°15.9
Altair	61°59.2	8°56.2
Peacock	53°04.4	-56°39.1
Deneb	49°25.1	45°22.2
Enif	33°38.1	9°59.6
Al Na'ir	27°32.0	-46°50.0
Fomalhaut	15°13.8	-29°29.0
Scheat	13°44.5	28°13.2
Markab	13°29.2	15°20.6

Jul 18 Fri	SHA	Mer.pass
Venus	286°06.1	09:12
Mars	190°55.2	15:31
Jupiter	260°35.5	10:52
Saturn	357°19.4	04:26

Jul 19 Sat	SHA	Mer.pass
Venus	284°54.2	09:13
Mars	190°22.2	15:29
Jupiter	260°21.0	10:49
Saturn	357°19.8	04:22

Jul 20 Sun	SHA	Mer.pass
Venus	283°42.0	09:13
Mars	189°49.2	15:27
Jupiter	260°06.6	10:46
Saturn	357°20.3	04:18

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°26.3	N21°00.8	273°43.5	10.8′	N12°33.5	15.3′	59.1′
1	193°26.2	21°00.3	288°13.4	10.8′	12°48.8	15.3′	59.1′
2	208°26.2	20°59.9	302°43.1	10.7′	13°04.1	15.2′	59.2′
3	223°26.1	·· 59.5	317°12.8	10.6′	13°19.3	15.1′	59.2′
4	238°26.1	59.0	331°42.4	10.5′	13°34.4	15.1′	59.2′
5	253°26.0	58.6	346°11.9	10.4′	13°49.5	15.0′	59.2′
6	268°26.0	N20°58.1	0°41.3	10.3′	N14°04.5	15.0′	59.2′
7	283°25.9	57.7	15°10.7	10.3′	14°19.5	14.8′	59.2′
8	298°25.9	57.3	29°39.9	10.2′	14°34.3	14.8′	59.2′
9	313°25.9	·· 56.8	44°09.1	10.1′	14°49.1	14.8′	59.2′
10	328°25.8	56.4	58°38.2	10.0′	15°03.9	14.6′	59.2′
11	343°25.8	55.9	73°07.2	9.9′	15°18.5	14.6′	59.2′
12	358°25.7	N20°55.5	87°36.1	9.8′	N15°33.1	14.5′	59.3′
13	13°25.7	55.0	102°04.9	9.7′	15°47.6	14.4′	59.3′
14	28°25.6	54.6	116°33.6	9.6′	16°02.0	14.3′	59.3′
15	43°25.6	·· 54.1	131°02.3	9.5′	16°16.3	14.2′	59.3′
16	58°25.5	53.7	145°30.8	9.5′	16°30.5	14.2′	59.3′
17	73°25.5	53.2	159°59.3	9.4′	16°44.7	14.0′	59.3′
18	88°25.5	N20°52.8	174°27.6	9.3′	N16°58.7	14.0′	59.3′
19	103°25.4	52.3	188°55.9	9.2′	17°12.7	13.9′	59.3′
20	118°25.4	51.9	203°24.0	9.1′	17°26.6	13.8′	59.3′
21	133°25.3	·· 51.4	217°52.1	9.0′	17°40.4	13.7′	59.3′
22	148°25.3	51.0	232°20.1	8.9′	17°54.1	13.6′	59.3′
23	163°25.2	50.5	246°48.0	8.8′	18°07.7	13.4′	59.4′
	SD = 15.7′	d = 0.4′	SD = 16.1′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°25.2	N20°50.1	261°15.7	8.7′	N18°21.1	13.4′	59.4′
1	193°25.2	49.6	275°43.4	8.6′	18°34.5	13.3′	59.4′
2	208°25.1	49.1	290°11.0	8.5′	18°47.8	13.2′	59.4′
3	223°25.1	·· 48.7	304°38.4	8.4′	19°01.0	13.1′	59.4′
4	238°25.0	48.2	319°05.8	8.3′	19°14.1	13.0′	59.4′
5	253°25.0	47.8	333°33.1	8.2′	19°27.1	12.8′	59.4′
6	268°25.0	N20°47.3	348°00.2	8.1′	N19°39.9	12.8′	59.4′
7	283°24.9	46.9	2°27.3	8.0′	19°52.7	12.6′	59.4′
8	298°24.9	46.4	16°54.2	7.9′	20°05.3	12.5′	59.4′
9	313°24.8	·· 45.9	31°21.1	7.7′	20°17.8	12.4′	59.4′
10	328°24.8	45.5	45°47.8	7.6′	20°30.2	12.3′	59.4′
11	343°24.8	45.0	60°14.5	7.5′	20°42.5	12.1′	59.4′
12	358°24.7	N20°44.6	74°41.0	7.4′	N20°54.6	12.1′	59.4′
13	13°24.7	44.1	89°07.5	7.3′	21°06.7	11.9′	59.4′
14	28°24.6	43.6	103°33.8	7.2′	21°18.6	11.8′	59.4′
15	43°24.6	·· 43.2	118°00.0	7.1′	21°30.4	11.6′	59.5′
16	58°24.6	42.7	132°26.1	7.0′	21°42.0	11.5′	59.5′
17	73°24.5	42.2	146°52.1	6.9′	21°53.5	11.4′	59.5′
18	88°24.5	N20°41.8	161°18.0	6.8′	N22°04.9	11.3′	59.5′
19	103°24.4	41.3	175°43.8	6.7′	22°16.2	11.1′	59.5′
20	118°24.4	40.8	190°09.5	6.6′	22°27.3	11.0′	59.5′
21	133°24.4	·· 40.4	204°35.1	6.5′	22°38.3	10.9′	59.5′
22	148°24.3	39.9	219°00.6	6.4′	22°49.2	10.7′	59.5′
23	163°24.3	39.4	233°26.0	6.3′	22°59.9	10.5′	59.5′
	SD = 15.7′	d = 0.5′	SD = 16.2′				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°24.3	N20°39.0	247°51.3	6.2′	N23°10.4	10.4′	59.5′
1	193°24.2	38.5	262°16.5	6.1′	23°20.8	10.3′	59.5′
2	208°24.2	38.0	276°41.5	6.0′	23°31.1	10.1′	59.5′
3	223°24.1	·· 37.6	291°06.5	5.9′	23°41.2	10.0′	59.5′
4	238°24.1	37.1	305°31.4	5.8′	23°51.2	9.8′	59.5′
5	253°24.1	36.6	319°56.2	5.7′	24°01.0	9.7′	59.5′
6	268°24.0	N20°36.1	334°20.8	5.6′	N24°10.7	9.5′	59.5′
7	283°24.0	35.7	348°45.4	5.5′	24°20.2	9.4′	59.5′
8	298°24.0	35.2	3°09.9	5.4′	24°29.6	9.2′	59.5′
9	313°23.9	·· 34.7	17°34.3	5.3′	24°38.8	9.0′	59.5′
10	328°23.9	34.2	31°58.5	5.2′	24°47.8	8.9′	59.5′
11	343°23.9	33.8	46°22.7	5.1′	24°56.7	8.7′	59.5′
12	358°23.8	N20°33.3	60°46.8	5.0′	N25°05.4	8.6′	59.5′
13	13°23.8	32.8	75°10.8	4.9′	25°14.0	8.4′	59.5′
14	28°23.8	32.3	89°34.7	4.8′	25°22.4	8.2′	59.5′
15	43°23.7	·· 31.9	103°58.5	4.7′	25°30.6	8.1′	59.5′
16	58°23.7	31.4	118°22.2	4.6′	25°38.7	7.8′	59.5′
17	73°23.7	30.9	132°45.9	4.5′	25°46.5	7.8′	59.5′
18	88°23.6	N20°30.4	147°09.4	4.5′	N25°54.3	7.5′	59.5′
19	103°23.6	29.9	161°32.9	4.4′	26°01.8	7.4′	59.5′
20	118°23.6	29.5	175°56.3	4.3′	26°09.2	7.1′	59.5′
21	133°23.5	·· 29.0	190°19.5	4.2′	26°16.3	7.0′	59.5′
22	148°23.5	28.5	204°42.8	4.1′	26°23.3	6.9′	59.5′
23	163°23.5	28.0	219°05.9	4.1′	26°30.2	6.6′	59.5′
	SD = 15.7′	d = 0.5′	SD = 16.2′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°						
N 70°						
68°	////	////	00:49	23:14	////	////
66°	////	////	01:54	22:15	////	////
64°	////	////	02:28	21:42	////	////
62°	////	01:17	02:53	21:18	22:51	////
60°	////	01:59	03:12	20:59	22:11	////
N 58°	////	02:26	03:28	20:44	21:44	////
56°	01:10	02:47	03:41	20:30	21:24	22:58
54°	01:49	03:04	03:53	20:19	21:07	22:21
52°	02:14	03:19	04:03	20:09	20:53	21:56
50°	02:34	03:31	04:12	20:00	20:41	21:37
45°	03:10	03:56	04:32	19:41	20:16	21:01
N 40°	03:36	04:16	04:47	19:25	19:57	20:36
35°	03:56	04:31	05:00	19:12	19:41	20:16
30°	04:13	04:45	05:11	19:01	19:28	20:00
20°	04:38	05:07	05:31	18:42	19:06	19:34
N 10°	04:58	05:25	05:47	18:25	18:48	19:14
0°	05:15	05:41	06:03	18:10	18:32	18:58
S 10°	05:30	05:56	06:18	17:55	18:17	18:43
20°	05:44	06:11	06:34	17:39	18:02	18:29
30°	05:58	06:27	06:53	17:20	17:46	18:15
35°	06:05	06:36	07:03	17:09	17:37	18:08
40°	06:13	06:46	07:16	16:57	17:27	18:00
45°	06:21	06:58	07:30	16:43	17:16	17:52
S 50°	06:31	07:11	07:48	16:25	17:02	17:42
52°	06:35	07:17	07:56	16:17	16:56	17:38
54°	06:39	07:24	08:05	16:08	16:49	17:34
56°	06:44	07:31	08:16	15:58	16:42	17:29
58°	06:50	07:40	08:27	15:46	16:34	17:24
S 60°	06:55	07:49	08:41	15:32	16:24	17:18

Lat.	**Moonrise** Fri	Sat	Sun	**Moonset** Fri	Sat	Sun
N 72°	19:36			16:43		
N 70°	20:30			15:52		
68°	21:03			15:20		
66°	21:27	20:49		14:57	17:30	
64°	21:47	21:29		14:39	16:51	
62°	22:03	21:57	21:49	14:25	16:24	18:35
60°	22:16	22:19	22:27	14:13	16:03	17:58
N 58°	22:28	22:37	22:54	14:02	15:46	17:31
56°	22:38	22:52	23:15	13:53	15:32	17:11
54°	22:47	23:05	23:33	13:45	15:19	16:54
52°	22:55	23:16	23:48	13:38	15:08	16:39
50°	23:02	23:26	·· ··	13:31	14:59	16:26
45°	23:18	23:48	·· ··	13:17	14:39	16:00
N 40°	23:31	·· ··	00:05	13:06	14:22	15:40
35°	23:42	·· ··	00:20	12:56	14:09	15:22
30°	23:51	·· ··	00:33	12:48	13:57	15:08
20°	·· ··	00:08	00:55	12:34	13:37	14:43
N 10°	·· ··	00:23	01:15	12:21	13:19	14:21
0°	·· ··	00:37	01:33	12:09	13:03	14:01
S 10°	·· ··	00:51	01:51	11:58	12:47	13:41
20°	00:05	01:06	02:11	11:45	12:30	13:20
30°	00:16	01:24	02:34	11:31	12:10	12:55
35°	00:23	01:34	02:47	11:23	11:58	12:41
40°	00:30	01:46	03:03	11:14	11:45	12:24
45°	00:40	02:00	03:22	11:03	11:30	12:04
S 50°	00:50	02:17	03:46	10:50	11:11	11:39
52°	00:56	02:25	03:57	10:44	11:02	11:28
54°	01:01	02:34	04:10	10:38	10:52	11:14
56°	01:08	02:45	04:25	10:30	10:41	10:58
58°	01:15	02:57	04:43	10:22	10:28	10:40
S 60°	01:23	03:10	05:05	10:13	10:14	10:17

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 23-25 50-28%
18	06:15	06:17	12:06	05:57	18:23	
19	06:19	06:21	12:06	06:50	19:18	
20	06:23	06:25	12:06	07:47	20:17	

July 21, 22, 23 UT (Mon., Tue., Wed.)

	Aries	Venus		Mars		Jupiter		Saturn	
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	299°00.9	221°30.5	N20°54.4	128°17.0	N04°48.7	198°53.1	N23°00.8	296°21.8	S01°23.2
1	314°03.4	236°30.0	54.7	143°18.1	48.1	213°54.9	00.7	311°24.3	23.2
2	329°05.9	251°29.4	55.1	158°19.2	47.5	228°56.8	00.7	326°26.7	23.2
3	344°08.3	266°28.8	·· 55.4	173°20.3	·· 46.9	243°58.7	·· 00.7	341°29.2	·· 23.2
4	359°10.8	281°28.3	55.8	188°21.4	46.2	259°00.5	00.6	356°31.7	23.3
5	14°13.3	296°27.7	56.1	203°22.4	45.6	274°02.4	00.6	11°34.2	23.3
6	29°15.7	311°27.2	N20°56.5	218°23.5	N04°45.0	289°04.3	N23°00.6	26°36.7	S01°23.3
7	44°18.2	326°26.6	56.8	233°24.6	44.4	304°06.1	00.5	41°39.2	23.3
8	59°20.6	341°26.0	57.2	248°25.7	43.7	319°08.0	00.5	56°41.7	23.4
9	74°23.1	356°25.5	·· 57.5	263°26.8	·· 43.1	334°09.9	·· 00.5	71°44.2	·· 23.4
10	89°25.6	11°24.9	57.8	278°27.9	42.5	349°11.7	00.4	86°46.7	23.4
11	104°28.0	26°24.3	58.2	293°29.0	41.9	4°13.6	00.4	101°49.2	23.4
12	119°30.5	41°23.8	N20°58.5	308°30.0	N04°41.3	19°15.5	N23°00.4	116°51.7	S01°23.5
13	134°33.0	56°23.2	58.9	323°31.1	40.6	34°17.3	00.3	131°54.2	23.5
14	149°35.4	71°22.6	59.2	338°32.2	40.0	49°19.2	00.3	146°56.6	23.5
15	164°37.9	86°22.1	·· 59.5	353°33.3	·· 39.4	64°21.1	·· 00.2	161°59.1	·· 23.5
16	179°40.4	101°21.5	20°59.9	8°34.4	38.8	79°22.9	00.2	177°01.6	23.6
17	194°42.8	116°20.9	21°00.2	23°35.5	38.1	94°24.8	00.2	192°04.1	23.6
18	209°45.3	131°20.4	N21°00.5	38°36.5	N04°37.5	109°26.7	N23°00.1	207°06.6	S01°23.6
19	224°47.8	146°19.8	00.9	53°37.6	36.9	124°28.5	00.1	222°09.1	23.6
20	239°50.2	161°19.2	01.2	68°38.7	36.3	139°30.4	00.1	237°11.6	23.7
21	254°52.7	176°18.7	·· 01.5	83°39.8	·· 35.7	154°32.3	·· 00.0	252°14.1	·· 23.7
22	269°55.1	191°18.1	01.9	98°40.9	35.0	169°34.1	00.0	267°16.6	23.7
23	284°57.6	206°17.5	02.2	113°42.0	34.4	184°36.0	00.0	282°19.1	23.7
Mer.pass. 04:03		ν -0.6′	d 0.3′	m -4.04	ν 1.1′	d 0.6′	m 1.57	ν 1.9′	d 0.0′ m -1.90	ν 2.5′	d 0.0′ m 0.86

Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	300°00.1	221°16.9	N21°02.5	128°43.0	N04°33.8	199°37.9	N22°59.9	297°21.6	S01°23.8
1	315°02.5	236°16.4	02.9	143°44.1	33.2	214°39.7	59.9	312°24.1	23.8
2	330°05.0	251°15.8	03.2	158°45.2	32.5	229°41.6	59.9	327°26.6	23.8
3	345°07.5	266°15.2	·· 03.5	173°46.3	·· 31.9	244°43.5	·· 59.8	342°29.1	·· 23.8
4	0°09.9	281°14.7	03.8	188°47.4	31.3	259°45.3	59.8	357°31.5	23.9
5	15°12.4	296°14.1	04.2	203°48.4	30.7	274°47.2	59.8	12°34.0	23.9
6	30°14.9	311°13.5	N21°04.5	218°49.5	N04°30.0	289°49.1	N22°59.7	27°36.5	S01°23.9
7	45°17.3	326°12.9	04.8	233°50.6	29.4	304°50.9	59.7	42°39.0	23.9
8	60°19.8	341°12.4	05.1	248°51.7	28.8	319°52.8	59.6	57°41.5	24.0
9	75°22.3	356°11.8	·· 05.5	263°52.8	·· 28.2	334°54.7	·· 59.6	72°44.0	·· 24.0
10	90°24.7	11°11.2	05.8	278°53.9	27.6	349°56.5	59.6	87°46.5	24.0
11	105°27.2	26°10.6	06.1	293°54.9	26.9	4°58.4	59.5	102°49.0	24.0
12	120°29.6	41°10.1	N21°06.4	308°56.0	N04°26.3	20°00.3	N22°59.5	117°51.5	S01°24.1
13	135°32.1	56°09.5	06.7	323°57.1	25.7	35°02.1	59.5	132°54.0	24.1
14	150°34.6	71°08.9	07.1	338°58.2	25.1	50°04.0	59.4	147°56.5	24.1
15	165°37.0	86°08.3	·· 07.4	353°59.3	·· 24.4	65°05.9	·· 59.4	162°59.0	·· 24.1
16	180°39.5	101°07.8	07.7	9°00.3	23.8	80°07.7	59.4	178°01.5	24.2
17	195°42.0	116°07.2	08.0	24°01.4	23.2	95°09.6	59.3	193°04.0	24.2
18	210°44.4	131°06.6	N21°08.3	39°02.5	N04°22.6	110°11.5	N22°59.3	208°06.5	S01°24.2
19	225°46.9	146°06.0	08.6	54°03.6	21.9	125°13.3	59.2	223°09.0	24.2
20	240°49.4	161°05.4	08.9	69°04.7	21.3	140°15.2	59.2	238°11.5	24.3
21	255°51.8	176°04.9	·· 09.3	84°05.8	·· 20.7	155°17.1	·· 59.2	253°14.0	·· 24.3
22	270°54.3	191°04.3	09.6	99°06.8	20.1	170°18.9	59.1	268°16.5	24.3
23	285°56.8	206°03.7	09.9	114°07.9	19.4	185°20.8	59.1	283°19.0	24.3
Mer.pass. 03:59		ν -0.6′	d 0.3′	m -4.04	ν 1.1′	d 0.6′	m 1.58	ν 1.9′	d 0.0′ m -1.90	ν 2.5′	d 0.0′ m 0.85

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	300°59.2	221°03.1	N21°10.2	129°09.0	N04°18.8	200°22.7	N22°59.1	298°21.5	S01°24.4
1	316°01.7	236°02.5	10.5	144°10.1	18.2	215°24.5	59.0	313°24.0	24.4
2	331°04.1	251°02.0	10.8	159°11.2	17.6	230°26.4	59.0	328°26.5	24.4
3	346°06.6	266°01.4	·· 11.1	174°12.2	·· 16.9	245°28.3	·· 59.0	343°29.0	·· 24.4
4	1°09.1	281°00.8	11.4	189°13.3	16.3	260°30.1	58.9	358°31.5	24.5
5	16°11.5	296°00.2	11.7	204°14.4	15.7	275°32.0	58.9	13°34.0	24.5
6	31°14.0	310°59.6	N21°12.0	219°15.5	N04°15.1	290°33.9	N22°58.8	28°36.5	S01°24.5
7	46°16.5	325°59.0	12.3	234°16.6	14.4	305°35.7	58.8	43°39.0	24.6
8	61°18.9	340°58.5	12.6	249°17.6	13.8	320°37.6	58.8	58°41.5	24.6
9	76°21.4	355°57.9	·· 12.9	264°18.7	·· 13.2	335°39.5	·· 58.7	73°44.0	·· 24.6
10	91°23.9	10°57.3	13.2	279°19.8	12.6	350°41.3	58.7	88°46.5	24.6
11	106°26.3	25°56.7	13.5	294°20.9	11.9	5°43.2	58.7	103°48.9	24.7
12	121°28.8	40°56.1	N21°13.8	309°22.0	N04°11.3	20°45.1	N22°58.6	118°51.4	S01°24.7
13	136°31.3	55°55.5	14.1	324°23.0	10.7	35°47.0	58.6	133°53.9	24.7
14	151°33.7	70°54.9	14.4	339°24.1	10.0	50°48.8	58.6	148°56.4	24.7
15	166°36.2	85°54.4	·· 14.7	354°25.2	·· 09.4	65°50.7	·· 58.5	163°58.9	·· 24.8
16	181°38.6	100°53.8	15.0	9°26.3	08.8	80°52.6	58.5	179°01.4	24.8
17	196°41.1	115°53.2	15.3	24°27.4	08.2	95°54.4	58.4	194°03.9	24.8
18	211°43.6	130°52.6	N21°15.6	39°28.4	N04°07.5	110°56.3	N22°58.4	209°06.4	S01°24.9
19	226°46.0	145°52.0	15.9	54°29.5	06.9	125°58.2	58.4	224°08.9	24.9
20	241°48.5	160°51.4	16.2	69°30.6	06.3	141°00.0	58.3	239°11.4	24.9
21	256°51.0	175°50.8	·· 16.4	84°31.7	·· 05.7	156°01.9	·· 58.3	254°14.0	·· 24.9
22	271°53.4	190°50.2	16.7	99°32.8	05.0	171°03.8	58.3	269°16.5	25.0
23	286°55.9	205°49.6	17.0	114°33.8	04.4	186°05.6	58.2	284°19.0	25.0
Mer.pass. 03:55		ν -0.6′	d 0.3′	m -4.03	ν 1.1′	d 0.6′	m 1.58	ν 1.9′	d 0.0′ m -1.91	ν 2.5′	d 0.0′ m 0.85

Stars

	SHA	Dec
Alpheratz	357°34.1	29°13.8
Ankaa	353°06.5	-42°09.7
Schedar	349°30.4	56°40.4
Diphda	348°46.7	-17°50.6
Achernar	335°19.8	-57°06.1
Hamal	327°50.7	23°34.9
Polaris	313°57.7	89°22.0
Acamar	315°11.5	-40°11.8
Menkar	314°05.8	4°11.5
Mirfak	308°27.8	49°56.9
Aldebaran	290°39.3	16°33.6
Rigel	281°03.7	-8°10.2
Capella	280°21.6	46°01.3
Bellatrix	278°22.7	6°22.4
Elnath	278°01.6	28°37.7
Alnilam	275°37.5	-1°11.0
Betelgeuse	270°51.9	7°24.8
Canopus	263°52.7	-52°42.4
Sirius	258°26.2	-16°45.0
Adhara	255°05.9	-29°00.3
Procyon	244°50.7	5°09.6
Pollux	243°17.1	27°57.9
Avior	234°15.2	-59°35.4
Suhail	222°46.4	-43°32.2
Miaplacidus	221°39.1	-69°49.4
Alphard	217°47.6	-8°46.1
Regulus	207°34.2	11°50.6
Dubhe	193°40.9	61°37.0
Denebola	182°24.7	14°25.9
Gienah	175°43.3	-17°41.1
Acrux	172°59.9	-63°14.7
Gacrux	171°51.4	-57°15.6
Alioth	166°12.7	55°49.5
Spica	158°21.9	-11°17.7
Alkaid	152°51.6	49°11.4
Hadar	148°35.3	-60°30.0
Menkent	147°57.1	-36°29.9
Arcturus	145°47.5	19°03.1
Rigil Kent.	139°39.6	-60°56.7
Kochab	137°19.5	74°03.3
Zuben'ubi	136°55.4	-16°08.9
Alphecca	126°03.2	26°37.9
Antares	112°15.0	-26°29.4
Atria	107°08.4	-69°04.6
Sabik	102°02.0	-15°45.4
Shaula	96°09.4	-37°07.4
Rasalhague	95°57.8	12°32.6
Eltanin	90°41.5	51°29.2
Kaus Aust.	83°31.5	-34°22.4
Vega	80°32.5	38°48.5
Nunki	75°46.8	-26°15.9
Altair	61°59.2	8°56.2
Peacock	53°04.4	-56°39.1
Deneb	49°25.0	45°22.3
Enif	33°38.1	9°59.6
Al Na'ir	27°31.9	-46°50.0
Fomalhaut	15°13.7	-29°29.0
Scheat	13°44.5	28°13.2
Markab	13°29.2	15°20.6

Jul 21 Mon	SHA	Mer.pass
Venus	282°29.6	09:14
Mars	189°16.1	15:26
Jupiter	259°52.1	10:43
Saturn	357°20.8	04:14

Jul 22 Tue	SHA	Mer.pass
Venus	281°16.9	09:15
Mars	188°43.0	15:24
Jupiter	259°37.8	10:40
Saturn	357°21.5	04:10

Jul 23 Wed	SHA	Mer.pass
Venus	280°03.9	09:16
Mars	188°09.8	15:22
Jupiter	259°23.4	10:37
Saturn	357°22.2	04:06

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°23.4	N20°27.5	233°29.0	4.0′	N26°36.8	6.5′	59.5′
1	193°23.4	27.0	247°51.9	3.9′	26°43.3	6.3′	59.5′
2	208°23.4	26.6	262°14.9	3.8′	26°49.6	6.1′	59.5′
3	223°23.4	·· 26.1	276°37.7	3.8′	26°55.7	5.9′	59.5′
4	238°23.3	25.6	291°00.5	3.7′	27°01.6	5.7′	59.5′
5	253°23.3	25.1	305°23.2	3.6′	27°07.3	5.6′	59.5′
6	268°23.3	N20°24.6	319°45.8	3.6′	N27°12.9	5.3′	59.5′
7	283°23.2	24.1	334°08.4	3.5′	27°18.2	5.2′	59.5′
8	298°23.2	23.6	348°30.9	3.5′	27°23.4	4.9′	59.5′
9	313°23.2	·· 23.2	2°53.4	3.4′	27°28.3	4.8′	59.5′
10	328°23.1	22.7	17°15.8	3.3′	27°33.1	4.6′	59.5′
11	343°23.1	22.2	31°38.1	3.3′	27°37.7	4.4′	59.5′
12	358°23.1	N20°21.7	46°00.4	3.3′	N27°42.1	4.2′	59.4′
13	13°23.1	21.2	60°22.7	3.2′	27°46.3	4.0′	59.4′
14	28°23.0	20.7	74°44.9	3.2′	27°50.3	3.8′	59.4′
15	43°23.0	·· 20.2	89°07.0	3.1′	27°54.1	3.6′	59.4′
16	58°23.0	19.7	103°29.2	3.1′	27°57.7	3.5′	59.4′
17	73°23.0	19.2	117°51.2	3.0′	28°01.2	3.2′	59.4′
18	88°22.9	N20°18.7	132°13.3	3.0′	N28°04.4	3.0′	59.4′
19	103°22.9	18.2	146°35.3	3.0′	28°07.4	2.8′	59.4′
20	118°22.9	17.7	160°57.3	3.0′	28°10.2	2.6′	59.4′
21	133°22.8	·· 17.2	175°19.2	2.9′	28°12.8	2.5′	59.4′
22	148°22.8	16.7	189°41.2	2.9′	28°15.3	2.2′	59.4′
23	163°22.8	16.2	204°03.1	2.9′	28°17.5	2.0′	59.4′
	SD = 15.7′	d = 0.5′	SD = 16.2′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°22.8	N20°15.8	218°25.0	2.9′	N28°19.5	1.8′	59.4′
1	193°22.7	15.3	232°46.9	2.9′	28°21.3	1.7′	59.4′
2	208°22.7	14.8	247°08.7	2.9′	28°23.0	1.4′	59.3′
3	223°22.7	·· 14.3	261°30.6	2.9′	28°24.4	1.2′	59.3′
4	238°22.7	13.8	275°52.4	2.8′	28°25.6	1.0′	59.3′
5	253°22.6	13.3	290°14.3	2.8′	28°26.6	0.8′	59.3′
6	268°22.6	N20°12.8	304°36.1	2.8′	N28°27.4	0.6′	59.3′
7	283°22.6	12.3	318°58.0	2.9′	28°28.0	0.5′	59.3′
8	298°22.6	11.7	333°19.8	2.9′	28°28.5	0.2′	59.3′
9	313°22.6	·· 11.2	347°41.7	2.9′	28°28.7	0.0′	59.3′
10	328°22.5	10.7	2°03.6	2.9′	28°28.7	0.2′	59.3′
11	343°22.5	10.2	16°25.5	2.9′	28°28.5	0.4′	59.3′
12	358°22.5	N20°09.7	30°47.4	2.9′	N28°28.1	0.6′	59.2′
13	13°22.5	09.2	45°09.3	2.9′	28°27.5	0.8′	59.2′
14	28°22.4	08.7	59°31.2	3.0′	28°26.7	1.0′	59.2′
15	43°22.4	·· 08.2	73°53.2	3.0′	28°25.7	1.2′	59.2′
16	58°22.4	07.7	88°15.2	3.0′	28°24.5	1.4′	59.2′
17	73°22.4	07.2	102°37.3	3.1′	28°23.1	1.6′	59.2′
18	88°22.4	N20°06.7	116°59.3	3.1′	N28°21.5	1.7′	59.2′
19	103°22.3	06.2	131°21.4	3.1′	28°19.8	2.0′	59.2′
20	118°22.3	05.7	145°43.6	3.2′	28°17.8	2.2′	59.1′
21	133°22.3	·· 05.2	160°05.8	3.2′	28°15.6	2.4′	59.1′
22	148°22.3	04.7	174°28.0	3.3′	28°13.2	2.6′	59.1′
23	163°22.3	04.1	188°50.3	3.3′	28°10.6	2.7′	59.1′
	SD = 15.7′	d = 0.5′	SD = 16.2′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°22.2	N20°03.6	203°12.6	3.4′	N28°07.9	3.0′	59.1′
1	193°22.2	03.1	217°35.0	3.4′	28°04.9	3.1′	59.1′
2	208°22.2	02.6	231°57.5	3.5′	28°01.8	3.4′	59.0′
3	223°22.2	·· 02.1	246°20.0	3.6′	27°58.4	3.5′	59.0′
4	238°22.2	01.6	260°42.5	3.6′	27°54.9	3.7′	59.0′
5	253°22.1	01.1	275°05.2	3.7′	27°51.2	4.0′	59.0′
6	268°22.1	N20°00.5	289°27.9	3.8′	N27°47.2	4.1′	59.0′
7	283°22.1	20°00.0	303°50.6	3.8′	27°43.1	4.2′	59.0′
8	298°22.1	19°59.5	318°13.5	3.9′	27°38.9	4.5′	58.9′
9	313°22.1	·· 59.0	332°36.4	4.0′	27°34.4	4.7′	58.9′
10	328°22.1	58.5	346°59.4	4.1′	27°29.7	4.8′	58.9′
11	343°22.0	58.0	1°22.5	4.2′	27°24.9	5.0′	58.9′
12	358°22.0	N19°57.4	15°45.6	4.2′	N27°19.9	5.2′	58.9′
13	13°22.0	56.9	30°08.8	4.3′	27°14.7	5.4′	58.9′
14	28°22.0	56.4	44°32.2	4.4′	27°09.3	5.6′	58.8′
15	43°22.0	·· 55.9	58°55.6	4.5′	27°03.7	5.7′	58.8′
16	58°22.0	55.4	73°19.1	4.6′	26°58.0	5.9′	58.8′
17	73°21.9	54.8	87°42.6	4.7′	26°52.1	6.1′	58.8′
18	88°21.9	N19°54.3	102°06.3	4.8′	N26°46.0	6.3′	58.8′
19	103°21.9	53.8	116°30.1	4.9′	26°39.7	6.4′	58.7′
20	118°21.9	53.3	130°54.0	5.0′	26°33.3	6.6′	58.7′
21	133°21.9	·· 52.7	145°17.9	5.1′	26°26.7	6.7′	58.7′
22	148°21.9	52.2	159°42.0	5.2′	26°20.0	7.0′	58.7′
23	163°21.9	51.7	174°06.2	5.3′	26°13.0	7.1′	58.7′
	SD = 15.7′	d = 0.5′	SD = 16.1′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	▭	▭	▭	▭	▭	▭
N 70°	▭	▭	▭	▭	▭	▭
68°	////	////	01:16	22:51	////	////
66°	////	////	02:06	22:03	////	////
64°	////	////	02:37	21:33	////	////
62°	////	01:32	03:00	21:11	22:37	////
60°	////	02:09	03:18	20:53	22:02	////
N 58°	////	02:34	03:34	20:38	21:37	////
56°	01:24	02:54	03:46	20:25	21:18	22:45
54°	01:58	03:10	03:58	20:14	21:02	22:13
52°	02:21	03:24	04:07	20:05	20:48	21:50
50°	02:40	03:35	04:16	19:56	20:37	21:32
45°	03:15	04:00	04:35	19:38	20:13	20:57
N 40°	03:39	04:18	04:50	19:23	19:54	20:33
35°	03:59	04:34	05:02	19:10	19:39	20:14
30°	04:15	04:47	05:13	18:59	19:26	19:58
20°	04:40	05:08	05:32	18:41	19:05	19:33
N 10°	04:59	05:25	05:48	18:25	18:47	19:14
0°	05:15	05:41	06:03	18:10	18:32	18:58
S 10°	05:30	05:55	06:18	17:55	18:18	18:43
20°	05:43	06:10	06:33	17:40	18:03	18:30
30°	05:57	06:26	06:51	17:22	17:47	18:17
35°	06:04	06:34	07:02	17:12	17:39	18:10
40°	06:11	06:44	07:14	17:00	17:29	18:02
45°	06:19	06:55	07:27	16:46	17:18	17:54
S 50°	06:28	07:08	07:44	16:29	17:05	17:45
52°	06:32	07:14	07:52	16:21	17:00	17:41
54°	06:36	07:20	08:01	16:12	16:53	17:37
56°	06:41	07:28	08:11	16:02	16:46	17:33
58°	06:46	07:36	08:23	15:51	16:38	17:28
S 60°	06:51	07:44	08:36	15:38	16:29	17:22

Lat.	**Moonrise** Mon	Tue	Wed	**Moonset** Mon	Tue	Wed
N 72°	▭	▭	▭	▭	▭	▭
N 70°	▭	▭	▭	▭	▭	▭
68°	▭	▭	▭	▭	▭	▭
66°	▭	▭	▭	▭	▭	▭
64°	▭	▭	▭	▭	▭	▭
62°	▭	▭	▭	▭	▭	21:52
60°	22:52	23:59	·· ··	19:44	20:50	21:14
N 58°	23:29	·· ··	00:36	19:07	20:13	20:48
56°	23:56	·· ··	01:03	18:40	19:46	20:26
54°	·· ··	00:17	01:24	18:19	19:25	20:09
52°	·· ··	00:35	01:41	18:02	19:08	19:54
50°	00:01	00:50	01:56	17:47	18:53	19:41
45°	00:28	01:20	02:26	17:17	18:22	19:14
N 40°	00:49	01:44	02:49	16:53	17:59	18:52
35°	01:07	02:04	03:09	16:34	17:39	18:35
30°	01:23	02:20	03:25	16:17	17:22	18:19
20°	01:49	02:49	03:53	15:49	16:54	17:53
N 10°	02:12	03:13	04:17	15:25	16:29	17:30
0°	02:33	03:36	04:39	15:03	16:07	17:09
S 10°	02:55	03:59	05:02	14:41	15:44	16:47
20°	03:18	04:24	05:26	14:17	15:19	16:24
30°	03:45	04:52	05:54	13:49	14:50	15:57
35°	04:01	05:10	06:10	13:32	14:33	15:42
40°	04:19	05:29	06:29	13:13	14:13	15:23
45°	04:42	05:54	06:52	12:50	13:49	15:00
S 50°	05:11	06:25	07:22	12:20	13:18	14:31
52°	05:25	06:41	07:36	12:06	13:02	14:17
54°	05:42	06:59	07:53	11:49	12:44	14:01
56°	06:02	07:21	08:13	11:29	12:22	13:41
58°	06:26	07:50	08:38	11:04	11:53	13:16
S 60°	07:00	08:32	09:12	10:30	11:11	12:43

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 26-28 18-4%
21	06:26	06:28	12:06	08:48	21:20	
22	06:29	06:30	12:07	09:51	22:23	
23	06:31	06:32	12:07	10:54	23:25	

July 24, 25, 26 UT (Thu., Fri., Sat.)

	Aries	Venus		Mars		Jupiter		Saturn	
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	301°58.4	220°49.1	N21°17.3	129°34.9	N04°03.8	201°07.5	N22°58.2	299°21.5	S01°25.0
1	317°00.8	235°48.5	17.6	144°36.0	03.2	216°09.4	58.1	314°24.0	25.0
2	332°03.3	250°47.9	17.9	159°37.1	02.5	231°11.3	58.1	329°26.5	25.1
3	347°05.8	265°47.3	·· 18.2	174°38.1	·· 01.9	246°13.1	·· 58.1	344°29.0	·· 25.1
4	2°08.2	280°46.7	18.5	189°39.2	01.3	261°15.0	58.0	359°31.5	25.1
5	17°10.7	295°46.1	18.7	204°40.3	00.6	276°16.9	58.0	14°34.0	25.2
6	32°13.1	310°45.5	N21°19.0	219°41.4	N04°00.0	291°18.7	N22°58.0	29°36.5	S01°25.2
7	47°15.6	325°44.9	19.3	234°42.5	03°59.4	306°20.6	57.9	44°39.0	25.2
8	62°18.1	340°44.3	19.6	249°43.5	58.8	321°22.5	57.9	59°41.5	25.2
9	77°20.5	355°43.7	·· 19.9	264°44.6	·· 58.1	336°24.3	·· 57.8	74°44.0	·· 25.3
10	92°23.0	10°43.1	20.1	279°45.7	57.5	351°26.2	57.8	89°46.5	25.3
11	107°25.5	25°42.5	20.4	294°46.8	56.9	6°28.1	57.8	104°49.0	25.3
12	122°27.9	40°41.9	N21°20.7	309°47.9	N03°56.3	21°30.0	N22°57.7	119°51.5	S01°25.4
13	137°30.4	55°41.3	21.0	324°48.9	55.6	36°31.8	57.7	134°54.0	25.4
14	152°32.9	70°40.7	21.2	339°50.0	55.0	51°33.7	57.7	149°56.5	25.4
15	167°35.3	85°40.1	·· 21.5	354°51.1	·· 54.4	66°35.6	·· 57.6	164°59.0	·· 25.4
16	182°37.8	100°39.5	21.8	9°52.2	53.7	81°37.4	57.6	180°01.5	25.5
17	197°40.3	115°38.9	22.1	24°53.2	53.1	96°39.3	57.5	195°04.0	25.5
18	212°42.7	130°38.3	N21°22.3	39°54.3	N03°52.5	111°41.2	N22°57.5	210°06.5	S01°25.5
19	227°45.2	145°37.7	22.6	54°55.4	51.9	126°43.1	57.5	225°09.0	25.6
20	242°47.6	160°37.1	22.9	69°56.5	51.2	141°44.9	57.4	240°11.5	25.6
21	257°50.1	175°36.6	·· 23.1	84°57.5	·· 50.6	156°46.8	·· 57.4	255°14.0	·· 25.6
22	272°52.6	190°36.0	23.4	99°58.6	50.0	171°48.7	57.4	270°16.5	25.7
23	287°55.0	205°35.4	23.7	114°59.7	49.3	186°50.5	57.3	285°19.0	25.7
Mer.pass.	03:51	ν -0.6′	d 0.3′	m -4.03	ν 1.1′	d 0.6′	m 1.58	ν 1.9′	d 0.0′ m -1.91	ν 2.5′	d 0.0′ m 0.84

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	302°57.5	220°34.7	N21°23.9	130°00.8	N03°48.7	201°52.4	N22°57.3	300°21.5	S01°25.7
1	318°00.0	235°34.1	24.2	145°01.9	48.1	216°54.3	57.2	315°24.0	25.7
2	333°02.4	250°33.5	24.5	160°02.9	47.5	231°56.1	57.2	330°26.5	25.8
3	348°04.9	265°32.9	·· 24.7	175°04.0	·· 46.8	246°58.0	·· 57.2	345°29.0	·· 25.8
4	3°07.4	280°32.3	25.0	190°05.1	46.2	261°59.9	57.1	0°31.6	25.8
5	18°09.8	295°31.7	25.2	205°06.2	45.6	277°01.8	57.1	15°34.1	25.9
6	33°12.3	310°31.1	N21°25.5	220°07.2	N03°44.9	292°03.6	N22°57.0	30°36.6	S01°25.9
7	48°14.7	325°30.5	25.8	235°08.3	44.3	307°05.5	57.0	45°39.1	25.9
8	63°17.2	340°29.9	26.0	250°09.4	43.7	322°07.4	57.0	60°41.6	26.0
9	78°19.7	355°29.3	·· 26.3	265°10.5	·· 43.0	337°09.3	·· 56.9	75°44.1	·· 26.0
10	93°22.1	10°28.7	26.5	280°11.5	42.4	352°11.1	56.9	90°46.6	26.0
11	108°24.6	25°28.1	26.8	295°12.6	41.8	7°13.0	56.9	105°49.1	26.0
12	123°27.1	40°27.5	N21°27.0	310°13.7	N03°41.2	22°14.9	N22°56.8	120°51.6	S01°26.1
13	138°29.5	55°26.9	27.3	325°14.8	40.5	37°16.7	56.8	135°54.1	26.1
14	153°32.0	70°26.3	27.5	340°15.8	39.9	52°18.6	56.7	150°56.6	26.1
15	168°34.5	85°25.7	·· 27.8	355°16.9	·· 39.3	67°20.5	·· 56.7	165°59.1	·· 26.2
16	183°36.9	100°25.1	28.0	10°18.0	38.6	82°22.4	56.7	181°01.6	26.2
17	198°39.4	115°24.5	28.3	25°19.1	38.0	97°24.2	56.6	196°04.1	26.2
18	213°41.9	130°23.9	N21°28.5	40°20.2	N03°37.4	112°26.1	N22°56.6	211°06.7	S01°26.3
19	228°44.3	145°23.3	28.8	55°21.2	36.7	127°28.0	56.6	226°09.2	26.3
20	243°46.8	160°22.7	29.0	70°22.3	36.1	142°29.8	56.5	241°11.7	26.3
21	258°49.2	175°22.1	·· 29.3	85°23.4	·· 35.5	157°31.7	·· 56.5	256°14.2	·· 26.3
22	273°51.7	190°21.4	29.5	100°24.5	34.9	172°33.6	56.4	271°16.7	26.4
23	288°54.2	205°20.8	29.8	115°25.5	34.2	187°35.5	56.4	286°19.2	26.4
Mer.pass.	03:48	ν -0.6′	d 0.3′	m -4.03	ν 1.1′	d 0.6′	m 1.59	ν 1.9′	d 0.0′ m -1.91	ν 2.5′	d 0.0′ m 0.84

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	303°56.6	220°20.2	N21°30.0	130°26.6	N03°33.6	202°37.3	N22°56.4	301°21.7	S01°26.4
1	318°59.1	235°19.6	30.3	145°27.7	33.0	217°39.2	56.3	316°24.2	26.5
2	334°01.6	250°19.0	30.5	160°28.8	32.3	232°41.1	56.3	331°26.7	26.5
3	349°04.0	265°18.4	·· 30.7	175°29.8	·· 31.7	247°43.0	·· 56.2	346°29.2	·· 26.5
4	4°06.5	280°17.8	31.0	190°30.9	31.1	262°44.8	56.2	1°31.7	26.6
5	19°09.0	295°17.2	31.2	205°32.0	30.4	277°46.7	56.2	16°34.2	26.6
6	34°11.4	310°16.6	N21°31.5	220°33.0	N03°29.8	292°48.6	N22°56.1	31°36.8	S01°26.6
7	49°13.9	325°16.0	31.7	235°34.1	29.2	307°50.5	56.1	46°39.3	26.7
8	64°16.4	340°15.3	31.9	250°35.2	28.6	322°52.3	56.0	61°41.8	26.7
9	79°18.8	355°14.7	·· 32.2	265°36.3	·· 27.9	337°54.2	·· 56.0	76°44.3	·· 26.7
10	94°21.3	10°14.1	32.4	280°37.3	27.3	352°56.1	56.0	91°46.8	26.8
11	109°23.7	25°13.5	32.6	295°38.4	26.7	7°58.0	55.9	106°49.3	26.8
12	124°26.2	40°12.9	N21°32.9	310°39.5	N03°26.0	22°59.8	N22°55.9	121°51.8	S01°26.8
13	139°28.7	55°12.3	33.1	325°40.6	25.4	38°01.7	55.9	136°54.3	26.9
14	154°31.1	70°11.7	33.3	340°41.6	24.8	53°03.6	55.8	151°56.8	26.9
15	169°33.6	85°11.0	·· 33.6	355°42.7	·· 24.1	68°05.4	·· 55.8	166°59.4	·· 26.9
16	184°36.1	100°10.4	33.8	10°43.8	23.5	83°07.3	55.7	182°01.9	27.0
17	199°38.5	115°09.8	34.0	25°44.9	22.9	98°09.2	55.7	197°04.4	27.0
18	214°41.0	130°09.2	N21°34.2	40°45.9	N03°22.2	113°11.1	N22°55.7	212°06.9	S01°27.0
19	229°43.5	145°08.6	34.5	55°47.0	21.6	128°12.9	55.6	227°09.4	27.0
20	244°45.9	160°08.0	34.7	70°48.1	21.0	143°14.8	55.6	242°11.9	27.1
21	259°48.4	175°07.3	·· 34.9	85°49.2	·· 20.3	158°16.7	·· 55.5	257°14.4	·· 27.1
22	274°50.8	190°06.7	35.1	100°50.2	19.7	173°18.6	55.5	272°16.9	27.1
23	289°53.3	205°06.1	35.4	115°51.3	19.1	188°20.4	55.5	287°19.4	27.2
Mer.pass.	03:44	ν -0.6′	d 0.2′	m -4.02	ν 1.1′	d 0.6′	m 1.59	ν 1.9′	d 0.0′ m -1.91	ν 2.5′	d 0.0′ m 0.83

Stars

	SHA	Dec
Alpheratz	357°34.1	29°13.8
Ankaa	353°06.5	-42°09.7
Schedar	349°30.3	56°40.5
Diphda	348°46.7	-17°50.6
Achernar	335°19.8	-57°06.1
Hamal	327°50.7	23°35.0
Polaris	313°56.0	89°22.0
Acamar	315°11.5	-40°11.8
Menkar	314°05.7	4°11.5
Mirfak	308°27.8	49°56.9
Aldebaran	290°39.3	16°33.7
Rigel	281°03.7	-8°10.2
Capella	280°21.6	46°01.3
Bellatrix	278°22.6	6°22.4
Elnath	278°01.6	28°37.7
Alnilam	275°37.5	-1°11.0
Betelgeuse	270°51.9	7°24.8
Canopus	263°52.7	-52°42.3
Sirius	258°26.2	-16°44.9
Adhara	255°05.9	-29°00.3
Procyon	244°50.7	5°09.6
Pollux	243°17.1	27°57.9
Avior	234°15.2	-59°35.4
Suhail	222°46.4	-43°32.1
Miaplacidus	221°39.1	-69°49.4
Alphard	217°47.6	-8°46.1
Regulus	207°34.2	11°50.6
Dubhe	193°40.9	61°37.0
Denebola	182°24.7	14°25.9
Gienah	175°43.3	-17°41.1
Acrux	172°59.9	-63°14.7
Gacrux	171°51.4	-57°15.6
Alioth	166°12.7	55°49.5
Spica	158°21.9	-11°17.7
Alkaid	152°51.6	49°11.4
Hadar	148°35.4	-60°30.0
Menkent	147°57.1	-36°29.9
Arcturus	145°47.5	19°03.1
Rigil Kent.	139°39.6	-60°56.7
Kochab	137°19.5	74°03.3
Zuben'ubi	136°55.4	-16°08.9
Alphecca	126°03.2	26°37.9
Antares	112°15.0	-26°29.4
Atria	107°08.4	-69°04.6
Sabik	102°02.0	-15°45.4
Shaula	96°09.4	-37°07.4
Rasalhague	95°57.8	12°32.6
Eltanin	90°41.5	51°29.2
Kaus Aust.	83°31.5	-34°22.4
Vega	80°32.5	38°48.5
Nunki	75°46.8	-26°15.9
Altair	61°59.2	8°56.2
Peacock	53°04.4	-56°39.1
Deneb	49°25.0	45°22.3
Enif	33°38.0	9°59.6
Al Na'ir	27°31.9	-46°50.0
Fomalhaut	15°13.7	-29°29.0
Scheat	13°44.5	28°13.3
Markab	13°29.2	15°20.6

Jul 24 Thu	SHA	Mer.pass
Venus	278°50.7	09:17
Mars	187°36.6	15:21
Jupiter	259°09.2	10:34
Saturn	357°23.1	04:02

Jul 25 Fri	SHA	Mer.pass
Venus	277°37.3	09:18
Mars	187°03.3	15:19
Jupiter	258°54.9	10:31
Saturn	357°24.0	03:58

Jul 26 Sat	SHA	Mer.pass
Venus	276°23.6	09:19
Mars	186°30.0	15:17
Jupiter	258°40.7	10:28
Saturn	357°25.1	03:54

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°21.9	N19°51.2	188°30.5	5.4′	N26°05.9	7.2′	58.6′
1	193°21.8	50.6	202°54.8	5.5′	25°58.7	7.4′	58.6′
2	208°21.8	50.1	217°19.3	5.6′	25°51.3	7.6′	58.6′
3	223°21.8	·· 49.6	231°43.9	5.7′	25°43.7	7.7′	58.6′
4	238°21.8	49.1	246°08.6	5.8′	25°36.0	7.9′	58.6′
5	253°21.8	48.5	260°33.4	5.9′	25°28.1	8.1′	58.5′
6	268°21.8	N19°48.0	274°58.3	6.0′	N25°20.0	8.2′	58.5′
7	283°21.8	47.5	289°23.4	6.1′	25°11.8	8.3′	58.5′
8	298°21.8	46.9	303°48.5	6.3′	25°03.5	8.5′	58.5′
9	313°21.7	·· 46.4	318°13.8	6.4′	24°55.0	8.6′	58.4′
10	328°21.7	45.9	332°39.1	6.5′	24°46.4	8.8′	58.4′
11	343°21.7	45.4	347°04.6	6.6′	24°37.6	8.9′	58.4′
12	358°21.7	N19°44.8	1°30.2	6.7′	N24°28.7	9.1′	58.4′
13	13°21.7	44.3	15°56.0	6.8′	24°19.6	9.2′	58.3′
14	28°21.7	43.8	30°21.8	7.0′	24°10.4	9.4′	58.3′
15	43°21.7	·· 43.2	44°47.8	7.1′	24°01.0	9.5′	58.3′
16	58°21.7	42.7	59°13.8	7.2′	23°51.5	9.6′	58.3′
17	73°21.7	42.2	73°40.0	7.3′	23°41.9	9.7′	58.3′
18	88°21.7	N19°41.6	88°06.3	7.4′	N23°32.2	9.9′	58.2′
19	103°21.6	41.1	102°32.8	7.6′	23°22.3	10.0′	58.2′
20	118°21.6	40.5	116°59.3	7.7′	23°12.3	10.2′	58.2′
21	133°21.6	·· 40.0	131°26.0	7.8′	23°02.1	10.2′	58.2′
22	148°21.6	39.5	145°52.8	7.9′	22°51.9	10.4′	58.1′
23	163°21.6	38.9	160°19.7	8.0′	22°41.5	10.5′	58.1′
	SD = 15.7′	d = 0.5′	SD = 16.0′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°21.6	N19°38.4	174°46.8	8.2′	N22°31.0	10.7′	58.1′
1	193°21.6	37.8	189°14.0	8.3′	22°20.3	10.7′	58.1′
2	208°21.6	37.3	203°41.2	8.4′	22°09.6	10.9′	58.0′
3	223°21.6	·· 36.8	218°08.6	8.5′	21°58.7	10.9′	58.0′
4	238°21.6	36.2	232°36.2	8.7′	21°47.8	11.1′	58.0′
5	253°21.6	35.7	247°03.8	8.8′	21°36.7	11.2′	57.9′
6	268°21.6	N19°35.1	261°31.6	8.9′	N21°25.5	11.3′	57.9′
7	283°21.6	34.6	275°59.5	9.0′	21°14.2	11.4′	57.9′
8	298°21.6	34.1	290°27.5	9.1′	21°02.8	11.6′	57.9′
9	313°21.6	·· 33.5	304°55.7	9.3′	20°51.2	11.6′	57.8′
10	328°21.6	33.0	319°23.9	9.4′	20°39.6	11.7′	57.8′
11	343°21.5	32.4	333°52.3	9.5′	20°27.9	11.8′	57.8′
12	358°21.5	N19°31.9	348°20.8	9.6′	N20°16.1	11.9′	57.8′
13	13°21.5	31.3	2°49.4	9.7′	20°04.2	12.0′	57.7′
14	28°21.5	30.8	17°18.2	9.9′	19°52.2	12.2′	57.7′
15	43°21.5	·· 30.2	31°47.0	10.0′	19°40.0	12.2′	57.7′
16	58°21.5	29.7	46°16.0	10.1′	19°27.8	12.2′	57.6′
17	73°21.5	29.1	60°45.1	10.2′	19°15.6	12.4′	57.6′
18	88°21.5	N19°28.6	75°14.3	10.3′	N19°03.2	12.5′	57.6′
19	103°21.5	28.0	89°43.6	10.4′	18°50.7	12.5′	57.6′
20	118°21.5	27.5	104°13.1	10.6′	18°38.2	12.7′	57.5′
21	133°21.5	·· 26.9	118°42.6	10.7′	18°25.5	12.7′	57.5′
22	148°21.5	26.4	133°12.3	10.8′	18°12.8	12.8′	57.5′
23	163°21.5	25.8	147°42.1	10.9′	18°00.0	12.9′	57.4′
	SD = 15.7′	d = 0.5′	SD = 15.8′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°21.5	N19°25.3	162°12.0	11.0′	N17°47.1	12.9′	57.4′
1	193°21.5	24.7	176°42.0	11.1′	17°34.2	13.0′	57.4′
2	208°21.5	24.2	191°12.1	11.2′	17°21.2	13.1′	57.4′
3	223°21.5	·· 23.6	205°42.3	11.3′	17°08.1	13.2′	57.3′
4	238°21.5	23.1	220°12.7	11.4′	16°54.9	13.2′	57.3′
5	253°21.5	22.5	234°43.1	11.6′	16°41.7	13.3′	57.3′
6	268°21.5	N19°21.9	249°13.7	11.7′	N16°28.4	13.4′	57.2′
7	283°21.5	21.4	263°44.3	11.8′	16°15.0	13.4′	57.2′
8	298°21.5	20.8	278°15.1	11.9′	16°01.6	13.5′	57.2′
9	313°21.5	·· 20.3	292°46.0	12.0′	15°48.1	13.6′	57.2′
10	328°21.5	19.7	307°17.0	12.1′	15°34.5	13.6′	57.1′
11	343°21.5	19.2	321°48.0	12.2′	15°20.9	13.7′	57.1′
12	358°21.5	N19°18.6	336°19.2	12.3′	N15°07.2	13.7′	57.1′
13	13°21.5	18.0	350°50.5	12.4′	14°53.5	13.8′	57.0′
14	28°21.5	17.5	5°21.9	12.5′	14°39.7	13.9′	57.0′
15	43°21.5	·· 16.9	19°53.4	12.6′	14°25.8	13.9′	57.0′
16	58°21.5	16.4	34°25.0	12.7′	14°11.9	13.9′	57.0′
17	73°21.5	15.8	48°56.6	12.8′	13°58.0	14.0′	56.9′
18	88°21.5	N19°15.2	63°28.4	12.9′	N13°44.0	14.1′	56.9′
19	103°21.6	14.7	78°00.3	13.0′	13°29.9	14.1′	56.9′
20	118°21.6	14.1	92°32.3	13.1′	13°15.8	14.1′	56.8′
21	133°21.6	·· 13.5	107°04.3	13.1′	13°01.7	14.2′	56.8′
22	148°21.6	13.0	121°36.5	13.2′	12°47.5	14.2′	56.8′
23	163°21.6	12.4	136°08.7	13.3′	12°33.3	14.3′	56.7′
	SD = 15.7′	d = 0.6′	SD = 15.7′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	▭	▭	▭	▭	▭	▭
N 70°	▭	▭	▭	▭	▭	▭
68°	////	////	01:37	22:31	////	////
66°	////	////	02:19	21:51	////	////
64°	////	00:47	02:47	21:24	23:16	////
62°	////	01:46	03:08	21:03	22:23	////
60°	////	02:18	03:25	20:46	21:52	////
N 58°	00:43	02:42	03:39	20:32	21:29	23:21
56°	01:37	03:00	03:52	20:20	21:11	22:33
54°	02:07	03:15	04:02	20:10	20:56	22:04
52°	02:28	03:29	04:12	20:01	20:43	21:43
50°	02:46	03:40	04:20	19:52	20:32	21:26
45°	03:19	04:03	04:38	19:35	20:09	20:53
N 40°	03:43	04:21	04:52	19:20	19:51	20:30
35°	04:02	04:36	05:04	19:08	19:37	20:11
30°	04:17	04:49	05:15	18:58	19:24	19:56
20°	04:41	05:09	05:33	18:40	19:04	19:32
N 10°	05:00	05:26	05:49	18:24	18:47	19:13
0°	05:16	05:41	06:03	18:10	18:32	18:58
S 10°	05:29	05:55	06:17	17:56	18:18	18:44
20°	05:42	06:09	06:33	17:41	18:04	18:31
30°	05:55	06:24	06:50	17:24	17:49	18:18
35°	06:02	06:33	07:00	17:14	17:41	18:12
40°	06:09	06:42	07:11	17:02	17:32	18:05
45°	06:17	06:52	07:25	16:49	17:21	17:57
S 50°	06:25	07:05	07:41	16:33	17:09	17:49
52°	06:29	07:10	07:48	16:25	17:03	17:45
54°	06:33	07:17	07:57	16:17	16:57	17:41
56°	06:37	07:23	08:06	16:07	16:50	17:37
58°	06:42	07:31	08:17	15:57	16:43	17:32
S 60°	06:47	07:39	08:30	15:44	16:34	17:27

Lat.	**Moonrise** Thu	Fri	Sat	**Moonset** Thu	Fri	Sat
N 72°	▭	▭	02:31	▭	▭	00:21 22:47
N 70°	▭	▭	03:32	▭	23:18	22:25
68°	▭	▭	04:07	▭	22:42	22:09
66°	▭	02:05	04:31	22:54	22:16	21:55
64°	▭	02:45	04:50	22:13	21:55	21:43
62°	01:07	03:13	05:06	21:44	21:39	21:34
60°	01:44	03:34	05:18	21:22	21:25	21:25
N 58°	02:10	03:51	05:29	21:04	21:13	21:18
56°	02:31	04:06	05:39	20:49	21:02	21:11
54°	02:48	04:18	05:47	20:36	20:53	21:05
52°	03:02	04:29	05:55	20:24	20:45	21:00
50°	03:15	04:39	06:02	20:14	20:38	20:55
45°	03:41	04:59	06:16	19:52	20:22	20:44
N 40°	04:02	05:16	06:28	19:35	20:08	20:35
35°	04:19	05:29	06:38	19:20	19:57	20:28
30°	04:33	05:41	06:46	19:07	19:47	20:21
20°	04:58	06:02	07:01	18:45	19:30	20:09
N 10°	05:20	06:19	07:14	18:25	19:15	19:59
0°	05:40	06:36	07:26	18:07	19:01	19:49
S 10°	06:00	06:52	07:39	17:49	18:46	19:39
20°	06:21	07:09	07:51	17:29	18:31	19:28
30°	06:46	07:29	08:06	17:06	18:13	19:16
35°	07:00	07:41	08:14	16:53	18:02	19:09
40°	07:17	07:54	08:24	16:37	17:50	19:01
45°	07:37	08:10	08:35	16:18	17:36	18:51
S 50°	08:01	08:29	08:49	15:54	17:19	18:40
52°	08:13	08:38	08:55	15:43	17:10	18:34
54°	08:27	08:48	09:02	15:30	17:01	18:28
56°	08:42	08:59	09:09	15:15	16:50	18:21
58°	09:01	09:12	09:18	14:57	16:38	18:14
S 60°	09:24	09:27	09:28	14:35	16:24	18:05

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 0-2 1-2%
24	06:33	06:33	12:07	11:54	–:–	
25	06:34	06:34	12:07	12:48	00:22	
26	06:34	06:34	12:07	13:38	01:14	

July 27, 28, 29 UT (Sun., Mon., Tue.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	304°55.8	220°05.5	N21°35.6	130°52.4	N03°18.4	203°22.3	N22°55.4	302°22.0	S01°27.2
1	319°58.2	235°04.9	35.8	145°53.4	17.8	218°24.2	55.4	317°24.5	27.2
2	335°00.7	250°04.3	36.0	160°54.5	17.2	233°26.1	55.3	332°27.0	27.3
3	350°03.2	265°03.6	·· 36.2	175°55.6	·· 16.5	248°27.9	·· 55.3	347°29.5	·· 27.3
4	5°05.6	280°03.0	36.5	190°56.7	15.9	263°29.8	55.3	2°32.0	27.3
5	20°08.1	295°02.4	36.7	205°57.7	15.3	278°31.7	55.2	17°34.5	27.4
6	35°10.6	310°01.8	N21°36.9	220°58.8	N03°14.6	293°33.6	N22°55.2	32°37.0	S01°27.4
7	50°13.0	325°01.2	37.1	235°59.9	14.0	308°35.5	55.1	47°39.6	27.4
8	65°15.5	340°00.5	37.3	251°01.0	13.4	323°37.3	55.1	62°42.1	27.5
9	80°18.0	354°59.9	·· 37.5	266°02.0	·· 12.8	338°39.2	·· 55.1	77°44.6	·· 27.5
10	95°20.4	9°59.3	37.7	281°03.1	12.1	353°41.1	55.0	92°47.1	27.5
11	110°22.9	24°58.7	37.9	296°04.2	11.5	8°43.0	55.0	107°49.6	27.6
12	125°25.3	39°58.0	N21°38.2	311°05.2	N03°10.9	23°44.8	N22°54.9	122°52.1	S01°27.6
13	140°27.8	54°57.4	38.4	326°06.3	10.2	38°46.7	54.9	137°54.6	27.6
14	155°30.3	69°56.8	38.6	341°07.4	09.6	53°48.6	54.9	152°57.2	27.7
15	170°32.7	84°56.2	·· 38.8	356°08.5	·· 09.0	68°50.5	·· 54.8	167°59.7	·· 27.7
16	185°35.2	99°55.6	39.0	11°09.5	08.3	83°52.3	54.8	183°02.2	27.7
17	200°37.7	114°54.9	39.2	26°10.6	07.7	98°54.2	54.7	198°04.7	27.8
18	215°40.1	129°54.3	N21°39.4	41°11.7	N03°07.1	113°56.1	N22°54.7	213°07.2	S01°27.8
19	230°42.6	144°53.7	39.6	56°12.7	06.4	128°58.0	54.7	228°09.7	27.8
20	245°45.1	159°53.1	39.8	71°13.8	05.8	143°59.8	54.6	243°12.2	27.9
21	260°47.5	174°52.4	·· 40.0	86°14.9	·· 05.2	159°01.7	·· 54.6	258°14.8	·· 27.9
22	275°50.0	189°51.8	40.2	101°16.0	04.5	174°03.6	54.5	273°17.3	27.9
23	290°52.5	204°51.2	40.4	116°17.0	03.9	189°05.5	54.5	288°19.8	28.0
Mer.pass. 03:40		ν -0.6′	d 0.2′	m -4.02	ν 1.1′	d 0.6′	m 1.59	ν 1.9′	d 0.0′ m -1.91	ν 2.5′	d 0.0′ m 0.83

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	305°54.9	219°50.6	N21°40.6	131°18.1	N03°03.3	204°07.3	N22°54.5	303°22.3	S01°28.0
1	320°57.4	234°49.9	40.8	146°19.2	02.6	219°09.2	54.4	318°24.8	28.1
2	335°59.8	249°49.3	41.0	161°20.2	02.0	234°11.1	54.4	333°27.3	28.1
3	351°02.3	264°48.7	·· 41.2	176°21.3	·· 01.3	249°13.0	·· 54.3	348°29.9	·· 28.1
4	6°04.8	279°48.0	41.4	191°22.4	00.7	264°14.9	54.3	3°32.4	28.2
5	21°07.2	294°47.4	41.6	206°23.4	03°00.1	279°16.7	54.3	18°34.9	28.2
6	36°09.7	309°46.8	N21°41.8	221°24.5	N02°59.4	294°18.6	N22°54.2	33°37.4	S01°28.2
7	51°12.2	324°46.2	42.0	236°25.6	58.8	309°20.5	54.2	48°39.9	28.3
8	66°14.6	339°45.5	42.1	251°26.7	58.2	324°22.4	54.1	63°42.4	28.3
9	81°17.1	354°44.9	·· 42.3	266°27.7	·· 57.5	339°24.2	·· 54.1	78°45.0	·· 28.3
10	96°19.6	9°44.3	42.5	281°28.8	56.9	354°26.1	54.1	93°47.5	28.4
11	111°22.0	24°43.6	42.7	296°29.9	56.3	9°28.0	54.0	108°50.0	28.4
12	126°24.5	39°43.0	N21°42.9	311°30.9	N02°55.6	24°29.9	N22°54.0	123°52.5	S01°28.4
13	141°26.9	54°42.4	43.1	326°32.0	55.0	39°31.8	53.9	138°55.0	28.5
14	156°29.4	69°41.8	43.3	341°33.1	54.4	54°33.6	53.9	153°57.6	28.5
15	171°31.9	84°41.1	·· 43.5	356°34.1	·· 53.7	69°35.5	·· 53.9	169°00.1	·· 28.5
16	186°34.3	99°40.5	43.6	11°35.2	53.1	84°37.4	53.8	184°02.6	28.6
17	201°36.8	114°39.9	43.8	26°36.3	52.5	99°39.3	53.8	199°05.1	28.6
18	216°39.3	129°39.2	N21°44.0	41°37.4	N02°51.8	114°41.2	N22°53.7	214°07.6	S01°28.6
19	231°41.7	144°38.6	44.2	56°38.4	51.2	129°43.0	53.7	229°10.2	28.7
20	246°44.2	159°38.0	44.4	71°39.5	50.6	144°44.9	53.7	244°12.7	28.7
21	261°46.7	174°37.3	·· 44.5	86°40.6	·· 49.9	159°46.8	·· 53.6	259°15.2	·· 28.8
22	276°49.1	189°36.7	44.7	101°41.6	49.3	174°48.7	53.6	274°17.7	28.8
23	291°51.6	204°36.1	44.9	116°42.7	48.7	189°50.5	53.5	289°20.2	28.8
Mer.pass. 03:36		ν -0.6′	d 0.2′	m -4.02	ν 1.1′	d 0.6′	m 1.59	ν 1.9′	d 0.0′ m -1.91	ν 2.5′	d 0.0′ m 0.82

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	306°54.1	219°35.4	N21°45.1	131°43.8	N02°48.0	204°52.4	N22°53.5	304°22.7	S01°28.9
1	321°56.5	234°34.8	45.2	146°44.8	47.4	219°54.3	53.4	319°25.3	28.9
2	336°59.0	249°34.2	45.4	161°45.9	46.7	234°56.2	53.4	334°27.8	28.9
3	352°01.4	264°33.5	·· 45.6	176°47.0	·· 46.1	249°58.1	·· 53.4	349°30.3	·· 29.0
4	7°03.9	279°32.9	45.8	191°48.0	45.5	264°59.9	53.3	4°32.8	29.0
5	22°06.4	294°32.2	45.9	206°49.1	44.8	280°01.8	53.3	19°35.4	29.0
6	37°08.8	309°31.6	N21°46.1	221°50.2	N02°44.2	295°03.7	N22°53.2	34°37.9	S01°29.1
7	52°11.3	324°31.0	46.3	236°51.2	43.6	310°05.6	53.2	49°40.4	29.1
8	67°13.8	339°30.3	46.4	251°52.3	42.9	325°07.5	53.2	64°42.9	29.2
9	82°16.2	354°29.7	·· 46.6	266°53.4	·· 42.3	340°09.3	·· 53.1	79°45.4	·· 29.2
10	97°18.7	9°29.1	46.8	281°54.5	41.7	355°11.2	53.1	94°48.0	29.2
11	112°21.2	24°28.4	46.9	296°55.5	41.0	10°13.1	53.0	109°50.5	29.3
12	127°23.6	39°27.8	N21°47.1	311°56.6	N02°40.4	25°15.0	N22°53.0	124°53.0	S01°29.3
13	142°26.1	54°27.2	47.3	326°57.7	39.8	40°16.9	53.0	139°55.5	29.3
14	157°28.5	69°26.5	47.4	341°58.7	39.1	55°18.7	52.9	154°58.0	29.4
15	172°31.0	84°25.9	·· 47.6	356°59.8	·· 38.5	70°20.6	·· 52.9	170°00.6	·· 29.4
16	187°33.5	99°25.2	47.7	12°00.9	37.8	85°22.5	52.8	185°03.1	29.4
17	202°35.9	114°24.6	47.9	27°01.9	37.2	100°24.4	52.8	200°05.6	29.5
18	217°38.4	129°24.0	N21°48.1	42°03.0	N02°36.6	115°26.3	N22°52.7	215°08.1	S01°29.5
19	232°40.9	144°23.3	48.2	57°04.1	35.9	130°28.1	52.7	230°10.7	29.6
20	247°43.3	159°22.7	48.4	72°05.1	35.3	145°30.0	52.7	245°13.2	29.6
21	262°45.8	174°22.0	·· 48.5	87°06.2	·· 34.7	160°31.9	·· 52.6	260°15.7	·· 29.6
22	277°48.3	189°21.4	48.7	102°07.3	34.0	175°33.8	52.6	275°18.2	29.7
23	292°50.7	204°20.8	48.8	117°08.3	33.4	190°35.7	52.5	290°20.8	29.7
Mer.pass. 03:32		ν -0.6′	d 0.2′	m -4.01	ν 1.1′	d 0.6′	m 1.60	ν 1.9′	d 0.0′ m -1.91	ν 2.5′	d 0.0′ m 0.82

Stars

	SHA	**Dec**
Alpheratz	357°34.1	29°13.9
Ankaa	353°06.5	-42°09.7
Schedar	349°30.3	56°40.5
Diphda	348°46.7	-17°50.6
Achernar	335°19.7	-57°06.1
Hamal	327°50.7	23°35.0
Polaris	313°54.6	89°22.0
Acamar	315°11.5	-40°11.8
Menkar	314°05.7	4°11.5
Mirfak	308°27.7	49°56.9
Aldebaran	290°39.3	16°33.7
Rigel	281°03.7	-8°10.2
Capella	280°21.5	46°01.3
Bellatrix	278°22.6	6°22.4
Elnath	278°01.6	28°37.7
Alnilam	275°37.5	-1°11.0
Betelgeuse	270°51.9	7°24.8
Canopus	263°52.7	-52°42.3
Sirius	258°26.1	-16°44.9
Adhara	255°05.9	-29°00.2
Procyon	244°50.7	5°09.6
Pollux	243°17.1	27°57.9
Avior	234°15.2	-59°35.4
Suhail	222°46.4	-43°32.1
Miaplacidus	221°39.2	-69°49.3
Alphard	217°47.6	-8°46.1
Regulus	207°34.2	11°50.6
Dubhe	193°40.9	61°37.0
Denebola	182°24.7	14°25.9
Gienah	175°43.3	-17°41.1
Acrux	172°59.9	-63°14.7
Gacrux	171°51.4	-57°15.6
Alioth	166°12.7	55°49.5
Spica	158°21.9	-11°17.7
Alkaid	152°51.7	49°11.4
Hadar	148°35.4	-60°30.0
Menkent	147°57.1	-36°29.9
Arcturus	145°47.5	19°03.1
Rigil Kent.	139°39.6	-60°56.7
Kochab	137°19.6	74°03.3
Zuben'ubi	136°55.4	-16°08.9
Alphecca	126°03.2	26°37.9
Antares	112°15.0	-26°29.4
Atria	107°08.5	-69°04.6
Sabik	102°02.0	-15°45.4
Shaula	96°09.4	-37°07.4
Rasalhague	95°57.8	12°32.6
Eltanin	90°41.5	51°29.3
Kaus Aust.	83°31.5	-34°22.4
Vega	80°32.5	38°48.5
Nunki	75°46.8	-26°15.9
Altair	61°59.2	8°56.2
Peacock	53°04.4	-56°39.1
Deneb	49°25.0	45°22.3
Enif	33°38.0	9°59.6
Al Na'ir	27°31.9	-46°50.0
Fomalhaut	15°13.7	-29°29.0
Scheat	13°44.5	28°13.3
Markab	13°29.2	15°20.6

Jul 27 Sun	**SHA**	**Mer.pass**
Venus	275°09.7	09:20
Mars	185°56.6	15:15
Jupiter	258°26.5	10:25
Saturn	357°26.2	03:50

Jul 28 Mon	**SHA**	**Mer.pass**
Venus	273°55.6	09:21
Mars	185°23.2	15:14
Jupiter	258°12.4	10:22
Saturn	357°27.4	03:46

Jul 29 Tue	**SHA**	**Mer.pass**
Venus	272°41.4	09:22
Mars	184°49.7	15:12
Jupiter	257°58.4	10:19
Saturn	357°28.7	03:42

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h — Sun — Moon

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	178°21.6	N19°11.8	150°41.0	13.4′	N12°19.0	14.3′	56.7′
1	193°21.6	11.3	165°13.4	13.5′	12°04.7	14.3′	56.7′
2	208°21.6	10.7	179°45.9	13.6′	11°50.4	14.4′	56.7′
3	223°21.6	·· 10.1	194°18.5	13.7′	11°36.0	14.4′	56.6′
4	238°21.6	09.6	208°51.2	13.8′	11°21.6	14.5′	56.6′
5	253°21.6	09.0	223°23.9	13.8′	11°07.1	14.4′	56.6′
6	268°21.6	N19°08.4	237°56.8	13.9′	N10°52.7	14.6′	56.5′
7	283°21.6	07.9	252°29.7	14.0′	10°38.1	14.5′	56.5′
8	298°21.6	07.3	267°02.7	14.1′	10°23.6	14.6′	56.5′
9	313°21.6	·· 06.7	281°35.8	14.1′	10°09.0	14.6′	56.5′
10	328°21.6	06.1	296°08.9	14.2′	09°54.4	14.6′	56.4′
11	343°21.7	05.6	310°42.1	14.3′	09°39.8	14.7′	56.4′
12	358°21.7	N19°05.0	325°15.4	14.4′	N09°25.1	14.6′	56.4′
13	13°21.7	04.4	339°48.8	14.4′	09°10.5	14.7′	56.3′
14	28°21.7	03.9	354°22.3	14.5′	08°55.8	14.8′	56.3′
15	43°21.7	·· 03.3	8°55.8	14.6′	08°41.0	14.7′	56.3′
16	58°21.7	02.7	23°29.4	14.7′	08°26.3	14.8′	56.3′
17	73°21.7	02.1	38°03.0	14.7′	08°11.5	14.7′	56.2′
18	88°21.7	N19°01.6	52°36.7	14.8′	N07°56.8	14.8′	56.2′
19	103°21.7	01.0	67°10.5	14.9′	07°42.0	14.8′	56.2′
20	118°21.7	19°00.4	81°44.4	14.9′	07°27.2	14.9′	56.1′
21	133°21.8	18°59.8	96°18.3	15.0′	07°12.3	14.8′	56.1′
22	148°21.8	59.2	110°52.3	15.0′	06°57.5	14.9′	56.1′
23	163°21.8	58.7	125°26.3	15.1′	06°42.6	14.8′	56.1′
	SD = 15.7′	d = 0.6′	SD = 15.5′				

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	178°21.8	N18°58.1	140°00.4	15.2′	N06°27.8	14.9′	56.0′
1	193°21.8	57.5	154°34.5	15.2′	06°12.9	14.9′	56.0′
2	208°21.8	56.9	169°08.8	15.3′	05°58.0	14.9′	56.0′
3	223°21.8	·· 56.3	183°43.0	15.3′	05°43.1	14.9′	55.9′
4	238°21.8	55.8	198°17.4	15.4′	05°28.2	14.9′	55.9′
5	253°21.9	55.2	212°51.7	15.4′	05°13.3	14.9′	55.9′
6	268°21.9	N18°54.6	227°26.2	15.5′	N04°58.4	14.9′	55.9′
7	283°21.9	54.0	242°00.6	15.5′	04°43.5	14.9′	55.8′
8	298°21.9	53.4	256°35.2	15.6′	04°28.6	14.9′	55.8′
9	313°21.9	·· 52.8	271°09.7	15.6′	04°13.7	15.0′	55.8′
10	328°21.9	52.3	285°44.4	15.7′	03°58.7	14.9′	55.8′
11	343°21.9	51.7	300°19.0	15.7′	03°43.8	14.9′	55.7′
12	358°22.0	N18°51.1	314°53.7	15.8′	N03°28.9	14.9′	55.7′
13	13°22.0	50.5	329°28.5	15.8′	03°14.0	14.9′	55.7′
14	28°22.0	49.9	344°03.3	15.8′	02°59.1	15.0′	55.6′
15	43°22.0	·· 49.3	358°38.1	15.9′	02°44.1	14.9′	55.6′
16	58°22.0	48.7	13°13.0	15.9′	02°29.2	14.9′	55.6′
17	73°22.0	48.2	27°47.9	16.0′	02°14.3	14.9′	55.6′
18	88°22.0	N18°47.6	42°22.9	16.0′	N01°59.4	14.9′	55.5′
19	103°22.1	47.0	56°57.9	16.0′	01°44.5	14.8′	55.5′
20	118°22.1	46.4	71°32.9	16.1′	01°29.7	14.9′	55.5′
21	133°22.1	·· 45.8	86°07.9	16.1′	01°14.8	14.9′	55.5′
22	148°22.1	45.2	100°43.0	16.1′	00°59.9	14.8′	55.4′
23	163°22.1	44.6	115°18.2	16.1′	00°45.1	14.9′	55.4′
	SD = 15.7′	d = 0.6′	SD = 15.3′				

Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	178°22.2	N18°44.0	129°53.3	16.2′	N00°30.2	14.8′	55.4′
1	193°22.2	43.4	144°28.5	16.2′	00°15.4	14.8′	55.4′
2	208°22.2	42.8	159°03.7	16.2′	N00°00.6	14.8′	55.3′
3	223°22.2	·· 42.2	173°38.9	16.3′	S00°14.2	14.8′	55.3′
4	238°22.2	41.6	188°14.2	16.3′	00°29.0	14.8′	55.3′
5	253°22.2	41.1	202°49.5	16.3′	00°43.8	14.8′	55.3′
6	268°22.3	N18°40.5	217°24.8	16.3′	S00°58.6	14.7′	55.3′
7	283°22.3	39.9	232°00.1	16.3′	01°13.3	14.7′	55.2′
8	298°22.3	39.3	246°35.4	16.4′	01°28.0	14.7′	55.2′
9	313°22.3	·· 38.7	261°10.8	16.4′	01°42.7	14.7′	55.2′
10	328°22.4	38.1	275°46.2	16.4′	01°57.4	14.7′	55.2′
11	343°22.4	37.5	290°21.6	16.4′	02°12.1	14.6′	55.1′
12	358°22.4	N18°36.9	304°57.0	16.4′	S02°26.7	14.6′	55.1′
13	13°22.4	36.3	319°32.4	16.4′	02°41.3	14.6′	55.1′
14	28°22.4	35.7	334°07.8	16.4′	02°55.9	14.6′	55.1′
15	43°22.5	·· 35.1	348°43.3	16.5′	03°10.5	14.6′	55.1′
16	58°22.5	34.5	3°18.7	16.5′	03°25.1	14.5′	55.0′
17	73°22.5	33.9	17°54.2	16.5′	03°39.6	14.5′	55.0′
18	88°22.5	N18°33.3	32°29.7	16.5′	S03°54.1	14.5′	55.0′
19	103°22.6	32.7	47°05.2	16.5′	04°08.6	14.4′	55.0′
20	118°22.6	32.1	61°40.6	16.5′	04°23.0	14.4′	54.9′
21	133°22.6	·· 31.5	76°16.1	16.5′	04°37.4	14.4′	54.9′
22	148°22.6	30.9	90°51.6	16.5′	04°51.8	14.4′	54.9′
23	163°22.6	30.3	105°27.1	16.5′	05°06.2	14.3′	54.9′
	SD = 15.7′	d = 0.6′	SD = 15.1′				

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	▭	▭	▭	▭	▭	▭
N 70°	////	////	00:41	23:17	////	////
68°	////	////	01:55	22:14	////	////
66°	////	////	02:31	21:39	////	////
64°	////	01:15	02:56	21:15	22:52	////
62°	////	01:59	03:16	20:55	22:10	////
60°	////	02:28	03:32	20:40	21:42	////
N 58°	01:08	02:50	03:45	20:26	21:22	22:59
56°	01:49	03:07	03:57	20:15	21:05	22:21
54°	02:15	03:21	04:07	20:05	20:50	21:55
52°	02:35	03:34	04:16	19:56	20:38	21:36
50°	02:52	03:45	04:24	19:48	20:27	21:20
45°	03:23	04:07	04:41	19:31	20:05	20:49
N 40°	03:46	04:24	04:55	19:18	19:48	20:26
35°	04:04	04:38	05:07	19:06	19:34	20:08
30°	04:19	04:51	05:17	18:56	19:22	19:53
20°	04:42	05:10	05:34	18:39	19:02	19:30
N 10°	05:01	05:27	05:49	18:24	18:46	19:12
0°	05:16	05:41	06:03	18:10	18:32	18:57
S 10°	05:29	05:55	06:17	17:56	18:18	18:44
20°	05:41	06:08	06:31	17:42	18:05	18:32
30°	05:54	06:23	06:48	17:25	17:51	18:20
35°	06:00	06:31	06:58	17:16	17:43	18:13
40°	06:07	06:39	07:09	17:05	17:34	18:07
45°	06:14	06:49	07:21	16:52	17:24	18:00
S 50°	06:22	07:01	07:37	16:37	17:12	17:52
52°	06:25	07:07	07:44	16:29	17:07	17:48
54°	06:29	07:12	07:52	16:21	17:01	17:45
56°	06:33	07:19	08:01	16:12	16:55	17:41
58°	06:37	07:26	08:12	16:02	16:48	17:37
S 60°	06:42	07:34	08:23	15:50	16:40	17:32

Lat.	Moonrise Sun	Moonrise Mon	Moonrise Tue	Moonset Sun	Moonset Mon	Moonset Tue
N 72°	05:44	07:59	10:03	22:03	21:29	20:56
N 70°	06:03	08:06	10:00	21:54	21:27	21:02
68°	06:17	08:11	09:57	21:46	21:26	21:08
66°	06:29	08:15	09:55	21:39	21:25	21:12
64°	06:39	08:19	09:54	21:34	21:25	21:16
62°	06:48	08:22	09:52	21:29	21:24	21:19
60°	06:55	08:25	09:51	21:24	21:23	21:22
N 58°	07:01	08:27	09:50	21:21	21:23	21:24
56°	07:07	08:29	09:49	21:17	21:22	21:27
54°	07:12	08:31	09:48	21:14	21:22	21:29
52°	07:16	08:33	09:47	21:11	21:21	21:31
50°	07:20	08:35	09:46	21:09	21:21	21:32
45°	07:29	08:38	09:45	21:03	21:20	21:36
N 40°	07:36	08:41	09:43	20:59	21:19	21:39
35°	07:42	08:43	09:42	20:54	21:19	21:42
30°	07:48	08:46	09:41	20:51	21:18	21:45
20°	07:57	08:49	09:40	20:44	21:17	21:49
N 10°	08:05	08:53	09:38	20:39	21:16	21:53
0°	08:13	08:56	09:37	20:34	21:15	21:56
S 10°	08:20	08:59	09:35	20:28	21:15	22:00
20°	08:28	09:02	09:34	20:22	21:14	22:03
30°	08:37	09:06	09:32	20:16	21:13	22:08
35°	08:43	09:08	09:31	20:12	21:12	22:10
40°	08:49	09:10	09:30	20:08	21:11	22:13
45°	08:55	09:13	09:29	20:02	21:10	22:16
S 50°	09:04	09:16	09:28	19:56	21:09	22:20
52°	09:07	09:18	09:27	19:53	21:09	22:22
54°	09:12	09:20	09:27	19:50	21:08	22:24
56°	09:16	09:21	09:26	19:47	21:08	22:26
58°	09:21	09:23	09:25	19:43	21:07	22:29
S 60°	09:27	09:26	09:24	19:38	21:06	22:31

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 3-5 6-19%
27	06:34	06:33	12:07	14:23	02:01	
28	06:33	06:32	12:07	15:06	02:45	
29	06:31	06:30	12:07	15:46	03:26	

July 30, 31, 01 UT (Wed., Thu., Fri.)

	Aries	Venus		Mars		Jupiter		Saturn	
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	307°53.2	219°20.1	N21°49.0	132°09.4	N02°32.8	205°37.5	N22°52.5	305°23.3	S01°29.7
1	322°55.7	234°19.5	49.1	147°10.5	32.1	220°39.4	52.5	320°25.8	29.8
2	337°58.1	249°18.8	49.3	162°11.5	31.5	235°41.3	52.4	335°28.3	29.8
3	353°00.6	264°18.2	·· 49.4	177°12.6	·· 30.8	250°43.2	·· 52.4	350°30.8	·· 29.9
4	8°03.0	279°17.5	49.6	192°13.7	30.2	265°45.1	52.3	5°33.4	29.9
5	23°05.5	294°16.9	49.7	207°14.7	29.6	280°47.0	52.3	20°35.9	29.9
6	38°08.0	309°16.3	N21°49.9	222°15.8	N02°28.9	295°48.8	N22°52.2	35°38.4	S01°30.0
7	53°10.4	324°15.6	50.0	237°16.9	28.3	310°50.7	52.2	50°40.9	30.0
8	68°12.9	339°15.0	50.2	252°17.9	27.7	325°52.6	52.2	65°43.5	30.0
9	83°15.4	354°14.3	·· 50.3	267°19.0	·· 27.0	340°54.5	·· 52.1	80°46.0	·· 30.1
10	98°17.8	9°13.7	50.5	282°20.1	26.4	355°56.4	52.1	95°48.5	30.1
11	113°20.3	24°13.0	50.6	297°21.1	25.7	10°58.2	52.0	110°51.0	30.2
12	128°22.8	39°12.4	N21°50.7	312°22.2	N02°25.1	26°00.1	N22°52.0	125°53.6	S01°30.2
13	143°25.2	54°11.7	50.9	327°23.3	24.5	41°02.0	52.0	140°56.1	30.2
14	158°27.7	69°11.1	51.0	342°24.3	23.8	56°03.9	51.9	155°58.6	30.3
15	173°30.2	84°10.5	·· 51.2	357°25.4	·· 23.2	71°05.8	·· 51.9	171°01.2	·· 30.3
16	188°32.6	99°09.8	51.3	12°26.4	22.6	86°07.7	51.8	186°03.7	30.3
17	203°35.1	114°09.2	51.4	27°27.5	21.9	101°09.5	51.8	201°06.2	30.4
18	218°37.5	129°08.5	N21°51.6	42°28.6	N02°21.3	116°11.4	N22°51.7	216°08.7	S01°30.4
19	233°40.0	144°07.9	51.7	57°29.6	20.6	131°13.3	51.7	231°11.3	30.5
20	248°42.5	159°07.2	51.8	72°30.7	20.0	146°15.2	51.7	246°13.8	30.5
21	263°44.9	174°06.6	·· 52.0	87°31.8	·· 19.4	161°17.1	·· 51.6	261°16.3	·· 30.5
22	278°47.4	189°05.9	52.1	102°32.8	18.7	176°19.0	51.6	276°18.8	30.6
23	293°49.9	204°05.3	52.2	117°33.9	18.1	191°20.8	51.5	291°21.4	30.6
Mer.pass. 03:28		ν -0.6′	d 0.2′	m -4.01	ν 1.1′	d 0.6′	m 1.60	ν 1.9′	d 0.0′ m -1.91	ν 2.5′	d 0.0′ m 0.81

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	308°52.3	219°04.6	N21°52.3	132°35.0	N02°17.4	206°22.7	N22°51.5	306°23.9	S01°30.7
1	323°54.8	234°04.0	52.5	147°36.0	16.8	221°24.6	51.4	321°26.4	30.7
2	338°57.3	249°03.3	52.6	162°37.1	16.2	236°26.5	51.4	336°28.9	30.7
3	353°59.7	264°02.7	·· 52.7	177°38.2	·· 15.5	251°28.4	·· 51.4	351°31.5	·· 30.8
4	9°02.2	279°02.0	52.8	192°39.2	14.9	266°30.3	51.3	6°34.0	30.8
5	24°04.6	294°01.4	53.0	207°40.3	14.3	281°32.1	51.3	21°36.5	30.9
6	39°07.1	309°00.7	N21°53.1	222°41.4	N02°13.6	296°34.0	N22°51.2	36°39.1	S01°30.9
7	54°09.6	324°00.1	53.2	237°42.4	13.0	311°35.9	51.2	51°41.6	30.9
8	69°12.0	338°59.4	53.3	252°43.5	12.3	326°37.8	51.1	66°44.1	31.0
9	84°14.5	353°58.8	·· 53.5	267°44.5	·· 11.7	341°39.7	·· 51.1	81°46.6	·· 31.0
10	99°17.0	8°58.1	53.6	282°45.6	11.1	356°41.6	51.1	96°49.2	31.0
11	114°19.4	23°57.5	53.7	297°46.7	10.4	11°43.4	51.0	111°51.7	31.1
12	129°21.9	38°56.8	N21°53.8	312°47.7	N02°09.8	26°45.3	N22°51.0	126°54.2	S01°31.1
13	144°24.4	53°56.2	53.9	327°48.8	09.1	41°47.2	50.9	141°56.8	31.2
14	159°26.8	68°55.5	54.0	342°49.9	08.5	56°49.1	50.9	156°59.3	31.2
15	174°29.3	83°54.9	·· 54.2	357°50.9	·· 07.9	71°51.0	·· 50.8	172°01.8	·· 31.2
16	189°31.8	98°54.2	54.3	12°52.0	07.2	86°52.9	50.8	187°04.4	31.3
17	204°34.2	113°53.6	54.4	27°53.0	06.6	101°54.8	50.8	202°06.9	31.3
18	219°36.7	128°52.9	N21°54.5	42°54.1	N02°06.0	116°56.6	N22°50.7	217°09.4	S01°31.4
19	234°39.1	143°52.3	54.6	57°55.2	05.3	131°58.5	50.7	232°11.9	31.4
20	249°41.6	158°51.6	54.7	72°56.2	04.7	147°00.4	50.6	247°14.5	31.4
21	264°44.1	173°51.0	·· 54.8	87°57.3	·· 04.0	162°02.3	·· 50.6	262°17.0	·· 31.5
22	279°46.5	188°50.3	54.9	102°58.4	03.4	177°04.2	50.5	277°19.5	31.5
23	294°49.0	203°49.6	55.0	117°59.4	02.8	192°06.1	50.5	292°22.1	31.6
Mer.pass. 03:24		ν -0.6′	d 0.1′	m -4.01	ν 1.1′	d 0.6′	m 1.60	ν 1.9′	d 0.0′ m -1.92	ν 2.5′	d 0.0′ m 0.81

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	309°51.5	218°49.0	N21°55.1	133°00.5	N02°02.1	207°08.0	N22°50.5	307°24.6	S01°31.6
1	324°53.9	233°48.3	55.2	148°01.5	01.5	222°09.8	50.4	322°27.1	31.6
2	339°56.4	248°47.7	55.3	163°02.6	00.8	237°11.7	50.4	337°29.7	31.7
3	354°58.9	263°47.0	·· 55.4	178°03.7	02°00.2	252°13.6	·· 50.3	352°32.2	·· 31.7
4	10°01.3	278°46.4	55.5	193°04.7	01°59.6	267°15.5	50.3	7°34.7	31.8
5	25°03.8	293°45.7	55.7	208°05.8	58.9	282°17.4	50.2	22°37.3	31.8
6	40°06.3	308°45.1	N21°55.7	223°06.9	N01°58.3	297°19.3	N22°50.2	37°39.8	S01°31.9
7	55°08.7	323°44.4	55.8	238°07.9	57.6	312°21.2	50.2	52°42.3	31.9
8	70°11.2	338°43.7	55.9	253°09.0	57.0	327°23.0	50.1	67°44.8	31.9
9	85°13.6	353°43.1	·· 56.0	268°10.0	·· 56.4	342°24.9	·· 50.1	82°47.4	·· 32.0
10	100°16.1	8°42.4	56.1	283°11.1	55.7	357°26.8	50.0	97°49.9	32.0
11	115°18.6	23°41.8	56.2	298°12.2	55.1	12°28.7	50.0	112°52.4	32.1
12	130°21.0	38°41.1	N21°56.3	313°13.2	N01°54.4	27°30.6	N22°49.9	127°55.0	S01°32.1
13	145°23.5	53°40.5	56.4	328°14.3	53.8	42°32.5	49.9	142°57.5	32.1
14	160°26.0	68°39.8	56.5	343°15.3	53.2	57°34.4	49.9	158°00.0	32.2
15	175°28.4	83°39.1	·· 56.6	358°16.4	·· 52.5	72°36.2	·· 49.8	173°02.6	·· 32.2
16	190°30.9	98°38.5	56.7	13°17.5	51.9	87°38.1	49.8	188°05.1	32.3
17	205°33.4	113°37.8	56.8	28°18.5	51.2	102°40.0	49.7	203°07.6	32.3
18	220°35.8	128°37.2	N21°56.9	43°19.6	N01°50.6	117°41.9	N22°49.7	218°10.2	S01°32.3
19	235°38.3	143°36.5	56.9	58°20.7	49.9	132°43.8	49.6	233°12.7	32.4
20	250°40.7	158°35.8	57.0	73°21.7	49.3	147°45.7	49.6	248°15.2	32.4
21	265°43.2	173°35.2	·· 57.1	88°22.8	·· 48.7	162°47.6	·· 49.6	263°17.8	·· 32.5
22	280°45.7	188°34.5	57.2	103°23.8	48.0	177°49.5	49.5	278°20.3	32.5
23	295°48.1	203°33.9	57.3	118°24.9	47.4	192°51.3	49.5	293°22.8	32.6
Mer.pass. 03:20		ν -0.7′	d 0.1′	m -4.00	ν 1.1′	d 0.6′	m 1.60	ν 1.9′	d 0.0′ m -1.92	ν 2.5′	d 0.0′ m 0.80

Stars

	SHA	Dec
Alpheratz	357°34.1	29°13.9
Ankaa	353°06.4	-42°09.7
Schedar	349°30.3	56°40.5
Diphda	348°46.7	-17°50.6
Achernar	335°19.7	-57°06.1
Hamal	327°50.6	23°35.0
Polaris	313°53.1	89°22.0
Acamar	315°11.5	-40°11.8
Menkar	314°05.7	4°11.5
Mirfak	308°27.7	49°56.9
Aldebaran	290°39.3	16°33.7
Rigel	281°03.6	-8°10.2
Capella	280°21.5	46°01.3
Bellatrix	278°22.6	6°22.5
Elnath	278°01.5	28°37.7
Alnilam	275°37.5	-1°11.0
Betelgeuse	270°51.8	7°24.8
Canopus	263°52.7	-52°42.3
Sirius	258°26.1	-16°44.9
Adhara	255°05.8	-29°00.2
Procyon	244°50.7	5°09.7
Pollux	243°17.1	27°57.9
Avior	234°15.2	-59°35.4
Suhail	222°46.4	-43°32.1
Miaplacidus	221°39.2	-69°49.3
Alphard	217°47.6	-8°46.1
Regulus	207°34.2	11°50.6
Dubhe	193°40.9	61°37.0
Denebola	182°24.7	14°25.9
Gienah	175°43.3	-17°41.1
Acrux	173°00.0	-63°14.7
Gacrux	171°51.4	-57°15.6
Alioth	166°12.7	55°49.5
Spica	158°21.9	-11°17.7
Alkaid	152°51.7	49°11.4
Hadar	148°35.4	-60°30.0
Menkent	147°57.1	-36°29.9
Arcturus	145°47.5	19°03.1
Rigil Kent.	139°39.6	-60°56.7
Kochab	137°19.6	74°03.3
Zuben'ubi	136°55.5	-16°08.9
Alphecca	126°03.2	26°37.9
Antares	112°15.1	-26°29.4
Atria	107°08.5	-69°04.6
Sabik	102°02.0	-15°45.4
Shaula	96°09.4	-37°07.4
Rasalhague	95°57.9	12°32.6
Eltanin	90°41.5	51°29.3
Kaus Aust.	83°31.5	-34°22.4
Vega	80°32.5	38°48.5
Nunki	75°46.8	-26°15.9
Altair	61°59.2	8°56.2
Peacock	53°04.4	-56°39.1
Deneb	49°25.0	45°22.3
Enif	33°38.0	9°59.6
Al Na'ir	27°31.9	-46°50.0
Fomalhaut	15°13.7	-29°29.0
Scheat	13°44.5	28°13.3
Markab	13°29.2	15°20.6

Jul 30 Wed	SHA	Mer.pass
Venus	271°26.9	09:23
Mars	184°16.2	15:10
Jupiter	257°44.4	10:16
Saturn	357°30.1	03:38

Jul 31 Thu	SHA	Mer.pass
Venus	270°12.3	09:24
Mars	183°42.6	15:09
Jupiter	257°30.4	10:13
Saturn	357°31.6	03:34

Aug 01 Fri	SHA	Mer.pass
Venus	268°57.5	09:25
Mars	183°09.0	15:07
Jupiter	257°16.5	10:10
Saturn	357°33.1	03:30

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h — Sun — Moon

Wed	GHA	Dec	GHA	ν	Dec	d	HP
0	178°22.7	N18°29.7	120°02.6	16.5′	S05°20.5	14.3′	54.9′
1	193°22.7	29.0	134°38.1	16.5′	05°34.8	14.3′	54.8′
2	208°22.7	28.4	149°13.6	16.5′	05°49.1	14.3′	54.8′
3	223°22.8	·· 27.8	163°49.1	16.5′	06°03.4	14.2′	54.8′
4	238°22.8	27.2	178°24.6	16.5′	06°17.6	14.1′	54.8′
5	253°22.8	26.6	193°00.1	16.5′	06°31.7	14.2′	54.8′
6	268°22.8	N18°26.0	207°35.6	16.5′	S06°45.9	14.1′	54.8′
7	283°22.9	25.4	222°11.1	16.5′	07°00.0	14.0′	54.7′
8	298°22.9	24.8	236°46.5	16.5′	07°14.0	14.1′	54.7′
9	313°22.9	·· 24.2	251°22.0	16.4′	07°28.1	14.0′	54.7′
10	328°22.9	23.6	265°57.4	16.4′	07°42.1	13.9′	54.7′
11	343°23.0	23.0	280°32.9	16.4′	07°56.0	14.0′	54.7′
12	358°23.0	N18°22.4	295°08.3	16.4′	S08°10.0	13.8′	54.7′
13	13°23.0	21.7	309°43.7	16.4′	08°23.8	13.9′	54.6′
14	28°23.1	21.1	324°19.1	16.4′	08°37.7	13.8′	54.6′
15	43°23.1	·· 20.5	338°54.5	16.4′	08°51.5	13.7′	54.6′
16	58°23.1	19.9	353°29.8	16.3′	09°05.2	13.8′	54.6′
17	73°23.1	19.3	8°05.2	16.3′	09°19.0	13.6′	54.6′
18	88°23.2	N18°18.7	22°40.5	16.3′	S09°32.6	13.7′	54.6′
19	103°23.2	18.1	37°15.8	16.3′	09°46.3	13.6′	54.5′
20	118°23.2	17.4	51°51.1	16.3′	09°59.9	13.5′	54.5′
21	133°23.3	·· 16.8	66°26.3	16.2′	10°13.4	13.5′	54.5′
22	148°23.3	16.2	81°01.6	16.2′	10°26.9	13.5′	54.5′
23	163°23.3	15.6	95°36.8	16.2′	10°40.4	13.4′	54.5′
	SD = 15.7′	d = 0.6′		SD = 15.0′			

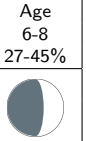
Thu	GHA	Dec	GHA	ν	Dec	d	HP
0	178°23.4	N18°15.0	110°12.0	16.2′	S10°53.8	13.3′	54.5′
1	193°23.4	14.4	124°47.1	16.1′	11°07.1	13.4′	54.5′
2	208°23.4	13.7	139°22.3	16.1′	11°20.5	13.2′	54.5′
3	223°23.4	·· 13.1	153°57.4	16.1′	11°33.7	13.2′	54.4′
4	238°23.5	12.5	168°32.5	16.0′	11°46.9	13.2′	54.4′
5	253°23.5	11.9	183°07.5	16.0′	12°00.1	13.1′	54.4′
6	268°23.5	N18°11.3	197°42.5	16.0′	S12°13.2	13.1′	54.4′
7	283°23.6	10.6	212°17.5	15.9′	12°26.3	13.0′	54.4′
8	298°23.6	10.0	226°52.4	15.9′	12°39.3	13.0′	54.4′
9	313°23.6	·· 09.4	241°27.4	15.9′	12°52.3	12.9′	54.4′
10	328°23.7	08.8	256°02.2	15.8′	13°05.2	12.8′	54.4′
11	343°23.7	08.2	270°37.1	15.8′	13°18.0	12.8′	54.4′
12	358°23.8	N18°07.5	285°11.9	15.8′	S13°30.8	12.7′	54.3′
13	13°23.8	06.9	299°46.6	15.7′	13°43.5	12.7′	54.3′
14	28°23.8	06.3	314°21.4	15.7′	13°56.2	12.7′	54.3′
15	43°23.9	·· 05.7	328°56.1	15.6′	14°08.9	12.5′	54.3′
16	58°23.9	05.0	343°30.7	15.6′	14°21.4	12.5′	54.3′
17	73°23.9	04.4	358°05.3	15.6′	14°33.9	12.5′	54.3′
18	88°24.0	N18°03.8	12°39.9	15.5′	S14°46.4	12.4′	54.3′
19	103°24.0	03.2	27°14.4	15.5′	14°58.8	12.3′	54.3′
20	118°24.0	02.5	41°48.8	15.4′	15°11.1	12.3′	54.3′
21	133°24.1	·· 01.9	56°23.3	15.4′	15°23.4	12.2′	54.3′
22	148°24.1	01.3	70°57.6	15.3′	15°35.6	12.1′	54.3′
23	163°24.1	00.6	85°31.9	15.3′	15°47.7	12.1′	54.3′
	SD = 15.7′	d = 0.6′		SD = 14.9′			

Fri	GHA	Dec	GHA	ν	Dec	d	HP
0	178°24.2	N18°00.0	100°06.2	15.2′	S15°59.8	12.0′	54.2′
1	193°24.2	17°59.4	114°40.5	15.2′	16°11.8	12.0′	54.2′
2	208°24.3	58.7	129°14.6	15.1′	16°23.8	11.9′	54.2′
3	223°24.3	·· 58.1	143°48.8	15.1′	16°35.7	11.8′	54.2′
4	238°24.3	57.5	158°22.8	15.0′	16°47.5	11.8′	54.2′
5	253°24.4	56.9	172°56.8	15.0′	16°59.3	11.6′	54.2′
6	268°24.4	N17°56.2	187°30.8	14.9′	S17°10.9	11.7′	54.2′
7	283°24.5	55.6	202°04.7	14.9′	17°22.6	11.5′	54.2′
8	298°24.5	55.0	216°38.6	14.8′	17°34.1	11.5′	54.2′
9	313°24.5	·· 54.3	231°12.4	14.7′	17°45.6	11.4′	54.2′
10	328°24.6	53.7	245°46.1	14.7′	17°57.0	11.3′	54.2′
11	343°24.6	53.0	260°19.8	14.6′	18°08.3	11.3′	54.2′
12	358°24.7	N17°52.4	274°53.4	14.6′	S18°19.6	11.2′	54.2′
13	13°24.7	51.8	289°27.0	14.5′	18°30.8	11.1′	54.2′
14	28°24.7	51.1	304°00.5	14.4′	18°41.9	11.0′	54.2′
15	43°24.8	·· 50.5	318°33.9	14.4′	18°52.9	11.0′	54.2′
16	58°24.8	49.9	333°07.3	14.3′	19°03.9	10.9′	54.2′
17	73°24.9	49.2	347°40.6	14.3′	19°14.8	10.8′	54.2′
18	88°24.9	N17°48.6	2°13.9	14.2′	S19°25.6	10.7′	54.2′
19	103°25.0	47.9	16°47.1	14.1′	19°36.3	10.7′	54.2′
20	118°25.0	47.3	31°20.2	14.1′	19°47.0	10.5′	54.2′
21	133°25.0	·· 46.7	45°53.3	14.0′	19°57.5	10.5′	54.2′
22	148°25.1	46.0	60°26.2	13.9′	20°08.0	10.4′	54.2′
23	163°25.1	45.4	74°59.2	13.9′	20°18.4	10.4′	54.2′
	SD = 15.8′	d = 0.6′		SD = 14.8′			

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	▭	▭	▭	▭	▭	▭
N 70°	////	////	01:19	22:45	////	////
68°	////	////	02:11	21:57	////	////
66°	////	////	02:43	21:27	////	////
64°	////	01:35	03:06	21:05	22:33	////
62°	////	02:12	03:24	20:47	21:57	////
60°	////	02:38	03:39	20:32	21:33	////
N 58°	01:26	02:57	03:52	20:20	21:13	22:42
56°	02:00	03:14	04:02	20:09	20:57	22:10
54°	02:24	03:27	04:12	20:00	20:44	21:47
52°	02:43	03:39	04:21	19:51	20:33	21:28
50°	02:58	03:49	04:28	19:44	20:22	21:13
45°	03:28	04:11	04:44	19:28	20:01	20:44
N 40°	03:50	04:27	04:58	19:15	19:45	20:22
35°	04:07	04:41	05:09	19:04	19:31	20:05
30°	04:21	04:53	05:19	18:54	19:20	19:51
20°	04:44	05:12	05:35	18:37	19:01	19:29
N 10°	05:01	05:27	05:50	18:23	18:45	19:11
0°	05:16	05:41	06:03	18:10	18:32	18:57
S 10°	05:29	05:54	06:16	17:57	18:19	18:44
20°	05:40	06:07	06:30	17:43	18:06	18:33
30°	05:52	06:21	06:46	17:27	17:52	18:21
35°	05:58	06:28	06:55	17:18	17:45	18:15
40°	06:04	06:37	07:06	17:08	17:36	18:09
45°	06:11	06:46	07:18	16:55	17:27	18:03
S 50°	06:18	06:57	07:33	16:41	17:16	17:55
52°	06:21	07:02	07:40	16:34	17:11	17:52
54°	06:25	07:08	07:47	16:26	17:06	17:49
56°	06:28	07:14	07:56	16:18	17:00	17:45
58°	06:32	07:21	08:05	16:08	16:53	17:41
S 60°	06:37	07:28	08:17	15:57	16:46	17:37

Lat.	Moonrise Wed	Moonrise Thu	Moonrise Fri	Moonset Wed	Moonset Thu	Moonset Fri
N 72°	12:06	14:26	▬	20:19	19:26	▬
N 70°	11:53	13:56	16:45	20:35	19:58	18:38
68°	11:43	13:33	15:43	20:47	20:22	19:42
66°	11:34	13:16	15:09	20:58	20:41	20:17
64°	11:27	13:02	14:44	21:06	20:56	20:43
62°	11:21	12:51	14:25	21:14	21:09	21:03
60°	11:15	12:41	14:09	21:21	21:20	21:20
N 58°	11:11	12:32	13:56	21:26	21:29	21:34
56°	11:07	12:25	13:44	21:32	21:38	21:46
54°	11:03	12:18	13:34	21:36	21:45	21:56
52°	11:00	12:12	13:26	21:41	21:52	22:06
50°	10:56	12:07	13:18	21:44	21:58	22:14
45°	10:50	11:55	13:01	21:53	22:11	22:32
N 40°	10:45	11:46	12:47	22:00	22:22	22:47
35°	10:40	11:38	12:36	22:06	22:31	22:59
30°	10:36	11:30	12:26	22:11	22:39	23:10
20°	10:29	11:18	12:09	22:21	22:54	23:29
N 10°	10:23	11:08	11:54	22:29	23:06	23:46
0°	10:17	10:58	11:40	22:37	23:18	·· ··
S 10°	10:11	10:48	11:27	22:44	23:30	·· ··
20°	10:05	10:38	11:12	22:53	23:43	·· ··
30°	09:59	10:26	10:55	23:02	23:57	·· ··
35°	09:55	10:19	10:46	23:08	·· ··	00:06
40°	09:50	10:12	10:35	23:14	·· ··	00:15
45°	09:45	10:03	10:22	23:21	·· ··	00:27
S 50°	09:40	09:52	10:07	23:30	·· ··	00:41
52°	09:37	09:47	10:00	23:34	·· ··	00:47
54°	09:34	09:42	09:52	23:39	·· ··	00:55
56°	09:31	09:36	09:43	23:44	·· ··	01:03
58°	09:27	09:29	09:33	23:50	·· ··	01:12
S 60°	09:23	09:22	09:21	23:56	·· ··	01:23

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 6-8 27-45%
30	06:29	06:28	12:06	16:27	04:07	
31	06:27	06:25	12:06	17:08	04:47	
01	06:23	06:21	12:06	17:51	05:29	



August 02, 03, 04 UT (Sat., Sun., Mon.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	310°50.6	218°33.2	N21°57.4	133°26.0	N01°46.7	207°53.2	N22°49.4	308°25.4	S01°32.6
1	325°53.1	233°32.5	57.4	148°27.0	46.1	222°55.1	49.4	323°27.9	32.6
2	340°55.5	248°31.9	57.5	163°28.1	45.5	237°57.0	49.3	338°30.5	32.7
3	355°58.0	263°31.2	·· 57.6	178°29.1	·· 44.8	252°58.9	·· 49.3	353°33.0	·· 32.7
4	11°00.5	278°30.6	57.7	193°30.2	44.2	268°00.8	49.2	8°35.5	32.8
5	26°02.9	293°29.9	57.8	208°31.3	43.5	283°02.7	49.2	23°38.1	32.8
6	41°05.4	308°29.2	N21°57.8	223°32.3	N01°42.9	298°04.6	N22°49.2	38°40.6	S01°32.8
7	56°07.9	323°28.6	57.9	238°33.4	42.3	313°06.4	49.1	53°43.1	32.9
8	71°10.3	338°27.9	58.0	253°34.4	41.6	328°08.3	49.1	68°45.7	32.9
9	86°12.8	353°27.2	·· 58.1	268°35.5	·· 41.0	343°10.2	·· 49.0	83°48.2	·· 33.0
10	101°15.2	8°26.6	58.1	283°36.6	40.3	358°12.1	49.0	98°50.7	33.0
11	116°17.7	23°25.9	58.2	298°37.6	39.7	13°14.0	48.9	113°53.3	33.1
12	131°20.2	38°25.2	N21°58.3	313°38.7	N01°39.0	28°15.9	N22°48.9	128°55.8	S01°33.1
13	146°22.6	53°24.6	58.3	328°39.7	38.4	43°17.8	48.8	143°58.3	33.1
14	161°25.1	68°23.9	58.4	343°40.8	37.8	58°19.7	48.8	159°00.9	33.2
15	176°27.6	83°23.3	·· 58.5	358°41.8	·· 37.1	73°21.6	·· 48.8	174°03.4	·· 33.2
16	191°30.0	98°22.6	58.5	13°42.9	36.5	88°23.4	48.7	189°06.0	33.3
17	206°32.5	113°21.9	58.6	28°44.0	35.8	103°25.3	48.7	204°08.5	33.3
18	221°35.0	128°21.3	N21°58.7	43°45.0	N01°35.2	118°27.2	N22°48.6	219°11.0	S01°33.4
19	236°37.4	143°20.6	58.7	58°46.1	34.6	133°29.1	48.6	234°13.6	33.4
20	251°39.9	158°19.9	58.8	73°47.1	33.9	148°31.0	48.5	249°16.1	33.4
21	266°42.4	173°19.3	·· 58.8	88°48.2	·· 33.3	163°32.9	·· 48.5	264°18.6	·· 33.5
22	281°44.8	188°18.6	58.9	103°49.3	32.6	178°34.8	48.5	279°21.2	33.5
23	296°47.3	203°17.9	59.0	118°50.3	32.0	193°36.7	48.4	294°23.7	33.6
Mer.pass. 03:16		ν -0.7′	d 0.1′	m -4.00	ν 1.1′	d 0.6′	m 1.60	ν 1.9′	d 0.0′ m -1.92	ν 2.5′	d 0.0′ m 0.79

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	311°49.7	218°17.3	N21°59.0	133°51.4	N01°31.3	208°38.6	N22°48.4	309°26.3	S01°33.6
1	326°52.2	233°16.6	59.1	148°52.4	30.7	223°40.5	48.3	324°28.8	33.7
2	341°54.7	248°15.9	59.1	163°53.5	30.1	238°42.3	48.3	339°31.3	33.7
3	356°57.1	263°15.3	·· 59.2	178°54.5	·· 29.4	253°44.2	·· 48.2	354°33.9	·· 33.7
4	11°59.6	278°14.6	59.2	193°55.6	28.8	268°46.1	48.2	9°36.4	33.8
5	27°02.1	293°13.9	59.3	208°56.7	28.1	283°48.0	48.1	24°39.0	33.8
6	42°04.5	308°13.3	N21°59.3	223°57.7	N01°27.5	298°49.9	N22°48.1	39°41.5	S01°33.9
7	57°07.0	323°12.6	59.4	238°58.8	26.8	313°51.8	48.1	54°44.0	33.9
8	72°09.5	338°11.9	59.4	253°59.8	26.2	328°53.7	48.0	69°46.6	34.0
9	87°11.9	353°11.3	·· 59.5	269°00.9	·· 25.6	343°55.6	·· 48.0	84°49.1	·· 34.0
10	102°14.4	8°10.6	59.5	284°01.9	24.9	358°57.5	47.9	99°51.6	34.0
11	117°16.8	23°09.9	59.6	299°03.0	24.3	13°59.4	47.9	114°54.2	34.1
12	132°19.3	38°09.3	N21°59.6	314°04.1	N01°23.6	29°01.3	N22°47.8	129°56.7	S01°34.1
13	147°21.8	53°08.6	59.7	329°05.1	23.0	44°03.1	47.8	144°59.3	34.2
14	162°24.2	68°07.9	59.7	344°06.2	22.4	59°05.0	47.7	160°01.8	34.2
15	177°26.7	83°07.2	·· 59.8	359°07.2	·· 21.7	74°06.9	·· 47.7	175°04.3	·· 34.3
16	192°29.2	98°06.6	59.8	14°08.3	21.1	89°08.8	47.6	190°06.9	34.3
17	207°31.6	113°05.9	59.8	29°09.3	20.4	104°10.7	47.6	205°09.4	34.4
18	222°34.1	128°05.2	N21°59.9	44°10.4	N01°19.8	119°12.6	N22°47.6	220°12.0	S01°34.4
19	237°36.6	143°04.6	21°59.9	59°11.5	19.1	134°14.5	47.5	235°14.5	34.4
20	252°39.0	158°03.9	22°00.0	74°12.5	18.5	149°16.4	47.5	250°17.1	34.5
21	267°41.5	173°03.2	·· 00.0	89°13.6	·· 17.8	164°18.3	·· 47.4	265°19.6	·· 34.5
22	282°44.0	188°02.5	00.0	104°14.6	17.2	179°20.2	47.4	280°22.1	34.6
23	297°46.4	203°01.9	00.1	119°15.7	16.6	194°22.1	47.3	295°24.7	34.6
Mer.pass. 03:12		ν -0.7′	d 0.1′	m -4.00	ν 1.1′	d 0.6′	m 1.61	ν 1.9′	d 0.0′ m -1.92	ν 2.5′	d 0.0′ m 0.79

Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	312°48.9	218°01.2	N22°00.1	134°16.7	N01°15.9	209°24.0	N22°47.3	310°27.2	S01°34.7
1	327°51.3	233°00.5	00.1	149°17.8	15.3	224°25.8	47.2	325°29.8	34.7
2	342°53.8	247°59.9	00.2	164°18.8	14.6	239°27.7	47.2	340°32.3	34.8
3	357°56.3	262°59.2	·· 00.2	179°19.9	·· 14.0	254°29.6	·· 47.2	355°34.8	·· 34.8
4	12°58.7	277°58.5	00.2	194°21.0	13.3	269°31.5	47.1	10°37.4	34.8
5	28°01.2	292°57.8	00.2	209°22.0	12.7	284°33.4	47.1	25°39.9	34.9
6	43°03.7	307°57.2	N22°00.3	224°23.1	N01°12.1	299°35.3	N22°47.0	40°42.5	S01°34.9
7	58°06.1	322°56.5	00.3	239°24.1	11.4	314°37.2	47.0	55°45.0	35.0
8	73°08.6	337°55.8	00.3	254°25.2	10.8	329°39.1	46.9	70°47.6	35.0
9	88°11.1	352°55.2	·· 00.3	269°26.2	·· 10.1	344°41.0	·· 46.9	85°50.1	·· 35.1
10	103°13.5	7°54.5	00.4	284°27.3	09.5	359°42.9	46.8	100°52.6	35.1
11	118°16.0	22°53.8	00.4	299°28.3	08.8	14°44.8	46.8	115°55.2	35.2
12	133°18.5	37°53.1	N22°00.4	314°29.4	N01°08.2	29°46.7	N22°46.7	130°57.7	S01°35.2
13	148°20.9	52°52.5	00.4	329°30.4	07.6	44°48.6	46.7	146°00.3	35.3
14	163°23.4	67°51.8	00.4	344°31.5	06.9	59°50.5	46.7	161°02.8	35.3
15	178°25.8	82°51.1	·· 00.5	359°32.6	·· 06.3	74°52.4	·· 46.6	176°05.4	·· 35.3
16	193°28.3	97°50.4	00.5	14°33.6	05.6	89°54.2	46.6	191°07.9	35.4
17	208°30.8	112°49.8	00.5	29°34.7	05.0	104°56.1	46.5	206°10.4	35.4
18	223°33.2	127°49.1	N22°00.5	44°35.7	N01°04.3	119°58.0	N22°46.5	221°13.0	S01°35.5
19	238°35.7	142°48.4	00.5	59°36.8	03.7	134°59.9	46.4	236°15.5	35.5
20	253°38.2	157°47.7	00.5	74°37.8	03.0	150°01.8	46.4	251°18.1	35.6
21	268°40.6	172°47.1	·· 00.6	89°38.9	·· 02.4	165°03.7	·· 46.3	266°20.6	·· 35.6
22	283°43.1	187°46.4	00.6	104°39.9	01.8	180°05.6	46.3	281°23.2	35.7
23	298°45.6	202°45.7	00.6	119°41.0	01.1	195°07.5	46.2	296°25.7	35.7
Mer.pass. 03:08		ν -0.7′	d 0.0′	m -3.99	ν 1.1′	d 0.6′	m 1.61	ν 1.9′	d 0.0′ m -1.92	ν 2.5′	d 0.0′ m 0.78

Stars

	SHA	Dec
Alpheratz	357°34.1	29°13.9
Ankaa	353°06.4	-42°09.7
Schedar	349°30.2	56°40.5
Diphda	348°46.6	-17°50.6
Achernar	335°19.7	-57°06.1
Hamal	327°50.6	23°35.0
Polaris	313°51.4	89°22.0
Acamar	315°11.4	-40°11.8
Menkar	314°05.7	4°11.5
Mirfak	308°27.7	49°56.9
Aldebaran	290°39.2	16°33.7
Rigel	281°03.6	-8°10.2
Capella	280°21.5	46°01.3
Bellatrix	278°22.6	6°22.5
Elnath	278°01.5	28°37.7
Alnilam	275°37.5	-1°11.0
Betelgeuse	270°51.8	7°24.8
Canopus	263°52.6	-52°42.3
Sirius	258°26.1	-16°44.9
Adhara	255°05.8	-29°00.2
Procyon	244°50.7	5°09.7
Pollux	243°17.1	27°57.9
Avior	234°15.2	-59°35.4
Suhail	222°46.4	-43°32.1
Miaplacidus	221°39.2	-69°49.3
Alphard	217°47.6	-8°46.1
Regulus	207°34.2	11°50.6
Dubhe	193°40.9	61°37.0
Denebola	182°24.7	14°25.9
Gienah	175°43.3	-17°41.1
Acrux	173°00.0	-63°14.7
Gacrux	171°51.5	-57°15.6
Alioth	166°12.8	55°49.5
Spica	158°21.9	-11°17.7
Alkaid	152°51.7	49°11.4
Hadar	148°35.4	-60°30.0
Menkent	147°57.1	-36°29.9
Arcturus	145°47.5	19°03.1
Rigil Kent.	139°39.7	-60°56.7
Kochab	137°19.7	74°03.3
Zuben'ubi	136°55.5	-16°08.9
Alphecca	126°03.2	26°37.9
Antares	112°15.1	-26°29.4
Atria	107°08.5	-69°04.6
Sabik	102°02.0	-15°45.4
Shaula	96°09.4	-37°07.4
Rasalhague	95°57.9	12°32.6
Eltanin	90°41.6	51°29.3
Kaus Aust.	83°31.5	-34°22.4
Vega	80°32.5	38°48.6
Nunki	75°46.8	-26°15.9
Altair	61°59.2	8°56.2
Peacock	53°04.4	-56°39.1
Deneb	49°25.0	45°22.3
Enif	33°38.0	9°59.6
Al Na'ir	27°31.9	-46°50.0
Fomalhaut	15°13.7	-29°29.0
Scheat	13°44.5	28°13.3
Markab	13°29.2	15°20.6

Aug 02 Sat	SHA	Mer.pass
Venus	267°42.6	09:26
Mars	182°35.4	15:05
Jupiter	257°02.6	10:07
Saturn	357°34.8	03:26

Aug 03 Sun	SHA	Mer.pass
Venus	266°27.5	09:27
Mars	182°01.6	15:04
Jupiter	256°48.8	10:04
Saturn	357°36.5	03:22

Aug 04 Mon	SHA	Mer.pass
Venus	265°12.3	09:28
Mars	181°27.9	15:02
Jupiter	256°35.1	10:01
Saturn	357°38.3	03:18

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h

Sat	Sun GHA	Sun Dec	Moon GHA	Moon ν	Moon Dec	Moon d	Moon HP
0	178°25.2	N17°44.7	89°32.0	13.8′	S20°28.8	10.2′	54.2′
1	193°25.2	44.1	104°04.8	13.7′	20°39.0	10.2′	54.2′
2	208°25.3	43.5	118°37.6	13.7′	20°49.2	10.0′	54.2′
3	223°25.3	·· 42.8	133°10.2	13.6′	20°59.2	10.0′	54.2′
4	238°25.4	42.2	147°42.8	13.5′	21°09.2	9.9′	54.2′
5	253°25.4	41.5	162°15.3	13.4′	21°19.1	9.9′	54.2′
6	268°25.4	N17°40.9	176°47.8	13.4′	S21°29.0	9.7′	54.2′
7	283°25.5	40.2	191°20.1	13.3′	21°38.7	9.6′	54.2′
8	298°25.5	39.6	205°52.4	13.2′	21°48.3	9.6′	54.2′
9	313°25.6	·· 38.9	220°24.7	13.2′	21°57.9	9.4′	54.2′
10	328°25.6	38.3	234°56.8	13.1′	22°07.3	9.4′	54.2′
11	343°25.7	37.7	249°28.9	13.0′	22°16.7	9.3′	54.2′
12	358°25.7	N17°37.0	264°00.9	12.9′	S22°26.0	9.1′	54.2′
13	13°25.8	36.4	278°32.9	12.9′	22°35.1	9.1′	54.2′
14	28°25.8	35.7	293°04.7	12.8′	22°44.2	9.0′	54.2′
15	43°25.9	·· 35.1	307°36.5	12.7′	22°53.2	8.9′	54.2′
16	58°25.9	34.4	322°08.2	12.6′	23°02.1	8.8′	54.2′
17	73°26.0	33.8	336°39.9	12.6′	23°10.9	8.7′	54.2′
18	88°26.0	N17°33.1	351°11.4	12.5′	S23°19.6	8.6′	54.2′
19	103°26.1	32.5	5°42.9	12.4′	23°28.2	8.5′	54.3′
20	118°26.1	31.8	20°14.3	12.3′	23°36.7	8.4′	54.3′
21	133°26.2	·· 31.2	34°45.7	12.3′	23°45.1	8.3′	54.3′
22	148°26.2	30.5	49°16.9	12.2′	23°53.4	8.2′	54.3′
23	163°26.3	29.8	63°48.1	12.1′	24°01.6	8.1′	54.3′
	SD = 15.8′	d = 0.6′		SD = 14.8′			

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	178°26.3	N17°29.2	78°19.2	12.0′	S24°09.7	7.9′	54.3′
1	193°26.4	28.5	92°50.3	12.0′	24°17.6	7.9′	54.3′
2	208°26.4	27.9	107°21.2	11.9′	24°25.5	7.8′	54.3′
3	223°26.5	·· 27.2	121°52.1	11.8′	24°33.3	7.7′	54.3′
4	238°26.5	26.6	136°22.9	11.7′	24°41.0	7.5′	54.3′
5	253°26.6	25.9	150°53.6	11.6′	24°48.5	7.5′	54.3′
6	268°26.6	N17°25.3	165°24.3	11.6′	S24°56.0	7.3′	54.3′
7	283°26.7	24.6	179°54.8	11.5′	25°03.3	7.2′	54.4′
8	298°26.7	23.9	194°25.3	11.4′	25°10.5	7.2′	54.4′
9	313°26.8	·· 23.3	208°55.7	11.3′	25°17.7	7.0′	54.4′
10	328°26.8	22.6	223°26.1	11.3′	25°24.7	6.9′	54.4′
11	343°26.9	22.0	237°56.4	11.2′	25°31.6	6.7′	54.4′
12	358°27.0	N17°21.3	252°26.5	11.1′	S25°38.3	6.7′	54.4′
13	13°27.0	20.7	266°56.7	11.0′	25°45.0	6.5′	54.4′
14	28°27.1	20.0	281°26.7	11.0′	25°51.5	6.5′	54.4′
15	43°27.1	·· 19.3	295°56.7	10.9′	25°58.0	6.3′	54.4′
16	58°27.2	18.7	310°26.5	10.8′	26°04.3	6.2′	54.5′
17	73°27.2	18.0	324°56.4	10.7′	26°10.5	6.0′	54.5′
18	88°27.3	N17°17.3	339°26.1	10.7′	S26°16.5	6.0′	54.5′
19	103°27.3	16.7	353°55.8	10.6′	26°22.5	5.8′	54.5′
20	118°27.4	16.0	8°25.3	10.5′	26°28.3	5.7′	54.5′
21	133°27.5	·· 15.4	22°54.9	10.4′	26°34.0	5.6′	54.5′
22	148°27.5	14.7	37°24.3	10.4′	26°39.6	5.5′	54.5′
23	163°27.6	14.0	51°53.7	10.3′	26°45.1	5.3′	54.6′
	SD = 15.8′	d = 0.7′		SD = 14.8′			

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	178°27.6	N17°13.4	66°23.0	10.2′	S26°50.4	5.2′	54.6′
1	193°27.7	12.7	80°52.2	10.2′	26°55.6	5.1′	54.6′
2	208°27.7	12.0	95°21.3	10.1′	27°00.7	4.9′	54.6′
3	223°27.8	·· 11.4	109°50.4	10.0′	27°05.6	4.8′	54.6′
4	238°27.9	10.7	124°19.4	9.9′	27°10.4	4.7′	54.6′
5	253°27.9	10.0	138°48.4	9.9′	27°15.1	4.6′	54.6′
6	268°28.0	N17°09.4	153°17.3	9.8′	S27°19.7	4.4′	54.7′
7	283°28.0	08.7	167°46.1	9.7′	27°24.1	4.3′	54.7′
8	298°28.1	08.0	182°14.8	9.7′	27°28.4	4.2′	54.7′
9	313°28.2	·· 07.4	196°43.5	9.6′	27°32.6	4.0′	54.7′
10	328°28.2	06.7	211°12.1	9.5′	27°36.6	3.9′	54.7′
11	343°28.3	06.0	225°40.7	9.5′	27°40.5	3.8′	54.7′
12	358°28.3	N17°05.3	240°09.1	9.4′	S27°44.3	3.6′	54.8′
13	13°28.4	04.7	254°37.6	9.4′	27°47.9	3.5′	54.8′
14	28°28.5	04.0	269°05.9	9.3′	27°51.4	3.4′	54.8′
15	43°28.5	·· 03.3	283°34.2	9.2′	27°54.8	3.2′	54.8′
16	58°28.6	02.7	298°02.5	9.2′	27°58.0	3.0′	54.8′
17	73°28.6	02.0	312°30.6	9.1′	28°01.0	3.0′	54.8′
18	88°28.7	N17°01.3	326°58.8	9.1′	S28°04.0	2.8′	54.9′
19	103°28.8	00.6	341°26.8	9.0′	28°06.8	2.6′	54.9′
20	118°28.8	17°00.0	355°54.8	9.0′	28°09.4	2.5′	54.9′
21	133°28.9	16°59.3	10°22.8	8.9′	28°11.9	2.4′	54.9′
22	148°29.0	58.6	24°50.7	8.8′	28°14.3	2.2′	54.9′
23	163°29.0	57.9	39°18.6	8.8′	28°16.5	2.1′	55.0′
	SD = 15.8′	d = 0.7′		SD = 14.9′			

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	▭	▭	▭	▭	▭	▭
N 70°	////	////	01:45	22:21	////	////
68°	////	////	02:26	21:42	////	////
66°	////	00:56	02:54	21:15	23:06	////
64°	////	01:52	03:15	20:55	22:16	////
62°	////	02:24	03:32	20:38	21:45	////
60°	00:51	02:47	03:46	20:25	21:23	23:12
N 58°	01:42	03:05	03:58	20:13	21:05	22:27
56°	02:11	03:20	04:08	20:03	20:50	21:59
54°	02:32	03:33	04:17	19:54	20:38	21:38
52°	02:50	03:44	04:25	19:46	20:27	21:21
50°	03:04	03:54	04:32	19:39	20:17	21:07
45°	03:32	04:14	04:48	19:24	19:57	20:39
N 40°	03:53	04:30	05:00	19:11	19:41	20:18
35°	04:10	04:43	05:11	19:01	19:28	20:02
30°	04:24	04:55	05:20	18:52	19:17	19:48
20°	04:45	05:13	05:36	18:36	18:59	19:27
N 10°	05:02	05:28	05:50	18:22	18:44	19:10
0°	05:16	05:41	06:03	18:10	18:31	18:56
S 10°	05:28	05:53	06:15	17:57	18:19	18:44
20°	05:39	06:06	06:29	17:44	18:07	18:33
30°	05:50	06:19	06:44	17:29	17:54	18:23
35°	05:56	06:26	06:53	17:20	17:47	18:17
40°	06:01	06:34	07:03	17:10	17:39	18:11
45°	06:08	06:43	07:14	16:59	17:30	18:05
S 50°	06:14	06:53	07:28	16:45	17:20	17:59
52°	06:17	06:58	07:35	16:38	17:15	17:56
54°	06:20	07:03	07:42	16:31	17:10	17:53
56°	06:24	07:09	07:50	16:23	17:04	17:50
58°	06:27	07:15	07:59	16:14	16:58	17:46
S 60°	06:31	07:22	08:09	16:04	16:51	17:42

Lat.	Moonrise Sat	Moonrise Sun	Moonrise Mon	Moonset Sat	Moonset Sun	Moonset Mon
N 72°	▬	▬	▬	▬	▬	▬
N 70°	▬	▬	▬	▬	▬	▬
68°	▬	▬	▬	▬	▬	▬
66°	17:39	▬	▬	19:22	▬	▬
64°	16:39	▬	▬	20:22	▬	▬
62°	16:06	17:57	▬	20:56	20:45	▬
60°	15:41	17:16	18:47	21:21	21:27	21:44
N 58°	15:22	16:48	18:08	21:41	21:55	22:22
56°	15:06	16:27	17:41	21:58	22:17	22:50
54°	14:52	16:09	17:20	22:12	22:35	23:11
52°	14:40	15:54	17:03	22:24	22:51	23:29
50°	14:30	15:41	16:48	22:35	23:04	23:44
45°	14:08	15:14	16:18	22:58	23:31	·· ··
N 40°	13:50	14:53	15:54	23:17	23:53	·· ··
35°	13:35	14:36	15:35	23:32	·· ··	00:11
30°	13:23	14:21	15:18	23:46	·· ··	00:27
20°	13:01	13:55	14:50	·· ··	00:09	00:53
N 10°	12:42	13:33	14:26	·· ··	00:29	01:16
0°	12:25	13:13	14:04	00:02	00:48	01:37
S 10°	12:08	12:53	13:42	00:17	01:07	01:59
20°	11:50	12:31	13:18	00:34	01:27	02:22
30°	11:28	12:07	12:51	00:53	01:51	02:48
35°	11:16	11:52	12:35	01:05	02:04	03:04
40°	11:02	11:35	12:16	01:18	02:20	03:23
45°	10:46	11:15	11:53	01:33	02:40	03:45
S 50°	10:25	10:50	11:24	01:52	03:04	04:13
52°	10:16	10:38	11:10	02:01	03:16	04:27
54°	10:05	10:24	10:53	02:12	03:29	04:44
56°	09:53	10:08	10:34	02:23	03:44	05:03
58°	09:39	09:49	10:10	02:37	04:03	05:27
S 60°	09:22	09:26	09:37	02:52	04:26	05:59

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 9-11 55-73%
02	06:19	06:17	12:06	18:36	06:13	
03	06:15	06:12	12:06	19:25	07:00	
04	06:09	06:07	12:06	20:17	07:51	

August 05, 06, 07 UT (Tue., Wed., Thu.)

	Aries	Venus		Mars		Jupiter		Saturn	
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	313°48.0	217°45.0	N22°00.6	134°42.0	N01°00.5	210°09.4	N22°46.2	311°28.3	S01°35.8
1	328°50.5	232°44.4	00.6	149°43.1	00°59.8	225°11.3	46.2	326°30.8	35.8
2	343°53.0	247°43.7	00.6	164°44.1	59.2	240°13.2	46.1	341°33.4	35.8
3	358°55.4	262°43.0	·· 00.6	179°45.2	·· 58.5	255°15.1	·· 46.1	356°35.9	·· 35.9
4	13°57.9	277°42.3	00.6	194°46.3	57.9	270°17.0	46.0	11°38.4	35.9
5	29°00.3	292°41.6	00.6	209°47.3	57.2	285°18.9	46.0	26°41.0	36.0
6	44°02.8	307°41.0	N22°00.6	224°48.4	N00°56.6	300°20.8	N22°45.9	41°43.5	S01°36.0
7	59°05.3	322°40.3	00.6	239°49.4	56.0	315°22.7	45.9	56°46.1	36.1
8	74°07.7	337°39.6	00.6	254°50.5	55.3	330°24.6	45.8	71°48.6	36.1
9	89°10.2	352°38.9	·· 00.6	269°51.5	·· 54.7	345°26.5	·· 45.8	86°51.2	·· 36.2
10	104°12.7	7°38.3	00.6	284°52.6	54.0	0°28.4	45.7	101°53.7	36.2
11	119°15.1	22°37.6	00.6	299°53.6	53.4	15°30.3	45.7	116°56.3	36.3
12	134°17.6	37°36.9	N22°00.6	314°54.7	N00°52.7	30°32.2	N22°45.7	131°58.8	S01°36.3
13	149°20.1	52°36.2	00.6	329°55.7	52.1	45°34.0	45.6	147°01.4	36.4
14	164°22.5	67°35.5	00.6	344°56.8	51.4	60°35.9	45.6	162°03.9	36.4
15	179°25.0	82°34.9	·· 00.6	359°57.8	·· 50.8	75°37.8	·· 45.5	177°06.5	·· 36.5
16	194°27.5	97°34.2	00.6	14°58.9	50.1	90°39.7	45.5	192°09.0	36.5
17	209°29.9	112°33.5	00.6	29°59.9	49.5	105°41.6	45.4	207°11.5	36.5
18	224°32.4	127°32.8	N22°00.6	45°01.0	N00°48.9	120°43.5	N22°45.4	222°14.1	S01°36.6
19	239°34.8	142°32.1	00.6	60°02.0	48.2	135°45.4	45.3	237°16.6	36.6
20	254°37.3	157°31.5	00.5	75°03.1	47.6	150°47.3	45.3	252°19.2	36.7
21	269°39.8	172°30.8	·· 00.5	90°04.1	·· 46.9	165°49.2	·· 45.2	267°21.7	·· 36.7
22	284°42.2	187°30.1	00.5	105°05.2	46.3	180°51.1	45.2	282°24.3	36.8
23	299°44.7	202°29.4	00.5	120°06.2	45.6	195°53.0	45.1	297°26.8	36.8
Mer.pass. 03:04		ν -0.7′	d 0.0′	ν 1.1′	d 0.6′	ν 1.9′	d 0.0′	ν 2.5′	d 0.0′
		m -3.99		m 1.61		m -1.92		m 0.78	

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	314°47.2	217°28.7	N22°00.5	135°07.3	N00°45.0	210°54.9	N22°45.1	312°29.4	S01°36.9
1	329°49.6	232°28.1	00.5	150°08.3	44.3	225°56.8	45.1	327°31.9	36.9
2	344°52.1	247°27.4	00.5	165°09.4	43.7	240°58.7	45.0	342°34.5	37.0
3	359°54.6	262°26.7	·· 00.4	180°10.4	·· 43.0	256°00.6	·· 45.0	357°37.0	·· 37.0
4	14°57.0	277°26.0	00.4	195°11.5	42.4	271°02.5	44.9	12°39.6	37.1
5	29°59.5	292°25.3	00.4	210°12.5	41.8	286°04.4	44.9	27°42.1	37.1
6	45°01.9	307°24.7	N22°00.4	225°13.6	N00°41.1	301°06.3	N22°44.8	42°44.7	S01°37.2
7	60°04.4	322°24.0	00.3	240°14.6	40.5	316°08.2	44.8	57°47.2	37.2
8	75°06.9	337°23.3	00.3	255°15.7	39.8	331°10.1	44.7	72°49.8	37.3
9	90°09.3	352°22.6	·· 00.3	270°16.7	·· 39.2	346°12.0	·· 44.7	87°52.3	·· 37.3
10	105°11.8	7°21.9	00.3	285°17.8	38.5	1°13.9	44.6	102°54.9	37.4
11	120°14.3	22°21.3	00.2	300°18.8	37.9	16°15.8	44.6	117°57.4	37.4
12	135°16.7	37°20.6	N22°00.2	315°19.9	N00°37.2	31°17.7	N22°44.5	133°00.0	S01°37.4
13	150°19.2	52°19.9	00.2	330°20.9	36.6	46°19.6	44.5	148°02.5	37.5
14	165°21.7	67°19.2	00.2	345°22.0	35.9	61°21.5	44.5	163°05.1	37.5
15	180°24.1	82°18.5	·· 00.1	0°23.0	·· 35.3	76°23.4	·· 44.4	178°07.6	·· 37.6
16	195°26.6	97°17.8	00.1	15°24.1	34.6	91°25.3	44.4	193°10.2	37.6
17	210°29.1	112°17.2	00.1	30°25.1	34.0	106°27.2	44.3	208°12.7	37.7
18	225°31.5	127°16.5	N22°00.0	45°26.2	N00°33.4	121°29.1	N22°44.3	223°15.3	S01°37.7
19	240°34.0	142°15.8	00.0	60°27.2	32.7	136°31.0	44.2	238°17.8	37.8
20	255°36.4	157°15.1	22°00.0	75°28.3	32.1	151°32.9	44.2	253°20.4	37.8
21	270°38.9	172°14.4	21°59.9	90°29.3	·· 31.4	166°34.8	·· 44.1	268°22.9	·· 37.9
22	285°41.4	187°13.7	59.9	105°30.4	30.8	181°36.7	44.1	283°25.5	37.9
23	300°43.8	202°13.1	59.8	120°31.4	30.1	196°38.6	44.0	298°28.0	38.0
Mer.pass. 03:00		ν -0.7′	d 0.0′	ν 1.1′	d 0.6′	ν 1.9′	d 0.0′	ν 2.5′	d 0.0′
		m -3.99		m 1.61		m -1.93		m 0.77	

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	315°46.3	217°12.4	N21°59.8	135°32.5	N00°29.5	211°40.5	N22°44.0	313°30.6	S01°38.0
1	330°48.8	232°11.7	59.8	150°33.5	28.8	226°42.4	43.9	328°33.1	38.1
2	345°51.2	247°11.0	59.7	165°34.6	28.2	241°44.3	43.9	343°35.7	38.1
3	0°53.7	262°10.3	·· 59.7	180°35.6	·· 27.5	256°46.2	·· 43.8	358°38.3	·· 38.2
4	15°56.2	277°09.6	59.6	195°36.7	26.9	271°48.1	43.8	13°40.8	38.2
5	30°58.6	292°08.9	59.6	210°37.7	26.2	286°50.0	43.8	28°43.4	38.3
6	46°01.1	307°08.3	N21°59.5	225°38.8	N00°25.6	301°51.9	N22°43.7	43°45.9	S01°38.3
7	61°03.6	322°07.6	59.5	240°39.8	25.0	316°53.8	43.7	58°48.5	38.4
8	76°06.0	337°06.9	59.4	255°40.9	24.3	331°55.7	43.6	73°51.0	38.4
9	91°08.5	352°06.2	·· 59.4	270°41.9	·· 23.7	346°57.6	·· 43.6	88°53.6	·· 38.5
10	106°10.9	7°05.5	59.3	285°43.0	23.0	1°59.5	43.5	103°56.1	38.5
11	121°13.4	22°04.8	59.3	300°44.0	22.4	17°01.4	43.5	118°58.7	38.6
12	136°15.9	37°04.1	N21°59.2	315°45.1	N00°21.7	32°03.3	N22°43.4	134°01.2	S01°38.6
13	151°18.3	52°03.5	59.2	330°46.1	21.1	47°05.2	43.4	149°03.8	38.7
14	166°20.8	67°02.8	59.1	345°47.2	20.4	62°07.1	43.3	164°06.3	38.7
15	181°23.3	82°02.1	·· 59.1	0°48.2	·· 19.8	77°09.0	·· 43.3	179°08.9	·· 38.8
16	196°25.7	97°01.4	59.0	15°49.3	19.1	92°10.9	43.2	194°11.4	38.8
17	211°28.2	112°00.7	59.0	30°50.3	18.5	107°12.8	43.2	209°14.0	38.9
18	226°30.7	127°00.0	N21°58.9	45°51.3	N00°17.8	122°14.7	N22°43.1	224°16.6	S01°38.9
19	241°33.1	141°59.3	58.8	60°52.4	17.2	137°16.6	43.1	239°19.1	39.0
20	256°35.6	156°58.7	58.8	75°53.4	16.5	152°18.5	43.0	254°21.7	39.0
21	271°38.1	171°58.0	·· 58.7	90°54.5	·· 15.9	167°20.4	·· 43.0	269°24.2	·· 39.1
22	286°40.5	186°57.3	58.7	105°55.5	15.2	182°22.3	43.0	284°26.8	39.1
23	301°43.0	201°56.6	58.6	120°56.6	14.6	197°24.2	42.9	299°29.3	39.2
Mer.pass. 02:56		ν -0.7′	d 0.0′	ν 1.0′	d 0.6′	ν 1.9′	d 0.0′	ν 2.6′	d 0.0′
		m -3.99		m 1.61		m -1.93		m 0.77	

Stars

	SHA	Dec
Alpheratz	357°34.0	29°13.9
Ankaa	353°06.4	-42°09.7
Schedar	349°30.2	56°40.5
Diphda	348°46.6	-17°50.6
Achernar	335°19.6	-57°06.1
Hamal	327°50.6	23°35.0
Polaris	313°49.6	89°22.0
Acamar	315°11.4	-40°11.8
Menkar	314°05.7	4°11.5
Mirfak	308°27.6	49°57.0
Aldebaran	290°39.2	16°33.7
Rigel	281°03.6	-8°10.2
Capella	280°21.5	46°01.3
Bellatrix	278°22.6	6°22.5
Elnath	278°01.5	28°37.7
Alnilam	275°37.5	-1°11.0
Betelgeuse	270°51.8	7°24.8
Canopus	263°52.6	-52°42.3
Sirius	258°26.1	-16°44.9
Adhara	255°05.8	-29°00.2
Procyon	244°50.6	5°09.7
Pollux	243°17.1	27°57.9
Avior	234°15.2	-59°35.4
Suhail	222°46.4	-43°32.1
Miaplacidus	221°39.2	-69°49.3
Alphard	217°47.6	-8°46.1
Regulus	207°34.2	11°50.6
Dubhe	193°40.9	61°37.0
Denebola	182°24.7	14°25.9
Gienah	175°43.3	-17°41.1
Acrux	173°00.0	-63°14.7
Gacrux	171°51.5	-57°15.6
Alioth	166°12.8	55°49.5
Spica	158°21.9	-11°17.7
Alkaid	152°51.7	49°11.4
Hadar	148°35.5	-60°30.0
Menkent	147°57.1	-36°29.9
Arcturus	145°47.5	19°03.1
Rigil Kent.	139°39.7	-60°56.7
Kochab	137°19.7	74°03.3
Zuben'ubi	136°55.5	-16°08.9
Alphecca	126°03.2	26°37.9
Antares	112°15.1	-26°29.4
Atria	107°08.5	-69°04.6
Sabik	102°02.0	-15°45.4
Shaula	96°09.4	-37°07.4
Rasalhague	95°57.9	12°32.6
Eltanin	90°41.6	51°29.3
Kaus Aust.	83°31.5	-34°22.4
Vega	80°32.5	38°48.6
Nunki	75°46.8	-26°15.9
Altair	61°59.2	8°56.2
Peacock	53°04.3	-56°39.1
Deneb	49°25.0	45°22.3
Enif	33°38.0	9°59.6
Al Na'ir	27°31.8	-46°50.1
Fomalhaut	15°13.7	-29°29.0
Scheat	13°44.4	28°13.3
Markab	13°29.1	15°20.6

Aug 05 Tue	SHA	Mer.pass
Venus	263°57.0	09:29
Mars	180°54.0	15:00
Jupiter	256°21.4	09:58
Saturn	357°40.2	03:14

Aug 06 Wed	SHA	Mer.pass
Venus	262°41.6	09:31
Mars	180°20.1	14:58
Jupiter	256°07.7	09:55
Saturn	357°42.2	03:10

Aug 07 Thu	SHA	Mer.pass
Venus	261°26.1	09:32
Mars	179°46.2	14:57
Jupiter	255°54.2	09:52
Saturn	357°44.3	03:05

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°29.1	N16°57.3	53°46.4	8.7′	S28°18.6	1.9′	55.0′
1	193°29.1	56.6	68°14.1	8.7′	28°20.5	1.8′	55.0′
2	208°29.2	55.9	82°41.8	8.7′	28°22.3	1.7′	55.0′
3	223°29.3	·· 55.2	97°09.5	8.6′	28°24.0	1.5′	55.0′
4	238°29.3	54.5	111°37.1	8.6′	28°25.5	1.3′	55.1′
5	253°29.4	53.9	126°04.6	8.5′	28°26.8	1.2′	55.1′
6	268°29.5	N16°53.2	140°32.1	8.5′	S28°28.0	1.1′	55.1′
7	283°29.5	52.5	154°59.6	8.4′	28°29.1	0.9′	55.1′
8	298°29.6	51.8	169°27.1	8.4′	28°30.0	0.7′	55.1′
9	313°29.7	·· 51.1	183°54.4	8.4′	28°30.7	0.6′	55.2′
10	328°29.7	50.5	198°21.8	8.3′	28°31.3	0.5′	55.2′
11	343°29.8	49.8	212°49.1	8.3′	28°31.8	0.3′	55.2′
12	358°29.9	N16°49.1	227°16.4	8.3′	S28°32.1	0.2′	55.2′
13	13°29.9	48.4	241°43.7	8.2′	28°32.3	0.0′	55.3′
14	28°30.0	47.7	256°10.9	8.2′	28°32.3	0.2′	55.3′
15	43°30.1	·· 47.0	270°38.1	8.2′	28°32.1	0.3′	55.3′
16	58°30.1	46.4	285°05.2	8.1′	28°31.8	0.4′	55.3′
17	73°30.2	45.7	299°32.4	8.1′	28°31.4	0.6′	55.4′
18	88°30.3	N16°45.0	313°59.5	8.1′	S28°30.8	0.8′	55.4′
19	103°30.3	44.3	328°26.5	8.1′	28°30.0	0.9′	55.4′
20	118°30.4	43.6	342°53.6	8.0′	28°29.1	1.1′	55.4′
21	133°30.5	·· 42.9	357°20.6	8.0′	28°28.0	1.2′	55.4′
22	148°30.6	42.2	11°47.7	8.0′	28°26.8	1.4′	55.5′
23	163°30.6	41.6	26°14.7	8.0′	28°25.4	1.5′	55.5′
	SD = 15.8′	d = 0.7′	SD = 15.0′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°30.7	N16°40.9	40°41.6	8.0′	S28°23.9	1.7′	55.5′
1	193°30.8	40.2	55°08.6	7.9′	28°22.2	1.9′	55.5′
2	208°30.8	39.5	69°35.5	7.9′	28°20.3	2.0′	55.6′
3	223°30.9	·· 38.8	84°02.5	7.9′	28°18.3	2.1′	55.6′
4	238°31.0	38.1	98°29.4	7.9′	28°16.2	2.3′	55.6′
5	253°31.0	37.4	112°56.3	7.9′	28°13.9	2.5′	55.6′
6	268°31.1	N16°36.7	127°23.2	7.9′	S28°11.4	2.6′	55.7′
7	283°31.2	36.0	141°50.1	7.9′	28°08.8	2.8′	55.7′
8	298°31.3	35.4	156°17.0	7.9′	28°06.0	2.9′	55.7′
9	313°31.3	·· 34.7	170°43.9	7.9′	28°03.1	3.1′	55.7′
10	328°31.4	34.0	185°10.8	7.9′	28°00.0	3.3′	55.8′
11	343°31.5	33.3	199°37.7	7.9′	27°56.7	3.4′	55.8′
12	358°31.6	N16°32.6	214°04.6	7.9′	S27°53.3	3.5′	55.8′
13	13°31.6	31.9	228°31.5	7.9′	27°49.8	3.7′	55.8′
14	28°31.7	31.2	242°58.4	7.9′	27°46.1	3.9′	55.9′
15	43°31.8	·· 30.5	257°25.3	7.9′	27°42.2	4.0′	55.9′
16	58°31.9	29.8	271°52.2	7.9′	27°38.2	4.2′	55.9′
17	73°31.9	29.1	286°19.1	7.9′	27°34.0	4.3′	55.9′
18	88°32.0	N16°28.4	300°46.1	7.9′	S27°29.7	4.5′	56.0′
19	103°32.1	27.7	315°13.0	8.0′	27°25.2	4.7′	56.0′
20	118°32.2	27.0	329°40.0	8.0′	27°20.5	4.8′	56.0′
21	133°32.2	·· 26.3	344°06.9	8.0′	27°15.7	4.9′	56.1′
22	148°32.3	25.6	358°33.9	8.0′	27°10.8	5.1′	56.1′
23	163°32.4	24.9	13°00.9	8.0′	27°05.7	5.3′	56.1′
	SD = 15.8′	d = 0.7′	SD = 15.1′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°32.5	N16°24.2	27°27.9	8.0′	S27°00.4	5.4′	56.1′
1	193°32.5	23.5	41°55.0	8.1′	26°55.0	5.6′	56.2′
2	208°32.6	22.8	56°22.0	8.1′	26°49.4	5.7′	56.2′
3	223°32.7	·· 22.1	70°49.1	8.1′	26°43.7	5.9′	56.2′
4	238°32.8	21.4	85°16.2	8.1′	26°37.8	6.0′	56.2′
5	253°32.8	20.7	99°43.4	8.2′	26°31.8	6.2′	56.3′
6	268°32.9	N16°20.0	114°10.5	8.2′	S26°25.6	6.3′	56.3′
7	283°33.0	19.3	128°37.7	8.2′	26°19.3	6.5′	56.3′
8	298°33.1	18.6	143°05.0	8.3′	26°12.8	6.6′	56.3′
9	313°33.2	·· 17.9	157°32.2	8.3′	26°06.2	6.8′	56.4′
10	328°33.2	17.2	171°59.5	8.3′	25°59.4	6.9′	56.4′
11	343°33.3	16.5	186°26.8	8.3′	25°52.5	7.1′	56.4′
12	358°33.4	N16°15.8	200°54.2	8.4′	S25°45.4	7.2′	56.5′
13	13°33.5	15.1	215°21.5	8.4′	25°38.2	7.3′	56.5′
14	28°33.6	14.4	229°49.0	8.5′	25°30.9	7.6′	56.5′
15	43°33.6	·· 13.7	244°16.4	8.5′	25°23.3	7.6′	56.5′
16	58°33.7	13.0	258°43.9	8.5′	25°15.7	7.8′	56.6′
17	73°33.8	12.3	273°11.4	8.6′	25°07.9	8.0′	56.6′
18	88°33.9	N16°11.6	287°39.0	8.6′	S24°59.9	8.1′	56.6′
19	103°34.0	10.9	302°06.6	8.7′	24°51.8	8.2′	56.6′
20	118°34.0	10.1	316°34.3	8.7′	24°43.6	8.4′	56.7′
21	133°34.1	·· 09.4	331°02.0	8.7′	24°35.2	8.5′	56.7′
22	148°34.2	08.7	345°29.7	8.8′	24°26.7	8.7′	56.7′
23	163°34.3	08.0	359°57.5	8.8′	24°18.0	8.8′	56.8′
	SD = 15.8′	d = 0.7′	SD = 15.3′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	////	////	01:02	22:57	////	////
N 70°	////	////	02:06	22:01	////	////
68°	////	////	02:41	21:27	////	////
66°	////	01:25	03:05	21:04	22:39	////
64°	////	02:08	03:25	20:45	22:00	////
62°	////	02:35	03:40	20:30	21:33	////
60°	01:17	02:56	03:53	20:17	21:13	22:49
N 58°	01:55	03:13	04:04	20:06	20:57	22:13
56°	02:21	03:27	04:14	19:57	20:43	21:48
54°	02:41	03:39	04:22	19:48	20:31	21:29
52°	02:57	03:50	04:30	19:41	20:21	21:13
50°	03:10	03:59	04:37	19:34	20:12	21:00
45°	03:37	04:18	04:51	19:20	19:53	20:34
N 40°	03:57	04:33	05:03	19:08	19:38	20:14
35°	04:13	04:46	05:13	18:58	19:25	19:58
30°	04:26	04:57	05:22	18:49	19:15	19:45
20°	04:47	05:14	05:37	18:34	18:58	19:25
N 10°	05:03	05:28	05:50	18:21	18:43	19:09
0°	05:16	05:41	06:02	18:09	18:31	18:56
S 10°	05:27	05:53	06:14	17:57	18:19	18:45
20°	05:38	06:04	06:27	17:45	18:08	18:34
30°	05:48	06:17	06:42	17:31	17:56	18:24
35°	05:53	06:23	06:50	17:22	17:49	18:19
40°	05:58	06:31	06:59	17:13	17:42	18:14
45°	06:04	06:39	07:10	17:02	17:33	18:08
S 50°	06:10	06:49	07:23	16:49	17:24	18:02
52°	06:13	06:53	07:30	16:43	17:19	18:00
54°	06:15	06:58	07:36	16:36	17:15	17:57
56°	06:18	07:03	07:44	16:29	17:09	17:54
58°	06:22	07:09	07:52	16:20	17:04	17:51
S 60°	06:25	07:15	08:02	16:10	16:57	17:48

Lat.	**Moonrise** Tue	Wed	Thu	**Moonset** Tue	Wed	Thu
N 72°	▬	▬	▬	▬	▬	▬
N 70°	▬	▬	▬	▬	▬	▬
68°	▬	▬	▬	▬	▬	▬
66°	▬	▬	▬	▬	▬	▬
64°	▬	▬	21:37	▬	▬	▬
62°	▬	21:11	20:56	▬	23:08	·· ··
60°	19:51	20:18	20:27	22:32	·· ··	00:00
N 58°	19:10	19:46	20:05	23:14	·· ··	00:32
56°	18:41	19:22	19:47	23:42	·· ··	00:55
54°	18:19	19:03	19:32	·· ··	00:04	01:15
52°	18:01	18:46	19:18	·· ··	00:22	01:31
50°	17:46	18:32	19:07	·· ··	00:37	01:45
45°	17:15	18:03	18:42	00:14	01:08	02:13
N 40°	16:51	17:41	18:23	00:38	01:32	02:35
35°	16:31	17:22	18:06	00:58	01:52	02:53
30°	16:14	17:06	17:52	01:14	02:09	03:09
20°	15:45	16:38	17:28	01:43	02:37	03:35
N 10°	15:21	16:15	17:07	02:07	03:02	03:58
0°	14:58	15:53	16:47	02:30	03:24	04:19
S 10°	14:35	15:31	16:28	02:53	03:47	04:40
20°	14:11	15:07	16:06	03:17	04:11	05:03
30°	13:42	14:40	15:42	03:45	04:39	05:28
35°	13:25	14:23	15:27	04:02	04:56	05:44
40°	13:05	14:04	15:10	04:22	05:15	06:01
45°	12:41	13:41	14:50	04:46	05:39	06:22
S 50°	12:11	13:11	14:24	05:16	06:09	06:49
52°	11:55	12:57	14:12	05:32	06:23	07:02
54°	11:37	12:40	13:58	05:49	06:41	07:16
56°	11:16	12:19	13:41	06:11	07:01	07:33
58°	10:48	11:54	13:21	06:39	07:27	07:54
S 60°	10:08	11:18	12:55	07:18	08:03	08:20

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 12-14 81-94%
05	06:04	06:01	12:06	21:11	08:44	
06	05:57	05:54	12:06	22:06	09:38	
07	05:50	05:46	12:06	23:00	10:33	

August 08, 09, 10 UT (Fri., Sat., Sun.)

	Aries	Venus		Mars		Jupiter		Saturn	
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	316°45.4	216°55.9	N21°58.5	135°57.6	N00°14.0	212°26.1	N22°42.9	314°31.9	S01°39.2
1	331°47.9	231°55.2	58.5	150°58.7	13.3	227°28.0	42.8	329°34.4	39.3
2	346°50.4	246°54.5	58.4	165°59.7	12.7	242°29.9	42.8	344°37.0	39.3
3	1°52.8	261°53.8	·· 58.3	181°00.8	·· 12.0	257°31.8	·· 42.7	359°39.6	·· 39.4
4	16°55.3	276°53.2	58.3	196°01.8	11.4	272°33.7	42.7	14°42.1	39.4
5	31°57.8	291°52.5	58.2	211°02.9	10.7	287°35.6	42.6	29°44.7	39.5
6	47°00.2	306°51.8	N21°58.1	226°03.9	N00°10.1	302°37.5	N22°42.6	44°47.2	S01°39.5
7	62°02.7	321°51.1	58.0	241°04.9	09.4	317°39.4	42.5	59°49.8	39.6
8	77°05.2	336°50.4	58.0	256°06.0	08.8	332°41.3	42.5	74°52.3	39.6
9	92°07.6	351°49.7	·· 57.9	271°07.0	·· 08.1	347°43.2	·· 42.4	89°54.9	·· 39.7
10	107°10.1	6°49.0	57.8	286°08.1	07.5	2°45.1	42.4	104°57.4	39.7
11	122°12.6	21°48.3	57.7	301°09.1	06.8	17°47.0	42.3	120°00.0	39.8
12	137°15.0	36°47.6	N21°57.7	316°10.2	N00°06.2	32°48.9	N22°42.3	135°02.6	S01°39.8
13	152°17.5	51°47.0	57.6	331°11.2	05.5	47°50.8	42.2	150°05.1	39.9
14	167°19.9	66°46.3	57.5	346°12.3	04.9	62°52.7	42.2	165°07.7	39.9
15	182°22.4	81°45.6	·· 57.4	1°13.3	·· 04.2	77°54.7	·· 42.1	180°10.2	·· 40.0
16	197°24.9	96°44.9	57.3	16°14.4	03.6	92°56.6	42.1	195°12.8	40.0
17	212°27.3	111°44.2	57.3	31°15.4	02.9	107°58.5	42.1	210°15.3	40.1
18	227°29.8	126°43.5	N21°57.2	46°16.4	N00°02.3	123°00.4	N22°42.0	225°17.9	S01°40.1
19	242°32.3	141°42.8	57.1	61°17.5	01.6	138°02.3	42.0	240°20.5	40.2
20	257°34.7	156°42.1	57.0	76°18.5	01.0	153°04.2	41.9	255°23.0	40.2
21	272°37.2	171°41.4	·· 56.9	91°19.6	N00°00.3	168°06.1	·· 41.9	270°25.6	·· 40.3
22	287°39.7	186°40.8	56.8	106°20.6	S00°00.3	183°08.0	41.8	285°28.1	40.3
23	302°42.1	201°40.1	56.7	121°21.7	00.9	198°09.9	41.8	300°30.7	40.4
Mer.pass. 02:52		ν -0.7′ d 0.1′	m -3.98	ν 1.0′ d 0.6′	m 1.61	ν 1.9′ d 0.0′	m -1.93	ν 2.6′ d 0.1′	m 0.76

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	317°44.6	216°39.4	N21°56.7	136°22.7	S00°01.6	213°11.8	N22°41.7	315°33.3	S01°40.4
1	332°47.0	231°38.7	56.6	151°23.7	02.2	228°13.7	41.7	330°35.8	40.5
2	347°49.5	246°38.0	56.5	166°24.8	02.9	243°15.6	41.6	345°38.4	40.5
3	2°52.0	261°37.3	·· 56.4	181°25.8	·· 03.5	258°17.5	·· 41.6	0°40.9	·· 40.6
4	17°54.4	276°36.6	56.3	196°26.9	04.2	273°19.4	41.5	15°43.5	40.6
5	32°56.9	291°35.9	56.2	211°27.9	04.8	288°21.3	41.5	30°46.0	40.7
6	47°59.4	306°35.2	N21°56.1	226°29.0	S00°05.5	303°23.2	N22°41.4	45°48.6	S01°40.7
7	63°01.8	321°34.5	56.0	241°30.0	06.1	318°25.1	41.4	60°51.2	40.8
8	78°04.3	336°33.8	55.9	256°31.0	06.8	333°27.0	41.3	75°53.7	40.8
9	93°06.8	351°33.2	·· 55.8	271°32.1	·· 07.4	348°28.9	·· 41.3	90°56.3	·· 40.9
10	108°09.2	6°32.5	55.7	286°33.1	08.1	3°30.8	41.2	105°58.8	40.9
11	123°11.7	21°31.8	55.6	301°34.2	08.7	18°32.8	41.2	121°01.4	41.0
12	138°14.2	36°31.1	N21°55.5	316°35.2	S00°09.4	33°34.7	N22°41.1	136°04.0	S01°41.1
13	153°16.6	51°30.4	55.4	331°36.3	10.0	48°36.6	41.1	151°06.5	41.1
14	168°19.1	66°29.7	55.3	346°37.3	10.7	63°38.5	41.0	166°09.1	41.2
15	183°21.5	81°29.0	·· 55.2	1°38.3	·· 11.3	78°40.4	·· 41.0	181°11.7	·· 41.2
16	198°24.0	96°28.3	55.1	16°39.4	12.0	93°42.3	40.9	196°14.2	41.3
17	213°26.5	111°27.6	55.0	31°40.4	12.6	108°44.2	40.9	211°16.8	41.3
18	228°28.9	126°26.9	N21°54.9	46°41.5	S00°13.3	123°46.1	N22°40.9	226°19.3	S01°41.4
19	243°31.4	141°26.2	54.7	61°42.5	13.9	138°48.0	40.8	241°21.9	41.4
20	258°33.9	156°25.5	54.6	76°43.6	14.6	153°49.9	40.8	256°24.5	41.5
21	273°36.3	171°24.9	·· 54.5	91°44.6	·· 15.2	168°51.8	·· 40.7	271°27.0	·· 41.5
22	288°38.8	186°24.2	54.4	106°45.6	15.9	183°53.7	40.7	286°29.6	41.6
23	303°41.3	201°23.5	54.3	121°46.7	16.5	198°55.6	40.6	301°32.1	41.6
Mer.pass. 02:49		ν -0.7′ d 0.1′	m -3.98	ν 1.0′ d 0.6′	m 1.61	ν 1.9′ d 0.0′	m -1.93	ν 2.6′ d 0.1′	m 0.76

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	318°43.7	216°22.8	N21°54.2	136°47.7	S00°17.2	213°57.5	N22°40.6	316°34.7	S01°41.7
1	333°46.2	231°22.1	54.1	151°48.8	17.8	228°59.5	40.5	331°37.3	41.7
2	348°48.7	246°21.4	54.0	166°49.8	18.5	244°01.4	40.5	346°39.8	41.8
3	3°51.1	261°20.7	·· 53.8	181°50.8	·· 19.1	259°03.3	·· 40.4	1°42.4	·· 41.8
4	18°53.6	276°20.0	53.7	196°51.9	19.8	274°05.2	40.4	16°45.0	41.9
5	33°56.0	291°19.3	53.6	211°52.9	20.4	289°07.1	40.3	31°47.5	41.9
6	48°58.5	306°18.6	N21°53.5	226°54.0	S00°21.1	304°09.0	N22°40.3	46°50.1	S01°42.0
7	64°01.0	321°17.9	53.4	241°55.0	21.7	319°10.9	40.2	61°52.6	42.1
8	79°03.4	336°17.2	53.2	256°56.0	22.4	334°12.8	40.2	76°55.2	42.1
9	94°05.9	351°16.5	·· 53.1	271°57.1	·· 23.0	349°14.7	·· 40.1	91°57.8	·· 42.2
10	109°08.4	6°15.8	53.0	286°58.1	23.7	4°16.6	40.1	107°00.3	42.2
11	124°10.8	21°15.1	52.9	301°59.2	24.3	19°18.5	40.0	122°02.9	42.3
12	139°13.3	36°14.5	N21°52.7	317°00.2	S00°25.0	34°20.4	N22°40.0	137°05.5	S01°42.3
13	154°15.8	51°13.8	52.6	332°01.2	25.6	49°22.4	39.9	152°08.0	42.4
14	169°18.2	66°13.1	52.5	347°02.3	26.3	64°24.3	39.9	167°10.6	42.4
15	184°20.7	81°12.4	·· 52.3	2°03.3	·· 26.9	79°26.2	·· 39.8	182°13.1	·· 42.5
16	199°23.1	96°11.7	52.2	17°04.4	27.6	94°28.1	39.8	197°15.7	42.5
17	214°25.6	111°11.0	52.1	32°05.4	28.2	109°30.0	39.7	212°18.3	42.6
18	229°28.1	126°10.3	N21°51.9	47°06.4	S00°28.9	124°31.9	N22°39.7	227°20.8	S01°42.6
19	244°30.5	141°09.6	51.8	62°07.5	29.5	139°33.8	39.6	242°23.4	42.7
20	259°33.0	156°08.9	51.7	77°08.5	30.2	154°35.7	39.6	257°26.0	42.7
21	274°35.5	171°08.2	·· 51.5	92°09.6	·· 30.8	169°37.6	·· 39.5	272°28.5	·· 42.8
22	289°37.9	186°07.5	51.4	107°10.6	31.5	184°39.5	39.5	287°31.1	42.9
23	304°40.4	201°06.8	51.3	122°11.6	32.1	199°41.5	39.4	302°33.7	42.9
Mer.pass. 02:45		ν -0.7′ d 0.1′	m -3.98	ν 1.0′ d 0.6′	m 1.62	ν 1.9′ d 0.0′	m -1.93	ν 2.6′ d 0.1′	m 0.75

Stars

	SHA	Dec
Alpheratz	357°34.0	29°13.9
Ankaa	353°06.4	-42°09.7
Schedar	349°30.2	56°40.5
Diphda	348°46.6	-17°50.6
Achernar	335°19.6	-57°06.0
Hamal	327°50.6	23°35.0
Polaris	313°47.9	89°22.0
Acamar	315°11.4	-40°11.8
Menkar	314°05.6	4°11.5
Mirfak	308°27.6	49°57.0
Aldebaran	290°39.2	16°33.7
Rigel	281°03.6	-8°10.1
Capella	280°21.4	46°01.3
Bellatrix	278°22.5	6°22.5
Elnath	278°01.5	28°37.7
Alnilam	275°37.4	-1°11.0
Betelgeuse	270°51.8	7°24.8
Canopus	263°52.6	-52°42.3
Sirius	258°26.1	-16°44.9
Adhara	255°05.8	-29°00.2
Procyon	244°50.6	5°09.7
Pollux	243°17.0	27°57.9
Avior	234°15.2	-59°35.4
Suhail	222°46.4	-43°32.1
Miaplacidus	221°39.2	-69°49.3
Alphard	217°47.6	-8°46.1
Regulus	207°34.2	11°50.6
Dubhe	193°40.9	61°36.9
Denebola	182°24.7	14°25.9
Gienah	175°43.3	-17°41.1
Acrux	173°00.0	-63°14.7
Gacrux	171°51.5	-57°15.6
Alioth	166°12.8	55°49.5
Spica	158°21.9	-11°17.7
Alkaid	152°51.7	49°11.4
Hadar	148°35.5	-60°30.0
Menkent	147°57.1	-36°29.9
Arcturus	145°47.5	19°03.1
Rigil Kent.	139°39.7	-60°56.7
Kochab	137°19.8	74°03.3
Zuben'ubi	136°55.5	-16°08.9
Alphecca	126°03.3	26°37.9
Antares	112°15.1	-26°29.4
Atria	107°08.6	-69°04.6
Sabik	102°02.0	-15°45.4
Shaula	96°09.4	-37°07.4
Rasalhague	95°57.9	12°32.6
Eltanin	90°41.6	51°29.3
Kaus Aust.	83°31.5	-34°22.4
Vega	80°32.5	38°48.6
Nunki	75°46.8	-26°15.9
Altair	61°59.2	8°56.3
Peacock	53°04.3	-56°39.1
Deneb	49°25.0	45°22.4
Enif	33°38.0	9°59.6
Al Na'ir	27°31.8	-46°50.1
Fomalhaut	15°13.6	-29°29.0
Scheat	13°44.4	28°13.3
Markab	13°29.1	15°20.7

Aug 08 Fri	SHA	Mer.pass
Venus	260°10.5	09:33
Mars	179°12.2	14:55
Jupiter	255°40.7	09:49
Saturn	357°46.4	03:01

Aug 09 Sat	SHA	Mer.pass
Venus	258°54.8	09:34
Mars	178°38.1	14:53
Jupiter	255°27.2	09:46
Saturn	357°48.7	02:57

Aug 10 Sun	SHA	Mer.pass
Venus	257°39.0	09:35
Mars	178°04.0	14:52
Jupiter	255°13.8	09:43
Saturn	357°51.0	02:53

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h — Sun — Moon

Fri	GHA	Dec	GHA	ν	Dec	d	HP
0	178°34.4	N16°07.3	14°25.3	8.9′	S24°09.2	8.9′	56.8′
1	193°34.5	06.6	28°53.2	8.9′	24°00.3	9.1′	56.8′
2	208°34.5	05.9	43°21.1	9.0′	23°51.2	9.2′	56.8′
3	223°34.6	·· 05.2	57°49.1	9.0′	23°42.0	9.4′	56.9′
4	238°34.7	04.5	72°17.1	9.1′	23°32.6	9.4′	56.9′
5	253°34.8	03.8	86°45.2	9.1′	23°23.2	9.7′	56.9′
6	268°34.9	N16°03.0	101°13.3	9.2′	S23°13.5	9.7′	56.9′
7	283°35.0	02.3	115°41.5	9.2′	23°03.8	9.9′	57.0′
8	298°35.0	01.6	130°09.7	9.3′	22°53.9	10.0′	57.0′
9	313°35.1	·· 00.9	144°37.9	9.3′	22°43.9	10.2′	57.0′
10	328°35.2	16°00.2	159°06.3	9.4′	22°33.7	10.3′	57.1′
11	343°35.3	15°59.5	173°34.6	9.4′	22°23.4	10.4′	57.1′
12	358°35.4	N15°58.8	188°03.0	9.5′	S22°13.0	10.5′	57.1′
13	13°35.5	58.0	202°31.5	9.5′	22°02.5	10.7′	57.1′
14	28°35.6	57.3	217°00.0	9.6′	21°51.8	10.8′	57.2′
15	43°35.6	·· 56.6	231°28.6	9.6′	21°41.0	10.9′	57.2′
16	58°35.7	55.9	245°57.2	9.7′	21°30.1	11.1′	57.2′
17	73°35.8	55.2	260°25.9	9.7′	21°19.0	11.1′	57.2′
18	88°35.9	N15°54.5	274°54.6	9.8′	S21°07.9	11.3′	57.3′
19	103°36.0	53.7	289°23.4	9.8′	20°56.6	11.4′	57.3′
20	118°36.1	53.0	303°52.3	9.9′	20°45.2	11.6′	57.3′
21	133°36.2	·· 52.3	318°21.2	9.9′	20°33.6	11.6′	57.3′
22	148°36.2	51.6	332°50.1	10.0′	20°22.0	11.8′	57.4′
23	163°36.3	50.9	347°19.1	10.1′	20°10.2	11.9′	57.4′
	SD = 15.8′	d = 0.7′	SD = 15.5′				

Sat	GHA	Dec	GHA	ν	Dec	d	HP
0	178°36.4	N15°50.1	1°48.2	10.1′	S19°58.3	12.0′	57.4′
1	193°36.5	49.4	16°17.3	10.2′	19°46.3	12.1′	57.4′
2	208°36.6	48.7	30°46.4	10.2′	19°34.2	12.2′	57.5′
3	223°36.7	·· 48.0	45°15.7	10.3′	19°22.0	12.3′	57.5′
4	238°36.8	47.3	59°44.9	10.3′	19°09.7	12.5′	57.5′
5	253°36.9	46.5	74°14.3	10.4′	18°57.2	12.5′	57.5′
6	268°37.0	N15°45.8	88°43.6	10.4′	S18°44.7	12.7′	57.6′
7	283°37.1	45.1	103°13.1	10.5′	18°32.0	12.8′	57.6′
8	298°37.1	44.4	117°42.6	10.5′	18°19.2	12.8′	57.6′
9	313°37.2	·· 43.6	132°12.1	10.6′	18°06.4	13.0′	57.6′
10	328°37.3	42.9	146°41.7	10.6′	17°53.4	13.1′	57.7′
11	343°37.4	42.2	161°11.3	10.7′	17°40.3	13.2′	57.7′
12	358°37.5	N15°41.5	175°41.0	10.7′	S17°27.1	13.3′	57.7′
13	13°37.6	40.7	190°10.8	10.8′	17°13.8	13.4′	57.7′
14	28°37.7	40.0	204°40.6	10.8′	17°00.4	13.4′	57.8′
15	43°37.8	·· 39.3	219°10.4	10.9′	16°47.0	13.6′	57.8′
16	58°37.9	38.6	233°40.3	11.0′	16°33.4	13.7′	57.8′
17	73°38.0	37.8	248°10.3	11.0′	16°19.7	13.8′	57.8′
18	88°38.1	N15°37.1	262°40.3	11.0′	S16°05.9	13.8′	57.9′
19	103°38.2	36.4	277°10.3	11.1′	15°52.1	14.0′	57.9′
20	118°38.3	35.6	291°40.4	11.1′	15°38.1	14.0′	57.9′
21	133°38.3	·· 34.9	306°10.6	11.2′	15°24.1	14.2′	57.9′
22	148°38.4	34.2	320°40.8	11.2′	15°09.9	14.2′	58.0′
23	163°38.5	33.5	335°11.0	11.3′	14°55.7	14.3′	58.0′
	SD = 15.8′	d = 0.7′	SD = 15.7′				

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	178°38.6	N15°32.7	349°41.3	11.3′	S14°41.4	14.4′	58.0′
1	193°38.7	32.0	4°11.6	11.4′	14°27.0	14.5′	58.0′
2	208°38.8	31.3	18°42.0	11.4′	14°12.5	14.5′	58.1′
3	223°38.9	·· 30.5	33°12.4	11.5′	13°58.0	14.7′	58.1′
4	238°39.0	29.8	47°42.9	11.5′	13°43.3	14.7′	58.1′
5	253°39.1	29.1	62°13.4	11.6′	13°28.6	14.8′	58.1′
6	268°39.2	N15°28.3	76°44.0	11.6′	S13°13.8	14.8′	58.1′
7	283°39.3	27.6	91°14.5	11.6′	12°59.0	15.0′	58.2′
8	298°39.4	26.9	105°45.2	11.7′	12°44.0	15.0′	58.2′
9	313°39.5	·· 26.1	120°15.9	11.7′	12°29.0	15.1′	58.2′
10	328°39.6	25.4	134°46.6	11.8′	12°13.9	15.2′	58.2′
11	343°39.7	24.7	149°17.3	11.8′	11°58.7	15.2′	58.2′
12	358°39.8	N15°23.9	163°48.1	11.8′	S11°43.5	15.3′	58.3′
13	13°39.9	23.2	178°19.0	11.9′	11°28.2	15.4′	58.3′
14	28°40.0	22.4	192°49.8	11.9′	11°12.8	15.4′	58.3′
15	43°40.1	·· 21.7	207°20.7	11.9′	10°57.4	15.5′	58.3′
16	58°40.2	21.0	221°51.7	12.0′	10°41.9	15.6′	58.4′
17	73°40.3	20.2	236°22.6	12.0′	10°26.3	15.6′	58.4′
18	88°40.4	N15°19.5	250°53.6	12.0′	S10°10.7	15.7′	58.4′
19	103°40.5	18.8	265°24.7	12.1′	09°55.0	15.7′	58.4′
20	118°40.6	18.0	279°55.7	12.1′	09°39.3	15.8′	58.4′
21	133°40.7	·· 17.3	294°26.8	12.1′	09°23.5	15.9′	58.4′
22	148°40.8	16.5	308°58.0	12.2′	09°07.6	15.9′	58.5′
23	163°40.9	15.8	323°29.1	12.2′	08°51.7	16.0′	58.5′
	SD = 15.8′	d = 0.7′	SD = 15.8′				

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	////	////	01:37	22:25	////	////
N 70°	////	////	02:24	21:42	////	////
68°	////	00:35	02:54	21:13	23:18	////
66°	////	01:47	03:17	20:52	22:18	////
64°	////	02:22	03:34	20:35	21:45	////
62°	00:32	02:46	03:48	20:21	21:22	23:23
60°	01:36	03:06	04:00	20:09	21:03	22:30
N 58°	02:08	03:21	04:11	19:59	20:48	22:00
56°	02:31	03:34	04:20	19:50	20:35	21:38
54°	02:49	03:45	04:28	19:42	20:24	21:20
52°	03:04	03:55	04:35	19:35	20:14	21:06
50°	03:16	04:04	04:41	19:29	20:06	20:53
45°	03:41	04:22	04:55	19:15	19:48	20:28
N 40°	04:00	04:36	05:06	19:04	19:34	20:10
35°	04:16	04:48	05:16	18:55	19:22	19:55
30°	04:28	04:58	05:24	18:47	19:12	19:42
20°	04:48	05:15	05:38	18:33	18:56	19:23
N 10°	05:03	05:29	05:51	18:20	18:42	19:08
0°	05:16	05:41	06:02	18:09	18:30	18:55
S 10°	05:26	05:52	06:13	17:58	18:19	18:45
20°	05:36	06:03	06:25	17:46	18:09	18:35
30°	05:46	06:14	06:39	17:32	17:57	18:26
35°	05:50	06:20	06:47	17:25	17:51	18:21
40°	05:55	06:27	06:56	17:16	17:44	18:16
45°	06:00	06:35	07:06	17:06	17:36	18:11
S 50°	06:06	06:44	07:18	16:53	17:28	18:06
52°	06:08	06:48	07:24	16:47	17:24	18:04
54°	06:10	06:53	07:31	16:41	17:19	18:01
56°	06:13	06:57	07:38	16:34	17:14	17:59
58°	06:16	07:03	07:46	16:26	17:09	17:56
S 60°	06:19	07:09	07:55	16:17	17:03	17:53

Lat.	Moonrise Fri	Moonrise Sat	Moonrise Sun	Moonset Fri	Moonset Sat	Moonset Sun
N 72°	▬	22:25	21:26	▬	▬	03:28
N 70°	▬	21:53	21:12	▬	▬	03:58
68°	22:18	21:29	21:01	▬	01:46	04:20
66°	21:38	21:10	20:51	▬	02:25	04:37
64°	21:10	20:54	20:43	00:35	02:52	04:51
62°	20:48	20:42	20:36	01:16	03:13	05:03
60°	20:30	20:31	20:30	01:44	03:30	05:13
N 58°	20:15	20:21	20:25	02:05	03:44	05:21
56°	20:02	20:13	20:20	02:23	03:56	05:29
54°	19:51	20:05	20:16	02:38	04:06	05:35
52°	19:41	19:58	20:12	02:50	04:15	05:41
50°	19:32	19:52	20:08	03:02	04:23	05:46
45°	19:14	19:39	20:00	03:25	04:41	05:58
N 40°	18:58	19:28	19:54	03:44	04:55	06:07
35°	18:45	19:18	19:48	03:59	05:07	06:15
30°	18:33	19:10	19:43	04:12	05:17	06:22
20°	18:14	18:56	19:34	04:35	05:35	06:34
N 10°	17:56	18:43	19:27	04:55	05:50	06:45
0°	17:40	18:31	19:20	05:13	06:05	06:54
S 10°	17:24	18:19	19:12	05:31	06:19	07:04
20°	17:06	18:06	19:05	05:50	06:34	07:14
30°	16:46	17:51	18:56	06:12	06:51	07:26
35°	16:34	17:43	18:51	06:25	07:01	07:32
40°	16:21	17:33	18:45	06:40	07:12	07:40
45°	16:04	17:21	18:38	06:57	07:25	07:48
S 50°	15:44	17:07	18:30	07:19	07:41	07:59
52°	15:35	17:00	18:26	07:29	07:48	08:03
54°	15:24	16:53	18:21	07:40	07:57	08:09
56°	15:12	16:45	18:17	07:53	08:06	08:14
58°	14:57	16:35	18:11	08:08	08:16	08:21
S 60°	14:40	16:24	18:06	08:26	08:28	08:28

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 15-17 98-99%
08	05:43	05:38	12:06	23:53	11:27	
09	05:34	05:30	12:05	–:–	12:18	
10	05:25	05:21	12:05	00:43	13:07	

August 11, 12, 13 UT (Mon., Tue., Wed.)

	Aries	Venus		Mars		Jupiter		Saturn	
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	319°42.9	216°06.1	N21°51.1	137°12.7	S00°32.8	214°43.4	N22°39.4	317°36.2	S01°43.0
1	334°45.3	231°05.4	51.0	152°13.7	33.4	229°45.3	39.3	332°38.8	43.0
2	349°47.8	246°04.7	50.8	167°14.8	34.1	244°47.2	39.3	347°41.4	43.1
3	4°50.3	261°04.0	·· 50.7	182°15.8	·· 34.7	259°49.1	·· 39.2	2°43.9	·· 43.1
4	19°52.7	276°03.3	50.5	197°16.8	35.4	274°51.0	39.2	17°46.5	43.2
5	34°55.2	291°02.7	50.4	212°17.9	36.0	289°52.9	39.2	32°49.1	43.2
6	49°57.6	306°02.0	N21°50.3	227°18.9	S00°36.7	304°54.8	N22°39.1	47°51.6	S01°43.3
7	65°00.1	321°01.3	50.1	242°19.9	37.3	319°56.7	39.1	62°54.2	43.3
8	80°02.6	336°00.6	50.0	257°21.0	38.0	334°58.7	39.0	77°56.8	43.4
9	95°05.0	350°59.9	·· 49.8	272°22.0	·· 38.6	350°00.6	·· 39.0	92°59.3	·· 43.5
10	110°07.5	5°59.2	49.7	287°23.1	39.3	5°02.5	38.9	108°01.9	43.5
11	125°10.0	20°58.5	49.5	302°24.1	39.9	20°04.4	38.9	123°04.5	43.6
12	140°12.4	35°57.8	N21°49.4	317°25.1	S00°40.6	35°06.3	N22°38.8	138°07.0	S01°43.6
13	155°14.9	50°57.1	49.2	332°26.2	41.2	50°08.2	38.8	153°09.6	43.7
14	170°17.4	65°56.4	49.1	347°27.2	41.9	65°10.1	38.7	168°12.2	43.7
15	185°19.8	80°55.7	·· 48.9	2°28.2	·· 42.5	80°12.0	·· 38.7	183°14.7	·· 43.8
16	200°22.3	95°55.0	48.7	17°29.3	43.2	95°13.9	38.6	198°17.3	43.8
17	215°24.8	110°54.3	48.6	32°30.3	43.8	110°15.9	38.6	213°19.9	43.9
18	230°27.2	125°53.6	N21°48.4	47°31.3	S00°44.5	125°17.8	N22°38.5	228°22.4	S01°43.9
19	245°29.7	140°52.9	48.3	62°32.4	45.1	140°19.7	38.5	243°25.0	44.0
20	260°32.1	155°52.2	48.1	77°33.4	45.8	155°21.6	38.4	258°27.6	44.1
21	275°34.6	170°51.5	·· 47.9	92°34.5	·· 46.4	170°23.5	·· 38.4	273°30.1	·· 44.1
22	290°37.1	185°50.8	47.8	107°35.5	47.1	185°25.4	38.3	288°32.7	44.2
23	305°39.5	200°50.1	47.6	122°36.5	47.7	200°27.3	38.3	303°35.3	44.2
Mer.pass. 02:41		ν -0.7′	d 0.1′	m -3.98	ν 1.0′	d 0.6′	m 1.62	ν 1.9′	d 0.0′ m -1.94	ν 2.6′	d 0.1′ m 0.75

Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	320°42.0	215°49.4	N21°47.5	137°37.6	S00°48.4	215°29.2	N22°38.2	318°37.8	S01°44.3
1	335°44.5	230°48.7	47.3	152°38.6	49.0	230°31.2	38.2	333°40.4	44.3
2	350°46.9	245°48.0	47.1	167°39.6	49.7	245°33.1	38.1	348°43.0	44.4
3	5°49.4	260°47.4	·· 46.9	182°40.7	·· 50.3	260°35.0	·· 38.1	3°45.5	·· 44.4
4	20°51.9	275°46.7	46.8	197°41.7	51.0	275°36.9	38.0	18°48.1	44.5
5	35°54.3	290°46.0	46.6	212°42.7	51.6	290°38.8	38.0	33°50.7	44.6
6	50°56.8	305°45.3	N21°46.4	227°43.8	S00°52.3	305°40.7	N22°37.9	48°53.2	S01°44.6
7	65°59.2	320°44.6	46.3	242°44.8	52.9	320°42.6	37.9	63°55.8	44.7
8	81°01.7	335°43.9	46.1	257°45.8	53.6	335°44.6	37.8	78°58.4	44.7
9	96°04.2	350°43.2	·· 45.9	272°46.9	·· 54.2	350°46.5	·· 37.8	94°01.0	·· 44.8
10	111°06.6	5°42.5	45.7	287°47.9	54.9	5°48.4	37.7	109°03.5	44.8
11	126°09.1	20°41.8	45.6	302°49.0	55.5	20°50.3	37.7	124°06.1	44.9
12	141°11.6	35°41.1	N21°45.4	317°50.0	S00°56.2	35°52.2	N22°37.6	139°08.7	S01°44.9
13	156°14.0	50°40.4	45.2	332°51.0	56.8	50°54.1	37.6	154°11.2	45.0
14	171°16.5	65°39.7	45.0	347°52.1	57.5	65°56.0	37.5	169°13.8	45.1
15	186°19.0	80°39.0	·· 44.9	2°53.1	·· 58.1	80°58.0	·· 37.5	184°16.4	·· 45.1
16	201°21.4	95°38.3	44.7	17°54.1	58.8	95°59.9	37.4	199°18.9	45.2
17	216°23.9	110°37.6	44.5	32°55.2	00°59.4	111°01.8	37.4	214°21.5	45.2
18	231°26.4	125°36.9	N21°44.3	47°56.2	S01°00.1	126°03.7	N22°37.3	229°24.1	S01°45.3
19	246°28.8	140°36.2	44.1	62°57.2	00.7	141°05.6	37.3	244°26.7	45.3
20	261°31.3	155°35.5	43.9	77°58.3	01.4	156°07.5	37.2	259°29.2	45.4
21	276°33.7	170°34.8	·· 43.7	92°59.3	·· 02.0	171°09.5	·· 37.2	274°31.8	·· 45.4
22	291°36.2	185°34.1	43.6	108°00.3	02.7	186°11.4	37.1	289°34.4	45.5
23	306°38.7	200°33.4	43.4	123°01.4	03.3	201°13.3	37.1	304°36.9	45.6
Mer.pass. 02:37		ν -0.7′	d 0.2′	m -3.98	ν 1.0′	d 0.7′	m 1.62	ν 1.9′	d 0.0′ m -1.94	ν 2.6′	d 0.1′ m 0.74

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	321°41.1	215°32.7	N21°43.2	138°02.4	S01°04.0	216°15.2	N22°37.0	319°39.5	S01°45.6
1	336°43.6	230°32.0	43.0	153°03.4	04.6	231°17.1	37.0	334°42.1	45.7
2	351°46.1	245°31.3	42.8	168°04.5	05.3	246°19.0	36.9	349°44.7	45.7
3	6°48.5	260°30.6	·· 42.6	183°05.5	·· 05.9	261°20.9	·· 36.9	4°47.2	·· 45.8
4	21°51.0	275°29.9	42.4	198°06.5	06.6	276°22.9	36.8	19°49.8	45.8
5	36°53.5	290°29.2	42.2	213°07.6	07.2	291°24.8	36.8	34°52.4	45.9
6	51°55.9	305°28.5	N21°42.0	228°08.6	S01°07.9	306°26.7	N22°36.7	49°54.9	S01°46.0
7	66°58.4	320°27.8	41.8	243°09.6	08.5	321°28.6	36.7	64°57.5	46.0
8	82°00.8	335°27.1	41.6	258°10.6	09.2	336°30.5	36.6	80°00.1	46.1
9	97°03.3	350°26.5	·· 41.4	273°11.7	·· 09.8	351°32.4	·· 36.6	95°02.7	·· 46.1
10	112°05.8	5°25.8	41.2	288°12.7	10.5	6°34.4	36.5	110°05.2	46.2
11	127°08.2	20°25.1	41.0	303°13.7	11.1	21°36.3	36.5	125°07.8	46.2
12	142°10.7	35°24.4	N21°40.8	318°14.8	S01°11.8	36°38.2	N22°36.4	140°10.4	S01°46.3
13	157°13.2	50°23.7	40.6	333°15.8	12.4	51°40.1	36.4	155°13.0	46.4
14	172°15.6	65°23.0	40.4	348°16.8	13.1	66°42.0	36.3	170°15.5	46.4
15	187°18.1	80°22.3	·· 40.2	3°17.9	·· 13.7	81°44.0	·· 36.3	185°18.1	·· 46.5
16	202°20.6	95°21.6	40.0	18°18.9	14.4	96°45.9	36.2	200°20.7	46.5
17	217°23.0	110°20.9	39.8	33°19.9	15.0	111°47.8	36.2	215°23.3	46.6
18	232°25.5	125°20.2	N21°39.6	48°21.0	S01°15.7	126°49.7	N22°36.1	230°25.8	S01°46.6
19	247°28.0	140°19.5	39.4	63°22.0	16.4	141°51.6	36.1	245°28.4	46.7
20	262°30.4	155°18.8	39.2	78°23.0	17.0	156°53.5	36.0	260°31.0	46.8
21	277°32.9	170°18.1	·· 39.0	93°24.1	·· 17.7	171°55.5	·· 36.0	275°33.6	·· 46.8
22	292°35.3	185°17.4	38.7	108°25.1	18.3	186°57.4	35.9	290°36.1	46.9
23	307°37.8	200°16.7	38.5	123°26.1	19.0	201°59.3	35.9	305°38.7	46.9
Mer.pass. 02:33		ν -0.7′	d 0.2′	m -3.97	ν 1.0′	d 0.7′	m 1.62	ν 1.9′	d 0.0′ m -1.94	ν 2.6′	d 0.1′ m 0.74

Stars

	SHA	Dec
Alpheratz	357°34.0	29°13.9
Ankaa	353°06.3	-42°09.7
Schedar	349°30.1	56°40.5
Diphda	348°46.6	-17°50.6
Achernar	335°19.5	-57°06.0
Hamal	327°50.5	23°35.0
Polaris	313°46.5	89°22.0
Acamar	315°11.4	-40°11.8
Menkar	314°05.6	4°11.5
Mirfak	308°27.6	49°57.0
Aldebaran	290°39.2	16°33.7
Rigel	281°03.6	-8°10.1
Capella	280°21.4	46°01.3
Bellatrix	278°22.5	6°22.5
Elnath	278°01.4	28°37.7
Alnilam	275°37.4	-1°11.0
Betelgeuse	270°51.8	7°24.8
Canopus	263°52.6	-52°42.3
Sirius	258°26.1	-16°44.9
Adhara	255°05.8	-29°00.2
Procyon	244°50.6	5°09.7
Pollux	243°17.0	27°57.9
Avior	234°15.2	-59°35.3
Suhail	222°46.4	-43°32.1
Miaplacidus	221°39.2	-69°49.3
Alphard	217°47.6	-8°46.1
Regulus	207°34.2	11°50.6
Dubhe	193°41.0	61°36.9
Denebola	182°24.7	14°25.9
Gienah	175°43.3	-17°41.1
Acrux	173°00.1	-63°14.7
Gacrux	171°51.5	-57°15.6
Alioth	166°12.8	55°49.5
Spica	158°21.9	-11°17.7
Alkaid	152°51.8	49°11.4
Hadar	148°35.5	-60°30.0
Menkent	147°57.1	-36°29.9
Arcturus	145°47.5	19°03.1
Rigil Kent.	139°39.7	-60°56.7
Kochab	137°19.8	74°03.3
Zuben'ubi	136°55.5	-16°08.9
Alphecca	126°03.3	26°37.9
Antares	112°15.1	-26°29.4
Atria	107°08.6	-69°04.6
Sabik	102°02.0	-15°45.4
Shaula	96°09.4	-37°07.4
Rasalhague	95°57.9	12°32.6
Eltanin	90°41.6	51°29.3
Kaus Aust.	83°31.5	-34°22.4
Vega	80°32.6	38°48.6
Nunki	75°46.8	-26°15.9
Altair	61°59.2	8°56.3
Peacock	53°04.3	-56°39.1
Deneb	49°25.0	45°22.4
Enif	33°38.0	9°59.6
Al Na'ir	27°31.8	-46°50.1
Fomalhaut	15°13.6	-29°29.0
Scheat	13°44.4	28°13.3
Markab	13°29.1	15°20.7

Aug 11 Mon	SHA	Mer.pass
Venus	256°23.3	09:36
Mars	177°29.8	14:50
Jupiter	255°00.5	09:40
Saturn	357°53.4	02:49

Aug 12 Tue	SHA	Mer.pass
Venus	255°07.4	09:37
Mars	176°55.6	14:48
Jupiter	254°47.2	09:37
Saturn	357°55.8	02:45

Aug 13 Wed	SHA	Mer.pass
Venus	253°51.6	09:38
Mars	176°21.3	14:47
Jupiter	254°34.1	09:34
Saturn	357°58.4	02:41

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°41.0	N15°15.1	338°00.3	12.2′	S08°35.7	16.0′	58.5′
1	193°41.1	14.3	352°31.5	12.2′	08°19.7	16.1′	58.5′
2	208°41.2	13.6	7°02.7	12.3′	08°03.6	16.1′	58.5′
3	223°41.3	·· 12.8	21°34.0	12.3′	07°47.5	16.1′	58.6′
4	238°41.4	12.1	36°05.3	12.3′	07°31.4	16.3′	58.6′
5	253°41.5	11.3	50°36.5	12.3′	07°15.1	16.2′	58.6′
6	268°41.6	N15°10.6	65°07.9	12.3′	S06°58.9	16.3′	58.6′
7	283°41.7	09.9	79°39.2	12.4′	06°42.6	16.3′	58.6′
8	298°41.8	09.1	94°10.6	12.4′	06°26.3	16.4′	58.6′
9	313°41.9	·· 08.4	108°41.9	12.4′	06°09.9	16.4′	58.7′
10	328°42.0	07.6	123°13.3	12.4′	05°53.5	16.5′	58.7′
11	343°42.1	06.9	137°44.7	12.4′	05°37.0	16.5′	58.7′
12	358°42.2	N15°06.1	152°16.2	12.4′	S05°20.5	16.5′	58.7′
13	13°42.3	05.4	166°47.6	12.4′	05°04.0	16.5′	58.7′
14	28°42.4	04.6	181°19.0	12.5′	04°47.5	16.6′	58.7′
15	43°42.5	·· 03.9	195°50.5	12.5′	04°30.9	16.6′	58.8′
16	58°42.6	03.1	210°22.0	12.5′	04°14.3	16.7′	58.8′
17	73°42.7	02.4	224°53.4	12.5′	03°57.6	16.7′	58.8′
18	88°42.8	N15°01.6	239°24.9	12.5′	S03°40.9	16.7′	58.8′
19	103°42.9	00.9	253°56.4	12.5′	03°24.2	16.7′	58.8′
20	118°43.0	15°00.1	268°27.9	12.5′	03°07.5	16.7′	58.8′
21	133°43.1	14°59.4	282°59.4	12.5′	02°50.8	16.8′	58.8′
22	148°43.3	58.6	297°30.9	12.5′	02°34.0	16.8′	58.9′
23	163°43.4	57.9	312°02.4	12.5′	02°17.2	16.8′	58.9′
	SD = 15.8′	d = 0.7′	SD = 16.0′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°43.5	N14°57.1	326°33.9	12.5′	S02°00.4	16.8′	58.9′
1	193°43.6	56.4	341°05.4	12.5′	01°43.6	16.8′	58.9′
2	208°43.7	55.6	355°36.9	12.5′	01°26.8	16.9′	58.9′
3	223°43.8	·· 54.9	10°08.4	12.5′	01°09.9	16.8′	58.9′
4	238°43.9	54.1	24°39.9	12.5′	00°53.1	16.9′	58.9′
5	253°44.0	53.4	39°11.4	12.5′	00°36.2	16.9′	58.9′
6	268°44.1	N14°52.6	53°42.8	12.5′	S00°19.3	16.8′	59.0′
7	283°44.2	51.9	68°14.3	12.5′	S00°02.5	16.9′	59.0′
8	298°44.3	51.1	82°45.8	12.4′	N00°14.4	16.9′	59.0′
9	313°44.4	·· 50.4	97°17.2	12.4′	00°31.3	16.9′	59.0′
10	328°44.5	49.6	111°48.6	12.4′	00°48.2	16.9′	59.0′
11	343°44.7	48.8	126°20.0	12.4′	01°05.1	16.9′	59.0′
12	358°44.8	N14°48.1	140°51.5	12.4′	N01°22.0	16.9′	59.0′
13	13°44.9	47.3	155°22.8	12.4′	01°38.9	16.9′	59.0′
14	28°45.0	46.6	169°54.2	12.4′	01°55.8	16.9′	59.1′
15	43°45.1	·· 45.8	184°25.6	12.3′	02°12.7	16.9′	59.1′
16	58°45.2	45.1	198°56.9	12.3′	02°29.6	16.8′	59.1′
17	73°45.3	44.3	213°28.2	12.3′	02°46.4	16.9′	59.1′
18	88°45.4	N14°43.5	227°59.5	12.3′	N03°03.3	16.9′	59.1′
19	103°45.5	42.8	242°30.8	12.2′	03°20.2	16.8′	59.1′
20	118°45.6	42.0	257°02.0	12.2′	03°37.0	16.8′	59.1′
21	133°45.8	·· 41.3	271°33.2	12.2′	03°53.8	16.8′	59.1′
22	148°45.9	40.5	286°04.4	12.2′	04°10.6	16.8′	59.1′
23	163°46.0	39.7	300°35.5	12.1′	04°27.4	16.8′	59.1′
	SD = 15.8′	d = 0.8′	SD = 16.1′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°46.1	N14°39.0	315°06.7	12.1′	N04°44.2	16.8′	59.1′
1	193°46.2	38.2	329°37.8	12.1′	05°01.0	16.7′	59.2′
2	208°46.3	37.5	344°08.8	12.0′	05°17.7	16.7′	59.2′
3	223°46.4	·· 36.7	358°39.8	12.0′	05°34.4	16.7′	59.2′
4	238°46.5	35.9	13°10.8	12.0′	05°51.1	16.7′	59.2′
5	253°46.7	35.2	27°41.8	11.9′	06°07.8	16.6′	59.2′
6	268°46.8	N14°34.4	42°12.7	11.9′	N06°24.4	16.6′	59.2′
7	283°46.9	33.6	56°43.6	11.8′	06°41.0	16.6′	59.2′
8	298°47.0	32.9	71°14.4	11.8′	06°57.6	16.5′	59.2′
9	313°47.1	·· 32.1	85°45.2	11.8′	07°14.1	16.5′	59.2′
10	328°47.2	31.4	100°16.0	11.7′	07°30.6	16.5′	59.2′
11	343°47.3	30.6	114°46.7	11.7′	07°47.1	16.4′	59.2′
12	358°47.5	N14°29.8	129°17.3	11.6′	N08°03.5	16.4′	59.2′
13	13°47.6	29.1	143°47.9	11.6′	08°19.9	16.4′	59.2′
14	28°47.7	28.3	158°18.5	11.5′	08°36.3	16.3′	59.2′
15	43°47.8	·· 27.5	172°49.0	11.5′	08°52.6	16.3′	59.2′
16	58°47.9	26.8	187°19.5	11.4′	09°08.9	16.2′	59.2′
17	73°48.0	26.0	201°49.9	11.4′	09°25.1	16.2′	59.3′
18	88°48.1	N14°25.2	216°20.3	11.3′	N09°41.3	16.1′	59.3′
19	103°48.3	24.4	230°50.6	11.3′	09°57.4	16.1′	59.3′
20	118°48.4	23.7	245°20.8	11.2′	10°13.5	16.0′	59.3′
21	133°48.5	·· 22.9	259°51.0	11.1′	10°29.5	16.0′	59.3′
22	148°48.6	22.1	274°21.2	11.1′	10°45.5	15.9′	59.3′
23	163°48.7	21.4	288°51.2	11.0′	11°01.4	15.9′	59.3′
	SD = 15.8′	d = 0.8′	SD = 16.1′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	////	////	02:04	22:00	////	////
N 70°	////	////	02:42	21:24	////	////
68°	////	01:19	03:08	20:59	22:43	////
66°	////	02:06	03:27	20:40	21:59	////
64°	////	02:35	03:43	20:24	21:31	////
62°	01:10	02:57	03:56	20:12	21:10	22:52
60°	01:53	03:14	04:07	20:01	20:53	22:13
N 58°	02:20	03:29	04:17	19:51	20:39	21:47
56°	02:40	03:41	04:25	19:43	20:27	21:27
54°	02:57	03:52	04:33	19:36	20:17	21:11
52°	03:10	04:01	04:39	19:29	20:08	20:58
50°	03:22	04:09	04:45	19:24	20:00	20:46
45°	03:46	04:26	04:58	19:11	19:43	20:23
N 40°	04:04	04:40	05:09	19:00	19:30	20:05
35°	04:18	04:51	05:18	18:52	19:19	19:51
30°	04:30	05:00	05:26	18:44	19:09	19:39
20°	04:49	05:16	05:39	18:31	18:54	19:21
N 10°	05:04	05:29	05:51	18:19	18:41	19:06
0°	05:15	05:40	06:02	18:08	18:30	18:55
S 10°	05:26	05:51	06:12	17:58	18:20	18:45
20°	05:35	06:01	06:24	17:47	18:09	18:36
30°	05:43	06:12	06:36	17:34	17:59	18:27
35°	05:48	06:17	06:44	17:27	17:53	18:23
40°	05:52	06:24	06:52	17:19	17:47	18:19
45°	05:56	06:31	07:02	17:09	17:40	18:14
S 50°	06:01	06:39	07:13	16:58	17:32	18:10
52°	06:03	06:43	07:19	16:52	17:28	18:08
54°	06:05	06:47	07:24	16:46	17:24	18:06
56°	06:07	06:51	07:31	16:40	17:20	18:04
58°	06:09	06:56	07:38	16:32	17:15	18:02
S 60°	06:12	07:01	07:47	16:24	17:10	17:59

Lat.	**Moonrise** Mon	Tue	Wed	**Moonset** Mon	Tue	Wed
N 72°	20:46	20:09	19:27	06:10	08:33	10:58
N 70°	20:42	20:13	19:42	06:21	08:33	10:46
68°	20:38	20:17	19:54	06:30	08:32	10:36
66°	20:35	20:20	20:05	06:37	08:32	10:28
64°	20:33	20:23	20:13	06:43	08:32	10:22
62°	20:31	20:26	20:21	06:48	08:32	10:16
60°	20:29	20:28	20:27	06:53	08:31	10:11
N 58°	20:27	20:30	20:33	06:57	08:31	10:07
56°	20:26	20:32	20:38	07:00	08:31	10:03
54°	20:25	20:33	20:42	07:03	08:31	10:00
52°	20:23	20:35	20:47	07:06	08:31	09:57
50°	20:22	20:36	20:50	07:09	08:31	09:54
45°	20:20	20:39	20:59	07:14	08:31	09:48
N 40°	20:18	20:41	21:06	07:19	08:30	09:43
35°	20:16	20:43	21:12	07:23	08:30	09:38
30°	20:14	20:45	21:17	07:26	08:30	09:35
20°	20:12	20:48	21:27	07:32	08:30	09:28
N 10°	20:09	20:51	21:35	07:37	08:30	09:22
0°	20:07	20:54	21:43	07:42	08:29	09:17
S 10°	20:05	20:57	21:51	07:47	08:29	09:12
20°	20:02	21:00	21:59	07:52	08:29	09:06
30°	20:00	21:04	22:09	07:58	08:28	08:59
35°	19:58	21:06	22:15	08:01	08:28	08:56
40°	19:56	21:08	22:21	08:04	08:28	08:52
45°	19:54	21:11	22:29	08:09	08:28	08:47
S 50°	19:52	21:14	22:38	08:13	08:27	08:41
52°	19:51	21:16	22:42	08:16	08:27	08:38
54°	19:49	21:17	22:47	08:18	08:27	08:36
56°	19:48	21:19	22:52	08:21	08:27	08:32
58°	19:46	21:21	22:58	08:24	08:26	08:29
S 60°	19:45	21:24	23:05	08:27	08:26	08:25

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 18-20 97-84%
11	05:16	05:11	12:05	01:31	13:55	
12	05:06	05:01	12:05	02:18	14:42	
13	04:56	04:50	12:05	03:06	15:30	

August 14, 15, 16 UT (Thu., Fri., Sat.)

	Aries	Venus		Mars		Jupiter		Saturn	
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	322°40.3	215°16.0	N21°38.3	138°27.1	S01°19.6	217°01.2	N22°35.8	320°41.3	S01°47.0
1	337°42.7	230°15.3	38.1	153°28.2	20.3	232°03.1	35.8	335°43.8	47.0
2	352°45.2	245°14.6	37.9	168°29.2	20.9	247°05.1	35.7	350°46.4	47.1
3	7°47.7	260°13.9	·· 37.7	183°30.2	·· 21.6	262°07.0	·· 35.7	5°49.0	·· 47.2
4	22°50.1	275°13.2	37.4	198°31.3	22.2	277°08.9	35.6	20°51.6	47.2
5	37°52.6	290°12.5	37.2	213°32.3	22.9	292°10.8	35.6	35°54.1	47.3
6	52°55.1	305°11.8	N21°37.0	228°33.3	S01°23.5	307°12.7	N22°35.5	50°56.7	S01°47.3
7	67°57.5	320°11.1	36.8	243°34.4	24.2	322°14.7	35.5	65°59.3	47.4
8	83°00.0	335°10.4	36.6	258°35.4	24.8	337°16.6	35.4	81°01.9	47.5
9	98°02.5	350°09.7	·· 36.3	273°36.4	·· 25.5	352°18.5	·· 35.4	96°04.5	·· 47.5
10	113°04.9	5°09.0	36.1	288°37.4	26.1	7°20.4	35.3	111°07.0	47.6
11	128°07.4	20°08.3	35.9	303°38.5	26.8	22°22.3	35.3	126°09.6	47.6
12	143°09.8	35°07.6	N21°35.6	318°39.5	S01°27.4	37°24.3	N22°35.2	141°12.2	S01°47.7
13	158°12.3	50°06.9	35.4	333°40.5	28.1	52°26.2	35.2	156°14.8	47.7
14	173°14.8	65°06.2	35.2	348°41.6	28.7	67°28.1	35.1	171°17.3	47.8
15	188°17.2	80°05.5	·· 35.0	3°42.6	·· 29.4	82°30.0	·· 35.1	186°19.9	·· 47.9
16	203°19.7	95°04.8	34.7	18°43.6	30.0	97°31.9	35.0	201°22.5	47.9
17	218°22.2	110°04.1	34.5	33°44.6	30.7	112°33.9	35.0	216°25.1	48.0
18	233°24.6	125°03.4	N21°34.3	48°45.7	S01°31.3	127°35.8	N22°34.9	231°27.6	S01°48.0
19	248°27.1	140°02.7	34.0	63°46.7	32.0	142°37.7	34.9	246°30.2	48.1
20	263°29.6	155°02.0	33.8	78°47.7	32.6	157°39.6	34.8	261°32.8	48.2
21	278°32.0	170°01.3	·· 33.6	93°48.7	·· 33.3	172°41.5	·· 34.8	276°35.4	·· 48.2
22	293°34.5	185°00.7	33.3	108°49.8	34.0	187°43.5	34.7	291°38.0	48.3
23	308°36.9	200°00.0	33.1	123°50.8	34.6	202°45.4	34.7	306°40.5	48.3
Mer.pass.	02:29	ν -0.7′	d 0.2′	m -3.97	ν 1.0′	d 0.7′	m 1.62	ν 1.9′	d 0.1′ m -1.94	ν 2.6′	d 0.1′ m 0.73

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	323°39.4	214°59.3	N21°32.8	138°51.8	S01°35.3	217°47.3	N22°34.6	321°43.1	S01°48.4
1	338°41.9	229°58.6	32.6	153°52.9	35.9	232°49.2	34.6	336°45.7	48.4
2	353°44.3	244°57.9	32.4	168°53.9	36.6	247°51.2	34.5	351°48.3	48.5
3	8°46.8	259°57.2	·· 32.1	183°54.9	·· 37.2	262°53.1	·· 34.5	6°50.8	·· 48.6
4	23°49.3	274°56.5	31.9	198°55.9	37.9	277°55.0	34.4	21°53.4	48.6
5	38°51.7	289°55.8	31.6	213°57.0	38.5	292°56.9	34.4	36°56.0	48.7
6	53°54.2	304°55.1	N21°31.4	228°58.0	S01°39.2	307°58.8	N22°34.3	51°58.6	S01°48.7
7	68°56.7	319°54.4	31.1	243°59.0	39.8	323°00.8	34.3	67°01.2	48.8
8	83°59.1	334°53.7	30.9	259°00.0	40.5	338°02.7	34.2	82°03.7	48.9
9	99°01.6	349°53.0	·· 30.6	274°01.1	·· 41.1	353°04.6	·· 34.1	97°06.3	·· 48.9
10	114°04.1	4°52.3	30.4	289°02.1	41.8	8°06.5	34.1	112°08.9	49.0
11	129°06.5	19°51.6	30.1	304°03.1	42.4	23°08.5	34.0	127°11.5	49.0
12	144°09.0	34°50.9	N21°29.9	319°04.1	S01°43.1	38°10.4	N22°34.0	142°14.0	S01°49.1
13	159°11.4	49°50.2	29.6	334°05.2	43.7	53°12.3	33.9	157°16.6	49.2
14	174°13.9	64°49.5	29.4	349°06.2	44.4	68°14.2	33.9	172°19.2	49.2
15	189°16.4	79°48.8	·· 29.1	4°07.2	·· 45.0	83°16.1	·· 33.8	187°21.8	·· 49.3
16	204°18.8	94°48.1	28.9	19°08.2	45.7	98°18.1	33.8	202°24.4	49.3
17	219°21.3	109°47.4	28.6	34°09.3	46.3	113°20.0	33.7	217°26.9	49.4
18	234°23.8	124°46.7	N21°28.3	49°10.3	S01°47.0	128°21.9	N22°33.7	232°29.5	S01°49.5
19	249°26.2	139°46.0	28.1	64°11.3	47.7	143°23.8	33.6	247°32.1	49.5
20	264°28.7	154°45.3	27.8	79°12.3	48.3	158°25.8	33.6	262°34.7	49.6
21	279°31.2	169°44.6	·· 27.6	94°13.4	·· 49.0	173°27.7	·· 33.5	277°37.3	·· 49.6
22	294°33.6	184°43.9	27.3	109°14.4	49.6	188°29.6	33.5	292°39.8	49.7
23	309°36.1	199°43.2	27.0	124°15.4	50.3	203°31.5	33.4	307°42.4	49.8
Mer.pass.	02:25	ν -0.7′	d 0.2′	m -3.97	ν 1.0′	d 0.7′	m 1.62	ν 1.9′	d 0.1′ m -1.94	ν 2.6′	d 0.1′ m 0.73

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	324°38.6	214°42.5	N21°26.8	139°16.4	S01°50.9	218°33.5	N22°33.4	322°45.0	S01°49.8
1	339°41.0	229°41.8	26.5	154°17.5	51.6	233°35.4	33.3	337°47.6	49.9
2	354°43.5	244°41.1	26.2	169°18.5	52.2	248°37.3	33.3	352°50.2	49.9
3	9°45.9	259°40.4	·· 26.0	184°19.5	·· 52.9	263°39.2	·· 33.2	7°52.8	·· 50.0
4	24°48.4	274°39.7	25.7	199°20.5	53.5	278°41.2	33.2	22°55.3	50.1
5	39°50.9	289°39.0	25.4	214°21.6	54.2	293°43.1	33.1	37°57.9	50.1
6	54°53.3	304°38.3	N21°25.1	229°22.6	S01°54.8	308°45.0	N22°33.1	53°00.5	S01°50.2
7	69°55.8	319°37.7	24.9	244°23.6	55.5	323°46.9	33.0	68°03.1	50.2
8	84°58.3	334°37.0	24.6	259°24.6	56.1	338°48.9	33.0	83°05.7	50.3
9	100°00.7	349°36.3	·· 24.3	274°25.7	·· 56.8	353°50.8	·· 32.9	98°08.2	·· 50.4
10	115°03.2	4°35.6	24.1	289°26.7	57.4	8°52.7	32.9	113°10.8	50.4
11	130°05.7	19°34.9	23.8	304°27.7	58.1	23°54.7	32.8	128°13.4	50.5
12	145°08.1	34°34.2	N21°23.5	319°28.7	S01°58.8	38°56.6	N22°32.8	143°16.0	S01°50.5
13	160°10.6	49°33.5	23.2	334°29.7	01°59.4	53°58.5	32.7	158°18.6	50.6
14	175°13.0	64°32.8	22.9	349°30.8	02°00.1	69°00.4	32.7	173°21.2	50.7
15	190°15.5	79°32.1	·· 22.7	4°31.8	·· 00.7	84°02.4	·· 32.6	188°23.7	·· 50.7
16	205°18.0	94°31.4	22.4	19°32.8	01.4	99°04.3	32.6	203°26.3	50.8
17	220°20.4	109°30.7	22.1	34°33.8	02.0	114°06.2	32.5	218°28.9	50.8
18	235°22.9	124°30.0	N21°21.8	49°34.9	S02°02.7	129°08.1	N22°32.5	233°31.5	S01°50.9
19	250°25.4	139°29.3	21.5	64°35.9	03.3	144°10.1	32.4	248°34.1	51.0
20	265°27.8	154°28.6	21.2	79°36.9	04.0	159°12.0	32.4	263°36.7	51.0
21	280°30.3	169°27.9	·· 21.0	94°37.9	·· 04.6	174°13.9	·· 32.3	278°39.2	·· 51.1
22	295°32.8	184°27.2	20.7	109°38.9	05.3	189°15.8	32.2	293°41.8	51.1
23	310°35.2	199°26.5	20.4	124°40.0	05.9	204°17.8	32.2	308°44.4	51.2
Mer.pass.	02:21	ν -0.7′	d 0.3′	m -3.97	ν 1.0′	d 0.7′	m 1.62	ν 1.9′	d 0.1′ m -1.95	ν 2.6′	d 0.1′ m 0.72

Stars

	SHA	Dec
Alpheratz	357°34.0	29°13.9
Ankaa	353°06.3	-42°09.7
Schedar	349°30.1	56°40.6
Diphda	348°46.6	-17°50.6
Achernar	335°19.5	-57°06.1
Hamal	327°50.5	23°35.0
Polaris	313°44.9	89°22.0
Acamar	315°11.3	-40°11.8
Menkar	314°05.6	4°11.5
Mirfak	308°27.5	49°57.0
Aldebaran	290°39.1	16°33.7
Rigel	281°03.5	-8°10.1
Capella	280°21.4	46°01.3
Bellatrix	278°22.5	6°22.5
Elnath	278°01.4	28°37.7
Alnilam	275°37.4	-1°11.0
Betelgeuse	270°51.7	7°24.8
Canopus	263°52.6	-52°42.2
Sirius	258°26.1	-16°44.9
Adhara	255°05.8	-29°00.2
Procyon	244°50.6	5°09.7
Pollux	243°17.0	27°57.9
Avior	234°15.2	-59°35.3
Suhail	222°46.4	-43°32.0
Miaplacidus	221°39.2	-69°49.2
Alphard	217°47.6	-8°46.1
Regulus	207°34.2	11°50.6
Dubhe	193°41.0	61°36.9
Denebola	182°24.7	14°25.9
Gienah	175°43.3	-17°41.0
Acrux	173°00.1	-63°14.7
Gacrux	171°51.5	-57°15.6
Alioth	166°12.8	55°49.5
Spica	158°21.9	-11°17.7
Alkaid	152°51.8	49°11.4
Hadar	148°35.5	-60°30.0
Menkent	147°57.2	-36°29.9
Arcturus	145°47.5	19°03.1
Rigil Kent.	139°39.8	-60°56.7
Kochab	137°19.9	74°03.3
Zuben'ubi	136°55.5	-16°08.9
Alphecca	126°03.3	26°37.9
Antares	112°15.1	-26°29.4
Atria	107°08.6	-69°04.6
Sabik	102°02.0	-15°45.4
Shaula	96°09.5	-37°07.4
Rasalhague	95°57.9	12°32.6
Eltanin	90°41.6	51°29.3
Kaus Aust.	83°31.6	-34°22.4
Vega	80°32.6	38°48.6
Nunki	75°46.8	-26°15.9
Altair	61°59.2	8°56.3
Peacock	53°04.3	-56°39.1
Deneb	49°25.0	45°22.4
Enif	33°38.0	9°59.6
Al Na'ir	27°31.8	-46°50.1
Fomalhaut	15°13.6	-29°29.0
Scheat	13°44.4	28°13.4
Markab	13°29.1	15°20.7

Aug 14 Thu	SHA	Mer.pass
Venus	252°35.7	09:39
Mars	175°46.9	14:45
Jupiter	254°20.9	09:31
Saturn	358°01.0	02:37

Aug 15 Fri	SHA	Mer.pass
Venus	251°19.8	09:40
Mars	175°12.4	14:44
Jupiter	254°07.9	09:28
Saturn	358°03.7	02:33

Aug 16 Sat	SHA	Mer.pass
Venus	250°04.0	09:42
Mars	174°37.9	14:42
Jupiter	253°54.9	09:25
Saturn	358°06.5	02:29

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h — Sun — Moon

Thu	GHA	Dec	GHA	ν	Dec	d	HP
0	178°48.9	N14°20.6	303°21.3	11.0′	N11°17.3	15.8′	59.3′
1	193°49.0	19.8	317°51.2	10.9′	11°33.1	15.7′	59.3′
2	208°49.1	19.1	332°21.1	10.8′	11°48.8	15.7′	59.3′
3	223°49.2	·· 18.3	346°50.9	10.8′	12°04.5	15.6′	59.3′
4	238°49.3	17.5	1°20.7	10.7′	12°20.1	15.6′	59.3′
5	253°49.4	16.7	15°50.4	10.6′	12°35.7	15.5′	59.3′
6	268°49.6	N14°16.0	30°20.0	10.6′	N12°51.2	15.4′	59.3′
7	283°49.7	15.2	44°49.6	10.5′	13°06.6	15.3′	59.3′
8	298°49.8	14.4	59°19.1	10.4′	13°21.9	15.3′	59.3′
9	313°49.9	·· 13.6	73°48.5	10.4′	13°37.2	15.2′	59.3′
10	328°50.0	12.9	88°17.9	10.3′	13°52.4	15.2′	59.3′
11	343°50.2	12.1	102°47.2	10.2′	14°07.6	15.0′	59.3′
12	358°50.3	N14°11.3	117°16.4	10.1′	N14°22.6	15.0′	59.3′
13	13°50.4	10.5	131°45.5	10.1′	14°37.6	14.9′	59.3′
14	28°50.5	09.8	146°14.6	10.0′	14°52.5	14.8′	59.3′
15	43°50.6	·· 09.0	160°43.6	9.9′	15°07.3	14.8′	59.3′
16	58°50.8	08.2	175°12.5	9.8′	15°22.1	14.6′	59.3′
17	73°50.9	07.4	189°41.3	9.8′	15°36.7	14.6′	59.3′
18	88°51.0	N14°06.7	204°10.1	9.7′	N15°51.3	14.5′	59.3′
19	103°51.1	05.9	218°38.7	9.6′	16°05.8	14.4′	59.3′
20	118°51.2	05.1	233°07.3	9.5′	16°20.2	14.3′	59.3′
21	133°51.4	·· 04.3	247°35.8	9.4′	16°34.5	14.2′	59.3′
22	148°51.5	03.5	262°04.3	9.3′	16°48.7	14.1′	59.3′
23	163°51.6	02.8	276°32.6	9.3′	17°02.8	14.0′	59.3′
	SD = 15.8′	d = 0.8′	SD = 16.2′				

Fri	GHA	Dec	GHA	ν	Dec	d	HP
0	178°51.7	N14°02.0	291°00.9	9.2′	N17°16.8	13.9′	59.3′
1	193°51.9	01.2	305°29.1	9.1′	17°30.7	13.8′	59.3′
2	208°52.0	14°00.4	319°57.2	9.0′	17°44.5	13.8′	59.3′
3	223°52.1	13°59.6	334°25.2	8.9′	17°58.3	13.6′	59.3′
4	238°52.2	58.9	348°53.1	8.8′	18°11.9	13.5′	59.3′
5	253°52.4	58.1	3°20.9	8.8′	18°25.4	13.4′	59.3′
6	268°52.5	N13°57.3	17°48.7	8.7′	N18°38.8	13.3′	59.3′
7	283°52.6	56.5	32°16.3	8.6′	18°52.1	13.2′	59.3′
8	298°52.7	55.7	46°43.9	8.5′	19°05.3	13.1′	59.3′
9	313°52.9	·· 54.9	61°11.4	8.4′	19°18.4	12.9′	59.3′
10	328°53.0	54.2	75°38.8	8.3′	19°31.3	12.9′	59.3′
11	343°53.1	53.4	90°06.1	8.2′	19°44.2	12.7′	59.3′
12	358°53.2	N13°52.6	104°33.3	8.1′	N19°56.9	12.6′	59.3′
13	13°53.4	51.8	119°00.5	8.0′	20°09.5	12.5′	59.3′
14	28°53.5	51.0	133°27.5	7.9′	20°22.0	12.4′	59.3′
15	43°53.6	·· 50.2	147°54.4	7.9′	20°34.4	12.2′	59.3′
16	58°53.7	49.4	162°21.3	7.8′	20°46.6	12.2′	59.3′
17	73°53.9	48.7	176°48.1	7.7′	20°58.8	12.0′	59.3′
18	88°54.0	N13°47.9	191°14.7	7.6′	N21°10.8	11.9′	59.3′
19	103°54.1	47.1	205°41.3	7.5′	21°22.7	11.7′	59.3′
20	118°54.2	46.3	220°07.8	7.4′	21°34.4	11.6′	59.3′
21	133°54.4	·· 45.5	234°34.2	7.3′	21°46.0	11.5′	59.2′
22	148°54.5	44.7	249°00.5	7.2′	21°57.5	11.4′	59.2′
23	163°54.6	43.9	263°26.7	7.1′	22°08.9	11.2′	59.2′
	SD = 15.8′	d = 0.8′	SD = 16.2′				

Sat	GHA	Dec	GHA	ν	Dec	d	HP
0	178°54.8	N13°43.1	277°52.9	7.0′	N22°20.1	11.0′	59.2′
1	193°54.9	42.3	292°18.9	6.9′	22°31.1	11.0′	59.2′
2	208°55.0	41.6	306°44.8	6.9′	22°42.1	10.8′	59.2′
3	223°55.1	·· 40.8	321°10.7	6.8′	22°52.9	10.6′	59.2′
4	238°55.3	40.0	335°36.5	6.7′	23°03.5	10.5′	59.2′
5	253°55.4	39.2	350°02.1	6.6′	23°14.0	10.4′	59.2′
6	268°55.5	N13°38.4	4°27.7	6.5′	N23°24.4	10.2′	59.2′
7	283°55.7	37.6	18°53.2	6.4′	23°34.6	10.1′	59.2′
8	298°55.8	36.8	33°18.6	6.3′	23°44.7	9.9′	59.2′
9	313°55.9	·· 36.0	47°43.9	6.2′	23°54.6	9.8′	59.2′
10	328°56.1	35.2	62°09.2	6.1′	24°04.4	9.6′	59.2′
11	343°56.2	34.4	76°34.3	6.1′	24°14.0	9.5′	59.2′
12	358°56.3	N13°33.6	90°59.4	6.0′	N24°23.5	9.3′	59.2′
13	13°56.4	32.8	105°24.3	5.9′	24°32.8	9.2′	59.2′
14	28°56.6	32.0	119°49.2	5.8′	24°42.0	9.0′	59.2′
15	43°56.7	·· 31.2	134°14.0	5.7′	24°51.0	8.8′	59.2′
16	58°56.8	30.5	148°38.8	5.6′	24°59.8	8.7′	59.1′
17	73°57.0	29.7	163°03.4	5.6′	25°08.5	8.5′	59.1′
18	88°57.1	N13°28.9	177°28.0	5.5′	N25°17.0	8.3′	59.1′
19	103°57.2	28.1	191°52.4	5.4′	25°25.3	8.2′	59.1′
20	118°57.4	27.3	206°16.9	5.3′	25°33.5	8.0′	59.1′
21	133°57.5	·· 26.5	220°41.2	5.3′	25°41.5	7.9′	59.1′
22	148°57.6	25.7	235°05.4	5.2′	25°49.4	7.7′	59.1′
23	163°57.8	24.9	249°29.6	5.1′	25°57.1	7.5′	59.1′
	SD = 15.8′	d = 0.8′	SD = 16.2′				

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	////	////	02:26	21:37	////	////
N 70°	////	////	02:58	21:07	23:25	////
68°	////	01:45	03:20	20:45	22:17	////
66°	////	02:22	03:38	20:28	21:42	////
64°	////	02:48	03:53	20:14	21:18	23:30
62°	01:33	03:07	04:05	20:02	20:59	22:30
60°	02:07	03:23	04:15	19:52	20:43	21:58
N 58°	02:31	03:37	04:24	19:44	20:30	21:35
56°	02:49	03:48	04:31	19:36	20:19	21:17
54°	03:04	03:58	04:38	19:30	20:10	21:02
52°	03:17	04:06	04:44	19:23	20:01	20:50
50°	03:28	04:14	04:50	19:18	19:54	20:39
45°	03:51	04:30	05:02	19:06	19:38	20:17
N 40°	04:08	04:43	05:12	18:56	19:25	20:00
35°	04:21	04:53	05:20	18:48	19:15	19:47
30°	04:32	05:02	05:27	18:41	19:06	19:36
20°	04:50	05:17	05:40	18:29	18:51	19:18
N 10°	05:04	05:29	05:51	18:18	18:39	19:05
0°	05:15	05:40	06:01	18:08	18:29	18:54
S 10°	05:25	05:49	06:11	17:58	18:20	18:44
20°	05:33	05:59	06:22	17:48	18:10	18:36
30°	05:41	06:09	06:33	17:36	18:00	18:29
35°	05:44	06:14	06:40	17:29	17:55	18:25
40°	05:48	06:20	06:48	17:21	17:49	18:21
45°	05:52	06:27	06:57	17:12	17:43	18:18
S 50°	05:56	06:34	07:08	17:02	17:36	18:14
52°	05:58	06:37	07:13	16:57	17:32	18:12
54°	05:59	06:41	07:18	16:51	17:29	18:10
56°	06:01	06:45	07:24	16:45	17:25	18:09
58°	06:03	06:49	07:31	16:39	17:21	18:07
S 60°	06:05	06:54	07:39	16:31	17:16	18:05

Lat.	Moonrise Thu	Moonrise Fri	Moonrise Sat	Moonset Thu	Moonset Fri	Moonset Sat
N 72°	18:22	▭	▭	13:50	▭	▭
N 70°	18:59	▭	▭	13:15	▭	▭
68°	19:25	18:25	▭	12:51	15:43	▭
66°	19:45	19:14	▭	12:32	14:55	▭
64°	20:02	19:46	19:10	12:17	14:24	16:59
62°	20:15	20:09	20:02	12:05	14:02	16:08
60°	20:27	20:28	20:34	11:55	13:43	15:37
N 58°	20:37	20:44	20:58	11:46	13:28	15:13
56°	20:46	20:58	21:17	11:38	13:16	14:55
54°	20:54	21:10	21:34	11:31	13:04	14:39
52°	21:01	21:20	21:48	11:24	12:55	14:25
50°	21:08	21:30	22:00	11:19	12:46	14:13
45°	21:22	21:50	22:26	11:07	12:27	13:49
N 40°	21:33	22:06	22:46	10:57	12:12	13:29
35°	21:43	22:20	23:03	10:48	12:00	13:13
30°	21:52	22:32	23:18	10:41	11:49	12:59
20°	22:07	22:53	23:44	10:28	11:30	12:35
N 10°	22:21	23:11	·· ··	10:17	11:14	12:14
0°	22:34	23:28	·· ··	10:06	10:59	11:55
S 10°	22:46	23:45	·· ··	09:56	10:44	11:36
20°	23:00	·· ··	00:04	09:45	10:28	11:16
30°	23:16	·· ··	00:25	09:33	10:10	10:52
35°	23:25	·· ··	00:38	09:25	09:59	10:39
40°	23:36	·· ··	00:53	09:17	09:47	10:23
45°	23:49	·· ··	01:10	09:08	09:33	10:04
S 50°	·· ··	00:04	01:32	08:57	09:16	09:41
52°	·· ··	00:12	01:43	08:51	09:08	09:30
54°	·· ··	00:20	01:55	08:46	08:59	09:18
56°	·· ··	00:29	02:08	08:39	08:49	09:03
58°	·· ··	00:39	02:24	08:32	08:37	08:46
S 60°	·· ··	00:51	02:44	08:24	08:24	08:26

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 21-23 75-53%
14	04:45	04:39	12:05	03:54	16:20	
15	04:33	04:27	12:04	04:46	17:13	
16	04:21	04:15	12:04	05:41	18:11	

August 17, 18, 19 UT (Sun., Mon., Tue.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	325°37.7	214°25.8	N21°20.1	139°41.0	S02°06.6	219°19.7	N22°32.1	323°47.0	S01°51.3
1	340°40.2	229°25.1	19.8	154°42.0	07.2	234°21.6	32.1	338°49.6	51.3
2	355°42.6	244°24.4	19.5	169°43.0	07.9	249°23.6	32.0	353°52.2	51.4
3	10°45.1	259°23.7	·· 19.2	184°44.1	·· 08.5	264°25.5	·· 32.0	8°54.7	·· 51.5
4	25°47.5	274°23.0	18.9	199°45.1	09.2	279°27.4	31.9	23°57.3	51.5
5	40°50.0	289°22.3	18.6	214°46.1	09.9	294°29.3	31.9	38°59.9	51.6
6	55°52.5	304°21.6	N21°18.3	229°47.1	S02°10.5	309°31.3	N22°31.8	54°02.5	S01°51.6
7	70°54.9	319°21.0	18.0	244°48.1	11.2	324°33.2	31.8	69°05.1	51.7
8	85°57.4	334°20.3	17.7	259°49.2	11.8	339°35.1	31.7	84°07.7	51.8
9	100°59.9	349°19.6	·· 17.4	274°50.2	·· 12.5	354°37.1	·· 31.7	99°10.2	·· 51.8
10	116°02.3	4°18.9	17.1	289°51.2	13.1	9°39.0	31.6	114°12.8	51.9
11	131°04.8	19°18.2	16.8	304°52.2	13.8	24°40.9	31.6	129°15.4	51.9
12	146°07.3	34°17.5	N21°16.5	319°53.2	S02°14.4	39°42.8	N22°31.5	144°18.0	S01°52.0
13	161°09.7	49°16.8	16.2	334°54.3	15.1	54°44.8	31.5	159°20.6	52.1
14	176°12.2	64°16.1	15.9	349°55.3	15.7	69°46.7	31.4	174°23.2	52.1
15	191°14.7	79°15.4	·· 15.6	4°56.3	·· 16.4	84°48.6	·· 31.4	189°25.8	·· 52.2
16	206°17.1	94°14.7	15.3	19°57.3	17.0	99°50.6	31.3	204°28.3	52.3
17	221°19.6	109°14.0	15.0	34°58.3	17.7	114°52.5	31.3	219°30.9	52.3
18	236°22.0	124°13.3	N21°14.7	49°59.3	S02°18.4	129°54.4	N22°31.2	234°33.5	S01°52.4
19	251°24.5	139°12.6	14.4	65°00.4	19.0	144°56.4	31.2	249°36.1	52.4
20	266°27.0	154°11.9	14.1	80°01.4	19.7	159°58.3	31.1	264°38.7	52.5
21	281°29.4	169°11.2	·· 13.8	95°02.4	·· 20.3	175°00.2	·· 31.1	279°41.3	·· 52.6
22	296°31.9	184°10.5	13.4	110°03.4	21.0	190°02.2	31.0	294°43.9	52.6
23	311°34.4	199°09.8	13.1	125°04.4	21.6	205°04.1	31.0	309°46.4	52.7
Mer.pass. 02:17		ν -0.7′ d 0.3′		m -3.97	ν 1.0′ d 0.7′		m 1.62	ν 1.9′ d 0.1′	m -1.95	ν 2.6′ d 0.1′	m 0.72

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	326°36.8	214°09.1	N21°12.8	140°05.5	S02°22.3	220°06.0	N22°30.9	324°49.0	S01°52.7
1	341°39.3	229°08.4	12.5	155°06.5	22.9	235°07.9	30.8	339°51.6	52.8
2	356°41.8	244°07.8	12.2	170°07.5	23.6	250°09.9	30.8	354°54.2	52.9
3	11°44.2	259°07.1	·· 11.9	185°08.5	·· 24.2	265°11.8	·· 30.7	9°56.8	·· 52.9
4	26°46.7	274°06.4	11.5	200°09.5	24.9	280°13.7	30.7	24°59.4	53.0
5	41°49.2	289°05.7	11.2	215°10.5	25.5	295°15.7	30.6	40°02.0	53.1
6	56°51.6	304°05.0	N21°10.9	230°11.6	S02°26.2	310°17.6	N22°30.6	55°04.6	S01°53.1
7	71°54.1	319°04.3	10.6	245°12.6	26.8	325°19.5	30.5	70°07.1	53.2
8	86°56.5	334°03.6	10.3	260°13.6	27.5	340°21.5	30.5	85°09.7	53.2
9	101°59.0	349°02.9	·· 09.9	275°14.6	·· 28.2	355°23.4	·· 30.4	100°12.3	·· 53.3
10	117°01.5	4°02.2	09.6	290°15.6	28.8	10°25.3	30.4	115°14.9	53.4
11	132°03.9	19°01.5	09.3	305°16.6	29.5	25°27.3	30.3	130°17.5	53.4
12	147°06.4	34°00.8	N21°09.0	320°17.7	S02°30.1	40°29.2	N22°30.3	145°20.1	S01°53.5
13	162°08.9	49°00.1	08.6	335°18.7	30.8	55°31.1	30.2	160°22.7	53.6
14	177°11.3	63°59.4	08.3	350°19.7	31.4	70°33.1	30.2	175°25.3	53.6
15	192°13.8	78°58.7	·· 08.0	5°20.7	·· 32.1	85°35.0	·· 30.1	190°27.9	·· 53.7
16	207°16.3	93°58.0	07.6	20°21.7	32.7	100°36.9	30.1	205°30.4	53.8
17	222°18.7	108°57.4	07.3	35°22.7	33.4	115°38.9	30.0	220°33.0	53.8
18	237°21.2	123°56.7	N21°07.0	50°23.8	S02°34.0	130°40.8	N22°30.0	235°35.6	S01°53.9
19	252°23.7	138°56.0	06.6	65°24.8	34.7	145°42.7	29.9	250°38.2	53.9
20	267°26.1	153°55.3	06.3	80°25.8	35.3	160°44.7	29.9	265°40.8	54.0
21	282°28.6	168°54.6	·· 06.0	95°26.8	·· 36.0	175°46.6	·· 29.8	280°43.4	·· 54.1
22	297°31.0	183°53.9	05.6	110°27.8	36.7	190°48.5	29.8	295°46.0	54.1
23	312°33.5	198°53.2	05.3	125°28.8	37.3	205°50.5	29.7	310°48.6	54.2
Mer.pass. 02:13		ν -0.7′ d 0.3′		m -3.96	ν 1.0′ d 0.7′		m 1.62	ν 1.9′ d 0.1′	m -1.95	ν 2.6′ d 0.1′	m 0.71

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	327°36.0	213°52.5	N21°04.9	140°29.8	S02°38.0	220°52.4	N22°29.6	325°51.2	S01°54.3
1	342°38.4	228°51.8	04.6	155°30.9	38.6	235°54.3	29.6	340°53.7	54.3
2	357°40.9	243°51.1	04.3	170°31.9	39.3	250°56.3	29.5	355°56.3	54.4
3	12°43.4	258°50.4	·· 03.9	185°32.9	·· 39.9	265°58.2	·· 29.5	10°58.9	·· 54.4
4	27°45.8	273°49.7	03.6	200°33.9	40.6	281°00.1	29.4	26°01.5	54.5
5	42°48.3	288°49.0	03.2	215°34.9	41.2	296°02.1	29.4	41°04.1	54.6
6	57°50.8	303°48.4	N21°02.9	230°35.9	S02°41.9	311°04.0	N22°29.3	56°06.7	S01°54.6
7	72°53.2	318°47.7	02.5	245°36.9	42.5	326°05.9	29.3	71°09.3	54.7
8	87°55.7	333°47.0	02.2	260°38.0	43.2	341°07.9	29.2	86°11.9	54.8
9	102°58.2	348°46.3	·· 01.8	275°39.0	·· 43.8	356°09.8	·· 29.2	101°14.5	·· 54.8
10	118°00.6	3°45.6	01.5	290°40.0	44.5	11°11.7	29.1	116°17.1	54.9
11	133°03.1	18°44.9	01.1	305°41.0	45.2	26°13.7	29.1	131°19.6	55.0
12	148°05.5	33°44.2	N21°00.8	320°42.0	S02°45.8	41°15.6	N22°29.0	146°22.2	S01°55.0
13	163°08.0	48°43.5	00.4	335°43.0	46.5	56°17.6	29.0	161°24.8	55.1
14	178°10.5	63°42.8	21°00.1	350°44.0	47.1	71°19.5	28.9	176°27.4	55.1
15	193°12.9	78°42.1	20°59.7	5°45.1	·· 47.8	86°21.4	·· 28.9	191°30.0	·· 55.2
16	208°15.4	93°41.4	59.4	20°46.1	48.4	101°23.4	28.8	206°32.6	55.3
17	223°17.9	108°40.8	59.0	35°47.1	49.1	116°25.3	28.8	221°35.2	55.3
18	238°20.3	123°40.1	N20°58.6	50°48.1	S02°49.7	131°27.2	N22°28.7	236°37.8	S01°55.4
19	253°22.8	138°39.4	58.3	65°49.1	50.4	146°29.2	28.6	251°40.4	55.5
20	268°25.3	153°38.7	57.9	80°50.1	51.0	161°31.1	28.6	266°43.0	55.5
21	283°27.7	168°38.0	·· 57.6	95°51.1	·· 51.7	176°33.0	·· 28.5	281°45.6	·· 55.6
22	298°30.2	183°37.3	57.2	110°52.1	52.3	191°35.0	28.5	296°48.2	55.7
23	313°32.6	198°36.6	56.8	125°53.1	53.0	206°36.9	28.4	311°50.7	55.7
Mer.pass. 02:09		ν -0.7′ d 0.3′		m -3.96	ν 1.0′ d 0.7′		m 1.62	ν 1.9′ d 0.1′	m -1.95	ν 2.6′ d 0.1′	m 0.71

Stars

	SHA	Dec
Alpheratz	357°34.0	29°13.9
Ankaa	353°06.3	-42°09.7
Schedar	349°30.1	56°40.6
Diphda	348°46.5	-17°50.5
Achernar	335°19.5	-57°06.1
Hamal	327°50.5	23°35.0
Polaris	313°43.1	89°22.0
Acamar	315°11.3	-40°11.8
Menkar	314°05.6	4°11.5
Mirfak	308°27.5	49°57.0
Aldebaran	290°39.1	16°33.7
Rigel	281°03.5	-8°10.1
Capella	280°21.3	46°01.3
Bellatrix	278°22.5	6°22.5
Elnath	278°01.4	28°37.7
Alnilam	275°37.4	-1°11.0
Betelgeuse	270°51.7	7°24.8
Canopus	263°52.5	-52°42.2
Sirius	258°26.0	-16°44.9
Adhara	255°05.8	-29°00.2
Procyon	244°50.6	5°09.7
Pollux	243°17.0	27°57.9
Avior	234°15.2	-59°35.3
Suhail	222°46.4	-43°32.0
Miaplacidus	221°39.2	-69°49.2
Alphard	217°47.6	-8°46.1
Regulus	207°34.2	11°50.6
Dubhe	193°41.0	61°36.9
Denebola	182°24.7	14°25.9
Gienah	175°43.3	-17°41.0
Acrux	173°00.1	-63°14.6
Gacrux	171°51.5	-57°15.6
Alioth	166°12.9	55°49.5
Spica	158°21.9	-11°17.7
Alkaid	152°51.8	49°11.4
Hadar	148°35.5	-60°30.0
Menkent	147°57.2	-36°29.9
Arcturus	145°47.5	19°03.1
Rigil Kent.	139°39.8	-60°56.7
Kochab	137°20.0	74°03.3
Zuben'ubi	136°55.5	-16°08.9
Alphecca	126°03.3	26°37.9
Antares	112°15.1	-26°29.4
Atria	107°08.7	-69°04.6
Sabik	102°02.1	-15°45.4
Shaula	96°09.5	-37°07.4
Rasalhague	95°57.9	12°32.6
Eltanin	90°41.6	51°29.3
Kaus Aust.	83°31.6	-34°22.4
Vega	80°32.6	38°48.6
Nunki	75°46.8	-26°15.9
Altair	61°59.2	8°56.3
Peacock	53°04.3	-56°39.2
Deneb	49°25.0	45°22.4
Enif	33°38.0	9°59.7
Al Na'ir	27°31.8	-46°50.1
Fomalhaut	15°13.6	-29°29.0
Scheat	13°44.4	28°13.4
Markab	13°29.1	15°20.7

Aug 17 Sun	**SHA**	**Mer.pass**
Venus	248°48.1	09:43
Mars	174°03.3	14:40
Jupiter	253°42.0	09:21
Saturn	358°09.3	02:24

Aug 18 Mon	**SHA**	**Mer.pass**
Venus	247°32.3	09:44
Mars	173°28.6	14:39
Jupiter	253°29.2	09:18
Saturn	358°12.2	02:20

Aug 19 Tue	**SHA**	**Mer.pass**
Venus	246°16.5	09:45
Mars	172°53.9	14:37
Jupiter	253°16.4	09:15
Saturn	358°15.2	02:16

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h

Sun	Sun		Moon				
Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°57.9	N13°24.1	263°53.7	5.0′	N26°04.6	7.3′	59.1′
1	193°58.0	23.3	278°17.7	5.0′	26°11.9	7.2′	59.1′
2	208°58.2	22.5	292°41.7	4.9′	26°19.1	7.0′	59.1′
3	223°58.3	·· 21.7	307°05.6	4.8′	26°26.1	6.8′	59.1′
4	238°58.4	20.9	321°29.4	4.8′	26°32.9	6.6′	59.1′
5	253°58.6	20.1	335°53.2	4.7′	26°39.5	6.5′	59.0′
6	268°58.7	N13°19.3	350°16.9	4.6′	N26°46.0	6.3′	59.0′
7	283°58.8	18.5	4°40.5	4.6′	26°52.3	6.1′	59.0′
8	298°59.0	17.7	19°04.1	4.5′	26°58.4	5.9′	59.0′
9	313°59.1	·· 16.9	33°27.6	4.5′	27°04.3	5.8′	59.0′
10	328°59.2	16.1	47°51.0	4.4′	27°10.1	5.6′	59.0′
11	343°59.4	15.3	62°14.4	4.3′	27°15.7	5.4′	59.0′
12	358°59.5	N13°14.5	76°37.8	4.3′	N27°21.1	5.2′	59.0′
13	13°59.7	13.7	91°01.1	4.2′	27°26.3	5.0′	59.0′
14	28°59.8	12.9	105°24.3	4.2′	27°31.3	4.8′	59.0′
15	43°59.9	·· 12.1	119°47.5	4.2′	27°36.1	4.7′	59.0′
16	59°00.1	11.2	134°10.7	4.1′	27°40.8	4.4′	58.9′
17	74°00.2	10.4	148°33.8	4.1′	27°45.2	4.3′	58.9′
18	89°00.3	N13°09.6	162°56.8	4.0′	N27°49.5	4.1′	58.9′
19	104°00.5	08.8	177°19.9	4.0′	27°53.6	3.9′	58.9′
20	119°00.6	08.0	191°42.9	4.0′	27°57.5	3.7′	58.9′
21	134°00.8	·· 07.2	206°05.8	3.9′	28°01.2	3.5′	58.9′
22	149°00.9	06.4	220°28.7	3.9′	28°04.7	3.3′	58.9′
23	164°01.0	05.6	234°51.6	3.9′	28°08.0	3.2′	58.9′
	SD = 15.8′	d = 0.8′	SD = 16.1′				

Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°01.2	N13°04.8	249°14.5	3.8′	N28°11.2	2.9′	58.9′
1	194°01.3	04.0	263°37.3	3.8′	28°14.1	2.8′	58.8′
2	209°01.4	03.2	278°00.2	3.8′	28°16.9	2.5′	58.8′
3	224°01.6	·· 02.4	292°23.0	3.8′	28°19.4	2.4′	58.8′
4	239°01.7	01.6	306°45.7	3.8′	28°21.8	2.2′	58.8′
5	254°01.9	13°00.8	321°08.5	3.8′	28°24.0	2.0′	58.8′
6	269°02.0	N12°59.9	335°31.3	3.7′	N28°26.0	1.8′	58.8′
7	284°02.1	59.1	349°54.0	3.7′	28°27.8	1.6′	58.8′
8	299°02.3	58.3	4°16.7	3.7′	28°29.4	1.4′	58.8′
9	314°02.4	·· 57.5	18°39.5	3.7′	28°30.8	1.2′	58.8′
10	329°02.6	56.7	33°02.2	3.7′	28°32.0	1.0′	58.7′
11	344°02.7	55.9	47°24.9	3.7′	28°33.0	0.9′	58.7′
12	359°02.8	N12°55.1	61°47.7	3.7′	N28°33.9	0.6′	58.7′
13	14°03.0	54.3	76°10.4	3.7′	28°34.5	0.4′	58.7′
14	29°03.1	53.5	90°33.1	3.8′	28°34.9	0.3′	58.7′
15	44°03.3	·· 52.6	104°55.9	3.8′	28°35.2	0.0′	58.7′
16	59°03.4	51.8	119°18.6	3.8′	28°35.2	0.1′	58.7′
17	74°03.6	51.0	133°41.4	3.8′	28°35.1	0.3′	58.7′
18	89°03.7	N12°50.2	148°04.2	3.8′	N28°34.8	0.5′	58.6′
19	104°03.8	49.4	162°27.0	3.8′	28°34.3	0.8′	58.6′
20	119°04.0	48.6	176°49.9	3.9′	28°33.5	0.9′	58.6′
21	134°04.1	·· 47.8	191°12.8	3.9′	28°32.6	1.1′	58.6′
22	149°04.3	46.9	205°35.6	3.9′	28°31.5	1.2′	58.6′
23	164°04.4	46.1	219°58.6	4.0′	28°30.3	1.5′	58.6′
	SD = 15.8′	d = 0.8′	SD = 16.1′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°04.6	N12°45.3	234°21.5	4.0′	N28°28.8	1.7′	58.6′
1	194°04.7	44.5	248°44.5	4.0′	28°27.1	1.8′	58.5′
2	209°04.8	43.7	263°07.6	4.1′	28°25.3	2.1′	58.5′
3	224°05.0	·· 42.9	277°30.6	4.1′	28°23.2	2.2′	58.5′
4	239°05.1	42.0	291°53.7	4.2′	28°21.0	2.4′	58.5′
5	254°05.3	41.2	306°16.9	4.2′	28°18.6	2.6′	58.5′
6	269°05.4	N12°40.4	320°40.1	4.3′	N28°16.0	2.8′	58.5′
7	284°05.6	39.6	335°03.4	4.3′	28°13.2	3.0′	58.5′
8	299°05.7	38.8	349°26.7	4.4′	28°10.2	3.2′	58.4′
9	314°05.9	·· 37.9	3°50.0	4.4′	28°07.0	3.3′	58.4′
10	329°06.0	37.1	18°13.4	4.5′	28°03.7	3.5′	58.4′
11	344°06.1	36.3	32°36.9	4.5′	28°00.2	3.7′	58.4′
12	359°06.3	N12°35.5	47°00.5	4.6′	N27°56.5	3.9′	58.4′
13	14°06.4	34.7	61°24.1	4.7′	27°52.6	4.1′	58.4′
14	29°06.6	33.8	75°47.7	4.7′	27°48.5	4.2′	58.4′
15	44°06.7	·· 33.0	90°11.5	4.8′	27°44.3	4.4′	58.3′
16	59°06.9	32.2	104°35.3	4.9′	27°39.9	4.6′	58.3′
17	74°07.0	31.4	118°59.1	4.9′	27°35.3	4.8′	58.3′
18	89°07.2	N12°30.6	133°23.1	5.0′	N27°30.5	5.0′	58.3′
19	104°07.3	29.7	147°47.1	5.1′	27°25.5	5.1′	58.3′
20	119°07.5	28.9	162°11.2	5.2′	27°20.4	5.3′	58.3′
21	134°07.6	·· 28.1	176°35.4	5.3′	27°15.1	5.4′	58.2′
22	149°07.8	27.3	190°59.7	5.3′	27°09.7	5.7′	58.2′
23	164°07.9	26.4	205°24.0	5.4′	27°04.0	5.8′	58.2′
	SD = 15.8′	d = 0.8′	SD = 16.0′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	////	////	02:46	21:17	////	////
N 70°	////	01:16	03:13	20:51	22:41	////
68°	////	02:07	03:33	20:32	21:56	////
66°	////	02:37	03:49	20:16	21:26	////
64°	01:07	03:00	04:02	20:04	21:05	22:52
62°	01:52	03:18	04:13	19:53	20:48	22:11
60°	02:20	03:32	04:22	19:44	20:33	21:44
N 58°	02:41	03:44	04:30	19:36	20:22	21:24
56°	02:58	03:55	04:37	19:29	20:11	21:07
54°	03:12	04:04	04:44	19:23	20:02	20:54
52°	03:24	04:12	04:49	19:17	19:55	20:42
50°	03:34	04:19	04:54	19:12	19:48	20:32
45°	03:55	04:34	05:05	19:01	19:33	20:11
N 40°	04:11	04:46	05:15	18:52	19:21	19:56
35°	04:24	04:56	05:22	18:45	19:11	19:43
30°	04:35	05:04	05:29	18:38	19:03	19:32
20°	04:51	05:18	05:41	18:26	18:49	19:16
N 10°	05:04	05:29	05:51	18:16	18:38	19:03
0°	05:15	05:39	06:00	18:07	18:28	18:53
S 10°	05:23	05:48	06:10	17:58	18:19	18:44
20°	05:31	05:57	06:19	17:48	18:11	18:37
30°	05:38	06:06	06:31	17:37	18:02	18:30
35°	05:41	06:11	06:37	17:31	17:57	18:27
40°	05:44	06:16	06:44	17:24	17:52	18:24
45°	05:48	06:22	06:52	17:16	17:46	18:21
S 50°	05:51	06:29	07:02	17:06	17:40	18:18
52°	05:52	06:32	07:07	17:02	17:37	18:16
54°	05:54	06:35	07:12	16:57	17:34	18:15
56°	05:55	06:38	07:17	16:51	17:30	18:14
58°	05:56	06:42	07:24	16:45	17:26	18:12
S 60°	05:58	06:47	07:31	16:38	17:22	18:11

Lat.	**Moonrise** Sun	Mon	Tue	**Moonset** Sun	Mon	Tue
N 72°						
N 70°						
68°						
66°						
64°						
62°	19:43		22:24	18:34		20:12
60°	20:50	21:39	23:13	17:27	18:48	19:22
N 58°	21:25	22:19	23:44	16:52	18:08	18:51
56°	21:51	22:47	·· ··	16:27	17:40	18:28
54°	22:11	23:09	·· ··	16:07	17:19	18:08
52°	22:28	23:27	·· ··	15:50	17:01	17:52
50°	22:43	23:42	·· ··	15:35	16:45	17:38
45°	23:13	·· ··	00:13	15:06	16:14	17:09
N 40°	23:36	·· ··	00:37	14:43	15:50	16:47
35°	23:56	·· ··	00:57	14:24	15:30	16:28
30°	·· ··	00:12	01:13	14:08	15:13	16:12
20°	·· ··	00:40	01:42	13:41	14:45	15:44
N 10°	00:06	01:05	02:07	13:17	14:20	15:21
0°	00:26	01:27	02:29	12:55	13:57	14:59
S 10°	00:47	01:50	02:52	12:33	13:34	14:36
20°	01:09	02:15	03:17	12:10	13:09	14:12
30°	01:35	02:43	03:45	11:43	12:40	13:44
35°	01:51	03:00	04:02	11:26	12:23	13:28
40°	02:09	03:20	04:22	11:08	12:03	13:08
45°	02:30	03:44	04:46	10:45	11:39	12:45
S 50°	02:58	04:15	05:17	10:17	11:08	12:15
52°	03:12	04:31	05:32	10:03	10:52	12:00
54°	03:27	04:49	05:50	09:47	10:34	11:42
56°	03:46	05:11	06:11	09:28	10:11	11:21
58°	04:09	05:40	06:38	09:05	09:43	10:54
S 60°	04:39	06:22	07:17	08:34	09:01	10:15

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 24-26 41-20%
17	04:08	04:02	12:04	06:41	19:11	
18	03:55	03:49	12:04	07:42	20:13	
19	03:42	03:35	12:04	08:44	21:14	

August 20, 21, 22 UT (Wed., Thu., Fri.)

	Aries	Venus		Mars		Jupiter		Saturn	
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	328°35.1	213°35.9	N20°56.5	140°54.2	S02°53.7	221°38.9	N22°28.4	326°53.3	S01°55.8
1	343°37.6	228°35.2	56.1	155°55.2	54.3	236°40.8	28.3	341°55.9	55.9
2	358°40.0	243°34.5	55.7	170°56.2	55.0	251°42.7	28.3	356°58.5	55.9
3	13°42.5	258°33.9	·· 55.4	185°57.2	·· 55.6	266°44.7	·· 28.2	12°01.1	·· 56.0
4	28°45.0	273°33.2	55.0	200°58.2	56.3	281°46.6	28.2	27°03.7	56.0
5	43°47.4	288°32.5	54.6	215°59.2	56.9	296°48.6	28.1	42°06.3	56.1
6	58°49.9	303°31.8	N20°54.3	231°00.2	S02°57.6	311°50.5	N22°28.1	57°08.9	S01°56.2
7	73°52.4	318°31.1	53.9	246°01.2	58.2	326°52.4	28.0	72°11.5	56.2
8	88°54.8	333°30.4	53.5	261°02.2	58.9	341°54.4	28.0	87°14.1	56.3
9	103°57.3	348°29.7	·· 53.2	276°03.3	02°59.5	356°56.3	·· 27.9	102°16.7	·· 56.4
10	118°59.8	3°29.0	52.8	291°04.3	03°00.2	11°58.2	27.9	117°19.3	56.4
11	134°02.2	18°28.3	52.4	306°05.3	00.9	27°00.2	27.8	132°21.9	56.5
12	149°04.7	33°27.7	N20°52.0	321°06.3	S03°01.5	42°02.1	N22°27.8	147°24.5	S01°56.6
13	164°07.1	48°27.0	51.6	336°07.3	02.2	57°04.1	27.7	162°27.0	56.6
14	179°09.6	63°26.3	51.3	351°08.3	02.8	72°06.0	27.6	177°29.6	56.7
15	194°12.1	78°25.6	·· 50.9	6°09.3	·· 03.5	87°07.9	·· 27.6	192°32.2	·· 56.8
16	209°14.5	93°24.9	50.5	21°10.3	04.1	102°09.9	27.5	207°34.8	56.8
17	224°17.0	108°24.2	50.1	36°11.3	04.8	117°11.8	27.5	222°37.4	56.9
18	239°19.5	123°23.5	N20°49.7	51°12.3	S03°05.4	132°13.8	N22°27.4	237°40.0	S01°57.0
19	254°21.9	138°22.8	49.4	66°13.4	06.1	147°15.7	27.4	252°42.6	57.0
20	269°24.4	153°22.2	49.0	81°14.4	06.7	162°17.6	27.3	267°45.2	57.1
21	284°26.9	168°21.5	·· 48.6	96°15.4	·· 07.4	177°19.6	·· 27.3	282°47.8	·· 57.1
22	299°29.3	183°20.8	48.2	111°16.4	08.0	192°21.5	27.2	297°50.4	57.2
23	314°31.8	198°20.1	47.8	126°17.4	08.7	207°23.5	27.2	312°53.0	57.3
Mer.pass. 02:05		ν -0.7′	d 0.4′	m -3.96	ν 1.0′	d 0.7′	m 1.62	ν 1.9′	d 0.1′ m -1.96	ν 2.6′	d 0.1′ m 0.71

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	329°34.3	213°19.4	N20°47.4	141°18.4	S03°09.4	222°25.4	N22°27.1	327°55.6	S01°57.3
1	344°36.7	228°18.7	47.0	156°19.4	10.0	237°27.3	27.1	342°58.2	57.4
2	359°39.2	243°18.0	46.6	171°20.4	10.7	252°29.3	27.0	358°00.8	57.5
3	14°41.6	258°17.3	·· 46.2	186°21.4	·· 11.3	267°31.2	·· 27.0	13°03.4	·· 57.5
4	29°44.1	273°16.7	45.9	201°22.4	12.0	282°33.2	26.9	28°06.0	57.6
5	44°46.6	288°16.0	45.5	216°23.4	12.6	297°35.1	26.9	43°08.6	57.7
6	59°49.0	303°15.3	N20°45.1	231°24.4	S03°13.3	312°37.1	N22°26.8	58°11.2	S01°57.7
7	74°51.5	318°14.6	44.7	246°25.4	13.9	327°39.0	26.7	73°13.8	57.8
8	89°54.0	333°13.9	44.3	261°26.5	14.6	342°40.9	26.7	88°16.4	57.9
9	104°56.4	348°13.2	·· 43.9	276°27.5	·· 15.2	357°42.9	·· 26.6	103°19.0	·· 57.9
10	119°58.9	3°12.5	43.5	291°28.5	15.9	12°44.8	26.6	118°21.5	58.0
11	135°01.4	18°11.9	43.1	306°29.5	16.6	27°46.8	26.5	133°24.1	58.1
12	150°03.8	33°11.2	N20°42.7	321°30.5	S03°17.2	42°48.7	N22°26.5	148°26.7	S01°58.1
13	165°06.3	48°10.5	42.3	336°31.5	17.9	57°50.7	26.4	163°29.3	58.2
14	180°08.8	63°09.8	41.9	351°32.5	18.5	72°52.6	26.4	178°31.9	58.3
15	195°11.2	78°09.1	·· 41.5	6°33.5	·· 19.2	87°54.5	·· 26.3	193°34.5	·· 58.3
16	210°13.7	93°08.4	41.1	21°34.5	19.8	102°56.5	26.3	208°37.1	58.4
17	225°16.1	108°07.7	40.7	36°35.5	20.5	117°58.4	26.2	223°39.7	58.5
18	240°18.6	123°07.1	N20°40.2	51°36.5	S03°21.1	133°00.4	N22°26.2	238°42.3	S01°58.5
19	255°21.1	138°06.4	39.8	66°37.5	21.8	148°02.3	26.1	253°44.9	58.6
20	270°23.5	153°05.7	39.4	81°38.5	22.4	163°04.3	26.1	268°47.5	58.7
21	285°26.0	168°05.0	·· 39.0	96°39.5	·· 23.1	178°06.2	·· 26.0	283°50.1	·· 58.7
22	300°28.5	183°04.3	38.6	111°40.5	23.8	193°08.1	25.9	298°52.7	58.8
23	315°30.9	198°03.6	38.2	126°41.5	24.4	208°10.1	25.9	313°55.3	58.9
Mer.pass. 02:01		ν -0.7′	d 0.4′	m -3.96	ν 1.0′	d 0.7′	m 1.62	ν 1.9′	d 0.1′ m -1.96	ν 2.6′	d 0.1′ m 0.70

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	330°33.4	213°03.0	N20°37.8	141°42.5	S03°25.1	223°12.0	N22°25.8	328°57.9	S01°58.9
1	345°35.9	228°02.3	37.4	156°43.6	25.7	238°14.0	25.8	344°00.5	59.0
2	0°38.3	243°01.6	37.0	171°44.6	26.4	253°15.9	25.7	359°03.1	59.1
3	15°40.8	258°00.9	·· 36.5	186°45.6	·· 27.0	268°17.9	·· 25.7	14°05.7	·· 59.1
4	30°43.2	273°00.2	36.1	201°46.6	27.7	283°19.8	25.6	29°08.3	59.2
5	45°45.7	287°59.5	35.7	216°47.6	28.3	298°21.8	25.6	44°10.9	59.3
6	60°48.2	302°58.9	N20°35.3	231°48.6	S03°29.0	313°23.7	N22°25.5	59°13.5	S01°59.3
7	75°50.6	317°58.2	34.9	246°49.6	29.6	328°25.6	25.5	74°16.1	59.4
8	90°53.1	332°57.5	34.4	261°50.6	30.3	343°27.6	25.4	89°18.7	59.5
9	105°55.6	347°56.8	·· 34.0	276°51.6	·· 30.9	358°29.5	·· 25.4	104°21.3	·· 59.5
10	120°58.0	2°56.1	33.6	291°52.6	31.6	13°31.5	25.3	119°23.9	59.6
11	136°00.5	17°55.5	33.2	306°53.6	32.3	28°33.4	25.3	134°26.5	59.7
12	151°03.0	32°54.8	N20°32.7	321°54.6	S03°32.9	43°35.4	N22°25.2	149°29.1	S01°59.7
13	166°05.4	47°54.1	32.3	336°55.6	33.6	58°37.3	25.1	164°31.7	59.8
14	181°07.9	62°53.4	31.9	351°56.6	34.2	73°39.3	25.1	179°34.3	59.9
15	196°10.4	77°52.7	·· 31.5	6°57.6	·· 34.9	88°41.2	·· 25.0	194°36.9	01°59.9
16	211°12.8	92°52.0	31.0	21°58.6	35.5	103°43.2	25.0	209°39.5	02°00.0
17	226°15.3	107°51.4	30.6	36°59.6	36.2	118°45.1	24.9	224°42.1	00.1
18	241°17.7	122°50.7	N20°30.2	52°00.6	S03°36.8	133°47.1	N22°24.9	239°44.7	S02°00.1
19	256°20.2	137°50.0	29.7	67°01.6	37.5	148°49.0	24.8	254°47.3	00.2
20	271°22.7	152°49.3	29.3	82°02.6	38.1	163°51.0	24.8	269°49.9	00.3
21	286°25.1	167°48.6	·· 28.9	97°03.6	·· 38.8	178°52.9	·· 24.7	284°52.5	·· 00.3
22	301°27.6	182°48.0	28.4	112°04.6	39.5	193°54.8	24.7	299°55.1	00.4
23	316°30.1	197°47.3	28.0	127°05.6	40.1	208°56.8	24.6	314°57.7	00.5
Mer.pass. 01:57		ν -0.7′	d 0.4′	m -3.96	ν 1.0′	d 0.7′	m 1.62	ν 1.9′	d 0.1′ m -1.96	ν 2.6′	d 0.1′ m 0.70

Stars

	SHA	Dec
Alpheratz	357°33.9	29°14.0
Ankaa	353°06.3	-42°09.7
Schedar	349°30.1	56°40.6
Diphda	348°46.5	-17°50.5
Achernar	335°19.5	-57°06.1
Hamal	327°50.5	23°35.0
Polaris	313°41.3	89°22.0
Acamar	315°11.3	-40°11.8
Menkar	314°05.5	4°11.5
Mirfak	308°27.5	49°57.0
Aldebaran	290°39.1	16°33.7
Rigel	281°03.5	-8°10.1
Capella	280°21.3	46°01.3
Bellatrix	278°22.5	6°22.5
Elnath	278°01.4	28°37.7
Alnilam	275°37.3	-1°11.0
Betelgeuse	270°51.7	7°24.8
Canopus	263°52.5	-52°42.2
Sirius	258°26.0	-16°44.9
Adhara	255°05.7	-29°00.2
Procyon	244°50.6	5°09.7
Pollux	243°17.0	27°57.9
Avior	234°15.1	-59°35.3
Suhail	222°46.4	-43°32.0
Miaplacidus	221°39.1	-69°49.2
Alphard	217°47.6	-8°46.1
Regulus	207°34.2	11°50.6
Dubhe	193°41.0	61°36.9
Denebola	182°24.7	14°25.8
Gienah	175°43.3	-17°41.0
Acrux	173°00.1	-63°14.6
Gacrux	171°51.5	-57°15.6
Alioth	166°12.9	55°49.5
Spica	158°21.9	-11°17.7
Alkaid	152°51.8	49°11.3
Hadar	148°35.6	-60°30.0
Menkent	147°57.2	-36°29.9
Arcturus	145°47.6	19°03.1
Rigil Kent.	139°39.8	-60°56.7
Kochab	137°20.0	74°03.2
Zuben'ubi	136°55.5	-16°08.9
Alphecca	126°03.3	26°37.9
Antares	112°15.1	-26°29.4
Atria	107°08.7	-69°04.6
Sabik	102°02.1	-15°45.4
Shaula	96°09.5	-37°07.4
Rasalhague	95°57.9	12°32.6
Eltanin	90°41.7	51°29.3
Kaus Aust.	83°31.6	-34°22.4
Vega	80°32.6	38°48.6
Nunki	75°46.8	-26°15.9
Altair	61°59.2	8°56.3
Peacock	53°04.3	-56°39.2
Deneb	49°25.0	45°22.4
Enif	33°38.0	9°59.7
Al Na'ir	27°31.8	-46°50.1
Fomalhaut	15°13.6	-29°29.0
Scheat	13°44.4	28°13.4
Markab	13°29.1	15°20.7

Aug 20 Wed	SHA	Mer.pass
Venus	245°00.8	09:46
Mars	172°19.0	14:35
Jupiter	253°03.7	09:12
Saturn	358°18.2	02:12

Aug 21 Thu	SHA	Mer.pass
Venus	243°45.2	09:47
Mars	171°44.1	14:34
Jupiter	252°51.2	09:09
Saturn	358°21.3	02:08

Aug 22 Fri	SHA	Mer.pass
Venus	242°29.6	09:48
Mars	171°09.2	14:32
Jupiter	252°38.6	09:06
Saturn	358°24.5	02:04

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.0768 sec ΔT = TT-UT1 = +69.1072 sec

2025 August 20 to Aug. 22 UT

h	Sun		Moon				
Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°08.1	N12°25.6	219°48.4	5.5′	N26°58.2	6.0′	58.2′
1	194°08.2	24.8	234°12.9	5.6′	26°52.2	6.1′	58.2′
2	209°08.4	24.0	248°37.5	5.7′	26°46.1	6.3′	58.2′
3	224°08.5	·· 23.1	263°02.2	5.8′	26°39.8	6.4′	58.1′
4	239°08.7	22.3	277°27.0	5.9′	26°33.4	6.7′	58.1′
5	254°08.8	21.5	291°51.8	6.0′	26°26.7	6.8′	58.1′
6	269°09.0	N12°20.7	306°16.8	6.1′	N26°19.9	6.9′	58.1′
7	284°09.1	19.8	320°41.9	6.1′	26°13.0	7.1′	58.1′
8	299°09.3	19.0	335°07.0	6.2′	26°05.9	7.2′	58.1′
9	314°09.4	·· 18.2	349°32.2	6.3′	25°58.7	7.5′	58.0′
10	329°09.6	17.4	3°57.6	6.4′	25°51.2	7.5′	58.0′
11	344°09.7	16.5	18°23.0	6.5′	25°43.7	7.7′	58.0′
12	359°09.9	N12°15.7	32°48.6	6.6′	N25°36.0	7.9′	58.0′
13	14°10.0	14.9	47°14.2	6.7′	25°28.1	8.0′	58.0′
14	29°10.2	14.0	61°39.9	6.8′	25°20.1	8.2′	58.0′
15	44°10.3	·· 13.2	76°05.8	6.9′	25°11.9	8.3′	57.9′
16	59°10.5	12.4	90°31.7	7.0′	25°03.6	8.4′	57.9′
17	74°10.6	11.6	104°57.8	7.2′	24°55.2	8.6′	57.9′
18	89°10.8	N12°10.7	119°23.9	7.3′	N24°46.6	8.7′	57.9′
19	104°10.9	09.9	133°50.2	7.4′	24°37.9	8.9′	57.9′
20	119°11.1	09.1	148°16.6	7.5′	24°29.0	9.0′	57.8′
21	134°11.2	·· 08.2	162°43.0	7.6′	24°20.0	9.2′	57.8′
22	149°11.4	07.4	177°09.6	7.7′	24°10.8	9.2′	57.8′
23	164°11.5	06.6	191°36.3	7.8′	24°01.6	9.5′	57.8′
	SD = 15.8′	d = 0.8′	SD = 15.9′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°11.7	N12°05.7	206°03.1	7.9′	N23°52.1	9.5′	57.8′
1	194°11.8	04.9	220°30.0	8.0′	23°42.6	9.7′	57.7′
2	209°12.0	04.1	234°57.0	8.1′	23°32.9	9.8′	57.7′
3	224°12.1	·· 03.2	249°24.1	8.2′	23°23.1	9.9′	57.7′
4	239°12.3	02.4	263°51.4	8.3′	23°13.2	10.0′	57.7′
5	254°12.4	01.6	278°18.7	8.5′	23°03.2	10.2′	57.7′
6	269°12.6	N12°00.7	292°46.2	8.6′	N22°53.0	10.3′	57.6′
7	284°12.8	11°59.9	307°13.7	8.7′	22°42.7	10.4′	57.6′
8	299°12.9	59.1	321°41.4	8.8′	22°32.3	10.5′	57.6′
9	314°13.1	·· 58.2	336°09.2	8.9′	22°21.8	10.7′	57.6′
10	329°13.2	57.4	350°37.1	9.0′	22°11.1	10.7′	57.6′
11	344°13.4	56.6	5°05.1	9.1′	22°00.4	10.9′	57.5′
12	359°13.5	N11°55.7	19°33.2	9.2′	N21°49.5	11.0′	57.5′
13	14°13.7	54.9	34°01.4	9.3′	21°38.5	11.1′	57.5′
14	29°13.8	54.0	48°29.8	9.4′	21°27.4	11.2′	57.5′
15	44°14.0	·· 53.2	62°58.2	9.6′	21°16.2	11.3′	57.5′
16	59°14.2	52.4	77°26.8	9.7′	21°04.9	11.4′	57.4′
17	74°14.3	51.5	91°55.4	9.8′	20°53.5	11.5′	57.4′
18	89°14.5	N11°50.7	106°24.2	9.9′	N20°42.0	11.6′	57.4′
19	104°14.6	49.9	120°53.1	10.0′	20°30.4	11.7′	57.4′
20	119°14.8	49.0	135°22.1	10.1′	20°18.7	11.9′	57.4′
21	134°14.9	·· 48.2	149°51.2	10.2′	20°06.8	11.9′	57.3′
22	149°15.1	47.3	164°20.4	10.3′	19°54.9	12.0′	57.3′
23	164°15.3	46.5	178°49.7	10.4′	19°42.9	12.1′	57.3′
	SD = 15.8′	d = 0.8′	SD = 15.8′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°15.4	N11°45.7	193°19.1	10.5′	N19°30.8	12.1′	57.3′
1	194°15.6	44.8	207°48.6	10.6′	19°18.7	12.3′	57.2′
2	209°15.7	44.0	222°18.3	10.7′	19°06.4	12.4′	57.2′
3	224°15.9	·· 43.1	236°48.0	10.8′	18°54.0	12.4′	57.2′
4	239°16.0	42.3	251°17.8	10.9′	18°41.6	12.6′	57.2′
5	254°16.2	41.4	265°47.8	11.1′	18°29.0	12.6′	57.2′
6	269°16.4	N11°40.6	280°17.8	11.2′	N18°16.4	12.7′	57.1′
7	284°16.5	39.8	294°48.0	11.3′	18°03.7	12.7′	57.1′
8	299°16.7	38.9	309°18.2	11.4′	17°51.0	12.9′	57.1′
9	314°16.8	·· 38.1	323°48.6	11.5′	17°38.1	12.9′	57.1′
10	329°17.0	37.2	338°19.1	11.6′	17°25.2	13.0′	57.0′
11	344°17.2	36.4	352°49.6	11.7′	17°12.2	13.1′	57.0′
12	359°17.3	N11°35.5	7°20.3	11.8′	N16°59.1	13.2′	57.0′
13	14°17.5	34.7	21°51.0	11.9′	16°45.9	13.2′	57.0′
14	29°17.6	33.9	36°21.9	11.9′	16°32.7	13.3′	57.0′
15	44°17.8	·· 33.0	50°52.8	12.0′	16°19.4	13.3′	56.9′
16	59°18.0	32.2	65°23.9	12.1′	16°06.1	13.5′	56.9′
17	74°18.1	31.3	79°55.0	12.2′	15°52.6	13.5′	56.9′
18	89°18.3	N11°30.5	94°26.2	12.3′	N15°39.1	13.5′	56.9′
19	104°18.5	29.6	108°57.6	12.4′	15°25.6	13.6′	56.8′
20	119°18.6	28.8	123°29.0	12.5′	15°12.0	13.7′	56.8′
21	134°18.8	·· 27.9	138°00.5	12.6′	14°58.3	13.7′	56.8′
22	149°18.9	27.1	152°32.1	12.7′	14°44.6	13.8′	56.8′
23	164°19.1	26.2	167°03.8	12.8′	14°30.8	13.9′	56.7′
	SD = 15.8′	d = 0.8′	SD = 15.6′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	////	////	03:04	20:58	23:25	////
N 70°	////	01:47	03:27	20:36	22:12	////
68°	////	02:25	03:45	20:18	21:36	////
66°	////	02:51	03:59	20:05	21:11	23:30
64°	01:33	03:11	04:11	19:53	20:52	22:26
62°	02:08	03:27	04:21	19:44	20:36	21:54
60°	02:33	03:40	04:29	19:35	20:24	21:30
N 58°	02:51	03:52	04:37	19:28	20:13	21:12
56°	03:07	04:01	04:43	19:22	20:03	20:57
54°	03:19	04:10	04:49	19:16	19:55	20:45
52°	03:30	04:17	04:54	19:11	19:48	20:34
50°	03:40	04:24	04:59	19:06	19:41	20:25
45°	03:59	04:38	05:09	18:56	19:28	20:06
N 40°	04:15	04:49	05:17	18:48	19:16	19:51
35°	04:27	04:58	05:25	18:41	19:07	19:39
30°	04:37	05:06	05:31	18:35	19:00	19:29
20°	04:52	05:19	05:42	18:24	18:47	19:13
N 10°	05:04	05:30	05:51	18:15	18:36	19:02
0°	05:14	05:39	06:00	18:06	18:28	18:52
S 10°	05:22	05:47	06:08	17:58	18:19	18:44
20°	05:29	05:55	06:17	17:49	18:12	18:37
30°	05:35	06:03	06:27	17:39	18:04	18:32
35°	05:38	06:07	06:33	17:33	17:59	18:29
40°	05:40	06:12	06:40	17:27	17:55	18:26
45°	05:43	06:17	06:47	17:19	17:50	18:24
S 50°	05:46	06:23	06:56	17:11	17:44	18:22
52°	05:46	06:26	07:01	17:06	17:41	18:21
54°	05:47	06:29	07:05	17:02	17:38	18:20
56°	05:48	06:32	07:10	16:57	17:35	18:19
58°	05:49	06:35	07:16	16:51	17:32	18:18
S 60°	05:50	06:39	07:22	16:45	17:29	18:17

Lat.	**Moonrise** Wed	Thu	Fri	**Moonset** Wed	Thu	Fri
N 72°	▭	▭	▭	▭	▭	21:25
N 70°	▭	▭	00:07	▭	22:23	20:55
68°	▭	▭	01:12	▭	21:17	20:33
66°	▭	▭	01:47	▭	20:40	20:15
64°	23:58	·· ··	02:12	20:38	20:14	20:00
62°	·· ··	00:36	02:32	20:00	19:53	19:48
60°	·· ··	01:02	02:48	19:33	19:37	19:37
N 58°	·· ··	01:22	03:01	19:12	19:22	19:28
56°	00:07	01:39	03:13	18:54	19:10	19:20
54°	00:26	01:54	03:23	18:40	18:59	19:13
52°	00:42	02:06	03:32	18:27	18:50	19:06
50°	00:56	02:17	03:40	18:15	18:41	19:00
45°	01:24	02:40	03:56	17:51	18:23	18:47
N 40°	01:46	02:58	04:10	17:32	18:08	18:37
35°	02:04	03:13	04:22	17:16	17:55	18:27
30°	02:19	03:26	04:32	17:02	17:44	18:19
20°	02:46	03:49	04:49	16:38	17:24	18:05
N 10°	03:09	04:08	05:04	16:17	17:07	17:53
0°	03:30	04:26	05:18	15:57	16:51	17:41
S 10°	03:51	04:44	05:32	15:37	16:35	17:29
20°	04:13	05:03	05:47	15:16	16:18	17:17
30°	04:39	05:25	06:03	14:51	15:58	17:02
35°	04:55	05:38	06:13	14:37	15:46	16:53
40°	05:12	05:53	06:24	14:20	15:33	16:44
45°	05:34	06:10	06:37	13:59	15:16	16:32
S 50°	06:01	06:31	06:53	13:33	14:56	16:18
52°	06:14	06:41	07:00	13:21	14:47	16:11
54°	06:29	06:53	07:09	13:06	14:36	16:04
56°	06:46	07:06	07:18	12:49	14:24	15:56
58°	07:07	07:21	07:28	12:29	14:09	15:46
S 60°	07:34	07:39	07:40	12:02	13:52	15:36

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 27-29 12-2%
20	03:28	03:21	12:03	09:44	22:12	
21	03:13	03:06	12:03	10:39	23:05	
22	02:58	02:51	12:03	11:30	23:53	

August 23, 24, 25 UT (Sat., Sun., Mon.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	331°32.5	212°46.6	N20°27.6	142°06.6	S03°40.8	223°58.7	N22°24.6	330°00.3	S02°00.5
1	346°35.0	227°45.9	27.1	157°07.6	41.4	239°00.7	24.5	345°02.9	00.6
2	1°37.5	242°45.2	26.7	172°08.6	42.1	254°02.6	24.4	0°05.5	00.7
3	16°39.9	257°44.6	·· 26.2	187°09.6	·· 42.7	269°04.6	·· 24.4	15°08.1	·· 00.7
4	31°42.4	272°43.9	25.8	202°10.6	43.4	284°06.5	24.3	30°10.7	00.8
5	46°44.9	287°43.2	25.4	217°11.6	44.0	299°08.5	24.3	45°13.3	00.9
6	61°47.3	302°42.5	N20°24.9	232°12.6	S03°44.7	314°10.4	N22°24.2	60°15.9	S02°00.9
7	76°49.8	317°41.9	24.5	247°13.6	45.3	329°12.4	24.2	75°18.5	01.0
8	91°52.2	332°41.2	24.0	262°14.6	46.0	344°14.3	24.1	90°21.1	01.1
9	106°54.7	347°40.5	·· 23.6	277°15.6	·· 46.7	359°16.3	·· 24.1	105°23.7	·· 01.1
10	121°57.2	2°39.8	23.1	292°16.6	47.3	14°18.2	24.0	120°26.3	01.2
11	136°59.6	17°39.1	22.7	307°17.6	48.0	29°20.2	24.0	135°28.9	01.3
12	152°02.1	32°38.5	N20°22.2	322°18.6	S03°48.6	44°22.1	N22°23.9	150°31.5	S02°01.3
13	167°04.6	47°37.8	21.8	337°19.6	49.3	59°24.1	23.9	165°34.1	01.4
14	182°07.0	62°37.1	21.3	352°20.6	49.9	74°26.0	23.8	180°36.7	01.5
15	197°09.5	77°36.4	·· 20.9	7°21.6	·· 50.6	89°28.0	·· 23.8	195°39.3	·· 01.5
16	212°12.0	92°35.8	20.4	22°22.6	51.2	104°29.9	23.7	210°41.9	01.6
17	227°14.4	107°35.1	20.0	37°23.6	51.9	119°31.9	23.6	225°44.5	01.7
18	242°16.9	122°34.4	N20°19.5	52°24.6	S03°52.5	134°33.8	N22°23.6	240°47.1	S02°01.8
19	257°19.3	137°33.7	19.0	67°25.6	53.2	149°35.8	23.5	255°49.7	01.8
20	272°21.8	152°33.0	18.6	82°26.6	53.8	164°37.7	23.5	270°52.3	01.9
21	287°24.3	167°32.4	·· 18.1	97°27.6	·· 54.5	179°39.7	·· 23.4	285°54.9	·· 02.0
22	302°26.7	182°31.7	17.7	112°28.6	55.2	194°41.6	23.4	300°57.5	02.0
23	317°29.2	197°31.0	17.2	127°29.6	55.8	209°43.6	23.3	316°00.1	02.1
Mer.pass. 01:54		ν -0.7′	d 0.4′	ν 1.0′	d 0.7′	ν 1.9′	d 0.1′	ν 2.6′	d 0.1′
		m -3.96		m 1.62		m -1.96		m 0.69	

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	332°31.7	212°30.3	N20°16.8	142°30.6	S03°56.5	224°45.5	N22°23.3	331°02.7	S02°02.2
1	347°34.1	227°29.7	16.3	157°31.6	57.1	239°47.5	23.2	346°05.3	02.2
2	2°36.6	242°29.0	15.8	172°32.6	57.8	254°49.4	23.2	1°07.9	02.3
3	17°39.1	257°28.3	·· 15.4	187°33.6	·· 58.4	269°51.4	·· 23.1	16°10.5	·· 02.4
4	32°41.5	272°27.6	14.9	202°34.6	59.1	284°53.3	23.1	31°13.1	02.4
5	47°44.0	287°27.0	14.4	217°35.6	03°59.7	299°55.3	23.0	46°15.7	02.5
6	62°46.5	302°26.3	N20°14.0	232°36.6	S04°00.4	314°57.3	N22°22.9	61°18.4	S02°02.6
7	77°48.9	317°25.6	13.5	247°37.6	01.0	329°59.2	22.9	76°21.0	02.6
8	92°51.4	332°25.0	13.0	262°38.6	01.7	345°01.2	22.8	91°23.6	02.7
9	107°53.8	347°24.3	·· 12.6	277°39.6	·· 02.4	0°03.1	·· 22.8	106°26.2	·· 02.8
10	122°56.3	2°23.6	12.1	292°40.6	03.0	15°05.1	22.7	121°28.8	02.8
11	137°58.8	17°22.9	11.6	307°41.6	03.7	30°07.0	22.7	136°31.4	02.9
12	153°01.2	32°22.3	N20°11.1	322°42.6	S04°04.3	45°09.0	N22°22.6	151°34.0	S02°03.0
13	168°03.7	47°21.6	10.7	337°43.6	05.0	60°10.9	22.6	166°36.6	03.1
14	183°06.2	62°20.9	10.2	352°44.6	05.6	75°12.9	22.5	181°39.2	03.1
15	198°08.6	77°20.2	·· 09.7	7°45.6	·· 06.3	90°14.8	·· 22.5	196°41.8	·· 03.2
16	213°11.1	92°19.6	09.2	22°46.6	06.9	105°16.8	22.4	211°44.4	03.3
17	228°13.6	107°18.9	08.7	37°47.6	07.6	120°18.7	22.3	226°47.0	03.3
18	243°16.0	122°18.2	N20°08.3	52°48.5	S04°08.2	135°20.7	N22°22.3	241°49.6	S02°03.4
19	258°18.5	137°17.5	07.8	67°49.5	08.9	150°22.7	22.2	256°52.2	03.5
20	273°20.9	152°16.9	07.3	82°50.5	09.5	165°24.6	22.2	271°54.8	03.5
21	288°23.4	167°16.2	·· 06.8	97°51.5	·· 10.2	180°26.6	·· 22.1	286°57.4	·· 03.6
22	303°25.9	182°15.5	06.3	112°52.5	10.9	195°28.5	22.1	302°00.0	03.7
23	318°28.3	197°14.9	05.9	127°53.5	11.5	210°30.5	22.0	317°02.6	03.7
Mer.pass. 01:50		ν -0.7′	d 0.5′	ν 1.0′	d 0.7′	ν 2.0′	d 0.1′	ν 2.6′	d 0.1′
		m -3.96		m 1.62		m -1.97		m 0.69	

Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	333°30.8	212°14.2	N20°05.4	142°54.5	S04°12.2	225°32.4	N22°22.0	332°05.2	S02°03.8
1	348°33.3	227°13.5	04.9	157°55.5	12.8	240°34.4	21.9	347°07.8	03.9
2	3°35.7	242°12.9	04.4	172°56.5	13.5	255°36.3	21.9	2°10.4	04.0
3	18°38.2	257°12.2	·· 03.9	187°57.5	·· 14.1	270°38.3	·· 21.8	17°13.1	·· 04.0
4	33°40.7	272°11.5	03.4	202°58.5	14.8	285°40.2	21.8	32°15.7	04.1
5	48°43.1	287°10.8	02.9	217°59.5	15.4	300°42.2	21.7	47°18.3	04.2
6	63°45.6	302°10.2	N20°02.4	233°00.5	S04°16.1	315°44.2	N22°21.6	62°20.9	S02°04.2
7	78°48.1	317°09.5	01.9	248°01.5	16.7	330°46.1	21.6	77°23.5	04.3
8	93°50.5	332°08.8	01.5	263°02.5	17.4	345°48.1	21.5	92°26.1	04.4
9	108°53.0	347°08.2	·· 01.0	278°03.5	·· 18.0	0°50.0	·· 21.5	107°28.7	·· 04.4
10	123°55.4	2°07.5	00.5	293°04.5	18.7	15°52.0	21.4	122°31.3	04.5
11	138°57.9	17°06.8	20°00.0	308°05.4	19.4	30°53.9	21.4	137°33.9	04.6
12	154°00.4	32°06.2	N19°59.5	323°06.4	S04°20.0	45°55.9	N22°21.3	152°36.5	S02°04.6
13	169°02.8	47°05.5	59.0	338°07.4	20.7	60°57.9	21.3	167°39.1	04.7
14	184°05.3	62°04.8	58.5	353°08.4	21.3	75°59.8	21.2	182°41.7	04.8
15	199°07.8	77°04.2	·· 58.0	8°09.4	·· 22.0	91°01.8	·· 21.2	197°44.3	·· 04.9
16	214°10.2	92°03.5	57.5	23°10.4	22.6	106°03.7	21.1	212°46.9	04.9
17	229°12.7	107°02.8	57.0	38°11.4	23.3	121°05.7	21.0	227°49.5	05.0
18	244°15.2	122°02.2	N19°56.5	53°12.4	S04°23.9	136°07.6	N22°21.0	242°52.2	S02°05.1
19	259°17.6	137°01.5	56.0	68°13.4	24.6	151°09.6	20.9	257°54.8	05.1
20	274°20.1	152°00.8	55.5	83°14.4	25.2	166°11.6	20.9	272°57.4	05.2
21	289°22.5	167°00.2	·· 54.9	98°15.4	·· 25.9	181°13.5	·· 20.8	288°00.0	·· 05.3
22	304°25.0	181°59.5	54.4	113°16.4	26.5	196°15.5	20.8	303°02.6	05.3
23	319°27.5	196°58.8	53.9	128°17.3	27.2	211°17.4	20.7	318°05.2	05.4
Mer.pass. 01:46		ν -0.7′	d 0.5′	ν 1.0′	d 0.7′	ν 2.0′	d 0.1′	ν 2.6′	d 0.1′
		m -3.95		m 1.62		m -1.97		m 0.68	

Stars

	SHA	Dec
Alpheratz	357°33.9	29°14.0
Ankaa	353°06.3	-42°09.7
Schedar	349°30.0	56°40.6
Diphda	348°46.5	-17°50.5
Achernar	335°19.4	-57°06.1
Hamal	327°50.4	23°35.1
Polaris	313°39.9	89°22.0
Acamar	315°11.2	-40°11.8
Menkar	314°05.5	4°11.6
Mirfak	308°27.4	49°57.0
Aldebaran	290°39.1	16°33.7
Rigel	281°03.5	-8°10.1
Capella	280°21.3	46°01.3
Bellatrix	278°22.4	6°22.5
Elnath	278°01.3	28°37.7
Alnilam	275°37.3	-1°11.0
Betelgeuse	270°51.7	7°24.8
Canopus	263°52.5	-52°42.2
Sirius	258°26.0	-16°44.9
Adhara	255°05.7	-29°00.2
Procyon	244°50.5	5°09.7
Pollux	243°17.0	27°57.9
Avior	234°15.1	-59°35.3
Suhail	222°46.4	-43°32.0
Miaplacidus	221°39.1	-69°49.2
Alphard	217°47.6	-8°46.1
Regulus	207°34.2	11°50.6
Dubhe	193°41.0	61°36.9
Denebola	182°24.7	14°25.8
Gienah	175°43.3	-17°41.0
Acrux	173°00.1	-63°14.6
Gacrux	171°51.6	-57°15.5
Alioth	166°12.9	55°49.4
Spica	158°21.9	-11°17.7
Alkaid	152°51.8	49°11.3
Hadar	148°35.6	-60°30.0
Menkent	147°57.2	-36°29.9
Arcturus	145°47.6	19°03.1
Rigil Kent.	139°39.8	-60°56.7
Kochab	137°20.1	74°03.2
Zuben'ubi	136°55.5	-16°08.9
Alphecca	126°03.3	26°37.9
Antares	112°15.1	-26°29.4
Atria	107°08.7	-69°04.7
Sabik	102°02.1	-15°45.4
Shaula	96°09.5	-37°07.4
Rasalhague	95°57.9	12°32.6
Eltanin	90°41.7	51°29.3
Kaus Aust.	83°31.6	-34°22.4
Vega	80°32.6	38°48.6
Nunki	75°46.8	-26°15.9
Altair	61°59.2	8°56.3
Peacock	53°04.3	-56°39.2
Deneb	49°25.0	45°22.4
Enif	33°38.0	9°59.7
Al Na'ir	27°31.8	-46°50.1
Fomalhaut	15°13.6	-29°29.0
Scheat	13°44.4	28°13.4
Markab	13°29.1	15°20.7

Aug 23 Sat	SHA	Mer.pass
Venus	241°14.1	09:49
Mars	170°34.1	14:31
Jupiter	252°26.2	09:03
Saturn	358°27.8	02:00

Aug 24 Sun	SHA	Mer.pass
Venus	239°58.7	09:50
Mars	169°58.9	14:29
Jupiter	252°13.9	09:00
Saturn	358°31.1	01:55

Aug 25 Mon	SHA	Mer.pass
Venus	238°43.4	09:51
Mars	169°23.7	14:27
Jupiter	252°01.6	08:57
Saturn	358°34.4	01:51

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Sat	**GHA**	**Dec**	**GHA**	*ν*	**Dec**	*d*	**HP**
0	179°19.3	N11°25.4	181°35.6	12.9′	N14°16.9	13.9′	56.7′
1	194°19.4	24.5	196°07.5	13.0′	14°03.0	13.9′	56.7′
2	209°19.6	23.7	210°39.4	13.0′	13°49.1	14.0′	56.7′
3	224°19.8	·· 22.8	225°11.5	13.1′	13°35.1	14.1′	56.7′
4	239°19.9	22.0	239°43.6	13.2′	13°21.0	14.1′	56.6′
5	254°20.1	21.1	254°15.8	13.3′	13°06.9	14.1′	56.6′
6	269°20.2	N11°20.3	268°48.1	13.4′	N12°52.8	14.2′	56.6′
7	284°20.4	19.4	283°20.5	13.5′	12°38.6	14.3′	56.6′
8	299°20.6	18.6	297°52.9	13.5′	12°24.3	14.2′	56.5′
9	314°20.7	·· 17.7	312°25.4	13.6′	12°10.1	14.4′	56.5′
10	329°20.9	16.9	326°58.1	13.7′	11°55.7	14.3′	56.5′
11	344°21.1	16.0	341°30.7	13.8′	11°41.4	14.4′	56.5′
12	359°21.2	N11°15.2	356°03.5	13.8′	N11°27.0	14.5′	56.4′
13	14°21.4	14.3	10°36.4	13.9′	11°12.5	14.5′	56.4′
14	29°21.6	13.5	25°09.3	14.0′	10°58.0	14.5′	56.4′
15	44°21.7	·· 12.6	39°42.3	14.1′	10°43.5	14.5′	56.4′
16	59°21.9	11.8	54°15.3	14.1′	10°29.0	14.6′	56.3′
17	74°22.1	10.9	68°48.5	14.2′	10°14.4	14.6′	56.3′
18	89°22.2	N11°10.1	83°21.7	14.3′	N09°59.8	14.7′	56.3′
19	104°22.4	09.2	97°54.9	14.3′	09°45.1	14.6′	56.3′
20	119°22.6	08.4	112°28.3	14.4′	09°30.5	14.7′	56.3′
21	134°22.7	·· 07.5	127°01.7	14.5′	09°15.8	14.7′	56.2′
22	149°22.9	06.7	141°35.2	14.5′	09°01.1	14.8′	56.2′
23	164°23.1	05.8	156°08.7	14.6′	08°46.3	14.8′	56.2′
	SD = 15.8′	*d* = 0.8′	SD = 15.5′				

Sun	**GHA**	**Dec**	**GHA**	*ν*	**Dec**	*d*	**HP**
0	179°23.2	N11°04.9	170°42.3	14.7′	N08°31.5	14.8′	56.2′
1	194°23.4	04.1	185°15.9	14.7′	08°16.7	14.8′	56.1′
2	209°23.6	03.2	199°49.7	14.8′	08°01.9	14.8′	56.1′
3	224°23.7	·· 02.4	214°23.5	14.8′	07°47.1	14.9′	56.1′
4	239°23.9	01.5	228°57.3	14.9′	07°32.2	14.9′	56.1′
5	254°24.1	11°00.7	243°31.2	15.0′	07°17.3	14.9′	56.0′
6	269°24.2	N10°59.8	258°05.1	15.0′	N07°02.4	14.9′	56.0′
7	284°24.4	58.9	272°39.2	15.1′	06°47.5	14.9′	56.0′
8	299°24.6	58.1	287°13.2	15.1′	06°32.6	14.9′	56.0′
9	314°24.7	·· 57.2	301°47.3	15.2′	06°17.7	15.0′	56.0′
10	329°24.9	56.4	316°21.5	15.2′	06°02.7	14.9′	55.9′
11	344°25.1	55.5	330°55.7	15.3′	05°47.8	15.0′	55.9′
12	359°25.2	N10°54.7	345°30.0	15.3′	N05°32.8	15.0′	55.9′
13	14°25.4	53.8	0°04.3	15.4′	05°17.8	15.0′	55.9′
14	29°25.6	52.9	14°38.7	15.4′	05°02.8	15.0′	55.8′
15	44°25.7	·· 52.1	29°13.1	15.5′	04°47.8	15.0′	55.8′
16	59°25.9	51.2	43°47.5	15.5′	04°32.8	15.0′	55.8′
17	74°26.1	50.4	58°22.0	15.5′	04°17.8	15.0′	55.8′
18	89°26.3	N10°49.5	72°56.6	15.6′	N04°02.8	15.0′	55.7′
19	104°26.4	48.6	87°31.1	15.6′	03°47.8	15.1′	55.7′
20	119°26.6	47.8	102°05.8	15.7′	03°32.7	15.0′	55.7′
21	134°26.8	·· 46.9	116°40.4	15.7′	03°17.7	15.0′	55.7′
22	149°26.9	46.0	131°15.1	15.7′	03°02.7	15.0′	55.7′
23	164°27.1	45.2	145°49.9	15.8′	02°47.7	15.0′	55.6′
	SD = 15.8′	*d* = 0.9′	SD = 15.3′				

Mon	**GHA**	**Dec**	**GHA**	*ν*	**Dec**	*d*	**HP**
0	179°27.3	N10°44.3	160°24.6	15.8′	N02°32.7	15.0′	55.6′
1	194°27.5	43.5	174°59.4	15.8′	02°17.7	15.1′	55.6′
2	209°27.6	42.6	189°34.3	15.9′	02°02.6	15.0′	55.6′
3	224°27.8	·· 41.7	204°09.2	15.9′	01°47.6	15.0′	55.5′
4	239°28.0	40.9	218°44.1	15.9′	01°32.6	14.9′	55.5′
5	254°28.1	40.0	233°19.0	16.0′	01°17.7	15.0′	55.5′
6	269°28.3	N10°39.1	247°54.0	16.0′	N01°02.7	15.0′	55.5′
7	284°28.5	38.3	262°28.9	16.0′	00°47.7	15.0′	55.5′
8	299°28.7	37.4	277°04.0	16.0′	00°32.7	14.9′	55.4′
9	314°28.8	·· 36.5	291°39.0	16.1′	00°17.8	15.0′	55.4′
10	329°29.0	35.7	306°14.1	16.1′	N00°02.8	14.9′	55.4′
11	344°29.2	34.8	320°49.2	16.1′	S00°12.1	14.9′	55.4′
12	359°29.4	N10°33.9	335°24.3	16.1′	S00°27.0	14.9′	55.3′
13	14°29.5	33.1	349°59.4	16.2′	00°41.9	14.9′	55.3′
14	29°29.7	32.2	4°34.6	16.2′	00°56.8	14.9′	55.3′
15	44°29.9	·· 31.3	19°09.7	16.2′	01°11.7	14.9′	55.3′
16	59°30.0	30.5	33°44.9	16.2′	01°26.6	14.8′	55.3′
17	74°30.2	29.6	48°20.1	16.2′	01°41.4	14.8′	55.2′
18	89°30.4	N10°28.7	62°55.3	16.2′	S01°56.2	14.8′	55.2′
19	104°30.6	27.9	77°30.6	16.2′	02°11.0	14.8′	55.2′
20	119°30.7	27.0	92°05.8	16.3′	02°25.8	14.8′	55.2′
21	134°30.9	·· 26.1	106°41.1	16.3′	02°40.6	14.7′	55.2′
22	149°31.1	25.3	121°16.4	16.3′	02°55.3	14.7′	55.1′
23	164°31.3	24.4	135°51.6	16.3′	03°10.0	14.7′	55.1′
	SD = 15.8′	*d* = 0.9′	SD = 15.2′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	////	01:18	03:21	20:40	22:35	////
N 70°	////	02:11	03:41	20:20	21:48	////
68°	////	02:42	03:57	20:05	21:18	////
66°	01:07	03:05	04:09	19:53	20:57	22:47
64°	01:54	03:22	04:20	19:43	20:39	22:05
62°	02:23	03:37	04:29	19:34	20:25	21:38
60°	02:44	03:49	04:36	19:27	20:14	21:18
N 58°	03:01	03:59	04:43	19:20	20:04	21:01
56°	03:15	04:08	04:49	19:14	19:55	20:48
54°	03:27	04:16	04:54	19:09	19:48	20:36
52°	03:37	04:23	04:59	19:05	19:41	20:26
50°	03:46	04:29	05:03	19:00	19:35	20:17
45°	04:04	04:42	05:13	18:51	19:22	20:00
N 40°	04:18	04:52	05:20	18:44	19:12	19:46
35°	04:29	05:01	05:27	18:37	19:03	19:35
30°	04:39	05:08	05:33	18:32	18:56	19:25
20°	04:53	05:20	05:43	18:22	18:44	19:11
N 10°	05:05	05:30	05:51	18:13	18:35	19:00
0°	05:13	05:38	05:59	18:06	18:27	18:51
S 10°	05:21	05:45	06:07	17:58	18:19	18:44
20°	05:27	05:53	06:15	17:50	18:12	18:38
30°	05:32	06:00	06:24	17:41	18:05	18:33
35°	05:34	06:04	06:29	17:36	18:01	18:31
40°	05:36	06:08	06:35	17:30	17:57	18:29
45°	05:38	06:12	06:42	17:23	17:53	18:27
S 50°	05:40	06:17	06:50	17:15	17:48	18:26
52°	05:41	06:20	06:54	17:11	17:46	18:25
54°	05:41	06:22	06:58	17:07	17:43	18:25
56°	05:42	06:25	07:03	17:03	17:41	18:24
58°	05:42	06:28	07:08	16:58	17:38	18:24
S 60°	05:42	06:31	07:14	16:52	17:35	18:23

Lat.	**Moonrise** Sat	Sun	Mon	**Moonset** Sat	Sun	Mon
N 72°	02:48	05:16	07:23	20:32	19:54	19:21
N 70°	03:16	05:27	07:24	20:18	19:50	19:24
68°	03:37	05:36	07:25	20:07	19:46	19:27
66°	03:53	05:43	07:26	19:57	19:43	19:29
64°	04:06	05:49	07:26	19:49	19:40	19:31
62°	04:17	05:55	07:27	19:43	19:38	19:33
60°	04:27	05:59	07:27	19:37	19:35	19:34
N 58°	04:35	06:03	07:27	19:31	19:34	19:35
56°	04:42	06:07	07:28	19:27	19:32	19:36
54°	04:48	06:10	07:28	19:22	19:30	19:37
52°	04:54	06:13	07:28	19:19	19:29	19:38
50°	04:59	06:15	07:28	19:15	19:28	19:39
45°	05:10	06:21	07:29	19:07	19:25	19:41
N 40°	05:19	06:26	07:29	19:01	19:22	19:43
35°	05:27	06:30	07:30	18:55	19:20	19:44
30°	05:34	06:33	07:30	18:50	19:19	19:45
20°	05:46	06:39	07:30	18:42	19:15	19:47
N 10°	05:56	06:45	07:31	18:34	19:12	19:49
0°	06:05	06:50	07:31	18:27	19:10	19:51
S 10°	06:15	06:55	07:32	18:20	19:07	19:53
20°	06:25	07:00	07:32	18:12	19:04	19:55
30°	06:36	07:06	07:33	18:03	19:01	19:57
35°	06:43	07:09	07:33	17:58	18:59	19:58
40°	06:51	07:13	07:34	17:52	18:56	19:59
45°	06:59	07:18	07:34	17:45	18:54	20:01
S 50°	07:10	07:23	07:35	17:36	18:51	20:03
52°	07:14	07:25	07:35	17:32	18:49	20:04
54°	07:20	07:28	07:35	17:28	18:48	20:05
56°	07:25	07:31	07:36	17:23	18:46	20:06
58°	07:32	07:34	07:36	17:18	18:44	20:07
S 60°	07:39	07:38	07:36	17:12	18:42	20:08

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 0-2 0-3%
23	02:43	02:35	12:03	12:16	–:–	
24	02:27	02:19	12:02	13:00	00:38	
25	02:11	02:03	12:02	13:41	01:21	

August 26, 27, 28 UT (Tue., Wed., Thu.)

	Aries	Venus		Mars		Jupiter		Saturn	
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	334°29.9	211°58.2	N19°53.4	143°18.3	S04°27.9	226°19.4	N22°20.7	333°07.8	S02°05.5
1	349°32.4	226°57.5	52.9	158°19.3	28.5	241°21.4	20.6	348°10.4	05.6
2	4°34.9	241°56.8	52.4	173°20.3	29.2	256°23.3	20.6	3°13.0	05.6
3	19°37.3	256°56.2	·· 51.9	188°21.3	·· 29.8	271°25.3	·· 20.5	18°15.6	·· 05.7
4	34°39.8	271°55.5	51.4	203°22.3	30.5	286°27.2	20.5	33°18.2	05.8
5	49°42.3	286°54.8	50.9	218°23.3	31.1	301°29.2	20.4	48°20.8	05.8
6	64°44.7	301°54.2	N19°50.3	233°24.3	S04°31.8	316°31.2	N22°20.3	63°23.4	S02°05.9
7	79°47.2	316°53.5	49.8	248°25.3	32.4	331°33.1	20.3	78°26.1	06.0
8	94°49.7	331°52.8	49.3	263°26.3	33.1	346°35.1	20.2	93°28.7	06.0
9	109°52.1	346°52.2	·· 48.8	278°27.2	·· 33.7	1°37.0	·· 20.2	108°31.3	·· 06.1
10	124°54.6	1°51.5	48.3	293°28.2	34.4	16°39.0	20.1	123°33.9	06.2
11	139°57.0	16°50.8	47.8	308°29.2	35.0	31°41.0	20.1	138°36.5	06.3
12	154°59.5	31°50.2	N19°47.2	323°30.2	S04°35.7	46°42.9	N22°20.0	153°39.1	S02°06.3
13	170°02.0	46°49.5	46.7	338°31.2	36.4	61°44.9	20.0	168°41.7	06.4
14	185°04.4	61°48.9	46.2	353°32.2	37.0	76°46.8	19.9	183°44.3	06.5
15	200°06.9	76°48.2	·· 45.7	8°33.2	·· 37.7	91°48.8	·· 19.9	198°46.9	·· 06.5
16	215°09.4	91°47.5	45.1	23°34.2	38.3	106°50.8	19.8	213°49.5	06.6
17	230°11.8	106°46.9	44.6	38°35.2	39.0	121°52.7	19.7	228°52.1	06.7
18	245°14.3	121°46.2	N19°44.1	53°36.1	S04°39.6	136°54.7	N22°19.7	243°54.8	S02°06.8
19	260°16.8	136°45.5	43.6	68°37.1	40.3	151°56.6	19.6	258°57.4	06.8
20	275°19.2	151°44.9	43.0	83°38.1	40.9	166°58.6	19.6	274°00.0	06.9
21	290°21.7	166°44.2	·· 42.5	98°39.1	·· 41.6	182°00.6	·· 19.5	289°02.6	·· 07.0
22	305°24.2	181°43.6	42.0	113°40.1	42.2	197°02.5	19.5	304°05.2	07.0
23	320°26.6	196°42.9	41.4	128°41.1	42.9	212°04.5	19.4	319°07.8	07.1
Mer.pass. 01:42		ν -0.7′	d 0.5′	m -3.95	ν 1.0′	d 0.7′	m 1.62	ν 2.0′	d 0.1′ m -1.97	ν 2.6′	d 0.1′ m 0.68

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	335°29.1	211°42.2	N19°40.9	143°42.1	S04°43.5	227°06.5	N22°19.4	334°10.4	S02°07.2
1	350°31.5	226°41.6	40.4	158°43.1	44.2	242°08.4	19.3	349°13.0	07.2
2	5°34.0	241°40.9	39.8	173°44.0	44.8	257°10.4	19.3	4°15.6	07.3
3	20°36.5	256°40.3	·· 39.3	188°45.0	·· 45.5	272°12.4	·· 19.2	19°18.2	·· 07.4
4	35°38.9	271°39.6	38.8	203°46.0	46.2	287°14.3	19.1	34°20.9	07.5
5	50°41.4	286°38.9	38.2	218°47.0	46.8	302°16.3	19.1	49°23.5	07.5
6	65°43.9	301°38.3	N19°37.7	233°48.0	S04°47.5	317°18.2	N22°19.0	64°26.1	S02°07.6
7	80°46.3	316°37.6	37.1	248°49.0	48.1	332°20.2	19.0	79°28.7	07.7
8	95°48.8	331°37.0	36.6	263°50.0	48.8	347°22.2	18.9	94°31.3	07.7
9	110°51.3	346°36.3	·· 36.1	278°51.0	·· 49.4	2°24.1	·· 18.9	109°33.9	·· 07.8
10	125°53.7	1°35.6	35.5	293°51.9	50.1	17°26.1	18.8	124°36.5	07.9
11	140°56.2	16°35.0	35.0	308°52.9	50.7	32°28.1	18.8	139°39.1	08.0
12	155°58.6	31°34.3	N19°34.4	323°53.9	S04°51.4	47°30.0	N22°18.7	154°41.7	S02°08.0
13	171°01.1	46°33.7	33.9	338°54.9	52.0	62°32.0	18.7	169°44.4	08.1
14	186°03.6	61°33.0	33.3	353°55.9	52.7	77°34.0	18.6	184°47.0	08.2
15	201°06.0	76°32.4	·· 32.8	8°56.9	·· 53.3	92°35.9	·· 18.5	199°49.6	·· 08.2
16	216°08.5	91°31.7	32.3	23°57.8	54.0	107°37.9	18.5	214°52.2	08.3
17	231°11.0	106°31.0	31.7	38°58.8	54.6	122°39.9	18.4	229°54.8	08.4
18	246°13.4	121°30.4	N19°31.2	53°59.8	S04°55.3	137°41.8	N22°18.4	244°57.4	S02°08.5
19	261°15.9	136°29.7	30.6	69°00.8	56.0	152°43.8	18.3	260°00.0	08.5
20	276°18.4	151°29.1	30.0	84°01.8	56.6	167°45.8	18.3	275°02.6	08.6
21	291°20.8	166°28.4	·· 29.5	99°02.8	·· 57.3	182°47.7	·· 18.2	290°05.2	·· 08.7
22	306°23.3	181°27.8	28.9	114°03.8	57.9	197°49.7	18.2	305°07.9	08.7
23	321°25.8	196°27.1	28.4	129°04.7	58.6	212°51.7	18.1	320°10.5	08.8
Mer.pass. 01:38		ν -0.7′	d 0.5′	m -3.95	ν 1.0′	d 0.7′	m 1.62	ν 2.0′	d 0.1′ m -1.98	ν 2.6′	d 0.1′ m 0.67

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	336°28.2	211°26.5	N19°27.8	144°05.7	S04°59.2	227°53.6	N22°18.1	335°13.1	S02°08.9
1	351°30.7	226°25.8	27.3	159°06.7	04°59.9	242°55.6	18.0	350°15.7	09.0
2	6°33.1	241°25.1	26.7	174°07.7	05°00.5	257°57.6	17.9	5°18.3	09.0
3	21°35.6	256°24.5	·· 26.2	189°08.7	·· 01.2	272°59.5	·· 17.9	20°20.9	·· 09.1
4	36°38.1	271°23.8	25.6	204°09.7	01.8	288°01.5	17.8	35°23.5	09.2
5	51°40.5	286°23.2	25.0	219°10.6	02.5	303°03.5	17.8	50°26.2	09.2
6	66°43.0	301°22.5	N19°24.5	234°11.6	S05°03.1	318°05.4	N22°17.7	65°28.8	S02°09.3
7	81°45.5	316°21.9	23.9	249°12.6	03.8	333°07.4	17.7	80°31.4	09.4
8	96°47.9	331°21.2	23.3	264°13.6	04.4	348°09.4	17.6	95°34.0	09.5
9	111°50.4	346°20.6	·· 22.8	279°14.6	·· 05.1	3°11.3	·· 17.6	110°36.6	·· 09.5
10	126°52.9	1°19.9	22.2	294°15.5	05.7	18°13.3	17.5	125°39.2	09.6
11	141°55.3	16°19.3	21.7	309°16.5	06.4	33°15.3	17.4	140°41.8	09.7
12	156°57.8	31°18.6	N19°21.1	324°17.5	S05°07.1	48°17.2	N22°17.4	155°44.4	S02°09.7
13	172°00.2	46°18.0	20.5	339°18.5	07.7	63°19.2	17.3	170°47.1	09.8
14	187°02.7	61°17.3	19.9	354°19.5	08.4	78°21.2	17.3	185°49.7	09.9
15	202°05.2	76°16.7	·· 19.4	9°20.5	·· 09.0	93°23.1	·· 17.2	200°52.3	·· 10.0
16	217°07.6	91°16.0	18.8	24°21.4	09.7	108°25.1	17.2	215°54.9	10.0
17	232°10.1	106°15.4	18.2	39°22.4	10.3	123°27.1	17.1	230°57.5	10.1
18	247°12.6	121°14.7	N19°17.7	54°23.4	S05°11.0	138°29.0	N22°17.1	246°00.1	S02°10.2
19	262°15.0	136°14.1	17.1	69°24.4	11.6	153°31.0	17.0	261°02.7	10.3
20	277°17.5	151°13.4	16.5	84°25.4	12.3	168°33.0	17.0	276°05.4	10.3
21	292°20.0	166°12.8	·· 15.9	99°26.3	·· 12.9	183°35.0	·· 16.9	291°08.0	·· 10.4
22	307°22.4	181°12.1	15.4	114°27.3	13.6	198°36.9	16.8	306°10.6	10.5
23	322°24.9	196°11.5	14.8	129°28.3	14.2	213°38.9	16.8	321°13.2	10.5
Mer.pass. 01:34		ν -0.7′	d 0.6′	m -3.95	ν 1.0′	d 0.7′	m 1.62	ν 2.0′	d 0.1′ m -1.98	ν 2.6′	d 0.1′ m 0.67

Stars

	SHA	Dec
Alpheratz	357°33.9	29°14.0
Ankaa	353°06.2	-42°09.7
Schedar	349°30.0	56°40.6
Diphda	348°46.5	-17°50.5
Achernar	335°19.4	-57°06.1
Hamal	327°50.4	23°35.1
Polaris	313°38.5	89°22.0
Acamar	315°11.2	-40°11.8
Menkar	314°05.5	4°11.6
Mirfak	308°27.4	49°57.0
Aldebaran	290°39.0	16°33.7
Rigel	281°03.4	-8°10.1
Capella	280°21.2	46°01.3
Bellatrix	278°22.4	6°22.5
Elnath	278°01.3	28°37.7
Alnilam	275°37.3	-1°11.0
Betelgeuse	270°51.7	7°24.8
Canopus	263°52.5	-52°42.2
Sirius	258°26.0	-16°44.9
Adhara	255°05.7	-29°00.1
Procyon	244°50.5	5°09.7
Pollux	243°16.9	27°57.9
Avior	234°15.1	-59°35.3
Suhail	222°46.4	-43°32.0
Miaplacidus	221°39.1	-69°49.2
Alphard	217°47.6	-8°46.1
Regulus	207°34.2	11°50.6
Dubhe	193°41.0	61°36.9
Denebola	182°24.7	14°25.8
Gienah	175°43.3	-17°41.0
Acrux	173°00.1	-63°14.6
Gacrux	171°51.6	-57°15.5
Alioth	166°12.9	55°49.4
Spica	158°22.0	-11°17.7
Alkaid	152°51.8	49°11.3
Hadar	148°35.6	-60°30.0
Menkent	147°57.2	-36°29.9
Arcturus	145°47.6	19°03.1
Rigil Kent.	139°39.9	-60°56.7
Kochab	137°20.1	74°03.2
Zuben'ubi	136°55.5	-16°08.9
Alphecca	126°03.3	26°37.9
Antares	112°15.2	-26°29.4
Atria	107°08.8	-69°04.7
Sabik	102°02.1	-15°45.4
Shaula	96°09.5	-37°07.4
Rasalhague	95°57.9	12°32.6
Eltanin	90°41.7	51°29.3
Kaus Aust.	83°31.6	-34°22.4
Vega	80°32.6	38°48.6
Nunki	75°46.9	-26°15.9
Altair	61°59.2	8°56.3
Peacock	53°04.3	-56°39.2
Deneb	49°25.0	45°22.5
Enif	33°38.0	9°59.7
Al Na'ir	27°31.8	-46°50.1
Fomalhaut	15°13.6	-29°29.0
Scheat	13°44.4	28°13.4
Markab	13°29.1	15°20.7

Aug 26 Tue	SHA	Mer.pass
Venus	237°28.2	09:53
Mars	168°48.4	14:26
Jupiter	251°49.5	08:54
Saturn	358°37.9	01:47

Aug 27 Wed	SHA	Mer.pass
Venus	236°13.2	09:54
Mars	168°13.0	14:24
Jupiter	251°37.4	08:50
Saturn	358°41.3	01:43

Aug 28 Thu	SHA	Mer.pass
Venus	234°58.2	09:55
Mars	167°37.5	14:23
Jupiter	251°25.4	08:47
Saturn	358°44.9	01:39

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°31.4	N10°23.5	150°26.9	16.3′	S03°24.7	14.7′	55.1′
1	194°31.6	22.7	165°02.2	16.3′	03°39.4	14.6′	55.1′
2	209°31.8	21.8	179°37.5	16.3′	03°54.0	14.7′	55.1′
3	224°32.0	·· 20.9	194°12.8	16.3′	04°08.7	14.6′	55.0′
4	239°32.2	20.0	208°48.2	16.3′	04°23.3	14.5′	55.0′
5	254°32.3	19.2	223°23.5	16.3′	04°37.8	14.6′	55.0′
6	269°32.5	N10°18.3	237°58.8	16.3′	S04°52.4	14.5′	55.0′
7	284°32.7	17.4	252°34.1	16.3′	05°06.9	14.4′	55.0′
8	299°32.9	16.6	267°09.4	16.3′	05°21.3	14.5′	54.9′
9	314°33.0	·· 15.7	281°44.8	16.3′	05°35.8	14.4′	54.9′
10	329°33.2	14.8	296°20.1	16.3′	05°50.2	14.4′	54.9′
11	344°33.4	13.9	310°55.4	16.3′	06°04.6	14.3′	54.9′
12	359°33.6	N10°13.1	325°30.7	16.3′	S06°18.9	14.3′	54.9′
13	14°33.7	12.2	340°06.0	16.3′	06°33.2	14.3′	54.9′
14	29°33.9	11.3	354°41.3	16.3′	06°47.5	14.3′	54.8′
15	44°34.1	·· 10.4	9°16.6	16.3′	07°01.8	14.2′	54.8′
16	59°34.3	09.6	23°51.9	16.3′	07°16.0	14.1′	54.8′
17	74°34.5	08.7	38°27.2	16.3′	07°30.1	14.2′	54.8′
18	89°34.6	N10°07.8	53°02.4	16.3′	S07°44.3	14.1′	54.8′
19	104°34.8	06.9	67°37.7	16.2′	07°58.4	14.0′	54.7′
20	119°35.0	06.1	82°12.9	16.2′	08°12.4	14.0′	54.7′
21	134°35.2	·· 05.2	96°48.2	16.2′	08°26.4	14.0′	54.7′
22	149°35.4	04.3	111°23.4	16.2′	08°40.4	14.0′	54.7′
23	164°35.5	03.4	125°58.6	16.2′	08°54.4	13.8′	54.7′
	SD = 15.8′	d = 0.9′	SD = 15.0′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°35.7	N10°02.6	140°33.8	16.2′	S09°08.2	13.9′	54.7′
1	194°35.9	01.7	155°08.9	16.1′	09°22.1	13.8′	54.7′
2	209°36.1	10°00.8	169°44.1	16.1′	09°35.9	13.8′	54.6′
3	224°36.3	09°59.9	184°19.2	16.1′	09°49.7	13.7′	54.6′
4	239°36.4	59.1	198°54.3	16.1′	10°03.4	13.6′	54.6′
5	254°36.6	58.2	213°29.4	16.1′	10°17.0	13.7′	54.6′
6	269°36.8	N09°57.3	228°04.5	16.0′	S10°30.7	13.5′	54.6′
7	284°37.0	56.4	242°39.5	16.0′	10°44.2	13.6′	54.6′
8	299°37.2	55.6	257°14.5	16.0′	10°57.8	13.4′	54.5′
9	314°37.3	·· 54.7	271°49.5	16.0′	11°11.2	13.5′	54.5′
10	329°37.5	53.8	286°24.5	15.9′	11°24.7	13.3′	54.5′
11	344°37.7	52.9	300°59.5	15.9′	11°38.0	13.4′	54.5′
12	359°37.9	N09°52.0	315°34.4	15.9′	S11°51.4	13.2′	54.5′
13	14°38.1	51.2	330°09.2	15.9′	12°04.6	13.3′	54.5′
14	29°38.3	50.3	344°44.1	15.8′	12°17.9	13.1′	54.5′
15	44°38.4	·· 49.4	359°18.9	15.8′	12°31.0	13.1′	54.5′
16	59°38.6	48.5	13°53.7	15.8′	12°44.1	13.1′	54.4′
17	74°38.8	47.6	28°28.5	15.7′	12°57.2	13.0′	54.4′
18	89°39.0	N09°46.8	43°03.2	15.7′	S13°10.2	12.9′	54.4′
19	104°39.2	45.9	57°37.9	15.7′	13°23.1	12.9′	54.4′
20	119°39.3	45.0	72°12.5	15.6′	13°36.0	12.9′	54.4′
21	134°39.5	·· 44.1	86°47.2	15.6′	13°48.9	12.7′	54.4′
22	149°39.7	43.2	101°21.8	15.5′	14°01.6	12.7′	54.4′
23	164°39.9	42.3	115°56.3	15.5′	14°14.3	12.7′	54.4′
	SD = 15.8′	d = 0.9′	SD = 14.9′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°40.1	N09°41.5	130°30.8	15.5′	S14°27.0	12.6′	54.3′
1	194°40.3	40.6	145°05.3	15.4′	14°39.6	12.5′	54.3′
2	209°40.5	39.7	159°39.7	15.4′	14°52.1	12.5′	54.3′
3	224°40.6	·· 38.8	174°14.1	15.3′	15°04.6	12.4′	54.3′
4	239°40.8	37.9	188°48.4	15.3′	15°17.0	12.3′	54.3′
5	254°41.0	37.0	203°22.7	15.3′	15°29.3	12.3′	54.3′
6	269°41.2	N09°36.2	217°57.0	15.2′	S15°41.6	12.2′	54.3′
7	284°41.4	35.3	232°31.2	15.2′	15°53.8	12.2′	54.3′
8	299°41.6	34.4	247°05.3	15.1′	16°06.0	12.0′	54.3′
9	314°41.7	·· 33.5	261°39.5	15.1′	16°18.0	12.0′	54.3′
10	329°41.9	32.6	276°13.5	15.0′	16°30.0	12.0′	54.3′
11	344°42.1	31.7	290°47.6	15.0′	16°42.0	11.8′	54.2′
12	359°42.3	N09°30.8	305°21.5	14.9′	S16°53.8	11.8′	54.2′
13	14°42.5	30.0	319°55.5	14.9′	17°05.6	11.8′	54.2′
14	29°42.7	29.1	334°29.3	14.8′	17°17.4	11.6′	54.2′
15	44°42.9	·· 28.2	349°03.2	14.8′	17°29.0	11.6′	54.2′
16	59°43.0	27.3	3°36.9	14.7′	17°40.6	11.5′	54.2′
17	74°43.2	26.4	18°10.6	14.7′	17°52.1	11.5′	54.2′
18	89°43.4	N09°25.5	32°44.3	14.6′	S18°03.6	11.3′	54.2′
19	104°43.6	24.6	47°17.9	14.6′	18°14.9	11.3′	54.2′
20	119°43.8	23.7	61°51.5	14.5′	18°26.2	11.2′	54.2′
21	134°44.0	·· 22.9	76°25.0	14.4′	18°37.4	11.2′	54.2′
22	149°44.2	22.0	90°58.4	14.4′	18°48.6	11.0′	54.2′
23	164°44.4	21.1	105°31.8	14.3′	18°59.6	11.0′	54.2′
	SD = 15.8′	d = 0.9′	SD = 14.8′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	////	01:52	03:37	20:22	22:03	////
N 70°	////	02:31	03:54	20:05	21:27	////
68°	////	02:57	04:08	19:52	21:02	23:23
66°	01:36	03:17	04:19	19:41	20:42	22:20
64°	02:12	03:33	04:29	19:32	20:27	21:47
62°	02:36	03:46	04:37	19:25	20:15	21:23
60°	02:55	03:57	04:44	19:18	20:04	21:05
N 58°	03:10	04:06	04:50	19:12	19:55	20:50
56°	03:23	04:14	04:55	19:07	19:47	20:38
54°	03:34	04:22	05:00	19:02	19:40	20:27
52°	03:43	04:28	05:04	18:58	19:34	20:18
50°	03:51	04:34	05:08	18:54	19:28	20:10
45°	04:08	04:45	05:16	18:46	19:17	19:54
N 40°	04:21	04:55	05:23	18:39	19:07	19:41
35°	04:32	05:03	05:29	18:33	18:59	19:30
30°	04:41	05:10	05:34	18:28	18:53	19:22
20°	04:54	05:21	05:43	18:19	18:42	19:08
N 10°	05:05	05:30	05:51	18:12	18:33	18:58
0°	05:13	05:37	05:58	18:05	18:26	18:50
S 10°	05:19	05:44	06:05	17:58	18:19	18:44
20°	05:25	05:50	06:13	17:51	18:13	18:39
30°	05:29	05:57	06:21	17:42	18:07	18:35
35°	05:31	06:00	06:26	17:38	18:03	18:33
40°	05:32	06:04	06:31	17:33	18:00	18:31
45°	05:33	06:07	06:37	17:27	17:56	18:30
S 50°	05:34	06:12	06:44	17:19	17:52	18:30
52°	05:34	06:14	06:48	17:16	17:50	18:29
54°	05:35	06:16	06:51	17:12	17:48	18:29
56°	05:35	06:18	06:56	17:08	17:46	18:29
58°	05:35	06:20	07:00	17:04	17:44	18:30
S 60°	05:34	06:23	07:05	16:59	17:42	18:30

Lat.	**Moonrise** Tue	Wed	Thu	**Moonset** Tue	Wed	Thu
N 72°	09:27	11:38	14:50	18:46	18:02	16:19
N 70°	09:18	11:16	13:37	18:58	18:26	17:34
68°	09:11	11:00	13:00	19:07	18:44	18:12
66°	09:05	10:46	12:34	19:15	18:59	18:39
64°	09:00	10:35	12:15	19:22	19:12	19:00
62°	08:56	10:26	11:59	19:27	19:22	19:16
60°	08:52	10:18	11:46	19:33	19:31	19:31
N 58°	08:49	10:11	11:34	19:37	19:39	19:43
56°	08:46	10:05	11:25	19:41	19:46	19:53
54°	08:44	10:00	11:16	19:45	19:53	20:03
52°	08:42	09:55	11:08	19:48	19:58	20:11
50°	08:40	09:50	11:01	19:51	20:04	20:19
45°	08:35	09:41	10:47	19:57	20:15	20:35
N 40°	08:31	09:33	10:35	20:03	20:24	20:48
35°	08:28	09:26	10:24	20:08	20:32	20:59
30°	08:25	09:20	10:16	20:12	20:39	21:09
20°	08:20	09:10	10:00	20:19	20:52	21:26
N 10°	08:16	09:01	09:47	20:26	21:03	21:41
0°	08:12	08:53	09:35	20:32	21:13	21:56
S 10°	08:08	08:45	09:23	20:38	21:23	22:10
20°	08:04	08:36	09:10	20:44	21:34	22:25
30°	07:59	08:26	08:55	20:52	21:47	22:43
35°	07:57	08:21	08:46	20:56	21:54	22:53
40°	07:54	08:14	08:37	21:01	22:03	23:05
45°	07:50	08:07	08:25	21:07	22:12	23:19
S 50°	07:46	07:58	08:12	21:14	22:24	23:36
52°	07:44	07:54	08:06	21:17	22:30	23:44
54°	07:42	07:50	07:59	21:20	22:36	23:53
56°	07:40	07:45	07:51	21:24	22:43	·· ··
58°	07:38	07:40	07:42	21:29	22:51	·· ··
S 60°	07:35	07:33	07:33	21:33	23:00	·· ··

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 3-5 8-21%
26	01:54	01:46	12:02	14:22	02:02	
27	01:37	01:28	12:01	15:03	02:42	
28	01:20	01:11	12:01	15:45	03:24	

August 29, 30, 31 UT (Fri., Sat., Sun.)

	Aries	Venus		Mars		Jupiter		Saturn	
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	337°27.4	211°10.8	N19°14.2	144°29.3	S05°14.9	228°40.9	N22°16.7	336°15.8	S02°10.6
1	352°29.8	226°10.2	13.6	159°30.3	15.5	243°42.8	16.7	351°18.4	10.7
2	7°32.3	241°09.5	13.0	174°31.2	16.2	258°44.8	16.6	6°21.0	10.8
3	22°34.7	256°08.9	·· 12.5	189°32.2	·· 16.8	273°46.8	·· 16.6	21°23.7	·· 10.8
4	37°37.2	271°08.2	11.9	204°33.2	17.5	288°48.8	16.5	36°26.3	10.9
5	52°39.7	286°07.6	11.3	219°34.2	18.1	303°50.7	16.5	51°28.9	11.0
6	67°42.1	301°06.9	N19°10.7	234°35.2	S05°18.8	318°52.7	N22°16.4	66°31.5	S02°11.1
7	82°44.6	316°06.3	10.1	249°36.1	19.5	333°54.7	16.4	81°34.1	11.1
8	97°47.1	331°05.6	09.5	264°37.1	20.1	348°56.6	16.3	96°36.7	11.2
9	112°49.5	346°05.0	·· 09.0	279°38.1	·· 20.8	3°58.6	·· 16.2	111°39.3	·· 11.3
10	127°52.0	1°04.3	08.4	294°39.1	21.4	19°00.6	16.2	126°42.0	11.3
11	142°54.5	16°03.7	07.8	309°40.0	22.1	34°02.6	16.1	141°44.6	11.4
12	157°56.9	31°03.0	N19°07.2	324°41.0	S05°22.7	49°04.5	N22°16.1	156°47.2	S02°11.5
13	172°59.4	46°02.4	06.6	339°42.0	23.4	64°06.5	16.0	171°49.8	11.6
14	188°01.9	61°01.7	06.0	354°43.0	24.0	79°08.5	16.0	186°52.4	11.6
15	203°04.3	76°01.1	·· 05.4	9°44.0	·· 24.7	94°10.4	·· 15.9	201°55.0	·· 11.7
16	218°06.8	91°00.5	04.8	24°44.9	25.3	109°12.4	15.9	216°57.7	11.8
17	233°09.2	105°59.8	04.2	39°45.9	26.0	124°14.4	15.8	232°00.3	11.8
18	248°11.7	120°59.2	N19°03.6	54°46.9	S05°26.6	139°16.4	N22°15.7	247°02.9	S02°11.9
19	263°14.2	135°58.5	03.0	69°47.9	27.3	154°18.3	15.7	262°05.5	12.0
20	278°16.6	150°57.9	02.4	84°48.8	27.9	169°20.3	15.6	277°08.1	12.1
21	293°19.1	165°57.2	·· 01.8	99°49.8	·· 28.6	184°22.3	·· 15.6	292°10.7	·· 12.1
22	308°21.6	180°56.6	01.2	114°50.8	29.2	199°24.3	15.5	307°13.4	12.2
23	323°24.0	195°55.9	00.6	129°51.8	29.9	214°26.2	15.5	322°16.0	12.3
Mer.pass.	01:30	ν -0.6′	d 0.6′	m -3.95	ν 1.0′	d 0.7′	m 1.62	ν 2.0′	d 0.1′ m -1.98	ν 2.6′	d 0.1′ m 0.66

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	338°26.5	210°55.3	N19°00.0	144°52.8	S05°30.5	229°28.2	N22°15.4	337°18.6	S02°12.4
1	353°29.0	225°54.7	18°59.4	159°53.7	31.2	244°30.2	15.4	352°21.2	12.4
2	8°31.4	240°54.0	58.8	174°54.7	31.8	259°32.2	15.3	7°23.8	12.5
3	23°33.9	255°53.4	·· 58.2	189°55.7	·· 32.5	274°34.1	·· 15.3	22°26.4	·· 12.6
4	38°36.3	270°52.7	57.6	204°56.7	33.1	289°36.1	15.2	37°29.1	12.7
5	53°38.8	285°52.1	57.0	219°57.6	33.8	304°38.1	15.1	52°31.7	12.7
6	68°41.3	300°51.4	N18°56.4	234°58.6	S05°34.5	319°40.1	N22°15.1	67°34.3	S02°12.8
7	83°43.7	315°50.8	55.8	249°59.6	35.1	334°42.0	15.0	82°36.9	12.9
8	98°46.2	330°50.2	55.2	265°00.6	35.8	349°44.0	15.0	97°39.5	12.9
9	113°48.7	345°49.5	·· 54.6	280°01.5	·· 36.4	4°46.0	·· 14.9	112°42.1	·· 13.0
10	128°51.1	0°48.9	54.0	295°02.5	37.1	19°48.0	14.9	127°44.8	13.1
11	143°53.6	15°48.2	53.4	310°03.5	37.7	34°49.9	14.8	142°47.4	13.2
12	158°56.1	30°47.6	N18°52.7	325°04.5	S05°38.4	49°51.9	N22°14.8	157°50.0	S02°13.2
13	173°58.5	45°47.0	52.1	340°05.4	39.0	64°53.9	14.7	172°52.6	13.3
14	189°01.0	60°46.3	51.5	355°06.4	39.7	79°55.9	14.6	187°55.2	13.4
15	204°03.5	75°45.7	·· 50.9	10°07.4	·· 40.3	94°57.9	·· 14.6	202°57.9	·· 13.5
16	219°05.9	90°45.0	50.3	25°08.3	41.0	109°59.8	14.5	218°00.5	13.5
17	234°08.4	105°44.4	49.7	40°09.3	41.6	125°01.8	14.5	233°03.1	13.6
18	249°10.8	120°43.8	N18°49.0	55°10.3	S05°42.3	140°03.8	N22°14.4	248°05.7	S02°13.7
19	264°13.3	135°43.1	48.4	70°11.3	42.9	155°05.8	14.4	263°08.3	13.8
20	279°15.8	150°42.5	47.8	85°12.2	43.6	170°07.7	14.3	278°10.9	13.8
21	294°18.2	165°41.9	·· 47.2	100°13.2	·· 44.2	185°09.7	·· 14.3	293°13.6	·· 13.9
22	309°20.7	180°41.2	46.6	115°14.2	44.9	200°11.7	14.2	308°16.2	14.0
23	324°23.2	195°40.6	45.9	130°15.2	45.5	215°13.7	14.2	323°18.8	14.0
Mer.pass.	01:26	ν -0.6′	d 0.6′	m -3.95	ν 1.0′	d 0.7′	m 1.62	ν 2.0′	d 0.1′ m -1.99	ν 2.6′	d 0.1′ m 0.66

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	339°25.6	210°39.9	N18°45.3	145°16.1	S05°46.2	230°15.7	N22°14.1	338°21.4	S02°14.1
1	354°28.1	225°39.3	44.7	160°17.1	46.8	245°17.6	14.0	353°24.0	14.2
2	9°30.6	240°38.7	44.1	175°18.1	47.5	260°19.6	14.0	8°26.7	14.3
3	24°33.0	255°38.0	·· 43.4	190°19.0	·· 48.1	275°21.6	·· 13.9	23°29.3	·· 14.3
4	39°35.5	270°37.4	42.8	205°20.0	48.8	290°23.6	13.9	38°31.9	14.4
5	54°38.0	285°36.8	42.2	220°21.0	49.4	305°25.5	13.8	53°34.5	14.5
6	69°40.4	300°36.1	N18°41.6	235°22.0	S05°50.1	320°27.5	N22°13.8	68°37.1	S02°14.6
7	84°42.9	315°35.5	40.9	250°22.9	50.7	335°29.5	13.7	83°39.7	14.6
8	99°45.3	330°34.9	40.3	265°23.9	51.4	350°31.5	13.7	98°42.4	14.7
9	114°47.8	345°34.2	·· 39.7	280°24.9	·· 52.0	5°33.5	·· 13.6	113°45.0	·· 14.8
10	129°50.3	0°33.6	39.0	295°25.8	52.7	20°35.4	13.5	128°47.6	14.9
11	144°52.7	15°33.0	38.4	310°26.8	53.3	35°37.4	13.5	143°50.2	14.9
12	159°55.2	30°32.3	N18°37.8	325°27.8	S05°54.0	50°39.4	N22°13.4	158°52.8	S02°15.0
13	174°57.7	45°31.7	37.1	340°28.8	54.6	65°41.4	13.4	173°55.5	15.1
14	190°00.1	60°31.1	36.5	355°29.7	55.3	80°43.4	13.3	188°58.1	15.2
15	205°02.6	75°30.4	·· 35.8	10°30.7	·· 55.9	95°45.4	·· 13.3	204°00.7	·· 15.2
16	220°05.1	90°29.8	35.2	25°31.7	56.6	110°47.3	13.2	219°03.3	15.3
17	235°07.5	105°29.2	34.6	40°32.6	57.2	125°49.3	13.2	234°05.9	15.4
18	250°10.0	120°28.5	N18°33.9	55°33.6	S05°57.9	140°51.3	N22°13.1	249°08.6	S02°15.5
19	265°12.5	135°27.9	33.3	70°34.6	58.5	155°53.3	13.1	264°11.2	15.5
20	280°14.9	150°27.3	32.6	85°35.5	59.2	170°55.3	13.0	279°13.8	15.6
21	295°17.4	165°26.6	·· 32.0	100°36.5	05°59.9	185°57.2	·· 12.9	294°16.4	·· 15.7
22	310°19.8	180°26.0	31.4	115°37.5	06°00.5	200°59.2	12.9	309°19.0	15.7
23	325°22.3	195°25.4	30.7	130°38.4	01.2	216°01.2	12.8	324°21.7	15.8
Mer.pass.	01:22	ν -0.6′	d 0.6′	m -3.95	ν 1.0′	d 0.7′	m 1.62	ν 2.0′	d 0.1′ m -1.99	ν 2.6′	d 0.1′ m 0.66

Stars

	SHA	Dec
Alpheratz	357°33.9	29°14.0
Ankaa	353°06.2	-42°09.8
Schedar	349°30.0	56°40.6
Diphda	348°46.5	-17°50.5
Achernar	335°19.4	-57°06.1
Hamal	327°50.4	23°35.1
Polaris	313°36.8	89°22.0
Acamar	315°11.2	-40°11.8
Menkar	314°05.5	4°11.6
Mirfak	308°27.4	49°57.0
Aldebaran	290°39.0	16°33.7
Rigel	281°03.4	-8°10.1
Capella	280°21.2	46°01.3
Bellatrix	278°22.4	6°22.5
Elnath	278°01.3	28°37.7
Alnilam	275°37.3	-1°11.0
Betelgeuse	270°51.6	7°24.8
Canopus	263°52.4	-52°42.2
Sirius	258°26.0	-16°44.8
Adhara	255°05.7	-29°00.1
Procyon	244°50.5	5°09.7
Pollux	243°16.9	27°57.9
Avior	234°15.1	-59°35.2
Suhail	222°46.4	-43°32.0
Miaplacidus	221°39.1	-69°49.2
Alphard	217°47.5	-8°46.1
Regulus	207°34.2	11°50.6
Dubhe	193°41.0	61°36.8
Denebola	182°24.7	14°25.8
Gienah	175°43.3	-17°41.0
Acrux	173°00.2	-63°14.6
Gacrux	171°51.6	-57°15.5
Alioth	166°12.9	55°49.4
Spica	158°22.0	-11°17.7
Alkaid	152°51.9	49°11.3
Hadar	148°35.6	-60°30.0
Menkent	147°57.2	-36°29.9
Arcturus	145°47.6	19°03.1
Rigil Kent.	139°39.9	-60°56.7
Kochab	137°20.2	74°03.2
Zuben'ubi	136°55.6	-16°08.9
Alphecca	126°03.4	26°37.9
Antares	112°15.2	-26°29.4
Atria	107°08.8	-69°04.7
Sabik	102°02.1	-15°45.4
Shaula	96°09.5	-37°07.4
Rasalhague	95°57.9	12°32.6
Eltanin	90°41.7	51°29.4
Kaus Aust.	83°31.6	-34°22.4
Vega	80°32.6	38°48.6
Nunki	75°46.9	-26°15.9
Altair	61°59.2	8°56.3
Peacock	53°04.4	-56°39.2
Deneb	49°25.0	45°22.5
Enif	33°38.0	9°59.7
Al Na'ir	27°31.8	-46°50.1
Fomalhaut	15°13.6	-29°29.0
Scheat	13°44.3	28°13.4
Markab	13°29.0	15°20.7

Aug 29 Fri	SHA	Mer.pass
Venus	233°43.5	09:56
Mars	167°01.9	14:21
Jupiter	251°13.5	08:44
Saturn	358°48.5	01:35

Aug 30 Sat	SHA	Mer.pass
Venus	232°28.8	09:57
Mars	166°26.3	14:20
Jupiter	251°01.7	08:41
Saturn	358°52.1	01:30

Aug 31 Sun	SHA	Mer.pass
Venus	231°14.3	09:58
Mars	165°50.5	14:18
Jupiter	250°50.0	08:38
Saturn	358°55.8	01:26

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°44.5	N09°20.2	120°05.2	14.3′	S19°10.6	10.9′	54.2′
1	194°44.7	19.3	134°38.4	14.2′	19°21.5	10.9′	54.2′
2	209°44.9	18.4	149°11.6	14.2′	19°32.4	10.7′	54.2′
3	224°45.1	·· 17.5	163°44.8	14.1′	19°43.1	10.7′	54.2′
4	239°45.3	16.6	178°17.9	14.0′	19°53.8	10.5′	54.1′
5	254°45.5	15.7	192°50.9	14.0′	20°04.3	10.5′	54.1′
6	269°45.7	N09°14.9	207°23.9	13.9′	S20°14.8	10.4′	54.1′
7	284°45.9	14.0	221°56.8	13.9′	20°25.2	10.4′	54.1′
8	299°46.0	13.1	236°29.7	13.8′	20°35.6	10.2′	54.1′
9	314°46.2	·· 12.2	251°02.5	13.7′	20°45.8	10.2′	54.1′
10	329°46.4	11.3	265°35.2	13.7′	20°56.0	10.0′	54.1′
11	344°46.6	10.4	280°07.9	13.6′	21°06.0	10.0′	54.1′
12	359°46.8	N09°09.5	294°40.5	13.5′	S21°16.0	9.9′	54.1′
13	14°47.0	08.6	309°13.0	13.5′	21°25.9	9.8′	54.1′
14	29°47.2	07.7	323°45.5	13.4′	21°35.7	9.7′	54.1′
15	44°47.4	·· 06.8	338°17.9	13.3′	21°45.4	9.6′	54.1′
16	59°47.6	05.9	352°50.2	13.3′	21°55.0	9.5′	54.1′
17	74°47.8	05.0	7°22.5	13.2′	22°04.5	9.5′	54.1′
18	89°47.9	N09°04.1	21°54.7	13.1′	S22°14.0	9.3′	54.1′
19	104°48.1	03.3	36°26.8	13.1′	22°23.3	9.3′	54.1′
20	119°48.3	02.4	50°58.9	13.0′	22°32.6	9.1′	54.1′
21	134°48.5	·· 01.5	65°30.9	12.9′	22°41.7	9.1′	54.1′
22	149°48.7	09°00.6	80°02.8	12.9′	22°50.8	8.9′	54.1′
23	164°48.9	08°59.7	94°34.7	12.8′	22°59.7	8.9′	54.1′
	SD = 15.8′	d = 0.9′	SD = 14.8′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°49.1	N08°58.8	109°06.5	12.7′	S23°08.6	8.7′	54.1′
1	194°49.3	57.9	123°38.2	12.7′	23°17.3	8.7′	54.1′
2	209°49.5	57.0	138°09.9	12.6′	23°26.0	8.6′	54.1′
3	224°49.7	·· 56.1	152°41.5	12.5′	23°34.6	8.4′	54.1′
4	239°49.9	55.2	167°13.0	12.5′	23°43.0	8.4′	54.2′
5	254°50.1	54.3	181°44.5	12.4′	23°51.4	8.2′	54.2′
6	269°50.2	N08°53.4	196°15.8	12.3′	S23°59.6	8.2′	54.2′
7	284°50.4	52.5	210°47.2	12.2′	24°07.8	8.0′	54.2′
8	299°50.6	51.6	225°18.4	12.2′	24°15.8	8.0′	54.2′
9	314°50.8	·· 50.7	239°49.6	12.1′	24°23.8	7.8′	54.2′
10	329°51.0	49.8	254°20.7	12.0′	24°31.6	7.7′	54.2′
11	344°51.2	48.9	268°51.7	12.0′	24°39.3	7.7′	54.2′
12	359°51.4	N08°48.0	283°22.7	11.9′	S24°47.0	7.5′	54.2′
13	14°51.6	47.1	297°53.6	11.8′	24°54.5	7.4′	54.2′
14	29°51.8	46.2	312°24.4	11.8′	25°01.9	7.3′	54.2′
15	44°52.0	·· 45.3	326°55.1	11.7′	25°09.2	7.2′	54.2′
16	59°52.2	44.4	341°25.8	11.6′	25°16.4	7.0′	54.2′
17	74°52.4	43.5	355°56.4	11.5′	25°23.4	7.0′	54.2′
18	89°52.6	N08°42.6	10°27.0	11.5′	S25°30.4	6.8′	54.2′
19	104°52.8	41.7	24°57.4	11.4′	25°37.2	6.8′	54.2′
20	119°53.0	40.8	39°27.8	11.3′	25°44.0	6.6′	54.2′
21	134°53.1	·· 39.9	53°58.2	11.3′	25°50.6	6.5′	54.3′
22	149°53.3	39.0	68°28.4	11.2′	25°57.1	6.4′	54.3′
23	164°53.5	38.1	82°58.6	11.1′	26°03.5	6.2′	54.3′
	SD = 15.8′	d = 0.9′	SD = 14.8′				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°53.7	N08°37.2	97°28.8	11.1′	S26°09.7	6.2′	54.3′
1	194°53.9	36.3	111°58.8	11.0′	26°15.9	6.0′	54.3′
2	209°54.1	35.4	126°28.8	10.9′	26°21.9	5.9′	54.3′
3	224°54.3	·· 34.5	140°58.7	10.9′	26°27.8	5.8′	54.3′
4	239°54.5	33.6	155°28.6	10.8′	26°33.6	5.6′	54.3′
5	254°54.7	32.7	169°58.3	10.7′	26°39.2	5.6′	54.3′
6	269°54.9	N08°31.8	184°28.1	10.7′	S26°44.8	5.4′	54.3′
7	284°55.1	30.9	198°57.7	10.6′	26°50.2	5.3′	54.4′
8	299°55.3	30.0	213°27.3	10.5′	26°55.5	5.2′	54.4′
9	314°55.5	·· 29.1	227°56.8	10.5′	27°00.7	5.0′	54.4′
10	329°55.7	28.2	242°26.3	10.4′	27°05.7	4.9′	54.4′
11	344°55.9	27.3	256°55.7	10.3′	27°10.6	4.8′	54.4′
12	359°56.1	N08°26.4	271°25.0	10.3′	S27°15.4	4.7′	54.4′
13	14°56.3	25.5	285°54.3	10.2′	27°20.1	4.5′	54.4′
14	29°56.5	24.6	300°23.5	10.1′	27°24.6	4.4′	54.4′
15	44°56.7	·· 23.7	314°52.6	10.1′	27°29.0	4.3′	54.5′
16	59°56.9	22.8	329°21.7	10.0′	27°33.3	4.1′	54.5′
17	74°57.1	21.9	343°50.7	10.0′	27°37.4	4.0′	54.5′
18	89°57.3	N08°21.0	358°19.6	9.9′	S27°41.4	3.9′	54.5′
19	104°57.5	20.1	12°48.5	9.8′	27°45.3	3.8′	54.5′
20	119°57.7	19.2	27°17.4	9.8′	27°49.1	3.6′	54.5′
21	134°57.9	·· 18.3	41°46.1	9.7′	27°52.7	3.4′	54.6′
22	149°58.1	17.3	56°14.9	9.7′	27°56.1	3.4′	54.6′
23	164°58.3	16.4	70°43.5	9.6′	27°59.5	3.2′	54.6′
	SD = 15.8′	d = 0.9′	SD = 14.8′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	////	02:18	03:52	20:05	21:37	////
N 70°	////	02:49	04:07	19:51	21:07	////
68°	01:12	03:12	04:19	19:39	20:46	22:39
66°	01:58	03:29	04:29	19:30	20:29	21:57
64°	02:27	03:44	04:38	19:22	20:15	21:30
62°	02:48	03:55	04:45	19:15	20:04	21:09
60°	03:05	04:05	04:51	19:09	19:54	20:53
N 58°	03:19	04:14	04:56	19:04	19:46	20:40
56°	03:31	04:21	05:01	18:59	19:39	20:29
54°	03:41	04:27	05:05	18:55	19:32	20:19
52°	03:49	04:33	05:09	18:51	19:27	20:10
50°	03:57	04:38	05:12	18:48	19:22	20:03
45°	04:13	04:49	05:20	18:41	19:11	19:47
N 40°	04:25	04:58	05:26	18:34	19:02	19:35
35°	04:35	05:05	05:31	18:29	18:55	19:26
30°	04:43	05:12	05:36	18:25	18:49	19:18
20°	04:55	05:22	05:44	18:17	18:39	19:05
N 10°	05:05	05:30	05:51	18:10	18:31	18:56
0°	05:12	05:36	05:57	18:04	18:25	18:49
S 10°	05:18	05:42	06:04	17:58	18:19	18:43
20°	05:22	05:48	06:10	17:51	18:14	18:39
30°	05:26	05:53	06:17	17:44	18:08	18:36
35°	05:27	05:56	06:22	17:40	18:05	18:35
40°	05:28	05:59	06:26	17:35	18:03	18:34
45°	05:28	06:02	06:32	17:30	18:00	18:34
S 50°	05:28	06:06	06:38	17:24	17:56	18:34
52°	05:28	06:07	06:41	17:21	17:55	18:34
54°	05:28	06:09	06:44	17:18	17:53	18:34
56°	05:28	06:10	06:48	17:14	17:52	18:35
58°	05:27	06:12	06:52	17:10	17:50	18:35
S 60°	05:26	06:14	06:56	17:06	17:48	18:36

Lat.	**Moonrise** Fri	Sat	Sun	**Moonset** Fri	Sat	Sun
N 72°	▬	▬	▬	▬	▬	▬
N 70°	▬	▬	▬	▬	▬	▬
68°	▬	▬	▬	▬	▬	▬
66°	14:42	▬	▬	18:03	▬	▬
64°	14:04	16:22	▬	18:42	18:01	▬
62°	13:37	15:24	17:33	19:10	19:01	18:36
60°	13:17	14:51	16:25	19:31	19:34	19:44
N 58°	13:00	14:26	15:50	19:49	19:59	20:19
56°	12:46	14:07	15:25	20:03	20:19	20:45
54°	12:33	13:51	15:05	20:16	20:36	21:05
52°	12:23	13:37	14:48	20:27	20:50	21:22
50°	12:13	13:25	14:33	20:37	21:02	21:37
45°	11:53	13:00	14:04	20:58	21:28	22:06
N 40°	11:37	12:40	13:41	21:16	21:49	22:30
35°	11:24	12:23	13:23	21:30	22:06	22:49
30°	11:12	12:09	13:07	21:43	22:21	23:05
20°	10:52	11:45	12:39	22:04	22:46	23:33
N 10°	10:35	11:24	12:16	22:23	23:08	23:57
0°	10:19	11:05	11:55	22:41	23:29	·· ··
S 10°	10:03	10:46	11:33	22:58	23:49	·· ··
20°	09:46	10:26	11:10	23:17	·· ··	00:11
30°	09:26	10:02	10:43	23:39	·· ··	00:37
35°	09:15	09:48	10:28	23:52	·· ··	00:52
40°	09:02	09:33	10:09	·· ··	00:07	01:10
45°	08:47	09:14	09:48	·· ··	00:25	01:31
S 50°	08:29	08:50	09:20	·· ··	00:48	01:58
52°	08:20	08:39	09:06	·· ··	00:58	02:11
54°	08:10	08:27	08:51	·· ··	01:10	02:26
56°	07:59	08:12	08:32	00:03	01:24	02:44
58°	07:47	07:55	08:10	00:15	01:41	03:06
S 60°	07:33	07:35	07:41	00:29	02:01	03:35

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 6-8 29-48%
29	01:02	00:53	12:01	16:30	04:07	
30	00:44	00:34	12:01	17:17	04:53	
31	00:25	00:16	12:00	18:07	05:42	

September 01, 02, 03 UT (Mon., Tue., Wed.)

	Aries	Venus		Mars		Jupiter		Saturn	
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	340°24.8	210°24.8	N18°30.1	145°39.4	S06°01.8	231°03.2	N22°12.8	339°24.3	S02°15.9
1	355°27.2	225°24.1	29.4	160°40.4	02.5	246°05.2	12.7	354°26.9	16.0
2	10°29.7	240°23.5	28.8	175°41.4	03.1	261°07.2	12.7	9°29.5	16.0
3	25°32.2	255°22.9	·· 28.1	190°42.3	·· 03.8	276°09.1	·· 12.6	24°32.2	·· 16.1
4	40°34.6	270°22.2	27.5	205°43.3	04.4	291°11.1	12.6	39°34.8	16.2
5	55°37.1	285°21.6	26.8	220°44.3	05.1	306°13.1	12.5	54°37.4	16.3
6	70°39.6	300°21.0	N18°26.2	235°45.2	S06°05.7	321°15.1	N22°12.4	69°40.0	S02°16.3
7	85°42.0	315°20.3	25.5	250°46.2	06.4	336°17.1	12.4	84°42.6	16.4
8	100°44.5	330°19.7	24.9	265°47.2	07.0	351°19.1	12.3	99°45.3	16.5
9	115°46.9	345°19.1	·· 24.2	280°48.1	·· 07.7	6°21.0	·· 12.3	114°47.9	·· 16.6
10	130°49.4	0°18.5	23.6	295°49.1	08.3	21°23.0	12.2	129°50.5	16.6
11	145°51.9	15°17.8	22.9	310°50.1	09.0	36°25.0	12.2	144°53.1	16.7
12	160°54.3	30°17.2	N18°22.2	325°51.0	S06°09.6	51°27.0	N22°12.1	159°55.7	S02°16.8
13	175°56.8	45°16.6	21.6	340°52.0	10.3	66°29.0	12.1	174°58.4	16.9
14	190°59.3	60°16.0	20.9	355°53.0	10.9	81°31.0	12.0	190°01.0	16.9
15	206°01.7	75°15.3	·· 20.3	10°53.9	·· 11.6	96°33.0	·· 12.0	205°03.6	·· 17.0
16	221°04.2	90°14.7	19.6	25°54.9	12.2	111°34.9	11.9	220°06.2	17.1
17	236°06.7	105°14.1	18.9	40°55.9	12.9	126°36.9	11.8	235°08.9	17.2
18	251°09.1	120°13.5	N18°18.3	55°56.8	S06°13.5	141°38.9	N22°11.8	250°11.5	S02°17.2
19	266°11.6	135°12.8	17.6	70°57.8	14.2	156°40.9	11.7	265°14.1	17.3
20	281°14.1	150°12.2	17.0	85°58.8	14.8	171°42.9	11.7	280°16.7	17.4
21	296°16.5	165°11.6	·· 16.3	100°59.7	·· 15.5	186°44.9	·· 11.6	295°19.3	·· 17.5
22	311°19.0	180°11.0	15.6	116°00.7	16.1	201°46.9	11.6	310°22.0	17.5
23	326°21.4	195°10.3	15.0	131°01.6	16.8	216°48.8	11.5	325°24.6	17.6
Mer.pass. 01:18		ν -0.6′	d 0.6′	m -3.95	ν 1.0′	d 0.7′	m 1.62	ν 2.0′	d 0.1′ m -1.99	ν 2.6′	d 0.1′ m 0.65

Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	341°23.9	210°09.7	N18°14.3	146°02.6	S06°17.4	231°50.8	N22°11.5	340°27.2	S02°17.7
1	356°26.4	225°09.1	13.6	161°03.6	18.1	246°52.8	11.4	355°29.8	17.8
2	11°28.8	240°08.5	13.0	176°04.5	18.7	261°54.8	11.3	10°32.5	17.8
3	26°31.3	255°07.8	·· 12.3	191°05.5	·· 19.4	276°56.8	·· 11.3	25°35.1	·· 17.9
4	41°33.8	270°07.2	11.6	206°06.5	20.0	291°58.8	11.2	40°37.7	18.0
5	56°36.2	285°06.6	10.9	221°07.4	20.7	307°00.8	11.2	55°40.3	18.1
6	71°38.7	300°06.0	N18°10.3	236°08.4	S06°21.3	322°02.8	N22°11.1	70°42.9	S02°18.1
7	86°41.2	315°05.4	09.6	251°09.4	22.0	337°04.7	11.1	85°45.6	18.2
8	101°43.6	330°04.7	08.9	266°10.3	22.6	352°06.7	11.0	100°48.2	18.3
9	116°46.1	345°04.1	·· 08.2	281°11.3	·· 23.3	7°08.7	·· 11.0	115°50.8	·· 18.4
10	131°48.6	0°03.5	07.6	296°12.2	23.9	22°10.7	10.9	130°53.4	18.4
11	146°51.0	15°02.9	06.9	311°13.2	24.6	37°12.7	10.8	145°56.1	18.5
12	161°53.5	30°02.3	N18°06.2	326°14.2	S06°25.2	52°14.7	N22°10.8	160°58.7	S02°18.6
13	176°55.9	45°01.6	05.5	341°15.1	25.9	67°16.7	10.7	176°01.3	18.7
14	191°58.4	60°01.0	04.8	356°16.1	26.5	82°18.7	10.7	191°03.9	18.7
15	207°00.9	75°00.4	·· 04.2	11°17.1	·· 27.1	97°20.7	·· 10.6	206°06.6	·· 18.8
16	222°03.3	89°59.8	03.5	26°18.0	27.8	112°22.6	10.6	221°09.2	18.9
17	237°05.8	104°59.2	02.8	41°19.0	28.4	127°24.6	10.5	236°11.8	19.0
18	252°08.3	119°58.5	N18°02.1	56°19.9	S06°29.1	142°26.6	N22°10.5	251°14.4	S02°19.0
19	267°10.7	134°57.9	01.4	71°20.9	29.7	157°28.6	10.4	266°17.0	19.1
20	282°13.2	149°57.3	00.7	86°21.9	30.4	172°30.6	10.4	281°19.7	19.2
21	297°15.7	164°56.7	18°00.1	101°22.8	·· 31.0	187°32.6	·· 10.3	296°22.3	·· 19.3
22	312°18.1	179°56.1	17°59.4	116°23.8	31.7	202°34.6	10.2	311°24.9	19.3
23	327°20.6	194°55.5	58.7	131°24.8	32.3	217°36.6	10.2	326°27.5	19.4
Mer.pass. 01:14		ν -0.6′	d 0.7′	m -3.95	ν 1.0′	d 0.6′	m 1.62	ν 2.0′	d 0.1′ m -2.00	ν 2.6′	d 0.1′ m 0.65

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	342°23.1	209°54.8	N17°58.0	146°25.7	S06°33.0	232°38.6	N22°10.1	341°30.2	S02°19.5
1	357°25.5	224°54.2	57.3	161°26.7	33.6	247°40.6	10.1	356°32.8	19.6
2	12°28.0	239°53.6	56.6	176°27.6	34.3	262°42.6	10.0	11°35.4	19.6
3	27°30.4	254°53.0	·· 55.9	191°28.6	·· 34.9	277°44.5	·· 10.0	26°38.0	·· 19.7
4	42°32.9	269°52.4	55.2	206°29.6	35.6	292°46.5	09.9	41°40.7	19.8
5	57°35.4	284°51.8	54.5	221°30.5	36.2	307°48.5	09.9	56°43.3	19.9
6	72°37.8	299°51.2	N17°53.8	236°31.5	S06°36.9	322°50.5	N22°09.8	71°45.9	S02°19.9
7	87°40.3	314°50.5	53.1	251°32.4	37.5	337°52.5	09.7	86°48.5	20.0
8	102°42.8	329°49.9	52.5	266°33.4	38.2	352°54.5	09.7	101°51.2	20.1
9	117°45.2	344°49.3	·· 51.8	281°34.3	·· 38.8	7°56.5	·· 09.6	116°53.8	·· 20.2
10	132°47.7	359°48.7	51.1	296°35.3	39.5	22°58.5	09.6	131°56.4	20.2
11	147°50.2	14°48.1	50.4	311°36.3	40.1	38°00.5	09.5	146°59.0	20.3
12	162°52.6	29°47.5	N17°49.7	326°37.2	S06°40.8	53°02.5	N22°09.5	162°01.7	S02°20.4
13	177°55.1	44°46.9	49.0	341°38.2	41.4	68°04.5	09.4	177°04.3	20.5
14	192°57.5	59°46.2	48.3	356°39.1	42.1	83°06.5	09.4	192°06.9	20.6
15	208°00.0	74°45.6	·· 47.6	11°40.1	·· 42.7	98°08.5	·· 09.3	207°09.5	·· 20.6
16	223°02.5	89°45.0	46.8	26°41.1	43.4	113°10.5	09.2	222°12.2	20.7
17	238°04.9	104°44.4	46.1	41°42.0	44.0	128°12.5	09.2	237°14.8	20.8
18	253°07.4	119°43.8	N17°45.4	56°43.0	S06°44.7	143°14.4	N22°09.1	252°17.4	S02°20.9
19	268°09.9	134°43.2	44.7	71°43.9	45.3	158°16.4	09.1	267°20.0	20.9
20	283°12.3	149°42.6	44.0	86°44.9	46.0	173°18.4	09.0	282°22.7	21.0
21	298°14.8	164°42.0	·· 43.3	101°45.8	·· 46.6	188°20.4	·· 09.0	297°25.3	·· 21.1
22	313°17.3	179°41.4	42.6	116°46.8	47.3	203°22.4	08.9	312°27.9	21.2
23	328°19.7	194°40.7	41.9	131°47.8	47.9	218°24.4	08.9	327°30.5	21.2
Mer.pass. 01:10		ν -0.6′	d 0.7′	m -3.94	ν 1.0′	d 0.6′	m 1.62	ν 2.0′	d 0.1′ m -2.00	ν 2.6′	d 0.1′ m 0.64

Stars

	SHA	Dec
Alpheratz	357°33.9	29°14.0
Ankaa	353°06.2	-42°09.8
Schedar	349°30.0	56°40.6
Diphda	348°46.5	-17°50.5
Achernar	335°19.3	-57°06.1
Hamal	327°50.4	23°35.1
Polaris	313°35.1	89°22.1
Acamar	315°11.2	-40°11.8
Menkar	314°05.5	4°11.6
Mirfak	308°27.3	49°57.0
Aldebaran	290°39.0	16°33.7
Rigel	281°03.4	-8°10.1
Capella	280°21.2	46°01.3
Bellatrix	278°22.4	6°22.5
Elnath	278°01.3	28°37.7
Alnilam	275°37.3	-1°11.0
Betelgeuse	270°51.6	7°24.8
Canopus	263°52.4	-52°42.2
Sirius	258°25.9	-16°44.8
Adhara	255°05.7	-29°00.1
Procyon	244°50.5	5°09.7
Pollux	243°16.9	27°57.9
Avior	234°15.1	-59°35.2
Suhail	222°46.3	-43°32.0
Miaplacidus	221°39.1	-69°49.2
Alphard	217°47.5	-8°46.1
Regulus	207°34.2	11°50.6
Dubhe	193°41.0	61°36.8
Denebola	182°24.7	14°25.8
Gienah	175°43.3	-17°41.0
Acrux	173°00.2	-63°14.6
Gacrux	171°51.6	-57°15.5
Alioth	166°12.9	55°49.4
Spica	158°22.0	-11°17.7
Alkaid	152°51.9	49°11.3
Hadar	148°35.7	-60°30.0
Menkent	147°57.2	-36°29.9
Arcturus	145°47.6	19°03.1
Rigil Kent.	139°39.9	-60°56.7
Kochab	137°20.3	74°03.2
Zuben'ubi	136°55.6	-16°08.9
Alphecca	126°03.4	26°37.9
Antares	112°15.2	-26°29.4
Atria	107°08.8	-69°04.7
Sabik	102°02.1	-15°45.4
Shaula	96°09.5	-37°07.4
Rasalhague	95°58.0	12°32.6
Eltanin	90°41.7	51°29.4
Kaus Aust.	83°31.6	-34°22.4
Vega	80°32.7	38°48.7
Nunki	75°46.9	-26°15.9
Altair	61°59.2	8°56.3
Peacock	53°04.4	-56°39.2
Deneb	49°25.1	45°22.5
Enif	33°38.0	9°59.7
Al Na'ir	27°31.8	-46°50.1
Fomalhaut	15°13.5	-29°29.0
Scheat	13°44.3	28°13.4
Markab	13°29.0	15°20.7

Sep 01 Mon	SHA	Mer.pass
Venus	230°00.0	09:59
Mars	165°14.6	14:16
Jupiter	250°38.4	08:35
Saturn	358°59.5	01:22

Sep 02 Tue	SHA	Mer.pass
Venus	228°45.8	10:00
Mars	164°38.7	14:15
Jupiter	250°26.9	08:31
Saturn	359°03.3	01:18

Sep 03 Wed	SHA	Mer.pass
Venus	227°31.8	10:01
Mars	164°02.7	14:13
Jupiter	250°15.5	08:28
Saturn	359°07.1	01:14

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h — Sun — Moon

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	179°58.4	N08°15.5	85°12.1	9.6′	S28°02.7	3.1′	54.6′
1	194°58.6	14.6	99°40.7	9.5′	28°05.8	2.9′	54.6′
2	209°58.8	13.7	114°09.2	9.5′	28°08.7	2.8′	54.6′
3	224°59.0	·· 12.8	128°37.7	9.4′	28°11.5	2.6′	54.7′
4	239°59.2	11.9	143°06.1	9.3′	28°14.1	2.5′	54.7′
5	254°59.4	11.0	157°34.4	9.3′	28°16.6	2.4′	54.7′
6	269°59.6	N08°10.1	172°02.7	9.2′	S28°19.0	2.3′	54.7′
7	284°59.8	09.2	186°31.0	9.2′	28°21.3	2.1′	54.7′
8	300°00.0	08.3	200°59.2	9.2′	28°23.4	1.9′	54.7′
9	315°00.2	·· 07.4	215°27.3	9.1′	28°25.3	1.8′	54.8′
10	330°00.4	06.5	229°55.4	9.1′	28°27.1	1.7′	54.8′
11	345°00.6	05.5	244°23.5	9.0′	28°28.8	1.5′	54.8′
12	0°00.8	N08°04.6	258°51.5	9.0′	S28°30.3	1.4′	54.8′
13	15°01.0	03.7	273°19.5	8.9′	28°31.7	1.2′	54.8′
14	30°01.2	02.8	287°47.4	8.9′	28°32.9	1.1′	54.9′
15	45°01.4	·· 01.9	302°15.3	8.9′	28°34.0	1.0′	54.9′
16	60°01.6	01.0	316°43.2	8.8′	28°35.0	0.8′	54.9′
17	75°01.8	08°00.1	331°11.0	8.8′	28°35.8	0.6′	54.9′
18	90°02.0	N07°59.2	345°38.8	8.7′	S28°36.4	0.5′	54.9′
19	105°02.2	58.3	0°06.5	8.7′	28°36.9	0.4′	55.0′
20	120°02.4	57.4	14°34.2	8.7′	28°37.3	0.2′	55.0′
21	135°02.6	·· 56.4	29°01.9	8.6′	28°37.5	0.1′	55.0′
22	150°02.8	55.5	43°29.6	8.6′	28°37.6	0.1′	55.0′
23	165°03.0	54.6	57°57.2	8.6′	28°37.5	0.3′	55.1′
	SD = 15.8′	d = 0.9′		SD = 14.9′			

Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	180°03.2	N07°53.7	72°24.8	8.6′	S28°37.2	0.3′	55.1′
1	195°03.4	52.8	86°52.3	8.5′	28°36.9	0.6′	55.1′
2	210°03.7	51.9	101°19.9	8.5′	28°36.3	0.7′	55.1′
3	225°03.9	·· 51.0	115°47.4	8.5′	28°35.6	0.8′	55.2′
4	240°04.1	50.1	130°14.9	8.5′	28°34.8	1.0′	55.2′
5	255°04.3	49.1	144°42.3	8.4′	28°33.8	1.1′	55.2′
6	270°04.5	N07°48.2	159°09.8	8.4′	S28°32.7	1.3′	55.2′
7	285°04.7	47.3	173°37.2	8.4′	28°31.4	1.4′	55.3′
8	300°04.9	46.4	188°04.6	8.4′	28°30.0	1.6′	55.3′
9	315°05.1	·· 45.5	202°32.0	8.4′	28°28.4	1.7′	55.3′
10	330°05.3	44.6	216°59.4	8.4′	28°26.7	1.9′	55.3′
11	345°05.5	43.7	231°26.7	8.3′	28°24.8	2.1′	55.4′
12	0°05.7	N07°42.8	245°54.1	8.3′	S28°22.7	2.2′	55.4′
13	15°05.9	41.8	260°21.4	8.3′	28°20.5	2.3′	55.4′
14	30°06.1	40.9	274°48.7	8.3′	28°18.2	2.5′	55.4′
15	45°06.3	·· 40.0	289°16.0	8.3′	28°15.7	2.7′	55.5′
16	60°06.5	39.1	303°43.3	8.3′	28°13.0	2.8′	55.5′
17	75°06.7	38.2	318°10.6	8.3′	28°10.2	2.9′	55.5′
18	90°06.9	N07°37.3	332°37.9	8.3′	S28°07.3	3.1′	55.5′
19	105°07.1	36.3	347°05.2	8.3′	28°04.2	3.3′	55.6′
20	120°07.3	35.4	1°32.5	8.3′	28°00.9	3.4′	55.6′
21	135°07.5	·· 34.5	15°59.8	8.3′	27°57.5	3.6′	55.6′
22	150°07.7	33.6	30°27.1	8.3′	27°53.9	3.7′	55.7′
23	165°07.9	32.7	44°54.3	8.3′	27°50.2	3.9′	55.7′
	SD = 15.8′	d = 0.9′		SD = 15.0′			

Wed	GHA	Dec	GHA	ν	Dec	d	HP
0	180°08.1	N07°31.8	59°21.6	8.3′	S27°46.3	4.0′	55.7′
1	195°08.3	30.8	73°48.9	8.3′	27°42.3	4.2′	55.7′
2	210°08.5	29.9	88°16.2	8.3′	27°38.1	4.3′	55.8′
3	225°08.7	·· 29.0	102°43.5	8.3′	27°33.8	4.5′	55.8′
4	240°08.9	28.1	117°10.8	8.3′	27°29.3	4.6′	55.8′
5	255°09.1	27.2	131°38.2	8.3′	27°24.7	4.8′	55.9′
6	270°09.3	N07°26.3	146°05.5	8.3′	S27°19.9	5.0′	55.9′
7	285°09.6	25.3	160°32.8	8.4′	27°14.9	5.1′	55.9′
8	300°09.8	24.4	175°00.2	8.4′	27°09.8	5.2′	55.9′
9	315°10.0	·· 23.5	189°27.6	8.4′	27°04.6	5.4′	56.0′
10	330°10.2	22.6	203°54.9	8.4′	26°59.2	5.6′	56.0′
11	345°10.4	21.7	218°22.3	8.4′	26°53.6	5.7′	56.0′
12	0°10.6	N07°20.7	232°49.8	8.4′	S26°47.9	5.8′	56.1′
13	15°10.8	19.8	247°17.2	8.5′	26°42.1	6.0′	56.1′
14	30°11.0	18.9	261°44.6	8.5′	26°36.1	6.2′	56.1′
15	45°11.2	·· 18.0	276°12.1	8.5′	26°29.9	6.2′	56.2′
16	60°11.4	17.1	290°39.6	8.5′	26°23.7	6.5′	56.2′
17	75°11.6	16.1	305°07.1	8.5′	26°17.2	6.6′	56.2′
18	90°11.8	N07°15.2	319°34.7	8.6′	S26°10.6	6.7′	56.2′
19	105°12.0	14.3	334°02.3	8.6′	26°03.9	6.9′	56.3′
20	120°12.2	13.4	348°29.9	8.6′	25°57.0	7.1′	56.3′
21	135°12.4	·· 12.5	2°57.5	8.6′	25°49.9	7.2′	56.3′
22	150°12.6	11.5	17°25.1	8.7′	25°42.7	7.3′	56.4′
23	165°12.9	10.6	31°52.8	8.7′	25°35.4	7.5′	56.4′
	SD = 15.8′	d = 0.9′		SD = 15.2′			

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	////	02:40	04:07	19:48	21:14	////
N 70°	00:24	03:06	04:20	19:36	20:49	23:10
68°	01:42	03:26	04:31	19:26	20:30	22:10
66°	02:17	03:41	04:39	19:18	20:15	21:37
64°	02:41	03:54	04:46	19:11	20:03	21:14
62°	03:00	04:04	04:52	19:05	19:53	20:56
60°	03:15	04:13	04:58	19:00	19:44	20:42
N 58°	03:28	04:21	05:02	18:55	19:37	20:30
56°	03:38	04:27	05:07	18:51	19:30	20:19
54°	03:47	04:33	05:10	18:48	19:25	20:10
52°	03:55	04:38	05:14	18:44	19:20	20:02
50°	04:02	04:43	05:17	18:41	19:15	19:56
45°	04:17	04:53	05:23	18:35	19:05	19:41
N 40°	04:28	05:01	05:29	18:30	18:57	19:30
35°	04:37	05:08	05:34	18:25	18:51	19:21
30°	04:45	05:13	05:38	18:21	18:45	19:14
20°	04:56	05:22	05:45	18:14	18:37	19:03
N 10°	05:05	05:30	05:51	18:08	18:30	18:54
0°	05:11	05:35	05:56	18:03	18:24	18:48
S 10°	05:16	05:41	06:02	17:58	18:19	18:43
20°	05:20	05:45	06:08	17:52	18:14	18:40
30°	05:22	05:50	06:14	17:46	18:10	18:38
35°	05:23	05:52	06:18	17:42	18:08	18:37
40°	05:23	05:55	06:22	17:38	18:05	18:37
45°	05:23	05:57	06:26	17:34	18:03	18:37
S 50°	05:22	06:00	06:32	17:28	18:01	18:38
52°	05:22	06:01	06:35	17:26	18:00	18:39
54°	05:21	06:02	06:37	17:23	17:58	18:39
56°	05:20	06:03	06:40	17:20	17:57	18:40
58°	05:19	06:04	06:44	17:16	17:56	18:41
S 60°	05:18	06:06	06:48	17:13	17:55	18:43

Lat.	Moonrise Mon	Moonrise Tue	Moonrise Wed	Moonset Mon	Moonset Tue	Moonset Wed
N 72°	▬	▬	▬	▬	▬	▬
N 70°	▬	▬	▬	▬	▬	▬
68°	▬	▬	▬	▬	▬	▬
66°	▬	▬	▬	▬	▬	▬
64°	▬	▬	20:40	▬	▬	21:05
62°	▬	▬	19:14	▬	▬	22:31
60°	17:43	18:23	18:37	20:16	21:28	23:07
N 58°	17:00	17:46	18:11	20:59	22:05	23:33
56°	16:31	17:19	17:50	21:27	22:31	23:53
54°	16:09	16:58	17:33	21:50	22:52	·· ··
52°	15:51	16:41	17:18	22:08	23:10	·· ··
50°	15:35	16:26	17:05	22:24	23:24	·· ··
45°	15:04	15:56	16:38	22:55	23:54	·· ··
N 40°	14:40	15:32	16:17	23:19	·· ··	00:18
35°	14:20	15:12	15:59	23:39	·· ··	00:37
30°	14:03	14:56	15:44	23:56	·· ··	00:53
20°	13:34	14:27	15:18	·· ··	00:25	01:21
N 10°	13:10	14:03	14:56	·· ··	00:50	01:45
0°	12:47	13:41	14:35	00:19	01:13	02:07
S 10°	12:24	13:18	14:14	00:42	01:35	02:29
20°	11:59	12:54	13:51	01:06	02:00	02:52
30°	11:31	12:25	13:25	01:34	02:29	03:19
35°	11:14	12:08	13:09	01:50	02:45	03:35
40°	10:55	11:49	12:51	02:10	03:05	03:54
45°	10:31	11:25	12:29	02:33	03:29	04:16
S 50°	10:00	10:54	12:02	03:04	04:00	04:45
52°	09:45	10:39	11:48	03:19	04:15	04:59
54°	09:28	10:21	11:32	03:36	04:33	05:15
56°	09:06	10:00	11:14	03:57	04:55	05:34
58°	08:39	09:32	10:51	04:24	05:23	05:57
S 60°	08:01	08:52	10:20	05:02	06:02	06:28

Day	Sun Eqn.of Time 00h	Sun Eqn.of Time 12h	Sun Mer. Pass	Moon Mer.Pass. Upper	Moon Mer.Pass. Lower	Moon Age
	mm:ss	mm:ss	hh:mm	hh:mm	hh:mm	9-11 57-76%
01	00:06	00:03	12:00	19:00	06:33	
02	00:13	00:23	12:00	19:54	07:26	
03	00:32	00:42	11:59	20:48	08:21	

September 04, 05, 06 UT (Thu., Fri., Sat.)

	Aries	Venus		Mars		Jupiter		Saturn	
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	343°22.2	209°40.1	N17°41.2	146°48.7	S06°48.6	233°26.4	N22°08.8	342°33.2	S02°21.3
1	358°24.7	224°39.5	40.5	161°49.7	49.2	248°28.4	08.8	357°35.8	21.4
2	13°27.1	239°38.9	39.8	176°50.6	49.8	263°30.4	08.7	12°38.4	21.5
3	28°29.6	254°38.3	·· 39.1	191°51.6	·· 50.5	278°32.4	·· 08.6	27°41.1	·· 21.5
4	43°32.0	269°37.7	38.3	206°52.5	51.1	293°34.4	08.6	42°43.7	21.6
5	58°34.5	284°37.1	37.6	221°53.5	51.8	308°36.4	08.5	57°46.3	21.7
6	73°37.0	299°36.5	N17°36.9	236°54.5	S06°52.4	323°38.4	N22°08.5	72°48.9	S02°21.8
7	88°39.4	314°35.9	36.2	251°55.4	53.1	338°40.4	08.4	87°51.6	21.8
8	103°41.9	329°35.3	35.5	266°56.4	53.7	353°42.4	08.4	102°54.2	21.9
9	118°44.4	344°34.7	·· 34.8	281°57.3	·· 54.4	8°44.4	·· 08.3	117°56.8	·· 22.0
10	133°46.8	359°34.1	34.0	296°58.3	55.0	23°46.4	08.3	132°59.4	22.1
11	148°49.3	14°33.5	33.3	311°59.2	55.7	38°48.4	08.2	148°02.1	22.1
12	163°51.8	29°32.9	N17°32.6	327°00.2	S06°56.3	53°50.4	N22°08.1	163°04.7	S02°22.2
13	178°54.2	44°32.2	31.9	342°01.1	57.0	68°52.4	08.1	178°07.3	22.3
14	193°56.7	59°31.6	31.2	357°02.1	57.6	83°54.4	08.0	193°09.9	22.4
15	208°59.2	74°31.0	·· 30.4	12°03.0	·· 58.3	98°56.4	·· 08.0	208°12.6	·· 22.5
16	224°01.6	89°30.4	29.7	27°04.0	58.9	113°58.4	07.9	223°15.2	22.5
17	239°04.1	104°29.8	29.0	42°05.0	06°59.6	129°00.4	07.9	238°17.8	22.6
18	254°06.5	119°29.2	N17°28.3	57°05.9	S07°00.2	144°02.4	N22°07.8	253°20.5	S02°22.7
19	269°09.0	134°28.6	27.5	72°06.9	00.9	159°04.4	07.8	268°23.1	22.8
20	284°11.5	149°28.0	26.8	87°07.8	01.5	174°06.4	07.7	283°25.7	22.8
21	299°13.9	164°27.4	·· 26.1	102°08.8	·· 02.1	189°08.4	·· 07.7	298°28.3	·· 22.9
22	314°16.4	179°26.8	25.3	117°09.7	02.8	204°10.4	07.6	313°31.0	23.0
23	329°18.9	194°26.2	24.6	132°10.7	03.4	219°12.4	07.5	328°33.6	23.1
Mer.pass. 01:06		ν -0.6′	d 0.7′	m -3.94	ν 1.0′	d 0.6′	m 1.62	ν 2.0′	d 0.1′ m -2.00	ν 2.6′	d 0.1′ m 0.64

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	344°21.3	209°25.6	N17°23.9	147°11.6	S07°04.1	234°14.4	N22°07.5	343°36.2	S02°23.1
1	359°23.8	224°25.0	23.2	162°12.6	04.7	249°16.4	07.4	358°38.8	23.2
2	14°26.3	239°24.4	22.4	177°13.5	05.4	264°18.4	07.4	13°41.5	23.3
3	29°28.7	254°23.8	·· 21.7	192°14.5	·· 06.0	279°20.4	·· 07.3	28°44.1	·· 23.4
4	44°31.2	269°23.2	20.9	207°15.4	06.7	294°22.4	07.3	43°46.7	23.4
5	59°33.7	284°22.6	20.2	222°16.4	07.3	309°24.4	07.2	58°49.4	23.5
6	74°36.1	299°22.0	N17°19.5	237°17.3	S07°08.0	324°26.4	N22°07.2	73°52.0	S02°23.6
7	89°38.6	314°21.4	18.7	252°18.3	08.6	339°28.4	07.1	88°54.6	23.7
8	104°41.0	329°20.8	18.0	267°19.2	09.3	354°30.4	07.0	103°57.2	23.7
9	119°43.5	344°20.2	·· 17.3	282°20.2	·· 09.9	9°32.4	·· 07.0	118°59.9	·· 23.8
10	134°46.0	359°19.6	16.5	297°21.1	10.6	24°34.4	06.9	134°02.5	23.9
11	149°48.4	14°19.0	15.8	312°22.1	11.2	39°36.4	06.9	149°05.1	24.0
12	164°50.9	29°18.4	N17°15.0	327°23.0	S07°11.8	54°38.4	N22°06.8	164°07.8	S02°24.1
13	179°53.4	44°17.8	14.3	342°24.0	12.5	69°40.4	06.8	179°10.4	24.1
14	194°55.8	59°17.2	13.6	357°24.9	13.1	84°42.4	06.7	194°13.0	24.2
15	209°58.3	74°16.6	·· 12.8	12°25.9	·· 13.8	99°44.4	·· 06.7	209°15.6	·· 24.3
16	225°00.8	89°16.0	12.1	27°26.8	14.4	114°46.4	06.6	224°18.3	24.4
17	240°03.2	104°15.4	11.3	42°27.8	15.1	129°48.4	06.5	239°20.9	24.4
18	255°05.7	119°14.8	N17°10.6	57°28.7	S07°15.7	144°50.4	N22°06.5	254°23.5	S02°24.5
19	270°08.1	134°14.2	09.8	72°29.7	16.4	159°52.4	06.4	269°26.2	24.6
20	285°10.6	149°13.6	09.1	87°30.6	17.0	174°54.4	06.4	284°28.8	24.7
21	300°13.1	164°13.0	·· 08.3	102°31.6	·· 17.7	189°56.4	·· 06.3	299°31.4	·· 24.7
22	315°15.5	179°12.4	07.6	117°32.5	18.3	204°58.4	06.3	314°34.0	24.8
23	330°18.0	194°11.9	06.8	132°33.5	19.0	220°00.4	06.2	329°36.7	24.9
Mer.pass. 01:02		ν -0.6′	d 0.7′	m -3.94	ν 1.0′	d 0.6′	m 1.62	ν 2.0′	d 0.1′ m -2.01	ν 2.6′	d 0.1′ m 0.64

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	345°20.5	209°11.3	N17°06.1	147°34.4	S07°19.6	235°02.4	N22°06.2	344°39.3	S02°25.0
1	0°22.9	224°10.7	05.3	162°35.4	20.2	250°04.4	06.1	359°41.9	25.1
2	15°25.4	239°10.1	04.6	177°36.3	20.9	265°06.4	06.1	14°44.6	25.1
3	30°27.9	254°09.5	·· 03.8	192°37.3	·· 21.5	280°08.4	·· 06.0	29°47.2	·· 25.2
4	45°30.3	269°08.9	03.1	207°38.2	22.2	295°10.4	05.9	44°49.8	25.3
5	60°32.8	284°08.3	02.3	222°39.2	22.8	310°12.4	05.9	59°52.4	25.4
6	75°35.3	299°07.7	N17°01.6	237°40.1	S07°23.5	325°14.4	N22°05.8	74°55.1	S02°25.4
7	90°37.7	314°07.1	00.8	252°41.1	24.1	340°16.5	05.8	89°57.7	25.5
8	105°40.2	329°06.5	17°00.0	267°42.0	24.8	355°18.5	05.7	105°00.3	25.6
9	120°42.6	344°05.9	16°59.3	282°43.0	·· 25.4	10°20.5	·· 05.7	120°03.0	·· 25.7
10	135°45.1	359°05.3	58.5	297°43.9	26.1	25°22.5	05.6	135°05.6	25.7
11	150°47.6	14°04.7	57.8	312°44.8	26.7	40°24.5	05.6	150°08.2	25.8
12	165°50.0	29°04.1	N16°57.0	327°45.8	S07°27.3	55°26.5	N22°05.5	165°10.8	S02°25.9
13	180°52.5	44°03.6	56.2	342°46.7	28.0	70°28.5	05.4	180°13.5	26.0
14	195°55.0	59°03.0	55.5	357°47.7	28.6	85°30.5	05.4	195°16.1	26.1
15	210°57.4	74°02.4	·· 54.7	12°48.6	·· 29.3	100°32.5	·· 05.3	210°18.7	·· 26.1
16	225°59.9	89°01.8	53.9	27°49.6	29.9	115°34.5	05.3	225°21.4	26.2
17	241°02.4	104°01.2	53.2	42°50.5	30.6	130°36.5	05.2	240°24.0	26.3
18	256°04.8	119°00.6	N16°52.4	57°51.5	S07°31.2	145°38.5	N22°05.2	255°26.6	S02°26.4
19	271°07.3	134°00.0	51.6	72°52.4	31.9	160°40.5	05.1	270°29.3	26.4
20	286°09.8	148°59.4	50.9	87°53.4	32.5	175°42.5	05.1	285°31.9	26.5
21	301°12.2	163°58.8	·· 50.1	102°54.3	·· 33.1	190°44.6	·· 05.0	300°34.5	·· 26.6
22	316°14.7	178°58.3	49.3	117°55.2	33.8	205°46.6	05.0	315°37.2	26.7
23	331°17.1	193°57.7	48.6	132°56.2	34.4	220°48.6	04.9	330°39.8	26.8
Mer.pass. 00:58		ν -0.6′	d 0.8′	m -3.94	ν 0.9′	d 0.6′	m 1.62	ν 2.0′	d 0.1′ m -2.01	ν 2.6′	d 0.1′ m 0.63

Stars

	SHA	Dec
Alpheratz	357°33.9	29°14.0
Ankaa	353°06.2	-42°09.8
Schedar	349°29.9	56°40.7
Diphda	348°46.4	-17°50.5
Achernar	335°19.3	-57°06.1
Hamal	327°50.4	23°35.1
Polaris	313°33.6	89°22.1
Acamar	315°11.1	-40°11.8
Menkar	314°05.4	4°11.6
Mirfak	308°27.3	49°57.0
Aldebaran	290°39.0	16°33.7
Rigel	281°03.4	-8°10.1
Capella	280°21.1	46°01.3
Bellatrix	278°22.3	6°22.5
Elnath	278°01.2	28°37.7
Alnilam	275°37.2	-1°11.0
Betelgeuse	270°51.6	7°24.8
Canopus	263°52.4	-52°42.2
Sirius	258°25.9	-16°44.8
Adhara	255°05.6	-29°00.1
Procyon	244°50.5	5°09.7
Pollux	243°16.9	27°57.9
Avior	234°15.0	-59°35.2
Suhail	222°46.3	-43°32.0
Miaplacidus	221°39.1	-69°49.1
Alphard	217°47.5	-8°46.0
Regulus	207°34.2	11°50.6
Dubhe	193°41.0	61°36.8
Denebola	182°24.7	14°25.8
Gienah	175°43.3	-17°41.0
Acrux	173°00.2	-63°14.6
Gacrux	171°51.6	-57°15.5
Alioth	166°12.9	55°49.4
Spica	158°22.0	-11°17.7
Alkaid	152°51.9	49°11.3
Hadar	148°35.7	-60°30.0
Menkent	147°57.2	-36°29.8
Arcturus	145°47.6	19°03.1
Rigil Kent.	139°39.9	-60°56.7
Kochab	137°20.3	74°03.2
Zuben'ubi	136°55.6	-16°08.9
Alphecca	126°03.4	26°37.9
Antares	112°15.2	-26°29.4
Atria	107°08.9	-69°04.7
Sabik	102°02.1	-15°45.4
Shaula	96°09.5	-37°07.4
Rasalhague	95°58.0	12°32.6
Eltanin	90°41.8	51°29.4
Kaus Aust.	83°31.6	-34°22.4
Vega	80°32.7	38°48.7
Nunki	75°46.9	-26°15.9
Altair	61°59.2	8°56.3
Peacock	53°04.4	-56°39.2
Deneb	49°25.1	45°22.5
Enif	33°37.9	9°59.7
Al Na'ir	27°31.7	-46°50.1
Fomalhaut	15°13.5	-29°29.0
Scheat	13°44.3	28°13.4
Markab	13°29.0	15°20.7

Sep 04 Thu	SHA	Mer.pass
Venus	226°17.9	10:02
Mars	163°26.5	14:12
Jupiter	250°04.2	08:25
Saturn	359°11.0	01:10

Sep 05 Fri	SHA	Mer.pass
Venus	225°04.3	10:03
Mars	162°50.3	14:10
Jupiter	249°53.0	08:22
Saturn	359°14.9	01:05

Sep 06 Sat	SHA	Mer.pass
Venus	223°50.8	10:04
Mars	162°14.0	14:09
Jupiter	249°41.9	08:19
Saturn	359°18.8	01:01

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°13.1	N07°09.7	46°20.5	8.7′	S25°27.9	7.6′	56.4′
1	195°13.3	08.8	60°48.2	8.8′	25°20.3	7.8′	56.5′
2	210°13.5	07.9	75°16.0	8.8′	25°12.5	7.9′	56.5′
3	225°13.7	·· 06.9	89°43.8	8.8′	25°04.6	8.0′	56.5′
4	240°13.9	06.0	104°11.6	8.9′	24°56.6	8.2′	56.6′
5	255°14.1	05.1	118°39.5	8.9′	24°48.4	8.4′	56.6′
6	270°14.3	N07°04.2	133°07.4	8.9′	S24°40.0	8.5′	56.6′
7	285°14.5	03.2	147°35.3	9.0′	24°31.5	8.6′	56.7′
8	300°14.7	02.3	162°03.3	9.0′	24°22.9	8.8′	56.7′
9	315°14.9	·· 01.4	176°31.3	9.0′	24°14.1	8.9′	56.7′
10	330°15.1	07°00.5	190°59.4	9.1′	24°05.2	9.0′	56.8′
11	345°15.3	06°59.5	205°27.5	9.1′	23°56.2	9.2′	56.8′
12	0°15.6	N06°58.6	219°55.6	9.2′	S23°47.0	9.3′	56.8′
13	15°15.8	57.7	234°23.7	9.2′	23°37.7	9.5′	56.9′
14	30°16.0	56.8	248°51.9	9.2′	23°28.2	9.6′	56.9′
15	45°16.2	·· 55.9	263°20.2	9.3′	23°18.6	9.7′	56.9′
16	60°16.4	54.9	277°48.4	9.3′	23°08.9	9.9′	57.0′
17	75°16.6	54.0	292°16.8	9.4′	22°59.0	10.0′	57.0′
18	90°16.8	N06°53.1	306°45.1	9.4′	S22°49.0	10.1′	57.0′
19	105°17.0	52.1	321°13.5	9.4′	22°38.9	10.3′	57.1′
20	120°17.2	51.2	335°42.0	9.5′	22°28.6	10.4′	57.1′
21	135°17.4	·· 50.3	350°10.4	9.5′	22°18.2	10.5′	57.1′
22	150°17.6	49.4	4°39.0	9.6′	22°07.7	10.7′	57.2′
23	165°17.9	48.4	19°07.5	9.6′	21°57.0	10.8′	57.2′
	SD = 15.9′	d = 0.9′	SD = 15.4′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°18.1	N06°47.5	33°36.2	9.7′	S21°46.2	10.9′	57.2′
1	195°18.3	46.6	48°04.8	9.7′	21°35.3	11.1′	57.3′
2	210°18.5	45.7	62°33.5	9.7′	21°24.2	11.1′	57.3′
3	225°18.7	·· 44.7	77°02.2	9.8′	21°13.1	11.3′	57.3′
4	240°18.9	43.8	91°31.0	9.8′	21°01.8	11.5′	57.4′
5	255°19.1	42.9	105°59.9	9.9′	20°50.3	11.5′	57.4′
6	270°19.3	N06°42.0	120°28.7	9.9′	S20°38.8	11.7′	57.4′
7	285°19.5	41.0	134°57.7	10.0′	20°27.1	11.8′	57.5′
8	300°19.7	40.1	149°26.6	10.0′	20°15.3	11.9′	57.5′
9	315°20.0	·· 39.2	163°55.6	10.0′	20°03.4	12.0′	57.5′
10	330°20.2	38.2	178°24.7	10.1′	19°51.4	12.2′	57.6′
11	345°20.4	37.3	192°53.8	10.1′	19°39.2	12.2′	57.6′
12	0°20.6	N06°36.4	207°22.9	10.2′	S19°27.0	12.4′	57.6′
13	15°20.8	35.5	221°52.1	10.2′	19°14.6	12.5′	57.7′
14	30°21.0	34.5	236°21.3	10.3′	19°02.1	12.6′	57.7′
15	45°21.2	·· 33.6	250°50.6	10.3′	18°49.5	12.8′	57.7′
16	60°21.4	32.7	265°19.9	10.4′	18°36.7	12.8′	57.8′
17	75°21.6	31.7	279°49.2	10.4′	18°23.9	13.0′	57.8′
18	90°21.9	N06°30.8	294°18.6	10.4′	S18°10.9	13.0′	57.8′
19	105°22.1	29.9	308°48.1	10.5′	17°57.9	13.2′	57.9′
20	120°22.3	29.0	323°17.5	10.5′	17°44.7	13.3′	57.9′
21	135°22.5	·· 28.0	337°47.1	10.6′	17°31.4	13.3′	57.9′
22	150°22.7	27.1	352°16.6	10.6′	17°18.1	13.5′	58.0′
23	165°22.9	26.2	6°46.2	10.6′	17°04.6	13.6′	58.0′
	SD = 15.9′	d = 0.9′	SD = 15.6′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°23.1	N06°25.2	21°15.9	10.7′	S16°51.0	13.7′	58.0′
1	195°23.3	24.3	35°45.6	10.7′	16°37.3	13.8′	58.1′
2	210°23.6	23.4	50°15.3	10.8′	16°23.5	13.9′	58.1′
3	225°23.8	·· 22.4	64°45.1	10.8′	16°09.6	14.0′	58.1′
4	240°24.0	21.5	79°14.9	10.8′	15°55.6	14.1′	58.2′
5	255°24.2	20.6	93°44.7	10.9′	15°41.5	14.2′	58.2′
6	270°24.4	N06°19.6	108°14.6	10.9′	S15°27.3	14.3′	58.2′
7	285°24.6	18.7	122°44.5	11.0′	15°13.0	14.4′	58.3′
8	300°24.8	17.8	137°14.5	11.0′	14°58.6	14.4′	58.3′
9	315°25.0	·· 16.8	151°44.5	11.0′	14°44.2	14.6′	58.3′
10	330°25.3	15.9	166°14.5	11.1′	14°29.6	14.6′	58.4′
11	345°25.5	15.0	180°44.6	11.1′	14°15.0	14.8′	58.4′
12	0°25.7	N06°14.0	195°14.7	11.1′	S14°00.2	14.8′	58.4′
13	15°25.9	13.1	209°44.8	11.2′	13°45.4	14.9′	58.4′
14	30°26.1	12.2	224°15.0	11.2′	13°30.5	15.0′	58.5′
15	45°26.3	·· 11.2	238°45.2	11.2′	13°15.5	15.1′	58.5′
16	60°26.5	10.3	253°15.4	11.3′	13°00.4	15.2′	58.5′
17	75°26.8	09.4	267°45.7	11.3′	12°45.2	15.2′	58.6′
18	90°27.0	N06°08.4	282°16.0	11.3′	S12°30.0	15.4′	58.6′
19	105°27.2	07.5	296°46.3	11.4′	12°14.6	15.4′	58.6′
20	120°27.4	06.6	311°16.7	11.4′	11°59.2	15.5′	58.7′
21	135°27.6	·· 05.6	325°47.0	11.4′	11°43.7	15.5′	58.7′
22	150°27.8	04.7	340°17.5	11.4′	11°28.2	15.6′	58.7′
23	165°28.0	03.8	354°47.9	11.5′	11°12.6	15.7′	58.7′
	SD = 15.9′	d = 0.9′	SD = 15.8′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	////	03:00	04:22	19:32	20:53	////
N 70°	01:20	03:22	04:33	19:22	20:32	22:27
68°	02:05	03:39	04:42	19:13	20:15	21:46
66°	02:34	03:52	04:49	19:06	20:02	21:19
64°	02:55	04:03	04:55	19:00	19:51	20:59
62°	03:11	04:13	05:00	18:55	19:42	20:43
60°	03:25	04:21	05:05	18:51	19:35	20:30
N 58°	03:36	04:28	05:09	18:47	19:28	20:19
56°	03:45	04:34	05:12	18:44	19:22	20:10
54°	03:54	04:39	05:16	18:40	19:17	20:02
52°	04:01	04:44	05:19	18:38	19:12	19:55
50°	04:08	04:48	05:21	18:35	19:08	19:48
45°	04:21	04:57	05:27	18:29	18:59	19:35
N 40°	04:31	05:04	05:32	18:25	18:52	19:25
35°	04:40	05:10	05:36	18:21	18:47	19:17
30°	04:47	05:15	05:39	18:18	18:42	19:10
20°	04:57	05:23	05:45	18:12	18:34	19:00
N 10°	05:05	05:29	05:51	18:07	18:28	18:52
0°	05:10	05:35	05:55	18:02	18:23	18:47
S 10°	05:14	05:39	06:00	17:57	18:18	18:43
20°	05:17	05:43	06:05	17:53	18:15	18:40
30°	05:19	05:46	06:10	17:47	18:11	18:39
35°	05:19	05:48	06:13	17:44	18:10	18:39
40°	05:19	05:50	06:17	17:41	18:08	18:39
45°	05:18	05:52	06:21	17:37	18:06	18:40
S 50°	05:16	05:53	06:26	17:32	18:05	18:42
52°	05:15	05:54	06:28	17:30	18:04	18:43
54°	05:14	05:55	06:30	17:28	18:04	18:44
56°	05:13	05:56	06:33	17:26	18:03	18:46
58°	05:11	05:56	06:36	17:23	18:02	18:48
S 60°	05:09	05:57	06:39	17:20	18:01	18:50

Lat.	**Moonrise** Thu	Fri	Sat	**Moonset** Thu	Fri	Sat
N 72°	▬	21:36	20:01	▬	23:53	·· ··
N 70°	▬	20:34	19:40	▬	▬	00:53
68°	▬	19:59	19:24	▬	▬	01:27
66°	20:13	19:33	19:11	23:23	·· ··	01:51
64°	19:32	19:13	19:00	·· ··	00:04	02:10
62°	19:04	18:57	18:51	·· ··	00:31	02:25
60°	18:42	18:43	18:43	·· ··	00:53	02:38
N 58°	18:24	18:31	18:35	·· ··	01:10	02:49
56°	18:09	18:21	18:29	·· ··	01:24	02:58
54°	17:56	18:11	18:23	00:10	01:37	03:06
52°	17:44	18:03	18:18	00:25	01:48	03:14
50°	17:34	17:56	18:13	00:37	01:57	03:20
45°	17:12	17:40	18:03	01:03	02:18	03:35
N 40°	16:55	17:27	17:55	01:23	02:34	03:46
35°	16:40	17:16	17:47	01:40	02:47	03:56
30°	16:27	17:06	17:41	01:55	02:59	04:05
20°	16:05	16:49	17:29	02:20	03:20	04:19
N 10°	15:46	16:34	17:19	02:41	03:37	04:32
0°	15:28	16:20	17:10	03:01	03:53	04:44
S 10°	15:10	16:06	17:00	03:20	04:09	04:56
20°	14:51	15:51	16:50	03:41	04:26	05:08
30°	14:28	15:33	16:39	04:05	04:46	05:22
35°	14:15	15:23	16:32	04:19	04:57	05:30
40°	14:00	15:11	16:24	04:35	05:10	05:40
45°	13:42	14:58	16:15	04:55	05:25	05:50
S 50°	13:19	14:41	16:04	05:18	05:44	06:03
52°	13:08	14:33	15:59	05:30	05:52	06:09
54°	12:55	14:24	15:53	05:43	06:02	06:16
56°	12:41	14:14	15:47	05:58	06:13	06:23
58°	12:24	14:02	15:40	06:15	06:25	06:31
S 60°	12:03	13:48	15:32	06:37	06:40	06:40

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 12-14 84-96%
04	00:52	01:02	11:59	21:41	09:14	
05	01:12	01:22	11:59	22:32	10:07	
06	01:33	01:43	11:58	23:22	10:57	

September 07, 08, 09 UT (Sun., Mon., Tue.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	346°19.6	208°57.1	N16°47.8	147°57.1	S07°35.1	235°50.6	N22°04.8	345°42.4	S02°26.8
1	1°22.1	223°56.5	47.0	162°58.1	35.7	250°52.6	04.8	0°45.0	26.9
2	16°24.5	238°55.9	46.2	177°59.0	36.4	265°54.6	04.7	15°47.7	27.0
3	31°27.0	253°55.3	·· 45.5	193°00.0	·· 37.0	280°56.6	·· 04.7	30°50.3	·· 27.1
4	46°29.5	268°54.7	44.7	208°00.9	37.7	295°58.6	04.6	45°52.9	27.1
5	61°31.9	283°54.2	43.9	223°01.9	38.3	311°00.6	04.6	60°55.6	27.2
6	76°34.4	298°53.6	N16°43.1	238°02.8	S07°38.9	326°02.6	N22°04.5	75°58.2	S02°27.3
7	91°36.9	313°53.0	42.4	253°03.7	39.6	341°04.6	04.5	91°00.8	27.4
8	106°39.3	328°52.4	41.6	268°04.7	40.2	356°06.7	04.4	106°03.5	27.4
9	121°41.8	343°51.8	·· 40.8	283°05.6	·· 40.9	11°08.7	·· 04.3	121°06.1	·· 27.5
10	136°44.2	358°51.2	40.0	298°06.6	41.5	26°10.7	04.3	136°08.7	27.6
11	151°46.7	13°50.6	39.2	313°07.5	42.2	41°12.7	04.2	151°11.4	27.7
12	166°49.2	28°50.1	N16°38.5	328°08.5	S07°42.8	56°14.7	N22°04.2	166°14.0	S02°27.8
13	181°51.6	43°49.5	37.7	343°09.4	43.4	71°16.7	04.1	181°16.6	27.8
14	196°54.1	58°48.9	36.9	358°10.3	44.1	86°18.7	04.1	196°19.2	27.9
15	211°56.6	73°48.3	·· 36.1	13°11.3	·· 44.7	101°20.7	·· 04.0	211°21.9	·· 28.0
16	226°59.0	88°47.7	35.3	28°12.2	45.4	116°22.7	04.0	226°24.5	28.1
17	242°01.5	103°47.1	34.5	43°13.2	46.0	131°24.8	03.9	241°27.1	28.1
18	257°04.0	118°46.6	N16°33.8	58°14.1	S07°46.7	146°26.8	N22°03.9	256°29.8	S02°28.2
19	272°06.4	133°46.0	33.0	73°15.0	47.3	161°28.8	03.8	271°32.4	28.3
20	287°08.9	148°45.4	32.2	88°16.0	48.0	176°30.8	03.7	286°35.0	28.4
21	302°11.4	163°44.8	·· 31.4	103°16.9	·· 48.6	191°32.8	·· 03.7	301°37.7	·· 28.5
22	317°13.8	178°44.2	30.6	118°17.9	49.2	206°34.8	03.6	316°40.3	28.5
23	332°16.3	193°43.7	29.8	133°18.8	49.9	221°36.8	03.6	331°42.9	28.6
Mer.pass. 00:55		ν -0.6′	d 0.8′	m -3.94	ν 0.9′	d 0.6′	m 1.62	ν 2.0′	d 0.1′ m -2.01	ν 2.6′	d 0.1′ m 0.63

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	347°18.7	208°43.1	N16°29.0	148°19.7	S07°50.5	236°38.8	N22°03.5	346°45.6	S02°28.7
1	2°21.2	223°42.5	28.2	163°20.7	51.2	251°40.9	03.5	1°48.2	28.8
2	17°23.7	238°41.9	27.4	178°21.6	51.8	266°42.9	03.4	16°50.8	28.8
3	32°26.1	253°41.3	·· 26.6	193°22.6	·· 52.5	281°44.9	·· 03.4	31°53.5	·· 28.9
4	47°28.6	268°40.8	25.8	208°23.5	53.1	296°46.9	03.3	46°56.1	29.0
5	62°31.1	283°40.2	25.0	223°24.4	53.7	311°48.9	03.3	61°58.7	29.1
6	77°33.5	298°39.6	N16°24.2	238°25.4	S07°54.4	326°50.9	N22°03.2	77°01.4	S02°29.2
7	92°36.0	313°39.0	23.5	253°26.3	55.0	341°52.9	03.1	92°04.0	29.2
8	107°38.5	328°38.5	22.7	268°27.3	55.7	356°55.0	03.1	107°06.6	29.3
9	122°40.9	343°37.9	·· 21.9	283°28.2	·· 56.3	11°57.0	·· 03.0	122°09.3	·· 29.4
10	137°43.4	358°37.3	21.1	298°29.1	57.0	26°59.0	03.0	137°11.9	29.5
11	152°45.8	13°36.7	20.3	313°30.1	57.6	42°01.0	02.9	152°14.5	29.5
12	167°48.3	28°36.2	N16°19.5	328°31.0	S07°58.2	57°03.0	N22°02.9	167°17.1	S02°29.6
13	182°50.8	43°35.6	18.7	343°31.9	58.9	72°05.0	02.8	182°19.8	29.7
14	197°53.2	58°35.0	17.8	358°32.9	07°59.5	87°07.1	02.8	197°22.4	29.8
15	212°55.7	73°34.4	·· 17.0	13°33.8	08°00.2	102°09.1	·· 02.7	212°25.0	·· 29.9
16	227°58.2	88°33.9	16.2	28°34.8	00.8	117°11.1	02.6	227°27.7	29.9
17	243°00.6	103°33.3	15.4	43°35.7	01.5	132°13.1	02.6	242°30.3	30.0
18	258°03.1	118°32.7	N16°14.6	58°36.6	S08°02.1	147°15.1	N22°02.5	257°32.9	S02°30.1
19	273°05.6	133°32.1	13.8	73°37.6	02.7	162°17.1	02.5	272°35.6	30.2
20	288°08.0	148°31.6	13.0	88°38.5	03.4	177°19.2	02.4	287°38.2	30.2
21	303°10.5	163°31.0	·· 12.2	103°39.4	·· 04.0	192°21.2	·· 02.4	302°40.8	·· 30.3
22	318°13.0	178°30.4	11.4	118°40.4	04.7	207°23.2	02.3	317°43.5	30.4
23	333°15.4	193°29.8	10.6	133°41.3	05.3	222°25.2	02.3	332°46.1	30.5
Mer.pass. 00:51		ν -0.6′	d 0.8′	m -3.94	ν 0.9′	d 0.6′	m 1.62	ν 2.0′	d 0.1′ m -2.02	ν 2.6′	d 0.1′ m 0.63

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	348°17.9	208°29.3	N16°09.8	148°42.2	S08°05.9	237°27.2	N22°02.2	347°48.7	S02°30.6
1	3°20.3	223°28.7	09.0	163°43.2	06.6	252°29.2	02.2	2°51.4	30.6
2	18°22.8	238°28.1	08.1	178°44.1	07.2	267°31.3	02.1	17°54.0	30.7
3	33°25.3	253°27.6	·· 07.3	193°45.0	·· 07.9	282°33.3	·· 02.0	32°56.6	·· 30.8
4	48°27.7	268°27.0	06.5	208°46.0	08.5	297°35.3	02.0	47°59.3	30.9
5	63°30.2	283°26.4	05.7	223°46.9	09.2	312°37.3	01.9	63°01.9	30.9
6	78°32.7	298°25.8	N16°04.9	238°47.8	S08°09.8	327°39.3	N22°01.9	78°04.5	S02°31.0
7	93°35.1	313°25.3	04.1	253°48.8	10.4	342°41.4	01.8	93°07.2	31.1
8	108°37.6	328°24.7	03.3	268°49.7	11.1	357°43.4	01.8	108°09.8	31.2
9	123°40.1	343°24.1	·· 02.4	283°50.7	·· 11.7	12°45.4	·· 01.7	123°12.4	·· 31.3
10	138°42.5	358°23.6	01.6	298°51.6	12.4	27°47.4	01.7	138°15.1	31.3
11	153°45.0	13°23.0	00.8	313°52.5	13.0	42°49.4	01.6	153°17.7	31.4
12	168°47.4	28°22.4	N16°00.0	328°53.5	S08°13.6	57°51.5	N22°01.6	168°20.3	S02°31.5
13	183°49.9	43°21.9	15°59.2	343°54.4	14.3	72°53.5	01.5	183°23.0	31.6
14	198°52.4	58°21.3	58.3	358°55.3	14.9	87°55.5	01.4	198°25.6	31.6
15	213°54.8	73°20.7	·· 57.5	13°56.2	·· 15.6	102°57.5	·· 01.4	213°28.2	·· 31.7
16	228°57.3	88°20.2	56.7	28°57.2	16.2	117°59.5	01.3	228°30.9	31.8
17	243°59.8	103°19.6	55.9	43°58.1	16.8	133°01.6	01.3	243°33.5	31.9
18	259°02.2	118°19.0	N15°55.0	58°59.0	S08°17.5	148°03.6	N22°01.2	258°36.1	S02°32.0
19	274°04.7	133°18.5	54.2	74°00.0	18.1	163°05.6	01.2	273°38.8	32.0
20	289°07.2	148°17.9	53.4	89°00.9	18.8	178°07.6	01.1	288°41.4	32.1
21	304°09.6	163°17.3	·· 52.6	104°01.8	·· 19.4	193°09.7	·· 01.1	303°44.0	·· 32.2
22	319°12.1	178°16.8	51.7	119°02.8	20.0	208°11.7	01.0	318°46.7	32.3
23	334°14.6	193°16.2	50.9	134°03.7	20.7	223°13.7	01.0	333°49.3	32.4
Mer.pass. 00:47		ν -0.6′	d 0.8′	m -3.94	ν 0.9′	d 0.6′	m 1.61	ν 2.0′	d 0.1′ m -2.02	ν 2.6′	d 0.1′ m 0.62

Stars

	SHA	**Dec**
Alpheratz	357°33.9	29°14.0
Ankaa	353°06.2	-42°09.8
Schedar	349°29.9	56°40.7
Diphda	348°46.4	-17°50.5
Achernar	335°19.3	-57°06.1
Hamal	327°50.3	23°35.1
Polaris	313°32.3	89°22.1
Acamar	315°11.1	-40°11.8
Menkar	314°05.4	4°11.6
Mirfak	308°27.3	49°57.0
Aldebaran	290°39.0	16°33.7
Rigel	281°03.4	-8°10.1
Capella	280°21.1	46°01.3
Bellatrix	278°22.3	6°22.5
Elnath	278°01.2	28°37.7
Alnilam	275°37.2	-1°11.0
Betelgeuse	270°51.6	7°24.8
Canopus	263°52.3	-52°42.2
Sirius	258°25.9	-16°44.8
Adhara	255°05.6	-29°00.1
Procyon	244°50.5	5°09.7
Pollux	243°16.9	27°57.9
Avior	234°15.0	-59°35.2
Suhail	222°46.3	-43°32.0
Miaplacidus	221°39.0	-69°49.1
Alphard	217°47.5	-8°46.0
Regulus	207°34.2	11°50.6
Dubhe	193°40.9	61°36.8
Denebola	182°24.7	14°25.8
Gienah	175°43.3	-17°41.0
Acrux	173°00.2	-63°14.6
Gacrux	171°51.6	-57°15.5
Alioth	166°12.9	55°49.4
Spica	158°22.0	-11°17.7
Alkaid	152°51.9	49°11.3
Hadar	148°35.7	-60°30.0
Menkent	147°57.2	-36°29.8
Arcturus	145°47.6	19°03.1
Rigil Kent.	139°40.0	-60°56.7
Kochab	137°20.3	74°03.2
Zuben'ubi	136°55.6	-16°08.9
Alphecca	126°03.4	26°37.9
Antares	112°15.2	-26°29.4
Atria	107°08.9	-69°04.7
Sabik	102°02.1	-15°45.4
Shaula	96°09.6	-37°07.4
Rasalhague	95°58.0	12°32.6
Eltanin	90°41.8	51°29.4
Kaus Aust.	83°31.6	-34°22.4
Vega	80°32.7	38°48.7
Nunki	75°46.9	-26°15.9
Altair	61°59.2	8°56.3
Peacock	53°04.4	-56°39.2
Deneb	49°25.1	45°22.5
Enif	33°38.0	9°59.7
Al Na'ir	27°31.7	-46°50.1
Fomalhaut	15°13.5	-29°29.0
Scheat	13°44.3	28°13.5
Markab	13°29.0	15°20.7

Sep 07 Sun	**SHA**	**Mer.pass**
Venus	222°37.5	10:05
Mars	161°37.5	14:07
Jupiter	249°31.0	08:16
Saturn	359°22.8	00:57

Sep 08 Mon	**SHA**	**Mer.pass**
Venus	221°24.3	10:06
Mars	161°01.0	14:06
Jupiter	249°20.1	08:12
Saturn	359°26.8	00:53

Sep 09 Tue	**SHA**	**Mer.pass**
Venus	220°11.4	10:06
Mars	160°24.4	14:04
Jupiter	249°09.3	08:09
Saturn	359°30.9	00:49

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h | Sun | | Moon | | | | |

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	180°28.3	N06°02.8	9°18.4	11.5′	S10°56.9	15.8′	58.8′
1	195°28.5	01.9	23°48.8	11.5′	10°41.1	15.9′	58.8′
2	210°28.7	01.0	38°19.4	11.5′	10°25.2	15.9′	58.8′
3	225°28.9	06°00.0	52°49.9	11.6′	10°09.3	16.0′	58.9′
4	240°29.1	05°59.1	67°20.4	11.6′	09°53.3	16.0′	58.9′
5	255°29.3	58.2	81°51.0	11.6′	09°37.3	16.1′	58.9′
6	270°29.5	N05°57.2	96°21.6	11.6′	S09°21.2	16.2′	58.9′
7	285°29.8	56.3	110°52.3	11.6′	09°05.0	16.2′	59.0′
8	300°30.0	55.4	125°22.9	11.7′	08°48.8	16.3′	59.0′
9	315°30.2	·· 54.4	139°53.5	11.7′	08°32.5	16.4′	59.0′
10	330°30.4	53.5	154°24.2	11.7′	08°16.1	16.4′	59.0′
11	345°30.6	52.5	168°54.9	11.7′	07°59.7	16.4′	59.1′
12	0°30.8	N05°51.6	183°25.6	11.7′	S07°43.3	16.5′	59.1′
13	15°31.0	50.7	197°56.3	11.7′	07°26.8	16.6′	59.1′
14	30°31.3	49.7	212°27.1	11.7′	07°10.2	16.6′	59.1′
15	45°31.5	·· 48.8	226°57.8	11.8′	06°53.6	16.7′	59.2′
16	60°31.7	47.9	241°28.6	11.8′	06°36.9	16.7′	59.2′
17	75°31.9	46.9	255°59.3	11.8′	06°20.2	16.7′	59.2′
18	90°32.1	N05°46.0	270°30.1	11.8′	S06°03.5	16.8′	59.2′
19	105°32.3	45.0	285°00.9	11.8′	05°46.7	16.9′	59.3′
20	120°32.6	44.1	299°31.7	11.8′	05°29.8	16.9′	59.3′
21	135°32.8	·· 43.2	314°02.5	11.8′	05°12.9	16.9′	59.3′
22	150°33.0	42.2	328°33.3	11.8′	04°56.0	17.0′	59.3′
23	165°33.2	41.3	343°04.1	11.8′	04°39.0	17.0′	59.4′
	SD = 15.9′	d = 0.9′	SD = 16.0′				

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	180°33.4	N05°40.3	357°34.9	11.8′	S04°22.0	17.0′	59.4′
1	195°33.6	39.4	12°05.7	11.8′	04°05.0	17.1′	59.4′
2	210°33.9	38.5	26°36.5	11.8′	03°47.9	17.0′	59.4′
3	225°34.1	·· 37.5	41°07.3	11.8′	03°30.9	17.2′	59.4′
4	240°34.3	36.6	55°38.1	11.8′	03°13.7	17.1′	59.5′
5	255°34.5	35.6	70°08.9	11.8′	02°56.6	17.2′	59.5′
6	270°34.7	N05°34.7	84°39.7	11.8′	S02°39.4	17.2′	59.5′
7	285°34.9	33.8	99°10.5	11.8′	02°22.2	17.2′	59.5′
8	300°35.2	32.8	113°41.2	11.8′	02°05.0	17.3′	59.5′
9	315°35.4	·· 31.9	128°12.0	11.8′	01°47.7	17.3′	59.6′
10	330°35.6	30.9	142°42.8	11.8′	01°30.4	17.2′	59.6′
11	345°35.8	30.0	157°13.5	11.7′	01°13.2	17.3′	59.6′
12	0°36.0	N05°29.1	171°44.3	11.7′	S00°55.9	17.4′	59.6′
13	15°36.2	28.1	186°15.0	11.7′	00°38.5	17.3′	59.6′
14	30°36.5	27.2	200°45.7	11.7′	00°21.2	17.3′	59.6′
15	45°36.7	·· 26.2	215°16.4	11.7′	S00°03.9	17.4′	59.7′
16	60°36.9	25.3	229°47.1	11.7′	N00°13.5	17.3′	59.7′
17	75°37.1	24.4	244°17.8	11.6′	00°30.8	17.4′	59.7′
18	90°37.3	N05°23.4	258°48.4	11.6′	N00°48.2	17.4′	59.7′
19	105°37.5	22.5	273°19.0	11.6′	01°05.6	17.3′	59.7′
20	120°37.8	21.5	287°49.6	11.6′	01°22.9	17.4′	59.7′
21	135°38.0	·· 20.6	302°20.2	11.6′	01°40.3	17.4′	59.8′
22	150°38.2	19.6	316°50.8	11.5′	01°57.7	17.4′	59.8′
23	165°38.4	18.7	331°21.3	11.5′	02°15.1	17.3′	59.8′
	SD = 15.9′	d = 0.9′	SD = 16.2′				

Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	180°38.6	N05°17.8	345°51.8	11.5′	N02°32.4	17.4′	59.8′
1	195°38.8	16.8	0°22.3	11.5′	02°49.8	17.3′	59.8′
2	210°39.1	15.9	14°52.7	11.4′	03°07.1	17.4′	59.8′
3	225°39.3	·· 14.9	29°23.2	11.4′	03°24.5	17.3′	59.8′
4	240°39.5	14.0	43°53.6	11.4′	03°41.8	17.3′	59.8′
5	255°39.7	13.0	58°23.9	11.3′	03°59.1	17.3′	59.9′
6	270°39.9	N05°12.1	72°54.2	11.3′	N04°16.4	17.3′	59.9′
7	285°40.2	11.2	87°24.5	11.3′	04°33.7	17.3′	59.9′
8	300°40.4	10.2	101°54.8	11.2′	04°51.0	17.2′	59.9′
9	315°40.6	·· 09.3	116°25.0	11.2′	05°08.2	17.2′	59.9′
10	330°40.8	08.3	130°55.2	11.1′	05°25.4	17.2′	59.9′
11	345°41.0	07.4	145°25.3	11.1′	05°42.6	17.2′	59.9′
12	0°41.2	N05°06.4	159°55.4	11.1′	N05°59.8	17.2′	59.9′
13	15°41.5	05.5	174°25.5	11.0′	06°17.0	17.1′	59.9′
14	30°41.7	04.5	188°55.5	11.0′	06°34.1	17.1′	59.9′
15	45°41.9	·· 03.6	203°25.5	10.9′	06°51.2	17.0′	60.0′
16	60°42.1	02.7	217°55.4	10.9′	07°08.2	17.0′	60.0′
17	75°42.3	01.7	232°25.3	10.8′	07°25.2	17.0′	60.0′
18	90°42.6	N05°00.8	246°55.1	10.8′	N07°42.2	17.0′	60.0′
19	105°42.8	04°59.8	261°24.9	10.7′	07°59.2	16.9′	60.0′
20	120°43.0	58.9	275°54.6	10.7′	08°16.1	16.8′	60.0′
21	135°43.2	·· 57.9	290°24.3	10.6′	08°32.9	16.8′	60.0′
22	150°43.4	57.0	304°53.9	10.6′	08°49.7	16.8′	60.0′
23	165°43.7	56.0	319°23.5	10.5′	09°06.5	16.7′	60.0′
	SD = 15.9′	d = 0.9′	SD = 16.3′				

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	00:42	03:18	04:36	19:16	20:33	22:54
N 70°	01:50	03:37	04:45	19:08	20:15	21:58
68°	02:25	03:51	04:52	19:01	20:01	21:26
66°	02:49	04:03	04:58	18:55	19:49	21:03
64°	03:07	04:13	05:04	18:50	19:40	20:45
62°	03:22	04:21	05:08	18:46	19:32	20:31
60°	03:34	04:28	05:12	18:42	19:25	20:19
N 58°	03:44	04:35	05:15	18:39	19:19	20:09
56°	03:53	04:40	05:18	18:36	19:14	20:01
54°	04:00	04:45	05:21	18:33	19:09	19:53
52°	04:07	04:49	05:23	18:31	19:05	19:47
50°	04:13	04:53	05:26	18:29	19:01	19:41
45°	04:25	05:01	05:30	18:24	18:54	19:29
N 40°	04:35	05:07	05:34	18:20	18:47	19:20
35°	04:42	05:12	05:38	18:17	18:42	19:12
30°	04:48	05:17	05:41	18:14	18:38	19:06
20°	04:58	05:24	05:46	18:09	18:31	18:57
N 10°	05:05	05:29	05:50	18:05	18:26	18:50
0°	05:09	05:34	05:54	18:01	18:22	18:46
S 10°	05:13	05:37	05:58	17:57	18:18	18:43
20°	05:15	05:40	06:02	17:53	18:15	18:41
30°	05:15	05:43	06:07	17:49	18:13	18:41
35°	05:15	05:44	06:09	17:46	18:12	18:41
40°	05:14	05:45	06:12	17:44	18:11	18:42
45°	05:12	05:46	06:15	17:41	18:10	18:44
S 50°	05:10	05:47	06:19	17:37	18:09	18:47
52°	05:08	05:47	06:21	17:35	18:09	18:48
54°	05:07	05:48	06:23	17:33	18:09	18:50
56°	05:05	05:48	06:25	17:31	18:08	18:52
58°	05:03	05:48	06:27	17:29	18:08	18:54
S 60°	05:00	05:48	06:30	17:27	18:08	18:56

Lat.	Moonrise Sun	Moonrise Mon	Moonrise Tue	Moonset Sun	Moonset Mon	Moonset Tue
N 72°	19:14	18:36	17:56	03:14	05:45	08:12
N 70°	19:06	18:37	18:07	03:32	05:49	08:05
68°	19:00	18:38	18:16	03:45	05:53	07:59
66°	18:54	18:39	18:23	03:57	05:56	07:54
64°	18:49	18:39	18:29	04:06	05:58	07:50
62°	18:45	18:40	18:35	04:14	06:00	07:47
60°	18:42	18:40	18:39	04:20	06:02	07:44
N 58°	18:38	18:41	18:44	04:26	06:03	07:41
56°	18:35	18:41	18:47	04:32	06:05	07:39
54°	18:33	18:42	18:51	04:36	06:06	07:37
52°	18:30	18:42	18:54	04:40	06:07	07:35
50°	18:28	18:42	18:57	04:44	06:08	07:33
45°	18:24	18:43	19:03	04:52	06:10	07:29
N 40°	18:20	18:44	19:08	04:59	06:12	07:26
35°	18:16	18:44	19:13	05:05	06:14	07:23
30°	18:13	18:45	19:17	05:10	06:15	07:21
20°	18:08	18:45	19:24	05:19	06:18	07:17
N 10°	18:03	18:46	19:30	05:26	06:20	07:13
0°	17:59	18:47	19:36	05:33	06:21	07:10
S 10°	17:54	18:48	19:42	05:40	06:23	07:07
20°	17:49	18:49	19:49	05:47	06:25	07:03
30°	17:44	18:50	19:56	05:56	06:27	06:59
35°	17:41	18:50	20:01	06:00	06:29	06:57
40°	17:37	18:51	20:06	06:06	06:30	06:54
45°	17:33	18:52	20:11	06:12	06:32	06:51
S 50°	17:28	18:53	20:18	06:19	06:33	06:47
52°	17:26	18:53	20:22	06:22	06:34	06:46
54°	17:23	18:53	20:25	06:26	06:35	06:44
56°	17:20	18:54	20:29	06:30	06:36	06:42
58°	17:17	18:55	20:34	06:35	06:37	06:40
S 60°	17:14	18:55	20:39	06:40	06:39	06:37

Day	Sun Eqn.of Time 00h	Sun Eqn.of Time 12h	Sun Mer. Pass	Moon Mer.Pass. Upper	Moon Mer.Pass. Lower	Age
	mm:ss	mm:ss	hh:mm	hh:mm	hh:mm	15-17 99-98%
07	01:53	02:03	11:58	–:–	11:46	
08	02:14	02:24	11:58	00:10	12:34	
09	02:35	02:45	11:57	00:58	13:23	

September 10, 11, 12 UT (Wed., Thu., Fri.)

	Aries	Venus		Mars		Jupiter		Saturn	
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	349°17.0	208°15.6	N15°50.1	149°04.6	S08°21.3	238°15.7	N22°00.9	348°52.0	S02°32.4
1	4°19.5	223°15.1	49.2	164°05.6	22.0	253°17.7	00.8	3°54.6	32.5
2	19°21.9	238°14.5	48.4	179°06.5	22.6	268°19.8	00.8	18°57.2	32.6
3	34°24.4	253°13.9	·· 47.6	194°07.4	·· 23.3	283°21.8	·· 00.7	33°59.9	·· 32.7
4	49°26.9	268°13.4	46.7	209°08.4	23.9	298°23.8	00.7	49°02.5	32.7
5	64°29.3	283°12.8	45.9	224°09.3	24.5	313°25.8	00.6	64°05.1	32.8
6	79°31.8	298°12.3	N15°45.1	239°10.2	S08°25.2	328°27.9	N22°00.6	79°07.8	S02°32.9
7	94°34.3	313°11.7	44.2	254°11.1	25.8	343°29.9	00.5	94°10.4	33.0
8	109°36.7	328°11.1	43.4	269°12.1	26.5	358°31.9	00.5	109°13.0	33.1
9	124°39.2	343°10.6	·· 42.6	284°13.0	·· 27.1	13°33.9	·· 00.4	124°15.7	·· 33.1
10	139°41.7	358°10.0	41.7	299°13.9	27.7	28°36.0	00.4	139°18.3	33.2
11	154°44.1	13°09.4	40.9	314°14.9	28.4	43°38.0	00.3	154°20.9	33.3
12	169°46.6	28°08.9	N15°40.0	329°15.8	S08°29.0	58°40.0	N22°00.2	169°23.6	S02°33.4
13	184°49.0	43°08.3	39.2	344°16.7	29.6	73°42.0	00.2	184°26.2	33.4
14	199°51.5	58°07.8	38.4	359°17.6	30.3	88°44.1	00.1	199°28.8	33.5
15	214°54.0	73°07.2	·· 37.5	14°18.6	·· 30.9	103°46.1	·· 00.1	214°31.5	·· 33.6
16	229°56.4	88°06.6	36.7	29°19.5	31.6	118°48.1	00.0	229°34.1	33.7
17	244°58.9	103°06.1	35.8	44°20.4	32.2	133°50.1	22°00.0	244°36.7	33.8
18	260°01.4	118°05.5	N15°35.0	59°21.4	S08°32.8	148°52.2	N21°59.9	259°39.4	S02°33.8
19	275°03.8	133°05.0	34.1	74°22.3	33.5	163°54.2	59.9	274°42.0	33.9
20	290°06.3	148°04.4	33.3	89°23.2	34.1	178°56.2	59.8	289°44.6	34.0
21	305°08.8	163°03.9	·· 32.5	104°24.1	·· 34.8	193°58.2	·· 59.8	304°47.3	·· 34.1
22	320°11.2	178°03.3	31.6	119°25.1	35.4	209°00.3	59.7	319°49.9	34.2
23	335°13.7	193°02.7	30.8	134°26.0	36.0	224°02.3	59.6	334°52.6	34.2
Mer.pass. 00:43		ν -0.6′	d 0.8′	m -3.94	ν 0.9′	d 0.6′	m 1.61	ν 2.0′	d 0.1′ m -2.02	ν 2.6′	d 0.1′ m 0.62

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	350°16.2	208°02.2	N15°29.9	149°26.9	S08°36.7	239°04.3	N21°59.6	349°55.2	S02°34.3
1	5°18.6	223°01.6	29.1	164°27.8	37.3	254°06.4	59.5	4°57.8	34.4
2	20°21.1	238°01.1	28.2	179°28.8	38.0	269°08.4	59.5	20°00.5	34.5
3	35°23.5	253°00.5	·· 27.4	194°29.7	·· 38.6	284°10.4	·· 59.4	35°03.1	·· 34.5
4	50°26.0	268°00.0	26.5	209°30.6	39.2	299°12.4	59.4	50°05.7	34.6
5	65°28.5	282°59.4	25.7	224°31.5	39.9	314°14.5	59.3	65°08.4	34.7
6	80°30.9	297°58.8	N15°24.8	239°32.5	S08°40.5	329°16.5	N21°59.3	80°11.0	S02°34.8
7	95°33.4	312°58.3	23.9	254°33.4	41.1	344°18.5	59.2	95°13.6	34.9
8	110°35.9	327°57.7	23.1	269°34.3	41.8	359°20.6	59.2	110°16.3	34.9
9	125°38.3	342°57.2	·· 22.2	284°35.2	·· 42.4	14°22.6	·· 59.1	125°18.9	·· 35.0
10	140°40.8	357°56.6	21.4	299°36.2	43.1	29°24.6	59.0	140°21.5	35.1
11	155°43.3	12°56.1	20.5	314°37.1	43.7	44°26.6	59.0	155°24.2	35.2
12	170°45.7	27°55.5	N15°19.7	329°38.0	S08°44.3	59°28.7	N21°58.9	170°26.8	S02°35.3
13	185°48.2	42°55.0	18.8	344°38.9	45.0	74°30.7	58.9	185°29.5	35.3
14	200°50.7	57°54.4	17.9	359°39.9	45.6	89°32.7	58.8	200°32.1	35.4
15	215°53.1	72°53.9	·· 17.1	14°40.8	·· 46.3	104°34.8	·· 58.8	215°34.7	·· 35.5
16	230°55.6	87°53.3	16.2	29°41.7	46.9	119°36.8	58.7	230°37.4	35.6
17	245°58.0	102°52.8	15.4	44°42.6	47.5	134°38.8	58.7	245°40.0	35.6
18	261°00.5	117°52.2	N15°14.5	59°43.6	S08°48.2	149°40.9	N21°58.6	260°42.6	S02°35.7
19	276°03.0	132°51.7	13.6	74°44.5	48.8	164°42.9	58.6	275°45.3	35.8
20	291°05.4	147°51.1	12.8	89°45.4	49.4	179°44.9	58.5	290°47.9	35.9
21	306°07.9	162°50.6	·· 11.9	104°46.3	·· 50.1	194°46.9	·· 58.4	305°50.5	·· 36.0
22	321°10.4	177°50.0	11.0	119°47.2	50.7	209°49.0	58.4	320°53.2	36.0
23	336°12.8	192°49.5	10.2	134°48.2	51.4	224°51.0	58.3	335°55.8	36.1
Mer.pass. 00:39		ν -0.6′	d 0.8′	m -3.94	ν 0.9′	d 0.6′	m 1.61	ν 2.0′	d 0.1′ m -2.03	ν 2.6′	d 0.1′ m 0.61

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	351°15.3	207°48.9	N15°09.3	149°49.1	S08°52.0	239°53.0	N21°58.3	350°58.5	S02°36.2
1	6°17.8	222°48.4	08.4	164°50.0	52.6	254°55.1	58.2	6°01.1	36.3
2	21°20.2	237°47.8	07.6	179°50.9	53.3	269°57.1	58.2	21°03.7	36.4
3	36°22.7	252°47.3	·· 06.7	194°51.9	·· 53.9	284°59.1	·· 58.1	36°06.4	·· 36.4
4	51°25.1	267°46.7	05.8	209°52.8	54.5	300°01.2	58.1	51°09.0	36.5
5	66°27.6	282°46.2	05.0	224°53.7	55.2	315°03.2	58.0	66°11.6	36.6
6	81°30.1	297°45.6	N15°04.1	239°54.6	S08°55.8	330°05.2	N21°58.0	81°14.3	S02°36.7
7	96°32.5	312°45.1	03.2	254°55.5	56.4	345°07.3	57.9	96°16.9	36.7
8	111°35.0	327°44.5	02.3	269°56.5	57.1	0°09.3	57.8	111°19.5	36.8
9	126°37.5	342°44.0	·· 01.5	284°57.4	·· 57.7	15°11.3	·· 57.8	126°22.2	·· 36.9
10	141°39.9	357°43.4	15°00.6	299°58.3	58.4	30°13.4	57.7	141°24.8	37.0
11	156°42.4	12°42.9	14°59.7	314°59.2	59.0	45°15.4	57.7	156°27.5	37.1
12	171°44.9	27°42.3	N14°58.8	330°00.1	S08°59.6	60°17.4	N21°57.6	171°30.1	S02°37.1
13	186°47.3	42°41.8	58.0	345°01.1	09°00.3	75°19.5	57.6	186°32.7	37.2
14	201°49.8	57°41.3	57.1	0°02.0	00.9	90°21.5	57.5	201°35.4	37.3
15	216°52.3	72°40.7	·· 56.2	15°02.9	·· 01.5	105°23.6	·· 57.5	216°38.0	·· 37.4
16	231°54.7	87°40.2	55.3	30°03.8	02.2	120°25.6	57.4	231°40.6	37.5
17	246°57.2	102°39.6	54.4	45°04.7	02.8	135°27.6	57.4	246°43.3	37.5
18	261°59.6	117°39.1	N14°53.6	60°05.6	S09°03.4	150°29.7	N21°57.3	261°45.9	S02°37.6
19	277°02.1	132°38.5	52.7	75°06.6	04.1	165°31.7	57.3	276°48.6	37.7
20	292°04.6	147°38.0	51.8	90°07.5	04.7	180°33.7	57.2	291°51.2	37.8
21	307°07.0	162°37.5	·· 50.9	105°08.4	·· 05.4	195°35.8	·· 57.1	306°53.8	·· 37.9
22	322°09.5	177°36.9	50.0	120°09.3	06.0	210°37.8	57.1	321°56.5	37.9
23	337°12.0	192°36.4	49.2	135°10.2	06.6	225°39.8	57.0	336°59.1	38.0
Mer.pass. 00:35		ν -0.5′	d 0.9′	m -3.94	ν 0.9′	d 0.6′	m 1.61	ν 2.0′	d 0.1′ m -2.03	ν 2.6′	d 0.1′ m 0.61

Stars

	SHA	Dec
Alpheratz	357°33.9	29°14.0
Ankaa	353°06.2	-42°09.8
Schedar	349°29.9	56°40.7
Diphda	348°46.4	-17°50.5
Achernar	335°19.3	-57°06.1
Hamal	327°50.3	23°35.1
Polaris	313°30.9	89°22.1
Acamar	315°11.1	-40°11.8
Menkar	314°05.4	4°11.6
Mirfak	308°27.3	49°57.0
Aldebaran	290°38.9	16°33.7
Rigel	281°03.3	-8°10.1
Capella	280°21.1	46°01.3
Bellatrix	278°22.3	6°22.5
Elnath	278°01.2	28°37.7
Alnilam	275°37.2	-1°11.0
Betelgeuse	270°51.5	7°24.8
Canopus	263°52.3	-52°42.2
Sirius	258°25.9	-16°44.8
Adhara	255°05.6	-29°00.1
Procyon	244°50.4	5°09.7
Pollux	243°16.8	27°57.9
Avior	234°15.0	-59°35.2
Suhail	222°46.3	-43°31.9
Miaplacidus	221°39.0	-69°49.1
Alphard	217°47.5	-8°46.0
Regulus	207°34.2	11°50.6
Dubhe	193°40.9	61°36.8
Denebola	182°24.7	14°25.8
Gienah	175°43.3	-17°41.0
Acrux	173°00.2	-63°14.5
Gacrux	171°51.6	-57°15.5
Alioth	166°12.9	55°49.4
Spica	158°22.0	-11°17.7
Alkaid	152°51.9	49°11.3
Hadar	148°35.7	-60°30.0
Menkent	147°57.3	-36°29.8
Arcturus	145°47.6	19°03.1
Rigil Kent.	139°40.0	-60°56.7
Kochab	137°20.4	74°03.2
Zuben'ubi	136°55.6	-16°08.9
Alphecca	126°03.4	26°37.9
Antares	112°15.2	-26°29.4
Atria	107°09.0	-69°04.7
Sabik	102°02.1	-15°45.4
Shaula	96°09.6	-37°07.4
Rasalhague	95°58.0	12°32.6
Eltanin	90°41.8	51°29.4
Kaus Aust.	83°31.7	-34°22.4
Vega	80°32.7	38°48.7
Nunki	75°46.9	-26°15.9
Altair	61°59.2	8°56.3
Peacock	53°04.4	-56°39.2
Deneb	49°25.1	45°22.5
Enif	33°38.0	9°59.7
Al Na'ir	27°31.7	-46°50.2
Fomalhaut	15°13.5	-29°29.0
Scheat	13°44.3	28°13.5
Markab	13°29.0	15°20.8

Sep 10 Wed	SHA	Mer.pass
Venus	218°58.6	10:07
Mars	159°47.6	14:03
Jupiter	248°58.7	08:06
Saturn	359°34.9	00:44

Sep 11 Thu	SHA	Mer.pass
Venus	217°46.0	10:08
Mars	159°10.8	14:01
Jupiter	248°48.2	08:03
Saturn	359°39.0	00:40

Sep 12 Fri	SHA	Mer.pass
Venus	216°33.6	10:09
Mars	158°33.8	14:00
Jupiter	248°37.8	07:59
Saturn	359°43.2	00:36

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h — Sun — Moon

Wed	GHA	Dec	GHA	ν	Dec	d	HP
0	180°43.9	N04°55.1	333°53.0	10.5′	N09°23.2	16.7′	60.0′
1	195°44.1	54.1	348°22.5	10.4′	09°39.9	16.6′	60.0′
2	210°44.3	53.2	2°51.9	10.3′	09°56.5	16.6′	60.0′
3	225°44.5	·· 52.2	17°21.2	10.3′	10°13.1	16.5′	60.0′
4	240°44.8	51.3	31°50.5	10.2′	10°29.6	16.5′	60.0′
5	255°45.0	50.3	46°19.7	10.2′	10°46.1	16.4′	60.0′
6	270°45.2	N04°49.4	60°48.9	10.1′	N11°02.5	16.3′	60.0′
7	285°45.4	48.5	75°18.0	10.0′	11°18.8	16.3′	60.0′
8	300°45.6	47.5	89°47.0	10.0′	11°35.1	16.2′	60.0′
9	315°45.9	·· 46.6	104°16.0	9.9′	11°51.3	16.2′	60.0′
10	330°46.1	45.6	118°44.9	9.8′	12°07.5	16.0′	60.0′
11	345°46.3	44.7	133°13.8	9.8′	12°23.5	16.0′	60.0′
12	0°46.5	N04°43.7	147°42.6	9.7′	N12°39.5	16.0′	60.0′
13	15°46.7	42.8	162°11.3	9.6′	12°55.5	15.8′	60.0′
14	30°47.0	41.8	176°39.9	9.6′	13°11.3	15.8′	60.0′
15	45°47.2	·· 40.9	191°08.5	9.5′	13°27.1	15.7′	60.0′
16	60°47.4	39.9	205°37.0	9.4′	13°42.8	15.7′	60.0′
17	75°47.6	39.0	220°05.4	9.4′	13°58.5	15.5′	60.0′
18	90°47.8	N04°38.0	234°33.8	9.3′	N14°14.0	15.5′	60.0′
19	105°48.1	37.1	249°02.0	9.2′	14°29.5	15.4′	60.0′
20	120°48.3	36.1	263°30.3	9.1′	14°44.9	15.3′	60.0′
21	135°48.5	·· 35.2	277°58.4	9.1′	15°00.2	15.2′	60.0′
22	150°48.7	34.2	292°26.4	9.0′	15°15.4	15.1′	60.0′
23	165°48.9	33.3	306°54.4	8.9′	15°30.5	15.0′	60.0′
	SD = 15.9′	d = 0.9′		SD = 16.4′			

Thu	GHA	Dec	GHA	ν	Dec	d	HP
0	180°49.2	N04°32.3	321°22.3	8.8′	N15°45.5	14.9′	60.0′
1	195°49.4	31.4	335°50.2	8.7′	16°00.4	14.9′	60.0′
2	210°49.6	30.4	350°17.9	8.7′	16°15.3	14.7′	60.0′
3	225°49.8	·· 29.5	4°45.6	8.6′	16°30.0	14.6′	60.0′
4	240°50.0	28.5	19°13.2	8.5′	16°44.6	14.6′	60.0′
5	255°50.3	27.6	33°40.7	8.4′	16°59.2	14.4′	60.0′
6	270°50.5	N04°26.6	48°08.1	8.3′	N17°13.6	14.3′	60.0′
7	285°50.7	25.7	62°35.4	8.3′	17°27.9	14.3′	60.0′
8	300°50.9	24.7	77°02.7	8.2′	17°42.2	14.1′	60.0′
9	315°51.1	·· 23.8	91°29.9	8.1′	17°56.3	14.0′	60.0′
10	330°51.4	22.8	105°57.0	8.0′	18°10.3	13.9′	60.0′
11	345°51.6	21.9	120°24.0	7.9′	18°24.2	13.7′	60.0′
12	0°51.8	N04°20.9	134°50.9	7.8′	N18°37.9	13.7′	59.9′
13	15°52.0	20.0	149°17.8	7.8′	18°51.6	13.5′	59.9′
14	30°52.2	19.0	163°44.5	7.7′	19°05.1	13.4′	59.9′
15	45°52.5	·· 18.1	178°11.2	7.6′	19°18.5	13.3′	59.9′
16	60°52.7	17.1	192°37.8	7.5′	19°31.8	13.2′	59.9′
17	75°52.9	16.1	207°04.3	7.4′	19°45.0	13.1′	59.9′
18	90°53.1	N04°15.2	221°30.8	7.3′	N19°58.1	12.9′	59.9′
19	105°53.4	14.2	235°57.1	7.3′	20°11.0	12.8′	59.9′
20	120°53.6	13.3	250°23.3	7.2′	20°23.8	12.7′	59.9′
21	135°53.8	·· 12.3	264°49.5	7.1′	20°36.5	12.5′	59.9′
22	150°54.0	11.4	279°15.6	7.0′	20°49.0	12.4′	59.9′
23	165°54.2	10.4	293°41.6	6.9′	21°01.4	12.3′	59.8′
	SD = 15.9′	d = 1.0′		SD = 16.4′			

Fri	GHA	Dec	GHA	ν	Dec	d	HP
0	180°54.5	N04°09.5	308°07.5	6.8′	N21°13.7	12.1′	59.8′
1	195°54.7	08.5	322°33.3	6.7′	21°25.8	12.0′	59.8′
2	210°54.9	07.6	336°59.1	6.7′	21°37.8	11.8′	59.8′
3	225°55.1	·· 06.6	351°24.7	6.6′	21°49.6	11.7′	59.8′
4	240°55.3	05.7	5°50.3	6.5′	22°01.3	11.6′	59.8′
5	255°55.6	04.7	20°15.8	6.4′	22°12.9	11.4′	59.8′
6	270°55.8	N04°03.8	34°41.2	6.3′	N22°24.3	11.3′	59.8′
7	285°56.0	02.8	49°06.5	6.2′	22°35.6	11.1′	59.7′
8	300°56.2	01.8	63°31.8	6.2′	22°46.7	11.0′	59.7′
9	315°56.5	04°00.9	77°56.9	6.1′	22°57.7	10.8′	59.7′
10	330°56.7	03°59.9	92°22.0	6.0′	23°08.5	10.7′	59.7′
11	345°56.9	59.0	106°47.0	5.9′	23°19.2	10.5′	59.7′
12	0°57.1	N03°58.0	121°11.9	5.8′	N23°29.7	10.4′	59.7′
13	15°57.3	57.1	135°36.8	5.8′	23°40.1	10.2′	59.7′
14	30°57.6	56.1	150°01.5	5.7′	23°50.3	10.0′	59.7′
15	45°57.8	·· 55.2	164°26.2	5.6′	24°00.3	9.9′	59.6′
16	60°58.0	54.2	178°50.8	5.5′	24°10.2	9.7′	59.6′
17	75°58.2	53.2	193°15.3	5.5′	24°19.9	9.6′	59.6′
18	90°58.5	N03°52.3	207°39.8	5.4′	N24°29.5	9.4′	59.6′
19	105°58.7	51.3	222°04.1	5.3′	24°38.9	9.2′	59.6′
20	120°58.9	50.4	236°28.5	5.2′	24°48.1	9.1′	59.6′
21	135°59.1	·· 49.4	250°52.7	5.2′	24°57.2	8.9′	59.5′
22	150°59.3	48.5	265°16.8	5.1′	25°06.1	8.7′	59.5′
23	165°59.6	47.5	279°40.9	5.0′	25°14.8	8.6′	59.5′
	SD = 15.9′	d = 1.0′		SD = 16.3′			

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	01:30	03:35	04:50	19:00	20:14	22:13
N 70°	02:14	03:51	04:57	18:53	19:59	21:33
68°	02:42	04:04	05:03	18:48	19:47	21:07
66°	03:02	04:14	05:08	18:43	19:37	20:47
64°	03:19	04:23	05:12	18:39	19:28	20:32
62°	03:32	04:30	05:16	18:36	19:21	20:19
60°	03:42	04:36	05:19	18:33	19:15	20:08
N 58°	03:52	04:41	05:22	18:30	19:10	19:59
56°	04:00	04:46	05:24	18:28	19:06	19:52
54°	04:06	04:50	05:26	18:26	19:02	19:45
52°	04:13	04:54	05:28	18:24	18:58	19:39
50°	04:18	04:57	05:30	18:22	18:55	19:34
45°	04:29	05:04	05:34	18:18	18:48	19:23
N 40°	04:38	05:10	05:37	18:15	18:42	19:15
35°	04:45	05:15	05:40	18:12	18:38	19:08
30°	04:50	05:18	05:42	18:10	18:34	19:02
20°	04:59	05:24	05:47	18:06	18:28	18:54
N 10°	05:05	05:29	05:50	18:03	18:24	18:48
0°	05:09	05:33	05:53	18:00	18:21	18:45
S 10°	05:11	05:35	05:56	17:57	18:18	18:42
20°	05:12	05:38	06:00	17:54	18:16	18:41
30°	05:11	05:39	06:03	17:50	18:14	18:42
35°	05:11	05:40	06:05	17:49	18:14	18:43
40°	05:09	05:40	06:07	17:46	18:14	18:45
45°	05:07	05:40	06:10	17:44	18:13	18:47
S 50°	05:03	05:41	06:13	17:41	18:14	18:51
52°	05:01	05:40	06:14	17:40	18:14	18:53
54°	04:59	05:40	06:15	17:39	18:14	18:55
56°	04:57	05:40	06:17	17:37	18:14	18:57
58°	04:54	05:40	06:19	17:35	18:15	19:00
S 60°	04:51	05:39	06:21	17:34	18:15	19:04

Lat.	Moonrise Wed	Moonrise Thu	Moonrise Fri	Moonset Wed	Moonset Thu	Moonset Fri
N 72°	17:03	▭	▭	10:54	▭	▭
N 70°	17:29	16:08	▭	10:30	13:44	▭
68°	17:49	17:04	▭	10:13	12:49	▭
66°	18:05	17:39	▭	09:58	12:17	▭
64°	18:18	18:04	17:38	09:47	11:53	14:18
62°	18:29	18:23	18:16	09:37	11:34	13:40
60°	18:39	18:40	18:43	09:29	11:19	13:14
N 58°	18:47	18:54	19:05	09:22	11:06	12:53
56°	18:55	19:06	19:22	09:15	10:55	12:37
54°	19:02	19:16	19:37	09:10	10:45	12:22
52°	19:08	19:26	19:50	09:04	10:37	12:10
50°	19:13	19:34	20:02	09:00	10:29	11:59
45°	19:25	19:52	20:26	08:50	10:13	11:36
N 40°	19:35	20:07	20:45	08:42	09:59	11:18
35°	19:44	20:19	21:01	08:35	09:48	11:02
30°	19:52	20:31	21:15	08:29	09:38	10:49
20°	20:05	20:50	21:40	08:18	09:21	10:27
N 10°	20:17	21:06	22:01	08:09	09:07	10:07
0°	20:28	21:22	22:20	08:00	08:53	09:49
S 10°	20:39	21:38	22:40	07:52	08:40	09:32
20°	20:51	21:55	23:02	07:43	08:25	09:12
30°	21:05	22:15	23:27	07:32	08:09	08:50
35°	21:13	22:27	23:41	07:26	07:59	08:38
40°	21:22	22:40	23:58	07:20	07:49	08:23
45°	21:33	22:56	·· ··	07:12	07:36	08:06
S 50°	21:46	23:16	·· ··	07:03	07:21	07:44
52°	21:53	23:26	·· ··	06:58	07:14	07:34
54°	22:00	23:37	·· ··	06:54	07:06	07:23
56°	22:07	23:49	·· ··	06:49	06:57	07:10
58°	22:16	·· ··	00:03	06:43	06:47	06:55
S 60°	22:26	·· ··	00:20	06:36	06:36	06:37

Day	Sun Eqn.of Time 00h	Sun Eqn.of Time 12h	Sun Mer. Pass	Moon Mer.Pass. Upper	Moon Mer.Pass. Lower	Moon Age	
	mm:ss	mm:ss	hh:mm	hh:mm	hh:mm	18-20 93-77%	
10	02:56	03:06	11:57	01:48	14:14		
11	03:17	03:27	11:57	02:40	15:08		
12	03:38	03:48	11:56	03:36	16:05		

September 13, 14, 15 UT (Sat., Sun., Mon.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	352°14.4	207°35.8	N14°48.3	150°11.2	S09°07.3	240°41.9	N21°57.0	352°01.7	S02°38.1
1	7°16.9	222°35.3	47.4	165°12.1	07.9	255°43.9	56.9	7°04.4	38.2
2	22°19.4	237°34.7	46.5	180°13.0	08.5	270°46.0	56.9	22°07.0	38.2
3	37°21.8	252°34.2	·· 45.6	195°13.9	·· 09.2	285°48.0	·· 56.8	37°09.7	·· 38.3
4	52°24.3	267°33.7	44.7	210°14.8	09.8	300°50.0	56.8	52°12.3	38.4
5	67°26.8	282°33.1	43.8	225°15.7	10.4	315°52.1	56.7	67°14.9	38.5
6	82°29.2	297°32.6	N14°42.9	240°16.7	S09°11.1	330°54.1	N21°56.7	82°17.6	S02°38.6
7	97°31.7	312°32.0	42.1	255°17.6	11.7	345°56.1	56.6	97°20.2	38.6
8	112°34.1	327°31.5	41.2	270°18.5	12.3	0°58.2	56.5	112°22.8	38.7
9	127°36.6	342°31.0	·· 40.3	285°19.4	·· 13.0	16°00.2	·· 56.5	127°25.5	·· 38.8
10	142°39.1	357°30.4	39.4	300°20.3	13.6	31°02.3	56.4	142°28.1	38.9
11	157°41.5	12°29.9	38.5	315°21.2	14.3	46°04.3	56.4	157°30.8	39.0
12	172°44.0	27°29.4	N14°37.6	330°22.1	S09°14.9	61°06.3	N21°56.3	172°33.4	S02°39.0
13	187°46.5	42°28.8	36.7	345°23.1	15.5	76°08.4	56.3	187°36.0	39.1
14	202°48.9	57°28.3	35.8	0°24.0	16.2	91°10.4	56.2	202°38.7	39.2
15	217°51.4	72°27.7	·· 34.9	15°24.9	·· 16.8	106°12.5	·· 56.2	217°41.3	·· 39.3
16	232°53.9	87°27.2	34.0	30°25.8	17.4	121°14.5	56.1	232°43.9	39.4
17	247°56.3	102°26.7	33.1	45°26.7	18.1	136°16.5	56.1	247°46.6	39.4
18	262°58.8	117°26.1	N14°32.2	60°27.6	S09°18.7	151°18.6	N21°56.0	262°49.2	S02°39.5
19	278°01.3	132°25.6	31.3	75°28.5	19.3	166°20.6	56.0	277°51.9	39.6
20	293°03.7	147°25.1	30.4	90°29.5	20.0	181°22.7	55.9	292°54.5	39.7
21	308°06.2	162°24.5	·· 29.5	105°30.4	·· 20.6	196°24.7	·· 55.8	307°57.1	·· 39.7
22	323°08.6	177°24.0	28.6	120°31.3	21.2	211°26.8	55.8	322°59.8	39.8
23	338°11.1	192°23.5	27.7	135°32.2	21.9	226°28.8	55.7	338°02.4	39.9
Mer.pass. 00:31		ν -0.5′	d 0.9′	m -3.94	ν 0.9′	d 0.6′	m 1.61	ν 2.0′	d 0.1′ m -2.04	ν 2.6′	d 0.1′ m 0.61

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	353°13.6	207°22.9	N14°26.8	150°33.1	S09°22.5	241°30.8	N21°55.7	353°05.1	S02°40.0
1	8°16.0	222°22.4	25.9	165°34.0	23.1	256°32.9	55.6	8°07.7	40.1
2	23°18.5	237°21.9	25.0	180°34.9	23.8	271°34.9	55.6	23°10.3	40.1
3	38°21.0	252°21.3	·· 24.1	195°35.8	·· 24.4	286°37.0	·· 55.5	38°13.0	·· 40.2
4	53°23.4	267°20.8	23.2	210°36.7	25.0	301°39.0	55.5	53°15.6	40.3
5	68°25.9	282°20.3	22.3	225°37.7	25.7	316°41.1	55.4	68°18.2	40.4
6	83°28.4	297°19.7	N14°21.4	240°38.6	S09°26.3	331°43.1	N21°55.4	83°20.9	S02°40.5
7	98°30.8	312°19.2	20.5	255°39.5	26.9	346°45.1	55.3	98°23.5	40.5
8	113°33.3	327°18.7	19.6	270°40.4	27.6	1°47.2	55.3	113°26.2	40.6
9	128°35.8	342°18.1	·· 18.6	285°41.3	·· 28.2	16°49.2	·· 55.2	128°28.8	·· 40.7
10	143°38.2	357°17.6	17.7	300°42.2	28.8	31°51.3	55.1	143°31.4	40.8
11	158°40.7	12°17.1	16.8	315°43.1	29.5	46°53.3	55.1	158°34.1	40.9
12	173°43.1	27°16.5	N14°15.9	330°44.0	S09°30.1	61°55.4	N21°55.0	173°36.7	S02°40.9
13	188°45.6	42°16.0	15.0	345°44.9	30.7	76°57.4	55.0	188°39.4	41.0
14	203°48.1	57°15.5	14.1	0°45.8	31.4	91°59.5	54.9	203°42.0	41.1
15	218°50.5	72°14.9	·· 13.2	15°46.8	·· 32.0	107°01.5	·· 54.9	218°44.6	·· 41.2
16	233°53.0	87°14.4	12.3	30°47.7	32.6	122°03.5	54.8	233°47.3	41.2
17	248°55.5	102°13.9	11.3	45°48.6	33.3	137°05.6	54.8	248°49.9	41.3
18	263°57.9	117°13.4	N14°10.4	60°49.5	S09°33.9	152°07.6	N21°54.7	263°52.5	S02°41.4
19	279°00.4	132°12.8	09.5	75°50.4	34.5	167°09.7	54.7	278°55.2	41.5
20	294°02.9	147°12.3	08.6	90°51.3	35.2	182°11.7	54.6	293°57.8	41.6
21	309°05.3	162°11.8	·· 07.7	105°52.2	·· 35.8	197°13.8	·· 54.6	309°00.5	·· 41.6
22	324°07.8	177°11.3	06.8	120°53.1	36.4	212°15.8	54.5	324°03.1	41.7
23	339°10.2	192°10.7	05.8	135°54.0	37.1	227°17.9	54.5	339°05.7	41.8
Mer.pass. 00:27		ν -0.5′	d 0.9′	m -3.94	ν 0.9′	d 0.6′	m 1.61	ν 2.0′	d 0.1′ m -2.04	ν 2.6′	d 0.1′ m 0.60

Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	354°12.7	207°10.2	N14°04.9	150°54.9	S09°37.7	242°19.9	N21°54.4	354°08.4	S02°41.9
1	9°15.2	222°09.7	04.0	165°55.8	38.3	257°22.0	54.3	9°11.0	42.0
2	24°17.6	237°09.1	03.1	180°56.7	39.0	272°24.0	54.3	24°13.7	42.0
3	39°20.1	252°08.6	·· 02.2	195°57.7	·· 39.6	287°26.1	·· 54.2	39°16.3	·· 42.1
4	54°22.6	267°08.1	01.2	210°58.6	40.2	302°28.1	54.2	54°18.9	42.2
5	69°25.0	282°07.6	14°00.3	225°59.5	40.8	317°30.2	54.1	69°21.6	42.3
6	84°27.5	297°07.0	N13°59.4	241°00.4	S09°41.5	332°32.2	N21°54.1	84°24.2	S02°42.4
7	99°30.0	312°06.5	58.5	256°01.3	42.1	347°34.3	54.0	99°26.9	42.4
8	114°32.4	327°06.0	57.5	271°02.2	42.7	2°36.3	54.0	114°29.5	42.5
9	129°34.9	342°05.5	·· 56.6	286°03.1	·· 43.4	17°38.4	·· 53.9	129°32.1	·· 42.6
10	144°37.4	357°05.0	55.7	301°04.0	44.0	32°40.4	53.9	144°34.8	42.7
11	159°39.8	12°04.4	54.8	316°04.9	44.6	47°42.4	53.8	159°37.4	42.7
12	174°42.3	27°03.9	N13°53.8	331°05.8	S09°45.3	62°44.5	N21°53.8	174°40.1	S02°42.8
13	189°44.7	42°03.4	52.9	346°06.7	45.9	77°46.5	53.7	189°42.7	42.9
14	204°47.2	57°02.9	52.0	1°07.6	46.5	92°48.6	53.6	204°45.3	43.0
15	219°49.7	72°02.3	·· 51.0	16°08.5	·· 47.2	107°50.7	·· 53.6	219°48.0	·· 43.1
16	234°52.1	87°01.8	50.1	31°09.4	47.8	122°52.7	53.5	234°50.6	43.1
17	249°54.6	102°01.3	49.2	46°10.3	48.4	137°54.8	53.5	249°53.2	43.2
18	264°57.1	117°00.8	N13°48.3	61°11.2	S09°49.1	152°56.8	N21°53.4	264°55.9	S02°43.3
19	279°59.5	132°00.3	47.3	76°12.1	49.7	167°58.9	53.4	279°58.5	43.4
20	295°02.0	146°59.7	46.4	91°13.0	50.3	183°00.9	53.3	295°01.2	43.5
21	310°04.5	161°59.2	·· 45.5	106°13.9	·· 50.9	198°03.0	·· 53.3	310°03.8	·· 43.5
22	325°06.9	176°58.7	44.5	121°14.8	51.6	213°05.0	53.2	325°06.4	43.6
23	340°09.4	191°58.2	43.6	136°15.7	52.2	228°07.1	53.2	340°09.1	43.7
Mer.pass. 00:23		ν -0.5′	d 0.9′	m -3.93	ν 0.9′	d 0.6′	m 1.61	ν 2.0′	d 0.1′ m -2.05	ν 2.6′	d 0.1′ m 0.60

Stars

	SHA	Dec
Alpheratz	357°33.9	29°14.1
Ankaa	353°06.2	-42°09.8
Schedar	349°29.9	56°40.7
Diphda	348°46.4	-17°50.5
Achernar	335°19.2	-57°06.1
Hamal	327°50.3	23°35.1
Polaris	313°29.2	89°22.1
Acamar	315°11.1	-40°11.8
Menkar	314°05.4	4°11.6
Mirfak	308°27.2	49°57.0
Aldebaran	290°38.9	16°33.7
Rigel	281°03.3	-8°10.1
Capella	280°21.0	46°01.3
Bellatrix	278°22.3	6°22.5
Elnath	278°01.2	28°37.7
Alnilam	275°37.2	-1°11.0
Betelgeuse	270°51.5	7°24.8
Canopus	263°52.3	-52°42.2
Sirius	258°25.9	-16°44.8
Adhara	255°05.6	-29°00.1
Procyon	244°50.4	5°09.7
Pollux	243°16.8	27°57.8
Avior	234°15.0	-59°35.2
Suhail	222°46.3	-43°31.9
Miaplacidus	221°39.0	-69°49.1
Alphard	217°47.5	-8°46.0
Regulus	207°34.1	11°50.6
Dubhe	193°40.9	61°36.8
Denebola	182°24.7	14°25.8
Gienah	175°43.3	-17°41.0
Acrux	173°00.2	-63°14.5
Gacrux	171°51.6	-57°15.5
Alioth	166°13.0	55°49.4
Spica	158°22.0	-11°17.7
Alkaid	152°51.9	49°11.3
Hadar	148°35.7	-60°29.9
Menkent	147°57.3	-36°29.8
Arcturus	145°47.6	19°03.1
Rigil Kent.	139°40.0	-60°56.6
Kochab	137°20.5	74°03.2
Zuben'ubi	136°55.6	-16°08.9
Alphecca	126°03.4	26°37.9
Antares	112°15.2	-26°29.4
Atria	107°09.0	-69°04.7
Sabik	102°02.2	-15°45.4
Shaula	96°09.6	-37°07.4
Rasalhague	95°58.0	12°32.6
Eltanin	90°41.8	51°29.4
Kaus Aust.	83°31.7	-34°22.4
Vega	80°32.7	38°48.7
Nunki	75°46.9	-26°15.9
Altair	61°59.2	8°56.3
Peacock	53°04.4	-56°39.2
Deneb	49°25.1	45°22.5
Enif	33°38.0	9°59.7
Al Na'ir	27°31.7	-46°50.2
Fomalhaut	15°13.5	-29°29.0
Scheat	13°44.3	28°13.5
Markab	13°29.0	15°20.8

Sep 13 Sat	SHA	Mer.pass
Venus	215°21.4	10:10
Mars	157°56.7	13:58
Jupiter	248°27.5	07:56
Saturn	359°47.3	00:32

Sep 14 Sun	SHA	Mer.pass
Venus	214°09.3	10:11
Mars	157°19.5	13:57
Jupiter	248°17.3	07:53
Saturn	359°51.5	00:28

Sep 15 Mon	SHA	Mer.pass
Venus	212°57.5	10:12
Mars	156°42.2	13:55
Jupiter	248°07.2	07:50
Saturn	359°55.7	00:23

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h

Sat	Sun GHA	Sun Dec	Moon GHA	ν	Moon Dec	d	HP
0	180°59.8	N03°46.6	294°05.0	5.0′	N25°23.4	8.4′	59.5′
1	196°00.0	45.6	308°28.9	4.9′	25°31.8	8.2′	59.5′
2	211°00.2	44.6	322°52.8	4.8′	25°40.0	8.0′	59.5′
3	226°00.5	·· 43.7	337°16.6	4.8′	25°48.0	7.9′	59.4′
4	241°00.7	42.7	351°40.4	4.7′	25°55.9	7.7′	59.4′
5	256°00.9	41.8	6°04.1	4.6′	26°03.6	7.5′	59.4′
6	271°01.1	N03°40.8	20°27.7	4.6′	N26°11.1	7.3′	59.4′
7	286°01.3	39.9	34°51.3	4.5′	26°18.4	7.2′	59.4′
8	301°01.6	38.9	49°14.8	4.5′	26°25.6	6.9′	59.4′
9	316°01.8	·· 37.9	63°38.3	4.4′	26°32.5	6.8′	59.3′
10	331°02.0	37.0	78°01.7	4.4′	26°39.3	6.6′	59.3′
11	346°02.2	36.0	92°25.1	4.3′	26°45.9	6.5′	59.3′
12	1°02.5	N03°35.1	106°48.4	4.3′	N26°52.4	6.2′	59.3′
13	16°02.7	34.1	121°11.7	4.2′	26°58.6	6.1′	59.3′
14	31°02.9	33.2	135°34.9	4.2′	27°04.7	5.8′	59.3′
15	46°03.1	·· 32.2	149°58.1	4.1′	27°10.5	5.7′	59.2′
16	61°03.3	31.2	164°21.2	4.1′	27°16.2	5.5′	59.2′
17	76°03.6	30.3	178°44.3	4.1′	27°21.7	5.3′	59.2′
18	91°03.8	N03°29.3	193°07.4	4.0′	N27°27.0	5.1′	59.2′
19	106°04.0	28.4	207°30.4	4.0′	27°32.1	5.0′	59.2′
20	121°04.2	27.4	221°53.4	4.0′	27°37.1	4.7′	59.1′
21	136°04.5	·· 26.4	236°16.3	3.9′	27°41.8	4.6′	59.1′
22	151°04.7	25.5	250°39.2	3.9′	27°46.4	4.3′	59.1′
23	166°04.9	24.5	265°02.1	3.9′	27°50.7	4.2′	59.1′
	SD = 15.9′	d = 1.0′	SD = 16.2′				

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	181°05.1	N03°23.6	279°25.0	3.9′	N27°54.9	4.0′	59.1′
1	196°05.4	22.6	293°47.9	3.8′	27°58.9	3.7′	59.0′
2	211°05.6	21.6	308°10.7	3.8′	28°02.6	3.6′	59.0′
3	226°05.8	·· 20.7	322°33.5	3.8′	28°06.2	3.4′	59.0′
4	241°06.0	19.7	336°56.3	3.8′	28°09.6	3.2′	59.0′
5	256°06.2	18.8	351°19.1	3.8′	28°12.8	3.1′	59.0′
6	271°06.5	N03°17.8	5°41.9	3.8′	N28°15.9	2.8′	58.9′
7	286°06.7	16.9	20°04.6	3.8′	28°18.7	2.6′	58.9′
8	301°06.9	15.9	34°27.4	3.8′	28°21.3	2.4′	58.9′
9	316°07.1	·· 14.9	48°50.1	3.8′	28°23.7	2.3′	58.9′
10	331°07.4	14.0	63°12.9	3.8′	28°26.0	2.0′	58.9′
11	346°07.6	13.0	77°35.6	3.8′	28°28.0	1.9′	58.8′
12	1°07.8	N03°12.0	91°58.4	3.8′	N28°29.9	1.7′	58.8′
13	16°08.0	11.1	106°21.2	3.8′	28°31.6	1.4′	58.8′
14	31°08.2	10.1	120°43.9	3.8′	28°33.0	1.3′	58.8′
15	46°08.5	·· 09.2	135°06.7	3.8′	28°34.3	1.1′	58.8′
16	61°08.7	08.2	149°29.5	3.8′	28°35.4	0.9′	58.7′
17	76°08.9	07.2	163°52.3	3.8′	28°36.3	0.7′	58.7′
18	91°09.1	N03°06.3	178°15.1	3.8′	N28°37.0	0.5′	58.7′
19	106°09.4	05.3	192°38.0	3.9′	28°37.5	0.3′	58.7′
20	121°09.6	04.4	207°00.9	3.9′	28°37.8	0.1′	58.7′
21	136°09.8	·· 03.4	221°23.7	3.9′	28°37.9	0.1′	58.6′
22	151°10.0	02.4	235°46.7	4.0′	28°37.8	0.2′	58.6′
23	166°10.3	01.5	250°09.6	4.0′	28°37.6	0.5′	58.6′
	SD = 15.9′	d = 1.0′	SD = 16.1′				

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	181°10.5	N03°00.5	264°32.6	4.0′	N28°37.1	0.6′	58.6′
1	196°10.7	02°59.6	278°55.6	4.1′	28°36.5	0.9′	58.5′
2	211°10.9	58.6	293°18.7	4.1′	28°35.6	1.0′	58.5′
3	226°11.1	·· 57.6	307°41.8	4.1′	28°34.6	1.2′	58.5′
4	241°11.4	56.7	322°04.9	4.2′	28°33.4	1.4′	58.5′
5	256°11.6	55.7	336°28.1	4.2′	28°32.0	1.6′	58.5′
6	271°11.8	N02°54.7	350°51.3	4.3′	N28°30.4	1.8′	58.4′
7	286°12.0	53.8	5°14.6	4.3′	28°28.6	1.9′	58.4′
8	301°12.3	52.8	19°38.0	4.4′	28°26.7	2.2′	58.4′
9	316°12.5	·· 51.9	34°01.3	4.4′	28°24.5	2.3′	58.4′
10	331°12.7	50.9	48°24.8	4.5′	28°22.2	2.5′	58.4′
11	346°12.9	49.9	62°48.3	4.6′	28°19.7	2.7′	58.3′
12	1°13.2	N02°49.0	77°11.8	4.6′	N28°17.0	2.9′	58.3′
13	16°13.4	48.0	91°35.5	4.7′	28°14.1	3.0′	58.3′
14	31°13.6	47.0	105°59.1	4.7′	28°11.1	3.3′	58.3′
15	46°13.8	·· 46.1	120°22.9	4.8′	28°07.8	3.4′	58.2′
16	61°14.0	45.1	134°46.7	4.9′	28°04.4	3.6′	58.2′
17	76°14.3	44.1	149°10.6	5.0′	28°00.8	3.7′	58.2′
18	91°14.5	N02°43.2	163°34.5	5.0′	N27°57.1	4.0′	58.2′
19	106°14.7	42.2	177°58.6	5.1′	27°53.1	4.1′	58.2′
20	121°14.9	41.3	192°22.7	5.2′	27°49.0	4.3′	58.1′
21	136°15.2	·· 40.3	206°46.8	5.3′	27°44.7	4.4′	58.1′
22	151°15.4	39.3	221°11.1	5.3′	27°40.3	4.7′	58.1′
23	166°15.6	38.4	235°35.4	5.4′	27°35.6	4.8′	58.1′
	SD = 15.9′	d = 1.0′	SD = 16.0′				

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	02:01	03:51	05:04	18:45	19:56	21:43
N 70°	02:34	04:05	05:09	18:39	19:43	21:12
68°	02:58	04:15	05:14	18:35	19:33	20:49
66°	03:16	04:24	05:17	18:32	19:24	20:32
64°	03:30	04:32	05:21	18:29	19:17	20:18
62°	03:41	04:38	05:23	18:26	19:11	20:07
60°	03:51	04:43	05:26	18:24	19:06	19:58
N 58°	03:59	04:48	05:28	18:22	19:01	19:50
56°	04:06	04:52	05:30	18:20	18:57	19:43
54°	04:13	04:56	05:32	18:18	18:54	19:37
52°	04:18	04:59	05:33	18:17	18:51	19:31
50°	04:23	05:02	05:35	18:15	18:48	19:27
45°	04:33	05:08	05:38	18:13	18:42	19:17
N 40°	04:41	05:13	05:40	18:10	18:37	19:09
35°	04:47	05:17	05:42	18:08	18:34	19:03
30°	04:52	05:20	05:44	18:06	18:30	18:58
20°	04:59	05:25	05:47	18:03	18:26	18:51
N 10°	05:04	05:29	05:50	18:01	18:22	18:46
0°	05:08	05:32	05:52	17:59	18:19	18:43
S 10°	05:09	05:34	05:55	17:57	18:18	18:42
20°	05:09	05:35	05:57	17:54	18:16	18:42
30°	05:08	05:35	05:59	17:52	18:16	18:44
35°	05:06	05:36	06:01	17:51	18:16	18:45
40°	05:04	05:35	06:02	17:49	18:16	18:48
45°	05:01	05:35	06:04	17:48	18:17	18:51
S 50°	04:57	05:34	06:06	17:46	18:18	18:56
52°	04:54	05:34	06:07	17:45	18:18	18:58
54°	04:52	05:33	06:08	17:44	18:19	19:00
56°	04:49	05:32	06:09	17:43	18:20	19:03
58°	04:46	05:31	06:10	17:42	18:21	19:07
S 60°	04:42	05:30	06:12	17:40	18:22	19:11

Lat.	Moonrise Sat	Moonrise Sun	Moonrise Mon	Moonset Sat	Moonset Sun	Moonset Mon
N 72°						
N 70°						
68°						
66°						
64°						
62°	18:03		19:47	16:00		18:36
60°	18:55	19:31	20:53	15:09	16:43	17:29
N 58°	19:27	20:11	21:27	14:37	16:02	16:54
56°	19:51	20:39	21:52	14:14	15:35	16:29
54°	20:10	21:01	22:13	13:55	15:13	16:09
52°	20:27	21:19	22:29	13:39	14:55	15:51
50°	20:41	21:35	22:44	13:25	14:39	15:37
45°	21:10	22:06	23:13	12:56	14:08	15:07
N 40°	21:32	22:30	23:36	12:34	13:44	14:44
35°	21:51	22:50	23:55	12:16	13:24	14:24
30°	22:08	23:07	·· ··	12:00	13:07	14:08
20°	22:35	23:36	·· ··	11:33	12:39	13:40
N 10°	22:59	·· ··	00:00	11:10	12:14	13:15
0°	23:21	·· ··	00:23	10:49	11:51	12:53
S 10°	23:44	·· ··	00:46	10:28	11:28	12:30
20°	·· ··	00:08	01:11	10:05	11:04	12:06
30°	·· ··	00:36	01:40	09:39	10:35	11:37
35°	·· ··	00:53	01:57	09:23	10:18	11:20
40°	·· ··	01:12	02:17	09:06	09:58	11:00
45°	00:19	01:36	02:42	08:44	09:34	10:36
S 50°	00:45	02:07	03:13	08:17	09:03	10:05
52°	00:58	02:22	03:29	08:04	08:48	09:50
54°	01:13	02:40	03:47	07:49	08:30	09:31
56°	01:30	03:01	04:09	07:31	08:08	09:09
58°	01:51	03:29	04:38	07:09	07:40	08:41
S 60°	02:18	04:08	05:20	06:42	07:00	07:59

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 21-23 66-44%
13	03:59	04:10	11:56	04:35	17:05	
14	04:21	04:31	11:55	05:36	18:07	
15	04:42	04:53	11:55	06:38	19:08	

September 16, 17, 18 UT (Tue., Wed., Thu.)

	Aries	Venus		Mars		Jupiter		Saturn	
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	355°11.9	206°57.7	N13°42.6	151°16.6	S09°52.8	243°09.1	N21°53.1	355°11.7	S02°43.8
1	10°14.3	221°57.1	41.7	166°17.5	53.5	258°11.2	53.1	10°14.4	43.9
2	25°16.8	236°56.6	40.8	181°18.4	54.1	273°13.2	53.0	25°17.0	43.9
3	40°19.2	251°56.1	·· 39.8	196°19.3	·· 54.7	288°15.3	·· 53.0	40°19.6	·· 44.0
4	55°21.7	266°55.6	38.9	211°20.2	55.4	303°17.3	52.9	55°22.3	44.1
5	70°24.2	281°55.1	38.0	226°21.2	56.0	318°19.4	52.9	70°24.9	44.2
6	85°26.6	296°54.5	N13°37.0	241°22.1	S09°56.6	333°21.4	N21°52.8	85°27.6	S02°44.3
7	100°29.1	311°54.0	36.1	256°23.0	57.2	348°23.5	52.7	100°30.2	44.3
8	115°31.6	326°53.5	35.1	271°23.9	57.9	3°25.5	52.7	115°32.8	44.4
9	130°34.0	341°53.0	·· 34.2	286°24.8	·· 58.5	18°27.6	·· 52.6	130°35.5	·· 44.5
10	145°36.5	356°52.5	33.2	301°25.7	59.1	33°29.7	52.6	145°38.1	44.6
11	160°39.0	11°52.0	32.3	316°26.6	09°59.8	48°31.7	52.5	160°40.8	44.6
12	175°41.4	26°51.5	N13°31.4	331°27.5	S10°00.4	63°33.8	N21°52.5	175°43.4	S02°44.7
13	190°43.9	41°50.9	30.4	346°28.4	01.0	78°35.8	52.4	190°46.0	44.8
14	205°46.4	56°50.4	29.5	1°29.3	01.6	93°37.9	52.4	205°48.7	44.9
15	220°48.8	71°49.9	·· 28.5	16°30.2	·· 02.3	108°39.9	·· 52.3	220°51.3	·· 45.0
16	235°51.3	86°49.4	27.6	31°31.0	02.9	123°42.0	52.3	235°54.0	45.0
17	250°53.7	101°48.9	26.6	46°31.9	03.5	138°44.0	52.2	250°56.6	45.1
18	265°56.2	116°48.4	N13°25.7	61°32.8	S10°04.2	153°46.1	N21°52.2	265°59.2	S02°45.2
19	280°58.7	131°47.9	24.7	76°33.7	04.8	168°48.2	52.1	281°01.9	45.3
20	296°01.1	146°47.3	23.8	91°34.6	05.4	183°50.2	52.1	296°04.5	45.4
21	311°03.6	161°46.8	·· 22.8	106°35.5	·· 06.0	198°52.3	·· 52.0	311°07.2	·· 45.4
22	326°06.1	176°46.3	21.9	121°36.4	06.7	213°54.3	51.9	326°09.8	45.5
23	341°08.5	191°45.8	20.9	136°37.3	07.3	228°56.4	51.9	341°12.4	45.6
Mer.pass. 00:19		ν -0.5′	d 0.9′	m -3.93	ν 0.9′	d 0.6′	m 1.60	ν 2.1′	d 0.1′ m -2.05	ν 2.6′	d 0.1′ m 0.60

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	356°11.0	206°45.3	N13°20.0	151°38.2	S10°07.9	243°58.4	N21°51.8	356°15.1	S02°45.7
1	11°13.5	221°44.8	19.0	166°39.1	08.6	259°00.5	51.8	11°17.7	45.8
2	26°15.9	236°44.3	18.1	181°40.0	09.2	274°02.6	51.7	26°20.4	45.8
3	41°18.4	251°43.8	·· 17.1	196°40.9	·· 09.8	289°04.6	·· 51.7	41°23.0	·· 45.9
4	56°20.9	266°43.3	16.2	211°41.8	10.4	304°06.7	51.6	56°25.6	46.0
5	71°23.3	281°42.7	15.2	226°42.7	11.1	319°08.7	51.6	71°28.3	46.1
6	86°25.8	296°42.2	N13°14.2	241°43.6	S10°11.7	334°10.8	N21°51.5	86°30.9	S02°46.2
7	101°28.2	311°41.7	13.3	256°44.5	12.3	349°12.8	51.5	101°33.6	46.2
8	116°30.7	326°41.2	12.3	271°45.4	13.0	4°14.9	51.4	116°36.2	46.3
9	131°33.2	341°40.7	·· 11.4	286°46.3	·· 13.6	19°17.0	·· 51.4	131°38.9	·· 46.4
10	146°35.6	356°40.2	10.4	301°47.2	14.2	34°19.0	51.3	146°41.5	46.5
11	161°38.1	11°39.7	09.4	316°48.1	14.8	49°21.1	51.3	161°44.1	46.5
12	176°40.6	26°39.2	N13°08.5	331°49.0	S10°15.5	64°23.1	N21°51.2	176°46.8	S02°46.6
13	191°43.0	41°38.7	07.5	346°49.9	16.1	79°25.2	51.2	191°49.4	46.7
14	206°45.5	56°38.2	06.6	1°50.8	16.7	94°27.3	51.1	206°52.1	46.8
15	221°48.0	71°37.7	·· 05.6	16°51.7	·· 17.3	109°29.3	·· 51.1	221°54.7	·· 46.9
16	236°50.4	86°37.2	04.6	31°52.6	18.0	124°31.4	51.0	236°57.3	46.9
17	251°52.9	101°36.6	03.7	46°53.5	18.6	139°33.5	50.9	252°00.0	47.0
18	266°55.3	116°36.1	N13°02.7	61°54.3	S10°19.2	154°35.5	N21°50.9	267°02.6	S02°47.1
19	281°57.8	131°35.6	01.7	76°55.2	19.8	169°37.6	50.8	282°05.3	47.2
20	297°00.3	146°35.1	13°00.8	91°56.1	20.5	184°39.6	50.8	297°07.9	47.3
21	312°02.7	161°34.6	12°59.8	106°57.0	·· 21.1	199°41.7	·· 50.7	312°10.5	·· 47.3
22	327°05.2	176°34.1	58.8	121°57.9	21.7	214°43.8	50.7	327°13.2	47.4
23	342°07.7	191°33.6	57.9	136°58.8	22.4	229°45.8	50.6	342°15.8	47.5
Mer.pass. 00:15		ν -0.5′	d 1.0′	m -3.93	ν 0.9′	d 0.6′	m 1.60	ν 2.1′	d 0.1′ m -2.05	ν 2.6′	d 0.1′ m 0.59

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	357°10.1	206°33.1	N12°56.9	151°59.7	S10°23.0	244°47.9	N21°50.6	357°18.5	S02°47.6
1	12°12.6	221°32.6	55.9	167°00.6	23.6	259°50.0	50.5	12°21.1	47.7
2	27°15.1	236°32.1	55.0	182°01.5	24.2	274°52.0	50.5	27°23.7	47.7
3	42°17.5	251°31.6	·· 54.0	197°02.4	·· 24.9	289°54.1	·· 50.4	42°26.4	·· 47.8
4	57°20.0	266°31.1	53.0	212°03.3	25.5	304°56.1	50.4	57°29.0	47.9
5	72°22.5	281°30.6	52.1	227°04.2	26.1	319°58.2	50.3	72°31.7	48.0
6	87°24.9	296°30.1	N12°51.1	242°05.1	S10°26.7	335°00.3	N21°50.3	87°34.3	S02°48.1
7	102°27.4	311°29.6	50.1	257°05.9	27.4	350°02.3	50.2	102°36.9	48.1
8	117°29.8	326°29.1	49.1	272°06.8	28.0	5°04.4	50.2	117°39.6	48.2
9	132°32.3	341°28.6	·· 48.2	287°07.7	·· 28.6	20°06.5	·· 50.1	132°42.2	·· 48.3
10	147°34.8	356°28.1	47.2	302°08.6	29.2	35°08.5	50.1	147°44.9	48.4
11	162°37.2	11°27.6	46.2	317°09.5	29.9	50°10.6	50.0	162°47.5	48.4
12	177°39.7	26°27.1	N12°45.2	332°10.4	S10°30.5	65°12.7	N21°50.0	177°50.2	S02°48.5
13	192°42.2	41°26.6	44.3	347°11.3	31.1	80°14.7	49.9	192°52.8	48.6
14	207°44.6	56°26.1	43.3	2°12.2	31.7	95°16.8	49.8	207°55.4	48.7
15	222°47.1	71°25.6	·· 42.3	17°13.1	·· 32.4	110°18.9	·· 49.8	222°58.1	·· 48.8
16	237°49.6	86°25.1	41.3	32°13.9	33.0	125°20.9	49.7	238°00.7	48.8
17	252°52.0	101°24.6	40.3	47°14.8	33.6	140°23.0	49.7	253°03.4	48.9
18	267°54.5	116°24.1	N12°39.4	62°15.7	S10°34.2	155°25.1	N21°49.6	268°06.0	S02°49.0
19	282°57.0	131°23.6	38.4	77°16.6	34.9	170°27.1	49.6	283°08.6	49.1
20	297°59.4	146°23.1	37.4	92°17.5	35.5	185°29.2	49.5	298°11.3	49.2
21	313°01.9	161°22.6	·· 36.4	107°18.4	·· 36.1	200°31.3	·· 49.5	313°13.9	·· 49.2
22	328°04.3	176°22.1	35.4	122°19.3	36.7	215°33.3	49.4	328°16.6	49.3
23	343°06.8	191°21.6	34.5	137°20.2	37.4	230°35.4	49.4	343°19.2	49.4
Mer.pass. 00:11		ν -0.5′	d 1.0′	m -3.93	ν 0.9′	d 0.6′	m 1.60	ν 2.1′	d 0.1′ m -2.06	ν 2.6′	d 0.1′ m 0.59

Stars

	SHA	Dec
Alpheratz	357°33.8	29°14.1
Ankaa	353°06.1	-42°09.8
Schedar	349°29.9	56°40.7
Diphda	348°46.4	-17°50.5
Achernar	335°19.2	-57°06.1
Hamal	327°50.3	23°35.1
Polaris	313°27.7	89°22.1
Acamar	315°11.1	-40°11.8
Menkar	314°05.4	4°11.6
Mirfak	308°27.2	49°57.1
Aldebaran	290°38.9	16°33.7
Rigel	281°03.3	-8°10.1
Capella	280°21.0	46°01.3
Bellatrix	278°22.2	6°22.5
Elnath	278°01.1	28°37.7
Alnilam	275°37.1	-1°11.0
Betelgeuse	270°51.5	7°24.8
Canopus	263°52.3	-52°42.2
Sirius	258°25.8	-16°44.8
Adhara	255°05.5	-29°00.1
Procyon	244°50.4	5°09.7
Pollux	243°16.8	27°57.8
Avior	234°14.9	-59°35.2
Suhail	222°46.3	-43°31.9
Miaplacidus	221°39.0	-69°49.1
Alphard	217°47.5	-8°46.0
Regulus	207°34.1	11°50.6
Dubhe	193°40.9	61°36.7
Denebola	182°24.7	14°25.8
Gienah	175°43.3	-17°41.0
Acrux	173°00.2	-63°14.5
Gacrux	171°51.6	-57°15.4
Alioth	166°13.0	55°49.3
Spica	158°22.0	-11°17.7
Alkaid	152°51.9	49°11.3
Hadar	148°35.7	-60°29.9
Menkent	147°57.3	-36°29.8
Arcturus	145°47.6	19°03.1
Rigil Kent.	139°40.0	-60°56.6
Kochab	137°20.5	74°03.2
Zuben'ubi	136°55.6	-16°08.9
Alphecca	126°03.4	26°37.9
Antares	112°15.2	-26°29.4
Atria	107°09.0	-69°04.7
Sabik	102°02.2	-15°45.4
Shaula	96°09.6	-37°07.4
Rasalhague	95°58.0	12°32.6
Eltanin	90°41.9	51°29.4
Kaus Aust.	83°31.7	-34°22.4
Vega	80°32.7	38°48.7
Nunki	75°46.9	-26°15.9
Altair	61°59.2	8°56.3
Peacock	53°04.4	-56°39.2
Deneb	49°25.1	45°22.5
Enif	33°38.0	9°59.7
Al Na'ir	27°31.7	-46°50.2
Fomalhaut	15°13.5	-29°29.1
Scheat	13°44.3	28°13.5
Markab	13°29.0	15°20.8

Sep 16 Tue	SHA	Mer.pass
Venus	211°45.8	10:13
Mars	156°04.8	13:54
Jupiter	247°57.3	07:46
Saturn	359°59.9	00:19

Sep 17 Wed	SHA	Mer.pass
Venus	210°34.3	10:13
Mars	155°27.2	13:53
Jupiter	247°47.4	07:43
Saturn	0°04.1	00:15

Sep 18 Thu	SHA	Mer.pass
Venus	209°23.0	10:14
Mars	154°49.6	13:51
Jupiter	247°37.8	07:40
Saturn	0°08.3	00:11

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Tue	**GHA**	**Dec**	**GHA**	*ν*	**Dec**	*d*	**HP**
0	181°15.8	N02°37.4	249°59.9	5.5′	N27°30.8	4.9′	58.0′
1	196°16.1	36.4	264°24.4	5.6′	27°25.9	5.2′	58.0′
2	211°16.3	35.5	278°49.0	5.7′	27°20.7	5.3′	58.0′
3	226°16.5	·· 34.5	293°13.6	5.8′	27°15.4	5.5′	58.0′
4	241°16.7	33.5	307°38.4	5.9′	27°09.9	5.6′	58.0′
5	256°16.9	32.6	322°03.2	5.9′	27°04.3	5.8′	57.9′
6	271°17.2	N02°31.6	336°28.2	6.0′	N26°58.5	5.9′	57.9′
7	286°17.4	30.7	350°53.2	6.1′	26°52.6	6.2′	57.9′
8	301°17.6	29.7	5°18.4	6.2′	26°46.4	6.2′	57.9′
9	316°17.8	·· 28.7	19°43.6	6.3′	26°40.2	6.5′	57.8′
10	331°18.1	27.8	34°08.9	6.4′	26°33.7	6.5′	57.8′
11	346°18.3	26.8	48°34.3	6.5′	26°27.2	6.8′	57.8′
12	1°18.5	N02°25.8	62°59.8	6.6′	N26°20.4	6.9′	57.8′
13	16°18.7	24.9	77°25.4	6.7′	26°13.5	7.0′	57.8′
14	31°19.0	23.9	91°51.1	6.8′	26°06.5	7.2′	57.7′
15	46°19.2	·· 22.9	106°16.9	6.9′	25°59.3	7.4′	57.7′
16	61°19.4	22.0	120°42.8	7.0′	25°51.9	7.5′	57.7′
17	76°19.6	21.0	135°08.9	7.1′	25°44.4	7.6′	57.7′
18	91°19.8	N02°20.0	149°35.0	7.2′	N25°36.8	7.8′	57.7′
19	106°20.1	19.1	164°01.2	7.3′	25°29.0	7.9′	57.6′
20	121°20.3	18.1	178°27.5	7.4′	25°21.1	8.1′	57.6′
21	136°20.5	·· 17.1	192°53.9	7.5′	25°13.0	8.2′	57.6′
22	151°20.7	16.2	207°20.5	7.6′	25°04.8	8.3′	57.6′
23	166°21.0	15.2	221°47.1	7.7′	24°56.5	8.5′	57.5′
	SD = 15.9′	*d* = 1.0′	SD = 15.8′				

Wed	**GHA**	**Dec**	**GHA**	*ν*	**Dec**	*d*	**HP**
0	181°21.2	N02°14.2	236°13.8	7.8′	N24°48.0	8.6′	57.5′
1	196°21.4	13.3	250°40.7	8.0′	24°39.4	8.7′	57.5′
2	211°21.6	12.3	265°07.6	8.1′	24°30.7	8.9′	57.5′
3	226°21.9	·· 11.3	279°34.7	8.2′	24°21.8	9.0′	57.5′
4	241°22.1	10.4	294°01.9	8.3′	24°12.8	9.2′	57.4′
5	256°22.3	09.4	308°29.2	8.4′	24°03.6	9.2′	57.4′
6	271°22.5	N02°08.4	322°56.5	8.5′	N23°54.4	9.4′	57.4′
7	286°22.7	07.5	337°24.0	8.6′	23°45.0	9.5′	57.4′
8	301°23.0	06.5	351°51.7	8.7′	23°35.5	9.7′	57.3′
9	316°23.2	·· 05.5	6°19.4	8.8′	23°25.8	9.7′	57.3′
10	331°23.4	04.6	20°47.2	8.9′	23°16.1	9.9′	57.3′
11	346°23.6	03.6	35°15.1	9.0′	23°06.2	10.0′	57.3′
12	1°23.9	N02°02.6	49°43.2	9.1′	N22°56.2	10.1′	57.3′
13	16°24.1	01.7	64°11.3	9.3′	22°46.1	10.2′	57.2′
14	31°24.3	02°00.7	78°39.6	9.4′	22°35.9	10.4′	57.2′
15	46°24.5	01°59.7	93°07.9	9.5′	22°25.5	10.4′	57.2′
16	61°24.8	58.8	107°36.4	9.6′	22°15.1	10.6′	57.2′
17	76°25.0	57.8	122°05.0	9.7′	22°04.5	10.7′	57.1′
18	91°25.2	N01°56.8	136°33.7	9.8′	N21°53.8	10.7′	57.1′
19	106°25.4	55.9	151°02.5	9.9′	21°43.1	10.9′	57.1′
20	121°25.6	54.9	165°31.4	10.0′	21°32.2	11.0′	57.1′
21	136°25.9	·· 53.9	180°00.4	10.1′	21°21.2	11.1′	57.1′
22	151°26.1	53.0	194°29.5	10.2′	21°10.1	11.2′	57.0′
23	166°26.3	52.0	208°58.7	10.3′	20°58.9	11.3′	57.0′
	SD = 15.9′	*d* = 1.0′	SD = 15.7′				

Thu	**GHA**	**Dec**	**GHA**	*ν*	**Dec**	*d*	**HP**
0	181°26.5	N01°51.0	223°28.0	10.4′	N20°47.6	11.4′	57.0′
1	196°26.8	50.1	237°57.5	10.5′	20°36.2	11.5′	57.0′
2	211°27.0	49.1	252°27.0	10.6′	20°24.7	11.5′	57.0′
3	226°27.2	·· 48.1	266°56.7	10.7′	20°13.2	11.7′	56.9′
4	241°27.4	47.2	281°26.4	10.9′	20°01.5	11.8′	56.9′
5	256°27.7	46.2	295°56.3	11.0′	19°49.7	11.8′	56.9′
6	271°27.9	N01°45.2	310°26.2	11.1′	N19°37.9	12.0′	56.9′
7	286°28.1	44.2	324°56.3	11.2′	19°25.9	12.0′	56.8′
8	301°28.3	43.3	339°26.4	11.3′	19°13.9	12.1′	56.8′
9	316°28.5	·· 42.3	353°56.7	11.4′	19°01.8	12.2′	56.8′
10	331°28.8	41.3	8°27.0	11.5′	18°49.6	12.3′	56.8′
11	346°29.0	40.4	22°57.5	11.6′	18°37.3	12.4′	56.8′
12	1°29.2	N01°39.4	37°28.1	11.7′	N18°24.9	12.4′	56.7′
13	16°29.4	38.4	51°58.7	11.8′	18°12.5	12.5′	56.7′
14	31°29.7	37.5	66°29.5	11.8′	18°00.0	12.6′	56.7′
15	46°29.9	·· 36.5	81°00.3	11.9′	17°47.4	12.7′	56.7′
16	61°30.1	35.5	95°31.2	12.0′	17°34.7	12.8′	56.7′
17	76°30.3	34.6	110°02.3	12.1′	17°21.9	12.8′	56.6′
18	91°30.5	N01°33.6	124°33.4	12.2′	N17°09.1	12.9′	56.6′
19	106°30.8	32.6	139°04.6	12.3′	16°56.2	13.0′	56.6′
20	121°31.0	31.7	153°36.0	12.4′	16°43.2	13.0′	56.6′
21	136°31.2	·· 30.7	168°07.4	12.5′	16°30.2	13.1′	56.5′
22	151°31.4	29.7	182°38.9	12.6′	16°17.1	13.2′	56.5′
23	166°31.7	28.7	197°10.5	12.7′	16°03.9	13.2′	56.5′
	SD = 15.9′	*d* = 1.0′	SD = 15.5′				

Lat.	**Twilight**		**Sunrise**	**Sunset**	**Twilight**	
	Naut.	Civil			Civil	Naut.
N 72°	02:25	04:06	05:17	18:29	19:39	21:17
N 70°	02:53	04:18	05:21	18:25	19:28	20:52
68°	03:12	04:27	05:24	18:22	19:19	20:33
66°	03:28	04:35	05:27	18:20	19:12	20:18
64°	03:40	04:41	05:29	18:18	19:06	20:06
62°	03:51	04:46	05:31	18:16	19:01	19:56
60°	03:59	04:51	05:33	18:14	18:56	19:47
N 58°	04:07	04:55	05:34	18:13	18:53	19:40
56°	04:13	04:58	05:36	18:12	18:49	19:34
54°	04:19	05:01	05:37	18:11	18:46	19:29
52°	04:24	05:04	05:38	18:10	18:44	19:24
50°	04:28	05:07	05:39	18:09	18:41	19:20
45°	04:37	05:12	05:41	18:07	18:36	19:11
N 40°	04:44	05:16	05:43	18:05	18:32	19:04
35°	04:49	05:19	05:44	18:04	18:29	18:59
30°	04:54	05:22	05:46	18:03	18:27	18:55
20°	05:00	05:26	05:48	18:01	18:23	18:48
N 10°	05:04	05:29	05:50	17:59	18:20	18:44
0°	05:06	05:30	05:51	17:58	18:18	18:42
S 10°	05:07	05:32	05:53	17:56	18:17	18:42
20°	05:07	05:32	05:54	17:55	18:17	18:43
30°	05:04	05:32	05:56	17:54	18:18	18:45
35°	05:02	05:31	05:56	17:53	18:18	18:48
40°	04:59	05:30	05:57	17:52	18:19	18:51
45°	04:55	05:29	05:58	17:51	18:20	18:55
S 50°	04:50	05:27	06:00	17:50	18:22	19:00
52°	04:47	05:27	06:00	17:50	18:23	19:03
54°	04:44	05:26	06:01	17:49	18:24	19:06
56°	04:41	05:24	06:01	17:49	18:26	19:09
58°	04:37	05:23	06:02	17:48	18:27	19:13
S 60°	04:32	05:21	06:03	17:47	18:29	19:18

Lat.	**Moonrise**			**Moonset**		
	Tue	Wed	Thu	Tue	Wed	Thu
N 72°	▭	▭	23:52	▭	▭	20:11
N 70°	▭	▭	▭	▭	▭	19:27
68°	▭	22:15	·· ··	▭	20:02	18:57
66°	▭	23:10	·· ··	▭	19:07	18:35
64°	21:15	23:42	·· ··	19:09	18:33	18:17
62°	22:07	·· ··	00:06	18:16	18:08	18:02
60°	22:39	·· ··	00:25	17:44	17:49	17:50
N 58°	23:02	·· ··	00:40	17:20	17:32	17:39
56°	23:21	·· ··	00:53	17:00	17:18	17:30
54°	23:37	·· ··	01:05	16:44	17:06	17:21
52°	23:51	·· ··	01:15	16:30	16:56	17:13
50°	·· ··	00:03	01:24	16:18	16:46	17:07
45°	·· ··	00:27	01:43	15:52	16:26	16:52
N 40°	·· ··	00:47	01:58	15:32	16:09	16:40
35°	·· ··	01:03	02:11	15:14	15:55	16:29
30°	00:11	01:17	02:22	15:00	15:43	16:20
20°	00:39	01:41	02:41	14:34	15:22	16:04
N 10°	01:02	02:02	02:58	14:12	15:04	15:50
0°	01:24	02:21	03:13	13:52	14:46	15:37
S 10°	01:46	02:40	03:29	13:31	14:29	15:23
20°	02:09	03:00	03:45	13:09	14:10	15:09
30°	02:36	03:24	04:04	12:43	13:49	14:52
35°	02:52	03:37	04:14	12:27	13:36	14:43
40°	03:11	03:53	04:27	12:09	13:21	14:32
45°	03:33	04:12	04:41	11:48	13:03	14:18
S 50°	04:01	04:35	04:59	11:20	12:41	14:02
52°	04:15	04:46	05:07	11:07	12:31	13:55
54°	04:31	04:59	05:16	10:51	12:19	13:46
56°	04:50	05:13	05:27	10:32	12:05	13:36
58°	05:14	05:30	05:39	10:10	11:48	13:25
S 60°	05:44	05:51	05:52	09:40	11:29	13:13

Day	**Sun**			**Moon**		
	Eqn.of Time		Mer.	Mer.Pass.		Age
	00^h	12^h	Pass	Upper	Lower	24-26
	mm:ss	mm:ss	hh:mm	hh:mm	hh:mm	33-15%
16	05:03	05:14	11:55	07:38	20:06	
17	05:25	05:35	11:54	08:34	21:00	
18	05:46	05:57	11:54	09:25	21:49	

September 19, 20, 21 UT (Fri., Sat., Sun.)

	Aries	Venus		Mars		Jupiter		Saturn	
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	358°09.3	206°21.1	N12°33.5	152°21.1	S10°38.0	245°37.5	N21°49.3	358°21.8	S02°49.5
1	13°11.7	221°20.6	32.5	167°21.9	38.6	260°39.5	49.3	13°24.5	49.6
2	28°14.2	236°20.1	31.5	182°22.8	39.2	275°41.6	49.2	28°27.1	49.6
3	43°16.7	251°19.6	·· 30.5	197°23.7	·· 39.8	290°43.7	·· 49.2	43°29.8	·· 49.7
4	58°19.1	266°19.1	29.5	212°24.6	40.5	305°45.7	49.1	58°32.4	49.8
5	73°21.6	281°18.6	28.5	227°25.5	41.1	320°47.8	49.1	73°35.1	49.9
6	88°24.1	296°18.1	N12°27.6	242°26.4	S10°41.7	335°49.9	N21°49.0	88°37.7	S02°49.9
7	103°26.5	311°17.6	26.6	257°27.3	42.3	350°52.0	49.0	103°40.3	50.0
8	118°29.0	326°17.1	25.6	272°28.1	43.0	5°54.0	48.9	118°43.0	50.1
9	133°31.4	341°16.6	·· 24.6	287°29.0	·· 43.6	20°56.1	·· 48.9	133°45.6	·· 50.2
10	148°33.9	356°16.1	23.6	302°29.9	44.2	35°58.2	48.8	148°48.3	50.3
11	163°36.4	11°15.7	22.6	317°30.8	44.8	51°00.2	48.8	163°50.9	50.3
12	178°38.8	26°15.2	N12°21.6	332°31.7	S10°45.5	66°02.3	N21°48.7	178°53.5	S02°50.4
13	193°41.3	41°14.7	20.6	347°32.6	46.1	81°04.4	48.6	193°56.2	50.5
14	208°43.8	56°14.2	19.6	2°33.4	46.7	96°06.5	48.6	208°58.8	50.6
15	223°46.2	71°13.7	·· 18.6	17°34.3	·· 47.3	111°08.5	·· 48.5	224°01.5	·· 50.7
16	238°48.7	86°13.2	17.7	32°35.2	47.9	126°10.6	48.5	239°04.1	50.7
17	253°51.2	101°12.7	16.7	47°36.1	48.6	141°12.7	48.4	254°06.7	50.8
18	268°53.6	116°12.2	N12°15.7	62°37.0	S10°49.2	156°14.7	N21°48.4	269°09.4	S02°50.9
19	283°56.1	131°11.7	14.7	77°37.9	49.8	171°16.8	48.3	284°12.0	51.0
20	298°58.6	146°11.2	13.7	92°38.7	50.4	186°18.9	48.3	299°14.7	51.1
21	314°01.0	161°10.7	·· 12.7	107°39.6	·· 51.1	201°21.0	·· 48.2	314°17.3	·· 51.1
22	329°03.5	176°10.2	11.7	122°40.5	51.7	216°23.0	48.2	329°20.0	51.2
23	344°05.9	191°09.8	10.7	137°41.4	52.3	231°25.1	48.1	344°22.6	51.3
Mer.pass. 00:07		ν -0.5′	d 1.0′	m -3.93	ν 0.9′	d 0.6′	m 1.60	ν 2.1′	d 0.1′ m -2.06	ν 2.6′	d 0.1′ m 0.59

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	359°08.4	206°09.3	N12°09.7	152°42.3	S10°52.9	246°27.2	N21°48.1	359°25.2	S02°51.4
1	14°10.9	221°08.8	08.7	167°43.2	53.5	261°29.3	48.0	14°27.9	51.4
2	29°13.3	236°08.3	07.7	182°44.0	54.2	276°31.3	48.0	29°30.5	51.5
3	44°15.8	251°07.8	·· 06.7	197°44.9	·· 54.8	291°33.4	·· 47.9	44°33.2	·· 51.6
4	59°18.3	266°07.3	05.7	212°45.8	55.4	306°35.5	47.9	59°35.8	51.7
5	74°20.7	281°06.8	04.7	227°46.7	56.0	321°37.6	47.8	74°38.4	51.8
6	89°23.2	296°06.3	N12°03.7	242°47.6	S10°56.6	336°39.6	N21°47.8	89°41.1	S02°51.8
7	104°25.7	311°05.8	02.7	257°48.4	57.3	351°41.7	47.7	104°43.7	51.9
8	119°28.1	326°05.4	01.7	272°49.3	57.9	6°43.8	47.7	119°46.4	52.0
9	134°30.6	341°04.9	12°00.7	287°50.2	·· 58.5	21°45.9	·· 47.6	134°49.0	·· 52.1
10	149°33.0	356°04.4	11°59.7	302°51.1	59.1	36°47.9	47.6	149°51.7	52.2
11	164°35.5	11°03.9	58.7	317°52.0	10°59.7	51°50.0	47.5	164°54.3	52.2
12	179°38.0	26°03.4	N11°57.7	332°52.8	S11°00.4	66°52.1	N21°47.5	179°56.9	S02°52.3
13	194°40.4	41°02.9	56.6	347°53.7	01.0	81°54.2	47.4	194°59.6	52.4
14	209°42.9	56°02.4	55.6	2°54.6	01.6	96°56.2	47.4	210°02.2	52.5
15	224°45.4	71°02.0	·· 54.6	17°55.5	·· 02.2	111°58.3	·· 47.3	225°04.9	·· 52.6
16	239°47.8	86°01.5	53.6	32°56.4	02.8	127°00.4	47.3	240°07.5	52.6
17	254°50.3	101°01.0	52.6	47°57.2	03.5	142°02.5	47.2	255°10.1	52.7
18	269°52.8	116°00.5	N11°51.6	62°58.1	S11°04.1	157°04.6	N21°47.2	270°12.8	S02°52.8
19	284°55.2	131°00.0	50.6	77°59.0	04.7	172°06.6	47.1	285°15.4	52.9
20	299°57.7	145°59.5	49.6	92°59.9	05.3	187°08.7	47.1	300°18.1	52.9
21	315°00.2	160°59.1	·· 48.6	108°00.7	·· 05.9	202°10.8	·· 47.0	315°20.7	·· 53.0
22	330°02.6	175°58.6	47.6	123°01.6	06.6	217°12.9	46.9	330°23.4	53.1
23	345°05.1	190°58.1	46.6	138°02.5	07.2	232°14.9	46.9	345°26.0	53.2
Mer.pass. 23:59		ν -0.5′	d 1.0′	m -3.93	ν 0.9′	d 0.6′	m 1.60	ν 2.1′	d 0.1′ m -2.07	ν 2.6′	d 0.1′ m 0.58

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	0°07.5	205°57.6	N11°45.5	153°03.4	S11°07.8	247°17.0	N21°46.8	0°28.6	S02°53.3
1	15°10.0	220°57.1	44.5	168°04.2	08.4	262°19.1	46.8	15°31.3	53.3
2	30°12.5	235°56.6	43.5	183°05.1	09.0	277°21.2	46.7	30°33.9	53.4
3	45°14.9	250°56.2	·· 42.5	198°06.0	·· 09.7	292°23.3	·· 46.7	45°36.6	·· 53.5
4	60°17.4	265°55.7	41.5	213°06.9	10.3	307°25.3	46.6	60°39.2	53.6
5	75°19.9	280°55.2	40.5	228°07.8	10.9	322°27.4	46.6	75°41.8	53.7
6	90°22.3	295°54.7	N11°39.5	243°08.6	S11°11.5	337°29.5	N21°46.5	90°44.5	S02°53.7
7	105°24.8	310°54.2	38.4	258°09.5	12.1	352°31.6	46.5	105°47.1	53.8
8	120°27.3	325°53.8	37.4	273°10.4	12.8	7°33.7	46.4	120°49.8	53.9
9	135°29.7	340°53.3	·· 36.4	288°11.3	·· 13.4	22°35.8	·· 46.4	135°52.4	·· 54.0
10	150°32.2	355°52.8	35.4	303°12.1	14.0	37°37.8	46.3	150°55.1	54.0
11	165°34.6	10°52.3	34.4	318°13.0	14.6	52°39.9	46.3	165°57.7	54.1
12	180°37.1	25°51.8	N11°33.3	333°13.9	S11°15.2	67°42.0	N21°46.2	181°00.3	S02°54.2
13	195°39.6	40°51.4	32.3	348°14.7	15.8	82°44.1	46.2	196°03.0	54.3
14	210°42.0	55°50.9	31.3	3°15.6	16.5	97°46.2	46.1	211°05.6	54.4
15	225°44.5	70°50.4	·· 30.3	18°16.5	·· 17.1	112°48.2	·· 46.1	226°08.3	·· 54.4
16	240°47.0	85°49.9	29.3	33°17.4	17.7	127°50.3	46.0	241°10.9	54.5
17	255°49.4	100°49.4	28.2	48°18.2	18.3	142°52.4	46.0	256°13.5	54.6
18	270°51.9	115°49.0	N11°27.2	63°19.1	S11°18.9	157°54.5	N21°45.9	271°16.2	S02°54.7
19	285°54.4	130°48.5	26.2	78°20.0	19.5	172°56.6	45.9	286°18.8	54.8
20	300°56.8	145°48.0	25.2	93°20.9	20.2	187°58.7	45.8	301°21.5	54.8
21	315°59.3	160°47.5	·· 24.1	108°21.7	·· 20.8	203°00.8	·· 45.8	316°24.1	·· 54.9
22	331°01.8	175°47.1	23.1	123°22.6	21.4	218°02.8	45.7	331°26.8	55.0
23	346°04.2	190°46.6	22.1	138°23.5	22.0	233°04.9	45.7	346°29.4	55.1
Mer.pass. 23:56		ν -0.5′	d 1.0′	m -3.93	ν 0.9′	d 0.6′	m 1.59	ν 2.1′	d 0.1′ m -2.07	ν 2.6′	d 0.1′ m 0.58

Stars	SHA	Dec
Alpheratz	357°33.8	29°14.1
Ankaa	353°06.1	-42°09.8
Schedar	349°29.9	56°40.7
Diphda	348°46.4	-17°50.5
Achernar	335°19.2	-57°06.1
Hamal	327°50.3	23°35.1
Polaris	313°26.5	89°22.1
Acamar	315°11.0	-40°11.8
Menkar	314°05.3	4°11.6
Mirfak	308°27.2	49°57.1
Aldebaran	290°38.9	16°33.7
Rigel	281°03.3	-8°10.1
Capella	280°21.0	46°01.3
Bellatrix	278°22.2	6°22.5
Elnath	278°01.1	28°37.7
Alnilam	275°37.1	-1°10.9
Betelgeuse	270°51.5	7°24.8
Canopus	263°52.2	-52°42.2
Sirius	258°25.8	-16°44.8
Adhara	255°05.5	-29°00.1
Procyon	244°50.4	5°09.7
Pollux	243°16.8	27°57.8
Avior	234°14.9	-59°35.2
Suhail	222°46.2	-43°31.9
Miaplacidus	221°38.9	-69°49.1
Alphard	217°47.5	-8°46.0
Regulus	207°34.1	11°50.6
Dubhe	193°40.9	61°36.7
Denebola	182°24.7	14°25.8
Gienah	175°43.3	-17°41.0
Acrux	173°00.2	-63°14.5
Gacrux	171°51.6	-57°15.4
Alioth	166°13.0	55°49.3
Spica	158°22.0	-11°17.7
Alkaid	152°51.9	49°11.2
Hadar	148°35.8	-60°29.9
Menkent	147°57.3	-36°29.8
Arcturus	145°47.6	19°03.0
Rigil Kent.	139°40.0	-60°56.6
Kochab	137°20.5	74°03.1
Zuben'ubi	136°55.6	-16°08.9
Alphecca	126°03.4	26°37.9
Antares	112°15.2	-26°29.4
Atria	107°09.1	-69°04.7
Sabik	102°02.2	-15°45.4
Shaula	96°09.6	-37°07.4
Rasalhague	95°58.0	12°32.6
Eltanin	90°41.9	51°29.4
Kaus Aust.	83°31.7	-34°22.4
Vega	80°32.8	38°48.7
Nunki	75°46.9	-26°15.9
Altair	61°59.2	8°56.3
Peacock	53°04.4	-56°39.3
Deneb	49°25.1	45°22.6
Enif	33°38.0	9°59.7
Al Na'ir	27°31.7	-46°50.2
Fomalhaut	15°13.5	-29°29.1
Scheat	13°44.3	28°13.5
Markab	13°29.0	15°20.8

Sep 19 Fri	SHA	Mer.pass
Venus	208°11.8	10:15
Mars	154°11.8	13:50
Jupiter	247°28.2	07:36
Saturn	0°12.6	00:07

Sep 20 Sat	SHA	Mer.pass
Venus	207°00.9	10:16
Mars	153°33.9	13:48
Jupiter	247°18.8	07:33
Saturn	0°16.8	00:02

Sep 21 Sun	SHA	Mer.pass
Venus	205°50.1	10:16
Mars	152°55.8	13:47
Jupiter	247°09.5	07:30
Saturn	0°21.1	23:54

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.0905 sec ΔT = TT-UT1 = +69.0935 sec

2025 September 19 to Sep. 21 UT

h	Sun		Moon				
Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	181°31.9	N01°27.8	211°42.1	12.8′	N15°50.7	13.3′	56.5′
1	196°32.1	26.8	226°13.9	12.9′	15°37.4	13.4′	56.5′
2	211°32.3	25.8	240°45.8	12.9′	15°24.0	13.4′	56.4′
3	226°32.5	·· 24.9	255°17.7	13.0′	15°10.6	13.5′	56.4′
4	241°32.8	23.9	269°49.7	13.1′	14°57.1	13.5′	56.4′
5	256°33.0	22.9	284°21.8	13.2′	14°43.6	13.6′	56.4′
6	271°33.2	N01°22.0	298°54.0	13.3′	N14°30.0	13.6′	56.4′
7	286°33.4	21.0	313°26.3	13.4′	14°16.4	13.7′	56.3′
8	301°33.7	20.0	327°58.6	13.4′	14°02.7	13.8′	56.3′
9	316°33.9	·· 19.0	342°31.1	13.5′	13°48.9	13.8′	56.3′
10	331°34.1	18.1	357°03.6	13.6′	13°35.1	13.9′	56.3′
11	346°34.3	17.1	11°36.2	13.7′	13°21.2	13.9′	56.3′
12	1°34.5	N01°16.1	26°08.9	13.7′	N13°07.3	13.9′	56.2′
13	16°34.8	15.2	40°41.6	13.8′	12°53.4	14.0′	56.2′
14	31°35.0	14.2	55°14.4	13.9′	12°39.4	14.1′	56.2′
15	46°35.2	·· 13.2	69°47.3	14.0′	12°25.3	14.1′	56.2′
16	61°35.4	12.3	84°20.3	14.0′	12°11.2	14.1′	56.1′
17	76°35.7	11.3	98°53.3	14.1′	11°57.1	14.2′	56.1′
18	91°35.9	N01°10.3	113°26.4	14.2′	N11°42.9	14.2′	56.1′
19	106°36.1	09.3	127°59.6	14.2′	11°28.7	14.2′	56.1′
20	121°36.3	08.4	142°32.9	14.3′	11°14.5	14.3′	56.1′
21	136°36.5	·· 07.4	157°06.2	14.4′	11°00.2	14.3′	56.0′
22	151°36.8	06.4	171°39.5	14.4′	10°45.9	14.4′	56.0′
23	166°37.0	05.5	186°13.0	14.5′	10°31.5	14.4′	56.0′
	SD = 15.9′	d = 1.0′	SD = 15.4′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	181°37.2	N01°04.5	200°46.5	14.6′	N10°17.1	14.4′	56.0′
1	196°37.4	03.5	215°20.1	14.6′	10°02.7	14.5′	56.0′
2	211°37.7	02.5	229°53.7	14.7′	09°48.2	14.5′	55.9′
3	226°37.9	·· 01.6	244°27.4	14.8′	09°33.7	14.5′	55.9′
4	241°38.1	01°00.6	259°01.2	14.8′	09°19.2	14.6′	55.9′
5	256°38.3	00°59.6	273°35.0	14.9′	09°04.6	14.5′	55.9′
6	271°38.5	N00°58.7	288°08.9	14.9′	N08°50.1	14.6′	55.9′
7	286°38.8	57.7	302°42.8	15.0′	08°35.5	14.7′	55.8′
8	301°39.0	56.7	317°16.8	15.0′	08°20.8	14.6′	55.8′
9	316°39.2	·· 55.7	331°50.8	15.1′	08°06.2	14.7′	55.8′
10	331°39.4	54.8	346°24.9	15.1′	07°51.5	14.7′	55.8′
11	346°39.6	53.8	0°59.1	15.2′	07°36.8	14.7′	55.8′
12	1°39.9	N00°52.8	15°33.3	15.2′	N07°22.1	14.8′	55.7′
13	16°40.1	51.9	30°07.5	15.3′	07°07.3	14.7′	55.7′
14	31°40.3	50.9	44°41.8	15.3′	06°52.6	14.8′	55.7′
15	46°40.5	·· 49.9	59°16.1	15.4′	06°37.8	14.8′	55.7′
16	61°40.8	48.9	73°50.5	15.4′	06°23.0	14.8′	55.7′
17	76°41.0	48.0	88°25.0	15.5′	06°08.2	14.8′	55.6′
18	91°41.2	N00°47.0	102°59.4	15.5′	N05°53.4	14.8′	55.6′
19	106°41.4	46.0	117°34.0	15.6′	05°38.6	14.9′	55.6′
20	121°41.6	45.1	132°08.5	15.6′	05°23.7	14.8′	55.6′
21	136°41.9	·· 44.1	146°43.1	15.6′	05°08.9	14.9′	55.6′
22	151°42.1	43.1	161°17.8	15.7′	04°54.0	14.9′	55.6′
23	166°42.3	42.1	175°52.5	15.7′	04°39.1	14.9′	55.5′
	SD = 15.9′	d = 1.0′	SD = 15.3′				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	181°42.5	N00°41.2	190°27.2	15.8′	N04°24.2	14.9′	55.5′
1	196°42.7	40.2	205°02.0	15.8′	04°09.3	14.9′	55.5′
2	211°43.0	39.2	219°36.8	15.8′	03°54.4	14.9′	55.5′
3	226°43.2	·· 38.3	234°11.6	15.9′	03°39.5	14.9′	55.5′
4	241°43.4	37.3	248°46.5	15.9′	03°24.6	14.9′	55.4′
5	256°43.6	36.3	263°21.3	15.9′	03°09.7	14.9′	55.4′
6	271°43.8	N00°35.3	277°56.3	16.0′	N02°54.8	14.9′	55.4′
7	286°44.1	34.4	292°31.2	16.0′	02°39.9	14.9′	55.4′
8	301°44.3	33.4	307°06.2	16.0′	02°25.0	15.0′	55.4′
9	316°44.5	·· 32.4	321°41.2	16.0′	02°10.0	14.9′	55.3′
10	331°44.7	31.4	336°16.3	16.1′	01°55.1	14.9′	55.3′
11	346°44.9	30.5	350°51.3	16.1′	01°40.2	14.9′	55.3′
12	1°45.2	N00°29.5	5°26.4	16.1′	N01°25.3	14.9′	55.3′
13	16°45.4	28.5	20°01.6	16.1′	01°10.4	14.9′	55.3′
14	31°45.6	27.6	34°36.7	16.2′	00°55.5	14.9′	55.3′
15	46°45.8	·· 26.6	49°11.8	16.2′	00°40.6	14.9′	55.2′
16	61°46.0	25.6	63°47.0	16.2′	00°25.7	14.8′	55.2′
17	76°46.3	24.6	78°22.2	16.2′	N00°10.9	14.9′	55.2′
18	91°46.5	N00°23.7	92°57.4	16.2′	S00°04.0	14.9′	55.2′
19	106°46.7	22.7	107°32.7	16.3′	00°18.9	14.8′	55.2′
20	121°46.9	21.7	122°07.9	16.3′	00°33.7	14.9′	55.1′
21	136°47.1	·· 20.7	136°43.2	16.3′	00°48.6	14.8′	55.1′
22	151°47.4	19.8	151°18.5	16.3′	01°03.4	14.8′	55.1′
23	166°47.6	18.8	165°53.8	16.3′	01°18.2	14.8′	55.1′
	SD = 15.9′	d = 1.0′	SD = 15.1′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	02:47	04:21	05:31	18:14	19:22	20:55
N 70°	03:09	04:31	05:33	18:12	19:13	20:33
68°	03:26	04:38	05:35	18:10	19:06	20:17
66°	03:40	04:45	05:36	18:08	19:00	20:04
64°	03:51	04:50	05:38	18:07	18:55	19:54
62°	04:00	04:54	05:39	18:06	18:51	19:45
60°	04:07	04:58	05:40	18:05	18:47	19:37
N 58°	04:14	05:01	05:41	18:05	18:44	19:31
56°	04:20	05:04	05:42	18:04	18:41	19:25
54°	04:25	05:07	05:42	18:03	18:39	19:21
52°	04:29	05:09	05:43	18:03	18:36	19:16
50°	04:33	05:11	05:44	18:02	18:34	19:13
45°	04:41	05:15	05:45	18:01	18:30	19:05
N 40°	04:47	05:19	05:46	18:00	18:27	18:59
35°	04:52	05:21	05:47	18:00	18:25	18:54
30°	04:56	05:23	05:47	17:59	18:23	18:51
20°	05:01	05:26	05:48	17:58	18:20	18:46
N 10°	05:04	05:28	05:49	17:57	18:18	18:43
0°	05:05	05:29	05:50	17:57	18:17	18:41
S 10°	05:05	05:30	05:51	17:56	18:17	18:41
20°	05:04	05:29	05:51	17:56	18:18	18:43
30°	05:00	05:28	05:52	17:55	18:19	18:47
35°	04:58	05:27	05:52	17:55	18:20	18:50
40°	04:54	05:25	05:52	17:55	18:22	18:54
45°	04:49	05:23	05:53	17:55	18:24	18:58
S 50°	04:43	05:21	05:53	17:55	18:27	19:05
52°	04:40	05:19	05:53	17:55	18:28	19:08
54°	04:36	05:18	05:53	17:55	18:30	19:12
56°	04:33	05:16	05:53	17:55	18:32	19:16
58°	04:28	05:14	05:53	17:55	18:34	19:20
S 60°	04:23	05:12	05:54	17:54	18:36	19:26

Lat.	**Moonrise** Fri	Sat	Sun	**Moonset** Fri	Sat	Sun
N 72°	·· ··	02:37	04:48	19:01	18:20	17:46
N 70°	00:34	02:53	04:52	18:43	18:12	17:47
68°	01:02	03:05	04:56	18:28	18:06	17:47
66°	01:23	03:16	04:59	18:16	18:01	17:47
64°	01:39	03:24	05:02	18:06	17:56	17:47
62°	01:53	03:31	05:04	17:57	17:52	17:47
60°	02:04	03:37	05:06	17:49	17:48	17:47
N 58°	02:14	03:43	05:07	17:43	17:45	17:47
56°	02:23	03:48	05:09	17:37	17:42	17:47
54°	02:30	03:52	05:10	17:32	17:40	17:47
52°	02:37	03:56	05:12	17:27	17:38	17:47
50°	02:43	03:59	05:13	17:22	17:35	17:47
45°	02:56	04:07	05:15	17:13	17:31	17:47
N 40°	03:07	04:13	05:17	17:05	17:27	17:47
35°	03:16	04:19	05:19	16:58	17:23	17:47
30°	03:24	04:24	05:21	16:52	17:20	17:47
20°	03:38	04:32	05:23	16:41	17:15	17:47
N 10°	03:50	04:39	05:26	16:32	17:11	17:47
0°	04:01	04:46	05:28	16:23	17:06	17:47
S 10°	04:12	04:52	05:30	16:14	17:02	17:47
20°	04:24	04:59	05:32	16:04	16:57	17:47
30°	04:38	05:08	05:35	15:53	16:51	17:47
35°	04:45	05:12	05:37	15:47	16:48	17:47
40°	04:54	05:17	05:38	15:39	16:44	17:47
45°	05:04	05:23	05:40	15:31	16:40	17:47
S 50°	05:17	05:31	05:43	15:20	16:35	17:47
52°	05:22	05:34	05:44	15:15	16:33	17:47
54°	05:28	05:37	05:45	15:10	16:30	17:47
56°	05:35	05:41	05:46	15:04	16:27	17:47
58°	05:43	05:46	05:48	14:57	16:24	17:47
S 60°	05:52	05:51	05:49	14:49	16:20	17:47

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 27-0 8-1%
19	06:08	06:18	11:54	10:12	22:34	
20	06:29	06:39	11:53	10:56	23:17	
21	06:50	07:01	11:53	11:38	23:58	

September 22, 23, 24 UT (Mon., Tue., Wed.)

	Aries	Venus		Mars		Jupiter		Saturn	
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	1°06.7	205°46.1	N11°21.1	153°24.3	S11°22.6	248°07.0	N21°45.6	1°32.0	S02°55.1
1	16°09.1	220°45.6	20.0	168°25.2	23.2	263°09.1	45.6	16°34.7	55.2
2	31°11.6	235°45.2	19.0	183°26.1	23.9	278°11.2	45.5	31°37.3	55.3
3	46°14.1	250°44.7	·· 18.0	198°27.0	·· 24.5	293°13.3	·· 45.5	46°40.0	·· 55.4
4	61°16.5	265°44.2	16.9	213°27.8	25.1	308°15.4	45.4	61°42.6	55.5
5	76°19.0	280°43.7	15.9	228°28.7	25.7	323°17.4	45.4	76°45.2	55.5
6	91°21.5	295°43.3	N11°14.9	243°29.6	S11°26.3	338°19.5	N21°45.3	91°47.9	S02°55.6
7	106°23.9	310°42.8	13.9	258°30.4	26.9	353°21.6	45.3	106°50.5	55.7
8	121°26.4	325°42.3	12.8	273°31.3	27.6	8°23.7	45.2	121°53.2	55.8
9	136°28.9	340°41.8	·· 11.8	288°32.2	·· 28.2	23°25.8	·· 45.2	136°55.8	·· 55.9
10	151°31.3	355°41.4	10.8	303°33.0	28.8	38°27.9	45.1	151°58.5	55.9
11	166°33.8	10°40.9	09.7	318°33.9	29.4	53°30.0	45.1	167°01.1	56.0
12	181°36.2	25°40.4	N11°08.7	333°34.8	S11°30.0	68°32.0	N21°45.0	182°03.7	S02°56.1
13	196°38.7	40°39.9	07.7	348°35.6	30.6	83°34.1	45.0	197°06.4	56.2
14	211°41.2	55°39.5	06.6	3°36.5	31.3	98°36.2	44.9	212°09.0	56.2
15	226°43.6	70°39.0	·· 05.6	18°37.4	·· 31.9	113°38.3	·· 44.9	227°11.7	·· 56.3
16	241°46.1	85°38.5	04.6	33°38.3	32.5	128°40.4	44.8	242°14.3	56.4
17	256°48.6	100°38.1	03.5	48°39.1	33.1	143°42.5	44.8	257°16.9	56.5
18	271°51.0	115°37.6	N11°02.5	63°40.0	S11°33.7	158°44.6	N21°44.7	272°19.6	S02°56.6
19	286°53.5	130°37.1	01.4	78°40.9	34.3	173°46.7	44.7	287°22.2	56.6
20	301°56.0	145°36.7	11°00.4	93°41.7	34.9	188°48.8	44.6	302°24.9	56.7
21	316°58.4	160°36.2	10°59.4	108°42.6	·· 35.6	203°50.9	·· 44.6	317°27.5	·· 56.8
22	332°00.9	175°35.7	58.3	123°43.5	36.2	218°52.9	44.5	332°30.2	56.9
23	347°03.4	190°35.2	57.3	138°44.3	36.8	233°55.0	44.5	347°32.8	57.0
Mer.pass. 23:52		ν -0.5′	d 1.0′	m -3.93	ν 0.9′	d 0.6′	m 1.59	ν 2.1′	d 0.1′ m -2.08	ν 2.6′	d 0.1′ m 0.58

Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	2°05.8	205°34.8	N10°56.2	153°45.2	S11°37.4	248°57.1	N21°44.4	2°35.4	S02°57.0
1	17°08.3	220°34.3	55.2	168°46.1	38.0	263°59.2	44.4	17°38.1	57.1
2	32°10.7	235°33.8	54.2	183°46.9	38.6	279°01.3	44.3	32°40.7	57.2
3	47°13.2	250°33.4	·· 53.1	198°47.8	·· 39.2	294°03.4	·· 44.3	47°43.4	·· 57.3
4	62°15.7	265°32.9	52.1	213°48.6	39.9	309°05.5	44.2	62°46.0	57.3
5	77°18.1	280°32.4	51.0	228°49.5	40.5	324°07.6	44.2	77°48.6	57.4
6	92°20.6	295°32.0	N10°50.0	243°50.4	S11°41.1	339°09.7	N21°44.1	92°51.3	S02°57.5
7	107°23.1	310°31.5	48.9	258°51.2	41.7	354°11.8	44.1	107°53.9	57.6
8	122°25.5	325°31.0	47.9	273°52.1	42.3	9°13.9	44.0	122°56.6	57.7
9	137°28.0	340°30.6	·· 46.9	288°53.0	·· 42.9	24°16.0	·· 44.0	137°59.2	·· 57.7
10	152°30.5	355°30.1	45.8	303°53.8	43.5	39°18.0	43.9	153°01.9	57.8
11	167°32.9	10°29.6	44.8	318°54.7	44.1	54°20.1	43.9	168°04.5	57.9
12	182°35.4	25°29.2	N10°43.7	333°55.6	S11°44.8	69°22.2	N21°43.8	183°07.1	S02°58.0
13	197°37.9	40°28.7	42.7	348°56.4	45.4	84°24.3	43.8	198°09.8	58.0
14	212°40.3	55°28.2	41.6	3°57.3	46.0	99°26.4	43.7	213°12.4	58.1
15	227°42.8	70°27.8	·· 40.6	18°58.1	·· 46.6	114°28.5	·· 43.7	228°15.1	·· 58.2
16	242°45.2	85°27.3	39.5	33°59.0	47.2	129°30.6	43.6	243°17.7	58.3
17	257°47.7	100°26.8	38.5	48°59.9	47.8	144°32.7	43.6	258°20.3	58.4
18	272°50.2	115°26.4	N10°37.4	64°00.7	S11°48.4	159°34.8	N21°43.5	273°23.0	S02°58.4
19	287°52.6	130°25.9	36.4	79°01.6	49.0	174°36.9	43.5	288°25.6	58.5
20	302°55.1	145°25.5	35.3	94°02.5	49.7	189°39.0	43.4	303°28.3	58.6
21	317°57.6	160°25.0	·· 34.3	109°03.3	·· 50.3	204°41.1	·· 43.4	318°30.9	·· 58.7
22	333°00.0	175°24.5	33.2	124°04.2	50.9	219°43.2	43.3	333°33.6	58.8
23	348°02.5	190°24.1	32.2	139°05.0	51.5	234°45.3	43.3	348°36.2	58.8
Mer.pass. 23:48		ν -0.5′	d 1.0′	m -3.93	ν 0.9′	d 0.6′	m 1.59	ν 2.1′	d 0.1′ m -2.08	ν 2.6′	d 0.1′ m 0.59

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	3°05.0	205°23.6	N10°31.1	154°05.9	S11°52.1	249°47.4	N21°43.2	3°38.8	S02°58.9
1	18°07.4	220°23.1	30.1	169°06.8	52.7	264°49.5	43.2	18°41.5	59.0
2	33°09.9	235°22.7	29.0	184°07.6	53.3	279°51.6	43.1	33°44.1	59.1
3	48°12.3	250°22.2	·· 28.0	199°08.5	·· 53.9	294°53.7	·· 43.1	48°46.8	·· 59.1
4	63°14.8	265°21.8	26.9	214°09.3	54.5	309°55.8	43.0	63°49.4	59.2
5	78°17.3	280°21.3	25.8	229°10.2	55.2	324°57.9	43.0	78°52.0	59.3
6	93°19.7	295°20.8	N10°24.8	244°11.1	S11°55.8	340°00.0	N21°42.9	93°54.7	S02°59.4
7	108°22.2	310°20.4	23.7	259°11.9	56.4	355°02.1	42.9	108°57.3	59.5
8	123°24.7	325°19.9	22.7	274°12.8	57.0	10°04.2	42.8	124°00.0	59.5
9	138°27.1	340°19.5	·· 21.6	289°13.6	·· 57.6	25°06.3	·· 42.8	139°02.6	·· 59.6
10	153°29.6	355°19.0	20.6	304°14.5	58.2	40°08.4	42.7	154°05.3	59.7
11	168°32.1	10°18.5	19.5	319°15.3	58.8	55°10.5	42.7	169°07.9	59.8
12	183°34.5	25°18.1	N10°18.4	334°16.2	S11°59.4	70°12.6	N21°42.6	184°10.5	S02°59.8
13	198°37.0	40°17.6	17.4	349°17.1	12°00.0	85°14.7	42.6	199°13.2	02°59.9
14	213°39.5	55°17.2	16.3	4°17.9	00.6	100°16.8	42.5	214°15.8	03°00.0
15	228°41.9	70°16.7	·· 15.3	19°18.8	·· 01.3	115°18.9	·· 42.5	229°18.5	·· 00.1
16	243°44.4	85°16.2	14.2	34°19.6	01.9	130°21.0	42.4	244°21.1	00.2
17	258°46.8	100°15.8	13.1	49°20.5	02.5	145°23.1	42.4	259°23.7	00.2
18	273°49.3	115°15.3	N10°12.1	64°21.3	S12°03.1	160°25.2	N21°42.3	274°26.4	S03°00.3
19	288°51.8	130°14.9	11.0	79°22.2	03.7	175°27.3	42.3	289°29.0	00.4
20	303°54.2	145°14.4	09.9	94°23.1	04.3	190°29.4	42.2	304°31.7	00.5
21	318°56.7	160°14.0	·· 08.9	109°23.9	·· 04.9	205°31.5	·· 42.2	319°34.3	·· 00.5
22	333°59.2	175°13.5	07.8	124°24.8	05.5	220°33.6	42.1	334°36.9	00.6
23	349°01.6	190°13.0	06.7	139°25.6	06.1	235°35.7	42.1	349°39.6	00.7
Mer.pass. 23:44		ν -0.5′	d 1.1′	m -3.93	ν 0.9′	d 0.6′	m 1.59	ν 2.1′	d 0.0′ m -2.09	ν 2.6′	d 0.1′ m 0.59

Stars

	SHA	Dec
Alpheratz	357°33.8	29°14.1
Ankaa	353°06.1	-42°09.8
Schedar	349°29.9	56°40.8
Diphda	348°46.4	-17°50.6
Achernar	335°19.2	-57°06.1
Hamal	327°50.3	23°35.1
Polaris	313°25.4	89°22.1
Acamar	315°11.0	-40°11.8
Menkar	314°05.3	4°11.6
Mirfak	308°27.1	49°57.1
Aldebaran	290°38.8	16°33.7
Rigel	281°03.2	-8°10.1
Capella	280°20.9	46°01.3
Bellatrix	278°22.2	6°22.5
Elnath	278°01.1	28°37.7
Alnilam	275°37.1	-1°10.9
Betelgeuse	270°51.5	7°24.8
Canopus	263°52.2	-52°42.2
Sirius	258°25.8	-16°44.8
Adhara	255°05.5	-29°00.1
Procyon	244°50.4	5°09.7
Pollux	243°16.8	27°57.8
Avior	234°14.9	-59°35.2
Suhail	222°46.2	-43°31.9
Miaplacidus	221°38.9	-69°49.1
Alphard	217°47.4	-8°46.0
Regulus	207°34.1	11°50.6
Dubhe	193°40.9	61°36.7
Denebola	182°24.7	14°25.8
Gienah	175°43.3	-17°41.0
Acrux	173°00.2	-63°14.5
Gacrux	171°51.6	-57°15.4
Alioth	166°13.0	55°49.3
Spica	158°22.0	-11°17.7
Alkaid	152°51.9	49°11.2
Hadar	148°35.8	-60°29.9
Menkent	147°57.3	-36°29.8
Arcturus	145°47.7	19°03.0
Rigil Kent.	139°40.1	-60°56.6
Kochab	137°20.6	74°03.1
Zuben'ubi	136°55.6	-16°08.9
Alphecca	126°03.5	26°37.9
Antares	112°15.3	-26°29.4
Atria	107°09.1	-69°04.6
Sabik	102°02.2	-15°45.4
Shaula	96°09.6	-37°07.4
Rasalhague	95°58.0	12°32.6
Eltanin	90°41.9	51°29.4
Kaus Aust.	83°31.7	-34°22.4
Vega	80°32.8	38°48.7
Nunki	75°47.0	-26°15.9
Altair	61°59.3	8°56.3
Peacock	53°04.5	-56°39.3
Deneb	49°25.1	45°22.6
Enif	33°38.0	9°59.7
Al Na'ir	27°31.8	-46°50.2
Fomalhaut	15°13.5	-29°29.1
Scheat	13°44.3	28°13.5
Markab	13°29.0	15°20.8

Sep 22 Mon	SHA	Mer.pass
Venus	204°39.4	10:17
Mars	152°17.7	13:46
Jupiter	247°00.3	07:26
Saturn	0°25.4	23:50

Sep 23 Tue	SHA	Mer.pass
Venus	203°29.0	10:18
Mars	151°39.4	13:44
Jupiter	246°51.3	07:23
Saturn	0°29.6	23:45

Sep 24 Wed	SHA	Mer.pass
Venus	202°18.6	10:19
Mars	151°00.9	13:43
Jupiter	246°42.4	07:20
Saturn	0°33.9	23:41

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h — Sun — Moon

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	181°47.8	N00°17.8	180°29.1	16.3′	S01°33.0	14.8′	55.1′
1	196°48.0	16.9	195°04.4	16.3′	01°47.8	14.7′	55.1′
2	211°48.2	15.9	209°39.7	16.3′	02°02.5	14.8′	55.0′
3	226°48.5	·· 14.9	224°15.1	16.3′	02°17.3	14.7′	55.0′
4	241°48.7	13.9	238°50.4	16.3′	02°32.0	14.7′	55.0′
5	256°48.9	13.0	253°25.7	16.4′	02°46.7	14.7′	55.0′
6	271°49.1	N00°12.0	268°01.1	16.4′	S03°01.4	14.7′	55.0′
7	286°49.3	11.0	282°36.5	16.4′	03°16.1	14.6′	55.0′
8	301°49.6	10.0	297°11.8	16.4′	03°30.7	14.6′	54.9′
9	316°49.8	·· 09.1	311°47.2	16.4′	03°45.3	14.6′	54.9′
10	331°50.0	08.1	326°22.6	16.4′	03°59.9	14.6′	54.9′
11	346°50.2	07.1	340°57.9	16.4′	04°14.5	14.6′	54.9′
12	1°50.4	N00°06.2	355°33.3	16.4′	S04°29.1	14.5′	54.9′
13	16°50.7	05.2	10°08.7	16.4′	04°43.6	14.5′	54.9′
14	31°50.9	04.2	24°44.0	16.4′	04°58.1	14.5′	54.8′
15	46°51.1	·· 03.2	39°19.4	16.4′	05°12.6	14.4′	54.8′
16	61°51.3	02.3	53°54.7	16.4′	05°27.0	14.4′	54.8′
17	76°51.5	01.3	68°30.1	16.3′	05°41.4	14.4′	54.8′
18	91°51.8	N00°00.3	83°05.4	16.3′	S05°55.8	14.4′	54.8′
19	106°52.0	S00°00.7	97°40.8	16.3′	06°10.2	14.3′	54.8′
20	121°52.2	01.6	112°16.1	16.3′	06°24.5	14.3′	54.7′
21	136°52.4	·· 02.6	126°51.4	16.3′	06°38.8	14.3′	54.7′
22	151°52.6	03.6	141°26.7	16.3′	06°53.1	14.2′	54.7′
23	166°52.9	04.6	156°02.0	16.3′	07°07.3	14.2′	54.7′
	SD = 15.9′	d = 1.0′		SD = 15.0′			

Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	181°53.1	S00°05.5	170°37.3	16.3′	S07°21.5	14.1′	54.7′
1	196°53.3	06.5	185°12.6	16.3′	07°35.6	14.2′	54.7′
2	211°53.5	07.5	199°47.9	16.2′	07°49.8	14.0′	54.7′
3	226°53.7	·· 08.5	214°23.1	16.2′	08°03.8	14.1′	54.6′
4	241°53.9	09.4	228°58.3	16.2′	08°17.9	14.0′	54.6′
5	256°54.2	10.4	243°33.5	16.2′	08°31.9	13.9′	54.6′
6	271°54.4	S00°11.4	258°08.7	16.2′	S08°45.8	14.0′	54.6′
7	286°54.6	12.3	272°43.9	16.2′	08°59.8	13.8′	54.6′
8	301°54.8	13.3	287°19.1	16.1′	09°13.6	13.9′	54.6′
9	316°55.0	·· 14.3	301°54.2	16.1′	09°27.5	13.8′	54.6′
10	331°55.3	15.3	316°29.3	16.1′	09°41.3	13.7′	54.5′
11	346°55.5	16.2	331°04.4	16.1′	09°55.0	13.7′	54.5′
12	1°55.7	S00°17.2	345°39.5	16.0′	S10°08.7	13.7′	54.5′
13	16°55.9	18.2	0°14.5	16.0′	10°22.4	13.6′	54.5′
14	31°56.1	19.2	14°49.5	16.0′	10°36.0	13.6′	54.5′
15	46°56.3	·· 20.1	29°24.5	16.0′	10°49.6	13.5′	54.5′
16	61°56.6	21.1	43°59.5	15.9′	11°03.1	13.5′	54.5′
17	76°56.8	22.1	58°34.4	15.9′	11°16.6	13.4′	54.4′
18	91°57.0	S00°23.1	73°09.4	15.9′	S11°30.0	13.4′	54.4′
19	106°57.2	24.0	87°44.2	15.9′	11°43.4	13.3′	54.4′
20	121°57.4	25.0	102°19.1	15.8′	11°56.7	13.3′	54.4′
21	136°57.7	·· 26.0	116°53.9	15.8′	12°10.0	13.2′	54.4′
22	151°57.9	27.0	131°28.7	15.8′	12°23.2	13.2′	54.4′
23	166°58.1	27.9	146°03.5	15.7′	12°36.4	13.1′	54.4′
	SD = 15.9′	d = 1.0′		SD = 14.9′			

Wed	GHA	Dec	GHA	ν	Dec	d	HP
0	181°58.3	S00°28.9	160°38.2	15.7′	S12°49.5	13.0′	54.4′
1	196°58.5	29.9	175°12.9	15.7′	13°02.5	13.0′	54.4′
2	211°58.7	30.8	189°47.5	15.6′	13°15.5	13.0′	54.3′
3	226°59.0	·· 31.8	204°22.1	15.6′	13°28.5	12.8′	54.3′
4	241°59.2	32.8	218°56.7	15.5′	13°41.3	12.9′	54.3′
5	256°59.4	33.8	233°31.3	15.5′	13°54.2	12.7′	54.3′
6	271°59.6	S00°34.7	248°05.8	15.5′	S14°06.9	12.7′	54.3′
7	286°59.8	35.7	262°40.2	15.4′	14°19.6	12.7′	54.3′
8	302°00.0	36.7	277°14.6	15.4′	14°32.3	12.6′	54.3′
9	317°00.3	·· 37.7	291°49.0	15.3′	14°44.9	12.5′	54.3′
10	332°00.5	38.6	306°23.4	15.3′	14°57.4	12.5′	54.3′
11	347°00.7	39.6	320°57.7	15.3′	15°09.9	12.4′	54.2′
12	2°00.9	S00°40.6	335°31.9	15.2′	S15°22.3	12.3′	54.2′
13	17°01.1	41.6	350°06.1	15.2′	15°34.6	12.3′	54.2′
14	32°01.3	42.5	4°40.3	15.1′	15°46.9	12.1′	54.2′
15	47°01.6	·· 43.5	19°14.4	15.1′	15°59.0	12.2′	54.2′
16	62°01.8	44.5	33°48.5	15.0′	16°11.2	12.0′	54.2′
17	77°02.0	45.5	48°22.6	15.0′	16°23.2	12.0′	54.2′
18	92°02.2	S00°46.4	62°56.5	14.9′	S16°35.2	12.0′	54.2′
19	107°02.4	47.4	77°30.5	14.9′	16°47.2	11.8′	54.2′
20	122°02.6	48.4	92°04.4	14.8′	16°59.0	11.8′	54.2′
21	137°02.9	·· 49.4	106°38.2	14.8′	17°10.8	11.7′	54.2′
22	152°03.1	50.3	121°12.0	14.7′	17°22.5	11.7′	54.1′
23	167°03.3	51.3	135°45.7	14.7′	17°34.2	11.5′	54.1′
	SD = 15.9′	d = 1.0′		SD = 14.8′			

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	03:06	04:36	05:44	17:58	19:06	20:34
N 70°	03:25	04:43	05:45	17:58	18:59	20:16
68°	03:39	04:49	05:45	17:57	18:53	20:02
66°	03:51	04:54	05:46	17:57	18:48	19:51
64°	04:01	04:59	05:46	17:57	18:44	19:42
62°	04:09	05:02	05:47	17:56	18:41	19:34
60°	04:15	05:05	05:47	17:56	18:38	19:27
N 58°	04:21	05:08	05:47	17:56	18:35	19:22
56°	04:26	05:10	05:48	17:56	18:33	19:17
54°	04:31	05:12	05:48	17:56	18:31	19:13
52°	04:34	05:14	05:48	17:56	18:29	19:09
50°	04:38	05:16	05:48	17:56	18:28	19:06
45°	04:45	05:19	05:48	17:55	18:25	18:59
N 40°	04:50	05:22	05:49	17:55	18:22	18:54
35°	04:54	05:24	05:49	17:55	18:20	18:50
30°	04:57	05:25	05:49	17:55	18:19	18:47
20°	05:02	05:27	05:49	17:55	18:17	18:43
N 10°	05:04	05:28	05:49	17:55	18:16	18:41
0°	05:04	05:28	05:49	17:56	18:16	18:40
S 10°	05:04	05:28	05:49	17:56	18:17	18:41
20°	05:01	05:27	05:49	17:56	18:18	18:44
30°	04:56	05:24	05:48	17:57	18:21	18:49
35°	04:53	05:23	05:48	17:57	18:23	18:52
40°	04:49	05:20	05:47	17:58	18:25	18:57
45°	04:43	05:18	05:47	17:58	18:28	19:02
S 50°	04:36	05:14	05:46	17:59	18:32	19:10
52°	04:33	05:12	05:46	18:00	18:33	19:13
54°	04:29	05:10	05:46	18:00	18:35	19:17
56°	04:24	05:08	05:45	18:00	18:38	19:22
58°	04:19	05:06	05:45	18:01	18:40	19:27
S 60°	04:13	05:03	05:44	18:02	18:43	19:34

Lat.	Moonrise Mon	Moonrise Tue	Moonrise Wed	Moonset Mon	Moonset Tue	Moonset Wed
N 72°	06:51	08:57	11:28	17:13	16:34	15:31
N 70°	06:46	08:41	10:49	17:21	16:52	16:11
68°	06:42	08:29	10:23	17:27	17:06	16:39
66°	06:39	08:19	10:03	17:33	17:18	17:00
64°	06:36	08:10	09:47	17:38	17:28	17:17
62°	06:34	08:03	09:34	17:42	17:37	17:31
60°	06:31	07:57	09:23	17:45	17:44	17:43
N 58°	06:30	07:51	09:14	17:49	17:51	17:54
56°	06:28	07:46	09:06	17:51	17:56	18:03
54°	06:27	07:42	08:58	17:54	18:02	18:11
52°	06:25	07:38	08:52	17:56	18:06	18:18
50°	06:24	07:35	08:46	17:59	18:11	18:25
45°	06:22	07:27	08:33	18:03	18:20	18:39
N 40°	06:19	07:21	08:23	18:07	18:28	18:51
35°	06:18	07:16	08:14	18:11	18:35	19:01
30°	06:16	07:11	08:06	18:14	18:41	19:10
20°	06:13	07:03	07:53	18:19	18:51	19:25
N 10°	06:11	06:56	07:41	18:24	19:00	19:38
0°	06:09	06:49	07:31	18:28	19:09	19:51
S 10°	06:06	06:43	07:20	18:32	19:18	20:04
20°	06:04	06:36	07:09	18:37	19:27	20:17
30°	06:01	06:28	06:56	18:43	19:38	20:33
35°	06:00	06:23	06:48	18:46	19:44	20:42
40°	05:58	06:18	06:40	18:49	19:51	20:53
45°	05:56	06:13	06:30	18:53	19:59	21:05
S 50°	05:54	06:06	06:19	18:58	20:09	21:20
52°	05:53	06:03	06:13	19:00	20:14	21:27
54°	05:52	05:59	06:07	19:03	20:19	21:35
56°	05:51	05:55	06:01	19:06	20:24	21:44
58°	05:49	05:51	05:53	19:09	20:31	21:54
S 60°	05:48	05:46	05:45	19:12	20:38	22:06

Day	Sun Eqn.of Time 00h	Sun Eqn.of Time 12h	Sun Mer. Pass	Moon Mer.Pass. Upper	Moon Mer.Pass. Lower	Age
	mm:ss	mm:ss	hh:mm	hh:mm	hh:mm	1-3 / 0-5%
22	07:11	07:22	11:53	12:18	–:–	
23	07:32	07:43	11:52	12:59	00:39	
24	07:53	08:04	11:52	13:41	01:20	

September 25, 26, 27 UT (Thu., Fri., Sat.)

	Aries	Venus		Mars		Jupiter		Saturn	
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	4°04.1	205°12.6	N10°05.7	154°26.5	S12°06.7	250°37.8	N21°42.0	4°42.2	S03°00.8
1	19°06.6	220°12.1	04.6	169°27.3	07.3	265°39.9	42.0	19°44.9	00.9
2	34°09.0	235°11.7	03.5	184°28.2	07.9	280°42.0	41.9	34°47.5	00.9
3	49°11.5	250°11.2	·· 02.5	199°29.0	·· 08.6	295°44.1	·· 41.9	49°50.2	·· 01.0
4	64°13.9	265°10.8	01.4	214°29.9	09.2	310°46.2	41.8	64°52.8	01.1
5	79°16.4	280°10.3	10°00.3	229°30.8	09.8	325°48.3	41.8	79°55.4	01.2
6	94°18.9	295°09.9	N09°59.3	244°31.6	S12°10.4	340°50.4	N21°41.7	94°58.1	S03°01.2
7	109°21.3	310°09.4	58.2	259°32.5	11.0	355°52.5	41.7	110°00.7	01.3
8	124°23.8	325°08.9	57.1	274°33.3	11.6	10°54.6	41.6	125°03.4	01.4
9	139°26.3	340°08.5	·· 56.1	289°34.2	·· 12.2	25°56.7	·· 41.6	140°06.0	·· 01.5
10	154°28.7	355°08.0	55.0	304°35.0	12.8	40°58.8	41.5	155°08.6	01.5
11	169°31.2	10°07.6	53.9	319°35.9	13.4	56°00.9	41.5	170°11.3	01.6
12	184°33.7	25°07.1	N09°52.9	334°36.7	S12°14.0	71°03.0	N21°41.4	185°13.9	S03°01.7
13	199°36.1	40°06.7	51.8	349°37.6	14.6	86°05.1	41.4	200°16.6	01.8
14	214°38.6	55°06.2	50.7	4°38.4	15.2	101°07.2	41.3	215°19.2	01.9
15	229°41.1	70°05.8	·· 49.6	19°39.3	·· 15.8	116°09.3	·· 41.3	230°21.8	·· 01.9
16	244°43.5	85°05.3	48.6	34°40.1	16.5	131°11.5	41.2	245°24.5	02.0
17	259°46.0	100°04.9	47.5	49°41.0	17.1	146°13.6	41.2	260°27.1	02.1
18	274°48.4	115°04.4	N09°46.4	64°41.8	S12°17.7	161°15.7	N21°41.1	275°29.8	S03°02.2
19	289°50.9	130°04.0	45.3	79°42.7	18.3	176°17.8	41.1	290°32.4	02.2
20	304°53.4	145°03.5	44.3	94°43.5	18.9	191°19.9	41.0	305°35.1	02.3
21	319°55.8	160°03.1	·· 43.2	109°44.4	·· 19.5	206°22.0	·· 41.0	320°37.7	·· 02.4
22	334°58.3	175°02.6	42.1	124°45.2	20.1	221°24.1	40.9	335°40.3	02.5
23	350°00.8	190°02.2	41.0	139°46.1	20.7	236°26.2	40.9	350°43.0	02.6
Mer.pass.	23:40	ν -0.5′	d 1.1′	m -3.93	ν 0.9′	d 0.6′	m 1.59	ν 2.1′	d 0.0′ m -2.09	ν 2.6′	d 0.1′ m 0.59

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	5°03.2	205°01.7	N09°39.9	154°46.9	S12°21.3	251°28.3	N21°40.9	5°45.6	S03°02.6
1	20°05.7	220°01.3	38.9	169°47.8	21.9	266°30.4	40.8	20°48.3	02.7
2	35°08.2	235°00.8	37.8	184°48.6	22.5	281°32.5	40.8	35°50.9	02.8
3	50°10.6	250°00.4	·· 36.7	199°49.5	·· 23.1	296°34.6	·· 40.7	50°53.5	·· 02.9
4	65°13.1	264°59.9	35.6	214°50.3	23.7	311°36.8	40.7	65°56.2	02.9
5	80°15.6	279°59.5	34.6	229°51.2	24.3	326°38.9	40.6	80°58.8	03.0
6	95°18.0	294°59.0	N09°33.5	244°52.0	S12°24.9	341°41.0	N21°40.6	96°01.5	S03°03.1
7	110°20.5	309°58.6	32.4	259°52.9	25.5	356°43.1	40.5	111°04.1	03.2
8	125°22.9	324°58.1	31.3	274°53.7	26.1	11°45.2	40.5	126°06.7	03.2
9	140°25.4	339°57.7	·· 30.2	289°54.6	·· 26.7	26°47.3	·· 40.4	141°09.4	·· 03.3
10	155°27.9	354°57.2	29.1	304°55.4	27.3	41°49.4	40.4	156°12.0	03.4
11	170°30.3	9°56.8	28.1	319°56.3	28.0	56°51.5	40.3	171°14.7	03.5
12	185°32.8	24°56.3	N09°27.0	334°57.1	S12°28.6	71°53.6	N21°40.3	186°17.3	S03°03.6
13	200°35.3	39°55.9	25.9	349°58.0	29.2	86°55.7	40.2	201°20.0	03.6
14	215°37.7	54°55.5	24.8	4°58.8	29.8	101°57.9	40.2	216°22.6	03.7
15	230°40.2	69°55.0	·· 23.7	19°59.6	·· 30.4	117°00.0	·· 40.1	231°25.2	·· 03.8
16	245°42.7	84°54.6	22.6	35°00.5	31.0	132°02.1	40.1	246°27.9	03.9
17	260°45.1	99°54.1	21.6	50°01.3	31.6	147°04.2	40.0	261°30.5	03.9
18	275°47.6	114°53.7	N09°20.5	65°02.2	S12°32.2	162°06.3	N21°40.0	276°33.2	S03°04.0
19	290°50.0	129°53.2	19.4	80°03.0	32.8	177°08.4	39.9	291°35.8	04.1
20	305°52.5	144°52.8	18.3	95°03.9	33.4	192°10.5	39.9	306°38.4	04.2
21	320°55.0	159°52.3	·· 17.2	110°04.7	·· 34.0	207°12.7	·· 39.8	321°41.1	·· 04.2
22	335°57.4	174°51.9	16.1	125°05.6	34.6	222°14.8	39.8	336°43.7	04.3
23	350°59.9	189°51.4	15.0	140°06.4	35.2	237°16.9	39.7	351°46.4	04.4
Mer.pass.	23:36	ν -0.4′	d 1.1′	m -3.93	ν 0.8′	d 0.6′	m 1.58	ν 2.1′	d 0.0′ m -2.10	ν 2.6′	d 0.1′ m 0.60

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	6°02.4	204°51.0	N09°13.9	155°07.3	S12°35.8	252°19.0	N21°39.7	6°49.0	S03°04.5
1	21°04.8	219°50.6	12.8	170°08.1	36.4	267°21.1	39.6	21°51.6	04.6
2	36°07.3	234°50.1	11.8	185°08.9	37.0	282°23.2	39.6	36°54.3	04.6
3	51°09.8	249°49.7	·· 10.7	200°09.8	·· 37.6	297°25.3	·· 39.5	51°56.9	·· 04.7
4	66°12.2	264°49.2	09.6	215°10.6	38.2	312°27.5	39.5	66°59.6	04.8
5	81°14.7	279°48.8	08.5	230°11.5	38.8	327°29.6	39.5	82°02.2	04.9
6	96°17.2	294°48.3	N09°07.4	245°12.3	S12°39.4	342°31.7	N21°39.4	97°04.8	S03°04.9
7	111°19.6	309°47.9	06.3	260°13.2	40.0	357°33.8	39.4	112°07.5	05.0
8	126°22.1	324°47.5	05.2	275°14.0	40.6	12°35.9	39.3	127°10.1	05.1
9	141°24.5	339°47.0	·· 04.1	290°14.8	·· 41.2	27°38.0	·· 39.3	142°12.8	·· 05.2
10	156°27.0	354°46.6	03.0	305°15.7	41.8	42°40.2	39.2	157°15.4	05.2
11	171°29.5	9°46.1	01.9	320°16.5	42.4	57°42.3	39.2	172°18.0	05.3
12	186°31.9	24°45.7	N09°00.8	335°17.4	S12°43.0	72°44.4	N21°39.1	187°20.7	S03°05.4
13	201°34.4	39°45.3	08°59.7	350°18.2	43.6	87°46.5	39.1	202°23.3	05.5
14	216°36.9	54°44.8	58.6	5°19.0	44.2	102°48.6	39.0	217°26.0	05.6
15	231°39.3	69°44.4	·· 57.5	20°19.9	·· 44.8	117°50.7	·· 39.0	232°28.6	·· 05.6
16	246°41.8	84°43.9	56.4	35°20.7	45.4	132°52.9	38.9	247°31.2	05.7
17	261°44.3	99°43.5	55.3	50°21.6	46.0	147°55.0	38.9	262°33.9	05.8
18	276°46.7	114°43.1	N08°54.2	65°22.4	S12°46.6	162°57.1	N21°38.8	277°36.5	S03°05.9
19	291°49.2	129°42.6	53.1	80°23.2	47.2	177°59.2	38.8	292°39.2	05.9
20	306°51.7	144°42.2	52.0	95°24.1	47.8	193°01.3	38.7	307°41.8	06.0
21	321°54.1	159°41.7	·· 51.0	110°24.9	·· 48.4	208°03.5	·· 38.7	322°44.4	·· 06.1
22	336°56.6	174°41.3	49.9	125°25.8	49.0	223°05.6	38.6	337°47.1	06.2
23	351°59.0	189°40.9	48.8	140°26.6	49.6	238°07.7	38.6	352°49.7	06.2
Mer.pass.	23:32	ν -0.4′	d 1.1′	m -3.93	ν 0.8′	d 0.6′	m 1.58	ν 2.1′	d 0.0′ m -2.10	ν 2.6′	d 0.1′ m 0.60

Stars

	SHA	Dec
Alpheratz	357°33.8	29°14.1
Ankaa	353°06.1	-42°09.8
Schedar	349°29.8	56°40.8
Diphda	348°46.4	-17°50.6
Achernar	335°19.2	-57°06.2
Hamal	327°50.2	23°35.1
Polaris	313°24.0	89°22.1
Acamar	315°11.0	-40°11.8
Menkar	314°05.3	4°11.6
Mirfak	308°27.1	49°57.1
Aldebaran	290°38.8	16°33.7
Rigel	281°03.2	-8°10.1
Capella	280°20.9	46°01.3
Bellatrix	278°22.2	6°22.5
Elnath	278°01.1	28°37.7
Alnilam	275°37.1	-1°10.9
Betelgeuse	270°51.4	7°24.8
Canopus	263°52.2	-52°42.2
Sirius	258°25.8	-16°44.8
Adhara	255°05.5	-29°00.1
Procyon	244°50.3	5°09.7
Pollux	243°16.7	27°57.8
Avior	234°14.9	-59°35.2
Suhail	222°46.2	-43°31.9
Miaplacidus	221°38.9	-69°49.1
Alphard	217°47.4	-8°46.0
Regulus	207°34.1	11°50.6
Dubhe	193°40.9	61°36.7
Denebola	182°24.7	14°25.8
Gienah	175°43.3	-17°41.0
Acrux	173°00.2	-63°14.5
Gacrux	171°51.6	-57°15.4
Alioth	166°13.0	55°49.3
Spica	158°22.0	-11°17.7
Alkaid	152°52.0	49°11.2
Hadar	148°35.8	-60°29.9
Menkent	147°57.3	-36°29.8
Arcturus	145°47.7	19°03.0
Rigil Kent.	139°40.1	-60°56.6
Kochab	137°20.6	74°03.1
Zuben'ubi	136°55.6	-16°08.9
Alphecca	126°03.5	26°37.9
Antares	112°15.3	-26°29.4
Atria	107°09.2	-69°04.6
Sabik	102°02.2	-15°45.4
Shaula	96°09.6	-37°07.4
Rasalhague	95°58.1	12°32.6
Eltanin	90°42.0	51°29.4
Kaus Aust.	83°31.7	-34°22.4
Vega	80°32.8	38°48.7
Nunki	75°47.0	-26°15.9
Altair	61°59.3	8°56.3
Peacock	53°04.5	-56°39.3
Deneb	49°25.2	45°22.6
Enif	33°38.0	9°59.7
Al Na'ir	27°31.8	-46°50.2
Fomalhaut	15°13.5	-29°29.1
Scheat	13°44.3	28°13.5
Markab	13°29.0	15°20.8

Sep 25 Thu	SHA	Mer.pass
Venus	201°08.5	10:19
Mars	150°22.4	13:41
Jupiter	246°33.7	07:16
Saturn	0°38.1	23:37

Sep 26 Fri	SHA	Mer.pass
Venus	199°58.5	10:20
Mars	149°43.7	13:40
Jupiter	246°25.1	07:13
Saturn	0°42.4	23:33

Sep 27 Sat	SHA	Mer.pass
Venus	198°48.6	10:21
Mars	149°04.9	13:39
Jupiter	246°16.6	07:10
Saturn	0°46.6	23:29

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.0898 sec ΔT = TT-UT1 = +69.0942 sec

2025 September 25 to Sep. 27 UT

h	Sun		Moon				
Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	182°03.5	S00°52.3	150°19.4	14.6′	S17°45.7	11.5′	54.1′
1	197°03.7	53.2	164°53.1	14.6′	17°57.2	11.4′	54.1′
2	212°03.9	54.2	179°26.7	14.5′	18°08.6	11.4′	54.1′
3	227°04.2	·· 55.2	194°00.2	14.5′	18°20.0	11.2′	54.1′
4	242°04.4	56.2	208°33.7	14.4′	18°31.2	11.2′	54.1′
5	257°04.6	57.1	223°07.1	14.4′	18°42.4	11.1′	54.1′
6	272°04.8	S00°58.1	237°40.5	14.3′	S18°53.5	11.1′	54.1′
7	287°05.0	00°59.1	252°13.8	14.3′	19°04.6	10.9′	54.1′
8	302°05.2	01°00.1	266°47.0	14.2′	19°15.5	10.9′	54.1′
9	317°05.4	·· 01.0	281°20.2	14.1′	19°26.4	10.8′	54.1′
10	332°05.7	02.0	295°53.4	14.1′	19°37.2	10.7′	54.1′
11	347°05.9	03.0	310°26.5	14.0′	19°47.9	10.6′	54.1′
12	2°06.1	S01°04.0	324°59.5	14.0′	S19°58.5	10.5′	54.1′
13	17°06.3	04.9	339°32.5	13.9′	20°09.0	10.5′	54.0′
14	32°06.5	05.9	354°05.4	13.9′	20°19.5	10.3′	54.0′
15	47°06.7	·· 06.9	8°38.3	13.8′	20°29.8	10.3′	54.0′
16	62°06.9	07.9	23°11.1	13.7′	20°40.1	10.2′	54.0′
17	77°07.2	08.8	37°43.8	13.7′	20°50.3	10.1′	54.0′
18	92°07.4	S01°09.8	52°16.5	13.6′	S21°00.4	10.0′	54.0′
19	107°07.6	10.8	66°49.1	13.6′	21°10.4	10.0′	54.0′
20	122°07.8	11.8	81°21.7	13.5′	21°20.4	9.8′	54.0′
21	137°08.0	·· 12.7	95°54.2	13.4′	21°30.2	9.7′	54.0′
22	152°08.2	13.7	110°26.6	13.4′	21°39.9	9.7′	54.0′
23	167°08.5	14.7	124°59.0	13.3′	21°49.6	9.6′	54.0′
	SD = 15.9′	d = 1.0′	SD = 14.8′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	182°08.7	S01°15.6	139°31.3	13.3′	S21°59.2	9.4′	54.0′
1	197°08.9	16.6	154°03.6	13.2′	22°08.6	9.4′	54.0′
2	212°09.1	17.6	168°35.8	13.1′	22°18.0	9.3′	54.0′
3	227°09.3	·· 18.6	183°07.9	13.1′	22°27.3	9.1′	54.0′
4	242°09.5	19.5	197°39.9	13.0′	22°36.4	9.1′	54.0′
5	257°09.7	20.5	212°11.9	12.9′	22°45.5	9.0′	54.0′
6	272°09.9	S01°21.5	226°43.9	12.9′	S22°54.5	8.9′	54.0′
7	287°10.2	22.5	241°15.8	12.8′	23°03.4	8.8′	54.0′
8	302°10.4	23.4	255°47.6	12.7′	23°12.2	8.7′	54.0′
9	317°10.6	·· 24.4	270°19.3	12.7′	23°20.9	8.6′	54.0′
10	332°10.8	25.4	284°51.0	12.6′	23°29.5	8.4′	54.0′
11	347°11.0	26.4	299°22.6	12.6′	23°37.9	8.4′	54.0′
12	2°11.2	S01°27.3	313°54.2	12.5′	S23°46.3	8.3′	54.0′
13	17°11.4	28.3	328°25.7	12.4′	23°54.6	8.2′	54.0′
14	32°11.7	29.3	342°57.1	12.4′	24°02.8	8.0′	54.0′
15	47°11.9	·· 30.3	357°28.5	12.3′	24°10.8	8.0′	54.0′
16	62°12.1	31.2	11°59.8	12.2′	24°18.8	7.9′	54.0′
17	77°12.3	32.2	26°31.0	12.2′	24°26.7	7.7′	54.0′
18	92°12.5	S01°33.2	41°02.2	12.1′	S24°34.4	7.7′	54.0′
19	107°12.7	34.1	55°33.3	12.0′	24°42.1	7.5′	54.0′
20	122°12.9	35.1	70°04.3	12.0′	24°49.6	7.4′	54.0′
21	137°13.1	·· 36.1	84°35.3	11.9′	24°57.0	7.3′	54.0′
22	152°13.4	37.1	99°06.2	11.9′	25°04.3	7.2′	54.0′
23	167°13.6	38.0	113°37.1	11.8′	25°11.5	7.1′	54.0′
	SD = 15.9′	d = 1.0′	SD = 14.7′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	182°13.8	S01°39.0	128°07.9	11.7′	S25°18.6	7.0′	54.0′
1	197°14.0	40.0	142°38.6	11.7′	25°25.6	6.9′	54.0′
2	212°14.2	41.0	157°09.2	11.6′	25°32.5	6.7′	54.0′
3	227°14.4	·· 41.9	171°39.8	11.5′	25°39.2	6.6′	54.0′
4	242°14.6	42.9	186°10.4	11.5′	25°45.8	6.6′	54.0′
5	257°14.8	43.9	200°40.9	11.4′	25°52.4	6.4′	54.0′
6	272°15.1	S01°44.9	215°11.3	11.4′	S25°58.8	6.2′	54.0′
7	287°15.3	45.8	229°41.6	11.3′	26°05.0	6.2′	54.1′
8	302°15.5	46.8	244°11.9	11.2′	26°11.2	6.1′	54.1′
9	317°15.7	·· 47.8	258°42.2	11.2′	26°17.3	5.9′	54.1′
10	332°15.9	48.7	273°12.3	11.1′	26°23.2	5.8′	54.1′
11	347°16.1	49.7	287°42.4	11.1′	26°29.0	5.7′	54.1′
12	2°16.3	S01°50.7	302°12.5	11.0′	S26°34.7	5.5′	54.1′
13	17°16.5	51.7	316°42.5	10.9′	26°40.2	5.5′	54.1′
14	32°16.7	52.6	331°12.4	10.9′	26°45.7	5.3′	54.1′
15	47°17.0	·· 53.6	345°42.3	10.8′	26°51.0	5.2′	54.1′
16	62°17.2	54.6	0°12.1	10.8′	26°56.2	5.1′	54.1′
17	77°17.4	55.6	14°41.9	10.7′	27°01.3	4.9′	54.1′
18	92°17.6	S01°56.5	29°11.6	10.6′	S27°06.2	4.8′	54.1′
19	107°17.8	57.5	43°41.2	10.6′	27°11.0	4.7′	54.1′
20	122°18.0	58.5	58°10.8	10.5′	27°15.7	4.6′	54.1′
21	137°18.2	01°59.4	72°40.4	10.5′	27°20.3	4.5′	54.2′
22	152°18.4	02°00.4	87°09.9	10.4′	27°24.8	4.3′	54.2′
23	167°18.6	01.4	101°39.3	10.4′	27°29.1	4.2′	54.2′
	SD = 15.9′	d = 1.0′	SD = 14.7′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	03:23	04:50	05:57	17:43	18:50	20:15
N 70°	03:39	04:56	05:57	17:44	18:44	20:00
68°	03:52	05:00	05:56	17:45	18:40	19:48
66°	04:02	05:04	05:55	17:45	18:36	19:38
64°	04:10	05:07	05:55	17:46	18:33	19:30
62°	04:17	05:10	05:54	17:47	18:31	19:23
60°	04:23	05:13	05:54	17:47	18:28	19:18
N 58°	04:28	05:15	05:54	17:48	18:27	19:13
56°	04:33	05:16	05:53	17:48	18:25	19:09
54°	04:36	05:18	05:53	17:48	18:23	19:05
52°	04:40	05:19	05:53	17:49	18:22	19:02
50°	04:43	05:20	05:53	17:49	18:21	18:59
45°	04:49	05:23	05:52	17:50	18:19	18:53
N 40°	04:53	05:25	05:52	17:50	18:17	18:49
35°	04:56	05:26	05:51	17:51	18:16	18:45
30°	04:59	05:27	05:51	17:51	18:15	18:43
20°	05:02	05:28	05:50	17:52	18:14	18:40
N 10°	05:04	05:28	05:49	17:53	18:14	18:39
0°	05:03	05:27	05:48	17:54	18:15	18:39
S 10°	05:02	05:26	05:47	17:56	18:17	18:41
20°	04:58	05:24	05:46	17:57	18:19	18:45
30°	04:53	05:20	05:44	17:59	18:23	18:50
35°	04:49	05:18	05:43	18:00	18:25	18:55
40°	04:44	05:15	05:42	18:01	18:28	19:00
45°	04:37	05:12	05:41	18:02	18:31	19:06
S 50°	04:29	05:07	05:40	18:04	18:36	19:15
52°	04:25	05:05	05:39	18:05	18:38	19:19
54°	04:21	05:03	05:38	18:05	18:41	19:23
56°	04:15	05:00	05:37	18:06	18:44	19:29
58°	04:10	04:57	05:36	18:07	18:47	19:35
S 60°	04:03	04:54	05:35	18:09	18:51	19:42

Lat.	**Moonrise** Thu	Fri	Sat	**Moonset** Thu	Fri	Sat
N 72°	▬	▬	▬	▬	▬	▬
N 70°	▬	▬	▬	▬	▬	▬
68°	12:43	▬	▬	15:49	▬	▬
66°	12:01	▬	▬	16:33	▬	▬
64°	11:32	13:33	▬	17:02	16:37	▬
62°	11:10	12:53	14:48	17:25	17:17	17:04
60°	10:53	12:26	14:00	17:43	17:45	17:52
N 58°	10:39	12:05	13:30	17:58	18:07	18:22
56°	10:26	11:48	13:07	18:11	18:24	18:46
54°	10:15	11:33	12:48	18:23	18:40	19:04
52°	10:06	11:20	12:33	18:33	18:53	19:20
50°	09:58	11:09	12:19	18:42	19:04	19:34
45°	09:40	10:46	11:52	19:01	19:28	20:03
N 40°	09:25	10:28	11:30	19:17	19:48	20:25
35°	09:13	10:12	11:12	19:30	20:04	20:43
30°	09:02	09:59	10:56	19:42	20:18	20:59
20°	08:44	09:37	10:30	20:01	20:42	21:26
N 10°	08:28	09:17	10:08	20:19	21:03	21:50
0°	08:14	08:59	09:47	20:35	21:22	22:11
S 10°	07:59	08:41	09:26	20:52	21:41	22:33
20°	07:44	08:22	09:04	21:09	22:02	22:56
30°	07:26	08:00	08:39	21:30	22:27	23:24
35°	07:16	07:47	08:24	21:42	22:41	23:40
40°	07:04	07:32	08:06	21:55	22:58	23:59
45°	06:51	07:15	07:46	22:12	23:18	·· ··
S 50°	06:34	06:54	07:20	22:32	23:43	·· ··
52°	06:26	06:43	07:07	22:42	23:55	·· ··
54°	06:18	06:32	06:53	22:53	·· ··	00:10
56°	06:08	06:19	06:36	23:05	·· ··	00:26
58°	05:57	06:04	06:16	23:20	·· ··	00:46
S 60°	05:45	05:46	05:50	23:37	·· ··	01:10

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 4-6 9-23%
25	08:14	08:24	11:52	14:24	02:02	
26	08:35	08:45	11:51	15:10	02:47	
27	08:55	09:05	11:51	15:59	03:34	

September 28, 29, 30 UT (Sun., Mon., Tue.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	7°01.5	204°40.4	N08°47.6	155°27.4	S12°50.2	253°09.8	N21°38.5	7°52.4	S03°06.3
1	22°04.0	219°40.0	46.5	170°28.3	50.8	268°11.9	38.5	22°55.0	06.4
2	37°06.4	234°39.5	45.4	185°29.1	51.4	283°14.1	38.5	37°57.6	06.5
3	52°08.9	249°39.1	·· 44.3	200°30.0	·· 52.0	298°16.2	·· 38.4	53°00.3	·· 06.5
4	67°11.4	264°38.7	43.2	215°30.8	52.6	313°18.3	38.4	68°02.9	06.6
5	82°13.8	279°38.2	42.1	230°31.6	53.2	328°20.4	38.3	83°05.6	06.7
6	97°16.3	294°37.8	N08°41.0	245°32.5	S12°53.8	343°22.6	N21°38.3	98°08.2	S03°06.8
7	112°18.8	309°37.4	39.9	260°33.3	54.4	358°24.7	38.2	113°10.8	06.8
8	127°21.2	324°36.9	38.8	275°34.1	55.0	13°26.8	38.2	128°13.5	06.9
9	142°23.7	339°36.5	·· 37.7	290°35.0	·· 55.6	28°28.9	·· 38.1	143°16.1	·· 07.0
10	157°26.2	354°36.1	36.6	305°35.8	56.2	43°31.0	38.1	158°18.8	07.1
11	172°28.6	9°35.6	35.5	320°36.6	56.8	58°33.2	38.0	173°21.4	07.2
12	187°31.1	24°35.2	N08°34.4	335°37.5	S12°57.4	73°35.3	N21°38.0	188°24.0	S03°07.2
13	202°33.5	39°34.7	33.3	350°38.3	58.0	88°37.4	37.9	203°26.7	07.3
14	217°36.0	54°34.3	32.2	5°39.2	58.6	103°39.5	37.9	218°29.3	07.4
15	232°38.5	69°33.9	·· 31.1	20°40.0	·· 59.2	118°41.7	·· 37.8	233°32.0	·· 07.5
16	247°40.9	84°33.4	30.0	35°40.8	12°59.8	133°43.8	37.8	248°34.6	07.5
17	262°43.4	99°33.0	28.9	50°41.7	13°00.4	148°45.9	37.7	263°37.2	07.6
18	277°45.9	114°32.6	N08°27.8	65°42.5	S13°01.0	163°48.0	N21°37.7	278°39.9	S03°07.7
19	292°48.3	129°32.1	26.7	80°43.3	01.6	178°50.2	37.7	293°42.5	07.8
20	307°50.8	144°31.7	25.5	95°44.2	02.2	193°52.3	37.6	308°45.2	07.8
21	322°53.3	159°31.3	·· 24.4	110°45.0	·· 02.8	208°54.4	·· 37.6	323°47.8	·· 07.9
22	337°55.7	174°30.8	23.3	125°45.8	03.4	223°56.5	37.5	338°50.4	08.0
23	352°58.2	189°30.4	22.2	140°46.7	04.0	238°58.7	37.5	353°53.1	08.1
Mer.pass.	23:28	ν -0.4′	d 1.1′	m -3.93	ν 0.8′	d 0.6′	m 1.58	ν 2.1′	d 0.0′ m -2.11	ν 2.6′	d 0.1′ m 0.60

Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	8°00.6	204°30.0	N08°21.1	155°47.5	S13°04.6	254°00.8	N21°37.4	8°55.7	S03°08.1
1	23°03.1	219°29.5	20.0	170°48.3	05.2	269°02.9	37.4	23°58.4	08.2
2	38°05.6	234°29.1	18.9	185°49.2	05.8	284°05.1	37.3	39°01.0	08.3
3	53°08.0	249°28.7	·· 17.8	200°50.0	·· 06.4	299°07.2	·· 37.3	54°03.6	·· 08.4
4	68°10.5	264°28.2	16.7	215°50.8	06.9	314°09.3	37.2	69°06.3	08.4
5	83°13.0	279°27.8	15.5	230°51.7	07.5	329°11.4	37.2	84°08.9	08.5
6	98°15.4	294°27.4	N08°14.4	245°52.5	S13°08.1	344°13.6	N21°37.1	99°11.6	S03°08.6
7	113°17.9	309°27.0	13.3	260°53.3	08.7	359°15.7	37.1	114°14.2	08.7
8	128°20.4	324°26.5	12.2	275°54.1	09.3	14°17.8	37.1	129°16.8	08.7
9	143°22.8	339°26.1	·· 11.1	290°55.0	·· 09.9	29°20.0	·· 37.0	144°19.5	·· 08.8
10	158°25.3	354°25.7	10.0	305°55.8	10.5	44°22.1	37.0	159°22.1	08.9
11	173°27.8	9°25.2	08.9	320°56.6	11.1	59°24.2	36.9	174°24.8	09.0
12	188°30.2	24°24.8	N08°07.7	335°57.5	S13°11.7	74°26.3	N21°36.9	189°27.4	S03°09.0
13	203°32.7	39°24.4	06.6	350°58.3	12.3	89°28.5	36.8	204°30.0	09.1
14	218°35.1	54°23.9	05.5	5°59.1	12.9	104°30.6	36.8	219°32.7	09.2
15	233°37.6	69°23.5	·· 04.4	21°00.0	·· 13.5	119°32.7	·· 36.7	234°35.3	·· 09.3
16	248°40.1	84°23.1	03.3	36°00.8	14.1	134°34.9	36.7	249°37.9	09.3
17	263°42.5	99°22.7	02.1	51°01.6	14.7	149°37.0	36.6	264°40.6	09.4
18	278°45.0	114°22.2	N08°01.0	66°02.4	S13°15.3	164°39.1	N21°36.6	279°43.2	S03°09.5
19	293°47.5	129°21.8	07°59.9	81°03.3	15.9	179°41.3	36.5	294°45.9	09.6
20	308°49.9	144°21.4	58.8	96°04.1	16.5	194°43.4	36.5	309°48.5	09.7
21	323°52.4	159°20.9	·· 57.7	111°04.9	·· 17.1	209°45.5	·· 36.5	324°51.1	·· 09.7
22	338°54.9	174°20.5	56.6	126°05.8	17.6	224°47.7	36.4	339°53.8	09.8
23	353°57.3	189°20.1	55.4	141°06.6	18.2	239°49.8	36.4	354°56.4	09.9
Mer.pass.	23:24	ν -0.4′	d 1.1′	m -3.93	ν 0.8′	d 0.6′	m 1.58	ν 2.1′	d 0.0′ m -2.11	ν 2.6′	d 0.1′ m 0.61

Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	8°59.8	204°19.7	N07°54.3	156°07.4	S13°18.8	254°51.9	N21°36.3	9°59.1	S03°10.0
1	24°02.3	219°19.2	53.2	171°08.2	19.4	269°54.1	36.3	25°01.7	10.0
2	39°04.7	234°18.8	52.1	186°09.1	20.0	284°56.2	36.2	40°04.3	10.1
3	54°07.2	249°18.4	·· 50.9	201°09.9	·· 20.6	299°58.3	·· 36.2	55°07.0	·· 10.2
4	69°09.6	264°17.9	49.8	216°10.7	21.2	315°00.5	36.1	70°09.6	10.3
5	84°12.1	279°17.5	48.7	231°11.5	21.8	330°02.6	36.1	85°12.3	10.3
6	99°14.6	294°17.1	N07°47.6	246°12.4	S13°22.4	345°04.7	N21°36.0	100°14.9	S03°10.4
7	114°17.0	309°16.7	46.4	261°13.2	23.0	0°06.9	36.0	115°17.5	10.5
8	129°19.5	324°16.2	45.3	276°14.0	23.6	15°09.0	35.9	130°20.2	10.6
9	144°22.0	339°15.8	·· 44.2	291°14.8	·· 24.2	30°11.1	·· 35.9	145°22.8	·· 10.6
10	159°24.4	354°15.4	43.1	306°15.7	24.8	45°13.3	35.9	160°25.4	10.7
11	174°26.9	9°15.0	41.9	321°16.5	25.3	60°15.4	35.8	175°28.1	10.8
12	189°29.4	24°14.5	N07°40.8	336°17.3	S13°25.9	75°17.5	N21°35.8	190°30.7	S03°10.9
13	204°31.8	39°14.1	39.7	351°18.1	26.5	90°19.7	35.7	205°33.4	10.9
14	219°34.3	54°13.7	38.6	6°19.0	27.1	105°21.8	35.7	220°36.0	11.0
15	234°36.8	69°13.3	·· 37.4	21°19.8	·· 27.7	120°24.0	·· 35.6	235°38.6	·· 11.1
16	249°39.2	84°12.8	36.3	36°20.6	28.3	135°26.1	35.6	250°41.3	11.2
17	264°41.7	99°12.4	35.2	51°21.4	28.9	150°28.2	35.5	265°43.9	11.2
18	279°44.1	114°12.0	N07°34.1	66°22.3	S13°29.5	165°30.4	N21°35.5	280°46.6	S03°11.3
19	294°46.6	129°11.6	32.9	81°23.1	30.1	180°32.5	35.4	295°49.2	11.4
20	309°49.1	144°11.1	31.8	96°23.9	30.7	195°34.6	35.4	310°51.8	11.4
21	324°51.5	159°10.7	·· 30.7	111°24.7	·· 31.2	210°36.8	·· 35.4	325°54.5	·· 11.5
22	339°54.0	174°10.3	29.5	126°25.5	31.8	225°38.9	35.3	340°57.1	11.6
23	354°56.5	189°09.9	28.4	141°26.4	32.4	240°41.1	35.3	355°59.7	11.7
Mer.pass.	23:20	ν -0.4′	d 1.1′	m -3.93	ν 0.8′	d 0.6′	m 1.57	ν 2.1′	d 0.0′ m -2.12	ν 2.6′	d 0.1′ m 0.61

Stars

	SHA	Dec
Alpheratz	357°33.8	29°14.1
Ankaa	353°06.1	-42°09.8
Schedar	349°29.8	56°40.8
Diphda	348°46.4	-17°50.6
Achernar	335°19.2	-57°06.2
Hamal	327°50.2	23°35.1
Polaris	313°22.6	89°22.2
Acamar	315°11.0	-40°11.8
Menkar	314°05.3	4°11.6
Mirfak	308°27.1	49°57.1
Aldebaran	290°38.8	16°33.7
Rigel	281°03.2	-8°10.1
Capella	280°20.9	46°01.3
Bellatrix	278°22.2	6°22.5
Elnath	278°01.0	28°37.7
Alnilam	275°37.1	-1°11.0
Betelgeuse	270°51.4	7°24.8
Canopus	263°52.1	-52°42.2
Sirius	258°25.7	-16°44.8
Adhara	255°05.5	-29°00.1
Procyon	244°50.3	5°09.7
Pollux	243°16.7	27°57.8
Avior	234°14.8	-59°35.2
Suhail	222°46.2	-43°31.9
Miaplacidus	221°38.8	-69°49.1
Alphard	217°47.4	-8°46.0
Regulus	207°34.1	11°50.6
Dubhe	193°40.9	61°36.7
Denebola	182°24.7	14°25.8
Gienah	175°43.3	-17°41.0
Acrux	173°00.2	-63°14.5
Gacrux	171°51.6	-57°15.4
Alioth	166°13.0	55°49.3
Spica	158°22.0	-11°17.7
Alkaid	152°52.0	49°11.2
Hadar	148°35.8	-60°29.9
Menkent	147°57.3	-36°29.8
Arcturus	145°47.7	19°03.0
Rigil Kent.	139°40.1	-60°56.6
Kochab	137°20.7	74°03.1
Zuben'ubi	136°55.6	-16°08.9
Alphecca	126°03.5	26°37.8
Antares	112°15.3	-26°29.4
Atria	107°09.2	-69°04.6
Sabik	102°02.2	-15°45.4
Shaula	96°09.7	-37°07.4
Rasalhague	95°58.1	12°32.6
Eltanin	90°42.0	51°29.4
Kaus Aust.	83°31.7	-34°22.4
Vega	80°32.8	38°48.7
Nunki	75°47.0	-26°15.9
Altair	61°59.3	8°56.3
Peacock	53°04.5	-56°39.3
Deneb	49°25.2	45°22.6
Enif	33°38.0	9°59.7
Al Na'ir	27°31.8	-46°50.2
Fomalhaut	15°13.5	-29°29.1
Scheat	13°44.3	28°13.5
Markab	13°29.0	15°20.8

Sep 28 Sun	SHA	Mer.pass
Venus	197°38.9	10:22
Mars	148°25.9	13:37
Jupiter	246°08.3	07:06
Saturn	0°50.9	23:24

Sep 29 Mon	SHA	Mer.pass
Venus	196°29.3	10:22
Mars	147°46.8	13:36
Jupiter	246°00.2	07:03
Saturn	0°55.1	23:20

Sep 30 Tue	SHA	Mer.pass
Venus	195°19.9	10:23
Mars	147°07.6	13:35
Jupiter	245°52.1	07:00
Saturn	0°59.3	23:16

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	182°18.8	S02°02.4	116°08.7	10.3′	S27°33.3	4.0′	54.2′
1	197°19.1	03.3	130°38.0	10.3′	27°37.3	3.9′	54.2′
2	212°19.3	04.3	145°07.3	10.2′	27°41.2	3.8′	54.2′
3	227°19.5	·· 05.3	159°36.5	10.2′	27°45.0	3.7′	54.2′
4	242°19.7	06.3	174°05.7	10.1′	27°48.7	3.5′	54.2′
5	257°19.9	07.2	188°34.8	10.1′	27°52.2	3.4′	54.2′
6	272°20.1	S02°08.2	203°03.9	10.0′	S27°55.6	3.3′	54.3′
7	287°20.3	09.2	217°32.9	10.0′	27°58.9	3.1′	54.3′
8	302°20.5	10.1	232°01.9	9.9′	28°02.0	3.0′	54.3′
9	317°20.7	·· 11.1	246°30.8	9.9′	28°05.0	2.9′	54.3′
10	332°20.9	12.1	260°59.7	9.9′	28°07.9	2.7′	54.3′
11	347°21.2	13.1	275°28.6	9.8′	28°10.6	2.6′	54.3′
12	2°21.4	S02°14.0	289°57.4	9.8′	S28°13.2	2.4′	54.3′
13	17°21.6	15.0	304°26.2	9.7′	28°15.6	2.4′	54.3′
14	32°21.8	16.0	318°54.9	9.7′	28°18.0	2.1′	54.4′
15	47°22.0	·· 17.0	333°23.6	9.6′	28°20.1	2.1′	54.4′
16	62°22.2	17.9	347°52.2	9.6′	28°22.2	1.9′	54.4′
17	77°22.4	18.9	2°20.8	9.6′	28°24.1	1.8′	54.4′
18	92°22.6	S02°19.9	16°49.4	9.5′	S28°25.9	1.6′	54.4′
19	107°22.8	20.8	31°17.9	9.5′	28°27.5	1.5′	54.4′
20	122°23.0	21.8	45°46.5	9.5′	28°29.0	1.3′	54.4′
21	137°23.2	·· 22.8	60°14.9	9.4′	28°30.3	1.2′	54.5′
22	152°23.4	23.8	74°43.4	9.4′	28°31.5	1.1′	54.5′
23	167°23.7	24.7	89°11.8	9.4′	28°32.6	0.9′	54.5′
	SD = 16.0′	d = 1.0′	SD = 14.8′				

Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	182°23.9	S02°25.7	103°40.1	9.3′	S28°33.5	0.8′	54.5′
1	197°24.1	26.7	118°08.5	9.3′	28°34.3	0.6′	54.5′
2	212°24.3	27.6	132°36.8	9.3′	28°34.9	0.5′	54.6′
3	227°24.5	·· 28.6	147°05.1	9.3′	28°35.4	0.4′	54.6′
4	242°24.7	29.6	161°33.3	9.2′	28°35.8	0.2′	54.6′
5	257°24.9	30.6	176°01.6	9.2′	28°36.0	0.1′	54.6′
6	272°25.1	S02°31.5	190°29.8	9.2′	S28°36.1	0.1′	54.6′
7	287°25.3	32.5	204°58.0	9.2′	28°36.0	0.2′	54.6′
8	302°25.5	33.5	219°26.1	9.1′	28°35.8	0.4′	54.7′
9	317°25.7	·· 34.4	233°54.3	9.1′	28°35.4	0.5′	54.7′
10	332°25.9	35.4	248°22.4	9.1′	28°34.9	0.6′	54.7′
11	347°26.1	36.4	262°50.5	9.1′	28°34.3	0.8′	54.7′
12	2°26.3	S02°37.4	277°18.6	9.1′	S28°33.5	1.0′	54.7′
13	17°26.6	38.3	291°46.7	9.1′	28°32.5	1.1′	54.8′
14	32°26.8	39.3	306°14.8	9.0′	28°31.4	1.2′	54.8′
15	47°27.0	·· 40.3	320°42.8	9.0′	28°30.2	1.4′	54.8′
16	62°27.2	41.2	335°10.8	9.0′	28°28.8	1.5′	54.8′
17	77°27.4	42.2	349°38.9	9.0′	28°27.3	1.7′	54.9′
18	92°27.6	S02°43.2	4°06.9	9.0′	S28°25.6	1.8′	54.9′
19	107°27.8	44.2	18°34.9	9.0′	28°23.8	1.9′	54.9′
20	122°28.0	45.1	33°02.9	9.0′	28°21.9	2.1′	54.9′
21	137°28.2	·· 46.1	47°30.9	9.0′	28°19.8	2.3′	54.9′
22	152°28.4	47.1	61°58.8	9.0′	28°17.5	2.4′	55.0′
23	167°28.6	48.0	76°26.8	9.0′	28°15.1	2.5′	55.0′
	SD = 16.0′	d = 1.0′	SD = 14.9′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	182°28.8	S02°49.0	90°54.8	9.0′	S28°12.6	2.7′	55.0′
1	197°29.0	50.0	105°22.8	9.0′	28°09.9	2.9′	55.0′
2	212°29.2	50.9	119°50.8	9.0′	28°07.0	3.0′	55.1′
3	227°29.4	·· 51.9	134°18.7	9.0′	28°04.0	3.1′	55.1′
4	242°29.6	52.9	148°46.7	9.0′	28°00.9	3.3′	55.1′
5	257°29.8	53.9	163°14.7	9.0′	27°57.6	3.4′	55.1′
6	272°30.0	S02°54.8	177°42.7	9.0′	S27°54.2	3.6′	55.2′
7	287°30.3	55.8	192°10.7	9.0′	27°50.6	3.7′	55.2′
8	302°30.5	56.8	206°38.6	9.0′	27°46.9	3.8′	55.2′
9	317°30.7	·· 57.7	221°06.6	9.0′	27°43.1	4.1′	55.2′
10	332°30.9	58.7	235°34.6	9.0′	27°39.0	4.1′	55.3′
11	347°31.1	02°59.7	250°02.7	9.0′	27°34.9	4.3′	55.3′
12	2°31.3	S03°00.7	264°30.7	9.0′	S27°30.6	4.5′	55.3′
13	17°31.5	01.6	278°58.7	9.0′	27°26.1	4.5′	55.3′
14	32°31.7	02.6	293°26.8	9.1′	27°21.6	4.8′	55.4′
15	47°31.9	·· 03.6	307°54.8	9.1′	27°16.8	4.9′	55.4′
16	62°32.1	04.5	322°22.9	9.1′	27°11.9	5.0′	55.4′
17	77°32.3	05.5	336°51.0	9.1′	27°06.9	5.2′	55.5′
18	92°32.5	S03°06.5	351°19.1	9.1′	S27°01.7	5.3′	55.5′
19	107°32.7	07.4	5°47.2	9.1′	26°56.4	5.4′	55.5′
20	122°32.9	08.4	20°15.4	9.2′	26°51.0	5.7′	55.5′
21	137°33.1	·· 09.4	34°43.5	9.2′	26°45.3	5.7′	55.6′
22	152°33.3	10.3	49°11.7	9.2′	26°39.6	5.9′	55.6′
23	167°33.5	11.3	63°39.9	9.2′	26°33.7	6.0′	55.6′
	SD = 16.0′	d = 1.0′	SD = 15.0′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	03:40	05:03	06:11	17:27	18:34	19:57
N 70°	03:53	05:08	06:08	17:30	18:30	19:44
68°	04:04	05:11	06:06	17:32	18:27	19:34
66°	04:13	05:14	06:05	17:34	18:25	19:25
64°	04:20	05:16	06:03	17:35	18:23	19:19
62°	04:26	05:18	06:02	17:37	18:21	19:13
60°	04:31	05:20	06:01	17:38	18:19	19:08
N 58°	04:35	05:21	06:00	17:39	18:18	19:04
56°	04:39	05:22	05:59	17:40	18:17	19:00
54°	04:42	05:23	05:59	17:41	18:16	18:57
52°	04:45	05:24	05:58	17:42	18:15	18:54
50°	04:47	05:25	05:57	17:42	18:15	18:52
45°	04:52	05:26	05:56	17:44	18:13	18:47
N 40°	04:56	05:27	05:54	17:45	18:12	18:44
35°	04:59	05:28	05:53	17:47	18:12	18:41
30°	05:01	05:28	05:52	17:48	18:12	18:39
20°	05:03	05:28	05:50	17:50	18:12	18:37
N 10°	05:03	05:28	05:49	17:52	18:13	18:37
0°	05:02	05:26	05:47	17:53	18:14	18:38
S 10°	05:00	05:24	05:45	17:55	18:16	18:41
20°	04:55	05:21	05:43	17:58	18:20	18:45
30°	04:49	05:17	05:41	18:00	18:24	18:52
35°	04:44	05:14	05:39	18:02	18:27	18:57
40°	04:39	05:10	05:38	18:04	18:31	19:03
45°	04:31	05:06	05:36	18:06	18:35	19:10
S 50°	04:22	05:01	05:33	18:08	18:41	19:20
52°	04:18	04:58	05:32	18:10	18:44	19:24
54°	04:13	04:55	05:31	18:11	18:47	19:29
56°	04:07	04:52	05:29	18:12	18:50	19:35
58°	04:00	04:48	05:28	18:14	18:54	19:42
S 60°	03:53	04:44	05:26	18:16	18:58	19:50

Lat.	**Moonrise** Sun	Mon	Tue	**Moonset** Sun	Mon	Tue
N 72°	▬	▬	▬	▬	▬	▬
N 70°	▬	▬	▬	▬	▬	▬
68°	▬	▬	▬	▬	▬	▬
66°	▬	▬	▬	▬	▬	▬
64°	▬	▬	▬	▬	▬	▬
62°	▬	▬	17:33	▬	▬	19:46
60°	15:26	16:22	16:44	18:12	19:06	20:34
N 58°	14:46	15:41	16:14	18:52	19:46	21:05
56°	14:18	15:13	15:50	19:20	20:14	21:28
54°	13:57	14:51	15:31	19:42	20:36	21:47
52°	13:39	14:33	15:15	20:00	20:54	22:02
50°	13:23	14:18	15:01	20:15	21:09	22:16
45°	12:53	13:47	14:33	20:46	21:40	22:44
N 40°	12:29	13:23	14:10	21:10	22:04	23:06
35°	12:09	13:03	13:52	21:30	22:24	23:24
30°	11:53	12:46	13:36	21:47	22:41	23:39
20°	11:24	12:18	13:08	22:16	23:09	·· ··
N 10°	11:00	11:53	12:45	22:40	23:33	·· ··
0°	10:38	11:30	12:23	23:03	23:56	·· ··
S 10°	10:15	11:07	12:01	23:26	·· ··	00:18
20°	09:51	10:43	11:38	23:50	·· ··	00:42
30°	09:23	10:14	11:11	·· ··	00:19	01:10
35°	09:07	09:57	10:54	·· ··	00:36	01:27
40°	08:48	09:38	10:36	·· ··	00:55	01:46
45°	08:25	09:14	10:13	00:21	01:19	02:09
S 50°	07:55	08:43	09:43	00:51	01:50	02:39
52°	07:40	08:27	09:29	01:05	02:06	02:54
54°	07:23	08:09	09:12	01:22	02:24	03:11
56°	07:03	07:47	08:52	01:42	02:45	03:31
58°	06:38	07:19	08:27	02:07	03:13	03:57
S 60°	06:03	06:39	07:52	02:41	03:54	04:32

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 7-9 31-50%
28	09:15	09:25	11:51	16:50	04:24	
29	09:35	09:45	11:50	17:43	05:16	
30	09:55	10:05	11:50	18:36	06:09	

October 01, 02, 03 UT (Wed., Thu., Fri.)

	Aries	Venus		Mars		Jupiter		Saturn	
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	9°58.9	204°09.5	N07°27.3	156°27.2	S13°33.0	255°43.2	N21°35.2	11°02.4	S03°11.7
1	25°01.4	219°09.0	26.1	171°28.0	33.6	270°45.3	35.2	26°05.0	11.8
2	40°03.9	234°08.6	25.0	186°28.8	34.2	285°47.5	35.1	41°07.7	11.9
3	55°06.3	249°08.2	·· 23.9	201°29.7	·· 34.8	300°49.6	·· 35.1	56°10.3	·· 12.0
4	70°08.8	264°07.8	22.7	216°30.5	35.4	315°51.8	35.0	71°12.9	12.0
5	85°11.2	279°07.3	21.6	231°31.3	36.0	330°53.9	35.0	86°15.6	12.1
6	100°13.7	294°06.9	N07°20.5	246°32.1	S13°36.5	345°56.0	N21°35.0	101°18.2	S03°12.2
7	115°16.2	309°06.5	19.3	261°32.9	37.1	0°58.2	34.9	116°20.8	12.3
8	130°18.6	324°06.1	18.2	276°33.8	37.7	16°00.3	34.9	131°23.5	12.3
9	145°21.1	339°05.7	·· 17.1	291°34.6	·· 38.3	31°02.5	·· 34.8	146°26.1	·· 12.4
10	160°23.6	354°05.2	15.9	306°35.4	38.9	46°04.6	34.8	161°28.8	12.5
11	175°26.0	9°04.8	14.8	321°36.2	39.5	61°06.7	34.7	176°31.4	12.6
12	190°28.5	24°04.4	N07°13.7	336°37.0	S13°40.1	76°08.9	N21°34.7	191°34.0	S03°12.6
13	205°31.0	39°04.0	12.5	351°37.8	40.7	91°11.0	34.6	206°36.7	12.7
14	220°33.4	54°03.6	11.4	6°38.7	41.3	106°13.2	34.6	221°39.3	12.8
15	235°35.9	69°03.1	·· 10.3	21°39.5	·· 41.8	121°15.3	·· 34.5	236°41.9	·· 12.9
16	250°38.4	84°02.7	09.1	36°40.3	42.4	136°17.5	34.5	251°44.6	12.9
17	265°40.8	99°02.3	08.0	51°41.1	43.0	151°19.6	34.5	266°47.2	13.0
18	280°43.3	114°01.9	N07°06.9	66°41.9	S13°43.6	166°21.8	N21°34.4	281°49.9	S03°13.1
19	295°45.7	129°01.5	05.7	81°42.8	44.2	181°23.9	34.4	296°52.5	13.2
20	310°48.2	144°01.0	04.6	96°43.6	44.8	196°26.0	34.3	311°55.1	13.2
21	325°50.7	159°00.6	·· 03.4	111°44.4	·· 45.4	211°28.2	·· 34.3	326°57.8	·· 13.3
22	340°53.1	174°00.2	02.3	126°45.2	45.9	226°30.3	34.2	342°00.4	13.4
23	355°55.6	188°59.8	01.2	141°46.0	46.5	241°32.5	34.2	357°03.0	13.5
Mer.pass. 23:16		ν -0.4′	d 1.1′	m -3.93	ν 0.8′	d 0.6′	m 1.57	ν 2.1′	d 0.0′ m -2.12	ν 2.6′	d 0.1′ m 0.62

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	10°58.1	203°59.4	N07°00.0	156°46.8	S13°47.1	256°34.6	N21°34.1	12°05.7	S03°13.5
1	26°00.5	218°59.0	06°58.9	171°47.6	47.7	271°36.8	34.1	27°08.3	13.6
2	41°03.0	233°58.5	57.7	186°48.5	48.3	286°38.9	34.1	42°11.0	13.7
3	56°05.5	248°58.1	·· 56.6	201°49.3	·· 48.9	301°41.1	·· 34.0	57°13.6	·· 13.8
4	71°07.9	263°57.7	55.5	216°50.1	49.5	316°43.2	34.0	72°16.2	13.8
5	86°10.4	278°57.3	54.3	231°50.9	50.0	331°45.4	33.9	87°18.9	13.9
6	101°12.9	293°56.9	N06°53.2	246°51.7	S13°50.6	346°47.5	N21°33.9	102°21.5	S03°14.0
7	116°15.3	308°56.4	52.0	261°52.5	51.2	1°49.7	33.8	117°24.1	14.0
8	131°17.8	323°56.0	50.9	276°53.4	51.8	16°51.8	33.8	132°26.8	14.1
9	146°20.2	338°55.6	·· 49.7	291°54.2	·· 52.4	31°53.9	·· 33.7	147°29.4	·· 14.2
10	161°22.7	353°55.2	48.6	306°55.0	53.0	46°56.1	33.7	162°32.0	14.3
11	176°25.2	8°54.8	47.5	321°55.8	53.6	61°58.2	33.7	177°34.7	14.3
12	191°27.6	23°54.4	N06°46.3	336°56.6	S13°54.1	77°00.4	N21°33.6	192°37.3	S03°14.4
13	206°30.1	38°54.0	45.2	351°57.4	54.7	92°02.5	33.6	207°40.0	14.5
14	221°32.6	53°53.5	44.0	6°58.2	55.3	107°04.7	33.5	222°42.6	14.6
15	236°35.0	68°53.1	·· 42.9	21°59.0	·· 55.9	122°06.8	·· 33.5	237°45.2	·· 14.6
16	251°37.5	83°52.7	41.7	36°59.9	56.5	137°09.0	33.4	252°47.9	14.7
17	266°40.0	98°52.3	40.6	52°00.7	57.1	152°11.1	33.4	267°50.5	14.8
18	281°42.4	113°51.9	N06°39.4	67°01.5	S13°57.6	167°13.3	N21°33.4	282°53.1	S03°14.9
19	296°44.9	128°51.5	38.3	82°02.3	58.2	182°15.4	33.3	297°55.8	14.9
20	311°47.3	143°51.0	37.1	97°03.1	58.8	197°17.6	33.3	312°58.4	15.0
21	326°49.8	158°50.6	·· 36.0	112°03.9	13°59.4	212°19.8	·· 33.2	328°01.0	·· 15.1
22	341°52.3	173°50.2	34.8	127°04.7	14°00.0	227°21.9	33.2	343°03.7	15.2
23	356°54.7	188°49.8	33.7	142°05.5	00.6	242°24.1	33.1	358°06.3	15.2
Mer.pass. 23:12		ν -0.4′	d 1.1′	m -3.93	ν 0.8′	d 0.6′	m 1.57	ν 2.1′	d 0.0′ m -2.13	ν 2.6′	d 0.1′ m 0.62

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	11°57.2	203°49.4	N06°32.5	157°06.3	S14°01.1	257°26.2	N21°33.1	13°09.0	S03°15.3
1	26°59.7	218°49.0	31.4	172°07.1	01.7	272°28.4	33.0	28°11.6	15.4
2	42°02.1	233°48.6	30.2	187°08.0	02.3	287°30.5	33.0	43°14.2	15.4
3	57°04.6	248°48.1	·· 29.1	202°08.8	·· 02.9	302°32.7	·· 33.0	58°16.9	·· 15.5
4	72°07.1	263°47.7	27.9	217°09.6	03.5	317°34.8	32.9	73°19.5	15.6
5	87°09.5	278°47.3	26.8	232°10.4	04.0	332°37.0	32.9	88°22.1	15.7
6	102°12.0	293°46.9	N06°25.6	247°11.2	S14°04.6	347°39.1	N21°32.8	103°24.8	S03°15.7
7	117°14.5	308°46.5	24.5	262°12.0	05.2	2°41.3	32.8	118°27.4	15.8
8	132°16.9	323°46.1	23.3	277°12.8	05.8	17°43.4	32.7	133°30.0	15.9
9	147°19.4	338°45.7	·· 22.2	292°13.6	·· 06.4	32°45.6	·· 32.7	148°32.7	·· 16.0
10	162°21.8	353°45.3	21.0	307°14.4	06.9	47°47.7	32.7	163°35.3	16.0
11	177°24.3	8°44.8	19.9	322°15.2	07.5	62°49.9	32.6	178°38.0	16.1
12	192°26.8	23°44.4	N06°18.7	337°16.0	S14°08.1	77°52.1	N21°32.6	193°40.6	S03°16.2
13	207°29.2	38°44.0	17.6	352°16.8	08.7	92°54.2	32.5	208°43.2	16.2
14	222°31.7	53°43.6	16.4	7°17.7	09.3	107°56.4	32.5	223°45.9	16.3
15	237°34.2	68°43.2	·· 15.3	22°18.5	·· 09.8	122°58.5	·· 32.4	238°48.5	·· 16.4
16	252°36.6	83°42.8	14.1	37°19.3	10.4	138°00.7	32.4	253°51.1	16.5
17	267°39.1	98°42.4	13.0	52°20.1	11.0	153°02.8	32.4	268°53.8	16.5
18	282°41.6	113°42.0	N06°11.8	67°20.9	S14°11.6	168°05.0	N21°32.3	283°56.4	S03°16.6
19	297°44.0	128°41.6	10.6	82°21.7	12.2	183°07.2	32.3	298°59.0	16.7
20	312°46.5	143°41.1	09.5	97°22.5	12.7	198°09.3	32.2	314°01.7	16.8
21	327°49.0	158°40.7	·· 08.3	112°23.3	·· 13.3	213°11.5	·· 32.2	329°04.3	·· 16.8
22	342°51.4	173°40.3	07.2	127°24.1	13.9	228°13.6	32.1	344°06.9	16.9
23	357°53.9	188°39.9	06.0	142°24.9	14.5	243°15.8	32.1	359°09.6	17.0
Mer.pass. 23:08		ν -0.4′	d 1.1′	m -3.92	ν 0.8′	d 0.6′	m 1.56	ν 2.2′	d 0.0′ m -2.13	ν 2.6′	d 0.1′ m 0.63

Stars

	SHA	Dec
Alpheratz	357°33.8	29°14.1
Ankaa	353°06.1	-42°09.8
Schedar	349°29.8	56°40.8
Diphda	348°46.4	-17°50.6
Achernar	335°19.1	-57°06.2
Hamal	327°50.2	23°35.2
Polaris	313°21.4	89°22.2
Acamar	315°11.0	-40°11.8
Menkar	314°05.3	4°11.6
Mirfak	308°27.0	49°57.1
Aldebaran	290°38.8	16°33.7
Rigel	281°03.2	-8°10.1
Capella	280°20.8	46°01.3
Bellatrix	278°22.1	6°22.5
Elnath	278°01.0	28°37.7
Alnilam	275°37.0	-1°11.0
Betelgeuse	270°51.4	7°24.8
Canopus	263°52.1	-52°42.2
Sirius	258°25.7	-16°44.8
Adhara	255°05.4	-29°00.1
Procyon	244°50.3	5°09.7
Pollux	243°16.7	27°57.8
Avior	234°14.8	-59°35.2
Suhail	222°46.2	-43°31.9
Miaplacidus	221°38.8	-69°49.0
Alphard	217°47.4	-8°46.0
Regulus	207°34.1	11°50.6
Dubhe	193°40.8	61°36.7
Denebola	182°24.7	14°25.8
Gienah	175°43.3	-17°41.0
Acrux	173°00.2	-63°14.5
Gacrux	171°51.6	-57°15.4
Alioth	166°13.0	55°49.3
Spica	158°22.0	-11°17.7
Alkaid	152°52.0	49°11.2
Hadar	148°35.8	-60°29.9
Menkent	147°57.3	-36°29.8
Arcturus	145°47.7	19°03.0
Rigil Kent.	139°40.1	-60°56.6
Kochab	137°20.7	74°03.1
Zuben'ubi	136°55.6	-16°08.9
Alphecca	126°03.5	26°37.8
Antares	112°15.3	-26°29.4
Atria	107°09.2	-69°04.6
Sabik	102°02.2	-15°45.4
Shaula	96°09.7	-37°07.4
Rasalhague	95°58.1	12°32.6
Eltanin	90°42.0	51°29.4
Kaus Aust.	83°31.7	-34°22.4
Vega	80°32.8	38°48.7
Nunki	75°47.0	-26°15.9
Altair	61°59.3	8°56.3
Peacock	53°04.5	-56°39.3
Deneb	49°25.2	45°22.6
Enif	33°38.0	9°59.8
Al Na'ir	27°31.8	-46°50.2
Fomalhaut	15°13.5	-29°29.1
Scheat	13°44.3	28°13.5
Markab	13°29.0	15°20.8

Oct 01 Wed	SHA	Mer.pass
Venus	194°10.5	10:24
Mars	146°28.3	13:33
Jupiter	245°44.3	06:56
Saturn	1°03.5	23:12

Oct 02 Thu	SHA	Mer.pass
Venus	193°01.3	10:24
Mars	145°48.8	13:32
Jupiter	245°36.6	06:53
Saturn	1°07.6	23:08

Oct 03 Fri	SHA	Mer.pass
Venus	191°52.2	10:25
Mars	145°09.1	13:31
Jupiter	245°29.0	06:49
Saturn	1°11.8	23:03

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	182°33.7	S03°12.3	78°08.1	9.2′	S26°27.7	6.2′	55.7′
1	197°33.9	13.3	92°36.4	9.3′	26°21.5	6.3′	55.7′
2	212°34.1	14.2	107°04.6	9.3′	26°15.2	6.5′	55.7′
3	227°34.3	·· 15.2	121°32.9	9.3′	26°08.7	6.6′	55.8′
4	242°34.5	16.2	136°01.2	9.3′	26°02.1	6.7′	55.8′
5	257°34.7	17.1	150°29.6	9.4′	25°55.4	6.9′	55.8′
6	272°34.9	S03°18.1	164°58.0	9.4′	S25°48.5	7.1′	55.9′
7	287°35.1	19.1	179°26.3	9.4′	25°41.4	7.1′	55.9′
8	302°35.3	20.0	193°54.8	9.4′	25°34.3	7.3′	55.9′
9	317°35.5	·· 21.0	208°23.2	9.5′	25°27.0	7.5′	56.0′
10	332°35.7	22.0	222°51.7	9.5′	25°19.5	7.6′	56.0′
11	347°35.9	22.9	237°20.2	9.5′	25°11.9	7.7′	56.0′
12	2°36.1	S03°23.9	251°48.7	9.6′	S25°04.2	7.8′	56.0′
13	17°36.3	24.9	266°17.3	9.6′	24°56.4	8.0′	56.1′
14	32°36.5	25.8	280°45.9	9.6′	24°48.4	8.2′	56.1′
15	47°36.7	·· 26.8	295°14.5	9.7′	24°40.2	8.3′	56.1′
16	62°36.9	27.8	309°43.2	9.7′	24°31.9	8.4′	56.2′
17	77°37.1	28.8	324°11.9	9.7′	24°23.5	8.5′	56.2′
18	92°37.3	S03°29.7	338°40.6	9.8′	S24°15.0	8.7′	56.3′
19	107°37.5	30.7	353°09.3	9.8′	24°06.3	8.8′	56.3′
20	122°37.7	31.7	7°38.1	9.8′	23°57.5	8.9′	56.3′
21	137°37.9	·· 32.6	22°06.9	9.9′	23°48.6	9.1′	56.4′
22	152°38.1	33.6	36°35.8	9.9′	23°39.5	9.2′	56.4′
23	167°38.3	34.6	51°04.7	9.9′	23°30.3	9.4′	56.4′
	SD = 16.0′	d = 1.0′	SD = 15.2′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	182°38.5	S03°35.5	65°33.6	10.0′	S23°20.9	9.5′	56.5′
1	197°38.7	36.5	80°02.6	10.0′	23°11.4	9.6′	56.5′
2	212°38.9	37.5	94°31.6	10.0′	23°01.8	9.7′	56.5′
3	227°39.1	·· 38.4	109°00.6	10.1′	22°52.1	9.9′	56.6′
4	242°39.3	39.4	123°29.7	10.1′	22°42.2	10.0′	56.6′
5	257°39.5	40.4	137°58.8	10.1′	22°32.2	10.1′	56.6′
6	272°39.7	S03°41.3	152°27.9	10.2′	S22°22.1	10.2′	56.7′
7	287°39.9	42.3	166°57.1	10.2′	22°11.9	10.4′	56.7′
8	302°40.1	43.3	181°26.3	10.3′	22°01.5	10.5′	56.7′
9	317°40.3	·· 44.2	195°55.6	10.3′	21°51.0	10.6′	56.8′
10	332°40.5	45.2	210°24.9	10.3′	21°40.4	10.8′	56.8′
11	347°40.7	46.2	224°54.2	10.4′	21°29.6	10.9′	56.9′
12	2°40.9	S03°47.1	239°23.5	10.4′	S21°18.7	11.0′	56.9′
13	17°41.1	48.1	253°52.9	10.4′	21°07.7	11.1′	56.9′
14	32°41.3	49.1	268°22.4	10.5′	20°56.6	11.2′	57.0′
15	47°41.5	·· 50.0	282°51.8	10.5′	20°45.4	11.4′	57.0′
16	62°41.7	51.0	297°21.4	10.5′	20°34.0	11.5′	57.0′
17	77°41.9	52.0	311°50.9	10.6′	20°22.5	11.6′	57.1′
18	92°42.1	S03°52.9	326°20.5	10.6′	S20°10.9	11.7′	57.1′
19	107°42.3	53.9	340°50.1	10.6′	19°59.2	11.8′	57.2′
20	122°42.5	54.9	355°19.7	10.7′	19°47.4	12.0′	57.2′
21	137°42.7	·· 55.8	9°49.4	10.7′	19°35.4	12.0′	57.2′
22	152°42.9	56.8	24°19.1	10.8′	19°23.4	12.2′	57.3′
23	167°43.1	57.8	38°48.9	10.8′	19°11.2	12.3′	57.3′
	SD = 16.0′	d = 1.0′	SD = 15.4′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	182°43.3	S03°58.7	53°18.7	10.8′	S18°58.9	12.4′	57.4′
1	197°43.5	03°59.7	67°48.5	10.9′	18°46.5	12.5′	57.4′
2	212°43.7	04°00.7	82°18.4	10.9′	18°34.0	12.7′	57.4′
3	227°43.9	·· 01.6	96°48.3	10.9′	18°21.3	12.7′	57.5′
4	242°44.1	02.6	111°18.2	11.0′	18°08.6	12.8′	57.5′
5	257°44.3	03.6	125°48.1	11.0′	17°55.8	13.0′	57.5′
6	272°44.5	S04°04.5	140°18.1	11.0′	S17°42.8	13.1′	57.6′
7	287°44.7	05.5	154°48.2	11.1′	17°29.7	13.1′	57.6′
8	302°44.9	06.4	169°18.2	11.1′	17°16.6	13.3′	57.7′
9	317°45.1	·· 07.4	183°48.3	11.1′	17°03.3	13.4′	57.7′
10	332°45.2	08.4	198°18.4	11.1′	16°49.9	13.5′	57.7′
11	347°45.4	09.3	212°48.6	11.2′	16°36.4	13.6′	57.8′
12	2°45.6	S04°10.3	227°18.8	11.2′	S16°22.8	13.6′	57.8′
13	17°45.8	11.3	241°49.0	11.2′	16°09.2	13.8′	57.9′
14	32°46.0	12.2	256°19.2	11.3′	15°55.4	13.9′	57.9′
15	47°46.2	·· 13.2	270°49.5	11.3′	15°41.5	14.0′	57.9′
16	62°46.4	14.2	285°19.8	11.3′	15°27.5	14.1′	58.0′
17	77°46.6	15.1	299°50.1	11.3′	15°13.4	14.2′	58.0′
18	92°46.8	S04°16.1	314°20.4	11.4′	S14°59.2	14.2′	58.1′
19	107°47.0	17.1	328°50.8	11.4′	14°45.0	14.4′	58.1′
20	122°47.2	18.0	343°21.2	11.4′	14°30.6	14.5′	58.1′
21	137°47.4	·· 19.0	357°51.6	11.4′	14°16.1	14.5′	58.2′
22	152°47.6	19.9	12°22.0	11.5′	14°01.6	14.7′	58.2′
23	167°47.8	20.9	26°52.5	11.5′	13°46.9	14.7′	58.2′
	SD = 16.0′	d = 1.0′	SD = 15.6′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	03:55	05:17	06:24	17:12	18:19	19:40
N 70°	04:07	05:20	06:20	17:16	18:17	19:29
68°	04:16	05:22	06:17	17:20	18:15	19:20
66°	04:23	05:23	06:14	17:22	18:13	19:13
64°	04:29	05:25	06:12	17:25	18:12	19:08
62°	04:34	05:26	06:10	17:27	18:11	19:03
60°	04:38	05:27	06:08	17:29	18:10	18:59
N 58°	04:42	05:28	06:07	17:31	18:10	18:55
56°	04:45	05:28	06:05	17:32	18:09	18:52
54°	04:48	05:29	06:04	17:33	18:09	18:50
52°	04:50	05:29	06:03	17:35	18:08	18:47
50°	04:52	05:30	06:02	17:36	18:08	18:45
45°	04:56	05:30	05:59	17:38	18:08	18:42
N 40°	04:59	05:30	05:57	17:41	18:07	18:39
35°	05:01	05:30	05:56	17:42	18:08	18:37
30°	05:02	05:30	05:54	17:44	18:08	18:36
20°	05:04	05:29	05:51	17:47	18:09	18:35
N 10°	05:03	05:28	05:49	17:50	18:11	18:35
0°	05:01	05:25	05:46	17:53	18:13	18:37
S 10°	04:58	05:22	05:43	17:55	18:16	18:41
20°	04:53	05:18	05:40	17:58	18:20	18:46
30°	04:45	05:13	05:37	18:02	18:26	18:54
35°	04:40	05:10	05:35	18:04	18:30	19:00
40°	04:33	05:05	05:33	18:07	18:34	19:06
45°	04:25	05:00	05:30	18:09	18:39	19:14
S 50°	04:15	04:54	05:27	18:13	18:46	19:25
52°	04:10	04:51	05:25	18:15	18:49	19:30
54°	04:04	04:48	05:23	18:16	18:52	19:36
56°	03:58	04:44	05:21	18:18	18:56	19:42
58°	03:51	04:40	05:19	18:20	19:01	19:50
S 60°	03:42	04:35	05:17	18:23	19:06	19:59

Lat.	**Moonrise** Wed	Thu	Fri	**Moonset** Wed	Thu	Fri
N 72°	▬	▬	18:45	▬	▬	▬
N 70°	▬	19:58	18:14	▬	21:01	·· ··
68°	▬	18:38	17:51	▬	22:20	·· ··
66°	▬	18:00	17:33	▬	22:57	·· ··
64°	17:58	17:32	17:18	21:11	23:23	·· ··
62°	17:19	17:11	17:05	21:49	23:43	·· ··
60°	16:52	16:54	16:54	22:16	23:59	·· ··
N 58°	16:30	16:40	16:45	22:36	·· ··	00:13
56°	16:13	16:27	16:37	22:54	·· ··	00:24
54°	15:58	16:16	16:29	23:08	·· ··	00:35
52°	15:45	16:06	16:23	23:20	·· ··	00:44
50°	15:33	15:58	16:17	23:32	·· ··	00:52
45°	15:09	15:39	16:04	23:54	·· ··	01:09
N 40°	14:50	15:24	15:53	·· ··	00:13	01:23
35°	14:34	15:11	15:44	·· ··	00:28	01:35
30°	14:20	15:00	15:36	·· ··	00:41	01:45
20°	13:56	14:40	15:21	00:05	01:04	02:02
N 10°	13:35	14:23	15:09	00:28	01:23	02:17
0°	13:16	14:07	14:57	00:49	01:41	02:31
S 10°	12:56	13:51	14:45	01:09	01:59	02:45
20°	12:35	13:34	14:33	01:32	02:17	03:00
30°	12:11	13:14	14:18	01:57	02:39	03:17
35°	11:57	13:02	14:10	02:12	02:52	03:26
40°	11:40	12:49	14:00	02:30	03:06	03:37
45°	11:20	12:33	13:49	02:50	03:23	03:50
S 50°	10:55	12:13	13:35	03:16	03:44	04:06
52°	10:43	12:04	13:28	03:29	03:54	04:13
54°	10:29	11:53	13:21	03:44	04:06	04:21
56°	10:12	11:41	13:13	04:00	04:18	04:30
58°	09:53	11:27	13:04	04:20	04:33	04:40
S 60°	09:28	11:10	12:53	04:46	04:50	04:52

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 10-12 60-79%
01	10:15	10:25	11:50	19:28	07:02	
02	10:34	10:44	11:49	20:19	07:54	
03	10:53	11:03	11:49	21:09	08:44	

October 04, 05, 06 UT (Sat., Sun., Mon.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	12°56.3	203°39.5	N06°04.9	157°25.7	S14°15.1	258°17.9	N21°32.1	14°12.2	S03°17.0
1	27°58.8	218°39.1	03.7	172°26.5	15.6	273°20.1	32.0	29°14.8	17.1
2	43°01.3	233°38.7	02.6	187°27.3	16.2	288°22.3	32.0	44°17.5	17.2
3	58°03.7	248°38.3	·· 01.4	202°28.1	·· 16.8	303°24.4	·· 31.9	59°20.1	·· 17.3
4	73°06.2	263°37.9	06°00.2	217°28.9	17.4	318°26.6	31.9	74°22.7	17.3
5	88°08.7	278°37.5	05°59.1	232°29.7	18.0	333°28.7	31.8	89°25.4	17.4
6	103°11.1	293°37.1	N05°57.9	247°30.5	S14°18.5	348°30.9	N21°31.8	104°28.0	S03°17.5
7	118°13.6	308°36.6	56.8	262°31.3	19.1	3°33.1	31.8	119°30.7	17.6
8	133°16.1	323°36.2	55.6	277°32.1	19.7	18°35.2	31.7	134°33.3	17.6
9	148°18.5	338°35.8	·· 54.4	292°32.9	·· 20.3	33°37.4	·· 31.7	149°35.9	·· 17.7
10	163°21.0	353°35.4	53.3	307°33.7	20.8	48°39.5	31.6	164°38.6	17.8
11	178°23.4	8°35.0	52.1	322°34.5	21.4	63°41.7	31.6	179°41.2	17.8
12	193°25.9	23°34.6	N05°51.0	337°35.3	S14°22.0	78°43.9	N21°31.5	194°43.8	S03°17.9
13	208°28.4	38°34.2	49.8	352°36.1	22.6	93°46.0	31.5	209°46.5	18.0
14	223°30.8	53°33.8	48.6	7°36.9	23.1	108°48.2	31.5	224°49.1	18.1
15	238°33.3	68°33.4	·· 47.5	22°37.7	·· 23.7	123°50.4	·· 31.4	239°51.7	·· 18.1
16	253°35.8	83°33.0	46.3	37°38.5	24.3	138°52.5	31.4	254°54.4	18.2
17	268°38.2	98°32.6	45.1	52°39.3	24.9	153°54.7	31.3	269°57.0	18.3
18	283°40.7	113°32.2	N05°44.0	67°40.1	S14°25.4	168°56.8	N21°31.3	284°59.6	S03°18.4
19	298°43.2	128°31.7	42.8	82°40.9	26.0	183°59.0	31.2	300°02.3	18.4
20	313°45.6	143°31.3	41.7	97°41.7	26.6	199°01.2	31.2	315°04.9	18.5
21	328°48.1	158°30.9	·· 40.5	112°42.5	·· 27.2	214°03.3	·· 31.2	330°07.5	·· 18.6
22	343°50.6	173°30.5	39.3	127°43.3	27.7	229°05.5	31.1	345°10.2	18.6
23	358°53.0	188°30.1	38.2	142°44.1	28.3	244°07.7	31.1	0°12.8	18.7
Mer.pass. 23:04		ν -0.4′	d 1.2′	m -3.92	ν 0.8′	d 0.6′	m 1.56	ν 2.2′	d 0.0′ m -2.14	ν 2.6′	d 0.1′ m 0.63

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	13°55.5	203°29.7	N05°37.0	157°44.9	S14°28.9	259°09.8	N21°31.0	15°15.4	S03°18.8
1	28°57.9	218°29.3	35.8	172°45.7	29.5	274°12.0	31.0	30°18.1	18.9
2	44°00.4	233°28.9	34.7	187°46.5	30.0	289°14.2	31.0	45°20.7	18.9
3	59°02.9	248°28.5	·· 33.5	202°47.3	·· 30.6	304°16.3	·· 30.9	60°23.3	·· 19.0
4	74°05.3	263°28.1	32.3	217°48.1	31.2	319°18.5	30.9	75°26.0	19.1
5	89°07.8	278°27.7	31.2	232°48.9	31.8	334°20.7	30.8	90°28.6	19.1
6	104°10.3	293°27.3	N05°30.0	247°49.7	S14°32.3	349°22.8	N21°30.8	105°31.2	S03°19.2
7	119°12.7	308°26.9	28.8	262°50.5	32.9	4°25.0	30.7	120°33.9	19.3
8	134°15.2	323°26.5	27.7	277°51.3	33.5	19°27.2	30.7	135°36.5	19.4
9	149°17.7	338°26.1	·· 26.5	292°52.1	·· 34.1	34°29.3	·· 30.7	150°39.1	·· 19.4
10	164°20.1	353°25.7	25.3	307°52.9	34.6	49°31.5	30.6	165°41.8	19.5
11	179°22.6	8°25.3	24.2	322°53.7	35.2	64°33.7	30.6	180°44.4	19.6
12	194°25.0	23°24.9	N05°23.0	337°54.5	S14°35.8	79°35.8	N21°30.5	195°47.0	S03°19.6
13	209°27.5	38°24.4	21.8	352°55.3	36.4	94°38.0	30.5	210°49.7	19.7
14	224°30.0	53°24.0	20.7	7°56.1	36.9	109°40.2	30.5	225°52.3	19.8
15	239°32.4	68°23.6	·· 19.5	22°56.9	·· 37.5	124°42.4	·· 30.4	240°54.9	·· 19.9
16	254°34.9	83°23.2	18.3	37°57.7	38.1	139°44.5	30.4	255°57.6	19.9
17	269°37.4	98°22.8	17.1	52°58.5	38.6	154°46.7	30.3	271°00.2	20.0
18	284°39.8	113°22.4	N05°16.0	67°59.2	S14°39.2	169°48.9	N21°30.3	286°02.8	S03°20.1
19	299°42.3	128°22.0	14.8	83°00.0	39.8	184°51.0	30.2	301°05.5	20.1
20	314°44.8	143°21.6	13.6	98°00.8	40.4	199°53.2	30.2	316°08.1	20.2
21	329°47.2	158°21.2	·· 12.5	113°01.6	·· 40.9	214°55.4	·· 30.2	331°10.7	·· 20.3
22	344°49.7	173°20.8	11.3	128°02.4	41.5	229°57.5	30.1	346°13.4	20.4
23	359°52.2	188°20.4	10.1	143°03.2	42.1	244°59.7	30.1	1°16.0	20.4
Mer.pass. 23:01		ν -0.4′	d 1.2′	m -3.92	ν 0.8′	d 0.6′	m 1.56	ν 2.2′	d 0.0′ m -2.15	ν 2.6′	d 0.1′ m 0.63

Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	14°54.6	203°20.0	N05°08.9	158°04.0	S14°42.6	260°01.9	N21°30.0	16°18.6	S03°20.5
1	29°57.1	218°19.6	07.8	173°04.8	43.2	275°04.1	30.0	31°21.3	20.6
2	44°59.5	233°19.2	06.6	188°05.6	43.8	290°06.2	30.0	46°23.9	20.6
3	60°02.0	248°18.8	·· 05.4	203°06.4	·· 44.3	305°08.4	·· 29.9	61°26.5	·· 20.7
4	75°04.5	263°18.4	04.3	218°07.2	44.9	320°10.6	29.9	76°29.2	20.8
5	90°06.9	278°18.0	03.1	233°08.0	45.5	335°12.8	29.8	91°31.8	20.9
6	105°09.4	293°17.6	N05°01.9	248°08.8	S14°46.1	350°14.9	N21°29.8	106°34.4	S03°20.9
7	120°11.9	308°17.2	05°00.7	263°09.5	46.6	5°17.1	29.8	121°37.1	21.0
8	135°14.3	323°16.8	04°59.6	278°10.3	47.2	20°19.3	29.7	136°39.7	21.1
9	150°16.8	338°16.4	·· 58.4	293°11.1	·· 47.8	35°21.5	·· 29.7	151°42.3	·· 21.1
10	165°19.3	353°16.0	57.2	308°11.9	48.3	50°23.6	29.6	166°45.0	21.2
11	180°21.7	8°15.6	56.0	323°12.7	48.9	65°25.8	29.6	181°47.6	21.3
12	195°24.2	23°15.2	N04°54.9	338°13.5	S14°49.5	80°28.0	N21°29.6	196°50.2	S03°21.3
13	210°26.7	38°14.8	53.7	353°14.3	50.0	95°30.2	29.5	211°52.8	21.4
14	225°29.1	53°14.4	52.5	8°15.1	50.6	110°32.3	29.5	226°55.5	21.5
15	240°31.6	68°14.0	·· 51.3	23°15.9	·· 51.2	125°34.5	·· 29.4	241°58.1	·· 21.6
16	255°34.0	83°13.6	50.2	38°16.6	51.7	140°36.7	29.4	257°00.7	21.6
17	270°36.5	98°13.2	49.0	53°17.4	52.3	155°38.9	29.3	272°03.4	21.7
18	285°39.0	113°12.8	N04°47.8	68°18.2	S14°52.9	170°41.0	N21°29.3	287°06.0	S03°21.8
19	300°41.4	128°12.4	46.6	83°19.0	53.4	185°43.2	29.3	302°08.6	21.8
20	315°43.9	143°12.0	45.4	98°19.8	54.0	200°45.4	29.2	317°11.3	21.9
21	330°46.4	158°11.6	·· 44.3	113°20.6	·· 54.6	215°47.6	·· 29.2	332°13.9	·· 22.0
22	345°48.8	173°11.2	43.1	128°21.4	55.1	230°49.7	29.1	347°16.5	22.1
23	0°51.3	188°10.8	41.9	143°22.2	55.7	245°51.9	29.1	2°19.2	22.1
Mer.pass. 22:57		ν -0.4′	d 1.2′	m -3.92	ν 0.8′	d 0.6′	m 1.56	ν 2.2′	d 0.0′ m -2.15	ν 2.6′	d 0.1′ m 0.64

Stars

	SHA	Dec
Alpheratz	357°33.8	29°14.1
Ankaa	353°06.1	-42°09.9
Schedar	349°29.8	56°40.8
Diphda	348°46.4	-17°50.6
Achernar	335°19.1	-57°06.2
Hamal	327°50.2	23°35.2
Polaris	313°20.5	89°22.2
Acamar	315°10.9	-40°11.8
Menkar	314°05.3	4°11.6
Mirfak	308°27.0	49°57.1
Aldebaran	290°38.7	16°33.7
Rigel	281°03.2	-8°10.1
Capella	280°20.8	46°01.3
Bellatrix	278°22.1	6°22.5
Elnath	278°01.0	28°37.7
Alnilam	275°37.0	-1°11.0
Betelgeuse	270°51.4	7°24.8
Canopus	263°52.1	-52°42.2
Sirius	258°25.7	-16°44.8
Adhara	255°05.4	-29°00.1
Procyon	244°50.3	5°09.7
Pollux	243°16.7	27°57.8
Avior	234°14.8	-59°35.1
Suhail	222°46.1	-43°31.9
Miaplacidus	221°38.7	-69°49.0
Alphard	217°47.4	-8°46.0
Regulus	207°34.0	11°50.6
Dubhe	193°40.8	61°36.6
Denebola	182°24.6	14°25.8
Gienah	175°43.3	-17°41.0
Acrux	173°00.2	-63°14.4
Gacrux	171°51.6	-57°15.4
Alioth	166°13.0	55°49.2
Spica	158°22.0	-11°17.7
Alkaid	152°52.0	49°11.2
Hadar	148°35.8	-60°29.9
Menkent	147°57.3	-36°29.8
Arcturus	145°47.7	19°03.0
Rigil Kent.	139°40.1	-60°56.6
Kochab	137°20.7	74°03.1
Zuben'ubi	136°55.6	-16°08.9
Alphecca	126°03.5	26°37.8
Antares	112°15.3	-26°29.4
Atria	107°09.2	-69°04.6
Sabik	102°02.2	-15°45.4
Shaula	96°09.7	-37°07.4
Rasalhague	95°58.1	12°32.6
Eltanin	90°42.0	51°29.4
Kaus Aust.	83°31.8	-34°22.4
Vega	80°32.9	38°48.7
Nunki	75°47.0	-26°15.9
Altair	61°59.3	8°56.3
Peacock	53°04.5	-56°39.3
Deneb	49°25.2	45°22.6
Enif	33°38.0	9°59.8
Al Na'ir	27°31.8	-46°50.2
Fomalhaut	15°13.5	-29°29.1
Scheat	13°44.3	28°13.5
Markab	13°29.0	15°20.8

Oct 04 Sat	SHA	Mer.pass
Venus	190°43.2	10:26
Mars	144°29.4	13:30
Jupiter	245°21.6	06:46
Saturn	1°15.9	22:59

Oct 05 Sun	SHA	Mer.pass
Venus	189°34.2	10:26
Mars	143°49.4	13:28
Jupiter	245°14.4	06:42
Saturn	1°20.0	22:55

Oct 06 Mon	SHA	Mer.pass
Venus	188°25.4	10:27
Mars	143°09.4	13:27
Jupiter	245°07.3	06:39
Saturn	1°24.0	22:51

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h

Sat	Sun GHA	Sun Dec	Moon GHA	Moon ν	Moon Dec	Moon d	Moon HP
0	182°48.0	S04°21.9	41°23.0	11.5′	S13°32.2	14.8′	58.3′
1	197°48.2	22.8	55°53.5	11.5′	13°17.4	14.9′	58.3′
2	212°48.3	23.8	70°24.0	11.6′	13°02.5	15.0′	58.4′
3	227°48.5	·· 24.8	84°54.6	11.6′	12°47.5	15.1′	58.4′
4	242°48.7	25.7	99°25.2	11.6′	12°32.4	15.1′	58.4′
5	257°48.9	26.7	113°55.8	11.6′	12°17.3	15.3′	58.5′
6	272°49.1	S04°27.7	128°26.4	11.6′	S12°02.0	15.3′	58.5′
7	287°49.3	28.6	142°57.0	11.6′	11°46.7	15.4′	58.6′
8	302°49.5	29.6	157°27.6	11.7′	11°31.3	15.5′	58.6′
9	317°49.7	·· 30.5	171°58.3	11.7′	11°15.8	15.5′	58.6′
10	332°49.9	31.5	186°28.9	11.7′	11°00.3	15.7′	58.7′
11	347°50.1	32.5	200°59.6	11.7′	10°44.6	15.7′	58.7′
12	2°50.3	S04°33.4	215°30.3	11.7′	S10°28.9	15.8′	58.7′
13	17°50.5	34.4	230°01.0	11.7′	10°13.1	15.8′	58.8′
14	32°50.7	35.4	244°31.7	11.7′	09°57.3	16.0′	58.8′
15	47°50.8	·· 36.3	259°02.4	11.7′	09°41.3	16.0′	58.9′
16	62°51.0	37.3	273°33.2	11.7′	09°25.3	16.0′	58.9′
17	77°51.2	38.2	288°03.9	11.7′	09°09.3	16.1′	58.9′
18	92°51.4	S04°39.2	302°34.6	11.7′	S08°53.2	16.2′	59.0′
19	107°51.6	40.2	317°05.4	11.8′	08°37.0	16.3′	59.0′
20	122°51.8	41.1	331°36.1	11.8′	08°20.7	16.3′	59.0′
21	137°52.0	·· 42.1	346°06.9	11.8′	08°04.4	16.4′	59.1′
22	152°52.2	43.0	0°37.6	11.8′	07°48.0	16.5′	59.1′
23	167°52.4	44.0	15°08.4	11.8′	07°31.5	16.5′	59.1′
	SD = 16.0′	d = 1.0′	SD = 15.9′				

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	182°52.6	S04°45.0	29°39.2	11.8′	S07°15.0	16.5′	59.2′
1	197°52.7	45.9	44°09.9	11.8′	06°58.5	16.7′	59.2′
2	212°52.9	46.9	58°40.7	11.8′	06°41.8	16.6′	59.2′
3	227°53.1	·· 47.9	73°11.4	11.7′	06°25.2	16.7′	59.3′
4	242°53.3	48.8	87°42.2	11.7′	06°08.5	16.8′	59.3′
5	257°53.5	49.8	102°12.9	11.7′	05°51.7	16.9′	59.4′
6	272°53.7	S04°50.7	116°43.6	11.7′	S05°34.8	16.8′	59.4′
7	287°53.9	51.7	131°14.4	11.7′	05°18.0	16.9′	59.4′
8	302°54.1	52.7	145°45.1	11.7′	05°01.1	17.0′	59.5′
9	317°54.3	·· 53.6	160°15.8	11.7′	04°44.1	17.0′	59.5′
10	332°54.4	54.6	174°46.5	11.7′	04°27.1	17.1′	59.5′
11	347°54.6	55.5	189°17.2	11.7′	04°10.0	17.1′	59.6′
12	2°54.8	S04°56.5	203°47.8	11.7′	S03°52.9	17.1′	59.6′
13	17°55.0	57.5	218°18.5	11.6′	03°35.8	17.2′	59.6′
14	32°55.2	58.4	232°49.1	11.6′	03°18.6	17.2′	59.6′
15	47°55.4	04°59.4	247°19.7	11.6′	03°01.4	17.2′	59.7′
16	62°55.6	05°00.3	261°50.4	11.6′	02°44.2	17.3′	59.7′
17	77°55.7	01.3	276°20.9	11.6′	02°26.9	17.3′	59.7′
18	92°55.9	S05°02.3	290°51.5	11.5′	S02°09.6	17.3′	59.8′
19	107°56.1	03.2	305°22.0	11.5′	01°52.3	17.4′	59.8′
20	122°56.3	04.2	319°52.6	11.5′	01°34.9	17.4′	59.8′
21	137°56.5	·· 05.1	334°23.1	11.5′	01°17.5	17.4′	59.9′
22	152°56.7	06.1	348°53.5	11.4′	01°00.1	17.4′	59.9′
23	167°56.9	07.0	3°24.0	11.4′	00°42.7	17.5′	59.9′
	SD = 16.0′	d = 1.0′	SD = 16.1′				

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	182°57.1	S05°08.0	17°54.4	11.4′	S00°25.2	17.5′	60.0′
1	197°57.2	09.0	32°24.8	11.4′	S00°07.7	17.5′	60.0′
2	212°57.4	09.9	46°55.1	11.3′	N00°09.8	17.5′	60.0′
3	227°57.6	·· 10.9	61°25.4	11.3′	00°27.3	17.5′	60.0′
4	242°57.8	11.8	75°55.7	11.3′	00°44.8	17.5′	60.1′
5	257°58.0	12.8	90°26.0	11.2′	01°02.3	17.6′	60.1′
6	272°58.2	S05°13.8	104°56.2	11.2′	N01°19.9	17.5′	60.1′
7	287°58.3	14.7	119°26.4	11.1′	01°37.4	17.6′	60.1′
8	302°58.5	15.7	133°56.5	11.1′	01°55.0	17.6′	60.2′
9	317°58.7	·· 16.6	148°26.6	11.1′	02°12.6	17.5′	60.2′
10	332°58.9	17.6	162°56.7	11.0′	02°30.1	17.6′	60.2′
11	347°59.1	18.5	177°26.7	11.0′	02°47.7	17.6′	60.2′
12	2°59.3	S05°19.5	191°56.7	10.9′	N03°05.3	17.5′	60.3′
13	17°59.4	20.5	206°26.6	10.9′	03°22.8	17.6′	60.3′
14	32°59.6	21.4	220°56.5	10.8′	03°40.4	17.6′	60.3′
15	47°59.8	·· 22.4	235°26.3	10.8′	03°58.0	17.5′	60.3′
16	63°00.0	23.3	249°56.1	10.7′	04°15.5	17.5′	60.4′
17	78°00.2	24.3	264°25.9	10.7′	04°33.0	17.6′	60.4′
18	93°00.4	S05°25.2	278°55.6	10.6′	N04°50.6	17.5′	60.4′
19	108°00.5	26.2	293°25.2	10.6′	05°08.1	17.5′	60.4′
20	123°00.7	27.2	307°54.8	10.5′	05°25.6	17.5′	60.4′
21	138°00.9	·· 28.1	322°24.3	10.5′	05°43.1	17.4′	60.5′
22	153°01.1	29.1	336°53.8	10.4′	06°00.5	17.5′	60.5′
23	168°01.3	30.0	351°23.2	10.4′	06°18.0	17.4′	60.5′
	SD = 16.0′	d = 1.0′	SD = 16.4′				

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	04:10	05:30	06:38	16:57	18:04	19:23
N 70°	04:20	05:31	06:32	17:02	18:03	19:14
68°	04:27	05:32	06:28	17:07	18:02	19:07
66°	04:33	05:33	06:24	17:11	18:02	19:02
64°	04:38	05:33	06:21	17:14	18:02	18:57
62°	04:42	05:34	06:18	17:17	18:01	18:53
60°	04:46	05:34	06:15	17:20	18:01	18:50
N 58°	04:49	05:34	06:13	17:22	18:01	18:47
56°	04:51	05:34	06:11	17:24	18:01	18:44
54°	04:53	05:34	06:10	17:26	18:01	18:42
52°	04:55	05:34	06:08	17:28	18:01	18:40
50°	04:57	05:34	06:06	17:29	18:02	18:39
45°	05:00	05:34	06:03	17:33	18:02	18:36
N 40°	05:02	05:33	06:00	17:36	18:03	18:34
35°	05:03	05:33	05:58	17:38	18:03	18:33
30°	05:04	05:32	05:56	17:40	18:04	18:32
20°	05:04	05:30	05:52	17:44	18:07	18:32
N 10°	05:03	05:27	05:48	17:48	18:09	18:34
0°	05:00	05:24	05:45	17:52	18:12	18:36
S 10°	04:56	05:21	05:42	17:55	18:16	18:41
20°	04:50	05:16	05:38	17:59	18:21	18:47
30°	04:41	05:09	05:33	18:04	18:28	18:56
35°	04:35	05:05	05:31	18:07	18:32	19:02
40°	04:28	05:00	05:28	18:10	18:37	19:09
45°	04:19	04:55	05:24	18:13	18:43	19:18
S 50°	04:08	04:47	05:20	18:18	18:51	19:30
52°	04:02	04:44	05:18	18:20	18:54	19:36
54°	03:56	04:40	05:16	18:22	18:58	19:42
56°	03:49	04:36	05:14	18:24	19:03	19:49
58°	03:41	04:31	05:11	18:27	19:08	19:58
S 60°	03:31	04:25	05:08	18:30	19:13	20:08

Lat.	Moonrise Sat	Moonrise Sun	Moonrise Mon	Moonset Sat	Moonset Sun	Moonset Mon
N 72°	17:47	17:07	16:29	00:01	02:42	05:10
N 70°	17:34	17:03	16:34	00:29	02:53	05:09
68°	17:23	17:01	16:39	00:51	03:01	05:07
66°	17:14	16:58	16:43	01:07	03:08	05:07
64°	17:06	16:56	16:46	01:21	03:13	05:06
62°	17:00	16:54	16:49	01:32	03:18	05:05
60°	16:54	16:53	16:52	01:41	03:23	05:04
N 58°	16:49	16:51	16:54	01:50	03:26	05:04
56°	16:44	16:50	16:56	01:57	03:30	05:04
54°	16:40	16:49	16:58	02:03	03:32	05:03
52°	16:36	16:48	17:00	02:09	03:35	05:03
50°	16:33	16:47	17:02	02:14	03:38	05:02
45°	16:25	16:45	17:05	02:25	03:43	05:02
N 40°	16:19	16:43	17:08	02:34	03:47	05:01
35°	16:13	16:42	17:11	02:42	03:51	05:00
30°	16:09	16:41	17:13	02:49	03:54	05:00
20°	16:00	16:38	17:17	03:01	04:00	04:59
N 10°	15:53	16:36	17:20	03:11	04:04	04:58
0°	15:46	16:34	17:24	03:20	04:09	04:58
S 10°	15:39	16:33	17:27	03:30	04:13	04:57
20°	15:31	16:31	17:31	03:40	04:18	04:56
30°	15:23	16:28	17:35	03:51	04:23	04:55
35°	15:18	16:27	17:38	03:57	04:26	04:54
40°	15:12	16:26	17:40	04:05	04:30	04:54
45°	15:06	16:24	17:44	04:13	04:33	04:53
S 50°	14:58	16:22	17:48	04:23	04:38	04:52
52°	14:54	16:21	17:50	04:28	04:40	04:52
54°	14:50	16:20	17:52	04:33	04:42	04:51
56°	14:45	16:19	17:54	04:38	04:45	04:51
58°	14:40	16:17	17:56	04:45	04:48	04:50
S 60°	14:35	16:16	17:59	04:52	04:51	04:50

Day	Sun Eqn.of Time 00h	Sun Eqn.of Time 12h	Sun Mer. Pass	Moon Mer.Pass. Upper	Moon Mer.Pass. Lower	Moon Age 13-15 / 87-98%
	mm:ss	mm:ss	hh:mm	hh:mm	hh:mm	
04	11:12	11:21	11:49	21:57	09:33	
05	11:30	11:39	11:48	22:46	10:22	
06	11:48	11:57	11:48	23:36	11:11	

October 07, 08, 09 UT (Tue., Wed., Thu.)

	Aries	Venus		Mars		Jupiter		Saturn	
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	15°53.8	203°10.4	N04°40.7	158°22.9	S14°56.3	260°54.1	N21°29.1	17°21.8	S03°22.2
1	30°56.2	218°10.0	39.6	173°23.7	56.8	275°56.3	29.0	32°24.4	22.3
2	45°58.7	233°09.6	38.4	188°24.5	57.4	290°58.5	29.0	47°27.1	22.3
3	61°01.1	248°09.2	·· 37.2	203°25.3	·· 58.0	306°00.6	·· 28.9	62°29.7	·· 22.4
4	76°03.6	263°08.8	36.0	218°26.1	58.5	321°02.8	28.9	77°32.3	22.5
5	91°06.1	278°08.4	34.8	233°26.9	59.1	336°05.0	28.9	92°35.0	22.5
6	106°08.5	293°08.0	N04°33.7	248°27.7	S14°59.7	351°07.2	N21°28.8	107°37.6	S03°22.6
7	121°11.0	308°07.6	32.5	263°28.4	15°00.2	6°09.4	28.8	122°40.2	22.7
8	136°13.5	323°07.2	31.3	278°29.2	00.8	21°11.5	28.7	137°42.8	22.8
9	151°15.9	338°06.8	·· 30.1	293°30.0	·· 01.4	36°13.7	·· 28.7	152°45.5	·· 22.8
10	166°18.4	353°06.4	28.9	308°30.8	01.9	51°15.9	28.7	167°48.1	22.9
11	181°20.9	8°06.0	27.7	323°31.6	02.5	66°18.1	28.6	182°50.7	23.0
12	196°23.3	23°05.6	N04°26.6	338°32.4	S15°03.1	81°20.3	N21°28.6	197°53.4	S03°23.0
13	211°25.8	38°05.2	25.4	353°33.1	03.6	96°22.5	28.5	212°56.0	23.1
14	226°28.3	53°04.8	24.2	8°33.9	04.2	111°24.6	28.5	227°58.6	23.2
15	241°30.7	68°04.4	·· 23.0	23°34.7	·· 04.8	126°26.8	·· 28.5	243°01.3	·· 23.2
16	256°33.2	83°04.0	21.8	38°35.5	05.3	141°29.0	28.4	258°03.9	23.3
17	271°35.6	98°03.6	20.6	53°36.3	05.9	156°31.2	28.4	273°06.5	23.4
18	286°38.1	113°03.2	N04°19.5	68°37.0	S15°06.5	171°33.4	N21°28.3	288°09.1	S03°23.5
19	301°40.6	128°02.8	18.3	83°37.8	07.0	186°35.6	28.3	303°11.8	23.5
20	316°43.0	143°02.4	17.1	98°38.6	07.6	201°37.7	28.3	318°14.4	23.6
21	331°45.5	158°02.0	·· 15.9	113°39.4	·· 08.1	216°39.9	·· 28.2	333°17.0	·· 23.7
22	346°48.0	173°01.6	14.7	128°40.2	08.7	231°42.1	28.2	348°19.7	23.7
23	1°50.4	188°01.2	13.5	143°41.0	09.3	246°44.3	28.2	3°22.3	23.8
Mer.pass. 22:53		ν -0.4′	d 1.2′	m -3.92	ν 0.8′	d 0.6′	m 1.55	ν 2.2′	d 0.0′ m -2.16	ν 2.6′	d 0.1′ m 0.64

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	16°52.9	203°00.8	N04°12.4	158°41.7	S15°09.8	261°46.5	N21°28.1	18°24.9	S03°23.9
1	31°55.4	218°00.4	11.2	173°42.5	10.4	276°48.7	28.1	33°27.6	23.9
2	46°57.8	233°00.0	10.0	188°43.3	11.0	291°50.9	28.0	48°30.2	24.0
3	62°00.3	247°59.6	·· 08.8	203°44.1	·· 11.5	306°53.0	·· 28.0	63°32.8	·· 24.1
4	77°02.7	262°59.2	07.6	218°44.9	12.1	321°55.2	28.0	78°35.4	24.1
5	92°05.2	277°58.8	06.4	233°45.6	12.6	336°57.4	27.9	93°38.1	24.2
6	107°07.7	292°58.4	N04°05.2	248°46.4	S15°13.2	351°59.6	N21°27.9	108°40.7	S03°24.3
7	122°10.1	307°58.0	04.0	263°47.2	13.8	7°01.8	27.8	123°43.3	24.4
8	137°12.6	322°57.6	02.9	278°48.0	14.3	22°04.0	27.8	138°46.0	24.4
9	152°15.1	337°57.2	·· 01.7	293°48.7	·· 14.9	37°06.2	·· 27.8	153°48.6	·· 24.5
10	167°17.5	352°56.8	04°00.5	308°49.5	15.4	52°08.4	27.7	168°51.2	24.6
11	182°20.0	7°56.4	03°59.3	323°50.3	16.0	67°10.5	27.7	183°53.9	24.6
12	197°22.5	22°56.0	N03°58.1	338°51.1	S15°16.6	82°12.7	N21°27.6	198°56.5	S03°24.7
13	212°24.9	37°55.6	56.9	353°51.9	17.1	97°14.9	27.6	213°59.1	24.8
14	227°27.4	52°55.2	55.7	8°52.6	17.7	112°17.1	27.6	229°01.7	24.8
15	242°29.9	67°54.8	·· 54.5	23°53.4	·· 18.2	127°19.3	·· 27.5	244°04.4	·· 24.9
16	257°32.3	82°54.4	53.4	38°54.2	18.8	142°21.5	27.5	259°07.0	25.0
17	272°34.8	97°54.1	52.2	53°55.0	19.4	157°23.7	27.4	274°09.6	25.0
18	287°37.2	112°53.7	N03°51.0	68°55.7	S15°19.9	172°25.9	N21°27.4	289°12.3	S03°25.1
19	302°39.7	127°53.3	49.8	83°56.5	20.5	187°28.1	27.4	304°14.9	25.2
20	317°42.2	142°52.9	48.6	98°57.3	21.0	202°30.3	27.3	319°17.5	25.2
21	332°44.6	157°52.5	·· 47.4	113°58.1	·· 21.6	217°32.4	·· 27.3	334°20.1	·· 25.3
22	347°47.1	172°52.1	46.2	128°58.8	22.2	232°34.6	27.3	349°22.8	25.4
23	2°49.6	187°51.7	45.0	143°59.6	22.7	247°36.8	27.2	4°25.4	25.5
Mer.pass. 22:49		ν -0.4′	d 1.2′	m -3.92	ν 0.8′	d 0.6′	m 1.55	ν 2.2′	d 0.0′ m -2.16	ν 2.6′	d 0.1′ m 0.65

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	17°52.0	202°51.3	N03°43.8	159°00.4	S15°23.3	262°39.0	N21°27.2	19°28.0	S03°25.5
1	32°54.5	217°50.9	42.6	174°01.2	23.8	277°41.2	27.1	34°30.7	25.6
2	47°57.0	232°50.5	41.4	189°01.9	24.4	292°43.4	27.1	49°33.3	25.7
3	62°59.4	247°50.1	·· 40.3	204°02.7	·· 24.9	307°45.6	·· 27.1	64°35.9	·· 25.7
4	78°01.9	262°49.7	39.1	219°03.5	25.5	322°47.8	27.0	79°38.5	25.8
5	93°04.4	277°49.3	37.9	234°04.2	26.1	337°50.0	27.0	94°41.2	25.9
6	108°06.8	292°48.9	N03°36.7	249°05.0	S15°26.6	352°52.2	N21°26.9	109°43.8	S03°25.9
7	123°09.3	307°48.5	35.5	264°05.8	27.2	7°54.4	26.9	124°46.4	26.0
8	138°11.7	322°48.1	34.3	279°06.6	27.7	22°56.6	26.9	139°49.0	26.1
9	153°14.2	337°47.7	·· 33.1	294°07.3	·· 28.3	37°58.8	·· 26.8	154°51.7	·· 26.1
10	168°16.7	352°47.3	31.9	309°08.1	28.8	53°01.0	26.8	169°54.3	26.2
11	183°19.1	7°46.9	30.7	324°08.9	29.4	68°03.2	26.8	184°56.9	26.3
12	198°21.6	22°46.5	N03°29.5	339°09.6	S15°30.0	83°05.4	N21°26.7	199°59.6	S03°26.3
13	213°24.1	37°46.1	28.3	354°10.4	30.5	98°07.5	26.7	215°02.2	26.4
14	228°26.5	52°45.8	27.1	9°11.2	31.1	113°09.7	26.6	230°04.8	26.5
15	243°29.0	67°45.4	·· 25.9	24°12.0	·· 31.6	128°11.9	·· 26.6	245°07.4	·· 26.5
16	258°31.5	82°45.0	24.7	39°12.7	32.2	143°14.1	26.6	260°10.1	26.6
17	273°33.9	97°44.6	23.5	54°13.5	32.7	158°16.3	26.5	275°12.7	26.7
18	288°36.4	112°44.2	N03°22.3	69°14.3	S15°33.3	173°18.5	N21°26.5	290°15.3	S03°26.7
19	303°38.8	127°43.8	21.2	84°15.0	33.8	188°20.7	26.5	305°17.9	26.8
20	318°41.3	142°43.4	20.0	99°15.8	34.4	203°22.9	26.4	320°20.6	26.9
21	333°43.8	157°43.0	·· 18.8	114°16.6	·· 35.0	218°25.1	·· 26.4	335°23.2	·· 27.0
22	348°46.2	172°42.6	17.6	129°17.3	35.5	233°27.3	26.3	350°25.8	27.0
23	3°48.7	187°42.2	16.4	144°18.1	36.1	248°29.5	26.3	5°28.5	27.1
Mer.pass. 22:45		ν -0.4′	d 1.2′	m -3.92	ν 0.8′	d 0.6′	m 1.55	ν 2.2′	d 0.0′ m -2.17	ν 2.6′	d 0.1′ m 0.65

Stars

	SHA	Dec
Alpheratz	357°33.8	29°14.1
Ankaa	353°06.1	-42°09.9
Schedar	349°29.8	56°40.8
Diphda	348°46.4	-17°50.6
Achernar	335°19.1	-57°06.2
Hamal	327°50.2	23°35.2
Polaris	313°19.5	89°22.2
Acamar	315°10.9	-40°11.8
Menkar	314°05.2	4°11.6
Mirfak	308°27.0	49°57.1
Aldebaran	290°38.7	16°33.7
Rigel	281°03.1	-8°10.1
Capella	280°20.8	46°01.3
Bellatrix	278°22.1	6°22.5
Elnath	278°01.0	28°37.7
Alnilam	275°37.0	-1°11.0
Betelgeuse	270°51.3	7°24.8
Canopus	263°52.0	-52°42.2
Sirius	258°25.7	-16°44.8
Adhara	255°05.4	-29°00.1
Procyon	244°50.3	5°09.7
Pollux	243°16.6	27°57.8
Avior	234°14.7	-59°35.1
Suhail	222°46.1	-43°31.9
Miaplacidus	221°38.7	-69°49.0
Alphard	217°47.4	-8°46.0
Regulus	207°34.0	11°50.6
Dubhe	193°40.8	61°36.6
Denebola	182°24.6	14°25.8
Gienah	175°43.3	-17°41.0
Acrux	173°00.2	-63°14.4
Gacrux	171°51.6	-57°15.4
Alioth	166°13.0	55°49.2
Spica	158°22.0	-11°17.7
Alkaid	152°52.0	49°11.2
Hadar	148°35.8	-60°29.9
Menkent	147°57.3	-36°29.8
Arcturus	145°47.7	19°03.0
Rigil Kent.	139°40.1	-60°56.6
Kochab	137°20.8	74°03.1
Zuben'ubi	136°55.7	-16°08.9
Alphecca	126°03.5	26°37.8
Antares	112°15.3	-26°29.4
Atria	107°09.3	-69°04.6
Sabik	102°02.3	-15°45.4
Shaula	96°09.7	-37°07.4
Rasalhague	95°58.1	12°32.6
Eltanin	90°42.1	51°29.4
Kaus Aust.	83°31.8	-34°22.4
Vega	80°32.9	38°48.7
Nunki	75°47.0	-26°15.9
Altair	61°59.3	8°56.3
Peacock	53°04.6	-56°39.3
Deneb	49°25.2	45°22.6
Enif	33°38.0	9°59.8
Al Na'ir	27°31.8	-46°50.2
Fomalhaut	15°13.5	-29°29.1
Scheat	13°44.3	28°13.6
Markab	13°29.0	15°20.8

Oct 07 Tue	SHA	Mer.pass
Venus	187°16.6	10:28
Mars	142°29.2	13:26
Jupiter	245°00.4	06:35
Saturn	1°28.0	22:47

Oct 08 Wed	SHA	Mer.pass
Venus	186°07.9	10:28
Mars	141°48.8	13:25
Jupiter	244°53.6	06:32
Saturn	1°32.0	22:42

Oct 09 Thu	SHA	Mer.pass
Venus	184°59.3	10:29
Mars	141°08.3	13:23
Jupiter	244°47.0	06:28
Saturn	1°36.0	22:38

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°01.5	S05°31.0	5°52.6	10.3′	N06°35.4	17.4′	60.5′
1	198°01.6	31.9	20°21.9	10.2′	06°52.8	17.3′	60.5′
2	213°01.8	32.9	34°51.2	10.2′	07°10.1	17.3′	60.6′
3	228°02.0	·· 33.8	49°20.3	10.1′	07°27.4	17.3′	60.6′
4	243°02.2	34.8	63°49.5	10.1′	07°44.7	17.3′	60.6′
5	258°02.4	35.8	78°18.5	10.0′	08°02.0	17.2′	60.6′
6	273°02.5	S05°36.7	92°47.5	9.9′	N08°19.2	17.2′	60.6′
7	288°02.7	37.7	107°16.4	9.9′	08°36.4	17.2′	60.6′
8	303°02.9	38.6	121°45.3	9.8′	08°53.6	17.1′	60.7′
9	318°03.1	·· 39.6	136°14.1	9.7′	09°10.7	17.0′	60.7′
10	333°03.3	40.5	150°42.8	9.6′	09°27.7	17.0′	60.7′
11	348°03.4	41.5	165°11.4	9.6′	09°44.7	17.0′	60.7′
12	3°03.6	S05°42.4	179°40.0	9.5′	N10°01.7	16.9′	60.7′
13	18°03.8	43.4	194°08.5	9.4′	10°18.6	16.9′	60.7′
14	33°04.0	44.3	208°37.0	9.4′	10°35.5	16.8′	60.7′
15	48°04.2	·· 45.3	223°05.3	9.3′	10°52.3	16.8′	60.7′
16	63°04.3	46.3	237°33.6	9.2′	11°09.1	16.6′	60.8′
17	78°04.5	47.2	252°01.8	9.1′	11°25.7	16.7′	60.8′
18	93°04.7	S05°48.2	266°29.9	9.0′	N11°42.4	16.5′	60.8′
19	108°04.9	49.1	280°58.0	9.0′	11°58.9	16.5′	60.8′
20	123°05.0	50.1	295°25.9	8.9′	12°15.4	16.5′	60.8′
21	138°05.2	·· 51.0	309°53.8	8.8′	12°31.9	16.3′	60.8′
22	153°05.4	52.0	324°21.6	8.7′	12°48.2	16.3′	60.8′
23	168°05.6	52.9	338°49.3	8.6′	13°04.5	16.2′	60.8′
	SD = 16.0′	d = 1.0′	SD = 16.5′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°05.8	S05°53.9	353°17.0	8.6′	N13°20.7	16.2′	60.8′
1	198°05.9	54.8	7°44.5	8.5′	13°36.9	16.0′	60.8′
2	213°06.1	55.8	22°12.0	8.4′	13°52.9	16.0′	60.8′
3	228°06.3	·· 56.7	36°39.4	8.3′	14°08.9	15.9′	60.8′
4	243°06.5	57.7	51°06.7	8.2′	14°24.8	15.8′	60.8′
5	258°06.6	58.6	65°33.9	8.1′	14°40.6	15.8′	60.8′
6	273°06.8	S05°59.6	80°01.0	8.0′	N14°56.4	15.6′	60.9′
7	288°07.0	06°00.5	94°28.0	7.9′	15°12.0	15.5′	60.9′
8	303°07.2	01.5	108°55.0	7.8′	15°27.5	15.5′	60.9′
9	318°07.3	·· 02.4	123°21.8	7.8′	15°43.0	15.3′	60.9′
10	333°07.5	03.4	137°48.6	7.7′	15°58.3	15.3′	60.9′
11	348°07.7	04.4	152°15.2	7.6′	16°13.6	15.1′	60.9′
12	3°07.9	S06°05.3	166°41.8	7.5′	N16°28.7	15.1′	60.9′
13	18°08.0	06.3	181°08.3	7.4′	16°43.8	14.9′	60.9′
14	33°08.2	07.2	195°34.7	7.3′	16°58.7	14.9′	60.9′
15	48°08.4	·· 08.2	210°01.0	7.2′	17°13.6	14.7′	60.9′
16	63°08.6	09.1	224°27.2	7.1′	17°28.3	14.6′	60.9′
17	78°08.7	10.1	238°53.3	7.0′	17°42.9	14.5′	60.9′
18	93°08.9	S06°11.0	253°19.3	6.9′	N17°57.4	14.4′	60.9′
19	108°09.1	12.0	267°45.2	6.8′	18°11.8	14.3′	60.9′
20	123°09.3	12.9	282°11.1	6.7′	18°26.1	14.1′	60.9′
21	138°09.4	·· 13.9	296°36.8	6.6′	18°40.2	14.0′	60.8′
22	153°09.6	14.8	311°02.4	6.5′	18°54.2	13.9′	60.8′
23	168°09.8	15.8	325°28.0	6.4′	19°08.1	13.8′	60.8′
	SD = 16.0′	d = 1.0′	SD = 16.6′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°10.0	S06°16.7	339°53.4	6.4′	N19°21.9	13.7′	60.8′
1	198°10.1	17.7	354°18.8	6.3′	19°35.6	13.5′	60.8′
2	213°10.3	18.6	8°44.0	6.2′	19°49.1	13.4′	60.8′
3	228°10.5	·· 19.6	23°09.2	6.1′	20°02.5	13.2′	60.8′
4	243°10.6	20.5	37°34.2	6.0′	20°15.7	13.1′	60.8′
5	258°10.8	21.5	51°59.2	5.9′	20°28.8	13.0′	60.8′
6	273°11.0	S06°22.4	66°24.1	5.8′	N20°41.8	12.8′	60.8′
7	288°11.2	23.3	80°48.9	5.7′	20°54.6	12.7′	60.8′
8	303°11.3	24.3	95°13.6	5.6′	21°07.3	12.6′	60.8′
9	318°11.5	·· 25.2	109°38.2	5.5′	21°19.9	12.4′	60.8′
10	333°11.7	26.2	124°02.7	5.4′	21°32.3	12.2′	60.8′
11	348°11.8	27.1	138°27.1	5.3′	21°44.5	12.1′	60.7′
12	3°12.0	S06°28.1	152°51.4	5.2′	N21°56.6	12.0′	60.7′
13	18°12.2	29.0	167°15.6	5.1′	22°08.6	11.7′	60.7′
14	33°12.3	30.0	181°39.8	5.1′	22°20.3	11.7′	60.7′
15	48°12.5	·· 30.9	196°03.8	5.0′	22°32.0	11.5′	60.7′
16	63°12.7	31.9	210°27.8	4.9′	22°43.5	11.3′	60.7′
17	78°12.9	32.8	224°51.7	4.8′	22°54.8	11.1′	60.7′
18	93°13.0	S06°33.8	239°15.5	4.7′	N23°05.9	11.0′	60.7′
19	108°13.2	34.7	253°39.2	4.6′	23°16.9	10.9′	60.6′
20	123°13.4	35.7	268°02.8	4.5′	23°27.8	10.6′	60.6′
21	138°13.5	·· 36.6	282°26.3	4.4′	23°38.4	10.5′	60.6′
22	153°13.7	37.6	296°49.8	4.4′	23°48.9	10.3′	60.6′
23	168°13.9	38.5	311°13.1	4.3′	23°59.2	10.2′	60.6′
	SD = 16.0′	d = 0.9′	SD = 16.6′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	04:24	05:44	06:52	16:41	17:49	19:07
N 70°	04:32	05:43	06:45	16:49	17:50	19:00
68°	04:38	05:43	06:39	16:55	17:50	18:55
66°	04:43	05:42	06:34	17:00	17:51	18:50
64°	04:47	05:42	06:30	17:04	17:51	18:46
62°	04:50	05:41	06:26	17:08	17:52	18:43
60°	04:53	05:41	06:23	17:11	17:53	18:41
N 58°	04:55	05:41	06:20	17:14	17:53	18:38
56°	04:57	05:40	06:17	17:17	17:54	18:37
54°	04:59	05:40	06:15	17:19	17:54	18:35
52°	05:00	05:39	06:13	17:21	17:55	18:34
50°	05:01	05:39	06:11	17:23	17:55	18:33
45°	05:04	05:38	06:07	17:27	17:57	18:31
N 40°	05:05	05:36	06:03	17:31	17:58	18:29
35°	05:06	05:35	06:00	17:34	17:59	18:29
30°	05:06	05:34	05:58	17:37	18:01	18:29
20°	05:05	05:31	05:53	17:42	18:04	18:30
N 10°	05:03	05:27	05:48	17:46	18:08	18:32
0°	04:59	05:23	05:44	17:51	18:12	18:36
S 10°	04:54	05:19	05:40	17:55	18:16	18:41
20°	04:47	05:13	05:35	18:00	18:22	18:48
30°	04:37	05:06	05:30	18:06	18:30	18:58
35°	04:31	05:01	05:27	18:09	18:35	19:05
40°	04:23	04:56	05:23	18:13	18:40	19:13
45°	04:13	04:49	05:19	18:17	18:47	19:23
S 50°	04:01	04:41	05:14	18:22	18:56	19:36
52°	03:55	04:37	05:11	18:25	19:00	19:42
54°	03:48	04:32	05:09	18:28	19:04	19:49
56°	03:40	04:27	05:06	18:30	19:09	19:57
58°	03:31	04:22	05:03	18:34	19:15	20:06
S 60°	03:21	04:15	04:59	18:38	19:21	20:17

Lat.	**Moonrise** Tue	Wed	Thu	**Moonset** Tue	Wed	Thu
N 72°	15:44	14:22		07:44	11:00	
N 70°	16:01	15:10		07:30	10:15	
68°	16:15	15:41		07:19	09:45	
66°	16:26	16:05	15:24	07:09	09:23	12:04
64°	16:36	16:23	16:05	07:02	09:06	11:25
62°	16:44	16:39	16:33	06:55	08:52	10:58
60°	16:51	16:52	16:54	06:50	08:40	10:37
N 58°	16:58	17:03	17:12	06:45	08:30	10:20
56°	17:03	17:13	17:27	06:40	08:21	10:06
54°	17:09	17:22	17:40	06:36	08:13	09:54
52°	17:13	17:30	17:52	06:33	08:06	09:43
50°	17:17	17:37	18:02	06:30	08:00	09:33
45°	17:27	17:52	18:24	06:23	07:47	09:13
N 40°	17:34	18:05	18:41	06:17	07:36	08:57
35°	17:41	18:16	18:56	06:12	07:26	08:43
30°	17:47	18:25	19:09	06:08	07:18	08:31
20°	17:57	18:42	19:31	06:00	07:04	08:11
N 10°	18:07	18:56	19:51	05:54	06:52	07:54
0°	18:15	19:10	20:09	05:48	06:41	07:37
S 10°	18:24	19:24	20:27	05:42	06:29	07:21
20°	18:33	19:39	20:47	05:35	06:17	07:04
30°	18:44	19:56	21:10	05:28	06:04	06:44
35°	18:51	20:06	21:24	05:24	05:56	06:33
40°	18:58	20:18	21:40	05:19	05:47	06:20
45°	19:07	20:32	21:59	05:14	05:37	06:05
S 50°	19:17	20:49	22:22	05:07	05:24	05:46
52°	19:22	20:57	22:34	05:04	05:18	05:37
54°	19:27	21:06	22:47	05:01	05:12	05:27
56°	19:33	21:16	23:02	04:57	05:05	05:16
58°	19:40	21:28	23:20	04:53	04:57	05:04
S 60°	19:47	21:42	23:42	04:49	04:48	04:49

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 16-18 100-95%
07	12:06	12:14	11:48	–:–	12:01	
08	12:23	12:31	11:47	00:28	12:55	
09	12:40	12:48	11:47	01:24	13:53	

October 10, 11, 12 UT (Fri., Sat., Sun.)

	Aries	Venus		Mars		Jupiter		Saturn	
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	18°51.2	202°41.8	N03°15.2	159°18.9	S15°36.6	263°31.7	N21°26.3	20°31.1	S03°27.2
1	33°53.6	217°41.4	14.0	174°19.6	37.2	278°33.9	26.2	35°33.7	27.2
2	48°56.1	232°41.0	12.8	189°20.4	37.7	293°36.1	26.2	50°36.3	27.3
3	63°58.6	247°40.6	·· 11.6	204°21.2	·· 38.3	308°38.3	·· 26.2	65°39.0	·· 27.4
4	79°01.0	262°40.2	10.4	219°21.9	38.8	323°40.5	26.1	80°41.6	27.4
5	94°03.5	277°39.8	09.2	234°22.7	39.4	338°42.7	26.1	95°44.2	27.5
6	109°06.0	292°39.4	N03°08.0	249°23.5	S15°39.9	353°44.9	N21°26.0	110°46.8	S03°27.6
7	124°08.4	307°39.1	06.8	264°24.2	40.5	8°47.1	26.0	125°49.5	27.6
8	139°10.9	322°38.7	05.6	279°25.0	41.0	23°49.3	26.0	140°52.1	27.7
9	154°13.3	337°38.3	·· 04.4	294°25.8	·· 41.6	38°51.5	·· 25.9	155°54.7	·· 27.8
10	169°15.8	352°37.9	03.2	309°26.5	42.1	53°53.7	25.9	170°57.3	27.8
11	184°18.3	7°37.5	02.0	324°27.3	42.7	68°55.9	25.9	186°00.0	27.9
12	199°20.7	22°37.1	N03°00.8	339°28.1	S15°43.2	83°58.1	N21°25.8	201°02.6	S03°28.0
13	214°23.2	37°36.7	02°59.6	354°28.8	43.8	99°00.3	25.8	216°05.2	28.0
14	229°25.7	52°36.3	58.4	9°29.6	44.4	114°02.5	25.7	231°07.8	28.1
15	244°28.1	67°35.9	·· 57.2	24°30.4	·· 44.9	129°04.8	·· 25.7	246°10.5	·· 28.2
16	259°30.6	82°35.5	56.0	39°31.1	45.5	144°07.0	25.7	261°13.1	28.2
17	274°33.1	97°35.1	54.8	54°31.9	46.0	159°09.2	25.6	276°15.7	28.3
18	289°35.5	112°34.7	N02°53.6	69°32.6	S15°46.6	174°11.4	N21°25.6	291°18.4	S03°28.4
19	304°38.0	127°34.3	52.4	84°33.4	47.1	189°13.6	25.6	306°21.0	28.4
20	319°40.5	142°33.9	51.2	99°34.2	47.7	204°15.8	25.5	321°23.6	28.5
21	334°42.9	157°33.6	·· 50.0	114°34.9	·· 48.2	219°18.0	·· 25.5	336°26.2	·· 28.6
22	349°45.4	172°33.2	48.8	129°35.7	48.8	234°20.2	25.5	351°28.9	28.6
23	4°47.8	187°32.8	47.6	144°36.5	49.3	249°22.4	25.4	6°31.5	28.7
Mer.pass. 22:41		ν -0.4′	d 1.2′	ν 0.8′	d 0.6′	ν 2.2′	d 0.0′	ν 2.6′	d 0.1′
		m -3.92		m 1.54		m -2.17		m 0.66	

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	19°50.3	202°32.4	N02°46.4	159°37.2	S15°49.9	264°24.6	N21°25.4	21°34.1	S03°28.8
1	34°52.8	217°32.0	45.2	174°38.0	50.4	279°26.8	25.3	36°36.7	28.8
2	49°55.2	232°31.6	44.0	189°38.7	51.0	294°29.0	25.3	51°39.4	28.9
3	64°57.7	247°31.2	·· 42.8	204°39.5	·· 51.5	309°31.2	·· 25.3	66°42.0	·· 29.0
4	80°00.2	262°30.8	41.6	219°40.3	52.0	324°33.4	25.2	81°44.6	29.0
5	95°02.6	277°30.4	40.4	234°41.0	52.6	339°35.6	25.2	96°47.2	29.1
6	110°05.1	292°30.0	N02°39.2	249°41.8	S15°53.1	354°37.8	N21°25.2	111°49.9	S03°29.2
7	125°07.6	307°29.6	38.0	264°42.5	53.7	9°40.1	25.1	126°52.5	29.2
8	140°10.0	322°29.2	36.8	279°43.3	54.2	24°42.3	25.1	141°55.1	29.3
9	155°12.5	337°28.8	·· 35.6	294°44.1	·· 54.8	39°44.5	·· 25.1	156°57.7	·· 29.4
10	170°15.0	352°28.5	34.4	309°44.8	55.3	54°46.7	25.0	172°00.3	29.4
11	185°17.4	7°28.1	33.2	324°45.6	55.9	69°48.9	25.0	187°03.0	29.5
12	200°19.9	22°27.7	N02°32.0	339°46.3	S15°56.4	84°51.1	N21°24.9	202°05.6	S03°29.6
13	215°22.3	37°27.3	30.8	354°47.1	57.0	99°53.3	24.9	217°08.2	29.6
14	230°24.8	52°26.9	29.5	9°47.8	57.5	114°55.5	24.9	232°10.8	29.7
15	245°27.3	67°26.5	·· 28.3	24°48.6	·· 58.1	129°57.7	·· 24.8	247°13.5	·· 29.8
16	260°29.7	82°26.1	27.1	39°49.4	58.6	144°59.9	24.8	262°16.1	29.8
17	275°32.2	97°25.7	25.9	54°50.1	59.2	160°02.2	24.8	277°18.7	29.9
18	290°34.7	112°25.3	N02°24.7	69°50.9	S15°59.7	175°04.4	N21°24.7	292°21.3	S03°30.0
19	305°37.1	127°24.9	23.5	84°51.6	16°00.3	190°06.6	24.7	307°24.0	30.0
20	320°39.6	142°24.5	22.3	99°52.4	00.8	205°08.8	24.7	322°26.6	30.1
21	335°42.1	157°24.1	·· 21.1	114°53.1	·· 01.3	220°11.0	·· 24.6	337°29.2	·· 30.2
22	350°44.5	172°23.8	19.9	129°53.9	01.9	235°13.2	24.6	352°31.8	30.2
23	5°47.0	187°23.4	18.7	144°54.7	02.4	250°15.4	24.6	7°34.5	30.3
Mer.pass. 22:37		ν -0.4′	d 1.2′	ν 0.8′	d 0.5′	ν 2.2′	d 0.0′	ν 2.6′	d 0.1′
		m -3.92		m 1.54		m -2.18		m 0.66	

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	20°49.5	202°23.0	N02°17.5	159°55.4	S16°03.0	265°17.6	N21°24.5	22°37.1	S03°30.4
1	35°51.9	217°22.6	16.3	174°56.2	03.5	280°19.9	24.5	37°39.7	30.4
2	50°54.4	232°22.2	15.1	189°56.9	04.1	295°22.1	24.4	52°42.3	30.5
3	65°56.8	247°21.8	·· 13.9	204°57.7	·· 04.6	310°24.3	·· 24.4	67°45.0	·· 30.5
4	80°59.3	262°21.4	12.7	219°58.4	05.2	325°26.5	24.4	82°47.6	30.6
5	96°01.8	277°21.0	11.5	234°59.2	05.7	340°28.7	24.3	97°50.2	30.7
6	111°04.2	292°20.6	N02°10.3	249°59.9	S16°06.2	355°30.9	N21°24.3	112°52.8	S03°30.7
7	126°06.7	307°20.2	09.0	265°00.7	06.8	10°33.1	24.3	127°55.4	30.8
8	141°09.2	322°19.8	07.8	280°01.4	07.3	25°35.4	24.2	142°58.1	30.9
9	156°11.6	337°19.4	·· 06.6	295°02.2	·· 07.9	40°37.6	·· 24.2	158°00.7	·· 30.9
10	171°14.1	352°19.1	05.4	310°02.9	08.4	55°39.8	24.2	173°03.3	31.0
11	186°16.6	7°18.7	04.2	325°03.7	09.0	70°42.0	24.1	188°05.9	31.1
12	201°19.0	22°18.3	N02°03.0	340°04.5	S16°09.5	85°44.2	N21°24.1	203°08.6	S03°31.1
13	216°21.5	37°17.9	01.8	355°05.2	10.0	100°46.4	24.1	218°11.2	31.2
14	231°23.9	52°17.5	02°00.6	10°06.0	10.6	115°48.7	24.0	233°13.8	31.3
15	246°26.4	67°17.1	01°59.4	25°06.7	·· 11.1	130°50.9	·· 24.0	248°16.4	·· 31.3
16	261°28.9	82°16.7	58.2	40°07.5	11.7	145°53.1	24.0	263°19.0	31.4
17	276°31.3	97°16.3	57.0	55°08.2	12.2	160°55.3	23.9	278°21.7	31.5
18	291°33.8	112°15.9	N01°55.8	70°09.0	S16°12.8	175°57.5	N21°23.9	293°24.3	S03°31.5
19	306°36.3	127°15.5	54.6	85°09.7	13.3	190°59.8	23.9	308°26.9	31.6
20	321°38.7	142°15.1	53.3	100°10.5	13.8	206°02.0	23.8	323°29.5	31.7
21	336°41.2	157°14.8	·· 52.1	115°11.2	·· 14.4	221°04.2	·· 23.8	338°32.2	·· 31.7
22	351°43.7	172°14.4	50.9	130°12.0	14.9	236°06.4	23.7	353°34.8	31.8
23	6°46.1	187°14.0	49.7	145°12.7	15.5	251°08.6	23.7	8°37.4	31.8
Mer.pass. 22:33		ν -0.4′	d 1.2′	ν 0.8′	d 0.5′	ν 2.2′	d 0.0′	ν 2.6′	d 0.1′
		m -3.92		m 1.54		m -2.19		m 0.67	

Stars

	SHA	Dec
Alpheratz	357°33.8	29°14.1
Ankaa	353°06.1	-42°09.9
Schedar	349°29.8	56°40.9
Diphda	348°46.4	-17°50.6
Achernar	335°19.1	-57°06.2
Hamal	327°50.2	23°35.2
Polaris	313°18.2	89°22.2
Acamar	315°10.9	-40°11.8
Menkar	314°05.2	4°11.6
Mirfak	308°27.0	49°57.1
Aldebaran	290°38.7	16°33.7
Rigel	281°03.1	-8°10.1
Capella	280°20.8	46°01.3
Bellatrix	278°22.1	6°22.5
Elnath	278°00.9	28°37.7
Alnilam	275°37.0	-1°11.0
Betelgeuse	270°51.3	7°24.8
Canopus	263°52.0	-52°42.2
Sirius	258°25.7	-16°44.8
Adhara	255°05.4	-29°00.1
Procyon	244°50.2	5°09.6
Pollux	243°16.6	27°57.8
Avior	234°14.7	-59°35.1
Suhail	222°46.1	-43°31.9
Miaplacidus	221°38.6	-69°49.0
Alphard	217°47.3	-8°46.0
Regulus	207°34.0	11°50.5
Dubhe	193°40.8	61°36.6
Denebola	182°24.6	14°25.8
Gienah	175°43.3	-17°41.0
Acrux	173°00.2	-63°14.4
Gacrux	171°51.6	-57°15.3
Alioth	166°13.0	55°49.2
Spica	158°22.0	-11°17.7
Alkaid	152°52.0	49°11.1
Hadar	148°35.8	-60°29.8
Menkent	147°57.3	-36°29.8
Arcturus	145°47.7	19°03.0
Rigil Kent.	139°40.1	-60°56.6
Kochab	137°20.8	74°03.0
Zuben'ubi	136°55.7	-16°08.9
Alphecca	126°03.5	26°37.8
Antares	112°15.3	-26°29.4
Atria	107°09.3	-69°04.6
Sabik	102°02.3	-15°45.4
Shaula	96°09.7	-37°07.4
Rasalhague	95°58.1	12°32.6
Eltanin	90°42.1	51°29.4
Kaus Aust.	83°31.8	-34°22.4
Vega	80°32.9	38°48.7
Nunki	75°47.0	-26°15.9
Altair	61°59.3	8°56.3
Peacock	53°04.6	-56°39.3
Deneb	49°25.2	45°22.6
Enif	33°38.0	9°59.8
Al Na'ir	27°31.8	-46°50.2
Fomalhaut	15°13.5	-29°29.1
Scheat	13°44.3	28°13.6
Markab	13°29.0	15°20.8

Oct 10 Fri	SHA	Mer.pass
Venus	183°50.6	10:29
Mars	140°27.7	13:22
Jupiter	244°40.6	06:25
Saturn	1°39.9	22:34

Oct 11 Sat	SHA	Mer.pass
Venus	182°42.1	10:30
Mars	139°46.9	13:21
Jupiter	244°34.3	06:21
Saturn	1°43.8	22:30

Oct 12 Sun	SHA	Mer.pass
Venus	181°33.5	10:31
Mars	139°06.0	13:20
Jupiter	244°28.2	06:18
Saturn	1°47.6	22:26

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°14.0	S06°39.5	325°36.4	4.2′	N24°09.4	10.0′	60.6′
1	198°14.2	40.4	339°59.6	4.1′	24°19.4	9.8′	60.5′
2	213°14.4	41.3	354°22.7	4.1′	24°29.2	9.6′	60.5′
3	228°14.5	·· 42.3	8°45.8	4.0′	24°38.8	9.4′	60.5′
4	243°14.7	43.2	23°08.8	3.9′	24°48.2	9.3′	60.5′
5	258°14.9	44.2	37°31.7	3.8′	24°57.5	9.1′	60.5′
6	273°15.0	S06°45.1	51°54.5	3.8′	N25°06.6	8.9′	60.5′
7	288°15.2	46.1	66°17.3	3.7′	25°15.5	8.7′	60.4′
8	303°15.4	47.0	80°40.0	3.6′	25°24.2	8.6′	60.4′
9	318°15.5	·· 48.0	95°02.6	3.6′	25°32.8	8.3′	60.4′
10	333°15.7	48.9	109°25.2	3.5′	25°41.1	8.2′	60.4′
11	348°15.9	49.8	123°47.7	3.4′	25°49.3	7.9′	60.4′
12	3°16.0	S06°50.8	138°10.1	3.4′	N25°57.2	7.8′	60.3′
13	18°16.2	51.7	152°32.5	3.3′	26°05.0	7.6′	60.3′
14	33°16.4	52.7	166°54.8	3.3′	26°12.6	7.4′	60.3′
15	48°16.5	·· 53.6	181°17.1	3.2′	26°20.0	7.2′	60.3′
16	63°16.7	54.6	195°39.3	3.2′	26°27.2	7.1′	60.3′
17	78°16.9	55.5	210°01.5	3.1′	26°34.3	6.8′	60.2′
18	93°17.0	S06°56.5	224°23.6	3.1′	N26°41.1	6.6′	60.2′
19	108°17.2	57.4	238°45.7	3.0′	26°47.7	6.4′	60.2′
20	123°17.3	58.3	253°07.7	3.0′	26°54.1	6.3′	60.2′
21	138°17.5	06°59.3	267°29.7	2.9′	27°00.4	6.0′	60.1′
22	153°17.7	07°00.2	281°51.6	2.9′	27°06.4	5.8′	60.1′
23	168°17.8	01.2	296°13.5	2.9′	27°12.2	5.6′	60.1′
	SD = 16.0′	d = 0.9′	SD = 16.5′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°18.0	S07°02.1	310°35.4	2.8′	N27°17.8	5.5′	60.1′
1	198°18.2	03.1	324°57.3	2.8′	27°23.3	5.2′	60.0′
2	213°18.3	04.0	339°19.1	2.8′	27°28.5	5.0′	60.0′
3	228°18.5	·· 04.9	353°40.9	2.8′	27°33.5	4.9′	60.0′
4	243°18.6	05.9	8°02.6	2.7′	27°38.4	4.6′	60.0′
5	258°18.8	06.8	22°24.4	2.7′	27°43.0	4.4′	59.9′
6	273°19.0	S07°07.8	36°46.1	2.7′	N27°47.4	4.2′	59.9′
7	288°19.1	08.7	51°07.8	2.7′	27°51.6	4.0′	59.9′
8	303°19.3	09.6	65°29.5	2.7′	27°55.6	3.9′	59.9′
9	318°19.4	·· 10.6	79°51.2	2.7′	27°59.5	3.6′	59.8′
10	333°19.6	11.5	94°12.9	2.7′	28°03.1	3.4′	59.8′
11	348°19.8	12.5	108°34.6	2.7′	28°06.5	3.2′	59.8′
12	3°19.9	S07°13.4	122°56.2	2.7′	N28°09.7	3.0′	59.8′
13	18°20.1	14.3	137°17.9	2.7′	28°12.7	2.7′	59.7′
14	33°20.2	15.3	151°39.6	2.7′	28°15.4	2.6′	59.7′
15	48°20.4	·· 16.2	166°01.3	2.7′	28°18.0	2.4′	59.7′
16	63°20.6	17.2	180°23.0	2.7′	28°20.4	2.2′	59.6′
17	78°20.7	18.1	194°44.7	2.7′	28°22.6	2.0′	59.6′
18	93°20.9	S07°19.0	209°06.4	2.7′	N28°24.6	1.7′	59.6′
19	108°21.0	20.0	223°28.1	2.8′	28°26.3	1.6′	59.6′
20	123°21.2	20.9	237°49.9	2.8′	28°27.9	1.3′	59.5′
21	138°21.4	·· 21.9	252°11.7	2.8′	28°29.2	1.2′	59.5′
22	153°21.5	22.8	266°33.5	2.8′	28°30.4	1.0′	59.5′
23	168°21.7	23.7	280°55.3	2.9′	28°31.4	0.7′	59.4′
	SD = 16.0′	d = 0.9′	SD = 16.4′				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°21.8	S07°24.7	295°17.2	2.9′	N28°32.1	0.6′	59.4′
1	198°22.0	25.6	309°39.1	2.9′	28°32.7	0.3′	59.4′
2	213°22.1	26.6	324°01.0	3.0′	28°33.0	0.2′	59.4′
3	228°22.3	·· 27.5	338°23.0	3.0′	28°33.2	0.1′	59.3′
4	243°22.5	28.4	352°45.0	3.1′	28°33.1	0.2′	59.3′
5	258°22.6	29.4	7°07.1	3.1′	28°32.9	0.5′	59.3′
6	273°22.8	S07°30.3	21°29.2	3.2′	N28°32.4	0.6′	59.2′
7	288°22.9	31.2	35°51.3	3.2′	28°31.8	0.9′	59.2′
8	303°23.1	32.2	50°13.5	3.3′	28°30.9	1.0′	59.2′
9	318°23.2	·· 33.1	64°35.8	3.3′	28°29.9	1.3′	59.1′
10	333°23.4	34.0	78°58.1	3.4′	28°28.6	1.4′	59.1′
11	348°23.5	35.0	93°20.5	3.4′	28°27.2	1.6′	59.1′
12	3°23.7	S07°35.9	107°43.0	3.5′	N28°25.6	1.9′	59.1′
13	18°23.9	36.9	122°05.5	3.6′	28°23.7	2.0′	59.0′
14	33°24.0	37.8	136°28.1	3.6′	28°21.7	2.2′	59.0′
15	48°24.2	·· 38.7	150°50.7	3.7′	28°19.5	2.4′	59.0′
16	63°24.3	39.7	165°13.4	3.8′	28°17.1	2.5′	58.9′
17	78°24.5	40.6	179°36.2	3.9′	28°14.6	2.8′	58.9′
18	93°24.6	S07°41.5	193°59.1	4.0′	N28°11.8	3.0′	58.9′
19	108°24.8	42.5	208°22.0	4.0′	28°08.8	3.1′	58.8′
20	123°24.9	43.4	222°45.1	4.1′	28°05.7	3.3′	58.8′
21	138°25.1	·· 44.3	237°08.2	4.2′	28°02.4	3.5′	58.8′
22	153°25.2	45.3	251°31.4	4.3′	27°58.9	3.7′	58.7′
23	168°25.4	46.2	265°54.7	4.4′	27°55.2	3.9′	58.7′
	SD = 16.0′	d = 0.9′	SD = 16.2′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	04:38	05:57	07:06	16:26	17:34	18:52
N 70°	04:44	05:55	06:57	16:35	17:36	18:47
68°	04:49	05:53	06:50	16:42	17:38	18:42
66°	04:52	05:52	06:44	16:48	17:40	18:39
64°	04:55	05:50	06:38	16:54	17:41	18:36
62°	04:58	05:49	06:34	16:58	17:43	18:34
60°	05:00	05:48	06:30	17:02	17:44	18:32
N 58°	05:02	05:47	06:27	17:06	17:45	18:30
56°	05:03	05:46	06:23	17:09	17:46	18:29
54°	05:04	05:45	06:21	17:12	17:47	18:28
52°	05:05	05:44	06:18	17:14	17:48	18:27
50°	05:06	05:43	06:16	17:17	17:49	18:26
45°	05:07	05:41	06:11	17:22	17:51	18:25
N 40°	05:08	05:39	06:06	17:26	17:53	18:25
35°	05:08	05:37	06:03	17:30	17:55	18:25
30°	05:08	05:35	05:59	17:33	17:58	18:25
20°	05:06	05:31	05:54	17:39	18:02	18:27
N 10°	05:03	05:27	05:48	17:45	18:06	18:30
0°	04:58	05:23	05:43	17:50	18:11	18:35
S 10°	04:52	05:17	05:38	17:55	18:16	18:41
20°	04:44	05:10	05:33	18:01	18:23	18:49
30°	04:34	05:02	05:26	18:08	18:32	19:00
35°	04:27	04:57	05:23	18:11	18:37	19:08
40°	04:18	04:51	05:18	18:16	18:43	19:16
45°	04:07	04:43	05:13	18:21	18:51	19:27
S 50°	03:54	04:34	05:07	18:27	19:01	19:41
52°	03:47	04:30	05:04	18:30	19:05	19:48
54°	03:39	04:25	05:01	18:33	19:10	19:56
56°	03:31	04:19	04:58	18:37	19:16	20:04
58°	03:21	04:13	04:54	18:41	19:22	20:15
S 60°	03:09	04:06	04:50	18:45	19:29	20:27

Lat.	**Moonrise** Fri	Sat	Sun	**Moonset** Fri	Sat	Sun
N 72°	▭	▭	▭	▭	▭	▭
N 70°	▭	▭	▭	▭	▭	▭
68°	▭	▭	▭	▭	▭	▭
66°	▭	▭	▭	▭	▭	▭
64°	▭	▭	▭	▭	▭	▭
62°	16:24	▭	▭	13:15	▭	▭
60°	17:03	17:28	18:37	12:37	14:25	15:30
N 58°	17:30	18:07	19:14	12:11	13:47	14:52
56°	17:51	18:34	19:41	11:50	13:21	14:26
54°	18:09	18:55	20:02	11:32	12:59	14:05
52°	18:24	19:13	20:19	11:17	12:42	13:47
50°	18:38	19:28	20:34	11:05	12:27	13:32
45°	19:05	19:58	21:04	10:38	11:56	13:01
N 40°	19:27	20:22	21:27	10:17	11:33	12:38
35°	19:45	20:42	21:47	10:00	11:13	12:18
30°	20:00	20:59	22:03	09:45	10:57	12:01
20°	20:27	21:28	22:31	09:20	10:28	11:33
N 10°	20:50	21:52	22:55	08:58	10:04	11:08
0°	21:11	22:15	23:18	08:38	09:42	10:45
S 10°	21:33	22:38	23:40	08:18	09:19	10:22
20°	21:56	23:03	·· ··	07:57	08:55	09:58
30°	22:23	23:32	·· ··	07:32	08:27	09:29
35°	22:39	23:49	·· ··	07:17	08:10	09:12
40°	22:58	·· ··	00:09	07:01	07:51	08:52
45°	23:21	·· ··	00:33	06:41	07:28	08:28
S 50°	23:50	·· ··	01:05	06:16	06:58	07:56
52°	·· ··	00:05	01:20	06:04	06:43	07:40
54°	·· ··	00:22	01:39	05:50	06:26	07:22
56°	·· ··	00:42	02:01	05:34	06:05	07:00
58°	·· ··	01:07	02:30	05:15	05:40	06:31
S 60°	·· ··	01:42	03:13	04:52	05:05	05:48

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 19-21 88-69%
10	12:56	13:04	11:47	02:23	14:55	
11	13:12	13:20	11:47	03:26	15:58	
12	13:27	13:35	11:46	04:30	17:02	

October 13, 14, 15 UT (Mon., Tue., Wed.)

	Aries	Venus		Mars		Jupiter		Saturn	
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	21°48.6	202°13.6	N01°48.5	160°13.5	S16°16.0	266°10.9	N21°23.7	23°40.0	S03°31.9
1	36°51.1	217°13.2	47.3	175°14.2	16.5	281°13.1	23.6	38°42.6	32.0
2	51°53.5	232°12.8	46.1	190°14.9	17.1	296°15.3	23.6	53°45.3	32.0
3	66°56.0	247°12.4	·· 44.9	205°15.7	·· 17.6	311°17.5	·· 23.6	68°47.9	·· 32.1
4	81°58.4	262°12.0	43.7	220°16.4	18.2	326°19.7	23.5	83°50.5	32.2
5	97°00.9	277°11.6	42.5	235°17.2	18.7	341°22.0	23.5	98°53.1	32.2
6	112°03.4	292°11.2	N01°41.2	250°17.9	S16°19.2	356°24.2	N21°23.5	113°55.7	S03°32.3
7	127°05.8	307°10.8	40.0	265°18.7	19.8	11°26.4	23.4	128°58.4	32.4
8	142°08.3	322°10.5	38.8	280°19.4	20.3	26°28.6	23.4	144°01.0	32.4
9	157°10.8	337°10.1	·· 37.6	295°20.2	·· 20.9	41°30.9	·· 23.4	159°03.6	·· 32.5
10	172°13.2	352°09.7	36.4	310°20.9	21.4	56°33.1	23.3	174°06.2	32.6
11	187°15.7	7°09.3	35.2	325°21.7	21.9	71°35.3	23.3	189°08.8	32.6
12	202°18.2	22°08.9	N01°34.0	340°22.4	S16°22.5	86°37.5	N21°23.3	204°11.5	S03°32.7
13	217°20.6	37°08.5	32.8	355°23.2	23.0	101°39.8	23.2	219°14.1	32.7
14	232°23.1	52°08.1	31.5	10°23.9	23.5	116°42.0	23.2	234°16.7	32.8
15	247°25.6	67°07.7	·· 30.3	25°24.6	·· 24.1	131°44.2	·· 23.2	249°19.3	·· 32.9
16	262°28.0	82°07.3	29.1	40°25.4	24.6	146°46.4	23.1	264°21.9	32.9
17	277°30.5	97°06.9	27.9	55°26.1	25.2	161°48.7	23.1	279°24.6	33.0
18	292°32.9	112°06.6	N01°26.7	70°26.9	S16°25.7	176°50.9	N21°23.1	294°27.2	S03°33.1
19	307°35.4	127°06.2	25.5	85°27.6	26.2	191°53.1	23.0	309°29.8	33.1
20	322°37.9	142°05.8	24.3	100°28.4	26.8	206°55.3	23.0	324°32.4	33.2
21	337°40.3	157°05.4	·· 23.1	115°29.1	·· 27.3	221°57.6	·· 23.0	339°35.0	·· 33.3
22	352°42.8	172°05.0	21.8	130°29.9	27.8	236°59.8	22.9	354°37.7	33.3
23	7°45.3	187°04.6	20.6	145°30.6	28.4	252°02.0	22.9	9°40.3	33.4
Mer.pass. 22:29		ν -0.4′	d 1.2′	ν 0.7′	d 0.5′	ν 2.2′	d 0.0′	ν 2.6′	d 0.1′
		m -3.92		m 1.53		m -2.19		m 0.67	

Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	22°47.7	202°04.2	N01°19.4	160°31.3	S16°28.9	267°04.2	N21°22.9	24°42.9	S03°33.4
1	37°50.2	217°03.8	18.2	175°32.1	29.4	282°06.5	22.8	39°45.5	33.5
2	52°52.7	232°03.4	17.0	190°32.8	30.0	297°08.7	22.8	54°48.1	33.6
3	67°55.1	247°03.0	·· 15.8	205°33.6	·· 30.5	312°10.9	·· 22.8	69°50.8	·· 33.6
4	82°57.6	262°02.6	14.6	220°34.3	31.0	327°13.2	22.7	84°53.4	33.7
5	98°00.1	277°02.3	13.4	235°35.0	31.6	342°15.4	22.7	99°56.0	33.8
6	113°02.5	292°01.9	N01°12.1	250°35.8	S16°32.1	357°17.6	N21°22.7	114°58.6	S03°33.8
7	128°05.0	307°01.5	10.9	265°36.5	32.7	12°19.8	22.6	130°01.2	33.9
8	143°07.4	322°01.1	09.7	280°37.3	33.2	27°22.1	22.6	145°03.9	34.0
9	158°09.9	337°00.7	·· 08.5	295°38.0	·· 33.7	42°24.3	·· 22.6	160°06.5	·· 34.0
10	173°12.4	352°00.3	07.3	310°38.7	34.3	57°26.5	22.5	175°09.1	34.1
11	188°14.8	6°59.9	06.1	325°39.5	34.8	72°28.8	22.5	190°11.7	34.1
12	203°17.3	21°59.5	N01°04.9	340°40.2	S16°35.3	87°31.0	N21°22.5	205°14.3	S03°34.2
13	218°19.8	36°59.1	03.6	355°41.0	35.9	102°33.2	22.4	220°17.0	34.3
14	233°22.2	51°58.7	02.4	10°41.7	36.4	117°35.5	22.4	235°19.6	34.3
15	248°24.7	66°58.3	·· 01.2	25°42.4	·· 36.9	132°37.7	·· 22.4	250°22.2	·· 34.4
16	263°27.2	81°58.0	01°00.0	40°43.2	37.4	147°39.9	22.3	265°24.8	34.5
17	278°29.6	96°57.6	00°58.8	55°43.9	38.0	162°42.2	22.3	280°27.4	34.5
18	293°32.1	111°57.2	N00°57.6	70°44.6	S16°38.5	177°44.4	N21°22.3	295°30.0	S03°34.6
19	308°34.6	126°56.8	56.3	85°45.4	39.0	192°46.6	22.2	310°32.7	34.6
20	323°37.0	141°56.4	55.1	100°46.1	39.6	207°48.9	22.2	325°35.3	34.7
21	338°39.5	156°56.0	·· 53.9	115°46.9	·· 40.1	222°51.1	·· 22.2	340°37.9	·· 34.8
22	353°41.9	171°55.6	52.7	130°47.6	40.6	237°53.3	22.1	355°40.5	34.8
23	8°44.4	186°55.2	51.5	145°48.3	41.2	252°55.6	22.1	10°43.1	34.9
Mer.pass. 22:25		ν -0.4′	d 1.2′	ν 0.7′	d 0.5′	ν 2.2′	d 0.0′	ν 2.6′	d 0.1′
		m -3.92		m 1.53		m -2.20		m 0.68	

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	23°46.9	201°54.8	N00°50.3	160°49.1	S16°41.7	267°57.8	N21°22.1	25°45.7	S03°35.0
1	38°49.3	216°54.4	49.1	175°49.8	42.2	283°00.0	22.1	40°48.4	35.0
2	53°51.8	231°54.1	47.8	190°50.5	42.8	298°02.3	22.0	55°51.0	35.1
3	68°54.3	246°53.7	·· 46.6	205°51.3	·· 43.3	313°04.5	·· 22.0	70°53.6	·· 35.1
4	83°56.7	261°53.3	45.4	220°52.0	43.8	328°06.8	22.0	85°56.2	35.2
5	98°59.2	276°52.9	44.2	235°52.7	44.3	343°09.0	21.9	100°58.8	35.3
6	114°01.7	291°52.5	N00°43.0	250°53.5	S16°44.9	358°11.2	N21°21.9	116°01.5	S03°35.3
7	129°04.1	306°52.1	41.8	265°54.2	45.4	13°13.5	21.9	131°04.1	35.4
8	144°06.6	321°51.7	40.5	280°54.9	45.9	28°15.7	21.8	146°06.7	35.5
9	159°09.0	336°51.3	·· 39.3	295°55.7	·· 46.5	43°17.9	·· 21.8	161°09.3	·· 35.5
10	174°11.5	351°50.9	38.1	310°56.4	47.0	58°20.2	21.8	176°11.9	35.6
11	189°14.0	6°50.5	36.9	325°57.1	47.5	73°22.4	21.7	191°14.5	35.6
12	204°16.4	21°50.1	N00°35.7	340°57.9	S16°48.0	88°24.7	N21°21.7	206°17.2	S03°35.7
13	219°18.9	36°49.8	34.4	355°58.6	48.6	103°26.9	21.7	221°19.8	35.8
14	234°21.4	51°49.4	33.2	10°59.3	49.1	118°29.1	21.6	236°22.4	35.8
15	249°23.8	66°49.0	·· 32.0	26°00.1	·· 49.6	133°31.4	·· 21.6	251°25.0	·· 35.9
16	264°26.3	81°48.6	30.8	41°00.8	50.2	148°33.6	21.6	266°27.6	36.0
17	279°28.8	96°48.2	29.6	56°01.5	50.7	163°35.9	21.5	281°30.2	36.0
18	294°31.2	111°47.8	N00°28.4	71°02.3	S16°51.2	178°38.1	N21°21.5	296°32.8	S03°36.1
19	309°33.7	126°47.4	27.1	86°03.0	51.7	193°40.3	21.5	311°35.5	36.1
20	324°36.2	141°47.0	25.9	101°03.7	52.3	208°42.6	21.4	326°38.1	36.2
21	339°38.6	156°46.6	·· 24.7	116°04.5	·· 52.8	223°44.8	·· 21.4	341°40.7	·· 36.3
22	354°41.1	171°46.2	23.5	131°05.2	53.3	238°47.1	21.4	356°43.3	36.3
23	9°43.5	186°45.8	22.3	146°05.9	53.8	253°49.3	21.4	11°45.9	36.4
Mer.pass. 22:21		ν -0.4′	d 1.2′	ν 0.7′	d 0.5′	ν 2.2′	d 0.0′	ν 2.6′	d 0.1′
		m -3.92		m 1.53		m -2.21		m 0.68	

Stars

	SHA	Dec
Alpheratz	357°33.8	29°14.2
Ankaa	353°06.1	-42°09.9
Schedar	349°29.8	56°40.9
Diphda	348°46.3	-17°50.6
Achernar	335°19.1	-57°06.2
Hamal	327°50.2	23°35.2
Polaris	313°17.1	89°22.2
Acamar	315°10.9	-40°11.9
Menkar	314°05.2	4°11.6
Mirfak	308°26.9	49°57.1
Aldebaran	290°38.7	16°33.7
Rigel	281°03.1	-8°10.1
Capella	280°20.7	46°01.3
Bellatrix	278°22.0	6°22.5
Elnath	278°00.9	28°37.7
Alnilam	275°36.9	-1°11.0
Betelgeuse	270°51.3	7°24.8
Canopus	263°52.0	-52°42.2
Sirius	258°25.6	-16°44.8
Adhara	255°05.3	-29°00.1
Procyon	244°50.2	5°09.6
Pollux	243°16.6	27°57.8
Avior	234°14.7	-59°35.1
Suhail	222°46.1	-43°31.9
Miaplacidus	221°38.6	-69°49.0
Alphard	217°47.3	-8°46.0
Regulus	207°34.0	11°50.5
Dubhe	193°40.8	61°36.6
Denebola	182°24.6	14°25.7
Gienah	175°43.3	-17°41.0
Acrux	173°00.1	-63°14.4
Gacrux	171°51.6	-57°15.3
Alioth	166°13.0	55°49.2
Spica	158°22.0	-11°17.7
Alkaid	152°52.0	49°11.1
Hadar	148°35.8	-60°29.8
Menkent	147°57.3	-36°29.8
Arcturus	145°47.7	19°03.0
Rigil Kent.	139°40.1	-60°56.5
Kochab	137°20.8	74°03.0
Zuben'ubi	136°55.6	-16°08.9
Alphecca	126°03.5	26°37.8
Antares	112°15.3	-26°29.4
Atria	107°09.3	-69°04.6
Sabik	102°02.3	-15°45.4
Shaula	96°09.7	-37°07.4
Rasalhague	95°58.1	12°32.6
Eltanin	90°42.1	51°29.4
Kaus Aust.	83°31.8	-34°22.4
Vega	80°32.9	38°48.7
Nunki	75°47.0	-26°15.9
Altair	61°59.3	8°56.3
Peacock	53°04.6	-56°39.3
Deneb	49°25.3	45°22.6
Enif	33°38.0	9°59.8
Al Na'ir	27°31.8	-46°50.2
Fomalhaut	15°13.5	-29°29.1
Scheat	13°44.3	28°13.6
Markab	13°29.0	15°20.8

Oct 13 Mon	SHA	Mer.pass
Venus	180°25.0	10:31
Mars	138°24.9	13:18
Jupiter	244°22.3	06:14
Saturn	1°51.4	22:21

Oct 14 Tue	SHA	Mer.pass
Venus	179°16.5	10:32
Mars	137°43.6	13:17
Jupiter	244°16.5	06:11
Saturn	1°55.2	22:17

Oct 15 Wed	SHA	Mer.pass
Venus	178°08.0	10:33
Mars	137°02.2	13:16
Jupiter	244°10.9	06:07
Saturn	1°58.9	22:13

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h

Mon	Sun GHA	Sun Dec	Moon GHA	Moon ν	Moon Dec	Moon d	Moon HP
0	183°25.5	S07°47.1	280°18.1	4.5′	N27°51.3	4.0′	58.7′
1	198°25.7	48.1	294°41.5	4.6′	27°47.3	4.3′	58.6′
2	213°25.8	49.0	309°05.1	4.7′	27°43.0	4.4′	58.6′
3	228°26.0	·· 49.9	323°28.7	4.7′	27°38.6	4.5′	58.6′
4	243°26.1	50.9	337°52.5	4.8′	27°34.1	4.8′	58.6′
5	258°26.3	51.8	352°16.3	4.9′	27°29.3	4.9′	58.5′
6	273°26.4	S07°52.7	6°40.3	5.0′	N27°24.4	5.1′	58.5′
7	288°26.6	53.7	21°04.3	5.1′	27°19.3	5.3′	58.5′
8	303°26.7	54.6	35°28.4	5.2′	27°14.0	5.4′	58.4′
9	318°26.9	·· 55.5	49°52.7	5.4′	27°08.6	5.6′	58.4′
10	333°27.0	56.5	64°17.0	5.5′	27°03.0	5.7′	58.4′
11	348°27.2	57.4	78°41.5	5.6′	26°57.3	6.0′	58.3′
12	3°27.3	S07°58.3	93°06.1	5.7′	N26°51.3	6.1′	58.3′
13	18°27.5	07°59.3	107°30.7	5.8′	26°45.2	6.2′	58.3′
14	33°27.6	08°00.2	121°55.5	5.9′	26°39.0	6.4′	58.2′
15	48°27.8	·· 01.1	136°20.4	6.0′	26°32.6	6.6′	58.2′
16	63°27.9	02.1	150°45.4	6.1′	26°26.0	6.7′	58.2′
17	78°28.1	03.0	165°10.5	6.2′	26°19.3	6.8′	58.1′
18	93°28.2	S08°03.9	179°35.8	6.3′	N26°12.5	7.1′	58.1′
19	108°28.4	04.9	194°01.1	6.5′	26°05.4	7.1′	58.1′
20	123°28.5	05.8	208°26.6	6.6′	25°58.3	7.3′	58.1′
21	138°28.7	·· 06.7	222°52.2	6.7′	25°51.0	7.5′	58.0′
22	153°28.8	07.6	237°17.8	6.8′	25°43.5	7.6′	58.0′
23	168°29.0	08.6	251°43.7	6.9′	25°35.9	7.8′	58.0′
	SD = 16.0′	d = 0.9′		SD = 16.0′			

Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	183°29.1	S08°09.5	266°09.6	7.0′	N25°28.1	7.9′	57.9′
1	198°29.3	10.4	280°35.6	7.2′	25°20.2	8.0′	57.9′
2	213°29.4	11.4	295°01.8	7.3′	25°12.2	8.2′	57.9′
3	228°29.5	·· 12.3	309°28.1	7.4′	25°04.0	8.3′	57.8′
4	243°29.7	13.2	323°54.5	7.5′	24°55.7	8.4′	57.8′
5	258°29.8	14.1	338°21.0	7.6′	24°47.3	8.6′	57.8′
6	273°30.0	S08°15.1	352°47.6	7.8′	N24°38.7	8.7′	57.7′
7	288°30.1	16.0	7°14.4	7.9′	24°30.0	8.8′	57.7′
8	303°30.3	16.9	21°41.3	8.0′	24°21.2	9.0′	57.7′
9	318°30.4	·· 17.9	36°08.3	8.1′	24°12.2	9.1′	57.6′
10	333°30.6	18.8	50°35.4	8.2′	24°03.1	9.2′	57.6′
11	348°30.7	19.7	65°02.6	8.4′	23°53.9	9.4′	57.6′
12	3°30.8	S08°20.6	79°30.0	8.5′	N23°44.5	9.4′	57.6′
13	18°31.0	21.6	93°57.5	8.6′	23°35.1	9.6′	57.5′
14	33°31.1	22.5	108°25.1	8.7′	23°25.5	9.7′	57.5′
15	48°31.3	·· 23.4	122°52.8	8.8′	23°15.8	9.9′	57.5′
16	63°31.4	24.4	137°20.7	9.0′	23°05.9	9.9′	57.4′
17	78°31.6	25.3	151°48.6	9.1′	22°56.0	10.1′	57.4′
18	93°31.7	S08°26.2	166°16.7	9.2′	N22°45.9	10.1′	57.4′
19	108°31.8	27.1	180°44.9	9.3′	22°35.8	10.3′	57.3′
20	123°32.0	28.1	195°13.2	9.4′	22°25.5	10.4′	57.3′
21	138°32.1	·· 29.0	209°41.7	9.6′	22°15.1	10.5′	57.3′
22	153°32.3	29.9	224°10.2	9.7′	22°04.6	10.6′	57.3′
23	168°32.4	30.8	238°38.9	9.8′	21°54.0	10.7′	57.2′
	SD = 16.0′	d = 0.9′		SD = 15.8′			

Wed	GHA	Dec	GHA	ν	Dec	d	HP
0	183°32.5	S08°31.8	253°07.7	9.9′	N21°43.3	10.8′	57.2′
1	198°32.7	32.7	267°36.6	10.0′	21°32.5	10.9′	57.2′
2	213°32.8	33.6	282°05.6	10.1′	21°21.6	11.0′	57.1′
3	228°33.0	·· 34.5	296°34.8	10.3′	21°10.6	11.1′	57.1′
4	243°33.1	35.5	311°04.0	10.4′	20°59.5	11.2′	57.1′
5	258°33.2	36.4	325°33.4	10.5′	20°48.3	11.2′	57.1′
6	273°33.4	S08°37.3	340°02.9	10.6′	N20°37.1	11.4′	57.0′
7	288°33.5	38.2	354°32.5	10.7′	20°25.7	11.5′	57.0′
8	303°33.6	39.1	9°02.2	10.8′	20°14.2	11.6′	57.0′
9	318°33.8	·· 40.1	23°32.0	10.9′	20°02.6	11.6′	56.9′
10	333°33.9	41.0	38°02.0	11.0′	19°51.0	11.8′	56.9′
11	348°34.1	41.9	52°32.0	11.2′	19°39.2	11.8′	56.9′
12	3°34.2	S08°42.8	67°02.2	11.3′	N19°27.4	11.9′	56.9′
13	18°34.3	43.8	81°32.4	11.4′	19°15.5	12.0′	56.8′
14	33°34.5	44.7	96°02.8	11.5′	19°03.5	12.1′	56.8′
15	48°34.6	·· 45.6	110°33.3	11.6′	18°51.4	12.1′	56.8′
16	63°34.7	46.5	125°03.9	11.7′	18°39.3	12.2′	56.7′
17	78°34.9	47.4	139°34.5	11.8′	18°27.1	12.3′	56.7′
18	93°35.0	S08°48.4	154°05.3	11.9′	N18°14.8	12.4′	56.7′
19	108°35.2	49.3	168°36.2	12.0′	18°02.4	12.5′	56.7′
20	123°35.3	50.2	183°07.2	12.1′	17°49.9	12.5′	56.6′
21	138°35.4	·· 51.1	197°38.3	12.2′	17°37.4	12.6′	56.6′
22	153°35.6	52.0	212°09.5	12.3′	17°24.8	12.7′	56.6′
23	168°35.7	53.0	226°40.8	12.4′	17°12.1	12.7′	56.6′
	SD = 16.0′	d = 0.9′		SD = 15.6′			

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	04:52	06:10	07:20	16:10	17:20	18:37
N 70°	04:56	06:07	07:10	16:21	17:23	18:34
68°	04:59	06:04	07:01	16:30	17:26	18:31
66°	05:02	06:01	06:53	16:37	17:29	18:28
64°	05:04	05:59	06:47	16:43	17:31	18:26
62°	05:06	05:57	06:42	16:49	17:34	18:25
60°	05:07	05:55	06:37	16:53	17:35	18:23
N 58°	05:08	05:54	06:33	16:58	17:37	18:22
56°	05:09	05:52	06:30	17:01	17:39	18:22
54°	05:10	05:51	06:26	17:05	17:40	18:21
52°	05:10	05:49	06:23	17:08	17:42	18:21
50°	05:11	05:48	06:21	17:11	17:43	18:20
45°	05:11	05:45	06:15	17:17	17:46	18:20
N 40°	05:11	05:42	06:10	17:22	17:49	18:20
35°	05:10	05:40	06:05	17:26	17:52	18:21
30°	05:09	05:37	06:01	17:30	17:54	18:22
20°	05:07	05:32	05:55	17:37	17:59	18:25
N 10°	05:03	05:27	05:48	17:43	18:04	18:29
0°	04:58	05:22	05:43	17:49	18:10	18:34
S 10°	04:51	05:15	05:37	17:55	18:17	18:41
20°	04:42	05:08	05:30	18:02	18:24	18:50
30°	04:30	04:59	05:23	18:09	18:34	19:03
35°	04:22	04:53	05:19	18:14	18:40	19:10
40°	04:13	04:46	05:14	18:19	18:47	19:20
45°	04:01	04:38	05:08	18:25	18:55	19:32
S 50°	03:46	04:27	05:01	18:32	19:06	19:47
52°	03:39	04:22	04:58	18:35	19:11	19:54
54°	03:31	04:17	04:54	18:39	19:16	20:03
56°	03:22	04:11	04:50	18:43	19:23	20:12
58°	03:11	04:04	04:46	18:47	19:30	20:24
S 60°	02:58	03:56	04:41	18:53	19:38	20:37

Lat.	Moonrise Mon	Moonrise Tue	Moonrise Wed	Moonset Mon	Moonset Tue	Moonset Wed
N 72°	▭	▭	20:40	▭	▭	19:17
N 70°	▭	▭	21:56	▭	▭	18:00
68°	▭	▭	22:33	▭	▭	17:21
66°	▭	20:35	22:59	▭	17:34	16:54
64°	▭	21:17	23:18	▭	16:51	16:33
62°	19:42	21:45	23:34	16:30	16:22	16:16
60°	20:20	22:07	23:48	15:52	15:59	16:02
N 58°	20:46	22:24	23:59	15:25	15:41	15:49
56°	21:07	22:39	·· ··	15:04	15:26	15:39
54°	21:24	22:52	·· ··	14:47	15:13	15:29
52°	21:39	23:03	·· ··	14:32	15:01	15:21
50°	21:51	23:13	·· ··	14:19	14:51	15:13
45°	22:17	23:33	·· ··	13:52	14:29	14:57
N 40°	22:38	23:50	·· ··	13:30	14:11	14:43
35°	22:55	·· ··	00:04	13:12	13:56	14:32
30°	23:10	·· ··	00:16	12:57	13:43	14:22
20°	23:35	·· ··	00:36	12:30	13:21	14:04
N 10°	23:57	·· ··	00:54	12:08	13:01	13:49
0°	·· ··	00:17	01:10	11:46	12:43	13:34
S 10°	·· ··	00:37	01:27	11:25	12:25	13:20
20°	00:04	00:58	01:44	11:02	12:05	13:04
30°	00:32	01:23	02:05	10:35	11:42	12:46
35°	00:48	01:37	02:16	10:19	11:28	12:35
40°	01:07	01:54	02:30	10:00	11:12	12:23
45°	01:31	02:13	02:45	09:38	10:53	12:09
S 50°	02:00	02:38	03:05	09:09	10:30	11:51
52°	02:15	02:50	03:14	08:55	10:18	11:42
54°	02:31	03:04	03:24	08:38	10:05	11:33
56°	02:51	03:19	03:35	08:18	09:50	11:22
58°	03:16	03:38	03:48	07:54	09:32	11:10
S 60°	03:50	04:01	04:04	07:20	09:10	10:55

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 22-24 59-37%
13	13:42	13:49	11:46	05:32	18:02	
14	13:56	14:03	11:46	06:30	18:57	
15	14:10	14:17	11:46	07:23	19:47	

October 16, 17, 18 UT (Thu., Fri., Sat.)

	Aries	Venus		Mars		Jupiter		Saturn	
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	24°46.0	201°45.5	N00°21.1	161°06.6	S16°54.4	268°51.5	N21°21.3	26°48.5	S03°36.4
1	39°48.5	216°45.1	19.8	176°07.4	54.9	283°53.8	21.3	41°51.2	36.5
2	54°50.9	231°44.7	18.6	191°08.1	55.4	298°56.0	21.3	56°53.8	36.6
3	69°53.4	246°44.3	·· 17.4	206°08.8	·· 55.9	313°58.3	·· 21.2	71°56.4	·· 36.6
4	84°55.9	261°43.9	16.2	221°09.6	56.5	329°00.5	21.2	86°59.0	36.7
5	99°58.3	276°43.5	15.0	236°10.3	57.0	344°02.8	21.2	102°01.6	36.8
6	115°00.8	291°43.1	N00°13.7	251°11.0	S16°57.5	359°05.0	N21°21.1	117°04.2	S03°36.8
7	130°03.3	306°42.7	12.5	266°11.7	58.0	14°07.3	21.1	132°06.8	36.9
8	145°05.7	321°42.3	11.3	281°12.5	58.6	29°09.5	21.1	147°09.5	36.9
9	160°08.2	336°41.9	·· 10.1	296°13.2	·· 59.1	44°11.7	·· 21.0	162°12.1	·· 37.0
10	175°10.7	351°41.5	08.9	311°13.9	16°59.6	59°14.0	21.0	177°14.7	37.1
11	190°13.1	6°41.1	07.6	326°14.6	17°00.1	74°16.2	21.0	192°17.3	37.1
12	205°15.6	21°40.8	N00°06.4	341°15.4	S17°00.7	89°18.5	N21°21.0	207°19.9	S03°37.2
13	220°18.0	36°40.4	05.2	356°16.1	01.2	104°20.7	20.9	222°22.5	37.2
14	235°20.5	51°40.0	04.0	11°16.8	01.7	119°23.0	20.9	237°25.1	37.3
15	250°23.0	66°39.6	·· 02.8	26°17.5	·· 02.2	134°25.2	·· 20.9	252°27.8	·· 37.4
16	265°25.4	81°39.2	01.5	41°18.3	02.7	149°27.5	20.8	267°30.4	37.4
17	280°27.9	96°38.8	N00°00.3	56°19.0	03.3	164°29.7	20.8	282°33.0	37.5
18	295°30.4	111°38.4	S00°00.9	71°19.7	S17°03.8	179°32.0	N21°20.8	297°35.6	S03°37.5
19	310°32.8	126°38.0	02.1	86°20.4	04.3	194°34.2	20.7	312°38.2	37.6
20	325°35.3	141°37.6	03.3	101°21.2	04.8	209°36.5	20.7	327°40.8	37.7
21	340°37.8	156°37.2	·· 04.6	116°21.9	·· 05.4	224°38.7	·· 20.7	342°43.4	·· 37.7
22	355°40.2	171°36.8	05.8	131°22.6	05.9	239°41.0	20.7	357°46.1	37.8
23	10°42.7	186°36.4	07.0	146°23.3	06.4	254°43.2	20.6	12°48.7	37.8
Mer.pass.	22:17	ν -0.4′	d 1.2′	m -3.92	ν 0.7′	d 0.5′	m 1.52	ν 2.2′	d 0.0′ m -2.21	ν 2.6′	d 0.1′ m 0.68

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	25°45.1	201°36.1	S00°08.2	161°24.1	S17°06.9	269°45.5	N21°20.6	27°51.3	S03°37.9
1	40°47.6	216°35.7	09.4	176°24.8	07.4	284°47.7	20.6	42°53.9	38.0
2	55°50.1	231°35.3	10.7	191°25.5	08.0	299°50.0	20.5	57°56.5	38.0
3	70°52.5	246°34.9	·· 11.9	206°26.2	·· 08.5	314°52.2	·· 20.5	72°59.1	·· 38.1
4	85°55.0	261°34.5	13.1	221°26.9	09.0	329°54.5	20.5	88°01.7	38.1
5	100°57.5	276°34.1	14.3	236°27.7	09.5	344°56.7	20.4	103°04.3	38.2
6	115°59.9	291°33.7	S00°15.5	251°28.4	S17°10.0	359°59.0	N21°20.4	118°07.0	S03°38.3
7	131°02.4	306°33.3	16.8	266°29.1	10.6	15°01.2	20.4	133°09.6	38.3
8	146°04.9	321°32.9	18.0	281°29.8	11.1	30°03.5	20.4	148°12.2	38.4
9	161°07.3	336°32.5	·· 19.2	296°30.6	·· 11.6	45°05.7	·· 20.3	163°14.8	·· 38.4
10	176°09.8	351°32.1	20.4	311°31.3	12.1	60°08.0	20.3	178°17.4	38.5
11	191°12.3	6°31.7	21.6	326°32.0	12.6	75°10.2	20.3	193°20.0	38.6
12	206°14.7	21°31.3	S00°22.9	341°32.7	S17°13.1	90°12.5	N21°20.2	208°22.6	S03°38.6
13	221°17.2	36°31.0	24.1	356°33.4	13.7	105°14.8	20.2	223°25.2	38.7
14	236°19.6	51°30.6	25.3	11°34.1	14.2	120°17.0	20.2	238°27.9	38.7
15	251°22.1	66°30.2	·· 26.5	26°34.9	·· 14.7	135°19.3	·· 20.1	253°30.5	·· 38.8
16	266°24.6	81°29.8	27.7	41°35.6	15.2	150°21.5	20.1	268°33.1	38.9
17	281°27.0	96°29.4	29.0	56°36.3	15.7	165°23.8	20.1	283°35.7	38.9
18	296°29.5	111°29.0	S00°30.2	71°37.0	S17°16.2	180°26.0	N21°20.1	298°38.3	S03°39.0
19	311°32.0	126°28.6	31.4	86°37.7	16.8	195°28.3	20.0	313°40.9	39.0
20	326°34.4	141°28.2	32.6	101°38.5	17.3	210°30.5	20.0	328°43.5	39.1
21	341°36.9	156°27.8	·· 33.9	116°39.2	·· 17.8	225°32.8	·· 20.0	343°46.1	·· 39.2
22	356°39.4	171°27.4	35.1	131°39.9	18.3	240°35.1	19.9	358°48.7	39.2
23	11°41.8	186°27.0	36.3	146°40.6	18.8	255°37.3	19.9	13°51.4	39.3
Mer.pass.	22:13	ν -0.4′	d 1.2′	m -3.92	ν 0.7′	d 0.5′	m 1.52	ν 2.3′	d 0.0′ m -2.22	ν 2.6′	d 0.1′ m 0.69

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	26°44.3	201°26.6	S00°37.5	161°41.3	S17°19.3	270°39.6	N21°19.9	28°54.0	S03°39.3
1	41°46.7	216°26.2	38.7	176°42.0	19.9	285°41.8	19.9	43°56.6	39.4
2	56°49.2	231°25.8	40.0	191°42.8	20.4	300°44.1	19.8	58°59.2	39.5
3	71°51.7	246°25.5	·· 41.2	206°43.5	·· 20.9	315°46.3	·· 19.8	74°01.8	·· 39.5
4	86°54.1	261°25.1	42.4	221°44.2	21.4	330°48.6	19.8	89°04.4	39.6
5	101°56.6	276°24.7	43.6	236°44.9	21.9	345°50.9	19.7	104°07.0	39.6
6	116°59.1	291°24.3	S00°44.8	251°45.6	S17°22.4	0°53.1	N21°19.7	119°09.6	S03°39.7
7	132°01.5	306°23.9	46.1	266°46.3	22.9	15°55.4	19.7	134°12.2	39.7
8	147°04.0	321°23.5	47.3	281°47.0	23.5	30°57.6	19.7	149°14.9	39.8
9	162°06.5	336°23.1	·· 48.5	296°47.8	·· 24.0	45°59.9	·· 19.6	164°17.5	·· 39.9
10	177°08.9	351°22.7	49.7	311°48.5	24.5	61°02.2	19.6	179°20.1	39.9
11	192°11.4	6°22.3	51.0	326°49.2	25.0	76°04.4	19.6	194°22.7	40.0
12	207°13.9	21°21.9	S00°52.2	341°49.9	S17°25.5	91°06.7	N21°19.5	209°25.3	S03°40.0
13	222°16.3	36°21.5	53.4	356°50.6	26.0	106°09.0	19.5	224°27.9	40.1
14	237°18.8	51°21.1	54.6	11°51.3	26.5	121°11.2	19.5	239°30.5	40.2
15	252°21.2	66°20.7	·· 55.8	26°52.0	·· 27.0	136°13.5	·· 19.5	254°33.1	·· 40.2
16	267°23.7	81°20.3	57.1	41°52.7	27.6	151°15.7	19.4	269°35.7	40.3
17	282°26.2	96°19.9	58.3	56°53.5	28.1	166°18.0	19.4	284°38.3	40.3
18	297°28.6	111°19.5	S00°59.5	71°54.2	S17°28.6	181°20.3	N21°19.4	299°40.9	S03°40.4
19	312°31.1	126°19.1	01°00.7	86°54.9	29.1	196°22.5	19.4	314°43.6	40.4
20	327°33.6	141°18.8	02.0	101°55.6	29.6	211°24.8	19.3	329°46.2	40.5
21	342°36.0	156°18.4	·· 03.2	116°56.3	·· 30.1	226°27.1	·· 19.3	344°48.8	·· 40.6
22	357°38.5	171°18.0	04.4	131°57.0	30.6	241°29.3	19.3	359°51.4	40.6
23	12°41.0	186°17.6	05.6	146°57.7	31.1	256°31.6	19.2	14°54.0	40.7
Mer.pass.	22:09	ν -0.4′	d 1.2′	m -3.92	ν 0.7′	d 0.5′	m 1.52	ν 2.3′	d 0.0′ m -2.23	ν 2.6′	d 0.1′ m 0.69

Stars

	SHA	Dec
Alpheratz	357°33.8	29°14.2
Ankaa	353°06.1	-42°09.9
Schedar	349°29.8	56°40.9
Diphda	348°46.3	-17°50.6
Achernar	335°19.1	-57°06.2
Hamal	327°50.2	23°35.2
Polaris	313°16.3	89°22.3
Acamar	315°10.9	-40°11.9
Menkar	314°05.2	4°11.6
Mirfak	308°26.9	49°57.2
Aldebaran	290°38.7	16°33.7
Rigel	281°03.1	-8°10.1
Capella	280°20.7	46°01.3
Bellatrix	278°22.0	6°22.5
Elnath	278°00.9	28°37.7
Alnilam	275°36.9	-1°11.0
Betelgeuse	270°51.3	7°24.8
Canopus	263°51.9	-52°42.2
Sirius	258°25.6	-16°44.8
Adhara	255°05.3	-29°00.1
Procyon	244°50.2	5°09.6
Pollux	243°16.5	27°57.8
Avior	234°14.6	-59°35.1
Suhail	222°46.0	-43°31.9
Miaplacidus	221°38.6	-69°49.0
Alphard	217°47.3	-8°46.1
Regulus	207°34.0	11°50.5
Dubhe	193°40.7	61°36.6
Denebola	182°24.6	14°25.7
Gienah	175°43.3	-17°41.0
Acrux	173°00.1	-63°14.4
Gacrux	171°51.6	-57°15.3
Alioth	166°12.9	55°49.2
Spica	158°22.0	-11°17.7
Alkaid	152°52.0	49°11.1
Hadar	148°35.8	-60°29.8
Menkent	147°57.3	-36°29.8
Arcturus	145°47.7	19°03.0
Rigil Kent.	139°40.1	-60°56.5
Kochab	137°20.9	74°03.0
Zuben'ubi	136°55.6	-16°08.9
Alphecca	126°03.5	26°37.8
Antares	112°15.3	-26°29.4
Atria	107°09.4	-69°04.6
Sabik	102°02.3	-15°45.4
Shaula	96°09.7	-37°07.4
Rasalhague	95°58.1	12°32.6
Eltanin	90°42.1	51°29.4
Kaus Aust.	83°31.8	-34°22.4
Vega	80°32.9	38°48.7
Nunki	75°47.1	-26°15.9
Altair	61°59.3	8°56.3
Peacock	53°04.6	-56°39.3
Deneb	49°25.3	45°22.6
Enif	33°38.0	9°59.8
Al Na'ir	27°31.8	-46°50.3
Fomalhaut	15°13.5	-29°29.1
Scheat	13°44.3	28°13.6
Markab	13°29.0	15°20.8

Oct 16 Thu	SHA	Mer.pass
Venus	176°59.4	10:33
Mars	136°20.6	13:15
Jupiter	244°05.5	06:04
Saturn	2°02.5	22:09

Oct 17 Fri	SHA	Mer.pass
Venus	175°50.9	10:34
Mars	135°38.9	13:14
Jupiter	244°00.3	06:00
Saturn	2°06.1	22:05

Oct 18 Sat	SHA	Mer.pass
Venus	174°42.3	10:35
Mars	134°57.0	13:13
Jupiter	243°55.3	05:56
Saturn	2°09.7	22:01

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°35.8	S08°53.9	241°12.2	12.5′	N16°59.4	12.8′	56.5′
1	198°36.0	54.8	255°43.7	12.6′	16°46.6	12.9′	56.5′
2	213°36.1	55.7	270°15.3	12.7′	16°33.7	12.9′	56.5′
3	228°36.2	·· 56.6	284°47.0	12.8′	16°20.8	13.0′	56.4′
4	243°36.4	57.6	299°18.8	12.9′	16°07.8	13.1′	56.4′
5	258°36.5	58.5	313°50.6	13.0′	15°54.7	13.1′	56.4′
6	273°36.6	S08°59.4	328°22.6	13.1′	N15°41.6	13.2′	56.4′
7	288°36.8	09°00.3	342°54.7	13.1′	15°28.4	13.2′	56.3′
8	303°36.9	01.2	357°26.8	13.2′	15°15.2	13.3′	56.3′
9	318°37.0	·· 02.2	11°59.0	13.3′	15°01.9	13.4′	56.3′
10	333°37.1	03.1	26°31.4	13.4′	14°48.5	13.4′	56.3′
11	348°37.3	04.0	41°03.8	13.5′	14°35.1	13.4′	56.2′
12	3°37.4	S09°04.9	55°36.3	13.6′	N14°21.7	13.5′	56.2′
13	18°37.5	05.8	70°08.8	13.7′	14°08.2	13.6′	56.2′
14	33°37.7	06.7	84°41.5	13.7′	13°54.6	13.6′	56.2′
15	48°37.8	·· 07.7	99°14.2	13.8′	13°41.0	13.6′	56.1′
16	63°37.9	08.6	113°47.1	13.9′	13°27.4	13.7′	56.1′
17	78°38.1	09.5	128°20.0	14.0′	13°13.7	13.8′	56.1′
18	93°38.2	S09°10.4	142°53.0	14.1′	N12°59.9	13.8′	56.1′
19	108°38.3	11.3	157°26.0	14.1′	12°46.1	13.8′	56.0′
20	123°38.4	12.2	171°59.2	14.2′	12°32.3	13.9′	56.0′
21	138°38.6	·· 13.2	186°32.4	14.3′	12°18.4	13.9′	56.0′
22	153°38.7	14.1	201°05.6	14.4′	12°04.5	14.0′	56.0′
23	168°38.8	15.0	215°39.0	14.4′	11°50.5	14.0′	56.0′
	SD = 16.0′	d = 0.9′	SD = 15.4′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°39.0	S09°15.9	230°12.4	14.5′	N11°36.5	14.0′	55.9′
1	198°39.1	16.8	244°45.9	14.6′	11°22.5	14.1′	55.9′
2	213°39.2	17.7	259°19.5	14.6′	11°08.4	14.1′	55.9′
3	228°39.3	·· 18.6	273°53.1	14.7′	10°54.3	14.1′	55.9′
4	243°39.5	19.5	288°26.8	14.8′	10°40.2	14.2′	55.8′
5	258°39.6	20.5	303°00.6	14.8′	10°26.0	14.2′	55.8′
6	273°39.7	S09°21.4	317°34.4	14.9′	N10°11.8	14.2′	55.8′
7	288°39.8	22.3	332°08.3	15.0′	09°57.6	14.3′	55.8′
8	303°40.0	23.2	346°42.3	15.0′	09°43.3	14.3′	55.7′
9	318°40.1	·· 24.1	1°16.3	15.1′	09°29.0	14.3′	55.7′
10	333°40.2	25.0	15°50.4	15.1′	09°14.7	14.4′	55.7′
11	348°40.3	25.9	30°24.5	15.2′	09°00.3	14.3′	55.7′
12	3°40.5	S09°26.8	44°58.7	15.2′	N08°46.0	14.4′	55.7′
13	18°40.6	27.8	59°33.0	15.3′	08°31.6	14.5′	55.6′
14	33°40.7	28.7	74°07.3	15.4′	08°17.1	14.4′	55.6′
15	48°40.8	·· 29.6	88°41.6	15.4′	08°02.7	14.5′	55.6′
16	63°41.0	30.5	103°16.0	15.5′	07°48.2	14.5′	55.6′
17	78°41.1	31.4	117°50.5	15.5′	07°33.7	14.5′	55.6′
18	93°41.2	S09°32.3	132°25.0	15.6′	N07°19.2	14.5′	55.5′
19	108°41.3	33.2	146°59.6	15.6′	07°04.7	14.5′	55.5′
20	123°41.5	34.1	161°34.2	15.7′	06°50.2	14.6′	55.5′
21	138°41.6	·· 35.0	176°08.8	15.7′	06°35.6	14.6′	55.5′
22	153°41.7	36.0	190°43.5	15.7′	06°21.0	14.6′	55.4′
23	168°41.8	36.9	205°18.3	15.8′	06°06.4	14.6′	55.4′
	SD = 16.0′	d = 0.9′	SD = 15.3′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°41.9	S09°37.8	219°53.0	15.8′	N05°51.8	14.6′	55.4′
1	198°42.1	38.7	234°27.9	15.9′	05°37.2	14.6′	55.4′
2	213°42.2	39.6	249°02.7	15.9′	05°22.6	14.7′	55.4′
3	228°42.3	·· 40.5	263°37.6	15.9′	05°07.9	14.6′	55.3′
4	243°42.4	41.4	278°12.6	16.0′	04°53.3	14.7′	55.3′
5	258°42.6	42.3	292°47.6	16.0′	04°38.6	14.7′	55.3′
6	273°42.7	S09°43.2	307°22.6	16.1′	N04°23.9	14.6′	55.3′
7	288°42.8	44.1	321°57.6	16.1′	04°09.3	14.7′	55.3′
8	303°42.9	45.0	336°32.7	16.1′	03°54.6	14.7′	55.3′
9	318°43.0	·· 45.9	351°07.9	16.2′	03°39.9	14.7′	55.2′
10	333°43.1	46.8	5°43.0	16.2′	03°25.2	14.7′	55.2′
11	348°43.3	47.7	20°18.2	16.2′	03°10.5	14.7′	55.2′
12	3°43.4	S09°48.7	34°53.4	16.2′	N02°55.8	14.7′	55.2′
13	18°43.5	49.6	49°28.6	16.3′	02°41.1	14.7′	55.2′
14	33°43.6	50.5	64°03.9	16.3′	02°26.4	14.7′	55.1′
15	48°43.7	·· 51.4	78°39.2	16.3′	02°11.7	14.7′	55.1′
16	63°43.9	52.3	93°14.5	16.3′	01°57.0	14.8′	55.1′
17	78°44.0	53.2	107°49.8	16.4′	01°42.2	14.7′	55.1′
18	93°44.1	S09°54.1	122°25.2	16.4′	N01°27.5	14.7′	55.1′
19	108°44.2	55.0	137°00.6	16.4′	01°12.8	14.6′	55.1′
20	123°44.3	55.9	151°36.0	16.4′	00°58.2	14.7′	55.0′
21	138°44.4	·· 56.8	166°11.4	16.4′	00°43.5	14.7′	55.0′
22	153°44.5	57.7	180°46.8	16.5′	00°28.8	14.7′	55.0′
23	168°44.7	58.6	195°22.3	16.5′	00°14.1	14.7′	55.0′
	SD = 16.0′	d = 0.9′	SD = 15.1′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	05:05	06:23	07:35	15:54	17:05	18:23
N 70°	05:08	06:18	07:22	16:07	17:10	18:21
68°	05:10	06:14	07:12	16:17	17:15	18:19
66°	05:11	06:11	07:04	16:26	17:18	18:18
64°	05:12	06:07	06:56	16:33	17:22	18:17
62°	05:13	06:05	06:50	16:39	17:25	18:16
60°	05:14	06:02	06:45	16:45	17:27	18:15
N 58°	05:15	06:00	06:40	16:50	17:29	18:15
56°	05:15	05:58	06:36	16:54	17:32	18:15
54°	05:15	05:56	06:32	16:58	17:34	18:14
52°	05:15	05:54	06:29	17:01	17:35	18:14
50°	05:15	05:53	06:25	17:04	17:37	18:15
45°	05:15	05:49	06:18	17:11	17:41	18:15
N 40°	05:14	05:45	06:13	17:17	17:45	18:16
35°	05:13	05:42	06:08	17:22	17:48	18:17
30°	05:11	05:39	06:03	17:27	17:51	18:19
20°	05:08	05:33	05:56	17:35	17:57	18:23
N 10°	05:03	05:27	05:49	17:42	18:03	18:28
0°	04:57	05:21	05:42	17:49	18:10	18:34
S 10°	04:49	05:14	05:35	17:55	18:17	18:42
20°	04:39	05:06	05:28	18:03	18:25	18:52
30°	04:26	04:55	05:20	18:11	18:36	19:05
35°	04:18	04:49	05:15	18:16	18:42	19:13
40°	04:08	04:41	05:09	18:22	18:50	19:24
45°	03:55	04:32	05:03	18:29	18:59	19:36
S 50°	03:39	04:21	04:55	18:37	19:11	19:53
52°	03:31	04:15	04:51	18:41	19:16	20:01
54°	03:22	04:09	04:47	18:45	19:23	20:10
56°	03:12	04:03	04:43	18:49	19:29	20:21
58°	03:00	03:55	04:38	18:54	19:37	20:33
S 60°	02:46	03:46	04:32	19:00	19:46	20:47

Lat.	**Moonrise** Thu	Fri	Sat	**Moonset** Thu	Fri	Sat
N 72°	·· ··	00:05	02:19	17:29	16:44	16:10
N 70°	·· ··	00:25	02:27	17:06	16:33	16:07
68°	·· ··	00:41	02:33	16:48	16:25	16:05
66°	·· ··	00:54	02:39	16:33	16:17	16:04
64°	·· ··	01:05	02:43	16:21	16:11	16:02
62°	·· ··	01:14	02:47	16:11	16:06	16:01
60°	·· ··	01:22	02:50	16:02	16:01	16:00
N 58°	·· ··	01:28	02:53	15:54	15:57	15:59
56°	00:09	01:34	02:55	15:47	15:53	15:58
54°	00:18	01:40	02:58	15:41	15:50	15:57
52°	00:25	01:44	03:00	15:35	15:47	15:56
50°	00:32	01:49	03:02	15:30	15:44	15:56
45°	00:47	01:58	03:06	15:19	15:38	15:54
N 40°	00:59	02:05	03:09	15:10	15:32	15:53
35°	01:09	02:12	03:12	15:02	15:28	15:52
30°	01:18	02:18	03:15	14:55	15:24	15:51
20°	01:34	02:28	03:19	14:42	15:17	15:49
N 10°	01:47	02:36	03:23	14:32	15:11	15:48
0°	01:59	02:44	03:27	14:21	15:05	15:46
S 10°	02:12	02:53	03:30	14:11	14:59	15:45
20°	02:25	03:01	03:34	14:00	14:53	15:43
30°	02:40	03:11	03:39	13:47	14:45	15:41
35°	02:49	03:16	03:41	13:40	14:41	15:40
40°	02:58	03:23	03:44	13:31	14:36	15:39
45°	03:10	03:30	03:47	13:21	14:31	15:38
S 50°	03:24	03:39	03:51	13:09	14:24	15:36
52°	03:30	03:43	03:53	13:04	14:21	15:35
54°	03:37	03:47	03:55	12:57	14:17	15:34
56°	03:45	03:52	03:57	12:50	14:14	15:33
58°	03:54	03:57	03:59	12:42	14:09	15:32
S 60°	04:04	04:03	04:02	12:33	14:04	15:31

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 25-27 27-11%
16	14:23	14:30	11:46	08:11	20:33	
17	14:36	14:42	11:45	08:55	21:16	
18	14:48	14:54	11:45	09:36	21:57	

October 19, 20, 21 UT (Sun., Mon., Tue.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	27°43.4	201°17.2	S01°06.8	161°58.4	S17°31.6	271°33.9	N21°19.2	29°56.6	S03°40.7
1	42°45.9	216°16.8	08.1	176°59.1	32.1	286°36.1	19.2	44°59.2	40.8
2	57°48.3	231°16.4	09.3	191°59.8	32.7	301°38.4	19.2	60°01.8	40.8
3	72°50.8	246°16.0	·· 10.5	207°00.5	·· 33.2	316°40.7	·· 19.1	75°04.4	·· 40.9
4	87°53.3	261°15.6	11.7	222°01.3	33.7	331°42.9	19.1	90°07.0	41.0
5	102°55.7	276°15.2	13.0	237°02.0	34.2	346°45.2	19.1	105°09.6	41.0
6	117°58.2	291°14.8	S01°14.2	252°02.7	S17°34.7	1°47.5	N21°19.0	120°12.3	S03°41.1
7	133°00.7	306°14.4	15.4	267°03.4	35.2	16°49.7	19.0	135°14.9	41.1
8	148°03.1	321°14.0	16.6	282°04.1	35.7	31°52.0	19.0	150°17.5	41.2
9	163°05.6	336°13.6	·· 17.8	297°04.8	·· 36.2	46°54.3	·· 19.0	165°20.1	·· 41.3
10	178°08.1	351°13.2	19.1	312°05.5	36.7	61°56.5	18.9	180°22.7	41.3
11	193°10.5	6°12.8	20.3	327°06.2	37.2	76°58.8	18.9	195°25.3	41.4
12	208°13.0	21°12.4	S01°21.5	342°06.9	S17°37.7	92°01.1	N21°18.9	210°27.9	S03°41.4
13	223°15.5	36°12.0	22.7	357°07.6	38.2	107°03.3	18.9	225°30.5	41.5
14	238°17.9	51°11.6	24.0	12°08.3	38.8	122°05.6	18.8	240°33.1	41.5
15	253°20.4	66°11.2	·· 25.2	27°09.0	·· 39.3	137°07.9	·· 18.8	255°35.7	·· 41.6
16	268°22.8	81°10.8	26.4	42°09.7	39.8	152°10.2	18.8	270°38.3	41.7
17	283°25.3	96°10.4	27.6	57°10.4	40.3	167°12.4	18.8	285°40.9	41.7
18	298°27.8	111°10.1	S01°28.9	72°11.1	S17°40.8	182°14.7	N21°18.7	300°43.5	S03°41.8
19	313°30.2	126°09.7	30.1	87°11.8	41.3	197°17.0	18.7	315°46.1	41.8
20	328°32.7	141°09.3	31.3	102°12.6	41.8	212°19.2	18.7	330°48.8	41.9
21	343°35.2	156°08.9	·· 32.5	117°13.3	·· 42.3	227°21.5	·· 18.6	345°51.4	·· 41.9
22	358°37.6	171°08.5	33.7	132°14.0	42.8	242°23.8	18.6	0°54.0	42.0
23	13°40.1	186°08.1	35.0	147°14.7	43.3	257°26.1	18.6	15°56.6	42.0
Mer.pass. 22:05		ν -0.4′	d 1.2′	m -3.92	ν 0.7′	d 0.5′	m 1.51	ν 2.3′	d 0.0′ m -2.23	ν 2.6′	d 0.1′ m 0.70

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	28°42.6	201°07.7	S01°36.2	162°15.4	S17°43.8	272°28.3	N21°18.6	30°59.2	S03°42.1
1	43°45.0	216°07.3	37.4	177°16.1	44.3	287°30.6	18.5	46°01.8	42.2
2	58°47.5	231°06.9	38.6	192°16.8	44.8	302°32.9	18.5	61°04.4	42.2
3	73°50.0	246°06.5	·· 39.9	207°17.5	·· 45.3	317°35.2	·· 18.5	76°07.0	·· 42.3
4	88°52.4	261°06.1	41.1	222°18.2	45.8	332°37.4	18.5	91°09.6	42.3
5	103°54.9	276°05.7	42.3	237°18.9	46.3	347°39.7	18.4	106°12.2	42.4
6	118°57.3	291°05.3	S01°43.5	252°19.6	S17°46.8	2°42.0	N21°18.4	121°14.8	S03°42.4
7	133°59.8	306°04.9	44.7	267°20.3	47.3	17°44.3	18.4	136°17.4	42.5
8	149°02.3	321°04.5	46.0	282°21.0	47.8	32°46.5	18.4	151°20.0	42.6
9	164°04.7	336°04.1	·· 47.2	297°21.7	·· 48.3	47°48.8	·· 18.3	166°22.6	·· 42.6
10	179°07.2	351°03.7	48.4	312°22.4	48.8	62°51.1	18.3	181°25.2	42.7
11	194°09.7	6°03.3	49.6	327°23.1	49.3	77°53.4	18.3	196°27.8	42.7
12	209°12.1	21°02.9	S01°50.9	342°23.8	S17°49.8	92°55.6	N21°18.3	211°30.4	S03°42.8
13	224°14.6	36°02.5	52.1	357°24.5	50.3	107°57.9	18.2	226°33.0	42.8
14	239°17.1	51°02.1	53.3	12°25.2	50.8	123°00.2	18.2	241°35.6	42.9
15	254°19.5	66°01.7	·· 54.5	27°25.9	·· 51.3	138°02.5	·· 18.2	256°38.3	·· 42.9
16	269°22.0	81°01.3	55.8	42°26.6	51.8	153°04.8	18.2	271°40.9	43.0
17	284°24.4	96°00.9	57.0	57°27.3	52.3	168°07.0	18.1	286°43.5	43.1
18	299°26.9	111°00.5	S01°58.2	72°28.0	S17°52.8	183°09.3	N21°18.1	301°46.1	S03°43.1
19	314°29.4	126°00.1	01°59.4	87°28.7	53.3	198°11.6	18.1	316°48.7	43.2
20	329°31.8	140°59.7	02°00.6	102°29.4	53.8	213°13.9	18.1	331°51.3	43.2
21	344°34.3	155°59.3	·· 01.9	117°30.1	·· 54.3	228°16.1	·· 18.0	346°53.9	·· 43.3
22	359°36.8	170°58.9	03.1	132°30.8	54.8	243°18.4	18.0	1°56.5	43.3
23	14°39.2	185°58.5	04.3	147°31.5	55.3	258°20.7	18.0	16°59.1	43.4
Mer.pass. 22:02		ν -0.4′	d 1.2′	m -3.92	ν 0.7′	d 0.5′	m 1.51	ν 2.3′	d 0.0′ m -2.24	ν 2.6′	d 0.1′ m 0.70

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	29°41.7	200°58.1	S02°05.5	162°32.2	S17°55.8	273°23.0	N21°18.0	32°01.7	S03°43.4
1	44°44.2	215°57.7	06.8	177°32.8	56.3	288°25.3	17.9	47°04.3	43.5
2	59°46.6	230°57.3	08.0	192°33.5	56.8	303°27.6	17.9	62°06.9	43.6
3	74°49.1	245°56.9	·· 09.2	207°34.2	·· 57.3	318°29.8	·· 17.9	77°09.5	·· 43.6
4	89°51.6	260°56.5	10.4	222°34.9	57.8	333°32.1	17.9	92°12.1	43.7
5	104°54.0	275°56.1	11.6	237°35.6	58.3	348°34.4	17.8	107°14.7	43.7
6	119°56.5	290°55.7	S02°12.9	252°36.3	S17°58.8	3°36.7	N21°17.8	122°17.3	S03°43.8
7	134°58.9	305°55.3	14.1	267°37.0	59.3	18°39.0	17.8	137°19.9	43.8
8	150°01.4	320°54.9	15.3	282°37.7	17°59.8	33°41.3	17.8	152°22.5	43.9
9	165°03.9	335°54.5	·· 16.5	297°38.4	18°00.3	48°43.5	·· 17.7	167°25.1	·· 43.9
10	180°06.3	350°54.1	17.8	312°39.1	00.8	63°45.8	17.7	182°27.7	44.0
11	195°08.8	5°53.7	19.0	327°39.8	01.3	78°48.1	17.7	197°30.3	44.0
12	210°11.3	20°53.3	S02°20.2	342°40.5	S18°01.8	93°50.4	N21°17.7	212°32.9	S03°44.1
13	225°13.7	35°52.9	21.4	357°41.2	02.3	108°52.7	17.6	227°35.5	44.2
14	240°16.2	50°52.5	22.6	12°41.9	02.8	123°55.0	17.6	242°38.1	44.2
15	255°18.7	65°52.1	·· 23.9	27°42.6	·· 03.3	138°57.2	·· 17.6	257°40.7	·· 44.3
16	270°21.1	80°51.7	25.1	42°43.3	03.8	153°59.5	17.6	272°43.3	44.3
17	285°23.6	95°51.3	26.3	57°43.9	04.3	169°01.8	17.5	287°45.9	44.4
18	300°26.0	110°50.9	S02°27.5	72°44.6	S18°04.8	184°04.1	N21°17.5	302°48.5	S03°44.4
19	315°28.5	125°50.5	28.8	87°45.3	05.3	199°06.4	17.5	317°51.1	44.5
20	330°31.0	140°50.1	30.0	102°46.0	05.8	214°08.7	17.5	332°53.7	44.5
21	345°33.4	155°49.7	·· 31.2	117°46.7	·· 06.3	229°11.0	·· 17.4	347°56.3	·· 44.6
22	0°35.9	170°49.3	32.4	132°47.4	06.8	244°13.3	17.4	2°58.9	44.6
23	15°38.4	185°48.9	33.6	147°48.1	07.2	259°15.5	17.4	18°01.5	44.7
Mer.pass. 21:58		ν -0.4′	d 1.2′	m -3.92	ν 0.7′	d 0.5′	m 1.50	ν 2.3′	d 0.0′ m -2.24	ν 2.6′	d 0.1′ m 0.71

Stars

	SHA	**Dec**
Alpheratz	357°33.8	29°14.2
Ankaa	353°06.1	-42°09.9
Schedar	349°29.8	56°40.9
Diphda	348°46.3	-17°50.6
Achernar	335°19.1	-57°06.3
Hamal	327°50.1	23°35.2
Polaris	313°15.6	89°22.3
Acamar	315°10.9	-40°11.9
Menkar	314°05.2	4°11.6
Mirfak	308°26.9	49°57.2
Aldebaran	290°38.6	16°33.8
Rigel	281°03.1	-8°10.1
Capella	280°20.7	46°01.3
Bellatrix	278°22.0	6°22.5
Elnath	278°00.9	28°37.7
Alnilam	275°36.9	-1°11.0
Betelgeuse	270°51.2	7°24.8
Canopus	263°51.9	-52°42.2
Sirius	258°25.6	-16°44.9
Adhara	255°05.3	-29°00.1
Procyon	244°50.2	5°09.6
Pollux	243°16.5	27°57.8
Avior	234°14.6	-59°35.1
Suhail	222°46.0	-43°31.9
Miaplacidus	221°38.5	-69°49.0
Alphard	217°47.3	-8°46.1
Regulus	207°34.0	11°50.5
Dubhe	193°40.7	61°36.6
Denebola	182°24.6	14°25.7
Gienah	175°43.3	-17°41.0
Acrux	173°00.1	-63°14.4
Gacrux	171°51.5	-57°15.3
Alioth	166°12.9	55°49.2
Spica	158°22.0	-11°17.7
Alkaid	152°52.0	49°11.1
Hadar	148°35.8	-60°29.8
Menkent	147°57.3	-36°29.7
Arcturus	145°47.7	19°03.0
Rigil Kent.	139°40.1	-60°56.5
Kochab	137°20.9	74°03.0
Zuben'ubi	136°55.7	-16°08.9
Alphecca	126°03.5	26°37.8
Antares	112°15.4	-26°29.4
Atria	107°09.4	-69°04.6
Sabik	102°02.3	-15°45.4
Shaula	96°09.8	-37°07.4
Rasalhague	95°58.2	12°32.6
Eltanin	90°42.1	51°29.3
Kaus Aust.	83°31.8	-34°22.4
Vega	80°32.9	38°48.7
Nunki	75°47.1	-26°15.9
Altair	61°59.4	8°56.3
Peacock	53°04.6	-56°39.3
Deneb	49°25.3	45°22.6
Enif	33°38.0	9°59.8
Al Na'ir	27°31.9	-46°50.3
Fomalhaut	15°13.6	-29°29.1
Scheat	13°44.3	28°13.6
Markab	13°29.0	15°20.8

Oct 19 Sun	**SHA**	**Mer.pass**
Venus	173°33.8	10:35
Mars	134°15.0	13:11
Jupiter	243°50.4	05:53
Saturn	2°13.2	21:56

Oct 20 Mon	**SHA**	**Mer.pass**
Venus	172°25.1	10:36
Mars	133°32.8	13:10
Jupiter	243°45.8	05:49
Saturn	2°16.6	21:52

Oct 21 Tue	**SHA**	**Mer.pass**
Venus	171°16.4	10:36
Mars	132°50.5	13:09
Jupiter	243°41.3	05:46
Saturn	2°20.0	21:48

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°44.8	S09°59.5	209°57.8	16.5′	S00°00.6	14.6′	55.0′
1	198°44.9	10°00.4	224°33.2	16.5′	00°15.2	14.7′	54.9′
2	213°45.0	01.3	239°08.7	16.5′	00°29.9	14.6′	54.9′
3	228°45.1	·· 02.2	253°44.3	16.5′	00°44.5	14.7′	54.9′
4	243°45.2	03.1	268°19.8	16.5′	00°59.2	14.6′	54.9′
5	258°45.3	04.0	282°55.3	16.5′	01°13.8	14.6′	54.9′
6	273°45.5	S10°04.9	297°30.8	16.5′	S01°28.4	14.6′	54.9′
7	288°45.6	05.8	312°06.4	16.6′	01°43.0	14.6′	54.8′
8	303°45.7	06.7	326°42.0	16.6′	01°57.6	14.5′	54.8′
9	318°45.8	·· 07.6	341°17.5	16.6′	02°12.1	14.6′	54.8′
10	333°45.9	08.5	355°53.1	16.6′	02°26.7	14.5′	54.8′
11	348°46.0	09.4	10°28.7	16.6′	02°41.2	14.5′	54.8′
12	3°46.1	S10°10.3	25°04.2	16.6′	S02°55.7	14.5′	54.8′
13	18°46.2	11.2	39°39.8	16.6′	03°10.2	14.5′	54.8′
14	33°46.4	12.1	54°15.4	16.6′	03°24.7	14.5′	54.7′
15	48°46.5	·· 13.0	68°50.9	16.6′	03°39.2	14.4′	54.7′
16	63°46.6	13.9	83°26.5	16.6′	03°53.6	14.4′	54.7′
17	78°46.7	14.8	98°02.1	16.6′	04°08.0	14.4′	54.7′
18	93°46.8	S10°15.7	112°37.7	16.6′	S04°22.4	14.4′	54.7′
19	108°46.9	16.6	127°13.2	16.6′	04°36.8	14.4′	54.7′
20	123°47.0	17.5	141°48.8	16.6′	04°51.2	14.3′	54.7′
21	138°47.1	·· 18.4	156°24.3	16.5′	05°05.5	14.3′	54.6′
22	153°47.2	19.3	170°59.9	16.5′	05°19.8	14.2′	54.6′
23	168°47.3	20.2	185°35.4	16.5′	05°34.0	14.3′	54.6′
	SD = 16.0′	d = 0.9′	SD = 15.0′				

Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°47.5	S10°21.1	200°10.9	16.5′	S05°48.3	14.2′	54.6′
1	198°47.6	22.0	214°46.5	16.5′	06°02.5	14.2′	54.6′
2	213°47.7	22.9	229°22.0	16.5′	06°16.7	14.2′	54.6′
3	228°47.8	·· 23.8	243°57.5	16.5′	06°30.9	14.1′	54.6′
4	243°47.9	24.7	258°32.9	16.5′	06°45.0	14.1′	54.5′
5	258°48.0	25.6	273°08.4	16.4′	06°59.1	14.0′	54.5′
6	273°48.1	S10°26.5	287°43.8	16.4′	S07°13.1	14.1′	54.5′
7	288°48.2	27.4	302°19.3	16.4′	07°27.2	14.0′	54.5′
8	303°48.3	28.3	316°54.7	16.4′	07°41.2	13.9′	54.5′
9	318°48.4	·· 29.2	331°30.1	16.4′	07°55.1	14.0′	54.5′
10	333°48.5	30.0	346°05.5	16.4′	08°09.1	13.8′	54.5′
11	348°48.6	30.9	0°40.8	16.3′	08°22.9	13.9′	54.4′
12	3°48.7	S10°31.8	15°16.2	16.3′	S08°36.8	13.8′	54.4′
13	18°48.8	32.7	29°51.5	16.3′	08°50.6	13.8′	54.4′
14	33°48.9	33.6	44°26.8	16.3′	09°04.4	13.7′	54.4′
15	48°49.0	·· 34.5	59°02.1	16.2′	09°18.1	13.7′	54.4′
16	63°49.1	35.4	73°37.3	16.2′	09°31.8	13.7′	54.4′
17	78°49.2	36.3	88°12.5	16.2′	09°45.5	13.6′	54.4′
18	93°49.3	S10°37.2	102°47.7	16.2′	S09°59.1	13.6′	54.4′
19	108°49.5	38.1	117°22.9	16.1′	10°12.7	13.5′	54.4′
20	123°49.6	39.0	131°58.0	16.1′	10°26.2	13.5′	54.3′
21	138°49.7	·· 39.9	146°33.1	16.1′	10°39.7	13.4′	54.3′
22	153°49.8	40.8	161°08.2	16.0′	10°53.1	13.4′	54.3′
23	168°49.9	41.6	175°43.3	16.0′	11°06.5	13.4′	54.3′
	SD = 16.1′	d = 0.9′	SD = 14.9′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°50.0	S10°42.5	190°18.3	16.0′	S11°19.9	13.3′	54.3′
1	198°50.1	43.4	204°53.3	16.0′	11°33.2	13.2′	54.3′
2	213°50.2	44.3	219°28.2	15.9′	11°46.4	13.2′	54.3′
3	228°50.3	·· 45.2	234°03.1	15.9′	11°59.6	13.2′	54.3′
4	243°50.4	46.1	248°38.0	15.8′	12°12.8	13.1′	54.3′
5	258°50.5	47.0	263°12.9	15.8′	12°25.9	13.0′	54.2′
6	273°50.6	S10°47.9	277°47.7	15.8′	S12°38.9	13.0′	54.2′
7	288°50.7	48.8	292°22.5	15.7′	12°51.9	12.9′	54.2′
8	303°50.8	49.6	306°57.2	15.7′	13°04.8	12.9′	54.2′
9	318°50.9	·· 50.5	321°31.9	15.7′	13°17.7	12.9′	54.2′
10	333°51.0	51.4	336°06.6	15.6′	13°30.6	12.7′	54.2′
11	348°51.1	52.3	350°41.2	15.6′	13°43.3	12.8′	54.2′
12	3°51.2	S10°53.2	5°15.7	15.5′	S13°56.1	12.6′	54.2′
13	18°51.3	54.1	19°50.3	15.5′	14°08.7	12.6′	54.2′
14	33°51.3	55.0	34°24.8	15.5′	14°21.3	12.6′	54.2′
15	48°51.4	·· 55.9	48°59.2	15.4′	14°33.9	12.4′	54.1′
16	63°51.5	56.7	63°33.6	15.4′	14°46.3	12.5′	54.1′
17	78°51.6	57.6	78°08.0	15.3′	14°58.8	12.3′	54.1′
18	93°51.7	S10°58.5	92°42.3	15.3′	S15°11.1	12.3′	54.1′
19	108°51.8	10°59.4	107°16.6	15.2′	15°23.4	12.3′	54.1′
20	123°51.9	11°00.3	121°50.8	15.2′	15°35.7	12.1′	54.1′
21	138°52.0	·· 01.2	136°25.0	15.1′	15°47.8	12.1′	54.1′
22	153°52.1	02.0	150°59.1	15.1′	15°59.9	12.1′	54.1′
23	168°52.2	02.9	165°33.2	15.0′	16°12.0	12.0′	54.1′
	SD = 16.1′	d = 0.9′	SD = 14.8′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	05:18	06:37	07:50	15:37	16:51	18:09
N 70°	05:19	06:30	07:35	15:52	16:58	18:08
68°	05:20	06:25	07:24	16:05	17:03	18:08
66°	05:20	06:20	07:14	16:14	17:08	18:07
64°	05:21	06:16	07:05	16:23	17:12	18:07
62°	05:21	06:12	06:58	16:30	17:16	18:07
60°	05:21	06:09	06:52	16:36	17:19	18:07
N 58°	05:21	06:06	06:47	16:42	17:22	18:07
56°	05:21	06:04	06:42	16:47	17:25	18:08
54°	05:20	06:02	06:38	16:51	17:27	18:08
52°	05:20	05:59	06:34	16:55	17:29	18:08
50°	05:20	05:57	06:30	16:59	17:31	18:09
45°	05:18	05:53	06:22	17:06	17:36	18:10
N 40°	05:17	05:48	06:16	17:13	17:40	18:12
35°	05:15	05:45	06:10	17:19	17:44	18:14
30°	05:13	05:41	06:05	17:24	17:48	18:16
20°	05:08	05:34	05:57	17:33	17:55	18:21
N 10°	05:03	05:27	05:49	17:41	18:02	18:27
0°	04:56	05:20	05:41	17:48	18:09	18:34
S 10°	04:48	05:13	05:34	17:56	18:17	18:42
20°	04:37	05:03	05:26	18:04	18:27	18:53
30°	04:23	04:52	05:16	18:14	18:38	19:07
35°	04:14	04:45	05:11	18:19	18:45	19:16
40°	04:03	04:37	05:05	18:25	18:54	19:28
45°	03:49	04:27	04:58	18:33	19:04	19:41
S 50°	03:32	04:14	04:49	18:42	19:16	19:59
52°	03:24	04:09	04:45	18:46	19:22	20:08
54°	03:14	04:02	04:40	18:51	19:29	20:18
56°	03:03	03:55	04:35	18:56	19:37	20:29
58°	02:50	03:46	04:30	19:01	19:45	20:43
S 60°	02:34	03:37	04:23	19:08	19:55	20:59

Lat.	**Moonrise** Sun	Mon	Tue	**Moonset** Sun	Mon	Tue
N 72°	04:22	06:24	08:40	15:37	15:01	14:12
N 70°	04:20	06:13	08:13	15:42	15:15	14:41
68°	04:19	06:03	07:53	15:47	15:27	15:03
66°	04:18	05:56	07:38	15:50	15:36	15:20
64°	04:17	05:50	07:25	15:53	15:44	15:34
62°	04:16	05:44	07:14	15:56	15:51	15:46
60°	04:15	05:39	07:05	15:58	15:57	15:56
N 58°	04:15	05:35	06:57	16:00	16:02	16:05
56°	04:14	05:32	06:50	16:02	16:07	16:13
54°	04:13	05:28	06:44	16:04	16:11	16:20
52°	04:13	05:25	06:38	16:06	16:15	16:26
50°	04:13	05:23	06:33	16:07	16:19	16:32
45°	04:12	05:17	06:22	16:10	16:27	16:45
N 40°	04:11	05:12	06:13	16:13	16:33	16:55
35°	04:10	05:08	06:06	16:15	16:39	17:04
30°	04:10	05:04	05:59	16:17	16:44	17:12
20°	04:09	04:58	05:48	16:21	16:52	17:25
N 10°	04:08	04:53	05:38	16:24	17:00	17:37
0°	04:07	04:47	05:28	16:27	17:07	17:48
S 10°	04:07	04:42	05:19	16:29	17:14	18:00
20°	04:06	04:37	05:09	16:33	17:22	18:12
30°	04:05	04:31	04:58	16:36	17:31	18:26
35°	04:04	04:28	04:52	16:38	17:36	18:34
40°	04:04	04:24	04:45	16:40	17:42	18:43
45°	04:03	04:19	04:36	16:43	17:48	18:54
S 50°	04:03	04:14	04:27	16:46	17:57	19:07
52°	04:02	04:12	04:22	16:48	18:00	19:13
54°	04:02	04:09	04:17	16:50	18:04	19:20
56°	04:02	04:06	04:11	16:51	18:09	19:28
58°	04:01	04:03	04:05	16:53	18:14	19:37
S 60°	04:01	03:59	03:58	16:56	18:20	19:47

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 28-0 6-0%
19	14:59	15:05	11:45	10:17	22:37	
20	15:10	15:15	11:45	10:57	23:18	
21	15:20	15:25	11:45	11:38	–:–	

October 22, 23, 24 UT (Wed., Thu., Fri.)

	Aries	Venus		Mars		Jupiter		Saturn	
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	30°40.8	200°48.5	S02°34.9	162°48.8	S18°07.7	274°17.8	N21°17.4	33°04.1	S03°44.8
1	45°43.3	215°48.1	36.1	177°49.5	08.2	289°20.1	17.3	48°06.7	44.8
2	60°45.8	230°47.7	37.3	192°50.2	08.7	304°22.4	17.3	63°09.3	44.9
3	75°48.2	245°47.3	·· 38.5	207°50.8	·· 09.2	319°24.7	·· 17.3	78°11.9	·· 44.9
4	90°50.7	260°46.9	39.7	222°51.5	09.7	334°27.0	17.3	93°14.5	45.0
5	105°53.2	275°46.5	41.0	237°52.2	10.2	349°29.3	17.2	108°17.1	45.0
6	120°55.6	290°46.1	S02°42.2	252°52.9	S18°10.7	4°31.6	N21°17.2	123°19.7	S03°45.1
7	135°58.1	305°45.7	43.4	267°53.6	11.2	19°33.9	17.2	138°22.3	45.1
8	151°00.5	320°45.3	44.6	282°54.3	11.7	34°36.2	17.2	153°24.9	45.2
9	166°03.0	335°44.9	·· 45.9	297°55.0	·· 12.2	49°38.5	·· 17.2	168°27.5	·· 45.2
10	181°05.5	350°44.5	47.1	312°55.7	12.7	64°40.7	17.1	183°30.1	45.3
11	196°07.9	5°44.1	48.3	327°56.3	13.1	79°43.0	17.1	198°32.7	45.3
12	211°10.4	20°43.7	S02°49.5	342°57.0	S18°13.6	94°45.3	N21°17.1	213°35.3	S03°45.4
13	226°12.9	35°43.3	50.7	357°57.7	14.1	109°47.6	17.1	228°37.9	45.4
14	241°15.3	50°42.9	52.0	12°58.4	14.6	124°49.9	17.0	243°40.5	45.5
15	256°17.8	65°42.5	·· 53.2	27°59.1	·· 15.1	139°52.2	·· 17.0	258°43.1	·· 45.6
16	271°20.3	80°42.1	54.4	42°59.8	15.6	154°54.5	17.0	273°45.7	45.6
17	286°22.7	95°41.7	55.6	58°00.5	16.1	169°56.8	17.0	288°48.3	45.7
18	301°25.2	110°41.2	S02°56.8	73°01.1	S18°16.6	184°59.1	N21°16.9	303°50.9	S03°45.7
19	316°27.7	125°40.8	58.1	88°01.8	17.1	200°01.4	16.9	318°53.5	45.8
20	331°30.1	140°40.4	02°59.3	103°02.5	17.5	215°03.7	16.9	333°56.1	45.8
21	346°32.6	155°40.0	03°00.5	118°03.2	·· 18.0	230°06.0	·· 16.9	348°58.7	·· 45.9
22	1°35.0	170°39.6	01.7	133°03.9	18.5	245°08.3	16.9	4°01.3	45.9
23	16°37.5	185°39.2	02.9	148°04.6	19.0	260°10.6	16.8	19°03.9	46.0
Mer.pass. 21:54		ν -0.4′	d 1.2′	m -3.92	ν 0.7′	d 0.5′	m 1.50	ν 2.3′	d 0.0′ m -2.25	ν 2.6′	d 0.1′ m 0.71

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	31°40.0	200°38.8	S03°04.2	163°05.2	S18°19.5	275°12.9	N21°16.8	34°06.5	S03°46.0
1	46°42.4	215°38.4	05.4	178°05.9	20.0	290°15.2	16.8	49°09.1	46.1
2	61°44.9	230°38.0	06.6	193°06.6	20.5	305°17.5	16.8	64°11.7	46.1
3	76°47.4	245°37.6	·· 07.8	208°07.3	·· 21.0	320°19.8	·· 16.7	79°14.3	·· 46.2
4	91°49.8	260°37.2	09.0	223°08.0	21.4	335°22.1	16.7	94°16.9	46.2
5	106°52.3	275°36.8	10.3	238°08.7	21.9	350°24.4	16.7	109°19.5	46.3
6	121°54.8	290°36.4	S03°11.5	253°09.3	S18°22.4	5°26.7	N21°16.7	124°22.1	S03°46.3
7	136°57.2	305°36.0	12.7	268°10.0	22.9	20°29.0	16.7	139°24.7	46.4
8	151°59.7	320°35.6	13.9	283°10.7	23.4	35°31.3	16.6	154°27.3	46.4
9	167°02.1	335°35.2	·· 15.1	298°11.4	·· 23.9	50°33.6	·· 16.6	169°29.9	·· 46.5
10	182°04.6	350°34.8	16.4	313°12.1	24.4	65°35.9	16.6	184°32.5	46.5
11	197°07.1	5°34.4	17.6	328°12.7	24.8	80°38.2	16.6	199°35.1	46.6
12	212°09.5	20°33.9	S03°18.8	343°13.4	S18°25.3	95°40.5	N21°16.5	214°37.7	S03°46.7
13	227°12.0	35°33.5	20.0	358°14.1	25.8	110°42.8	16.5	229°40.3	46.7
14	242°14.5	50°33.1	21.2	13°14.8	26.3	125°45.1	16.5	244°42.9	46.8
15	257°16.9	65°32.7	·· 22.5	28°15.5	·· 26.8	140°47.4	·· 16.5	259°45.5	·· 46.8
16	272°19.4	80°32.3	23.7	43°16.1	27.3	155°49.7	16.5	274°48.1	46.9
17	287°21.9	95°31.9	24.9	58°16.8	27.7	170°52.0	16.4	289°50.7	46.9
18	302°24.3	110°31.5	S03°26.1	73°17.5	S18°28.2	185°54.3	N21°16.4	304°53.3	S03°47.0
19	317°26.8	125°31.1	27.3	88°18.2	28.7	200°56.6	16.4	319°55.9	47.0
20	332°29.3	140°30.7	28.6	103°18.8	29.2	215°58.9	16.4	334°58.5	47.1
21	347°31.7	155°30.3	·· 29.8	118°19.5	·· 29.7	231°01.2	·· 16.3	350°01.1	·· 47.1
22	2°34.2	170°29.9	31.0	133°20.2	30.2	246°03.5	16.3	5°03.7	47.2
23	17°36.6	185°29.5	32.2	148°20.9	30.6	261°05.8	16.3	20°06.3	47.2
Mer.pass. 21:50		ν -0.4′	d 1.2′	m -3.92	ν 0.7′	d 0.5′	m 1.50	ν 2.3′	d 0.0′ m -2.26	ν 2.6′	d 0.1′ m 0.72

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	32°39.1	200°29.1	S03°33.4	163°21.6	S18°31.1	276°08.1	N21°16.3	35°08.9	S03°47.3
1	47°41.6	215°28.6	34.6	178°22.2	31.6	291°10.4	16.3	50°11.5	47.3
2	62°44.0	230°28.2	35.9	193°22.9	32.1	306°12.7	16.2	65°14.0	47.4
3	77°46.5	245°27.8	·· 37.1	208°23.6	·· 32.6	321°15.0	·· 16.2	80°16.6	·· 47.4
4	92°49.0	260°27.4	38.3	223°24.3	33.0	336°17.3	16.2	95°19.2	47.5
5	107°51.4	275°27.0	39.5	238°24.9	33.5	351°19.6	16.2	110°21.8	47.5
6	122°53.9	290°26.6	S03°40.7	253°25.6	S18°34.0	6°21.9	N21°16.2	125°24.4	S03°47.6
7	137°56.4	305°26.2	42.0	268°26.3	34.5	21°24.2	16.1	140°27.0	47.6
8	152°58.8	320°25.8	43.2	283°27.0	35.0	36°26.6	16.1	155°29.6	47.7
9	168°01.3	335°25.4	·· 44.4	298°27.6	·· 35.4	51°28.9	·· 16.1	170°32.2	·· 47.7
10	183°03.8	350°25.0	45.6	313°28.3	35.9	66°31.2	16.1	185°34.8	47.8
11	198°06.2	5°24.6	46.8	328°29.0	36.4	81°33.5	16.1	200°37.4	47.8
12	213°08.7	20°24.1	S03°48.0	343°29.6	S18°36.9	96°35.8	N21°16.0	215°40.0	S03°47.9
13	228°11.1	35°23.7	49.3	358°30.3	37.3	111°38.1	16.0	230°42.6	47.9
14	243°13.6	50°23.3	50.5	13°31.0	37.8	126°40.4	16.0	245°45.2	48.0
15	258°16.1	65°22.9	·· 51.7	28°31.7	·· 38.3	141°42.7	·· 16.0	260°47.8	·· 48.0
16	273°18.5	80°22.5	52.9	43°32.3	38.8	156°45.0	16.0	275°50.4	48.1
17	288°21.0	95°22.1	54.1	58°33.0	39.3	171°47.3	15.9	290°53.0	48.1
18	303°23.5	110°21.7	S03°55.3	73°33.7	S18°39.7	186°49.7	N21°15.9	305°55.6	S03°48.2
19	318°25.9	125°21.3	56.6	88°34.4	40.2	201°52.0	15.9	320°58.1	48.2
20	333°28.4	140°20.9	57.8	103°35.0	40.7	216°54.3	15.9	336°00.7	48.3
21	348°30.9	155°20.4	03°59.0	118°35.7	·· 41.2	231°56.6	·· 15.8	351°03.3	·· 48.3
22	3°33.3	170°20.0	04°00.2	133°36.4	41.6	246°58.9	15.8	6°05.9	48.4
23	18°35.8	185°19.6	01.4	148°37.0	42.1	262°01.2	15.8	21°08.5	48.4
Mer.pass. 21:46		ν -0.4′	d 1.2′	m -3.92	ν 0.7′	d 0.5′	m 1.49	ν 2.3′	d 0.0′ m -2.27	ν 2.6′	d 0.1′ m 0.73

Stars

	SHA	Dec
Alpheratz	357°33.8	29°14.2
Ankaa	353°06.1	-42°09.9
Schedar	349°29.8	56°40.9
Diphda	348°46.3	-17°50.6
Achernar	335°19.1	-57°06.3
Hamal	327°50.1	23°35.2
Polaris	313°14.8	89°22.3
Acamar	315°10.9	-40°11.9
Menkar	314°05.2	4°11.6
Mirfak	308°26.9	49°57.2
Aldebaran	290°38.6	16°33.7
Rigel	281°03.0	-8°10.1
Capella	280°20.6	46°01.3
Bellatrix	278°22.0	6°22.5
Elnath	278°00.8	28°37.7
Alnilam	275°36.9	-1°11.0
Betelgeuse	270°51.2	7°24.8
Canopus	263°51.9	-52°42.2
Sirius	258°25.6	-16°44.9
Adhara	255°05.3	-29°00.1
Procyon	244°50.1	5°09.6
Pollux	243°16.5	27°57.8
Avior	234°14.5	-59°35.1
Suhail	222°46.0	-43°31.9
Miaplacidus	221°38.5	-69°49.0
Alphard	217°47.3	-8°46.1
Regulus	207°33.9	11°50.5
Dubhe	193°40.7	61°36.5
Denebola	182°24.6	14°25.7
Gienah	175°43.2	-17°41.0
Acrux	173°00.1	-63°14.4
Gacrux	171°51.5	-57°15.3
Alioth	166°12.9	55°49.1
Spica	158°22.0	-11°17.7
Alkaid	152°52.0	49°11.1
Hadar	148°35.8	-60°29.8
Menkent	147°57.3	-36°29.7
Arcturus	145°47.7	19°03.0
Rigil Kent.	139°40.1	-60°56.5
Kochab	137°20.9	74°03.0
Zuben'ubi	136°55.7	-16°08.9
Alphecca	126°03.5	26°37.8
Antares	112°15.4	-26°29.3
Atria	107°09.4	-69°04.6
Sabik	102°02.3	-15°45.4
Shaula	96°09.8	-37°07.4
Rasalhague	95°58.2	12°32.6
Eltanin	90°42.2	51°29.3
Kaus Aust.	83°31.9	-34°22.4
Vega	80°33.0	38°48.7
Nunki	75°47.1	-26°15.9
Altair	61°59.4	8°56.3
Peacock	53°04.7	-56°39.3
Deneb	49°25.3	45°22.6
Enif	33°38.1	9°59.8
Al Na'ir	27°31.9	-46°50.3
Fomalhaut	15°13.6	-29°29.1
Scheat	13°44.4	28°13.6
Markab	13°29.0	15°20.8

Oct 22 Wed	SHA	Mer.pass
Venus	170°07.7	10:37
Mars	132°07.9	13:08
Jupiter	243°37.0	05:42
Saturn	2°23.3	21:44

Oct 23 Thu	SHA	Mer.pass
Venus	168°58.8	10:38
Mars	131°25.3	13:07
Jupiter	243°32.9	05:38
Saturn	2°26.6	21:40

Oct 24 Fri	SHA	Mer.pass
Venus	167°49.9	10:38
Mars	130°42.4	13:06
Jupiter	243°29.0	05:35
Saturn	2°29.7	21:36

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°52.3	S11°03.8	180°07.2	15.0′	S16°24.0	11.9′	54.1′
1	198°52.4	04.7	194°41.2	14.9′	16°35.9	11.8′	54.1′
2	213°52.5	05.6	209°15.1	14.9′	16°47.7	11.8′	54.1′
3	228°52.6	·· 06.5	223°49.0	14.8′	16°59.5	11.7′	54.0′
4	243°52.7	07.3	238°22.9	14.8′	17°11.2	11.6′	54.0′
5	258°52.8	08.2	252°56.6	14.7′	17°22.8	11.5′	54.0′
6	273°52.9	S11°09.1	267°30.4	14.7′	S17°34.3	11.5′	54.0′
7	288°53.0	10.0	282°04.0	14.6′	17°45.8	11.4′	54.0′
8	303°53.1	10.9	296°37.6	14.6′	17°57.2	11.4′	54.0′
9	318°53.1	·· 11.8	311°11.2	14.5′	18°08.6	11.2′	54.0′
10	333°53.2	12.6	325°44.7	14.5′	18°19.8	11.2′	54.0′
11	348°53.3	13.5	340°18.2	14.4′	18°31.0	11.1′	54.0′
12	3°53.4	S11°14.4	354°51.6	14.3′	S18°42.1	11.0′	54.0′
13	18°53.5	15.3	9°24.9	14.3′	18°53.1	11.0′	54.0′
14	33°53.6	16.2	23°58.2	14.2′	19°04.1	10.9′	54.0′
15	48°53.7	·· 17.0	38°31.4	14.2′	19°15.0	10.7′	54.0′
16	63°53.8	17.9	53°04.6	14.1′	19°25.7	10.8′	54.0′
17	78°53.9	18.8	67°37.7	14.1′	19°36.5	10.6′	54.0′
18	93°54.0	S11°19.7	82°10.8	14.0′	S19°47.1	10.5′	54.0′
19	108°54.0	20.5	96°43.8	13.9′	19°57.6	10.5′	54.0′
20	123°54.1	21.4	111°16.7	13.9′	20°08.1	10.4′	53.9′
21	138°54.2	·· 22.3	125°49.6	13.8′	20°18.5	10.2′	53.9′
22	153°54.3	23.2	140°22.4	13.8′	20°28.7	10.2′	53.9′
23	168°54.4	24.1	154°55.1	13.7′	20°38.9	10.2′	53.9′
	SD = 16.1′	d = 0.9′	SD = 14.7′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°54.5	S11°24.9	169°27.8	13.6′	S20°49.1	10.0′	53.9′
1	198°54.6	25.8	184°00.5	13.6′	20°59.1	9.9′	53.9′
2	213°54.7	26.7	198°33.1	13.5′	21°09.0	9.9′	53.9′
3	228°54.7	·· 27.6	213°05.6	13.5′	21°18.9	9.7′	53.9′
4	243°54.8	28.4	227°38.0	13.4′	21°28.6	9.7′	53.9′
5	258°54.9	29.3	242°10.4	13.3′	21°38.3	9.6′	53.9′
6	273°55.0	S11°30.2	256°42.7	13.3′	S21°47.9	9.4′	53.9′
7	288°55.1	31.1	271°15.0	13.2′	21°57.3	9.4′	53.9′
8	303°55.2	31.9	285°47.2	13.1′	22°06.7	9.3′	53.9′
9	318°55.3	·· 32.8	300°19.4	13.1′	22°16.0	9.2′	53.9′
10	333°55.3	33.7	314°51.4	13.0′	22°25.2	9.1′	53.9′
11	348°55.4	34.6	329°23.5	13.0′	22°34.3	9.0′	53.9′
12	3°55.5	S11°35.4	343°55.4	12.9′	S22°43.3	8.9′	53.9′
13	18°55.6	36.3	358°27.3	12.8′	22°52.2	8.8′	53.9′
14	33°55.7	37.2	12°59.1	12.8′	23°01.0	8.7′	53.9′
15	48°55.8	·· 38.0	27°30.9	12.7′	23°09.7	8.6′	53.9′
16	63°55.8	38.9	42°02.6	12.6′	23°18.3	8.5′	53.9′
17	78°55.9	39.8	56°34.3	12.6′	23°26.8	8.4′	53.9′
18	93°56.0	S11°40.7	71°05.9	12.5′	S23°35.2	8.3′	53.9′
19	108°56.1	41.5	85°37.4	12.5′	23°43.5	8.2′	53.9′
20	123°56.2	42.4	100°08.8	12.4′	23°51.7	8.1′	53.9′
21	138°56.2	·· 43.3	114°40.2	12.3′	23°59.8	8.0′	53.9′
22	153°56.3	44.1	129°11.6	12.3′	24°07.8	7.9′	53.9′
23	168°56.4	45.0	143°42.8	12.2′	24°15.7	7.7′	53.9′
	SD = 16.1′	d = 0.9′	SD = 14.7′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°56.5	S11°45.9	158°14.0	12.1′	S24°23.4	7.7′	53.9′
1	198°56.6	46.7	172°45.2	12.1′	24°31.1	7.6′	53.9′
2	213°56.6	47.6	187°16.3	12.0′	24°38.7	7.4′	53.9′
3	228°56.7	·· 48.5	201°47.3	12.0′	24°46.1	7.3′	53.9′
4	243°56.8	49.3	216°18.3	11.9′	24°53.4	7.3′	53.9′
5	258°56.9	50.2	230°49.2	11.8′	25°00.7	7.1′	53.9′
6	273°57.0	S11°51.1	245°20.0	11.8′	S25°07.8	7.0′	53.9′
7	288°57.0	51.9	259°50.8	11.7′	25°14.8	6.8′	53.9′
8	303°57.1	52.8	274°21.5	11.7′	25°21.6	6.8′	53.9′
9	318°57.2	·· 53.7	288°52.2	11.6′	25°28.4	6.7′	53.9′
10	333°57.3	54.5	303°22.8	11.5′	25°35.1	6.5′	53.9′
11	348°57.3	55.4	317°53.3	11.5′	25°41.6	6.4′	53.9′
12	3°57.4	S11°56.3	332°23.8	11.4′	S25°48.0	6.3′	53.9′
13	18°57.5	57.1	346°54.3	11.4′	25°54.3	6.2′	53.9′
14	33°57.6	58.0	1°24.6	11.3′	26°00.5	6.1′	53.9′
15	48°57.7	·· 58.9	15°55.0	11.3′	26°06.6	5.9′	53.9′
16	63°57.7	11°59.7	30°25.2	11.2′	26°12.5	5.9′	53.9′
17	78°57.8	12°00.6	44°55.4	11.2′	26°18.4	5.7′	53.9′
18	93°57.9	S12°01.5	59°25.6	11.1′	S26°24.1	5.6′	53.9′
19	108°58.0	02.3	73°55.7	11.0′	26°29.7	5.5′	53.9′
20	123°58.0	03.2	88°25.7	11.0′	26°35.2	5.3′	53.9′
21	138°58.1	·· 04.1	102°55.7	10.9′	26°40.5	5.2′	53.9′
22	153°58.2	04.9	117°25.7	10.9′	26°45.7	5.1′	53.9′
23	168°58.2	05.8	131°55.5	10.8′	26°50.8	5.0′	53.9′
	SD = 16.1′	d = 0.9′	SD = 14.7′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	05:30	06:50	08:06	15:21	16:37	17:56
N 70°	05:30	06:42	07:49	15:38	16:45	17:56
68°	05:30	06:35	07:35	15:52	16:52	17:57
66°	05:29	06:29	07:24	16:03	16:58	17:57
64°	05:29	06:24	07:15	16:13	17:03	17:58
62°	05:28	06:20	07:07	16:21	17:07	17:59
60°	05:28	06:16	07:00	16:28	17:11	18:00
N 58°	05:27	06:13	06:54	16:34	17:15	18:00
56°	05:26	06:10	06:48	16:39	17:18	18:01
54°	05:26	06:07	06:43	16:44	17:21	18:02
52°	05:25	06:04	06:39	16:49	17:23	18:03
50°	05:24	06:02	06:35	16:53	17:26	18:04
45°	05:22	05:56	06:26	17:02	17:32	18:06
N 40°	05:20	05:52	06:19	17:09	17:36	18:08
35°	05:18	05:47	06:13	17:15	17:41	18:11
30°	05:15	05:43	06:07	17:21	17:45	18:13
20°	05:09	05:35	05:58	17:31	17:53	18:19
N 10°	05:03	05:28	05:49	17:39	18:01	18:26
0°	04:55	05:20	05:41	17:48	18:09	18:33
S 10°	04:46	05:11	05:33	17:56	18:18	18:43
20°	04:35	05:01	05:24	18:05	18:28	18:54
30°	04:19	04:49	05:13	18:16	18:40	19:10
35°	04:10	04:41	05:07	18:22	18:48	19:20
40°	03:58	04:32	05:01	18:29	18:57	19:31
45°	03:44	04:21	04:53	18:37	19:08	19:46
S 50°	03:25	04:08	04:43	18:47	19:22	20:05
52°	03:16	04:02	04:38	18:51	19:28	20:15
54°	03:05	03:55	04:33	18:57	19:36	20:25
56°	02:53	03:47	04:28	19:02	19:44	20:38
58°	02:39	03:37	04:22	19:08	19:53	20:53
S 60°	02:21	03:27	04:15	19:16	20:04	21:11

Lat.	**Moonrise** Wed	Thu	Fri	**Moonset** Wed	Thu	Fri
N 72°	▬	▬	▬	▬	▬	▬
N 70°	10:48	▬	▬	13:36	▬	▬
68°	09:59	▬	▬	14:26	▬	▬
66°	09:28	11:46	▬	14:58	14:14	▬
64°	09:06	10:58	▬	15:22	15:03	▬
62°	08:48	10:27	12:15	15:40	15:34	15:25
60°	08:33	10:04	11:38	15:56	15:58	16:03
N 58°	08:20	09:46	11:12	16:09	16:17	16:30
56°	08:10	09:31	10:51	16:21	16:33	16:51
54°	08:00	09:18	10:34	16:31	16:46	17:08
52°	07:52	09:06	10:19	16:40	16:58	17:23
50°	07:44	08:56	10:07	16:48	17:09	17:36
45°	07:28	08:35	09:41	17:06	17:31	18:03
N 40°	07:15	08:18	09:20	17:20	17:49	18:24
35°	07:04	08:04	09:03	17:32	18:04	18:42
30°	06:55	07:51	08:48	17:43	18:17	18:57
20°	06:38	07:30	08:24	18:01	18:40	19:23
N 10°	06:24	07:12	08:02	18:17	18:59	19:45
0°	06:11	06:55	07:42	18:32	19:18	20:06
S 10°	05:57	06:38	07:23	18:47	19:36	20:27
20°	05:44	06:21	07:02	19:03	19:56	20:50
30°	05:28	06:00	06:37	19:22	20:19	21:16
35°	05:18	05:48	06:23	19:33	20:32	21:31
40°	05:08	05:35	06:07	19:45	20:48	21:49
45°	04:56	05:19	05:47	20:00	21:07	22:11
S 50°	04:41	04:59	05:23	20:19	21:30	22:39
52°	04:34	04:50	05:11	20:28	21:42	22:53
54°	04:27	04:39	04:58	20:37	21:54	23:08
56°	04:18	04:28	04:42	20:48	22:09	23:27
58°	04:09	04:14	04:24	21:01	22:27	23:50
S 60°	03:58	03:59	04:02	21:16	22:49	·· ··

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 1-3 0-6%
22	15:29	15:34	11:44	12:21	00:00	
23	15:38	15:42	11:44	13:06	00:43	
24	15:46	15:50	11:44	13:54	01:30	

October 25, 26, 27 UT (Sat., Sun., Mon.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	33°38.2	200°19.2	S04°02.6	163°37.7	S18°42.6	277°03.5	N21°15.8	36°11.1	S03°48.5
1	48°40.7	215°18.8	03.9	178°38.4	43.1	292°05.8	15.8	51°13.7	48.5
2	63°43.2	230°18.4	05.1	193°39.0	43.5	307°08.2	15.8	66°16.3	48.6
3	78°45.6	245°18.0	·· 06.3	208°39.7	·· 44.0	322°10.5	·· 15.7	81°18.9	·· 48.6
4	93°48.1	260°17.6	07.5	223°40.4	44.5	337°12.8	15.7	96°21.5	48.7
5	108°50.6	275°17.1	08.7	238°41.0	45.0	352°15.1	15.7	111°24.1	48.7
6	123°53.0	290°16.7	S04°09.9	253°41.7	S18°45.4	7°17.4	N21°15.7	126°26.7	S03°48.8
7	138°55.5	305°16.3	11.2	268°42.4	45.9	22°19.7	15.7	141°29.3	48.8
8	153°58.0	320°15.9	12.4	283°43.1	46.4	37°22.0	15.6	156°31.8	48.9
9	169°00.4	335°15.5	·· 13.6	298°43.7	·· 46.9	52°24.4	·· 15.6	171°34.4	·· 48.9
10	184°02.9	350°15.1	14.8	313°44.4	47.3	67°26.7	15.6	186°37.0	49.0
11	199°05.4	5°14.7	16.0	328°45.1	47.8	82°29.0	15.6	201°39.6	49.0
12	214°07.8	20°14.2	S04°17.2	343°45.7	S18°48.3	97°31.3	N21°15.6	216°42.2	S03°49.1
13	229°10.3	35°13.8	18.4	358°46.4	48.7	112°33.6	15.5	231°44.8	49.1
14	244°12.7	50°13.4	19.7	13°47.1	49.2	127°35.9	15.5	246°47.4	49.2
15	259°15.2	65°13.0	·· 20.9	28°47.7	·· 49.7	142°38.3	·· 15.5	261°50.0	·· 49.2
16	274°17.7	80°12.6	22.1	43°48.4	50.2	157°40.6	15.5	276°52.6	49.3
17	289°20.1	95°12.2	23.3	58°49.0	50.6	172°42.9	15.5	291°55.2	49.3
18	304°22.6	110°11.7	S04°24.5	73°49.7	S18°51.1	187°45.2	N21°15.4	306°57.8	S03°49.4
19	319°25.1	125°11.3	25.7	88°50.4	51.6	202°47.5	15.4	322°00.4	49.4
20	334°27.5	140°10.9	26.9	103°51.0	52.0	217°49.9	15.4	337°02.9	49.5
21	349°30.0	155°10.5	·· 28.2	118°51.7	·· 52.5	232°52.2	·· 15.4	352°05.5	·· 49.5
22	4°32.5	170°10.1	29.4	133°52.4	53.0	247°54.5	15.4	7°08.1	49.6
23	19°34.9	185°09.7	30.6	148°53.0	53.4	262°56.8	15.3	22°10.7	49.6
Mer.pass. 21:42		ν -0.4′	d 1.2′	m -3.92	ν 0.7′	d 0.5′	m 1.49	ν 2.3′	d 0.0′ m -2.27	ν 2.6′	d 0.0′ m 0.73

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	34°37.4	200°09.2	S04°31.8	163°53.7	S18°53.9	277°59.1	N21°15.3	37°13.3	S03°49.7
1	49°39.9	215°08.8	33.0	178°54.4	54.4	293°01.5	15.3	52°15.9	49.7
2	64°42.3	230°08.4	34.2	193°55.0	54.8	308°03.8	15.3	67°18.5	49.7
3	79°44.8	245°08.0	·· 35.4	208°55.7	·· 55.3	323°06.1	·· 15.3	82°21.1	·· 49.8
4	94°47.2	260°07.6	36.6	223°56.3	55.8	338°08.4	15.3	97°23.7	49.8
5	109°49.7	275°07.2	37.9	238°57.0	56.3	353°10.8	15.2	112°26.2	49.9
6	124°52.2	290°06.7	S04°39.1	253°57.7	S18°56.7	8°13.1	N21°15.2	127°28.8	S03°49.9
7	139°54.6	305°06.3	40.3	268°58.3	57.2	23°15.4	15.2	142°31.4	50.0
8	154°57.1	320°05.9	41.5	283°59.0	57.7	38°17.7	15.2	157°34.0	50.0
9	169°59.6	335°05.5	·· 42.7	298°59.6	·· 58.1	53°20.0	·· 15.2	172°36.6	·· 50.1
10	185°02.0	350°05.1	43.9	314°00.3	58.6	68°22.4	15.1	187°39.2	50.1
11	200°04.5	5°04.7	45.1	329°01.0	59.1	83°24.7	15.1	202°41.8	50.2
12	215°07.0	20°04.2	S04°46.3	344°01.6	S18°59.5	98°27.0	N21°15.1	217°44.4	S03°50.2
13	230°09.4	35°03.8	47.6	359°02.3	19°00.0	113°29.3	15.1	232°47.0	50.3
14	245°11.9	50°03.4	48.8	14°02.9	00.4	128°31.7	15.1	247°49.5	50.3
15	260°14.4	65°03.0	·· 50.0	29°03.6	·· 00.9	143°34.0	·· 15.1	262°52.1	·· 50.4
16	275°16.8	80°02.6	51.2	44°04.3	01.4	158°36.3	15.0	277°54.7	50.4
17	290°19.3	95°02.1	52.4	59°04.9	01.8	173°38.7	15.0	292°57.3	50.5
18	305°21.7	110°01.7	S04°53.6	74°05.6	S19°02.3	188°41.0	N21°15.0	307°59.9	S03°50.5
19	320°24.2	125°01.3	54.8	89°06.2	02.8	203°43.3	15.0	323°02.5	50.6
20	335°26.7	140°00.9	56.0	104°06.9	03.2	218°45.6	15.0	338°05.1	50.6
21	350°29.1	155°00.5	·· 57.2	119°07.6	·· 03.7	233°48.0	·· 15.0	353°07.7	·· 50.7
22	5°31.6	170°00.0	58.5	134°08.2	04.2	248°50.3	14.9	8°10.2	50.7
23	20°34.1	184°59.6	59.7	149°08.9	04.6	263°52.6	14.9	23°12.8	50.7
Mer.pass. 21:38		ν -0.4′	d 1.2′	m -3.91	ν 0.7′	d 0.5′	m 1.48	ν 2.3′	d 0.0′ m -2.28	ν 2.6′	d 0.0′ m 0.74

Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	35°36.5	199°59.2	S05°00.9	164°09.5	S19°05.1	278°55.0	N21°14.9	38°15.4	S03°50.8
1	50°39.0	214°58.8	02.1	179°10.2	05.5	293°57.3	14.9	53°18.0	50.8
2	65°41.5	229°58.3	03.3	194°10.8	06.0	308°59.6	14.9	68°20.6	50.9
3	80°43.9	244°57.9	·· 04.5	209°11.5	·· 06.5	324°01.9	·· 14.8	83°23.2	·· 50.9
4	95°46.4	259°57.5	05.7	224°12.2	06.9	339°04.3	14.8	98°25.8	51.0
5	110°48.9	274°57.1	06.9	239°12.8	07.4	354°06.6	14.8	113°28.4	51.0
6	125°51.3	289°56.7	S05°08.1	254°13.5	S19°07.9	9°08.9	N21°14.8	128°30.9	S03°51.1
7	140°53.8	304°56.2	09.3	269°14.1	08.3	24°11.3	14.8	143°33.5	51.1
8	155°56.2	319°55.8	10.5	284°14.8	08.8	39°13.6	14.8	158°36.1	51.2
9	170°58.7	334°55.4	·· 11.8	299°15.4	·· 09.2	54°15.9	·· 14.7	173°38.7	·· 51.2
10	186°01.2	349°55.0	13.0	314°16.1	09.7	69°18.3	14.7	188°41.3	51.3
11	201°03.6	4°54.5	14.2	329°16.7	10.2	84°20.6	14.7	203°43.9	51.3
12	216°06.1	19°54.1	S05°15.4	344°17.4	S19°10.6	99°22.9	N21°14.7	218°46.5	S03°51.3
13	231°08.6	34°53.7	16.6	359°18.0	11.1	114°25.3	14.7	233°49.0	51.4
14	246°11.0	49°53.3	17.8	14°18.7	11.5	129°27.6	14.7	248°51.6	51.4
15	261°13.5	64°52.8	·· 19.0	29°19.3	·· 12.0	144°29.9	·· 14.7	263°54.2	·· 51.5
16	276°16.0	79°52.4	20.2	44°20.0	12.5	159°32.3	14.6	278°56.8	51.5
17	291°18.4	94°52.0	21.4	59°20.6	12.9	174°34.6	14.6	293°59.4	51.6
18	306°20.9	109°51.6	S05°22.6	74°21.3	S19°13.4	189°36.9	N21°14.6	309°02.0	S03°51.6
19	321°23.3	124°51.1	23.8	89°21.9	13.8	204°39.3	14.6	324°04.5	51.7
20	336°25.8	139°50.7	25.0	104°22.6	14.3	219°41.6	14.6	339°07.1	51.7
21	351°28.3	154°50.3	·· 26.2	119°23.3	·· 14.7	234°43.9	·· 14.6	354°09.7	·· 51.8
22	6°30.7	169°49.9	27.4	134°23.9	15.2	249°46.3	14.5	9°12.3	51.8
23	21°33.2	184°49.4	28.7	149°24.6	15.7	264°48.6	14.5	24°14.9	51.8
Mer.pass. 21:34		ν -0.4′	d 1.2′	m -3.91	ν 0.7′	d 0.5′	m 1.48	ν 2.3′	d 0.0′ m -2.29	ν 2.6′	d 0.0′ m 0.74

Stars

	SHA	Dec
Alpheratz	357°33.8	29°14.2
Ankaa	353°06.1	-42°09.9
Schedar	349°29.8	56°40.9
Diphda	348°46.3	-17°50.6
Achernar	335°19.1	-57°06.3
Hamal	327°50.1	23°35.2
Polaris	313°13.9	89°22.3
Acamar	315°10.9	-40°11.9
Menkar	314°05.2	4°11.6
Mirfak	308°26.9	49°57.2
Aldebaran	290°38.6	16°33.7
Rigel	281°03.0	-8°10.1
Capella	280°20.6	46°01.3
Bellatrix	278°22.0	6°22.5
Elnath	278°00.8	28°37.7
Alnilam	275°36.9	-1°11.0
Betelgeuse	270°51.2	7°24.8
Canopus	263°51.9	-52°42.2
Sirius	258°25.5	-16°44.9
Adhara	255°05.2	-29°00.1
Procyon	244°50.1	5°09.6
Pollux	243°16.5	27°57.8
Avior	234°14.5	-59°35.1
Suhail	222°46.0	-43°31.9
Miaplacidus	221°38.4	-69°49.0
Alphard	217°47.2	-8°46.1
Regulus	207°33.9	11°50.5
Dubhe	193°40.6	61°36.5
Denebola	182°24.6	14°25.7
Gienah	175°43.2	-17°41.0
Acrux	173°00.1	-63°14.4
Gacrux	171°51.5	-57°15.3
Alioth	166°12.9	55°49.1
Spica	158°22.0	-11°17.7
Alkaid	152°52.0	49°11.1
Hadar	148°35.8	-60°29.8
Menkent	147°57.3	-36°29.7
Arcturus	145°47.7	19°02.9
Rigil Kent.	139°40.1	-60°56.5
Kochab	137°20.9	74°02.9
Zuben'ubi	136°55.7	-16°08.9
Alphecca	126°03.5	26°37.8
Antares	112°15.4	-26°29.3
Atria	107°09.4	-69°04.6
Sabik	102°02.3	-15°45.4
Shaula	96°09.8	-37°07.4
Rasalhague	95°58.2	12°32.6
Eltanin	90°42.2	51°29.3
Kaus Aust.	83°31.9	-34°22.4
Vega	80°33.0	38°48.7
Nunki	75°47.1	-26°15.9
Altair	61°59.4	8°56.3
Peacock	53°04.7	-56°39.3
Deneb	49°25.3	45°22.6
Enif	33°38.1	9°59.8
Al Na'ir	27°31.9	-46°50.3
Fomalhaut	15°13.6	-29°29.1
Scheat	13°44.4	28°13.6
Markab	13°29.1	15°20.8

Oct 25 Sat	SHA	Mer.pass
Venus	166°41.0	10:39
Mars	129°59.5	13:05
Jupiter	243°25.3	05:31
Saturn	2°32.9	21:32

Oct 26 Sun	SHA	Mer.pass
Venus	165°31.9	10:40
Mars	129°16.3	13:04
Jupiter	243°21.8	05:27
Saturn	2°35.9	21:27

Oct 27 Mon	SHA	Mer.pass
Venus	164°22.7	10:40
Mars	128°33.0	13:03
Jupiter	243°18.4	05:23
Saturn	2°38.9	21:23

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°58.3	S12°06.6	146°25.4	10.8′	S26°55.8	4.8′	53.9′
1	198°58.4	07.5	160°55.2	10.7′	27°00.6	4.8′	53.9′
2	213°58.5	08.4	175°24.9	10.7′	27°05.4	4.6′	53.9′
3	228°58.5	·· 09.2	189°54.6	10.6′	27°10.0	4.4′	54.0′
4	243°58.6	10.1	204°24.2	10.6′	27°14.4	4.4′	54.0′
5	258°58.7	10.9	218°53.8	10.5′	27°18.8	4.2′	54.0′
6	273°58.7	S12°11.8	233°23.4	10.5′	S27°23.0	4.1′	54.0′
7	288°58.8	12.7	247°52.9	10.5′	27°27.1	3.9′	54.0′
8	303°58.9	13.5	262°22.3	10.4′	27°31.0	3.9′	54.0′
9	318°59.0	·· 14.4	276°51.7	10.4′	27°34.9	3.7′	54.0′
10	333°59.0	15.2	291°21.1	10.3′	27°38.6	3.5′	54.0′
11	348°59.1	16.1	305°50.4	10.3′	27°42.1	3.5′	54.0′
12	3°59.2	S12°16.9	320°19.7	10.2′	S27°45.6	3.3′	54.0′
13	18°59.2	17.8	334°48.9	10.2′	27°48.9	3.1′	54.0′
14	33°59.3	18.7	349°18.1	10.2′	27°52.0	3.1′	54.0′
15	48°59.4	·· 19.5	3°47.3	10.1′	27°55.1	2.9′	54.0′
16	63°59.4	20.4	18°16.4	10.1′	27°58.0	2.8′	54.0′
17	78°59.5	21.2	32°45.5	10.1′	28°00.8	2.6′	54.1′
18	93°59.6	S12°22.1	47°14.6	10.0′	S28°03.4	2.5′	54.1′
19	108°59.6	22.9	61°43.6	10.0′	28°05.9	2.4′	54.1′
20	123°59.7	23.8	76°12.6	10.0′	28°08.3	2.2′	54.1′
21	138°59.8	·· 24.7	90°41.5	9.9′	28°10.5	2.1′	54.1′
22	153°59.8	25.5	105°10.5	9.9′	28°12.6	1.9′	54.1′
23	168°59.9	26.4	119°39.3	9.9′	28°14.5	1.9′	54.1′
	SD = 16.1′	d = 0.9′	SD = 14.7′				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	184°00.0	S12°27.2	134°08.2	9.8′	S28°16.4	1.7′	54.1′
1	199°00.0	28.1	148°37.0	9.8′	28°18.1	1.5′	54.1′
2	214°00.1	28.9	163°05.8	9.8′	28°19.6	1.4′	54.1′
3	229°00.2	·· 29.8	177°34.6	9.8′	28°21.0	1.3′	54.1′
4	244°00.2	30.6	192°03.4	9.7′	28°22.3	1.1′	54.2′
5	259°00.3	31.5	206°32.1	9.7′	28°23.4	1.0′	54.2′
6	274°00.4	S12°32.3	221°00.8	9.7′	S28°24.4	0.9′	54.2′
7	289°00.4	33.2	235°29.5	9.7′	28°25.3	0.7′	54.2′
8	304°00.5	34.0	249°58.2	9.6′	28°26.0	0.6′	54.2′
9	319°00.5	·· 34.9	264°26.8	9.6′	28°26.6	0.4′	54.2′
10	334°00.6	35.7	278°55.5	9.6′	28°27.0	0.3′	54.2′
11	349°00.7	36.6	293°24.1	9.6′	28°27.3	0.2′	54.2′
12	4°00.7	S12°37.4	307°52.7	9.6′	S28°27.5	0.0′	54.3′
13	19°00.8	38.3	322°21.2	9.6′	28°27.5	0.1′	54.3′
14	34°00.9	39.1	336°49.8	9.6′	28°27.4	0.2′	54.3′
15	49°00.9	·· 40.0	351°18.4	9.5′	28°27.2	0.4′	54.3′
16	64°01.0	40.8	5°46.9	9.5′	28°26.8	0.6′	54.3′
17	79°01.0	41.7	20°15.5	9.5′	28°26.2	0.7′	54.3′
18	94°01.1	S12°42.5	34°44.0	9.5′	S28°25.5	0.8′	54.3′
19	109°01.2	43.4	49°12.5	9.5′	28°24.7	0.9′	54.4′
20	124°01.2	44.2	63°41.0	9.5′	28°23.8	1.1′	54.4′
21	139°01.3	·· 45.1	78°09.5	9.5′	28°22.7	1.3′	54.4′
22	154°01.3	45.9	92°38.0	9.5′	28°21.4	1.4′	54.4′
23	169°01.4	46.7	107°06.5	9.5′	28°20.0	1.5′	54.4′
	SD = 16.1′	d = 0.9′	SD = 14.8′				

Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	184°01.4	S12°47.6	121°35.0	9.5′	S28°18.5	1.7′	54.4′
1	199°01.5	48.4	136°03.5	9.5′	28°16.8	1.8′	54.5′
2	214°01.6	49.3	150°32.0	9.5′	28°15.0	1.9′	54.5′
3	229°01.6	·· 50.1	165°00.5	9.5′	28°13.1	2.1′	54.5′
4	244°01.7	51.0	179°29.0	9.5′	28°11.0	2.2′	54.5′
5	259°01.7	51.8	193°57.5	9.5′	28°08.8	2.4′	54.5′
6	274°01.8	S12°52.7	208°26.0	9.5′	S28°06.4	2.5′	54.5′
7	289°01.8	53.5	222°54.6	9.5′	28°03.9	2.7′	54.6′
8	304°01.9	54.3	237°23.1	9.5′	28°01.2	2.8′	54.6′
9	319°01.9	·· 55.2	251°51.6	9.5′	27°58.4	2.9′	54.6′
10	334°02.0	56.0	266°20.2	9.6′	27°55.5	3.1′	54.6′
11	349°02.1	56.9	280°48.7	9.6′	27°52.4	3.2′	54.6′
12	4°02.1	S12°57.7	295°17.3	9.6′	S27°49.2	3.4′	54.6′
13	19°02.2	58.6	309°45.8	9.6′	27°45.8	3.5′	54.7′
14	34°02.2	12°59.4	324°14.4	9.6′	27°42.3	3.6′	54.7′
15	49°02.3	13°00.2	338°43.0	9.6′	27°38.7	3.8′	54.7′
16	64°02.3	01.1	353°11.7	9.6′	27°34.9	3.9′	54.7′
17	79°02.4	01.9	7°40.3	9.7′	27°31.0	4.0′	54.7′
18	94°02.4	S13°02.8	22°08.9	9.7′	S27°27.0	4.2′	54.8′
19	109°02.5	03.6	36°37.6	9.7′	27°22.8	4.4′	54.8′
20	124°02.5	04.4	51°06.3	9.7′	27°18.4	4.4′	54.8′
21	139°02.6	·· 05.3	65°35.0	9.7′	27°14.0	4.6′	54.8′
22	154°02.6	06.1	80°03.7	9.8′	27°09.4	4.8′	54.9′
23	169°02.7	06.9	94°32.5	9.8′	27°04.6	4.9′	54.9′
	SD = 16.1′	d = 0.8′	SD = 14.8′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	05:43	07:03	08:23	15:04	16:23	17:43
N 70°	05:41	06:53	08:03	15:24	16:33	17:45
68°	05:40	06:45	07:47	15:39	16:41	17:46
66°	05:38	06:39	07:35	15:52	16:48	17:48
64°	05:37	06:33	07:24	16:03	16:54	17:49
62°	05:36	06:28	07:15	16:12	16:59	17:51
60°	05:35	06:23	07:07	16:20	17:03	17:52
N 58°	05:33	06:19	07:01	16:26	17:07	17:53
56°	05:32	06:16	06:55	16:32	17:11	17:55
54°	05:31	06:12	06:49	16:38	17:15	17:56
52°	05:30	06:09	06:44	16:43	17:18	17:57
50°	05:29	06:07	06:40	16:47	17:21	17:58
45°	05:26	06:00	06:30	16:57	17:27	18:01
N 40°	05:23	05:55	06:23	17:05	17:33	18:04
35°	05:20	05:50	06:16	17:12	17:38	18:07
30°	05:17	05:45	06:10	17:18	17:42	18:11
20°	05:10	05:36	05:59	17:29	17:51	18:17
N 10°	05:03	05:28	05:50	17:38	18:00	18:25
0°	04:55	05:19	05:41	17:47	18:09	18:33
S 10°	04:45	05:10	05:32	17:57	18:18	18:43
20°	04:32	04:59	05:22	18:06	18:29	18:56
30°	04:16	04:46	05:11	18:18	18:43	19:12
35°	04:06	04:37	05:04	18:25	18:51	19:23
40°	03:53	04:28	04:56	18:32	19:01	19:35
45°	03:38	04:16	04:48	18:41	19:13	19:51
S 50°	03:18	04:02	04:37	18:52	19:27	20:12
52°	03:08	03:55	04:32	18:57	19:34	20:22
54°	02:57	03:47	04:27	19:02	19:42	20:33
56°	02:43	03:39	04:21	19:09	19:51	20:47
58°	02:27	03:29	04:14	19:16	20:01	21:03
S 60°	02:08	03:17	04:06	19:24	20:13	21:24

Lat.	**Moonrise** Sat	Sun	Mon	**Moonset** Sat	Sun	Mon
N 72°						
N 70°						
68°						
66°						
64°						
62°	14:36		15:50	14:49		17:12
60°	13:07	14:15	14:48	16:18	16:58	18:14
N 58°	12:31	13:34	14:14	16:54	17:39	18:47
56°	12:05	13:06	13:49	17:20	18:07	19:12
54°	11:45	12:44	13:28	17:41	18:28	19:32
52°	11:28	12:26	13:12	17:58	18:46	19:49
50°	11:13	12:11	12:57	18:13	19:02	20:03
45°	10:43	11:40	12:28	18:43	19:33	20:32
N 40°	10:20	11:16	12:05	19:06	19:57	20:54
35°	10:01	10:56	11:46	19:26	20:16	21:13
30°	09:45	10:39	11:29	19:42	20:33	21:29
20°	09:17	10:11	11:02	20:10	21:02	21:56
N 10°	08:54	09:46	10:38	20:34	21:26	22:19
0°	08:32	09:23	10:16	20:57	21:49	22:41
S 10°	08:10	09:01	09:53	21:19	22:11	23:02
20°	07:47	08:36	09:30	21:43	22:36	23:25
30°	07:20	08:08	09:02	22:11	23:04	23:52
35°	07:04	07:51	08:45	22:28	23:20	·· ··
40°	06:45	07:32	08:26	22:47	23:40	·· ··
45°	06:23	07:08	08:03	23:11	·· ··	00:03
S 50°	05:55	06:37	07:33	23:41	·· ··	00:34
52°	05:41	06:22	07:18	23:56	·· ··	00:49
54°	05:25	06:05	07:01	·· ··	00:14	01:06
56°	05:06	05:43	06:40	·· ··	00:35	01:27
58°	04:42	05:16	06:13	·· ··	01:02	01:53
S 60°	04:12	04:38	05:37	00:20	01:41	02:30

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 4-6 11-25%
25	15:53	15:57	11:44	14:44	02:19	
26	16:00	16:03	11:44	15:36	03:10	
27	16:06	16:08	11:44	16:28	04:02	

October 28, 29, 30 UT (Tue., Wed., Thu.)

	Aries	Venus		Mars		Jupiter		Saturn	
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	36°35.7	199°49.0	S05°29.9	164°25.2	S19°16.1	279°51.0	N21°14.5	39°17.5	S03°51.9
1	51°38.1	214°48.6	31.1	179°25.9	16.6	294°53.3	14.5	54°20.0	51.9
2	66°40.6	229°48.2	32.3	194°26.5	17.0	309°55.6	14.5	69°22.6	52.0
3	81°43.1	244°47.7	·· 33.5	209°27.2	·· 17.5	324°58.0	·· 14.5	84°25.2	·· 52.0
4	96°45.5	259°47.3	34.7	224°27.8	17.9	340°00.3	14.4	99°27.8	52.1
5	111°48.0	274°46.9	35.9	239°28.4	18.4	355°02.7	14.4	114°30.4	52.1
6	126°50.5	289°46.5	S05°37.1	254°29.1	S19°18.8	10°05.0	N21°14.4	129°33.0	S03°52.2
7	141°52.9	304°46.0	38.3	269°29.7	19.3	25°07.3	14.4	144°35.5	52.2
8	156°55.4	319°45.6	39.5	284°30.4	19.7	40°09.7	14.4	159°38.1	52.3
9	171°57.8	334°45.2	·· 40.7	299°31.0	·· 20.2	55°12.0	·· 14.4	174°40.7	·· 52.3
10	187°00.3	349°44.7	41.9	314°31.7	20.7	70°14.4	14.4	189°43.3	52.3
11	202°02.8	4°44.3	43.1	329°32.3	21.1	85°16.7	14.3	204°45.9	52.4
12	217°05.2	19°43.9	S05°44.3	344°33.0	S19°21.6	100°19.0	N21°14.3	219°48.5	S03°52.4
13	232°07.7	34°43.4	45.5	359°33.6	22.0	115°21.4	14.3	234°51.0	52.5
14	247°10.2	49°43.0	46.7	14°34.3	22.5	130°23.7	14.3	249°53.6	52.5
15	262°12.6	64°42.6	·· 47.9	29°34.9	·· 22.9	145°26.1	·· 14.3	264°56.2	·· 52.6
16	277°15.1	79°42.2	49.1	44°35.6	23.4	160°28.4	14.3	279°58.8	52.6
17	292°17.6	94°41.7	50.3	59°36.2	23.8	175°30.7	14.2	295°01.4	52.7
18	307°20.0	109°41.3	S05°51.5	74°36.9	S19°24.3	190°33.1	N21°14.2	310°04.0	S03°52.7
19	322°22.5	124°40.9	52.7	89°37.5	24.7	205°35.4	14.2	325°06.5	52.7
20	337°25.0	139°40.4	53.9	104°38.1	25.2	220°37.8	14.2	340°09.1	52.8
21	352°27.4	154°40.0	·· 55.1	119°38.8	·· 25.6	235°40.1	·· 14.2	355°11.7	·· 52.8
22	7°29.9	169°39.6	56.3	134°39.4	26.1	250°42.5	14.2	10°14.3	52.9
23	22°32.3	184°39.1	57.5	149°40.1	26.5	265°44.8	14.2	25°16.9	52.9
Mer.pass. 21:30		ν -0.4′	d 1.2′	m -3.91	ν 0.6′	d 0.5′	m 1.48	ν 2.3′	d 0.0′ m -2.29	ν 2.6′	d 0.0′ m 0.75

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	37°34.8	199°38.7	S05°58.7	164°40.7	S19°27.0	280°47.2	N21°14.1	40°19.4	S03°53.0
1	52°37.3	214°38.3	05°59.9	179°41.4	27.4	295°49.5	14.1	55°22.0	53.0
2	67°39.7	229°37.8	06°01.1	194°42.0	27.9	310°51.9	14.1	70°24.6	53.1
3	82°42.2	244°37.4	·· 02.3	209°42.6	·· 28.3	325°54.2	·· 14.1	85°27.2	·· 53.1
4	97°44.7	259°37.0	03.5	224°43.3	28.8	340°56.5	14.1	100°29.8	53.1
5	112°47.1	274°36.5	04.7	239°43.9	29.2	355°58.9	14.1	115°32.3	53.2
6	127°49.6	289°36.1	S06°06.0	254°44.6	S19°29.7	11°01.2	N21°14.1	130°34.9	S03°53.2
7	142°52.1	304°35.7	07.2	269°45.2	30.1	26°03.6	14.0	145°37.5	53.3
8	157°54.5	319°35.2	08.3	284°45.9	30.6	41°05.9	14.0	160°40.1	53.3
9	172°57.0	334°34.8	·· 09.5	299°46.5	·· 31.0	56°08.3	·· 14.0	175°42.7	·· 53.4
10	187°59.5	349°34.4	10.7	314°47.1	31.5	71°10.6	14.0	190°45.2	53.4
11	203°01.9	4°33.9	11.9	329°47.8	31.9	86°13.0	14.0	205°47.8	53.4
12	218°04.4	19°33.5	S06°13.1	344°48.4	S19°32.3	101°15.3	N21°14.0	220°50.4	S03°53.5
13	233°06.8	34°33.1	14.3	359°49.1	32.8	116°17.7	14.0	235°53.0	53.5
14	248°09.3	49°32.6	15.5	14°49.7	33.2	131°20.0	14.0	250°55.6	53.6
15	263°11.8	64°32.2	·· 16.7	29°50.3	·· 33.7	146°22.4	·· 13.9	265°58.1	·· 53.6
16	278°14.2	79°31.8	17.9	44°51.0	34.1	161°24.7	13.9	281°00.7	53.7
17	293°16.7	94°31.3	19.1	59°51.6	34.6	176°27.1	13.9	296°03.3	53.7
18	308°19.2	109°30.9	S06°20.3	74°52.3	S19°35.0	191°29.4	N21°13.9	311°05.9	S03°53.7
19	323°21.6	124°30.5	21.5	89°52.9	35.5	206°31.8	13.9	326°08.4	53.8
20	338°24.1	139°30.0	22.7	104°53.5	35.9	221°34.2	13.9	341°11.0	53.8
21	353°26.6	154°29.6	·· 23.9	119°54.2	·· 36.4	236°36.5	·· 13.9	356°13.6	·· 53.9
22	8°29.0	169°29.1	25.1	134°54.8	36.8	251°38.9	13.8	11°16.2	53.9
23	23°31.5	184°28.7	26.3	149°55.4	37.2	266°41.2	13.8	26°18.8	54.0
Mer.pass. 21:26		ν -0.4′	d 1.2′	m -3.91	ν 0.6′	d 0.4′	m 1.47	ν 2.3′	d 0.0′ m -2.30	ν 2.6′	d 0.0′ m 0.75

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	38°33.9	199°28.3	S06°27.5	164°56.1	S19°37.7	281°43.6	N21°13.8	41°21.3	S03°54.0
1	53°36.4	214°27.8	28.7	179°56.7	38.1	296°45.9	13.8	56°23.9	54.0
2	68°38.9	229°27.4	29.9	194°57.4	38.6	311°48.3	13.8	71°26.5	54.1
3	83°41.3	244°27.0	·· 31.1	209°58.0	·· 39.0	326°50.6	·· 13.8	86°29.1	·· 54.1
4	98°43.8	259°26.5	32.3	224°58.6	39.4	341°53.0	13.8	101°31.6	54.2
5	113°46.3	274°26.1	33.5	239°59.3	39.9	356°55.3	13.8	116°34.2	54.2
6	128°48.7	289°25.6	S06°34.7	254°59.9	S19°40.3	11°57.7	N21°13.7	131°36.8	S03°54.2
7	143°51.2	304°25.2	35.9	270°00.5	40.8	27°00.1	13.7	146°39.4	54.3
8	158°53.7	319°24.8	37.1	285°01.2	41.2	42°02.4	13.7	161°42.0	54.3
9	173°56.1	334°24.3	·· 38.3	300°01.8	·· 41.7	57°04.8	·· 13.7	176°44.5	·· 54.4
10	188°58.6	349°23.9	39.5	315°02.4	42.1	72°07.1	13.7	191°47.1	54.4
11	204°01.1	4°23.4	40.7	330°03.1	42.5	87°09.5	13.7	206°49.7	54.5
12	219°03.5	19°23.0	S06°41.9	345°03.7	S19°43.0	102°11.8	N21°13.7	221°52.3	S03°54.5
13	234°06.0	34°22.6	43.1	0°04.3	43.4	117°14.2	13.7	236°54.8	54.5
14	249°08.4	49°22.1	44.2	15°05.0	43.9	132°16.6	13.6	251°57.4	54.6
15	264°10.9	64°21.7	·· 45.4	30°05.6	·· 44.3	147°18.9	·· 13.6	267°00.0	·· 54.6
16	279°13.4	79°21.2	46.6	45°06.2	44.7	162°21.3	13.6	282°02.6	54.7
17	294°15.8	94°20.8	47.8	60°06.9	45.2	177°23.6	13.6	297°05.1	54.7
18	309°18.3	109°20.4	S06°49.0	75°07.5	S19°45.6	192°26.0	N21°13.6	312°07.7	S03°54.7
19	324°20.8	124°19.9	50.2	90°08.1	46.0	207°28.4	13.6	327°10.3	54.8
20	339°23.2	139°19.5	51.4	105°08.8	46.5	222°30.7	13.6	342°12.9	54.8
21	354°25.7	154°19.0	·· 52.6	120°09.4	·· 46.9	237°33.1	·· 13.6	357°15.4	·· 54.9
22	9°28.2	169°18.6	53.8	135°10.0	47.4	252°35.4	13.5	12°18.0	54.9
23	24°30.6	184°18.1	55.0	150°10.7	47.8	267°37.8	13.5	27°20.6	54.9
Mer.pass. 21:22		ν -0.4′	d 1.2′	m -3.91	ν 0.6′	d 0.4′	m 1.47	ν 2.4′	d 0.0′ m -2.31	ν 2.6′	d 0.0′ m 0.76

Stars

	SHA	Dec
Alpheratz	357°33.8	29°14.2
Ankaa	353°06.1	-42°09.9
Schedar	349°29.8	56°40.9
Diphda	348°46.3	-17°50.6
Achernar	335°19.1	-57°06.3
Hamal	327°50.1	23°35.2
Polaris	313°13.2	89°22.3
Acamar	315°10.8	-40°11.9
Menkar	314°05.1	4°11.6
Mirfak	308°26.8	49°57.2
Aldebaran	290°38.6	16°33.7
Rigel	281°03.0	-8°10.1
Capella	280°20.6	46°01.4
Bellatrix	278°21.9	6°22.5
Elnath	278°00.8	28°37.7
Alnilam	275°36.8	-1°11.0
Betelgeuse	270°51.2	7°24.8
Canopus	263°51.8	-52°42.2
Sirius	258°25.5	-16°44.9
Adhara	255°05.2	-29°00.1
Procyon	244°50.1	5°09.6
Pollux	243°16.4	27°57.8
Avior	234°14.5	-59°35.1
Suhail	222°45.9	-43°31.9
Miaplacidus	221°38.4	-69°49.0
Alphard	217°47.2	-8°46.1
Regulus	207°33.9	11°50.5
Dubhe	193°40.6	61°36.5
Denebola	182°24.5	14°25.7
Gienah	175°43.2	-17°41.0
Acrux	173°00.0	-63°14.3
Gacrux	171°51.5	-57°15.3
Alioth	166°12.9	55°49.1
Spica	158°21.9	-11°17.7
Alkaid	152°52.0	49°11.0
Hadar	148°35.8	-60°29.8
Menkent	147°57.3	-36°29.7
Arcturus	145°47.7	19°02.9
Rigil Kent.	139°40.1	-60°56.5
Kochab	137°20.9	74°02.9
Zuben'ubi	136°55.6	-16°08.9
Alphecca	126°03.5	26°37.8
Antares	112°15.4	-26°29.3
Atria	107°09.4	-69°04.5
Sabik	102°02.3	-15°45.4
Shaula	96°09.8	-37°07.4
Rasalhague	95°58.2	12°32.6
Eltanin	90°42.2	51°29.3
Kaus Aust.	83°31.9	-34°22.4
Vega	80°33.0	38°48.7
Nunki	75°47.1	-26°15.9
Altair	61°59.4	8°56.3
Peacock	53°04.7	-56°39.3
Deneb	49°25.4	45°22.6
Enif	33°38.1	9°59.8
Al Na'ir	27°31.9	-46°50.3
Fomalhaut	15°13.6	-29°29.1
Scheat	13°44.4	28°13.6
Markab	13°29.1	15°20.8

Oct 28 Tue	SHA	Mer.pass
Venus	163°13.3	10:41
Mars	127°49.5	13:02
Jupiter	243°15.3	05:20
Saturn	2°41.8	21:19

Oct 29 Wed	SHA	Mer.pass
Venus	162°03.9	10:42
Mars	127°05.9	13:01
Jupiter	243°12.4	05:16
Saturn	2°44.6	21:15

Oct 30 Thu	SHA	Mer.pass
Venus	160°54.3	10:42
Mars	126°22.1	13:00
Jupiter	243°09.6	05:12
Saturn	2°47.4	21:11

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	184°02.7	S13°07.8	109°01.3	9.8′	S26°59.7	5.0′	54.9′
1	199°02.8	08.6	123°30.1	9.8′	26°54.7	5.2′	54.9′
2	214°02.8	09.4	137°58.9	9.8′	26°49.5	5.3′	54.9′
3	229°02.9	·· 10.3	152°27.7	9.9′	26°44.2	5.4′	55.0′
4	244°02.9	11.1	166°56.6	9.9′	26°38.8	5.6′	55.0′
5	259°03.0	12.0	181°25.5	9.9′	26°33.2	5.7′	55.0′
6	274°03.0	S13°12.8	195°54.5	10.0′	S26°27.5	5.8′	55.0′
7	289°03.1	13.6	210°23.4	10.0′	26°21.7	6.0′	55.1′
8	304°03.1	14.5	224°52.4	10.0′	26°15.7	6.1′	55.1′
9	319°03.2	·· 15.3	239°21.4	10.0′	26°09.6	6.2′	55.1′
10	334°03.2	16.1	253°50.5	10.1′	26°03.4	6.4′	55.1′
11	349°03.3	17.0	268°19.5	10.1′	25°57.0	6.5′	55.2′
12	4°03.3	S13°17.8	282°48.6	10.1′	S25°50.5	6.6′	55.2′
13	19°03.4	18.6	297°17.8	10.2′	25°43.9	6.8′	55.2′
14	34°03.4	19.5	311°47.0	10.2′	25°37.1	6.9′	55.2′
15	49°03.4	·· 20.3	326°16.2	10.2′	25°30.2	7.1′	55.3′
16	64°03.5	21.1	340°45.4	10.3′	25°23.1	7.1′	55.3′
17	79°03.5	21.9	355°14.7	10.3′	25°16.0	7.3′	55.3′
18	94°03.6	S13°22.8	9°44.0	10.3′	S25°08.7	7.5′	55.4′
19	109°03.6	23.6	24°13.3	10.4′	25°01.2	7.5′	55.4′
20	124°03.7	24.4	38°42.7	10.4′	24°53.7	7.7′	55.4′
21	139°03.7	·· 25.3	53°12.1	10.4′	24°46.0	7.8′	55.4′
22	154°03.8	26.1	67°41.6	10.5′	24°38.2	8.0′	55.5′
23	169°03.8	26.9	82°11.1	10.5′	24°30.2	8.0′	55.5′
	SD = 16.1′	d = 0.8′	SD = 15.0′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	184°03.8	S13°27.8	96°40.6	10.6′	S24°22.2	8.2′	55.5′
1	199°03.9	28.6	111°10.1	10.6′	24°14.0	8.4′	55.5′
2	214°03.9	29.4	125°39.7	10.6′	24°05.6	8.4′	55.6′
3	229°04.0	·· 30.2	140°09.4	10.7′	23°57.2	8.6′	55.6′
4	244°04.0	31.1	154°39.0	10.7′	23°48.6	8.7′	55.6′
5	259°04.0	31.9	169°08.8	10.7′	23°39.9	8.8′	55.7′
6	274°04.1	S13°32.7	183°38.5	10.8′	S23°31.1	9.0′	55.7′
7	289°04.1	33.5	198°08.3	10.8′	23°22.1	9.0′	55.7′
8	304°04.2	34.4	212°38.1	10.9′	23°13.1	9.2′	55.8′
9	319°04.2	·· 35.2	227°08.0	10.9′	23°03.9	9.3′	55.8′
10	334°04.2	36.0	241°37.9	10.9′	22°54.6	9.5′	55.8′
11	349°04.3	36.8	256°07.8	11.0′	22°45.1	9.5′	55.9′
12	4°04.3	S13°37.7	270°37.8	11.0′	S22°35.6	9.7′	55.9′
13	19°04.4	38.5	285°07.8	11.1′	22°25.9	9.8′	55.9′
14	34°04.4	39.3	299°37.9	11.1′	22°16.1	9.9′	55.9′
15	49°04.4	·· 40.1	314°08.0	11.1′	22°06.2	10.0′	56.0′
16	64°04.5	41.0	328°38.1	11.2′	21°56.2	10.2′	56.0′
17	79°04.5	41.8	343°08.3	11.2′	21°46.0	10.2′	56.0′
18	94°04.5	S13°42.6	357°38.5	11.3′	S21°35.8	10.4′	56.1′
19	109°04.6	43.4	12°08.8	11.3′	21°25.4	10.5′	56.1′
20	124°04.6	44.2	26°39.0	11.3′	21°14.9	10.6′	56.1′
21	139°04.7	·· 45.1	41°09.4	11.4′	21°04.3	10.7′	56.2′
22	154°04.7	45.9	55°39.7	11.4′	20°53.6	10.9′	56.2′
23	169°04.7	46.7	70°10.1	11.4′	20°42.7	10.9′	56.2′
	SD = 16.1′	d = 0.8′	SD = 15.1′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	184°04.8	S13°47.5	84°40.6	11.5′	S20°31.8	11.1′	56.3′
1	199°04.8	48.3	99°11.1	11.5′	20°20.7	11.1′	56.3′
2	214°04.8	49.2	113°41.6	11.6′	20°09.6	11.3′	56.4′
3	229°04.9	·· 50.0	128°12.1	11.6′	19°58.3	11.4′	56.4′
4	244°04.9	50.8	142°42.7	11.6′	19°46.9	11.5′	56.4′
5	259°04.9	51.6	157°13.3	11.7′	19°35.4	11.6′	56.5′
6	274°05.0	S13°52.4	171°44.0	11.7′	S19°23.8	11.7′	56.5′
7	289°05.0	53.2	186°14.7	11.7′	19°12.1	11.8′	56.5′
8	304°05.0	54.1	200°45.4	11.8′	19°00.3	12.0′	56.6′
9	319°05.1	·· 54.9	215°16.2	11.8′	18°48.3	12.0′	56.6′
10	334°05.1	55.7	229°47.0	11.8′	18°36.3	12.1′	56.6′
11	349°05.1	56.5	244°17.8	11.9′	18°24.2	12.3′	56.7′
12	4°05.1	S13°57.3	258°48.7	11.9′	S18°11.9	12.3′	56.7′
13	19°05.2	58.1	273°19.5	11.9′	17°59.6	12.4′	56.7′
14	34°05.2	58.9	287°50.5	12.0′	17°47.2	12.6′	56.8′
15	49°05.2	13°59.8	302°21.4	12.0′	17°34.6	12.6′	56.8′
16	64°05.3	14°00.6	316°52.4	12.0′	17°22.0	12.8′	56.9′
17	79°05.3	01.4	331°23.4	12.0′	17°09.2	12.8′	56.9′
18	94°05.3	S14°02.2	345°54.5	12.1′	S16°56.4	12.9′	56.9′
19	109°05.4	03.0	0°25.5	12.1′	16°43.5	13.1′	57.0′
20	124°05.4	03.8	14°56.7	12.1′	16°30.4	13.1′	57.0′
21	139°05.4	·· 04.6	29°27.8	12.2′	16°17.3	13.2′	57.1′
22	154°05.4	05.4	43°58.9	12.2′	16°04.1	13.3′	57.1′
23	169°05.5	06.2	58°30.1	12.2′	15°50.8	13.4′	57.1′
	SD = 16.1′	d = 0.8′	SD = 15.3′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	05:55	07:17	08:40	14:46	16:09	17:30
N 70°	05:52	07:05	08:17	15:09	16:21	17:34
68°	05:50	06:56	07:59	15:27	16:30	17:36
66°	05:47	06:48	07:45	15:41	16:38	17:39
64°	05:45	06:41	07:33	15:53	16:45	17:41
62°	05:43	06:36	07:24	16:03	16:51	17:43
60°	05:41	06:30	07:15	16:11	16:56	17:45
N 58°	05:40	06:26	07:08	16:19	17:01	17:47
56°	05:38	06:22	07:01	16:26	17:05	17:49
54°	05:36	06:18	06:55	16:31	17:09	17:50
52°	05:35	06:14	06:50	16:37	17:12	17:52
50°	05:33	06:11	06:45	16:42	17:15	17:53
45°	05:30	06:04	06:35	16:52	17:23	17:57
N 40°	05:26	05:58	06:26	17:01	17:29	18:01
35°	05:23	05:52	06:18	17:09	17:35	18:04
30°	05:19	05:47	06:12	17:15	17:40	18:08
20°	05:12	05:38	06:00	17:27	17:50	18:16
N 10°	05:03	05:28	05:50	17:37	17:59	18:24
0°	04:54	05:19	05:40	17:47	18:08	18:33
S 10°	04:44	05:09	05:31	17:57	18:19	18:44
20°	04:30	04:57	05:20	18:08	18:31	18:58
30°	04:13	04:43	05:08	18:20	18:45	19:15
35°	04:02	04:34	05:01	18:27	18:54	19:26
40°	03:49	04:24	04:53	18:36	19:05	19:40
45°	03:32	04:11	04:43	18:45	19:17	19:56
S 50°	03:11	03:56	04:32	18:57	19:33	20:18
52°	03:00	03:48	04:26	19:02	19:40	20:29
54°	02:48	03:40	04:20	19:08	19:49	20:42
56°	02:33	03:31	04:14	19:15	19:58	20:56
58°	02:16	03:20	04:06	19:23	20:10	21:15
S 60°	01:54	03:07	03:58	19:31	20:22	21:37

Lat.	**Moonrise** Tue	Wed	Thu	**Moonset** Tue	Wed	Thu
N 72°	▬	▬	17:42	▬	▬	20:39
N 70°	▬	▬	16:50	▬	▬	21:29
68°	▬	17:35	16:17	▬	19:01	22:00
66°	▬	16:26	15:53	▬	20:08	22:23
64°	16:27	15:50	15:34	18:23	20:44	22:41
62°	15:32	15:24	15:18	19:17	21:09	22:55
60°	14:59	15:04	15:05	19:49	21:28	23:07
N 58°	14:35	14:47	14:54	20:13	21:45	23:18
56°	14:15	14:32	14:44	20:32	21:58	23:27
54°	13:59	14:20	14:35	20:48	22:10	23:35
52°	13:45	14:09	14:27	21:02	22:21	23:42
50°	13:33	13:59	14:20	21:14	22:30	23:49
45°	13:07	13:38	14:04	21:38	22:49	·· ··
N 40°	12:47	13:22	13:52	21:58	23:05	·· ··
35°	12:29	13:07	13:41	22:14	23:18	·· ··
30°	12:15	12:55	13:31	22:28	23:30	·· ··
20°	11:50	12:34	13:15	22:52	23:49	·· ··
N 10°	11:28	12:15	13:00	23:13	·· ··	00:06
0°	11:07	11:58	12:47	23:32	·· ··	00:22
S 10°	10:47	11:40	12:33	23:51	·· ··	00:37
20°	10:25	11:22	12:19	·· ··	00:11	00:54
30°	10:00	11:00	12:02	·· ··	00:34	01:12
35°	09:45	10:47	11:52	00:07	00:48	01:23
40°	09:27	10:33	11:41	00:25	01:04	01:36
45°	09:06	10:15	11:27	00:47	01:22	01:50
S 50°	08:39	09:53	11:11	01:14	01:45	02:08
52°	08:26	09:42	11:03	01:28	01:56	02:17
54°	08:11	09:31	10:54	01:43	02:08	02:26
56°	07:53	09:17	10:45	02:01	02:23	02:36
58°	07:32	09:01	10:34	02:23	02:39	02:48
S 60°	07:04	08:42	10:21	02:51	02:59	03:02

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 7-9 34-53%
28	16:11	16:13	11:44	17:20	04:54	
29	16:15	16:17	11:44	18:10	05:45	
30	16:19	16:21	11:44	18:58	06:34	

October 31, 01, 02 UT (Fri., Sat., Sun.)

	Aries	Venus		Mars		Jupiter		Saturn	
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	39°33.1	199°17.7	S06°56.2	165°11.3	S19°48.2	282°40.2	N21°13.5	42°23.2	S03°55.0
1	54°35.6	214°17.2	57.4	180°11.9	48.7	297°42.5	13.5	57°25.7	55.0
2	69°38.0	229°16.8	58.5	195°12.5	49.1	312°44.9	13.5	72°28.3	55.1
3	84°40.5	244°16.4	06°59.7	210°13.2	·· 49.5	327°47.3	·· 13.5	87°30.9	·· 55.1
4	99°42.9	259°15.9	07°00.9	225°13.8	50.0	342°49.6	13.5	102°33.5	55.2
5	114°45.4	274°15.5	02.1	240°14.4	50.4	357°52.0	13.5	117°36.0	55.2
6	129°47.9	289°15.0	S07°03.3	255°15.1	S19°50.8	12°54.4	N21°13.5	132°38.6	S03°55.2
7	144°50.3	304°14.6	04.5	270°15.7	51.3	27°56.7	13.4	147°41.2	55.3
8	159°52.8	319°14.1	05.7	285°16.3	51.7	42°59.1	13.4	162°43.7	55.3
9	174°55.3	334°13.7	·· 06.9	300°16.9	·· 52.1	58°01.4	·· 13.4	177°46.3	·· 55.4
10	189°57.7	349°13.2	08.1	315°17.6	52.6	73°03.8	13.4	192°48.9	55.4
11	205°00.2	4°12.8	09.2	330°18.2	53.0	88°06.2	13.4	207°51.5	55.4
12	220°02.7	19°12.3	S07°10.4	345°18.8	S19°53.4	103°08.5	N21°13.4	222°54.0	S03°55.5
13	235°05.1	34°11.9	11.6	0°19.5	53.9	118°10.9	13.4	237°56.6	55.5
14	250°07.6	49°11.4	12.8	15°20.1	54.3	133°13.3	13.4	252°59.2	55.6
15	265°10.0	64°11.0	·· 14.0	30°20.7	·· 54.7	148°15.6	·· 13.4	268°01.8	·· 55.6
16	280°12.5	79°10.6	15.2	45°21.3	55.2	163°18.0	13.4	283°04.3	55.6
17	295°15.0	94°10.1	16.4	60°22.0	55.6	178°20.4	13.3	298°06.9	55.7
18	310°17.4	109°09.7	S07°17.6	75°22.6	S19°56.0	193°22.8	N21°13.3	313°09.5	S03°55.7
19	325°19.9	124°09.2	18.7	90°23.2	56.5	208°25.1	13.3	328°12.0	55.8
20	340°22.4	139°08.8	19.9	105°23.8	56.9	223°27.5	13.3	343°14.6	55.8
21	355°24.8	154°08.3	·· 21.1	120°24.5	·· 57.3	238°29.9	·· 13.3	358°17.2	·· 55.8
22	10°27.3	169°07.9	22.3	135°25.1	57.7	253°32.2	13.3	13°19.8	55.9
23	25°29.8	184°07.4	23.5	150°25.7	58.2	268°34.6	13.3	28°22.3	55.9
Mer.pass. 21:18		ν -0.4′	d 1.2′	m -3.91	ν 0.6′	d 0.4′	m 1.46	ν 2.4′	d 0.0′ m -2.31	ν 2.6′	d 0.0′ m 0.76

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	40°32.2	199°07.0	S07°24.7	165°26.3	S19°58.6	283°37.0	N21°13.3	43°24.9	S03°55.9
1	55°34.7	214°06.5	25.9	180°27.0	59.0	298°39.3	13.3	58°27.5	56.0
2	70°37.2	229°06.1	27.0	195°27.6	59.5	313°41.7	13.2	73°30.0	56.0
3	85°39.6	244°05.6	·· 28.2	210°28.2	19°59.9	328°44.1	·· 13.2	88°32.6	·· 56.1
4	100°42.1	259°05.1	29.4	225°28.8	20°00.3	343°46.5	13.2	103°35.2	56.1
5	115°44.5	274°04.7	30.6	240°29.4	00.7	358°48.8	13.2	118°37.8	56.1
6	130°47.0	289°04.2	S07°31.8	255°30.1	S20°01.2	13°51.2	N21°13.2	133°40.3	S03°56.2
7	145°49.5	304°03.8	33.0	270°30.7	01.6	28°53.6	13.2	148°42.9	56.2
8	160°51.9	319°03.3	34.1	285°31.3	02.0	43°56.0	13.2	163°45.5	56.3
9	175°54.4	334°02.9	·· 35.3	300°31.9	·· 02.5	58°58.3	·· 13.2	178°48.0	·· 56.3
10	190°56.9	349°02.4	36.5	315°32.6	02.9	74°00.7	13.2	193°50.6	56.3
11	205°59.3	4°02.0	37.7	330°33.2	03.3	89°03.1	13.2	208°53.2	56.4
12	221°01.8	19°01.5	S07°38.9	345°33.8	S20°03.7	104°05.5	N21°13.2	223°55.7	S03°56.4
13	236°04.3	34°01.1	40.0	0°34.4	04.2	119°07.8	13.1	238°58.3	56.5
14	251°06.7	49°00.6	41.2	15°35.0	04.6	134°10.2	13.1	254°00.9	56.5
15	266°09.2	64°00.2	·· 42.4	30°35.7	·· 05.0	149°12.6	·· 13.1	269°03.5	·· 56.5
16	281°11.7	78°59.7	43.6	45°36.3	05.4	164°15.0	13.1	284°06.0	56.6
17	296°14.1	93°59.3	44.8	60°36.9	05.9	179°17.3	13.1	299°08.6	56.6
18	311°16.6	108°58.8	S07°45.9	75°37.5	S20°06.3	194°19.7	N21°13.1	314°11.2	S03°56.6
19	326°19.0	123°58.3	47.1	90°38.1	06.7	209°22.1	13.1	329°13.7	56.7
20	341°21.5	138°57.9	48.3	105°38.8	07.1	224°24.5	13.1	344°16.3	56.7
21	356°24.0	153°57.4	·· 49.5	120°39.4	·· 07.5	239°26.8	·· 13.1	359°18.9	·· 56.8
22	11°26.4	168°57.0	50.7	135°40.0	08.0	254°29.2	13.1	14°21.4	56.8
23	26°28.9	183°56.5	51.8	150°40.6	08.4	269°31.6	13.1	29°24.0	56.8
Mer.pass. 21:14		ν -0.5′	d 1.2′	m -3.91	ν 0.6′	d 0.4′	m 1.46	ν 2.4′	d 0.0′ m -2.32	ν 2.6′	d 0.0′ m 0.77

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	41°31.4	198°56.1	S07°53.0	165°41.2	S20°08.8	284°34.0	N21°13.0	44°26.6	S03°56.9
1	56°33.8	213°55.6	54.2	180°41.8	09.2	299°36.4	13.0	59°29.1	56.9
2	71°36.3	228°55.1	55.4	195°42.5	09.7	314°38.7	13.0	74°31.7	56.9
3	86°38.8	243°54.7	·· 56.6	210°43.1	·· 10.1	329°41.1	·· 13.0	89°34.3	·· 57.0
4	101°41.2	258°54.2	57.7	225°43.7	10.5	344°43.5	13.0	104°36.8	57.0
5	116°43.7	273°53.8	07°58.9	240°44.3	10.9	359°45.9	13.0	119°39.4	57.1
6	131°46.1	288°53.3	S08°00.1	255°44.9	S20°11.3	14°48.3	N21°13.0	134°42.0	S03°57.1
7	146°48.6	303°52.8	01.3	270°45.5	11.8	29°50.6	13.0	149°44.5	57.1
8	161°51.1	318°52.4	02.4	285°46.2	12.2	44°53.0	13.0	164°47.1	57.2
9	176°53.5	333°51.9	·· 03.6	300°46.8	·· 12.6	59°55.4	·· 13.0	179°49.7	·· 57.2
10	191°56.0	348°51.5	04.8	315°47.4	13.0	74°57.8	13.0	194°52.2	57.2
11	206°58.5	3°51.0	06.0	330°48.0	13.4	90°00.2	13.0	209°54.8	57.3
12	222°00.9	18°50.5	S08°07.1	345°48.6	S20°13.9	105°02.6	N21°12.9	224°57.4	S03°57.3
13	237°03.4	33°50.1	08.3	0°49.2	14.3	120°04.9	12.9	239°59.9	57.4
14	252°05.9	48°49.6	09.5	15°49.8	14.7	135°07.3	12.9	255°02.5	57.4
15	267°08.3	63°49.2	·· 10.7	30°50.4	·· 15.1	150°09.7	·· 12.9	270°05.1	·· 57.4
16	282°10.8	78°48.7	11.8	45°51.1	15.5	165°12.1	12.9	285°07.6	57.5
17	297°13.3	93°48.2	13.0	60°51.7	15.9	180°14.5	12.9	300°10.2	57.5
18	312°15.7	108°47.8	S08°14.2	75°52.3	S20°16.4	195°16.9	N21°12.9	315°12.8	S03°57.5
19	327°18.2	123°47.3	15.3	90°52.9	16.8	210°19.3	12.9	330°15.3	57.6
20	342°20.6	138°46.8	16.5	105°53.5	17.2	225°21.6	12.9	345°17.9	57.6
21	357°23.1	153°46.4	·· 17.7	120°54.1	·· 17.6	240°24.0	·· 12.9	0°20.5	·· 57.6
22	12°25.6	168°45.9	18.9	135°54.7	18.0	255°26.4	12.9	15°23.0	57.7
23	27°28.0	183°45.4	20.0	150°55.3	18.4	270°28.8	12.9	30°25.6	57.7
Mer.pass. 21:10		ν -0.5′	d 1.2′	m -3.91	ν 0.6′	d 0.4′	m 1.45	ν 2.4′	d 0.0′ m -2.33	ν 2.6′	d 0.0′ m 0.77

Stars

	SHA	Dec
Alpheratz	357°33.8	29°14.2
Ankaa	353°06.1	-42°10.0
Schedar	349°29.8	56°41.0
Diphda	348°46.3	-17°50.6
Achernar	335°19.1	-57°06.3
Hamal	327°50.1	23°35.2
Polaris	313°12.8	89°22.3
Acamar	315°10.8	-40°11.9
Menkar	314°05.1	4°11.6
Mirfak	308°26.8	49°57.2
Aldebaran	290°38.6	16°33.8
Rigel	281°03.0	-8°10.1
Capella	280°20.6	46°01.4
Bellatrix	278°21.9	6°22.5
Elnath	278°00.8	28°37.7
Alnilam	275°36.8	-1°11.0
Betelgeuse	270°51.2	7°24.8
Canopus	263°51.8	-52°42.2
Sirius	258°25.5	-16°44.9
Adhara	255°05.2	-29°00.2
Procyon	244°50.1	5°09.6
Pollux	243°16.4	27°57.8
Avior	234°14.4	-59°35.1
Suhail	222°45.9	-43°31.9
Miaplacidus	221°38.3	-69°49.0
Alphard	217°47.2	-8°46.1
Regulus	207°33.9	11°50.5
Dubhe	193°40.6	61°36.5
Denebola	182°24.5	14°25.7
Gienah	175°43.2	-17°41.0
Acrux	173°00.0	-63°14.3
Gacrux	171°51.5	-57°15.3
Alioth	166°12.9	55°49.1
Spica	158°21.9	-11°17.7
Alkaid	152°52.0	49°11.0
Hadar	148°35.8	-60°29.8
Menkent	147°57.3	-36°29.7
Arcturus	145°47.7	19°02.9
Rigil Kent.	139°40.1	-60°56.5
Kochab	137°20.9	74°02.9
Zuben'ubi	136°55.6	-16°08.9
Alphecca	126°03.5	26°37.7
Antares	112°15.4	-26°29.3
Atria	107°09.5	-69°04.5
Sabik	102°02.3	-15°45.4
Shaula	96°09.8	-37°07.4
Rasalhague	95°58.2	12°32.6
Eltanin	90°42.2	51°29.3
Kaus Aust.	83°31.9	-34°22.4
Vega	80°33.0	38°48.7
Nunki	75°47.1	-26°15.9
Altair	61°59.4	8°56.3
Peacock	53°04.7	-56°39.3
Deneb	49°25.4	45°22.6
Enif	33°38.1	9°59.8
Al Na'ir	27°31.9	-46°50.3
Fomalhaut	15°13.6	-29°29.2
Scheat	13°44.4	28°13.6
Markab	13°29.1	15°20.8

Oct 31 Fri	SHA	Mer.pass
Venus	159°44.6	10:43
Mars	125°38.2	12:59
Jupiter	243°07.1	05:09
Saturn	2°50.1	21:07

Nov 01 Sat	SHA	Mer.pass
Venus	158°34.7	10:44
Mars	124°54.1	12:58
Jupiter	243°04.7	05:05
Saturn	2°52.7	21:03

Nov 02 Sun	SHA	Mer.pass
Venus	157°24.7	10:45
Mars	124°09.9	12:57
Jupiter	243°02.6	05:01
Saturn	2°55.2	20:59

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	184°05.5	S14°07.1	73°01.3	12.2′	S15°37.4	13.5′	57.2′
1	199°05.5	07.9	87°32.6	12.3′	15°23.9	13.6′	57.2′
2	214°05.5	08.7	102°03.8	12.3′	15°10.3	13.7′	57.2′
3	229°05.6	·· 09.5	116°35.1	12.3′	14°56.6	13.8′	57.3′
4	244°05.6	10.3	131°06.4	12.3′	14°42.8	13.9′	57.3′
5	259°05.6	11.1	145°37.7	12.3′	14°28.9	13.9′	57.4′
6	274°05.6	S14°11.9	160°09.1	12.4′	S14°15.0	14.1′	57.4′
7	289°05.7	12.7	174°40.4	12.4′	14°00.9	14.1′	57.4′
8	304°05.7	13.5	189°11.8	12.4′	13°46.8	14.2′	57.5′
9	319°05.7	·· 14.3	203°43.2	12.4′	13°32.6	14.3′	57.5′
10	334°05.7	15.1	218°14.6	12.4′	13°18.3	14.4′	57.6′
11	349°05.8	15.9	232°46.1	12.4′	13°03.9	14.4′	57.6′
12	4°05.8	S14°16.7	247°17.5	12.5′	S12°49.5	14.6′	57.6′
13	19°05.8	17.5	261°49.0	12.5′	12°34.9	14.6′	57.7′
14	34°05.8	18.4	276°20.4	12.5′	12°20.3	14.7′	57.7′
15	49°05.8	·· 19.2	290°51.9	12.5′	12°05.6	14.8′	57.8′
16	64°05.9	20.0	305°23.4	12.5′	11°50.8	14.8′	57.8′
17	79°05.9	20.8	319°54.9	12.5′	11°36.0	15.0′	57.8′
18	94°05.9	S14°21.6	334°26.5	12.5′	S11°21.0	15.0′	57.9′
19	109°05.9	22.4	348°58.0	12.5′	11°06.0	15.0′	57.9′
20	124°05.9	23.2	3°29.5	12.5′	10°51.0	15.2′	58.0′
21	139°06.0	·· 24.0	18°01.1	12.5′	10°35.8	15.2′	58.0′
22	154°06.0	24.8	32°32.6	12.6′	10°20.6	15.3′	58.0′
23	169°06.0	25.6	47°04.2	12.6′	10°05.3	15.4′	58.1′
	SD = 16.1′	d = 0.8′	SD = 15.6′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	184°06.0	S14°26.4	61°35.7	12.6′	S09°49.9	15.5′	58.1′
1	199°06.0	27.2	76°07.3	12.6′	09°34.4	15.5′	58.2′
2	214°06.1	28.0	90°38.9	12.6′	09°18.9	15.5′	58.2′
3	229°06.1	·· 28.8	105°10.4	12.6′	09°03.4	15.7′	58.3′
4	244°06.1	29.6	119°42.0	12.6′	08°47.7	15.7′	58.3′
5	259°06.1	30.4	134°13.5	12.6′	08°32.0	15.8′	58.3′
6	274°06.1	S14°31.2	148°45.1	12.6′	S08°16.2	15.8′	58.4′
7	289°06.1	32.0	163°16.6	12.5′	08°00.4	15.9′	58.4′
8	304°06.2	32.8	177°48.2	12.5′	07°44.5	15.9′	58.5′
9	319°06.2	·· 33.6	192°19.7	12.5′	07°28.6	16.1′	58.5′
10	334°06.2	34.3	206°51.3	12.5′	07°12.5	16.0′	58.5′
11	349°06.2	35.1	221°22.8	12.5′	06°56.5	16.2′	58.6′
12	4°06.2	S14°35.9	235°54.3	12.5′	S06°40.3	16.1′	58.6′
13	19°06.2	36.7	250°25.8	12.5′	06°24.2	16.3′	58.7′
14	34°06.2	37.5	264°57.3	12.5′	06°07.9	16.3′	58.7′
15	49°06.3	·· 38.3	279°28.7	12.5′	05°51.6	16.3′	58.7′
16	64°06.3	39.1	294°00.2	12.4′	05°35.3	16.4′	58.8′
17	79°06.3	39.9	308°31.6	12.4′	05°18.9	16.5′	58.8′
18	94°06.3	S14°40.7	323°03.1	12.4′	S05°02.4	16.5′	58.9′
19	109°06.3	41.5	337°34.5	12.4′	04°45.9	16.5′	58.9′
20	124°06.3	42.3	352°05.9	12.4′	04°29.4	16.6′	58.9′
21	139°06.3	·· 43.1	6°37.2	12.3′	04°12.8	16.6′	59.0′
22	154°06.3	43.9	21°08.6	12.3′	03°56.2	16.7′	59.0′
23	169°06.4	44.7	35°39.9	12.3′	03°39.5	16.7′	59.1′
	SD = 16.1′	d = 0.8′	SD = 15.9′				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	184°06.4	S14°45.4	50°11.2	12.3′	S03°22.8	16.8′	59.1′
1	199°06.4	46.2	64°42.4	12.2′	03°06.0	16.8′	59.1′
2	214°06.4	47.0	79°13.7	12.2′	02°49.2	16.8′	59.2′
3	229°06.4	·· 47.8	93°44.9	12.2′	02°32.4	16.9′	59.2′
4	244°06.4	48.6	108°16.1	12.1′	02°15.5	16.9′	59.3′
5	259°06.4	49.4	122°47.2	12.1′	01°58.6	16.9′	59.3′
6	274°06.4	S14°50.2	137°18.3	12.1′	S01°41.7	17.0′	59.3′
7	289°06.4	51.0	151°49.4	12.0′	01°24.7	17.0′	59.4′
8	304°06.4	51.8	166°20.4	12.0′	01°07.7	17.0′	59.4′
9	319°06.4	·· 52.5	180°51.5	12.0′	00°50.7	17.0′	59.5′
10	334°06.4	53.3	195°22.4	11.9′	00°33.7	17.1′	59.5′
11	349°06.5	54.1	209°53.3	11.9′	S00°16.6	17.1′	59.5′
12	4°06.5	S14°54.9	224°24.2	11.8′	N00°00.5	17.2′	59.6′
13	19°06.5	55.7	238°55.1	11.8′	00°17.7	17.1′	59.6′
14	34°06.5	56.5	253°25.9	11.8′	00°34.8	17.2′	59.6′
15	49°06.5	·· 57.3	267°56.6	11.7′	00°52.0	17.2′	59.7′
16	64°06.5	58.0	282°27.3	11.7′	01°09.2	17.2′	59.7′
17	79°06.5	58.8	296°58.0	11.6′	01°26.4	17.2′	59.8′
18	94°06.5	S14°59.6	311°28.6	11.6′	N01°43.6	17.2′	59.8′
19	109°06.5	15°00.4	325°59.2	11.5′	02°00.8	17.2′	59.8′
20	124°06.5	01.2	340°29.7	11.5′	02°18.0	17.3′	59.9′
21	139°06.5	·· 01.9	355°00.1	11.4′	02°35.3	17.3′	59.9′
22	154°06.5	02.7	9°30.5	11.3′	02°52.6	17.2′	59.9′
23	169°06.5	03.5	24°00.9	11.3′	03°09.8	17.3′	60.0′
	SD = 16.1′	d = 0.8′	SD = 16.1′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	06:07	07:30	08:58	14:27	15:55	17:18
N 70°	06:03	07:17	08:32	14:54	16:09	17:23
68°	05:59	07:06	08:12	15:14	16:19	17:27
66°	05:56	06:57	07:56	15:30	16:28	17:30
64°	05:53	06:50	07:43	15:43	16:36	17:33
62°	05:50	06:43	07:32	15:54	16:43	17:36
60°	05:48	06:37	07:23	16:04	16:49	17:38
N 58°	05:46	06:32	07:15	16:12	16:54	17:40
56°	05:44	06:28	07:07	16:19	16:59	17:43
54°	05:42	06:23	07:01	16:25	17:03	17:45
52°	05:40	06:20	06:55	16:31	17:07	17:47
50°	05:38	06:16	06:50	16:37	17:10	17:49
45°	05:33	06:08	06:39	16:48	17:19	17:53
N 40°	05:29	06:01	06:29	16:57	17:26	17:58
35°	05:25	05:55	06:21	17:06	17:32	18:02
30°	05:21	05:49	06:14	17:13	17:38	18:06
20°	05:13	05:39	06:02	17:25	17:48	18:14
N 10°	05:04	05:29	05:51	17:36	17:58	18:23
0°	04:54	05:19	05:40	17:47	18:08	18:33
S 10°	04:42	05:08	05:30	17:58	18:19	18:45
20°	04:28	04:55	05:18	18:09	18:32	18:59
30°	04:10	04:40	05:05	18:22	18:48	19:18
35°	03:58	04:31	04:58	18:30	18:57	19:30
40°	03:44	04:20	04:49	18:39	19:08	19:44
45°	03:27	04:06	04:39	18:49	19:22	20:02
S 50°	03:04	03:50	04:26	19:02	19:39	20:25
52°	02:52	03:42	04:20	19:08	19:47	20:37
54°	02:39	03:33	04:14	19:15	19:56	20:50
56°	02:23	03:23	04:07	19:22	20:06	21:06
58°	02:04	03:11	03:59	19:30	20:18	21:26
S 60°	01:39	02:57	03:49	19:39	20:32	21:53

Lat.	**Moonrise** Fri	Sat	Sun	**Moonset** Fri	Sat	Sun
N 72°	16:21	15:37	15:00	23:41	·· ··	02:07
N 70°	16:01	15:29	15:01	23:58	·· ··	02:11
68°	15:46	15:22	15:01	·· ··	00:11	02:15
66°	15:33	15:17	15:02	·· ··	00:22	02:18
64°	15:22	15:12	15:03	·· ··	00:31	02:20
62°	15:13	15:08	15:03	·· ··	00:39	02:22
60°	15:05	15:04	15:03	·· ··	00:45	02:24
N 58°	14:58	15:01	15:04	·· ··	00:51	02:25
56°	14:52	14:58	15:04	·· ··	00:56	02:27
54°	14:46	14:56	15:05	·· ··	01:01	02:28
52°	14:41	14:53	15:05	·· ··	01:05	02:29
50°	14:36	14:51	15:05	·· ··	01:09	02:30
45°	14:26	14:46	15:06	00:02	01:17	02:33
N 40°	14:18	14:42	15:06	00:14	01:23	02:34
35°	14:11	14:39	15:07	00:23	01:29	02:36
30°	14:04	14:36	15:07	00:31	01:34	02:37
20°	13:53	14:31	15:08	00:46	01:42	02:40
N 10°	13:44	14:26	15:09	00:58	01:50	02:42
0°	13:34	14:21	15:09	01:10	01:57	02:44
S 10°	13:25	14:17	15:10	01:21	02:04	02:46
20°	13:15	14:12	15:11	01:33	02:11	02:48
30°	13:04	14:07	15:11	01:47	02:19	02:50
35°	12:57	14:04	15:12	01:55	02:24	02:51
40°	12:50	14:00	15:13	02:04	02:29	02:53
45°	12:41	13:56	15:13	02:14	02:35	02:54
S 50°	12:30	13:51	15:14	02:27	02:42	02:56
52°	12:25	13:49	15:15	02:32	02:45	02:57
54°	12:20	13:46	15:15	02:39	02:49	02:58
56°	12:14	13:44	15:15	02:46	02:53	02:59
58°	12:07	13:40	15:16	02:54	02:57	03:00
S 60°	11:59	13:37	15:17	03:03	03:02	03:01

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 10-12 64-83%
31	16:22	16:23	11:44	19:46	07:22	
01	16:24	16:25	11:44	20:33	08:09	
02	16:25	16:26	11:44	21:21	08:56	

November 03, 04, 05 UT (Mon., Tue., Wed.)

	Aries	Venus		Mars		Jupiter		Saturn	
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	42°30.5	198°45.0	S08°21.2	165°56.0	S20°18.9	285°31.2	N21°12.9	45°28.2	S03°57.7
1	57°33.0	213°44.5	22.4	180°56.6	19.3	300°33.6	12.8	60°30.7	57.8
2	72°35.4	228°44.1	23.5	195°57.2	19.7	315°36.0	12.8	75°33.3	57.8
3	87°37.9	243°43.6	·· 24.7	210°57.8	·· 20.1	330°38.4	·· 12.8	90°35.8	·· 57.9
4	102°40.4	258°43.1	25.9	225°58.4	20.5	345°40.7	12.8	105°38.4	57.9
5	117°42.8	273°42.7	27.1	240°59.0	20.9	0°43.1	12.8	120°41.0	57.9
6	132°45.3	288°42.2	S08°28.2	255°59.6	S20°21.3	15°45.5	N21°12.8	135°43.5	S03°58.0
7	147°47.7	303°41.7	29.4	271°00.2	21.8	30°47.9	12.8	150°46.1	58.0
8	162°50.2	318°41.3	30.6	286°00.8	22.2	45°50.3	12.8	165°48.7	58.0
9	177°52.7	333°40.8	·· 31.7	301°01.4	·· 22.6	60°52.7	·· 12.8	180°51.2	·· 58.1
10	192°55.1	348°40.3	32.9	316°02.1	23.0	75°55.1	12.8	195°53.8	58.1
11	207°57.6	3°39.8	34.1	331°02.7	23.4	90°57.5	12.8	210°56.4	58.1
12	223°00.1	18°39.4	S08°35.2	346°03.3	S20°23.8	105°59.9	N21°12.8	225°58.9	S03°58.2
13	238°02.5	33°38.9	36.4	1°03.9	24.2	121°02.3	12.8	241°01.5	58.2
14	253°05.0	48°38.4	37.6	16°04.5	24.6	136°04.7	12.8	256°04.0	58.2
15	268°07.5	63°38.0	·· 38.7	31°05.1	·· 25.0	151°07.0	·· 12.8	271°06.6	·· 58.3
16	283°09.9	78°37.5	39.9	46°05.7	25.5	166°09.4	12.8	286°09.2	58.3
17	298°12.4	93°37.0	41.1	61°06.3	25.9	181°11.8	12.7	301°11.7	58.4
18	313°14.9	108°36.6	S08°42.2	76°06.9	S20°26.3	196°14.2	N21°12.7	316°14.3	S03°58.4
19	328°17.3	123°36.1	43.4	91°07.5	26.7	211°16.6	12.7	331°16.8	58.4
20	343°19.8	138°35.6	44.6	106°08.1	27.1	226°19.0	12.7	346°19.4	58.5
21	358°22.2	153°35.1	·· 45.7	121°08.7	·· 27.5	241°21.4	·· 12.7	1°22.0	·· 58.5
22	13°24.7	168°34.7	46.9	136°09.3	27.9	256°23.8	12.7	16°24.5	58.5
23	28°27.2	183°34.2	48.1	151°09.9	28.3	271°26.2	12.7	31°27.1	58.6
Mer.pass. 21:06		ν -0.5′	d 1.2′	m -3.91	ν 0.6′	d 0.4′	m 1.45	ν 2.4′	d 0.0′ m -2.34	ν 2.6′	d 0.0′ m 0.78

Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	43°29.6	198°33.7	S08°49.2	166°10.5	S20°28.7	286°28.6	N21°12.7	46°29.7	S03°58.6
1	58°32.1	213°33.3	50.4	181°11.1	29.1	301°31.0	12.7	61°32.2	58.6
2	73°34.6	228°32.8	51.5	196°11.7	29.5	316°33.4	12.7	76°34.8	58.7
3	88°37.0	243°32.3	·· 52.7	211°12.3	·· 29.9	331°35.8	·· 12.7	91°37.3	·· 58.7
4	103°39.5	258°31.8	53.9	226°13.0	30.4	346°38.2	12.7	106°39.9	58.7
5	118°42.0	273°31.4	55.0	241°13.6	30.8	1°40.6	12.7	121°42.5	58.8
6	133°44.4	288°30.9	S08°56.2	256°14.2	S20°31.2	16°43.0	N21°12.7	136°45.0	S03°58.8
7	148°46.9	303°30.4	57.3	271°14.8	31.6	31°45.4	12.7	151°47.6	58.8
8	163°49.3	318°29.9	58.5	286°15.4	32.0	46°47.8	12.7	166°50.1	58.9
9	178°51.8	333°29.5	08°59.7	301°16.0	·· 32.4	61°50.2	·· 12.7	181°52.7	·· 58.9
10	193°54.3	348°29.0	09°00.8	316°16.6	32.8	76°52.6	12.6	196°55.3	58.9
11	208°56.7	3°28.5	02.0	331°17.2	33.2	91°55.0	12.6	211°57.8	59.0
12	223°59.2	18°28.0	S09°03.1	346°17.8	S20°33.6	106°57.4	N21°12.6	227°00.4	S03°59.0
13	239°01.7	33°27.6	04.3	1°18.4	34.0	121°59.8	12.6	242°02.9	59.0
14	254°04.1	48°27.1	05.5	16°19.0	34.4	137°02.2	12.6	257°05.5	59.1
15	269°06.6	63°26.6	·· 06.6	31°19.6	·· 34.8	152°04.6	·· 12.6	272°08.1	·· 59.1
16	284°09.1	78°26.1	07.8	46°20.2	35.2	167°07.0	12.6	287°10.6	59.1
17	299°11.5	93°25.6	08.9	61°20.8	35.6	182°09.4	12.6	302°13.2	59.2
18	314°14.0	108°25.2	S09°10.1	76°21.4	S20°36.0	197°11.8	N21°12.6	317°15.7	S03°59.2
19	329°16.5	123°24.7	11.3	91°22.0	36.4	212°14.2	12.6	332°18.3	59.2
20	344°18.9	138°24.2	12.4	106°22.6	36.8	227°16.6	12.6	347°20.8	59.3
21	359°21.4	153°23.7	·· 13.6	121°23.2	·· 37.2	242°19.0	·· 12.6	2°23.4	·· 59.3
22	14°23.8	168°23.2	14.7	136°23.8	37.6	257°21.4	12.6	17°26.0	59.3
23	29°26.3	183°22.8	15.9	151°24.4	38.0	272°23.8	12.6	32°28.5	59.4
Mer.pass. 21:03		ν -0.5′	d 1.2′	m -3.91	ν 0.6′	d 0.4′	m 1.44	ν 2.4′	d 0.0′ m -2.34	ν 2.6′	d 0.0′ m 0.78

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	44°28.8	198°22.3	S09°17.0	166°25.0	S20°38.4	287°26.2	N21°12.6	47°31.1	S03°59.4
1	59°31.2	213°21.8	18.2	181°25.6	38.8	302°28.6	12.6	62°33.6	59.4
2	74°33.7	228°21.3	19.3	196°26.2	39.2	317°31.0	12.6	77°36.2	59.5
3	89°36.2	243°20.8	·· 20.5	211°26.8	·· 39.6	332°33.4	·· 12.6	92°38.7	·· 59.5
4	104°38.6	258°20.4	21.7	226°27.3	40.0	347°35.8	12.6	107°41.3	59.5
5	119°41.1	273°19.9	22.8	241°27.9	40.4	2°38.2	12.6	122°43.9	59.6
6	134°43.6	288°19.4	S09°24.0	256°28.5	S20°40.8	17°40.7	N21°12.6	137°46.4	S03°59.6
7	149°46.0	303°18.9	25.1	271°29.1	41.2	32°43.1	12.6	152°49.0	59.6
8	164°48.5	318°18.4	26.3	286°29.7	41.6	47°45.5	12.6	167°51.5	59.7
9	179°51.0	333°17.9	·· 27.4	301°30.3	·· 42.0	62°47.9	·· 12.5	182°54.1	·· 59.7
10	194°53.4	348°17.5	28.6	316°30.9	42.4	77°50.3	12.5	197°56.6	59.7
11	209°55.9	3°17.0	29.7	331°31.5	42.8	92°52.7	12.5	212°59.2	59.8
12	224°58.3	18°16.5	S09°30.9	346°32.1	S20°43.2	107°55.1	N21°12.5	228°01.8	S03°59.8
13	240°00.8	33°16.0	32.0	1°32.7	43.6	122°57.5	12.5	243°04.3	59.8
14	255°03.3	48°15.5	33.2	16°33.3	44.0	137°59.9	12.5	258°06.9	59.8
15	270°05.7	63°15.0	·· 34.3	31°33.9	·· 44.4	153°02.3	·· 12.5	273°09.4	·· 59.9
16	285°08.2	78°14.5	35.5	46°34.5	44.8	168°04.7	12.5	288°12.0	59.9
17	300°10.7	93°14.1	36.6	61°35.1	45.2	183°07.2	12.5	303°14.5	03°59.9
18	315°13.1	108°13.6	S09°37.8	76°35.7	S20°45.6	198°09.6	N21°12.5	318°17.1	S04°00.0
19	330°15.6	123°13.1	38.9	91°36.3	46.0	213°12.0	12.5	333°19.6	00.0
20	345°18.1	138°12.6	40.1	106°36.9	46.4	228°14.4	12.5	348°22.2	00.0
21	0°20.5	153°12.1	·· 41.2	121°37.5	·· 46.7	243°16.8	·· 12.5	3°24.8	·· 00.1
22	15°23.0	168°11.6	42.4	136°38.0	47.1	258°19.2	12.5	18°27.3	00.1
23	30°25.5	183°11.1	43.5	151°38.6	47.5	273°21.6	12.5	33°29.9	00.1
Mer.pass. 20:59		ν -0.5′	d 1.2′	m -3.91	ν 0.6′	d 0.4′	m 1.44	ν 2.4′	d 0.0′ m -2.35	ν 2.6′	d 0.0′ m 0.79

Stars

	SHA	Dec
Alpheratz	357°33.8	29°14.2
Ankaa	353°06.1	-42°10.0
Schedar	349°29.8	56°41.0
Diphda	348°46.3	-17°50.6
Achernar	335°19.1	-57°06.3
Hamal	327°50.1	23°35.2
Polaris	313°12.5	89°22.4
Acamar	315°10.8	-40°11.9
Menkar	314°05.1	4°11.6
Mirfak	308°26.8	49°57.2
Aldebaran	290°38.6	16°33.8
Rigel	281°03.0	-8°10.1
Capella	280°20.5	46°01.4
Bellatrix	278°21.9	6°22.5
Elnath	278°00.7	28°37.8
Alnilam	275°36.8	-1°11.0
Betelgeuse	270°51.1	7°24.8
Canopus	263°51.8	-52°42.2
Sirius	258°25.5	-16°44.9
Adhara	255°05.2	-29°00.2
Procyon	244°50.0	5°09.6
Pollux	243°16.4	27°57.8
Avior	234°14.4	-59°35.2
Suhail	222°45.9	-43°31.9
Miaplacidus	221°38.3	-69°49.0
Alphard	217°47.2	-8°46.1
Regulus	207°33.9	11°50.5
Dubhe	193°40.5	61°36.5
Denebola	182°24.5	14°25.7
Gienah	175°43.2	-17°41.0
Acrux	173°00.0	-63°14.3
Gacrux	171°51.4	-57°15.3
Alioth	166°12.9	55°49.1
Spica	158°21.9	-11°17.7
Alkaid	152°51.9	49°11.0
Hadar	148°35.8	-60°29.8
Menkent	147°57.3	-36°29.7
Arcturus	145°47.7	19°02.9
Rigil Kent.	139°40.1	-60°56.5
Kochab	137°21.0	74°02.9
Zuben'ubi	136°55.6	-16°08.9
Alphecca	126°03.5	26°37.7
Antares	112°15.4	-26°29.3
Atria	107°09.5	-69°04.5
Sabik	102°02.3	-15°45.4
Shaula	96°09.8	-37°07.4
Rasalhague	95°58.2	12°32.6
Eltanin	90°42.3	51°29.3
Kaus Aust.	83°31.9	-34°22.4
Vega	80°33.0	38°48.6
Nunki	75°47.1	-26°15.9
Altair	61°59.4	8°56.3
Peacock	53°04.8	-56°39.3
Deneb	49°25.4	45°22.6
Enif	33°38.1	9°59.8
Al Na'ir	27°31.9	-46°50.3
Fomalhaut	15°13.6	-29°29.2
Scheat	13°44.4	28°13.6
Markab	13°29.1	15°20.8

Nov 03 Mon	SHA	Mer.pass
Venus	156°14.5	10:45
Mars	123°25.5	12:56
Jupiter	243°00.7	04:57
Saturn	2°57.7	20:55

Nov 04 Tue	SHA	Mer.pass
Venus	155°04.1	10:46
Mars	122°40.9	12:55
Jupiter	242°59.0	04:53
Saturn	3°00.0	20:50

Nov 05 Wed	SHA	Mer.pass
Venus	153°53.5	10:47
Mars	121°56.2	12:54
Jupiter	242°57.4	04:49
Saturn	3°02.3	20:46

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h — Sun — Moon

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	184°06.5	S15°04.3	38°31.1	11.2′	N03°27.1	17.3′	60.0′
1	199°06.5	05.1	53°01.4	11.2′	03°44.4	17.2′	60.0′
2	214°06.5	05.8	67°31.5	11.1′	04°01.6	17.3′	60.1′
3	229°06.5	·· 06.6	82°01.6	11.0′	04°18.9	17.3′	60.1′
4	244°06.5	07.4	96°31.7	11.0′	04°36.2	17.2′	60.1′
5	259°06.5	08.2	111°01.6	10.9′	04°53.4	17.3′	60.2′
6	274°06.5	S15°09.0	125°31.5	10.8′	N05°10.7	17.2′	60.2′
7	289°06.5	09.7	140°01.4	10.8′	05°27.9	17.3′	60.2′
8	304°06.5	10.5	154°31.1	10.7′	05°45.2	17.2′	60.3′
9	319°06.5	·· 11.3	169°00.8	10.6′	06°02.4	17.2′	60.3′
10	334°06.5	12.1	183°30.5	10.6′	06°19.6	17.2′	60.3′
11	349°06.5	12.8	198°00.0	10.5′	06°36.8	17.2′	60.4′
12	4°06.5	S15°13.6	212°29.5	10.4′	N06°54.0	17.2′	60.4′
13	19°06.5	14.4	226°58.9	10.3′	07°11.2	17.1′	60.4′
14	34°06.5	15.2	241°28.2	10.2′	07°28.3	17.1′	60.5′
15	49°06.5	·· 15.9	255°57.5	10.2′	07°45.4	17.1′	60.5′
16	64°06.5	16.7	270°26.7	10.1′	08°02.5	17.1′	60.5′
17	79°06.5	17.5	284°55.8	10.0′	08°19.6	17.0′	60.6′
18	94°06.5	S15°18.3	299°24.8	9.9′	N08°36.6	17.0′	60.6′
19	109°06.5	19.0	313°53.7	9.8′	08°53.6	17.0′	60.6′
20	124°06.5	19.8	328°22.5	9.8′	09°10.6	16.9′	60.6′
21	139°06.5	·· 20.6	342°51.3	9.7′	09°27.5	16.9′	60.7′
22	154°06.5	21.3	357°19.9	9.6′	09°44.4	16.9′	60.7′
23	169°06.5	22.1	11°48.5	9.5′	10°01.3	16.8′	60.7′
	SD = 16.1′	d = 0.8′	SD = 16.4′				

Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	184°06.5	S15°22.9	26°17.0	9.4′	N10°18.1	16.8′	60.7′
1	199°06.4	23.7	40°45.4	9.3′	10°34.9	16.7′	60.8′
2	214°06.4	24.4	55°13.7	9.2′	10°51.6	16.7′	60.8′
3	229°06.4	·· 25.2	69°41.9	9.1′	11°08.3	16.6′	60.8′
4	244°06.4	26.0	84°10.0	9.0′	11°24.9	16.5′	60.8′
5	259°06.4	26.7	98°38.0	8.9′	11°41.4	16.6′	60.9′
6	274°06.4	S15°27.5	113°06.0	8.8′	N11°58.0	16.4′	60.9′
7	289°06.4	28.3	127°33.8	8.7′	12°14.4	16.4′	60.9′
8	304°06.4	29.0	142°01.5	8.6′	12°30.8	16.3′	60.9′
9	319°06.4	·· 29.8	156°29.1	8.5′	12°47.1	16.3′	61.0′
10	334°06.4	30.6	170°56.7	8.4′	13°03.4	16.2′	61.0′
11	349°06.4	31.3	185°24.1	8.3′	13°19.6	16.1′	61.0′
12	4°06.3	S15°32.1	199°51.4	8.2′	N13°35.7	16.1′	61.0′
13	19°06.3	32.8	214°18.6	8.1′	13°51.8	16.0′	61.0′
14	34°06.3	33.6	228°45.7	8.0′	14°07.8	15.9′	61.1′
15	49°06.3	·· 34.4	243°12.7	7.9′	14°23.7	15.8′	61.1′
16	64°06.3	35.1	257°39.6	7.8′	14°39.5	15.8′	61.1′
17	79°06.3	35.9	272°06.4	7.7′	14°55.3	15.6′	61.1′
18	94°06.3	S15°36.7	286°33.1	7.6′	N15°10.9	15.6′	61.1′
19	109°06.3	37.4	300°59.7	7.5′	15°26.5	15.5′	61.1′
20	124°06.2	38.2	315°26.1	7.4′	15°42.0	15.4′	61.2′
21	139°06.2	·· 38.9	329°52.5	7.2′	15°57.4	15.3′	61.2′
22	154°06.2	39.7	344°18.7	7.1′	16°12.7	15.2′	61.2′
23	169°06.2	40.5	358°44.9	7.0′	16°27.9	15.1′	61.2′
	SD = 16.1′	d = 0.8′	SD = 16.6′				

Wed	GHA	Dec	GHA	ν	Dec	d	HP
0	184°06.2	S15°41.2	13°10.9	6.9′	N16°43.0	15.1′	61.2′
1	199°06.2	42.0	27°36.8	6.8′	16°58.1	14.9′	61.2′
2	214°06.2	42.7	42°02.6	6.7′	17°13.0	14.8′	61.2′
3	229°06.1	·· 43.5	56°28.2	6.6′	17°27.8	14.7′	61.3′
4	244°06.1	44.3	70°53.8	6.4′	17°42.5	14.6′	61.3′
5	259°06.1	45.0	85°19.3	6.3′	17°57.1	14.4′	61.3′
6	274°06.1	S15°45.8	99°44.6	6.2′	N18°11.5	14.4′	61.3′
7	289°06.1	46.5	114°09.8	6.1′	18°25.9	14.2′	61.3′
8	304°06.1	47.3	128°34.9	6.0′	18°40.1	14.2′	61.3′
9	319°06.0	·· 48.0	142°59.9	5.9′	18°54.3	14.0′	61.3′
10	334°06.0	48.8	157°24.8	5.8′	19°08.3	13.8′	61.3′
11	349°06.0	49.5	171°49.5	5.6′	19°22.1	13.8′	61.3′
12	4°06.0	S15°50.3	186°14.2	5.5′	N19°35.9	13.6′	61.3′
13	19°06.0	51.0	200°38.7	5.4′	19°49.5	13.5′	61.3′
14	34°05.9	51.8	215°03.1	5.3′	20°03.0	13.4′	61.4′
15	49°05.9	·· 52.6	229°27.4	5.2′	20°16.4	13.2′	61.4′
16	64°05.9	53.3	243°51.6	5.1′	20°29.6	13.1′	61.4′
17	79°05.9	54.1	258°15.7	5.0′	20°42.7	12.9′	61.4′
18	94°05.9	S15°54.8	272°39.6	4.8′	N20°55.6	12.8′	61.4′
19	109°05.8	55.6	287°03.5	4.7′	21°08.4	12.6′	61.4′
20	124°05.8	56.3	301°27.2	4.6′	21°21.0	12.5′	61.4′
21	139°05.8	·· 57.1	315°50.8	4.5′	21°33.5	12.4′	61.4′
22	154°05.8	57.8	330°14.3	4.4′	21°45.9	12.2′	61.4′
23	169°05.7	58.6	344°37.7	4.3′	21°58.1	12.0′	61.4′
	SD = 16.1′	d = 0.8′	SD = 16.7′				

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	06:19	07:44	09:18	14:08	15:42	17:07
N 70°	06:13	07:29	08:47	14:39	15:57	17:12
68°	06:09	07:17	08:24	15:02	16:09	17:17
66°	06:04	07:07	08:07	15:19	16:19	17:21
64°	06:01	06:58	07:53	15:34	16:28	17:25
62°	05:57	06:51	07:41	15:46	16:35	17:29
60°	05:54	06:44	07:30	15:56	16:42	17:32
N 58°	05:52	06:39	07:22	16:05	16:48	17:34
56°	05:49	06:34	07:14	16:13	16:53	17:37
54°	05:47	06:29	07:07	16:20	16:58	17:40
52°	05:44	06:25	07:01	16:26	17:02	17:42
50°	05:42	06:21	06:55	16:32	17:06	17:44
45°	05:37	06:12	06:43	16:44	17:15	17:50
N 40°	05:32	06:04	06:33	16:54	17:22	17:54
35°	05:28	05:58	06:24	17:03	17:29	17:59
30°	05:23	05:51	06:16	17:11	17:35	18:04
20°	05:14	05:40	06:03	17:24	17:47	18:13
N 10°	05:04	05:30	05:51	17:36	17:58	18:23
0°	04:54	05:19	05:40	17:47	18:08	18:33
S 10°	04:41	05:07	05:29	17:58	18:20	18:46
20°	04:26	04:54	05:17	18:11	18:34	19:01
30°	04:07	04:37	05:03	18:25	18:50	19:21
35°	03:55	04:28	04:55	18:33	19:00	19:33
40°	03:40	04:16	04:45	18:42	19:12	19:48
45°	03:22	04:02	04:34	18:54	19:26	20:07
S 50°	02:57	03:44	04:21	19:07	19:44	20:32
52°	02:45	03:36	04:15	19:14	19:53	20:44
54°	02:30	03:26	04:08	19:21	20:03	20:59
56°	02:13	03:15	04:00	19:28	20:14	21:17
58°	01:52	03:03	03:51	19:37	20:27	21:39
S 60°	01:22	02:48	03:41	19:48	20:42	22:10

Lat.	Moonrise Mon	Moonrise Tue	Moonrise Wed	Moonset Mon	Moonset Tue	Moonset Wed
N 72°	14:21	13:27		04:32	07:16	
N 70°	14:31	13:53	12:28	04:25	06:53	10:16
68°	14:40	14:13	13:28	04:20	06:35	09:18
66°	14:47	14:29	14:03	04:15	06:21	08:45
64°	14:53	14:42	14:28	04:11	06:10	08:21
62°	14:58	14:53	14:48	04:08	06:00	08:02
60°	15:03	15:03	15:05	04:05	05:52	07:46
N 58°	15:07	15:12	15:19	04:02	05:44	07:33
56°	15:11	15:19	15:31	04:00	05:38	07:22
54°	15:14	15:26	15:42	03:58	05:32	07:12
52°	15:17	15:32	15:51	03:56	05:27	07:03
50°	15:20	15:38	16:00	03:55	05:23	06:55
45°	15:26	15:50	16:18	03:51	05:13	06:39
N 40°	15:31	16:00	16:33	03:48	05:05	06:25
35°	15:36	16:08	16:46	03:45	04:58	06:14
30°	15:40	16:16	16:57	03:43	04:52	06:04
20°	15:47	16:29	17:17	03:39	04:41	05:47
N 10°	15:53	16:41	17:34	03:36	04:32	05:32
0°	15:59	16:52	17:50	03:32	04:23	05:19
S 10°	16:05	17:03	18:06	03:29	04:15	05:05
20°	16:11	17:15	18:23	03:26	04:06	04:51
30°	16:19	17:29	18:43	03:22	03:56	04:34
35°	16:23	17:37	18:55	03:19	03:50	04:24
40°	16:28	17:47	19:09	03:17	03:43	04:14
45°	16:33	17:58	19:25	03:14	03:35	04:01
S 50°	16:40	18:11	19:46	03:10	03:26	03:45
52°	16:44	18:17	19:55	03:09	03:22	03:38
54°	16:47	18:24	20:06	03:07	03:17	03:30
56°	16:51	18:32	20:19	03:05	03:12	03:22
58°	16:55	18:41	20:33	03:03	03:06	03:12
S 60°	17:00	18:51	20:51	03:01	03:00	03:00

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 13-15 91-99%
03	16:26	16:26	11:44	22:11	09:45	
04	16:26	16:25	11:44	23:05	10:38	
05	16:25	16:24	11:44	–:–	11:34	

November 06, 07, 08 UT (Thu., Fri., Sat.)

	Aries	Venus		Mars		Jupiter		Saturn	
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	45°27.9	198°10.6	S09°44.7	166°39.2	S20°47.9	288°24.0	N21°12.5	48°32.4	S04°00.2
1	60°30.4	213°10.2	45.8	181°39.8	48.3	303°26.5	12.5	63°35.0	00.2
2	75°32.8	228°09.7	46.9	196°40.4	48.7	318°28.9	12.5	78°37.5	00.2
3	90°35.3	243°09.2	·· 48.1	211°41.0	·· 49.1	333°31.3	·· 12.5	93°40.1	·· 00.3
4	105°37.8	258°08.7	49.2	226°41.6	49.5	348°33.7	12.5	108°42.6	00.3
5	120°40.2	273°08.2	50.4	241°42.2	49.9	3°36.1	12.5	123°45.2	00.3
6	135°42.7	288°07.7	S09°51.5	256°42.8	S20°50.3	18°38.5	N21°12.5	138°47.7	S04°00.3
7	150°45.2	303°07.2	52.7	271°43.4	50.7	33°40.9	12.5	153°50.3	00.4
8	165°47.6	318°06.7	53.8	286°43.9	51.1	48°43.4	12.5	168°52.8	00.4
9	180°50.1	333°06.2	·· 55.0	301°44.5	·· 51.4	63°45.8	·· 12.5	183°55.4	·· 00.4
10	195°52.6	348°05.7	56.1	316°45.1	51.8	78°48.2	12.5	198°57.9	00.5
11	210°55.0	3°05.2	57.2	331°45.7	52.2	93°50.6	12.5	214°00.5	00.5
12	225°57.5	18°04.7	S09°58.4	346°46.3	S20°52.6	108°53.0	N21°12.5	229°03.1	S04°00.5
13	240°59.9	33°04.2	09°59.5	1°46.9	53.0	123°55.4	12.5	244°05.6	00.6
14	256°02.4	48°03.8	10°00.7	16°47.5	53.4	138°57.9	12.5	259°08.2	00.6
15	271°04.9	63°03.3	·· 01.8	31°48.1	·· 53.8	154°00.3	·· 12.5	274°10.7	·· 00.6
16	286°07.3	78°02.8	02.9	46°48.7	54.2	169°02.7	12.5	289°13.3	00.6
17	301°09.8	93°02.3	04.1	61°49.2	54.6	184°05.1	12.5	304°15.8	00.7
18	316°12.3	108°01.8	S10°05.2	76°49.8	S20°54.9	199°07.5	N21°12.5	319°18.4	S04°00.7
19	331°14.7	123°01.3	06.4	91°50.4	55.3	214°10.0	12.5	334°20.9	00.7
20	346°17.2	138°00.8	07.5	106°51.0	55.7	229°12.4	12.5	349°23.5	00.8
21	1°19.7	153°00.3	·· 08.6	121°51.6	·· 56.1	244°14.8	·· 12.5	4°26.0	·· 00.8
22	16°22.1	167°59.8	09.8	136°52.2	56.5	259°17.2	12.5	19°28.6	00.8
23	31°24.6	182°59.3	10.9	151°52.8	56.9	274°19.6	12.5	34°31.1	00.9
Mer.pass.	20:55	ν -0.5′	d 1.1′	m -3.91	ν 0.6′	d 0.4′	m 1.43	ν 2.4′	d 0.0′ m -2.36	ν 2.6′	d 0.0′ m 0.79

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	46°27.1	197°58.8	S10°12.1	166°53.3	S20°57.3	289°22.1	N21°12.5	49°33.7	S04°00.9
1	61°29.5	212°58.3	13.2	181°53.9	57.6	304°24.5	12.5	64°36.2	00.9
2	76°32.0	227°57.8	14.3	196°54.5	58.0	319°26.9	12.4	79°38.8	00.9
3	91°34.4	242°57.3	·· 15.5	211°55.1	·· 58.4	334°29.3	·· 12.4	94°41.3	·· 01.0
4	106°36.9	257°56.8	16.6	226°55.7	58.8	349°31.8	12.4	109°43.9	01.0
5	121°39.4	272°56.3	17.7	241°56.3	59.2	4°34.2	12.4	124°46.4	01.0
6	136°41.8	287°55.8	S10°18.9	256°56.8	S20°59.6	19°36.6	N21°12.4	139°49.0	S04°01.1
7	151°44.3	302°55.3	20.0	271°57.4	20°59.9	34°39.0	12.4	154°51.5	01.1
8	166°46.8	317°54.8	21.1	286°58.0	21°00.3	49°41.5	12.4	169°54.1	01.1
9	181°49.2	332°54.3	·· 22.3	301°58.6	·· 00.7	64°43.9	·· 12.4	184°56.6	·· 01.1
10	196°51.7	347°53.8	23.4	316°59.2	01.1	79°46.3	12.4	199°59.2	01.2
11	211°54.2	2°53.3	24.5	331°59.8	01.5	94°48.7	12.4	215°01.7	01.2
12	226°56.6	17°52.8	S10°25.7	347°00.3	S21°01.9	109°51.2	N21°12.4	230°04.3	S04°01.2
13	241°59.1	32°52.3	26.8	2°00.9	02.2	124°53.6	12.4	245°06.8	01.3
14	257°01.6	47°51.8	27.9	17°01.5	02.6	139°56.0	12.4	260°09.4	01.3
15	272°04.0	62°51.3	·· 29.1	32°02.1	·· 03.0	154°58.4	·· 12.4	275°11.9	·· 01.3
16	287°06.5	77°50.8	30.2	47°02.7	03.4	170°00.9	12.4	290°14.5	01.3
17	302°08.9	92°50.3	31.3	62°03.2	03.8	185°03.3	12.4	305°17.0	01.4
18	317°11.4	107°49.8	S10°32.5	77°03.8	S21°04.1	200°05.7	N21°12.4	320°19.6	S04°01.4
19	332°13.9	122°49.2	33.6	92°04.4	04.5	215°08.2	12.4	335°22.1	01.4
20	347°16.3	137°48.7	34.7	107°05.0	04.9	230°10.6	12.4	350°24.7	01.5
21	2°18.8	152°48.2	·· 35.8	122°05.6	·· 05.3	245°13.0	·· 12.4	5°27.2	·· 01.5
22	17°21.3	167°47.7	37.0	137°06.1	05.7	260°15.4	12.4	20°29.7	01.5
23	32°23.7	182°47.2	38.1	152°06.7	06.0	275°17.9	12.4	35°32.3	01.5
Mer.pass.	20:51	ν -0.5′	d 1.1′	m -3.91	ν 0.6′	d 0.4′	m 1.43	ν 2.4′	d 0.0′ m -2.36	ν 2.6′	d 0.0′ m 0.80

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	47°26.2	197°46.7	S10°39.2	167°07.3	S21°06.4	290°20.3	N21°12.4	50°34.8	S04°01.6
1	62°28.7	212°46.2	40.4	182°07.9	06.8	305°22.7	12.4	65°37.4	01.6
2	77°31.1	227°45.7	41.5	197°08.5	07.2	320°25.2	12.4	80°39.9	01.6
3	92°33.6	242°45.2	·· 42.6	212°09.0	·· 07.5	335°27.6	·· 12.4	95°42.5	·· 01.7
4	107°36.1	257°44.7	43.7	227°09.6	07.9	350°30.0	12.4	110°45.0	01.7
5	122°38.5	272°44.2	44.9	242°10.2	08.3	5°32.5	12.4	125°47.6	01.7
6	137°41.0	287°43.7	S10°46.0	257°10.8	S21°08.7	20°34.9	N21°12.4	140°50.1	S04°01.7
7	152°43.4	302°43.2	47.1	272°11.3	09.0	35°37.3	12.4	155°52.7	01.8
8	167°45.9	317°42.6	48.2	287°11.9	09.4	50°39.8	12.4	170°55.2	01.8
9	182°48.4	332°42.1	·· 49.4	302°12.5	·· 09.8	65°42.2	·· 12.4	185°57.8	·· 01.8
10	197°50.8	347°41.6	50.5	317°13.1	10.2	80°44.6	12.4	201°00.3	01.8
11	212°53.3	2°41.1	51.6	332°13.6	10.5	95°47.1	12.4	216°02.8	01.9
12	227°55.8	17°40.6	S10°52.7	347°14.2	S21°10.9	110°49.5	N21°12.4	231°05.4	S04°01.9
13	242°58.2	32°40.1	53.8	2°14.8	11.3	125°51.9	12.4	246°07.9	01.9
14	258°00.7	47°39.6	55.0	17°15.4	11.7	140°54.4	12.4	261°10.5	02.0
15	273°03.2	62°39.1	·· 56.1	32°15.9	·· 12.0	155°56.8	·· 12.5	276°13.0	·· 02.0
16	288°05.6	77°38.5	57.2	47°16.5	12.4	170°59.2	12.5	291°15.6	02.0
17	303°08.1	92°38.0	58.3	62°17.1	12.8	186°01.7	12.5	306°18.1	02.0
18	318°10.6	107°37.5	S10°59.4	77°17.7	S21°13.2	201°04.1	N21°12.5	321°20.7	S04°02.1
19	333°13.0	122°37.0	11°00.6	92°18.2	13.5	216°06.5	12.5	336°23.2	02.1
20	348°15.5	137°36.5	01.7	107°18.8	13.9	231°09.0	12.5	351°25.7	02.1
21	3°17.9	152°36.0	·· 02.8	122°19.4	·· 14.3	246°11.4	·· 12.5	6°28.3	·· 02.1
22	18°20.4	167°35.5	03.9	137°20.0	14.6	261°13.9	12.5	21°30.8	02.2
23	33°22.9	182°34.9	05.0	152°20.5	15.0	276°16.3	12.5	36°33.4	02.2
Mer.pass.	20:47	ν -0.5′	d 1.1′	m -3.91	ν 0.6′	d 0.4′	m 1.43	ν 2.4′	d 0.0′ m -2.37	ν 2.5′	d 0.0′ m 0.80

Stars

	SHA	Dec
Alpheratz	357°33.8	29°14.2
Ankaa	353°06.1	-42°10.0
Schedar	349°29.8	56°41.0
Diphda	348°46.4	-17°50.6
Achernar	335°19.1	-57°06.4
Hamal	327°50.1	23°35.2
Polaris	313°11.8	89°22.4
Acamar	315°10.8	-40°12.0
Menkar	314°05.1	4°11.6
Mirfak	308°26.8	49°57.2
Aldebaran	290°38.5	16°33.7
Rigel	281°02.9	-8°10.2
Capella	280°20.5	46°01.4
Bellatrix	278°21.9	6°22.5
Elnath	278°00.7	28°37.7
Alnilam	275°36.8	-1°11.0
Betelgeuse	270°51.1	7°24.8
Canopus	263°51.7	-52°42.2
Sirius	258°25.5	-16°44.9
Adhara	255°05.1	-29°00.2
Procyon	244°50.0	5°09.6
Pollux	243°16.4	27°57.8
Avior	234°14.4	-59°35.2
Suhail	222°45.8	-43°31.9
Miaplacidus	221°38.2	-69°49.0
Alphard	217°47.1	-8°46.1
Regulus	207°33.8	11°50.5
Dubhe	193°40.5	61°36.5
Denebola	182°24.5	14°25.7
Gienah	175°43.2	-17°41.0
Acrux	173°00.0	-63°14.3
Gacrux	171°51.4	-57°15.3
Alioth	166°12.9	55°49.0
Spica	158°21.9	-11°17.7
Alkaid	152°51.9	49°11.0
Hadar	148°35.7	-60°29.7
Menkent	147°57.2	-36°29.7
Arcturus	145°47.6	19°02.9
Rigil Kent.	139°40.1	-60°56.4
Kochab	137°21.0	74°02.9
Zuben'ubi	136°55.6	-16°08.9
Alphecca	126°03.5	26°37.7
Antares	112°15.4	-26°29.3
Atria	107°09.5	-69°04.5
Sabik	102°02.3	-15°45.4
Shaula	96°09.8	-37°07.4
Rasalhague	95°58.2	12°32.6
Eltanin	90°42.3	51°29.3
Kaus Aust.	83°31.9	-34°22.4
Vega	80°33.0	38°48.6
Nunki	75°47.1	-26°15.9
Altair	61°59.4	8°56.3
Peacock	53°04.8	-56°39.3
Deneb	49°25.4	45°22.6
Enif	33°38.1	9°59.8
Al Na'ir	27°32.0	-46°50.3
Fomalhaut	15°13.6	-29°29.2
Scheat	13°44.4	28°13.6
Markab	13°29.1	15°20.8

Nov 06 Thu	SHA	Mer.pass
Venus	152°42.7	10:48
Mars	121°11.3	12:53
Jupiter	242°56.1	04:46
Saturn	3°04.5	20:42

Nov 07 Fri	SHA	Mer.pass
Venus	151°31.7	10:48
Mars	120°26.3	12:52
Jupiter	242°55.0	04:42
Saturn	3°06.6	20:38

Nov 08 Sat	SHA	Mer.pass
Venus	150°20.5	10:49
Mars	119°41.1	12:51
Jupiter	242°54.1	04:38
Saturn	3°08.6	20:34

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	184°05.7	S15°59.3	359°01.0	4.2′	N22°10.1	11.9′	61.4′
1	199°05.7	16°00.1	13°24.2	4.1′	22°22.0	11.7′	61.4′
2	214°05.7	00.8	27°47.2	4.0′	22°33.7	11.6′	61.4′
3	229°05.7	·· 01.5	42°10.2	3.8′	22°45.3	11.4′	61.4′
4	244°05.6	02.3	56°33.0	3.7′	22°56.7	11.2′	61.4′
5	259°05.6	03.0	70°55.8	3.6′	23°07.9	11.1′	61.4′
6	274°05.6	S16°03.8	85°18.4	3.5′	N23°19.0	10.9′	61.4′
7	289°05.5	04.5	99°40.9	3.4′	23°29.9	10.7′	61.4′
8	304°05.5	05.3	114°03.4	3.3′	23°40.6	10.5′	61.3′
9	319°05.5	·· 06.0	128°25.7	3.2′	23°51.1	10.4′	61.3′
10	334°05.5	06.8	142°47.9	3.1′	24°01.5	10.2′	61.3′
11	349°05.4	07.5	157°10.1	3.0′	24°11.7	10.0′	61.3′
12	4°05.4	S16°08.2	171°32.1	2.9′	N24°21.7	9.8′	61.3′
13	19°05.4	09.0	185°54.1	2.9′	24°31.5	9.7′	61.3′
14	34°05.4	09.7	200°15.9	2.8′	24°41.2	9.4′	61.3′
15	49°05.3	·· 10.5	214°37.7	2.7′	24°50.6	9.3′	61.3′
16	64°05.3	11.2	228°59.4	2.6′	24°59.9	9.1′	61.3′
17	79°05.3	12.0	243°21.0	2.5′	25°09.0	8.9′	61.3′
18	94°05.2	S16°12.7	257°42.5	2.4′	N25°17.9	8.7′	61.3′
19	109°05.2	13.4	272°03.9	2.3′	25°26.6	8.5′	61.2′
20	124°05.2	14.2	286°25.2	2.3′	25°35.1	8.3′	61.2′
21	139°05.1	·· 14.9	300°46.5	2.2′	25°43.4	8.1′	61.2′
22	154°05.1	15.6	315°07.7	2.1′	25°51.5	7.9′	61.2′
23	169°05.1	16.4	329°28.8	2.0′	25°59.4	7.7′	61.2′
	SD = 16.1′	d = 0.7′	SD = 16.7′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	184°05.0	S16°17.1	343°49.9	2.0′	N26°07.1	7.5′	61.2′
1	199°05.0	17.9	358°10.8	1.9′	26°14.6	7.3′	61.2′
2	214°05.0	18.6	12°31.8	1.9′	26°21.9	7.1′	61.2′
3	229°04.9	·· 19.3	26°52.6	1.8′	26°29.0	6.9′	61.1′
4	244°04.9	20.1	41°13.4	1.7′	26°35.9	6.7′	61.1′
5	259°04.9	20.8	55°34.1	1.7′	26°42.6	6.5′	61.1′
6	274°04.8	S16°21.5	69°54.8	1.6′	N26°49.1	6.3′	61.1′
7	289°04.8	22.3	84°15.4	1.6′	26°55.4	6.0′	61.1′
8	304°04.8	23.0	98°36.0	1.5′	27°01.4	5.9′	61.0′
9	319°04.7	·· 23.7	112°56.6	1.5′	27°07.3	5.6′	61.0′
10	334°04.7	24.5	127°17.0	1.5′	27°12.9	5.4′	61.0′
11	349°04.7	25.2	141°37.5	1.4′	27°18.3	5.2′	61.0′
12	4°04.6	S16°25.9	155°57.9	1.4′	N27°23.5	5.0′	61.0′
13	19°04.6	26.7	170°18.3	1.4′	27°28.5	4.8′	60.9′
14	34°04.6	27.4	184°38.6	1.3′	27°33.3	4.6′	60.9′
15	49°04.5	·· 28.1	198°59.0	1.3′	27°37.9	4.3′	60.9′
16	64°04.5	28.9	213°19.3	1.3′	27°42.2	4.1′	60.9′
17	79°04.4	29.6	227°39.5	1.3′	27°46.3	4.0′	60.9′
18	94°04.4	S16°30.3	241°59.8	1.2′	N27°50.3	3.6′	60.8′
19	109°04.4	31.0	256°20.0	1.2′	27°53.9	3.5′	60.8′
20	124°04.3	31.8	270°40.3	1.2′	27°57.4	3.3′	60.8′
21	139°04.3	·· 32.5	285°00.5	1.2′	28°00.7	3.0′	60.8′
22	154°04.2	33.2	299°20.7	1.2′	28°03.7	2.8′	60.7′
23	169°04.2	33.9	313°41.0	1.2′	28°06.5	2.7′	60.7′
	SD = 16.1′	d = 0.7′	SD = 16.7′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	184°04.2	S16°34.7	328°01.2	1.2′	N28°09.2	2.3′	60.7′
1	199°04.1	35.4	342°21.4	1.2′	28°11.5	2.2′	60.7′
2	214°04.1	36.1	356°41.7	1.3′	28°13.7	2.0′	60.6′
3	229°04.0	·· 36.8	11°01.9	1.3′	28°15.7	1.7′	60.6′
4	244°04.0	37.6	25°22.2	1.3′	28°17.4	1.5′	60.6′
5	259°04.0	38.3	39°42.5	1.3′	28°18.9	1.3′	60.5′
6	274°03.9	S16°39.0	54°02.8	1.3′	N28°20.2	1.1′	60.5′
7	289°03.9	39.7	68°23.2	1.4′	28°21.3	0.8′	60.5′
8	304°03.8	40.5	82°43.6	1.4′	28°22.1	0.7′	60.5′
9	319°03.8	·· 41.2	97°04.0	1.4′	28°22.8	0.4′	60.4′
10	334°03.7	41.9	111°24.4	1.5′	28°23.2	0.2′	60.4′
11	349°03.7	42.6	125°44.9	1.5′	28°23.4	0.0′	60.4′
12	4°03.6	S16°43.3	140°05.4	1.6′	N28°23.4	0.2′	60.3′
13	19°03.6	44.1	154°26.0	1.6′	28°23.2	0.4′	60.3′
14	34°03.5	44.8	168°46.7	1.7′	28°22.8	0.7′	60.3′
15	49°03.5	·· 45.5	183°07.3	1.7′	28°22.1	0.8′	60.3′
16	64°03.5	46.2	197°28.1	1.8′	28°21.3	1.1′	60.2′
17	79°03.4	46.9	211°48.9	1.9′	28°20.2	1.2′	60.2′
18	94°03.4	S16°47.6	226°09.7	1.9′	N28°19.0	1.5′	60.2′
19	109°03.3	48.4	240°30.7	2.0′	28°17.5	1.7′	60.1′
20	124°03.3	49.1	254°51.7	2.1′	28°15.8	1.9′	60.1′
21	139°03.2	·· 49.8	269°12.7	2.1′	28°13.9	2.1′	60.1′
22	154°03.2	50.5	283°33.9	2.2′	28°11.8	2.3′	60.0′
23	169°03.1	51.2	297°55.1	2.3′	28°09.5	2.5′	60.0′
	SD = 16.1′	d = 0.7′	SD = 16.6′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	06:30	07:58	09:40	13:46	15:28	16:55
N 70°	06:24	07:41	09:03	14:23	15:45	17:02
68°	06:18	07:27	08:37	14:49	15:59	17:08
66°	06:13	07:16	08:18	15:08	16:10	17:13
64°	06:08	07:07	08:02	15:24	16:20	17:18
62°	06:04	06:58	07:49	15:37	16:28	17:22
60°	06:01	06:51	07:38	15:48	16:35	17:25
N 58°	05:58	06:45	07:29	15:58	16:42	17:29
56°	05:55	06:39	07:20	16:06	16:47	17:32
54°	05:52	06:34	07:13	16:14	16:52	17:35
52°	05:49	06:30	07:06	16:21	16:57	17:38
50°	05:47	06:25	07:00	16:27	17:01	17:40
45°	05:41	06:16	06:47	16:40	17:11	17:46
N 40°	05:35	06:08	06:36	16:51	17:19	17:52
35°	05:30	06:00	06:27	17:00	17:27	17:57
30°	05:25	05:54	06:19	17:08	17:33	18:02
20°	05:15	05:42	06:05	17:23	17:46	18:12
N 10°	05:05	05:30	05:52	17:35	17:57	18:22
0°	04:54	05:19	05:40	17:47	18:09	18:34
S 10°	04:41	05:06	05:28	17:59	18:21	18:47
20°	04:25	04:52	05:15	18:12	18:35	19:03
30°	04:05	04:35	05:01	18:27	18:53	19:23
35°	03:52	04:25	04:52	18:36	19:03	19:36
40°	03:36	04:12	04:42	18:46	19:16	19:52
45°	03:16	03:57	04:30	18:58	19:31	20:12
S 50°	02:50	03:39	04:16	19:12	19:50	20:39
52°	02:37	03:30	04:09	19:19	19:59	20:52
54°	02:22	03:19	04:02	19:27	20:09	21:08
56°	02:03	03:08	03:54	19:35	20:21	21:27
58°	01:39	02:54	03:44	19:45	20:35	21:53
S 60°	01:04	02:38	03:34	19:56	20:52	22:30

Lat.	**Moonrise** Thu	Fri	Sat	**Moonset** Thu	Fri	Sat
N 72°						
N 70°						
68°						
66°						
64°	14:02			10:55		
62°	14:43	14:33		10:15	12:42	
60°	15:11	15:28	16:18	09:48	11:47	13:16
N 58°	15:33	16:01	16:57	09:26	11:15	12:38
56°	15:51	16:25	17:24	09:09	10:51	12:11
54°	16:06	16:45	17:45	08:54	10:31	11:50
52°	16:19	17:02	18:03	08:41	10:15	11:32
50°	16:31	17:16	18:18	08:30	10:01	11:17
45°	16:56	17:45	18:48	08:07	09:32	10:46
N 40°	17:15	18:08	19:12	07:48	09:09	10:22
35°	17:32	18:27	19:32	07:33	08:51	10:02
30°	17:46	18:44	19:49	07:19	08:35	09:46
20°	18:11	19:12	20:17	06:57	08:08	09:17
N 10°	18:32	19:36	20:41	06:37	07:45	08:52
0°	18:52	19:58	21:04	06:19	07:23	08:30
S 10°	19:12	20:21	21:27	06:01	07:02	08:07
20°	19:34	20:45	21:51	05:41	06:39	07:42
30°	19:59	21:13	22:20	05:19	06:12	07:13
35°	20:14	21:30	22:36	05:06	05:56	06:56
40°	20:32	21:50	22:56	04:51	05:38	06:37
45°	20:53	22:13	23:20	04:33	05:16	06:13
S 50°	21:20	22:44	23:50	04:11	04:48	05:42
52°	21:33	22:59	·· ··	04:01	04:35	05:26
54°	21:48	23:17	·· ··	03:49	04:20	05:08
56°	22:06	23:39	·· ··	03:36	04:01	04:46
58°	22:27	·· ··	00:07	03:21	03:39	04:18
S 60°	22:55	·· ··	00:47	03:03	03:11	03:38

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 16-18 100-91%
06	16:23	16:22	11:44	00:04	12:35	
07	16:20	16:19	11:44	01:08	13:41	
08	16:17	16:15	11:44	02:14	14:47	

November 09, 10, 11 UT (Sun., Mon., Tue.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	48°25.3	197°34.4	S11°06.2	167°21.1	S21°15.4	291°18.7	N21°12.5	51°35.9	S04°02.2
1	63°27.8	212°33.9	07.3	182°21.7	15.7	306°21.2	12.5	66°38.5	02.2
2	78°30.3	227°33.4	08.4	197°22.2	16.1	321°23.6	12.5	81°41.0	02.3
3	93°32.7	242°32.9	·· 09.5	212°22.8	·· 16.5	336°26.1	·· 12.5	96°43.6	·· 02.3
4	108°35.2	257°32.3	10.6	227°23.4	16.8	351°28.5	12.5	111°46.1	02.3
5	123°37.7	272°31.8	11.7	242°24.0	17.2	6°30.9	12.5	126°48.6	02.3
6	138°40.1	287°31.3	S11°12.8	257°24.5	S21°17.6	21°33.4	N21°12.5	141°51.2	S04°02.4
7	153°42.6	302°30.8	14.0	272°25.1	18.0	36°35.8	12.5	156°53.7	02.4
8	168°45.1	317°30.3	15.1	287°25.7	18.3	51°38.3	12.5	171°56.3	02.4
9	183°47.5	332°29.7	·· 16.2	302°26.2	·· 18.7	66°40.7	·· 12.5	186°58.8	·· 02.4
10	198°50.0	347°29.2	17.3	317°26.8	19.1	81°43.2	12.5	202°01.3	02.5
11	213°52.4	2°28.7	18.4	332°27.4	19.4	96°45.6	12.5	217°03.9	02.5
12	228°54.9	17°28.2	S11°19.5	347°27.9	S21°19.8	111°48.0	N21°12.5	232°06.4	S04°02.5
13	243°57.4	32°27.7	20.6	2°28.5	20.2	126°50.5	12.5	247°09.0	02.5
14	258°59.8	47°27.1	21.7	17°29.1	20.5	141°52.9	12.5	262°11.5	02.6
15	274°02.3	62°26.6	·· 22.9	32°29.7	·· 20.9	156°55.4	·· 12.5	277°14.1	·· 02.6
16	289°04.8	77°26.1	24.0	47°30.2	21.2	171°57.8	12.5	292°16.6	02.6
17	304°07.2	92°25.6	25.1	62°30.8	21.6	187°00.3	12.5	307°19.1	02.6
18	319°09.7	107°25.0	S11°26.2	77°31.4	S21°22.0	202°02.7	N21°12.5	322°21.7	S04°02.7
19	334°12.2	122°24.5	27.3	92°31.9	22.3	217°05.2	12.5	337°24.2	02.7
20	349°14.6	137°24.0	28.4	107°32.5	22.7	232°07.6	12.5	352°26.8	02.7
21	4°17.1	152°23.5	·· 29.5	122°33.1	·· 23.1	247°10.0	·· 12.5	7°29.3	·· 02.7
22	19°19.6	167°22.9	30.6	137°33.6	23.4	262°12.5	12.5	22°31.8	02.8
23	34°22.0	182°22.4	31.7	152°34.2	23.8	277°14.9	12.5	37°34.4	02.8
Mer.pass. 20:43		ν -0.5′	d 1.1′	m -3.91	ν 0.6′	d 0.4′	m 1.42	ν 2.4′	d 0.0′ m -2.38	ν 2.5′	d 0.0′ m 0.81

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	49°24.5	197°21.9	S11°32.8	167°34.8	S21°24.1	292°17.4	N21°12.5	52°36.9	S04°02.8
1	64°26.9	212°21.4	33.9	182°35.3	24.5	307°19.8	12.5	67°39.5	02.8
2	79°29.4	227°20.8	35.0	197°35.9	24.9	322°22.3	12.5	82°42.0	02.9
3	94°31.9	242°20.3	·· 36.1	212°36.4	·· 25.2	337°24.7	·· 12.5	97°44.5	·· 02.9
4	109°34.3	257°19.8	37.2	227°37.0	25.6	352°27.2	12.5	112°47.1	02.9
5	124°36.8	272°19.2	38.4	242°37.6	26.0	7°29.6	12.5	127°49.6	02.9
6	139°39.3	287°18.7	S11°39.5	257°38.1	S21°26.3	22°32.1	N21°12.5	142°52.2	S04°03.0
7	154°41.7	302°18.2	40.6	272°38.7	26.7	37°34.5	12.6	157°54.7	03.0
8	169°44.2	317°17.7	41.7	287°39.3	27.0	52°37.0	12.6	172°57.2	03.0
9	184°46.7	332°17.1	·· 42.8	302°39.8	·· 27.4	67°39.4	·· 12.6	187°59.8	·· 03.0
10	199°49.1	347°16.6	43.9	317°40.4	27.7	82°41.9	12.6	203°02.3	03.1
11	214°51.6	2°16.1	45.0	332°41.0	28.1	97°44.3	12.6	218°04.8	03.1
12	229°54.1	17°15.5	S11°46.1	347°41.5	S21°28.5	112°46.8	N21°12.6	233°07.4	S04°03.1
13	244°56.5	32°15.0	47.2	2°42.1	28.8	127°49.2	12.6	248°09.9	03.1
14	259°59.0	47°14.5	48.3	17°42.6	29.2	142°51.7	12.6	263°12.5	03.2
15	275°01.4	62°13.9	·· 49.4	32°43.2	·· 29.5	157°54.2	·· 12.6	278°15.0	·· 03.2
16	290°03.9	77°13.4	50.5	47°43.8	29.9	172°56.6	12.6	293°17.5	03.2
17	305°06.4	92°12.9	51.6	62°44.3	30.2	187°59.1	12.6	308°20.1	03.2
18	320°08.8	107°12.3	S11°52.7	77°44.9	S21°30.6	203°01.5	N21°12.6	323°22.6	S04°03.2
19	335°11.3	122°11.8	53.8	92°45.4	31.0	218°04.0	12.6	338°25.1	03.3
20	350°13.8	137°11.3	54.9	107°46.0	31.3	233°06.4	12.6	353°27.7	03.3
21	5°16.2	152°10.7	·· 55.9	122°46.6	·· 31.7	248°08.9	·· 12.6	8°30.2	·· 03.3
22	20°18.7	167°10.2	57.0	137°47.1	32.0	263°11.3	12.6	23°32.8	03.3
23	35°21.2	182°09.7	58.1	152°47.7	32.4	278°13.8	12.6	38°35.3	03.4
Mer.pass. 20:39		ν -0.5′	d 1.1′	m -3.91	ν 0.6′	d 0.4′	m 1.42	ν 2.4′	d 0.0′ m -2.39	ν 2.5′	d 0.0′ m 0.81

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	50°23.6	197°09.1	S11°59.2	167°48.2	S21°32.7	293°16.2	N21°12.6	53°37.8	S04°03.4
1	65°26.1	212°08.6	12°00.3	182°48.8	33.1	308°18.7	12.6	68°40.4	03.4
2	80°28.5	227°08.0	01.4	197°49.4	33.4	323°21.2	12.6	83°42.9	03.4
3	95°31.0	242°07.5	·· 02.5	212°49.9	·· 33.8	338°23.6	·· 12.6	98°45.4	·· 03.4
4	110°33.5	257°07.0	03.6	227°50.5	34.1	353°26.1	12.6	113°48.0	03.5
5	125°35.9	272°06.4	04.7	242°51.0	34.5	8°28.5	12.6	128°50.5	03.5
6	140°38.4	287°05.9	S12°05.8	257°51.6	S21°34.8	23°31.0	N21°12.7	143°53.0	S04°03.5
7	155°40.9	302°05.3	06.9	272°52.2	35.2	38°33.5	12.7	158°55.6	03.5
8	170°43.3	317°04.8	08.0	287°52.7	35.6	53°35.9	12.7	173°58.1	03.6
9	185°45.8	332°04.3	·· 09.1	302°53.3	·· 35.9	68°38.4	·· 12.7	189°00.6	·· 03.6
10	200°48.3	347°03.7	10.2	317°53.8	36.3	83°40.8	12.7	204°03.2	03.6
11	215°50.7	2°03.2	11.2	332°54.4	36.6	98°43.3	12.7	219°05.7	03.6
12	230°53.2	17°02.6	S12°12.3	347°54.9	S21°37.0	113°45.8	N21°12.7	234°08.2	S04°03.6
13	245°55.7	32°02.1	13.4	2°55.5	37.3	128°48.2	12.7	249°10.8	03.7
14	260°58.1	47°01.6	14.5	17°56.0	37.7	143°50.7	12.7	264°13.3	03.7
15	276°00.6	62°01.0	·· 15.6	32°56.6	·· 38.0	158°53.1	·· 12.7	279°15.8	·· 03.7
16	291°03.0	77°00.5	16.7	47°57.2	38.3	173°55.6	12.7	294°18.4	03.7
17	306°05.5	91°59.9	17.8	62°57.7	38.7	188°58.1	12.7	309°20.9	03.8
18	321°08.0	106°59.4	S12°18.9	77°58.3	S21°39.0	204°00.5	N21°12.7	324°23.4	S04°03.8
19	336°10.4	121°58.8	19.9	92°58.8	39.4	219°03.0	12.7	339°26.0	03.8
20	351°12.9	136°58.3	21.0	107°59.4	39.7	234°05.5	12.7	354°28.5	03.8
21	6°15.4	151°57.7	·· 22.1	122°59.9	·· 40.1	249°07.9	·· 12.7	9°31.0	·· 03.8
22	21°17.8	166°57.2	23.2	138°00.5	40.4	264°10.4	12.7	24°33.6	03.9
23	36°20.3	181°56.6	24.3	153°01.0	40.8	279°12.9	12.8	39°36.1	03.9
Mer.pass. 20:35		ν -0.5′	d 1.1′	m -3.91	ν 0.6′	d 0.4′	m 1.41	ν 2.5′	d 0.0′ m -2.39	ν 2.5′	d 0.0′ m 0.82

Stars

	SHA	Dec
Alpheratz	357°33.8	29°14.2
Ankaa	353°06.1	-42°10.0
Schedar	349°29.8	56°41.0
Diphda	348°46.3	-17°50.6
Achernar	335°19.1	-57°06.4
Hamal	327°50.1	23°35.2
Polaris	313°11.2	89°22.4
Acamar	315°10.8	-40°12.0
Menkar	314°05.1	4°11.6
Mirfak	308°26.8	49°57.2
Aldebaran	290°38.5	16°33.7
Rigel	281°02.9	-8°10.2
Capella	280°20.5	46°01.4
Bellatrix	278°21.9	6°22.5
Elnath	278°00.7	28°37.8
Alnilam	275°36.8	-1°11.0
Betelgeuse	270°51.1	7°24.8
Canopus	263°51.7	-52°42.3
Sirius	258°25.4	-16°44.9
Adhara	255°05.1	-29°00.2
Procyon	244°50.0	5°09.6
Pollux	243°16.3	27°57.8
Avior	234°14.3	-59°35.2
Suhail	222°45.8	-43°31.9
Miaplacidus	221°38.1	-69°49.0
Alphard	217°47.1	-8°46.1
Regulus	207°33.8	11°50.5
Dubhe	193°40.5	61°36.5
Denebola	182°24.5	14°25.7
Gienah	175°43.1	-17°41.0
Acrux	172°59.9	-63°14.3
Gacrux	171°51.4	-57°15.3
Alioth	166°12.8	55°49.0
Spica	158°21.9	-11°17.7
Alkaid	152°51.9	49°11.0
Hadar	148°35.7	-60°29.7
Menkent	147°57.2	-36°29.7
Arcturus	145°47.6	19°02.9
Rigil Kent.	139°40.1	-60°56.4
Kochab	137°21.0	74°02.9
Zuben'ubi	136°55.6	-16°08.9
Alphecca	126°03.5	26°37.7
Antares	112°15.4	-26°29.3
Atria	107°09.5	-69°04.5
Sabik	102°02.3	-15°45.4
Shaula	96°09.8	-37°07.4
Rasalhague	95°58.2	12°32.6
Eltanin	90°42.3	51°29.3
Kaus Aust.	83°31.9	-34°22.4
Vega	80°33.0	38°48.6
Nunki	75°47.1	-26°15.9
Altair	61°59.4	8°56.3
Peacock	53°04.8	-56°39.3
Deneb	49°25.4	45°22.6
Enif	33°38.1	9°59.8
Al Na'ir	27°32.0	-46°50.3
Fomalhaut	15°13.6	-29°29.2
Scheat	13°44.4	28°13.6
Markab	13°29.1	15°20.8

Nov 09 Sun	**SHA**	**Mer.pass**
Venus	149°09.1	10:50
Mars	118°55.8	12:50
Jupiter	242°53.4	04:34
Saturn	3°10.6	20:30

Nov 10 Mon	**SHA**	**Mer.pass**
Venus	147°57.4	10:51
Mars	118°10.3	12:49
Jupiter	242°52.9	04:30
Saturn	3°12.4	20:26

Nov 11 Tue	**SHA**	**Mer.pass**
Venus	146°45.5	10:52
Mars	117°24.6	12:48
Jupiter	242°52.6	04:26
Saturn	3°14.2	20:22

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	184°03.1	S16°51.9	312°16.4	2.4′	N28°07.0	2.7′	60.0′
1	199°03.0	52.7	326°37.8	2.5′	28°04.3	2.9′	59.9′
2	214°03.0	53.4	340°59.3	2.6′	28°01.4	3.1′	59.9′
3	229°02.9	·· 54.1	355°20.8	2.7′	27°58.3	3.3′	59.9′
4	244°02.9	54.8	9°42.5	2.7′	27°55.0	3.5′	59.8′
5	259°02.8	55.5	24°04.2	2.8′	27°51.5	3.7′	59.8′
6	274°02.8	S16°56.2	38°26.1	2.9′	N27°47.8	3.9′	59.7′
7	289°02.7	56.9	52°48.0	3.0′	27°43.9	4.1′	59.7′
8	304°02.6	57.6	67°10.1	3.1′	27°39.8	4.3′	59.7′
9	319°02.6	·· 58.3	81°32.2	3.2′	27°35.5	4.4′	59.6′
10	334°02.5	59.1	95°54.4	3.4′	27°31.1	4.7′	59.6′
11	349°02.5	16°59.8	110°16.8	3.5′	27°26.4	4.8′	59.6′
12	4°02.4	S17°00.5	124°39.3	3.6′	N27°21.6	5.0′	59.5′
13	19°02.4	01.2	139°01.8	3.7′	27°16.6	5.2′	59.5′
14	34°02.3	01.9	153°24.5	3.8′	27°11.4	5.4′	59.5′
15	49°02.3	·· 02.6	167°47.3	3.9′	27°06.0	5.5′	59.4′
16	64°02.2	03.3	182°10.3	4.0′	27°00.5	5.8′	59.4′
17	79°02.2	04.0	196°33.3	4.2′	26°54.7	5.9′	59.3′
18	94°02.1	S17°04.7	210°56.5	4.3′	N26°48.8	6.0′	59.3′
19	109°02.0	05.4	225°19.7	4.4′	26°42.8	6.3′	59.3′
20	124°02.0	06.1	239°43.1	4.5′	26°36.5	6.4′	59.2′
21	139°01.9	·· 06.8	254°06.7	4.7′	26°30.1	6.6′	59.2′
22	154°01.9	07.5	268°30.3	4.8′	26°23.5	6.7′	59.2′
23	169°01.8	08.2	282°54.1	4.9′	26°16.8	6.9′	59.1′
	SD = 16.1′	d = 0.7′	SD = 16.4′				

Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	184°01.7	S17°08.9	297°18.0	5.0′	N26°09.9	7.1′	59.1′
1	199°01.7	09.6	311°42.0	5.2′	26°02.8	7.2′	59.0′
2	214°01.6	10.3	326°06.2	5.3′	25°55.6	7.4′	59.0′
3	229°01.6	·· 11.0	340°30.5	5.4′	25°48.2	7.6′	59.0′
4	244°01.5	11.7	354°54.9	5.6′	25°40.6	7.7′	58.9′
5	259°01.4	12.4	9°19.5	5.7′	25°32.9	7.8′	58.9′
6	274°01.4	S17°13.1	23°44.2	5.8′	N25°25.1	8.0′	58.9′
7	289°01.3	13.8	38°09.0	6.0′	25°17.1	8.2′	58.8′
8	304°01.3	14.5	52°34.0	6.1′	25°08.9	8.2′	58.8′
9	319°01.2	·· 15.2	66°59.1	6.2′	25°00.7	8.5′	58.7′
10	334°01.1	15.9	81°24.3	6.4′	24°52.2	8.6′	58.7′
11	349°01.1	16.6	95°49.7	6.5′	24°43.6	8.7′	58.7′
12	4°01.0	S17°17.3	110°15.2	6.6′	N24°34.9	8.8′	58.6′
13	19°00.9	18.0	124°40.9	6.8′	24°26.1	9.0′	58.6′
14	34°00.9	18.7	139°06.6	6.9′	24°17.1	9.1′	58.5′
15	49°00.8	·· 19.4	153°32.6	7.1′	24°08.0	9.3′	58.5′
16	64°00.7	20.1	167°58.6	7.2′	23°58.7	9.4′	58.5′
17	79°00.7	20.8	182°24.8	7.3′	23°49.3	9.5′	58.4′
18	94°00.6	S17°21.5	196°51.2	7.5′	N23°39.8	9.6′	58.4′
19	109°00.5	22.2	211°17.6	7.6′	23°30.2	9.8′	58.3′
20	124°00.5	22.9	225°44.2	7.7′	23°20.4	9.9′	58.3′
21	139°00.4	·· 23.5	240°11.0	7.9′	23°10.5	10.0′	58.3′
22	154°00.3	24.2	254°37.9	8.0′	23°00.5	10.1′	58.2′
23	169°00.3	24.9	269°04.9	8.2′	22°50.4	10.3′	58.2′
	SD = 16.1′	d = 0.7′	SD = 16.1′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	184°00.2	S17°25.6	283°32.0	8.3′	N22°40.1	10.3′	58.2′
1	199°00.1	26.3	297°59.3	8.4′	22°29.8	10.5′	58.1′
2	214°00.1	27.0	312°26.8	8.6′	22°19.3	10.6′	58.1′
3	229°00.0	·· 27.7	326°54.3	8.7′	22°08.7	10.7′	58.0′
4	243°59.9	28.4	341°22.0	8.8′	21°58.0	10.7′	58.0′
5	258°59.9	29.1	355°49.9	9.0′	21°47.3	10.9′	58.0′
6	273°59.8	S17°29.7	10°17.8	9.1′	N21°36.4	11.1′	57.9′
7	288°59.7	30.4	24°45.9	9.2′	21°25.3	11.1′	57.9′
8	303°59.7	31.1	39°14.2	9.4′	21°14.2	11.2′	57.8′
9	318°59.6	·· 31.8	53°42.5	9.5′	21°03.0	11.3′	57.8′
10	333°59.5	32.5	68°11.0	9.6′	20°51.7	11.4′	57.8′
11	348°59.4	33.2	82°39.7	9.8′	20°40.3	11.5′	57.7′
12	3°59.4	S17°33.9	97°08.4	9.9′	N20°28.8	11.5′	57.7′
13	18°59.3	34.5	111°37.3	10.0′	20°17.3	11.7′	57.7′
14	33°59.2	35.2	126°06.3	10.1′	20°05.6	11.8′	57.6′
15	48°59.1	·· 35.9	140°35.5	10.3′	19°53.8	11.8′	57.6′
16	63°59.1	36.6	155°04.8	10.4′	19°42.0	12.0′	57.5′
17	78°59.0	37.3	169°34.2	10.5′	19°30.0	12.0′	57.5′
18	93°58.9	S17°37.9	184°03.7	10.6′	N19°18.0	12.1′	57.5′
19	108°58.8	38.6	198°33.3	10.8′	19°05.9	12.2′	57.4′
20	123°58.8	39.3	213°03.1	10.9′	18°53.7	12.3′	57.4′
21	138°58.7	·· 40.0	227°33.0	11.0′	18°41.4	12.3′	57.4′
22	153°58.6	40.7	242°03.0	11.1′	18°29.1	12.4′	57.3′
23	168°58.5	41.3	256°33.1	11.2′	18°16.7	12.5′	57.3′
	SD = 16.1′	d = 0.7′	SD = 15.9′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	06:42	08:12	10:05	13:22	15:15	16:45
N 70°	06:34	07:53	09:20	14:07	15:34	16:53
68°	06:27	07:38	08:51	14:36	15:49	17:00
66°	06:21	07:25	08:29	14:58	16:02	17:06
64°	06:16	07:15	08:12	15:15	16:12	17:11
62°	06:11	07:06	07:58	15:29	16:21	17:16
60°	06:07	06:58	07:46	15:41	16:29	17:20
N 58°	06:03	06:51	07:36	15:52	16:36	17:24
56°	06:00	06:45	07:26	16:01	16:42	17:27
54°	05:57	06:40	07:19	16:09	16:48	17:30
52°	05:54	06:35	07:11	16:16	16:53	17:33
50°	05:51	06:30	07:05	16:22	16:57	17:36
45°	05:44	06:20	06:51	16:36	17:08	17:43
N 40°	05:38	06:11	06:40	16:48	17:17	17:49
35°	05:33	06:03	06:30	16:58	17:24	17:55
30°	05:27	05:56	06:21	17:06	17:32	18:00
20°	05:17	05:43	06:06	17:22	17:45	18:11
N 10°	05:06	05:31	05:53	17:35	17:57	18:22
0°	04:54	05:19	05:40	17:47	18:09	18:34
S 10°	04:40	05:06	05:28	18:00	18:22	18:48
20°	04:23	04:51	05:14	18:14	18:37	19:05
30°	04:02	04:33	04:59	18:30	18:55	19:26
35°	03:49	04:22	04:49	18:39	19:07	19:40
40°	03:32	04:09	04:39	18:50	19:20	19:57
45°	03:12	03:53	04:27	19:02	19:36	20:18
S 50°	02:44	03:33	04:11	19:17	19:56	20:46
52°	02:30	03:24	04:04	19:25	20:05	21:00
54°	02:13	03:13	03:56	19:33	20:16	21:17
56°	01:52	03:01	03:48	19:42	20:29	21:39
58°	01:25	02:46	03:38	19:52	20:44	22:08
S 60°	00:40	02:28	03:26	20:04	21:02	22:57

Lat.	**Moonrise** Sun	Mon	Tue	**Moonset** Sun	Mon	Tue
N 72°	▭	▭	▭	▭	▭	▭
N 70°	▭	▭	19:03	▭	▭	16:44
68°	▭	▭	19:59	▭	▭	15:47
66°	▭	17:37	20:32	▭	16:17	15:13
64°	▭	18:44	20:55	▭	15:09	14:48
62°	17:08	19:19	21:14	14:41	14:33	14:28
60°	17:54	19:44	21:30	13:55	14:07	14:11
N 58°	18:24	20:04	21:43	13:25	13:47	13:58
56°	18:47	20:21	21:54	13:01	13:30	13:46
54°	19:05	20:35	22:03	12:43	13:15	13:35
52°	19:21	20:47	22:12	12:27	13:02	13:26
50°	19:34	20:58	22:20	12:13	12:51	13:17
45°	20:02	21:20	22:36	11:44	12:28	12:59
N 40°	20:24	21:38	22:50	11:22	12:09	12:45
35°	20:42	21:53	23:01	11:03	11:53	12:32
30°	20:57	22:06	23:11	10:47	11:39	12:21
20°	21:23	22:28	23:28	10:20	11:15	12:02
N 10°	21:46	22:47	23:42	09:57	10:54	11:45
0°	22:07	23:04	23:56	09:35	10:35	11:30
S 10°	22:28	23:22	·· ··	09:13	10:16	11:14
20°	22:50	23:41	·· ··	08:49	09:55	10:57
30°	23:16	·· ··	00:02	08:21	09:30	10:37
35°	23:31	·· ··	00:15	08:04	09:16	10:26
40°	23:49	·· ··	00:29	07:45	08:59	10:12
45°	·· ··	00:10	00:47	07:22	08:39	09:57
S 50°	·· ··	00:36	01:08	06:52	08:13	09:37
52°	00:05	00:49	01:18	06:37	08:01	09:28
54°	00:23	01:04	01:29	06:19	07:46	09:17
56°	00:44	01:21	01:41	05:59	07:30	09:05
58°	01:11	01:42	01:56	05:32	07:10	08:51
S 60°	01:48	02:08	02:13	04:55	06:44	08:35

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 19-21 83-63%
09	16:12	16:10	11:44	03:19	15:51	
10	16:07	16:04	11:44	04:21	16:50	
11	16:01	15:57	11:44	05:17	17:43	

November 12, 13, 14 UT (Wed., Thu., Fri.)

	Aries	Venus		Mars		Jupiter		Saturn	
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	51°22.8	196°56.1	S12°25.4	168°01.6	S21°41.1	294°15.3	N21°12.8	54°38.6	S04°03.9
1	66°25.2	211°55.5	26.4	183°02.1	41.5	309°17.8	12.8	69°41.2	03.9
2	81°27.7	226°55.0	27.5	198°02.7	41.8	324°20.3	12.8	84°43.7	03.9
3	96°30.2	241°54.4	·· 28.6	213°03.2	·· 42.2	339°22.7	·· 12.8	99°46.2	·· 04.0
4	111°32.6	256°53.9	29.7	228°03.8	42.5	354°25.2	12.8	114°48.8	04.0
5	126°35.1	271°53.4	30.8	243°04.4	42.8	9°27.7	12.8	129°51.3	04.0
6	141°37.5	286°52.8	S12°31.8	258°04.9	S21°43.2	24°30.1	N21°12.8	144°53.8	S04°04.0
7	156°40.0	301°52.3	32.9	273°05.5	43.5	39°32.6	12.8	159°56.4	04.0
8	171°42.5	316°51.7	34.0	288°06.0	43.9	54°35.1	12.8	174°58.9	04.1
9	186°44.9	331°51.1	·· 35.1	303°06.6	·· 44.2	69°37.5	·· 12.8	190°01.4	·· 04.1
10	201°47.4	346°50.6	36.2	318°07.1	44.6	84°40.0	12.8	205°04.0	04.1
11	216°49.9	1°50.0	37.2	333°07.7	44.9	99°42.5	12.8	220°06.5	04.1
12	231°52.3	16°49.5	S12°38.3	348°08.2	S21°45.2	114°44.9	N21°12.8	235°09.0	S04°04.1
13	246°54.8	31°48.9	39.4	3°08.8	45.6	129°47.4	12.8	250°11.5	04.2
14	261°57.3	46°48.4	40.5	18°09.3	45.9	144°49.9	12.9	265°14.1	04.2
15	276°59.7	61°47.8	·· 41.5	33°09.9	·· 46.3	159°52.3	·· 12.9	280°16.6	·· 04.2
16	292°02.2	76°47.3	42.6	48°10.4	46.6	174°54.8	12.9	295°19.1	04.2
17	307°04.6	91°46.7	43.7	63°10.9	46.9	189°57.3	12.9	310°21.7	04.2
18	322°07.1	106°46.2	S12°44.8	78°11.5	S21°47.3	204°59.8	N21°12.9	325°24.2	S04°04.3
19	337°09.6	121°45.6	45.8	93°12.0	47.6	220°02.2	12.9	340°26.7	04.3
20	352°12.0	136°45.1	46.9	108°12.6	48.0	235°04.7	12.9	355°29.3	04.3
21	7°14.5	151°44.5	·· 48.0	123°13.1	·· 48.3	250°07.2	·· 12.9	10°31.8	·· 04.3
22	22°17.0	166°43.9	49.0	138°13.7	48.6	265°09.7	12.9	25°34.3	04.3
23	37°19.4	181°43.4	50.1	153°14.2	49.0	280°12.1	12.9	40°36.8	04.4
Mer.pass. 20:31		ν -0.5′	d 1.1′	m -3.91	ν 0.6′	d 0.3′	m 1.41	ν 2.5′	d 0.0′ m -2.40	ν 2.5′	d 0.0′ m 0.82

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	52°21.9	196°42.8	S12°51.2	168°14.8	S21°49.3	295°14.6	N21°12.9	55°39.4	S04°04.4
1	67°24.4	211°42.3	52.3	183°15.3	49.7	310°17.1	12.9	70°41.9	04.4
2	82°26.8	226°41.7	53.3	198°15.9	50.0	325°19.6	12.9	85°44.4	04.4
3	97°29.3	241°41.1	·· 54.4	213°16.4	·· 50.3	340°22.0	·· 13.0	100°47.0	·· 04.4
4	112°31.8	256°40.6	55.5	228°17.0	50.7	355°24.5	13.0	115°49.5	04.5
5	127°34.2	271°40.0	56.5	243°17.5	51.0	10°27.0	13.0	130°52.0	04.5
6	142°36.7	286°39.5	S12°57.6	258°18.1	S21°51.3	25°29.5	N21°13.0	145°54.5	S04°04.5
7	157°39.1	301°38.9	58.7	273°18.6	51.7	40°31.9	13.0	160°57.1	04.5
8	172°41.6	316°38.3	12°59.7	288°19.1	52.0	55°34.4	13.0	175°59.6	04.5
9	187°44.1	331°37.8	13°00.8	303°19.7	·· 52.3	70°36.9	·· 13.0	191°02.1	·· 04.6
10	202°46.5	346°37.2	01.9	318°20.2	52.7	85°39.4	13.0	206°04.6	04.6
11	217°49.0	1°36.6	02.9	333°20.8	53.0	100°41.8	13.0	221°07.2	04.6
12	232°51.5	16°36.1	S13°04.0	348°21.3	S21°53.3	115°44.3	N21°13.0	236°09.7	S04°04.6
13	247°53.9	31°35.5	05.0	3°21.9	53.7	130°46.8	13.0	251°12.2	04.6
14	262°56.4	46°35.0	06.1	18°22.4	54.0	145°49.3	13.1	266°14.8	04.6
15	277°58.9	61°34.4	·· 07.2	33°22.9	·· 54.3	160°51.8	·· 13.1	281°17.3	·· 04.7
16	293°01.3	76°33.8	08.2	48°23.5	54.7	175°54.2	13.1	296°19.8	04.7
17	308°03.8	91°33.3	09.3	63°24.0	55.0	190°56.7	13.1	311°22.3	04.7
18	323°06.3	106°32.7	S13°10.4	78°24.6	S21°55.3	205°59.2	N21°13.1	326°24.9	S04°04.7
19	338°08.7	121°32.1	11.4	93°25.1	55.7	221°01.7	13.1	341°27.4	04.7
20	353°11.2	136°31.6	12.5	108°25.7	56.0	236°04.2	13.1	356°29.9	04.8
21	8°13.6	151°31.0	·· 13.5	123°26.2	·· 56.3	251°06.6	·· 13.1	11°32.4	·· 04.8
22	23°16.1	166°30.4	14.6	138°26.7	56.6	266°09.1	13.1	26°35.0	04.8
23	38°18.6	181°29.9	15.6	153°27.3	57.0	281°11.6	13.1	41°37.5	04.8
Mer.pass. 20:27		ν -0.6′	d 1.1′	m -3.91	ν 0.5′	d 0.3′	m 1.40	ν 2.5′	d 0.0′ m -2.41	ν 2.5′	d 0.0′ m 0.83

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	53°21.0	196°29.3	S13°16.7	168°27.8	S21°57.3	296°14.1	N21°13.1	56°40.0	S04°04.8
1	68°23.5	211°28.7	17.8	183°28.4	57.6	311°16.6	13.2	71°42.5	04.8
2	83°26.0	226°28.1	18.8	198°28.9	58.0	326°19.1	13.2	86°45.1	04.9
3	98°28.4	241°27.6	·· 19.9	213°29.4	·· 58.3	341°21.5	·· 13.2	101°47.6	·· 04.9
4	113°30.9	256°27.0	20.9	228°30.0	58.6	356°24.0	13.2	116°50.1	04.9
5	128°33.4	271°26.4	22.0	243°30.5	58.9	11°26.5	13.2	131°52.6	04.9
6	143°35.8	286°25.9	S13°23.0	258°31.1	S21°59.3	26°29.0	N21°13.2	146°55.2	S04°04.9
7	158°38.3	301°25.3	24.1	273°31.6	59.6	41°31.5	13.2	161°57.7	04.9
8	173°40.7	316°24.7	25.1	288°32.1	21°59.9	56°34.0	13.2	177°00.2	05.0
9	188°43.2	331°24.1	·· 26.2	303°32.7	22°00.3	71°36.5	·· 13.2	192°02.7	·· 05.0
10	203°45.7	346°23.6	27.2	318°33.2	00.6	86°38.9	13.2	207°05.2	05.0
11	218°48.1	1°23.0	28.3	333°33.7	00.9	101°41.4	13.3	222°07.8	05.0
12	233°50.6	16°22.4	S13°29.3	348°34.3	S22°01.2	116°43.9	N21°13.3	237°10.3	S04°05.0
13	248°53.1	31°21.8	30.4	3°34.8	01.6	131°46.4	13.3	252°12.8	05.0
14	263°55.5	46°21.3	31.4	18°35.4	01.9	146°48.9	13.3	267°15.3	05.1
15	278°58.0	61°20.7	·· 32.5	33°35.9	·· 02.2	161°51.4	·· 13.3	282°17.9	·· 05.1
16	294°00.5	76°20.1	33.5	48°36.4	02.5	176°53.9	13.3	297°20.4	05.1
17	309°02.9	91°19.5	34.6	63°37.0	02.8	191°56.4	13.3	312°22.9	05.1
18	324°05.4	106°19.0	S13°35.6	78°37.5	S22°03.2	206°58.9	N21°13.3	327°25.4	S04°05.1
19	339°07.9	121°18.4	36.7	93°38.0	03.5	222°01.3	13.3	342°27.9	05.1
20	354°10.3	136°17.8	37.7	108°38.6	03.8	237°03.8	13.3	357°30.5	05.2
21	9°12.8	151°17.2	·· 38.8	123°39.1	·· 04.1	252°06.3	·· 13.4	12°33.0	·· 05.2
22	24°15.2	166°16.6	39.8	138°39.6	04.5	267°08.8	13.4	27°35.5	05.2
23	39°17.7	181°16.1	40.9	153°40.2	04.8	282°11.3	13.4	42°38.0	05.2
Mer.pass. 20:23		ν -0.6′	d 1.1′	m -3.91	ν 0.5′	d 0.3′	m 1.40	ν 2.5′	d 0.0′ m -2.42	ν 2.5′	d 0.0′ m 0.83

Stars

	SHA	Dec
Alpheratz	357°33.8	29°14.2
Ankaa	353°06.2	-42°10.0
Schedar	349°29.8	56°41.0
Diphda	348°46.3	-17°50.6
Achernar	335°19.1	-57°06.4
Hamal	327°50.1	23°35.2
Polaris	313°11.1	89°22.4
Acamar	315°10.8	-40°12.0
Menkar	314°05.1	4°11.6
Mirfak	308°26.8	49°57.3
Aldebaran	290°38.5	16°33.7
Rigel	281°02.9	-8°10.2
Capella	280°20.5	46°01.4
Bellatrix	278°21.9	6°22.5
Elnath	278°00.7	28°37.8
Alnilam	275°36.8	-1°11.0
Betelgeuse	270°51.1	7°24.8
Canopus	263°51.7	-52°42.3
Sirius	258°25.4	-16°44.9
Adhara	255°05.1	-29°00.2
Procyon	244°50.0	5°09.6
Pollux	243°16.3	27°57.7
Avior	234°14.3	-59°35.2
Suhail	222°45.8	-43°31.9
Miaplacidus	221°38.1	-69°49.0
Alphard	217°47.1	-8°46.1
Regulus	207°33.8	11°50.5
Dubhe	193°40.4	61°36.4
Denebola	182°24.4	14°25.6
Gienah	175°43.1	-17°41.0
Acrux	172°59.9	-63°14.3
Gacrux	171°51.3	-57°15.3
Alioth	166°12.8	55°49.0
Spica	158°21.9	-11°17.7
Alkaid	152°51.9	49°10.9
Hadar	148°35.7	-60°29.7
Menkent	147°57.2	-36°29.7
Arcturus	145°47.6	19°02.9
Rigil Kent.	139°40.0	-60°56.4
Kochab	137°21.0	74°02.8
Zuben'ubi	136°55.6	-16°08.9
Alphecca	126°03.5	26°37.7
Antares	112°15.4	-26°29.3
Atria	107°09.5	-69°04.5
Sabik	102°02.3	-15°45.4
Shaula	96°09.8	-37°07.4
Rasalhague	95°58.2	12°32.6
Eltanin	90°42.3	51°29.3
Kaus Aust.	83°31.9	-34°22.4
Vega	80°33.1	38°48.6
Nunki	75°47.1	-26°15.9
Altair	61°59.4	8°56.3
Peacock	53°04.8	-56°39.3
Deneb	49°25.5	45°22.6
Enif	33°38.1	9°59.8
Al Na'ir	27°32.0	-46°50.3
Fomalhaut	15°13.6	-29°29.2
Scheat	13°44.4	28°13.6
Markab	13°29.1	15°20.8

Nov 12 Wed	SHA	Mer.pass
Venus	145°33.3	10:53
Mars	116°38.8	12:47
Jupiter	242°52.6	04:22
Saturn	3°15.9	20:18

Nov 13 Thu	SHA	Mer.pass
Venus	144°20.9	10:54
Mars	115°52.9	12:47
Jupiter	242°52.7	04:18
Saturn	3°17.5	20:14

Nov 14 Fri	SHA	Mer.pass
Venus	143°08.2	10:54
Mars	115°06.8	12:46
Jupiter	242°53.1	04:14
Saturn	3°19.0	20:10

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h

Wed	Sun GHA	Sun Dec	Moon GHA	Moon ν	Moon Dec	Moon d	Moon HP
0	183°58.5	S17°42.0	271°03.4	11.4′	N18°04.2	12.6′	57.3′
1	198°58.4	42.7	285°33.7	11.5′	17°51.6	12.6′	57.2′
2	213°58.3	43.4	300°04.2	11.6′	17°39.0	12.7′	57.2′
3	228°58.2	·· 44.0	314°34.8	11.7′	17°26.3	12.8′	57.1′
4	243°58.2	44.7	329°05.5	11.8′	17°13.5	12.8′	57.1′
5	258°58.1	45.4	343°36.4	11.9′	17°00.7	12.9′	57.1′
6	273°58.0	S17°46.1	358°07.3	12.0′	N16°47.8	13.0′	57.0′
7	288°57.9	46.7	12°38.3	12.2′	16°34.8	13.0′	57.0′
8	303°57.8	47.4	27°09.5	12.3′	16°21.8	13.1′	57.0′
9	318°57.8	·· 48.1	41°40.8	12.4′	16°08.7	13.2′	56.9′
10	333°57.7	48.8	56°12.1	12.5′	15°55.5	13.2′	56.9′
11	348°57.6	49.4	70°43.6	12.6′	15°42.3	13.3′	56.9′
12	3°57.5	S17°50.1	85°15.2	12.7′	N15°29.0	13.3′	56.8′
13	18°57.4	50.8	99°46.9	12.8′	15°15.7	13.4′	56.8′
14	33°57.3	51.4	114°18.7	12.9′	15°02.3	13.4′	56.8′
15	48°57.3	·· 52.1	128°50.6	13.0′	14°48.9	13.5′	56.7′
16	63°57.2	52.8	143°22.5	13.1′	14°35.4	13.5′	56.7′
17	78°57.1	53.4	157°54.6	13.2′	14°21.9	13.6′	56.7′
18	93°57.0	S17°54.1	172°26.8	13.3′	N14°08.3	13.6′	56.6′
19	108°56.9	54.8	186°59.1	13.4′	13°54.7	13.7′	56.6′
20	123°56.8	55.4	201°31.5	13.5′	13°41.0	13.7′	56.6′
21	138°56.8	·· 56.1	216°03.9	13.6′	13°27.3	13.7′	56.5′
22	153°56.7	56.8	230°36.5	13.6′	13°13.6	13.8′	56.5′
23	168°56.6	57.4	245°09.1	13.7′	12°59.8	13.9′	56.5′
	SD = 16.1′	d = 0.7′		SD = 15.6′			

Thu	GHA	Dec	GHA	ν	Dec	d	HP
0	183°56.5	S17°58.1	259°41.9	13.8′	N12°45.9	13.8′	56.4′
1	198°56.4	58.8	274°14.7	13.9′	12°32.1	14.0′	56.4′
2	213°56.3	17°59.4	288°47.6	14.0′	12°18.1	13.9′	56.4′
3	228°56.2	18°00.1	303°20.6	14.1′	12°04.2	14.0′	56.3′
4	243°56.1	00.8	317°53.7	14.2′	11°50.2	14.0′	56.3′
5	258°56.1	01.4	332°26.8	14.2′	11°36.2	14.1′	56.3′
6	273°56.0	S18°02.1	347°00.1	14.3′	N11°22.1	14.1′	56.2′
7	288°55.9	02.7	1°33.4	14.4′	11°08.0	14.1′	56.2′
8	303°55.8	03.4	16°06.8	14.5′	10°53.9	14.2′	56.2′
9	318°55.7	·· 04.1	30°40.2	14.5′	10°39.7	14.2′	56.1′
10	333°55.6	04.7	45°13.8	14.6′	10°25.5	14.2′	56.1′
11	348°55.5	05.4	59°47.4	14.7′	10°11.3	14.2′	56.1′
12	3°55.4	S18°06.0	74°21.1	14.8′	N09°57.1	14.3′	56.1′
13	18°55.3	06.7	88°54.9	14.8′	09°42.8	14.3′	56.0′
14	33°55.2	07.4	103°28.7	14.9′	09°28.5	14.3′	56.0′
15	48°55.2	·· 08.0	118°02.6	15.0′	09°14.2	14.3′	56.0′
16	63°55.1	08.7	132°36.6	15.0′	08°59.9	14.4′	55.9′
17	78°55.0	09.3	147°10.6	15.1′	08°45.5	14.4′	55.9′
18	93°54.9	S18°10.0	161°44.7	15.2′	N08°31.1	14.4′	55.9′
19	108°54.8	10.6	176°18.9	15.2′	08°16.7	14.4′	55.8′
20	123°54.7	11.3	190°53.1	15.3′	08°02.3	14.4′	55.8′
21	138°54.6	·· 11.9	205°27.4	15.3′	07°47.9	14.5′	55.8′
22	153°54.5	12.6	220°01.8	15.4′	07°33.4	14.5′	55.8′
23	168°54.4	13.2	234°36.2	15.5′	07°18.9	14.4′	55.7′
	SD = 16.2′	d = 0.7′		SD = 15.4′			

Fri	GHA	Dec	GHA	ν	Dec	d	HP
0	183°54.3	S18°13.9	249°10.6	15.5′	N07°04.5	14.6′	55.7′
1	198°54.2	14.5	263°45.1	15.6′	06°49.9	14.5′	55.7′
2	213°54.1	15.2	278°19.7	15.6′	06°35.4	14.5′	55.7′
3	228°54.0	·· 15.8	292°54.3	15.7′	06°20.9	14.5′	55.6′
4	243°53.9	16.5	307°29.0	15.7′	06°06.4	14.6′	55.6′
5	258°53.8	17.1	322°03.7	15.8′	05°51.8	14.5′	55.6′
6	273°53.7	S18°17.8	336°38.5	15.8′	N05°37.3	14.6′	55.5′
7	288°53.6	18.4	351°13.3	15.9′	05°22.7	14.6′	55.5′
8	303°53.5	19.1	5°48.2	15.9′	05°08.1	14.6′	55.5′
9	318°53.4	·· 19.7	20°23.1	16.0′	04°53.5	14.6′	55.5′
10	333°53.3	20.4	34°58.0	16.0′	04°38.9	14.6′	55.4′
11	348°53.2	21.0	49°33.0	16.0′	04°24.3	14.6′	55.4′
12	3°53.1	S18°21.7	64°08.1	16.1′	N04°09.7	14.6′	55.4′
13	18°53.0	22.3	78°43.1	16.1′	03°55.1	14.6′	55.4′
14	33°52.9	22.9	93°18.2	16.1′	03°40.5	14.6′	55.3′
15	48°52.8	·· 23.6	107°53.4	16.2′	03°25.9	14.6′	55.3′
16	63°52.7	24.2	122°28.6	16.2′	03°11.3	14.6′	55.3′
17	78°52.6	24.9	137°03.8	16.3′	02°56.7	14.6′	55.3′
18	93°52.5	S18°25.5	151°39.0	16.3′	N02°42.1	14.6′	55.3′
19	108°52.4	26.2	166°14.3	16.3′	02°27.5	14.6′	55.2′
20	123°52.3	26.8	180°49.6	16.3′	02°12.9	14.6′	55.2′
21	138°52.2	·· 27.4	195°25.0	16.4′	01°58.3	14.6′	55.2′
22	153°52.1	28.1	210°00.4	16.4′	01°43.7	14.6′	55.2′
23	168°52.0	28.7	224°35.8	16.4′	01°29.1	14.6′	55.1′
	SD = 16.2′	d = 0.7′		SD = 15.2′			

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	06:53	08:26	10:36	12:52	15:02	16:34
N 70°	06:44	08:05	09:38	13:49	15:23	16:44
68°	06:36	07:48	09:05	14:23	15:40	16:52
66°	06:29	07:34	08:40	14:47	15:53	16:59
64°	06:23	07:23	08:22	15:06	16:05	17:04
62°	06:18	07:13	08:06	15:22	16:14	17:10
60°	06:13	07:05	07:53	15:34	16:23	17:14
N 58°	06:09	06:57	07:42	15:45	16:30	17:19
56°	06:05	06:51	07:33	15:55	16:37	17:23
54°	06:02	06:45	07:24	16:04	16:43	17:26
52°	05:58	06:39	07:17	16:11	16:49	17:30
50°	05:55	06:34	07:10	16:18	16:54	17:33
45°	05:48	06:23	06:55	16:33	17:05	17:40
N 40°	05:41	06:14	06:43	16:45	17:14	17:47
35°	05:35	06:06	06:33	16:56	17:22	17:53
30°	05:29	05:58	06:24	17:05	17:30	17:59
20°	05:18	05:45	06:08	17:21	17:44	18:10
N 10°	05:06	05:32	05:54	17:35	17:57	18:22
0°	04:54	05:19	05:41	17:48	18:10	18:35
S 10°	04:39	05:05	05:28	18:01	18:23	18:49
20°	04:22	04:50	05:13	18:16	18:39	19:07
30°	04:00	04:31	04:57	18:32	18:58	19:29
35°	03:46	04:19	04:47	18:42	19:10	19:44
40°	03:29	04:06	04:36	18:53	19:23	20:01
45°	03:07	03:49	04:23	19:06	19:40	20:23
S 50°	02:38	03:28	04:07	19:22	20:01	20:53
52°	02:23	03:18	04:00	19:30	20:12	21:08
54°	02:04	03:07	03:51	19:39	20:23	21:27
56°	01:41	02:53	03:42	19:48	20:37	21:50
58°	01:09	02:38	03:31	19:59	20:53	22:24
S 60°	////	02:18	03:19	20:12	21:13	////

Lat.	Moonrise Wed	Moonrise Thu	Moonrise Fri	Moonset Wed	Moonset Thu	Moonset Fri
N 72°	21:32	23:55	·· ··	15:57	15:06	14:30
N 70°	21:58	·· ··	00:05	15:28	14:53	14:26
68°	22:18	·· ··	00:14	15:06	14:42	14:22
66°	22:34	·· ··	00:21	14:49	14:33	14:19
64°	22:47	·· ··	00:27	14:35	14:25	14:16
62°	22:57	·· ··	00:32	14:23	14:18	14:14
60°	23:07	·· ··	00:37	14:13	14:12	14:12
N 58°	23:14	·· ··	00:41	14:04	14:07	14:10
56°	23:21	·· ··	00:44	13:56	14:03	14:08
54°	23:28	·· ··	00:47	13:49	13:58	14:06
52°	23:33	·· ··	00:50	13:42	13:55	14:05
50°	23:38	·· ··	00:52	13:36	13:51	14:04
45°	23:49	·· ··	00:58	13:24	13:44	14:01
N 40°	23:58	·· ··	01:03	13:13	13:37	13:59
35°	·· ··	00:06	01:07	13:04	13:32	13:57
30°	·· ··	00:12	01:10	12:56	13:27	13:55
20°	·· ··	00:24	01:16	12:43	13:19	13:52
N 10°	·· ··	00:34	01:21	12:31	13:11	13:49
0°	·· ··	00:43	01:26	12:19	13:04	13:46
S 10°	00:10	00:52	01:31	12:08	12:57	13:43
20°	00:24	01:02	01:36	11:55	12:49	13:40
30°	00:41	01:13	01:42	11:41	12:40	13:37
35°	00:50	01:20	01:46	11:32	12:35	13:35
40°	01:01	01:27	01:49	11:23	12:29	13:33
45°	01:14	01:36	01:54	11:12	12:23	13:30
S 50°	01:29	01:46	01:59	10:58	12:14	13:27
52°	01:37	01:50	02:01	10:51	12:10	13:26
54°	01:44	01:56	02:04	10:44	12:06	13:24
56°	01:53	02:01	02:07	10:36	12:02	13:22
58°	02:03	02:08	02:10	10:27	11:56	13:20
S 60°	02:15	02:15	02:14	10:17	11:50	13:18

Day	Sun Eqn.of Time 00h	Sun Eqn.of Time 12h	Sun Mer. Pass	Moon Mer.Pass. Upper	Moon Mer.Pass. Lower	Moon Age 22-24 53-32%
	mm:ss	mm:ss	hh:mm	hh:mm	hh:mm	
12	15:54	15:50	11:44	06:08	18:31	
13	15:46	15:42	11:44	06:54	19:15	
14	15:37	15:33	11:44	07:36	19:57	

November 15, 16, 17 UT (Sat., Sun., Mon.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	54°20.2	196°15.5	S13°41.9	168°40.7	S22°05.1	297°13.8	N21°13.4	57°40.6	S04°05.2
1	69°22.6	211°14.9	42.9	183°41.2	05.4	312°16.3	13.4	72°43.1	05.2
2	84°25.1	226°14.3	44.0	198°41.8	05.7	327°18.8	13.4	87°45.6	05.3
3	99°27.6	241°13.7	·· 45.0	213°42.3	·· 06.1	342°21.3	·· 13.4	102°48.1	·· 05.3
4	114°30.0	256°13.2	46.1	228°42.8	06.4	357°23.8	13.4	117°50.6	05.3
5	129°32.5	271°12.6	47.1	243°43.4	06.7	12°26.3	13.4	132°53.2	05.3
6	144°35.0	286°12.0	S13°48.1	258°43.9	S22°07.0	27°28.8	N21°13.5	147°55.7	S04°05.3
7	159°37.4	301°11.4	49.2	273°44.4	07.3	42°31.3	13.5	162°58.2	05.3
8	174°39.9	316°10.8	50.2	288°45.0	07.6	57°33.7	13.5	178°00.7	05.3
9	189°42.4	331°10.2	·· 51.3	303°45.5	·· 08.0	72°36.2	·· 13.5	193°03.2	·· 05.4
10	204°44.8	346°09.7	52.3	318°46.0	08.3	87°38.7	13.5	208°05.8	05.4
11	219°47.3	1°09.1	53.3	333°46.6	08.6	102°41.2	13.5	223°08.3	05.4
12	234°49.7	16°08.5	S13°54.4	348°47.1	S22°08.9	117°43.7	N21°13.5	238°10.8	S04°05.4
13	249°52.2	31°07.9	55.4	3°47.6	09.2	132°46.2	13.5	253°13.3	05.4
14	264°54.7	46°07.3	56.4	18°48.2	09.5	147°48.7	13.6	268°15.8	05.4
15	279°57.1	61°06.7	·· 57.5	33°48.7	·· 09.9	162°51.2	·· 13.6	283°18.3	·· 05.4
16	294°59.6	76°06.1	58.5	48°49.2	10.2	177°53.7	13.6	298°20.9	05.5
17	310°02.1	91°05.5	13°59.5	63°49.8	10.5	192°56.2	13.6	313°23.4	05.5
18	325°04.5	106°05.0	S14°00.6	78°50.3	S22°10.8	207°58.7	N21°13.6	328°25.9	S04°05.5
19	340°07.0	121°04.4	01.6	93°50.8	11.1	223°01.2	13.6	343°28.4	05.5
20	355°09.5	136°03.8	02.6	108°51.3	11.4	238°03.7	13.6	358°30.9	05.5
21	10°11.9	151°03.2	·· 03.7	123°51.9	·· 11.7	253°06.2	·· 13.6	13°33.5	·· 05.5
22	25°14.4	166°02.6	04.7	138°52.4	12.1	268°08.7	13.6	28°36.0	05.5
23	40°16.8	181°02.0	05.7	153°52.9	12.4	283°11.2	13.7	43°38.5	05.6
Mer.pass. 20:19		ν -0.6′	d 1.0′	m -3.91	ν 0.5′	d 0.3′	m 1.39	ν 2.5′	d 0.0′ m 0.84

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	55°19.3	196°01.4	S14°06.8	168°53.5	S22°12.7	298°13.7	N21°13.7	58°41.0	S04°05.6
1	70°21.8	211°00.8	07.8	183°54.0	13.0	313°16.2	13.7	73°43.5	05.6
2	85°24.2	226°00.2	08.8	198°54.5	13.3	328°18.7	13.7	88°46.0	05.6
3	100°26.7	240°59.6	·· 09.8	213°55.0	·· 13.6	343°21.2	·· 13.7	103°48.6	·· 05.6
4	115°29.2	255°59.0	10.9	228°55.6	13.9	358°23.7	13.7	118°51.1	05.6
5	130°31.6	270°58.4	11.9	243°56.1	14.2	13°26.2	13.7	133°53.6	05.6
6	145°34.1	285°57.8	S14°12.9	258°56.6	S22°14.5	28°28.7	N21°13.7	148°56.1	S04°05.7
7	160°36.6	300°57.3	13.9	273°57.1	14.9	43°31.2	13.8	163°58.6	05.7
8	175°39.0	315°56.7	15.0	288°57.7	15.2	58°33.7	13.8	179°01.1	05.7
9	190°41.5	330°56.1	·· 16.0	303°58.2	·· 15.5	73°36.2	·· 13.8	194°03.6	·· 05.7
10	205°44.0	345°55.5	17.0	318°58.7	15.8	88°38.7	13.8	209°06.2	05.7
11	220°46.4	0°54.9	18.0	333°59.3	16.1	103°41.2	13.8	224°08.7	05.7
12	235°48.9	15°54.3	S14°19.1	348°59.8	S22°16.4	118°43.8	N21°13.8	239°11.2	S04°05.7
13	250°51.3	30°53.7	20.1	4°00.3	16.7	133°46.3	13.8	254°13.7	05.8
14	265°53.8	45°53.1	21.1	19°00.8	17.0	148°48.8	13.9	269°16.2	05.8
15	280°56.3	60°52.5	·· 22.1	34°01.4	·· 17.3	163°51.3	·· 13.9	284°18.7	·· 05.8
16	295°58.7	75°51.9	23.1	49°01.9	17.6	178°53.8	13.9	299°21.3	05.8
17	311°01.2	90°51.3	24.2	64°02.4	17.9	193°56.3	13.9	314°23.8	05.8
18	326°03.7	105°50.7	S14°25.2	79°02.9	S22°18.2	208°58.8	N21°13.9	329°26.3	S04°05.8
19	341°06.1	120°50.1	26.2	94°03.4	18.5	224°01.3	13.9	344°28.8	05.8
20	356°08.6	135°49.5	27.2	109°04.0	18.8	239°03.8	13.9	359°31.3	05.8
21	11°11.1	150°48.9	·· 28.2	124°04.5	·· 19.1	254°06.3	·· 14.0	14°33.8	·· 05.9
22	26°13.5	165°48.3	29.2	139°05.0	19.4	269°08.8	14.0	29°36.3	05.9
23	41°16.0	180°47.7	30.3	154°05.5	19.8	284°11.3	14.0	44°38.8	05.9
Mer.pass. 20:15		ν -0.6′	d 1.0′	m -3.91	ν 0.5′	d 0.3′	m 1.39	ν 2.5′	d 0.0′ m -2.43	ν 2.5′	d 0.0′ m 0.85

Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	56°18.4	195°47.1	S14°31.3	169°06.1	S22°20.1	299°13.8	N21°14.0	59°41.4	S04°05.9
1	71°20.9	210°46.5	32.3	184°06.6	20.4	314°16.4	14.0	74°43.9	05.9
2	86°23.4	225°45.8	33.3	199°07.1	20.7	329°18.9	14.0	89°46.4	05.9
3	101°25.8	240°45.2	·· 34.3	214°07.6	·· 21.0	344°21.4	·· 14.0	104°48.9	·· 05.9
4	116°28.3	255°44.6	35.3	229°08.1	21.3	359°23.9	14.0	119°51.4	05.9
5	131°30.8	270°44.0	36.3	244°08.7	21.6	14°26.4	14.1	134°53.9	05.9
6	146°33.2	285°43.4	S14°37.3	259°09.2	S22°21.9	29°28.9	N21°14.1	149°56.4	S04°06.0
7	161°35.7	300°42.8	38.4	274°09.7	22.2	44°31.4	14.1	164°58.9	06.0
8	176°38.2	315°42.2	39.4	289°10.2	22.5	59°33.9	14.1	180°01.5	06.0
9	191°40.6	330°41.6	·· 40.4	304°10.7	·· 22.8	74°36.4	·· 14.1	195°04.0	·· 06.0
10	206°43.1	345°41.0	41.4	319°11.3	23.1	89°39.0	14.1	210°06.5	06.0
11	221°45.6	0°40.4	42.4	334°11.8	23.4	104°41.5	14.2	225°09.0	06.0
12	236°48.0	15°39.8	S14°43.4	349°12.3	S22°23.7	119°44.0	N21°14.2	240°11.5	S04°06.0
13	251°50.5	30°39.2	44.4	4°12.8	24.0	134°46.5	14.2	255°14.0	06.0
14	266°52.9	45°38.6	45.4	19°13.3	24.3	149°49.0	14.2	270°16.5	06.1
15	281°55.4	60°37.9	·· 46.4	34°13.9	·· 24.6	164°51.5	·· 14.2	285°19.0	·· 06.1
16	296°57.9	75°37.3	47.4	49°14.4	24.9	179°54.0	14.2	300°21.5	06.1
17	312°00.3	90°36.7	48.4	64°14.9	25.2	194°56.6	14.2	315°24.1	06.1
18	327°02.8	105°36.1	S14°49.4	79°15.4	S22°25.4	209°59.1	N21°14.3	330°26.6	S04°06.1
19	342°05.3	120°35.5	50.4	94°15.9	25.7	225°01.6	14.3	345°29.1	06.1
20	357°07.7	135°34.9	51.4	109°16.4	26.0	240°04.1	14.3	0°31.6	06.1
21	12°10.2	150°34.3	·· 52.4	124°17.0	·· 26.3	255°06.6	·· 14.3	15°34.1	·· 06.1
22	27°12.7	165°33.7	53.4	139°17.5	26.6	270°09.1	14.3	30°36.6	06.1
23	42°15.1	180°33.0	54.4	154°18.0	26.9	285°11.7	14.3	45°39.1	06.1
Mer.pass. 20:11		ν -0.6′	d 1.0′	m -3.91	ν 0.5′	d 0.3′	m 1.38	ν 2.5′	d 0.0′ m -2.44	ν 2.5′	d 0.0′ m 0.85

Stars

	SHA	Dec
Alpheratz	357°33.8	29°14.2
Ankaa	353°06.2	-42°10.0
Schedar	349°29.9	56°41.0
Diphda	348°46.4	-17°50.7
Achernar	335°19.1	-57°06.4
Hamal	327°50.1	23°35.2
Polaris	313°11.1	89°22.4
Acamar	315°10.8	-40°12.0
Menkar	314°05.1	4°11.6
Mirfak	308°26.8	49°57.3
Aldebaran	290°38.5	16°33.7
Rigel	281°02.9	-8°10.2
Capella	280°20.4	46°01.4
Bellatrix	278°21.8	6°22.5
Elnath	278°00.7	28°37.8
Alnilam	275°36.7	-1°11.0
Betelgeuse	270°51.1	7°24.8
Canopus	263°51.7	-52°42.3
Sirius	258°25.4	-16°44.9
Adhara	255°05.1	-29°00.2
Procyon	244°49.9	5°09.6
Pollux	243°16.3	27°57.7
Avior	234°14.2	-59°35.2
Suhail	222°45.8	-43°31.9
Miaplacidus	221°38.0	-69°49.0
Alphard	217°47.1	-8°46.1
Regulus	207°33.7	11°50.4
Dubhe	193°40.4	61°36.4
Denebola	182°24.4	14°25.6
Gienah	175°43.1	-17°41.0
Acrux	172°59.9	-63°14.3
Gacrux	171°51.3	-57°15.3
Alioth	166°12.8	55°49.0
Spica	158°21.9	-11°17.7
Alkaid	152°51.9	49°10.9
Hadar	148°35.7	-60°29.7
Menkent	147°57.2	-36°29.7
Arcturus	145°47.6	19°02.9
Rigil Kent.	139°40.0	-60°56.4
Kochab	137°21.0	74°02.8
Zuben'ubi	136°55.6	-16°08.9
Alphecca	126°03.5	26°37.7
Antares	112°15.4	-26°29.3
Atria	107°09.5	-69°04.5
Sabik	102°02.3	-15°45.4
Shaula	96°09.8	-37°07.4
Rasalhague	95°58.2	12°32.5
Eltanin	90°42.3	51°29.3
Kaus Aust.	83°31.9	-34°22.4
Vega	80°33.1	38°48.6
Nunki	75°47.2	-26°15.9
Altair	61°59.5	8°56.3
Peacock	53°04.8	-56°39.3
Deneb	49°25.5	45°22.6
Enif	33°38.1	9°59.8
Al Na'ir	27°32.0	-46°50.3
Fomalhaut	15°13.6	-29°29.2
Scheat	13°44.4	28°13.6
Markab	13°29.1	15°20.8

Nov 15 Sat	SHA	Mer.pass
Venus	141°55.3	10:55
Mars	114°20.5	12:45
Jupiter	242°53.6	04:10
Saturn	3°20.4	20:06

Nov 16 Sun	SHA	Mer.pass
Venus	140°42.1	10:56
Mars	113°34.1	12:44
Jupiter	242°54.4	04:06
Saturn	3°21.7	20:02

Nov 17 Mon	SHA	Mer.pass
Venus	139°28.6	10:57
Mars	112°47.6	12:43
Jupiter	242°55.4	04:02
Saturn	3°22.9	19:58

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h — Sun — Moon

Sat	GHA	Dec	GHA	ν	Dec	d	HP
0	183°51.9	S18°29.4	239°11.2	16.4′	N01°14.5	14.6′	55.1′
1	198°51.8	30.0	253°46.6	16.5′	00°59.9	14.6′	55.1′
2	213°51.7	30.6	268°22.1	16.5′	00°45.3	14.5′	55.1′
3	228°51.6	·· 31.3	282°57.6	16.5′	00°30.8	14.6′	55.0′
4	243°51.5	31.9	297°33.1	16.5′	00°16.2	14.5′	55.0′
5	258°51.4	32.5	312°08.6	16.6′	N00°01.7	14.6′	55.0′
6	273°51.3	S18°33.2	326°44.2	16.6′	S00°12.9	14.5′	55.0′
7	288°51.2	33.8	341°19.8	16.6′	00°27.4	14.5′	55.0′
8	303°51.1	34.4	355°55.3	16.6′	00°41.9	14.5′	54.9′
9	318°51.0	·· 35.1	10°30.9	16.6′	00°56.4	14.5′	54.9′
10	333°50.8	35.7	25°06.6	16.6′	01°10.9	14.5′	54.9′
11	348°50.7	36.3	39°42.2	16.6′	01°25.4	14.5′	54.9′
12	3°50.6	S18°37.0	54°17.8	16.6′	S01°39.9	14.4′	54.9′
13	18°50.5	37.6	68°53.5	16.7′	01°54.3	14.4′	54.8′
14	33°50.4	38.2	83°29.1	16.7′	02°08.7	14.4′	54.8′
15	48°50.3	·· 38.9	98°04.8	16.7′	02°23.1	14.4′	54.8′
16	63°50.2	39.5	112°40.5	16.7′	02°37.5	14.4′	54.8′
17	78°50.1	40.1	127°16.1	16.7′	02°51.9	14.4′	54.8′
18	93°50.0	S18°40.7	141°51.8	16.7′	S03°06.3	14.3′	54.8′
19	108°49.9	41.4	156°27.5	16.7′	03°20.6	14.3′	54.7′
20	123°49.7	42.0	171°03.2	16.7′	03°34.9	14.3′	54.7′
21	138°49.6	·· 42.6	185°38.9	16.7′	03°49.2	14.3′	54.7′
22	153°49.5	43.2	200°14.6	16.7′	04°03.5	14.3′	54.7′
23	168°49.4	43.9	214°50.3	16.7′	04°17.8	14.2′	54.7′
	SD = 16.2′	d = 0.6′	SD = 15.0′				

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	183°49.3	S18°44.5	229°25.9	16.7′	S04°32.0	14.2′	54.6′
1	198°49.2	45.1	244°01.6	16.7′	04°46.2	14.2′	54.6′
2	213°49.1	45.7	258°37.3	16.7′	05°00.4	14.1′	54.6′
3	228°49.0	·· 46.4	273°13.0	16.7′	05°14.5	14.2′	54.6′
4	243°48.8	47.0	287°48.6	16.7′	05°28.7	14.1′	54.6′
5	258°48.7	47.6	302°24.3	16.6′	05°42.8	14.0′	54.6′
6	273°48.6	S18°48.2	316°59.9	16.6′	S05°56.8	14.1′	54.5′
7	288°48.5	48.8	331°35.6	16.6′	06°10.9	14.0′	54.5′
8	303°48.4	49.5	346°11.2	16.6′	06°24.9	14.0′	54.5′
9	318°48.3	·· 50.1	0°46.8	16.6′	06°38.9	13.9′	54.5′
10	333°48.1	50.7	15°22.4	16.6′	06°52.8	14.0′	54.5′
11	348°48.0	51.3	29°58.0	16.6′	07°06.8	13.9′	54.5′
12	3°47.9	S18°51.9	44°33.6	16.6′	S07°20.7	13.8′	54.5′
13	18°47.8	52.5	59°09.1	16.5′	07°34.5	13.8′	54.4′
14	33°47.7	53.2	73°44.7	16.5′	07°48.3	13.8′	54.4′
15	48°47.6	·· 53.8	88°20.2	16.5′	08°02.1	13.8′	54.4′
16	63°47.4	54.4	102°55.7	16.5′	08°15.9	13.7′	54.4′
17	78°47.3	55.0	117°31.2	16.5′	08°29.6	13.7′	54.4′
18	93°47.2	S18°55.6	132°06.6	16.4′	S08°43.3	13.6′	54.4′
19	108°47.1	56.2	146°42.1	16.4′	08°56.9	13.6′	54.4′
20	123°47.0	56.8	161°17.5	16.4′	09°10.5	13.6′	54.3′
21	138°46.8	·· 57.5	175°52.9	16.4′	09°24.1	13.5′	54.3′
22	153°46.7	58.1	190°28.2	16.3′	09°37.6	13.5′	54.3′
23	168°46.6	58.7	205°03.6	16.3′	09°51.1	13.4′	54.3′
	SD = 16.2′	d = 0.6′	SD = 14.9′				

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	183°46.5	S18°59.3	219°38.9	16.3′	S10°04.5	13.4′	54.3′
1	198°46.3	18°59.9	234°14.2	16.3′	10°17.9	13.4′	54.3′
2	213°46.2	19°00.5	248°49.4	16.2′	10°31.3	13.3′	54.3′
3	228°46.1	·· 01.1	263°24.7	16.2′	10°44.6	13.3′	54.3′
4	243°46.0	01.7	277°59.8	16.2′	10°57.9	13.2′	54.2′
5	258°45.9	02.3	292°35.0	16.1′	11°11.1	13.2′	54.2′
6	273°45.7	S19°02.9	307°10.1	16.1′	S11°24.3	13.1′	54.2′
7	288°45.6	03.5	321°45.2	16.1′	11°37.4	13.1′	54.2′
8	303°45.5	04.2	336°20.3	16.0′	11°50.5	13.0′	54.2′
9	318°45.4	·· 04.8	350°55.3	16.0′	12°03.5	13.0′	54.2′
10	333°45.2	05.4	5°30.3	16.0′	12°16.5	12.9′	54.2′
11	348°45.1	06.0	20°05.3	15.9′	12°29.4	12.9′	54.2′
12	3°45.0	S19°06.6	34°40.2	15.9′	S12°42.3	12.8′	54.2′
13	18°44.8	07.2	49°15.1	15.8′	12°55.1	12.8′	54.1′
14	33°44.7	07.8	63°49.9	15.8′	13°07.9	12.8′	54.1′
15	48°44.6	·· 08.4	78°24.7	15.8′	13°20.7	12.6′	54.1′
16	63°44.5	09.0	92°59.5	15.7′	13°33.3	12.6′	54.1′
17	78°44.3	09.6	107°34.2	15.7′	13°45.9	12.6′	54.1′
18	93°44.2	S19°10.2	122°08.9	15.6′	S13°58.5	12.5′	54.1′
19	108°44.1	10.8	136°43.5	15.6′	14°11.0	12.5′	54.1′
20	123°43.9	11.4	151°18.1	15.5′	14°23.5	12.4′	54.1′
21	138°43.8	·· 12.0	165°52.6	15.5′	14°35.9	12.3′	54.1′
22	153°43.7	12.6	180°27.1	15.4′	14°48.2	12.3′	54.1′
23	168°43.6	13.2	195°01.6	15.4′	15°00.5	12.2′	54.1′
	SD = 16.2′	d = 0.6′	SD = 14.8′				

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	07:04	08:40	▬	▬	14:48	16:25
N 70°	06:53	08:16	09:58	13:31	15:12	16:35
68°	06:44	07:58	09:19	14:10	15:31	16:44
66°	06:37	07:43	08:52	14:37	15:45	16:52
64°	06:30	07:31	08:31	14:58	15:58	16:58
62°	06:25	07:21	08:15	15:14	16:08	17:04
60°	06:19	07:11	08:01	15:28	16:17	17:09
N 58°	06:15	07:04	07:49	15:40	16:25	17:14
56°	06:11	06:56	07:39	15:50	16:33	17:18
54°	06:07	06:50	07:30	15:59	16:39	17:22
52°	06:03	06:44	07:22	16:07	16:45	17:26
50°	05:59	06:39	07:15	16:14	16:50	17:30
45°	05:52	06:27	06:59	16:30	17:02	17:38
N 40°	05:45	06:17	06:46	16:43	17:12	17:45
35°	05:38	06:09	06:36	16:54	17:21	17:51
30°	05:32	06:01	06:26	17:03	17:29	17:58
20°	05:20	05:46	06:09	17:20	17:43	18:10
N 10°	05:07	05:33	05:55	17:35	17:57	18:22
0°	04:54	05:19	05:41	17:48	18:10	18:36
S 10°	04:39	05:05	05:27	18:02	18:25	18:51
20°	04:21	04:49	05:13	18:17	18:41	19:09
30°	03:58	04:29	04:55	18:35	19:01	19:32
35°	03:43	04:17	04:45	18:45	19:13	19:47
40°	03:25	04:03	04:34	18:57	19:27	20:05
45°	03:02	03:46	04:20	19:10	19:45	20:28
S 50°	02:32	03:24	04:03	19:27	20:07	21:00
52°	02:15	03:13	03:55	19:36	20:18	21:16
54°	01:56	03:01	03:46	19:44	20:30	21:36
56°	01:30	02:47	03:36	19:55	20:45	22:03
58°	00:52	02:30	03:25	20:06	21:02	22:44
S 60°	////	02:09	03:12	20:20	21:24	////

Lat.	Moonrise Sat	Moonrise Sun	Moonrise Mon	Moonset Sat	Moonset Sun	Moonset Mon
N 72°	01:58	03:59	06:07	13:58	13:25	12:42
N 70°	01:59	03:50	05:46	14:01	13:36	13:05
68°	02:00	03:44	05:30	14:04	13:45	13:23
66°	02:01	03:38	05:17	14:06	13:52	13:37
64°	02:01	03:33	05:07	14:08	13:59	13:49
62°	02:02	03:29	04:58	14:09	14:04	14:00
60°	02:02	03:26	04:50	14:10	14:09	14:09
N 58°	02:03	03:23	04:43	14:12	14:14	14:16
56°	02:03	03:20	04:37	14:13	14:18	14:23
54°	02:03	03:18	04:32	14:14	14:21	14:29
52°	02:03	03:15	04:27	14:15	14:24	14:35
50°	02:04	03:13	04:23	14:15	14:27	14:40
45°	02:04	03:09	04:14	14:17	14:33	14:51
N 40°	02:05	03:06	04:06	14:19	14:39	15:00
35°	02:05	03:02	04:00	14:20	14:43	15:08
30°	02:05	03:00	03:54	14:21	14:47	15:15
20°	02:06	02:55	03:44	14:23	14:54	15:27
N 10°	02:07	02:51	03:35	14:25	15:01	15:37
0°	02:07	02:47	03:27	14:26	15:06	15:47
S 10°	02:08	02:43	03:20	14:28	15:12	15:57
20°	02:08	02:39	03:11	14:30	15:19	16:08
30°	02:09	02:35	03:02	14:32	15:26	16:20
35°	02:09	02:32	02:56	14:33	15:30	16:28
40°	02:10	02:30	02:50	14:34	15:35	16:36
45°	02:10	02:26	02:43	14:36	15:40	16:45
S 50°	02:11	02:22	02:34	14:37	15:47	16:57
52°	02:11	02:21	02:31	14:38	15:50	17:02
54°	02:11	02:19	02:26	14:39	15:53	17:08
56°	02:12	02:16	02:22	14:40	15:57	17:15
58°	02:12	02:14	02:16	14:41	16:01	17:23
S 60°	02:13	02:11	02:10	14:43	16:06	17:31

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 25-27 23-9%
15	15:28	15:23	11:45	08:17	20:37	
16	15:17	15:12	11:45	08:57	21:17	
17	15:06	15:00	11:45	09:37	21:58	

November 18, 19, 20 UT (Tue., Wed., Thu.)

	Aries	Venus		Mars		Jupiter		Saturn	
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	57°17.6	195°32.4	S14°55.4	169°18.5	S22°27.2	300°14.2	N21°14.3	60°41.6	S04°06.2
1	72°20.1	210°31.8	56.4	184°19.0	27.5	315°16.7	14.4	75°44.1	06.2
2	87°22.5	225°31.2	57.4	199°19.5	27.8	330°19.2	14.4	90°46.6	06.2
3	102°25.0	240°30.6	·· 58.4	214°20.1	·· 28.1	345°21.7	·· 14.4	105°49.2	·· 06.2
4	117°27.4	255°30.0	14°59.4	229°20.6	28.4	0°24.3	14.4	120°51.7	06.2
5	132°29.9	270°29.3	15°00.4	244°21.1	28.7	15°26.8	14.4	135°54.2	06.2
6	147°32.4	285°28.7	S15°01.4	259°21.6	S22°29.0	30°29.3	N21°14.4	150°56.7	S04°06.2
7	162°34.8	300°28.1	02.4	274°22.1	29.3	45°31.8	14.5	165°59.2	06.2
8	177°37.3	315°27.5	03.4	289°22.6	29.6	60°34.3	14.5	181°01.7	06.2
9	192°39.8	330°26.9	·· 04.4	304°23.1	·· 29.9	75°36.9	·· 14.5	196°04.2	·· 06.2
10	207°42.2	345°26.2	05.4	319°23.7	30.1	90°39.4	14.5	211°06.7	06.3
11	222°44.7	0°25.6	06.4	334°24.2	30.4	105°41.9	14.5	226°09.2	06.3
12	237°47.2	15°25.0	S15°07.3	349°24.7	S22°30.7	120°44.4	N21°14.5	241°11.7	S04°06.3
13	252°49.6	30°24.4	08.3	4°25.2	31.0	135°47.0	14.6	256°14.2	06.3
14	267°52.1	45°23.8	09.3	19°25.7	31.3	150°49.5	14.6	271°16.7	06.3
15	282°54.5	60°23.1	·· 10.3	34°26.2	·· 31.6	165°52.0	·· 14.6	286°19.2	·· 06.3
16	297°57.0	75°22.5	11.3	49°26.7	31.9	180°54.5	14.6	301°21.7	06.3
17	312°59.5	90°21.9	12.3	64°27.2	32.2	195°57.1	14.6	316°24.3	06.3
18	328°01.9	105°21.3	S15°13.3	79°27.8	S22°32.5	210°59.6	N21°14.6	331°26.8	S04°06.3
19	343°04.4	120°20.6	14.3	94°28.3	32.7	226°02.1	14.7	346°29.3	06.3
20	358°06.9	135°20.0	15.2	109°28.8	33.0	241°04.6	14.7	1°31.8	06.3
21	13°09.3	150°19.4	·· 16.2	124°29.3	·· 33.3	256°07.2	·· 14.7	16°34.3	·· 06.4
22	28°11.8	165°18.8	17.2	139°29.8	33.6	271°09.7	14.7	31°36.8	06.4
23	43°14.3	180°18.1	18.2	154°30.3	33.9	286°12.2	14.7	46°39.3	06.4
Mer.pass. 20:08		ν -0.6′	d 1.0′	m -3.91	ν 0.5′	d 0.3′	m 1.38	ν 2.5′	d 0.0′ m -2.45	ν 2.5′	d 0.0′ m 0.85

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	58°16.7	195°17.5	S15°19.2	169°30.8	S22°34.2	301°14.7	N21°14.7	61°41.8	S04°06.4
1	73°19.2	210°16.9	20.2	184°31.3	34.5	316°17.3	14.8	76°44.3	06.4
2	88°21.7	225°16.3	21.1	199°31.8	34.7	331°19.8	14.8	91°46.8	06.4
3	103°24.1	240°15.6	·· 22.1	214°32.4	·· 35.0	346°22.3	·· 14.8	106°49.3	·· 06.4
4	118°26.6	255°15.0	23.1	229°32.9	35.3	1°24.8	14.8	121°51.8	06.4
5	133°29.0	270°14.4	24.1	244°33.4	35.6	16°27.4	14.8	136°54.3	06.4
6	148°31.5	285°13.7	S15°25.1	259°33.9	S22°35.9	31°29.9	N21°14.8	151°56.8	S04°06.4
7	163°34.0	300°13.1	26.0	274°34.4	36.2	46°32.4	14.9	166°59.3	06.4
8	178°36.4	315°12.5	27.0	289°34.9	36.4	61°35.0	14.9	182°01.8	06.4
9	193°38.9	330°11.8	·· 28.0	304°35.4	·· 36.7	76°37.5	·· 14.9	197°04.3	·· 06.5
10	208°41.4	345°11.2	29.0	319°35.9	37.0	91°40.0	14.9	212°06.8	06.5
11	223°43.8	0°10.6	29.9	334°36.4	37.3	106°42.6	14.9	227°09.3	06.5
12	238°46.3	15°09.9	S15°30.9	349°36.9	S22°37.6	121°45.1	N21°15.0	242°11.8	S04°06.5
13	253°48.8	30°09.3	31.9	4°37.4	37.8	136°47.6	15.0	257°14.3	06.5
14	268°51.2	45°08.7	32.9	19°37.9	38.1	151°50.2	15.0	272°16.8	06.5
15	283°53.7	60°08.0	·· 33.8	34°38.5	·· 38.4	166°52.7	·· 15.0	287°19.3	·· 06.5
16	298°56.2	75°07.4	34.8	49°39.0	38.7	181°55.2	15.0	302°21.9	06.5
17	313°58.6	90°06.8	35.8	64°39.5	39.0	196°57.8	15.0	317°24.4	06.5
18	329°01.1	105°06.1	S15°36.8	79°40.0	S22°39.2	212°00.3	N21°15.1	332°26.9	S04°06.5
19	344°03.5	120°05.5	37.7	94°40.5	39.5	227°02.8	15.1	347°29.4	06.5
20	359°06.0	135°04.9	38.7	109°41.0	39.8	242°05.4	15.1	2°31.9	06.5
21	14°08.5	150°04.2	·· 39.7	124°41.5	·· 40.1	257°07.9	·· 15.1	17°34.4	·· 06.5
22	29°10.9	165°03.6	40.6	139°42.0	40.4	272°10.4	15.1	32°36.9	06.6
23	44°13.4	180°02.9	41.6	154°42.5	40.6	287°13.0	15.2	47°39.4	06.6
Mer.pass. 20:04		ν -0.6′	d 1.0′	m -3.91	ν 0.5′	d 0.3′	m 1.37	ν 2.5′	d 0.0′ m -2.45	ν 2.5′	d 0.0′ m 0.86

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	59°15.9	195°02.3	S15°42.6	169°43.0	S22°40.9	302°15.5	N21°15.2	62°41.9	S04°06.6
1	74°18.3	210°01.7	43.5	184°43.5	41.2	317°18.0	15.2	77°44.4	06.6
2	89°20.8	225°01.0	44.5	199°44.0	41.5	332°20.6	15.2	92°46.9	06.6
3	104°23.3	240°00.4	·· 45.5	214°44.5	·· 41.7	347°23.1	·· 15.2	107°49.4	·· 06.6
4	119°25.7	254°59.7	46.4	229°45.0	42.0	2°25.6	15.2	122°51.9	06.6
5	134°28.2	269°59.1	47.4	244°45.5	42.3	17°28.2	15.3	137°54.4	06.6
6	149°30.7	284°58.5	S15°48.3	259°46.0	S22°42.6	32°30.7	N21°15.3	152°56.9	S04°06.6
7	164°33.1	299°57.8	49.3	274°46.5	42.8	47°33.3	15.3	167°59.4	06.6
8	179°35.6	314°57.2	50.3	289°47.0	43.1	62°35.8	15.3	183°01.9	06.6
9	194°38.0	329°56.5	·· 51.2	304°47.5	·· 43.4	77°38.3	·· 15.3	198°04.4	·· 06.6
10	209°40.5	344°55.9	52.2	319°48.0	43.7	92°40.9	15.4	213°06.9	06.6
11	224°43.0	359°55.2	53.1	334°48.5	43.9	107°43.4	15.4	228°09.4	06.6
12	239°45.4	14°54.6	S15°54.1	349°49.0	S22°44.2	122°46.0	N21°15.4	243°11.9	S04°06.6
13	254°47.9	29°53.9	55.1	4°49.5	44.5	137°48.5	15.4	258°14.4	06.6
14	269°50.4	44°53.3	56.0	19°50.0	44.7	152°51.0	15.4	273°16.9	06.7
15	284°52.8	59°52.6	·· 57.0	34°50.5	·· 45.0	167°53.6	·· 15.5	288°19.4	·· 06.7
16	299°55.3	74°52.0	57.9	49°51.0	45.3	182°56.1	15.5	303°21.9	06.7
17	314°57.8	89°51.4	58.9	64°51.5	45.5	197°58.7	15.5	318°24.4	06.7
18	330°00.2	104°50.7	S15°59.8	79°52.0	S22°45.8	213°01.2	N21°15.5	333°26.9	S04°06.7
19	345°02.7	119°50.1	16°00.8	94°52.5	46.1	228°03.8	15.5	348°29.4	06.7
20	0°05.1	134°49.4	01.7	109°53.0	46.4	243°06.3	15.6	3°31.9	06.7
21	15°07.6	149°48.8	·· 02.7	124°53.5	·· 46.6	258°08.8	·· 15.6	18°34.3	·· 06.7
22	30°10.1	164°48.1	03.6	139°54.0	46.9	273°11.4	15.6	33°36.8	06.7
23	45°12.5	179°47.5	04.6	154°54.5	47.2	288°13.9	15.6	48°39.3	06.7
Mer.pass. 20:00		ν -0.6′	d 1.0′	m -3.91	ν 0.5′	d 0.3′	m 1.37	ν 2.5′	d 0.0′ m -2.46	ν 2.5′	d 0.0′ m 0.86

Stars

	SHA	Dec
Alpheratz	357°33.9	29°14.2
Ankaa	353°06.2	-42°10.0
Schedar	349°29.9	56°41.0
Diphda	348°46.4	-17°50.7
Achernar	335°19.1	-57°06.4
Hamal	327°50.1	23°35.2
Polaris	313°10.9	89°22.5
Acamar	315°10.8	-40°12.0
Menkar	314°05.1	4°11.6
Mirfak	308°26.8	49°57.3
Aldebaran	290°38.5	16°33.7
Rigel	281°02.9	-8°10.2
Capella	280°20.4	46°01.4
Bellatrix	278°21.8	6°22.5
Elnath	278°00.6	28°37.8
Alnilam	275°36.7	-1°11.0
Betelgeuse	270°51.0	7°24.8
Canopus	263°51.6	-52°42.3
Sirius	258°25.4	-16°44.9
Adhara	255°05.1	-29°00.2
Procyon	244°49.9	5°09.6
Pollux	243°16.3	27°57.7
Avior	234°14.2	-59°35.2
Suhail	222°45.7	-43°31.9
Miaplacidus	221°38.0	-69°49.0
Alphard	217°47.0	-8°46.1
Regulus	207°33.7	11°50.4
Dubhe	193°40.4	61°36.4
Denebola	182°24.4	14°25.6
Gienah	175°43.1	-17°41.0
Acrux	172°59.8	-63°14.3
Gacrux	171°51.3	-57°15.2
Alioth	166°12.8	55°49.0
Spica	158°21.8	-11°17.7
Alkaid	152°51.9	49°10.9
Hadar	148°35.6	-60°29.7
Menkent	147°57.2	-36°29.7
Arcturus	145°47.6	19°02.8
Rigil Kent.	139°40.0	-60°56.4
Kochab	137°21.0	74°02.8
Zuben'ubi	136°55.6	-16°08.9
Alphecca	126°03.5	26°37.7
Antares	112°15.4	-26°29.3
Atria	107°09.5	-69°04.5
Sabik	102°02.3	-15°45.4
Shaula	96°09.8	-37°07.4
Rasalhague	95°58.2	12°32.5
Eltanin	90°42.3	51°29.2
Kaus Aust.	83°31.9	-34°22.4
Vega	80°33.1	38°48.6
Nunki	75°47.2	-26°15.9
Altair	61°59.5	8°56.3
Peacock	53°04.9	-56°39.3
Deneb	49°25.5	45°22.6
Enif	33°38.1	9°59.8
Al Na'ir	27°32.0	-46°50.3
Fomalhaut	15°13.7	-29°29.2
Scheat	13°44.4	28°13.6
Markab	13°29.1	15°20.8

Nov 18 Tue	SHA	Mer.pass
Venus	138°14.8	10:58
Mars	112°00.9	12:42
Jupiter	242°56.6	03:58
Saturn	3°24.0	19:54

Nov 19 Wed	SHA	Mer.pass
Venus	137°00.8	10:59
Mars	111°14.1	12:42
Jupiter	242°58.0	03:54
Saturn	3°25.1	19:50

Nov 20 Thu	SHA	Mer.pass
Venus	135°46.4	11:00
Mars	110°27.1	12:41
Jupiter	242°59.6	03:50
Saturn	3°26.0	19:46

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°43.4	S19°13.8	209°36.0	15.4′	S15°12.7	12.1′	54.0′
1	198°43.3	14.4	224°10.3	15.3′	15°24.8	12.1′	54.0′
2	213°43.2	15.0	238°44.6	15.3′	15°36.9	12.0′	54.0′
3	228°43.0	·· 15.5	253°18.9	15.2′	15°48.9	12.0′	54.0′
4	243°42.9	16.1	267°53.1	15.2′	16°00.9	11.9′	54.0′
5	258°42.8	16.7	282°27.2	15.1′	16°12.8	11.8′	54.0′
6	273°42.6	S19°17.3	297°01.3	15.1′	S16°24.6	11.8′	54.0′
7	288°42.5	17.9	311°35.4	15.0′	16°36.4	11.7′	54.0′
8	303°42.4	18.5	326°09.4	14.9′	16°48.1	11.6′	54.0′
9	318°42.2	·· 19.1	340°43.3	14.9′	16°59.7	11.6′	54.0′
10	333°42.1	19.7	355°17.2	14.8′	17°11.3	11.5′	54.0′
11	348°42.0	20.3	9°51.1	14.8′	17°22.8	11.4′	54.0′
12	3°41.8	S19°20.9	24°24.9	14.7′	S17°34.2	11.4′	54.0′
13	18°41.7	21.5	38°58.6	14.7′	17°45.6	11.3′	54.0′
14	33°41.6	22.0	53°32.2	14.6′	17°56.9	11.2′	54.0′
15	48°41.4	·· 22.6	68°05.9	14.6′	18°08.1	11.1′	53.9′
16	63°41.3	23.2	82°39.4	14.5′	18°19.2	11.0′	53.9′
17	78°41.1	23.8	97°12.9	14.4′	18°30.2	11.0′	53.9′
18	93°41.0	S19°24.4	111°46.4	14.4′	S18°41.2	10.9′	53.9′
19	108°40.9	25.0	126°19.7	14.3′	18°52.1	10.9′	53.9′
20	123°40.7	25.6	140°53.1	14.3′	19°03.0	10.7′	53.9′
21	138°40.6	·· 26.1	155°26.3	14.2′	19°13.7	10.7′	53.9′
22	153°40.5	26.7	169°59.5	14.1′	19°24.4	10.6′	53.9′
23	168°40.3	27.3	184°32.7	14.1′	19°35.0	10.5′	53.9′
	SD = 16.2′	d = 0.6′	SD = 14.7′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°40.2	S19°27.9	199°05.7	14.0′	S19°45.5	10.4′	53.9′
1	198°40.0	28.5	213°38.8	14.0′	19°55.9	10.4′	53.9′
2	213°39.9	29.0	228°11.7	13.9′	20°06.3	10.2′	53.9′
3	228°39.8	·· 29.6	242°44.6	13.8′	20°16.5	10.2′	53.9′
4	243°39.6	30.2	257°17.4	13.8′	20°26.7	10.1′	53.9′
5	258°39.5	30.8	271°50.2	13.7′	20°36.8	10.0′	53.9′
6	273°39.3	S19°31.4	286°22.9	13.6′	S20°46.8	9.9′	53.9′
7	288°39.2	31.9	300°55.6	13.6′	20°56.7	9.9′	53.9′
8	303°39.0	32.5	315°28.1	13.5′	21°06.6	9.7′	53.9′
9	318°38.9	·· 33.1	330°00.7	13.5′	21°16.3	9.7′	53.9′
10	333°38.8	33.7	344°33.1	13.4′	21°26.0	9.5′	53.9′
11	348°38.6	34.2	359°05.5	13.3′	21°35.5	9.5′	53.9′
12	3°38.5	S19°34.8	13°37.8	13.3′	S21°45.0	9.4′	53.9′
13	18°38.3	35.4	28°10.1	13.2′	21°54.4	9.3′	53.9′
14	33°38.2	36.0	42°42.3	13.1′	22°03.7	9.2′	53.9′
15	48°38.0	·· 36.5	57°14.4	13.1′	22°12.9	9.1′	53.9′
16	63°37.9	37.1	71°46.5	13.0′	22°22.0	9.0′	53.9′
17	78°37.8	37.7	86°18.5	12.9′	22°31.0	8.9′	53.9′
18	93°37.6	S19°38.2	100°50.4	12.9′	S22°39.9	8.8′	53.9′
19	108°37.5	38.8	115°22.3	12.8′	22°48.7	8.7′	53.9′
20	123°37.3	39.4	129°54.1	12.7′	22°57.4	8.6′	53.9′
21	138°37.2	·· 40.0	144°25.8	12.7′	23°06.0	8.6′	53.9′
22	153°37.0	40.5	158°57.5	12.6′	23°14.6	8.4′	53.9′
23	168°36.9	41.1	173°29.1	12.5′	23°23.0	8.3′	53.9′
	SD = 16.2′	d = 0.6′	SD = 14.7′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°36.7	S19°41.7	188°00.7	12.5′	S23°31.3	8.2′	53.9′
1	198°36.6	42.2	202°32.1	12.4′	23°39.5	8.1′	53.8′
2	213°36.4	42.8	217°03.5	12.4′	23°47.6	8.0′	53.8′
3	228°36.3	·· 43.4	231°34.9	12.3′	23°55.6	7.9′	53.8′
4	243°36.1	43.9	246°06.2	12.2′	24°03.5	7.8′	53.8′
5	258°36.0	44.5	260°37.4	12.2′	24°11.3	7.7′	53.8′
6	273°35.8	S19°45.0	275°08.6	12.1′	S24°19.0	7.5′	53.9′
7	288°35.7	45.6	289°39.7	12.0′	24°26.5	7.5′	53.9′
8	303°35.5	46.2	304°10.7	12.0′	24°34.0	7.4′	53.9′
9	318°35.4	·· 46.7	318°41.7	11.9′	24°41.4	7.2′	53.9′
10	333°35.2	47.3	333°12.6	11.8′	24°48.6	7.2′	53.9′
11	348°35.1	47.9	347°43.4	11.8′	24°55.8	7.0′	53.9′
12	3°34.9	S19°48.4	2°14.2	11.7′	S25°02.8	6.9′	53.9′
13	18°34.8	49.0	16°44.9	11.7′	25°09.7	6.8′	53.9′
14	33°34.6	49.5	31°15.6	11.6′	25°16.5	6.7′	53.9′
15	48°34.5	·· 50.1	45°46.2	11.5′	25°23.2	6.6′	53.9′
16	63°34.3	50.6	60°16.7	11.5′	25°29.8	6.4′	53.9′
17	78°34.1	51.2	74°47.2	11.4′	25°36.2	6.4′	53.9′
18	93°34.0	S19°51.8	89°17.6	11.4′	S25°42.6	6.2′	53.9′
19	108°33.8	52.3	103°48.0	11.3′	25°48.8	6.1′	53.9′
20	123°33.7	52.9	118°18.3	11.2′	25°54.9	6.0′	53.9′
21	138°33.5	·· 53.4	132°48.5	11.2′	26°00.9	5.9′	53.9′
22	153°33.4	54.0	147°18.7	11.1′	26°06.8	5.7′	53.9′
23	168°33.2	54.5	161°48.9	11.1′	26°12.5	5.6′	53.9′
	SD = 16.2′	d = 0.6′	SD = 14.7′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	07:14	08:54	▬	▬	14:35	16:15
N 70°	07:02	08:28	10:20	13:10	15:02	16:27
68°	06:53	08:08	09:33	13:57	15:22	16:37
66°	06:44	07:52	09:03	14:27	15:38	16:46
64°	06:37	07:39	08:41	14:49	15:51	16:53
62°	06:31	07:28	08:23	15:07	16:03	16:59
60°	06:25	07:18	08:08	15:22	16:12	17:05
N 58°	06:20	07:09	07:56	15:34	16:21	17:10
56°	06:16	07:02	07:45	15:45	16:28	17:15
54°	06:11	06:55	07:36	15:55	16:35	17:19
52°	06:07	06:49	07:27	16:03	16:41	17:23
50°	06:04	06:43	07:19	16:11	16:47	17:27
45°	05:55	06:31	07:03	16:27	16:59	17:35
N 40°	05:48	06:21	06:50	16:41	17:10	17:43
35°	05:41	06:11	06:38	16:52	17:19	17:50
30°	05:34	06:03	06:28	17:02	17:28	17:57
20°	05:21	05:48	06:11	17:19	17:43	18:10
N 10°	05:08	05:34	05:56	17:35	17:57	18:23
0°	04:54	05:20	05:42	17:49	18:11	18:37
S 10°	04:39	05:05	05:27	18:04	18:26	18:52
20°	04:20	04:48	05:12	18:19	18:43	19:11
30°	03:56	04:28	04:54	18:37	19:04	19:35
35°	03:41	04:15	04:43	18:48	19:16	19:51
40°	03:22	04:00	04:31	19:00	19:31	20:10
45°	02:58	03:42	04:17	19:15	19:49	20:34
S 50°	02:26	03:19	03:59	19:32	20:13	21:07
52°	02:09	03:08	03:51	19:41	20:24	21:24
54°	01:47	02:55	03:42	19:50	20:37	21:46
56°	01:18	02:40	03:31	20:01	20:52	22:16
58°	00:29	02:22	03:19	20:13	21:11	23:12
S 60°	////	01:59	03:05	20:28	21:35	////

Lat.	**Moonrise** Tue	Wed	Thu	**Moonset** Tue	Wed	Thu
N 72°	09:02	▬	▬	11:16	▬	▬
N 70°	08:02	▬	▬	12:17	▬	▬
68°	07:28	10:14	▬	12:53	11:39	▬
66°	07:03	09:06	▬	13:19	12:47	▬
64°	06:44	08:31	10:39	13:38	13:23	12:52
62°	06:29	08:06	09:50	13:55	13:49	13:43
60°	06:16	07:46	09:19	14:08	14:10	14:14
N 58°	06:05	07:30	08:55	14:20	14:27	14:38
56°	05:56	07:16	08:37	14:30	14:41	14:57
54°	05:48	07:04	08:21	14:40	14:53	15:13
52°	05:40	06:54	08:08	14:48	15:04	15:27
50°	05:33	06:45	07:56	14:55	15:14	15:39
45°	05:19	06:25	07:31	15:11	15:35	16:04
N 40°	05:07	06:10	07:12	15:24	15:51	16:25
35°	04:58	05:56	06:56	15:35	16:06	16:41
30°	04:49	05:45	06:42	15:45	16:18	16:56
20°	04:34	05:25	06:18	16:01	16:39	17:21
N 10°	04:21	05:09	05:58	16:16	16:58	17:42
0°	04:09	04:53	05:39	16:30	17:15	18:03
S 10°	03:57	04:37	05:20	16:44	17:32	18:23
20°	03:45	04:21	05:00	16:59	17:51	18:44
30°	03:30	04:02	04:37	17:16	18:12	19:10
35°	03:22	03:51	04:24	17:26	18:25	19:24
40°	03:12	03:38	04:08	17:37	18:40	19:42
45°	03:01	03:23	03:50	17:51	18:57	20:03
S 50°	02:48	03:05	03:27	18:08	19:19	20:29
52°	02:42	02:57	03:16	18:16	19:30	20:42
54°	02:35	02:47	03:04	18:24	19:41	20:57
56°	02:28	02:37	02:50	18:34	19:55	21:14
58°	02:20	02:25	02:33	18:46	20:11	21:35
S 60°	02:10	02:11	02:14	18:59	20:30	22:02

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 28-0 5-0%
18	14:54	14:47	11:45	10:19	22:41	
19	14:41	14:34	11:45	11:04	23:27	
20	14:27	14:20	11:46	11:51	–:–	

November 21, 22, 23 UT (Fri., Sat., Sun.)

	Aries	Venus		Mars		Jupiter		Saturn	
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	60°15.0	194°46.8	S16°05.5	169°55.0	S22°47.4	303°16.5	N21°15.6	63°41.8	S04°06.7
1	75°17.5	209°46.2	06.5	184°55.5	47.7	318°19.0	15.7	78°44.3	06.7
2	90°19.9	224°45.5	07.4	199°56.0	48.0	333°21.6	15.7	93°46.8	06.7
3	105°22.4	239°44.8	·· 08.4	214°56.5	·· 48.2	348°24.1	·· 15.7	108°49.3	·· 06.7
4	120°24.9	254°44.2	09.3	229°57.0	48.5	3°26.7	15.7	123°51.8	06.7
5	135°27.3	269°43.5	10.3	244°57.5	48.8	18°29.2	15.7	138°54.3	06.7
6	150°29.8	284°42.9	S16°11.2	259°58.0	S22°49.0	33°31.7	N21°15.8	153°56.8	S04°06.7
7	165°32.3	299°42.2	12.2	274°58.5	49.3	48°34.3	15.8	168°59.3	06.7
8	180°34.7	314°41.6	13.1	289°59.0	49.6	63°36.8	15.8	184°01.8	06.7
9	195°37.2	329°40.9	·· 14.0	304°59.5	·· 49.8	78°39.4	·· 15.8	199°04.3	·· 06.7
10	210°39.6	344°40.3	15.0	320°00.0	50.1	93°41.9	15.8	214°06.8	06.7
11	225°42.1	359°39.6	15.9	335°00.5	50.3	108°44.5	15.9	229°09.3	06.8
12	240°44.6	14°38.9	S16°16.9	350°01.0	S22°50.6	123°47.0	N21°15.9	244°11.8	S04°06.8
13	255°47.0	29°38.3	17.8	5°01.5	50.9	138°49.6	15.9	259°14.3	06.8
14	270°49.5	44°37.6	18.7	20°02.0	51.1	153°52.1	15.9	274°16.8	06.8
15	285°52.0	59°37.0	·· 19.7	35°02.5	·· 51.4	168°54.7	·· 15.9	289°19.3	·· 06.8
16	300°54.4	74°36.3	20.6	50°03.0	51.6	183°57.2	16.0	304°21.8	06.8
17	315°56.9	89°35.6	21.6	65°03.5	51.9	198°59.8	16.0	319°24.3	06.8
18	330°59.4	104°35.0	S16°22.5	80°04.0	S22°52.2	214°02.3	N21°16.0	334°26.8	S04°06.8
19	346°01.8	119°34.3	23.4	95°04.5	52.4	229°04.9	16.0	349°29.3	06.8
20	1°04.3	134°33.7	24.4	110°05.0	52.7	244°07.4	16.1	4°31.7	06.8
21	16°06.8	149°33.0	·· 25.3	125°05.5	·· 52.9	259°10.0	·· 16.1	19°34.2	·· 06.8
22	31°09.2	164°32.3	26.2	140°06.0	53.2	274°12.5	16.1	34°36.7	06.8
23	46°11.7	179°31.7	27.2	155°06.4	53.5	289°15.1	16.1	49°39.2	06.8
Mer.pass. 19:56		ν -0.7′ d 0.9′		ν 0.5′ d 0.3′		ν 2.5′ d 0.0′		ν 2.5′ d 0.0′	

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	61°14.1	194°31.0	S16°28.1	170°06.9	S22°53.7	304°17.7	N21°16.1	64°41.7	S04°06.8
1	76°16.6	209°30.3	29.0	185°07.4	54.0	319°20.2	16.2	79°44.2	06.8
2	91°19.1	224°29.7	30.0	200°07.9	54.2	334°22.8	16.2	94°46.7	06.8
3	106°21.5	239°29.0	·· 30.9	215°08.4	·· 54.5	349°25.3	·· 16.2	109°49.2	·· 06.8
4	121°24.0	254°28.4	31.8	230°08.9	54.8	4°27.9	16.2	124°51.7	06.8
5	136°26.5	269°27.7	32.7	245°09.4	55.0	19°30.4	16.3	139°54.2	06.8
6	151°28.9	284°27.0	S16°33.7	260°09.9	S22°55.3	34°33.0	N21°16.3	154°56.7	S04°06.8
7	166°31.4	299°26.3	34.6	275°10.4	55.5	49°35.5	16.3	169°59.2	06.8
8	181°33.9	314°25.7	35.5	290°10.9	55.8	64°38.1	16.3	185°01.7	06.8
9	196°36.3	329°25.0	·· 36.4	305°11.4	·· 56.0	79°40.7	·· 16.3	200°04.1	·· 06.8
10	211°38.8	344°24.3	37.4	320°11.9	56.3	94°43.2	16.4	215°06.6	06.8
11	226°41.3	359°23.7	38.3	335°12.4	56.5	109°45.8	16.4	230°09.1	06.8
12	241°43.7	14°23.0	S16°39.2	350°12.8	S22°56.8	124°48.3	N21°16.4	245°11.6	S04°06.8
13	256°46.2	29°22.3	40.1	5°13.3	57.0	139°50.9	16.4	260°14.1	06.8
14	271°48.6	44°21.7	41.1	20°13.8	57.3	154°53.4	16.5	275°16.6	06.8
15	286°51.1	59°21.0	·· 42.0	35°14.3	·· 57.5	169°56.0	·· 16.5	290°19.1	·· 06.8
16	301°53.6	74°20.3	42.9	50°14.8	57.8	184°58.6	16.5	305°21.6	06.8
17	316°56.0	89°19.6	43.8	65°15.3	58.0	200°01.1	16.5	320°24.1	06.8
18	331°58.5	104°19.0	S16°44.7	80°15.8	S22°58.3	215°03.7	N21°16.5	335°26.6	S04°06.8
19	347°01.0	119°18.3	45.6	95°16.3	58.6	230°06.2	16.6	350°29.1	06.8
20	2°03.4	134°17.6	46.6	110°16.8	58.8	245°08.8	16.6	5°31.5	06.8
21	17°05.9	149°17.0	·· 47.5	125°17.2	·· 59.1	260°11.4	·· 16.6	20°34.0	·· 06.8
22	32°08.4	164°16.3	48.4	140°17.7	59.3	275°13.9	16.6	35°36.5	06.8
23	47°10.8	179°15.6	49.3	155°18.2	59.5	290°16.5	16.7	50°39.0	06.8
Mer.pass. 19:52		ν -0.7′ d 0.9′		ν 0.5′ d 0.3′		ν 2.6′ d 0.0′		ν 2.5′ d 0.0′	

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	62°13.3	194°14.9	S16°50.2	170°18.7	S22°59.8	305°19.0	N21°16.7	65°41.5	S04°06.8
1	77°15.8	209°14.2	51.1	185°19.2	23°00.0	320°21.6	16.7	80°44.0	06.8
2	92°18.2	224°13.6	52.0	200°19.7	00.3	335°24.2	16.7	95°46.5	06.8
3	107°20.7	239°12.9	·· 53.0	215°20.2	·· 00.5	350°26.7	·· 16.7	110°49.0	·· 06.9
4	122°23.1	254°12.2	53.9	230°20.7	00.8	5°29.3	16.8	125°51.5	06.9
5	137°25.6	269°11.5	54.8	245°21.1	01.0	20°31.9	16.8	140°53.9	06.9
6	152°28.1	284°10.9	S16°55.7	260°21.6	S23°01.3	35°34.4	N21°16.8	155°56.4	S04°06.9
7	167°30.5	299°10.2	56.6	275°22.1	01.5	50°37.0	16.8	170°58.9	06.9
8	182°33.0	314°09.5	57.5	290°22.6	01.8	65°39.6	16.9	186°01.4	06.9
9	197°35.5	329°08.8	·· 58.4	305°23.1	·· 02.0	80°42.1	·· 16.9	201°03.9	·· 06.9
10	212°37.9	344°08.1	16°59.3	320°23.6	02.3	95°44.7	16.9	216°06.4	06.9
11	227°40.4	359°07.4	17°00.2	335°24.1	02.5	110°47.3	16.9	231°08.9	06.9
12	242°42.9	14°06.8	S17°01.1	350°24.5	S23°02.8	125°49.8	N21°17.0	246°11.4	S04°06.9
13	257°45.3	29°06.1	02.0	5°25.0	03.0	140°52.4	17.0	261°13.8	06.9
14	272°47.8	44°05.4	02.9	20°25.5	03.2	155°55.0	17.0	276°16.3	06.9
15	287°50.2	59°04.7	·· 03.8	35°26.0	·· 03.5	170°57.5	·· 17.0	291°18.8	·· 06.9
16	302°52.7	74°04.0	04.7	50°26.5	03.7	186°00.1	17.1	306°21.3	06.9
17	317°55.2	89°03.3	05.6	65°27.0	04.0	201°02.7	17.1	321°23.8	06.9
18	332°57.6	104°02.7	S17°06.5	80°27.5	S23°04.2	216°05.2	N21°17.1	336°26.3	S04°06.9
19	348°00.1	119°02.0	07.4	95°27.9	04.4	231°07.8	17.1	351°28.8	06.9
20	3°02.6	134°01.3	08.3	110°28.4	04.7	246°10.4	17.2	6°31.2	06.9
21	18°05.0	149°00.6	·· 09.2	125°28.9	·· 04.9	261°12.9	·· 17.2	21°33.7	·· 06.9
22	33°07.5	163°59.9	10.1	140°29.4	05.2	276°15.5	17.2	36°36.2	06.9
23	48°10.0	178°59.2	11.0	155°29.9	05.4	291°18.1	17.2	51°38.7	06.9
Mer.pass. 19:48		ν -0.7′ d 0.9′		ν 0.5′ d 0.2′		ν 2.6′ d 0.0′		ν 2.5′ d 0.0′	

Stars

	SHA	Dec
Alpheratz	357°33.9	29°14.2
Ankaa	353°06.2	-42°10.0
Schedar	349°29.9	56°41.0
Diphda	348°46.4	-17°50.7
Achernar	335°19.2	-57°06.4
Hamal	327°50.1	23°35.2
Polaris	313°10.7	89°22.5
Acamar	315°10.8	-40°12.0
Menkar	314°05.1	4°11.6
Mirfak	308°26.7	49°57.3
Aldebaran	290°38.5	16°33.7
Rigel	281°02.9	-8°10.2
Capella	280°20.4	46°01.4
Bellatrix	278°21.8	6°22.5
Elnath	278°00.6	28°37.8
Alnilam	275°36.7	-1°11.0
Betelgeuse	270°51.0	7°24.8
Canopus	263°51.6	-52°42.3
Sirius	258°25.3	-16°45.0
Adhara	255°05.0	-29°00.2
Procyon	244°49.9	5°09.6
Pollux	243°16.2	27°57.7
Avior	234°14.2	-59°35.2
Suhail	222°45.7	-43°31.9
Miaplacidus	221°37.9	-69°49.0
Alphard	217°47.0	-8°46.1
Regulus	207°33.7	11°50.4
Dubhe	193°40.3	61°36.4
Denebola	182°24.4	14°25.6
Gienah	175°43.1	-17°41.0
Acrux	172°59.8	-63°14.3
Gacrux	171°51.2	-57°15.2
Alioth	166°12.7	55°49.0
Spica	158°21.8	-11°17.7
Alkaid	152°51.9	49°10.9
Hadar	148°35.6	-60°29.7
Menkent	147°57.2	-36°29.7
Arcturus	145°47.6	19°02.8
Rigil Kent.	139°40.0	-60°56.4
Kochab	137°20.9	74°02.8
Zuben'ubi	136°55.6	-16°08.9
Alphecca	126°03.5	26°37.6
Antares	112°15.4	-26°29.3
Atria	107°09.5	-69°04.4
Sabik	102°02.3	-15°45.4
Shaula	96°09.8	-37°07.4
Rasalhague	95°58.2	12°32.5
Eltanin	90°42.3	51°29.2
Kaus Aust.	83°31.9	-34°22.4
Vega	80°33.1	38°48.6
Nunki	75°47.2	-26°15.9
Altair	61°59.5	8°56.3
Peacock	53°04.9	-56°39.3
Deneb	49°25.5	45°22.6
Enif	33°38.1	9°59.8
Al Na'ir	27°32.0	-46°50.3
Fomalhaut	15°13.7	-29°29.2
Scheat	13°44.4	28°13.6
Markab	13°29.1	15°20.8

Nov 21 Fri	SHA	Mer.pass
Venus	134°31.8	11:01
Mars	109°40.0	12:40
Jupiter	243°01.5	03:46
Saturn	3°26.8	19:42

Nov 22 Sat	SHA	Mer.pass
Venus	133°16.9	11:02
Mars	108°52.8	12:39
Jupiter	243°03.5	03:42
Saturn	3°27.6	19:38

Nov 23 Sun	SHA	Mer.pass
Venus	132°01.6	11:04
Mars	108°05.4	12:38
Jupiter	243°05.8	03:38
Saturn	3°28.2	19:34

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h — Sun — Moon

Fri	GHA	Dec	GHA	ν	Dec	d	HP
0	183°33.1	S19°55.1	176°18.9	11.0′	S26°18.1	5.5′	53.9′
1	198°32.9	55.6	190°49.0	11.0′	26°23.6	5.4′	53.9′
2	213°32.7	56.2	205°18.9	10.9′	26°29.0	5.3′	53.9′
3	228°32.6	·· 56.7	219°48.8	10.9′	26°34.3	5.1′	53.9′
4	243°32.4	57.3	234°18.7	10.8′	26°39.4	5.0′	53.9′
5	258°32.3	57.8	248°48.5	10.8′	26°44.4	4.9′	53.9′
6	273°32.1	S19°58.4	263°18.3	10.7′	S26°49.3	4.8′	53.9′
7	288°32.0	58.9	277°48.0	10.7′	26°54.1	4.6′	53.9′
8	303°31.8	19°59.5	292°17.6	10.6′	26°58.7	4.5′	53.9′
9	318°31.6	20°00.0	306°47.2	10.6′	27°03.2	4.4′	53.9′
10	333°31.5	00.6	321°16.8	10.5′	27°07.6	4.3′	53.9′
11	348°31.3	01.1	335°46.3	10.5′	27°11.9	4.1′	53.9′
12	3°31.2	S20°01.6	350°15.8	10.4′	S27°16.0	4.0′	53.9′
13	18°31.0	02.2	4°45.2	10.4′	27°20.0	3.9′	53.9′
14	33°30.8	02.7	19°14.6	10.3′	27°23.9	3.7′	53.9′
15	48°30.7	·· 03.3	33°43.9	10.3′	27°27.6	3.6′	53.9′
16	63°30.5	03.8	48°13.2	10.3′	27°31.2	3.5′	54.0′
17	78°30.3	04.4	62°42.5	10.2′	27°34.7	3.4′	54.0′
18	93°30.2	S20°04.9	77°11.7	10.2′	S27°38.1	3.2′	54.0′
19	108°30.0	05.4	91°40.9	10.1′	27°41.3	3.1′	54.0′
20	123°29.9	06.0	106°10.0	10.1′	27°44.4	2.9′	54.0′
21	138°29.7	·· 06.5	120°39.1	10.1′	27°47.3	2.8′	54.0′
22	153°29.5	07.0	135°08.2	10.0′	27°50.1	2.7′	54.0′
23	168°29.4	07.6	149°37.2	10.0′	27°52.8	2.6′	54.0′
	SD = 16.2′	d = 0.6′	SD = 14.7′				

Sat	GHA	Dec	GHA	ν	Dec	d	HP
0	183°29.2	S20°08.1	164°06.2	10.0′	S27°55.4	2.4′	54.0′
1	198°29.0	08.7	178°35.1	9.9′	27°57.8	2.2′	54.0′
2	213°28.9	09.2	193°04.1	9.9′	28°00.0	2.2′	54.0′
3	228°28.7	·· 09.7	207°33.0	9.9′	28°02.2	2.0′	54.0′
4	243°28.5	10.3	222°01.9	9.8′	28°04.2	1.9′	54.0′
5	258°28.4	10.8	236°30.7	9.8′	28°06.1	1.7′	54.0′
6	273°28.2	S20°11.3	250°59.5	9.8′	S28°07.8	1.6′	54.0′
7	288°28.0	11.9	265°28.3	9.8′	28°09.4	1.4′	54.1′
8	303°27.9	12.4	279°57.1	9.7′	28°10.8	1.4′	54.1′
9	318°27.7	·· 12.9	294°25.8	9.7′	28°12.2	1.1′	54.1′
10	333°27.5	13.5	308°54.6	9.7′	28°13.3	1.1′	54.1′
11	348°27.4	14.0	323°23.3	9.7′	28°14.4	0.9′	54.1′
12	3°27.2	S20°14.5	337°52.0	9.7′	S28°15.3	0.8′	54.1′
13	18°27.0	15.0	352°20.6	9.7′	28°16.1	0.6′	54.1′
14	33°26.9	15.6	6°49.3	9.6′	28°16.7	0.5′	54.1′
15	48°26.7	·· 16.1	21°17.9	9.6′	28°17.2	0.3′	54.1′
16	63°26.5	16.6	35°46.6	9.6′	28°17.5	0.2′	54.1′
17	78°26.3	17.1	50°15.2	9.6′	28°17.7	0.1′	54.1′
18	93°26.2	S20°17.7	64°43.8	9.6′	S28°17.8	0.1′	54.2′
19	108°26.0	18.2	79°12.4	9.6′	28°17.7	0.2′	54.2′
20	123°25.8	18.7	93°40.9	9.6′	28°17.5	0.3′	54.2′
21	138°25.7	·· 19.2	108°09.5	9.6′	28°17.2	0.5′	54.2′
22	153°25.5	19.8	122°38.1	9.6′	28°16.7	0.7′	54.2′
23	168°25.3	20.3	137°06.7	9.6′	28°16.0	0.7′	54.2′
	SD = 16.2′	d = 0.5′	SD = 14.7′				

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	183°25.1	S20°20.8	151°35.2	9.6′	S28°15.3	0.9′	54.2′
1	198°25.0	21.3	166°03.8	9.6′	28°14.4	1.1′	54.2′
2	213°24.8	21.8	180°32.3	9.6′	28°13.3	1.2′	54.2′
3	228°24.6	·· 22.4	195°00.9	9.6′	28°12.1	1.3′	54.2′
4	243°24.4	22.9	209°29.5	9.6′	28°10.8	1.5′	54.3′
5	258°24.3	23.4	223°58.0	9.6′	28°09.3	1.6′	54.3′
6	273°24.1	S20°23.9	238°26.6	9.6′	S28°07.7	1.7′	54.3′
7	288°23.9	24.4	252°55.2	9.6′	28°06.0	1.9′	54.3′
8	303°23.7	24.9	267°23.8	9.6′	28°04.1	2.0′	54.3′
9	318°23.6	·· 25.5	281°52.4	9.6′	28°02.1	2.2′	54.3′
10	333°23.4	26.0	296°21.0	9.6′	27°59.9	2.3′	54.3′
11	348°23.2	26.5	310°49.6	9.6′	27°57.6	2.5′	54.3′
12	3°23.0	S20°27.0	325°18.2	9.6′	S27°55.1	2.6′	54.4′
13	18°22.9	27.5	339°46.8	9.6′	27°52.5	2.7′	54.4′
14	33°22.7	28.0	354°15.5	9.7′	27°49.8	2.8′	54.4′
15	48°22.5	·· 28.5	8°44.1	9.7′	27°47.0	3.1′	54.4′
16	63°22.3	29.1	23°12.8	9.7′	27°43.9	3.1′	54.4′
17	78°22.1	29.6	37°41.5	9.7′	27°40.8	3.3′	54.4′
18	93°22.0	S20°30.1	52°10.2	9.7′	S27°37.5	3.4′	54.4′
19	108°21.8	30.6	66°39.0	9.8′	27°34.1	3.5′	54.5′
20	123°21.6	31.1	81°07.7	9.8′	27°30.6	3.7′	54.5′
21	138°21.4	·· 31.6	95°36.5	9.8′	27°26.9	3.9′	54.5′
22	153°21.3	32.1	110°05.3	9.8′	27°23.0	3.9′	54.5′
23	168°21.1	32.6	124°34.1	9.9′	27°19.1	4.1′	54.5′
	SD = 16.2′	d = 0.5′	SD = 14.8′				

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	07:24	09:09	▬	▬	14:23	16:07
N 70°	07:11	08:39	10:47	12:44	14:52	16:20
68°	07:01	08:18	09:48	13:43	15:14	16:31
66°	06:52	08:00	09:15	14:17	15:31	16:40
64°	06:44	07:46	08:50	14:41	15:45	16:48
62°	06:37	07:34	08:31	15:01	15:57	16:55
60°	06:31	07:24	08:16	15:16	16:08	17:01
N 58°	06:25	07:15	08:02	15:29	16:17	17:06
56°	06:20	07:07	07:51	15:41	16:25	17:11
54°	06:16	07:00	07:41	15:51	16:32	17:16
52°	06:12	06:54	07:32	16:00	16:38	17:20
50°	06:08	06:48	07:24	16:08	16:44	17:24
45°	05:59	06:35	07:07	16:25	16:57	17:33
N 40°	05:51	06:24	06:53	16:39	17:08	17:41
35°	05:43	06:14	06:41	16:51	17:18	17:49
30°	05:36	06:05	06:31	17:01	17:27	17:56
20°	05:23	05:50	06:13	17:19	17:43	18:10
N 10°	05:09	05:35	05:57	17:35	17:57	18:23
0°	04:55	05:21	05:43	17:50	18:12	18:37
S 10°	04:39	05:05	05:28	18:05	18:27	18:54
20°	04:19	04:48	05:12	18:21	18:45	19:13
30°	03:55	04:26	04:53	18:40	19:06	19:38
35°	03:39	04:13	04:42	18:51	19:19	19:54
40°	03:19	03:58	04:29	19:03	19:35	20:14
45°	02:55	03:39	04:14	19:19	19:54	20:39
S 50°	02:20	03:15	03:56	19:37	20:18	21:14
52°	02:02	03:04	03:47	19:46	20:30	21:32
54°	01:39	02:50	03:38	19:56	20:44	21:56
56°	01:06	02:34	03:27	20:07	21:00	22:31
58°	////	02:15	03:14	20:20	21:20	////
S 60°	////	01:50	02:59	20:35	21:46	////

Lat.	Moonrise Fri	Moonrise Sat	Moonrise Sun	Moonset Fri	Moonset Sat	Moonset Sun
N 72°	▬	▬	▬	▬	▬	▬
N 70°	▬	▬	▬	▬	▬	▬
68°	▬	▬	▬	▬	▬	▬
66°	▬	▬	▬	▬	▬	▬
64°	▬	▬	▬	▬	▬	▬
62°	11:44	▬	14:04	13:31	▬	14:47
60°	10:50	12:05	12:48	14:26	14:57	16:03
N 58°	10:17	11:26	12:13	14:59	15:37	16:38
56°	09:53	10:59	11:47	15:23	16:04	17:04
54°	09:34	10:37	11:26	15:42	16:26	17:24
52°	09:18	10:20	11:09	15:59	16:43	17:41
50°	09:04	10:04	10:54	16:13	16:58	17:56
45°	08:35	09:34	10:25	16:42	17:29	18:25
N 40°	08:13	09:10	10:01	17:05	17:53	18:48
35°	07:55	08:51	09:42	17:24	18:12	19:07
30°	07:39	08:34	09:25	17:40	18:29	19:24
20°	07:12	08:06	08:58	18:07	18:57	19:51
N 10°	06:49	07:42	08:34	18:31	19:22	20:14
0°	06:28	07:19	08:11	18:53	19:44	20:36
S 10°	06:07	06:57	07:49	19:15	20:07	20:58
20°	05:44	06:33	07:25	19:38	20:31	21:21
30°	05:18	06:05	06:57	20:06	20:59	21:48
35°	05:03	05:48	06:40	20:22	21:16	22:04
40°	04:45	05:29	06:21	20:41	21:35	22:23
45°	04:23	05:06	05:58	21:04	21:59	22:45
S 50°	03:56	04:36	05:27	21:34	22:29	23:13
52°	03:43	04:21	05:13	21:48	22:44	23:27
54°	03:28	04:04	04:55	22:05	23:02	23:43
56°	03:11	03:44	04:34	22:26	23:23	·· ··
58°	02:49	03:18	04:08	22:51	23:49	·· ··
S 60°	02:22	02:42	03:30	23:26	·· ··	00:27

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 1-3 1-7%
21	14:12	14:05	11:46	12:40	00:15	
22	13:57	13:49	11:46	13:32	01:06	
23	13:41	13:32	11:46	14:24	01:58	

November 24, 25, 26 UT (Mon., Tue., Wed.)

	Aries	Venus		Mars		Jupiter		Saturn	
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	63°12.4	193°58.5	S17°11.9	170°30.4	S23°05.6	306°20.6	N21°17.3	66°41.2	S04°06.9
1	78°14.9	208°57.8	12.8	185°30.8	05.9	321°23.2	17.3	81°43.7	06.9
2	93°17.4	223°57.2	13.7	200°31.3	06.1	336°25.8	17.3	96°46.2	06.9
3	108°19.8	238°56.5	·· 14.6	215°31.8	·· 06.4	351°28.4	·· 17.3	111°48.6	·· 06.9
4	123°22.3	253°55.8	15.5	230°32.3	06.6	6°30.9	17.4	126°51.1	06.9
5	138°24.7	268°55.1	16.4	245°32.8	06.8	21°33.5	17.4	141°53.6	06.9
6	153°27.2	283°54.4	S17°17.2	260°33.2	S23°07.1	36°36.1	N21°17.4	156°56.1	S04°06.8
7	168°29.7	298°53.7	18.1	275°33.7	07.3	51°38.7	17.4	171°58.6	06.8
8	183°32.1	313°53.0	19.0	290°34.2	07.5	66°41.2	17.5	187°01.1	06.8
9	198°34.6	328°52.3	·· 19.9	305°34.7	·· 07.8	81°43.8	·· 17.5	202°03.5	·· 06.8
10	213°37.1	343°51.6	20.8	320°35.2	08.0	96°46.4	17.5	217°06.0	06.8
11	228°39.5	358°50.9	21.7	335°35.6	08.3	111°48.9	17.5	232°08.5	06.8
12	243°42.0	13°50.2	S17°22.6	350°36.1	S23°08.5	126°51.5	N21°17.6	247°11.0	S04°06.8
13	258°44.5	28°49.5	23.5	5°36.6	08.7	141°54.1	17.6	262°13.5	06.8
14	273°46.9	43°48.8	24.3	20°37.1	09.0	156°56.7	17.6	277°16.0	06.8
15	288°49.4	58°48.1	·· 25.2	35°37.6	·· 09.2	171°59.3	·· 17.6	292°18.4	·· 06.8
16	303°51.9	73°47.4	26.1	50°38.0	09.4	187°01.8	17.7	307°20.9	06.8
17	318°54.3	88°46.7	27.0	65°38.5	09.7	202°04.4	17.7	322°23.4	06.8
18	333°56.8	103°46.1	S17°27.9	80°39.0	S23°09.9	217°07.0	N21°17.7	337°25.9	S04°06.8
19	348°59.2	118°45.4	28.7	95°39.5	10.1	232°09.6	17.7	352°28.4	06.8
20	4°01.7	133°44.7	29.6	110°40.0	10.3	247°12.1	17.8	7°30.8	06.8
21	19°04.2	148°44.0	·· 30.5	125°40.4	·· 10.6	262°14.7	·· 17.8	22°33.3	·· 06.8
22	34°06.6	163°43.3	31.4	140°40.9	10.8	277°17.3	17.8	37°35.8	06.8
23	49°09.1	178°42.6	32.2	155°41.4	11.0	292°19.9	17.8	52°38.3	06.8
Mer.pass. 19:44		ν -0.7′	d 0.9′	m -3.90	ν 0.5′	d 0.2′	m 1.34	ν 2.6′	d 0.0′ m -2.49	ν 2.5′	d 0.0′ m 0.88

Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	64°11.6	193°41.9	S17°33.1	170°41.9	S23°11.3	307°22.5	N21°17.9	67°40.8	S04°06.8
1	79°14.0	208°41.1	34.0	185°42.3	11.5	322°25.0	17.9	82°43.2	06.8
2	94°16.5	223°40.4	34.9	200°42.8	11.7	337°27.6	17.9	97°45.7	06.8
3	109°19.0	238°39.7	·· 35.7	215°43.3	·· 12.0	352°30.2	·· 17.9	112°48.2	·· 06.8
4	124°21.4	253°39.0	36.6	230°43.8	12.2	7°32.8	18.0	127°50.7	06.8
5	139°23.9	268°38.3	37.5	245°44.3	12.4	22°35.4	18.0	142°53.2	06.8
6	154°26.4	283°37.6	S17°38.4	260°44.7	S23°12.6	37°37.9	N21°18.0	157°55.6	S04°06.8
7	169°28.8	298°36.9	39.2	275°45.2	12.9	52°40.5	18.0	172°58.1	06.8
8	184°31.3	313°36.2	40.1	290°45.7	13.1	67°43.1	18.1	188°00.6	06.8
9	199°33.7	328°35.5	·· 41.0	305°46.2	·· 13.3	82°45.7	·· 18.1	203°03.1	·· 06.8
10	214°36.2	343°34.8	41.8	320°46.6	13.5	97°48.3	18.1	218°05.6	06.8
11	229°38.7	358°34.1	42.7	335°47.1	13.8	112°50.9	18.2	233°08.0	06.8
12	244°41.1	13°33.4	S17°43.6	350°47.6	S23°14.0	127°53.4	N21°18.2	248°10.5	S04°06.8
13	259°43.6	28°32.7	44.4	5°48.1	14.2	142°56.0	18.2	263°13.0	06.8
14	274°46.1	43°32.0	45.3	20°48.5	14.4	157°58.6	18.2	278°15.5	06.8
15	289°48.5	58°31.3	·· 46.2	35°49.0	·· 14.7	173°01.2	·· 18.3	293°18.0	·· 06.8
16	304°51.0	73°30.6	47.0	50°49.5	14.9	188°03.8	18.3	308°20.4	06.8
17	319°53.5	88°29.9	47.9	65°49.9	15.1	203°06.4	18.3	323°22.9	06.8
18	334°55.9	103°29.1	S17°48.7	80°50.4	S23°15.3	218°08.9	N21°18.3	338°25.4	S04°06.8
19	349°58.4	118°28.4	49.6	95°50.9	15.6	233°11.5	18.4	353°27.9	06.8
20	5°00.9	133°27.7	50.5	110°51.4	15.8	248°14.1	18.4	8°30.3	06.8
21	20°03.3	148°27.0	·· 51.3	125°51.8	·· 16.0	263°16.7	·· 18.4	23°32.8	·· 06.7
22	35°05.8	163°26.3	52.2	140°52.3	16.2	278°19.3	18.5	38°35.3	06.7
23	50°08.2	178°25.6	53.0	155°52.8	16.4	293°21.9	18.5	53°37.8	06.7
Mer.pass. 19:40		ν -0.7′	d 0.9′	m -3.90	ν 0.5′	d 0.2′	m 1.34	ν 2.6′	d 0.0′ m -2.49	ν 2.5′	d 0.0′ m 0.89

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	65°10.7	193°24.9	S17°53.9	170°53.3	S23°16.7	308°24.5	N21°18.5	68°40.3	S04°06.7
1	80°13.2	208°24.2	54.7	185°53.7	16.9	323°27.1	18.5	83°42.7	06.7
2	95°15.6	223°23.4	55.6	200°54.2	17.1	338°29.6	18.6	98°45.2	06.7
3	110°18.1	238°22.7	·· 56.4	215°54.7	·· 17.3	353°32.2	·· 18.6	113°47.7	·· 06.7
4	125°20.6	253°22.0	57.3	230°55.1	17.5	8°34.8	18.6	128°50.2	06.7
5	140°23.0	268°21.3	58.1	245°55.6	17.8	23°37.4	18.6	143°52.6	06.7
6	155°25.5	283°20.6	S17°59.0	260°56.1	S23°18.0	38°40.0	N21°18.7	158°55.1	S04°06.7
7	170°28.0	298°19.9	17°59.8	275°56.6	18.2	53°42.6	18.7	173°57.6	06.7
8	185°30.4	313°19.1	18°00.7	290°57.0	18.4	68°45.2	18.7	189°00.1	06.7
9	200°32.9	328°18.4	·· 01.5	305°57.5	·· 18.6	83°47.8	·· 18.8	204°02.5	·· 06.7
10	215°35.3	343°17.7	02.4	320°58.0	18.8	98°50.4	18.8	219°05.0	06.7
11	230°37.8	358°17.0	03.2	335°58.4	19.1	113°53.0	18.8	234°07.5	06.7
12	245°40.3	13°16.3	S18°04.1	350°58.9	S23°19.3	128°55.5	N21°18.8	249°10.0	S04°06.7
13	260°42.7	28°15.5	04.9	5°59.4	19.5	143°58.1	18.9	264°12.4	06.7
14	275°45.2	43°14.8	05.8	20°59.8	19.7	159°00.7	18.9	279°14.9	06.7
15	290°47.7	58°14.1	·· 06.6	36°00.3	·· 19.9	174°03.3	·· 18.9	294°17.4	·· 06.7
16	305°50.1	73°13.4	07.4	51°00.8	20.1	189°05.9	19.0	309°19.9	06.7
17	320°52.6	88°12.7	08.3	66°01.3	20.3	204°08.5	19.0	324°22.3	06.7
18	335°55.1	103°11.9	S18°09.1	81°01.7	S23°20.5	219°11.1	N21°19.0	339°24.8	S04°06.6
19	350°57.5	118°11.2	10.0	96°02.2	20.8	234°13.7	19.0	354°27.3	06.6
20	6°00.0	133°10.5	10.8	111°02.7	21.0	249°16.3	19.1	9°29.7	06.6
21	21°02.5	148°09.8	·· 11.6	126°03.1	·· 21.2	264°18.9	·· 19.1	24°32.2	·· 06.6
22	36°04.9	163°09.0	12.5	141°03.6	21.4	279°21.5	19.1	39°34.7	06.6
23	51°07.4	178°08.3	13.3	156°04.1	21.6	294°24.1	19.2	54°37.2	06.6
Mer.pass. 19:36		ν -0.7′	d 0.9′	m -3.90	ν 0.5′	d 0.2′	m 1.33	ν 2.6′	d 0.0′ m -2.50	ν 2.5′	d 0.0′ m 0.89

Stars

	SHA	Dec
Alpheratz	357°33.9	29°14.2
Ankaa	353°06.2	-42°10.0
Schedar	349°29.9	56°41.1
Diphda	348°46.4	-17°50.7
Achernar	335°19.2	-57°06.4
Hamal	327°50.1	23°35.2
Polaris	313°10.7	89°22.5
Acamar	315°10.8	-40°12.0
Menkar	314°05.1	4°11.6
Mirfak	308°26.7	49°57.3
Aldebaran	290°38.5	16°33.7
Rigel	281°02.9	-8°10.2
Capella	280°20.4	46°01.4
Bellatrix	278°21.8	6°22.5
Elnath	278°00.6	28°37.8
Alnilam	275°36.7	-1°11.0
Betelgeuse	270°51.0	7°24.8
Canopus	263°51.6	-52°42.3
Sirius	258°25.3	-16°45.0
Adhara	255°05.0	-29°00.2
Procyon	244°49.9	5°09.6
Pollux	243°16.2	27°57.7
Avior	234°14.1	-59°35.2
Suhail	222°45.7	-43°31.9
Miaplacidus	221°37.9	-69°49.0
Alphard	217°47.0	-8°46.1
Regulus	207°33.7	11°50.4
Dubhe	193°40.3	61°36.4
Denebola	182°24.4	14°25.6
Gienah	175°43.0	-17°41.0
Acrux	172°59.7	-63°14.3
Gacrux	171°51.2	-57°15.2
Alioth	166°12.7	55°48.9
Spica	158°21.8	-11°17.7
Alkaid	152°51.8	49°10.9
Hadar	148°35.6	-60°29.7
Menkent	147°57.1	-36°29.7
Arcturus	145°47.6	19°02.8
Rigil Kent.	139°40.0	-60°56.4
Kochab	137°20.9	74°02.8
Zuben'ubi	136°55.6	-16°08.9
Alphecca	126°03.5	26°37.6
Antares	112°15.3	-26°29.3
Atria	107°09.5	-69°04.4
Sabik	102°02.3	-15°45.4
Shaula	96°09.8	-37°07.4
Rasalhague	95°58.2	12°32.5
Eltanin	90°42.3	51°29.2
Kaus Aust.	83°31.9	-34°22.4
Vega	80°33.1	38°48.6
Nunki	75°47.2	-26°15.9
Altair	61°59.5	8°56.3
Peacock	53°04.9	-56°39.3
Deneb	49°25.5	45°22.6
Enif	33°38.2	9°59.8
Al Na'ir	27°32.0	-46°50.3
Fomalhaut	15°13.7	-29°29.2
Scheat	13°44.4	28°13.6
Markab	13°29.1	15°20.8

Nov 24 Mon	SHA	Mer.pass
Venus	130°46.1	11:05
Mars	107°17.9	12:38
Jupiter	243°08.2	03:34
Saturn	3°28.8	19:30

Nov 25 Tue	SHA	Mer.pass
Venus	129°30.3	11:06
Mars	106°30.3	12:37
Jupiter	243°10.9	03:30
Saturn	3°29.2	19:26

Nov 26 Wed	SHA	Mer.pass
Venus	128°14.2	11:07
Mars	105°42.6	12:36
Jupiter	243°13.8	03:26
Saturn	3°29.5	19:22

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°20.9	S20°33.1	139°03.0	9.9′	S27°15.0	4.3′	54.5′
1	198°20.7	33.6	153°31.9	9.9′	27°10.7	4.3′	54.5′
2	213°20.5	34.1	168°00.8	9.9′	27°06.4	4.6′	54.6′
3	228°20.3	·· 34.6	182°29.7	10.0′	27°01.8	4.6′	54.6′
4	243°20.2	35.1	196°58.7	10.0′	26°57.2	4.8′	54.6′
5	258°20.0	35.6	211°27.7	10.0′	26°52.4	4.9′	54.6′
6	273°19.8	S20°36.1	225°56.7	10.1′	S26°47.5	5.0′	54.6′
7	288°19.6	36.6	240°25.8	10.1′	26°42.5	5.2′	54.6′
8	303°19.4	37.1	254°54.8	10.1′	26°37.3	5.3′	54.7′
9	318°19.2	·· 37.6	269°24.0	10.2′	26°32.0	5.5′	54.7′
10	333°19.1	38.1	283°53.1	10.2′	26°26.5	5.5′	54.7′
11	348°18.9	38.6	298°22.3	10.2′	26°21.0	5.8′	54.7′
12	3°18.7	S20°39.1	312°51.6	10.3′	S26°15.2	5.8′	54.7′
13	18°18.5	39.6	327°20.8	10.3′	26°09.4	6.0′	54.7′
14	33°18.3	40.1	341°50.1	10.3′	26°03.4	6.1′	54.8′
15	48°18.1	·· 40.6	356°19.5	10.4′	25°57.3	6.2′	54.8′
16	63°18.0	41.1	10°48.8	10.4′	25°51.1	6.3′	54.8′
17	78°17.8	41.6	25°18.3	10.5′	25°44.8	6.5′	54.8′
18	93°17.6	S20°42.1	39°47.7	10.5′	S25°38.3	6.6′	54.8′
19	108°17.4	42.6	54°17.2	10.5′	25°31.7	6.8′	54.8′
20	123°17.2	43.1	68°46.8	10.6′	25°24.9	6.8′	54.9′
21	138°17.0	·· 43.6	83°16.3	10.6′	25°18.1	7.0′	54.9′
22	153°16.8	44.1	97°46.0	10.7′	25°11.1	7.2′	54.9′
23	168°16.6	44.5	112°15.6	10.7′	25°03.9	7.2′	54.9′
	SD = 16.2′	d = 0.5′	SD = 14.9′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°16.4	S20°45.0	126°45.3	10.8′	S24°56.7	7.4′	54.9′
1	198°16.3	45.5	141°15.1	10.8′	24°49.3	7.5′	55.0′
2	213°16.1	46.0	155°44.9	10.8′	24°41.8	7.6′	55.0′
3	228°15.9	·· 46.5	170°14.7	10.9′	24°34.2	7.7′	55.0′
4	243°15.7	47.0	184°44.6	10.9′	24°26.5	7.9′	55.0′
5	258°15.5	47.5	199°14.6	11.0′	24°18.6	7.9′	55.1′
6	273°15.3	S20°48.0	213°44.5	11.0′	S24°10.7	8.1′	55.1′
7	288°15.1	48.4	228°14.6	11.1′	24°02.6	8.2′	55.1′
8	303°14.9	48.9	242°44.6	11.1′	23°54.4	8.4′	55.1′
9	318°14.7	·· 49.4	257°14.8	11.2′	23°46.0	8.4′	55.1′
10	333°14.5	49.9	271°44.9	11.2′	23°37.6	8.6′	55.2′
11	348°14.4	50.4	286°15.1	11.3′	23°29.0	8.7′	55.2′
12	3°14.2	S20°50.9	300°45.4	11.3′	S23°20.3	8.8′	55.2′
13	18°14.0	51.3	315°15.7	11.4′	23°11.5	8.9′	55.2′
14	33°13.8	51.8	329°46.0	11.4′	23°02.6	9.1′	55.2′
15	48°13.6	·· 52.3	344°16.4	11.4′	22°53.5	9.1′	55.3′
16	63°13.4	52.8	358°46.9	11.5′	22°44.4	9.3′	55.3′
17	78°13.2	53.2	13°17.4	11.5′	22°35.1	9.4′	55.3′
18	93°13.0	S20°53.7	27°47.9	11.6′	S22°25.7	9.4′	55.3′
19	108°12.8	54.2	42°18.5	11.6′	22°16.3	9.6′	55.4′
20	123°12.6	54.7	56°49.1	11.7′	22°06.7	9.8′	55.4′
21	138°12.4	·· 55.2	71°19.8	11.7′	21°56.9	9.8′	55.4′
22	153°12.2	55.6	85°50.5	11.8′	21°47.1	9.9′	55.4′
23	168°12.0	56.1	100°21.3	11.8′	21°37.2	10.0′	55.5′
	SD = 16.2′	d = 0.5′	SD = 15.0′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°11.8	S20°56.6	114°52.1	11.9′	S21°27.2	10.2′	55.5′
1	198°11.6	57.0	129°23.0	11.9′	21°17.0	10.2′	55.5′
2	213°11.4	57.5	143°53.9	12.0′	21°06.8	10.4′	55.5′
3	228°11.2	·· 58.0	158°24.9	12.0′	20°56.4	10.5′	55.6′
4	243°11.0	58.5	172°55.9	12.1′	20°45.9	10.5′	55.6′
5	258°10.8	58.9	187°27.0	12.1′	20°35.4	10.7′	55.6′
6	273°10.6	S20°59.4	201°58.1	12.1′	S20°24.7	10.8′	55.6′
7	288°10.4	20°59.9	216°29.2	12.2′	20°13.9	10.9′	55.7′
8	303°10.2	21°00.3	231°00.4	12.2′	20°03.0	10.9′	55.7′
9	318°10.0	·· 00.8	245°31.6	12.3′	19°52.1	11.1′	55.7′
10	333°09.8	01.3	260°02.9	12.3′	19°41.0	11.2′	55.8′
11	348°09.6	01.7	274°34.2	12.4′	19°29.8	11.3′	55.8′
12	3°09.4	S21°02.2	289°05.6	12.4′	S19°18.5	11.4′	55.8′
13	18°09.2	02.7	303°37.0	12.4′	19°07.1	11.4′	55.8′
14	33°09.0	03.1	318°08.4	12.5′	18°55.7	11.6′	55.9′
15	48°08.8	·· 03.6	332°39.9	12.5′	18°44.1	11.7′	55.9′
16	63°08.6	04.0	347°11.5	12.6′	18°32.4	11.7′	55.9′
17	78°08.4	04.5	1°43.0	12.6′	18°20.7	11.9′	55.9′
18	93°08.2	S21°05.0	16°14.7	12.7′	S18°08.8	11.9′	56.0′
19	108°08.0	05.4	30°46.3	12.7′	17°56.9	12.1′	56.0′
20	123°07.8	05.9	45°18.0	12.7′	17°44.8	12.1′	56.0′
21	138°07.6	·· 06.3	59°49.7	12.8′	17°32.7	12.3′	56.1′
22	153°07.4	06.8	74°21.5	12.8′	17°20.4	12.3′	56.1′
23	168°07.2	07.3	88°53.3	12.8′	17°08.1	12.4′	56.1′
	SD = 16.2′	d = 0.5′	SD = 15.1′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	07:34	09:23	▬	▬	14:10	15:59
N 70°	07:20	08:51	▬	▬	14:43	16:13
68°	07:08	08:27	10:04	13:30	15:06	16:25
66°	06:58	08:09	09:26	14:08	15:25	16:35
64°	06:50	07:54	08:59	14:34	15:40	16:43
62°	06:43	07:41	08:39	14:54	15:53	16:51
60°	06:36	07:30	08:22	15:11	16:03	16:57
N 58°	06:30	07:21	08:09	15:25	16:13	17:03
56°	06:25	07:12	07:57	15:37	16:21	17:08
54°	06:20	07:05	07:46	15:47	16:29	17:13
52°	06:16	06:58	07:37	15:57	16:36	17:18
50°	06:12	06:52	07:29	16:05	16:42	17:22
45°	06:02	06:38	07:11	16:23	16:55	17:32
N 40°	05:53	06:27	06:56	16:37	17:07	17:40
35°	05:46	06:17	06:44	16:50	17:17	17:48
30°	05:38	06:08	06:33	17:00	17:26	17:56
20°	05:24	05:51	06:15	17:19	17:43	18:10
N 10°	05:10	05:36	05:59	17:35	17:58	18:24
0°	04:56	05:21	05:43	17:51	18:13	18:39
S 10°	04:39	05:05	05:28	18:06	18:29	18:55
20°	04:19	04:47	05:11	18:23	18:47	19:15
30°	03:53	04:25	04:52	18:42	19:09	19:41
35°	03:37	04:12	04:41	18:54	19:22	19:58
40°	03:17	03:56	04:28	19:07	19:38	20:18
45°	02:51	03:37	04:12	19:22	19:58	20:44
S 50°	02:15	03:12	03:53	19:42	20:23	21:20
52°	01:56	03:00	03:44	19:51	20:36	21:40
54°	01:30	02:45	03:34	20:01	20:50	22:06
56°	00:52	02:28	03:22	20:13	21:07	22:46
58°	////	02:07	03:09	20:27	21:29	////
S 60°	////	01:40	02:53	20:43	21:57	////

Lat.	**Moonrise** Mon	Tue	Wed	**Moonset** Mon	Tue	Wed
N 72°	▬	▬	▬	▬	▬	▬
N 70°	▬	▬	15:26	▬	▬	18:40
68°	▬	▬	14:41	▬	▬	19:24
66°	▬	14:53	14:11	▬	17:31	19:53
64°	▬	14:06	13:48	▬	18:17	20:14
62°	13:43	13:35	13:29	16:56	18:47	20:32
60°	13:05	13:12	13:14	17:33	19:09	20:46
N 58°	12:39	12:53	13:01	17:59	19:27	20:58
56°	12:18	12:37	12:50	18:19	19:43	21:08
54°	12:01	12:24	12:40	18:36	19:56	21:18
52°	11:46	12:12	12:31	18:51	20:07	21:26
50°	11:33	12:02	12:23	19:03	20:17	21:33
45°	11:06	11:39	12:06	19:29	20:38	21:49
N 40°	10:45	11:22	11:53	19:50	20:55	22:01
35°	10:27	11:07	11:41	20:07	21:09	22:12
30°	10:12	10:53	11:30	20:22	21:21	22:21
20°	09:46	10:31	11:12	20:46	21:42	22:37
N 10°	09:24	10:12	10:56	21:08	22:00	22:51
0°	09:03	09:53	10:42	21:27	22:17	23:04
S 10°	08:42	09:35	10:27	21:47	22:33	23:17
20°	08:19	09:15	10:11	22:08	22:51	23:30
30°	07:53	08:52	09:52	22:32	23:11	23:46
35°	07:38	08:39	09:42	22:46	23:23	23:55
40°	07:20	08:23	09:29	23:03	23:36	·· ··
45°	06:58	08:05	09:15	23:22	23:52	·· ··
S 50°	06:30	07:41	08:56	23:47	·· ··	00:12
52°	06:17	07:30	08:48	23:58	·· ··	00:21
54°	06:01	07:17	08:38	·· ··	00:11	00:31
56°	05:43	07:03	08:27	00:02	00:27	00:42
58°	05:20	06:45	08:15	00:25	00:45	00:56
S 60°	04:50	06:24	08:00	00:55	01:07	01:11

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 4-6 12-28%
24	13:24	13:15	11:47	15:15	02:50	
25	13:06	12:57	11:47	16:05	03:40	
26	12:47	12:38	11:47	16:53	04:29	

November 27, 28, 29 UT (Thu., Fri., Sat.)

	Aries	Venus		Mars		Jupiter		Saturn	
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	66°09.8	193°07.6	S18°14.1	171°04.5	S23°21.8	309°26.7	N21°19.2	69°39.6	S04°06.6
1	81°12.3	208°06.9	15.0	186°05.0	22.0	324°29.3	19.2	84°42.1	06.6
2	96°14.8	223°06.1	15.8	201°05.5	22.2	339°31.9	19.2	99°44.6	06.6
3	111°17.2	238°05.4	·· 16.6	216°05.9	·· 22.4	354°34.5	·· 19.3	114°47.1	·· 06.6
4	126°19.7	253°04.7	17.5	231°06.4	22.7	9°37.1	19.3	129°49.5	06.6
5	141°22.2	268°03.9	18.3	246°06.9	22.9	24°39.7	19.3	144°52.0	06.6
6	156°24.6	283°03.2	S18°19.1	261°07.3	S23°23.1	39°42.3	N21°19.4	159°54.5	S04°06.6
7	171°27.1	298°02.5	20.0	276°07.8	23.3	54°44.9	19.4	174°56.9	06.6
8	186°29.6	313°01.8	20.8	291°08.3	23.5	69°47.5	19.4	189°59.4	06.6
9	201°32.0	328°01.0	·· 21.6	306°08.7	·· 23.7	84°50.1	·· 19.4	205°01.9	·· 06.6
10	216°34.5	343°00.3	22.4	321°09.2	23.9	99°52.7	19.5	220°04.4	06.5
11	231°37.0	357°59.6	23.3	336°09.7	24.1	114°55.3	19.5	235°06.8	06.5
12	246°39.4	12°58.8	S18°24.1	351°10.1	S23°24.3	129°57.9	N21°19.5	250°09.3	S04°06.5
13	261°41.9	27°58.1	24.9	6°10.6	24.5	145°00.5	19.6	265°11.8	06.5
14	276°44.3	42°57.4	25.7	21°11.0	24.7	160°03.1	19.6	280°14.2	06.5
15	291°46.8	57°56.6	·· 26.6	36°11.5	·· 24.9	175°05.7	·· 19.6	295°16.7	·· 06.5
16	306°49.3	72°55.9	27.4	51°12.0	25.1	190°08.3	19.7	310°19.2	06.5
17	321°51.7	87°55.2	28.2	66°12.4	25.3	205°10.9	19.7	325°21.6	06.5
18	336°54.2	102°54.4	S18°29.0	81°12.9	S23°25.5	220°13.5	N21°19.7	340°24.1	S04°06.5
19	351°56.7	117°53.7	29.8	96°13.4	25.7	235°16.1	19.7	355°26.6	06.5
20	6°59.1	132°53.0	30.7	111°13.8	25.9	250°18.7	19.8	10°29.1	06.5
21	22°01.6	147°52.2	·· 31.5	126°14.3	·· 26.1	265°21.3	·· 19.8	25°31.5	·· 06.5
22	37°04.1	162°51.5	32.3	141°14.8	26.3	280°23.9	19.8	40°34.0	06.5
23	52°06.5	177°50.7	33.1	156°15.2	26.5	295°26.5	19.9	55°36.5	06.5
Mer.pass. 19:32		ν -0.7′ d 0.8′	m -3.90	ν 0.5′ d 0.2′	m 1.33	ν 2.6′ d 0.0′	m -2.51	ν 2.5′ d 0.0′	m 0.90

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	67°09.0	192°50.0	S18°33.9	171°15.7	S23°26.7	310°29.1	N21°19.9	70°38.9	S04°06.4
1	82°11.5	207°49.3	34.7	186°16.1	26.9	325°31.7	19.9	85°41.4	06.4
2	97°13.9	222°48.5	35.5	201°16.6	27.1	340°34.3	20.0	100°43.9	06.4
3	112°16.4	237°47.8	·· 36.4	216°17.1	·· 27.3	355°36.9	·· 20.0	115°46.3	·· 06.4
4	127°18.8	252°47.0	37.2	231°17.5	27.5	10°39.5	20.0	130°48.8	06.4
5	142°21.3	267°46.3	38.0	246°18.0	27.7	25°42.1	20.1	145°51.3	06.4
6	157°23.8	282°45.6	S18°38.8	261°18.5	S23°27.9	40°44.7	N21°20.1	160°53.7	S04°06.4
7	172°26.2	297°44.8	39.6	276°18.9	28.1	55°47.3	20.1	175°56.2	06.4
8	187°28.7	312°44.1	40.4	291°19.4	28.3	70°50.0	20.1	190°58.7	06.4
9	202°31.2	327°43.3	·· 41.2	306°19.8	·· 28.5	85°52.6	·· 20.2	206°01.1	·· 06.4
10	217°33.6	342°42.6	42.0	321°20.3	28.7	100°55.2	20.2	221°03.6	06.4
11	232°36.1	357°41.8	42.8	336°20.8	28.9	115°57.8	20.2	236°06.1	06.4
12	247°38.6	12°41.1	S18°43.6	351°21.2	S23°29.1	131°00.4	N21°20.3	251°08.5	S04°06.3
13	262°41.0	27°40.4	44.4	6°21.7	29.3	146°03.0	20.3	266°11.0	06.3
14	277°43.5	42°39.6	45.2	21°22.1	29.5	161°05.6	20.3	281°13.5	06.3
15	292°45.9	57°38.9	·· 46.0	36°22.6	·· 29.7	176°08.2	·· 20.4	296°15.9	·· 06.3
16	307°48.4	72°38.1	46.8	51°23.1	29.9	191°10.8	20.4	311°18.4	06.3
17	322°50.9	87°37.4	47.6	66°23.5	30.1	206°13.4	20.4	326°20.9	06.3
18	337°53.3	102°36.6	S18°48.4	81°24.0	S23°30.3	221°16.0	N21°20.5	341°23.3	S04°06.3
19	352°55.8	117°35.9	49.2	96°24.4	30.5	236°18.7	20.5	356°25.8	06.3
20	7°58.3	132°35.1	50.0	111°24.9	30.7	251°21.3	20.5	11°28.3	06.3
21	23°00.7	147°34.4	·· 50.8	126°25.3	·· 30.9	266°23.9	·· 20.5	26°30.7	·· 06.3
22	38°03.2	162°33.6	51.6	141°25.8	31.0	281°26.5	20.6	41°33.2	06.3
23	53°05.7	177°32.9	52.4	156°26.3	31.2	296°29.1	20.6	56°35.7	06.2
Mer.pass. 19:28		ν -0.7′ d 0.8′	m -3.90	ν 0.5′ d 0.2′	m 1.32	ν 2.6′ d 0.0′	m -2.52	ν 2.5′ d 0.0′	m 0.90

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	68°08.1	192°32.1	S18°53.2	171°26.7	S23°31.4	311°31.7	N21°20.6	71°38.1	S04°06.2
1	83°10.6	207°31.4	54.0	186°27.2	31.6	326°34.3	20.7	86°40.6	06.2
2	98°13.1	222°30.6	54.8	201°27.6	31.8	341°36.9	20.7	101°43.0	06.2
3	113°15.5	237°29.9	·· 55.6	216°28.1	·· 32.0	356°39.6	·· 20.7	116°45.5	·· 06.2
4	128°18.0	252°29.1	56.4	231°28.5	32.2	11°42.2	20.8	131°48.0	06.2
5	143°20.4	267°28.4	57.1	246°29.0	32.4	26°44.8	20.8	146°50.4	06.2
6	158°22.9	282°27.6	S18°57.9	261°29.5	S23°32.6	41°47.4	N21°20.8	161°52.9	S04°06.2
7	173°25.4	297°26.8	58.7	276°29.9	32.7	56°50.0	20.9	176°55.4	06.2
8	188°27.8	312°26.1	18°59.5	291°30.4	32.9	71°52.6	20.9	191°57.8	06.2
9	203°30.3	327°25.3	19°00.3	306°30.8	·· 33.1	86°55.3	·· 20.9	207°00.3	·· 06.1
10	218°32.8	342°24.6	01.1	321°31.3	33.3	101°57.9	21.0	222°02.8	06.1
11	233°35.2	357°23.8	01.8	336°31.7	33.5	117°00.5	21.0	237°05.2	06.1
12	248°37.7	12°23.1	S19°02.6	351°32.2	S23°33.7	132°03.1	N21°21.0	252°07.7	S04°06.1
13	263°40.2	27°22.3	03.4	6°32.7	33.9	147°05.7	21.1	267°10.1	06.1
14	278°42.6	42°21.6	04.2	21°33.1	34.0	162°08.3	21.1	282°12.6	06.1
15	293°45.1	57°20.8	·· 05.0	36°33.6	·· 34.2	177°11.0	·· 21.1	297°15.1	·· 06.1
16	308°47.5	72°20.0	05.7	51°34.0	34.4	192°13.6	21.2	312°17.5	06.1
17	323°50.0	87°19.3	06.5	66°34.5	34.6	207°16.2	21.2	327°20.0	06.1
18	338°52.5	102°18.5	S19°07.3	81°34.9	S23°34.8	222°18.8	N21°21.2	342°22.4	S04°06.0
19	353°54.9	117°17.8	08.1	96°35.4	35.0	237°21.4	21.3	357°24.9	06.0
20	8°57.4	132°17.0	08.8	111°35.8	35.1	252°24.1	21.3	12°27.4	06.0
21	23°59.9	147°16.2	·· 09.6	126°36.3	·· 35.3	267°26.7	·· 21.3	27°29.8	·· 06.0
22	39°02.3	162°15.5	10.4	141°36.7	35.5	282°29.3	21.4	42°32.3	06.0
23	54°04.8	177°14.7	11.2	156°37.2	35.7	297°31.9	21.4	57°34.7	06.0
Mer.pass. 19:24		ν -0.8′ d 0.8′	m -3.90	ν 0.5′ d 0.2′	m 1.32	ν 2.6′ d 0.0′	m -2.52	ν 2.5′ d 0.0′	m 0.91

Stars

	SHA	Dec
Alpheratz	357°33.9	29°14.2
Ankaa	353°06.2	-42°10.0
Schedar	349°29.9	56°41.1
Diphda	348°46.4	-17°50.7
Achernar	335°19.2	-57°06.4
Hamal	327°50.1	23°35.2
Polaris	313°10.9	89°22.5
Acamar	315°10.8	-40°12.0
Menkar	314°05.1	4°11.6
Mirfak	308°26.7	49°57.3
Aldebaran	290°38.4	16°33.7
Rigel	281°02.8	-8°10.2
Capella	280°20.3	46°01.4
Bellatrix	278°21.8	6°22.5
Elnath	278°00.6	28°37.8
Alnilam	275°36.7	-1°11.0
Betelgeuse	270°51.0	7°24.8
Canopus	263°51.6	-52°42.3
Sirius	258°25.3	-16°45.0
Adhara	255°05.0	-29°00.3
Procyon	244°49.9	5°09.5
Pollux	243°16.2	27°57.7
Avior	234°14.1	-59°35.2
Suhail	222°45.6	-43°32.0
Miaplacidus	221°37.8	-69°49.1
Alphard	217°47.0	-8°46.2
Regulus	207°33.6	11°50.4
Dubhe	193°40.2	61°36.4
Denebola	182°24.3	14°25.6
Gienah	175°43.0	-17°41.0
Acrux	172°59.7	-63°14.3
Gacrux	171°51.2	-57°15.2
Alioth	166°12.7	55°48.9
Spica	158°21.8	-11°17.7
Alkaid	152°51.8	49°10.9
Hadar	148°35.6	-60°29.7
Menkent	147°57.1	-36°29.7
Arcturus	145°47.6	19°02.8
Rigil Kent.	139°39.9	-60°56.4
Kochab	137°20.9	74°02.7
Zuben'ubi	136°55.5	-16°08.9
Alphecca	126°03.5	26°37.6
Antares	112°15.3	-26°29.3
Atria	107°09.5	-69°04.4
Sabik	102°02.3	-15°45.4
Shaula	96°09.8	-37°07.4
Rasalhague	95°58.2	12°32.5
Eltanin	90°42.4	51°29.2
Kaus Aust.	83°31.9	-34°22.4
Vega	80°33.1	38°48.6
Nunki	75°47.2	-26°15.9
Altair	61°59.5	8°56.3
Peacock	53°04.9	-56°39.3
Deneb	49°25.5	45°22.6
Enif	33°38.2	9°59.7
Al Na'ir	27°32.1	-46°50.3
Fomalhaut	15°13.7	-29°29.2
Scheat	13°44.5	28°13.6
Markab	13°29.1	15°20.8

Nov 27 Thu	SHA	Mer.pass
Venus	126°57.7	11:08
Mars	104°54.7	12:35
Jupiter	243°16.8	03:22
Saturn	3°29.8	19:18

Nov 28 Fri	SHA	Mer.pass
Venus	125°41.0	11:09
Mars	104°06.7	12:35
Jupiter	243°20.1	03:17
Saturn	3°29.9	19:14

Nov 29 Sat	SHA	Mer.pass
Venus	124°24.0	11:10
Mars	103°18.6	12:34
Jupiter	243°23.6	03:13
Saturn	3°30.0	19:10

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°07.0	S21°07.7	103°25.2	12.9′	S16°55.7	12.5′	56.2′
1	198°06.8	08.2	117°57.0	12.9′	16°43.2	12.6′	56.2′
2	213°06.6	08.6	132°29.0	13.0′	16°30.6	12.6′	56.2′
3	228°06.4	·· 09.1	147°00.9	13.0′	16°18.0	12.8′	56.2′
4	243°06.2	09.5	161°32.9	13.0′	16°05.2	12.8′	56.3′
5	258°06.0	10.0	176°04.9	13.0′	15°52.4	13.0′	56.3′
6	273°05.8	S21°10.4	190°37.0	13.1′	S15°39.4	13.0′	56.3′
7	288°05.6	10.9	205°09.0	13.1′	15°26.4	13.1′	56.4′
8	303°05.4	11.3	219°41.1	13.1′	15°13.3	13.1′	56.4′
9	318°05.2	·· 11.8	234°13.3	13.2′	15°00.2	13.3′	56.4′
10	333°05.0	12.2	248°45.5	13.2′	14°46.9	13.3′	56.5′
11	348°04.8	12.7	263°17.7	13.2′	14°33.6	13.5′	56.5′
12	3°04.5	S21°13.1	277°49.9	13.3′	S14°20.1	13.5′	56.5′
13	18°04.3	13.6	292°22.1	13.3′	14°06.6	13.5′	56.6′
14	33°04.1	14.0	306°54.4	13.3′	13°53.1	13.7′	56.6′
15	48°03.9	·· 14.5	321°26.7	13.3′	13°39.4	13.7′	56.6′
16	63°03.7	14.9	335°59.1	13.4′	13°25.7	13.8′	56.7′
17	78°03.5	15.4	350°31.4	13.4′	13°11.9	13.9′	56.7′
18	93°03.3	S21°15.8	5°03.8	13.4′	S12°58.0	14.0′	56.7′
19	108°03.1	16.3	19°36.2	13.4′	12°44.0	14.0′	56.8′
20	123°02.9	16.7	34°08.6	13.4′	12°30.0	14.1′	56.8′
21	138°02.7	·· 17.1	48°41.0	13.5′	12°15.9	14.1′	56.8′
22	153°02.5	17.6	63°13.5	13.5′	12°01.8	14.3′	56.9′
23	168°02.2	18.0	77°46.0	13.5′	11°47.5	14.3′	56.9′
	SD = 16.2′	d = 0.5′	SD = 15.3′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°02.0	S21°18.5	92°18.4	13.5′	S11°33.2	14.4′	56.9′
1	198°01.8	18.9	106°50.9	13.5′	11°18.8	14.4′	57.0′
2	213°01.6	19.3	121°23.5	13.5′	11°04.4	14.5′	57.0′
3	228°01.4	·· 19.8	135°56.0	13.5′	10°49.9	14.6′	57.0′
4	243°01.2	20.2	150°28.5	13.6′	10°35.3	14.7′	57.1′
5	258°01.0	20.7	165°01.1	13.6′	10°20.6	14.7′	57.1′
6	273°00.8	S21°21.1	179°33.6	13.6′	S10°05.9	14.7′	57.1′
7	288°00.6	21.5	194°06.2	13.6′	09°51.2	14.9′	57.2′
8	303°00.3	22.0	208°38.8	13.6′	09°36.3	14.9′	57.2′
9	318°00.1	·· 22.4	223°11.4	13.6′	09°21.4	14.9′	57.2′
10	332°59.9	22.8	237°44.0	13.6′	09°06.5	15.0′	57.3′
11	347°59.7	23.3	252°16.6	13.6′	08°51.5	15.1′	57.3′
12	2°59.5	S21°23.7	266°49.2	13.6′	S08°36.4	15.1′	57.4′
13	17°59.3	24.1	281°21.8	13.6′	08°21.3	15.2′	57.4′
14	32°59.1	24.5	295°54.4	13.6′	08°06.1	15.2′	57.4′
15	47°58.8	·· 25.0	310°27.0	13.6′	07°50.9	15.3′	57.5′
16	62°58.6	25.4	324°59.6	13.6′	07°35.6	15.4′	57.5′
17	77°58.4	25.8	339°32.1	13.6′	07°20.2	15.4′	57.5′
18	92°58.2	S21°26.3	354°04.7	13.6′	S07°04.8	15.4′	57.6′
19	107°58.0	26.7	8°37.3	13.6′	06°49.4	15.5′	57.6′
20	122°57.8	27.1	23°09.9	13.6′	06°33.9	15.6′	57.6′
21	137°57.5	·· 27.5	37°42.5	13.6′	06°18.3	15.6′	57.7′
22	152°57.3	28.0	52°15.0	13.6′	06°02.7	15.7′	57.7′
23	167°57.1	28.4	66°47.6	13.5′	05°47.0	15.7′	57.8′
	SD = 16.2′	d = 0.4′	SD = 15.5′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	182°56.9	S21°28.8	81°20.1	13.5′	S05°31.3	15.7′	57.8′
1	197°56.7	29.2	95°52.6	13.5′	05°15.6	15.8′	57.8′
2	212°56.4	29.6	110°25.2	13.5′	04°59.8	15.8′	57.9′
3	227°56.2	·· 30.1	124°57.7	13.5′	04°44.0	15.9′	57.9′
4	242°56.0	30.5	139°30.1	13.5′	04°28.1	15.9′	57.9′
5	257°55.8	30.9	154°02.6	13.4′	04°12.2	16.0′	58.0′
6	272°55.6	S21°31.3	168°35.0	13.4′	S03°56.2	16.0′	58.0′
7	287°55.3	31.7	183°07.5	13.4′	03°40.2	16.0′	58.1′
8	302°55.1	32.2	197°39.8	13.4′	03°24.2	16.1′	58.1′
9	317°54.9	·· 32.6	212°12.2	13.3′	03°08.1	16.1′	58.1′
10	332°54.7	33.0	226°44.6	13.3′	02°52.0	16.1′	58.2′
11	347°54.5	33.4	241°16.9	13.3′	02°35.9	16.2′	58.2′
12	2°54.2	S21°33.8	255°49.2	13.3′	S02°19.7	16.2′	58.2′
13	17°54.0	34.2	270°21.4	13.2′	02°03.5	16.2′	58.3′
14	32°53.8	34.7	284°53.7	13.2′	01°47.3	16.3′	58.3′
15	47°53.6	·· 35.1	299°25.9	13.2′	01°31.0	16.3′	58.4′
16	62°53.4	35.5	313°58.1	13.1′	01°14.7	16.3′	58.4′
17	77°53.1	35.9	328°30.2	13.1′	00°58.4	16.4′	58.4′
18	92°52.9	S21°36.3	343°02.3	13.1′	S00°42.0	16.3′	58.5′
19	107°52.7	36.7	357°34.3	13.0′	00°25.7	16.4′	58.5′
20	122°52.5	37.1	12°06.4	13.0′	S00°09.3	16.5′	58.6′
21	137°52.2	·· 37.5	26°38.3	12.9′	N00°07.2	16.4′	58.6′
22	152°52.0	37.9	41°10.3	12.9′	00°23.6	16.5′	58.6′
23	167°51.8	38.3	55°42.2	12.8′	00°40.1	16.5′	58.7′
	SD = 16.2′	d = 0.4′	SD = 15.8′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	07:43	09:37	▬	▬	13:58	15:52
N 70°	07:28	09:01	▬	▬	14:34	16:07
68°	07:15	08:36	10:20	13:15	14:59	16:20
66°	07:05	08:16	09:37	13:59	15:19	16:30
64°	06:56	08:00	09:08	14:27	15:35	16:39
62°	06:48	07:47	08:47	14:49	15:48	16:47
60°	06:41	07:36	08:29	15:06	16:00	16:54
N 58°	06:35	07:26	08:15	15:21	16:10	17:00
56°	06:30	07:17	08:02	15:34	16:19	17:06
54°	06:24	07:09	07:51	15:45	16:26	17:11
52°	06:20	07:02	07:42	15:54	16:33	17:16
50°	06:15	06:56	07:33	16:03	16:40	17:20
45°	06:05	06:42	07:15	16:21	16:54	17:31
N 40°	05:56	06:30	07:00	16:36	17:06	17:39
35°	05:48	06:19	06:47	16:49	17:16	17:48
30°	05:41	06:10	06:36	17:00	17:26	17:55
20°	05:26	05:53	06:17	17:19	17:43	18:10
N 10°	05:12	05:38	06:00	17:36	17:58	18:24
0°	04:56	05:22	05:44	17:52	18:14	18:40
S 10°	04:39	05:06	05:29	18:08	18:30	18:57
20°	04:19	04:47	05:11	18:25	18:49	19:18
30°	03:52	04:25	04:52	18:45	19:12	19:44
35°	03:36	04:11	04:40	18:57	19:25	20:01
40°	03:15	03:55	04:26	19:10	19:42	20:22
45°	02:48	03:35	04:10	19:26	20:02	20:49
S 50°	02:11	03:09	03:51	19:46	20:28	21:27
52°	01:50	02:56	03:41	19:56	20:41	21:48
54°	01:22	02:41	03:31	20:06	20:56	22:17
56°	00:37	02:23	03:18	20:19	21:15	23:05
58°	////	02:01	03:04	20:33	21:37	////
S 60°	////	01:31	02:48	20:50	22:08	////

Lat.	**Moonrise** Thu	Fri	Sat	**Moonset** Thu	Fri	Sat
N 72°	14:51	14:02	13:25	20:55	23:20	·· ··
N 70°	14:25	13:50	13:22	21:18	23:29	·· ··
68°	14:05	13:41	13:20	21:36	23:36	·· ··
66°	13:49	13:33	13:18	21:51	23:42	·· ··
64°	13:36	13:26	13:17	22:02	23:47	·· ··
62°	13:24	13:20	13:15	22:12	23:51	·· ··
60°	13:15	13:15	13:14	22:21	23:55	·· ··
N 58°	13:06	13:10	13:13	22:28	23:58	·· ··
56°	12:59	13:06	13:12	22:34	·· ··	00:01
54°	12:52	13:02	13:11	22:40	·· ··	00:03
52°	12:46	12:59	13:10	22:45	·· ··	00:06
50°	12:41	12:56	13:09	22:50	·· ··	00:08
45°	12:29	12:49	13:08	23:00	·· ··	00:12
N 40°	12:19	12:43	13:06	23:08	·· ··	00:16
35°	12:11	12:38	13:05	23:15	·· ··	00:19
30°	12:03	12:34	13:04	23:22	·· ··	00:22
20°	11:50	12:27	13:02	23:32	·· ··	00:27
N 10°	11:39	12:20	13:01	23:41	·· ··	00:31
0°	11:28	12:14	12:59	23:50	·· ··	00:35
S 10°	11:17	12:07	12:58	23:58	·· ··	00:39
20°	11:06	12:01	12:56	·· ··	00:07	00:43
30°	10:53	11:53	12:54	·· ··	00:18	00:48
35°	10:45	11:49	12:53	·· ··	00:24	00:50
40°	10:36	11:43	12:52	00:05	00:30	00:53
45°	10:26	11:38	12:51	00:17	00:38	00:57
S 50°	10:13	11:30	12:49	00:31	00:47	01:01
52°	10:07	11:27	12:48	00:38	00:51	01:03
54°	10:01	11:24	12:47	00:45	00:56	01:05
56°	09:53	11:20	12:47	00:53	01:01	01:07
58°	09:45	11:15	12:46	01:02	01:06	01:09
S 60°	09:36	11:10	12:44	01:13	01:13	01:12

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 7-9 37-58%
27	12:28	12:18	11:48	17:39	05:16	
28	12:08	11:58	11:48	18:24	06:02	
29	11:48	11:37	11:48	19:10	06:47	

November 30, 01, 02 UT (Sun., Mon., Tue.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	69°07.3	192°13.9	S19°11.9	171°37.6	S23°35.9	312°34.5	N21°21.4	72°37.2	S04°06.0
1	84°09.7	207°13.2	12.7	186°38.1	36.1	327°37.2	21.5	87°39.7	06.0
2	99°12.2	222°12.4	13.5	201°38.6	36.2	342°39.8	21.5	102°42.1	06.0
3	114°14.7	237°11.6	·· 14.2	216°39.0	·· 36.4	357°42.4	·· 21.5	117°44.6	·· 05.9
4	129°17.1	252°10.9	15.0	231°39.5	36.6	12°45.0	21.6	132°47.0	05.9
5	144°19.6	267°10.1	15.8	246°39.9	36.8	27°47.7	21.6	147°49.5	05.9
6	159°22.0	282°09.4	S19°16.5	261°40.4	S23°36.9	42°50.3	N21°21.6	162°52.0	S04°05.9
7	174°24.5	297°08.6	17.3	276°40.8	37.1	57°52.9	21.7	177°54.4	05.9
8	189°27.0	312°07.8	18.1	291°41.3	37.3	72°55.5	21.7	192°56.9	05.9
9	204°29.4	327°07.0	·· 18.8	306°41.7	·· 37.5	87°58.1	·· 21.7	207°59.3	·· 05.9
10	219°31.9	342°06.3	19.6	321°42.2	37.7	103°00.8	21.8	223°01.8	05.9
11	234°34.4	357°05.5	20.4	336°42.6	37.8	118°03.4	21.8	238°04.3	05.9
12	249°36.8	12°04.7	S19°21.1	351°43.1	S23°38.0	133°06.0	N21°21.8	253°06.7	S04°05.8
13	264°39.3	27°04.0	21.9	6°43.5	38.2	148°08.6	21.9	268°09.2	05.8
14	279°41.8	42°03.2	22.6	21°44.0	38.4	163°11.3	21.9	283°11.6	05.8
15	294°44.2	57°02.4	·· 23.4	36°44.4	·· 38.5	178°13.9	·· 21.9	298°14.1	·· 05.8
16	309°46.7	72°01.7	24.1	51°44.9	38.7	193°16.5	22.0	313°16.5	05.8
17	324°49.2	87°00.9	24.9	66°45.3	38.9	208°19.2	22.0	328°19.0	05.8
18	339°51.6	102°00.1	S19°25.6	81°45.8	S23°39.0	223°21.8	N21°22.0	343°21.5	S04°05.8
19	354°54.1	116°59.3	26.4	96°46.2	39.2	238°24.4	22.1	358°23.9	05.8
20	9°56.5	131°58.6	27.2	111°46.7	39.4	253°27.0	22.1	13°26.4	05.7
21	24°59.0	146°57.8	·· 27.9	126°47.1	·· 39.6	268°29.7	·· 22.1	28°28.8	·· 05.7
22	40°01.5	161°57.0	28.7	141°47.6	39.7	283°32.3	22.2	43°31.3	05.7
23	55°03.9	176°56.2	29.4	156°48.0	39.9	298°34.9	22.2	58°33.7	05.7
Mer.pass. 19:20		ν -0.8′	d 0.8′	m -3.90	ν 0.5′	d 0.2′	m 1.31	ν 2.6′	d 0.0′ m -2.53	ν 2.5′	d 0.0′ m 0.91

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	70°06.4	191°55.5	S19°30.1	171°48.5	S23°40.1	313°37.6	N21°22.2	73°36.2	S04°05.7
1	85°08.9	206°54.7	30.9	186°48.9	40.2	328°40.2	22.3	88°38.7	05.7
2	100°11.3	221°53.9	31.6	201°49.4	40.4	343°42.8	22.3	103°41.1	05.7
3	115°13.8	236°53.1	·· 32.4	216°49.8	·· 40.6	358°45.4	·· 22.3	118°43.6	·· 05.6
4	130°16.3	251°52.4	33.1	231°50.3	40.8	13°48.1	22.4	133°46.0	05.6
5	145°18.7	266°51.6	33.9	246°50.7	40.9	28°50.7	22.4	148°48.5	05.6
6	160°21.2	281°50.8	S19°34.6	261°51.1	S23°41.1	43°53.3	N21°22.4	163°50.9	S04°05.6
7	175°23.6	296°50.0	35.4	276°51.6	41.3	58°56.0	22.5	178°53.4	05.6
8	190°26.1	311°49.2	36.1	291°52.0	41.4	73°58.6	22.5	193°55.8	05.6
9	205°28.6	326°48.5	·· 36.8	306°52.5	·· 41.6	89°01.2	·· 22.5	208°58.3	·· 05.6
10	220°31.0	341°47.7	37.6	321°52.9	41.8	104°03.9	22.6	224°00.8	05.5
11	235°33.5	356°46.9	38.3	336°53.4	41.9	119°06.5	22.6	239°03.2	05.5
12	250°36.0	11°46.1	S19°39.1	351°53.8	S23°42.1	134°09.1	N21°22.6	254°05.7	S04°05.5
13	265°38.4	26°45.3	39.8	6°54.3	42.3	149°11.8	22.7	269°08.1	05.5
14	280°40.9	41°44.6	40.5	21°54.7	42.4	164°14.4	22.7	284°10.6	05.5
15	295°43.4	56°43.8	·· 41.3	36°55.2	·· 42.6	179°17.0	·· 22.8	299°13.0	·· 05.5
16	310°45.8	71°43.0	42.0	51°55.6	42.7	194°19.7	22.8	314°15.5	05.5
17	325°48.3	86°42.2	42.7	66°56.1	42.9	209°22.3	22.8	329°17.9	05.4
18	340°50.8	101°41.4	S19°43.5	81°56.5	S23°43.1	224°24.9	N21°22.9	344°20.4	S04°05.4
19	355°53.2	116°40.6	44.2	96°56.9	43.2	239°27.6	22.9	359°22.8	05.4
20	10°55.7	131°39.9	44.9	111°57.4	43.4	254°30.2	22.9	14°25.3	05.4
21	25°58.1	146°39.1	·· 45.6	126°57.8	·· 43.6	269°32.9	·· 23.0	29°27.7	·· 05.4
22	41°00.6	161°38.3	46.4	141°58.3	43.7	284°35.5	23.0	44°30.2	05.4
23	56°03.1	176°37.5	47.1	156°58.7	43.9	299°38.1	23.0	59°32.6	05.4
Mer.pass. 19:16		ν -0.8′	d 0.7′	m -3.90	ν 0.4′	d 0.2′	m 1.31	ν 2.6′	d 0.0′ m -2.54	ν 2.5′	d 0.0′ m 0.91

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	71°05.5	191°36.7	S19°47.8	171°59.2	S23°44.0	314°40.8	N21°23.1	74°35.1	S04°05.3
1	86°08.0	206°35.9	48.5	186°59.6	44.2	329°43.4	23.1	89°37.5	05.3
2	101°10.5	221°35.1	49.3	202°00.1	44.4	344°46.0	23.1	104°40.0	05.3
3	116°12.9	236°34.3	·· 50.0	217°00.5	·· 44.5	359°48.7	·· 23.2	119°42.4	·· 05.3
4	131°15.4	251°33.5	50.7	232°00.9	44.7	14°51.3	23.2	134°44.9	05.3
5	146°17.9	266°32.8	51.4	247°01.4	44.8	29°54.0	23.2	149°47.4	05.3
6	161°20.3	281°32.0	S19°52.1	262°01.8	S23°45.0	44°56.6	N21°23.3	164°49.8	S04°05.3
7	176°22.8	296°31.2	52.9	277°02.3	45.2	59°59.2	23.3	179°52.3	05.2
8	191°25.3	311°30.4	53.6	292°02.7	45.3	75°01.9	23.4	194°54.7	05.2
9	206°27.7	326°29.6	·· 54.3	307°03.2	·· 45.5	90°04.5	·· 23.4	209°57.2	·· 05.2
10	221°30.2	341°28.8	55.0	322°03.6	45.6	105°07.2	23.4	224°59.6	05.2
11	236°32.6	356°28.0	55.7	337°04.0	45.8	120°09.8	23.5	240°02.1	05.2
12	251°35.1	11°27.2	S19°56.4	352°04.5	S23°45.9	135°12.4	N21°23.5	255°04.5	S04°05.2
13	266°37.6	26°26.4	57.2	7°04.9	46.1	150°15.1	23.5	270°07.0	05.1
14	281°40.0	41°25.6	57.9	22°05.4	46.2	165°17.7	23.6	285°09.4	05.1
15	296°42.5	56°24.8	·· 58.6	37°05.8	·· 46.4	180°20.4	·· 23.6	300°11.9	·· 05.1
16	311°45.0	71°24.0	19°59.3	52°06.3	46.5	195°23.0	23.6	315°14.3	05.1
17	326°47.4	86°23.2	20°00.0	67°06.7	46.7	210°25.7	23.7	330°16.8	05.1
18	341°49.9	101°22.4	S20°00.7	82°07.1	S23°46.9	225°28.3	N21°23.7	345°19.2	S04°05.1
19	356°52.4	116°21.6	01.4	97°07.6	47.0	240°30.9	23.8	0°21.6	05.0
20	11°54.8	131°20.8	02.1	112°08.0	47.2	255°33.6	23.8	15°24.1	05.0
21	26°57.3	146°20.0	·· 02.8	127°08.5	·· 47.3	270°36.2	·· 23.8	30°26.5	·· 05.0
22	41°59.7	161°19.3	03.5	142°08.9	47.5	285°38.9	23.9	45°29.0	05.0
23	57°02.2	176°18.5	04.2	157°09.3	47.6	300°41.5	23.9	60°31.4	05.0
Mer.pass. 19:12		ν -0.8′	d 0.7′	m -3.90	ν 0.4′	d 0.2′	m 1.30	ν 2.6′	d 0.0′ m -2.54	ν 2.5′	d 0.0′ m 0.92

Stars

	SHA	Dec
Alpheratz	357°33.9	29°14.2
Ankaa	353°06.2	-42°10.0
Schedar	349°29.9	56°41.1
Diphda	348°46.4	-17°50.7
Achernar	335°19.2	-57°06.5
Hamal	327°50.1	23°35.2
Polaris	313°11.3	89°22.5
Acamar	315°10.8	-40°12.1
Menkar	314°05.1	4°11.6
Mirfak	308°26.7	49°57.3
Aldebaran	290°38.4	16°33.7
Rigel	281°02.8	-8°10.2
Capella	280°20.3	46°01.4
Bellatrix	278°21.8	6°22.4
Elnath	278°00.6	28°37.8
Alnilam	275°36.7	-1°11.1
Betelgeuse	270°51.0	7°24.8
Canopus	263°51.6	-52°42.4
Sirius	258°25.3	-16°45.0
Adhara	255°05.0	-29°00.3
Procyon	244°49.8	5°09.5
Pollux	243°16.2	27°57.7
Avior	234°14.1	-59°35.2
Suhail	222°45.6	-43°32.0
Miaplacidus	221°37.8	-69°49.1
Alphard	217°46.9	-8°46.2
Regulus	207°33.6	11°50.4
Dubhe	193°40.2	61°36.4
Denebola	182°24.3	14°25.6
Gienah	175°43.0	-17°41.0
Acrux	172°59.7	-63°14.3
Gacrux	171°51.1	-57°15.2
Alioth	166°12.7	55°48.9
Spica	158°21.8	-11°17.7
Alkaid	152°51.8	49°10.8
Hadar	148°35.5	-60°29.7
Menkent	147°57.1	-36°29.7
Arcturus	145°47.5	19°02.8
Rigil Kent.	139°39.9	-60°56.4
Kochab	137°20.9	74°02.7
Zuben'ubi	136°55.5	-16°08.9
Alphecca	126°03.5	26°37.6
Antares	112°15.3	-26°29.3
Atria	107°09.5	-69°04.4
Sabik	102°02.3	-15°45.4
Shaula	96°09.8	-37°07.4
Rasalhague	95°58.2	12°32.5
Eltanin	90°42.4	51°29.2
Kaus Aust.	83°31.9	-34°22.4
Vega	80°33.1	38°48.6
Nunki	75°47.2	-26°15.9
Altair	61°59.5	8°56.3
Peacock	53°04.9	-56°39.3
Deneb	49°25.6	45°22.6
Enif	33°38.2	9°59.7
Al Na'ir	27°32.1	-46°50.3
Fomalhaut	15°13.7	-29°29.2
Scheat	13°44.5	28°13.6
Markab	13°29.1	15°20.8

Nov 30 Sun	**SHA**	**Mer.pass**
Venus	123°06.7	11:12
Mars	102°30.4	12:33
Jupiter	243°27.3	03:09
Saturn	3°29.9	19:06

Dec 01 Mon	**SHA**	**Mer.pass**
Venus	121°49.1	11:13
Mars	101°42.1	12:32
Jupiter	243°31.2	03:05
Saturn	3°29.8	19:02

Dec 02 Tue	**SHA**	**Mer.pass**
Venus	120°31.2	11:14
Mars	100°53.6	12:32
Jupiter	243°35.2	03:01
Saturn	3°29.6	18:59

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	182°51.6	S21°38.7	70°14.0	12.8′	N00°56.6	16.5′	58.7′
1	197°51.3	39.1	84°45.8	12.8′	01°13.1	16.5′	58.7′
2	212°51.1	39.5	99°17.6	12.7′	01°29.6	16.5′	58.8′
3	227°50.9	·· 40.0	113°49.3	12.7′	01°46.1	16.6′	58.8′
4	242°50.7	40.4	128°20.9	12.6′	02°02.7	16.5′	58.9′
5	257°50.4	40.8	142°52.5	12.5′	02°19.2	16.6′	58.9′
6	272°50.2	S21°41.2	157°24.1	12.5′	N02°35.8	16.6′	58.9′
7	287°50.0	41.6	171°55.6	12.4′	02°52.4	16.6′	59.0′
8	302°49.8	42.0	186°27.0	12.4′	03°09.0	16.5′	59.0′
9	317°49.5	·· 42.4	200°58.4	12.3′	03°25.5	16.6′	59.0′
10	332°49.3	42.8	215°29.7	12.3′	03°42.1	16.7′	59.1′
11	347°49.1	43.2	230°01.0	12.2′	03°58.8	16.6′	59.1′
12	2°48.8	S21°43.6	244°32.2	12.1′	N04°15.4	16.6′	59.2′
13	17°48.6	43.9	259°03.3	12.1′	04°32.0	16.6′	59.2′
14	32°48.4	44.3	273°34.4	12.0′	04°48.6	16.6′	59.2′
15	47°48.2	·· 44.7	288°05.4	11.9′	05°05.2	16.6′	59.3′
16	62°47.9	45.1	302°36.3	11.9′	05°21.8	16.6′	59.3′
17	77°47.7	45.5	317°07.2	11.8′	05°38.4	16.6′	59.3′
18	92°47.5	S21°45.9	331°37.9	11.7′	N05°55.0	16.5′	59.4′
19	107°47.2	46.3	346°08.7	11.6′	06°11.5	16.6′	59.4′
20	122°47.0	46.7	0°39.3	11.6′	06°28.1	16.6′	59.5′
21	137°46.8	·· 47.1	15°09.9	11.5′	06°44.7	16.5′	59.5′
22	152°46.5	47.5	29°40.4	11.4′	07°01.2	16.5′	59.5′
23	167°46.3	47.9	44°10.8	11.3′	07°17.7	16.5′	59.6′
	SD = 16.2′	d = 0.4′	SD = 16.0′				

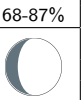
Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	182°46.1	S21°48.3	58°41.1	11.2′	N07°34.2	16.5′	59.6′
1	197°45.9	48.6	73°11.3	11.2′	07°50.7	16.5′	59.6′
2	212°45.6	49.0	87°41.5	11.1′	08°07.2	16.5′	59.7′
3	227°45.4	·· 49.4	102°11.6	11.0′	08°23.7	16.4′	59.7′
4	242°45.2	49.8	116°41.6	10.9′	08°40.1	16.4′	59.7′
5	257°44.9	50.2	131°11.5	10.8′	08°56.5	16.4′	59.8′
6	272°44.7	S21°50.6	145°41.3	10.7′	N09°12.9	16.3′	59.8′
7	287°44.5	51.0	160°11.0	10.6′	09°29.2	16.3′	59.8′
8	302°44.2	51.3	174°40.6	10.5′	09°45.5	16.3′	59.9′
9	317°44.0	·· 51.7	189°10.1	10.4′	10°01.8	16.2′	59.9′
10	332°43.8	52.1	203°39.6	10.3′	10°18.0	16.3′	59.9′
11	347°43.5	52.5	218°08.9	10.2′	10°34.3	16.1′	60.0′
12	2°43.3	S21°52.9	232°38.2	10.1′	N10°50.4	16.1′	60.0′
13	17°43.1	53.2	247°07.3	10.0′	11°06.5	16.1′	60.0′
14	32°42.8	53.6	261°36.4	9.9′	11°22.6	16.1′	60.1′
15	47°42.6	·· 54.0	276°05.3	9.8′	11°38.7	16.0′	60.1′
16	62°42.3	54.4	290°34.1	9.7′	11°54.7	15.9′	60.1′
17	77°42.1	54.8	305°02.9	9.6′	12°10.6	15.9′	60.2′
18	92°41.9	S21°55.1	319°31.5	9.5′	N12°26.5	15.9′	60.2′
19	107°41.6	55.5	334°00.0	9.4′	12°42.4	15.7′	60.2′
20	122°41.4	55.9	348°28.5	9.3′	12°58.1	15.8′	60.3′
21	137°41.2	·· 56.2	2°56.8	9.2′	13°13.9	15.6′	60.3′
22	152°40.9	56.6	17°24.9	9.1′	13°29.5	15.7′	60.3′
23	167°40.7	57.0	31°53.0	9.0′	13°45.2	15.5′	60.4′
	SD = 16.2′	d = 0.4′	SD = 16.3′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	182°40.4	S21°57.4	46°21.0	8.9′	N14°00.7	15.5′	60.4′
1	197°40.2	57.7	60°48.9	8.7′	14°16.2	15.4′	60.4′
2	212°40.0	58.1	75°16.6	8.6′	14°31.6	15.3′	60.5′
3	227°39.7	·· 58.5	89°44.2	8.5′	14°46.9	15.3′	60.5′
4	242°39.5	58.8	104°11.7	8.4′	15°02.2	15.2′	60.5′
5	257°39.3	59.2	118°39.1	8.3′	15°17.4	15.1′	60.5′
6	272°39.0	S21°59.6	133°06.4	8.1′	N15°32.5	15.1′	60.6′
7	287°38.8	21°59.9	147°33.5	8.0′	15°47.6	14.9′	60.6′
8	302°38.5	22°00.3	162°00.5	7.9′	16°02.5	14.9′	60.6′
9	317°38.3	·· 00.7	176°27.4	7.8′	16°17.4	14.8′	60.6′
10	332°38.1	01.0	190°54.2	7.7′	16°32.2	14.7′	60.7′
11	347°37.8	01.4	205°20.9	7.5′	16°46.9	14.6′	60.7′
12	2°37.6	S22°01.8	219°47.4	7.4′	N17°01.5	14.5′	60.7′
13	17°37.3	02.1	234°13.8	7.3′	17°16.0	14.5′	60.7′
14	32°37.1	02.5	248°40.1	7.1′	17°30.5	14.3′	60.8′
15	47°36.8	·· 02.8	263°06.2	7.0′	17°44.8	14.2′	60.8′
16	62°36.6	03.2	277°32.2	6.9′	17°59.0	14.1′	60.8′
17	77°36.4	03.6	291°58.1	6.8′	18°13.1	14.0′	60.8′
18	92°36.1	S22°03.9	306°23.9	6.6′	N18°27.1	14.0′	60.9′
19	107°35.9	04.3	320°49.5	6.5′	18°41.1	13.8′	60.9′
20	122°35.6	04.6	335°15.0	6.4′	18°54.9	13.6′	60.9′
21	137°35.4	·· 05.0	349°40.4	6.2′	19°08.5	13.6′	60.9′
22	152°35.1	05.3	4°05.7	6.1′	19°22.1	13.5′	61.0′
23	167°34.9	05.7	18°30.8	6.0′	19°35.6	13.3′	61.0′
	SD = 16.2′	d = 0.4′	SD = 16.5′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	07:52	09:51	▬	▬	13:46	15:46
N 70°	07:35	09:12	▬	▬	14:26	16:02
68°	07:22	08:44	10:38	13:00	14:53	16:16
66°	07:11	08:24	09:48	13:50	15:14	16:27
64°	07:02	08:07	09:17	14:21	15:31	16:36
62°	06:53	07:53	08:54	14:44	15:45	16:44
60°	06:46	07:41	08:35	15:02	15:57	16:52
N 58°	06:40	07:31	08:20	15:18	16:07	16:58
56°	06:34	07:22	08:07	15:31	16:16	17:04
54°	06:28	07:14	07:56	15:42	16:24	17:09
52°	06:23	07:06	07:46	15:52	16:32	17:14
50°	06:19	07:00	07:37	16:01	16:38	17:19
45°	06:08	06:45	07:18	16:20	16:53	17:30
N 40°	05:59	06:33	07:03	16:35	17:05	17:39
35°	05:51	06:22	06:50	16:48	17:16	17:47
30°	05:43	06:12	06:38	17:00	17:26	17:55
20°	05:28	05:55	06:19	17:19	17:43	18:10
N 10°	05:13	05:39	06:02	17:37	17:59	18:25
0°	04:57	05:23	05:45	17:53	18:15	18:41
S 10°	04:40	05:06	05:29	18:09	18:32	18:59
20°	04:19	04:47	05:12	18:27	18:51	19:20
30°	03:52	04:24	04:51	18:47	19:14	19:47
35°	03:34	04:10	04:39	18:59	19:28	20:04
40°	03:13	03:53	04:25	19:13	19:45	20:26
45°	02:46	03:33	04:09	19:30	20:06	20:53
S 50°	02:06	03:06	03:49	19:50	20:33	21:33
52°	01:44	02:53	03:39	20:00	20:46	21:56
54°	01:14	02:37	03:28	20:11	21:02	22:27
56°	00:15	02:18	03:15	20:24	21:21	23:36
58°	////	01:55	03:01	20:39	21:45	////
S 60°	////	01:22	02:43	20:56	22:19	////

Lat.	**Moonrise** Sun	Mon	Tue	**Moonset** Sun	Mon	Tue
N 72°	12:50	12:07	10:53	01:37	04:03	07:09
N 70°	12:55	12:24	11:37	01:36	03:49	06:27
68°	13:00	12:38	12:06	01:34	03:38	05:59
66°	13:04	12:49	12:29	01:33	03:29	05:38
64°	13:08	12:58	12:47	01:32	03:22	05:22
62°	13:11	13:06	13:02	01:31	03:15	05:08
60°	13:13	13:13	13:14	01:30	03:10	04:57
N 58°	13:16	13:20	13:25	01:29	03:05	04:47
56°	13:18	13:25	13:35	01:29	03:01	04:38
54°	13:20	13:30	13:44	01:28	02:57	04:31
52°	13:22	13:35	13:51	01:28	02:53	04:24
50°	13:23	13:39	13:58	01:27	02:50	04:18
45°	13:27	13:48	14:13	01:26	02:43	04:05
N 40°	13:30	13:55	14:25	01:25	02:38	03:54
35°	13:32	14:02	14:36	01:25	02:33	03:45
30°	13:35	14:08	14:45	01:24	02:29	03:37
20°	13:39	14:18	15:02	01:23	02:21	03:23
N 10°	13:42	14:27	15:16	01:22	02:15	03:11
0°	13:46	14:35	15:29	01:21	02:09	03:00
S 10°	13:49	14:44	15:43	01:20	02:03	02:49
20°	13:53	14:53	15:58	01:19	01:57	02:38
30°	13:57	15:04	16:15	01:18	01:49	02:24
35°	14:00	15:10	16:25	01:17	01:45	02:17
40°	14:03	15:17	16:36	01:16	01:41	02:08
45°	14:06	15:26	16:49	01:15	01:35	01:58
S 50°	14:10	15:36	17:06	01:14	01:29	01:46
52°	14:12	15:40	17:14	01:14	01:26	01:40
54°	14:14	15:46	17:23	01:13	01:23	01:34
56°	14:16	15:51	17:33	01:13	01:19	01:27
58°	14:19	15:58	17:44	01:12	01:15	01:19
S 60°	14:22	16:05	17:57	01:11	01:11	01:11

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 10-12 68-87%
30	11:26	11:15	11:49	19:57	07:33	
01	11:04	10:53	11:49	20:48	08:22	
02	10:42	10:30	11:49	21:43	09:15	



December 03, 04, 05 UT (Wed., Thu., Fri.)

	Aries	Venus		Mars		Jupiter		Saturn	
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	72°04.7	191°17.7	S20°04.9	172°09.8	S23°47.8	315°44.2	N21°23.9	75°33.9	S04°05.0
1	87°07.1	206°16.9	05.6	187°10.2	47.9	330°46.8	24.0	90°36.3	04.9
2	102°09.6	221°16.1	06.3	202°10.7	48.1	345°49.5	24.0	105°38.8	04.9
3	117°12.1	236°15.3	·· 07.0	217°11.1	·· 48.2	0°52.1	·· 24.1	120°41.2	·· 04.9
4	132°14.5	251°14.4	07.7	232°11.5	48.4	15°54.8	24.1	135°43.7	04.9
5	147°17.0	266°13.6	08.4	247°12.0	48.5	30°57.4	24.1	150°46.1	04.9
6	162°19.5	281°12.8	S20°09.1	262°12.4	S23°48.6	46°00.0	N21°24.2	165°48.6	S04°04.9
7	177°21.9	296°12.0	09.8	277°12.9	48.8	61°02.7	24.2	180°51.0	04.8
8	192°24.4	311°11.2	10.5	292°13.3	48.9	76°05.3	24.2	195°53.5	04.8
9	207°26.9	326°10.4	·· 11.2	307°13.7	·· 49.1	91°08.0	·· 24.3	210°55.9	·· 04.8
10	222°29.3	341°09.6	11.9	322°14.2	49.2	106°10.6	24.3	225°58.4	04.8
11	237°31.8	356°08.8	12.6	337°14.6	49.4	121°13.3	24.3	241°00.8	04.8
12	252°34.2	11°08.0	S20°13.3	352°15.0	S23°49.5	136°15.9	N21°24.4	256°03.2	S04°04.8
13	267°36.7	26°07.2	14.0	7°15.5	49.7	151°18.6	24.4	271°05.7	04.7
14	282°39.2	41°06.4	14.6	22°15.9	49.8	166°21.2	24.5	286°08.1	04.7
15	297°41.6	56°05.6	·· 15.3	37°16.4	·· 50.0	181°23.9	·· 24.5	301°10.6	·· 04.7
16	312°44.1	71°04.8	16.0	52°16.8	50.1	196°26.5	24.5	316°13.0	04.7
17	327°46.6	86°04.0	16.7	67°17.2	50.2	211°29.2	24.6	331°15.5	04.7
18	342°49.0	101°03.2	S20°17.4	82°17.7	S23°50.4	226°31.8	N21°24.6	346°17.9	S04°04.6
19	357°51.5	116°02.4	18.1	97°18.1	50.5	241°34.5	24.7	1°20.4	04.6
20	12°54.0	131°01.6	18.8	112°18.5	50.7	256°37.1	24.7	16°22.8	04.6
21	27°56.4	146°00.7	·· 19.4	127°19.0	·· 50.8	271°39.8	·· 24.7	31°25.3	·· 04.6
22	42°58.9	160°59.9	20.1	142°19.4	51.0	286°42.4	24.8	46°27.7	04.6
23	58°01.4	175°59.1	20.8	157°19.8	51.1	301°45.1	24.8	61°30.1	04.6
Mer.pass. 19:09		ν -0.8′	d 0.7′	m -3.90	ν 0.4′	d 0.1′	m 1.29	ν 2.6′	d 0.0′ m -2.55	ν 2.4′	d 0.0′ m 0.92

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	73°03.8	190°58.3	S20°21.5	172°20.3	S23°51.2	316°47.8	N21°24.8	76°32.6	S04°04.5
1	88°06.3	205°57.5	22.1	187°20.7	51.4	331°50.4	24.9	91°35.0	04.5
2	103°08.7	220°56.7	22.8	202°21.2	51.5	346°53.1	24.9	106°37.5	04.5
3	118°11.2	235°55.9	·· 23.5	217°21.6	·· 51.6	1°55.7	·· 25.0	121°39.9	·· 04.5
4	133°13.7	250°55.1	24.2	232°22.0	51.8	16°58.4	25.0	136°42.4	04.5
5	148°16.1	265°54.2	24.8	247°22.5	51.9	32°01.0	25.0	151°44.8	04.4
6	163°18.6	280°53.4	S20°25.5	262°22.9	S23°52.1	47°03.7	N21°25.1	166°47.2	S04°04.4
7	178°21.1	295°52.6	26.2	277°23.3	52.2	62°06.3	25.1	181°49.7	04.4
8	193°23.5	310°51.8	26.9	292°23.8	52.3	77°09.0	25.1	196°52.1	04.4
9	208°26.0	325°51.0	·· 27.5	307°24.2	·· 52.5	92°11.7	·· 25.2	211°54.6	·· 04.4
10	223°28.5	340°50.2	28.2	322°24.6	52.6	107°14.3	25.2	226°57.0	04.3
11	238°30.9	355°49.4	28.9	337°25.1	52.7	122°17.0	25.3	241°59.5	04.3
12	253°33.4	10°48.5	S20°29.5	352°25.5	S23°52.9	137°19.6	N21°25.3	257°01.9	S04°04.3
13	268°35.9	25°47.7	30.2	7°25.9	53.0	152°22.3	25.3	272°04.3	04.3
14	283°38.3	40°46.9	30.9	22°26.4	53.1	167°24.9	25.4	287°06.8	04.3
15	298°40.8	55°46.1	·· 31.5	37°26.8	·· 53.3	182°27.6	·· 25.4	302°09.2	·· 04.2
16	313°43.2	70°45.3	32.2	52°27.2	53.4	197°30.3	25.5	317°11.7	04.2
17	328°45.7	85°44.4	32.8	67°27.7	53.5	212°32.9	25.5	332°14.1	04.2
18	343°48.2	100°43.6	S20°33.5	82°28.1	S23°53.7	227°35.6	N21°25.5	347°16.5	S04°04.2
19	358°50.6	115°42.8	34.2	97°28.5	53.8	242°38.2	25.6	2°19.0	04.2
20	13°53.1	130°42.0	34.8	112°29.0	53.9	257°40.9	25.6	17°21.4	04.1
21	28°55.6	145°41.2	·· 35.5	127°29.4	·· 54.1	272°43.6	·· 25.7	32°23.9	·· 04.1
22	43°58.0	160°40.3	36.1	142°29.8	54.2	287°46.2	25.7	47°26.3	04.1
23	59°00.5	175°39.5	36.8	157°30.3	54.3	302°48.9	25.7	62°28.7	04.1
Mer.pass. 19:05		ν -0.8′	d 0.7′	m -3.90	ν 0.4′	d 0.1′	m 1.29	ν 2.7′	d 0.0′ m -2.55	ν 2.4′	d 0.0′ m 0.93

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	74°03.0	190°38.7	S20°37.4	172°30.7	S23°54.5	317°51.5	N21°25.8	77°31.2	S04°04.1
1	89°05.4	205°37.9	38.1	187°31.1	54.6	332°54.2	25.8	92°33.6	04.0
2	104°07.9	220°37.0	38.7	202°31.6	54.7	347°56.9	25.8	107°36.1	04.0
3	119°10.4	235°36.2	·· 39.4	217°32.0	·· 54.8	2°59.5	·· 25.9	122°38.5	·· 04.0
4	134°12.8	250°35.4	40.0	232°32.4	55.0	18°02.2	25.9	137°40.9	04.0
5	149°15.3	265°34.6	40.7	247°32.8	55.1	33°04.8	26.0	152°43.4	04.0
6	164°17.7	280°33.7	S20°41.3	262°33.3	S23°55.2	48°07.5	N21°26.0	167°45.8	S04°03.9
7	179°20.2	295°32.9	42.0	277°33.7	55.3	63°10.2	26.0	182°48.3	03.9
8	194°22.7	310°32.1	42.6	292°34.1	55.5	78°12.8	26.1	197°50.7	03.9
9	209°25.1	325°31.3	·· 43.3	307°34.6	·· 55.6	93°15.5	·· 26.1	212°53.1	·· 03.9
10	224°27.6	340°30.4	43.9	322°35.0	55.7	108°18.2	26.2	227°55.6	03.9
11	239°30.1	355°29.6	44.6	337°35.4	55.8	123°20.8	26.2	242°58.0	03.8
12	254°32.5	10°28.8	S20°45.2	352°35.9	S23°56.0	138°23.5	N21°26.2	258°00.4	S04°03.8
13	269°35.0	25°27.9	45.8	7°36.3	56.1	153°26.2	26.3	273°02.9	03.8
14	284°37.5	40°27.1	46.5	22°36.7	56.2	168°28.8	26.3	288°05.3	03.8
15	299°39.9	55°26.3	·· 47.1	37°37.1	·· 56.3	183°31.5	·· 26.4	303°07.8	·· 03.7
16	314°42.4	70°25.5	47.8	52°37.6	56.5	198°34.2	26.4	318°10.2	03.7
17	329°44.9	85°24.6	48.4	67°38.0	56.6	213°36.8	26.4	333°12.6	03.7
18	344°47.3	100°23.8	S20°49.0	82°38.4	S23°56.7	228°39.5	N21°26.5	348°15.1	S04°03.7
19	359°49.8	115°23.0	49.7	97°38.9	56.8	243°42.2	26.5	3°17.5	03.7
20	14°52.2	130°22.1	50.3	112°39.3	57.0	258°44.8	26.6	18°19.9	03.6
21	29°54.7	145°21.3	·· 50.9	127°39.7	·· 57.1	273°47.5	·· 26.6	33°22.4	·· 03.6
22	44°57.2	160°20.5	51.6	142°40.1	57.2	288°50.2	26.6	48°24.8	03.6
23	59°59.6	175°19.6	52.2	157°40.6	57.3	303°52.8	26.7	63°27.2	03.6
Mer.pass. 19:01		ν -0.8′	d 0.7′	m -3.90	ν 0.4′	d 0.1′	m 1.28	ν 2.7′	d 0.0′ m -2.56	ν 2.4′	d 0.0′ m 0.93

Stars

	SHA	Dec
Alpheratz	357°33.9	29°14.2
Ankaa	353°06.2	-42°10.1
Schedar	349°29.9	56°41.1
Diphda	348°46.4	-17°50.7
Achernar	335°19.2	-57°06.5
Hamal	327°50.1	23°35.2
Polaris	313°11.4	89°22.5
Acamar	315°10.8	-40°12.1
Menkar	314°05.1	4°11.6
Mirfak	308°26.7	49°57.3
Aldebaran	290°38.4	16°33.7
Rigel	281°02.8	-8°10.2
Capella	280°20.3	46°01.4
Bellatrix	278°21.8	6°22.4
Elnath	278°00.6	28°37.8
Alnilam	275°36.7	-1°11.1
Betelgeuse	270°51.0	7°24.8
Canopus	263°51.6	-52°42.4
Sirius	258°25.3	-16°45.0
Adhara	255°05.0	-29°00.3
Procyon	244°49.8	5°09.5
Pollux	243°16.1	27°57.7
Avior	234°14.0	-59°35.3
Suhail	222°45.6	-43°32.0
Miaplacidus	221°37.7	-69°49.1
Alphard	217°46.9	-8°46.2
Regulus	207°33.6	11°50.4
Dubhe	193°40.1	61°36.4
Denebola	182°24.3	14°25.6
Gienah	175°43.0	-17°41.0
Acrux	172°59.6	-63°14.3
Gacrux	171°51.1	-57°15.2
Alioth	166°12.6	55°48.9
Spica	158°21.7	-11°17.7
Alkaid	152°51.8	49°10.8
Hadar	148°35.5	-60°29.7
Menkent	147°57.1	-36°29.7
Arcturus	145°47.5	19°02.8
Rigil Kent.	139°39.9	-60°56.4
Kochab	137°20.9	74°02.7
Zuben'ubi	136°55.5	-16°08.9
Alphecca	126°03.5	26°37.6
Antares	112°15.3	-26°29.3
Atria	107°09.5	-69°04.4
Sabik	102°02.3	-15°45.4
Shaula	96°09.8	-37°07.3
Rasalhague	95°58.2	12°32.5
Eltanin	90°42.4	51°29.2
Kaus Aust.	83°31.9	-34°22.4
Vega	80°33.1	38°48.5
Nunki	75°47.2	-26°15.9
Altair	61°59.5	8°56.3
Peacock	53°04.9	-56°39.3
Deneb	49°25.6	45°22.6
Enif	33°38.2	9°59.7
Al Na'ir	27°32.1	-46°50.3
Fomalhaut	15°13.7	-29°29.2
Scheat	13°44.5	28°13.6
Markab	13°29.2	15°20.8

Dec 03 Wed	SHA	Mer.pass
Venus	119°13.0	11:15
Mars	100°05.1	12:31
Jupiter	243°39.5	02:57
Saturn	3°29.2	18:55

Dec 04 Thu	SHA	Mer.pass
Venus	117°54.5	11:17
Mars	99°16.5	12:30
Jupiter	243°43.9	02:52
Saturn	3°28.8	18:51

Dec 05 Fri	SHA	Mer.pass
Venus	116°35.7	11:18
Mars	98°27.7	12:30
Jupiter	243°48.6	02:48
Saturn	3°28.2	18:47

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.0909 sec ΔT = TT-UT1 = +69.0931 sec

2025 December 03 to Dec. 05 UT

h	Sun		Moon				
Wed	GHA	Dec	GHA	ν	Dec	d	HP
0	182°34.7	S22°06.0	32°55.8	5.9′	N19°48.9	13.2′	61.0′
1	197°34.4	06.4	47°20.6	5.7′	20°02.1	13.1′	61.0′
2	212°34.2	06.8	61°45.3	5.6′	20°15.2	13.0′	61.0′
3	227°33.9	·· 07.1	76°09.9	5.5′	20°28.2	12.8′	61.0′
4	242°33.7	07.5	90°34.4	5.3′	20°41.0	12.7′	61.1′
5	257°33.4	07.8	104°58.7	5.2′	20°53.7	12.6′	61.1′
6	272°33.2	S22°08.2	119°22.9	5.1′	N21°06.3	12.4′	61.1′
7	287°32.9	08.5	133°47.0	4.9′	21°18.7	12.3′	61.1′
8	302°32.7	08.8	148°10.9	4.8′	21°31.0	12.2′	61.1′
9	317°32.4	·· 09.2	162°34.7	4.7′	21°43.2	12.0′	61.1′
10	332°32.2	09.5	176°58.4	4.5′	21°55.2	11.9′	61.2′
11	347°32.0	09.9	191°22.0	4.4′	22°07.1	11.7′	61.2′
12	2°31.7	S22°10.2	205°45.4	4.3′	N22°18.8	11.5′	61.2′
13	17°31.5	10.6	220°08.7	4.2′	22°30.3	11.5′	61.2′
14	32°31.2	10.9	234°31.8	4.0′	22°41.8	11.2′	61.2′
15	47°31.0	·· 11.3	248°54.9	3.9′	22°53.0	11.1′	61.2′
16	62°30.7	11.6	263°17.8	3.8′	23°04.1	10.9′	61.2′
17	77°30.5	11.9	277°40.6	3.7′	23°15.0	10.8′	61.3′
18	92°30.2	S22°12.3	292°03.2	3.5′	N23°25.8	10.6′	61.3′
19	107°30.0	12.6	306°25.8	3.4′	23°36.4	10.5′	61.3′
20	122°29.7	13.0	320°48.2	3.3′	23°46.9	10.2′	61.3′
21	137°29.5	·· 13.3	335°10.5	3.2′	23°57.1	10.1′	61.3′
22	152°29.2	13.6	349°32.7	3.1′	24°07.2	10.0′	61.3′
23	167°29.0	14.0	3°54.8	3.0′	24°17.2	9.7′	61.3′
	SD = 16.2′	d = 0.4′	SD = 16.6′				

Thu	GHA	Dec	GHA	ν	Dec	d	HP
0	182°28.7	S22°14.3	18°16.7	2.8′	N24°26.9	9.6′	61.3′
1	197°28.5	14.6	32°38.6	2.7′	24°36.5	9.4′	61.3′
2	212°28.2	15.0	47°00.3	2.6′	24°45.9	9.2′	61.3′
3	227°28.0	·· 15.3	61°21.9	2.5′	24°55.1	9.0′	61.3′
4	242°27.7	15.6	75°43.4	2.4′	25°04.1	8.8′	61.3′
5	257°27.5	16.0	90°04.8	2.3′	25°12.9	8.7′	61.3′
6	272°27.2	S22°16.3	104°26.1	2.2′	N25°21.6	8.4′	61.3′
7	287°27.0	16.6	118°47.3	2.1′	25°30.0	8.3′	61.3′
8	302°26.7	17.0	133°08.4	2.0′	25°38.3	8.1′	61.3′
9	317°26.5	·· 17.3	147°29.4	1.9′	25°46.4	7.9′	61.3′
10	332°26.2	17.6	161°50.3	1.8′	25°54.3	7.6′	61.3′
11	347°26.0	17.9	176°11.1	1.7′	26°01.9	7.5′	61.3′
12	2°25.7	S22°18.3	190°31.8	1.6′	N26°09.4	7.3′	61.3′
13	17°25.4	18.6	204°52.4	1.5′	26°16.7	7.0′	61.3′
14	32°25.2	18.9	219°13.0	1.5′	26°23.7	6.9′	61.3′
15	47°24.9	·· 19.2	233°33.4	1.4′	26°30.6	6.7′	61.3′
16	62°24.7	19.6	247°53.8	1.3′	26°37.3	6.4′	61.3′
17	77°24.4	19.9	262°14.1	1.2′	26°43.7	6.3′	61.3′
18	92°24.2	S22°20.2	276°34.3	1.2′	N26°50.0	6.0′	61.3′
19	107°23.9	20.5	290°54.5	1.1′	26°56.0	5.8′	61.3′
20	122°23.7	20.9	305°14.6	1.0′	27°01.8	5.6′	61.3′
21	137°23.4	·· 21.2	319°34.6	1.0′	27°07.4	5.4′	61.3′
22	152°23.2	21.5	333°54.6	0.9′	27°12.8	5.2′	61.3′
23	167°22.9	21.8	348°14.5	0.8′	27°18.0	5.0′	61.3′
	SD = 16.2′	d = 0.3′	SD = 16.7′				

Fri	GHA	Dec	GHA	ν	Dec	d	HP
0	182°22.6	S22°22.1	2°34.3	0.8′	N27°23.0	4.7′	61.3′
1	197°22.4	22.4	16°54.1	0.7′	27°27.7	4.5′	61.3′
2	212°22.1	22.8	31°13.9	0.7′	27°32.2	4.3′	61.3′
3	227°21.9	·· 23.1	45°33.6	0.7′	27°36.5	4.1′	61.3′
4	242°21.6	23.4	59°53.2	0.6′	27°40.6	3.9′	61.3′
5	257°21.4	23.7	74°12.9	0.6′	27°44.5	3.6′	61.3′
6	272°21.1	S22°24.0	88°32.5	0.6′	N27°48.1	3.4′	61.2′
7	287°20.8	24.3	102°52.0	0.5′	27°51.5	3.2′	61.2′
8	302°20.6	24.6	117°11.6	0.5′	27°54.7	3.0′	61.2′
9	317°20.3	·· 25.0	131°31.1	0.5′	27°57.7	2.7′	61.2′
10	332°20.1	25.3	145°50.6	0.5′	28°00.4	2.6′	61.2′
11	347°19.8	25.6	160°10.0	0.5′	28°03.0	2.3′	61.2′
12	2°19.5	S22°25.9	174°29.5	0.5′	N28°05.3	2.0′	61.2′
13	17°19.3	26.2	188°49.0	0.5′	28°07.3	1.9′	61.2′
14	32°19.0	26.5	203°08.4	0.5′	28°09.2	1.6′	61.1′
15	47°18.8	·· 26.8	217°27.9	0.5′	28°10.8	1.4′	61.1′
16	62°18.5	27.1	231°47.3	0.5′	28°12.2	1.2′	61.1′
17	77°18.3	27.4	246°06.8	0.5′	28°13.4	0.9′	61.1′
18	92°18.0	S22°27.7	260°26.3	0.5′	N28°14.3	0.8′	61.1′
19	107°17.7	28.0	274°45.7	0.5′	28°15.1	0.5′	61.1′
20	122°17.5	28.3	289°05.3	0.5′	28°15.6	0.2′	61.0′
21	137°17.2	·· 28.6	303°24.8	0.6′	28°15.8	0.1′	61.0′
22	152°16.9	28.9	317°44.3	0.6′	28°15.9	0.2′	61.0′
23	167°16.7	29.2	332°03.9	0.6′	28°15.7	0.4′	61.0′
	SD = 16.2′	d = 0.3′	SD = 16.7′				

Lat.	Twilight		Sunrise	Sunset	Twilight	
	Naut.	Civil			Civil	Naut.
N 72°	07:59	10:05	▬	▬	13:35	15:41
N 70°	07:42	09:21	▬	▬	14:19	15:58
68°	07:28	08:52	10:57	12:43	14:48	16:12
66°	07:17	08:30	09:58	13:42	15:10	16:24
64°	07:07	08:13	09:25	14:16	15:27	16:33
62°	06:58	07:58	09:00	14:40	15:42	16:42
60°	06:51	07:46	08:41	14:59	15:54	16:50
N 58°	06:44	07:35	08:25	15:15	16:05	16:56
56°	06:38	07:26	08:12	15:28	16:14	17:03
54°	06:32	07:18	08:00	15:40	16:23	17:08
52°	06:27	07:10	07:50	15:50	16:30	17:13
50°	06:22	07:03	07:41	16:00	16:37	17:18
45°	06:11	06:48	07:21	16:19	16:52	17:29
N 40°	06:02	06:35	07:06	16:35	17:05	17:39
35°	05:53	06:24	06:52	16:48	17:16	17:47
30°	05:45	06:15	06:41	17:00	17:26	17:55
20°	05:30	05:57	06:21	17:20	17:44	18:11
N 10°	05:14	05:40	06:03	17:37	18:00	18:26
0°	04:58	05:24	05:47	17:54	18:16	18:42
S 10°	04:40	05:07	05:30	18:11	18:34	19:00
20°	04:19	04:48	05:12	18:29	18:53	19:22
30°	03:51	04:24	04:51	18:50	19:17	19:50
35°	03:34	04:10	04:39	19:02	19:31	20:07
40°	03:12	03:53	04:25	19:16	19:48	20:29
45°	02:44	03:31	04:08	19:33	20:10	20:58
S 50°	02:03	03:04	03:47	19:54	20:37	21:39
52°	01:39	02:50	03:37	20:04	20:51	22:03
54°	01:06	02:34	03:26	20:16	21:08	22:37
56°	////	02:14	03:13	20:29	21:28	////
58°	////	01:49	02:57	20:44	21:53	////
S 60°	////	01:14	02:39	21:03	22:30	////

Lat.	Moonrise			Moonset		
	Wed	Thu	Fri	Wed	Thu	Fri
N 72°	▭	▭	▭	▭	▭	▭
N 70°	▭	▭	▭	▭	▭	▭
68°	10:39	▭	▭	09:27	▭	▭
66°	11:53	▭	▭	08:14	▭	▭
64°	12:30	11:35	▭	07:38	10:46	▭
62°	12:57	12:52	12:40	07:12	09:30	12:03
60°	13:18	13:29	14:00	06:52	08:54	10:44
N 58°	13:36	13:55	14:36	06:36	08:28	10:08
56°	13:50	14:16	15:02	06:22	08:07	09:42
54°	14:03	14:33	15:23	06:10	07:50	09:21
52°	14:14	14:48	15:40	05:59	07:36	09:04
50°	14:24	15:01	15:55	05:50	07:23	08:49
45°	14:45	15:28	16:26	05:30	06:57	08:19
N 40°	15:03	15:50	16:49	05:15	06:37	07:55
35°	15:17	16:08	17:09	05:01	06:20	07:36
30°	15:30	16:23	17:25	04:50	06:05	07:20
20°	15:52	16:49	17:54	04:30	05:40	06:52
N 10°	16:11	17:12	18:18	04:13	05:19	06:28
0°	16:29	17:33	18:41	03:57	04:59	06:05
S 10°	16:47	17:55	19:04	03:41	04:39	05:43
20°	17:06	18:18	19:28	03:24	04:18	05:19
30°	17:29	18:45	19:57	03:05	03:53	04:51
35°	17:43	19:01	20:14	02:54	03:39	04:35
40°	17:58	19:19	20:34	02:41	03:22	04:15
45°	18:17	19:42	20:58	02:26	03:03	03:52
S 50°	18:40	20:11	21:29	02:07	02:38	03:23
52°	18:51	20:25	21:44	01:59	02:26	03:08
54°	19:04	20:42	22:02	01:49	02:13	02:51
56°	19:19	21:02	22:24	01:39	01:57	02:31
58°	19:36	21:26	22:52	01:26	01:39	02:06
S 60°	19:58	22:00	23:32	01:12	01:17	01:33

Day	Sun			Moon		
	Eqn.of Time		Mer.	Mer.Pass.		Age
	00^h	12^h	Pass	Upper	Lower	13-15
	mm:ss	mm:ss	hh:mm	hh:mm	hh:mm	94-100%
03	10:19	10:07	11:50	22:44	10:13	
04	09:55	09:43	11:50	23:49	11:16	
05	09:31	09:18	11:51	–:–	12:23	

December 06, 07, 08 UT (Sat., Sun., Mon.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	75°02.1	190°18.8	S20°52.8	172°41.0	S23°57.4	318°55.5	N21°26.7	78°29.7	S04°03.5
1	90°04.6	205°18.0	53.4	187°41.4	57.5	333°58.2	26.8	93°32.1	03.5
2	105°07.0	220°17.1	54.1	202°41.9	57.7	349°00.8	26.8	108°34.6	03.5
3	120°09.5	235°16.3	·· 54.7	217°42.3	·· 57.8	4°03.5	·· 26.8	123°37.0	·· 03.5
4	135°12.0	250°15.5	55.3	232°42.7	57.9	19°06.2	26.9	138°39.4	03.5
5	150°14.4	265°14.6	55.9	247°43.1	58.0	34°08.8	26.9	153°41.9	03.4
6	165°16.9	280°13.8	S20°56.6	262°43.6	S23°58.1	49°11.5	N21°27.0	168°44.3	S04°03.4
7	180°19.4	295°12.9	57.2	277°44.0	58.3	64°14.2	27.0	183°46.7	03.4
8	195°21.8	310°12.1	57.8	292°44.4	58.4	79°16.9	27.1	198°49.2	03.4
9	210°24.3	325°11.3	·· 58.4	307°44.8	·· 58.5	94°19.5	·· 27.1	213°51.6	·· 03.3
10	225°26.7	340°10.4	59.0	322°45.3	58.6	109°22.2	27.1	228°54.0	03.3
11	240°29.2	355°09.6	20°59.7	337°45.7	58.7	124°24.9	27.2	243°56.5	03.3
12	255°31.7	10°08.7	S21°00.3	352°46.1	S23°58.8	139°27.6	N21°27.2	258°58.9	S04°03.3
13	270°34.1	25°07.9	00.9	7°46.5	58.9	154°30.2	27.3	274°01.3	03.2
14	285°36.6	40°07.1	01.5	22°47.0	59.1	169°32.9	27.3	289°03.8	03.2
15	300°39.1	55°06.2	·· 02.1	37°47.4	·· 59.2	184°35.6	·· 27.3	304°06.2	·· 03.2
16	315°41.5	70°05.4	02.7	52°47.8	59.3	199°38.2	27.4	319°08.6	03.2
17	330°44.0	85°04.5	03.3	67°48.2	59.4	214°40.9	27.4	334°11.1	03.2
18	345°46.5	100°03.7	S21°04.0	82°48.7	S23°59.5	229°43.6	N21°27.5	349°13.5	S04°03.1
19	0°48.9	115°02.8	04.6	97°49.1	59.6	244°46.3	27.5	4°15.9	03.1
20	15°51.4	130°02.0	05.2	112°49.5	59.7	259°48.9	27.5	19°18.4	03.1
21	30°53.9	145°01.2	·· 05.8	127°49.9	·· 59.8	274°51.6	·· 27.6	34°20.8	·· 03.1
22	45°56.3	160°00.3	06.4	142°50.4	23°59.9	289°54.3	27.6	49°23.2	03.0
23	60°58.8	174°59.5	07.0	157°50.8	24°00.0	304°57.0	27.7	64°25.6	03.0
Mer.pass. 18:57		ν -0.8′	d 0.6′	m -3.90	ν 0.4′	d 0.1′	m 1.28	ν 2.7′	d 0.0′ m -2.57	ν 2.4′	d 0.0′ m 0.93

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	76°01.2	189°58.6	S21°07.6	172°51.2	S24°00.2	319°59.6	N21°27.7	79°28.1	S04°03.0
1	91°03.7	204°57.8	08.2	187°51.6	00.3	335°02.3	27.8	94°30.5	03.0
2	106°06.2	219°56.9	08.8	202°52.1	00.4	350°05.0	27.8	109°32.9	02.9
3	121°08.6	234°56.1	·· 09.4	217°52.5	·· 00.5	5°07.7	·· 27.8	124°35.4	·· 02.9
4	136°11.1	249°55.2	10.0	232°52.9	00.6	20°10.4	27.9	139°37.8	02.9
5	151°13.6	264°54.4	10.6	247°53.3	00.7	35°13.0	27.9	154°40.2	02.9
6	166°16.0	279°53.5	S21°11.2	262°53.8	S24°00.8	50°15.7	N21°28.0	169°42.7	S04°02.8
7	181°18.5	294°52.7	11.8	277°54.2	00.9	65°18.4	28.0	184°45.1	02.8
8	196°21.0	309°51.8	12.4	292°54.6	01.0	80°21.1	28.0	199°47.5	02.8
9	211°23.4	324°51.0	·· 13.0	307°55.0	·· 01.1	95°23.7	·· 28.1	214°50.0	·· 02.8
10	226°25.9	339°50.1	13.6	322°55.4	01.2	110°26.4	28.1	229°52.4	02.7
11	241°28.4	354°49.3	14.2	337°55.9	01.3	125°29.1	28.2	244°54.8	02.7
12	256°30.8	9°48.4	S21°14.7	352°56.3	S24°01.4	140°31.8	N21°28.2	259°57.2	S04°02.7
13	271°33.3	24°47.6	15.3	7°56.7	01.5	155°34.5	28.3	274°59.7	02.7
14	286°35.7	39°46.7	15.9	22°57.1	01.6	170°37.2	28.3	290°02.1	02.6
15	301°38.2	54°45.9	·· 16.5	37°57.6	·· 01.7	185°39.8	·· 28.3	305°04.5	·· 02.6
16	316°40.7	69°45.0	17.1	52°58.0	01.8	200°42.5	28.4	320°07.0	02.6
17	331°43.1	84°44.2	17.7	67°58.4	01.9	215°45.2	28.4	335°09.4	02.6
18	346°45.6	99°43.3	S21°18.3	82°58.8	S24°02.0	230°47.9	N21°28.5	350°11.8	S04°02.5
19	1°48.1	114°42.5	18.9	97°59.2	02.1	245°50.6	28.5	5°14.2	02.5
20	16°50.5	129°41.6	19.4	112°59.7	02.2	260°53.2	28.6	20°16.7	02.5
21	31°53.0	144°40.8	·· 20.0	128°00.1	·· 02.3	275°55.9	·· 28.6	35°19.1	·· 02.5
22	46°55.5	159°39.9	20.6	143°00.5	02.4	290°58.6	28.6	50°21.5	02.4
23	61°57.9	174°39.0	21.2	158°00.9	02.5	306°01.3	28.7	65°24.0	02.4
Mer.pass. 18:53		ν -0.8′	d 0.6′	m -3.90	ν 0.4′	d 0.1′	m 1.27	ν 2.7′	d 0.0′ m -2.57	ν 2.4′	d 0.0′ m 0.94

Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	77°00.4	189°38.2	S21°21.8	173°01.3	S24°02.6	321°04.0	N21°28.7	80°26.4	S04°02.4
1	92°02.9	204°37.3	22.3	188°01.8	02.7	336°06.7	28.8	95°28.8	02.4
2	107°05.3	219°36.5	22.9	203°02.2	02.8	351°09.3	28.8	110°31.2	02.3
3	122°07.8	234°35.6	·· 23.5	218°02.6	·· 02.9	6°12.0	·· 28.9	125°33.7	·· 02.3
4	137°10.2	249°34.8	24.1	233°03.0	03.0	21°14.7	28.9	140°36.1	02.3
5	152°12.7	264°33.9	24.6	248°03.4	03.1	36°17.4	28.9	155°38.5	02.3
6	167°15.2	279°33.0	S21°25.2	263°03.9	S24°03.2	51°20.1	N21°29.0	170°40.9	S04°02.2
7	182°17.6	294°32.2	25.8	278°04.3	03.3	66°22.8	29.0	185°43.4	02.2
8	197°20.1	309°31.3	26.3	293°04.7	03.4	81°25.5	29.1	200°45.8	02.2
9	212°22.6	324°30.5	·· 26.9	308°05.1	·· 03.5	96°28.1	·· 29.1	215°48.2	·· 02.2
10	227°25.0	339°29.6	27.5	323°05.5	03.6	111°30.8	29.2	230°50.6	02.1
11	242°27.5	354°28.7	28.0	338°06.0	03.7	126°33.5	29.2	245°53.1	02.1
12	257°30.0	9°27.9	S21°28.6	353°06.4	S24°03.8	141°36.2	N21°29.2	260°55.5	S04°02.1
13	272°32.4	24°27.0	29.2	8°06.8	03.9	156°38.9	29.3	275°57.9	02.0
14	287°34.9	39°26.2	29.7	23°07.2	04.0	171°41.6	29.3	291°00.3	02.0
15	302°37.3	54°25.3	·· 30.3	38°07.6	·· 04.0	186°44.3	·· 29.4	306°02.8	·· 02.0
16	317°39.8	69°24.4	30.9	53°08.0	04.1	201°47.0	29.4	321°05.2	02.0
17	332°42.3	84°23.6	31.4	68°08.5	04.2	216°49.7	29.5	336°07.6	01.9
18	347°44.7	99°22.7	S21°32.0	83°08.9	S24°04.3	231°52.3	N21°29.5	351°10.0	S04°01.9
19	2°47.2	114°21.8	32.5	98°09.3	04.4	246°55.0	29.5	6°12.5	01.9
20	17°49.7	129°21.0	33.1	113°09.7	04.5	261°57.7	29.6	21°14.9	01.9
21	32°52.1	144°20.1	·· 33.6	128°10.1	·· 04.6	277°00.4	·· 29.6	36°17.3	·· 01.8
22	47°54.6	159°19.2	34.2	143°10.6	04.7	292°03.1	29.7	51°19.7	01.8
23	62°57.1	174°18.4	34.7	158°11.0	04.8	307°05.8	29.7	66°22.2	01.8
Mer.pass. 18:49		ν -0.9′	d 0.6′	m -3.90	ν 0.4′	d 0.1′	m 1.27	ν 2.7′	d 0.0′ m -2.58	ν 2.4′	d 0.0′ m 0.94

Stars

	SHA	Dec
Alpheratz	357°33.9	29°14.2
Ankaa	353°06.2	-42°10.1
Schedar	349°29.9	56°41.1
Diphda	348°46.4	-17°50.7
Achernar	335°19.2	-57°06.5
Hamal	327°50.1	23°35.3
Polaris	313°11.5	89°22.6
Acamar	315°10.8	-40°12.1
Menkar	314°05.1	4°11.6
Mirfak	308°26.7	49°57.3
Aldebaran	290°38.4	16°33.7
Rigel	281°02.8	-8°10.2
Capella	280°20.3	46°01.4
Bellatrix	278°21.7	6°22.4
Elnath	278°00.5	28°37.8
Alnilam	275°36.6	-1°11.1
Betelgeuse	270°50.9	7°24.7
Canopus	263°51.5	-52°42.4
Sirius	258°25.3	-16°45.0
Adhara	255°04.9	-29°00.3
Procyon	244°49.8	5°09.5
Pollux	243°16.1	27°57.7
Avior	234°14.0	-59°35.3
Suhail	222°45.5	-43°32.0
Miaplacidus	221°37.7	-69°49.1
Alphard	217°46.9	-8°46.2
Regulus	207°33.6	11°50.4
Dubhe	193°40.1	61°36.4
Denebola	182°24.3	14°25.5
Gienah	175°42.9	-17°41.1
Acrux	172°59.5	-63°14.3
Gacrux	171°51.1	-57°15.2
Alioth	166°12.6	55°48.9
Spica	158°21.7	-11°17.7
Alkaid	152°51.8	49°10.8
Hadar	148°35.4	-60°29.7
Menkent	147°57.0	-36°29.7
Arcturus	145°47.5	19°02.8
Rigil Kent.	139°39.8	-60°56.4
Kochab	137°20.8	74°02.7
Zuben'ubi	136°55.5	-16°08.9
Alphecca	126°03.5	26°37.6
Antares	112°15.3	-26°29.3
Atria	107°09.4	-69°04.4
Sabik	102°02.3	-15°45.4
Shaula	96°09.8	-37°07.3
Rasalhague	95°58.2	12°32.5
Eltanin	90°42.4	51°29.2
Kaus Aust.	83°31.9	-34°22.4
Vega	80°33.1	38°48.5
Nunki	75°47.2	-26°15.9
Altair	61°59.5	8°56.3
Peacock	53°04.9	-56°39.3
Deneb	49°25.6	45°22.6
Enif	33°38.2	9°59.7
Al Na'ir	27°32.1	-46°50.3
Fomalhaut	15°13.7	-29°29.2
Scheat	13°44.5	28°13.6
Markab	13°29.2	15°20.8

Dec 06 Sat	SHA	Mer.pass
Venus	115°16.7	11:19
Mars	97°38.9	12:29
Jupiter	243°53.4	02:44
Saturn	3°27.6	18:43

Dec 07 Sun	SHA	Mer.pass
Venus	113°57.4	11:21
Mars	96°50.0	12:28
Jupiter	243°58.4	02:40
Saturn	3°26.8	18:39

Dec 08 Mon	SHA	Mer.pass
Venus	112°37.8	11:22
Mars	96°01.0	12:28
Jupiter	244°03.6	02:35
Saturn	3°26.0	18:35

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h

Sat	Sun GHA	Sun Dec	Moon GHA	Moon ν	Moon Dec	Moon d	Moon HP
0	182°16.4	S22°29.5	346°23.6	0.7′	N28°15.3	0.6′	61.0′
1	197°16.2	29.8	0°43.2	0.7′	28°14.7	0.9′	60.9′
2	212°15.9	30.1	15°02.9	0.7′	28°13.8	1.0′	60.9′
3	227°15.6	·· 30.4	29°22.7	0.8′	28°12.8	1.3′	60.9′
4	242°15.4	30.7	43°42.5	0.9′	28°11.5	1.5′	60.9′
5	257°15.1	31.0	58°02.3	0.9′	28°10.0	1.7′	60.8′
6	272°14.8	S22°31.3	72°22.2	1.0′	N28°08.3	2.0′	60.8′
7	287°14.6	31.6	86°42.2	1.0′	28°06.3	2.1′	60.8′
8	302°14.3	31.9	101°02.2	1.1′	28°04.2	2.4′	60.8′
9	317°14.1	·· 32.2	115°22.3	1.2′	28°01.8	2.6′	60.7′
10	332°13.8	32.5	129°42.5	1.2′	27°59.2	2.8′	60.7′
11	347°13.5	32.8	144°02.7	1.3′	27°56.4	3.0′	60.7′
12	2°13.3	S22°33.1	158°23.0	1.4′	N27°53.4	3.2′	60.7′
13	17°13.0	33.3	172°43.4	1.5′	27°50.2	3.5′	60.6′
14	32°12.7	33.6	187°03.9	1.6′	27°46.7	3.6′	60.6′
15	47°12.5	·· 33.9	201°24.5	1.7′	27°43.1	3.8′	60.6′
16	62°12.2	34.2	215°45.1	1.7′	27°39.3	4.1′	60.6′
17	77°11.9	34.5	230°05.9	1.8′	27°35.2	4.3′	60.5′
18	92°11.7	S22°34.8	244°26.7	1.9′	N27°30.9	4.4′	60.5′
19	107°11.4	35.1	258°47.7	2.0′	27°26.5	4.7′	60.5′
20	122°11.1	35.4	273°08.7	2.1′	27°21.8	4.8′	60.4′
21	137°10.9	·· 35.6	287°29.8	2.2′	27°17.0	5.1′	60.4′
22	152°10.6	35.9	301°51.1	2.4′	27°11.9	5.2′	60.4′
23	167°10.3	36.2	316°12.4	2.5′	27°06.7	5.5′	60.3′
	SD = 16.2′	d = 0.3′		SD = 16.6′			

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	182°10.1	S22°36.5	330°33.9	2.6′	N27°01.2	5.6′	60.3′
1	197°09.8	36.8	344°55.5	2.7′	26°55.6	5.8′	60.3′
2	212°09.5	37.0	359°17.2	2.8′	26°49.8	6.0′	60.3′
3	227°09.3	·· 37.3	13°39.0	2.9′	26°43.8	6.2′	60.2′
4	242°09.0	37.6	28°00.9	3.1′	26°37.6	6.4′	60.2′
5	257°08.7	37.9	42°23.0	3.2′	26°31.2	6.6′	60.2′
6	272°08.5	S22°38.2	56°45.1	3.3′	N26°24.6	6.7′	60.1′
7	287°08.2	38.4	71°07.4	3.4′	26°17.9	6.9′	60.1′
8	302°07.9	38.7	85°29.9	3.6′	26°11.0	7.1′	60.1′
9	317°07.7	·· 39.0	99°52.4	3.7′	26°03.9	7.3′	60.0′
10	332°07.4	39.2	114°15.1	3.8′	25°56.6	7.5′	60.0′
11	347°07.1	39.5	128°37.9	4.0′	25°49.1	7.6′	59.9′
12	2°06.8	S22°39.8	143°00.9	4.1′	N25°41.5	7.7′	59.9′
13	17°06.6	40.1	157°24.0	4.2′	25°33.8	8.0′	59.9′
14	32°06.3	40.3	171°47.2	4.4′	25°25.8	8.1′	59.8′
15	47°06.0	·· 40.6	186°10.6	4.5′	25°17.7	8.3′	59.8′
16	62°05.8	40.9	200°34.0	4.6′	25°09.4	8.4′	59.8′
17	77°05.5	41.1	214°57.7	4.8′	25°01.0	8.6′	59.7′
18	92°05.2	S22°41.4	229°21.5	4.9′	N24°52.4	8.7′	59.7′
19	107°05.0	41.7	243°45.4	5.1′	24°43.7	8.9′	59.7′
20	122°04.7	41.9	258°09.4	5.2′	24°34.8	9.1′	59.6′
21	137°04.4	·· 42.2	272°33.6	5.3′	24°25.7	9.1′	59.6′
22	152°04.1	42.5	286°58.0	5.5′	24°16.6	9.4′	59.5′
23	167°03.9	42.7	301°22.5	5.6′	24°07.2	9.5′	59.5′
	SD = 16.2′	d = 0.3′		SD = 16.4′			

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	182°03.6	S22°43.0	315°47.1	5.8′	N23°57.7	9.6′	59.5′
1	197°03.3	43.3	330°11.9	5.9′	23°48.1	9.7′	59.4′
2	212°03.0	43.5	344°36.8	6.1′	23°38.4	9.9′	59.4′
3	227°02.8	·· 43.8	359°01.9	6.2′	23°28.5	10.1′	59.4′
4	242°02.5	44.0	13°27.1	6.4′	23°18.4	10.1′	59.3′
5	257°02.2	44.3	27°52.5	6.5′	23°08.3	10.3′	59.3′
6	272°02.0	S22°44.6	42°18.0	6.7′	N22°58.0	10.4′	59.2′
7	287°01.7	44.8	56°43.6	6.8′	22°47.6	10.6′	59.2′
8	302°01.4	45.1	71°09.5	6.9′	22°37.0	10.6′	59.2′
9	317°01.1	·· 45.3	85°35.4	7.1′	22°26.4	10.8′	59.1′
10	332°00.9	45.6	100°01.5	7.2′	22°15.6	10.9′	59.1′
11	347°00.6	45.8	114°27.7	7.4′	22°04.7	11.1′	59.0′
12	2°00.3	S22°46.1	128°54.1	7.5′	N21°53.6	11.1′	59.0′
13	17°00.0	46.3	143°20.7	7.7′	21°42.5	11.3′	59.0′
14	31°59.8	46.6	157°47.3	7.8′	21°31.2	11.3′	58.9′
15	46°59.5	·· 46.8	172°14.2	8.0′	21°19.9	11.5′	58.9′
16	61°59.2	47.1	186°41.1	8.1′	21°08.4	11.6′	58.8′
17	76°58.9	47.3	201°08.2	8.3′	20°56.8	11.7′	58.8′
18	91°58.7	S22°47.6	215°35.5	8.4′	N20°45.1	11.8′	58.8′
19	106°58.4	47.8	230°02.9	8.5′	20°33.3	11.8′	58.7′
20	121°58.1	48.1	244°30.4	8.7′	20°21.5	12.0′	58.7′
21	136°57.8	·· 48.3	258°58.1	8.8′	20°09.5	12.1′	58.6′
22	151°57.5	48.6	273°25.9	9.0′	19°57.4	12.2′	58.6′
23	166°57.3	48.8	287°53.9	9.1′	19°45.2	12.2′	58.5′
	SD = 16.2′	d = 0.3′		SD = 16.2′			

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	08:06	10:18	▬	▬	13:24	15:36
N 70°	07:48	09:30	▬	▬	14:13	15:54
68°	07:34	08:59	11:21	12:21	14:43	16:09
66°	07:22	08:36	10:08	13:35	15:06	16:21
64°	07:11	08:18	09:32	14:11	15:25	16:31
62°	07:02	08:03	09:06	14:36	15:40	16:40
60°	06:55	07:50	08:46	14:56	15:52	16:48
N 58°	06:48	07:39	08:30	15:13	16:03	16:55
56°	06:41	07:30	08:16	15:27	16:13	17:02
54°	06:35	07:21	08:04	15:39	16:22	17:07
52°	06:30	07:13	07:54	15:49	16:29	17:13
50°	06:25	07:06	07:44	15:59	16:37	17:18
45°	06:14	06:51	07:25	16:18	16:52	17:29
N 40°	06:04	06:38	07:08	16:35	17:05	17:39
35°	05:55	06:27	06:55	16:48	17:16	17:48
30°	05:47	06:17	06:43	17:00	17:26	17:56
20°	05:31	05:59	06:22	17:21	17:44	18:12
N 10°	05:16	05:42	06:05	17:38	18:01	18:27
0°	04:59	05:25	05:48	17:55	18:18	18:44
S 10°	04:41	05:08	05:31	18:12	18:35	19:02
20°	04:19	04:48	05:13	18:31	18:55	19:24
30°	03:51	04:24	04:51	18:52	19:19	19:52
35°	03:33	04:10	04:39	19:04	19:34	20:10
40°	03:11	03:52	04:24	19:19	19:51	20:32
45°	02:42	03:30	04:07	19:36	20:13	21:02
S 50°	02:00	03:02	03:46	19:58	20:41	21:44
52°	01:35	02:48	03:35	20:08	20:56	22:09
54°	00:59	02:31	03:24	20:20	21:13	22:46
56°	////	02:11	03:10	20:33	21:33	////
58°	////	01:45	02:55	20:49	22:00	////
S 60°	////	01:06	02:36	21:08	22:40	////

Lat.	Moonrise Sat	Moonrise Sun	Moonrise Mon	Moonset Sat	Moonset Sun	Moonset Mon
N 72°	▭	▭	▭	▭	▭	▭
N 70°	▭	▭	▭	▭	▭	▭
68°	▭	▭	16:54	▭	▭	14:28
66°	▭	▭	17:46	▭	▭	13:36
64°	▭	15:44	18:17	▭	13:36	13:03
62°	14:15	16:36	18:41	12:51	12:44	12:39
60°	15:17	17:07	18:59	11:48	12:11	12:19
N 58°	15:51	17:31	19:15	11:14	11:47	12:03
56°	16:16	17:50	19:28	10:49	11:28	11:49
54°	16:36	18:06	19:39	10:28	11:11	11:37
52°	16:53	18:19	19:49	10:11	10:57	11:26
50°	17:07	18:31	19:58	09:57	10:45	11:17
45°	17:37	18:56	20:17	09:27	10:19	10:57
N 40°	18:00	19:16	20:32	09:04	09:58	10:40
35°	18:19	19:32	20:45	08:44	09:41	10:26
30°	18:35	19:46	20:56	08:28	09:26	10:14
20°	19:02	20:10	21:15	08:00	09:01	09:53
N 10°	19:26	20:31	21:31	07:36	08:39	09:35
0°	19:48	20:50	21:46	07:13	08:18	09:18
S 10°	20:10	21:09	22:02	06:50	07:57	09:00
20°	20:33	21:30	22:18	06:26	07:35	08:42
30°	21:00	21:53	22:36	05:58	07:09	08:20
35°	21:16	22:07	22:47	05:41	06:53	08:07
40°	21:35	22:23	22:59	05:21	06:35	07:52
45°	21:57	22:41	23:14	04:57	06:13	07:35
S 50°	22:26	23:05	23:31	04:26	05:46	07:12
52°	22:40	23:16	23:39	04:11	05:32	07:02
54°	22:56	23:29	23:49	03:53	05:16	06:50
56°	23:15	23:43	23:59	03:31	04:58	06:36
58°	23:38	·· ··	00:00	03:03	04:35	06:20
S 60°	·· ··	00:09	00:20	02:23	04:04	06:00

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 16-18 98-87%
06	09:06	08:53	11:51	00:57	13:30	
07	08:40	08:27	11:52	02:03	14:34	
08	08:14	08:01	11:52	03:04	15:32	

December 09, 10, 11 UT (Tue., Wed., Thu.)

	Aries	Venus		Mars		Jupiter		Saturn	
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	77°59.5	189°17.5	S21°35.3	173°11.4	S24°04.8	322°08.5	N21°29.8	81°24.6	S04°01.8
1	93°02.0	204°16.6	35.8	188°11.8	04.9	337°11.2	29.8	96°27.0	01.7
2	108°04.5	219°15.8	36.4	203°12.2	05.0	352°13.9	29.9	111°29.4	01.7
3	123°06.9	234°14.9	·· 36.9	218°12.6	·· 05.1	7°16.6	·· 29.9	126°31.9	·· 01.7
4	138°09.4	249°14.0	37.5	233°13.1	05.2	22°19.3	29.9	141°34.3	01.6
5	153°11.8	264°13.2	38.0	248°13.5	05.3	37°21.9	30.0	156°36.7	01.6
6	168°14.3	279°12.3	S21°38.6	263°13.9	S24°05.4	52°24.6	N21°30.0	171°39.1	S04°01.6
7	183°16.8	294°11.4	39.1	278°14.3	05.4	67°27.3	30.1	186°41.5	01.6
8	198°19.2	309°10.5	39.7	293°14.7	05.5	82°30.0	30.1	201°44.0	01.5
9	213°21.7	324°09.7	·· 40.2	308°15.1	·· 05.6	97°32.7	·· 30.2	216°46.4	·· 01.5
10	228°24.2	339°08.8	40.8	323°15.5	05.7	112°35.4	30.2	231°48.8	01.5
11	243°26.6	354°07.9	41.3	338°16.0	05.8	127°38.1	30.3	246°51.2	01.4
12	258°29.1	9°07.1	S21°41.8	353°16.4	S24°05.9	142°40.8	N21°30.3	261°53.7	S04°01.4
13	273°31.6	24°06.2	42.4	8°16.8	05.9	157°43.5	30.3	276°56.1	01.4
14	288°34.0	39°05.3	42.9	23°17.2	06.0	172°46.2	30.4	291°58.5	01.4
15	303°36.5	54°04.4	·· 43.4	38°17.6	·· 06.1	187°48.9	·· 30.4	307°00.9	·· 01.3
16	318°39.0	69°03.6	44.0	53°18.0	06.2	202°51.6	30.5	322°03.3	01.3
17	333°41.4	84°02.7	44.5	68°18.4	06.3	217°54.3	30.5	337°05.8	01.3
18	348°43.9	99°01.8	S21°45.0	83°18.9	S24°06.3	232°57.0	N21°30.6	352°08.2	S04°01.2
19	3°46.3	114°00.9	45.6	98°19.3	06.4	247°59.7	30.6	7°10.6	01.2
20	18°48.8	129°00.1	46.1	113°19.7	06.5	263°02.4	30.7	22°13.0	01.2
21	33°51.3	143°59.2	·· 46.6	128°20.1	·· 06.6	278°05.1	·· 30.7	37°15.4	·· 01.2
22	48°53.7	158°58.3	47.2	143°20.5	06.7	293°07.8	30.7	52°17.9	01.1
23	63°56.2	173°57.4	47.7	158°20.9	06.7	308°10.5	30.8	67°20.3	01.1
Mer.pass. 18:45		ν -0.9′	d 0.6′	m -3.90	ν 0.4′	d 0.1′	m 1.26	ν 2.7′	d 0.0′ m -2.58	ν 2.4′	d 0.0′ m 0.94

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	78°58.7	188°56.6	S21°48.2	173°21.3	S24°06.8	323°13.2	N21°30.8	82°22.7	S04°01.1
1	94°01.1	203°55.7	48.7	188°21.8	06.9	338°15.9	30.9	97°25.1	01.0
2	109°03.6	218°54.8	49.3	203°22.2	07.0	353°18.6	30.9	112°27.5	01.0
3	124°06.1	233°53.9	·· 49.8	218°22.6	·· 07.0	8°21.3	·· 31.0	127°29.9	·· 01.0
4	139°08.5	248°53.0	50.3	233°23.0	07.1	23°24.0	31.0	142°32.4	01.0
5	154°11.0	263°52.2	50.8	248°23.4	07.2	38°26.7	31.1	157°34.8	00.9
6	169°13.5	278°51.3	S21°51.3	263°23.8	S24°07.3	53°29.4	N21°31.1	172°37.2	S04°00.9
7	184°15.9	293°50.4	51.9	278°24.2	07.3	68°32.1	31.1	187°39.6	00.9
8	199°18.4	308°49.5	52.4	293°24.6	07.4	83°34.8	31.2	202°42.0	00.8
9	214°20.8	323°48.6	·· 52.9	308°25.1	·· 07.5	98°37.5	·· 31.2	217°44.5	·· 00.8
10	229°23.3	338°47.8	53.4	323°25.5	07.5	113°40.2	31.3	232°46.9	00.8
11	244°25.8	353°46.9	53.9	338°25.9	07.6	128°42.9	31.3	247°49.3	00.7
12	259°28.2	8°46.0	S21°54.4	353°26.3	S24°07.7	143°45.6	N21°31.4	262°51.7	S04°00.7
13	274°30.7	23°45.1	54.9	8°26.7	07.8	158°48.3	31.4	277°54.1	00.7
14	289°33.2	38°44.2	55.4	23°27.1	07.8	173°51.0	31.5	292°56.5	00.7
15	304°35.6	53°43.3	·· 56.0	38°27.5	·· 07.9	188°53.7	·· 31.5	307°59.0	·· 00.6
16	319°38.1	68°42.5	56.5	53°27.9	08.0	203°56.4	31.6	323°01.4	00.6
17	334°40.6	83°41.6	57.0	68°28.3	08.0	218°59.1	31.6	338°03.8	00.6
18	349°43.0	98°40.7	S21°57.5	83°28.8	S24°08.1	234°01.8	N21°31.6	353°06.2	S04°00.5
19	4°45.5	113°39.8	58.0	98°29.2	08.2	249°04.5	31.7	8°08.6	00.5
20	19°47.9	128°38.9	58.5	113°29.6	08.2	264°07.2	31.7	23°11.0	00.5
21	34°50.4	143°38.0	·· 59.0	128°30.0	·· 08.3	279°09.9	·· 31.8	38°13.5	·· 00.4
22	49°52.9	158°37.1	21°59.5	143°30.4	08.4	294°12.6	31.8	53°15.9	00.4
23	64°55.3	173°36.3	22°00.0	158°30.8	08.4	309°15.3	31.9	68°18.3	00.4
Mer.pass. 18:41		ν -0.9′	d 0.5′	m -3.90	ν 0.4′	d 0.1′	m 1.25	ν 2.7′	d 0.0′ m -2.59	ν 2.4′	d 0.0′ m 0.95

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	79°57.8	188°35.4	S22°00.5	173°31.2	S24°08.5	324°18.0	N21°31.9	83°20.7	S04°00.3
1	95°00.3	203°34.5	01.0	188°31.6	08.6	339°20.7	32.0	98°23.1	00.3
2	110°02.7	218°33.6	01.5	203°32.0	08.6	354°23.4	32.0	113°25.5	00.3
3	125°05.2	233°32.7	·· 02.0	218°32.4	·· 08.7	9°26.1	·· 32.1	128°27.9	·· 00.3
4	140°07.7	248°31.8	02.5	233°32.9	08.8	24°28.8	32.1	143°30.4	00.2
5	155°10.1	263°30.9	02.9	248°33.3	08.8	39°31.6	32.2	158°32.8	00.2
6	170°12.6	278°30.0	S22°03.4	263°33.7	S24°08.9	54°34.3	N21°32.2	173°35.2	S04°00.2
7	185°15.1	293°29.1	03.9	278°34.1	09.0	69°37.0	32.2	188°37.6	00.1
8	200°17.5	308°28.3	04.4	293°34.5	09.0	84°39.7	32.3	203°40.0	00.1
9	215°20.0	323°27.4	·· 04.9	308°34.9	·· 09.1	99°42.4	·· 32.3	218°42.4	·· 00.1
10	230°22.4	338°26.5	05.4	323°35.3	09.1	114°45.1	32.4	233°44.8	00.0
11	245°24.9	353°25.6	05.9	338°35.7	09.2	129°47.8	32.4	248°47.3	00.0
12	260°27.4	8°24.7	S22°06.4	353°36.1	S24°09.3	144°50.5	N21°32.5	263°49.7	S04°00.0
13	275°29.8	23°23.8	06.8	8°36.5	09.3	159°53.2	32.5	278°52.1	03°59.9
14	290°32.3	38°22.9	07.3	23°36.9	09.4	174°55.9	32.6	293°54.5	59.9
15	305°34.8	53°22.0	·· 07.8	38°37.4	·· 09.4	189°58.6	·· 32.6	308°56.9	·· 59.9
16	320°37.2	68°21.1	08.3	53°37.8	09.5	205°01.4	32.7	323°59.3	59.8
17	335°39.7	83°20.2	08.8	68°38.2	09.6	220°04.1	32.7	339°01.7	59.8
18	350°42.2	98°19.3	S22°09.3	83°38.6	S24°09.6	235°06.8	N21°32.8	354°04.1	S03°59.8
19	5°44.6	113°18.4	09.7	98°39.0	09.7	250°09.5	32.8	9°06.6	59.7
20	20°47.1	128°17.5	10.2	113°39.4	09.7	265°12.2	32.9	24°09.0	59.7
21	35°49.6	143°16.6	·· 10.7	128°39.8	·· 09.8	280°14.9	·· 32.9	39°11.4	·· 59.7
22	50°52.0	158°15.7	11.1	143°40.2	09.8	295°17.6	32.9	54°13.8	59.6
23	65°54.5	173°14.8	11.6	158°40.6	09.9	310°20.3	33.0	69°16.2	59.6
Mer.pass. 18:37		ν -0.9′	d 0.5′	m -3.90	ν 0.4′	d 0.1′	m 1.25	ν 2.7′	d 0.0′ m -2.60	ν 2.4′	d 0.0′ m 0.95

Stars

	SHA	Dec
Alpheratz	357°33.9	29°14.2
Ankaa	353°06.3	-42°10.1
Schedar	349°30.0	56°41.1
Diphda	348°46.4	-17°50.7
Achernar	335°19.2	-57°06.5
Hamal	327°50.1	23°35.3
Polaris	313°12.0	89°22.6
Acamar	315°10.8	-40°12.1
Menkar	314°05.1	4°11.6
Mirfak	308°26.7	49°57.3
Aldebaran	290°38.4	16°33.7
Rigel	281°02.8	-8°10.2
Capella	280°20.3	46°01.4
Bellatrix	278°21.7	6°22.4
Elnath	278°00.5	28°37.8
Alnilam	275°36.6	-1°11.1
Betelgeuse	270°50.9	7°24.7
Canopus	263°51.5	-52°42.4
Sirius	258°25.2	-16°45.0
Adhara	255°04.9	-29°00.3
Procyon	244°49.8	5°09.5
Pollux	243°16.1	27°57.7
Avior	234°14.0	-59°35.3
Suhail	222°45.5	-43°32.0
Miaplacidus	221°37.6	-69°49.1
Alphard	217°46.9	-8°46.2
Regulus	207°33.5	11°50.4
Dubhe	193°40.0	61°36.3
Denebola	182°24.2	14°25.5
Gienah	175°42.9	-17°41.1
Acrux	172°59.5	-63°14.3
Gacrux	171°51.0	-57°15.2
Alioth	166°12.5	55°48.9
Spica	158°21.7	-11°17.8
Alkaid	152°51.7	49°10.8
Hadar	148°35.4	-60°29.7
Menkent	147°57.0	-36°29.7
Arcturus	145°47.5	19°02.7
Rigil Kent.	139°39.8	-60°56.4
Kochab	137°20.8	74°02.7
Zuben'ubi	136°55.5	-16°08.9
Alphecca	126°03.4	26°37.6
Antares	112°15.3	-26°29.3
Atria	107°09.4	-69°04.4
Sabik	102°02.3	-15°45.4
Shaula	96°09.8	-37°07.3
Rasalhague	95°58.2	12°32.5
Eltanin	90°42.4	51°29.1
Kaus Aust.	83°31.9	-34°22.4
Vega	80°33.1	38°48.5
Nunki	75°47.2	-26°15.9
Altair	61°59.5	8°56.3
Peacock	53°05.0	-56°39.3
Deneb	49°25.6	45°22.6
Enif	33°38.2	9°59.7
Al Na'ir	27°32.1	-46°50.3
Fomalhaut	15°13.7	-29°29.2
Scheat	13°44.5	28°13.6
Markab	13°29.2	15°20.8

Dec 09 Tue	SHA	Mer.pass
Venus	111°18.0	11:23
Mars	95°11.9	12:27
Jupiter	244°09.0	02:31
Saturn	3°25.1	18:31

Dec 10 Wed	SHA	Mer.pass
Venus	109°57.9	11:25
Mars	94°22.7	12:26
Jupiter	244°14.5	02:27
Saturn	3°24.0	18:28

Dec 11 Thu	SHA	Mer.pass
Venus	108°37.6	11:26
Mars	93°33.4	12:26
Jupiter	244°20.2	02:22
Saturn	3°22.9	18:24

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h

Tue	Sun GHA	Sun Dec	Moon GHA	Moon ν	Moon Dec	Moon d	Moon HP
0	181°57.0	S22°49.1	302°22.0	9.2′	N19°33.0	12.4′	58.5′
1	196°56.7	49.3	316°50.2	9.4′	19°20.6	12.4′	58.5′
2	211°56.4	49.6	331°18.6	9.5′	19°08.2	12.6′	58.4′
3	226°56.2	·· 49.8	345°47.1	9.6′	18°55.6	12.6′	58.4′
4	241°55.9	50.0	0°15.7	9.8′	18°43.0	12.7′	58.3′
5	256°55.6	50.3	14°44.5	9.9′	18°30.3	12.8′	58.3′
6	271°55.3	S22°50.5	29°13.4	10.0′	N18°17.5	12.8′	58.3′
7	286°55.0	50.8	43°42.5	10.2′	18°04.7	12.9′	58.2′
8	301°54.8	51.0	58°11.6	10.3′	17°51.8	13.1′	58.2′
9	316°54.5	·· 51.2	72°40.9	10.4′	17°38.7	13.0′	58.1′
10	331°54.2	51.5	87°10.4	10.6′	17°25.7	13.2′	58.1′
11	346°53.9	51.7	101°39.9	10.7′	17°12.5	13.2′	58.1′
12	1°53.6	S22°51.9	116°09.6	10.8′	N16°59.3	13.3′	58.0′
13	16°53.4	52.2	130°39.4	10.9′	16°46.0	13.3′	58.0′
14	31°53.1	52.4	145°09.4	11.1′	16°32.7	13.5′	57.9′
15	46°52.8	·· 52.6	159°39.4	11.2′	16°19.2	13.4′	57.9′
16	61°52.5	52.9	174°09.6	11.3′	16°05.8	13.6′	57.8′
17	76°52.2	53.1	188°39.9	11.4′	15°52.2	13.6′	57.8′
18	91°52.0	S22°53.3	203°10.3	11.5′	N15°38.6	13.6′	57.8′
19	106°51.7	53.6	217°40.9	11.7′	15°25.0	13.7′	57.7′
20	121°51.4	53.8	232°11.5	11.8′	15°11.3	13.8′	57.7′
21	136°51.1	·· 54.0	246°42.3	11.9′	14°57.5	13.8′	57.6′
22	151°50.8	54.2	261°13.2	12.0′	14°43.7	13.9′	57.6′
23	166°50.6	54.5	275°44.2	12.1′	14°29.8	13.9′	57.6′
	SD = 16.2′	d = 0.2′		SD = 16.0′			

Wed	GHA	Dec	GHA	ν	Dec	d	HP
0	181°50.3	S22°54.7	290°15.3	12.2′	N14°15.9	14.0′	57.5′
1	196°50.0	54.9	304°46.6	12.3′	14°01.9	14.0′	57.5′
2	211°49.7	55.1	319°17.9	12.4′	13°47.9	14.0′	57.4′
3	226°49.4	·· 55.4	333°49.3	12.5′	13°33.9	14.1′	57.4′
4	241°49.1	55.6	348°20.9	12.7′	13°19.8	14.2′	57.4′
5	256°48.9	55.8	2°52.5	12.8′	13°05.6	14.2′	57.3′
6	271°48.6	S22°56.0	17°24.3	12.9′	N12°51.4	14.2′	57.3′
7	286°48.3	56.2	31°56.1	13.0′	12°37.2	14.3′	57.2′
8	301°48.0	56.5	46°28.1	13.1′	12°22.9	14.3′	57.2′
9	316°47.7	·· 56.7	61°00.1	13.2′	12°08.6	14.3′	57.2′
10	331°47.4	56.9	75°32.3	13.2′	11°54.3	14.4′	57.1′
11	346°47.2	57.1	90°04.5	13.3′	11°39.9	14.4′	57.1′
12	1°46.9	S22°57.3	104°36.9	13.4′	N11°25.5	14.4′	57.1′
13	16°46.6	57.6	119°09.3	13.5′	11°11.1	14.4′	57.0′
14	31°46.3	57.8	133°41.8	13.6′	10°56.7	14.5′	57.0′
15	46°46.0	·· 58.0	148°14.5	13.7′	10°42.2	14.5′	56.9′
16	61°45.7	58.2	162°47.2	13.8′	10°27.7	14.6′	56.9′
17	76°45.5	58.4	177°20.0	13.9′	10°13.1	14.6′	56.9′
18	91°45.2	S22°58.6	191°52.8	14.0′	N09°58.5	14.5′	56.8′
19	106°44.9	58.8	206°25.8	14.0′	09°44.0	14.7′	56.8′
20	121°44.6	59.0	220°58.9	14.1′	09°29.3	14.6′	56.7′
21	136°44.3	·· 59.2	235°32.0	14.2′	09°14.7	14.6′	56.7′
22	151°44.0	59.5	250°05.2	14.3′	09°00.1	14.7′	56.7′
23	166°43.7	59.7	264°38.5	14.4′	08°45.4	14.7′	56.6′
	SD = 16.2′	d = 0.2′		SD = 15.7′			

Thu	GHA	Dec	GHA	ν	Dec	d	HP
0	181°43.5	S22°59.9	279°11.9	14.4′	N08°30.7	14.7′	56.6′
1	196°43.2	23°00.1	293°45.3	14.5′	08°16.0	14.7′	56.6′
2	211°42.9	00.3	308°18.8	14.6′	08°01.3	14.8′	56.5′
3	226°42.6	·· 00.5	322°52.4	14.7′	07°46.5	14.7′	56.5′
4	241°42.3	00.7	337°26.1	14.7′	07°31.8	14.8′	56.5′
5	256°42.0	00.9	351°59.8	14.8′	07°17.0	14.7′	56.4′
6	271°41.7	S23°01.1	6°33.6	14.9′	N07°02.3	14.8′	56.4′
7	286°41.4	01.3	21°07.4	14.9′	06°47.5	14.8′	56.3′
8	301°41.2	01.5	35°41.4	15.0′	06°32.7	14.8′	56.3′
9	316°40.9	·· 01.7	50°15.4	15.1′	06°17.9	14.8′	56.3′
10	331°40.6	01.9	64°49.4	15.1′	06°03.1	14.8′	56.2′
11	346°40.3	02.1	79°23.5	15.2′	05°48.3	14.9′	56.2′
12	1°40.0	S23°02.3	93°57.7	15.2′	N05°33.4	14.8′	56.2′
13	16°39.7	02.5	108°32.0	15.3′	05°18.6	14.8′	56.1′
14	31°39.4	02.7	123°06.2	15.3′	05°03.8	14.8′	56.1′
15	46°39.1	·· 02.9	137°40.6	15.4′	04°49.0	14.9′	56.1′
16	61°38.8	03.1	152°15.0	15.5′	04°34.1	14.8′	56.0′
17	76°38.6	03.3	166°49.5	15.5′	04°19.3	14.8′	56.0′
18	91°38.3	S23°03.4	181°24.0	15.6′	N04°04.5	14.8′	56.0′
19	106°38.0	03.6	195°58.5	15.6′	03°49.7	14.9′	55.9′
20	121°37.7	03.8	210°33.1	15.7′	03°34.8	14.8′	55.9′
21	136°37.4	·· 04.0	225°07.8	15.7′	03°20.0	14.8′	55.9′
22	151°37.1	04.2	239°42.5	15.7′	03°05.2	14.8′	55.8′
23	166°36.8	04.4	254°17.2	15.8′	02°50.4	14.8′	55.8′
	SD = 16.2′	d = 0.2′		SD = 15.4′			

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	08:12	10:30	▬	▬	13:15	15:33
N 70°	07:54	09:38	▬	▬	14:08	15:52
68°	07:38	09:05	▬	▬	14:40	16:07
66°	07:26	08:42	10:16	13:29	15:04	16:19
64°	07:15	08:23	09:38	14:07	15:23	16:30
62°	07:06	08:07	09:12	14:34	15:38	16:39
60°	06:58	07:54	08:51	14:54	15:51	16:47
N 58°	06:51	07:43	08:34	15:11	16:02	16:55
56°	06:44	07:33	08:20	15:25	16:12	17:01
54°	06:39	07:24	08:08	15:38	16:21	17:07
52°	06:33	07:17	07:57	15:48	16:29	17:12
50°	06:28	07:09	07:48	15:58	16:36	17:18
45°	06:17	06:54	07:27	16:18	16:52	17:29
N 40°	06:07	06:41	07:11	16:35	17:05	17:39
35°	05:58	06:29	06:57	16:48	17:17	17:48
30°	05:49	06:19	06:45	17:01	17:27	17:57
20°	05:33	06:00	06:24	17:21	17:45	18:13
N 10°	05:17	05:43	06:06	17:40	18:02	18:29
0°	05:01	05:27	05:49	17:57	18:19	18:45
S 10°	04:42	05:09	05:32	18:14	18:37	19:04
20°	04:20	04:49	05:13	18:32	18:57	19:26
30°	03:51	04:25	04:52	18:54	19:21	19:55
35°	03:33	04:10	04:39	19:07	19:36	20:13
40°	03:11	03:52	04:25	19:21	19:54	20:35
45°	02:41	03:30	04:07	19:39	20:16	21:05
S 50°	01:58	03:01	03:45	20:01	20:45	21:49
52°	01:32	02:47	03:35	20:12	21:00	22:15
54°	00:53	02:29	03:23	20:24	21:17	22:55
56°	////	02:08	03:09	20:37	21:38	////
58°	////	01:41	02:53	20:54	22:06	////
S 60°	////	00:58	02:33	21:13	22:50	////

Lat.	Moonrise Tue	Moonrise Wed	Moonrise Thu	Moonset Tue	Moonset Wed	Moonset Thu
N 72°	18:37	21:21	23:32	14:36	13:30	12:51
N 70°	19:16	21:36	23:35	13:56	13:13	12:44
68°	19:43	21:48	23:38	13:27	12:59	12:38
66°	20:03	21:57	23:41	13:06	12:48	12:33
64°	20:19	22:05	23:43	12:48	12:38	12:29
62°	20:32	22:12	23:45	12:34	12:30	12:25
60°	20:43	22:18	23:47	12:22	12:22	12:22
N 58°	20:53	22:23	23:48	12:11	12:16	12:19
56°	21:01	22:28	23:49	12:02	12:10	12:17
54°	21:08	22:32	23:50	11:54	12:05	12:14
52°	21:15	22:35	23:52	11:46	12:01	12:12
50°	21:21	22:39	23:52	11:40	11:56	12:10
45°	21:34	22:46	23:55	11:25	11:47	12:06
N 40°	21:44	22:52	23:56	11:13	11:40	12:02
35°	21:53	22:57	23:58	11:03	11:33	11:59
30°	22:01	23:02	23:59	10:54	11:27	11:56
20°	22:14	23:09	·· ··	10:38	11:17	11:52
N 10°	22:26	23:16	·· ··	10:24	11:08	11:47
0°	22:37	23:23	·· ··	10:11	10:59	11:43
S 10°	22:48	23:29	·· ··	09:58	10:51	11:39
20°	22:59	23:36	·· ··	09:44	10:41	11:35
30°	23:12	23:43	·· ··	09:27	10:31	11:30
35°	23:20	23:48	·· ··	09:18	10:24	11:27
40°	23:28	23:53	·· ··	09:07	10:17	11:23
45°	23:38	23:58	·· ··	08:54	10:09	11:19
S 50°	23:50	·· ··	00:05	08:38	09:59	11:15
52°	23:56	·· ··	00:08	08:30	09:54	11:12
54°	·· ··	00:02	00:12	08:22	09:49	11:10
56°	·· ··	00:09	00:15	08:13	09:43	11:07
58°	00:11	00:16	00:20	08:02	09:37	11:04
S 60°	00:24	00:25	00:24	07:49	09:29	11:01

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Age 19-21 79-59%
09	07:48	07:35	11:52	03:59	16:24	
10	07:21	07:08	11:53	04:48	17:11	
11	06:54	06:40	11:53	05:33	17:54	

December 12, 13, 14 UT (Fri., Sat., Sun.)

	Aries	Venus		Mars		Jupiter		Saturn	
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	80°56.9	188°13.9	S22°12.1	173°41.0	S24°10.0	325°23.0	N21°33.0	84°18.6	S03°59.6
1	95°59.4	203°13.1	12.6	188°41.4	10.0	340°25.8	33.1	99°21.0	59.5
2	111°01.9	218°12.2	13.0	203°41.8	10.1	355°28.5	33.1	114°23.4	59.5
3	126°04.3	233°11.3	·· 13.5	218°42.2	·· 10.1	10°31.2	·· 33.2	129°25.8	·· 59.5
4	141°06.8	248°10.4	14.0	233°42.6	10.2	25°33.9	33.2	144°28.3	59.4
5	156°09.3	263°09.5	14.4	248°43.0	10.2	40°36.6	33.3	159°30.7	59.4
6	171°11.7	278°08.6	S22°14.9	263°43.5	S24°10.3	55°39.3	N21°33.3	174°33.1	S03°59.4
7	186°14.2	293°07.7	15.4	278°43.9	10.3	70°42.0	33.4	189°35.5	59.3
8	201°16.7	308°06.8	15.8	293°44.3	10.4	85°44.8	33.4	204°37.9	59.3
9	216°19.1	323°05.9	·· 16.3	308°44.7	·· 10.4	100°47.5	·· 33.5	219°40.3	·· 59.3
10	231°21.6	338°05.0	16.7	323°45.1	10.5	115°50.2	33.5	234°42.7	59.2
11	246°24.0	353°04.1	17.2	338°45.5	10.5	130°52.9	33.6	249°45.1	59.2
12	261°26.5	8°03.2	S22°17.7	353°45.9	S24°10.6	145°55.6	N21°33.6	264°47.5	S03°59.2
13	276°29.0	23°02.3	18.1	8°46.3	10.6	160°58.3	33.7	279°49.9	59.1
14	291°31.4	38°01.4	18.6	23°46.7	10.7	176°01.1	33.7	294°52.3	59.1
15	306°33.9	53°00.4	·· 19.0	38°47.1	·· 10.7	191°03.8	·· 33.7	309°54.8	·· 59.1
16	321°36.4	67°59.5	19.5	53°47.5	10.8	206°06.5	33.8	324°57.2	59.0
17	336°38.8	82°58.6	19.9	68°47.9	10.8	221°09.2	33.8	339°59.6	59.0
18	351°41.3	97°57.7	S22°20.4	83°48.3	S24°10.9	236°11.9	N21°33.9	355°02.0	S03°59.0
19	6°43.8	112°56.8	20.8	98°48.7	10.9	251°14.6	33.9	10°04.4	58.9
20	21°46.2	127°55.9	21.3	113°49.1	11.0	266°17.4	34.0	25°06.8	58.9
21	36°48.7	142°55.0	·· 21.7	128°49.5	·· 11.0	281°20.1	·· 34.0	40°09.2	·· 58.9
22	51°51.2	157°54.1	22.2	143°49.9	11.1	296°22.8	34.1	55°11.6	58.8
23	66°53.6	172°53.2	22.6	158°50.3	11.1	311°25.5	34.1	70°14.0	58.8
Mer.pass. 18:33		ν -0.9′	d 0.5′	m -3.90	ν 0.4′	d 0.1′	m 1.24	ν 2.7′	d 0.0′ m -2.60	ν 2.4′	d 0.0′ m 0.95

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	81°56.1	187°52.3	S22°23.0	173°50.7	S24°11.1	326°28.2	N21°34.2	85°16.4	S03°58.8
1	96°58.5	202°51.4	23.5	188°51.1	11.2	341°31.0	34.2	100°18.8	58.7
2	112°01.0	217°50.5	23.9	203°51.5	11.2	356°33.7	34.3	115°21.2	58.7
3	127°03.5	232°49.6	·· 24.4	218°52.0	·· 11.3	11°36.4	·· 34.3	130°23.6	·· 58.7
4	142°05.9	247°48.7	24.8	233°52.4	11.3	26°39.1	34.4	145°26.1	58.6
5	157°08.4	262°47.8	25.2	248°52.8	11.4	41°41.8	34.4	160°28.5	58.6
6	172°10.9	277°46.9	S22°25.7	263°53.2	S24°11.4	56°44.6	N21°34.5	175°30.9	S03°58.6
7	187°13.3	292°46.0	26.1	278°53.6	11.4	71°47.3	34.5	190°33.3	58.5
8	202°15.8	307°45.0	26.6	293°54.0	11.5	86°50.0	34.6	205°35.7	58.5
9	217°18.3	322°44.1	·· 27.0	308°54.4	·· 11.5	101°52.7	·· 34.6	220°38.1	·· 58.5
10	232°20.7	337°43.2	27.4	323°54.8	11.6	116°55.4	34.7	235°40.5	58.4
11	247°23.2	352°42.3	27.8	338°55.2	11.6	131°58.2	34.7	250°42.9	58.4
12	262°25.6	7°41.4	S22°28.3	353°55.6	S24°11.6	147°00.9	N21°34.8	265°45.3	S03°58.4
13	277°28.1	22°40.5	28.7	8°56.0	11.7	162°03.6	34.8	280°47.7	58.3
14	292°30.6	37°39.6	29.1	23°56.4	11.7	177°06.3	34.8	295°50.1	58.3
15	307°33.0	52°38.7	·· 29.6	38°56.8	·· 11.8	192°09.1	·· 34.9	310°52.5	·· 58.2
16	322°35.5	67°37.8	30.0	53°57.2	11.8	207°11.8	34.9	325°54.9	58.2
17	337°38.0	82°36.8	30.4	68°57.6	11.8	222°14.5	35.0	340°57.3	58.2
18	352°40.4	97°35.9	S22°30.8	83°58.0	S24°11.9	237°17.2	N21°35.0	355°59.7	S03°58.1
19	7°42.9	112°35.0	31.3	98°58.4	11.9	252°20.0	35.1	11°02.1	58.1
20	22°45.4	127°34.1	31.7	113°58.8	11.9	267°22.7	35.1	26°04.5	58.1
21	37°47.8	142°33.2	·· 32.1	128°59.2	·· 12.0	282°25.4	·· 35.2	41°06.9	·· 58.0
22	52°50.3	157°32.3	32.5	143°59.6	12.0	297°28.1	35.2	56°09.3	58.0
23	67°52.8	172°31.4	32.9	159°00.0	12.0	312°30.9	35.3	71°11.7	58.0
Mer.pass. 18:29		ν -0.9′	d 0.4′	m -3.90	ν 0.4′	d 0.0′	m 1.24	ν 2.7′	d 0.0′ m -2.61	ν 2.4′	d 0.0′ m 0.96

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	82°55.2	187°30.5	S22°33.3	174°00.4	S24°12.1	327°33.6	N21°35.3	86°14.1	S03°57.9
1	97°57.7	202°29.5	33.8	189°00.8	12.1	342°36.3	35.4	101°16.5	57.9
2	113°00.1	217°28.6	34.2	204°01.2	12.1	357°39.0	35.4	116°18.9	57.8
3	128°02.6	232°27.7	·· 34.6	219°01.6	·· 12.2	12°41.8	·· 35.5	131°21.3	·· 57.8
4	143°05.1	247°26.8	35.0	234°02.0	12.2	27°44.5	35.5	146°23.7	57.8
5	158°07.5	262°25.9	35.4	249°02.4	12.2	42°47.2	35.6	161°26.2	57.7
6	173°10.0	277°25.0	S22°35.8	264°02.8	S24°12.3	57°49.9	N21°35.6	176°28.6	S03°57.7
7	188°12.5	292°24.0	36.2	279°03.2	12.3	72°52.7	35.7	191°31.0	57.7
8	203°14.9	307°23.1	36.6	294°03.6	12.3	87°55.4	35.7	206°33.4	57.6
9	218°17.4	322°22.2	·· 37.0	309°04.0	·· 12.3	102°58.1	·· 35.8	221°35.8	·· 57.6
10	233°19.9	337°21.3	37.4	324°04.4	12.4	118°00.9	35.8	236°38.2	57.6
11	248°22.3	352°20.4	37.8	339°04.8	12.4	133°03.6	35.9	251°40.6	57.5
12	263°24.8	7°19.5	S22°38.2	354°05.2	S24°12.4	148°06.3	N21°35.9	266°43.0	S03°57.5
13	278°27.3	22°18.5	38.6	9°05.6	12.5	163°09.1	36.0	281°45.4	57.4
14	293°29.7	37°17.6	39.0	24°06.0	12.5	178°11.8	36.0	296°47.8	57.4
15	308°32.2	52°16.7	·· 39.4	39°06.4	·· 12.5	193°14.5	·· 36.1	311°50.2	·· 57.4
16	323°34.6	67°15.8	39.8	54°06.8	12.5	208°17.2	36.1	326°52.6	57.3
17	338°37.1	82°14.9	40.2	69°07.2	12.6	223°20.0	36.2	341°55.0	57.3
18	353°39.6	97°13.9	S22°40.6	84°07.6	S24°12.6	238°22.7	N21°36.2	356°57.4	S03°57.3
19	8°42.0	112°13.0	41.0	99°08.0	12.6	253°25.4	36.3	11°59.8	57.2
20	23°44.5	127°12.1	41.4	114°08.4	12.6	268°28.2	36.3	27°02.2	57.2
21	38°47.0	142°11.2	·· 41.8	129°08.8	·· 12.7	283°30.9	·· 36.4	42°04.6	·· 57.1
22	53°49.4	157°10.2	42.2	144°09.2	12.7	298°33.6	36.4	57°07.0	57.1
23	68°51.9	172°09.3	42.6	159°09.6	12.7	313°36.4	36.5	72°09.4	57.1
Mer.pass. 18:25		ν -0.9′	d 0.4′	m -3.90	ν 0.4′	d 0.0′	m 1.23	ν 2.7′	d 0.0′ m -2.61	ν 2.4′	d 0.0′ m 0.96

Stars

	SHA	Dec
Alpheratz	357°33.9	29°14.2
Ankaa	353°06.3	-42°10.1
Schedar	349°30.0	56°41.1
Diphda	348°46.4	-17°50.7
Achernar	335°19.3	-57°06.5
Hamal	327°50.1	23°35.3
Polaris	313°12.7	89°22.6
Acamar	315°10.8	-40°12.1
Menkar	314°05.1	4°11.6
Mirfak	308°26.7	49°57.4
Aldebaran	290°38.4	16°33.7
Rigel	281°02.8	-8°10.3
Capella	280°20.3	46°01.5
Bellatrix	278°21.7	6°22.4
Elnath	278°00.5	28°37.8
Alnilam	275°36.6	-1°11.1
Betelgeuse	270°50.9	7°24.7
Canopus	263°51.5	-52°42.4
Sirius	258°25.2	-16°45.0
Adhara	255°04.9	-29°00.3
Procyon	244°49.8	5°09.5
Pollux	243°16.1	27°57.7
Avior	234°14.0	-59°35.3
Suhail	222°45.5	-43°32.0
Miaplacidus	221°37.6	-69°49.1
Alphard	217°46.8	-8°46.2
Regulus	207°33.5	11°50.4
Dubhe	193°40.0	61°36.3
Denebola	182°24.2	14°25.5
Gienah	175°42.9	-17°41.1
Acrux	172°59.5	-63°14.3
Gacrux	171°51.0	-57°15.2
Alioth	166°12.5	55°48.8
Spica	158°21.7	-11°17.8
Alkaid	152°51.7	49°10.8
Hadar	148°35.4	-60°29.7
Menkent	147°57.0	-36°29.7
Arcturus	145°47.5	19°02.7
Rigil Kent.	139°39.8	-60°56.4
Kochab	137°20.8	74°02.6
Zuben'ubi	136°55.5	-16°08.9
Alphecca	126°03.4	26°37.5
Antares	112°15.3	-26°29.3
Atria	107°09.4	-69°04.4
Sabik	102°02.3	-15°45.4
Shaula	96°09.8	-37°07.3
Rasalhague	95°58.2	12°32.5
Eltanin	90°42.4	51°29.1
Kaus Aust.	83°31.9	-34°22.4
Vega	80°33.1	38°48.5
Nunki	75°47.2	-26°15.9
Altair	61°59.5	8°56.3
Peacock	53°05.0	-56°39.3
Deneb	49°25.6	45°22.6
Enif	33°38.2	9°59.7
Al Na'ir	27°32.1	-46°50.3
Fomalhaut	15°13.7	-29°29.2
Scheat	13°44.5	28°13.6
Markab	13°29.2	15°20.8

Dec 12 Fri	SHA	Mer.pass
Venus	107°17.0	11:28
Mars	92°44.1	12:25
Jupiter	244°26.1	02:18
Saturn	3°21.7	18:20

Dec 13 Sat	SHA	Mer.pass
Venus	105°56.2	11:29
Mars	91°54.7	12:24
Jupiter	244°32.2	02:14
Saturn	3°20.3	18:16

Dec 14 Sun	SHA	Mer.pass
Venus	104°35.2	11:31
Mars	91°05.2	12:24
Jupiter	244°38.4	02:09
Saturn	3°18.9	18:12

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h

Fri	Sun GHA	Sun Dec	Moon GHA	Moon ν	Moon Dec	Moon d	Moon HP
0	181°36.5	S23°04.6	268°52.0	15.8′	N02°35.6	14.8′	55.8′
1	196°36.2	04.8	283°26.8	15.9′	02°20.8	14.8′	55.8′
2	211°35.9	05.0	298°01.7	15.9′	02°06.0	14.8′	55.7′
3	226°35.7	·· 05.1	312°36.6	15.9′	01°51.2	14.8′	55.7′
4	241°35.4	05.3	327°11.5	16.0′	01°36.4	14.8′	55.7′
5	256°35.1	05.5	341°46.5	16.0′	01°21.6	14.7′	55.6′
6	271°34.8	S23°05.7	356°21.5	16.0′	N01°06.9	14.8′	55.6′
7	286°34.5	05.9	10°56.6	16.1′	00°52.1	14.7′	55.6′
8	301°34.2	06.1	25°31.7	16.1′	00°37.4	14.7′	55.5′
9	316°33.9	·· 06.2	40°06.8	16.1′	00°22.7	14.7′	55.5′
10	331°33.6	06.4	54°41.9	16.2′	N00°08.0	14.7′	55.5′
11	346°33.3	06.6	69°17.1	16.2′	S00°06.7	14.7′	55.5′
12	1°33.0	S23°06.8	83°52.3	16.2′	S00°21.4	14.7′	55.4′
13	16°32.7	06.9	98°27.5	16.2′	00°36.1	14.6′	55.4′
14	31°32.4	07.1	113°02.8	16.3′	00°50.7	14.6′	55.4′
15	46°32.1	·· 07.3	127°38.0	16.3′	01°05.3	14.6′	55.3′
16	61°31.9	07.5	142°13.3	16.3′	01°19.9	14.6′	55.3′
17	76°31.6	07.6	156°48.6	16.3′	01°34.5	14.6′	55.3′
18	91°31.3	S23°07.8	171°24.0	16.3′	S01°49.1	14.6′	55.3′
19	106°31.0	08.0	185°59.3	16.4′	02°03.7	14.5′	55.2′
20	121°30.7	08.2	200°34.7	16.4′	02°18.2	14.5′	55.2′
21	136°30.4	·· 08.3	215°10.1	16.4′	02°32.7	14.5′	55.2′
22	151°30.1	08.5	229°45.5	16.4′	02°47.2	14.4′	55.2′
23	166°29.8	08.7	244°20.9	16.4′	03°01.6	14.5′	55.1′
	SD = 16.2′	d = 0.2′		SD = 15.2′			

Sat	GHA	Dec	GHA	ν	Dec	d	HP
0	181°29.5	S23°08.8	258°56.3	16.4′	S03°16.1	14.4′	55.1′
1	196°29.2	09.0	273°31.7	16.4′	03°30.5	14.4′	55.1′
2	211°28.9	09.2	288°07.2	16.4′	03°44.9	14.3′	55.1′
3	226°28.6	·· 09.3	302°42.6	16.5′	03°59.2	14.4′	55.0′
4	241°28.3	09.5	317°18.1	16.5′	04°13.6	14.3′	55.0′
5	256°28.0	09.7	331°53.5	16.5′	04°27.9	14.2′	55.0′
6	271°27.7	S23°09.8	346°29.0	16.5′	S04°42.1	14.3′	55.0′
7	286°27.4	10.0	1°04.5	16.5′	04°56.4	14.2′	54.9′
8	301°27.1	10.2	15°39.9	16.5′	05°10.6	14.2′	54.9′
9	316°26.8	·· 10.3	30°15.4	16.5′	05°24.8	14.2′	54.9′
10	331°26.6	10.5	44°50.9	16.5′	05°39.0	14.1′	54.9′
11	346°26.3	10.6	59°26.3	16.5′	05°53.1	14.1′	54.8′
12	1°26.0	S23°10.8	74°01.8	16.5′	S06°07.2	14.0′	54.8′
13	16°25.7	11.0	88°37.3	16.5′	06°21.2	14.1′	54.8′
14	31°25.4	11.1	103°12.7	16.5′	06°35.3	14.0′	54.8′
15	46°25.1	·· 11.3	117°48.2	16.4′	06°49.3	13.9′	54.8′
16	61°24.8	11.4	132°23.6	16.4′	07°03.2	13.9′	54.7′
17	76°24.5	11.6	146°59.1	16.4′	07°17.1	13.9′	54.7′
18	91°24.2	S23°11.7	161°34.5	16.4′	S07°31.0	13.9′	54.7′
19	106°23.9	11.9	176°09.9	16.4′	07°44.9	13.8′	54.7′
20	121°23.6	12.0	190°45.3	16.4′	07°58.7	13.8′	54.7′
21	136°23.3	·· 12.2	205°20.7	16.4′	08°12.5	13.7′	54.6′
22	151°23.0	12.3	219°56.1	16.4′	08°26.2	13.7′	54.6′
23	166°22.7	12.5	234°31.4	16.3′	08°39.9	13.6′	54.6′
	SD = 16.2′	d = 0.2′		SD = 15.0′			

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	181°22.4	S23°12.6	249°06.8	16.3′	S08°53.5	13.7′	54.6′
1	196°22.1	12.8	263°42.1	16.3′	09°07.2	13.5′	54.6′
2	211°21.8	12.9	278°17.4	16.3′	09°20.7	13.6′	54.5′
3	226°21.5	·· 13.1	292°52.7	16.3′	09°34.3	13.4′	54.5′
4	241°21.2	13.2	307°28.0	16.2′	09°47.7	13.5′	54.5′
5	256°20.9	13.4	322°03.2	16.2′	10°01.2	13.4′	54.5′
6	271°20.6	S23°13.5	336°38.5	16.2′	S10°14.6	13.3′	54.5′
7	286°20.3	13.7	351°13.7	16.2′	10°27.9	13.3′	54.5′
8	301°20.0	13.8	5°48.8	16.2′	10°41.2	13.3′	54.4′
9	316°19.7	·· 13.9	20°24.0	16.1′	10°54.5	13.2′	54.4′
10	331°19.4	14.1	34°59.1	16.1′	11°07.7	13.2′	54.4′
11	346°19.1	14.2	49°34.2	16.1′	11°20.9	13.1′	54.4′
12	1°18.8	S23°14.4	64°09.3	16.0′	S11°34.0	13.0′	54.4′
13	16°18.5	14.5	78°44.3	16.0′	11°47.0	13.1′	54.4′
14	31°18.2	14.6	93°19.3	16.0′	12°00.1	12.9′	54.4′
15	46°17.9	·· 14.8	107°54.3	15.9′	12°13.0	12.9′	54.3′
16	61°17.6	14.9	122°29.3	15.9′	12°25.9	12.9′	54.3′
17	76°17.3	15.1	137°04.2	15.9′	12°38.8	12.8′	54.3′
18	91°17.0	S23°15.2	151°39.1	15.8′	S12°51.6	12.7′	54.3′
19	106°16.7	15.3	166°13.9	15.8′	13°04.3	12.7′	54.3′
20	121°16.4	15.5	180°48.7	15.8′	13°17.0	12.7′	54.3′
21	136°16.1	·· 15.6	195°23.5	15.7′	13°29.7	12.6′	54.3′
22	151°15.8	15.7	209°58.2	15.7′	13°42.3	12.5′	54.2′
23	166°15.5	15.9	224°32.9	15.7′	13°54.8	12.5′	54.2′
	SD = 16.2′	d = 0.1′		SD = 14.9′			

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	08:18	10:41	▬	▬	13:07	15:31
N 70°	07:58	09:44	▬	▬	14:04	15:50
68°	07:43	09:11	▬	▬	14:38	16:06
66°	07:30	08:46	10:24	13:25	15:02	16:18
64°	07:19	08:27	09:43	14:05	15:21	16:29
62°	07:10	08:11	09:16	14:32	15:37	16:39
60°	07:01	07:58	08:55	14:53	15:50	16:47
N 58°	06:54	07:46	08:38	15:10	16:02	16:54
56°	06:47	07:36	08:23	15:25	16:12	17:01
54°	06:41	07:27	08:11	15:37	16:21	17:07
52°	06:36	07:19	08:00	15:48	16:29	17:13
50°	06:31	07:12	07:50	15:58	16:36	17:18
45°	06:19	06:56	07:30	16:19	16:52	17:29
N 40°	06:09	06:43	07:13	16:35	17:06	17:40
35°	06:00	06:31	06:59	16:49	17:17	17:49
30°	05:51	06:21	06:47	17:01	17:28	17:58
20°	05:35	06:02	06:26	17:22	17:46	18:14
N 10°	05:19	05:45	06:08	17:41	18:04	18:30
0°	05:02	05:28	05:51	17:58	18:21	18:47
S 10°	04:43	05:10	05:33	18:15	18:38	19:05
20°	04:21	04:50	05:14	18:34	18:59	19:28
30°	03:52	04:25	04:53	18:56	19:23	19:57
35°	03:34	04:10	04:40	19:09	19:39	20:15
40°	03:11	03:52	04:25	19:24	19:57	20:38
45°	02:41	03:30	04:07	19:42	20:19	21:08
S 50°	01:56	03:01	03:45	20:04	20:48	21:53
52°	01:30	02:46	03:34	20:15	21:03	22:20
54°	00:47	02:28	03:22	20:27	21:21	23:03
56°	////	02:07	03:08	20:41	21:43	////
58°	////	01:38	02:52	20:57	22:11	////
S 60°	////	00:52	02:32	21:17	22:58	////

Lat.	Moonrise Fri	Moonrise Sat	Moonrise Sun	Moonset Fri	Moonset Sat	Moonset Sun
N 72°	·· ··	01:33	03:38	12:18	11:46	11:07
N 70°	·· ··	01:28	03:22	12:19	11:54	11:26
68°	·· ··	01:23	03:09	12:20	12:01	11:41
66°	·· ··	01:20	02:58	12:20	12:07	11:53
64°	·· ··	01:17	02:50	12:21	12:12	12:03
62°	·· ··	01:14	02:42	12:21	12:16	12:12
60°	·· ··	01:12	02:36	12:21	12:20	12:20
N 58°	·· ··	01:10	02:30	12:21	12:24	12:26
56°	·· ··	01:08	02:25	12:22	12:27	12:32
54°	·· ··	01:06	02:21	12:22	12:29	12:37
52°	·· ··	01:05	02:17	12:22	12:32	12:42
50°	·· ··	01:03	02:13	12:22	12:34	12:47
45°	·· ··	01:01	02:06	12:23	12:39	12:56
N 40°	·· ··	00:58	01:59	12:23	12:43	13:04
35°	·· ··	00:56	01:54	12:23	12:47	13:11
30°	·· ··	00:54	01:49	12:24	12:50	13:17
20°	00:01	00:51	01:40	12:24	12:56	13:28
N 10°	00:03	00:48	01:33	12:24	13:01	13:37
0°	00:05	00:46	01:26	12:25	13:05	13:46
S 10°	00:07	00:43	01:20	12:25	13:10	13:55
20°	00:09	00:41	01:12	12:25	13:15	14:04
30°	00:11	00:38	01:04	12:26	13:21	14:15
35°	00:13	00:36	01:00	12:26	13:24	14:21
40°	00:14	00:34	00:55	12:26	13:28	14:28
45°	00:16	00:32	00:49	12:27	13:32	14:37
S 50°	00:18	00:30	00:42	12:27	13:37	14:47
52°	00:19	00:28	00:38	12:27	13:40	14:52
54°	00:20	00:27	00:35	12:27	13:42	14:57
56°	00:21	00:26	00:31	12:27	13:45	15:03
58°	00:22	00:24	00:26	12:27	13:48	15:09
S 60°	00:23	00:22	00:21	12:28	13:52	15:17

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 22-24 49-30%
12	06:26	06:12	11:54	06:15	18:35	
13	05:58	05:44	11:54	06:56	19:16	
14	05:30	05:15	11:55	07:36	19:57	

December 15, 16, 17 UT (Mon., Tue., Wed.)

	Aries	Venus		Mars		Jupiter		Saturn	
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	83°54.4	187°08.4	S22°42.9	174°10.0	S24°12.7	328°39.1	N21°36.5	87°11.8	S03°57.0
1	98°56.8	202°07.5	43.3	189°10.4	12.8	343°41.8	36.6	102°14.2	57.0
2	113°59.3	217°06.6	43.7	204°10.8	12.8	358°44.6	36.6	117°16.6	57.0
3	129°01.7	232°05.6	·· 44.1	219°11.2	·· 12.8	13°47.3	·· 36.7	132°19.0	·· 56.9
4	144°04.2	247°04.7	44.5	234°11.6	12.8	28°50.0	36.7	147°21.4	56.9
5	159°06.7	262°03.8	44.9	249°12.0	12.8	43°52.8	36.8	162°23.7	56.8
6	174°09.1	277°02.9	S22°45.2	264°12.4	S24°12.9	58°55.5	N21°36.8	177°26.1	S03°56.8
7	189°11.6	292°01.9	45.6	279°12.8	12.9	73°58.2	36.9	192°28.5	56.8
8	204°14.1	307°01.0	46.0	294°13.2	12.9	89°01.0	36.9	207°30.9	56.7
9	219°16.5	322°00.1	·· 46.4	309°13.6	·· 12.9	104°03.7	·· 37.0	222°33.3	·· 56.7
10	234°19.0	336°59.2	46.8	324°14.0	12.9	119°06.4	37.0	237°35.7	56.6
11	249°21.5	351°58.2	47.1	339°14.4	12.9	134°09.2	37.1	252°38.1	56.6
12	264°23.9	6°57.3	S22°47.5	354°14.8	S24°13.0	149°11.9	N21°37.1	267°40.5	S03°56.6
13	279°26.4	21°56.4	47.9	9°15.2	13.0	164°14.6	37.2	282°42.9	56.5
14	294°28.9	36°55.4	48.2	24°15.6	13.0	179°17.4	37.2	297°45.3	56.5
15	309°31.3	51°54.5	·· 48.6	39°15.9	·· 13.0	194°20.1	·· 37.3	312°47.7	·· 56.5
16	324°33.8	66°53.6	49.0	54°16.3	13.0	209°22.9	37.3	327°50.1	56.4
17	339°36.2	81°52.7	49.3	69°16.7	13.0	224°25.6	37.4	342°52.5	56.4
18	354°38.7	96°51.7	S22°49.7	84°17.1	S24°13.1	239°28.3	N21°37.4	357°54.9	S03°56.3
19	9°41.2	111°50.8	50.1	99°17.5	13.1	254°31.1	37.5	12°57.3	56.3
20	24°43.6	126°49.9	50.4	114°17.9	13.1	269°33.8	37.5	27°59.7	56.3
21	39°46.1	141°48.9	·· 50.8	129°18.3	·· 13.1	284°36.5	·· 37.6	43°02.1	·· 56.2
22	54°48.6	156°48.0	51.2	144°18.7	13.1	299°39.3	37.6	58°04.5	56.2
23	69°51.0	171°47.1	51.5	159°19.1	13.1	314°42.0	37.7	73°06.9	56.1
Mer.pass. 18:21		ν -0.9′	d 0.4′	m -3.90	ν 0.4′	d 0.0′	m 1.23	ν 2.7′	d 0.0′ m -2.62	ν 2.4′	d 0.0′ m 0.96

Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	84°53.5	186°46.2	S22°51.9	174°19.5	S24°13.1	329°44.8	N21°37.7	88°09.3	S03°56.1
1	99°56.0	201°45.2	52.2	189°19.9	13.1	344°47.5	37.8	103°11.7	56.1
2	114°58.4	216°44.3	52.6	204°20.3	13.1	359°50.2	37.8	118°14.1	56.0
3	130°00.9	231°43.4	·· 52.9	219°20.7	·· 13.2	14°53.0	·· 37.9	133°16.5	·· 56.0
4	145°03.4	246°42.4	53.3	234°21.1	13.2	29°55.7	37.9	148°18.9	55.9
5	160°05.8	261°41.5	53.6	249°21.5	13.2	44°58.5	38.0	163°21.3	55.9
6	175°08.3	276°40.6	S22°54.0	264°21.9	S24°13.2	60°01.2	N21°38.0	178°23.6	S03°55.9
7	190°10.7	291°39.6	54.3	279°22.3	13.2	75°03.9	38.1	193°26.0	55.8
8	205°13.2	306°38.7	54.7	294°22.7	13.2	90°06.7	38.1	208°28.4	55.8
9	220°15.7	321°37.8	·· 55.0	309°23.1	·· 13.2	105°09.4	·· 38.2	223°30.8	·· 55.7
10	235°18.1	336°36.8	55.4	324°23.5	13.2	120°12.2	38.2	238°33.2	55.7
11	250°20.6	351°35.9	55.7	339°23.9	13.2	135°14.9	38.3	253°35.6	55.7
12	265°23.1	6°35.0	S22°56.1	354°24.3	S24°13.2	150°17.6	N21°38.3	268°38.0	S03°55.6
13	280°25.5	21°34.0	56.4	9°24.6	13.2	165°20.4	38.4	283°40.4	55.6
14	295°28.0	36°33.1	56.8	24°25.0	13.2	180°23.1	38.4	298°42.8	55.5
15	310°30.5	51°32.2	·· 57.1	39°25.4	·· 13.2	195°25.9	·· 38.5	313°45.2	·· 55.5
16	325°32.9	66°31.2	57.4	54°25.8	13.2	210°28.6	38.5	328°47.6	55.5
17	340°35.4	81°30.3	57.8	69°26.2	13.3	225°31.4	38.6	343°50.0	55.4
18	355°37.9	96°29.4	S22°58.1	84°26.6	S24°13.3	240°34.1	N21°38.6	358°52.4	S03°55.4
19	10°40.3	111°28.4	58.5	99°27.0	13.3	255°36.9	38.7	13°54.7	55.3
20	25°42.8	126°27.5	58.8	114°27.4	13.3	270°39.6	38.7	28°57.1	55.3
21	40°45.2	141°26.6	·· 59.1	129°27.8	·· 13.3	285°42.3	·· 38.8	43°59.5	·· 55.2
22	55°47.7	156°25.6	59.5	144°28.2	13.3	300°45.1	38.8	59°01.9	55.2
23	70°50.2	171°24.7	59.8	159°28.6	13.3	315°47.8	38.9	74°04.3	55.2
Mer.pass. 18:17		ν -0.9′	d 0.4′	m -3.90	ν 0.4′	d 0.0′	m 1.22	ν 2.7′	d 0.1′ m -2.62	ν 2.4′	d 0.0′ m 0.97

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	85°52.6	186°23.7	S23°00.1	174°29.0	S24°13.3	330°50.6	N21°38.9	89°06.7	S03°55.1
1	100°55.1	201°22.8	00.4	189°29.4	13.3	345°53.3	39.0	104°09.1	55.1
2	115°57.6	216°21.9	00.8	204°29.8	13.3	0°56.1	39.0	119°11.5	55.0
3	131°00.0	231°20.9	·· 01.1	219°30.2	·· 13.3	15°58.8	·· 39.1	134°13.9	·· 55.0
4	146°02.5	246°20.0	01.4	234°30.6	13.3	31°01.6	39.1	149°16.3	55.0
5	161°05.0	261°19.0	01.7	249°30.9	13.3	46°04.3	39.2	164°18.7	54.9
6	176°07.4	276°18.1	S23°02.1	264°31.3	S24°13.3	61°07.1	N21°39.2	179°21.0	S03°54.9
7	191°09.9	291°17.2	02.4	279°31.7	13.3	76°09.8	39.3	194°23.4	54.8
8	206°12.3	306°16.2	02.7	294°32.1	13.2	91°12.5	39.3	209°25.8	54.8
9	221°14.8	321°15.3	·· 03.0	309°32.5	·· 13.2	106°15.3	·· 39.4	224°28.2	·· 54.7
10	236°17.3	336°14.3	03.3	324°32.9	13.2	121°18.0	39.4	239°30.6	54.7
11	251°19.7	351°13.4	03.7	339°33.3	13.2	136°20.8	39.5	254°33.0	54.7
12	266°22.2	6°12.5	S23°04.0	354°33.7	S24°13.2	151°23.5	N21°39.5	269°35.4	S03°54.6
13	281°24.7	21°11.5	04.3	9°34.1	13.2	166°26.3	39.6	284°37.8	54.6
14	296°27.1	36°10.6	04.6	24°34.5	13.2	181°29.0	39.7	299°40.2	54.5
15	311°29.6	51°09.6	·· 04.9	39°34.9	·· 13.2	196°31.8	·· 39.7	314°42.5	·· 54.5
16	326°32.1	66°08.7	05.2	54°35.3	13.2	211°34.5	39.8	329°44.9	54.5
17	341°34.5	81°07.8	05.5	69°35.7	13.2	226°37.3	39.8	344°47.3	54.4
18	356°37.0	96°06.8	S23°05.8	84°36.0	S24°13.2	241°40.0	N21°39.9	359°49.7	S03°54.4
19	11°39.5	111°05.9	06.1	99°36.4	13.2	256°42.8	39.9	14°52.1	54.3
20	26°41.9	126°04.9	06.4	114°36.8	13.2	271°45.5	40.0	29°54.5	54.3
21	41°44.4	141°04.0	·· 06.7	129°37.2	·· 13.2	286°48.3	·· 40.0	44°56.9	·· 54.2
22	56°46.8	156°03.0	07.0	144°37.6	13.2	301°51.0	40.1	59°59.3	54.2
23	71°49.3	171°02.1	07.3	159°38.0	13.1	316°53.8	40.1	75°01.6	54.2
Mer.pass. 18:13		ν -0.9′	d 0.3′	m -3.90	ν 0.4′	d 0.0′	m 1.21	ν 2.7′	d 0.1′ m -2.63	ν 2.4′	d 0.0′ m 0.97

Stars

	SHA	Dec
Alpheratz	357°33.9	29°14.2
Ankaa	353°06.3	-42°10.1
Schedar	349°30.0	56°41.1
Diphda	348°46.4	-17°50.7
Achernar	335°19.3	-57°06.5
Hamal	327°50.1	23°35.3
Polaris	313°13.3	89°22.6
Acamar	315°10.8	-40°12.1
Menkar	314°05.1	4°11.5
Mirfak	308°26.7	49°57.4
Aldebaran	290°38.4	16°33.7
Rigel	281°02.8	-8°10.3
Capella	280°20.3	46°01.5
Bellatrix	278°21.7	6°22.4
Elnath	278°00.5	28°37.8
Alnilam	275°36.6	-1°11.1
Betelgeuse	270°50.9	7°24.7
Canopus	263°51.5	-52°42.5
Sirius	258°25.2	-16°45.0
Adhara	255°04.9	-29°00.3
Procyon	244°49.7	5°09.5
Pollux	243°16.0	27°57.7
Avior	234°13.9	-59°35.3
Suhail	222°45.5	-43°32.0
Miaplacidus	221°37.6	-69°49.1
Alphard	217°46.8	-8°46.2
Regulus	207°33.5	11°50.3
Dubhe	193°40.0	61°36.3
Denebola	182°24.2	14°25.5
Gienah	175°42.9	-17°41.1
Acrux	172°59.4	-63°14.3
Gacrux	171°50.9	-57°15.2
Alioth	166°12.5	55°48.8
Spica	158°21.7	-11°17.8
Alkaid	152°51.7	49°10.8
Hadar	148°35.3	-60°29.7
Menkent	147°57.0	-36°29.7
Arcturus	145°47.4	19°02.7
Rigil Kent.	139°39.7	-60°56.3
Kochab	137°20.7	74°02.6
Zuben'ubi	136°55.4	-16°08.9
Alphecca	126°03.4	26°37.5
Antares	112°15.3	-26°29.3
Atria	107°09.4	-69°04.3
Sabik	102°02.3	-15°45.4
Shaula	96°09.8	-37°07.3
Rasalhague	95°58.2	12°32.5
Eltanin	90°42.4	51°29.1
Kaus Aust.	83°31.9	-34°22.3
Vega	80°33.1	38°48.5
Nunki	75°47.2	-26°15.9
Altair	61°59.5	8°56.3
Peacock	53°05.0	-56°39.2
Deneb	49°25.6	45°22.5
Enif	33°38.2	9°59.7
Al Na'ir	27°32.1	-46°50.3
Fomalhaut	15°13.7	-29°29.2
Scheat	13°44.5	28°13.6
Markab	13°29.2	15°20.8

Dec 15 Mon	SHA	Mer.pass
Venus	103°14.0	11:32
Mars	90°15.6	12:23
Jupiter	244°44.7	02:05
Saturn	3°17.4	18:08

Dec 16 Tue	SHA	Mer.pass
Venus	101°52.7	11:34
Mars	89°26.0	12:22
Jupiter	244°51.3	02:01
Saturn	3°15.8	18:04

Dec 17 Wed	SHA	Mer.pass
Venus	100°31.1	11:35
Mars	88°36.3	12:22
Jupiter	244°57.9	01:56
Saturn	3°14.1	18:01

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	181°15.2	S23°16.0	239°07.5	15.6′	S14°07.3	12.4′	54.2′
1	196°14.9	16.1	253°42.2	15.6′	14°19.7	12.4′	54.2′
2	211°14.6	16.2	268°16.7	15.5′	14°32.1	12.3′	54.2′
3	226°14.3	·· 16.4	282°51.3	15.5′	14°44.4	12.2′	54.2′
4	241°14.0	16.5	297°25.7	15.4′	14°56.6	12.2′	54.2′
5	256°13.7	16.6	312°00.2	15.4′	15°08.8	12.1′	54.2′
6	271°13.4	S23°16.7	326°34.6	15.3′	S15°20.9	12.0′	54.1′
7	286°13.1	16.9	341°08.9	15.3′	15°32.9	12.0′	54.1′
8	301°12.8	17.0	355°43.2	15.3′	15°44.9	11.9′	54.1′
9	316°12.5	·· 17.1	10°17.5	15.2′	15°56.8	11.9′	54.1′
10	331°12.2	17.2	24°51.7	15.2′	16°08.7	11.8′	54.1′
11	346°11.9	17.4	39°25.9	15.1′	16°20.5	11.7′	54.1′
12	1°11.6	S23°17.5	54°00.0	15.1′	S16°32.2	11.7′	54.1′
13	16°11.3	17.6	68°34.0	15.0′	16°43.9	11.6′	54.1′
14	31°11.0	17.7	83°08.0	15.0′	16°55.5	11.5′	54.1′
15	46°10.7	·· 17.8	97°42.0	14.9′	17°07.0	11.5′	54.1′
16	61°10.4	17.9	112°15.9	14.8′	17°18.5	11.3′	54.1′
17	76°10.1	18.1	126°49.7	14.8′	17°29.8	11.3′	54.0′
18	91°09.8	S23°18.2	141°23.5	14.7′	S17°41.1	11.3′	54.0′
19	106°09.5	18.3	155°57.3	14.7′	17°52.4	11.2′	54.0′
20	121°09.2	18.4	170°31.0	14.6′	18°03.6	11.1′	54.0′
21	136°08.9	·· 18.5	185°04.6	14.6′	18°14.7	11.0′	54.0′
22	151°08.6	18.6	199°38.2	14.5′	18°25.7	10.9′	54.0′
23	166°08.3	18.7	214°11.7	14.5′	18°36.6	10.9′	54.0′
	SD = 16.2′	d = 0.1′	SD = 14.8′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	181°08.0	S23°18.9	228°45.1	14.4′	S18°47.5	10.8′	54.0′
1	196°07.7	19.0	243°18.5	14.3′	18°58.3	10.7′	54.0′
2	211°07.4	19.1	257°51.9	14.3′	19°09.0	10.6′	54.0′
3	226°07.0	·· 19.2	272°25.2	14.2′	19°19.6	10.6′	54.0′
4	241°06.7	19.3	286°58.4	14.2′	19°30.2	10.5′	54.0′
5	256°06.4	19.4	301°31.5	14.1′	19°40.7	10.4′	54.0′
6	271°06.1	S23°19.5	316°04.6	14.0′	S19°51.1	10.3′	54.0′
7	286°05.8	19.6	330°37.7	14.0′	20°01.4	10.2′	54.0′
8	301°05.5	19.7	345°10.7	13.9′	20°11.6	10.2′	54.0′
9	316°05.2	·· 19.8	359°43.6	13.9′	20°21.8	10.0′	53.9′
10	331°04.9	19.9	14°16.4	13.8′	20°31.8	10.0′	53.9′
11	346°04.6	20.0	28°49.2	13.7′	20°41.8	9.9′	53.9′
12	1°04.3	S23°20.1	43°21.9	13.7′	S20°51.7	9.8′	53.9′
13	16°04.0	20.2	57°54.6	13.6′	21°01.5	9.8′	53.9′
14	31°03.7	20.3	72°27.2	13.5′	21°11.3	9.6′	53.9′
15	46°03.4	·· 20.4	86°59.7	13.5′	21°20.9	9.5′	53.9′
16	61°03.1	20.5	101°32.2	13.4′	21°30.4	9.5′	53.9′
17	76°02.8	20.6	116°04.6	13.3′	21°39.9	9.3′	53.9′
18	91°02.5	S23°20.7	130°36.9	13.3′	S21°49.2	9.3′	53.9′
19	106°02.2	20.8	145°09.2	13.2′	21°58.5	9.2′	53.9′
20	121°01.9	20.9	159°41.4	13.1′	22°07.7	9.1′	53.9′
21	136°01.6	·· 21.0	174°13.6	13.1′	22°16.8	9.0′	53.9′
22	151°01.3	21.1	188°45.6	13.0′	22°25.8	8.9′	53.9′
23	166°01.0	21.2	203°17.7	12.9′	22°34.7	8.8′	53.9′
	SD = 16.2′	d = 0.1′	SD = 14.7′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	181°00.6	S23°21.3	217°49.6	12.9′	S22°43.5	8.7′	53.9′
1	196°00.3	21.4	232°21.5	12.8′	22°52.2	8.6′	53.9′
2	211°00.0	21.4	246°53.3	12.7′	23°00.8	8.5′	53.9′
3	225°59.7	·· 21.5	261°25.0	12.7′	23°09.3	8.4′	53.9′
4	240°59.4	21.6	275°56.7	12.6′	23°17.7	8.3′	53.9′
5	255°59.1	21.7	290°28.3	12.5′	23°26.0	8.2′	53.9′
6	270°58.8	S23°21.8	304°59.8	12.5′	S23°34.2	8.1′	53.9′
7	285°58.5	21.9	319°31.3	12.4′	23°42.3	8.0′	53.9′
8	300°58.2	22.0	334°02.7	12.3′	23°50.3	7.9′	53.9′
9	315°57.9	·· 22.0	348°34.1	12.3′	23°58.2	7.8′	53.9′
10	330°57.6	22.1	3°05.3	12.2′	24°06.0	7.7′	53.9′
11	345°57.3	22.2	17°36.6	12.1′	24°13.7	7.6′	53.9′
12	0°57.0	S23°22.3	32°07.7	12.1′	S24°21.3	7.5′	53.9′
13	15°56.7	22.4	46°38.8	12.0′	24°28.8	7.3′	53.9′
14	30°56.4	22.4	61°09.8	11.9′	24°36.1	7.3′	53.9′
15	45°56.0	·· 22.5	75°40.7	11.9′	24°43.4	7.2′	53.9′
16	60°55.7	22.6	90°11.6	11.8′	24°50.6	7.0′	53.9′
17	75°55.4	22.7	104°42.4	11.8′	24°57.6	6.9′	53.9′
18	90°55.1	S23°22.8	119°13.2	11.7′	S25°04.5	6.8′	53.9′
19	105°54.8	22.8	133°43.9	11.6′	25°11.3	6.8′	53.9′
20	120°54.5	22.9	148°14.5	11.6′	25°18.1	6.5′	53.9′
21	135°54.2	·· 23.0	162°45.0	11.5′	25°24.6	6.5′	53.9′
22	150°53.9	23.1	177°15.5	11.4′	25°31.1	6.4′	53.9′
23	165°53.6	23.1	191°46.0	11.4′	25°37.5	6.2′	53.9′
	SD = 16.2′	d = 0.1′	SD = 14.7′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	08:22	10:50	▬	▬	13:01	15:30
N 70°	08:02	09:50	▬	▬	14:02	15:49
68°	07:46	09:15	▬	▬	14:36	16:05
66°	07:33	08:50	10:29	13:22	15:01	16:18
64°	07:22	08:30	09:48	14:04	15:21	16:29
62°	07:12	08:14	09:20	14:32	15:37	16:39
60°	07:04	08:01	08:58	14:53	15:51	16:47
N 58°	06:57	07:49	08:41	15:10	16:02	16:55
56°	06:50	07:39	08:26	15:25	16:12	17:01
54°	06:44	07:30	08:14	15:38	16:21	17:08
52°	06:38	07:22	08:03	15:49	16:30	17:13
50°	06:33	07:14	07:53	15:59	16:37	17:19
45°	06:21	06:58	07:32	16:19	16:53	17:30
N 40°	06:11	06:45	07:15	16:36	17:06	17:41
35°	06:01	06:33	07:01	16:50	17:18	17:50
30°	05:53	06:23	06:49	17:02	17:29	17:59
20°	05:36	06:04	06:28	17:24	17:48	18:15
N 10°	05:20	05:47	06:09	17:42	18:05	18:31
0°	05:03	05:29	05:52	17:59	18:22	18:48
S 10°	04:44	05:11	05:34	18:17	18:40	19:07
20°	04:22	04:51	05:16	18:36	19:00	19:30
30°	03:53	04:26	04:54	18:58	19:25	19:59
35°	03:34	04:11	04:41	19:11	19:41	20:17
40°	03:11	03:53	04:26	19:26	19:59	20:40
45°	02:41	03:30	04:08	19:44	20:21	21:11
S 50°	01:56	03:01	03:45	20:06	20:51	21:56
52°	01:28	02:46	03:34	20:17	21:06	22:24
54°	00:43	02:28	03:22	20:29	21:24	23:09
56°	////	02:06	03:08	20:44	21:46	////
58°	////	01:36	02:51	21:00	22:16	////
S 60°	////	00:48	02:31	21:21	23:05	////

Lat.	**Moonrise** Mon	Tue	Wed	**Moonset** Mon	Tue	Wed
N 72°	06:07	▬	▬	10:06	▬	▬
N 70°	05:28	▬	▬	10:46	▬	▬
68°	05:02	07:20	▬	11:14	10:27	▬
66°	04:42	06:37	▬	11:36	11:11	▬
64°	04:26	06:09	08:06	11:53	11:40	11:18
62°	04:12	05:47	07:28	12:07	12:02	11:57
60°	04:01	05:30	07:01	12:19	12:20	12:24
N 58°	03:52	05:15	06:40	12:30	12:36	12:45
56°	03:43	05:03	06:23	12:39	12:49	13:03
54°	03:36	04:52	06:09	12:47	13:00	13:18
52°	03:29	04:43	05:56	12:55	13:10	13:31
50°	03:23	04:34	05:45	13:01	13:19	13:42
45°	03:11	04:16	05:22	13:15	13:38	14:06
N 40°	03:00	04:02	05:04	13:27	13:54	14:25
35°	02:51	03:50	04:49	13:37	14:07	14:41
30°	02:43	03:39	04:36	13:46	14:18	14:55
20°	02:30	03:21	04:13	14:02	14:38	15:19
N 10°	02:18	03:05	03:54	14:15	14:56	15:39
0°	02:07	02:50	03:36	14:28	15:12	15:59
S 10°	01:57	02:36	03:18	14:41	15:28	16:18
20°	01:45	02:20	02:59	14:54	15:46	16:39
30°	01:32	02:03	02:37	15:10	16:06	17:03
35°	01:25	01:53	02:24	15:19	16:18	17:17
40°	01:16	01:41	02:10	15:30	16:32	17:34
45°	01:07	01:27	01:52	15:42	16:48	17:54
S 50°	00:55	01:11	01:31	15:57	17:08	18:19
52°	00:49	01:03	01:21	16:05	17:18	18:31
54°	00:43	00:54	01:10	16:12	17:29	18:45
56°	00:37	00:45	00:57	16:21	17:41	19:01
58°	00:29	00:34	00:42	16:32	17:56	19:20
S 60°	00:21	00:21	00:24	16:43	18:13	19:45

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 25-27 22-8%
15	05:01	04:46	11:55	08:18	20:39	
16	04:32	04:17	11:56	09:01	21:24	
17	04:03	03:48	11:56	09:47	22:11	

December 18, 19, 20 UT (Thu., Fri., Sat.)

	Aries	Venus		Mars		Jupiter		Saturn	
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	86°51.8	186°01.2	S23°07.6	174°38.4	S24°13.1	331°56.5	N21°40.2	90°04.0	S03°54.1
1	101°54.2	201°00.2	07.9	189°38.8	13.1	346°59.3	40.2	105°06.4	54.1
2	116°56.7	215°59.3	08.2	204°39.2	13.1	2°02.0	40.3	120°08.8	54.0
3	131°59.2	230°58.3	·· 08.5	219°39.6	·· 13.1	17°04.8	·· 40.3	135°11.2	·· 54.0
4	147°01.6	245°57.4	08.8	234°40.0	13.1	32°07.5	40.4	150°13.6	53.9
5	162°04.1	260°56.4	09.1	249°40.4	13.1	47°10.3	40.4	165°16.0	53.9
6	177°06.6	275°55.5	S23°09.4	264°40.7	S24°13.1	62°13.0	N21°40.5	180°18.4	S03°53.8
7	192°09.0	290°54.5	09.7	279°41.1	13.0	77°15.8	40.5	195°20.7	53.8
8	207°11.5	305°53.6	10.0	294°41.5	13.0	92°18.5	40.6	210°23.1	53.8
9	222°14.0	320°52.7	·· 10.3	309°41.9	·· 13.0	107°21.3	·· 40.6	225°25.5	·· 53.7
10	237°16.4	335°51.7	10.6	324°42.3	13.0	122°24.1	40.7	240°27.9	53.7
11	252°18.9	350°50.8	10.9	339°42.7	13.0	137°26.8	40.7	255°30.3	53.6
12	267°21.3	5°49.8	S23°11.2	354°43.1	S24°13.0	152°29.6	N21°40.8	270°32.7	S03°53.6
13	282°23.8	20°48.9	11.4	9°43.5	12.9	167°32.3	40.8	285°35.0	53.5
14	297°26.3	35°47.9	11.7	24°43.9	12.9	182°35.1	40.9	300°37.4	53.5
15	312°28.7	50°47.0	·· 12.0	39°44.3	·· 12.9	197°37.8	·· 41.0	315°39.8	·· 53.5
16	327°31.2	65°46.0	12.3	54°44.6	12.9	212°40.6	41.0	330°42.2	53.4
17	342°33.7	80°45.1	12.6	69°45.0	12.9	227°43.3	41.1	345°44.6	53.4
18	357°36.1	95°44.1	S23°12.8	84°45.4	S24°12.9	242°46.1	N21°41.1	0°47.0	S03°53.3
19	12°38.6	110°43.2	13.1	99°45.8	12.8	257°48.8	41.2	15°49.4	53.3
20	27°41.1	125°42.2	13.4	114°46.2	12.8	272°51.6	41.2	30°51.7	53.2
21	42°43.5	140°41.3	·· 13.7	129°46.6	·· 12.8	287°54.4	·· 41.3	45°54.1	·· 53.2
22	57°46.0	155°40.3	13.9	144°47.0	12.8	302°57.1	41.3	60°56.5	53.1
23	72°48.5	170°39.4	14.2	159°47.4	12.8	317°59.9	41.4	75°58.9	53.1
Mer.pass. 18:10		ν -0.9′	d 0.3′	m -3.90	ν 0.4′	d 0.0′	m 1.21	ν 2.8′	d 0.1′ m -2.63	ν 2.4′	d 0.0′ m 0.97

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	87°50.9	185°38.4	S23°14.5	174°47.8	S24°12.7	333°02.6	N21°41.4	91°01.3	S03°53.1
1	102°53.4	200°37.5	14.7	189°48.1	12.7	348°05.4	41.5	106°03.7	53.0
2	117°55.8	215°36.5	15.0	204°48.5	12.7	3°08.1	41.5	121°06.0	53.0
3	132°58.3	230°35.6	·· 15.3	219°48.9	·· 12.7	18°10.9	·· 41.6	136°08.4	·· 52.9
4	148°00.8	245°34.6	15.5	234°49.3	12.6	33°13.7	41.6	151°10.8	52.9
5	163°03.2	260°33.7	15.8	249°49.7	12.6	48°16.4	41.7	166°13.2	52.8
6	178°05.7	275°32.7	S23°16.1	264°50.1	S24°12.6	63°19.2	N21°41.7	181°15.6	S03°52.8
7	193°08.2	290°31.8	16.3	279°50.5	12.6	78°21.9	41.8	196°17.9	52.7
8	208°10.6	305°30.8	16.6	294°50.9	12.5	93°24.7	41.8	211°20.3	52.7
9	223°13.1	320°29.9	·· 16.9	309°51.3	·· 12.5	108°27.5	·· 41.9	226°22.7	·· 52.6
10	238°15.6	335°28.9	17.1	324°51.6	12.5	123°30.2	42.0	241°25.1	52.6
11	253°18.0	350°28.0	17.4	339°52.0	12.5	138°33.0	42.0	256°27.5	52.6
12	268°20.5	5°27.0	S23°17.6	354°52.4	S24°12.4	153°35.7	N21°42.1	271°29.8	S03°52.5
13	283°23.0	20°26.1	17.9	9°52.8	12.4	168°38.5	42.1	286°32.2	52.5
14	298°25.4	35°25.1	18.1	24°53.2	12.4	183°41.3	42.2	301°34.6	52.4
15	313°27.9	50°24.2	·· 18.4	39°53.6	·· 12.3	198°44.0	·· 42.2	316°37.0	·· 52.4
16	328°30.3	65°23.2	18.6	54°54.0	12.3	213°46.8	42.3	331°39.4	52.3
17	343°32.8	80°22.2	18.9	69°54.4	12.3	228°49.5	42.3	346°41.8	52.3
18	358°35.3	95°21.3	S23°19.1	84°54.8	S24°12.3	243°52.3	N21°42.4	1°44.1	S03°52.2
19	13°37.7	110°20.3	19.4	99°55.1	12.2	258°55.1	42.4	16°46.5	52.2
20	28°40.2	125°19.4	19.6	114°55.5	12.2	273°57.8	42.5	31°48.9	52.1
21	43°42.7	140°18.4	·· 19.9	129°55.9	·· 12.2	289°00.6	·· 42.5	46°51.3	·· 52.1
22	58°45.1	155°17.5	20.1	144°56.3	12.1	304°03.3	42.6	61°53.6	52.0
23	73°47.6	170°16.5	20.4	159°56.7	12.1	319°06.1	42.6	76°56.0	52.0
Mer.pass. 18:06		ν -1.0′	d 0.3′	m -3.90	ν 0.4′	d 0.0′	m 1.20	ν 2.8′	d 0.1′ m -2.63	ν 2.4′	d 0.0′ m 0.98

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	88°50.1	185°15.6	S23°20.6	174°57.1	S24°12.1	334°08.9	N21°42.7	91°58.4	S03°52.0
1	103°52.5	200°14.6	20.8	189°57.5	12.0	349°11.6	42.7	107°00.8	51.9
2	118°55.0	215°13.7	21.1	204°57.9	12.0	4°14.4	42.8	122°03.2	51.9
3	133°57.5	230°12.7	·· 21.3	219°58.2	·· 12.0	19°17.2	·· 42.9	137°05.5	·· 51.8
4	148°59.9	245°11.7	21.6	234°58.6	11.9	34°19.9	42.9	152°07.9	51.8
5	164°02.4	260°10.8	21.8	249°59.0	11.9	49°22.7	43.0	167°10.3	51.7
6	179°04.8	275°09.8	S23°22.0	264°59.4	S24°11.9	64°25.4	N21°43.0	182°12.7	S03°51.7
7	194°07.3	290°08.9	22.3	279°59.8	11.8	79°28.2	43.1	197°15.1	51.6
8	209°09.8	305°07.9	22.5	295°00.2	11.8	94°31.0	43.1	212°17.4	51.6
9	224°12.2	320°07.0	·· 22.7	310°00.6	·· 11.8	109°33.7	·· 43.2	227°19.8	·· 51.5
10	239°14.7	335°06.0	22.9	325°01.0	11.7	124°36.5	43.2	242°22.2	51.5
11	254°17.2	350°05.0	23.2	340°01.3	11.7	139°39.3	43.3	257°24.6	51.4
12	269°19.6	5°04.1	S23°23.4	355°01.7	S24°11.6	154°42.0	N21°43.3	272°26.9	S03°51.4
13	284°22.1	20°03.1	23.6	10°02.1	11.6	169°44.8	43.4	287°29.3	51.3
14	299°24.6	35°02.2	23.8	25°02.5	11.6	184°47.6	43.4	302°31.7	51.3
15	314°27.0	50°01.2	·· 24.1	40°02.9	·· 11.5	199°50.3	·· 43.5	317°34.1	·· 51.2
16	329°29.5	65°00.3	24.3	55°03.3	11.5	214°53.1	43.5	332°36.4	51.2
17	344°31.9	79°59.3	24.5	70°03.7	11.4	229°55.9	43.6	347°38.8	51.2
18	359°34.4	94°58.3	S23°24.7	85°04.0	S24°11.4	244°58.6	N21°43.7	2°41.2	S03°51.1
19	14°36.9	109°57.4	24.9	100°04.4	11.4	260°01.4	43.7	17°43.6	51.1
20	29°39.3	124°56.4	25.2	115°04.8	11.3	275°04.2	43.8	32°46.0	51.0
21	44°41.8	139°55.5	·· 25.4	130°05.2	·· 11.3	290°06.9	·· 43.8	47°48.3	·· 51.0
22	59°44.3	154°54.5	25.6	145°05.6	11.2	305°09.7	43.9	62°50.7	50.9
23	74°46.7	169°53.5	25.8	160°06.0	11.2	320°12.5	43.9	77°53.1	50.9
Mer.pass. 18:02		ν -1.0′	d 0.2′	m -3.90	ν 0.4′	d 0.0′	m 1.20	ν 2.8′	d 0.1′ m -2.64	ν 2.4′	d 0.0′ m 0.98

Stars

	SHA	Dec
Alpheratz	357°33.9	29°14.2
Ankaa	353°06.3	-42°10.1
Schedar	349°30.0	56°41.1
Diphda	348°46.4	-17°50.7
Achernar	335°19.3	-57°06.5
Hamal	327°50.1	23°35.3
Polaris	313°13.9	89°22.6
Acamar	315°10.8	-40°12.1
Menkar	314°05.1	4°11.5
Mirfak	308°26.7	49°57.4
Aldebaran	290°38.4	16°33.7
Rigel	281°02.8	-8°10.3
Capella	280°20.2	46°01.5
Bellatrix	278°21.7	6°22.4
Elnath	278°00.5	28°37.8
Alnilam	275°36.6	-1°11.1
Betelgeuse	270°50.9	7°24.7
Canopus	263°51.5	-52°42.5
Sirius	258°25.2	-16°45.1
Adhara	255°04.9	-29°00.4
Procyon	244°49.7	5°09.5
Pollux	243°16.0	27°57.7
Avior	234°13.9	-59°35.3
Suhail	222°45.4	-43°32.0
Miaplacidus	221°37.5	-69°49.1
Alphard	217°46.8	-8°46.2
Regulus	207°33.5	11°50.3
Dubhe	193°39.9	61°36.3
Denebola	182°24.2	14°25.5
Gienah	175°42.8	-17°41.1
Acrux	172°59.4	-63°14.3
Gacrux	171°50.9	-57°15.3
Alioth	166°12.5	55°48.8
Spica	158°21.6	-11°17.8
Alkaid	152°51.6	49°10.7
Hadar	148°35.3	-60°29.7
Menkent	147°56.9	-36°29.7
Arcturus	145°47.4	19°02.7
Rigil Kent.	139°39.7	-60°56.3
Kochab	137°20.7	74°02.6
Zuben'ubi	136°55.4	-16°08.9
Alphecca	126°03.4	26°37.5
Antares	112°15.2	-26°29.3
Atria	107°09.3	-69°04.3
Sabik	102°02.2	-15°45.4
Shaula	96°09.7	-37°07.3
Rasalhague	95°58.2	12°32.4
Eltanin	90°42.4	51°29.1
Kaus Aust.	83°31.9	-34°22.3
Vega	80°33.1	38°48.5
Nunki	75°47.2	-26°15.9
Altair	61°59.5	8°56.2
Peacock	53°05.0	-56°39.2
Deneb	49°25.6	45°22.5
Enif	33°38.2	9°59.7
Al Na'ir	27°32.2	-46°50.3
Fomalhaut	15°13.8	-29°29.2
Scheat	13°44.5	28°13.6
Markab	13°29.2	15°20.8

Dec 18 Thu	SHA	Mer.pass
Venus	99°09.4	11:37
Mars	87°46.6	12:21
Jupiter	245°04.8	01:52
Saturn	3°12.3	17:57

Dec 19 Fri	SHA	Mer.pass
Venus	97°47.5	11:38
Mars	86°56.8	12:20
Jupiter	245°11.7	01:47
Saturn	3°10.4	17:53

Dec 20 Sat	SHA	Mer.pass
Venus	96°25.5	11:40
Mars	86°07.0	12:20
Jupiter	245°18.8	01:43
Saturn	3°08.3	17:49

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h — Sun — Moon

Thu	GHA	Dec	GHA	ν	Dec	d	HP
0	180°53.3	S23°23.2	206°16.3	11.3′	S25°43.7	6.2′	53.9′
1	195°53.0	23.3	220°46.7	11.2′	25°49.9	6.0′	53.9′
2	210°52.7	23.3	235°16.9	11.2′	25°55.9	5.9′	53.9′
3	225°52.4	·· 23.4	249°47.1	11.1′	26°01.8	5.7′	53.9′
4	240°52.1	23.5	264°17.2	11.1′	26°07.5	5.7′	53.9′
5	255°51.7	23.5	278°47.3	11.0′	26°13.2	5.5′	53.9′
6	270°51.4	S23°23.6	293°17.3	10.9′	S26°18.7	5.4′	54.0′
7	285°51.1	23.7	307°47.2	10.9′	26°24.1	5.3′	54.0′
8	300°50.8	23.7	322°17.1	10.8′	26°29.4	5.2′	54.0′
9	315°50.5	·· 23.8	336°47.0	10.8′	26°34.6	5.1′	54.0′
10	330°50.2	23.9	351°16.7	10.7′	26°39.7	4.9′	54.0′
11	345°49.9	23.9	5°46.5	10.7′	26°44.6	4.8′	54.0′
12	0°49.6	S23°24.0	20°16.1	10.6′	S26°49.4	4.6′	54.0′
13	15°49.3	24.1	34°45.7	10.6′	26°54.0	4.6′	54.0′
14	30°49.0	24.1	49°15.3	10.5′	26°58.6	4.4′	54.0′
15	45°48.7	·· 24.2	63°44.8	10.5′	27°03.0	4.3′	54.0′
16	60°48.3	24.2	78°14.3	10.4′	27°07.3	4.2′	54.0′
17	75°48.0	24.3	92°43.7	10.4′	27°11.5	4.0′	54.0′
18	90°47.7	S23°24.3	107°13.0	10.3′	S27°15.5	3.9′	54.0′
19	105°47.4	24.4	121°42.3	10.3′	27°19.4	3.8′	54.0′
20	120°47.1	24.5	136°11.6	10.2′	27°23.2	3.6′	54.0′
21	135°46.8	·· 24.5	150°40.8	10.2′	27°26.8	3.5′	54.0′
22	150°46.5	24.6	165°10.0	10.1′	27°30.3	3.4′	54.0′
23	165°46.2	24.6	179°39.1	10.1′	27°33.7	3.3′	54.0′
	SD = 16.2′	d = 0.1′	SD = 14.7′				

Fri	GHA	Dec	GHA	ν	Dec	d	HP
0	180°45.9	S23°24.7	194°08.2	10.0′	S27°37.0	3.1′	54.1′
1	195°45.6	24.7	208°37.2	10.0′	27°40.1	3.0′	54.1′
2	210°45.3	24.8	223°06.2	10.0′	27°43.1	2.8′	54.1′
3	225°44.9	·· 24.8	237°35.2	9.9′	27°45.9	2.7′	54.1′
4	240°44.6	24.9	252°04.1	9.9′	27°48.6	2.6′	54.1′
5	255°44.3	24.9	266°33.0	9.8′	27°51.2	2.4′	54.1′
6	270°44.0	S23°25.0	281°01.9	9.8′	S27°53.6	2.3′	54.1′
7	285°43.7	25.0	295°30.7	9.8′	27°55.9	2.2′	54.1′
8	300°43.4	25.1	309°59.4	9.7′	27°58.1	2.1′	54.1′
9	315°43.1	·· 25.1	324°28.2	9.7′	28°00.2	1.9′	54.1′
10	330°42.8	25.1	338°56.9	9.7′	28°02.1	1.7′	54.1′
11	345°42.5	25.2	353°25.6	9.7′	28°03.8	1.6′	54.1′
12	0°42.2	S23°25.2	7°54.2	9.6′	S28°05.4	1.5′	54.1′
13	15°41.9	25.3	22°22.9	9.6′	28°06.9	1.4′	54.2′
14	30°41.5	25.3	36°51.4	9.6′	28°08.3	1.2′	54.2′
15	45°41.2	·· 25.4	51°20.0	9.5′	28°09.5	1.0′	54.2′
16	60°40.9	25.4	65°48.6	9.5′	28°10.5	1.0′	54.2′
17	75°40.6	25.4	80°17.1	9.5′	28°11.5	0.8′	54.2′
18	90°40.3	S23°25.5	94°45.6	9.5′	S28°12.3	0.6′	54.2′
19	105°40.0	25.5	109°14.1	9.5′	28°12.9	0.5′	54.2′
20	120°39.7	25.5	123°42.6	9.4′	28°13.4	0.4′	54.2′
21	135°39.4	·· 25.6	138°11.0	9.4′	28°13.8	0.2′	54.2′
22	150°39.1	25.6	152°39.4	9.4′	28°14.0	0.1′	54.2′
23	165°38.7	25.6	167°07.9	9.4′	28°14.1	0.0′	54.2′
	SD = 16.2′	d = 0.1′	SD = 14.7′				

Sat	GHA	Dec	GHA	ν	Dec	d	HP
0	180°38.4	S23°25.7	181°36.3	9.4′	S28°14.1	0.2′	54.3′
1	195°38.1	25.7	196°04.7	9.4′	28°13.9	0.4′	54.3′
2	210°37.8	25.7	210°33.0	9.4′	28°13.5	0.5′	54.3′
3	225°37.5	·· 25.8	225°01.4	9.4′	28°13.0	0.6′	54.3′
4	240°37.2	25.8	239°29.8	9.4′	28°12.4	0.7′	54.3′
5	255°36.9	25.8	253°58.1	9.4′	28°11.7	0.9′	54.3′
6	270°36.6	S23°25.8	268°26.5	9.4′	S28°10.8	1.1′	54.3′
7	285°36.3	25.9	282°54.9	9.4′	28°09.7	1.2′	54.3′
8	300°36.0	25.9	297°23.2	9.4′	28°08.5	1.3′	54.3′
9	315°35.6	·· 25.9	311°51.6	9.4′	28°07.2	1.5′	54.4′
10	330°35.3	26.0	326°19.9	9.4′	28°05.7	1.6′	54.4′
11	345°35.0	26.0	340°48.3	9.4′	28°04.1	1.7′	54.4′
12	0°34.7	S23°26.0	355°16.6	9.4′	S28°02.4	1.9′	54.4′
13	15°34.4	26.0	9°45.0	9.4′	28°00.5	2.1′	54.4′
14	30°34.1	26.0	24°13.4	9.4′	27°58.4	2.1′	54.4′
15	45°33.8	·· 26.1	38°41.7	9.4′	27°56.3	2.4′	54.4′
16	60°33.5	26.1	53°10.1	9.4′	27°53.9	2.4′	54.4′
17	75°33.2	26.1	67°38.5	9.4′	27°51.5	2.6′	54.4′
18	90°32.8	S23°26.1	82°06.9	9.4′	S27°48.9	2.8′	54.5′
19	105°32.5	26.1	96°35.4	9.4′	27°46.1	2.8′	54.5′
20	120°32.2	26.1	111°03.8	9.5′	27°43.3	3.1′	54.5′
21	135°31.9	·· 26.2	125°32.3	9.5′	27°40.2	3.1′	54.5′
22	150°31.6	26.2	140°00.7	9.5′	27°37.1	3.3′	54.5′
23	165°31.3	26.2	154°29.2	9.5′	27°33.8	3.5′	54.5′
	SD = 16.2′	d = 0.0′	SD = 14.8′				

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	08:25	10:56	▬	▬	12:58	15:30
N 70°	08:04	09:53	▬	▬	14:01	15:50
68°	07:49	09:18	▬	▬	14:36	16:06
66°	07:35	08:53	10:33	13:21	15:02	16:19
64°	07:24	08:33	09:51	14:03	15:22	16:30
62°	07:15	08:17	09:23	14:32	15:38	16:40
60°	07:06	08:03	09:01	14:53	15:51	16:48
N 58°	06:59	07:51	08:43	15:11	16:03	16:56
56°	06:52	07:41	08:29	15:26	16:13	17:02
54°	06:46	07:32	08:16	15:38	16:22	17:09
52°	06:40	07:24	08:05	15:50	16:31	17:14
50°	06:35	07:16	07:55	15:59	16:38	17:20
45°	06:23	07:00	07:34	16:20	16:54	17:31
N 40°	06:13	06:47	07:17	16:37	17:08	17:42
35°	06:03	06:35	07:03	16:51	17:19	17:51
30°	05:54	06:24	06:51	17:04	17:30	18:00
20°	05:38	06:05	06:29	17:25	17:49	18:16
N 10°	05:22	05:48	06:11	17:43	18:06	18:33
0°	05:05	05:31	05:53	18:01	18:23	18:50
S 10°	04:46	05:13	05:36	18:19	18:42	19:09
20°	04:23	04:52	05:17	18:38	19:02	19:31
30°	03:54	04:27	04:55	19:00	19:27	20:00
35°	03:35	04:12	04:42	19:13	19:42	20:19
40°	03:12	03:54	04:27	19:28	20:01	20:42
45°	02:41	03:31	04:09	19:46	20:23	21:13
S 50°	01:56	03:01	03:46	20:08	20:53	21:59
52°	01:28	02:46	03:35	20:19	21:08	22:27
54°	00:41	02:28	03:23	20:32	21:26	23:14
56°	////	02:06	03:09	20:46	21:49	////
58°	////	01:36	02:52	21:03	22:18	////
S 60°	////	00:45	02:31	21:23	23:10	////

Lat.	Moonrise Thu	Moonrise Fri	Moonrise Sat	Moonset Thu	Moonset Fri	Moonset Sat
N 72°	▬	▬	▬	▬	▬	▬
N 70°	▬	▬	▬	▬	▬	▬
68°	▬	▬	▬	▬	▬	▬
66°	▬	▬	▬	▬	▬	▬
64°	▬	▬	▬	▬	▬	▬
62°	09:17	▬	▬	11:48	▬	▬
60°	08:33	09:55	10:49	12:33	12:57	13:53
N 58°	08:04	09:18	10:11	13:03	13:35	14:30
56°	07:42	08:51	09:45	13:25	14:02	14:57
54°	07:23	08:30	09:24	13:44	14:23	15:17
52°	07:08	08:13	09:06	14:00	14:40	15:35
50°	06:54	07:58	08:51	14:13	14:55	15:50
45°	06:27	07:28	08:21	14:41	15:25	16:20
N 40°	06:06	07:04	07:58	15:03	15:49	16:43
35°	05:48	06:45	07:38	15:21	16:08	17:02
30°	05:33	06:29	07:22	15:37	16:25	17:19
20°	05:07	06:01	06:54	16:04	16:53	17:46
N 10°	04:45	05:37	06:29	16:27	17:17	18:10
0°	04:24	05:15	06:07	16:48	17:40	18:32
S 10°	04:04	04:53	05:44	17:10	18:02	18:54
20°	03:42	04:29	05:20	17:33	18:26	19:18
30°	03:16	04:01	04:52	18:00	18:55	19:45
35°	03:01	03:45	04:36	18:16	19:11	20:02
40°	02:44	03:26	04:16	18:34	19:31	20:20
45°	02:24	03:03	03:53	18:57	19:54	20:43
S 50°	01:58	02:34	03:23	19:25	20:24	21:12
52°	01:45	02:20	03:08	19:40	20:39	21:26
54°	01:31	02:03	02:50	19:56	20:57	21:43
56°	01:15	01:44	02:29	20:16	21:18	22:02
58°	00:55	01:19	02:03	20:40	21:44	22:26
S 60°	00:30	00:46	01:25	21:13	22:22	22:59

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 28-0 4-0%
18	03:33	03:18	11:57	10:36	23:01	
19	03:04	02:49	11:57	11:27	23:53	
20	02:34	02:19	11:58	12:20	–:–	

December 21, 22, 23 UT (Sun., Mon., Tue.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	89°49.2	184°52.6	S23°26.0	175°06.4	S24°11.1	335°15.2	N21°44.0	92°55.5	S03°50.8
1	104°51.7	199°51.6	26.2	190°06.7	11.1	350°18.0	44.0	107°57.8	50.8
2	119°54.1	214°50.7	26.4	205°07.1	11.0	5°20.8	44.1	123°00.2	50.7
3	134°56.6	229°49.7	·· 26.6	220°07.5	·· 11.0	20°23.5	·· 44.1	138°02.6	·· 50.7
4	149°59.1	244°48.7	26.8	235°07.9	11.0	35°26.3	44.2	153°04.9	50.6
5	165°01.5	259°47.8	27.0	250°08.3	10.9	50°29.1	44.2	168°07.3	50.6
6	180°04.0	274°46.8	S23°27.2	265°08.7	S24°10.9	65°31.8	N21°44.3	183°09.7	S03°50.5
7	195°06.4	289°45.9	27.4	280°09.1	10.8	80°34.6	44.4	198°12.1	50.5
8	210°08.9	304°44.9	27.6	295°09.4	10.8	95°37.4	44.4	213°14.4	50.4
9	225°11.4	319°43.9	·· 27.8	310°09.8	·· 10.7	110°40.1	·· 44.5	228°16.8	·· 50.4
10	240°13.8	334°43.0	28.0	325°10.2	10.7	125°42.9	44.5	243°19.2	50.3
11	255°16.3	349°42.0	28.2	340°10.6	10.6	140°45.7	44.6	258°21.6	50.3
12	270°18.8	4°41.0	S23°28.4	355°11.0	S24°10.6	155°48.5	N21°44.6	273°23.9	S03°50.2
13	285°21.2	19°40.1	28.6	10°11.4	10.5	170°51.2	44.7	288°26.3	50.2
14	300°23.7	34°39.1	28.8	25°11.8	10.5	185°54.0	44.7	303°28.7	50.1
15	315°26.2	49°38.2	·· 29.0	40°12.1	·· 10.4	200°56.8	·· 44.8	318°31.1	·· 50.1
16	330°28.6	64°37.2	29.2	55°12.5	10.4	215°59.5	44.8	333°33.4	50.0
17	345°31.1	79°36.2	29.4	70°12.9	10.3	231°02.3	44.9	348°35.8	50.0
18	0°33.6	94°35.3	S23°29.6	85°13.3	S24°10.3	246°05.1	N21°45.0	3°38.2	S03°49.9
19	15°36.0	109°34.3	29.8	100°13.7	10.2	261°07.9	45.0	18°40.5	49.9
20	30°38.5	124°33.3	30.0	115°14.1	10.2	276°10.6	45.1	33°42.9	49.8
21	45°40.9	139°32.4	·· 30.1	130°14.4	·· 10.1	291°13.4	·· 45.1	48°45.3	·· 49.8
22	60°43.4	154°31.4	30.3	145°14.8	10.1	306°16.2	45.2	63°47.7	49.7
23	75°45.9	169°30.5	30.5	160°15.2	10.0	321°18.9	45.2	78°50.0	49.7
Mer.pass. 17:58		ν -1.0′	d 0.2′	m -3.90	ν 0.4′	d 0.0′	m 1.19	ν 2.8′	d 0.1′ m -2.64	ν 2.4′	d 0.0′ m 0.98

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	90°48.3	184°29.5	S23°30.7	175°15.6	S24°09.9	336°21.7	N21°45.3	93°52.4	S03°49.6
1	105°50.8	199°28.5	30.9	190°16.0	09.9	351°24.5	45.3	108°54.8	49.6
2	120°53.3	214°27.6	31.0	205°16.4	09.8	6°27.3	45.4	123°57.1	49.5
3	135°55.7	229°26.6	·· 31.2	220°16.8	·· 09.8	21°30.0	·· 45.4	138°59.5	·· 49.5
4	150°58.2	244°25.6	31.4	235°17.1	09.7	36°32.8	45.5	154°01.9	49.4
5	166°00.7	259°24.7	31.6	250°17.5	09.7	51°35.6	45.5	169°04.3	49.4
6	181°03.1	274°23.7	S23°31.8	265°17.9	S24°09.6	66°38.4	N21°45.6	184°06.6	S03°49.3
7	196°05.6	289°22.7	31.9	280°18.3	09.5	81°41.1	45.7	199°09.0	49.3
8	211°08.1	304°21.8	32.1	295°18.7	09.5	96°43.9	45.7	214°11.4	49.2
9	226°10.5	319°20.8	·· 32.3	310°19.1	·· 09.4	111°46.7	·· 45.8	229°13.7	·· 49.2
10	241°13.0	334°19.8	32.4	325°19.4	09.4	126°49.5	45.8	244°16.1	49.1
11	256°15.4	349°18.9	32.6	340°19.8	09.3	141°52.2	45.9	259°18.5	49.1
12	271°17.9	4°17.9	S23°32.8	355°20.2	S24°09.2	156°55.0	N21°45.9	274°20.8	S03°49.0
13	286°20.4	19°16.9	32.9	10°20.6	09.2	171°57.8	46.0	289°23.2	49.0
14	301°22.8	34°16.0	33.1	25°21.0	09.1	187°00.6	46.0	304°25.6	48.9
15	316°25.3	49°15.0	·· 33.3	40°21.4	·· 09.1	202°03.3	·· 46.1	319°27.9	·· 48.9
16	331°27.8	64°14.1	33.4	55°21.7	09.0	217°06.1	46.2	334°30.3	48.8
17	346°30.2	79°13.1	33.6	70°22.1	08.9	232°08.9	46.2	349°32.7	48.8
18	1°32.7	94°12.1	S23°33.7	85°22.5	S24°08.9	247°11.7	N21°46.3	4°35.1	S03°48.7
19	16°35.2	109°11.2	33.9	100°22.9	08.8	262°14.4	46.3	19°37.4	48.7
20	31°37.6	124°10.2	34.0	115°23.3	08.7	277°17.2	46.4	34°39.8	48.6
21	46°40.1	139°09.2	·· 34.2	130°23.7	·· 08.7	292°20.0	·· 46.4	49°42.2	·· 48.6
22	61°42.6	154°08.3	34.4	145°24.0	08.6	307°22.8	46.5	64°44.5	48.5
23	76°45.0	169°07.3	34.5	160°24.4	08.5	322°25.6	46.5	79°46.9	48.5
Mer.pass. 17:54		ν -1.0′	d 0.2′	m -3.90	ν 0.4′	d 0.1′	m 1.18	ν 2.8′	d 0.1′ m -2.65	ν 2.4′	d 0.0′ m 0.98

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	91°47.5	184°06.3	S23°34.7	175°24.8	S24°08.5	337°28.3	N21°46.6	94°49.3	S03°48.4
1	106°49.9	199°05.3	34.8	190°25.2	08.4	352°31.1	46.6	109°51.6	48.4
2	121°52.4	214°04.4	35.0	205°25.6	08.3	7°33.9	46.7	124°54.0	48.3
3	136°54.9	229°03.4	·· 35.1	220°26.0	·· 08.3	22°36.7	·· 46.8	139°56.4	·· 48.3
4	151°57.3	244°02.4	35.2	235°26.3	08.2	37°39.4	46.8	154°58.7	48.2
5	166°59.8	259°01.5	35.4	250°26.7	08.1	52°42.2	46.9	170°01.1	48.2
6	182°02.3	274°00.5	S23°35.5	265°27.1	S24°08.1	67°45.0	N21°46.9	185°03.5	S03°48.1
7	197°04.7	288°59.5	35.7	280°27.5	08.0	82°47.8	47.0	200°05.8	48.1
8	212°07.2	303°58.6	35.8	295°27.9	07.9	97°50.6	47.0	215°08.2	48.0
9	227°09.7	318°57.6	·· 36.0	310°28.3	·· 07.9	112°53.3	·· 47.1	230°10.6	·· 48.0
10	242°12.1	333°56.6	36.1	325°28.6	07.8	127°56.1	47.1	245°12.9	47.9
11	257°14.6	348°55.7	36.2	340°29.0	07.7	142°58.9	47.2	260°15.3	47.9
12	272°17.1	3°54.7	S23°36.4	355°29.4	S24°07.6	158°01.7	N21°47.2	275°17.7	S03°47.8
13	287°19.5	18°53.7	36.5	10°29.8	07.6	173°04.5	47.3	290°20.0	47.8
14	302°22.0	33°52.8	36.6	25°30.2	07.5	188°07.2	47.4	305°22.4	47.7
15	317°24.4	48°51.8	·· 36.8	40°30.6	·· 07.4	203°10.0	·· 47.4	320°24.7	·· 47.6
16	332°26.9	63°50.8	36.9	55°30.9	07.3	218°12.8	47.5	335°27.1	47.6
17	347°29.4	78°49.9	37.0	70°31.3	07.3	233°15.6	47.5	350°29.5	47.5
18	2°31.8	93°48.9	S23°37.1	85°31.7	S24°07.2	248°18.4	N21°47.6	5°31.8	S03°47.5
19	17°34.3	108°47.9	37.3	100°32.1	07.1	263°21.1	47.6	20°34.2	47.4
20	32°36.8	123°46.9	37.4	115°32.5	07.0	278°23.9	47.7	35°36.6	47.4
21	47°39.2	138°46.0	·· 37.5	130°32.8	·· 07.0	293°26.7	·· 47.7	50°38.9	·· 47.3
22	62°41.7	153°45.0	37.6	145°33.2	06.9	308°29.5	47.8	65°41.3	47.3
23	77°44.2	168°44.0	37.8	160°33.6	06.8	323°32.3	47.9	80°43.7	47.2
Mer.pass. 17:50		ν -1.0′	d 0.1′	m -3.90	ν 0.4′	d 0.1′	m 1.18	ν 2.8′	d 0.1′ m -2.65	ν 2.4′	d 0.1′ m 0.99

Stars

	SHA	Dec
Alpheratz	357°33.9	29°14.2
Ankaa	353°06.3	-42°10.1
Schedar	349°30.0	56°41.1
Diphda	348°46.4	-17°50.7
Achernar	335°19.3	-57°06.5
Hamal	327°50.1	23°35.3
Polaris	313°14.5	89°22.6
Acamar	315°10.9	-40°12.1
Menkar	314°05.1	4°11.5
Mirfak	308°26.7	49°57.4
Aldebaran	290°38.4	16°33.7
Rigel	281°02.8	-8°10.3
Capella	280°20.2	46°01.5
Bellatrix	278°21.7	6°22.4
Elnath	278°00.5	28°37.8
Alnilam	275°36.6	-1°11.1
Betelgeuse	270°50.9	7°24.7
Canopus	263°51.5	-52°42.5
Sirius	258°25.2	-16°45.1
Adhara	255°04.9	-29°00.4
Procyon	244°49.7	5°09.5
Pollux	243°16.0	27°57.7
Avior	234°13.9	-59°35.4
Suhail	222°45.4	-43°32.1
Miaplacidus	221°37.5	-69°49.2
Alphard	217°46.8	-8°46.2
Regulus	207°33.4	11°50.3
Dubhe	193°39.9	61°36.3
Denebola	182°24.1	14°25.5
Gienah	175°42.8	-17°41.1
Acrux	172°59.3	-63°14.3
Gacrux	171°50.9	-57°15.3
Alioth	166°12.4	55°48.8
Spica	158°21.6	-11°17.8
Alkaid	152°51.6	49°10.7
Hadar	148°35.2	-60°29.7
Menkent	147°56.9	-36°29.7
Arcturus	145°47.4	19°02.7
Rigil Kent.	139°39.6	-60°56.3
Kochab	137°20.6	74°02.6
Zuben'ubi	136°55.4	-16°08.9
Alphecca	126°03.4	26°37.5
Antares	112°15.2	-26°29.3
Atria	107°09.3	-69°04.3
Sabik	102°02.2	-15°45.4
Shaula	96°09.7	-37°07.3
Rasalhague	95°58.2	12°32.4
Eltanin	90°42.4	51°29.1
Kaus Aust.	83°31.9	-34°22.3
Vega	80°33.1	38°48.5
Nunki	75°47.2	-26°15.9
Altair	61°59.5	8°56.2
Peacock	53°05.0	-56°39.2
Deneb	49°25.6	45°22.5
Enif	33°38.2	9°59.7
Al Na'ir	27°32.2	-46°50.3
Fomalhaut	15°13.8	-29°29.2
Scheat	13°44.5	28°13.6
Markab	13°29.2	15°20.8

Dec 21 Sun	**SHA**	**Mer.pass**
Venus	95°03.4	11:41
Mars	85°17.2	12:19
Jupiter	245°26.0	01:39
Saturn	3°06.3	17:45

Dec 22 Mon	**SHA**	**Mer.pass**
Venus	93°41.2	11:43
Mars	84°27.3	12:19
Jupiter	245°33.4	01:34
Saturn	3°04.1	17:42

Dec 23 Tue	**SHA**	**Mer.pass**
Venus	92°18.8	11:44
Mars	83°37.3	12:18
Jupiter	245°40.8	01:30
Saturn	3°01.8	17:38

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°31.0	S23°26.2	168°57.7	9.5′	S27°30.3	3.6′	54.5′
1	195°30.7	26.2	183°26.3	9.6′	27°26.7	3.7′	54.6′
2	210°30.4	26.2	197°54.8	9.6′	27°23.0	3.8′	54.6′
3	225°30.0	·· 26.2	212°23.4	9.6′	27°19.2	4.0′	54.6′
4	240°29.7	26.2	226°52.0	9.6′	27°15.2	4.2′	54.6′
5	255°29.4	26.3	241°20.6	9.7′	27°11.0	4.2′	54.6′
6	270°29.1	S23°26.3	255°49.3	9.7′	S27°06.8	4.5′	54.6′
7	285°28.8	26.3	270°18.0	9.7′	27°02.3	4.5′	54.6′
8	300°28.5	26.3	284°46.7	9.7′	26°57.8	4.7′	54.6′
9	315°28.2	·· 26.3	299°15.4	9.8′	26°53.1	4.8′	54.7′
10	330°27.9	26.3	313°44.2	9.8′	26°48.3	5.0′	54.7′
11	345°27.6	26.3	328°13.0	9.8′	26°43.3	5.1′	54.7′
12	0°27.2	S23°26.3	342°41.8	9.9′	S26°38.2	5.2′	54.7′
13	15°26.9	26.3	357°10.7	9.9′	26°33.0	5.3′	54.7′
14	30°26.6	26.3	11°39.6	9.9′	26°27.7	5.5′	54.7′
15	45°26.3	·· 26.3	26°08.6	10.0′	26°22.2	5.7′	54.7′
16	60°26.0	26.3	40°37.5	10.0′	26°16.5	5.7′	54.8′
17	75°25.7	26.3	55°06.6	10.1′	26°10.8	5.9′	54.8′
18	90°25.4	S23°26.3	69°35.6	10.1′	S26°04.9	6.0′	54.8′
19	105°25.1	26.3	84°04.7	10.1′	25°58.9	6.2′	54.8′
20	120°24.7	26.3	98°33.9	10.2′	25°52.7	6.3′	54.8′
21	135°24.4	·· 26.3	113°03.0	10.2′	25°46.4	6.4′	54.8′
22	150°24.1	26.3	127°32.3	10.3′	25°40.0	6.5′	54.9′
23	165°23.8	26.3	142°01.5	10.3′	25°33.5	6.7′	54.9′
	SD = 16.2′	d = 0.0′	SD = 14.9′				

Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°23.5	S23°26.3	156°30.9	10.4′	S25°26.8	6.8′	54.9′
1	195°23.2	26.3	171°00.2	10.4′	25°20.0	6.9′	54.9′
2	210°22.9	26.2	185°29.6	10.4′	25°13.1	7.1′	54.9′
3	225°22.6	·· 26.2	199°59.1	10.5′	25°06.0	7.1′	54.9′
4	240°22.3	26.2	214°28.6	10.5′	24°58.9	7.3′	54.9′
5	255°21.9	26.2	228°58.1	10.6′	24°51.6	7.5′	55.0′
6	270°21.6	S23°26.2	243°27.7	10.6′	S24°44.1	7.5′	55.0′
7	285°21.3	26.2	257°57.3	10.7′	24°36.6	7.7′	55.0′
8	300°21.0	26.2	272°27.0	10.7′	24°28.9	7.8′	55.0′
9	315°20.7	·· 26.2	286°56.8	10.8′	24°21.1	7.9′	55.0′
10	330°20.4	26.1	301°26.5	10.8′	24°13.2	8.0′	55.0′
11	345°20.1	26.1	315°56.4	10.9′	24°05.2	8.2′	55.1′
12	0°19.8	S23°26.1	330°26.3	10.9′	S23°57.0	8.3′	55.1′
13	15°19.4	26.1	344°56.2	11.0′	23°48.7	8.4′	55.1′
14	30°19.1	26.1	359°26.2	11.0′	23°40.3	8.5′	55.1′
15	45°18.8	·· 26.1	13°56.3	11.1′	23°31.8	8.6′	55.1′
16	60°18.5	26.0	28°26.4	11.2′	23°23.2	8.8′	55.2′
17	75°18.2	26.0	42°56.5	11.2′	23°14.4	8.8′	55.2′
18	90°17.9	S23°26.0	57°26.7	11.3′	S23°05.6	9.0′	55.2′
19	105°17.6	26.0	71°57.0	11.3′	22°56.6	9.1′	55.2′
20	120°17.3	26.0	86°27.3	11.4′	22°47.5	9.2′	55.2′
21	135°17.0	·· 25.9	100°57.6	11.4′	22°38.3	9.3′	55.2′
22	150°16.6	25.9	115°28.1	11.5′	22°29.0	9.4′	55.3′
23	165°16.3	25.9	129°58.5	11.5′	22°19.6	9.6′	55.3′
	SD = 16.3′	d = 0.0′	SD = 15.0′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°16.0	S23°25.8	144°29.0	11.6′	S22°10.0	9.6′	55.3′
1	195°15.7	25.8	158°59.6	11.6′	22°00.4	9.8′	55.3′
2	210°15.4	25.8	173°30.3	11.7′	21°50.6	9.8′	55.3′
3	225°15.1	·· 25.8	188°00.9	11.7′	21°40.8	10.0′	55.4′
4	240°14.8	25.7	202°31.7	11.8′	21°30.8	10.1′	55.4′
5	255°14.5	25.7	217°02.5	11.8′	21°20.7	10.1′	55.4′
6	270°14.2	S23°25.7	231°33.3	11.9′	S21°10.6	10.3′	55.4′
7	285°13.8	25.6	246°04.2	12.0′	21°00.3	10.4′	55.4′
8	300°13.5	25.6	260°35.2	12.0′	20°49.9	10.5′	55.4′
9	315°13.2	·· 25.6	275°06.2	12.1′	20°39.4	10.6′	55.5′
10	330°12.9	25.5	289°37.2	12.1′	20°28.8	10.7′	55.5′
11	345°12.6	25.5	304°08.4	12.2′	20°18.1	10.8′	55.5′
12	0°12.3	S23°25.5	318°39.5	12.2′	S20°07.3	10.9′	55.5′
13	15°12.0	25.4	333°10.7	12.3′	19°56.4	11.0′	55.5′
14	30°11.7	25.4	347°42.0	12.3′	19°45.4	11.1′	55.6′
15	45°11.4	·· 25.4	2°13.3	12.4′	19°34.3	11.1′	55.6′
16	60°11.0	25.3	16°44.7	12.4′	19°23.2	11.3′	55.6′
17	75°10.7	25.3	31°16.1	12.5′	19°11.9	11.4′	55.6′
18	90°10.4	S23°25.2	45°47.6	12.5′	S19°00.5	11.5′	55.6′
19	105°10.1	25.2	60°19.1	12.6′	18°49.0	11.5′	55.7′
20	120°09.8	25.1	74°50.7	12.6′	18°37.5	11.7′	55.7′
21	135°09.5	·· 25.1	89°22.3	12.7′	18°25.8	11.7′	55.7′
22	150°09.2	25.1	103°54.0	12.7′	18°14.1	11.9′	55.7′
23	165°08.9	25.0	118°25.8	12.8′	18°02.2	11.9′	55.8′
	SD = 16.3′	d = 0.0′	SD = 15.1′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	08:26	10:58	▬	▬	12:59	15:31
N 70°	08:06	09:55	▬	▬	14:02	15:51
68°	07:50	09:20	▬	▬	14:38	16:07
66°	07:37	08:54	10:35	13:22	15:03	16:20
64°	07:26	08:35	09:53	14:05	15:23	16:31
62°	07:16	08:18	09:24	14:33	15:39	16:41
60°	07:08	08:05	09:03	14:55	15:53	16:50
N 58°	07:00	07:53	08:45	15:12	16:04	16:57
56°	06:54	07:43	08:30	15:27	16:15	17:04
54°	06:47	07:34	08:18	15:40	16:24	17:10
52°	06:42	07:25	08:06	15:51	16:32	17:16
50°	06:36	07:18	07:56	16:01	16:39	17:21
45°	06:25	07:02	07:36	16:22	16:56	17:33
N 40°	06:14	06:48	07:19	16:39	17:09	17:43
35°	06:05	06:36	07:05	16:53	17:21	17:53
30°	05:56	06:26	06:52	17:05	17:32	18:01
20°	05:39	06:07	06:31	17:26	17:50	18:18
N 10°	05:23	05:50	06:12	17:45	18:08	18:34
0°	05:06	05:32	05:55	18:02	18:25	18:51
S 10°	04:47	05:14	05:37	18:20	18:43	19:10
20°	04:24	04:54	05:18	18:39	19:04	19:33
30°	03:55	04:29	04:56	19:01	19:29	20:02
35°	03:37	04:13	04:43	19:14	19:44	20:21
40°	03:13	03:55	04:28	19:29	20:02	20:44
45°	02:43	03:33	04:10	19:47	20:25	21:15
S 50°	01:57	03:03	03:47	20:10	20:55	22:00
52°	01:29	02:48	03:37	20:21	21:10	22:28
54°	00:42	02:30	03:24	20:33	21:28	23:15
56°	////	02:07	03:10	20:47	21:50	////
58°	////	01:37	02:53	21:04	22:20	////
S 60°	////	00:46	02:33	21:25	23:11	////

Lat.	**Moonrise** Sun	Mon	Tue	**Moonset** Sun	Mon	Tue
N 72°	▬	▬	▬	▬	▬	▬
N 70°	▬	▬	14:17	▬	▬	15:44
68°	▬	▬	13:05	▬	▬	16:54
66°	▬	13:33	12:28	▬	14:44	17:30
64°	▬	12:23	12:02	▬	15:54	17:55
62°	11:55	11:47	11:41	14:36	16:29	18:15
60°	11:12	11:21	11:24	15:18	16:54	18:31
N 58°	10:43	11:00	11:10	15:47	17:14	18:45
56°	10:21	10:43	10:57	16:09	17:31	18:56
54°	10:02	10:29	10:47	16:27	17:45	19:06
52°	09:47	10:16	10:37	16:42	17:57	19:15
50°	09:33	10:05	10:28	16:55	18:08	19:23
45°	09:06	09:41	10:10	17:22	18:30	19:40
N 40°	08:44	09:23	09:55	17:43	18:48	19:54
35°	08:26	09:07	09:42	18:01	19:03	20:06
30°	08:10	08:53	09:31	18:16	19:16	20:16
20°	07:44	08:30	09:12	18:42	19:38	20:33
N 10°	07:21	08:09	08:55	19:04	19:57	20:48
0°	06:59	07:50	08:39	19:24	20:14	21:02
S 10°	06:38	07:31	08:24	19:44	20:32	21:16
20°	06:15	07:11	08:07	20:06	20:50	21:31
30°	05:48	06:47	07:47	20:31	21:12	21:47
35°	05:32	06:33	07:35	20:46	21:24	21:57
40°	05:14	06:17	07:22	21:03	21:38	22:08
45°	04:51	05:57	07:06	21:23	21:55	22:21
S 50°	04:23	05:32	06:47	21:49	22:16	22:37
52°	04:09	05:21	06:38	22:01	22:26	22:44
54°	03:53	05:07	06:27	22:15	22:37	22:52
56°	03:33	04:51	06:15	22:31	22:49	23:01
58°	03:09	04:32	06:02	22:50	23:03	23:11
S 60°	02:37	04:09	05:45	23:14	23:20	23:23

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 1-3 1-8%
21	02:04	01:49	11:58	13:12	00:46	
22	01:34	01:19	11:59	14:02	01:37	
23	01:04	00:49	11:59	14:51	02:27	

December 24, 25, 26 UT (Wed., Thu., Fri.)

	Aries	Venus		Mars		Jupiter		Saturn	
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	92°46.6	183°43.1	S23°37.9	175°34.0	S24°06.7	338°35.1	N21°47.9	95°46.0	S03°47.2
1	107°49.1	198°42.1	38.0	190°34.4	06.7	353°37.8	48.0	110°48.4	47.1
2	122°51.5	213°41.1	38.1	205°34.8	06.6	8°40.6	48.0	125°50.7	47.1
3	137°54.0	228°40.2	·· 38.2	220°35.1	·· 06.5	23°43.4	·· 48.1	140°53.1	·· 47.0
4	152°56.5	243°39.2	38.4	235°35.5	06.4	38°46.2	48.1	155°55.5	47.0
5	167°58.9	258°38.2	38.5	250°35.9	06.3	53°49.0	48.2	170°57.8	46.9
6	183°01.4	273°37.2	S23°38.6	265°36.3	S24°06.3	68°51.8	N21°48.2	186°00.2	S03°46.9
7	198°03.9	288°36.3	38.7	280°36.7	06.2	83°54.5	48.3	201°02.6	46.8
8	213°06.3	303°35.3	38.8	295°37.0	06.1	98°57.3	48.4	216°04.9	46.7
9	228°08.8	318°34.3	·· 38.9	310°37.4	·· 06.0	114°00.1	·· 48.4	231°07.3	·· 46.7
10	243°11.3	333°33.4	39.0	325°37.8	05.9	129°02.9	48.5	246°09.6	46.6
11	258°13.7	348°32.4	39.1	340°38.2	05.9	144°05.7	48.5	261°12.0	46.6
12	273°16.2	3°31.4	S23°39.2	355°38.6	S24°05.8	159°08.5	N21°48.6	276°14.4	S03°46.5
13	288°18.7	18°30.4	39.3	10°39.0	05.7	174°11.2	48.6	291°16.7	46.5
14	303°21.1	33°29.5	39.4	25°39.3	05.6	189°14.0	48.7	306°19.1	46.4
15	318°23.6	48°28.5	·· 39.5	40°39.7	·· 05.5	204°16.8	·· 48.7	321°21.5	·· 46.4
16	333°26.0	63°27.5	39.6	55°40.1	05.4	219°19.6	48.8	336°23.8	46.3
17	348°28.5	78°26.6	39.7	70°40.5	05.4	234°22.4	48.9	351°26.2	46.3
18	3°31.0	93°25.6	S23°39.8	85°40.9	S24°05.3	249°25.2	N21°48.9	6°28.5	S03°46.2
19	18°33.4	108°24.6	39.9	100°41.2	05.2	264°28.0	49.0	21°30.9	46.2
20	33°35.9	123°23.6	40.0	115°41.6	05.1	279°30.7	49.0	36°33.3	46.1
21	48°38.4	138°22.7	·· 40.1	130°42.0	·· 05.0	294°33.5	·· 49.1	51°35.6	·· 46.0
22	63°40.8	153°21.7	40.2	145°42.4	04.9	309°36.3	49.1	66°38.0	46.0
23	78°43.3	168°20.7	40.3	160°42.8	04.8	324°39.1	49.2	81°40.3	45.9
Mer.pass. 17:46		ν -1.0′	d 0.1′	m -3.90	ν 0.4′	d 0.1′	m 1.17	ν 2.8′	d 0.1′ m -2.65	ν 2.4′	d 0.1′ m 0.99

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	93°45.8	183°19.8	S23°40.4	175°43.1	S24°04.7	339°41.9	N21°49.2	96°42.7	S03°45.9
1	108°48.2	198°18.8	40.5	190°43.5	04.6	354°44.7	49.3	111°45.1	45.8
2	123°50.7	213°17.8	40.6	205°43.9	04.6	9°47.5	49.4	126°47.4	45.8
3	138°53.2	228°16.8	·· 40.7	220°44.3	·· 04.5	24°50.2	·· 49.4	141°49.8	·· 45.7
4	153°55.6	243°15.9	40.7	235°44.7	04.4	39°53.0	49.5	156°52.1	45.7
5	168°58.1	258°14.9	40.8	250°45.1	04.3	54°55.8	49.5	171°54.5	45.6
6	184°00.5	273°13.9	S23°40.9	265°45.4	S24°04.2	69°58.6	N21°49.6	186°56.8	S03°45.6
7	199°03.0	288°13.0	41.0	280°45.8	04.1	85°01.4	49.6	201°59.2	45.5
8	214°05.5	303°12.0	41.1	295°46.2	04.0	100°04.2	49.7	217°01.6	45.4
9	229°07.9	318°11.0	·· 41.1	310°46.6	·· 03.9	115°07.0	·· 49.7	232°03.9	·· 45.4
10	244°10.4	333°10.0	41.2	325°47.0	03.8	130°09.8	49.8	247°06.3	45.3
11	259°12.9	348°09.1	41.3	340°47.3	03.7	145°12.6	49.9	262°08.6	45.3
12	274°15.3	3°08.1	S23°41.4	355°47.7	S24°03.6	160°15.3	N21°49.9	277°11.0	S03°45.2
13	289°17.8	18°07.1	41.4	10°48.1	03.5	175°18.1	50.0	292°13.4	45.2
14	304°20.3	33°06.1	41.5	25°48.5	03.4	190°20.9	50.0	307°15.7	45.1
15	319°22.7	48°05.2	·· 41.6	40°48.9	·· 03.4	205°23.7	·· 50.1	322°18.1	·· 45.1
16	334°25.2	63°04.2	41.7	55°49.2	03.3	220°26.5	50.1	337°20.4	45.0
17	349°27.6	78°03.2	41.7	70°49.6	03.2	235°29.3	50.2	352°22.8	44.9
18	4°30.1	93°02.3	S23°41.8	85°50.0	S24°03.1	250°32.1	N21°50.3	7°25.1	S03°44.9
19	19°32.6	108°01.3	41.9	100°50.4	03.0	265°34.9	50.3	22°27.5	44.8
20	34°35.0	123°00.3	41.9	115°50.8	02.9	280°37.7	50.4	37°29.8	44.8
21	49°37.5	137°59.3	·· 42.0	130°51.1	·· 02.8	295°40.5	·· 50.4	52°32.2	·· 44.7
22	64°40.0	152°58.4	42.0	145°51.5	02.7	310°43.2	50.5	67°34.6	44.7
23	79°42.4	167°57.4	42.1	160°51.9	02.6	325°46.0	50.5	82°36.9	44.6
Mer.pass. 17:42		ν -1.0′	d 0.1′	m -3.90	ν 0.4′	d 0.1′	m 1.17	ν 2.8′	d 0.1′ m -2.66	ν 2.4′	d 0.1′ m 0.99

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	94°44.9	182°56.4	S23°42.2	175°52.3	S24°02.5	340°48.8	N21°50.6	97°39.3	S03°44.5
1	109°47.4	197°55.4	42.2	190°52.7	02.4	355°51.6	50.6	112°41.6	44.5
2	124°49.8	212°54.5	42.3	205°53.1	02.3	10°54.4	50.7	127°44.0	44.4
3	139°52.3	227°53.5	·· 42.3	220°53.4	·· 02.2	25°57.2	·· 50.8	142°46.3	·· 44.4
4	154°54.8	242°52.5	42.4	235°53.8	02.1	41°00.0	50.8	157°48.7	44.3
5	169°57.2	257°51.5	42.4	250°54.2	02.0	56°02.8	50.9	172°51.0	44.3
6	184°59.7	272°50.6	S23°42.5	265°54.6	S24°01.9	71°05.6	N21°50.9	187°53.4	S03°44.2
7	200°02.1	287°49.6	42.5	280°55.0	01.8	86°08.4	51.0	202°55.8	44.2
8	215°04.6	302°48.6	42.6	295°55.3	01.7	101°11.2	51.0	217°58.1	44.1
9	230°07.1	317°47.6	·· 42.6	310°55.7	·· 01.5	116°14.0	·· 51.1	233°00.5	·· 44.0
10	245°09.5	332°46.7	42.7	325°56.1	01.4	131°16.7	51.1	248°02.8	44.0
11	260°12.0	347°45.7	42.7	340°56.5	01.3	146°19.5	51.2	263°05.2	43.9
12	275°14.5	2°44.7	S23°42.8	355°56.9	S24°01.2	161°22.3	N21°51.3	278°07.5	S03°43.9
13	290°16.9	17°43.8	42.8	10°57.2	01.1	176°25.1	51.3	293°09.9	43.8
14	305°19.4	32°42.8	42.9	25°57.6	01.0	191°27.9	51.4	308°12.2	43.8
15	320°21.9	47°41.8	·· 42.9	40°58.0	·· 00.9	206°30.7	·· 51.4	323°14.6	·· 43.7
16	335°24.3	62°40.8	42.9	55°58.4	00.8	221°33.5	51.5	338°16.9	43.6
17	350°26.8	77°39.9	43.0	70°58.8	00.7	236°36.3	51.5	353°19.3	43.6
18	5°29.3	92°38.9	S23°43.0	85°59.1	S24°00.6	251°39.1	N21°51.6	8°21.6	S03°43.5
19	20°31.7	107°37.9	43.0	100°59.5	00.5	266°41.9	51.7	23°24.0	43.5
20	35°34.2	122°36.9	43.1	115°59.9	00.4	281°44.7	51.7	38°26.4	43.4
21	50°36.6	137°36.0	·· 43.1	131°00.3	·· 00.3	296°47.5	·· 51.8	53°28.7	·· 43.4
22	65°39.1	152°35.0	43.1	146°00.7	00.1	311°50.3	51.8	68°31.1	43.3
23	80°41.6	167°34.0	43.2	161°01.0	00.0	326°53.1	51.9	83°33.4	43.2
Mer.pass. 17:38		ν -1.0′	d 0.1′	m -3.90	ν 0.4′	d 0.1′	m 1.16	ν 2.8′	d 0.1′ m -2.66	ν 2.4′	d 0.1′ m 0.99

Stars

	SHA	Dec
Alpheratz	357°34.0	29°14.2
Ankaa	353°06.3	-42°10.1
Schedar	349°30.1	56°41.1
Diphda	348°46.4	-17°50.7
Achernar	335°19.4	-57°06.5
Hamal	327°50.1	23°35.3
Polaris	313°15.5	89°22.7
Acamar	315°10.9	-40°12.2
Menkar	314°05.1	4°11.5
Mirfak	308°26.7	49°57.4
Aldebaran	290°38.4	16°33.7
Rigel	281°02.8	-8°10.3
Capella	280°20.2	46°01.5
Bellatrix	278°21.7	6°22.4
Elnath	278°00.5	28°37.8
Alnilam	275°36.6	-1°11.1
Betelgeuse	270°50.9	7°24.7
Canopus	263°51.5	-52°42.5
Sirius	258°25.2	-16°45.1
Adhara	255°04.9	-29°00.4
Procyon	244°49.7	5°09.5
Pollux	243°16.0	27°57.7
Avior	234°13.9	-59°35.4
Suhail	222°45.4	-43°32.1
Miaplacidus	221°37.4	-69°49.2
Alphard	217°46.7	-8°46.3
Regulus	207°33.4	11°50.3
Dubhe	193°39.8	61°36.3
Denebola	182°24.1	14°25.5
Gienah	175°42.8	-17°41.1
Acrux	172°59.3	-63°14.3
Gacrux	171°50.8	-57°15.3
Alioth	166°12.4	55°48.8
Spica	158°21.6	-11°17.8
Alkaid	152°51.6	49°10.7
Hadar	148°35.2	-60°29.7
Menkent	147°56.9	-36°29.7
Arcturus	145°47.4	19°02.7
Rigil Kent.	139°39.6	-60°56.3
Kochab	137°20.6	74°02.6
Zuben'ubi	136°55.4	-16°08.9
Alphecca	126°03.4	26°37.5
Antares	112°15.2	-26°29.3
Atria	107°09.3	-69°04.3
Sabik	102°02.2	-15°45.4
Shaula	96°09.7	-37°07.3
Rasalhague	95°58.2	12°32.4
Eltanin	90°42.4	51°29.0
Kaus Aust.	83°31.9	-34°22.3
Vega	80°33.1	38°48.4
Nunki	75°47.1	-26°15.9
Altair	61°59.5	8°56.2
Peacock	53°05.0	-56°39.2
Deneb	49°25.7	45°22.5
Enif	33°38.2	9°59.7
Al Na'ir	27°32.2	-46°50.3
Fomalhaut	15°13.8	-29°29.2
Scheat	13°44.5	28°13.6
Markab	13°29.2	15°20.8

Dec 24 Wed	SHA	Mer.pass
Venus	90°56.4	11:46
Mars	82°47.4	12:17
Jupiter	245°48.4	01:25
Saturn	2°59.4	17:34

Dec 25 Thu	SHA	Mer.pass
Venus	89°34.0	11:47
Mars	81°57.4	12:17
Jupiter	245°56.1	01:21
Saturn	2°56.9	17:30

Dec 26 Fri	SHA	Mer.pass
Venus	88°11.5	11:49
Mars	81°07.4	12:16
Jupiter	246°03.9	01:17
Saturn	2°54.4	17:27

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°08.5	S23°25.0	132°57.5	12.8′	S17°50.3	12.0′	55.8′
1	195°08.2	24.9	147°29.4	12.9′	17°38.3	12.1′	55.8′
2	210°07.9	24.9	162°01.2	12.9′	17°26.2	12.2′	55.8′
3	225°07.6	·· 24.8	176°33.1	13.0′	17°14.0	12.3′	55.8′
4	240°07.3	24.8	191°05.1	13.0′	17°01.7	12.3′	55.9′
5	255°07.0	24.7	205°37.1	13.1′	16°49.4	12.5′	55.9′
6	270°06.7	S23°24.7	220°09.2	13.1′	S16°36.9	12.5′	55.9′
7	285°06.4	24.6	234°41.3	13.1′	16°24.4	12.6′	55.9′
8	300°06.1	24.6	249°13.4	13.2′	16°11.8	12.7′	55.9′
9	315°05.7	·· 24.5	263°45.6	13.2′	15°59.1	12.7′	56.0′
10	330°05.4	24.5	278°17.8	13.3′	15°46.4	12.9′	56.0′
11	345°05.1	24.4	292°50.1	13.3′	15°33.5	12.9′	56.0′
12	0°04.8	S23°24.3	307°22.4	13.4′	S15°20.6	13.0′	56.0′
13	15°04.5	24.3	321°54.8	13.4′	15°07.6	13.1′	56.1′
14	30°04.2	24.2	336°27.1	13.4′	14°54.5	13.1′	56.1′
15	45°03.9	·· 24.2	350°59.6	13.5′	14°41.4	13.2′	56.1′
16	60°03.6	24.1	5°32.0	13.5′	14°28.2	13.3′	56.1′
17	75°03.3	24.1	20°04.6	13.5′	14°14.9	13.4′	56.2′
18	90°03.0	S23°24.0	34°37.1	13.6′	S14°01.5	13.4′	56.2′
19	105°02.6	23.9	49°09.7	13.6′	13°48.1	13.6′	56.2′
20	120°02.3	23.9	63°42.3	13.6′	13°34.5	13.5′	56.2′
21	135°02.0	·· 23.8	78°14.9	13.7′	13°21.0	13.7′	56.2′
22	150°01.7	23.7	92°47.6	13.7′	13°07.3	13.7′	56.3′
23	165°01.4	23.7	107°20.3	13.7′	12°53.6	13.8′	56.3′
	SD = 16.3′	d = 0.0′	SD = 15.2′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°01.1	S23°23.6	121°53.1	13.8′	S12°39.8	13.8′	56.3′
1	195°00.8	23.5	136°25.8	13.8′	12°26.0	14.0′	56.3′
2	210°00.5	23.5	150°58.7	13.8′	12°12.0	13.9′	56.4′
3	225°00.2	·· 23.4	165°31.5	13.9′	11°58.1	14.1′	56.4′
4	239°59.8	23.3	180°04.3	13.9′	11°44.0	14.1′	56.4′
5	254°59.5	23.3	194°37.2	13.9′	11°29.9	14.2′	56.4′
6	269°59.2	S23°23.2	209°10.1	13.9′	S11°15.7	14.2′	56.5′
7	284°58.9	23.1	223°43.1	14.0′	11°01.5	14.3′	56.5′
8	299°58.6	23.1	238°16.0	14.0′	10°47.2	14.3′	56.5′
9	314°58.3	·· 23.0	252°49.0	14.0′	10°32.9	14.4′	56.5′
10	329°58.0	22.9	267°22.0	14.0′	10°18.5	14.5′	56.6′
11	344°57.7	22.8	281°55.1	14.0′	10°04.0	14.5′	56.6′
12	359°57.4	S23°22.8	296°28.1	14.1′	S09°49.5	14.6′	56.6′
13	14°57.1	22.7	311°01.2	14.1′	09°34.9	14.6′	56.6′
14	29°56.8	22.6	325°34.2	14.1′	09°20.3	14.7′	56.7′
15	44°56.4	·· 22.5	340°07.3	14.1′	09°05.6	14.7′	56.7′
16	59°56.1	22.4	354°40.5	14.1′	08°50.9	14.8′	56.7′
17	74°55.8	22.4	9°13.6	14.1′	08°36.1	14.8′	56.8′
18	89°55.5	S23°22.3	23°46.7	14.2′	S08°21.3	14.9′	56.8′
19	104°55.2	22.2	38°19.9	14.2′	08°06.4	14.9′	56.8′
20	119°54.9	22.1	52°53.0	14.2′	07°51.5	15.0′	56.8′
21	134°54.6	·· 22.0	67°26.2	14.2′	07°36.5	15.0′	56.9′
22	149°54.3	22.0	81°59.4	14.2′	07°21.5	15.1′	56.9′
23	164°54.0	21.9	96°32.6	14.2′	07°06.4	15.1′	56.9′
	SD = 16.3′	d = 0.1′	SD = 15.4′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°53.7	S23°21.8	111°05.8	14.2′	S06°51.3	15.1′	56.9′
1	194°53.3	21.7	125°39.0	14.2′	06°36.2	15.2′	57.0′
2	209°53.0	21.6	140°12.2	14.2′	06°21.0	15.3′	57.0′
3	224°52.7	·· 21.5	154°45.4	14.2′	06°05.7	15.2′	57.0′
4	239°52.4	21.4	169°18.6	14.2′	05°50.5	15.4′	57.0′
5	254°52.1	21.3	183°51.8	14.2′	05°35.1	15.3′	57.1′
6	269°51.8	S23°21.3	198°25.0	14.2′	S05°19.8	15.4′	57.1′
7	284°51.5	21.2	212°58.2	14.2′	05°04.4	15.4′	57.1′
8	299°51.2	21.1	227°31.4	14.2′	04°49.0	15.5′	57.2′
9	314°50.9	·· 21.0	242°04.6	14.2′	04°33.5	15.5′	57.2′
10	329°50.6	20.9	256°37.8	14.2′	04°18.0	15.5′	57.2′
11	344°50.3	20.8	271°11.0	14.2′	04°02.5	15.6′	57.2′
12	359°50.0	S23°20.7	285°44.1	14.2′	S03°46.9	15.6′	57.3′
13	14°49.6	20.6	300°17.3	14.1′	03°31.3	15.6′	57.3′
14	29°49.3	20.5	314°50.4	14.1′	03°15.7	15.7′	57.3′
15	44°49.0	·· 20.4	329°23.6	14.1′	03°00.0	15.6′	57.4′
16	59°48.7	20.3	343°56.7	14.1′	02°44.4	15.7′	57.4′
17	74°48.4	20.2	358°29.8	14.1′	02°28.7	15.8′	57.4′
18	89°48.1	S23°20.1	13°02.9	14.1′	S02°12.9	15.7′	57.4′
19	104°47.8	20.0	27°36.0	14.1′	01°57.2	15.8′	57.5′
20	119°47.5	19.9	42°09.0	14.0′	01°41.4	15.8′	57.5′
21	134°47.2	·· 19.8	56°42.1	14.0′	01°25.6	15.9′	57.5′
22	149°46.9	19.7	71°15.1	14.0′	01°09.7	15.8′	57.6′
23	164°46.6	19.6	85°48.1	14.0′	00°53.9	15.9′	57.6′
	SD = 16.3′	d = 0.1′	SD = 15.5′				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	08:27	10:57	▬	▬	13:04	15:34
N 70°	08:07	09:55	▬	▬	14:05	15:53
68°	07:51	09:20	▬	▬	14:40	16:09
66°	07:38	08:55	10:35	13:25	15:05	16:22
64°	07:27	08:35	09:53	14:07	15:25	16:34
62°	07:17	08:19	09:25	14:35	15:41	16:43
60°	07:09	08:06	09:03	14:57	15:55	16:51
N 58°	07:01	07:54	08:46	15:14	16:06	16:59
56°	06:55	07:44	08:31	15:29	16:17	17:06
54°	06:49	07:35	08:19	15:42	16:26	17:12
52°	06:43	07:27	08:08	15:53	16:34	17:18
50°	06:38	07:19	07:58	16:03	16:41	17:23
45°	06:26	07:03	07:37	16:23	16:57	17:35
N 40°	06:15	06:50	07:20	16:40	17:11	17:45
35°	06:06	06:38	07:06	16:54	17:23	17:54
30°	05:57	06:27	06:54	17:07	17:33	18:03
20°	05:41	06:08	06:32	17:28	17:52	18:20
N 10°	05:25	05:51	06:14	17:46	18:09	18:36
0°	05:08	05:34	05:56	18:04	18:26	18:53
S 10°	04:49	05:16	05:39	18:21	18:45	19:12
20°	04:26	04:55	05:20	18:40	19:05	19:34
30°	03:57	04:30	04:58	19:02	19:30	20:03
35°	03:38	04:15	04:45	19:15	19:45	20:22
40°	03:15	03:57	04:30	19:30	20:03	20:45
45°	02:45	03:34	04:12	19:48	20:26	21:16
S 50°	01:59	03:05	03:49	20:11	20:56	22:01
52°	01:31	02:50	03:38	20:22	21:11	22:29
54°	00:45	02:32	03:26	20:34	21:28	23:14
56°	////	02:09	03:12	20:48	21:51	////
58°	////	01:40	02:55	21:05	22:20	////
S 60°	////	00:49	02:35	21:25	23:10	////

Lat.	**Moonrise** Wed	Thu	Fri	**Moonset** Wed	Thu	Fri
N 72°	13:19	12:24	11:46	18:20	20:51	23:04
N 70°	12:47	12:09	11:41	18:51	21:03	23:06
68°	12:23	11:57	11:36	19:13	21:13	23:07
66°	12:04	11:47	11:33	19:30	21:21	23:08
64°	11:49	11:39	11:30	19:44	21:27	23:09
62°	11:36	11:31	11:27	19:56	21:33	23:10
60°	11:25	11:25	11:24	20:06	21:38	23:10
N 58°	11:16	11:19	11:22	20:14	21:42	23:11
56°	11:07	11:14	11:20	20:22	21:46	23:11
54°	11:00	11:10	11:19	20:28	21:50	23:12
52°	10:53	11:06	11:17	20:34	21:53	23:12
50°	10:47	11:02	11:16	20:39	21:56	23:12
45°	10:34	10:54	11:12	20:51	22:02	23:13
N 40°	10:23	10:47	11:10	21:00	22:07	23:14
35°	10:13	10:41	11:07	21:09	22:11	23:14
30°	10:05	10:36	11:05	21:16	22:15	23:15
20°	09:51	10:27	11:02	21:28	22:22	23:15
N 10°	09:38	10:19	10:59	21:38	22:27	23:16
0°	09:26	10:11	10:56	21:48	22:33	23:17
S 10°	09:14	10:04	10:53	21:58	22:38	23:17
20°	09:02	09:56	10:50	22:08	22:43	23:18
30°	08:47	09:46	10:46	22:20	22:50	23:19
35°	08:38	09:41	10:44	22:26	22:53	23:19
40°	08:29	09:35	10:42	22:34	22:57	23:19
45°	08:17	09:28	10:39	22:43	23:02	23:20
S 50°	08:03	09:19	10:36	22:53	23:07	23:20
52°	07:56	09:15	10:34	22:58	23:10	23:21
54°	07:49	09:11	10:32	23:03	23:13	23:21
56°	07:41	09:06	10:30	23:09	23:16	23:21
58°	07:32	09:00	10:28	23:16	23:19	23:22
S 60°	07:21	08:54	10:26	23:23	23:23	23:22

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 4-6 14-31%
24	00:34	00:19	12:00	15:37	03:14	
25	00:04	00:11	12:00	16:22	04:00	
26	00:25	00:40	12:01	17:06	04:44	

December 27, 28, 29 UT (Sat., Sun., Mon.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	95°44.0	182°33.0	S23°43.2	176°01.4	S23°59.9	341°55.9	N21°51.9	98°35.8	S03°43.2
1	110°46.5	197°32.1	43.2	191°01.8	59.8	356°58.7	52.0	113°38.1	43.1
2	125°49.0	212°31.1	43.3	206°02.2	59.7	12°01.4	52.0	128°40.5	43.1
3	140°51.4	227°30.1	·· 43.3	221°02.6	·· 59.6	27°04.2	·· 52.1	143°42.8	·· 43.0
4	155°53.9	242°29.1	43.3	236°02.9	59.5	42°07.0	52.2	158°45.2	43.0
5	170°56.4	257°28.2	43.3	251°03.3	59.4	57°09.8	52.2	173°47.5	42.9
6	185°58.8	272°27.2	S23°43.3	266°03.7	S23°59.3	72°12.6	N21°52.3	188°49.9	S03°42.8
7	201°01.3	287°26.2	43.4	281°04.1	59.1	87°15.4	52.3	203°52.2	42.8
8	216°03.7	302°25.2	43.4	296°04.5	59.0	102°18.2	52.4	218°54.6	42.7
9	231°06.2	317°24.3	·· 43.4	311°04.8	·· 58.9	117°21.0	·· 52.4	233°56.9	·· 42.7
10	246°08.7	332°23.3	43.4	326°05.2	58.8	132°23.8	52.5	248°59.3	42.6
11	261°11.1	347°22.3	43.4	341°05.6	58.7	147°26.6	52.6	264°01.6	42.5
12	276°13.6	2°21.3	S23°43.4	356°06.0	S23°58.6	162°29.4	N21°52.6	279°04.0	S03°42.5
13	291°16.1	17°20.4	43.5	11°06.4	58.4	177°32.2	52.7	294°06.3	42.4
14	306°18.5	32°19.4	43.5	26°06.7	58.3	192°35.0	52.7	309°08.7	42.4
15	321°21.0	47°18.4	·· 43.5	41°07.1	·· 58.2	207°37.8	·· 52.8	324°11.0	·· 42.3
16	336°23.5	62°17.4	43.5	56°07.5	58.1	222°40.6	52.8	339°13.4	42.2
17	351°25.9	77°16.5	43.5	71°07.9	58.0	237°43.4	52.9	354°15.7	42.2
18	6°28.4	92°15.5	S23°43.5	86°08.3	S23°57.8	252°46.2	N21°53.0	9°18.1	S03°42.1
19	21°30.9	107°14.5	43.5	101°08.6	57.7	267°49.0	53.0	24°20.4	42.1
20	36°33.3	122°13.5	43.5	116°09.0	57.6	282°51.8	53.1	39°22.8	42.0
21	51°35.8	137°12.6	·· 43.5	131°09.4	·· 57.5	297°54.6	·· 53.1	54°25.1	·· 42.0
22	66°38.2	152°11.6	43.5	146°09.8	57.4	312°57.4	53.2	69°27.5	41.9
23	81°40.7	167°10.6	43.5	161°10.1	57.2	328°00.2	53.2	84°29.8	41.8
Mer.pass. 17:34		ν -1.0′	d 0.0′	m -3.90	ν 0.4′	d 0.1′	m 1.15	ν 2.8′	d 0.1′ m -2.66	ν 2.4′	d 0.1′ m 1.00

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	96°43.2	182°09.7	S23°43.5	176°10.5	S23°57.1	343°03.0	N21°53.3	99°32.2	S03°41.8
1	111°45.6	197°08.7	43.5	191°10.9	57.0	358°05.8	53.3	114°34.5	41.7
2	126°48.1	212°07.7	43.5	206°11.3	56.9	13°08.6	53.4	129°36.9	41.7
3	141°50.6	227°06.7	·· 43.5	221°11.7	·· 56.7	28°11.4	·· 53.5	144°39.2	·· 41.6
4	156°53.0	242°05.8	43.5	236°12.0	56.6	43°14.2	53.5	159°41.6	41.5
5	171°55.5	257°04.8	43.5	251°12.4	56.5	58°17.0	53.6	174°43.9	41.5
6	186°58.0	272°03.8	S23°43.5	266°12.8	S23°56.4	73°19.8	N21°53.6	189°46.2	S03°41.4
7	202°00.4	287°02.8	43.5	281°13.2	56.2	88°22.6	53.7	204°48.6	41.4
8	217°02.9	302°01.9	43.4	296°13.6	56.1	103°25.4	53.7	219°50.9	41.3
9	232°05.4	317°00.9	·· 43.4	311°13.9	·· 56.0	118°28.2	·· 53.8	234°53.3	·· 41.2
10	247°07.8	331°59.9	43.4	326°14.3	55.9	133°31.0	53.9	249°55.6	41.2
11	262°10.3	346°58.9	43.4	341°14.7	55.7	148°33.8	53.9	264°58.0	41.1
12	277°12.7	1°58.0	S23°43.4	356°15.1	S23°55.6	163°36.6	N21°54.0	280°00.3	S03°41.1
13	292°15.2	16°57.0	43.4	11°15.5	55.5	178°39.4	54.0	295°02.7	41.0
14	307°17.7	31°56.0	43.3	26°15.8	55.4	193°42.2	54.1	310°05.0	40.9
15	322°20.1	46°55.0	·· 43.3	41°16.2	·· 55.2	208°45.0	·· 54.1	325°07.4	·· 40.9
16	337°22.6	61°54.1	43.3	56°16.6	55.1	223°47.8	54.2	340°09.7	40.8
17	352°25.1	76°53.1	43.3	71°17.0	55.0	238°50.6	54.3	355°12.1	40.8
18	7°27.5	91°52.1	S23°43.2	86°17.4	S23°54.8	253°53.4	N21°54.3	10°14.4	S03°40.7
19	22°30.0	106°51.1	43.2	101°17.7	54.7	268°56.2	54.4	25°16.7	40.6
20	37°32.5	121°50.2	43.2	116°18.1	54.6	283°59.0	54.4	40°19.1	40.6
21	52°34.9	136°49.2	·· 43.2	131°18.5	·· 54.4	299°01.8	·· 54.5	55°21.4	·· 40.5
22	67°37.4	151°48.2	43.1	146°18.9	54.3	314°04.6	54.5	70°23.8	40.5
23	82°39.8	166°47.2	43.1	161°19.3	54.2	329°07.4	54.6	85°26.1	40.4
Mer.pass. 17:30		ν -1.0′	d 0.0′	m -3.90	ν 0.4′	d 0.1′	m 1.15	ν 2.8′	d 0.1′ m -2.66	ν 2.3′	d 0.1′ m 1.00

Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	97°42.3	181°46.3	S23°43.1	176°19.6	S23°54.0	344°10.2	N21°54.7	100°28.5	S03°40.3
1	112°44.8	196°45.3	43.0	191°20.0	53.9	359°13.0	54.7	115°30.8	40.3
2	127°47.2	211°44.3	43.0	206°20.4	53.8	14°15.8	54.8	130°33.2	40.2
3	142°49.7	226°43.4	·· 43.0	221°20.8	·· 53.6	29°18.6	·· 54.8	145°35.5	·· 40.2
4	157°52.2	241°42.4	42.9	236°21.2	53.5	44°21.4	54.9	160°37.8	40.1
5	172°54.6	256°41.4	42.9	251°21.5	53.4	59°24.2	54.9	175°40.2	40.0
6	187°57.1	271°40.4	S23°42.8	266°21.9	S23°53.2	74°27.0	N21°55.0	190°42.5	S03°40.0
7	202°59.6	286°39.5	42.8	281°22.3	53.1	89°29.8	55.0	205°44.9	39.9
8	218°02.0	301°38.5	42.8	296°22.7	53.0	104°32.6	55.1	220°47.2	39.8
9	233°04.5	316°37.5	·· 42.7	311°23.1	·· 52.8	119°35.4	·· 55.2	235°49.6	·· 39.8
10	248°07.0	331°36.5	42.7	326°23.4	52.7	134°38.2	55.2	250°51.9	39.7
11	263°09.4	346°35.6	42.6	341°23.8	52.5	149°41.0	55.3	265°54.2	39.7
12	278°11.9	1°34.6	S23°42.6	356°24.2	S23°52.4	164°43.8	N21°55.3	280°56.6	S03°39.6
13	293°14.3	16°33.6	42.5	11°24.6	52.3	179°46.6	55.4	295°58.9	39.5
14	308°16.8	31°32.6	42.5	26°24.9	52.1	194°49.4	55.4	311°01.3	39.5
15	323°19.3	46°31.7	·· 42.4	41°25.3	·· 52.0	209°52.2	·· 55.5	326°03.6	·· 39.4
16	338°21.7	61°30.7	42.4	56°25.7	51.8	224°55.0	55.6	341°06.0	39.4
17	353°24.2	76°29.7	42.3	71°26.1	51.7	239°57.8	55.6	356°08.3	39.3
18	8°26.7	91°28.8	S23°42.3	86°26.5	S23°51.6	255°00.7	N21°55.7	11°10.6	S03°39.2
19	23°29.1	106°27.8	42.2	101°26.8	51.4	270°03.5	55.7	26°13.0	39.2
20	38°31.6	121°26.8	42.1	116°27.2	51.3	285°06.3	55.8	41°15.3	39.1
21	53°34.1	136°25.8	·· 42.1	131°27.6	·· 51.1	300°09.1	·· 55.8	56°17.7	·· 39.0
22	68°36.5	151°24.9	42.0	146°28.0	51.0	315°11.9	55.9	71°20.0	39.0
23	83°39.0	166°23.9	42.0	161°28.4	50.8	330°14.7	56.0	86°22.4	38.9
Mer.pass. 17:26		ν -1.0′	d 0.0′	m -3.90	ν 0.4′	d 0.1′	m 1.14	ν 2.8′	d 0.1′ m -2.67	ν 2.3′	d 0.1′ m 1.00

Stars

	SHA	Dec
Alpheratz	357°34.0	29°14.2
Ankaa	353°06.3	-42°10.1
Schedar	349°30.1	56°41.1
Diphda	348°46.5	-17°50.7
Achernar	335°19.4	-57°06.5
Hamal	327°50.1	23°35.3
Polaris	313°16.6	89°22.7
Acamar	315°10.9	-40°12.2
Menkar	314°05.1	4°11.5
Mirfak	308°26.7	49°57.4
Aldebaran	290°38.4	16°33.7
Rigel	281°02.8	-8°10.3
Capella	280°20.2	46°01.5
Bellatrix	278°21.7	6°22.4
Elnath	278°00.5	28°37.8
Alnilam	275°36.6	-1°11.1
Betelgeuse	270°50.9	7°24.7
Canopus	263°51.5	-52°42.5
Sirius	258°25.2	-16°45.1
Adhara	255°04.8	-29°00.4
Procyon	244°49.7	5°09.5
Pollux	243°16.0	27°57.7
Avior	234°13.8	-59°35.4
Suhail	222°45.4	-43°32.1
Miaplacidus	221°37.4	-69°49.2
Alphard	217°46.7	-8°46.3
Regulus	207°33.4	11°50.3
Dubhe	193°39.8	61°36.3
Denebola	182°24.1	14°25.5
Gienah	175°42.8	-17°41.1
Acrux	172°59.2	-63°14.3
Gacrux	171°50.8	-57°15.3
Alioth	166°12.3	55°48.8
Spica	158°21.6	-11°17.8
Alkaid	152°51.6	49°10.7
Hadar	148°35.2	-60°29.7
Menkent	147°56.9	-36°29.7
Arcturus	145°47.3	19°02.7
Rigil Kent.	139°39.6	-60°56.3
Kochab	137°20.5	74°02.6
Zuben'ubi	136°55.3	-16°09.0
Alphecca	126°03.3	26°37.5
Antares	112°15.2	-26°29.3
Atria	107°09.2	-69°04.3
Sabik	102°02.2	-15°45.4
Shaula	96°09.7	-37°07.3
Rasalhague	95°58.1	12°32.4
Eltanin	90°42.4	51°29.0
Kaus Aust.	83°31.9	-34°22.3
Vega	80°33.1	38°48.4
Nunki	75°47.1	-26°15.9
Altair	61°59.5	8°56.2
Peacock	53°05.0	-56°39.2
Deneb	49°25.7	45°22.5
Enif	33°38.2	9°59.7
Al Na'ir	27°32.2	-46°50.3
Fomalhaut	15°13.8	-29°29.2
Scheat	13°44.6	28°13.6
Markab	13°29.2	15°20.8

Dec 27 Sat	SHA	Mer.pass
Venus	86°49.0	11:51
Mars	80°17.4	12:16
Jupiter	246°11.8	01:12
Saturn	2°51.7	17:23

Dec 28 Sun	SHA	Mer.pass
Venus	85°26.5	11:52
Mars	79°27.4	12:15
Jupiter	246°19.8	01:08
Saturn	2°49.0	17:19

Dec 29 Mon	SHA	Mer.pass
Venus	84°04.0	11:54
Mars	78°37.3	12:14
Jupiter	246°27.9	01:03
Saturn	2°46.2	17:15

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h

Sat	Sun GHA	Sun Dec	Moon GHA	Moon ν	Moon Dec	Moon d	Moon HP
0	179°46.3	S23°19.5	100°21.0	13.9′	S00°38.0	15.9′	57.6′
1	194°45.9	19.4	114°54.0	13.9′	00°22.1	15.9′	57.6′
2	209°45.6	19.3	129°26.9	13.9′	S00°06.2	15.9′	57.7′
3	224°45.3	·· 19.2	143°59.7	13.8′	N00°09.7	15.9′	57.7′
4	239°45.0	19.1	158°32.6	13.8′	00°25.6	16.0′	57.7′
5	254°44.7	19.0	173°05.4	13.8′	00°41.6	15.9′	57.8′
6	269°44.4	S23°18.8	187°38.2	13.7′	N00°57.5	16.0′	57.8′
7	284°44.1	18.7	202°10.9	13.7′	01°13.5	16.0′	57.8′
8	299°43.8	18.6	216°43.7	13.7′	01°29.5	16.0′	57.9′
9	314°43.5	·· 18.5	231°16.3	13.6′	01°45.5	16.0′	57.9′
10	329°43.2	18.4	245°49.0	13.6′	02°01.5	16.0′	57.9′
11	344°42.9	18.3	260°21.6	13.6′	02°17.5	16.0′	57.9′
12	359°42.6	S23°18.2	274°54.1	13.5′	N02°33.5	16.1′	58.0′
13	14°42.3	18.1	289°26.6	13.5′	02°49.6	16.0′	58.0′
14	29°42.0	17.9	303°59.1	13.4′	03°05.6	16.0′	58.0′
15	44°41.7	·· 17.8	318°31.5	13.4′	03°21.6	16.0′	58.1′
16	59°41.3	17.7	333°03.9	13.3′	03°37.6	16.1′	58.1′
17	74°41.0	17.6	347°36.2	13.3′	03°53.7	16.0′	58.1′
18	89°40.7	S23°17.5	2°08.5	13.2′	N04°09.7	16.0′	58.2′
19	104°40.4	17.3	16°40.7	13.2′	04°25.7	16.1′	58.2′
20	119°40.1	17.2	31°12.9	13.1′	04°41.8	16.0′	58.2′
21	134°39.8	·· 17.1	45°45.0	13.1′	04°57.8	16.0′	58.2′
22	149°39.5	17.0	60°17.1	13.0′	05°13.8	16.0′	58.3′
23	164°39.2	16.9	74°49.1	12.9′	05°29.8	16.0′	58.3′
	SD = 16.3′	d = 0.1′		SD = 15.7′			

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	179°38.9	S23°16.7	89°21.0	12.9′	N05°45.8	16.0′	58.3′
1	194°38.6	16.6	103°52.9	12.8′	06°01.8	15.9′	58.4′
2	209°38.3	16.5	118°24.7	12.8′	06°17.7	16.0′	58.4′
3	224°38.0	·· 16.4	132°56.5	12.7′	06°33.7	15.9′	58.4′
4	239°37.7	16.2	147°28.1	12.6′	06°49.6	16.0′	58.5′
5	254°37.4	16.1	161°59.8	12.6′	07°05.6	15.9′	58.5′
6	269°37.1	S23°16.0	176°31.3	12.5′	N07°21.5	15.9′	58.5′
7	284°36.8	15.8	191°02.8	12.4′	07°37.4	15.8′	58.6′
8	299°36.5	15.7	205°34.2	12.3′	07°53.2	15.9′	58.6′
9	314°36.2	·· 15.6	220°05.6	12.3′	08°09.1	15.8′	58.6′
10	329°35.8	15.4	234°36.8	12.2′	08°24.9	15.8′	58.6′
11	344°35.5	15.3	249°08.0	12.1′	08°40.7	15.8′	58.7′
12	359°35.2	S23°15.2	263°39.1	12.0′	N08°56.5	15.8′	58.7′
13	14°34.9	15.0	278°10.2	12.0′	09°12.3	15.7′	58.7′
14	29°34.6	14.9	292°41.1	11.9′	09°28.0	15.7′	58.8′
15	44°34.3	·· 14.8	307°12.0	11.8′	09°43.7	15.6′	58.8′
16	59°34.0	14.6	321°42.8	11.7′	09°59.3	15.7′	58.8′
17	74°33.7	14.5	336°13.5	11.6′	10°15.0	15.5′	58.9′
18	89°33.4	S23°14.4	350°44.1	11.5′	N10°30.5	15.6′	58.9′
19	104°33.1	14.2	5°14.7	11.4′	10°46.1	15.5′	58.9′
20	119°32.8	14.1	19°45.1	11.4′	11°01.6	15.5′	58.9′
21	134°32.5	·· 13.9	34°15.5	11.3′	11°17.1	15.4′	59.0′
22	149°32.2	13.8	48°45.7	11.2′	11°32.5	15.4′	59.0′
23	164°31.9	13.6	63°15.9	11.1′	11°47.9	15.4′	59.0′
	SD = 16.3′	d = 0.1′		SD = 15.9′			

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	179°31.6	S23°13.5	77°46.0	11.0′	N12°03.3	15.3′	59.1′
1	194°31.3	13.4	92°16.0	10.9′	12°18.6	15.2′	59.1′
2	209°31.0	13.2	106°45.8	10.8′	12°33.8	15.2′	59.1′
3	224°30.7	·· 13.1	121°15.6	10.7′	12°49.0	15.2′	59.2′
4	239°30.4	12.9	135°45.3	10.6′	13°04.2	15.0′	59.2′
5	254°30.1	12.8	150°14.9	10.5′	13°19.2	15.1′	59.2′
6	269°29.8	S23°12.6	164°44.4	10.4′	N13°34.3	15.0′	59.2′
7	284°29.5	12.5	179°13.8	10.3′	13°49.3	14.9′	59.3′
8	299°29.2	12.3	193°43.0	10.2′	14°04.2	14.9′	59.3′
9	314°28.9	·· 12.2	208°12.2	10.1′	14°19.1	14.8′	59.3′
10	329°28.6	12.0	222°41.3	10.0′	14°33.9	14.7′	59.4′
11	344°28.3	11.9	237°10.2	9.8′	14°48.6	14.7′	59.4′
12	359°28.0	S23°11.7	251°39.1	9.7′	N15°03.3	14.6′	59.4′
13	14°27.7	11.6	266°07.8	9.6′	15°17.9	14.5′	59.4′
14	29°27.4	11.4	280°36.4	9.5′	15°32.4	14.4′	59.5′
15	44°27.1	·· 11.2	295°04.9	9.4′	15°46.8	14.4′	59.5′
16	59°26.8	11.1	309°33.3	9.3′	16°01.2	14.3′	59.5′
17	74°26.4	10.9	324°01.6	9.2′	16°15.5	14.3′	59.5′
18	89°26.1	S23°10.8	338°29.8	9.0′	N16°29.8	14.1′	59.6′
19	104°25.8	10.6	352°57.8	8.9′	16°43.9	14.1′	59.6′
20	119°25.5	10.5	7°25.8	8.8′	16°58.0	14.0′	59.6′
21	134°25.2	·· 10.3	21°53.6	8.7′	17°12.0	13.9′	59.7′
22	149°24.9	10.1	36°21.3	8.6′	17°25.9	13.8′	59.7′
23	164°24.6	10.0	50°48.8	8.4′	17°39.7	13.7′	59.7′
	SD = 16.3′	d = 0.1′		SD = 16.1′			

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	08:26	10:52	▬	▬	13:11	15:37
N 70°	08:07	09:54	▬	▬	14:10	15:57
68°	07:51	09:20	▬	▬	14:44	16:12
66°	07:38	08:55	10:33	13:30	15:09	16:25
64°	07:27	08:35	09:52	14:11	15:28	16:36
62°	07:18	08:20	09:25	14:39	15:44	16:46
60°	07:09	08:06	09:03	15:00	15:57	16:54
N 58°	07:02	07:55	08:46	15:17	16:09	17:01
56°	06:55	07:44	08:32	15:32	16:19	17:08
54°	06:49	07:35	08:19	15:44	16:28	17:14
52°	06:44	07:27	08:08	15:55	16:36	17:20
50°	06:38	07:20	07:58	16:05	16:43	17:25
45°	06:27	07:04	07:38	16:26	16:59	17:37
N 40°	06:17	06:51	07:21	16:42	17:13	17:47
35°	06:07	06:39	07:07	16:56	17:24	17:56
30°	05:59	06:28	06:55	17:09	17:35	18:05
20°	05:42	06:10	06:34	17:30	17:54	18:21
N 10°	05:26	05:52	06:15	17:48	18:11	18:37
0°	05:09	05:35	05:58	18:05	18:28	18:54
S 10°	04:50	05:17	05:40	18:23	18:46	19:13
20°	04:28	04:57	05:22	18:42	19:06	19:35
30°	03:59	04:32	05:00	19:04	19:31	20:04
35°	03:40	04:17	04:47	19:16	19:46	20:23
40°	03:17	03:59	04:32	19:31	20:04	20:46
45°	02:47	03:37	04:14	19:49	20:26	21:16
S 50°	02:02	03:07	03:52	20:12	20:56	22:01
52°	01:35	02:52	03:41	20:22	21:11	22:28
54°	00:51	02:34	03:29	20:34	21:28	23:11
56°	////	02:12	03:14	20:48	21:50	////
58°	////	01:43	02:58	21:05	22:19	////
S 60°	////	00:55	02:38	21:25	23:06	////

Lat.	Moonrise Sat	Moonrise Sun	Moonrise Mon	Moonset Sat	Moonset Sun	Moonset Mon
N 72°	11:12	10:34	09:41	·· ··	01:20	03:56
N 70°	11:15	10:46	10:09	·· ··	01:11	03:30
68°	11:17	10:56	10:31	·· ··	01:04	03:11
66°	11:19	11:05	10:48	·· ··	00:58	02:56
64°	11:21	11:12	11:02	·· ··	00:53	02:43
62°	11:22	11:18	11:14	·· ··	00:48	02:33
60°	11:24	11:23	11:24	·· ··	00:45	02:24
N 58°	11:25	11:28	11:33	·· ··	00:41	02:16
56°	11:26	11:32	11:40	·· ··	00:38	02:10
54°	11:27	11:36	11:48	·· ··	00:36	02:04
52°	11:28	11:40	11:54	·· ··	00:33	01:58
50°	11:29	11:43	12:00	·· ··	00:31	01:53
45°	11:31	11:50	12:12	·· ··	00:26	01:43
N 40°	11:32	11:56	12:23	·· ··	00:22	01:34
35°	11:33	12:01	12:31	·· ··	00:19	01:27
30°	11:35	12:05	12:39	·· ··	00:16	01:20
20°	11:37	12:13	12:53	·· ··	00:11	01:09
N 10°	11:39	12:20	13:05	·· ··	00:06	00:59
0°	11:40	12:27	13:17	·· ··	00:02	00:50
S 10°	11:42	12:34	13:28	23:58	·· ··	00:41
20°	11:44	12:41	13:41	23:53	·· ··	00:31
30°	11:46	12:49	13:55	23:48	·· ··	00:20
35°	11:48	12:54	14:03	23:45	·· ··	00:14
40°	11:49	12:59	14:13	23:42	·· ··	00:07
45°	11:51	13:06	14:24	23:38	23:59	·· ··
S 50°	11:53	13:14	14:38	23:34	23:49	·· ··
52°	11:54	13:17	14:45	23:32	23:44	·· ··
54°	11:55	13:21	14:52	23:29	23:39	23:52
56°	11:56	13:26	15:00	23:27	23:34	23:43
58°	11:58	13:30	15:09	23:24	23:28	23:33
S 60°	11:59	13:36	15:20	23:21	23:21	23:21

Day	Sun Eqn.of Time 00h	Sun Eqn.of Time 12h	Sun Mer. Pass	Moon Mer.Pass. Upper	Moon Mer.Pass. Lower	Age 7-9
	mm:ss	mm:ss	hh:mm	hh:mm	hh:mm	41-63%
27	00:55	01:10	12:01	17:51	05:29	
28	01:24	01:39	12:02	18:38	06:14	
29	01:54	02:08	12:02	19:29	07:03	

December 30, 31, 01 UT (Tue., Wed., Thu.)

	Aries	Venus		Mars		Jupiter		Saturn	
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	98°41.5	181°22.9	S23°41.9	176°28.7	S23°50.7	345°17.5	N21°56.0	101°24.7	S03°38.9
1	113°43.9	196°22.0	41.8	191°29.1	50.6	0°20.3	56.1	116°27.0	38.8
2	128°46.4	211°21.0	41.8	206°29.5	50.4	15°23.1	56.1	131°29.4	38.7
3	143°48.8	226°20.0	·· 41.7	221°29.9	·· 50.3	30°25.9	·· 56.2	146°31.7	·· 38.7
4	158°51.3	241°19.0	41.6	236°30.3	50.1	45°28.7	56.2	161°34.1	38.6
5	173°53.8	256°18.1	41.6	251°30.6	50.0	60°31.5	56.3	176°36.4	38.5
6	188°56.2	271°17.1	S23°41.5	266°31.0	S23°49.8	75°34.3	N21°56.4	191°38.7	S03°38.5
7	203°58.7	286°16.1	41.4	281°31.4	49.7	90°37.1	56.4	206°41.1	38.4
8	219°01.2	301°15.1	41.3	296°31.8	49.5	105°39.9	56.5	221°43.4	38.4
9	234°03.6	316°14.2	·· 41.3	311°32.2	·· 49.4	120°42.7	·· 56.5	236°45.8	·· 38.3
10	249°06.1	331°13.2	41.2	326°32.5	49.2	135°45.5	56.6	251°48.1	38.2
11	264°08.6	346°12.2	41.1	341°32.9	49.1	150°48.3	56.6	266°50.4	38.2
12	279°11.0	1°11.3	S23°41.0	356°33.3	S23°48.9	165°51.2	N21°56.7	281°52.8	S03°38.1
13	294°13.5	16°10.3	41.0	11°33.7	48.8	180°54.0	56.8	296°55.1	38.0
14	309°16.0	31°09.3	40.9	26°34.1	48.6	195°56.8	56.8	311°57.4	38.0
15	324°18.4	46°08.3	·· 40.8	41°34.4	·· 48.5	210°59.6	·· 56.9	326°59.8	·· 37.9
16	339°20.9	61°07.4	40.7	56°34.8	48.3	226°02.4	56.9	342°02.1	37.8
17	354°23.3	76°06.4	40.6	71°35.2	48.2	241°05.2	57.0	357°04.5	37.8
18	9°25.8	91°05.4	S23°40.5	86°35.6	S23°48.0	256°08.0	N21°57.0	12°06.8	S03°37.7
19	24°28.3	106°04.5	40.4	101°35.9	47.9	271°10.8	57.1	27°09.1	37.7
20	39°30.7	121°03.5	40.4	116°36.3	47.7	286°13.6	57.2	42°11.5	37.6
21	54°33.2	136°02.5	·· 40.3	131°36.7	·· 47.5	301°16.4	·· 57.2	57°13.8	·· 37.5
22	69°35.7	151°01.5	40.2	146°37.1	47.4	316°19.2	57.3	72°16.2	37.5
23	84°38.1	166°00.6	40.1	161°37.5	47.2	331°22.0	57.3	87°18.5	37.4
Mer.pass. 17:22		ν -1.0′	d 0.1′	m -3.90	ν 0.4′	d 0.1′	m 1.14	ν 2.8′	d 0.1′ m -2.67	ν 2.3′	d 0.1′ m 1.00

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	99°40.6	180°59.6	S23°40.0	176°37.8	S23°47.1	346°24.8	N21°57.4	102°20.8	S03°37.3
1	114°43.1	195°58.6	39.9	191°38.2	46.9	1°27.7	57.4	117°23.2	37.3
2	129°45.5	210°57.7	39.8	206°38.6	46.8	16°30.5	57.5	132°25.5	37.2
3	144°48.0	225°56.7	·· 39.7	221°39.0	·· 46.6	31°33.3	·· 57.6	147°27.8	·· 37.1
4	159°50.4	240°55.7	39.6	236°39.4	46.5	46°36.1	57.6	162°30.2	37.1
5	174°52.9	255°54.8	39.5	251°39.7	46.3	61°38.9	57.7	177°32.5	37.0
6	189°55.4	270°53.8	S23°39.4	266°40.1	S23°46.1	76°41.7	N21°57.7	192°34.8	S03°37.0
7	204°57.8	285°52.8	39.3	281°40.5	46.0	91°44.5	57.8	207°37.2	36.9
8	220°00.3	300°51.8	39.2	296°40.9	45.8	106°47.3	57.8	222°39.5	36.8
9	235°02.8	315°50.9	·· 39.1	311°41.3	·· 45.7	121°50.1	·· 57.9	237°41.9	·· 36.8
10	250°05.2	330°49.9	39.0	326°41.6	45.5	136°52.9	58.0	252°44.2	36.7
11	265°07.7	345°48.9	38.9	341°42.0	45.3	151°55.7	58.0	267°46.5	36.6
12	280°10.2	0°48.0	S23°38.8	356°42.4	S23°45.2	166°58.6	N21°58.1	282°48.9	S03°36.6
13	295°12.6	15°47.0	38.6	11°42.8	45.0	182°01.4	58.1	297°51.2	36.5
14	310°15.1	30°46.0	38.5	26°43.2	44.9	197°04.2	58.2	312°53.5	36.4
15	325°17.6	45°45.1	·· 38.4	41°43.5	·· 44.7	212°07.0	·· 58.2	327°55.9	·· 36.4
16	340°20.0	60°44.1	38.3	56°43.9	44.5	227°09.8	58.3	342°58.2	36.3
17	355°22.5	75°43.1	38.2	71°44.3	44.4	242°12.6	58.3	358°00.5	36.2
18	10°24.9	90°42.2	S23°38.1	86°44.7	S23°44.2	257°15.4	N21°58.4	13°02.9	S03°36.2
19	25°27.4	105°41.2	38.0	101°45.1	44.0	272°18.2	58.5	28°05.2	36.1
20	40°29.9	120°40.2	37.8	116°45.4	43.9	287°21.0	58.5	43°07.5	36.0
21	55°32.3	135°39.2	·· 37.7	131°45.8	·· 43.7	302°23.8	·· 58.6	58°09.9	·· 36.0
22	70°34.8	150°38.3	37.6	146°46.2	43.5	317°26.7	58.6	73°12.2	35.9
23	85°37.3	165°37.3	37.5	161°46.6	43.4	332°29.5	58.7	88°14.5	35.8
Mer.pass. 17:18		ν -1.0′	d 0.1′	m -3.90	ν 0.4′	d 0.2′	m 1.13	ν 2.8′	d 0.1′ m -2.67	ν 2.3′	d 0.1′ m 1.00

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	100°39.7	180°36.3	S23°37.3	176°47.0	S23°43.2	347°32.3	N21°58.7	103°16.9	S03°35.8
1	115°42.2	195°35.4	37.2	191°47.3	43.0	2°35.1	58.8	118°19.2	35.7
2	130°44.7	210°34.4	37.1	206°47.7	42.9	17°37.9	58.9	133°21.5	35.7
3	145°47.1	225°33.4	·· 37.0	221°48.1	·· 42.7	32°40.7	·· 58.9	148°23.9	·· 35.6
4	160°49.6	240°32.5	36.8	236°48.5	42.5	47°43.5	59.0	163°26.2	35.5
5	175°52.1	255°31.5	36.7	251°48.9	42.4	62°46.3	59.0	178°28.5	35.5
6	190°54.5	270°30.5	S23°36.6	266°49.2	S23°42.2	77°49.1	N21°59.1	193°30.9	S03°35.4
7	205°57.0	285°29.6	36.4	281°49.6	42.0	92°52.0	59.1	208°33.2	35.3
8	220°59.4	300°28.6	36.3	296°50.0	41.8	107°54.8	59.2	223°35.5	35.3
9	236°01.9	315°27.6	·· 36.2	311°50.4	·· 41.7	122°57.6	·· 59.3	238°37.9	·· 35.2
10	251°04.4	330°26.7	36.0	326°50.8	41.5	138°00.4	59.3	253°40.2	35.1
11	266°06.8	345°25.7	35.9	341°51.1	41.3	153°03.2	59.4	268°42.5	35.1
12	281°09.3	0°24.7	S23°35.7	356°51.5	S23°41.2	168°06.0	N21°59.4	283°44.9	S03°35.0
13	296°11.8	15°23.8	35.6	11°51.9	41.0	183°08.8	59.5	298°47.2	34.9
14	311°14.2	30°22.8	35.5	26°52.3	40.8	198°11.6	59.5	313°49.5	34.9
15	326°16.7	45°21.8	·· 35.3	41°52.7	·· 40.6	213°14.4	·· 59.6	328°51.9	·· 34.8
16	341°19.2	60°20.9	35.2	56°53.0	40.5	228°17.3	59.7	343°54.2	34.7
17	356°21.6	75°19.9	35.0	71°53.4	40.3	243°20.1	59.7	358°56.5	34.7
18	11°24.1	90°18.9	S23°34.9	86°53.8	S23°40.1	258°22.9	N21°59.8	13°58.9	S03°34.6
19	26°26.6	105°18.0	34.7	101°54.2	39.9	273°25.7	59.8	29°01.2	34.5
20	41°29.0	120°17.0	34.6	116°54.6	39.8	288°28.5	59.9	44°03.5	34.5
21	56°31.5	135°16.0	·· 34.4	131°54.9	·· 39.6	303°31.3	21°59.9	59°05.8	·· 34.4
22	71°33.9	150°15.1	34.3	146°55.3	39.4	318°34.1	22°00.0	74°08.2	34.3
23	86°36.4	165°14.1	34.1	161°55.7	39.2	333°37.0	00.1	89°10.5	34.3
Mer.pass. 17:15		ν -1.0′	d 0.1′	m -3.90	ν 0.4′	d 0.2′	m 1.12	ν 2.8′	d 0.1′ m -2.67	ν 2.3′	d 0.1′ m 1.01

Stars

	SHA	Dec
Alpheratz	357°34.0	29°14.2
Ankaa	353°06.4	-42°10.1
Schedar	349°30.1	56°41.1
Diphda	348°46.5	-17°50.7
Achernar	335°19.4	-57°06.5
Hamal	327°50.1	23°35.3
Polaris	313°17.4	89°22.7
Acamar	315°10.9	-40°12.2
Menkar	314°05.1	4°11.5
Mirfak	308°26.7	49°57.4
Aldebaran	290°38.4	16°33.7
Rigel	281°02.8	-8°10.3
Capella	280°20.2	46°01.5
Bellatrix	278°21.7	6°22.4
Elnath	278°00.5	28°37.8
Alnilam	275°36.6	-1°11.1
Betelgeuse	270°50.9	7°24.7
Canopus	263°51.5	-52°42.5
Sirius	258°25.2	-16°45.1
Adhara	255°04.8	-29°00.4
Procyon	244°49.7	5°09.5
Pollux	243°16.0	27°57.7
Avior	234°13.8	-59°35.4
Suhail	222°45.4	-43°32.1
Miaplacidus	221°37.4	-69°49.2
Alphard	217°46.7	-8°46.3
Regulus	207°33.4	11°50.3
Dubhe	193°39.7	61°36.3
Denebola	182°24.1	14°25.5
Gienah	175°42.7	-17°41.1
Acrux	172°59.2	-63°14.3
Gacrux	171°50.7	-57°15.3
Alioth	166°12.3	55°48.8
Spica	158°21.5	-11°17.8
Alkaid	152°51.5	49°10.7
Hadar	148°35.1	-60°29.7
Menkent	147°56.8	-36°29.7
Arcturus	145°47.3	19°02.7
Rigil Kent.	139°39.5	-60°56.3
Kochab	137°20.5	74°02.6
Zuben'ubi	136°55.3	-16°09.0
Alphecca	126°03.3	26°37.5
Antares	112°15.2	-26°29.3
Atria	107°09.2	-69°04.3
Sabik	102°02.2	-15°45.4
Shaula	96°09.7	-37°07.3
Rasalhague	95°58.1	12°32.4
Eltanin	90°42.3	51°29.0
Kaus Aust.	83°31.9	-34°22.3
Vega	80°33.1	38°48.4
Nunki	75°47.1	-26°15.9
Altair	61°59.5	8°56.2
Peacock	53°05.0	-56°39.2
Deneb	49°25.7	45°22.5
Enif	33°38.2	9°59.7
Al Na'ir	27°32.2	-46°50.3
Fomalhaut	15°13.8	-29°29.2
Scheat	13°44.6	28°13.6
Markab	13°29.2	15°20.8

Dec 30 Tue	SHA	Mer.pass
Venus	82°41.5	11:55
Mars	77°47.3	12:14
Jupiter	246°36.0	00:59
Saturn	2°43.2	17:12

Dec 31 Wed	SHA	Mer.pass
Venus	81°19.0	11:57
Mars	76°57.3	12:13
Jupiter	246°44.3	00:54
Saturn	2°40.2	17:08

Jan 01 Thu	SHA	Mer.pass
Venus	79°56.6	11:58
Mars	76°07.2	12:13
Jupiter	246°52.5	00:50
Saturn	2°37.1	17:04

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.0881 sec ΔT = TT-UT1 = +69.0959 sec

2025 December 30 to Jan. 01 UT

h

Tue	Sun GHA	Sun Dec	Moon GHA	ν	Moon Dec	d	HP
0	179°24.3	S23°09.8	65°16.3	8.3′	N17°53.4	13.6′	59.7′
1	194°24.0	09.6	79°43.6	8.2′	18°07.0	13.6′	59.8′
2	209°23.7	09.5	94°10.8	8.1′	18°20.6	13.4′	59.8′
3	224°23.4	·· 09.3	108°37.8	7.9′	18°34.0	13.3′	59.8′
4	239°23.1	09.1	123°04.8	7.8′	18°47.3	13.3′	59.8′
5	254°22.8	09.0	137°31.6	7.7′	19°00.6	13.1′	59.9′
6	269°22.5	S23°08.8	151°58.3	7.6′	N19°13.7	13.1′	59.9′
7	284°22.2	08.6	166°24.9	7.4′	19°26.8	12.9′	59.9′
8	299°21.9	08.5	180°51.3	7.3′	19°39.7	12.8′	59.9′
9	314°21.6	·· 08.3	195°17.6	7.2′	19°52.5	12.7′	60.0′
10	329°21.3	08.1	209°43.8	7.1′	20°05.2	12.6′	60.0′
11	344°21.0	08.0	224°09.9	6.9′	20°17.8	12.5′	60.0′
12	359°20.7	S23°07.8	238°35.8	6.8′	N20°30.3	12.3′	60.0′
13	14°20.4	07.6	253°01.6	6.7′	20°42.6	12.3′	60.1′
14	29°20.1	07.4	267°27.2	6.5′	20°54.9	12.1′	60.1′
15	44°19.8	·· 07.3	281°52.8	6.4′	21°07.0	12.0′	60.1′
16	59°19.5	07.1	296°18.2	6.3′	21°19.0	11.9′	60.1′
17	74°19.2	06.9	310°43.4	6.1′	21°30.9	11.7′	60.1′
18	89°18.9	S23°06.7	325°08.6	6.0′	N21°42.6	11.6′	60.2′
19	104°18.6	06.6	339°33.6	5.9′	21°54.2	11.5′	60.2′
20	119°18.4	06.4	353°58.5	5.7′	22°05.7	11.3′	60.2′
21	134°18.1	·· 06.2	8°23.2	5.6′	22°17.0	11.2′	60.2′
22	149°17.8	06.0	22°47.8	5.5′	22°28.2	11.1′	60.3′
23	164°17.5	05.8	37°12.3	5.4′	22°39.3	10.9′	60.3′
	SD = 16.3′	d = 0.2′	SD = 16.3′				

Wed	GHA	Dec	GHA	ν	Dec	d	HP
0	179°17.2	S23°05.7	51°36.7	5.2′	N22°50.2	10.8′	60.3′
1	194°16.9	05.5	66°00.9	5.1′	23°01.0	10.6′	60.3′
2	209°16.6	05.3	80°25.0	5.0′	23°11.6	10.5′	60.3′
3	224°16.3	·· 05.1	94°49.0	4.8′	23°22.1	10.3′	60.3′
4	239°16.0	04.9	109°12.8	4.7′	23°32.4	10.2′	60.4′
5	254°15.7	04.7	123°36.5	4.6′	23°42.6	10.0′	60.4′
6	269°15.4	S23°04.5	138°00.1	4.5′	N23°52.6	9.9′	60.4′
7	284°15.1	04.4	152°23.6	4.3′	24°02.5	9.7′	60.4′
8	299°14.8	04.2	166°46.9	4.2′	24°12.2	9.6′	60.4′
9	314°14.5	·· 04.0	181°10.2	4.1′	24°21.8	9.3′	60.5′
10	329°14.2	03.8	195°33.2	4.0′	24°31.1	9.3′	60.5′
11	344°13.9	03.6	209°56.2	3.9′	24°40.4	9.0′	60.5′
12	359°13.6	S23°03.4	224°19.1	3.7′	N24°49.4	8.9′	60.5′
13	14°13.3	03.2	238°41.8	3.6′	24°58.3	8.7′	60.5′
14	29°13.0	03.0	253°04.4	3.5′	25°07.0	8.5′	60.5′
15	44°12.7	·· 02.8	267°26.9	3.4′	25°15.5	8.4′	60.5′
16	59°12.4	02.6	281°49.3	3.3′	25°23.9	8.2′	60.6′
17	74°12.1	02.4	296°11.6	3.2′	25°32.1	8.0′	60.6′
18	89°11.8	S23°02.2	310°33.8	3.1′	N25°40.1	7.8′	60.6′
19	104°11.5	02.0	324°55.8	2.9′	25°47.9	7.6′	60.6′
20	119°11.2	01.8	339°17.8	2.8′	25°55.5	7.5′	60.6′
21	134°10.9	·· 01.6	353°39.6	2.7′	26°03.0	7.3′	60.6′
22	149°10.6	01.4	8°01.3	2.6′	26°10.3	7.0′	60.6′
23	164°10.3	01.2	22°23.0	2.5′	26°17.3	6.9′	60.6′
	SD = 16.3′	d = 0.2′	SD = 16.4′				

Thu	GHA	Dec	GHA	ν	Dec	d	HP
0	179°10.1	S23°01.0	36°44.5	2.4′	N26°24.2	6.7′	60.7′
1	194°09.8	00.8	51°06.0	2.3′	26°30.9	6.5′	60.7′
2	209°09.5	00.6	65°27.3	2.3′	26°37.4	6.3′	60.7′
3	224°09.2	·· 00.4	79°48.6	2.2′	26°43.7	6.1′	60.7′
4	239°08.9	00.2	94°09.7	2.1′	26°49.8	5.9′	60.7′
5	254°08.6	23°00.0	108°30.8	2.0′	26°55.7	5.8′	60.7′
6	269°08.3	S22°59.8	122°51.8	1.9′	N27°01.5	5.5′	60.7′
7	284°08.0	59.6	137°12.7	1.8′	27°07.0	5.3′	60.7′
8	299°07.7	59.4	151°33.5	1.8′	27°12.3	5.1′	60.7′
9	314°07.4	·· 59.2	165°54.3	1.7′	27°17.4	4.9′	60.7′
10	329°07.1	59.0	180°14.9	1.6′	27°22.3	4.7′	60.7′
11	344°06.8	58.8	194°35.6	1.5′	27°27.0	4.4′	60.7′
12	359°06.5	S22°58.6	208°56.1	1.5′	N27°31.4	4.3′	60.7′
13	14°06.2	58.3	223°16.6	1.4′	27°35.7	4.1′	60.8′
14	29°05.9	58.1	237°37.0	1.4′	27°39.8	3.8′	60.8′
15	44°05.6	·· 57.9	251°57.3	1.3′	27°43.6	3.7′	60.8′
16	59°05.4	57.7	266°17.6	1.2′	27°47.3	3.4′	60.8′
17	74°05.1	57.5	280°37.9	1.2′	27°50.7	3.2′	60.8′
18	89°04.8	S22°57.3	294°58.1	1.2′	N27°53.9	3.0′	60.8′
19	104°04.5	57.1	309°18.2	1.1′	27°56.9	2.8′	60.8′
20	119°04.2	56.8	323°38.3	1.1′	27°59.7	2.5′	60.8′
21	134°03.9	·· 56.6	337°58.4	1.0′	28°02.2	2.4′	60.8′
22	149°03.6	56.4	352°18.5	1.0′	28°04.6	2.1′	60.8′
23	164°03.3	56.2	6°38.5	1.0′	28°06.7	1.9′	60.8′
	SD = 16.3′	d = 0.2′	SD = 16.5′				

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	08:25	10:45	▬	▬	13:21	15:42
N 70°	08:06	09:51	▬	▬	14:16	16:01
68°	07:50	09:18	▬	▬	14:49	16:16
66°	07:38	08:54	10:29	13:37	15:13	16:29
64°	07:27	08:35	09:50	14:16	15:32	16:40
62°	07:18	08:19	09:23	14:43	15:47	16:49
60°	07:09	08:06	09:03	15:04	16:01	16:57
N 58°	07:02	07:54	08:46	15:21	16:12	17:04
56°	06:56	07:44	08:31	15:35	16:22	17:11
54°	06:50	07:36	08:19	15:47	16:31	17:17
52°	06:44	07:28	08:08	15:58	16:39	17:22
50°	06:39	07:20	07:59	16:08	16:46	17:27
45°	06:27	07:05	07:38	16:28	17:02	17:39
N 40°	06:17	06:51	07:22	16:45	17:15	17:49
35°	06:08	06:40	07:08	16:58	17:27	17:58
30°	06:00	06:29	06:56	17:11	17:37	18:07
20°	05:43	06:11	06:35	17:31	17:55	18:23
N 10°	05:27	05:54	06:17	17:50	18:12	18:39
0°	05:11	05:37	05:59	18:07	18:29	18:55
S 10°	04:52	05:19	05:42	18:24	18:47	19:14
20°	04:30	04:59	05:23	18:43	19:07	19:36
30°	04:01	04:34	05:02	19:04	19:32	20:05
35°	03:43	04:19	04:49	19:17	19:47	20:23
40°	03:20	04:01	04:34	19:32	20:05	20:46
45°	02:50	03:39	04:16	19:50	20:27	21:16
S 50°	02:06	03:10	03:54	20:12	20:56	22:00
52°	01:39	02:55	03:44	20:22	21:10	22:26
54°	00:58	02:38	03:32	20:34	21:28	23:06
56°	////	02:16	03:18	20:48	21:49	////
58°	////	01:48	03:01	21:04	22:17	////
S 60°	////	01:03	02:42	21:24	23:01	////

Lat.	Moonrise Tue	Moonrise Wed	Moonrise Thu	Moonset Tue	Moonset Wed	Moonset Thu
N 72°	▭	▭	▭	▭	▭	▭
N 70°	08:43	▭	▭	06:48	▭	▭
68°	09:47	▭	▭	05:46	▭	▭
66°	10:23	▭	▭	05:11	▭	▭
64°	10:49	10:25	▭	04:46	07:12	▭
62°	11:09	11:04	10:58	04:27	06:34	08:53
60°	11:26	11:32	11:50	04:11	06:07	08:02
N 58°	11:40	11:54	12:21	03:58	05:45	07:31
56°	11:52	12:12	12:45	03:47	05:28	07:07
54°	12:03	12:27	13:05	03:37	05:14	06:48
52°	12:13	12:40	13:21	03:28	05:01	06:32
50°	12:21	12:52	13:36	03:20	04:50	06:18
45°	12:40	13:16	14:05	03:03	04:27	05:49
N 40°	12:55	13:35	14:27	02:50	04:08	05:27
35°	13:08	13:52	14:46	02:38	03:53	05:09
30°	13:19	14:06	15:03	02:28	03:40	04:53
20°	13:38	14:30	15:30	02:11	03:17	04:26
N 10°	13:55	14:52	15:54	01:56	02:57	04:03
0°	14:11	15:11	16:16	01:42	02:39	03:42
S 10°	14:27	15:31	16:39	01:28	02:21	03:20
20°	14:45	15:53	17:03	01:13	02:02	02:58
30°	15:05	16:18	17:31	00:57	01:40	02:31
35°	15:17	16:33	17:48	00:47	01:27	02:16
40°	15:31	16:50	18:07	00:36	01:12	01:58
45°	15:47	17:11	18:31	00:23	00:54	01:36
S 50°	16:07	17:38	19:01	00:07	00:32	01:08
52°	16:17	17:51	19:16	00:00	00:22	00:55
54°	16:28	18:05	19:34	·· ··	00:11	00:40
56°	16:40	18:23	19:55	23:57	·· ··	00:22
58°	16:55	18:44	20:23	23:42	·· ··	00:00
S 60°	17:12	19:11	21:01	23:24	23:33	·· ··

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 10-12 74-91%
30	02:23	02:37	12:03	20:25	07:56	
31	02:51	03:06	12:03	21:26	08:55	
01	03:20	03:34	12:04	22:32	09:59	

Conversion of Arc to Time

0° - 59°		
°	h	m
0	0	00
1	0	04
2	0	08
3	0	12
4	0	16
5	0	20
6	0	24
7	0	28
8	0	32
9	0	36
10	0	40
11	0	44
12	0	48
13	0	52
14	0	56
15	1	00
16	1	04
17	1	08
18	1	12
19	1	16
20	1	20
21	1	24
22	1	28
23	1	32
24	1	36
25	1	40
26	1	44
27	1	48
28	1	52
29	1	56
30	2	00
31	2	04
32	2	08
33	2	12
34	2	16
35	2	20
36	2	24
37	2	28
38	2	32
39	2	36
40	2	40
41	2	44
42	2	48
43	2	52
44	2	56
45	3	00
46	3	04
47	3	08
48	3	12
49	3	16
50	3	20
51	3	24
52	3	28
53	3	32
54	3	36
55	3	40
56	3	44
57	3	48
58	3	52
59	3	56
60	4	00

60° - 119°		
°	h	m
60	4	00
61	4	04
62	4	08
63	4	12
64	4	16
65	4	20
66	4	24
67	4	28
68	4	32
69	4	36
70	4	40
71	4	44
72	4	48
73	4	52
74	4	56
75	5	00
76	5	04
77	5	08
78	5	12
79	5	16
80	5	20
81	5	24
82	5	28
83	5	32
84	5	36
85	5	40
86	5	44
87	5	48
88	5	52
89	5	56
90	6	00
91	6	04
92	6	08
93	6	12
94	6	16
95	6	20
96	6	24
97	6	28
98	6	32
99	6	36
100	6	40
101	6	44
102	6	48
103	6	52
104	6	56
105	7	00
106	7	04
107	7	08
108	7	12
109	7	16
110	7	20
111	7	24
112	7	28
113	7	32
114	7	36
115	7	40
116	7	44
117	7	48
118	7	52
119	7	56
120	8	00

120° - 179°		
°	h	m
120	8	00
121	8	04
122	8	08
123	8	12
124	8	16
125	8	20
126	8	24
127	8	28
128	8	32
129	8	36
130	8	40
131	8	44
132	8	48
133	8	52
134	8	56
135	9	00
136	9	04
137	9	08
138	9	12
139	9	16
140	9	20
141	9	24
142	9	28
143	9	32
144	9	36
145	9	40
146	9	44
147	9	48
148	9	52
149	9	56
150	10	00
151	10	04
152	10	08
153	10	12
154	10	16
155	10	20
156	10	24
157	10	28
158	10	32
159	10	36
160	10	40
161	10	44
162	10	48
163	10	52
164	10	56
165	11	00
166	11	04
167	11	08
168	11	12
169	11	16
170	11	20
171	11	24
172	11	28
173	11	32
174	11	36
175	11	40
176	11	44
177	11	48
178	11	52
179	11	56
180	12	00

180° - 239°		
°	h	m
180	12	00
181	12	04
182	12	08
183	12	12
184	12	16
185	12	20
186	12	24
187	12	28
188	12	32
189	12	36
190	12	40
191	12	44
192	12	48
193	12	52
194	12	56
195	13	00
196	13	04
197	13	08
198	13	12
199	13	16
200	13	20
201	13	24
202	13	28
203	13	32
204	13	36
205	13	40
206	13	44
207	13	48
208	13	52
209	13	56
210	14	00
211	14	04
212	14	08
213	14	12
214	14	16
215	14	20
216	14	24
217	14	28
218	14	32
219	14	36
220	14	40
221	14	44
222	14	48
223	14	52
224	14	56
225	15	00
226	15	04
227	15	08
228	15	12
229	15	16
230	15	20
231	15	24
232	15	28
233	15	32
234	15	36
235	15	40
236	15	44
237	15	48
238	15	52
239	15	56
240	16	00

240° - 299°		
°	h	m
240	16	00
241	16	04
242	16	08
243	16	12
244	16	16
245	16	20
246	16	24
247	16	28
248	16	32
249	16	36
250	16	40
251	16	44
252	16	48
253	16	52
254	16	56
255	17	00
256	17	04
257	17	08
258	17	12
259	17	16
260	17	20
261	17	24
262	17	28
263	17	32
264	17	36
265	17	40
266	17	44
267	17	48
268	17	52
269	17	56
270	18	00
271	18	04
272	18	08
273	18	12
274	18	16
275	18	20
276	18	24
277	18	28
278	18	32
279	18	36
280	18	40
281	18	44
282	18	48
283	18	52
284	18	56
285	19	00
286	19	04
287	19	08
288	19	12
289	19	16
290	19	20
291	19	24
292	19	28
293	19	32
294	19	36
295	19	40
296	19	44
297	19	48
298	19	52
299	19	56
300	20	00

300° - 360°		
°	h	m
300	20	00
301	20	04
302	20	08
303	20	12
304	20	16
305	20	20
306	20	24
307	20	28
308	20	32
309	20	36
310	20	40
311	20	44
312	20	48
313	20	52
314	20	56
315	21	00
316	21	04
317	21	08
318	21	12
319	21	16
320	21	20
321	21	24
322	21	28
323	21	32
324	21	36
325	21	40
326	21	44
327	21	48
328	21	52
329	21	56
330	22	00
331	22	04
332	22	08
333	22	12
334	22	16
335	22	20
336	22	24
337	22	28
338	22	32
339	22	36
340	22	40
341	22	44
342	22	48
343	22	52
344	22	56
345	23	00
346	23	04
347	23	08
348	23	12
349	23	16
350	23	20
351	23	24
352	23	28
353	23	32
354	23	36
355	23	40
356	23	44
357	23	48
358	23	52
359	23	56
360	24	00

0′ - 59′		
′	m	s
0	0	00
1	0	04
2	0	08
3	0	12
4	0	16
5	0	20
6	0	24
7	0	28
8	0	32
9	0	36
10	0	40
11	0	44
12	0	48
13	0	52
14	0	56
15	1	00
16	1	04
17	1	08
18	1	12
19	1	16
20	1	20
21	1	24
22	1	28
23	1	32
24	1	36
25	1	40
26	1	44
27	1	48
28	1	52
29	1	56
30	2	00
31	2	04
32	2	08
33	2	12
34	2	16
35	2	20
36	2	24
37	2	28
38	2	32
39	2	36
40	2	40
41	2	44
42	2	48
43	2	52
44	2	56
45	3	00
46	3	04
47	3	08
48	3	12
49	3	16
50	3	20
51	3	24
52	3	28
53	3	32
54	3	36
55	3	40
56	3	44
57	3	48
58	3	52
59	3	56
60	4	00

0″ - 59″	
″	s
0	0.00
1	0.07
2	0.13
3	0.20
4	0.27
5	0.33
6	0.40
7	0.47
8	0.53
9	0.60
10	0.67
11	0.73
12	0.80
13	0.87
14	0.93
15	1.00
16	1.07
17	1.13
18	1.20
19	1.27
20	1.33
21	1.40
22	1.47
23	1.53
24	1.60
25	1.67
26	1.73
27	1.80
28	1.87
29	1.93
30	2.00
31	2.07
32	2.13
33	2.20
34	2.27
35	2.33
36	2.40
37	2.47
38	2.53
39	2.60
40	2.67
41	2.73
42	2.80
43	2.87
44	2.93
45	3.00
46	3.07
47	3.13
48	3.20
49	3.27
50	3.33
51	3.40
52	3.47
53	3.53
54	3.60
55	3.67
56	3.73
57	3.80
58	3.87
59	3.93
60	4.00

h= hours of time **m**= minutes of time **s** = seconds of time **′** = minutes of arc **″** = seconds of arc

Increments and Corrections

m 0	Sun Plan.	Aries	Moon	v and d corr		
0	0°00.0	0°00.0	0°00.0	0.0 - 0.0	6.0 - 0.1	12.0 - 0.1
1	0°00.3	0°00.3	0°00.2	0.1 - 0.0	6.1 - 0.1	12.1 - 0.1
2	0°00.5	0°00.5	0°00.5	0.2 - 0.0	6.2 - 0.1	12.2 - 0.1
3	0°00.8	0°00.8	0°00.7	0.3 - 0.0	6.3 - 0.1	12.3 - 0.1
4	0°01.0	0°01.0	0°01.0	0.4 - 0.0	6.4 - 0.1	12.4 - 0.1
5	0°01.3	0°01.3	0°01.2	0.5 - 0.0	6.5 - 0.1	12.5 - 0.1
6	0°01.5	0°01.5	0°01.4	0.6 - 0.0	6.6 - 0.1	12.6 - 0.1
7	0°01.8	0°01.8	0°01.7	0.7 - 0.0	6.7 - 0.1	12.7 - 0.1
8	0°02.0	0°02.0	0°01.9	0.8 - 0.0	6.8 - 0.1	12.8 - 0.1
9	0°02.3	0°02.3	0°02.1	0.9 - 0.0	6.9 - 0.1	12.9 - 0.1
10	0°02.5	0°02.5	0°02.4	1.0 - 0.0	7.0 - 0.1	13.0 - 0.1
11	0°02.8	0°02.8	0°02.6	1.1 - 0.0	7.1 - 0.1	13.1 - 0.1
12	0°03.0	0°03.0	0°02.9	1.2 - 0.0	7.2 - 0.1	13.2 - 0.1
13	0°03.3	0°03.3	0°03.1	1.3 - 0.0	7.3 - 0.1	13.3 - 0.1
14	0°03.5	0°03.5	0°03.3	1.4 - 0.0	7.4 - 0.1	13.4 - 0.1
15	0°03.8	0°03.8	0°03.6	1.5 - 0.0	7.5 - 0.1	13.5 - 0.1
16	0°04.0	0°04.0	0°03.8	1.6 - 0.0	7.6 - 0.1	13.6 - 0.1
17	0°04.3	0°04.3	0°04.1	1.7 - 0.0	7.7 - 0.1	13.7 - 0.1
18	0°04.5	0°04.5	0°04.3	1.8 - 0.0	7.8 - 0.1	13.8 - 0.1
19	0°04.8	0°04.8	0°04.5	1.9 - 0.0	7.9 - 0.1	13.9 - 0.1
20	0°05.0	0°05.0	0°04.8	2.0 - 0.0	8.0 - 0.1	14.0 - 0.1
21	0°05.3	0°05.3	0°05.0	2.1 - 0.0	8.1 - 0.1	14.1 - 0.1
22	0°05.5	0°05.5	0°05.2	2.2 - 0.0	8.2 - 0.1	14.2 - 0.1
23	0°05.8	0°05.8	0°05.5	2.3 - 0.0	8.3 - 0.1	14.3 - 0.1
24	0°06.0	0°06.0	0°05.7	2.4 - 0.0	8.4 - 0.1	14.4 - 0.1
25	0°06.3	0°06.3	0°06.0	2.5 - 0.0	8.5 - 0.1	14.5 - 0.1
26	0°06.5	0°06.5	0°06.2	2.6 - 0.0	8.6 - 0.1	14.6 - 0.1
27	0°06.8	0°06.8	0°06.4	2.7 - 0.0	8.7 - 0.1	14.7 - 0.1
28	0°07.0	0°07.0	0°06.7	2.8 - 0.0	8.8 - 0.1	14.8 - 0.1
29	0°07.3	0°07.3	0°06.9	2.9 - 0.0	8.9 - 0.1	14.9 - 0.1
30	0°07.5	0°07.5	0°07.2	3.0 - 0.0	9.0 - 0.1	15.0 - 0.1
31	0°07.8	0°07.8	0°07.4	3.1 - 0.0	9.1 - 0.1	15.1 - 0.1
32	0°08.0	0°08.0	0°07.6	3.2 - 0.0	9.2 - 0.1	15.2 - 0.1
33	0°08.3	0°08.3	0°07.9	3.3 - 0.0	9.3 - 0.1	15.3 - 0.1
34	0°08.5	0°08.5	0°08.1	3.4 - 0.0	9.4 - 0.1	15.4 - 0.1
35	0°08.8	0°08.8	0°08.4	3.5 - 0.0	9.5 - 0.1	15.5 - 0.1
36	0°09.0	0°09.0	0°08.6	3.6 - 0.0	9.6 - 0.1	15.6 - 0.1
37	0°09.3	0°09.3	0°08.8	3.7 - 0.0	9.7 - 0.1	15.7 - 0.1
38	0°09.5	0°09.5	0°09.1	3.8 - 0.0	9.8 - 0.1	15.8 - 0.1
39	0°09.8	0°09.8	0°09.3	3.9 - 0.0	9.9 - 0.1	15.9 - 0.1
40	0°10.0	0°10.0	0°09.5	4.0 - 0.0	10.0 - 0.1	16.0 - 0.1
41	0°10.3	0°10.3	0°09.8	4.1 - 0.0	10.1 - 0.1	16.1 - 0.1
42	0°10.5	0°10.5	0°10.0	4.2 - 0.0	10.2 - 0.1	16.2 - 0.1
43	0°10.8	0°10.8	0°10.3	4.3 - 0.0	10.3 - 0.1	16.3 - 0.1
44	0°11.0	0°11.0	0°10.5	4.4 - 0.0	10.4 - 0.1	16.4 - 0.1
45	0°11.3	0°11.3	0°10.7	4.5 - 0.0	10.5 - 0.1	16.5 - 0.1
46	0°11.5	0°11.5	0°11.0	4.6 - 0.0	10.6 - 0.1	16.6 - 0.1
47	0°11.8	0°11.8	0°11.2	4.7 - 0.0	10.7 - 0.1	16.7 - 0.1
48	0°12.0	0°12.0	0°11.5	4.8 - 0.0	10.8 - 0.1	16.8 - 0.1
49	0°12.3	0°12.3	0°11.7	4.9 - 0.0	10.9 - 0.1	16.9 - 0.1
50	0°12.5	0°12.5	0°11.9	5.0 - 0.0	11.0 - 0.1	17.0 - 0.1
51	0°12.8	0°12.8	0°12.2	5.1 - 0.0	11.1 - 0.1	17.1 - 0.1
52	0°13.0	0°13.0	0°12.4	5.2 - 0.0	11.2 - 0.1	17.2 - 0.1
53	0°13.3	0°13.3	0°12.6	5.3 - 0.0	11.3 - 0.1	17.3 - 0.1
54	0°13.5	0°13.5	0°12.9	5.4 - 0.0	11.4 - 0.1	17.4 - 0.1
55	0°13.8	0°13.8	0°13.1	5.5 - 0.0	11.5 - 0.1	17.5 - 0.1
56	0°14.0	0°14.0	0°13.4	5.6 - 0.0	11.6 - 0.1	17.6 - 0.1
57	0°14.2	0°14.3	0°13.6	5.7 - 0.0	11.7 - 0.1	17.7 - 0.1
58	0°14.5	0°14.5	0°13.8	5.8 - 0.0	11.8 - 0.1	17.8 - 0.1
59	0°14.7	0°14.8	0°14.1	5.9 - 0.0	11.9 - 0.1	17.9 - 0.1

m 1	Sun Plan.	Aries	Moon	v and d corr		
0	0°15.0	0°15.0	0°14.3	0.0 - 0.0	6.0 - 0.2	12.0 - 0.3
1	0°15.3	0°15.3	0°14.6	0.1 - 0.0	6.1 - 0.2	12.1 - 0.3
2	0°15.5	0°15.5	0°14.8	0.2 - 0.0	6.2 - 0.2	12.2 - 0.3
3	0°15.8	0°15.8	0°15.0	0.3 - 0.0	6.3 - 0.2	12.3 - 0.3
4	0°16.0	0°16.0	0°15.3	0.4 - 0.0	6.4 - 0.2	12.4 - 0.3
5	0°16.3	0°16.3	0°15.5	0.5 - 0.0	6.5 - 0.2	12.5 - 0.3
6	0°16.5	0°16.5	0°15.7	0.6 - 0.0	6.6 - 0.2	12.6 - 0.3
7	0°16.8	0°16.8	0°16.0	0.7 - 0.0	6.7 - 0.2	12.7 - 0.3
8	0°17.0	0°17.0	0°16.2	0.8 - 0.0	6.8 - 0.2	12.8 - 0.3
9	0°17.3	0°17.3	0°16.5	0.9 - 0.0	6.9 - 0.2	12.9 - 0.3
10	0°17.5	0°17.5	0°16.7	1.0 - 0.0	7.0 - 0.2	13.0 - 0.3
11	0°17.8	0°17.8	0°16.9	1.1 - 0.0	7.1 - 0.2	13.1 - 0.3
12	0°18.0	0°18.0	0°17.2	1.2 - 0.0	7.2 - 0.2	13.2 - 0.3
13	0°18.3	0°18.3	0°17.4	1.3 - 0.0	7.3 - 0.2	13.3 - 0.3
14	0°18.5	0°18.6	0°17.7	1.4 - 0.0	7.4 - 0.2	13.4 - 0.3
15	0°18.8	0°18.8	0°17.9	1.5 - 0.0	7.5 - 0.2	13.5 - 0.3
16	0°19.0	0°19.1	0°18.1	1.6 - 0.0	7.6 - 0.2	13.6 - 0.3
17	0°19.3	0°19.3	0°18.4	1.7 - 0.0	7.7 - 0.2	13.7 - 0.3
18	0°19.5	0°19.6	0°18.6	1.8 - 0.0	7.8 - 0.2	13.8 - 0.3
19	0°19.8	0°19.8	0°18.9	1.9 - 0.0	7.9 - 0.2	13.9 - 0.3
20	0°20.0	0°20.1	0°19.1	2.0 - 0.1	8.0 - 0.2	14.0 - 0.4
21	0°20.3	0°20.3	0°19.3	2.1 - 0.1	8.1 - 0.2	14.1 - 0.4
22	0°20.5	0°20.6	0°19.6	2.2 - 0.1	8.2 - 0.2	14.2 - 0.4
23	0°20.8	0°20.8	0°19.8	2.3 - 0.1	8.3 - 0.2	14.3 - 0.4
24	0°21.0	0°21.1	0°20.0	2.4 - 0.1	8.4 - 0.2	14.4 - 0.4
25	0°21.3	0°21.3	0°20.3	2.5 - 0.1	8.5 - 0.2	14.5 - 0.4
26	0°21.5	0°21.6	0°20.5	2.6 - 0.1	8.6 - 0.2	14.6 - 0.4
27	0°21.8	0°21.8	0°20.8	2.7 - 0.1	8.7 - 0.2	14.7 - 0.4
28	0°22.0	0°22.1	0°21.0	2.8 - 0.1	8.8 - 0.2	14.8 - 0.4
29	0°22.3	0°22.3	0°21.2	2.9 - 0.1	8.9 - 0.2	14.9 - 0.4
30	0°22.5	0°22.6	0°21.5	3.0 - 0.1	9.0 - 0.2	15.0 - 0.4
31	0°22.8	0°22.8	0°21.7	3.1 - 0.1	9.1 - 0.2	15.1 - 0.4
32	0°23.0	0°23.1	0°22.0	3.2 - 0.1	9.2 - 0.2	15.2 - 0.4
33	0°23.3	0°23.3	0°22.2	3.3 - 0.1	9.3 - 0.2	15.3 - 0.4
34	0°23.5	0°23.6	0°22.4	3.4 - 0.1	9.4 - 0.2	15.4 - 0.4
35	0°23.8	0°23.8	0°22.7	3.5 - 0.1	9.5 - 0.2	15.5 - 0.4
36	0°24.0	0°24.1	0°22.9	3.6 - 0.1	9.6 - 0.2	15.6 - 0.4
37	0°24.3	0°24.3	0°23.1	3.7 - 0.1	9.7 - 0.2	15.7 - 0.4
38	0°24.5	0°24.6	0°23.4	3.8 - 0.1	9.8 - 0.2	15.8 - 0.4
39	0°24.8	0°24.8	0°23.6	3.9 - 0.1	9.9 - 0.2	15.9 - 0.4
40	0°25.0	0°25.1	0°23.9	4.0 - 0.1	10.0 - 0.3	16.0 - 0.4
41	0°25.3	0°25.3	0°24.1	4.1 - 0.1	10.1 - 0.3	16.1 - 0.4
42	0°25.5	0°25.6	0°24.3	4.2 - 0.1	10.2 - 0.3	16.2 - 0.4
43	0°25.8	0°25.8	0°24.6	4.3 - 0.1	10.3 - 0.3	16.3 - 0.4
44	0°26.0	0°26.1	0°24.8	4.4 - 0.1	10.4 - 0.3	16.4 - 0.4
45	0°26.3	0°26.3	0°25.1	4.5 - 0.1	10.5 - 0.3	16.5 - 0.4
46	0°26.5	0°26.6	0°25.3	4.6 - 0.1	10.6 - 0.3	16.6 - 0.4
47	0°26.8	0°26.8	0°25.5	4.7 - 0.1	10.7 - 0.3	16.7 - 0.4
48	0°27.0	0°27.1	0°25.8	4.8 - 0.1	10.8 - 0.3	16.8 - 0.4
49	0°27.3	0°27.3	0°26.0	4.9 - 0.1	10.9 - 0.3	16.9 - 0.4
50	0°27.5	0°27.6	0°26.2	5.0 - 0.1	11.0 - 0.3	17.0 - 0.4
51	0°27.8	0°27.8	0°26.5	5.1 - 0.1	11.1 - 0.3	17.1 - 0.4
52	0°28.0	0°28.1	0°26.7	5.2 - 0.1	11.2 - 0.3	17.2 - 0.4
53	0°28.3	0°28.3	0°27.0	5.3 - 0.1	11.3 - 0.3	17.3 - 0.4
54	0°28.5	0°28.6	0°27.2	5.4 - 0.1	11.4 - 0.3	17.4 - 0.4
55	0°28.7	0°28.8	0°27.4	5.5 - 0.1	11.5 - 0.3	17.5 - 0.4
56	0°29.0	0°29.1	0°27.7	5.6 - 0.1	11.6 - 0.3	17.6 - 0.4
57	0°29.3	0°29.3	0°27.9	5.7 - 0.1	11.7 - 0.3	17.7 - 0.4
58	0°29.5	0°29.6	0°28.2	5.8 - 0.1	11.8 - 0.3	17.8 - 0.4
59	0°29.7	0°29.8	0°28.4	5.9 - 0.1	11.9 - 0.3	17.9 - 0.4

m 2	Sun Plan.	Aries	Moon	v and d corr		
0	0°30.0	0°30.1	0°28.6	0.0 - 0.0	6.0 - 0.3	12.0 - 0.5
1	0°30.3	0°30.3	0°28.9	0.1 - 0.0	6.1 - 0.3	12.1 - 0.5
2	0°30.5	0°30.6	0°29.1	0.2 - 0.0	6.2 - 0.3	12.2 - 0.5
3	0°30.7	0°30.8	0°29.3	0.3 - 0.0	6.3 - 0.3	12.3 - 0.5
4	0°31.0	0°31.1	0°29.6	0.4 - 0.0	6.4 - 0.3	12.4 - 0.5
5	0°31.3	0°31.3	0°29.8	0.5 - 0.0	6.5 - 0.3	12.5 - 0.5
6	0°31.5	0°31.6	0°30.1	0.6 - 0.0	6.6 - 0.3	12.6 - 0.5
7	0°31.8	0°31.8	0°30.3	0.7 - 0.0	6.7 - 0.3	12.7 - 0.5
8	0°32.0	0°32.1	0°30.5	0.8 - 0.0	6.8 - 0.3	12.8 - 0.5
9	0°32.3	0°32.3	0°30.8	0.9 - 0.0	6.9 - 0.3	12.9 - 0.5
10	0°32.5	0°32.6	0°31.0	1.0 - 0.0	7.0 - 0.3	13.0 - 0.5
11	0°32.8	0°32.8	0°31.3	1.1 - 0.0	7.1 - 0.3	13.1 - 0.5
12	0°33.0	0°33.1	0°31.5	1.2 - 0.1	7.2 - 0.3	13.2 - 0.5
13	0°33.3	0°33.3	0°31.7	1.3 - 0.1	7.3 - 0.3	13.3 - 0.6
14	0°33.5	0°33.6	0°32.0	1.4 - 0.1	7.4 - 0.3	13.4 - 0.6
15	0°33.8	0°33.8	0°32.2	1.5 - 0.1	7.5 - 0.3	13.5 - 0.6
16	0°34.0	0°34.1	0°32.5	1.6 - 0.1	7.6 - 0.3	13.6 - 0.6
17	0°34.3	0°34.3	0°32.7	1.7 - 0.1	7.7 - 0.3	13.7 - 0.6
18	0°34.5	0°34.6	0°32.9	1.8 - 0.1	7.8 - 0.3	13.8 - 0.6
19	0°34.8	0°34.8	0°33.2	1.9 - 0.1	7.9 - 0.3	13.9 - 0.6
20	0°35.0	0°35.1	0°33.4	2.0 - 0.1	8.0 - 0.3	14.0 - 0.6
21	0°35.3	0°35.3	0°33.6	2.1 - 0.1	8.1 - 0.3	14.1 - 0.6
22	0°35.5	0°35.6	0°33.9	2.2 - 0.1	8.2 - 0.3	14.2 - 0.6
23	0°35.8	0°35.8	0°34.1	2.3 - 0.1	8.3 - 0.3	14.3 - 0.6
24	0°36.0	0°36.1	0°34.4	2.4 - 0.1	8.4 - 0.3	14.4 - 0.6
25	0°36.3	0°36.3	0°34.6	2.5 - 0.1	8.5 - 0.4	14.5 - 0.6
26	0°36.5	0°36.6	0°34.8	2.6 - 0.1	8.6 - 0.4	14.6 - 0.6
27	0°36.8	0°36.9	0°35.1	2.7 - 0.1	8.7 - 0.4	14.7 - 0.6
28	0°37.0	0°37.1	0°35.3	2.8 - 0.1	8.8 - 0.4	14.8 - 0.6
29	0°37.3	0°37.4	0°35.6	2.9 - 0.1	8.9 - 0.4	14.9 - 0.6
30	0°37.5	0°37.6	0°35.8	3.0 - 0.1	9.0 - 0.4	15.0 - 0.6
31	0°37.8	0°37.9	0°36.0	3.1 - 0.1	9.1 - 0.4	15.1 - 0.6
32	0°38.0	0°38.1	0°36.3	3.2 - 0.1	9.2 - 0.4	15.2 - 0.6
33	0°38.3	0°38.4	0°36.5	3.3 - 0.1	9.3 - 0.4	15.3 - 0.6
34	0°38.5	0°38.6	0°36.7	3.4 - 0.1	9.4 - 0.4	15.4 - 0.6
35	0°38.8	0°38.9	0°37.0	3.5 - 0.1	9.5 - 0.4	15.5 - 0.6
36	0°39.0	0°39.1	0°37.2	3.6 - 0.1	9.6 - 0.4	15.6 - 0.6
37	0°39.3	0°39.4	0°37.5	3.7 - 0.2	9.7 - 0.4	15.7 - 0.7
38	0°39.5	0°39.6	0°37.7	3.8 - 0.2	9.8 - 0.4	15.8 - 0.7
39	0°39.8	0°39.9	0°37.9	3.9 - 0.2	9.9 - 0.4	15.9 - 0.7
40	0°40.0	0°40.1	0°38.2	4.0 - 0.2	10.0 - 0.4	16.0 - 0.7
41	0°40.3	0°40.4	0°38.4	4.1 - 0.2	10.1 - 0.4	16.1 - 0.7
42	0°40.5	0°40.6	0°38.7	4.2 - 0.2	10.2 - 0.4	16.2 - 0.7
43	0°40.8	0°40.9	0°38.9	4.3 - 0.2	10.3 - 0.4	16.3 - 0.7
44	0°41.0	0°41.1	0°39.1	4.4 - 0.2	10.4 - 0.4	16.4 - 0.7
45	0°41.3	0°41.4	0°39.4	4.5 - 0.2	10.5 - 0.4	16.5 - 0.7
46	0°41.5	0°41.6	0°39.6	4.6 - 0.2	10.6 - 0.4	16.6 - 0.7
47	0°41.8	0°41.9	0°39.8	4.7 - 0.2	10.7 - 0.4	16.7 - 0.7
48	0°42.0	0°42.1	0°40.1	4.8 - 0.2	10.8 - 0.5	16.8 - 0.7
49	0°42.3	0°42.4	0°40.3	4.9 - 0.2	10.9 - 0.5	16.9 - 0.7
50	0°42.5	0°42.6	0°40.6	5.0 - 0.2	11.0 - 0.5	17.0 - 0.7
51	0°42.8	0°42.9	0°40.8	5.1 - 0.2	11.1 - 0.5	17.1 - 0.7
52	0°43.0	0°43.1	0°41.0	5.2 - 0.2	11.2 - 0.5	17.2 - 0.7
53	0°43.3	0°43.4	0°41.3	5.3 - 0.2	11.3 - 0.5	17.3 - 0.7
54	0°43.5	0°43.6	0°41.5	5.4 - 0.2	11.4 - 0.5	17.4 - 0.7
55	0°43.8	0°43.9	0°41.8	5.5 - 0.2	11.5 - 0.5	17.5 - 0.7
56	0°44.0	0°44.1	0°42.0	5.6 - 0.2	11.6 - 0.5	17.6 - 0.7
57	0°44.3	0°44.4	0°42.2	5.7 - 0.2	11.7 - 0.5	17.7 - 0.7
58	0°44.5	0°44.6	0°42.5	5.8 - 0.2	11.8 - 0.5	17.8 - 0.7
59	0°44.8	0°44.9	0°42.7	5.9 - 0.2	11.9 - 0.5	17.9 - 0.7

Increments and Corrections

m 3	Sun Plan.	Aries	Moon	v and d corr		
0	0°45.0	0°45.1	0°43.0	0.0 - 0.0	6.0 - 0.3	12.0 - 0.7
1	0°45.3	0°45.4	0°43.2	0.1 - 0.0	6.1 - 0.4	12.1 - 0.7
2	0°45.5	0°45.6	0°43.4	0.2 - 0.0	6.2 - 0.4	12.2 - 0.7
3	0°45.8	0°45.9	0°43.7	0.3 - 0.0	6.3 - 0.4	12.3 - 0.7
4	0°46.0	0°46.1	0°43.9	0.4 - 0.0	6.4 - 0.4	12.4 - 0.7
5	0°46.3	0°46.4	0°44.1	0.5 - 0.0	6.5 - 0.4	12.5 - 0.7
6	0°46.5	0°46.6	0°44.4	0.6 - 0.0	6.6 - 0.4	12.6 - 0.7
7	0°46.8	0°46.9	0°44.6	0.7 - 0.0	6.7 - 0.4	12.7 - 0.7
8	0°47.0	0°47.1	0°44.9	0.8 - 0.0	6.8 - 0.4	12.8 - 0.7
9	0°47.3	0°47.4	0°45.1	0.9 - 0.1	6.9 - 0.4	12.9 - 0.8
10	0°47.5	0°47.6	0°45.3	1.0 - 0.1	7.0 - 0.4	13.0 - 0.8
11	0°47.8	0°47.9	0°45.6	1.1 - 0.1	7.1 - 0.4	13.1 - 0.8
12	0°48.0	0°48.1	0°45.8	1.2 - 0.1	7.2 - 0.4	13.2 - 0.8
13	0°48.3	0°48.4	0°46.1	1.3 - 0.1	7.3 - 0.4	13.3 - 0.8
14	0°48.5	0°48.6	0°46.3	1.4 - 0.1	7.4 - 0.4	13.4 - 0.8
15	0°48.8	0°48.9	0°46.5	1.5 - 0.1	7.5 - 0.4	13.5 - 0.8
16	0°49.0	0°49.1	0°46.8	1.6 - 0.1	7.6 - 0.4	13.6 - 0.8
17	0°49.3	0°49.4	0°47.0	1.7 - 0.1	7.7 - 0.4	13.7 - 0.8
18	0°49.5	0°49.6	0°47.2	1.8 - 0.1	7.8 - 0.5	13.8 - 0.8
19	0°49.8	0°49.9	0°47.5	1.9 - 0.1	7.9 - 0.5	13.9 - 0.8
20	0°50.0	0°50.1	0°47.7	2.0 - 0.1	8.0 - 0.5	14.0 - 0.8
21	0°50.3	0°50.4	0°48.0	2.1 - 0.1	8.1 - 0.5	14.1 - 0.8
22	0°50.5	0°50.6	0°48.2	2.2 - 0.1	8.2 - 0.5	14.2 - 0.8
23	0°50.8	0°50.9	0°48.4	2.3 - 0.1	8.3 - 0.5	14.3 - 0.8
24	0°51.0	0°51.1	0°48.7	2.4 - 0.1	8.4 - 0.5	14.4 - 0.8
25	0°51.3	0°51.4	0°48.9	2.5 - 0.1	8.5 - 0.5	14.5 - 0.8
26	0°51.5	0°51.6	0°49.2	2.6 - 0.2	8.6 - 0.5	14.6 - 0.9
27	0°51.8	0°51.9	0°49.4	2.7 - 0.2	8.7 - 0.5	14.7 - 0.9
28	0°52.0	0°52.1	0°49.6	2.8 - 0.2	8.8 - 0.5	14.8 - 0.9
29	0°52.3	0°52.4	0°49.9	2.9 - 0.2	8.9 - 0.5	14.9 - 0.9
30	0°52.5	0°52.6	0°50.1	3.0 - 0.2	9.0 - 0.5	15.0 - 0.9
31	0°52.8	0°52.9	0°50.3	3.1 - 0.2	9.1 - 0.5	15.1 - 0.9
32	0°53.0	0°53.1	0°50.6	3.2 - 0.2	9.2 - 0.5	15.2 - 0.9
33	0°53.3	0°53.4	0°50.8	3.3 - 0.2	9.3 - 0.5	15.3 - 0.9
34	0°53.5	0°53.6	0°51.1	3.4 - 0.2	9.4 - 0.5	15.4 - 0.9
35	0°53.8	0°53.9	0°51.3	3.5 - 0.2	9.5 - 0.6	15.5 - 0.9
36	0°54.0	0°54.1	0°51.5	3.6 - 0.2	9.6 - 0.6	15.6 - 0.9
37	0°54.3	0°54.4	0°51.8	3.7 - 0.2	9.7 - 0.6	15.7 - 0.9
38	0°54.5	0°54.6	0°52.0	3.8 - 0.2	9.8 - 0.6	15.8 - 0.9
39	0°54.8	0°54.9	0°52.3	3.9 - 0.2	9.9 - 0.6	15.9 - 0.9
40	0°55.0	0°55.2	0°52.5	4.0 - 0.2	10.0 - 0.6	16.0 - 0.9
41	0°55.3	0°55.4	0°52.7	4.1 - 0.2	10.1 - 0.6	16.1 - 0.9
42	0°55.5	0°55.7	0°53.0	4.2 - 0.2	10.2 - 0.6	16.2 - 0.9
43	0°55.8	0°55.9	0°53.2	4.3 - 0.3	10.3 - 0.6	16.3 - 1.0
44	0°56.0	0°56.2	0°53.4	4.4 - 0.3	10.4 - 0.6	16.4 - 1.0
45	0°56.3	0°56.4	0°53.7	4.5 - 0.3	10.5 - 0.6	16.5 - 1.0
46	0°56.5	0°56.7	0°53.9	4.6 - 0.3	10.6 - 0.6	16.6 - 1.0
47	0°56.8	0°56.9	0°54.2	4.7 - 0.3	10.7 - 0.6	16.7 - 1.0
48	0°57.0	0°57.2	0°54.4	4.8 - 0.3	10.8 - 0.6	16.8 - 1.0
49	0°57.3	0°57.4	0°54.6	4.9 - 0.3	10.9 - 0.6	16.9 - 1.0
50	0°57.5	0°57.7	0°54.9	5.0 - 0.3	11.0 - 0.6	17.0 - 1.0
51	0°57.7	0°57.9	0°55.1	5.1 - 0.3	11.1 - 0.6	17.1 - 1.0
52	0°58.0	0°58.2	0°55.4	5.2 - 0.3	11.2 - 0.7	17.2 - 1.0
53	0°58.3	0°58.4	0°55.6	5.3 - 0.3	11.3 - 0.7	17.3 - 1.0
54	0°58.5	0°58.7	0°55.8	5.4 - 0.3	11.4 - 0.7	17.4 - 1.0
55	0°58.8	0°58.9	0°56.1	5.5 - 0.3	11.5 - 0.7	17.5 - 1.0
56	0°59.0	0°59.2	0°56.3	5.6 - 0.3	11.6 - 0.7	17.6 - 1.0
57	0°59.3	0°59.4	0°56.6	5.7 - 0.3	11.7 - 0.7	17.7 - 1.0
58	0°59.5	0°59.7	0°56.8	5.8 - 0.3	11.8 - 0.7	17.8 - 1.0
59	0°59.8	0°59.9	0°57.0	5.9 - 0.3	11.9 - 0.7	17.9 - 1.0

m 4	Sun Plan.	Aries	Moon	v and d corr		
0	1°00.0	1°00.2	0°57.3	0.0 - 0.0	6.0 - 0.4	12.0 - 0.9
1	1°00.2	1°00.4	0°57.5	0.1 - 0.0	6.1 - 0.5	12.1 - 0.9
2	1°00.5	1°00.7	0°57.7	0.2 - 0.0	6.2 - 0.5	12.2 - 0.9
3	1°00.7	1°00.9	0°58.0	0.3 - 0.0	6.3 - 0.5	12.3 - 0.9
4	1°01.0	1°01.2	0°58.2	0.4 - 0.0	6.4 - 0.5	12.4 - 0.9
5	1°01.2	1°01.4	0°58.5	0.5 - 0.0	6.5 - 0.5	12.5 - 0.9
6	1°01.5	1°01.7	0°58.7	0.6 - 0.0	6.6 - 0.5	12.6 - 0.9
7	1°01.7	1°01.9	0°58.9	0.7 - 0.1	6.7 - 0.5	12.7 - 1.0
8	1°02.0	1°02.2	0°59.2	0.8 - 0.1	6.8 - 0.5	12.8 - 1.0
9	1°02.3	1°02.4	0°59.4	0.9 - 0.1	6.9 - 0.5	12.9 - 1.0
10	1°02.5	1°02.7	0°59.7	1.0 - 0.1	7.0 - 0.5	13.0 - 1.0
11	1°02.8	1°02.9	0°59.9	1.1 - 0.1	7.1 - 0.5	13.1 - 1.0
12	1°03.0	1°03.2	1°00.1	1.2 - 0.1	7.2 - 0.5	13.2 - 1.0
13	1°03.3	1°03.4	1°00.4	1.3 - 0.1	7.3 - 0.5	13.3 - 1.0
14	1°03.5	1°03.7	1°00.6	1.4 - 0.1	7.4 - 0.6	13.4 - 1.0
15	1°03.8	1°03.9	1°00.8	1.5 - 0.1	7.5 - 0.6	13.5 - 1.0
16	1°04.0	1°04.2	1°01.1	1.6 - 0.1	7.6 - 0.6	13.6 - 1.0
17	1°04.2	1°04.4	1°01.3	1.7 - 0.1	7.7 - 0.6	13.7 - 1.0
18	1°04.5	1°04.7	1°01.6	1.8 - 0.1	7.8 - 0.6	13.8 - 1.0
19	1°04.7	1°04.9	1°01.8	1.9 - 0.1	7.9 - 0.6	13.9 - 1.0
20	1°05.0	1°05.2	1°02.0	2.0 - 0.1	8.0 - 0.6	14.0 - 1.1
21	1°05.2	1°05.4	1°02.3	2.1 - 0.2	8.1 - 0.6	14.1 - 1.1
22	1°05.5	1°05.7	1°02.5	2.2 - 0.2	8.2 - 0.6	14.2 - 1.1
23	1°05.8	1°05.9	1°02.8	2.3 - 0.2	8.3 - 0.6	14.3 - 1.1
24	1°06.0	1°06.2	1°03.0	2.4 - 0.2	8.4 - 0.6	14.4 - 1.1
25	1°06.3	1°06.4	1°03.2	2.5 - 0.2	8.5 - 0.6	14.5 - 1.1
26	1°06.5	1°06.7	1°03.5	2.6 - 0.2	8.6 - 0.6	14.6 - 1.1
27	1°06.8	1°06.9	1°03.7	2.7 - 0.2	8.7 - 0.7	14.7 - 1.1
28	1°07.0	1°07.2	1°03.9	2.8 - 0.2	8.8 - 0.7	14.8 - 1.1
29	1°07.3	1°07.4	1°04.2	2.9 - 0.2	8.9 - 0.7	14.9 - 1.1
30	1°07.5	1°07.7	1°04.4	3.0 - 0.2	9.0 - 0.7	15.0 - 1.1
31	1°07.7	1°07.9	1°04.7	3.1 - 0.2	9.1 - 0.7	15.1 - 1.1
32	1°08.0	1°08.2	1°04.9	3.2 - 0.2	9.2 - 0.7	15.2 - 1.1
33	1°08.2	1°08.4	1°05.1	3.3 - 0.2	9.3 - 0.7	15.3 - 1.1
34	1°08.5	1°08.7	1°05.4	3.4 - 0.3	9.4 - 0.7	15.4 - 1.2
35	1°08.7	1°08.9	1°05.6	3.5 - 0.3	9.5 - 0.7	15.5 - 1.2
36	1°09.0	1°09.2	1°05.9	3.6 - 0.3	9.6 - 0.7	15.6 - 1.2
37	1°09.3	1°09.4	1°06.1	3.7 - 0.3	9.7 - 0.7	15.7 - 1.2
38	1°09.5	1°09.7	1°06.3	3.8 - 0.3	9.8 - 0.7	15.8 - 1.2
39	1°09.8	1°09.9	1°06.6	3.9 - 0.3	9.9 - 0.7	15.9 - 1.2
40	1°10.0	1°10.2	1°06.8	4.0 - 0.3	10.0 - 0.8	16.0 - 1.2
41	1°10.3	1°10.4	1°07.0	4.1 - 0.3	10.1 - 0.8	16.1 - 1.2
42	1°10.5	1°10.7	1°07.3	4.2 - 0.3	10.2 - 0.8	16.2 - 1.2
43	1°10.8	1°10.9	1°07.5	4.3 - 0.3	10.3 - 0.8	16.3 - 1.2
44	1°11.0	1°11.2	1°07.8	4.4 - 0.3	10.4 - 0.8	16.4 - 1.2
45	1°11.3	1°11.4	1°08.0	4.5 - 0.3	10.5 - 0.8	16.5 - 1.2
46	1°11.5	1°11.7	1°08.2	4.6 - 0.3	10.6 - 0.8	16.6 - 1.2
47	1°11.7	1°11.9	1°08.5	4.7 - 0.4	10.7 - 0.8	16.7 - 1.3
48	1°12.0	1°12.2	1°08.7	4.8 - 0.4	10.8 - 0.8	16.8 - 1.3
49	1°12.2	1°12.4	1°09.0	4.9 - 0.4	10.9 - 0.8	16.9 - 1.3
50	1°12.5	1°12.7	1°09.2	5.0 - 0.4	11.0 - 0.8	17.0 - 1.3
51	1°12.7	1°12.9	1°09.4	5.1 - 0.4	11.1 - 0.8	17.1 - 1.3
52	1°13.0	1°13.2	1°09.7	5.2 - 0.4	11.2 - 0.8	17.2 - 1.3
53	1°13.2	1°13.5	1°09.9	5.3 - 0.4	11.3 - 0.8	17.3 - 1.3
54	1°13.5	1°13.7	1°10.2	5.4 - 0.4	11.4 - 0.9	17.4 - 1.3
55	1°13.8	1°14.0	1°10.4	5.5 - 0.4	11.5 - 0.9	17.5 - 1.3
56	1°14.0	1°14.2	1°10.6	5.6 - 0.4	11.6 - 0.9	17.6 - 1.3
57	1°14.3	1°14.5	1°10.9	5.7 - 0.4	11.7 - 0.9	17.7 - 1.3
58	1°14.5	1°14.7	1°11.1	5.8 - 0.4	11.8 - 0.9	17.8 - 1.3
59	1°14.8	1°15.0	1°11.3	5.9 - 0.4	11.9 - 0.9	17.9 - 1.3

m 5	Sun Plan.	Aries	Moon	v and d corr		
0	1°15.0	1°15.2	1°11.6	0.0 - 0.0	6.0 - 0.5	12.0 - 1.1
1	1°15.3	1°15.5	1°11.8	0.1 - 0.0	6.1 - 0.6	12.1 - 1.1
2	1°15.5	1°15.7	1°12.1	0.2 - 0.0	6.2 - 0.6	12.2 - 1.1
3	1°15.7	1°16.0	1°12.3	0.3 - 0.0	6.3 - 0.6	12.3 - 1.1
4	1°16.0	1°16.2	1°12.5	0.4 - 0.0	6.4 - 0.6	12.4 - 1.1
5	1°16.2	1°16.5	1°12.8	0.5 - 0.0	6.5 - 0.6	12.5 - 1.1
6	1°16.5	1°16.7	1°13.0	0.6 - 0.1	6.6 - 0.6	12.6 - 1.2
7	1°16.7	1°17.0	1°13.3	0.7 - 0.1	6.7 - 0.6	12.7 - 1.2
8	1°17.0	1°17.2	1°13.5	0.8 - 0.1	6.8 - 0.6	12.8 - 1.2
9	1°17.3	1°17.5	1°13.7	0.9 - 0.1	6.9 - 0.6	12.9 - 1.2
10	1°17.5	1°17.7	1°14.0	1.0 - 0.1	7.0 - 0.6	13.0 - 1.2
11	1°17.8	1°18.0	1°14.2	1.1 - 0.1	7.1 - 0.7	13.1 - 1.2
12	1°18.0	1°18.2	1°14.4	1.2 - 0.1	7.2 - 0.7	13.2 - 1.2
13	1°18.3	1°18.5	1°14.7	1.3 - 0.1	7.3 - 0.7	13.3 - 1.2
14	1°18.5	1°18.7	1°14.9	1.4 - 0.1	7.4 - 0.7	13.4 - 1.2
15	1°18.8	1°19.0	1°15.2	1.5 - 0.1	7.5 - 0.7	13.5 - 1.2
16	1°19.0	1°19.2	1°15.4	1.6 - 0.1	7.6 - 0.7	13.6 - 1.2
17	1°19.3	1°19.5	1°15.6	1.7 - 0.2	7.7 - 0.7	13.7 - 1.3
18	1°19.5	1°19.7	1°15.9	1.8 - 0.2	7.8 - 0.7	13.8 - 1.3
19	1°19.7	1°20.0	1°16.1	1.9 - 0.2	7.9 - 0.7	13.9 - 1.3
20	1°20.0	1°20.2	1°16.4	2.0 - 0.2	8.0 - 0.7	14.0 - 1.3
21	1°20.2	1°20.5	1°16.6	2.1 - 0.2	8.1 - 0.7	14.1 - 1.3
22	1°20.5	1°20.7	1°16.8	2.2 - 0.2	8.2 - 0.8	14.2 - 1.3
23	1°20.8	1°21.0	1°17.1	2.3 - 0.2	8.3 - 0.8	14.3 - 1.3
24	1°21.0	1°21.2	1°17.3	2.4 - 0.2	8.4 - 0.8	14.4 - 1.3
25	1°21.3	1°21.5	1°17.5	2.5 - 0.2	8.5 - 0.8	14.5 - 1.3
26	1°21.5	1°21.7	1°17.8	2.6 - 0.2	8.6 - 0.8	14.6 - 1.3
27	1°21.8	1°22.0	1°18.0	2.7 - 0.2	8.7 - 0.8	14.7 - 1.3
28	1°22.0	1°22.2	1°18.3	2.8 - 0.3	8.8 - 0.8	14.8 - 1.4
29	1°22.3	1°22.5	1°18.5	2.9 - 0.3	8.9 - 0.8	14.9 - 1.4
30	1°22.5	1°22.7	1°18.7	3.0 - 0.3	9.0 - 0.8	15.0 - 1.4
31	1°22.8	1°23.0	1°19.0	3.1 - 0.3	9.1 - 0.8	15.1 - 1.4
32	1°23.0	1°23.2	1°19.2	3.2 - 0.3	9.2 - 0.8	15.2 - 1.4
33	1°23.2	1°23.5	1°19.5	3.3 - 0.3	9.3 - 0.9	15.3 - 1.4
34	1°23.5	1°23.7	1°19.7	3.4 - 0.3	9.4 - 0.9	15.4 - 1.4
35	1°23.7	1°24.0	1°19.9	3.5 - 0.3	9.5 - 0.9	15.5 - 1.4
36	1°24.0	1°24.2	1°20.2	3.6 - 0.3	9.6 - 0.9	15.6 - 1.4
37	1°24.3	1°24.5	1°20.4	3.7 - 0.3	9.7 - 0.9	15.7 - 1.4
38	1°24.5	1°24.7	1°20.7	3.8 - 0.3	9.8 - 0.9	15.8 - 1.4
39	1°24.8	1°25.0	1°20.9	3.9 - 0.4	9.9 - 0.9	15.9 - 1.5
40	1°25.0	1°25.2	1°21.1	4.0 - 0.4	10.0 - 0.9	16.0 - 1.5
41	1°25.3	1°25.5	1°21.4	4.1 - 0.4	10.1 - 0.9	16.1 - 1.5
42	1°25.5	1°25.7	1°21.6	4.2 - 0.4	10.2 - 0.9	16.2 - 1.5
43	1°25.8	1°26.0	1°21.8	4.3 - 0.4	10.3 - 0.9	16.3 - 1.5
44	1°26.0	1°26.2	1°22.1	4.4 - 0.4	10.4 - 1.0	16.4 - 1.5
45	1°26.3	1°26.5	1°22.3	4.5 - 0.4	10.5 - 1.0	16.5 - 1.5
46	1°26.5	1°26.7	1°22.6	4.6 - 0.4	10.6 - 1.0	16.6 - 1.5
47	1°26.8	1°27.0	1°22.8	4.7 - 0.4	10.7 - 1.0	16.7 - 1.5
48	1°27.0	1°27.2	1°23.0	4.8 - 0.4	10.8 - 1.0	16.8 - 1.5
49	1°27.2	1°27.5	1°23.3	4.9 - 0.4	10.9 - 1.0	16.9 - 1.5
50	1°27.5	1°27.7	1°23.5	5.0 - 0.5	11.0 - 1.0	17.0 - 1.6
51	1°27.7	1°28.0	1°23.8	5.1 - 0.5	11.1 - 1.0	17.1 - 1.6
52	1°28.0	1°28.2	1°24.0	5.2 - 0.5	11.2 - 1.0	17.2 - 1.6
53	1°28.2	1°28.5	1°24.2	5.3 - 0.5	11.3 - 1.0	17.3 - 1.6
54	1°28.5	1°28.7	1°24.5	5.4 - 0.5	11.4 - 1.0	17.4 - 1.6
55	1°28.8	1°29.0	1°24.7	5.5 - 0.5	11.5 - 1.1	17.5 - 1.6
56	1°29.0	1°29.2	1°24.9	5.6 - 0.5	11.6 - 1.1	17.6 - 1.6
57	1°29.3	1°29.5	1°25.2	5.7 - 0.5	11.7 - 1.1	17.7 - 1.6
58	1°29.5	1°29.7	1°25.4	5.8 - 0.5	11.8 - 1.1	17.8 - 1.6
59	1°29.8	1°30.0	1°25.7	5.9 - 0.5	11.9 - 1.1	17.9 - 1.6

Increments and Corrections

m 6	Sun Plan.	Aries	Moon	v and d corr		
0	1°30.0	1°30.2	1°25.9	0.0 - 0.0	6.0 - 0.7	12.0 - 1.3
1	1°30.3	1°30.5	1°26.1	0.1 - 0.0	6.1 - 0.7	12.1 - 1.3
2	1°30.5	1°30.7	1°26.4	0.2 - 0.0	6.2 - 0.7	12.2 - 1.3
3	1°30.7	1°31.0	1°26.6	0.3 - 0.0	6.3 - 0.7	12.3 - 1.3
4	1°31.0	1°31.2	1°26.9	0.4 - 0.0	6.4 - 0.7	12.4 - 1.3
5	1°31.2	1°31.5	1°27.1	0.5 - 0.1	6.5 - 0.7	12.5 - 1.4
6	1°31.5	1°31.8	1°27.3	0.6 - 0.1	6.6 - 0.7	12.6 - 1.4
7	1°31.7	1°32.0	1°27.6	0.7 - 0.1	6.7 - 0.7	12.7 - 1.4
8	1°32.0	1°32.3	1°27.8	0.8 - 0.1	6.8 - 0.7	12.8 - 1.4
9	1°32.3	1°32.5	1°28.0	0.9 - 0.1	6.9 - 0.7	12.9 - 1.4
10	1°32.5	1°32.8	1°28.3	1.0 - 0.1	7.0 - 0.8	13.0 - 1.4
11	1°32.8	1°33.0	1°28.5	1.1 - 0.1	7.1 - 0.8	13.1 - 1.4
12	1°33.0	1°33.3	1°28.8	1.2 - 0.1	7.2 - 0.8	13.2 - 1.4
13	1°33.3	1°33.5	1°29.0	1.3 - 0.1	7.3 - 0.8	13.3 - 1.4
14	1°33.5	1°33.8	1°29.2	1.4 - 0.2	7.4 - 0.8	13.4 - 1.5
15	1°33.8	1°34.0	1°29.5	1.5 - 0.2	7.5 - 0.8	13.5 - 1.5
16	1°34.0	1°34.3	1°29.7	1.6 - 0.2	7.6 - 0.8	13.6 - 1.5
17	1°34.3	1°34.5	1°30.0	1.7 - 0.2	7.7 - 0.8	13.7 - 1.5
18	1°34.5	1°34.8	1°30.2	1.8 - 0.2	7.8 - 0.8	13.8 - 1.5
19	1°34.8	1°35.0	1°30.4	1.9 - 0.2	7.9 - 0.9	13.9 - 1.5
20	1°35.0	1°35.3	1°30.7	2.0 - 0.2	8.0 - 0.9	14.0 - 1.5
21	1°35.2	1°35.5	1°30.9	2.1 - 0.2	8.1 - 0.9	14.1 - 1.5
22	1°35.5	1°35.8	1°31.1	2.2 - 0.2	8.2 - 0.9	14.2 - 1.5
23	1°35.8	1°36.0	1°31.4	2.3 - 0.2	8.3 - 0.9	14.3 - 1.5
24	1°36.0	1°36.3	1°31.6	2.4 - 0.3	8.4 - 0.9	14.4 - 1.6
25	1°36.3	1°36.5	1°31.9	2.5 - 0.3	8.5 - 0.9	14.5 - 1.6
26	1°36.5	1°36.8	1°32.1	2.6 - 0.3	8.6 - 0.9	14.6 - 1.6
27	1°36.8	1°37.0	1°32.3	2.7 - 0.3	8.7 - 0.9	14.7 - 1.6
28	1°37.0	1°37.3	1°32.6	2.8 - 0.3	8.8 - 1.0	14.8 - 1.6
29	1°37.3	1°37.5	1°32.8	2.9 - 0.3	8.9 - 1.0	14.9 - 1.6
30	1°37.5	1°37.8	1°33.1	3.0 - 0.3	9.0 - 1.0	15.0 - 1.6
31	1°37.8	1°38.0	1°33.3	3.1 - 0.3	9.1 - 1.0	15.1 - 1.6
32	1°38.0	1°38.3	1°33.5	3.2 - 0.3	9.2 - 1.0	15.2 - 1.6
33	1°38.3	1°38.5	1°33.8	3.3 - 0.4	9.3 - 1.0	15.3 - 1.7
34	1°38.5	1°38.8	1°34.0	3.4 - 0.4	9.4 - 1.0	15.4 - 1.7
35	1°38.7	1°39.0	1°34.3	3.5 - 0.4	9.5 - 1.0	15.5 - 1.7
36	1°39.0	1°39.3	1°34.5	3.6 - 0.4	9.6 - 1.0	15.6 - 1.7
37	1°39.3	1°39.5	1°34.7	3.7 - 0.4	9.7 - 1.1	15.7 - 1.7
38	1°39.5	1°39.8	1°35.0	3.8 - 0.4	9.8 - 1.1	15.8 - 1.7
39	1°39.8	1°40.0	1°35.2	3.9 - 0.4	9.9 - 1.1	15.9 - 1.7
40	1°40.0	1°40.3	1°35.4	4.0 - 0.4	10.0 - 1.1	16.0 - 1.7
41	1°40.3	1°40.5	1°35.7	4.1 - 0.4	10.1 - 1.1	16.1 - 1.7
42	1°40.5	1°40.8	1°35.9	4.2 - 0.5	10.2 - 1.1	16.2 - 1.8
43	1°40.8	1°41.0	1°36.2	4.3 - 0.5	10.3 - 1.1	16.3 - 1.8
44	1°41.0	1°41.3	1°36.4	4.4 - 0.5	10.4 - 1.1	16.4 - 1.8
45	1°41.3	1°41.5	1°36.6	4.5 - 0.5	10.5 - 1.1	16.5 - 1.8
46	1°41.5	1°41.8	1°36.9	4.6 - 0.5	10.6 - 1.1	16.6 - 1.8
47	1°41.8	1°42.0	1°37.1	4.7 - 0.5	10.7 - 1.2	16.7 - 1.8
48	1°42.0	1°42.3	1°37.4	4.8 - 0.5	10.8 - 1.2	16.8 - 1.8
49	1°42.3	1°42.5	1°37.6	4.9 - 0.5	10.9 - 1.2	16.9 - 1.8
50	1°42.5	1°42.8	1°37.8	5.0 - 0.5	11.0 - 1.2	17.0 - 1.8
51	1°42.7	1°43.0	1°38.1	5.1 - 0.6	11.1 - 1.2	17.1 - 1.9
52	1°43.0	1°43.3	1°38.3	5.2 - 0.6	11.2 - 1.2	17.2 - 1.9
53	1°43.2	1°43.5	1°38.5	5.3 - 0.6	11.3 - 1.2	17.3 - 1.9
54	1°43.5	1°43.8	1°38.8	5.4 - 0.6	11.4 - 1.2	17.4 - 1.9
55	1°43.8	1°44.0	1°39.0	5.5 - 0.6	11.5 - 1.2	17.5 - 1.9
56	1°44.0	1°44.3	1°39.3	5.6 - 0.6	11.6 - 1.3	17.6 - 1.9
57	1°44.3	1°44.5	1°39.5	5.7 - 0.6	11.7 - 1.3	17.7 - 1.9
58	1°44.5	1°44.8	1°39.7	5.8 - 0.6	11.8 - 1.3	17.8 - 1.9
59	1°44.8	1°45.0	1°40.0	5.9 - 0.6	11.9 - 1.3	17.9 - 1.9

m 7	Sun Plan.	Aries	Moon	v and d corr		
0	1°45.0	1°45.3	1°40.2	0.0 - 0.0	6.0 - 0.8	12.0 - 1.5
1	1°45.3	1°45.5	1°40.5	0.1 - 0.0	6.1 - 0.8	12.1 - 1.5
2	1°45.5	1°45.8	1°40.7	0.2 - 0.0	6.2 - 0.8	12.2 - 1.5
3	1°45.8	1°46.0	1°40.9	0.3 - 0.0	6.3 - 0.8	12.3 - 1.5
4	1°46.0	1°46.3	1°41.2	0.4 - 0.1	6.4 - 0.8	12.4 - 1.6
5	1°46.2	1°46.5	1°41.4	0.5 - 0.1	6.5 - 0.8	12.5 - 1.6
6	1°46.5	1°46.8	1°41.6	0.6 - 0.1	6.6 - 0.8	12.6 - 1.6
7	1°46.7	1°47.0	1°41.9	0.7 - 0.1	6.7 - 0.8	12.7 - 1.6
8	1°47.0	1°47.3	1°42.1	0.8 - 0.1	6.8 - 0.8	12.8 - 1.6
9	1°47.3	1°47.5	1°42.4	0.9 - 0.1	6.9 - 0.9	12.9 - 1.6
10	1°47.5	1°47.8	1°42.6	1.0 - 0.1	7.0 - 0.9	13.0 - 1.6
11	1°47.8	1°48.0	1°42.8	1.1 - 0.1	7.1 - 0.9	13.1 - 1.6
12	1°48.0	1°48.3	1°43.1	1.2 - 0.2	7.2 - 0.9	13.2 - 1.6
13	1°48.3	1°48.5	1°43.3	1.3 - 0.2	7.3 - 0.9	13.3 - 1.7
14	1°48.5	1°48.8	1°43.6	1.4 - 0.2	7.4 - 0.9	13.4 - 1.7
15	1°48.8	1°49.0	1°43.8	1.5 - 0.2	7.5 - 0.9	13.5 - 1.7
16	1°49.0	1°49.3	1°44.0	1.6 - 0.2	7.6 - 0.9	13.6 - 1.7
17	1°49.3	1°49.5	1°44.3	1.7 - 0.2	7.7 - 1.0	13.7 - 1.7
18	1°49.5	1°49.8	1°44.5	1.8 - 0.2	7.8 - 1.0	13.8 - 1.7
19	1°49.8	1°50.0	1°44.8	1.9 - 0.2	7.9 - 1.0	13.9 - 1.7
20	1°50.0	1°50.3	1°45.0	2.0 - 0.3	8.0 - 1.0	14.0 - 1.8
21	1°50.2	1°50.6	1°45.2	2.1 - 0.3	8.1 - 1.0	14.1 - 1.8
22	1°50.5	1°50.8	1°45.5	2.2 - 0.3	8.2 - 1.0	14.2 - 1.8
23	1°50.8	1°51.1	1°45.7	2.3 - 0.3	8.3 - 1.0	14.3 - 1.8
24	1°51.0	1°51.3	1°45.9	2.4 - 0.3	8.4 - 1.1	14.4 - 1.8
25	1°51.3	1°51.6	1°46.2	2.5 - 0.3	8.5 - 1.1	14.5 - 1.8
26	1°51.5	1°51.8	1°46.4	2.6 - 0.3	8.6 - 1.1	14.6 - 1.8
27	1°51.8	1°52.1	1°46.7	2.7 - 0.3	8.7 - 1.1	14.7 - 1.8
28	1°52.0	1°52.3	1°46.9	2.8 - 0.4	8.8 - 1.1	14.8 - 1.9
29	1°52.3	1°52.6	1°47.1	2.9 - 0.4	8.9 - 1.1	14.9 - 1.9
30	1°52.5	1°52.8	1°47.4	3.0 - 0.4	9.0 - 1.1	15.0 - 1.9
31	1°52.7	1°53.1	1°47.6	3.1 - 0.4	9.1 - 1.1	15.1 - 1.9
32	1°53.0	1°53.3	1°47.9	3.2 - 0.4	9.2 - 1.1	15.2 - 1.9
33	1°53.3	1°53.6	1°48.1	3.3 - 0.4	9.3 - 1.2	15.3 - 1.9
34	1°53.5	1°53.8	1°48.3	3.4 - 0.4	9.4 - 1.2	15.4 - 1.9
35	1°53.7	1°54.1	1°48.6	3.5 - 0.4	9.5 - 1.2	15.5 - 1.9
36	1°54.0	1°54.3	1°48.8	3.6 - 0.5	9.6 - 1.2	15.6 - 1.9
37	1°54.2	1°54.6	1°49.0	3.7 - 0.5	9.7 - 1.2	15.7 - 2.0
38	1°54.5	1°54.8	1°49.3	3.8 - 0.5	9.8 - 1.2	15.8 - 2.0
39	1°54.8	1°55.1	1°49.5	3.9 - 0.5	9.9 - 1.2	15.9 - 2.0
40	1°55.0	1°55.3	1°49.8	4.0 - 0.5	10.0 - 1.3	16.0 - 2.0
41	1°55.3	1°55.6	1°50.0	4.1 - 0.5	10.1 - 1.3	16.1 - 2.0
42	1°55.5	1°55.8	1°50.2	4.2 - 0.5	10.2 - 1.3	16.2 - 2.0
43	1°55.8	1°56.1	1°50.5	4.3 - 0.5	10.3 - 1.3	16.3 - 2.0
44	1°56.0	1°56.3	1°50.7	4.4 - 0.6	10.4 - 1.3	16.4 - 2.0
45	1°56.3	1°56.6	1°51.0	4.5 - 0.6	10.5 - 1.3	16.5 - 2.1
46	1°56.5	1°56.8	1°51.2	4.6 - 0.6	10.6 - 1.3	16.6 - 2.1
47	1°56.7	1°57.1	1°51.4	4.7 - 0.6	10.7 - 1.3	16.7 - 2.1
48	1°57.0	1°57.3	1°51.7	4.8 - 0.6	10.8 - 1.4	16.8 - 2.1
49	1°57.3	1°57.6	1°51.9	4.9 - 0.6	10.9 - 1.4	16.9 - 2.1
50	1°57.5	1°57.8	1°52.1	5.0 - 0.6	11.0 - 1.4	17.0 - 2.1
51	1°57.7	1°58.1	1°52.4	5.1 - 0.6	11.1 - 1.4	17.1 - 2.1
52	1°58.0	1°58.3	1°52.6	5.2 - 0.7	11.2 - 1.4	17.2 - 2.1
53	1°58.2	1°58.6	1°52.9	5.3 - 0.7	11.3 - 1.4	17.3 - 2.2
54	1°58.5	1°58.8	1°53.1	5.4 - 0.7	11.4 - 1.4	17.4 - 2.2
55	1°58.8	1°59.1	1°53.3	5.5 - 0.7	11.5 - 1.4	17.5 - 2.2
56	1°59.0	1°59.3	1°53.6	5.6 - 0.7	11.6 - 1.5	17.6 - 2.2
57	1°59.3	1°59.6	1°53.8	5.7 - 0.7	11.7 - 1.5	17.7 - 2.2
58	1°59.5	1°59.8	1°54.1	5.8 - 0.7	11.8 - 1.5	17.8 - 2.2
59	1°59.8	2°00.1	1°54.3	5.9 - 0.7	11.9 - 1.5	17.9 - 2.2

m 8	Sun Plan.	Aries	Moon	v and d corr		
0	2°00.0	2°00.3	1°54.5	0.0 - 0.0	6.0 - 0.8	12.0 - 1.7
1	2°00.3	2°00.6	1°54.8	0.1 - 0.0	6.1 - 0.9	12.1 - 1.7
2	2°00.5	2°00.8	1°55.0	0.2 - 0.0	6.2 - 0.9	12.2 - 1.7
3	2°00.8	2°01.1	1°55.2	0.3 - 0.0	6.3 - 0.9	12.3 - 1.7
4	2°01.0	2°01.3	1°55.5	0.4 - 0.1	6.4 - 0.9	12.4 - 1.8
5	2°01.3	2°01.6	1°55.7	0.5 - 0.1	6.5 - 0.9	12.5 - 1.8
6	2°01.5	2°01.8	1°56.0	0.6 - 0.1	6.6 - 0.9	12.6 - 1.8
7	2°01.8	2°02.1	1°56.2	0.7 - 0.1	6.7 - 0.9	12.7 - 1.8
8	2°02.0	2°02.3	1°56.4	0.8 - 0.1	6.8 - 1.0	12.8 - 1.8
9	2°02.3	2°02.6	1°56.7	0.9 - 0.1	6.9 - 1.0	12.9 - 1.8
10	2°02.5	2°02.8	1°56.9	1.0 - 0.1	7.0 - 1.0	13.0 - 1.8
11	2°02.8	2°03.1	1°57.2	1.1 - 0.2	7.1 - 1.0	13.1 - 1.9
12	2°03.0	2°03.3	1°57.4	1.2 - 0.2	7.2 - 1.0	13.2 - 1.9
13	2°03.3	2°03.6	1°57.6	1.3 - 0.2	7.3 - 1.0	13.3 - 1.9
14	2°03.5	2°03.8	1°57.9	1.4 - 0.2	7.4 - 1.0	13.4 - 1.9
15	2°03.8	2°04.1	1°58.1	1.5 - 0.2	7.5 - 1.1	13.5 - 1.9
16	2°04.0	2°04.3	1°58.4	1.6 - 0.2	7.6 - 1.1	13.6 - 1.9
17	2°04.2	2°04.6	1°58.6	1.7 - 0.2	7.7 - 1.1	13.7 - 1.9
18	2°04.5	2°04.8	1°58.8	1.8 - 0.3	7.8 - 1.1	13.8 - 2.0
19	2°04.7	2°05.1	1°59.1	1.9 - 0.3	7.9 - 1.1	13.9 - 2.0
20	2°05.0	2°05.3	1°59.3	2.0 - 0.3	8.0 - 1.1	14.0 - 2.0
21	2°05.2	2°05.6	1°59.5	2.1 - 0.3	8.1 - 1.1	14.1 - 2.0
22	2°05.5	2°05.8	1°59.8	2.2 - 0.3	8.2 - 1.2	14.2 - 2.0
23	2°05.7	2°06.1	2°00.0	2.3 - 0.3	8.3 - 1.2	14.3 - 2.0
24	2°06.0	2°06.3	2°00.3	2.4 - 0.3	8.4 - 1.2	14.4 - 2.0
25	2°06.2	2°06.6	2°00.5	2.5 - 0.4	8.5 - 1.2	14.5 - 2.1
26	2°06.5	2°06.8	2°00.7	2.6 - 0.4	8.6 - 1.2	14.6 - 2.1
27	2°06.7	2°07.1	2°01.0	2.7 - 0.4	8.7 - 1.2	14.7 - 2.1
28	2°07.0	2°07.3	2°01.2	2.8 - 0.4	8.8 - 1.2	14.8 - 2.1
29	2°07.2	2°07.6	2°01.5	2.9 - 0.4	8.9 - 1.3	14.9 - 2.1
30	2°07.5	2°07.8	2°01.7	3.0 - 0.4	9.0 - 1.3	15.0 - 2.1
31	2°07.8	2°08.1	2°01.9	3.1 - 0.4	9.1 - 1.3	15.1 - 2.1
32	2°08.0	2°08.3	2°02.2	3.2 - 0.5	9.2 - 1.3	15.2 - 2.2
33	2°08.3	2°08.6	2°02.4	3.3 - 0.5	9.3 - 1.3	15.3 - 2.2
34	2°08.5	2°08.9	2°02.6	3.4 - 0.5	9.4 - 1.3	15.4 - 2.2
35	2°08.8	2°09.1	2°02.9	3.5 - 0.5	9.5 - 1.3	15.5 - 2.2
36	2°09.0	2°09.4	2°03.1	3.6 - 0.5	9.6 - 1.4	15.6 - 2.2
37	2°09.3	2°09.6	2°03.4	3.7 - 0.5	9.7 - 1.4	15.7 - 2.2
38	2°09.5	2°09.9	2°03.6	3.8 - 0.5	9.8 - 1.4	15.8 - 2.2
39	2°09.8	2°10.1	2°03.8	3.9 - 0.6	9.9 - 1.4	15.9 - 2.3
40	2°10.0	2°10.4	2°04.1	4.0 - 0.6	10.0 - 1.4	16.0 - 2.3
41	2°10.3	2°10.6	2°04.3	4.1 - 0.6	10.1 - 1.4	16.1 - 2.3
42	2°10.5	2°10.9	2°04.6	4.2 - 0.6	10.2 - 1.4	16.2 - 2.3
43	2°10.8	2°11.1	2°04.8	4.3 - 0.6	10.3 - 1.5	16.3 - 2.3
44	2°11.0	2°11.4	2°05.0	4.4 - 0.6	10.4 - 1.5	16.4 - 2.3
45	2°11.3	2°11.6	2°05.3	4.5 - 0.6	10.5 - 1.5	16.5 - 2.3
46	2°11.5	2°11.9	2°05.5	4.6 - 0.7	10.6 - 1.5	16.6 - 2.4
47	2°11.7	2°12.1	2°05.7	4.7 - 0.7	10.7 - 1.5	16.7 - 2.4
48	2°12.0	2°12.4	2°06.0	4.8 - 0.7	10.8 - 1.5	16.8 - 2.4
49	2°12.2	2°12.6	2°06.2	4.9 - 0.7	10.9 - 1.5	16.9 - 2.4
50	2°12.5	2°12.9	2°06.5	5.0 - 0.7	11.0 - 1.6	17.0 - 2.4
51	2°12.7	2°13.1	2°06.7	5.1 - 0.7	11.1 - 1.6	17.1 - 2.4
52	2°13.0	2°13.4	2°06.9	5.2 - 0.7	11.2 - 1.6	17.2 - 2.4
53	2°13.2	2°13.6	2°07.2	5.3 - 0.8	11.3 - 1.6	17.3 - 2.5
54	2°13.5	2°13.9	2°07.4	5.4 - 0.8	11.4 - 1.6	17.4 - 2.5
55	2°13.7	2°14.1	2°07.7	5.5 - 0.8	11.5 - 1.6	17.5 - 2.5
56	2°14.0	2°14.4	2°07.9	5.6 - 0.8	11.6 - 1.6	17.6 - 2.5
57	2°14.2	2°14.6	2°08.1	5.7 - 0.8	11.7 - 1.7	17.7 - 2.5
58	2°14.5	2°14.9	2°08.4	5.8 - 0.8	11.8 - 1.7	17.8 - 2.5
59	2°14.7	2°15.1	2°08.6	5.9 - 0.8	11.9 - 1.7	17.9 - 2.5

Increments and Corrections

m 9	Sun Plan.	Aries	Moon	v and d corr		
0	2°15.0	2°15.4	2°08.8	0.0 - 0.0	6.0 - 0.9	12.0 - 1.9
1	2°15.3	2°15.6	2°09.1	0.1 - 0.0	6.1 - 1.0	12.1 - 1.9
2	2°15.5	2°15.9	2°09.3	0.2 - 0.0	6.2 - 1.0	12.2 - 1.9
3	2°15.8	2°16.1	2°09.6	0.3 - 0.0	6.3 - 1.0	12.3 - 1.9
4	2°16.0	2°16.4	2°09.8	0.4 - 0.1	6.4 - 1.0	12.4 - 2.0
5	2°16.3	2°16.6	2°10.0	0.5 - 0.1	6.5 - 1.0	12.5 - 2.0
6	2°16.5	2°16.9	2°10.3	0.6 - 0.1	6.6 - 1.0	12.6 - 2.0
7	2°16.8	2°17.1	2°10.5	0.7 - 0.1	6.7 - 1.1	12.7 - 2.0
8	2°17.0	2°17.4	2°10.8	0.8 - 0.1	6.8 - 1.1	12.8 - 2.0
9	2°17.3	2°17.6	2°11.0	0.9 - 0.1	6.9 - 1.1	12.9 - 2.0
10	2°17.5	2°17.9	2°11.2	1.0 - 0.2	7.0 - 1.1	13.0 - 2.1
11	2°17.8	2°18.1	2°11.5	1.1 - 0.2	7.1 - 1.1	13.1 - 2.1
12	2°18.0	2°18.4	2°11.7	1.2 - 0.2	7.2 - 1.1	13.2 - 2.1
13	2°18.3	2°18.6	2°12.0	1.3 - 0.2	7.3 - 1.2	13.3 - 2.1
14	2°18.5	2°18.9	2°12.2	1.4 - 0.2	7.4 - 1.2	13.4 - 2.1
15	2°18.8	2°19.1	2°12.4	1.5 - 0.2	7.5 - 1.2	13.5 - 2.1
16	2°19.0	2°19.4	2°12.7	1.6 - 0.3	7.6 - 1.2	13.6 - 2.2
17	2°19.3	2°19.6	2°12.9	1.7 - 0.3	7.7 - 1.2	13.7 - 2.2
18	2°19.5	2°19.9	2°13.1	1.8 - 0.3	7.8 - 1.2	13.8 - 2.2
19	2°19.7	2°20.1	2°13.4	1.9 - 0.3	7.9 - 1.3	13.9 - 2.2
20	2°20.0	2°20.4	2°13.6	2.0 - 0.3	8.0 - 1.3	14.0 - 2.2
21	2°20.2	2°20.6	2°13.9	2.1 - 0.3	8.1 - 1.3	14.1 - 2.2
22	2°20.5	2°20.9	2°14.1	2.2 - 0.3	8.2 - 1.3	14.2 - 2.2
23	2°20.7	2°21.1	2°14.3	2.3 - 0.4	8.3 - 1.3	14.3 - 2.3
24	2°21.0	2°21.4	2°14.6	2.4 - 0.4	8.4 - 1.3	14.4 - 2.3
25	2°21.2	2°21.6	2°14.8	2.5 - 0.4	8.5 - 1.3	14.5 - 2.3
26	2°21.5	2°21.9	2°15.1	2.6 - 0.4	8.6 - 1.4	14.6 - 2.3
27	2°21.7	2°22.1	2°15.3	2.7 - 0.4	8.7 - 1.4	14.7 - 2.3
28	2°22.0	2°22.4	2°15.5	2.8 - 0.4	8.8 - 1.4	14.8 - 2.3
29	2°22.2	2°22.6	2°15.8	2.9 - 0.5	8.9 - 1.4	14.9 - 2.4
30	2°22.5	2°22.9	2°16.0	3.0 - 0.5	9.0 - 1.4	15.0 - 2.4
31	2°22.8	2°23.1	2°16.2	3.1 - 0.5	9.1 - 1.4	15.1 - 2.4
32	2°23.0	2°23.4	2°16.5	3.2 - 0.5	9.2 - 1.5	15.2 - 2.4
33	2°23.3	2°23.6	2°16.7	3.3 - 0.5	9.3 - 1.5	15.3 - 2.4
34	2°23.5	2°23.9	2°17.0	3.4 - 0.5	9.4 - 1.5	15.4 - 2.4
35	2°23.8	2°24.1	2°17.2	3.5 - 0.6	9.5 - 1.5	15.5 - 2.5
36	2°24.0	2°24.4	2°17.4	3.6 - 0.6	9.6 - 1.5	15.6 - 2.5
37	2°24.3	2°24.6	2°17.7	3.7 - 0.6	9.7 - 1.5	15.7 - 2.5
38	2°24.5	2°24.9	2°17.9	3.8 - 0.6	9.8 - 1.6	15.8 - 2.5
39	2°24.8	2°25.1	2°18.2	3.9 - 0.6	9.9 - 1.6	15.9 - 2.5
40	2°25.0	2°25.4	2°18.4	4.0 - 0.6	10.0 - 1.6	16.0 - 2.5
41	2°25.3	2°25.6	2°18.6	4.1 - 0.6	10.1 - 1.6	16.1 - 2.5
42	2°25.5	2°25.9	2°18.9	4.2 - 0.7	10.2 - 1.6	16.2 - 2.6
43	2°25.8	2°26.1	2°19.1	4.3 - 0.7	10.3 - 1.6	16.3 - 2.6
44	2°26.0	2°26.4	2°19.3	4.4 - 0.7	10.4 - 1.6	16.4 - 2.6
45	2°26.3	2°26.6	2°19.6	4.5 - 0.7	10.5 - 1.7	16.5 - 2.6
46	2°26.5	2°26.9	2°19.8	4.6 - 0.7	10.6 - 1.7	16.6 - 2.6
47	2°26.8	2°27.2	2°20.1	4.7 - 0.7	10.7 - 1.7	16.7 - 2.6
48	2°27.0	2°27.4	2°20.3	4.8 - 0.8	10.8 - 1.7	16.8 - 2.7
49	2°27.2	2°27.7	2°20.5	4.9 - 0.8	10.9 - 1.7	16.9 - 2.7
50	2°27.5	2°27.9	2°20.8	5.0 - 0.8	11.0 - 1.7	17.0 - 2.7
51	2°27.7	2°28.2	2°21.0	5.1 - 0.8	11.1 - 1.8	17.1 - 2.7
52	2°28.0	2°28.4	2°21.3	5.2 - 0.8	11.2 - 1.8	17.2 - 2.7
53	2°28.2	2°28.7	2°21.5	5.3 - 0.8	11.3 - 1.8	17.3 - 2.7
54	2°28.5	2°28.9	2°21.7	5.4 - 0.9	11.4 - 1.8	17.4 - 2.8
55	2°28.7	2°29.2	2°22.0	5.5 - 0.9	11.5 - 1.8	17.5 - 2.8
56	2°29.0	2°29.4	2°22.2	5.6 - 0.9	11.6 - 1.8	17.6 - 2.8
57	2°29.2	2°29.7	2°22.5	5.7 - 0.9	11.7 - 1.9	17.7 - 2.8
58	2°29.5	2°29.9	2°22.7	5.8 - 0.9	11.8 - 1.9	17.8 - 2.8
59	2°29.7	2°30.2	2°22.9	5.9 - 0.9	11.9 - 1.9	17.9 - 2.8

m 10	Sun Plan.	Aries	Moon	v and d corr		
0	2°30.0	2°30.4	2°23.2	0.0 - 0.0	6.0 - 1.0	12.0 - 2.1
1	2°30.3	2°30.7	2°23.4	0.1 - 0.0	6.1 - 1.1	12.1 - 2.1
2	2°30.5	2°30.9	2°23.6	0.2 - 0.0	6.2 - 1.1	12.2 - 2.1
3	2°30.8	2°31.2	2°23.9	0.3 - 0.1	6.3 - 1.1	12.3 - 2.2
4	2°31.0	2°31.4	2°24.1	0.4 - 0.1	6.4 - 1.1	12.4 - 2.2
5	2°31.3	2°31.7	2°24.4	0.5 - 0.1	6.5 - 1.1	12.5 - 2.2
6	2°31.5	2°31.9	2°24.6	0.6 - 0.1	6.6 - 1.2	12.6 - 2.2
7	2°31.8	2°32.2	2°24.8	0.7 - 0.1	6.7 - 1.2	12.7 - 2.2
8	2°32.0	2°32.4	2°25.1	0.8 - 0.1	6.8 - 1.2	12.8 - 2.2
9	2°32.3	2°32.7	2°25.3	0.9 - 0.2	6.9 - 1.2	12.9 - 2.3
10	2°32.5	2°32.9	2°25.6	1.0 - 0.2	7.0 - 1.2	13.0 - 2.3
11	2°32.8	2°33.2	2°25.8	1.1 - 0.2	7.1 - 1.2	13.1 - 2.3
12	2°33.0	2°33.4	2°26.0	1.2 - 0.2	7.2 - 1.3	13.2 - 2.3
13	2°33.3	2°33.7	2°26.3	1.3 - 0.2	7.3 - 1.3	13.3 - 2.3
14	2°33.5	2°33.9	2°26.5	1.4 - 0.2	7.4 - 1.3	13.4 - 2.3
15	2°33.8	2°34.2	2°26.7	1.5 - 0.3	7.5 - 1.3	13.5 - 2.4
16	2°34.0	2°34.4	2°27.0	1.6 - 0.3	7.6 - 1.3	13.6 - 2.4
17	2°34.3	2°34.7	2°27.2	1.7 - 0.3	7.7 - 1.3	13.7 - 2.4
18	2°34.5	2°34.9	2°27.5	1.8 - 0.3	7.8 - 1.4	13.8 - 2.4
19	2°34.8	2°35.2	2°27.7	1.9 - 0.3	7.9 - 1.4	13.9 - 2.4
20	2°35.0	2°35.4	2°27.9	2.0 - 0.3	8.0 - 1.4	14.0 - 2.4
21	2°35.2	2°35.7	2°28.2	2.1 - 0.4	8.1 - 1.4	14.1 - 2.5
22	2°35.5	2°35.9	2°28.4	2.2 - 0.4	8.2 - 1.4	14.2 - 2.5
23	2°35.7	2°36.2	2°28.7	2.3 - 0.4	8.3 - 1.5	14.3 - 2.5
24	2°36.0	2°36.4	2°28.9	2.4 - 0.4	8.4 - 1.5	14.4 - 2.5
25	2°36.2	2°36.7	2°29.1	2.5 - 0.4	8.5 - 1.5	14.5 - 2.5
26	2°36.5	2°36.9	2°29.4	2.6 - 0.5	8.6 - 1.5	14.6 - 2.6
27	2°36.7	2°37.2	2°29.6	2.7 - 0.5	8.7 - 1.5	14.7 - 2.6
28	2°37.0	2°37.4	2°29.8	2.8 - 0.5	8.8 - 1.5	14.8 - 2.6
29	2°37.2	2°37.7	2°30.1	2.9 - 0.5	8.9 - 1.6	14.9 - 2.6
30	2°37.5	2°37.9	2°30.3	3.0 - 0.5	9.0 - 1.6	15.0 - 2.6
31	2°37.8	2°38.2	2°30.6	3.1 - 0.5	9.1 - 1.6	15.1 - 2.6
32	2°38.0	2°38.4	2°30.8	3.2 - 0.6	9.2 - 1.6	15.2 - 2.7
33	2°38.3	2°38.7	2°31.0	3.3 - 0.6	9.3 - 1.6	15.3 - 2.7
34	2°38.5	2°38.9	2°31.3	3.4 - 0.6	9.4 - 1.6	15.4 - 2.7
35	2°38.8	2°39.2	2°31.5	3.5 - 0.6	9.5 - 1.7	15.5 - 2.7
36	2°39.0	2°39.4	2°31.8	3.6 - 0.6	9.6 - 1.7	15.6 - 2.7
37	2°39.3	2°39.7	2°32.0	3.7 - 0.6	9.7 - 1.7	15.7 - 2.7
38	2°39.5	2°39.9	2°32.2	3.8 - 0.7	9.8 - 1.7	15.8 - 2.8
39	2°39.8	2°40.2	2°32.5	3.9 - 0.7	9.9 - 1.7	15.9 - 2.8
40	2°40.0	2°40.4	2°32.7	4.0 - 0.7	10.0 - 1.8	16.0 - 2.8
41	2°40.3	2°40.7	2°32.9	4.1 - 0.7	10.1 - 1.8	16.1 - 2.8
42	2°40.5	2°40.9	2°33.2	4.2 - 0.7	10.2 - 1.8	16.2 - 2.8
43	2°40.8	2°41.2	2°33.4	4.3 - 0.8	10.3 - 1.8	16.3 - 2.9
44	2°41.0	2°41.4	2°33.7	4.4 - 0.8	10.4 - 1.8	16.4 - 2.9
45	2°41.3	2°41.7	2°33.9	4.5 - 0.8	10.5 - 1.8	16.5 - 2.9
46	2°41.5	2°41.9	2°34.1	4.6 - 0.8	10.6 - 1.9	16.6 - 2.9
47	2°41.8	2°42.2	2°34.4	4.7 - 0.8	10.7 - 1.9	16.7 - 2.9
48	2°42.0	2°42.4	2°34.6	4.8 - 0.8	10.8 - 1.9	16.8 - 2.9
49	2°42.3	2°42.7	2°34.9	4.9 - 0.9	10.9 - 1.9	16.9 - 3.0
50	2°42.5	2°42.9	2°35.1	5.0 - 0.9	11.0 - 1.9	17.0 - 3.0
51	2°42.7	2°43.2	2°35.3	5.1 - 0.9	11.1 - 1.9	17.1 - 3.0
52	2°43.0	2°43.4	2°35.6	5.2 - 0.9	11.2 - 2.0	17.2 - 3.0
53	2°43.2	2°43.7	2°35.8	5.3 - 0.9	11.3 - 2.0	17.3 - 3.0
54	2°43.5	2°43.9	2°36.1	5.4 - 0.9	11.4 - 2.0	17.4 - 3.0
55	2°43.7	2°44.2	2°36.3	5.5 - 1.0	11.5 - 2.0	17.5 - 3.1
56	2°44.0	2°44.4	2°36.5	5.6 - 1.0	11.6 - 2.0	17.6 - 3.1
57	2°44.2	2°44.7	2°36.8	5.7 - 1.0	11.7 - 2.0	17.7 - 3.1
58	2°44.5	2°44.9	2°37.0	5.8 - 1.0	11.8 - 2.1	17.8 - 3.1
59	2°44.7	2°45.2	2°37.2	5.9 - 1.0	11.9 - 2.1	17.9 - 3.1

m 11	Sun Plan.	Aries	Moon	v and d corr		
0	2°45.0	2°45.5	2°37.5	0.0 - 0.0	6.0 - 1.2	12.0 - 2.3
1	2°45.3	2°45.7	2°37.7	0.1 - 0.0	6.1 - 1.2	12.1 - 2.3
2	2°45.5	2°46.0	2°38.0	0.2 - 0.0	6.2 - 1.2	12.2 - 2.3
3	2°45.8	2°46.2	2°38.2	0.3 - 0.1	6.3 - 1.2	12.3 - 2.4
4	2°46.0	2°46.5	2°38.4	0.4 - 0.1	6.4 - 1.2	12.4 - 2.4
5	2°46.3	2°46.7	2°38.7	0.5 - 0.1	6.5 - 1.2	12.5 - 2.4
6	2°46.5	2°47.0	2°38.9	0.6 - 0.1	6.6 - 1.3	12.6 - 2.4
7	2°46.8	2°47.2	2°39.2	0.7 - 0.1	6.7 - 1.3	12.7 - 2.4
8	2°47.0	2°47.5	2°39.4	0.8 - 0.2	6.8 - 1.3	12.8 - 2.5
9	2°47.3	2°47.7	2°39.6	0.9 - 0.2	6.9 - 1.3	12.9 - 2.5
10	2°47.5	2°48.0	2°39.9	1.0 - 0.2	7.0 - 1.3	13.0 - 2.5
11	2°47.8	2°48.2	2°40.1	1.1 - 0.2	7.1 - 1.4	13.1 - 2.5
12	2°48.0	2°48.5	2°40.3	1.2 - 0.2	7.2 - 1.4	13.2 - 2.5
13	2°48.3	2°48.7	2°40.6	1.3 - 0.2	7.3 - 1.4	13.3 - 2.5
14	2°48.5	2°49.0	2°40.8	1.4 - 0.3	7.4 - 1.4	13.4 - 2.6
15	2°48.8	2°49.2	2°41.1	1.5 - 0.3	7.5 - 1.4	13.5 - 2.6
16	2°49.0	2°49.5	2°41.3	1.6 - 0.3	7.6 - 1.5	13.6 - 2.6
17	2°49.3	2°49.7	2°41.5	1.7 - 0.3	7.7 - 1.5	13.7 - 2.6
18	2°49.5	2°50.0	2°41.8	1.8 - 0.3	7.8 - 1.5	13.8 - 2.6
19	2°49.8	2°50.2	2°42.0	1.9 - 0.4	7.9 - 1.5	13.9 - 2.7
20	2°50.0	2°50.5	2°42.3	2.0 - 0.4	8.0 - 1.5	14.0 - 2.7
21	2°50.2	2°50.7	2°42.5	2.1 - 0.4	8.1 - 1.6	14.1 - 2.7
22	2°50.5	2°51.0	2°42.7	2.2 - 0.4	8.2 - 1.6	14.2 - 2.7
23	2°50.7	2°51.2	2°43.0	2.3 - 0.4	8.3 - 1.6	14.3 - 2.7
24	2°51.0	2°51.5	2°43.2	2.4 - 0.5	8.4 - 1.6	14.4 - 2.8
25	2°51.2	2°51.7	2°43.4	2.5 - 0.5	8.5 - 1.6	14.5 - 2.8
26	2°51.5	2°52.0	2°43.7	2.6 - 0.5	8.6 - 1.6	14.6 - 2.8
27	2°51.7	2°52.2	2°43.9	2.7 - 0.5	8.7 - 1.7	14.7 - 2.8
28	2°52.0	2°52.5	2°44.2	2.8 - 0.5	8.8 - 1.7	14.8 - 2.8
29	2°52.2	2°52.7	2°44.4	2.9 - 0.6	8.9 - 1.7	14.9 - 2.9
30	2°52.5	2°53.0	2°44.6	3.0 - 0.6	9.0 - 1.7	15.0 - 2.9
31	2°52.8	2°53.2	2°44.9	3.1 - 0.6	9.1 - 1.7	15.1 - 2.9
32	2°53.0	2°53.5	2°45.1	3.2 - 0.6	9.2 - 1.8	15.2 - 2.9
33	2°53.3	2°53.7	2°45.4	3.3 - 0.6	9.3 - 1.8	15.3 - 2.9
34	2°53.5	2°54.0	2°45.6	3.4 - 0.7	9.4 - 1.8	15.4 - 3.0
35	2°53.8	2°54.2	2°45.8	3.5 - 0.7	9.5 - 1.8	15.5 - 3.0
36	2°54.0	2°54.5	2°46.1	3.6 - 0.7	9.6 - 1.8	15.6 - 3.0
37	2°54.3	2°54.7	2°46.3	3.7 - 0.7	9.7 - 1.9	15.7 - 3.0
38	2°54.5	2°55.0	2°46.6	3.8 - 0.7	9.8 - 1.9	15.8 - 3.0
39	2°54.8	2°55.2	2°46.8	3.9 - 0.7	9.9 - 1.9	15.9 - 3.0
40	2°55.0	2°55.5	2°47.0	4.0 - 0.8	10.0 - 1.9	16.0 - 3.1
41	2°55.3	2°55.7	2°47.3	4.1 - 0.8	10.1 - 1.9	16.1 - 3.1
42	2°55.5	2°56.0	2°47.5	4.2 - 0.8	10.2 - 2.0	16.2 - 3.1
43	2°55.8	2°56.2	2°47.7	4.3 - 0.8	10.3 - 2.0	16.3 - 3.1
44	2°56.0	2°56.5	2°48.0	4.4 - 0.8	10.4 - 2.0	16.4 - 3.1
45	2°56.3	2°56.7	2°48.2	4.5 - 0.9	10.5 - 2.0	16.5 - 3.2
46	2°56.5	2°57.0	2°48.5	4.6 - 0.9	10.6 - 2.0	16.6 - 3.2
47	2°56.8	2°57.2	2°48.7	4.7 - 0.9	10.7 - 2.1	16.7 - 3.2
48	2°57.0	2°57.5	2°48.9	4.8 - 0.9	10.8 - 2.1	16.8 - 3.2
49	2°57.3	2°57.7	2°49.2	4.9 - 0.9	10.9 - 2.1	16.9 - 3.2
50	2°57.5	2°58.0	2°49.4	5.0 - 1.0	11.0 - 2.1	17.0 - 3.3
51	2°57.7	2°58.2	2°49.7	5.1 - 1.0	11.1 - 2.1	17.1 - 3.3
52	2°58.0	2°58.5	2°49.9	5.2 - 1.0	11.2 - 2.1	17.2 - 3.3
53	2°58.2	2°58.7	2°50.1	5.3 - 1.0	11.3 - 2.2	17.3 - 3.3
54	2°58.5	2°59.0	2°50.4	5.4 - 1.0	11.4 - 2.2	17.4 - 3.3
55	2°58.7	2°59.2	2°50.6	5.5 - 1.1	11.5 - 2.2	17.5 - 3.4
56	2°59.0	2°59.5	2°50.8	5.6 - 1.1	11.6 - 2.2	17.6 - 3.4
57	2°59.2	2°59.7	2°51.1	5.7 - 1.1	11.7 - 2.2	17.7 - 3.4
58	2°59.5	3°00.0	2°51.3	5.8 - 1.1	11.8 - 2.3	17.8 - 3.4
59	2°59.7	3°00.2	2°51.6	5.9 - 1.1	11.9 - 2.3	17.9 - 3.4

Increments and Corrections

m 12	Sun Plan.	Aries	Moon	v and d corr		
0	3°00.0	3°00.5	2°51.8	0.0 - 0.0	6.0 - 1.3	12.0 - 2.5
1	3°00.3	3°00.7	2°52.0	0.1 - 0.0	6.1 - 1.3	12.1 - 2.5
2	3°00.5	3°01.0	2°52.3	0.2 - 0.0	6.2 - 1.3	12.2 - 2.5
3	3°00.8	3°01.2	2°52.5	0.3 - 0.1	6.3 - 1.3	12.3 - 2.6
4	3°01.0	3°01.5	2°52.8	0.4 - 0.1	6.4 - 1.3	12.4 - 2.6
5	3°01.3	3°01.7	2°53.0	0.5 - 0.1	6.5 - 1.4	12.5 - 2.6
6	3°01.5	3°02.0	2°53.2	0.6 - 0.1	6.6 - 1.4	12.6 - 2.6
7	3°01.8	3°02.2	2°53.5	0.7 - 0.1	6.7 - 1.4	12.7 - 2.6
8	3°02.0	3°02.5	2°53.7	0.8 - 0.2	6.8 - 1.4	12.8 - 2.7
9	3°02.3	3°02.7	2°53.9	0.9 - 0.2	6.9 - 1.4	12.9 - 2.7
10	3°02.5	3°03.0	2°54.2	1.0 - 0.2	7.0 - 1.5	13.0 - 2.7
11	3°02.8	3°03.2	2°54.4	1.1 - 0.2	7.1 - 1.5	13.1 - 2.7
12	3°03.0	3°03.5	2°54.7	1.2 - 0.3	7.2 - 1.5	13.2 - 2.8
13	3°03.3	3°03.8	2°54.9	1.3 - 0.3	7.3 - 1.5	13.3 - 2.8
14	3°03.5	3°04.0	2°55.1	1.4 - 0.3	7.4 - 1.5	13.4 - 2.8
15	3°03.8	3°04.3	2°55.4	1.5 - 0.3	7.5 - 1.6	13.5 - 2.8
16	3°04.0	3°04.5	2°55.6	1.6 - 0.3	7.6 - 1.6	13.6 - 2.8
17	3°04.2	3°04.8	2°55.9	1.7 - 0.4	7.7 - 1.6	13.7 - 2.9
18	3°04.5	3°05.0	2°56.1	1.8 - 0.4	7.8 - 1.6	13.8 - 2.9
19	3°04.7	3°05.3	2°56.3	1.9 - 0.4	7.9 - 1.6	13.9 - 2.9
20	3°05.0	3°05.5	2°56.6	2.0 - 0.4	8.0 - 1.7	14.0 - 2.9
21	3°05.2	3°05.8	2°56.8	2.1 - 0.4	8.1 - 1.7	14.1 - 2.9
22	3°05.5	3°06.0	2°57.0	2.2 - 0.5	8.2 - 1.7	14.2 - 3.0
23	3°05.7	3°06.3	2°57.3	2.3 - 0.5	8.3 - 1.7	14.3 - 3.0
24	3°06.0	3°06.5	2°57.5	2.4 - 0.5	8.4 - 1.8	14.4 - 3.0
25	3°06.2	3°06.8	2°57.8	2.5 - 0.5	8.5 - 1.8	14.5 - 3.0
26	3°06.5	3°07.0	2°58.0	2.6 - 0.5	8.6 - 1.8	14.6 - 3.0
27	3°06.7	3°07.3	2°58.2	2.7 - 0.6	8.7 - 1.8	14.7 - 3.1
28	3°07.0	3°07.5	2°58.5	2.8 - 0.6	8.8 - 1.8	14.8 - 3.1
29	3°07.2	3°07.8	2°58.7	2.9 - 0.6	8.9 - 1.9	14.9 - 3.1
30	3°07.5	3°08.0	2°59.0	3.0 - 0.6	9.0 - 1.9	15.0 - 3.1
31	3°07.8	3°08.3	2°59.2	3.1 - 0.6	9.1 - 1.9	15.1 - 3.1
32	3°08.0	3°08.5	2°59.4	3.2 - 0.7	9.2 - 1.9	15.2 - 3.2
33	3°08.3	3°08.8	2°59.7	3.3 - 0.7	9.3 - 1.9	15.3 - 3.2
34	3°08.5	3°09.0	2°59.9	3.4 - 0.7	9.4 - 2.0	15.4 - 3.2
35	3°08.8	3°09.3	3°00.2	3.5 - 0.7	9.5 - 2.0	15.5 - 3.2
36	3°09.0	3°09.5	3°00.4	3.6 - 0.8	9.6 - 2.0	15.6 - 3.3
37	3°09.3	3°09.8	3°00.6	3.7 - 0.8	9.7 - 2.0	15.7 - 3.3
38	3°09.5	3°10.0	3°00.9	3.8 - 0.8	9.8 - 2.0	15.8 - 3.3
39	3°09.8	3°10.3	3°01.1	3.9 - 0.8	9.9 - 2.1	15.9 - 3.3
40	3°10.0	3°10.5	3°01.3	4.0 - 0.8	10.0 - 2.1	16.0 - 3.3
41	3°10.3	3°10.8	3°01.6	4.1 - 0.9	10.1 - 2.1	16.1 - 3.4
42	3°10.5	3°11.0	3°01.8	4.2 - 0.9	10.2 - 2.1	16.2 - 3.4
43	3°10.8	3°11.3	3°02.1	4.3 - 0.9	10.3 - 2.1	16.3 - 3.4
44	3°11.0	3°11.5	3°02.3	4.4 - 0.9	10.4 - 2.2	16.4 - 3.4
45	3°11.3	3°11.8	3°02.5	4.5 - 0.9	10.5 - 2.2	16.5 - 3.4
46	3°11.5	3°12.0	3°02.8	4.6 - 1.0	10.6 - 2.2	16.6 - 3.5
47	3°11.7	3°12.3	3°03.0	4.7 - 1.0	10.7 - 2.2	16.7 - 3.5
48	3°12.0	3°12.5	3°03.3	4.8 - 1.0	10.8 - 2.3	16.8 - 3.5
49	3°12.2	3°12.8	3°03.5	4.9 - 1.0	10.9 - 2.3	16.9 - 3.5
50	3°12.5	3°13.0	3°03.7	5.0 - 1.0	11.0 - 2.3	17.0 - 3.5
51	3°12.7	3°13.3	3°04.0	5.1 - 1.1	11.1 - 2.3	17.1 - 3.6
52	3°13.0	3°13.5	3°04.2	5.2 - 1.1	11.2 - 2.3	17.2 - 3.6
53	3°13.2	3°13.8	3°04.4	5.3 - 1.1	11.3 - 2.4	17.3 - 3.6
54	3°13.5	3°14.0	3°04.7	5.4 - 1.1	11.4 - 2.4	17.4 - 3.6
55	3°13.7	3°14.3	3°04.9	5.5 - 1.1	11.5 - 2.4	17.5 - 3.6
56	3°14.0	3°14.5	3°05.2	5.6 - 1.2	11.6 - 2.4	17.6 - 3.7
57	3°14.2	3°14.8	3°05.4	5.7 - 1.2	11.7 - 2.4	17.7 - 3.7
58	3°14.5	3°15.0	3°05.6	5.8 - 1.2	11.8 - 2.5	17.8 - 3.7
59	3°14.7	3°15.3	3°05.9	5.9 - 1.2	11.9 - 2.5	17.9 - 3.7

m 13	Sun Plan.	Aries	Moon	v and d corr		
0	3°15.0	3°15.5	3°06.1	0.0 - 0.0	6.0 - 1.4	12.0 - 2.7
1	3°15.3	3°15.8	3°06.4	0.1 - 0.0	6.1 - 1.4	12.1 - 2.7
2	3°15.5	3°16.0	3°06.6	0.2 - 0.0	6.2 - 1.4	12.2 - 2.7
3	3°15.8	3°16.3	3°06.8	0.3 - 0.1	6.3 - 1.4	12.3 - 2.8
4	3°16.0	3°16.5	3°07.1	0.4 - 0.1	6.4 - 1.4	12.4 - 2.8
5	3°16.3	3°16.8	3°07.3	0.5 - 0.1	6.5 - 1.5	12.5 - 2.8
6	3°16.5	3°17.0	3°07.5	0.6 - 0.1	6.6 - 1.5	12.6 - 2.8
7	3°16.8	3°17.3	3°07.8	0.7 - 0.2	6.7 - 1.5	12.7 - 2.9
8	3°17.0	3°17.5	3°08.0	0.8 - 0.2	6.8 - 1.5	12.8 - 2.9
9	3°17.3	3°17.8	3°08.3	0.9 - 0.2	6.9 - 1.6	12.9 - 2.9
10	3°17.5	3°18.0	3°08.5	1.0 - 0.2	7.0 - 1.6	13.0 - 2.9
11	3°17.8	3°18.3	3°08.7	1.1 - 0.2	7.1 - 1.6	13.1 - 2.9
12	3°18.0	3°18.5	3°09.0	1.2 - 0.3	7.2 - 1.6	13.2 - 3.0
13	3°18.3	3°18.8	3°09.2	1.3 - 0.3	7.3 - 1.6	13.3 - 3.0
14	3°18.5	3°19.0	3°09.5	1.4 - 0.3	7.4 - 1.7	13.4 - 3.0
15	3°18.8	3°19.3	3°09.7	1.5 - 0.3	7.5 - 1.7	13.5 - 3.0
16	3°19.0	3°19.5	3°09.9	1.6 - 0.4	7.6 - 1.7	13.6 - 3.1
17	3°19.3	3°19.8	3°10.2	1.7 - 0.4	7.7 - 1.7	13.7 - 3.1
18	3°19.5	3°20.0	3°10.4	1.8 - 0.4	7.8 - 1.8	13.8 - 3.1
19	3°19.7	3°20.3	3°10.7	1.9 - 0.4	7.9 - 1.8	13.9 - 3.1
20	3°20.0	3°20.5	3°10.9	2.0 - 0.5	8.0 - 1.8	14.0 - 3.1
21	3°20.2	3°20.8	3°11.1	2.1 - 0.5	8.1 - 1.8	14.1 - 3.2
22	3°20.5	3°21.0	3°11.4	2.2 - 0.5	8.2 - 1.8	14.2 - 3.2
23	3°20.7	3°21.3	3°11.6	2.3 - 0.5	8.3 - 1.9	14.3 - 3.2
24	3°21.0	3°21.5	3°11.8	2.4 - 0.5	8.4 - 1.9	14.4 - 3.2
25	3°21.2	3°21.8	3°12.1	2.5 - 0.6	8.5 - 1.9	14.5 - 3.3
26	3°21.5	3°22.1	3°12.3	2.6 - 0.6	8.6 - 1.9	14.6 - 3.3
27	3°21.7	3°22.3	3°12.6	2.7 - 0.6	8.7 - 2.0	14.7 - 3.3
28	3°22.0	3°22.6	3°12.8	2.8 - 0.6	8.8 - 2.0	14.8 - 3.3
29	3°22.2	3°22.8	3°13.0	2.9 - 0.7	8.9 - 2.0	14.9 - 3.4
30	3°22.5	3°23.1	3°13.3	3.0 - 0.7	9.0 - 2.0	15.0 - 3.4
31	3°22.8	3°23.3	3°13.5	3.1 - 0.7	9.1 - 2.0	15.1 - 3.4
32	3°23.0	3°23.6	3°13.8	3.2 - 0.7	9.2 - 2.1	15.2 - 3.4
33	3°23.3	3°23.8	3°14.0	3.3 - 0.7	9.3 - 2.1	15.3 - 3.4
34	3°23.5	3°24.1	3°14.2	3.4 - 0.8	9.4 - 2.1	15.4 - 3.5
35	3°23.8	3°24.3	3°14.5	3.5 - 0.8	9.5 - 2.1	15.5 - 3.5
36	3°24.0	3°24.6	3°14.7	3.6 - 0.8	9.6 - 2.2	15.6 - 3.5
37	3°24.3	3°24.8	3°14.9	3.7 - 0.8	9.7 - 2.2	15.7 - 3.5
38	3°24.5	3°25.1	3°15.2	3.8 - 0.9	9.8 - 2.2	15.8 - 3.6
39	3°24.8	3°25.3	3°15.4	3.9 - 0.9	9.9 - 2.2	15.9 - 3.6
40	3°25.0	3°25.6	3°15.7	4.0 - 0.9	10.0 - 2.3	16.0 - 3.6
41	3°25.3	3°25.8	3°15.9	4.1 - 0.9	10.1 - 2.3	16.1 - 3.6
42	3°25.5	3°26.1	3°16.1	4.2 - 0.9	10.2 - 2.3	16.2 - 3.6
43	3°25.8	3°26.3	3°16.4	4.3 - 1.0	10.3 - 2.3	16.3 - 3.7
44	3°26.0	3°26.6	3°16.6	4.4 - 1.0	10.4 - 2.3	16.4 - 3.7
45	3°26.3	3°26.8	3°16.9	4.5 - 1.0	10.5 - 2.4	16.5 - 3.7
46	3°26.5	3°27.1	3°17.1	4.6 - 1.0	10.6 - 2.4	16.6 - 3.7
47	3°26.8	3°27.3	3°17.3	4.7 - 1.1	10.7 - 2.4	16.7 - 3.8
48	3°27.0	3°27.6	3°17.6	4.8 - 1.1	10.8 - 2.4	16.8 - 3.8
49	3°27.2	3°27.8	3°17.8	4.9 - 1.1	10.9 - 2.5	16.9 - 3.8
50	3°27.5	3°28.1	3°18.0	5.0 - 1.1	11.0 - 2.5	17.0 - 3.8
51	3°27.7	3°28.3	3°18.3	5.1 - 1.1	11.1 - 2.5	17.1 - 3.8
52	3°28.0	3°28.6	3°18.5	5.2 - 1.2	11.2 - 2.5	17.2 - 3.9
53	3°28.2	3°28.8	3°18.8	5.3 - 1.2	11.3 - 2.5	17.3 - 3.9
54	3°28.5	3°29.1	3°19.0	5.4 - 1.2	11.4 - 2.6	17.4 - 3.9
55	3°28.7	3°29.3	3°19.2	5.5 - 1.2	11.5 - 2.6	17.5 - 3.9
56	3°29.0	3°29.6	3°19.5	5.6 - 1.3	11.6 - 2.6	17.6 - 4.0
57	3°29.2	3°29.8	3°19.7	5.7 - 1.3	11.7 - 2.6	17.7 - 4.0
58	3°29.5	3°30.1	3°20.0	5.8 - 1.3	11.8 - 2.7	17.8 - 4.0
59	3°29.7	3°30.3	3°20.2	5.9 - 1.3	11.9 - 2.7	17.9 - 4.0

m 14	Sun Plan.	Aries	Moon	v and d corr		
0	3°30.0	3°30.6	3°20.4	0.0 - 0.0	6.0 - 1.4	12.0 - 2.9
1	3°30.3	3°30.8	3°20.7	0.1 - 0.0	6.1 - 1.5	12.1 - 2.9
2	3°30.5	3°31.1	3°20.9	0.2 - 0.0	6.2 - 1.5	12.2 - 2.9
3	3°30.8	3°31.3	3°21.1	0.3 - 0.1	6.3 - 1.5	12.3 - 3.0
4	3°31.0	3°31.6	3°21.4	0.4 - 0.1	6.4 - 1.5	12.4 - 3.0
5	3°31.3	3°31.8	3°21.6	0.5 - 0.1	6.5 - 1.6	12.5 - 3.0
6	3°31.5	3°32.1	3°21.9	0.6 - 0.1	6.6 - 1.6	12.6 - 3.0
7	3°31.8	3°32.3	3°22.1	0.7 - 0.2	6.7 - 1.6	12.7 - 3.1
8	3°32.0	3°32.6	3°22.3	0.8 - 0.2	6.8 - 1.6	12.8 - 3.1
9	3°32.3	3°32.8	3°22.6	0.9 - 0.2	6.9 - 1.7	12.9 - 3.1
10	3°32.5	3°33.1	3°22.8	1.0 - 0.2	7.0 - 1.7	13.0 - 3.1
11	3°32.8	3°33.3	3°23.1	1.1 - 0.3	7.1 - 1.7	13.1 - 3.2
12	3°33.0	3°33.6	3°23.3	1.2 - 0.3	7.2 - 1.7	13.2 - 3.2
13	3°33.3	3°33.8	3°23.5	1.3 - 0.3	7.3 - 1.8	13.3 - 3.2
14	3°33.5	3°34.1	3°23.8	1.4 - 0.3	7.4 - 1.8	13.4 - 3.2
15	3°33.8	3°34.3	3°24.0	1.5 - 0.4	7.5 - 1.8	13.5 - 3.3
16	3°34.0	3°34.6	3°24.3	1.6 - 0.4	7.6 - 1.8	13.6 - 3.3
17	3°34.3	3°34.8	3°24.5	1.7 - 0.4	7.7 - 1.9	13.7 - 3.3
18	3°34.5	3°35.1	3°24.7	1.8 - 0.4	7.8 - 1.9	13.8 - 3.3
19	3°34.8	3°35.3	3°25.0	1.9 - 0.5	7.9 - 1.9	13.9 - 3.4
20	3°35.0	3°35.6	3°25.2	2.0 - 0.5	8.0 - 1.9	14.0 - 3.4
21	3°35.2	3°35.8	3°25.4	2.1 - 0.5	8.1 - 2.0	14.1 - 3.4
22	3°35.5	3°36.1	3°25.7	2.2 - 0.5	8.2 - 2.0	14.2 - 3.4
23	3°35.7	3°36.3	3°25.9	2.3 - 0.6	8.3 - 2.0	14.3 - 3.5
24	3°36.0	3°36.6	3°26.2	2.4 - 0.6	8.4 - 2.0	14.4 - 3.5
25	3°36.2	3°36.8	3°26.4	2.5 - 0.6	8.5 - 2.1	14.5 - 3.5
26	3°36.5	3°37.1	3°26.6	2.6 - 0.6	8.6 - 2.1	14.6 - 3.5
27	3°36.7	3°37.3	3°26.9	2.7 - 0.7	8.7 - 2.1	14.7 - 3.6
28	3°37.0	3°37.6	3°27.1	2.8 - 0.7	8.8 - 2.1	14.8 - 3.6
29	3°37.2	3°37.8	3°27.4	2.9 - 0.7	8.9 - 2.2	14.9 - 3.6
30	3°37.5	3°38.1	3°27.6	3.0 - 0.7	9.0 - 2.2	15.0 - 3.6
31	3°37.8	3°38.3	3°27.8	3.1 - 0.7	9.1 - 2.2	15.1 - 3.6
32	3°38.0	3°38.6	3°28.1	3.2 - 0.8	9.2 - 2.2	15.2 - 3.7
33	3°38.3	3°38.8	3°28.3	3.3 - 0.8	9.3 - 2.2	15.3 - 3.7
34	3°38.5	3°39.1	3°28.5	3.4 - 0.8	9.4 - 2.3	15.4 - 3.7
35	3°38.8	3°39.3	3°28.8	3.5 - 0.8	9.5 - 2.3	15.5 - 3.7
36	3°39.0	3°39.6	3°29.0	3.6 - 0.9	9.6 - 2.3	15.6 - 3.8
37	3°39.3	3°39.8	3°29.3	3.7 - 0.9	9.7 - 2.3	15.7 - 3.8
38	3°39.5	3°40.1	3°29.5	3.8 - 0.9	9.8 - 2.4	15.8 - 3.8
39	3°39.8	3°40.4	3°29.7	3.9 - 0.9	9.9 - 2.4	15.9 - 3.8
40	3°40.0	3°40.6	3°30.0	4.0 - 1.0	10.0 - 2.4	16.0 - 3.9
41	3°40.3	3°40.9	3°30.2	4.1 - 1.0	10.1 - 2.4	16.1 - 3.9
42	3°40.5	3°41.1	3°30.5	4.2 - 1.0	10.2 - 2.5	16.2 - 3.9
43	3°40.8	3°41.4	3°30.7	4.3 - 1.0	10.3 - 2.5	16.3 - 3.9
44	3°41.0	3°41.6	3°30.9	4.4 - 1.1	10.4 - 2.5	16.4 - 4.0
45	3°41.3	3°41.9	3°31.2	4.5 - 1.1	10.5 - 2.5	16.5 - 4.0
46	3°41.5	3°42.1	3°31.4	4.6 - 1.1	10.6 - 2.6	16.6 - 4.0
47	3°41.8	3°42.4	3°31.6	4.7 - 1.1	10.7 - 2.6	16.7 - 4.0
48	3°42.0	3°42.6	3°31.9	4.8 - 1.2	10.8 - 2.6	16.8 - 4.1
49	3°42.3	3°42.9	3°32.1	4.9 - 1.2	10.9 - 2.6	16.9 - 4.1
50	3°42.5	3°43.1	3°32.4	5.0 - 1.2	11.0 - 2.7	17.0 - 4.1
51	3°42.7	3°43.4	3°32.6	5.1 - 1.2	11.1 - 2.7	17.1 - 4.1
52	3°43.0	3°43.6	3°32.8	5.2 - 1.3	11.2 - 2.7	17.2 - 4.2
53	3°43.2	3°43.9	3°33.1	5.3 - 1.3	11.3 - 2.7	17.3 - 4.2
54	3°43.5	3°44.1	3°33.3	5.4 - 1.3	11.4 - 2.8	17.4 - 4.2
55	3°43.7	3°44.4	3°33.6	5.5 - 1.3	11.5 - 2.8	17.5 - 4.2
56	3°44.0	3°44.6	3°33.8	5.6 - 1.4	11.6 - 2.8	17.6 - 4.3
57	3°44.2	3°44.9	3°34.0	5.7 - 1.4	11.7 - 2.8	17.7 - 4.3
58	3°44.5	3°45.1	3°34.3	5.8 - 1.4	11.8 - 2.9	17.8 - 4.3
59	3°44.7	3°45.4	3°34.5	5.9 - 1.4	11.9 - 2.9	17.9 - 4.3

Increments and Corrections

m 15	Sun Plan.	Aries	Moon	v and d corr		
0	3°45.0	3°45.6	3°34.8	0.0 - 0.0	6.0 - 1.6	12.0 - 3.1
1	3°45.2	3°45.9	3°35.0	0.1 - 0.0	6.1 - 1.6	12.1 - 3.1
2	3°45.5	3°46.1	3°35.2	0.2 - 0.1	6.2 - 1.6	12.2 - 3.2
3	3°45.8	3°46.4	3°35.5	0.3 - 0.1	6.3 - 1.6	12.3 - 3.2
4	3°46.0	3°46.6	3°35.7	0.4 - 0.1	6.4 - 1.7	12.4 - 3.2
5	3°46.2	3°46.9	3°35.9	0.5 - 0.1	6.5 - 1.7	12.5 - 3.2
6	3°46.5	3°47.1	3°36.2	0.6 - 0.2	6.6 - 1.7	12.6 - 3.3
7	3°46.8	3°47.4	3°36.4	0.7 - 0.2	6.7 - 1.7	12.7 - 3.3
8	3°47.0	3°47.6	3°36.7	0.8 - 0.2	6.8 - 1.8	12.8 - 3.3
9	3°47.3	3°47.9	3°36.9	0.9 - 0.2	6.9 - 1.8	12.9 - 3.3
10	3°47.5	3°48.1	3°37.1	1.0 - 0.3	7.0 - 1.8	13.0 - 3.4
11	3°47.7	3°48.4	3°37.4	1.1 - 0.3	7.1 - 1.8	13.1 - 3.4
12	3°48.0	3°48.6	3°37.6	1.2 - 0.3	7.2 - 1.9	13.2 - 3.4
13	3°48.3	3°48.9	3°37.9	1.3 - 0.3	7.3 - 1.9	13.3 - 3.4
14	3°48.5	3°49.1	3°38.1	1.4 - 0.4	7.4 - 1.9	13.4 - 3.5
15	3°48.8	3°49.4	3°38.3	1.5 - 0.4	7.5 - 1.9	13.5 - 3.5
16	3°49.0	3°49.6	3°38.6	1.6 - 0.4	7.6 - 2.0	13.6 - 3.5
17	3°49.3	3°49.9	3°38.8	1.7 - 0.4	7.7 - 2.0	13.7 - 3.5
18	3°49.5	3°50.1	3°39.0	1.8 - 0.5	7.8 - 2.0	13.8 - 3.6
19	3°49.8	3°50.4	3°39.3	1.9 - 0.5	7.9 - 2.0	13.9 - 3.6
20	3°50.0	3°50.6	3°39.5	2.0 - 0.5	8.0 - 2.1	14.0 - 3.6
21	3°50.2	3°50.9	3°39.8	2.1 - 0.5	8.1 - 2.1	14.1 - 3.6
22	3°50.5	3°51.1	3°40.0	2.2 - 0.6	8.2 - 2.1	14.2 - 3.7
23	3°50.7	3°51.4	3°40.2	2.3 - 0.6	8.3 - 2.1	14.3 - 3.7
24	3°51.0	3°51.6	3°40.5	2.4 - 0.6	8.4 - 2.2	14.4 - 3.7
25	3°51.2	3°51.9	3°40.7	2.5 - 0.6	8.5 - 2.2	14.5 - 3.7
26	3°51.5	3°52.1	3°41.0	2.6 - 0.7	8.6 - 2.2	14.6 - 3.8
27	3°51.8	3°52.4	3°41.2	2.7 - 0.7	8.7 - 2.2	14.7 - 3.8
28	3°52.0	3°52.6	3°41.4	2.8 - 0.7	8.8 - 2.3	14.8 - 3.8
29	3°52.2	3°52.9	3°41.7	2.9 - 0.7	8.9 - 2.3	14.9 - 3.8
30	3°52.5	3°53.1	3°41.9	3.0 - 0.8	9.0 - 2.3	15.0 - 3.9
31	3°52.8	3°53.4	3°42.1	3.1 - 0.8	9.1 - 2.4	15.1 - 3.9
32	3°53.0	3°53.6	3°42.4	3.2 - 0.8	9.2 - 2.4	15.2 - 3.9
33	3°53.2	3°53.9	3°42.6	3.3 - 0.9	9.3 - 2.4	15.3 - 4.0
34	3°53.5	3°54.1	3°42.9	3.4 - 0.9	9.4 - 2.4	15.4 - 4.0
35	3°53.8	3°54.4	3°43.1	3.5 - 0.9	9.5 - 2.5	15.5 - 4.0
36	3°54.0	3°54.6	3°43.3	3.6 - 0.9	9.6 - 2.5	15.6 - 4.0
37	3°54.3	3°54.9	3°43.6	3.7 - 1.0	9.7 - 2.5	15.7 - 4.1
38	3°54.5	3°55.1	3°43.8	3.8 - 1.0	9.8 - 2.5	15.8 - 4.1
39	3°54.8	3°55.4	3°44.1	3.9 - 1.0	9.9 - 2.6	15.9 - 4.1
40	3°55.0	3°55.6	3°44.3	4.0 - 1.0	10.0 - 2.6	16.0 - 4.1
41	3°55.3	3°55.9	3°44.5	4.1 - 1.1	10.1 - 2.6	16.1 - 4.2
42	3°55.5	3°56.1	3°44.8	4.2 - 1.1	10.2 - 2.6	16.2 - 4.2
43	3°55.7	3°56.4	3°45.0	4.3 - 1.1	10.3 - 2.7	16.3 - 4.2
44	3°56.0	3°56.6	3°45.2	4.4 - 1.1	10.4 - 2.7	16.4 - 4.2
45	3°56.3	3°56.9	3°45.5	4.5 - 1.2	10.5 - 2.7	16.5 - 4.3
46	3°56.5	3°57.1	3°45.7	4.6 - 1.2	10.6 - 2.7	16.6 - 4.3
47	3°56.8	3°57.4	3°46.0	4.7 - 1.2	10.7 - 2.8	16.7 - 4.3
48	3°57.0	3°57.6	3°46.2	4.8 - 1.2	10.8 - 2.8	16.8 - 4.3
49	3°57.3	3°57.9	3°46.4	4.9 - 1.3	10.9 - 2.8	16.9 - 4.4
50	3°57.5	3°58.1	3°46.7	5.0 - 1.3	11.0 - 2.8	17.0 - 4.4
51	3°57.7	3°58.4	3°46.9	5.1 - 1.3	11.1 - 2.9	17.1 - 4.4
52	3°58.0	3°58.7	3°47.2	5.2 - 1.3	11.2 - 2.9	17.2 - 4.4
53	3°58.2	3°58.9	3°47.4	5.3 - 1.4	11.3 - 2.9	17.3 - 4.5
54	3°58.5	3°59.2	3°47.6	5.4 - 1.4	11.4 - 2.9	17.4 - 4.5
55	3°58.7	3°59.4	3°47.9	5.5 - 1.4	11.5 - 3.0	17.5 - 4.5
56	3°59.0	3°59.7	3°48.1	5.6 - 1.4	11.6 - 3.0	17.6 - 4.5
57	3°59.2	3°59.9	3°48.4	5.7 - 1.5	11.7 - 3.0	17.7 - 4.6
58	3°59.5	4°00.2	3°48.6	5.8 - 1.5	11.8 - 3.0	17.8 - 4.6
59	3°59.8	4°00.4	3°48.8	5.9 - 1.5	11.9 - 3.1	17.9 - 4.6

m 16	Sun Plan.	Aries	Moon	v and d corr		
0	4°00.0	4°00.7	3°49.1	0.0 - 0.0	6.0 - 1.7	12.0 - 3.3
1	4°00.2	4°00.9	3°49.3	0.1 - 0.0	6.1 - 1.7	12.1 - 3.3
2	4°00.5	4°01.2	3°49.5	0.2 - 0.1	6.2 - 1.7	12.2 - 3.4
3	4°00.8	4°01.4	3°49.8	0.3 - 0.1	6.3 - 1.7	12.3 - 3.4
4	4°01.0	4°01.7	3°50.0	0.4 - 0.1	6.4 - 1.8	12.4 - 3.4
5	4°01.2	4°01.9	3°50.3	0.5 - 0.1	6.5 - 1.8	12.5 - 3.4
6	4°01.5	4°02.2	3°50.5	0.6 - 0.2	6.6 - 1.8	12.6 - 3.5
7	4°01.8	4°02.4	3°50.7	0.7 - 0.2	6.7 - 1.8	12.7 - 3.5
8	4°02.0	4°02.7	3°51.0	0.8 - 0.2	6.8 - 1.9	12.8 - 3.5
9	4°02.2	4°02.9	3°51.2	0.9 - 0.2	6.9 - 1.9	12.9 - 3.5
10	4°02.5	4°03.2	3°51.5	1.0 - 0.3	7.0 - 1.9	13.0 - 3.6
11	4°02.8	4°03.4	3°51.7	1.1 - 0.3	7.1 - 2.0	13.1 - 3.6
12	4°03.0	4°03.7	3°51.9	1.2 - 0.3	7.2 - 2.0	13.2 - 3.6
13	4°03.2	4°03.9	3°52.2	1.3 - 0.4	7.3 - 2.0	13.3 - 3.7
14	4°03.5	4°04.2	3°52.4	1.4 - 0.4	7.4 - 2.0	13.4 - 3.7
15	4°03.8	4°04.4	3°52.6	1.5 - 0.4	7.5 - 2.1	13.5 - 3.7
16	4°04.0	4°04.7	3°52.9	1.6 - 0.4	7.6 - 2.1	13.6 - 3.7
17	4°04.3	4°04.9	3°53.1	1.7 - 0.5	7.7 - 2.1	13.7 - 3.8
18	4°04.5	4°05.2	3°53.4	1.8 - 0.5	7.8 - 2.1	13.8 - 3.8
19	4°04.7	4°05.4	3°53.6	1.9 - 0.5	7.9 - 2.2	13.9 - 3.8
20	4°05.0	4°05.7	3°53.8	2.0 - 0.6	8.0 - 2.2	14.0 - 3.9
21	4°05.3	4°05.9	3°54.1	2.1 - 0.6	8.1 - 2.2	14.1 - 3.9
22	4°05.5	4°06.2	3°54.3	2.2 - 0.6	8.2 - 2.3	14.2 - 3.9
23	4°05.7	4°06.4	3°54.6	2.3 - 0.6	8.3 - 2.3	14.3 - 3.9
24	4°06.0	4°06.7	3°54.8	2.4 - 0.7	8.4 - 2.3	14.4 - 4.0
25	4°06.3	4°06.9	3°55.0	2.5 - 0.7	8.5 - 2.3	14.5 - 4.0
26	4°06.5	4°07.2	3°55.3	2.6 - 0.7	8.6 - 2.4	14.6 - 4.0
27	4°06.7	4°07.4	3°55.5	2.7 - 0.7	8.7 - 2.4	14.7 - 4.0
28	4°07.0	4°07.7	3°55.7	2.8 - 0.8	8.8 - 2.4	14.8 - 4.1
29	4°07.3	4°07.9	3°56.0	2.9 - 0.8	8.9 - 2.4	14.9 - 4.1
30	4°07.5	4°08.2	3°56.2	3.0 - 0.8	9.0 - 2.5	15.0 - 4.1
31	4°07.7	4°08.4	3°56.5	3.1 - 0.9	9.1 - 2.5	15.1 - 4.2
32	4°08.0	4°08.7	3°56.7	3.2 - 0.9	9.2 - 2.5	15.2 - 4.2
33	4°08.3	4°08.9	3°56.9	3.3 - 0.9	9.3 - 2.6	15.3 - 4.2
34	4°08.5	4°09.2	3°57.2	3.4 - 0.9	9.4 - 2.6	15.4 - 4.2
35	4°08.7	4°09.4	3°57.4	3.5 - 1.0	9.5 - 2.6	15.5 - 4.3
36	4°09.0	4°09.7	3°57.7	3.6 - 1.0	9.6 - 2.6	15.6 - 4.3
37	4°09.3	4°09.9	3°57.9	3.7 - 1.0	9.7 - 2.7	15.7 - 4.3
38	4°09.5	4°10.2	3°58.1	3.8 - 1.0	9.8 - 2.7	15.8 - 4.3
39	4°09.7	4°10.4	3°58.4	3.9 - 1.1	9.9 - 2.7	15.9 - 4.4
40	4°10.0	4°10.7	3°58.6	4.0 - 1.1	10.0 - 2.8	16.0 - 4.4
41	4°10.3	4°10.9	3°58.8	4.1 - 1.1	10.1 - 2.8	16.1 - 4.4
42	4°10.5	4°11.2	3°59.1	4.2 - 1.2	10.2 - 2.8	16.2 - 4.5
43	4°10.7	4°11.4	3°59.3	4.3 - 1.2	10.3 - 2.8	16.3 - 4.5
44	4°11.0	4°11.7	3°59.6	4.4 - 1.2	10.4 - 2.9	16.4 - 4.5
45	4°11.3	4°11.9	3°59.8	4.5 - 1.2	10.5 - 2.9	16.5 - 4.5
46	4°11.5	4°12.2	4°00.0	4.6 - 1.3	10.6 - 2.9	16.6 - 4.6
47	4°11.8	4°12.4	4°00.3	4.7 - 1.3	10.7 - 2.9	16.7 - 4.6
48	4°12.0	4°12.7	4°00.5	4.8 - 1.3	10.8 - 3.0	16.8 - 4.6
49	4°12.2	4°12.9	4°00.8	4.9 - 1.3	10.9 - 3.0	16.9 - 4.6
50	4°12.5	4°13.2	4°01.0	5.0 - 1.4	11.0 - 3.0	17.0 - 4.7
51	4°12.8	4°13.4	4°01.2	5.1 - 1.4	11.1 - 3.1	17.1 - 4.7
52	4°13.0	4°13.7	4°01.5	5.2 - 1.4	11.2 - 3.1	17.2 - 4.7
53	4°13.2	4°13.9	4°01.7	5.3 - 1.5	11.3 - 3.1	17.3 - 4.8
54	4°13.5	4°14.2	4°02.0	5.4 - 1.5	11.4 - 3.1	17.4 - 4.8
55	4°13.8	4°14.4	4°02.2	5.5 - 1.5	11.5 - 3.2	17.5 - 4.8
56	4°14.0	4°14.7	4°02.4	5.6 - 1.5	11.6 - 3.2	17.6 - 4.8
57	4°14.2	4°14.9	4°02.7	5.7 - 1.6	11.7 - 3.2	17.7 - 4.9
58	4°14.5	4°15.2	4°02.9	5.8 - 1.6	11.8 - 3.2	17.8 - 4.9
59	4°14.8	4°15.4	4°03.1	5.9 - 1.6	11.9 - 3.3	17.9 - 4.9

m 17	Sun Plan.	Aries	Moon	v and d corr		
0	4°15.0	4°15.7	4°03.4	0.0 - 0.0	6.0 - 1.8	12.0 - 3.5
1	4°15.2	4°15.9	4°03.6	0.1 - 0.0	6.1 - 1.8	12.1 - 3.5
2	4°15.5	4°16.2	4°03.9	0.2 - 0.1	6.2 - 1.8	12.2 - 3.6
3	4°15.8	4°16.4	4°04.1	0.3 - 0.1	6.3 - 1.8	12.3 - 3.6
4	4°16.0	4°16.7	4°04.3	0.4 - 0.1	6.4 - 1.9	12.4 - 3.6
5	4°16.2	4°17.0	4°04.6	0.5 - 0.1	6.5 - 1.9	12.5 - 3.6
6	4°16.5	4°17.2	4°04.8	0.6 - 0.2	6.6 - 1.9	12.6 - 3.7
7	4°16.8	4°17.5	4°05.1	0.7 - 0.2	6.7 - 2.0	12.7 - 3.7
8	4°17.0	4°17.7	4°05.3	0.8 - 0.2	6.8 - 2.0	12.8 - 3.7
9	4°17.2	4°18.0	4°05.5	0.9 - 0.3	6.9 - 2.0	12.9 - 3.8
10	4°17.5	4°18.2	4°05.8	1.0 - 0.3	7.0 - 2.0	13.0 - 3.8
11	4°17.8	4°18.5	4°06.0	1.1 - 0.3	7.1 - 2.1	13.1 - 3.8
12	4°18.0	4°18.7	4°06.2	1.2 - 0.4	7.2 - 2.1	13.2 - 3.9
13	4°18.2	4°19.0	4°06.5	1.3 - 0.4	7.3 - 2.1	13.3 - 3.9
14	4°18.5	4°19.2	4°06.7	1.4 - 0.4	7.4 - 2.2	13.4 - 3.9
15	4°18.8	4°19.5	4°07.0	1.5 - 0.4	7.5 - 2.2	13.5 - 3.9
16	4°19.0	4°19.7	4°07.2	1.6 - 0.5	7.6 - 2.2	13.6 - 4.0
17	4°19.3	4°20.0	4°07.4	1.7 - 0.5	7.7 - 2.2	13.7 - 4.0
18	4°19.5	4°20.2	4°07.7	1.8 - 0.5	7.8 - 2.3	13.8 - 4.0
19	4°19.7	4°20.5	4°07.9	1.9 - 0.6	7.9 - 2.3	13.9 - 4.1
20	4°20.0	4°20.7	4°08.2	2.0 - 0.6	8.0 - 2.3	14.0 - 4.1
21	4°20.3	4°21.0	4°08.4	2.1 - 0.6	8.1 - 2.4	14.1 - 4.1
22	4°20.5	4°21.2	4°08.6	2.2 - 0.6	8.2 - 2.4	14.2 - 4.1
23	4°20.7	4°21.5	4°08.9	2.3 - 0.7	8.3 - 2.4	14.3 - 4.2
24	4°21.0	4°21.7	4°09.1	2.4 - 0.7	8.4 - 2.5	14.4 - 4.2
25	4°21.3	4°22.0	4°09.3	2.5 - 0.7	8.5 - 2.5	14.5 - 4.2
26	4°21.5	4°22.2	4°09.6	2.6 - 0.8	8.6 - 2.5	14.6 - 4.3
27	4°21.7	4°22.5	4°09.8	2.7 - 0.8	8.7 - 2.5	14.7 - 4.3
28	4°22.0	4°22.7	4°10.1	2.8 - 0.8	8.8 - 2.6	14.8 - 4.3
29	4°22.3	4°23.0	4°10.3	2.9 - 0.8	8.9 - 2.6	14.9 - 4.3
30	4°22.5	4°23.2	4°10.5	3.0 - 0.9	9.0 - 2.6	15.0 - 4.4
31	4°22.7	4°23.5	4°10.8	3.1 - 0.9	9.1 - 2.7	15.1 - 4.4
32	4°23.0	4°23.7	4°11.0	3.2 - 0.9	9.2 - 2.7	15.2 - 4.4
33	4°23.3	4°24.0	4°11.3	3.3 - 1.0	9.3 - 2.7	15.3 - 4.5
34	4°23.5	4°24.2	4°11.5	3.4 - 1.0	9.4 - 2.7	15.4 - 4.5
35	4°23.7	4°24.5	4°11.7	3.5 - 1.0	9.5 - 2.8	15.5 - 4.5
36	4°24.0	4°24.7	4°12.0	3.6 - 1.1	9.6 - 2.8	15.6 - 4.5
37	4°24.3	4°25.0	4°12.2	3.7 - 1.1	9.7 - 2.8	15.7 - 4.6
38	4°24.5	4°25.2	4°12.5	3.8 - 1.1	9.8 - 2.9	15.8 - 4.6
39	4°24.7	4°25.5	4°12.7	3.9 - 1.1	9.9 - 2.9	15.9 - 4.6
40	4°25.0	4°25.7	4°12.9	4.0 - 1.2	10.0 - 2.9	16.0 - 4.7
41	4°25.3	4°26.0	4°13.2	4.1 - 1.2	10.1 - 2.9	16.1 - 4.7
42	4°25.5	4°26.2	4°13.4	4.2 - 1.2	10.2 - 3.0	16.2 - 4.7
43	4°25.7	4°26.5	4°13.6	4.3 - 1.3	10.3 - 3.0	16.3 - 4.8
44	4°26.0	4°26.7	4°13.9	4.4 - 1.3	10.4 - 3.0	16.4 - 4.8
45	4°26.3	4°27.0	4°14.1	4.5 - 1.3	10.5 - 3.1	16.5 - 4.8
46	4°26.5	4°27.2	4°14.4	4.6 - 1.3	10.6 - 3.1	16.6 - 4.8
47	4°26.8	4°27.5	4°14.6	4.7 - 1.4	10.7 - 3.1	16.7 - 4.9
48	4°27.0	4°27.7	4°14.8	4.8 - 1.4	10.8 - 3.2	16.8 - 4.9
49	4°27.2	4°28.0	4°15.1	4.9 - 1.4	10.9 - 3.2	16.9 - 4.9
50	4°27.5	4°28.2	4°15.3	5.0 - 1.5	11.0 - 3.2	17.0 - 5.0
51	4°27.8	4°28.5	4°15.6	5.1 - 1.5	11.1 - 3.2	17.1 - 5.0
52	4°28.0	4°28.7	4°15.8	5.2 - 1.5	11.2 - 3.3	17.2 - 5.0
53	4°28.2	4°29.0	4°16.0	5.3 - 1.5	11.3 - 3.3	17.3 - 5.0
54	4°28.5	4°29.2	4°16.3	5.4 - 1.6	11.4 - 3.3	17.4 - 5.1
55	4°28.8	4°29.5	4°16.5	5.5 - 1.6	11.5 - 3.4	17.5 - 5.1
56	4°29.0	4°29.7	4°16.7	5.6 - 1.6	11.6 - 3.4	17.6 - 5.1
57	4°29.2	4°30.0	4°17.0	5.7 - 1.7	11.7 - 3.4	17.7 - 5.2
58	4°29.5	4°30.2	4°17.2	5.8 - 1.7	11.8 - 3.4	17.8 - 5.2
59	4°29.8	4°30.5	4°17.5	5.9 - 1.7	11.9 - 3.5	17.9 - 5.2

Increments and Corrections

m	Sun	Aries	Moon	v and d corr		
18	Plan.					
0	4°30.0	4°30.7	4°17.7	0.0 - 0.0	6.0 - 1.9	12.0 - 3.7
1	4°30.2	4°31.0	4°17.9	0.1 - 0.0	6.1 - 1.9	12.1 - 3.7
2	4°30.5	4°31.2	4°18.2	0.2 - 0.1	6.2 - 1.9	12.2 - 3.8
3	4°30.8	4°31.5	4°18.4	0.3 - 0.1	6.3 - 1.9	12.3 - 3.8
4	4°31.0	4°31.7	4°18.7	0.4 - 0.1	6.4 - 2.0	12.4 - 3.8
5	4°31.2	4°32.0	4°18.9	0.5 - 0.2	6.5 - 2.0	12.5 - 3.9
6	4°31.5	4°32.2	4°19.1	0.6 - 0.2	6.6 - 2.0	12.6 - 3.9
7	4°31.8	4°32.5	4°19.4	0.7 - 0.2	6.7 - 2.1	12.7 - 3.9
8	4°32.0	4°32.7	4°19.6	0.8 - 0.2	6.8 - 2.1	12.8 - 3.9
9	4°32.2	4°33.0	4°19.8	0.9 - 0.3	6.9 - 2.1	12.9 - 4.0
10	4°32.5	4°33.2	4°20.1	1.0 - 0.3	7.0 - 2.2	13.0 - 4.0
11	4°32.8	4°33.5	4°20.3	1.1 - 0.3	7.1 - 2.2	13.1 - 4.0
12	4°33.0	4°33.7	4°20.6	1.2 - 0.4	7.2 - 2.2	13.2 - 4.1
13	4°33.2	4°34.0	4°20.8	1.3 - 0.4	7.3 - 2.3	13.3 - 4.1
14	4°33.5	4°34.2	4°21.0	1.4 - 0.4	7.4 - 2.3	13.4 - 4.1
15	4°33.8	4°34.5	4°21.3	1.5 - 0.5	7.5 - 2.3	13.5 - 4.2
16	4°34.0	4°34.7	4°21.5	1.6 - 0.5	7.6 - 2.3	13.6 - 4.2
17	4°34.3	4°35.0	4°21.8	1.7 - 0.5	7.7 - 2.4	13.7 - 4.2
18	4°34.5	4°35.3	4°22.0	1.8 - 0.6	7.8 - 2.4	13.8 - 4.3
19	4°34.8	4°35.5	4°22.2	1.9 - 0.6	7.9 - 2.4	13.9 - 4.3
20	4°35.0	4°35.8	4°22.5	2.0 - 0.6	8.0 - 2.5	14.0 - 4.3
21	4°35.3	4°36.0	4°22.7	2.1 - 0.6	8.1 - 2.5	14.1 - 4.3
22	4°35.5	4°36.3	4°22.9	2.2 - 0.7	8.2 - 2.5	14.2 - 4.4
23	4°35.7	4°36.5	4°23.2	2.3 - 0.7	8.3 - 2.6	14.3 - 4.4
24	4°36.0	4°36.8	4°23.4	2.4 - 0.7	8.4 - 2.6	14.4 - 4.4
25	4°36.3	4°37.0	4°23.7	2.5 - 0.8	8.5 - 2.6	14.5 - 4.5
26	4°36.5	4°37.3	4°23.9	2.6 - 0.8	8.6 - 2.7	14.6 - 4.5
27	4°36.7	4°37.5	4°24.1	2.7 - 0.8	8.7 - 2.7	14.7 - 4.5
28	4°37.0	4°37.8	4°24.4	2.8 - 0.9	8.8 - 2.7	14.8 - 4.6
29	4°37.3	4°38.0	4°24.6	2.9 - 0.9	8.9 - 2.7	14.9 - 4.6
30	4°37.5	4°38.3	4°24.9	3.0 - 0.9	9.0 - 2.8	15.0 - 4.6
31	4°37.7	4°38.5	4°25.1	3.1 - 1.0	9.1 - 2.8	15.1 - 4.7
32	4°38.0	4°38.8	4°25.3	3.2 - 1.0	9.2 - 2.8	15.2 - 4.7
33	4°38.3	4°39.0	4°25.6	3.3 - 1.0	9.3 - 2.9	15.3 - 4.7
34	4°38.5	4°39.3	4°25.8	3.4 - 1.0	9.4 - 2.9	15.4 - 4.7
35	4°38.7	4°39.5	4°26.1	3.5 - 1.1	9.5 - 2.9	15.5 - 4.8
36	4°39.0	4°39.8	4°26.3	3.6 - 1.1	9.6 - 3.0	15.6 - 4.8
37	4°39.3	4°40.0	4°26.5	3.7 - 1.1	9.7 - 3.0	15.7 - 4.8
38	4°39.5	4°40.3	4°26.8	3.8 - 1.2	9.8 - 3.0	15.8 - 4.9
39	4°39.7	4°40.5	4°27.0	3.9 - 1.2	9.9 - 3.1	15.9 - 4.9
40	4°40.0	4°40.8	4°27.2	4.0 - 1.2	10.0 - 3.1	16.0 - 4.9
41	4°40.3	4°41.0	4°27.5	4.1 - 1.3	10.1 - 3.1	16.1 - 5.0
42	4°40.5	4°41.3	4°27.7	4.2 - 1.3	10.2 - 3.1	16.2 - 5.0
43	4°40.7	4°41.5	4°28.0	4.3 - 1.3	10.3 - 3.2	16.3 - 5.0
44	4°41.0	4°41.8	4°28.2	4.4 - 1.4	10.4 - 3.2	16.4 - 5.1
45	4°41.3	4°42.0	4°28.4	4.5 - 1.4	10.5 - 3.2	16.5 - 5.1
46	4°41.5	4°42.3	4°28.7	4.6 - 1.4	10.6 - 3.3	16.6 - 5.1
47	4°41.8	4°42.5	4°28.9	4.7 - 1.4	10.7 - 3.3	16.7 - 5.1
48	4°42.0	4°42.8	4°29.2	4.8 - 1.5	10.8 - 3.3	16.8 - 5.2
49	4°42.3	4°43.0	4°29.4	4.9 - 1.5	10.9 - 3.4	16.9 - 5.2
50	4°42.5	4°43.3	4°29.6	5.0 - 1.5	11.0 - 3.4	17.0 - 5.2
51	4°42.8	4°43.5	4°29.9	5.1 - 1.6	11.1 - 3.4	17.1 - 5.3
52	4°43.0	4°43.8	4°30.1	5.2 - 1.6	11.2 - 3.5	17.2 - 5.3
53	4°43.2	4°44.0	4°30.3	5.3 - 1.6	11.3 - 3.5	17.3 - 5.3
54	4°43.5	4°44.3	4°30.6	5.4 - 1.7	11.4 - 3.5	17.4 - 5.4
55	4°43.8	4°44.5	4°30.8	5.5 - 1.7	11.5 - 3.5	17.5 - 5.4
56	4°44.0	4°44.8	4°31.1	5.6 - 1.7	11.6 - 3.6	17.6 - 5.4
57	4°44.2	4°45.0	4°31.3	5.7 - 1.8	11.7 - 3.6	17.7 - 5.5
58	4°44.5	4°45.3	4°31.5	5.8 - 1.8	11.8 - 3.6	17.8 - 5.5
59	4°44.8	4°45.5	4°31.8	5.9 - 1.8	11.9 - 3.7	17.9 - 5.5

m	Sun	Aries	Moon	v and d corr		
19	Plan.					
0	4°45.0	4°45.8	4°32.0	0.0 - 0.0	6.0 - 2.0	12.0 - 3.9
1	4°45.2	4°46.0	4°32.3	0.1 - 0.0	6.1 - 2.0	12.1 - 3.9
2	4°45.5	4°46.3	4°32.5	0.2 - 0.1	6.2 - 2.0	12.2 - 4.0
3	4°45.8	4°46.5	4°32.7	0.3 - 0.1	6.3 - 2.0	12.3 - 4.0
4	4°46.0	4°46.8	4°33.0	0.4 - 0.1	6.4 - 2.1	12.4 - 4.0
5	4°46.2	4°47.0	4°33.2	0.5 - 0.2	6.5 - 2.1	12.5 - 4.1
6	4°46.5	4°47.3	4°33.4	0.6 - 0.2	6.6 - 2.1	12.6 - 4.1
7	4°46.8	4°47.5	4°33.7	0.7 - 0.2	6.7 - 2.2	12.7 - 4.1
8	4°47.0	4°47.8	4°33.9	0.8 - 0.3	6.8 - 2.2	12.8 - 4.2
9	4°47.2	4°48.0	4°34.2	0.9 - 0.3	6.9 - 2.2	12.9 - 4.2
10	4°47.5	4°48.3	4°34.4	1.0 - 0.3	7.0 - 2.3	13.0 - 4.2
11	4°47.8	4°48.5	4°34.6	1.1 - 0.4	7.1 - 2.3	13.1 - 4.3
12	4°48.0	4°48.8	4°34.9	1.2 - 0.4	7.2 - 2.3	13.2 - 4.3
13	4°48.2	4°49.0	4°35.1	1.3 - 0.4	7.3 - 2.4	13.3 - 4.3
14	4°48.5	4°49.3	4°35.4	1.4 - 0.5	7.4 - 2.4	13.4 - 4.4
15	4°48.8	4°49.5	4°35.6	1.5 - 0.5	7.5 - 2.4	13.5 - 4.4
16	4°49.0	4°49.8	4°35.8	1.6 - 0.5	7.6 - 2.5	13.6 - 4.4
17	4°49.3	4°50.0	4°36.1	1.7 - 0.6	7.7 - 2.5	13.7 - 4.5
18	4°49.5	4°50.3	4°36.3	1.8 - 0.6	7.8 - 2.5	13.8 - 4.5
19	4°49.8	4°50.5	4°36.6	1.9 - 0.6	7.9 - 2.6	13.9 - 4.5
20	4°50.0	4°50.8	4°36.8	2.0 - 0.7	8.0 - 2.6	14.0 - 4.5
21	4°50.3	4°51.0	4°37.0	2.1 - 0.7	8.1 - 2.6	14.1 - 4.6
22	4°50.5	4°51.3	4°37.3	2.2 - 0.7	8.2 - 2.7	14.2 - 4.6
23	4°50.7	4°51.5	4°37.5	2.3 - 0.7	8.3 - 2.7	14.3 - 4.6
24	4°51.0	4°51.8	4°37.7	2.4 - 0.8	8.4 - 2.7	14.4 - 4.7
25	4°51.3	4°52.0	4°38.0	2.5 - 0.8	8.5 - 2.8	14.5 - 4.7
26	4°51.5	4°52.3	4°38.2	2.6 - 0.8	8.6 - 2.8	14.6 - 4.7
27	4°51.7	4°52.5	4°38.5	2.7 - 0.9	8.7 - 2.8	14.7 - 4.8
28	4°52.0	4°52.8	4°38.7	2.8 - 0.9	8.8 - 2.9	14.8 - 4.8
29	4°52.3	4°53.0	4°38.9	2.9 - 0.9	8.9 - 2.9	14.9 - 4.8
30	4°52.5	4°53.3	4°39.2	3.0 - 1.0	9.0 - 2.9	15.0 - 4.9
31	4°52.7	4°53.6	4°39.4	3.1 - 1.0	9.1 - 3.0	15.1 - 4.9
32	4°53.0	4°53.8	4°39.7	3.2 - 1.0	9.2 - 3.0	15.2 - 4.9
33	4°53.3	4°54.1	4°39.9	3.3 - 1.1	9.3 - 3.0	15.3 - 5.0
34	4°53.5	4°54.3	4°40.1	3.4 - 1.1	9.4 - 3.1	15.4 - 5.0
35	4°53.7	4°54.6	4°40.4	3.5 - 1.1	9.5 - 3.1	15.5 - 5.0
36	4°54.0	4°54.8	4°40.6	3.6 - 1.2	9.6 - 3.1	15.6 - 5.1
37	4°54.3	4°55.1	4°40.8	3.7 - 1.2	9.7 - 3.2	15.7 - 5.1
38	4°54.5	4°55.3	4°41.1	3.8 - 1.2	9.8 - 3.2	15.8 - 5.1
39	4°54.7	4°55.6	4°41.3	3.9 - 1.3	9.9 - 3.2	15.9 - 5.2
40	4°55.0	4°55.8	4°41.6	4.0 - 1.3	10.0 - 3.3	16.0 - 5.2
41	4°55.3	4°56.1	4°41.8	4.1 - 1.3	10.1 - 3.3	16.1 - 5.2
42	4°55.5	4°56.3	4°42.0	4.2 - 1.4	10.2 - 3.3	16.2 - 5.3
43	4°55.7	4°56.6	4°42.3	4.3 - 1.4	10.3 - 3.3	16.3 - 5.3
44	4°56.0	4°56.8	4°42.5	4.4 - 1.4	10.4 - 3.4	16.4 - 5.3
45	4°56.3	4°57.1	4°42.8	4.5 - 1.5	10.5 - 3.4	16.5 - 5.4
46	4°56.5	4°57.3	4°43.0	4.6 - 1.5	10.6 - 3.4	16.6 - 5.4
47	4°56.8	4°57.6	4°43.2	4.7 - 1.5	10.7 - 3.5	16.7 - 5.4
48	4°57.0	4°57.8	4°43.5	4.8 - 1.6	10.8 - 3.5	16.8 - 5.5
49	4°57.3	4°58.1	4°43.7	4.9 - 1.6	10.9 - 3.5	16.9 - 5.5
50	4°57.5	4°58.3	4°43.9	5.0 - 1.6	11.0 - 3.6	17.0 - 5.5
51	4°57.8	4°58.6	4°44.2	5.1 - 1.7	11.1 - 3.6	17.1 - 5.6
52	4°58.0	4°58.8	4°44.4	5.2 - 1.7	11.2 - 3.6	17.2 - 5.6
53	4°58.2	4°59.1	4°44.7	5.3 - 1.7	11.3 - 3.7	17.3 - 5.6
54	4°58.5	4°59.3	4°44.9	5.4 - 1.8	11.4 - 3.7	17.4 - 5.7
55	4°58.8	4°59.6	4°45.1	5.5 - 1.8	11.5 - 3.7	17.5 - 5.7
56	4°59.0	4°59.8	4°45.4	5.6 - 1.8	11.6 - 3.8	17.6 - 5.7
57	4°59.2	5°00.1	4°45.6	5.7 - 1.9	11.7 - 3.8	17.7 - 5.8
58	4°59.5	5°00.3	4°45.9	5.8 - 1.9	11.8 - 3.8	17.8 - 5.8
59	4°59.8	5°00.6	4°46.1	5.9 - 1.9	11.9 - 3.9	17.9 - 5.8

m	Sun	Aries	Moon	v and d corr		
20	Plan.					
0	5°00.0	5°00.8	4°46.3	0.0 - 0.0	6.0 - 2.0	12.0 - 4.1
1	5°00.2	5°01.1	4°46.6	0.1 - 0.0	6.1 - 2.1	12.1 - 4.1
2	5°00.5	5°01.3	4°46.8	0.2 - 0.1	6.2 - 2.1	12.2 - 4.2
3	5°00.8	5°01.6	4°47.0	0.3 - 0.1	6.3 - 2.2	12.3 - 4.2
4	5°01.0	5°01.8	4°47.3	0.4 - 0.1	6.4 - 2.2	12.4 - 4.2
5	5°01.2	5°02.1	4°47.5	0.5 - 0.2	6.5 - 2.2	12.5 - 4.3
6	5°01.5	5°02.3	4°47.8	0.6 - 0.2	6.6 - 2.3	12.6 - 4.3
7	5°01.8	5°02.6	4°48.0	0.7 - 0.2	6.7 - 2.3	12.7 - 4.3
8	5°02.0	5°02.8	4°48.2	0.8 - 0.3	6.8 - 2.3	12.8 - 4.4
9	5°02.2	5°03.1	4°48.5	0.9 - 0.3	6.9 - 2.4	12.9 - 4.4
10	5°02.5	5°03.3	4°48.7	1.0 - 0.3	7.0 - 2.4	13.0 - 4.4
11	5°02.8	5°03.6	4°49.0	1.1 - 0.4	7.1 - 2.4	13.1 - 4.5
12	5°03.0	5°03.8	4°49.2	1.2 - 0.4	7.2 - 2.5	13.2 - 4.5
13	5°03.2	5°04.1	4°49.4	1.3 - 0.4	7.3 - 2.5	13.3 - 4.5
14	5°03.5	5°04.3	4°49.7	1.4 - 0.5	7.4 - 2.5	13.4 - 4.6
15	5°03.8	5°04.6	4°49.9	1.5 - 0.5	7.5 - 2.6	13.5 - 4.6
16	5°04.0	5°04.8	4°50.2	1.6 - 0.5	7.6 - 2.6	13.6 - 4.6
17	5°04.3	5°05.1	4°50.4	1.7 - 0.6	7.7 - 2.6	13.7 - 4.7
18	5°04.5	5°05.3	4°50.6	1.8 - 0.6	7.8 - 2.7	13.8 - 4.7
19	5°04.7	5°05.6	4°50.9	1.9 - 0.6	7.9 - 2.7	13.9 - 4.7
20	5°05.0	5°05.8	4°51.1	2.0 - 0.7	8.0 - 2.7	14.0 - 4.8
21	5°05.3	5°06.1	4°51.3	2.1 - 0.7	8.1 - 2.8	14.1 - 4.8
22	5°05.5	5°06.3	4°51.6	2.2 - 0.8	8.2 - 2.8	14.2 - 4.9
23	5°05.7	5°06.6	4°51.8	2.3 - 0.8	8.3 - 2.8	14.3 - 4.9
24	5°06.0	5°06.8	4°52.1	2.4 - 0.8	8.4 - 2.9	14.4 - 4.9
25	5°06.3	5°07.1	4°52.3	2.5 - 0.9	8.5 - 2.9	14.5 - 5.0
26	5°06.5	5°07.3	4°52.5	2.6 - 0.9	8.6 - 2.9	14.6 - 5.0
27	5°06.7	5°07.6	4°52.8	2.7 - 0.9	8.7 - 3.0	14.7 - 5.0
28	5°07.0	5°07.8	4°53.0	2.8 - 1.0	8.8 - 3.0	14.8 - 5.1
29	5°07.3	5°08.1	4°53.3	2.9 - 1.0	8.9 - 3.0	14.9 - 5.1
30	5°07.5	5°08.3	4°53.5	3.0 - 1.0	9.0 - 3.1	15.0 - 5.1
31	5°07.7	5°08.6	4°53.7	3.1 - 1.1	9.1 - 3.1	15.1 - 5.2
32	5°08.0	5°08.8	4°54.0	3.2 - 1.1	9.2 - 3.1	15.2 - 5.2
33	5°08.3	5°09.1	4°54.2	3.3 - 1.1	9.3 - 3.2	15.3 - 5.2
34	5°08.5	5°09.3	4°54.4	3.4 - 1.2	9.4 - 3.2	15.4 - 5.3
35	5°08.7	5°09.6	4°54.7	3.5 - 1.2	9.5 - 3.2	15.5 - 5.3
36	5°09.0	5°09.8	4°54.9	3.6 - 1.2	9.6 - 3.3	15.6 - 5.3
37	5°09.3	5°10.1	4°55.2	3.7 - 1.3	9.7 - 3.3	15.7 - 5.4
38	5°09.5	5°10.3	4°55.4	3.8 - 1.3	9.8 - 3.3	15.8 - 5.4
39	5°09.7	5°10.6	4°55.6	3.9 - 1.3	9.9 - 3.4	15.9 - 5.4
40	5°10.0	5°10.8	4°55.9	4.0 - 1.4	10.0 - 3.4	16.0 - 5.5
41	5°10.3	5°11.1	4°56.1	4.1 - 1.4	10.1 - 3.5	16.1 - 5.5
42	5°10.5	5°11.3	4°56.4	4.2 - 1.4	10.2 - 3.5	16.2 - 5.5
43	5°10.7	5°11.6	4°56.6	4.3 - 1.5	10.3 - 3.5	16.3 - 5.6
44	5°11.0	5°11.9	4°56.8	4.4 - 1.5	10.4 - 3.6	16.4 - 5.6
45	5°11.3	5°12.1	4°57.1	4.5 - 1.5	10.5 - 3.6	16.5 - 5.6
46	5°11.5	5°12.4	4°57.3	4.6 - 1.6	10.6 - 3.6	16.6 - 5.7
47	5°11.8	5°12.6	4°57.5	4.7 - 1.6	10.7 - 3.7	16.7 - 5.7
48	5°12.0	5°12.9	4°57.8	4.8 - 1.6	10.8 - 3.7	16.8 - 5.7
49	5°12.2	5°13.1	4°58.0	4.9 - 1.7	10.9 - 3.7	16.9 - 5.8
50	5°12.5	5°13.4	4°58.3	5.0 - 1.7	11.0 - 3.8	17.0 - 5.8
51	5°12.8	5°13.6	4°58.5	5.1 - 1.7	11.1 - 3.8	17.1 - 5.8
52	5°13.0	5°13.9	4°58.7	5.2 - 1.8	11.2 - 3.8	17.2 - 5.9
53	5°13.2	5°14.1	4°59.0	5.3 - 1.8	11.3 - 3.9	17.3 - 5.9
54	5°13.5	5°14.4	4°59.2	5.4 - 1.8	11.4 - 3.9	17.4 - 5.9
55	5°13.8	5°14.6	4°59.5	5.5 - 1.9	11.5 - 3.9	17.5 - 6.0
56	5°14.0	5°14.9	4°59.7	5.6 - 1.9	11.6 - 4.0	17.6 - 6.0
57	5°14.2	5°15.1	4°59.9	5.7 - 1.9	11.7 - 4.0	17.7 - 6.0
58	5°14.5	5°15.4	5°00.2	5.8 - 2.0	11.8 - 4.0	17.8 - 6.1
59	5°14.8	5°15.6	5°00.4	5.9 - 2.0	11.9 - 4.1	17.9 - 6.1

Increments and Corrections

m 21	Sun Plan.	Aries	Moon	v and d corr		
0	5°15.0	5°15.9	5°00.6	0.0 - 0.0	6.0 - 2.1	12.0 - 4.3
1	5°15.2	5°16.1	5°00.9	0.1 - 0.0	6.1 - 2.2	12.1 - 4.3
2	5°15.5	5°16.4	5°01.1	0.2 - 0.1	6.2 - 2.2	12.2 - 4.4
3	5°15.8	5°16.6	5°01.4	0.3 - 0.1	6.3 - 2.3	12.3 - 4.4
4	5°16.0	5°16.9	5°01.6	0.4 - 0.1	6.4 - 2.3	12.4 - 4.4
5	5°16.2	5°17.1	5°01.8	0.5 - 0.2	6.5 - 2.3	12.5 - 4.5
6	5°16.5	5°17.4	5°02.1	0.6 - 0.2	6.6 - 2.4	12.6 - 4.5
7	5°16.8	5°17.6	5°02.3	0.7 - 0.3	6.7 - 2.4	12.7 - 4.6
8	5°17.0	5°17.9	5°02.6	0.8 - 0.3	6.8 - 2.4	12.8 - 4.6
9	5°17.2	5°18.1	5°02.8	0.9 - 0.3	6.9 - 2.5	12.9 - 4.6
10	5°17.5	5°18.4	5°03.0	1.0 - 0.4	7.0 - 2.5	13.0 - 4.7
11	5°17.8	5°18.6	5°03.3	1.1 - 0.4	7.1 - 2.5	13.1 - 4.7
12	5°18.0	5°18.9	5°03.5	1.2 - 0.4	7.2 - 2.6	13.2 - 4.7
13	5°18.2	5°19.1	5°03.8	1.3 - 0.5	7.3 - 2.6	13.3 - 4.8
14	5°18.5	5°19.4	5°04.0	1.4 - 0.5	7.4 - 2.7	13.4 - 4.8
15	5°18.8	5°19.6	5°04.2	1.5 - 0.5	7.5 - 2.7	13.5 - 4.8
16	5°19.0	5°19.9	5°04.5	1.6 - 0.6	7.6 - 2.7	13.6 - 4.9
17	5°19.3	5°20.1	5°04.7	1.7 - 0.6	7.7 - 2.8	13.7 - 4.9
18	5°19.5	5°20.4	5°04.9	1.8 - 0.6	7.8 - 2.8	13.8 - 4.9
19	5°19.7	5°20.6	5°05.2	1.9 - 0.7	7.9 - 2.8	13.9 - 5.0
20	5°20.0	5°20.9	5°05.4	2.0 - 0.7	8.0 - 2.9	14.0 - 5.0
21	5°20.3	5°21.1	5°05.7	2.1 - 0.8	8.1 - 2.9	14.1 - 5.1
22	5°20.5	5°21.4	5°05.9	2.2 - 0.8	8.2 - 2.9	14.2 - 5.1
23	5°20.7	5°21.6	5°06.1	2.3 - 0.8	8.3 - 3.0	14.3 - 5.1
24	5°21.0	5°21.9	5°06.4	2.4 - 0.9	8.4 - 3.0	14.4 - 5.2
25	5°21.3	5°22.1	5°06.6	2.5 - 0.9	8.5 - 3.0	14.5 - 5.2
26	5°21.5	5°22.4	5°06.9	2.6 - 0.9	8.6 - 3.1	14.6 - 5.2
27	5°21.7	5°22.6	5°07.1	2.7 - 1.0	8.7 - 3.1	14.7 - 5.3
28	5°22.0	5°22.9	5°07.3	2.8 - 1.0	8.8 - 3.2	14.8 - 5.3
29	5°22.3	5°23.1	5°07.6	2.9 - 1.0	8.9 - 3.2	14.9 - 5.3
30	5°22.5	5°23.4	5°07.8	3.0 - 1.1	9.0 - 3.2	15.0 - 5.4
31	5°22.7	5°23.6	5°08.0	3.1 - 1.1	9.1 - 3.3	15.1 - 5.4
32	5°23.0	5°23.9	5°08.3	3.2 - 1.1	9.2 - 3.3	15.2 - 5.4
33	5°23.3	5°24.1	5°08.5	3.3 - 1.2	9.3 - 3.3	15.3 - 5.5
34	5°23.5	5°24.4	5°08.8	3.4 - 1.2	9.4 - 3.4	15.4 - 5.5
35	5°23.7	5°24.6	5°09.0	3.5 - 1.3	9.5 - 3.4	15.5 - 5.6
36	5°24.0	5°24.9	5°09.2	3.6 - 1.3	9.6 - 3.4	15.6 - 5.6
37	5°24.3	5°25.1	5°09.5	3.7 - 1.3	9.7 - 3.5	15.7 - 5.6
38	5°24.5	5°25.4	5°09.7	3.8 - 1.4	9.8 - 3.5	15.8 - 5.7
39	5°24.7	5°25.6	5°10.0	3.9 - 1.4	9.9 - 3.5	15.9 - 5.7
40	5°25.0	5°25.9	5°10.2	4.0 - 1.4	10.0 - 3.6	16.0 - 5.7
41	5°25.3	5°26.1	5°10.4	4.1 - 1.5	10.1 - 3.6	16.1 - 5.8
42	5°25.5	5°26.4	5°10.7	4.2 - 1.5	10.2 - 3.7	16.2 - 5.8
43	5°25.7	5°26.6	5°10.9	4.3 - 1.5	10.3 - 3.7	16.3 - 5.8
44	5°26.0	5°26.9	5°11.1	4.4 - 1.6	10.4 - 3.7	16.4 - 5.9
45	5°26.3	5°27.1	5°11.4	4.5 - 1.6	10.5 - 3.8	16.5 - 5.9
46	5°26.5	5°27.4	5°11.6	4.6 - 1.6	10.6 - 3.8	16.6 - 5.9
47	5°26.8	5°27.6	5°11.9	4.7 - 1.7	10.7 - 3.8	16.7 - 6.0
48	5°27.0	5°27.9	5°12.1	4.8 - 1.7	10.8 - 3.9	16.8 - 6.0
49	5°27.2	5°28.1	5°12.3	4.9 - 1.8	10.9 - 3.9	16.9 - 6.1
50	5°27.5	5°28.4	5°12.6	5.0 - 1.8	11.0 - 3.9	17.0 - 6.1
51	5°27.8	5°28.6	5°12.8	5.1 - 1.8	11.1 - 4.0	17.1 - 6.1
52	5°28.0	5°28.9	5°13.1	5.2 - 1.9	11.2 - 4.0	17.2 - 6.2
53	5°28.2	5°29.1	5°13.3	5.3 - 1.9	11.3 - 4.0	17.3 - 6.2
54	5°28.5	5°29.4	5°13.5	5.4 - 1.9	11.4 - 4.1	17.4 - 6.2
55	5°28.8	5°29.6	5°13.8	5.5 - 2.0	11.5 - 4.1	17.5 - 6.3
56	5°29.0	5°29.9	5°14.0	5.6 - 2.0	11.6 - 4.2	17.6 - 6.3
57	5°29.2	5°30.1	5°14.3	5.7 - 2.0	11.7 - 4.2	17.7 - 6.3
58	5°29.5	5°30.4	5°14.5	5.8 - 2.1	11.8 - 4.2	17.8 - 6.4
59	5°29.8	5°30.7	5°14.7	5.9 - 2.1	11.9 - 4.3	17.9 - 6.4

m 22	Sun Plan.	Aries	Moon	v and d corr		
0	5°30.0	5°30.9	5°15.0	0.0 - 0.0	6.0 - 2.3	12.0 - 4.5
1	5°30.2	5°31.2	5°15.2	0.1 - 0.0	6.1 - 2.3	12.1 - 4.5
2	5°30.5	5°31.4	5°15.4	0.2 - 0.1	6.2 - 2.3	12.2 - 4.6
3	5°30.8	5°31.7	5°15.7	0.3 - 0.1	6.3 - 2.4	12.3 - 4.6
4	5°31.0	5°31.9	5°15.9	0.4 - 0.2	6.4 - 2.4	12.4 - 4.7
5	5°31.2	5°32.2	5°16.2	0.5 - 0.2	6.5 - 2.4	12.5 - 4.7
6	5°31.5	5°32.4	5°16.4	0.6 - 0.2	6.6 - 2.5	12.6 - 4.7
7	5°31.8	5°32.7	5°16.6	0.7 - 0.3	6.7 - 2.5	12.7 - 4.8
8	5°32.0	5°32.9	5°16.9	0.8 - 0.3	6.8 - 2.5	12.8 - 4.8
9	5°32.2	5°33.2	5°17.1	0.9 - 0.3	6.9 - 2.6	12.9 - 4.8
10	5°32.5	5°33.4	5°17.4	1.0 - 0.4	7.0 - 2.6	13.0 - 4.9
11	5°32.8	5°33.7	5°17.6	1.1 - 0.4	7.1 - 2.7	13.1 - 4.9
12	5°33.0	5°33.9	5°17.8	1.2 - 0.5	7.2 - 2.7	13.2 - 4.9
13	5°33.2	5°34.2	5°18.1	1.3 - 0.5	7.3 - 2.7	13.3 - 5.0
14	5°33.5	5°34.4	5°18.3	1.4 - 0.5	7.4 - 2.8	13.4 - 5.0
15	5°33.8	5°34.7	5°18.5	1.5 - 0.6	7.5 - 2.8	13.5 - 5.1
16	5°34.0	5°34.9	5°18.8	1.6 - 0.6	7.6 - 2.8	13.6 - 5.1
17	5°34.3	5°35.2	5°19.0	1.7 - 0.6	7.7 - 2.9	13.7 - 5.1
18	5°34.5	5°35.4	5°19.3	1.8 - 0.7	7.8 - 2.9	13.8 - 5.2
19	5°34.8	5°35.7	5°19.5	1.9 - 0.7	7.9 - 3.0	13.9 - 5.2
20	5°35.0	5°35.9	5°19.7	2.0 - 0.8	8.0 - 3.0	14.0 - 5.3
21	5°35.3	5°36.2	5°20.0	2.1 - 0.8	8.1 - 3.0	14.1 - 5.3
22	5°35.5	5°36.4	5°20.2	2.2 - 0.8	8.2 - 3.1	14.2 - 5.3
23	5°35.7	5°36.7	5°20.5	2.3 - 0.9	8.3 - 3.1	14.3 - 5.4
24	5°36.0	5°36.9	5°20.7	2.4 - 0.9	8.4 - 3.2	14.4 - 5.4
25	5°36.3	5°37.2	5°20.9	2.5 - 0.9	8.5 - 3.2	14.5 - 5.4
26	5°36.5	5°37.4	5°21.2	2.6 - 1.0	8.6 - 3.2	14.6 - 5.5
27	5°36.7	5°37.7	5°21.4	2.7 - 1.0	8.7 - 3.3	14.7 - 5.5
28	5°37.0	5°37.9	5°21.6	2.8 - 1.1	8.8 - 3.3	14.8 - 5.6
29	5°37.3	5°38.2	5°21.9	2.9 - 1.1	8.9 - 3.3	14.9 - 5.6
30	5°37.5	5°38.4	5°22.1	3.0 - 1.1	9.0 - 3.4	15.0 - 5.6
31	5°37.7	5°38.7	5°22.4	3.1 - 1.2	9.1 - 3.4	15.1 - 5.7
32	5°38.0	5°38.9	5°22.6	3.2 - 1.2	9.2 - 3.4	15.2 - 5.7
33	5°38.3	5°39.2	5°22.8	3.3 - 1.2	9.3 - 3.5	15.3 - 5.7
34	5°38.5	5°39.4	5°23.1	3.4 - 1.3	9.4 - 3.5	15.4 - 5.8
35	5°38.7	5°39.7	5°23.3	3.5 - 1.3	9.5 - 3.6	15.5 - 5.8
36	5°39.0	5°39.9	5°23.6	3.6 - 1.4	9.6 - 3.6	15.6 - 5.8
37	5°39.3	5°40.2	5°23.8	3.7 - 1.4	9.7 - 3.6	15.7 - 5.9
38	5°39.5	5°40.4	5°24.0	3.8 - 1.4	9.8 - 3.7	15.8 - 5.9
39	5°39.7	5°40.7	5°24.3	3.9 - 1.5	9.9 - 3.7	15.9 - 6.0
40	5°40.0	5°40.9	5°24.5	4.0 - 1.5	10.0 - 3.8	16.0 - 6.0
41	5°40.3	5°41.2	5°24.7	4.1 - 1.5	10.1 - 3.8	16.1 - 6.0
42	5°40.5	5°41.4	5°25.0	4.2 - 1.6	10.2 - 3.8	16.2 - 6.1
43	5°40.7	5°41.7	5°25.2	4.3 - 1.6	10.3 - 3.9	16.3 - 6.1
44	5°41.0	5°41.9	5°25.5	4.4 - 1.7	10.4 - 3.9	16.4 - 6.1
45	5°41.3	5°42.2	5°25.7	4.5 - 1.7	10.5 - 3.9	16.5 - 6.2
46	5°41.5	5°42.4	5°25.9	4.6 - 1.7	10.6 - 4.0	16.6 - 6.2
47	5°41.8	5°42.7	5°26.2	4.7 - 1.8	10.7 - 4.0	16.7 - 6.3
48	5°42.0	5°42.9	5°26.4	4.8 - 1.8	10.8 - 4.1	16.8 - 6.3
49	5°42.3	5°43.2	5°26.7	4.9 - 1.8	10.9 - 4.1	16.9 - 6.3
50	5°42.5	5°43.4	5°26.9	5.0 - 1.9	11.0 - 4.1	17.0 - 6.4
51	5°42.8	5°43.7	5°27.1	5.1 - 1.9	11.1 - 4.2	17.1 - 6.4
52	5°43.0	5°43.9	5°27.4	5.2 - 2.0	11.2 - 4.2	17.2 - 6.4
53	5°43.2	5°44.2	5°27.6	5.3 - 2.0	11.3 - 4.2	17.3 - 6.5
54	5°43.5	5°44.4	5°27.9	5.4 - 2.0	11.4 - 4.3	17.4 - 6.5
55	5°43.8	5°44.7	5°28.1	5.5 - 2.1	11.5 - 4.3	17.5 - 6.6
56	5°44.0	5°44.9	5°28.3	5.6 - 2.1	11.6 - 4.4	17.6 - 6.6
57	5°44.2	5°45.2	5°28.6	5.7 - 2.1	11.7 - 4.4	17.7 - 6.6
58	5°44.5	5°45.4	5°28.8	5.8 - 2.2	11.8 - 4.4	17.8 - 6.7
59	5°44.8	5°45.7	5°29.0	5.9 - 2.2	11.9 - 4.5	17.9 - 6.7

m 23	Sun Plan.	Aries	Moon	v and d corr		
0	5°45.0	5°45.9	5°29.3	0.0 - 0.0	6.0 - 2.4	12.0 - 4.7
1	5°45.2	5°46.2	5°29.5	0.1 - 0.0	6.1 - 2.4	12.1 - 4.7
2	5°45.5	5°46.4	5°29.8	0.2 - 0.1	6.2 - 2.4	12.2 - 4.8
3	5°45.8	5°46.7	5°30.0	0.3 - 0.1	6.3 - 2.5	12.3 - 4.8
4	5°46.0	5°46.9	5°30.2	0.4 - 0.2	6.4 - 2.5	12.4 - 4.9
5	5°46.2	5°47.2	5°30.5	0.5 - 0.2	6.5 - 2.5	12.5 - 4.9
6	5°46.5	5°47.4	5°30.7	0.6 - 0.2	6.6 - 2.6	12.6 - 4.9
7	5°46.8	5°47.7	5°31.0	0.7 - 0.3	6.7 - 2.6	12.7 - 5.0
8	5°47.0	5°47.9	5°31.2	0.8 - 0.3	6.8 - 2.7	12.8 - 5.0
9	5°47.2	5°48.2	5°31.4	0.9 - 0.4	6.9 - 2.7	12.9 - 5.1
10	5°47.5	5°48.4	5°31.7	1.0 - 0.4	7.0 - 2.7	13.0 - 5.1
11	5°47.8	5°48.7	5°31.9	1.1 - 0.4	7.1 - 2.8	13.1 - 5.1
12	5°48.0	5°49.0	5°32.1	1.2 - 0.5	7.2 - 2.8	13.2 - 5.2
13	5°48.2	5°49.2	5°32.4	1.3 - 0.5	7.3 - 2.9	13.3 - 5.2
14	5°48.5	5°49.5	5°32.6	1.4 - 0.5	7.4 - 2.9	13.4 - 5.2
15	5°48.8	5°49.7	5°32.9	1.5 - 0.6	7.5 - 2.9	13.5 - 5.3
16	5°49.0	5°50.0	5°33.1	1.6 - 0.6	7.6 - 3.0	13.6 - 5.3
17	5°49.3	5°50.2	5°33.3	1.7 - 0.7	7.7 - 3.0	13.7 - 5.4
18	5°49.5	5°50.5	5°33.6	1.8 - 0.7	7.8 - 3.1	13.8 - 5.4
19	5°49.8	5°50.7	5°33.8	1.9 - 0.7	7.9 - 3.1	13.9 - 5.4
20	5°50.0	5°51.0	5°34.1	2.0 - 0.8	8.0 - 3.1	14.0 - 5.5
21	5°50.3	5°51.2	5°34.3	2.1 - 0.8	8.1 - 3.2	14.1 - 5.5
22	5°50.5	5°51.5	5°34.5	2.2 - 0.9	8.2 - 3.2	14.2 - 5.6
23	5°50.7	5°51.7	5°34.8	2.3 - 0.9	8.3 - 3.3	14.3 - 5.6
24	5°51.0	5°52.0	5°35.0	2.4 - 0.9	8.4 - 3.3	14.4 - 5.6
25	5°51.3	5°52.2	5°35.2	2.5 - 1.0	8.5 - 3.3	14.5 - 5.7
26	5°51.5	5°52.5	5°35.5	2.6 - 1.0	8.6 - 3.4	14.6 - 5.7
27	5°51.7	5°52.7	5°35.7	2.7 - 1.1	8.7 - 3.4	14.7 - 5.8
28	5°52.0	5°53.0	5°36.0	2.8 - 1.1	8.8 - 3.4	14.8 - 5.8
29	5°52.3	5°53.2	5°36.2	2.9 - 1.1	8.9 - 3.5	14.9 - 5.8
30	5°52.5	5°53.5	5°36.4	3.0 - 1.2	9.0 - 3.5	15.0 - 5.9
31	5°52.7	5°53.7	5°36.7	3.1 - 1.2	9.1 - 3.6	15.1 - 5.9
32	5°53.0	5°54.0	5°36.9	3.2 - 1.3	9.2 - 3.6	15.2 - 6.0
33	5°53.3	5°54.2	5°37.2	3.3 - 1.3	9.3 - 3.6	15.3 - 6.0
34	5°53.5	5°54.5	5°37.4	3.4 - 1.3	9.4 - 3.7	15.4 - 6.0
35	5°53.7	5°54.7	5°37.6	3.5 - 1.4	9.5 - 3.7	15.5 - 6.1
36	5°54.0	5°55.0	5°37.9	3.6 - 1.4	9.6 - 3.8	15.6 - 6.1
37	5°54.3	5°55.2	5°38.1	3.7 - 1.4	9.7 - 3.8	15.7 - 6.1
38	5°54.5	5°55.5	5°38.4	3.8 - 1.5	9.8 - 3.8	15.8 - 6.2
39	5°54.7	5°55.7	5°38.6	3.9 - 1.5	9.9 - 3.9	15.9 - 6.2
40	5°55.0	5°56.0	5°38.8	4.0 - 1.6	10.0 - 3.9	16.0 - 6.3
41	5°55.3	5°56.2	5°39.1	4.1 - 1.6	10.1 - 4.0	16.1 - 6.3
42	5°55.5	5°56.5	5°39.3	4.2 - 1.6	10.2 - 4.0	16.2 - 6.3
43	5°55.7	5°56.7	5°39.5	4.3 - 1.7	10.3 - 4.0	16.3 - 6.4
44	5°56.0	5°57.0	5°39.8	4.4 - 1.7	10.4 - 4.1	16.4 - 6.4
45	5°56.3	5°57.2	5°40.0	4.5 - 1.8	10.5 - 4.1	16.5 - 6.5
46	5°56.5	5°57.5	5°40.3	4.6 - 1.8	10.6 - 4.2	16.6 - 6.5
47	5°56.8	5°57.7	5°40.5	4.7 - 1.8	10.7 - 4.2	16.7 - 6.5
48	5°57.0	5°58.0	5°40.7	4.8 - 1.9	10.8 - 4.2	16.8 - 6.6
49	5°57.3	5°58.2	5°41.0	4.9 - 1.9	10.9 - 4.3	16.9 - 6.6
50	5°57.5	5°58.5	5°41.2	5.0 - 2.0	11.0 - 4.3	17.0 - 6.7
51	5°57.8	5°58.7	5°41.5	5.1 - 2.0	11.1 - 4.3	17.1 - 6.7
52	5°58.0	5°59.0	5°41.7	5.2 - 2.0	11.2 - 4.4	17.2 - 6.7
53	5°58.2	5°59.2	5°41.9	5.3 - 2.1	11.3 - 4.4	17.3 - 6.8
54	5°58.5	5°59.5	5°42.2	5.4 - 2.1	11.4 - 4.5	17.4 - 6.8
55	5°58.8	5°59.7	5°42.4	5.5 - 2.2	11.5 - 4.5	17.5 - 6.9
56	5°59.0	6°00.0	5°42.6	5.6 - 2.2	11.6 - 4.5	17.6 - 6.9
57	5°59.2	6°00.2	5°42.9	5.7 - 2.2	11.7 - 4.6	17.7 - 6.9
58	5°59.5	6°00.5	5°43.1	5.8 - 2.3	11.8 - 4.6	17.8 - 7.0
59	5°59.8	6°00.7	5°43.4	5.9 - 2.3	11.9 - 4.7	17.9 - 7.0

Increments and Corrections

m 24	Sun Plan.	Aries	Moon	v and d corr		
0	6°00.0	6°01.0	5°43.6	0.0 - 0.0	6.0 - 2.5	12.0 - 4.9
1	6°00.2	6°01.2	5°43.8	0.1 - 0.0	6.1 - 2.5	12.1 - 4.9
2	6°00.5	6°01.5	5°44.1	0.2 - 0.1	6.2 - 2.5	12.2 - 5.0
3	6°00.8	6°01.7	5°44.3	0.3 - 0.1	6.3 - 2.6	12.3 - 5.0
4	6°01.0	6°02.0	5°44.6	0.4 - 0.2	6.4 - 2.6	12.4 - 5.1
5	6°01.2	6°02.2	5°44.8	0.5 - 0.2	6.5 - 2.7	12.5 - 5.1
6	6°01.5	6°02.5	5°45.0	0.6 - 0.2	6.6 - 2.7	12.6 - 5.1
7	6°01.8	6°02.7	5°45.3	0.7 - 0.3	6.7 - 2.7	12.7 - 5.2
8	6°02.0	6°03.0	5°45.5	0.8 - 0.3	6.8 - 2.8	12.8 - 5.2
9	6°02.2	6°03.2	5°45.7	0.9 - 0.4	6.9 - 2.8	12.9 - 5.3
10	6°02.5	6°03.5	5°46.0	1.0 - 0.4	7.0 - 2.9	13.0 - 5.3
11	6°02.8	6°03.7	5°46.2	1.1 - 0.4	7.1 - 2.9	13.1 - 5.3
12	6°03.0	6°04.0	5°46.5	1.2 - 0.5	7.2 - 2.9	13.2 - 5.4
13	6°03.2	6°04.2	5°46.7	1.3 - 0.5	7.3 - 3.0	13.3 - 5.4
14	6°03.5	6°04.5	5°46.9	1.4 - 0.6	7.4 - 3.0	13.4 - 5.5
15	6°03.8	6°04.7	5°47.2	1.5 - 0.6	7.5 - 3.1	13.5 - 5.5
16	6°04.0	6°05.0	5°47.4	1.6 - 0.7	7.6 - 3.1	13.6 - 5.6
17	6°04.3	6°05.2	5°47.7	1.7 - 0.7	7.7 - 3.1	13.7 - 5.6
18	6°04.5	6°05.5	5°47.9	1.8 - 0.7	7.8 - 3.2	13.8 - 5.6
19	6°04.7	6°05.7	5°48.1	1.9 - 0.8	7.9 - 3.2	13.9 - 5.7
20	6°05.0	6°06.0	5°48.4	2.0 - 0.8	8.0 - 3.3	14.0 - 5.7
21	6°05.3	6°06.2	5°48.6	2.1 - 0.9	8.1 - 3.3	14.1 - 5.8
22	6°05.5	6°06.5	5°48.8	2.2 - 0.9	8.2 - 3.3	14.2 - 5.8
23	6°05.7	6°06.7	5°49.1	2.3 - 0.9	8.3 - 3.4	14.3 - 5.8
24	6°06.0	6°07.0	5°49.3	2.4 - 1.0	8.4 - 3.4	14.4 - 5.9
25	6°06.3	6°07.3	5°49.6	2.5 - 1.0	8.5 - 3.5	14.5 - 5.9
26	6°06.5	6°07.5	5°49.8	2.6 - 1.1	8.6 - 3.5	14.6 - 6.0
27	6°06.7	6°07.8	5°50.0	2.7 - 1.1	8.7 - 3.6	14.7 - 6.0
28	6°07.0	6°08.0	5°50.3	2.8 - 1.1	8.8 - 3.6	14.8 - 6.0
29	6°07.3	6°08.3	5°50.5	2.9 - 1.2	8.9 - 3.6	14.9 - 6.1
30	6°07.5	6°08.5	5°50.8	3.0 - 1.2	9.0 - 3.7	15.0 - 6.1
31	6°07.7	6°08.8	5°51.0	3.1 - 1.3	9.1 - 3.7	15.1 - 6.2
32	6°08.0	6°09.0	5°51.2	3.2 - 1.3	9.2 - 3.8	15.2 - 6.2
33	6°08.3	6°09.3	5°51.5	3.3 - 1.3	9.3 - 3.8	15.3 - 6.2
34	6°08.5	6°09.5	5°51.7	3.4 - 1.4	9.4 - 3.8	15.4 - 6.3
35	6°08.7	6°09.8	5°52.0	3.5 - 1.4	9.5 - 3.9	15.5 - 6.3
36	6°09.0	6°10.0	5°52.2	3.6 - 1.5	9.6 - 3.9	15.6 - 6.4
37	6°09.3	6°10.3	5°52.4	3.7 - 1.5	9.7 - 4.0	15.7 - 6.4
38	6°09.5	6°10.5	5°52.7	3.8 - 1.6	9.8 - 4.0	15.8 - 6.5
39	6°09.7	6°10.8	5°52.9	3.9 - 1.6	9.9 - 4.0	15.9 - 6.5
40	6°10.0	6°11.0	5°53.1	4.0 - 1.6	10.0 - 4.1	16.0 - 6.5
41	6°10.3	6°11.3	5°53.4	4.1 - 1.7	10.1 - 4.1	16.1 - 6.6
42	6°10.5	6°11.5	5°53.6	4.2 - 1.7	10.2 - 4.2	16.2 - 6.6
43	6°10.7	6°11.8	5°53.9	4.3 - 1.8	10.3 - 4.2	16.3 - 6.7
44	6°11.0	6°12.0	5°54.1	4.4 - 1.8	10.4 - 4.2	16.4 - 6.7
45	6°11.3	6°12.3	5°54.3	4.5 - 1.8	10.5 - 4.3	16.5 - 6.7
46	6°11.5	6°12.5	5°54.6	4.6 - 1.9	10.6 - 4.3	16.6 - 6.8
47	6°11.8	6°12.8	5°54.8	4.7 - 1.9	10.7 - 4.4	16.7 - 6.8
48	6°12.0	6°13.0	5°55.1	4.8 - 2.0	10.8 - 4.4	16.8 - 6.9
49	6°12.2	6°13.3	5°55.3	4.9 - 2.0	10.9 - 4.5	16.9 - 6.9
50	6°12.5	6°13.5	5°55.5	5.0 - 2.0	11.0 - 4.5	17.0 - 6.9
51	6°12.8	6°13.8	5°55.8	5.1 - 2.1	11.1 - 4.5	17.1 - 7.0
52	6°13.0	6°14.0	5°56.0	5.2 - 2.1	11.2 - 4.6	17.2 - 7.0
53	6°13.2	6°14.3	5°56.2	5.3 - 2.2	11.3 - 4.6	17.3 - 7.1
54	6°13.5	6°14.5	5°56.5	5.4 - 2.2	11.4 - 4.7	17.4 - 7.1
55	6°13.8	6°14.8	5°56.7	5.5 - 2.2	11.5 - 4.7	17.5 - 7.1
56	6°14.0	6°15.0	5°57.0	5.6 - 2.3	11.6 - 4.7	17.6 - 7.2
57	6°14.2	6°15.3	5°57.2	5.7 - 2.3	11.7 - 4.8	17.7 - 7.2
58	6°14.5	6°15.5	5°57.4	5.8 - 2.4	11.8 - 4.8	17.8 - 7.3
59	6°14.8	6°15.8	5°57.7	5.9 - 2.4	11.9 - 4.9	17.9 - 7.3

m 25	Sun Plan.	Aries	Moon	v and d corr		
0	6°15.0	6°16.0	5°57.9	0.0 - 0.0	6.0 - 2.5	12.0 - 5.1
1	6°15.2	6°16.3	5°58.2	0.1 - 0.0	6.1 - 2.6	12.1 - 5.1
2	6°15.5	6°16.5	5°58.4	0.2 - 0.1	6.2 - 2.6	12.2 - 5.2
3	6°15.8	6°16.8	5°58.6	0.3 - 0.1	6.3 - 2.7	12.3 - 5.2
4	6°16.0	6°17.0	5°58.9	0.4 - 0.2	6.4 - 2.7	12.4 - 5.3
5	6°16.2	6°17.3	5°59.1	0.5 - 0.2	6.5 - 2.8	12.5 - 5.3
6	6°16.5	6°17.5	5°59.3	0.6 - 0.3	6.6 - 2.8	12.6 - 5.4
7	6°16.8	6°17.8	5°59.6	0.7 - 0.3	6.7 - 2.8	12.7 - 5.4
8	6°17.0	6°18.0	5°59.8	0.8 - 0.3	6.8 - 2.9	12.8 - 5.4
9	6°17.2	6°18.3	6°00.1	0.9 - 0.4	6.9 - 2.9	12.9 - 5.5
10	6°17.5	6°18.5	6°00.3	1.0 - 0.4	7.0 - 3.0	13.0 - 5.5
11	6°17.8	6°18.8	6°00.5	1.1 - 0.5	7.1 - 3.0	13.1 - 5.6
12	6°18.0	6°19.0	6°00.8	1.2 - 0.5	7.2 - 3.1	13.2 - 5.6
13	6°18.2	6°19.3	6°01.0	1.3 - 0.6	7.3 - 3.1	13.3 - 5.7
14	6°18.5	6°19.5	6°01.3	1.4 - 0.6	7.4 - 3.1	13.4 - 5.7
15	6°18.8	6°19.8	6°01.5	1.5 - 0.6	7.5 - 3.2	13.5 - 5.7
16	6°19.0	6°20.0	6°01.7	1.6 - 0.7	7.6 - 3.2	13.6 - 5.8
17	6°19.3	6°20.3	6°02.0	1.7 - 0.7	7.7 - 3.3	13.7 - 5.8
18	6°19.5	6°20.5	6°02.2	1.8 - 0.8	7.8 - 3.3	13.8 - 5.9
19	6°19.7	6°20.8	6°02.5	1.9 - 0.8	7.9 - 3.4	13.9 - 5.9
20	6°20.0	6°21.0	6°02.7	2.0 - 0.8	8.0 - 3.4	14.0 - 6.0
21	6°20.3	6°21.3	6°02.9	2.1 - 0.9	8.1 - 3.4	14.1 - 6.0
22	6°20.5	6°21.5	6°03.2	2.2 - 0.9	8.2 - 3.5	14.2 - 6.0
23	6°20.7	6°21.8	6°03.4	2.3 - 1.0	8.3 - 3.5	14.3 - 6.1
24	6°21.0	6°22.0	6°03.6	2.4 - 1.0	8.4 - 3.6	14.4 - 6.1
25	6°21.3	6°22.3	6°03.9	2.5 - 1.1	8.5 - 3.6	14.5 - 6.2
26	6°21.5	6°22.5	6°04.1	2.6 - 1.1	8.6 - 3.7	14.6 - 6.2
27	6°21.7	6°22.8	6°04.4	2.7 - 1.1	8.7 - 3.7	14.7 - 6.2
28	6°22.0	6°23.0	6°04.6	2.8 - 1.2	8.8 - 3.7	14.8 - 6.3
29	6°22.3	6°23.3	6°04.8	2.9 - 1.2	8.9 - 3.8	14.9 - 6.3
30	6°22.5	6°23.5	6°05.1	3.0 - 1.3	9.0 - 3.8	15.0 - 6.4
31	6°22.7	6°23.8	6°05.3	3.1 - 1.3	9.1 - 3.9	15.1 - 6.4
32	6°23.0	6°24.0	6°05.6	3.2 - 1.4	9.2 - 3.9	15.2 - 6.5
33	6°23.3	6°24.3	6°05.8	3.3 - 1.4	9.3 - 4.0	15.3 - 6.5
34	6°23.5	6°24.5	6°06.0	3.4 - 1.4	9.4 - 4.0	15.4 - 6.5
35	6°23.7	6°24.8	6°06.3	3.5 - 1.5	9.5 - 4.0	15.5 - 6.6
36	6°24.0	6°25.0	6°06.5	3.6 - 1.5	9.6 - 4.1	15.6 - 6.6
37	6°24.3	6°25.3	6°06.7	3.7 - 1.6	9.7 - 4.1	15.7 - 6.7
38	6°24.5	6°25.6	6°07.0	3.8 - 1.6	9.8 - 4.2	15.8 - 6.7
39	6°24.7	6°25.8	6°07.2	3.9 - 1.7	9.9 - 4.2	15.9 - 6.8
40	6°25.0	6°26.1	6°07.5	4.0 - 1.7	10.0 - 4.3	16.0 - 6.8
41	6°25.3	6°26.3	6°07.7	4.1 - 1.7	10.1 - 4.3	16.1 - 6.8
42	6°25.5	6°26.6	6°07.9	4.2 - 1.8	10.2 - 4.3	16.2 - 6.9
43	6°25.7	6°26.8	6°08.2	4.3 - 1.8	10.3 - 4.4	16.3 - 6.9
44	6°26.0	6°27.1	6°08.4	4.4 - 1.9	10.4 - 4.4	16.4 - 7.0
45	6°26.3	6°27.3	6°08.7	4.5 - 1.9	10.5 - 4.5	16.5 - 7.0
46	6°26.5	6°27.6	6°08.9	4.6 - 2.0	10.6 - 4.5	16.6 - 7.1
47	6°26.8	6°27.8	6°09.1	4.7 - 2.0	10.7 - 4.5	16.7 - 7.1
48	6°27.0	6°28.1	6°09.4	4.8 - 2.0	10.8 - 4.6	16.8 - 7.1
49	6°27.2	6°28.3	6°09.6	4.9 - 2.1	10.9 - 4.6	16.9 - 7.2
50	6°27.5	6°28.6	6°09.8	5.0 - 2.1	11.0 - 4.7	17.0 - 7.2
51	6°27.8	6°28.8	6°10.1	5.1 - 2.2	11.1 - 4.7	17.1 - 7.3
52	6°28.0	6°29.1	6°10.3	5.2 - 2.2	11.2 - 4.8	17.2 - 7.3
53	6°28.2	6°29.3	6°10.6	5.3 - 2.3	11.3 - 4.8	17.3 - 7.4
54	6°28.5	6°29.6	6°10.8	5.4 - 2.3	11.4 - 4.8	17.4 - 7.4
55	6°28.8	6°29.8	6°11.0	5.5 - 2.3	11.5 - 4.9	17.5 - 7.4
56	6°29.0	6°30.1	6°11.3	5.6 - 2.4	11.6 - 4.9	17.6 - 7.5
57	6°29.2	6°30.3	6°11.5	5.7 - 2.4	11.7 - 5.0	17.7 - 7.5
58	6°29.5	6°30.6	6°11.8	5.8 - 2.5	11.8 - 5.0	17.8 - 7.6
59	6°29.8	6°30.8	6°12.0	5.9 - 2.5	11.9 - 5.1	17.9 - 7.6

m 26	Sun Plan.	Aries	Moon	v and d corr		
0	6°30.0	6°31.1	6°12.2	0.0 - 0.0	6.0 - 2.6	12.0 - 5.3
1	6°30.2	6°31.3	6°12.5	0.1 - 0.0	6.1 - 2.7	12.1 - 5.3
2	6°30.5	6°31.6	6°12.7	0.2 - 0.1	6.2 - 2.7	12.2 - 5.4
3	6°30.8	6°31.8	6°12.9	0.3 - 0.1	6.3 - 2.8	12.3 - 5.4
4	6°31.0	6°32.1	6°13.2	0.4 - 0.2	6.4 - 2.8	12.4 - 5.5
5	6°31.2	6°32.3	6°13.4	0.5 - 0.2	6.5 - 2.9	12.5 - 5.5
6	6°31.5	6°32.6	6°13.7	0.6 - 0.3	6.6 - 2.9	12.6 - 5.6
7	6°31.8	6°32.8	6°13.9	0.7 - 0.3	6.7 - 3.0	12.7 - 5.6
8	6°32.0	6°33.1	6°14.1	0.8 - 0.4	6.8 - 3.0	12.8 - 5.7
9	6°32.2	6°33.3	6°14.4	0.9 - 0.4	6.9 - 3.0	12.9 - 5.7
10	6°32.5	6°33.6	6°14.6	1.0 - 0.4	7.0 - 3.1	13.0 - 5.7
11	6°32.8	6°33.8	6°14.9	1.1 - 0.5	7.1 - 3.1	13.1 - 5.8
12	6°33.0	6°34.1	6°15.1	1.2 - 0.5	7.2 - 3.2	13.2 - 5.8
13	6°33.2	6°34.3	6°15.3	1.3 - 0.6	7.3 - 3.2	13.3 - 5.9
14	6°33.5	6°34.6	6°15.6	1.4 - 0.6	7.4 - 3.3	13.4 - 5.9
15	6°33.8	6°34.8	6°15.8	1.5 - 0.7	7.5 - 3.3	13.5 - 6.0
16	6°34.0	6°35.1	6°16.1	1.6 - 0.7	7.6 - 3.4	13.6 - 6.0
17	6°34.3	6°35.3	6°16.3	1.7 - 0.8	7.7 - 3.4	13.7 - 6.1
18	6°34.5	6°35.6	6°16.5	1.8 - 0.8	7.8 - 3.4	13.8 - 6.1
19	6°34.8	6°35.8	6°16.8	1.9 - 0.8	7.9 - 3.5	13.9 - 6.1
20	6°35.0	6°36.1	6°17.0	2.0 - 0.9	8.0 - 3.5	14.0 - 6.2
21	6°35.3	6°36.3	6°17.2	2.1 - 0.9	8.1 - 3.6	14.1 - 6.2
22	6°35.5	6°36.6	6°17.5	2.2 - 1.0	8.2 - 3.6	14.2 - 6.3
23	6°35.7	6°36.8	6°17.7	2.3 - 1.0	8.3 - 3.7	14.3 - 6.3
24	6°36.0	6°37.1	6°18.0	2.4 - 1.1	8.4 - 3.7	14.4 - 6.4
25	6°36.3	6°37.3	6°18.2	2.5 - 1.1	8.5 - 3.8	14.5 - 6.4
26	6°36.5	6°37.6	6°18.4	2.6 - 1.1	8.6 - 3.8	14.6 - 6.4
27	6°36.7	6°37.8	6°18.7	2.7 - 1.2	8.7 - 3.8	14.7 - 6.5
28	6°37.0	6°38.1	6°18.9	2.8 - 1.2	8.8 - 3.9	14.8 - 6.5
29	6°37.3	6°38.3	6°19.2	2.9 - 1.3	8.9 - 3.9	14.9 - 6.6
30	6°37.5	6°38.6	6°19.4	3.0 - 1.3	9.0 - 4.0	15.0 - 6.6
31	6°37.7	6°38.8	6°19.6	3.1 - 1.4	9.1 - 4.0	15.1 - 6.7
32	6°38.0	6°39.1	6°19.9	3.2 - 1.4	9.2 - 4.1	15.2 - 6.7
33	6°38.3	6°39.3	6°20.1	3.3 - 1.5	9.3 - 4.1	15.3 - 6.8
34	6°38.5	6°39.6	6°20.3	3.4 - 1.5	9.4 - 4.2	15.4 - 6.8
35	6°38.7	6°39.8	6°20.6	3.5 - 1.5	9.5 - 4.2	15.5 - 6.8
36	6°39.0	6°40.1	6°20.8	3.6 - 1.6	9.6 - 4.2	15.6 - 6.9
37	6°39.3	6°40.3	6°21.1	3.7 - 1.6	9.7 - 4.3	15.7 - 6.9
38	6°39.5	6°40.6	6°21.3	3.8 - 1.7	9.8 - 4.3	15.8 - 7.0
39	6°39.7	6°40.8	6°21.5	3.9 - 1.7	9.9 - 4.4	15.9 - 7.0
40	6°40.0	6°41.1	6°21.8	4.0 - 1.8	10.0 - 4.4	16.0 - 7.1
41	6°40.3	6°41.3	6°22.0	4.1 - 1.8	10.1 - 4.5	16.1 - 7.1
42	6°40.5	6°41.6	6°22.3	4.2 - 1.9	10.2 - 4.5	16.2 - 7.2
43	6°40.7	6°41.8	6°22.5	4.3 - 1.9	10.3 - 4.5	16.3 - 7.2
44	6°41.0	6°42.1	6°22.7	4.4 - 1.9	10.4 - 4.6	16.4 - 7.2
45	6°41.3	6°42.3	6°23.0	4.5 - 2.0	10.5 - 4.6	16.5 - 7.3
46	6°41.5	6°42.6	6°23.2	4.6 - 2.0	10.6 - 4.7	16.6 - 7.3
47	6°41.8	6°42.8	6°23.4	4.7 - 2.1	10.7 - 4.7	16.7 - 7.4
48	6°42.0	6°43.1	6°23.7	4.8 - 2.1	10.8 - 4.8	16.8 - 7.4
49	6°42.3	6°43.3	6°23.9	4.9 - 2.2	10.9 - 4.8	16.9 - 7.5
50	6°42.5	6°43.6	6°24.2	5.0 - 2.2	11.0 - 4.9	17.0 - 7.5
51	6°42.8	6°43.9	6°24.4	5.1 - 2.3	11.1 - 4.9	17.1 - 7.6
52	6°43.0	6°44.1	6°24.6	5.2 - 2.3	11.2 - 4.9	17.2 - 7.6
53	6°43.2	6°44.4	6°24.9	5.3 - 2.3	11.3 - 5.0	17.3 - 7.6
54	6°43.5	6°44.6	6°25.1	5.4 - 2.4	11.4 - 5.0	17.4 - 7.7
55	6°43.8	6°44.9	6°25.4	5.5 - 2.4	11.5 - 5.1	17.5 - 7.7
56	6°44.0	6°45.1	6°25.6	5.6 - 2.5	11.6 - 5.1	17.6 - 7.8
57	6°44.2	6°45.4	6°25.8	5.7 - 2.5	11.7 - 5.2	17.7 - 7.8
58	6°44.5	6°45.6	6°26.1	5.8 - 2.6	11.8 - 5.2	17.8 - 7.9
59	6°44.8	6°45.9	6°26.3	5.9 - 2.6	11.9 - 5.3	17.9 - 7.9

Increments and Corrections

m 27	Sun Plan.	Aries	Moon	v and d corr		
0	6°45.0	6°46.1	6°26.5	0.0 - 0.0	6.0 - 2.8	12.0 - 5.5
1	6°45.2	6°46.4	6°26.8	0.1 - 0.0	6.1 - 2.8	12.1 - 5.5
2	6°45.5	6°46.6	6°27.0	0.2 - 0.1	6.2 - 2.8	12.2 - 5.6
3	6°45.8	6°46.9	6°27.3	0.3 - 0.1	6.3 - 2.9	12.3 - 5.6
4	6°46.0	6°47.1	6°27.5	0.4 - 0.2	6.4 - 2.9	12.4 - 5.7
5	6°46.2	6°47.4	6°27.7	0.5 - 0.2	6.5 - 3.0	12.5 - 5.7
6	6°46.5	6°47.6	6°28.0	0.6 - 0.3	6.6 - 3.0	12.6 - 5.8
7	6°46.8	6°47.9	6°28.2	0.7 - 0.3	6.7 - 3.1	12.7 - 5.8
8	6°47.0	6°48.1	6°28.5	0.8 - 0.4	6.8 - 3.1	12.8 - 5.9
9	6°47.2	6°48.4	6°28.7	0.9 - 0.4	6.9 - 3.2	12.9 - 5.9
10	6°47.5	6°48.6	6°28.9	1.0 - 0.5	7.0 - 3.2	13.0 - 6.0
11	6°47.8	6°48.9	6°29.2	1.1 - 0.5	7.1 - 3.3	13.1 - 6.0
12	6°48.0	6°49.1	6°29.4	1.2 - 0.6	7.2 - 3.3	13.2 - 6.0
13	6°48.2	6°49.4	6°29.7	1.3 - 0.6	7.3 - 3.3	13.3 - 6.1
14	6°48.5	6°49.6	6°29.9	1.4 - 0.6	7.4 - 3.4	13.4 - 6.1
15	6°48.8	6°49.9	6°30.1	1.5 - 0.7	7.5 - 3.4	13.5 - 6.2
16	6°49.0	6°50.1	6°30.4	1.6 - 0.7	7.6 - 3.5	13.6 - 6.2
17	6°49.3	6°50.4	6°30.6	1.7 - 0.8	7.7 - 3.5	13.7 - 6.3
18	6°49.5	6°50.6	6°30.8	1.8 - 0.8	7.8 - 3.6	13.8 - 6.3
19	6°49.8	6°50.9	6°31.1	1.9 - 0.9	7.9 - 3.6	13.9 - 6.4
20	6°50.0	6°51.1	6°31.3	2.0 - 0.9	8.0 - 3.7	14.0 - 6.4
21	6°50.3	6°51.4	6°31.6	2.1 - 1.0	8.1 - 3.7	14.1 - 6.5
22	6°50.5	6°51.6	6°31.8	2.2 - 1.0	8.2 - 3.8	14.2 - 6.5
23	6°50.7	6°51.9	6°32.0	2.3 - 1.1	8.3 - 3.8	14.3 - 6.6
24	6°51.0	6°52.1	6°32.3	2.4 - 1.1	8.4 - 3.9	14.4 - 6.6
25	6°51.3	6°52.4	6°32.5	2.5 - 1.1	8.5 - 3.9	14.5 - 6.6
26	6°51.5	6°52.6	6°32.8	2.6 - 1.2	8.6 - 3.9	14.6 - 6.7
27	6°51.7	6°52.9	6°33.0	2.7 - 1.2	8.7 - 4.0	14.7 - 6.7
28	6°52.0	6°53.1	6°33.2	2.8 - 1.3	8.8 - 4.0	14.8 - 6.8
29	6°52.3	6°53.4	6°33.5	2.9 - 1.3	8.9 - 4.1	14.9 - 6.8
30	6°52.5	6°53.6	6°33.7	3.0 - 1.4	9.0 - 4.1	15.0 - 6.9
31	6°52.7	6°53.9	6°33.9	3.1 - 1.4	9.1 - 4.2	15.1 - 6.9
32	6°53.0	6°54.1	6°34.2	3.2 - 1.5	9.2 - 4.2	15.2 - 7.0
33	6°53.3	6°54.4	6°34.4	3.3 - 1.5	9.3 - 4.3	15.3 - 7.0
34	6°53.5	6°54.6	6°34.7	3.4 - 1.6	9.4 - 4.3	15.4 - 7.1
35	6°53.7	6°54.9	6°34.9	3.5 - 1.6	9.5 - 4.4	15.5 - 7.1
36	6°54.0	6°55.1	6°35.1	3.6 - 1.6	9.6 - 4.4	15.6 - 7.1
37	6°54.3	6°55.4	6°35.4	3.7 - 1.7	9.7 - 4.4	15.7 - 7.2
38	6°54.5	6°55.6	6°35.6	3.8 - 1.7	9.8 - 4.5	15.8 - 7.2
39	6°54.7	6°55.9	6°35.9	3.9 - 1.8	9.9 - 4.5	15.9 - 7.3
40	6°55.0	6°56.1	6°36.1	4.0 - 1.8	10.0 - 4.6	16.0 - 7.3
41	6°55.3	6°56.4	6°36.3	4.1 - 1.9	10.1 - 4.6	16.1 - 7.4
42	6°55.5	6°56.6	6°36.6	4.2 - 1.9	10.2 - 4.7	16.2 - 7.4
43	6°55.7	6°56.9	6°36.8	4.3 - 2.0	10.3 - 4.7	16.3 - 7.5
44	6°56.0	6°57.1	6°37.0	4.4 - 2.0	10.4 - 4.8	16.4 - 7.5
45	6°56.3	6°57.4	6°37.3	4.5 - 2.1	10.5 - 4.8	16.5 - 7.6
46	6°56.5	6°57.6	6°37.5	4.6 - 2.1	10.6 - 4.9	16.6 - 7.6
47	6°56.8	6°57.9	6°37.8	4.7 - 2.2	10.7 - 4.9	16.7 - 7.7
48	6°57.0	6°58.1	6°38.0	4.8 - 2.2	10.8 - 5.0	16.8 - 7.7
49	6°57.3	6°58.4	6°38.2	4.9 - 2.2	10.9 - 5.0	16.9 - 7.7
50	6°57.5	6°58.6	6°38.5	5.0 - 2.3	11.0 - 5.0	17.0 - 7.8
51	6°57.8	6°58.9	6°38.7	5.1 - 2.3	11.1 - 5.1	17.1 - 7.8
52	6°58.0	6°59.1	6°39.0	5.2 - 2.4	11.2 - 5.1	17.2 - 7.9
53	6°58.2	6°59.4	6°39.2	5.3 - 2.4	11.3 - 5.2	17.3 - 7.9
54	6°58.5	6°59.6	6°39.4	5.4 - 2.5	11.4 - 5.2	17.4 - 8.0
55	6°58.8	6°59.9	6°39.7	5.5 - 2.5	11.5 - 5.3	17.5 - 8.0
56	6°59.0	7°00.1	6°39.9	5.6 - 2.6	11.6 - 5.3	17.6 - 8.1
57	6°59.2	7°00.4	6°40.2	5.7 - 2.6	11.7 - 5.4	17.7 - 8.1
58	6°59.5	7°00.6	6°40.4	5.8 - 2.7	11.8 - 5.4	17.8 - 8.2
59	6°59.8	7°00.9	6°40.6	5.9 - 2.7	11.9 - 5.5	17.9 - 8.2

m 28	Sun Plan.	Aries	Moon	v and d corr		
0	7°00.0	7°01.1	6°40.9	0.0 - 0.0	6.0 - 2.8	12.0 - 5.7
1	7°00.2	7°01.4	6°41.1	0.1 - 0.0	6.1 - 2.9	12.1 - 5.7
2	7°00.5	7°01.6	6°41.3	0.2 - 0.1	6.2 - 2.9	12.2 - 5.8
3	7°00.8	7°01.9	6°41.6	0.3 - 0.1	6.3 - 3.0	12.3 - 5.8
4	7°01.0	7°02.2	6°41.8	0.4 - 0.2	6.4 - 3.0	12.4 - 5.9
5	7°01.2	7°02.4	6°42.1	0.5 - 0.2	6.5 - 3.1	12.5 - 5.9
6	7°01.5	7°02.7	6°42.3	0.6 - 0.3	6.6 - 3.1	12.6 - 6.0
7	7°01.8	7°02.9	6°42.5	0.7 - 0.3	6.7 - 3.2	12.7 - 6.0
8	7°02.0	7°03.2	6°42.8	0.8 - 0.4	6.8 - 3.2	12.8 - 6.1
9	7°02.2	7°03.4	6°43.0	0.9 - 0.4	6.9 - 3.3	12.9 - 6.1
10	7°02.5	7°03.7	6°43.3	1.0 - 0.5	7.0 - 3.3	13.0 - 6.2
11	7°02.8	7°03.9	6°43.5	1.1 - 0.5	7.1 - 3.4	13.1 - 6.2
12	7°03.0	7°04.2	6°43.7	1.2 - 0.6	7.2 - 3.4	13.2 - 6.3
13	7°03.2	7°04.4	6°44.0	1.3 - 0.6	7.3 - 3.5	13.3 - 6.3
14	7°03.5	7°04.7	6°44.2	1.4 - 0.7	7.4 - 3.5	13.4 - 6.4
15	7°03.8	7°04.9	6°44.4	1.5 - 0.7	7.5 - 3.6	13.5 - 6.4
16	7°04.0	7°05.2	6°44.7	1.6 - 0.8	7.6 - 3.6	13.6 - 6.5
17	7°04.3	7°05.4	6°44.9	1.7 - 0.8	7.7 - 3.7	13.7 - 6.5
18	7°04.5	7°05.7	6°45.2	1.8 - 0.9	7.8 - 3.7	13.8 - 6.6
19	7°04.7	7°05.9	6°45.4	1.9 - 0.9	7.9 - 3.8	13.9 - 6.6
20	7°05.0	7°06.2	6°45.6	2.0 - 0.9	8.0 - 3.8	14.0 - 6.6
21	7°05.3	7°06.4	6°45.9	2.1 - 1.0	8.1 - 3.8	14.1 - 6.7
22	7°05.5	7°06.7	6°46.1	2.2 - 1.0	8.2 - 3.9	14.2 - 6.7
23	7°05.7	7°06.9	6°46.4	2.3 - 1.1	8.3 - 3.9	14.3 - 6.8
24	7°06.0	7°07.2	6°46.6	2.4 - 1.1	8.4 - 4.0	14.4 - 6.8
25	7°06.3	7°07.4	6°46.8	2.5 - 1.2	8.5 - 4.0	14.5 - 6.9
26	7°06.5	7°07.7	6°47.1	2.6 - 1.2	8.6 - 4.1	14.6 - 6.9
27	7°06.7	7°07.9	6°47.3	2.7 - 1.3	8.7 - 4.1	14.7 - 7.0
28	7°07.0	7°08.2	6°47.5	2.8 - 1.3	8.8 - 4.2	14.8 - 7.0
29	7°07.3	7°08.4	6°47.8	2.9 - 1.4	8.9 - 4.2	14.9 - 7.1
30	7°07.5	7°08.7	6°48.0	3.0 - 1.4	9.0 - 4.3	15.0 - 7.1
31	7°07.7	7°08.9	6°48.3	3.1 - 1.5	9.1 - 4.3	15.1 - 7.2
32	7°08.0	7°09.2	6°48.5	3.2 - 1.5	9.2 - 4.4	15.2 - 7.2
33	7°08.3	7°09.4	6°48.7	3.3 - 1.6	9.3 - 4.4	15.3 - 7.3
34	7°08.5	7°09.7	6°49.0	3.4 - 1.6	9.4 - 4.5	15.4 - 7.3
35	7°08.7	7°09.9	6°49.2	3.5 - 1.7	9.5 - 4.5	15.5 - 7.4
36	7°09.0	7°10.2	6°49.5	3.6 - 1.7	9.6 - 4.6	15.6 - 7.4
37	7°09.3	7°10.4	6°49.7	3.7 - 1.8	9.7 - 4.6	15.7 - 7.5
38	7°09.5	7°10.7	6°49.9	3.8 - 1.8	9.8 - 4.7	15.8 - 7.5
39	7°09.7	7°10.9	6°50.2	3.9 - 1.9	9.9 - 4.7	15.9 - 7.6
40	7°10.0	7°11.2	6°50.4	4.0 - 1.9	10.0 - 4.8	16.0 - 7.6
41	7°10.3	7°11.4	6°50.6	4.1 - 1.9	10.1 - 4.8	16.1 - 7.6
42	7°10.5	7°11.7	6°50.9	4.2 - 2.0	10.2 - 4.8	16.2 - 7.7
43	7°10.7	7°11.9	6°51.1	4.3 - 2.0	10.3 - 4.9	16.3 - 7.7
44	7°11.0	7°12.2	6°51.4	4.4 - 2.1	10.4 - 4.9	16.4 - 7.8
45	7°11.3	7°12.4	6°51.6	4.5 - 2.1	10.5 - 5.0	16.5 - 7.8
46	7°11.5	7°12.7	6°51.8	4.6 - 2.2	10.6 - 5.0	16.6 - 7.9
47	7°11.8	7°12.9	6°52.1	4.7 - 2.2	10.7 - 5.1	16.7 - 7.9
48	7°12.0	7°13.2	6°52.3	4.8 - 2.3	10.8 - 5.1	16.8 - 8.0
49	7°12.2	7°13.4	6°52.6	4.9 - 2.3	10.9 - 5.2	16.9 - 8.0
50	7°12.5	7°13.7	6°52.8	5.0 - 2.4	11.0 - 5.2	17.0 - 8.1
51	7°12.8	7°13.9	6°53.0	5.1 - 2.4	11.1 - 5.3	17.1 - 8.1
52	7°13.0	7°14.2	6°53.3	5.2 - 2.5	11.2 - 5.3	17.2 - 8.2
53	7°13.2	7°14.4	6°53.5	5.3 - 2.5	11.3 - 5.4	17.3 - 8.2
54	7°13.5	7°14.7	6°53.8	5.4 - 2.6	11.4 - 5.4	17.4 - 8.3
55	7°13.8	7°14.9	6°54.0	5.5 - 2.6	11.5 - 5.5	17.5 - 8.3
56	7°14.0	7°15.2	6°54.2	5.6 - 2.7	11.6 - 5.5	17.6 - 8.4
57	7°14.2	7°15.4	6°54.5	5.7 - 2.7	11.7 - 5.6	17.7 - 8.4
58	7°14.5	7°15.7	6°54.7	5.8 - 2.8	11.8 - 5.6	17.8 - 8.5
59	7°14.8	7°15.9	6°54.9	5.9 - 2.8	11.9 - 5.7	17.9 - 8.5

m 29	Sun Plan.	Aries	Moon	v and d corr		
0	7°15.0	7°16.2	6°55.2	0.0 - 0.0	6.0 - 2.9	12.0 - 5.9
1	7°15.2	7°16.4	6°55.4	0.1 - 0.0	6.1 - 3.0	12.1 - 5.9
2	7°15.5	7°16.7	6°55.7	0.2 - 0.1	6.2 - 3.0	12.2 - 6.0
3	7°15.8	7°16.9	6°55.9	0.3 - 0.1	6.3 - 3.1	12.3 - 6.0
4	7°16.0	7°17.2	6°56.1	0.4 - 0.2	6.4 - 3.1	12.4 - 6.1
5	7°16.2	7°17.4	6°56.4	0.5 - 0.2	6.5 - 3.2	12.5 - 6.1
6	7°16.5	7°17.7	6°56.6	0.6 - 0.3	6.6 - 3.2	12.6 - 6.2
7	7°16.8	7°17.9	6°56.9	0.7 - 0.3	6.7 - 3.3	12.7 - 6.2
8	7°17.0	7°18.2	6°57.1	0.8 - 0.4	6.8 - 3.3	12.8 - 6.3
9	7°17.2	7°18.4	6°57.3	0.9 - 0.4	6.9 - 3.4	12.9 - 6.3
10	7°17.5	7°18.7	6°57.6	1.0 - 0.5	7.0 - 3.4	13.0 - 6.4
11	7°17.8	7°18.9	6°57.8	1.1 - 0.5	7.1 - 3.5	13.1 - 6.4
12	7°18.0	7°19.2	6°58.0	1.2 - 0.6	7.2 - 3.5	13.2 - 6.5
13	7°18.2	7°19.4	6°58.3	1.3 - 0.6	7.3 - 3.6	13.3 - 6.5
14	7°18.5	7°19.7	6°58.5	1.4 - 0.7	7.4 - 3.6	13.4 - 6.6
15	7°18.8	7°19.9	6°58.8	1.5 - 0.7	7.5 - 3.7	13.5 - 6.6
16	7°19.0	7°20.2	6°59.0	1.6 - 0.8	7.6 - 3.7	13.6 - 6.7
17	7°19.3	7°20.5	6°59.2	1.7 - 0.8	7.7 - 3.8	13.7 - 6.7
18	7°19.5	7°20.7	6°59.5	1.8 - 0.9	7.8 - 3.8	13.8 - 6.8
19	7°19.7	7°21.0	6°59.7	1.9 - 0.9	7.9 - 3.9	13.9 - 6.8
20	7°20.0	7°21.2	7°00.0	2.0 - 1.0	8.0 - 3.9	14.0 - 6.9
21	7°20.3	7°21.5	7°00.2	2.1 - 1.0	8.1 - 4.0	14.1 - 6.9
22	7°20.5	7°21.7	7°00.4	2.2 - 1.1	8.2 - 4.0	14.2 - 7.0
23	7°20.7	7°22.0	7°00.7	2.3 - 1.1	8.3 - 4.1	14.3 - 7.0
24	7°21.0	7°22.2	7°00.9	2.4 - 1.2	8.4 - 4.1	14.4 - 7.1
25	7°21.3	7°22.5	7°01.1	2.5 - 1.2	8.5 - 4.2	14.5 - 7.1
26	7°21.5	7°22.7	7°01.4	2.6 - 1.3	8.6 - 4.2	14.6 - 7.2
27	7°21.7	7°23.0	7°01.6	2.7 - 1.3	8.7 - 4.3	14.7 - 7.2
28	7°22.0	7°23.2	7°01.9	2.8 - 1.4	8.8 - 4.3	14.8 - 7.3
29	7°22.3	7°23.5	7°02.1	2.9 - 1.4	8.9 - 4.4	14.9 - 7.3
30	7°22.5	7°23.7	7°02.3	3.0 - 1.5	9.0 - 4.4	15.0 - 7.4
31	7°22.7	7°24.0	7°02.6	3.1 - 1.5	9.1 - 4.5	15.1 - 7.4
32	7°23.0	7°24.2	7°02.8	3.2 - 1.6	9.2 - 4.5	15.2 - 7.5
33	7°23.3	7°24.5	7°03.1	3.3 - 1.6	9.3 - 4.6	15.3 - 7.5
34	7°23.5	7°24.7	7°03.3	3.4 - 1.7	9.4 - 4.6	15.4 - 7.6
35	7°23.7	7°25.0	7°03.5	3.5 - 1.7	9.5 - 4.7	15.5 - 7.6
36	7°24.0	7°25.2	7°03.8	3.6 - 1.8	9.6 - 4.7	15.6 - 7.7
37	7°24.3	7°25.5	7°04.0	3.7 - 1.8	9.7 - 4.8	15.7 - 7.7
38	7°24.5	7°25.7	7°04.3	3.8 - 1.9	9.8 - 4.8	15.8 - 7.8
39	7°24.7	7°26.0	7°04.5	3.9 - 1.9	9.9 - 4.9	15.9 - 7.8
40	7°25.0	7°26.2	7°04.7	4.0 - 2.0	10.0 - 4.9	16.0 - 7.9
41	7°25.3	7°26.5	7°05.0	4.1 - 2.0	10.1 - 5.0	16.1 - 7.9
42	7°25.5	7°26.7	7°05.2	4.2 - 2.1	10.2 - 5.0	16.2 - 8.0
43	7°25.7	7°27.0	7°05.4	4.3 - 2.1	10.3 - 5.1	16.3 - 8.0
44	7°26.0	7°27.2	7°05.7	4.4 - 2.2	10.4 - 5.1	16.4 - 8.1
45	7°26.3	7°27.5	7°05.9	4.5 - 2.2	10.5 - 5.2	16.5 - 8.1
46	7°26.5	7°27.7	7°06.2	4.6 - 2.3	10.6 - 5.2	16.6 - 8.2
47	7°26.8	7°28.0	7°06.4	4.7 - 2.3	10.7 - 5.3	16.7 - 8.2
48	7°27.0	7°28.2	7°06.6	4.8 - 2.4	10.8 - 5.3	16.8 - 8.3
49	7°27.2	7°28.5	7°06.9	4.9 - 2.4	10.9 - 5.4	16.9 - 8.3
50	7°27.5	7°28.7	7°07.1	5.0 - 2.5	11.0 - 5.4	17.0 - 8.4
51	7°27.8	7°29.0	7°07.4	5.1 - 2.5	11.1 - 5.5	17.1 - 8.4
52	7°28.0	7°29.2	7°07.6	5.2 - 2.6	11.2 - 5.5	17.2 - 8.5
53	7°28.2	7°29.5	7°07.8	5.3 - 2.6	11.3 - 5.6	17.3 - 8.5
54	7°28.5	7°29.7	7°08.1	5.4 - 2.7	11.4 - 5.6	17.4 - 8.6
55	7°28.8	7°30.0	7°08.3	5.5 - 2.7	11.5 - 5.7	17.5 - 8.6
56	7°29.0	7°30.2	7°08.5	5.6 - 2.8	11.6 - 5.7	17.6 - 8.7
57	7°29.2	7°30.5	7°08.8	5.7 - 2.8	11.7 - 5.8	17.7 - 8.7
58	7°29.5	7°30.7	7°09.0	5.8 - 2.9	11.8 - 5.8	17.8 - 8.8
59	7°29.8	7°31.0	7°09.3	5.9 - 2.9	11.9 - 5.9	17.9 - 8.8

Increments and Corrections

m 30	Sun Plan.	Aries	Moon	v and d corr		
0	7°30.0	7°31.2	7°09.5	0.0 - 0.0	6.0 - 3.0	12.0 - 6.1
1	7°30.2	7°31.5	7°09.7	0.1 - 0.1	6.1 - 3.1	12.1 - 6.2
2	7°30.5	7°31.7	7°10.0	0.2 - 0.1	6.2 - 3.2	12.2 - 6.2
3	7°30.8	7°32.0	7°10.2	0.3 - 0.2	6.3 - 3.2	12.3 - 6.3
4	7°31.0	7°32.2	7°10.5	0.4 - 0.2	6.4 - 3.3	12.4 - 6.3
5	7°31.2	7°32.5	7°10.7	0.5 - 0.3	6.5 - 3.3	12.5 - 6.4
6	7°31.5	7°32.7	7°10.9	0.6 - 0.3	6.6 - 3.4	12.6 - 6.4
7	7°31.7	7°33.0	7°11.2	0.7 - 0.4	6.7 - 3.4	12.7 - 6.5
8	7°32.0	7°33.2	7°11.4	0.8 - 0.4	6.8 - 3.5	12.8 - 6.5
9	7°32.2	7°33.5	7°11.6	0.9 - 0.5	6.9 - 3.5	12.9 - 6.6
10	7°32.5	7°33.7	7°11.9	1.0 - 0.5	7.0 - 3.6	13.0 - 6.6
11	7°32.8	7°34.0	7°12.1	1.1 - 0.6	7.1 - 3.6	13.1 - 6.7
12	7°33.0	7°34.2	7°12.4	1.2 - 0.6	7.2 - 3.7	13.2 - 6.7
13	7°33.3	7°34.5	7°12.6	1.3 - 0.7	7.3 - 3.7	13.3 - 6.8
14	7°33.5	7°34.7	7°12.8	1.4 - 0.7	7.4 - 3.8	13.4 - 6.8
15	7°33.8	7°35.0	7°13.1	1.5 - 0.8	7.5 - 3.8	13.5 - 6.9
16	7°34.0	7°35.2	7°13.3	1.6 - 0.8	7.6 - 3.9	13.6 - 6.9
17	7°34.3	7°35.5	7°13.6	1.7 - 0.9	7.7 - 3.9	13.7 - 7.0
18	7°34.5	7°35.7	7°13.8	1.8 - 0.9	7.8 - 4.0	13.8 - 7.0
19	7°34.8	7°36.0	7°14.0	1.9 - 1.0	7.9 - 4.0	13.9 - 7.1
20	7°35.0	7°36.2	7°14.3	2.0 - 1.0	8.0 - 4.1	14.0 - 7.1
21	7°35.3	7°36.5	7°14.5	2.1 - 1.1	8.1 - 4.1	14.1 - 7.2
22	7°35.5	7°36.7	7°14.7	2.2 - 1.1	8.2 - 4.2	14.2 - 7.2
23	7°35.7	7°37.0	7°15.0	2.3 - 1.2	8.3 - 4.2	14.3 - 7.3
24	7°36.0	7°37.2	7°15.2	2.4 - 1.2	8.4 - 4.3	14.4 - 7.3
25	7°36.2	7°37.5	7°15.5	2.5 - 1.3	8.5 - 4.3	14.5 - 7.4
26	7°36.5	7°37.7	7°15.7	2.6 - 1.3	8.6 - 4.4	14.6 - 7.4
27	7°36.7	7°38.0	7°15.9	2.7 - 1.4	8.7 - 4.4	14.7 - 7.5
28	7°37.0	7°38.2	7°16.2	2.8 - 1.4	8.8 - 4.5	14.8 - 7.5
29	7°37.3	7°38.5	7°16.4	2.9 - 1.5	8.9 - 4.5	14.9 - 7.6
30	7°37.5	7°38.8	7°16.7	3.0 - 1.5	9.0 - 4.6	15.0 - 7.6
31	7°37.7	7°39.0	7°16.9	3.1 - 1.6	9.1 - 4.6	15.1 - 7.7
32	7°38.0	7°39.3	7°17.1	3.2 - 1.6	9.2 - 4.7	15.2 - 7.7
33	7°38.3	7°39.5	7°17.4	3.3 - 1.7	9.3 - 4.7	15.3 - 7.8
34	7°38.5	7°39.8	7°17.6	3.4 - 1.7	9.4 - 4.8	15.4 - 7.8
35	7°38.7	7°40.0	7°17.9	3.5 - 1.8	9.5 - 4.8	15.5 - 7.9
36	7°39.0	7°40.3	7°18.1	3.6 - 1.8	9.6 - 4.9	15.6 - 7.9
37	7°39.3	7°40.5	7°18.3	3.7 - 1.9	9.7 - 4.9	15.7 - 8.0
38	7°39.5	7°40.8	7°18.6	3.8 - 1.9	9.8 - 5.0	15.8 - 8.0
39	7°39.8	7°41.0	7°18.8	3.9 - 2.0	9.9 - 5.0	15.9 - 8.1
40	7°40.0	7°41.3	7°19.0	4.0 - 2.0	10.0 - 5.1	16.0 - 8.1
41	7°40.3	7°41.5	7°19.3	4.1 - 2.1	10.1 - 5.1	16.1 - 8.2
42	7°40.5	7°41.8	7°19.5	4.2 - 2.1	10.2 - 5.2	16.2 - 8.2
43	7°40.7	7°42.0	7°19.8	4.3 - 2.2	10.3 - 5.2	16.3 - 8.3
44	7°41.0	7°42.3	7°20.0	4.4 - 2.2	10.4 - 5.3	16.4 - 8.3
45	7°41.2	7°42.5	7°20.2	4.5 - 2.3	10.5 - 5.3	16.5 - 8.4
46	7°41.5	7°42.8	7°20.5	4.6 - 2.3	10.6 - 5.4	16.6 - 8.4
47	7°41.8	7°43.0	7°20.7	4.7 - 2.4	10.7 - 5.4	16.7 - 8.5
48	7°42.0	7°43.3	7°21.0	4.8 - 2.4	10.8 - 5.5	16.8 - 8.5
49	7°42.3	7°43.5	7°21.2	4.9 - 2.5	10.9 - 5.5	16.9 - 8.6
50	7°42.5	7°43.8	7°21.4	5.0 - 2.5	11.0 - 5.6	17.0 - 8.6
51	7°42.8	7°44.0	7°21.7	5.1 - 2.6	11.1 - 5.6	17.1 - 8.7
52	7°43.0	7°44.3	7°21.9	5.2 - 2.6	11.2 - 5.7	17.2 - 8.7
53	7°43.2	7°44.5	7°22.1	5.3 - 2.7	11.3 - 5.7	17.3 - 8.8
54	7°43.5	7°44.8	7°22.4	5.4 - 2.7	11.4 - 5.8	17.4 - 8.8
55	7°43.8	7°45.0	7°22.6	5.5 - 2.8	11.5 - 5.8	17.5 - 8.9
56	7°44.0	7°45.3	7°22.9	5.6 - 2.8	11.6 - 5.9	17.6 - 8.9
57	7°44.3	7°45.5	7°23.1	5.7 - 2.9	11.7 - 5.9	17.7 - 9.0
58	7°44.5	7°45.8	7°23.3	5.8 - 2.9	11.8 - 6.0	17.8 - 9.0
59	7°44.8	7°46.0	7°23.6	5.9 - 3.0	11.9 - 6.0	17.9 - 9.1

m 31	Sun Plan.	Aries	Moon	v and d corr		
0	7°45.0	7°46.3	7°23.8	0.0 - 0.0	6.0 - 3.2	12.0 - 6.3
1	7°45.2	7°46.5	7°24.1	0.1 - 0.1	6.1 - 3.2	12.1 - 6.4
2	7°45.5	7°46.8	7°24.3	0.2 - 0.1	6.2 - 3.3	12.2 - 6.4
3	7°45.7	7°47.0	7°24.5	0.3 - 0.2	6.3 - 3.3	12.3 - 6.5
4	7°46.0	7°47.3	7°24.8	0.4 - 0.2	6.4 - 3.4	12.4 - 6.5
5	7°46.2	7°47.5	7°25.0	0.5 - 0.3	6.5 - 3.4	12.5 - 6.6
6	7°46.5	7°47.8	7°25.2	0.6 - 0.3	6.6 - 3.5	12.6 - 6.6
7	7°46.8	7°48.0	7°25.5	0.7 - 0.4	6.7 - 3.5	12.7 - 6.7
8	7°47.0	7°48.3	7°25.7	0.8 - 0.4	6.8 - 3.6	12.8 - 6.7
9	7°47.2	7°48.5	7°26.0	0.9 - 0.5	6.9 - 3.6	12.9 - 6.8
10	7°47.5	7°48.8	7°26.2	1.0 - 0.5	7.0 - 3.7	13.0 - 6.8
11	7°47.7	7°49.0	7°26.4	1.1 - 0.6	7.1 - 3.7	13.1 - 6.9
12	7°48.0	7°49.3	7°26.7	1.2 - 0.6	7.2 - 3.8	13.2 - 6.9
13	7°48.2	7°49.5	7°26.9	1.3 - 0.7	7.3 - 3.8	13.3 - 7.0
14	7°48.5	7°49.8	7°27.2	1.4 - 0.7	7.4 - 3.9	13.4 - 7.0
15	7°48.8	7°50.0	7°27.4	1.5 - 0.8	7.5 - 3.9	13.5 - 7.1
16	7°49.0	7°50.3	7°27.6	1.6 - 0.8	7.6 - 4.0	13.6 - 7.1
17	7°49.3	7°50.5	7°27.9	1.7 - 0.9	7.7 - 4.0	13.7 - 7.2
18	7°49.5	7°50.8	7°28.1	1.8 - 0.9	7.8 - 4.1	13.8 - 7.2
19	7°49.8	7°51.0	7°28.4	1.9 - 1.0	7.9 - 4.1	13.9 - 7.3
20	7°50.0	7°51.3	7°28.6	2.0 - 1.1	8.0 - 4.2	14.0 - 7.4
21	7°50.3	7°51.5	7°28.8	2.1 - 1.1	8.1 - 4.3	14.1 - 7.4
22	7°50.5	7°51.8	7°29.1	2.2 - 1.2	8.2 - 4.3	14.2 - 7.5
23	7°50.7	7°52.0	7°29.3	2.3 - 1.2	8.3 - 4.4	14.3 - 7.5
24	7°51.0	7°52.3	7°29.5	2.4 - 1.3	8.4 - 4.4	14.4 - 7.6
25	7°51.3	7°52.5	7°29.8	2.5 - 1.3	8.5 - 4.5	14.5 - 7.6
26	7°51.5	7°52.8	7°30.0	2.6 - 1.4	8.6 - 4.5	14.6 - 7.7
27	7°51.7	7°53.0	7°30.3	2.7 - 1.4	8.7 - 4.6	14.7 - 7.7
28	7°52.0	7°53.3	7°30.5	2.8 - 1.5	8.8 - 4.6	14.8 - 7.8
29	7°52.2	7°53.5	7°30.7	2.9 - 1.5	8.9 - 4.7	14.9 - 7.8
30	7°52.5	7°53.8	7°31.0	3.0 - 1.6	9.0 - 4.7	15.0 - 7.9
31	7°52.7	7°54.0	7°31.2	3.1 - 1.6	9.1 - 4.8	15.1 - 7.9
32	7°53.0	7°54.3	7°31.5	3.2 - 1.7	9.2 - 4.8	15.2 - 8.0
33	7°53.3	7°54.5	7°31.7	3.3 - 1.7	9.3 - 4.9	15.3 - 8.0
34	7°53.5	7°54.8	7°31.9	3.4 - 1.8	9.4 - 4.9	15.4 - 8.1
35	7°53.8	7°55.0	7°32.2	3.5 - 1.8	9.5 - 5.0	15.5 - 8.1
36	7°54.0	7°55.3	7°32.4	3.6 - 1.9	9.6 - 5.0	15.6 - 8.2
37	7°54.3	7°55.5	7°32.6	3.7 - 1.9	9.7 - 5.1	15.7 - 8.2
38	7°54.5	7°55.8	7°32.9	3.8 - 2.0	9.8 - 5.1	15.8 - 8.3
39	7°54.7	7°56.0	7°33.1	3.9 - 2.0	9.9 - 5.2	15.9 - 8.3
40	7°55.0	7°56.3	7°33.4	4.0 - 2.1	10.0 - 5.3	16.0 - 8.4
41	7°55.3	7°56.5	7°33.6	4.1 - 2.2	10.1 - 5.3	16.1 - 8.5
42	7°55.5	7°56.8	7°33.8	4.2 - 2.2	10.2 - 5.4	16.2 - 8.5
43	7°55.7	7°57.1	7°34.1	4.3 - 2.3	10.3 - 5.4	16.3 - 8.6
44	7°56.0	7°57.3	7°34.3	4.4 - 2.3	10.4 - 5.5	16.4 - 8.6
45	7°56.3	7°57.6	7°34.6	4.5 - 2.4	10.5 - 5.5	16.5 - 8.7
46	7°56.5	7°57.8	7°34.8	4.6 - 2.4	10.6 - 5.6	16.6 - 8.7
47	7°56.7	7°58.1	7°35.0	4.7 - 2.5	10.7 - 5.6	16.7 - 8.8
48	7°57.0	7°58.3	7°35.3	4.8 - 2.5	10.8 - 5.7	16.8 - 8.8
49	7°57.2	7°58.6	7°35.5	4.9 - 2.6	10.9 - 5.7	16.9 - 8.9
50	7°57.5	7°58.8	7°35.7	5.0 - 2.6	11.0 - 5.8	17.0 - 8.9
51	7°57.8	7°59.1	7°36.0	5.1 - 2.7	11.1 - 5.8	17.1 - 9.0
52	7°58.0	7°59.3	7°36.2	5.2 - 2.7	11.2 - 5.9	17.2 - 9.0
53	7°58.2	7°59.6	7°36.5	5.3 - 2.8	11.3 - 5.9	17.3 - 9.1
54	7°58.5	7°59.8	7°36.7	5.4 - 2.8	11.4 - 6.0	17.4 - 9.1
55	7°58.8	8°00.1	7°36.9	5.5 - 2.9	11.5 - 6.0	17.5 - 9.2
56	7°59.0	8°00.3	7°37.2	5.6 - 2.9	11.6 - 6.1	17.6 - 9.2
57	7°59.2	8°00.6	7°37.4	5.7 - 3.0	11.7 - 6.1	17.7 - 9.3
58	7°59.5	8°00.8	7°37.7	5.8 - 3.0	11.8 - 6.2	17.8 - 9.3
59	7°59.8	8°01.1	7°37.9	5.9 - 3.1	11.9 - 6.2	17.9 - 9.4

m 32	Sun Plan.	Aries	Moon	v and d corr		
0	8°00.0	8°01.3	7°38.1	0.0 - 0.0	6.0 - 3.3	12.0 - 6.5
1	8°00.2	8°01.6	7°38.4	0.1 - 0.1	6.1 - 3.3	12.1 - 6.6
2	8°00.5	8°01.8	7°38.6	0.2 - 0.1	6.2 - 3.4	12.2 - 6.6
3	8°00.7	8°02.1	7°38.8	0.3 - 0.2	6.3 - 3.4	12.3 - 6.7
4	8°01.0	8°02.3	7°39.1	0.4 - 0.2	6.4 - 3.5	12.4 - 6.7
5	8°01.3	8°02.6	7°39.3	0.5 - 0.3	6.5 - 3.5	12.5 - 6.8
6	8°01.5	8°02.8	7°39.6	0.6 - 0.3	6.6 - 3.6	12.6 - 6.8
7	8°01.8	8°03.1	7°39.8	0.7 - 0.4	6.7 - 3.6	12.7 - 6.9
8	8°02.0	8°03.3	7°40.0	0.8 - 0.4	6.8 - 3.7	12.8 - 6.9
9	8°02.2	8°03.6	7°40.3	0.9 - 0.5	6.9 - 3.7	12.9 - 7.0
10	8°02.5	8°03.8	7°40.5	1.0 - 0.5	7.0 - 3.8	13.0 - 7.0
11	8°02.7	8°04.1	7°40.8	1.1 - 0.6	7.1 - 3.8	13.1 - 7.1
12	8°03.0	8°04.3	7°41.0	1.2 - 0.7	7.2 - 3.9	13.2 - 7.1
13	8°03.3	8°04.6	7°41.2	1.3 - 0.7	7.3 - 4.0	13.3 - 7.2
14	8°03.5	8°04.8	7°41.5	1.4 - 0.8	7.4 - 4.0	13.4 - 7.3
15	8°03.8	8°05.1	7°41.7	1.5 - 0.8	7.5 - 4.1	13.5 - 7.3
16	8°04.0	8°05.3	7°42.0	1.6 - 0.9	7.6 - 4.1	13.6 - 7.4
17	8°04.2	8°05.6	7°42.2	1.7 - 0.9	7.7 - 4.2	13.7 - 7.4
18	8°04.5	8°05.8	7°42.4	1.8 - 1.0	7.8 - 4.2	13.8 - 7.5
19	8°04.8	8°06.1	7°42.7	1.9 - 1.0	7.9 - 4.3	13.9 - 7.5
20	8°05.0	8°06.3	7°42.9	2.0 - 1.1	8.0 - 4.3	14.0 - 7.6
21	8°05.3	8°06.6	7°43.1	2.1 - 1.1	8.1 - 4.4	14.1 - 7.6
22	8°05.5	8°06.8	7°43.4	2.2 - 1.2	8.2 - 4.4	14.2 - 7.7
23	8°05.7	8°07.1	7°43.6	2.3 - 1.2	8.3 - 4.5	14.3 - 7.7
24	8°06.0	8°07.3	7°43.9	2.4 - 1.3	8.4 - 4.5	14.4 - 7.8
25	8°06.2	8°07.6	7°44.1	2.5 - 1.4	8.5 - 4.6	14.5 - 7.9
26	8°06.5	8°07.8	7°44.3	2.6 - 1.4	8.6 - 4.7	14.6 - 7.9
27	8°06.8	8°08.1	7°44.6	2.7 - 1.5	8.7 - 4.7	14.7 - 8.0
28	8°07.0	8°08.3	7°44.8	2.8 - 1.5	8.8 - 4.8	14.8 - 8.0
29	8°07.3	8°08.6	7°45.1	2.9 - 1.6	8.9 - 4.8	14.9 - 8.1
30	8°07.5	8°08.8	7°45.3	3.0 - 1.6	9.0 - 4.9	15.0 - 8.1
31	8°07.7	8°09.1	7°45.5	3.1 - 1.7	9.1 - 4.9	15.1 - 8.2
32	8°08.0	8°09.3	7°45.8	3.2 - 1.7	9.2 - 5.0	15.2 - 8.2
33	8°08.2	8°09.6	7°46.0	3.3 - 1.8	9.3 - 5.0	15.3 - 8.3
34	8°08.5	8°09.8	7°46.2	3.4 - 1.8	9.4 - 5.1	15.4 - 8.3
35	8°08.8	8°10.1	7°46.5	3.5 - 1.9	9.5 - 5.1	15.5 - 8.4
36	8°09.0	8°10.3	7°46.7	3.6 - 1.9	9.6 - 5.2	15.6 - 8.4
37	8°09.3	8°10.6	7°47.0	3.7 - 2.0	9.7 - 5.3	15.7 - 8.5
38	8°09.5	8°10.8	7°47.2	3.8 - 2.1	9.8 - 5.3	15.8 - 8.6
39	8°09.7	8°11.1	7°47.4	3.9 - 2.1	9.9 - 5.4	15.9 - 8.6
40	8°10.0	8°11.3	7°47.7	4.0 - 2.2	10.0 - 5.4	16.0 - 8.7
41	8°10.2	8°11.6	7°47.9	4.1 - 2.2	10.1 - 5.5	16.1 - 8.7
42	8°10.5	8°11.8	7°48.2	4.2 - 2.3	10.2 - 5.5	16.2 - 8.8
43	8°10.8	8°12.1	7°48.4	4.3 - 2.3	10.3 - 5.6	16.3 - 8.8
44	8°11.0	8°12.3	7°48.6	4.4 - 2.4	10.4 - 5.6	16.4 - 8.9
45	8°11.3	8°12.6	7°48.9	4.5 - 2.4	10.5 - 5.7	16.5 - 8.9
46	8°11.5	8°12.8	7°49.1	4.6 - 2.5	10.6 - 5.7	16.6 - 9.0
47	8°11.7	8°13.1	7°49.3	4.7 - 2.5	10.7 - 5.8	16.7 - 9.0
48	8°12.0	8°13.3	7°49.6	4.8 - 2.6	10.8 - 5.8	16.8 - 9.1
49	8°12.3	8°13.6	7°49.8	4.9 - 2.7	10.9 - 5.9	16.9 - 9.2
50	8°12.5	8°13.8	7°50.1	5.0 - 2.7	11.0 - 6.0	17.0 - 9.2
51	8°12.8	8°14.1	7°50.3	5.1 - 2.8	11.1 - 6.0	17.1 - 9.3
52	8°13.0	8°14.3	7°50.5	5.2 - 2.8	11.2 - 6.1	17.2 - 9.3
53	8°13.2	8°14.6	7°50.8	5.3 - 2.9	11.3 - 6.1	17.3 - 9.4
54	8°13.5	8°14.8	7°51.0	5.4 - 2.9	11.4 - 6.2	17.4 - 9.4
55	8°13.7	8°15.1	7°51.3	5.5 - 3.0	11.5 - 6.2	17.5 - 9.5
56	8°14.0	8°15.4	7°51.5	5.6 - 3.0	11.6 - 6.3	17.6 - 9.5
57	8°14.3	8°15.6	7°51.7	5.7 - 3.1	11.7 - 6.3	17.7 - 9.6
58	8°14.5	8°15.9	7°52.0	5.8 - 3.1	11.8 - 6.4	17.8 - 9.6
59	8°14.8	8°16.1	7°52.2	5.9 - 3.2	11.9 - 6.4	17.9 - 9.7

Increments and Corrections

m 33	Sun Plan.	Aries	Moon	v and d corr		
0	8°15.0	8°16.4	7°52.5	0.0 - 0.0	6.0 - 3.4	12.0 - 6.7
1	8°15.2	8°16.6	7°52.7	0.1 - 0.1	6.1 - 3.4	12.1 - 6.8
2	8°15.5	8°16.9	7°52.9	0.2 - 0.1	6.2 - 3.5	12.2 - 6.8
3	8°15.7	8°17.1	7°53.2	0.3 - 0.2	6.3 - 3.5	12.3 - 6.9
4	8°16.0	8°17.4	7°53.4	0.4 - 0.2	6.4 - 3.6	12.4 - 6.9
5	8°16.3	8°17.6	7°53.6	0.5 - 0.3	6.5 - 3.6	12.5 - 7.0
6	8°16.5	8°17.9	7°53.9	0.6 - 0.3	6.6 - 3.7	12.6 - 7.0
7	8°16.8	8°18.1	7°54.1	0.7 - 0.4	6.7 - 3.7	12.7 - 7.1
8	8°17.0	8°18.4	7°54.4	0.8 - 0.4	6.8 - 3.8	12.8 - 7.1
9	8°17.2	8°18.6	7°54.6	0.9 - 0.5	6.9 - 3.9	12.9 - 7.2
10	8°17.5	8°18.9	7°54.8	1.0 - 0.6	7.0 - 3.9	13.0 - 7.3
11	8°17.7	8°19.1	7°55.1	1.1 - 0.6	7.1 - 4.0	13.1 - 7.3
12	8°18.0	8°19.4	7°55.3	1.2 - 0.7	7.2 - 4.0	13.2 - 7.4
13	8°18.3	8°19.6	7°55.6	1.3 - 0.7	7.3 - 4.1	13.3 - 7.4
14	8°18.5	8°19.9	7°55.8	1.4 - 0.8	7.4 - 4.1	13.4 - 7.5
15	8°18.8	8°20.1	7°56.0	1.5 - 0.8	7.5 - 4.2	13.5 - 7.5
16	8°19.0	8°20.4	7°56.3	1.6 - 0.9	7.6 - 4.2	13.6 - 7.6
17	8°19.2	8°20.6	7°56.5	1.7 - 0.9	7.7 - 4.3	13.7 - 7.6
18	8°19.5	8°20.9	7°56.7	1.8 - 1.0	7.8 - 4.4	13.8 - 7.7
19	8°19.8	8°21.1	7°57.0	1.9 - 1.1	7.9 - 4.4	13.9 - 7.8
20	8°20.0	8°21.4	7°57.2	2.0 - 1.1	8.0 - 4.5	14.0 - 7.8
21	8°20.3	8°21.6	7°57.5	2.1 - 1.2	8.1 - 4.5	14.1 - 7.9
22	8°20.5	8°21.9	7°57.7	2.2 - 1.2	8.2 - 4.6	14.2 - 7.9
23	8°20.7	8°22.1	7°57.9	2.3 - 1.3	8.3 - 4.6	14.3 - 8.0
24	8°21.0	8°22.4	7°58.2	2.4 - 1.3	8.4 - 4.7	14.4 - 8.0
25	8°21.2	8°22.6	7°58.4	2.5 - 1.4	8.5 - 4.7	14.5 - 8.1
26	8°21.5	8°22.9	7°58.7	2.6 - 1.5	8.6 - 4.8	14.6 - 8.2
27	8°21.8	8°23.1	7°58.9	2.7 - 1.5	8.7 - 4.9	14.7 - 8.2
28	8°22.0	8°23.4	7°59.1	2.8 - 1.6	8.8 - 4.9	14.8 - 8.3
29	8°22.3	8°23.6	7°59.4	2.9 - 1.6	8.9 - 5.0	14.9 - 8.3
30	8°22.5	8°23.9	7°59.6	3.0 - 1.7	9.0 - 5.0	15.0 - 8.4
31	8°22.7	8°24.1	7°59.8	3.1 - 1.7	9.1 - 5.1	15.1 - 8.4
32	8°23.0	8°24.4	8°00.1	3.2 - 1.8	9.2 - 5.1	15.2 - 8.5
33	8°23.2	8°24.6	8°00.3	3.3 - 1.8	9.3 - 5.2	15.3 - 8.5
34	8°23.5	8°24.9	8°00.6	3.4 - 1.9	9.4 - 5.2	15.4 - 8.6
35	8°23.8	8°25.1	8°00.8	3.5 - 2.0	9.5 - 5.3	15.5 - 8.7
36	8°24.0	8°25.4	8°01.0	3.6 - 2.0	9.6 - 5.4	15.6 - 8.7
37	8°24.3	8°25.6	8°01.3	3.7 - 2.1	9.7 - 5.4	15.7 - 8.8
38	8°24.5	8°25.9	8°01.5	3.8 - 2.1	9.8 - 5.5	15.8 - 8.8
39	8°24.7	8°26.1	8°01.8	3.9 - 2.2	9.9 - 5.5	15.9 - 8.9
40	8°25.0	8°26.4	8°02.0	4.0 - 2.2	10.0 - 5.6	16.0 - 8.9
41	8°25.2	8°26.6	8°02.2	4.1 - 2.3	10.1 - 5.6	16.1 - 9.0
42	8°25.5	8°26.9	8°02.5	4.2 - 2.3	10.2 - 5.7	16.2 - 9.0
43	8°25.8	8°27.1	8°02.7	4.3 - 2.4	10.3 - 5.8	16.3 - 9.1
44	8°26.0	8°27.4	8°02.9	4.4 - 2.5	10.4 - 5.8	16.4 - 9.2
45	8°26.3	8°27.6	8°03.2	4.5 - 2.5	10.5 - 5.9	16.5 - 9.2
46	8°26.5	8°27.9	8°03.4	4.6 - 2.6	10.6 - 5.9	16.6 - 9.3
47	8°26.7	8°28.1	8°03.7	4.7 - 2.6	10.7 - 6.0	16.7 - 9.3
48	8°27.0	8°28.4	8°03.9	4.8 - 2.7	10.8 - 6.0	16.8 - 9.4
49	8°27.3	8°28.6	8°04.1	4.9 - 2.7	10.9 - 6.1	16.9 - 9.4
50	8°27.5	8°28.9	8°04.4	5.0 - 2.8	11.0 - 6.1	17.0 - 9.5
51	8°27.8	8°29.1	8°04.6	5.1 - 2.8	11.1 - 6.2	17.1 - 9.5
52	8°28.0	8°29.4	8°04.9	5.2 - 2.9	11.2 - 6.3	17.2 - 9.6
53	8°28.2	8°29.6	8°05.1	5.3 - 3.0	11.3 - 6.3	17.3 - 9.7
54	8°28.5	8°29.9	8°05.3	5.4 - 3.0	11.4 - 6.4	17.4 - 9.7
55	8°28.7	8°30.1	8°05.6	5.5 - 3.1	11.5 - 6.4	17.5 - 9.8
56	8°29.0	8°30.4	8°05.8	5.6 - 3.1	11.6 - 6.5	17.6 - 9.8
57	8°29.3	8°30.6	8°06.1	5.7 - 3.2	11.7 - 6.5	17.7 - 9.9
58	8°29.5	8°30.9	8°06.3	5.8 - 3.2	11.8 - 6.6	17.8 - 9.9
59	8°29.8	8°31.1	8°06.5	5.9 - 3.3	11.9 - 6.6	17.9 - 10.0

m 34	Sun Plan.	Aries	Moon	v and d corr		
0	8°30.0	8°31.4	8°06.8	0.0 - 0.0	6.0 - 3.4	12.0 - 6.9
1	8°30.2	8°31.6	8°07.0	0.1 - 0.1	6.1 - 3.5	12.1 - 7.0
2	8°30.5	8°31.9	8°07.2	0.2 - 0.1	6.2 - 3.6	12.2 - 7.0
3	8°30.7	8°32.1	8°07.5	0.3 - 0.2	6.3 - 3.6	12.3 - 7.1
4	8°31.0	8°32.4	8°07.7	0.4 - 0.2	6.4 - 3.7	12.4 - 7.1
5	8°31.3	8°32.6	8°08.0	0.5 - 0.3	6.5 - 3.7	12.5 - 7.2
6	8°31.5	8°32.9	8°08.2	0.6 - 0.3	6.6 - 3.8	12.6 - 7.2
7	8°31.8	8°33.1	8°08.4	0.7 - 0.4	6.7 - 3.9	12.7 - 7.3
8	8°32.0	8°33.4	8°08.7	0.8 - 0.5	6.8 - 3.9	12.8 - 7.4
9	8°32.2	8°33.7	8°08.9	0.9 - 0.5	6.9 - 4.0	12.9 - 7.4
10	8°32.5	8°33.9	8°09.2	1.0 - 0.6	7.0 - 4.0	13.0 - 7.5
11	8°32.7	8°34.2	8°09.4	1.1 - 0.6	7.1 - 4.1	13.1 - 7.5
12	8°33.0	8°34.4	8°09.6	1.2 - 0.7	7.2 - 4.1	13.2 - 7.6
13	8°33.3	8°34.7	8°09.9	1.3 - 0.7	7.3 - 4.2	13.3 - 7.6
14	8°33.5	8°34.9	8°10.1	1.4 - 0.8	7.4 - 4.3	13.4 - 7.7
15	8°33.8	8°35.2	8°10.3	1.5 - 0.9	7.5 - 4.3	13.5 - 7.8
16	8°34.0	8°35.4	8°10.6	1.6 - 0.9	7.6 - 4.4	13.6 - 7.8
17	8°34.2	8°35.7	8°10.8	1.7 - 1.0	7.7 - 4.4	13.7 - 7.9
18	8°34.5	8°35.9	8°11.1	1.8 - 1.0	7.8 - 4.5	13.8 - 7.9
19	8°34.8	8°36.2	8°11.3	1.9 - 1.1	7.9 - 4.5	13.9 - 8.0
20	8°35.0	8°36.4	8°11.5	2.0 - 1.1	8.0 - 4.6	14.0 - 8.0
21	8°35.3	8°36.7	8°11.8	2.1 - 1.2	8.1 - 4.7	14.1 - 8.1
22	8°35.5	8°36.9	8°12.0	2.2 - 1.3	8.2 - 4.7	14.2 - 8.2
23	8°35.7	8°37.2	8°12.3	2.3 - 1.3	8.3 - 4.8	14.3 - 8.2
24	8°36.0	8°37.4	8°12.5	2.4 - 1.4	8.4 - 4.8	14.4 - 8.3
25	8°36.2	8°37.7	8°12.7	2.5 - 1.4	8.5 - 4.9	14.5 - 8.3
26	8°36.5	8°37.9	8°13.0	2.6 - 1.5	8.6 - 4.9	14.6 - 8.4
27	8°36.8	8°38.2	8°13.2	2.7 - 1.6	8.7 - 5.0	14.7 - 8.5
28	8°37.0	8°38.4	8°13.4	2.8 - 1.6	8.8 - 5.1	14.8 - 8.5
29	8°37.3	8°38.7	8°13.7	2.9 - 1.7	8.9 - 5.1	14.9 - 8.6
30	8°37.5	8°38.9	8°13.9	3.0 - 1.7	9.0 - 5.2	15.0 - 8.6
31	8°37.7	8°39.2	8°14.2	3.1 - 1.8	9.1 - 5.2	15.1 - 8.7
32	8°38.0	8°39.4	8°14.4	3.2 - 1.8	9.2 - 5.3	15.2 - 8.7
33	8°38.2	8°39.7	8°14.6	3.3 - 1.9	9.3 - 5.3	15.3 - 8.8
34	8°38.5	8°39.9	8°14.9	3.4 - 2.0	9.4 - 5.4	15.4 - 8.9
35	8°38.8	8°40.2	8°15.1	3.5 - 2.0	9.5 - 5.5	15.5 - 8.9
36	8°39.0	8°40.4	8°15.4	3.6 - 2.1	9.6 - 5.5	15.6 - 9.0
37	8°39.3	8°40.7	8°15.6	3.7 - 2.1	9.7 - 5.6	15.7 - 9.0
38	8°39.5	8°40.9	8°15.8	3.8 - 2.2	9.8 - 5.6	15.8 - 9.1
39	8°39.7	8°41.2	8°16.1	3.9 - 2.2	9.9 - 5.7	15.9 - 9.1
40	8°40.0	8°41.4	8°16.3	4.0 - 2.3	10.0 - 5.8	16.0 - 9.2
41	8°40.2	8°41.7	8°16.5	4.1 - 2.4	10.1 - 5.8	16.1 - 9.3
42	8°40.5	8°41.9	8°16.8	4.2 - 2.4	10.2 - 5.9	16.2 - 9.3
43	8°40.8	8°42.2	8°17.0	4.3 - 2.5	10.3 - 5.9	16.3 - 9.4
44	8°41.0	8°42.4	8°17.3	4.4 - 2.5	10.4 - 6.0	16.4 - 9.4
45	8°41.3	8°42.7	8°17.5	4.5 - 2.6	10.5 - 6.0	16.5 - 9.5
46	8°41.5	8°42.9	8°17.7	4.6 - 2.6	10.6 - 6.1	16.6 - 9.5
47	8°41.7	8°43.2	8°18.0	4.7 - 2.7	10.7 - 6.2	16.7 - 9.6
48	8°42.0	8°43.4	8°18.2	4.8 - 2.8	10.8 - 6.2	16.8 - 9.7
49	8°42.3	8°43.7	8°18.5	4.9 - 2.8	10.9 - 6.3	16.9 - 9.7
50	8°42.5	8°43.9	8°18.7	5.0 - 2.9	11.0 - 6.3	17.0 - 9.8
51	8°42.8	8°44.2	8°18.9	5.1 - 2.9	11.1 - 6.4	17.1 - 9.8
52	8°43.0	8°44.4	8°19.2	5.2 - 3.0	11.2 - 6.4	17.2 - 9.9
53	8°43.2	8°44.7	8°19.4	5.3 - 3.0	11.3 - 6.5	17.3 - 9.9
54	8°43.5	8°44.9	8°19.7	5.4 - 3.1	11.4 - 6.6	17.4 - 10.0
55	8°43.7	8°45.2	8°19.9	5.5 - 3.2	11.5 - 6.6	17.5 - 10.1
56	8°44.0	8°45.4	8°20.1	5.6 - 3.2	11.6 - 6.7	17.6 - 10.1
57	8°44.3	8°45.7	8°20.4	5.7 - 3.3	11.7 - 6.7	17.7 - 10.2
58	8°44.5	8°45.9	8°20.6	5.8 - 3.3	11.8 - 6.8	17.8 - 10.2
59	8°44.8	8°46.2	8°20.8	5.9 - 3.4	11.9 - 6.8	17.9 - 10.3

m 35	Sun Plan.	Aries	Moon	v and d corr		
0	8°45.0	8°46.4	8°21.1	0.0 - 0.0	6.0 - 3.5	12.0 - 7.1
1	8°45.2	8°46.7	8°21.3	0.1 - 0.1	6.1 - 3.6	12.1 - 7.2
2	8°45.5	8°46.9	8°21.6	0.2 - 0.1	6.2 - 3.7	12.2 - 7.2
3	8°45.7	8°47.2	8°21.8	0.3 - 0.2	6.3 - 3.7	12.3 - 7.3
4	8°46.0	8°47.4	8°22.0	0.4 - 0.2	6.4 - 3.8	12.4 - 7.3
5	8°46.3	8°47.7	8°22.3	0.5 - 0.3	6.5 - 3.8	12.5 - 7.4
6	8°46.5	8°47.9	8°22.5	0.6 - 0.4	6.6 - 3.9	12.6 - 7.5
7	8°46.8	8°48.2	8°22.8	0.7 - 0.4	6.7 - 4.0	12.7 - 7.5
8	8°47.0	8°48.4	8°23.0	0.8 - 0.5	6.8 - 4.0	12.8 - 7.6
9	8°47.2	8°48.7	8°23.2	0.9 - 0.5	6.9 - 4.1	12.9 - 7.6
10	8°47.5	8°48.9	8°23.5	1.0 - 0.6	7.0 - 4.1	13.0 - 7.7
11	8°47.7	8°49.2	8°23.7	1.1 - 0.7	7.1 - 4.2	13.1 - 7.8
12	8°48.0	8°49.4	8°23.9	1.2 - 0.7	7.2 - 4.3	13.2 - 7.8
13	8°48.3	8°49.7	8°24.2	1.3 - 0.8	7.3 - 4.3	13.3 - 7.9
14	8°48.5	8°49.9	8°24.4	1.4 - 0.8	7.4 - 4.4	13.4 - 7.9
15	8°48.8	8°50.2	8°24.7	1.5 - 0.9	7.5 - 4.4	13.5 - 8.0
16	8°49.0	8°50.4	8°24.9	1.6 - 0.9	7.6 - 4.5	13.6 - 8.0
17	8°49.2	8°50.7	8°25.1	1.7 - 1.0	7.7 - 4.6	13.7 - 8.1
18	8°49.5	8°50.9	8°25.4	1.8 - 1.1	7.8 - 4.6	13.8 - 8.2
19	8°49.8	8°51.2	8°25.6	1.9 - 1.1	7.9 - 4.7	13.9 - 8.2
20	8°50.0	8°51.4	8°25.9	2.0 - 1.2	8.0 - 4.7	14.0 - 8.3
21	8°50.3	8°51.7	8°26.1	2.1 - 1.2	8.1 - 4.8	14.1 - 8.3
22	8°50.5	8°52.0	8°26.3	2.2 - 1.3	8.2 - 4.9	14.2 - 8.4
23	8°50.7	8°52.2	8°26.6	2.3 - 1.4	8.3 - 4.9	14.3 - 8.5
24	8°51.0	8°52.5	8°26.8	2.4 - 1.4	8.4 - 5.0	14.4 - 8.5
25	8°51.2	8°52.7	8°27.0	2.5 - 1.5	8.5 - 5.0	14.5 - 8.6
26	8°51.5	8°53.0	8°27.3	2.6 - 1.5	8.6 - 5.1	14.6 - 8.6
27	8°51.8	8°53.2	8°27.5	2.7 - 1.6	8.7 - 5.1	14.7 - 8.7
28	8°52.0	8°53.5	8°27.8	2.8 - 1.7	8.8 - 5.2	14.8 - 8.8
29	8°52.3	8°53.7	8°28.0	2.9 - 1.7	8.9 - 5.3	14.9 - 8.8
30	8°52.5	8°54.0	8°28.2	3.0 - 1.8	9.0 - 5.3	15.0 - 8.9
31	8°52.7	8°54.2	8°28.5	3.1 - 1.8	9.1 - 5.4	15.1 - 8.9
32	8°53.0	8°54.5	8°28.7	3.2 - 1.9	9.2 - 5.4	15.2 - 9.0
33	8°53.2	8°54.7	8°29.0	3.3 - 2.0	9.3 - 5.5	15.3 - 9.1
34	8°53.5	8°55.0	8°29.2	3.4 - 2.0	9.4 - 5.6	15.4 - 9.1
35	8°53.8	8°55.2	8°29.4	3.5 - 2.1	9.5 - 5.6	15.5 - 9.2
36	8°54.0	8°55.5	8°29.7	3.6 - 2.1	9.6 - 5.7	15.6 - 9.2
37	8°54.3	8°55.7	8°29.9	3.7 - 2.2	9.7 - 5.7	15.7 - 9.3
38	8°54.5	8°56.0	8°30.2	3.8 - 2.2	9.8 - 5.8	15.8 - 9.3
39	8°54.7	8°56.2	8°30.4	3.9 - 2.3	9.9 - 5.9	15.9 - 9.4
40	8°55.0	8°56.5	8°30.6	4.0 - 2.4	10.0 - 5.9	16.0 - 9.5
41	8°55.2	8°56.7	8°30.9	4.1 - 2.4	10.1 - 6.0	16.1 - 9.5
42	8°55.5	8°57.0	8°31.1	4.2 - 2.5	10.2 - 6.0	16.2 - 9.6
43	8°55.8	8°57.2	8°31.3	4.3 - 2.5	10.3 - 6.1	16.3 - 9.6
44	8°56.0	8°57.5	8°31.6	4.4 - 2.6	10.4 - 6.2	16.4 - 9.7
45	8°56.3	8°57.7	8°31.8	4.5 - 2.7	10.5 - 6.2	16.5 - 9.8
46	8°56.5	8°58.0	8°32.1	4.6 - 2.7	10.6 - 6.3	16.6 - 9.8
47	8°56.7	8°58.2	8°32.3	4.7 - 2.8	10.7 - 6.3	16.7 - 9.9
48	8°57.0	8°58.5	8°32.5	4.8 - 2.8	10.8 - 6.4	16.8 - 9.9
49	8°57.3	8°58.7	8°32.8	4.9 - 2.9	10.9 - 6.4	16.9 - 10.0
50	8°57.5	8°59.0	8°33.0	5.0 - 3.0	11.0 - 6.5	17.0 - 10.1
51	8°57.8	8°59.2	8°33.3	5.1 - 3.0	11.1 - 6.6	17.1 - 10.1
52	8°58.0	8°59.5	8°33.5	5.2 - 3.1	11.2 - 6.6	17.2 - 10.2
53	8°58.2	8°59.7	8°33.7	5.3 - 3.1	11.3 - 6.7	17.3 - 10.2
54	8°58.5	9°00.0	8°34.0	5.4 - 3.2	11.4 - 6.7	17.4 - 10.3
55	8°58.7	9°00.2	8°34.2	5.5 - 3.3	11.5 - 6.8	17.5 - 10.4
56	8°59.0	9°00.5	8°34.4	5.6 - 3.3	11.6 - 6.9	17.6 - 10.4
57	8°59.3	9°00.7	8°34.7	5.7 - 3.4	11.7 - 6.9	17.7 - 10.5
58	8°59.5	9°01.0	8°34.9	5.8 - 3.4	11.8 - 7.0	17.8 - 10.5
59	8°59.8	9°01.2	8°35.2	5.9 - 3.5	11.9 - 7.0	17.9 - 10.6

Increments and Corrections

m 36	Sun Plan.	Aries	Moon	v and d corr		
0	9°00.0	9°01.5	8°35.4	0.0 - 0.0	6.0 - 3.6	12.0 - 7.3
1	9°00.2	9°01.7	8°35.6	0.1 - 0.1	6.1 - 3.7	12.1 - 7.4
2	9°00.5	9°02.0	8°35.9	0.2 - 0.1	6.2 - 3.8	12.2 - 7.4
3	9°00.7	9°02.2	8°36.1	0.3 - 0.2	6.3 - 3.8	12.3 - 7.5
4	9°01.0	9°02.5	8°36.4	0.4 - 0.2	6.4 - 3.9	12.4 - 7.5
5	9°01.3	9°02.7	8°36.6	0.5 - 0.3	6.5 - 4.0	12.5 - 7.6
6	9°01.5	9°03.0	8°36.8	0.6 - 0.4	6.6 - 4.0	12.6 - 7.7
7	9°01.8	9°03.2	8°37.1	0.7 - 0.4	6.7 - 4.1	12.7 - 7.7
8	9°02.0	9°03.5	8°37.3	0.8 - 0.5	6.8 - 4.1	12.8 - 7.8
9	9°02.2	9°03.7	8°37.5	0.9 - 0.5	6.9 - 4.2	12.9 - 7.8
10	9°02.5	9°04.0	8°37.8	1.0 - 0.6	7.0 - 4.3	13.0 - 7.9
11	9°02.7	9°04.2	8°38.0	1.1 - 0.7	7.1 - 4.3	13.1 - 8.0
12	9°03.0	9°04.5	8°38.3	1.2 - 0.7	7.2 - 4.4	13.2 - 8.0
13	9°03.3	9°04.7	8°38.5	1.3 - 0.8	7.3 - 4.4	13.3 - 8.1
14	9°03.5	9°05.0	8°38.7	1.4 - 0.9	7.4 - 4.5	13.4 - 8.2
15	9°03.8	9°05.2	8°39.0	1.5 - 0.9	7.5 - 4.6	13.5 - 8.2
16	9°04.0	9°05.5	8°39.2	1.6 - 1.0	7.6 - 4.6	13.6 - 8.3
17	9°04.2	9°05.7	8°39.5	1.7 - 1.0	7.7 - 4.7	13.7 - 8.3
18	9°04.5	9°06.0	8°39.7	1.8 - 1.1	7.8 - 4.7	13.8 - 8.4
19	9°04.8	9°06.2	8°39.9	1.9 - 1.2	7.9 - 4.8	13.9 - 8.5
20	9°05.0	9°06.5	8°40.2	2.0 - 1.2	8.0 - 4.9	14.0 - 8.5
21	9°05.3	9°06.7	8°40.4	2.1 - 1.3	8.1 - 4.9	14.1 - 8.6
22	9°05.5	9°07.0	8°40.6	2.2 - 1.3	8.2 - 5.0	14.2 - 8.6
23	9°05.7	9°07.2	8°40.9	2.3 - 1.4	8.3 - 5.0	14.3 - 8.7
24	9°06.0	9°07.5	8°41.1	2.4 - 1.5	8.4 - 5.1	14.4 - 8.8
25	9°06.2	9°07.7	8°41.4	2.5 - 1.5	8.5 - 5.2	14.5 - 8.8
26	9°06.5	9°08.0	8°41.6	2.6 - 1.6	8.6 - 5.2	14.6 - 8.9
27	9°06.8	9°08.2	8°41.8	2.7 - 1.6	8.7 - 5.3	14.7 - 8.9
28	9°07.0	9°08.5	8°42.1	2.8 - 1.7	8.8 - 5.4	14.8 - 9.0
29	9°07.3	9°08.7	8°42.3	2.9 - 1.8	8.9 - 5.4	14.9 - 9.1
30	9°07.5	9°09.0	8°42.6	3.0 - 1.8	9.0 - 5.5	15.0 - 9.1
31	9°07.7	9°09.2	8°42.8	3.1 - 1.9	9.1 - 5.5	15.1 - 9.2
32	9°08.0	9°09.5	8°43.0	3.2 - 1.9	9.2 - 5.6	15.2 - 9.2
33	9°08.2	9°09.7	8°43.3	3.3 - 2.0	9.3 - 5.7	15.3 - 9.3
34	9°08.5	9°10.0	8°43.5	3.4 - 2.1	9.4 - 5.7	15.4 - 9.4
35	9°08.8	9°10.2	8°43.8	3.5 - 2.1	9.5 - 5.8	15.5 - 9.4
36	9°09.0	9°10.5	8°44.0	3.6 - 2.2	9.6 - 5.8	15.6 - 9.5
37	9°09.3	9°10.8	8°44.2	3.7 - 2.3	9.7 - 5.9	15.7 - 9.6
38	9°09.5	9°11.0	8°44.5	3.8 - 2.3	9.8 - 6.0	15.8 - 9.6
39	9°09.7	9°11.3	8°44.7	3.9 - 2.4	9.9 - 6.0	15.9 - 9.7
40	9°10.0	9°11.5	8°44.9	4.0 - 2.4	10.0 - 6.1	16.0 - 9.7
41	9°10.2	9°11.8	8°45.2	4.1 - 2.5	10.1 - 6.1	16.1 - 9.8
42	9°10.5	9°12.0	8°45.4	4.2 - 2.6	10.2 - 6.2	16.2 - 9.9
43	9°10.8	9°12.3	8°45.7	4.3 - 2.6	10.3 - 6.3	16.3 - 9.9
44	9°11.0	9°12.5	8°45.9	4.4 - 2.7	10.4 - 6.3	16.4 - 10.0
45	9°11.3	9°12.8	8°46.1	4.5 - 2.7	10.5 - 6.4	16.5 - 10.0
46	9°11.5	9°13.0	8°46.4	4.6 - 2.8	10.6 - 6.4	16.6 - 10.1
47	9°11.7	9°13.3	8°46.6	4.7 - 2.9	10.7 - 6.5	16.7 - 10.2
48	9°12.0	9°13.5	8°46.9	4.8 - 2.9	10.8 - 6.6	16.8 - 10.2
49	9°12.3	9°13.8	8°47.1	4.9 - 3.0	10.9 - 6.6	16.9 - 10.3
50	9°12.5	9°14.0	8°47.3	5.0 - 3.0	11.0 - 6.7	17.0 - 10.3
51	9°12.8	9°14.3	8°47.6	5.1 - 3.1	11.1 - 6.8	17.1 - 10.4
52	9°13.0	9°14.5	8°47.8	5.2 - 3.2	11.2 - 6.8	17.2 - 10.5
53	9°13.2	9°14.8	8°48.0	5.3 - 3.2	11.3 - 6.9	17.3 - 10.5
54	9°13.5	9°15.0	8°48.3	5.4 - 3.3	11.4 - 6.9	17.4 - 10.6
55	9°13.7	9°15.3	8°48.5	5.5 - 3.3	11.5 - 7.0	17.5 - 10.6
56	9°14.0	9°15.5	8°48.8	5.6 - 3.4	11.6 - 7.1	17.6 - 10.7
57	9°14.3	9°15.8	8°49.0	5.7 - 3.5	11.7 - 7.1	17.7 - 10.8
58	9°14.5	9°16.0	8°49.2	5.8 - 3.5	11.8 - 7.2	17.8 - 10.8
59	9°14.8	9°16.3	8°49.5	5.9 - 3.6	11.9 - 7.2	17.9 - 10.9

m 37	Sun Plan.	Aries	Moon	v and d corr		
0	9°15.0	9°16.5	8°49.7	0.0 - 0.0	6.0 - 3.8	12.0 - 7.5
1	9°15.2	9°16.8	8°50.0	0.1 - 0.1	6.1 - 3.8	12.1 - 7.6
2	9°15.5	9°17.0	8°50.2	0.2 - 0.1	6.2 - 3.9	12.2 - 7.6
3	9°15.7	9°17.3	8°50.4	0.3 - 0.2	6.3 - 3.9	12.3 - 7.7
4	9°16.0	9°17.5	8°50.7	0.4 - 0.3	6.4 - 4.0	12.4 - 7.8
5	9°16.3	9°17.8	8°50.9	0.5 - 0.3	6.5 - 4.1	12.5 - 7.8
6	9°16.5	9°18.0	8°51.1	0.6 - 0.4	6.6 - 4.1	12.6 - 7.9
7	9°16.8	9°18.3	8°51.4	0.7 - 0.4	6.7 - 4.2	12.7 - 7.9
8	9°17.0	9°18.5	8°51.6	0.8 - 0.5	6.8 - 4.3	12.8 - 8.0
9	9°17.2	9°18.8	8°51.9	0.9 - 0.6	6.9 - 4.3	12.9 - 8.1
10	9°17.5	9°19.0	8°52.1	1.0 - 0.6	7.0 - 4.4	13.0 - 8.1
11	9°17.7	9°19.3	8°52.3	1.1 - 0.7	7.1 - 4.4	13.1 - 8.2
12	9°18.0	9°19.5	8°52.6	1.2 - 0.8	7.2 - 4.5	13.2 - 8.3
13	9°18.3	9°19.8	8°52.8	1.3 - 0.8	7.3 - 4.6	13.3 - 8.3
14	9°18.5	9°20.0	8°53.1	1.4 - 0.9	7.4 - 4.6	13.4 - 8.4
15	9°18.8	9°20.3	8°53.3	1.5 - 0.9	7.5 - 4.7	13.5 - 8.4
16	9°19.0	9°20.5	8°53.5	1.6 - 1.0	7.6 - 4.8	13.6 - 8.5
17	9°19.2	9°20.8	8°53.8	1.7 - 1.1	7.7 - 4.8	13.7 - 8.6
18	9°19.5	9°21.0	8°54.0	1.8 - 1.1	7.8 - 4.9	13.8 - 8.6
19	9°19.8	9°21.3	8°54.3	1.9 - 1.2	7.9 - 4.9	13.9 - 8.7
20	9°20.0	9°21.5	8°54.5	2.0 - 1.3	8.0 - 5.0	14.0 - 8.8
21	9°20.3	9°21.8	8°54.7	2.1 - 1.3	8.1 - 5.1	14.1 - 8.8
22	9°20.5	9°22.0	8°55.0	2.2 - 1.4	8.2 - 5.1	14.2 - 8.9
23	9°20.7	9°22.3	8°55.2	2.3 - 1.4	8.3 - 5.2	14.3 - 8.9
24	9°21.0	9°22.5	8°55.4	2.4 - 1.5	8.4 - 5.3	14.4 - 9.0
25	9°21.2	9°22.8	8°55.7	2.5 - 1.6	8.5 - 5.3	14.5 - 9.1
26	9°21.5	9°23.0	8°55.9	2.6 - 1.6	8.6 - 5.4	14.6 - 9.1
27	9°21.8	9°23.3	8°56.2	2.7 - 1.7	8.7 - 5.4	14.7 - 9.2
28	9°22.0	9°23.5	8°56.4	2.8 - 1.8	8.8 - 5.5	14.8 - 9.3
29	9°22.3	9°23.8	8°56.6	2.9 - 1.8	8.9 - 5.6	14.9 - 9.3
30	9°22.5	9°24.0	8°56.9	3.0 - 1.9	9.0 - 5.6	15.0 - 9.4
31	9°22.7	9°24.3	8°57.1	3.1 - 1.9	9.1 - 5.7	15.1 - 9.4
32	9°23.0	9°24.5	8°57.4	3.2 - 2.0	9.2 - 5.8	15.2 - 9.5
33	9°23.2	9°24.8	8°57.6	3.3 - 2.1	9.3 - 5.8	15.3 - 9.6
34	9°23.5	9°25.0	8°57.8	3.4 - 2.1	9.4 - 5.9	15.4 - 9.6
35	9°23.8	9°25.3	8°58.1	3.5 - 2.2	9.5 - 5.9	15.5 - 9.7
36	9°24.0	9°25.5	8°58.3	3.6 - 2.3	9.6 - 6.0	15.6 - 9.8
37	9°24.3	9°25.8	8°58.5	3.7 - 2.3	9.7 - 6.1	15.7 - 9.8
38	9°24.5	9°26.0	8°58.8	3.8 - 2.4	9.8 - 6.1	15.8 - 9.9
39	9°24.7	9°26.3	8°59.0	3.9 - 2.4	9.9 - 6.2	15.9 - 9.9
40	9°25.0	9°26.5	8°59.3	4.0 - 2.5	10.0 - 6.3	16.0 - 10.0
41	9°25.2	9°26.8	8°59.5	4.1 - 2.6	10.1 - 6.3	16.1 - 10.1
42	9°25.5	9°27.0	8°59.7	4.2 - 2.6	10.2 - 6.4	16.2 - 10.1
43	9°25.8	9°27.3	9°00.0	4.3 - 2.7	10.3 - 6.4	16.3 - 10.2
44	9°26.0	9°27.5	9°00.2	4.4 - 2.8	10.4 - 6.5	16.4 - 10.3
45	9°26.3	9°27.8	9°00.5	4.5 - 2.8	10.5 - 6.6	16.5 - 10.3
46	9°26.5	9°28.0	9°00.7	4.6 - 2.9	10.6 - 6.6	16.6 - 10.4
47	9°26.7	9°28.3	9°00.9	4.7 - 2.9	10.7 - 6.7	16.7 - 10.4
48	9°27.0	9°28.5	9°01.2	4.8 - 3.0	10.8 - 6.8	16.8 - 10.5
49	9°27.3	9°28.8	9°01.4	4.9 - 3.1	10.9 - 6.8	16.9 - 10.6
50	9°27.5	9°29.1	9°01.6	5.0 - 3.1	11.0 - 6.9	17.0 - 10.6
51	9°27.8	9°29.3	9°01.9	5.1 - 3.2	11.1 - 6.9	17.1 - 10.7
52	9°28.0	9°29.6	9°02.1	5.2 - 3.3	11.2 - 7.0	17.2 - 10.8
53	9°28.2	9°29.8	9°02.4	5.3 - 3.3	11.3 - 7.1	17.3 - 10.8
54	9°28.5	9°30.1	9°02.6	5.4 - 3.4	11.4 - 7.1	17.4 - 10.9
55	9°28.7	9°30.3	9°02.8	5.5 - 3.4	11.5 - 7.2	17.5 - 10.9
56	9°29.0	9°30.6	9°03.1	5.6 - 3.5	11.6 - 7.3	17.6 - 11.0
57	9°29.3	9°30.8	9°03.3	5.7 - 3.6	11.7 - 7.3	17.7 - 11.1
58	9°29.5	9°31.1	9°03.6	5.8 - 3.6	11.8 - 7.4	17.8 - 11.1
59	9°29.8	9°31.3	9°03.8	5.9 - 3.7	11.9 - 7.4	17.9 - 11.2

m 38	Sun Plan.	Aries	Moon	v and d corr		
0	9°30.0	9°31.6	9°04.0	0.0 - 0.0	6.0 - 3.9	12.0 - 7.7
1	9°30.2	9°31.8	9°04.3	0.1 - 0.1	6.1 - 3.9	12.1 - 7.8
2	9°30.5	9°32.1	9°04.5	0.2 - 0.1	6.2 - 4.0	12.2 - 7.8
3	9°30.7	9°32.3	9°04.7	0.3 - 0.2	6.3 - 4.0	12.3 - 7.9
4	9°31.0	9°32.6	9°05.0	0.4 - 0.3	6.4 - 4.1	12.4 - 8.0
5	9°31.3	9°32.8	9°05.2	0.5 - 0.3	6.5 - 4.2	12.5 - 8.0
6	9°31.5	9°33.1	9°05.5	0.6 - 0.4	6.6 - 4.2	12.6 - 8.1
7	9°31.8	9°33.3	9°05.7	0.7 - 0.4	6.7 - 4.3	12.7 - 8.1
8	9°32.0	9°33.6	9°05.9	0.8 - 0.5	6.8 - 4.4	12.8 - 8.2
9	9°32.2	9°33.8	9°06.2	0.9 - 0.6	6.9 - 4.4	12.9 - 8.3
10	9°32.5	9°34.1	9°06.4	1.0 - 0.6	7.0 - 4.5	13.0 - 8.3
11	9°32.7	9°34.3	9°06.7	1.1 - 0.7	7.1 - 4.6	13.1 - 8.4
12	9°33.0	9°34.6	9°06.9	1.2 - 0.8	7.2 - 4.6	13.2 - 8.5
13	9°33.3	9°34.8	9°07.1	1.3 - 0.8	7.3 - 4.7	13.3 - 8.5
14	9°33.5	9°35.1	9°07.4	1.4 - 0.9	7.4 - 4.7	13.4 - 8.6
15	9°33.8	9°35.3	9°07.6	1.5 - 1.0	7.5 - 4.8	13.5 - 8.7
16	9°34.0	9°35.6	9°07.9	1.6 - 1.0	7.6 - 4.9	13.6 - 8.7
17	9°34.2	9°35.8	9°08.1	1.7 - 1.1	7.7 - 4.9	13.7 - 8.8
18	9°34.5	9°36.1	9°08.3	1.8 - 1.2	7.8 - 5.0	13.8 - 8.9
19	9°34.8	9°36.3	9°08.6	1.9 - 1.2	7.9 - 5.1	13.9 - 8.9
20	9°35.0	9°36.6	9°08.8	2.0 - 1.3	8.0 - 5.1	14.0 - 9.0
21	9°35.3	9°36.8	9°09.0	2.1 - 1.3	8.1 - 5.2	14.1 - 9.0
22	9°35.5	9°37.1	9°09.3	2.2 - 1.4	8.2 - 5.3	14.2 - 9.1
23	9°35.7	9°37.3	9°09.5	2.3 - 1.5	8.3 - 5.3	14.3 - 9.2
24	9°36.0	9°37.6	9°09.8	2.4 - 1.5	8.4 - 5.4	14.4 - 9.2
25	9°36.2	9°37.8	9°10.0	2.5 - 1.6	8.5 - 5.5	14.5 - 9.3
26	9°36.5	9°38.1	9°10.2	2.6 - 1.7	8.6 - 5.5	14.6 - 9.4
27	9°36.8	9°38.3	9°10.5	2.7 - 1.7	8.7 - 5.6	14.7 - 9.4
28	9°37.0	9°38.6	9°10.7	2.8 - 1.8	8.8 - 5.6	14.8 - 9.5
29	9°37.3	9°38.8	9°11.0	2.9 - 1.9	8.9 - 5.7	14.9 - 9.6
30	9°37.5	9°39.1	9°11.2	3.0 - 1.9	9.0 - 5.8	15.0 - 9.6
31	9°37.7	9°39.3	9°11.4	3.1 - 2.0	9.1 - 5.8	15.1 - 9.7
32	9°38.0	9°39.6	9°11.7	3.2 - 2.1	9.2 - 5.9	15.2 - 9.8
33	9°38.2	9°39.8	9°11.9	3.3 - 2.1	9.3 - 6.0	15.3 - 9.8
34	9°38.5	9°40.1	9°12.1	3.4 - 2.2	9.4 - 6.0	15.4 - 9.9
35	9°38.8	9°40.3	9°12.4	3.5 - 2.2	9.5 - 6.1	15.5 - 9.9
36	9°39.0	9°40.6	9°12.6	3.6 - 2.3	9.6 - 6.2	15.6 - 10.0
37	9°39.3	9°40.8	9°12.9	3.7 - 2.4	9.7 - 6.2	15.7 - 10.1
38	9°39.5	9°41.1	9°13.1	3.8 - 2.4	9.8 - 6.3	15.8 - 10.1
39	9°39.7	9°41.3	9°13.3	3.9 - 2.5	9.9 - 6.4	15.9 - 10.2
40	9°40.0	9°41.6	9°13.6	4.0 - 2.6	10.0 - 6.4	16.0 - 10.3
41	9°40.2	9°41.8	9°13.8	4.1 - 2.6	10.1 - 6.5	16.1 - 10.3
42	9°40.5	9°42.1	9°14.1	4.2 - 2.7	10.2 - 6.5	16.2 - 10.4
43	9°40.8	9°42.3	9°14.3	4.3 - 2.8	10.3 - 6.6	16.3 - 10.5
44	9°41.0	9°42.6	9°14.5	4.4 - 2.8	10.4 - 6.7	16.4 - 10.5
45	9°41.3	9°42.8	9°14.8	4.5 - 2.9	10.5 - 6.7	16.5 - 10.6
46	9°41.5	9°43.1	9°15.0	4.6 - 3.0	10.6 - 6.8	16.6 - 10.7
47	9°41.7	9°43.3	9°15.2	4.7 - 3.0	10.7 - 6.9	16.7 - 10.7
48	9°42.0	9°43.6	9°15.5	4.8 - 3.1	10.8 - 6.9	16.8 - 10.8
49	9°42.3	9°43.8	9°15.7	4.9 - 3.1	10.9 - 7.0	16.9 - 10.8
50	9°42.5	9°44.1	9°16.0	5.0 - 3.2	11.0 - 7.1	17.0 - 10.9
51	9°42.8	9°44.3	9°16.2	5.1 - 3.3	11.1 - 7.1	17.1 - 11.0
52	9°43.0	9°44.6	9°16.4	5.2 - 3.3	11.2 - 7.2	17.2 - 11.0
53	9°43.2	9°44.8	9°16.7	5.3 - 3.4	11.3 - 7.3	17.3 - 11.1
54	9°43.5	9°45.1	9°16.9	5.4 - 3.5	11.4 - 7.3	17.4 - 11.2
55	9°43.7	9°45.3	9°17.2	5.5 - 3.5	11.5 - 7.4	17.5 - 11.2
56	9°44.0	9°45.6	9°17.4	5.6 - 3.6	11.6 - 7.4	17.6 - 11.3
57	9°44.3	9°45.8	9°17.6	5.7 - 3.7	11.7 - 7.5	17.7 - 11.4
58	9°44.5	9°46.1	9°17.9	5.8 - 3.7	11.8 - 7.6	17.8 - 11.4
59	9°44.8	9°46.3	9°18.1	5.9 - 3.8	11.9 - 7.6	17.9 - 11.5

Increments and Corrections

m 39	Sun Plan.	Aries	Moon	v and d corr		
0	9°45.0	9°46.6	9°18.4	0.0 - 0.0	6.0 - 4.0	12.0 - 7.9
1	9°45.2	9°46.8	9°18.6	0.1 - 0.1	6.1 - 4.0	12.1 - 8.0
2	9°45.5	9°47.1	9°18.8	0.2 - 0.1	6.2 - 4.1	12.2 - 8.0
3	9°45.7	9°47.4	9°19.1	0.3 - 0.2	6.3 - 4.1	12.3 - 8.1
4	9°46.0	9°47.6	9°19.3	0.4 - 0.3	6.4 - 4.2	12.4 - 8.2
5	9°46.3	9°47.9	9°19.5	0.5 - 0.3	6.5 - 4.3	12.5 - 8.2
6	9°46.5	9°48.1	9°19.8	0.6 - 0.4	6.6 - 4.3	12.6 - 8.3
7	9°46.8	9°48.4	9°20.0	0.7 - 0.5	6.7 - 4.4	12.7 - 8.4
8	9°47.0	9°48.6	9°20.3	0.8 - 0.5	6.8 - 4.5	12.8 - 8.4
9	9°47.2	9°48.9	9°20.5	0.9 - 0.6	6.9 - 4.5	12.9 - 8.5
10	9°47.5	9°49.1	9°20.7	1.0 - 0.7	7.0 - 4.6	13.0 - 8.6
11	9°47.7	9°49.4	9°21.0	1.1 - 0.7	7.1 - 4.7	13.1 - 8.6
12	9°48.0	9°49.6	9°21.2	1.2 - 0.8	7.2 - 4.7	13.2 - 8.7
13	9°48.3	9°49.9	9°21.5	1.3 - 0.9	7.3 - 4.8	13.3 - 8.8
14	9°48.5	9°50.1	9°21.7	1.4 - 0.9	7.4 - 4.9	13.4 - 8.8
15	9°48.8	9°50.4	9°21.9	1.5 - 1.0	7.5 - 4.9	13.5 - 8.9
16	9°49.0	9°50.6	9°22.2	1.6 - 1.1	7.6 - 5.0	13.6 - 9.0
17	9°49.2	9°50.9	9°22.4	1.7 - 1.1	7.7 - 5.1	13.7 - 9.0
18	9°49.5	9°51.1	9°22.6	1.8 - 1.2	7.8 - 5.1	13.8 - 9.1
19	9°49.8	9°51.4	9°22.9	1.9 - 1.3	7.9 - 5.2	13.9 - 9.2
20	9°50.0	9°51.6	9°23.1	2.0 - 1.3	8.0 - 5.3	14.0 - 9.2
21	9°50.3	9°51.9	9°23.4	2.1 - 1.4	8.1 - 5.3	14.1 - 9.3
22	9°50.5	9°52.1	9°23.6	2.2 - 1.4	8.2 - 5.4	14.2 - 9.3
23	9°50.7	9°52.4	9°23.8	2.3 - 1.5	8.3 - 5.5	14.3 - 9.4
24	9°51.0	9°52.6	9°24.1	2.4 - 1.6	8.4 - 5.5	14.4 - 9.5
25	9°51.2	9°52.9	9°24.3	2.5 - 1.6	8.5 - 5.6	14.5 - 9.5
26	9°51.5	9°53.1	9°24.6	2.6 - 1.7	8.6 - 5.7	14.6 - 9.6
27	9°51.8	9°53.4	9°24.8	2.7 - 1.8	8.7 - 5.7	14.7 - 9.7
28	9°52.0	9°53.6	9°25.0	2.8 - 1.8	8.8 - 5.8	14.8 - 9.7
29	9°52.3	9°53.9	9°25.3	2.9 - 1.9	8.9 - 5.9	14.9 - 9.8
30	9°52.5	9°54.1	9°25.5	3.0 - 2.0	9.0 - 5.9	15.0 - 9.9
31	9°52.7	9°54.4	9°25.7	3.1 - 2.0	9.1 - 6.0	15.1 - 9.9
32	9°53.0	9°54.6	9°26.0	3.2 - 2.1	9.2 - 6.1	15.2 - 10.0
33	9°53.2	9°54.9	9°26.2	3.3 - 2.2	9.3 - 6.1	15.3 - 10.1
34	9°53.5	9°55.1	9°26.5	3.4 - 2.2	9.4 - 6.2	15.4 - 10.1
35	9°53.8	9°55.4	9°26.7	3.5 - 2.3	9.5 - 6.3	15.5 - 10.2
36	9°54.0	9°55.6	9°26.9	3.6 - 2.4	9.6 - 6.3	15.6 - 10.3
37	9°54.3	9°55.9	9°27.2	3.7 - 2.4	9.7 - 6.4	15.7 - 10.3
38	9°54.5	9°56.1	9°27.4	3.8 - 2.5	9.8 - 6.5	15.8 - 10.4
39	9°54.7	9°56.4	9°27.7	3.9 - 2.6	9.9 - 6.5	15.9 - 10.5
40	9°55.0	9°56.6	9°27.9	4.0 - 2.6	10.0 - 6.6	16.0 - 10.5
41	9°55.2	9°56.9	9°28.1	4.1 - 2.7	10.1 - 6.6	16.1 - 10.6
42	9°55.5	9°57.1	9°28.4	4.2 - 2.8	10.2 - 6.7	16.2 - 10.7
43	9°55.8	9°57.4	9°28.6	4.3 - 2.8	10.3 - 6.8	16.3 - 10.7
44	9°56.0	9°57.6	9°28.8	4.4 - 2.9	10.4 - 6.8	16.4 - 10.8
45	9°56.3	9°57.9	9°29.1	4.5 - 3.0	10.5 - 6.9	16.5 - 10.9
46	9°56.5	9°58.1	9°29.3	4.6 - 3.0	10.6 - 7.0	16.6 - 10.9
47	9°56.7	9°58.4	9°29.6	4.7 - 3.1	10.7 - 7.0	16.7 - 11.0
48	9°57.0	9°58.6	9°29.8	4.8 - 3.2	10.8 - 7.1	16.8 - 11.1
49	9°57.3	9°58.9	9°30.0	4.9 - 3.2	10.9 - 7.2	16.9 - 11.1
50	9°57.5	9°59.1	9°30.3	5.0 - 3.3	11.0 - 7.2	17.0 - 11.2
51	9°57.8	9°59.4	9°30.5	5.1 - 3.4	11.1 - 7.3	17.1 - 11.3
52	9°58.0	9°59.6	9°30.8	5.2 - 3.4	11.2 - 7.4	17.2 - 11.3
53	9°58.2	9°59.9	9°31.0	5.3 - 3.5	11.3 - 7.4	17.3 - 11.4
54	9°58.5	10°00.1	9°31.2	5.4 - 3.6	11.4 - 7.5	17.4 - 11.5
55	9°58.7	10°00.4	9°31.5	5.5 - 3.6	11.5 - 7.6	17.5 - 11.5
56	9°59.0	10°00.6	9°31.7	5.6 - 3.7	11.6 - 7.6	17.6 - 11.6
57	9°59.3	10°00.9	9°32.0	5.7 - 3.8	11.7 - 7.7	17.7 - 11.7
58	9°59.5	10°01.1	9°32.2	5.8 - 3.8	11.8 - 7.8	17.8 - 11.7
59	9°59.8	10°01.4	9°32.4	5.9 - 3.9	11.9 - 7.8	17.9 - 11.8

m 40	Sun Plan.	Aries	Moon	v and d corr		
0	10°00.0	10°01.6	9°32.7	0.0 - 0.0	6.0 - 4.1	12.0 - 8.1
1	10°00.2	10°01.9	9°32.9	0.1 - 0.1	6.1 - 4.1	12.1 - 8.2
2	10°00.5	10°02.1	9°33.1	0.2 - 0.1	6.2 - 4.2	12.2 - 8.2
3	10°00.7	10°02.4	9°33.4	0.3 - 0.2	6.3 - 4.3	12.3 - 8.3
4	10°01.0	10°02.6	9°33.6	0.4 - 0.3	6.4 - 4.3	12.4 - 8.4
5	10°01.3	10°02.9	9°33.9	0.5 - 0.3	6.5 - 4.4	12.5 - 8.4
6	10°01.5	10°03.1	9°34.1	0.6 - 0.4	6.6 - 4.5	12.6 - 8.5
7	10°01.8	10°03.4	9°34.3	0.7 - 0.5	6.7 - 4.5	12.7 - 8.6
8	10°02.0	10°03.6	9°34.6	0.8 - 0.5	6.8 - 4.6	12.8 - 8.6
9	10°02.2	10°03.9	9°34.8	0.9 - 0.6	6.9 - 4.7	12.9 - 8.7
10	10°02.5	10°04.1	9°35.1	1.0 - 0.7	7.0 - 4.7	13.0 - 8.8
11	10°02.7	10°04.4	9°35.3	1.1 - 0.7	7.1 - 4.8	13.1 - 8.8
12	10°03.0	10°04.6	9°35.5	1.2 - 0.8	7.2 - 4.9	13.2 - 8.9
13	10°03.3	10°04.9	9°35.8	1.3 - 0.9	7.3 - 4.9	13.3 - 9.0
14	10°03.5	10°05.1	9°36.0	1.4 - 0.9	7.4 - 5.0	13.4 - 9.0
15	10°03.8	10°05.4	9°36.2	1.5 - 1.0	7.5 - 5.1	13.5 - 9.1
16	10°04.0	10°05.7	9°36.5	1.6 - 1.1	7.6 - 5.1	13.6 - 9.2
17	10°04.2	10°05.9	9°36.7	1.7 - 1.1	7.7 - 5.2	13.7 - 9.2
18	10°04.5	10°06.2	9°37.0	1.8 - 1.2	7.8 - 5.3	13.8 - 9.3
19	10°04.8	10°06.4	9°37.2	1.9 - 1.3	7.9 - 5.3	13.9 - 9.4
20	10°05.0	10°06.7	9°37.4	2.0 - 1.4	8.0 - 5.4	14.0 - 9.5
21	10°05.3	10°06.9	9°37.7	2.1 - 1.4	8.1 - 5.5	14.1 - 9.5
22	10°05.5	10°07.2	9°37.9	2.2 - 1.5	8.2 - 5.5	14.2 - 9.6
23	10°05.7	10°07.4	9°38.2	2.3 - 1.6	8.3 - 5.6	14.3 - 9.7
24	10°06.0	10°07.7	9°38.4	2.4 - 1.6	8.4 - 5.7	14.4 - 9.7
25	10°06.2	10°07.9	9°38.6	2.5 - 1.7	8.5 - 5.7	14.5 - 9.8
26	10°06.5	10°08.2	9°38.9	2.6 - 1.8	8.6 - 5.8	14.6 - 9.9
27	10°06.8	10°08.4	9°39.1	2.7 - 1.8	8.7 - 5.9	14.7 - 9.9
28	10°07.0	10°08.7	9°39.3	2.8 - 1.9	8.8 - 5.9	14.8 - 10.0
29	10°07.3	10°08.9	9°39.6	2.9 - 2.0	8.9 - 6.0	14.9 - 10.1
30	10°07.5	10°09.2	9°39.8	3.0 - 2.0	9.0 - 6.1	15.0 - 10.1
31	10°07.7	10°09.4	9°40.1	3.1 - 2.1	9.1 - 6.1	15.1 - 10.2
32	10°08.0	10°09.7	9°40.3	3.2 - 2.2	9.2 - 6.2	15.2 - 10.3
33	10°08.2	10°09.9	9°40.5	3.3 - 2.2	9.3 - 6.3	15.3 - 10.3
34	10°08.5	10°10.2	9°40.8	3.4 - 2.3	9.4 - 6.3	15.4 - 10.4
35	10°08.8	10°10.4	9°41.0	3.5 - 2.4	9.5 - 6.4	15.5 - 10.5
36	10°09.0	10°10.7	9°41.3	3.6 - 2.4	9.6 - 6.5	15.6 - 10.5
37	10°09.3	10°10.9	9°41.5	3.7 - 2.5	9.7 - 6.5	15.7 - 10.6
38	10°09.5	10°11.2	9°41.7	3.8 - 2.6	9.8 - 6.6	15.8 - 10.7
39	10°09.7	10°11.4	9°42.0	3.9 - 2.6	9.9 - 6.7	15.9 - 10.7
40	10°10.0	10°11.7	9°42.2	4.0 - 2.7	10.0 - 6.8	16.0 - 10.8
41	10°10.2	10°11.9	9°42.4	4.1 - 2.8	10.1 - 6.8	16.1 - 10.9
42	10°10.5	10°12.2	9°42.7	4.2 - 2.8	10.2 - 6.9	16.2 - 10.9
43	10°10.8	10°12.4	9°42.9	4.3 - 2.9	10.3 - 7.0	16.3 - 11.0
44	10°11.0	10°12.7	9°43.2	4.4 - 3.0	10.4 - 7.0	16.4 - 11.1
45	10°11.3	10°12.9	9°43.4	4.5 - 3.0	10.5 - 7.1	16.5 - 11.1
46	10°11.5	10°13.2	9°43.6	4.6 - 3.1	10.6 - 7.2	16.6 - 11.2
47	10°11.7	10°13.4	9°43.9	4.7 - 3.2	10.7 - 7.2	16.7 - 11.3
48	10°12.0	10°13.7	9°44.1	4.8 - 3.2	10.8 - 7.3	16.8 - 11.3
49	10°12.3	10°13.9	9°44.4	4.9 - 3.3	10.9 - 7.4	16.9 - 11.4
50	10°12.5	10°14.2	9°44.6	5.0 - 3.4	11.0 - 7.4	17.0 - 11.5
51	10°12.8	10°14.4	9°44.8	5.1 - 3.4	11.1 - 7.5	17.1 - 11.5
52	10°13.0	10°14.7	9°45.1	5.2 - 3.5	11.2 - 7.6	17.2 - 11.6
53	10°13.2	10°14.9	9°45.3	5.3 - 3.6	11.3 - 7.6	17.3 - 11.7
54	10°13.5	10°15.2	9°45.6	5.4 - 3.6	11.4 - 7.7	17.4 - 11.7
55	10°13.7	10°15.4	9°45.8	5.5 - 3.7	11.5 - 7.8	17.5 - 11.8
56	10°14.0	10°15.7	9°46.0	5.6 - 3.8	11.6 - 7.8	17.6 - 11.9
57	10°14.3	10°15.9	9°46.3	5.7 - 3.8	11.7 - 7.9	17.7 - 11.9
58	10°14.5	10°16.2	9°46.5	5.8 - 3.9	11.8 - 8.0	17.8 - 12.0
59	10°14.8	10°16.4	9°46.7	5.9 - 4.0	11.9 - 8.0	17.9 - 12.1

m 41	Sun Plan.	Aries	Moon	v and d corr		
0	10°15.0	10°16.7	9°47.0	0.0 - 0.0	6.0 - 4.2	12.0 - 8.3
1	10°15.2	10°16.9	9°47.2	0.1 - 0.1	6.1 - 4.2	12.1 - 8.4
2	10°15.5	10°17.2	9°47.5	0.2 - 0.1	6.2 - 4.3	12.2 - 8.4
3	10°15.7	10°17.4	9°47.7	0.3 - 0.2	6.3 - 4.4	12.3 - 8.5
4	10°16.0	10°17.7	9°47.9	0.4 - 0.3	6.4 - 4.4	12.4 - 8.6
5	10°16.3	10°17.9	9°48.2	0.5 - 0.3	6.5 - 4.5	12.5 - 8.6
6	10°16.5	10°18.2	9°48.4	0.6 - 0.4	6.6 - 4.6	12.6 - 8.7
7	10°16.8	10°18.4	9°48.7	0.7 - 0.5	6.7 - 4.6	12.7 - 8.8
8	10°17.0	10°18.7	9°48.9	0.8 - 0.6	6.8 - 4.7	12.8 - 8.9
9	10°17.2	10°18.9	9°49.1	0.9 - 0.6	6.9 - 4.8	12.9 - 8.9
10	10°17.5	10°19.2	9°49.4	1.0 - 0.7	7.0 - 4.8	13.0 - 9.0
11	10°17.7	10°19.4	9°49.6	1.1 - 0.8	7.1 - 4.9	13.1 - 9.1
12	10°18.0	10°19.7	9°49.8	1.2 - 0.8	7.2 - 5.0	13.2 - 9.1
13	10°18.3	10°19.9	9°50.1	1.3 - 0.9	7.3 - 5.0	13.3 - 9.2
14	10°18.5	10°20.2	9°50.3	1.4 - 1.0	7.4 - 5.1	13.4 - 9.3
15	10°18.8	10°20.4	9°50.6	1.5 - 1.0	7.5 - 5.2	13.5 - 9.3
16	10°19.0	10°20.7	9°50.8	1.6 - 1.1	7.6 - 5.3	13.6 - 9.4
17	10°19.2	10°20.9	9°51.0	1.7 - 1.2	7.7 - 5.3	13.7 - 9.5
18	10°19.5	10°21.2	9°51.3	1.8 - 1.2	7.8 - 5.4	13.8 - 9.5
19	10°19.8	10°21.4	9°51.5	1.9 - 1.3	7.9 - 5.5	13.9 - 9.6
20	10°20.0	10°21.7	9°51.8	2.0 - 1.4	8.0 - 5.5	14.0 - 9.7
21	10°20.3	10°21.9	9°52.0	2.1 - 1.5	8.1 - 5.6	14.1 - 9.8
22	10°20.5	10°22.2	9°52.2	2.2 - 1.5	8.2 - 5.7	14.2 - 9.8
23	10°20.7	10°22.4	9°52.5	2.3 - 1.6	8.3 - 5.7	14.3 - 9.9
24	10°21.0	10°22.7	9°52.7	2.4 - 1.7	8.4 - 5.8	14.4 - 10.0
25	10°21.2	10°22.9	9°52.9	2.5 - 1.7	8.5 - 5.9	14.5 - 10.0
26	10°21.5	10°23.2	9°53.2	2.6 - 1.8	8.6 - 5.9	14.6 - 10.1
27	10°21.8	10°23.4	9°53.4	2.7 - 1.9	8.7 - 6.0	14.7 - 10.2
28	10°22.0	10°23.7	9°53.7	2.8 - 1.9	8.8 - 6.1	14.8 - 10.2
29	10°22.3	10°24.0	9°53.9	2.9 - 2.0	8.9 - 6.2	14.9 - 10.3
30	10°22.5	10°24.2	9°54.1	3.0 - 2.1	9.0 - 6.2	15.0 - 10.4
31	10°22.7	10°24.5	9°54.4	3.1 - 2.1	9.1 - 6.3	15.1 - 10.4
32	10°23.0	10°24.7	9°54.6	3.2 - 2.2	9.2 - 6.4	15.2 - 10.5
33	10°23.2	10°25.0	9°54.9	3.3 - 2.3	9.3 - 6.4	15.3 - 10.6
34	10°23.5	10°25.2	9°55.1	3.4 - 2.4	9.4 - 6.5	15.4 - 10.7
35	10°23.8	10°25.5	9°55.3	3.5 - 2.4	9.5 - 6.6	15.5 - 10.7
36	10°24.0	10°25.7	9°55.6	3.6 - 2.5	9.6 - 6.6	15.6 - 10.8
37	10°24.3	10°26.0	9°55.8	3.7 - 2.6	9.7 - 6.7	15.7 - 10.9
38	10°24.5	10°26.2	9°56.1	3.8 - 2.6	9.8 - 6.8	15.8 - 10.9
39	10°24.7	10°26.5	9°56.3	3.9 - 2.7	9.9 - 6.8	15.9 - 11.0
40	10°25.0	10°26.7	9°56.5	4.0 - 2.8	10.0 - 6.9	16.0 - 11.1
41	10°25.2	10°27.0	9°56.8	4.1 - 2.8	10.1 - 7.0	16.1 - 11.1
42	10°25.5	10°27.2	9°57.0	4.2 - 2.9	10.2 - 7.1	16.2 - 11.2
43	10°25.8	10°27.5	9°57.2	4.3 - 3.0	10.3 - 7.1	16.3 - 11.3
44	10°26.0	10°27.7	9°57.5	4.4 - 3.0	10.4 - 7.2	16.4 - 11.3
45	10°26.3	10°28.0	9°57.7	4.5 - 3.1	10.5 - 7.3	16.5 - 11.4
46	10°26.5	10°28.2	9°58.0	4.6 - 3.2	10.6 - 7.3	16.6 - 11.5
47	10°26.7	10°28.5	9°58.2	4.7 - 3.3	10.7 - 7.4	16.7 - 11.6
48	10°27.0	10°28.7	9°58.4	4.8 - 3.3	10.8 - 7.5	16.8 - 11.6
49	10°27.3	10°29.0	9°58.7	4.9 - 3.4	10.9 - 7.5	16.9 - 11.7
50	10°27.5	10°29.2	9°58.9	5.0 - 3.5	11.0 - 7.6	17.0 - 11.8
51	10°27.8	10°29.5	9°59.2	5.1 - 3.5	11.1 - 7.7	17.1 - 11.8
52	10°28.0	10°29.7	9°59.4	5.2 - 3.6	11.2 - 7.7	17.2 - 11.9
53	10°28.2	10°30.0	9°59.6	5.3 - 3.7	11.3 - 7.8	17.3 - 12.0
54	10°28.5	10°30.2	9°59.9	5.4 - 3.7	11.4 - 7.9	17.4 - 12.0
55	10°28.7	10°30.5	10°00.1	5.5 - 3.8	11.5 - 8.0	17.5 - 12.1
56	10°29.0	10°30.7	10°00.3	5.6 - 3.9	11.6 - 8.0	17.6 - 12.2
57	10°29.3	10°31.0	10°00.6	5.7 - 3.9	11.7 - 8.1	17.7 - 12.2
58	10°29.5	10°31.2	10°00.8	5.8 - 4.0	11.8 - 8.2	17.8 - 12.3
59	10°29.8	10°31.5	10°01.1	5.9 - 4.1	11.9 - 8.2	17.9 - 12.4

Increments and Corrections

m 42	Sun Plan.	Aries	Moon	v and d corr		
0	10°30.0	10°31.7	10°01.3	0.0 - 0.0	6.0 - 4.3	12.0 - 8.5
1	10°30.2	10°32.0	10°01.5	0.1 - 0.1	6.1 - 4.3	12.1 - 8.6
2	10°30.5	10°32.2	10°01.8	0.2 - 0.1	6.2 - 4.4	12.2 - 8.6
3	10°30.7	10°32.5	10°02.0	0.3 - 0.2	6.3 - 4.5	12.3 - 8.7
4	10°31.0	10°32.7	10°02.3	0.4 - 0.3	6.4 - 4.5	12.4 - 8.8
5	10°31.3	10°33.0	10°02.5	0.5 - 0.4	6.5 - 4.6	12.5 - 8.9
6	10°31.5	10°33.2	10°02.7	0.6 - 0.4	6.6 - 4.7	12.6 - 8.9
7	10°31.8	10°33.5	10°03.0	0.7 - 0.5	6.7 - 4.7	12.7 - 9.0
8	10°32.0	10°33.7	10°03.2	0.8 - 0.6	6.8 - 4.8	12.8 - 9.1
9	10°32.2	10°34.0	10°03.4	0.9 - 0.6	6.9 - 4.9	12.9 - 9.1
10	10°32.5	10°34.2	10°03.7	1.0 - 0.7	7.0 - 5.0	13.0 - 9.2
11	10°32.7	10°34.5	10°03.9	1.1 - 0.8	7.1 - 5.0	13.1 - 9.3
12	10°33.0	10°34.7	10°04.2	1.2 - 0.9	7.2 - 5.1	13.2 - 9.3
13	10°33.3	10°35.0	10°04.4	1.3 - 0.9	7.3 - 5.2	13.3 - 9.4
14	10°33.5	10°35.2	10°04.6	1.4 - 1.0	7.4 - 5.2	13.4 - 9.5
15	10°33.8	10°35.5	10°04.9	1.5 - 1.1	7.5 - 5.3	13.5 - 9.6
16	10°34.0	10°35.7	10°05.1	1.6 - 1.1	7.6 - 5.4	13.6 - 9.6
17	10°34.2	10°36.0	10°05.4	1.7 - 1.2	7.7 - 5.5	13.7 - 9.7
18	10°34.5	10°36.2	10°05.6	1.8 - 1.3	7.8 - 5.5	13.8 - 9.8
19	10°34.8	10°36.5	10°05.8	1.9 - 1.3	7.9 - 5.6	13.9 - 9.8
20	10°35.0	10°36.7	10°06.1	2.0 - 1.4	8.0 - 5.7	14.0 - 9.9
21	10°35.3	10°37.0	10°06.3	2.1 - 1.5	8.1 - 5.7	14.1 - 10.0
22	10°35.5	10°37.2	10°06.5	2.2 - 1.6	8.2 - 5.8	14.2 - 10.1
23	10°35.7	10°37.5	10°06.8	2.3 - 1.6	8.3 - 5.9	14.3 - 10.1
24	10°36.0	10°37.7	10°07.0	2.4 - 1.7	8.4 - 6.0	14.4 - 10.2
25	10°36.2	10°38.0	10°07.3	2.5 - 1.8	8.5 - 6.0	14.5 - 10.3
26	10°36.5	10°38.2	10°07.5	2.6 - 1.8	8.6 - 6.1	14.6 - 10.3
27	10°36.8	10°38.5	10°07.7	2.7 - 1.9	8.7 - 6.2	14.7 - 10.4
28	10°37.0	10°38.7	10°08.0	2.8 - 2.0	8.8 - 6.2	14.8 - 10.5
29	10°37.3	10°39.0	10°08.2	2.9 - 2.1	8.9 - 6.3	14.9 - 10.6
30	10°37.5	10°39.2	10°08.5	3.0 - 2.1	9.0 - 6.4	15.0 - 10.6
31	10°37.7	10°39.5	10°08.7	3.1 - 2.2	9.1 - 6.4	15.1 - 10.7
32	10°38.0	10°39.7	10°08.9	3.2 - 2.3	9.2 - 6.5	15.2 - 10.8
33	10°38.2	10°40.0	10°09.2	3.3 - 2.3	9.3 - 6.6	15.3 - 10.8
34	10°38.5	10°40.2	10°09.4	3.4 - 2.4	9.4 - 6.7	15.4 - 10.9
35	10°38.8	10°40.5	10°09.7	3.5 - 2.5	9.5 - 6.7	15.5 - 11.0
36	10°39.0	10°40.7	10°09.9	3.6 - 2.6	9.6 - 6.8	15.6 - 11.1
37	10°39.3	10°41.0	10°10.1	3.7 - 2.6	9.7 - 6.9	15.7 - 11.1
38	10°39.5	10°41.2	10°10.4	3.8 - 2.7	9.8 - 6.9	15.8 - 11.2
39	10°39.7	10°41.5	10°10.6	3.9 - 2.8	9.9 - 7.0	15.9 - 11.3
40	10°40.0	10°41.7	10°10.8	4.0 - 2.8	10.0 - 7.1	16.0 - 11.3
41	10°40.2	10°42.0	10°11.1	4.1 - 2.9	10.1 - 7.2	16.1 - 11.4
42	10°40.5	10°42.3	10°11.3	4.2 - 3.0	10.2 - 7.2	16.2 - 11.5
43	10°40.8	10°42.5	10°11.6	4.3 - 3.0	10.3 - 7.3	16.3 - 11.5
44	10°41.0	10°42.8	10°11.8	4.4 - 3.1	10.4 - 7.4	16.4 - 11.6
45	10°41.3	10°43.0	10°12.0	4.5 - 3.2	10.5 - 7.4	16.5 - 11.7
46	10°41.5	10°43.3	10°12.3	4.6 - 3.3	10.6 - 7.5	16.6 - 11.8
47	10°41.7	10°43.5	10°12.5	4.7 - 3.3	10.7 - 7.6	16.7 - 11.8
48	10°42.0	10°43.8	10°12.8	4.8 - 3.4	10.8 - 7.7	16.8 - 11.9
49	10°42.3	10°44.0	10°13.0	4.9 - 3.5	10.9 - 7.7	16.9 - 12.0
50	10°42.5	10°44.3	10°13.2	5.0 - 3.5	11.0 - 7.8	17.0 - 12.0
51	10°42.8	10°44.5	10°13.5	5.1 - 3.6	11.1 - 7.9	17.1 - 12.1
52	10°43.0	10°44.8	10°13.7	5.2 - 3.7	11.2 - 7.9	17.2 - 12.2
53	10°43.2	10°45.0	10°13.9	5.3 - 3.8	11.3 - 8.0	17.3 - 12.3
54	10°43.5	10°45.3	10°14.2	5.4 - 3.8	11.4 - 8.1	17.4 - 12.3
55	10°43.7	10°45.5	10°14.4	5.5 - 3.9	11.5 - 8.1	17.5 - 12.4
56	10°44.0	10°45.8	10°14.7	5.6 - 4.0	11.6 - 8.2	17.6 - 12.5
57	10°44.3	10°46.0	10°14.9	5.7 - 4.0	11.7 - 8.3	17.7 - 12.5
58	10°44.5	10°46.3	10°15.1	5.8 - 4.1	11.8 - 8.4	17.8 - 12.6
59	10°44.8	10°46.5	10°15.4	5.9 - 4.2	11.9 - 8.4	17.9 - 12.7

m 43	Sun Plan.	Aries	Moon	v and d corr		
0	10°45.0	10°46.8	10°15.6	0.0 - 0.0	6.0 - 4.3	12.0 - 8.7
1	10°45.2	10°47.0	10°15.9	0.1 - 0.1	6.1 - 4.4	12.1 - 8.8
2	10°45.5	10°47.3	10°16.1	0.2 - 0.1	6.2 - 4.5	12.2 - 8.8
3	10°45.7	10°47.5	10°16.3	0.3 - 0.2	6.3 - 4.6	12.3 - 8.9
4	10°46.0	10°47.8	10°16.6	0.4 - 0.3	6.4 - 4.6	12.4 - 9.0
5	10°46.3	10°48.0	10°16.8	0.5 - 0.4	6.5 - 4.7	12.5 - 9.1
6	10°46.5	10°48.3	10°17.0	0.6 - 0.4	6.6 - 4.8	12.6 - 9.1
7	10°46.8	10°48.5	10°17.3	0.7 - 0.5	6.7 - 4.9	12.7 - 9.2
8	10°47.0	10°48.8	10°17.5	0.8 - 0.6	6.8 - 4.9	12.8 - 9.3
9	10°47.2	10°49.0	10°17.8	0.9 - 0.7	6.9 - 5.0	12.9 - 9.4
10	10°47.5	10°49.3	10°18.0	1.0 - 0.7	7.0 - 5.1	13.0 - 9.4
11	10°47.7	10°49.5	10°18.2	1.1 - 0.8	7.1 - 5.1	13.1 - 9.5
12	10°48.0	10°49.8	10°18.5	1.2 - 0.9	7.2 - 5.2	13.2 - 9.6
13	10°48.3	10°50.0	10°18.7	1.3 - 0.9	7.3 - 5.3	13.3 - 9.6
14	10°48.5	10°50.3	10°19.0	1.4 - 1.0	7.4 - 5.4	13.4 - 9.7
15	10°48.8	10°50.5	10°19.2	1.5 - 1.1	7.5 - 5.4	13.5 - 9.8
16	10°49.0	10°50.8	10°19.4	1.6 - 1.2	7.6 - 5.5	13.6 - 9.9
17	10°49.2	10°51.0	10°19.7	1.7 - 1.2	7.7 - 5.6	13.7 - 9.9
18	10°49.5	10°51.3	10°19.9	1.8 - 1.3	7.8 - 5.7	13.8 - 10.0
19	10°49.8	10°51.5	10°20.2	1.9 - 1.4	7.9 - 5.7	13.9 - 10.1
20	10°50.0	10°51.8	10°20.4	2.0 - 1.4	8.0 - 5.8	14.0 - 10.2
21	10°50.3	10°52.0	10°20.6	2.1 - 1.5	8.1 - 5.9	14.1 - 10.2
22	10°50.5	10°52.3	10°20.9	2.2 - 1.6	8.2 - 5.9	14.2 - 10.3
23	10°50.7	10°52.5	10°21.1	2.3 - 1.7	8.3 - 6.0	14.3 - 10.4
24	10°51.0	10°52.8	10°21.3	2.4 - 1.7	8.4 - 6.1	14.4 - 10.4
25	10°51.2	10°53.0	10°21.6	2.5 - 1.8	8.5 - 6.2	14.5 - 10.5
26	10°51.5	10°53.3	10°21.8	2.6 - 1.9	8.6 - 6.2	14.6 - 10.6
27	10°51.8	10°53.5	10°22.1	2.7 - 2.0	8.7 - 6.3	14.7 - 10.7
28	10°52.0	10°53.8	10°22.3	2.8 - 2.0	8.8 - 6.4	14.8 - 10.7
29	10°52.3	10°54.0	10°22.5	2.9 - 2.1	8.9 - 6.5	14.9 - 10.8
30	10°52.5	10°54.3	10°22.8	3.0 - 2.2	9.0 - 6.5	15.0 - 10.9
31	10°52.7	10°54.5	10°23.0	3.1 - 2.2	9.1 - 6.6	15.1 - 10.9
32	10°53.0	10°54.8	10°23.3	3.2 - 2.3	9.2 - 6.7	15.2 - 11.0
33	10°53.2	10°55.0	10°23.5	3.3 - 2.4	9.3 - 6.7	15.3 - 11.1
34	10°53.5	10°55.3	10°23.7	3.4 - 2.5	9.4 - 6.8	15.4 - 11.2
35	10°53.8	10°55.5	10°24.0	3.5 - 2.5	9.5 - 6.9	15.5 - 11.2
36	10°54.0	10°55.8	10°24.2	3.6 - 2.6	9.6 - 7.0	15.6 - 11.3
37	10°54.3	10°56.0	10°24.4	3.7 - 2.7	9.7 - 7.0	15.7 - 11.4
38	10°54.5	10°56.3	10°24.7	3.8 - 2.8	9.8 - 7.1	15.8 - 11.5
39	10°54.7	10°56.5	10°24.9	3.9 - 2.8	9.9 - 7.2	15.9 - 11.5
40	10°55.0	10°56.8	10°25.2	4.0 - 2.9	10.0 - 7.3	16.0 - 11.6
41	10°55.2	10°57.0	10°25.4	4.1 - 3.0	10.1 - 7.3	16.1 - 11.7
42	10°55.5	10°57.3	10°25.6	4.2 - 3.0	10.2 - 7.4	16.2 - 11.7
43	10°55.8	10°57.5	10°25.9	4.3 - 3.1	10.3 - 7.5	16.3 - 11.8
44	10°56.0	10°57.8	10°26.1	4.4 - 3.2	10.4 - 7.5	16.4 - 11.9
45	10°56.3	10°58.0	10°26.4	4.5 - 3.3	10.5 - 7.6	16.5 - 12.0
46	10°56.5	10°58.3	10°26.6	4.6 - 3.3	10.6 - 7.7	16.6 - 12.0
47	10°56.7	10°58.5	10°26.8	4.7 - 3.4	10.7 - 7.8	16.7 - 12.1
48	10°57.0	10°58.8	10°27.1	4.8 - 3.5	10.8 - 7.8	16.8 - 12.2
49	10°57.3	10°59.0	10°27.3	4.9 - 3.6	10.9 - 7.9	16.9 - 12.3
50	10°57.5	10°59.3	10°27.5	5.0 - 3.6	11.0 - 8.0	17.0 - 12.3
51	10°57.8	10°59.5	10°27.8	5.1 - 3.7	11.1 - 8.0	17.1 - 12.4
52	10°58.0	10°59.8	10°28.0	5.2 - 3.8	11.2 - 8.1	17.2 - 12.5
53	10°58.2	11°00.0	10°28.3	5.3 - 3.8	11.3 - 8.2	17.3 - 12.5
54	10°58.5	11°00.3	10°28.5	5.4 - 3.9	11.4 - 8.3	17.4 - 12.6
55	10°58.7	11°00.6	10°28.7	5.5 - 4.0	11.5 - 8.3	17.5 - 12.7
56	10°59.0	11°00.8	10°29.0	5.6 - 4.1	11.6 - 8.4	17.6 - 12.8
57	10°59.3	11°01.1	10°29.2	5.7 - 4.1	11.7 - 8.5	17.7 - 12.8
58	10°59.5	11°01.3	10°29.5	5.8 - 4.2	11.8 - 8.6	17.8 - 12.9
59	10°59.8	11°01.6	10°29.7	5.9 - 4.3	11.9 - 8.6	17.9 - 13.0

m 44	Sun Plan.	Aries	Moon	v and d corr		
0	11°00.0	11°01.8	10°29.9	0.0 - 0.0	6.0 - 4.5	12.0 - 8.9
1	11°00.2	11°02.1	10°30.2	0.1 - 0.1	6.1 - 4.5	12.1 - 9.0
2	11°00.5	11°02.3	10°30.4	0.2 - 0.1	6.2 - 4.6	12.2 - 9.0
3	11°00.7	11°02.6	10°30.6	0.3 - 0.2	6.3 - 4.7	12.3 - 9.1
4	11°01.0	11°02.8	10°30.9	0.4 - 0.3	6.4 - 4.7	12.4 - 9.2
5	11°01.3	11°03.1	10°31.1	0.5 - 0.4	6.5 - 4.8	12.5 - 9.3
6	11°01.5	11°03.3	10°31.4	0.6 - 0.4	6.6 - 4.9	12.6 - 9.3
7	11°01.8	11°03.6	10°31.6	0.7 - 0.5	6.7 - 5.0	12.7 - 9.4
8	11°02.0	11°03.8	10°31.8	0.8 - 0.6	6.8 - 5.0	12.8 - 9.5
9	11°02.2	11°04.1	10°32.1	0.9 - 0.7	6.9 - 5.1	12.9 - 9.6
10	11°02.5	11°04.3	10°32.3	1.0 - 0.7	7.0 - 5.2	13.0 - 9.6
11	11°02.7	11°04.6	10°32.6	1.1 - 0.8	7.1 - 5.3	13.1 - 9.7
12	11°03.0	11°04.8	10°32.8	1.2 - 0.9	7.2 - 5.3	13.2 - 9.8
13	11°03.3	11°05.1	10°33.0	1.3 - 1.0	7.3 - 5.4	13.3 - 9.9
14	11°03.5	11°05.3	10°33.3	1.4 - 1.0	7.4 - 5.5	13.4 - 9.9
15	11°03.8	11°05.6	10°33.5	1.5 - 1.1	7.5 - 5.6	13.5 - 10.0
16	11°04.0	11°05.8	10°33.8	1.6 - 1.2	7.6 - 5.6	13.6 - 10.1
17	11°04.2	11°06.1	10°34.0	1.7 - 1.3	7.7 - 5.7	13.7 - 10.2
18	11°04.5	11°06.3	10°34.2	1.8 - 1.3	7.8 - 5.8	13.8 - 10.2
19	11°04.8	11°06.6	10°34.5	1.9 - 1.4	7.9 - 5.9	13.9 - 10.3
20	11°05.0	11°06.8	10°34.7	2.0 - 1.5	8.0 - 5.9	14.0 - 10.4
21	11°05.3	11°07.1	10°34.9	2.1 - 1.6	8.1 - 6.0	14.1 - 10.5
22	11°05.5	11°07.3	10°35.2	2.2 - 1.6	8.2 - 6.1	14.2 - 10.5
23	11°05.7	11°07.6	10°35.4	2.3 - 1.7	8.3 - 6.2	14.3 - 10.6
24	11°06.0	11°07.8	10°35.7	2.4 - 1.8	8.4 - 6.2	14.4 - 10.7
25	11°06.2	11°08.1	10°35.9	2.5 - 1.9	8.5 - 6.3	14.5 - 10.8
26	11°06.5	11°08.3	10°36.1	2.6 - 1.9	8.6 - 6.4	14.6 - 10.8
27	11°06.8	11°08.6	10°36.4	2.7 - 2.0	8.7 - 6.5	14.7 - 10.9
28	11°07.0	11°08.8	10°36.6	2.8 - 2.1	8.8 - 6.5	14.8 - 11.0
29	11°07.3	11°09.1	10°36.9	2.9 - 2.2	8.9 - 6.6	14.9 - 11.1
30	11°07.5	11°09.3	10°37.1	3.0 - 2.2	9.0 - 6.7	15.0 - 11.1
31	11°07.7	11°09.6	10°37.3	3.1 - 2.3	9.1 - 6.7	15.1 - 11.2
32	11°08.0	11°09.8	10°37.6	3.2 - 2.4	9.2 - 6.8	15.2 - 11.3
33	11°08.2	11°10.1	10°37.8	3.3 - 2.4	9.3 - 6.9	15.3 - 11.3
34	11°08.5	11°10.3	10°38.0	3.4 - 2.5	9.4 - 7.0	15.4 - 11.4
35	11°08.8	11°10.6	10°38.3	3.5 - 2.6	9.5 - 7.0	15.5 - 11.5
36	11°09.0	11°10.8	10°38.5	3.6 - 2.7	9.6 - 7.1	15.6 - 11.6
37	11°09.3	11°11.1	10°38.8	3.7 - 2.7	9.7 - 7.2	15.7 - 11.6
38	11°09.5	11°11.3	10°39.0	3.8 - 2.8	9.8 - 7.3	15.8 - 11.7
39	11°09.7	11°11.6	10°39.2	3.9 - 2.9	9.9 - 7.3	15.9 - 11.8
40	11°10.0	11°11.8	10°39.5	4.0 - 3.0	10.0 - 7.4	16.0 - 11.9
41	11°10.2	11°12.1	10°39.7	4.1 - 3.0	10.1 - 7.5	16.1 - 11.9
42	11°10.5	11°12.3	10°40.0	4.2 - 3.1	10.2 - 7.6	16.2 - 12.0
43	11°10.8	11°12.6	10°40.2	4.3 - 3.2	10.3 - 7.6	16.3 - 12.1
44	11°11.0	11°12.8	10°40.4	4.4 - 3.3	10.4 - 7.7	16.4 - 12.2
45	11°11.3	11°13.1	10°40.7	4.5 - 3.3	10.5 - 7.8	16.5 - 12.2
46	11°11.5	11°13.3	10°40.9	4.6 - 3.4	10.6 - 7.9	16.6 - 12.3
47	11°11.7	11°13.6	10°41.1	4.7 - 3.5	10.7 - 7.9	16.7 - 12.4
48	11°12.0	11°13.8	10°41.4	4.8 - 3.6	10.8 - 8.0	16.8 - 12.5
49	11°12.3	11°14.1	10°41.6	4.9 - 3.6	10.9 - 8.1	16.9 - 12.5
50	11°12.5	11°14.3	10°41.9	5.0 - 3.7	11.0 - 8.2	17.0 - 12.6
51	11°12.8	11°14.6	10°42.1	5.1 - 3.8	11.1 - 8.2	17.1 - 12.7
52	11°13.0	11°14.8	10°42.3	5.2 - 3.9	11.2 - 8.3	17.2 - 12.8
53	11°13.2	11°15.1	10°42.6	5.3 - 3.9	11.3 - 8.4	17.3 - 12.8
54	11°13.5	11°15.3	10°42.8	5.4 - 4.0	11.4 - 8.5	17.4 - 12.9
55	11°13.7	11°15.6	10°43.1	5.5 - 4.1	11.5 - 8.5	17.5 - 13.0
56	11°14.0	11°15.8	10°43.3	5.6 - 4.2	11.6 - 8.6	17.6 - 13.1
57	11°14.3	11°16.1	10°43.5	5.7 - 4.2	11.7 - 8.7	17.7 - 13.1
58	11°14.5	11°16.3	10°43.8	5.8 - 4.3	11.8 - 8.8	17.8 - 13.2
59	11°14.8	11°16.6	10°44.0	5.9 - 4.4	11.9 - 8.8	17.9 - 13.3

Increments and Corrections

m 45	Sun Plan.	Aries	Moon	v and d corr		
0	11°15.0	11°16.8	10°44.3	0.0 - 0.0	6.0 - 4.5	12.0 - 9.1
1	11°15.2	11°17.1	10°44.5	0.1 - 0.1	6.1 - 4.6	12.1 - 9.2
2	11°15.5	11°17.3	10°44.7	0.2 - 0.2	6.2 - 4.7	12.2 - 9.3
3	11°15.7	11°17.6	10°45.0	0.3 - 0.2	6.3 - 4.8	12.3 - 9.3
4	11°16.0	11°17.8	10°45.2	0.4 - 0.3	6.4 - 4.9	12.4 - 9.4
5	11°16.3	11°18.1	10°45.4	0.5 - 0.4	6.5 - 4.9	12.5 - 9.5
6	11°16.5	11°18.3	10°45.7	0.6 - 0.5	6.6 - 5.0	12.6 - 9.6
7	11°16.8	11°18.6	10°45.9	0.7 - 0.5	6.7 - 5.1	12.7 - 9.6
8	11°17.0	11°18.9	10°46.2	0.8 - 0.6	6.8 - 5.2	12.8 - 9.7
9	11°17.2	11°19.1	10°46.4	0.9 - 0.7	6.9 - 5.2	12.9 - 9.8
10	11°17.5	11°19.4	10°46.6	1.0 - 0.8	7.0 - 5.3	13.0 - 9.9
11	11°17.7	11°19.6	10°46.9	1.1 - 0.8	7.1 - 5.4	13.1 - 9.9
12	11°18.0	11°19.9	10°47.1	1.2 - 0.9	7.2 - 5.5	13.2 - 10.0
13	11°18.3	11°20.1	10°47.4	1.3 - 1.0	7.3 - 5.5	13.3 - 10.1
14	11°18.5	11°20.4	10°47.6	1.4 - 1.1	7.4 - 5.6	13.4 - 10.2
15	11°18.8	11°20.6	10°47.8	1.5 - 1.1	7.5 - 5.7	13.5 - 10.2
16	11°19.0	11°20.9	10°48.1	1.6 - 1.2	7.6 - 5.8	13.6 - 10.3
17	11°19.2	11°21.1	10°48.3	1.7 - 1.3	7.7 - 5.8	13.7 - 10.4
18	11°19.5	11°21.4	10°48.5	1.8 - 1.4	7.8 - 5.9	13.8 - 10.5
19	11°19.8	11°21.6	10°48.8	1.9 - 1.4	7.9 - 6.0	13.9 - 10.5
20	11°20.0	11°21.9	10°49.0	2.0 - 1.5	8.0 - 6.1	14.0 - 10.6
21	11°20.3	11°22.1	10°49.3	2.1 - 1.6	8.1 - 6.1	14.1 - 10.7
22	11°20.5	11°22.4	10°49.5	2.2 - 1.7	8.2 - 6.2	14.2 - 10.8
23	11°20.7	11°22.6	10°49.7	2.3 - 1.7	8.3 - 6.3	14.3 - 10.8
24	11°21.0	11°22.9	10°50.0	2.4 - 1.8	8.4 - 6.4	14.4 - 10.9
25	11°21.2	11°23.1	10°50.2	2.5 - 1.9	8.5 - 6.4	14.5 - 11.0
26	11°21.5	11°23.4	10°50.5	2.6 - 2.0	8.6 - 6.5	14.6 - 11.1
27	11°21.8	11°23.6	10°50.7	2.7 - 2.0	8.7 - 6.6	14.7 - 11.1
28	11°22.0	11°23.9	10°50.9	2.8 - 2.1	8.8 - 6.7	14.8 - 11.2
29	11°22.3	11°24.1	10°51.2	2.9 - 2.2	8.9 - 6.7	14.9 - 11.3
30	11°22.5	11°24.4	10°51.4	3.0 - 2.3	9.0 - 6.8	15.0 - 11.4
31	11°22.7	11°24.6	10°51.6	3.1 - 2.4	9.1 - 6.9	15.1 - 11.5
32	11°23.0	11°24.9	10°51.9	3.2 - 2.4	9.2 - 7.0	15.2 - 11.5
33	11°23.2	11°25.1	10°52.1	3.3 - 2.5	9.3 - 7.1	15.3 - 11.6
34	11°23.5	11°25.4	10°52.4	3.4 - 2.6	9.4 - 7.1	15.4 - 11.7
35	11°23.8	11°25.6	10°52.6	3.5 - 2.7	9.5 - 7.2	15.5 - 11.8
36	11°24.0	11°25.9	10°52.8	3.6 - 2.7	9.6 - 7.3	15.6 - 11.8
37	11°24.3	11°26.1	10°53.1	3.7 - 2.8	9.7 - 7.4	15.7 - 11.9
38	11°24.5	11°26.4	10°53.3	3.8 - 2.9	9.8 - 7.4	15.8 - 12.0
39	11°24.7	11°26.6	10°53.6	3.9 - 3.0	9.9 - 7.5	15.9 - 12.1
40	11°25.0	11°26.9	10°53.8	4.0 - 3.0	10.0 - 7.6	16.0 - 12.1
41	11°25.2	11°27.1	10°54.0	4.1 - 3.1	10.1 - 7.7	16.1 - 12.2
42	11°25.5	11°27.4	10°54.3	4.2 - 3.2	10.2 - 7.7	16.2 - 12.3
43	11°25.8	11°27.6	10°54.5	4.3 - 3.3	10.3 - 7.8	16.3 - 12.4
44	11°26.0	11°27.9	10°54.7	4.4 - 3.3	10.4 - 7.9	16.4 - 12.4
45	11°26.3	11°28.1	10°55.0	4.5 - 3.4	10.5 - 8.0	16.5 - 12.5
46	11°26.5	11°28.4	10°55.2	4.6 - 3.5	10.6 - 8.0	16.6 - 12.6
47	11°26.7	11°28.6	10°55.5	4.7 - 3.6	10.7 - 8.1	16.7 - 12.7
48	11°27.0	11°28.9	10°55.7	4.8 - 3.6	10.8 - 8.2	16.8 - 12.7
49	11°27.3	11°29.1	10°55.9	4.9 - 3.7	10.9 - 8.3	16.9 - 12.8
50	11°27.5	11°29.4	10°56.2	5.0 - 3.8	11.0 - 8.3	17.0 - 12.9
51	11°27.8	11°29.6	10°56.4	5.1 - 3.9	11.1 - 8.4	17.1 - 13.0
52	11°28.0	11°29.9	10°56.7	5.2 - 3.9	11.2 - 8.5	17.2 - 13.0
53	11°28.2	11°30.1	10°56.9	5.3 - 4.0	11.3 - 8.6	17.3 - 13.1
54	11°28.5	11°30.4	10°57.1	5.4 - 4.1	11.4 - 8.6	17.4 - 13.2
55	11°28.7	11°30.6	10°57.4	5.5 - 4.2	11.5 - 8.7	17.5 - 13.3
56	11°29.0	11°30.9	10°57.6	5.6 - 4.2	11.6 - 8.8	17.6 - 13.3
57	11°29.3	11°31.1	10°57.9	5.7 - 4.3	11.7 - 8.9	17.7 - 13.4
58	11°29.5	11°31.4	10°58.1	5.8 - 4.4	11.8 - 8.9	17.8 - 13.5
59	11°29.8	11°31.6	10°58.3	5.9 - 4.5	11.9 - 9.0	17.9 - 13.6

m 46	Sun Plan.	Aries	Moon	v and d corr		
0	11°30.0	11°31.9	10°58.6	0.0 - 0.0	6.0 - 4.7	12.0 - 9.3
1	11°30.2	11°32.1	10°58.8	0.1 - 0.1	6.1 - 4.7	12.1 - 9.4
2	11°30.5	11°32.4	10°59.0	0.2 - 0.2	6.2 - 4.8	12.2 - 9.5
3	11°30.7	11°32.6	10°59.3	0.3 - 0.2	6.3 - 4.9	12.3 - 9.5
4	11°31.0	11°32.9	10°59.5	0.4 - 0.3	6.4 - 5.0	12.4 - 9.6
5	11°31.3	11°33.1	10°59.8	0.5 - 0.4	6.5 - 5.0	12.5 - 9.7
6	11°31.5	11°33.4	11°00.0	0.6 - 0.5	6.6 - 5.1	12.6 - 9.8
7	11°31.8	11°33.6	11°00.2	0.7 - 0.5	6.7 - 5.2	12.7 - 9.8
8	11°32.0	11°33.9	11°00.5	0.8 - 0.6	6.8 - 5.3	12.8 - 9.9
9	11°32.2	11°34.1	11°00.7	0.9 - 0.7	6.9 - 5.3	12.9 - 10.0
10	11°32.5	11°34.4	11°01.0	1.0 - 0.8	7.0 - 5.4	13.0 - 10.1
11	11°32.7	11°34.6	11°01.2	1.1 - 0.9	7.1 - 5.5	13.1 - 10.2
12	11°33.0	11°34.9	11°01.4	1.2 - 0.9	7.2 - 5.6	13.2 - 10.2
13	11°33.3	11°35.1	11°01.7	1.3 - 1.0	7.3 - 5.7	13.3 - 10.3
14	11°33.5	11°35.4	11°01.9	1.4 - 1.1	7.4 - 5.7	13.4 - 10.4
15	11°33.8	11°35.6	11°02.1	1.5 - 1.2	7.5 - 5.8	13.5 - 10.5
16	11°34.0	11°35.9	11°02.4	1.6 - 1.2	7.6 - 5.9	13.6 - 10.5
17	11°34.2	11°36.1	11°02.6	1.7 - 1.3	7.7 - 6.0	13.7 - 10.6
18	11°34.5	11°36.4	11°02.9	1.8 - 1.4	7.8 - 6.0	13.8 - 10.7
19	11°34.8	11°36.6	11°03.1	1.9 - 1.5	7.9 - 6.1	13.9 - 10.8
20	11°35.0	11°36.9	11°03.3	2.0 - 1.6	8.0 - 6.2	14.0 - 10.8
21	11°35.3	11°37.2	11°03.6	2.1 - 1.6	8.1 - 6.3	14.1 - 10.9
22	11°35.5	11°37.4	11°03.8	2.2 - 1.7	8.2 - 6.4	14.2 - 11.0
23	11°35.7	11°37.7	11°04.1	2.3 - 1.8	8.3 - 6.4	14.3 - 11.1
24	11°36.0	11°37.9	11°04.3	2.4 - 1.9	8.4 - 6.5	14.4 - 11.2
25	11°36.2	11°38.2	11°04.5	2.5 - 1.9	8.5 - 6.6	14.5 - 11.2
26	11°36.5	11°38.4	11°04.8	2.6 - 2.0	8.6 - 6.7	14.6 - 11.3
27	11°36.8	11°38.7	11°05.0	2.7 - 2.1	8.7 - 6.7	14.7 - 11.4
28	11°37.0	11°38.9	11°05.2	2.8 - 2.2	8.8 - 6.8	14.8 - 11.5
29	11°37.3	11°39.2	11°05.5	2.9 - 2.2	8.9 - 6.9	14.9 - 11.5
30	11°37.5	11°39.4	11°05.7	3.0 - 2.3	9.0 - 7.0	15.0 - 11.6
31	11°37.7	11°39.7	11°06.0	3.1 - 2.4	9.1 - 7.1	15.1 - 11.7
32	11°38.0	11°39.9	11°06.2	3.2 - 2.5	9.2 - 7.1	15.2 - 11.8
33	11°38.2	11°40.2	11°06.4	3.3 - 2.6	9.3 - 7.2	15.3 - 11.9
34	11°38.5	11°40.4	11°06.7	3.4 - 2.6	9.4 - 7.3	15.4 - 11.9
35	11°38.8	11°40.7	11°06.9	3.5 - 2.7	9.5 - 7.4	15.5 - 12.0
36	11°39.0	11°40.9	11°07.2	3.6 - 2.8	9.6 - 7.4	15.6 - 12.1
37	11°39.3	11°41.2	11°07.4	3.7 - 2.9	9.7 - 7.5	15.7 - 12.2
38	11°39.5	11°41.4	11°07.6	3.8 - 2.9	9.8 - 7.6	15.8 - 12.2
39	11°39.7	11°41.7	11°07.9	3.9 - 3.0	9.9 - 7.7	15.9 - 12.3
40	11°40.0	11°41.9	11°08.1	4.0 - 3.1	10.0 - 7.8	16.0 - 12.4
41	11°40.2	11°42.2	11°08.3	4.1 - 3.2	10.1 - 7.8	16.1 - 12.5
42	11°40.5	11°42.4	11°08.6	4.2 - 3.3	10.2 - 7.9	16.2 - 12.6
43	11°40.8	11°42.7	11°08.8	4.3 - 3.3	10.3 - 8.0	16.3 - 12.6
44	11°41.0	11°42.9	11°09.1	4.4 - 3.4	10.4 - 8.1	16.4 - 12.7
45	11°41.3	11°43.2	11°09.3	4.5 - 3.5	10.5 - 8.1	16.5 - 12.8
46	11°41.5	11°43.4	11°09.5	4.6 - 3.6	10.6 - 8.2	16.6 - 12.9
47	11°41.7	11°43.7	11°09.8	4.7 - 3.6	10.7 - 8.3	16.7 - 12.9
48	11°42.0	11°43.9	11°10.0	4.8 - 3.7	10.8 - 8.4	16.8 - 13.0
49	11°42.3	11°44.2	11°10.3	4.9 - 3.8	10.9 - 8.4	16.9 - 13.1
50	11°42.5	11°44.4	11°10.5	5.0 - 3.9	11.0 - 8.5	17.0 - 13.2
51	11°42.8	11°44.7	11°10.7	5.1 - 4.0	11.1 - 8.6	17.1 - 13.3
52	11°43.0	11°44.9	11°11.0	5.2 - 4.0	11.2 - 8.7	17.2 - 13.3
53	11°43.2	11°45.2	11°11.2	5.3 - 4.1	11.3 - 8.8	17.3 - 13.4
54	11°43.5	11°45.4	11°11.5	5.4 - 4.2	11.4 - 8.8	17.4 - 13.5
55	11°43.7	11°45.7	11°11.7	5.5 - 4.3	11.5 - 8.9	17.5 - 13.6
56	11°44.0	11°45.9	11°11.9	5.6 - 4.3	11.6 - 9.0	17.6 - 13.6
57	11°44.3	11°46.2	11°12.2	5.7 - 4.4	11.7 - 9.1	17.7 - 13.7
58	11°44.5	11°46.4	11°12.4	5.8 - 4.5	11.8 - 9.1	17.8 - 13.8
59	11°44.8	11°46.7	11°12.6	5.9 - 4.6	11.9 - 9.2	17.9 - 13.9

m 47	Sun Plan.	Aries	Moon	v and d corr		
0	11°45.0	11°46.9	11°12.9	0.0 - 0.0	6.0 - 4.8	12.0 - 9.5
1	11°45.2	11°47.2	11°13.1	0.1 - 0.1	6.1 - 4.8	12.1 - 9.6
2	11°45.5	11°47.4	11°13.4	0.2 - 0.2	6.2 - 4.9	12.2 - 9.7
3	11°45.7	11°47.7	11°13.6	0.3 - 0.2	6.3 - 5.0	12.3 - 9.7
4	11°46.0	11°47.9	11°13.8	0.4 - 0.3	6.4 - 5.1	12.4 - 9.8
5	11°46.3	11°48.2	11°14.1	0.5 - 0.4	6.5 - 5.1	12.5 - 9.9
6	11°46.5	11°48.4	11°14.3	0.6 - 0.5	6.6 - 5.2	12.6 - 10.0
7	11°46.8	11°48.7	11°14.6	0.7 - 0.6	6.7 - 5.3	12.7 - 10.1
8	11°47.0	11°48.9	11°14.8	0.8 - 0.6	6.8 - 5.4	12.8 - 10.1
9	11°47.2	11°49.2	11°15.0	0.9 - 0.7	6.9 - 5.5	12.9 - 10.2
10	11°47.5	11°49.4	11°15.3	1.0 - 0.8	7.0 - 5.5	13.0 - 10.3
11	11°47.7	11°49.7	11°15.5	1.1 - 0.9	7.1 - 5.6	13.1 - 10.4
12	11°48.0	11°49.9	11°15.7	1.2 - 1.0	7.2 - 5.7	13.2 - 10.4
13	11°48.3	11°50.2	11°16.0	1.3 - 1.0	7.3 - 5.8	13.3 - 10.5
14	11°48.5	11°50.4	11°16.2	1.4 - 1.1	7.4 - 5.9	13.4 - 10.6
15	11°48.8	11°50.7	11°16.5	1.5 - 1.2	7.5 - 5.9	13.5 - 10.7
16	11°49.0	11°50.9	11°16.7	1.6 - 1.3	7.6 - 6.0	13.6 - 10.8
17	11°49.2	11°51.2	11°16.9	1.7 - 1.3	7.7 - 6.1	13.7 - 10.8
18	11°49.5	11°51.4	11°17.2	1.8 - 1.4	7.8 - 6.2	13.8 - 10.9
19	11°49.8	11°51.7	11°17.4	1.9 - 1.5	7.9 - 6.3	13.9 - 11.0
20	11°50.0	11°51.9	11°17.7	2.0 - 1.6	8.0 - 6.3	14.0 - 11.1
21	11°50.3	11°52.2	11°17.9	2.1 - 1.7	8.1 - 6.4	14.1 - 11.2
22	11°50.5	11°52.4	11°18.1	2.2 - 1.7	8.2 - 6.5	14.2 - 11.2
23	11°50.7	11°52.7	11°18.4	2.3 - 1.8	8.3 - 6.6	14.3 - 11.3
24	11°51.0	11°52.9	11°18.6	2.4 - 1.9	8.4 - 6.7	14.4 - 11.4
25	11°51.2	11°53.2	11°18.8	2.5 - 2.0	8.5 - 6.7	14.5 - 11.5
26	11°51.5	11°53.4	11°19.1	2.6 - 2.1	8.6 - 6.8	14.6 - 11.6
27	11°51.8	11°53.7	11°19.3	2.7 - 2.1	8.7 - 6.9	14.7 - 11.6
28	11°52.0	11°53.9	11°19.6	2.8 - 2.2	8.8 - 7.0	14.8 - 11.7
29	11°52.3	11°54.2	11°19.8	2.9 - 2.3	8.9 - 7.0	14.9 - 11.8
30	11°52.5	11°54.4	11°20.0	3.0 - 2.4	9.0 - 7.1	15.0 - 11.9
31	11°52.7	11°54.7	11°20.3	3.1 - 2.5	9.1 - 7.2	15.1 - 12.0
32	11°53.0	11°54.9	11°20.5	3.2 - 2.5	9.2 - 7.3	15.2 - 12.0
33	11°53.2	11°55.2	11°20.8	3.3 - 2.6	9.3 - 7.4	15.3 - 12.1
34	11°53.5	11°55.5	11°21.0	3.4 - 2.7	9.4 - 7.4	15.4 - 12.2
35	11°53.8	11°55.7	11°21.2	3.5 - 2.8	9.5 - 7.5	15.5 - 12.3
36	11°54.0	11°56.0	11°21.5	3.6 - 2.9	9.6 - 7.6	15.6 - 12.3
37	11°54.3	11°56.2	11°21.7	3.7 - 2.9	9.7 - 7.7	15.7 - 12.4
38	11°54.5	11°56.5	11°22.0	3.8 - 3.0	9.8 - 7.8	15.8 - 12.5
39	11°54.7	11°56.7	11°22.2	3.9 - 3.1	9.9 - 7.8	15.9 - 12.6
40	11°55.0	11°57.0	11°22.4	4.0 - 3.2	10.0 - 7.9	16.0 - 12.7
41	11°55.2	11°57.2	11°22.7	4.1 - 3.2	10.1 - 8.0	16.1 - 12.7
42	11°55.5	11°57.5	11°22.9	4.2 - 3.3	10.2 - 8.1	16.2 - 12.8
43	11°55.8	11°57.7	11°23.1	4.3 - 3.4	10.3 - 8.2	16.3 - 12.9
44	11°56.0	11°58.0	11°23.4	4.4 - 3.5	10.4 - 8.2	16.4 - 13.0
45	11°56.3	11°58.2	11°23.6	4.5 - 3.6	10.5 - 8.3	16.5 - 13.1
46	11°56.5	11°58.5	11°23.9	4.6 - 3.6	10.6 - 8.4	16.6 - 13.1
47	11°56.7	11°58.7	11°24.1	4.7 - 3.7	10.7 - 8.5	16.7 - 13.2
48	11°57.0	11°59.0	11°24.3	4.8 - 3.8	10.8 - 8.6	16.8 - 13.3
49	11°57.3	11°59.2	11°24.6	4.9 - 3.9	10.9 - 8.6	16.9 - 13.4
50	11°57.5	11°59.5	11°24.8	5.0 - 4.0	11.0 - 8.7	17.0 - 13.5
51	11°57.8	11°59.7	11°25.1	5.1 - 4.0	11.1 - 8.8	17.1 - 13.5
52	11°58.0	12°00.0	11°25.3	5.2 - 4.1	11.2 - 8.9	17.2 - 13.6
53	11°58.2	12°00.2	11°25.5	5.3 - 4.2	11.3 - 8.9	17.3 - 13.7
54	11°58.5	12°00.5	11°25.8	5.4 - 4.3	11.4 - 9.0	17.4 - 13.8
55	11°58.7	12°00.7	11°26.0	5.5 - 4.4	11.5 - 9.1	17.5 - 13.9
56	11°59.0	12°01.0	11°26.2	5.6 - 4.4	11.6 - 9.2	17.6 - 13.9
57	11°59.3	12°01.2	11°26.5	5.7 - 4.5	11.7 - 9.3	17.7 - 14.0
58	11°59.5	12°01.5	11°26.7	5.8 - 4.6	11.8 - 9.3	17.8 - 14.1
59	11°59.8	12°01.7	11°27.0	5.9 - 4.7	11.9 - 9.4	17.9 - 14.2

Increments and Corrections

m 48	Sun Plan.	Aries	Moon	v and d corr		
0	12°00.0	12°02.0	11°27.2	0.0 - 0.0	6.0 - 4.8	12.0 - 9.7
1	12°00.2	12°02.2	11°27.4	0.1 - 0.1	6.1 - 4.9	12.1 - 9.8
2	12°00.5	12°02.5	11°27.7	0.2 - 0.2	6.2 - 5.0	12.2 - 9.9
3	12°00.7	12°02.7	11°27.9	0.3 - 0.2	6.3 - 5.1	12.3 - 9.9
4	12°01.0	12°03.0	11°28.2	0.4 - 0.3	6.4 - 5.2	12.4 - 10.0
5	12°01.3	12°03.2	11°28.4	0.5 - 0.4	6.5 - 5.3	12.5 - 10.1
6	12°01.5	12°03.5	11°28.6	0.6 - 0.5	6.6 - 5.3	12.6 - 10.2
7	12°01.8	12°03.7	11°28.9	0.7 - 0.6	6.7 - 5.4	12.7 - 10.3
8	12°02.0	12°04.0	11°29.1	0.8 - 0.6	6.8 - 5.5	12.8 - 10.3
9	12°02.2	12°04.2	11°29.3	0.9 - 0.7	6.9 - 5.6	12.9 - 10.4
10	12°02.5	12°04.5	11°29.6	1.0 - 0.8	7.0 - 5.7	13.0 - 10.5
11	12°02.7	12°04.7	11°29.8	1.1 - 0.9	7.1 - 5.7	13.1 - 10.6
12	12°03.0	12°05.0	11°30.1	1.2 - 1.0	7.2 - 5.8	13.2 - 10.7
13	12°03.3	12°05.2	11°30.3	1.3 - 1.1	7.3 - 5.9	13.3 - 10.8
14	12°03.5	12°05.5	11°30.5	1.4 - 1.1	7.4 - 6.0	13.4 - 10.8
15	12°03.8	12°05.7	11°30.8	1.5 - 1.2	7.5 - 6.1	13.5 - 10.9
16	12°04.0	12°06.0	11°31.0	1.6 - 1.3	7.6 - 6.1	13.6 - 11.0
17	12°04.2	12°06.2	11°31.3	1.7 - 1.4	7.7 - 6.2	13.7 - 11.1
18	12°04.5	12°06.5	11°31.5	1.8 - 1.5	7.8 - 6.3	13.8 - 11.2
19	12°04.8	12°06.7	11°31.7	1.9 - 1.5	7.9 - 6.4	13.9 - 11.2
20	12°05.0	12°07.0	11°32.0	2.0 - 1.6	8.0 - 6.5	14.0 - 11.3
21	12°05.3	12°07.2	11°32.2	2.1 - 1.7	8.1 - 6.5	14.1 - 11.4
22	12°05.5	12°07.5	11°32.4	2.2 - 1.8	8.2 - 6.6	14.2 - 11.5
23	12°05.7	12°07.7	11°32.7	2.3 - 1.9	8.3 - 6.7	14.3 - 11.6
24	12°06.0	12°08.0	11°32.9	2.4 - 1.9	8.4 - 6.8	14.4 - 11.6
25	12°06.2	12°08.2	11°33.2	2.5 - 2.0	8.5 - 6.9	14.5 - 11.7
26	12°06.5	12°08.5	11°33.4	2.6 - 2.1	8.6 - 7.0	14.6 - 11.8
27	12°06.8	12°08.7	11°33.6	2.7 - 2.2	8.7 - 7.0	14.7 - 11.9
28	12°07.0	12°09.0	11°33.9	2.8 - 2.3	8.8 - 7.1	14.8 - 12.0
29	12°07.3	12°09.2	11°34.1	2.9 - 2.3	8.9 - 7.2	14.9 - 12.0
30	12°07.5	12°09.5	11°34.4	3.0 - 2.4	9.0 - 7.3	15.0 - 12.1
31	12°07.7	12°09.7	11°34.6	3.1 - 2.5	9.1 - 7.4	15.1 - 12.2
32	12°08.0	12°10.0	11°34.8	3.2 - 2.6	9.2 - 7.4	15.2 - 12.3
33	12°08.2	12°10.2	11°35.1	3.3 - 2.7	9.3 - 7.5	15.3 - 12.4
34	12°08.5	12°10.5	11°35.3	3.4 - 2.7	9.4 - 7.6	15.4 - 12.4
35	12°08.8	12°10.7	11°35.6	3.5 - 2.8	9.5 - 7.7	15.5 - 12.5
36	12°09.0	12°11.0	11°35.8	3.6 - 2.9	9.6 - 7.8	15.6 - 12.6
37	12°09.3	12°11.2	11°36.0	3.7 - 3.0	9.7 - 7.8	15.7 - 12.7
38	12°09.5	12°11.5	11°36.3	3.8 - 3.1	9.8 - 7.9	15.8 - 12.8
39	12°09.7	12°11.7	11°36.5	3.9 - 3.2	9.9 - 8.0	15.9 - 12.9
40	12°10.0	12°12.0	11°36.7	4.0 - 3.2	10.0 - 8.1	16.0 - 12.9
41	12°10.2	12°12.2	11°37.0	4.1 - 3.3	10.1 - 8.2	16.1 - 13.0
42	12°10.5	12°12.5	11°37.2	4.2 - 3.4	10.2 - 8.2	16.2 - 13.1
43	12°10.8	12°12.7	11°37.5	4.3 - 3.5	10.3 - 8.3	16.3 - 13.2
44	12°11.0	12°13.0	11°37.7	4.4 - 3.6	10.4 - 8.4	16.4 - 13.3
45	12°11.3	12°13.2	11°37.9	4.5 - 3.6	10.5 - 8.5	16.5 - 13.3
46	12°11.5	12°13.5	11°38.2	4.6 - 3.7	10.6 - 8.6	16.6 - 13.4
47	12°11.7	12°13.8	11°38.4	4.7 - 3.8	10.7 - 8.6	16.7 - 13.5
48	12°12.0	12°14.0	11°38.7	4.8 - 3.9	10.8 - 8.7	16.8 - 13.6
49	12°12.3	12°14.3	11°38.9	4.9 - 4.0	10.9 - 8.8	16.9 - 13.7
50	12°12.5	12°14.5	11°39.1	5.0 - 4.0	11.0 - 8.9	17.0 - 13.7
51	12°12.8	12°14.8	11°39.4	5.1 - 4.1	11.1 - 9.0	17.1 - 13.8
52	12°13.0	12°15.0	11°39.6	5.2 - 4.2	11.2 - 9.1	17.2 - 13.9
53	12°13.2	12°15.3	11°39.8	5.3 - 4.3	11.3 - 9.1	17.3 - 14.0
54	12°13.5	12°15.5	11°40.1	5.4 - 4.4	11.4 - 9.2	17.4 - 14.1
55	12°13.7	12°15.8	11°40.3	5.5 - 4.4	11.5 - 9.3	17.5 - 14.1
56	12°14.0	12°16.0	11°40.6	5.6 - 4.5	11.6 - 9.4	17.6 - 14.2
57	12°14.3	12°16.3	11°40.8	5.7 - 4.6	11.7 - 9.5	17.7 - 14.3
58	12°14.5	12°16.5	11°41.0	5.8 - 4.7	11.8 - 9.5	17.8 - 14.4
59	12°14.8	12°16.8	11°41.3	5.9 - 4.8	11.9 - 9.6	17.9 - 14.5

m 49	Sun Plan.	Aries	Moon	v and d corr		
0	12°15.0	12°17.0	11°41.5	0.0 - 0.0	6.0 - 4.9	12.0 - 9.9
1	12°15.2	12°17.3	11°41.8	0.1 - 0.1	6.1 - 5.0	12.1 - 10.0
2	12°15.5	12°17.5	11°42.0	0.2 - 0.2	6.2 - 5.1	12.2 - 10.1
3	12°15.7	12°17.8	11°42.2	0.3 - 0.2	6.3 - 5.2	12.3 - 10.1
4	12°16.0	12°18.0	11°42.5	0.4 - 0.3	6.4 - 5.3	12.4 - 10.2
5	12°16.3	12°18.3	11°42.7	0.5 - 0.4	6.5 - 5.4	12.5 - 10.3
6	12°16.5	12°18.5	11°42.9	0.6 - 0.5	6.6 - 5.4	12.6 - 10.4
7	12°16.8	12°18.8	11°43.2	0.7 - 0.6	6.7 - 5.5	12.7 - 10.5
8	12°17.0	12°19.0	11°43.4	0.8 - 0.7	6.8 - 5.6	12.8 - 10.6
9	12°17.2	12°19.3	11°43.7	0.9 - 0.7	6.9 - 5.7	12.9 - 10.6
10	12°17.5	12°19.5	11°43.9	1.0 - 0.8	7.0 - 5.8	13.0 - 10.7
11	12°17.7	12°19.8	11°44.1	1.1 - 0.9	7.1 - 5.9	13.1 - 10.8
12	12°18.0	12°20.0	11°44.4	1.2 - 1.0	7.2 - 5.9	13.2 - 10.9
13	12°18.3	12°20.3	11°44.6	1.3 - 1.1	7.3 - 6.0	13.3 - 11.0
14	12°18.5	12°20.5	11°44.9	1.4 - 1.2	7.4 - 6.1	13.4 - 11.1
15	12°18.8	12°20.8	11°45.1	1.5 - 1.2	7.5 - 6.2	13.5 - 11.1
16	12°19.0	12°21.0	11°45.3	1.6 - 1.3	7.6 - 6.3	13.6 - 11.2
17	12°19.2	12°21.3	11°45.6	1.7 - 1.4	7.7 - 6.4	13.7 - 11.3
18	12°19.5	12°21.5	11°45.8	1.8 - 1.5	7.8 - 6.4	13.8 - 11.4
19	12°19.8	12°21.8	11°46.1	1.9 - 1.6	7.9 - 6.5	13.9 - 11.5
20	12°20.0	12°22.0	11°46.3	2.0 - 1.6	8.0 - 6.6	14.0 - 11.5
21	12°20.3	12°22.3	11°46.5	2.1 - 1.7	8.1 - 6.7	14.1 - 11.6
22	12°20.5	12°22.5	11°46.8	2.2 - 1.8	8.2 - 6.8	14.2 - 11.7
23	12°20.7	12°22.8	11°47.0	2.3 - 1.9	8.3 - 6.8	14.3 - 11.8
24	12°21.0	12°23.0	11°47.2	2.4 - 2.0	8.4 - 6.9	14.4 - 11.9
25	12°21.2	12°23.3	11°47.5	2.5 - 2.1	8.5 - 7.0	14.5 - 12.0
26	12°21.5	12°23.5	11°47.7	2.6 - 2.1	8.6 - 7.1	14.6 - 12.0
27	12°21.8	12°23.8	11°48.0	2.7 - 2.2	8.7 - 7.2	14.7 - 12.1
28	12°22.0	12°24.0	11°48.2	2.8 - 2.3	8.8 - 7.3	14.8 - 12.2
29	12°22.3	12°24.3	11°48.4	2.9 - 2.4	8.9 - 7.3	14.9 - 12.3
30	12°22.5	12°24.5	11°48.7	3.0 - 2.5	9.0 - 7.4	15.0 - 12.4
31	12°22.7	12°24.8	11°48.9	3.1 - 2.6	9.1 - 7.5	15.1 - 12.5
32	12°23.0	12°25.0	11°49.2	3.2 - 2.6	9.2 - 7.6	15.2 - 12.5
33	12°23.2	12°25.3	11°49.4	3.3 - 2.7	9.3 - 7.7	15.3 - 12.6
34	12°23.5	12°25.5	11°49.6	3.4 - 2.8	9.4 - 7.8	15.4 - 12.7
35	12°23.8	12°25.8	11°49.9	3.5 - 2.9	9.5 - 7.8	15.5 - 12.8
36	12°24.0	12°26.0	11°50.1	3.6 - 3.0	9.6 - 7.9	15.6 - 12.9
37	12°24.3	12°26.3	11°50.3	3.7 - 3.1	9.7 - 8.0	15.7 - 13.0
38	12°24.5	12°26.5	11°50.6	3.8 - 3.1	9.8 - 8.1	15.8 - 13.0
39	12°24.7	12°26.8	11°50.8	3.9 - 3.2	9.9 - 8.2	15.9 - 13.1
40	12°25.0	12°27.0	11°51.1	4.0 - 3.3	10.0 - 8.3	16.0 - 13.2
41	12°25.2	12°27.3	11°51.3	4.1 - 3.4	10.1 - 8.3	16.1 - 13.3
42	12°25.5	12°27.5	11°51.5	4.2 - 3.5	10.2 - 8.4	16.2 - 13.4
43	12°25.8	12°27.8	11°51.8	4.3 - 3.5	10.3 - 8.5	16.3 - 13.4
44	12°26.0	12°28.0	11°52.0	4.4 - 3.6	10.4 - 8.6	16.4 - 13.5
45	12°26.3	12°28.3	11°52.3	4.5 - 3.7	10.5 - 8.7	16.5 - 13.6
46	12°26.5	12°28.5	11°52.5	4.6 - 3.8	10.6 - 8.7	16.6 - 13.7
47	12°26.7	12°28.8	11°52.7	4.7 - 3.9	10.7 - 8.8	16.7 - 13.8
48	12°27.0	12°29.0	11°53.0	4.8 - 4.0	10.8 - 8.9	16.8 - 13.9
49	12°27.3	12°29.3	11°53.2	4.9 - 4.0	10.9 - 9.0	16.9 - 13.9
50	12°27.5	12°29.5	11°53.4	5.0 - 4.1	11.0 - 9.1	17.0 - 14.0
51	12°27.8	12°29.8	11°53.7	5.1 - 4.2	11.1 - 9.2	17.1 - 14.1
52	12°28.0	12°30.0	11°53.9	5.2 - 4.3	11.2 - 9.2	17.2 - 14.2
53	12°28.2	12°30.3	11°54.2	5.3 - 4.4	11.3 - 9.3	17.3 - 14.3
54	12°28.5	12°30.5	11°54.4	5.4 - 4.5	11.4 - 9.4	17.4 - 14.4
55	12°28.7	12°30.8	11°54.6	5.5 - 4.5	11.5 - 9.5	17.5 - 14.4
56	12°29.0	12°31.0	11°54.9	5.6 - 4.6	11.6 - 9.6	17.6 - 14.5
57	12°29.3	12°31.3	11°55.1	5.7 - 4.7	11.7 - 9.7	17.7 - 14.6
58	12°29.5	12°31.5	11°55.4	5.8 - 4.8	11.8 - 9.7	17.8 - 14.7
59	12°29.8	12°31.8	11°55.6	5.9 - 4.9	11.9 - 9.8	17.9 - 14.8

m 50	Sun Plan.	Aries	Moon	v and d corr		
0	12°30.0	12°32.1	11°55.8	0.0 - 0.0	6.0 - 5.0	12.0 - 10.1
1	12°30.2	12°32.3	11°56.1	0.1 - 0.1	6.1 - 5.1	12.1 - 10.2
2	12°30.5	12°32.6	11°56.3	0.2 - 0.2	6.2 - 5.2	12.2 - 10.3
3	12°30.7	12°32.8	11°56.5	0.3 - 0.3	6.3 - 5.3	12.3 - 10.4
4	12°31.0	12°33.1	11°56.8	0.4 - 0.3	6.4 - 5.4	12.4 - 10.4
5	12°31.3	12°33.3	11°57.0	0.5 - 0.4	6.5 - 5.5	12.5 - 10.5
6	12°31.5	12°33.6	11°57.3	0.6 - 0.5	6.6 - 5.6	12.6 - 10.6
7	12°31.8	12°33.8	11°57.5	0.7 - 0.6	6.7 - 5.6	12.7 - 10.7
8	12°32.0	12°34.1	11°57.7	0.8 - 0.7	6.8 - 5.7	12.8 - 10.8
9	12°32.2	12°34.3	11°58.0	0.9 - 0.8	6.9 - 5.8	12.9 - 10.9
10	12°32.5	12°34.6	11°58.2	1.0 - 0.8	7.0 - 5.9	13.0 - 10.9
11	12°32.7	12°34.8	11°58.5	1.1 - 0.9	7.1 - 6.0	13.1 - 11.0
12	12°33.0	12°35.1	11°58.7	1.2 - 1.0	7.2 - 6.1	13.2 - 11.1
13	12°33.3	12°35.3	11°58.9	1.3 - 1.1	7.3 - 6.1	13.3 - 11.2
14	12°33.5	12°35.6	11°59.2	1.4 - 1.2	7.4 - 6.2	13.4 - 11.3
15	12°33.8	12°35.8	11°59.4	1.5 - 1.3	7.5 - 6.3	13.5 - 11.4
16	12°34.0	12°36.1	11°59.7	1.6 - 1.3	7.6 - 6.4	13.6 - 11.4
17	12°34.2	12°36.3	11°59.9	1.7 - 1.4	7.7 - 6.5	13.7 - 11.5
18	12°34.5	12°36.6	12°00.1	1.8 - 1.5	7.8 - 6.6	13.8 - 11.6
19	12°34.8	12°36.8	12°00.4	1.9 - 1.6	7.9 - 6.6	13.9 - 11.7
20	12°35.0	12°37.1	12°00.6	2.0 - 1.7	8.0 - 6.7	14.0 - 11.8
21	12°35.3	12°37.3	12°00.8	2.1 - 1.8	8.1 - 6.8	14.1 - 11.9
22	12°35.5	12°37.6	12°01.1	2.2 - 1.9	8.2 - 6.9	14.2 - 12.0
23	12°35.7	12°37.8	12°01.3	2.3 - 1.9	8.3 - 7.0	14.3 - 12.0
24	12°36.0	12°38.1	12°01.6	2.4 - 2.0	8.4 - 7.1	14.4 - 12.1
25	12°36.2	12°38.3	12°01.8	2.5 - 2.1	8.5 - 7.2	14.5 - 12.2
26	12°36.5	12°38.6	12°02.0	2.6 - 2.2	8.6 - 7.2	14.6 - 12.3
27	12°36.8	12°38.8	12°02.3	2.7 - 2.3	8.7 - 7.3	14.7 - 12.4
28	12°37.0	12°39.1	12°02.5	2.8 - 2.4	8.8 - 7.4	14.8 - 12.5
29	12°37.3	12°39.3	12°02.8	2.9 - 2.4	8.9 - 7.5	14.9 - 12.5
30	12°37.5	12°39.6	12°03.0	3.0 - 2.5	9.0 - 7.6	15.0 - 12.6
31	12°37.7	12°39.8	12°03.2	3.1 - 2.6	9.1 - 7.7	15.1 - 12.7
32	12°38.0	12°40.1	12°03.5	3.2 - 2.7	9.2 - 7.7	15.2 - 12.8
33	12°38.2	12°40.3	12°03.7	3.3 - 2.8	9.3 - 7.8	15.3 - 12.9
34	12°38.5	12°40.6	12°03.9	3.4 - 2.9	9.4 - 7.9	15.4 - 13.0
35	12°38.8	12°40.8	12°04.2	3.5 - 2.9	9.5 - 8.0	15.5 - 13.0
36	12°39.0	12°41.1	12°04.4	3.6 - 3.0	9.6 - 8.1	15.6 - 13.1
37	12°39.3	12°41.3	12°04.7	3.7 - 3.1	9.7 - 8.2	15.7 - 13.2
38	12°39.5	12°41.6	12°04.9	3.8 - 3.2	9.8 - 8.2	15.8 - 13.3
39	12°39.7	12°41.8	12°05.1	3.9 - 3.3	9.9 - 8.3	15.9 - 13.4
40	12°40.0	12°42.1	12°05.4	4.0 - 3.4	10.0 - 8.4	16.0 - 13.5
41	12°40.2	12°42.3	12°05.6	4.1 - 3.5	10.1 - 8.5	16.1 - 13.6
42	12°40.5	12°42.6	12°05.9	4.2 - 3.5	10.2 - 8.6	16.2 - 13.6
43	12°40.8	12°42.8	12°06.1	4.3 - 3.6	10.3 - 8.7	16.3 - 13.7
44	12°41.0	12°43.1	12°06.3	4.4 - 3.7	10.4 - 8.8	16.4 - 13.8
45	12°41.3	12°43.3	12°06.6	4.5 - 3.8	10.5 - 8.8	16.5 - 13.9
46	12°41.5	12°43.6	12°06.8	4.6 - 3.9	10.6 - 8.9	16.6 - 14.0
47	12°41.7	12°43.8	12°07.0	4.7 - 4.0	10.7 - 9.0	16.7 - 14.1
48	12°42.0	12°44.1	12°07.3	4.8 - 4.0	10.8 - 9.1	16.8 - 14.1
49	12°42.3	12°44.3	12°07.5	4.9 - 4.1	10.9 - 9.2	16.9 - 14.2
50	12°42.5	12°44.6	12°07.8	5.0 - 4.2	11.0 - 9.3	17.0 - 14.3
51	12°42.8	12°44.8	12°08.0	5.1 - 4.3	11.1 - 9.3	17.1 - 14.4
52	12°43.0	12°45.1	12°08.2	5.2 - 4.4	11.2 - 9.4	17.2 - 14.5
53	12°43.2	12°45.3	12°08.5	5.3 - 4.5	11.3 - 9.5	17.3 - 14.6
54	12°43.5	12°45.6	12°08.7	5.4 - 4.5	11.4 - 9.6	17.4 - 14.6
55	12°43.7	12°45.8	12°09.0	5.5 - 4.6	11.5 - 9.7	17.5 - 14.7
56	12°44.0	12°46.1	12°09.2	5.6 - 4.7	11.6 - 9.8	17.6 - 14.8
57	12°44.3	12°46.3	12°09.4	5.7 - 4.8	11.7 - 9.8	17.7 - 14.9
58	12°44.5	12°46.6	12°09.7	5.8 - 4.9	11.8 - 9.9	17.8 - 15.0
59	12°44.8	12°46.8	12°09.9	5.9 - 5.0	11.9 - 10.0	17.9 - 15.1

Increments and Corrections

m 51	Sun Plan.	Aries	Moon	v and d corr		
0	12°45.0	12°47.1	12°10.1	0.0 - 0.0	6.0 - 5.1	12.0 - 10.3
1	12°45.2	12°47.3	12°10.4	0.1 - 0.1	6.1 - 5.2	12.1 - 10.4
2	12°45.5	12°47.6	12°10.6	0.2 - 0.2	6.2 - 5.3	12.2 - 10.5
3	12°45.7	12°47.8	12°10.9	0.3 - 0.3	6.3 - 5.4	12.3 - 10.6
4	12°46.0	12°48.1	12°11.1	0.4 - 0.3	6.4 - 5.5	12.4 - 10.6
5	12°46.3	12°48.3	12°11.3	0.5 - 0.4	6.5 - 5.6	12.5 - 10.7
6	12°46.5	12°48.6	12°11.6	0.6 - 0.5	6.6 - 5.7	12.6 - 10.8
7	12°46.8	12°48.8	12°11.8	0.7 - 0.6	6.7 - 5.8	12.7 - 10.9
8	12°47.0	12°49.1	12°12.1	0.8 - 0.7	6.8 - 5.8	12.8 - 11.0
9	12°47.2	12°49.3	12°12.3	0.9 - 0.8	6.9 - 5.9	12.9 - 11.1
10	12°47.5	12°49.6	12°12.5	1.0 - 0.9	7.0 - 6.0	13.0 - 11.2
11	12°47.7	12°49.8	12°12.8	1.1 - 0.9	7.1 - 6.1	13.1 - 11.2
12	12°48.0	12°50.1	12°13.0	1.2 - 1.0	7.2 - 6.2	13.2 - 11.3
13	12°48.3	12°50.3	12°13.3	1.3 - 1.1	7.3 - 6.3	13.3 - 11.4
14	12°48.5	12°50.6	12°13.5	1.4 - 1.2	7.4 - 6.4	13.4 - 11.5
15	12°48.8	12°50.9	12°13.7	1.5 - 1.3	7.5 - 6.4	13.5 - 11.6
16	12°49.0	12°51.1	12°14.0	1.6 - 1.4	7.6 - 6.5	13.6 - 11.7
17	12°49.2	12°51.4	12°14.2	1.7 - 1.5	7.7 - 6.6	13.7 - 11.8
18	12°49.5	12°51.6	12°14.4	1.8 - 1.5	7.8 - 6.7	13.8 - 11.8
19	12°49.8	12°51.9	12°14.7	1.9 - 1.6	7.9 - 6.8	13.9 - 11.9
20	12°50.0	12°52.1	12°14.9	2.0 - 1.7	8.0 - 6.9	14.0 - 12.0
21	12°50.3	12°52.4	12°15.2	2.1 - 1.8	8.1 - 7.0	14.1 - 12.1
22	12°50.5	12°52.6	12°15.4	2.2 - 1.9	8.2 - 7.0	14.2 - 12.2
23	12°50.7	12°52.9	12°15.6	2.3 - 2.0	8.3 - 7.1	14.3 - 12.3
24	12°51.0	12°53.1	12°15.9	2.4 - 2.1	8.4 - 7.2	14.4 - 12.4
25	12°51.2	12°53.4	12°16.1	2.5 - 2.1	8.5 - 7.3	14.5 - 12.4
26	12°51.5	12°53.6	12°16.4	2.6 - 2.2	8.6 - 7.4	14.6 - 12.5
27	12°51.8	12°53.9	12°16.6	2.7 - 2.3	8.7 - 7.5	14.7 - 12.6
28	12°52.0	12°54.1	12°16.8	2.8 - 2.4	8.8 - 7.6	14.8 - 12.7
29	12°52.3	12°54.4	12°17.1	2.9 - 2.5	8.9 - 7.6	14.9 - 12.8
30	12°52.5	12°54.6	12°17.3	3.0 - 2.6	9.0 - 7.7	15.0 - 12.9
31	12°52.7	12°54.9	12°17.5	3.1 - 2.7	9.1 - 7.8	15.1 - 13.0
32	12°53.0	12°55.1	12°17.8	3.2 - 2.7	9.2 - 7.9	15.2 - 13.0
33	12°53.2	12°55.4	12°18.0	3.3 - 2.8	9.3 - 8.0	15.3 - 13.1
34	12°53.5	12°55.6	12°18.3	3.4 - 2.9	9.4 - 8.1	15.4 - 13.2
35	12°53.8	12°55.9	12°18.5	3.5 - 3.0	9.5 - 8.2	15.5 - 13.3
36	12°54.0	12°56.1	12°18.7	3.6 - 3.1	9.6 - 8.2	15.6 - 13.4
37	12°54.3	12°56.4	12°19.0	3.7 - 3.2	9.7 - 8.3	15.7 - 13.5
38	12°54.5	12°56.6	12°19.2	3.8 - 3.3	9.8 - 8.4	15.8 - 13.6
39	12°54.7	12°56.9	12°19.5	3.9 - 3.3	9.9 - 8.5	15.9 - 13.6
40	12°55.0	12°57.1	12°19.7	4.0 - 3.4	10.0 - 8.6	16.0 - 13.7
41	12°55.2	12°57.4	12°19.9	4.1 - 3.5	10.1 - 8.7	16.1 - 13.8
42	12°55.5	12°57.6	12°20.2	4.2 - 3.6	10.2 - 8.8	16.2 - 13.9
43	12°55.8	12°57.9	12°20.4	4.3 - 3.7	10.3 - 8.8	16.3 - 14.0
44	12°56.0	12°58.1	12°20.6	4.4 - 3.8	10.4 - 8.9	16.4 - 14.1
45	12°56.3	12°58.4	12°20.9	4.5 - 3.9	10.5 - 9.0	16.5 - 14.2
46	12°56.5	12°58.6	12°21.1	4.6 - 3.9	10.6 - 9.1	16.6 - 14.2
47	12°56.7	12°58.9	12°21.4	4.7 - 4.0	10.7 - 9.2	16.7 - 14.3
48	12°57.0	12°59.1	12°21.6	4.8 - 4.1	10.8 - 9.3	16.8 - 14.4
49	12°57.3	12°59.4	12°21.8	4.9 - 4.2	10.9 - 9.4	16.9 - 14.5
50	12°57.5	12°59.6	12°22.1	5.0 - 4.3	11.0 - 9.4	17.0 - 14.6
51	12°57.8	12°59.9	12°22.3	5.1 - 4.4	11.1 - 9.5	17.1 - 14.7
52	12°58.0	13°00.1	12°22.6	5.2 - 4.5	11.2 - 9.6	17.2 - 14.8
53	12°58.2	13°00.4	12°22.8	5.3 - 4.5	11.3 - 9.7	17.3 - 14.8
54	12°58.5	13°00.6	12°23.0	5.4 - 4.6	11.4 - 9.8	17.4 - 14.9
55	12°58.7	13°00.9	12°23.3	5.5 - 4.7	11.5 - 9.9	17.5 - 15.0
56	12°59.0	13°01.1	12°23.5	5.6 - 4.8	11.6 - 10.0	17.6 - 15.1
57	12°59.3	13°01.4	12°23.8	5.7 - 4.9	11.7 - 10.0	17.7 - 15.2
58	12°59.5	13°01.6	12°24.0	5.8 - 5.0	11.8 - 10.1	17.8 - 15.3
59	12°59.8	13°01.9	12°24.2	5.9 - 5.1	11.9 - 10.2	17.9 - 15.4

m 52	Sun Plan.	Aries	Moon	v and d corr		
0	13°00.0	13°02.1	12°24.5	0.0 - 0.0	6.0 - 5.3	12.0 - 10.5
1	13°00.2	13°02.4	12°24.7	0.1 - 0.1	6.1 - 5.3	12.1 - 10.6
2	13°00.5	13°02.6	12°24.9	0.2 - 0.2	6.2 - 5.4	12.2 - 10.7
3	13°00.7	13°02.9	12°25.2	0.3 - 0.3	6.3 - 5.5	12.3 - 10.8
4	13°01.0	13°03.1	12°25.4	0.4 - 0.4	6.4 - 5.6	12.4 - 10.8
5	13°01.3	13°03.4	12°25.7	0.5 - 0.4	6.5 - 5.7	12.5 - 10.9
6	13°01.5	13°03.6	12°25.9	0.6 - 0.5	6.6 - 5.8	12.6 - 11.0
7	13°01.8	13°03.9	12°26.1	0.7 - 0.6	6.7 - 5.9	12.7 - 11.1
8	13°02.0	13°04.1	12°26.4	0.8 - 0.7	6.8 - 6.0	12.8 - 11.2
9	13°02.2	13°04.4	12°26.6	0.9 - 0.8	6.9 - 6.0	12.9 - 11.3
10	13°02.5	13°04.6	12°26.9	1.0 - 0.9	7.0 - 6.1	13.0 - 11.4
11	13°02.7	13°04.9	12°27.1	1.1 - 1.0	7.1 - 6.2	13.1 - 11.5
12	13°03.0	13°05.1	12°27.3	1.2 - 1.1	7.2 - 6.3	13.2 - 11.5
13	13°03.3	13°05.4	12°27.6	1.3 - 1.1	7.3 - 6.4	13.3 - 11.6
14	13°03.5	13°05.6	12°27.8	1.4 - 1.2	7.4 - 6.5	13.4 - 11.7
15	13°03.8	13°05.9	12°28.0	1.5 - 1.3	7.5 - 6.6	13.5 - 11.8
16	13°04.0	13°06.1	12°28.3	1.6 - 1.4	7.6 - 6.6	13.6 - 11.9
17	13°04.2	13°06.4	12°28.5	1.7 - 1.5	7.7 - 6.7	13.7 - 12.0
18	13°04.5	13°06.6	12°28.8	1.8 - 1.6	7.8 - 6.8	13.8 - 12.1
19	13°04.8	13°06.9	12°29.0	1.9 - 1.7	7.9 - 6.9	13.9 - 12.2
20	13°05.0	13°07.1	12°29.2	2.0 - 1.8	8.0 - 7.0	14.0 - 12.3
21	13°05.3	13°07.4	12°29.5	2.1 - 1.8	8.1 - 7.1	14.1 - 12.3
22	13°05.5	13°07.6	12°29.7	2.2 - 1.9	8.2 - 7.2	14.2 - 12.4
23	13°05.7	13°07.9	12°30.0	2.3 - 2.0	8.3 - 7.3	14.3 - 12.5
24	13°06.0	13°08.1	12°30.2	2.4 - 2.1	8.4 - 7.4	14.4 - 12.6
25	13°06.2	13°08.4	12°30.4	2.5 - 2.2	8.5 - 7.4	14.5 - 12.7
26	13°06.5	13°08.6	12°30.7	2.6 - 2.3	8.6 - 7.5	14.6 - 12.8
27	13°06.8	13°08.9	12°30.9	2.7 - 2.4	8.7 - 7.6	14.7 - 12.9
28	13°07.0	13°09.2	12°31.1	2.8 - 2.5	8.8 - 7.7	14.8 - 13.0
29	13°07.3	13°09.4	12°31.4	2.9 - 2.5	8.9 - 7.8	14.9 - 13.0
30	13°07.5	13°09.7	12°31.6	3.0 - 2.6	9.0 - 7.9	15.0 - 13.1
31	13°07.7	13°09.9	12°31.9	3.1 - 2.7	9.1 - 8.0	15.1 - 13.2
32	13°08.0	13°10.2	12°32.1	3.2 - 2.8	9.2 - 8.0	15.2 - 13.3
33	13°08.2	13°10.4	12°32.3	3.3 - 2.9	9.3 - 8.1	15.3 - 13.4
34	13°08.5	13°10.7	12°32.6	3.4 - 3.0	9.4 - 8.2	15.4 - 13.5
35	13°08.8	13°10.9	12°32.8	3.5 - 3.1	9.5 - 8.3	15.5 - 13.6
36	13°09.0	13°11.2	12°33.1	3.6 - 3.1	9.6 - 8.4	15.6 - 13.7
37	13°09.3	13°11.4	12°33.3	3.7 - 3.2	9.7 - 8.5	15.7 - 13.7
38	13°09.5	13°11.7	12°33.5	3.8 - 3.3	9.8 - 8.6	15.8 - 13.8
39	13°09.7	13°11.9	12°33.8	3.9 - 3.4	9.9 - 8.7	15.9 - 13.9
40	13°10.0	13°12.2	12°34.0	4.0 - 3.5	10.0 - 8.8	16.0 - 14.0
41	13°10.2	13°12.4	12°34.2	4.1 - 3.6	10.1 - 8.8	16.1 - 14.1
42	13°10.5	13°12.7	12°34.5	4.2 - 3.7	10.2 - 8.9	16.2 - 14.2
43	13°10.8	13°12.9	12°34.7	4.3 - 3.8	10.3 - 9.0	16.3 - 14.3
44	13°11.0	13°13.2	12°35.0	4.4 - 3.9	10.4 - 9.1	16.4 - 14.3
45	13°11.3	13°13.4	12°35.2	4.5 - 3.9	10.5 - 9.2	16.5 - 14.4
46	13°11.5	13°13.7	12°35.4	4.6 - 4.0	10.6 - 9.3	16.6 - 14.5
47	13°11.7	13°13.9	12°35.7	4.7 - 4.1	10.7 - 9.4	16.7 - 14.6
48	13°12.0	13°14.2	12°35.9	4.8 - 4.2	10.8 - 9.5	16.8 - 14.7
49	13°12.3	13°14.4	12°36.2	4.9 - 4.3	10.9 - 9.5	16.9 - 14.8
50	13°12.5	13°14.7	12°36.4	5.0 - 4.4	11.0 - 9.6	17.0 - 14.9
51	13°12.8	13°14.9	12°36.6	5.1 - 4.5	11.1 - 9.7	17.1 - 15.0
52	13°13.0	13°15.2	12°36.9	5.2 - 4.5	11.2 - 9.8	17.2 - 15.0
53	13°13.2	13°15.4	12°37.1	5.3 - 4.6	11.3 - 9.9	17.3 - 15.1
54	13°13.5	13°15.7	12°37.4	5.4 - 4.7	11.4 - 10.0	17.4 - 15.2
55	13°13.7	13°15.9	12°37.6	5.5 - 4.8	11.5 - 10.1	17.5 - 15.3
56	13°14.0	13°16.2	12°37.8	5.6 - 4.9	11.6 - 10.2	17.6 - 15.4
57	13°14.3	13°16.4	12°38.1	5.7 - 5.0	11.7 - 10.2	17.7 - 15.5
58	13°14.5	13°16.7	12°38.3	5.8 - 5.1	11.8 - 10.3	17.8 - 15.6
59	13°14.8	13°16.9	12°38.5	5.9 - 5.2	11.9 - 10.4	17.9 - 15.7

m 53	Sun Plan.	Aries	Moon	v and d corr		
0	13°15.0	13°17.2	12°38.8	0.0 - 0.0	6.0 - 5.4	12.0 - 10.7
1	13°15.2	13°17.4	12°39.0	0.1 - 0.1	6.1 - 5.4	12.1 - 10.8
2	13°15.5	13°17.7	12°39.3	0.2 - 0.2	6.2 - 5.5	12.2 - 10.9
3	13°15.7	13°17.9	12°39.5	0.3 - 0.3	6.3 - 5.6	12.3 - 11.0
4	13°16.0	13°18.2	12°39.7	0.4 - 0.4	6.4 - 5.7	12.4 - 11.1
5	13°16.3	13°18.4	12°40.0	0.5 - 0.4	6.5 - 5.8	12.5 - 11.1
6	13°16.5	13°18.7	12°40.2	0.6 - 0.5	6.6 - 5.9	12.6 - 11.2
7	13°16.8	13°18.9	12°40.5	0.7 - 0.6	6.7 - 6.0	12.7 - 11.3
8	13°17.0	13°19.2	12°40.7	0.8 - 0.7	6.8 - 6.1	12.8 - 11.4
9	13°17.2	13°19.4	12°40.9	0.9 - 0.8	6.9 - 6.2	12.9 - 11.5
10	13°17.5	13°19.7	12°41.2	1.0 - 0.9	7.0 - 6.2	13.0 - 11.6
11	13°17.7	13°19.9	12°41.4	1.1 - 1.0	7.1 - 6.3	13.1 - 11.7
12	13°18.0	13°20.2	12°41.6	1.2 - 1.1	7.2 - 6.4	13.2 - 11.8
13	13°18.3	13°20.4	12°41.9	1.3 - 1.2	7.3 - 6.5	13.3 - 11.9
14	13°18.5	13°20.7	12°42.1	1.4 - 1.2	7.4 - 6.6	13.4 - 11.9
15	13°18.8	13°20.9	12°42.4	1.5 - 1.3	7.5 - 6.7	13.5 - 12.0
16	13°19.0	13°21.2	12°42.6	1.6 - 1.4	7.6 - 6.8	13.6 - 12.1
17	13°19.2	13°21.4	12°42.8	1.7 - 1.5	7.7 - 6.9	13.7 - 12.2
18	13°19.5	13°21.7	12°43.1	1.8 - 1.6	7.8 - 7.0	13.8 - 12.3
19	13°19.8	13°21.9	12°43.3	1.9 - 1.7	7.9 - 7.0	13.9 - 12.4
20	13°20.0	13°22.2	12°43.6	2.0 - 1.8	8.0 - 7.1	14.0 - 12.5
21	13°20.3	13°22.4	12°43.8	2.1 - 1.9	8.1 - 7.2	14.1 - 12.6
22	13°20.5	13°22.7	12°44.0	2.2 - 2.0	8.2 - 7.3	14.2 - 12.7
23	13°20.7	13°22.9	12°44.3	2.3 - 2.1	8.3 - 7.4	14.3 - 12.8
24	13°21.0	13°23.2	12°44.5	2.4 - 2.1	8.4 - 7.5	14.4 - 12.8
25	13°21.2	13°23.4	12°44.7	2.5 - 2.2	8.5 - 7.6	14.5 - 12.9
26	13°21.5	13°23.7	12°45.0	2.6 - 2.3	8.6 - 7.7	14.6 - 13.0
27	13°21.8	13°23.9	12°45.2	2.7 - 2.4	8.7 - 7.8	14.7 - 13.1
28	13°22.0	13°24.2	12°45.5	2.8 - 2.5	8.8 - 7.8	14.8 - 13.2
29	13°22.3	13°24.4	12°45.7	2.9 - 2.6	8.9 - 7.9	14.9 - 13.3
30	13°22.5	13°24.7	12°45.9	3.0 - 2.7	9.0 - 8.0	15.0 - 13.4
31	13°22.7	13°24.9	12°46.2	3.1 - 2.8	9.1 - 8.1	15.1 - 13.5
32	13°23.0	13°25.2	12°46.4	3.2 - 2.9	9.2 - 8.2	15.2 - 13.6
33	13°23.2	13°25.4	12°46.7	3.3 - 2.9	9.3 - 8.3	15.3 - 13.6
34	13°23.5	13°25.7	12°46.9	3.4 - 3.0	9.4 - 8.4	15.4 - 13.7
35	13°23.8	13°25.9	12°47.1	3.5 - 3.1	9.5 - 8.5	15.5 - 13.8
36	13°24.0	13°26.2	12°47.4	3.6 - 3.2	9.6 - 8.6	15.6 - 13.9
37	13°24.3	13°26.4	12°47.6	3.7 - 3.3	9.7 - 8.6	15.7 - 14.0
38	13°24.5	13°26.7	12°47.9	3.8 - 3.4	9.8 - 8.7	15.8 - 14.1
39	13°24.7	13°26.9	12°48.1	3.9 - 3.5	9.9 - 8.8	15.9 - 14.2
40	13°25.0	13°27.2	12°48.3	4.0 - 3.6	10.0 - 8.9	16.0 - 14.3
41	13°25.2	13°27.5	12°48.6	4.1 - 3.7	10.1 - 9.0	16.1 - 14.4
42	13°25.5	13°27.7	12°48.8	4.2 - 3.7	10.2 - 9.1	16.2 - 14.4
43	13°25.8	13°28.0	12°49.0	4.3 - 3.8	10.3 - 9.2	16.3 - 14.5
44	13°26.0	13°28.2	12°49.3	4.4 - 3.9	10.4 - 9.3	16.4 - 14.6
45	13°26.3	13°28.5	12°49.5	4.5 - 4.0	10.5 - 9.4	16.5 - 14.7
46	13°26.5	13°28.7	12°49.8	4.6 - 4.1	10.6 - 9.5	16.6 - 14.8
47	13°26.7	13°29.0	12°50.0	4.7 - 4.2	10.7 - 9.5	16.7 - 14.9
48	13°27.0	13°29.2	12°50.2	4.8 - 4.3	10.8 - 9.6	16.8 - 15.0
49	13°27.3	13°29.5	12°50.5	4.9 - 4.4	10.9 - 9.7	16.9 - 15.1
50	13°27.5	13°29.7	12°50.7	5.0 - 4.5	11.0 - 9.8	17.0 - 15.2
51	13°27.8	13°30.0	12°51.0	5.1 - 4.5	11.1 - 9.9	17.1 - 15.2
52	13°28.0	13°30.2	12°51.2	5.2 - 4.6	11.2 - 10.0	17.2 - 15.3
53	13°28.2	13°30.5	12°51.4	5.3 - 4.7	11.3 - 10.1	17.3 - 15.4
54	13°28.5	13°30.7	12°51.7	5.4 - 4.8	11.4 - 10.2	17.4 - 15.5
55	13°28.7	13°31.0	12°51.9	5.5 - 4.9	11.5 - 10.3	17.5 - 15.6
56	13°29.0	13°31.2	12°52.1	5.6 - 5.0	11.6 - 10.3	17.6 - 15.7
57	13°29.3	13°31.5	12°52.4	5.7 - 5.1	11.7 - 10.4	17.7 - 15.8
58	13°29.5	13°31.7	12°52.6	5.8 - 5.2	11.8 - 10.5	17.8 - 15.9
59	13°29.8	13°32.0	12°52.9	5.9 - 5.3	11.9 - 10.6	17.9 - 16.0

Increments and Corrections

m 54	Sun Plan.	Aries	Moon	v and d corr		
0	13°30.0	13°32.2	12°53.1	0.0 - 0.0	6.0 - 5.5	12.0 - 10.9
1	13°30.2	13°32.5	12°53.3	0.1 - 0.1	6.1 - 5.5	12.1 - 11.0
2	13°30.5	13°32.7	12°53.6	0.2 - 0.2	6.2 - 5.6	12.2 - 11.1
3	13°30.7	13°33.0	12°53.8	0.3 - 0.3	6.3 - 5.7	12.3 - 11.2
4	13°31.0	13°33.2	12°54.1	0.4 - 0.4	6.4 - 5.8	12.4 - 11.3
5	13°31.3	13°33.5	12°54.3	0.5 - 0.5	6.5 - 5.9	12.5 - 11.4
6	13°31.5	13°33.7	12°54.5	0.6 - 0.5	6.6 - 6.0	12.6 - 11.4
7	13°31.8	13°34.0	12°54.8	0.7 - 0.6	6.7 - 6.1	12.7 - 11.5
8	13°32.0	13°34.2	12°55.0	0.8 - 0.7	6.8 - 6.2	12.8 - 11.6
9	13°32.2	13°34.5	12°55.2	0.9 - 0.8	6.9 - 6.3	12.9 - 11.7
10	13°32.5	13°34.7	12°55.5	1.0 - 0.9	7.0 - 6.4	13.0 - 11.8
11	13°32.7	13°35.0	12°55.7	1.1 - 1.0	7.1 - 6.4	13.1 - 11.9
12	13°33.0	13°35.2	12°56.0	1.2 - 1.1	7.2 - 6.5	13.2 - 12.0
13	13°33.3	13°35.5	12°56.2	1.3 - 1.2	7.3 - 6.6	13.3 - 12.1
14	13°33.5	13°35.7	12°56.4	1.4 - 1.3	7.4 - 6.7	13.4 - 12.2
15	13°33.8	13°36.0	12°56.7	1.5 - 1.4	7.5 - 6.8	13.5 - 12.3
16	13°34.0	13°36.2	12°56.9	1.6 - 1.5	7.6 - 6.9	13.6 - 12.4
17	13°34.2	13°36.5	12°57.2	1.7 - 1.5	7.7 - 7.0	13.7 - 12.4
18	13°34.5	13°36.7	12°57.4	1.8 - 1.6	7.8 - 7.1	13.8 - 12.5
19	13°34.8	13°37.0	12°57.6	1.9 - 1.7	7.9 - 7.2	13.9 - 12.6
20	13°35.0	13°37.2	12°57.9	2.0 - 1.8	8.0 - 7.3	14.0 - 12.7
21	13°35.3	13°37.5	12°58.1	2.1 - 1.9	8.1 - 7.4	14.1 - 12.8
22	13°35.5	13°37.7	12°58.3	2.2 - 2.0	8.2 - 7.4	14.2 - 12.9
23	13°35.7	13°38.0	12°58.6	2.3 - 2.1	8.3 - 7.5	14.3 - 13.0
24	13°36.0	13°38.2	12°58.8	2.4 - 2.2	8.4 - 7.6	14.4 - 13.1
25	13°36.2	13°38.5	12°59.1	2.5 - 2.3	8.5 - 7.7	14.5 - 13.2
26	13°36.5	13°38.7	12°59.3	2.6 - 2.4	8.6 - 7.8	14.6 - 13.3
27	13°36.8	13°39.0	12°59.5	2.7 - 2.5	8.7 - 7.9	14.7 - 13.4
28	13°37.0	13°39.2	12°59.8	2.8 - 2.5	8.8 - 8.0	14.8 - 13.4
29	13°37.3	13°39.5	13°00.0	2.9 - 2.6	8.9 - 8.1	14.9 - 13.5
30	13°37.5	13°39.7	13°00.3	3.0 - 2.7	9.0 - 8.2	15.0 - 13.6
31	13°37.7	13°40.0	13°00.5	3.1 - 2.8	9.1 - 8.3	15.1 - 13.7
32	13°38.0	13°40.2	13°00.7	3.2 - 2.9	9.2 - 8.4	15.2 - 13.8
33	13°38.2	13°40.5	13°01.0	3.3 - 3.0	9.3 - 8.4	15.3 - 13.9
34	13°38.5	13°40.7	13°01.2	3.4 - 3.1	9.4 - 8.5	15.4 - 14.0
35	13°38.8	13°41.0	13°01.5	3.5 - 3.2	9.5 - 8.6	15.5 - 14.1
36	13°39.0	13°41.2	13°01.7	3.6 - 3.3	9.6 - 8.7	15.6 - 14.2
37	13°39.3	13°41.5	13°01.9	3.7 - 3.4	9.7 - 8.8	15.7 - 14.3
38	13°39.5	13°41.7	13°02.2	3.8 - 3.5	9.8 - 8.9	15.8 - 14.4
39	13°39.7	13°42.0	13°02.4	3.9 - 3.5	9.9 - 9.0	15.9 - 14.4
40	13°40.0	13°42.2	13°02.6	4.0 - 3.6	10.0 - 9.1	16.0 - 14.5
41	13°40.2	13°42.5	13°02.9	4.1 - 3.7	10.1 - 9.2	16.1 - 14.6
42	13°40.5	13°42.7	13°03.1	4.2 - 3.8	10.2 - 9.3	16.2 - 14.7
43	13°40.8	13°43.0	13°03.4	4.3 - 3.9	10.3 - 9.4	16.3 - 14.8
44	13°41.0	13°43.2	13°03.6	4.4 - 4.0	10.4 - 9.4	16.4 - 14.9
45	13°41.3	13°43.5	13°03.8	4.5 - 4.1	10.5 - 9.5	16.5 - 15.0
46	13°41.5	13°43.7	13°04.1	4.6 - 4.2	10.6 - 9.6	16.6 - 15.1
47	13°41.7	13°44.0	13°04.3	4.7 - 4.3	10.7 - 9.7	16.7 - 15.2
48	13°42.0	13°44.2	13°04.6	4.8 - 4.4	10.8 - 9.8	16.8 - 15.3
49	13°42.3	13°44.5	13°04.8	4.9 - 4.5	10.9 - 9.9	16.9 - 15.4
50	13°42.5	13°44.7	13°05.0	5.0 - 4.5	11.0 - 10.0	17.0 - 15.4
51	13°42.8	13°45.0	13°05.3	5.1 - 4.6	11.1 - 10.1	17.1 - 15.5
52	13°43.0	13°45.2	13°05.5	5.2 - 4.7	11.2 - 10.2	17.2 - 15.6
53	13°43.2	13°45.5	13°05.7	5.3 - 4.8	11.3 - 10.3	17.3 - 15.7
54	13°43.5	13°45.8	13°06.0	5.4 - 4.9	11.4 - 10.4	17.4 - 15.8
55	13°43.7	13°46.0	13°06.2	5.5 - 5.0	11.5 - 10.4	17.5 - 15.9
56	13°44.0	13°46.3	13°06.5	5.6 - 5.1	11.6 - 10.5	17.6 - 16.0
57	13°44.3	13°46.5	13°06.7	5.7 - 5.2	11.7 - 10.6	17.7 - 16.1
58	13°44.5	13°46.8	13°06.9	5.8 - 5.3	11.8 - 10.7	17.8 - 16.2
59	13°44.8	13°47.0	13°07.2	5.9 - 5.4	11.9 - 10.8	17.9 - 16.3

m 55	Sun Plan.	Aries	Moon	v and d corr		
0	13°45.0	13°47.3	13°07.4	0.0 - 0.0	6.0 - 5.6	12.0 - 11.1
1	13°45.2	13°47.5	13°07.7	0.1 - 0.1	6.1 - 5.6	12.1 - 11.2
2	13°45.5	13°47.8	13°07.9	0.2 - 0.2	6.2 - 5.7	12.2 - 11.3
3	13°45.7	13°48.0	13°08.1	0.3 - 0.3	6.3 - 5.8	12.3 - 11.4
4	13°46.0	13°48.3	13°08.4	0.4 - 0.4	6.4 - 5.9	12.4 - 11.5
5	13°46.3	13°48.5	13°08.6	0.5 - 0.5	6.5 - 6.0	12.5 - 11.6
6	13°46.5	13°48.8	13°08.8	0.6 - 0.6	6.6 - 6.1	12.6 - 11.7
7	13°46.8	13°49.0	13°09.1	0.7 - 0.6	6.7 - 6.2	12.7 - 11.7
8	13°47.0	13°49.3	13°09.3	0.8 - 0.7	6.8 - 6.3	12.8 - 11.8
9	13°47.2	13°49.5	13°09.6	0.9 - 0.8	6.9 - 6.4	12.9 - 11.9
10	13°47.5	13°49.8	13°09.8	1.0 - 0.9	7.0 - 6.5	13.0 - 12.0
11	13°47.7	13°50.0	13°10.0	1.1 - 1.0	7.1 - 6.6	13.1 - 12.1
12	13°48.0	13°50.3	13°10.3	1.2 - 1.1	7.2 - 6.7	13.2 - 12.2
13	13°48.3	13°50.5	13°10.5	1.3 - 1.2	7.3 - 6.8	13.3 - 12.3
14	13°48.5	13°50.8	13°10.8	1.4 - 1.3	7.4 - 6.8	13.4 - 12.4
15	13°48.8	13°51.0	13°11.0	1.5 - 1.4	7.5 - 6.9	13.5 - 12.5
16	13°49.0	13°51.3	13°11.2	1.6 - 1.5	7.6 - 7.0	13.6 - 12.6
17	13°49.2	13°51.5	13°11.5	1.7 - 1.6	7.7 - 7.1	13.7 - 12.7
18	13°49.5	13°51.8	13°11.7	1.8 - 1.7	7.8 - 7.2	13.8 - 12.8
19	13°49.8	13°52.0	13°12.0	1.9 - 1.8	7.9 - 7.3	13.9 - 12.9
20	13°50.0	13°52.3	13°12.2	2.0 - 1.9	8.0 - 7.4	14.0 - 13.0
21	13°50.3	13°52.5	13°12.4	2.1 - 1.9	8.1 - 7.5	14.1 - 13.0
22	13°50.5	13°52.8	13°12.7	2.2 - 2.0	8.2 - 7.6	14.2 - 13.1
23	13°50.7	13°53.0	13°12.9	2.3 - 2.1	8.3 - 7.7	14.3 - 13.2
24	13°51.0	13°53.3	13°13.1	2.4 - 2.2	8.4 - 7.8	14.4 - 13.3
25	13°51.2	13°53.5	13°13.4	2.5 - 2.3	8.5 - 7.9	14.5 - 13.4
26	13°51.5	13°53.8	13°13.6	2.6 - 2.4	8.6 - 8.0	14.6 - 13.5
27	13°51.8	13°54.0	13°13.9	2.7 - 2.5	8.7 - 8.0	14.7 - 13.6
28	13°52.0	13°54.3	13°14.1	2.8 - 2.6	8.8 - 8.1	14.8 - 13.7
29	13°52.3	13°54.5	13°14.3	2.9 - 2.7	8.9 - 8.2	14.9 - 13.8
30	13°52.5	13°54.8	13°14.6	3.0 - 2.8	9.0 - 8.3	15.0 - 13.9
31	13°52.7	13°55.0	13°14.8	3.1 - 2.9	9.1 - 8.4	15.1 - 14.0
32	13°53.0	13°55.3	13°15.1	3.2 - 3.0	9.2 - 8.5	15.2 - 14.1
33	13°53.2	13°55.5	13°15.3	3.3 - 3.1	9.3 - 8.6	15.3 - 14.2
34	13°53.5	13°55.8	13°15.5	3.4 - 3.1	9.4 - 8.7	15.4 - 14.2
35	13°53.8	13°56.0	13°15.8	3.5 - 3.2	9.5 - 8.8	15.5 - 14.3
36	13°54.0	13°56.3	13°16.0	3.6 - 3.3	9.6 - 8.9	15.6 - 14.4
37	13°54.3	13°56.5	13°16.2	3.7 - 3.4	9.7 - 9.0	15.7 - 14.5
38	13°54.5	13°56.8	13°16.5	3.8 - 3.5	9.8 - 9.1	15.8 - 14.6
39	13°54.7	13°57.0	13°16.7	3.9 - 3.6	9.9 - 9.2	15.9 - 14.7
40	13°55.0	13°57.3	13°17.0	4.0 - 3.7	10.0 - 9.3	16.0 - 14.8
41	13°55.2	13°57.5	13°17.2	4.1 - 3.8	10.1 - 9.3	16.1 - 14.9
42	13°55.5	13°57.8	13°17.4	4.2 - 3.9	10.2 - 9.4	16.2 - 15.0
43	13°55.8	13°58.0	13°17.7	4.3 - 4.0	10.3 - 9.5	16.3 - 15.1
44	13°56.0	13°58.3	13°17.9	4.4 - 4.1	10.4 - 9.6	16.4 - 15.2
45	13°56.3	13°58.5	13°18.2	4.5 - 4.2	10.5 - 9.7	16.5 - 15.3
46	13°56.5	13°58.8	13°18.4	4.6 - 4.3	10.6 - 9.8	16.6 - 15.4
47	13°56.7	13°59.0	13°18.6	4.7 - 4.3	10.7 - 9.9	16.7 - 15.4
48	13°57.0	13°59.3	13°18.9	4.8 - 4.4	10.8 - 10.0	16.8 - 15.5
49	13°57.3	13°59.5	13°19.1	4.9 - 4.5	10.9 - 10.1	16.9 - 15.6
50	13°57.5	13°59.8	13°19.3	5.0 - 4.6	11.0 - 10.2	17.0 - 15.7
51	13°57.8	14°00.0	13°19.6	5.1 - 4.7	11.1 - 10.3	17.1 - 15.8
52	13°58.0	14°00.3	13°19.8	5.2 - 4.8	11.2 - 10.4	17.2 - 15.9
53	13°58.2	14°00.5	13°20.1	5.3 - 4.9	11.3 - 10.5	17.3 - 16.0
54	13°58.5	14°00.8	13°20.3	5.4 - 5.0	11.4 - 10.5	17.4 - 16.1
55	13°58.7	14°01.0	13°20.5	5.5 - 5.1	11.5 - 10.6	17.5 - 16.2
56	13°59.0	14°01.3	13°20.8	5.6 - 5.2	11.6 - 10.7	17.6 - 16.3
57	13°59.3	14°01.5	13°21.0	5.7 - 5.3	11.7 - 10.8	17.7 - 16.4
58	13°59.5	14°01.8	13°21.3	5.8 - 5.4	11.8 - 10.9	17.8 - 16.5
59	13°59.8	14°02.0	13°21.5	5.9 - 5.5	11.9 - 11.0	17.9 - 16.6

m 56	Sun Plan.	Aries	Moon	v and d corr		
0	14°00.0	14°02.3	13°21.7	0.0 - 0.0	6.0 - 5.7	12.0 - 11.3
1	14°00.2	14°02.5	13°22.0	0.1 - 0.1	6.1 - 5.7	12.1 - 11.4
2	14°00.5	14°02.8	13°22.2	0.2 - 0.2	6.2 - 5.8	12.2 - 11.5
3	14°00.7	14°03.0	13°22.4	0.3 - 0.3	6.3 - 5.9	12.3 - 11.6
4	14°01.0	14°03.3	13°22.7	0.4 - 0.4	6.4 - 6.0	12.4 - 11.7
5	14°01.3	14°03.5	13°22.9	0.5 - 0.5	6.5 - 6.1	12.5 - 11.8
6	14°01.5	14°03.8	13°23.2	0.6 - 0.6	6.6 - 6.2	12.6 - 11.9
7	14°01.8	14°04.1	13°23.4	0.7 - 0.7	6.7 - 6.3	12.7 - 12.0
8	14°02.0	14°04.3	13°23.6	0.8 - 0.8	6.8 - 6.4	12.8 - 12.1
9	14°02.2	14°04.6	13°23.9	0.9 - 0.8	6.9 - 6.5	12.9 - 12.1
10	14°02.5	14°04.8	13°24.1	1.0 - 0.9	7.0 - 6.6	13.0 - 12.2
11	14°02.7	14°05.1	13°24.4	1.1 - 1.0	7.1 - 6.7	13.1 - 12.3
12	14°03.0	14°05.3	13°24.6	1.2 - 1.1	7.2 - 6.8	13.2 - 12.4
13	14°03.3	14°05.6	13°24.8	1.3 - 1.2	7.3 - 6.9	13.3 - 12.5
14	14°03.5	14°05.8	13°25.1	1.4 - 1.3	7.4 - 7.0	13.4 - 12.6
15	14°03.8	14°06.1	13°25.3	1.5 - 1.4	7.5 - 7.1	13.5 - 12.7
16	14°04.0	14°06.3	13°25.6	1.6 - 1.5	7.6 - 7.2	13.6 - 12.8
17	14°04.2	14°06.6	13°25.8	1.7 - 1.6	7.7 - 7.3	13.7 - 12.9
18	14°04.5	14°06.8	13°26.0	1.8 - 1.7	7.8 - 7.3	13.8 - 13.0
19	14°04.8	14°07.1	13°26.3	1.9 - 1.8	7.9 - 7.4	13.9 - 13.1
20	14°05.0	14°07.3	13°26.5	2.0 - 1.9	8.0 - 7.5	14.0 - 13.2
21	14°05.3	14°07.6	13°26.7	2.1 - 2.0	8.1 - 7.6	14.1 - 13.3
22	14°05.5	14°07.8	13°27.0	2.2 - 2.1	8.2 - 7.7	14.2 - 13.4
23	14°05.7	14°08.1	13°27.2	2.3 - 2.2	8.3 - 7.8	14.3 - 13.5
24	14°06.0	14°08.3	13°27.5	2.4 - 2.3	8.4 - 7.9	14.4 - 13.6
25	14°06.2	14°08.6	13°27.7	2.5 - 2.4	8.5 - 8.0	14.5 - 13.7
26	14°06.5	14°08.8	13°27.9	2.6 - 2.4	8.6 - 8.1	14.6 - 13.7
27	14°06.8	14°09.1	13°28.2	2.7 - 2.5	8.7 - 8.2	14.7 - 13.8
28	14°07.0	14°09.3	13°28.4	2.8 - 2.6	8.8 - 8.3	14.8 - 13.9
29	14°07.3	14°09.6	13°28.7	2.9 - 2.7	8.9 - 8.4	14.9 - 14.0
30	14°07.5	14°09.8	13°28.9	3.0 - 2.8	9.0 - 8.5	15.0 - 14.1
31	14°07.7	14°10.1	13°29.1	3.1 - 2.9	9.1 - 8.6	15.1 - 14.2
32	14°08.0	14°10.3	13°29.4	3.2 - 3.0	9.2 - 8.7	15.2 - 14.3
33	14°08.2	14°10.6	13°29.6	3.3 - 3.1	9.3 - 8.8	15.3 - 14.4
34	14°08.5	14°10.8	13°29.8	3.4 - 3.2	9.4 - 8.9	15.4 - 14.5
35	14°08.8	14°11.1	13°30.1	3.5 - 3.3	9.5 - 8.9	15.5 - 14.6
36	14°09.0	14°11.3	13°30.3	3.6 - 3.4	9.6 - 9.0	15.6 - 14.7
37	14°09.3	14°11.6	13°30.6	3.7 - 3.5	9.7 - 9.1	15.7 - 14.8
38	14°09.5	14°11.8	13°30.8	3.8 - 3.6	9.8 - 9.2	15.8 - 14.9
39	14°09.7	14°12.1	13°31.0	3.9 - 3.7	9.9 - 9.3	15.9 - 15.0
40	14°10.0	14°12.3	13°31.3	4.0 - 3.8	10.0 - 9.4	16.0 - 15.1
41	14°10.2	14°12.6	13°31.5	4.1 - 3.9	10.1 - 9.5	16.1 - 15.2
42	14°10.5	14°12.8	13°31.8	4.2 - 4.0	10.2 - 9.6	16.2 - 15.3
43	14°10.8	14°13.1	13°32.0	4.3 - 4.0	10.3 - 9.7	16.3 - 15.3
44	14°11.0	14°13.3	13°32.2	4.4 - 4.1	10.4 - 9.8	16.4 - 15.4
45	14°11.3	14°13.6	13°32.5	4.5 - 4.2	10.5 - 9.9	16.5 - 15.5
46	14°11.5	14°13.8	13°32.7	4.6 - 4.3	10.6 - 10.0	16.6 - 15.6
47	14°11.7	14°14.1	13°32.9	4.7 - 4.4	10.7 - 10.1	16.7 - 15.7
48	14°12.0	14°14.3	13°33.2	4.8 - 4.5	10.8 - 10.2	16.8 - 15.8
49	14°12.3	14°14.6	13°33.4	4.9 - 4.6	10.9 - 10.3	16.9 - 15.9
50	14°12.5	14°14.8	13°33.7	5.0 - 4.7	11.0 - 10.4	17.0 - 16.0
51	14°12.8	14°15.1	13°33.9	5.1 - 4.8	11.1 - 10.5	17.1 - 16.1
52	14°13.0	14°15.3	13°34.1	5.2 - 4.9	11.2 - 10.5	17.2 - 16.2
53	14°13.2	14°15.6	13°34.4	5.3 - 5.0	11.3 - 10.6	17.3 - 16.3
54	14°13.5	14°15.8	13°34.6	5.4 - 5.1	11.4 - 10.7	17.4 - 16.4
55	14°13.7	14°16.1	13°34.9	5.5 - 5.2	11.5 - 10.8	17.5 - 16.5
56	14°14.0	14°16.3	13°35.1	5.6 - 5.3	11.6 - 10.9	17.6 - 16.6
57	14°14.3	14°16.6	13°35.3	5.7 - 5.4	11.7 - 11.0	17.7 - 16.7
58	14°14.5	14°16.8	13°35.6	5.8 - 5.5	11.8 - 11.1	17.8 - 16.8
59	14°14.8	14°17.1	13°35.8	5.9 - 5.6	11.9 - 11.2	17.9 - 16.9

Increments and Corrections

m 57	Sun Plan.	Aries	Moon	v and d corr		
0	14°15.0	14°17.3	13°36.0	0.0 - 0.0	6.0 - 5.8	12.0 - 11.5
1	14°15.2	14°17.6	13°36.3	0.1 - 0.1	6.1 - 5.8	12.1 - 11.6
2	14°15.5	14°17.8	13°36.5	0.2 - 0.2	6.2 - 5.9	12.2 - 11.7
3	14°15.7	14°18.1	13°36.8	0.3 - 0.3	6.3 - 6.0	12.3 - 11.8
4	14°16.0	14°18.3	13°37.0	0.4 - 0.4	6.4 - 6.1	12.4 - 11.9
5	14°16.3	14°18.6	13°37.2	0.5 - 0.5	6.5 - 6.2	12.5 - 12.0
6	14°16.5	14°18.8	13°37.5	0.6 - 0.6	6.6 - 6.3	12.6 - 12.1
7	14°16.8	14°19.1	13°37.7	0.7 - 0.7	6.7 - 6.4	12.7 - 12.2
8	14°17.0	14°19.3	13°38.0	0.8 - 0.8	6.8 - 6.5	12.8 - 12.3
9	14°17.2	14°19.6	13°38.2	0.9 - 0.9	6.9 - 6.6	12.9 - 12.4
10	14°17.5	14°19.8	13°38.4	1.0 - 1.0	7.0 - 6.7	13.0 - 12.5
11	14°17.7	14°20.1	13°38.7	1.1 - 1.1	7.1 - 6.8	13.1 - 12.6
12	14°18.0	14°20.3	13°38.9	1.2 - 1.2	7.2 - 6.9	13.2 - 12.7
13	14°18.3	14°20.6	13°39.2	1.3 - 1.2	7.3 - 7.0	13.3 - 12.7
14	14°18.5	14°20.8	13°39.4	1.4 - 1.3	7.4 - 7.1	13.4 - 12.8
15	14°18.8	14°21.1	13°39.6	1.5 - 1.4	7.5 - 7.2	13.5 - 12.9
16	14°19.0	14°21.3	13°39.9	1.6 - 1.5	7.6 - 7.3	13.6 - 13.0
17	14°19.2	14°21.6	13°40.1	1.7 - 1.6	7.7 - 7.4	13.7 - 13.1
18	14°19.5	14°21.8	13°40.3	1.8 - 1.7	7.8 - 7.5	13.8 - 13.2
19	14°19.8	14°22.1	13°40.6	1.9 - 1.8	7.9 - 7.6	13.9 - 13.3
20	14°20.0	14°22.4	13°40.8	2.0 - 1.9	8.0 - 7.7	14.0 - 13.4
21	14°20.3	14°22.6	13°41.1	2.1 - 2.0	8.1 - 7.8	14.1 - 13.5
22	14°20.5	14°22.9	13°41.3	2.2 - 2.1	8.2 - 7.9	14.2 - 13.6
23	14°20.7	14°23.1	13°41.5	2.3 - 2.2	8.3 - 8.0	14.3 - 13.7
24	14°21.0	14°23.4	13°41.8	2.4 - 2.3	8.4 - 8.1	14.4 - 13.8
25	14°21.2	14°23.6	13°42.0	2.5 - 2.4	8.5 - 8.1	14.5 - 13.9
26	14°21.5	14°23.9	13°42.3	2.6 - 2.5	8.6 - 8.2	14.6 - 14.0
27	14°21.8	14°24.1	13°42.5	2.7 - 2.6	8.7 - 8.3	14.7 - 14.1
28	14°22.0	14°24.4	13°42.7	2.8 - 2.7	8.8 - 8.4	14.8 - 14.2
29	14°22.3	14°24.6	13°43.0	2.9 - 2.8	8.9 - 8.5	14.9 - 14.3
30	14°22.5	14°24.9	13°43.2	3.0 - 2.9	9.0 - 8.6	15.0 - 14.4
31	14°22.7	14°25.1	13°43.4	3.1 - 3.0	9.1 - 8.7	15.1 - 14.5
32	14°23.0	14°25.4	13°43.7	3.2 - 3.1	9.2 - 8.8	15.2 - 14.6
33	14°23.2	14°25.6	13°43.9	3.3 - 3.2	9.3 - 8.9	15.3 - 14.7
34	14°23.5	14°25.9	13°44.2	3.4 - 3.3	9.4 - 9.0	15.4 - 14.8
35	14°23.8	14°26.1	13°44.4	3.5 - 3.4	9.5 - 9.1	15.5 - 14.9
36	14°24.0	14°26.4	13°44.6	3.6 - 3.5	9.6 - 9.2	15.6 - 15.0
37	14°24.3	14°26.6	13°44.9	3.7 - 3.5	9.7 - 9.3	15.7 - 15.0
38	14°24.5	14°26.9	13°45.1	3.8 - 3.6	9.8 - 9.4	15.8 - 15.1
39	14°24.7	14°27.1	13°45.4	3.9 - 3.7	9.9 - 9.5	15.9 - 15.2
40	14°25.0	14°27.4	13°45.6	4.0 - 3.8	10.0 - 9.6	16.0 - 15.3
41	14°25.2	14°27.6	13°45.8	4.1 - 3.9	10.1 - 9.7	16.1 - 15.4
42	14°25.5	14°27.9	13°46.1	4.2 - 4.0	10.2 - 9.8	16.2 - 15.5
43	14°25.8	14°28.1	13°46.3	4.3 - 4.1	10.3 - 9.9	16.3 - 15.6
44	14°26.0	14°28.4	13°46.5	4.4 - 4.2	10.4 - 10.0	16.4 - 15.7
45	14°26.3	14°28.6	13°46.8	4.5 - 4.3	10.5 - 10.1	16.5 - 15.8
46	14°26.5	14°28.9	13°47.0	4.6 - 4.4	10.6 - 10.2	16.6 - 15.9
47	14°26.7	14°29.1	13°47.3	4.7 - 4.5	10.7 - 10.3	16.7 - 16.0
48	14°27.0	14°29.4	13°47.5	4.8 - 4.6	10.8 - 10.4	16.8 - 16.1
49	14°27.3	14°29.6	13°47.7	4.9 - 4.7	10.9 - 10.4	16.9 - 16.2
50	14°27.5	14°29.9	13°48.0	5.0 - 4.8	11.0 - 10.5	17.0 - 16.3
51	14°27.8	14°30.1	13°48.2	5.1 - 4.9	11.1 - 10.6	17.1 - 16.4
52	14°28.0	14°30.4	13°48.5	5.2 - 5.0	11.2 - 10.7	17.2 - 16.5
53	14°28.2	14°30.6	13°48.7	5.3 - 5.1	11.3 - 10.8	17.3 - 16.6
54	14°28.5	14°30.9	13°48.9	5.4 - 5.2	11.4 - 10.9	17.4 - 16.7
55	14°28.7	14°31.1	13°49.2	5.5 - 5.3	11.5 - 11.0	17.5 - 16.8
56	14°29.0	14°31.4	13°49.4	5.6 - 5.4	11.6 - 11.1	17.6 - 16.9
57	14°29.3	14°31.6	13°49.7	5.7 - 5.5	11.7 - 11.2	17.7 - 17.0
58	14°29.5	14°31.9	13°49.9	5.8 - 5.6	11.8 - 11.3	17.8 - 17.1
59	14°29.8	14°32.1	13°50.1	5.9 - 5.7	11.9 - 11.4	17.9 - 17.2

m 58	Sun Plan.	Aries	Moon	v and d corr		
0	14°30.0	14°32.4	13°50.4	0.0 - 0.0	6.0 - 5.8	12.0 - 11.7
1	14°30.2	14°32.6	13°50.6	0.1 - 0.1	6.1 - 5.9	12.1 - 11.8
2	14°30.5	14°32.9	13°50.8	0.2 - 0.2	6.2 - 6.0	12.2 - 11.9
3	14°30.7	14°33.1	13°51.1	0.3 - 0.3	6.3 - 6.1	12.3 - 12.0
4	14°31.0	14°33.4	13°51.3	0.4 - 0.4	6.4 - 6.2	12.4 - 12.1
5	14°31.3	14°33.6	13°51.6	0.5 - 0.5	6.5 - 6.3	12.5 - 12.2
6	14°31.5	14°33.9	13°51.8	0.6 - 0.6	6.6 - 6.4	12.6 - 12.3
7	14°31.8	14°34.1	13°52.0	0.7 - 0.7	6.7 - 6.5	12.7 - 12.4
8	14°32.0	14°34.4	13°52.3	0.8 - 0.8	6.8 - 6.6	12.8 - 12.5
9	14°32.2	14°34.6	13°52.5	0.9 - 0.9	6.9 - 6.7	12.9 - 12.6
10	14°32.5	14°34.9	13°52.8	1.0 - 1.0	7.0 - 6.8	13.0 - 12.7
11	14°32.7	14°35.1	13°53.0	1.1 - 1.1	7.1 - 6.9	13.1 - 12.8
12	14°33.0	14°35.4	13°53.2	1.2 - 1.2	7.2 - 7.0	13.2 - 12.9
13	14°33.3	14°35.6	13°53.5	1.3 - 1.3	7.3 - 7.1	13.3 - 13.0
14	14°33.5	14°35.9	13°53.7	1.4 - 1.4	7.4 - 7.2	13.4 - 13.1
15	14°33.8	14°36.1	13°53.9	1.5 - 1.5	7.5 - 7.3	13.5 - 13.2
16	14°34.0	14°36.4	13°54.2	1.6 - 1.6	7.6 - 7.4	13.6 - 13.3
17	14°34.2	14°36.6	13°54.4	1.7 - 1.7	7.7 - 7.5	13.7 - 13.4
18	14°34.5	14°36.9	13°54.7	1.8 - 1.8	7.8 - 7.6	13.8 - 13.5
19	14°34.8	14°37.1	13°54.9	1.9 - 1.9	7.9 - 7.7	13.9 - 13.6
20	14°35.0	14°37.4	13°55.1	2.0 - 1.9	8.0 - 7.8	14.0 - 13.7
21	14°35.3	14°37.6	13°55.4	2.1 - 2.0	8.1 - 7.9	14.1 - 13.7
22	14°35.5	14°37.9	13°55.6	2.2 - 2.1	8.2 - 8.0	14.2 - 13.8
23	14°35.7	14°38.1	13°55.9	2.3 - 2.2	8.3 - 8.1	14.3 - 13.9
24	14°36.0	14°38.4	13°56.1	2.4 - 2.3	8.4 - 8.2	14.4 - 14.0
25	14°36.2	14°38.6	13°56.3	2.5 - 2.4	8.5 - 8.3	14.5 - 14.1
26	14°36.5	14°38.9	13°56.6	2.6 - 2.5	8.6 - 8.4	14.6 - 14.2
27	14°36.8	14°39.1	13°56.8	2.7 - 2.6	8.7 - 8.5	14.7 - 14.3
28	14°37.0	14°39.4	13°57.0	2.8 - 2.7	8.8 - 8.6	14.8 - 14.4
29	14°37.3	14°39.6	13°57.3	2.9 - 2.8	8.9 - 8.7	14.9 - 14.5
30	14°37.5	14°39.9	13°57.5	3.0 - 2.9	9.0 - 8.8	15.0 - 14.6
31	14°37.7	14°40.1	13°57.8	3.1 - 3.0	9.1 - 8.9	15.1 - 14.7
32	14°38.0	14°40.4	13°58.0	3.2 - 3.1	9.2 - 9.0	15.2 - 14.8
33	14°38.2	14°40.7	13°58.2	3.3 - 3.2	9.3 - 9.1	15.3 - 14.9
34	14°38.5	14°40.9	13°58.5	3.4 - 3.3	9.4 - 9.2	15.4 - 15.0
35	14°38.8	14°41.2	13°58.7	3.5 - 3.4	9.5 - 9.3	15.5 - 15.1
36	14°39.0	14°41.4	13°59.0	3.6 - 3.5	9.6 - 9.4	15.6 - 15.2
37	14°39.3	14°41.7	13°59.2	3.7 - 3.6	9.7 - 9.5	15.7 - 15.3
38	14°39.5	14°41.9	13°59.4	3.8 - 3.7	9.8 - 9.6	15.8 - 15.4
39	14°39.7	14°42.2	13°59.7	3.9 - 3.8	9.9 - 9.7	15.9 - 15.5
40	14°40.0	14°42.4	13°59.9	4.0 - 3.9	10.0 - 9.8	16.0 - 15.6
41	14°40.2	14°42.7	14°00.1	4.1 - 4.0	10.1 - 9.8	16.1 - 15.7
42	14°40.5	14°42.9	14°00.4	4.2 - 4.1	10.2 - 9.9	16.2 - 15.8
43	14°40.8	14°43.2	14°00.6	4.3 - 4.2	10.3 - 10.0	16.3 - 15.9
44	14°41.0	14°43.4	14°00.9	4.4 - 4.3	10.4 - 10.1	16.4 - 16.0
45	14°41.3	14°43.7	14°01.1	4.5 - 4.4	10.5 - 10.2	16.5 - 16.1
46	14°41.5	14°43.9	14°01.3	4.6 - 4.5	10.6 - 10.3	16.6 - 16.2
47	14°41.7	14°44.2	14°01.6	4.7 - 4.6	10.7 - 10.4	16.7 - 16.3
48	14°42.0	14°44.4	14°01.8	4.8 - 4.7	10.8 - 10.5	16.8 - 16.4
49	14°42.3	14°44.7	14°02.1	4.9 - 4.8	10.9 - 10.6	16.9 - 16.5
50	14°42.5	14°44.9	14°02.3	5.0 - 4.9	11.0 - 10.7	17.0 - 16.6
51	14°42.8	14°45.2	14°02.5	5.1 - 5.0	11.1 - 10.8	17.1 - 16.7
52	14°43.0	14°45.4	14°02.8	5.2 - 5.1	11.2 - 10.9	17.2 - 16.8
53	14°43.2	14°45.7	14°03.0	5.3 - 5.2	11.3 - 11.0	17.3 - 16.9
54	14°43.5	14°45.9	14°03.3	5.4 - 5.3	11.4 - 11.1	17.4 - 17.0
55	14°43.7	14°46.2	14°03.5	5.5 - 5.4	11.5 - 11.2	17.5 - 17.1
56	14°44.0	14°46.4	14°03.7	5.6 - 5.5	11.6 - 11.3	17.6 - 17.2
57	14°44.3	14°46.7	14°04.0	5.7 - 5.6	11.7 - 11.4	17.7 - 17.3
58	14°44.5	14°46.9	14°04.2	5.8 - 5.7	11.8 - 11.5	17.8 - 17.4
59	14°44.8	14°47.2	14°04.4	5.9 - 5.8	11.9 - 11.6	17.9 - 17.5

m 59	Sun Plan.	Aries	Moon	v and d corr		
0	14°45.0	14°47.4	14°04.7	0.0 - 0.0	6.0 - 6.0	12.0 - 11.9
1	14°45.2	14°47.7	14°04.9	0.1 - 0.1	6.1 - 6.0	12.1 - 12.0
2	14°45.5	14°47.9	14°05.2	0.2 - 0.2	6.2 - 6.1	12.2 - 12.1
3	14°45.7	14°48.2	14°05.4	0.3 - 0.3	6.3 - 6.2	12.3 - 12.2
4	14°46.0	14°48.4	14°05.6	0.4 - 0.4	6.4 - 6.3	12.4 - 12.3
5	14°46.3	14°48.7	14°05.9	0.5 - 0.5	6.5 - 6.4	12.5 - 12.4
6	14°46.5	14°48.9	14°06.1	0.6 - 0.6	6.6 - 6.5	12.6 - 12.5
7	14°46.8	14°49.2	14°06.4	0.7 - 0.7	6.7 - 6.6	12.7 - 12.6
8	14°47.0	14°49.4	14°06.6	0.8 - 0.8	6.8 - 6.7	12.8 - 12.7
9	14°47.2	14°49.7	14°06.8	0.9 - 0.9	6.9 - 6.8	12.9 - 12.8
10	14°47.5	14°49.9	14°07.1	1.0 - 1.0	7.0 - 6.9	13.0 - 12.9
11	14°47.7	14°50.2	14°07.3	1.1 - 1.1	7.1 - 7.0	13.1 - 13.0
12	14°48.0	14°50.4	14°07.5	1.2 - 1.2	7.2 - 7.1	13.2 - 13.1
13	14°48.3	14°50.7	14°07.8	1.3 - 1.3	7.3 - 7.2	13.3 - 13.2
14	14°48.5	14°50.9	14°08.0	1.4 - 1.4	7.4 - 7.3	13.4 - 13.3
15	14°48.8	14°51.2	14°08.3	1.5 - 1.5	7.5 - 7.4	13.5 - 13.4
16	14°49.0	14°51.4	14°08.5	1.6 - 1.6	7.6 - 7.5	13.6 - 13.5
17	14°49.2	14°51.7	14°08.7	1.7 - 1.7	7.7 - 7.6	13.7 - 13.6
18	14°49.5	14°51.9	14°09.0	1.8 - 1.8	7.8 - 7.7	13.8 - 13.7
19	14°49.8	14°52.2	14°09.2	1.9 - 1.9	7.9 - 7.8	13.9 - 13.8
20	14°50.0	14°52.4	14°09.5	2.0 - 2.0	8.0 - 7.9	14.0 - 13.9
21	14°50.3	14°52.7	14°09.7	2.1 - 2.1	8.1 - 8.0	14.1 - 14.0
22	14°50.5	14°52.9	14°09.9	2.2 - 2.2	8.2 - 8.1	14.2 - 14.1
23	14°50.7	14°53.2	14°10.2	2.3 - 2.3	8.3 - 8.2	14.3 - 14.2
24	14°51.0	14°53.4	14°10.4	2.4 - 2.4	8.4 - 8.3	14.4 - 14.3
25	14°51.2	14°53.7	14°10.6	2.5 - 2.5	8.5 - 8.4	14.5 - 14.4
26	14°51.5	14°53.9	14°10.9	2.6 - 2.6	8.6 - 8.5	14.6 - 14.5
27	14°51.8	14°54.2	14°11.1	2.7 - 2.7	8.7 - 8.6	14.7 - 14.6
28	14°52.0	14°54.4	14°11.4	2.8 - 2.8	8.8 - 8.7	14.8 - 14.7
29	14°52.3	14°54.7	14°11.6	2.9 - 2.9	8.9 - 8.8	14.9 - 14.8
30	14°52.5	14°54.9	14°11.8	3.0 - 3.0	9.0 - 8.9	15.0 - 14.9
31	14°52.7	14°55.2	14°12.1	3.1 - 3.1	9.1 - 9.0	15.1 - 15.0
32	14°53.0	14°55.4	14°12.3	3.2 - 3.2	9.2 - 9.1	15.2 - 15.1
33	14°53.2	14°55.7	14°12.6	3.3 - 3.3	9.3 - 9.2	15.3 - 15.2
34	14°53.5	14°55.9	14°12.8	3.4 - 3.4	9.4 - 9.3	15.4 - 15.3
35	14°53.8	14°56.2	14°13.0	3.5 - 3.5	9.5 - 9.4	15.5 - 15.4
36	14°54.0	14°56.4	14°13.3	3.6 - 3.6	9.6 - 9.5	15.6 - 15.5
37	14°54.3	14°56.7	14°13.5	3.7 - 3.7	9.7 - 9.6	15.7 - 15.6
38	14°54.5	14°56.9	14°13.8	3.8 - 3.8	9.8 - 9.7	15.8 - 15.7
39	14°54.7	14°57.2	14°14.0	3.9 - 3.9	9.9 - 9.8	15.9 - 15.8
40	14°55.0	14°57.4	14°14.2	4.0 - 4.0	10.0 - 9.9	16.0 - 15.9
41	14°55.2	14°57.7	14°14.5	4.1 - 4.1	10.1 - 10.0	16.1 - 16.0
42	14°55.5	14°57.9	14°14.7	4.2 - 4.2	10.2 - 10.1	16.2 - 16.1
43	14°55.8	14°58.2	14°14.9	4.3 - 4.3	10.3 - 10.2	16.3 - 16.2
44	14°56.0	14°58.4	14°15.2	4.4 - 4.4	10.4 - 10.3	16.4 - 16.3
45	14°56.3	14°58.7	14°15.4	4.5 - 4.5	10.5 - 10.4	16.5 - 16.4
46	14°56.5	14°59.0	14°15.7	4.6 - 4.6	10.6 - 10.5	16.6 - 16.5
47	14°56.7	14°59.2	14°15.9	4.7 - 4.7	10.7 - 10.6	16.7 - 16.6
48	14°57.0	14°59.5	14°16.1	4.8 - 4.8	10.8 - 10.7	16.8 - 16.7
49	14°57.3	14°59.7	14°16.4	4.9 - 4.9	10.9 - 10.8	16.9 - 16.8
50	14°57.5	15°00.0	14°16.6	5.0 - 5.0	11.0 - 10.9	17.0 - 16.9
51	14°57.8	15°00.2	14°16.9	5.1 - 5.1	11.1 - 11.0	17.1 - 17.0
52	14°58.0	15°00.5	14°17.1	5.2 - 5.2	11.2 - 11.1	17.2 - 17.1
53	14°58.2	15°00.7	14°17.3	5.3 - 5.3	11.3 - 11.2	17.3 - 17.2
54	14°58.5	15°01.0	14°17.6	5.4 - 5.4	11.4 - 11.3	17.4 - 17.3
55	14°58.7	15°01.2	14°17.8	5.5 - 5.5	11.5 - 11.4	17.5 - 17.4
56	14°59.0	15°01.5	14°18.0	5.6 - 5.6	11.6 - 11.5	17.6 - 17.5
57	14°59.3	15°01.7	14°18.3	5.7 - 5.7	11.7 - 11.6	17.7 - 17.6
58	14°59.5	15°02.0	14°18.5	5.8 - 5.8	11.8 - 11.7	17.8 - 17.7
59	14°59.8	15°02.2	14°18.8	5.9 - 5.9	11.9 - 11.8	17.9 - 17.8

Altitude Correction Tables for 10° to 90° — Sun, Stars, Planets

SUN
October – March

App. Alt.	Lower Limb	Upper Limb
° ′	′	′
9 33	+10.8	– 21.5
9 45	+10.9	– 21.4
9 56	+11.0	– 21.3
10 08	+11.1	– 21.2
10 20	+11.2	– 21.1
10 33	+11.3	– 21.0
10 46	+11.4	– 20.9
11 00	+11.5	– 20.8
11 15	+11.6	– 20.7
11 30	+11.7	– 20.6
11 45	+11.8	– 20.5
12 01	+11.9	– 20.4
12 18	+12.0	– 20.3
12 36	+12.1	– 20.2
12 54	+12.2	– 20.1
13 14	+12.3	– 20.0
13 34	+12.4	– 19.9
13 55	+12.5	– 19.8
14 17	+12.6	– 19.7
14 41	+12.7	– 19.6
15 05	+12.8	– 19.5
15 31	+12.9	– 19.4
15 59	+13.0	– 19.3
16 27	+13.1	– 19.2
16 58	+13.2	– 19.1
17 30	+13.3	– 19.0
18 05	+13.4	– 18.9
18 41	+13.5	– 18.8
19 20	+13.6	– 18.7
20 02	+13.7	– 18.6
20 46	+13.8	– 18.5
21 34	+13.9	– 18.4
22 25	+14.0	– 18.3
23 20	+14.1	– 18.2
24 20	+14.2	– 18.1
25 24	+14.3	– 18.0
26 34	+14.4	– 17.9
27 50	+14.5	– 17.8
29 13	+14.6	– 17.7
30 44	+14.7	– 17.6
32 24	+14.8	– 17.5
34 15	+14.9	– 17.4
36 17	+15.0	– 17.3
38 34	+15.1	– 17.2
41 06	+15.2	– 17.1
43 56	+15.3	– 17.0
47 07	+15.4	– 16.9
50 43	+15.5	– 16.8
54 46	+15.6	– 16.7
59 21	+15.7	– 16.6
64 28	+15.8	– 16.5
70 10	+15.9	– 16.4
76 24	+16.0	– 16.3
83 05	+16.1	– 16.2
90 00		

SUN
April – September

App. Alt.	Lower Limb	Upper Limb
° ′	′	′
9 39	+10.6	– 21.2
9 50	+10.7	– 21.1
10 02	+10.8	– 21.0
10 14	+10.9	– 20.9
10 27	+11.0	– 20.8
10 40	+11.1	– 20.7
10 53	+11.2	– 20.6
11 07	+11.3	– 20.5
11 22	+11.4	– 20.4
11 37	+11.5	– 20.3
11 53	+11.6	– 20.2
12 10	+11.7	– 20.1
12 27	+11.8	– 20.0
14 45	+11.9	– 19.9
13 04	+12.0	– 19.8
13 24	+12.1	– 19.7
13 44	+12.2	– 19.6
14 06	+12.3	– 19.5
14 29	+12.4	– 19.4
14 53	+12.5	– 19.3
15 18	+12.6	– 19.2
15 45	+12.7	– 19.1
16 13	+12.8	– 19.0
16 43	+12.9	– 18.9
17 14	+13.0	– 18.8
17 47	+13.1	– 18.7
18 23	+13.2	– 18.6
19 00	+13.3	– 18.5
19 41	+13.4	– 18.4
20 24	+13.5	– 18.3
21 10	+13.6	– 18.2
21 59	+13.7	– 18.1
22 52	+13.8	– 18.0
23 49	+13.9	– 17.9
24 51	+14.0	– 17.8
25 58	+14.1	– 17.7
27 11	+14.2	– 17.6
28 31	+14.3	– 17.5
29 58	+14.4	– 17.4
31 33	+14.5	– 17.3
33 18	+14.6	– 17.2
35 15	+14.7	– 17.1
37 24	+14.8	– 17.0
39 48	+14.9	– 16.9
42 28	+15.0	– 16.8
45 29	+15.1	– 16.7
48 52	+15.2	– 16.6
51 41	+15.3	– 16.5
56 59	+15.4	– 16.4
61 50	+15.5	– 16.3
67 15	+15.6	– 16.2
73 14	+15.7	– 16.1
79 42	+15.8	– 16.0
86 21	+15.9	– 15.9
90 00		

Stars & Planets

App. Alt.	Corr
° ′	′
9 55	– 5.3
10 07	– 5.2
10 20	– 5.1
10 32	– 5.0
10 46	– 4.9
10 59	– 4.8
11 14	– 4.7
11 29	– 4.6
11 44	– 4.5
12 00	– 4.4
12 17	– 4.3
12 35	– 4.2
12 53	– 4.1
13 12	– 4.0
13 32	– 3.9
13 53	– 3.8
14 16	– 3.7
14 39	– 3.6
15 03	– 3.5
15 29	– 3.4
15 56	– 3.3
16 25	– 3.2
16 55	– 3.1
17 27	– 3.0
18 01	– 2.9
18 37	– 2.8
19 16	– 2.7
19 56	– 2.6
20 40	– 2.5
21 27	– 2.4
22 17	– 2.3
23 11	– 2.2
24 09	– 2.1
25 12	– 2.0
26 20	– 1.9
27 34	– 1.8
28 54	– 1.7
30 22	– 1.6
31 58	– 1.5
33 43	– 1.4
35 38	– 1.3
37 45	– 1.2
40 06	– 1.1
42 42	– 1.0
45 34	– 0.9
48 45	– 0.8
52 16	– 0.7
56 09	– 0.6
60 26	– 0.5
65 06	– 0.4
70 09	– 0.3
75 32	– 0.2
81 12	– 0.1
87 03	0.0
90 00	

Additional Altitude Correction for Mars & Venus

A small additional altitude correction for Mars & Venus can be obtained in the Daily Pages of The Nautical Almanac for the day of the observation.

Find the correction in the block labeled **Horizontal parallax**.

The figure will cover the range of 3 days found on that Daily Page.

The correction is to be added to Apparent Altitude.

Refraction

App. Alt.	Corr
°	′
5.5	– 9.1
6.0	– 8.5
6.5	– 7.9
7.0	– 7.5
7.5	– 7.0
8.0	– 6.6
8.5	– 6.3
9.0	– 5.9
9.5	– 5.7
10.0	– 5.4
10.5	– 5.1
11.0	– 4.9
11.5	– 4.7
12.0	– 4.5
12.5	– 4.4
13.0	– 4.2
13.5	– 4.0
14.0	– 3.9
14.5	– 3.8
15.0	– 3.6
15.5	– 3.5
16.0	– 3.4
16.5	– 3.3
17.0	– 3.2
17.5	– 3.1
18.0	– 3.0
18.5	– 2.9
19.0	– 2.9
19.5	– 2.8
20.0	– 2.7
21.0	– 2.6
22.0	– 2.4
23.0	– 2.3
24.0	– 2.2
25.0	– 2.1
26.0	– 2.0
27.0	– 1.9
28.0	– 1.9
29.0	– 1.8
30.0	– 1.7
31.0	– 1.7
32.0	– 1.6
33.0	– 1.5
34.0	– 1.5
35.0	– 1.4
36.0	– 1.4
37.0	– 1.3
38.0	– 1.3
39.0	– 1.2
40.0	– 1.2
45.0	– 1.0
50.0	– 0.8
55.0	– 0.7
60.0	– 0.6
65.0	– 0.5
70.0	– 0.4
75.0	– 0.3
80.0	– 0.2
85.0	– 0.1

DIP
always subtracted from Hs

Ht. of Eye	Corr	Ht. of Eye	Ht. of Eye	Corr
meters	′	**feet**	**meters**	′
2.4	**– 2.8**	8.0	1.0	**– 1.8**
2.6	**– 2.9**	8.6	1.5	**– 2.2**
2.8	**– 3.0**	9.2	2.0	**– 2.5**
3.0	**– 3.1**	9.8	2.5	**– 2.8**
3.2	**– 3.2**	10.5	3.0	**– 3.0**
3.4	**– 3.3**	11.2	See table ←	
3.6	**– 3.4**	11.9		
3.8	**– 3.5**	12.6	**meters**	
4.0	**– 3.6**	13.3	20	**– 7.9**
4.3	**– 3.7**	14.1	22	**– 8.3**
4.5	**– 3.8**	14.9	24	**– 8.6**
4.7	**– 3.9**	15.7	26	**– 9.0**
5.0	**– 4.0**	16.5	28	**– 9.3**
5.2	**– 4.1**	17.4		
5.5	**– 4.2**	18.3	30	**– 9.6**
5.8	**– 4.3**	19.1	32	**– 10.0**
6.1	**– 4.4**	20.1	34	**– 10.3**
6.3	**– 4.5**	21.0	36	**– 10.6**
6.6	**– 4.6**	22.0	38	**– 10.8**
6.9	**– 4.7**	22.9		
7.2	**– 4.8**	23.9	40	**– 11.1**
7.5	**– 4.9**	24.9	42	**– 11.4**
7.9	**– 5.0**	26.0	44	**– 11.7**
8.2	**– 5.1**	27.1	46	**– 11.9**
8.5	**– 5.2**	28.1	48	**– 12.2**
8.8	**– 5.3**	29.2	**feet**	′
9.2	**– 5.4**	30.4	2	**– 1.4**
9.5	**– 5.5**	31.5	4	**– 1.9**
9.9	**– 5.6**	32.7	6	**– 2.4**
10.3	**– 5.7**	33.9	8	**– 2.7**
10.6	**– 5.8**	35.1	10	**– 3.1**
11.0	**– 5.9**	36.3	See table ←	
11.4	**– 6.0**	37.6		
11.8	**– 6.1**	38.9	**feet**	′
12.2	**– 6.2**	40.1	70	**– 8.1**
12.6	**– 6.3**	41.5	75	**– 8.4**
13.0	**– 6.4**	42.8	80	**– 8.7**
13.4	**– 6.5**	44.2	85	**– 8.9**
13.8	**– 6.6**	45.5	90	**– 9.2**
14.2	**– 6.7**	46.9	95	**9.5**
14.7	**– 6.8**	48.4		
15.1	**– 6.9**	49.8	100	**– 9.7**
15.5	**– 7.0**	51.3	105	**– 9.9**
16.0	**– 7.1**	52.8	110	**– 10.2**
16.5	**– 7.2**	54.3	115	**– 10.4**
16.9	**– 7.3**	55.8	120	**– 10.6**
17.4	**– 7.4**	57.4	125	**– 10.8**
17.9	**– 7.5**	58.9	130	**– 11.1**
18.4	**– 7.6**	60.5	135	**– 11.3**
18.8	**– 7.7**	62.1	140	**– 11.5**
19.3	**– 7.8**	63.8	145	**– 11.7**
19.8	**– 7.9**	65.4	150	**– 11.9**
20.4	**– 8.0**	67.1	155	**– 12.1**
20.9	**– 8.1**	68.8		
21.4		70.5		

App. Alt. = Apparent altitude = Sextant altitude corrected for index error and dip.

Altitude Correction Tables for 0° to 10° — Sun, Stars, Planets

App. Alt.	Sun October – March Lower Limb	Sun October – March Upper Limb	Sun April – September Lower Limb	Sun April – September Upper Limb	Stars & Planets
° ′	′	′	′	′	′
0 00	– 17.5	– 49.8	– 17.8	– 49.6	– 33.8
0 03	16.9	49.2	17.2	49.0	33.2
0 06	16.3	48.6	16.6	48.4	32.6
0 09	15.7	48.0	16.0	47.8	32.0
0 12	15.2	47.5	15.4	47.2	31.5
0 15	14.6	46.9	14.8	46.6	30.9
0 18	– 14.1	– 46.4	– 14.3	– 46.1	– 30.4
0 21	13.5	45.8	13.8	33.8	29.8
0 24	13.0	45.3	13.3	45.1	29.3
0 27	12.5	44.8	12.8	44.6	28.8
0 30	12.0	44.3	12.3	44.1	28.3
0 33	11.6	43.9	11.8	43.6	27.9
0 36	– 11.1	– 10.0	– 11.3	– 43.1	– 27.4
0 39	10.6	42.9	10.9	42.7	26.9
0 42	10.2	42.5	10.5	42.3	26.5
0 45	9.8	42.1	10.0	41.8	26.1
0 48	9.4	41.7	9.6	41.4	25.7
0 51	9.0	41.3	9.2	41.0	25.3
0 54	– 8.6	– 40.9	– 8.8	– 40.6	– 24.9
0 57	8.2	40.5	8.4	40.2	24.5
1 00	7.8	40.1	8.0	39.8	24.1
1 03	7.4	39.7	7.7	39.5	23.7
1 06	7.1	39.4	7.3	39.1	23.4
1 09	6.7	39.0	7.0	38.8	23.0
1 12	– 6.4	– 38.7	– 6.6	– 38.4	– 22.7
1 15	6.0	38.3	6.3	38.1	22.3
1 18	5.7	38.0	6.0	37.8	22.0
1 21	5.4	37.7	5.7	37.5	21.7
1 24	5.1	37.4	5.3	37.1	21.4
1 27	4.8	37.1	5.0	33.8	21.1
1 30	– 4.5	– 36.8	– 4.7	– 36.5	– 20.8
1 35	4.0	36.3	4.3	36.1	20.3
1 40	3.6	35.9	3.8	35.6	19.9
1 45	3.1	35.4	3.4	35.2	19.4
1 50	2.7	35.0	2.9	34.7	19.0
1 55	2.3	34.6	2.5	34.3	18.6
2 00	– 1.9	– 34.2	– 2.1	– 33.9	– 18.2
2 05	1.5	33.8	1.7	33.5	17.8
2 10	1.1	33.4	1.4	33.2	17.4
2 15	0.8	33.1	1.0	32.8	17.1
2 20	0.4	32.7	0.7	32.5	16.7
2 25	– 0.1	32.4	– 0.3	32.1	16.4
2 30	+ 0.2	– 32.1	0.0	– 31.8	– 16.1
2 35	0.5	31.8	+ 0.3	31.5	15.8
2 40	0.8	31.5	0.6	31.2	15.4
2 45	1.1	31.2	0.9	30.9	15.2
2 50	1.4	30.9	1.2	30.6	14.9
2 55	1.7	30.6	1.4	30.4	14.9
3 00	+ 2.0	– 30.3	+ 1.7	– 30.1	– 14.3
3 05	2.2	30.1	2.0	29.8	14.1
3 10	2.5	29.8	2.2	29.6	13.8
3 15	2.7	29.6	2.5	29.3	13.6
3 20	2.9	29.4	2.7	29.1	13.4
3 25	3.2	29.1	2.9	28.9	13.4
3 30	3.4	– 28.9	+ 3.1	– 28.7	– 12.9

App. Alt.	Sun October – March Lower Limb	Sun October – March Upper Limb	Sun April – September Lower Limb	Sun April – September Upper Limb	Stars & Planets
° ′	′	′	′	′	′
3 30	+ 3.4	– 28.9	+ 3.1	– 28.7	– 12.9
3 35	3.6	28.7	3.3	28.5	12.7
3 40	3.8	28.5	3.6	28.2	12.5
3 45	4.0	28.3	3.8	28.0	12.3
3 50	4.2	28.1	4.0	27.8	12.1
3 55	4.4	27.9	4.1	27.7	11.9
4 00	+ 4.6	– 27.7	+ 4.3	– 27.5	– 11.7
4 05	4.8	27.5	4.5	27.3	11.5
4 10	4.9	27.4	4.7	27.1	11.4
4 15	5.1	27.2	4.9	26.9	11.2
4 20	5.3	27.0	5.0	26.8	11.0
4 25	5.4	26.9	5.2	26.6	10.9
4 30	+ 5.6	– 26.7	+ 5.3	– 26.5	– 10.7
4 35	5.7	26.6	5.5	26.3	10.6
4 40	5.9	26.4	5.6	26.2	10.4
4 45	6.0	26.3	5.8	26.0	10.3
4 50	6.2	26.1	5.9	25.9	10.1
4 55	6.3	26.0	6.1	25.7	10.0
5 00	+ 6.4	– 25.9	+ 6.2	– 25.6	– 9.9
5 05	6.6	25.7	6.3	25.5	9.7
5 10	6.7	25.6	6.5	25.3	9.6
5 15	6.8	25.5	6.6	25.2	9.5
5 20	7.0	25.3	6.7	25.1	9.3
5 25	7.1	25.2	6.8	25.0	9.2
5 30	+ 7.2	– 25.1	+ 6.9	– 24.9	– 9.1
5 35	7.3	25.0	7.1	24.7	9.0
5 40	7.4	24.9	7.2	24.6	8.9
5 45	7.5	24.8	7.3	24.5	8.8
5 50	7.6	24.7	7.4	24.4	8.7
5 55	7.7	24.6	7.5	24.3	8.6
6 00	+ 7.8	– 24.5	+ 7.6	– 24.2	– 8.5
6 10	8.0	24.3	7.8	24.0	8.3
6 20	8.2	24.1	8.0	23.8	8.1
6 30	8.4	23.9	8.2	23.6	7.9
6 40	8.6	23.7	8.3	23.5	7.7
6 50	8.7	23.6	8.5	23.3	7.6
7 00	+ 8.9	– 23.4	+ 8.7	– 23.1	– 7.4
7 10	9.1	23.2	8.8	23.0	7.2
7 20	9.2	23.1	9.0	22.8	7.1
7 30	9.3	23.0	9.1	22.7	6.9
7 40	9.5	22.8	9.2	22.6	6.8
7 50	9.6	22.7	9.4	22.4	6.7
8 00	+ 9.7	– 22.6	+ 9.5	– 22.3	– 6.6
8 10	9.9	22.4	9.6	22.2	6.4
8 20	10.0	22.3	9.7	22.1	6.3
8 30	10.1	22.2	9.9	21.9	6.2
8 40	10.2	22.1	10.0	21.8	6.1
8 50	10.3	22.0	10.1	21.7	6.0
9 00	+ 10.4	– 21.9	+ 10.2	– 21.6	– 5.9
9 10	10.5	21.8	10.3	21.5	5.8
9 20	10.6	21.7	10.4	21.4	5.7
9 30	10.7	21.6	10.5	21.3	5.6
9 40	10.8	21.5	10.6	21.2	5.5
9 50	10.9	21.4	10.6	21.2	5.4
10 00	+ 11.0	– 21.3	+ 10.7	– 21.1	– 5.3

For bubble sextant observations- ignore dip and use star corrections for the Sun, planets and stars.

ALTITUDE CORRECTION TABLES 0° – 35° — MOON

App. Alt.	0° – 4°		5° – 9°		10° – 14°		15° – 19°		20° – 24°		25° – 29°		30° – 34°		App. Alt.
	Corrⁿ		Corrⁿ		Corrⁿ		Corrⁿ		Corrⁿ		Corrⁿ		Corrⁿ		
'	'		'		'		'		'		'		'		'
	0°		5°		10°		15°		20°		25°		30°		
00	34.5		58.2		62.1		62.8		62.2		60.8		58.9		00
10	36.5		58.5		62.2		62.8		62.2		60.8		58.8		10
20	38.3		58.7		62.2		62.8		62.1		60.7		58.8		20
30	40.0		58.9		62.3		62.8		62.1		60.7		58.7		30
40	41.5		59.1		62.3		62.8		62.0		60.6		58.6		40
50	42.9		59.3		62.4		62.7		62.0		60.6		58.5		50
	1°		6°		11°		16°		21°		26°		31°		
00	44.2		59.5		62.4		62.7		62.0		60.5		58.5		00
10	45.4		59.7		62.4		62.7		61.9		60.4		58.4		10
20	46.5		59.9		62.5		62.7		61.9		60.4		58.3		20
30	47.5		60.0		62.5		62.7		61.9		60.3		58.2		30
40	48.4		60.2		62.5		62.7		61.8		60.3		58.2		40
50	49.3		60.3		62.6		62.7		61.8		60.2		58.1		50
	2°		7°		12°		17°		22°		27°		32°		
00	50.1		60.5		62.6		62.7		61.7		60.1		58.0		00
10	50.8		60.6		62.6		62.6		61.7		60.1		57.9		10
20	51.5		60.7		62.6		62.6		61.6		60.0		57.8		20
30	52.2		60.9		62.7		62.6		61.6		59.9		57.8		30
40	52.8		61.0		62.7		62.6		61.6		59.9		57.7		40
50	53.4		61.1		62.7		62.6		61.5		59.8		57.6		50
	3°		8°		13°		18°		23°		28°		33°		
00	53.9		61.2		62.7		62.5		61.5		59.7		57.5		00
10	54.4		61.3		62.7		62.5		61.4		59.7		57.4		10
20	54.9		61.4		62.7		62.5		61.4		59.6		57.4		20
30	55.3		61.5		62.8		62.5		61.3		59.5		57.3		30
40	55.7		61.6		62.8		62.4		61.3		59.5		57.2		40
50	56.1		61.6		62.8		62.4		61.2		59.4		57.1		50
	4°		9°		14°		19°		24°		29°		34°		
00	56.4		61.7		62.8		62.4		61.2		59.3		57.0		00
10	56.8		61.8		62.8		62.4		61.1		59.3		56.9		10
20	57.1		61.9		62.8		62.3		61.1		59.2		56.9		20
30	57.4		61.9		62.8		62.3		61.0		59.1		56.8		30
40	57.7		62.0		62.8		62.3		61.0		59.1		56.7		40
50	58.0		62.1		62.8		62.2		60.9		59.0		56.6		50
HP	L	U	L	U	L	U	L	U	L	U	L	U	L	U	HP
'	'	'	'	'	'	'	'	'	'	'	'	'	'	'	'
54.0	0.3	0.9	0.3	0.9	0.4	1.0	0.5	1.1	0.6	1.2	0.7	1.3	0.9	1.5	54.0
54.3	0.7	1.1	0.7	1.2	0.8	1.2	0.8	1.3	0.9	1.4	1.1	1.5	1.2	1.7	54.3
54.6	1.1	1.4	1.1	1.4	1.1	1.4	1.2	1.5	1.3	1.6	1.4	1.7	1.5	1.8	54.6
54.9	1.4	1.6	1.4	1.6	1.5	1.6	1.6	1.7	1.6	1.8	1.8	1.9	1.9	2.0	54.9
55.2	1.8	1.8	1.8	1.8	1.9	1.8	1.9	1.9	2.0	2.0	2.1	2.1	2.2	2.2	55.2
55.5	2.2	2.0	2.2	2.0	2.3	2.1	2.3	2.1	2.4	2.2	2.4	2.3	2.5	2.4	55.5
55.8	2.6	2.2	2.6	2.2	2.6	2.3	2.7	2.3	2.7	2.4	2.8	2.4	2.9	2.5	55.8
56.1	3.0	2.4	3.0	2.5	3.0	2.5	3.0	2.5	3.1	2.6	3.1	2.6	3.2	2.7	56.1
56.4	3.3	2.7	3.3	2.7	3.4	2.7	3.4	2.7	3.4	2.8	3.5	2.8	3.5	2.9	56.4
56.7	3.7	2.9	3.7	2.9	3.8	2.9	3.8	2.9	3.8	3.0	3.8	3.0	3.9	3.0	56.7
57.0	4.1	3.1	4.1	3.1	4.1	3.1	4.1	3.1	4.2	3.2	4.2	3.2	4.2	3.2	57.0
57.3	4.5	3.3	4.5	3.3	4.5	3.3	4.5	3.3	4.5	3.3	4.5	3.4	4.6	3.4	57.3
57.6	4.9	3.5	4.9	3.5	4.9	3.5	4.9	3.5	4.9	3.5	4.9	3.5	4.9	3.6	57.6
57.9	5.3	3.8	5.3	3.8	5.2	3.8	5.2	3.7	5.2	3.7	5.2	3.7	5.2	3.7	57.9
58.2	5.6	4.0	5.6	4.0	5.6	4.0	5.6	4.0	5.6	3.9	5.6	3.9	5.6	3.9	58.2
58.5	6.0	4.2	6.0	4.2	6.0	4.2	6.0	4.2	6.0	4.1	5.9	4.1	5.9	4.1	58.5
58.8	6.4	4.4	6.4	4.4	6.4	4.4	6.3	4.4	6.3	4.3	6.3	4.3	6.2	4.2	58.8
59.1	6.8	4.6	6.8	4.6	6.7	4.6	6.7	4.6	6.7	4.5	6.6	4.5	6.6	4.4	59.1
59.4	7.2	4.8	7.1	4.8	7.1	4.8	7.1	4.8	7.0	4.7	7.0	4.7	6.9	4.6	59.4
59.7	7.5	5.1	7.5	5.0	7.5	5.0	7.5	5.0	7.4	4.9	7.3	4.8	7.2	4.8	59.7
60.0	7.9	5.3	7.9	5.3	7.9	5.2	7.8	5.2	7.8	5.1	7.7	5.0	7.6	4.9	60.0
60.3	8.3	5.5	8.3	5.5	8.2	5.4	8.2	5.4	8.1	5.3	8.0	5.2	7.9	5.1	60.3
60.6	8.7	5.7	8.7	5.7	8.6	5.7	8.6	5.6	8.5	5.5	8.4	5.4	8.2	5.3	60.6
60.9	9.1	5.9	9.0	5.9	9.0	5.9	8.9	5.8	8.8	5.7	8.7	5.6	8.6	5.4	60.9
61.2	9.5	6.2	9.4	6.1	9.4	6.1	9.3	6.0	9.2	5.9	9.1	5.8	8.9	5.6	61.2
61.5	9.8	6.4	9.8	6.3	9.7	6.3	9.7	6.2	9.5	6.1	9.4	5.9	9.2	5.8	61.5

DIP					
Ht. of Eye	Corrⁿ	Ht. of Eye	Ht. of Eye	Corrⁿ	Ht. of Eye
m	'	ft	m	'	ft
2.4	-2.8	7.9	9.5	-5.5	31.2
2.6	-2.9	8.5	9.9	-5.6	32.5
2.8	-3.0	9.2	10.3	-5.7	33.8
3.0	-3.1	9.8	10.6	-5.8	34.8
3.2	-3.2	10.5	11.0	-5.9	36.1
3.4	-3.3	11.2	11.4	-6.0	37.4
3.6	-3.4	11.8	11.8	-6.1	38.7
3.8	-3.5	12.5	12.2	-6.2	40.0
4.0	-3.6	13.1	12.6	-6.3	41.3
4.3	-3.7	14.1	13.0	-6.4	42.7
4.5	-3.8	14.8	13.4	-6.5	44.0
4.7	-3.9	15.4	13.8	-6.6	45.3
5.0	-4.0	16.4	14.2	-6.7	46.6
5.2	-4.1	17.1	14.7	-6.8	48.2
5.5	-4.2	18.0	15.1	-6.9	49.5
5.8	-4.3	19.0	15.5	-7.0	50.9
6.1	-4.4	20.0	16.0	-7.1	52.5
6.3	-4.5	20.7	16.5	-7.2	54.1
6.6	-4.6	21.7	16.9	-7.3	55.4
6.9	-4.7	22.6	17.4	-7.4	57.1
7.2	-4.8	23.6	17.9	-7.5	58.7
7.5	-4.9	24.6	18.4	-7.6	60.4
7.9	-5.0	25.9	18.8	-7.7	61.7
8.2	-5.1	26.9	19.3	-7.8	63.3
8.5	-5.2	27.9	19.8	-7.9	65.0
8.8	-5.3	28.9	20.4	-8.0	66.9
9.2	-5.4	30.2	20.9	-8.1	68.6
9.5		31.2	21.4		70.2

MOON CORRECTION TABLE

The correction is in two parts; the first correction is taken from the upper part of the table with argument apparent altitude, and the second from the lower part, with argument HP, in the same column as that from which the first correction was taken. Separate corrections are given in the lower part for lower (L) and upper (U) limbs. All corrections are to be **added** to apparent altitude, *but* 30' *is to be subtracted from the altitude of the upper limb.*

For corrections for pressure and temperature see page A4.

For bubble sextant observations ignore dip, take the mean of upper and lower limb corrections and subtract 15' from the altitude.

App. Alt. = Apparent altitude = Sextant altitude corrected for index error and dip.

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ALTITUDE CORRECTION TABLES 35° – 90° — MOON

App. Alt.	35° – 39°		40° – 44°		45° – 49°		50° – 54°		55° – 59°		60° – 64°		65° – 69°		70° – 74°		75° – 79°		80° – 84°		85° – 89°		App. Alt.
	Corrⁿ		Corrⁿ		Corrⁿ		Corrⁿ		Corrⁿ		Corrⁿ		Corrⁿ		Corrⁿ		Corrⁿ		Corrⁿ		Corrⁿ		
'	35°	'	40°	'	45°	'	50°	'	55°	'	60°	'	65°	'	70°	'	75°	'	80°	'	85°	'	'
00		56.5		53.7		50.5		46.9		43.1		38.9		34.6		30.0		25.3		20.5		15.6	00
10		56.4		53.6		50.4		46.8		42.9		38.8		34.4		29.9		25.2		20.4		15.5	10
20		56.3		53.5		50.2		46.7		42.8		38.7		34.3		29.7		25.0		20.2		15.3	20
30		56.2		53.4		50.1		46.5		42.7		38.5		34.1		29.6		24.9		20.0		15.1	30
40		56.2		53.3		50.0		46.4		42.5		38.4		34.0		29.4		24.7		19.9		15.0	40
50		56.1		53.2		49.9		46.3		42.4		38.2		33.8		29.3		24.5		19.7		14.8	50
	36°		41°		46°		51°		56°		61°		66°		71°		76°		81°		86°		
00		56.0		53.1		49.8		46.2		42.3		38.1		33.7		29.1		24.4		19.6		14.6	00
10		55.9		53.0		49.7		46.0		42.1		37.9		33.5		29.0		24.2		19.4		14.5	10
20		55.8		52.9		49.5		45.9		42.0		37.8		33.4		28.8		24.1		19.2		14.3	20
30		55.7		52.8		49.4		45.8		41.9		37.7		33.2		28.7		23.9		19.1		14.2	30
40		55.6		52.6		49.3		45.7		41.7		37.5		33.1		28.5		23.8		18.9		14.0	40
50		55.5		52.5		49.2		45.5		41.6		37.4		32.9		28.3		23.6		18.7		13.8	50
	37°		42°		47°		52°		57°		62°		67°		72°		77°		82°		87°		
00		55.4		52.4		49.1		45.4		41.4		37.2		32.8		28.2		23.4		18.6		13.7	00
10		55.3		52.3		49.0		45.3		41.3		37.1		32.6		28.0		23.3		18.4		13.5	10
20		55.2		52.2		48.8		45.2		41.2		36.9		32.5		27.9		23.1		18.2		13.3	20
30		55.1		52.1		48.7		45.0		41.0		36.8		32.3		27.7		22.9		18.1		13.2	30
40		55.0		52.0		48.6		44.9		40.9		36.6		32.2		27.6		22.8		17.9		13.0	40
50		55.0		51.9		48.5		44.8		40.8		36.5		32.0		27.4		22.6		17.8		12.8	50
	38°		43°		48°		53°		58°		63°		68°		73°		78°		83°		88°		
00		54.9		51.8		48.4		44.6		40.6		36.4		31.9		27.2		22.5		17.6		12.7	00
10		54.8		51.7		48.3		44.5		40.5		36.2		31.7		27.1		22.3		17.4		12.5	10
20		54.7		51.6		48.1		44.4		40.3		36.1		31.6		26.9		22.1		17.3		12.3	20
30		54.6		51.5		48.0		44.2		40.2		35.9		31.4		26.8		22.0		17.1		12.2	30
40		54.5		51.4		47.9		44.1		40.1		35.8		31.3		26.6		21.8		16.9		12.0	40
50		54.4		51.2		47.8		44.0		39.9		35.6		31.1		26.5		21.7		16.8		11.8	50
	39°		44°		49°		54°		59°		64°		69°		74°		79°		84°		89°		
00		54.3		51.1		47.7		43.9		39.8		35.5		31.0		26.3		21.5		16.6		11.7	00
10		54.2		51.0		47.5		43.7		39.6		35.3		30.8		26.1		21.3		16.4		11.5	10
20		54.1		50.9		47.4		43.6		39.5		35.2		30.7		26.0		21.2		16.3		11.4	20
30		54.0		50.8		47.3		43.5		39.4		35.0		30.5		25.8		21.0		16.1		11.2	30
40		53.9		50.7		47.2		43.3		39.2		34.9		30.4		25.7		20.9		16.0		11.0	40
50		53.8		50.6		47.0		43.2		39.1		34.7		30.2		25.5		20.7		15.8		10.9	50
HP	L	U	L	U	L	U	L	U	L	U	L	U	L	U	L	U	L	U	L	U	L	U	HP
'	'	'	'	'	'	'	'	'	'	'	'	'	'	'	'	'	'	'	'	'	'	'	'
54.0	1.1	1.7	1.3	1.9	1.5	2.1	1.7	2.4	2.0	2.6	2.3	2.9	2.6	3.2	2.9	3.5	3.2	3.8	3.5	4.1	3.8	4.5	54.0
54.3	1.4	1.8	1.6	2.0	1.8	2.2	2.0	2.5	2.2	2.7	2.5	3.0	2.8	3.2	3.1	3.5	3.3	3.8	3.6	4.1	3.9	4.4	54.3
54.6	1.7	2.0	1.9	2.2	2.1	2.4	2.3	2.6	2.5	2.8	2.7	3.0	3.0	3.3	3.2	3.5	3.5	3.8	3.8	4.0	4.0	4.3	54.6
54.9	2.0	2.2	2.2	2.3	2.4	2.5	2.5	2.7	2.7	2.9	2.9	3.1	3.2	3.3	3.4	3.5	3.6	3.8	3.9	4.0	4.1	4.3	54.9
55.2	2.3	2.3	2.5	2.4	2.6	2.6	2.8	2.8	3.0	2.9	3.2	3.1	3.4	3.3	3.6	3.5	3.8	3.7	4.0	4.0	4.2	4.2	55.2
55.5	2.7	2.5	2.8	2.6	2.9	2.7	3.1	2.9	3.2	3.0	3.4	3.2	3.6	3.4	3.7	3.5	3.9	3.7	4.1	3.9	4.3	4.1	55.5
55.8	3.0	2.6	3.1	2.7	3.2	2.8	3.3	3.0	3.5	3.1	3.6	3.3	3.8	3.4	3.9	3.6	4.1	3.7	4.2	3.9	4.4	4.0	55.8
56.1	3.3	2.8	3.4	2.9	3.5	3.0	3.6	3.1	3.7	3.2	3.8	3.3	4.0	3.4	4.1	3.6	4.2	3.7	4.4	3.8	4.5	4.0	56.1
56.4	3.6	2.9	3.7	3.0	3.8	3.1	3.9	3.2	3.9	3.3	4.0	3.4	4.1	3.5	4.3	3.6	4.4	3.7	4.5	3.8	4.6	3.9	56.4
56.7	3.9	3.1	4.0	3.1	4.1	3.2	4.1	3.3	4.2	3.3	4.3	3.4	4.3	3.5	4.4	3.6	4.5	3.7	4.6	3.8	4.7	3.8	56.7
57.0	4.3	3.2	4.3	3.3	4.3	3.3	4.4	3.4	4.4	3.4	4.5	3.5	4.5	3.5	4.6	3.6	4.7	3.6	4.7	3.7	4.8	3.8	57.0
57.3	4.6	3.4	4.6	3.4	4.6	3.4	4.6	3.5	4.7	3.5	4.7	3.5	4.7	3.6	4.8	3.6	4.8	3.6	4.8	3.7	4.9	3.7	57.3
57.6	4.9	3.6	4.9	3.6	4.9	3.6	4.9	3.6	4.9	3.6	4.9	3.6	4.9	3.6	4.9	3.6	5.0	3.6	5.0	3.6	5.0	3.6	57.6
57.9	5.2	3.7	5.2	3.7	5.2	3.7	5.2	3.7	5.2	3.7	5.1	3.6	5.1	3.6	5.1	3.6	5.1	3.6	5.1	3.6	5.1	3.6	57.9
58.2	5.5	3.9	5.5	3.8	5.5	3.8	5.4	3.8	5.4	3.7	5.4	3.7	5.3	3.7	5.3	3.6	5.2	3.6	5.2	3.5	5.2	3.5	58.2
58.5	5.9	4.0	5.8	4.0	5.8	3.9	5.7	3.9	5.6	3.8	5.6	3.8	5.5	3.7	5.5	3.6	5.4	3.6	5.3	3.5	5.3	3.4	58.5
58.8	6.2	4.2	6.1	4.1	6.0	4.1	6.0	4.0	5.9	3.9	5.8	3.8	5.7	3.7	5.6	3.6	5.5	3.5	5.4	3.5	5.3	3.4	58.8
59.1	6.5	4.3	6.4	4.3	6.3	4.2	6.2	4.1	6.1	4.0	6.0	3.9	5.9	3.8	5.8	3.6	5.7	3.5	5.6	3.4	5.4	3.3	59.1
59.4	6.8	4.5	6.7	4.4	6.6	4.3	6.5	4.2	6.4	4.1	6.2	3.9	6.1	3.8	6.0	3.7	5.8	3.5	5.7	3.4	5.5	3.2	59.4
59.7	7.1	4.7	7.0	4.5	6.9	4.4	6.8	4.3	6.6	4.1	6.5	4.0	6.3	3.8	6.1	3.7	6.0	3.5	5.8	3.3	5.6	3.2	59.7
60.0	7.5	4.8	7.3	4.7	7.2	4.5	7.0	4.4	6.9	4.2	6.7	4.0	6.5	3.9	6.3	3.7	6.1	3.5	5.9	3.3	5.7	3.1	60.0
60.3	7.8	5.0	7.6	4.8	7.5	4.7	7.3	4.5	7.1	4.3	6.9	4.1	6.7	3.9	6.5	3.7	6.3	3.5	6.0	3.2	5.8	3.0	60.3
60.6	8.1	5.1	7.9	5.0	7.7	4.8	7.6	4.6	7.3	4.4	7.1	4.2	6.9	3.9	6.7	3.7	6.4	3.4	6.2	3.2	5.9	2.9	60.6
60.9	8.4	5.3	8.2	5.1	8.0	4.9	7.8	4.7	7.6	4.5	7.3	4.2	7.1	4.0	6.8	3.7	6.6	3.4	6.3	3.2	6.0	2.9	60.9
61.2	8.7	5.4	8.5	5.2	8.3	5.0	8.1	4.8	7.8	4.5	7.6	4.3	7.3	4.0	7.0	3.7	6.7	3.4	6.4	3.1	6.1	2.8	61.2
61.5	9.1	5.6	8.8	5.4	8.6	5.1	8.3	4.9	8.1	4.6	7.8	4.3	7.5	4.0	7.2	3.7	6.9	3.4	6.5	3.1	6.2	2.7	61.5

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POLARIS (POLE STAR) TABLE, 2025

For Determining The Latitude From a Sextant Altitude

LHA Aries	Q	LHA Aries	Q	LHA Aries	Q	LHA Aries	Q	LHA Aries	Q	LHA Aries	Q	LHA Aries	Q	LHA Aries	Q	LHA Aries	Q	LHA Aries	Q	LHA Aries	Q
359°	-26'	**30°**	-37'	**60°**	-37'	**90°**	-27'	**120°**	-10'	**150°**	+9'	**180°**	+26'	**210°**	+37'	**240°**	+37'	**270°**	+27'	**300°**	+10'	**330°**	-9'
1°	-27'	31°	-37'	61°	-37'	91°	-27'	121°	-10'	151°	+10'	181°	+27'	211°	+37'	241°	+37'	271°	+27'	301°	+10'	331°	-10'
2°	-27'	32°	-37'	62°	-37'	92°	-26'	122°	-9'	152°	+11'	182°	+27'	212°	+37'	242°	+37'	272°	+26'	302°	+9'	332°	-11'
3°	-28'	33°	-37'	63°	-36'	93°	-26'	123°	-8'	153°	+11'	183°	+28'	213°	+37'	243°	+36'	273°	+26'	303°	+8'	333°	-11'
4°	-28'	34°	-37'	64°	-36'	94°	-25'	124°	-8'	154°	+12'	184°	+28'	214°	+37'	244°	+36'	274°	+25'	304°	+8'	334°	-12'
5°	-29'	35°	-37'	65°	-36'	95°	-25'	125°	-7'	155°	+12'	185°	+29'	215°	+37'	245°	+36'	275°	+25'	305°	+7'	335°	-12'
6°	-29'	36°	-37'	66°	-36'	96°	-24'	126°	-7'	156°	+13'	186°	+29'	216°	+37'	246°	+36'	276°	+24'	306°	+7'	336°	-13'
7°	-30'	37°	-38'	67°	-35'	97°	-24'	127°	-6'	157°	+14'	187°	+30'	217°	+38'	247°	+35'	277°	+24'	307°	+6'	337°	-14'
8°	-30'	38°	-38'	68°	-35'	98°	-23'	128°	-5'	158°	+14'	188°	+30'	218°	+38'	248°	+35'	278°	+23'	308°	+5'	338°	-14'
9°	-30'	39°	-38'	69°	-35'	99°	-23'	129°	-5'	159°	+15'	189°	+30'	219°	+38'	249°	+35'	279°	+23'	309°	+5'	339°	-15'
10°	-31'	**40°**	-38'	**70°**	-35'	**100°**	-22'	**130°**	-4'	**160°**	+16'	**190°**	+31'	**220°**	+38'	**250°**	+35'	**280°**	+22'	**310°**	+4'	**340°**	-16'
11°	-31'	41°	-38'	71°	-34'	101°	-22'	131°	-3'	161°	+16'	191°	+31'	221°	+38'	251°	+34'	281°	+22'	311°	+3'	341°	-16'
12°	-32'	42°	-38'	72°	-34'	102°	-21'	132°	-3'	162°	+17'	192°	+32'	222°	+38'	252°	+34'	282°	+21'	312°	+3'	342°	-17'
13°	-32'	43°	-38'	73°	-34'	103°	-21'	133°	-2'	163°	+17'	193°	+32'	223°	+38'	253°	+34'	283°	+21'	313°	+2'	343°	-17'
14°	-32'	44°	-38'	74°	-34'	104°	-20'	134°	-1'	164°	+18'	194°	+32'	224°	+38'	254°	+34'	284°	+20'	314°	+1'	344°	-18'
15°	-33'	45°	-38'	75°	-33'	105°	-19'	135°	-1'	165°	+19'	195°	+33'	225°	+38'	255°	+33'	285°	+19'	315°	+1'	345°	-19'
16°	-33'	46°	-38'	76°	-33'	106°	-19'	136°	+0'	166°	+19'	196°	+33'	226°	+38'	256°	+33'	286°	+19'	316°	-0'	346°	-19'
17°	-33'	47°	-38'	77°	-33'	107°	-18'	137°	+1'	167°	+20'	197°	+33'	227°	+38'	257°	+33'	287°	+18'	317°	-1'	347°	-20'
18°	-34'	48°	-38'	78°	-32'	108°	-18'	138°	+1'	168°	+20'	198°	+34'	228°	+38'	258°	+32'	288°	+18'	318°	-1'	348°	-20'
19°	-34'	49°	-38'	79°	-32'	109°	-17'	139°	+2'	169°	+21'	199°	+34'	229°	+38'	259°	+32'	289°	+17'	319°	-2'	349°	-21'
20°	-34'	**50°**	-38'	**80°**	-31'	**110°**	-17'	**140°**	+3'	**170°**	+21'	**200°**	+34'	**230°**	+38'	**260°**	+31'	**290°**	+17'	**320°**	-3'	**350°**	-21'
21°	-34'	51°	-38'	81°	-31'	111°	-16'	141°	+3'	171°	+22'	201°	+34'	231°	+38'	261°	+31'	291°	+16'	321°	-3'	351°	-22'
22°	-35'	52°	-38'	82°	-31'	112°	-15'	142°	+4'	172°	+22'	202°	+35'	232°	+38'	262°	+31'	292°	+15'	322°	-4'	352°	-22'
23°	-35'	53°	-38'	83°	-30'	113°	-15'	143°	+5'	173°	+23'	203°	+35'	233°	+38'	263°	+30'	293°	+15'	323°	-5'	353°	-23'
24°	-35'	54°	-38'	84°	-30'	114°	-14'	144°	+5'	174°	+23'	204°	+35'	234°	+38'	264°	+30'	294°	+14'	324°	-5'	354°	-23'
25°	-36'	55°	-38'	85°	-29'	115°	-14'	145°	+6'	175°	+24'	205°	+36'	235°	+38'	265°	+29'	295°	+14'	325°	-6'	355°	-24'
26°	-36'	56°	-37'	86°	-29'	116°	-13'	146°	+7'	176°	+24'	206°	+36'	236°	+37'	266°	+29'	296°	+13'	326°	-7'	356°	-24'
27°	-36'	57°	-37'	87°	-29'	117°	-12'	147°	+7'	177°	+25'	207°	+36'	237°	+37'	267°	+29'	297°	+12'	327°	-7'	357°	-25'
28°	-36'	58°	-37'	88°	-28'	118°	-12'	148°	+8'	178°	+25'	208°	+36'	238°	+37'	268°	+28'	298°	+12'	328°	-8'	358°	-25'
29°	-36'	59°	-37'	89°	-28'	119°	-11'	149°	+9'	179°	+26'	209°	+36'	239°	+37'	269°	+28'	299°	+11'	329°	-9'	359°	-26'
																						360°	-26'

In critical cases, ascend

Q, which does not include refraction, is to be applied to the corrected sextant altitude of *Polaris*

Polaris, Mag. 2.0 SHA 314° 08.3', Dec N 89° 22.0'

Azimuth of Polaris- 2025

LHA Aries	Latitude 0	30°	50°	55°	60°	65°	70°	LHA Aries	Latitude 0	30°	50°	55°	60°	65°	70°
°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
0	0.5	0.5	0.7	0.8	0.9	1.1	1.3	**180**	359.5	359.5	359.3	359.2	359.1	358.9	358.7
10	0.4	0.4	0.6	0.6	0.7	0.9	1.1	**190**	359.6	359.6	359.4	359.4	359.3	359.1	358.9
20	0.3	0.3	0.4	0.5	0.6	0.7	0.8	**200**	359.7	359.7	359.6	359.5	359.4	359.3	359.2
30	0.2	0.2	0.3	0.3	0.3	0.4	0.5	**210**	359.8	359.8	359.7	359.7	359.7	359.6	359.5
40	0.1	0.1	0.1	0.1	0.1	0.2	0.2	**220**	359.9	359.9	359.9	359.9	359.9	359.8	359.8
50	360.0	359.9	359.9	359.9	359.9	359.9	359.9	**230**	0.0	0.1	0.1	0.1	0.1	0.1	0.1
60	359.8	359.8	359.8	359.7	359.7	359.6	359.5	**240**	0.2	0.2	0.2	0.3	0.3	0.4	0.5
70	359.7	359.7	359.6	359.5	359.5	359.4	359.2	**250**	0.3	0.3	0.4	0.5	0.5	0.6	0.8
80	359.6	359.6	359.4	359.4	359.3	359.2	359.0	**260**	0.4	0.4	0.6	0.6	0.7	0.8	1.0
90	359.6	359.5	359.3	359.2	359.1	359.0	358.7	**270**	0.4	0.5	0.7	0.8	0.9	1.0	1.3
100	359.5	359.4	359.2	359.1	359.0	358.8	358.5	**280**	0.5	0.6	0.8	0.9	1.0	1.2	1.5
110	359.4	359.3	359.1	359.0	358.9	358.7	358.3	**290**	0.6	0.7	0.9	1.0	1.1	1.3	1.7
120	359.4	359.3	359.1	358.9	358.8	358.6	358.2	**300**	0.6	0.7	0.9	1.1	1.2	1.4	1.8
130	359.4	359.3	359.0	358.9	358.7	358.5	358.2	**310**	0.6	0.7	1.0	1.1	1.3	1.5	1.8
140	359.4	359.3	359.0	358.9	358.7	358.5	358.2	**320**	0.6	0.7	1.0	1.1	1.3	1.5	1.8
150	359.4	359.3	359.0	358.9	358.8	358.5	358.2	**330**	0.6	0.7	1.0	1.1	1.2	1.5	1.8
160	359.4	359.3	359.1	359.0	358.8	358.6	358.3	**340**	0.6	0.7	0.9	1.0	1.2	1.4	1.7
170	359.5	359.4	359.2	359.1	359.0	358.8	358.5	**350**	0.5	0.6	0.8	0.9	1.0	1.2	1.5
180	359.5	359.5	359.3	359.2	359.1	358.9	358.7	**360**	0.5	0.5	0.7	0.8	0.9	1.1	1.3

When Cassiopeia is left (right), Polaris is west (east)

www.TheNauticalAlmanac.com

Total Lunar Eclipse of 2025 Mar 14

Ecliptic Conjunction = 06:55:48.0 TD (= 06:54:33.5 UT)
Greatest Eclipse = 06:59:56.2 TD (= 06:58:41.7 UT)

Penumbral Magnitude = 2.2595 P. Radius = 1.1899° Gamma = 0.3484
Umbral Magnitude = 1.1784 U. Radius = 0.6537° Axis = 0.3171°

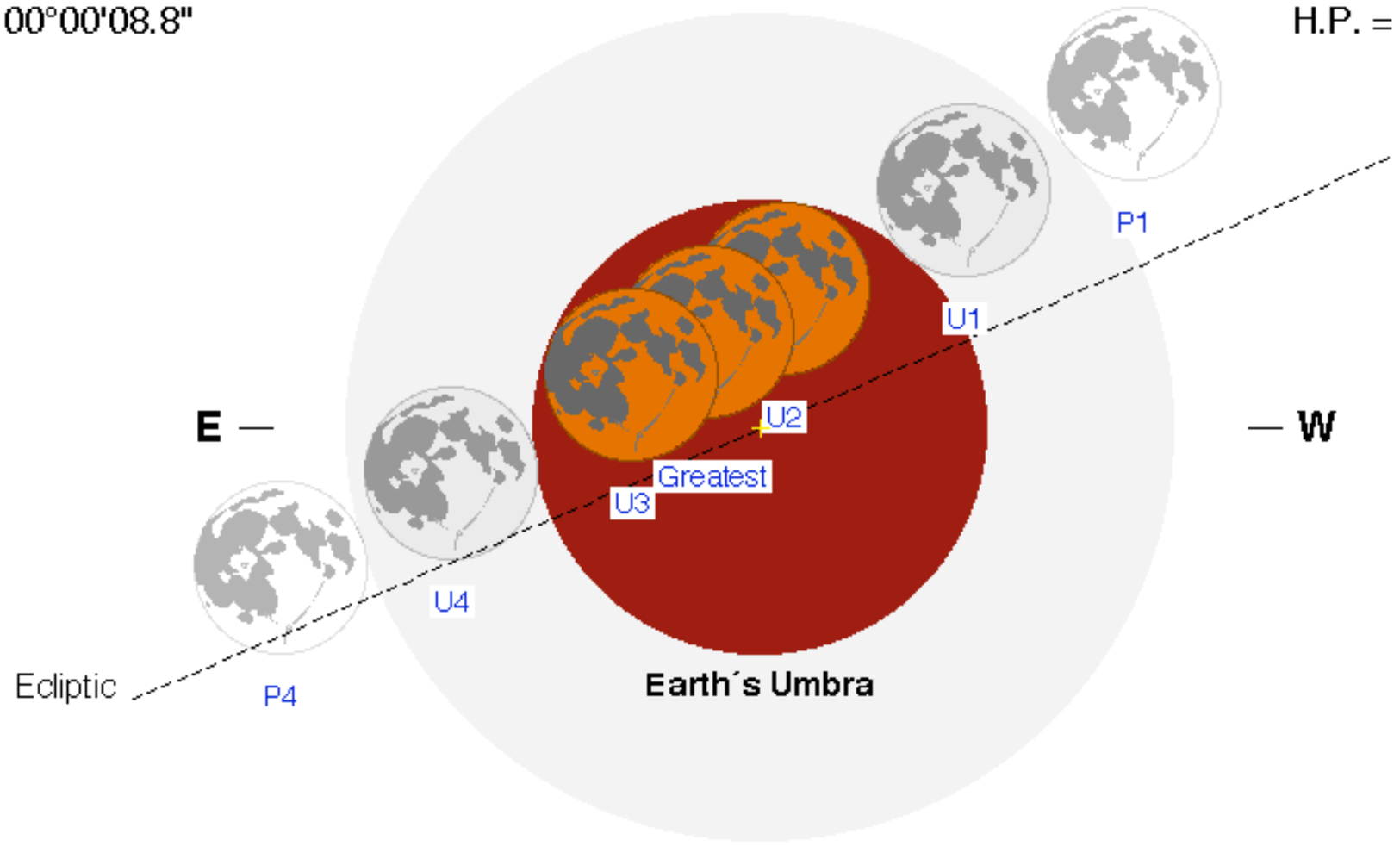
Saros Series = 123 Member = 53 of 73

<u>Sun at Greatest Eclipse</u>
(Geocentric Coordinates)

R.A. = 23h37m46.0s
Dec. = -02°24'16.8"
S.D. = 00°16'05.2"
H.P. = 00°00'08.8"

<u>Moon at Greatest Eclipse</u>
(Geocentric Coordinates)

R.A. = 11h38m23.0s
Dec. = +02°40'54.6"
S.D. = 00°14'52.8"
H.P. = 00°54'36.8"



<u>Eclipse Durations</u>

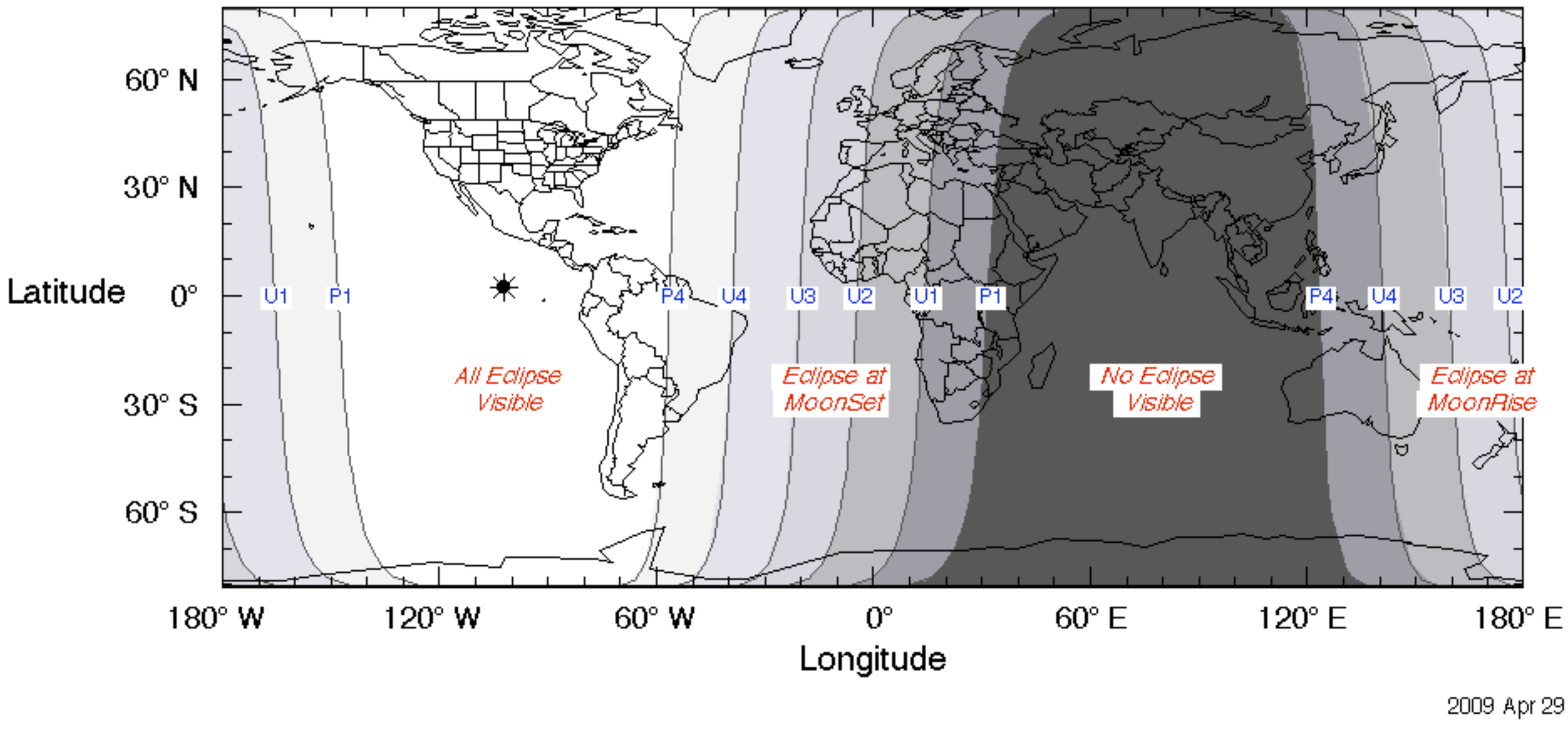
Penumbral = 06h02m37s
Umbral = 03h38m15s
Total = 01h05m24s

ΔT = 75 s
Rule = CdT (Danjon)
Eph. = VSOP87/ELP2000-85

F. Espenak, NASA's GSFC
eclipse.gsfc.nasa.gov/eclipse.html

<u>Eclipse Contacts</u>

P1 = 03:57:24 UT
U1 = 05:09:33 UT
U2 = 06:25:59 UT
U3 = 07:31:23 UT
U4 = 08:47:48 UT
P4 = 10:00:01 UT



2009 Apr 29

Total Lunar Eclipse of 2025 Sep 07

Ecliptic Conjunction = 18:10:03.1 TD (= 18:08:48.3 UT)
Greatest Eclipse = 18:12:57.9 TD (= 18:11:43.1 UT)

Penumbral Magnitude = 2.3440 P. Radius = 1.2655° Gamma = -0.2752
Umbral Magnitude = 1.3619 U. Radius = 0.7364° Axis = 0.2720°

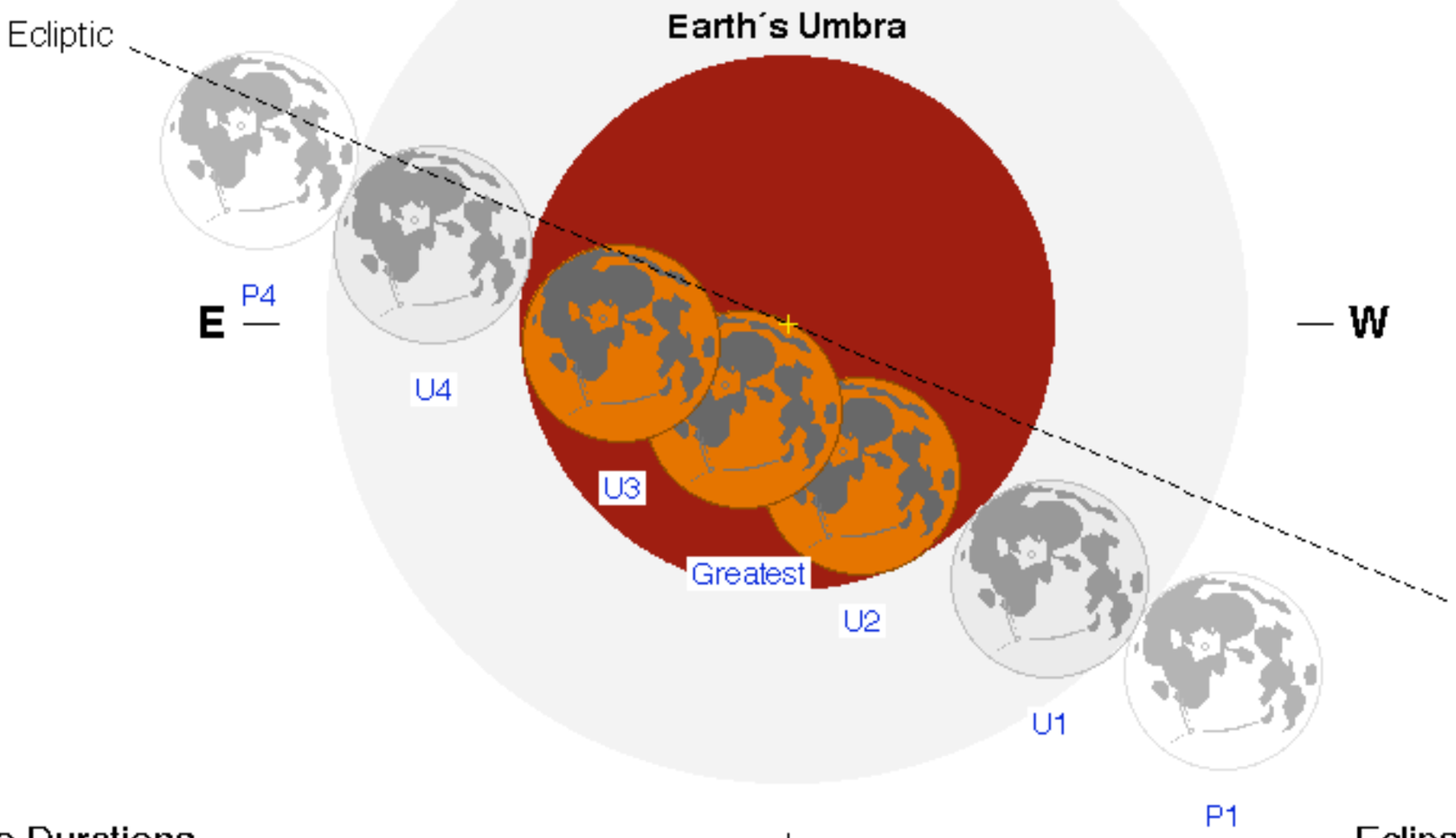
Saros Series = 128 Member = 41 of 71

<u>Sun at Greatest Eclipse</u>
(Geocentric Coordinates)

R.A. = 11h06m09.1s
Dec. = +05°45'47.5"
S.D. = 00°15'52.4"
H.P. = 00°00'08.7"

<u>Moon at Greatest Eclipse</u>
(Geocentric Coordinates)

R.A. = 23h06m40.4s
Dec. = -06°00'08.9"
S.D. = 00°16'09.8"
H.P. = 00°59'19.1"



<u>Eclipse Durations</u>

Penumbral = 05h26m40s
Umbral = 03h29m24s
Total = 01h22m06s

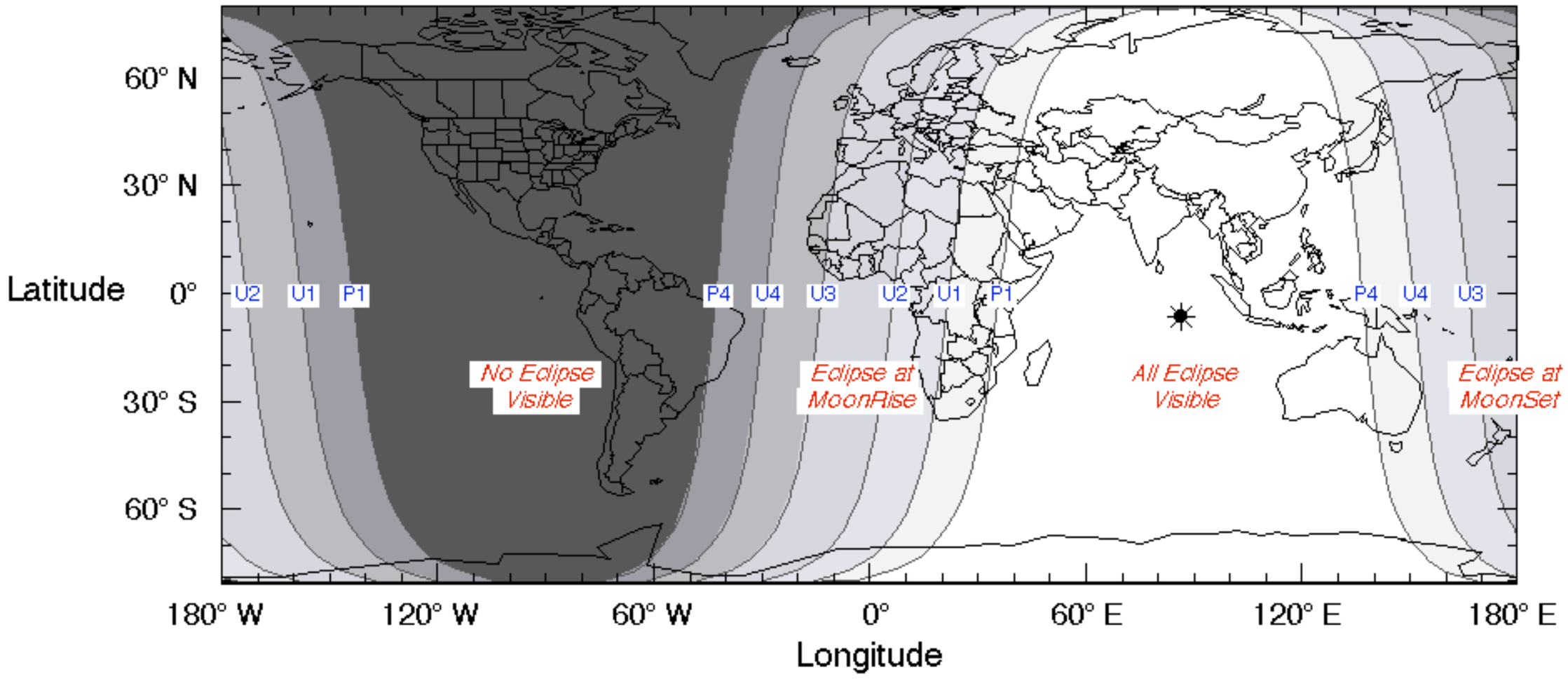
ΔT = 75 s
Rule = CdT (Danjon)
Eph. = VSOP87/ELP2000-85

0 15 30 45 60
Arc-Minutes

F. Espenak, NASA's GSFC
eclipse.gsfc.nasa.gov/eclipse.html

<u>Eclipse Contacts</u>

P1 = 15:28:21 UT
U1 = 16:27:02 UT
U2 = 17:30:41 UT
U3 = 18:52:47 UT
U4 = 19:56:26 UT
P4 = 20:55:00 UT



2009 Apr 29

Partial Solar Eclipse of 2025 Mar 29

Geocentric Conjunction = 11:46:09.2 UT J.D. = 2460763.990384
Greatest Eclipse = 10:47:18.4 UT J.D. = 2460763.949519

Eclipse Magnitude = 0.9361 Gamma = 1.0405

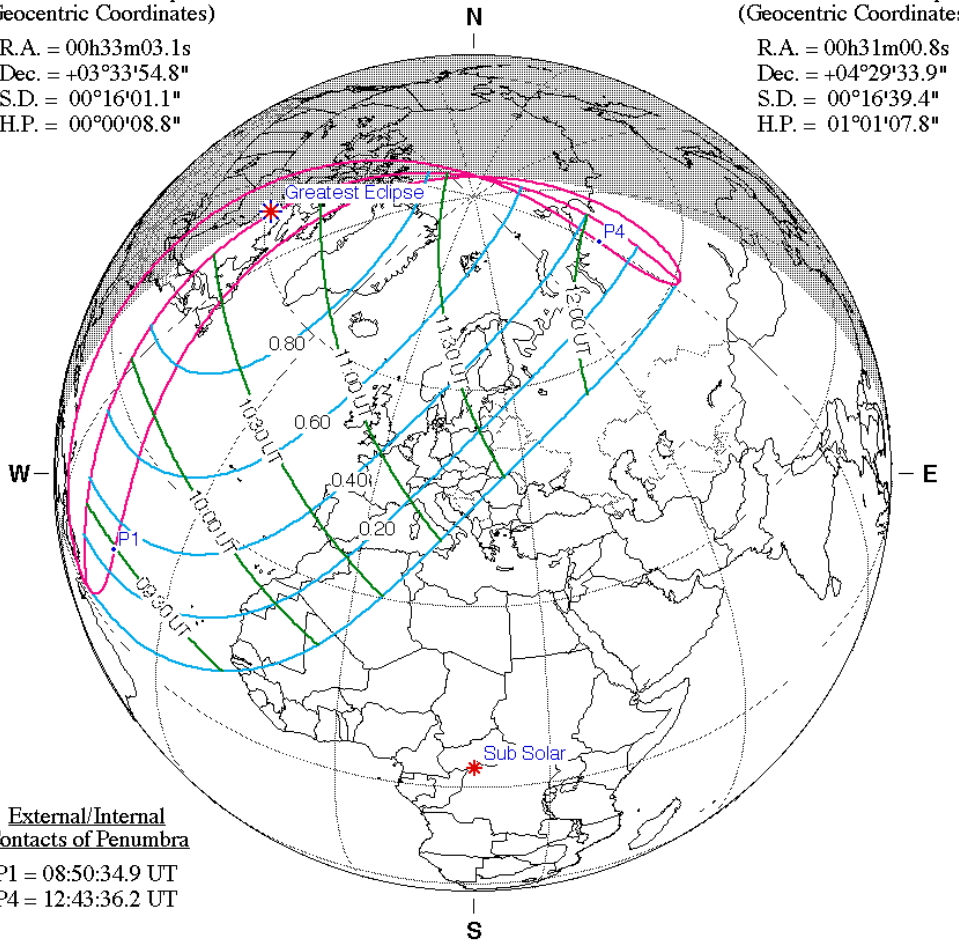
Saros Series = 149 Member = 21 of 71

Sun at Greatest Eclipse
(Geocentric Coordinates)

R.A. = 00h33m03.1s
Dec. = +03°33'54.8"
S.D. = 00°16'01.1"
H.P. = 00°00'08.8"

Moon at Greatest Eclipse
(Geocentric Coordinates)

R.A. = 00h31m00.8s
Dec. = +04°29'33.9"
S.D. = 00°16'39.4"
H.P. = 01°01'07.8"



External/Internal Contacts of Penumbra

P1 = 08:50:34.9 UT
P4 = 12:43:36.2 UT

Ephemeris & Constants

Eph. = Newcomb/ILE
ΔT = 82.3 s
k1 = 0.2724880
k2 = 0.2722810
Δb = 0.0" Δl = 0.0"

Geocentric Libration
(Optical + Physical)

l = -2.00°
b = -1.35°
c = -21.73°

Brown Lun. No. = 1265

0 1000 2000 3000 4000 5000
Kilometers

F. Espenak, NASA's GSFC - Fri, Jul 2,
sunearth.gsfc.nasa.gov/eclipse/eclipse.html

Partial Solar Eclipse of 2025 Sep 21

Geocentric Conjunction = 20:50:18.4 UT J.D. = 2460940.368269
Greatest Eclipse = 19:41:43.6 UT J.D. = 2460940.320643

Eclipse Magnitude = 0.8535 Gamma = -1.0652

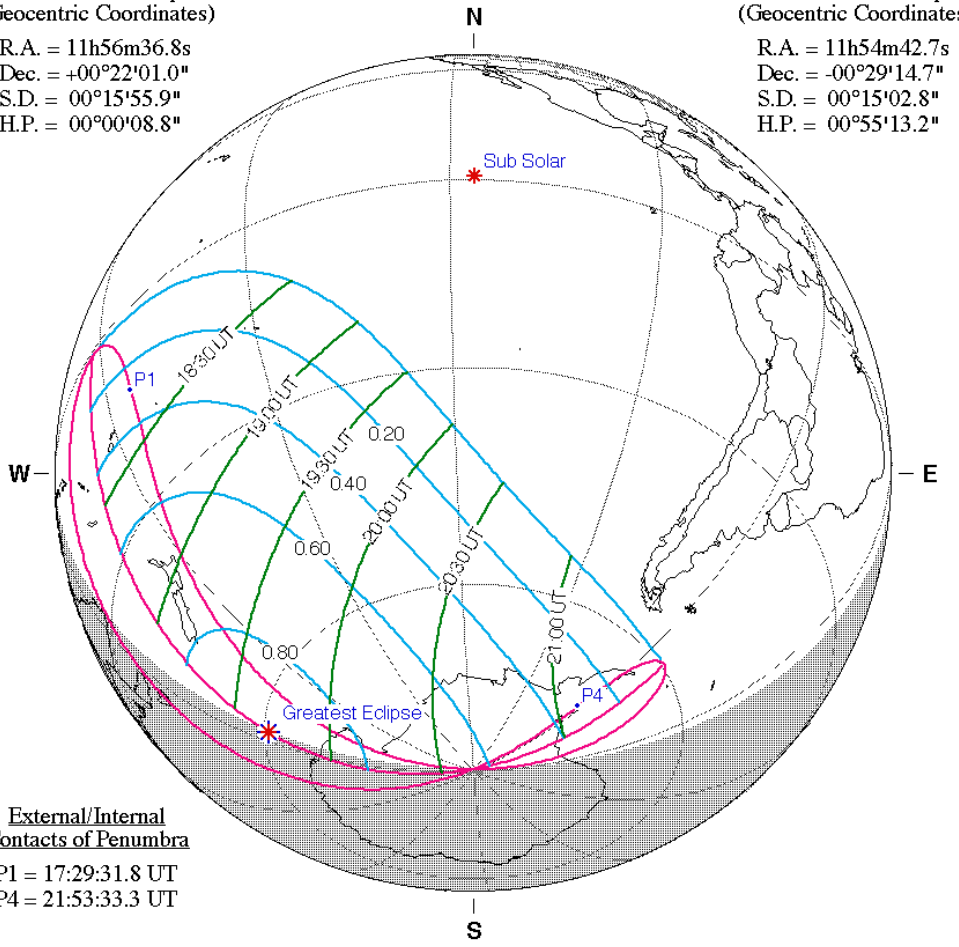
Saros Series = 154 Member = 7 of 71

Sun at Greatest Eclipse
(Geocentric Coordinates)

R.A. = 11h56m36.8s
Dec. = +00°22'01.0"
S.D. = 00°15'55.9"
H.P. = 00°00'08.8"

Moon at Greatest Eclipse
(Geocentric Coordinates)

R.A. = 11h54m42.7s
Dec. = -00°29'14.7"
S.D. = 00°15'02.8"
H.P. = 00°55'13.2"



External/Internal Contacts of Penumbra

P1 = 17:29:31.8 UT
P4 = 21:53:33.3 UT

Ephemeris & Constants

Eph. = Newcomb/ILE
ΔT = 82.8 s
k1 = 0.2724880
k2 = 0.2722810
Δb = 0.0" Δl = 0.0"

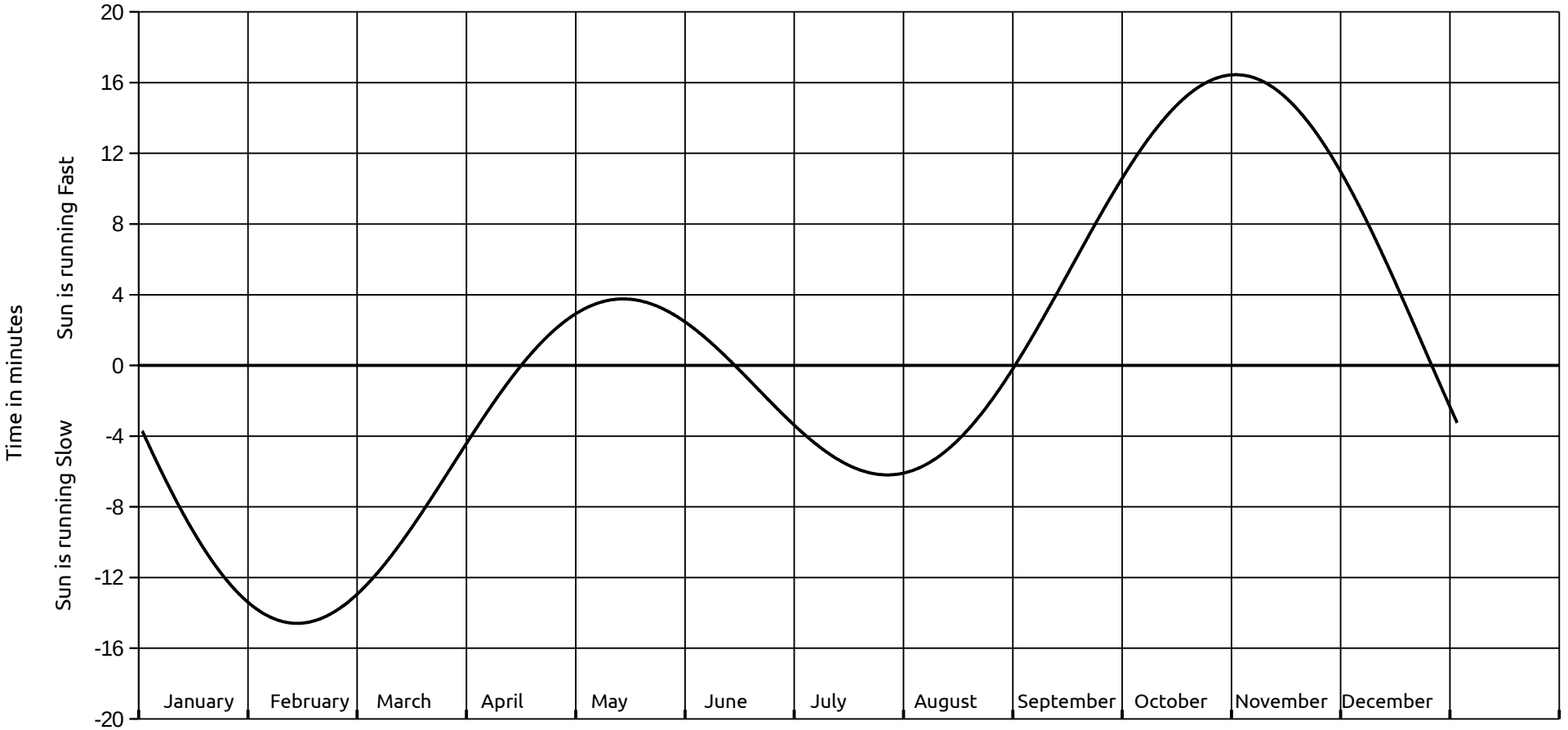
Geocentric Libration
(Optical + Physical)

l = 4.15°
b = 1.31°
c = 21.92°
Brown Lun. No. = 1271

0 1000 2000 3000 4000 5000
Kilometers

F. Espenak, NASA's GSFC - Fri, Jul 2,
sunearth.gsfc.nasa.gov/eclipse/eclipse.html

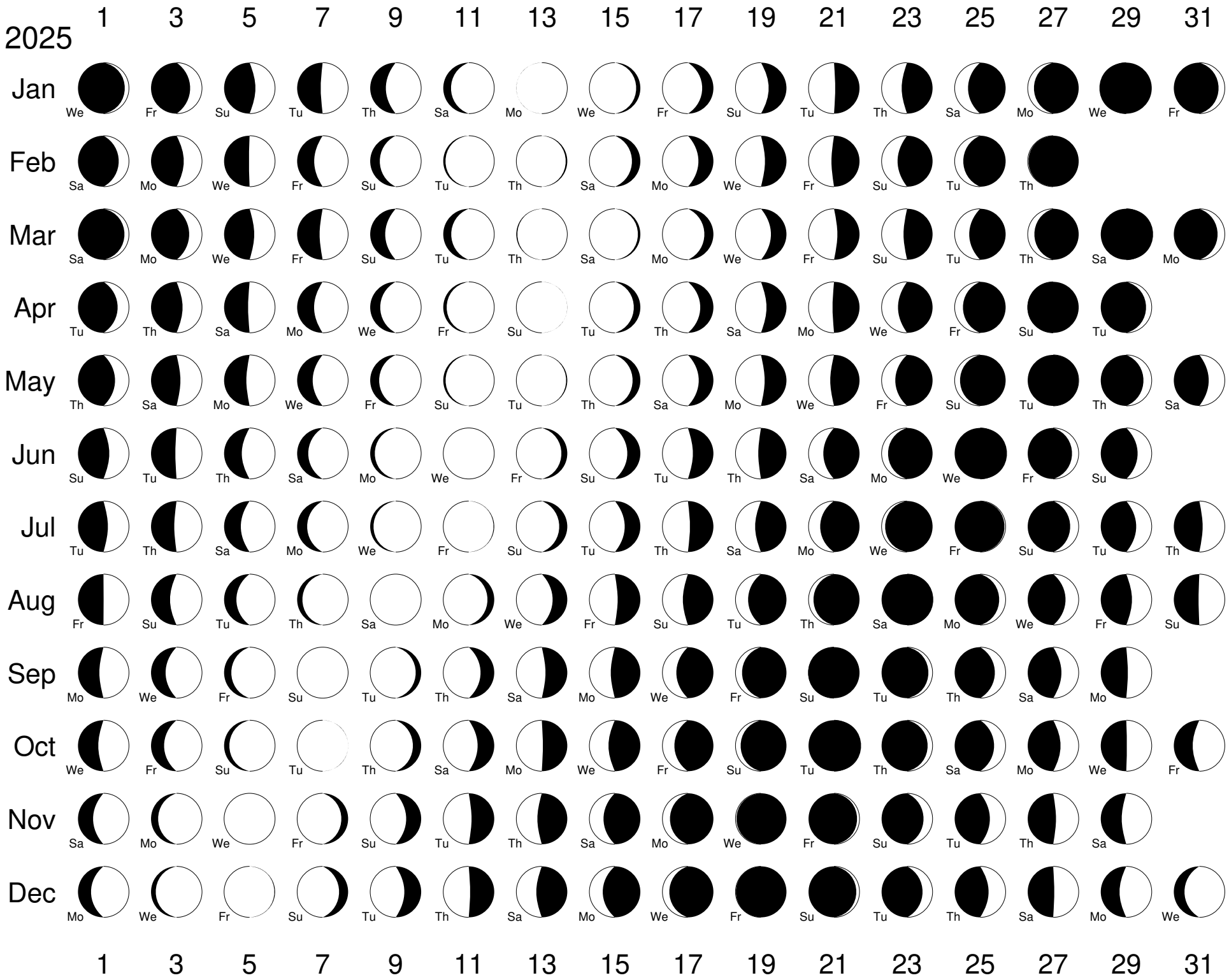
Equation of Time
for the Sun



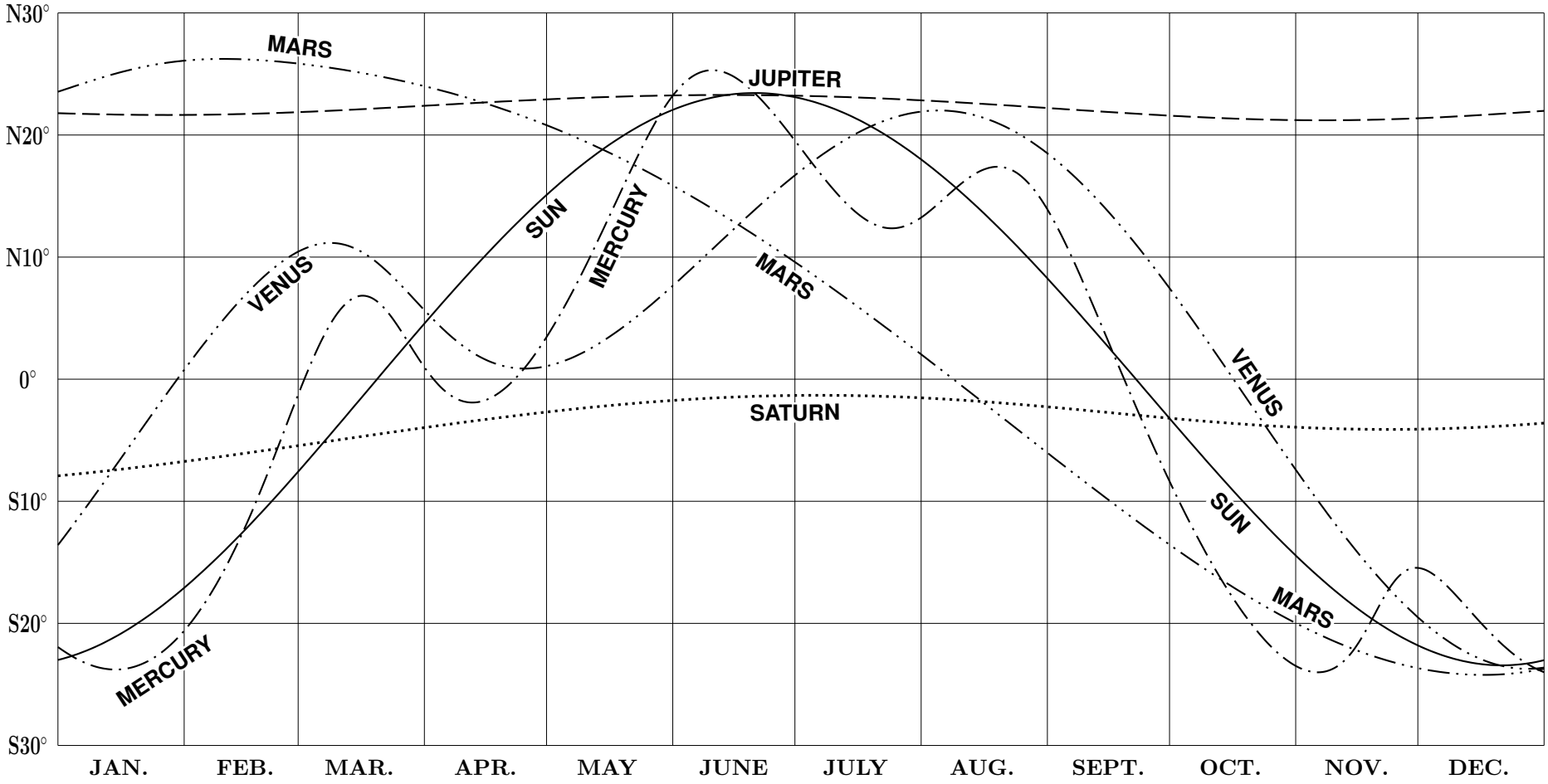
Equation_of_Time_Curve.odt

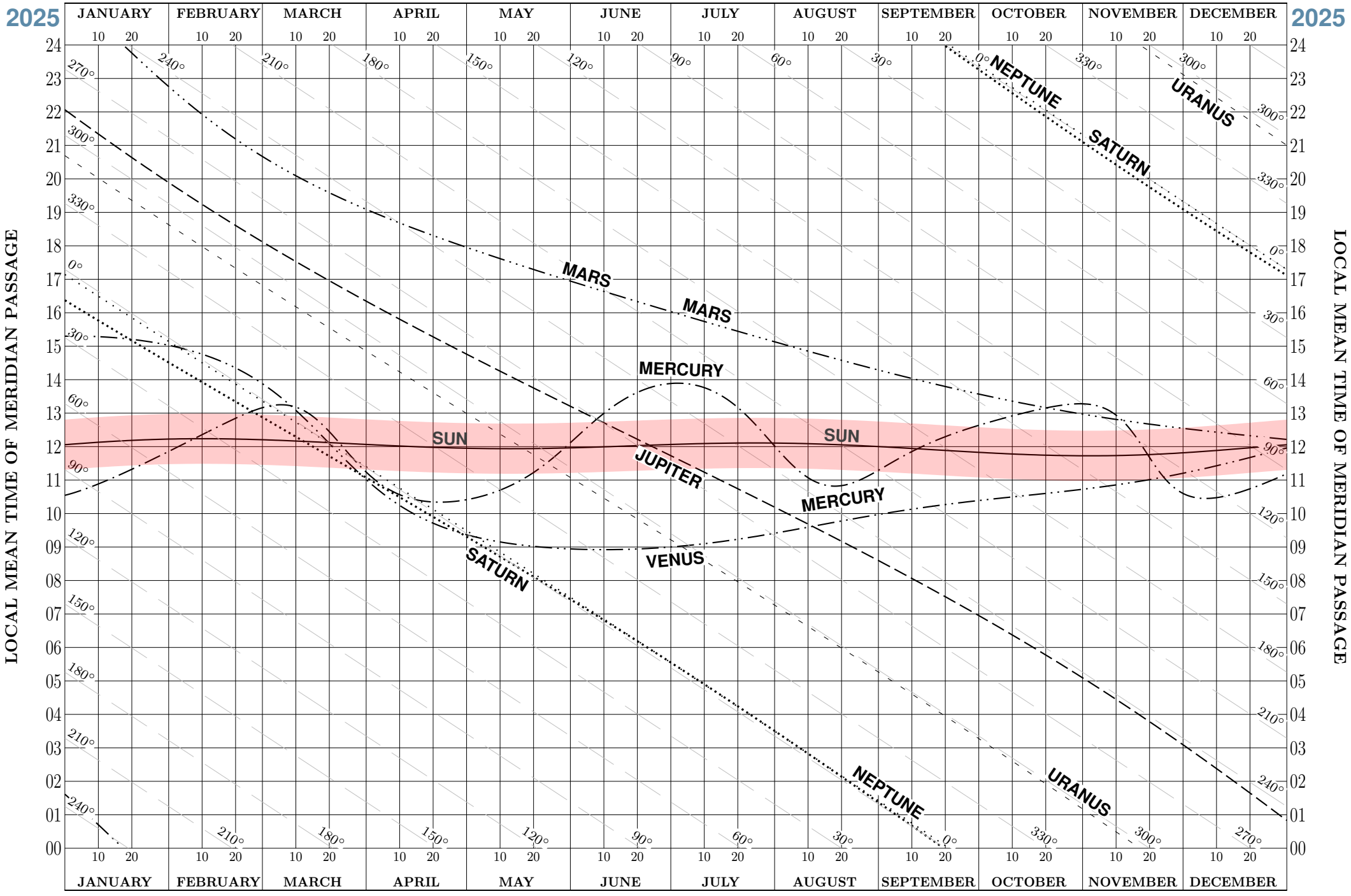
2025 Moon Phases
Date and Time (GMT/Universal Time)

New Moon	First Quarter	Full Moon	Last Quarter
--	January 06 23:56	January 13 22:27	January 21 20:31
January 29 12:36	February 05 08:02	February 12 13:53	February 20 17:32
February 28 00:45	March 06 16:31	March 14 06:55	March 22 11:29
March 29 10:58	April 05 02:15	April 13 00:22	April 21 01:35
April 27 19:31	May 04 13:52	May 12 16:56	May 20 11:59
May 27 03:02	June 03 03:41	June 11 07:44	June 18 19:19
June 25 10:31	July 02 19:30	July 10 20:37	July 18 00:38
July 24 19:11	August 01 12:41	August 09 07:55	August 16 05:12
August 23 06:06	August 31 06:25	September 07 18:09	September 14 10:33
September 21 19:54	September 29 23:54	October 07 03:47	October 13 18:13
October 21 12:25	October 29 16:21	November 05 13:19	November 12 05:28
November 20 06:47	November 28 06:59	December 04 23:14	December 11 20:52
December 20 01:43	December 27 19:10	--	--


2025
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31
Jan We Fr Su Tu Th Sa Mo We Fr Su Tu Th Sa Mo We Fr
Feb Sa Mo We Fr Su Tu Th Sa Mo We Fr Su Tu Th
Mar Sa Mo We Fr Su Tu Th Sa Mo We Fr Su Tu Th Sa Mo
Apr Tu Th Sa Mo We Fr Su Tu Th Sa Mo We Fr Su Tu
May Th Sa Mo We Fr Su Tu Th Sa Mo We Fr Su Tu Th Sa
Jun Su Tu Th Sa Mo We Fr Su Tu Th Sa Mo We Fr Su
Jul Tu Th Sa Mo We Fr Su Tu Th Sa Mo We Fr Su Tu Th
Aug Fr Su Tu Th Sa Mo We Fr Su Tu Th Sa Mo We Fr Su
Sep Mo We Fr Su Tu Th Sa Mo We Fr Su Tu Th Sa Mo
Oct We Fr Su Tu Th Sa Mo We Fr Su Tu Th Sa Mo We Fr
Nov Sa Mo We Fr Su Tu Th Sa Mo We Fr Su Tu Th Sa
Dec Mo We Fr Su Tu Th Sa Mo We Fr Su Tu Th Sa Mo We
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31

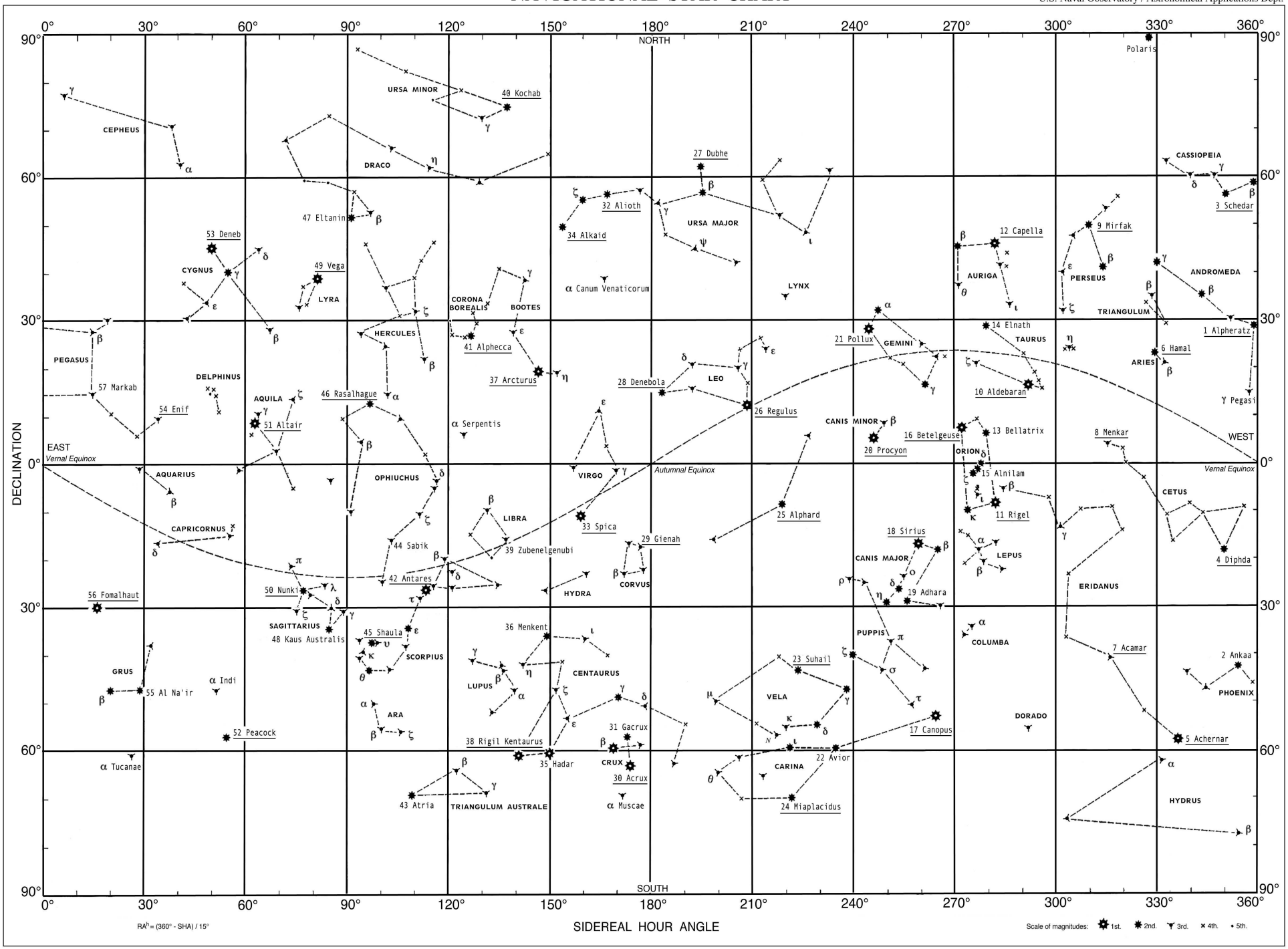
DECLINATION OF SUN AND PLANETS, 2025

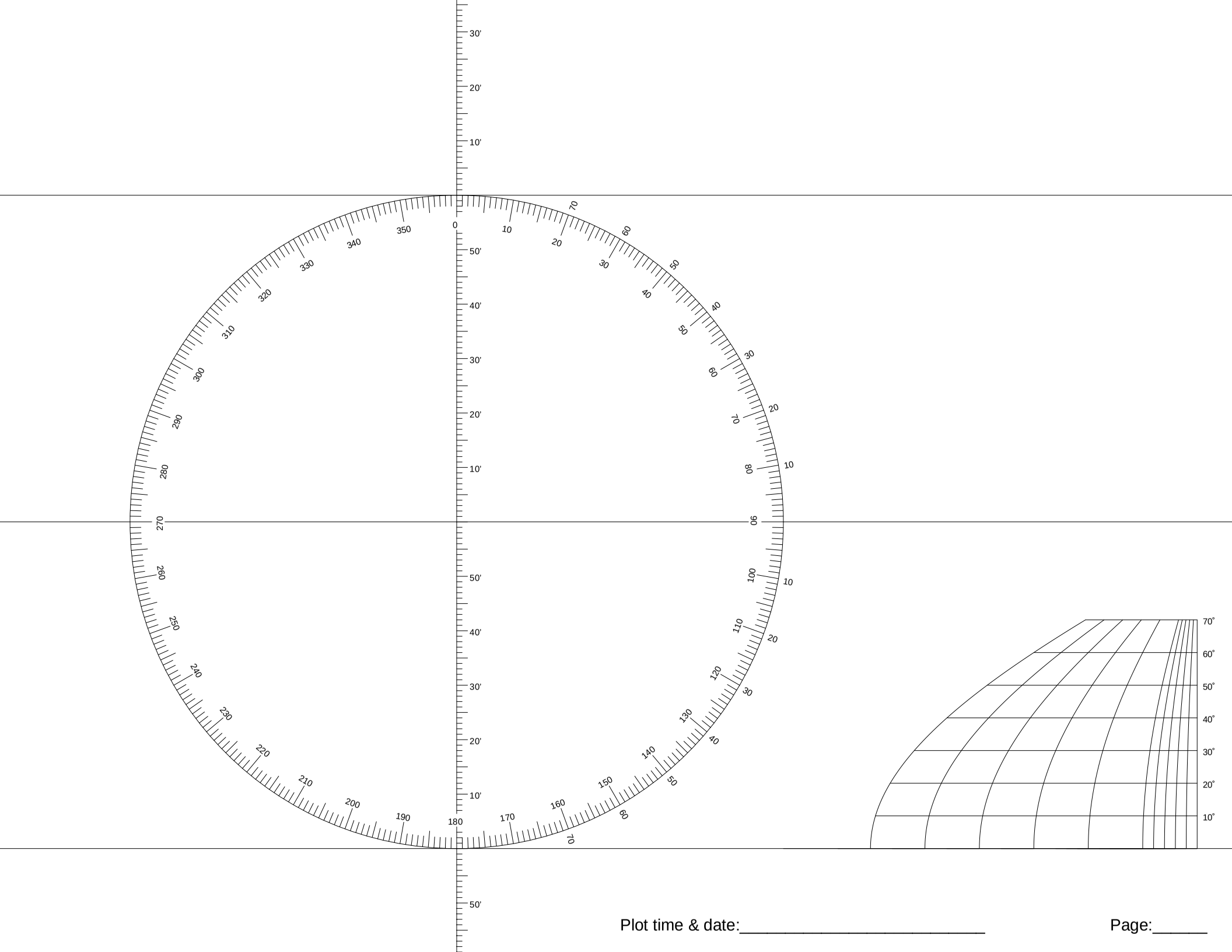



2025
JANUARY
FEBRUARY
MARCH
APRIL
MAY
JUNE
JULY
AUGUST
SEPTEMBER
OCTOBER
NOVEMBER
DECEMBER
10
20
LOCAL MEAN TIME OF MERIDIAN PASSAGE
LOCAL MEAN TIME OF MERIDIAN PASSAGE
NEPTUNE
URANUS
SATURN
MARS
MERCURY
SUN
JUPITER
VENUS

NAVIGATIONAL STAR CHART

U.S. Naval Observatory / Astronomical Applications Dept.





Plot time & date:_____

Page:_____