The Nautical Almanac 2024

TheNauticalAlmanac.com

The Nautical Almanac

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fair winds, clear skies & following seas

TheNauticalAlmanac.com

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. To that end 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.

freely ye received, freely give

2024

January

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

February

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

March

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

April

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

May

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

June

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

July

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

August

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

September

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

October

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

November

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

December

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

2024

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

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

Day of Month	3 March			
	Day of Week	Day of Year	Days remaining	Week number
1	Fri	61	305	9
2	Sat	62	304	
3	Sun	63	303	10
4	Mon	64	302	
5	Tue	65	301	
6	Wed	66	300	
7	Thu	67	299	
8	Fri	68	298	
9	Sat	69	297	
10	Sun	70	296	11
11	Mon	71	295	
12	Tue	72	294	
13	Wed	73	293	
14	Thu	74	292	
15	Fri	75	291	
16	Sat	76	290	
17	Sun	77	289	12
18	Mon	78	288	
19	Tue	79	287	
20	Wed	80	286	
21	Thu	81	285	
22	Fri	82	284	
23	Sat	83	283	
24	Sun	84	282	13
25	Mon	85	281	
26	Tue	86	280	
27	Wed	87	279	
28	Thu	88	278	
29	Fri	89	277	
30	Sat	90	276	
31	Sun	91	275	14

Day of Month	4 April			
	Day of Week	Day of Year	Days remaining	Week number
1	Mon	92	274	14
2	Tue	93	273	
3	Wed	94	272	
4	Thu	95	271	
5	Fri	96	270	
6	Sat	97	269	
7	Sun	98	268	15
8	Mon	99	267	
9	Tue	100	266	
10	Wed	101	265	
11	Thu	102	264	
12	Fri	103	263	
13	Sat	104	262	
14	Sun	105	261	16
15	Mon	106	260	
16	Tue	107	259	
17	Wed	108	258	
18	Thu	109	257	
19	Fri	110	256	
20	Sat	111	255	
21	Sun	112	254	17
22	Mon	113	253	
23	Tue	114	252	
24	Wed	115	251	
25	Thu	116	250	
26	Fri	117	249	
27	Sat	118	248	
28	Sun	119	247	18
29	Mon	120	246	
30	Tue	121	245	

Day of Month	5 May			
	Day of Week	Day of Year	Days remaining	Week number
1	Wed	122	244	18
2	Thu	123	243	
3	Fri	124	242	
4	Sat	125	241	
5	Sun	126	240	19
6	Mon	127	239	
7	Tue	128	238	
8	Wed	129	237	
9	Thu	130	236	
10	Fri	131	235	
11	Sat	132	234	
12	Sun	133	233	20
13	Mon	134	232	
14	Tue	135	231	
15	Wed	136	230	
16	Thu	137	229	
17	Fri	138	228	
18	Sat	139	227	
19	Sun	140	226	21
20	Mon	141	225	
21	Tue	142	224	
22	Wed	143	223	
23	Thu	144	222	
24	Fri	145	221	
25	Sat	146	220	
26	Sun	147	219	22
27	Mon	148	218	
28	Tue	149	217	
29	Wed	150	216	
30	Thu	151	215	
31	Fri	152	214	

Day of Month	6 June			
	Day of Week	Day of Year	Days remaining	Week number
1	Sat	153	213	22
2	Sun	154	212	23
3	Mon	155	211	
4	Tue	156	210	
5	Wed	157	209	
6	Thu	158	208	
7	Fri	159	207	
8	Sat	160	206	
9	Sun	161	205	24
10	Mon	162	204	
11	Tue	163	203	
12	Wed	164	202	
13	Thu	165	201	
14	Fri	166	200	
15	Sat	167	199	
16	Sun	168	198	25
17	Mon	169	197	
18	Tue	170	196	
19	Wed	171	195	
20	Thu	172	194	
21	Fri	173	193	
22	Sat	174	192	
23	Sun	175	191	26
24	Mon	176	190	
25	Tue	177	189	
26	Wed	178	188	
27	Thu	179	187	
28	Fri	180	186	
29	Sat	181	185	
30	Sun	182	184	27

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	Mon	183	183	27
2	Tue	184	182	
3	Wed	185	181	
4	Thu	186	180	
5	Fri	187	179	
6	Sat	188	178	
7	Sun	189	177	28
8	Mon	190	176	
9	Tue	191	175	
10	Wed	192	174	
11	Thu	193	173	
12	Fri	194	172	
13	Sat	195	171	
14	Sun	196	170	29
15	Mon	197	169	
16	Tue	198	168	
17	Wed	199	167	
18	Thu	200	166	
19	Fri	201	165	
20	Sat	202	164	
21	Sun	203	163	30
22	Mon	204	162	
23	Tue	205	161	
24	Wed	206	160	
25	Thu	207	159	
26	Fri	208	158	
27	Sat	209	157	
28	Sun	210	156	31
29	Mon	211	155	
30	Tue	212	154	
31	Wed	213	153	

Day of Month	8 August			
	Day of Week	Day of Year	Days remaining	Week number
1	Thu	214	152	31
2	Fri	215	151	
3	Sat	216	150	
4	Sun	217	149	32
5	Mon	218	148	
6	Tue	219	147	
7	Wed	220	146	
8	Thu	221	145	
9	Fri	222	144	
10	Sat	223	143	
11	Sun	224	142	33
12	Mon	225	141	
13	Tue	226	140	
14	Wed	227	139	
15	Thu	228	138	
16	Fri	229	137	
17	Sat	230	136	
18	Sun	231	135	34
19	Mon	232	134	
20	Tue	233	133	
21	Wed	234	132	
22	Thu	235	131	
23	Fri	236	130	
24	Sat	237	129	
25	Sun	238	128	35
26	Mon	239	127	
27	Tue	240	126	
28	Wed	241	125	
29	Thu	242	124	
30	Fri	243	123	
31	Sat	244	122	

Day of Month	9 September			
	Day of Week	Day of Year	Days remaining	Week number
1	Sun	245	121	36
2	Mon	246	120	
3	Tue	247	119	
4	Wed	248	118	
5	Thu	249	117	
6	Fri	250	116	
7	Sat	251	115	
8	Sun	252	114	37
9	Mon	253	113	
10	Tue	254	112	
11	Wed	255	111	
12	Thu	256	110	
13	Fri	257	109	
14	Sat	258	108	
15	Sun	259	107	38
16	Mon	260	106	
17	Tue	261	105	
18	Wed	262	104	
19	Thu	263	103	
20	Fri	264	102	
21	Sat	265	101	
22	Sun	266	100	39
23	Mon	267	99	
24	Tue	268	98	
25	Wed	269	97	
26	Thu	270	96	
27	Fri	271	95	
28	Sat	272	94	
29	Sun	273	93	40
30	Mon	274	92	

Day of Month	10 October			
	Day of Week	Day of Year	Days remaining	Week number
1	Tue	275	91	40
2	Wed	276	90	
3	Thu	277	89	
4	Fri	278	88	
5	Sat	279	87	
6	Sun	280	86	41
7	Mon	281	85	
8	Tue	282	84	
9	Wed	283	83	
10	Thu	284	82	
11	Fri	285	81	
12	Sat	286	80	
13	Sun	287	79	42
14	Mon	288	78	
15	Tue	289	77	
16	Wed	290	76	
17	Thu	291	75	
18	Fri	292	74	
19	Sat	293	73	
20	Sun	294	72	43
21	Mon	295	71	
22	Tue	296	70	
23	Wed	297	69	
24	Thu	298	68	
25	Fri	299	67	
26	Sat	300	66	
27	Sun	301	65	44
28	Mon	302	64	
29	Tue	303	63	
30	Wed	304	62	
31	Thu	305	61	

Day of Month	11 November			
	Day of Week	Day of Year	Days remaining	Week number
1	Fri	306	60	44
2	Sat	307	59	
3	Sun	308	58	45
4	Mon	309	57	
5	Tue	310	56	
6	Wed	311	55	
7	Thu	312	54	
8	Fri	313	53	
9	Sat	314	52	
10	Sun	315	51	46
11	Mon	316	50	
12	Tue	317	49	
13	Wed	318	48	
14	Thu	319	47	
15	Fri	320	46	
16	Sat	321	45	
17	Sun	322	44	47
18	Mon	323	43	
19	Tue	324	42	
20	Wed	325	41	
21	Thu	326	40	
22	Fri	327	39	
23	Sat	328	38	
24	Sun	329	37	48
25	Mon	330	36	
26	Tue	331	35	
27	Wed	332	34	
28	Thu	333	33	
29	Fri	334	32	
30	Sat	335	31	

Day of Month	12 December			
	Day of Week	Day of Year	Days remaining	Week number
1	Sun	336	30	49
2	Mon	337	29	
3	Tue	338	28	
4	Wed	339	27	
5	Thu	340	26	
6	Fri	341	25	
7	Sat	342	24	
8	Sun	343	23	50
9	Mon	344	22	
10	Tue	345	21	
11	Wed	346	20	
12	Thu	347	19	
13	Fri	348	18	
14	Sat	349	17	
15	Sun	350	16	51
16	Mon	351	15	
17	Tue	352	14	
18	Wed	353	13	
19	Thu	354	12	
20	Fri	355	11	
21	Sat	356	10	
22	Sun	357	9	52
23	Mon	358	8	
24	Tue	359	7	
25	Wed	360	6	
26	Thu	361	5	
27	Fri	362	4	
28	Sat	363	3	
29	Sun	364	2	1
30	Mon	365	1	
31	Tue	366	0	

Thirty days hath September, April, June, and November; February has twenty-eight alone, All the rest have thirty-one,
Excepting leap-year, that's the time when February's days are twenty-nine.

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 *2019- The American Practical Navigator*

https://TheNauticalAlmanac.com/2019_Bowditch-_American_Practical_Navigator.html

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

The Terrestrial Almanac Annual calendar and day planner for the entire year.

https://TheNauticalAlmanac.com/TerrestrialAlmanac.html

Pub. No. 249 Download individual Latitudes or Volumes

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

Epoch 2025 https://www.thenauticalalmanac.com/Pub_No_249_Epoch_2025.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° 20.4′ ***v =*** 12.1′ GHA increment 4° 34.4′ ***v-*** correction for 12.1′ + 0° 03.9′ GHA= 251° 58.7′ 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.

Wednesday, February 24, 2021

Explanation_of_The_Nautical_Almanac_Daily_Pages.odt

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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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	▭

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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	

1

2020 January 01 to Jan. 03

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 (Mon., Tue., Wed.)

	Aries	Venus		Mars		Jupiter		Saturn	
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	100°09.1	219°12.0	S18°46.2	193°05.8	S23°57.7	66°27.9	N12°15.8	124°22.4	S11°50.3
1	115°11.5	234°11.4	46.8	208°06.2	57.7	81°30.4	15.9	139°24.6	50.3
2	130°14.0	249°10.7	47.5	223°06.7	57.8	96°32.9	15.9	154°26.9	50.2
3	145°16.5	264°10.0	·· 48.1	238°07.1	·· 57.9	111°35.3	·· 15.9	169°29.1	·· 50.1
4	160°18.9	279°09.4	48.8	253°07.6	57.9	126°37.8	15.9	184°31.4	50.0
5	175°21.4	294°08.7	49.4	268°08.0	58.0	141°40.2	15.9	199°33.6	49.9
6	190°23.9	309°08.0	S18°50.1	283°08.4	S23°58.0	156°42.7	N12°15.9	214°35.9	S11°49.8
7	205°26.3	324°07.3	50.8	298°08.9	58.1	171°45.2	15.9	229°38.2	49.8
8	220°28.8	339°06.7	51.4	313°09.3	58.2	186°47.6	16.0	244°40.4	49.7
9	235°31.3	354°06.0	·· 52.1	328°09.7	·· 58.2	201°50.1	·· 16.0	259°42.7	·· 49.6
10	250°33.7	9°05.3	52.7	343°10.2	58.3	216°52.5	16.0	274°44.9	49.5
11	265°36.2	24°04.6	53.4	358°10.6	58.3	231°55.0	16.0	289°47.2	49.4
12	280°38.6	39°04.0	S18°54.0	13°11.0	S23°58.4	246°57.5	N12°16.0	304°49.4	S11°49.3
13	295°41.1	54°03.3	54.7	28°11.5	58.5	261°59.9	16.0	319°51.7	49.3
14	310°43.6	69°02.6	55.3	43°11.9	58.5	277°02.4	16.1	334°53.9	49.2
15	325°46.0	84°01.9	·· 56.0	58°12.3	·· 58.6	292°04.8	·· 16.1	349°56.2	·· 49.1
16	340°48.5	99°01.3	56.6	73°12.8	58.6	307°07.3	16.1	4°58.4	49.0
17	355°51.0	114°00.6	57.3	88°13.2	58.7	322°09.7	16.1	20°00.7	48.9
18	10°53.4	128°59.9	S18°57.9	103°13.7	S23°58.7	337°12.2	N12°16.1	35°02.9	S11°48.8
19	25°55.9	143°59.2	58.5	118°14.1	58.8	352°14.6	16.1	50°05.2	48.8
20	40°58.4	158°58.6	59.2	133°14.5	58.8	7°17.1	16.2	65°07.4	48.7
21	56°00.8	173°57.9	18°59.8	148°15.0	·· 58.9	22°19.5	·· 16.2	80°09.7	·· 48.6
22	71°03.3	188°57.2	19°00.5	163°15.4	58.9	37°22.0	16.2	95°12.0	48.5
23	86°05.7	203°56.5	01.1	178°15.8	59.0	52°24.5	16.2	110°14.2	48.4
Mer.pass. 17:17		ν -0.7′	d -0.7′	m -4.02	ν 0.4′	d -0.1′	m 1.37	ν 2.5′	d 0.0′ m -2.59	ν 2.3′	d 0.1′ m 0.95

Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	101°08.2	218°55.8	S19°01.8	193°16.3	S23°59.1	67°26.9	N12°16.2	125°16.5	S11°48.3
1	116°10.7	233°55.2	02.4	208°16.7	59.1	82°29.4	16.2	140°18.7	48.3
2	131°13.1	248°54.5	03.0	223°17.1	59.2	97°31.8	16.3	155°21.0	48.2
3	146°15.6	263°53.8	·· 03.7	238°17.6	·· 59.2	112°34.3	·· 16.3	170°23.2	·· 48.1
4	161°18.1	278°53.1	04.3	253°18.0	59.3	127°36.7	16.3	185°25.5	48.0
5	176°20.5	293°52.4	04.9	268°18.4	59.3	142°39.2	16.3	200°27.7	47.9
6	191°23.0	308°51.7	S19°05.6	283°18.9	S23°59.4	157°41.6	N12°16.3	215°30.0	S11°47.8
7	206°25.5	323°51.1	06.2	298°19.3	59.4	172°44.1	16.3	230°32.2	47.8
8	221°27.9	338°50.4	06.8	313°19.7	59.5	187°46.5	16.4	245°34.5	47.7
9	236°30.4	353°49.7	·· 07.5	328°20.2	·· 59.5	202°49.0	·· 16.4	260°36.7	·· 47.6
10	251°32.9	8°49.0	08.1	343°20.6	59.5	217°51.4	16.4	275°39.0	47.5
11	266°35.3	23°48.3	08.7	358°21.0	59.6	232°53.9	16.4	290°41.2	47.4
12	281°37.8	38°47.6	S19°09.4	13°21.5	S23°59.6	247°56.3	N12°16.4	305°43.5	S11°47.3
13	296°40.2	53°46.9	10.0	28°21.9	59.7	262°58.8	16.5	320°45.7	47.2
14	311°42.7	68°46.2	10.6	43°22.3	59.7	278°01.2	16.5	335°48.0	47.2
15	326°45.2	83°45.6	·· 11.3	58°22.8	·· 59.8	293°03.7	·· 16.5	350°50.2	·· 47.1
16	341°47.6	98°44.9	11.9	73°23.2	59.8	308°06.1	16.5	5°52.5	47.0
17	356°50.1	113°44.2	12.5	88°23.6	59.9	323°08.6	16.5	20°54.7	46.9
18	11°52.6	128°43.5	S19°13.1	103°24.1	S23°59.9	338°11.0	N12°16.6	35°57.0	S11°46.8
19	26°55.0	143°42.8	13.8	118°24.5	24°00.0	353°13.4	16.6	50°59.2	46.7
20	41°57.5	158°42.1	14.4	133°24.9	00.0	8°15.9	16.6	66°01.5	46.7
21	57°00.0	173°41.4	·· 15.0	148°25.3	·· 00.0	23°18.3	·· 16.6	81°03.7	·· 46.6
22	72°02.4	188°40.7	15.6	163°25.8	00.1	38°20.8	16.6	96°06.0	46.5
23	87°04.9	203°40.0	16.2	178°26.2	00.1	53°23.2	16.7	111°08.2	46.4
Mer.pass. 17:13		ν -0.7′	d -0.6′	m -4.01	ν 0.4′	d -0.1′	m 1.37	ν 2.5′	d 0.0′ m -2.58	ν 2.3′	d 0.1′ m 0.95

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	102°07.4	218°39.3	S19°16.9	193°26.6	S24°00.2	68°25.7	N12°16.7	126°10.5	S11°46.3
1	117°09.8	233°38.6	17.5	208°27.1	00.2	83°28.1	16.7	141°12.7	46.2
2	132°12.3	248°37.9	18.1	223°27.5	00.3	98°30.6	16.7	156°15.0	46.1
3	147°14.7	263°37.2	·· 18.7	238°27.9	·· 00.3	113°33.0	·· 16.7	171°17.2	·· 46.1
4	162°17.2	278°36.6	19.3	253°28.4	00.3	128°35.4	16.8	186°19.5	46.0
5	177°19.7	293°35.9	20.0	268°28.8	00.4	143°37.9	16.8	201°21.7	45.9
6	192°22.1	308°35.2	S19°20.6	283°29.2	S24°00.4	158°40.3	N12°16.8	216°24.0	S11°45.8
7	207°24.6	323°34.5	21.2	298°29.7	00.4	173°42.8	16.8	231°26.2	45.7
8	222°27.1	338°33.8	21.8	313°30.1	00.5	188°45.2	16.8	246°28.5	45.6
9	237°29.5	353°33.1	·· 22.4	328°30.5	·· 00.5	203°47.7	·· 16.9	261°30.7	·· 45.5
10	252°32.0	8°32.4	23.0	343°31.0	00.6	218°50.1	16.9	276°33.0	45.5
11	267°34.5	23°31.7	23.6	358°31.4	00.6	233°52.5	16.9	291°35.2	45.4
12	282°36.9	38°31.0	S19°24.2	13°31.8	S24°00.6	248°55.0	N12°16.9	306°37.5	S11°45.3
13	297°39.4	53°30.3	24.8	28°32.2	00.7	263°57.4	17.0	321°39.7	45.2
14	312°41.8	68°29.6	25.5	43°32.7	00.7	278°59.9	17.0	336°42.0	45.1
15	327°44.3	83°28.9	·· 26.1	58°33.1	·· 00.7	294°02.3	·· 17.0	351°44.2	·· 45.0
16	342°46.8	98°28.2	26.7	73°33.5	00.8	309°04.7	17.0	6°46.5	44.9
17	357°49.2	113°27.5	27.3	88°34.0	00.8	324°07.2	17.0	21°48.7	44.9
18	12°51.7	128°26.8	S19°27.9	103°34.4	S24°00.8	339°09.6	N12°17.1	36°50.9	S11°44.8
19	27°54.2	143°26.1	28.5	118°34.8	00.9	354°12.1	17.1	51°53.2	44.7
20	42°56.6	158°25.4	29.1	133°35.2	00.9	9°14.5	17.1	66°55.4	44.6
21	57°59.1	173°24.7	·· 29.7	148°35.7	·· 00.9	24°16.9	·· 17.1	81°57.7	·· 44.5
22	73°01.6	188°24.0	30.3	163°36.1	01.0	39°19.4	17.2	96°59.9	44.4
23	88°04.0	203°23.2	30.9	178°36.5	01.0	54°21.8	17.2	112°02.2	44.3
Mer.pass. 17:09		ν -0.7′	d -0.6′	m -4.01	ν 0.4′	d -0.0′	m 1.37	ν 2.4′	d 0.0′ m -2.58	ν 2.2′	d 0.1′ m 0.96

Stars

	SHA	Dec
Alpheratz	357°35.7	29°13.5
Ankaa	353°08.0	-42°10.8
Schedar	349°32.0	56°40.4
Diphda	348°48.1	-17°51.5
Achernar	335°20.6	-57°07.2
Hamal	327°52.0	23°34.6
Polaris	314°08.6	89°22.2
Acamar	315°12.2	-40°12.7
Menkar	314°06.8	4°11.0
Mirfak	308°29.1	49°56.9
Aldebaran	290°40.3	16°33.5
Rigel	281°04.4	-8°10.5
Capella	280°22.7	46°01.4
Bellatrix	278°23.5	6°22.3
Elnath	278°02.6	28°37.7
Alnilam	275°38.3	-1°11.2
Betelgeuse	270°52.7	7°24.7
Canopus	263°52.2	-52°42.5
Sirius	258°26.6	-16°44.9
Adhara	255°06.1	-29°00.2
Procyon	244°51.4	5°09.8
Pollux	243°18.0	27°58.0
Avior	234°14.5	-59°35.0
Suhail	222°46.6	-43°31.6
Miaplacidus	221°37.7	-69°48.7
Alphard	217°48.3	-8°45.7
Regulus	207°35.1	11°51.0
Dubhe	193°41.7	61°37.0
Denebola	182°25.7	14°26.2
Gienah	175°44.4	-17°40.4
Acrux	173°01.0	-63°13.6
Gacrux	171°52.6	-57°14.5
Alioth	166°13.7	55°49.5
Spica	158°23.3	-11°17.1
Alkaid	152°52.8	49°11.3
Hadar	148°37.5	-60°29.0
Menkent	147°58.8	-36°29.1
Arcturus	145°48.8	19°03.3
Rigil Kent.	139°41.8	-60°55.8
Kochab	137°20.4	74°03.1
Zuben'ubi	136°57.2	-16°08.4
Alphecca	126°04.7	26°37.9
Antares	112°17.2	-26°29.0
Atria	107°12.7	-69°04.1
Sabik	102°04.1	-15°45.3
Shaula	96°11.9	-37°07.2
Rasalhague	95°59.7	12°32.5
Eltanin	90°43.1	51°29.0
Kaus Aust.	83°34.1	-34°22.4
Vega	80°34.2	38°48.3
Nunki	75°49.2	-26°16.1
Altair	62°01.1	8°55.9
Peacock	53°07.6	-56°39.6
Deneb	49°26.8	45°22.0
Enif	33°39.9	9°59.1
Al Na'ir	27°34.3	-46°50.9
Fomalhaut	15°15.6	-29°29.9
Scheat	13°46.2	28°12.9
Markab	13°30.9	15°20.1

Jan 01 Mon	SHA	Mer.pass
Venus	119°03.0	09:24
Mars	92°56.7	11:07
Jupiter	326°18.9	19:31
Saturn	24°13.3	15:40

Jan 02 Tue	SHA	Mer.pass
Venus	117°47.6	09:25
Mars	92°08.0	11:07
Jupiter	326°18.7	19:27
Saturn	24°08.2	15:37

Jan 03 Wed	SHA	Mer.pass
Venus	116°32.0	09:26
Mars	91°19.3	11:06
Jupiter	326°18.3	19:23
Saturn	24°03.1	15:33

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	179°13.8	S23°03.5	301°02.0	16.1′	N12°37.7	12.8′	54.1′
1	194°13.5	03.3	315°37.0	16.1′	12°24.9	12.8′	54.1′
2	209°13.2	03.1	330°12.2	16.2′	12°12.1	12.8′	54.1′
3	224°12.9	·· 02.9	344°47.3	16.2′	11°59.3	12.8′	54.1′
4	239°12.6	02.7	359°22.6	16.3′	11°46.5	12.9′	54.1′
5	254°12.3	02.5	13°57.8	16.3′	11°33.6	13.0′	54.1′
6	269°12.0	S23°02.3	28°33.1	16.4′	N11°20.6	13.0′	54.1′
7	284°11.7	02.1	43°08.5	16.4′	11°07.6	13.0′	54.1′
8	299°11.4	01.9	57°43.9	16.5′	10°54.6	13.0′	54.1′
9	314°11.2	·· 01.7	72°19.4	16.5′	10°41.6	13.1′	54.1′
10	329°10.9	01.5	86°54.9	16.5′	10°28.5	13.1′	54.1′
11	344°10.6	01.3	101°30.4	16.6′	10°15.4	13.2′	54.1′
12	359°10.3	S23°01.1	116°06.0	16.6′	N10°02.2	13.2′	54.1′
13	14°10.0	00.9	130°41.6	16.7′	09°49.0	13.2′	54.1′
14	29°09.7	00.7	145°17.2	16.7′	09°35.8	13.3′	54.1′
15	44°09.4	·· 00.5	159°52.9	16.7′	09°22.5	13.3′	54.1′
16	59°09.1	00.3	174°28.7	16.8′	09°09.2	13.3′	54.1′
17	74°08.8	23°00.1	189°04.4	16.8′	08°55.9	13.4′	54.1′
18	89°08.5	S22°59.9	203°40.2	16.8′	N08°42.5	13.4′	54.1′
19	104°08.2	59.7	218°16.1	16.9′	08°29.1	13.4′	54.1′
20	119°07.9	59.5	232°51.9	16.9′	08°15.7	13.5′	54.1′
21	134°07.6	·· 59.3	247°27.8	16.9′	08°02.2	13.4′	54.1′
22	149°07.3	59.1	262°03.7	17.0′	07°48.8	13.5′	54.1′
23	164°07.0	58.9	276°39.7	17.0′	07°35.3	13.6′	54.1′
	SD = 16.3′	d = 0.2′		SD = 14.8′			

Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	179°06.7	S22°58.7	291°15.7	17.0′	N07°21.7	13.5′	54.1′
1	194°06.4	58.5	305°51.7	17.0′	07°08.2	13.6′	54.1′
2	209°06.1	58.2	320°27.7	17.1′	06°54.6	13.6′	54.1′
3	224°05.9	·· 58.0	335°03.8	17.1′	06°41.0	13.7′	54.1′
4	239°05.6	57.8	349°39.9	17.1′	06°27.3	13.6′	54.1′
5	254°05.3	57.6	4°16.0	17.1′	06°13.7	13.7′	54.1′
6	269°05.0	S22°57.4	18°52.1	17.1′	N06°00.0	13.7′	54.1′
7	284°04.7	57.2	33°28.2	17.2′	05°46.3	13.7′	54.1′
8	299°04.4	57.0	48°04.4	17.2′	05°32.6	13.8′	54.1′
9	314°04.1	·· 56.7	62°40.6	17.2′	05°18.8	13.8′	54.1′
10	329°03.8	56.5	77°16.8	17.2′	05°05.0	13.7′	54.1′
11	344°03.5	56.3	91°53.0	17.2′	04°51.3	13.9′	54.1′
12	359°03.2	S22°56.1	106°29.2	17.2′	N04°37.4	13.8′	54.2′
13	14°02.9	55.9	121°05.4	17.2′	04°23.6	13.8′	54.2′
14	29°02.6	55.6	135°41.7	17.3′	04°09.8	13.9′	54.2′
15	44°02.3	·· 55.4	150°17.9	17.3′	03°55.9	13.9′	54.2′
16	59°02.1	55.2	164°54.2	17.3′	03°42.0	13.9′	54.2′
17	74°01.8	55.0	179°30.5	17.3′	03°28.1	13.9′	54.2′
18	89°01.5	S22°54.7	194°06.8	17.3′	N03°14.2	13.9′	54.2′
19	104°01.2	54.5	208°43.1	17.3′	03°00.3	13.9′	54.2′
20	119°00.9	54.3	223°19.4	17.3′	02°46.4	14.0′	54.2′
21	134°00.6	·· 54.1	237°55.7	17.3′	02°32.4	13.9′	54.2′
22	149°00.3	53.8	252°32.0	17.3′	02°18.5	14.0′	54.2′
23	164°00.0	53.6	267°08.3	17.3′	02°04.5	14.0′	54.2′
	SD = 16.3′	d = 0.2′		SD = 14.8′			

Wed	GHA	Dec	GHA	ν	Dec	d	HP
0	178°59.7	S22°53.4	281°44.6	17.3′	N01°50.5	14.0′	54.2′
1	193°59.4	53.1	296°20.9	17.3′	01°36.5	14.0′	54.3′
2	208°59.1	52.9	310°57.2	17.3′	01°22.5	14.0′	54.3′
3	223°58.9	·· 52.7	325°33.5	17.3′	01°08.5	14.0′	54.3′
4	238°58.6	52.5	340°09.8	17.3′	00°54.5	14.1′	54.3′
5	253°58.3	52.2	354°46.0	17.3′	00°40.4	14.0′	54.3′
6	268°58.0	S22°52.0	9°22.3	17.3′	N00°26.4	14.1′	54.3′
7	283°57.7	51.7	23°58.6	17.3′	N00°12.3	14.0′	54.3′
8	298°57.4	51.5	38°34.8	17.2′	S00°01.7	14.1′	54.3′
9	313°57.1	·· 51.3	53°11.1	17.2′	00°15.8	14.0′	54.3′
10	328°56.8	51.0	67°47.3	17.2′	00°29.8	14.1′	54.4′
11	343°56.5	50.8	82°23.6	17.2′	00°43.9	14.1′	54.4′
12	358°56.3	S22°50.6	96°59.8	17.2′	S00°58.0	14.1′	54.4′
13	13°56.0	50.3	111°36.0	17.2′	01°12.1	14.0′	54.4′
14	28°55.7	50.1	126°12.1	17.2′	01°26.1	14.1′	54.4′
15	43°55.4	·· 49.8	140°48.3	17.1′	01°40.2	14.1′	54.4′
16	58°55.1	49.6	155°24.4	17.1′	01°54.3	14.1′	54.4′
17	73°54.8	49.4	170°00.5	17.1′	02°08.4	14.1′	54.4′
18	88°54.5	S22°49.1	184°36.6	17.1′	S02°22.5	14.0′	54.5′
19	103°54.2	48.9	199°12.7	17.0′	02°36.5	14.1′	54.5′
20	118°53.9	48.6	213°48.8	17.0′	02°50.6	14.1′	54.5′
21	133°53.7	·· 48.4	228°24.8	17.0′	03°04.7	14.1′	54.5′
22	148°53.4	48.1	243°00.8	17.0′	03°18.8	14.0′	54.5′
23	163°53.1	47.9	257°36.8	16.9′	03°32.8	14.1′	54.5′
	SD = 16.3′	d = 0.2′		SD = 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	18:39
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	03:19	20:47	21:48	–:–
58°	–:–	01:51	03:03	21:04	22:15	–:–
S 60°	–:–	01:08	02:44	21:23	22:58	–:–

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

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 20-22 78-61%
01	03:05	03:19	12:03	04:03	16:23	
02	03:33	03:47	12:04	04:42	17:02	
03	04:01	04:15	12:04	05:21	17:41	

January 04, 05, 06 UT (Thu., Fri., Sat.)

	Aries	Venus		Mars		Jupiter		Saturn	
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	103°06.5	218°22.5	S19°31.5	193°37.0	S24°01.0	69°24.2	N12°17.2	127°04.4	S11°44.3
1	118°09.0	233°21.8	32.1	208°37.4	01.1	84°26.7	17.2	142°06.7	44.2
2	133°11.4	248°21.1	32.7	223°37.8	01.1	99°29.1	17.2	157°08.9	44.1
3	148°13.9	263°20.4	·· 33.3	238°38.3	·· 01.1	114°31.5	·· 17.3	172°11.2	·· 44.0
4	163°16.3	278°19.7	33.9	253°38.7	01.2	129°34.0	17.3	187°13.4	43.9
5	178°18.8	293°19.0	34.5	268°39.1	01.2	144°36.4	17.3	202°15.7	43.8
6	193°21.3	308°18.3	S19°35.1	283°39.5	S24°01.2	159°38.8	N12°17.3	217°17.9	S11°43.7
7	208°23.7	323°17.6	35.7	298°40.0	01.2	174°41.3	17.4	232°20.2	43.7
8	223°26.2	338°16.9	36.2	313°40.4	01.3	189°43.7	17.4	247°22.4	43.6
9	238°28.7	353°16.2	·· 36.8	328°40.8	·· 01.3	204°46.1	·· 17.4	262°24.7	·· 43.5
10	253°31.1	8°15.5	37.4	343°41.2	01.3	219°48.6	17.4	277°26.9	43.4
11	268°33.6	23°14.8	38.0	358°41.7	01.3	234°51.0	17.5	292°29.1	43.3
12	283°36.1	38°14.0	S19°38.6	13°42.1	S24°01.4	249°53.4	N12°17.5	307°31.4	S11°43.2
13	298°38.5	53°13.3	39.2	28°42.5	01.4	264°55.9	17.5	322°33.6	43.1
14	313°41.0	68°12.6	39.8	43°43.0	01.4	279°58.3	17.5	337°35.9	43.1
15	328°43.5	83°11.9	·· 40.4	58°43.4	·· 01.4	295°00.7	·· 17.6	352°38.1	·· 43.0
16	343°45.9	98°11.2	40.9	73°43.8	01.5	310°03.2	17.6	7°40.4	42.9
17	358°48.4	113°10.5	41.5	88°44.2	01.5	325°05.6	17.6	22°42.6	42.8
18	13°50.8	128°09.8	S19°42.1	103°44.7	S24°01.5	340°08.0	N12°17.6	37°44.9	S11°42.7
19	28°53.3	143°09.1	42.7	118°45.1	01.5	355°10.5	17.7	52°47.1	42.6
20	43°55.8	158°08.3	43.3	133°45.5	01.6	10°12.9	17.7	67°49.3	42.5
21	58°58.2	173°07.6	·· 43.9	148°45.9	·· 01.6	25°15.3	·· 17.7	82°51.6	·· 42.4
22	74°00.7	188°06.9	44.4	163°46.4	01.6	40°17.7	17.7	97°53.8	42.4
23	89°03.2	203°06.2	45.0	178°46.8	01.6	55°20.2	17.8	112°56.1	42.3
Mer.pass. 17:05		ν -0.7′	d -0.6′	m -4.00	ν 0.4′	d -0.0′	m 1.37	ν 2.4′	d 0.0′ m -2.57	ν 2.2′	d 0.1′ m 0.96

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	104°05.6	218°05.5	S19°45.6	193°47.2	S24°01.6	70°22.6	N12°17.8	127°58.3	S11°42.2
1	119°08.1	233°04.8	46.2	208°47.7	01.7	85°25.0	17.8	143°00.6	42.1
2	134°10.6	248°04.0	46.7	223°48.1	01.7	100°27.5	17.8	158°02.8	42.0
3	149°13.0	263°03.3	·· 47.3	238°48.5	·· 01.7	115°29.9	·· 17.9	173°05.1	·· 41.9
4	164°15.5	278°02.6	47.9	253°48.9	01.7	130°32.3	17.9	188°07.3	41.8
5	179°17.9	293°01.9	48.5	268°49.4	01.7	145°34.7	17.9	203°09.5	41.7
6	194°20.4	308°01.2	S19°49.0	283°49.8	S24°01.8	160°37.2	N12°17.9	218°11.8	S11°41.7
7	209°22.9	323°00.4	49.6	298°50.2	01.8	175°39.6	18.0	233°14.0	41.6
8	224°25.3	337°59.7	50.2	313°50.6	01.8	190°42.0	18.0	248°16.3	41.5
9	239°27.8	352°59.0	·· 50.8	328°51.1	·· 01.8	205°44.4	·· 18.0	263°18.5	·· 41.4
10	254°30.3	7°58.3	51.3	343°51.5	01.8	220°46.9	18.1	278°20.8	41.3
11	269°32.7	22°57.6	51.9	358°51.9	01.8	235°49.3	18.1	293°23.0	41.2
12	284°35.2	37°56.8	S19°52.5	13°52.3	S24°01.9	250°51.7	N12°18.1	308°25.3	S11°41.1
13	299°37.7	52°56.1	53.0	28°52.8	01.9	265°54.1	18.1	323°27.5	41.0
14	314°40.1	67°55.4	53.6	43°53.2	01.9	280°56.6	18.2	338°29.7	41.0
15	329°42.6	82°54.7	·· 54.2	58°53.6	·· 01.9	295°59.0	·· 18.2	353°32.0	·· 40.9
16	344°45.1	97°53.9	54.7	73°54.0	01.9	311°01.4	18.2	8°34.2	40.8
17	359°47.5	112°53.2	55.3	88°54.5	01.9	326°03.8	18.3	23°36.5	40.7
18	14°50.0	127°52.5	S19°55.8	103°54.9	S24°01.9	341°06.2	N12°18.3	38°38.7	S11°40.6
19	29°52.4	142°51.8	56.4	118°55.3	01.9	356°08.7	18.3	53°41.0	40.5
20	44°54.9	157°51.0	57.0	133°55.7	02.0	11°11.1	18.3	68°43.2	40.4
21	59°57.4	172°50.3	·· 57.5	148°56.2	·· 02.0	26°13.5	·· 18.4	83°45.4	·· 40.3
22	74°59.8	187°49.6	58.1	163°56.6	02.0	41°15.9	18.4	98°47.7	40.3
23	90°02.3	202°48.9	58.6	178°57.0	02.0	56°18.3	18.4	113°49.9	40.2
Mer.pass. 17:01		ν -0.7′	d -0.6′	m -4.00	ν 0.4′	d -0.0′	m 1.36	ν 2.4′	d 0.0′ m -2.56	ν 2.2′	d 0.1′ m 0.96

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	105°04.8	217°48.1	S19°59.2	193°57.4	S24°02.0	71°20.8	N12°18.4	128°52.2	S11°40.1
1	120°07.2	232°47.4	19°59.7	208°57.9	02.0	86°23.2	18.5	143°54.4	40.0
2	135°09.7	247°46.7	20°00.3	223°58.3	02.0	101°25.6	18.5	158°56.6	39.9
3	150°12.2	262°45.9	·· 00.8	238°58.7	·· 02.0	116°28.0	·· 18.5	173°58.9	·· 39.8
4	165°14.6	277°45.2	01.4	253°59.1	02.0	131°30.4	18.6	189°01.1	39.7
5	180°17.1	292°44.5	02.0	268°59.6	02.0	146°32.9	18.6	204°03.4	39.6
6	195°19.6	307°43.7	S20°02.5	284°00.0	S24°02.1	161°35.3	N12°18.6	219°05.6	S11°39.6
7	210°22.0	322°43.0	03.1	299°00.4	02.1	176°37.7	18.7	234°07.9	39.5
8	225°24.5	337°42.3	03.6	314°00.8	02.1	191°40.1	18.7	249°10.1	39.4
9	240°26.9	352°41.5	·· 04.1	329°01.3	·· 02.1	206°42.5	·· 18.7	264°12.3	·· 39.3
10	255°29.4	7°40.8	04.7	344°01.7	02.1	221°44.9	18.7	279°14.6	39.2
11	270°31.9	22°40.1	05.2	359°02.1	02.1	236°47.4	18.8	294°16.8	39.1
12	285°34.3	37°39.3	S20°05.8	14°02.5	S24°02.1	251°49.8	N12°18.8	309°19.1	S11°39.0
13	300°36.8	52°38.6	06.3	29°02.9	02.1	266°52.2	18.8	324°21.3	38.9
14	315°39.3	67°37.9	06.9	44°03.4	02.1	281°54.6	18.9	339°23.5	38.8
15	330°41.7	82°37.1	·· 07.4	59°03.8	·· 02.1	296°57.0	·· 18.9	354°25.8	·· 38.8
16	345°44.2	97°36.4	08.0	74°04.2	02.1	311°59.4	18.9	9°28.0	38.7
17	0°46.7	112°35.7	08.5	89°04.6	02.1	327°01.8	19.0	24°30.3	38.6
18	15°49.1	127°34.9	S20°09.0	104°05.1	S24°02.1	342°04.3	N12°19.0	39°32.5	S11°38.5
19	30°51.6	142°34.2	09.6	119°05.5	02.1	357°06.7	19.0	54°34.7	38.4
20	45°54.0	157°33.5	10.1	134°05.9	02.1	12°09.1	19.1	69°37.0	38.3
21	60°56.5	172°32.7	·· 10.6	149°06.3	·· 02.1	27°11.5	·· 19.1	84°39.2	·· 38.2
22	75°59.0	187°32.0	11.2	164°06.7	02.1	42°13.9	19.1	99°41.5	38.1
23	91°01.4	202°31.2	11.7	179°07.2	02.1	57°16.3	19.1	114°43.7	38.0
Mer.pass. 16:57		ν -0.7′	d -0.6′	m -4.00	ν 0.4′	d -0.0′	m 1.36	ν 2.4′	d 0.0′ m -2.55	ν 2.2′	d 0.1′ m 0.96

Stars

	SHA	Dec
Alpheratz	357°35.7	29°13.5
Ankaa	353°08.0	-42°10.8
Schedar	349°32.0	56°40.4
Diphda	348°48.2	-17°51.5
Achernar	335°20.7	-57°07.2
Hamal	327°52.0	23°34.6
Polaris	314°09.8	89°22.2
Acamar	315°12.2	-40°12.7
Menkar	314°06.8	4°11.0
Mirfak	308°29.1	49°56.9
Aldebaran	290°40.3	16°33.5
Rigel	281°04.4	-8°10.5
Capella	280°22.7	46°01.4
Bellatrix	278°23.5	6°22.3
Elnath	278°02.6	28°37.7
Alnilam	275°38.3	-1°11.2
Betelgeuse	270°52.7	7°24.7
Canopus	263°52.2	-52°42.5
Sirius	258°26.6	-16°44.9
Adhara	255°06.1	-29°00.3
Procyon	244°51.4	5°09.8
Pollux	243°18.0	27°58.0
Avior	234°14.5	-59°35.0
Suhail	222°46.6	-43°31.6
Miaplacidus	221°37.7	-69°48.7
Alphard	217°48.3	-8°45.7
Regulus	207°35.1	11°50.9
Dubhe	193°41.7	61°37.0
Denebola	182°25.7	14°26.2
Gienah	175°44.4	-17°40.4
Acrux	173°01.0	-63°13.6
Gacrux	171°52.6	-57°14.6
Alioth	166°13.7	55°49.5
Spica	158°23.2	-11°17.1
Alkaid	152°52.8	49°11.3
Hadar	148°37.4	-60°29.0
Menkent	147°58.8	-36°29.1
Arcturus	145°48.8	19°03.3
Rigil Kent.	139°41.8	-60°55.8
Kochab	137°20.4	74°03.1
Zuben'ubi	136°57.1	-16°08.4
Alphecca	126°04.7	26°37.9
Antares	112°17.2	-26°29.0
Atria	107°12.7	-69°04.1
Sabik	102°04.1	-15°45.3
Shaula	96°11.9	-37°07.2
Rasalhague	95°59.7	12°32.5
Eltanin	90°43.1	51°29.0
Kaus Aust.	83°34.0	-34°22.4
Vega	80°34.2	38°48.3
Nunki	75°49.2	-26°16.1
Altair	62°01.1	8°55.8
Peacock	53°07.6	-56°39.6
Deneb	49°26.8	45°22.0
Enif	33°39.9	9°59.1
Al Na'ir	27°34.3	-46°50.9
Fomalhaut	15°15.6	-29°29.9
Scheat	13°46.2	28°12.9
Markab	13°30.9	15°20.1

Jan 04 Thu	SHA	Mer.pass
Venus	115°16.1	09:27
Mars	90°30.5	11:05
Jupiter	326°17.7	19:19
Saturn	23°57.9	15:29

Jan 05 Fri	SHA	Mer.pass
Venus	113°59.8	09:28
Mars	89°41.6	11:05
Jupiter	326°17.0	19:15
Saturn	23°52.7	15:26

Jan 06 Sat	SHA	Mer.pass
Venus	112°43.4	09:29
Mars	88°52.7	11:04
Jupiter	326°16.0	19:12
Saturn	23°47.4	15:22

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.0899 sec ΔT = TT-UT1 = +69.0941 sec

2024 January 04 to Jan. 06 UT

h	Sun		Moon				
Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°52.8	S22°47.6	272°12.7	16.9′	S03°46.9	14.1′	54.6′
1	193°52.5	47.4	286°48.6	16.9′	04°01.0	14.0′	54.6′
2	208°52.2	47.1	301°24.5	16.8′	04°15.0	14.1′	54.6′
3	223°51.9	·· 46.9	316°00.3	16.8′	04°29.1	14.0′	54.6′
4	238°51.7	46.6	330°36.1	16.8′	04°43.1	14.1′	54.6′
5	253°51.4	46.4	345°11.9	16.7′	04°57.2	14.0′	54.6′
6	268°51.1	S22°46.1	359°47.7	16.7′	S05°11.2	14.0′	54.7′
7	283°50.8	45.9	14°23.4	16.7′	05°25.2	14.0′	54.7′
8	298°50.5	45.6	28°59.0	16.6′	05°39.2	14.0′	54.7′
9	313°50.2	·· 45.4	43°34.6	16.6′	05°53.2	14.0′	54.7′
10	328°49.9	45.1	58°10.2	16.5′	06°07.2	14.0′	54.7′
11	343°49.7	44.8	72°45.8	16.5′	06°21.2	13.9′	54.8′
12	358°49.4	S22°44.6	87°21.2	16.4′	S06°35.1	14.0′	54.8′
13	13°49.1	44.3	101°56.7	16.4′	06°49.1	13.9′	54.8′
14	28°48.8	44.1	116°32.1	16.4′	07°03.0	13.9′	54.8′
15	43°48.5	·· 43.8	131°07.4	16.3′	07°16.9	13.9′	54.8′
16	58°48.2	43.5	145°42.7	16.3′	07°30.8	13.9′	54.9′
17	73°48.0	43.3	160°18.0	16.2′	07°44.7	13.9′	54.9′
18	88°47.7	S22°43.0	174°53.2	16.1′	S07°58.6	13.8′	54.9′
19	103°47.4	42.8	189°28.3	16.1′	08°12.4	13.8′	54.9′
20	118°47.1	42.5	204°03.4	16.0′	08°26.2	13.8′	54.9′
21	133°46.8	·· 42.2	218°38.5	16.0′	08°40.0	13.8′	55.0′
22	148°46.5	42.0	233°13.5	15.9′	08°53.8	13.8′	55.0′
23	163°46.3	41.7	247°48.4	15.9′	09°07.6	13.7′	55.0′
	SD = 16.3′	d = 0.2′	SD = 14.9′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°46.0	S22°41.4	262°23.2	15.8′	S09°21.3	13.8′	55.0′
1	193°45.7	41.2	276°58.0	15.7′	09°35.1	13.7′	55.1′
2	208°45.4	40.9	291°32.8	15.7′	09°48.8	13.6′	55.1′
3	223°45.1	·· 40.6	306°07.4	15.6′	10°02.4	13.7′	55.1′
4	238°44.8	40.3	320°42.1	15.5′	10°16.1	13.6′	55.1′
5	253°44.6	40.1	335°16.6	15.5′	10°29.7	13.6′	55.2′
6	268°44.3	S22°39.8	349°51.1	15.4′	S10°43.3	13.5′	55.2′
7	283°44.0	39.5	4°25.5	15.3′	10°56.8	13.6′	55.2′
8	298°43.7	39.3	18°59.8	15.3′	11°10.4	13.5′	55.2′
9	313°43.4	·· 39.0	33°34.1	15.2′	11°23.9	13.4′	55.3′
10	328°43.2	38.7	48°08.3	15.1′	11°37.3	13.5′	55.3′
11	343°42.9	38.4	62°42.4	15.0′	11°50.8	13.4′	55.3′
12	358°42.6	S22°38.2	77°16.5	15.0′	S12°04.2	13.3′	55.3′
13	13°42.3	37.9	91°50.4	14.9′	12°17.5	13.4′	55.4′
14	28°42.0	37.6	106°24.3	14.8′	12°30.9	13.3′	55.4′
15	43°41.7	·· 37.3	120°58.1	14.7′	12°44.2	13.2′	55.4′
16	58°41.5	37.0	135°31.9	14.7′	12°57.4	13.2′	55.5′
17	73°41.2	36.8	150°05.5	14.6′	13°10.6	13.2′	55.5′
18	88°40.9	S22°36.5	164°39.1	14.5′	S13°23.8	13.1′	55.5′
19	103°40.6	36.2	179°12.6	14.4′	13°36.9	13.1′	55.5′
20	118°40.4	35.9	193°46.0	14.3′	13°50.0	13.1′	55.6′
21	133°40.1	·· 35.6	208°19.3	14.2′	14°03.1	13.0′	55.6′
22	148°39.8	35.3	222°52.5	14.1′	14°16.1	13.0′	55.6′
23	163°39.5	35.1	237°25.6	14.0′	14°29.1	12.9′	55.7′
	SD = 16.3′	d = 0.3′	SD = 15.0′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°39.2	S22°34.8	251°58.7	14.0′	S14°42.0	12.8′	55.7′
1	193°39.0	34.5	266°31.6	13.9′	14°54.8	12.9′	55.7′
2	208°38.7	34.2	281°04.5	13.8′	15°07.7	12.7′	55.7′
3	223°38.4	·· 33.9	295°37.3	13.7′	15°20.4	12.7′	55.8′
4	238°38.1	33.6	310°10.0	13.6′	15°33.1	12.7′	55.8′
5	253°37.8	33.3	324°42.5	13.5′	15°45.8	12.6′	55.8′
6	268°37.6	S22°33.0	339°15.0	13.4′	S15°58.4	12.6′	55.9′
7	283°37.3	32.7	353°47.4	13.3′	16°11.0	12.5′	55.9′
8	298°37.0	32.5	8°19.7	13.2′	16°23.5	12.4′	55.9′
9	313°36.7	·· 32.2	22°51.9	13.1′	16°35.9	12.4′	56.0′
10	328°36.5	31.9	37°24.0	13.0′	16°48.3	12.3′	56.0′
11	343°36.2	31.6	51°55.9	12.9′	17°00.6	12.3′	56.0′
12	358°35.9	S22°31.3	66°27.8	12.8′	S17°12.9	12.2′	56.1′
13	13°35.6	31.0	80°59.6	12.7′	17°25.1	12.1′	56.1′
14	28°35.4	30.7	95°31.2	12.6′	17°37.2	12.1′	56.1′
15	43°35.1	·· 30.4	110°02.8	12.4′	17°49.3	12.0′	56.2′
16	58°34.8	30.1	124°34.2	12.3′	18°01.3	11.9′	56.2′
17	73°34.5	29.8	139°05.6	12.2′	18°13.2	11.9′	56.2′
18	88°34.3	S22°29.5	153°36.8	12.1′	S18°25.1	11.8′	56.3′
19	103°34.0	29.2	168°07.9	12.0′	18°36.9	11.7′	56.3′
20	118°33.7	28.9	182°38.9	11.9′	18°48.6	11.7′	56.3′
21	133°33.4	·· 28.6	197°09.8	11.8′	19°00.3	11.6′	56.4′
22	148°33.2	28.3	211°40.6	11.7′	19°11.9	11.5′	56.4′
23	163°32.9	28.0	226°11.3	11.5′	19°23.4	11.4′	56.4′
	SD = 16.3′	d = 0.3′	SD = 15.2′				

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

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

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 23-25 51-32%
04	04:29	04:43	12:05	06:01	18:21	
05	04:56	05:10	12:05	06:42	19:03	
06	05:23	05:36	12:06	07:26	19:49	

No IERS EOP prediction data available

January 07, 08, 09 UT (Sun., Mon., Tue.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	106°03.9	217°30.5	S20°12.3	194°07.6	S24°02.1	72°18.7	N12°19.2	129°45.9	S11°38.0
1	121°06.4	232°29.8	12.8	209°08.0	02.1	87°21.1	19.2	144°48.2	37.9
2	136°08.8	247°29.0	13.3	224°08.4	02.1	102°23.5	19.2	159°50.4	37.8
3	151°11.3	262°28.3	·· 13.8	239°08.9	·· 02.1	117°26.0	·· 19.3	174°52.7	·· 37.7
4	166°13.8	277°27.5	14.4	254°09.3	02.1	132°28.4	19.3	189°54.9	37.6
5	181°16.2	292°26.8	14.9	269°09.7	02.1	147°30.8	19.3	204°57.1	37.5
6	196°18.7	307°26.1	S20°15.4	284°10.1	S24°02.1	162°33.2	N12°19.4	219°59.4	S11°37.4
7	211°21.2	322°25.3	16.0	299°10.5	02.1	177°35.6	19.4	235°01.6	37.3
8	226°23.6	337°24.6	16.5	314°11.0	02.1	192°38.0	19.4	250°03.8	37.2
9	241°26.1	352°23.8	·· 17.0	329°11.4	·· 02.1	207°40.4	·· 19.5	265°06.1	·· 37.2
10	256°28.5	7°23.1	17.5	344°11.8	02.1	222°42.8	19.5	280°08.3	37.1
11	271°31.0	22°22.3	18.1	359°12.2	02.1	237°45.2	19.5	295°10.6	37.0
12	286°33.5	37°21.6	S20°18.6	14°12.7	S24°02.1	252°47.6	N12°19.6	310°12.8	S11°36.9
13	301°35.9	52°20.9	19.1	29°13.1	02.1	267°50.0	19.6	325°15.0	36.8
14	316°38.4	67°20.1	19.6	44°13.5	02.0	282°52.4	19.6	340°17.3	36.7
15	331°40.9	82°19.4	·· 20.1	59°13.9	·· 02.0	297°54.8	·· 19.7	355°19.5	·· 36.6
16	346°43.3	97°18.6	20.7	74°14.3	02.0	312°57.3	19.7	10°21.8	36.5
17	1°45.8	112°17.9	21.2	89°14.8	02.0	327°59.7	19.7	25°24.0	36.4
18	16°48.3	127°17.1	S20°21.7	104°15.2	S24°02.0	343°02.1	N12°19.8	40°26.2	S11°36.4
19	31°50.7	142°16.4	22.2	119°15.6	02.0	358°04.5	19.8	55°28.5	36.3
20	46°53.2	157°15.6	22.7	134°16.0	02.0	13°06.9	19.8	70°30.7	36.2
21	61°55.7	172°14.9	·· 23.2	149°16.4	·· 02.0	28°09.3	·· 19.9	85°32.9	·· 36.1
22	76°58.1	187°14.1	23.8	164°16.9	02.0	43°11.7	19.9	100°35.2	36.0
23	92°00.6	202°13.4	24.3	179°17.3	02.0	58°14.1	19.9	115°37.4	35.9
Mer.pass. 16:53		ν -0.7′	d -0.5′	m -3.99	ν 0.4′	d 0.0′	m 1.36	ν 2.4′	d 0.0′ m -2.54	ν 2.2′	d 0.1′ m 0.96

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	107°03.0	217°12.6	S20°24.8	194°17.7	S24°01.9	73°16.5	N12°20.0	130°39.7	S11°35.8
1	122°05.5	232°11.9	25.3	209°18.1	01.9	88°18.9	20.0	145°41.9	35.7
2	137°08.0	247°11.1	25.8	224°18.5	01.9	103°21.3	20.0	160°44.1	35.6
3	152°10.4	262°10.4	·· 26.3	239°19.0	·· 01.9	118°23.7	·· 20.1	175°46.4	·· 35.5
4	167°12.9	277°09.6	26.8	254°19.4	01.9	133°26.1	20.1	190°48.6	35.5
5	182°15.4	292°08.9	27.3	269°19.8	01.9	148°28.5	20.1	205°50.8	35.4
6	197°17.8	307°08.1	S20°27.8	284°20.2	S24°01.9	163°30.9	N12°20.2	220°53.1	S11°35.3
7	212°20.3	322°07.4	28.3	299°20.6	01.9	178°33.3	20.2	235°55.3	35.2
8	227°22.8	337°06.6	28.8	314°21.1	01.8	193°35.7	20.3	250°57.5	35.1
9	242°25.2	352°05.9	·· 29.3	329°21.5	·· 01.8	208°38.1	·· 20.3	265°59.8	·· 35.0
10	257°27.7	7°05.1	29.8	344°21.9	01.8	223°40.5	20.3	281°02.0	34.9
11	272°30.2	22°04.3	30.3	359°22.3	01.8	238°42.9	20.4	296°04.3	34.8
12	287°32.6	37°03.6	S20°30.8	14°22.7	S24°01.8	253°45.3	N12°20.4	311°06.5	S11°34.7
13	302°35.1	52°02.8	31.3	29°23.2	01.8	268°47.7	20.4	326°08.7	34.6
14	317°37.5	67°02.1	31.8	44°23.6	01.7	283°50.1	20.5	341°11.0	34.6
15	332°40.0	82°01.3	·· 32.3	59°24.0	·· 01.7	298°52.5	·· 20.5	356°13.2	·· 34.5
16	347°42.5	97°00.6	32.8	74°24.4	01.7	313°54.9	20.5	11°15.4	34.4
17	2°44.9	111°59.8	33.3	89°24.8	01.7	328°57.3	20.6	26°17.7	34.3
18	17°47.4	126°59.0	S20°33.8	104°25.3	S24°01.7	343°59.7	N12°20.6	41°19.9	S11°34.2
19	32°49.9	141°58.3	34.3	119°25.7	01.6	359°02.1	20.6	56°22.1	34.1
20	47°52.3	156°57.5	34.8	134°26.1	01.6	14°04.5	20.7	71°24.4	34.0
21	62°54.8	171°56.8	·· 35.3	149°26.5	·· 01.6	29°06.9	·· 20.7	86°26.6	·· 33.9
22	77°57.3	186°56.0	35.8	164°26.9	01.6	44°09.3	20.8	101°28.8	33.8
23	92°59.7	201°55.3	36.3	179°27.3	01.6	59°11.7	20.8	116°31.1	33.7
Mer.pass. 16:49		ν -0.8′	d -0.5′	m -3.99	ν 0.4′	d 0.0′	m 1.36	ν 2.4′	d 0.0′ m -2.53	ν 2.2′	d 0.1′ m 0.97

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	108°02.2	216°54.5	S20°36.8	194°27.8	S24°01.5	74°14.1	N12°20.8	131°33.3	S11°33.6
1	123°04.7	231°53.7	37.2	209°28.2	01.5	89°16.4	20.9	146°35.5	33.6
2	138°07.1	246°53.0	37.7	224°28.6	01.5	104°18.8	20.9	161°37.8	33.5
3	153°09.6	261°52.2	·· 38.2	239°29.0	·· 01.5	119°21.2	·· 20.9	176°40.0	·· 33.4
4	168°12.0	276°51.4	38.7	254°29.4	01.4	134°23.6	21.0	191°42.2	33.3
5	183°14.5	291°50.7	39.2	269°29.9	01.4	149°26.0	21.0	206°44.5	33.2
6	198°17.0	306°49.9	S20°39.7	284°30.3	S24°01.4	164°28.4	N12°21.1	221°46.7	S11°33.1
7	213°19.4	321°49.2	40.1	299°30.7	01.4	179°30.8	21.1	236°49.0	33.0
8	228°21.9	336°48.4	40.6	314°31.1	01.3	194°33.2	21.1	251°51.2	32.9
9	243°24.4	351°47.6	·· 41.1	329°31.5	·· 01.3	209°35.6	·· 21.2	266°53.4	·· 32.8
10	258°26.8	6°46.9	41.6	344°31.9	01.3	224°38.0	21.2	281°55.7	32.7
11	273°29.3	21°46.1	42.1	359°32.4	01.3	239°40.4	21.3	296°57.9	32.6
12	288°31.8	36°45.3	S20°42.5	14°32.8	S24°01.2	254°42.8	N12°21.3	312°00.1	S11°32.6
13	303°34.2	51°44.6	43.0	29°33.2	01.2	269°45.2	21.3	327°02.4	32.5
14	318°36.7	66°43.8	43.5	44°33.6	01.2	284°47.5	21.4	342°04.6	32.4
15	333°39.2	81°43.0	·· 44.0	59°34.0	·· 01.2	299°49.9	·· 21.4	357°06.8	·· 32.3
16	348°41.6	96°42.3	44.4	74°34.4	01.1	314°52.3	21.4	12°09.1	32.2
17	3°44.1	111°41.5	44.9	89°34.9	01.1	329°54.7	21.5	27°11.3	32.1
18	18°46.5	126°40.7	S20°45.4	104°35.3	S24°01.1	344°57.1	N12°21.5	42°13.5	S11°32.0
19	33°49.0	141°40.0	45.8	119°35.7	01.0	359°59.5	21.6	57°15.8	31.9
20	48°51.5	156°39.2	46.3	134°36.1	01.0	15°01.9	21.6	72°18.0	31.8
21	63°53.9	171°38.4	·· 46.8	149°36.5	·· 01.0	30°04.3	·· 21.6	87°20.2	·· 31.7
22	78°56.4	186°37.7	47.2	164°37.0	00.9	45°06.6	21.7	102°22.4	31.6
23	93°58.9	201°36.9	47.7	179°37.4	00.9	60°09.0	21.7	117°24.7	31.6
Mer.pass. 16:45		ν -0.8′	d -0.5′	m -3.98	ν 0.4′	d 0.0′	m 1.36	ν 2.4′	d 0.0′ m -2.53	ν 2.2′	d 0.1′ m 0.97

Stars

	SHA	**Dec**
Alpheratz	357°35.7	29°13.5
Ankaa	353°08.0	-42°10.8
Schedar	349°32.1	56°40.4
Diphda	348°48.2	-17°51.5
Achernar	335°20.7	-57°07.2
Hamal	327°52.0	23°34.6
Polaris	314°10.8	89°22.2
Acamar	315°12.2	-40°12.7
Menkar	314°06.9	4°11.0
Mirfak	308°29.1	49°56.9
Aldebaran	290°40.3	16°33.5
Rigel	281°04.4	-8°10.5
Capella	280°22.7	46°01.4
Bellatrix	278°23.5	6°22.3
Elnath	278°02.6	28°37.7
Alnilam	275°38.3	-1°11.2
Betelgeuse	270°52.7	7°24.7
Canopus	263°52.2	-52°42.5
Sirius	258°26.6	-16°45.0
Adhara	255°06.1	-29°00.3
Procyon	244°51.4	5°09.8
Pollux	243°18.0	27°58.0
Avior	234°14.5	-59°35.0
Suhail	222°46.5	-43°31.6
Miaplacidus	221°37.6	-69°48.7
Alphard	217°48.3	-8°45.7
Regulus	207°35.1	11°50.9
Dubhe	193°41.7	61°37.0
Denebola	182°25.7	14°26.2
Gienah	175°44.4	-17°40.4
Acrux	173°00.9	-63°13.6
Gacrux	171°52.5	-57°14.6
Alioth	166°13.7	55°49.5
Spica	158°23.2	-11°17.1
Alkaid	152°52.8	49°11.3
Hadar	148°37.4	-60°29.0
Menkent	147°58.7	-36°29.1
Arcturus	145°48.8	19°03.3
Rigil Kent.	139°41.7	-60°55.8
Kochab	137°20.3	74°03.1
Zuben'ubi	136°57.1	-16°08.4
Alphecca	126°04.7	26°37.9
Antares	112°17.2	-26°29.0
Atria	107°12.6	-69°04.0
Sabik	102°04.1	-15°45.3
Shaula	96°11.9	-37°07.2
Rasalhague	95°59.6	12°32.5
Eltanin	90°43.1	51°29.0
Kaus Aust.	83°34.0	-34°22.4
Vega	80°34.2	38°48.2
Nunki	75°49.2	-26°16.1
Altair	62°01.1	8°55.8
Peacock	53°07.6	-56°39.6
Deneb	49°26.8	45°22.0
Enif	33°39.9	9°59.1
Al Na'ir	27°34.3	-46°50.9
Fomalhaut	15°15.6	-29°29.9
Scheat	13°46.2	28°12.8
Markab	13°30.9	15°20.1

Jan 07 Sun	**SHA**	**Mer.pass**
Venus	111°26.6	09:30
Mars	88°03.7	11:03
Jupiter	326°14.8	19:08
Saturn	23°42.0	15:19

Jan 08 Mon	**SHA**	**Mer.pass**
Venus	110°09.6	09:32
Mars	87°14.7	11:03
Jupiter	326°13.4	19:04
Saturn	23°36.6	15:15

Jan 09 Tue	**SHA**	**Mer.pass**
Venus	108°52.3	09:33
Mars	86°25.6	11:02
Jupiter	326°11.9	19:00
Saturn	23°31.1	15:12

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°32.6	S22°27.7	240°41.8	11.4′	S19°34.8	11.3′	56.5′
1	193°32.3	27.4	255°12.3	11.3′	19°46.1	11.3′	56.5′
2	208°32.1	27.1	269°42.6	11.2′	19°57.4	11.2′	56.5′
3	223°31.8	·· 26.8	284°12.8	11.1′	20°08.6	11.1′	56.6′
4	238°31.5	26.4	298°42.9	11.0′	20°19.7	11.0′	56.6′
5	253°31.2	26.1	313°12.8	10.8′	20°30.7	10.9′	56.6′
6	268°31.0	S22°25.8	327°42.6	10.7′	S20°41.6	10.8′	56.7′
7	283°30.7	25.5	342°12.4	10.6′	20°52.4	10.8′	56.7′
8	298°30.4	25.2	356°42.0	10.5′	21°03.2	10.6′	56.7′
9	313°30.2	·· 24.9	11°11.4	10.3′	21°13.8	10.6′	56.8′
10	328°29.9	24.6	25°40.8	10.2′	21°24.4	10.4′	56.8′
11	343°29.6	24.3	40°10.0	10.1′	21°34.8	10.4′	56.8′
12	358°29.3	S22°24.0	54°39.1	10.0′	S21°45.2	10.3′	56.9′
13	13°29.1	23.6	69°08.1	9.8′	21°55.5	10.2′	56.9′
14	28°28.8	23.3	83°36.9	9.7′	22°05.7	10.0′	56.9′
15	43°28.5	·· 23.0	98°05.6	9.6′	22°15.7	10.0′	57.0′
16	58°28.3	22.7	112°34.2	9.5′	22°25.7	9.8′	57.0′
17	73°28.0	22.4	127°02.7	9.3′	22°35.5	9.8′	57.1′
18	88°27.7	S22°22.1	141°31.1	9.2′	S22°45.3	9.6′	57.1′
19	103°27.4	21.7	155°59.3	9.1′	22°54.9	9.6′	57.1′
20	118°27.2	21.4	170°27.4	9.0′	23°04.5	9.4′	57.2′
21	133°26.9	·· 21.1	184°55.3	8.8′	23°13.9	9.3′	57.2′
22	148°26.6	20.8	199°23.2	8.7′	23°23.2	9.2′	57.2′
23	163°26.4	20.5	213°50.9	8.6′	23°32.4	9.1′	57.3′
	SD = 16.3′	d = 0.3′	SD = 15.4′				

Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°26.1	S22°20.1	228°18.4	8.4′	S23°41.5	8.9′	57.3′
1	193°25.8	19.8	242°45.9	8.3′	23°50.4	8.9′	57.3′
2	208°25.6	19.5	257°13.2	8.2′	23°59.3	8.7′	57.4′
3	223°25.3	·· 19.2	271°40.4	8.1′	24°08.0	8.6′	57.4′
4	238°25.0	18.8	286°07.5	7.9′	24°16.6	8.4′	57.5′
5	253°24.8	18.5	300°34.4	7.8′	24°25.0	8.4′	57.5′
6	268°24.5	S22°18.2	315°01.2	7.7′	S24°33.4	8.2′	57.5′
7	283°24.2	17.8	329°27.9	7.6′	24°41.6	8.0′	57.6′
8	298°23.9	17.5	343°54.5	7.4′	24°49.6	8.0′	57.6′
9	313°23.7	·· 17.2	358°20.9	7.3′	24°57.6	7.8′	57.6′
10	328°23.4	16.9	12°47.2	7.2′	25°05.4	7.7′	57.7′
11	343°23.1	16.5	27°13.4	7.1′	25°13.1	7.5′	57.7′
12	358°22.9	S22°16.2	41°39.4	6.9′	S25°20.6	7.4′	57.7′
13	13°22.6	15.9	56°05.4	6.8′	25°28.0	7.2′	57.8′
14	28°22.3	15.5	70°31.2	6.7′	25°35.2	7.1′	57.8′
15	43°22.1	·· 15.2	84°56.8	6.6′	25°42.3	7.0′	57.9′
16	58°21.8	14.9	99°22.4	6.4′	25°49.3	6.8′	57.9′
17	73°21.6	14.5	113°47.8	6.3′	25°56.1	6.7′	57.9′
18	88°21.3	S22°14.2	128°13.2	6.2′	S26°02.8	6.5′	58.0′
19	103°21.0	13.8	142°38.4	6.1′	26°09.3	6.4′	58.0′
20	118°20.8	13.5	157°03.4	6.0′	26°15.7	6.2′	58.0′
21	133°20.5	·· 13.2	171°28.4	5.8′	26°21.9	6.0′	58.1′
22	148°20.2	12.8	185°53.3	5.7′	26°27.9	5.9′	58.1′
23	163°20.0	12.5	200°18.0	5.6′	26°33.8	5.8′	58.1′
	SD = 16.3′	d = 0.3′	SD = 15.6′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°19.7	S22°12.1	214°42.6	5.5′	S26°39.6	5.6′	58.2′
1	193°19.4	11.8	229°07.1	5.4′	26°45.2	5.4′	58.2′
2	208°19.2	11.5	243°31.5	5.3′	26°50.6	5.2′	58.3′
3	223°18.9	·· 11.1	257°55.8	5.2′	26°55.8	5.1′	58.3′
4	238°18.6	10.8	272°20.0	5.1′	27°00.9	4.9′	58.3′
5	253°18.4	10.4	286°44.1	5.0′	27°05.8	4.8′	58.4′
6	268°18.1	S22°10.1	301°08.0	4.9′	S27°10.6	4.6′	58.4′
7	283°17.9	09.7	315°31.9	4.8′	27°15.2	4.4′	58.4′
8	298°17.6	09.4	329°55.6	4.7′	27°19.6	4.2′	58.5′
9	313°17.3	·· 09.0	344°19.3	4.6′	27°23.8	4.1′	58.5′
10	328°17.1	08.7	358°42.9	4.5′	27°27.9	3.9′	58.5′
11	343°16.8	08.3	13°06.3	4.4′	27°31.8	3.7′	58.6′
12	358°16.6	S22°08.0	27°29.7	4.3′	S27°35.5	3.5′	58.6′
13	13°16.3	07.6	41°53.0	4.2′	27°39.0	3.3′	58.6′
14	28°16.0	07.3	56°16.2	4.1′	27°42.3	3.2′	58.7′
15	43°15.8	·· 06.9	70°39.3	4.0′	27°45.5	3.0′	58.7′
16	58°15.5	06.6	85°02.3	3.9′	27°48.5	2.8′	58.7′
17	73°15.2	06.2	99°25.3	3.9′	27°51.3	2.6′	58.8′
18	88°15.0	S22°05.9	113°48.1	3.8′	S27°53.9	2.4′	58.8′
19	103°14.7	05.5	128°10.9	3.7′	27°56.3	2.3′	58.8′
20	118°14.5	05.2	142°33.6	3.6′	27°58.6	2.0′	58.9′
21	133°14.2	·· 04.8	156°56.3	3.6′	28°00.6	1.9′	58.9′
22	148°14.0	04.4	171°18.8	3.5′	28°02.5	1.7′	58.9′
23	163°13.7	04.1	185°41.3	3.4′	28°04.2	1.4′	59.0′
	SD = 16.3′	d = 0.3′	SD = 15.9′				

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

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

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 23-8%
07	05:50	06:03	12:06	08:14	20:40	
08	06:16	06:28	12:06	09:07	21:35	
09	06:41	06:54	12:07	10:05	22:36	

January 10, 11, 12 UT (Wed., Thu., Fri.)

	Aries	Venus		Mars		Jupiter		Saturn	
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	109°01.3	216°36.1	S20°48.2	194°37.8	S24°00.9	75°11.4	N12°21.8	132°26.9	S11°31.5
1	124°03.8	231°35.3	48.6	209°38.2	00.8	90°13.8	21.8	147°29.1	31.4
2	139°06.3	246°34.6	49.1	224°38.6	00.8	105°16.2	21.8	162°31.4	31.3
3	154°08.7	261°33.8	·· 49.6	239°39.0	·· 00.8	120°18.6	·· 21.9	177°33.6	·· 31.2
4	169°11.2	276°33.0	50.0	254°39.5	00.7	135°21.0	21.9	192°35.8	31.1
5	184°13.6	291°32.3	50.5	269°39.9	00.7	150°23.3	22.0	207°38.1	31.0
6	199°16.1	306°31.5	S20°50.9	284°40.3	S24°00.7	165°25.7	N12°22.0	222°40.3	S11°30.9
7	214°18.6	321°30.7	51.4	299°40.7	00.6	180°28.1	22.0	237°42.5	30.8
8	229°21.0	336°29.9	51.8	314°41.1	00.6	195°30.5	22.1	252°44.8	30.7
9	244°23.5	351°29.2	·· 52.3	329°41.5	·· 00.6	210°32.9	·· 22.1	267°47.0	·· 30.6
10	259°26.0	6°28.4	52.8	344°42.0	00.5	225°35.3	22.2	282°49.2	30.5
11	274°28.4	21°27.6	53.2	359°42.4	00.5	240°37.6	22.2	297°51.5	30.4
12	289°30.9	36°26.8	S20°53.7	14°42.8	S24°00.4	255°40.0	N12°22.3	312°53.7	S11°30.4
13	304°33.4	51°26.1	54.1	29°43.2	00.4	270°42.4	22.3	327°55.9	30.3
14	319°35.8	66°25.3	54.6	44°43.6	00.4	285°44.8	22.3	342°58.2	30.2
15	334°38.3	81°24.5	·· 55.0	59°44.0	·· 00.3	300°47.2	·· 22.4	358°00.4	·· 30.1
16	349°40.8	96°23.7	55.5	74°44.4	00.3	315°49.6	22.4	13°02.6	30.0
17	4°43.2	111°22.9	55.9	89°44.9	00.2	330°51.9	22.5	28°04.8	29.9
18	19°45.7	126°22.2	S20°56.4	104°45.3	S24°00.2	345°54.3	N12°22.5	43°07.1	S11°29.8
19	34°48.1	141°21.4	56.8	119°45.7	00.2	0°56.7	22.5	58°09.3	29.7
20	49°50.6	156°20.6	57.2	134°46.1	00.1	15°59.1	22.6	73°11.5	29.6
21	64°53.1	171°19.8	·· 57.7	149°46.5	·· 00.1	31°01.5	·· 22.6	88°13.8	·· 29.5
22	79°55.5	186°19.1	58.1	164°46.9	00.0	46°03.8	22.7	103°16.0	29.4
23	94°58.0	201°18.3	58.6	179°47.4	00.0	61°06.2	22.7	118°18.2	29.3
Mer.pass. 16:41		ν -0.8′ d -0.5′	m -3.98	ν 0.4′ d 0.0′	m 1.36	ν 2.4′ d 0.0′	m -2.52	ν 2.2′ d 0.1′	m 0.97

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	110°00.5	216°17.5	S20°59.0	194°47.8	S23°59.9	76°08.6	N12°22.8	133°20.5	S11°29.2
1	125°02.9	231°16.7	59.5	209°48.2	59.9	91°11.0	22.8	148°22.7	29.2
2	140°05.4	246°15.9	20°59.9	224°48.6	59.9	106°13.3	22.8	163°24.9	29.1
3	155°07.9	261°15.2	21°00.3	239°49.0	·· 59.8	121°15.7	·· 22.9	178°27.2	·· 29.0
4	170°10.3	276°14.4	00.8	254°49.4	59.8	136°18.1	22.9	193°29.4	28.9
5	185°12.8	291°13.6	01.2	269°49.9	59.7	151°20.5	23.0	208°31.6	28.8
6	200°15.3	306°12.8	S21°01.6	284°50.3	S23°59.7	166°22.8	N12°23.0	223°33.8	S11°28.7
7	215°17.7	321°12.0	02.1	299°50.7	59.6	181°25.2	23.1	238°36.1	28.6
8	230°20.2	336°11.2	02.5	314°51.1	59.6	196°27.6	23.1	253°38.3	28.5
9	245°22.6	351°10.5	·· 02.9	329°51.5	·· 59.5	211°30.0	·· 23.2	268°40.5	·· 28.4
10	260°25.1	6°09.7	03.4	344°51.9	59.5	226°32.4	23.2	283°42.8	28.3
11	275°27.6	21°08.9	03.8	359°52.3	59.4	241°34.7	23.2	298°45.0	28.2
12	290°30.0	36°08.1	S21°04.2	14°52.8	S23°59.4	256°37.1	N12°23.3	313°47.2	S11°28.1
13	305°32.5	51°07.3	04.6	29°53.2	59.3	271°39.5	23.3	328°49.4	28.0
14	320°35.0	66°06.5	05.1	44°53.6	59.3	286°41.8	23.4	343°51.7	27.9
15	335°37.4	81°05.7	·· 05.5	59°54.0	·· 59.2	301°44.2	·· 23.4	358°53.9	·· 27.9
16	350°39.9	96°05.0	05.9	74°54.4	59.2	316°46.6	23.5	13°56.1	27.8
17	5°42.4	111°04.2	06.3	89°54.8	59.1	331°49.0	23.5	28°58.4	27.7
18	20°44.8	126°03.4	S21°06.8	104°55.2	S23°59.1	346°51.3	N12°23.6	44°00.6	S11°27.6
19	35°47.3	141°02.6	07.2	119°55.7	59.0	1°53.7	23.6	59°02.8	27.5
20	50°49.8	156°01.8	07.6	134°56.1	59.0	16°56.1	23.6	74°05.0	27.4
21	65°52.2	171°01.0	·· 08.0	149°56.5	·· 58.9	31°58.4	·· 23.7	89°07.3	·· 27.3
22	80°54.7	186°00.2	08.4	164°56.9	58.9	47°00.8	23.7	104°09.5	27.2
23	95°57.1	200°59.4	08.9	179°57.3	58.8	62°03.2	23.8	119°11.7	27.1
Mer.pass. 16:37		ν -0.8′ d -0.4′	m -3.98	ν 0.4′ d 0.0′	m 1.36	ν 2.4′ d 0.0′	m -2.51	ν 2.2′ d 0.1′	m 0.97

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	110°59.6	215°58.7	S21°09.3	194°57.7	S23°58.8	77°05.6	N12°23.8	134°14.0	S11°27.0
1	126°02.1	230°57.9	09.7	209°58.1	58.7	92°07.9	23.9	149°16.2	26.9
2	141°04.5	245°57.1	10.1	224°58.6	58.7	107°10.3	23.9	164°18.4	26.8
3	156°07.0	260°56.3	·· 10.5	239°59.0	·· 58.6	122°12.7	·· 24.0	179°20.6	·· 26.7
4	171°09.5	275°55.5	10.9	254°59.4	58.5	137°15.0	24.0	194°22.9	26.6
5	186°11.9	290°54.7	11.3	269°59.8	58.5	152°17.4	24.1	209°25.1	26.6
6	201°14.4	305°53.9	S21°11.8	285°00.2	S23°58.4	167°19.8	N12°24.1	224°27.3	S11°26.5
7	216°16.9	320°53.1	12.2	300°00.6	58.4	182°22.1	24.1	239°29.5	26.4
8	231°19.3	335°52.3	12.6	315°01.0	58.3	197°24.5	24.2	254°31.8	26.3
9	246°21.8	350°51.5	·· 13.0	330°01.5	·· 58.3	212°26.9	·· 24.2	269°34.0	·· 26.2
10	261°24.3	5°50.7	13.4	345°01.9	58.2	227°29.2	24.3	284°36.2	26.1
11	276°26.7	20°49.9	13.8	0°02.3	58.1	242°31.6	24.3	299°38.5	26.0
12	291°29.2	35°49.2	S21°14.2	15°02.7	S23°58.1	257°34.0	N12°24.4	314°40.7	S11°25.9
13	306°31.6	50°48.4	14.6	30°03.1	58.0	272°36.3	24.4	329°42.9	25.8
14	321°34.1	65°47.6	15.0	45°03.5	58.0	287°38.7	24.5	344°45.1	25.7
15	336°36.6	80°46.8	·· 15.4	60°03.9	·· 57.9	302°41.1	·· 24.5	359°47.4	·· 25.6
16	351°39.0	95°46.0	15.8	75°04.4	57.8	317°43.4	24.6	14°49.6	25.5
17	6°41.5	110°45.2	16.2	90°04.8	57.8	332°45.8	24.6	29°51.8	25.4
18	21°44.0	125°44.4	S21°16.6	105°05.2	S23°57.7	347°48.2	N12°24.7	44°54.0	S11°25.3
19	36°46.4	140°43.6	17.0	120°05.6	57.6	2°50.5	24.7	59°56.3	25.2
20	51°48.9	155°42.8	17.4	135°06.0	57.6	17°52.9	24.8	74°58.5	25.1
21	66°51.4	170°42.0	·· 17.8	150°06.4	·· 57.5	32°55.3	·· 24.8	90°00.7	·· 25.0
22	81°53.8	185°41.2	18.2	165°06.8	57.5	47°57.6	24.9	105°02.9	25.0
23	96°56.3	200°40.4	18.6	180°07.2	57.4	63°00.0	24.9	120°05.2	24.9
Mer.pass. 16:33		ν -0.8′ d -0.4′	m -3.97	ν 0.4′ d 0.1′	m 1.36	ν 2.4′ d 0.0′	m -2.50	ν 2.2′ d 0.1′	m 0.97

Stars

	SHA	Dec
Alpheratz	357°35.7	29°13.5
Ankaa	353°08.0	-42°10.8
Schedar	349°32.1	56°40.4
Diphda	348°48.2	-17°51.5
Achernar	335°20.7	-57°07.2
Hamal	327°52.0	23°34.6
Polaris	314°11.7	89°22.2
Acamar	315°12.2	-40°12.7
Menkar	314°06.9	4°11.0
Mirfak	308°29.1	49°57.0
Aldebaran	290°40.3	16°33.5
Rigel	281°04.4	-8°10.5
Capella	280°22.7	46°01.4
Bellatrix	278°23.5	6°22.3
Elnath	278°02.6	28°37.7
Alnilam	275°38.3	-1°11.2
Betelgeuse	270°52.7	7°24.7
Canopus	263°52.2	-52°42.5
Sirius	258°26.6	-16°45.0
Adhara	255°06.1	-29°00.3
Procyon	244°51.4	5°09.8
Pollux	243°17.9	27°58.0
Avior	234°14.4	-59°35.1
Suhail	222°46.5	-43°31.6
Miaplacidus	221°37.6	-69°48.7
Alphard	217°48.3	-8°45.7
Regulus	207°35.1	11°50.9
Dubhe	193°41.6	61°37.0
Denebola	182°25.7	14°26.2
Gienah	175°44.4	-17°40.4
Acrux	173°00.9	-63°13.6
Gacrux	171°52.5	-57°14.6
Alioth	166°13.6	55°49.5
Spica	158°23.2	-11°17.2
Alkaid	152°52.7	49°11.3
Hadar	148°37.3	-60°29.0
Menkent	147°58.7	-36°29.1
Arcturus	145°48.8	19°03.3
Rigil Kent.	139°41.7	-60°55.8
Kochab	137°20.3	74°03.1
Zuben'ubi	136°57.1	-16°08.4
Alphecca	126°04.7	26°37.8
Antares	112°17.1	-26°29.0
Atria	107°12.6	-69°04.0
Sabik	102°04.0	-15°45.3
Shaula	96°11.9	-37°07.2
Rasalhague	95°59.6	12°32.4
Eltanin	90°43.1	51°29.0
Kaus Aust.	83°34.0	-34°22.4
Vega	80°34.2	38°48.2
Nunki	75°49.2	-26°16.1
Altair	62°01.1	8°55.8
Peacock	53°07.6	-56°39.6
Deneb	49°26.8	45°22.0
Enif	33°39.9	9°59.1
Al Na'ir	27°34.3	-46°50.9
Fomalhaut	15°15.6	-29°29.9
Scheat	13°46.2	28°12.8
Markab	13°30.9	15°20.1

Jan 10 Wed	SHA	Mer.pass
Venus	107°34.8	09:34
Mars	85°36.5	11:01
Jupiter	326°10.1	18:56
Saturn	23°25.6	15:08

Jan 11 Thu	SHA	Mer.pass
Venus	106°17.0	09:35
Mars	84°47.3	11:01
Jupiter	326°08.1	18:52
Saturn	23°20.0	15:04

Jan 12 Fri	SHA	Mer.pass
Venus	104°59.0	09:37
Mars	83°58.1	11:00
Jupiter	326°05.9	18:49
Saturn	23°14.3	15:01

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.0916 sec ΔT = TT-UT1 = +69.0924 sec

2024 January 10 to Jan. 12 UT

h	Sun		Moon				
Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°13.4	S22°03.7	200°03.7	3.4′	S28°05.6	1.3′	59.0′
1	193°13.2	03.4	214°26.1	3.3′	28°06.9	1.1′	59.0′
2	208°12.9	03.0	228°48.4	3.2′	28°08.0	0.9′	59.1′
3	223°12.7	·· 02.6	243°10.7	3.2′	28°08.9	0.7′	59.1′
4	238°12.4	02.3	257°32.9	3.1′	28°09.6	0.5′	59.1′
5	253°12.1	01.9	271°55.0	3.1′	28°10.1	0.3′	59.2′
6	268°11.9	S22°01.5	286°17.1	3.0′	S28°10.4	0.2′	59.2′
7	283°11.6	01.2	300°39.1	3.0′	28°10.6	0.1′	59.2′
8	298°11.4	00.8	315°01.1	3.0′	28°10.5	0.3′	59.3′
9	313°11.1	·· 00.5	329°23.1	2.9′	28°10.2	0.5′	59.3′
10	328°10.9	22°00.1	343°45.0	2.9′	28°09.7	0.7′	59.3′
11	343°10.6	21°59.7	358°06.9	2.9′	28°09.0	0.9′	59.3′
12	358°10.4	S21°59.3	12°28.8	2.8′	S28°08.1	1.1′	59.4′
13	13°10.1	59.0	26°50.6	2.8′	28°07.0	1.2′	59.4′
14	28°09.8	58.6	41°12.4	2.8′	28°05.8	1.5′	59.4′
15	43°09.6	·· 58.2	55°34.2	2.8′	28°04.3	1.7′	59.5′
16	58°09.3	57.9	69°56.0	2.7′	28°02.6	1.9′	59.5′
17	73°09.1	57.5	84°17.7	2.7′	28°00.7	2.1′	59.5′
18	88°08.8	S21°57.1	98°39.4	2.7′	S27°58.6	2.3′	59.5′
19	103°08.6	56.7	113°01.2	2.7′	27°56.3	2.5′	59.6′
20	118°08.3	56.4	127°22.9	2.7′	27°53.8	2.7′	59.6′
21	133°08.1	·· 56.0	141°44.6	2.7′	27°51.1	2.9′	59.6′
22	148°07.8	55.6	156°06.3	2.7′	27°48.2	3.1′	59.6′
23	163°07.6	55.2	170°28.0	2.7′	27°45.1	3.3′	59.7′
	SD = 16.3′	d = 0.4′	SD = 16.1′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°07.3	S21°54.9	184°49.7	2.7′	S27°41.8	3.6′	59.7′
1	193°07.1	54.5	199°11.5	2.7′	27°38.2	3.7′	59.7′
2	208°06.8	54.1	213°33.2	2.7′	27°34.5	3.9′	59.7′
3	223°06.5	·· 53.7	227°54.9	2.8′	27°30.6	4.1′	59.8′
4	238°06.3	53.3	242°16.7	2.8′	27°26.5	4.3′	59.8′
5	253°06.0	53.0	256°38.5	2.8′	27°22.2	4.6′	59.8′
6	268°05.8	S21°52.6	271°00.3	2.8′	S27°17.6	4.7′	59.8′
7	283°05.5	52.2	285°22.1	2.9′	27°12.9	4.9′	59.9′
8	298°05.3	51.8	299°44.0	2.9′	27°08.0	5.1′	59.9′
9	313°05.0	·· 51.4	314°05.9	2.9′	27°02.9	5.3′	59.9′
10	328°04.8	51.1	328°27.8	3.0′	26°57.6	5.5′	59.9′
11	343°04.5	50.7	342°49.7	3.0′	26°52.1	5.7′	59.9′
12	358°04.3	S21°50.3	357°11.7	3.0′	S26°46.4	6.0′	60.0′
13	13°04.0	49.9	11°33.8	3.1′	26°40.4	6.1′	60.0′
14	28°03.8	49.5	25°55.9	3.1′	26°34.3	6.2′	60.0′
15	43°03.5	·· 49.1	40°18.0	3.2′	26°28.1	6.5′	60.0′
16	58°03.3	48.7	54°40.2	3.2′	26°21.6	6.7′	60.0′
17	73°03.0	48.3	69°02.4	3.3′	26°14.9	6.9′	60.1′
18	88°02.8	S21°47.9	83°24.7	3.3′	S26°08.0	7.0′	60.1′
19	103°02.5	47.6	97°47.0	3.4′	26°01.0	7.3′	60.1′
20	118°02.3	47.2	112°09.4	3.5′	25°53.7	7.4′	60.1′
21	133°02.1	·· 46.8	126°31.9	3.5′	25°46.3	7.7′	60.1′
22	148°01.8	46.4	140°54.4	3.6′	25°38.6	7.8′	60.2′
23	163°01.6	46.0	155°17.0	3.7′	25°30.8	8.0′	60.2′
	SD = 16.3′	d = 0.4′	SD = 16.3′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°01.3	S21°45.6	169°39.6	3.7′	S25°22.8	8.1′	60.2′
1	193°01.1	45.2	184°02.4	3.8′	25°14.7	8.4′	60.2′
2	208°00.8	44.8	198°25.2	3.9′	25°06.3	8.5′	60.2′
3	223°00.6	·· 44.4	212°48.0	3.9′	24°57.8	8.7′	60.2′
4	238°00.3	44.0	227°11.0	4.0′	24°49.1	8.9′	60.2′
5	253°00.1	43.6	241°34.0	4.1′	24°40.2	9.1′	60.3′
6	267°59.8	S21°43.2	255°57.1	4.2′	S24°31.1	9.3′	60.3′
7	282°59.6	42.8	270°20.3	4.3′	24°21.8	9.4′	60.3′
8	297°59.4	42.4	284°43.5	4.3′	24°12.4	9.6′	60.3′
9	312°59.1	·· 42.0	299°06.9	4.4′	24°02.8	9.7′	60.3′
10	327°58.9	41.6	313°30.3	4.5′	23°53.1	9.9′	60.3′
11	342°58.6	41.2	327°53.8	4.6′	23°43.2	10.1′	60.3′
12	357°58.4	S21°40.8	342°17.4	4.7′	S23°33.1	10.3′	60.3′
13	12°58.1	40.4	356°41.1	4.8′	23°22.8	10.4′	60.3′
14	27°57.9	40.0	11°04.9	4.9′	23°12.4	10.6′	60.4′
15	42°57.6	·· 39.6	25°28.7	5.0′	23°01.8	10.7′	60.4′
16	57°57.4	39.2	39°52.7	5.1′	22°51.1	10.9′	60.4′
17	72°57.2	38.8	54°16.7	5.1′	22°40.2	11.0′	60.4′
18	87°56.9	S21°38.3	68°40.9	5.2′	S22°29.2	11.2′	60.4′
19	102°56.7	37.9	83°05.1	5.3′	22°18.0	11.4′	60.4′
20	117°56.4	37.5	97°29.5	5.4′	22°06.6	11.5′	60.4′
21	132°56.2	·· 37.1	111°53.9	5.5′	21°55.1	11.6′	60.4′
22	147°56.0	36.7	126°18.4	5.6′	21°43.5	11.8′	60.4′
23	162°55.7	36.3	140°43.1	5.7′	21°31.7	12.0′	60.4′
	SD = 16.3′	d = 0.4′	SD = 16.4′				

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

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

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 3-1%
10	07:06	07:19	12:07	11:08	23:40	
11	07:31	07:43	12:08	12:12	–:–	
12	07:55	08:07	12:08	13:14	00:43	

January 13, 14, 15 UT (Sat., Sun., Mon.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	111°58.8	215°39.6	S21°19.0	195°07.7	S23°57.3	78°02.3	N12°25.0	135°07.4	S11°24.8
1	127°01.2	230°38.8	19.4	210°08.1	57.3	93°04.7	25.0	150°09.6	24.7
2	142°03.7	245°38.0	19.7	225°08.5	57.2	108°07.1	25.0	165°11.8	24.6
3	157°06.1	260°37.2	·· 20.1	240°08.9	·· 57.1	123°09.4	·· 25.1	180°14.1	·· 24.5
4	172°08.6	275°36.4	20.5	255°09.3	57.1	138°11.8	25.1	195°16.3	24.4
5	187°11.1	290°35.6	20.9	270°09.7	57.0	153°14.1	25.2	210°18.5	24.3
6	202°13.5	305°34.8	S21°21.3	285°10.1	S23°56.9	168°16.5	N12°25.2	225°20.7	S11°24.2
7	217°16.0	320°34.0	21.7	300°10.6	56.9	183°18.9	25.3	240°23.0	24.1
8	232°18.5	335°33.2	22.1	315°11.0	56.8	198°21.2	25.3	255°25.2	24.0
9	247°20.9	350°32.4	·· 22.4	330°11.4	·· 56.7	213°23.6	·· 25.4	270°27.4	·· 23.9
10	262°23.4	5°31.6	22.8	345°11.8	56.6	228°25.9	25.4	285°29.6	23.8
11	277°25.9	20°30.8	23.2	0°12.2	56.6	243°28.3	25.5	300°31.9	23.7
12	292°28.3	35°30.0	S21°23.6	15°12.6	S23°56.5	258°30.7	N12°25.5	315°34.1	S11°23.6
13	307°30.8	50°29.2	24.0	30°13.0	56.4	273°33.0	25.6	330°36.3	23.5
14	322°33.3	65°28.4	24.3	45°13.4	56.4	288°35.4	25.6	345°38.5	23.4
15	337°35.7	80°27.6	·· 24.7	60°13.9	·· 56.3	303°37.7	·· 25.7	0°40.8	·· 23.4
16	352°38.2	95°26.8	25.1	75°14.3	56.2	318°40.1	25.7	15°43.0	23.3
17	7°40.6	110°26.0	25.5	90°14.7	56.1	333°42.4	25.8	30°45.2	23.2
18	22°43.1	125°25.2	S21°25.8	105°15.1	S23°56.1	348°44.8	N12°25.8	45°47.4	S11°23.1
19	37°45.6	140°24.4	26.2	120°15.5	56.0	3°47.1	25.9	60°49.7	23.0
20	52°48.0	155°23.6	26.6	135°15.9	55.9	18°49.5	25.9	75°51.9	22.9
21	67°50.5	170°22.7	·· 26.9	150°16.3	·· 55.9	33°51.9	·· 26.0	90°54.1	·· 22.8
22	82°53.0	185°21.9	27.3	165°16.7	55.8	48°54.2	26.0	105°56.3	22.7
23	97°55.4	200°21.1	27.7	180°17.2	55.7	63°56.6	26.1	120°58.6	22.6
Mer.pass. 16:29		ν -0.8′ d -0.4′	m -3.97	ν 0.4′ d 0.1′	m 1.36	ν 2.4′ d 0.0′	m -2.49	ν 2.2′ d 0.1′	m 0.97

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	112°57.9	215°20.3	S21°28.0	195°17.6	S23°55.6	78°58.9	N12°26.1	136°00.8	S11°22.5
1	128°00.4	230°19.5	28.4	210°18.0	55.5	94°01.3	26.2	151°03.0	22.4
2	143°02.8	245°18.7	28.8	225°18.4	55.5	109°03.6	26.2	166°05.2	22.3
3	158°05.3	260°17.9	·· 29.1	240°18.8	·· 55.4	124°06.0	·· 26.3	181°07.5	·· 22.2
4	173°07.7	275°17.1	29.5	255°19.2	55.3	139°08.3	26.4	196°09.7	22.1
5	188°10.2	290°16.3	29.9	270°19.6	55.2	154°10.7	26.4	211°11.9	22.0
6	203°12.7	305°15.5	S21°30.2	285°20.0	S23°55.2	169°13.0	N12°26.5	226°14.1	S11°21.9
7	218°15.1	320°14.7	30.6	300°20.5	55.1	184°15.4	26.5	241°16.3	21.8
8	233°17.6	335°13.9	30.9	315°20.9	55.0	199°17.7	26.6	256°18.6	21.7
9	248°20.1	350°13.1	·· 31.3	330°21.3	·· 54.9	214°20.1	·· 26.6	271°20.8	·· 21.6
10	263°22.5	5°12.2	31.7	345°21.7	54.8	229°22.4	26.7	286°23.0	21.5
11	278°25.0	20°11.4	32.0	0°22.1	54.8	244°24.8	26.7	301°25.2	21.5
12	293°27.5	35°10.6	S21°32.4	15°22.5	S23°54.7	259°27.1	N12°26.8	316°27.5	S11°21.4
13	308°29.9	50°09.8	32.7	30°22.9	54.6	274°29.5	26.8	331°29.7	21.3
14	323°32.4	65°09.0	33.1	45°23.3	54.5	289°31.8	26.9	346°31.9	21.2
15	338°34.9	80°08.2	·· 33.4	60°23.7	·· 54.4	304°34.2	·· 26.9	1°34.1	·· 21.1
16	353°37.3	95°07.4	33.8	75°24.2	54.3	319°36.5	27.0	16°36.4	21.0
17	8°39.8	110°06.6	34.1	90°24.6	54.3	334°38.9	27.0	31°38.6	20.9
18	23°42.2	125°05.8	S21°34.5	105°25.0	S23°54.2	349°41.2	N12°27.1	46°40.8	S11°20.8
19	38°44.7	140°04.9	34.8	120°25.4	54.1	4°43.6	27.1	61°43.0	20.7
20	53°47.2	155°04.1	35.2	135°25.8	54.0	19°45.9	27.2	76°45.2	20.6
21	68°49.6	170°03.3	·· 35.5	150°26.2	·· 53.9	34°48.3	·· 27.2	91°47.5	·· 20.5
22	83°52.1	185°02.5	35.8	165°26.6	53.8	49°50.6	27.3	106°49.7	20.4
23	98°54.6	200°01.7	36.2	180°27.0	53.8	64°53.0	27.4	121°51.9	20.3
Mer.pass. 16:25		ν -0.8′ d -0.4′	m -3.97	ν 0.4′ d 0.1′	m 1.35	ν 2.4′ d 0.1′	m -2.49	ν 2.2′ d 0.1′	m 0.97

Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	113°57.0	215°00.9	S21°36.5	195°27.5	S23°53.7	79°55.3	N12°27.4	136°54.1	S11°20.2
1	128°59.5	230°00.1	36.9	210°27.9	53.6	94°57.7	27.5	151°56.3	20.1
2	144°02.0	244°59.2	37.2	225°28.3	53.5	110°00.0	27.5	166°58.6	20.0
3	159°04.4	259°58.4	·· 37.5	240°28.7	·· 53.4	125°02.3	·· 27.6	182°00.8	·· 19.9
4	174°06.9	274°57.6	37.9	255°29.1	53.3	140°04.7	27.6	197°03.0	19.8
5	189°09.4	289°56.8	38.2	270°29.5	53.2	155°07.0	27.7	212°05.2	19.7
6	204°11.8	304°56.0	S21°38.5	285°29.9	S23°53.1	170°09.4	N12°27.7	227°07.5	S11°19.6
7	219°14.3	319°55.2	38.9	300°30.3	53.0	185°11.7	27.8	242°09.7	19.5
8	234°16.7	334°54.3	39.2	315°30.7	53.0	200°14.1	27.8	257°11.9	19.4
9	249°19.2	349°53.5	·· 39.5	330°31.2	·· 52.9	215°16.4	·· 27.9	272°14.1	·· 19.3
10	264°21.7	4°52.7	39.9	345°31.6	52.8	230°18.7	27.9	287°16.3	19.2
11	279°24.1	19°51.9	40.2	0°32.0	52.7	245°21.1	28.0	302°18.6	19.2
12	294°26.6	34°51.1	S21°40.5	15°32.4	S23°52.6	260°23.4	N12°28.1	317°20.8	S11°19.1
13	309°29.1	49°50.3	40.9	30°32.8	52.5	275°25.8	28.1	332°23.0	19.0
14	324°31.5	64°49.4	41.2	45°33.2	52.4	290°28.1	28.2	347°25.2	18.9
15	339°34.0	79°48.6	·· 41.5	60°33.6	·· 52.3	305°30.5	·· 28.2	2°27.4	·· 18.8
16	354°36.5	94°47.8	41.8	75°34.0	52.2	320°32.8	28.3	17°29.7	18.7
17	9°38.9	109°47.0	42.2	90°34.4	52.1	335°35.1	28.3	32°31.9	18.6
18	24°41.4	124°46.2	S21°42.5	105°34.9	S23°52.0	350°37.5	N12°28.4	47°34.1	S11°18.5
19	39°43.8	139°45.3	42.8	120°35.3	51.9	5°39.8	28.4	62°36.3	18.4
20	54°46.3	154°44.5	43.1	135°35.7	51.8	20°42.1	28.5	77°38.5	18.3
21	69°48.8	169°43.7	·· 43.4	150°36.1	·· 51.7	35°44.5	·· 28.6	92°40.8	·· 18.2
22	84°51.2	184°42.9	43.8	165°36.5	51.6	50°46.8	28.6	107°43.0	18.1
23	99°53.7	199°42.1	44.1	180°36.9	51.5	65°49.2	28.7	122°45.2	18.0
Mer.pass. 16:22		ν -0.8′ d -0.3′	m -3.96	ν 0.4′ d 0.1′	m 1.35	ν 2.3′ d 0.1′	m -2.48	ν 2.2′ d 0.1′	m 0.98

Stars

	SHA	Dec
Alpheratz	357°35.7	29°13.5
Ankaa	353°08.0	-42°10.8
Schedar	349°32.1	56°40.4
Diphda	348°48.2	-17°51.5
Achernar	335°20.7	-57°07.2
Hamal	327°52.0	23°34.6
Polaris	314°13.1	89°22.2
Acamar	315°12.2	-40°12.7
Menkar	314°06.9	4°11.0
Mirfak	308°29.2	49°57.0
Aldebaran	290°40.3	16°33.5
Rigel	281°04.4	-8°10.5
Capella	280°22.7	46°01.4
Bellatrix	278°23.5	6°22.3
Elnath	278°02.6	28°37.7
Alnilam	275°38.2	-1°11.2
Betelgeuse	270°52.6	7°24.7
Canopus	263°52.2	-52°42.5
Sirius	258°26.6	-16°45.0
Adhara	255°06.1	-29°00.3
Procyon	244°51.3	5°09.8
Pollux	243°17.9	27°58.0
Avior	234°14.4	-59°35.1
Suhail	222°46.5	-43°31.7
Miaplacidus	221°37.6	-69°48.7
Alphard	217°48.3	-8°45.8
Regulus	207°35.0	11°50.9
Dubhe	193°41.6	61°37.0
Denebola	182°25.6	14°26.2
Gienah	175°44.3	-17°40.4
Acrux	173°00.9	-63°13.6
Gacrux	171°52.4	-57°14.6
Alioth	166°13.6	55°49.5
Spica	158°23.2	-11°17.2
Alkaid	152°52.7	49°11.3
Hadar	148°37.3	-60°29.0
Menkent	147°58.7	-36°29.1
Arcturus	145°48.7	19°03.3
Rigil Kent.	139°41.6	-60°55.8
Kochab	137°20.2	74°03.0
Zuben'ubi	136°57.0	-16°08.5
Alphecca	126°04.6	26°37.8
Antares	112°17.1	-26°29.1
Atria	107°12.5	-69°04.0
Sabik	102°04.0	-15°45.3
Shaula	96°11.8	-37°07.2
Rasalhague	95°59.6	12°32.4
Eltanin	90°43.1	51°28.9
Kaus Aust.	83°34.0	-34°22.4
Vega	80°34.2	38°48.2
Nunki	75°49.1	-26°16.1
Altair	62°01.1	8°55.8
Peacock	53°07.6	-56°39.6
Deneb	49°26.8	45°21.9
Enif	33°39.9	9°59.1
Al Na'ir	27°34.3	-46°50.9
Fomalhaut	15°15.6	-29°29.9
Scheat	13°46.2	28°12.8
Markab	13°30.9	15°20.1

Jan 13 Sat	SHA	Mer.pass
Venus	103°40.8	09:38
Mars	83°08.9	10:59
Jupiter	326°03.6	18:45
Saturn	23°08.6	14:57

Jan 14 Sun	SHA	Mer.pass
Venus	102°22.4	09:39
Mars	82°19.7	10:59
Jupiter	326°01.0	18:41
Saturn	23°02.9	14:54

Jan 15 Mon	SHA	Mer.pass
Venus	101°03.8	09:40
Mars	81°30.4	10:58
Jupiter	325°58.3	18:37
Saturn	22°57.1	14:50

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.0924 sec ΔT = TT-UT1 = +69.0916 sec

2024 January 13 to Jan. 15 UT

h	Sun		Moon				
Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	177°55.5	S21°35.9	155°07.8	5.8′	S21°19.7	12.0′	60.4′
1	192°55.2	35.5	169°32.6	5.9′	21°07.7	12.3′	60.4′
2	207°55.0	35.1	183°57.5	6.0′	20°55.4	12.3′	60.4′
3	222°54.8	·· 34.6	198°22.6	6.1′	20°43.1	12.5′	60.4′
4	237°54.5	34.2	212°47.7	6.2′	20°30.6	12.6′	60.4′
5	252°54.3	33.8	227°12.9	6.3′	20°18.0	12.8′	60.4′
6	267°54.0	S21°33.4	241°38.2	6.4′	S20°05.2	12.9′	60.4′
7	282°53.8	33.0	256°03.7	6.5′	19°52.3	13.0′	60.4′
8	297°53.6	32.6	270°29.2	6.6′	19°39.3	13.1′	60.4′
9	312°53.3	·· 32.1	284°54.8	6.7′	19°26.2	13.3′	60.4′
10	327°53.1	31.7	299°20.6	6.8′	19°12.9	13.4′	60.4′
11	342°52.8	31.3	313°46.4	6.9′	18°59.5	13.5′	60.4′
12	357°52.6	S21°30.9	328°12.3	7.0′	S18°46.0	13.6′	60.4′
13	12°52.4	30.4	342°38.4	7.1′	18°32.4	13.8′	60.4′
14	27°52.1	30.0	357°04.5	7.2′	18°18.6	13.8′	60.4′
15	42°51.9	·· 29.6	11°30.7	7.3′	18°04.8	14.0′	60.4′
16	57°51.7	29.2	25°57.1	7.4′	17°50.8	14.0′	60.4′
17	72°51.4	28.8	40°23.5	7.5′	17°36.8	14.2′	60.4′
18	87°51.2	S21°28.3	54°50.0	7.6′	S17°22.6	14.3′	60.4′
19	102°51.0	27.9	69°16.7	7.7′	17°08.3	14.4′	60.4′
20	117°50.7	27.5	83°43.4	7.8′	16°53.9	14.5′	60.4′
21	132°50.5	·· 27.0	98°10.2	7.9′	16°39.4	14.5′	60.4′
22	147°50.3	26.6	112°37.2	8.0′	16°24.9	14.7′	60.4′
23	162°50.0	26.2	127°04.2	8.1′	16°10.2	14.8′	60.4′
	SD = 16.3′	d = 0.4′	SD = 16.5′				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	177°49.8	S21°25.8	141°31.3	8.2′	S15°55.4	14.9′	60.4′
1	192°49.6	25.3	155°58.5	8.3′	15°40.5	14.9′	60.4′
2	207°49.3	24.9	170°25.9	8.4′	15°25.6	15.1′	60.4′
3	222°49.1	·· 24.5	184°53.3	8.5′	15°10.5	15.1′	60.4′
4	237°48.9	24.0	199°20.8	8.6′	14°55.4	15.2′	60.4′
5	252°48.6	23.6	213°48.4	8.7′	14°40.2	15.3′	60.4′
6	267°48.4	S21°23.2	228°16.1	8.8′	S14°24.9	15.4′	60.4′
7	282°48.2	22.7	242°43.8	8.9′	14°09.5	15.4′	60.4′
8	297°47.9	22.3	257°11.7	9.0′	13°54.1	15.5′	60.4′
9	312°47.7	·· 21.9	271°39.7	9.1′	13°38.6	15.7′	60.3′
10	327°47.5	21.4	286°07.7	9.1′	13°22.9	15.6′	60.3′
11	342°47.2	21.0	300°35.9	9.2′	13°07.3	15.8′	60.3′
12	357°47.0	S21°20.5	315°04.1	9.3′	S12°51.5	15.8′	60.3′
13	12°46.8	20.1	329°32.4	9.4′	12°35.7	15.8′	60.3′
14	27°46.6	19.7	344°00.8	9.5′	12°19.9	16.0′	60.3′
15	42°46.3	·· 19.2	358°29.3	9.6′	12°03.9	16.0′	60.3′
16	57°46.1	18.8	12°57.8	9.6′	11°47.9	16.0′	60.3′
17	72°45.9	18.3	27°26.5	9.7′	11°31.9	16.2′	60.3′
18	87°45.6	S21°17.9	41°55.2	9.8′	S11°15.7	16.1′	60.2′
19	102°45.4	17.4	56°24.0	9.9′	10°59.6	16.3′	60.2′
20	117°45.2	17.0	70°52.9	10.0′	10°43.3	16.2′	60.2′
21	132°45.0	·· 16.6	85°21.9	10.0′	10°27.1	16.4′	60.2′
22	147°44.7	16.1	99°50.9	10.1′	10°10.7	16.3′	60.2′
23	162°44.5	15.7	114°20.0	10.2′	09°54.4	16.5′	60.2′
	SD = 16.3′	d = 0.4′	SD = 16.5′				

Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	177°44.3	S21°15.2	128°49.2	10.3′	S09°37.9	16.4′	60.2′
1	192°44.0	14.8	143°18.5	10.3′	09°21.5	16.5′	60.1′
2	207°43.8	14.3	157°47.8	10.4′	09°05.0	16.6′	60.1′
3	222°43.6	·· 13.9	172°17.2	10.5′	08°48.4	16.6′	60.1′
4	237°43.4	13.4	186°46.7	10.5′	08°31.8	16.6′	60.1′
5	252°43.1	13.0	201°16.2	10.6′	08°15.2	16.7′	60.1′
6	267°42.9	S21°12.5	215°45.8	10.7′	S07°58.5	16.7′	60.1′
7	282°42.7	12.1	230°15.5	10.7′	07°41.8	16.7′	60.1′
8	297°42.5	11.6	244°45.3	10.8′	07°25.1	16.7′	60.0′
9	312°42.2	·· 11.2	259°15.1	10.9′	07°08.4	16.8′	60.0′
10	327°42.0	10.7	273°44.9	10.9′	06°51.6	16.8′	60.0′
11	342°41.8	10.3	288°14.8	11.0′	06°34.8	16.8′	60.0′
12	357°41.6	S21°09.8	302°44.8	11.0′	S06°18.0	16.9′	60.0′
13	12°41.4	09.3	317°14.9	11.1′	06°01.1	16.9′	59.9′
14	27°41.1	08.9	331°44.9	11.1′	05°44.2	16.9′	59.9′
15	42°40.9	·· 08.4	346°15.1	11.2′	05°27.3	16.9′	59.9′
16	57°40.7	08.0	0°45.3	11.3′	05°10.4	16.9′	59.9′
17	72°40.5	07.5	15°15.5	11.3′	04°53.5	16.9′	59.9′
18	87°40.2	S21°07.1	29°45.8	11.4′	S04°36.6	17.0′	59.8′
19	102°40.0	06.6	44°16.2	11.4′	04°19.6	16.9′	59.8′
20	117°39.8	06.1	58°46.6	11.4′	04°02.7	17.0′	59.8′
21	132°39.6	·· 05.7	73°17.0	11.5′	03°45.7	17.0′	59.8′
22	147°39.4	05.2	87°47.5	11.5′	03°28.7	17.0′	59.8′
23	162°39.1	04.7	102°18.1	11.6′	03°11.7	16.9′	59.7′
	SD = 16.3′	d = 0.4′	SD = 16.4′				

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

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

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 2-4 3-17%
13	08:18	08:30	12:08	14:12	01:44	
14	08:41	08:52	12:09	15:06	02:40	
15	09:03	09:14	12:09	15:57	03:32	

January 16, 17, 18 UT (Tue., Wed., Thu.)

	Aries	Venus		Mars		Jupiter		Saturn	
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	114°56.2	214°41.2	S21°44.4	195°37.3	S23°51.5	80°51.5	N12°28.7	137°47.4	S11°17.9
1	129°58.6	229°40.4	44.7	210°37.7	51.4	95°53.8	28.8	152°49.6	17.8
2	145°01.1	244°39.6	45.0	225°38.1	51.3	110°56.2	28.8	167°51.9	17.7
3	160°03.6	259°38.8	·· 45.3	240°38.6	·· 51.2	125°58.5	·· 28.9	182°54.1	·· 17.6
4	175°06.0	274°37.9	45.6	255°39.0	51.1	141°00.8	29.0	197°56.3	17.5
5	190°08.5	289°37.1	46.0	270°39.4	51.0	156°03.2	29.0	212°58.5	17.4
6	205°11.0	304°36.3	S21°46.3	285°39.8	S23°50.9	171°05.5	N12°29.1	228°00.7	S11°17.3
7	220°13.4	319°35.5	46.6	300°40.2	50.8	186°07.9	29.1	243°02.9	17.2
8	235°15.9	334°34.6	46.9	315°40.6	50.7	201°10.2	29.2	258°05.2	17.1
9	250°18.3	349°33.8	·· 47.2	330°41.0	·· 50.6	216°12.5	·· 29.2	273°07.4	·· 17.0
10	265°20.8	4°33.0	47.5	345°41.4	50.4	231°14.9	29.3	288°09.6	16.9
11	280°23.3	19°32.2	47.8	0°41.8	50.3	246°17.2	29.4	303°11.8	16.8
12	295°25.7	34°31.3	S21°48.1	15°42.3	S23°50.2	261°19.5	N12°29.4	318°14.0	S11°16.7
13	310°28.2	49°30.5	48.4	30°42.7	50.1	276°21.9	29.5	333°16.3	16.6
14	325°30.7	64°29.7	48.7	45°43.1	50.0	291°24.2	29.5	348°18.5	16.5
15	340°33.1	79°28.9	·· 49.0	60°43.5	·· 49.9	306°26.5	·· 29.6	3°20.7	·· 16.4
16	355°35.6	94°28.0	49.3	75°43.9	49.8	321°28.9	29.6	18°22.9	16.4
17	10°38.1	109°27.2	49.6	90°44.3	49.7	336°31.2	29.7	33°25.1	16.3
18	25°40.5	124°26.4	S21°49.9	105°44.7	S23°49.6	351°33.5	N12°29.8	48°27.4	S11°16.2
19	40°43.0	139°25.6	50.2	120°45.1	49.5	6°35.9	29.8	63°29.6	16.1
20	55°45.5	154°24.7	50.5	135°45.5	49.4	21°38.2	29.9	78°31.8	16.0
21	70°47.9	169°23.9	·· 50.8	150°46.0	·· 49.3	36°40.5	·· 29.9	93°34.0	·· 15.9
22	85°50.4	184°23.1	51.1	165°46.4	49.2	51°42.8	30.0	108°36.2	15.8
23	100°52.8	199°22.2	51.3	180°46.8	49.1	66°45.2	30.0	123°38.4	15.7
Mer.pass. 16:18		ν -0.8′	d -0.3′	m -3.96	ν 0.4′	d 0.1′	m 1.35	ν 2.3′	d 0.1′ m -2.47	ν 2.2′	d 0.1′ m 0.98

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	115°55.3	214°21.4	S21°51.6	195°47.2	S23°49.0	81°47.5	N12°30.1	138°40.7	S11°15.6
1	130°57.8	229°20.6	51.9	210°47.6	48.9	96°49.8	30.2	153°42.9	15.5
2	146°00.2	244°19.8	52.2	225°48.0	48.8	111°52.2	30.2	168°45.1	15.4
3	161°02.7	259°18.9	·· 52.5	240°48.4	·· 48.6	126°54.5	·· 30.3	183°47.3	·· 15.3
4	176°05.2	274°18.1	52.8	255°48.8	48.5	141°56.8	30.3	198°49.5	15.2
5	191°07.6	289°17.3	53.1	270°49.2	48.4	156°59.1	30.4	213°51.7	15.1
6	206°10.1	304°16.4	S21°53.4	285°49.7	S23°48.3	172°01.5	N12°30.5	228°54.0	S11°15.0
7	221°12.6	319°15.6	53.6	300°50.1	48.2	187°03.8	30.5	243°56.2	14.9
8	236°15.0	334°14.8	53.9	315°50.5	48.1	202°06.1	30.6	258°58.4	14.8
9	251°17.5	349°13.9	·· 54.2	330°50.9	·· 48.0	217°08.5	·· 30.6	274°00.6	·· 14.7
10	266°19.9	4°13.1	54.5	345°51.3	47.9	232°10.8	30.7	289°02.8	14.6
11	281°22.4	19°12.3	54.8	0°51.7	47.8	247°13.1	30.8	304°05.0	14.5
12	296°24.9	34°11.4	S21°55.0	15°52.1	S23°47.6	262°15.4	N12°30.8	319°07.3	S11°14.4
13	311°27.3	49°10.6	55.3	30°52.5	47.5	277°17.8	30.9	334°09.5	14.3
14	326°29.8	64°09.8	55.6	45°52.9	47.4	292°20.1	30.9	349°11.7	14.2
15	341°32.3	79°08.9	·· 55.9	60°53.3	·· 47.3	307°22.4	·· 31.0	4°13.9	·· 14.1
16	356°34.7	94°08.1	56.1	75°53.8	47.2	322°24.7	31.1	19°16.1	14.0
17	11°37.2	109°07.3	56.4	90°54.2	47.1	337°27.1	31.1	34°18.3	13.9
18	26°39.7	124°06.4	S21°56.7	105°54.6	S23°46.9	352°29.4	N12°31.2	49°20.6	S11°13.8
19	41°42.1	139°05.6	56.9	120°55.0	46.8	7°31.7	31.2	64°22.8	13.7
20	56°44.6	154°04.8	57.2	135°55.4	46.7	22°34.0	31.3	79°25.0	13.6
21	71°47.1	169°03.9	·· 57.5	150°55.8	·· 46.6	37°36.4	·· 31.4	94°27.2	·· 13.5
22	86°49.5	184°03.1	57.7	165°56.2	46.5	52°38.7	31.4	109°29.4	13.4
23	101°52.0	199°02.3	58.0	180°56.6	46.4	67°41.0	31.5	124°31.6	13.3
Mer.pass. 16:14		ν -0.8′	d -0.3′	m -3.96	ν 0.4′	d 0.1′	m 1.35	ν 2.3′	d 0.1′ m -2.46	ν 2.2′	d 0.1′ m 0.98

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	116°54.4	214°01.4	S21°58.3	195°57.0	S23°46.2	82°43.3	N12°31.6	139°33.9	S11°13.2
1	131°56.9	229°00.6	58.5	210°57.5	46.1	97°45.6	31.6	154°36.1	13.1
2	146°59.4	243°59.8	58.8	225°57.9	46.0	112°48.0	31.7	169°38.3	13.0
3	162°01.8	258°58.9	·· 59.0	240°58.3	·· 45.9	127°50.3	·· 31.7	184°40.5	·· 12.9
4	177°04.3	273°58.1	59.3	255°58.7	45.8	142°52.6	31.8	199°42.7	12.8
5	192°06.8	288°57.3	59.6	270°59.1	45.6	157°54.9	31.9	214°44.9	12.7
6	207°09.2	303°56.4	S21°59.8	285°59.5	S23°45.5	172°57.2	N12°31.9	229°47.1	S11°12.6
7	222°11.7	318°55.6	22°00.1	300°59.9	45.4	187°59.6	32.0	244°49.4	12.5
8	237°14.2	333°54.7	00.3	316°00.3	45.3	203°01.9	32.1	259°51.6	12.4
9	252°16.6	348°53.9	·· 00.6	331°00.7	·· 45.1	218°04.2	·· 32.1	274°53.8	·· 12.3
10	267°19.1	3°53.1	00.8	346°01.1	45.0	233°06.5	32.2	289°56.0	12.2
11	282°21.5	18°52.2	01.1	1°01.6	44.9	248°08.8	32.2	304°58.2	12.1
12	297°24.0	33°51.4	S22°01.3	16°02.0	S23°44.8	263°11.2	N12°32.3	320°00.4	S11°12.0
13	312°26.5	48°50.6	01.6	31°02.4	44.7	278°13.5	32.4	335°02.7	12.0
14	327°28.9	63°49.7	01.8	46°02.8	44.5	293°15.8	32.4	350°04.9	11.9
15	342°31.4	78°48.9	·· 02.1	61°03.2	·· 44.4	308°18.1	·· 32.5	5°07.1	·· 11.8
16	357°33.9	93°48.0	02.3	76°03.6	44.3	323°20.4	32.6	20°09.3	11.7
17	12°36.3	108°47.2	02.6	91°04.0	44.1	338°22.7	32.6	35°11.5	11.6
18	27°38.8	123°46.4	S22°02.8	106°04.4	S23°44.0	353°25.1	N12°32.7	50°13.7	S11°11.5
19	42°41.3	138°45.5	03.1	121°04.8	43.9	8°27.4	32.7	65°15.9	11.4
20	57°43.7	153°44.7	03.3	136°05.2	43.8	23°29.7	32.8	80°18.2	11.3
21	72°46.2	168°43.8	·· 03.5	151°05.7	·· 43.6	38°32.0	·· 32.9	95°20.4	·· 11.2
22	87°48.7	183°43.0	03.8	166°06.1	43.5	53°34.3	32.9	110°22.6	11.1
23	102°51.1	198°42.2	04.0	181°06.5	43.4	68°36.6	33.0	125°24.8	11.0
Mer.pass. 16:10		ν -0.8′	d -0.3′	m -3.95	ν 0.4′	d 0.1′	m 1.35	ν 2.3′	d 0.1′ m -2.45	ν 2.2′	d 0.1′ m 0.98

Stars

	SHA	Dec
Alpheratz	357°35.8	29°13.5
Ankaa	353°08.1	-42°10.8
Schedar	349°32.1	56°40.4
Diphda	348°48.2	-17°51.5
Achernar	335°20.8	-57°07.2
Hamal	327°52.1	23°34.6
Polaris	314°14.5	89°22.2
Acamar	315°12.2	-40°12.7
Menkar	314°06.9	4°11.0
Mirfak	308°29.2	49°57.0
Aldebaran	290°40.3	16°33.5
Rigel	281°04.4	-8°10.5
Capella	280°22.7	46°01.4
Bellatrix	278°23.5	6°22.3
Elnath	278°02.6	28°37.7
Alnilam	275°38.3	-1°11.2
Betelgeuse	270°52.7	7°24.7
Canopus	263°52.2	-52°42.6
Sirius	258°26.6	-16°45.0
Adhara	255°06.1	-29°00.3
Procyon	244°51.3	5°09.8
Pollux	243°17.9	27°58.0
Avior	234°14.4	-59°35.1
Suhail	222°46.5	-43°31.7
Miaplacidus	221°37.6	-69°48.8
Alphard	217°48.2	-8°45.8
Regulus	207°35.0	11°50.9
Dubhe	193°41.5	61°37.0
Denebola	182°25.6	14°26.2
Gienah	175°44.3	-17°40.5
Acrux	173°00.8	-63°13.6
Gacrux	171°52.4	-57°14.6
Alioth	166°13.5	55°49.5
Spica	158°23.1	-11°17.2
Alkaid	152°52.7	49°11.3
Hadar	148°37.3	-60°29.0
Menkent	147°58.6	-36°29.1
Arcturus	145°48.7	19°03.3
Rigil Kent.	139°41.6	-60°55.8
Kochab	137°20.1	74°03.0
Zuben'ubi	136°57.0	-16°08.5
Alphecca	126°04.6	26°37.8
Antares	112°17.1	-26°29.1
Atria	107°12.5	-69°04.0
Sabik	102°04.0	-15°45.3
Shaula	96°11.8	-37°07.2
Rasalhague	95°59.6	12°32.4
Eltanin	90°43.0	51°28.9
Kaus Aust.	83°34.0	-34°22.4
Vega	80°34.2	38°48.2
Nunki	75°49.1	-26°16.1
Altair	62°01.1	8°55.8
Peacock	53°07.6	-56°39.6
Deneb	49°26.8	45°21.9
Enif	33°39.9	9°59.0
Al Na'ir	27°34.3	-46°50.9
Fomalhaut	15°15.6	-29°29.9
Scheat	13°46.2	28°12.8
Markab	13°30.9	15°20.1

Jan 16 Tue	SHA	Mer.pass
Venus	99°45.1	09:42
Mars	80°41.2	10:57
Jupiter	325°55.3	18:34
Saturn	22°51.2	14:47

Jan 17 Wed	SHA	Mer.pass
Venus	98°26.1	09:43
Mars	79°51.9	10:57
Jupiter	325°52.2	18:30
Saturn	22°45.4	14:43

Jan 18 Thu	SHA	Mer.pass
Venus	97°07.0	09:44
Mars	79°02.6	10:56
Jupiter	325°48.9	18:26
Saturn	22°39.4	14:40

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.0933 sec ΔT = TT-UT1 = +69.0907 sec

2024 January 16 to Jan. 18 UT

h	Sun		Moon				
Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	177°38.9	S21°04.3	116°48.6	11.6′	S02°54.8	17.0′	59.7′
1	192°38.7	03.8	131°19.2	11.7′	02°37.8	17.0′	59.7′
2	207°38.5	03.3	145°49.9	11.7′	02°20.8	17.0′	59.7′
3	222°38.3	·· 02.9	160°20.6	11.7′	02°03.8	17.0′	59.7′
4	237°38.0	02.4	174°51.3	11.8′	01°46.8	17.0′	59.6′
5	252°37.8	01.9	189°22.1	11.8′	01°29.8	16.9′	59.6′
6	267°37.6	S21°01.5	203°52.9	11.8′	S01°12.9	17.0′	59.6′
7	282°37.4	01.0	218°23.7	11.9′	00°55.9	17.0′	59.6′
8	297°37.2	00.5	232°54.6	11.9′	00°38.9	16.9′	59.6′
9	312°37.0	21°00.1	247°25.5	11.9′	00°22.0	16.9′	59.5′
10	327°36.7	20°59.6	261°56.4	11.9′	S00°05.1	17.0′	59.5′
11	342°36.5	59.1	276°27.3	12.0′	N00°11.9	16.9′	59.5′
12	357°36.3	S20°58.7	290°58.3	12.0′	N00°28.8	16.9′	59.5′
13	12°36.1	58.2	305°29.3	12.0′	00°45.7	16.8′	59.4′
14	27°35.9	57.7	320°00.3	12.0′	01°02.5	16.9′	59.4′
15	42°35.7	·· 57.2	334°31.3	12.1′	01°19.4	16.8′	59.4′
16	57°35.4	56.8	349°02.4	12.1′	01°36.2	16.8′	59.4′
17	72°35.2	56.3	3°33.5	12.1′	01°53.0	16.8′	59.3′
18	87°35.0	S20°55.8	18°04.6	12.1′	N02°09.8	16.8′	59.3′
19	102°34.8	55.3	32°35.7	12.1′	02°26.6	16.7′	59.3′
20	117°34.6	54.8	47°06.8	12.1′	02°43.3	16.7′	59.3′
21	132°34.4	·· 54.4	61°37.9	12.1′	03°00.0	16.7′	59.2′
22	147°34.2	53.9	76°09.1	12.2′	03°16.7	16.6′	59.2′
23	162°34.0	53.4	90°40.2	12.2′	03°33.3	16.6′	59.2′
	SD = 16.3′	d = 0.5′	SD = 16.3′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	177°33.7	S20°52.9	105°11.4	12.2′	N03°49.9	16.6′	59.2′
1	192°33.5	52.4	119°42.6	12.2′	04°06.5	16.6′	59.1′
2	207°33.3	52.0	134°13.7	12.2′	04°23.1	16.5′	59.1′
3	222°33.1	·· 51.5	148°44.9	12.2′	04°39.6	16.5′	59.1′
4	237°32.9	51.0	163°16.1	12.2′	04°56.1	16.4′	59.1′
5	252°32.7	50.5	177°47.3	12.2′	05°12.5	16.4′	59.0′
6	267°32.5	S20°50.0	192°18.5	12.2′	N05°28.9	16.3′	59.0′
7	282°32.3	49.5	206°49.7	12.2′	05°45.2	16.3′	59.0′
8	297°32.1	49.1	221°20.9	12.2′	06°01.5	16.3′	59.0′
9	312°31.8	·· 48.6	235°52.0	12.2′	06°17.8	16.2′	58.9′
10	327°31.6	48.1	250°23.2	12.2′	06°34.0	16.2′	58.9′
11	342°31.4	47.6	264°54.4	12.2′	06°50.2	16.1′	58.9′
12	357°31.2	S20°47.1	279°25.6	12.2′	N07°06.3	16.1′	58.9′
13	12°31.0	46.6	293°56.7	12.1′	07°22.4	16.0′	58.8′
14	27°30.8	46.1	308°27.9	12.1′	07°38.4	16.0′	58.8′
15	42°30.6	·· 45.6	322°59.0	12.1′	07°54.4	15.9′	58.8′
16	57°30.4	45.1	337°30.1	12.1′	08°10.3	15.9′	58.8′
17	72°30.2	44.6	352°01.3	12.1′	08°26.2	15.8′	58.7′
18	87°30.0	S20°44.2	6°32.4	12.1′	N08°42.0	15.7′	58.7′
19	102°29.8	43.7	21°03.4	12.1′	08°57.7	15.7′	58.7′
20	117°29.6	43.2	35°34.5	12.0′	09°13.4	15.6′	58.7′
21	132°29.4	·· 42.7	50°05.6	12.0′	09°29.0	15.6′	58.6′
22	147°29.2	42.2	64°36.6	12.0′	09°44.6	15.5′	58.6′
23	162°28.9	41.7	79°07.6	12.0′	10°00.1	15.5′	58.6′
	SD = 16.3′	d = 0.5′	SD = 16.1′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	177°28.7	S20°41.2	93°38.6	12.0′	N10°15.6	15.3′	58.5′
1	192°28.5	40.7	108°09.5	11.9′	10°30.9	15.4′	58.5′
2	207°28.3	40.2	122°40.5	11.9′	10°46.3	15.2′	58.5′
3	222°28.1	·· 39.7	137°11.4	11.9′	11°01.5	15.2′	58.5′
4	237°27.9	39.2	151°42.3	11.9′	11°16.7	15.1′	58.4′
5	252°27.7	38.7	166°13.2	11.8′	11°31.8	15.0′	58.4′
6	267°27.5	S20°38.2	180°44.0	11.8′	N11°46.8	15.0′	58.4′
7	282°27.3	37.7	195°14.8	11.8′	12°01.8	14.9′	58.4′
8	297°27.1	37.2	209°45.6	11.7′	12°16.7	14.8′	58.3′
9	312°26.9	·· 36.7	224°16.3	11.7′	12°31.5	14.8′	58.3′
10	327°26.7	36.2	238°47.1	11.7′	12°46.3	14.6′	58.3′
11	342°26.5	35.7	253°17.7	11.6′	13°00.9	14.6′	58.3′
12	357°26.3	S20°35.2	267°48.4	11.6′	N13°15.5	14.5′	58.2′
13	12°26.1	34.7	282°19.0	11.6′	13°30.0	14.5′	58.2′
14	27°25.9	34.1	296°49.6	11.5′	13°44.5	14.3′	58.2′
15	42°25.7	·· 33.6	311°20.1	11.5′	13°58.8	14.3′	58.1′
16	57°25.5	33.1	325°50.6	11.5′	14°13.1	14.2′	58.1′
17	72°25.3	32.6	340°21.1	11.4′	14°27.3	14.1′	58.1′
18	87°25.1	S20°32.1	354°51.5	11.4′	N14°41.4	14.0′	58.1′
19	102°24.9	31.6	9°21.9	11.3′	14°55.4	13.9′	58.0′
20	117°24.7	31.1	23°52.3	11.3′	15°09.3	13.9′	58.0′
21	132°24.5	·· 30.6	38°22.6	11.3′	15°23.2	13.7′	58.0′
22	147°24.3	30.1	52°52.8	11.2′	15°36.9	13.7′	58.0′
23	162°24.1	29.6	67°23.0	11.2′	15°50.6	13.5′	57.9′
	SD = 16.3′	d = 0.5′	SD = 16.0′				

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

Lat.	**Moonrise** Tue	Wed	Thu	**Moonset** Tue	Wed	Thu
N 72°	10:34	09:58	09:12	23:43	·· ··	02:11
N 70°	10:34	10:06	09:34	23:38	·· ··	01:53
68°	10:34	10:14	09:50	23:34	·· ··	01:38
66°	10:34	10:20	10:04	23:30	·· ··	01:26
64°	10:34	10:25	10:15	23:27	·· ··	01:17
62°	10:34	10:30	10:25	23:25	·· ··	01:08
60°	10:34	10:34	10:34	23:22	·· ··	01:01
N 58°	10:34	10:37	10:41	23:20	·· ··	00:55
56°	10:34	10:40	10:48	23:18	·· ··	00:50
54°	10:34	10:43	10:54	23:17	·· ··	00:45
52°	10:34	10:46	10:59	23:15	·· ··	00:40
50°	10:34	10:48	11:04	23:14	·· ··	00:36
45°	10:34	10:54	11:14	23:11	·· ··	00:28
N 40°	10:34	10:58	11:23	23:09	·· ··	00:21
35°	10:34	11:02	11:31	23:07	·· ··	00:14
30°	10:34	11:05	11:38	23:05	·· ··	00:09
20°	10:34	11:11	11:49	23:02	·· ··	00:00
N 10°	10:34	11:17	12:00	22:59	23:52	·· ··
0°	10:34	11:22	12:10	22:57	23:44	·· ··
S 10°	10:34	11:27	12:20	22:54	23:37	·· ··
20°	10:34	11:32	12:30	22:51	23:29	·· ··
30°	10:34	11:39	12:43	22:48	23:20	23:53
35°	10:34	11:42	12:50	22:46	23:15	23:45
40°	10:34	11:46	12:58	22:44	23:09	23:35
45°	10:35	11:51	13:08	22:42	23:02	23:24
S 50°	10:35	11:57	13:19	22:39	22:54	23:11
52°	10:35	12:00	13:25	22:38	22:50	23:04
54°	10:35	12:03	13:31	22:37	22:46	22:57
56°	10:35	12:06	13:37	22:35	22:42	22:50
58°	10:35	12:10	13:45	22:33	22:37	22:41
S 60°	10:35	12:14	13:54	22:31	22:31	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 5-7 26-48%
16	09:24	09:35	12:10	16:45	04:21	
17	09:45	09:55	12:10	17:33	05:09	
18	10:05	10:15	12:10	18:21	05:57	

January 19, 20, 21 UT (Fri., Sat., Sun.)

	Aries	Venus		Mars		Jupiter		Saturn	
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	117°53.6	213°41.3	S22°04.2	196°06.9	S23°43.2	83°38.9	N12°33.1	140°27.0	S11°10.9
1	132°56.0	228°40.5	04.5	211°07.3	43.1	98°41.3	33.1	155°29.2	10.8
2	147°58.5	243°39.6	04.7	226°07.7	43.0	113°43.6	33.2	170°31.4	10.7
3	163°01.0	258°38.8	·· 05.0	241°08.1	·· 42.9	128°45.9	·· 33.3	185°33.6	·· 10.6
4	178°03.4	273°37.9	05.2	256°08.5	42.7	143°48.2	33.3	200°35.9	10.5
5	193°05.9	288°37.1	05.4	271°08.9	42.6	158°50.5	33.4	215°38.1	10.4
6	208°08.4	303°36.3	S22°05.6	286°09.4	S23°42.5	173°52.8	N12°33.4	230°40.3	S11°10.3
7	223°10.8	318°35.4	05.9	301°09.8	42.3	188°55.1	33.5	245°42.5	10.2
8	238°13.3	333°34.6	06.1	316°10.2	42.2	203°57.4	33.6	260°44.7	10.1
9	253°15.8	348°33.7	·· 06.3	331°10.6	·· 42.1	218°59.8	·· 33.6	275°46.9	·· 10.0
10	268°18.2	3°32.9	06.6	346°11.0	41.9	234°02.1	33.7	290°49.1	09.9
11	283°20.7	18°32.0	06.8	1°11.4	41.8	249°04.4	33.8	305°51.4	09.8
12	298°23.2	33°31.2	S22°07.0	16°11.8	S23°41.7	264°06.7	N12°33.8	320°53.6	S11°09.7
13	313°25.6	48°30.3	07.2	31°12.2	41.5	279°09.0	33.9	335°55.8	09.6
14	328°28.1	63°29.5	07.4	46°12.6	41.4	294°11.3	34.0	350°58.0	09.5
15	343°30.5	78°28.7	·· 07.7	61°13.0	·· 41.2	309°13.6	·· 34.0	6°00.2	·· 09.4
16	358°33.0	93°27.8	07.9	76°13.5	41.1	324°15.9	34.1	21°02.4	09.3
17	13°35.5	108°27.0	08.1	91°13.9	41.0	339°18.2	34.2	36°04.6	09.2
18	28°37.9	123°26.1	S22°08.3	106°14.3	S23°40.8	354°20.5	N12°34.2	51°06.8	S11°09.1
19	43°40.4	138°25.3	08.5	121°14.7	40.7	9°22.9	34.3	66°09.1	09.0
20	58°42.9	153°24.4	08.8	136°15.1	40.6	24°25.2	34.4	81°11.3	08.9
21	73°45.3	168°23.6	·· 09.0	151°15.5	·· 40.4	39°27.5	·· 34.4	96°13.5	·· 08.8
22	88°47.8	183°22.7	09.2	166°15.9	40.3	54°29.8	34.5	111°15.7	08.7
23	103°50.3	198°21.9	09.4	181°16.3	40.1	69°32.1	34.6	126°17.9	08.6
Mer.pass. 16:06		ν -0.8′	d -0.2′	m -3.95	ν 0.4′	d 0.1′	m 1.35	ν 2.3′	d 0.1′ m -2.45	ν 2.2′	d 0.1′ m 0.98

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	118°52.7	213°21.0	S22°09.6	196°16.7	S23°40.0	84°34.4	N12°34.6	141°20.1	S11°08.5
1	133°55.2	228°20.2	09.8	211°17.1	39.9	99°36.7	34.7	156°22.3	08.4
2	148°57.7	243°19.3	10.0	226°17.6	39.7	114°39.0	34.8	171°24.5	08.3
3	164°00.1	258°18.5	·· 10.2	241°18.0	·· 39.6	129°41.3	·· 34.8	186°26.8	·· 08.2
4	179°02.6	273°17.7	10.4	256°18.4	39.4	144°43.6	34.9	201°29.0	08.1
5	194°05.0	288°16.8	10.6	271°18.8	39.3	159°45.9	35.0	216°31.2	08.0
6	209°07.5	303°16.0	S22°10.8	286°19.2	S23°39.1	174°48.2	N12°35.0	231°33.4	S11°07.9
7	224°10.0	318°15.1	11.0	301°19.6	39.0	189°50.5	35.1	246°35.6	07.8
8	239°12.4	333°14.3	11.2	316°20.0	38.9	204°52.8	35.2	261°37.8	07.7
9	254°14.9	348°13.4	·· 11.4	331°20.4	·· 38.7	219°55.1	·· 35.2	276°40.0	·· 07.6
10	269°17.4	3°12.6	11.6	346°20.8	38.6	234°57.4	35.3	291°42.2	07.5
11	284°19.8	18°11.7	11.8	1°21.3	38.4	249°59.7	35.4	306°44.4	07.4
12	299°22.3	33°10.9	S22°12.0	16°21.7	S23°38.3	265°02.0	N12°35.4	321°46.7	S11°07.3
13	314°24.8	48°10.0	12.2	31°22.1	38.1	280°04.3	35.5	336°48.9	07.2
14	329°27.2	63°09.2	12.4	46°22.5	38.0	295°06.6	35.6	351°51.1	07.1
15	344°29.7	78°08.3	·· 12.6	61°22.9	·· 37.8	310°08.9	·· 35.6	6°53.3	·· 07.0
16	359°32.1	93°07.5	12.8	76°23.3	37.7	325°11.2	35.7	21°55.5	06.9
17	14°34.6	108°06.6	13.0	91°23.7	37.5	340°13.5	35.8	36°57.7	06.8
18	29°37.1	123°05.8	S22°13.2	106°24.1	S23°37.4	355°15.8	N12°35.8	51°59.9	S11°06.7
19	44°39.5	138°04.9	13.4	121°24.5	37.2	10°18.1	35.9	67°02.1	06.6
20	59°42.0	153°04.1	13.6	136°24.9	37.1	25°20.4	36.0	82°04.3	06.5
21	74°44.5	168°03.2	·· 13.8	151°25.4	·· 36.9	40°22.7	·· 36.1	97°06.5	·· 06.4
22	89°46.9	183°02.4	13.9	166°25.8	36.8	55°25.0	36.1	112°08.8	06.3
23	104°49.4	198°01.5	14.1	181°26.2	36.6	70°27.3	36.2	127°11.0	06.2
Mer.pass. 16:02		ν -0.8′	d -0.2′	m -3.95	ν 0.4′	d 0.1′	m 1.35	ν 2.3′	d 0.1′ m -2.44	ν 2.2′	d 0.1′ m 0.98

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	119°51.9	213°00.7	S22°14.3	196°26.6	S23°36.5	85°29.6	N12°36.3	142°13.2	S11°06.1
1	134°54.3	227°59.8	14.5	211°27.0	36.3	100°31.9	36.3	157°15.4	06.0
2	149°56.8	242°58.9	14.7	226°27.4	36.2	115°34.2	36.4	172°17.6	05.9
3	164°59.3	257°58.1	·· 14.9	241°27.8	·· 36.0	130°36.5	·· 36.5	187°19.8	·· 05.8
4	180°01.7	272°57.2	15.0	256°28.2	35.9	145°38.8	36.5	202°22.0	05.7
5	195°04.2	287°56.4	15.2	271°28.6	35.7	160°41.1	36.6	217°24.2	05.6
6	210°06.6	302°55.5	S22°15.4	286°29.1	S23°35.6	175°43.4	N12°36.7	232°26.4	S11°05.5
7	225°09.1	317°54.7	15.6	301°29.5	35.4	190°45.7	36.7	247°28.6	05.4
8	240°11.6	332°53.8	15.7	316°29.9	35.3	205°48.0	36.8	262°30.9	05.3
9	255°14.0	347°53.0	·· 15.9	331°30.3	·· 35.1	220°50.3	·· 36.9	277°33.1	·· 05.2
10	270°16.5	2°52.1	16.1	346°30.7	34.9	235°52.6	37.0	292°35.3	05.1
11	285°19.0	17°51.3	16.2	1°31.1	34.8	250°54.9	37.0	307°37.5	05.0
12	300°21.4	32°50.4	S22°16.4	16°31.5	S23°34.6	265°57.2	N12°37.1	322°39.7	S11°04.9
13	315°23.9	47°49.6	16.6	31°31.9	34.5	280°59.5	37.2	337°41.9	04.8
14	330°26.4	62°48.7	16.8	46°32.3	34.3	296°01.8	37.2	352°44.1	04.7
15	345°28.8	77°47.8	·· 16.9	61°32.7	·· 34.2	311°04.1	·· 37.3	7°46.3	·· 04.6
16	0°31.3	92°47.0	17.1	76°33.2	34.0	326°06.4	37.4	22°48.5	04.5
17	15°33.8	107°46.1	17.3	91°33.6	33.8	341°08.7	37.4	37°50.7	04.4
18	30°36.2	122°45.3	S22°17.4	106°34.0	S23°33.7	356°11.0	N12°37.5	52°53.0	S11°04.3
19	45°38.7	137°44.4	17.6	121°34.4	33.5	11°13.3	37.6	67°55.2	04.2
20	60°41.1	152°43.6	17.7	136°34.8	33.4	26°15.5	37.7	82°57.4	04.1
21	75°43.6	167°42.7	·· 17.9	151°35.2	·· 33.2	41°17.8	·· 37.7	97°59.6	·· 04.0
22	90°46.1	182°41.9	18.1	166°35.6	33.0	56°20.1	37.8	113°01.8	03.9
23	105°48.5	197°41.0	18.2	181°36.0	32.9	71°22.4	37.9	128°04.0	03.8
Mer.pass. 15:58		ν -0.9′	d -0.2′	m -3.94	ν 0.4′	d 0.2′	m 1.34	ν 2.3′	d 0.1′ m -2.43	ν 2.2′	d 0.1′ m 0.98

Stars

	SHA	Dec
Alpheratz	357°35.8	29°13.5
Ankaa	353°08.1	-42°10.8
Schedar	349°32.2	56°40.4
Diphda	348°48.2	-17°51.5
Achernar	335°20.8	-57°07.2
Hamal	327°52.1	23°34.6
Polaris	314°15.8	89°22.2
Acamar	315°12.2	-40°12.7
Menkar	314°06.9	4°11.0
Mirfak	308°29.2	49°57.0
Aldebaran	290°40.3	16°33.5
Rigel	281°04.4	-8°10.5
Capella	280°22.7	46°01.4
Bellatrix	278°23.5	6°22.3
Elnath	278°02.6	28°37.7
Alnilam	275°38.3	-1°11.2
Betelgeuse	270°52.7	7°24.7
Canopus	263°52.2	-52°42.6
Sirius	258°26.6	-16°45.0
Adhara	255°06.1	-29°00.3
Procyon	244°51.3	5°09.8
Pollux	243°17.9	27°58.0
Avior	234°14.4	-59°35.1
Suhail	222°46.5	-43°31.7
Miaplacidus	221°37.6	-69°48.8
Alphard	217°48.2	-8°45.8
Regulus	207°35.0	11°50.9
Dubhe	193°41.5	61°37.1
Denebola	182°25.6	14°26.2
Gienah	175°44.3	-17°40.5
Acrux	173°00.8	-63°13.7
Gacrux	171°52.4	-57°14.6
Alioth	166°13.5	55°49.5
Spica	158°23.1	-11°17.2
Alkaid	152°52.6	49°11.3
Hadar	148°37.2	-60°29.0
Menkent	147°58.6	-36°29.1
Arcturus	145°48.7	19°03.3
Rigil Kent.	139°41.6	-60°55.8
Kochab	137°20.1	74°03.0
Zuben'ubi	136°57.0	-16°08.5
Alphecca	126°04.6	26°37.8
Antares	112°17.1	-26°29.1
Atria	107°12.4	-69°04.0
Sabik	102°04.0	-15°45.3
Shaula	96°11.8	-37°07.2
Rasalhague	95°59.6	12°32.4
Eltanin	90°43.0	51°28.9
Kaus Aust.	83°34.0	-34°22.4
Vega	80°34.2	38°48.2
Nunki	75°49.1	-26°16.0
Altair	62°01.1	8°55.8
Peacock	53°07.6	-56°39.6
Deneb	49°26.8	45°21.9
Enif	33°39.9	9°59.0
Al Na'ir	27°34.3	-46°50.9
Fomalhaut	15°15.7	-29°29.9
Scheat	13°46.2	28°12.8
Markab	13°30.9	15°20.0

Jan 19 Fri	SHA	Mer.pass
Venus	95°47.7	09:46
Mars	78°13.3	10:55
Jupiter	325°45.4	18:23
Saturn	22°33.4	14:36

Jan 20 Sat	SHA	Mer.pass
Venus	94°28.3	09:47
Mars	77°24.0	10:55
Jupiter	325°41.7	18:19
Saturn	22°27.4	14:33

Jan 21 Sun	SHA	Mer.pass
Venus	93°08.8	09:49
Mars	76°34.7	10:54
Jupiter	325°37.8	18:15
Saturn	22°21.3	14:29

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h

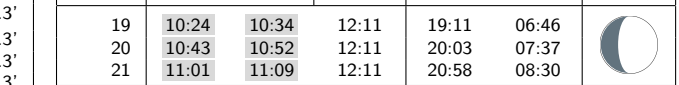
Fri	Sun GHA	Sun Dec	Moon GHA	Moon ν	Moon Dec	Moon d	Moon HP
0	177°23.9	S20°29.0	81°53.2	11.1′	N16°04.1	13.5′	57.9′
1	192°23.7	28.5	96°23.3	11.1′	16°17.6	13.4′	57.9′
2	207°23.5	28.0	110°53.4	11.0′	16°31.0	13.3′	57.9′
3	222°23.3	·· 27.5	125°23.5	11.0′	16°44.3	13.2′	57.8′
4	237°23.1	27.0	139°53.4	10.9′	16°57.5	13.1′	57.8′
5	252°22.9	26.5	154°23.4	10.9′	17°10.6	12.9′	57.8′
6	267°22.8	S20°25.9	168°53.3	10.8′	N17°23.5	12.9′	57.8′
7	282°22.6	25.4	183°23.1	10.8′	17°36.4	12.8′	57.7′
8	297°22.4	24.9	197°52.9	10.7′	17°49.2	12.7′	57.7′
9	312°22.2	·· 24.4	212°22.7	10.7′	18°01.9	12.6′	57.7′
10	327°22.0	23.9	226°52.4	10.6′	18°14.5	12.5′	57.7′
11	342°21.8	23.4	241°22.0	10.6′	18°27.0	12.4′	57.6′
12	357°21.6	S20°22.8	255°51.6	10.5′	N18°39.4	12.3′	57.6′
13	12°21.4	22.3	270°21.2	10.5′	18°51.7	12.1′	57.6′
14	27°21.2	21.8	284°50.6	10.4′	19°03.8	12.1′	57.5′
15	42°21.0	·· 21.3	299°20.1	10.4′	19°15.9	11.9′	57.5′
16	57°20.8	20.7	313°49.5	10.3′	19°27.8	11.9′	57.5′
17	72°20.6	20.2	328°18.8	10.3′	19°39.7	11.7′	57.5′
18	87°20.4	S20°19.7	342°48.1	10.2′	N19°51.4	11.6′	57.4′
19	102°20.2	19.2	357°17.3	10.2′	20°03.0	11.5′	57.4′
20	117°20.1	18.6	11°46.5	10.1′	20°14.5	11.4′	57.4′
21	132°19.9	·· 18.1	26°15.6	10.1′	20°25.9	11.3′	57.4′
22	147°19.7	17.6	40°44.6	10.0′	20°37.2	11.1′	57.3′
23	162°19.5	17.0	55°13.7	10.0′	20°48.3	11.1′	57.3′
	SD = 16.2′	d = 0.5′	SD = 15.8′				

Sat	GHA	Dec	GHA	ν	Dec	d	HP
0	177°19.3	S20°16.5	69°42.6	9.9′	N20°59.4	10.9′	57.3′
1	192°19.1	16.0	84°11.5	9.8′	21°10.3	10.8′	57.3′
2	207°18.9	15.5	98°40.3	9.8′	21°21.1	10.7′	57.2′
3	222°18.7	·· 14.9	113°09.1	9.7′	21°31.8	10.5′	57.2′
4	237°18.5	14.4	127°37.9	9.7′	21°42.3	10.5′	57.2′
5	252°18.4	13.9	142°06.5	9.6′	21°52.8	10.3′	57.2′
6	267°18.2	S20°13.3	156°35.2	9.6′	N22°03.1	10.2′	57.1′
7	282°18.0	12.8	171°03.7	9.5′	22°13.3	10.0′	57.1′
8	297°17.8	12.3	185°32.2	9.5′	22°23.3	10.0′	57.1′
9	312°17.6	·· 11.7	200°00.7	9.4′	22°33.3	9.8′	57.1′
10	327°17.4	11.2	214°29.1	9.3′	22°43.1	9.7′	57.0′
11	342°17.2	10.7	228°57.5	9.3′	22°52.8	9.5′	57.0′
12	357°17.1	S20°10.1	243°25.8	9.2′	N23°02.3	9.4′	57.0′
13	12°16.9	09.6	257°54.0	9.2′	23°11.7	9.3′	57.0′
14	27°16.7	09.0	272°22.2	9.1′	23°21.0	9.2′	56.9′
15	42°16.5	·· 08.5	286°50.3	9.1′	23°30.2	9.0′	56.9′
16	57°16.3	08.0	301°18.4	9.0′	23°39.2	8.9′	56.9′
17	72°16.1	07.4	315°46.4	9.0′	23°48.1	8.7′	56.9′
18	87°15.9	S20°06.9	330°14.4	8.9′	N23°56.8	8.7′	56.9′
19	102°15.8	06.3	344°42.3	8.9′	24°05.5	8.5′	56.8′
20	117°15.6	05.8	359°10.2	8.8′	24°14.0	8.3′	56.8′
21	132°15.4	·· 05.2	13°38.0	8.8′	24°22.3	8.2′	56.8′
22	147°15.2	04.7	28°05.8	8.7′	24°30.5	8.1′	56.8′
23	162°15.0	04.2	42°33.5	8.7′	24°38.6	7.9′	56.7′
	SD = 16.2′	d = 0.5′	SD = 15.6′				

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	177°14.9	S20°03.6	57°01.2	8.6′	N24°46.5	7.8′	56.7′
1	192°14.7	03.1	71°28.9	8.6′	24°54.3	7.7′	56.7′
2	207°14.5	02.5	85°56.4	8.5′	25°02.0	7.5′	56.7′
3	222°14.3	·· 02.0	100°24.0	8.5′	25°09.5	7.3′	56.6′
4	237°14.1	01.4	114°51.5	8.4′	25°16.8	7.3′	56.6′
5	252°14.0	00.9	129°18.9	8.4′	25°24.1	7.0′	56.6′
6	267°13.8	S20°00.3	143°46.3	8.4′	N25°31.1	7.0′	56.6′
7	282°13.6	19°59.8	158°13.7	8.3′	25°38.1	6.8′	56.6′
8	297°13.4	59.2	172°41.0	8.3′	25°44.9	6.6′	56.5′
9	312°13.2	·· 58.7	187°08.3	8.2′	25°51.5	6.5′	56.5′
10	327°13.1	58.1	201°35.5	8.2′	25°58.0	6.4′	56.5′
11	342°12.9	57.6	216°02.7	8.2′	26°04.4	6.2′	56.5′
12	357°12.7	S19°57.0	230°29.9	8.1′	N26°10.6	6.0′	56.4′
13	12°12.5	56.5	244°57.0	8.1′	26°16.6	5.9′	56.4′
14	27°12.4	55.9	259°24.1	8.1′	26°22.5	5.8′	56.4′
15	42°12.2	·· 55.4	273°51.1	8.0′	26°28.3	5.6′	56.4′
16	57°12.0	54.8	288°18.2	8.0′	26°33.9	5.4′	56.4′
17	72°11.8	54.2	302°45.1	8.0′	26°39.3	5.4′	56.3′
18	87°11.6	S19°53.7	317°12.1	7.9′	N26°44.7	5.1′	56.3′
19	102°11.5	53.1	331°39.0	7.9′	26°49.8	5.0′	56.3′
20	117°11.3	52.6	346°05.9	7.9′	26°54.8	4.9′	56.3′
21	132°11.1	·· 52.0	0°32.8	7.8′	26°59.7	4.7′	56.2′
22	147°11.0	51.5	14°59.6	7.8′	27°04.4	4.5′	56.2′
23	162°10.8	50.9	29°26.4	7.8′	27°08.9	4.4′	56.2′
	SD = 16.2′	d = 0.5′	SD = 15.5′				

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

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

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 8-10 59-79%
19	10:24	10:34	12:11	19:11	06:46	
20	10:43	10:52	12:11	20:03	07:37	
21	11:01	11:09	12:11	20:58	08:30	

January 22, 23, 24 UT (Mon., Tue., Wed.)

	Aries	Venus		Mars		Jupiter		Saturn	
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	120°51.0	212°40.1	S22°18.4	196°36.4	S23°32.7	86°24.7	N12°37.9	143°06.2	S11°03.7
1	135°53.5	227°39.3	18.5	211°36.9	32.6	101°27.0	38.0	158°08.4	03.6
2	150°55.9	242°38.4	18.7	226°37.3	32.4	116°29.3	38.1	173°10.6	03.5
3	165°58.4	257°37.6	·· 18.8	241°37.7	·· 32.2	131°31.6	·· 38.2	188°12.8	·· 03.4
4	181°00.9	272°36.7	19.0	256°38.1	32.1	146°33.9	38.2	203°15.0	03.3
5	196°03.3	287°35.9	19.1	271°38.5	31.9	161°36.2	38.3	218°17.2	03.2
6	211°05.8	302°35.0	S22°19.3	286°38.9	S23°31.7	176°38.5	N12°38.4	233°19.5	S11°03.1
7	226°08.3	317°34.1	19.4	301°39.3	31.6	191°40.7	38.5	248°21.7	03.0
8	241°10.7	332°33.3	19.6	316°39.7	31.4	206°43.0	38.5	263°23.9	02.9
9	256°13.2	347°32.4	·· 19.7	331°40.1	·· 31.2	221°45.3	·· 38.6	278°26.1	·· 02.8
10	271°15.6	2°31.6	19.9	346°40.6	31.1	236°47.6	38.7	293°28.3	02.7
11	286°18.1	17°30.7	20.0	1°41.0	30.9	251°49.9	38.7	308°30.5	02.6
12	301°20.6	32°29.9	S22°20.2	16°41.4	S23°30.7	266°52.2	N12°38.8	323°32.7	S11°02.5
13	316°23.0	47°29.0	20.3	31°41.8	30.6	281°54.5	38.9	338°34.9	02.4
14	331°25.5	62°28.1	20.4	46°42.2	30.4	296°56.8	39.0	353°37.1	02.3
15	346°28.0	77°27.3	·· 20.6	61°42.6	·· 30.2	311°59.0	·· 39.0	8°39.3	·· 02.2
16	1°30.4	92°26.4	20.7	76°43.0	30.1	327°01.3	39.1	23°41.5	02.1
17	16°32.9	107°25.6	20.8	91°43.4	29.9	342°03.6	39.2	38°43.7	02.0
18	31°35.4	122°24.7	S22°21.0	106°43.8	S23°29.7	357°05.9	N12°39.3	53°45.9	S11°01.9
19	46°37.8	137°23.8	21.1	121°44.3	29.6	12°08.2	39.3	68°48.1	01.8
20	61°40.3	152°23.0	21.3	136°44.7	29.4	27°10.5	39.4	83°50.4	01.6
21	76°42.8	167°22.1	·· 21.4	151°45.1	·· 29.2	42°12.8	·· 39.5	98°52.6	·· 01.5
22	91°45.2	182°21.3	21.5	166°45.5	29.0	57°15.0	39.5	113°54.8	01.4
23	106°47.7	197°20.4	21.6	181°45.9	28.9	72°17.3	39.6	128°57.0	01.3
Mer.pass. 15:54		ν -0.9′	d -0.2′	m -3.94	ν 0.4′	d 0.2′	m 1.34	ν 2.3′	d 0.1′ m -2.42	ν 2.2′	d 0.1′ m 0.98

Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	121°50.1	212°19.5	S22°21.8	196°46.3	S23°28.7	87°19.6	N12°39.7	143°59.2	S11°01.2
1	136°52.6	227°18.7	21.9	211°46.7	28.5	102°21.9	39.8	159°01.4	01.1
2	151°55.1	242°17.8	22.0	226°47.1	28.4	117°24.2	39.8	174°03.6	01.0
3	166°57.5	257°17.0	·· 22.2	241°47.5	·· 28.2	132°26.5	·· 39.9	189°05.8	·· 00.9
4	182°00.0	272°16.1	22.3	256°48.0	28.0	147°28.7	40.0	204°08.0	00.8
5	197°02.5	287°15.2	22.4	271°48.4	27.8	162°31.0	40.1	219°10.2	00.7
6	212°04.9	302°14.4	S22°22.5	286°48.8	S23°27.7	177°33.3	N12°40.1	234°12.4	S11°00.6
7	227°07.4	317°13.5	22.6	301°49.2	27.5	192°35.6	40.2	249°14.6	00.5
8	242°09.9	332°12.6	22.8	316°49.6	27.3	207°37.9	40.3	264°16.8	00.4
9	257°12.3	347°11.8	·· 22.9	331°50.0	·· 27.1	222°40.1	·· 40.4	279°19.0	·· 00.3
10	272°14.8	2°10.9	23.0	346°50.4	26.9	237°42.4	40.4	294°21.2	00.2
11	287°17.3	17°10.1	23.1	1°50.8	26.8	252°44.7	40.5	309°23.5	00.1
12	302°19.7	32°09.2	S22°23.2	16°51.2	S23°26.6	267°47.0	N12°40.6	324°25.7	S11°00.0
13	317°22.2	47°08.3	23.3	31°51.7	26.4	282°49.3	40.7	339°27.9	10°59.9
14	332°24.6	62°07.5	23.5	46°52.1	26.2	297°51.5	40.7	354°30.1	59.8
15	347°27.1	77°06.6	·· 23.6	61°52.5	·· 26.1	312°53.8	·· 40.8	9°32.3	·· 59.7
16	2°29.6	92°05.7	23.7	76°52.9	25.9	327°56.1	40.9	24°34.5	59.6
17	17°32.0	107°04.9	23.8	91°53.3	25.7	342°58.4	41.0	39°36.7	59.5
18	32°34.5	122°04.0	S22°23.9	106°53.7	S23°25.5	358°00.7	N12°41.0	54°38.9	S10°59.4
19	47°37.0	137°03.2	24.0	121°54.1	25.3	13°02.9	41.1	69°41.1	59.3
20	62°39.4	152°02.3	24.1	136°54.5	25.2	28°05.2	41.2	84°43.3	59.2
21	77°41.9	167°01.4	·· 24.2	151°54.9	·· 25.0	43°07.5	·· 41.3	99°45.5	·· 59.1
22	92°44.4	182°00.6	24.3	166°55.4	24.8	58°09.8	41.3	114°47.7	59.0
23	107°46.8	196°59.7	24.4	181°55.8	24.6	73°12.0	41.4	129°49.9	58.9
Mer.pass. 15:50		ν -0.9′	d -0.1′	m -3.94	ν 0.4′	d 0.2′	m 1.34	ν 2.3′	d 0.1′ m -2.42	ν 2.2′	d 0.1′ m 0.98

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	122°49.3	211°58.8	S22°24.5	196°56.2	S23°24.4	88°14.3	N12°41.5	144°52.1	S10°58.8
1	137°51.7	226°58.0	24.6	211°56.6	24.2	103°16.6	41.6	159°54.3	58.7
2	152°54.2	241°57.1	24.7	226°57.0	24.1	118°18.9	41.7	174°56.5	58.6
3	167°56.7	256°56.2	·· 24.8	241°57.4	·· 23.9	133°21.1	·· 41.7	189°58.7	·· 58.5
4	182°59.1	271°55.4	24.9	256°57.8	23.7	148°23.4	41.8	205°00.9	58.4
5	198°01.6	286°54.5	25.0	271°58.2	23.5	163°25.7	41.9	220°03.2	58.3
6	213°04.1	301°53.6	S22°25.1	286°58.7	S23°23.3	178°28.0	N12°42.0	235°05.4	S10°58.2
7	228°06.5	316°52.8	25.2	301°59.1	23.1	193°30.2	42.0	250°07.6	58.1
8	243°09.0	331°51.9	25.3	316°59.5	22.9	208°32.5	42.1	265°09.8	58.0
9	258°11.5	346°51.1	·· 25.4	331°59.9	·· 22.8	223°34.8	·· 42.2	280°12.0	·· 57.9
10	273°13.9	1°50.2	25.5	347°00.3	22.6	238°37.1	42.3	295°14.2	57.8
11	288°16.4	16°49.3	25.6	2°00.7	22.4	253°39.3	42.3	310°16.4	57.7
12	303°18.9	31°48.5	S22°25.7	17°01.1	S23°22.2	268°41.6	N12°42.4	325°18.6	S10°57.6
13	318°21.3	46°47.6	25.7	32°01.5	22.0	283°43.9	42.5	340°20.8	57.5
14	333°23.8	61°46.7	25.8	47°01.9	21.8	298°46.1	42.6	355°23.0	57.4
15	348°26.2	76°45.9	·· 25.9	62°02.4	·· 21.6	313°48.4	·· 42.7	10°25.2	·· 57.3
16	3°28.7	91°45.0	26.0	77°02.8	21.4	328°50.7	42.7	25°27.4	57.2
17	18°31.2	106°44.1	26.1	92°03.2	21.2	343°53.0	42.8	40°29.6	57.1
18	33°33.6	121°43.3	S22°26.2	107°03.6	S23°21.0	358°55.2	N12°42.9	55°31.8	S10°57.0
19	48°36.1	136°42.4	26.2	122°04.0	20.9	13°57.5	43.0	70°34.0	56.9
20	63°38.6	151°41.5	26.3	137°04.4	20.7	28°59.8	43.0	85°36.2	56.7
21	78°41.0	166°40.7	·· 26.4	152°04.8	·· 20.5	44°02.0	·· 43.1	100°38.4	·· 56.6
22	93°43.5	181°39.8	26.5	167°05.2	20.3	59°04.3	43.2	115°40.6	56.5
23	108°46.0	196°38.9	26.5	182°05.7	20.1	74°06.6	43.3	130°42.8	56.4
Mer.pass. 15:46		ν -0.9′	d -0.1′	m -3.94	ν 0.4′	d 0.2′	m 1.34	ν 2.3′	d 0.1′ m -2.41	ν 2.2′	d 0.1′ m 0.98

Stars

	SHA	Dec
Alpheratz	357°35.8	29°13.4
Ankaa	353°08.1	-42°10.8
Schedar	349°32.2	56°40.4
Diphda	348°48.2	-17°51.5
Achernar	335°20.8	-57°07.2
Hamal	327°52.1	23°34.6
Polaris	314°16.9	89°22.2
Acamar	315°12.3	-40°12.7
Menkar	314°06.9	4°11.0
Mirfak	308°29.2	49°57.0
Aldebaran	290°40.3	16°33.5
Rigel	281°04.4	-8°10.5
Capella	280°22.7	46°01.4
Bellatrix	278°23.5	6°22.3
Elnath	278°02.6	28°37.7
Alnilam	275°38.3	-1°11.2
Betelgeuse	270°52.6	7°24.7
Canopus	263°52.2	-52°42.6
Sirius	258°26.6	-16°45.0
Adhara	255°06.1	-29°00.3
Procyon	244°51.3	5°09.8
Pollux	243°17.9	27°58.0
Avior	234°14.4	-59°35.1
Suhail	222°46.5	-43°31.7
Miaplacidus	221°37.5	-69°48.8
Alphard	217°48.2	-8°45.8
Regulus	207°35.0	11°50.9
Dubhe	193°41.5	61°37.1
Denebola	182°25.6	14°26.1
Gienah	175°44.3	-17°40.5
Acrux	173°00.7	-63°13.7
Gacrux	171°52.3	-57°14.6
Alioth	166°13.5	55°49.5
Spica	158°23.1	-11°17.2
Alkaid	152°52.6	49°11.3
Hadar	148°37.2	-60°29.1
Menkent	147°58.6	-36°29.1
Arcturus	145°48.7	19°03.3
Rigil Kent.	139°41.5	-60°55.8
Kochab	137°20.0	74°03.0
Zuben'ubi	136°57.0	-16°08.5
Alphecca	126°04.6	26°37.8
Antares	112°17.0	-26°29.1
Atria	107°12.4	-69°04.0
Sabik	102°03.9	-15°45.3
Shaula	96°11.8	-37°07.2
Rasalhague	95°59.6	12°32.4
Eltanin	90°43.0	51°28.9
Kaus Aust.	83°33.9	-34°22.4
Vega	80°34.2	38°48.2
Nunki	75°49.1	-26°16.0
Altair	62°01.1	8°55.8
Peacock	53°07.6	-56°39.5
Deneb	49°26.8	45°21.9
Enif	33°39.9	9°59.0
Al Na'ir	27°34.3	-46°50.9
Fomalhaut	15°15.7	-29°29.9
Scheat	13°46.2	28°12.8
Markab	13°30.9	15°20.0

Jan 22 Mon	SHA	Mer.pass
Venus	91°49.1	09:50
Mars	75°45.4	10:53
Jupiter	325°33.7	18:12
Saturn	22°15.2	14:25

Jan 23 Tue	SHA	Mer.pass
Venus	90°29.4	09:51
Mars	74°56.2	10:53
Jupiter	325°29.5	18:08
Saturn	22°09.0	14:22

Jan 24 Wed	SHA	Mer.pass
Venus	89°09.5	09:53
Mars	74°06.9	10:52
Jupiter	325°25.0	18:04
Saturn	22°02.8	14:18

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.0949 sec ΔT = TT-UT1 = +69.0891 sec

2024 January 22 to Jan. 24 UT

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	Sun		Moon				
Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	177°10.6	S19°50.3	43°53.2	7.8′	N27°13.3	4.2′	56.2′
1	192°10.4	49.8	58°20.0	7.8′	27°17.5	4.1′	56.2′
2	207°10.3	49.2	72°46.8	7.7′	27°21.6	3.9′	56.1′
3	222°10.1	·· 48.7	87°13.5	7.7′	27°25.5	3.8′	56.1′
4	237°09.9	48.1	101°40.2	7.7′	27°29.3	3.6′	56.1′
5	252°09.7	47.5	116°06.9	7.7′	27°32.9	3.5′	56.1′
6	267°09.6	S19°47.0	130°33.6	7.7′	N27°36.4	3.3′	56.1′
7	282°09.4	46.4	145°00.2	7.7′	27°39.7	3.1′	56.0′
8	297°09.2	45.8	159°26.9	7.6′	27°42.8	3.0′	56.0′
9	312°09.1	·· 45.3	173°53.6	7.6′	27°45.8	2.9′	56.0′
10	327°08.9	44.7	188°20.2	7.6′	27°48.7	2.7′	56.0′
11	342°08.7	44.1	202°46.8	7.6′	27°51.4	2.5′	56.0′
12	357°08.6	S19°43.6	217°13.4	7.6′	N27°53.9	2.4′	55.9′
13	12°08.4	43.0	231°40.1	7.6′	27°56.3	2.2′	55.9′
14	27°08.2	42.4	246°06.7	7.6′	27°58.5	2.0′	55.9′
15	42°08.0	·· 41.9	260°33.3	7.6′	28°00.5	1.9′	55.9′
16	57°07.9	41.3	274°59.9	7.6′	28°02.4	1.8′	55.9′
17	72°07.7	40.7	289°26.5	7.6′	28°04.2	1.6′	55.8′
18	87°07.5	S19°40.1	303°53.2	7.6′	N28°05.8	1.4′	55.8′
19	102°07.4	39.6	318°19.8	7.6′	28°07.2	1.3′	55.8′
20	117°07.2	39.0	332°46.4	7.6′	28°08.5	1.1′	55.8′
21	132°07.0	·· 38.4	347°13.1	7.7′	28°09.6	0.9′	55.8′
22	147°06.9	37.8	1°39.7	7.7′	28°10.5	0.8′	55.7′
23	162°06.7	37.3	16°06.4	7.7′	28°11.3	0.7′	55.7′
	SD = 16.2′	d = 0.6′	SD = 15.3′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	177°06.5	S19°36.7	30°33.1	7.7′	N28°12.0	0.5′	55.7′
1	192°06.4	36.1	44°59.8	7.7′	28°12.5	0.3′	55.7′
2	207°06.2	35.5	59°26.5	7.7′	28°12.8	0.2′	55.7′
3	222°06.1	·· 35.0	73°53.2	7.8′	28°13.0	0.0′	55.6′
4	237°05.9	34.4	88°20.0	7.8′	28°13.0	0.1′	55.6′
5	252°05.7	33.8	102°46.8	7.8′	28°12.9	0.3′	55.6′
6	267°05.6	S19°33.2	117°13.6	7.8′	N28°12.6	0.4′	55.6′
7	282°05.4	32.6	131°40.4	7.9′	28°12.2	0.6′	55.6′
8	297°05.2	32.1	146°07.3	7.9′	28°11.6	0.7′	55.5′
9	312°05.1	·· 31.5	160°34.1	7.9′	28°10.9	0.9′	55.5′
10	327°04.9	30.9	175°01.1	7.9′	28°10.0	1.1′	55.5′
11	342°04.8	30.3	189°28.0	8.0′	28°08.9	1.2′	55.5′
12	357°04.6	S19°29.7	203°55.0	8.0′	N28°07.7	1.3′	55.5′
13	12°04.4	29.1	218°22.0	8.1′	28°06.4	1.6′	55.5′
14	27°04.3	28.6	232°49.1	8.1′	28°04.8	1.6′	55.4′
15	42°04.1	·· 28.0	247°16.1	8.1′	28°03.2	1.8′	55.4′
16	57°04.0	27.4	261°43.3	8.2′	28°01.4	2.0′	55.4′
17	72°03.8	26.8	276°10.4	8.2′	27°59.4	2.1′	55.4′
18	87°03.6	S19°26.2	290°37.7	8.3′	N27°57.3	2.2′	55.4′
19	102°03.5	25.6	305°04.9	8.3′	27°55.1	2.4′	55.3′
20	117°03.3	25.0	319°32.2	8.3′	27°52.7	2.6′	55.3′
21	132°03.2	·· 24.5	333°59.6	8.4′	27°50.1	2.7′	55.3′
22	147°03.0	23.9	348°27.0	8.4′	27°47.4	2.8′	55.3′
23	162°02.8	23.3	2°54.4	8.5′	27°44.6	3.0′	55.3′
	SD = 16.2′	d = 0.6′	SD = 15.2′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	177°02.7	S19°22.7	17°21.9	8.6′	N27°41.6	3.1′	55.3′
1	192°02.5	22.1	31°49.5	8.6′	27°38.5	3.3′	55.2′
2	207°02.4	21.5	46°17.1	8.7′	27°35.2	3.4′	55.2′
3	222°02.2	·· 20.9	60°44.7	8.7′	27°31.8	3.6′	55.2′
4	237°02.1	20.3	75°12.4	8.8′	27°28.2	3.7′	55.2′
5	252°01.9	19.7	89°40.2	8.8′	27°24.5	3.8′	55.2′
6	267°01.8	S19°19.1	104°08.0	8.9′	N27°20.7	4.0′	55.2′
7	282°01.6	18.5	118°35.9	9.0′	27°16.7	4.2′	55.1′
8	297°01.4	17.9	133°03.9	9.0′	27°12.5	4.2′	55.1′
9	312°01.3	·· 17.3	147°31.9	9.1′	27°08.3	4.4′	55.1′
10	327°01.1	16.7	162°00.0	9.1′	27°03.9	4.6′	55.1′
11	342°01.0	16.1	176°28.1	9.2′	26°59.3	4.6′	55.1′
12	357°00.8	S19°15.5	190°56.3	9.3′	N26°54.7	4.9′	55.1′
13	12°00.7	14.9	205°24.6	9.3′	26°49.8	4.9′	55.0′
14	27°00.5	14.3	219°53.0	9.4′	26°44.9	5.1′	55.0′
15	42°00.4	·· 13.7	234°21.4	9.5′	26°39.8	5.2′	55.0′
16	57°00.2	13.1	248°49.9	9.6′	26°34.6	5.3′	55.0′
17	72°00.1	12.5	263°18.4	9.6′	26°29.3	5.5′	55.0′
18	86°59.9	S19°11.9	277°47.0	9.7′	N26°23.8	5.6′	55.0′
19	101°59.8	11.3	292°15.7	9.8′	26°18.2	5.7′	54.9′
20	116°59.6	10.7	306°44.5	9.8′	26°12.5	5.9′	54.9′
21	131°59.5	·· 10.1	321°13.4	9.9′	26°06.6	6.0′	54.9′
22	146°59.3	09.5	335°42.3	10.0′	26°00.6	6.1′	54.9′
23	161°59.2	08.9	350°11.3	10.1′	25°54.5	6.2′	54.9′
	SD = 16.2′	d = 0.6′	SD = 15.1′				

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

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

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%
22	11:18	11:26	12:11	21:53	09:25	
23	11:34	11:42	12:12	22:48	10:21	
24	11:49	11:57	12:12	23:41	11:15	

January 25, 26, 27 UT (Thu., Fri., Sat.)

	Aries	Venus		Mars		Jupiter		Saturn	
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	123°48.4	211°38.1	S22°26.6	197°06.1	S23°19.9	89°08.8	N12°43.4	145°45.0	S10°56.3
1	138°50.9	226°37.2	26.7	212°06.5	19.7	104°11.1	43.4	160°47.2	56.2
2	153°53.4	241°36.3	26.8	227°06.9	19.5	119°13.4	43.5	175°49.4	56.1
3	168°55.8	256°35.5	·· 26.8	242°07.3	·· 19.3	134°15.7	·· 43.6	190°51.6	·· 56.0
4	183°58.3	271°34.6	26.9	257°07.7	19.1	149°17.9	43.7	205°53.8	55.9
5	199°00.7	286°33.7	27.0	272°08.1	18.9	164°20.2	43.8	220°56.0	55.8
6	214°03.2	301°32.9	S22°27.0	287°08.5	S23°18.7	179°22.5	N12°43.8	235°58.3	S10°55.7
7	229°05.7	316°32.0	27.1	302°09.0	18.5	194°24.7	43.9	251°00.5	55.6
8	244°08.1	331°31.1	27.2	317°09.4	18.3	209°27.0	44.0	266°02.7	55.5
9	259°10.6	346°30.3	·· 27.2	332°09.8	·· 18.1	224°29.3	·· 44.1	281°04.9	·· 55.4
10	274°13.1	1°29.4	27.3	347°10.2	17.9	239°31.5	44.2	296°07.1	55.3
11	289°15.5	16°28.5	27.4	2°10.6	17.7	254°33.8	44.2	311°09.3	55.2
12	304°18.0	31°27.6	S22°27.4	17°11.0	S23°17.5	269°36.0	N12°44.3	326°11.5	S10°55.1
13	319°20.5	46°26.8	27.5	32°11.4	17.3	284°38.3	44.4	341°13.7	55.0
14	334°22.9	61°25.9	27.5	47°11.8	17.1	299°40.6	44.5	356°15.9	54.9
15	349°25.4	76°25.0	·· 27.6	62°12.3	·· 16.9	314°42.8	·· 44.6	11°18.1	·· 54.8
16	4°27.9	91°24.2	27.6	77°12.7	16.7	329°45.1	44.6	26°20.3	54.7
17	19°30.3	106°23.3	27.7	92°13.1	16.5	344°47.4	44.7	41°22.5	54.6
18	34°32.8	121°22.4	S22°27.8	107°13.5	S23°16.3	359°49.6	N12°44.8	56°24.7	S10°54.5
19	49°35.2	136°21.6	27.8	122°13.9	16.1	14°51.9	44.9	71°26.9	54.4
20	64°37.7	151°20.7	27.9	137°14.3	15.9	29°54.2	45.0	86°29.1	54.3
21	79°40.2	166°19.8	·· 27.9	152°14.7	·· 15.7	44°56.4	·· 45.0	101°31.3	·· 54.2
22	94°42.6	181°19.0	28.0	167°15.2	15.5	59°58.7	45.1	116°33.5	54.1
23	109°45.1	196°18.1	28.0	182°15.6	15.3	75°00.9	45.2	131°35.7	54.0
Mer.pass. 15:42		ν -0.9′	d -0.1′	m -3.93	ν 0.4′	d 0.2′	m 1.34	ν 2.3′	d 0.1′ m -2.40	ν 2.2′	d 0.1′ m 0.99

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	124°47.6	211°17.2	S22°28.1	197°16.0	S23°15.1	90°03.2	N12°45.3	146°37.9	S10°53.9
1	139°50.0	226°16.4	28.1	212°16.4	14.9	105°05.5	45.4	161°40.1	53.8
2	154°52.5	241°15.5	28.1	227°16.8	14.7	120°07.7	45.4	176°42.3	53.7
3	169°55.0	256°14.6	·· 28.2	242°17.2	·· 14.5	135°10.0	·· 45.5	191°44.5	·· 53.6
4	184°57.4	271°13.7	28.2	257°17.6	14.3	150°12.2	45.6	206°46.7	53.4
5	199°59.9	286°12.9	28.3	272°18.0	14.1	165°14.5	45.7	221°48.9	53.3
6	215°02.4	301°12.0	S22°28.3	287°18.5	S23°13.9	180°16.8	N12°45.8	236°51.1	S10°53.2
7	230°04.8	316°11.1	28.3	302°18.9	13.7	195°19.0	45.8	251°53.3	53.1
8	245°07.3	331°10.3	28.4	317°19.3	13.4	210°21.3	45.9	266°55.5	53.0
9	260°09.7	346°09.4	·· 28.4	332°19.7	·· 13.2	225°23.5	·· 46.0	281°57.7	·· 52.9
10	275°12.2	1°08.5	28.5	347°20.1	13.0	240°25.8	46.1	296°59.9	52.8
11	290°14.7	16°07.7	28.5	2°20.5	12.8	255°28.1	46.2	312°02.1	52.7
12	305°17.1	31°06.8	S22°28.5	17°20.9	S23°12.6	270°30.3	N12°46.3	327°04.3	S10°52.6
13	320°19.6	46°05.9	28.5	32°21.4	12.4	285°32.6	46.3	342°06.5	52.5
14	335°22.1	61°05.0	28.6	47°21.8	12.2	300°34.8	46.4	357°08.7	52.4
15	350°24.5	76°04.2	·· 28.6	62°22.2	·· 12.0	315°37.1	·· 46.5	12°10.9	·· 52.3
16	5°27.0	91°03.3	28.6	77°22.6	11.8	330°39.3	46.6	27°13.1	52.2
17	20°29.5	106°02.4	28.7	92°23.0	11.6	345°41.6	46.7	42°15.3	52.1
18	35°31.9	121°01.6	S22°28.7	107°23.4	S23°11.3	0°43.9	N12°46.8	57°17.5	S10°52.0
19	50°34.4	136°00.7	28.7	122°23.8	11.1	15°46.1	46.8	72°19.7	51.9
20	65°36.8	150°59.8	28.7	137°24.3	10.9	30°48.4	46.9	87°21.9	51.8
21	80°39.3	165°58.9	·· 28.8	152°24.7	·· 10.7	45°50.6	·· 47.0	102°24.1	·· 51.7
22	95°41.8	180°58.1	28.8	167°25.1	10.5	60°52.9	47.1	117°26.3	51.6
23	110°44.2	195°57.2	28.8	182°25.5	10.3	75°55.1	47.2	132°28.5	51.5
Mer.pass. 15:38		ν -0.9′	d -0.0′	m -3.93	ν 0.4′	d 0.2′	m 1.34	ν 2.3′	d 0.1′ m -2.39	ν 2.2′	d 0.1′ m 0.99

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	125°46.7	210°56.3	S22°28.8	197°25.9	S23°10.1	90°57.4	N12°47.3	147°30.7	S10°51.4
1	140°49.2	225°55.5	28.8	212°26.3	09.8	105°59.6	47.3	162°32.9	51.3
2	155°51.6	240°54.6	28.9	227°26.7	09.6	121°01.9	47.4	177°35.1	51.2
3	170°54.1	255°53.7	·· 28.9	242°27.1	·· 09.4	136°04.1	·· 47.5	192°37.3	·· 51.1
4	185°56.6	270°52.8	28.9	257°27.6	09.2	151°06.4	47.6	207°39.5	51.0
5	200°59.0	285°52.0	28.9	272°28.0	09.0	166°08.7	47.7	222°41.7	50.9
6	216°01.5	300°51.1	S22°28.9	287°28.4	S23°08.8	181°10.9	N12°47.8	237°43.9	S10°50.8
7	231°04.0	315°50.2	28.9	302°28.8	08.5	196°13.2	47.8	252°46.1	50.6
8	246°06.4	330°49.4	28.9	317°29.2	08.3	211°15.4	47.9	267°48.3	50.5
9	261°08.9	345°48.5	·· 28.9	332°29.6	·· 08.1	226°17.7	·· 48.0	282°50.5	·· 50.4
10	276°11.3	0°47.6	28.9	347°30.0	07.9	241°19.9	48.1	297°52.7	50.3
11	291°13.8	15°46.7	28.9	2°30.5	07.7	256°22.2	48.2	312°54.9	50.2
12	306°16.3	30°45.9	S22°29.0	17°30.9	S23°07.4	271°24.4	N12°48.3	327°57.1	S10°50.1
13	321°18.7	45°45.0	29.0	32°31.3	07.2	286°26.7	48.3	342°59.3	50.0
14	336°21.2	60°44.1	29.0	47°31.7	07.0	301°28.9	48.4	358°01.5	49.9
15	351°23.7	75°43.3	·· 29.0	62°32.1	·· 06.8	316°31.2	·· 48.5	13°03.7	·· 49.8
16	6°26.1	90°42.4	29.0	77°32.5	06.6	331°33.4	48.6	28°05.9	49.7
17	21°28.6	105°41.5	29.0	92°33.0	06.3	346°35.7	48.7	43°08.1	49.6
18	36°31.1	120°40.6	S22°29.0	107°33.4	S23°06.1	1°37.9	N12°48.8	58°10.3	S10°49.5
19	51°33.5	135°39.8	29.0	122°33.8	05.9	16°40.2	48.9	73°12.5	49.4
20	66°36.0	150°38.9	28.9	137°34.2	05.7	31°42.4	48.9	88°14.7	49.3
21	81°38.5	165°38.0	·· 28.9	152°34.6	·· 05.4	46°44.7	·· 49.0	103°16.9	·· 49.2
22	96°40.9	180°37.2	28.9	167°35.0	05.2	61°46.9	49.1	118°19.1	49.1
23	111°43.4	195°36.3	28.9	182°35.4	05.0	76°49.1	49.2	133°21.3	49.0
Mer.pass. 15:34		ν -0.9′	d -0.0′	m -3.93	ν 0.4′	d 0.2′	m 1.34	ν 2.3′	d 0.1′ m -2.39	ν 2.2′	d 0.1′ m 0.99

Stars

	SHA	Dec
Alpheratz	357°35.8	29°13.4
Ankaa	353°08.1	-42°10.8
Schedar	349°32.2	56°40.4
Diphda	348°48.2	-17°51.5
Achernar	335°20.8	-57°07.2
Hamal	327°52.1	23°34.6
Polaris	314°18.3	89°22.3
Acamar	315°12.3	-40°12.7
Menkar	314°06.9	4°11.0
Mirfak	308°29.2	49°57.0
Aldebaran	290°40.3	16°33.5
Rigel	281°04.4	-8°10.5
Capella	280°22.7	46°01.4
Bellatrix	278°23.5	6°22.3
Elnath	278°02.6	28°37.7
Alnilam	275°38.3	-1°11.3
Betelgeuse	270°52.6	7°24.7
Canopus	263°52.3	-52°42.6
Sirius	258°26.6	-16°45.0
Adhara	255°06.1	-29°00.4
Procyon	244°51.3	5°09.8
Pollux	243°17.9	27°58.0
Avior	234°14.4	-59°35.1
Suhail	222°46.5	-43°31.7
Miaplacidus	221°37.5	-69°48.8
Alphard	217°48.2	-8°45.8
Regulus	207°35.0	11°50.9
Dubhe	193°41.4	61°37.1
Denebola	182°25.5	14°26.1
Gienah	175°44.2	-17°40.5
Acrux	173°00.7	-63°13.7
Gacrux	171°52.3	-57°14.6
Alioth	166°13.4	55°49.5
Spica	158°23.1	-11°17.2
Alkaid	152°52.6	49°11.3
Hadar	148°37.1	-60°29.1
Menkent	147°58.5	-36°29.1
Arcturus	145°48.6	19°03.2
Rigil Kent.	139°41.5	-60°55.8
Kochab	137°19.9	74°03.0
Zuben'ubi	136°56.9	-16°08.5
Alphecca	126°04.5	26°37.8
Antares	112°17.0	-26°29.1
Atria	107°12.3	-69°04.0
Sabik	102°03.9	-15°45.3
Shaula	96°11.8	-37°07.2
Rasalhague	95°59.5	12°32.4
Eltanin	90°43.0	51°28.9
Kaus Aust.	83°33.9	-34°22.4
Vega	80°34.1	38°48.2
Nunki	75°49.1	-26°16.0
Altair	62°01.1	8°55.8
Peacock	53°07.5	-56°39.5
Deneb	49°26.8	45°21.9
Enif	33°39.9	9°59.0
Al Na'ir	27°34.3	-46°50.9
Fomalhaut	15°15.7	-29°29.9
Scheat	13°46.2	28°12.8
Markab	13°30.9	15°20.0

Jan 25 Thu	SHA	Mer.pass
Venus	87°49.6	09:54
Mars	73°17.6	10:51
Jupiter	325°20.4	18:01
Saturn	21°56.6	14:15

Jan 26 Fri	SHA	Mer.pass
Venus	86°29.7	09:55
Mars	72°28.4	10:51
Jupiter	325°15.6	17:57
Saturn	21°50.3	14:11

Jan 27 Sat	SHA	Mer.pass
Venus	85°09.6	09:57
Mars	71°39.2	10:50
Jupiter	325°10.7	17:53
Saturn	21°44.0	14:08

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°59.0	S19°08.3	4°40.3	10.1′	N25°48.3	6.4′	54.9′
1	191°58.9	07.7	19°09.5	10.2′	25°41.9	6.5′	54.9′
2	206°58.7	07.1	33°38.7	10.3′	25°35.4	6.6′	54.8′
3	221°58.6	·· 06.5	48°08.0	10.4′	25°28.8	6.7′	54.8′
4	236°58.4	05.9	62°37.4	10.5′	25°22.1	6.9′	54.8′
5	251°58.3	05.3	77°06.9	10.5′	25°15.2	6.9′	54.8′
6	266°58.1	S19°04.7	91°36.4	10.6′	N25°08.3	7.1′	54.8′
7	281°58.0	04.1	106°06.0	10.7′	25°01.2	7.2′	54.8′
8	296°57.8	03.5	120°35.7	10.8′	24°54.0	7.3′	54.8′
9	311°57.7	·· 02.8	135°05.5	10.9′	24°46.7	7.5′	54.7′
10	326°57.6	02.2	149°35.4	10.9′	24°39.2	7.5′	54.7′
11	341°57.4	01.6	164°05.3	11.0′	24°31.7	7.7′	54.7′
12	356°57.3	S19°01.0	178°35.3	11.1′	N24°24.0	7.7′	54.7′
13	11°57.1	19°00.4	193°05.5	11.2′	24°16.3	7.9′	54.7′
14	26°57.0	18°59.8	207°35.6	11.3′	24°08.4	8.0′	54.7′
15	41°56.8	·· 59.2	222°05.9	11.4′	24°00.4	8.1′	54.7′
16	56°56.7	58.5	236°36.3	11.4′	23°52.3	8.2′	54.6′
17	71°56.5	57.9	251°06.7	11.5′	23°44.1	8.3′	54.6′
18	86°56.4	S18°57.3	265°37.2	11.6′	N23°35.8	8.4′	54.6′
19	101°56.3	56.7	280°07.9	11.7′	23°27.4	8.6′	54.6′
20	116°56.1	56.1	294°38.5	11.8′	23°18.8	8.6′	54.6′
21	131°56.0	·· 55.5	309°09.3	11.9′	23°10.2	8.7′	54.6′
22	146°55.8	54.8	323°40.2	11.9′	23°01.5	8.8′	54.6′
23	161°55.7	54.2	338°11.1	12.0′	22°52.7	9.0′	54.5′
	SD = 16.2′	d = 0.6′	SD = 15.0′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°55.6	S18°53.6	352°42.1	12.1′	N22°43.7	9.0′	54.5′
1	191°55.4	53.0	7°13.3	12.2′	22°34.7	9.1′	54.5′
2	206°55.3	52.4	21°44.4	12.3′	22°25.6	9.2′	54.5′
3	221°55.1	·· 51.7	36°15.7	12.4′	22°16.4	9.3′	54.5′
4	236°55.0	51.1	50°47.1	12.4′	22°07.1	9.4′	54.5′
5	251°54.9	50.5	65°18.5	12.5′	21°57.7	9.5′	54.5′
6	266°54.7	S18°49.9	79°50.1	12.6′	N21°48.2	9.6′	54.5′
7	281°54.6	49.2	94°21.7	12.7′	21°38.6	9.7′	54.4′
8	296°54.4	48.6	108°53.4	12.8′	21°28.9	9.8′	54.4′
9	311°54.3	·· 48.0	123°25.1	12.9′	21°19.1	9.8′	54.4′
10	326°54.2	47.4	137°57.0	12.9′	21°09.3	10.0′	54.4′
11	341°54.0	46.7	152°28.9	13.0′	20°59.3	10.0′	54.4′
12	356°53.9	S18°46.1	167°00.9	13.1′	N20°49.3	10.1′	54.4′
13	11°53.8	45.5	181°33.1	13.2′	20°39.2	10.2′	54.4′
14	26°53.6	44.9	196°05.2	13.3′	20°29.0	10.3′	54.4′
15	41°53.5	·· 44.2	210°37.5	13.3′	20°18.7	10.4′	54.4′
16	56°53.4	43.6	225°09.8	13.4′	20°08.3	10.4′	54.3′
17	71°53.2	43.0	239°42.3	13.5′	19°57.9	10.5′	54.3′
18	86°53.1	S18°42.3	254°14.8	13.6′	N19°47.4	10.7′	54.3′
19	101°52.9	41.7	268°47.3	13.7′	19°36.7	10.6′	54.3′
20	116°52.8	41.1	283°20.0	13.7′	19°26.1	10.8′	54.3′
21	131°52.7	·· 40.4	297°52.7	13.8′	19°15.3	10.8′	54.3′
22	146°52.6	39.8	312°25.6	13.9′	19°04.5	10.9′	54.3′
23	161°52.4	39.2	326°58.5	14.0′	18°53.6	11.0′	54.3′
	SD = 16.2′	d = 0.6′	SD = 14.9′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°52.3	S18°38.5	341°31.4	14.0′	N18°42.6	11.1′	54.3′
1	191°52.2	37.9	356°04.5	14.1′	18°31.5	11.1′	54.3′
2	206°52.0	37.3	10°37.6	14.2′	18°20.4	11.2′	54.2′
3	221°51.9	·· 36.6	25°10.8	14.3′	18°09.2	11.3′	54.2′
4	236°51.8	36.0	39°44.1	14.3′	17°57.9	11.3′	54.2′
5	251°51.6	35.4	54°17.4	14.4′	17°46.6	11.4′	54.2′
6	266°51.5	S18°34.7	68°50.8	14.5′	N17°35.2	11.5′	54.2′
7	281°51.4	34.1	83°24.3	14.6′	17°23.7	11.5′	54.2′
8	296°51.2	33.4	97°57.9	14.6′	17°12.2	11.7′	54.2′
9	311°51.1	·· 32.8	112°31.5	14.7′	17°00.5	11.6′	54.2′
10	326°51.0	32.2	127°05.2	14.8′	16°48.9	11.7′	54.2′
11	341°50.9	31.5	141°39.0	14.8′	16°37.2	11.8′	54.2′
12	356°50.7	S18°30.9	156°12.8	14.9′	N16°25.4	11.9′	54.2′
13	11°50.6	30.2	170°46.7	15.0′	16°13.5	11.9′	54.2′
14	26°50.5	29.6	185°20.7	15.0′	16°01.6	12.0′	54.1′
15	41°50.3	·· 29.0	199°54.7	15.1′	15°49.6	12.0′	54.1′
16	56°50.2	28.3	214°28.9	15.2′	15°37.6	12.1′	54.1′
17	71°50.1	27.7	229°03.0	15.2′	15°25.5	12.1′	54.1′
18	86°50.0	S18°27.0	243°37.3	15.3′	N15°13.4	12.2′	54.1′
19	101°49.8	26.4	258°11.6	15.4′	15°01.2	12.3′	54.1′
20	116°49.7	25.7	272°45.9	15.4′	14°48.9	12.3′	54.1′
21	131°49.6	·· 25.1	287°20.4	15.5′	14°36.6	12.3′	54.1′
22	146°49.5	24.4	301°54.9	15.5′	14°24.3	12.4′	54.1′
23	161°49.3	23.8	316°29.4	15.6′	14°11.9	12.5′	54.1′
	SD = 16.2′	d = 0.6′	SD = 14.8′				

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

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

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 14-16 99-98%
25	12:04	12:11	12:12	–:–	12:06	
26	12:18	12:24	12:12	00:30	12:54	
27	12:31	12:37	12:13	01:16	13:38	

January 28, 29, 30 UT (Sun., Mon., Tue.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	126°45.8	210°35.4	S22°28.9	197°35.9	S23°04.8	91°51.4	N12°49.3	148°23.5	S10°48.9
1	141°48.3	225°34.5	28.9	212°36.3	04.5	106°53.6	49.4	163°25.7	48.8
2	156°50.8	240°33.7	28.9	227°36.7	04.3	121°55.9	49.4	178°27.9	48.7
3	171°53.2	255°32.8	·· 28.9	242°37.1	·· 04.1	136°58.1	·· 49.5	193°30.1	·· 48.6
4	186°55.7	270°31.9	28.9	257°37.5	03.9	152°00.4	49.6	208°32.3	48.5
5	201°58.2	285°31.0	28.9	272°37.9	03.6	167°02.6	49.7	223°34.5	48.3
6	217°00.6	300°30.2	S22°28.8	287°38.3	S23°03.4	182°04.9	N12°49.8	238°36.7	S10°48.2
7	232°03.1	315°29.3	28.8	302°38.8	03.2	197°07.1	49.9	253°38.9	48.1
8	247°05.6	330°28.4	28.8	317°39.2	02.9	212°09.4	50.0	268°41.1	48.0
9	262°08.0	345°27.6	·· 28.8	332°39.6	·· 02.7	227°11.6	·· 50.1	283°43.3	·· 47.9
10	277°10.5	0°26.7	28.8	347°40.0	02.5	242°13.8	50.1	298°45.5	47.8
11	292°12.9	15°25.8	28.7	2°40.4	02.3	257°16.1	50.2	313°47.7	47.7
12	307°15.4	30°24.9	S22°28.7	17°40.8	S23°02.0	272°18.3	N12°50.3	328°49.9	S10°47.6
13	322°17.9	45°24.1	28.7	32°41.3	01.8	287°20.6	50.4	343°52.1	47.5
14	337°20.3	60°23.2	28.7	47°41.7	01.6	302°22.8	50.5	358°54.3	47.4
15	352°22.8	75°22.3	·· 28.6	62°42.1	·· 01.3	317°25.1	·· 50.6	13°56.5	·· 47.3
16	7°25.3	90°21.4	28.6	77°42.5	01.1	332°27.3	50.7	28°58.7	47.2
17	22°27.7	105°20.6	28.6	92°42.9	00.9	347°29.5	50.7	44°00.9	47.1
18	37°30.2	120°19.7	S22°28.5	107°43.3	S23°00.6	2°31.8	N12°50.8	59°03.1	S10°47.0
19	52°32.7	135°18.8	28.5	122°43.8	00.4	17°34.0	50.9	74°05.3	46.9
20	67°35.1	150°18.0	28.5	137°44.2	23°00.2	32°36.3	51.0	89°07.5	46.8
21	82°37.6	165°17.1	·· 28.5	152°44.6	22°59.9	47°38.5	·· 51.1	104°09.7	·· 46.7
22	97°40.1	180°16.2	28.4	167°45.0	59.7	62°40.8	51.2	119°11.9	46.6
23	112°42.5	195°15.3	28.4	182°45.4	59.5	77°43.0	51.3	134°14.1	46.5
Mer.pass. 15:30		ν -0.9′	d 0.0′	m -3.93	ν 0.4′	d 0.2′	m 1.33	ν 2.2′	d 0.1′ m -2.38	ν 2.2′	d 0.1′ m 0.99

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	127°45.0	210°14.5	S22°28.3	197°45.8	S22°59.2	92°45.2	N12°51.4	149°16.3	S10°46.4
1	142°47.4	225°13.6	28.3	212°46.3	59.0	107°47.5	51.4	164°18.5	46.3
2	157°49.9	240°12.7	28.3	227°46.7	58.7	122°49.7	51.5	179°20.7	46.1
3	172°52.4	255°11.8	·· 28.2	242°47.1	·· 58.5	137°51.9	·· 51.6	194°22.9	·· 46.0
4	187°54.8	270°11.0	28.2	257°47.5	58.3	152°54.2	51.7	209°25.1	45.9
5	202°57.3	285°10.1	28.1	272°47.9	58.0	167°56.4	51.8	224°27.3	45.8
6	217°59.8	300°09.2	S22°28.1	287°48.3	S22°57.8	182°58.7	N12°51.9	239°29.5	S10°45.7
7	233°02.2	315°08.4	28.1	302°48.7	57.6	198°00.9	52.0	254°31.7	45.6
8	248°04.7	330°07.5	28.0	317°49.2	57.3	213°03.1	52.1	269°33.9	45.5
9	263°07.2	345°06.6	·· 28.0	332°49.6	·· 57.1	228°05.4	·· 52.2	284°36.1	·· 45.4
10	278°09.6	0°05.7	27.9	347°50.0	56.8	243°07.6	52.2	299°38.3	45.3
11	293°12.1	15°04.9	27.9	2°50.4	56.6	258°09.8	52.3	314°40.5	45.2
12	308°14.6	30°04.0	S22°27.8	17°50.8	S22°56.3	273°12.1	N12°52.4	329°42.6	S10°45.1
13	323°17.0	45°03.1	27.8	32°51.3	56.1	288°14.3	52.5	344°44.8	45.0
14	338°19.5	60°02.2	27.7	47°51.7	55.9	303°16.6	52.6	359°47.0	44.9
15	353°21.9	75°01.4	·· 27.6	62°52.1	·· 55.6	318°18.8	·· 52.7	14°49.2	·· 44.8
16	8°24.4	90°00.5	27.6	77°52.5	55.4	333°21.0	52.8	29°51.4	44.7
17	23°26.9	104°59.6	27.5	92°52.9	55.1	348°23.3	52.9	44°53.6	44.6
18	38°29.3	119°58.7	S22°27.5	107°53.3	S22°54.9	3°25.5	N12°53.0	59°55.8	S10°44.5
19	53°31.8	134°57.9	27.4	122°53.8	54.6	18°27.7	53.0	74°58.0	44.4
20	68°34.3	149°57.0	27.4	137°54.2	54.4	33°30.0	53.1	90°00.2	44.3
21	83°36.7	164°56.1	·· 27.3	152°54.6	·· 54.2	48°32.2	·· 53.2	105°02.4	·· 44.1
22	98°39.2	179°55.3	27.2	167°55.0	53.9	63°34.4	53.3	120°04.6	44.0
23	113°41.7	194°54.4	27.2	182°55.4	53.7	78°36.7	53.4	135°06.8	43.9
Mer.pass. 15:26		ν -0.9′	d 0.0′	m -3.92	ν 0.4′	d 0.2′	m 1.33	ν 2.2′	d 0.1′ m -2.37	ν 2.2′	d 0.1′ m 0.99

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	128°44.1	209°53.5	S22°27.1	197°55.8	S22°53.4	93°38.9	N12°53.5	150°09.0	S10°43.8
1	143°46.6	224°52.6	27.0	212°56.3	53.2	108°41.1	53.6	165°11.2	43.7
2	158°49.0	239°51.8	27.0	227°56.7	52.9	123°43.4	53.7	180°13.4	43.6
3	173°51.5	254°50.9	·· 26.9	242°57.1	·· 52.7	138°45.6	·· 53.8	195°15.6	·· 43.5
4	188°54.0	269°50.0	26.8	257°57.5	52.4	153°47.8	53.8	210°17.8	43.4
5	203°56.4	284°49.1	26.8	272°57.9	52.2	168°50.1	53.9	225°20.0	43.3
6	218°58.9	299°48.3	S22°26.7	287°58.3	S22°51.9	183°52.3	N12°54.0	240°22.2	S10°43.2
7	234°01.4	314°47.4	26.6	302°58.8	51.7	198°54.5	54.1	255°24.4	43.1
8	249°03.8	329°46.5	26.5	317°59.2	51.4	213°56.7	54.2	270°26.6	43.0
9	264°06.3	344°45.7	·· 26.5	332°59.6	·· 51.2	228°59.0	·· 54.3	285°28.8	·· 42.9
10	279°08.8	359°44.8	26.4	348°00.0	50.9	244°01.2	54.4	300°31.0	42.8
11	294°11.2	14°43.9	26.3	3°00.4	50.7	259°03.4	54.5	315°33.2	42.7
12	309°13.7	29°43.0	S22°26.2	18°00.9	S22°50.4	274°05.7	N12°54.6	330°35.4	S10°42.6
13	324°16.2	44°42.2	26.1	33°01.3	50.2	289°07.9	54.7	345°37.6	42.5
14	339°18.6	59°41.3	26.1	48°01.7	49.9	304°10.1	54.8	0°39.8	42.3
15	354°21.1	74°40.4	·· 26.0	63°02.1	·· 49.7	319°12.3	·· 54.8	15°41.9	·· 42.2
16	9°23.5	89°39.5	25.9	78°02.5	49.4	334°14.6	54.9	30°44.1	42.1
17	24°26.0	104°38.7	25.8	93°02.9	49.2	349°16.8	55.0	45°46.3	42.0
18	39°28.5	119°37.8	S22°25.7	108°03.4	S22°48.9	4°19.0	N12°55.1	60°48.5	S10°41.9
19	54°30.9	134°36.9	25.6	123°03.8	48.6	19°21.3	55.2	75°50.7	41.8
20	69°33.4	149°36.1	25.6	138°04.2	48.4	34°23.5	55.3	90°52.9	41.7
21	84°35.9	164°35.2	·· 25.5	153°04.6	·· 48.1	49°25.7	·· 55.4	105°55.1	·· 41.6
22	99°38.3	179°34.3	25.4	168°05.0	47.9	64°27.9	55.5	120°57.3	41.5
23	114°40.8	194°33.4	25.3	183°05.5	47.6	79°30.2	55.6	135°59.5	41.4
Mer.pass. 15:23		ν -0.9′	d 0.1′	m -3.92	ν 0.4′	d 0.2′	m 1.33	ν 2.2′	d 0.1′ m -2.36	ν 2.2′	d 0.1′ m 0.99

Stars

	SHA	**Dec**
Alpheratz	357°35.8	29°13.4
Ankaa	353°08.1	-42°10.8
Schedar	349°32.2	56°40.3
Diphda	348°48.2	-17°51.5
Achernar	335°20.9	-57°07.2
Hamal	327°52.1	23°34.6
Polaris	314°19.9	89°22.3
Acamar	315°12.3	-40°12.8
Menkar	314°06.9	4°11.0
Mirfak	308°29.2	49°57.0
Aldebaran	290°40.3	16°33.5
Rigel	281°04.4	-8°10.5
Capella	280°22.7	46°01.4
Bellatrix	278°23.5	6°22.3
Elnath	278°02.6	28°37.7
Alnilam	275°38.3	-1°11.3
Betelgeuse	270°52.7	7°24.7
Canopus	263°52.3	-52°42.6
Sirius	258°26.6	-16°45.0
Adhara	255°06.1	-29°00.4
Procyon	244°51.3	5°09.7
Pollux	243°17.9	27°58.1
Avior	234°14.4	-59°35.2
Suhail	222°46.4	-43°31.7
Miaplacidus	221°37.5	-69°48.8
Alphard	217°48.2	-8°45.8
Regulus	207°35.0	11°50.9
Dubhe	193°41.4	61°37.1
Denebola	182°25.5	14°26.1
Gienah	175°44.2	-17°40.5
Acrux	173°00.7	-63°13.7
Gacrux	171°52.3	-57°14.7
Alioth	166°13.4	55°49.5
Spica	158°23.0	-11°17.2
Alkaid	152°52.5	49°11.3
Hadar	148°37.1	-60°29.1
Menkent	147°58.5	-36°29.2
Arcturus	145°48.6	19°03.2
Rigil Kent.	139°41.4	-60°55.8
Kochab	137°19.9	74°03.0
Zuben'ubi	136°56.9	-16°08.5
Alphecca	126°04.5	26°37.8
Antares	112°17.0	-26°29.1
Atria	107°12.3	-69°04.0
Sabik	102°03.9	-15°45.3
Shaula	96°11.7	-37°07.2
Rasalhague	95°59.5	12°32.4
Eltanin	90°43.0	51°28.9
Kaus Aust.	83°33.9	-34°22.4
Vega	80°34.1	38°48.1
Nunki	75°49.1	-26°16.0
Altair	62°01.0	8°55.8
Peacock	53°07.5	-56°39.5
Deneb	49°26.8	45°21.9
Enif	33°39.9	9°59.0
Al Na'ir	27°34.3	-46°50.9
Fomalhaut	15°15.7	-29°29.9
Scheat	13°46.3	28°12.8
Markab	13°30.9	15°20.0

Jan 28 Sun	**SHA**	**Mer.pass**
Venus	83°49.6	09:58
Mars	70°50.0	10:49
Jupiter	325°05.6	17:50
Saturn	21°37.7	14:04

Jan 29 Mon	**SHA**	**Mer.pass**
Venus	82°29.5	10:00
Mars	70°00.9	10:49
Jupiter	325°00.2	17:46
Saturn	21°31.3	14:01

Jan 30 Tue	**SHA**	**Mer.pass**
Venus	81°09.4	10:01
Mars	69°11.7	10:48
Jupiter	324°54.8	17:43
Saturn	21°24.9	13:57

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.0966 sec ΔT = TT-UT1 = +69.0874 sec

2024 January 28 to Jan. 30 UT

h	Sun		Moon				
Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°49.2	S18°23.1	331°04.0	15.7′	N13°59.4	12.5′	54.1′
1	191°49.1	22.5	345°38.7	15.7′	13°46.9	12.6′	54.1′
2	206°49.0	21.8	0°13.4	15.8′	13°34.3	12.6′	54.1′
3	221°48.8	·· 21.2	14°48.2	15.8′	13°21.7	12.6′	54.1′
4	236°48.7	20.5	29°23.0	15.9′	13°09.1	12.7′	54.1′
5	251°48.6	19.9	43°57.9	15.9′	12°56.4	12.7′	54.0′
6	266°48.5	S18°19.2	58°32.9	16.0′	N12°43.7	12.8′	54.0′
7	281°48.4	18.6	73°07.9	16.1′	12°30.9	12.9′	54.0′
8	296°48.2	17.9	87°42.9	16.1′	12°18.0	12.8′	54.0′
9	311°48.1	·· 17.3	102°18.0	16.2′	12°05.2	12.9′	54.0′
10	326°48.0	16.6	116°53.2	16.2′	11°52.3	13.0′	54.0′
11	341°47.9	16.0	131°28.4	16.3′	11°39.3	13.0′	54.0′
12	356°47.8	S18°15.3	146°03.6	16.3′	N11°26.3	13.0′	54.0′
13	11°47.6	14.7	160°39.0	16.4′	11°13.3	13.1′	54.0′
14	26°47.5	14.0	175°14.3	16.4′	11°00.2	13.1′	54.0′
15	41°47.4	·· 13.4	189°49.7	16.4′	10°47.1	13.2′	54.0′
16	56°47.3	12.7	204°25.1	16.5′	10°33.9	13.1′	54.0′
17	71°47.2	12.0	219°00.6	16.5′	10°20.8	13.3′	54.0′
18	86°47.0	S18°11.4	233°36.2	16.6′	N10°07.5	13.2′	54.0′
19	101°46.9	10.7	248°11.7	16.6′	09°54.3	13.3′	54.0′
20	116°46.8	10.1	262°47.3	16.7′	09°41.0	13.3′	54.0′
21	131°46.7	·· 09.4	277°23.0	16.7′	09°27.7	13.4′	54.0′
22	146°46.6	08.7	291°58.7	16.7′	09°14.3	13.3′	54.0′
23	161°46.5	08.1	306°34.4	16.8′	09°01.0	13.4′	54.0′
	SD = 16.2′	d = 0.6′	SD = 14.7′				

Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°46.3	S18°07.4	321°10.2	16.8′	N08°47.6	13.5′	54.0′
1	191°46.2	06.8	335°46.0	16.8′	08°34.1	13.5′	54.0′
2	206°46.1	06.1	350°21.8	16.9′	08°20.6	13.4′	54.0′
3	221°46.0	·· 05.4	4°57.7	16.9′	08°07.2	13.6′	54.0′
4	236°45.9	04.8	19°33.6	16.9′	07°53.6	13.5′	54.0′
5	251°45.8	04.1	34°09.6	17.0′	07°40.1	13.6′	54.0′
6	266°45.7	S18°03.4	48°45.5	17.0′	N07°26.5	13.6′	54.0′
7	281°45.5	02.8	63°21.5	17.0′	07°12.9	13.6′	54.0′
8	296°45.4	02.1	77°57.6	17.1′	06°59.3	13.7′	54.0′
9	311°45.3	·· 01.4	92°33.6	17.1′	06°45.6	13.6′	54.0′
10	326°45.2	00.8	107°09.7	17.1′	06°32.0	13.7′	54.0′
11	341°45.1	18°00.1	121°45.8	17.1′	06°18.3	13.8′	54.0′
12	356°45.0	S17°59.4	136°22.0	17.2′	N06°04.5	13.7′	54.0′
13	11°44.9	58.8	150°58.1	17.2′	05°50.8	13.7′	54.0′
14	26°44.8	58.1	165°34.3	17.2′	05°37.1	13.8′	54.0′
15	41°44.7	·· 57.4	180°10.5	17.2′	05°23.3	13.8′	54.0′
16	56°44.5	56.7	194°46.8	17.2′	05°09.5	13.8′	54.0′
17	71°44.4	56.1	209°23.0	17.3′	04°55.7	13.9′	54.0′
18	86°44.3	S17°55.4	223°59.3	17.3′	N04°41.8	13.8′	54.0′
19	101°44.2	54.7	238°35.6	17.3′	04°28.0	13.9′	54.0′
20	116°44.1	54.1	253°11.9	17.3′	04°14.1	13.8′	54.0′
21	131°44.0	·· 53.4	267°48.2	17.3′	04°00.3	13.9′	54.0′
22	146°43.9	52.7	282°24.5	17.3′	03°46.4	13.9′	54.0′
23	161°43.8	52.0	297°00.9	17.4′	03°32.5	13.9′	54.0′
	SD = 16.2′	d = 0.7′	SD = 14.7′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°43.7	S17°51.4	311°37.2	17.4′	N03°18.6	14.0′	54.0′
1	191°43.6	50.7	326°13.6	17.4′	03°04.6	13.9′	54.0′
2	206°43.5	50.0	340°50.0	17.4′	02°50.7	14.0′	54.0′
3	221°43.4	·· 49.3	355°26.4	17.4′	02°36.7	13.9′	54.0′
4	236°43.3	48.7	10°02.8	17.4′	02°22.8	14.0′	54.0′
5	251°43.1	48.0	24°39.2	17.4′	02°08.8	14.0′	54.0′
6	266°43.0	S17°47.3	39°15.6	17.4′	N01°54.8	14.0′	54.0′
7	281°42.9	46.6	53°52.0	17.4′	01°40.8	14.0′	54.0′
8	296°42.8	45.9	68°28.4	17.4′	01°26.8	14.0′	54.0′
9	311°42.7	·· 45.3	83°04.8	17.4′	01°12.8	14.0′	54.0′
10	326°42.6	44.6	97°41.3	17.4′	00°58.8	14.0′	54.0′
11	341°42.5	43.9	112°17.7	17.4′	00°44.8	14.0′	54.1′
12	356°42.4	S17°43.2	126°54.1	17.4′	N00°30.8	14.0′	54.1′
13	11°42.3	42.5	141°30.5	17.4′	00°16.8	14.1′	54.1′
14	26°42.2	41.8	156°07.0	17.4′	N00°02.7	14.0′	54.1′
15	41°42.1	·· 41.2	170°43.4	17.4′	S00°11.3	14.0′	54.1′
16	56°42.0	40.5	185°19.8	17.4′	00°25.3	14.0′	54.1′
17	71°41.9	39.8	199°56.2	17.4′	00°39.3	14.1′	54.1′
18	86°41.8	S17°39.1	214°32.6	17.4′	S00°53.4	14.0′	54.1′
19	101°41.7	38.4	229°09.0	17.4′	01°07.4	14.0′	54.1′
20	116°41.6	37.7	243°45.4	17.4′	01°21.4	14.1′	54.1′
21	131°41.5	·· 37.0	258°21.7	17.4′	01°35.5	14.0′	54.1′
22	146°41.4	36.4	272°58.1	17.3′	01°49.5	14.0′	54.1′
23	161°41.3	35.7	287°34.4	17.3′	02°03.5	14.0′	54.1′
	SD = 16.2′	d = 0.7′	SD = 14.7′				

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

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

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 17-19 95-84%
28	12:43	12:49	12:13	01:59	14:20	
29	12:55	13:00	12:13	02:40	14:59	
30	13:05	13:10	12:13	03:19	15:38	

January 31, 01, 02 UT (Wed., Thu., Fri.)

	Aries	Venus		Mars		Jupiter		Saturn	
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	129°43.3	209°32.6	S22°25.2	198°05.9	S22°47.4	94°32.4	N12°55.7	151°01.7	S10°41.3
1	144°45.7	224°31.7	25.1	213°06.3	47.1	109°34.6	55.8	166°03.9	41.2
2	159°48.2	239°30.8	25.0	228°06.7	46.8	124°36.8	55.9	181°06.1	41.1
3	174°50.6	254°29.9	·· 24.9	243°07.1	·· 46.6	139°39.1	·· 55.9	196°08.3	·· 41.0
4	189°53.1	269°29.1	24.8	258°07.6	46.3	154°41.3	56.0	211°10.5	40.9
5	204°55.6	284°28.2	24.7	273°08.0	46.1	169°43.5	56.1	226°12.7	40.8
6	219°58.0	299°27.3	S22°24.6	288°08.4	S22°45.8	184°45.7	N12°56.2	241°14.9	S10°40.6
7	235°00.5	314°26.5	24.5	303°08.8	45.6	199°48.0	56.3	256°17.1	40.5
8	250°03.0	329°25.6	24.4	318°09.2	45.3	214°50.2	56.4	271°19.3	40.4
9	265°05.4	344°24.7	·· 24.3	333°09.7	·· 45.0	229°52.4	·· 56.5	286°21.5	·· 40.3
10	280°07.9	359°23.8	24.2	348°10.1	44.8	244°54.6	56.6	301°23.7	40.2
11	295°10.4	14°23.0	24.1	3°10.5	44.5	259°56.9	56.7	316°25.8	40.1
12	310°12.8	29°22.1	S22°24.0	18°10.9	S22°44.2	274°59.1	N12°56.8	331°28.0	S10°40.0
13	325°15.3	44°21.2	23.9	33°11.3	44.0	290°01.3	56.9	346°30.2	39.9
14	340°17.8	59°20.4	23.8	48°11.8	43.7	305°03.5	57.0	1°32.4	39.8
15	355°20.2	74°19.5	·· 23.7	63°12.2	·· 43.5	320°05.7	·· 57.1	16°34.6	·· 39.7
16	10°22.7	89°18.6	23.5	78°12.6	43.2	335°08.0	57.2	31°36.8	39.6
17	25°25.1	104°17.7	23.4	93°13.0	42.9	350°10.2	57.3	46°39.0	39.5
18	40°27.6	119°16.9	S22°23.3	108°13.4	S22°42.7	5°12.4	N12°57.3	61°41.2	S10°39.4
19	55°30.1	134°16.0	23.2	123°13.9	42.4	20°14.6	57.4	76°43.4	39.3
20	70°32.5	149°15.1	23.1	138°14.3	42.1	35°16.8	57.5	91°45.6	39.2
21	85°35.0	164°14.2	·· 23.0	153°14.7	·· 41.9	50°19.1	·· 57.6	106°47.8	·· 39.1
22	100°37.5	179°13.4	22.8	168°15.1	41.6	65°21.3	57.7	121°50.0	38.9
23	115°39.9	194°12.5	22.7	183°15.5	41.3	80°23.5	57.8	136°52.2	38.8
Mer.pass. 15:19		ν -0.9′	d 0.1′	ν 0.4′	d 0.3′	ν 2.2′	d 0.1′	ν 2.2′	d 0.1′
		m -3.92		m 1.33		m -2.36		m 0.99	

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	130°42.4	209°11.6	S22°22.6	198°16.0	S22°41.1	95°25.7	N12°57.9	151°54.4	S10°38.7
1	145°44.9	224°10.8	22.5	213°16.4	40.8	110°27.9	58.0	166°56.6	38.6
2	160°47.3	239°09.9	22.4	228°16.8	40.5	125°30.2	58.1	181°58.8	38.5
3	175°49.8	254°09.0	·· 22.2	243°17.2	·· 40.3	140°32.4	·· 58.2	197°00.9	·· 38.4
4	190°52.3	269°08.1	22.1	258°17.6	40.0	155°34.6	58.3	212°03.1	38.3
5	205°54.7	284°07.3	22.0	273°18.1	39.7	170°36.8	58.4	227°05.3	38.2
6	220°57.2	299°06.4	S22°21.9	288°18.5	S22°39.4	185°39.0	N12°58.5	242°07.5	S10°38.1
7	235°59.6	314°05.5	21.7	303°18.9	39.2	200°41.2	58.6	257°09.7	38.0
8	251°02.1	329°04.7	21.6	318°19.3	38.9	215°43.5	58.7	272°11.9	37.9
9	266°04.6	344°03.8	·· 21.5	333°19.7	·· 38.6	230°45.7	·· 58.8	287°14.1	·· 37.8
10	281°07.0	359°02.9	21.3	348°20.2	38.4	245°47.9	58.9	302°16.3	37.7
11	296°09.5	14°02.1	21.2	3°20.6	38.1	260°50.1	59.0	317°18.5	37.6
12	311°12.0	29°01.2	S22°21.1	18°21.0	S22°37.8	275°52.3	N12°59.0	332°20.7	S10°37.5
13	326°14.4	44°00.3	20.9	33°21.4	37.5	290°54.5	59.1	347°22.9	37.3
14	341°16.9	58°59.4	20.8	48°21.8	37.3	305°56.8	59.2	2°25.1	37.2
15	356°19.4	73°58.6	·· 20.7	63°22.3	·· 37.0	320°59.0	·· 59.3	17°27.3	·· 37.1
16	11°21.8	88°57.7	20.5	78°22.7	36.7	336°01.2	59.4	32°29.5	37.0
17	26°24.3	103°56.8	20.4	93°23.1	36.5	351°03.4	59.5	47°31.7	36.9
18	41°26.7	118°56.0	S22°20.2	108°23.5	S22°36.2	6°05.6	N12°59.6	62°33.8	S10°36.8
19	56°29.2	133°55.1	20.1	123°24.0	35.9	21°07.8	59.7	77°36.0	36.7
20	71°31.7	148°54.2	19.9	138°24.4	35.6	36°10.0	59.8	92°38.2	36.6
21	86°34.1	163°53.3	·· 19.8	153°24.8	·· 35.3	51°12.2	12°59.9	107°40.4	·· 36.5
22	101°36.6	178°52.5	19.6	168°25.2	35.1	66°14.5	13°00.0	122°42.6	36.4
23	116°39.1	193°51.6	19.5	183°25.6	34.8	81°16.7	00.1	137°44.8	36.3
Mer.pass. 15:15		ν -0.9′	d 0.1′	ν 0.4′	d 0.3′	ν 2.2′	d 0.1′	ν 2.2′	d 0.1′
		m -3.92		m 1.33		m -2.35		m 0.99	

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	131°41.5	208°50.7	S22°19.4	198°26.1	S22°34.5	96°18.9	N13°00.2	152°47.0	S10°36.2
1	146°44.0	223°49.9	19.2	213°26.5	34.2	111°21.1	00.3	167°49.2	36.1
2	161°46.5	238°49.0	19.1	228°26.9	34.0	126°23.3	00.4	182°51.4	36.0
3	176°48.9	253°48.1	·· 18.9	243°27.3	·· 33.7	141°25.5	·· 00.5	197°53.6	·· 35.8
4	191°51.4	268°47.3	18.7	258°27.8	33.4	156°27.7	00.6	212°55.8	35.7
5	206°53.9	283°46.4	18.6	273°28.2	33.1	171°29.9	00.7	227°58.0	35.6
6	221°56.3	298°45.5	S22°18.4	288°28.6	S22°32.8	186°32.1	N13°00.8	243°00.2	S10°35.5
7	236°58.8	313°44.6	18.3	303°29.0	32.6	201°34.4	00.9	258°02.3	35.4
8	252°01.2	328°43.8	18.1	318°29.4	32.3	216°36.6	01.0	273°04.5	35.3
9	267°03.7	343°42.9	·· 18.0	333°29.9	·· 32.0	231°38.8	·· 01.1	288°06.7	·· 35.2
10	282°06.2	358°42.0	17.8	348°30.3	31.7	246°41.0	01.2	303°08.9	35.1
11	297°08.6	13°41.2	17.6	3°30.7	31.4	261°43.2	01.3	318°11.1	35.0
12	312°11.1	28°40.3	S22°17.5	18°31.1	S22°31.1	276°45.4	N13°01.4	333°13.3	S10°34.9
13	327°13.6	43°39.4	17.3	33°31.6	30.9	291°47.6	01.5	348°15.5	34.8
14	342°16.0	58°38.6	17.1	48°32.0	30.6	306°49.8	01.6	3°17.7	34.7
15	357°18.5	73°37.7	·· 17.0	63°32.4	·· 30.3	321°52.0	·· 01.6	18°19.9	·· 34.6
16	12°21.0	88°36.8	16.8	78°32.8	30.0	336°54.2	01.7	33°22.1	34.4
17	27°23.4	103°36.0	16.6	93°33.3	29.7	351°56.4	01.8	48°24.3	34.3
18	42°25.9	118°35.1	S22°16.5	108°33.7	S22°29.4	6°58.6	N13°01.9	63°26.5	S10°34.2
19	57°28.4	133°34.2	16.3	123°34.1	29.2	22°00.9	02.0	78°28.6	34.1
20	72°30.8	148°33.4	16.1	138°34.5	28.9	37°03.1	02.1	93°30.8	34.0
21	87°33.3	163°32.5	·· 16.0	153°34.9	·· 28.6	52°05.3	·· 02.2	108°33.0	·· 33.9
22	102°35.7	178°31.6	15.8	168°35.4	28.3	67°07.5	02.3	123°35.2	33.8
23	117°38.2	193°30.8	15.6	183°35.8	28.0	82°09.7	02.4	138°37.4	33.7
Mer.pass. 15:11		ν -0.9′	d 0.2′	ν 0.4′	d 0.3′	ν 2.2′	d 0.1′	ν 2.2′	d 0.1′
		m -3.91		m 1.32		m -2.34		m 0.99	

Stars

	SHA	Dec
Alpheratz	357°35.8	29°13.4
Ankaa	353°08.1	-42°10.8
Schedar	349°32.2	56°40.3
Diphda	348°48.2	-17°51.5
Achernar	335°20.9	-57°07.2
Hamal	327°52.1	23°34.6
Polaris	314°21.5	89°22.3
Acamar	315°12.3	-40°12.8
Menkar	314°06.9	4°11.0
Mirfak	308°29.3	49°57.0
Aldebaran	290°40.3	16°33.5
Rigel	281°04.4	-8°10.5
Capella	280°22.7	46°01.4
Bellatrix	278°23.5	6°22.2
Elnath	278°02.6	28°37.7
Alnilam	275°38.3	-1°11.3
Betelgeuse	270°52.7	7°24.7
Canopus	263°52.3	-52°42.6
Sirius	258°26.6	-16°45.0
Adhara	255°06.1	-29°00.4
Procyon	244°51.3	5°09.7
Pollux	243°17.9	27°58.1
Avior	234°14.4	-59°35.2
Suhail	222°46.4	-43°31.8
Miaplacidus	221°37.5	-69°48.9
Alphard	217°48.2	-8°45.8
Regulus	207°35.0	11°50.9
Dubhe	193°41.4	61°37.1
Denebola	182°25.5	14°26.1
Gienah	175°44.2	-17°40.5
Acrux	173°00.6	-63°13.7
Gacrux	171°52.2	-57°14.7
Alioth	166°13.4	55°49.5
Spica	158°23.0	-11°17.2
Alkaid	152°52.5	49°11.3
Hadar	148°37.0	-60°29.1
Menkent	147°58.5	-36°29.2
Arcturus	145°48.6	19°03.2
Rigil Kent.	139°41.4	-60°55.8
Kochab	137°19.8	74°03.0
Zuben'ubi	136°56.9	-16°08.5
Alphecca	126°04.5	26°37.8
Antares	112°17.0	-26°29.1
Atria	107°12.2	-69°04.0
Sabik	102°03.9	-15°45.3
Shaula	96°11.7	-37°07.2
Rasalhague	95°59.5	12°32.4
Eltanin	90°42.9	51°28.8
Kaus Aust.	83°33.9	-34°22.4
Vega	80°34.1	38°48.1
Nunki	75°49.0	-26°16.0
Altair	62°01.0	8°55.8
Peacock	53°07.5	-56°39.5
Deneb	49°26.8	45°21.9
Enif	33°39.9	9°59.0
Al Na'ir	27°34.3	-46°50.9
Fomalhaut	15°15.7	-29°29.9
Scheat	13°46.3	28°12.8
Markab	13°30.9	15°20.0

Jan 31 Wed	SHA	Mer.pass
Venus	79°49.3	10:02
Mars	68°22.6	10:47
Jupiter	324°49.1	17:39
Saturn	21°18.4	13:54

Feb 01 Thu	SHA	Mer.pass
Venus	78°29.2	10:04
Mars	67°33.6	10:47
Jupiter	324°43.3	17:36
Saturn	21°12.0	13:50

Feb 02 Fri	SHA	Mer.pass
Venus	77°09.2	10:05
Mars	66°44.5	10:46
Jupiter	324°37.3	17:32
Saturn	21°05.5	13:47

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°41.2	S17°35.0	302°10.7	17.3′	S02°17.5	14.1′	54.2′
1	191°41.1	34.3	316°47.1	17.3′	02°31.6	14.0′	54.2′
2	206°41.0	33.6	331°23.4	17.3′	02°45.6	14.0′	54.2′
3	221°40.9	·· 32.9	345°59.6	17.3′	02°59.6	14.0′	54.2′
4	236°40.8	32.2	0°35.9	17.2′	03°13.6	14.0′	54.2′
5	251°40.7	31.5	15°12.1	17.2′	03°27.6	14.0′	54.2′
6	266°40.6	S17°30.8	29°48.4	17.2′	S03°41.6	14.0′	54.2′
7	281°40.5	30.1	44°24.6	17.2′	03°55.6	13.9′	54.2′
8	296°40.4	29.5	59°00.7	17.1′	04°09.5	14.0′	54.2′
9	311°40.3	·· 28.8	73°36.9	17.1′	04°23.5	13.9′	54.3′
10	326°40.2	28.1	88°13.0	17.1′	04°37.4	14.0′	54.3′
11	341°40.1	27.4	102°49.1	17.1′	04°51.4	13.9′	54.3′
12	356°40.1	S17°26.7	117°25.2	17.0′	S05°05.3	13.9′	54.3′
13	11°40.0	26.0	132°01.2	17.0′	05°19.2	13.9′	54.3′
14	26°39.9	25.3	146°37.2	17.0′	05°33.1	13.9′	54.3′
15	41°39.8	·· 24.6	161°13.2	16.9′	05°47.0	13.9′	54.3′
16	56°39.7	23.9	175°49.1	16.9′	06°00.9	13.9′	54.3′
17	71°39.6	23.2	190°25.0	16.9′	06°14.8	13.8′	54.4′
18	86°39.5	S17°22.5	205°00.9	16.8′	S06°28.6	13.8′	54.4′
19	101°39.4	21.8	219°36.8	16.8′	06°42.4	13.8′	54.4′
20	116°39.3	21.1	234°12.6	16.8′	06°56.2	13.8′	54.4′
21	131°39.2	·· 20.4	248°48.3	16.7′	07°10.0	13.8′	54.4′
22	146°39.1	19.7	263°24.0	16.7′	07°23.8	13.8′	54.4′
23	161°39.0	19.0	277°59.7	16.6′	07°37.6	13.7′	54.4′
	SD = 16.2′	d = 0.7′	SD = 14.8′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°38.9	S17°18.3	292°35.4	16.6′	S07°51.3	13.7′	54.5′
1	191°38.9	17.6	307°11.0	16.6′	08°05.0	13.7′	54.5′
2	206°38.8	16.9	321°46.5	16.5′	08°18.7	13.7′	54.5′
3	221°38.7	·· 16.2	336°22.0	16.5′	08°32.4	13.6′	54.5′
4	236°38.6	15.5	350°57.5	16.4′	08°46.0	13.6′	54.5′
5	251°38.5	14.8	5°32.9	16.4′	08°59.6	13.6′	54.5′
6	266°38.4	S17°14.1	20°08.2	16.3′	S09°13.2	13.6′	54.6′
7	281°38.3	13.4	34°43.6	16.3′	09°26.8	13.5′	54.6′
8	296°38.2	12.7	49°18.8	16.2′	09°40.3	13.6′	54.6′
9	311°38.1	·· 12.0	63°54.0	16.1′	09°53.9	13.4′	54.6′
10	326°38.1	11.2	78°29.2	16.1′	10°07.3	13.5′	54.6′
11	341°38.0	10.5	93°04.3	16.0′	10°20.8	13.4′	54.7′
12	356°37.9	S17°09.8	107°39.3	16.0′	S10°34.2	13.4′	54.7′
13	11°37.8	09.1	122°14.3	15.9′	10°47.6	13.4′	54.7′
14	26°37.7	08.4	136°49.2	15.9′	11°01.0	13.3′	54.7′
15	41°37.6	·· 07.7	151°24.1	15.8′	11°14.3	13.3′	54.7′
16	56°37.5	07.0	165°58.9	15.7′	11°27.6	13.3′	54.8′
17	71°37.5	06.3	180°33.6	15.7′	11°40.9	13.2′	54.8′
18	86°37.4	S17°05.6	195°08.3	15.6′	S11°54.1	13.2′	54.8′
19	101°37.3	04.9	209°42.9	15.5′	12°07.3	13.2′	54.8′
20	116°37.2	04.1	224°17.4	15.5′	12°20.5	13.1′	54.8′
21	131°37.1	·· 03.4	238°51.9	15.4′	12°33.6	13.1′	54.9′
22	146°37.0	02.7	253°26.3	15.3′	12°46.7	13.0′	54.9′
23	161°37.0	02.0	268°00.6	15.3′	12°59.7	13.0′	54.9′
	SD = 16.2′	d = 0.7′	SD = 14.9′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°36.9	S17°01.3	282°34.9	15.2′	S13°12.7	13.0′	54.9′
1	191°36.8	17°00.6	297°09.1	15.1′	13°25.7	12.9′	54.9′
2	206°36.7	16°59.9	311°43.2	15.0′	13°38.6	12.9′	55.0′
3	221°36.6	·· 59.1	326°17.2	15.0′	13°51.5	12.8′	55.0′
4	236°36.5	58.4	340°51.2	14.9′	14°04.3	12.8′	55.0′
5	251°36.5	57.7	355°25.1	14.8′	14°17.1	12.8′	55.0′
6	266°36.4	S16°57.0	9°58.9	14.7′	S14°29.9	12.7′	55.1′
7	281°36.3	56.3	24°32.6	14.7′	14°42.6	12.6′	55.1′
8	296°36.2	55.6	39°06.3	14.6′	14°55.2	12.6′	55.1′
9	311°36.1	·· 54.8	53°39.8	14.5′	15°07.8	12.6′	55.1′
10	326°36.1	54.1	68°13.3	14.4′	15°20.4	12.5′	55.2′
11	341°36.0	53.4	82°46.7	14.3′	15°32.9	12.4′	55.2′
12	356°35.9	S16°52.7	97°20.0	14.2′	S15°45.3	12.4′	55.2′
13	11°35.8	52.0	111°53.3	14.1′	15°57.7	12.3′	55.2′
14	26°35.8	51.2	126°26.4	14.1′	16°10.0	12.3′	55.3′
15	41°35.7	·· 50.5	140°59.5	14.0′	16°22.3	12.2′	55.3′
16	56°35.6	49.8	155°32.4	13.9′	16°34.5	12.2′	55.3′
17	71°35.5	49.1	170°05.3	13.8′	16°46.7	12.1′	55.4′
18	86°35.5	S16°48.3	184°38.1	13.7′	S16°58.8	12.1′	55.4′
19	101°35.4	47.6	199°10.8	13.6′	17°10.9	12.0′	55.4′
20	116°35.3	46.9	213°43.4	13.5′	17°22.9	11.9′	55.4′
21	131°35.2	·· 46.2	228°15.9	13.4′	17°34.8	11.8′	55.5′
22	146°35.2	45.4	242°48.3	13.3′	17°46.6	11.8′	55.5′
23	161°35.1	44.7	257°20.6	13.2′	17°58.4	11.8′	55.5′
	SD = 16.2′	d = 0.7′	SD = 15.0′				

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

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

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 20-22 77-59%
31	13:15	13:20	12:13	03:58	16:17	
01	13:24	13:28	12:13	04:37	16:58	
02	13:33	13:36	12:14	05:19	17:41	

February 03, 04, 05 UT (Sat., Sun., Mon.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	132°40.7	208°29.9	S22°15.4	198°36.2	S22°27.7	97°11.9	N13°02.5	153°39.6	S10°33.6
1	147°43.1	223°29.0	15.3	213°36.6	27.4	112°14.1	02.6	168°41.8	33.5
2	162°45.6	238°28.2	15.1	228°37.1	27.1	127°16.3	02.7	183°44.0	33.4
3	177°48.1	253°27.3	·· 14.9	243°37.5	·· 26.8	142°18.5	·· 02.8	198°46.2	·· 33.3
4	192°50.5	268°26.4	14.7	258°37.9	26.6	157°20.7	02.9	213°48.4	33.2
5	207°53.0	283°25.6	14.5	273°38.3	26.3	172°22.9	03.0	228°50.6	33.0
6	222°55.5	298°24.7	S22°14.3	288°38.8	S22°26.0	187°25.1	N13°03.1	243°52.8	S10°32.9
7	237°57.9	313°23.8	14.2	303°39.2	25.7	202°27.3	03.2	258°54.9	32.8
8	253°00.4	328°23.0	14.0	318°39.6	25.4	217°29.5	03.3	273°57.1	32.7
9	268°02.8	343°22.1	·· 13.8	333°40.0	·· 25.1	232°31.7	·· 03.4	288°59.3	·· 32.6
10	283°05.3	358°21.2	13.6	348°40.5	24.8	247°33.9	03.5	304°01.5	32.5
11	298°07.8	13°20.4	13.4	3°40.9	24.5	262°36.1	03.6	319°03.7	32.4
12	313°10.2	28°19.5	S22°13.2	18°41.3	S22°24.2	277°38.3	N13°03.7	334°05.9	S10°32.3
13	328°12.7	43°18.6	13.0	33°41.7	23.9	292°40.5	03.8	349°08.1	32.2
14	343°15.2	58°17.8	12.8	48°42.2	23.6	307°42.7	03.9	4°10.3	32.1
15	358°17.6	73°16.9	·· 12.6	63°42.6	·· 23.3	322°44.9	·· 04.0	19°12.5	·· 32.0
16	13°20.1	88°16.0	12.4	78°43.0	23.0	337°47.1	04.1	34°14.7	31.9
17	28°22.6	103°15.2	12.2	93°43.4	22.8	352°49.3	04.2	49°16.8	31.8
18	43°25.0	118°14.3	S22°12.0	108°43.9	S22°22.5	7°51.5	N13°04.3	64°19.0	S10°31.6
19	58°27.5	133°13.4	11.9	123°44.3	22.2	22°53.7	04.4	79°21.2	31.5
20	73°30.0	148°12.6	11.7	138°44.7	21.9	37°55.9	04.5	94°23.4	31.4
21	88°32.4	163°11.7	·· 11.4	153°45.1	·· 21.6	52°58.1	·· 04.6	109°25.6	·· 31.3
22	103°34.9	178°10.8	11.2	168°45.6	21.3	68°00.3	04.7	124°27.8	31.2
23	118°37.3	193°10.0	11.0	183°46.0	21.0	83°02.5	04.8	139°30.0	31.1
Mer.pass. 15:07		ν -0.9′	d 0.2′	m -3.91	ν 0.4′	d 0.3′	m 1.32	ν 2.2′	d 0.1′ m 0.99

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	133°39.8	208°09.1	S22°10.8	198°46.4	S22°20.7	98°04.7	N13°04.9	154°32.2	S10°31.0
1	148°42.3	223°08.2	10.6	213°46.8	20.4	113°06.9	05.0	169°34.4	30.9
2	163°44.7	238°07.4	10.4	228°47.3	20.1	128°09.1	05.1	184°36.6	30.8
3	178°47.2	253°06.5	·· 10.2	243°47.7	·· 19.8	143°11.3	·· 05.2	199°38.8	·· 30.7
4	193°49.7	268°05.6	10.0	258°48.1	19.5	158°13.5	05.3	214°40.9	30.6
5	208°52.1	283°04.8	09.8	273°48.5	19.2	173°15.7	05.4	229°43.1	30.5
6	223°54.6	298°03.9	S22°09.6	288°49.0	S22°18.9	188°17.9	N13°05.5	244°45.3	S10°30.3
7	238°57.1	313°03.0	09.4	303°49.4	18.6	203°20.1	05.6	259°47.5	30.2
8	253°59.5	328°02.2	09.2	318°49.8	18.3	218°22.3	05.7	274°49.7	30.1
9	269°02.0	343°01.3	·· 08.9	333°50.2	·· 18.0	233°24.5	·· 05.8	289°51.9	·· 30.0
10	284°04.5	358°00.5	08.7	348°50.7	17.7	248°26.7	05.9	304°54.1	29.9
11	299°06.9	12°59.6	08.5	3°51.1	17.4	263°28.9	06.0	319°56.3	29.8
12	314°09.4	27°58.7	S22°08.3	18°51.5	S22°17.1	278°31.1	N13°06.1	334°58.5	S10°29.7
13	329°11.8	42°57.9	08.1	33°52.0	16.8	293°33.3	06.2	350°00.6	29.6
14	344°14.3	57°57.0	07.9	48°52.4	16.5	308°35.5	06.3	5°02.8	29.5
15	359°16.8	72°56.1	·· 07.6	63°52.8	·· 16.1	323°37.7	·· 06.4	20°05.0	·· 29.4
16	14°19.2	87°55.3	07.4	78°53.2	15.8	338°39.8	06.5	35°07.2	29.3
17	29°21.7	102°54.4	07.2	93°53.7	15.5	353°42.0	06.6	50°09.4	29.2
18	44°24.2	117°53.6	S22°07.0	108°54.1	S22°15.2	8°44.2	N13°06.7	65°11.6	S10°29.0
19	59°26.6	132°52.7	06.7	123°54.5	14.9	23°46.4	06.8	80°13.8	28.9
20	74°29.1	147°51.8	06.5	138°54.9	14.6	38°48.6	06.9	95°16.0	28.8
21	89°31.6	162°51.0	·· 06.3	153°55.4	·· 14.3	53°50.8	·· 07.0	110°18.2	·· 28.7
22	104°34.0	177°50.1	06.0	168°55.8	14.0	68°53.0	07.1	125°20.4	28.6
23	119°36.5	192°49.2	05.8	183°56.2	13.7	83°55.2	07.2	140°22.5	28.5
Mer.pass. 15:03		ν -0.9′	d 0.2′	m -3.91	ν 0.4′	d 0.3′	m 1.32	ν 2.2′	d 0.1′ m -2.33	ν 2.2′	d 0.1′ m 0.99

Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	134°38.9	207°48.4	S22°05.6	198°56.7	S22°13.4	98°57.4	N13°07.4	155°24.7	S10°28.4
1	149°41.4	222°47.5	05.3	213°57.1	13.1	113°59.6	07.5	170°26.9	28.3
2	164°43.9	237°46.7	05.1	228°57.5	12.8	129°01.8	07.6	185°29.1	28.2
3	179°46.3	252°45.8	·· 04.9	243°57.9	·· 12.5	144°04.0	·· 07.7	200°31.3	·· 28.1
4	194°48.8	267°44.9	04.6	258°58.4	12.1	159°06.1	07.8	215°33.5	28.0
5	209°51.3	282°44.1	04.4	273°58.8	11.8	174°08.3	07.9	230°35.7	27.9
6	224°53.7	297°43.2	S22°04.2	288°59.2	S22°11.5	189°10.5	N13°08.0	245°37.9	S10°27.7
7	239°56.2	312°42.4	03.9	303°59.7	11.2	204°12.7	08.1	260°40.1	27.6
8	254°58.7	327°41.5	03.7	319°00.1	10.9	219°14.9	08.2	275°42.2	27.5
9	270°01.1	342°40.6	·· 03.4	334°00.5	·· 10.6	234°17.1	·· 08.3	290°44.4	·· 27.4
10	285°03.6	357°39.8	03.2	349°00.9	10.3	249°19.3	08.4	305°46.6	27.3
11	300°06.1	12°38.9	03.0	4°01.4	10.0	264°21.5	08.5	320°48.8	27.2
12	315°08.5	27°38.1	S22°02.7	19°01.8	S22°09.6	279°23.7	N13°08.6	335°51.0	S10°27.1
13	330°11.0	42°37.2	02.5	34°02.2	09.3	294°25.9	08.7	350°53.2	27.0
14	345°13.4	57°36.3	02.2	49°02.7	09.0	309°28.0	08.8	5°55.4	26.9
15	0°15.9	72°35.5	·· 02.0	64°03.1	·· 08.7	324°30.2	·· 08.9	20°57.6	·· 26.8
16	15°18.4	87°34.6	01.7	79°03.5	08.4	339°32.4	09.0	35°59.7	26.7
17	30°20.8	102°33.8	01.5	94°03.9	08.1	354°34.6	09.1	51°01.9	26.5
18	45°23.3	117°32.9	S22°01.2	109°04.4	S22°07.8	9°36.8	N13°09.2	66°04.1	S10°26.4
19	60°25.8	132°32.0	01.0	124°04.8	07.4	24°39.0	09.3	81°06.3	26.3
20	75°28.2	147°31.2	00.7	139°05.2	07.1	39°41.2	09.4	96°08.5	26.2
21	90°30.7	162°30.3	·· 00.4	154°05.7	·· 06.8	54°43.3	·· 09.5	111°10.7	·· 26.1
22	105°33.2	177°29.5	22°00.2	169°06.1	06.5	69°45.5	09.6	126°12.9	26.0
23	120°35.6	192°28.6	21°59.9	184°06.5	06.2	84°47.7	09.7	141°15.1	25.9
Mer.pass. 14:59		ν -0.9′	d 0.2′	m -3.91	ν 0.4′	d 0.3′	m 1.32	ν 2.2′	d 0.1′ m -2.32	ν 2.2′	d 0.1′ m 0.99

Stars

	SHA	Dec
Alpheratz	357°35.8	29°13.4
Ankaa	353°08.1	-42°10.8
Schedar	349°32.3	56°40.3
Diphda	348°48.2	-17°51.5
Achernar	335°20.9	-57°07.2
Hamal	327°52.1	23°34.6
Polaris	314°22.8	89°22.3
Acamar	315°12.3	-40°12.8
Menkar	314°06.9	4°11.0
Mirfak	308°29.3	49°57.0
Aldebaran	290°40.3	16°33.5
Rigel	281°04.4	-8°10.5
Capella	280°22.7	46°01.4
Bellatrix	278°23.5	6°22.2
Elnath	278°02.6	28°37.7
Alnilam	275°38.3	-1°11.3
Betelgeuse	270°52.7	7°24.7
Canopus	263°52.3	-52°42.6
Sirius	258°26.6	-16°45.0
Adhara	255°06.1	-29°00.4
Procyon	244°51.3	5°09.7
Pollux	243°17.9	27°58.1
Avior	234°14.4	-59°35.2
Suhail	222°46.4	-43°31.8
Miaplacidus	221°37.5	-69°48.9
Alphard	217°48.2	-8°45.8
Regulus	207°34.9	11°50.9
Dubhe	193°41.3	61°37.1
Denebola	182°25.5	14°26.1
Gienah	175°44.2	-17°40.5
Acrux	173°00.6	-63°13.7
Gacrux	171°52.2	-57°14.7
Alioth	166°13.3	55°49.5
Spica	158°23.0	-11°17.2
Alkaid	152°52.5	49°11.3
Hadar	148°37.0	-60°29.1
Menkent	147°58.5	-36°29.2
Arcturus	145°48.6	19°03.2
Rigil Kent.	139°41.3	-60°55.8
Kochab	137°19.7	74°03.0
Zuben'ubi	136°56.9	-16°08.5
Alphecca	126°04.5	26°37.8
Antares	112°16.9	-26°29.1
Atria	107°12.2	-69°04.0
Sabik	102°03.9	-15°45.3
Shaula	96°11.7	-37°07.2
Rasalhague	95°59.5	12°32.4
Eltanin	90°42.9	51°28.8
Kaus Aust.	83°33.9	-34°22.4
Vega	80°34.1	38°48.1
Nunki	75°49.0	-26°16.0
Altair	62°01.0	8°55.8
Peacock	53°07.5	-56°39.5
Deneb	49°26.8	45°21.8
Enif	33°39.9	9°59.0
Al Na'ir	27°34.3	-46°50.8
Fomalhaut	15°15.7	-29°29.9
Scheat	13°46.3	28°12.8
Markab	13°30.9	15°20.0

Feb 03 Sat	SHA	Mer.pass
Venus	75°49.2	10:07
Mars	65°55.5	10:45
Jupiter	324°31.2	17:29
Saturn	20°58.9	13:43

Feb 04 Sun	SHA	Mer.pass
Venus	74°29.3	10:08
Mars	65°06.6	10:45
Jupiter	324°24.9	17:25
Saturn	20°52.4	13:40

Feb 05 Mon	SHA	Mer.pass
Venus	73°09.4	10:09
Mars	64°17.7	10:44
Jupiter	324°18.4	17:22
Saturn	20°45.8	13:36

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.0982 sec ΔT = TT-UT1 = +69.0858 sec

2024 February 03 to Feb. 05 UT

h	Sun		Moon				
Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°35.0	S16°44.0	271°52.8	13.1′	S18°10.2	11.6′	55.5′
1	191°34.9	43.3	286°24.9	13.0′	18°21.8	11.6′	55.6′
2	206°34.9	42.5	300°56.9	12.9′	18°33.4	11.6′	55.6′
3	221°34.8	·· 41.8	315°28.8	12.8′	18°45.0	11.4′	55.6′
4	236°34.7	41.1	330°00.6	12.7′	18°56.4	11.4′	55.7′
5	251°34.6	40.4	344°32.3	12.6′	19°07.8	11.3′	55.7′
6	266°34.6	S16°39.6	359°03.9	12.5′	S19°19.1	11.3′	55.7′
7	281°34.5	38.9	13°35.4	12.4′	19°30.4	11.1′	55.8′
8	296°34.4	38.2	28°06.7	12.3′	19°41.5	11.1′	55.8′
9	311°34.4	·· 37.4	42°38.0	12.2′	19°52.6	11.0′	55.8′
10	326°34.3	36.7	57°09.2	12.1′	20°03.6	10.9′	55.9′
11	341°34.2	36.0	71°40.2	11.9′	20°14.5	10.9′	55.9′
12	356°34.1	S16°35.2	86°11.2	11.8′	S20°25.4	10.8′	55.9′
13	11°34.1	34.5	100°42.0	11.7′	20°36.2	10.6′	55.9′
14	26°34.0	33.8	115°12.7	11.6′	20°46.8	10.6′	56.0′
15	41°33.9	·· 33.0	129°43.4	11.5′	20°57.4	10.5′	56.0′
16	56°33.9	32.3	144°13.9	11.4′	21°07.9	10.5′	56.0′
17	71°33.8	31.6	158°44.2	11.3′	21°18.4	10.3′	56.1′
18	86°33.7	S16°30.8	173°14.5	11.2′	S21°28.7	10.2′	56.1′
19	101°33.7	30.1	187°44.7	11.0′	21°38.9	10.2′	56.1′
20	116°33.6	29.4	202°14.7	10.9′	21°49.1	10.1′	56.2′
21	131°33.5	·· 28.6	216°44.6	10.8′	21°59.2	9.9′	56.2′
22	146°33.5	27.9	231°14.4	10.7′	22°09.1	9.9′	56.2′
23	161°33.4	27.1	245°44.1	10.6′	22°19.0	9.7′	56.3′
	SD = 16.2′	d = 0.7′	SD = 15.1′				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°33.3	S16°26.4	260°13.7	10.4′	S22°28.7	9.7′	56.3′
1	191°33.3	25.7	274°43.1	10.3′	22°38.4	9.6′	56.4′
2	206°33.2	24.9	289°12.5	10.2′	22°48.0	9.4′	56.4′
3	221°33.1	·· 24.2	303°41.7	10.1′	22°57.4	9.4′	56.4′
4	236°33.1	23.4	318°10.8	10.0′	23°06.8	9.3′	56.5′
5	251°33.0	22.7	332°39.7	9.8′	23°16.1	9.1′	56.5′
6	266°32.9	S16°22.0	347°08.6	9.7′	S23°25.2	9.1′	56.5′
7	281°32.9	21.2	1°37.3	9.6′	23°34.3	8.9′	56.6′
8	296°32.8	20.5	16°05.9	9.5′	23°43.2	8.8′	56.6′
9	311°32.8	·· 19.7	30°34.4	9.4′	23°52.0	8.7′	56.6′
10	326°32.7	19.0	45°02.7	9.2′	24°00.7	8.6′	56.7′
11	341°32.6	18.2	59°31.0	9.1′	24°09.3	8.5′	56.7′
12	356°32.6	S16°17.5	73°59.1	9.0′	S24°17.8	8.3′	56.7′
13	11°32.5	16.8	88°27.1	8.9′	24°26.1	8.3′	56.8′
14	26°32.5	16.0	102°55.0	8.7′	24°34.4	8.1′	56.8′
15	41°32.4	·· 15.3	117°22.7	8.6′	24°42.5	8.0′	56.9′
16	56°32.3	14.5	131°50.3	8.5′	24°50.5	7.8′	56.9′
17	71°32.3	13.8	146°17.8	8.4′	24°58.3	7.8′	56.9′
18	86°32.2	S16°13.0	160°45.2	8.3′	S25°06.1	7.6′	57.0′
19	101°32.2	12.3	175°12.5	8.1′	25°13.7	7.5′	57.0′
20	116°32.1	11.5	189°39.6	8.0′	25°21.2	7.4′	57.1′
21	131°32.0	·· 10.8	204°06.6	7.9′	25°28.6	7.2′	57.1′
22	146°32.0	10.0	218°33.5	7.8′	25°35.8	7.1′	57.1′
23	161°31.9	09.3	233°00.3	7.6′	25°42.9	6.9′	57.2′
	SD = 16.2′	d = 0.7′	SD = 15.4′				

Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°31.9	S16°08.5	247°26.9	7.5′	S25°49.8	6.8′	57.2′
1	191°31.8	07.8	261°53.4	7.4′	25°56.6	6.7′	57.2′
2	206°31.8	07.0	276°19.8	7.3′	26°03.3	6.6′	57.3′
3	221°31.7	·· 06.3	290°46.1	7.2′	26°09.9	6.3′	57.3′
4	236°31.6	05.5	305°12.3	7.0′	26°16.2	6.3′	57.4′
5	251°31.6	04.8	319°38.3	6.9′	26°22.5	6.1′	57.4′
6	266°31.5	S16°04.0	334°04.3	6.8′	S26°28.6	6.0′	57.4′
7	281°31.5	03.3	348°30.1	6.7′	26°34.6	5.8′	57.5′
8	296°31.4	02.5	2°55.8	6.6′	26°40.4	5.6′	57.5′
9	311°31.4	·· 01.7	17°21.4	6.5′	26°46.0	5.5′	57.6′
10	326°31.3	01.0	31°46.8	6.4′	26°51.5	5.4′	57.6′
11	341°31.3	16°00.2	46°12.2	6.2′	26°56.9	5.2′	57.6′
12	356°31.2	S15°59.5	60°37.4	6.1′	S27°02.1	5.0′	57.7′
13	11°31.1	58.7	75°02.6	6.0′	27°07.1	4.9′	57.7′
14	26°31.1	58.0	89°27.6	5.9′	27°12.0	4.8′	57.8′
15	41°31.0	·· 57.2	103°52.5	5.8′	27°16.8	4.5′	57.8′
16	56°31.0	56.4	118°17.3	5.7′	27°21.3	4.4′	57.8′
17	71°30.9	55.7	132°42.0	5.6′	27°25.7	4.3′	57.9′
18	86°30.9	S15°54.9	147°06.6	5.5′	S27°30.0	4.0′	57.9′
19	101°30.8	54.2	161°31.1	5.4′	27°34.0	4.0′	58.0′
20	116°30.8	53.4	175°55.5	5.3′	27°38.0	3.7′	58.0′
21	131°30.7	·· 52.6	190°19.8	5.2′	27°41.7	3.6′	58.0′
22	146°30.7	51.9	204°44.0	5.1′	27°45.3	3.4′	58.1′
23	161°30.6	51.1	219°08.1	5.0′	27°48.7	3.2′	58.1′
	SD = 16.2′	d = 0.8′	SD = 15.6′				

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

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

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 50-30%
03	13:40	13:43	12:14	06:04	18:28	
04	13:47	13:50	12:14	06:53	19:20	
05	13:53	13:55	12:14	07:48	20:17	

February 06, 07, 08 UT (Tue., Wed., Thu.)

	Aries	Venus		Mars		Jupiter		Saturn	
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	135°38.1	207°27.8	S21°59.7	199°06.9	S22°05.9	99°49.9	N13°09.8	156°17.3	S10°25.8
1	150°40.6	222°26.9	59.4	214°07.4	05.5	114°52.1	09.9	171°19.4	25.7
2	165°43.0	237°26.0	59.1	229°07.8	05.2	129°54.3	10.0	186°21.6	25.6
3	180°45.5	252°25.2	·· 58.9	244°08.2	·· 04.9	144°56.5	·· 10.1	201°23.8	·· 25.5
4	195°47.9	267°24.3	58.6	259°08.7	04.6	159°58.6	10.3	216°26.0	25.3
5	210°50.4	282°23.5	58.3	274°09.1	04.3	175°00.8	10.4	231°28.2	25.2
6	225°52.9	297°22.6	S21°58.1	289°09.5	S22°03.9	190°03.0	N13°10.5	246°30.4	S10°25.1
7	240°55.3	312°21.8	57.8	304°10.0	03.6	205°05.2	10.6	261°32.6	25.0
8	255°57.8	327°20.9	57.5	319°10.4	03.3	220°07.4	10.7	276°34.8	24.9
9	271°00.3	342°20.1	·· 57.3	334°10.8	·· 03.0	235°09.6	·· 10.8	291°36.9	·· 24.8
10	286°02.7	357°19.2	57.0	349°11.3	02.6	250°11.7	10.9	306°39.1	24.7
11	301°05.2	12°18.3	56.7	4°11.7	02.3	265°13.9	11.0	321°41.3	24.6
12	316°07.7	27°17.5	S21°56.5	19°12.1	S22°02.0	280°16.1	N13°11.1	336°43.5	S10°24.5
13	331°10.1	42°16.6	56.2	34°12.5	01.7	295°18.3	11.2	351°45.7	24.4
14	346°12.6	57°15.8	55.9	49°13.0	01.3	310°20.5	11.3	6°47.9	24.3
15	1°15.1	72°14.9	·· 55.6	64°13.4	·· 01.0	325°22.6	·· 11.4	21°50.1	·· 24.1
16	16°17.5	87°14.1	55.4	79°13.8	00.7	340°24.8	11.5	36°52.3	24.0
17	31°20.0	102°13.2	55.1	94°14.3	00.4	355°27.0	11.6	51°54.4	23.9
18	46°22.4	117°12.4	S21°54.8	109°14.7	S22°00.0	10°29.2	N13°11.7	66°56.6	S10°23.8
19	61°24.9	132°11.5	54.5	124°15.1	21°59.7	25°31.4	11.8	81°58.8	23.7
20	76°27.4	147°10.6	54.2	139°15.6	59.4	40°33.5	11.9	97°01.0	23.6
21	91°29.8	162°09.8	·· 53.9	154°16.0	·· 59.1	55°35.7	·· 12.0	112°03.2	·· 23.5
22	106°32.3	177°08.9	53.7	169°16.4	58.7	70°37.9	12.1	127°05.4	23.4
23	121°34.8	192°08.1	53.4	184°16.9	58.4	85°40.1	12.3	142°07.6	23.3
Mer.pass. 14:55		ν -0.9′	d 0.3′	m -3.91	ν 0.4′	d 0.3′	m 1.32	ν 2.2′	d 0.1′ m -2.32	ν 2.2′	d 0.1′ m 0.99

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	136°37.2	207°07.2	S21°53.1	199°17.3	S21°58.1	100°42.3	N13°12.4	157°09.8	S10°23.2
1	151°39.7	222°06.4	52.8	214°17.7	57.8	115°44.4	12.5	172°11.9	23.1
2	166°42.2	237°05.5	52.5	229°18.2	57.4	130°46.6	12.6	187°14.1	22.9
3	181°44.6	252°04.7	·· 52.2	244°18.6	·· 57.1	145°48.8	·· 12.7	202°16.3	·· 22.8
4	196°47.1	267°03.8	51.9	259°19.0	56.8	160°51.0	12.8	217°18.5	22.7
5	211°49.6	282°03.0	51.6	274°19.5	56.4	175°53.1	12.9	232°20.7	22.6
6	226°52.0	297°02.1	S21°51.3	289°19.9	S21°56.1	190°55.3	N13°13.0	247°22.9	S10°22.5
7	241°54.5	312°01.3	51.0	304°20.3	55.8	205°57.5	13.1	262°25.1	22.4
8	256°56.9	327°00.4	50.7	319°20.8	55.4	220°59.7	13.2	277°27.2	22.3
9	271°59.4	341°59.6	·· 50.4	334°21.2	·· 55.1	236°01.8	·· 13.3	292°29.4	·· 22.2
10	287°01.9	356°58.7	50.2	349°21.6	54.8	251°04.0	13.4	307°31.6	22.1
11	302°04.3	11°57.9	49.9	4°22.1	54.4	266°06.2	13.5	322°33.8	22.0
12	317°06.8	26°57.0	S21°49.6	19°22.5	S21°54.1	281°08.4	N13°13.6	337°36.0	S10°21.8
13	332°09.3	41°56.2	49.2	34°22.9	53.8	296°10.5	13.8	352°38.2	21.7
14	347°11.7	56°55.3	48.9	49°23.4	53.4	311°12.7	13.9	7°40.4	21.6
15	2°14.2	71°54.5	·· 48.6	64°23.8	·· 53.1	326°14.9	·· 14.0	22°42.6	·· 21.5
16	17°16.7	86°53.6	48.3	79°24.2	52.8	341°17.1	14.1	37°44.7	21.4
17	32°19.1	101°52.8	48.0	94°24.7	52.4	356°19.2	14.2	52°46.9	21.3
18	47°21.6	116°51.9	S21°47.7	109°25.1	S21°52.1	11°21.4	N13°14.3	67°49.1	S10°21.2
19	62°24.1	131°51.1	47.4	124°25.5	51.8	26°23.6	14.4	82°51.3	21.1
20	77°26.5	146°50.2	47.1	139°26.0	51.4	41°25.8	14.5	97°53.5	21.0
21	92°29.0	161°49.4	·· 46.8	154°26.4	·· 51.1	56°27.9	·· 14.6	112°55.7	·· 20.9
22	107°31.4	176°48.5	46.5	169°26.8	50.7	71°30.1	14.7	127°57.9	20.7
23	122°33.9	191°47.7	46.2	184°27.3	50.4	86°32.3	14.8	143°00.0	20.6
Mer.pass. 14:51		ν -0.9′	d 0.3′	m -3.90	ν 0.4′	d 0.3′	m 1.32	ν 2.2′	d 0.1′ m -2.31	ν 2.2′	d 0.1′ m 0.99

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	137°36.4	206°46.8	S21°45.9	199°27.7	S21°50.1	101°34.5	N13°14.9	158°02.2	S10°20.5
1	152°38.8	221°46.0	45.5	214°28.1	49.7	116°36.6	15.0	173°04.4	20.4
2	167°41.3	236°45.1	45.2	229°28.6	49.4	131°38.8	15.2	188°06.6	20.3
3	182°43.8	251°44.3	·· 44.9	244°29.0	·· 49.0	146°41.0	·· 15.3	203°08.8	·· 20.2
4	197°46.2	266°43.4	44.6	259°29.4	48.7	161°43.1	15.4	218°11.0	20.1
5	212°48.7	281°42.6	44.3	274°29.9	48.4	176°45.3	15.5	233°13.2	20.0
6	227°51.2	296°41.7	S21°43.9	289°30.3	S21°48.0	191°47.5	N13°15.6	248°15.3	S10°19.9
7	242°53.6	311°40.9	43.6	304°30.7	47.7	206°49.6	15.7	263°17.5	19.8
8	257°56.1	326°40.1	43.3	319°31.2	47.3	221°51.8	15.8	278°19.7	19.7
9	272°58.6	341°39.2	·· 43.0	334°31.6	·· 47.0	236°54.0	·· 15.9	293°21.9	·· 19.5
10	288°01.0	356°38.4	42.6	349°32.0	46.7	251°56.2	16.0	308°24.1	19.4
11	303°03.5	11°37.5	42.3	4°32.5	46.3	266°58.3	16.1	323°26.3	19.3
12	318°05.9	26°36.7	S21°42.0	19°32.9	S21°46.0	282°00.5	N13°16.2	338°28.5	S10°19.2
13	333°08.4	41°35.8	41.7	34°33.4	45.6	297°02.7	16.4	353°30.6	19.1
14	348°10.9	56°35.0	41.3	49°33.8	45.3	312°04.8	16.5	8°32.8	19.0
15	3°13.3	71°34.1	·· 41.0	64°34.2	·· 44.9	327°07.0	·· 16.6	23°35.0	·· 18.9
16	18°15.8	86°33.3	40.7	79°34.7	44.6	342°09.2	16.7	38°37.2	18.8
17	33°18.3	101°32.4	40.3	94°35.1	44.2	357°11.3	16.8	53°39.4	18.7
18	48°20.7	116°31.6	S21°40.0	109°35.5	S21°43.9	12°13.5	N13°16.9	68°41.6	S10°18.5
19	63°23.2	131°30.8	39.7	124°36.0	43.6	27°15.7	17.0	83°43.8	18.4
20	78°25.7	146°29.9	39.3	139°36.4	43.2	42°17.8	17.1	98°45.9	18.3
21	93°28.1	161°29.1	·· 39.0	154°36.8	·· 42.9	57°20.0	·· 17.2	113°48.1	·· 18.2
22	108°30.6	176°28.2	38.6	169°37.3	42.5	72°22.2	17.3	128°50.3	18.1
23	123°33.0	191°27.4	38.3	184°37.7	42.2	87°24.3	17.4	143°52.5	18.0
Mer.pass. 14:47		ν -0.8′	d 0.3′	m -3.90	ν 0.4′	d 0.3′	m 1.31	ν 2.2′	d 0.1′ m -2.30	ν 2.2′	d 0.1′ m 0.99

Stars

	SHA	Dec
Alpheratz	357°35.8	29°13.4
Ankaa	353°08.1	-42°10.8
Schedar	349°32.3	56°40.3
Diphda	348°48.2	-17°51.5
Achernar	335°20.9	-57°07.2
Hamal	327°52.1	23°34.6
Polaris	314°24.0	89°22.3
Acamar	315°12.3	-40°12.8
Menkar	314°06.9	4°11.0
Mirfak	308°29.3	49°57.0
Aldebaran	290°40.3	16°33.5
Rigel	281°04.4	-8°10.5
Capella	280°22.7	46°01.5
Bellatrix	278°23.5	6°22.2
Elnath	278°02.6	28°37.7
Alnilam	275°38.3	-1°11.3
Betelgeuse	270°52.7	7°24.6
Canopus	263°52.3	-52°42.7
Sirius	258°26.6	-16°45.1
Adhara	255°06.1	-29°00.4
Procyon	244°51.3	5°09.7
Pollux	243°17.9	27°58.1
Avior	234°14.4	-59°35.2
Suhail	222°46.4	-43°31.8
Miaplacidus	221°37.5	-69°48.9
Alphard	217°48.2	-8°45.8
Regulus	207°34.9	11°50.9
Dubhe	193°41.3	61°37.1
Denebola	182°25.5	14°26.1
Gienah	175°44.1	-17°40.5
Acrux	173°00.5	-63°13.7
Gacrux	171°52.2	-57°14.7
Alioth	166°13.3	55°49.5
Spica	158°23.0	-11°17.3
Alkaid	152°52.4	49°11.3
Hadar	148°37.0	-60°29.1
Menkent	147°58.4	-36°29.2
Arcturus	145°48.5	19°03.2
Rigil Kent.	139°41.3	-60°55.8
Kochab	137°19.7	74°03.0
Zuben'ubi	136°56.8	-16°08.5
Alphecca	126°04.4	26°37.8
Antares	112°16.9	-26°29.1
Atria	107°12.1	-69°04.0
Sabik	102°03.8	-15°45.3
Shaula	96°11.7	-37°07.2
Rasalhague	95°59.5	12°32.4
Eltanin	90°42.9	51°28.8
Kaus Aust.	83°33.8	-34°22.4
Vega	80°34.1	38°48.1
Nunki	75°49.0	-26°16.0
Altair	62°01.0	8°55.8
Peacock	53°07.5	-56°39.5
Deneb	49°26.8	45°21.8
Enif	33°39.9	9°59.0
Al Na'ir	27°34.3	-46°50.8
Fomalhaut	15°15.7	-29°29.9
Scheat	13°46.3	28°12.8
Markab	13°30.9	15°20.0

Feb 06 Tue	SHA	Mer.pass
Venus	71°49.7	10:11
Mars	63°28.9	10:43
Jupiter	324°11.8	17:18
Saturn	20°39.2	13:33

Feb 07 Wed	SHA	Mer.pass
Venus	70°30.0	10:12
Mars	62°40.1	10:43
Jupiter	324°05.0	17:15
Saturn	20°32.5	13:29

Feb 08 Thu	SHA	Mer.pass
Venus	69°10.5	10:13
Mars	61°51.3	10:42
Jupiter	323°58.1	17:11
Saturn	20°25.9	13:26

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.0990 sec ΔT = TT-UT1 = +69.0850 sec

2024 February 06 to Feb. 08 UT

h	Sun		Moon				
Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°30.6	S15°50.4	233°32.1	4.9′	S27°51.9	3.0′	58.2′
1	191°30.5	49.6	247°56.0	4.8′	27°54.9	2.9′	58.2′
2	206°30.5	48.8	262°19.8	4.7′	27°57.8	2.7′	58.2′
3	221°30.4	·· 48.1	276°43.5	4.6′	28°00.5	2.5′	58.3′
4	236°30.4	47.3	291°07.2	4.6′	28°03.0	2.4′	58.3′
5	251°30.3	46.5	305°30.7	4.5′	28°05.4	2.1′	58.4′
6	266°30.3	S15°45.8	319°54.2	4.4′	S28°07.5	2.0′	58.4′
7	281°30.3	45.0	334°17.6	4.3′	28°09.5	1.8′	58.4′
8	296°30.2	44.2	348°40.9	4.2′	28°11.3	1.6′	58.5′
9	311°30.2	·· 43.5	3°04.1	4.2′	28°12.9	1.5′	58.5′
10	326°30.1	42.7	17°27.2	4.1′	28°14.4	1.2′	58.6′
11	341°30.1	41.9	31°50.3	4.0′	28°15.6	1.1′	58.6′
12	356°30.0	S15°41.2	46°13.3	3.9′	S28°16.7	0.8′	58.6′
13	11°30.0	40.4	60°36.3	3.9′	28°17.5	0.7′	58.7′
14	26°29.9	39.6	74°59.1	3.8′	28°18.2	0.5′	58.7′
15	41°29.9	·· 38.9	89°21.9	3.7′	28°18.7	0.3′	58.8′
16	56°29.9	38.1	103°44.7	3.7′	28°19.0	0.1′	58.8′
17	71°29.8	37.3	118°07.4	3.6′	28°19.1	0.1′	58.8′
18	86°29.8	S15°36.6	132°30.0	3.6′	S28°19.0	0.3′	58.9′
19	101°29.7	35.8	146°52.6	3.5′	28°18.7	0.4′	58.9′
20	116°29.7	35.0	161°15.1	3.5′	28°18.3	0.7′	59.0′
21	131°29.6	·· 34.2	175°37.6	3.4′	28°17.6	0.9′	59.0′
22	146°29.6	33.5	190°00.0	3.4′	28°16.7	1.0′	59.0′
23	161°29.6	32.7	204°22.4	3.3′	28°15.7	1.3′	59.1′
	SD = 16.2′	d = 0.8′	SD = 15.9′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°29.5	S15°31.9	218°44.8	3.3′	S28°14.4	1.5′	59.1′
1	191°29.5	31.2	233°07.1	3.3′	28°12.9	1.6′	59.2′
2	206°29.4	30.4	247°29.3	3.2′	28°11.3	1.9′	59.2′
3	221°29.4	·· 29.6	261°51.6	3.2′	28°09.4	2.0′	59.2′
4	236°29.4	28.8	276°13.8	3.2′	28°07.4	2.3′	59.3′
5	251°29.3	28.1	290°36.0	3.2′	28°05.1	2.4′	59.3′
6	266°29.3	S15°27.3	304°58.1	3.1′	S28°02.7	2.7′	59.3′
7	281°29.2	26.5	319°20.3	3.1′	28°00.0	2.8′	59.4′
8	296°29.2	25.7	333°42.4	3.1′	27°57.2	3.1′	59.4′
9	311°29.2	·· 24.9	348°04.5	3.1′	27°54.1	3.2′	59.5′
10	326°29.1	24.2	2°26.6	3.1′	27°50.9	3.5′	59.5′
11	341°29.1	23.4	16°48.6	3.1′	27°47.4	3.6′	59.5′
12	356°29.1	S15°22.6	31°10.7	3.1′	S27°43.8	3.9′	59.6′
13	11°29.0	21.8	45°32.8	3.1′	27°39.9	4.0′	59.6′
14	26°29.0	21.1	59°54.8	3.1′	27°35.9	4.3′	59.6′
15	41°28.9	·· 20.3	74°16.9	3.1′	27°31.6	4.5′	59.7′
16	56°28.9	19.5	88°38.9	3.1′	27°27.1	4.6′	59.7′
17	71°28.9	18.7	103°01.0	3.1′	27°22.5	4.9′	59.7′
18	86°28.8	S15°17.9	117°23.1	3.1′	S27°17.6	5.0′	59.8′
19	101°28.8	17.1	131°45.2	3.1′	27°12.6	5.3′	59.8′
20	116°28.8	16.4	146°07.3	3.1′	27°07.3	5.4′	59.8′
21	131°28.7	·· 15.6	160°29.4	3.1′	27°01.9	5.7′	59.9′
22	146°28.7	14.8	174°51.5	3.2′	26°56.2	5.8′	59.9′
23	161°28.7	14.0	189°13.7	3.2′	26°50.4	6.1′	59.9′
	SD = 16.2′	d = 0.8′	SD = 16.1′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°28.6	S15°13.2	203°35.9	3.2′	S26°44.3	6.2′	60.0′
1	191°28.6	12.4	217°58.1	3.2′	26°38.1	6.5′	60.0′
2	206°28.6	11.7	232°20.3	3.3′	26°31.6	6.6′	60.0′
3	221°28.5	·· 10.9	246°42.6	3.3′	26°25.0	6.8′	60.1′
4	236°28.5	10.1	261°04.9	3.3′	26°18.2	7.1′	60.1′
5	251°28.5	09.3	275°27.2	3.4′	26°11.1	7.2′	60.1′
6	266°28.4	S15°08.5	289°49.6	3.4′	S26°03.9	7.4′	60.2′
7	281°28.4	07.7	304°12.0	3.5′	25°56.5	7.6′	60.2′
8	296°28.4	06.9	318°34.4	3.5′	25°48.9	7.8′	60.2′
9	311°28.4	·· 06.2	332°56.9	3.5′	25°41.1	8.0′	60.3′
10	326°28.3	05.4	347°19.5	3.6′	25°33.1	8.2′	60.3′
11	341°28.3	04.6	1°42.1	3.6′	25°24.9	8.3′	60.3′
12	356°28.3	S15°03.8	16°04.7	3.7′	S25°16.6	8.6′	60.3′
13	11°28.2	03.0	30°27.4	3.8′	25°08.0	8.7′	60.4′
14	26°28.2	02.2	44°50.2	3.8′	24°59.3	8.9′	60.4′
15	41°28.2	·· 01.4	59°13.0	3.9′	24°50.4	9.1′	60.4′
16	56°28.2	15°00.6	73°35.9	3.9′	24°41.3	9.3′	60.4′
17	71°28.1	14°59.8	87°58.8	4.0′	24°32.0	9.5′	60.5′
18	86°28.1	S14°59.0	102°21.8	4.1′	S24°22.5	9.6′	60.5′
19	101°28.1	58.2	116°44.9	4.1′	24°12.9	9.8′	60.5′
20	116°28.1	57.4	131°08.0	4.2′	24°03.1	10.0′	60.6′
21	131°28.0	·· 56.7	145°31.2	4.3′	23°53.1	10.2′	60.6′
22	146°28.0	55.9	159°54.4	4.3′	23°42.9	10.3′	60.6′
23	161°28.0	55.1	174°17.8	4.4′	23°32.6	10.6′	60.6′
	SD = 16.2′	d = 0.8′	SD = 16.4′				

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

Lat.	**Moonrise** Tue	Wed	Thu	**Moonset** Tue	Wed	Thu
N 72°	▬	▬	▬	▬	▬	▬
N 70°	▬	▬	▬	▬	▬	▬
68°	▬	▬	▬	▬	▬	▬
66°	▬	▬	▬	▬	▬	▬
64°	▬	▬	10:13	▬	▬	11:44
62°	▬	▬	09:11	▬	▬	12:46
60°	07:19	08:16	08:36	10:13	11:27	13:20
N 58°	06:40	07:40	08:11	10:53	12:04	13:45
56°	06:13	07:13	07:51	11:20	12:30	14:04
54°	05:51	06:52	07:34	11:42	12:51	14:21
52°	05:33	06:35	07:19	12:00	13:08	14:35
50°	05:18	06:20	07:06	12:15	13:23	14:47
45°	04:47	05:50	06:40	12:46	13:53	15:12
N 40°	04:24	05:26	06:19	13:10	14:16	15:32
35°	04:04	05:07	06:02	13:29	14:35	15:49
30°	03:47	04:50	05:47	13:46	14:52	16:03
20°	03:19	04:22	05:21	14:15	15:19	16:28
N 10°	02:55	03:57	04:59	14:39	15:43	16:48
0°	02:33	03:35	04:38	15:02	16:05	17:08
S 10°	02:10	03:12	04:17	15:25	16:27	17:27
20°	01:46	02:48	03:55	15:49	16:50	17:47
30°	01:18	02:20	03:29	16:17	17:17	18:11
35°	01:02	02:03	03:13	16:34	17:33	18:24
40°	00:43	01:43	02:55	16:54	17:52	18:40
45°	00:20	01:20	02:34	17:18	18:14	18:59
S 50°	·· ··	00:49	02:06	17:48	18:42	19:22
52°	·· ··	00:34	01:53	18:03	18:56	19:33
54°	·· ··	00:17	01:37	18:21	19:12	19:45
56°	23:56	·· ··	01:19	18:42	19:30	19:59
58°	23:29	·· ··	00:57	19:09	19:53	20:16
S 60°	22:51	·· ··	00:27	19:46	20:23	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 26-28 20-6%
06	13:58	14:00	12:14	08:47	21:18	
07	14:02	14:04	12:14	09:50	22:21	
08	14:05	14:07	12:14	10:53	23:24	

February 09, 10, 11 UT (Fri., Sat., Sun.)

	Aries	Venus		Mars		Jupiter		Saturn	
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	138°35.5	206°26.5	S21°38.0	199°38.2	S21°41.8	102°26.5	N13°17.6	158°54.7	S10°17.9
1	153°38.0	221°25.7	37.6	214°38.6	41.5	117°28.7	17.7	173°56.9	17.8
2	168°40.4	236°24.9	37.3	229°39.0	41.1	132°30.8	17.8	188°59.0	17.7
3	183°42.9	251°24.0	·· 36.9	244°39.5	·· 40.8	147°33.0	·· 17.9	204°01.2	·· 17.6
4	198°45.4	266°23.2	36.6	259°39.9	40.4	162°35.2	18.0	219°03.4	17.4
5	213°47.8	281°22.3	36.2	274°40.3	40.1	177°37.3	18.1	234°05.6	17.3
6	228°50.3	296°21.5	S21°35.9	289°40.8	S21°39.7	192°39.5	N13°18.2	249°07.8	S10°17.2
7	243°52.8	311°20.7	35.5	304°41.2	39.4	207°41.6	18.3	264°10.0	17.1
8	258°55.2	326°19.8	35.2	319°41.7	39.0	222°43.8	18.4	279°12.2	17.0
9	273°57.7	341°19.0	·· 34.8	334°42.1	·· 38.7	237°46.0	·· 18.6	294°14.3	·· 16.9
10	289°00.2	356°18.1	34.5	349°42.5	38.3	252°48.1	18.7	309°16.5	16.8
11	304°02.6	11°17.3	34.1	4°43.0	38.0	267°50.3	18.8	324°18.7	16.7
12	319°05.1	26°16.5	S21°33.8	19°43.4	S21°37.6	282°52.5	N13°18.9	339°20.9	S10°16.6
13	334°07.5	41°15.6	33.4	34°43.8	37.3	297°54.6	19.0	354°23.1	16.5
14	349°10.0	56°14.8	33.1	49°44.3	36.9	312°56.8	19.1	9°25.3	16.3
15	4°12.5	71°13.9	·· 32.7	64°44.7	·· 36.5	327°58.9	·· 19.2	24°27.5	·· 16.2
16	19°14.9	86°13.1	32.4	79°45.2	36.2	343°01.1	19.3	39°29.6	16.1
17	34°17.4	101°12.3	32.0	94°45.6	35.8	358°03.3	19.4	54°31.8	16.0
18	49°19.9	116°11.4	S21°31.6	109°46.0	S21°35.5	13°05.4	N13°19.6	69°34.0	S10°15.9
19	64°22.3	131°10.6	31.3	124°46.5	35.1	28°07.6	19.7	84°36.2	15.8
20	79°24.8	146°09.8	30.9	139°46.9	34.8	43°09.7	19.8	99°38.4	15.7
21	94°27.3	161°08.9	·· 30.5	154°47.4	·· 34.4	58°11.9	·· 19.9	114°40.6	·· 15.6
22	109°29.7	176°08.1	30.2	169°47.8	34.0	73°14.1	20.0	129°42.7	15.5
23	124°32.2	191°07.2	29.8	184°48.2	33.7	88°16.2	20.1	144°44.9	15.4
Mer.pass. 14:43		ν -0.8′ d 0.3′		ν 0.4′ d 0.3′		ν 2.2′ d 0.1′		ν 2.2′ d 0.1′	
0	139°34.7	206°06.4	S21°29.4	199°48.7	S21°33.3	103°18.4	N13°20.2	159°47.1	S10°15.2
1	154°37.1	221°05.6	29.1	214°49.1	33.0	118°20.5	20.3	174°49.3	15.1
2	169°39.6	236°04.7	28.7	229°49.6	32.6	133°22.7	20.4	189°51.5	15.0
3	184°42.0	251°03.9	·· 28.3	244°50.0	·· 32.3	148°24.9	·· 20.6	204°53.7	·· 14.9
4	199°44.5	266°03.1	28.0	259°50.4	31.9	163°27.0	20.7	219°55.8	14.8
5	214°47.0	281°02.2	27.6	274°50.9	31.5	178°29.2	20.8	234°58.0	14.7
6	229°49.4	296°01.4	S21°27.2	289°51.3	S21°31.2	193°31.3	N13°20.9	250°00.2	S10°14.6
7	244°51.9	311°00.6	26.8	304°51.8	30.8	208°33.5	21.0	265°02.4	14.5
8	259°54.4	325°59.7	26.5	319°52.2	30.5	223°35.6	21.1	280°04.6	14.4
9	274°56.8	340°58.9	·· 26.1	334°52.6	·· 30.1	238°37.8	·· 21.2	295°06.8	·· 14.2
10	289°59.3	355°58.1	25.7	349°53.1	29.7	253°40.0	21.3	310°09.0	14.1
11	305°01.8	10°57.2	25.3	4°53.5	29.4	268°42.1	21.5	325°11.1	14.0
12	320°04.2	25°56.4	S21°24.9	19°54.0	S21°29.0	283°44.3	N13°21.6	340°13.3	S10°13.9
13	335°06.7	40°55.6	24.5	34°54.4	28.6	298°46.4	21.7	355°15.5	13.8
14	350°09.2	55°54.7	24.2	49°54.8	28.3	313°48.6	21.8	10°17.7	13.7
15	5°11.6	70°53.9	·· 23.8	64°55.3	·· 27.9	328°50.7	·· 21.9	25°19.9	·· 13.6
16	20°14.1	85°53.1	23.4	79°55.7	27.5	343°52.9	22.0	40°22.1	13.5
17	35°16.5	100°52.2	23.0	94°56.2	27.2	358°55.0	22.1	55°24.2	13.4
18	50°19.0	115°51.4	S21°22.6	109°56.6	S21°26.8	13°57.2	N13°22.2	70°26.4	S10°13.2
19	65°21.5	130°50.6	22.2	124°57.1	26.4	28°59.4	22.4	85°28.6	13.1
20	80°23.9	145°49.7	21.8	139°57.5	26.1	44°01.5	22.5	100°30.8	13.0
21	95°26.4	160°48.9	·· 21.4	154°57.9	·· 25.7	59°03.7	·· 22.6	115°33.0	·· 12.9
22	110°28.9	175°48.1	21.1	169°58.4	25.3	74°05.8	22.7	130°35.2	12.8
23	125°31.3	190°47.3	20.7	184°58.8	25.0	89°08.0	22.8	145°37.3	12.7
Mer.pass. 14:39		ν -0.8′ d 0.4′		ν 0.4′ d 0.4′		ν 2.2′ d 0.1′		ν 2.2′ d 0.1′	
0	140°33.8	205°46.4	S21°20.3	199°59.3	S21°24.6	104°10.1	N13°22.9	160°39.5	S10°12.6
1	155°36.3	220°45.6	19.9	214°59.7	24.2	119°12.3	23.0	175°41.7	12.5
2	170°38.7	235°44.8	19.5	230°00.2	23.9	134°14.4	23.2	190°43.9	12.4
3	185°41.2	250°43.9	·· 19.1	245°00.6	·· 23.5	149°16.6	·· 23.3	205°46.1	·· 12.3
4	200°43.6	265°43.1	18.7	260°01.0	23.1	164°18.7	23.4	220°48.3	12.1
5	215°46.1	280°42.3	18.3	275°01.5	22.8	179°20.9	23.5	235°50.4	12.0
6	230°48.6	295°41.5	S21°17.9	290°01.9	S21°22.4	194°23.0	N13°23.6	250°52.6	S10°11.9
7	245°51.0	310°40.6	17.5	305°02.4	22.0	209°25.2	23.7	265°54.8	11.8
8	260°53.5	325°39.8	17.1	320°02.8	21.7	224°27.3	23.8	280°57.0	11.7
9	275°56.0	340°39.0	·· 16.7	335°03.3	·· 21.3	239°29.5	·· 24.0	295°59.2	·· 11.6
10	290°58.4	355°38.1	16.3	350°03.7	20.9	254°31.6	24.1	311°01.4	11.5
11	306°00.9	10°37.3	15.8	5°04.1	20.5	269°33.8	24.2	326°03.5	11.4
12	321°03.4	25°36.5	S21°15.4	20°04.6	S21°20.2	284°35.9	N13°24.3	341°05.7	S10°11.3
13	336°05.8	40°35.7	15.0	35°05.0	19.8	299°38.1	24.4	356°07.9	11.1
14	351°08.3	55°34.8	14.6	50°05.5	19.4	314°40.2	24.5	11°10.1	11.0
15	6°10.8	70°34.0	·· 14.2	65°05.9	·· 19.0	329°42.4	·· 24.6	26°12.3	·· 10.9
16	21°13.2	85°33.2	13.8	80°06.4	18.7	344°44.5	24.8	41°14.5	10.8
17	36°15.7	100°32.4	13.4	95°06.8	18.3	359°46.7	24.9	56°16.6	10.7
18	51°18.1	115°31.5	S21°13.0	110°07.3	S21°17.9	14°48.8	N13°25.0	71°18.8	S10°10.6
19	66°20.6	130°30.7	12.6	125°07.7	17.5	29°51.0	25.1	86°21.0	10.5
20	81°23.1	145°29.9	12.1	140°08.1	17.2	44°53.1	25.2	101°23.2	10.4
21	96°25.5	160°29.1	·· 11.7	155°08.6	·· 16.8	59°55.3	·· 25.3	116°25.4	·· 10.3
22	111°28.0	175°28.3	11.3	170°09.0	16.4	74°57.4	25.4	131°27.5	10.1
23	126°30.5	190°27.4	10.9	185°09.5	16.0	89°59.6	25.6	146°29.7	10.0
Mer.pass. 14:35		ν -0.8′ d 0.4′		ν 0.4′ d 0.4′		ν 2.2′ d 0.1′		ν 2.2′ d 0.1′	

Stars

	SHA	Dec
Alpheratz	357°35.8	29°13.4
Ankaa	353°08.1	-42°10.8
Schedar	349°32.3	56°40.3
Diphda	348°48.2	-17°51.5
Achernar	335°20.9	-57°07.2
Hamal	327°52.1	23°34.6
Polaris	314°25.5	89°22.3
Acamar	315°12.3	-40°12.8
Menkar	314°06.9	4°11.0
Mirfak	308°29.3	49°57.0
Aldebaran	290°40.4	16°33.5
Rigel	281°04.4	-8°10.5
Capella	280°22.7	46°01.5
Bellatrix	278°23.5	6°22.2
Elnath	278°02.6	28°37.7
Alnilam	275°38.3	-1°11.3
Betelgeuse	270°52.7	7°24.6
Canopus	263°52.3	-52°42.7
Sirius	258°26.6	-16°45.1
Adhara	255°06.1	-29°00.4
Procyon	244°51.3	5°09.7
Pollux	243°17.9	27°58.1
Avior	234°14.4	-59°35.2
Suhail	222°46.4	-43°31.8
Miaplacidus	221°37.5	-69°48.9
Alphard	217°48.2	-8°45.8
Regulus	207°34.9	11°50.9
Dubhe	193°41.3	61°37.1
Denebola	182°25.4	14°26.1
Gienah	175°44.1	-17°40.6
Acrux	173°00.5	-63°13.8
Gacrux	171°52.1	-57°14.7
Alioth	166°13.3	55°49.5
Spica	158°22.9	-11°17.3
Alkaid	152°52.4	49°11.3
Hadar	148°36.9	-60°29.1
Menkent	147°58.4	-36°29.2
Arcturus	145°48.5	19°03.2
Rigil Kent.	139°41.2	-60°55.8
Kochab	137°19.6	74°03.0
Zuben'ubi	136°56.8	-16°08.5
Alphecca	126°04.4	26°37.7
Antares	112°16.9	-26°29.1
Atria	107°12.0	-69°04.0
Sabik	102°03.8	-15°45.3
Shaula	96°11.6	-37°07.2
Rasalhague	95°59.4	12°32.3
Eltanin	90°42.9	51°28.8
Kaus Aust.	83°33.8	-34°22.4
Vega	80°34.1	38°48.1
Nunki	75°49.0	-26°16.0
Altair	62°01.0	8°55.8
Peacock	53°07.5	-56°39.5
Deneb	49°26.8	45°21.8
Enif	33°39.9	9°59.0
Al Na'ir	27°34.3	-46°50.8
Fomalhaut	15°15.7	-29°29.9
Scheat	13°46.3	28°12.8
Markab	13°30.9	15°20.0

Feb 09 Fri	SHA	Mer.pass
Venus	67°51.0	10:15
Mars	61°02.6	10:41
Jupiter	323°51.0	17:08
Saturn	20°19.2	13:22

Feb 10 Sat	SHA	Mer.pass
Venus	66°31.8	10:16
Mars	60°14.0	10:40
Jupiter	323°43.7	17:04
Saturn	20°12.5	13:19

Feb 11 Sun	SHA	Mer.pass
Venus	65°12.6	10:17
Mars	59°25.5	10:40
Jupiter	323°36.3	17:01
Saturn	20°05.7	13:15

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.0998 sec ΔT = TT-UT1 = +69.0842 sec

2024 February 09 to Feb. 11 UT

h

Fri	Sun GHA	Sun Dec	Moon GHA	Moon ν	Moon Dec	Moon d	Moon HP
0	176°28.0	S14°54.3	188°41.2	4.5′	S23°22.0	10.6′	60.6′
1	191°27.9	53.5	203°04.7	4.6′	23°11.4	10.9′	60.7′
2	206°27.9	52.7	217°28.2	4.6′	23°00.5	11.0′	60.7′
3	221°27.9	·· 51.9	231°51.8	4.7′	22°49.5	11.2′	60.7′
4	236°27.9	51.1	246°15.5	4.8′	22°38.3	11.3′	60.7′
5	251°27.8	50.3	260°39.3	4.9′	22°27.0	11.6′	60.8′
6	266°27.8	S14°49.5	275°03.2	4.9′	S22°15.4	11.6′	60.8′
7	281°27.8	48.7	289°27.1	5.0′	22°03.8	11.9′	60.8′
8	296°27.8	47.9	303°51.1	5.1′	21°51.9	11.9′	60.8′
9	311°27.7	·· 47.1	318°15.3	5.2′	21°40.0	12.2′	60.8′
10	326°27.7	46.3	332°39.4	5.3′	21°27.8	12.3′	60.9′
11	341°27.7	45.5	347°03.7	5.4′	21°15.5	12.4′	60.9′
12	356°27.7	S14°44.7	1°28.1	5.4′	S21°03.1	12.6′	60.9′
13	11°27.7	43.9	15°52.5	5.5′	20°50.5	12.8′	60.9′
14	26°27.6	43.1	30°17.0	5.6′	20°37.7	12.8′	60.9′
15	41°27.6	·· 42.3	44°41.6	5.7′	20°24.9	13.1′	60.9′
16	56°27.6	41.5	59°06.3	5.8′	20°11.8	13.1′	61.0′
17	71°27.6	40.7	73°31.1	5.9′	19°58.7	13.3′	61.0′
18	86°27.6	S14°39.9	87°56.0	6.0′	S19°45.4	13.5′	61.0′
19	101°27.6	39.1	102°20.9	6.0′	19°31.9	13.6′	61.0′
20	116°27.5	38.3	116°46.0	6.1′	19°18.3	13.7′	61.0′
21	131°27.5	·· 37.5	131°11.1	6.2′	19°04.6	13.8′	61.0′
22	146°27.5	36.7	145°36.3	6.3′	18°50.8	14.0′	61.0′
23	161°27.5	35.9	160°01.6	6.4′	18°36.8	14.1′	61.0′
	SD = 16.2′	d = 0.8′	SD = 16.5′				

Sat	GHA	Dec	GHA	ν	Dec	d	HP
0	176°27.5	S14°35.1	174°27.0	6.5′	S18°22.7	14.2′	61.1′
1	191°27.4	34.3	188°52.5	6.6′	18°08.5	14.4′	61.1′
2	206°27.4	33.4	203°18.1	6.7′	17°54.1	14.4′	61.1′
3	221°27.4	·· 32.6	217°43.8	6.8′	17°39.7	14.6′	61.1′
4	236°27.4	31.8	232°09.5	6.8′	17°25.1	14.7′	61.1′
5	251°27.4	31.0	246°35.4	6.9′	17°10.4	14.8′	61.1′
6	266°27.4	S14°30.2	261°01.3	7.0′	S16°55.6	15.0′	61.1′
7	281°27.4	29.4	275°27.3	7.1′	16°40.6	15.0′	61.1′
8	296°27.3	28.6	289°53.4	7.2′	16°25.6	15.1′	61.1′
9	311°27.3	·· 27.8	304°19.6	7.3′	16°10.5	15.3′	61.1′
10	326°27.3	27.0	318°45.9	7.4′	15°55.2	15.4′	61.1′
11	341°27.3	26.2	333°12.3	7.5′	15°39.8	15.4′	61.1′
12	356°27.3	S14°25.4	347°38.7	7.5′	S15°24.4	15.6′	61.1′
13	11°27.3	24.6	2°05.2	7.6′	15°08.8	15.6′	61.1′
14	26°27.3	23.7	16°31.9	7.7′	14°53.2	15.7′	61.1′
15	41°27.3	·· 22.9	30°58.6	7.8′	14°37.5	15.9′	61.2′
16	56°27.2	22.1	45°25.4	7.9′	14°21.6	15.9′	61.2′
17	71°27.2	21.3	59°52.2	8.0′	14°05.7	16.0′	61.2′
18	86°27.2	S14°20.5	74°19.2	8.0′	S13°49.7	16.1′	61.2′
19	101°27.2	19.7	88°46.2	8.1′	13°33.6	16.2′	61.2′
20	116°27.2	18.9	103°13.4	8.2′	13°17.4	16.2′	61.2′
21	131°27.2	·· 18.0	117°40.6	8.3′	13°01.2	16.4′	61.2′
22	146°27.2	17.2	132°07.8	8.4′	12°44.8	16.4′	61.2′
23	161°27.2	16.4	146°35.2	8.4′	12°28.4	16.5′	61.2′
	SD = 16.2′	d = 0.8′	SD = 16.7′				

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	176°27.2	S14°15.6	161°02.6	8.5′	S12°11.9	16.5′	61.1′
1	191°27.2	14.8	175°30.2	8.6′	11°55.4	16.7′	61.1′
2	206°27.2	14.0	189°57.7	8.7′	11°38.7	16.7′	61.1′
3	221°27.2	·· 13.2	204°25.4	8.7′	11°22.0	16.7′	61.1′
4	236°27.1	12.3	218°53.2	8.8′	11°05.3	16.8′	61.1′
5	251°27.1	11.5	233°21.0	8.9′	10°48.5	16.9′	61.1′
6	266°27.1	S14°10.7	247°48.9	9.0′	S10°31.6	17.0′	61.1′
7	281°27.1	09.9	262°16.8	9.0′	10°14.6	17.0′	61.1′
8	296°27.1	09.1	276°44.9	9.1′	09°57.6	17.0′	61.1′
9	311°27.1	·· 08.2	291°13.0	9.2′	09°40.6	17.1′	61.1′
10	326°27.1	07.4	305°41.1	9.2′	09°23.5	17.2′	61.1′
11	341°27.1	06.6	320°09.4	9.3′	09°06.3	17.2′	61.1′
12	356°27.1	S14°05.8	334°37.7	9.4′	S08°49.1	17.2′	61.1′
13	11°27.1	05.0	349°06.0	9.4′	08°31.9	17.3′	61.1′
14	26°27.1	04.1	3°34.5	9.5′	08°14.6	17.4′	61.1′
15	41°27.1	·· 03.3	18°03.0	9.6′	07°57.2	17.3′	61.0′
16	56°27.1	02.5	32°31.5	9.6′	07°39.9	17.4′	61.0′
17	71°27.1	01.7	47°00.2	9.7′	07°22.5	17.5′	61.0′
18	86°27.1	S14°00.9	61°28.8	9.7′	S07°05.0	17.5′	61.0′
19	101°27.1	14°00.0	75°57.6	9.8′	06°47.5	17.5′	61.0′
20	116°27.1	13°59.2	90°26.4	9.9′	06°30.0	17.5′	61.0′
21	131°27.1	·· 58.4	104°55.2	9.9′	06°12.5	17.6′	61.0′
22	146°27.1	57.6	119°24.1	10.0′	05°54.9	17.5′	61.0′
23	161°27.1	56.7	133°53.1	10.0′	05°37.4	17.7′	60.9′
	SD = 16.2′	d = 0.8′	SD = 16.7′				

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

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

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 0-2 2-2%
09	14:08	14:09	12:14	11:54	–:–	
10	14:10	14:11	12:14	12:51	00:23	
11	14:11	14:12	12:14	13:45	01:19	

February 12, 13, 14 UT (Mon., Tue., Wed.)

	Aries	Venus		Mars		Jupiter		Saturn	
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	141°32.9	205°26.6	S21°10.5	200°09.9	S21°15.7	105°01.7	N13°25.7	161°31.9	S10°09.9
1	156°35.4	220°25.8	10.0	215°10.4	15.3	120°03.9	25.8	176°34.1	09.8
2	171°37.9	235°25.0	09.6	230°10.8	14.9	135°06.0	25.9	191°36.3	09.7
3	186°40.3	250°24.1	·· 09.2	245°11.3	·· 14.5	150°08.1	·· 26.0	206°38.5	·· 09.6
4	201°42.8	265°23.3	08.8	260°11.7	14.1	165°10.3	26.1	221°40.6	09.5
5	216°45.2	280°22.5	08.3	275°12.2	13.8	180°12.4	26.3	236°42.8	09.4
6	231°47.7	295°21.7	S21°07.9	290°12.6	S21°13.4	195°14.6	N13°26.4	251°45.0	S10°09.3
7	246°50.2	310°20.9	07.5	305°13.0	13.0	210°16.7	26.5	266°47.2	09.1
8	261°52.6	325°20.0	07.0	320°13.5	12.6	225°18.9	26.6	281°49.4	09.0
9	276°55.1	340°19.2	·· 06.6	335°13.9	·· 12.2	240°21.0	·· 26.7	296°51.6	·· 08.9
10	291°57.6	355°18.4	06.2	350°14.4	11.9	255°23.2	26.8	311°53.7	08.8
11	307°00.0	10°17.6	05.8	5°14.8	11.5	270°25.3	27.0	326°55.9	08.7
12	322°02.5	25°16.8	S21°05.3	20°15.3	S21°11.1	285°27.4	N13°27.1	341°58.1	S10°08.6
13	337°05.0	40°15.9	04.9	35°15.7	10.7	300°29.6	27.2	357°00.3	08.5
14	352°07.4	55°15.1	04.4	50°16.2	10.3	315°31.7	27.3	12°02.5	08.4
15	7°09.9	70°14.3	·· 04.0	65°16.6	·· 09.9	330°33.9	·· 27.4	27°04.7	·· 08.3
16	22°12.4	85°13.5	03.6	80°17.1	09.6	345°36.0	27.5	42°06.8	08.1
17	37°14.8	100°12.7	03.1	95°17.5	09.2	0°38.2	27.6	57°09.0	08.0
18	52°17.3	115°11.9	S21°02.7	110°18.0	S21°08.8	15°40.3	N13°27.8	72°11.2	S10°07.9
19	67°19.7	130°11.0	02.2	125°18.4	08.4	30°42.4	27.9	87°13.4	07.8
20	82°22.2	145°10.2	01.8	140°18.9	08.0	45°44.6	28.0	102°15.6	07.7
21	97°24.7	160°09.4	·· 01.4	155°19.3	·· 07.6	60°46.7	·· 28.1	117°17.7	·· 07.6
22	112°27.1	175°08.6	00.9	170°19.8	07.3	75°48.9	28.2	132°19.9	07.5
23	127°29.6	190°07.8	00.5	185°20.2	06.9	90°51.0	28.3	147°22.1	07.4
Mer.pass. 14:31		ν -0.8′	d 0.4′	ν 0.4′	d 0.4′	ν 2.1′	d 0.1′	ν 2.2′	d 0.1′
		m -3.90		m 1.31		m -2.28		m 0.99	

Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	142°32.1	205°07.0	S21°00.0	200°20.7	S21°06.5	105°53.1	N13°28.5	162°24.3	S10°07.2
1	157°34.5	220°06.1	20°59.6	215°21.1	06.1	120°55.3	28.6	177°26.5	07.1
2	172°37.0	235°05.3	59.1	230°21.6	05.7	135°57.4	28.7	192°28.7	07.0
3	187°39.5	250°04.5	·· 58.7	245°22.0	·· 05.3	150°59.6	·· 28.8	207°30.8	·· 06.9
4	202°41.9	265°03.7	58.2	260°22.4	04.9	166°01.7	28.9	222°33.0	06.8
5	217°44.4	280°02.9	57.8	275°22.9	04.5	181°03.8	29.1	237°35.2	06.7
6	232°46.9	295°02.1	S20°57.3	290°23.3	S21°04.1	196°06.0	N13°29.2	252°37.4	S10°06.6
7	247°49.3	310°01.3	56.9	305°23.8	03.8	211°08.1	29.3	267°39.6	06.5
8	262°51.8	325°00.5	56.4	320°24.2	03.4	226°10.3	29.4	282°41.7	06.4
9	277°54.2	339°59.6	·· 55.9	335°24.7	·· 03.0	241°12.4	·· 29.5	297°43.9	·· 06.2
10	292°56.7	354°58.8	55.5	350°25.1	02.6	256°14.5	29.6	312°46.1	06.1
11	307°59.2	9°58.0	55.0	5°25.6	02.2	271°16.7	29.8	327°48.3	06.0
12	323°01.6	24°57.2	S20°54.6	20°26.0	S21°01.8	286°18.8	N13°29.9	342°50.5	S10°05.9
13	338°04.1	39°56.4	54.1	35°26.5	01.4	301°20.9	30.0	357°52.7	05.8
14	353°06.6	54°55.6	53.6	50°26.9	01.0	316°23.1	30.1	12°54.8	05.7
15	8°09.0	69°54.8	·· 53.2	65°27.4	·· 00.6	331°25.2	·· 30.2	27°57.0	·· 05.6
16	23°11.5	84°54.0	52.7	80°27.8	21°00.2	346°27.4	30.3	42°59.2	05.5
17	38°14.0	99°53.2	52.2	95°28.3	20°59.8	1°29.5	30.5	58°01.4	05.4
18	53°16.4	114°52.4	S20°51.8	110°28.7	S20°59.4	16°31.6	N13°30.6	73°03.6	S10°05.2
19	68°18.9	129°51.5	51.3	125°29.2	59.0	31°33.8	30.7	88°05.7	05.1
20	83°21.3	144°50.7	50.8	140°29.7	58.6	46°35.9	30.8	103°07.9	05.0
21	98°23.8	159°49.9	·· 50.4	155°30.1	·· 58.3	61°38.0	·· 30.9	118°10.1	·· 04.9
22	113°26.3	174°49.1	49.9	170°30.6	57.9	76°40.2	31.1	133°12.3	04.8
23	128°28.7	189°48.3	49.4	185°31.0	57.5	91°42.3	31.2	148°14.5	04.7
Mer.pass. 14:27		ν -0.8′	d 0.4′	ν 0.4′	d 0.4′	ν 2.1′	d 0.1′	ν 2.2′	d 0.1′
		m -3.89		m 1.30		m -2.27		m 0.99	

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	143°31.2	204°47.5	S20°49.0	200°31.5	S20°57.1	106°44.4	N13°31.3	163°16.6	S10°04.6
1	158°33.7	219°46.7	48.5	215°31.9	56.7	121°46.6	31.4	178°18.8	04.5
2	173°36.1	234°45.9	48.0	230°32.4	56.3	136°48.7	31.5	193°21.0	04.3
3	188°38.6	249°45.1	·· 47.5	245°32.8	·· 55.9	151°50.8	·· 31.7	208°23.2	·· 04.2
4	203°41.1	264°44.3	47.1	260°33.3	55.5	166°53.0	31.8	223°25.4	04.1
5	218°43.5	279°43.5	46.6	275°33.7	55.1	181°55.1	31.9	238°27.6	04.0
6	233°46.0	294°42.7	S20°46.1	290°34.2	S20°54.7	196°57.2	N13°32.0	253°29.7	S10°03.9
7	248°48.5	309°41.9	45.6	305°34.6	54.3	211°59.4	32.1	268°31.9	03.8
8	263°50.9	324°41.1	45.1	320°35.1	53.9	227°01.5	32.2	283°34.1	03.7
9	278°53.4	339°40.3	·· 44.7	335°35.5	·· 53.5	242°03.6	·· 32.4	298°36.3	·· 03.6
10	293°55.8	354°39.5	44.2	350°36.0	53.1	257°05.8	32.5	313°38.5	03.5
11	308°58.3	9°38.7	43.7	5°36.4	52.7	272°07.9	32.6	328°40.6	03.3
12	324°00.8	24°37.8	S20°43.2	20°36.9	S20°52.3	287°10.0	N13°32.7	343°42.8	S10°03.2
13	339°03.2	39°37.0	42.7	35°37.3	51.9	302°12.2	32.8	358°45.0	03.1
14	354°05.7	54°36.2	42.2	50°37.8	51.5	317°14.3	33.0	13°47.2	03.0
15	9°08.2	69°35.4	·· 41.7	65°38.2	·· 51.1	332°16.4	·· 33.1	28°49.4	·· 02.9
16	24°10.6	84°34.6	41.2	80°38.7	50.7	347°18.6	33.2	43°51.5	02.8
17	39°13.1	99°33.8	40.8	95°39.2	50.3	2°20.7	33.3	58°53.7	02.7
18	54°15.6	114°33.0	S20°40.3	110°39.6	S20°49.9	17°22.8	N13°33.4	73°55.9	S10°02.6
19	69°18.0	129°32.2	39.8	125°40.1	49.5	32°24.9	33.6	88°58.1	02.4
20	84°20.5	144°31.4	39.3	140°40.5	49.0	47°27.1	33.7	104°00.3	02.3
21	99°22.9	159°30.6	·· 38.8	155°41.0	·· 48.6	62°29.2	·· 33.8	119°02.5	·· 02.2
22	114°25.4	174°29.8	38.3	170°41.4	48.2	77°31.3	33.9	134°04.6	02.1
23	129°27.9	189°29.0	37.8	185°41.9	47.8	92°33.5	34.0	149°06.8	02.0
Mer.pass. 14:24		ν -0.8′	d 0.5′	ν 0.5′	d 0.4′	ν 2.1′	d 0.1′	ν 2.2′	d 0.1′
		m -3.89		m 1.30		m -2.27		m 0.98	

Stars

	SHA	Dec
Alpheratz	357°35.8	29°13.4
Ankaa	353°08.2	-42°10.8
Schedar	349°32.3	56°40.3
Diphda	348°48.3	-17°51.5
Achernar	335°21.0	-57°07.2
Hamal	327°52.2	23°34.6
Polaris	314°27.2	89°22.3
Acamar	315°12.4	-40°12.8
Menkar	314°07.0	4°11.0
Mirfak	308°29.3	49°57.0
Aldebaran	290°40.4	16°33.5
Rigel	281°04.4	-8°10.5
Capella	280°22.8	46°01.5
Bellatrix	278°23.5	6°22.2
Elnath	278°02.6	28°37.7
Alnilam	275°38.3	-1°11.3
Betelgeuse	270°52.7	7°24.6
Canopus	263°52.3	-52°42.7
Sirius	258°26.6	-16°45.1
Adhara	255°06.2	-29°00.4
Procyon	244°51.3	5°09.7
Pollux	243°17.9	27°58.1
Avior	234°14.4	-59°35.3
Suhail	222°46.4	-43°31.8
Miaplacidus	221°37.5	-69°48.9
Alphard	217°48.2	-8°45.8
Regulus	207°34.9	11°50.9
Dubhe	193°41.3	61°37.1
Denebola	182°25.4	14°26.1
Gienah	175°44.1	-17°40.6
Acrux	173°00.5	-63°13.8
Gacrux	171°52.1	-57°14.7
Alioth	166°13.2	55°49.5
Spica	158°22.9	-11°17.3
Alkaid	152°52.4	49°11.3
Hadar	148°36.9	-60°29.1
Menkent	147°58.4	-36°29.2
Arcturus	145°48.5	19°03.2
Rigil Kent.	139°41.2	-60°55.9
Kochab	137°19.5	74°03.0
Zuben'ubi	136°56.8	-16°08.5
Alphecca	126°04.4	26°37.7
Antares	112°16.9	-26°29.1
Atria	107°12.0	-69°04.0
Sabik	102°03.8	-15°45.3
Shaula	96°11.6	-37°07.2
Rasalhague	95°59.4	12°32.3
Eltanin	90°42.8	51°28.8
Kaus Aust.	83°33.8	-34°22.4
Vega	80°34.0	38°48.1
Nunki	75°49.0	-26°16.0
Altair	62°01.0	8°55.7
Peacock	53°07.4	-56°39.5
Deneb	49°26.8	45°21.8
Enif	33°39.9	9°59.0
Al Na'ir	27°34.3	-46°50.8
Fomalhaut	15°15.7	-29°29.9
Scheat	13°46.3	28°12.7
Markab	13°30.9	15°20.0

Feb 12 Mon	SHA	Mer.pass
Venus	63°53.7	10:19
Mars	58°37.0	10:39
Jupiter	323°28.8	16:57
Saturn	19°59.0	13:12

Feb 13 Tue	SHA	Mer.pass
Venus	62°34.9	10:20
Mars	57°48.6	10:38
Jupiter	323°21.1	16:54
Saturn	19°52.2	13:08

Feb 14 Wed	SHA	Mer.pass
Venus	61°16.3	10:21
Mars	57°00.3	10:38
Jupiter	323°13.2	16:51
Saturn	19°45.4	13:05

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°27.1	S13°55.9	148°22.1	10.1′	S05°19.7	17.6′	60.9′
1	191°27.1	55.1	162°51.2	10.1′	05°02.1	17.6′	60.9′
2	206°27.1	54.3	177°20.3	10.2′	04°44.5	17.7′	60.9′
3	221°27.1	·· 53.4	191°49.5	10.2′	04°26.8	17.7′	60.9′
4	236°27.1	52.6	206°18.7	10.3′	04°09.1	17.7′	60.9′
5	251°27.1	51.8	220°47.9	10.3′	03°51.4	17.7′	60.8′
6	266°27.1	S13°51.0	235°17.2	10.3′	S03°33.7	17.7′	60.8′
7	281°27.1	50.1	249°46.6	10.4′	03°16.0	17.7′	60.8′
8	296°27.1	49.3	264°16.0	10.4′	02°58.3	17.7′	60.8′
9	311°27.1	·· 48.5	278°45.4	10.5′	02°40.6	17.7′	60.8′
10	326°27.1	47.6	293°14.9	10.5′	02°22.9	17.7′	60.7′
11	341°27.1	46.8	307°44.4	10.5′	02°05.2	17.8′	60.7′
12	356°27.1	S13°46.0	322°13.9	10.6′	S01°47.4	17.7′	60.7′
13	11°27.1	45.1	336°43.5	10.6′	01°29.7	17.7′	60.7′
14	26°27.1	44.3	351°13.1	10.6′	01°12.0	17.7′	60.7′
15	41°27.1	·· 43.5	5°42.8	10.7′	00°54.3	17.7′	60.6′
16	56°27.1	42.7	20°12.4	10.7′	00°36.6	17.7′	60.6′
17	71°27.1	41.8	34°42.2	10.7′	00°18.9	17.6′	60.6′
18	86°27.1	S13°41.0	49°11.9	10.8′	S00°01.3	17.7′	60.6′
19	101°27.1	40.2	63°41.7	10.8′	N00°16.4	17.6′	60.5′
20	116°27.1	39.3	78°11.5	10.8′	00°34.0	17.7′	60.5′
21	131°27.2	·· 38.5	92°41.3	10.8′	00°51.7	17.6′	60.5′
22	146°27.2	37.7	107°11.1	10.9′	01°09.3	17.5′	60.5′
23	161°27.2	36.8	121°41.0	10.9′	01°26.8	17.6′	60.4′
	SD = 16.2′	d = 0.8′	SD = 16.6′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°27.2	S13°36.0	136°10.9	10.9′	N01°44.4	17.5′	60.4′
1	191°27.2	35.2	150°40.8	10.9′	02°01.9	17.5′	60.4′
2	206°27.2	34.3	165°10.7	10.9′	02°19.4	17.5′	60.4′
3	221°27.2	·· 33.5	179°40.7	11.0′	02°36.9	17.5′	60.3′
4	236°27.2	32.6	194°10.6	11.0′	02°54.4	17.4′	60.3′
5	251°27.2	31.8	208°40.6	11.0′	03°11.8	17.4′	60.3′
6	266°27.2	S13°31.0	223°10.6	11.0′	N03°29.2	17.3′	60.3′
7	281°27.2	30.1	237°40.6	11.0′	03°46.5	17.3′	60.2′
8	296°27.3	29.3	252°10.6	11.0′	04°03.8	17.3′	60.2′
9	311°27.3	·· 28.5	266°40.6	11.0′	04°21.1	17.2′	60.2′
10	326°27.3	27.6	281°10.7	11.0′	04°38.3	17.2′	60.1′
11	341°27.3	26.8	295°40.7	11.0′	04°55.5	17.1′	60.1′
12	356°27.3	S13°25.9	310°10.7	11.1′	N05°12.6	17.1′	60.1′
13	11°27.3	25.1	324°40.8	11.1′	05°29.7	17.1′	60.1′
14	26°27.3	24.3	339°10.9	11.1′	05°46.8	17.0′	60.0′
15	41°27.3	·· 23.4	353°40.9	11.1′	06°03.8	16.9′	60.0′
16	56°27.3	22.6	8°11.0	11.1′	06°20.7	16.9′	60.0′
17	71°27.4	21.7	22°41.0	11.1′	06°37.6	16.9′	59.9′
18	86°27.4	S13°20.9	37°11.1	11.1′	N06°54.5	16.7′	59.9′
19	101°27.4	20.1	51°41.1	11.1′	07°11.2	16.8′	59.9′
20	116°27.4	19.2	66°11.2	11.0′	07°28.0	16.7′	59.8′
21	131°27.4	·· 18.4	80°41.2	11.0′	07°44.7	16.6′	59.8′
22	146°27.4	17.5	95°11.3	11.0′	08°01.3	16.5′	59.8′
23	161°27.4	16.7	109°41.3	11.0′	08°17.8	16.5′	59.7′
	SD = 16.2′	d = 0.8′	SD = 16.5′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°27.5	S13°15.8	124°11.3	11.0′	N08°34.3	16.4′	59.7′
1	191°27.5	15.0	138°41.3	11.0′	08°50.7	16.4′	59.7′
2	206°27.5	14.2	153°11.3	11.0′	09°07.1	16.3′	59.7′
3	221°27.5	·· 13.3	167°41.3	11.0′	09°23.4	16.2′	59.6′
4	236°27.5	12.5	182°11.3	11.0′	09°39.6	16.2′	59.6′
5	251°27.5	11.6	196°41.3	11.0′	09°55.8	16.1′	59.6′
6	266°27.6	S13°10.8	211°11.2	10.9′	N10°11.9	16.0′	59.5′
7	281°27.6	09.9	225°41.2	10.9′	10°27.9	15.9′	59.5′
8	296°27.6	09.1	240°11.1	10.9′	10°43.8	15.9′	59.5′
9	311°27.6	·· 08.2	254°41.0	10.9′	10°59.7	15.8′	59.4′
10	326°27.6	07.4	269°10.9	10.9′	11°15.5	15.7′	59.4′
11	341°27.7	06.5	283°40.7	10.8′	11°31.2	15.6′	59.3′
12	356°27.7	S13°05.7	298°10.6	10.8′	N11°46.8	15.6′	59.3′
13	11°27.7	04.8	312°40.4	10.8′	12°02.4	15.4′	59.3′
14	26°27.7	04.0	327°10.2	10.8′	12°17.8	15.4′	59.2′
15	41°27.7	·· 03.1	341°40.0	10.7′	12°33.2	15.3′	59.2′
16	56°27.8	02.3	356°09.7	10.7′	12°48.5	15.2′	59.2′
17	71°27.8	01.4	10°39.4	10.7′	13°03.7	15.2′	59.1′
18	86°27.8	S13°00.6	25°09.1	10.7′	N13°18.9	15.0′	59.1′
19	101°27.8	12°59.7	39°38.8	10.6′	13°33.9	15.0′	59.1′
20	116°27.9	58.9	54°08.4	10.6′	13°48.9	14.8′	59.0′
21	131°27.9	·· 58.0	68°38.0	10.6′	14°03.7	14.8′	59.0′
22	146°27.9	57.2	83°07.6	10.5′	14°18.5	14.6′	59.0′
23	161°27.9	56.3	97°37.2	10.5′	14°33.1	14.6′	58.9′
	SD = 16.2′	d = 0.8′	SD = 16.3′				

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

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

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 3-5 6-22%
12	14:12	14:12	12:14	14:36	02:11	
13	14:11	14:11	12:14	15:26	03:01	
14	14:10	14:09	12:14	16:16	03:51	

February 15, 16, 17 UT (Thu., Fri., Sat.)

	Aries	Venus		Mars		Jupiter		Saturn	
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	144°30.3	204°28.2	S20°37.3	200°42.3	S20°47.4	107°35.6	N13°34.2	164°09.0	S10°01.9
1	159°32.8	219°27.4	36.8	215°42.8	47.0	122°37.7	34.3	179°11.2	01.8
2	174°35.3	234°26.6	36.3	230°43.2	46.6	137°39.8	34.4	194°13.4	01.7
3	189°37.7	249°25.9	·· 35.8	245°43.7	·· 46.2	152°42.0	·· 34.5	209°15.5	·· 01.6
4	204°40.2	264°25.1	35.3	260°44.2	45.8	167°44.1	34.6	224°17.7	01.4
5	219°42.7	279°24.3	34.8	275°44.6	45.4	182°46.2	34.8	239°19.9	01.3
6	234°45.1	294°23.5	S20°34.3	290°45.1	S20°45.0	197°48.4	N13°34.9	254°22.1	S10°01.2
7	249°47.6	309°22.7	33.8	305°45.5	44.6	212°50.5	35.0	269°24.3	01.1
8	264°50.1	324°21.9	33.3	320°46.0	44.2	227°52.6	35.1	284°26.4	01.0
9	279°52.5	339°21.1	·· 32.7	335°46.4	·· 43.8	242°54.7	·· 35.3	299°28.6	·· 00.9
10	294°55.0	354°20.3	32.2	350°46.9	43.3	257°56.9	35.4	314°30.8	00.8
11	309°57.4	9°19.5	31.7	5°47.3	42.9	272°59.0	35.5	329°33.0	00.7
12	324°59.9	24°18.7	S20°31.2	20°47.8	S20°42.5	288°01.1	N13°35.6	344°35.2	S10°00.5
13	340°02.4	39°17.9	30.7	35°48.3	42.1	303°03.2	35.7	359°37.3	00.4
14	355°04.8	54°17.1	30.2	50°48.7	41.7	318°05.4	35.9	14°39.5	00.3
15	10°07.3	69°16.3	·· 29.7	65°49.2	·· 41.3	333°07.5	·· 36.0	29°41.7	·· 00.2
16	25°09.8	84°15.5	29.2	80°49.6	40.9	348°09.6	36.1	44°43.9	00.1
17	40°12.2	99°14.7	28.6	95°50.1	40.5	3°11.7	36.2	59°46.1	10°00.0
18	55°14.7	114°13.9	S20°28.1	110°50.5	S20°40.1	18°13.9	N13°36.3	74°48.2	S09°59.9
19	70°17.2	129°13.1	27.6	125°51.0	39.6	33°16.0	36.5	89°50.4	59.8
20	85°19.6	144°12.3	27.1	140°51.5	39.2	48°18.1	36.6	104°52.6	59.6
21	100°22.1	159°11.6	·· 26.6	155°51.9	·· 38.8	63°20.2	·· 36.7	119°54.8	·· 59.5
22	115°24.6	174°10.8	26.0	170°52.4	38.4	78°22.3	36.8	134°57.0	59.4
23	130°27.0	189°10.0	25.5	185°52.8	38.0	93°24.5	37.0	149°59.1	59.3
Mer.pass. 14:20		ν -0.8′ d 0.5′		m -3.89	ν 0.5′ d 0.4′		m 1.30	ν 2.1′ d 0.1′	m -2.26
								ν 2.2′ d 0.1′	m 0.98

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	145°29.5	204°09.2	S20°25.0	200°53.3	S20°37.6	108°26.6	N13°37.1	165°01.3	S09°59.2
1	160°31.9	219°08.4	24.5	215°53.7	37.2	123°28.7	37.2	180°03.5	59.1
2	175°34.4	234°07.6	23.9	230°54.2	36.7	138°30.8	37.3	195°05.7	59.0
3	190°36.9	249°06.8	·· 23.4	245°54.7	·· 36.3	153°33.0	·· 37.4	210°07.9	·· 58.9
4	205°39.3	264°06.0	22.9	260°55.1	35.9	168°35.1	37.6	225°10.0	58.7
5	220°41.8	279°05.2	22.4	275°55.6	35.5	183°37.2	37.7	240°12.2	58.6
6	235°44.3	294°04.5	S20°21.8	290°56.0	S20°35.1	198°39.3	N13°37.8	255°14.4	S09°58.5
7	250°46.7	309°03.7	21.3	305°56.5	34.6	213°41.4	37.9	270°16.6	58.4
8	265°49.2	324°02.9	20.8	320°57.0	34.2	228°43.6	38.1	285°18.8	58.3
9	280°51.7	339°02.1	·· 20.2	335°57.4	·· 33.8	243°45.7	·· 38.2	300°20.9	·· 58.2
10	295°54.1	354°01.3	19.7	350°57.9	33.4	258°47.8	38.3	315°23.1	58.1
11	310°56.6	9°00.5	19.2	5°58.3	33.0	273°49.9	38.4	330°25.3	58.0
12	325°59.0	23°59.7	S20°18.6	20°58.8	S20°32.6	288°52.0	N13°38.5	345°27.5	S09°57.9
13	341°01.5	38°59.0	18.1	35°59.3	32.1	303°54.2	38.7	0°29.7	57.7
14	356°04.0	53°58.2	17.6	50°59.7	31.7	318°56.3	38.8	15°31.8	57.6
15	11°06.4	68°57.4	·· 17.0	66°00.2	·· 31.3	333°58.4	·· 38.9	30°34.0	·· 57.5
16	26°08.9	83°56.6	16.5	81°00.6	30.9	349°00.5	39.0	45°36.2	57.4
17	41°11.4	98°55.8	15.9	96°01.1	30.4	4°02.6	39.2	60°38.4	57.3
18	56°13.8	113°55.0	S20°15.4	111°01.6	S20°30.0	19°04.8	N13°39.3	75°40.6	S09°57.2
19	71°16.3	128°54.3	14.8	126°02.0	29.6	34°06.9	39.4	90°42.7	57.1
20	86°18.8	143°53.5	14.3	141°02.5	29.2	49°09.0	39.5	105°44.9	57.0
21	101°21.2	158°52.7	·· 13.8	156°02.9	·· 28.8	64°11.1	·· 39.6	120°47.1	·· 56.8
22	116°23.7	173°51.9	13.2	171°03.4	28.3	79°13.2	39.8	135°49.3	56.7
23	131°26.2	188°51.1	12.7	186°03.9	27.9	94°15.3	39.9	150°51.5	56.6
Mer.pass. 14:16		ν -0.8′ d 0.5′		m -3.89	ν 0.5′ d 0.4′		m 1.30	ν 2.1′ d 0.1′	m -2.25
								ν 2.2′ d 0.1′	m 0.98

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	146°28.6	203°50.3	S20°12.1	201°04.3	S20°27.5	109°17.5	N13°40.0	165°53.6	S09°56.5
1	161°31.1	218°49.6	11.6	216°04.8	27.1	124°19.6	40.1	180°55.8	56.4
2	176°33.5	233°48.8	11.0	231°05.2	26.6	139°21.7	40.3	195°58.0	56.3
3	191°36.0	248°48.0	·· 10.5	246°05.7	·· 26.2	154°23.8	·· 40.4	211°00.2	·· 56.2
4	206°38.5	263°47.2	09.9	261°06.2	25.8	169°25.9	40.5	226°02.4	56.1
5	221°40.9	278°46.4	09.4	276°06.6	25.4	184°28.0	40.6	241°04.5	55.9
6	236°43.4	293°45.7	S20°08.8	291°07.1	S20°24.9	199°30.2	N13°40.8	256°06.7	S09°55.8
7	251°45.9	308°44.9	08.2	306°07.6	24.5	214°32.3	40.9	271°08.9	55.7
8	266°48.3	323°44.1	07.7	321°08.0	24.1	229°34.4	41.0	286°11.1	55.6
9	281°50.8	338°43.3	·· 07.1	336°08.5	·· 23.6	244°36.5	·· 41.1	301°13.3	·· 55.5
10	296°53.3	353°42.6	06.6	351°08.9	23.2	259°38.6	41.3	316°15.4	55.4
11	311°55.7	8°41.8	06.0	6°09.4	22.8	274°40.7	41.4	331°17.6	55.3
12	326°58.2	23°41.0	S20°05.4	21°09.9	S20°22.4	289°42.8	N13°41.5	346°19.8	S09°55.2
13	342°00.7	38°40.2	04.9	36°10.3	21.9	304°45.0	41.6	1°22.0	55.0
14	357°03.1	53°39.5	04.3	51°10.8	21.5	319°47.1	41.8	16°24.2	54.9
15	12°05.6	68°38.7	·· 03.8	66°11.3	·· 21.1	334°49.2	·· 41.9	31°26.3	·· 54.8
16	27°08.0	83°37.9	03.2	81°11.7	20.6	349°51.3	42.0	46°28.5	54.7
17	42°10.5	98°37.1	02.6	96°12.2	20.2	4°53.4	42.1	61°30.7	54.6
18	57°13.0	113°36.4	S20°02.1	111°12.7	S20°19.8	19°55.5	N13°42.3	76°32.9	S09°54.5
19	72°15.4	128°35.6	01.5	126°13.1	19.3	34°57.6	42.4	91°35.0	54.4
20	87°17.9	143°34.8	00.9	141°13.6	18.9	49°59.7	42.5	106°37.2	54.3
21	102°20.4	158°34.0	20°00.3	156°14.0	·· 18.5	65°01.9	·· 42.6	121°39.4	·· 54.1
22	117°22.8	173°33.3	19°59.8	171°14.5	18.0	80°04.0	42.7	136°41.6	54.0
23	132°25.3	188°32.5	59.2	186°15.0	17.6	95°06.1	42.9	151°43.8	53.9
Mer.pass. 14:12		ν -0.8′ d 0.5′		m -3.89	ν 0.5′ d 0.4′		m 1.29	ν 2.1′ d 0.1′	m -2.25
								ν 2.2′ d 0.1′	m 0.98

Stars	SHA	Dec
Alpheratz	357°35.8	29°13.4
Ankaa	353°08.2	-42°10.7
Schedar	349°32.3	56°40.3
Diphda	348°48.3	-17°51.5
Achernar	335°21.0	-57°07.2
Hamal	327°52.2	23°34.6
Polaris	314°28.6	89°22.3
Acamar	315°12.4	-40°12.8
Menkar	314°07.0	4°11.0
Mirfak	308°29.3	49°57.0
Aldebaran	290°40.4	16°33.5
Rigel	281°04.4	-8°10.5
Capella	280°22.8	46°01.5
Bellatrix	278°23.5	6°22.2
Elnath	278°02.6	28°37.7
Alnilam	275°38.3	-1°11.3
Betelgeuse	270°52.7	7°24.6
Canopus	263°52.4	-52°42.7
Sirius	258°26.6	-16°45.1
Adhara	255°06.2	-29°00.4
Procyon	244°51.3	5°09.7
Pollux	243°17.9	27°58.1
Avior	234°14.5	-59°35.3
Suhail	222°46.4	-43°31.8
Miaplacidus	221°37.6	-69°49.0
Alphard	217°48.2	-8°45.9
Regulus	207°34.9	11°50.9
Dubhe	193°41.2	61°37.1
Denebola	182°25.4	14°26.1
Gienah	175°44.1	-17°40.6
Acrux	173°00.5	-63°13.8
Gacrux	171°52.1	-57°14.7
Alioth	166°13.2	55°49.5
Spica	158°22.9	-11°17.3
Alkaid	152°52.3	49°11.3
Hadar	148°36.8	-60°29.1
Menkent	147°58.4	-36°29.2
Arcturus	145°48.5	19°03.2
Rigil Kent.	139°41.2	-60°55.9
Kochab	137°19.5	74°03.0
Zuben'ubi	136°56.8	-16°08.5
Alphecca	126°04.4	26°37.7
Antares	112°16.8	-26°29.1
Atria	107°11.9	-69°04.0
Sabik	102°03.8	-15°45.3
Shaula	96°11.6	-37°07.2
Rasalhague	95°59.4	12°32.3
Eltanin	90°42.8	51°28.8
Kaus Aust.	83°33.8	-34°22.4
Vega	80°34.0	38°48.1
Nunki	75°48.9	-26°16.0
Altair	62°01.0	8°55.7
Peacock	53°07.4	-56°39.4
Deneb	49°26.8	45°21.8
Enif	33°39.9	9°59.0
Al Na'ir	27°34.3	-46°50.8
Fomalhaut	15°15.7	-29°29.9
Scheat	13°46.3	28°12.7
Markab	13°30.9	15°20.0

Feb 15 Thu	SHA	Mer.pass
Venus	59°57.9	10:23
Mars	56°12.0	10:37
Jupiter	323°05.2	16:47
Saturn	19°38.7	13:02

Feb 16 Fri	SHA	Mer.pass
Venus	58°39.7	10:24
Mars	55°23.8	10:36
Jupiter	322°57.1	16:44
Saturn	19°31.8	12:58

Feb 17 Sat	SHA	Mer.pass
Venus	57°21.7	10:25
Mars	54°35.7	10:35
Jupiter	322°48.8	16:40
Saturn	19°25.0	12:55

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°27.9	S12°55.5	112°06.7	10.5′	N14°47.7	14.5′	58.9′
1	191°28.0	54.6	126°36.2	10.5′	15°02.2	14.4′	58.9′
2	206°28.0	53.8	141°05.6	10.4′	15°16.6	14.3′	58.8′
3	221°28.0	·· 52.9	155°35.1	10.4′	15°30.9	14.2′	58.8′
4	236°28.0	52.1	170°04.4	10.3′	15°45.1	14.0′	58.8′
5	251°28.1	51.2	184°33.8	10.3′	15°59.1	14.0′	58.7′
6	266°28.1	S12°50.4	199°03.1	10.3′	N16°13.1	13.9′	58.7′
7	281°28.1	49.5	213°32.4	10.2′	16°27.0	13.8′	58.6′
8	296°28.1	48.6	228°01.6	10.2′	16°40.8	13.6′	58.6′
9	311°28.2	·· 47.8	242°30.8	10.2′	16°54.4	13.6′	58.6′
10	326°28.2	46.9	257°00.0	10.1′	17°08.0	13.5′	58.5′
11	341°28.2	46.1	271°29.1	10.1′	17°21.5	13.3′	58.5′
12	356°28.3	S12°45.2	285°58.2	10.0′	N17°34.8	13.2′	58.5′
13	11°28.3	44.4	300°27.3	10.0′	17°48.0	13.2′	58.4′
14	26°28.3	43.5	314°56.3	10.0′	18°01.2	13.0′	58.4′
15	41°28.3	·· 42.6	329°25.2	9.9′	18°14.2	12.9′	58.4′
16	56°28.4	41.8	343°54.1	9.9′	18°27.1	12.8′	58.3′
17	71°28.4	40.9	358°23.0	9.8′	18°39.9	12.6′	58.3′
18	86°28.4	S12°40.1	12°51.9	9.8′	N18°52.5	12.6′	58.3′
19	101°28.5	39.2	27°20.7	9.8′	19°05.1	12.4′	58.2′
20	116°28.5	38.4	41°49.4	9.7′	19°17.5	12.3′	58.2′
21	131°28.5	·· 37.5	56°18.1	9.7′	19°29.8	12.2′	58.1′
22	146°28.5	36.6	70°46.8	9.6′	19°42.0	12.1′	58.1′
23	161°28.6	35.8	85°15.4	9.6′	19°54.1	11.9′	58.1′
	SD = 16.2′	d = 0.9′	SD = 16.1′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°28.6	S12°34.9	99°44.0	9.5′	N20°06.0	11.9′	58.0′
1	191°28.6	34.1	114°12.6	9.5′	20°17.9	11.7′	58.0′
2	206°28.7	33.2	128°41.1	9.5′	20°29.6	11.6′	58.0′
3	221°28.7	·· 32.3	143°09.5	9.4′	20°41.2	11.4′	57.9′
4	236°28.7	31.5	157°37.9	9.4′	20°52.6	11.4′	57.9′
5	251°28.8	30.6	172°06.3	9.3′	21°04.0	11.2′	57.9′
6	266°28.8	S12°29.7	186°34.6	9.3′	N21°15.2	11.0′	57.8′
7	281°28.8	28.9	201°02.9	9.2′	21°26.2	11.0′	57.8′
8	296°28.9	28.0	215°31.1	9.2′	21°37.2	10.8′	57.8′
9	311°28.9	·· 27.1	229°59.3	9.1′	21°48.0	10.7′	57.7′
10	326°28.9	26.3	244°27.4	9.1′	21°58.7	10.5′	57.7′
11	341°29.0	25.4	258°55.5	9.1′	22°09.2	10.5′	57.7′
12	356°29.0	S12°24.6	273°23.6	9.0′	N22°19.7	10.2′	57.6′
13	11°29.1	23.7	287°51.6	9.0′	22°29.9	10.2′	57.6′
14	26°29.1	22.8	302°19.6	8.9′	22°40.1	10.0′	57.6′
15	41°29.1	·· 22.0	316°47.5	8.9′	22°50.1	9.9′	57.5′
16	56°29.2	21.1	331°15.4	8.8′	23°00.0	9.7′	57.5′
17	71°29.2	20.2	345°43.2	8.8′	23°09.7	9.6′	57.5′
18	86°29.2	S12°19.4	0°11.0	8.8′	N23°19.3	9.5′	57.4′
19	101°29.3	18.5	14°38.7	8.7′	23°28.8	9.3′	57.4′
20	116°29.3	17.6	29°06.5	8.7′	23°38.1	9.2′	57.4′
21	131°29.3	·· 16.7	43°34.1	8.6′	23°47.3	9.1′	57.3′
22	146°29.4	15.9	58°01.8	8.6′	23°56.4	8.9′	57.3′
23	161°29.4	15.0	72°29.3	8.5′	24°05.3	8.8′	57.3′
	SD = 16.2′	d = 0.9′	SD = 15.8′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°29.5	S12°14.1	86°56.9	8.5′	N24°14.1	8.6′	57.2′
1	191°29.5	13.3	101°24.4	8.5′	24°22.7	8.5′	57.2′
2	206°29.5	12.4	115°51.9	8.4′	24°31.2	8.3′	57.2′
3	221°29.6	·· 11.5	130°19.3	8.4′	24°39.5	8.2′	57.1′
4	236°29.6	10.7	144°46.7	8.4′	24°47.7	8.0′	57.1′
5	251°29.7	09.8	159°14.0	8.3′	24°55.7	7.9′	57.1′
6	266°29.7	S12°08.9	173°41.4	8.3′	N25°03.6	7.8′	57.0′
7	281°29.7	08.0	188°08.6	8.2′	25°11.4	7.6′	57.0′
8	296°29.8	07.2	202°35.9	8.2′	25°19.0	7.4′	57.0′
9	311°29.8	·· 06.3	217°03.1	8.2′	25°26.4	7.3′	56.9′
10	326°29.9	05.4	231°30.3	8.1′	25°33.7	7.2′	56.9′
11	341°29.9	04.6	245°57.4	8.1′	25°40.9	7.0′	56.9′
12	356°30.0	S12°03.7	260°24.5	8.1′	N25°47.9	6.9′	56.8′
13	11°30.0	02.8	274°51.6	8.1′	25°54.8	6.7′	56.8′
14	26°30.0	01.9	289°18.7	8.0′	26°01.5	6.5′	56.8′
15	41°30.1	·· 01.1	303°45.7	8.0′	26°08.0	6.4′	56.7′
16	56°30.1	12°00.2	318°12.7	8.0′	26°14.4	6.3′	56.7′
17	71°30.2	11°59.3	332°39.7	7.9′	26°20.7	6.1′	56.7′
18	86°30.2	S11°58.4	347°06.6	7.9′	N26°26.8	5.9′	56.6′
19	101°30.3	57.6	1°33.5	7.9′	26°32.7	5.8′	56.6′
20	116°30.3	56.7	16°00.4	7.9′	26°38.5	5.7′	56.6′
21	131°30.4	·· 55.8	30°27.3	7.9′	26°44.2	5.4′	56.6′
22	146°30.4	54.9	44°54.2	7.8′	26°49.6	5.4′	56.5′
23	161°30.5	54.1	59°21.0	7.8′	26°55.0	5.2′	56.5′
	SD = 16.2′	d = 0.9′	SD = 15.6′				

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

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

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 6-8 32-54%
15	14:08	14:07	12:14	17:07	04:41	
16	14:06	14:04	12:14	17:59	05:33	
17	14:02	14:00	12:14	18:54	06:26	

February 18, 19, 20 UT (Sun., Monday., Tue.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	147°27.8	203°31.7	S19°58.6	201°15.4	S20°17.2	110°08.2	N13°43.0	166°45.9	S09°53.8
1	162°30.2	218°31.0	58.1	216°15.9	16.7	125°10.3	43.1	181°48.1	53.7
2	177°32.7	233°30.2	57.5	231°16.4	16.3	140°12.4	43.2	196°50.3	53.6
3	192°35.2	248°29.4	·· 56.9	246°16.8	·· 15.9	155°14.5	·· 43.4	211°52.5	·· 53.5
4	207°37.6	263°28.6	56.3	261°17.3	15.4	170°16.6	43.5	226°54.7	53.4
5	222°40.1	278°27.9	55.7	276°17.8	15.0	185°18.7	43.6	241°56.8	53.2
6	237°42.5	293°27.1	S19°55.2	291°18.2	S20°14.6	200°20.9	N13°43.8	256°59.0	S09°53.1
7	252°45.0	308°26.3	54.6	306°18.7	14.1	215°23.0	43.9	272°01.2	53.0
8	267°47.5	323°25.6	54.0	321°19.2	13.7	230°25.1	44.0	287°03.4	52.9
9	282°49.9	338°24.8	·· 53.4	336°19.6	·· 13.3	245°27.2	·· 44.1	302°05.6	·· 52.8
10	297°52.4	353°24.0	52.8	351°20.1	12.8	260°29.3	44.3	317°07.7	52.7
11	312°54.9	8°23.3	52.3	6°20.6	12.4	275°31.4	44.4	332°09.9	52.6
12	327°57.3	23°22.5	S19°51.7	21°21.0	S20°11.9	290°33.5	N13°44.5	347°12.1	S09°52.4
13	342°59.8	38°21.7	51.1	36°21.5	11.5	305°35.6	44.6	2°14.3	52.3
14	358°02.3	53°21.0	50.5	51°22.0	11.1	320°37.7	44.8	17°16.5	52.2
15	13°04.7	68°20.2	·· 49.9	66°22.4	·· 10.6	335°39.8	·· 44.9	32°18.6	·· 52.1
16	28°07.2	83°19.4	49.3	81°22.9	10.2	350°41.9	45.0	47°20.8	52.0
17	43°09.7	98°18.7	48.7	96°23.4	09.8	5°44.0	45.1	62°23.0	51.9
18	58°12.1	113°17.9	S19°48.1	111°23.8	S20°09.3	20°46.1	N13°45.3	77°25.2	S09°51.8
19	73°14.6	128°17.1	47.5	126°24.3	08.9	35°48.3	45.4	92°27.3	51.7
20	88°17.0	143°16.4	47.0	141°24.8	08.4	50°50.4	45.5	107°29.5	51.5
21	103°19.5	158°15.6	·· 46.4	156°25.2	·· 08.0	65°52.5	·· 45.6	122°31.7	·· 51.4
22	118°22.0	173°14.8	45.8	171°25.7	07.5	80°54.6	45.8	137°33.9	51.3
23	133°24.4	188°14.1	45.2	186°26.2	07.1	95°56.7	45.9	152°36.1	51.2
Mer.pass. 14:08		ν -0.8′	d 0.6′	m -3.89	ν 0.5′	d 0.4′	m 1.29	ν 2.1′	d 0.1′ m -2.24	ν 2.2′	d 0.1′ m 0.98

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	148°26.9	203°13.3	S19°44.6	201°26.6	S20°06.7	110°58.8	N13°46.0	167°38.2	S09°51.1
1	163°29.4	218°12.6	44.0	216°27.1	06.2	126°00.9	46.1	182°40.4	51.0
2	178°31.8	233°11.8	43.4	231°27.6	05.8	141°03.0	46.3	197°42.6	50.9
3	193°34.3	248°11.0	·· 42.8	246°28.0	·· 05.3	156°05.1	·· 46.4	212°44.8	·· 50.8
4	208°36.8	263°10.3	42.2	261°28.5	04.9	171°07.2	46.5	227°47.0	50.6
5	223°39.2	278°09.5	41.6	276°29.0	04.4	186°09.3	46.6	242°49.1	50.5
6	238°41.7	293°08.8	S19°41.0	291°29.4	S20°04.0	201°11.4	N13°46.8	257°51.3	S09°50.4
7	253°44.1	308°08.0	40.4	306°29.9	03.6	216°13.5	46.9	272°53.5	50.3
8	268°46.6	323°07.2	39.8	321°30.4	03.1	231°15.6	47.0	287°55.7	50.2
9	283°49.1	338°06.5	·· 39.1	336°30.9	·· 02.7	246°17.7	·· 47.2	302°57.8	·· 50.1
10	298°51.5	353°05.7	38.5	351°31.3	02.2	261°19.8	47.3	318°00.0	50.0
11	313°54.0	8°05.0	37.9	6°31.8	01.8	276°21.9	47.4	333°02.2	49.9
12	328°56.5	23°04.2	S19°37.3	21°32.3	S20°01.3	291°24.0	N13°47.5	348°04.4	S09°49.7
13	343°58.9	38°03.5	36.7	36°32.7	00.9	306°26.1	47.7	3°06.6	49.6
14	359°01.4	53°02.7	36.1	51°33.2	00.4	321°28.2	47.8	18°08.7	49.5
15	14°03.9	68°01.9	·· 35.5	66°33.7	20°00.0	336°30.3	·· 47.9	33°10.9	·· 49.4
16	29°06.3	83°01.2	34.9	81°34.1	19°59.5	351°32.4	48.0	48°13.1	49.3
17	44°08.8	98°00.4	34.3	96°34.6	59.1	6°34.5	48.2	63°15.3	49.2
18	59°11.3	112°59.7	S19°33.6	111°35.1	S19°58.6	21°36.6	N13°48.3	78°17.5	S09°49.1
19	74°13.7	127°58.9	33.0	126°35.6	58.2	36°38.7	48.4	93°19.6	49.0
20	89°16.2	142°58.2	32.4	141°36.0	57.7	51°40.8	48.6	108°21.8	48.8
21	104°18.6	157°57.4	·· 31.8	156°36.5	·· 57.3	66°42.9	·· 48.7	123°24.0	·· 48.7
22	119°21.1	172°56.7	31.2	171°37.0	56.8	81°45.0	48.8	138°26.2	48.6
23	134°23.6	187°55.9	30.5	186°37.4	56.4	96°47.1	48.9	153°28.3	48.5
Mer.pass. 14:04		ν -0.8′	d 0.6′	m -3.89	ν 0.5′	d 0.4′	m 1.29	ν 2.1′	d 0.1′ m -2.24	ν 2.2′	d 0.1′ m 0.98

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	149°26.0	202°55.2	S19°29.9	201°37.9	S19°55.9	111°49.2	N13°49.1	168°30.5	S09°48.4
1	164°28.5	217°54.4	29.3	216°38.4	55.5	126°51.3	49.2	183°32.7	48.3
2	179°31.0	232°53.7	28.7	231°38.9	55.0	141°53.4	49.3	198°34.9	48.2
3	194°33.4	247°52.9	·· 28.1	246°39.3	·· 54.6	156°55.5	·· 49.5	213°37.1	·· 48.0
4	209°35.9	262°52.2	27.4	261°39.8	54.1	171°57.6	49.6	228°39.2	47.9
5	224°38.4	277°51.4	26.8	276°40.3	53.7	186°59.7	49.7	243°41.4	47.8
6	239°40.8	292°50.7	S19°26.2	291°40.7	S19°53.2	202°01.8	N13°49.8	258°43.6	S09°47.7
7	254°43.3	307°49.9	25.5	306°41.2	52.8	217°03.9	50.0	273°45.8	47.6
8	269°45.8	322°49.2	24.9	321°41.7	52.3	232°06.0	50.1	288°48.0	47.5
9	284°48.2	337°48.4	·· 24.3	336°42.2	·· 51.8	247°08.1	·· 50.2	303°50.1	·· 47.4
10	299°50.7	352°47.7	23.7	351°42.6	51.4	262°10.2	50.4	318°52.3	47.3
11	314°53.1	7°46.9	23.0	6°43.1	50.9	277°12.3	50.5	333°54.5	47.1
12	329°55.6	22°46.2	S19°22.4	21°43.6	S19°50.5	292°14.4	N13°50.6	348°56.7	S09°47.0
13	344°58.1	37°45.4	21.8	36°44.1	50.0	307°16.5	50.7	3°58.8	46.9
14	0°00.5	52°44.7	21.1	51°44.5	49.6	322°18.6	50.9	19°01.0	46.8
15	15°03.0	67°43.9	·· 20.5	66°45.0	·· 49.1	337°20.7	·· 51.0	34°03.2	·· 46.7
16	30°05.5	82°43.2	19.9	81°45.5	48.7	352°22.8	51.1	49°05.4	46.6
17	45°07.9	97°42.4	19.2	96°46.0	48.2	7°24.9	51.3	64°07.6	46.5
18	60°10.4	112°41.7	S19°18.6	111°46.4	S19°47.7	22°27.0	N13°51.4	79°09.7	S09°46.4
19	75°12.9	127°41.0	17.9	126°46.9	47.3	37°29.1	51.5	94°11.9	46.2
20	90°15.3	142°40.2	17.3	141°47.4	46.8	52°31.2	51.6	109°14.1	46.1
21	105°17.8	157°39.5	·· 16.7	156°47.9	·· 46.4	67°33.3	·· 51.8	124°16.3	·· 46.0
22	120°20.3	172°38.7	16.0	171°48.3	45.9	82°35.4	51.9	139°18.4	45.9
23	135°22.7	187°38.0	15.4	186°48.8	45.4	97°37.5	52.0	154°20.6	45.8
Mer.pass. 14:00		ν -0.8′	d 0.6′	m -3.89	ν 0.5′	d 0.5′	m 1.29	ν 2.1′	d 0.1′ m -2.23	ν 2.2′	d 0.1′ m 0.98

Stars

	SHA	Dec
Alpheratz	357°35.8	29°13.4
Ankaa	353°08.2	-42°10.7
Schedar	349°32.3	56°40.3
Diphda	348°48.3	-17°51.5
Achernar	335°21.0	-57°07.1
Hamal	327°52.2	23°34.6
Polaris	314°29.8	89°22.3
Acamar	315°12.4	-40°12.7
Menkar	314°07.0	4°11.0
Mirfak	308°29.4	49°57.0
Aldebaran	290°40.4	16°33.5
Rigel	281°04.4	-8°10.6
Capella	280°22.8	46°01.5
Bellatrix	278°23.5	6°22.2
Elnath	278°02.6	28°37.7
Alnilam	275°38.3	-1°11.3
Betelgeuse	270°52.7	7°24.6
Canopus	263°52.4	-52°42.7
Sirius	258°26.7	-16°45.1
Adhara	255°06.2	-29°00.4
Procyon	244°51.3	5°09.7
Pollux	243°17.9	27°58.1
Avior	234°14.5	-59°35.3
Suhail	222°46.4	-43°31.9
Miaplacidus	221°37.6	-69°49.0
Alphard	217°48.2	-8°45.9
Regulus	207°34.9	11°50.9
Dubhe	193°41.2	61°37.1
Denebola	182°25.4	14°26.1
Gienah	175°44.1	-17°40.6
Acrux	173°00.4	-63°13.8
Gacrux	171°52.0	-57°14.8
Alioth	166°13.2	55°49.5
Spica	158°22.9	-11°17.3
Alkaid	152°52.3	49°11.3
Hadar	148°36.8	-60°29.1
Menkent	147°58.3	-36°29.2
Arcturus	145°48.4	19°03.2
Rigil Kent.	139°41.1	-60°55.9
Kochab	137°19.4	74°03.0
Zuben'ubi	136°56.7	-16°08.5
Alphecca	126°04.3	26°37.7
Antares	112°16.8	-26°29.1
Atria	107°11.9	-69°04.0
Sabik	102°03.7	-15°45.3
Shaula	96°11.5	-37°07.2
Rasalhague	95°59.4	12°32.3
Eltanin	90°42.8	51°28.8
Kaus Aust.	83°33.7	-34°22.4
Vega	80°34.0	38°48.1
Nunki	75°48.9	-26°16.0
Altair	62°00.9	8°55.7
Peacock	53°07.4	-56°39.4
Deneb	49°26.8	45°21.8
Enif	33°39.8	9°59.0
Al Na'ir	27°34.3	-46°50.8
Fomalhaut	15°15.7	-29°29.8
Scheat	13°46.3	28°12.7
Markab	13°30.9	15°20.0

Feb 18 Sun	**SHA**	**Mer.pass**
Venus	56°04.0	10:26
Mars	53°47.7	10:35
Jupiter	322°40.4	16:37
Saturn	19°18.2	12:51

Feb 19 Mon	**SHA**	**Mer.pass**
Venus	54°46.4	10:28
Mars	52°59.7	10:34
Jupiter	322°31.9	16:34
Saturn	19°11.3	12:48

Feb 20 Tue	**SHA**	**Mer.pass**
Venus	53°29.1	10:29
Mars	52°11.9	10:33
Jupiter	322°23.2	16:30
Saturn	19°04.5	12:44

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°30.5	S11°53.2	73°47.8	7.8′	N27°00.2	5.0′	56.5′
1	191°30.5	52.3	88°14.6	7.8′	27°05.2	4.9′	56.4′
2	206°30.6	51.4	102°41.4	7.8′	27°10.1	4.7′	56.4′
3	221°30.6	·· 50.5	117°08.1	7.7′	27°14.8	4.5′	56.4′
4	236°30.7	49.7	131°34.9	7.7′	27°19.3	4.4′	56.3′
5	251°30.7	48.8	146°01.6	7.7′	27°23.7	4.3′	56.3′
6	266°30.8	S11°47.9	160°28.3	7.7′	N27°28.0	4.1′	56.3′
7	281°30.8	47.0	174°55.0	7.7′	27°32.1	3.9′	56.3′
8	296°30.9	46.1	189°21.7	7.7′	27°36.0	3.8′	56.2′
9	311°30.9	·· 45.3	203°48.4	7.7′	27°39.8	3.6′	56.2′
10	326°31.0	44.4	218°15.1	7.7′	27°43.4	3.4′	56.2′
11	341°31.0	43.5	232°41.8	7.7′	27°46.8	3.4′	56.1′
12	356°31.1	S11°42.6	247°08.5	7.7′	N27°50.2	3.1′	56.1′
13	11°31.1	41.7	261°35.1	7.7′	27°53.3	3.0′	56.1′
14	26°31.2	40.9	276°01.8	7.7′	27°56.3	2.8′	56.1′
15	41°31.2	·· 40.0	290°28.5	7.7′	27°59.1	2.7′	56.0′
16	56°31.3	39.1	304°55.1	7.7′	28°01.8	2.5′	56.0′
17	71°31.3	38.2	319°21.8	7.7′	28°04.3	2.4′	56.0′
18	86°31.4	S11°37.3	333°48.5	7.7′	N28°06.7	2.2′	56.0′
19	101°31.4	36.5	348°15.2	7.7′	28°08.9	2.0′	55.9′
20	116°31.5	35.6	2°41.9	7.7′	28°10.9	1.9′	55.9′
21	131°31.5	·· 34.7	17°08.6	7.7′	28°12.8	1.8′	55.9′
22	146°31.6	33.8	31°35.3	7.7′	28°14.6	1.6′	55.9′
23	161°31.7	32.9	46°02.0	7.7′	28°16.2	1.4′	55.8′
	SD = 16.2′	d = 0.9′	SD = 15.4′				

Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°31.7	S11°32.0	60°28.8	7.8′	N28°17.6	1.2′	55.8′
1	191°31.8	31.1	74°55.5	7.8′	28°18.8	1.2′	55.8′
2	206°31.8	30.3	89°22.3	7.8′	28°20.0	0.9′	55.8′
3	221°31.9	·· 29.4	103°49.1	7.8′	28°20.9	0.8′	55.7′
4	236°31.9	28.5	118°15.9	7.8′	28°21.7	0.7′	55.7′
5	251°32.0	27.6	132°42.7	7.8′	28°22.4	0.4′	55.7′
6	266°32.0	S11°26.7	147°09.5	7.9′	N28°22.8	0.4′	55.7′
7	281°32.1	25.8	161°36.4	7.9′	28°23.2	0.2′	55.6′
8	296°32.2	24.9	176°03.3	7.9′	28°23.4	0.0′	55.6′
9	311°32.2	·· 24.1	190°30.2	8.0′	28°23.4	0.1′	55.6′
10	326°32.3	23.2	204°57.2	8.0′	28°23.3	0.3′	55.6′
11	341°32.3	22.3	219°24.2	8.0′	28°23.0	0.5′	55.5′
12	356°32.4	S11°21.4	233°51.2	8.0′	N28°22.5	0.5′	55.5′
13	11°32.4	20.5	248°18.2	8.1′	28°22.0	0.8′	55.5′
14	26°32.5	19.6	262°45.3	8.1′	28°21.2	0.9′	55.5′
15	41°32.6	·· 18.7	277°12.4	8.1′	28°20.3	1.0′	55.4′
16	56°32.6	17.8	291°39.6	8.2′	28°19.3	1.2′	55.4′
17	71°32.7	16.9	306°06.8	8.2′	28°18.1	1.3′	55.4′
18	86°32.7	S11°16.0	320°34.0	8.3′	N28°16.8	1.5′	55.4′
19	101°32.8	15.2	335°01.2	8.3′	28°15.3	1.7′	55.4′
20	116°32.9	14.3	349°28.6	8.4′	28°13.6	1.8′	55.3′
21	131°32.9	·· 13.4	3°55.9	8.4′	28°11.8	1.9′	55.3′
22	146°33.0	12.5	18°23.3	8.4′	28°09.9	2.1′	55.3′
23	161°33.0	11.6	32°50.8	8.5′	28°07.8	2.2′	55.3′
	SD = 16.2′	d = 0.9′	SD = 15.2′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°33.1	S11°10.7	47°18.2	8.5′	N28°05.6	2.4′	55.3′
1	191°33.2	09.8	61°45.8	8.6′	28°03.2	2.5′	55.2′
2	206°33.2	08.9	76°13.4	8.6′	28°00.7	2.7′	55.2′
3	221°33.3	·· 08.0	90°41.0	8.7′	27°58.0	2.8′	55.2′
4	236°33.3	07.1	105°08.7	8.7′	27°55.2	3.0′	55.2′
5	251°33.4	06.2	119°36.4	8.8′	27°52.2	3.1′	55.1′
6	266°33.5	S11°05.3	134°04.2	8.9′	N27°49.1	3.2′	55.1′
7	281°33.5	04.4	148°32.1	8.9′	27°45.9	3.4′	55.1′
8	296°33.6	03.6	163°00.0	9.0′	27°42.5	3.5′	55.1′
9	311°33.7	·· 02.7	177°28.0	9.0′	27°39.0	3.7′	55.1′
10	326°33.7	01.8	191°56.0	9.1′	27°35.3	3.8′	55.1′
11	341°33.8	00.9	206°24.1	9.1′	27°31.5	3.9′	55.0′
12	356°33.9	S11°00.0	220°52.2	9.2′	N27°27.6	4.1′	55.0′
13	11°33.9	10°59.1	235°20.5	9.3′	27°23.5	4.2′	55.0′
14	26°34.0	58.2	249°48.7	9.3′	27°19.3	4.4′	55.0′
15	41°34.0	·· 57.3	264°17.1	9.4′	27°14.9	4.5′	55.0′
16	56°34.1	56.4	278°45.5	9.5′	27°10.4	4.6′	54.9′
17	71°34.2	55.5	293°13.9	9.5′	27°05.8	4.7′	54.9′
18	86°34.2	S10°54.6	307°42.5	9.6′	N27°01.1	4.9′	54.9′
19	101°34.3	53.7	322°11.1	9.7′	26°56.2	5.1′	54.9′
20	116°34.4	52.8	336°39.7	9.7′	26°51.1	5.1′	54.9′
21	131°34.4	·· 51.9	351°08.5	9.8′	26°46.0	5.3′	54.9′
22	146°34.5	51.0	5°37.3	9.9′	26°40.7	5.4′	54.8′
23	161°34.6	50.1	20°06.2	10.0′	26°35.3	5.5′	54.8′
	SD = 16.2′	d = 0.9′	SD = 15.1′				

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

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

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 9-11 64-82%
18	13:58	13:56	12:14	19:49	07:21	
19	13:53	13:50	12:14	20:44	08:16	
20	13:48	13:45	12:14	21:37	09:11	

February 21, 22, 23 UT (Wed., Thu., Fri.)

	Aries	Venus		Mars		Jupiter		Saturn	
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	150°25.2	202°37.2	S19°14.7	201°49.3	S19°45.0	112°39.6	N13°52.2	169°22.8	S09°45.7
1	165°27.6	217°36.5	14.1	216°49.8	44.5	127°41.7	52.3	184°25.0	45.6
2	180°30.1	232°35.8	13.4	231°50.2	44.1	142°43.8	52.4	199°27.2	45.4
3	195°32.6	247°35.0	·· 12.8	246°50.7	·· 43.6	157°45.9	·· 52.5	214°29.3	·· 45.3
4	210°35.0	262°34.3	12.1	261°51.2	43.1	172°47.9	52.7	229°31.5	45.2
5	225°37.5	277°33.5	11.5	276°51.7	42.7	187°50.0	52.8	244°33.7	45.1
6	240°40.0	292°32.8	S19°10.8	291°52.1	S19°42.2	202°52.1	N13°52.9	259°35.9	S09°45.0
7	255°42.4	307°32.1	10.2	306°52.6	41.8	217°54.2	53.1	274°38.0	44.9
8	270°44.9	322°31.3	09.5	321°53.1	41.3	232°56.3	53.2	289°40.2	44.8
9	285°47.4	337°30.6	·· 08.9	336°53.6	·· 40.8	247°58.4	·· 53.3	304°42.4	·· 44.7
10	300°49.8	352°29.8	08.2	351°54.0	40.4	263°00.5	53.4	319°44.6	44.5
11	315°52.3	7°29.1	07.6	6°54.5	39.9	278°02.6	53.6	334°46.8	44.4
12	330°54.7	22°28.4	S19°06.9	21°55.0	S19°39.4	293°04.7	N13°53.7	349°48.9	S09°44.3
13	345°57.2	37°27.6	06.2	36°55.5	39.0	308°06.8	53.8	4°51.1	44.2
14	0°59.7	52°26.9	05.6	51°55.9	38.5	323°08.9	54.0	19°53.3	44.1
15	16°02.1	67°26.2	·· 04.9	66°56.4	·· 38.0	338°11.0	·· 54.1	34°55.5	·· 44.0
16	31°04.6	82°25.4	04.3	81°56.9	37.6	353°13.0	54.2	49°57.6	43.9
17	46°07.1	97°24.7	03.6	96°57.4	37.1	8°15.1	54.4	64°59.8	43.8
18	61°09.5	112°24.0	S19°02.9	111°57.9	S19°36.6	23°17.2	N13°54.5	80°02.0	S09°43.6
19	76°12.0	127°23.2	02.3	126°58.3	36.2	38°19.3	54.6	95°04.2	43.5
20	91°14.5	142°22.5	01.6	141°58.8	35.7	53°21.4	54.8	110°06.4	43.4
21	106°16.9	157°21.8	·· 01.0	156°59.3	·· 35.2	68°23.5	·· 54.9	125°08.5	·· 43.3
22	121°19.4	172°21.0	19°00.3	171°59.8	34.8	83°25.6	55.0	140°10.7	43.2
23	136°21.9	187°20.3	18°59.6	187°00.2	34.3	98°27.7	55.1	155°12.9	43.1
Mer.pass. 13:56		ν -0.7′	d 0.6′	m -3.88	ν 0.5′	d 0.5′	m 1.29	ν 2.1′	d 0.1′ m -2.23	ν 2.2′	d 0.1′ m 0.97

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	151°24.3	202°19.6	S18°59.0	202°00.7	S19°33.8	113°29.8	N13°55.3	170°15.1	S09°43.0
1	166°26.8	217°18.8	58.3	217°01.2	33.4	128°31.9	55.4	185°17.2	42.8
2	181°29.2	232°18.1	57.6	232°01.7	32.9	143°33.9	55.5	200°19.4	42.7
3	196°31.7	247°17.4	·· 56.9	247°02.2	·· 32.4	158°36.0	·· 55.7	215°21.6	·· 42.6
4	211°34.2	262°16.6	56.3	262°02.6	31.9	173°38.1	55.8	230°23.8	42.5
5	226°36.6	277°15.9	55.6	277°03.1	31.5	188°40.2	55.9	245°26.0	42.4
6	241°39.1	292°15.2	S18°54.9	292°03.6	S19°31.0	203°42.3	N13°56.1	260°28.1	S09°42.3
7	256°41.6	307°14.4	54.3	307°04.1	30.5	218°44.4	56.2	275°30.3	42.2
8	271°44.0	322°13.7	53.6	322°04.6	30.1	233°46.5	56.3	290°32.5	42.1
9	286°46.5	337°13.0	·· 52.9	337°05.0	·· 29.6	248°48.6	·· 56.4	305°34.7	·· 41.9
10	301°49.0	352°12.3	52.2	352°05.5	29.1	263°50.6	56.6	320°36.8	41.8
11	316°51.4	7°11.5	51.5	7°06.0	28.6	278°52.7	56.7	335°39.0	41.7
12	331°53.9	22°10.8	S18°50.9	22°06.5	S19°28.2	293°54.8	N13°56.8	350°41.2	S09°41.6
13	346°56.4	37°10.1	50.2	37°07.0	27.7	308°56.9	57.0	5°43.4	41.5
14	1°58.8	52°09.4	49.5	52°07.4	27.2	323°59.0	57.1	20°45.6	41.4
15	17°01.3	67°08.6	·· 48.8	67°07.9	·· 26.8	339°01.1	·· 57.2	35°47.7	·· 41.3
16	32°03.7	82°07.9	48.1	82°08.4	26.3	354°03.2	57.4	50°49.9	41.1
17	47°06.2	97°07.2	47.5	97°08.9	25.8	9°05.2	57.5	65°52.1	41.0
18	62°08.7	112°06.5	S18°46.8	112°09.4	S19°25.3	24°07.3	N13°57.6	80°54.3	S09°40.9
19	77°11.1	127°05.7	46.1	127°09.8	24.9	39°09.4	57.8	95°56.4	40.8
20	92°13.6	142°05.0	45.4	142°10.3	24.4	54°11.5	57.9	110°58.6	40.7
21	107°16.1	157°04.3	·· 44.7	157°10.8	·· 23.9	69°13.6	·· 58.0	126°00.8	·· 40.6
22	122°18.5	172°03.6	44.0	172°11.3	23.4	84°15.7	58.2	141°03.0	40.5
23	137°21.0	187°02.8	43.3	187°11.8	22.9	99°17.8	58.3	156°05.2	40.4
Mer.pass. 13:52		ν -0.7′	d 0.7′	m -3.88	ν 0.5′	d 0.5′	m 1.28	ν 2.1′	d 0.1′ m -2.22	ν 2.2′	d 0.1′ m 0.97

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	152°23.5	202°02.1	S18°42.6	202°12.3	S19°22.5	114°19.8	N13°58.4	171°07.3	S09°40.2
1	167°25.9	217°01.4	41.9	217°12.7	22.0	129°21.9	58.6	186°09.5	40.1
2	182°28.4	232°00.7	41.3	232°13.2	21.5	144°24.0	58.7	201°11.7	40.0
3	197°30.9	247°00.0	·· 40.6	247°13.7	·· 21.0	159°26.1	·· 58.8	216°13.9	·· 39.9
4	212°33.3	261°59.2	39.9	262°14.2	20.6	174°28.2	58.9	231°16.0	39.8
5	227°35.8	276°58.5	39.2	277°14.7	20.1	189°30.2	59.1	246°18.2	39.7
6	242°38.2	291°57.8	S18°38.5	292°15.2	S19°19.6	204°32.3	N13°59.2	261°20.4	S09°39.6
7	257°40.7	306°57.1	37.8	307°15.6	19.1	219°34.4	59.3	276°22.6	39.4
8	272°43.2	321°56.4	37.1	322°16.1	18.6	234°36.5	59.5	291°24.8	39.3
9	287°45.6	336°55.6	·· 36.4	337°16.6	·· 18.2	249°38.6	·· 59.6	306°26.9	·· 39.2
10	302°48.1	351°54.9	35.7	352°17.1	17.7	264°40.7	59.7	321°29.1	39.1
11	317°50.6	6°54.2	35.0	7°17.6	17.2	279°42.7	13°59.9	336°31.3	39.0
12	332°53.0	21°53.5	S18°34.3	22°18.1	S19°16.7	294°44.8	N14°00.0	351°33.5	S09°38.9
13	347°55.5	36°52.8	33.6	37°18.5	16.2	309°46.9	00.1	6°35.6	38.8
14	2°58.0	51°52.1	32.9	52°19.0	15.7	324°49.0	00.3	21°37.8	38.7
15	18°00.4	66°51.4	·· 32.2	67°19.5	·· 15.3	339°51.1	·· 00.4	36°40.0	·· 38.5
16	33°02.9	81°50.6	31.5	82°20.0	14.8	354°53.1	00.5	51°42.2	38.4
17	48°05.3	96°49.9	30.8	97°20.5	14.3	9°55.2	00.7	66°44.3	38.3
18	63°07.8	111°49.2	S18°30.0	112°21.0	S19°13.8	24°57.3	N14°00.8	81°46.5	S09°38.2
19	78°10.3	126°48.5	29.3	127°21.5	13.3	39°59.4	00.9	96°48.7	38.1
20	93°12.7	141°47.8	28.6	142°21.9	12.8	55°01.5	01.1	111°50.9	38.0
21	108°15.2	156°47.1	·· 27.9	157°22.4	·· 12.4	70°03.5	·· 01.2	126°53.1	·· 37.9
22	123°17.7	171°46.4	27.2	172°22.9	11.9	85°05.6	01.3	141°55.2	37.8
23	138°20.1	186°45.7	26.5	187°23.4	11.4	100°07.7	01.5	156°57.4	37.6
Mer.pass. 13:48		ν -0.7′	d 0.7′	m -3.88	ν 0.5′	d 0.5′	m 1.28	ν 2.1′	d 0.1′ m -2.22	ν 2.2′	d 0.1′ m 0.97

Stars

	SHA	Dec
Alpheratz	357°35.8	29°13.4
Ankaa	353°08.2	-42°10.7
Schedar	349°32.3	56°40.3
Diphda	348°48.3	-17°51.4
Achernar	335°21.0	-57°07.1
Hamal	327°52.2	23°34.6
Polaris	314°31.2	89°22.3
Acamar	315°12.4	-40°12.7
Menkar	314°07.0	4°11.0
Mirfak	308°29.4	49°57.0
Aldebaran	290°40.4	16°33.5
Rigel	281°04.5	-8°10.6
Capella	280°22.8	46°01.5
Bellatrix	278°23.5	6°22.2
Elnath	278°02.6	28°37.7
Alnilam	275°38.3	-1°11.3
Betelgeuse	270°52.7	7°24.6
Canopus	263°52.4	-52°42.7
Sirius	258°26.7	-16°45.1
Adhara	255°06.2	-29°00.4
Procyon	244°51.3	5°09.7
Pollux	243°17.9	27°58.1
Avior	234°14.5	-59°35.3
Suhail	222°46.4	-43°31.9
Miaplacidus	221°37.6	-69°49.0
Alphard	217°48.1	-8°45.9
Regulus	207°34.9	11°50.9
Dubhe	193°41.2	61°37.1
Denebola	182°25.4	14°26.1
Gienah	175°44.1	-17°40.6
Acrux	173°00.4	-63°13.8
Gacrux	171°52.0	-57°14.8
Alioth	166°13.1	55°49.5
Spica	158°22.9	-11°17.3
Alkaid	152°52.3	49°11.3
Hadar	148°36.8	-60°29.2
Menkent	147°58.3	-36°29.2
Arcturus	145°48.4	19°03.2
Rigil Kent.	139°41.1	-60°55.9
Kochab	137°19.4	74°03.0
Zuben'ubi	136°56.7	-16°08.6
Alphecca	126°04.3	26°37.7
Antares	112°16.8	-26°29.1
Atria	107°11.8	-69°04.0
Sabik	102°03.7	-15°45.3
Shaula	96°11.5	-37°07.2
Rasalhague	95°59.3	12°32.3
Eltanin	90°42.8	51°28.8
Kaus Aust.	83°33.7	-34°22.4
Vega	80°34.0	38°48.0
Nunki	75°48.9	-26°16.0
Altair	62°00.9	8°55.7
Peacock	53°07.4	-56°39.4
Deneb	49°26.7	45°21.8
Enif	33°39.8	9°59.0
Al Na'ir	27°34.3	-46°50.8
Fomalhaut	15°15.7	-29°29.8
Scheat	13°46.3	28°12.7
Markab	13°30.9	15°20.0

Feb 21 Wed	SHA	Mer.pass
Venus	52°12.1	10:30
Mars	51°24.1	10:32
Jupiter	322°14.4	16:27
Saturn	18°57.6	12:41

Feb 22 Thu	SHA	Mer.pass
Venus	50°55.2	10:31
Mars	50°36.4	10:32
Jupiter	322°05.4	16:24
Saturn	18°50.8	12:37

Feb 23 Fri	SHA	Mer.pass
Venus	49°38.7	10:32
Mars	49°48.8	10:31
Jupiter	321°56.4	16:20
Saturn	18°43.9	12:34

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h — Sun — Moon

Wed	GHA	Dec	GHA	ν	Dec	d	HP
0	176°34.7	S10°49.2	34°35.1	10.0′	N26°29.8	5.7′	54.8′
1	191°34.7	48.3	49°04.2	10.1′	26°24.1	5.8′	54.8′
2	206°34.8	47.4	63°33.2	10.2′	26°18.3	5.9′	54.8′
3	221°34.9	·· 46.5	78°02.4	10.2′	26°12.4	6.1′	54.8′
4	236°34.9	45.6	92°31.7	10.3′	26°06.3	6.1′	54.7′
5	251°35.0	44.7	107°01.0	10.4′	26°00.2	6.3′	54.7′
6	266°35.1	S10°43.8	121°30.4	10.5′	N25°53.9	6.4′	54.7′
7	281°35.1	42.9	135°59.8	10.5′	25°47.5	6.6′	54.7′
8	296°35.2	42.0	150°29.4	10.6′	25°40.9	6.6′	54.7′
9	311°35.3	·· 41.1	164°59.0	10.7′	25°34.3	6.8′	54.7′
10	326°35.3	40.2	179°28.7	10.8′	25°27.5	6.9′	54.6′
11	341°35.4	39.3	193°58.5	10.9′	25°20.6	7.0′	54.6′
12	356°35.5	S10°38.4	208°28.3	10.9′	N25°13.6	7.1′	54.6′
13	11°35.6	37.5	222°58.3	11.0′	25°06.5	7.3′	54.6′
14	26°35.6	36.6	237°28.3	11.1′	24°59.2	7.3′	54.6′
15	41°35.7	·· 35.7	251°58.4	11.2′	24°51.9	7.5′	54.6′
16	56°35.8	34.8	266°28.5	11.2′	24°44.4	7.6′	54.6′
17	71°35.9	33.9	280°58.8	11.3′	24°36.8	7.7′	54.5′
18	86°35.9	S10°33.0	295°29.1	11.4′	N24°29.1	7.8′	54.5′
19	101°36.0	32.1	309°59.5	11.5′	24°21.3	7.9′	54.5′
20	116°36.1	31.2	324°30.0	11.6′	24°13.4	8.0′	54.5′
21	131°36.1	·· 30.2	339°00.5	11.6′	24°05.4	8.1′	54.5′
22	146°36.2	29.3	353°31.2	11.7′	23°57.3	8.2′	54.5′
23	161°36.3	28.4	8°01.9	11.8′	23°49.1	8.4′	54.5′
	SD = 16.2′	d = 0.9′	SD = 14.9′				

Thu	GHA	Dec	GHA	ν	Dec	d	HP
0	176°36.4	S10°27.5	22°32.7	11.9′	N23°40.7	8.4′	54.5′
1	191°36.4	26.6	37°03.6	12.0′	23°32.3	8.6′	54.4′
2	206°36.5	25.7	51°34.6	12.0′	23°23.7	8.6′	54.4′
3	221°36.6	·· 24.8	66°05.6	12.1′	23°15.1	8.8′	54.4′
4	236°36.7	23.9	80°36.7	12.2′	23°06.3	8.8′	54.4′
5	251°36.7	23.0	95°07.9	12.3′	22°57.5	8.9′	54.4′
6	266°36.8	S10°22.1	109°39.2	12.4′	N22°48.6	9.1′	54.4′
7	281°36.9	21.2	124°10.6	12.4′	22°39.5	9.1′	54.4′
8	296°37.0	20.3	138°42.0	12.5′	22°30.4	9.3′	54.4′
9	311°37.1	·· 19.4	153°13.6	12.6′	22°21.1	9.3′	54.3′
10	326°37.1	18.5	167°45.2	12.7′	22°11.8	9.4′	54.3′
11	341°37.2	17.5	182°16.8	12.8′	22°02.4	9.5′	54.3′
12	356°37.3	S10°16.6	196°48.6	12.8′	N21°52.9	9.6′	54.3′
13	11°37.4	15.7	211°20.4	12.9′	21°43.3	9.7′	54.3′
14	26°37.4	14.8	225°52.4	13.0′	21°33.6	9.8′	54.3′
15	41°37.5	·· 13.9	240°24.4	13.1′	21°23.8	9.9′	54.3′
16	56°37.6	13.0	254°56.4	13.2′	21°13.9	10.0′	54.3′
17	71°37.7	12.1	269°28.6	13.2′	21°03.9	10.0′	54.3′
18	86°37.8	S10°11.2	284°00.8	13.3′	N20°53.9	10.1′	54.2′
19	101°37.8	10.3	298°33.1	13.4′	20°43.8	10.3′	54.2′
20	116°37.9	09.3	313°05.5	13.5′	20°33.5	10.3′	54.2′
21	131°38.0	·· 08.4	327°38.0	13.5′	20°23.2	10.3′	54.2′
22	146°38.1	07.5	342°10.5	13.6′	20°12.9	10.5′	54.2′
23	161°38.2	06.6	356°43.2	13.7′	20°02.4	10.6′	54.2′
	SD = 16.2′	d = 0.9′	SD = 14.8′				

Fri	GHA	Dec	GHA	ν	Dec	d	HP
0	176°38.3	S10°05.7	11°15.8	13.8′	N19°51.8	10.6′	54.2′
1	191°38.3	04.8	25°48.6	13.8′	19°41.2	10.7′	54.2′
2	206°38.4	03.9	40°21.4	13.9′	19°30.5	10.8′	54.2′
3	221°38.5	·· 03.0	54°54.4	14.0′	19°19.7	10.8′	54.2′
4	236°38.6	02.0	69°27.3	14.1′	19°08.9	11.0′	54.2′
5	251°38.7	01.1	84°00.4	14.1′	18°57.9	11.0′	54.1′
6	266°38.7	S10°00.2	98°33.5	14.2′	N18°46.9	11.1′	54.1′
7	281°38.8	09°59.3	113°06.7	14.3′	18°35.8	11.1′	54.1′
8	296°38.9	58.4	127°40.0	14.3′	18°24.7	11.2′	54.1′
9	311°39.0	·· 57.5	142°13.4	14.4′	18°13.5	11.3′	54.1′
10	326°39.1	56.6	156°46.8	14.5′	18°02.2	11.4′	54.1′
11	341°39.2	55.6	171°20.3	14.6′	17°50.8	11.4′	54.1′
12	356°39.3	S09°54.7	185°53.8	14.6′	N17°39.4	11.5′	54.1′
13	11°39.3	53.8	200°27.4	14.7′	17°27.9	11.6′	54.1′
14	26°39.4	52.9	215°01.1	14.8′	17°16.3	11.6′	54.1′
15	41°39.5	·· 52.0	229°34.9	14.8′	17°04.7	11.7′	54.1′
16	56°39.6	51.1	244°08.7	14.9′	16°53.0	11.8′	54.1′
17	71°39.7	50.1	258°42.6	15.0′	16°41.2	11.8′	54.1′
18	86°39.8	S09°49.2	273°16.6	15.0′	N16°29.4	11.9′	54.0′
19	101°39.9	48.3	287°50.6	15.1′	16°17.5	12.0′	54.0′
20	116°39.9	47.4	302°24.7	15.1′	16°05.5	12.0′	54.0′
21	131°40.0	·· 46.5	316°58.8	15.2′	15°53.5	12.0′	54.0′
22	146°40.1	45.6	331°33.0	15.3′	15°41.5	12.2′	54.0′
23	161°40.2	44.6	346°07.3	15.3′	15°29.3	12.2′	54.0′
	SD = 16.2′	d = 0.9′	SD = 14.8′				

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

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

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 89-98%
21	13:41	13:38	12:14	22:27	10:02	
22	13:35	13:31	12:14	23:14	10:51	
23	13:27	13:23	12:13	23:57	11:36	

February 24, 25, 26 UT (Sat., Sun., Mon.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	153°22.6	201°44.9	S18°25.8	202°23.9	S19°10.9	115°09.8	N14°01.6	171°59.6	S09°37.5
1	168°25.1	216°44.2	25.1	217°24.4	10.4	130°11.9	01.7	187°01.8	37.4
2	183°27.5	231°43.5	24.4	232°24.9	09.9	145°13.9	01.9	202°03.9	37.3
3	198°30.0	246°42.8	·· 23.6	247°25.3	·· 09.4	160°16.0	·· 02.0	217°06.1	·· 37.2
4	213°32.5	261°42.1	22.9	262°25.8	09.0	175°18.1	02.1	232°08.3	37.1
5	228°34.9	276°41.4	22.2	277°26.3	08.5	190°20.2	02.3	247°10.5	37.0
6	243°37.4	291°40.7	S18°21.5	292°26.8	S19°08.0	205°22.2	N14°02.4	262°12.7	S09°36.8
7	258°39.8	306°40.0	20.8	307°27.3	07.5	220°24.3	02.5	277°14.8	36.7
8	273°42.3	321°39.3	20.0	322°27.8	07.0	235°26.4	02.7	292°17.0	36.6
9	288°44.8	336°38.6	·· 19.3	337°28.3	·· 06.5	250°28.5	·· 02.8	307°19.2	·· 36.5
10	303°47.2	351°37.9	18.6	352°28.8	06.0	265°30.5	02.9	322°21.4	36.4
11	318°49.7	6°37.2	17.9	7°29.2	05.5	280°32.6	03.1	337°23.5	36.3
12	333°52.2	21°36.4	S18°17.2	22°29.7	S19°05.0	295°34.7	N14°03.2	352°25.7	S09°36.2
13	348°54.6	36°35.7	16.4	37°30.2	04.5	310°36.8	03.3	7°27.9	36.0
14	3°57.1	51°35.0	15.7	52°30.7	04.1	325°38.8	03.5	22°30.1	35.9
15	18°59.6	66°34.3	·· 15.0	67°31.2	·· 03.6	340°40.9	·· 03.6	37°32.2	·· 35.8
16	34°02.0	81°33.6	14.3	82°31.7	03.1	355°43.0	03.7	52°34.4	35.7
17	49°04.5	96°32.9	13.5	97°32.2	02.6	10°45.1	03.9	67°36.6	35.6
18	64°06.9	111°32.2	S18°12.8	112°32.7	S19°02.1	25°47.1	N14°04.0	82°38.8	S09°35.5
19	79°09.4	126°31.5	12.1	127°33.1	01.6	40°49.2	04.1	97°41.0	35.4
20	94°11.9	141°30.8	11.3	142°33.6	01.1	55°51.3	04.3	112°43.1	35.3
21	109°14.3	156°30.1	·· 10.6	157°34.1	·· 00.6	70°53.4	·· 04.4	127°45.3	·· 35.1
22	124°16.8	171°29.4	09.9	172°34.6	19°00.1	85°55.4	04.5	142°47.5	35.0
23	139°19.3	186°28.7	09.1	187°35.1	18°59.6	100°57.5	04.7	157°49.7	34.9
Mer.pass. 13:44		ν -0.7′	d 0.7′	m -3.88	ν 0.5′	d 0.5′	m 1.28	ν 2.1′	d 0.1′ m -2.21	ν 2.2′	d 0.1′ m 0.96

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	154°21.7	201°28.0	S18°08.4	202°35.6	S18°59.1	115°59.6	N14°04.8	172°51.8	S09°34.8
1	169°24.2	216°27.3	07.7	217°36.1	58.6	131°01.7	04.9	187°54.0	34.7
2	184°26.7	231°26.6	06.9	232°36.6	58.1	146°03.7	05.1	202°56.2	34.6
3	199°29.1	246°25.9	·· 06.2	247°37.1	·· 57.6	161°05.8	·· 05.2	217°58.4	·· 34.5
4	214°31.6	261°25.2	05.5	262°37.6	57.1	176°07.9	05.3	233°00.6	34.3
5	229°34.1	276°24.5	04.7	277°38.0	56.7	191°10.0	05.5	248°02.7	34.2
6	244°36.5	291°23.8	S18°04.0	292°38.5	S18°56.2	206°12.0	N14°05.6	263°04.9	S09°34.1
7	259°39.0	306°23.1	03.2	307°39.0	55.7	221°14.1	05.8	278°07.1	34.0
8	274°41.4	321°22.4	02.5	322°39.5	55.2	236°16.2	05.9	293°09.3	33.9
9	289°43.9	336°21.7	·· 01.7	337°40.0	·· 54.7	251°18.2	·· 06.0	308°11.4	·· 33.8
10	304°46.4	351°21.0	01.0	352°40.5	54.2	266°20.3	06.2	323°13.6	33.7
11	319°48.8	6°20.3	18°00.3	7°41.0	53.7	281°22.4	06.3	338°15.8	33.6
12	334°51.3	21°19.7	S17°59.5	22°41.5	S18°53.2	296°24.5	N14°06.4	353°18.0	S09°33.4
13	349°53.8	36°19.0	58.8	37°42.0	52.7	311°26.5	06.6	8°20.1	33.3
14	4°56.2	51°18.3	58.0	52°42.5	52.2	326°28.6	06.7	23°22.3	33.2
15	19°58.7	66°17.6	·· 57.3	67°43.0	·· 51.7	341°30.7	·· 06.8	38°24.5	·· 33.1
16	35°01.2	81°16.9	56.5	82°43.4	51.2	356°32.7	07.0	53°26.7	33.0
17	50°03.6	96°16.2	55.8	97°43.9	50.7	11°34.8	07.1	68°28.9	32.9
18	65°06.1	111°15.5	S17°55.0	112°44.4	S18°50.2	26°36.9	N14°07.2	83°31.0	S09°32.8
19	80°08.6	126°14.8	54.3	127°44.9	49.7	41°38.9	07.4	98°33.2	32.6
20	95°11.0	141°14.1	53.5	142°45.4	49.2	56°41.0	07.5	113°35.4	32.5
21	110°13.5	156°13.4	·· 52.8	157°45.9	·· 48.7	71°43.1	·· 07.6	128°37.6	·· 32.4
22	125°15.9	171°12.7	52.0	172°46.4	48.2	86°45.1	07.8	143°39.7	32.3
23	140°18.4	186°12.0	51.2	187°46.9	47.7	101°47.2	07.9	158°41.9	32.2
Mer.pass. 13:40		ν -0.7′	d 0.7′	m -3.88	ν 0.5′	d 0.5′	m 1.28	ν 2.1′	d 0.1′ m -2.21	ν 2.2′	d 0.1′ m 0.96

Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	155°20.9	201°11.3	S17°50.5	202°47.4	S18°47.2	116°49.3	N14°08.1	173°44.1	S09°32.1
1	170°23.3	216°10.7	49.7	217°47.9	46.7	131°51.4	08.2	188°46.3	32.0
2	185°25.8	231°10.0	49.0	232°48.4	46.2	146°53.4	08.3	203°48.4	31.9
3	200°28.3	246°09.3	·· 48.2	247°48.9	·· 45.6	161°55.5	·· 08.5	218°50.6	·· 31.7
4	215°30.7	261°08.6	47.5	262°49.4	45.1	176°57.6	08.6	233°52.8	31.6
5	230°33.2	276°07.9	46.7	277°49.9	44.6	191°59.6	08.7	248°55.0	31.5
6	245°35.7	291°07.2	S17°45.9	292°50.4	S18°44.1	207°01.7	N14°08.9	263°57.2	S09°31.4
7	260°38.1	306°06.5	45.2	307°50.8	43.6	222°03.8	09.0	278°59.3	31.3
8	275°40.6	321°05.9	44.4	322°51.3	43.1	237°05.8	09.1	294°01.5	31.2
9	290°43.0	336°05.2	·· 43.6	337°51.8	·· 42.6	252°07.9	·· 09.3	309°03.7	·· 31.1
10	305°45.5	351°04.5	42.9	352°52.3	42.1	267°10.0	09.4	324°05.9	30.9
11	320°48.0	6°03.8	42.1	7°52.8	41.6	282°12.0	09.5	339°08.0	30.8
12	335°50.4	21°03.1	S17°41.3	22°53.3	S18°41.1	297°14.1	N14°09.7	354°10.2	S09°30.7
13	350°52.9	36°02.4	40.6	37°53.8	40.6	312°16.1	09.8	9°12.4	30.6
14	5°55.4	51°01.7	39.8	52°54.3	40.1	327°18.2	10.0	24°14.6	30.5
15	20°57.8	66°01.1	·· 39.0	67°54.8	·· 39.6	342°20.3	·· 10.1	39°16.7	·· 30.4
16	36°00.3	81°00.4	38.3	82°55.3	39.1	357°22.3	10.2	54°18.9	30.3
17	51°02.8	95°59.7	37.5	97°55.8	38.6	12°24.4	10.4	69°21.1	30.2
18	66°05.2	110°59.0	S17°36.7	112°56.3	S18°38.0	27°26.5	N14°10.5	84°23.3	S09°30.0
19	81°07.7	125°58.3	36.0	127°56.8	37.5	42°28.5	10.6	99°25.5	29.9
20	96°10.2	140°57.7	35.2	142°57.3	37.0	57°30.6	10.8	114°27.6	29.8
21	111°12.6	155°57.0	·· 34.4	157°57.8	·· 36.5	72°32.7	·· 10.9	129°29.8	·· 29.7
22	126°15.1	170°56.3	33.6	172°58.3	36.0	87°34.7	11.0	144°32.0	29.6
23	141°17.5	185°55.6	32.9	187°58.8	35.5	102°36.8	11.2	159°34.2	29.5
Mer.pass. 13:36		ν -0.7′	d 0.8′	m -3.88	ν 0.5′	d 0.5′	m 1.27	ν 2.1′	d 0.1′ m -2.20	ν 2.2′	d 0.1′ m 0.96

Stars

	SHA	Dec
Alpheratz	357°35.8	29°13.4
Ankaa	353°08.2	-42°10.7
Schedar	349°32.4	56°40.3
Diphda	348°48.3	-17°51.4
Achernar	335°21.1	-57°07.1
Hamal	327°52.2	23°34.6
Polaris	314°32.8	89°22.3
Acamar	315°12.4	-40°12.7
Menkar	314°07.0	4°11.0
Mirfak	308°29.4	49°57.0
Aldebaran	290°40.4	16°33.5
Rigel	281°04.5	-8°10.6
Capella	280°22.8	46°01.5
Bellatrix	278°23.5	6°22.2
Elnath	278°02.7	28°37.7
Alnilam	275°38.3	-1°11.3
Betelgeuse	270°52.7	7°24.6
Canopus	263°52.4	-52°42.7
Sirius	258°26.7	-16°45.1
Adhara	255°06.2	-29°00.5
Procyon	244°51.3	5°09.7
Pollux	243°17.9	27°58.1
Avior	234°14.5	-59°35.3
Suhail	222°46.4	-43°31.9
Miaplacidus	221°37.6	-69°49.0
Alphard	217°48.1	-8°45.9
Regulus	207°34.9	11°50.9
Dubhe	193°41.2	61°37.2
Denebola	182°25.4	14°26.1
Gienah	175°44.0	-17°40.6
Acrux	173°00.4	-63°13.8
Gacrux	171°52.0	-57°14.8
Alioth	166°13.1	55°49.5
Spica	158°22.8	-11°17.3
Alkaid	152°52.2	49°11.3
Hadar	148°36.7	-60°29.2
Menkent	147°58.3	-36°29.3
Arcturus	145°48.4	19°03.2
Rigil Kent.	139°41.0	-60°55.9
Kochab	137°19.3	74°03.0
Zuben'ubi	136°56.7	-16°08.6
Alphecca	126°04.3	26°37.7
Antares	112°16.7	-26°29.1
Atria	107°11.7	-69°04.0
Sabik	102°03.7	-15°45.3
Shaula	96°11.5	-37°07.2
Rasalhague	95°59.3	12°32.3
Eltanin	90°42.7	51°28.8
Kaus Aust.	83°33.7	-34°22.4
Vega	80°33.9	38°48.0
Nunki	75°48.9	-26°16.0
Altair	62°00.9	8°55.7
Peacock	53°07.3	-56°39.4
Deneb	49°26.7	45°21.7
Enif	33°39.8	9°59.0
Al Na'ir	27°34.2	-46°50.8
Fomalhaut	15°15.6	-29°29.8
Scheat	13°46.3	28°12.7
Markab	13°30.9	15°20.0

Feb 24 Sat	SHA	Mer.pass
Venus	48°22.3	10:34
Mars	49°01.3	10:30
Jupiter	321°47.2	16:17
Saturn	18°37.0	12:30

Feb 25 Sun	SHA	Mer.pass
Venus	47°06.3	10:35
Mars	48°13.9	10:29
Jupiter	321°37.9	16:14
Saturn	18°30.1	12:27

Feb 26 Mon	SHA	Mer.pass
Venus	45°50.5	10:36
Mars	47°26.5	10:28
Jupiter	321°28.4	16:10
Saturn	18°23.2	12:23

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h — Sun — Moon

Sat	GHA	Dec	GHA	ν	Dec	d	HP
0	176°40.3	S09°43.7	0°41.6	15.4′	N15°17.1	12.2′	54.0′
1	191°40.4	42.8	15°16.0	15.5′	15°04.9	12.3′	54.0′
2	206°40.5	41.9	29°50.5	15.5′	14°52.6	12.3′	54.0′
3	221°40.6	·· 41.0	44°25.0	15.6′	14°40.3	12.5′	54.0′
4	236°40.6	40.0	58°59.5	15.6′	14°27.8	12.4′	54.0′
5	251°40.7	39.1	73°34.2	15.7′	14°15.4	12.5′	54.0′
6	266°40.8	S09°38.2	88°08.9	15.7′	N14°02.9	12.6′	54.0′
7	281°40.9	37.3	102°43.6	15.8′	13°50.3	12.6′	54.0′
8	296°41.0	36.4	117°18.4	15.8′	13°37.7	12.6′	54.0′
9	311°41.1	·· 35.4	131°53.2	15.9′	13°25.1	12.8′	54.0′
10	326°41.2	34.5	146°28.1	15.9′	13°12.3	12.7′	54.0′
11	341°41.3	33.6	161°03.1	16.0′	12°59.6	12.8′	54.0′
12	356°41.4	S09°32.7	175°38.1	16.1′	N12°46.8	12.9′	54.0′
13	11°41.5	31.8	190°13.1	16.1′	12°33.9	12.8′	54.0′
14	26°41.6	30.8	204°48.2	16.2′	12°21.1	13.0′	53.9′
15	41°41.6	·· 29.9	219°23.4	16.2′	12°08.1	13.0′	53.9′
16	56°41.7	29.0	233°58.6	16.2′	11°55.1	13.0′	53.9′
17	71°41.8	28.1	248°33.8	16.3′	11°42.1	13.0′	53.9′
18	86°41.9	S09°27.1	263°09.1	16.3′	N11°29.1	13.1′	53.9′
19	101°42.0	26.2	277°44.5	16.4′	11°16.0	13.2′	53.9′
20	116°42.1	25.3	292°19.8	16.4′	11°02.8	13.2′	53.9′
21	131°42.2	·· 24.4	306°55.3	16.5′	10°49.6	13.2′	53.9′
22	146°42.3	23.4	321°30.7	16.5′	10°36.4	13.2′	53.9′
23	161°42.4	22.5	336°06.2	16.6′	10°23.2	13.3′	53.9′
	SD = 16.2′	d = 0.9′	SD = 14.7′				

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	176°42.5	S09°21.6	350°41.8	16.6′	N10°09.9	13.4′	53.9′
1	191°42.6	20.7	5°17.4	16.6′	09°56.5	13.3′	53.9′
2	206°42.7	19.7	19°53.0	16.7′	09°43.2	13.4′	53.9′
3	221°42.8	·· 18.8	34°28.7	16.7′	09°29.8	13.5′	53.9′
4	236°42.9	17.9	49°04.4	16.7′	09°16.3	13.4′	53.9′
5	251°43.0	17.0	63°40.1	16.8′	09°02.9	13.5′	53.9′
6	266°43.1	S09°16.0	78°15.9	16.8′	N08°49.4	13.5′	53.9′
7	281°43.1	15.1	92°51.7	16.8′	08°35.9	13.6′	53.9′
8	296°43.2	14.2	107°27.6	16.9′	08°22.3	13.6′	53.9′
9	311°43.3	·· 13.3	122°03.5	16.9′	08°08.7	13.6′	53.9′
10	326°43.4	12.3	136°39.4	16.9′	07°55.1	13.6′	53.9′
11	341°43.5	11.4	151°15.3	17.0′	07°41.5	13.7′	53.9′
12	356°43.6	S09°10.5	165°51.3	17.0′	N07°27.8	13.7′	53.9′
13	11°43.7	09.5	180°27.3	17.0′	07°14.1	13.7′	53.9′
14	26°43.8	08.6	195°03.3	17.1′	07°00.4	13.7′	53.9′
15	41°43.9	·· 07.7	209°39.4	17.1′	06°46.7	13.8′	53.9′
16	56°44.0	06.8	224°15.5	17.1′	06°32.9	13.8′	53.9′
17	71°44.1	05.8	238°51.6	17.1′	06°19.1	13.8′	53.9′
18	86°44.2	S09°04.9	253°27.7	17.2′	N06°05.3	13.8′	53.9′
19	101°44.3	04.0	268°03.9	17.2′	05°51.5	13.9′	53.9′
20	116°44.4	03.0	282°40.0	17.2′	05°37.6	13.8′	53.9′
21	131°44.5	·· 02.1	297°16.2	17.2′	05°23.8	13.9′	53.9′
22	146°44.6	01.2	311°52.5	17.2′	05°09.9	13.9′	53.9′
23	161°44.7	00.3	326°28.7	17.3′	04°56.0	14.0′	53.9′
	SD = 16.2′	d = 0.9′	SD = 14.7′				

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	176°44.8	S08°59.3	341°05.0	17.3′	N04°42.0	13.9′	53.9′
1	191°44.9	58.4	355°41.2	17.3′	04°28.1	14.0′	53.9′
2	206°45.0	57.5	10°17.5	17.3′	04°14.1	13.9′	53.9′
3	221°45.1	·· 56.5	24°53.8	17.3′	04°00.2	14.0′	53.9′
4	236°45.2	55.6	39°30.1	17.3′	03°46.2	14.0′	53.9′
5	251°45.3	54.7	54°06.5	17.3′	03°32.2	14.0′	53.9′
6	266°45.4	S08°53.7	68°42.8	17.4′	N03°18.2	14.1′	53.9′
7	281°45.5	52.8	83°19.2	17.4′	03°04.1	14.0′	53.9′
8	296°45.6	51.9	97°55.6	17.4′	02°50.1	14.0′	53.9′
9	311°45.7	·· 50.9	112°31.9	17.4′	02°36.1	14.1′	53.9′
10	326°45.8	50.0	127°08.3	17.4′	02°22.0	14.1′	53.9′
11	341°45.9	49.1	141°44.7	17.4′	02°07.9	14.0′	53.9′
12	356°46.0	S08°48.1	156°21.1	17.4′	N01°53.9	14.1′	53.9′
13	11°46.1	47.2	170°57.5	17.4′	01°39.8	14.1′	53.9′
14	26°46.2	46.3	185°34.0	17.4′	01°25.7	14.1′	53.9′
15	41°46.4	·· 45.3	200°10.4	17.4′	01°11.6	14.1′	53.9′
16	56°46.5	44.4	214°46.8	17.4′	00°57.5	14.1′	54.0′
17	71°46.6	43.5	229°23.2	17.4′	00°43.4	14.1′	54.0′
18	86°46.7	S08°42.5	243°59.6	17.4′	N00°29.3	14.1′	54.0′
19	101°46.8	41.6	258°36.1	17.4′	00°15.2	14.2′	54.0′
20	116°46.9	40.7	273°12.5	17.4′	N00°01.0	14.1′	54.0′
21	131°47.0	·· 39.7	287°48.9	17.4′	S00°13.1	14.1′	54.0′
22	146°47.1	38.8	302°25.3	17.4′	00°27.2	14.1′	54.0′
23	161°47.2	37.9	317°01.7	17.4′	00°41.3	14.1′	54.0′
	SD = 16.2′	d = 0.9′	SD = 14.7′				

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

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

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 15-17 100-98%
24	13:19	13:15	12:13	–:–	12:18	
25	13:10	13:05	12:13	00:38	12:58	
26	13:01	12:56	12:13	01:18	13:37	

February 27, 28, 29 UT (Tue., Wed., Thu.)

	Aries	Venus		Mars		Jupiter		Saturn	
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	156°20.0	200°54.9	S17°32.1	202°59.3	S18°35.0	117°38.9	N14°11.3	174°36.3	S09°29.4
1	171°22.5	215°54.3	31.3	217°59.8	34.5	132°40.9	11.5	189°38.5	29.2
2	186°24.9	230°53.6	30.5	233°00.3	34.0	147°43.0	11.6	204°40.7	29.1
3	201°27.4	245°52.9	·· 29.7	248°00.8	·· 33.5	162°45.0	·· 11.7	219°42.9	·· 29.0
4	216°29.9	260°52.2	29.0	263°01.3	32.9	177°47.1	11.9	234°45.0	28.9
5	231°32.3	275°51.6	28.2	278°01.8	32.4	192°49.2	12.0	249°47.2	28.8
6	246°34.8	290°50.9	S17°27.4	293°02.3	S18°31.9	207°51.2	N14°12.1	264°49.4	S09°28.7
7	261°37.3	305°50.2	26.6	308°02.8	31.4	222°53.3	12.3	279°51.6	28.6
8	276°39.7	320°49.5	25.8	323°03.3	30.9	237°55.4	12.4	294°53.8	28.5
9	291°42.2	335°48.9	·· 25.0	338°03.8	·· 30.4	252°57.4	·· 12.5	309°55.9	·· 28.3
10	306°44.6	350°48.2	24.3	353°04.3	29.9	267°59.5	12.7	324°58.1	28.2
11	321°47.1	5°47.5	23.5	8°04.8	29.3	283°01.5	12.8	340°00.3	28.1
12	336°49.6	20°46.8	S17°22.7	23°05.3	S18°28.8	298°03.6	N14°13.0	355°02.5	S09°28.0
13	351°52.0	35°46.2	21.9	38°05.8	28.3	313°05.7	13.1	10°04.6	27.9
14	6°54.5	50°45.5	21.1	53°06.3	27.8	328°07.7	13.2	25°06.8	27.8
15	21°57.0	65°44.8	·· 20.3	68°06.8	·· 27.3	343°09.8	·· 13.4	40°09.0	·· 27.7
16	36°59.4	80°44.2	19.5	83°07.3	26.8	358°11.8	13.5	55°11.2	27.5
17	52°01.9	95°43.5	18.7	98°07.8	26.2	13°13.9	13.6	70°13.3	27.4
18	67°04.4	110°42.8	S17°17.9	113°08.3	S18°25.7	28°16.0	N14°13.8	85°15.5	S09°27.3
19	82°06.8	125°42.1	17.1	128°08.8	25.2	43°18.0	13.9	100°17.7	27.2
20	97°09.3	140°41.5	16.3	143°09.3	24.7	58°20.1	14.1	115°19.9	27.1
21	112°11.8	155°40.8	·· 15.6	158°09.8	·· 24.2	73°22.1	·· 14.2	130°22.1	·· 27.0
22	127°14.2	170°40.1	14.8	173°10.3	23.7	88°24.2	14.3	145°24.2	26.9
23	142°16.7	185°39.5	14.0	188°10.8	23.1	103°26.2	14.5	160°26.4	26.7
Mer.pass. 13:32		ν -0.7′	d 0.8′	m -3.88	ν 0.5′	d 0.5′	m 1.27	ν 2.1′	d 0.1′ m -2.20	ν 2.2′	d 0.1′ m 0.95

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	157°19.1	200°38.8	S17°13.2	203°11.3	S18°22.6	118°28.3	N14°14.6	175°28.6	S09°26.6
1	172°21.6	215°38.1	12.4	218°11.8	22.1	133°30.4	14.7	190°30.8	26.5
2	187°24.1	230°37.5	11.6	233°12.3	21.6	148°32.4	14.9	205°32.9	26.4
3	202°26.5	245°36.8	·· 10.8	248°12.8	·· 21.1	163°34.5	·· 15.0	220°35.1	·· 26.3
4	217°29.0	260°36.1	10.0	263°13.3	20.5	178°36.5	15.2	235°37.3	26.2
5	232°31.5	275°35.5	09.2	278°13.8	20.0	193°38.6	15.3	250°39.5	26.1
6	247°33.9	290°34.8	S17°08.4	293°14.3	S18°19.5	208°40.6	N14°15.4	265°41.6	S09°26.0
7	262°36.4	305°34.1	07.6	308°14.8	19.0	223°42.7	15.6	280°43.8	25.8
8	277°38.9	320°33.5	06.7	323°15.3	18.5	238°44.8	15.7	295°46.0	25.7
9	292°41.3	335°32.8	·· 05.9	338°15.8	·· 17.9	253°46.8	·· 15.9	310°48.2	·· 25.6
10	307°43.8	350°32.2	05.1	353°16.3	17.4	268°48.9	16.0	325°50.4	25.5
11	322°46.2	5°31.5	04.3	8°16.8	16.9	283°50.9	16.1	340°52.5	25.4
12	337°48.7	20°30.8	S17°03.5	23°17.3	S18°16.4	298°53.0	N14°16.3	355°54.7	S09°25.3
13	352°51.2	35°30.2	02.7	38°17.8	15.8	313°55.0	16.4	10°56.9	25.2
14	7°53.6	50°29.5	01.9	53°18.3	15.3	328°57.1	16.5	25°59.1	25.0
15	22°56.1	65°28.8	·· 01.1	68°18.8	·· 14.8	343°59.1	·· 16.7	41°01.2	·· 24.9
16	37°58.6	80°28.2	17°00.3	83°19.3	14.3	359°01.2	16.8	56°03.4	24.8
17	53°01.0	95°27.5	16°59.5	98°19.8	13.7	14°03.3	17.0	71°05.6	24.7
18	68°03.5	110°26.9	S16°58.7	113°20.3	S18°13.2	29°05.3	N14°17.1	86°07.8	S09°24.6
19	83°06.0	125°26.2	57.8	128°20.8	12.7	44°07.4	17.2	101°09.9	24.5
20	98°08.4	140°25.5	57.0	143°21.3	12.2	59°09.4	17.4	116°12.1	24.4
21	113°10.9	155°24.9	·· 56.2	158°21.8	·· 11.6	74°11.5	·· 17.5	131°14.3	·· 24.3
22	128°13.4	170°24.2	55.4	173°22.3	11.1	89°13.5	17.7	146°16.5	24.1
23	143°15.8	185°23.6	54.6	188°22.8	10.6	104°15.6	17.8	161°18.7	24.0
Mer.pass. 13:29		ν -0.7′	d 0.8′	m -3.88	ν 0.5′	d 0.5′	m 1.27	ν 2.1′	d 0.1′ m -2.19	ν 2.2′	d 0.1′ m 0.95

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	158°18.3	200°22.9	S16°53.8	203°23.3	S18°10.1	119°17.6	N14°17.9	176°20.8	S09°23.9
1	173°20.7	215°22.3	52.9	218°23.8	09.5	134°19.7	18.1	191°23.0	23.8
2	188°23.2	230°21.6	52.1	233°24.3	09.0	149°21.7	18.2	206°25.2	23.7
3	203°25.7	245°21.0	·· 51.3	248°24.8	·· 08.5	164°23.8	·· 18.3	221°27.4	·· 23.6
4	218°28.1	260°20.3	50.5	263°25.3	08.0	179°25.8	18.5	236°29.5	23.5
5	233°30.6	275°19.6	49.7	278°25.9	07.4	194°27.9	18.6	251°31.7	23.3
6	248°33.1	290°19.0	S16°48.8	293°26.4	S18°06.9	209°29.9	N14°18.8	266°33.9	S09°23.2
7	263°35.5	305°18.3	48.0	308°26.9	06.4	224°32.0	18.9	281°36.1	23.1
8	278°38.0	320°17.7	47.2	323°27.4	05.8	239°34.1	19.0	296°38.2	23.0
9	293°40.5	335°17.0	·· 46.4	338°27.9	·· 05.3	254°36.1	·· 19.2	311°40.4	·· 22.9
10	308°42.9	350°16.4	45.5	353°28.4	04.8	269°38.2	19.3	326°42.6	22.8
11	323°45.4	5°15.7	44.7	8°28.9	04.2	284°40.2	19.5	341°44.8	22.7
12	338°47.8	20°15.1	S16°43.9	23°29.4	S18°03.7	299°42.3	N14°19.6	356°47.0	S09°22.5
13	353°50.3	35°14.4	43.0	38°29.9	03.2	314°44.3	19.7	11°49.1	22.4
14	8°52.8	50°13.8	42.2	53°30.4	02.7	329°46.4	19.9	26°51.3	22.3
15	23°55.2	65°13.1	·· 41.4	68°30.9	·· 02.1	344°48.4	·· 20.0	41°53.5	·· 22.2
16	38°57.7	80°12.5	40.6	83°31.4	01.6	359°50.5	20.2	56°55.7	22.1
17	54°00.2	95°11.8	39.7	98°31.9	01.1	14°52.5	20.3	71°57.8	22.0
18	69°02.6	110°11.2	S16°38.9	113°32.4	S18°00.5	29°54.6	N14°20.4	87°00.0	S09°21.9
19	84°05.1	125°10.5	38.1	128°32.9	18°00.0	44°56.6	20.6	102°02.2	21.8
20	99°07.6	140°09.9	37.2	143°33.5	17°59.5	59°58.7	20.7	117°04.4	21.6
21	114°10.0	155°09.2	·· 36.4	158°34.0	·· 58.9	75°00.7	·· 20.9	132°06.5	·· 21.5
22	129°12.5	170°08.6	35.5	173°34.5	58.4	90°02.8	21.0	147°08.7	21.4
23	144°15.0	185°07.9	34.7	188°35.0	57.9	105°04.8	21.1	162°10.9	21.3
Mer.pass. 13:25		ν -0.7′	d 0.8′	m -3.88	ν 0.5′	d 0.5′	m 1.27	ν 2.1′	d 0.1′ m -2.19	ν 2.2′	d 0.1′ m 0.95

Stars

	SHA	Dec
Alpheratz	357°35.9	29°13.4
Ankaa	353°08.2	-42°10.7
Schedar	349°32.4	56°40.2
Diphda	348°48.3	-17°51.4
Achernar	335°21.1	-57°07.1
Hamal	327°52.2	23°34.6
Polaris	314°34.3	89°22.2
Acamar	315°12.5	-40°12.7
Menkar	314°07.0	4°11.0
Mirfak	308°29.4	49°57.0
Aldebaran	290°40.4	16°33.5
Rigel	281°04.5	-8°10.6
Capella	280°22.8	46°01.5
Bellatrix	278°23.6	6°22.2
Elnath	278°02.7	28°37.7
Alnilam	275°38.4	-1°11.3
Betelgeuse	270°52.7	7°24.6
Canopus	263°52.5	-52°42.7
Sirius	258°26.7	-16°45.1
Adhara	255°06.2	-29°00.5
Procyon	244°51.3	5°09.7
Pollux	243°17.9	27°58.1
Avior	234°14.5	-59°35.3
Suhail	222°46.4	-43°31.9
Miaplacidus	221°37.6	-69°49.0
Alphard	217°48.2	-8°45.9
Regulus	207°34.9	11°50.9
Dubhe	193°41.2	61°37.2
Denebola	182°25.4	14°26.1
Gienah	175°44.0	-17°40.6
Acrux	173°00.4	-63°13.9
Gacrux	171°52.0	-57°14.8
Alioth	166°13.1	55°49.5
Spica	158°22.8	-11°17.3
Alkaid	152°52.2	49°11.3
Hadar	148°36.7	-60°29.2
Menkent	147°58.3	-36°29.3
Arcturus	145°48.4	19°03.2
Rigil Kent.	139°41.0	-60°55.9
Kochab	137°19.2	74°03.0
Zuben'ubi	136°56.7	-16°08.6
Alphecca	126°04.3	26°37.7
Antares	112°16.7	-26°29.1
Atria	107°11.7	-69°04.0
Sabik	102°03.7	-15°45.3
Shaula	96°11.5	-37°07.2
Rasalhague	95°59.3	12°32.3
Eltanin	90°42.7	51°28.8
Kaus Aust.	83°33.6	-34°22.4
Vega	80°33.9	38°48.0
Nunki	75°48.9	-26°16.0
Altair	62°00.9	8°55.7
Peacock	53°07.3	-56°39.4
Deneb	49°26.7	45°21.7
Enif	33°39.8	9°59.0
Al Na'ir	27°34.2	-46°50.7
Fomalhaut	15°15.6	-29°29.8
Scheat	13°46.3	28°12.7
Markab	13°30.9	15°20.0

Feb 27 Tue	SHA	Mer.pass
Venus	44°34.9	10:37
Mars	46°39.3	10:28
Jupiter	321°18.8	16:07
Saturn	18°16.3	12:20

Feb 28 Wed	SHA	Mer.pass
Venus	43°19.7	10:38
Mars	45°52.1	10:27
Jupiter	321°09.2	16:04
Saturn	18°09.4	12:16

Feb 29 Thu	SHA	Mer.pass
Venus	42°04.6	10:39
Mars	45°05.0	10:26
Jupiter	320°59.4	16:01
Saturn	18°02.5	12:13

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°47.3	S08°36.9	331°38.1	17.4′	S00°55.4	14.1′	54.0′
1	191°47.4	36.0	346°14.5	17.4′	01°09.5	14.2′	54.0′
2	206°47.5	35.0	0°50.9	17.4′	01°23.7	14.1′	54.0′
3	221°47.6	·· 34.1	15°27.3	17.4′	01°37.8	14.1′	54.0′
4	236°47.7	33.2	30°03.6	17.4′	01°51.9	14.1′	54.0′
5	251°47.8	32.2	44°40.0	17.3′	02°06.0	14.1′	54.0′
6	266°47.9	S08°31.3	59°16.4	17.3′	S02°20.1	14.1′	54.0′
7	281°48.0	30.4	73°52.7	17.3′	02°34.2	14.1′	54.0′
8	296°48.2	29.4	88°29.0	17.3′	02°48.3	14.1′	54.0′
9	311°48.3	·· 28.5	103°05.3	17.3′	03°02.4	14.0′	54.0′
10	326°48.4	27.5	117°41.6	17.3′	03°16.4	14.1′	54.1′
11	341°48.5	26.6	132°17.9	17.3′	03°30.5	14.0′	54.1′
12	356°48.6	S08°25.7	146°54.1	17.2′	S03°44.5	14.1′	54.1′
13	11°48.7	24.7	161°30.4	17.2′	03°58.6	14.0′	54.1′
14	26°48.8	23.8	176°06.6	17.2′	04°12.6	14.1′	54.1′
15	41°48.9	·· 22.9	190°42.8	17.2′	04°26.7	14.0′	54.1′
16	56°49.0	21.9	205°18.9	17.1′	04°40.7	14.0′	54.1′
17	71°49.1	21.0	219°55.1	17.1′	04°54.7	13.9′	54.1′
18	86°49.2	S08°20.0	234°31.2	17.1′	S05°08.6	14.0′	54.1′
19	101°49.4	19.1	249°07.3	17.1′	05°22.6	14.0′	54.1′
20	116°49.5	18.2	263°43.4	17.0′	05°36.6	13.9′	54.1′
21	131°49.6	·· 17.2	278°19.4	17.0′	05°50.5	13.9′	54.1′
22	146°49.7	16.3	292°55.4	17.0′	06°04.4	13.9′	54.2′
23	161°49.8	15.3	307°31.4	17.0′	06°18.3	13.9′	54.2′
	SD = 16.1′	d = 0.9′	SD = 14.7′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°49.9	S08°14.4	322°07.4	16.9′	S06°32.2	13.9′	54.2′
1	191°50.0	13.4	336°43.3	16.9′	06°46.1	13.8′	54.2′
2	206°50.1	12.5	351°19.2	16.9′	06°59.9	13.9′	54.2′
3	221°50.2	·· 11.6	5°55.1	16.8′	07°13.8	13.8′	54.2′
4	236°50.4	10.6	20°30.9	16.8′	07°27.6	13.8′	54.2′
5	251°50.5	09.7	35°06.7	16.7′	07°41.4	13.7′	54.2′
6	266°50.6	S08°08.7	49°42.4	16.7′	S07°55.1	13.8′	54.2′
7	281°50.7	07.8	64°18.1	16.7′	08°08.9	13.7′	54.2′
8	296°50.8	06.8	78°53.8	16.6′	08°22.6	13.7′	54.3′
9	311°50.9	·· 05.9	93°29.4	16.6′	08°36.3	13.6′	54.3′
10	326°51.0	05.0	108°05.0	16.5′	08°49.9	13.7′	54.3′
11	341°51.2	04.0	122°40.5	16.5′	09°03.6	13.6′	54.3′
12	356°51.3	S08°03.1	137°16.0	16.5′	S09°17.2	13.5′	54.3′
13	11°51.4	02.1	151°51.5	16.4′	09°30.7	13.6′	54.3′
14	26°51.5	01.2	166°26.9	16.4′	09°44.3	13.5′	54.3′
15	41°51.6	08°00.2	181°02.3	16.3′	09°57.8	13.5′	54.3′
16	56°51.7	07°59.3	195°37.6	16.3′	10°11.3	13.4′	54.4′
17	71°51.8	58.4	210°12.9	16.2′	10°24.7	13.5′	54.4′
18	86°52.0	S07°57.4	224°48.1	16.2′	S10°38.2	13.4′	54.4′
19	101°52.1	56.5	239°23.3	16.1′	10°51.6	13.3′	54.4′
20	116°52.2	55.5	253°58.4	16.1′	11°04.9	13.3′	54.4′
21	131°52.3	·· 54.6	268°33.4	16.0′	11°18.2	13.3′	54.4′
22	146°52.4	53.6	283°08.4	16.0′	11°31.5	13.3′	54.4′
23	161°52.5	52.7	297°43.4	15.9′	11°44.8	13.2′	54.5′
	SD = 16.1′	d = 0.9′	SD = 14.8′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°52.7	S07°51.7	312°18.3	15.8′	S11°58.0	13.1′	54.5′
1	191°52.8	50.8	326°53.1	15.8′	12°11.1	13.2′	54.5′
2	206°52.9	49.8	341°27.9	15.7′	12°24.3	13.1′	54.5′
3	221°53.0	·· 48.9	356°02.6	15.7′	12°37.4	13.0′	54.5′
4	236°53.1	47.9	10°37.3	15.6′	12°50.4	13.0′	54.5′
5	251°53.2	47.0	25°11.9	15.5′	13°03.4	13.0′	54.6′
6	266°53.4	S07°46.1	39°46.4	15.5′	S13°16.4	12.9′	54.6′
7	281°53.5	45.1	54°20.9	15.4′	13°29.3	12.9′	54.6′
8	296°53.6	44.2	68°55.3	15.3′	13°42.2	12.8′	54.6′
9	311°53.7	·· 43.2	83°29.6	15.3′	13°55.0	12.8′	54.6′
10	326°53.8	42.3	98°03.9	15.2′	14°07.8	12.7′	54.6′
11	341°54.0	41.3	112°38.1	15.1′	14°20.5	12.7′	54.7′
12	356°54.1	S07°40.4	127°12.2	15.1′	S14°33.2	12.6′	54.7′
13	11°54.2	39.4	141°46.3	15.0′	14°45.8	12.6′	54.7′
14	26°54.3	38.5	156°20.3	14.9′	14°58.4	12.6′	54.7′
15	41°54.4	·· 37.5	170°54.2	14.8′	15°11.0	12.4′	54.7′
16	56°54.6	36.6	185°28.0	14.8′	15°23.4	12.5′	54.7′
17	71°54.7	35.6	200°01.8	14.7′	15°35.9	12.3′	54.8′
18	86°54.8	S07°34.7	214°35.5	14.6′	S15°48.2	12.4′	54.8′
19	101°54.9	33.7	229°09.1	14.5′	16°00.6	12.2′	54.8′
20	116°55.0	32.8	243°42.7	14.5′	16°12.8	12.2′	54.8′
21	131°55.2	·· 31.8	258°16.2	14.4′	16°25.0	12.2′	54.8′
22	146°55.3	30.9	272°49.5	14.3′	16°37.2	12.0′	54.9′
23	161°55.4	29.9	287°22.8	14.2′	16°49.2	12.1′	54.9′
	SD = 16.1′	d = 0.9′	SD = 14.9′				

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

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

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 18-20 95-83%
27	12:51	12:46	12:13	01:57	14:16	
28	12:40	12:35	12:13	02:36	14:56	
29	12:29	12:24	12:12	03:16	15:37	

March 01, 02, 03 UT (Fri., Sat., Sun.)

	Aries	Venus		Mars		Jupiter		Saturn	
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	159°17.4	200°07.3	S16°33.9	203°35.5	S17°57.3	120°06.8	N14°21.3	177°13.1	S09°21.2
1	174°19.9	215°06.7	33.0	218°36.0	56.8	135°08.9	21.4	192°15.3	21.1
2	189°22.3	230°06.0	32.2	233°36.5	56.2	150°10.9	21.6	207°17.4	21.0
3	204°24.8	245°05.4	·· 31.4	248°37.0	·· 55.7	165°13.0	·· 21.7	222°19.6	·· 20.8
4	219°27.3	260°04.7	30.5	263°37.5	55.2	180°15.0	21.8	237°21.8	20.7
5	234°29.7	275°04.1	29.7	278°38.0	54.6	195°17.1	22.0	252°24.0	20.6
6	249°32.2	290°03.4	S16°28.8	293°38.5	S17°54.1	210°19.1	N14°22.1	267°26.1	S09°20.5
7	264°34.7	305°02.8	28.0	308°39.1	53.6	225°21.2	22.3	282°28.3	20.4
8	279°37.1	320°02.2	27.1	323°39.6	53.0	240°23.2	22.4	297°30.5	20.3
9	294°39.6	335°01.5	·· 26.3	338°40.1	·· 52.5	255°25.3	·· 22.5	312°32.7	·· 20.2
10	309°42.1	350°00.9	25.4	353°40.6	52.0	270°27.3	22.7	327°34.8	20.1
11	324°44.5	5°00.2	24.6	8°41.1	51.4	285°29.4	22.8	342°37.0	19.9
12	339°47.0	19°59.6	S16°23.8	23°41.6	S17°50.9	300°31.4	N14°23.0	357°39.2	S09°19.8
13	354°49.5	34°59.0	22.9	38°42.1	50.3	315°33.5	23.1	12°41.4	19.7
14	9°51.9	49°58.3	22.1	53°42.6	49.8	330°35.5	23.2	27°43.6	19.6
15	24°54.4	64°57.7	·· 21.2	68°43.1	·· 49.3	345°37.5	·· 23.4	42°45.7	·· 19.5
16	39°56.8	79°57.0	20.4	83°43.6	48.7	0°39.6	23.5	57°47.9	19.4
17	54°59.3	94°56.4	19.5	98°44.2	48.2	15°41.6	23.7	72°50.1	19.3
18	70°01.8	109°55.8	S16°18.7	113°44.7	S17°47.6	30°43.7	N14°23.8	87°52.3	S09°19.1
19	85°04.2	124°55.1	17.8	128°45.2	47.1	45°45.7	23.9	102°54.4	19.0
20	100°06.7	139°54.5	16.9	143°45.7	46.6	60°47.8	24.1	117°56.6	18.9
21	115°09.2	154°53.9	·· 16.1	158°46.2	·· 46.0	75°49.8	·· 24.2	132°58.8	·· 18.8
22	130°11.6	169°53.2	15.2	173°46.7	45.5	90°51.9	24.4	148°01.0	18.7
23	145°14.1	184°52.6	14.4	188°47.2	44.9	105°53.9	24.5	163°03.1	18.6
Mer.pass. 13:21		ν -0.6′	d 0.8′	m -3.88	ν 0.5′	d 0.5′	m 1.27	ν 2.0′	d 0.1′ m -2.18	ν 2.2′	d 0.1′ m 0.96

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	160°16.6	199°52.0	S16°13.5	203°47.7	S17°44.4	120°55.9	N14°24.7	178°05.3	S09°18.5
1	175°19.0	214°51.3	12.7	218°48.3	43.8	135°58.0	24.8	193°07.5	18.3
2	190°21.5	229°50.7	11.8	233°48.8	43.3	151°00.0	24.9	208°09.7	18.2
3	205°23.9	244°50.1	·· 10.9	248°49.3	·· 42.8	166°02.1	·· 25.1	223°11.9	·· 18.1
4	220°26.4	259°49.4	10.1	263°49.8	42.2	181°04.1	25.2	238°14.0	18.0
5	235°28.9	274°48.8	09.2	278°50.3	41.7	196°06.2	25.4	253°16.2	17.9
6	250°31.3	289°48.2	S16°08.4	293°50.8	S17°41.1	211°08.2	N14°25.5	268°18.4	S09°17.8
7	265°33.8	304°47.5	07.5	308°51.3	40.6	226°10.2	25.6	283°20.6	17.7
8	280°36.3	319°46.9	06.6	323°51.8	40.0	241°12.3	25.8	298°22.7	17.6
9	295°38.7	334°46.3	·· 05.8	338°52.4	·· 39.5	256°14.3	·· 25.9	313°24.9	·· 17.4
10	310°41.2	349°45.6	04.9	353°52.9	38.9	271°16.4	26.1	328°27.1	17.3
11	325°43.7	4°45.0	04.0	8°53.4	38.4	286°18.4	26.2	343°29.3	17.2
12	340°46.1	19°44.4	S16°03.2	23°53.9	S17°37.8	301°20.5	N14°26.3	358°31.4	S09°17.1
13	355°48.6	34°43.7	02.3	38°54.4	37.3	316°22.5	26.5	13°33.6	17.0
14	10°51.1	49°43.1	01.4	53°54.9	36.8	331°24.5	26.6	28°35.8	16.9
15	25°53.5	64°42.5	16°00.6	68°55.4	·· 36.2	346°26.6	·· 26.8	43°38.0	·· 16.8
16	40°56.0	79°41.9	15°59.7	83°56.0	35.7	1°28.6	26.9	58°40.2	16.6
17	55°58.4	94°41.2	58.8	98°56.5	35.1	16°30.7	27.1	73°42.3	16.5
18	71°00.9	109°40.6	S15°58.0	113°57.0	S17°34.6	31°32.7	N14°27.2	88°44.5	S09°16.4
19	86°03.4	124°40.0	57.1	128°57.5	34.0	46°34.7	27.3	103°46.7	16.3
20	101°05.8	139°39.4	56.2	143°58.0	33.5	61°36.8	27.5	118°48.9	16.2
21	116°08.3	154°38.7	·· 55.3	158°58.5	·· 32.9	76°38.8	·· 27.6	133°51.0	·· 16.1
22	131°10.8	169°38.1	54.5	173°59.1	32.4	91°40.9	27.8	148°53.2	16.0
23	146°13.2	184°37.5	53.6	188°59.6	31.8	106°42.9	27.9	163°55.4	15.8
Mer.pass. 13:17		ν -0.6′	d 0.9′	m -3.88	ν 0.5′	d 0.5′	m 1.26	ν 2.0′	d 0.1′ m -2.18	ν 2.2′	d 0.1′ m 0.96

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	161°15.7	199°36.9	S15°52.7	204°00.1	S17°31.3	121°44.9	N14°28.0	178°57.6	S09°15.7
1	176°18.2	214°36.2	51.8	219°00.6	30.7	136°47.0	28.2	193°59.7	15.6
2	191°20.6	229°35.6	51.0	234°01.1	30.2	151°49.0	28.3	209°01.9	15.5
3	206°23.1	244°35.0	·· 50.1	249°01.6	·· 29.6	166°51.0	·· 28.5	224°04.1	·· 15.4
4	221°25.6	259°34.4	49.2	264°02.2	29.1	181°53.1	28.6	239°06.3	15.3
5	236°28.0	274°33.8	48.3	279°02.7	28.5	196°55.1	28.8	254°08.5	15.2
6	251°30.5	289°33.1	S15°47.4	294°03.2	S17°28.0	211°57.2	N14°28.9	269°10.6	S09°15.1
7	266°32.9	304°32.5	46.6	309°03.7	27.4	226°59.2	29.0	284°12.8	14.9
8	281°35.4	319°31.9	45.7	324°04.2	26.8	242°01.2	29.2	299°15.0	14.8
9	296°37.9	334°31.3	·· 44.8	339°04.7	·· 26.3	257°03.3	·· 29.3	314°17.2	·· 14.7
10	311°40.3	349°30.7	43.9	354°05.3	25.7	272°05.3	29.5	329°19.3	14.6
11	326°42.8	4°30.0	43.0	9°05.8	25.2	287°07.3	29.6	344°21.5	14.5
12	341°45.3	19°29.4	S15°42.1	24°06.3	S17°24.6	302°09.4	N14°29.8	359°23.7	S09°14.4
13	356°47.7	34°28.8	41.2	39°06.8	24.1	317°11.4	29.9	14°25.9	14.3
14	11°50.2	49°28.2	40.4	54°07.3	23.5	332°13.5	30.0	29°28.1	14.1
15	26°52.7	64°27.6	·· 39.5	69°07.9	·· 23.0	347°15.5	·· 30.2	44°30.2	·· 14.0
16	41°55.1	79°27.0	38.6	84°08.4	22.4	2°17.5	30.3	59°32.4	13.9
17	56°57.6	94°26.3	37.7	99°08.9	21.9	17°19.6	30.5	74°34.6	13.8
18	72°00.1	109°25.7	S15°36.8	114°09.4	S17°21.3	32°21.6	N14°30.6	89°36.8	S09°13.7
19	87°02.5	124°25.1	35.9	129°09.9	20.7	47°23.6	30.8	104°38.9	13.6
20	102°05.0	139°24.5	35.0	144°10.4	20.2	62°25.7	30.9	119°41.1	13.5
21	117°07.4	154°23.9	·· 34.1	159°11.0	·· 19.6	77°27.7	·· 31.0	134°43.3	·· 13.4
22	132°09.9	169°23.3	33.2	174°11.5	19.1	92°29.7	31.2	149°45.5	13.2
23	147°12.4	184°22.7	32.3	189°12.0	18.5	107°31.8	31.3	164°47.6	13.1
Mer.pass. 13:13		ν -0.6′	d 0.9′	m -3.88	ν 0.5′	d 0.6′	m 1.26	ν 2.0′	d 0.1′ m -2.17	ν 2.2′	d 0.1′ m 0.97

Stars

	SHA	Dec
Alpheratz	357°35.9	29°13.3
Ankaa	353°08.2	-42°10.7
Schedar	349°32.4	56°40.2
Diphda	348°48.3	-17°51.4
Achernar	335°21.1	-57°07.1
Hamal	327°52.2	23°34.6
Polaris	314°35.6	89°22.2
Acamar	315°12.5	-40°12.7
Menkar	314°07.0	4°11.0
Mirfak	308°29.4	49°57.0
Aldebaran	290°40.4	16°33.5
Rigel	281°04.5	-8°10.6
Capella	280°22.9	46°01.5
Bellatrix	278°23.6	6°22.2
Elnath	278°02.7	28°37.7
Alnilam	275°38.4	-1°11.3
Betelgeuse	270°52.8	7°24.6
Canopus	263°52.5	-52°42.7
Sirius	258°26.7	-16°45.1
Adhara	255°06.2	-29°00.5
Procyon	244°51.4	5°09.7
Pollux	243°17.9	27°58.1
Avior	234°14.5	-59°35.3
Suhail	222°46.5	-43°31.9
Miaplacidus	221°37.6	-69°49.0
Alphard	217°48.2	-8°45.9
Regulus	207°34.9	11°50.9
Dubhe	193°41.2	61°37.2
Denebola	182°25.4	14°26.1
Gienah	175°44.0	-17°40.6
Acrux	173°00.3	-63°13.9
Gacrux	171°52.0	-57°14.8
Alioth	166°13.1	55°49.5
Spica	158°22.8	-11°17.3
Alkaid	152°52.2	49°11.3
Hadar	148°36.7	-60°29.2
Menkent	147°58.2	-36°29.3
Arcturus	145°48.4	19°03.2
Rigil Kent.	139°41.0	-60°55.9
Kochab	137°19.2	74°03.0
Zuben'ubi	136°56.7	-16°08.6
Alphecca	126°04.2	26°37.7
Antares	112°16.7	-26°29.1
Atria	107°11.6	-69°04.0
Sabik	102°03.6	-15°45.3
Shaula	96°11.4	-37°07.2
Rasalhague	95°59.3	12°32.3
Eltanin	90°42.7	51°28.7
Kaus Aust.	83°33.6	-34°22.3
Vega	80°33.9	38°48.0
Nunki	75°48.8	-26°16.0
Altair	62°00.9	8°55.7
Peacock	53°07.3	-56°39.4
Deneb	49°26.7	45°21.7
Enif	33°39.8	9°59.0
Al Na'ir	27°34.2	-46°50.7
Fomalhaut	15°15.6	-29°29.8
Scheat	13°46.3	28°12.7
Markab	13°30.9	15°20.0

Mar 01 Fri	SHA	Mer.pass
Venus	40°49.9	10:40
Mars	44°18.1	10:25
Jupiter	320°49.4	15:57
Saturn	17°55.7	12:09

Mar 02 Sat	SHA	Mer.pass
Venus	39°35.4	10:41
Mars	43°31.2	10:24
Jupiter	320°39.4	15:54
Saturn	17°48.8	12:06

Mar 03 Sun	SHA	Mer.pass
Venus	38°21.2	10:42
Mars	42°44.4	10:24
Jupiter	320°29.2	15:51
Saturn	17°41.9	12:02

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.1056 sec ΔT = TT-UT1 = +69.0784 sec

2024 March 01 to Mar. 03 UT

h

	Sun		Moon				
Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°55.5	S07°29.0	301°56.1	14.1′	S17°01.3	11.9′	54.9′
1	191°55.7	28.0	316°29.2	14.1′	17°13.2	11.9′	54.9′
2	206°55.8	27.1	331°02.3	14.0′	17°25.1	11.9′	54.9′
3	221°55.9	·· 26.1	345°35.3	13.9′	17°37.0	11.7′	55.0′
4	236°56.0	25.2	0°08.1	13.8′	17°48.7	11.8′	55.0′
5	251°56.1	24.2	14°41.0	13.7′	18°00.5	11.6′	55.0′
6	266°56.3	S07°23.3	29°13.7	13.6′	S18°12.1	11.6′	55.0′
7	281°56.4	22.3	43°46.3	13.5′	18°23.7	11.5′	55.0′
8	296°56.5	21.3	58°18.9	13.5′	18°35.2	11.4′	55.1′
9	311°56.6	·· 20.4	72°51.3	13.4′	18°46.6	11.4′	55.1′
10	326°56.8	19.4	87°23.7	13.3′	18°58.0	11.2′	55.1′
11	341°56.9	18.5	101°55.9	13.2′	19°09.2	11.3′	55.1′
12	356°57.0	S07°17.5	116°28.1	13.1′	S19°20.5	11.1′	55.2′
13	11°57.1	16.6	131°00.2	13.0′	19°31.6	11.1′	55.2′
14	26°57.3	15.6	145°32.2	12.9′	19°42.7	10.9′	55.2′
15	41°57.4	·· 14.7	160°04.1	12.8′	19°53.6	11.0′	55.2′
16	56°57.5	13.7	174°35.9	12.7′	20°04.6	10.8′	55.3′
17	71°57.6	12.8	189°07.6	12.6′	20°15.4	10.7′	55.3′
18	86°57.8	S07°11.8	203°39.2	12.5′	S20°26.1	10.7′	55.3′
19	101°57.9	10.9	218°10.7	12.4′	20°36.8	10.6′	55.3′
20	116°58.0	09.9	232°42.2	12.3′	20°47.4	10.5′	55.4′
21	131°58.1	·· 09.0	247°13.5	12.2′	20°57.9	10.4′	55.4′
22	146°58.3	08.0	261°44.7	12.1′	21°08.3	10.3′	55.4′
23	161°58.4	07.0	276°15.8	12.0′	21°18.6	10.3′	55.4′
	SD = 16.1′	d = 1.0′	SD = 15.0′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	176°58.5	S07°06.1	290°46.8	11.9′	S21°28.9	10.1′	55.5′
1	191°58.7	05.1	305°17.8	11.8′	21°39.0	10.1′	55.5′
2	206°58.8	04.2	319°48.6	11.7′	21°49.1	9.9′	55.5′
3	221°58.9	·· 03.2	334°19.3	11.6′	21°59.0	9.9′	55.5′
4	236°59.0	02.3	348°49.9	11.5′	22°08.9	9.8′	55.6′
5	251°59.2	01.3	3°20.4	11.4′	22°18.7	9.7′	55.6′
6	266°59.3	S07°00.3	17°50.8	11.3′	S22°28.4	9.6′	55.6′
7	281°59.4	06°59.4	32°21.1	11.2′	22°38.0	9.4′	55.6′
8	296°59.6	58.4	46°51.3	11.1′	22°47.4	9.4′	55.7′
9	311°59.7	·· 57.5	61°21.4	11.0′	22°56.8	9.3′	55.7′
10	326°59.8	56.5	75°51.3	10.9′	23°06.1	9.2′	55.7′
11	341°59.9	55.6	90°21.2	10.8′	23°15.3	9.1′	55.8′
12	357°00.1	S06°54.6	104°51.0	10.7′	S23°24.4	9.0′	55.8′
13	12°00.2	53.6	119°20.6	10.5′	23°33.4	8.8′	55.8′
14	27°00.3	52.7	133°50.2	10.4′	23°42.2	8.8′	55.8′
15	42°00.5	·· 51.7	148°19.6	10.3′	23°51.0	8.7′	55.9′
16	57°00.6	50.8	162°49.0	10.2′	23°59.7	8.5′	55.9′
17	72°00.7	49.8	177°18.2	10.1′	24°08.2	8.4′	55.9′
18	87°00.9	S06°48.9	191°47.3	10.0′	S24°16.6	8.4′	56.0′
19	102°01.0	47.9	206°16.3	9.9′	24°25.0	8.2′	56.0′
20	117°01.1	46.9	220°45.2	9.8′	24°33.2	8.1′	56.0′
21	132°01.2	·· 46.0	235°14.0	9.7′	24°41.3	7.9′	56.1′
22	147°01.4	45.0	249°42.7	9.6′	24°49.2	7.9′	56.1′
23	162°01.5	44.1	264°11.3	9.5′	24°57.1	7.7′	56.1′
	SD = 16.1′	d = 1.0′	SD = 15.1′				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	177°01.6	S06°43.1	278°39.7	9.4′	S25°04.8	7.7′	56.2′
1	192°01.8	42.1	293°08.1	9.2′	25°12.5	7.5′	56.2′
2	207°01.9	41.2	307°36.3	9.1′	25°20.0	7.3′	56.2′
3	222°02.0	·· 40.2	322°04.5	9.0′	25°27.3	7.3′	56.3′
4	237°02.2	39.3	336°32.5	8.9′	25°34.6	7.1′	56.3′
5	252°02.3	38.3	351°00.4	8.8′	25°41.7	7.0′	56.3′
6	267°02.4	S06°37.3	5°28.2	8.7′	S25°48.7	6.8′	56.3′
7	282°02.6	36.4	19°55.9	8.6′	25°55.5	6.8′	56.4′
8	297°02.7	35.4	34°23.5	8.5′	26°02.3	6.6′	56.4′
9	312°02.8	·· 34.5	48°51.0	8.4′	26°08.9	6.4′	56.4′
10	327°03.0	33.5	63°18.4	8.3′	26°15.3	6.4′	56.5′
11	342°03.1	32.5	77°45.7	8.2′	26°21.7	6.2′	56.5′
12	357°03.2	S06°31.6	92°12.9	8.1′	S26°27.9	6.0′	56.5′
13	12°03.4	30.6	106°39.9	8.0′	26°33.9	5.9′	56.6′
14	27°03.5	29.7	121°06.9	7.9′	26°39.8	5.8′	56.6′
15	42°03.6	·· 28.7	135°33.8	7.8′	26°45.6	5.7′	56.7′
16	57°03.8	27.7	150°00.5	7.7′	26°51.3	5.5′	56.7′
17	72°03.9	26.8	164°27.2	7.6′	26°56.8	5.3′	56.7′
18	87°04.1	S06°25.8	178°53.7	7.5′	S27°02.1	5.2′	56.8′
19	102°04.2	24.8	193°20.2	7.4′	27°07.3	5.1′	56.8′
20	117°04.3	23.9	207°46.6	7.3′	27°12.4	4.9′	56.8′
21	132°04.5	·· 22.9	222°12.8	7.2′	27°17.3	4.7′	56.9′
22	147°04.6	22.0	236°39.0	7.1′	27°22.0	4.6′	56.9′
23	162°04.7	21.0	251°05.0	7.0′	27°26.6	4.5′	56.9′
	SD = 16.1′	d = 1.0′	SD = 15.3′				

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

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

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 21-23 75-57%
01	12:18	12:12	12:12	03:59	16:22	
02	12:06	12:00	12:12	04:46	17:11	
03	11:53	11:47	12:12	05:37	18:05	

No IERS EOP prediction data available

March 04, 05, 06 UT (Mon., Tue., Wed.)

	Aries	Venus		Mars		Jupiter		Saturn	
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	162°14.8	199°22.0	S15°31.5	204°12.5	S17°18.0	122°33.8	N14°31.5	179°49.8	S09°13.0
1	177°17.3	214°21.4	30.6	219°13.0	17.4	137°35.8	31.6	194°52.0	12.9
2	192°19.8	229°20.8	29.7	234°13.6	16.8	152°37.9	31.8	209°54.2	12.8
3	207°22.2	244°20.2	·· 28.8	249°14.1	·· 16.3	167°39.9	·· 31.9	224°56.4	·· 12.7
4	222°24.7	259°19.6	27.9	264°14.6	15.7	182°41.9	32.0	239°58.5	12.6
5	237°27.2	274°19.0	27.0	279°15.1	15.2	197°44.0	32.2	255°00.7	12.4
6	252°29.6	289°18.4	S15°26.1	294°15.6	S17°14.6	212°46.0	N14°32.3	270°02.9	S09°12.3
7	267°32.1	304°17.8	25.2	309°16.2	14.0	227°48.0	32.5	285°05.1	12.2
8	282°34.5	319°17.2	24.3	324°16.7	13.5	242°50.1	32.6	300°07.2	12.1
9	297°37.0	334°16.6	·· 23.4	339°17.2	·· 12.9	257°52.1	·· 32.8	315°09.4	·· 12.0
10	312°39.5	349°15.9	22.5	354°17.7	12.4	272°54.1	32.9	330°11.6	11.9
11	327°41.9	4°15.3	21.6	9°18.3	11.8	287°56.2	33.0	345°13.8	11.8
12	342°44.4	19°14.7	S15°20.7	24°18.8	S17°11.2	302°58.2	N14°33.2	0°16.0	S09°11.7
13	357°46.9	34°14.1	19.8	39°19.3	10.7	318°00.2	33.3	15°18.1	11.5
14	12°49.3	49°13.5	18.9	54°19.8	10.1	333°02.3	33.5	30°20.3	11.4
15	27°51.8	64°12.9	·· 17.9	69°20.3	·· 09.6	348°04.3	·· 33.6	45°22.5	·· 11.3
16	42°54.3	79°12.3	17.0	84°20.9	09.0	3°06.3	33.8	60°24.7	11.2
17	57°56.7	94°11.7	16.1	99°21.4	08.4	18°08.3	33.9	75°26.8	11.1
18	72°59.2	109°11.1	S15°15.2	114°21.9	S17°07.9	33°10.4	N14°34.0	90°29.0	S09°11.0
19	88°01.7	124°10.5	14.3	129°22.4	07.3	48°12.4	34.2	105°31.2	10.9
20	103°04.1	139°09.9	13.4	144°23.0	06.7	63°14.4	34.3	120°33.4	10.7
21	118°06.6	154°09.3	·· 12.5	159°23.5	·· 06.2	78°16.5	·· 34.5	135°35.5	·· 10.6
22	133°09.0	169°08.7	11.6	174°24.0	05.6	93°18.5	34.6	150°37.7	10.5
23	148°11.5	184°08.1	10.7	189°24.5	05.0	108°20.5	34.8	165°39.9	10.4
Mer.pass. 13:09		ν -0.6′	d 0.9′	m -3.88	ν 0.5′	d 0.6′	m 1.26	ν 2.0′	d 0.1′ m -2.17	ν 2.2′	d 0.1′ m 0.97

Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	163°14.0	199°07.5	S15°09.8	204°25.1	S17°04.5	123°22.6	N14°34.9	180°42.1	S09°10.3
1	178°16.4	214°06.9	08.8	219°25.6	03.9	138°24.6	35.1	195°44.3	10.2
2	193°18.9	229°06.3	07.9	234°26.1	03.3	153°26.6	35.2	210°46.4	10.1
3	208°21.4	244°05.7	·· 07.0	249°26.6	·· 02.8	168°28.6	·· 35.3	225°48.6	·· 10.0
4	223°23.8	259°05.1	06.1	264°27.2	02.2	183°30.7	35.5	240°50.8	09.8
5	238°26.3	274°04.5	05.2	279°27.7	01.6	198°32.7	35.6	255°53.0	09.7
6	253°28.8	289°03.9	S15°04.3	294°28.2	S17°01.1	213°34.7	N14°35.8	270°55.1	S09°09.6
7	268°31.2	304°03.3	03.4	309°28.7	17°00.5	228°36.8	35.9	285°57.3	09.5
8	283°33.7	319°02.7	02.4	324°29.3	16°59.9	243°38.8	36.1	300°59.5	09.4
9	298°36.2	334°02.1	·· 01.5	339°29.8	·· 59.4	258°40.8	·· 36.2	316°01.7	·· 09.3
10	313°38.6	349°01.5	15°00.6	354°30.3	58.8	273°42.8	36.4	331°03.9	09.2
11	328°41.1	4°00.9	14°59.7	9°30.8	58.2	288°44.9	36.5	346°06.0	09.0
12	343°43.5	19°00.3	S14°58.8	24°31.4	S16°57.7	303°46.9	N14°36.6	1°08.2	S09°08.9
13	358°46.0	33°59.7	57.8	39°31.9	57.1	318°48.9	36.8	16°10.4	08.8
14	13°48.5	48°59.1	56.9	54°32.4	56.5	333°51.0	36.9	31°12.6	08.7
15	28°50.9	63°58.5	·· 56.0	69°32.9	·· 56.0	348°53.0	·· 37.1	46°14.7	·· 08.6
16	43°53.4	78°57.9	55.1	84°33.5	55.4	3°55.0	37.2	61°16.9	08.5
17	58°55.9	93°57.3	54.1	99°34.0	54.8	18°57.0	37.4	76°19.1	08.4
18	73°58.3	108°56.7	S14°53.2	114°34.5	S16°54.3	33°59.1	N14°37.5	91°21.3	S09°08.3
19	89°00.8	123°56.1	52.3	129°35.0	53.7	49°01.1	37.7	106°23.5	08.1
20	104°03.3	138°55.6	51.4	144°35.6	53.1	64°03.1	37.8	121°25.6	08.0
21	119°05.7	153°55.0	·· 50.4	159°36.1	·· 52.5	79°05.1	·· 37.9	136°27.8	·· 07.9
22	134°08.2	168°54.4	49.5	174°36.6	52.0	94°07.2	38.1	151°30.0	07.8
23	149°10.7	183°53.8	48.6	189°37.2	51.4	109°09.2	38.2	166°32.2	07.7
Mer.pass. 13:05		ν -0.6′	d 0.9′	m -3.88	ν 0.5′	d 0.6′	m 1.26	ν 2.0′	d 0.1′ m -2.16	ν 2.2′	d 0.1′ m 0.98

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	164°13.1	198°53.2	S14°47.6	204°37.7	S16°50.8	124°11.2	N14°38.4	181°34.3	S09°07.6
1	179°15.6	213°52.6	46.7	219°38.2	50.2	139°13.2	38.5	196°36.5	07.5
2	194°18.0	228°52.0	45.8	234°38.7	49.7	154°15.3	38.7	211°38.7	07.3
3	209°20.5	243°51.4	·· 44.9	249°39.3	·· 49.1	169°17.3	·· 38.8	226°40.9	·· 07.2
4	224°23.0	258°50.8	43.9	264°39.8	48.5	184°19.3	39.0	241°43.1	07.1
5	239°25.4	273°50.2	43.0	279°40.3	48.0	199°21.3	39.1	256°45.2	07.0
6	254°27.9	288°49.7	S14°42.1	294°40.9	S16°47.4	214°23.4	N14°39.2	271°47.4	S09°06.9
7	269°30.4	303°49.1	41.1	309°41.4	46.8	229°25.4	39.4	286°49.6	06.8
8	284°32.8	318°48.5	40.2	324°41.9	46.2	244°27.4	39.5	301°51.8	06.7
9	299°35.3	333°47.9	·· 39.3	339°42.4	·· 45.7	259°29.4	·· 39.7	316°53.9	·· 06.6
10	314°37.8	348°47.3	38.3	354°43.0	45.1	274°31.4	39.8	331°56.1	06.4
11	329°40.2	3°46.7	37.4	9°43.5	44.5	289°33.5	40.0	346°58.3	06.3
12	344°42.7	18°46.1	S14°36.4	24°44.0	S16°43.9	304°35.5	N14°40.1	2°00.5	S09°06.2
13	359°45.2	33°45.6	35.5	39°44.6	43.3	319°37.5	40.3	17°02.7	06.1
14	14°47.6	48°45.0	34.6	54°45.1	42.8	334°39.5	40.4	32°04.8	06.0
15	29°50.1	63°44.4	·· 33.6	69°45.6	·· 42.2	349°41.6	·· 40.6	47°07.0	·· 05.9
16	44°52.5	78°43.8	32.7	84°46.2	41.6	4°43.6	40.7	62°09.2	05.8
17	59°55.0	93°43.2	31.7	99°46.7	41.0	19°45.6	40.8	77°11.4	05.6
18	74°57.5	108°42.6	S14°30.8	114°47.2	S16°40.5	34°47.6	N14°41.0	92°13.5	S09°05.5
19	89°59.9	123°42.1	29.9	129°47.7	39.9	49°49.6	41.1	107°15.7	05.4
20	105°02.4	138°41.5	28.9	144°48.3	39.3	64°51.7	41.3	122°17.9	05.3
21	120°04.9	153°40.9	·· 28.0	159°48.8	·· 38.7	79°53.7	·· 41.4	137°20.1	·· 05.2
22	135°07.3	168°40.3	27.0	174°49.3	38.1	94°55.7	41.6	152°22.3	05.1
23	150°09.8	183°39.7	26.1	189°49.9	37.6	109°57.7	41.7	167°24.4	05.0
Mer.pass. 13:01		ν -0.6′	d 0.9′	m -3.88	ν 0.5′	d 0.6′	m 1.25	ν 2.0′	d 0.1′ m -2.16	ν 2.2′	d 0.1′ m 0.99

Stars

	SHA	Dec
Alpheratz	357°35.9	29°13.3
Ankaa	353°08.2	-42°10.7
Schedar	349°32.4	56°40.2
Diphda	348°48.3	-17°51.4
Achernar	335°21.1	-57°07.1
Hamal	327°52.2	23°34.6
Polaris	314°36.7	89°22.2
Acamar	315°12.5	-40°12.7
Menkar	314°07.0	4°11.0
Mirfak	308°29.5	49°57.0
Aldebaran	290°40.5	16°33.5
Rigel	281°04.5	-8°10.6
Capella	280°22.9	46°01.5
Bellatrix	278°23.6	6°22.2
Elnath	278°02.7	28°37.7
Alnilam	275°38.4	-1°11.3
Betelgeuse	270°52.8	7°24.6
Canopus	263°52.5	-52°42.7
Sirius	258°26.7	-16°45.1
Adhara	255°06.2	-29°00.5
Procyon	244°51.4	5°09.7
Pollux	243°17.9	27°58.1
Avior	234°14.6	-59°35.4
Suhail	222°46.5	-43°31.9
Miaplacidus	221°37.7	-69°49.1
Alphard	217°48.2	-8°45.9
Regulus	207°34.9	11°50.9
Dubhe	193°41.2	61°37.2
Denebola	182°25.3	14°26.1
Gienah	175°44.0	-17°40.6
Acrux	173°00.3	-63°13.9
Gacrux	171°51.9	-57°14.8
Alioth	166°13.1	55°49.5
Spica	158°22.8	-11°17.3
Alkaid	152°52.2	49°11.3
Hadar	148°36.6	-60°29.2
Menkent	147°58.2	-36°29.3
Arcturus	145°48.3	19°03.2
Rigil Kent.	139°40.9	-60°55.9
Kochab	137°19.1	74°03.0
Zuben'ubi	136°56.6	-16°08.6
Alphecca	126°04.2	26°37.7
Antares	112°16.7	-26°29.1
Atria	107°11.6	-69°04.0
Sabik	102°03.6	-15°45.3
Shaula	96°11.4	-37°07.2
Rasalhague	95°59.3	12°32.3
Eltanin	90°42.6	51°28.7
Kaus Aust.	83°33.6	-34°22.3
Vega	80°33.9	38°48.0
Nunki	75°48.8	-26°16.0
Altair	62°00.9	8°55.7
Peacock	53°07.3	-56°39.4
Deneb	49°26.7	45°21.7
Enif	33°39.8	9°59.0
Al Na'ir	27°34.2	-46°50.7
Fomalhaut	15°15.6	-29°29.8
Scheat	13°46.3	28°12.7
Markab	13°30.9	15°20.0

Mar 04 Mon	SHA	Mer.pass
Venus	37°07.2	10:43
Mars	41°57.7	10:23
Jupiter	320°19.0	15:48
Saturn	17°35.0	11:59

Mar 05 Tue	SHA	Mer.pass
Venus	35°53.5	10:44
Mars	41°11.1	10:22
Jupiter	320°08.6	15:44
Saturn	17°28.1	11:55

Mar 06 Wed	SHA	Mer.pass
Venus	34°40.1	10:45
Mars	40°24.6	10:21
Jupiter	319°58.1	15:41
Saturn	17°21.2	11:52

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	177°04.9	S06°20.0	265°31.0	6.9′	S27°31.1	4.3′	57.0′
1	192°05.0	19.1	279°56.9	6.8′	27°35.4	4.1′	57.0′
2	207°05.1	18.1	294°22.6	6.7′	27°39.5	4.0′	57.0′
3	222°05.3	·· 17.1	308°48.3	6.6′	27°43.5	3.9′	57.1′
4	237°05.4	16.2	323°13.9	6.5′	27°47.4	3.6′	57.1′
5	252°05.6	15.2	337°39.4	6.4′	27°51.0	3.5′	57.2′
6	267°05.7	S06°14.2	352°04.8	6.3′	S27°54.5	3.4′	57.2′
7	282°05.8	13.3	6°30.1	6.2′	27°57.9	3.2′	57.2′
8	297°06.0	12.3	20°55.4	6.1′	28°01.1	3.0′	57.3′
9	312°06.1	·· 11.3	35°20.5	6.1′	28°04.1	2.9′	57.3′
10	327°06.2	10.4	49°45.6	6.0′	28°07.0	2.7′	57.3′
11	342°06.4	09.4	64°10.5	5.9′	28°09.7	2.5′	57.4′
12	357°06.5	S06°08.5	78°35.4	5.8′	S28°12.2	2.4′	57.4′
13	12°06.7	07.5	93°00.3	5.7′	28°14.6	2.2′	57.5′
14	27°06.8	06.5	107°25.0	5.7′	28°16.8	2.0′	57.5′
15	42°06.9	·· 05.6	121°49.7	5.6′	28°18.8	1.8′	57.5′
16	57°07.1	04.6	136°14.3	5.5′	28°20.6	1.7′	57.6′
17	72°07.2	03.6	150°38.8	5.4′	28°22.3	1.5′	57.6′
18	87°07.4	S06°02.7	165°03.2	5.4′	S28°23.8	1.3′	57.6′
19	102°07.5	01.7	179°27.6	5.3′	28°25.1	1.2′	57.7′
20	117°07.6	06°00.7	193°51.9	5.2′	28°26.3	1.0′	57.7′
21	132°07.8	05°59.8	208°16.2	5.2′	28°27.3	0.8′	57.8′
22	147°07.9	58.8	222°40.4	5.1′	28°28.1	0.6′	57.8′
23	162°08.1	57.8	237°04.5	5.1′	28°28.7	0.4′	57.8′
	SD = 16.1′	d = 1.0′	SD = 15.5′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	177°08.2	S05°56.9	251°28.5	5.0′	S28°29.1	0.3′	57.9′
1	192°08.3	55.9	265°52.6	4.9′	28°29.4	0.1′	57.9′
2	207°08.5	54.9	280°16.5	4.9′	28°29.5	0.1′	58.0′
3	222°08.6	·· 54.0	294°40.4	4.8′	28°29.4	0.3′	58.0′
4	237°08.8	53.0	309°04.2	4.8′	28°29.1	0.4′	58.0′
5	252°08.9	52.0	323°28.0	4.7′	28°28.7	0.7′	58.1′
6	267°09.0	S05°51.1	337°51.8	4.7′	S28°28.0	0.8′	58.1′
7	282°09.2	50.1	352°15.5	4.7′	28°27.2	1.0′	58.1′
8	297°09.3	49.1	6°39.1	4.6′	28°26.2	1.2′	58.2′
9	312°09.5	·· 48.1	21°02.8	4.6′	28°25.0	1.4′	58.2′
10	327°09.6	47.2	35°26.3	4.5′	28°23.6	1.6′	58.3′
11	342°09.8	46.2	49°49.9	4.5′	28°22.0	1.7′	58.3′
12	357°09.9	S05°45.2	64°13.4	4.5′	S28°20.3	2.0′	58.3′
13	12°10.0	44.3	78°36.8	4.4′	28°18.3	2.1′	58.4′
14	27°10.2	43.3	93°00.3	4.4′	28°16.2	2.3′	58.4′
15	42°10.3	·· 42.3	107°23.7	4.4′	28°13.9	2.5′	58.5′
16	57°10.5	41.4	121°47.1	4.4′	28°11.4	2.7′	58.5′
17	72°10.6	40.4	136°10.5	4.3′	28°08.7	2.9′	58.5′
18	87°10.8	S05°39.4	150°33.8	4.3′	S28°05.8	3.1′	58.6′
19	102°10.9	38.5	164°57.1	4.3′	28°02.7	3.3′	58.6′
20	117°11.1	37.5	179°20.4	4.3′	27°59.4	3.4′	58.7′
21	132°11.2	·· 36.5	193°43.7	4.3′	27°56.0	3.7′	58.7′
22	147°11.3	35.5	208°07.0	4.3′	27°52.3	3.8′	58.7′
23	162°11.5	34.6	222°30.3	4.3′	27°48.5	4.0′	58.8′
	SD = 16.1′	d = 1.0′	SD = 15.8′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	177°11.6	S05°33.6	236°53.6	4.3′	S27°44.5	4.2′	58.8′
1	192°11.8	32.6	251°16.8	4.3′	27°40.3	4.5′	58.9′
2	207°11.9	31.7	265°40.1	4.3′	27°35.8	4.6′	58.9′
3	222°12.1	·· 30.7	280°03.3	4.3′	27°31.2	4.7′	58.9′
4	237°12.2	29.7	294°26.6	4.3′	27°26.5	5.0′	59.0′
5	252°12.4	28.7	308°49.8	4.3′	27°21.5	5.2′	59.0′
6	267°12.5	S05°27.8	323°13.1	4.3′	S27°16.3	5.3′	59.1′
7	282°12.7	26.8	337°36.4	4.3′	27°11.0	5.6′	59.1′
8	297°12.8	25.8	351°59.7	4.3′	27°05.4	5.7′	59.1′
9	312°12.9	·· 24.9	6°23.0	4.3′	26°59.7	5.9′	59.2′
10	327°13.1	23.9	20°46.3	4.3′	26°53.8	6.1′	59.2′
11	342°13.2	22.9	35°09.6	4.3′	26°47.7	6.3′	59.2′
12	357°13.4	S05°21.9	49°32.9	4.4′	S26°41.4	6.5′	59.3′
13	12°13.5	21.0	63°56.3	4.4′	26°34.9	6.7′	59.3′
14	27°13.7	20.0	78°19.7	4.4′	26°28.2	6.8′	59.4′
15	42°13.8	·· 19.0	92°43.1	4.4′	26°21.4	7.1′	59.4′
16	57°14.0	18.1	107°06.5	4.5′	26°14.3	7.2′	59.4′
17	72°14.1	17.1	121°30.0	4.5′	26°07.1	7.4′	59.5′
18	87°14.3	S05°16.1	135°53.5	4.5′	S25°59.7	7.6′	59.5′
19	102°14.4	15.1	150°17.0	4.6′	25°52.1	7.8′	59.5′
20	117°14.6	14.2	164°40.6	4.6′	25°44.3	8.0′	59.6′
21	132°14.7	·· 13.2	179°04.1	4.6′	25°36.3	8.1′	59.6′
22	147°14.9	12.2	193°27.8	4.7′	25°28.2	8.3′	59.7′
23	162°15.0	11.2	207°51.4	4.7′	25°19.9	8.6′	59.7′
	SD = 16.1′	d = 1.0′	SD = 16.0′				

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

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

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 24-26 46-26%
04	11:41	11:34	12:12	06:33	19:02	
05	11:27	11:20	12:11	07:32	20:03	
06	11:13	11:06	12:11	08:33	21:04	

March 07, 08, 09 UT (Thu., Fri., Sat.)

	Aries	Venus		Mars		Jupiter		Saturn	
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	165°12.3	198°39.2	S14°25.1	204°50.4	S16°37.0	124°59.8	N14°41.9	182°26.6	S09°04.9
1	180°14.7	213°38.6	24.2	219°50.9	36.4	140°01.8	42.0	197°28.8	04.7
2	195°17.2	228°38.0	23.2	234°51.5	35.8	155°03.8	42.2	212°31.0	04.6
3	210°19.6	243°37.4	·· 22.3	249°52.0	·· 35.2	170°05.8	·· 42.3	227°33.1	·· 04.5
4	225°22.1	258°36.8	21.3	264°52.5	34.7	185°07.8	42.4	242°35.3	04.4
5	240°24.6	273°36.3	20.4	279°53.1	34.1	200°09.8	42.6	257°37.5	04.3
6	255°27.0	288°35.7	S14°19.4	294°53.6	S16°33.5	215°11.9	N14°42.7	272°39.7	S09°04.2
7	270°29.5	303°35.1	18.5	309°54.1	32.9	230°13.9	42.9	287°41.9	04.1
8	285°32.0	318°34.5	17.5	324°54.7	32.3	245°15.9	43.0	302°44.0	04.0
9	300°34.4	333°34.0	·· 16.6	339°55.2	·· 31.8	260°17.9	·· 43.2	317°46.2	·· 03.8
10	315°36.9	348°33.4	15.6	354°55.7	31.2	275°19.9	43.3	332°48.4	03.7
11	330°39.4	3°32.8	14.7	9°56.3	30.6	290°22.0	43.5	347°50.6	03.6
12	345°41.8	18°32.2	S14°13.7	24°56.8	S16°30.0	305°24.0	N14°43.6	2°52.7	S09°03.5
13	0°44.3	33°31.7	12.8	39°57.3	29.4	320°26.0	43.8	17°54.9	03.4
14	15°46.8	48°31.1	11.8	54°57.9	28.8	335°28.0	43.9	32°57.1	03.3
15	30°49.2	63°30.5	·· 10.8	69°58.4	·· 28.3	350°30.0	·· 44.1	47°59.3	·· 03.2
16	45°51.7	78°29.9	09.9	84°58.9	27.7	5°32.1	44.2	63°01.5	03.0
17	60°54.1	93°29.4	08.9	99°59.5	27.1	20°34.1	44.3	78°03.6	02.9
18	75°56.6	108°28.8	S14°08.0	115°00.0	S16°26.5	35°36.1	N14°44.5	93°05.8	S09°02.8
19	90°59.1	123°28.2	07.0	130°00.5	25.9	50°38.1	44.6	108°08.0	02.7
20	106°01.5	138°27.7	06.1	145°01.1	25.3	65°40.1	44.8	123°10.2	02.6
21	121°04.0	153°27.1	·· 05.1	160°01.6	·· 24.7	80°42.1	·· 44.9	138°12.4	·· 02.5
22	136°06.5	168°26.5	04.1	175°02.1	24.2	95°44.2	45.1	153°14.5	02.4
23	151°08.9	183°25.9	03.2	190°02.7	23.6	110°46.2	45.2	168°16.7	02.3
Mer.pass. 12:57		ν -0.6′ d 0.9′	m -3.88	ν 0.5′ d 0.6′	m 1.25	ν 2.0′ d 0.1′	m -2.15	ν 2.2′ d 0.1′	m 0.99

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	166°11.4	198°25.4	S14°02.2	205°03.2	S16°23.0	125°48.2	N14°45.4	183°18.9	S09°02.1
1	181°13.9	213°24.8	01.2	220°03.8	22.4	140°50.2	45.5	198°21.1	02.0
2	196°16.3	228°24.2	14°00.3	235°04.3	21.8	155°52.2	45.7	213°23.2	01.9
3	211°18.8	243°23.7	13°59.3	250°04.8	·· 21.2	170°54.2	·· 45.8	228°25.4	·· 01.8
4	226°21.3	258°23.1	58.3	265°05.4	20.6	185°56.2	46.0	243°27.6	01.7
5	241°23.7	273°22.5	57.4	280°05.9	20.1	200°58.3	46.1	258°29.8	01.6
6	256°26.2	288°22.0	S13°56.4	295°06.4	S16°19.5	216°00.3	N14°46.3	273°32.0	S09°01.5
7	271°28.6	303°21.4	55.4	310°07.0	18.9	231°02.3	46.4	288°34.1	01.4
8	286°31.1	318°20.8	54.5	325°07.5	18.3	246°04.3	46.5	303°36.3	01.2
9	301°33.6	333°20.3	·· 53.5	340°08.0	·· 17.7	261°06.3	·· 46.7	318°38.5	·· 01.1
10	316°36.0	348°19.7	52.5	355°08.6	17.1	276°08.3	46.8	333°40.7	01.0
11	331°38.5	3°19.1	51.6	10°09.1	16.5	291°10.3	47.0	348°42.9	00.9
12	346°41.0	18°18.6	S13°50.6	25°09.7	S16°15.9	306°12.4	N14°47.1	3°45.0	S09°00.8
13	1°43.4	33°18.0	49.6	40°10.2	15.3	321°14.4	47.3	18°47.2	00.7
14	16°45.9	48°17.5	48.7	55°10.7	14.7	336°16.4	47.4	33°49.4	00.6
15	31°48.4	63°16.9	·· 47.7	70°11.3	·· 14.2	351°18.4	·· 47.6	48°51.6	·· 00.5
16	46°50.8	78°16.3	46.7	85°11.8	13.6	6°20.4	47.7	63°53.7	00.3
17	61°53.3	93°15.8	45.7	100°12.4	13.0	21°22.4	47.9	78°55.9	00.2
18	76°55.8	108°15.2	S13°44.8	115°12.9	S16°12.4	36°24.4	N14°48.0	93°58.1	S09°00.1
19	91°58.2	123°14.6	43.8	130°13.4	11.8	51°26.5	48.2	109°00.3	09°00.0
20	107°00.7	138°14.1	42.8	145°14.0	11.2	66°28.5	48.3	124°02.5	08°59.9
21	122°03.1	153°13.5	·· 41.8	160°14.5	·· 10.6	81°30.5	·· 48.5	139°04.6	·· 59.8
22	137°05.6	168°13.0	40.9	175°15.1	10.0	96°32.5	48.6	154°06.8	59.7
23	152°08.1	183°12.4	39.9	190°15.6	09.4	111°34.5	48.8	169°09.0	59.5
Mer.pass. 12:53		ν -0.6′ d 1.0′	m -3.88	ν 0.5′ d 0.6′	m 1.25	ν 2.0′ d 0.1′	m -2.15	ν 2.2′ d 0.1′	m 0.99

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	167°10.5	198°11.9	S13°38.9	205°16.1	S16°08.8	126°36.5	N14°48.9	184°11.2	S08°59.4
1	182°13.0	213°11.3	37.9	220°16.7	08.2	141°38.5	49.0	199°13.4	59.3
2	197°15.5	228°10.7	36.9	235°17.2	07.6	156°40.5	49.2	214°15.5	59.2
3	212°17.9	243°10.2	·· 36.0	250°17.8	·· 07.0	171°42.5	·· 49.3	229°17.7	·· 59.1
4	227°20.4	258°09.6	35.0	265°18.3	06.4	186°44.6	49.5	244°19.9	59.0
5	242°22.9	273°09.1	34.0	280°18.8	05.9	201°46.6	49.6	259°22.1	58.9
6	257°25.3	288°08.5	S13°33.0	295°19.4	S16°05.3	216°48.6	N14°49.8	274°24.2	S08°58.8
7	272°27.8	303°08.0	32.0	310°19.9	04.7	231°50.6	49.9	289°26.4	58.6
8	287°30.2	318°07.4	31.0	325°20.5	04.1	246°52.6	50.1	304°28.6	58.5
9	302°32.7	333°06.8	·· 30.1	340°21.0	·· 03.5	261°54.6	·· 50.2	319°30.8	·· 58.4
10	317°35.2	348°06.3	29.1	355°21.5	02.9	276°56.6	50.4	334°33.0	58.3
11	332°37.6	3°05.7	28.1	10°22.1	02.3	291°58.6	50.5	349°35.1	58.2
12	347°40.1	18°05.2	S13°27.1	25°22.6	S16°01.7	307°00.6	N14°50.7	4°37.3	S08°58.1
13	2°42.6	33°04.6	26.1	40°23.2	01.1	322°02.6	50.8	19°39.5	58.0
14	17°45.0	48°04.1	25.1	55°23.7	16°00.5	337°04.7	51.0	34°41.7	57.9
15	32°47.5	63°03.5	·· 24.1	70°24.3	15°59.9	352°06.7	·· 51.1	49°43.9	·· 57.7
16	47°50.0	78°03.0	23.1	85°24.8	59.3	7°08.7	51.3	64°46.0	57.6
17	62°52.4	93°02.4	22.2	100°25.3	58.7	22°10.7	51.4	79°48.2	57.5
18	77°54.9	108°01.9	S13°21.2	115°25.9	S15°58.1	37°12.7	N14°51.6	94°50.4	S08°57.4
19	92°57.4	123°01.3	20.2	130°26.4	57.5	52°14.7	51.7	109°52.6	57.3
20	107°59.8	138°00.8	19.2	145°27.0	56.9	67°16.7	51.9	124°54.8	57.2
21	123°02.3	153°00.2	·· 18.2	160°27.5	·· 56.3	82°18.7	·· 52.0	139°56.9	·· 57.1
22	138°04.7	167°59.7	17.2	175°28.1	55.7	97°20.7	52.2	154°59.1	57.0
23	153°07.2	182°59.1	16.2	190°28.6	55.1	112°22.7	52.3	170°01.3	56.8
Mer.pass. 12:49		ν -0.6′ d 1.0′	m -3.88	ν 0.5′ d 0.6′	m 1.25	ν 2.0′ d 0.1′	m -2.14	ν 2.2′ d 0.1′	m 1.00

Stars

	SHA	Dec
Alpheratz	357°35.9	29°13.3
Ankaa	353°08.2	-42°10.7
Schedar	349°32.4	56°40.2
Diphda	348°48.3	-17°51.4
Achernar	335°21.1	-57°07.1
Hamal	327°52.2	23°34.6
Polaris	314°38.0	89°22.2
Acamar	315°12.5	-40°12.7
Menkar	314°07.0	4°11.0
Mirfak	308°29.5	49°56.9
Aldebaran	290°40.5	16°33.5
Rigel	281°04.5	-8°10.6
Capella	280°22.9	46°01.5
Bellatrix	278°23.6	6°22.2
Elnath	278°02.7	28°37.7
Alnilam	275°38.4	-1°11.3
Betelgeuse	270°52.8	7°24.6
Canopus	263°52.5	-52°42.7
Sirius	258°26.7	-16°45.1
Adhara	255°06.2	-29°00.5
Procyon	244°51.4	5°09.7
Pollux	243°17.9	27°58.1
Avior	234°14.6	-59°35.4
Suhail	222°46.5	-43°31.9
Miaplacidus	221°37.7	-69°49.1
Alphard	217°48.2	-8°45.9
Regulus	207°34.9	11°50.9
Dubhe	193°41.1	61°37.2
Denebola	182°25.3	14°26.1
Gienah	175°44.0	-17°40.6
Acrux	173°00.3	-63°13.9
Gacrux	171°51.9	-57°14.9
Alioth	166°13.0	55°49.5
Spica	158°22.8	-11°17.3
Alkaid	152°52.2	49°11.3
Hadar	148°36.6	-60°29.2
Menkent	147°58.2	-36°29.3
Arcturus	145°48.3	19°03.2
Rigil Kent.	139°40.9	-60°55.9
Kochab	137°19.1	74°03.0
Zuben'ubi	136°56.6	-16°08.6
Alphecca	126°04.2	26°37.7
Antares	112°16.6	-26°29.1
Atria	107°11.5	-69°04.0
Sabik	102°03.6	-15°45.4
Shaula	96°11.4	-37°07.2
Rasalhague	95°59.2	12°32.3
Eltanin	90°42.6	51°28.7
Kaus Aust.	83°33.6	-34°22.3
Vega	80°33.9	38°48.0
Nunki	75°48.8	-26°16.0
Altair	62°00.8	8°55.7
Peacock	53°07.2	-56°39.4
Deneb	49°26.7	45°21.7
Enif	33°39.8	9°59.0
Al Na'ir	27°34.2	-46°50.7
Fomalhaut	15°15.6	-29°29.8
Scheat	13°46.2	28°12.7
Markab	13°30.9	15°20.0

Mar 07 Thu	SHA	Mer.pass
Venus	33°26.9	10:46
Mars	39°38.1	10:20
Jupiter	319°47.5	15:38
Saturn	17°14.4	11:49

Mar 08 Fri	SHA	Mer.pass
Venus	32°14.0	10:47
Mars	38°51.8	10:19
Jupiter	319°36.8	15:35
Saturn	17°07.5	11:45

Mar 09 Sat	SHA	Mer.pass
Venus	31°01.3	10:48
Mars	38°05.6	10:19
Jupiter	319°26.0	15:31
Saturn	17°00.6	11:42

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.1072 sec ΔT = TT-UT1 = +69.0768 sec

2024 March 07 to Mar. 09 UT

h	Sun		Moon				
Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	177°15.2	S05°10.3	222°15.1	4.7′	S25°11.3	8.6′	59.7′
1	192°15.3	09.3	236°38.9	4.8′	25°02.7	8.9′	59.8′
2	207°15.5	08.3	251°02.7	4.8′	24°53.8	9.0′	59.8′
3	222°15.6	·· 07.4	265°26.5	4.9′	24°44.8	9.3′	59.8′
4	237°15.8	06.4	279°50.4	4.9′	24°35.5	9.4′	59.9′
5	252°15.9	05.4	294°14.3	5.0′	24°26.1	9.5′	59.9′
6	267°16.1	S05°04.4	308°38.3	5.0′	S24°16.6	9.8′	59.9′
7	282°16.2	03.5	323°02.3	5.1′	24°06.8	9.9′	60.0′
8	297°16.4	02.5	337°26.4	5.1′	23°56.9	10.1′	60.0′
9	312°16.5	·· 01.5	351°50.5	5.2′	23°46.8	10.2′	60.0′
10	327°16.7	05°00.5	6°14.7	5.2′	23°36.6	10.4′	60.1′
11	342°16.8	04°59.6	20°39.0	5.3′	23°26.2	10.6′	60.1′
12	357°17.0	S04°58.6	35°03.3	5.4′	S23°15.6	10.8′	60.1′
13	12°17.1	57.6	49°27.6	5.4′	23°04.8	10.9′	60.2′
14	27°17.3	56.6	63°52.0	5.5′	22°53.9	11.1′	60.2′
15	42°17.4	·· 55.7	78°16.5	5.5′	22°42.8	11.2′	60.2′
16	57°17.6	54.7	92°41.0	5.6′	22°31.6	11.4′	60.3′
17	72°17.7	53.7	107°05.6	5.7′	22°20.2	11.6′	60.3′
18	87°17.9	S04°52.7	121°30.3	5.7′	S22°08.6	11.7′	60.3′
19	102°18.0	51.8	135°55.0	5.8′	21°56.9	11.9′	60.4′
20	117°18.2	50.8	150°19.8	5.8′	21°45.0	12.1′	60.4′
21	132°18.3	·· 49.8	164°44.6	5.9′	21°32.9	12.1′	60.4′
22	147°18.5	48.8	179°09.5	6.0′	21°20.8	12.4′	60.5′
23	162°18.6	47.9	193°34.5	6.0′	21°08.4	12.5′	60.5′
	SD = 16.1′	d = 1.0′	SD = 16.3′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	177°18.8	S04°46.9	207°59.5	6.1′	S20°55.9	12.6′	60.5′
1	192°18.9	45.9	222°24.7	6.2′	20°43.3	12.8′	60.5′
2	207°19.1	44.9	236°49.8	6.2′	20°30.5	12.9′	60.6′
3	222°19.3	·· 43.9	251°15.1	6.3′	20°17.6	13.1′	60.6′
4	237°19.4	43.0	265°40.4	6.4′	20°04.5	13.2′	60.6′
5	252°19.6	42.0	280°05.8	6.4′	19°51.3	13.4′	60.7′
6	267°19.7	S04°41.0	294°31.2	6.5′	S19°37.9	13.5′	60.7′
7	282°19.9	40.0	308°56.7	6.6′	19°24.4	13.6′	60.7′
8	297°20.0	39.1	323°22.3	6.7′	19°10.8	13.8′	60.7′
9	312°20.2	·· 38.1	337°48.0	6.7′	18°57.0	13.9′	60.8′
10	327°20.3	37.1	352°13.7	6.8′	18°43.1	14.0′	60.8′
11	342°20.5	36.1	6°39.5	6.9′	18°29.1	14.2′	60.8′
12	357°20.6	S04°35.2	21°05.3	6.9′	S18°14.9	14.3′	60.8′
13	12°20.8	34.2	35°31.3	7.0′	18°00.6	14.4′	60.9′
14	27°21.0	33.2	49°57.3	7.1′	17°46.2	14.6′	60.9′
15	42°21.1	·· 32.2	64°23.3	7.1′	17°31.6	14.6′	60.9′
16	57°21.3	31.2	78°49.5	7.2′	17°17.0	14.8′	60.9′
17	72°21.4	30.3	93°15.7	7.3′	17°02.2	14.9′	60.9′
18	87°21.6	S04°29.3	107°41.9	7.3′	S16°47.3	15.0′	61.0′
19	102°21.7	28.3	122°08.3	7.4′	16°32.3	15.2′	61.0′
20	117°21.9	27.3	136°34.7	7.5′	16°17.1	15.2′	61.0′
21	132°22.0	·· 26.3	151°01.2	7.5′	16°01.9	15.4′	61.0′
22	147°22.2	25.4	165°27.7	7.6′	15°46.5	15.4′	61.0′
23	162°22.4	24.4	179°54.3	7.7′	15°31.1	15.6′	61.1′
	SD = 16.1′	d = 1.0′	SD = 16.5′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	177°22.5	S04°23.4	194°21.0	7.7′	S15°15.5	15.7′	61.1′
1	192°22.7	22.4	208°47.8	7.8′	14°59.8	15.8′	61.1′
2	207°22.8	21.5	223°14.6	7.9′	14°44.0	15.8′	61.1′
3	222°23.0	·· 20.5	237°41.5	7.9′	14°28.2	16.0′	61.1′
4	237°23.1	19.5	252°08.4	8.0′	14°12.2	16.1′	61.1′
5	252°23.3	18.5	266°35.4	8.1′	13°56.1	16.1′	61.2′
6	267°23.5	S04°17.5	281°02.5	8.1′	S13°40.0	16.3′	61.2′
7	282°23.6	16.6	295°29.6	8.2′	13°23.7	16.4′	61.2′
8	297°23.8	15.6	309°56.8	8.3′	13°07.3	16.4′	61.2′
9	312°23.9	·· 14.6	324°24.1	8.3′	12°50.9	16.5′	61.2′
10	327°24.1	13.6	338°51.4	8.4′	12°34.4	16.6′	61.2′
11	342°24.2	12.6	353°18.7	8.4′	12°17.8	16.7′	61.2′
12	357°24.4	S04°11.7	7°46.2	8.5′	S12°01.1	16.8′	61.3′
13	12°24.6	10.7	22°13.7	8.6′	11°44.3	16.8′	61.3′
14	27°24.7	09.7	36°41.2	8.6′	11°27.5	16.9′	61.3′
15	42°24.9	·· 08.7	51°08.8	8.7′	11°10.6	17.0′	61.3′
16	57°25.0	07.7	65°36.5	8.7′	10°53.6	17.1′	61.3′
17	72°25.2	06.8	80°04.2	8.8′	10°36.5	17.1′	61.3′
18	87°25.4	S04°05.8	94°32.0	8.8′	S10°19.4	17.2′	61.3′
19	102°25.5	04.8	108°59.8	8.9′	10°02.2	17.3′	61.3′
20	117°25.7	03.8	123°27.7	8.9′	09°44.9	17.3′	61.3′
21	132°25.8	·· 02.8	137°55.7	9.0′	09°27.6	17.4′	61.3′
22	147°26.0	01.9	152°23.6	9.0′	09°10.2	17.5′	61.3′
23	162°26.2	00.9	166°51.7	9.1′	08°52.7	17.4′	61.3′
	SD = 16.1′	d = 1.0′	SD = 16.7′				

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

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

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 27-29 16-3%
07	10:59	10:52	12:11	09:34	22:04	
08	10:45	10:37	12:11	10:32	23:00	
09	10:30	10:22	12:10	11:28	23:54	

No IERS EOP prediction data available

March 10, 11, 12 UT (Sun., Mon., Tue.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	168°09.7	197°58.6	S13°15.2	205°29.1	S15°54.5	127°24.7	N14°52.4	185°03.5	S08°56.7
1	183°12.1	212°58.0	14.2	220°29.7	53.9	142°26.7	52.6	200°05.6	56.6
2	198°14.6	227°57.5	13.2	235°30.2	53.3	157°28.8	52.7	215°07.8	56.5
3	213°17.1	242°56.9	·· 12.2	250°30.8	·· 52.7	172°30.8	·· 52.9	230°10.0	·· 56.4
4	228°19.5	257°56.4	11.2	265°31.3	52.1	187°32.8	53.0	245°12.2	56.3
5	243°22.0	272°55.9	10.2	280°31.9	51.5	202°34.8	53.2	260°14.4	56.2
6	258°24.5	287°55.3	S13°09.2	295°32.4	S15°50.9	217°36.8	N14°53.3	275°16.5	S08°56.1
7	273°26.9	302°54.8	08.2	310°33.0	50.3	232°38.8	53.5	290°18.7	55.9
8	288°29.4	317°54.2	07.2	325°33.5	49.7	247°40.8	53.6	305°20.9	55.8
9	303°31.8	332°53.7	·· 06.2	340°34.0	·· 49.1	262°42.8	·· 53.8	320°23.1	·· 55.7
10	318°34.3	347°53.1	05.2	355°34.6	48.5	277°44.8	53.9	335°25.3	55.6
11	333°36.8	2°52.6	04.2	10°35.1	47.9	292°46.8	54.1	350°27.4	55.5
12	348°39.2	17°52.0	S13°03.2	25°35.7	S15°47.3	307°48.8	N14°54.2	5°29.6	S08°55.4
13	3°41.7	32°51.5	02.2	40°36.2	46.7	322°50.8	54.4	20°31.8	55.3
14	18°44.2	47°51.0	01.2	55°36.8	46.1	337°52.8	54.5	35°34.0	55.2
15	33°46.6	62°50.4	13°00.2	70°37.3	·· 45.5	352°54.8	·· 54.7	50°36.2	·· 55.0
16	48°49.1	77°49.9	12°59.2	85°37.9	44.9	7°56.8	54.8	65°38.3	54.9
17	63°51.6	92°49.3	58.2	100°38.4	44.2	22°58.8	55.0	80°40.5	54.8
18	78°54.0	107°48.8	S12°57.2	115°39.0	S15°43.6	38°00.8	N14°55.1	95°42.7	S08°54.7
19	93°56.5	122°48.3	56.2	130°39.5	43.0	53°02.8	55.3	110°44.9	54.6
20	108°59.0	137°47.7	55.2	145°40.1	42.4	68°04.9	55.4	125°47.1	54.5
21	124°01.4	152°47.2	·· 54.2	160°40.6	·· 41.8	83°06.9	·· 55.6	140°49.2	·· 54.4
22	139°03.9	167°46.6	53.2	175°41.2	41.2	98°08.9	55.7	155°51.4	54.3
23	154°06.3	182°46.1	52.2	190°41.7	40.6	113°10.9	55.9	170°53.6	54.1
Mer.pass. 12:45		ν -0.5′	d 1.0′	m -3.88	ν 0.5′	d 0.6′	m 1.24	ν 2.0′	d 0.1′ m -2.14	ν 2.2′	d 0.1′ m 1.00

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	169°08.8	197°45.6	S12°51.2	205°42.2	S15°40.0	128°12.9	N14°56.0	185°55.8	S08°54.0
1	184°11.3	212°45.0	50.2	220°42.8	39.4	143°14.9	56.2	200°58.0	53.9
2	199°13.7	227°44.5	49.1	235°43.3	38.8	158°16.9	56.3	216°00.1	53.8
3	214°16.2	242°44.0	·· 48.1	250°43.9	·· 38.2	173°18.9	·· 56.5	231°02.3	·· 53.7
4	229°18.7	257°43.4	47.1	265°44.4	37.6	188°20.9	56.6	246°04.5	53.6
5	244°21.1	272°42.9	46.1	280°45.0	37.0	203°22.9	56.8	261°06.7	53.5
6	259°23.6	287°42.3	S12°45.1	295°45.5	S15°36.4	218°24.9	N14°56.9	276°08.9	S08°53.4
7	274°26.1	302°41.8	44.1	310°46.1	35.7	233°26.9	57.1	291°11.0	53.2
8	289°28.5	317°41.3	43.1	325°46.6	35.1	248°28.9	57.2	306°13.2	53.1
9	304°31.0	332°40.7	·· 42.1	340°47.2	·· 34.5	263°30.9	·· 57.4	321°15.4	·· 53.0
10	319°33.4	347°40.2	41.0	355°47.7	33.9	278°32.9	57.5	336°17.6	52.9
11	334°35.9	2°39.7	40.0	10°48.3	33.3	293°34.9	57.6	351°19.8	52.8
12	349°38.4	17°39.1	S12°39.0	25°48.8	S15°32.7	308°36.9	N14°57.8	6°21.9	S08°52.7
13	4°40.8	32°38.6	38.0	40°49.4	32.1	323°38.9	57.9	21°24.1	52.6
14	19°43.3	47°38.1	37.0	55°49.9	31.5	338°40.9	58.1	36°26.3	52.5
15	34°45.8	62°37.6	·· 36.0	70°50.5	·· 30.9	353°42.9	·· 58.2	51°28.5	·· 52.4
16	49°48.2	77°37.0	34.9	85°51.0	30.3	8°44.9	58.4	66°30.7	52.2
17	64°50.7	92°36.5	33.9	100°51.6	29.6	23°46.9	58.5	81°32.8	52.1
18	79°53.2	107°36.0	S12°32.9	115°52.1	S15°29.0	38°48.9	N14°58.7	96°35.0	S08°52.0
19	94°55.6	122°35.4	31.9	130°52.7	28.4	53°50.9	58.8	111°37.2	51.9
20	109°58.1	137°34.9	30.9	145°53.2	27.8	68°52.9	59.0	126°39.4	51.8
21	125°00.6	152°34.4	·· 29.8	160°53.8	·· 27.2	83°54.9	·· 59.1	141°41.6	·· 51.7
22	140°03.0	167°33.8	28.8	175°54.3	26.6	98°56.9	59.3	156°43.7	51.6
23	155°05.5	182°33.3	27.8	190°54.9	26.0	113°58.9	59.4	171°45.9	51.5
Mer.pass. 12:41		ν -0.5′	d 1.0′	m -3.88	ν 0.5′	d 0.6′	m 1.24	ν 2.0′	d 0.1′ m -2.14	ν 2.2′	d 0.1′ m 1.01

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	170°07.9	197°32.8	S12°26.8	205°55.5	S15°25.4	129°00.9	N14°59.6	186°48.1	S08°51.3
1	185°10.4	212°32.3	25.7	220°56.0	24.7	144°02.9	59.7	201°50.3	51.2
2	200°12.9	227°31.7	24.7	235°56.6	24.1	159°04.9	14°59.9	216°52.5	51.1
3	215°15.3	242°31.2	·· 23.7	250°57.1	·· 23.5	174°06.9	15°00.0	231°54.6	·· 51.0
4	230°17.8	257°30.7	22.7	265°57.7	22.9	189°08.9	00.2	246°56.8	50.9
5	245°20.3	272°30.2	21.6	280°58.2	22.3	204°10.9	00.3	261°59.0	50.8
6	260°22.7	287°29.6	S12°20.6	295°58.8	S15°21.7	219°12.9	N15°00.5	277°01.2	S08°50.7
7	275°25.2	302°29.1	19.6	310°59.3	21.1	234°14.9	00.6	292°03.4	50.6
8	290°27.7	317°28.6	18.6	325°59.9	20.4	249°16.9	00.8	307°05.5	50.4
9	305°30.1	332°28.1	·· 17.5	341°00.4	·· 19.8	264°18.9	·· 00.9	322°07.7	·· 50.3
10	320°32.6	347°27.5	16.5	356°01.0	19.2	279°20.9	01.1	337°09.9	50.2
11	335°35.1	2°27.0	15.5	11°01.5	18.6	294°22.9	01.2	352°12.1	50.1
12	350°37.5	17°26.5	S12°14.4	26°02.1	S15°18.0	309°24.9	N15°01.4	7°14.3	S08°50.0
13	5°40.0	32°26.0	13.4	41°02.6	17.4	324°26.9	01.5	22°16.4	49.9
14	20°42.4	47°25.5	12.4	56°03.2	16.7	339°28.9	01.7	37°18.6	49.8
15	35°44.9	62°24.9	·· 11.3	71°03.8	·· 16.1	354°30.9	·· 01.8	52°20.8	·· 49.7
16	50°47.4	77°24.4	10.3	86°04.3	15.5	9°32.8	02.0	67°23.0	49.5
17	65°49.8	92°23.9	09.3	101°04.9	14.9	24°34.8	02.1	82°25.2	49.4
18	80°52.3	107°23.4	S12°08.2	116°05.4	S15°14.3	39°36.8	N15°02.3	97°27.3	S08°49.3
19	95°54.8	122°22.9	07.2	131°06.0	13.7	54°38.8	02.4	112°29.5	49.2
20	110°57.2	137°22.3	06.2	146°06.5	13.0	69°40.8	02.6	127°31.7	49.1
21	125°59.7	152°21.8	·· 05.1	161°07.1	·· 12.4	84°42.8	·· 02.7	142°33.9	·· 49.0
22	141°02.2	167°21.3	04.1	176°07.6	11.8	99°44.8	02.9	157°36.1	48.9
23	156°04.6	182°20.8	03.1	191°08.2	11.2	114°46.8	03.0	172°38.2	48.8
Mer.pass. 12:37		ν -0.5′	d 1.0′	m -3.88	ν 0.6′	d 0.6′	m 1.24	ν 2.0′	d 0.1′ m -2.13	ν 2.2′	d 0.1′ m 1.01

Stars

	SHA	**Dec**
Alpheratz	357°35.9	29°13.3
Ankaa	353°08.2	-42°10.7
Schedar	349°32.4	56°40.2
Diphda	348°48.3	-17°51.4
Achernar	335°21.1	-57°07.1
Hamal	327°52.2	23°34.6
Polaris	314°39.4	89°22.2
Acamar	315°12.5	-40°12.7
Menkar	314°07.0	4°11.0
Mirfak	308°29.5	49°56.9
Aldebaran	290°40.5	16°33.5
Rigel	281°04.5	-8°10.6
Capella	280°22.9	46°01.5
Bellatrix	278°23.6	6°22.2
Elnath	278°02.7	28°37.7
Alnilam	275°38.4	-1°11.3
Betelgeuse	270°52.8	7°24.6
Canopus	263°52.6	-52°42.7
Sirius	258°26.7	-16°45.1
Adhara	255°06.3	-29°00.5
Procyon	244°51.4	5°09.7
Pollux	243°17.9	27°58.1
Avior	234°14.6	-59°35.4
Suhail	222°46.5	-43°32.0
Miaplacidus	221°37.7	-69°49.1
Alphard	217°48.2	-8°45.9
Regulus	207°34.9	11°50.9
Dubhe	193°41.1	61°37.2
Denebola	182°25.3	14°26.1
Gienah	175°44.0	-17°40.7
Acrux	173°00.3	-63°13.9
Gacrux	171°51.9	-57°14.9
Alioth	166°13.0	55°49.5
Spica	158°22.8	-11°17.3
Alkaid	152°52.1	49°11.3
Hadar	148°36.6	-60°29.2
Menkent	147°58.2	-36°29.3
Arcturus	145°48.3	19°03.2
Rigil Kent.	139°40.9	-60°56.0
Kochab	137°19.0	74°03.0
Zuben'ubi	136°56.6	-16°08.6
Alphecca	126°04.2	26°37.7
Antares	112°16.6	-26°29.1
Atria	107°11.4	-69°04.0
Sabik	102°03.6	-15°45.4
Shaula	96°11.3	-37°07.2
Rasalhague	95°59.2	12°32.3
Eltanin	90°42.6	51°28.7
Kaus Aust.	83°33.5	-34°22.3
Vega	80°33.8	38°48.0
Nunki	75°48.8	-26°16.0
Altair	62°00.8	8°55.7
Peacock	53°07.2	-56°39.4
Deneb	49°26.6	45°21.7
Enif	33°39.8	9°59.0
Al Na'ir	27°34.2	-46°50.7
Fomalhaut	15°15.6	-29°29.8
Scheat	13°46.2	28°12.7
Markab	13°30.9	15°20.0

Mar 10 Sun	**SHA**	**Mer.pass**
Venus	29°48.9	10:48
Mars	37°19.5	10:18
Jupiter	319°15.1	15:28
Saturn	16°53.8	11:38

Mar 11 Mon	**SHA**	**Mer.pass**
Venus	28°36.8	10:49
Mars	36°33.4	10:17
Jupiter	319°04.1	15:25
Saturn	16°47.0	11:35

Mar 12 Tue	**SHA**	**Mer.pass**
Venus	27°24.8	10:50
Mars	35°47.5	10:16
Jupiter	318°52.9	15:22
Saturn	16°40.1	11:31

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	177°26.3	S03°59.9	181°19.8	9.1′	S08°35.3	17.6′	61.3′
1	192°26.5	58.9	195°47.9	9.2′	08°17.7	17.6′	61.4′
2	207°26.6	57.9	210°16.1	9.2′	08°00.1	17.7′	61.4′
3	222°26.8	·· 56.9	224°44.3	9.3′	07°42.4	17.7′	61.4′
4	237°27.0	56.0	239°12.6	9.3′	07°24.7	17.7′	61.4′
5	252°27.1	55.0	253°40.9	9.4′	07°07.0	17.8′	61.4′
6	267°27.3	S03°54.0	268°09.2	9.4′	S06°49.2	17.8′	61.4′
7	282°27.4	53.0	282°37.6	9.4′	06°31.4	17.9′	61.4′
8	297°27.6	52.0	297°06.1	9.5′	06°13.5	17.9′	61.4′
9	312°27.8	·· 51.1	311°34.5	9.5′	05°55.6	17.9′	61.4′
10	327°27.9	50.1	326°03.0	9.6′	05°37.7	18.0′	61.4′
11	342°28.1	49.1	340°31.6	9.6′	05°19.7	18.0′	61.4′
12	357°28.2	S03°48.1	355°00.2	9.6′	S05°01.7	18.0′	61.4′
13	12°28.4	47.1	9°28.8	9.7′	04°43.7	18.1′	61.4′
14	27°28.6	46.1	23°57.5	9.7′	04°25.6	18.1′	61.3′
15	42°28.7	·· 45.2	38°26.1	9.7′	04°07.5	18.0′	61.3′
16	57°28.9	44.2	52°54.9	9.7′	03°49.5	18.2′	61.3′
17	72°29.1	43.2	67°23.6	9.8′	03°31.3	18.1′	61.3′
18	87°29.2	S03°42.2	81°52.4	9.8′	S03°13.2	18.1′	61.3′
19	102°29.4	41.2	96°21.2	9.8′	02°55.1	18.2′	61.3′
20	117°29.5	40.3	110°50.0	9.9′	02°36.9	18.2′	61.3′
21	132°29.7	·· 39.3	125°18.9	9.9′	02°18.7	18.1′	61.3′
22	147°29.9	38.3	139°47.8	9.9′	02°00.6	18.2′	61.3′
23	162°30.0	37.3	154°16.7	9.9′	01°42.4	18.2′	61.3′
	SD = 16.1′	d = 1.0′	SD = 16.7′				

Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	177°30.2	S03°36.3	168°45.6	9.9′	S01°24.2	18.2′	61.3′
1	192°30.4	35.3	183°14.5	10.0′	01°06.0	18.2′	61.3′
2	207°30.5	34.4	197°43.5	10.0′	00°47.8	18.2′	61.3′
3	222°30.7	·· 33.4	212°12.5	10.0′	00°29.6	18.2′	61.2′
4	237°30.8	32.4	226°41.5	10.0′	S00°11.4	18.1′	61.2′
5	252°31.0	31.4	241°10.5	10.0′	N00°06.7	18.2′	61.2′
6	267°31.2	S03°30.4	255°39.5	10.0′	N00°24.9	18.2′	61.2′
7	282°31.3	29.4	270°08.6	10.1′	00°43.1	18.1′	61.2′
8	297°31.5	28.5	284°37.6	10.1′	01°01.2	18.1′	61.2′
9	312°31.7	·· 27.5	299°06.7	10.1′	01°19.3	18.1′	61.2′
10	327°31.8	26.5	313°35.8	10.1′	01°37.4	18.1′	61.1′
11	342°32.0	25.5	328°04.9	10.1′	01°55.5	18.1′	61.1′
12	357°32.2	S03°24.5	342°34.0	10.1′	N02°13.6	18.0′	61.1′
13	12°32.3	23.5	357°03.1	10.1′	02°31.6	18.1′	61.1′
14	27°32.5	22.6	11°32.2	10.1′	02°49.7	18.0′	61.1′
15	42°32.7	·· 21.6	26°01.3	10.1′	03°07.7	17.9′	61.1′
16	57°32.8	20.6	40°30.4	10.1′	03°25.6	18.0′	61.0′
17	72°33.0	19.6	54°59.5	10.1′	03°43.6	17.9′	61.0′
18	87°33.2	S03°18.6	69°28.6	10.1′	N04°01.5	17.8′	61.0′
19	102°33.3	17.6	83°57.7	10.1′	04°19.3	17.9′	61.0′
20	117°33.5	16.6	98°26.8	10.1′	04°37.2	17.8′	61.0′
21	132°33.7	·· 15.7	112°55.9	10.1′	04°55.0	17.7′	60.9′
22	147°33.8	14.7	127°25.0	10.1′	05°12.7	17.7′	60.9′
23	162°34.0	13.7	141°54.1	10.1′	05°30.4	17.7′	60.9′
	SD = 16.1′	d = 1.0′	SD = 16.7′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	177°34.2	S03°12.7	156°23.2	10.1′	N05°48.1	17.6′	60.9′
1	192°34.3	11.7	170°52.3	10.1′	06°05.7	17.6′	60.8′
2	207°34.5	10.7	185°21.4	10.1′	06°23.3	17.5′	60.8′
3	222°34.7	·· 09.8	199°50.4	10.0′	06°40.8	17.5′	60.8′
4	237°34.8	08.8	214°19.5	10.0′	06°58.3	17.4′	60.8′
5	252°35.0	07.8	228°48.5	10.0′	07°15.7	17.3′	60.8′
6	267°35.2	S03°06.8	243°17.5	10.0′	N07°33.0	17.3′	60.7′
7	282°35.3	05.8	257°46.5	10.0′	07°50.3	17.3′	60.7′
8	297°35.5	04.8	272°15.5	10.0′	08°07.6	17.1′	60.7′
9	312°35.7	·· 03.8	286°44.5	10.0′	08°24.7	17.2′	60.6′
10	327°35.8	02.9	301°13.5	9.9′	08°41.9	17.0′	60.6′
11	342°36.0	01.9	315°42.4	9.9′	08°58.9	17.0′	60.6′
12	357°36.2	S03°00.9	330°11.3	9.9′	N09°15.9	16.9′	60.6′
13	12°36.3	02°59.9	344°40.2	9.9′	09°32.8	16.8′	60.5′
14	27°36.5	58.9	359°09.1	9.9′	09°49.6	16.8′	60.5′
15	42°36.7	·· 57.9	13°38.0	9.8′	10°06.4	16.7′	60.5′
16	57°36.8	56.9	28°06.8	9.8′	10°23.1	16.6′	60.4′
17	72°37.0	56.0	42°35.6	9.8′	10°39.7	16.6′	60.4′
18	87°37.2	S02°55.0	57°04.4	9.8′	N10°56.3	16.4′	60.4′
19	102°37.3	54.0	71°33.1	9.7′	11°12.7	16.4′	60.4′
20	117°37.5	53.0	86°01.9	9.7′	11°29.1	16.3′	60.3′
21	132°37.7	·· 52.0	100°30.6	9.7′	11°45.4	16.2′	60.3′
22	147°37.9	51.0	114°59.3	9.6′	12°01.6	16.2′	60.3′
23	162°38.0	50.0	129°27.9	9.6′	12°17.8	16.0′	60.2′
	SD = 16.1′	d = 1.0′	SD = 16.6′				

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

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

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 0-2 0-4%
10	10:15	10:07	12:10	12:21	–:–	
11	09:59	09:51	12:10	13:12	00:47	
12	09:43	09:35	12:10	14:04	01:38	

March 13, 14, 15 UT (Wed., Thu., Fri.)

	Aries	Venus		Mars		Jupiter		Saturn	
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	171°07.1	197°20.3	S12°02.0	206°08.8	S15°10.6	129°48.8	N15°03.2	187°40.4	S08°48.7
1	186°09.5	212°19.7	12°01.0	221°09.3	09.9	144°50.8	03.3	202°42.6	48.5
2	201°12.0	227°19.2	11°59.9	236°09.9	09.3	159°52.8	03.5	217°44.8	48.4
3	216°14.5	242°18.7	·· 58.9	251°10.4	·· 08.7	174°54.8	·· 03.6	232°47.0	·· 48.3
4	231°16.9	257°18.2	57.9	266°11.0	08.1	189°56.8	03.8	247°49.2	48.2
5	246°19.4	272°17.7	56.8	281°11.5	07.5	204°58.8	03.9	262°51.3	48.1
6	261°21.9	287°17.2	S11°55.8	296°12.1	S15°06.8	220°00.8	N15°04.1	277°53.5	S08°48.0
7	276°24.3	302°16.7	54.7	311°12.7	06.2	235°02.8	04.2	292°55.7	47.9
8	291°26.8	317°16.1	53.7	326°13.2	05.6	250°04.8	04.4	307°57.9	47.8
9	306°29.3	332°15.6	·· 52.7	341°13.8	·· 05.0	265°06.8	·· 04.5	323°00.1	·· 47.6
10	321°31.7	347°15.1	51.6	356°14.3	04.3	280°08.8	04.7	338°02.2	47.5
11	336°34.2	2°14.6	50.6	11°14.9	03.7	295°10.7	04.8	353°04.4	47.4
12	351°36.7	17°14.1	S11°49.5	26°15.4	S15°03.1	310°12.7	N15°05.0	8°06.6	S08°47.3
13	6°39.1	32°13.6	48.5	41°16.0	02.5	325°14.7	05.1	23°08.8	47.2
14	21°41.6	47°13.1	47.4	56°16.6	01.9	340°16.7	05.3	38°11.0	47.1
15	36°44.0	62°12.6	·· 46.4	71°17.1	·· 01.2	355°18.7	·· 05.4	53°13.1	·· 47.0
16	51°46.5	77°12.0	45.3	86°17.7	00.6	10°20.7	05.6	68°15.3	46.9
17	66°49.0	92°11.5	44.3	101°18.2	15°00.0	25°22.7	05.7	83°17.5	46.8
18	81°51.4	107°11.0	S11°43.3	116°18.8	S14°59.4	40°24.7	N15°05.9	98°19.7	S08°46.6
19	96°53.9	122°10.5	42.2	131°19.4	58.7	55°26.7	06.0	113°21.9	46.5
20	111°56.4	137°10.0	41.2	146°19.9	58.1	70°28.7	06.2	128°24.0	46.4
21	126°58.8	152°09.5	·· 40.1	161°20.5	·· 57.5	85°30.7	·· 06.3	143°26.2	·· 46.3
22	142°01.3	167°09.0	39.1	176°21.0	56.9	100°32.7	06.5	158°28.4	46.2
23	157°03.8	182°08.5	38.0	191°21.6	56.2	115°34.7	06.6	173°30.6	46.1
Mer.pass. 12:33		ν -0.5′	d 1.0′	m -3.88	ν 0.6′	d 0.6′	m 1.24	ν 2.0′	d 0.2′ m -2.13	ν 2.2′	d 0.1′ m 1.01

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	172°06.2	197°08.0	S11°37.0	206°22.2	S14°55.6	130°36.6	N15°06.8	188°32.8	S08°46.0
1	187°08.7	212°07.5	35.9	221°22.7	55.0	145°38.6	06.9	203°35.0	45.9
2	202°11.1	227°07.0	34.9	236°23.3	54.4	160°40.6	07.1	218°37.1	45.7
3	217°13.6	242°06.5	·· 33.8	251°23.8	·· 53.7	175°42.6	·· 07.2	233°39.3	·· 45.6
4	232°16.1	257°05.9	32.8	266°24.4	53.1	190°44.6	07.4	248°41.5	45.5
5	247°18.5	272°05.4	31.7	281°25.0	52.5	205°46.6	07.5	263°43.7	45.4
6	262°21.0	287°04.9	S11°30.6	296°25.5	S14°51.8	220°48.6	N15°07.7	278°45.9	S08°45.3
7	277°23.5	302°04.4	29.6	311°26.1	51.2	235°50.6	07.9	293°48.0	45.2
8	292°25.9	317°03.9	28.5	326°26.6	50.6	250°52.6	08.0	308°50.2	45.1
9	307°28.4	332°03.4	·· 27.5	341°27.2	·· 50.0	265°54.6	·· 08.2	323°52.4	·· 45.0
10	322°30.9	347°02.9	26.4	356°27.8	49.3	280°56.5	08.3	338°54.6	44.9
11	337°33.3	2°02.4	25.4	11°28.3	48.7	295°58.5	08.5	353°56.8	44.7
12	352°35.8	17°01.9	S11°24.3	26°28.9	S14°48.1	311°00.5	N15°08.6	8°59.0	S08°44.6
13	7°38.3	32°01.4	23.3	41°29.5	47.4	326°02.5	08.8	24°01.1	44.5
14	22°40.7	47°00.9	22.2	56°30.0	46.8	341°04.5	08.9	39°03.3	44.4
15	37°43.2	62°00.4	·· 21.1	71°30.6	·· 46.2	356°06.5	·· 09.1	54°05.5	·· 44.3
16	52°45.6	76°59.9	20.1	86°31.1	45.6	11°08.5	09.2	69°07.7	44.2
17	67°48.1	91°59.4	19.0	101°31.7	44.9	26°10.5	09.4	84°09.9	44.1
18	82°50.6	106°58.9	S11°18.0	116°32.3	S14°44.3	41°12.5	N15°09.5	99°12.0	S08°44.0
19	97°53.0	121°58.4	16.9	131°32.8	43.7	56°14.4	09.7	114°14.2	43.9
20	112°55.5	136°57.9	15.8	146°33.4	43.0	71°16.4	09.8	129°16.4	43.7
21	127°58.0	151°57.4	·· 14.8	161°34.0	·· 42.4	86°18.4	·· 10.0	144°18.6	·· 43.6
22	143°00.4	166°56.9	13.7	176°34.5	41.8	101°20.4	10.1	159°20.8	43.5
23	158°02.9	181°56.4	12.6	191°35.1	41.1	116°22.4	10.3	174°23.0	43.4
Mer.pass. 12:30		ν -0.5′	d 1.1′	m -3.88	ν 0.6′	d 0.6′	m 1.23	ν 2.0′	d 0.2′ m -2.12	ν 2.2′	d 0.1′ m 1.02

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	173°05.4	196°55.9	S11°11.6	206°35.7	S14°40.5	131°24.4	N15°10.4	189°25.1	S08°43.3
1	188°07.8	211°55.4	10.5	221°36.2	39.9	146°26.4	10.6	204°27.3	43.2
2	203°10.3	226°54.9	09.5	236°36.8	39.2	161°28.3	10.7	219°29.5	43.1
3	218°12.8	241°54.4	·· 08.4	251°37.3	·· 38.6	176°30.3	·· 10.9	234°31.7	·· 43.0
4	233°15.2	256°53.9	07.3	266°37.9	38.0	191°32.3	11.0	249°33.9	42.9
5	248°17.7	271°53.4	06.3	281°38.5	37.3	206°34.3	11.2	264°36.0	42.7
6	263°20.1	286°52.9	S11°05.2	296°39.0	S14°36.7	221°36.3	N15°11.3	279°38.2	S08°42.6
7	278°22.6	301°52.4	04.1	311°39.6	36.1	236°38.3	11.5	294°40.4	42.5
8	293°25.1	316°51.9	03.1	326°40.2	35.4	251°40.3	11.6	309°42.6	42.4
9	308°27.5	331°51.4	·· 02.0	341°40.7	·· 34.8	266°42.3	·· 11.8	324°44.8	·· 42.3
10	323°30.0	346°51.0	11°00.9	356°41.3	34.2	281°44.2	11.9	339°47.0	42.2
11	338°32.5	1°50.5	10°59.8	11°41.9	33.5	296°46.2	12.1	354°49.1	42.1
12	353°34.9	16°50.0	S10°58.8	26°42.4	S14°32.9	311°48.2	N15°12.2	9°51.3	S08°42.0
13	8°37.4	31°49.5	57.7	41°43.0	32.3	326°50.2	12.4	24°53.5	41.8
14	23°39.9	46°49.0	56.6	56°43.6	31.6	341°52.2	12.5	39°55.7	41.7
15	38°42.3	61°48.5	·· 55.6	71°44.1	·· 31.0	356°54.2	·· 12.7	54°57.9	·· 41.6
16	53°44.8	76°48.0	54.5	86°44.7	30.4	11°56.1	12.8	70°00.1	41.5
17	68°47.3	91°47.5	53.4	101°45.3	29.7	26°58.1	13.0	85°02.2	41.4
18	83°49.7	106°47.0	S10°52.3	116°45.8	S14°29.1	42°00.1	N15°13.1	100°04.4	S08°41.3
19	98°52.2	121°46.5	51.3	131°46.4	28.5	57°02.1	13.3	115°06.6	41.2
20	113°54.6	136°46.0	50.2	146°47.0	27.8	72°04.1	13.5	130°08.8	41.1
21	128°57.1	151°45.5	·· 49.1	161°47.5	·· 27.2	87°06.1	·· 13.6	145°11.0	·· 41.0
22	143°59.6	166°45.1	48.0	176°48.1	26.5	102°08.0	13.8	160°13.2	40.8
23	159°02.0	181°44.6	47.0	191°48.7	25.9	117°10.0	13.9	175°15.3	40.7
Mer.pass. 12:26		ν -0.5′	d 1.1′	m -3.88	ν 0.6′	d 0.6′	m 1.23	ν 2.0′	d 0.2′ m -2.12	ν 2.2′	d 0.1′ m 1.02

Stars

	SHA	Dec
Alpheratz	357°35.9	29°13.3
Ankaa	353°08.2	-42°10.6
Schedar	349°32.4	56°40.2
Diphda	348°48.3	-17°51.4
Achernar	335°21.2	-57°07.0
Hamal	327°52.3	23°34.6
Polaris	314°40.6	89°22.2
Acamar	315°12.5	-40°12.7
Menkar	314°07.1	4°11.0
Mirfak	308°29.5	49°56.9
Aldebaran	290°40.5	16°33.4
Rigel	281°04.6	-8°10.6
Capella	280°22.9	46°01.5
Bellatrix	278°23.6	6°22.2
Elnath	278°02.7	28°37.7
Alnilam	275°38.4	-1°11.3
Betelgeuse	270°52.8	7°24.6
Canopus	263°52.6	-52°42.8
Sirius	258°26.8	-16°45.1
Adhara	255°06.3	-29°00.5
Procyon	244°51.4	5°09.7
Pollux	243°18.0	27°58.1
Avior	234°14.6	-59°35.4
Suhail	222°46.5	-43°32.0
Miaplacidus	221°37.7	-69°49.1
Alphard	217°48.2	-8°45.9
Regulus	207°34.9	11°50.9
Dubhe	193°41.1	61°37.2
Denebola	182°25.3	14°26.1
Gienah	175°44.0	-17°40.7
Acrux	173°00.3	-63°14.0
Gacrux	171°51.9	-57°14.9
Alioth	166°13.0	55°49.6
Spica	158°22.8	-11°17.3
Alkaid	152°52.1	49°11.3
Hadar	148°36.5	-60°29.3
Menkent	147°58.2	-36°29.3
Arcturus	145°48.3	19°03.2
Rigil Kent.	139°40.8	-60°56.0
Kochab	137°19.0	74°03.0
Zuben'ubi	136°56.6	-16°08.6
Alphecca	126°04.1	26°37.7
Antares	112°16.6	-26°29.1
Atria	107°11.4	-69°04.0
Sabik	102°03.5	-15°45.4
Shaula	96°11.3	-37°07.2
Rasalhague	95°59.2	12°32.3
Eltanin	90°42.6	51°28.7
Kaus Aust.	83°33.5	-34°22.3
Vega	80°33.8	38°48.0
Nunki	75°48.7	-26°16.0
Altair	62°00.8	8°55.7
Peacock	53°07.2	-56°39.3
Deneb	49°26.6	45°21.7
Enif	33°39.8	9°58.9
Al Na'ir	27°34.2	-46°50.7
Fomalhaut	15°15.6	-29°29.8
Scheat	13°46.2	28°12.7
Markab	13°30.9	15°19.9

Mar 13 Wed	SHA	Mer.pass
Venus	26°13.2	10:51
Mars	35°01.7	10:15
Jupiter	318°41.7	15:19
Saturn	16°33.3	11:28

Mar 14 Thu	SHA	Mer.pass
Venus	25°01.8	10:52
Mars	34°15.9	10:14
Jupiter	318°30.4	15:16
Saturn	16°26.6	11:24

Mar 15 Fri	SHA	Mer.pass
Venus	23°50.6	10:53
Mars	33°30.3	10:13
Jupiter	318°19.0	15:12
Saturn	16°19.8	11:21

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	177°38.2	S02°49.1	143°56.5	9.6′	N12°33.8	16.0′	60.2′
1	192°38.4	48.1	158°25.1	9.6′	12°49.8	15.8′	60.2′
2	207°38.5	47.1	172°53.6	9.5′	13°05.6	15.8′	60.1′
3	222°38.7	·· 46.1	187°22.2	9.5′	13°21.4	15.7′	60.1′
4	237°38.9	45.1	201°50.7	9.5′	13°37.1	15.5′	60.1′
5	252°39.0	44.1	216°19.1	9.4′	13°52.6	15.5′	60.0′
6	267°39.2	S02°43.1	230°47.5	9.4′	N14°08.1	15.4′	60.0′
7	282°39.4	42.2	245°15.9	9.3′	14°23.5	15.3′	60.0′
8	297°39.6	41.2	259°44.2	9.3′	14°38.8	15.2′	59.9′
9	312°39.7	·· 40.2	274°12.6	9.3′	14°54.0	15.1′	59.9′
10	327°39.9	39.2	288°40.8	9.2′	15°09.1	14.9′	59.9′
11	342°40.1	38.2	303°09.1	9.2′	15°24.0	14.9′	59.8′
12	357°40.2	S02°37.2	317°37.3	9.2′	N15°38.9	14.8′	59.8′
13	12°40.4	36.2	332°05.4	9.1′	15°53.7	14.6′	59.8′
14	27°40.6	35.3	346°33.5	9.1′	16°08.3	14.6′	59.7′
15	42°40.8	·· 34.3	1°01.6	9.0′	16°22.9	14.4′	59.7′
16	57°40.9	33.3	15°29.6	9.0′	16°37.3	14.3′	59.6′
17	72°41.1	32.3	29°57.6	9.0′	16°51.6	14.2′	59.6′
18	87°41.3	S02°31.3	44°25.6	8.9′	N17°05.8	14.1′	59.6′
19	102°41.4	30.3	58°53.5	8.9′	17°19.9	14.0′	59.5′
20	117°41.6	29.3	73°21.4	8.8′	17°33.9	13.8′	59.5′
21	132°41.8	·· 28.3	87°49.2	8.8′	17°47.7	13.7′	59.5′
22	147°42.0	27.4	102°17.0	8.7′	18°01.4	13.7′	59.4′
23	162°42.1	26.4	116°44.7	8.7′	18°15.1	13.4′	59.4′
	SD = 16.1′	d = 1.0′	SD = 16.4′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	177°42.3	S02°25.4	131°12.4	8.7′	N18°28.5	13.4′	59.3′
1	192°42.5	24.4	145°40.1	8.6′	18°41.9	13.2′	59.3′
2	207°42.6	23.4	160°07.7	8.6′	18°55.1	13.1′	59.3′
3	222°42.8	·· 22.4	174°35.3	8.5′	19°08.2	13.0′	59.2′
4	237°43.0	21.4	189°02.8	8.5′	19°21.2	12.9′	59.2′
5	252°43.2	20.4	203°30.3	8.4′	19°34.1	12.7′	59.1′
6	267°43.3	S02°19.5	217°57.7	8.4′	N19°46.8	12.6′	59.1′
7	282°43.5	18.5	232°25.1	8.4′	19°59.4	12.5′	59.1′
8	297°43.7	17.5	246°52.5	8.3′	20°11.9	12.3′	59.0′
9	312°43.9	·· 16.5	261°19.8	8.3′	20°24.2	12.2′	59.0′
10	327°44.0	15.5	275°47.0	8.2′	20°36.4	12.0′	59.0′
11	342°44.2	14.5	290°14.2	8.2′	20°48.4	11.9′	58.9′
12	357°44.4	S02°13.5	304°41.4	8.1′	N21°00.3	11.8′	58.9′
13	12°44.5	12.5	319°08.5	8.1′	21°12.1	11.7′	58.8′
14	27°44.7	11.6	333°35.6	8.0′	21°23.8	11.5′	58.8′
15	42°44.9	·· 10.6	348°02.7	8.0′	21°35.3	11.3′	58.8′
16	57°45.1	09.6	2°29.7	8.0′	21°46.6	11.2′	58.7′
17	72°45.2	08.6	16°56.6	7.9′	21°57.8	11.1′	58.7′
18	87°45.4	S02°07.6	31°23.6	7.9′	N22°08.9	10.9′	58.6′
19	102°45.6	06.6	45°50.4	7.8′	22°19.8	10.8′	58.6′
20	117°45.8	05.6	60°17.3	7.8′	22°30.6	10.7′	58.6′
21	132°45.9	·· 04.6	74°44.1	7.8′	22°41.3	10.5′	58.5′
22	147°46.1	03.7	89°10.8	7.7′	22°51.8	10.3′	58.5′
23	162°46.3	02.7	103°37.5	7.7′	23°02.1	10.2′	58.4′
	SD = 16.1′	d = 1.0′	SD = 16.2′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	177°46.5	S02°01.7	118°04.2	7.6′	N23°12.3	10.0′	58.4′
1	192°46.6	02°00.7	132°30.9	7.6′	23°22.3	9.9′	58.4′
2	207°46.8	01°59.7	146°57.4	7.6′	23°32.2	9.8′	58.3′
3	222°47.0	·· 58.7	161°24.0	7.5′	23°42.0	9.6′	58.3′
4	237°47.2	57.7	175°50.5	7.5′	23°51.6	9.4′	58.2′
5	252°47.3	56.7	190°17.0	7.5′	24°01.0	9.3′	58.2′
6	267°47.5	S01°55.8	204°43.5	7.4′	N24°10.3	9.1′	58.2′
7	282°47.7	54.8	219°09.9	7.4′	24°19.4	9.0′	58.1′
8	297°47.9	53.8	233°36.3	7.3′	24°28.4	8.8′	58.1′
9	312°48.1	·· 52.8	248°02.6	7.3′	24°37.2	8.7′	58.0′
10	327°48.2	51.8	262°28.9	7.3′	24°45.9	8.5′	58.0′
11	342°48.4	50.8	276°55.2	7.3′	24°54.4	8.4′	58.0′
12	357°48.6	S01°49.8	291°21.5	7.2′	N25°02.8	8.1′	57.9′
13	12°48.8	48.8	305°47.7	7.2′	25°10.9	8.1′	57.9′
14	27°48.9	47.8	320°13.9	7.2′	25°19.0	7.9′	57.8′
15	42°49.1	·· 46.9	334°40.0	7.1′	25°26.9	7.7′	57.8′
16	57°49.3	45.9	349°06.2	7.1′	25°34.6	7.5′	57.8′
17	72°49.5	44.9	3°32.3	7.1′	25°42.1	7.4′	57.7′
18	87°49.6	S01°43.9	17°58.4	7.1′	N25°49.5	7.2′	57.7′
19	102°49.8	42.9	32°24.4	7.0′	25°56.7	7.1′	57.6′
20	117°50.0	41.9	46°50.5	7.0′	26°03.8	6.9′	57.6′
21	132°50.2	·· 40.9	61°16.5	7.0′	26°10.7	6.8′	57.6′
22	147°50.3	39.9	75°42.5	7.0′	26°17.5	6.6′	57.5′
23	162°50.5	39.0	90°08.5	7.0′	26°24.1	6.4′	57.5′
	SD = 16.1′	d = 1.0′	SD = 15.9′				

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

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

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 3-5 10-28%
13	09:27	09:19	12:09	14:56	02:29	
14	09:11	09:02	12:09	15:50	03:22	
15	08:54	08:46	12:09	16:45	04:17	

March 16, 17, 18 UT (Sat., Sun., Mon.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	174°04.5	196°44.1	S10°45.9	206°49.2	S14°25.3	132°12.0	N15°14.1	190°17.5	S08°40.6
1	189°07.0	211°43.6	44.8	221°49.8	24.6	147°14.0	14.2	205°19.7	40.5
2	204°09.4	226°43.1	43.7	236°50.4	24.0	162°16.0	14.4	220°21.9	40.4
3	219°11.9	241°42.6	·· 42.7	251°51.0	·· 23.3	177°18.0	·· 14.5	235°24.1	·· 40.3
4	234°14.4	256°42.1	41.6	266°51.5	22.7	192°19.9	14.7	250°26.2	40.2
5	249°16.8	271°41.6	40.5	281°52.1	22.1	207°21.9	14.8	265°28.4	40.1
6	264°19.3	286°41.2	S10°39.4	296°52.7	S14°21.4	222°23.9	N15°15.0	280°30.6	S08°40.0
7	279°21.7	301°40.7	38.4	311°53.2	20.8	237°25.9	15.1	295°32.8	39.9
8	294°24.2	316°40.2	37.3	326°53.8	20.2	252°27.9	15.3	310°35.0	39.7
9	309°26.7	331°39.7	·· 36.2	341°54.4	·· 19.5	267°29.9	·· 15.4	325°37.2	·· 39.6
10	324°29.1	346°39.2	35.1	356°54.9	18.9	282°31.8	15.6	340°39.3	39.5
11	339°31.6	1°38.7	34.0	11°55.5	18.2	297°33.8	15.7	355°41.5	39.4
12	354°34.1	16°38.2	S10°32.9	26°56.1	S14°17.6	312°35.8	N15°15.9	10°43.7	S08°39.3
13	9°36.5	31°37.8	31.9	41°56.7	16.9	327°37.8	16.0	25°45.9	39.2
14	24°39.0	46°37.3	30.8	56°57.2	16.3	342°39.8	16.2	40°48.1	39.1
15	39°41.5	61°36.8	·· 29.7	71°57.8	·· 15.7	357°41.7	·· 16.3	55°50.3	·· 39.0
16	54°43.9	76°36.3	28.6	86°58.4	15.0	12°43.7	16.5	70°52.4	38.9
17	69°46.4	91°35.8	27.5	101°58.9	14.4	27°45.7	16.6	85°54.6	38.7
18	84°48.9	106°35.3	S10°26.4	116°59.5	S14°13.7	42°47.7	N15°16.8	100°56.8	S08°38.6
19	99°51.3	121°34.9	25.4	132°00.1	13.1	57°49.7	17.0	115°59.0	38.5
20	114°53.8	136°34.4	24.3	147°00.7	12.5	72°51.6	17.1	131°01.2	38.4
21	129°56.2	151°33.9	·· 23.2	162°01.2	·· 11.8	87°53.6	·· 17.3	146°03.4	·· 38.3
22	144°58.7	166°33.4	22.1	177°01.8	11.2	102°55.6	17.4	161°05.5	38.2
23	160°01.2	181°32.9	21.0	192°02.4	10.5	117°57.6	17.6	176°07.7	38.1
Mer.pass. 12:22		ν -0.5′	d 1.1′	m -3.88	ν 0.6′	d 0.6′	m 1.23	ν 2.0′	d 0.2′ m -2.12	ν 2.2′	d 0.1′ m 1.02

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	175°03.6	196°32.5	S10°19.9	207°02.9	S14°09.9	132°59.6	N15°17.7	191°09.9	S08°38.0
1	190°06.1	211°32.0	18.8	222°03.5	09.2	148°01.5	17.9	206°12.1	37.9
2	205°08.6	226°31.5	17.7	237°04.1	08.6	163°03.5	18.0	221°14.3	37.7
3	220°11.0	241°31.0	·· 16.7	252°04.7	·· 07.9	178°05.5	·· 18.2	236°16.5	·· 37.6
4	235°13.5	256°30.6	15.6	267°05.2	07.3	193°07.5	18.3	251°18.7	37.5
5	250°16.0	271°30.1	14.5	282°05.8	06.7	208°09.5	18.5	266°20.8	37.4
6	265°18.4	286°29.6	S10°13.4	297°06.4	S14°06.0	223°11.4	N15°18.6	281°23.0	S08°37.3
7	280°20.9	301°29.1	12.3	312°07.0	05.4	238°13.4	18.8	296°25.2	37.2
8	295°23.4	316°28.6	11.2	327°07.5	04.7	253°15.4	18.9	311°27.4	37.1
9	310°25.8	331°28.2	·· 10.1	342°08.1	·· 04.1	268°17.4	·· 19.1	326°29.6	·· 37.0
10	325°28.3	346°27.7	09.0	357°08.7	03.4	283°19.4	19.2	341°31.8	36.9
11	340°30.7	1°27.2	07.9	12°09.3	02.8	298°21.3	19.4	356°33.9	36.7
12	355°33.2	16°26.7	S10°06.8	27°09.8	S14°02.1	313°23.3	N15°19.5	11°36.1	S08°36.6
13	10°35.7	31°26.3	05.7	42°10.4	01.5	328°25.3	19.7	26°38.3	36.5
14	25°38.1	46°25.8	04.6	57°11.0	00.8	343°27.3	19.8	41°40.5	36.4
15	40°40.6	61°25.3	·· 03.6	72°11.5	14°00.2	358°29.2	·· 20.0	56°42.7	·· 36.3
16	55°43.1	76°24.8	02.5	87°12.1	13°59.5	13°31.2	20.2	71°44.9	36.2
17	70°45.5	91°24.4	01.4	102°12.7	58.9	28°33.2	20.3	86°47.0	36.1
18	85°48.0	106°23.9	S10°00.3	117°13.3	S13°58.3	43°35.2	N15°20.5	101°49.2	S08°36.0
19	100°50.5	121°23.4	09°59.2	132°13.9	57.6	58°37.1	20.6	116°51.4	35.9
20	115°52.9	136°23.0	58.1	147°14.4	57.0	73°39.1	20.8	131°53.6	35.8
21	130°55.4	151°22.5	·· 57.0	162°15.0	·· 56.3	88°41.1	·· 20.9	146°55.8	·· 35.6
22	145°57.9	166°22.0	55.9	177°15.6	55.7	103°43.1	21.1	161°58.0	35.5
23	161°00.3	181°21.5	54.8	192°16.2	55.0	118°45.1	21.2	177°00.1	35.4
Mer.pass. 12:18		ν -0.5′	d 1.1′	m -3.88	ν 0.6′	d 0.6′	m 1.23	ν 2.0′	d 0.2′ m -2.11	ν 2.2′	d 0.1′ m 1.02

Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	176°02.8	196°21.1	S09°53.7	207°16.7	S13°54.4	133°47.0	N15°21.4	192°02.3	S08°35.3
1	191°05.2	211°20.6	52.6	222°17.3	53.7	148°49.0	21.5	207°04.5	35.2
2	206°07.7	226°20.1	51.5	237°17.9	53.1	163°51.0	21.7	222°06.7	35.1
3	221°10.2	241°19.7	·· 50.4	252°18.5	·· 52.4	178°53.0	·· 21.8	237°08.9	·· 35.0
4	236°12.6	256°19.2	49.3	267°19.0	51.8	193°54.9	22.0	252°11.1	34.9
5	251°15.1	271°18.7	48.2	282°19.6	51.1	208°56.9	22.1	267°13.3	34.8
6	266°17.6	286°18.2	S09°47.1	297°20.2	S13°50.5	223°58.9	N15°22.3	282°15.4	S08°34.7
7	281°20.0	301°17.8	46.0	312°20.8	49.8	239°00.9	22.4	297°17.6	34.5
8	296°22.5	316°17.3	44.9	327°21.3	49.2	254°02.8	22.6	312°19.8	34.4
9	311°25.0	331°16.8	·· 43.8	342°21.9	·· 48.5	269°04.8	·· 22.8	327°22.0	·· 34.3
10	326°27.4	346°16.4	42.7	357°22.5	47.9	284°06.8	22.9	342°24.2	34.2
11	341°29.9	1°15.9	41.6	12°23.1	47.2	299°08.8	23.1	357°26.4	34.1
12	356°32.3	16°15.4	S09°40.4	27°23.7	S13°46.5	314°10.7	N15°23.2	12°28.5	S08°34.0
13	11°34.8	31°15.0	39.3	42°24.2	45.9	329°12.7	23.4	27°30.7	33.9
14	26°37.3	46°14.5	38.2	57°24.8	45.2	344°14.7	23.5	42°32.9	33.8
15	41°39.7	61°14.0	·· 37.1	72°25.4	·· 44.6	359°16.6	·· 23.7	57°35.1	·· 33.7
16	56°42.2	76°13.6	36.0	87°26.0	43.9	14°18.6	23.8	72°37.3	33.5
17	71°44.7	91°13.1	34.9	102°26.6	43.3	29°20.6	24.0	87°39.5	33.4
18	86°47.1	106°12.7	S09°33.8	117°27.1	S13°42.6	44°22.6	N15°24.1	102°41.7	S08°33.3
19	101°49.6	121°12.2	32.7	132°27.7	42.0	59°24.5	24.3	117°43.8	33.2
20	116°52.1	136°11.7	31.6	147°28.3	41.3	74°26.5	24.4	132°46.0	33.1
21	131°54.5	151°11.3	·· 30.5	162°28.9	·· 40.7	89°28.5	·· 24.6	147°48.2	·· 33.0
22	146°57.0	166°10.8	29.4	177°29.5	40.0	104°30.5	24.7	162°50.4	32.9
23	161°59.5	181°10.3	28.3	192°30.0	39.4	119°32.4	24.9	177°52.6	32.8
Mer.pass. 12:14		ν -0.5′	d 1.1′	m -3.88	ν 0.6′	d 0.6′	m 1.23	ν 2.0′	d 0.2′ m -2.11	ν 2.2′	d 0.1′ m 1.03

Stars

	SHA	Dec
Alpheratz	357°35.9	29°13.3
Ankaa	353°08.2	-42°10.6
Schedar	349°32.4	56°40.2
Diphda	348°48.3	-17°51.4
Achernar	335°21.2	-57°07.0
Hamal	327°52.3	23°34.6
Polaris	314°41.4	89°22.2
Acamar	315°12.5	-40°12.7
Menkar	314°07.1	4°11.0
Mirfak	308°29.5	49°56.9
Aldebaran	290°40.5	16°33.4
Rigel	281°04.6	-8°10.6
Capella	280°23.0	46°01.5
Bellatrix	278°23.6	6°22.2
Elnath	278°02.8	28°37.7
Alnilam	275°38.4	-1°11.3
Betelgeuse	270°52.8	7°24.6
Canopus	263°52.6	-52°42.8
Sirius	258°26.8	-16°45.1
Adhara	255°06.3	-29°00.5
Procyon	244°51.4	5°09.7
Pollux	243°18.0	27°58.1
Avior	234°14.7	-59°35.4
Suhail	222°46.5	-43°32.0
Miaplacidus	221°37.8	-69°49.1
Alphard	217°48.2	-8°45.9
Regulus	207°34.9	11°50.9
Dubhe	193°41.1	61°37.2
Denebola	182°25.3	14°26.1
Gienah	175°44.0	-17°40.7
Acrux	173°00.2	-63°14.0
Gacrux	171°51.9	-57°14.9
Alioth	166°13.0	55°49.6
Spica	158°22.7	-11°17.4
Alkaid	152°52.1	49°11.3
Hadar	148°36.5	-60°29.3
Menkent	147°58.1	-36°29.3
Arcturus	145°48.3	19°03.2
Rigil Kent.	139°40.8	-60°56.0
Kochab	137°18.9	74°03.0
Zuben'ubi	136°56.6	-16°08.6
Alphecca	126°04.1	26°37.7
Antares	112°16.6	-26°29.1
Atria	107°11.3	-69°04.0
Sabik	102°03.5	-15°45.4
Shaula	96°11.3	-37°07.2
Rasalhague	95°59.2	12°32.3
Eltanin	90°42.5	51°28.7
Kaus Aust.	83°33.5	-34°22.3
Vega	80°33.8	38°48.0
Nunki	75°48.7	-26°16.0
Altair	62°00.8	8°55.7
Peacock	53°07.1	-56°39.3
Deneb	49°26.6	45°21.7
Enif	33°39.7	9°58.9
Al Na'ir	27°34.2	-46°50.7
Fomalhaut	15°15.6	-29°29.8
Scheat	13°46.2	28°12.7
Markab	13°30.9	15°19.9

Mar 16 Sat	SHA	Mer.pass
Venus	22°39.6	10:53
Mars	32°44.8	10:12
Jupiter	318°07.5	15:09
Saturn	16°13.0	11:17

Mar 17 Sun	SHA	Mer.pass
Venus	21°28.8	10:54
Mars	31°59.3	10:11
Jupiter	317°55.9	15:06
Saturn	16°06.3	11:14

Mar 18 Mon	SHA	Mer.pass
Venus	20°18.3	10:55
Mars	31°14.0	10:10
Jupiter	317°44.2	15:03
Saturn	15°59.6	11:10

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h — Sun — Moon

Sat	GHA	Dec	GHA	ν	Dec	d	HP
0	177°50.7	S01°38.0	104°34.5	6.9′	N26°30.5	6.2′	57.4′
1	192°50.9	37.0	119°00.4	6.9′	26°36.7	6.1′	57.4′
2	207°51.1	36.0	133°26.3	6.9′	26°42.8	6.0′	57.4′
3	222°51.2	·· 35.0	147°52.2	6.9′	26°48.8	5.7′	57.3′
4	237°51.4	34.0	162°18.1	6.9′	26°54.5	5.6′	57.3′
5	252°51.6	33.0	176°44.0	6.9′	27°00.1	5.4′	57.2′
6	267°51.8	S01°32.0	191°09.9	6.9′	N27°05.5	5.3′	57.2′
7	282°51.9	31.0	205°35.8	6.9′	27°10.8	5.1′	57.2′
8	297°52.1	30.1	220°01.7	6.9′	27°15.9	5.0′	57.1′
9	312°52.3	·· 29.1	234°27.5	6.9′	27°20.9	4.7′	57.1′
10	327°52.5	28.1	248°53.4	6.9′	27°25.6	4.6′	57.1′
11	342°52.7	27.1	263°19.2	6.9′	27°30.2	4.5′	57.0′
12	357°52.8	S01°26.1	277°45.1	6.9′	N27°34.7	4.3′	57.0′
13	12°53.0	25.1	292°10.9	6.9′	27°39.0	4.1′	57.0′
14	27°53.2	24.1	306°36.8	6.9′	27°43.1	3.9′	56.9′
15	42°53.4	·· 23.1	321°02.6	6.9′	27°47.0	3.8′	56.9′
16	57°53.6	22.1	335°28.5	6.9′	27°50.8	3.6′	56.8′
17	72°53.7	21.2	349°54.4	6.9′	27°54.4	3.4′	56.8′
18	87°53.9	S01°20.2	4°20.2	6.9′	N27°57.8	3.3′	56.8′
19	102°54.1	19.2	18°46.1	6.9′	28°01.1	3.1′	56.7′
20	117°54.3	18.2	33°12.0	6.9′	28°04.2	3.0′	56.7′
21	132°54.5	·· 17.2	47°37.9	6.9′	28°07.2	2.8′	56.7′
22	147°54.6	16.2	62°03.8	6.9′	28°10.0	2.6′	56.6′
23	162°54.8	15.2	76°29.8	6.9′	28°12.6	2.5′	56.6′
	SD = 16.1′	d = 1.0′	SD = 15.7′				

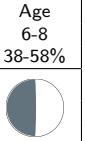
Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	177°55.0	S01°14.2	90°55.7	7.0′	N28°15.1	2.2′	56.6′
1	192°55.2	13.3	105°21.7	7.0′	28°17.3	2.2′	56.5′
2	207°55.4	12.3	119°47.7	7.0′	28°19.5	1.9′	56.5′
3	222°55.5	·· 11.3	134°13.7	7.0′	28°21.4	1.8′	56.5′
4	237°55.7	10.3	148°39.7	7.1′	28°23.2	1.7′	56.4′
5	252°55.9	09.3	163°05.8	7.1′	28°24.9	1.4′	56.4′
6	267°56.1	S01°08.3	177°31.9	7.1′	N28°26.3	1.4′	56.4′
7	282°56.3	07.3	191°58.0	7.1′	28°27.7	1.1′	56.3′
8	297°56.4	06.3	206°24.1	7.2′	28°28.8	1.0′	56.3′
9	312°56.6	·· 05.3	220°50.3	7.2′	28°29.8	0.8′	56.3′
10	327°56.8	04.4	235°16.5	7.2′	28°30.6	0.7′	56.2′
11	342°57.0	03.4	249°42.7	7.3′	28°31.3	0.5′	56.2′
12	357°57.2	S01°02.4	264°09.0	7.3′	N28°31.8	0.3′	56.2′
13	12°57.3	01.4	278°35.3	7.3′	28°32.1	0.2′	56.1′
14	27°57.5	01°00.4	293°01.6	7.4′	28°32.3	0.0′	56.1′
15	42°57.7	00°59.4	307°28.0	7.4′	28°32.3	0.1′	56.1′
16	57°57.9	58.4	321°54.4	7.5′	28°32.2	0.3′	56.0′
17	72°58.1	57.4	336°20.9	7.5′	28°31.9	0.5′	56.0′
18	87°58.2	S00°56.4	350°47.4	7.6′	N28°31.4	0.6′	56.0′
19	102°58.4	55.5	5°14.0	7.6′	28°30.8	0.7′	55.9′
20	117°58.6	54.5	19°40.6	7.6′	28°30.1	1.0′	55.9′
21	132°58.8	·· 53.5	34°07.2	7.7′	28°29.1	1.0′	55.9′
22	147°59.0	52.5	48°33.9	7.7′	28°28.1	1.3′	55.8′
23	162°59.1	51.5	63°00.7	7.8′	28°26.8	1.3′	55.8′
	SD = 16.1′	d = 1.0′	SD = 15.4′				

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	177°59.3	S00°50.5	77°27.5	7.9′	N28°25.5	1.6′	55.8′
1	192°59.5	49.5	91°54.3	7.9′	28°23.9	1.7′	55.7′
2	207°59.7	48.5	106°21.2	8.0′	28°22.2	1.8′	55.7′
3	222°59.9	·· 47.5	120°48.2	8.0′	28°20.4	2.0′	55.7′
4	238°00.1	46.6	135°15.2	8.1′	28°18.4	2.2′	55.7′
5	253°00.2	45.6	149°42.3	8.1′	28°16.2	2.2′	55.6′
6	268°00.4	S00°44.6	164°09.4	8.2′	N28°14.0	2.5′	55.6′
7	283°00.6	43.6	178°36.6	8.3′	28°11.5	2.6′	55.6′
8	298°00.8	42.6	193°03.9	8.3′	28°08.9	2.7′	55.5′
9	313°01.0	·· 41.6	207°31.2	8.4′	28°06.2	2.9′	55.5′
10	328°01.2	40.6	221°58.6	8.5′	28°03.3	3.0′	55.5′
11	343°01.3	39.6	236°26.1	8.5′	28°00.3	3.2′	55.5′
12	358°01.5	S00°38.6	250°53.6	8.6′	N27°57.1	3.3′	55.4′
13	13°01.7	37.7	265°21.2	8.7′	27°53.8	3.5′	55.4′
14	28°01.9	36.7	279°48.8	8.7′	27°50.3	3.6′	55.4′
15	43°02.1	·· 35.7	294°16.6	8.8′	27°46.7	3.7′	55.4′
16	58°02.2	34.7	308°44.4	8.9′	27°43.0	3.9′	55.3′
17	73°02.4	33.7	323°12.2	8.9′	27°39.1	4.0′	55.3′
18	88°02.6	S00°32.7	337°40.2	9.0′	N27°35.1	4.2′	55.3′
19	103°02.8	31.7	352°08.2	9.1′	27°30.9	4.3′	55.3′
20	118°03.0	30.7	6°36.3	9.2′	27°26.6	4.4′	55.2′
21	133°03.2	·· 29.7	21°04.4	9.2′	27°22.2	4.6′	55.2′
22	148°03.3	28.8	35°32.7	9.3′	27°17.6	4.7′	55.2′
23	163°03.5	27.8	50°01.0	9.4′	27°12.9	4.8′	55.2′
	SD = 16.1′	d = 1.0′	SD = 15.2′				

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

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

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 6-8 38-58%
16	08:37	08:29	12:08	17:42	05:14	
17	08:20	08:11	12:08	18:38	06:10	
18	08:03	07:54	12:08	19:33	07:06	



March 19, 20, 21 UT (Tue., Wed., Thu.)

	Aries	Venus		Mars		Jupiter		Saturn	
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	177°01.9	196°09.9	S09°27.2	207°30.6	S13°38.7	134°34.4	N15°25.1	192°54.8	S08°32.7
1	192°04.4	211°09.4	26.0	222°31.2	38.0	149°36.4	25.2	207°57.0	32.6
2	207°06.8	226°08.9	24.9	237°31.8	37.4	164°38.3	25.4	222°59.1	32.4
3	222°09.3	241°08.5	·· 23.8	252°32.4	·· 36.7	179°40.3	·· 25.5	238°01.3	·· 32.3
4	237°11.8	256°08.0	22.7	267°32.9	36.1	194°42.3	25.7	253°03.5	32.2
5	252°14.2	271°07.6	21.6	282°33.5	35.4	209°44.3	25.8	268°05.7	32.1
6	267°16.7	286°07.1	S09°20.5	297°34.1	S13°34.8	224°46.2	N15°26.0	283°07.9	S08°32.0
7	282°19.2	301°06.6	19.4	312°34.7	34.1	239°48.2	26.1	298°10.1	31.9
8	297°21.6	316°06.2	18.3	327°35.3	33.5	254°50.2	26.3	313°12.3	31.8
9	312°24.1	331°05.7	·· 17.1	342°35.8	·· 32.8	269°52.1	·· 26.4	328°14.4	·· 31.7
10	327°26.6	346°05.3	16.0	357°36.4	32.1	284°54.1	26.6	343°16.6	31.6
11	342°29.0	1°04.8	14.9	12°37.0	31.5	299°56.1	26.7	358°18.8	31.5
12	357°31.5	16°04.4	S09°13.8	27°37.6	S13°30.8	314°58.1	N15°26.9	13°21.0	S08°31.3
13	12°34.0	31°03.9	12.7	42°38.2	30.2	330°00.0	27.0	28°23.2	31.2
14	27°36.4	46°03.4	11.6	57°38.8	29.5	345°02.0	27.2	43°25.4	31.1
15	42°38.9	61°03.0	·· 10.5	72°39.3	·· 28.9	0°04.0	·· 27.4	58°27.6	·· 31.0
16	57°41.3	76°02.5	09.3	87°39.9	28.2	15°05.9	27.5	73°29.7	30.9
17	72°43.8	91°02.1	08.2	102°40.5	27.5	30°07.9	27.7	88°31.9	30.8
18	87°46.3	106°01.6	S09°07.1	117°41.1	S13°26.9	45°09.9	N15°27.8	103°34.1	S08°30.7
19	102°48.7	121°01.2	06.0	132°41.7	26.2	60°11.8	28.0	118°36.3	30.6
20	117°51.2	136°00.7	04.9	147°42.3	25.6	75°13.8	28.1	133°38.5	30.5
21	132°53.7	151°00.2	·· 03.7	162°42.8	·· 24.9	90°15.8	·· 28.3	148°40.7	·· 30.4
22	147°56.1	165°59.8	02.6	177°43.4	24.2	105°17.7	28.4	163°42.9	30.3
23	162°58.6	180°59.3	01.5	192°44.0	23.6	120°19.7	28.6	178°45.0	30.1
Mer.pass. 12:10		ν -0.5′	d 1.1′	m -3.88	ν 0.6′	d 0.7′	m 1.22	ν 2.0′	d 0.2′ m -2.11	ν 2.2′	d 0.1′ m 1.03

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	178°01.1	195°58.9	S09°00.4	207°44.6	S13°22.9	135°21.7	N15°28.7	193°47.2	S08°30.0
1	193°03.5	210°58.4	08°59.3	222°45.2	22.3	150°23.7	28.9	208°49.4	29.9
2	208°06.0	225°58.0	58.1	237°45.8	21.6	165°25.6	29.0	223°51.6	29.8
3	223°08.5	240°57.5	·· 57.0	252°46.3	·· 20.9	180°27.6	·· 29.2	238°53.8	·· 29.7
4	238°10.9	255°57.1	55.9	267°46.9	20.3	195°29.6	29.4	253°56.0	29.6
5	253°13.4	270°56.6	54.8	282°47.5	19.6	210°31.5	29.5	268°58.2	29.5
6	268°15.8	285°56.2	S08°53.7	297°48.1	S13°19.0	225°33.5	N15°29.7	284°00.3	S08°29.4
7	283°18.3	300°55.7	52.5	312°48.7	18.3	240°35.5	29.8	299°02.5	29.3
8	298°20.8	315°55.3	51.4	327°49.3	17.6	255°37.4	30.0	314°04.7	29.2
9	313°23.2	330°54.8	·· 50.3	342°49.9	·· 17.0	270°39.4	·· 30.1	329°06.9	·· 29.0
10	328°25.7	345°54.4	49.2	357°50.4	16.3	285°41.4	30.3	344°09.1	28.9
11	343°28.2	0°53.9	48.0	12°51.0	15.6	300°43.3	30.4	359°11.3	28.8
12	358°30.6	15°53.5	S08°46.9	27°51.6	S13°15.0	315°45.3	N15°30.6	14°13.5	S08°28.7
13	13°33.1	30°53.0	45.8	42°52.2	14.3	330°47.3	30.7	29°15.6	28.6
14	28°35.6	45°52.6	44.7	57°52.8	13.6	345°49.2	30.9	44°17.8	28.5
15	43°38.0	60°52.1	·· 43.5	72°53.4	·· 13.0	0°51.2	·· 31.0	59°20.0	·· 28.4
16	58°40.5	75°51.7	42.4	87°54.0	12.3	15°53.2	31.2	74°22.2	28.3
17	73°42.9	90°51.2	41.3	102°54.5	11.7	30°55.1	31.4	89°24.4	28.2
18	88°45.4	105°50.8	S08°40.1	117°55.1	S13°11.0	45°57.1	N15°31.5	104°26.6	S08°28.1
19	103°47.9	120°50.3	39.0	132°55.7	10.3	60°59.1	31.7	119°28.8	28.0
20	118°50.3	135°49.9	37.9	147°56.3	09.7	76°01.0	31.8	134°31.0	27.8
21	133°52.8	150°49.4	·· 36.8	162°56.9	·· 09.0	91°03.0	·· 32.0	149°33.1	·· 27.7
22	148°55.3	165°49.0	35.6	177°57.5	08.3	106°05.0	32.1	164°35.3	27.6
23	163°57.7	180°48.5	34.5	192°58.1	07.7	121°06.9	32.3	179°37.5	27.5
Mer.pass. 12:06		ν -0.5′	d 1.1′	m -3.88	ν 0.6′	d 0.7′	m 1.22	ν 2.0′	d 0.2′ m -2.10	ν 2.2′	d 0.1′ m 1.03

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	179°00.2	195°48.1	S08°33.4	207°58.7	S13°07.0	136°08.9	N15°32.4	194°39.7	S08°27.4
1	194°02.7	210°47.6	32.2	222°59.2	06.3	151°10.9	32.6	209°41.9	27.3
2	209°05.1	225°47.2	31.1	237°59.8	05.7	166°12.8	32.7	224°44.1	27.2
3	224°07.6	240°46.7	·· 30.0	253°00.4	·· 05.0	181°14.8	·· 32.9	239°46.3	·· 27.1
4	239°10.1	255°46.3	28.8	268°01.0	04.3	196°16.7	33.0	254°48.5	27.0
5	254°12.5	270°45.8	27.7	283°01.6	03.7	211°18.7	33.2	269°50.6	26.9
6	269°15.0	285°45.4	S08°26.6	298°02.2	S13°03.0	226°20.7	N15°33.4	284°52.8	S08°26.8
7	284°17.4	300°45.0	25.5	313°02.8	02.3	241°22.6	33.5	299°55.0	26.6
8	299°19.9	315°44.5	24.3	328°03.4	01.7	256°24.6	33.7	314°57.2	26.5
9	314°22.4	330°44.1	·· 23.2	343°04.0	·· 01.0	271°26.6	·· 33.8	329°59.4	·· 26.4
10	329°24.8	345°43.6	22.0	358°04.5	13°00.3	286°28.5	34.0	345°01.6	26.3
11	344°27.3	0°43.2	20.9	13°05.1	12°59.7	301°30.5	34.1	0°03.8	26.2
12	359°29.8	15°42.7	S08°19.8	28°05.7	S12°59.0	316°32.5	N15°34.3	15°05.9	S08°26.1
13	14°32.2	30°42.3	18.6	43°06.3	58.3	331°34.4	34.4	30°08.1	26.0
14	29°34.7	45°41.9	17.5	58°06.9	57.7	346°36.4	34.6	45°10.3	25.9
15	44°37.2	60°41.4	·· 16.4	73°07.5	·· 57.0	1°38.3	·· 34.7	60°12.5	·· 25.8
16	59°39.6	75°41.0	15.2	88°08.1	56.3	16°40.3	34.9	75°14.7	25.7
17	74°42.1	90°40.5	14.1	103°08.7	55.7	31°42.3	35.1	90°16.9	25.6
18	89°44.6	105°40.1	S08°13.0	118°09.3	S12°55.0	46°44.2	N15°35.2	105°19.1	S08°25.4
19	104°47.0	120°39.7	11.8	133°09.9	54.3	61°46.2	35.4	120°21.3	25.3
20	119°49.5	135°39.2	10.7	148°10.5	53.6	76°48.2	35.5	135°23.5	25.2
21	134°51.9	150°38.8	·· 09.5	163°11.0	·· 53.0	91°50.1	·· 35.7	150°25.6	·· 25.1
22	149°54.4	165°38.3	08.4	178°11.6	52.3	106°52.1	35.8	165°27.8	25.0
23	164°56.9	180°37.9	07.3	193°12.2	51.6	121°54.0	36.0	180°30.0	24.9
Mer.pass. 12:02		ν -0.4′	d 1.1′	m -3.88	ν 0.6′	d 0.7′	m 1.22	ν 2.0′	d 0.2′ m -2.10	ν 2.2′	d 0.1′ m 1.03

Stars

	SHA	Dec
Alpheratz	357°35.8	29°13.3
Ankaa	353°08.2	-42°10.6
Schedar	349°32.4	56°40.2
Diphda	348°48.3	-17°51.4
Achernar	335°21.2	-57°07.0
Hamal	327°52.3	23°34.5
Polaris	314°42.4	89°22.2
Acamar	315°12.6	-40°12.7
Menkar	314°07.1	4°11.0
Mirfak	308°29.5	49°56.9
Aldebaran	290°40.5	16°33.4
Rigel	281°04.6	-8°10.6
Capella	280°23.0	46°01.5
Bellatrix	278°23.6	6°22.2
Elnath	278°02.8	28°37.7
Alnilam	275°38.4	-1°11.3
Betelgeuse	270°52.8	7°24.6
Canopus	263°52.6	-52°42.8
Sirius	258°26.8	-16°45.1
Adhara	255°06.3	-29°00.5
Procyon	244°51.4	5°09.7
Pollux	243°18.0	27°58.1
Avior	234°14.7	-59°35.4
Suhail	222°46.5	-43°32.0
Miaplacidus	221°37.8	-69°49.1
Alphard	217°48.2	-8°45.9
Regulus	207°34.9	11°50.9
Dubhe	193°41.1	61°37.3
Denebola	182°25.3	14°26.1
Gienah	175°44.0	-17°40.7
Acrux	173°00.2	-63°14.0
Gacrux	171°51.9	-57°14.9
Alioth	166°13.0	55°49.6
Spica	158°22.7	-11°17.4
Alkaid	152°52.1	49°11.3
Hadar	148°36.5	-60°29.3
Menkent	147°58.1	-36°29.3
Arcturus	145°48.2	19°03.2
Rigil Kent.	139°40.8	-60°56.0
Kochab	137°18.9	74°03.1
Zuben'ubi	136°56.5	-16°08.6
Alphecca	126°04.1	26°37.7
Antares	112°16.5	-26°29.1
Atria	107°11.3	-69°04.0
Sabik	102°03.5	-15°45.4
Shaula	96°11.2	-37°07.2
Rasalhague	95°59.1	12°32.3
Eltanin	90°42.5	51°28.7
Kaus Aust.	83°33.4	-34°22.3
Vega	80°33.7	38°48.0
Nunki	75°48.7	-26°16.0
Altair	62°00.8	8°55.7
Peacock	53°07.1	-56°39.3
Deneb	49°26.6	45°21.7
Enif	33°39.7	9°58.9
Al Na'ir	27°34.1	-46°50.6
Fomalhaut	15°15.6	-29°29.8
Scheat	13°46.2	28°12.7
Markab	13°30.9	15°19.9

Mar 19 Tue	SHA	Mer.pass
Venus	19°08.0	10:56
Mars	30°28.7	10:10
Jupiter	317°32.5	15:00
Saturn	15°52.8	11:07

Mar 20 Wed	SHA	Mer.pass
Venus	17°57.8	10:56
Mars	29°43.5	10:09
Jupiter	317°20.6	14:57
Saturn	15°46.2	11:03

Mar 21 Thu	SHA	Mer.pass
Venus	16°47.9	10:57
Mars	28°58.5	10:08
Jupiter	317°08.7	14:53
Saturn	15°39.5	11:00

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h — Sun — Moon

Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	178°03.7	S00°26.8	64°29.4	9.5′	N27°08.1	5.0′	55.1′
1	193°03.9	25.8	78°57.8	9.5′	27°03.1	5.1′	55.1′
2	208°04.1	24.8	93°26.4	9.6′	26°58.0	5.3′	55.1′
3	223°04.3	·· 23.8	107°55.0	9.7′	26°52.7	5.3′	55.1′
4	238°04.5	22.8	122°23.7	9.8′	26°47.4	5.5′	55.0′
5	253°04.6	21.8	136°52.5	9.9′	26°41.9	5.6′	55.0′
6	268°04.8	S00°20.9	151°21.3	9.9′	N26°36.3	5.8′	55.0′
7	283°05.0	19.9	165°50.3	10.0′	26°30.5	5.9′	55.0′
8	298°05.2	18.9	180°19.3	10.1′	26°24.6	6.0′	55.0′
9	313°05.4	·· 17.9	194°48.4	10.2′	26°18.6	6.1′	54.9′
10	328°05.6	16.9	209°17.6	10.3′	26°12.5	6.2′	54.9′
11	343°05.7	15.9	223°46.9	10.4′	26°06.3	6.4′	54.9′
12	358°05.9	S00°14.9	238°16.2	10.4′	N25°59.9	6.5′	54.9′
13	13°06.1	13.9	252°45.6	10.5′	25°53.4	6.6′	54.8′
14	28°06.3	12.9	267°15.2	10.6′	25°46.8	6.7′	54.8′
15	43°06.5	·· 12.0	281°44.8	10.7′	25°40.1	6.9′	54.8′
16	58°06.7	11.0	296°14.4	10.8′	25°33.2	6.9′	54.8′
17	73°06.8	10.0	310°44.2	10.9′	25°26.3	7.1′	54.8′
18	88°07.0	S00°09.0	325°14.1	10.9′	N25°19.2	7.2′	54.7′
19	103°07.2	08.0	339°44.0	11.0′	25°12.0	7.3′	54.7′
20	118°07.4	07.0	354°14.0	11.1′	25°04.7	7.5′	54.7′
21	133°07.6	·· 06.0	8°44.1	11.2′	24°57.2	7.5′	54.7′
22	148°07.8	05.0	23°14.3	11.3′	24°49.7	7.6′	54.7′
23	163°08.0	04.1	37°44.6	11.4′	24°42.1	7.8′	54.7′
	SD = 16.1′	d = 1.0′	SD = 15.0′				

Wed	GHA	Dec	GHA	ν	Dec	d	HP
0	178°08.1	S00°03.1	52°15.0	11.5′	N24°34.3	7.8′	54.6′
1	193°08.3	02.1	66°45.4	11.5′	24°26.5	8.0′	54.6′
2	208°08.5	01.1	81°16.0	11.6′	24°18.5	8.1′	54.6′
3	223°08.7	S00°00.1	95°46.6	11.7′	24°10.4	8.2′	54.6′
4	238°08.9	N00°00.9	110°17.3	11.8′	24°02.2	8.3′	54.6′
5	253°09.1	01.9	124°48.1	11.9′	23°53.9	8.3′	54.5′
6	268°09.3	N00°02.9	139°19.0	12.0′	N23°45.6	8.5′	54.5′
7	283°09.4	03.9	153°49.9	12.0′	23°37.1	8.6′	54.5′
8	298°09.6	04.8	168°21.0	12.1′	23°28.5	8.7′	54.5′
9	313°09.8	·· 05.8	182°52.1	12.2′	23°19.8	8.8′	54.5′
10	328°10.0	06.8	197°23.3	12.3′	23°11.0	8.9′	54.5′
11	343°10.2	07.8	211°54.6	12.4′	23°02.1	9.0′	54.5′
12	358°10.4	N00°08.8	226°26.0	12.5′	N22°53.1	9.1′	54.4′
13	13°10.6	09.8	240°57.5	12.5′	22°44.0	9.2′	54.4′
14	28°10.7	10.8	255°29.0	12.6′	22°34.8	9.2′	54.4′
15	43°10.9	·· 11.8	270°00.6	12.7′	22°25.6	9.4′	54.4′
16	58°11.1	12.7	284°32.3	12.8′	22°16.2	9.5′	54.4′
17	73°11.3	13.7	299°04.1	12.9′	22°06.7	9.5′	54.4′
18	88°11.5	N00°14.7	313°36.0	13.0′	N21°57.2	9.7′	54.3′
19	103°11.7	15.7	328°08.0	13.0′	21°47.5	9.7′	54.3′
20	118°11.9	16.7	342°40.0	13.1′	21°37.8	9.8′	54.3′
21	133°12.0	·· 17.7	357°12.1	13.2′	21°28.0	9.9′	54.3′
22	148°12.2	18.7	11°44.3	13.3′	21°18.1	10.0′	54.3′
23	163°12.4	19.7	26°16.6	13.4′	21°08.1	10.1′	54.3′
	SD = 16.1′	d = 1.0′	SD = 14.9′				

Thu	GHA	Dec	GHA	ν	Dec	d	HP
0	178°12.6	N00°20.6	40°49.0	13.4′	N20°58.0	10.1′	54.3′
1	193°12.8	21.6	55°21.4	13.5′	20°47.9	10.3′	54.3′
2	208°13.0	22.6	69°53.9	13.6′	20°37.6	10.3′	54.2′
3	223°13.2	·· 23.6	84°26.5	13.7′	20°27.3	10.4′	54.2′
4	238°13.3	24.6	98°59.2	13.7′	20°16.9	10.5′	54.2′
5	253°13.5	25.6	113°31.9	13.8′	20°06.4	10.6′	54.2′
6	268°13.7	N00°26.6	128°04.8	13.9′	N19°55.8	10.6′	54.2′
7	283°13.9	27.6	142°37.7	14.0′	19°45.2	10.7′	54.2′
8	298°14.1	28.5	157°10.6	14.1′	19°34.5	10.8′	54.2′
9	313°14.3	·· 29.5	171°43.7	14.1′	19°23.7	10.9′	54.2′
10	328°14.5	30.5	186°16.8	14.2′	19°12.8	11.0′	54.2′
11	343°14.7	31.5	200°50.0	14.3′	19°01.8	11.0′	54.1′
12	358°14.8	N00°32.5	215°23.3	14.3′	N18°50.8	11.1′	54.1′
13	13°15.0	33.5	229°56.6	14.4′	18°39.7	11.2′	54.1′
14	28°15.2	34.5	244°30.0	14.5′	18°28.5	11.2′	54.1′
15	43°15.4	·· 35.4	259°03.5	14.6′	18°17.3	11.3′	54.1′
16	58°15.6	36.4	273°37.1	14.6′	18°06.0	11.4′	54.1′
17	73°15.8	37.4	288°10.7	14.7′	17°54.6	11.4′	54.1′
18	88°16.0	N00°38.4	302°44.4	14.8′	N17°43.2	11.5′	54.1′
19	103°16.2	39.4	317°18.2	14.8′	17°31.7	11.6′	54.1′
20	118°16.3	40.4	331°52.0	14.9′	17°20.1	11.7′	54.1′
21	133°16.5	·· 41.4	346°25.9	15.0′	17°08.4	11.7′	54.1′
22	148°16.7	42.4	0°59.8	15.0′	16°56.7	11.7′	54.1′
23	163°16.9	43.3	15°33.9	15.1′	16°45.0	11.9′	54.0′
	SD = 16.0′	d = 1.0′	SD = 14.8′				

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

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

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 9-11 68-84%
19	07:45	07:36	12:08	20:24	07:59	
20	07:27	07:19	12:07	21:12	08:48	
21	07:10	07:01	12:07	21:56	09:34	

March 22, 23, 24 UT (Fri., Sat., Sun.)

	Aries	Venus		Mars		Jupiter		Saturn	
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	179°59.3	195°37.5	S08°06.1	208°12.8	S12°51.0	136°56.0	N15°36.1	195°32.2	S08°24.8
1	195°01.8	210°37.0	05.0	223°13.4	50.3	151°58.0	36.3	210°34.4	24.7
2	210°04.3	225°36.6	03.8	238°14.0	49.6	166°59.9	36.4	225°36.6	24.6
3	225°06.7	240°36.1	·· 02.7	253°14.6	·· 48.9	182°01.9	·· 36.6	240°38.8	·· 24.5
4	240°09.2	255°35.7	01.6	268°15.2	48.3	197°03.9	36.8	255°41.0	24.4
5	255°11.7	270°35.3	08°00.4	283°15.8	47.6	212°05.8	36.9	270°43.1	24.2
6	270°14.1	285°34.8	S07°59.3	298°16.4	S12°46.9	227°07.8	N15°37.1	285°45.3	S08°24.1
7	285°16.6	300°34.4	58.1	313°17.0	46.3	242°09.7	37.2	300°47.5	24.0
8	300°19.0	315°34.0	57.0	328°17.6	45.6	257°11.7	37.4	315°49.7	23.9
9	315°21.5	330°33.5	·· 55.9	343°18.2	·· 44.9	272°13.7	·· 37.5	330°51.9	·· 23.8
10	330°24.0	345°33.1	54.7	358°18.7	44.2	287°15.6	37.7	345°54.1	23.7
11	345°26.4	0°32.6	53.6	13°19.3	43.6	302°17.6	37.8	0°56.3	23.6
12	0°28.9	15°32.2	S07°52.4	28°19.9	S12°42.9	317°19.5	N15°38.0	15°58.5	S08°23.5
13	15°31.4	30°31.8	51.3	43°20.5	42.2	332°21.5	38.1	31°00.7	23.4
14	30°33.8	45°31.3	50.1	58°21.1	41.5	347°23.5	38.3	46°02.8	23.3
15	45°36.3	60°30.9	·· 49.0	73°21.7	·· 40.9	2°25.4	·· 38.5	61°05.0	·· 23.2
16	60°38.8	75°30.5	47.8	88°22.3	40.2	17°27.4	38.6	76°07.2	23.1
17	75°41.2	90°30.0	46.7	103°22.9	39.5	32°29.3	38.8	91°09.4	22.9
18	90°43.7	105°29.6	S07°45.6	118°23.5	S12°38.9	47°31.3	N15°38.9	106°11.6	S08°22.8
19	105°46.2	120°29.2	44.4	133°24.1	38.2	62°33.3	39.1	121°13.8	22.7
20	120°48.6	135°28.7	43.3	148°24.7	37.5	77°35.2	39.2	136°16.0	22.6
21	135°51.1	150°28.3	·· 42.1	163°25.3	·· 36.8	92°37.2	·· 39.4	151°18.2	·· 22.5
22	150°53.5	165°27.9	41.0	178°25.9	36.2	107°39.1	39.5	166°20.3	22.4
23	165°56.0	180°27.4	39.8	193°26.5	35.5	122°41.1	39.7	181°22.5	22.3
Mer.pass. 11:58		ν -0.4′	d 1.1′	m -3.88	ν 0.6′	d 0.7′	m 1.22	ν 2.0′	d 0.2′ m -2.10	ν 2.2′	d 0.1′ m 1.04

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	180°58.5	195°27.0	S07°38.7	208°27.1	S12°34.8	137°43.0	N15°39.8	196°24.7	S08°22.2
1	196°00.9	210°26.6	37.5	223°27.7	34.1	152°45.0	40.0	211°26.9	22.1
2	211°03.4	225°26.1	36.4	238°28.3	33.4	167°47.0	40.2	226°29.1	22.0
3	226°05.9	240°25.7	·· 35.2	253°28.9	·· 32.8	182°48.9	·· 40.3	241°31.3	·· 21.9
4	241°08.3	255°25.3	34.1	268°29.5	32.1	197°50.9	40.5	256°33.5	21.8
5	256°10.8	270°24.9	32.9	283°30.1	31.4	212°52.8	40.6	271°35.7	21.6
6	271°13.3	285°24.4	S07°31.8	298°30.7	S12°30.7	227°54.8	N15°40.8	286°37.9	S08°21.5
7	286°15.7	300°24.0	30.6	313°31.2	30.1	242°56.8	40.9	301°40.1	21.4
8	301°18.2	315°23.6	29.5	328°31.8	29.4	257°58.7	41.1	316°42.2	21.3
9	316°20.6	330°23.1	·· 28.3	343°32.4	·· 28.7	273°00.7	·· 41.2	331°44.4	·· 21.2
10	331°23.1	345°22.7	27.2	358°33.0	28.0	288°02.6	41.4	346°46.6	21.1
11	346°25.6	0°22.3	26.0	13°33.6	27.4	303°04.6	41.6	1°48.8	21.0
12	1°28.0	15°21.8	S07°24.9	28°34.2	S12°26.7	318°06.5	N15°41.7	16°51.0	S08°20.9
13	16°30.5	30°21.4	23.7	43°34.8	26.0	333°08.5	41.9	31°53.2	20.8
14	31°33.0	45°21.0	22.5	58°35.4	25.3	348°10.4	42.0	46°55.4	20.7
15	46°35.4	60°20.6	·· 21.4	73°36.0	·· 24.6	3°12.4	·· 42.2	61°57.6	·· 20.6
16	61°37.9	75°20.1	20.2	88°36.6	24.0	18°14.4	42.3	76°59.8	20.5
17	76°40.4	90°19.7	19.1	103°37.2	23.3	33°16.3	42.5	92°01.9	20.3
18	91°42.8	105°19.3	S07°17.9	118°37.8	S12°22.6	48°18.3	N15°42.6	107°04.1	S08°20.2
19	106°45.3	120°18.9	16.8	133°38.4	21.9	63°20.2	42.8	122°06.3	20.1
20	121°47.8	135°18.4	15.6	148°39.0	21.2	78°22.2	42.9	137°08.5	20.0
21	136°50.2	150°18.0	·· 14.5	163°39.6	·· 20.6	93°24.1	·· 43.1	152°10.7	·· 19.9
22	151°52.7	165°17.6	13.3	178°40.2	19.9	108°26.1	43.3	167°12.9	19.8
23	166°55.1	180°17.2	12.2	193°40.8	19.2	123°28.0	43.4	182°15.1	19.7
Mer.pass. 11:54		ν -0.4′	d 1.1′	m -3.88	ν 0.6′	d 0.7′	m 1.21	ν 2.0′	d 0.2′ m -2.09	ν 2.2′	d 0.1′ m 1.04

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	181°57.6	195°16.7	S07°11.0	208°41.4	S12°18.5	138°30.0	N15°43.6	197°17.3	S08°19.6
1	197°00.1	210°16.3	09.8	223°42.0	17.8	153°32.0	43.7	212°19.5	19.5
2	212°02.5	225°15.9	08.7	238°42.6	17.2	168°33.9	43.9	227°21.7	19.4
3	227°05.0	240°15.5	·· 07.5	253°43.2	·· 16.5	183°35.9	·· 44.0	242°23.8	·· 19.3
4	242°07.5	255°15.0	06.4	268°43.8	15.8	198°37.8	44.2	257°26.0	19.2
5	257°09.9	270°14.6	05.2	283°44.4	15.1	213°39.8	44.3	272°28.2	19.1
6	272°12.4	285°14.2	S07°04.0	298°45.0	S12°14.4	228°41.7	N15°44.5	287°30.4	S08°18.9
7	287°14.9	300°13.8	02.9	313°45.6	13.7	243°43.7	44.7	302°32.6	18.8
8	302°17.3	315°13.3	01.7	328°46.2	13.1	258°45.6	44.8	317°34.8	18.7
9	317°19.8	330°12.9	07°00.6	343°46.8	·· 12.4	273°47.6	·· 45.0	332°37.0	·· 18.6
10	332°22.2	345°12.5	06°59.4	358°47.4	11.7	288°49.5	45.1	347°39.2	18.5
11	347°24.7	0°12.1	58.2	13°48.0	11.0	303°51.5	45.3	2°41.4	18.4
12	2°27.2	15°11.6	S06°57.1	28°48.6	S12°10.3	318°53.5	N15°45.4	17°43.6	S08°18.3
13	17°29.6	30°11.2	55.9	43°49.2	09.6	333°55.4	45.6	32°45.7	18.2
14	32°32.1	45°10.8	54.8	58°49.8	09.0	348°57.4	45.7	47°47.9	18.1
15	47°34.6	60°10.4	·· 53.6	73°50.4	·· 08.3	3°59.3	·· 45.9	62°50.1	·· 18.0
16	62°37.0	75°10.0	52.4	88°51.0	07.6	19°01.3	46.0	77°52.3	17.9
17	77°39.5	90°09.5	51.3	103°51.6	06.9	34°03.2	46.2	92°54.5	17.8
18	92°42.0	105°09.1	S06°50.1	118°52.2	S12°06.2	49°05.2	N15°46.4	107°56.7	S08°17.7
19	107°44.4	120°08.7	48.9	133°52.8	05.5	64°07.1	46.5	122°58.9	17.5
20	122°46.9	135°08.3	47.8	148°53.4	04.9	79°09.1	46.7	138°01.1	17.4
21	137°49.4	150°07.9	·· 46.6	163°54.0	·· 04.2	94°11.0	·· 46.8	153°03.3	·· 17.3
22	152°51.8	165°07.4	45.5	178°54.6	03.5	109°13.0	47.0	168°05.5	17.2
23	167°54.3	180°07.0	44.3	193°55.2	02.8	124°14.9	47.1	183°07.7	17.1
Mer.pass. 11:50		ν -0.4′	d 1.2′	m -3.88	ν 0.6′	d 0.7′	m 1.21	ν 2.0′	d 0.2′ m -2.09	ν 2.2′	d 0.1′ m 1.04

Stars

	SHA	Dec
Alpheratz	357°35.8	29°13.3
Ankaa	353°08.2	-42°10.6
Schedar	349°32.4	56°40.1
Diphda	348°48.3	-17°51.4
Achernar	335°21.2	-57°07.0
Hamal	327°52.3	23°34.5
Polaris	314°43.6	89°22.2
Acamar	315°12.6	-40°12.7
Menkar	314°07.1	4°11.0
Mirfak	308°29.6	49°56.9
Aldebaran	290°40.5	16°33.4
Rigel	281°04.6	-8°10.6
Capella	280°23.0	46°01.5
Bellatrix	278°23.7	6°22.2
Elnath	278°02.8	28°37.7
Alnilam	275°38.5	-1°11.3
Betelgeuse	270°52.8	7°24.6
Canopus	263°52.7	-52°42.8
Sirius	258°26.8	-16°45.1
Adhara	255°06.3	-29°00.5
Procyon	244°51.4	5°09.7
Pollux	243°18.0	27°58.1
Avior	234°14.7	-59°35.4
Suhail	222°46.5	-43°32.0
Miaplacidus	221°37.8	-69°49.2
Alphard	217°48.2	-8°45.9
Regulus	207°34.9	11°50.9
Dubhe	193°41.1	61°37.3
Denebola	182°25.3	14°26.1
Gienah	175°44.0	-17°40.7
Acrux	173°00.2	-63°14.0
Gacrux	171°51.9	-57°15.0
Alioth	166°13.0	55°49.6
Spica	158°22.7	-11°17.4
Alkaid	152°52.1	49°11.3
Hadar	148°36.5	-60°29.3
Menkent	147°58.1	-36°29.4
Arcturus	145°48.2	19°03.2
Rigil Kent.	139°40.7	-60°56.0
Kochab	137°18.8	74°03.1
Zuben'ubi	136°56.5	-16°08.6
Alphecca	126°04.1	26°37.7
Antares	112°16.5	-26°29.1
Atria	107°11.2	-69°04.0
Sabik	102°03.5	-15°45.4
Shaula	96°11.2	-37°07.2
Rasalhague	95°59.1	12°32.3
Eltanin	90°42.5	51°28.7
Kaus Aust.	83°33.4	-34°22.3
Vega	80°33.7	38°48.0
Nunki	75°48.7	-26°16.0
Altair	62°00.7	8°55.7
Peacock	53°07.1	-56°39.3
Deneb	49°26.6	45°21.7
Enif	33°39.7	9°58.9
Al Na'ir	27°34.1	-46°50.6
Fomalhaut	15°15.6	-29°29.7
Scheat	13°46.2	28°12.6
Markab	13°30.9	15°19.9

Mar 22 Fri	SHA	Mer.pass
Venus	15°38.1	10:58
Mars	28°13.5	10:07
Jupiter	316°56.7	14:50
Saturn	15°32.9	10:56

Mar 23 Sat	SHA	Mer.pass
Venus	14°28.5	10:59
Mars	27°28.6	10:06
Jupiter	316°44.6	14:47
Saturn	15°26.3	10:53

Mar 24 Sun	SHA	Mer.pass
Venus	13°19.1	10:59
Mars	26°43.8	10:05
Jupiter	316°32.4	14:44
Saturn	15°19.7	10:49

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h

	Sun		Moon				
Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°17.1	N00°44.3	30°07.9	15.2′	N16°33.1	11.9′	54.0′
1	193°17.3	45.3	44°42.1	15.2′	16°21.2	11.9′	54.0′
2	208°17.5	46.3	59°16.3	15.3′	16°09.3	12.1′	54.0′
3	223°17.7	·· 47.3	73°50.6	15.3′	15°57.2	12.0′	54.0′
4	238°17.8	48.3	88°24.9	15.4′	15°45.2	12.2′	54.0′
5	253°18.0	49.3	102°59.3	15.5′	15°33.0	12.2′	54.0′
6	268°18.2	N00°50.2	117°33.8	15.5′	N15°20.8	12.2′	54.0′
7	283°18.4	51.2	132°08.3	15.6′	15°08.6	12.3′	54.0′
8	298°18.6	52.2	146°42.9	15.6′	14°56.3	12.4′	54.0′
9	313°18.8	·· 53.2	161°17.5	15.7′	14°43.9	12.4′	54.0′
10	328°19.0	54.2	175°52.2	15.7′	14°31.5	12.4′	54.0′
11	343°19.2	55.2	190°26.9	15.8′	14°19.1	12.6′	54.0′
12	358°19.3	N00°56.2	205°01.7	15.8′	N14°06.5	12.5′	54.0′
13	13°19.5	57.1	219°36.6	15.9′	13°54.0	12.7′	54.0′
14	28°19.7	58.1	234°11.5	16.0′	13°41.3	12.6′	54.0′
15	43°19.9	00°59.1	248°46.4	16.0′	13°28.7	12.7′	54.0′
16	58°20.1	01°00.1	263°21.4	16.1′	13°16.0	12.8′	53.9′
17	73°20.3	01.1	277°56.5	16.1′	13°03.2	12.8′	53.9′
18	88°20.5	N01°02.1	292°31.6	16.2′	N12°50.4	12.9′	53.9′
19	103°20.7	03.1	307°06.7	16.2′	12°37.5	12.9′	53.9′
20	118°20.8	04.0	321°41.9	16.2′	12°24.6	12.9′	53.9′
21	133°21.0	·· 05.0	336°17.2	16.3′	12°11.7	13.0′	53.9′
22	148°21.2	06.0	350°52.5	16.3′	11°58.7	13.1′	53.9′
23	163°21.4	07.0	5°27.8	16.4′	11°45.6	13.1′	53.9′
	SD = 16.0′	d = 1.0′	SD = 14.7′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°21.6	N01°08.0	20°03.2	16.4′	N11°32.5	13.1′	53.9′
1	193°21.8	09.0	34°38.6	16.5′	11°19.4	13.1′	53.9′
2	208°22.0	10.0	49°14.1	16.5′	11°06.3	13.2′	53.9′
3	223°22.2	·· 10.9	63°49.6	16.5′	10°53.1	13.3′	53.9′
4	238°22.4	11.9	78°25.1	16.6′	10°39.8	13.3′	53.9′
5	253°22.5	12.9	93°00.7	16.6′	10°26.5	13.3′	53.9′
6	268°22.7	N01°13.9	107°36.4	16.7′	N10°13.2	13.3′	53.9′
7	283°22.9	14.9	122°12.0	16.7′	09°59.9	13.4′	53.9′
8	298°23.1	15.9	136°47.7	16.7′	09°46.5	13.4′	53.9′
9	313°23.3	·· 16.8	151°23.5	16.8′	09°33.1	13.5′	53.9′
10	328°23.5	17.8	165°59.2	16.8′	09°19.6	13.5′	53.9′
11	343°23.7	18.8	180°35.0	16.8′	09°06.1	13.5′	53.9′
12	358°23.9	N01°19.8	195°10.9	16.9′	N08°52.6	13.6′	53.9′
13	13°24.1	20.8	209°46.7	16.9′	08°39.0	13.6′	53.9′
14	28°24.2	21.8	224°22.6	16.9′	08°25.4	13.6′	53.9′
15	43°24.4	·· 22.8	238°58.6	17.0′	08°11.8	13.6′	53.9′
16	58°24.6	23.7	253°34.5	17.0′	07°58.2	13.7′	53.9′
17	73°24.8	24.7	268°10.5	17.0′	07°44.5	13.7′	53.9′
18	88°25.0	N01°25.7	282°46.5	17.0′	N07°30.8	13.7′	53.9′
19	103°25.2	26.7	297°22.6	17.1′	07°17.1	13.8′	53.9′
20	118°25.4	27.7	311°58.6	17.1′	07°03.3	13.8′	53.9′
21	133°25.6	·· 28.7	326°34.7	17.1′	06°49.5	13.8′	53.9′
22	148°25.8	29.6	341°10.8	17.1′	06°35.7	13.8′	53.9′
23	163°25.9	30.6	355°47.0	17.2′	06°21.9	13.9′	53.9′
	SD = 16.0′	d = 1.0′	SD = 14.7′				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°26.1	N01°31.6	10°23.1	17.2′	N06°08.0	13.8′	53.9′
1	193°26.3	32.6	24°59.3	17.2′	05°54.2	14.0′	53.9′
2	208°26.5	33.6	39°35.5	17.2′	05°40.2	13.9′	53.9′
3	223°26.7	·· 34.6	54°11.7	17.2′	05°26.3	13.9′	53.9′
4	238°26.9	35.5	68°47.9	17.2′	05°12.4	14.0′	53.9′
5	253°27.1	36.5	83°24.2	17.3′	04°58.4	14.0′	53.9′
6	268°27.3	N01°37.5	98°00.5	17.3′	N04°44.4	14.0′	53.9′
7	283°27.5	38.5	112°36.7	17.3′	04°30.4	14.0′	53.9′
8	298°27.6	39.5	127°13.0	17.3′	04°16.4	14.0′	53.9′
9	313°27.8	·· 40.5	141°49.3	17.3′	04°02.4	14.1′	53.9′
10	328°28.0	41.4	156°25.7	17.3′	03°48.3	14.0′	53.9′
11	343°28.2	42.4	171°02.0	17.3′	03°34.3	14.1′	53.9′
12	358°28.4	N01°43.4	185°38.3	17.3′	N03°20.2	14.1′	53.9′
13	13°28.6	44.4	200°14.7	17.4′	03°06.1	14.1′	53.9′
14	28°28.8	45.4	214°51.0	17.4′	02°52.0	14.1′	53.9′
15	43°29.0	·· 46.4	229°27.4	17.4′	02°37.9	14.2′	53.9′
16	58°29.2	47.3	244°03.7	17.4′	02°23.7	14.1′	53.9′
17	73°29.3	48.3	258°40.1	17.4′	02°09.6	14.1′	54.0′
18	88°29.5	N01°49.3	273°16.5	17.4′	N01°55.5	14.2′	54.0′
19	103°29.7	50.3	287°52.9	17.4′	01°41.3	14.2′	54.0′
20	118°29.9	51.3	302°29.2	17.4′	01°27.1	14.1′	54.0′
21	133°30.1	·· 52.2	317°05.6	17.4′	01°13.0	14.2′	54.0′
22	148°30.3	53.2	331°42.0	17.4′	00°58.8	14.2′	54.0′
23	163°30.5	54.2	346°18.4	17.4′	00°44.6	14.2′	54.0′
	SD = 16.0′	d = 1.0′	SD = 14.7′				

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

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

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 12-14 91-98%
22	06:52	06:43	12:07	22:38	10:17	
23	06:34	06:25	12:06	23:17	10:58	
24	06:15	06:06	12:06	23:56	11:37	

March 25, 26, 27 UT (Mon., Tue., Wed.)

	Aries	Venus		Mars		Jupiter		Saturn	
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	182°56.7	195°06.6	S06°43.1	208°55.8	S12°02.1	139°16.9	N15°47.3	198°09.8	S08°17.0
1	197°59.2	210°06.2	42.0	223°56.4	01.4	154°18.8	47.4	213°12.0	16.9
2	213°01.7	225°05.8	40.8	238°57.1	00.7	169°20.8	47.6	228°14.2	16.8
3	228°04.1	240°05.4	·· 39.6	253°57.7	12°00.1	184°22.7	·· 47.8	243°16.4	·· 16.7
4	243°06.6	255°04.9	38.5	268°58.3	11°59.4	199°24.7	47.9	258°18.6	16.6
5	258°09.1	270°04.5	37.3	283°58.9	58.7	214°26.6	48.1	273°20.8	16.5
6	273°11.5	285°04.1	S06°36.1	298°59.5	S11°58.0	229°28.6	N15°48.2	288°23.0	S08°16.4
7	288°14.0	300°03.7	35.0	314°00.1	57.3	244°30.5	48.4	303°25.2	16.3
8	303°16.5	315°03.3	33.8	329°00.7	56.6	259°32.5	48.5	318°27.4	16.2
9	318°18.9	330°02.8	·· 32.6	344°01.3	·· 55.9	274°34.4	·· 48.7	333°29.6	·· 16.0
10	333°21.4	345°02.4	31.5	359°01.9	55.3	289°36.4	48.8	348°31.8	15.9
11	348°23.8	0°02.0	30.3	14°02.5	54.6	304°38.3	49.0	3°34.0	15.8
12	3°26.3	15°01.6	S06°29.1	29°03.1	S11°53.9	319°40.3	N15°49.2	18°36.1	S08°15.7
13	18°28.8	30°01.2	28.0	44°03.7	53.2	334°42.2	49.3	33°38.3	15.6
14	33°31.2	45°00.8	26.8	59°04.3	52.5	349°44.2	49.5	48°40.5	15.5
15	48°33.7	60°00.4	·· 25.6	74°04.9	·· 51.8	4°46.1	·· 49.6	63°42.7	·· 15.4
16	63°36.2	74°59.9	24.4	89°05.5	51.1	19°48.1	49.8	78°44.9	15.3
17	78°38.6	89°59.5	23.3	104°06.1	50.4	34°50.0	49.9	93°47.1	15.2
18	93°41.1	104°59.1	S06°22.1	119°06.7	S11°49.7	49°52.0	N15°50.1	108°49.3	S08°15.1
19	108°43.6	119°58.7	20.9	134°07.3	49.1	64°53.9	50.2	123°51.5	15.0
20	123°46.0	134°58.3	19.8	149°07.9	48.4	79°55.9	50.4	138°53.7	14.9
21	138°48.5	149°57.9	·· 18.6	164°08.5	·· 47.7	94°57.8	·· 50.6	153°55.9	·· 14.8
22	153°51.0	164°57.5	17.4	179°09.1	47.0	109°59.8	50.7	168°58.1	14.7
23	168°53.4	179°57.0	16.2	194°09.8	46.3	125°01.7	50.9	184°00.3	14.5
Mer.pass. 11:46		ν -0.4′	d 1.2′	m -3.88	ν 0.6′	d 0.7′	m 1.21	ν 2.0′	d 0.2′ m -2.09	ν 2.2′	d 0.1′ m 1.04

Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	183°55.9	194°56.6	S06°15.1	209°10.4	S11°45.6	140°03.7	N15°51.0	199°02.4	S08°14.4
1	198°58.3	209°56.2	13.9	224°11.0	44.9	155°05.6	51.2	214°04.6	14.3
2	214°00.8	224°55.8	12.7	239°11.6	44.2	170°07.6	51.3	229°06.8	14.2
3	229°03.3	239°55.4	·· 11.6	254°12.2	·· 43.5	185°09.5	·· 51.5	244°09.0	·· 14.1
4	244°05.7	254°55.0	10.4	269°12.8	42.8	200°11.5	51.6	259°11.2	14.0
5	259°08.2	269°54.6	09.2	284°13.4	42.2	215°13.4	51.8	274°13.4	13.9
6	274°10.7	284°54.2	S06°08.0	299°14.0	S11°41.5	230°15.4	N15°52.0	289°15.6	S08°13.8
7	289°13.1	299°53.7	06.9	314°14.6	40.8	245°17.3	52.1	304°17.8	13.7
8	304°15.6	314°53.3	05.7	329°15.2	40.1	260°19.3	52.3	319°20.0	13.6
9	319°18.1	329°52.9	·· 04.5	344°15.8	·· 39.4	275°21.2	·· 52.4	334°22.2	·· 13.5
10	334°20.5	344°52.5	03.3	359°16.4	38.7	290°23.2	52.6	349°24.4	13.4
11	349°23.0	359°52.1	02.2	14°17.0	38.0	305°25.1	52.7	4°26.6	13.3
12	4°25.5	14°51.7	S06°01.0	29°17.7	S11°37.3	320°27.1	N15°52.9	19°28.8	S08°13.2
13	19°27.9	29°51.3	05°59.8	44°18.3	36.6	335°29.0	53.0	34°31.0	13.0
14	34°30.4	44°50.9	58.6	59°18.9	35.9	350°30.9	53.2	49°33.1	12.9
15	49°32.8	59°50.5	·· 57.5	74°19.5	·· 35.2	5°32.9	·· 53.4	64°35.3	·· 12.8
16	64°35.3	74°50.1	56.3	89°20.1	34.5	20°34.8	53.5	79°37.5	12.7
17	79°37.8	89°49.7	55.1	104°20.7	33.8	35°36.8	53.7	94°39.7	12.6
18	94°40.2	104°49.2	S05°53.9	119°21.3	S11°33.1	50°38.7	N15°53.8	109°41.9	S08°12.5
19	109°42.7	119°48.8	52.7	134°21.9	32.5	65°40.7	54.0	124°44.1	12.4
20	124°45.2	134°48.4	51.6	149°22.5	31.8	80°42.6	54.1	139°46.3	12.3
21	139°47.6	149°48.0	·· 50.4	164°23.1	·· 31.1	95°44.6	·· 54.3	154°48.5	·· 12.2
22	154°50.1	164°47.6	49.2	179°23.7	30.4	110°46.5	54.4	169°50.7	12.1
23	169°52.6	179°47.2	48.0	194°24.4	29.7	125°48.5	54.6	184°52.9	12.0
Mer.pass. 11:42		ν -0.4′	d 1.2′	m -3.88	ν 0.6′	d 0.7′	m 1.21	ν 1.9′	d 0.2′ m -2.08	ν 2.2′	d 0.1′ m 1.04

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	184°55.0	194°46.8	S05°46.8	209°25.0	S11°29.0	140°50.4	N15°54.8	199°55.1	S08°11.9
1	199°57.5	209°46.4	45.7	224°25.6	28.3	155°52.4	54.9	214°57.3	11.8
2	214°59.9	224°46.0	44.5	239°26.2	27.6	170°54.3	55.1	229°59.5	11.7
3	230°02.4	239°45.6	·· 43.3	254°26.8	·· 26.9	185°56.2	·· 55.2	245°01.7	·· 11.6
4	245°04.9	254°45.2	42.1	269°27.4	26.2	200°58.2	55.4	260°03.8	11.4
5	260°07.3	269°44.8	40.9	284°28.0	25.5	216°00.1	55.5	275°06.0	11.3
6	275°09.8	284°44.4	S05°39.8	299°28.6	S11°24.8	231°02.1	N15°55.7	290°08.2	S08°11.2
7	290°12.3	299°44.0	38.6	314°29.2	24.1	246°04.0	55.8	305°10.4	11.1
8	305°14.7	314°43.6	37.4	329°29.8	23.4	261°06.0	56.0	320°12.6	11.0
9	320°17.2	329°43.1	·· 36.2	344°30.5	·· 22.7	276°07.9	·· 56.2	335°14.8	·· 10.9
10	335°19.7	344°42.7	35.0	359°31.1	22.0	291°09.9	56.3	350°17.0	10.8
11	350°22.1	359°42.3	33.9	14°31.7	21.3	306°11.8	56.5	5°19.2	10.7
12	5°24.6	14°41.9	S05°32.7	29°32.3	S11°20.6	321°13.7	N15°56.6	20°21.4	S08°10.6
13	20°27.1	29°41.5	31.5	44°32.9	19.9	336°15.7	56.8	35°23.6	10.5
14	35°29.5	44°41.1	30.3	59°33.5	19.2	351°17.6	56.9	50°25.8	10.4
15	50°32.0	59°40.7	·· 29.1	74°34.1	·· 18.5	6°19.6	·· 57.1	65°28.0	·· 10.3
16	65°34.4	74°40.3	27.9	89°34.7	17.8	21°21.5	57.2	80°30.2	10.2
17	80°36.9	89°39.9	26.8	104°35.4	17.1	36°23.5	57.4	95°32.4	10.1
18	95°39.4	104°39.5	S05°25.6	119°36.0	S11°16.4	51°25.4	N15°57.6	110°34.6	S08°10.0
19	110°41.8	119°39.1	24.4	134°36.6	15.7	66°27.3	57.7	125°36.8	09.9
20	125°44.3	134°38.7	23.2	149°37.2	15.0	81°29.3	57.9	140°39.0	09.8
21	140°46.8	149°38.3	·· 22.0	164°37.8	·· 14.4	96°31.2	·· 58.0	155°41.1	·· 09.6
22	155°49.2	164°37.9	20.8	179°38.4	13.7	111°33.2	58.2	170°43.3	09.5
23	170°51.7	179°37.5	19.6	194°39.0	13.0	126°35.1	58.3	185°45.5	09.4
Mer.pass. 11:38		ν -0.4′	d 1.2′	m -3.88	ν 0.6′	d 0.7′	m 1.20	ν 1.9′	d 0.2′ m -2.08	ν 2.2′	d 0.1′ m 1.05

Stars

	SHA	Dec
Alpheratz	357°35.8	29°13.3
Ankaa	353°08.2	-42°10.6
Schedar	349°32.4	56°40.1
Diphda	348°48.3	-17°51.4
Achernar	335°21.2	-57°07.0
Hamal	327°52.3	23°34.5
Polaris	314°44.6	89°22.2
Acamar	315°12.6	-40°12.7
Menkar	314°07.1	4°11.0
Mirfak	308°29.6	49°56.9
Aldebaran	290°40.5	16°33.4
Rigel	281°04.6	-8°10.6
Capella	280°23.0	46°01.5
Bellatrix	278°23.7	6°22.2
Elnath	278°02.8	28°37.7
Alnilam	275°38.5	-1°11.3
Betelgeuse	270°52.8	7°24.6
Canopus	263°52.7	-52°42.8
Sirius	258°26.8	-16°45.1
Adhara	255°06.3	-29°00.5
Procyon	244°51.4	5°09.7
Pollux	243°18.0	27°58.1
Avior	234°14.7	-59°35.4
Suhail	222°46.5	-43°32.0
Miaplacidus	221°37.9	-69°49.2
Alphard	217°48.2	-8°45.9
Regulus	207°34.9	11°50.9
Dubhe	193°41.2	61°37.3
Denebola	182°25.3	14°26.1
Gienah	175°44.0	-17°40.7
Acrux	173°00.2	-63°14.0
Gacrux	171°51.9	-57°15.0
Alioth	166°13.0	55°49.6
Spica	158°22.7	-11°17.4
Alkaid	152°52.1	49°11.4
Hadar	148°36.4	-60°29.3
Menkent	147°58.1	-36°29.4
Arcturus	145°48.2	19°03.2
Rigil Kent.	139°40.7	-60°56.0
Kochab	137°18.8	74°03.1
Zuben'ubi	136°56.5	-16°08.6
Alphecca	126°04.1	26°37.7
Antares	112°16.5	-26°29.2
Atria	107°11.2	-69°04.0
Sabik	102°03.5	-15°45.4
Shaula	96°11.2	-37°07.2
Rasalhague	95°59.1	12°32.3
Eltanin	90°42.4	51°28.7
Kaus Aust.	83°33.4	-34°22.3
Vega	80°33.7	38°48.0
Nunki	75°48.6	-26°16.0
Altair	62°00.7	8°55.7
Peacock	53°07.0	-56°39.3
Deneb	49°26.5	45°21.7
Enif	33°39.7	9°58.9
Al Na'ir	27°34.1	-46°50.6
Fomalhaut	15°15.6	-29°29.7
Scheat	13°46.2	28°12.6
Markab	13°30.9	15°19.9

Mar 25 Mon	SHA	Mer.pass
Venus	12°09.9	11:00
Mars	25°59.1	10:04
Jupiter	316°20.1	14:41
Saturn	15°13.1	10:46

Mar 26 Tue	SHA	Mer.pass
Venus	11°00.7	11:01
Mars	25°14.5	10:03
Jupiter	316°07.8	14:38
Saturn	15°06.6	10:42

Mar 27 Wed	SHA	Mer.pass
Venus	9°51.8	11:01
Mars	24°29.9	10:02
Jupiter	315°55.4	14:35
Saturn	15°00.1	10:39

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h

Mon	Sun GHA	Sun Dec	Moon GHA	ν	Moon Dec	d	HP
0	178°30.7	N01°55.2	0°54.8	17.4′	N00°30.4	14.2′	54.0′
1	193°30.9	56.2	15°31.1	17.4′	00°16.2	14.2′	54.0′
2	208°31.1	57.2	30°07.5	17.4′	N00°02.0	14.2′	54.0′
3	223°31.2	·· 58.1	44°43.9	17.4′	S00°12.2	14.2′	54.0′
4	238°31.4	01°59.1	59°20.2	17.4′	00°26.4	14.2′	54.0′
5	253°31.6	02°00.1	73°56.6	17.3′	00°40.6	14.2′	54.0′
6	268°31.8	N02°01.1	88°32.9	17.3′	S00°54.8	14.2′	54.0′
7	283°32.0	02.1	103°09.3	17.3′	01°09.0	14.3′	54.0′
8	298°32.2	03.0	117°45.6	17.3′	01°23.3	14.2′	54.0′
9	313°32.4	·· 04.0	132°21.9	17.3′	01°37.5	14.2′	54.0′
10	328°32.6	05.0	146°58.2	17.3′	01°51.7	14.2′	54.0′
11	343°32.8	06.0	161°34.5	17.3′	02°05.9	14.2′	54.0′
12	358°32.9	N02°07.0	176°10.8	17.3′	S02°20.1	14.2′	54.1′
13	13°33.1	08.0	190°47.0	17.2′	02°34.3	14.2′	54.1′
14	28°33.3	08.9	205°23.3	17.2′	02°48.5	14.1′	54.1′
15	43°33.5	·· 09.9	219°59.5	17.2′	03°02.6	14.2′	54.1′
16	58°33.7	10.9	234°35.7	17.2′	03°16.8	14.2′	54.1′
17	73°33.9	11.9	249°11.9	17.2′	03°31.0	14.1′	54.1′
18	88°34.1	N02°12.9	263°48.1	17.1′	S03°45.1	14.2′	54.1′
19	103°34.3	13.8	278°24.2	17.1′	03°59.3	14.1′	54.1′
20	118°34.5	14.8	293°00.3	17.1′	04°13.4	14.1′	54.1′
21	133°34.7	·· 15.8	307°36.4	17.1′	04°27.5	14.2′	54.1′
22	148°34.8	16.8	322°12.5	17.1′	04°41.7	14.1′	54.1′
23	163°35.0	17.8	336°48.6	17.0′	04°55.8	14.1′	54.1′
	SD = 16.0′	d = 1.0′		SD = 14.7′			

Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	178°35.2	N02°18.7	351°24.6	17.0′	S05°09.9	14.0′	54.1′
1	193°35.4	19.7	6°00.6	17.0′	05°23.9	14.1′	54.2′
2	208°35.6	20.7	20°36.6	16.9′	05°38.0	14.0′	54.2′
3	223°35.8	·· 21.7	35°12.5	16.9′	05°52.0	14.1′	54.2′
4	238°36.0	22.7	49°48.4	16.9′	06°06.1	14.0′	54.2′
5	253°36.2	23.6	64°24.3	16.9′	06°20.1	14.0′	54.2′
6	268°36.4	N02°24.6	79°00.2	16.8′	S06°34.1	13.9′	54.2′
7	283°36.5	25.6	93°36.0	16.8′	06°48.0	14.0′	54.2′
8	298°36.7	26.6	108°11.8	16.7′	07°02.0	13.9′	54.2′
9	313°36.9	·· 27.6	122°47.5	16.7′	07°15.9	13.9′	54.2′
10	328°37.1	28.5	137°23.2	16.7′	07°29.8	13.9′	54.2′
11	343°37.3	29.5	151°58.9	16.6′	07°43.7	13.9′	54.2′
12	358°37.5	N02°30.5	166°34.5	16.6′	S07°57.6	13.8′	54.3′
13	13°37.7	31.5	181°10.1	16.6′	08°11.4	13.9′	54.3′
14	28°37.9	32.5	195°45.7	16.5′	08°25.3	13.8′	54.3′
15	43°38.1	·· 33.4	210°21.2	16.5′	08°39.1	13.7′	54.3′
16	58°38.3	34.4	224°56.7	16.4′	08°52.8	13.8′	54.3′
17	73°38.4	35.4	239°32.1	16.4′	09°06.6	13.7′	54.3′
18	88°38.6	N02°36.4	254°07.5	16.3′	S09°20.3	13.6′	54.3′
19	103°38.8	37.3	268°42.8	16.3′	09°33.9	13.7′	54.3′
20	118°39.0	38.3	283°18.1	16.2′	09°47.6	13.6′	54.3′
21	133°39.2	·· 39.3	297°53.4	16.2′	10°01.2	13.6′	54.4′
22	148°39.4	40.3	312°28.6	16.2′	10°14.8	13.5′	54.4′
23	163°39.6	41.3	327°03.7	16.1′	10°28.3	13.6′	54.4′
	SD = 16.0′	d = 1.0′		SD = 14.8′			

Wed	GHA	Dec	GHA	ν	Dec	d	HP
0	178°39.8	N02°42.2	341°38.8	16.1′	S10°41.9	13.4′	54.4′
1	193°40.0	43.2	356°13.9	16.0′	10°55.3	13.5′	54.4′
2	208°40.1	44.2	10°48.9	15.9′	11°08.8	13.4′	54.4′
3	223°40.3	·· 45.2	25°23.8	15.9′	11°22.2	13.4′	54.4′
4	238°40.5	46.1	39°58.7	15.8′	11°35.6	13.3′	54.4′
5	253°40.7	47.1	54°33.6	15.8′	11°48.9	13.3′	54.4′
6	268°40.9	N02°48.1	69°08.4	15.7′	S12°02.2	13.3′	54.5′
7	283°41.1	49.1	83°43.1	15.7′	12°15.5	13.2′	54.5′
8	298°41.3	50.1	98°17.8	15.6′	12°28.7	13.2′	54.5′
9	313°41.5	·· 51.0	112°52.4	15.6′	12°41.9	13.1′	54.5′
10	328°41.7	52.0	127°26.9	15.5′	12°55.0	13.1′	54.5′
11	343°41.9	53.0	142°01.4	15.4′	13°08.1	13.0′	54.5′
12	358°42.0	N02°54.0	156°35.8	15.4′	S13°21.1	13.0′	54.5′
13	13°42.2	54.9	171°10.2	15.3′	13°34.1	13.0′	54.5′
14	28°42.4	55.9	185°44.5	15.2′	13°47.1	12.9′	54.6′
15	43°42.6	·· 56.9	200°18.7	15.2′	14°00.0	12.8′	54.6′
16	58°42.8	57.9	214°52.9	15.1′	14°12.8	12.8′	54.6′
17	73°43.0	58.8	229°27.0	15.0′	14°25.6	12.8′	54.6′
18	88°43.2	N02°59.8	244°01.1	15.0′	S14°38.4	12.7′	54.6′
19	103°43.4	03°00.8	258°35.0	14.9′	14°51.1	12.6′	54.6′
20	118°43.6	01.8	273°08.9	14.8′	15°03.7	12.6′	54.6′
21	133°43.7	·· 02.8	287°42.8	14.8′	15°16.3	12.6′	54.7′
22	148°43.9	03.7	302°16.5	14.7′	15°28.9	12.4′	54.7′
23	163°44.1	04.7	316°50.2	14.6′	15°41.3	12.5′	54.7′
	SD = 16.0′	d = 1.0′		SD = 14.8′			

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

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

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 15-17 100-97%
25	05:57	05:48	12:06	–:–	12:16	
26	05:39	05:30	12:06	00:35	12:55	
27	05:21	05:12	12:05	01:16	13:36	

March 28, 29, 30 UT (Thu., Fri., Sat.)

	Aries	Venus		Mars		Jupiter		Saturn	
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	185°54.2	194°37.1	S05°18.5	209°39.6	S11°12.3	141°37.1	N15°58.5	200°47.7	S08°09.3
1	200°56.6	209°36.7	17.3	224°40.3	11.6	156°39.0	58.7	215°49.9	09.2
2	215°59.1	224°36.3	16.1	239°40.9	10.9	171°40.9	58.8	230°52.1	09.1
3	231°01.5	239°35.9	·· 14.9	254°41.5	·· 10.2	186°42.9	·· 59.0	245°54.3	·· 09.0
4	246°04.0	254°35.5	13.7	269°42.1	09.5	201°44.8	59.1	260°56.5	08.9
5	261°06.5	269°35.1	12.5	284°42.7	08.8	216°46.8	59.3	275°58.7	08.8
6	276°08.9	284°34.7	S05°11.3	299°43.3	S11°08.1	231°48.7	N15°59.4	291°00.9	S08°08.7
7	291°11.4	299°34.3	10.2	314°43.9	07.4	246°50.7	59.6	306°03.1	08.6
8	306°13.9	314°33.9	09.0	329°44.6	06.7	261°52.6	59.7	321°05.3	08.5
9	321°16.3	329°33.5	·· 07.8	344°45.2	·· 06.0	276°54.5	15°59.9	336°07.5	·· 08.4
10	336°18.8	344°33.1	06.6	359°45.8	05.3	291°56.5	16°00.1	351°09.7	08.3
11	351°21.3	359°32.7	05.4	14°46.4	04.6	306°58.4	00.2	6°11.9	08.2
12	6°23.7	14°32.3	S05°04.2	29°47.0	S11°03.8	322°00.4	N16°00.4	21°14.1	S08°08.1
13	21°26.2	29°31.9	03.0	44°47.6	03.1	337°02.3	00.5	36°16.3	08.0
14	36°28.7	44°31.5	01.8	59°48.3	02.4	352°04.2	00.7	51°18.5	07.8
15	51°31.1	59°31.1	05°00.6	74°48.9	·· 01.7	7°06.2	·· 00.8	66°20.7	·· 07.7
16	66°33.6	74°30.7	04°59.5	89°49.5	01.0	22°08.1	01.0	81°22.9	07.6
17	81°36.0	89°30.3	58.3	104°50.1	11°00.3	37°10.1	01.1	96°25.0	07.5
18	96°38.5	104°29.9	S04°57.1	119°50.7	S10°59.6	52°12.0	N16°01.3	111°27.2	S08°07.4
19	111°41.0	119°29.5	55.9	134°51.3	58.9	67°13.9	01.5	126°29.4	07.3
20	126°43.4	134°29.1	54.7	149°51.9	58.2	82°15.9	01.6	141°31.6	07.2
21	141°45.9	149°28.7	·· 53.5	164°52.6	·· 57.5	97°17.8	·· 01.8	156°33.8	·· 07.1
22	156°48.4	164°28.3	52.3	179°53.2	56.8	112°19.8	01.9	171°36.0	07.0
23	171°50.8	179°27.9	51.1	194°53.8	56.1	127°21.7	02.1	186°38.2	06.9
Mer.pass. 11:34		ν -0.4′	d 1.2′	m -3.88	ν 0.6′	d 0.7′	m 1.20	ν 1.9′	d 0.2′ m -2.08	ν 2.2′	d 0.1′ m 1.05

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	186°53.3	194°27.5	S04°49.9	209°54.4	S10°55.4	142°23.6	N16°02.2	201°40.4	S08°06.8
1	201°55.8	209°27.1	48.7	224°55.0	54.7	157°25.6	02.4	216°42.6	06.7
2	216°58.2	224°26.7	47.5	239°55.7	54.0	172°27.5	02.6	231°44.8	06.6
3	232°00.7	239°26.3	·· 46.3	254°56.3	·· 53.3	187°29.5	·· 02.7	246°47.0	·· 06.5
4	247°03.2	254°25.9	45.2	269°56.9	52.6	202°31.4	02.9	261°49.2	06.4
5	262°05.6	269°25.5	44.0	284°57.5	51.9	217°33.3	03.0	276°51.4	06.3
6	277°08.1	284°25.1	S04°42.8	299°58.1	S10°51.2	232°35.3	N16°03.2	291°53.6	S08°06.2
7	292°10.5	299°24.7	41.6	314°58.7	50.5	247°37.2	03.3	306°55.8	06.1
8	307°13.0	314°24.3	40.4	329°59.4	49.8	262°39.1	03.5	321°58.0	05.9
9	322°15.5	329°24.0	·· 39.2	345°00.0	·· 49.1	277°41.1	·· 03.6	337°00.2	·· 05.8
10	337°17.9	344°23.6	38.0	0°00.6	48.4	292°43.0	03.8	352°02.4	05.7
11	352°20.4	359°23.2	36.8	15°01.2	47.7	307°45.0	04.0	7°04.6	05.6
12	7°22.9	14°22.8	S04°35.6	30°01.8	S10°47.0	322°46.9	N16°04.1	22°06.8	S08°05.5
13	22°25.3	29°22.4	34.4	45°02.4	46.3	337°48.8	04.3	37°09.0	05.4
14	37°27.8	44°22.0	33.2	60°03.1	45.6	352°50.8	04.4	52°11.2	05.3
15	52°30.3	59°21.6	·· 32.0	75°03.7	·· 44.8	7°52.7	·· 04.6	67°13.4	·· 05.2
16	67°32.7	74°21.2	30.8	90°04.3	44.1	22°54.6	04.7	82°15.6	05.1
17	82°35.2	89°20.8	29.6	105°04.9	43.4	37°56.6	04.9	97°17.8	05.0
18	97°37.6	104°20.4	S04°28.4	120°05.5	S10°42.7	52°58.5	N16°05.1	112°19.9	S08°04.9
19	112°40.1	119°20.0	27.2	135°06.2	42.0	68°00.5	05.2	127°22.1	04.8
20	127°42.6	134°19.6	26.0	150°06.8	41.3	83°02.4	05.4	142°24.3	04.7
21	142°45.0	149°19.2	·· 24.8	165°07.4	·· 40.6	98°04.3	·· 05.5	157°26.5	·· 04.6
22	157°47.5	164°18.8	23.6	180°08.0	39.9	113°06.3	05.7	172°28.7	04.5
23	172°50.0	179°18.4	22.4	195°08.6	39.2	128°08.2	05.8	187°30.9	04.4
Mer.pass. 11:31		ν -0.4′	d 1.2′	m -3.88	ν 0.6′	d 0.7′	m 1.20	ν 1.9′	d 0.2′ m -2.07	ν 2.2′	d 0.1′ m 1.05

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	187°52.4	194°18.0	S04°21.3	210°09.3	S10°38.5	143°10.1	N16°06.0	202°33.1	S08°04.3
1	202°54.9	209°17.7	20.1	225°09.9	37.8	158°12.1	06.1	217°35.3	04.2
2	217°57.4	224°17.3	18.9	240°10.5	37.1	173°14.0	06.3	232°37.5	04.1
3	232°59.8	239°16.9	·· 17.7	255°11.1	·· 36.4	188°15.9	·· 06.5	247°39.7	·· 04.0
4	248°02.3	254°16.5	16.5	270°11.7	35.7	203°17.9	06.6	262°41.9	03.8
5	263°04.8	269°16.1	15.3	285°12.4	34.9	218°19.8	06.8	277°44.1	03.7
6	278°07.2	284°15.7	S04°14.1	300°13.0	S10°34.2	233°21.8	N16°06.9	292°46.3	S08°03.6
7	293°09.7	299°15.3	12.9	315°13.6	33.5	248°23.7	07.1	307°48.5	03.5
8	308°12.1	314°14.9	11.7	330°14.2	32.8	263°25.6	07.2	322°50.7	03.4
9	323°14.6	329°14.5	·· 10.5	345°14.9	·· 32.1	278°27.6	·· 07.4	337°52.9	·· 03.3
10	338°17.1	344°14.1	09.3	0°15.5	31.4	293°29.5	07.6	352°55.1	03.2
11	353°19.5	359°13.7	08.1	15°16.1	30.7	308°31.4	07.7	7°57.3	03.1
12	8°22.0	14°13.3	S04°06.9	30°16.7	S10°30.0	323°33.4	N16°07.9	22°59.5	S08°03.0
13	23°24.5	29°13.0	05.7	45°17.3	29.3	338°35.3	08.0	38°01.7	02.9
14	38°26.9	44°12.6	04.5	60°18.0	28.6	353°37.2	08.2	53°03.9	02.8
15	53°29.4	59°12.2	·· 03.3	75°18.6	·· 27.8	8°39.2	·· 08.3	68°06.1	·· 02.7
16	68°31.9	74°11.8	02.1	90°19.2	27.1	23°41.1	08.5	83°08.3	02.6
17	83°34.3	89°11.4	04°00.9	105°19.8	26.4	38°43.0	08.6	98°10.5	02.5
18	98°36.8	104°11.0	S03°59.7	120°20.5	S10°25.7	53°45.0	N16°08.8	113°12.7	S08°02.4
19	113°39.3	119°10.6	58.5	135°21.1	25.0	68°46.9	09.0	128°14.9	02.3
20	128°41.7	134°10.2	57.3	150°21.7	24.3	83°48.8	09.1	143°17.1	02.2
21	143°44.2	149°09.8	·· 56.1	165°22.3	·· 23.6	98°50.8	·· 09.3	158°19.3	·· 02.1
22	158°46.6	164°09.5	54.9	180°22.9	22.9	113°52.7	09.4	173°21.5	02.0
23	173°49.1	179°09.1	53.7	195°23.6	22.2	128°54.6	09.6	188°23.7	01.9
Mer.pass. 11:27		ν -0.4′	d 1.2′	m -3.88	ν 0.6′	d 0.7′	m 1.20	ν 1.9′	d 0.2′ m -2.07	ν 2.2′	d 0.1′ m 1.05

Stars

	SHA	Dec
Alpheratz	357°35.8	29°13.3
Ankaa	353°08.2	-42°10.6
Schedar	349°32.4	56°40.1
Diphda	348°48.3	-17°51.4
Achernar	335°21.2	-57°07.0
Hamal	327°52.3	23°34.5
Polaris	314°45.4	89°22.2
Acamar	315°12.6	-40°12.7
Menkar	314°07.1	4°11.0
Mirfak	308°29.6	49°56.9
Aldebaran	290°40.6	16°33.4
Rigel	281°04.6	-8°10.6
Capella	280°23.0	46°01.5
Bellatrix	278°23.7	6°22.2
Elnath	278°02.8	28°37.7
Alnilam	275°38.5	-1°11.3
Betelgeuse	270°52.9	7°24.6
Canopus	263°52.7	-52°42.8
Sirius	258°26.8	-16°45.1
Adhara	255°06.4	-29°00.5
Procyon	244°51.5	5°09.7
Pollux	243°18.0	27°58.1
Avior	234°14.8	-59°35.4
Suhail	222°46.6	-43°32.0
Miaplacidus	221°37.9	-69°49.2
Alphard	217°48.2	-8°45.9
Regulus	207°34.9	11°50.9
Dubhe	193°41.2	61°37.3
Denebola	182°25.3	14°26.1
Gienah	175°44.0	-17°40.7
Acrux	173°00.2	-63°14.0
Gacrux	171°51.9	-57°15.0
Alioth	166°13.0	55°49.6
Spica	158°22.7	-11°17.4
Alkaid	152°52.0	49°11.4
Hadar	148°36.4	-60°29.3
Menkent	147°58.1	-36°29.4
Arcturus	145°48.2	19°03.2
Rigil Kent.	139°40.7	-60°56.0
Kochab	137°18.8	74°03.1
Zuben'ubi	136°56.5	-16°08.6
Alphecca	126°04.0	26°37.7
Antares	112°16.5	-26°29.2
Atria	107°11.1	-69°04.0
Sabik	102°03.4	-15°45.4
Shaula	96°11.2	-37°07.2
Rasalhague	95°59.1	12°32.3
Eltanin	90°42.4	51°28.7
Kaus Aust.	83°33.4	-34°22.3
Vega	80°33.7	38°48.0
Nunki	75°48.6	-26°16.0
Altair	62°00.7	8°55.7
Peacock	53°07.0	-56°39.3
Deneb	49°26.5	45°21.7
Enif	33°39.7	9°58.9
Al Na'ir	27°34.1	-46°50.6
Fomalhaut	15°15.6	-29°29.7
Scheat	13°46.2	28°12.6
Markab	13°30.9	15°19.9

Mar 28 Thu	SHA	Mer.pass
Venus	8°42.9	11:02
Mars	23°45.5	10:01
Jupiter	315°42.9	14:32
Saturn	14°53.6	10:35

Mar 29 Fri	SHA	Mer.pass
Venus	7°34.2	11:02
Mars	23°01.1	10:00
Jupiter	315°30.3	14:29
Saturn	14°47.1	10:32

Mar 30 Sat	SHA	Mer.pass
Venus	6°25.6	11:03
Mars	22°16.8	09:59
Jupiter	315°17.7	14:25
Saturn	14°40.7	10:28

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.1129 sec ΔT = TT-UT1 = +69.0711 sec

2024 March 28 to Mar. 30 UT

h	Sun		Moon				
Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°44.3	N03°05.7	331°23.8	14.5′	S15°53.8	12.3′	54.7′
1	193°44.5	06.7	345°57.4	14.5′	16°06.1	12.4′	54.7′
2	208°44.7	07.6	0°30.9	14.4′	16°18.5	12.2′	54.7′
3	223°44.9	·· 08.6	15°04.3	14.3′	16°30.7	12.2′	54.8′
4	238°45.1	09.6	29°37.6	14.2′	16°42.9	12.1′	54.8′
5	253°45.3	10.6	44°10.8	14.2′	16°55.0	12.1′	54.8′
6	268°45.4	N03°11.5	58°44.0	14.1′	S17°07.1	12.0′	54.8′
7	283°45.6	12.5	73°17.1	14.0′	17°19.1	11.9′	54.8′
8	298°45.8	13.5	87°50.1	13.9′	17°31.0	11.9′	54.8′
9	313°46.0	·· 14.5	102°23.0	13.9′	17°42.9	11.8′	54.9′
10	328°46.2	15.4	116°55.9	13.8′	17°54.7	11.7′	54.9′
11	343°46.4	16.4	131°28.7	13.7′	18°06.4	11.7′	54.9′
12	358°46.6	N03°17.4	146°01.3	13.6′	S18°18.1	11.6′	54.9′
13	13°46.8	18.4	160°33.9	13.5′	18°29.7	11.5′	54.9′
14	28°47.0	19.3	175°06.5	13.4′	18°41.2	11.4′	54.9′
15	43°47.1	·· 20.3	189°38.9	13.4′	18°52.6	11.4′	55.0′
16	58°47.3	21.3	204°11.3	13.3′	19°04.0	11.3′	55.0′
17	73°47.5	22.3	218°43.5	13.2′	19°15.3	11.2′	55.0′
18	88°47.7	N03°23.2	233°15.7	13.1′	S19°26.5	11.2′	55.0′
19	103°47.9	24.2	247°47.8	13.0′	19°37.7	11.0′	55.0′
20	118°48.1	25.2	262°19.8	12.9′	19°48.7	11.0′	55.0′
21	133°48.3	·· 26.1	276°51.7	12.8′	19°59.7	10.9′	55.1′
22	148°48.5	27.1	291°23.6	12.7′	20°10.6	10.8′	55.1′
23	163°48.7	28.1	305°55.3	12.7′	20°21.4	10.8′	55.1′
	SD = 16.0′	d = 1.0′	SD = 14.9′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°48.8	N03°29.1	320°26.9	12.6′	S20°32.2	10.6′	55.1′
1	193°49.0	30.0	334°58.5	12.5′	20°42.8	10.6′	55.1′
2	208°49.2	31.0	349°30.0	12.4′	20°53.4	10.5′	55.2′
3	223°49.4	·· 32.0	4°01.4	12.3′	21°03.9	10.3′	55.2′
4	238°49.6	33.0	18°32.6	12.2′	21°14.2	10.3′	55.2′
5	253°49.8	33.9	33°03.8	12.1′	21°24.5	10.3′	55.2′
6	268°50.0	N03°34.9	47°34.9	12.0′	S21°34.8	10.1′	55.2′
7	283°50.2	35.9	62°05.9	11.9′	21°44.9	10.0′	55.3′
8	298°50.4	36.8	76°36.9	11.8′	21°54.9	9.9′	55.3′
9	313°50.5	·· 37.8	91°07.7	11.7′	22°04.8	9.9′	55.3′
10	328°50.7	38.8	105°38.4	11.6′	22°14.7	9.7′	55.3′
11	343°50.9	39.8	120°09.0	11.5′	22°24.4	9.7′	55.3′
12	358°51.1	N03°40.7	134°39.6	11.4′	S22°34.1	9.5′	55.4′
13	13°51.3	41.7	149°10.0	11.3′	22°43.6	9.5′	55.4′
14	28°51.5	42.7	163°40.4	11.2′	22°53.1	9.3′	55.4′
15	43°51.7	·· 43.6	178°10.6	11.2′	23°02.4	9.2′	55.4′
16	58°51.9	44.6	192°40.8	11.1′	23°11.6	9.2′	55.4′
17	73°52.0	45.6	207°10.8	11.0′	23°20.8	9.0′	55.5′
18	88°52.2	N03°46.6	221°40.8	10.9′	S23°29.8	8.9′	55.5′
19	103°52.4	47.5	236°10.6	10.8′	23°38.7	8.8′	55.5′
20	118°52.6	48.5	250°40.4	10.7′	23°47.5	8.7′	55.5′
21	133°52.8	·· 49.5	265°10.1	10.6′	23°56.2	8.6′	55.5′
22	148°53.0	50.4	279°39.6	10.5′	24°04.8	8.5′	55.6′
23	163°53.2	51.4	294°09.1	10.4′	24°13.3	8.4′	55.6′
	SD = 16.0′	d = 1.0′	SD = 15.0′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°53.4	N03°52.4	308°38.5	10.3′	S24°21.7	8.3′	55.6′
1	193°53.5	53.4	323°07.8	10.2′	24°30.0	8.1′	55.6′
2	208°53.7	54.3	337°37.0	10.1′	24°38.1	8.0′	55.7′
3	223°53.9	·· 55.3	352°06.1	10.0′	24°46.1	8.0′	55.7′
4	238°54.1	56.3	6°35.0	9.9′	24°54.1	7.7′	55.7′
5	253°54.3	57.2	21°03.9	9.8′	25°01.8	7.7′	55.7′
6	268°54.5	N03°58.2	35°32.7	9.7′	S25°09.5	7.6′	55.8′
7	283°54.7	03°59.2	50°01.4	9.6′	25°17.1	7.4′	55.8′
8	298°54.9	04°00.1	64°30.0	9.5′	25°24.5	7.3′	55.8′
9	313°55.0	·· 01.1	78°58.6	9.4′	25°31.8	7.2′	55.8′
10	328°55.2	02.1	93°27.0	9.3′	25°39.0	7.0′	55.9′
11	343°55.4	03.1	107°55.3	9.2′	25°46.0	7.0′	55.9′
12	358°55.6	N04°04.0	122°23.5	9.1′	S25°53.0	6.8′	55.9′
13	13°55.8	05.0	136°51.7	9.0′	25°59.8	6.6′	55.9′
14	28°56.0	06.0	151°19.7	8.9′	26°06.4	6.6′	56.0′
15	43°56.2	·· 06.9	165°47.6	8.9′	26°13.0	6.4′	56.0′
16	58°56.4	07.9	180°15.5	8.8′	26°19.4	6.2′	56.0′
17	73°56.5	08.9	194°43.2	8.7′	26°25.6	6.2′	56.0′
18	88°56.7	N04°09.8	209°10.9	8.6′	S26°31.8	6.0′	56.1′
19	103°56.9	10.8	223°38.5	8.5′	26°37.8	5.8′	56.1′
20	118°57.1	11.8	238°06.0	8.4′	26°43.6	5.7′	56.1′
21	133°57.3	·· 12.7	252°33.4	8.3′	26°49.3	5.6′	56.1′
22	148°57.5	13.7	267°00.7	8.2′	26°54.9	5.5′	56.2′
23	163°57.7	14.7	281°27.9	8.1′	27°00.4	5.3′	56.2′
	SD = 16.0′	d = 1.0′	SD = 15.2′				

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

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

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 18-20 93-80%
28	05:03	04:54	12:05	01:58	14:20	
29	04:45	04:36	12:05	02:43	15:08	
30	04:27	04:18	12:04	03:33	15:59	

March 31, 01, 02 UT (Sun., Mon., Tue.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	188°51.6	194°08.7	S03°52.5	210°24.2	S10°21.5	143°56.6	N16°09.7	203°25.9	S08°01.8
1	203°54.0	209°08.3	51.2	225°24.8	20.7	158°58.5	09.9	218°28.1	01.6
2	218°56.5	224°07.9	50.0	240°25.4	20.0	174°00.4	10.1	233°30.3	01.5
3	233°59.0	239°07.5	·· 48.8	255°26.1	·· 19.3	189°02.4	·· 10.2	248°32.5	·· 01.4
4	249°01.4	254°07.1	47.6	270°26.7	18.6	204°04.3	10.4	263°34.7	01.3
5	264°03.9	269°06.7	46.4	285°27.3	17.9	219°06.2	10.5	278°36.9	01.2
6	279°06.4	284°06.4	S03°45.2	300°27.9	S10°17.2	234°08.2	N16°10.7	293°39.1	S08°01.1
7	294°08.8	299°06.0	44.0	315°28.6	16.5	249°10.1	10.8	308°41.3	01.0
8	309°11.3	314°05.6	42.8	330°29.2	15.8	264°12.0	11.0	323°43.5	00.9
9	324°13.8	329°05.2	·· 41.6	345°29.8	·· 15.0	279°14.0	·· 11.1	338°45.7	·· 00.8
10	339°16.2	344°04.8	40.4	0°30.4	14.3	294°15.9	11.3	353°47.9	00.7
11	354°18.7	359°04.4	39.2	15°31.1	13.6	309°17.8	11.5	8°50.1	00.6
12	9°21.1	14°04.0	S03°38.0	30°31.7	S10°12.9	324°19.8	N16°11.6	23°52.3	S08°00.5
13	24°23.6	29°03.6	36.8	45°32.3	12.2	339°21.7	11.8	38°54.5	00.4
14	39°26.1	44°03.3	35.6	60°32.9	11.5	354°23.6	11.9	53°56.7	00.3
15	54°28.5	59°02.9	·· 34.4	75°33.6	·· 10.8	9°25.6	·· 12.1	68°58.9	·· 00.2
16	69°31.0	74°02.5	33.2	90°34.2	10.0	24°27.5	12.2	84°01.1	00.1
17	84°33.5	89°02.1	32.0	105°34.8	09.3	39°29.4	12.4	99°03.3	08°00.0
18	99°35.9	104°01.7	S03°30.8	120°35.4	S10°08.6	54°31.4	N16°12.6	114°05.5	S07°59.9
19	114°38.4	119°01.3	29.6	135°36.1	07.9	69°33.3	12.7	129°07.7	59.8
20	129°40.9	134°00.9	28.4	150°36.7	07.2	84°35.2	12.9	144°09.9	59.7
21	144°43.3	149°00.6	·· 27.2	165°37.3	·· 06.5	99°37.1	·· 13.0	159°12.0	·· 59.6
22	159°45.8	164°00.2	25.9	180°37.9	05.8	114°39.1	13.2	174°14.2	59.5
23	174°48.2	178°59.8	24.7	195°38.6	05.0	129°41.0	13.3	189°16.4	59.4
Mer.pass. 11:23		ν -0.4′	d 1.2′	m -3.88	ν 0.6′	d 0.7′	m 1.19	ν 1.9′	d 0.2′ m -2.07	ν 2.2′	d 0.1′ m 1.05

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	189°50.7	193°59.4	S03°23.5	210°39.2	S10°04.3	144°42.9	N16°13.5	204°18.6	S07°59.3
1	204°53.2	208°59.0	22.3	225°39.8	03.6	159°44.9	13.7	219°20.8	59.2
2	219°55.6	223°58.6	21.1	240°40.5	02.9	174°46.8	13.8	234°23.0	59.0
3	234°58.1	238°58.3	·· 19.9	255°41.1	·· 02.2	189°48.7	·· 14.0	249°25.2	·· 58.9
4	250°00.6	253°57.9	18.7	270°41.7	01.5	204°50.7	14.1	264°27.4	58.8
5	265°03.0	268°57.5	17.5	285°42.3	00.7	219°52.6	14.3	279°29.6	58.7
6	280°05.5	283°57.1	S03°16.3	300°43.0	S10°00.0	234°54.5	N16°14.4	294°31.8	S07°58.6
7	295°08.0	298°56.7	15.1	315°43.6	09°59.3	249°56.4	14.6	309°34.0	58.5
8	310°10.4	313°56.3	13.9	330°44.2	58.6	264°58.4	14.7	324°36.2	58.4
9	325°12.9	328°55.9	·· 12.7	345°44.9	·· 57.9	280°00.3	·· 14.9	339°38.4	·· 58.3
10	340°15.4	343°55.6	11.5	0°45.5	57.2	295°02.2	15.1	354°40.6	58.2
11	355°17.8	358°55.2	10.2	15°46.1	56.4	310°04.2	15.2	9°42.8	58.1
12	10°20.3	13°54.8	S03°09.0	30°46.7	S09°55.7	325°06.1	N16°15.4	24°45.0	S07°58.0
13	25°22.7	28°54.4	07.8	45°47.4	55.0	340°08.0	15.5	39°47.2	57.9
14	40°25.2	43°54.0	06.6	60°48.0	54.3	355°09.9	15.7	54°49.4	57.8
15	55°27.7	58°53.6	·· 05.4	75°48.6	·· 53.6	10°11.9	·· 15.8	69°51.6	·· 57.7
16	70°30.1	73°53.3	04.2	90°49.3	52.9	25°13.8	16.0	84°53.9	57.6
17	85°32.6	88°52.9	03.0	105°49.9	52.1	40°15.7	16.2	99°56.1	57.5
18	100°35.1	103°52.5	S03°01.8	120°50.5	S09°51.4	55°17.7	N16°16.3	114°58.3	S07°57.4
19	115°37.5	118°52.1	03°00.6	135°51.1	50.7	70°19.6	16.5	130°00.5	57.3
20	130°40.0	133°51.7	02°59.4	150°51.8	50.0	85°21.5	16.6	145°02.7	57.2
21	145°42.5	148°51.4	·· 58.1	165°52.4	·· 49.3	100°23.4	·· 16.8	160°04.9	·· 57.1
22	160°44.9	163°51.0	56.9	180°53.0	48.5	115°25.4	16.9	175°07.1	57.0
23	175°47.4	178°50.6	55.7	195°53.7	47.8	130°27.3	17.1	190°09.3	56.9
Mer.pass. 11:19		ν -0.4′	d 1.2′	m -3.88	ν 0.6′	d 0.7′	m 1.19	ν 1.9′	d 0.2′ m -2.07	ν 2.2′	d 0.1′ m 1.06

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	190°49.9	193°50.2	S02°54.5	210°54.3	S09°47.1	145°29.2	N16°17.3	205°11.5	S07°56.8
1	205°52.3	208°49.8	53.3	225°54.9	46.4	160°31.2	17.4	220°13.7	56.7
2	220°54.8	223°49.4	52.1	240°55.5	45.7	175°33.1	17.6	235°15.9	56.6
3	235°57.2	238°49.1	·· 50.9	255°56.2	·· 44.9	190°35.0	·· 17.7	250°18.1	·· 56.5
4	250°59.7	253°48.7	49.7	270°56.8	44.2	205°36.9	17.9	265°20.3	56.4
5	266°02.2	268°48.3	48.5	285°57.4	43.5	220°38.9	18.0	280°22.5	56.3
6	281°04.6	283°47.9	S02°47.2	300°58.1	S09°42.8	235°40.8	N16°18.2	295°24.7	S07°56.2
7	296°07.1	298°47.5	46.0	315°58.7	42.1	250°42.7	18.3	310°26.9	56.1
8	311°09.6	313°47.2	44.8	330°59.3	41.3	265°44.6	18.5	325°29.1	55.9
9	326°12.0	328°46.8	·· 43.6	346°00.0	·· 40.6	280°46.6	·· 18.7	340°31.3	·· 55.8
10	341°14.5	343°46.4	42.4	1°00.6	39.9	295°48.5	18.8	355°33.5	55.7
11	356°17.0	358°46.0	41.2	16°01.2	39.2	310°50.4	19.0	10°35.7	55.6
12	11°19.4	13°45.6	S02°40.0	31°01.9	S09°38.5	325°52.4	N16°19.1	25°37.9	S07°55.5
13	26°21.9	28°45.3	38.8	46°02.5	37.7	340°54.3	19.3	40°40.1	55.4
14	41°24.4	43°44.9	37.5	61°03.1	37.0	355°56.2	19.4	55°42.3	55.3
15	56°26.8	58°44.5	·· 36.3	76°03.8	·· 36.3	10°58.1	·· 19.6	70°44.5	·· 55.2
16	71°29.3	73°44.1	35.1	91°04.4	35.6	26°00.1	19.8	85°46.7	55.1
17	86°31.7	88°43.7	33.9	106°05.0	34.9	41°02.0	19.9	100°48.9	55.0
18	101°34.2	103°43.4	S02°32.7	121°05.7	S09°34.1	56°03.9	N16°20.1	115°51.1	S07°54.9
19	116°36.7	118°43.0	31.5	136°06.3	33.4	71°05.8	20.2	130°53.3	54.8
20	131°39.1	133°42.6	30.3	151°06.9	32.7	86°07.8	20.4	145°55.5	54.7
21	146°41.6	148°42.2	·· 29.0	166°07.6	·· 32.0	101°09.7	·· 20.5	160°57.7	·· 54.6
22	161°44.1	163°41.9	27.8	181°08.2	31.2	116°11.6	20.7	175°59.9	54.5
23	176°46.5	178°41.5	26.6	196°08.8	30.5	131°13.5	20.9	191°02.1	54.4
Mer.pass. 11:15		ν -0.4′	d 1.2′	m -3.88	ν 0.6′	d 0.7′	m 1.19	ν 1.9′	d 0.2′ m -2.06	ν 2.2′	d 0.1′ m 1.06

Stars

	SHA	**Dec**
Alpheratz	357°35.8	29°13.3
Ankaa	353°08.2	-42°10.6
Schedar	349°32.4	56°40.1
Diphda	348°48.3	-17°51.4
Achernar	335°21.2	-57°07.0
Hamal	327°52.3	23°34.5
Polaris	314°46.0	89°22.1
Acamar	315°12.6	-40°12.6
Menkar	314°07.1	4°11.0
Mirfak	308°29.6	49°56.9
Aldebaran	290°40.6	16°33.4
Rigel	281°04.6	-8°10.6
Capella	280°23.0	46°01.5
Bellatrix	278°23.7	6°22.2
Elnath	278°02.8	28°37.7
Alnilam	275°38.5	-1°11.3
Betelgeuse	270°52.9	7°24.6
Canopus	263°52.7	-52°42.8
Sirius	258°26.8	-16°45.1
Adhara	255°06.4	-29°00.5
Procyon	244°51.5	5°09.7
Pollux	243°18.0	27°58.1
Avior	234°14.8	-59°35.5
Suhail	222°46.6	-43°32.0
Miaplacidus	221°37.9	-69°49.2
Alphard	217°48.2	-8°45.9
Regulus	207°34.9	11°50.9
Dubhe	193°41.2	61°37.3
Denebola	182°25.3	14°26.1
Gienah	175°44.0	-17°40.7
Acrux	173°00.2	-63°14.1
Gacrux	171°51.8	-57°15.0
Alioth	166°12.9	55°49.6
Spica	158°22.7	-11°17.4
Alkaid	152°52.0	49°11.4
Hadar	148°36.4	-60°29.3
Menkent	147°58.0	-36°29.4
Arcturus	145°48.2	19°03.2
Rigil Kent.	139°40.7	-60°56.1
Kochab	137°18.7	74°03.1
Zuben'ubi	136°56.5	-16°08.6
Alphecca	126°04.0	26°37.7
Antares	112°16.5	-26°29.2
Atria	107°11.0	-69°04.0
Sabik	102°03.4	-15°45.4
Shaula	96°11.1	-37°07.2
Rasalhague	95°59.1	12°32.3
Eltanin	90°42.4	51°28.7
Kaus Aust.	83°33.3	-34°22.3
Vega	80°33.6	38°48.0
Nunki	75°48.6	-26°16.0
Altair	62°00.7	8°55.7
Peacock	53°07.0	-56°39.3
Deneb	49°26.5	45°21.6
Enif	33°39.7	9°58.9
Al Na'ir	27°34.1	-46°50.6
Fomalhaut	15°15.5	-29°29.7
Scheat	13°46.2	28°12.6
Markab	13°30.9	15°19.9

Mar 31 Sun	**SHA**	**Mer.pass**
Venus	5°17.1	11:04
Mars	21°32.6	09:58
Jupiter	315°05.0	14:22
Saturn	14°34.3	10:25

Apr 01 Mon	**SHA**	**Mer.pass**
Venus	4°08.7	11:04
Mars	20°48.5	09:57
Jupiter	314°52.2	14:19
Saturn	14°27.9	10:21

Apr 02 Tue	**SHA**	**Mer.pass**
Venus	3°00.4	11:05
Mars	20°04.4	09:56
Jupiter	314°39.4	14:16
Saturn	14°21.6	10:18

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h — Sun — Moon

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	178°57.9	N04°15.6	295°55.0	8.0′	S27°05.7	5.1′	56.2′
1	193°58.0	16.6	310°22.1	8.0′	27°10.8	5.1′	56.2′
2	208°58.2	17.6	324°49.0	7.9′	27°15.9	4.8′	56.3′
3	223°58.4	·· 18.5	339°15.9	7.8′	27°20.7	4.7′	56.3′
4	238°58.6	19.5	353°42.7	7.7′	27°25.4	4.6′	56.3′
5	253°58.8	20.5	8°09.4	7.6′	27°30.0	4.4′	56.3′
6	268°59.0	N04°21.4	22°36.1	7.5′	S27°34.4	4.3′	56.4′
7	283°59.2	22.4	37°02.6	7.5′	27°38.7	4.2′	56.4′
8	298°59.3	23.4	51°29.1	7.4′	27°42.9	3.9′	56.4′
9	313°59.5	·· 24.3	65°55.5	7.3′	27°46.8	3.8′	56.5′
10	328°59.7	25.3	80°21.8	7.2′	27°50.6	3.7′	56.5′
11	343°59.9	26.3	94°48.0	7.2′	27°54.3	3.5′	56.5′
12	359°00.1	N04°27.2	109°14.2	7.1′	S27°57.8	3.4′	56.5′
13	14°00.3	28.2	123°40.3	7.0′	28°01.2	3.2′	56.6′
14	29°00.5	29.2	138°06.3	6.9′	28°04.4	3.0′	56.6′
15	44°00.6	·· 30.1	152°32.3	6.9′	28°07.4	2.9′	56.6′
16	59°00.8	31.1	166°58.1	6.8′	28°10.3	2.7′	56.7′
17	74°01.0	32.1	181°23.9	6.7′	28°13.0	2.6′	56.7′
18	89°01.2	N04°33.0	195°49.7	6.7′	S28°15.6	2.4′	56.7′
19	104°01.4	34.0	210°15.4	6.6′	28°18.0	2.3′	56.7′
20	119°01.6	35.0	224°41.0	6.6′	28°20.3	2.0′	56.8′
21	134°01.8	·· 35.9	239°06.5	6.5′	28°22.3	1.9′	56.8′
22	149°01.9	36.9	253°32.0	6.4′	28°24.2	1.8′	56.8′
23	164°02.1	37.8	267°57.5	6.4′	28°26.0	1.6′	56.9′
	SD = 16.0′	d = 1.0′		SD = 15.3′			

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	179°02.3	N04°38.8	282°22.9	6.3′	S28°27.6	1.4′	56.9′
1	194°02.5	39.8	296°48.2	6.3′	28°29.0	1.2′	56.9′
2	209°02.7	40.7	311°13.4	6.2′	28°30.2	1.1′	57.0′
3	224°02.9	·· 41.7	325°38.7	6.2′	28°31.3	0.9′	57.0′
4	239°03.1	42.7	340°03.8	6.1′	28°32.2	0.8′	57.0′
5	254°03.2	43.6	354°28.9	6.1′	28°33.0	0.6′	57.0′
6	269°03.4	N04°44.6	8°54.0	6.0′	S28°33.6	0.4′	57.1′
7	284°03.6	45.6	23°19.0	6.0′	28°34.0	0.2′	57.1′
8	299°03.8	46.5	37°44.0	5.9′	28°34.2	0.1′	57.1′
9	314°04.0	·· 47.5	52°09.0	5.9′	28°34.3	0.1′	57.2′
10	329°04.2	48.4	66°33.9	5.9′	28°34.2	0.3′	57.2′
11	344°04.4	49.4	80°58.7	5.8′	28°33.9	0.5′	57.2′
12	359°04.5	N04°50.4	95°23.5	5.8′	S28°33.4	0.6′	57.3′
13	14°04.7	51.3	109°48.3	5.8′	28°32.8	0.8′	57.3′
14	29°04.9	52.3	124°13.1	5.7′	28°32.0	1.0′	57.3′
15	44°05.1	·· 53.3	138°37.8	5.7′	28°31.0	1.1′	57.4′
16	59°05.3	54.2	153°02.5	5.7′	28°29.9	1.4′	57.4′
17	74°05.5	55.2	167°27.2	5.6′	28°28.5	1.5′	57.4′
18	89°05.6	N04°56.1	181°51.8	5.6′	S28°27.0	1.7′	57.5′
19	104°05.8	57.1	196°16.5	5.6′	28°25.3	1.8′	57.5′
20	119°06.0	58.1	210°41.1	5.6′	28°23.5	2.1′	57.5′
21	134°06.2	04°59.0	225°05.7	5.6′	28°21.4	2.2′	57.6′
22	149°06.4	05°00.0	239°30.2	5.6′	28°19.2	2.4′	57.6′
23	164°06.6	00.9	253°54.8	5.5′	28°16.8	2.5′	57.6′
	SD = 16.0′	d = 1.0′		SD = 15.5′			

Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	179°06.8	N05°01.9	268°19.3	5.5′	S28°14.3	2.8′	57.7′
1	194°06.9	02.9	282°43.8	5.5′	28°11.5	2.9′	57.7′
2	209°07.1	03.8	297°08.3	5.5′	28°08.6	3.1′	57.7′
3	224°07.3	·· 04.8	311°32.9	5.5′	28°05.5	3.3′	57.8′
4	239°07.5	05.7	325°57.4	5.5′	28°02.2	3.4′	57.8′
5	254°07.7	06.7	340°21.9	5.5′	27°58.8	3.6′	57.8′
6	269°07.9	N05°07.7	354°46.3	5.5′	S27°55.2	3.9′	57.9′
7	284°08.0	08.6	9°10.8	5.5′	27°51.3	3.9′	57.9′
8	299°08.2	09.6	23°35.3	5.5′	27°47.4	4.2′	57.9′
9	314°08.4	·· 10.5	37°59.8	5.5′	27°43.2	4.4′	58.0′
10	329°08.6	11.5	52°24.3	5.5′	27°38.8	4.5′	58.0′
11	344°08.8	12.5	66°48.9	5.5′	27°34.3	4.7′	58.0′
12	359°09.0	N05°13.4	81°13.4	5.5′	S27°29.6	4.8′	58.1′
13	14°09.1	14.4	95°37.9	5.5′	27°24.8	5.1′	58.1′
14	29°09.3	15.3	110°02.4	5.6′	27°19.7	5.2′	58.1′
15	44°09.5	·· 16.3	124°27.0	5.6′	27°14.5	5.4′	58.2′
16	59°09.7	17.3	138°51.6	5.6′	27°09.1	5.6′	58.2′
17	74°09.9	18.2	153°16.2	5.6′	27°03.5	5.8′	58.2′
18	89°10.1	N05°19.2	167°40.8	5.6′	S26°57.7	5.9′	58.3′
19	104°10.2	20.1	182°05.4	5.7′	26°51.8	6.1′	58.3′
20	119°10.4	21.1	196°30.1	5.7′	26°45.7	6.3′	58.3′
21	134°10.6	·· 22.0	210°54.7	5.7′	26°39.4	6.4′	58.4′
22	149°10.8	23.0	225°19.4	5.7′	26°33.0	6.7′	58.4′
23	164°11.0	24.0	239°44.2	5.8′	26°26.3	6.8′	58.4′
	SD = 16.0′	d = 1.0′		SD = 15.7′			

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

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

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	21-23 72-51%
31	04:09	04:00	12:04	04:26	16:54	
01	03:51	03:42	12:04	05:23	17:52	
02	03:33	03:24	12:03	06:22	18:51	

April 03, 04, 05 UT (Wed., Thu., Fri.)

	Aries	Venus		Mars		Jupiter		Saturn	
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	191°49.0	193°41.1	S02°25.4	211°09.5	S09°29.8	146°15.5	N16°21.0	206°04.3	S07°54.3
1	206°51.5	208°40.7	24.2	226°10.1	29.1	161°17.4	21.2	221°06.5	54.2
2	221°53.9	223°40.3	23.0	241°10.7	28.4	176°19.3	21.3	236°08.7	54.1
3	236°56.4	238°40.0	·· 21.8	256°11.4	·· 27.6	191°21.2	·· 21.5	251°10.9	·· 54.0
4	251°58.9	253°39.6	20.5	271°12.0	26.9	206°23.2	21.6	266°13.1	53.9
5	267°01.3	268°39.2	19.3	286°12.6	26.2	221°25.1	21.8	281°15.3	53.8
6	282°03.8	283°38.8	S02°18.1	301°13.3	S09°25.5	236°27.0	N16°21.9	296°17.5	S07°53.7
7	297°06.2	298°38.4	16.9	316°13.9	24.7	251°28.9	22.1	311°19.7	53.6
8	312°08.7	313°38.1	15.7	331°14.5	24.0	266°30.9	22.3	326°21.9	53.5
9	327°11.2	328°37.7	·· 14.5	346°15.2	·· 23.3	281°32.8	·· 22.4	341°24.1	·· 53.4
10	342°13.6	343°37.3	13.3	1°15.8	22.6	296°34.7	22.6	356°26.3	53.3
11	357°16.1	358°36.9	12.0	16°16.4	21.8	311°36.6	22.7	11°28.5	53.2
12	12°18.6	13°36.6	S02°10.8	31°17.1	S09°21.1	326°38.5	N16°22.9	26°30.7	S07°53.1
13	27°21.0	28°36.2	09.6	46°17.7	20.4	341°40.5	23.0	41°32.9	53.0
14	42°23.5	43°35.8	08.4	61°18.3	19.7	356°42.4	23.2	56°35.1	52.9
15	57°26.0	58°35.4	·· 07.2	76°19.0	·· 18.9	11°44.3	·· 23.4	71°37.3	·· 52.8
16	72°28.4	73°35.1	06.0	91°19.6	18.2	26°46.2	23.5	86°39.5	52.7
17	87°30.9	88°34.7	04.7	106°20.2	17.5	41°48.2	23.7	101°41.7	52.6
18	102°33.3	103°34.3	S02°03.5	121°20.9	S09°16.8	56°50.1	N16°23.8	116°44.0	S07°52.5
19	117°35.8	118°33.9	02.3	136°21.5	16.0	71°52.0	24.0	131°46.2	52.4
20	132°38.3	133°33.5	02°01.1	151°22.1	15.3	86°53.9	24.1	146°48.4	52.3
21	147°40.7	148°33.2	01°59.9	166°22.8	·· 14.6	101°55.9	·· 24.3	161°50.6	·· 52.2
22	162°43.2	163°32.8	58.7	181°23.4	13.9	116°57.8	24.5	176°52.8	52.1
23	177°45.7	178°32.4	57.4	196°24.1	13.1	131°59.7	24.6	191°55.0	52.0
Mer.pass. 11:11		ν -0.4′	d 1.2′	m -3.88	ν 0.6′	d 0.7′	m 1.19	ν 1.9′	d 0.2′ m -2.06	ν 2.2′	d 0.1′ m 1.06

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	192°48.1	193°32.0	S01°56.2	211°24.7	S09°12.4	147°01.6	N16°24.8	206°57.2	S07°51.9
1	207°50.6	208°31.7	55.0	226°25.3	11.7	162°03.5	24.9	221°59.4	51.7
2	222°53.1	223°31.3	53.8	241°26.0	11.0	177°05.5	25.1	237°01.6	51.6
3	237°55.5	238°30.9	·· 52.6	256°26.6	·· 10.2	192°07.4	·· 25.2	252°03.8	·· 51.5
4	252°58.0	253°30.5	51.3	271°27.2	09.5	207°09.3	25.4	267°06.0	51.4
5	268°00.5	268°30.2	50.1	286°27.9	08.8	222°11.2	25.5	282°08.2	51.3
6	283°02.9	283°29.8	S01°48.9	301°28.5	S09°08.0	237°13.1	N16°25.7	297°10.4	S07°51.2
7	298°05.4	298°29.4	47.7	316°29.1	07.3	252°15.1	25.9	312°12.6	51.1
8	313°07.8	313°29.0	46.5	331°29.8	06.6	267°17.0	26.0	327°14.8	51.0
9	328°10.3	328°28.7	·· 45.3	346°30.4	·· 05.9	282°18.9	·· 26.2	342°17.0	·· 50.9
10	343°12.8	343°28.3	44.0	1°31.1	05.1	297°20.8	26.3	357°19.2	50.8
11	358°15.2	358°27.9	42.8	16°31.7	04.4	312°22.8	26.5	12°21.4	50.7
12	13°17.7	13°27.5	S01°41.6	31°32.3	S09°03.7	327°24.7	N16°26.6	27°23.6	S07°50.6
13	28°20.2	28°27.2	40.4	46°33.0	03.0	342°26.6	26.8	42°25.8	50.5
14	43°22.6	43°26.8	39.2	61°33.6	02.2	357°28.5	27.0	57°28.0	50.4
15	58°25.1	58°26.4	·· 37.9	76°34.2	·· 01.5	12°30.4	·· 27.1	72°30.2	·· 50.3
16	73°27.6	73°26.0	36.7	91°34.9	00.8	27°32.4	27.3	87°32.4	50.2
17	88°30.0	88°25.7	35.5	106°35.5	09°00.0	42°34.3	27.4	102°34.7	50.1
18	103°32.5	103°25.3	S01°34.3	121°36.2	S08°59.3	57°36.2	N16°27.6	117°36.9	S07°50.0
19	118°35.0	118°24.9	33.1	136°36.8	58.6	72°38.1	27.7	132°39.1	49.9
20	133°37.4	133°24.5	31.8	151°37.4	57.9	87°40.0	27.9	147°41.3	49.8
21	148°39.9	148°24.2	·· 30.6	166°38.1	·· 57.1	102°42.0	·· 28.1	162°43.5	·· 49.7
22	163°42.3	163°23.8	29.4	181°38.7	56.4	117°43.9	28.2	177°45.7	49.6
23	178°44.8	178°23.4	28.2	196°39.4	55.7	132°45.8	28.4	192°47.9	49.5
Mer.pass. 11:07		ν -0.4′	d 1.2′	m -3.89	ν 0.6′	d 0.7′	m 1.18	ν 1.9′	d 0.2′ m -2.06	ν 2.2′	d 0.1′ m 1.06

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	193°47.3	193°23.0	S01°27.0	211°40.0	S08°54.9	147°47.7	N16°28.5	207°50.1	S07°49.4
1	208°49.7	208°22.7	25.7	226°40.6	54.2	162°49.6	28.7	222°52.3	49.3
2	223°52.2	223°22.3	24.5	241°41.3	53.5	177°51.6	28.8	237°54.5	49.2
3	238°54.7	238°21.9	·· 23.3	256°41.9	·· 52.7	192°53.5	·· 29.0	252°56.7	·· 49.1
4	253°57.1	253°21.5	22.1	271°42.6	52.0	207°55.4	29.1	267°58.9	49.0
5	268°59.6	268°21.2	20.9	286°43.2	51.3	222°57.3	29.3	283°01.1	48.9
6	284°02.1	283°20.8	S01°19.6	301°43.8	S08°50.6	237°59.2	N16°29.5	298°03.3	S07°48.8
7	299°04.5	298°20.4	18.4	316°44.5	49.8	253°01.1	29.6	313°05.5	48.7
8	314°07.0	313°20.1	17.2	331°45.1	49.1	268°03.1	29.8	328°07.7	48.6
9	329°09.4	328°19.7	·· 16.0	346°45.8	·· 48.4	283°05.0	·· 29.9	343°09.9	·· 48.5
10	344°11.9	343°19.3	14.8	1°46.4	47.6	298°06.9	30.1	358°12.1	48.4
11	359°14.4	358°18.9	13.5	16°47.0	46.9	313°08.8	30.2	13°14.4	48.3
12	14°16.8	13°18.6	S01°12.3	31°47.7	S08°46.2	328°10.7	N16°30.4	28°16.6	S07°48.2
13	29°19.3	28°18.2	11.1	46°48.3	45.4	343°12.7	30.6	43°18.8	48.1
14	44°21.8	43°17.8	09.9	61°49.0	44.7	358°14.6	30.7	58°21.0	48.0
15	59°24.2	58°17.4	·· 08.6	76°49.6	·· 44.0	13°16.5	·· 30.9	73°23.2	·· 47.9
16	74°26.7	73°17.1	07.4	91°50.2	43.2	28°18.4	31.0	88°25.4	47.8
17	89°29.2	88°16.7	06.2	106°50.9	42.5	43°20.3	31.2	103°27.6	47.7
18	104°31.6	103°16.3	S01°05.0	121°51.5	S08°41.8	58°22.2	N16°31.3	118°29.8	S07°47.6
19	119°34.1	118°16.0	03.8	136°52.2	41.0	73°24.2	31.5	133°32.0	47.5
20	134°36.6	133°15.6	02.5	151°52.8	40.3	88°26.1	31.7	148°34.2	47.4
21	149°39.0	148°15.2	·· 01.3	166°53.5	·· 39.6	103°28.0	·· 31.8	163°36.4	·· 47.3
22	164°41.5	163°14.8	01°00.1	181°54.1	38.8	118°29.9	32.0	178°38.6	47.2
23	179°43.9	178°14.5	00°58.9	196°54.7	38.1	133°31.8	32.1	193°40.8	47.1
Mer.pass. 11:03		ν -0.4′	d 1.2′	m -3.89	ν 0.6′	d 0.7′	m 1.18	ν 1.9′	d 0.2′ m -2.06	ν 2.2′	d 0.1′ m 1.06

Stars

	SHA	Dec
Alpheratz	357°35.8	29°13.3
Ankaa	353°08.2	-42°10.5
Schedar	349°32.4	56°40.1
Diphda	348°48.3	-17°51.4
Achernar	335°21.2	-57°06.9
Hamal	327°52.3	23°34.5
Polaris	314°46.7	89°22.1
Acamar	315°12.6	-40°12.6
Menkar	314°07.1	4°11.0
Mirfak	308°29.6	49°56.9
Aldebaran	290°40.6	16°33.4
Rigel	281°04.6	-8°10.5
Capella	280°23.1	46°01.5
Bellatrix	278°23.7	6°22.2
Elnath	278°02.8	28°37.7
Alnilam	275°38.5	-1°11.3
Betelgeuse	270°52.9	7°24.6
Canopus	263°52.8	-52°42.8
Sirius	258°26.8	-16°45.1
Adhara	255°06.4	-29°00.5
Procyon	244°51.5	5°09.7
Pollux	243°18.0	27°58.1
Avior	234°14.8	-59°35.5
Suhail	222°46.6	-43°32.0
Miaplacidus	221°38.0	-69°49.2
Alphard	217°48.2	-8°45.9
Regulus	207°34.9	11°50.9
Dubhe	193°41.2	61°37.3
Denebola	182°25.3	14°26.1
Gienah	175°43.9	-17°40.7
Acrux	173°00.2	-63°14.1
Gacrux	171°51.8	-57°15.0
Alioth	166°12.9	55°49.6
Spica	158°22.7	-11°17.4
Alkaid	152°52.0	49°11.4
Hadar	148°36.4	-60°29.4
Menkent	147°58.0	-36°29.4
Arcturus	145°48.2	19°03.2
Rigil Kent.	139°40.6	-60°56.1
Kochab	137°18.7	74°03.1
Zuben'ubi	136°56.5	-16°08.6
Alphecca	126°04.0	26°37.7
Antares	112°16.4	-26°29.2
Atria	107°11.0	-69°04.0
Sabik	102°03.4	-15°45.4
Shaula	96°11.1	-37°07.2
Rasalhague	95°59.0	12°32.3
Eltanin	90°42.3	51°28.7
Kaus Aust.	83°33.3	-34°22.3
Vega	80°33.6	38°48.0
Nunki	75°48.6	-26°16.0
Altair	62°00.7	8°55.7
Peacock	53°06.9	-56°39.3
Deneb	49°26.5	45°21.6
Enif	33°39.6	9°58.9
Al Na'ir	27°34.0	-46°50.6
Fomalhaut	15°15.5	-29°29.7
Scheat	13°46.2	28°12.6
Markab	13°30.8	15°19.9

Apr 03 Wed	SHA	Mer.pass
Venus	1°52.1	11:06
Mars	19°20.5	09:55
Jupiter	314°26.5	14:13
Saturn	14°15.3	10:14

Apr 04 Thu	SHA	Mer.pass
Venus	0°43.9	11:06
Mars	18°36.6	09:54
Jupiter	314°13.5	14:10
Saturn	14°09.0	10:11

Apr 05 Fri	SHA	Mer.pass
Venus	359°35.8	11:07
Mars	17°52.7	09:53
Jupiter	314°00.4	14:07
Saturn	14°02.8	10:07

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.1145 sec ΔT = TT-UT1 = +69.0695 sec

2024 April 03 to Apr. 05 UT

h

	Sun		Moon				
Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°11.1	N05°24.9	254°08.9	5.8′	S26°19.5	6.9′	58.5′
1	194°11.3	25.9	268°33.7	5.8′	26°12.6	7.2′	58.5′
2	209°11.5	26.8	282°58.5	5.8′	26°05.4	7.3′	58.5′
3	224°11.7	·· 27.8	297°23.4	5.9′	25°58.1	7.5′	58.6′
4	239°11.9	28.7	311°48.2	5.9′	25°50.6	7.7′	58.6′
5	254°12.1	29.7	326°13.2	6.0′	25°42.9	7.8′	58.6′
6	269°12.2	N05°30.7	340°38.1	6.0′	S25°35.1	8.0′	58.7′
7	284°12.4	31.6	355°03.1	6.0′	25°27.1	8.1′	58.7′
8	299°12.6	32.6	9°28.1	6.1′	25°19.0	8.4′	58.7′
9	314°12.8	·· 33.5	23°53.2	6.1′	25°10.6	8.5′	58.8′
10	329°13.0	34.5	38°18.3	6.2′	25°02.1	8.6′	58.8′
11	344°13.2	35.4	52°43.5	6.2′	24°53.5	8.9′	58.8′
12	359°13.3	N05°36.4	67°08.7	6.2′	S24°44.6	9.0′	58.9′
13	14°13.5	37.3	81°33.9	6.3′	24°35.6	9.1′	58.9′
14	29°13.7	38.3	95°59.2	6.3′	24°26.5	9.3′	58.9′
15	44°13.9	·· 39.2	110°24.6	6.4′	24°17.2	9.5′	59.0′
16	59°14.1	40.2	124°50.0	6.4′	24°07.7	9.6′	59.0′
17	74°14.2	41.2	139°15.4	6.5′	23°58.1	9.8′	59.0′
18	89°14.4	N05°42.1	153°40.9	6.5′	S23°48.3	10.0′	59.1′
19	104°14.6	43.1	168°06.4	6.6′	23°38.3	10.1′	59.1′
20	119°14.8	44.0	182°32.0	6.6′	23°28.2	10.3′	59.1′
21	134°15.0	·· 45.0	196°57.6	6.7′	23°17.9	10.4′	59.2′
22	149°15.1	45.9	211°23.3	6.7′	23°07.5	10.6′	59.2′
23	164°15.3	46.9	225°49.1	6.8′	22°56.9	10.7′	59.2′
	SD = 16.0′	d = 1.0′	SD = 15.9′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°15.5	N05°47.8	240°14.9	6.9′	S22°46.2	10.9′	59.3′
1	194°15.7	48.8	254°40.7	6.9′	22°35.3	11.0′	59.3′
2	209°15.9	49.7	269°06.6	7.0′	22°24.3	11.2′	59.3′
3	224°16.0	·· 50.7	283°32.6	7.0′	22°13.1	11.3′	59.4′
4	239°16.2	51.6	297°58.6	7.1′	22°01.8	11.5′	59.4′
5	254°16.4	52.6	312°24.7	7.1′	21°50.3	11.7′	59.4′
6	269°16.6	N05°53.5	326°50.8	7.2′	S21°38.6	11.7′	59.5′
7	284°16.8	54.5	341°17.0	7.2′	21°26.9	11.9′	59.5′
8	299°16.9	55.4	355°43.2	7.3′	21°15.0	12.1′	59.5′
9	314°17.1	·· 56.4	10°09.5	7.4′	21°02.9	12.2′	59.6′
10	329°17.3	57.3	24°35.9	7.4′	20°50.7	12.3′	59.6′
11	344°17.5	58.3	39°02.3	7.5′	20°38.4	12.5′	59.6′
12	359°17.7	N05°59.3	53°28.8	7.5′	S20°25.9	12.6′	59.6′
13	14°17.8	06°00.2	67°55.3	7.6′	20°13.3	12.8′	59.7′
14	29°18.0	01.2	82°21.9	7.7′	20°00.5	12.8′	59.7′
15	44°18.2	·· 02.1	96°48.6	7.7′	19°47.7	13.0′	59.7′
16	59°18.4	03.1	111°15.3	7.8′	19°34.7	13.2′	59.8′
17	74°18.6	04.0	125°42.0	7.8′	19°21.5	13.3′	59.8′
18	89°18.7	N06°05.0	140°08.9	7.9′	S19°08.2	13.4′	59.8′
19	104°18.9	05.9	154°35.8	7.9′	18°54.8	13.5′	59.9′
20	119°19.1	06.9	169°02.7	8.0′	18°41.3	13.7′	59.9′
21	134°19.3	·· 07.8	183°29.7	8.1′	18°27.6	13.7′	59.9′
22	149°19.5	08.7	197°56.8	8.1′	18°13.9	13.9′	59.9′
23	164°19.6	09.7	212°23.9	8.2′	18°00.0	14.1′	60.0′
	SD = 16.0′	d = 1.0′	SD = 16.2′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°19.8	N06°10.6	226°51.0	8.2′	S17°45.9	14.1′	60.0′
1	194°20.0	11.6	241°18.3	8.3′	17°31.8	14.3′	60.0′
2	209°20.2	12.5	255°45.6	8.3′	17°17.5	14.3′	60.1′
3	224°20.3	·· 13.5	270°12.9	8.4′	17°03.2	14.5′	60.1′
4	239°20.5	14.4	284°40.3	8.5′	16°48.7	14.6′	60.1′
5	254°20.7	15.4	299°07.8	8.5′	16°34.1	14.7′	60.1′
6	269°20.9	N06°16.3	313°35.3	8.6′	S16°19.4	14.9′	60.2′
7	284°21.1	17.3	328°02.8	8.6′	16°04.5	14.9′	60.2′
8	299°21.2	18.2	342°30.5	8.7′	15°49.6	15.0′	60.2′
9	314°21.4	·· 19.2	356°58.1	8.7′	15°34.6	15.2′	60.2′
10	329°21.6	20.1	11°25.8	8.8′	15°19.4	15.2′	60.3′
11	344°21.8	21.1	25°53.6	8.8′	15°04.2	15.4′	60.3′
12	359°21.9	N06°22.0	40°21.5	8.9′	S14°48.8	15.4′	60.3′
13	14°22.1	23.0	54°49.3	8.9′	14°33.4	15.6′	60.3′
14	29°22.3	23.9	69°17.3	9.0′	14°17.8	15.6′	60.4′
15	44°22.5	·· 24.9	83°45.3	9.0′	14°02.2	15.7′	60.4′
16	59°22.7	25.8	98°13.3	9.1′	13°46.5	15.9′	60.4′
17	74°22.8	26.7	112°41.4	9.1′	13°30.6	15.9′	60.4′
18	89°23.0	N06°27.7	127°09.5	9.2′	S13°14.7	16.0′	60.5′
19	104°23.2	28.6	141°37.7	9.2′	12°58.7	16.1′	60.5′
20	119°23.4	29.6	156°05.9	9.3′	12°42.6	16.2′	60.5′
21	134°23.5	·· 30.5	170°34.1	9.3′	12°26.4	16.2′	60.5′
22	149°23.7	31.5	185°02.5	9.4′	12°10.2	16.4′	60.5′
23	164°23.9	32.4	199°30.8	9.4′	11°53.8	16.4′	60.6′
	SD = 16.0′	d = 0.9′	SD = 16.4′				

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

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

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 24-26 41-20%
03	03:15	03:07	12:03	07:21	19:49	
04	02:58	02:49	12:03	08:18	20:45	
05	02:41	02:32	12:03	09:13	21:39	

April 06, 07, 08 UT (Sat., Sun., Mon.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	194°46.4	193°14.1	S00°57.6	211°55.4	S08°37.4	148°33.7	N16°32.3	208°43.0	S07°47.0
1	209°48.9	208°13.7	56.4	226°56.0	36.7	163°35.7	32.4	223°45.2	46.9
2	224°51.3	223°13.3	55.2	241°56.7	35.9	178°37.6	32.6	238°47.5	46.8
3	239°53.8	238°13.0	·· 54.0	256°57.3	·· 35.2	193°39.5	·· 32.7	253°49.7	·· 46.7
4	254°56.3	253°12.6	52.8	271°58.0	34.5	208°41.4	32.9	268°51.9	46.6
5	269°58.7	268°12.2	51.5	286°58.6	33.7	223°43.3	33.1	283°54.1	46.5
6	285°01.2	283°11.9	S00°50.3	301°59.2	S08°33.0	238°45.2	N16°33.2	298°56.3	S07°46.4
7	300°03.7	298°11.5	49.1	316°59.9	32.3	253°47.2	33.4	313°58.5	46.3
8	315°06.1	313°11.1	47.9	332°00.5	31.5	268°49.1	33.5	329°00.7	46.2
9	330°08.6	328°10.7	·· 46.6	347°01.2	·· 30.8	283°51.0	·· 33.7	344°02.9	·· 46.1
10	345°11.1	343°10.4	45.4	2°01.8	30.0	298°52.9	33.8	359°05.1	46.0
11	0°13.5	358°10.0	44.2	17°02.5	29.3	313°54.8	34.0	14°07.3	45.9
12	15°16.0	13°09.6	S00°43.0	32°03.1	S08°28.6	328°56.7	N16°34.2	29°09.5	S07°45.8
13	30°18.4	28°09.3	41.8	47°03.7	27.8	343°58.7	34.3	44°11.7	45.7
14	45°20.9	43°08.9	40.5	62°04.4	27.1	359°00.6	34.5	59°13.9	45.6
15	60°23.4	58°08.5	·· 39.3	77°05.0	·· 26.4	14°02.5	·· 34.6	74°16.1	·· 45.5
16	75°25.8	73°08.1	38.1	92°05.7	25.6	29°04.4	34.8	89°18.4	45.4
17	90°28.3	88°07.8	36.9	107°06.3	24.9	44°06.3	34.9	104°20.6	45.3
18	105°30.8	103°07.4	S00°35.6	122°07.0	S08°24.2	59°08.2	N16°35.1	119°22.8	S07°45.2
19	120°33.2	118°07.0	34.4	137°07.6	23.4	74°10.1	35.3	134°25.0	45.1
20	135°35.7	133°06.7	33.2	152°08.3	22.7	89°12.1	35.4	149°27.2	45.0
21	150°38.2	148°06.3	·· 32.0	167°08.9	·· 22.0	104°14.0	·· 35.6	164°29.4	·· 44.9
22	165°40.6	163°05.9	30.7	182°09.5	21.2	119°15.9	35.7	179°31.6	44.8
23	180°43.1	178°05.5	29.5	197°10.2	20.5	134°17.8	35.9	194°33.8	44.7
Mer.pass. 10:59		ν -0.4′	d 1.2′	m -3.89	ν 0.6′	d 0.7′	m 1.18	ν 1.9′	d 0.2′ m -2.05	ν 2.2′	d 0.1′ m 1.06

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	195°45.5	193°05.2	S00°28.3	212°10.8	S08°19.8	149°19.7	N16°36.0	209°36.0	S07°44.6
1	210°48.0	208°04.8	27.1	227°11.5	19.0	164°21.6	36.2	224°38.2	44.5
2	225°50.5	223°04.4	25.8	242°12.1	18.3	179°23.5	36.3	239°40.4	44.4
3	240°52.9	238°04.1	·· 24.6	257°12.8	·· 17.6	194°25.5	·· 36.5	254°42.7	·· 44.3
4	255°55.4	253°03.7	23.4	272°13.4	16.8	209°27.4	36.7	269°44.9	44.2
5	270°57.9	268°03.3	22.2	287°14.1	16.1	224°29.3	36.8	284°47.1	44.1
6	286°00.3	283°02.9	S00°20.9	302°14.7	S08°15.3	239°31.2	N16°37.0	299°49.3	S07°44.0
7	301°02.8	298°02.6	19.7	317°15.4	14.6	254°33.1	37.1	314°51.5	43.9
8	316°05.3	313°02.2	18.5	332°16.0	13.9	269°35.0	37.3	329°53.7	43.8
9	331°07.7	328°01.8	·· 17.3	347°16.7	·· 13.1	284°36.9	·· 37.4	344°55.9	·· 43.7
10	346°10.2	343°01.5	16.1	2°17.3	12.4	299°38.9	37.6	359°58.1	43.6
11	1°12.7	358°01.1	14.8	17°17.9	11.7	314°40.8	37.8	15°00.3	43.5
12	16°15.1	13°00.7	S00°13.6	32°18.6	S08°10.9	329°42.7	N16°37.9	30°02.5	S07°43.4
13	31°17.6	28°00.4	12.4	47°19.2	10.2	344°44.6	38.1	45°04.7	43.3
14	46°20.0	43°00.0	11.2	62°19.9	09.4	359°46.5	38.2	60°07.0	43.2
15	61°22.5	57°59.6	·· 09.9	77°20.5	·· 08.7	14°48.4	·· 38.4	75°09.2	·· 43.1
16	76°25.0	72°59.2	08.7	92°21.2	08.0	29°50.3	38.5	90°11.4	43.0
17	91°27.4	87°58.9	07.5	107°21.8	07.2	44°52.2	38.7	105°13.6	42.9
18	106°29.9	102°58.5	S00°06.3	122°22.5	S08°06.5	59°54.2	N16°38.8	120°15.8	S07°42.8
19	121°32.4	117°58.1	05.0	137°23.1	05.8	74°56.1	39.0	135°18.0	42.7
20	136°34.8	132°57.8	03.8	152°23.8	05.0	89°58.0	39.2	150°20.2	42.6
21	151°37.3	147°57.4	·· 02.6	167°24.4	·· 04.3	104°59.9	·· 39.3	165°22.4	·· 42.5
22	166°39.8	162°57.0	01.4	182°25.1	03.5	120°01.8	39.5	180°24.6	42.4
23	181°42.2	177°56.6	00.1	197°25.7	02.8	135°03.7	39.6	195°26.8	42.3
Mer.pass. 10:55		ν -0.4′	d 1.2′	m -3.89	ν 0.6′	d 0.7′	m 1.18	ν 1.9′	d 0.2′ m -2.05	ν 2.2′	d 0.1′ m 1.06

Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	196°44.7	192°56.3	N00°01.1	212°26.4	S08°02.1	150°05.6	N16°39.8	210°29.1	S07°42.2
1	211°47.1	207°55.9	02.3	227°27.0	01.3	165°07.5	39.9	225°31.3	42.1
2	226°49.6	222°55.5	03.5	242°27.7	08°00.6	180°09.5	40.1	240°33.5	42.0
3	241°52.1	237°55.2	·· 04.8	257°28.3	07°59.8	195°11.4	·· 40.3	255°35.7	·· 41.9
4	256°54.5	252°54.8	06.0	272°29.0	59.1	210°13.3	40.4	270°37.9	41.8
5	271°57.0	267°54.4	07.2	287°29.6	58.4	225°15.2	40.6	285°40.1	41.7
6	286°59.5	282°54.1	N00°08.4	302°30.3	S07°57.6	240°17.1	N16°40.7	300°42.3	S07°41.6
7	302°01.9	297°53.7	09.7	317°30.9	56.9	255°19.0	40.9	315°44.5	41.5
8	317°04.4	312°53.3	10.9	332°31.6	56.2	270°20.9	41.0	330°46.7	41.4
9	332°06.9	327°52.9	·· 12.1	347°32.2	·· 55.4	285°22.8	·· 41.2	345°48.9	·· 41.3
10	347°09.3	342°52.6	13.3	2°32.9	54.7	300°24.7	41.3	0°51.2	41.2
11	2°11.8	357°52.2	14.6	17°33.5	53.9	315°26.6	41.5	15°53.4	41.1
12	17°14.3	12°51.8	N00°15.8	32°34.2	S07°53.2	330°28.6	N16°41.7	30°55.6	S07°41.0
13	32°16.7	27°51.5	17.0	47°34.8	52.5	345°30.5	41.8	45°57.8	40.9
14	47°19.2	42°51.1	18.2	62°35.5	51.7	0°32.4	42.0	61°00.0	40.8
15	62°21.6	57°50.7	·· 19.5	77°36.1	·· 51.0	15°34.3	·· 42.1	76°02.2	·· 40.7
16	77°24.1	72°50.4	20.7	92°36.8	50.2	30°36.2	42.3	91°04.4	40.6
17	92°26.6	87°50.0	21.9	107°37.4	49.5	45°38.1	42.4	106°06.6	40.5
18	107°29.0	102°49.6	N00°23.1	122°38.1	S07°48.8	60°40.0	N16°42.6	121°08.8	S07°40.4
19	122°31.5	117°49.3	24.4	137°38.7	48.0	75°41.9	42.8	136°11.1	40.3
20	137°34.0	132°48.9	25.6	152°39.4	47.3	90°43.8	42.9	151°13.3	40.2
21	152°36.4	147°48.5	·· 26.8	167°40.0	·· 46.5	105°45.7	·· 43.1	166°15.5	·· 40.1
22	167°38.9	162°48.1	28.0	182°40.7	45.8	120°47.7	43.2	181°17.7	40.0
23	182°41.4	177°47.8	29.3	197°41.3	45.0	135°49.6	43.4	196°19.9	39.9
Mer.pass. 10:51		ν -0.4′	d 1.2′	m -3.89	ν 0.6′	d 0.7′	m 1.17	ν 1.9′	d 0.2′ m -2.05	ν 2.2′	d 0.1′ m 1.06

Stars

	SHA	Dec
Alpheratz	357°35.8	29°13.3
Ankaa	353°08.2	-42°10.5
Schedar	349°32.4	56°40.1
Diphda	348°48.3	-17°51.3
Achernar	335°21.2	-57°06.9
Hamal	327°52.3	23°34.5
Polaris	314°47.5	89°22.1
Acamar	315°12.6	-40°12.6
Menkar	314°07.1	4°11.0
Mirfak	308°29.6	49°56.9
Aldebaran	290°40.6	16°33.4
Rigel	281°04.6	-8°10.5
Capella	280°23.1	46°01.5
Bellatrix	278°23.7	6°22.2
Elnath	278°02.8	28°37.7
Alnilam	275°38.5	-1°11.3
Betelgeuse	270°52.9	7°24.6
Canopus	263°52.8	-52°42.8
Sirius	258°26.9	-16°45.1
Adhara	255°06.4	-29°00.5
Procyon	244°51.5	5°09.7
Pollux	243°18.0	27°58.1
Avior	234°14.9	-59°35.5
Suhail	222°46.6	-43°32.0
Miaplacidus	221°38.0	-69°49.2
Alphard	217°48.2	-8°45.9
Regulus	207°34.9	11°50.9
Dubhe	193°41.2	61°37.3
Denebola	182°25.3	14°26.1
Gienah	175°43.9	-17°40.7
Acrux	173°00.2	-63°14.1
Gacrux	171°51.8	-57°15.0
Alioth	166°12.9	55°49.7
Spica	158°22.7	-11°17.4
Alkaid	152°52.0	49°11.4
Hadar	148°36.3	-60°29.4
Menkent	147°58.0	-36°29.4
Arcturus	145°48.2	19°03.2
Rigil Kent.	139°40.6	-60°56.1
Kochab	137°18.7	74°03.1
Zuben'ubi	136°56.4	-16°08.6
Alphecca	126°04.0	26°37.8
Antares	112°16.4	-26°29.2
Atria	107°10.9	-69°04.1
Sabik	102°03.4	-15°45.4
Shaula	96°11.1	-37°07.2
Rasalhague	95°59.0	12°32.3
Eltanin	90°42.3	51°28.7
Kaus Aust.	83°33.3	-34°22.3
Vega	80°33.6	38°48.0
Nunki	75°48.5	-26°16.0
Altair	62°00.6	8°55.7
Peacock	53°06.9	-56°39.3
Deneb	49°26.4	45°21.6
Enif	33°39.6	9°58.9
Al Na'ir	27°34.0	-46°50.6
Fomalhaut	15°15.5	-29°29.7
Scheat	13°46.1	28°12.6
Markab	13°30.8	15°19.9

Apr 06 Sat	SHA	Mer.pass
Venus	358°27.7	11:07
Mars	17°09.0	09:52
Jupiter	313°47.3	14:04
Saturn	13°56.6	10:04

Apr 07 Sun	SHA	Mer.pass
Venus	357°19.6	11:08
Mars	16°25.3	09:51
Jupiter	313°34.2	14:01
Saturn	13°50.5	10:00

Apr 08 Mon	SHA	Mer.pass
Venus	356°11.6	11:09
Mars	15°41.7	09:50
Jupiter	313°20.9	13:58
Saturn	13°44.4	09:57

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.1153 sec ΔT = TT-UT1 = +69.0687 sec

2024 April 06 to Apr. 08 UT

h

	Sun		Moon				
Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°24.1	N06°33.4	213°59.2	9.4′	S11°37.4	16.5′	60.6′
1	194°24.2	34.3	228°27.6	9.5′	11°20.9	16.6′	60.6′
2	209°24.4	35.2	242°56.1	9.5′	11°04.3	16.7′	60.6′
3	224°24.6	·· 36.2	257°24.6	9.6′	10°47.6	16.7′	60.6′
4	239°24.8	37.1	271°53.2	9.6′	10°30.9	16.8′	60.7′
5	254°24.9	38.1	286°21.8	9.6′	10°14.1	16.9′	60.7′
6	269°25.1	N06°39.0	300°50.4	9.7′	S09°57.2	16.9′	60.7′
7	284°25.3	40.0	315°19.1	9.7′	09°40.3	17.1′	60.7′
8	299°25.5	40.9	329°47.8	9.7′	09°23.2	17.0′	60.7′
9	314°25.6	·· 41.8	344°16.6	9.8′	09°06.2	17.2′	60.8′
10	329°25.8	42.8	358°45.3	9.8′	08°49.0	17.2′	60.8′
11	344°26.0	43.7	13°14.1	9.8′	08°31.8	17.2′	60.8′
12	359°26.2	N06°44.7	27°43.0	9.9′	S08°14.6	17.3′	60.8′
13	14°26.3	45.6	42°11.8	9.9′	07°57.3	17.4′	60.8′
14	29°26.5	46.6	56°40.7	9.9′	07°39.9	17.4′	60.8′
15	44°26.7	·· 47.5	71°09.7	10.0′	07°22.5	17.5′	60.8′
16	59°26.9	48.4	85°38.6	10.0′	07°05.0	17.5′	60.9′
17	74°27.0	49.4	100°07.6	10.0′	06°47.5	17.5′	60.9′
18	89°27.2	N06°50.3	114°36.6	10.0′	S06°30.0	17.7′	60.9′
19	104°27.4	51.3	129°05.6	10.0′	06°12.3	17.6′	60.9′
20	119°27.6	52.2	143°34.7	10.1′	05°54.7	17.7′	60.9′
21	134°27.7	·· 53.1	158°03.7	10.1′	05°37.0	17.7′	60.9′
22	149°27.9	54.1	172°32.8	10.1′	05°19.3	17.8′	60.9′
23	164°28.1	55.0	187°01.9	10.1′	05°01.5	17.8′	60.9′
	SD = 16.0′	d = 0.9′	SD = 16.5′				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°28.3	N06°56.0	201°31.0	10.1′	S04°43.7	17.8′	60.9′
1	194°28.4	56.9	216°00.2	10.2′	04°25.9	17.9′	61.0′
2	209°28.6	57.8	230°29.3	10.2′	04°08.0	17.9′	61.0′
3	224°28.8	·· 58.8	244°58.5	10.2′	03°50.1	17.9′	61.0′
4	239°29.0	06°59.7	259°27.7	10.2′	03°32.2	18.0′	61.0′
5	254°29.1	07°00.7	273°56.9	10.2′	03°14.2	17.9′	61.0′
6	269°29.3	N07°01.6	288°26.1	10.2′	S02°56.3	18.0′	61.0′
7	284°29.5	02.5	302°55.3	10.2′	02°38.3	18.0′	61.0′
8	299°29.7	03.5	317°24.5	10.2′	02°20.3	18.0′	61.0′
9	314°29.8	·· 04.4	331°53.8	10.2′	02°02.3	18.1′	61.0′
10	329°30.0	05.3	346°23.0	10.2′	01°44.2	18.0′	61.0′
11	344°30.2	06.3	0°52.2	10.2′	01°26.2	18.1′	61.0′
12	359°30.3	N07°07.2	15°21.5	10.2′	S01°08.1	18.1′	61.0′
13	14°30.5	08.2	29°50.7	10.2′	00°50.0	18.1′	61.0′
14	29°30.7	09.1	44°20.0	10.2′	00°31.9	18.1′	61.0′
15	44°30.9	·· 10.0	58°49.2	10.2′	S00°13.8	18.0′	61.0′
16	59°31.0	11.0	73°18.5	10.2′	N00°04.2	18.1′	61.0′
17	74°31.2	11.9	87°47.7	10.2′	00°22.3	18.1′	61.0′
18	89°31.4	N07°12.8	102°16.9	10.2′	N00°40.4	18.1′	61.0′
19	104°31.6	13.8	116°46.2	10.2′	00°58.5	18.1′	61.0′
20	119°31.7	14.7	131°15.4	10.2′	01°16.6	18.1′	61.0′
21	134°31.9	·· 15.6	145°44.6	10.2′	01°34.7	18.0′	61.0′
22	149°32.1	16.6	160°13.8	10.2′	01°52.7	18.1′	61.0′
23	164°32.2	17.5	174°43.0	10.2′	02°10.8	18.0′	61.0′
	SD = 16.0′	d = 0.9′	SD = 16.6′				

Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°32.4	N07°18.4	189°12.2	10.2′	N02°28.8	18.0′	61.0′
1	194°32.6	19.4	203°41.4	10.2′	02°46.8	18.0′	61.0′
2	209°32.8	20.3	218°10.6	10.1′	03°04.8	18.0′	61.0′
3	224°32.9	·· 21.2	232°39.7	10.1′	03°22.8	18.0′	61.0′
4	239°33.1	22.2	247°08.9	10.1′	03°40.8	17.9′	61.0′
5	254°33.3	23.1	261°38.0	10.1′	03°58.7	17.9′	61.0′
6	269°33.4	N07°24.0	276°07.1	10.1′	N04°16.6	17.9′	61.0′
7	284°33.6	25.0	290°36.1	10.1′	04°34.5	17.9′	61.0′
8	299°33.8	25.9	305°05.2	10.0′	04°52.4	17.8′	61.0′
9	314°33.9	·· 26.8	319°34.2	10.0′	05°10.2	17.8′	61.0′
10	329°34.1	27.8	334°03.2	10.0′	05°28.0	17.8′	61.0′
11	344°34.3	28.7	348°32.2	10.0′	05°45.8	17.7′	60.9′
12	359°34.5	N07°29.6	3°01.2	9.9′	N06°03.5	17.7′	60.9′
13	14°34.6	30.6	17°30.1	9.9′	06°21.2	17.6′	60.9′
14	29°34.8	31.5	31°59.1	9.9′	06°38.8	17.6′	60.9′
15	44°35.0	·· 32.4	46°27.9	9.9′	06°56.4	17.5′	60.9′
16	59°35.1	33.4	60°56.8	9.8′	07°13.9	17.5′	60.9′
17	74°35.3	34.3	75°25.6	9.8′	07°31.4	17.5′	60.9′
18	89°35.5	N07°35.2	89°54.4	9.8′	N07°48.9	17.4′	60.9′
19	104°35.6	36.2	104°23.2	9.7′	08°06.3	17.3′	60.9′
20	119°35.8	37.1	118°51.9	9.7′	08°23.6	17.3′	60.8′
21	134°36.0	·· 38.0	133°20.6	9.7′	08°40.9	17.2′	60.8′
22	149°36.2	38.9	147°49.2	9.6′	08°58.1	17.2′	60.8′
23	164°36.3	39.9	162°17.9	9.6′	09°15.3	17.1′	60.8′
	SD = 16.0′	d = 0.9′	SD = 16.6′				

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

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

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 27-0 11-1%
06	02:24	02:15	12:02	10:05	22:31	
07	02:07	01:59	12:02	10:56	23:22	
08	01:50	01:42	12:02	11:47	–:–	

April 09, 10, 11 UT (Tue., Wed., Thu.)

	Aries	Venus		Mars		Jupiter		Saturn	
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	197°43.8	192°47.4	N00°30.5	212°42.0	S07°44.3	150°51.5	N16°43.5	211°22.1	S07°39.8
1	212°46.3	207°47.0	31.7	227°42.6	43.6	165°53.4	43.7	226°24.3	39.7
2	227°48.7	222°46.7	32.9	242°43.3	42.8	180°55.3	43.8	241°26.5	39.6
3	242°51.2	237°46.3	·· 34.2	257°43.9	·· 42.1	195°57.2	·· 44.0	256°28.8	·· 39.5
4	257°53.7	252°45.9	35.4	272°44.6	41.3	210°59.1	44.2	271°31.0	39.4
5	272°56.1	267°45.6	36.6	287°45.2	40.6	226°01.0	44.3	286°33.2	39.3
6	287°58.6	282°45.2	N00°37.9	302°45.9	S07°39.9	241°02.9	N16°44.5	301°35.4	S07°39.2
7	303°01.1	297°44.8	39.1	317°46.5	39.1	256°04.8	44.6	316°37.6	39.1
8	318°03.5	312°44.4	40.3	332°47.2	38.4	271°06.7	44.8	331°39.8	39.0
9	333°06.0	327°44.1	·· 41.5	347°47.8	·· 37.6	286°08.7	·· 44.9	346°42.0	·· 38.9
10	348°08.5	342°43.7	42.8	2°48.5	36.9	301°10.6	45.1	1°44.2	38.8
11	3°10.9	357°43.3	44.0	17°49.1	36.1	316°12.5	45.2	16°46.5	38.8
12	18°13.4	12°43.0	N00°45.2	32°49.8	S07°35.4	331°14.4	N16°45.4	31°48.7	S07°38.7
13	33°15.9	27°42.6	46.4	47°50.4	34.7	346°16.3	45.6	46°50.9	38.6
14	48°18.3	42°42.2	47.7	62°51.1	33.9	1°18.2	45.7	61°53.1	38.5
15	63°20.8	57°41.9	·· 48.9	77°51.8	·· 33.2	16°20.1	·· 45.9	76°55.3	·· 38.4
16	78°23.2	72°41.5	50.1	92°52.4	32.4	31°22.0	46.0	91°57.5	38.3
17	93°25.7	87°41.1	51.3	107°53.1	31.7	46°23.9	46.2	106°59.7	38.2
18	108°28.2	102°40.8	N00°52.6	122°53.7	S07°30.9	61°25.8	N16°46.3	122°01.9	S07°38.1
19	123°30.6	117°40.4	53.8	137°54.4	30.2	76°27.7	46.5	137°04.2	38.0
20	138°33.1	132°40.0	55.0	152°55.0	29.5	91°29.6	46.7	152°06.4	37.9
21	153°35.6	147°39.6	·· 56.2	167°55.7	·· 28.7	106°31.5	·· 46.8	167°08.6	·· 37.8
22	168°38.0	162°39.3	57.5	182°56.3	28.0	121°33.5	47.0	182°10.8	37.7
23	183°40.5	177°38.9	58.7	197°57.0	27.2	136°35.4	47.1	197°13.0	37.6
Mer.pass. 10:47		ν -0.4′	d 1.2′	ν 0.7′	d 0.7′	ν 1.9′	d 0.2′	ν 2.2′	d 0.1′
		m -3.89		m 1.17		m -2.05		m 1.07	

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	198°43.0	192°38.5	N00°59.9	212°57.6	S07°26.5	151°37.3	N16°47.3	212°15.2	S07°37.5
1	213°45.4	207°38.2	01°01.1	227°58.3	25.7	166°39.2	47.4	227°17.4	37.4
2	228°47.9	222°37.8	02.4	242°58.9	25.0	181°41.1	47.6	242°19.7	37.3
3	243°50.4	237°37.4	·· 03.6	257°59.6	·· 24.2	196°43.0	·· 47.7	257°21.9	·· 37.2
4	258°52.8	252°37.1	04.8	273°00.3	23.5	211°44.9	47.9	272°24.1	37.1
5	273°55.3	267°36.7	06.0	288°00.9	22.8	226°46.8	48.1	287°26.3	37.0
6	288°57.7	282°36.3	N01°07.3	303°01.6	S07°22.0	241°48.7	N16°48.2	302°28.5	S07°36.9
7	304°00.2	297°36.0	08.5	318°02.2	21.3	256°50.6	48.4	317°30.7	36.8
8	319°02.7	312°35.6	09.7	333°02.9	20.5	271°52.5	48.5	332°32.9	36.7
9	334°05.1	327°35.2	·· 10.9	348°03.5	·· 19.8	286°54.4	·· 48.7	347°35.1	·· 36.6
10	349°07.6	342°34.8	12.2	3°04.2	19.0	301°56.3	48.8	2°37.4	36.5
11	4°10.1	357°34.5	13.4	18°04.8	18.3	316°58.2	49.0	17°39.6	36.4
12	19°12.5	12°34.1	N01°14.6	33°05.5	S07°17.5	332°00.1	N16°49.1	32°41.8	S07°36.3
13	34°15.0	27°33.7	15.8	48°06.2	16.8	347°02.1	49.3	47°44.0	36.2
14	49°17.5	42°33.4	17.1	63°06.8	16.1	2°04.0	49.5	62°46.2	36.1
15	64°19.9	57°33.0	·· 18.3	78°07.5	·· 15.3	17°05.9	·· 49.6	77°48.4	·· 36.0
16	79°22.4	72°32.6	19.5	93°08.1	14.6	32°07.8	49.8	92°50.7	35.9
17	94°24.8	87°32.3	20.7	108°08.8	13.8	47°09.7	49.9	107°52.9	35.8
18	109°27.3	102°31.9	N01°22.0	123°09.4	S07°13.1	62°11.6	N16°50.1	122°55.1	S07°35.7
19	124°29.8	117°31.5	23.2	138°10.1	12.3	77°13.5	50.2	137°57.3	35.6
20	139°32.2	132°31.1	24.4	153°10.7	11.6	92°15.4	50.4	152°59.5	35.5
21	154°34.7	147°30.8	·· 25.6	168°11.4	·· 10.8	107°17.3	·· 50.6	168°01.7	·· 35.4
22	169°37.2	162°30.4	26.9	183°12.1	10.1	122°19.2	50.7	183°03.9	35.3
23	184°39.6	177°30.0	28.1	198°12.7	09.3	137°21.1	50.9	198°06.2	35.2
Mer.pass. 10:43		ν -0.4′	d 1.2′	ν 0.7′	d 0.7′	ν 1.9′	d 0.2′	ν 2.2′	d 0.1′
		m -3.89		m 1.17		m -2.04		m 1.07	

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	199°42.1	192°29.7	N01°29.3	213°13.4	S07°08.6	152°23.0	N16°51.0	213°08.4	S07°35.1
1	214°44.6	207°29.3	30.5	228°14.0	07.8	167°24.9	51.2	228°10.6	35.0
2	229°47.0	222°28.9	31.8	243°14.7	07.1	182°26.8	51.3	243°12.8	35.0
3	244°49.5	237°28.6	·· 33.0	258°15.3	·· 06.4	197°28.7	·· 51.5	258°15.0	·· 34.9
4	259°52.0	252°28.2	34.2	273°16.0	05.6	212°30.6	51.6	273°17.2	34.8
5	274°54.4	267°27.8	35.4	288°16.7	04.9	227°32.5	51.8	288°19.5	34.7
6	289°56.9	282°27.5	N01°36.7	303°17.3	S07°04.1	242°34.4	N16°52.0	303°21.7	S07°34.6
7	304°59.3	297°27.1	37.9	318°18.0	03.4	257°36.3	52.1	318°23.9	34.5
8	320°01.8	312°26.7	39.1	333°18.6	02.6	272°38.2	52.3	333°26.1	34.4
9	335°04.3	327°26.3	·· 40.3	348°19.3	·· 01.9	287°40.1	·· 52.4	348°28.3	·· 34.3
10	350°06.7	342°26.0	41.6	3°20.0	01.1	302°42.0	52.6	3°30.5	34.2
11	5°09.2	357°25.6	42.8	18°20.6	07°00.4	317°44.0	52.7	18°32.7	34.1
12	20°11.7	12°25.2	N01°44.0	33°21.3	S06°59.6	332°45.9	N16°52.9	33°35.0	S07°34.0
13	35°14.1	27°24.9	45.2	48°21.9	58.9	347°47.8	53.0	48°37.2	33.9
14	50°16.6	42°24.5	46.5	63°22.6	58.1	2°49.7	53.2	63°39.4	33.8
15	65°19.1	57°24.1	·· 47.7	78°23.2	·· 57.4	17°51.6	·· 53.4	78°41.6	·· 33.7
16	80°21.5	72°23.8	48.9	93°23.9	56.6	32°53.5	53.5	93°43.8	33.6
17	95°24.0	87°23.4	50.1	108°24.6	55.9	47°55.4	53.7	108°46.0	33.5
18	110°26.5	102°23.0	N01°51.4	123°25.2	S06°55.1	62°57.3	N16°53.8	123°48.3	S07°33.4
19	125°28.9	117°22.6	52.6	138°25.9	54.4	77°59.2	54.0	138°50.5	33.3
20	140°31.4	132°22.3	53.8	153°26.5	53.6	93°01.1	54.1	153°52.7	33.2
21	155°33.8	147°21.9	·· 55.0	168°27.2	·· 52.9	108°03.0	·· 54.3	168°54.9	·· 33.1
22	170°36.3	162°21.5	56.3	183°27.9	52.1	123°04.9	54.4	183°57.1	33.0
23	185°38.8	177°21.2	57.5	198°28.5	51.4	138°06.8	54.6	198°59.3	32.9
Mer.pass. 10:39		ν -0.4′	d 1.2′	ν 0.7′	d 0.7′	ν 1.9′	d 0.2′	ν 2.2′	d 0.1′
		m -3.89		m 1.17		m -2.04		m 1.07	

Stars

	SHA	Dec
Alpheratz	357°35.8	29°13.3
Ankaa	353°08.2	-42°10.5
Schedar	349°32.4	56°40.1
Diphda	348°48.3	-17°51.3
Achernar	335°21.2	-57°06.9
Hamal	327°52.3	23°34.5
Polaris	314°48.1	89°22.1
Acamar	315°12.6	-40°12.6
Menkar	314°07.1	4°11.0
Mirfak	308°29.6	49°56.9
Aldebaran	290°40.6	16°33.4
Rigel	281°04.7	-8°10.5
Capella	280°23.1	46°01.4
Bellatrix	278°23.7	6°22.2
Elnath	278°02.9	28°37.7
Alnilam	275°38.5	-1°11.3
Betelgeuse	270°52.9	7°24.6
Canopus	263°52.8	-52°42.7
Sirius	258°26.9	-16°45.1
Adhara	255°06.4	-29°00.5
Procyon	244°51.5	5°09.7
Pollux	243°18.1	27°58.1
Avior	234°14.9	-59°35.5
Suhail	222°46.6	-43°32.0
Miaplacidus	221°38.1	-69°49.2
Alphard	217°48.2	-8°45.9
Regulus	207°34.9	11°50.9
Dubhe	193°41.2	61°37.3
Denebola	182°25.3	14°26.1
Gienah	175°43.9	-17°40.7
Acrux	173°00.2	-63°14.1
Gacrux	171°51.8	-57°15.0
Alioth	166°12.9	55°49.7
Spica	158°22.7	-11°17.4
Alkaid	152°52.0	49°11.4
Hadar	148°36.3	-60°29.4
Menkent	147°58.0	-36°29.4
Arcturus	145°48.2	19°03.2
Rigil Kent.	139°40.6	-60°56.1
Kochab	137°18.6	74°03.2
Zuben'ubi	136°56.4	-16°08.6
Alphecca	126°04.0	26°37.8
Antares	112°16.4	-26°29.2
Atria	107°10.9	-69°04.1
Sabik	102°03.3	-15°45.4
Shaula	96°11.1	-37°07.2
Rasalhague	95°59.0	12°32.3
Eltanin	90°42.3	51°28.8
Kaus Aust.	83°33.3	-34°22.3
Vega	80°33.6	38°48.0
Nunki	75°48.5	-26°16.0
Altair	62°00.6	8°55.7
Peacock	53°06.9	-56°39.3
Deneb	49°26.4	45°21.6
Enif	33°39.6	9°59.0
Al Na'ir	27°34.0	-46°50.6
Fomalhaut	15°15.5	-29°29.7
Scheat	13°46.1	28°12.6
Markab	13°30.8	15°19.9

Apr 09 Tue	SHA	Mer.pass
Venus	355°03.6	11:09
Mars	14°58.1	09:49
Jupiter	313°07.7	13:55
Saturn	13°38.3	09:53

Apr 10 Wed	SHA	Mer.pass
Venus	353°55.6	11:10
Mars	14°14.7	09:48
Jupiter	312°54.3	13:52
Saturn	13°32.3	09:50

Apr 11 Thu	SHA	Mer.pass
Venus	352°47.6	11:10
Mars	13°31.3	09:47
Jupiter	312°40.9	13:49
Saturn	13°26.3	09:46

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.1161 sec ΔT = TT-UT1 = +69.0679 sec

2024 April 09 to Apr. 11 UT

h

Tue	Sun GHA	Sun Dec	Moon GHA	ν	Moon Dec	d	HP
0	179°36.5	N07°40.8	176°46.4	9.5′	N09°32.4	17.1′	60.8′
1	194°36.7	41.7	191°15.0	9.5′	09°49.5	16.9′	60.8′
2	209°36.8	42.7	205°43.5	9.5′	10°06.4	17.0′	60.7′
3	224°37.0	·· 43.6	220°11.9	9.4′	10°23.4	16.8′	60.7′
4	239°37.2	44.5	234°40.4	9.4′	10°40.2	16.8′	60.7′
5	254°37.3	45.4	249°08.7	9.3′	10°57.0	16.7′	60.7′
6	269°37.5	N07°46.4	263°37.1	9.3′	N11°13.7	16.6′	60.7′
7	284°37.7	47.3	278°05.4	9.2′	11°30.3	16.5′	60.7′
8	299°37.8	48.2	292°33.6	9.2′	11°46.8	16.5′	60.6′
9	314°38.0	·· 49.2	307°01.8	9.2′	12°03.3	16.4′	60.6′
10	329°38.2	50.1	321°30.0	9.1′	12°19.7	16.3′	60.6′
11	344°38.3	51.0	335°58.1	9.1′	12°36.0	16.2′	60.6′
12	359°38.5	N07°51.9	350°26.2	9.0′	N12°52.2	16.1′	60.6′
13	14°38.7	52.9	4°54.2	9.0′	13°08.3	16.0′	60.5′
14	29°38.8	53.8	19°22.1	8.9′	13°24.3	16.0′	60.5′
15	44°39.0	·· 54.7	33°50.1	8.9′	13°40.3	15.8′	60.5′
16	59°39.2	55.6	48°17.9	8.8′	13°56.1	15.8′	60.5′
17	74°39.3	56.6	62°45.7	8.8′	14°11.9	15.7′	60.4′
18	89°39.5	N07°57.5	77°13.5	8.7′	N14°27.6	15.5′	60.4′
19	104°39.7	58.4	91°41.2	8.7′	14°43.1	15.5′	60.4′
20	119°39.8	07°59.3	106°08.9	8.6′	14°58.6	15.4′	60.4′
21	134°40.0	08°00.3	120°36.5	8.6′	15°14.0	15.2′	60.3′
22	149°40.2	01.2	135°04.0	8.5′	15°29.2	15.2′	60.3′
23	164°40.3	02.1	149°31.5	8.4′	15°44.4	15.0′	60.3′
	SD = 16.0′	d = 0.9′		SD = 16.6′			

Wed	GHA	Dec	GHA	ν	Dec	d	HP
0	179°40.5	N08°03.0	163°59.0	8.4′	N15°59.4	15.0′	60.3′
1	194°40.7	04.0	178°26.4	8.3′	16°14.4	14.8′	60.2′
2	209°40.8	04.9	192°53.7	8.3′	16°29.2	14.7′	60.2′
3	224°41.0	·· 05.8	207°21.0	8.2′	16°43.9	14.6′	60.2′
4	239°41.2	06.7	221°48.2	8.2′	16°58.5	14.5′	60.1′
5	254°41.3	07.6	236°15.4	8.1′	17°13.0	14.4′	60.1′
6	269°41.5	N08°08.6	250°42.5	8.1′	N17°27.4	14.2′	60.1′
7	284°41.7	09.5	265°09.6	8.0′	17°41.6	14.2′	60.1′
8	299°41.8	10.4	279°36.6	7.9′	17°55.8	14.0′	60.0′
9	314°42.0	·· 11.3	294°03.5	7.9′	18°09.8	13.8′	60.0′
10	329°42.2	12.3	308°30.4	7.8′	18°23.6	13.8′	60.0′
11	344°42.3	13.2	322°57.2	7.8′	18°37.4	13.6′	59.9′
12	359°42.5	N08°14.1	337°24.0	7.7′	N18°51.0	13.5′	59.9′
13	14°42.7	15.0	351°50.7	7.7′	19°04.5	13.4′	59.9′
14	29°42.8	15.9	6°17.4	7.6′	19°17.9	13.3′	59.8′
15	44°43.0	·· 16.9	20°44.0	7.5′	19°31.2	13.1′	59.8′
16	59°43.1	17.8	35°10.5	7.5′	19°44.3	12.9′	59.8′
17	74°43.3	18.7	49°37.0	7.4′	19°57.2	12.9′	59.7′
18	89°43.5	N08°19.6	64°03.4	7.4′	N20°10.1	12.7′	59.7′
19	104°43.6	20.5	78°29.8	7.3′	20°22.8	12.5′	59.7′
20	119°43.8	21.4	92°56.1	7.3′	20°35.3	12.5′	59.6′
21	134°44.0	·· 22.4	107°22.4	7.2′	20°47.8	12.3′	59.6′
22	149°44.1	23.3	121°48.6	7.2′	21°00.1	12.1′	59.6′
23	164°44.3	24.2	136°14.8	7.1′	21°12.2	12.0′	59.5′
	SD = 16.0′	d = 0.9′		SD = 16.4′			

Thu	GHA	Dec	GHA	ν	Dec	d	HP
0	179°44.5	N08°25.1	150°40.9	7.0′	N21°24.2	11.8′	59.5′
1	194°44.6	26.0	165°06.9	7.0′	21°36.0	11.7′	59.5′
2	209°44.8	27.0	179°32.9	6.9′	21°47.7	11.6′	59.4′
3	224°44.9	·· 27.9	193°58.8	6.9′	21°59.3	11.4′	59.4′
4	239°45.1	28.8	208°24.7	6.8′	22°10.7	11.2′	59.4′
5	254°45.3	29.7	222°50.6	6.8′	22°21.9	11.1′	59.3′
6	269°45.4	N08°30.6	237°16.3	6.7′	N22°33.0	11.0′	59.3′
7	284°45.6	31.5	251°42.1	6.7′	22°44.0	10.8′	59.3′
8	299°45.8	32.5	266°07.8	6.6′	22°54.8	10.6′	59.2′
9	314°45.9	·· 33.4	280°33.4	6.6′	23°05.4	10.5′	59.2′
10	329°46.1	34.3	294°59.0	6.5′	23°15.9	10.3′	59.1′
11	344°46.2	35.2	309°24.5	6.5′	23°26.2	10.2′	59.1′
12	359°46.4	N08°36.1	323°50.0	6.4′	N23°36.4	10.0′	59.1′
13	14°46.6	37.0	338°15.5	6.4′	23°46.4	9.8′	59.0′
14	29°46.7	37.9	352°40.9	6.4′	23°56.2	9.7′	59.0′
15	44°46.9	·· 38.9	7°06.2	6.3′	24°05.9	9.5′	59.0′
16	59°47.0	39.8	21°31.6	6.3′	24°15.4	9.4′	58.9′
17	74°47.2	40.7	35°56.8	6.2′	24°24.8	9.2′	58.9′
18	89°47.4	N08°41.6	50°22.1	6.2′	N24°34.0	9.0′	58.8′
19	104°47.5	42.5	64°47.3	6.2′	24°43.0	8.9′	58.8′
20	119°47.7	43.4	79°12.4	6.1′	24°51.9	8.7′	58.8′
21	134°47.9	·· 44.3	93°37.5	6.1′	25°00.6	8.5′	58.7′
22	149°48.0	45.2	108°02.6	6.1′	25°09.1	8.4′	58.7′
23	164°48.2	46.2	122°27.7	6.0′	25°17.5	8.2′	58.7′
	SD = 16.0′	d = 0.9′		SD = 16.2′			

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

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

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%
09	01:34	01:26	12:01	12:40	00:13	
10	01:18	01:10	12:01	13:34	01:06	
11	01:02	00:54	12:01	14:30	02:02	

April 12, 13, 14 UT (Fri., Sat., Sun.)

	Aries	Venus		Mars		Jupiter		Saturn	
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	200°41.2	192°20.8	N01°58.7	213°29.2	S06°50.7	153°08.7	N16°54.8	214°01.6	S07°32.8
1	215°43.7	207°20.4	01°59.9	228°29.8	49.9	168°10.6	54.9	229°03.8	32.7
2	230°46.2	222°20.0	02°01.2	243°30.5	49.2	183°12.5	55.1	244°06.0	32.6
3	245°48.6	237°19.7	·· 02.4	258°31.2	·· 48.4	198°14.4	·· 55.2	259°08.2	·· 32.5
4	260°51.1	252°19.3	03.6	273°31.8	47.7	213°16.3	55.4	274°10.4	32.4
5	275°53.6	267°18.9	04.8	288°32.5	46.9	228°18.2	55.5	289°12.7	32.3
6	290°56.0	282°18.6	N02°06.1	303°33.1	S06°46.2	243°20.1	N16°55.7	304°14.9	S07°32.3
7	305°58.5	297°18.2	07.3	318°33.8	45.4	258°22.0	55.8	319°17.1	32.2
8	321°00.9	312°17.8	08.5	333°34.5	44.7	273°23.9	56.0	334°19.3	32.1
9	336°03.4	327°17.5	·· 09.7	348°35.1	·· 43.9	288°25.8	·· 56.2	349°21.5	·· 32.0
10	351°05.9	342°17.1	11.0	3°35.8	43.2	303°27.7	56.3	4°23.7	31.9
11	6°08.3	357°16.7	12.2	18°36.4	42.4	318°29.6	56.5	19°26.0	31.8
12	21°10.8	12°16.3	N02°13.4	33°37.1	S06°41.7	333°31.5	N16°56.6	34°28.2	S07°31.7
13	36°13.3	27°16.0	14.6	48°37.8	40.9	348°33.4	56.8	49°30.4	31.6
14	51°15.7	42°15.6	15.8	63°38.4	40.2	3°35.3	56.9	64°32.6	31.5
15	66°18.2	57°15.2	·· 17.1	78°39.1	·· 39.4	18°37.2	·· 57.1	79°34.8	·· 31.4
16	81°20.7	72°14.9	18.3	93°39.8	38.7	33°39.1	57.2	94°37.1	31.3
17	96°23.1	87°14.5	19.5	108°40.4	37.9	48°41.0	57.4	109°39.3	31.2
18	111°25.6	102°14.1	N02°20.7	123°41.1	S06°37.2	63°42.9	N16°57.6	124°41.5	S07°31.1
19	126°28.1	117°13.7	22.0	138°41.7	36.4	78°44.8	57.7	139°43.7	31.0
20	141°30.5	132°13.4	23.2	153°42.4	35.7	93°46.7	57.9	154°45.9	30.9
21	156°33.0	147°13.0	·· 24.4	168°43.1	·· 34.9	108°48.6	·· 58.0	169°48.1	·· 30.8
22	171°35.4	162°12.6	25.6	183°43.7	34.2	123°50.5	58.2	184°50.4	30.7
23	186°37.9	177°12.3	26.9	198°44.4	33.4	138°52.4	58.3	199°52.6	30.6
Mer.pass. 10:36		ν -0.4′	d 1.2′	ν 0.7′	d 0.7′	ν 1.9′	d 0.2′	ν 2.2′	d 0.1′
		m -3.89		m 1.16		m -2.04		m 1.07	

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	201°40.4	192°11.9	N02°28.1	213°45.0	S06°32.7	153°54.3	N16°58.5	214°54.8	S07°30.5
1	216°42.8	207°11.5	29.3	228°45.7	31.9	168°56.2	58.6	229°57.0	30.4
2	231°45.3	222°11.1	30.5	243°46.4	31.2	183°58.1	58.8	244°59.2	30.3
3	246°47.8	237°10.8	·· 31.7	258°47.0	·· 30.4	199°00.0	·· 59.0	260°01.5	·· 30.2
4	261°50.2	252°10.4	33.0	273°47.7	29.6	214°01.9	59.1	275°03.7	30.2
5	276°52.7	267°10.0	34.2	288°48.4	28.9	229°03.8	59.3	290°05.9	30.1
6	291°55.2	282°09.7	N02°35.4	303°49.0	S06°28.1	244°05.7	N16°59.4	305°08.1	S07°30.0
7	306°57.6	297°09.3	36.6	318°49.7	27.4	259°07.6	59.6	320°10.3	29.9
8	322°00.1	312°08.9	37.9	333°50.4	26.6	274°09.5	59.7	335°12.6	29.8
9	337°02.6	327°08.5	·· 39.1	348°51.0	·· 25.9	289°11.4	16°59.9	350°14.8	·· 29.7
10	352°05.0	342°08.2	40.3	3°51.7	25.1	304°13.3	17°00.0	5°17.0	29.6
11	7°07.5	357°07.8	41.5	18°52.3	24.4	319°15.2	00.2	20°19.2	29.5
12	22°09.9	12°07.4	N02°42.7	33°53.0	S06°23.6	334°17.1	N17°00.3	35°21.4	S07°29.4
13	37°12.4	27°07.1	44.0	48°53.7	22.9	349°19.0	00.5	50°23.7	29.3
14	52°14.9	42°06.7	45.2	63°54.3	22.1	4°20.9	00.7	65°25.9	29.2
15	67°17.3	57°06.3	·· 46.4	78°55.0	·· 21.4	19°22.8	·· 00.8	80°28.1	·· 29.1
16	82°19.8	72°05.9	47.6	93°55.7	20.6	34°24.7	01.0	95°30.3	29.0
17	97°22.3	87°05.6	48.9	108°56.3	19.9	49°26.6	01.1	110°32.5	28.9
18	112°24.7	102°05.2	N02°50.1	123°57.0	S06°19.1	64°28.5	N17°01.3	125°34.8	S07°28.8
19	127°27.2	117°04.8	51.3	138°57.7	18.4	79°30.4	01.4	140°37.0	28.7
20	142°29.7	132°04.4	52.5	153°58.3	17.6	94°32.3	01.6	155°39.2	28.6
21	157°32.1	147°04.1	·· 53.7	168°59.0	·· 16.9	109°34.2	·· 01.7	170°41.4	·· 28.5
22	172°34.6	162°03.7	55.0	183°59.7	16.1	124°36.1	01.9	185°43.6	28.4
23	187°37.1	177°03.3	56.2	199°00.3	15.4	139°38.0	02.1	200°45.9	28.4
Mer.pass. 10:32		ν -0.4′	d 1.2′	ν 0.7′	d 0.8′	ν 1.9′	d 0.2′	ν 2.2′	d 0.1′
		m -3.89		m 1.16		m -2.04		m 1.07	

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	202°39.5	192°03.0	N02°57.4	214°01.0	S06°14.6	154°39.9	N17°02.2	215°48.1	S07°28.3
1	217°42.0	207°02.6	58.6	229°01.6	13.9	169°41.8	02.4	230°50.3	28.2
2	232°44.4	222°02.2	02°59.8	244°02.3	13.1	184°43.7	02.5	245°52.5	28.1
3	247°46.9	237°01.8	03°01.1	259°03.0	·· 12.3	199°45.6	·· 02.7	260°54.7	·· 28.0
4	262°49.4	252°01.5	02.3	274°03.6	11.6	214°47.5	02.8	275°57.0	27.9
5	277°51.8	267°01.1	03.5	289°04.3	10.8	229°49.4	03.0	290°59.2	27.8
6	292°54.3	282°00.7	N03°04.7	304°05.0	S06°10.1	244°51.3	N17°03.1	306°01.4	S07°27.7
7	307°56.8	297°00.3	05.9	319°05.6	09.3	259°53.2	03.3	321°03.6	27.6
8	322°59.2	312°00.0	07.2	334°06.3	08.6	274°55.1	03.5	336°05.9	27.5
9	338°01.7	326°59.6	·· 08.4	349°07.0	·· 07.8	289°57.0	·· 03.6	351°08.1	·· 27.4
10	353°04.2	341°59.2	09.6	4°07.6	07.1	304°58.9	03.8	6°10.3	27.3
11	8°06.6	356°58.8	10.8	19°08.3	06.3	320°00.8	03.9	21°12.5	27.2
12	23°09.1	11°58.5	N03°12.0	34°09.0	S06°05.6	335°02.7	N17°04.1	36°14.7	S07°27.1
13	38°11.6	26°58.1	13.3	49°09.6	04.8	350°04.6	04.2	51°17.0	27.0
14	53°14.0	41°57.7	14.5	64°10.3	04.1	5°06.5	04.4	66°19.2	26.9
15	68°16.5	56°57.4	·· 15.7	79°11.0	·· 03.3	20°08.4	·· 04.5	81°21.4	·· 26.8
16	83°18.9	71°57.0	16.9	94°11.6	02.6	35°10.3	04.7	96°23.6	26.7
17	98°21.4	86°56.6	18.1	109°12.3	01.8	50°12.1	04.8	111°25.9	26.7
18	113°23.9	101°56.2	N03°19.4	124°13.0	S06°01.0	65°14.0	N17°05.0	126°28.1	S07°26.6
19	128°26.3	116°55.9	20.6	139°13.6	06°00.3	80°15.9	05.2	141°30.3	26.5
20	143°28.8	131°55.5	21.8	154°14.3	05°59.5	95°17.8	05.3	156°32.5	26.4
21	158°31.3	146°55.1	·· 23.0	169°15.0	·· 58.8	110°19.7	·· 05.5	171°34.7	·· 26.3
22	173°33.7	161°54.7	24.2	184°15.6	58.0	125°21.6	05.6	186°37.0	26.2
23	188°36.2	176°54.4	25.5	199°16.3	57.3	140°23.5	05.8	201°39.2	26.1
Mer.pass. 10:28		ν -0.4′	d 1.2′	ν 0.7′	d 0.8′	ν 1.9′	d 0.2′	ν 2.2′	d 0.1′
		m -3.89		m 1.16		m -2.04		m 1.07	

Stars

	SHA	Dec
Alpheratz	357°35.8	29°13.3
Ankaa	353°08.2	-42°10.5
Schedar	349°32.4	56°40.1
Diphda	348°48.2	-17°51.3
Achernar	335°21.2	-57°06.9
Hamal	327°52.3	23°34.5
Polaris	314°48.3	89°22.1
Acamar	315°12.6	-40°12.6
Menkar	314°07.1	4°11.0
Mirfak	308°29.6	49°56.9
Aldebaran	290°40.6	16°33.4
Rigel	281°04.7	-8°10.5
Capella	280°23.1	46°01.4
Bellatrix	278°23.7	6°22.2
Elnath	278°02.9	28°37.7
Alnilam	275°38.5	-1°11.3
Betelgeuse	270°52.9	7°24.6
Canopus	263°52.9	-52°42.7
Sirius	258°26.9	-16°45.1
Adhara	255°06.4	-29°00.5
Procyon	244°51.5	5°09.7
Pollux	243°18.1	27°58.1
Avior	234°14.9	-59°35.5
Suhail	222°46.6	-43°32.1
Miaplacidus	221°38.1	-69°49.2
Alphard	217°48.2	-8°45.9
Regulus	207°34.9	11°50.9
Dubhe	193°41.2	61°37.4
Denebola	182°25.3	14°26.1
Gienah	175°43.9	-17°40.7
Acrux	173°00.2	-63°14.1
Gacrux	171°51.8	-57°15.1
Alioth	166°12.9	55°49.7
Spica	158°22.7	-11°17.4
Alkaid	152°52.0	49°11.4
Hadar	148°36.3	-60°29.4
Menkent	147°58.0	-36°29.4
Arcturus	145°48.2	19°03.2
Rigil Kent.	139°40.6	-60°56.1
Kochab	137°18.6	74°03.2
Zuben'ubi	136°56.4	-16°08.6
Alphecca	126°04.0	26°37.8
Antares	112°16.4	-26°29.2
Atria	107°10.8	-69°04.1
Sabik	102°03.3	-15°45.4
Shaula	96°11.0	-37°07.2
Rasalhague	95°59.0	12°32.3
Eltanin	90°42.3	51°28.8
Kaus Aust.	83°33.2	-34°22.3
Vega	80°33.5	38°48.0
Nunki	75°48.5	-26°16.0
Altair	62°00.6	8°55.7
Peacock	53°06.8	-56°39.3
Deneb	49°26.4	45°21.6
Enif	33°39.6	9°59.0
Al Na'ir	27°34.0	-46°50.5
Fomalhaut	15°15.5	-29°29.7
Scheat	13°46.1	28°12.6
Markab	13°30.8	15°19.9

Apr 12 Fri	SHA	Mer.pass
Venus	351°39.6	11:11
Mars	12°47.9	09:46
Jupiter	312°27.5	13:46
Saturn	13°20.3	09:42

Apr 13 Sat	SHA	Mer.pass
Venus	350°31.5	11:11
Mars	12°04.7	09:45
Jupiter	312°13.9	13:43
Saturn	13°14.4	09:39

Apr 14 Sun	SHA	Mer.pass
Venus	349°23.4	11:12
Mars	11°21.5	09:44
Jupiter	312°00.4	13:40
Saturn	13°08.6	09:35

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°48.3	N08°47.1	136°52.7	6.0′	N25°25.7	8.0′	58.6′
1	194°48.5	48.0	151°17.7	6.0′	25°33.7	7.8′	58.6′
2	209°48.7	48.9	165°42.7	5.9′	25°41.5	7.7′	58.5′
3	224°48.8	·· 49.8	180°07.6	5.9′	25°49.2	7.5′	58.5′
4	239°49.0	50.7	194°32.5	5.9′	25°56.7	7.4′	58.5′
5	254°49.1	51.6	208°57.4	5.9′	26°04.1	7.1′	58.4′
6	269°49.3	N08°52.5	223°22.2	5.8′	N26°11.2	7.0′	58.4′
7	284°49.4	53.4	237°47.1	5.8′	26°18.2	6.8′	58.3′
8	299°49.6	54.4	252°11.9	5.8′	26°25.0	6.7′	58.3′
9	314°49.8	·· 55.3	266°36.7	5.8′	26°31.7	6.4′	58.3′
10	329°49.9	56.2	281°01.4	5.8′	26°38.1	6.3′	58.2′
11	344°50.1	57.1	295°26.2	5.7′	26°44.4	6.1′	58.2′
12	359°50.2	N08°58.0	309°50.9	5.7′	N26°50.5	6.0′	58.1′
13	14°50.4	58.9	324°15.7	5.7′	26°56.5	5.8′	58.1′
14	29°50.6	08°59.8	338°40.4	5.7′	27°02.3	5.5′	58.1′
15	44°50.7	09°00.7	353°05.1	5.7′	27°07.8	5.5′	58.0′
16	59°50.9	01.6	7°29.8	5.7′	27°13.3	5.2′	58.0′
17	74°51.0	02.5	21°54.5	5.7′	27°18.5	5.1′	57.9′
18	89°51.2	N09°03.4	36°19.2	5.7′	N27°23.6	4.8′	57.9′
19	104°51.3	04.3	50°43.9	5.7′	27°28.4	4.7′	57.9′
20	119°51.5	05.3	65°08.5	5.7′	27°33.1	4.6′	57.8′
21	134°51.7	·· 06.2	79°33.2	5.7′	27°37.7	4.3′	57.8′
22	149°51.8	07.1	93°57.9	5.7′	27°42.0	4.2′	57.7′
23	164°52.0	08.0	108°22.6	5.7′	27°46.2	4.0′	57.7′
	SD = 15.9′	d = 0.9′	SD = 16.0′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°52.1	N09°08.9	122°47.3	5.7′	N27°50.2	3.8′	57.7′
1	194°52.3	09.8	137°12.0	5.7′	27°54.0	3.7′	57.6′
2	209°52.4	10.7	151°36.8	5.7′	27°57.7	3.4′	57.6′
3	224°52.6	·· 11.6	166°01.5	5.8′	28°01.1	3.3′	57.5′
4	239°52.8	12.5	180°26.3	5.8′	28°04.4	3.2′	57.5′
5	254°52.9	13.4	194°51.0	5.8′	28°07.6	2.9′	57.5′
6	269°53.1	N09°14.3	209°15.8	5.8′	N28°10.5	2.8′	57.4′
7	284°53.2	15.2	223°40.6	5.8′	28°13.3	2.6′	57.4′
8	299°53.4	16.1	238°05.4	5.9′	28°15.9	2.4′	57.4′
9	314°53.5	·· 17.0	252°30.3	5.9′	28°18.3	2.2′	57.3′
10	329°53.7	17.9	266°55.2	5.9′	28°20.5	2.1′	57.3′
11	344°53.9	18.8	281°20.1	5.9′	28°22.6	1.9′	57.2′
12	359°54.0	N09°19.7	295°45.0	6.0′	N28°24.5	1.7′	57.2′
13	14°54.2	20.6	310°10.0	6.0′	28°26.2	1.5′	57.2′
14	29°54.3	21.5	324°35.0	6.0′	28°27.7	1.4′	57.1′
15	44°54.5	·· 22.4	339°00.0	6.1′	28°29.1	1.2′	57.1′
16	59°54.6	23.3	353°25.1	6.1′	28°30.3	1.0′	57.0′
17	74°54.8	24.2	7°50.2	6.2′	28°31.3	0.9′	57.0′
18	89°54.9	N09°25.1	22°15.3	6.2′	N28°32.2	0.6′	57.0′
19	104°55.1	26.0	36°40.5	6.2′	28°32.8	0.6′	56.9′
20	119°55.2	26.9	51°05.8	6.3′	28°33.4	0.3′	56.9′
21	134°55.4	·· 27.8	65°31.1	6.3′	28°33.7	0.2′	56.9′
22	149°55.6	28.7	79°56.4	6.4′	28°33.9	0.0′	56.8′
23	164°55.7	29.6	94°21.8	6.4′	28°33.9	0.2′	56.8′
	SD = 15.9′	d = 0.9′	SD = 15.7′				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°55.9	N09°30.5	108°47.2	6.5′	N28°33.7	0.3′	56.7′
1	194°56.0	31.4	123°12.7	6.5′	28°33.4	0.5′	56.7′
2	209°56.2	32.3	137°38.2	6.6′	28°32.9	0.7′	56.7′
3	224°56.3	·· 33.2	152°03.8	6.7′	28°32.2	0.8′	56.6′
4	239°56.5	34.1	166°29.5	6.7′	28°31.4	1.0′	56.6′
5	254°56.6	35.0	180°55.2	6.8′	28°30.4	1.1′	56.6′
6	269°56.8	N09°35.9	195°21.0	6.8′	N28°29.3	1.4′	56.5′
7	284°56.9	36.8	209°46.8	6.9′	28°27.9	1.4′	56.5′
8	299°57.1	37.7	224°12.7	7.0′	28°26.5	1.7′	56.5′
9	314°57.2	·· 38.6	238°38.7	7.0′	28°24.8	1.8′	56.4′
10	329°57.4	39.5	253°04.7	7.1′	28°23.0	1.9′	56.4′
11	344°57.5	40.4	267°30.8	7.2′	28°21.1	2.1′	56.4′
12	359°57.7	N09°41.3	281°57.0	7.2′	N28°19.0	2.3′	56.3′
13	14°57.8	42.2	296°23.2	7.3′	28°16.7	2.4′	56.3′
14	29°58.0	43.1	310°49.5	7.4′	28°14.3	2.6′	56.3′
15	44°58.1	·· 44.0	325°15.9	7.5′	28°11.7	2.7′	56.2′
16	59°58.3	44.9	339°42.4	7.5′	28°09.0	2.9′	56.2′
17	74°58.5	45.8	354°08.9	7.6′	28°06.1	3.1′	56.1′
18	89°58.6	N09°46.7	8°35.5	7.7′	N28°03.0	3.2′	56.1′
19	104°58.8	47.6	23°02.2	7.8′	27°59.8	3.3′	56.1′
20	119°58.9	48.4	37°29.0	7.9′	27°56.5	3.5′	56.1′
21	134°59.1	·· 49.3	51°55.8	7.9′	27°53.0	3.6′	56.0′
22	149°59.2	50.2	66°22.8	8.0′	27°49.4	3.8′	56.0′
23	164°59.4	51.1	80°49.8	8.1′	27°45.6	4.0′	56.0′
	SD = 15.9′	d = 0.9′	SD = 15.5′				

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

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

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 14-32%
12	00:47	00:39	12:01	15:29	02:59	
13	00:31	00:24	12:00	16:27	03:58	
14	00:17	00:09	12:00	17:24	04:56	

April 15, 16, 17 UT (Mon., Tue., Wed.)

	Aries	Venus		Mars		Jupiter		Saturn	
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	203°38.7	191°54.0	N03°26.7	214°17.0	S05°56.5	155°25.4	N17°05.9	216°41.4	S07°26.0
1	218°41.1	206°53.6	27.9	229°17.6	55.8	170°27.3	06.1	231°43.6	25.9
2	233°43.6	221°53.2	29.1	244°18.3	55.0	185°29.2	06.2	246°45.9	25.8
3	248°46.1	236°52.9	·· 30.3	259°19.0	·· 54.3	200°31.1	·· 06.4	261°48.1	·· 25.7
4	263°48.5	251°52.5	31.5	274°19.7	53.5	215°33.0	06.5	276°50.3	25.6
5	278°51.0	266°52.1	32.8	289°20.3	52.7	230°34.9	06.7	291°52.5	25.5
6	293°53.4	281°51.7	N03°34.0	304°21.0	S05°52.0	245°36.8	N17°06.9	306°54.7	S07°25.4
7	308°55.9	296°51.4	35.2	319°21.7	51.2	260°38.7	07.0	321°57.0	25.3
8	323°58.4	311°51.0	36.4	334°22.3	50.5	275°40.6	07.2	336°59.2	25.3
9	339°00.8	326°50.6	·· 37.6	349°23.0	·· 49.7	290°42.5	·· 07.3	352°01.4	·· 25.2
10	354°03.3	341°50.2	38.8	4°23.7	49.0	305°44.4	07.5	7°03.6	25.1
11	9°05.8	356°49.9	40.1	19°24.3	48.2	320°46.3	07.6	22°05.9	25.0
12	24°08.2	11°49.5	N03°41.3	34°25.0	S05°47.5	335°48.2	N17°07.8	37°08.1	S07°24.9
13	39°10.7	26°49.1	42.5	49°25.7	46.7	350°50.1	07.9	52°10.3	24.8
14	54°13.2	41°48.7	43.7	64°26.3	45.9	5°52.0	08.1	67°12.5	24.7
15	69°15.6	56°48.3	·· 44.9	79°27.0	·· 45.2	20°53.9	·· 08.2	82°14.8	·· 24.6
16	84°18.1	71°48.0	46.1	94°27.7	44.4	35°55.7	08.4	97°17.0	24.5
17	99°20.5	86°47.6	47.4	109°28.3	43.7	50°57.6	08.6	112°19.2	24.4
18	114°23.0	101°47.2	N03°48.6	124°29.0	S05°42.9	65°59.5	N17°08.7	127°21.4	S07°24.3
19	129°25.5	116°46.8	49.8	139°29.7	42.2	81°01.4	08.9	142°23.7	24.2
20	144°27.9	131°46.5	51.0	154°30.4	41.4	96°03.3	09.0	157°25.9	24.1
21	159°30.4	146°46.1	·· 52.2	169°31.0	·· 40.6	111°05.2	·· 09.2	172°28.1	·· 24.0
22	174°32.9	161°45.7	53.4	184°31.7	39.9	126°07.1	09.3	187°30.3	24.0
23	189°35.3	176°45.3	54.7	199°32.4	39.1	141°09.0	09.5	202°32.6	23.9
Mer.pass. 10:24		ν -0.4′	d 1.2′	m -3.90	ν 0.7′	d 0.8′	m 1.16	ν 1.9′	d 0.2′ m -2.03	ν 2.2′	d 0.1′ m 1.07

Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	204°37.8	191°45.0	N03°55.9	214°33.0	S05°38.4	156°10.9	N17°09.6	217°34.8	S07°23.8
1	219°40.3	206°44.6	57.1	229°33.7	37.6	171°12.8	09.8	232°37.0	23.7
2	234°42.7	221°44.2	58.3	244°34.4	36.9	186°14.7	09.9	247°39.2	23.6
3	249°45.2	236°43.8	03°59.5	259°35.0	·· 36.1	201°16.6	·· 10.1	262°41.5	·· 23.5
4	264°47.7	251°43.4	04°00.7	274°35.7	35.4	216°18.5	10.3	277°43.7	23.4
5	279°50.1	266°43.1	02.0	289°36.4	34.6	231°20.4	10.4	292°45.9	23.3
6	294°52.6	281°42.7	N04°03.2	304°37.1	S05°33.8	246°22.3	N17°10.6	307°48.1	S07°23.2
7	309°55.0	296°42.3	04.4	319°37.7	33.1	261°24.2	10.7	322°50.4	23.1
8	324°57.5	311°41.9	05.6	334°38.4	32.3	276°26.0	10.9	337°52.6	23.0
9	340°00.0	326°41.6	·· 06.8	349°39.1	·· 31.6	291°27.9	·· 11.0	352°54.8	·· 22.9
10	355°02.4	341°41.2	08.0	4°39.7	30.8	306°29.8	11.2	7°57.0	22.8
11	10°04.9	356°40.8	09.2	19°40.4	30.1	321°31.7	11.3	22°59.3	22.7
12	25°07.4	11°40.4	N04°10.5	34°41.1	S05°29.3	336°33.6	N17°11.5	38°01.5	S07°22.7
13	40°09.8	26°40.0	11.7	49°41.8	28.5	351°35.5	11.6	53°03.7	22.6
14	55°12.3	41°39.7	12.9	64°42.4	27.8	6°37.4	11.8	68°05.9	22.5
15	70°14.8	56°39.3	·· 14.1	79°43.1	·· 27.0	21°39.3	·· 12.0	83°08.2	·· 22.4
16	85°17.2	71°38.9	15.3	94°43.8	26.3	36°41.2	12.1	98°10.4	22.3
17	100°19.7	86°38.5	16.5	109°44.4	25.5	51°43.1	12.3	113°12.6	22.2
18	115°22.2	101°38.2	N04°17.7	124°45.1	S05°24.7	66°45.0	N17°12.4	128°14.8	S07°22.1
19	130°24.6	116°37.8	18.9	139°45.8	24.0	81°46.9	12.6	143°17.1	22.0
20	145°27.1	131°37.4	20.2	154°46.5	23.2	96°48.8	12.7	158°19.3	21.9
21	160°29.5	146°37.0	·· 21.4	169°47.1	·· 22.5	111°50.7	·· 12.9	173°21.5	·· 21.8
22	175°32.0	161°36.6	22.6	184°47.8	21.7	126°52.5	13.0	188°23.8	21.7
23	190°34.5	176°36.3	23.8	199°48.5	21.0	141°54.4	13.2	203°26.0	21.6
Mer.pass. 10:20		ν -0.4′	d 1.2′	m -3.90	ν 0.7′	d 0.8′	m 1.15	ν 1.9′	d 0.2′ m -2.03	ν 2.2′	d 0.1′ m 1.07

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	205°36.9	191°35.9	N04°25.0	214°49.2	S05°20.2	156°56.3	N17°13.3	218°28.2	S07°21.6
1	220°39.4	206°35.5	26.2	229°49.8	19.4	171°58.2	13.5	233°30.4	21.5
2	235°41.9	221°35.1	27.4	244°50.5	18.7	187°00.1	13.7	248°32.7	21.4
3	250°44.3	236°34.7	·· 28.6	259°51.2	·· 17.9	202°02.0	·· 13.8	263°34.9	·· 21.3
4	265°46.8	251°34.4	29.9	274°51.8	17.2	217°03.9	14.0	278°37.1	21.2
5	280°49.3	266°34.0	31.1	289°52.5	16.4	232°05.8	14.1	293°39.3	21.1
6	295°51.7	281°33.6	N04°32.3	304°53.2	S05°15.7	247°07.7	N17°14.3	308°41.6	S07°21.0
7	310°54.2	296°33.2	33.5	319°53.9	14.9	262°09.6	14.4	323°43.8	20.9
8	325°56.6	311°32.8	34.7	334°54.5	14.1	277°11.5	14.6	338°46.0	20.8
9	340°59.1	326°32.4	·· 35.9	349°55.2	·· 13.4	292°13.4	·· 14.7	353°48.2	·· 20.7
10	356°01.6	341°32.1	37.1	4°55.9	12.6	307°15.2	14.9	8°50.5	20.6
11	11°04.0	356°31.7	38.3	19°56.6	11.9	322°17.1	15.0	23°52.7	20.5
12	26°06.5	11°31.3	N04°39.5	34°57.2	S05°11.1	337°19.0	N17°15.2	38°54.9	S07°20.5
13	41°09.0	26°30.9	40.8	49°57.9	10.3	352°20.9	15.3	53°57.2	20.4
14	56°11.4	41°30.5	42.0	64°58.6	09.6	7°22.8	15.5	68°59.4	20.3
15	71°13.9	56°30.2	·· 43.2	79°59.3	·· 08.8	22°24.7	·· 15.7	84°01.6	·· 20.2
16	86°16.4	71°29.8	44.4	94°59.9	08.1	37°26.6	15.8	99°03.8	20.1
17	101°18.8	86°29.4	45.6	110°00.6	07.3	52°28.5	16.0	114°06.1	20.0
18	116°21.3	101°29.0	N04°46.8	125°01.3	S05°06.5	67°30.4	N17°16.1	129°08.3	S07°19.9
19	131°23.8	116°28.6	48.0	140°02.0	05.8	82°32.3	16.3	144°10.5	19.8
20	146°26.2	131°28.2	49.2	155°02.6	05.0	97°34.2	16.4	159°12.8	19.7
21	161°28.7	146°27.9	·· 50.4	170°03.3	·· 04.3	112°36.0	·· 16.6	174°15.0	·· 19.6
22	176°31.1	161°27.5	51.6	185°04.0	03.5	127°37.9	16.7	189°17.2	19.5
23	191°33.6	176°27.1	52.8	200°04.6	02.7	142°39.8	16.9	204°19.4	19.4
Mer.pass. 10:16		ν -0.4′	d 1.2′	m -3.90	ν 0.7′	d 0.8′	m 1.15	ν 1.9′	d 0.2′ m -2.03	ν 2.2′	d 0.1′ m 1.07

Stars

	SHA	Dec
Alpheratz	357°35.8	29°13.3
Ankaa	353°08.1	-42°10.5
Schedar	349°32.3	56°40.1
Diphda	348°48.2	-17°51.3
Achernar	335°21.2	-57°06.9
Hamal	327°52.3	23°34.5
Polaris	314°48.6	89°22.1
Acamar	315°12.6	-40°12.6
Menkar	314°07.1	4°11.0
Mirfak	308°29.6	49°56.9
Aldebaran	290°40.6	16°33.4
Rigel	281°04.7	-8°10.5
Capella	280°23.1	46°01.4
Bellatrix	278°23.7	6°22.2
Elnath	278°02.9	28°37.7
Alnilam	275°38.5	-1°11.3
Betelgeuse	270°52.9	7°24.6
Canopus	263°52.9	-52°42.7
Sirius	258°26.9	-16°45.1
Adhara	255°06.4	-29°00.5
Procyon	244°51.5	5°09.7
Pollux	243°18.1	27°58.1
Avior	234°14.9	-59°35.5
Suhail	222°46.7	-43°32.1
Miaplacidus	221°38.1	-69°49.2
Alphard	217°48.2	-8°45.9
Regulus	207°34.9	11°50.9
Dubhe	193°41.2	61°37.4
Denebola	182°25.3	14°26.1
Gienah	175°43.9	-17°40.7
Acrux	173°00.2	-63°14.1
Gacrux	171°51.8	-57°15.1
Alioth	166°12.9	55°49.7
Spica	158°22.6	-11°17.4
Alkaid	152°52.0	49°11.4
Hadar	148°36.3	-60°29.4
Menkent	147°58.0	-36°29.4
Arcturus	145°48.1	19°03.2
Rigil Kent.	139°40.6	-60°56.1
Kochab	137°18.6	74°03.2
Zuben'ubi	136°56.4	-16°08.7
Alphecca	126°03.9	26°37.8
Antares	112°16.3	-26°29.2
Atria	107°10.8	-69°04.1
Sabik	102°03.3	-15°45.4
Shaula	96°11.0	-37°07.2
Rasalhague	95°58.9	12°32.3
Eltanin	90°42.2	51°28.8
Kaus Aust.	83°33.2	-34°22.3
Vega	80°33.5	38°48.0
Nunki	75°48.4	-26°16.0
Altair	62°00.6	8°55.7
Peacock	53°06.8	-56°39.2
Deneb	49°26.3	45°21.6
Enif	33°39.6	9°59.0
Al Na'ir	27°33.9	-46°50.5
Fomalhaut	15°15.5	-29°29.7
Scheat	13°46.1	28°12.6
Markab	13°30.8	15°19.9

Apr 15 Mon	SHA	Mer.pass
Venus	348°15.3	11:13
Mars	10°38.3	09:42
Jupiter	311°46.8	13:37
Saturn	13°02.8	09:32

Apr 16 Tue	SHA	Mer.pass
Venus	347°07.2	11:13
Mars	9°55.2	09:41
Jupiter	311°33.1	13:34
Saturn	12°57.0	09:28

Apr 17 Wed	SHA	Mer.pass
Venus	345°58.9	11:14
Mars	9°12.2	09:40
Jupiter	311°19.4	13:31
Saturn	12°51.3	09:25

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h — Sun — Moon

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	179°59.5	N09°52.0	95°16.9	8.2′	N27°41.6	4.0′	55.9′
1	194°59.7	52.9	109°44.1	8.3′	27°37.6	4.2′	55.9′
2	209°59.8	53.8	124°11.3	8.4′	27°33.4	4.4′	55.9′
3	225°00.0	·· 54.7	138°38.7	8.4′	27°29.0	4.5′	55.8′
4	240°00.1	55.6	153°06.1	8.5′	27°24.5	4.7′	55.8′
5	255°00.3	56.5	167°33.7	8.6′	27°19.8	4.7′	55.8′
6	270°00.4	N09°57.4	182°01.3	8.7′	N27°15.1	5.0′	55.7′
7	285°00.6	58.3	196°29.0	8.8′	27°10.1	5.0′	55.7′
8	300°00.7	09°59.1	210°56.8	8.9′	27°05.1	5.2′	55.7′
9	315°00.8	10°00.0	225°24.7	9.0′	26°59.9	5.3′	55.6′
10	330°01.0	00.9	239°52.7	9.1′	26°54.6	5.5′	55.6′
11	345°01.1	01.8	254°20.7	9.2′	26°49.1	5.6′	55.6′
12	0°01.3	N10°02.7	268°48.9	9.3′	N26°43.5	5.7′	55.6′
13	15°01.4	03.6	283°17.2	9.4′	26°37.8	5.9′	55.5′
14	30°01.6	04.5	297°45.5	9.4′	26°31.9	6.0′	55.5′
15	45°01.7	·· 05.4	312°14.0	9.5′	26°25.9	6.1′	55.5′
16	60°01.9	06.3	326°42.5	9.6′	26°19.8	6.2′	55.4′
17	75°02.0	07.1	341°11.1	9.7′	26°13.6	6.4′	55.4′
18	90°02.2	N10°08.0	355°39.9	9.8′	N26°07.2	6.4′	55.4′
19	105°02.3	08.9	10°08.7	9.9′	26°00.8	6.7′	55.4′
20	120°02.5	09.8	24°37.6	10.0′	25°54.1	6.7′	55.3′
21	135°02.6	·· 10.7	39°06.6	10.1′	25°47.4	6.8′	55.3′
22	150°02.8	11.6	53°35.8	10.2′	25°40.6	7.0′	55.3′
23	165°02.9	12.5	68°05.0	10.3′	25°33.6	7.1′	55.2′
	SD = 15.9′	d = 0.9′	SD = 15.3′				

Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	180°03.1	N10°13.3	82°34.3	10.4′	N25°26.5	7.2′	55.2′
1	195°03.2	14.2	97°03.7	10.5′	25°19.3	7.3′	55.2′
2	210°03.4	15.1	111°33.2	10.6′	25°12.0	7.5′	55.2′
3	225°03.5	·· 16.0	126°02.8	10.7′	25°04.5	7.5′	55.1′
4	240°03.6	16.9	140°32.5	10.8′	24°57.0	7.7′	55.1′
5	255°03.8	17.8	155°02.3	10.9′	24°49.3	7.7′	55.1′
6	270°03.9	N10°18.6	169°32.1	11.0′	N24°41.6	7.9′	55.1′
7	285°04.1	19.5	184°02.1	11.1′	24°33.7	8.0′	55.0′
8	300°04.2	20.4	198°32.2	11.2′	24°25.7	8.1′	55.0′
9	315°04.4	·· 21.3	213°02.4	11.3′	24°17.6	8.2′	55.0′
10	330°04.5	22.2	227°32.7	11.4′	24°09.4	8.3′	55.0′
11	345°04.7	23.1	242°03.0	11.5′	24°01.1	8.5′	55.0′
12	0°04.8	N10°23.9	256°33.5	11.6′	N23°52.6	8.5′	54.9′
13	15°05.0	24.8	271°04.0	11.7′	23°44.1	8.6′	54.9′
14	30°05.1	25.7	285°34.7	11.7′	23°35.5	8.7′	54.9′
15	45°05.2	·· 26.6	300°05.4	11.8′	23°26.8	8.8′	54.9′
16	60°05.4	27.5	314°36.3	11.9′	23°18.0	9.0′	54.8′
17	75°05.5	28.3	329°07.2	12.0′	23°09.0	9.0′	54.8′
18	90°05.7	N10°29.2	343°38.3	12.1′	N23°00.0	9.1′	54.8′
19	105°05.8	30.1	358°09.4	12.2′	22°50.9	9.2′	54.8′
20	120°06.0	31.0	12°40.6	12.3′	22°41.7	9.3′	54.8′
21	135°06.1	·· 31.9	27°11.9	12.4′	22°32.4	9.4′	54.7′
22	150°06.2	32.7	41°43.3	12.5′	22°23.0	9.5′	54.7′
23	165°06.4	33.6	56°14.8	12.6′	22°13.5	9.6′	54.7′
	SD = 15.9′	d = 0.9′	SD = 15.1′				

Wed	GHA	Dec	GHA	ν	Dec	d	HP
0	180°06.5	N10°34.5	70°46.4	12.7′	N22°03.9	9.6′	54.7′
1	195°06.7	35.4	85°18.1	12.8′	21°54.3	9.8′	54.7′
2	210°06.8	36.2	99°49.8	12.9′	21°44.5	9.8′	54.6′
3	225°07.0	·· 37.1	114°21.7	12.9′	21°34.7	10.0′	54.6′
4	240°07.1	38.0	128°53.6	13.0′	21°24.7	10.0′	54.6′
5	255°07.2	38.9	143°25.7	13.1′	21°14.7	10.1′	54.6′
6	270°07.4	N10°39.8	157°57.8	13.2′	N21°04.6	10.2′	54.6′
7	285°07.5	40.6	172°30.0	13.3′	20°54.4	10.2′	54.5′
8	300°07.7	41.5	187°02.3	13.4′	20°44.2	10.4′	54.5′
9	315°07.8	·· 42.4	201°34.7	13.5′	20°33.8	10.4′	54.5′
10	330°08.0	43.3	216°07.1	13.5′	20°23.4	10.5′	54.5′
11	345°08.1	44.1	230°39.7	13.6′	20°12.9	10.6′	54.5′
12	0°08.2	N10°45.0	245°12.3	13.7′	N20°02.3	10.7′	54.5′
13	15°08.4	45.9	259°45.0	13.8′	19°51.6	10.7′	54.4′
14	30°08.5	46.8	274°17.8	13.9′	19°40.9	10.9′	54.4′
15	45°08.7	·· 47.6	288°50.7	14.0′	19°30.0	10.8′	54.4′
16	60°08.8	48.5	303°23.6	14.0′	19°19.2	11.0′	54.4′
17	75°08.9	49.4	317°56.7	14.1′	19°08.2	11.0′	54.4′
18	90°09.1	N10°50.2	332°29.8	14.2′	N18°57.2	11.2′	54.4′
19	105°09.2	51.1	347°03.0	14.3′	18°46.0	11.1′	54.4′
20	120°09.4	52.0	1°36.3	14.4′	18°34.9	11.3′	54.3′
21	135°09.5	·· 52.9	16°09.6	14.4′	18°23.6	11.3′	54.3′
22	150°09.6	53.7	30°43.1	14.5′	18°12.3	11.4′	54.3′
23	165°09.8	54.6	45°16.6	14.6′	18°00.9	11.4′	54.3′
	SD = 15.9′	d = 0.9′	SD = 14.9′				

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

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

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	7-9 42-62%
15	00:02	00:05	12:00	18:18	05:52	
16	00:12	00:19	12:00	19:08	06:43	
17	00:26	00:33	11:59	19:53	07:31	

April 18, 19, 20 UT (Thu., Fri., Sat.)

	Aries	Venus		Mars		Jupiter		Saturn	
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	206°36.1	191°26.7	N04°54.1	215°05.3	S05°02.0	157°41.7	N17°17.0	219°21.7	S07°19.4
1	221°38.5	206°26.3	55.3	230°06.0	01.2	172°43.6	17.2	234°23.9	19.3
2	236°41.0	221°26.0	56.5	245°06.7	05°00.5	187°45.5	17.3	249°26.1	19.2
3	251°43.5	236°25.6	·· 57.7	260°07.3	04°59.7	202°47.4	·· 17.5	264°28.4	·· 19.1
4	266°45.9	251°25.2	04°58.9	275°08.0	58.9	217°49.3	17.7	279°30.6	19.0
5	281°48.4	266°24.8	05°00.1	290°08.7	58.2	232°51.2	17.8	294°32.8	18.9
6	296°50.9	281°24.4	N05°01.3	305°09.4	S04°57.4	247°53.1	N17°18.0	309°35.0	S07°18.8
7	311°53.3	296°24.0	02.5	320°10.1	56.7	262°54.9	18.1	324°37.3	18.7
8	326°55.8	311°23.6	03.7	335°10.7	55.9	277°56.8	18.3	339°39.5	18.6
9	341°58.3	326°23.3	·· 04.9	350°11.4	·· 55.1	292°58.7	·· 18.4	354°41.7	·· 18.5
10	357°00.7	341°22.9	06.1	5°12.1	54.4	308°00.6	18.6	9°44.0	18.5
11	12°03.2	356°22.5	07.3	20°12.8	53.6	323°02.5	18.7	24°46.2	18.4
12	27°05.6	11°22.1	N05°08.5	35°13.4	S04°52.9	338°04.4	N17°18.9	39°48.4	S07°18.3
13	42°08.1	26°21.7	09.7	50°14.1	52.1	353°06.3	19.0	54°50.7	18.2
14	57°10.6	41°21.3	10.9	65°14.8	51.3	8°08.2	19.2	69°52.9	18.1
15	72°13.0	56°21.0	·· 12.2	80°15.5	·· 50.6	23°10.1	·· 19.3	84°55.1	·· 18.0
16	87°15.5	71°20.6	13.4	95°16.1	49.8	38°11.9	19.5	99°57.3	17.9
17	102°18.0	86°20.2	14.6	110°16.8	49.1	53°13.8	19.6	114°59.6	17.8
18	117°20.4	101°19.8	N05°15.8	125°17.5	S04°48.3	68°15.7	N17°19.8	130°01.8	S07°17.7
19	132°22.9	116°19.4	17.0	140°18.2	47.5	83°17.6	20.0	145°04.0	17.6
20	147°25.4	131°19.0	18.2	155°18.8	46.8	98°19.5	20.1	160°06.3	17.5
21	162°27.8	146°18.6	·· 19.4	170°19.5	·· 46.0	113°21.4	·· 20.3	175°08.5	·· 17.5
22	177°30.3	161°18.3	20.6	185°20.2	45.3	128°23.3	20.4	190°10.7	17.4
23	192°32.7	176°17.9	21.8	200°20.9	44.5	143°25.2	20.6	205°13.0	17.3
Mer.pass. 10:12		ν -0.4′	d 1.2′	m -3.90	ν 0.7′	d 0.8′	m 1.15	ν 1.9′	d 0.2′ m -2.03	ν 2.2′	d 0.1′ m 1.07

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	207°35.2	191°17.5	N05°23.0	215°21.5	S04°43.7	158°27.1	N17°20.7	220°15.2	S07°17.2
1	222°37.7	206°17.1	24.2	230°22.2	43.0	173°28.9	20.9	235°17.4	17.1
2	237°40.1	221°16.7	25.4	245°22.9	42.2	188°30.8	21.0	250°19.7	17.0
3	252°42.6	236°16.3	·· 26.6	260°23.6	·· 41.5	203°32.7	·· 21.2	265°21.9	·· 16.9
4	267°45.1	251°15.9	27.8	275°24.3	40.7	218°34.6	21.3	280°24.1	16.8
5	282°47.5	266°15.5	29.0	290°24.9	39.9	233°36.5	21.5	295°26.3	16.7
6	297°50.0	281°15.2	N05°30.2	305°25.6	S04°39.2	248°38.4	N17°21.6	310°28.6	S07°16.6
7	312°52.5	296°14.8	31.4	320°26.3	38.4	263°40.3	21.8	325°30.8	16.6
8	327°54.9	311°14.4	32.6	335°27.0	37.6	278°42.2	21.9	340°33.0	16.5
9	342°57.4	326°14.0	·· 33.8	350°27.6	·· 36.9	293°44.0	·· 22.1	355°35.3	·· 16.4
10	357°59.9	341°13.6	35.0	5°28.3	36.1	308°45.9	22.3	10°37.5	16.3
11	13°02.3	356°13.2	36.2	20°29.0	35.4	323°47.8	22.4	25°39.7	16.2
12	28°04.8	11°12.8	N05°37.4	35°29.7	S04°34.6	338°49.7	N17°22.6	40°42.0	S07°16.1
13	43°07.2	26°12.4	38.6	50°30.4	33.8	353°51.6	22.7	55°44.2	16.0
14	58°09.7	41°12.1	39.8	65°31.0	33.1	8°53.5	22.9	70°46.4	15.9
15	73°12.2	56°11.7	·· 41.0	80°31.7	·· 32.3	23°55.4	·· 23.0	85°48.7	·· 15.8
16	88°14.6	71°11.3	42.2	95°32.4	31.6	38°57.3	23.2	100°50.9	15.8
17	103°17.1	86°10.9	43.4	110°33.1	30.8	53°59.1	23.3	115°53.1	15.7
18	118°19.6	101°10.5	N05°44.6	125°33.8	S04°30.0	69°01.0	N17°23.5	130°55.4	S07°15.6
19	133°22.0	116°10.1	45.8	140°34.4	29.3	84°02.9	23.6	145°57.6	15.5
20	148°24.5	131°09.7	47.0	155°35.1	28.5	99°04.8	23.8	160°59.8	15.4
21	163°27.0	146°09.3	·· 48.2	170°35.8	·· 27.7	114°06.7	·· 23.9	176°02.1	·· 15.3
22	178°29.4	161°08.9	49.4	185°36.5	27.0	129°08.6	24.1	191°04.3	15.2
23	193°31.9	176°08.5	50.6	200°37.1	26.2	144°10.5	24.2	206°06.5	15.1
Mer.pass. 10:08		ν -0.4′	d 1.2′	m -3.90	ν 0.7′	d 0.8′	m 1.15	ν 1.9′	d 0.2′ m -2.03	ν 2.2′	d 0.1′ m 1.07

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	208°34.3	191°08.2	N05°51.8	215°37.8	S04°25.5	159°12.4	N17°24.4	221°08.8	S07°15.0
1	223°36.8	206°07.8	53.0	230°38.5	24.7	174°14.2	24.5	236°11.0	15.0
2	238°39.3	221°07.4	54.2	245°39.2	23.9	189°16.1	24.7	251°13.2	14.9
3	253°41.7	236°07.0	·· 55.4	260°39.9	·· 23.2	204°18.0	·· 24.9	266°15.5	·· 14.8
4	268°44.2	251°06.6	56.6	275°40.5	22.4	219°19.9	25.0	281°17.7	14.7
5	283°46.7	266°06.2	57.8	290°41.2	21.6	234°21.8	25.2	296°19.9	14.6
6	298°49.1	281°05.8	N05°59.0	305°41.9	S04°20.9	249°23.7	N17°25.3	311°22.2	S07°14.5
7	313°51.6	296°05.4	06°00.2	320°42.6	20.1	264°25.6	25.5	326°24.4	14.4
8	328°54.1	311°05.0	01.4	335°43.3	19.4	279°27.4	25.6	341°26.6	14.3
9	343°56.5	326°04.6	·· 02.6	350°43.9	·· 18.6	294°29.3	·· 25.8	356°28.9	·· 14.2
10	358°59.0	341°04.2	03.8	5°44.6	17.8	309°31.2	25.9	11°31.1	14.2
11	14°01.5	356°03.8	05.0	20°45.3	17.1	324°33.1	26.1	26°33.3	14.1
12	29°03.9	11°03.5	N06°06.2	35°46.0	S04°16.3	339°35.0	N17°26.2	41°35.6	S07°14.0
13	44°06.4	26°03.1	07.4	50°46.7	15.5	354°36.9	26.4	56°37.8	13.9
14	59°08.8	41°02.7	08.6	65°47.3	14.8	9°38.8	26.5	71°40.0	13.8
15	74°11.3	56°02.3	·· 09.8	80°48.0	·· 14.0	24°40.6	·· 26.7	86°42.3	·· 13.7
16	89°13.8	71°01.9	11.0	95°48.7	13.3	39°42.5	26.8	101°44.5	13.6
17	104°16.2	86°01.5	12.2	110°49.4	12.5	54°44.4	27.0	116°46.7	13.5
18	119°18.7	101°01.1	N06°13.4	125°50.1	S04°11.7	69°46.3	N17°27.1	131°49.0	S07°13.4
19	134°21.2	116°00.7	14.6	140°50.8	11.0	84°48.2	27.3	146°51.2	13.4
20	149°23.6	131°00.3	15.8	155°51.4	10.2	99°50.1	27.5	161°53.4	13.3
21	164°26.1	145°59.9	·· 17.0	170°52.1	·· 09.4	114°52.0	·· 27.6	176°55.7	·· 13.2
22	179°28.6	160°59.5	18.2	185°52.8	08.7	129°53.8	27.8	191°57.9	13.1
23	194°31.0	175°59.1	19.3	200°53.5	07.9	144°55.7	27.9	207°00.1	13.0
Mer.pass. 10:04		ν -0.4′	d 1.2′	m -3.90	ν 0.7′	d 0.8′	m 1.14	ν 1.9′	d 0.2′ m -2.02	ν 2.2′	d 0.1′ m 1.07

Stars

	SHA	Dec
Alpheratz	357°35.8	29°13.3
Ankaa	353°08.1	-42°10.5
Schedar	349°32.3	56°40.0
Diphda	348°48.2	-17°51.3
Achernar	335°21.2	-57°06.8
Hamal	327°52.3	23°34.5
Polaris	314°49.1	89°22.1
Acamar	315°12.6	-40°12.6
Menkar	314°07.1	4°11.0
Mirfak	308°29.6	49°56.8
Aldebaran	290°40.6	16°33.4
Rigel	281°04.7	-8°10.5
Capella	280°23.1	46°01.4
Bellatrix	278°23.8	6°22.2
Elnath	278°02.9	28°37.7
Alnilam	275°38.6	-1°11.3
Betelgeuse	270°52.9	7°24.6
Canopus	263°52.9	-52°42.7
Sirius	258°26.9	-16°45.1
Adhara	255°06.5	-29°00.5
Procyon	244°51.5	5°09.7
Pollux	243°18.1	27°58.1
Avior	234°15.0	-59°35.5
Suhail	222°46.7	-43°32.1
Miaplacidus	221°38.2	-69°49.2
Alphard	217°48.3	-8°45.9
Regulus	207°34.9	11°50.9
Dubhe	193°41.2	61°37.4
Denebola	182°25.3	14°26.1
Gienah	175°43.9	-17°40.7
Acrux	173°00.2	-63°14.2
Gacrux	171°51.8	-57°15.1
Alioth	166°12.9	55°49.7
Spica	158°22.6	-11°17.4
Alkaid	152°52.0	49°11.5
Hadar	148°36.3	-60°29.4
Menkent	147°58.0	-36°29.4
Arcturus	145°48.1	19°03.2
Rigil Kent.	139°40.5	-60°56.1
Kochab	137°18.6	74°03.2
Zuben'ubi	136°56.4	-16°08.7
Alphecca	126°03.9	26°37.8
Antares	112°16.3	-26°29.2
Atria	107°10.7	-69°04.1
Sabik	102°03.3	-15°45.4
Shaula	96°11.0	-37°07.2
Rasalhague	95°58.9	12°32.3
Eltanin	90°42.2	51°28.8
Kaus Aust.	83°33.2	-34°22.3
Vega	80°33.5	38°48.0
Nunki	75°48.4	-26°16.0
Altair	62°00.5	8°55.7
Peacock	53°06.7	-56°39.2
Deneb	49°26.3	45°21.6
Enif	33°39.5	9°59.0
Al Na'ir	27°33.9	-46°50.5
Fomalhaut	15°15.4	-29°29.6
Scheat	13°46.1	28°12.6
Markab	13°30.8	15°19.9

Apr 18 Thu	SHA	Mer.pass
Venus	344°50.6	11:15
Mars	8°29.2	09:39
Jupiter	311°05.6	13:28
Saturn	12°45.6	09:21

Apr 19 Fri	SHA	Mer.pass
Venus	343°42.3	11:15
Mars	7°46.3	09:38
Jupiter	310°51.8	13:25
Saturn	12°40.0	09:18

Apr 20 Sat	SHA	Mer.pass
Venus	342°33.8	11:16
Mars	7°03.5	09:37
Jupiter	310°38.0	13:21
Saturn	12°34.4	09:14

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°09.9	N10°55.5	59°50.1	14.7′	N17°49.5	11.6′	54.3′
1	195°10.1	56.3	74°23.8	14.7′	17°37.9	11.5′	54.3′
2	210°10.2	57.2	88°57.5	14.8′	17°26.4	11.7′	54.3′
3	225°10.3	·· 58.1	103°31.3	14.9′	17°14.7	11.7′	54.3′
4	240°10.5	58.9	118°05.2	14.9′	17°03.0	11.8′	54.2′
5	255°10.6	10°59.8	132°39.1	15.0′	16°51.2	11.8′	54.2′
6	270°10.7	N11°00.7	147°13.1	15.1′	N16°39.4	11.9′	54.2′
7	285°10.9	01.6	161°47.2	15.1′	16°27.5	12.0′	54.2′
8	300°11.0	02.4	176°21.3	15.2′	16°15.5	12.0′	54.2′
9	315°11.2	·· 03.3	190°55.6	15.3′	16°03.5	12.0′	54.2′
10	330°11.3	04.2	205°29.8	15.3′	15°51.5	12.2′	54.2′
11	345°11.4	05.0	220°04.2	15.4′	15°39.3	12.2′	54.2′
12	0°11.6	N11°05.9	234°38.6	15.5′	N15°27.1	12.2′	54.2′
13	15°11.7	06.8	249°13.0	15.5′	15°14.9	12.3′	54.2′
14	30°11.8	07.6	263°47.6	15.6′	15°02.6	12.3′	54.1′
15	45°12.0	·· 08.5	278°22.1	15.6′	14°50.3	12.4′	54.1′
16	60°12.1	09.4	292°56.8	15.7′	14°37.9	12.5′	54.1′
17	75°12.2	10.2	307°31.5	15.8′	14°25.4	12.5′	54.1′
18	90°12.4	N11°11.1	322°06.3	15.8′	N14°12.9	12.6′	54.1′
19	105°12.5	11.9	336°41.1	15.9′	14°00.3	12.6′	54.1′
20	120°12.7	12.8	351°16.0	15.9′	13°47.7	12.6′	54.1′
21	135°12.8	·· 13.7	5°50.9	16.0′	13°35.1	12.7′	54.1′
22	150°12.9	14.5	20°25.9	16.0′	13°22.4	12.8′	54.1′
23	165°13.1	15.4	35°00.9	16.1′	13°09.6	12.8′	54.1′
	SD = 15.9′	d = 0.9′	SD = 14.8′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°13.2	N11°16.3	49°36.0	16.1′	N12°56.8	12.8′	54.1′
1	195°13.3	17.1	64°11.1	16.2′	12°44.0	12.9′	54.1′
2	210°13.5	18.0	78°46.3	16.2′	12°31.1	12.9′	54.1′
3	225°13.6	·· 18.8	93°21.6	16.3′	12°18.2	13.0′	54.0′
4	240°13.7	19.7	107°56.8	16.3′	12°05.2	13.0′	54.0′
5	255°13.9	20.6	122°32.2	16.4′	11°52.2	13.0′	54.0′
6	270°14.0	N11°21.4	137°07.6	16.4′	N11°39.2	13.1′	54.0′
7	285°14.1	22.3	151°43.0	16.5′	11°26.1	13.2′	54.0′
8	300°14.3	23.2	166°18.5	16.5′	11°12.9	13.2′	54.0′
9	315°14.4	·· 24.0	180°54.0	16.6′	10°59.7	13.2′	54.0′
10	330°14.5	24.9	195°29.5	16.6′	10°46.5	13.2′	54.0′
11	345°14.7	25.7	210°05.1	16.6′	10°33.3	13.3′	54.0′
12	0°14.8	N11°26.6	224°40.7	16.7′	N10°20.0	13.3′	54.0′
13	15°14.9	27.4	239°16.4	16.7′	10°06.7	13.4′	54.0′
14	30°15.1	28.3	253°52.1	16.7′	09°53.3	13.4′	54.0′
15	45°15.2	·· 29.2	268°27.9	16.8′	09°39.9	13.4′	54.0′
16	60°15.3	30.0	283°03.7	16.8′	09°26.5	13.5′	54.0′
17	75°15.5	30.9	297°39.5	16.9′	09°13.0	13.5′	54.0′
18	90°15.6	N11°31.7	312°15.3	16.9′	N08°59.5	13.5′	54.0′
19	105°15.7	32.6	326°51.2	16.9′	08°46.0	13.6′	54.0′
20	120°15.9	33.4	341°27.1	16.9′	08°32.4	13.6′	54.0′
21	135°16.0	·· 34.3	356°03.1	17.0′	08°18.8	13.6′	54.0′
22	150°16.1	35.2	10°39.0	17.0′	08°05.2	13.6′	54.0′
23	165°16.2	36.0	25°15.1	17.0′	07°51.6	13.7′	54.0′
	SD = 15.9′	d = 0.9′	SD = 14.7′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°16.4	N11°36.9	39°51.1	17.1′	N07°37.9	13.7′	54.0′
1	195°16.5	37.7	54°27.1	17.1′	07°24.2	13.8′	54.0′
2	210°16.6	38.6	69°03.2	17.1′	07°10.4	13.7′	54.0′
3	225°16.8	·· 39.4	83°39.3	17.1′	06°56.7	13.8′	54.0′
4	240°16.9	40.3	98°15.5	17.2′	06°42.9	13.8′	54.0′
5	255°17.0	41.1	112°51.6	17.2′	06°29.1	13.8′	54.0′
6	270°17.2	N11°42.0	127°27.8	17.2′	N06°15.3	13.9′	54.0′
7	285°17.3	42.8	142°04.0	17.2′	06°01.4	13.9′	54.0′
8	300°17.4	43.7	156°40.2	17.2′	05°47.5	13.9′	54.0′
9	315°17.5	·· 44.5	171°16.4	17.2′	05°33.6	13.9′	54.0′
10	330°17.7	45.4	185°52.7	17.3′	05°19.7	13.9′	54.0′
11	345°17.8	46.2	200°28.9	17.3′	05°05.8	14.0′	54.0′
12	0°17.9	N11°47.1	215°05.2	17.3′	N04°51.8	14.0′	54.0′
13	15°18.1	48.0	229°41.5	17.3′	04°37.8	14.0′	54.0′
14	30°18.2	48.8	244°17.8	17.3′	04°23.8	14.0′	54.0′
15	45°18.3	·· 49.7	258°54.1	17.3′	04°09.8	14.0′	54.0′
16	60°18.4	50.5	273°30.4	17.3′	03°55.8	14.1′	54.0′
17	75°18.6	51.3	288°06.8	17.3′	03°41.7	14.0′	54.0′
18	90°18.7	N11°52.2	302°43.1	17.4′	N03°27.7	14.1′	54.0′
19	105°18.8	53.0	317°19.5	17.4′	03°13.6	14.1′	54.0′
20	120°18.9	53.9	331°55.8	17.4′	02°59.5	14.1′	54.0′
21	135°19.1	·· 54.7	346°32.2	17.4′	02°45.4	14.1′	54.0′
22	150°19.2	55.6	1°08.6	17.4′	02°31.3	14.2′	54.0′
23	165°19.3	56.4	15°44.9	17.4′	02°17.1	14.1′	54.0′
	SD = 15.9′	d = 0.9′	SD = 14.7′				

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

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

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 10-12 71-86%
18	00:40	00:46	11:59	20:36	08:15	
19	00:53	00:59	11:59	21:16	08:56	
20	01:05	01:12	11:59	21:55	09:36	

April 21, 22, 23 UT (Sun., Mon., Tue.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	209°33.5	190°58.7	N06°20.5	215°54.2	S04°07.2	159°57.6	N17°28.1	222°02.4	S07°12.9
1	224°36.0	205°58.3	21.7	230°54.8	06.4	174°59.5	28.2	237°04.6	12.8
2	239°38.4	220°57.9	22.9	245°55.5	05.6	190°01.4	28.4	252°06.9	12.7
3	254°40.9	235°57.5	·· 24.1	260°56.2	·· 04.9	205°03.3	·· 28.5	267°09.1	·· 12.6
4	269°43.3	250°57.1	25.3	275°56.9	04.1	220°05.1	28.7	282°11.3	12.6
5	284°45.8	265°56.7	26.5	290°57.6	03.3	235°07.0	28.8	297°13.6	12.5
6	299°48.3	280°56.3	N06°27.7	305°58.2	S04°02.6	250°08.9	N17°29.0	312°15.8	S07°12.4
7	314°50.7	295°56.0	28.9	320°58.9	01.8	265°10.8	29.1	327°18.0	12.3
8	329°53.2	310°55.6	30.1	335°59.6	01.0	280°12.7	29.3	342°20.3	12.2
9	344°55.7	325°55.2	·· 31.3	351°00.3	04°00.3	295°14.6	·· 29.4	357°22.5	·· 12.1
10	359°58.1	340°54.8	32.5	6°01.0	03°59.5	310°16.5	29.6	12°24.7	12.0
11	15°00.6	355°54.4	33.7	21°01.7	58.8	325°18.3	29.7	27°27.0	11.9
12	30°03.1	10°54.0	N06°34.8	36°02.3	S03°58.0	340°20.2	N17°29.9	42°29.2	S07°11.9
13	45°05.5	25°53.6	36.0	51°03.0	57.2	355°22.1	30.0	57°31.4	11.8
14	60°08.0	40°53.2	37.2	66°03.7	56.5	10°24.0	30.2	72°33.7	11.7
15	75°10.4	55°52.8	·· 38.4	81°04.4	·· 55.7	25°25.9	·· 30.3	87°35.9	·· 11.6
16	90°12.9	70°52.4	39.6	96°05.1	54.9	40°27.8	30.5	102°38.2	11.5
17	105°15.4	85°52.0	40.8	111°05.8	54.2	55°29.6	30.7	117°40.4	11.4
18	120°17.8	100°51.6	N06°42.0	126°06.4	S03°53.4	70°31.5	N17°30.8	132°42.6	S07°11.3
19	135°20.3	115°51.2	43.2	141°07.1	52.6	85°33.4	31.0	147°44.9	11.2
20	150°22.8	130°50.8	44.4	156°07.8	51.9	100°35.3	31.1	162°47.1	11.2
21	165°25.2	145°50.4	·· 45.6	171°08.5	·· 51.1	115°37.2	·· 31.3	177°49.3	·· 11.1
22	180°27.7	160°50.0	46.7	186°09.2	50.3	130°39.1	31.4	192°51.6	11.0
23	195°30.2	175°49.6	47.9	201°09.8	49.6	145°40.9	31.6	207°53.8	10.9
Mer.pass. 10:00		ν -0.4′	d 1.2′	m -3.90	ν 0.7′	d 0.8′	m 1.14	ν 1.9′	d 0.2′ m -2.02	ν 2.2′	d 0.1′ m 1.07

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	210°32.6	190°49.2	N06°49.1	216°10.5	S03°48.8	160°42.8	N17°31.7	222°56.1	S07°10.8
1	225°35.1	205°48.8	50.3	231°11.2	48.1	175°44.7	31.9	237°58.3	10.7
2	240°37.6	220°48.4	51.5	246°11.9	47.3	190°46.6	32.0	253°00.5	10.6
3	255°40.0	235°48.0	·· 52.7	261°12.6	·· 46.5	205°48.5	·· 32.2	268°02.8	·· 10.5
4	270°42.5	250°47.6	53.9	276°13.3	45.8	220°50.4	32.3	283°05.0	10.5
5	285°44.9	265°47.2	55.1	291°13.9	45.0	235°52.2	32.5	298°07.2	10.4
6	300°47.4	280°46.8	N06°56.2	306°14.6	S03°44.2	250°54.1	N17°32.6	313°09.5	S07°10.3
7	315°49.9	295°46.4	57.4	321°15.3	43.5	265°56.0	32.8	328°11.7	10.2
8	330°52.3	310°46.0	58.6	336°16.0	42.7	280°57.9	32.9	343°14.0	10.1
9	345°54.8	325°45.6	06°59.8	351°16.7	·· 41.9	295°59.8	·· 33.1	358°16.2	·· 10.0
10	0°57.3	340°45.2	07°01.0	6°17.4	41.2	311°01.7	33.2	13°18.4	09.9
11	15°59.7	355°44.8	02.2	21°18.1	40.4	326°03.5	33.4	28°20.7	09.9
12	31°02.2	10°44.4	N07°03.4	36°18.7	S03°39.6	341°05.4	N17°33.5	43°22.9	S07°09.8
13	46°04.7	25°44.0	04.5	51°19.4	38.9	356°07.3	33.7	58°25.1	09.7
14	61°07.1	40°43.6	05.7	66°20.1	38.1	11°09.2	33.8	73°27.4	09.6
15	76°09.6	55°43.2	·· 06.9	81°20.8	·· 37.3	26°11.1	·· 34.0	88°29.6	·· 09.5
16	91°12.0	70°42.8	08.1	96°21.5	36.6	41°12.9	34.1	103°31.9	09.4
17	106°14.5	85°42.4	09.3	111°22.2	35.8	56°14.8	34.3	118°34.1	09.3
18	121°17.0	100°41.9	N07°10.5	126°22.8	S03°35.1	71°16.7	N17°34.4	133°36.3	S07°09.2
19	136°19.4	115°41.5	11.6	141°23.5	34.3	86°18.6	34.6	148°38.6	09.2
20	151°21.9	130°41.1	12.8	156°24.2	33.5	101°20.5	34.8	163°40.8	09.1
21	166°24.4	145°40.7	·· 14.0	171°24.9	·· 32.8	116°22.4	·· 34.9	178°43.1	·· 09.0
22	181°26.8	160°40.3	15.2	186°25.6	32.0	131°24.2	35.1	193°45.3	08.9
23	196°29.3	175°39.9	16.4	201°26.3	31.2	146°26.1	35.2	208°47.5	08.8
Mer.pass. 09:56		ν -0.4′	d 1.2′	m -3.90	ν 0.7′	d 0.8′	m 1.14	ν 1.9′	d 0.2′ m -2.02	ν 2.2′	d 0.1′ m 1.07

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	211°31.8	190°39.5	N07°17.5	216°27.0	S03°30.5	161°28.0	N17°35.4	223°49.8	S07°08.7
1	226°34.2	205°39.1	18.7	231°27.6	29.7	176°29.9	35.5	238°52.0	08.6
2	241°36.7	220°38.7	19.9	246°28.3	28.9	191°31.8	35.7	253°54.3	08.6
3	256°39.2	235°38.3	·· 21.1	261°29.0	·· 28.2	206°33.6	·· 35.8	268°56.5	·· 08.5
4	271°41.6	250°37.9	22.3	276°29.7	27.4	221°35.5	36.0	283°58.7	08.4
5	286°44.1	265°37.5	23.5	291°30.4	26.6	236°37.4	36.1	299°01.0	08.3
6	301°46.5	280°37.1	N07°24.6	306°31.1	S03°25.9	251°39.3	N17°36.3	314°03.2	S07°08.2
7	316°49.0	295°36.7	25.8	321°31.8	25.1	266°41.2	36.4	329°05.5	08.1
8	331°51.5	310°36.3	27.0	336°32.4	24.3	281°43.0	36.6	344°07.7	08.0
9	346°53.9	325°35.9	·· 28.2	351°33.1	·· 23.6	296°44.9	·· 36.7	359°09.9	·· 08.0
10	1°56.4	340°35.5	29.4	6°33.8	22.8	311°46.8	36.9	14°12.2	07.9
11	16°58.9	355°35.0	30.5	21°34.5	22.0	326°48.7	37.0	29°14.4	07.8
12	32°01.3	10°34.6	N07°31.7	36°35.2	S03°21.3	341°50.6	N17°37.2	44°16.7	S07°07.7
13	47°03.8	25°34.2	32.9	51°35.9	20.5	356°52.5	37.3	59°18.9	07.6
14	62°06.3	40°33.8	34.1	66°36.6	19.7	11°54.3	37.5	74°21.1	07.5
15	77°08.7	55°33.4	·· 35.2	81°37.2	·· 19.0	26°56.2	·· 37.6	89°23.4	·· 07.4
16	92°11.2	70°33.0	36.4	96°37.9	18.2	41°58.1	37.8	104°25.6	07.4
17	107°13.7	85°32.6	37.6	111°38.6	17.4	57°00.0	37.9	119°27.9	07.3
18	122°16.1	100°32.2	N07°38.8	126°39.3	S03°16.7	72°01.9	N17°38.1	134°30.1	S07°07.2
19	137°18.6	115°31.8	39.9	141°40.0	15.9	87°03.7	38.2	149°32.3	07.1
20	152°21.0	130°31.4	41.1	156°40.7	15.1	102°05.6	38.4	164°34.6	07.0
21	167°23.5	145°31.0	·· 42.3	171°41.4	·· 14.4	117°07.5	·· 38.5	179°36.8	·· 06.9
22	182°26.0	160°30.5	43.5	186°42.0	13.6	132°09.4	38.7	194°39.1	06.8
23	197°28.4	175°30.1	44.6	201°42.7	12.9	147°11.3	38.8	209°41.3	06.8
Mer.pass. 09:52		ν -0.4′	d 1.2′	m -3.90	ν 0.7′	d 0.8′	m 1.14	ν 1.9′	d 0.2′ m -2.02	ν 2.2′	d 0.1′ m 1.07

Stars

	SHA	**Dec**
Alpheratz	357°35.7	29°13.3
Ankaa	353°08.1	-42°10.4
Schedar	349°32.3	56°40.0
Diphda	348°48.2	-17°51.3
Achernar	335°21.2	-57°06.8
Hamal	327°52.3	23°34.5
Polaris	314°49.5	89°22.0
Acamar	315°12.6	-40°12.5
Menkar	314°07.1	4°11.0
Mirfak	308°29.6	49°56.8
Aldebaran	290°40.6	16°33.4
Rigel	281°04.7	-8°10.5
Capella	280°23.1	46°01.4
Bellatrix	278°23.8	6°22.2
Elnath	278°02.9	28°37.7
Alnilam	275°38.6	-1°11.3
Betelgeuse	270°52.9	7°24.6
Canopus	263°52.9	-52°42.7
Sirius	258°26.9	-16°45.1
Adhara	255°06.5	-29°00.5
Procyon	244°51.5	5°09.7
Pollux	243°18.1	27°58.1
Avior	234°15.0	-59°35.5
Suhail	222°46.7	-43°32.1
Miaplacidus	221°38.2	-69°49.3
Alphard	217°48.3	-8°45.9
Regulus	207°34.9	11°50.9
Dubhe	193°41.3	61°37.4
Denebola	182°25.3	14°26.1
Gienah	175°43.9	-17°40.7
Acrux	173°00.2	-63°14.2
Gacrux	171°51.9	-57°15.1
Alioth	166°12.9	55°49.7
Spica	158°22.6	-11°17.4
Alkaid	152°52.0	49°11.5
Hadar	148°36.3	-60°29.5
Menkent	147°58.0	-36°29.5
Arcturus	145°48.1	19°03.2
Rigil Kent.	139°40.5	-60°56.2
Kochab	137°18.6	74°03.2
Zuben'ubi	136°56.4	-16°08.7
Alphecca	126°03.9	26°37.8
Antares	112°16.3	-26°29.2
Atria	107°10.7	-69°04.1
Sabik	102°03.3	-15°45.4
Shaula	96°11.0	-37°07.2
Rasalhague	95°58.9	12°32.3
Eltanin	90°42.2	51°28.8
Kaus Aust.	83°33.2	-34°22.3
Vega	80°33.5	38°48.0
Nunki	75°48.4	-26°16.0
Altair	62°00.5	8°55.7
Peacock	53°06.7	-56°39.2
Deneb	49°26.3	45°21.6
Enif	33°39.5	9°59.0
Al Na'ir	27°33.9	-46°50.5
Fomalhaut	15°15.4	-29°29.6
Scheat	13°46.1	28°12.6
Markab	13°30.7	15°19.9

Apr 21 Sun	**SHA**	**Mer.pass**
Venus	341°25.2	11:16
Mars	6°20.7	09:36
Jupiter	310°24.1	13:18
Saturn	12°28.9	09:10

Apr 22 Mon	**SHA**	**Mer.pass**
Venus	340°16.6	11:17
Mars	5°37.9	09:35
Jupiter	310°10.2	13:15
Saturn	12°23.4	09:07

Apr 23 Tue	**SHA**	**Mer.pass**
Venus	339°07.8	11:18
Mars	4°55.2	09:34
Jupiter	309°56.2	13:12
Saturn	12°18.0	09:03

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.1193 sec ΔT = TT-UT1 = +69.0647 sec

2024 April 21 to Apr. 23 UT

h	Sun		Moon				
Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°19.5	N11°57.3	30°21.3	17.4′	N02°03.0	14.2′	54.0′
1	195°19.6	58.1	44°57.7	17.4′	01°48.8	14.1′	54.0′
2	210°19.7	59.0	59°34.1	17.4′	01°34.7	14.2′	54.0′
3	225°19.8	11°59.8	74°10.4	17.4′	01°20.5	14.2′	54.1′
4	240°20.0	12°00.7	88°46.8	17.4′	01°06.3	14.2′	54.1′
5	255°20.1	01.5	103°23.2	17.4′	00°52.1	14.2′	54.1′
6	270°20.2	N12°02.4	117°59.5	17.4′	N00°37.9	14.2′	54.1′
7	285°20.3	03.2	132°35.9	17.4′	00°23.7	14.2′	54.1′
8	300°20.5	04.0	147°12.2	17.3′	N00°09.5	14.2′	54.1′
9	315°20.6	·· 04.9	161°48.6	17.3′	S00°04.7	14.2′	54.1′
10	330°20.7	05.7	176°24.9	17.3′	00°18.9	14.2′	54.1′
11	345°20.8	06.6	191°01.3	17.3′	00°33.1	14.2′	54.1′
12	0°20.9	N12°07.4	205°37.6	17.3′	S00°47.3	14.3′	54.1′
13	15°21.1	08.3	220°13.9	17.3′	01°01.6	14.2′	54.1′
14	30°21.2	09.1	234°50.2	17.3′	01°15.8	14.2′	54.1′
15	45°21.3	·· 09.9	249°26.4	17.3′	01°30.0	14.2′	54.1′
16	60°21.4	10.8	264°02.7	17.3′	01°44.2	14.3′	54.1′
17	75°21.6	11.6	278°39.0	17.2′	01°58.5	14.2′	54.1′
18	90°21.7	N12°12.5	293°15.2	17.2′	S02°12.7	14.2′	54.2′
19	105°21.8	13.3	307°51.4	17.2′	02°26.9	14.2′	54.2′
20	120°21.9	14.1	322°27.6	17.2′	02°41.1	14.2′	54.2′
21	135°22.1	·· 15.0	337°03.8	17.2′	02°55.3	14.2′	54.2′
22	150°22.2	15.8	351°39.9	17.1′	03°09.5	14.2′	54.2′
23	165°22.3	16.7	6°16.1	17.1′	03°23.7	14.2′	54.2′
	SD = 15.9′	d = 0.8′	SD = 14.7′				

Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°22.4	N12°17.5	20°52.2	17.1′	S03°37.9	14.2′	54.2′
1	195°22.5	18.3	35°28.3	17.1′	03°52.1	14.2′	54.2′
2	210°22.7	19.2	50°04.3	17.0′	04°06.3	14.1′	54.2′
3	225°22.8	·· 20.0	64°40.4	17.0′	04°20.4	14.2′	54.2′
4	240°22.9	20.8	79°16.4	17.0′	04°34.6	14.2′	54.2′
5	255°23.0	21.7	93°52.4	17.0′	04°48.8	14.1′	54.2′
6	270°23.1	N12°22.5	108°28.3	16.9′	S05°02.9	14.1′	54.3′
7	285°23.3	23.4	123°04.2	16.9′	05°17.0	14.1′	54.3′
8	300°23.4	24.2	137°40.1	16.9′	05°31.1	14.1′	54.3′
9	315°23.5	·· 25.0	152°16.0	16.8′	05°45.2	14.1′	54.3′
10	330°23.6	25.9	166°51.8	16.8′	05°59.3	14.1′	54.3′
11	345°23.7	26.7	181°27.6	16.8′	06°13.4	14.0′	54.3′
12	0°23.9	N12°27.5	196°03.4	16.7′	S06°27.4	14.0′	54.3′
13	15°24.0	28.4	210°39.1	16.7′	06°41.4	14.1′	54.3′
14	30°24.1	29.2	225°14.8	16.6′	06°55.5	14.0′	54.3′
15	45°24.2	·· 30.0	239°50.4	16.6′	07°09.5	13.9′	54.4′
16	60°24.3	30.9	254°26.0	16.6′	07°23.4	14.0′	54.4′
17	75°24.5	31.7	269°01.6	16.5′	07°37.4	13.9′	54.4′
18	90°24.6	N12°32.5	283°37.1	16.5′	S07°51.3	13.9′	54.4′
19	105°24.7	33.4	298°12.6	16.4′	08°05.2	13.9′	54.4′
20	120°24.8	34.2	312°48.0	16.4′	08°19.1	13.9′	54.4′
21	135°24.9	·· 35.0	327°23.4	16.3′	08°33.0	13.8′	54.4′
22	150°25.0	35.9	341°58.7	16.3′	08°46.8	13.8′	54.4′
23	165°25.2	36.7	356°34.0	16.3′	09°00.6	13.8′	54.4′
	SD = 15.9′	d = 0.8′	SD = 14.8′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°25.3	N12°37.5	11°09.3	16.2′	S09°14.4	13.8′	54.5′
1	195°25.4	38.3	25°44.5	16.2′	09°28.2	13.7′	54.5′
2	210°25.5	39.2	40°19.6	16.1′	09°41.9	13.7′	54.5′
3	225°25.6	·· 40.0	54°54.7	16.0′	09°55.6	13.7′	54.5′
4	240°25.7	40.8	69°29.8	16.0′	10°09.3	13.6′	54.5′
5	255°25.9	41.7	84°04.8	15.9′	10°22.9	13.6′	54.5′
6	270°26.0	N12°42.5	98°39.7	15.9′	S10°36.5	13.6′	54.5′
7	285°26.1	43.3	113°14.6	15.8′	10°50.1	13.5′	54.5′
8	300°26.2	44.1	127°49.4	15.8′	11°03.6	13.5′	54.6′
9	315°26.3	·· 45.0	142°24.2	15.7′	11°17.1	13.5′	54.6′
10	330°26.4	45.8	156°58.9	15.7′	11°30.6	13.4′	54.6′
11	345°26.6	46.6	171°33.6	15.6′	11°44.0	13.4′	54.6′
12	0°26.7	N12°47.4	186°08.2	15.5′	S11°57.4	13.4′	54.6′
13	15°26.8	48.3	200°42.7	15.5′	12°10.8	13.3′	54.6′
14	30°26.9	49.1	215°17.2	15.4′	12°24.1	13.3′	54.6′
15	45°27.0	·· 49.9	229°51.6	15.4′	12°37.4	13.2′	54.7′
16	60°27.1	50.7	244°26.0	15.3′	12°50.6	13.2′	54.7′
17	75°27.2	51.6	259°00.3	15.2′	13°03.8	13.1′	54.7′
18	90°27.3	N12°52.4	273°34.5	15.2′	S13°16.9	13.1′	54.7′
19	105°27.5	53.2	288°08.7	15.1′	13°30.0	13.1′	54.7′
20	120°27.6	54.0	302°42.8	15.0′	13°43.1	13.0′	54.7′
21	135°27.7	·· 54.9	317°16.8	15.0′	13°56.1	12.9′	54.7′
22	150°27.8	55.7	331°50.7	14.9′	14°09.0	12.9′	54.8′
23	165°27.9	56.5	346°24.6	14.8′	14°21.9	12.9′	54.8′
	SD = 15.9′	d = 0.8′	SD = 14.9′				

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

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

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 13-15 92-99%
21	01:18	01:24	11:59	22:34	10:15	
22	01:30	01:35	11:58	23:14	10:54	
23	01:41	01:47	11:58	23:56	11:35	

April 24, 25, 26 UT (Wed., Thu., Fri.)

	Aries	Venus		Mars		Jupiter		Saturn	
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	212°30.9	190°29.7	N07°45.8	216°43.4	S03°12.1	162°13.1	N17°39.0	224°43.6	S07°06.7
1	227°33.4	205°29.3	47.0	231°44.1	11.3	177°15.0	39.1	239°45.8	06.6
2	242°35.8	220°28.9	48.2	246°44.8	10.6	192°16.9	39.3	254°48.0	06.5
3	257°38.3	235°28.5	·· 49.3	261°45.5	·· 09.8	207°18.8	·· 39.4	269°50.3	·· 06.4
4	272°40.8	250°28.1	50.5	276°46.2	09.0	222°20.7	39.6	284°52.5	06.3
5	287°43.2	265°27.7	51.7	291°46.9	08.3	237°22.5	39.7	299°54.8	06.2
6	302°45.7	280°27.3	N07°52.9	306°47.5	S03°07.5	252°24.4	N17°39.9	314°57.0	S07°06.2
7	317°48.1	295°26.8	54.0	321°48.2	06.7	267°26.3	40.0	329°59.2	06.1
8	332°50.6	310°26.4	55.2	336°48.9	06.0	282°28.2	40.2	345°01.5	06.0
9	347°53.1	325°26.0	·· 56.4	351°49.6	·· 05.2	297°30.1	·· 40.3	0°03.7	·· 05.9
10	2°55.5	340°25.6	57.6	6°50.3	04.4	312°31.9	40.5	15°06.0	05.8
11	17°58.0	355°25.2	58.7	21°51.0	03.7	327°33.8	40.7	30°08.2	05.7
12	33°00.5	10°24.8	N07°59.9	36°51.7	S03°02.9	342°35.7	N17°40.8	45°10.5	S07°05.7
13	48°02.9	25°24.4	08°01.1	51°52.4	02.1	357°37.6	41.0	60°12.7	05.6
14	63°05.4	40°24.0	02.2	66°53.0	01.4	12°39.4	41.1	75°14.9	05.5
15	78°07.9	55°23.5	·· 03.4	81°53.7	03°00.6	27°41.3	·· 41.3	90°17.2	·· 05.4
16	93°10.3	70°23.1	04.6	96°54.4	02°59.8	42°43.2	41.4	105°19.4	05.3
17	108°12.8	85°22.7	05.8	111°55.1	59.1	57°45.1	41.6	120°21.7	05.2
18	123°15.3	100°22.3	N08°06.9	126°55.8	S02°58.3	72°47.0	N17°41.7	135°23.9	S07°05.1
19	138°17.7	115°21.9	08.1	141°56.5	57.5	87°48.8	41.9	150°26.2	05.1
20	153°20.2	130°21.5	09.3	156°57.2	56.8	102°50.7	42.0	165°28.4	05.0
21	168°22.6	145°21.0	·· 10.4	171°57.9	·· 56.0	117°52.6	·· 42.2	180°30.7	·· 04.9
22	183°25.1	160°20.6	11.6	186°58.6	55.2	132°54.5	42.3	195°32.9	04.8
23	198°27.6	175°20.2	12.8	201°59.2	54.5	147°56.4	42.5	210°35.1	04.7
Mer.pass. 09:48		ν -0.4′	d 1.2′	m -3.90	ν 0.7′	d 0.8′	m 1.13	ν 1.9′	d 0.2′ m -2.02	ν 2.2′	d 0.1′ m 1.07

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	213°30.0	190°19.8	N08°13.9	216°59.9	S02°53.7	162°58.2	N17°42.6	225°37.4	S07°04.6
1	228°32.5	205°19.4	15.1	232°00.6	52.9	178°00.1	42.8	240°39.6	04.6
2	243°35.0	220°19.0	16.3	247°01.3	52.2	193°02.0	42.9	255°41.9	04.5
3	258°37.4	235°18.5	·· 17.4	262°02.0	·· 51.4	208°03.9	·· 43.1	270°44.1	·· 04.4
4	273°39.9	250°18.1	18.6	277°02.7	50.6	223°05.7	43.2	285°46.4	04.3
5	288°42.4	265°17.7	19.8	292°03.4	49.9	238°07.6	43.4	300°48.6	04.2
6	303°44.8	280°17.3	N08°20.9	307°04.1	S02°49.1	253°09.5	N17°43.5	315°50.9	S07°04.1
7	318°47.3	295°16.9	22.1	322°04.8	48.3	268°11.4	43.7	330°53.1	04.1
8	333°49.7	310°16.5	23.3	337°05.4	47.6	283°13.3	43.8	345°55.3	04.0
9	348°52.2	325°16.0	·· 24.4	352°06.1	·· 46.8	298°15.1	·· 44.0	0°57.6	·· 03.9
10	3°54.7	340°15.6	25.6	7°06.8	46.0	313°17.0	44.1	15°59.8	03.8
11	18°57.1	355°15.2	26.8	22°07.5	45.3	328°18.9	44.3	31°02.1	03.7
12	33°59.6	10°14.8	N08°27.9	37°08.2	S02°44.5	343°20.8	N17°44.4	46°04.3	S07°03.6
13	49°02.1	25°14.4	29.1	52°08.9	43.7	358°22.6	44.6	61°06.6	03.5
14	64°04.5	40°13.9	30.2	67°09.6	43.0	13°24.5	44.7	76°08.8	03.5
15	79°07.0	55°13.5	·· 31.4	82°10.3	·· 42.2	28°26.4	·· 44.9	91°11.1	·· 03.4
16	94°09.5	70°13.1	32.6	97°11.0	41.4	43°28.3	45.0	106°13.3	03.3
17	109°11.9	85°12.7	33.7	112°11.6	40.7	58°30.2	45.2	121°15.6	03.2
18	124°14.4	100°12.2	N08°34.9	127°12.3	S02°39.9	73°32.0	N17°45.3	136°17.8	S07°03.1
19	139°16.9	115°11.8	36.1	142°13.0	39.1	88°33.9	45.5	151°20.0	03.0
20	154°19.3	130°11.4	37.2	157°13.7	38.4	103°35.8	45.6	166°22.3	03.0
21	169°21.8	145°11.0	·· 38.4	172°14.4	·· 37.6	118°37.7	·· 45.8	181°24.5	·· 02.9
22	184°24.2	160°10.6	39.5	187°15.1	36.8	133°39.5	45.9	196°26.8	02.8
23	199°26.7	175°10.1	40.7	202°15.8	36.1	148°41.4	46.1	211°29.0	02.7
Mer.pass. 09:44		ν -0.4′	d 1.2′	m -3.90	ν 0.7′	d 0.8′	m 1.13	ν 1.9′	d 0.2′ m -2.02	ν 2.2′	d 0.1′ m 1.07

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	214°29.2	190°09.7	N08°41.9	217°16.5	S02°35.3	163°43.3	N17°46.2	226°31.3	S07°02.6
1	229°31.6	205°09.3	43.0	232°17.2	34.5	178°45.2	46.4	241°33.5	02.5
2	244°34.1	220°08.9	44.2	247°17.9	33.7	193°47.0	46.5	256°35.8	02.5
3	259°36.6	235°08.4	·· 45.3	262°18.5	·· 33.0	208°48.9	·· 46.7	271°38.0	·· 02.4
4	274°39.0	250°08.0	46.5	277°19.2	32.2	223°50.8	46.8	286°40.3	02.3
5	289°41.5	265°07.6	47.7	292°19.9	31.4	238°52.7	47.0	301°42.5	02.2
6	304°44.0	280°07.2	N08°48.8	307°20.6	S02°30.7	253°54.6	N17°47.1	316°44.8	S07°02.1
7	319°46.4	295°06.7	50.0	322°21.3	29.9	268°56.4	47.3	331°47.0	02.0
8	334°48.9	310°06.3	51.1	337°22.0	29.1	283°58.3	47.4	346°49.2	02.0
9	349°51.4	325°05.9	·· 52.3	352°22.7	·· 28.4	299°00.2	·· 47.6	1°51.5	·· 01.9
10	4°53.8	340°05.5	53.4	7°23.4	27.6	314°02.1	47.7	16°53.7	01.8
11	19°56.3	355°05.0	54.6	22°24.1	26.8	329°03.9	47.9	31°56.0	01.7
12	34°58.7	10°04.6	N08°55.8	37°24.8	S02°26.1	344°05.8	N17°48.0	46°58.2	S07°01.6
13	50°01.2	25°04.2	56.9	52°25.5	25.3	359°07.7	48.2	62°00.5	01.6
14	65°03.7	40°03.8	58.1	67°26.1	24.5	14°09.6	48.3	77°02.7	01.5
15	80°06.1	55°03.3	08°59.2	82°26.8	·· 23.8	29°11.4	·· 48.5	92°05.0	·· 01.4
16	95°08.6	70°02.9	09°00.4	97°27.5	23.0	44°13.3	48.6	107°07.2	01.3
17	110°11.1	85°02.5	01.5	112°28.2	22.2	59°15.2	48.8	122°09.5	01.2
18	125°13.5	100°02.0	N09°02.7	127°28.9	S02°21.5	74°17.1	N17°48.9	137°11.7	S07°01.1
19	140°16.0	115°01.6	03.8	142°29.6	20.7	89°18.9	49.1	152°14.0	01.1
20	155°18.5	130°01.2	05.0	157°30.3	19.9	104°20.8	49.2	167°16.2	01.0
21	170°20.9	145°00.8	·· 06.1	172°31.0	·· 19.2	119°22.7	·· 49.4	182°18.5	·· 00.9
22	185°23.4	160°00.3	07.3	187°31.7	18.4	134°24.6	49.5	197°20.7	00.8
23	200°25.9	174°59.9	08.4	202°32.4	17.6	149°26.4	49.7	212°23.0	00.7
Mer.pass. 09:40		ν -0.4′	d 1.2′	m -3.91	ν 0.7′	d 0.8′	m 1.13	ν 1.9′	d 0.2′ m -2.01	ν 2.2′	d 0.1′ m 1.07

Stars

	SHA	Dec
Alpheratz	357°35.7	29°13.3
Ankaa	353°08.1	-42°10.4
Schedar	349°32.3	56°40.0
Diphda	348°48.2	-17°51.3
Achernar	335°21.2	-57°06.8
Hamal	327°52.3	23°34.5
Polaris	314°49.6	89°22.0
Acamar	315°12.6	-40°12.5
Menkar	314°07.1	4°11.0
Mirfak	308°29.6	49°56.8
Aldebaran	290°40.6	16°33.4
Rigel	281°04.7	-8°10.5
Capella	280°23.1	46°01.4
Bellatrix	278°23.8	6°22.2
Elnath	278°02.9	28°37.7
Alnilam	275°38.6	-1°11.3
Betelgeuse	270°53.0	7°24.6
Canopus	263°52.9	-52°42.7
Sirius	258°26.9	-16°45.1
Adhara	255°06.5	-29°00.5
Procyon	244°51.6	5°09.7
Pollux	243°18.1	27°58.1
Avior	234°15.0	-59°35.5
Suhail	222°46.7	-43°32.1
Miaplacidus	221°38.3	-69°49.3
Alphard	217°48.3	-8°45.9
Regulus	207°35.0	11°50.9
Dubhe	193°41.3	61°37.4
Denebola	182°25.3	14°26.2
Gienah	175°44.0	-17°40.7
Acrux	173°00.2	-63°14.2
Gacrux	171°51.9	-57°15.1
Alioth	166°13.0	55°49.7
Spica	158°22.6	-11°17.4
Alkaid	152°52.0	49°11.5
Hadar	148°36.3	-60°29.5
Menkent	147°58.0	-36°29.5
Arcturus	145°48.1	19°03.3
Rigil Kent.	139°40.5	-60°56.2
Kochab	137°18.6	74°03.2
Zuben'ubi	136°56.4	-16°08.7
Alphecca	126°03.9	26°37.8
Antares	112°16.3	-26°29.2
Atria	107°10.7	-69°04.1
Sabik	102°03.2	-15°45.4
Shaula	96°10.9	-37°07.2
Rasalhague	95°58.9	12°32.3
Eltanin	90°42.1	51°28.8
Kaus Aust.	83°33.1	-34°22.3
Vega	80°33.4	38°48.0
Nunki	75°48.4	-26°16.0
Altair	62°00.5	8°55.7
Peacock	53°06.7	-56°39.2
Deneb	49°26.3	45°21.6
Enif	33°39.5	9°59.0
Al Na'ir	27°33.9	-46°50.5
Fomalhaut	15°15.4	-29°29.6
Scheat	13°46.0	28°12.6
Markab	13°30.7	15°19.9

Apr 24 Wed	SHA	Mer.pass
Venus	337°58.8	11:18
Mars	4°12.5	09:33
Jupiter	309°42.2	13:09
Saturn	12°12.7	09:00

Apr 25 Thu	SHA	Mer.pass
Venus	336°49.8	11:19
Mars	3°29.9	09:32
Jupiter	309°28.2	13:06
Saturn	12°07.3	08:56

Apr 26 Fri	SHA	Mer.pass
Venus	335°40.5	11:20
Mars	2°47.3	09:30
Jupiter	309°14.1	13:03
Saturn	12°02.1	08:53

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°28.0	N12°57.3	0°58.4	14.7′	S14°34.8	12.8′	54.8′
1	195°28.1	58.1	15°32.2	14.7′	14°47.6	12.7′	54.8′
2	210°28.2	59.0	30°05.9	14.6′	15°00.3	12.7′	54.8′
3	225°28.4	12°59.8	44°39.5	14.5′	15°13.0	12.7′	54.8′
4	240°28.5	13°00.6	59°13.0	14.4′	15°25.7	12.6′	54.8′
5	255°28.6	01.4	73°46.4	14.4′	15°38.3	12.5′	54.9′
6	270°28.7	N13°02.2	88°19.8	14.3′	S15°50.8	12.5′	54.9′
7	285°28.8	03.1	102°53.1	14.2′	16°03.3	12.4′	54.9′
8	300°28.9	03.9	117°26.3	14.1′	16°15.7	12.3′	54.9′
9	315°29.0	·· 04.7	131°59.5	14.1′	16°28.0	12.3′	54.9′
10	330°29.1	05.5	146°32.5	14.0′	16°40.3	12.3′	54.9′
11	345°29.2	06.3	161°05.5	13.9′	16°52.6	12.1′	55.0′
12	0°29.3	N13°07.1	175°38.4	13.8′	S17°04.7	12.1′	55.0′
13	15°29.5	08.0	190°11.2	13.7′	17°16.8	12.1′	55.0′
14	30°29.6	08.8	204°44.0	13.7′	17°28.9	11.9′	55.0′
15	45°29.7	·· 09.6	219°16.6	13.6′	17°40.8	11.9′	55.0′
16	60°29.8	10.4	233°49.2	13.5′	17°52.7	11.9′	55.0′
17	75°29.9	11.2	248°21.7	13.4′	18°04.6	11.7′	55.1′
18	90°30.0	N13°12.0	262°54.1	13.3′	S18°16.3	11.7′	55.1′
19	105°30.1	12.8	277°26.4	13.2′	18°28.0	11.6′	55.1′
20	120°30.2	13.7	291°58.7	13.1′	18°39.6	11.6′	55.1′
21	135°30.3	·· 14.5	306°30.8	13.1′	18°51.2	11.4′	55.1′
22	150°30.4	15.3	321°02.9	13.0′	19°02.6	11.4′	55.1′
23	165°30.5	16.1	335°34.9	12.9′	19°14.0	11.3′	55.2′
	SD = 15.9′	d = 0.8′	SD = 14.9′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°30.6	N13°16.9	350°06.7	12.8′	S19°25.3	11.2′	55.2′
1	195°30.8	17.7	4°38.5	12.7′	19°36.5	11.2′	55.2′
2	210°30.9	18.5	19°10.2	12.6′	19°47.7	11.1′	55.2′
3	225°31.0	·· 19.3	33°41.9	12.5′	19°58.8	11.0′	55.2′
4	240°31.1	20.2	48°13.4	12.4′	20°09.8	10.9′	55.2′
5	255°31.2	21.0	62°44.8	12.3′	20°20.7	10.8′	55.3′
6	270°31.3	N13°21.8	77°16.2	12.3′	S20°31.5	10.7′	55.3′
7	285°31.4	22.6	91°47.4	12.2′	20°42.2	10.6′	55.3′
8	300°31.5	23.4	106°18.6	12.1′	20°52.8	10.6′	55.3′
9	315°31.6	·· 24.2	120°49.7	12.0′	21°03.4	10.5′	55.3′
10	330°31.7	25.0	135°20.6	11.9′	21°13.9	10.3′	55.3′
11	345°31.8	25.8	149°51.5	11.8′	21°24.2	10.3′	55.4′
12	0°31.9	N13°26.6	164°22.3	11.7′	S21°34.5	10.2′	55.4′
13	15°32.0	27.4	178°53.0	11.6′	21°44.7	10.1′	55.4′
14	30°32.1	28.2	193°23.6	11.5′	21°54.8	10.0′	55.4′
15	45°32.2	·· 29.0	207°54.1	11.4′	22°04.8	9.9′	55.4′
16	60°32.3	29.9	222°24.5	11.3′	22°14.7	9.8′	55.5′
17	75°32.4	30.7	236°54.8	11.2′	22°24.5	9.7′	55.5′
18	90°32.5	N13°31.5	251°25.0	11.1′	S22°34.2	9.6′	55.5′
19	105°32.6	32.3	265°55.2	11.0′	22°43.8	9.5′	55.5′
20	120°32.7	33.1	280°25.2	10.9′	22°53.3	9.4′	55.5′
21	135°32.8	·· 33.9	294°55.1	10.8′	23°02.7	9.2′	55.5′
22	150°32.9	34.7	309°25.0	10.7′	23°11.9	9.2′	55.6′
23	165°33.0	35.5	323°54.7	10.6′	23°21.1	9.1′	55.6′
	SD = 15.9′	d = 0.8′	SD = 15.0′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°33.1	N13°36.3	338°24.4	10.6′	S23°30.2	8.9′	55.6′
1	195°33.2	37.1	352°53.9	10.5′	23°39.1	8.9′	55.6′
2	210°33.4	37.9	7°23.4	10.4′	23°48.0	8.7′	55.6′
3	225°33.5	·· 38.7	21°52.7	10.3′	23°56.7	8.6′	55.7′
4	240°33.6	39.5	36°22.0	10.2′	24°05.3	8.5′	55.7′
5	255°33.7	40.3	50°51.2	10.1′	24°13.8	8.4′	55.7′
6	270°33.8	N13°41.1	65°20.2	10.0′	S24°22.2	8.3′	55.7′
7	285°33.9	41.9	79°49.2	9.9′	24°30.5	8.2′	55.7′
8	300°34.0	42.7	94°18.1	9.8′	24°38.7	8.0′	55.8′
9	315°34.1	·· 43.5	108°46.9	9.7′	24°46.7	7.9′	55.8′
10	330°34.2	44.3	123°15.6	9.6′	24°54.6	7.8′	55.8′
11	345°34.3	45.1	137°44.2	9.5′	25°02.4	7.7′	55.8′
12	0°34.4	N13°45.9	152°12.7	9.4′	S25°10.1	7.5′	55.8′
13	15°34.5	46.7	166°41.1	9.3′	25°17.6	7.4′	55.9′
14	30°34.5	47.5	181°09.5	9.2′	25°25.0	7.3′	55.9′
15	45°34.6	·· 48.3	195°37.7	9.1′	25°32.3	7.2′	55.9′
16	60°34.7	49.1	210°05.8	9.1′	25°39.5	7.0′	55.9′
17	75°34.8	49.9	224°33.9	9.0′	25°46.5	6.9′	55.9′
18	90°34.9	N13°50.7	239°01.9	8.9′	S25°53.4	6.8′	56.0′
19	105°35.0	51.5	253°29.7	8.8′	26°00.2	6.6′	56.0′
20	120°35.1	52.3	267°57.5	8.7′	26°06.8	6.5′	56.0′
21	135°35.2	·· 53.1	282°25.2	8.6′	26°13.3	6.4′	56.0′
22	150°35.3	53.8	296°52.8	8.5′	26°19.7	6.2′	56.0′
23	165°35.4	54.6	311°20.4	8.4′	26°25.9	6.1′	56.1′
	SD = 15.9′	d = 0.8′	SD = 15.2′				

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

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

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 16-18 100-96%
24	01:52	01:57	11:58	–:–	12:18	
25	02:03	02:08	11:58	00:41	13:05	
26	02:13	02:17	11:58	01:29	13:55	

April 27, 28, 29 UT (Sat., Sun., Mon.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	215°28.3	189°59.5	N09°09.6	217°33.1	S02°16.9	164°28.3	N17°49.8	227°25.2	S07°00.6
1	230°30.8	204°59.0	10.7	232°33.8	16.1	179°30.2	50.0	242°27.5	00.6
2	245°33.2	219°58.6	11.9	247°34.4	15.3	194°32.1	50.1	257°29.7	00.5
3	260°35.7	234°58.2	·· 13.0	262°35.1	·· 14.6	209°33.9	·· 50.3	272°32.0	·· 00.4
4	275°38.2	249°57.8	14.2	277°35.8	13.8	224°35.8	50.4	287°34.2	00.3
5	290°40.6	264°57.3	15.3	292°36.5	13.0	239°37.7	50.6	302°36.5	00.2
6	305°43.1	279°56.9	N09°16.5	307°37.2	S02°12.3	254°39.6	N17°50.7	317°38.7	S07°00.2
7	320°45.6	294°56.5	17.6	322°37.9	11.5	269°41.4	50.9	332°41.0	00.1
8	335°48.0	309°56.0	18.8	337°38.6	10.7	284°43.3	51.0	347°43.2	07°00.0
9	350°50.5	324°55.6	·· 19.9	352°39.3	·· 10.0	299°45.2	·· 51.2	2°45.5	06°59.9
10	5°53.0	339°55.2	21.1	7°40.0	09.2	314°47.1	51.3	17°47.7	59.8
11	20°55.4	354°54.7	22.2	22°40.7	08.4	329°48.9	51.5	32°50.0	59.7
12	35°57.9	9°54.3	N09°23.4	37°41.4	S02°07.7	344°50.8	N17°51.6	47°52.2	S06°59.7
13	51°00.4	24°53.9	24.5	52°42.1	06.9	359°52.7	51.8	62°54.5	59.6
14	66°02.8	39°53.4	25.7	67°42.8	06.1	14°54.6	51.9	77°56.7	59.5
15	81°05.3	54°53.0	·· 26.8	82°43.4	·· 05.3	29°56.4	·· 52.1	92°59.0	·· 59.4
16	96°07.7	69°52.6	28.0	97°44.1	04.6	44°58.3	52.2	108°01.2	59.3
17	111°10.2	84°52.1	29.1	112°44.8	03.8	60°00.2	52.4	123°03.5	59.3
18	126°12.7	99°51.7	N09°30.3	127°45.5	S02°03.0	75°02.1	N17°52.5	138°05.7	S06°59.2
19	141°15.1	114°51.2	31.4	142°46.2	02.3	90°03.9	52.7	153°08.0	59.1
20	156°17.6	129°50.8	32.5	157°46.9	01.5	105°05.8	52.8	168°10.2	59.0
21	171°20.1	144°50.4	·· 33.7	172°47.6	·· 00.7	120°07.7	·· 52.9	183°12.5	·· 58.9
22	186°22.5	159°49.9	34.8	187°48.3	02°00.0	135°09.6	53.1	198°14.7	58.8
23	201°25.0	174°49.5	36.0	202°49.0	01°59.2	150°11.4	53.2	213°17.0	58.8
Mer.pass. 09:37		ν -0.4′	d 1.2′	m -3.91	ν 0.7′	d 0.8′	m 1.13	ν 1.9′	d 0.1′ m -2.01	ν 2.2′	d 0.1′ m 1.07

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	216°27.5	189°49.1	N09°37.1	217°49.7	S01°58.4	165°13.3	N17°53.4	228°19.2	S06°58.7
1	231°29.9	204°48.6	38.3	232°50.4	57.7	180°15.2	53.5	243°21.5	58.6
2	246°32.4	219°48.2	39.4	247°51.1	56.9	195°17.1	53.7	258°23.7	58.5
3	261°34.8	234°47.8	·· 40.5	262°51.8	·· 56.1	210°18.9	·· 53.8	273°26.0	·· 58.4
4	276°37.3	249°47.3	41.7	277°52.5	55.4	225°20.8	54.0	288°28.2	58.4
5	291°39.8	264°46.9	42.8	292°53.2	54.6	240°22.7	54.1	303°30.5	58.3
6	306°42.2	279°46.4	N09°44.0	307°53.8	S01°53.8	255°24.6	N17°54.3	318°32.7	S06°58.2
7	321°44.7	294°46.0	45.1	322°54.5	53.1	270°26.4	54.4	333°35.0	58.1
8	336°47.2	309°45.6	46.3	337°55.2	52.3	285°28.3	54.6	348°37.2	58.0
9	351°49.6	324°45.1	·· 47.4	352°55.9	·· 51.5	300°30.2	·· 54.7	3°39.5	·· 58.0
10	6°52.1	339°44.7	48.5	7°56.6	50.8	315°32.0	54.9	18°41.7	57.9
11	21°54.6	354°44.2	49.7	22°57.3	50.0	330°33.9	55.0	33°44.0	57.8
12	36°57.0	9°43.8	N09°50.8	37°58.0	S01°49.2	345°35.8	N17°55.2	48°46.2	S06°57.7
13	51°59.5	24°43.4	51.9	52°58.7	48.5	0°37.7	55.3	63°48.5	57.6
14	67°02.0	39°42.9	53.1	67°59.4	47.7	15°39.5	55.5	78°50.7	57.6
15	82°04.4	54°42.5	·· 54.2	83°00.1	·· 46.9	30°41.4	·· 55.6	93°53.0	·· 57.5
16	97°06.9	69°42.0	55.4	98°00.8	46.2	45°43.3	55.8	108°55.2	57.4
17	112°09.3	84°41.6	56.5	113°01.5	45.4	60°45.2	55.9	123°57.5	57.3
18	127°11.8	99°41.1	N09°57.6	128°02.2	S01°44.6	75°47.0	N17°56.1	138°59.8	S06°57.2
19	142°14.3	114°40.7	58.8	143°02.9	43.8	90°48.9	56.2	154°02.0	57.2
20	157°16.7	129°40.3	09°59.9	158°03.6	43.1	105°50.8	56.4	169°04.3	57.1
21	172°19.2	144°39.8	10°01.0	173°04.3	·· 42.3	120°52.7	·· 56.5	184°06.5	·· 57.0
22	187°21.7	159°39.4	02.2	188°05.0	41.5	135°54.5	56.7	199°08.8	56.9
23	202°24.1	174°38.9	03.3	203°05.6	40.8	150°56.4	56.8	214°11.0	56.8
Mer.pass. 09:33		ν -0.4′	d 1.1′	m -3.91	ν 0.7′	d 0.8′	m 1.13	ν 1.9′	d 0.1′ m -2.01	ν 2.3′	d 0.1′ m 1.07

Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	217°26.6	189°38.5	N10°04.4	218°06.3	S01°40.0	165°58.3	N17°57.0	229°13.3	S06°56.8
1	232°29.1	204°38.0	05.6	233°07.0	39.2	181°00.1	57.1	244°15.5	56.7
2	247°31.5	219°37.6	06.7	248°07.7	38.5	196°02.0	57.3	259°17.8	56.6
3	262°34.0	234°37.1	·· 07.8	263°08.4	·· 37.7	211°03.9	·· 57.4	274°20.0	·· 56.5
4	277°36.5	249°36.7	09.0	278°09.1	36.9	226°05.8	57.6	289°22.3	56.4
5	292°38.9	264°36.3	10.1	293°09.8	36.2	241°07.6	57.7	304°24.5	56.4
6	307°41.4	279°35.8	N10°11.2	308°10.5	S01°35.4	256°09.5	N17°57.9	319°26.8	S06°56.3
7	322°43.8	294°35.4	12.4	323°11.2	34.6	271°11.4	58.0	334°29.0	56.2
8	337°46.3	309°34.9	13.5	338°11.9	33.9	286°13.2	58.2	349°31.3	56.1
9	352°48.8	324°34.5	·· 14.6	353°12.6	·· 33.1	301°15.1	·· 58.3	4°33.6	·· 56.0
10	7°51.2	339°34.0	15.8	8°13.3	32.3	316°17.0	58.4	19°35.8	56.0
11	22°53.7	354°33.6	16.9	23°14.0	31.6	331°18.9	58.6	34°38.1	55.9
12	37°56.2	9°33.1	N10°18.0	38°14.7	S01°30.8	346°20.7	N17°58.7	49°40.3	S06°55.8
13	52°58.6	24°32.7	19.1	53°15.4	30.0	1°22.6	58.9	64°42.6	55.7
14	68°01.1	39°32.2	20.3	68°16.1	29.3	16°24.5	59.0	79°44.8	55.6
15	83°03.6	54°31.8	·· 21.4	83°16.8	·· 28.5	31°26.4	·· 59.2	94°47.1	·· 55.6
16	98°06.0	69°31.3	22.5	98°17.5	27.7	46°28.2	59.3	109°49.3	55.5
17	113°08.5	84°30.9	23.6	113°18.2	26.9	61°30.1	59.5	124°51.6	55.4
18	128°11.0	99°30.4	N10°24.8	128°18.9	S01°26.2	76°32.0	N17°59.6	139°53.9	S06°55.3
19	143°13.4	114°30.0	25.9	143°19.5	25.4	91°33.8	59.8	154°56.1	55.2
20	158°15.9	129°29.5	27.0	158°20.2	24.6	106°35.7	17°59.9	169°58.4	55.2
21	173°18.3	144°29.1	·· 28.2	173°20.9	·· 23.9	121°37.6	18°00.1	185°00.6	·· 55.1
22	188°20.8	159°28.6	29.3	188°21.6	23.1	136°39.5	00.2	200°02.9	55.0
23	203°23.3	174°28.2	30.4	203°22.3	22.3	151°41.3	00.4	215°05.1	54.9
Mer.pass. 09:29		ν -0.4′	d 1.1′	m -3.91	ν 0.7′	d 0.8′	m 1.12	ν 1.9′	d 0.1′ m -2.01	ν 2.3′	d 0.1′ m 1.07

Stars

	SHA	Dec
Alpheratz	357°35.7	29°13.3
Ankaa	353°08.1	-42°10.4
Schedar	349°32.3	56°40.0
Diphda	348°48.2	-17°51.3
Achernar	335°21.2	-57°06.8
Hamal	327°52.2	23°34.5
Polaris	314°49.4	89°22.0
Acamar	315°12.6	-40°12.5
Menkar	314°07.1	4°11.0
Mirfak	308°29.6	49°56.8
Aldebaran	290°40.6	16°33.4
Rigel	281°04.7	-8°10.5
Capella	280°23.2	46°01.4
Bellatrix	278°23.8	6°22.2
Elnath	278°02.9	28°37.7
Alnilam	275°38.6	-1°11.3
Betelgeuse	270°53.0	7°24.6
Canopus	263°53.0	-52°42.7
Sirius	258°26.9	-16°45.1
Adhara	255°06.5	-29°00.5
Procyon	244°51.6	5°09.7
Pollux	243°18.1	27°58.1
Avior	234°15.1	-59°35.5
Suhail	222°46.7	-43°32.1
Miaplacidus	221°38.3	-69°49.3
Alphard	217°48.3	-8°45.9
Regulus	207°35.0	11°50.9
Dubhe	193°41.3	61°37.4
Denebola	182°25.3	14°26.2
Gienah	175°43.9	-17°40.7
Acrux	173°00.2	-63°14.2
Gacrux	171°51.9	-57°15.1
Alioth	166°13.0	55°49.7
Spica	158°22.6	-11°17.4
Alkaid	152°52.0	49°11.5
Hadar	148°36.3	-60°29.5
Menkent	147°58.0	-36°29.5
Arcturus	145°48.1	19°03.3
Rigil Kent.	139°40.5	-60°56.2
Kochab	137°18.6	74°03.2
Zuben'ubi	136°56.4	-16°08.7
Alphecca	126°03.9	26°37.8
Antares	112°16.3	-26°29.2
Atria	107°10.6	-69°04.1
Sabik	102°03.2	-15°45.4
Shaula	96°10.9	-37°07.2
Rasalhague	95°58.9	12°32.3
Eltanin	90°42.1	51°28.8
Kaus Aust.	83°33.1	-34°22.3
Vega	80°33.4	38°48.0
Nunki	75°48.4	-26°16.0
Altair	62°00.5	8°55.7
Peacock	53°06.6	-56°39.2
Deneb	49°26.2	45°21.7
Enif	33°39.5	9°59.0
Al Na'ir	27°33.8	-46°50.5
Fomalhaut	15°15.4	-29°29.6
Scheat	13°46.0	28°12.6
Markab	13°30.7	15°20.0

Apr 27 Sat	SHA	Mer.pass
Venus	334°31.2	11:20
Mars	2°04.7	09:29
Jupiter	309°00.0	13:00
Saturn	11°56.9	08:49

Apr 28 Sun	SHA	Mer.pass
Venus	333°21.6	11:21
Mars	1°22.2	09:28
Jupiter	308°45.9	12:57
Saturn	11°51.8	08:45

Apr 29 Mon	SHA	Mer.pass
Venus	332°11.9	11:22
Mars	0°39.7	09:27
Jupiter	308°31.7	12:55
Saturn	11°46.7	08:42

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h — Sun — Moon

Sat	GHA	Dec	GHA	ν	Dec	d	HP
0	180°35.5	N13°55.4	325°47.8	8.4′	S26°32.0	6.0′	56.1′
1	195°35.6	56.2	340°15.2	8.3′	26°38.0	5.8′	56.1′
2	210°35.7	57.0	354°42.4	8.2′	26°43.8	5.7′	56.1′
3	225°35.8	·· 57.8	9°09.6	8.1′	26°49.5	5.5′	56.1′
4	240°35.9	58.6	23°36.7	8.0′	26°55.0	5.4′	56.2′
5	255°36.0	13°59.4	38°03.8	7.9′	27°00.4	5.2′	56.2′
6	270°36.1	N14°00.2	52°30.7	7.9′	S27°05.6	5.1′	56.2′
7	285°36.2	01.0	66°57.6	7.8′	27°10.7	5.0′	56.2′
8	300°36.3	01.8	81°24.4	7.7′	27°15.7	4.8′	56.3′
9	315°36.4	·· 02.6	95°51.1	7.6′	27°20.5	4.6′	56.3′
10	330°36.5	03.3	110°17.7	7.6′	27°25.1	4.5′	56.3′
11	345°36.6	04.1	124°44.3	7.5′	27°29.6	4.4′	56.3′
12	0°36.7	N14°04.9	139°10.8	7.4′	S27°34.0	4.2′	56.3′
13	15°36.8	05.7	153°37.2	7.4′	27°38.2	4.0′	56.4′
14	30°36.9	06.5	168°03.5	7.3′	27°42.2	3.9′	56.4′
15	45°36.9	·· 07.3	182°29.8	7.2′	27°46.1	3.8′	56.4′
16	60°37.0	08.1	196°56.0	7.1′	27°49.9	3.5′	56.4′
17	75°37.1	08.9	211°22.2	7.1′	27°53.4	3.5′	56.4′
18	90°37.2	N14°09.7	225°48.3	7.0′	S27°56.9	3.2′	56.5′
19	105°37.3	10.4	240°14.3	7.0′	28°00.1	3.1′	56.5′
20	120°37.4	11.2	254°40.2	6.9′	28°03.2	3.0′	56.5′
21	135°37.5	·· 12.0	269°06.1	6.8′	28°06.2	2.8′	56.5′
22	150°37.6	12.8	283°32.0	6.8′	28°09.0	2.6′	56.6′
23	165°37.7	13.6	297°57.8	6.7′	28°11.6	2.5′	56.6′
	SD = 15.9′	d = 0.8′	SD = 15.3′				

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	180°37.8	N14°14.4	312°23.5	6.7′	S28°14.1	2.3′	56.6′
1	195°37.9	15.1	326°49.2	6.6′	28°16.4	2.1′	56.6′
2	210°38.0	15.9	341°14.8	6.6′	28°18.5	2.0′	56.6′
3	225°38.0	·· 16.7	355°40.4	6.5′	28°20.5	1.8′	56.7′
4	240°38.1	17.5	10°05.9	6.5′	28°22.3	1.7′	56.7′
5	255°38.2	18.3	24°31.4	6.4′	28°24.0	1.5′	56.7′
6	270°38.3	N14°19.1	38°56.8	6.4′	S28°25.5	1.3′	56.7′
7	285°38.4	19.8	53°22.2	6.3′	28°26.8	1.1′	56.8′
8	300°38.5	20.6	67°47.6	6.3′	28°27.9	1.0′	56.8′
9	315°38.6	·· 21.4	82°12.9	6.3′	28°28.9	0.8′	56.8′
10	330°38.7	22.2	96°38.1	6.2′	28°29.7	0.7′	56.8′
11	345°38.8	23.0	111°03.4	6.2′	28°30.4	0.5′	56.8′
12	0°38.8	N14°23.7	125°28.6	6.2′	S28°30.9	0.3′	56.9′
13	15°38.9	24.5	139°53.7	6.1′	28°31.2	0.1′	56.9′
14	30°39.0	25.3	154°18.9	6.1′	28°31.3	0.0′	56.9′
15	45°39.1	·· 26.1	168°44.0	6.1′	28°31.3	0.2′	56.9′
16	60°39.2	26.8	183°09.1	6.1′	28°31.1	0.4′	57.0′
17	75°39.3	27.6	197°34.1	6.0′	28°30.7	0.6′	57.0′
18	90°39.4	N14°28.4	211°59.2	6.0′	S28°30.1	0.7′	57.0′
19	105°39.5	29.2	226°24.2	6.0′	28°29.4	0.9′	57.0′
20	120°39.5	30.0	240°49.2	6.0′	28°28.5	1.0′	57.1′
21	135°39.6	·· 30.7	255°14.2	6.0′	28°27.5	1.2′	57.1′
22	150°39.7	31.5	269°39.2	6.0′	28°26.3	1.5′	57.1′
23	165°39.8	32.3	284°04.1	5.9′	28°24.8	1.5′	57.1′
	SD = 15.9′	d = 0.8′	SD = 15.4′				

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	180°39.9	N14°33.1	298°29.1	5.9′	S28°23.3	1.8′	57.2′
1	195°40.0	33.8	312°54.0	5.9′	28°21.5	1.9′	57.2′
2	210°40.1	34.6	327°18.9	5.9′	28°19.6	2.1′	57.2′
3	225°40.1	·· 35.4	341°43.8	5.9′	28°17.5	2.3′	57.2′
4	240°40.2	36.1	356°08.8	5.9′	28°15.2	2.4′	57.2′
5	255°40.3	36.9	10°33.7	5.9′	28°12.8	2.6′	57.3′
6	270°40.4	N14°37.7	24°58.6	5.9′	S28°10.2	2.8′	57.3′
7	285°40.5	38.5	39°23.5	5.9′	28°07.4	3.0′	57.3′
8	300°40.6	39.2	53°48.5	5.9′	28°04.4	3.1′	57.3′
9	315°40.6	·· 40.0	68°13.4	5.9′	28°01.3	3.3′	57.4′
10	330°40.7	40.8	82°38.3	6.0′	27°58.0	3.5′	57.4′
11	345°40.8	41.5	97°03.3	6.0′	27°54.5	3.6′	57.4′
12	0°40.9	N14°42.3	111°28.2	6.0′	S27°50.9	3.8′	57.4′
13	15°41.0	43.1	125°53.2	6.0′	27°47.1	4.0′	57.5′
14	30°41.1	43.8	140°18.2	6.0′	27°43.1	4.2′	57.5′
15	45°41.1	·· 44.6	154°43.2	6.0′	27°38.9	4.3′	57.5′
16	60°41.2	45.4	169°08.3	6.0′	27°34.6	4.5′	57.5′
17	75°41.3	46.1	183°33.3	6.1′	27°30.1	4.7′	57.6′
18	90°41.4	N14°46.9	197°58.4	6.1′	S27°25.4	4.9′	57.6′
19	105°41.5	47.7	212°23.5	6.1′	27°20.5	5.0′	57.6′
20	120°41.5	48.4	226°48.6	6.1′	27°15.5	5.2′	57.6′
21	135°41.6	·· 49.2	241°13.7	6.2′	27°10.3	5.3′	57.7′
22	150°41.7	50.0	255°38.9	6.2′	27°05.0	5.5′	57.7′
23	165°41.8	50.7	270°04.1	6.2′	26°59.5	5.7′	57.7′
	SD = 15.9′	d = 0.8′	SD = 15.6′				

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

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

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 19-21 91-76%
27	02:22	02:27	11:58	02:22	14:50	
28	02:31	02:35	11:57	03:18	15:47	
29	02:40	02:44	11:57	04:16	16:45	

April 30, 01, 02 UT (Tue., Wed., Thu.)

	Aries	Venus		Mars		Jupiter		Saturn	
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	218°25.7	189°27.7	N10°31.5	218°23.0	S01°21.6	166°43.2	N18°00.5	230°07.4	S06°54.8
1	233°28.2	204°27.3	32.6	233°23.7	20.8	181°45.1	00.7	245°09.6	54.8
2	248°30.7	219°26.8	33.8	248°24.4	20.0	196°46.9	00.8	260°11.9	54.7
3	263°33.1	234°26.3	·· 34.9	263°25.1	·· 19.3	211°48.8	·· 01.0	275°14.2	·· 54.6
4	278°35.6	249°25.9	36.0	278°25.8	18.5	226°50.7	01.1	290°16.4	54.5
5	293°38.1	264°25.4	37.1	293°26.5	17.7	241°52.5	01.3	305°18.7	54.4
6	308°40.5	279°25.0	N10°38.3	308°27.2	S01°17.0	256°54.4	N18°01.4	320°20.9	S06°54.4
7	323°43.0	294°24.5	39.4	323°27.9	16.2	271°56.3	01.6	335°23.2	54.3
8	338°45.5	309°24.1	40.5	338°28.6	15.4	286°58.2	01.7	350°25.4	54.2
9	353°47.9	324°23.6	·· 41.6	353°29.3	·· 14.7	302°00.0	·· 01.9	5°27.7	·· 54.1
10	8°50.4	339°23.2	42.7	8°30.0	13.9	317°01.9	02.0	20°30.0	54.1
11	23°52.8	354°22.7	43.9	23°30.7	13.1	332°03.8	02.1	35°32.2	54.0
12	38°55.3	9°22.3	N10°45.0	38°31.4	S01°12.4	347°05.6	N18°02.3	50°34.5	S06°53.9
13	53°57.8	24°21.8	46.1	53°32.1	11.6	2°07.5	02.4	65°36.7	53.8
14	69°00.2	39°21.3	47.2	68°32.8	10.8	17°09.4	02.6	80°39.0	53.7
15	84°02.7	54°20.9	·· 48.3	83°33.5	·· 10.1	32°11.3	·· 02.7	95°41.2	·· 53.7
16	99°05.2	69°20.4	49.5	98°34.2	09.3	47°13.1	02.9	110°43.5	53.6
17	114°07.6	84°20.0	50.6	113°34.9	08.5	62°15.0	03.0	125°45.8	53.5
18	129°10.1	99°19.5	N10°51.7	128°35.6	S01°07.7	77°16.9	N18°03.2	140°48.0	S06°53.4
19	144°12.6	114°19.0	52.8	143°36.3	07.0	92°18.7	03.3	155°50.3	53.3
20	159°15.0	129°18.6	53.9	158°37.0	06.2	107°20.6	03.5	170°52.5	53.3
21	174°17.5	144°18.1	·· 55.0	173°37.7	·· 05.4	122°22.5	·· 03.6	185°54.8	·· 53.2
22	189°19.9	159°17.7	56.1	188°38.4	04.7	137°24.3	03.8	200°57.0	53.1
23	204°22.4	174°17.2	57.3	203°39.0	03.9	152°26.2	03.9	215°59.3	53.0
Mer.pass. 09:25		ν -0.5′	d 1.1′	m -3.91	ν 0.7′	d 0.8′	m 1.12	ν 1.9′	d 0.1′ m -2.01	ν 2.3′	d 0.1′ m 1.07

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	219°24.9	189°16.7	N10°58.4	218°39.7	S01°03.1	167°28.1	N18°04.1	231°01.6	S06°53.0
1	234°27.3	204°16.3	10°59.5	233°40.4	02.4	182°30.0	04.2	246°03.8	52.9
2	249°29.8	219°15.8	11°00.6	248°41.1	01.6	197°31.8	04.4	261°06.1	52.8
3	264°32.3	234°15.4	·· 01.7	263°41.8	·· 00.8	212°33.7	·· 04.5	276°08.3	·· 52.7
4	279°34.7	249°14.9	02.8	278°42.5	01°00.1	227°35.6	04.7	291°10.6	52.6
5	294°37.2	264°14.4	03.9	293°43.2	00°59.3	242°37.4	04.8	306°12.9	52.6
6	309°39.7	279°14.0	N11°05.0	308°43.9	S00°58.5	257°39.3	N18°04.9	321°15.1	S06°52.5
7	324°42.1	294°13.5	06.2	323°44.6	57.8	272°41.2	05.1	336°17.4	52.4
8	339°44.6	309°13.0	07.3	338°45.3	57.0	287°43.0	05.2	351°19.6	52.3
9	354°47.1	324°12.6	·· 08.4	353°46.0	·· 56.2	302°44.9	·· 05.4	6°21.9	·· 52.3
10	9°49.5	339°12.1	09.5	8°46.7	55.5	317°46.8	05.5	21°24.2	52.2
11	24°52.0	354°11.7	10.6	23°47.4	54.7	332°48.7	05.7	36°26.4	52.1
12	39°54.4	9°11.2	N11°11.7	38°48.1	S00°53.9	347°50.5	N18°05.8	51°28.7	S06°52.0
13	54°56.9	24°10.7	12.8	53°48.8	53.2	2°52.4	06.0	66°30.9	52.0
14	69°59.4	39°10.3	13.9	68°49.5	52.4	17°54.3	06.1	81°33.2	51.9
15	85°01.8	54°09.8	·· 15.0	83°50.2	·· 51.6	32°56.1	·· 06.3	96°35.4	·· 51.8
16	100°04.3	69°09.3	16.1	98°50.9	50.9	47°58.0	06.4	111°37.7	51.7
17	115°06.8	84°08.9	17.2	113°51.6	50.1	62°59.9	06.6	126°40.0	51.6
18	130°09.2	99°08.4	N11°18.3	128°52.3	S00°49.3	78°01.7	N18°06.7	141°42.2	S06°51.6
19	145°11.7	114°07.9	19.4	143°53.0	48.6	93°03.6	06.9	156°44.5	51.5
20	160°14.2	129°07.5	20.6	158°53.7	47.8	108°05.5	07.0	171°46.8	51.4
21	175°16.6	144°07.0	·· 21.7	173°54.4	·· 47.0	123°07.3	·· 07.2	186°49.0	·· 51.3
22	190°19.1	159°06.5	22.8	188°55.1	46.2	138°09.2	07.3	201°51.3	51.3
23	205°21.6	174°06.0	23.9	203°55.8	45.5	153°11.1	07.4	216°53.5	51.2
Mer.pass. 09:21		ν -0.5′	d 1.1′	m -3.91	ν 0.7′	d 0.8′	m 1.12	ν 1.9′	d 0.1′ m -2.01	ν 2.3′	d 0.1′ m 1.07

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	220°24.0	189°05.6	N11°25.0	218°56.5	S00°44.7	168°13.0	N18°07.6	231°55.8	S06°51.1
1	235°26.5	204°05.1	26.1	233°57.2	43.9	183°14.8	07.7	246°58.1	51.0
2	250°28.9	219°04.6	27.2	248°57.9	43.2	198°16.7	07.9	262°00.3	51.0
3	265°31.4	234°04.2	·· 28.3	263°58.6	·· 42.4	213°18.6	·· 08.0	277°02.6	·· 50.9
4	280°33.9	249°03.7	29.4	278°59.3	41.6	228°20.4	08.2	292°04.8	50.8
5	295°36.3	264°03.2	30.5	294°00.0	40.9	243°22.3	08.3	307°07.1	50.7
6	310°38.8	279°02.8	N11°31.6	309°00.7	S00°40.1	258°24.2	N18°08.5	322°09.4	S06°50.6
7	325°41.3	294°02.3	32.7	324°01.4	39.3	273°26.0	08.6	337°11.6	50.6
8	340°43.7	309°01.8	33.8	339°02.1	38.6	288°27.9	08.8	352°13.9	50.5
9	355°46.2	324°01.3	·· 34.9	354°02.8	·· 37.8	303°29.8	·· 08.9	7°16.1	·· 50.4
10	10°48.7	339°00.9	36.0	9°03.5	37.0	318°31.6	09.1	22°18.4	50.3
11	25°51.1	354°00.4	37.1	24°04.2	36.3	333°33.5	09.2	37°20.7	50.3
12	40°53.6	8°59.9	N11°38.2	39°04.9	S00°35.5	348°35.4	N18°09.3	52°22.9	S06°50.2
13	55°56.1	23°59.4	39.3	54°05.6	34.7	3°37.2	09.5	67°25.2	50.1
14	70°58.5	38°59.0	40.4	69°06.3	34.0	18°39.1	09.6	82°27.5	50.0
15	86°01.0	53°58.5	·· 41.5	84°07.0	·· 33.2	33°41.0	·· 09.8	97°29.7	·· 50.0
16	101°03.4	68°58.0	42.6	99°07.7	32.4	48°42.8	09.9	112°32.0	49.9
17	116°05.9	83°57.5	43.6	114°08.4	31.7	63°44.7	10.1	127°34.2	49.8
18	131°08.4	98°57.1	N11°44.7	129°09.1	S00°30.9	78°46.6	N18°10.2	142°36.5	S06°49.7
19	146°10.8	113°56.6	45.8	144°09.8	30.1	93°48.4	10.4	157°38.8	49.7
20	161°13.3	128°56.1	46.9	159°10.5	29.4	108°50.3	10.5	172°41.0	49.6
21	176°15.8	143°55.6	·· 48.0	174°11.2	·· 28.6	123°52.2	·· 10.7	187°43.3	·· 49.5
22	191°18.2	158°55.2	49.1	189°11.9	27.8	138°54.1	10.8	202°45.6	49.4
23	206°20.7	173°54.7	50.2	204°12.6	27.1	153°55.9	11.0	217°47.8	49.4
Mer.pass. 09:17		ν -0.5′	d 1.1′	m -3.91	ν 0.7′	d 0.8′	m 1.12	ν 1.9′	d 0.1′ m -2.01	ν 2.3′	d 0.1′ m 1.07

Stars

	SHA	Dec
Alpheratz	357°35.7	29°13.3
Ankaa	353°08.1	-42°10.4
Schedar	349°32.3	56°40.0
Diphda	348°48.2	-17°51.3
Achernar	335°21.2	-57°06.8
Hamal	327°52.2	23°34.5
Polaris	314°49.3	89°22.0
Acamar	315°12.6	-40°12.5
Menkar	314°07.1	4°11.0
Mirfak	308°29.6	49°56.8
Aldebaran	290°40.6	16°33.4
Rigel	281°04.7	-8°10.5
Capella	280°23.2	46°01.4
Bellatrix	278°23.8	6°22.2
Elnath	278°02.9	28°37.7
Alnilam	275°38.6	-1°11.3
Betelgeuse	270°53.0	7°24.7
Canopus	263°53.0	-52°42.7
Sirius	258°27.0	-16°45.1
Adhara	255°06.5	-29°00.5
Procyon	244°51.6	5°09.7
Pollux	243°18.1	27°58.1
Avior	234°15.1	-59°35.5
Suhail	222°46.7	-43°32.1
Miaplacidus	221°38.4	-69°49.3
Alphard	217°48.3	-8°45.9
Regulus	207°35.0	11°50.9
Dubhe	193°41.3	61°37.4
Denebola	182°25.3	14°26.2
Gienah	175°43.9	-17°40.7
Acrux	173°00.2	-63°14.2
Gacrux	171°51.9	-57°15.1
Alioth	166°13.0	55°49.8
Spica	158°22.6	-11°17.4
Alkaid	152°52.0	49°11.5
Hadar	148°36.2	-60°29.5
Menkent	147°57.9	-36°29.5
Arcturus	145°48.1	19°03.3
Rigil Kent.	139°40.5	-60°56.2
Kochab	137°18.5	74°03.3
Zuben'ubi	136°56.3	-16°08.7
Alphecca	126°03.9	26°37.8
Antares	112°16.2	-26°29.2
Atria	107°10.6	-69°04.1
Sabik	102°03.2	-15°45.4
Shaula	96°10.9	-37°07.2
Rasalhague	95°58.9	12°32.4
Eltanin	90°42.1	51°28.8
Kaus Aust.	83°33.1	-34°22.3
Vega	80°33.4	38°48.1
Nunki	75°48.3	-26°16.0
Altair	62°00.5	8°55.8
Peacock	53°06.6	-56°39.2
Deneb	49°26.2	45°21.7
Enif	33°39.5	9°59.0
Al Na'ir	27°33.8	-46°50.5
Fomalhaut	15°15.4	-29°29.6
Scheat	13°46.0	28°12.6
Markab	13°30.7	15°20.0

Apr 30 Tue	SHA	Mer.pass
Venus	331°02.0	11:22
Mars	359°57.3	09:26
Jupiter	308°17.5	12:52
Saturn	11°41.6	08:38

May 01 Wed	SHA	Mer.pass
Venus	329°51.9	11:23
Mars	359°14.9	09:25
Jupiter	308°03.2	12:49
Saturn	11°36.7	08:35

May 02 Thu	SHA	Mer.pass
Venus	328°41.6	11:24
Mars	358°32.5	09:24
Jupiter	307°48.9	12:46
Saturn	11°31.8	08:31

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°41.9	N14°51.5	284°29.4	6.3′	S26°53.8	5.9′	57.7′
1	195°41.9	52.3	298°54.6	6.3′	26°47.9	6.0′	57.8′
2	210°42.0	53.0	313°19.9	6.3′	26°41.9	6.2′	57.8′
3	225°42.1	·· 53.8	327°45.3	6.4′	26°35.7	6.3′	57.8′
4	240°42.2	54.6	342°10.7	6.4′	26°29.4	6.6′	57.8′
5	255°42.3	55.3	356°36.1	6.5′	26°22.8	6.7′	57.9′
6	270°42.3	N14°56.1	11°01.5	6.5′	S26°16.1	6.8′	57.9′
7	285°42.4	56.8	25°27.0	6.5′	26°09.3	7.0′	57.9′
8	300°42.5	57.6	39°52.6	6.6′	26°02.3	7.2′	57.9′
9	315°42.6	·· 58.4	54°18.2	6.6′	25°55.1	7.3′	58.0′
10	330°42.7	59.1	68°43.8	6.7′	25°47.8	7.5′	58.0′
11	345°42.7	14°59.9	83°09.5	6.7′	25°40.3	7.7′	58.0′
12	0°42.8	N15°00.6	97°35.2	6.8′	S25°32.6	7.8′	58.0′
13	15°42.9	01.4	112°01.0	6.8′	25°24.8	7.9′	58.1′
14	30°43.0	02.2	126°26.8	6.9′	25°16.9	8.2′	58.1′
15	45°43.0	·· 02.9	140°52.7	6.9′	25°08.7	8.3′	58.1′
16	60°43.1	03.7	155°18.6	7.0′	25°00.4	8.4′	58.1′
17	75°43.2	04.4	169°44.6	7.0′	24°52.0	8.6′	58.2′
18	90°43.3	N15°05.2	184°10.6	7.1′	S24°43.4	8.7′	58.2′
19	105°43.3	05.9	198°36.7	7.1′	24°34.7	8.9′	58.2′
20	120°43.4	06.7	213°02.8	7.2′	24°25.8	9.1′	58.2′
21	135°43.5	·· 07.5	227°29.0	7.3′	24°16.7	9.2′	58.3′
22	150°43.6	08.2	241°55.3	7.3′	24°07.5	9.4′	58.3′
23	165°43.6	09.0	256°21.6	7.4′	23°58.1	9.5′	58.3′
	SD = 15.9′	d = 0.8′	SD = 15.7′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°43.7	N15°09.7	270°48.0	7.4′	S23°48.6	9.6′	58.3′
1	195°43.8	10.5	285°14.4	7.5′	23°39.0	9.8′	58.4′
2	210°43.9	11.2	299°40.9	7.5′	23°29.2	10.0′	58.4′
3	225°43.9	·· 12.0	314°07.4	7.6′	23°19.2	10.0′	58.4′
4	240°44.0	12.7	328°34.0	7.7′	23°09.2	10.3′	58.4′
5	255°44.1	13.5	343°00.7	7.7′	22°58.9	10.4′	58.5′
6	270°44.2	N15°14.2	357°27.4	7.8′	S22°48.5	10.5′	58.5′
7	285°44.2	15.0	11°54.2	7.8′	22°38.0	10.6′	58.5′
8	300°44.3	15.7	26°21.1	7.9′	22°27.4	10.8′	58.5′
9	315°44.4	·· 16.5	40°48.0	8.0′	22°16.6	11.0′	58.6′
10	330°44.4	17.2	55°14.9	8.0′	22°05.6	11.0′	58.6′
11	345°44.5	18.0	69°42.0	8.1′	21°54.6	11.2′	58.6′
12	0°44.6	N15°18.7	84°09.1	8.2′	S21°43.4	11.4′	58.6′
13	15°44.7	19.5	98°36.2	8.2′	21°32.0	11.4′	58.7′
14	30°44.7	20.2	113°03.5	8.3′	21°20.6	11.6′	58.7′
15	45°44.8	·· 21.0	127°30.7	8.3′	21°09.0	11.8′	58.7′
16	60°44.9	21.7	141°58.1	8.4′	20°57.2	11.8′	58.7′
17	75°44.9	22.5	156°25.5	8.5′	20°45.4	12.0′	58.8′
18	90°45.0	N15°23.2	170°53.0	8.5′	S20°33.4	12.2′	58.8′
19	105°45.1	24.0	185°20.5	8.6′	20°21.2	12.2′	58.8′
20	120°45.1	24.7	199°48.1	8.7′	20°09.0	12.4′	58.8′
21	135°45.2	·· 25.4	214°15.8	8.7′	19°56.6	12.5′	58.9′
22	150°45.3	26.2	228°43.5	8.8′	19°44.1	12.6′	58.9′
23	165°45.3	26.9	243°11.3	8.8′	19°31.5	12.7′	58.9′
	SD = 15.9′	d = 0.8′	SD = 15.9′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°45.4	N15°27.7	257°39.1	8.9′	S19°18.8	12.9′	58.9′
1	195°45.5	28.4	272°07.0	9.0′	19°05.9	12.9′	58.9′
2	210°45.6	29.2	286°35.0	9.0′	18°53.0	13.1′	59.0′
3	225°45.6	·· 29.9	301°03.0	9.1′	18°39.9	13.2′	59.0′
4	240°45.7	30.6	315°31.1	9.2′	18°26.7	13.4′	59.0′
5	255°45.8	31.4	329°59.3	9.2′	18°13.3	13.4′	59.0′
6	270°45.8	N15°32.1	344°27.5	9.3′	S17°59.9	13.5′	59.1′
7	285°45.9	32.9	358°55.8	9.3′	17°46.4	13.7′	59.1′
8	300°46.0	33.6	13°24.1	9.4′	17°32.7	13.7′	59.1′
9	315°46.0	·· 34.3	27°52.5	9.4′	17°19.0	13.9′	59.1′
10	330°46.1	35.1	42°20.9	9.5′	17°05.1	14.0′	59.2′
11	345°46.1	35.8	56°49.4	9.6′	16°51.1	14.1′	59.2′
12	0°46.2	N15°36.6	71°18.0	9.6′	S16°37.0	14.1′	59.2′
13	15°46.3	37.3	85°46.6	9.7′	16°22.9	14.3′	59.2′
14	30°46.3	38.0	100°15.3	9.7′	16°08.6	14.4′	59.3′
15	45°46.4	·· 38.8	114°44.0	9.8′	15°54.2	14.5′	59.3′
16	60°46.5	39.5	129°12.8	9.8′	15°39.7	14.6′	59.3′
17	75°46.5	40.2	143°41.6	9.9′	15°25.1	14.6′	59.3′
18	90°46.6	N15°41.0	158°10.5	9.9′	S15°10.5	14.8′	59.3′
19	105°46.7	41.7	172°39.4	10.0′	14°55.7	14.8′	59.4′
20	120°46.7	42.4	187°08.4	10.0′	14°40.9	15.0′	59.4′
21	135°46.8	·· 43.2	201°37.5	10.1′	14°25.9	15.0′	59.4′
22	150°46.9	43.9	216°06.5	10.1′	14°10.9	15.2′	59.4′
23	165°46.9	44.7	230°35.7	10.2′	13°55.7	15.2′	59.4′
	SD = 15.9′	d = 0.7′	SD = 16.1′				

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

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

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 22-24 66-44%
30	02:47	02:51	11:57	05:14	17:43	
01	02:55	02:58	11:57	06:11	18:38	
02	03:02	03:05	11:57	07:04	19:30	

May 03, 04, 05 UT (Fri., Sat., Sun.)

	Aries	Venus		Mars		Jupiter		Saturn	
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	221°23.2	188°54.2	N11°51.3	219°13.3	S00°26.3	168°57.8	N18°11.1	232°50.1	S06°49.3
1	236°25.6	203°53.7	52.4	234°14.0	25.5	183°59.7	11.2	247°52.4	49.2
2	251°28.1	218°53.2	53.5	249°14.7	24.8	199°01.5	11.4	262°54.6	49.1
3	266°30.5	233°52.8	·· 54.6	264°15.4	·· 24.0	214°03.4	·· 11.5	277°56.9	·· 49.0
4	281°33.0	248°52.3	55.7	279°16.1	23.2	229°05.3	11.7	292°59.1	49.0
5	296°35.5	263°51.8	56.7	294°16.8	22.5	244°07.1	11.8	308°01.4	48.9
6	311°37.9	278°51.3	N11°57.8	309°17.5	S00°21.7	259°09.0	N18°12.0	323°03.7	S06°48.8
7	326°40.4	293°50.8	11°58.9	324°18.2	20.9	274°10.9	12.1	338°05.9	48.7
8	341°42.9	308°50.4	12°00.0	339°18.9	20.2	289°12.7	12.3	353°08.2	48.7
9	356°45.3	323°49.9	·· 01.1	354°19.6	·· 19.4	304°14.6	·· 12.4	8°10.5	·· 48.6
10	11°47.8	338°49.4	02.2	9°20.3	18.6	319°16.5	12.6	23°12.7	48.5
11	26°50.3	353°48.9	03.3	24°21.0	17.9	334°18.3	12.7	38°15.0	48.4
12	41°52.7	8°48.4	N12°04.4	39°21.7	S00°17.1	349°20.2	N18°12.9	53°17.3	S06°48.4
13	56°55.2	23°48.0	05.4	54°22.4	16.3	4°22.1	13.0	68°19.5	48.3
14	71°57.7	38°47.5	06.5	69°23.1	15.6	19°23.9	13.1	83°21.8	48.2
15	87°00.1	53°47.0	·· 07.6	84°23.8	·· 14.8	34°25.8	·· 13.3	98°24.1	·· 48.1
16	102°02.6	68°46.5	08.7	99°24.5	14.0	49°27.7	13.4	113°26.3	48.1
17	117°05.0	83°46.0	09.8	114°25.2	13.3	64°29.5	13.6	128°28.6	48.0
18	132°07.5	98°45.5	N12°10.9	129°25.9	S00°12.5	79°31.4	N18°13.7	143°30.9	S06°47.9
19	147°10.0	113°45.0	11.9	144°26.6	11.7	94°33.3	13.9	158°33.1	47.8
20	162°12.4	128°44.6	13.0	159°27.3	11.0	109°35.1	14.0	173°35.4	47.8
21	177°14.9	143°44.1	·· 14.1	174°28.0	·· 10.2	124°37.0	·· 14.2	188°37.6	·· 47.7
22	192°17.4	158°43.6	15.2	189°28.7	09.4	139°38.9	14.3	203°39.9	47.6
23	207°19.8	173°43.1	16.3	204°29.4	08.7	154°40.7	14.5	218°42.2	47.5
Mer.pass. 09:13		ν -0.5′ d 1.1′		ν 0.7′ d 0.8′		ν 1.9′ d 0.1′		ν 2.3′ d 0.1′	

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	222°22.3	188°42.6	N12°17.4	219°30.1	S00°07.9	169°42.6	N18°14.6	233°44.4	S06°47.5
1	237°24.8	203°42.1	18.4	234°30.8	07.1	184°44.5	14.7	248°46.7	47.4
2	252°27.2	218°41.6	19.5	249°31.5	06.4	199°46.3	14.9	263°49.0	47.3
3	267°29.7	233°41.1	·· 20.6	264°32.2	·· 05.6	214°48.2	·· 15.0	278°51.2	·· 47.3
4	282°32.1	248°40.7	21.7	279°32.9	04.8	229°50.1	15.2	293°53.5	47.2
5	297°34.6	263°40.2	22.7	294°33.6	04.1	244°51.9	15.3	308°55.8	47.1
6	312°37.1	278°39.7	N12°23.8	309°34.3	S00°03.3	259°53.8	N18°15.5	323°58.0	S06°47.0
7	327°39.5	293°39.2	24.9	324°35.0	02.5	274°55.7	15.6	339°00.3	47.0
8	342°42.0	308°38.7	26.0	339°35.7	01.8	289°57.5	15.8	354°02.6	46.9
9	357°44.5	323°38.2	·· 27.0	354°36.4	·· 01.0	304°59.4	·· 15.9	9°04.8	·· 46.8
10	12°46.9	338°37.7	28.1	9°37.1	S00°00.2	320°01.3	16.0	24°07.1	46.7
11	27°49.4	353°37.2	29.2	24°37.8	N00°00.5	335°03.1	16.2	39°09.4	46.7
12	42°51.9	8°36.7	N12°30.3	39°38.5	N00°01.3	350°05.0	N18°16.3	54°11.6	S06°46.6
13	57°54.3	23°36.2	31.3	54°39.2	02.1	5°06.9	16.5	69°13.9	46.5
14	72°56.8	38°35.7	32.4	69°39.9	02.8	20°08.7	16.6	84°16.2	46.4
15	87°59.3	53°35.3	·· 33.5	84°40.6	·· 03.6	35°10.6	·· 16.8	99°18.5	·· 46.4
16	103°01.7	68°34.8	34.6	99°41.3	04.4	50°12.5	16.9	114°20.7	46.3
17	118°04.2	83°34.3	35.6	114°42.0	05.1	65°14.3	17.1	129°23.0	46.2
18	133°06.6	98°33.8	N12°36.7	129°42.7	N00°05.9	80°16.2	N18°17.2	144°25.3	S06°46.1
19	148°09.1	113°33.3	37.8	144°43.4	06.7	95°18.0	17.4	159°27.5	46.1
20	163°11.6	128°32.8	38.8	159°44.1	07.4	110°19.9	17.5	174°29.8	46.0
21	178°14.0	143°32.3	·· 39.9	174°44.8	·· 08.2	125°21.8	·· 17.6	189°32.1	·· 45.9
22	193°16.5	158°31.8	41.0	189°45.5	09.0	140°23.6	17.8	204°34.3	45.8
23	208°19.0	173°31.3	42.0	204°46.2	09.7	155°25.5	17.9	219°36.6	45.8
Mer.pass. 09:09		ν -0.5′ d 1.1′		ν 0.7′ d 0.8′		ν 1.9′ d 0.1′		ν 2.3′ d 0.1′	

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	223°21.4	188°30.8	N12°43.1	219°46.9	N00°10.5	170°27.4	N18°18.1	234°38.9	S06°45.7
1	238°23.9	203°30.3	44.2	234°47.6	11.3	185°29.2	18.2	249°41.1	45.6
2	253°26.4	218°29.8	45.2	249°48.3	12.0	200°31.1	18.4	264°43.4	45.6
3	268°28.8	233°29.3	·· 46.3	264°49.0	·· 12.8	215°33.0	·· 18.5	279°45.7	·· 45.5
4	283°31.3	248°28.8	47.4	279°49.7	13.6	230°34.8	18.7	294°47.9	45.4
5	298°33.8	263°28.3	48.4	294°50.4	14.3	245°36.7	18.8	309°50.2	45.3
6	313°36.2	278°27.8	N12°49.5	309°51.1	N00°15.1	260°38.6	N18°18.9	324°52.5	S06°45.3
7	328°38.7	293°27.3	50.6	324°51.8	15.9	275°40.4	19.1	339°54.8	45.2
8	343°41.1	308°26.8	51.6	339°52.5	16.6	290°42.3	19.2	354°57.0	45.1
9	358°43.6	323°26.3	·· 52.7	354°53.2	·· 17.4	305°44.2	·· 19.4	9°59.3	·· 45.0
10	13°46.1	338°25.8	53.8	9°53.9	18.2	320°46.0	19.5	25°01.6	45.0
11	28°48.5	353°25.3	54.8	24°54.6	18.9	335°47.9	19.7	40°03.8	44.9
12	43°51.0	8°24.8	N12°55.9	39°55.3	N00°19.7	350°49.8	N18°19.8	55°06.1	S06°44.8
13	58°53.5	23°24.3	56.9	54°56.0	20.5	5°51.6	20.0	70°08.4	44.8
14	73°55.9	38°23.8	58.0	69°56.7	21.2	20°53.5	20.1	85°10.6	44.7
15	88°58.4	53°23.3	12°59.1	84°57.4	·· 22.0	35°55.3	·· 20.2	100°12.9	·· 44.6
16	104°00.9	68°22.8	13°00.1	99°58.1	22.8	50°57.2	20.4	115°15.2	44.5
17	119°03.3	83°22.3	01.2	114°58.8	23.5	65°59.1	20.5	130°17.5	44.5
18	134°05.8	98°21.8	N13°02.2	129°59.5	N00°24.3	81°00.9	N18°20.7	145°19.7	S06°44.4
19	149°08.2	113°21.3	03.3	145°00.2	25.1	96°02.8	20.8	160°22.0	44.3
20	164°10.7	128°20.8	04.4	160°00.9	25.8	111°04.7	21.0	175°24.3	44.2
21	179°13.2	143°20.3	·· 05.4	175°01.6	·· 26.6	126°06.5	·· 21.1	190°26.5	·· 44.2
22	194°15.6	158°19.8	06.5	190°02.3	27.3	141°08.4	21.3	205°28.8	44.1
23	209°18.1	173°19.3	07.5	205°03.0	28.1	156°10.3	21.4	220°31.1	44.0
Mer.pass. 09:05		ν -0.5′ d 1.1′		ν 0.7′ d 0.8′		ν 1.9′ d 0.1′		ν 2.3′ d 0.1′	

Stars

	SHA	Dec
Alpheratz	357°35.7	29°13.3
Ankaa	353°08.0	-42°10.4
Schedar	349°32.2	56°40.0
Diphda	348°48.2	-17°51.2
Achernar	335°21.2	-57°06.8
Hamal	327°52.2	23°34.5
Polaris	314°49.4	89°22.0
Acamar	315°12.6	-40°12.5
Menkar	314°07.1	4°11.0
Mirfak	308°29.6	49°56.8
Aldebaran	290°40.6	16°33.4
Rigel	281°04.7	-8°10.5
Capella	280°23.2	46°01.4
Bellatrix	278°23.8	6°22.3
Elnath	278°02.9	28°37.7
Alnilam	275°38.6	-1°11.3
Betelgeuse	270°53.0	7°24.7
Canopus	263°53.0	-52°42.7
Sirius	258°27.0	-16°45.1
Adhara	255°06.5	-29°00.5
Procyon	244°51.6	5°09.7
Pollux	243°18.2	27°58.1
Avior	234°15.1	-59°35.5
Suhail	222°46.8	-43°32.1
Miaplacidus	221°38.4	-69°49.3
Alphard	217°48.3	-8°45.9
Regulus	207°35.0	11°50.9
Dubhe	193°41.3	61°37.4
Denebola	182°25.3	14°26.2
Gienah	175°44.0	-17°40.8
Acrux	173°00.3	-63°14.2
Gacrux	171°51.9	-57°15.2
Alioth	166°13.0	55°49.8
Spica	158°22.6	-11°17.4
Alkaid	152°52.0	49°11.5
Hadar	148°36.2	-60°29.5
Menkent	147°57.9	-36°29.5
Arcturus	145°48.1	19°03.3
Rigil Kent.	139°40.5	-60°56.2
Kochab	137°18.5	74°03.3
Zuben'ubi	136°56.3	-16°08.7
Alphecca	126°03.9	26°37.8
Antares	112°16.2	-26°29.2
Atria	107°10.5	-69°04.2
Sabik	102°03.2	-15°45.4
Shaula	96°10.9	-37°07.2
Rasalhague	95°58.8	12°32.4
Eltanin	90°42.1	51°28.8
Kaus Aust.	83°33.0	-34°22.3
Vega	80°33.4	38°48.1
Nunki	75°48.3	-26°16.0
Altair	62°00.4	8°55.8
Peacock	53°06.5	-56°39.2
Deneb	49°26.2	45°21.7
Enif	33°39.4	9°59.0
Al Na'ir	27°33.8	-46°50.5
Fomalhaut	15°15.3	-29°29.6
Scheat	13°46.0	28°12.6
Markab	13°30.7	15°20.0

May 03 Fri	SHA	Mer.pass
Venus	327°31.0	11:25
Mars	357°50.1	09:23
Jupiter	307°34.6	12:43
Saturn	11°26.9	08:27

May 04 Sat	SHA	Mer.pass
Venus	326°20.3	11:26
Mars	357°07.8	09:22
Jupiter	307°20.3	12:40
Saturn	11°22.2	08:24

May 05 Sun	SHA	Mer.pass
Venus	325°09.4	11:26
Mars	356°25.5	09:20
Jupiter	307°05.9	12:37
Saturn	11°17.4	08:20

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°47.0	N15°45.4	245°04.9	10.2′	S13°40.5	15.3′	59.5′
1	195°47.0	46.1	259°34.1	10.3′	13°25.2	15.4′	59.5′
2	210°47.1	46.8	274°03.4	10.3′	13°09.8	15.4′	59.5′
3	225°47.2	·· 47.6	288°32.7	10.4′	12°54.4	15.6′	59.5′
4	240°47.2	48.3	303°02.1	10.4′	12°38.8	15.6′	59.6′
5	255°47.3	49.0	317°31.5	10.4′	12°23.2	15.7′	59.6′
6	270°47.3	N15°49.8	332°00.9	10.5′	S12°07.5	15.8′	59.6′
7	285°47.4	50.5	346°30.4	10.5′	11°51.7	15.8′	59.6′
8	300°47.5	51.2	0°59.9	10.6′	11°35.9	16.0′	59.6′
9	315°47.5	·· 52.0	15°29.5	10.6′	11°19.9	16.0′	59.7′
10	330°47.6	52.7	29°59.1	10.6′	11°03.9	16.0′	59.7′
11	345°47.6	53.4	44°28.8	10.7′	10°47.9	16.2′	59.7′
12	0°47.7	N15°54.1	58°58.4	10.7′	S10°31.7	16.2′	59.7′
13	15°47.8	54.9	73°28.1	10.7′	10°15.5	16.3′	59.7′
14	30°47.8	55.6	87°57.9	10.8′	09°59.2	16.3′	59.7′
15	45°47.9	·· 56.3	102°27.7	10.8′	09°42.9	16.4′	59.8′
16	60°47.9	57.0	116°57.5	10.8′	09°26.5	16.5′	59.8′
17	75°48.0	57.8	131°27.3	10.9′	09°10.0	16.5′	59.8′
18	90°48.1	N15°58.5	145°57.2	10.9′	S08°53.5	16.5′	59.8′
19	105°48.1	59.2	160°27.1	10.9′	08°37.0	16.7′	59.8′
20	120°48.2	15°59.9	174°57.0	11.0′	08°20.3	16.7′	59.9′
21	135°48.2	16°00.7	189°27.0	11.0′	08°03.6	16.7′	59.9′
22	150°48.3	01.4	203°57.0	11.0′	07°46.9	16.8′	59.9′
23	165°48.3	02.1	218°27.0	11.0′	07°30.1	16.8′	59.9′
	SD = 15.9′	d = 0.7′	SD = 16.2′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°48.4	N16°02.8	232°57.0	11.0′	S07°13.3	16.9′	59.9′
1	195°48.5	03.6	247°27.0	11.1′	06°56.4	17.0′	59.9′
2	210°48.5	04.3	261°57.1	11.1′	06°39.4	16.9′	59.9′
3	225°48.6	·· 05.0	276°27.2	11.1′	06°22.5	17.1′	60.0′
4	240°48.6	05.7	290°57.3	11.1′	06°05.4	17.0′	60.0′
5	255°48.7	06.4	305°27.4	11.1′	05°48.4	17.1′	60.0′
6	270°48.7	N16°07.2	319°57.5	11.1′	S05°31.3	17.2′	60.0′
7	285°48.8	07.9	334°27.7	11.2′	05°14.1	17.2′	60.0′
8	300°48.8	08.6	348°57.8	11.2′	04°56.9	17.2′	60.0′
9	315°48.9	·· 09.3	3°28.0	11.2′	04°39.7	17.2′	60.0′
10	330°48.9	10.0	17°58.2	11.2′	04°22.5	17.3′	60.1′
11	345°49.0	10.7	32°28.4	11.2′	04°05.2	17.3′	60.1′
12	0°49.1	N16°11.5	46°58.6	11.2′	S03°47.9	17.3′	60.1′
13	15°49.1	12.2	61°28.8	11.2′	03°30.6	17.4′	60.1′
14	30°49.2	12.9	75°59.0	11.2′	03°13.2	17.4′	60.1′
15	45°49.2	·· 13.6	90°29.2	11.2′	02°55.8	17.4′	60.1′
16	60°49.3	14.3	104°59.4	11.2′	02°38.4	17.4′	60.1′
17	75°49.3	15.0	119°29.6	11.2′	02°21.0	17.5′	60.1′
18	90°49.4	N16°15.7	133°59.8	11.2′	S02°03.5	17.5′	60.2′
19	105°49.4	16.5	148°30.0	11.2′	01°46.0	17.4′	60.2′
20	120°49.5	17.2	163°00.2	11.2′	01°28.6	17.6′	60.2′
21	135°49.5	·· 17.9	177°30.4	11.2′	01°11.0	17.5′	60.2′
22	150°49.6	18.6	192°00.6	11.2′	00°53.5	17.5′	60.2′
23	165°49.6	19.3	206°30.8	11.2′	00°36.0	17.5′	60.2′
	SD = 15.9′	d = 0.7′	SD = 16.3′				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°49.7	N16°20.0	221°01.0	11.2′	S00°18.5	17.6′	60.2′
1	195°49.7	20.7	235°31.1	11.2′	S00°00.9	17.5′	60.2′
2	210°49.8	21.4	250°01.3	11.1′	N00°16.6	17.6′	60.2′
3	225°49.8	·· 22.1	264°31.4	11.1′	00°34.2	17.5′	60.2′
4	240°49.9	22.8	279°01.6	11.1′	00°51.7	17.6′	60.2′
5	255°49.9	23.6	293°31.7	11.1′	01°09.3	17.5′	60.2′
6	270°50.0	N16°24.3	308°01.8	11.1′	N01°26.8	17.6′	60.3′
7	285°50.0	25.0	322°31.9	11.1′	01°44.4	17.5′	60.3′
8	300°50.1	25.7	337°01.9	11.0′	02°01.9	17.6′	60.3′
9	315°50.1	·· 26.4	351°32.0	11.0′	02°19.5	17.5′	60.3′
10	330°50.2	27.1	6°02.0	11.0′	02°37.0	17.5′	60.3′
11	345°50.2	27.8	20°32.0	11.0′	02°54.5	17.5′	60.3′
12	0°50.3	N16°28.5	35°02.0	11.0′	N03°12.0	17.5′	60.3′
13	15°50.3	29.2	49°32.0	10.9′	03°29.5	17.5′	60.3′
14	30°50.4	29.9	64°01.9	10.9′	03°47.0	17.5′	60.3′
15	45°50.4	·· 30.6	78°31.8	10.9′	04°04.5	17.4′	60.3′
16	60°50.4	31.3	93°01.6	10.8′	04°21.9	17.5′	60.3′
17	75°50.5	32.0	107°31.5	10.8′	04°39.4	17.4′	60.3′
18	90°50.5	N16°32.7	122°01.3	10.8′	N04°56.8	17.3′	60.3′
19	105°50.6	33.4	136°31.1	10.7′	05°14.1	17.4′	60.3′
20	120°50.6	34.1	151°00.8	10.7′	05°31.5	17.3′	60.3′
21	135°50.7	·· 34.8	165°30.5	10.7′	05°48.8	17.3′	60.3′
22	150°50.7	35.5	180°00.2	10.6′	06°06.1	17.2′	60.3′
23	165°50.8	36.2	194°29.8	10.6′	06°23.3	17.3′	60.3′
	SD = 15.9′	d = 0.7′	SD = 16.4′				

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

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

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 33-13%
03	03:08	03:11	11:57	07:56	20:21	
04	03:14	03:16	11:57	08:46	21:10	
05	03:19	03:21	11:57	09:35	22:00	

May 06, 07, 08 UT (Mon., Tue., Wed.)

	Aries	Venus		Mars		Jupiter		Saturn	
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	224°20.6	188°18.8	N13°08.6	220°03.7	N00°28.9	171°12.1	N18°21.5	235°33.4	S06°44.0
1	239°23.0	203°18.2	09.6	235°04.5	29.6	186°14.0	21.7	250°35.6	43.9
2	254°25.5	218°17.7	10.7	250°05.2	30.4	201°15.9	21.8	265°37.9	43.8
3	269°28.0	233°17.2	·· 11.7	265°05.9	·· 31.2	216°17.7	·· 22.0	280°40.2	·· 43.7
4	284°30.4	248°16.7	12.8	280°06.6	31.9	231°19.6	22.1	295°42.4	43.7
5	299°32.9	263°16.2	13.8	295°07.3	32.7	246°21.5	22.3	310°44.7	43.6
6	314°35.4	278°15.7	N13°14.9	310°08.0	N00°33.5	261°23.3	N18°22.4	325°47.0	S06°43.5
7	329°37.8	293°15.2	15.9	325°08.7	34.2	276°25.2	22.5	340°49.3	43.5
8	344°40.3	308°14.7	17.0	340°09.4	35.0	291°27.0	22.7	355°51.5	43.4
9	359°42.7	323°14.2	·· 18.0	355°10.1	·· 35.8	306°28.9	·· 22.8	10°53.8	·· 43.3
10	14°45.2	338°13.7	19.1	10°10.8	36.5	321°30.8	23.0	25°56.1	43.2
11	29°47.7	353°13.2	20.1	25°11.5	37.3	336°32.6	23.1	40°58.3	43.2
12	44°50.1	8°12.6	N13°21.2	40°12.2	N00°38.1	351°34.5	N18°23.3	56°00.6	S06°43.1
13	59°52.6	23°12.1	22.2	55°12.9	38.8	6°36.4	23.4	71°02.9	43.0
14	74°55.1	38°11.6	23.3	70°13.6	39.6	21°38.2	23.6	86°05.2	43.0
15	89°57.5	53°11.1	·· 24.3	85°14.3	·· 40.4	36°40.1	·· 23.7	101°07.4	·· 42.9
16	105°00.0	68°10.6	25.4	100°15.0	41.1	51°42.0	23.8	116°09.7	42.8
17	120°02.5	83°10.1	26.4	115°15.7	41.9	66°43.8	24.0	131°12.0	42.7
18	135°04.9	98°09.6	N13°27.5	130°16.4	N00°42.6	81°45.7	N18°24.1	146°14.3	S06°42.7
19	150°07.4	113°09.1	28.5	145°17.1	43.4	96°47.5	24.3	161°16.5	42.6
20	165°09.8	128°08.5	29.6	160°17.8	44.2	111°49.4	24.4	176°18.8	42.5
21	180°12.3	143°08.0	·· 30.6	175°18.5	·· 44.9	126°51.3	·· 24.6	191°21.1	·· 42.5
22	195°14.8	158°07.5	31.6	190°19.2	45.7	141°53.1	24.7	206°23.4	42.4
23	210°17.2	173°07.0	32.7	205°19.9	46.5	156°55.0	24.8	221°25.6	42.3
Mer.pass. 09:01		ν -0.5′	d 1.1′	ν 0.7′	d 0.8′	ν 1.9′	d 0.1′	ν 2.3′	d 0.1′
		m -3.91		m 1.11		m -2.00		m 1.07	

Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	225°19.7	188°06.5	N13°33.7	220°20.6	N00°47.2	171°56.9	N18°25.0	236°27.9	S06°42.2
1	240°22.2	203°06.0	34.8	235°21.3	48.0	186°58.7	25.1	251°30.2	42.2
2	255°24.6	218°05.4	35.8	250°22.0	48.8	202°00.6	25.3	266°32.5	42.1
3	270°27.1	233°04.9	·· 36.8	265°22.7	·· 49.5	217°02.4	·· 25.4	281°34.7	·· 42.0
4	285°29.6	248°04.4	37.9	280°23.4	50.3	232°04.3	25.6	296°37.0	42.0
5	300°32.0	263°03.9	38.9	295°24.1	51.1	247°06.2	25.7	311°39.3	41.9
6	315°34.5	278°03.4	N13°40.0	310°24.8	N00°51.8	262°08.0	N18°25.8	326°41.6	S06°41.8
7	330°37.0	293°02.9	41.0	325°25.5	52.6	277°09.9	26.0	341°43.8	41.7
8	345°39.4	308°02.3	42.0	340°26.3	53.3	292°11.8	26.1	356°46.1	41.7
9	0°41.9	323°01.8	·· 43.1	355°27.0	·· 54.1	307°13.6	·· 26.3	11°48.4	·· 41.6
10	15°44.3	338°01.3	44.1	10°27.7	54.9	322°15.5	26.4	26°50.7	41.5
11	30°46.8	353°00.8	45.1	25°28.4	55.6	337°17.4	26.6	41°52.9	41.5
12	45°49.3	8°00.2	N13°46.2	40°29.1	N00°56.4	352°19.2	N18°26.7	56°55.2	S06°41.4
13	60°51.7	22°59.7	47.2	55°29.8	57.2	7°21.1	26.8	71°57.5	41.3
14	75°54.2	37°59.2	48.2	70°30.5	57.9	22°22.9	27.0	86°59.8	41.3
15	90°56.7	52°58.7	·· 49.3	85°31.2	·· 58.7	37°24.8	·· 27.1	102°02.0	·· 41.2
16	105°59.1	67°58.2	50.3	100°31.9	00°59.5	52°26.7	27.3	117°04.3	41.1
17	121°01.6	82°57.6	51.3	115°32.6	01°00.2	67°28.5	27.4	132°06.6	41.0
18	136°04.1	97°57.1	N13°52.4	130°33.3	N01°01.0	82°30.4	N18°27.6	147°08.9	S06°41.0
19	151°06.5	112°56.6	53.4	145°34.0	01.7	97°32.3	27.7	162°11.1	40.9
20	166°09.0	127°56.1	54.4	160°34.7	02.5	112°34.1	27.8	177°13.4	40.8
21	181°11.5	142°55.5	·· 55.5	175°35.4	·· 03.3	127°36.0	·· 28.0	192°15.7	·· 40.8
22	196°13.9	157°55.0	56.5	190°36.1	04.0	142°37.8	28.1	207°18.0	40.7
23	211°16.4	172°54.5	57.5	205°36.8	04.8	157°39.7	28.3	222°20.2	40.6
Mer.pass. 08:57		ν -0.5′	d 1.0′	ν 0.7′	d 0.8′	ν 1.9′	d 0.1′	ν 2.3′	d 0.1′
		m -3.91		m 1.10		m -2.00		m 1.07	

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	226°18.8	187°54.0	N13°58.5	220°37.5	N01°05.6	172°41.6	N18°28.4	237°22.5	S06°40.6
1	241°21.3	202°53.4	13°59.6	235°38.2	06.3	187°43.4	28.6	252°24.8	40.5
2	256°23.8	217°52.9	14°00.6	250°38.9	07.1	202°45.3	28.7	267°27.1	40.4
3	271°26.2	232°52.4	·· 01.6	265°39.6	·· 07.9	217°47.2	·· 28.8	282°29.4	·· 40.3
4	286°28.7	247°51.8	02.6	280°40.3	08.6	232°49.0	29.0	297°31.6	40.3
5	301°31.2	262°51.3	03.7	295°41.0	09.4	247°50.9	29.1	312°33.9	40.2
6	316°33.6	277°50.8	N14°04.7	310°41.7	N01°10.1	262°52.7	N18°29.3	327°36.2	S06°40.1
7	331°36.1	292°50.3	05.7	325°42.4	10.9	277°54.6	29.4	342°38.5	40.1
8	346°38.6	307°49.7	06.7	340°43.2	11.7	292°56.5	29.5	357°40.7	40.0
9	1°41.0	322°49.2	·· 07.8	355°43.9	·· 12.4	307°58.3	·· 29.7	12°43.0	·· 39.9
10	16°43.5	337°48.7	08.8	10°44.6	13.2	323°00.2	29.8	27°45.3	39.9
11	31°46.0	352°48.1	09.8	25°45.3	14.0	338°02.1	30.0	42°47.6	39.8
12	46°48.4	7°47.6	N14°10.8	40°46.0	N01°14.7	353°03.9	N18°30.1	57°49.9	S06°39.7
13	61°50.9	22°47.1	11.8	55°46.7	15.5	8°05.8	30.3	72°52.1	39.7
14	76°53.3	37°46.5	12.9	70°47.4	16.2	23°07.6	30.4	87°54.4	39.6
15	91°55.8	52°46.0	·· 13.9	85°48.1	·· 17.0	38°09.5	·· 30.5	102°56.7	·· 39.5
16	106°58.3	67°45.5	14.9	100°48.8	17.8	53°11.4	30.7	117°59.0	39.4
17	122°00.7	82°44.9	15.9	115°49.5	18.5	68°13.2	30.8	133°01.2	39.4
18	137°03.2	97°44.4	N14°16.9	130°50.2	N01°19.3	83°15.1	N18°31.0	148°03.5	S06°39.3
19	152°05.7	112°43.9	18.0	145°50.9	20.1	98°16.9	31.1	163°05.8	39.2
20	167°08.1	127°43.3	19.0	160°51.6	20.8	113°18.8	31.3	178°08.1	39.2
21	182°10.6	142°42.8	·· 20.0	175°52.3	·· 21.6	128°20.7	·· 31.4	193°10.4	·· 39.1
22	197°13.1	157°42.3	21.0	190°53.0	22.3	143°22.5	31.5	208°12.6	39.0
23	212°15.5	172°41.7	22.0	205°53.7	23.1	158°24.4	31.7	223°14.9	39.0
Mer.pass. 08:53		ν -0.5′	d 1.0′	ν 0.7′	d 0.8′	ν 1.9′	d 0.1′	ν 2.3′	d 0.1′
		m -3.91		m 1.10		m -2.00		m 1.07	

Stars

	SHA	Dec
Alpheratz	357°35.7	29°13.3
Ankaa	353°08.0	-42°10.4
Schedar	349°32.2	56°40.0
Diphda	348°48.2	-17°51.2
Achernar	335°21.1	-57°06.7
Hamal	327°52.2	23°34.5
Polaris	314°49.3	89°22.0
Acamar	315°12.6	-40°12.5
Menkar	314°07.1	4°11.0
Mirfak	308°29.6	49°56.8
Aldebaran	290°40.6	16°33.4
Rigel	281°04.7	-8°10.5
Capella	280°23.2	46°01.4
Bellatrix	278°23.8	6°22.3
Elnath	278°02.9	28°37.7
Alnilam	275°38.6	-1°11.2
Betelgeuse	270°53.0	7°24.7
Canopus	263°53.0	-52°42.7
Sirius	258°27.0	-16°45.1
Adhara	255°06.5	-29°00.5
Procyon	244°51.6	5°09.7
Pollux	243°18.2	27°58.1
Avior	234°15.2	-59°35.5
Suhail	222°46.8	-43°32.1
Miaplacidus	221°38.5	-69°49.3
Alphard	217°48.3	-8°45.9
Regulus	207°35.0	11°50.9
Dubhe	193°41.4	61°37.4
Denebola	182°25.3	14°26.2
Gienah	175°44.0	-17°40.8
Acrux	173°00.3	-63°14.2
Gacrux	171°51.9	-57°15.2
Alioth	166°13.0	55°49.8
Spica	158°22.6	-11°17.4
Alkaid	152°52.0	49°11.5
Hadar	148°36.2	-60°29.5
Menkent	147°57.9	-36°29.5
Arcturus	145°48.1	19°03.3
Rigil Kent.	139°40.5	-60°56.2
Kochab	137°18.5	74°03.3
Zuben'ubi	136°56.3	-16°08.7
Alphecca	126°03.9	26°37.8
Antares	112°16.2	-26°29.2
Atria	107°10.5	-69°04.2
Sabik	102°03.2	-15°45.4
Shaula	96°10.8	-37°07.3
Rasalhague	95°58.8	12°32.4
Eltanin	90°42.1	51°28.8
Kaus Aust.	83°33.0	-34°22.3
Vega	80°33.4	38°48.1
Nunki	75°48.3	-26°16.0
Altair	62°00.4	8°55.8
Peacock	53°06.5	-56°39.2
Deneb	49°26.1	45°21.7
Enif	33°39.4	9°59.0
Al Na'ir	27°33.7	-46°50.5
Fomalhaut	15°15.3	-29°29.6
Scheat	13°46.0	28°12.6
Markab	13°30.6	15°20.0

May 06 Mon	SHA	Mer.pass
Venus	323°58.2	11:27
Mars	355°43.2	09:19
Jupiter	306°51.6	12:34
Saturn	11°12.8	08:17

May 07 Tue	SHA	Mer.pass
Venus	322°46.8	11:28
Mars	355°00.9	09:18
Jupiter	306°37.2	12:31
Saturn	11°08.2	08:13

May 08 Wed	SHA	Mer.pass
Venus	321°35.1	11:29
Mars	354°18.7	09:17
Jupiter	306°22.7	12:28
Saturn	11°03.7	08:09

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°50.8	N16°36.9	208°59.4	10.6′	N06°40.6	17.2′	60.3′
1	195°50.9	37.6	223°29.0	10.5′	06°57.8	17.1′	60.3′
2	210°50.9	38.3	237°58.5	10.5′	07°14.9	17.1′	60.3′
3	225°50.9	·· 39.0	252°28.0	10.4′	07°32.0	17.1′	60.3′
4	240°51.0	39.7	266°57.4	10.4′	07°49.1	17.0′	60.3′
5	255°51.0	40.4	281°26.8	10.3′	08°06.1	17.0′	60.3′
6	270°51.1	N16°41.1	295°56.1	10.3′	N08°23.1	16.9′	60.3′
7	285°51.1	41.8	310°25.4	10.2′	08°40.0	16.9′	60.3′
8	300°51.2	42.5	324°54.7	10.2′	08°56.9	16.8′	60.3′
9	315°51.2	·· 43.2	339°23.9	10.1′	09°13.7	16.8′	60.3′
10	330°51.2	43.9	353°53.0	10.1′	09°30.5	16.7′	60.3′
11	345°51.3	44.6	8°22.1	10.0′	09°47.2	16.7′	60.3′
12	0°51.3	N16°45.3	22°51.1	10.0′	N10°03.9	16.6′	60.3′
13	15°51.4	46.0	37°20.1	9.9′	10°20.5	16.6′	60.3′
14	30°51.4	46.7	51°49.1	9.9′	10°37.1	16.4′	60.3′
15	45°51.4	·· 47.4	66°18.0	9.8′	10°53.5	16.5′	60.2′
16	60°51.5	48.0	80°46.8	9.8′	11°10.0	16.3′	60.2′
17	75°51.5	48.7	95°15.6	9.7′	11°26.3	16.3′	60.2′
18	90°51.6	N16°49.4	109°44.3	9.7′	N11°42.6	16.2′	60.2′
19	105°51.6	50.1	124°12.9	9.6′	11°58.8	16.2′	60.2′
20	120°51.6	50.8	138°41.5	9.5′	12°15.0	16.0′	60.2′
21	135°51.7	·· 51.5	153°10.1	9.5′	12°31.0	16.0′	60.2′
22	150°51.7	52.2	167°38.5	9.4′	12°47.0	16.0′	60.2′
23	165°51.8	52.9	182°06.9	9.4′	13°03.0	15.8′	60.2′
	SD = 15.8′	d = 0.7′	SD = 16.4′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°51.8	N16°53.6	196°35.3	9.3′	N13°18.8	15.8′	60.2′
1	195°51.8	54.2	211°03.6	9.2′	13°34.6	15.6′	60.2′
2	210°51.9	54.9	225°31.8	9.2′	13°50.2	15.6′	60.1′
3	225°51.9	·· 55.6	240°00.0	9.1′	14°05.8	15.5′	60.1′
4	240°51.9	56.3	254°28.1	9.0′	14°21.3	15.4′	60.1′
5	255°52.0	57.0	268°56.1	9.0′	14°36.7	15.4′	60.1′
6	270°52.0	N16°57.7	283°24.0	8.9′	N14°52.1	15.2′	60.1′
7	285°52.1	58.4	297°51.9	8.8′	15°07.3	15.1′	60.1′
8	300°52.1	59.0	312°19.8	8.8′	15°22.4	15.1′	60.1′
9	315°52.1	16°59.7	326°47.5	8.7′	15°37.5	14.9′	60.0′
10	330°52.2	17°00.4	341°15.2	8.6′	15°52.4	14.9′	60.0′
11	345°52.2	01.1	355°42.8	8.5′	16°07.3	14.7′	60.0′
12	0°52.2	N17°01.8	10°10.4	8.5′	N16°22.0	14.6′	60.0′
13	15°52.3	02.4	24°37.9	8.4′	16°36.6	14.6′	60.0′
14	30°52.3	03.1	39°05.3	8.3′	16°51.2	14.4′	60.0′
15	45°52.3	·· 03.8	53°32.6	8.3′	17°05.6	14.3′	60.0′
16	60°52.4	04.5	67°59.9	8.2′	17°19.9	14.2′	59.9′
17	75°52.4	05.2	82°27.1	8.1′	17°34.1	14.1′	59.9′
18	90°52.4	N17°05.8	96°54.2	8.1′	N17°48.2	14.0′	59.9′
19	105°52.5	06.5	111°21.2	8.0′	18°02.2	13.8′	59.9′
20	120°52.5	07.2	125°48.2	7.9′	18°16.0	13.8′	59.9′
21	135°52.5	·· 07.9	140°15.1	7.8′	18°29.8	13.6′	59.8′
22	150°52.6	08.6	154°42.0	7.8′	18°43.4	13.5′	59.8′
23	165°52.6	09.2	169°08.7	7.7′	18°56.9	13.4′	59.8′
	SD = 15.8′	d = 0.7′	SD = 16.4′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°52.6	N17°09.9	183°35.4	7.6′	N19°10.3	13.2′	59.8′
1	195°52.7	10.6	198°02.0	7.5′	19°23.5	13.1′	59.8′
2	210°52.7	11.3	212°28.6	7.5′	19°36.6	13.0′	59.7′
3	225°52.7	·· 11.9	226°55.0	7.4′	19°49.6	12.9′	59.7′
4	240°52.8	12.6	241°21.4	7.3′	20°02.5	12.7′	59.7′
5	255°52.8	13.3	255°47.8	7.3′	20°15.2	12.6′	59.7′
6	270°52.8	N17°14.0	270°14.0	7.2′	N20°27.8	12.5′	59.7′
7	285°52.9	14.6	284°40.2	7.1′	20°40.3	12.3′	59.6′
8	300°52.9	15.3	299°06.3	7.0′	20°52.6	12.2′	59.6′
9	315°52.9	·· 16.0	313°32.4	7.0′	21°04.8	12.1′	59.6′
10	330°53.0	16.6	327°58.4	6.9′	21°16.9	11.9′	59.6′
11	345°53.0	17.3	342°24.3	6.8′	21°28.8	11.8′	59.5′
12	0°53.0	N17°18.0	356°50.1	6.8′	N21°40.6	11.6′	59.5′
13	15°53.0	18.6	11°15.9	6.7′	21°52.2	11.5′	59.5′
14	30°53.1	19.3	25°41.6	6.6′	22°03.7	11.3′	59.5′
15	45°53.1	·· 20.0	40°07.2	6.6′	22°15.0	11.2′	59.4′
16	60°53.1	20.7	54°32.8	6.5′	22°26.2	11.0′	59.4′
17	75°53.2	21.3	68°58.3	6.4′	22°37.2	10.9′	59.4′
18	90°53.2	N17°22.0	83°23.7	6.4′	N22°48.1	10.7′	59.4′
19	105°53.2	22.7	97°49.1	6.3′	22°58.8	10.6′	59.3′
20	120°53.2	23.3	112°14.4	6.2′	23°09.4	10.4′	59.3′
21	135°53.3	·· 24.0	126°39.6	6.2′	23°19.8	10.3′	59.3′
22	150°53.3	24.6	141°04.8	6.1′	23°30.1	10.1′	59.3′
23	165°53.3	25.3	155°30.0	6.1′	23°40.2	9.9′	59.2′
	SD = 15.8′	d = 0.7′	SD = 16.3′				

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

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

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 28-0 6-0%
06	03:23	03:25	11:57	10:25	22:51	
07	03:27	03:29	11:57	11:18	23:45	
08	03:31	03:32	11:56	12:13	–:–	

May 09, 10, 11 UT (Thu., Fri., Sat.)

	Aries	Venus		Mars		Jupiter		Saturn	
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	227°18.0	187°41.2	N14°23.0	220°54.4	N01°23.9	173°26.3	N18°31.8	238°17.2	S06°38.9
1	242°20.4	202°40.7	24.0	235°55.1	24.6	188°28.1	32.0	253°19.5	38.8
2	257°22.9	217°40.1	25.0	250°55.8	25.4	203°30.0	32.1	268°21.8	38.8
3	272°25.4	232°39.6	·· 26.1	265°56.6	·· 26.1	218°31.8	·· 32.2	283°24.0	·· 38.7
4	287°27.8	247°39.0	27.1	280°57.3	26.9	233°33.7	32.4	298°26.3	38.6
5	302°30.3	262°38.5	28.1	295°58.0	27.7	248°35.6	32.5	313°28.6	38.6
6	317°32.8	277°38.0	N14°29.1	310°58.7	N01°28.4	263°37.4	N18°32.7	328°30.9	S06°38.5
7	332°35.2	292°37.4	30.1	325°59.4	29.2	278°39.3	32.8	343°33.2	38.4
8	347°37.7	307°36.9	31.1	341°00.1	30.0	293°41.1	33.0	358°35.4	38.4
9	2°40.2	322°36.3	·· 32.1	356°00.8	·· 30.7	308°43.0	·· 33.1	13°37.7	·· 38.3
10	17°42.6	337°35.8	33.1	11°01.5	31.5	323°44.9	33.2	28°40.0	38.2
11	32°45.1	352°35.3	34.1	26°02.2	32.2	338°46.7	33.4	43°42.3	38.1
12	47°47.6	7°34.7	N14°35.1	41°02.9	N01°33.0	353°48.6	N18°33.5	58°44.6	S06°38.1
13	62°50.0	22°34.2	36.1	56°03.6	33.8	8°50.5	33.7	73°46.9	38.0
14	77°52.5	37°33.6	37.1	71°04.3	34.5	23°52.3	33.8	88°49.1	37.9
15	92°54.9	52°33.1	·· 38.1	86°05.0	·· 35.3	38°54.2	·· 33.9	103°51.4	·· 37.9
16	107°57.4	67°32.5	39.2	101°05.7	36.0	53°56.0	34.1	118°53.7	37.8
17	122°59.9	82°32.0	40.2	116°06.4	36.8	68°57.9	34.2	133°56.0	37.7
18	138°02.3	97°31.5	N14°41.2	131°07.1	N01°37.6	83°59.8	N18°34.4	148°58.3	S06°37.7
19	153°04.8	112°30.9	42.2	146°07.8	38.3	99°01.6	34.5	164°00.5	37.6
20	168°07.3	127°30.4	43.2	161°08.5	39.1	114°03.5	34.6	179°02.8	37.5
21	183°09.7	142°29.8	·· 44.2	176°09.3	·· 39.9	129°05.3	·· 34.8	194°05.1	·· 37.5
22	198°12.2	157°29.3	45.2	191°10.0	40.6	144°07.2	34.9	209°07.4	37.4
23	213°14.7	172°28.7	46.2	206°10.7	41.4	159°09.1	35.1	224°09.7	37.3
Mer.pass. 08:49		ν -0.5′	d 1.0′	m -3.91	ν 0.7′	d 0.8′	m 1.10	ν 1.9′	d 0.1′ m -2.00	ν 2.3′	d 0.1′ m 1.06

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	228°17.1	187°28.2	N14°47.2	221°11.4	N01°42.1	174°10.9	N18°35.2	239°12.0	S06°37.3
1	243°19.6	202°27.6	48.2	236°12.1	42.9	189°12.8	35.4	254°14.2	37.2
2	258°22.1	217°27.1	49.1	251°12.8	43.7	204°14.6	35.5	269°16.5	37.1
3	273°24.5	232°26.5	·· 50.1	266°13.5	·· 44.4	219°16.5	·· 35.6	284°18.8	·· 37.1
4	288°27.0	247°26.0	51.1	281°14.2	45.2	234°18.4	35.8	299°21.1	37.0
5	303°29.4	262°25.4	52.1	296°14.9	45.9	249°20.2	35.9	314°23.4	36.9
6	318°31.9	277°24.9	N14°53.1	311°15.6	N01°46.7	264°22.1	N18°36.1	329°25.7	S06°36.9
7	333°34.4	292°24.3	54.1	326°16.3	47.5	279°23.9	36.2	344°27.9	36.8
8	348°36.8	307°23.8	55.1	341°17.0	48.2	294°25.8	36.3	359°30.2	36.7
9	3°39.3	322°23.2	·· 56.1	356°17.7	·· 49.0	309°27.7	·· 36.5	14°32.5	·· 36.7
10	18°41.8	337°22.7	57.1	11°18.4	49.7	324°29.5	36.6	29°34.8	36.6
11	33°44.2	352°22.1	58.1	26°19.1	50.5	339°31.4	36.8	44°37.1	36.5
12	48°46.7	7°21.6	N14°59.1	41°19.8	N01°51.3	354°33.3	N18°36.9	59°39.4	S06°36.5
13	63°49.2	22°21.0	15°00.1	56°20.6	52.0	9°35.1	37.0	74°41.6	36.4
14	78°51.6	37°20.5	01.1	71°21.3	52.8	24°37.0	37.2	89°43.9	36.3
15	93°54.1	52°19.9	·· 02.1	86°22.0	·· 53.5	39°38.8	·· 37.3	104°46.2	·· 36.3
16	108°56.6	67°19.4	03.0	101°22.7	54.3	54°40.7	37.5	119°48.5	36.2
17	123°59.0	82°18.8	04.0	116°23.4	55.1	69°42.6	37.6	134°50.8	36.1
18	139°01.5	97°18.3	N15°05.0	131°24.1	N01°55.8	84°44.4	N18°37.7	149°53.1	S06°36.1
19	154°03.9	112°17.7	06.0	146°24.8	56.6	99°46.3	37.9	164°55.3	36.0
20	169°06.4	127°17.1	07.0	161°25.5	57.3	114°48.1	38.0	179°57.6	35.9
21	184°08.9	142°16.6	·· 08.0	176°26.2	·· 58.1	129°50.0	·· 38.2	194°59.9	·· 35.9
22	199°11.3	157°16.0	09.0	191°26.9	58.9	144°51.9	38.3	210°02.2	35.8
23	214°13.8	172°15.5	09.9	206°27.6	59.6	159°53.7	38.4	225°04.5	35.7
Mer.pass. 08:45		ν -0.5′	d 1.0′	m -3.92	ν 0.7′	d 0.8′	m 1.10	ν 1.9′	d 0.1′ m -2.00	ν 2.3′	d 0.1′ m 1.06

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	229°16.3	187°14.9	N15°10.9	221°28.3	N02°00.4	174°55.6	N18°38.6	240°06.8	S06°35.7
1	244°18.7	202°14.4	11.9	236°29.0	01.1	189°57.4	38.7	255°09.1	35.6
2	259°21.2	217°13.8	12.9	251°29.7	01.9	204°59.3	38.9	270°11.3	35.5
3	274°23.7	232°13.2	·· 13.9	266°30.4	·· 02.6	220°01.2	·· 39.0	285°13.6	·· 35.5
4	289°26.1	247°12.7	14.8	281°31.2	03.4	235°03.0	39.1	300°15.9	35.4
5	304°28.6	262°12.1	15.8	296°31.9	04.2	250°04.9	39.3	315°18.2	35.3
6	319°31.1	277°11.6	N15°16.8	311°32.6	N02°04.9	265°06.7	N18°39.4	330°20.5	S06°35.3
7	334°33.5	292°11.0	17.8	326°33.3	05.7	280°08.6	39.6	345°22.8	35.2
8	349°36.0	307°10.4	18.8	341°34.0	06.4	295°10.5	39.7	0°25.1	35.1
9	4°38.4	322°09.9	·· 19.7	356°34.7	·· 07.2	310°12.3	·· 39.8	15°27.3	·· 35.1
10	19°40.9	337°09.3	20.7	11°35.4	08.0	325°14.2	40.0	30°29.6	35.0
11	34°43.4	352°08.7	21.7	26°36.1	08.7	340°16.0	40.1	45°31.9	34.9
12	49°45.8	7°08.2	N15°22.7	41°36.8	N02°09.5	355°17.9	N18°40.3	60°34.2	S06°34.9
13	64°48.3	22°07.6	23.6	56°37.5	10.2	10°19.8	40.4	75°36.5	34.8
14	79°50.8	37°07.1	24.6	71°38.2	11.0	25°21.6	40.5	90°38.8	34.8
15	94°53.2	52°06.5	·· 25.6	86°38.9	·· 11.8	40°23.5	·· 40.7	105°41.1	·· 34.7
16	109°55.7	67°05.9	26.6	101°39.6	12.5	55°25.3	40.8	120°43.4	34.6
17	124°58.2	82°05.4	27.5	116°40.3	13.3	70°27.2	41.0	135°45.6	34.6
18	140°00.6	97°04.8	N15°28.5	131°41.1	N02°14.0	85°29.0	N18°41.1	150°47.9	S06°34.5
19	155°03.1	112°04.2	29.5	146°41.8	14.8	100°30.9	41.2	165°50.2	34.4
20	170°05.6	127°03.7	30.4	161°42.5	15.5	115°32.8	41.4	180°52.5	34.4
21	185°08.0	142°03.1	·· 31.4	176°43.2	·· 16.3	130°34.6	·· 41.5	195°54.8	·· 34.3
22	200°10.5	157°02.5	32.4	191°43.9	17.1	145°36.5	41.7	210°57.1	34.2
23	215°12.9	172°02.0	33.3	206°44.6	17.8	160°38.3	41.8	225°59.4	34.2
Mer.pass. 08:41		ν -0.6′	d 1.0′	m -3.92	ν 0.7′	d 0.8′	m 1.09	ν 1.9′	d 0.1′ m -2.00	ν 2.3′	d 0.1′ m 1.06

Stars

	SHA	Dec
Alpheratz	357°35.6	29°13.3
Ankaa	353°08.0	-42°10.4
Schedar	349°32.2	56°40.0
Diphda	348°48.1	-17°51.2
Achernar	335°21.1	-57°06.7
Hamal	327°52.2	23°34.5
Polaris	314°48.8	89°22.0
Acamar	315°12.6	-40°12.5
Menkar	314°07.1	4°11.0
Mirfak	308°29.6	49°56.8
Aldebaran	290°40.6	16°33.4
Rigel	281°04.7	-8°10.5
Capella	280°23.2	46°01.4
Bellatrix	278°23.8	6°22.3
Elnath	278°02.9	28°37.7
Alnilam	275°38.6	-1°11.2
Betelgeuse	270°53.0	7°24.7
Canopus	263°53.0	-52°42.7
Sirius	258°27.0	-16°45.1
Adhara	255°06.6	-29°00.5
Procyon	244°51.6	5°09.7
Pollux	243°18.2	27°58.1
Avior	234°15.2	-59°35.5
Suhail	222°46.8	-43°32.1
Miaplacidus	221°38.5	-69°49.3
Alphard	217°48.3	-8°45.9
Regulus	207°35.0	11°50.9
Dubhe	193°41.4	61°37.4
Denebola	182°25.3	14°26.2
Gienah	175°44.0	-17°40.8
Acrux	173°00.3	-63°14.3
Gacrux	171°51.9	-57°15.2
Alioth	166°13.0	55°49.8
Spica	158°22.6	-11°17.4
Alkaid	152°52.0	49°11.6
Hadar	148°36.2	-60°29.5
Menkent	147°57.9	-36°29.5
Arcturus	145°48.1	19°03.3
Rigil Kent.	139°40.5	-60°56.2
Kochab	137°18.6	74°03.3
Zuben'ubi	136°56.3	-16°08.7
Alphecca	126°03.9	26°37.9
Antares	112°16.2	-26°29.2
Atria	107°10.5	-69°04.2
Sabik	102°03.1	-15°45.4
Shaula	96°10.8	-37°07.3
Rasalhague	95°58.8	12°32.4
Eltanin	90°42.0	51°28.9
Kaus Aust.	83°33.0	-34°22.3
Vega	80°33.3	38°48.1
Nunki	75°48.3	-26°16.0
Altair	62°00.4	8°55.8
Peacock	53°06.5	-56°39.2
Deneb	49°26.1	45°21.7
Enif	33°39.4	9°59.0
Al Na'ir	27°33.7	-46°50.4
Fomalhaut	15°15.3	-29°29.6
Scheat	13°45.9	28°12.6
Markab	13°30.6	15°20.0

May 09 Thu	SHA	Mer.pass
Venus	320°23.2	11:30
Mars	353°36.4	09:16
Jupiter	306°08.3	12:25
Saturn	10°59.2	08:06

May 10 Fri	SHA	Mer.pass
Venus	319°11.1	11:31
Mars	352°54.2	09:15
Jupiter	305°53.8	12:22
Saturn	10°54.8	08:02

May 11 Sat	SHA	Mer.pass
Venus	317°58.6	11:31
Mars	352°12.1	09:14
Jupiter	305°39.3	12:19
Saturn	10°50.5	07:58

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.1241 sec ΔT = TT-UT1 = +69.0599 sec

2024 May 09 to May. 11 UT

h	Sun		Moon				
Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°53.3	N17°26.0	169°55.0	6.0′	N23°50.1	9.8′	59.2′
1	195°53.4	26.6	184°20.0	6.0′	23°59.9	9.6′	59.2′
2	210°53.4	27.3	198°45.0	5.9′	24°09.5	9.5′	59.1′
3	225°53.4	·· 28.0	213°09.9	5.8′	24°19.0	9.3′	59.1′
4	240°53.4	28.6	227°34.7	5.8′	24°28.3	9.1′	59.1′
5	255°53.5	29.3	241°59.5	5.7′	24°37.4	9.0′	59.1′
6	270°53.5	N17°29.9	256°24.2	5.7′	N24°46.4	8.8′	59.0′
7	285°53.5	30.6	270°48.9	5.6′	24°55.2	8.6′	59.0′
8	300°53.5	31.3	285°13.5	5.6′	25°03.8	8.5′	59.0′
9	315°53.6	·· 31.9	299°38.1	5.5′	25°12.3	8.3′	58.9′
10	330°53.6	32.6	314°02.7	5.5′	25°20.6	8.1′	58.9′
11	345°53.6	33.2	328°27.2	5.5′	25°28.7	7.9′	58.9′
12	0°53.6	N17°33.9	342°51.6	5.4′	N25°36.6	7.8′	58.8′
13	15°53.7	34.6	357°16.0	5.4′	25°44.4	7.6′	58.8′
14	30°53.7	35.2	11°40.4	5.3′	25°52.0	7.4′	58.8′
15	45°53.7	·· 35.9	26°04.7	5.3′	25°59.4	7.3′	58.7′
16	60°53.7	36.5	40°29.0	5.3′	26°06.7	7.1′	58.7′
17	75°53.8	37.2	54°53.3	5.2′	26°13.8	6.8′	58.7′
18	90°53.8	N17°37.8	69°17.5	5.2′	N26°20.6	6.8′	58.6′
19	105°53.8	38.5	83°41.7	5.2′	26°27.4	6.5′	58.6′
20	120°53.8	39.1	98°05.9	5.1′	26°33.9	6.4′	58.6′
21	135°53.8	·· 39.8	112°30.0	5.1′	26°40.3	6.2′	58.6′
22	150°53.9	40.4	126°54.1	5.1′	26°46.5	6.0′	58.5′
23	165°53.9	41.1	141°18.2	5.1′	26°52.5	5.8′	58.5′
	SD = 15.8′	d = 0.7′	SD = 16.1′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°53.9	N17°41.7	155°42.3	5.1′	N26°58.3	5.6′	58.5′
1	195°53.9	42.4	170°06.4	5.0′	27°03.9	5.5′	58.4′
2	210°53.9	43.0	184°30.4	5.0′	27°09.4	5.3′	58.4′
3	225°54.0	·· 43.7	198°54.4	5.0′	27°14.7	5.1′	58.4′
4	240°54.0	44.3	213°18.4	5.0′	27°19.8	4.9′	58.3′
5	255°54.0	45.0	227°42.4	5.0′	27°24.7	4.7′	58.3′
6	270°54.0	N17°45.6	242°06.4	5.0′	N27°29.4	4.6′	58.3′
7	285°54.0	46.3	256°30.4	5.0′	27°34.0	4.4′	58.2′
8	300°54.1	46.9	270°54.3	5.0′	27°38.4	4.1′	58.2′
9	315°54.1	·· 47.6	285°18.3	5.0′	27°42.5	4.0′	58.1′
10	330°54.1	48.2	299°42.3	5.0′	27°46.5	3.9′	58.1′
11	345°54.1	48.9	314°06.3	5.0′	27°50.4	3.6′	58.1′
12	0°54.1	N17°49.5	328°30.2	5.0′	N27°54.0	3.5′	58.0′
13	15°54.2	50.2	342°54.2	5.0′	27°57.5	3.2′	58.0′
14	30°54.2	50.8	357°18.2	5.0′	28°00.7	3.1′	58.0′
15	45°54.2	·· 51.5	11°42.2	5.0′	28°03.8	2.9′	57.9′
16	60°54.2	52.1	26°06.2	5.0′	28°06.7	2.8′	57.9′
17	75°54.2	52.7	40°30.3	5.1′	28°09.5	2.5′	57.9′
18	90°54.2	N17°53.4	54°54.3	5.1′	N28°12.0	2.4′	57.8′
19	105°54.2	54.0	69°18.4	5.1′	28°14.4	2.2′	57.8′
20	120°54.3	54.7	83°42.5	5.1′	28°16.6	2.0′	57.8′
21	135°54.3	·· 55.3	98°06.6	5.1′	28°18.6	1.8′	57.7′
22	150°54.3	55.9	112°30.7	5.2′	28°20.4	1.6′	57.7′
23	165°54.3	56.6	126°54.9	5.2′	28°22.0	1.5′	57.7′
	SD = 15.8′	d = 0.7′	SD = 15.9′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°54.3	N17°57.2	141°19.1	5.2′	N28°23.5	1.2′	57.6′
1	195°54.3	57.9	155°43.4	5.3′	28°24.7	1.1′	57.6′
2	210°54.4	58.5	170°07.6	5.3′	28°25.8	1.0′	57.6′
3	225°54.4	·· 59.1	184°31.9	5.3′	28°26.8	0.7′	57.5′
4	240°54.4	17°59.8	198°56.3	5.4′	28°27.5	0.6′	57.5′
5	255°54.4	18°00.4	213°20.7	5.4′	28°28.1	0.3′	57.4′
6	270°54.4	N18°01.0	227°45.1	5.5′	N28°28.4	0.3′	57.4′
7	285°54.4	01.7	242°09.6	5.5′	28°28.7	0.0′	57.4′
8	300°54.4	02.3	256°34.1	5.6′	28°28.7	0.2′	57.3′
9	315°54.4	·· 03.0	270°58.7	5.6′	28°28.5	0.3′	57.3′
10	330°54.5	03.6	285°23.3	5.7′	28°28.2	0.5′	57.3′
11	345°54.5	04.2	299°48.0	5.7′	28°27.7	0.6′	57.2′
12	0°54.5	N18°04.8	314°12.8	5.8′	N28°27.1	0.9′	57.2′
13	15°54.5	05.5	328°37.6	5.9′	28°26.2	1.0′	57.2′
14	30°54.5	06.1	343°02.4	5.9′	28°25.2	1.2′	57.1′
15	45°54.5	·· 06.7	357°27.3	6.0′	28°24.0	1.3′	57.1′
16	60°54.5	07.4	11°52.3	6.1′	28°22.7	1.5′	57.1′
17	75°54.5	08.0	26°17.4	6.1′	28°21.2	1.7′	57.0′
18	90°54.5	N18°08.6	40°42.5	6.2′	N28°19.5	1.9′	57.0′
19	105°54.6	09.3	55°07.7	6.3′	28°17.6	2.0′	57.0′
20	120°54.6	09.9	69°32.9	6.3′	28°15.6	2.2′	56.9′
21	135°54.6	·· 10.5	83°58.3	6.4′	28°13.4	2.3′	56.9′
22	150°54.6	11.1	98°23.7	6.5′	28°11.1	2.5′	56.9′
23	165°54.6	11.8	112°49.2	6.6′	28°08.6	2.7′	56.8′
	SD = 15.8′	d = 0.6′	SD = 15.7′				

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

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

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	Lower hh:mm	Age 1-3 1-10%
09	03:33	03:35	11:56	13:11	00:42	
10	03:36	03:37	11:56	14:11	01:41	
11	03:37	03:38	11:56	15:11	02:41	

No IERS EOP prediction data available

May 12, 13, 14 UT (Sun., Mon., Tue.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	230°15.4	187°01.4	N15°34.3	221°45.3	N02°18.6	175°40.2	N18°41.9	241°01.7	S06°34.1
1	245°17.9	202°00.8	35.3	236°46.0	19.3	190°42.1	42.1	256°04.0	34.0
2	260°20.3	217°00.2	36.2	251°46.7	20.1	205°43.9	42.2	271°06.2	34.0
3	275°22.8	231°59.7	·· 37.2	266°47.4	·· 20.8	220°45.8	·· 42.4	286°08.5	·· 33.9
4	290°25.3	246°59.1	38.2	281°48.1	21.6	235°47.6	42.5	301°10.8	33.8
5	305°27.7	261°58.5	39.1	296°48.8	22.4	250°49.5	42.6	316°13.1	33.8
6	320°30.2	276°58.0	N15°40.1	311°49.5	N02°23.1	265°51.4	N18°42.8	331°15.4	S06°33.7
7	335°32.7	291°57.4	41.1	326°50.2	23.9	280°53.2	42.9	346°17.7	33.7
8	350°35.1	306°56.8	42.0	341°51.0	24.6	295°55.1	43.1	1°20.0	33.6
9	5°37.6	321°56.2	·· 43.0	356°51.7	·· 25.4	310°56.9	·· 43.2	16°22.3	·· 33.5
10	20°40.0	336°55.7	43.9	11°52.4	26.1	325°58.8	43.3	31°24.6	33.5
11	35°42.5	351°55.1	44.9	26°53.1	26.9	341°00.7	43.5	46°26.8	33.4
12	50°45.0	6°54.5	N15°45.9	41°53.8	N02°27.7	356°02.5	N18°43.6	61°29.1	S06°33.3
13	65°47.4	21°53.9	46.8	56°54.5	28.4	11°04.4	43.8	76°31.4	33.3
14	80°49.9	36°53.4	47.8	71°55.2	29.2	26°06.2	43.9	91°33.7	33.2
15	95°52.4	51°52.8	·· 48.7	86°55.9	·· 29.9	41°08.1	·· 44.0	106°36.0	·· 33.1
16	110°54.8	66°52.2	49.7	101°56.6	30.7	56°10.0	44.2	121°38.3	33.1
17	125°57.3	81°51.6	50.6	116°57.3	31.4	71°11.8	44.3	136°40.6	33.0
18	140°59.8	96°51.1	N15°51.6	131°58.0	N02°32.2	86°13.7	N18°44.4	151°42.9	S06°32.9
19	156°02.2	111°50.5	52.6	146°58.7	33.0	101°15.5	44.6	166°45.2	32.9
20	171°04.7	126°49.9	53.5	161°59.4	33.7	116°17.4	44.7	181°47.5	32.8
21	186°07.2	141°49.3	·· 54.5	177°00.2	·· 34.5	131°19.2	·· 44.9	196°49.7	·· 32.8
22	201°09.6	156°48.8	55.4	192°00.9	35.2	146°21.1	45.0	211°52.0	32.7
23	216°12.1	171°48.2	56.4	207°01.6	36.0	161°23.0	45.1	226°54.3	32.6
Mer.pass. 08:38		ν -0.6′	d 1.0′	ν 0.7′	d 0.8′	ν 1.9′	d 0.1′	ν 2.3′	d 0.1′
		m -3.92		m 1.09		m -2.00		m 1.06	

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	231°14.5	186°47.6	N15°57.3	222°02.3	N02°36.7	176°24.8	N18°45.3	241°56.6	S06°32.6
1	246°17.0	201°47.0	58.3	237°03.0	37.5	191°26.7	45.4	256°58.9	32.5
2	261°19.5	216°46.4	15°59.2	252°03.7	38.2	206°28.5	45.6	272°01.2	32.4
3	276°21.9	231°45.8	16°00.2	267°04.4	·· 39.0	221°30.4	·· 45.7	287°03.5	·· 32.4
4	291°24.4	246°45.3	01.1	282°05.1	39.8	236°32.3	45.8	302°05.8	32.3
5	306°26.9	261°44.7	02.1	297°05.8	40.5	251°34.1	46.0	317°08.1	32.3
6	321°29.3	276°44.1	N16°03.0	312°06.5	N02°41.3	266°36.0	N18°46.1	332°10.4	S06°32.2
7	336°31.8	291°43.5	03.9	327°07.2	42.0	281°37.8	46.2	347°12.7	32.1
8	351°34.3	306°42.9	04.9	342°07.9	42.8	296°39.7	46.4	2°15.0	32.1
9	6°36.7	321°42.4	·· 05.8	357°08.7	·· 43.5	311°41.6	·· 46.5	17°17.2	·· 32.0
10	21°39.2	336°41.8	06.8	12°09.4	44.3	326°43.4	46.7	32°19.5	31.9
11	36°41.7	351°41.2	07.7	27°10.1	45.0	341°45.3	46.8	47°21.8	31.9
12	51°44.1	6°40.6	N16°08.7	42°10.8	N02°45.8	356°47.1	N18°46.9	62°24.1	S06°31.8
13	66°46.6	21°40.0	09.6	57°11.5	46.6	11°49.0	47.1	77°26.4	31.7
14	81°49.0	36°39.4	10.5	72°12.2	47.3	26°50.8	47.2	92°28.7	31.7
15	96°51.5	51°38.8	·· 11.5	87°12.9	·· 48.1	41°52.7	·· 47.4	107°31.0	·· 31.6
16	111°54.0	66°38.3	12.4	102°13.6	48.8	56°54.6	47.5	122°33.3	31.6
17	126°56.4	81°37.7	13.4	117°14.3	49.6	71°56.4	47.6	137°35.6	31.5
18	141°58.9	96°37.1	N16°14.3	132°15.0	N02°50.3	86°58.3	N18°47.8	152°37.9	S06°31.4
19	157°01.4	111°36.5	15.2	147°15.7	51.1	102°00.1	47.9	167°40.2	31.4
20	172°03.8	126°35.9	16.2	162°16.4	51.8	117°02.0	48.0	182°42.5	31.3
21	187°06.3	141°35.3	·· 17.1	177°17.2	·· 52.6	132°03.9	·· 48.2	197°44.8	·· 31.2
22	202°08.8	156°34.7	18.0	192°17.9	53.3	147°05.7	48.3	212°47.1	31.2
23	217°11.2	171°34.1	19.0	207°18.6	54.1	162°07.6	48.5	227°49.4	31.1
Mer.pass. 08:34		ν -0.6′	d 0.9′	ν 0.7′	d 0.8′	ν 1.9′	d 0.1′	ν 2.3′	d 0.1′
		m -3.92		m 1.09		m -2.00		m 1.06	

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	232°13.7	186°33.5	N16°19.9	222°19.3	N02°54.8	177°09.4	N18°48.6	242°51.7	S06°31.1
1	247°16.2	201°32.9	20.8	237°20.0	55.6	192°11.3	48.7	257°53.9	31.0
2	262°18.6	216°32.4	21.8	252°20.7	56.4	207°13.1	48.9	272°56.2	30.9
3	277°21.1	231°31.8	·· 22.7	267°21.4	·· 57.1	222°15.0	·· 49.0	287°58.5	·· 30.9
4	292°23.5	246°31.2	23.6	282°22.1	57.9	237°16.9	49.1	303°00.8	30.8
5	307°26.0	261°30.6	24.6	297°22.8	58.6	252°18.7	49.3	318°03.1	30.8
6	322°28.5	276°30.0	N16°25.5	312°23.5	N02°59.4	267°20.6	N18°49.4	333°05.4	S06°30.7
7	337°30.9	291°29.4	26.4	327°24.2	03°00.1	282°22.4	49.6	348°07.7	30.6
8	352°33.4	306°28.8	27.4	342°24.9	00.9	297°24.3	49.7	3°10.0	30.6
9	7°35.9	321°28.2	·· 28.3	357°25.7	·· 01.6	312°26.2	·· 49.8	18°12.3	·· 30.5
10	22°38.3	336°27.6	29.2	12°26.4	02.4	327°28.0	50.0	33°14.6	30.4
11	37°40.8	351°27.0	30.1	27°27.1	03.1	342°29.9	50.1	48°16.9	30.4
12	52°43.3	6°26.4	N16°31.1	42°27.8	N03°03.9	357°31.7	N18°50.2	63°19.2	S06°30.3
13	67°45.7	21°25.8	32.0	57°28.5	04.6	12°33.6	50.4	78°21.5	30.3
14	82°48.2	36°25.2	32.9	72°29.2	05.4	27°35.4	50.5	93°23.8	30.2
15	97°50.7	51°24.6	·· 33.8	87°29.9	·· 06.1	42°37.3	·· 50.7	108°26.1	·· 30.1
16	112°53.1	66°24.0	34.8	102°30.6	06.9	57°39.2	50.8	123°28.4	30.1
17	127°55.6	81°23.4	35.7	117°31.3	07.7	72°41.0	50.9	138°30.7	30.0
18	142°58.0	96°22.8	N16°36.6	132°32.0	N03°08.4	87°42.9	N18°51.1	153°33.0	S06°30.0
19	158°00.5	111°22.2	37.5	147°32.7	09.2	102°44.7	51.2	168°35.3	29.9
20	173°03.0	126°21.6	38.4	162°33.5	09.9	117°46.6	51.3	183°37.6	29.8
21	188°05.4	141°21.0	·· 39.4	177°34.2	·· 10.7	132°48.4	·· 51.5	198°39.9	·· 29.8
22	203°07.9	156°20.4	40.3	192°34.9	11.4	147°50.3	51.6	213°42.2	29.7
23	218°10.4	171°19.8	41.2	207°35.6	12.2	162°52.2	51.7	228°44.5	29.7
Mer.pass. 08:30		ν -0.6′	d 0.9′	ν 0.7′	d 0.8′	ν 1.9′	d 0.1′	ν 2.3′	d 0.1′
		m -3.92		m 1.09		m -2.00		m 1.06	

Stars

	SHA	**Dec**
Alpheratz	357°35.6	29°13.3
Ankaa	353°08.0	-42°10.3
Schedar	349°32.1	56°40.0
Diphda	348°48.1	-17°51.2
Achernar	335°21.1	-57°06.7
Hamal	327°52.2	23°34.5
Polaris	314°48.3	89°21.9
Acamar	315°12.6	-40°12.4
Menkar	314°07.1	4°11.0
Mirfak	308°29.6	49°56.8
Aldebaran	290°40.6	16°33.4
Rigel	281°04.7	-8°10.5
Capella	280°23.2	46°01.4
Bellatrix	278°23.8	6°22.3
Elnath	278°02.9	28°37.7
Alnilam	275°38.6	-1°11.2
Betelgeuse	270°53.0	7°24.7
Canopus	263°53.1	-52°42.7
Sirius	258°27.0	-16°45.1
Adhara	255°06.6	-29°00.4
Procyon	244°51.6	5°09.7
Pollux	243°18.2	27°58.1
Avior	234°15.2	-59°35.5
Suhail	222°46.8	-43°32.1
Miaplacidus	221°38.5	-69°49.3
Alphard	217°48.3	-8°45.9
Regulus	207°35.0	11°50.9
Dubhe	193°41.4	61°37.4
Denebola	182°25.3	14°26.2
Gienah	175°44.0	-17°40.8
Acrux	173°00.3	-63°14.3
Gacrux	171°51.9	-57°15.2
Alioth	166°13.0	55°49.8
Spica	158°22.6	-11°17.4
Alkaid	152°52.0	49°11.6
Hadar	148°36.2	-60°29.6
Menkent	147°57.9	-36°29.5
Arcturus	145°48.1	19°03.3
Rigil Kent.	139°40.5	-60°56.3
Kochab	137°18.6	74°03.3
Zuben'ubi	136°56.3	-16°08.7
Alphecca	126°03.9	26°37.9
Antares	112°16.2	-26°29.2
Atria	107°10.4	-69°04.2
Sabik	102°03.1	-15°45.4
Shaula	96°10.8	-37°07.3
Rasalhague	95°58.8	12°32.4
Eltanin	90°42.0	51°28.9
Kaus Aust.	83°33.0	-34°22.3
Vega	80°33.3	38°48.1
Nunki	75°48.2	-26°16.0
Altair	62°00.4	8°55.8
Peacock	53°06.4	-56°39.2
Deneb	49°26.1	45°21.7
Enif	33°39.4	9°59.0
Al Na'ir	27°33.7	-46°50.4
Fomalhaut	15°15.3	-29°29.5
Scheat	13°45.9	28°12.6
Markab	13°30.6	15°20.0

May 12 Sun	**SHA**	**Mer.pass**
Venus	316°46.0	11:32
Mars	351°29.9	09:13
Jupiter	305°24.8	12:16
Saturn	10°46.3	07:55

May 13 Mon	**SHA**	**Mer.pass**
Venus	315°33.0	11:33
Mars	350°47.7	09:11
Jupiter	305°10.3	12:13
Saturn	10°42.1	07:51

May 14 Tue	**SHA**	**Mer.pass**
Venus	314°19.8	11:34
Mars	350°05.6	09:10
Jupiter	304°55.7	12:10
Saturn	10°38.0	07:47

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h

Sun	Sun GHA	Sun Dec	Moon GHA	Moon ν	Moon Dec	Moon d	Moon HP
0	180°54.6	N18°12.4	127°14.7	6.6′	N28°05.9	2.8′	56.8′
1	195°54.6	13.0	141°40.4	6.7′	28°03.1	3.0′	56.7′
2	210°54.6	13.6	156°06.1	6.8′	28°00.1	3.2′	56.7′
3	225°54.6	·· 14.3	170°31.9	6.9′	27°56.9	3.3′	56.7′
4	240°54.6	14.9	184°57.8	7.0′	27°53.6	3.5′	56.6′
5	255°54.6	15.5	199°23.7	7.1′	27°50.1	3.6′	56.6′
6	270°54.7	N18°16.1	213°49.8	7.1′	N27°46.5	3.8′	56.6′
7	285°54.7	16.8	228°15.9	7.2′	27°42.7	3.9′	56.5′
8	300°54.7	17.4	242°42.2	7.3′	27°38.8	4.1′	56.5′
9	315°54.7	·· 18.0	257°08.5	7.4′	27°34.7	4.2′	56.5′
10	330°54.7	18.6	271°34.9	7.5′	27°30.5	4.4′	56.4′
11	345°54.7	19.3	286°01.4	7.6′	27°26.1	4.5′	56.4′
12	0°54.7	N18°19.9	300°28.0	7.7′	N27°21.6	4.7′	56.4′
13	15°54.7	20.5	314°54.7	7.8′	27°16.9	4.8′	56.3′
14	30°54.7	21.1	329°21.5	7.9′	27°12.1	5.0′	56.3′
15	45°54.7	·· 21.7	343°48.4	8.0′	27°07.1	5.1′	56.3′
16	60°54.7	22.3	358°15.3	8.1′	27°02.0	5.2′	56.2′
17	75°54.7	23.0	12°42.4	8.2′	26°56.8	5.4′	56.2′
18	90°54.7	N18°23.6	27°09.6	8.3′	N26°51.4	5.6′	56.2′
19	105°54.7	24.2	41°36.9	8.4′	26°45.8	5.6′	56.1′
20	120°54.7	24.8	56°04.2	8.5′	26°40.2	5.8′	56.1′
21	135°54.7	·· 25.4	70°31.7	8.6′	26°34.4	6.0′	56.1′
22	150°54.7	26.0	84°59.3	8.7′	26°28.4	6.0′	56.1′
23	165°54.7	26.7	99°27.0	8.8′	26°22.4	6.2′	56.0′
	SD = 15.8′	d = 0.6′		SD = 15.5′			

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	180°54.7	N18°27.3	113°54.8	8.9′	N26°16.2	6.4′	56.0′
1	195°54.7	27.9	128°22.6	9.0′	26°09.8	6.4′	56.0′
2	210°54.7	28.5	142°50.6	9.1′	26°03.4	6.6′	55.9′
3	225°54.8	·· 29.1	157°18.7	9.2′	25°56.8	6.8′	55.9′
4	240°54.8	29.7	171°46.9	9.3′	25°50.0	6.8′	55.9′
5	255°54.8	30.3	186°15.2	9.4′	25°43.2	7.0′	55.8′
6	270°54.8	N18°30.9	200°43.6	9.5′	N25°36.2	7.1′	55.8′
7	285°54.8	31.5	215°12.1	9.6′	25°29.1	7.2′	55.8′
8	300°54.8	32.1	229°40.8	9.7′	25°21.9	7.3′	55.8′
9	315°54.8	·· 32.8	244°09.5	9.8′	25°14.6	7.5′	55.7′
10	330°54.8	33.4	258°38.3	9.9′	25°07.1	7.6′	55.7′
11	345°54.8	34.0	273°07.2	10.0′	24°59.5	7.7′	55.7′
12	0°54.8	N18°34.6	287°36.3	10.1′	N24°51.8	7.8′	55.6′
13	15°54.8	35.2	302°05.4	10.3′	24°44.0	7.9′	55.6′
14	30°54.8	35.8	316°34.7	10.4′	24°36.1	8.0′	55.6′
15	45°54.8	·· 36.4	331°04.0	10.5′	24°28.1	8.2′	55.5′
16	60°54.8	37.0	345°33.5	10.6′	24°19.9	8.2′	55.5′
17	75°54.8	37.6	0°03.1	10.7′	24°11.7	8.4′	55.5′
18	90°54.8	N18°38.2	14°32.7	10.8′	N24°03.3	8.5′	55.5′
19	105°54.8	38.8	29°02.5	10.9′	23°54.8	8.5′	55.4′
20	120°54.8	39.4	43°32.4	11.0′	23°46.3	8.7′	55.4′
21	135°54.8	·· 40.0	58°02.4	11.1′	23°37.6	8.8′	55.4′
22	150°54.7	40.6	72°32.5	11.2′	23°28.8	8.9′	55.4′
23	165°54.7	41.2	87°02.7	11.3′	23°19.9	9.0′	55.3′
	SD = 15.8′	d = 0.6′		SD = 15.3′			

Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	180°54.7	N18°41.8	101°33.0	11.4′	N23°10.9	9.1′	55.3′
1	195°54.7	42.4	116°03.4	11.5′	23°01.8	9.2′	55.3′
2	210°54.7	43.0	130°33.9	11.6′	22°52.6	9.2′	55.3′
3	225°54.7	·· 43.6	145°04.5	11.7′	22°43.4	9.4′	55.2′
4	240°54.7	44.2	159°35.3	11.8′	22°34.0	9.5′	55.2′
5	255°54.7	44.8	174°06.1	11.9′	22°24.5	9.6′	55.2′
6	270°54.7	N18°45.4	188°37.0	12.0′	N22°14.9	9.6′	55.2′
7	285°54.7	46.0	203°08.0	12.1′	22°05.3	9.8′	55.1′
8	300°54.7	46.6	217°39.1	12.2′	21°55.5	9.8′	55.1′
9	315°54.7	·· 47.2	232°10.4	12.3′	21°45.7	10.0′	55.1′
10	330°54.7	47.8	246°41.7	12.4′	21°35.7	10.0′	55.1′
11	345°54.7	48.4	261°13.1	12.5′	21°25.7	10.1′	55.0′
12	0°54.7	N18°49.0	275°44.6	12.6′	N21°15.6	10.2′	55.0′
13	15°54.7	49.6	290°16.2	12.7′	21°05.4	10.2′	55.0′
14	30°54.7	50.2	304°47.9	12.8′	20°55.2	10.4′	55.0′
15	45°54.7	·· 50.8	319°19.7	12.9′	20°44.8	10.4′	54.9′
16	60°54.7	51.3	333°51.7	13.0′	20°34.4	10.6′	54.9′
17	75°54.7	51.9	348°23.6	13.1′	20°23.8	10.6′	54.9′
18	90°54.7	N18°52.5	2°55.7	13.2′	N20°13.2	10.6′	54.9′
19	105°54.6	53.1	17°27.9	13.3′	20°02.6	10.8′	54.9′
20	120°54.6	53.7	32°00.2	13.4′	19°51.8	10.8′	54.8′
21	135°54.6	·· 54.3	46°32.6	13.5′	19°41.0	10.9′	54.8′
22	150°54.6	54.9	61°05.0	13.5′	19°30.1	11.0′	54.8′
23	165°54.6	55.5	75°37.6	13.6′	19°19.1	11.1′	54.8′
	SD = 15.8′	d = 0.6′		SD = 15.1′			

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

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

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 4-6 18-36%
12	03:38	03:39	11:56	16:07	03:39	
13	03:39	03:39	11:56	17:00	04:34	
14	03:39	03:39	11:56	17:48	05:24	

May 15, 16, 17 UT (Wed., Thu., Fri.)

	Aries	Venus		Mars		Jupiter		Saturn	
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	233°12.8	186°19.2	N16°42.1	222°36.3	N03°12.9	177°54.0	N18°51.9	243°46.8	S06°29.6
1	248°15.3	201°18.6	43.0	237°37.0	13.7	192°55.9	52.0	258°49.0	29.5
2	263°17.8	216°18.0	43.9	252°37.7	14.4	207°57.7	52.2	273°51.3	29.5
3	278°20.2	231°17.4	·· 44.8	267°38.4	·· 15.2	222°59.6	·· 52.3	288°53.6	·· 29.4
4	293°22.7	246°16.8	45.8	282°39.1	15.9	238°01.4	52.4	303°55.9	29.3
5	308°25.1	261°16.2	46.7	297°39.8	16.7	253°03.3	52.6	318°58.2	29.3
6	323°27.6	276°15.6	N16°47.6	312°40.5	N03°17.4	268°05.2	N18°52.7	334°00.5	S06°29.2
7	338°30.1	291°15.0	48.5	327°41.3	18.2	283°07.0	52.8	349°02.8	29.2
8	353°32.5	306°14.4	49.4	342°42.0	18.9	298°08.9	53.0	4°05.1	29.1
9	8°35.0	321°13.8	·· 50.3	357°42.7	·· 19.7	313°10.7	·· 53.1	19°07.4	·· 29.0
10	23°37.5	336°13.2	51.2	12°43.4	20.4	328°12.6	53.3	34°09.7	29.0
11	38°39.9	351°12.6	52.1	27°44.1	21.2	343°14.5	53.4	49°12.0	28.9
12	53°42.4	6°11.9	N16°53.0	42°44.8	N03°21.9	358°16.3	N18°53.5	64°14.3	S06°28.9
13	68°44.9	21°11.3	53.9	57°45.5	22.7	13°18.2	53.7	79°16.6	28.8
14	83°47.3	36°10.7	54.8	72°46.2	23.4	28°20.0	53.8	94°18.9	28.7
15	98°49.8	51°10.1	·· 55.8	87°46.9	·· 24.2	43°21.9	·· 53.9	109°21.2	·· 28.7
16	113°52.3	66°09.5	56.7	102°47.6	24.9	58°23.7	54.1	124°23.5	28.6
17	128°54.7	81°08.9	57.6	117°48.3	25.7	73°25.6	54.2	139°25.8	28.6
18	143°57.2	96°08.3	N16°58.5	132°49.1	N03°26.4	88°27.5	N18°54.3	154°28.1	S06°28.5
19	158°59.6	111°07.7	16°59.4	147°49.8	27.2	103°29.3	54.5	169°30.4	28.4
20	174°02.1	126°07.1	17°00.3	162°50.5	27.9	118°31.2	54.6	184°32.7	28.4
21	189°04.6	141°06.5	·· 01.2	177°51.2	·· 28.7	133°33.0	·· 54.8	199°35.0	·· 28.3
22	204°07.0	156°05.8	02.1	192°51.9	29.4	148°34.9	54.9	214°37.3	28.3
23	219°09.5	171°05.2	03.0	207°52.6	30.2	163°36.7	55.0	229°39.6	28.2
Mer.pass. 08:26		ν -0.6′	d 0.9′	m -3.92	ν 0.7′	d 0.8′	m 1.08	ν 1.9′	d 0.1′ m -2.00	ν 2.3′	d 0.1′ m 1.06

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	234°12.0	186°04.6	N17°03.9	222°53.3	N03°30.9	178°38.6	N18°55.2	244°41.9	S06°28.1
1	249°14.4	201°04.0	04.8	237°54.0	31.7	193°40.5	55.3	259°44.2	28.1
2	264°16.9	216°03.4	05.7	252°54.7	32.4	208°42.3	55.4	274°46.5	28.0
3	279°19.4	231°02.8	·· 06.6	267°55.4	·· 33.2	223°44.2	·· 55.6	289°48.8	·· 28.0
4	294°21.8	246°02.2	07.5	282°56.1	33.9	238°46.0	55.7	304°51.1	27.9
5	309°24.3	261°01.5	08.3	297°56.9	34.7	253°47.9	55.8	319°53.4	27.9
6	324°26.8	276°00.9	N17°09.2	312°57.6	N03°35.4	268°49.7	N18°56.0	334°55.7	S06°27.8
7	339°29.2	291°00.3	10.1	327°58.3	36.2	283°51.6	56.1	349°58.0	27.7
8	354°31.7	305°59.7	11.0	342°59.0	36.9	298°53.5	56.2	5°00.3	27.7
9	9°34.1	320°59.1	·· 11.9	357°59.7	·· 37.7	313°55.3	·· 56.4	20°02.6	·· 27.6
10	24°36.6	335°58.5	12.8	13°00.4	38.4	328°57.2	56.5	35°04.9	27.6
11	39°39.1	350°57.8	13.7	28°01.1	39.2	343°59.0	56.7	50°07.2	27.5
12	54°41.5	5°57.2	N17°14.6	43°01.8	N03°39.9	359°00.9	N18°56.8	65°09.5	S06°27.4
13	69°44.0	20°56.6	15.5	58°02.5	40.7	14°02.7	56.9	80°11.8	27.4
14	84°46.5	35°56.0	16.4	73°03.2	41.4	29°04.6	57.1	95°14.1	27.3
15	99°48.9	50°55.4	·· 17.2	88°04.0	·· 42.2	44°06.5	·· 57.2	110°16.4	·· 27.3
16	114°51.4	65°54.7	18.1	103°04.7	42.9	59°08.3	57.3	125°18.7	27.2
17	129°53.9	80°54.1	19.0	118°05.4	43.7	74°10.2	57.5	140°21.0	27.1
18	144°56.3	95°53.5	N17°19.9	133°06.1	N03°44.4	89°12.0	N18°57.6	155°23.4	S06°27.1
19	159°58.8	110°52.9	20.8	148°06.8	45.2	104°13.9	57.7	170°25.7	27.0
20	175°01.2	125°52.2	21.7	163°07.5	45.9	119°15.7	57.9	185°28.0	27.0
21	190°03.7	140°51.6	·· 22.6	178°08.2	·· 46.7	134°17.6	·· 58.0	200°30.3	·· 26.9
22	205°06.2	155°51.0	23.4	193°08.9	47.4	149°19.5	58.1	215°32.6	26.9
23	220°08.6	170°50.4	24.3	208°09.6	48.2	164°21.3	58.3	230°34.9	26.8
Mer.pass. 08:22		ν -0.6′	d 0.9′	m -3.92	ν 0.7′	d 0.7′	m 1.08	ν 1.9′	d 0.1′ m -2.00	ν 2.3′	d 0.1′ m 1.05

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	235°11.1	185°49.7	N17°25.2	223°10.3	N03°48.9	179°23.2	N18°58.4	245°37.2	S06°26.7
1	250°13.6	200°49.1	26.1	238°11.0	49.7	194°25.0	58.5	260°39.5	26.7
2	265°16.0	215°48.5	26.9	253°11.8	50.4	209°26.9	58.7	275°41.8	26.6
3	280°18.5	230°47.9	·· 27.8	268°12.5	·· 51.2	224°28.7	·· 58.8	290°44.1	·· 26.6
4	295°21.0	245°47.2	28.7	283°13.2	51.9	239°30.6	59.0	305°46.4	26.5
5	310°23.4	260°46.6	29.6	298°13.9	52.6	254°32.4	59.1	320°48.7	26.5
6	325°25.9	275°46.0	N17°30.5	313°14.6	N03°53.4	269°34.3	N18°59.2	335°51.0	S06°26.4
7	340°28.4	290°45.4	31.3	328°15.3	54.1	284°36.2	59.4	350°53.3	26.3
8	355°30.8	305°44.7	32.2	343°16.0	54.9	299°38.0	59.5	5°55.6	26.3
9	10°33.3	320°44.1	·· 33.1	358°16.7	·· 55.6	314°39.9	·· 59.6	20°57.9	·· 26.2
10	25°35.7	335°43.5	33.9	13°17.4	56.4	329°41.7	59.8	36°00.2	26.2
11	40°38.2	350°42.8	34.8	28°18.1	57.1	344°43.6	18°59.9	51°02.5	26.1
12	55°40.7	5°42.2	N17°35.7	43°18.9	N03°57.9	359°45.4	N19°00.0	66°04.8	S06°26.0
13	70°43.1	20°41.6	36.6	58°19.6	58.6	14°47.3	00.2	81°07.1	26.0
14	85°45.6	35°40.9	37.4	73°20.3	03°59.4	29°49.2	00.3	96°09.4	25.9
15	100°48.1	50°40.3	·· 38.3	88°21.0	04°00.1	44°51.0	·· 00.4	111°11.7	·· 25.9
16	115°50.5	65°39.7	39.2	103°21.7	00.9	59°52.9	00.6	126°14.0	25.8
17	130°53.0	80°39.0	40.0	118°22.4	01.6	74°54.7	00.7	141°16.3	25.8
18	145°55.5	95°38.4	N17°40.9	133°23.1	N04°02.4	89°56.6	N19°00.8	156°18.7	S06°25.7
19	160°57.9	110°37.8	41.8	148°23.8	03.1	104°58.4	01.0	171°21.0	25.6
20	176°00.4	125°37.1	42.6	163°24.5	03.8	120°00.3	01.1	186°23.3	25.6
21	191°02.8	140°36.5	·· 43.5	178°25.2	·· 04.6	135°02.2	·· 01.2	201°25.6	·· 25.5
22	206°05.3	155°35.9	44.3	193°26.0	05.3	150°04.0	01.4	216°27.9	25.5
23	221°07.8	170°35.2	45.2	208°26.7	06.1	165°05.9	01.5	231°30.2	25.4
Mer.pass. 08:18		ν -0.6′	d 0.9′	m -3.92	ν 0.7′	d 0.7′	m 1.08	ν 1.9′	d 0.1′ m -2.00	ν 2.3′	d 0.1′ m 1.05

Stars

	SHA	Dec
Alpheratz	357°35.6	29°13.3
Ankaa	353°08.0	-42°10.3
Schedar	349°32.1	56°40.0
Diphda	348°48.1	-17°51.2
Achernar	335°21.1	-57°06.7
Hamal	327°52.2	23°34.5
Polaris	314°48.0	89°21.9
Acamar	315°12.6	-40°12.4
Menkar	314°07.1	4°11.0
Mirfak	308°29.6	49°56.8
Aldebaran	290°40.6	16°33.4
Rigel	281°04.7	-8°10.5
Capella	280°23.2	46°01.4
Bellatrix	278°23.8	6°22.3
Elnath	278°02.9	28°37.7
Alnilam	275°38.6	-1°11.2
Betelgeuse	270°53.0	7°24.7
Canopus	263°53.1	-52°42.7
Sirius	258°27.0	-16°45.1
Adhara	255°06.6	-29°00.4
Procyon	244°51.6	5°09.7
Pollux	243°18.2	27°58.1
Avior	234°15.2	-59°35.5
Suhail	222°46.8	-43°32.1
Miaplacidus	221°38.6	-69°49.3
Alphard	217°48.3	-8°45.9
Regulus	207°35.0	11°50.9
Dubhe	193°41.4	61°37.4
Denebola	182°25.4	14°26.2
Gienah	175°44.0	-17°40.8
Acrux	173°00.3	-63°14.3
Gacrux	171°51.9	-57°15.2
Alioth	166°13.0	55°49.8
Spica	158°22.6	-11°17.4
Alkaid	152°52.0	49°11.6
Hadar	148°36.2	-60°29.6
Menkent	147°57.9	-36°29.5
Arcturus	145°48.1	19°03.3
Rigil Kent.	139°40.5	-60°56.3
Kochab	137°18.6	74°03.3
Zuben'ubi	136°56.3	-16°08.7
Alphecca	126°03.8	26°37.9
Antares	112°16.2	-26°29.2
Atria	107°10.4	-69°04.2
Sabik	102°03.1	-15°45.4
Shaula	96°10.8	-37°07.3
Rasalhague	95°58.8	12°32.4
Eltanin	90°42.0	51°28.9
Kaus Aust.	83°32.9	-34°22.3
Vega	80°33.3	38°48.1
Nunki	75°48.2	-26°16.0
Altair	62°00.3	8°55.8
Peacock	53°06.4	-56°39.2
Deneb	49°26.1	45°21.7
Enif	33°39.3	9°59.0
Al Na'ir	27°33.6	-46°50.4
Fomalhaut	15°15.2	-29°29.5
Scheat	13°45.9	28°12.6
Markab	13°30.6	15°20.0

May 15 Wed	SHA	Mer.pass
Venus	313°06.4	11:35
Mars	349°23.5	09:09
Jupiter	304°41.2	12:07
Saturn	10°33.9	07:44

May 16 Thu	SHA	Mer.pass
Venus	311°52.6	11:36
Mars	348°41.3	09:08
Jupiter	304°26.6	12:04
Saturn	10°30.0	07:40

May 17 Fri	SHA	Mer.pass
Venus	310°38.6	11:37
Mars	347°59.2	09:07
Jupiter	304°12.1	12:01
Saturn	10°26.1	07:36

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.1257 sec ΔT = TT-UT1 = +69.0583 sec

2024 May 15 to May. 17 UT

h	Sun		Moon				
Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°54.6	N18°56.1	90°10.2	13.7′	N19°08.0	11.1′	54.8′
1	195°54.6	56.6	104°42.9	13.8′	18°56.9	11.2′	54.7′
2	210°54.6	57.2	119°15.8	13.9′	18°45.7	11.3′	54.7′
3	225°54.6	·· 57.8	133°48.7	14.0′	18°34.4	11.3′	54.7′
4	240°54.6	58.4	148°21.6	14.1′	18°23.1	11.4′	54.7′
5	255°54.6	59.0	162°54.7	14.2′	18°11.7	11.5′	54.7′
6	270°54.6	N18°59.6	177°27.9	14.2′	N18°00.2	11.5′	54.7′
7	285°54.5	19°00.1	192°01.1	14.3′	17°48.7	11.6′	54.6′
8	300°54.5	00.7	206°34.4	14.4′	17°37.1	11.7′	54.6′
9	315°54.5	·· 01.3	221°07.8	14.5′	17°25.4	11.7′	54.6′
10	330°54.5	01.9	235°41.3	14.6′	17°13.7	11.8′	54.6′
11	345°54.5	02.5	250°14.9	14.6′	17°01.9	11.8′	54.6′
12	0°54.5	N19°03.0	264°48.5	14.7′	N16°50.1	11.9′	54.6′
13	15°54.5	03.6	279°22.2	14.8′	16°38.2	12.0′	54.5′
14	30°54.5	04.2	293°56.0	14.9′	16°26.2	12.0′	54.5′
15	45°54.5	·· 04.8	308°29.9	14.9′	16°14.2	12.1′	54.5′
16	60°54.4	05.4	323°03.8	15.0′	16°02.1	12.1′	54.5′
17	75°54.4	05.9	337°37.8	15.1′	15°50.0	12.2′	54.5′
18	90°54.4	N19°06.5	352°11.9	15.2′	N15°37.8	12.3′	54.5′
19	105°54.4	07.1	6°46.1	15.2′	15°25.5	12.3′	54.4′
20	120°54.4	07.7	21°20.3	15.3′	15°13.2	12.3′	54.4′
21	135°54.4	·· 08.2	35°54.6	15.4′	15°00.9	12.4′	54.4′
22	150°54.4	08.8	50°29.0	15.4′	14°48.5	12.5′	54.4′
23	165°54.3	09.4	65°03.4	15.5′	14°36.0	12.5′	54.4′
	SD = 15.8′	d = 0.6′	SD = 14.9′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°54.3	N19°10.0	79°37.9	15.6′	N14°23.5	12.6′	54.4′
1	195°54.3	10.5	94°12.4	15.6′	14°10.9	12.6′	54.4′
2	210°54.3	11.1	108°47.1	15.7′	13°58.3	12.6′	54.4′
3	225°54.3	·· 11.7	123°21.7	15.7′	13°45.7	12.7′	54.3′
4	240°54.3	12.3	137°56.5	15.8′	13°33.0	12.8′	54.3′
5	255°54.3	12.8	152°31.3	15.9′	13°20.2	12.8′	54.3′
6	270°54.2	N19°13.4	167°06.2	15.9′	N13°07.4	12.8′	54.3′
7	285°54.2	14.0	181°41.1	16.0′	12°54.6	12.9′	54.3′
8	300°54.2	14.5	196°16.1	16.0′	12°41.7	12.9′	54.3′
9	315°54.2	·· 15.1	210°51.1	16.1′	12°28.8	12.9′	54.3′
10	330°54.2	15.7	225°26.2	16.1′	12°15.9	13.0′	54.3′
11	345°54.2	16.2	240°01.3	16.2′	12°02.9	13.1′	54.3′
12	0°54.1	N19°16.8	254°36.5	16.2′	N11°49.8	13.1′	54.3′
13	15°54.1	17.4	269°11.8	16.3′	11°36.7	13.1′	54.2′
14	30°54.1	17.9	283°47.1	16.3′	11°23.6	13.1′	54.2′
15	45°54.1	·· 18.5	298°22.4	16.4′	11°10.5	13.2′	54.2′
16	60°54.1	19.1	312°57.8	16.4′	10°57.3	13.3′	54.2′
17	75°54.1	19.6	327°33.3	16.5′	10°44.0	13.2′	54.2′
18	90°54.0	N19°20.2	342°08.8	16.5′	N10°30.8	13.3′	54.2′
19	105°54.0	20.7	356°44.3	16.6′	10°17.5	13.4′	54.2′
20	120°54.0	21.3	11°19.9	16.6′	10°04.1	13.3′	54.2′
21	135°54.0	·· 21.9	25°55.5	16.7′	09°50.8	13.4′	54.2′
22	150°54.0	22.4	40°31.1	16.7′	09°37.4	13.5′	54.2′
23	165°53.9	23.0	55°06.8	16.7′	09°23.9	13.4′	54.2′
	SD = 15.8′	d = 0.6′	SD = 14.8′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°53.9	N19°23.6	69°42.6	16.8′	N09°10.5	13.5′	54.2′
1	195°53.9	24.1	84°18.4	16.8′	08°57.0	13.6′	54.2′
2	210°53.9	24.7	98°54.2	16.8′	08°43.4	13.5′	54.2′
3	225°53.9	·· 25.2	113°30.0	16.9′	08°29.9	13.6′	54.2′
4	240°53.8	25.8	128°05.9	16.9′	08°16.3	13.6′	54.1′
5	255°53.8	26.3	142°41.8	16.9′	08°02.7	13.6′	54.1′
6	270°53.8	N19°26.9	157°17.8	17.0′	N07°49.1	13.7′	54.1′
7	285°53.8	27.5	171°53.8	17.0′	07°35.4	13.7′	54.1′
8	300°53.8	28.0	186°29.8	17.0′	07°21.7	13.7′	54.1′
9	315°53.7	·· 28.6	201°05.8	17.1′	07°08.0	13.8′	54.1′
10	330°53.7	29.1	215°41.9	17.1′	06°54.2	13.7′	54.1′
11	345°53.7	29.7	230°18.0	17.1′	06°40.5	13.8′	54.1′
12	0°53.7	N19°30.2	244°54.1	17.1′	N06°26.7	13.8′	54.1′
13	15°53.6	30.8	259°30.2	17.2′	06°12.9	13.8′	54.1′
14	30°53.6	31.3	274°06.4	17.2′	05°59.1	13.9′	54.1′
15	45°53.6	·· 31.9	288°42.6	17.2′	05°45.2	13.9′	54.1′
16	60°53.6	32.4	303°18.8	17.2′	05°31.3	13.9′	54.1′
17	75°53.6	33.0	317°55.0	17.2′	05°17.4	13.9′	54.1′
18	90°53.5	N19°33.5	332°31.3	17.3′	N05°03.5	13.9′	54.1′
19	105°53.5	34.1	347°07.5	17.3′	04°49.6	13.9′	54.1′
20	120°53.5	34.6	1°43.8	17.3′	04°35.7	14.0′	54.1′
21	135°53.5	·· 35.2	16°20.1	17.3′	04°21.7	14.0′	54.1′
22	150°53.4	35.7	30°56.4	17.3′	04°07.7	14.0′	54.1′
23	165°53.4	36.3	45°32.7	17.3′	03°53.7	14.0′	54.1′
	SD = 15.8′	d = 0.6′	SD = 14.8′				

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

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

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 45-64%
15	03:38	03:38	11:56	18:32	06:10	
16	03:37	03:37	11:56	19:13	06:53	
17	03:36	03:35	11:56	19:53	07:33	

May 18, 19, 20 UT (Sat., Sun., Mon.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	236°10.2	185°34.6	N17°46.1	223°27.4	N04°06.8	180°07.7	N19°01.6	246°32.5	S06°25.4
1	251°12.7	200°34.0	46.9	238°28.1	07.6	195°09.6	01.8	261°34.8	25.3
2	266°15.2	215°33.3	47.8	253°28.8	08.3	210°11.4	01.9	276°37.1	25.3
3	281°17.6	230°32.7	·· 48.6	268°29.5	·· 09.1	225°13.3	·· 02.0	291°39.4	·· 25.2
4	296°20.1	245°32.0	49.5	283°30.2	09.8	240°15.2	02.2	306°41.7	25.1
5	311°22.6	260°31.4	50.4	298°30.9	10.6	255°17.0	02.3	321°44.0	25.1
6	326°25.0	275°30.8	N17°51.2	313°31.6	N04°11.3	270°18.9	N19°02.4	336°46.3	S06°25.0
7	341°27.5	290°30.1	52.1	328°32.3	12.0	285°20.7	02.6	351°48.6	25.0
8	356°30.0	305°29.5	52.9	343°33.1	12.8	300°22.6	02.7	6°50.9	24.9
9	11°32.4	320°28.8	·· 53.8	358°33.8	·· 13.5	315°24.4	·· 02.8	21°53.3	·· 24.9
10	26°34.9	335°28.2	54.6	13°34.5	14.3	330°26.3	03.0	36°55.6	24.8
11	41°37.3	350°27.6	55.5	28°35.2	15.0	345°28.1	03.1	51°57.9	24.7
12	56°39.8	5°26.9	N17°56.3	43°35.9	N04°15.8	0°30.0	N19°03.2	67°00.2	S06°24.7
13	71°42.3	20°26.3	57.2	58°36.6	16.5	15°31.9	03.4	82°02.5	24.6
14	86°44.7	35°25.6	58.0	73°37.3	17.3	30°33.7	03.5	97°04.8	24.6
15	101°47.2	50°25.0	·· 58.9	88°38.0	·· 18.0	45°35.6	·· 03.6	112°07.1	·· 24.5
16	116°49.7	65°24.3	17°59.7	103°38.7	18.7	60°37.4	03.8	127°09.4	24.5
17	131°52.1	80°23.7	18°00.6	118°39.4	19.5	75°39.3	03.9	142°11.7	24.4
18	146°54.6	95°23.1	N18°01.4	133°40.2	N04°20.2	90°41.1	N19°04.0	157°14.0	S06°24.4
19	161°57.1	110°22.4	02.3	148°40.9	21.0	105°43.0	04.2	172°16.3	24.3
20	176°59.5	125°21.8	03.1	163°41.6	21.7	120°44.9	04.3	187°18.6	24.2
21	192°02.0	140°21.1	·· 04.0	178°42.3	·· 22.5	135°46.7	·· 04.4	202°21.0	·· 24.2
22	207°04.5	155°20.5	04.8	193°43.0	23.2	150°48.6	04.6	217°23.3	24.1
23	222°06.9	170°19.8	05.6	208°43.7	23.9	165°50.4	04.7	232°25.6	24.1
Mer.pass. 08:14		ν -0.6′	d 0.9′	m -3.92	ν 0.7′	d 0.7′	m 1.08	ν 1.9′	d 0.1′ m -2.00	ν 2.3′	d 0.1′ m 1.05

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	237°09.4	185°19.2	N18°06.5	223°44.4	N04°24.7	180°52.3	N19°04.8	247°27.9	S06°24.0
1	252°11.8	200°18.5	07.3	238°45.1	25.4	195°54.1	05.0	262°30.2	24.0
2	267°14.3	215°17.9	08.2	253°45.8	26.2	210°56.0	05.1	277°32.5	23.9
3	282°16.8	230°17.2	·· 09.0	268°46.5	·· 26.9	225°57.9	·· 05.2	292°34.8	·· 23.9
4	297°19.2	245°16.6	09.8	283°47.3	27.7	240°59.7	05.4	307°37.1	23.8
5	312°21.7	260°15.9	10.7	298°48.0	28.4	256°01.6	05.5	322°39.4	23.7
6	327°24.2	275°15.3	N18°11.5	313°48.7	N04°29.1	271°03.4	N19°05.6	337°41.7	S06°23.7
7	342°26.6	290°14.6	12.4	328°49.4	29.9	286°05.3	05.8	352°44.1	23.6
8	357°29.1	305°14.0	13.2	343°50.1	30.6	301°07.1	05.9	7°46.4	23.6
9	12°31.6	320°13.3	·· 14.0	358°50.8	·· 31.4	316°09.0	·· 06.0	22°48.7	·· 23.5
10	27°34.0	335°12.7	14.9	13°51.5	32.1	331°10.8	06.2	37°51.0	23.5
11	42°36.5	350°12.0	15.7	28°52.2	32.9	346°12.7	06.3	52°53.3	23.4
12	57°38.9	5°11.4	N18°16.5	43°52.9	N04°33.6	1°14.6	N19°06.4	67°55.6	S06°23.4
13	72°41.4	20°10.7	17.4	58°53.6	34.3	16°16.4	06.6	82°57.9	23.3
14	87°43.9	35°10.1	18.2	73°54.4	35.1	31°18.3	06.7	98°00.2	23.3
15	102°46.3	50°09.4	·· 19.0	88°55.1	·· 35.8	46°20.1	·· 06.8	113°02.5	·· 23.2
16	117°48.8	65°08.7	19.8	103°55.8	36.6	61°22.0	07.0	128°04.9	23.1
17	132°51.3	80°08.1	20.7	118°56.5	37.3	76°23.8	07.1	143°07.2	23.1
18	147°53.7	95°07.4	N18°21.5	133°57.2	N04°38.0	91°25.7	N19°07.2	158°09.5	S06°23.0
19	162°56.2	110°06.8	22.3	148°57.9	38.8	106°27.6	07.4	173°11.8	23.0
20	177°58.7	125°06.1	23.1	163°58.6	39.5	121°29.4	07.5	188°14.1	22.9
21	193°01.1	140°05.5	·· 24.0	178°59.3	·· 40.3	136°31.3	·· 07.6	203°16.4	·· 22.9
22	208°03.6	155°04.8	24.8	194°00.0	41.0	151°33.1	07.8	218°18.7	22.8
23	223°06.1	170°04.1	25.6	209°00.7	41.7	166°35.0	07.9	233°21.0	22.8
Mer.pass. 08:10		ν -0.6′	d 0.8′	m -3.92	ν 0.7′	d 0.7′	m 1.08	ν 1.9′	d 0.1′ m -2.00	ν 2.3′	d 0.1′ m 1.05

Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	238°08.5	185°03.5	N18°26.4	224°01.5	N04°42.5	181°36.8	N19°08.0	248°23.4	S06°22.7
1	253°11.0	200°02.8	27.3	239°02.2	43.2	196°38.7	08.2	263°25.7	22.7
2	268°13.4	215°02.2	28.1	254°02.9	44.0	211°40.5	08.3	278°28.0	22.6
3	283°15.9	230°01.5	·· 28.9	269°03.6	·· 44.7	226°42.4	·· 08.4	293°30.3	·· 22.6
4	298°18.4	245°00.8	29.7	284°04.3	45.4	241°44.3	08.6	308°32.6	22.5
5	313°20.8	260°00.2	30.5	299°05.0	46.2	256°46.1	08.7	323°34.9	22.4
6	328°23.3	274°59.5	N18°31.3	314°05.7	N04°46.9	271°48.0	N19°08.8	338°37.2	S06°22.4
7	343°25.8	289°58.8	32.2	329°06.4	47.7	286°49.8	09.0	353°39.5	22.3
8	358°28.2	304°58.2	33.0	344°07.1	48.4	301°51.7	09.1	8°41.9	22.3
9	13°30.7	319°57.5	·· 33.8	359°07.8	·· 49.1	316°53.5	·· 09.2	23°44.2	·· 22.2
10	28°33.2	334°56.8	34.6	14°08.6	49.9	331°55.4	09.4	38°46.5	22.2
11	43°35.6	349°56.2	35.4	29°09.3	50.6	346°57.2	09.5	53°48.8	22.1
12	58°38.1	4°55.5	N18°36.2	44°10.0	N04°51.4	1°59.1	N19°09.6	68°51.1	S06°22.1
13	73°40.5	19°54.9	37.0	59°10.7	52.1	17°01.0	09.8	83°53.4	22.0
14	88°43.0	34°54.2	37.8	74°11.4	52.8	32°02.8	09.9	98°55.7	22.0
15	103°45.5	49°53.5	·· 38.7	89°12.1	·· 53.6	47°04.7	·· 10.0	113°58.1	·· 21.9
16	118°47.9	64°52.9	39.5	104°12.8	54.3	62°06.5	10.1	129°00.4	21.9
17	133°50.4	79°52.2	40.3	119°13.5	55.1	77°08.4	10.3	144°02.7	21.8
18	148°52.9	94°51.5	N18°41.1	134°14.2	N04°55.8	92°10.2	N19°10.4	159°05.0	S06°21.8
19	163°55.3	109°50.8	41.9	149°14.9	56.5	107°12.1	10.5	174°07.3	21.7
20	178°57.8	124°50.2	42.7	164°15.7	57.3	122°13.9	10.7	189°09.6	21.6
21	194°00.3	139°49.5	·· 43.5	179°16.4	·· 58.0	137°15.8	·· 10.8	204°12.0	·· 21.6
22	209°02.7	154°48.8	44.3	194°17.1	58.8	152°17.7	10.9	219°14.3	21.5
23	224°05.2	169°48.2	45.1	209°17.8	59.5	167°19.5	11.1	234°16.6	21.5
Mer.pass. 08:06		ν -0.7′	d 0.8′	m -3.92	ν 0.7′	d 0.7′	m 1.07	ν 1.9′	d 0.1′ m -2.00	ν 2.3′	d 0.1′ m 1.05

Stars

	SHA	Dec
Alpheratz	357°35.6	29°13.3
Ankaa	353°07.9	-42°10.3
Schedar	349°32.1	56°40.0
Diphda	348°48.1	-17°51.2
Achernar	335°21.1	-57°06.7
Hamal	327°52.2	23°34.5
Polaris	314°47.7	89°21.9
Acamar	315°12.6	-40°12.4
Menkar	314°07.1	4°11.0
Mirfak	308°29.6	49°56.8
Aldebaran	290°40.6	16°33.4
Rigel	281°04.7	-8°10.5
Capella	280°23.2	46°01.4
Bellatrix	278°23.8	6°22.3
Elnath	278°02.9	28°37.7
Alnilam	275°38.6	-1°11.2
Betelgeuse	270°53.0	7°24.7
Canopus	263°53.1	-52°42.6
Sirius	258°27.0	-16°45.1
Adhara	255°06.6	-29°00.4
Procyon	244°51.6	5°09.7
Pollux	243°18.2	27°58.1
Avior	234°15.3	-59°35.5
Suhail	222°46.8	-43°32.1
Miaplacidus	221°38.6	-69°49.3
Alphard	217°48.4	-8°45.9
Regulus	207°35.0	11°50.9
Dubhe	193°41.5	61°37.5
Denebola	182°25.4	14°26.2
Gienah	175°44.0	-17°40.8
Acrux	173°00.3	-63°14.3
Gacrux	171°51.9	-57°15.2
Alioth	166°13.0	55°49.8
Spica	158°22.6	-11°17.4
Alkaid	152°52.0	49°11.6
Hadar	148°36.2	-60°29.6
Menkent	147°57.9	-36°29.5
Arcturus	145°48.1	19°03.3
Rigil Kent.	139°40.5	-60°56.3
Kochab	137°18.6	74°03.3
Zuben'ubi	136°56.3	-16°08.7
Alphecca	126°03.8	26°37.9
Antares	112°16.2	-26°29.2
Atria	107°10.4	-69°04.2
Sabik	102°03.1	-15°45.4
Shaula	96°10.7	-37°07.3
Rasalhague	95°58.8	12°32.4
Eltanin	90°42.0	51°28.9
Kaus Aust.	83°32.9	-34°22.3
Vega	80°33.3	38°48.1
Nunki	75°48.2	-26°16.0
Altair	62°00.3	8°55.8
Peacock	53°06.3	-56°39.2
Deneb	49°26.0	45°21.7
Enif	33°39.3	9°59.0
Al Na'ir	27°33.6	-46°50.4
Fomalhaut	15°15.2	-29°29.5
Scheat	13°45.9	28°12.6
Markab	13°30.6	15°20.0

May 18 Sat	SHA	Mer.pass
Venus	309°24.4	11:38
Mars	347°17.1	09:06
Jupiter	303°57.5	11:58
Saturn	10°22.2	07:33

May 19 Sun	SHA	Mer.pass
Venus	308°09.8	11:39
Mars	346°35.0	09:05
Jupiter	303°42.9	11:55
Saturn	10°18.5	07:29

May 20 Mon	SHA	Mer.pass
Venus	306°55.0	11:40
Mars	345°52.9	09:03
Jupiter	303°28.3	11:52
Saturn	10°14.8	07:25

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°53.4	N19°36.8	60°09.1	17.3′	N03°39.7	14.0′	54.1′
1	195°53.4	37.4	74°45.4	17.4′	03°25.7	14.0′	54.1′
2	210°53.3	37.9	89°21.7	17.4′	03°11.7	14.1′	54.1′
3	225°53.3	·· 38.4	103°58.1	17.4′	02°57.6	14.0′	54.1′
4	240°53.3	39.0	118°34.5	17.4′	02°43.6	14.1′	54.1′
5	255°53.2	39.5	133°10.8	17.4′	02°29.5	14.1′	54.1′
6	270°53.2	N19°40.1	147°47.2	17.4′	N02°15.4	14.1′	54.1′
7	285°53.2	40.6	162°23.6	17.4′	02°01.3	14.1′	54.1′
8	300°53.2	41.2	177°00.0	17.4′	01°47.2	14.1′	54.1′
9	315°53.1	·· 41.7	191°36.4	17.4′	01°33.1	14.1′	54.1′
10	330°53.1	42.2	206°12.8	17.4′	01°19.0	14.2′	54.1′
11	345°53.1	42.8	220°49.1	17.4′	01°04.8	14.1′	54.2′
12	0°53.1	N19°43.3	235°25.5	17.4′	N00°50.7	14.1′	54.2′
13	15°53.0	43.8	250°01.9	17.4′	00°36.6	14.2′	54.2′
14	30°53.0	44.4	264°38.3	17.4′	00°22.4	14.1′	54.2′
15	45°53.0	·· 44.9	279°14.6	17.4′	N00°08.3	14.2′	54.2′
16	60°52.9	45.5	293°51.0	17.4′	S00°05.9	14.1′	54.2′
17	75°52.9	46.0	308°27.4	17.3′	00°20.0	14.2′	54.2′
18	90°52.9	N19°46.5	323°03.7	17.3′	S00°34.2	14.2′	54.2′
19	105°52.9	47.1	337°40.0	17.3′	00°48.4	14.1′	54.2′
20	120°52.8	47.6	352°16.4	17.3′	01°02.5	14.2′	54.2′
21	135°52.8	·· 48.1	6°52.7	17.3′	01°16.7	14.2′	54.2′
22	150°52.8	48.7	21°29.0	17.3′	01°30.9	14.1′	54.2′
23	165°52.7	49.2	36°05.3	17.3′	01°45.0	14.2′	54.2′
	SD = 15.8′	d = 0.5′	SD = 14.8′				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°52.7	N19°49.7	50°41.5	17.2′	S01°59.2	14.2′	54.2′
1	195°52.7	50.3	65°17.8	17.2′	02°13.4	14.1′	54.2′
2	210°52.6	50.8	79°54.0	17.2′	02°27.5	14.2′	54.2′
3	225°52.6	·· 51.3	94°30.2	17.2′	02°41.7	14.1′	54.3′
4	240°52.6	51.8	109°06.4	17.2′	02°55.8	14.2′	54.3′
5	255°52.5	52.4	123°42.6	17.1′	03°10.0	14.1′	54.3′
6	270°52.5	N19°52.9	138°18.7	17.1′	S03°24.1	14.2′	54.3′
7	285°52.5	53.4	152°54.8	17.1′	03°38.3	14.1′	54.3′
8	300°52.4	54.0	167°30.9	17.1′	03°52.4	14.1′	54.3′
9	315°52.4	·· 54.5	182°07.0	17.0′	04°06.5	14.1′	54.3′
10	330°52.4	55.0	196°43.1	17.0′	04°20.6	14.1′	54.3′
11	345°52.3	55.5	211°19.1	17.0′	04°34.7	14.1′	54.3′
12	0°52.3	N19°56.1	225°55.1	17.0′	S04°48.8	14.1′	54.3′
13	15°52.3	56.6	240°31.0	16.9′	05°02.9	14.1′	54.3′
14	30°52.2	57.1	255°07.0	16.9′	05°17.0	14.0′	54.4′
15	45°52.2	·· 57.6	269°42.8	16.9′	05°31.0	14.1′	54.4′
16	60°52.2	58.2	284°18.7	16.8′	05°45.1	14.0′	54.4′
17	75°52.1	58.7	298°54.5	16.8′	05°59.1	14.0′	54.4′
18	90°52.1	N19°59.2	313°30.3	16.8′	S06°13.1	14.0′	54.4′
19	105°52.1	19°59.7	328°06.1	16.7′	06°27.1	14.0′	54.4′
20	120°52.0	20°00.2	342°41.8	16.7′	06°41.1	14.0′	54.4′
21	135°52.0	·· 00.8	357°17.5	16.6′	06°55.1	13.9′	54.4′
22	150°52.0	01.3	11°53.1	16.6′	07°09.0	13.9′	54.4′
23	165°51.9	01.8	26°28.7	16.5′	07°22.9	14.0′	54.5′
	SD = 15.8′	d = 0.5′	SD = 14.8′				

Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°51.9	N20°02.3	41°04.2	16.5′	S07°36.9	13.9′	54.5′
1	195°51.9	02.8	55°39.7	16.5′	07°50.8	13.8′	54.5′
2	210°51.8	03.3	70°15.2	16.4′	08°04.6	13.9′	54.5′
3	225°51.8	·· 03.9	84°50.6	16.4′	08°18.5	13.8′	54.5′
4	240°51.7	04.4	99°26.0	16.3′	08°32.3	13.8′	54.5′
5	255°51.7	04.9	114°01.3	16.3′	08°46.1	13.8′	54.5′
6	270°51.7	N20°05.4	128°36.5	16.2′	S08°59.9	13.7′	54.6′
7	285°51.6	05.9	143°11.8	16.2′	09°13.6	13.8′	54.6′
8	300°51.6	06.4	157°46.9	16.1′	09°27.4	13.7′	54.6′
9	315°51.6	·· 06.9	172°22.0	16.1′	09°41.1	13.6′	54.6′
10	330°51.5	07.5	186°57.1	16.0′	09°54.7	13.7′	54.6′
11	345°51.5	08.0	201°32.1	15.9′	10°08.4	13.6′	54.6′
12	0°51.4	N20°08.5	216°07.0	15.9′	S10°22.0	13.6′	54.6′
13	15°51.4	09.0	230°41.9	15.8′	10°35.6	13.5′	54.7′
14	30°51.4	09.5	245°16.8	15.8′	10°49.1	13.5′	54.7′
15	45°51.3	·· 10.0	259°51.5	15.7′	11°02.6	13.5′	54.7′
16	60°51.3	10.5	274°26.2	15.7′	11°16.1	13.4′	54.7′
17	75°51.2	11.0	289°00.9	15.6′	11°29.5	13.5′	54.7′
18	90°51.2	N20°11.5	303°35.5	15.5′	S11°43.0	13.3′	54.7′
19	105°51.2	12.0	318°10.0	15.5′	11°56.3	13.4′	54.7′
20	120°51.1	12.5	332°44.5	15.4′	12°09.7	13.3′	54.8′
21	135°51.1	·· 13.0	347°18.9	15.3′	12°23.0	13.2′	54.8′
22	150°51.0	13.5	1°53.2	15.3′	12°36.2	13.3′	54.8′
23	165°51.0	14.0	16°27.4	15.2′	12°49.5	13.1′	54.8′
	SD = 15.8′	d = 0.5′	SD = 14.9′				

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

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

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 10-12 73-88%
18	03:34	03:32	11:56	20:32	08:12	
19	03:31	03:29	11:57	21:11	08:51	
20	03:28	03:26	11:57	21:52	09:31	

May 21, 22, 23 UT (Tue., Wed., Thu.)

	Aries	Venus		Mars		Jupiter		Saturn	
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	239°07.7	184°47.5	N18°45.9	224°18.5	N05°00.2	182°21.4	N19°11.2	249°18.9	S06°21.4
1	254°10.1	199°46.8	46.7	239°19.2	01.0	197°23.2	11.3	264°21.2	21.4
2	269°12.6	214°46.2	47.5	254°19.9	01.7	212°25.1	11.5	279°23.5	21.3
3	284°15.0	229°45.5	·· 48.3	269°20.6	·· 02.4	227°26.9	·· 11.6	294°25.8	·· 21.3
4	299°17.5	244°44.8	49.1	284°21.3	03.2	242°28.8	11.7	309°28.2	21.2
5	314°20.0	259°44.1	49.9	299°22.1	03.9	257°30.7	11.9	324°30.5	21.2
6	329°22.4	274°43.5	N18°50.7	314°22.8	N05°04.7	272°32.5	N19°12.0	339°32.8	S06°21.1
7	344°24.9	289°42.8	51.5	329°23.5	05.4	287°34.4	12.1	354°35.1	21.1
8	359°27.4	304°42.1	52.3	344°24.2	06.1	302°36.2	12.3	9°37.4	21.0
9	14°29.8	319°41.4	·· 53.1	359°24.9	·· 06.9	317°38.1	·· 12.4	24°39.7	·· 21.0
10	29°32.3	334°40.8	53.9	14°25.6	07.6	332°39.9	12.5	39°42.1	20.9
11	44°34.8	349°40.1	54.7	29°26.3	08.3	347°41.8	12.6	54°44.4	20.9
12	59°37.2	4°39.4	N18°55.4	44°27.0	N05°09.1	2°43.6	N19°12.8	69°46.7	S06°20.8
13	74°39.7	19°38.7	56.2	59°27.7	09.8	17°45.5	12.9	84°49.0	20.8
14	89°42.2	34°38.0	57.0	74°28.4	10.5	32°47.4	13.0	99°51.3	20.7
15	104°44.6	49°37.4	·· 57.8	89°29.2	·· 11.3	47°49.2	·· 13.2	114°53.7	·· 20.7
16	119°47.1	64°36.7	58.6	104°29.9	12.0	62°51.1	13.3	129°56.0	20.6
17	134°49.5	79°36.0	18°59.4	119°30.6	12.8	77°52.9	13.4	144°58.3	20.6
18	149°52.0	94°35.3	N19°00.2	134°31.3	N05°13.5	92°54.8	N19°13.6	160°00.6	S06°20.5
19	164°54.5	109°34.6	01.0	149°32.0	14.2	107°56.6	13.7	175°02.9	20.4
20	179°56.9	124°34.0	01.7	164°32.7	15.0	122°58.5	13.8	190°05.2	20.4
21	194°59.4	139°33.3	·· 02.5	179°33.4	·· 15.7	138°00.3	·· 14.0	205°07.6	·· 20.3
22	210°01.9	154°32.6	03.3	194°34.1	16.4	153°02.2	14.1	220°09.9	20.3
23	225°04.3	169°31.9	04.1	209°34.8	17.2	168°04.1	14.2	235°12.2	20.2
Mer.pass. 08:02		ν -0.7′	d 0.8′	m -3.92	ν 0.7′	d 0.7′	m 1.07	ν 1.9′	d 0.1′ m -2.00	ν 2.3′	d 0.1′ m 1.05

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	240°06.8	184°31.2	N19°04.9	224°35.5	N05°17.9	183°05.9	N19°14.3	250°14.5	S06°20.2
1	255°09.3	199°30.6	05.6	239°36.3	18.6	198°07.8	14.5	265°16.8	20.1
2	270°11.7	214°29.9	06.4	254°37.0	19.4	213°09.6	14.6	280°19.2	20.1
3	285°14.2	229°29.2	·· 07.2	269°37.7	·· 20.1	228°11.5	·· 14.7	295°21.5	·· 20.0
4	300°16.7	244°28.5	08.0	284°38.4	20.8	243°13.3	14.9	310°23.8	20.0
5	315°19.1	259°27.8	08.8	299°39.1	21.6	258°15.2	15.0	325°26.1	19.9
6	330°21.6	274°27.1	N19°09.5	314°39.8	N05°22.3	273°17.0	N19°15.1	340°28.4	S06°19.9
7	345°24.0	289°26.4	10.3	329°40.5	23.0	288°18.9	15.3	355°30.8	19.8
8	0°26.5	304°25.8	11.1	344°41.2	23.8	303°20.8	15.4	10°33.1	19.8
9	15°29.0	319°25.1	·· 11.8	359°41.9	·· 24.5	318°22.6	·· 15.5	25°35.4	·· 19.7
10	30°31.4	334°24.4	12.6	14°42.6	25.2	333°24.5	15.6	40°37.7	19.7
11	45°33.9	349°23.7	13.4	29°43.4	26.0	348°26.3	15.8	55°40.0	19.6
12	60°36.4	4°23.0	N19°14.2	44°44.1	N05°26.7	3°28.2	N19°15.9	70°42.4	S06°19.6
13	75°38.8	19°22.3	14.9	59°44.8	27.4	18°30.0	16.0	85°44.7	19.5
14	90°41.3	34°21.6	15.7	74°45.5	28.2	33°31.9	16.2	100°47.0	19.5
15	105°43.8	49°20.9	·· 16.5	89°46.2	·· 28.9	48°33.7	·· 16.3	115°49.3	·· 19.4
16	120°46.2	64°20.2	17.2	104°46.9	29.6	63°35.6	16.4	130°51.6	19.4
17	135°48.7	79°19.6	18.0	119°47.6	30.4	78°37.5	16.6	145°54.0	19.3
18	150°51.1	94°18.9	N19°18.8	134°48.3	N05°31.1	93°39.3	N19°16.7	160°56.3	S06°19.3
19	165°53.6	109°18.2	19.5	149°49.0	31.8	108°41.2	16.8	175°58.6	19.2
20	180°56.1	124°17.5	20.3	164°49.7	32.6	123°43.0	16.9	191°00.9	19.2
21	195°58.5	139°16.8	·· 21.0	179°50.5	·· 33.3	138°44.9	·· 17.1	206°03.2	·· 19.1
22	211°01.0	154°16.1	21.8	194°51.2	34.0	153°46.7	17.2	221°05.6	19.1
23	226°03.5	169°15.4	22.6	209°51.9	34.8	168°48.6	17.3	236°07.9	19.0
Mer.pass. 07:58		ν -0.7′	d 0.8′	m -3.92	ν 0.7′	d 0.7′	m 1.07	ν 1.9′	d 0.1′ m -2.00	ν 2.3′	d 0.1′ m 1.04

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	241°05.9	184°14.7	N19°23.3	224°52.6	N05°35.5	183°50.4	N19°17.5	251°10.2	S06°19.0
1	256°08.4	199°14.0	24.1	239°53.3	36.2	198°52.3	17.6	266°12.5	18.9
2	271°10.9	214°13.3	24.8	254°54.0	37.0	213°54.1	17.7	281°14.9	18.9
3	286°13.3	229°12.6	·· 25.6	269°54.7	·· 37.7	228°56.0	·· 17.9	296°17.2	·· 18.8
4	301°15.8	244°11.9	26.4	284°55.4	38.4	243°57.9	18.0	311°19.5	18.8
5	316°18.3	259°11.2	27.1	299°56.1	39.2	258°59.7	18.1	326°21.8	18.7
6	331°20.7	274°10.5	N19°27.9	314°56.8	N05°39.9	274°01.6	N19°18.2	341°24.2	S06°18.7
7	346°23.2	289°09.8	28.6	329°57.6	40.6	289°03.4	18.4	356°26.5	18.6
8	1°25.6	304°09.1	29.4	344°58.3	41.4	304°05.3	18.5	11°28.8	18.6
9	16°28.1	319°08.4	·· 30.1	359°59.0	·· 42.1	319°07.1	·· 18.6	26°31.1	·· 18.5
10	31°30.6	334°07.7	30.9	14°59.7	42.8	334°09.0	18.8	41°33.4	18.5
11	46°33.0	349°07.0	31.6	30°00.4	43.6	349°10.8	18.9	56°35.8	18.4
12	61°35.5	4°06.3	N19°32.4	45°01.1	N05°44.3	4°12.7	N19°19.0	71°38.1	S06°18.4
13	76°38.0	19°05.6	33.1	60°01.8	45.0	19°14.6	19.1	86°40.4	18.3
14	91°40.4	34°04.9	33.9	75°02.5	45.7	34°16.4	19.3	101°42.7	18.3
15	106°42.9	49°04.2	·· 34.6	90°03.2	·· 46.5	49°18.3	·· 19.4	116°45.1	·· 18.2
16	121°45.4	64°03.5	35.3	105°03.9	47.2	64°20.1	19.5	131°47.4	18.2
17	136°47.8	79°02.8	36.1	120°04.6	47.9	79°22.0	19.7	146°49.7	18.1
18	151°50.3	94°02.1	N19°36.8	135°05.4	N05°48.7	94°23.8	N19°19.8	161°52.0	S06°18.1
19	166°52.8	109°01.4	37.6	150°06.1	49.4	109°25.7	19.9	176°54.4	18.0
20	181°55.2	124°00.7	38.3	165°06.8	50.1	124°27.5	20.0	191°56.7	18.0
21	196°57.7	139°00.0	·· 39.1	180°07.5	·· 50.9	139°29.4	·· 20.2	206°59.0	·· 18.0
22	212°00.1	153°59.3	39.8	195°08.2	51.6	154°31.3	20.3	222°01.3	17.9
23	227°02.6	168°58.6	40.5	210°08.9	52.3	169°33.1	20.4	237°03.7	17.9
Mer.pass. 07:54		ν -0.7′	d 0.8′	m -3.92	ν 0.7′	d 0.7′	m 1.07	ν 1.9′	d 0.1′ m -2.00	ν 2.3′	d 0.0′ m 1.04

Stars

	SHA	Dec
Alpheratz	357°35.5	29°13.3
Ankaa	353°07.9	-42°10.3
Schedar	349°32.1	56°40.0
Diphda	348°48.1	-17°51.2
Achernar	335°21.1	-57°06.6
Hamal	327°52.1	23°34.5
Polaris	314°47.1	89°21.9
Acamar	315°12.6	-40°12.4
Menkar	314°07.0	4°11.0
Mirfak	308°29.6	49°56.8
Aldebaran	290°40.6	16°33.4
Rigel	281°04.7	-8°10.5
Capella	280°23.2	46°01.4
Bellatrix	278°23.8	6°22.3
Elnath	278°02.9	28°37.7
Alnilam	275°38.6	-1°11.2
Betelgeuse	270°53.0	7°24.7
Canopus	263°53.1	-52°42.6
Sirius	258°27.0	-16°45.0
Adhara	255°06.6	-29°00.4
Procyon	244°51.6	5°09.7
Pollux	243°18.2	27°58.1
Avior	234°15.3	-59°35.5
Suhail	222°46.9	-43°32.1
Miaplacidus	221°38.7	-69°49.3
Alphard	217°48.4	-8°45.9
Regulus	207°35.0	11°50.9
Dubhe	193°41.5	61°37.5
Denebola	182°25.4	14°26.2
Gienah	175°44.0	-17°40.8
Acrux	173°00.4	-63°14.3
Gacrux	171°51.9	-57°15.2
Alioth	166°13.0	55°49.8
Spica	158°22.6	-11°17.4
Alkaid	152°52.0	49°11.6
Hadar	148°36.2	-60°29.6
Menkent	147°57.9	-36°29.5
Arcturus	145°48.1	19°03.3
Rigil Kent.	139°40.5	-60°56.3
Kochab	137°18.6	74°03.4
Zuben'ubi	136°56.3	-16°08.7
Alphecca	126°03.8	26°37.9
Antares	112°16.1	-26°29.2
Atria	107°10.3	-69°04.2
Sabik	102°03.1	-15°45.4
Shaula	96°10.7	-37°07.3
Rasalhague	95°58.7	12°32.4
Eltanin	90°42.0	51°28.9
Kaus Aust.	83°32.9	-34°22.3
Vega	80°33.3	38°48.1
Nunki	75°48.2	-26°16.0
Altair	62°00.3	8°55.8
Peacock	53°06.3	-56°39.2
Deneb	49°26.0	45°21.7
Enif	33°39.3	9°59.0
Al Na'ir	27°33.6	-46°50.4
Fomalhaut	15°15.2	-29°29.5
Scheat	13°45.8	28°12.7
Markab	13°30.5	15°20.0

May 21 Tue	SHA	Mer.pass
Venus	305°39.8	11:41
Mars	345°10.8	09:02
Jupiter	303°13.7	11:49
Saturn	10°11.2	07:22

May 22 Wed	SHA	Mer.pass
Venus	304°24.4	11:42
Mars	344°28.7	09:01
Jupiter	302°59.1	11:46
Saturn	10°07.7	07:18

May 23 Thu	SHA	Mer.pass
Venus	303°08.8	11:44
Mars	343°46.6	09:00
Jupiter	302°44.5	11:43
Saturn	10°04.3	07:14

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°50.9	N20°14.5	31°01.6	15.1′	S13°02.6	13.2′	54.8′
1	195°50.9	15.1	45°35.8	15.1′	13°15.8	13.1′	54.8′
2	210°50.9	15.6	60°09.8	15.0′	13°28.9	13.0′	54.9′
3	225°50.8	·· 16.1	74°43.8	14.9′	13°41.9	13.0′	54.9′
4	240°50.8	16.6	89°17.7	14.8′	13°54.9	13.0′	54.9′
5	255°50.7	17.1	103°51.5	14.8′	14°07.9	12.9′	54.9′
6	270°50.7	N20°17.6	118°25.3	14.7′	S14°20.8	12.8′	54.9′
7	285°50.6	18.1	132°59.0	14.6′	14°33.6	12.8′	55.0′
8	300°50.6	18.6	147°32.6	14.5′	14°46.4	12.8′	55.0′
9	315°50.6	·· 19.0	162°06.1	14.5′	14°59.2	12.7′	55.0′
10	330°50.5	19.5	176°39.6	14.4′	15°11.9	12.7′	55.0′
11	345°50.5	20.0	191°12.9	14.3′	15°24.6	12.5′	55.0′
12	0°50.4	N20°20.5	205°46.2	14.2′	S15°37.1	12.6′	55.0′
13	15°50.4	21.0	220°19.4	14.1′	15°49.7	12.5′	55.1′
14	30°50.3	21.5	234°52.6	14.0′	16°02.2	12.4′	55.1′
15	45°50.3	·· 22.0	249°25.6	14.0′	16°14.6	12.4′	55.1′
16	60°50.2	22.5	263°58.6	13.9′	16°27.0	12.3′	55.1′
17	75°50.2	23.0	278°31.5	13.8′	16°39.3	12.2′	55.1′
18	90°50.2	N20°23.5	293°04.2	13.7′	S16°51.5	12.2′	55.2′
19	105°50.1	24.0	307°37.0	13.6′	17°03.7	12.1′	55.2′
20	120°50.1	24.5	322°09.6	13.5′	17°15.8	12.1′	55.2′
21	135°50.0	·· 25.0	336°42.1	13.4′	17°27.9	12.0′	55.2′
22	150°50.0	25.5	351°14.5	13.4′	17°39.9	11.9′	55.2′
23	165°49.9	26.0	5°46.9	13.3′	17°51.8	11.9′	55.2′
	SD = 15.8′	d = 0.5′	SD = 15.0′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°49.9	N20°26.4	20°19.2	13.2′	S18°03.7	11.7′	55.3′
1	195°49.8	26.9	34°51.3	13.1′	18°15.4	11.8′	55.3′
2	210°49.8	27.4	49°23.4	13.0′	18°27.2	11.6′	55.3′
3	225°49.7	·· 27.9	63°55.4	12.9′	18°38.8	11.6′	55.3′
4	240°49.7	28.4	78°27.3	12.8′	18°50.4	11.5′	55.3′
5	255°49.6	28.9	92°59.1	12.7′	19°01.9	11.4′	55.4′
6	270°49.6	N20°29.4	107°30.8	12.6′	S19°13.3	11.3′	55.4′
7	285°49.5	29.8	122°02.4	12.5′	19°24.6	11.3′	55.4′
8	300°49.5	30.3	136°33.9	12.4′	19°35.9	11.2′	55.4′
9	315°49.4	·· 30.8	151°05.4	12.3′	19°47.1	11.1′	55.4′
10	330°49.4	31.3	165°36.7	12.2′	19°58.2	11.0′	55.5′
11	345°49.3	31.8	180°07.9	12.1′	20°09.2	10.9′	55.5′
12	0°49.3	N20°32.3	194°39.0	12.0′	S20°20.1	10.9′	55.5′
13	15°49.2	32.7	209°10.1	11.9′	20°31.0	10.7′	55.5′
14	30°49.2	33.2	223°41.0	11.8′	20°41.7	10.7′	55.6′
15	45°49.1	·· 33.7	238°11.8	11.7′	20°52.4	10.6′	55.6′
16	60°49.1	34.2	252°42.6	11.6′	21°03.0	10.5′	55.6′
17	75°49.0	34.7	267°13.2	11.5′	21°13.5	10.4′	55.6′
18	90°49.0	N20°35.1	281°43.7	11.4′	S21°23.9	10.3′	55.6′
19	105°48.9	35.6	296°14.2	11.3′	21°34.2	10.2′	55.7′
20	120°48.9	36.1	310°44.5	11.2′	21°44.4	10.1′	55.7′
21	135°48.8	·· 36.6	325°14.7	11.1′	21°54.5	10.0′	55.7′
22	150°48.8	37.0	339°44.9	11.0′	22°04.5	9.9′	55.7′
23	165°48.7	37.5	354°14.9	10.9′	22°14.4	9.9′	55.7′
	SD = 15.8′	d = 0.5′	SD = 15.1′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°48.7	N20°38.0	8°44.8	10.8′	S22°24.3	9.7′	55.8′
1	195°48.6	38.5	23°14.7	10.7′	22°34.0	9.6′	55.8′
2	210°48.6	38.9	37°44.4	10.6′	22°43.6	9.5′	55.8′
3	225°48.5	·· 39.4	52°14.0	10.5′	22°53.1	9.4′	55.8′
4	240°48.5	39.9	66°43.5	10.4′	23°02.5	9.3′	55.8′
5	255°48.4	40.3	81°12.9	10.3′	23°11.8	9.2′	55.9′
6	270°48.4	N20°40.8	95°42.3	10.2′	S23°21.0	9.1′	55.9′
7	285°48.3	41.3	110°11.5	10.1′	23°30.1	9.0′	55.9′
8	300°48.2	41.8	124°40.6	10.0′	23°39.1	8.8′	55.9′
9	315°48.2	·· 42.2	139°09.6	9.9′	23°47.9	8.8′	56.0′
10	330°48.1	42.7	153°38.5	9.8′	23°56.7	8.6′	56.0′
11	345°48.1	43.2	168°07.3	9.7′	24°05.3	8.5′	56.0′
12	0°48.0	N20°43.6	182°36.0	9.6′	S24°13.8	8.4′	56.0′
13	15°48.0	44.1	197°04.6	9.5′	24°22.2	8.3′	56.0′
14	30°47.9	44.6	211°33.1	9.4′	24°30.5	8.1′	56.1′
15	45°47.9	·· 45.0	226°01.5	9.3′	24°38.6	8.0′	56.1′
16	60°47.8	45.5	240°29.8	9.2′	24°46.6	8.0′	56.1′
17	75°47.7	45.9	254°58.0	9.1′	24°54.6	7.7′	56.1′
18	90°47.7	N20°46.4	269°26.1	9.0′	S25°02.3	7.7′	56.2′
19	105°47.6	46.9	283°54.1	8.9′	25°10.0	7.5′	56.2′
20	120°47.6	47.3	298°22.0	8.8′	25°17.5	7.4′	56.2′
21	135°47.5	·· 47.8	312°49.8	8.7′	25°24.9	7.3′	56.2′
22	150°47.5	48.3	327°17.6	8.6′	25°32.2	7.1′	56.2′
23	165°47.4	48.7	341°45.2	8.5′	25°39.3	7.0′	56.3′
	SD = 15.8′	d = 0.5′	SD = 15.2′				

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

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

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 93-100%
21	03:24	03:22	11:57	22:36	10:14	
22	03:19	03:17	11:57	23:24	10:59	
23	03:15	03:12	11:57	–:–	11:49	

May 24, 25, 26 UT (Fri., Sat., Sun.)

	Aries	Venus		Mars		Jupiter		Saturn	
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	242°05.1	183°57.9	N19°41.3	225°09.6	N05°53.0	184°35.0	N19°20.6	252°06.0	S06°17.8
1	257°07.5	198°57.2	42.0	240°10.3	53.8	199°36.8	20.7	267°08.3	17.8
2	272°10.0	213°56.5	42.7	255°11.0	54.5	214°38.7	20.8	282°10.6	17.7
3	287°12.5	228°55.8	·· 43.5	270°11.7	·· 55.2	229°40.5	·· 20.9	297°13.0	·· 17.7
4	302°14.9	243°55.1	44.2	285°12.5	56.0	244°42.4	21.1	312°15.3	17.6
5	317°17.4	258°54.3	44.9	300°13.2	56.7	259°44.2	21.2	327°17.6	17.6
6	332°19.9	273°53.6	N19°45.7	315°13.9	N05°57.4	274°46.1	N19°21.3	342°19.9	S06°17.5
7	347°22.3	288°52.9	46.4	330°14.6	58.2	289°48.0	21.5	357°22.3	17.5
8	2°24.8	303°52.2	47.1	345°15.3	58.9	304°49.8	21.6	12°24.6	17.4
9	17°27.3	318°51.5	·· 47.9	0°16.0	05°59.6	319°51.7	·· 21.7	27°26.9	·· 17.4
10	32°29.7	333°50.8	48.6	15°16.7	06°00.3	334°53.5	21.8	42°29.3	17.3
11	47°32.2	348°50.1	49.3	30°17.4	01.1	349°55.4	22.0	57°31.6	17.3
12	62°34.6	3°49.4	N19°50.0	45°18.1	N06°01.8	4°57.2	N19°22.1	72°33.9	S06°17.2
13	77°37.1	18°48.7	50.8	60°18.8	02.5	19°59.1	22.2	87°36.2	17.2
14	92°39.6	33°48.0	51.5	75°19.6	03.2	35°00.9	22.4	102°38.6	17.1
15	107°42.0	48°47.2	·· 52.2	90°20.3	·· 04.0	50°02.8	·· 22.5	117°40.9	·· 17.1
16	122°44.5	63°46.5	52.9	105°21.0	04.7	65°04.7	22.6	132°43.2	17.0
17	137°47.0	78°45.8	53.7	120°21.7	05.4	80°06.5	22.7	147°45.5	17.0
18	152°49.4	93°45.1	N19°54.4	135°22.4	N06°06.2	95°08.4	N19°22.9	162°47.9	S06°16.9
19	167°51.9	108°44.4	55.1	150°23.1	06.9	110°10.2	23.0	177°50.2	16.9
20	182°54.4	123°43.7	55.8	165°23.8	07.6	125°12.1	23.1	192°52.5	16.9
21	197°56.8	138°43.0	·· 56.5	180°24.5	·· 08.3	140°13.9	·· 23.3	207°54.9	·· 16.8
22	212°59.3	153°42.2	57.3	195°25.2	09.1	155°15.8	23.4	222°57.2	16.8
23	228°01.8	168°41.5	58.0	210°25.9	09.8	170°17.6	23.5	237°59.5	16.7
Mer.pass. 07:50		ν -0.7′	d 0.7′	m -3.92	ν 0.7′	d 0.7′	m 1.06	ν 1.9′	d 0.1′ m -2.00	ν 2.3′	d 0.0′ m 1.04

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	243°04.2	183°40.8	N19°58.7	225°26.6	N06°10.5	185°19.5	N19°23.6	253°01.8	S06°16.7
1	258°06.7	198°40.1	19°59.4	240°27.4	11.2	200°21.3	23.8	268°04.2	16.6
2	273°09.1	213°39.4	20°00.1	255°28.1	12.0	215°23.2	23.9	283°06.5	16.6
3	288°11.6	228°38.6	·· 00.8	270°28.8	·· 12.7	230°25.1	·· 24.0	298°08.8	·· 16.5
4	303°14.1	243°37.9	01.5	285°29.5	13.4	245°26.9	24.1	313°11.2	16.5
5	318°16.5	258°37.2	02.3	300°30.2	14.1	260°28.8	24.3	328°13.5	16.4
6	333°19.0	273°36.5	N20°03.0	315°30.9	N06°14.9	275°30.6	N19°24.4	343°15.8	S06°16.4
7	348°21.5	288°35.8	03.7	330°31.6	15.6	290°32.5	24.5	358°18.1	16.3
8	3°23.9	303°35.0	04.4	345°32.3	16.3	305°34.3	24.7	13°20.5	16.3
9	18°26.4	318°34.3	·· 05.1	0°33.0	·· 17.0	320°36.2	·· 24.8	28°22.8	·· 16.2
10	33°28.9	333°33.6	05.8	15°33.7	17.8	335°38.0	24.9	43°25.1	16.2
11	48°31.3	348°32.9	06.5	30°34.4	18.5	350°39.9	25.0	58°27.5	16.2
12	63°33.8	3°32.2	N20°07.2	45°35.2	N06°19.2	5°41.8	N19°25.2	73°29.8	S06°16.1
13	78°36.2	18°31.4	07.9	60°35.9	19.9	20°43.6	25.3	88°32.1	16.1
14	93°38.7	33°30.7	08.6	75°36.6	20.7	35°45.5	25.4	103°34.5	16.0
15	108°41.2	48°30.0	·· 09.3	90°37.3	·· 21.4	50°47.3	·· 25.5	118°36.8	·· 16.0
16	123°43.6	63°29.3	10.0	105°38.0	22.1	65°49.2	25.7	133°39.1	15.9
17	138°46.1	78°28.5	10.7	120°38.7	22.8	80°51.0	25.8	148°41.5	15.9
18	153°48.6	93°27.8	N20°11.4	135°39.4	N06°23.6	95°52.9	N19°25.9	163°43.8	S06°15.8
19	168°51.0	108°27.1	12.1	150°40.1	24.3	110°54.7	26.1	178°46.1	15.8
20	183°53.5	123°26.4	12.8	165°40.8	25.0	125°56.6	26.2	193°48.4	15.7
21	198°56.0	138°25.6	·· 13.5	180°41.5	·· 25.7	140°58.5	·· 26.3	208°50.8	·· 15.7
22	213°58.4	153°24.9	14.2	195°42.2	26.5	156°00.3	26.4	223°53.1	15.6
23	229°00.9	168°24.2	14.9	210°43.0	27.2	171°02.2	26.6	238°55.4	15.6
Mer.pass. 07:46		ν -0.7′	d 0.7′	m -3.92	ν 0.7′	d 0.7′	m 1.06	ν 1.9′	d 0.1′ m -2.00	ν 2.3′	d 0.0′ m 1.04

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	244°03.4	183°23.4	N20°15.6	225°43.7	N06°27.9	186°04.0	N19°26.7	253°57.8	S06°15.6
1	259°05.8	198°22.7	16.3	240°44.4	28.6	201°05.9	26.8	269°00.1	15.5
2	274°08.3	213°22.0	17.0	255°45.1	29.4	216°07.7	26.9	284°02.4	15.5
3	289°10.7	228°21.2	·· 17.6	270°45.8	·· 30.1	231°09.6	·· 27.1	299°04.8	·· 15.4
4	304°13.2	243°20.5	18.3	285°46.5	30.8	246°11.4	27.2	314°07.1	15.4
5	319°15.7	258°19.8	19.0	300°47.2	31.5	261°13.3	27.3	329°09.4	15.3
6	334°18.1	273°19.1	N20°19.7	315°47.9	N06°32.2	276°15.2	N19°27.5	344°11.8	S06°15.3
7	349°20.6	288°18.3	20.4	330°48.6	33.0	291°17.0	27.6	359°14.1	15.2
8	4°23.1	303°17.6	21.1	345°49.3	33.7	306°18.9	27.7	14°16.4	15.2
9	19°25.5	318°16.9	·· 21.8	0°50.0	·· 34.4	321°20.7	·· 27.8	29°18.8	·· 15.1
10	34°28.0	333°16.1	22.4	15°50.8	35.1	336°22.6	28.0	44°21.1	15.1
11	49°30.5	348°15.4	23.1	30°51.5	35.9	351°24.4	28.1	59°23.4	15.1
12	64°32.9	3°14.7	N20°23.8	45°52.2	N06°36.6	6°26.3	N19°28.2	74°25.8	S06°15.0
13	79°35.4	18°13.9	24.5	60°52.9	37.3	21°28.1	28.3	89°28.1	15.0
14	94°37.9	33°13.2	25.2	75°53.6	38.0	36°30.0	28.5	104°30.4	14.9
15	109°40.3	48°12.5	·· 25.8	90°54.3	·· 38.7	51°31.9	·· 28.6	119°32.8	·· 14.9
16	124°42.8	63°11.7	26.5	105°55.0	39.5	66°33.7	28.7	134°35.1	14.8
17	139°45.2	78°11.0	27.2	120°55.7	40.2	81°35.6	28.8	149°37.4	14.8
18	154°47.7	93°10.2	N20°27.9	135°56.4	N06°40.9	96°37.4	N19°29.0	164°39.8	S06°14.7
19	169°50.2	108°09.5	28.5	150°57.1	41.6	111°39.3	29.1	179°42.1	14.7
20	184°52.6	123°08.8	29.2	165°57.8	42.3	126°41.1	29.2	194°44.4	14.7
21	199°55.1	138°08.0	·· 29.9	180°58.6	·· 43.1	141°43.0	·· 29.3	209°46.8	·· 14.6
22	214°57.6	153°07.3	30.6	195°59.3	43.8	156°44.8	29.5	224°49.1	14.6
23	230°00.0	168°06.5	31.2	211°00.0	44.5	171°46.7	29.6	239°51.5	14.5
Mer.pass. 07:43		ν -0.7′	d 0.7′	m -3.92	ν 0.7′	d 0.7′	m 1.06	ν 1.9′	d 0.1′ m -2.00	ν 2.3′	d 0.0′ m 1.03

Stars

	SHA	Dec
Alpheratz	357°35.5	29°13.3
Ankaa	353°07.9	-42°10.3
Schedar	349°32.0	56°40.0
Diphda	348°48.0	-17°51.2
Achernar	335°21.0	-57°06.6
Hamal	327°52.1	23°34.5
Polaris	314°46.2	89°21.9
Acamar	315°12.6	-40°12.4
Menkar	314°07.0	4°11.1
Mirfak	308°29.5	49°56.7
Aldebaran	290°40.6	16°33.4
Rigel	281°04.7	-8°10.5
Capella	280°23.2	46°01.4
Bellatrix	278°23.8	6°22.3
Elnath	278°02.9	28°37.7
Alnilam	275°38.6	-1°11.2
Betelgeuse	270°53.0	7°24.7
Canopus	263°53.1	-52°42.6
Sirius	258°27.0	-16°45.0
Adhara	255°06.6	-29°00.4
Procyon	244°51.6	5°09.7
Pollux	243°18.2	27°58.1
Avior	234°15.3	-59°35.5
Suhail	222°46.9	-43°32.1
Miaplacidus	221°38.7	-69°49.3
Alphard	217°48.4	-8°45.9
Regulus	207°35.0	11°50.9
Dubhe	193°41.5	61°37.5
Denebola	182°25.4	14°26.2
Gienah	175°44.0	-17°40.8
Acrux	173°00.4	-63°14.3
Gacrux	171°52.0	-57°15.2
Alioth	166°13.1	55°49.8
Spica	158°22.6	-11°17.4
Alkaid	152°52.0	49°11.6
Hadar	148°36.2	-60°29.6
Menkent	147°57.9	-36°29.5
Arcturus	145°48.1	19°03.3
Rigil Kent.	139°40.5	-60°56.3
Kochab	137°18.6	74°03.4
Zuben'ubi	136°56.3	-16°08.7
Alphecca	126°03.8	26°37.9
Antares	112°16.1	-26°29.2
Atria	107°10.3	-69°04.2
Sabik	102°03.1	-15°45.3
Shaula	96°10.7	-37°07.3
Rasalhague	95°58.7	12°32.4
Eltanin	90°41.9	51°28.9
Kaus Aust.	83°32.9	-34°22.3
Vega	80°33.2	38°48.2
Nunki	75°48.1	-26°16.0
Altair	62°00.3	8°55.8
Peacock	53°06.3	-56°39.2
Deneb	49°26.0	45°21.7
Enif	33°39.3	9°59.1
Al Na'ir	27°33.5	-46°50.4
Fomalhaut	15°15.2	-29°29.5
Scheat	13°45.8	28°12.7
Markab	13°30.5	15°20.0

May 24 Fri	SHA	Mer.pass
Venus	301°52.8	11:45
Mars	343°04.5	08:59
Jupiter	302°29.9	11:40
Saturn	10°00.9	07:10

May 25 Sat	SHA	Mer.pass
Venus	300°36.6	11:46
Mars	342°22.4	08:58
Jupiter	302°15.3	11:37
Saturn	9°57.6	07:07

May 26 Sun	SHA	Mer.pass
Venus	299°20.1	11:47
Mars	341°40.3	08:57
Jupiter	302°00.7	11:34
Saturn	9°54.4	07:03

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.1281 sec ΔT = TT-UT1 = +69.0559 sec

2024 May 24 to May. 26 UT

h	Sun		Moon				
Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°47.3	N20°49.2	356°12.7	8.4′	S25°46.3	6.9′	56.3′
1	195°47.3	49.6	10°40.1	8.3′	25°53.2	6.7′	56.3′
2	210°47.2	50.1	25°07.4	8.2′	25°59.9	6.6′	56.3′
3	225°47.2	·· 50.5	39°34.7	8.1′	26°06.5	6.5′	56.3′
4	240°47.1	51.0	54°01.8	8.1′	26°13.0	6.3′	56.4′
5	255°47.1	51.5	68°28.9	8.0′	26°19.3	6.2′	56.4′
6	270°47.0	N20°51.9	82°55.9	7.9′	S26°25.5	6.0′	56.4′
7	285°46.9	52.4	97°22.7	7.8′	26°31.5	5.9′	56.4′
8	300°46.9	52.8	111°49.5	7.7′	26°37.4	5.7′	56.5′
9	315°46.8	·· 53.3	126°16.2	7.6′	26°43.1	5.6′	56.5′
10	330°46.8	53.7	140°42.8	7.5′	26°48.7	5.5′	56.5′
11	345°46.7	54.2	155°09.4	7.4′	26°54.2	5.3′	56.5′
12	0°46.6	N20°54.6	169°35.8	7.4′	S26°59.5	5.1′	56.5′
13	15°46.6	55.1	184°02.2	7.3′	27°04.6	5.0′	56.6′
14	30°46.5	55.5	198°28.4	7.2′	27°09.6	4.9′	56.6′
15	45°46.4	·· 56.0	212°54.6	7.1′	27°14.5	4.7′	56.6′
16	60°46.4	56.4	227°20.8	7.0′	27°19.2	4.5′	56.6′
17	75°46.3	56.9	241°46.8	7.0′	27°23.7	4.4′	56.6′
18	90°46.3	N20°57.3	256°12.8	6.9′	S27°28.1	4.2′	56.7′
19	105°46.2	57.8	270°38.7	6.8′	27°32.3	4.1′	56.7′
20	120°46.1	58.2	285°04.5	6.8′	27°36.4	3.9′	56.7′
21	135°46.1	·· 58.7	299°30.3	6.7′	27°40.3	3.8′	56.7′
22	150°46.0	59.1	313°55.9	6.6′	27°44.1	3.6′	56.8′
23	165°46.0	59.6	328°21.6	6.6′	27°47.7	3.4′	56.8′
	SD = 15.8′	d = 0.5′	SD = 15.3′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°45.9	N21°00.0	342°47.1	6.5′	S27°51.1	3.3′	56.8′
1	195°45.8	00.4	357°12.6	6.4′	27°54.4	3.1′	56.8′
2	210°45.8	00.9	11°38.0	6.4′	27°57.5	3.0′	56.8′
3	225°45.7	·· 01.3	26°03.4	6.3′	28°00.5	2.8′	56.9′
4	240°45.6	01.8	40°28.7	6.2′	28°03.3	2.6′	56.9′
5	255°45.6	02.2	54°53.9	6.2′	28°05.9	2.4′	56.9′
6	270°45.5	N21°02.7	69°19.1	6.1′	S28°08.3	2.3′	56.9′
7	285°45.4	03.1	83°44.3	6.1′	28°10.6	2.1′	56.9′
8	300°45.4	03.5	98°09.4	6.0′	28°12.7	2.0′	57.0′
9	315°45.3	·· 04.0	112°34.4	6.0′	28°14.7	1.8′	57.0′
10	330°45.2	04.4	126°59.4	5.9′	28°16.5	1.6′	57.0′
11	345°45.2	04.8	141°24.3	5.9′	28°18.1	1.4′	57.0′
12	0°45.1	N21°05.3	155°49.2	5.9′	S28°19.5	1.3′	57.1′
13	15°45.0	05.7	170°14.1	5.8′	28°20.8	1.1′	57.1′
14	30°45.0	06.2	184°38.9	5.8′	28°21.9	0.9′	57.1′
15	45°44.9	·· 06.6	199°03.7	5.7′	28°22.8	0.8′	57.1′
16	60°44.8	07.0	213°28.4	5.7′	28°23.6	0.6′	57.1′
17	75°44.8	07.5	227°53.2	5.7′	28°24.2	0.4′	57.2′
18	90°44.7	N21°07.9	242°17.8	5.7′	S28°24.6	0.2′	57.2′
19	105°44.6	08.3	256°42.5	5.6′	28°24.8	0.0′	57.2′
20	120°44.6	08.8	271°07.1	5.6′	28°24.8	0.1′	57.2′
21	135°44.5	·· 09.2	285°31.7	5.6′	28°24.7	0.3′	57.2′
22	150°44.4	09.6	299°56.3	5.6′	28°24.4	0.4′	57.3′
23	165°44.4	10.0	314°20.9	5.5′	28°24.0	0.7′	57.3′
	SD = 15.8′	d = 0.4′	SD = 15.5′				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°44.3	N21°10.5	328°45.4	5.5′	S28°23.3	0.8′	57.3′
1	195°44.2	10.9	343°10.0	5.5′	28°22.5	1.0′	57.3′
2	210°44.2	11.3	357°34.5	5.5′	28°21.5	1.1′	57.3′
3	225°44.1	·· 11.8	11°59.0	5.5′	28°20.4	1.4′	57.4′
4	240°44.0	12.2	26°23.5	5.5′	28°19.0	1.5′	57.4′
5	255°44.0	12.6	40°48.0	5.5′	28°17.5	1.7′	57.4′
6	270°43.9	N21°13.0	55°12.4	5.5′	S28°15.8	1.9′	57.4′
7	285°43.8	13.5	69°36.9	5.5′	28°13.9	2.0′	57.4′
8	300°43.8	13.9	84°01.4	5.5′	28°11.9	2.3′	57.5′
9	315°43.7	·· 14.3	98°25.9	5.5′	28°09.6	2.4′	57.5′
10	330°43.6	14.7	112°50.4	5.5′	28°07.2	2.6′	57.5′
11	345°43.5	15.1	127°14.9	5.5′	28°04.6	2.7′	57.5′
12	0°43.5	N21°15.6	141°39.4	5.5′	S28°01.9	2.9′	57.5′
13	15°43.4	16.0	156°03.9	5.5′	27°59.0	3.2′	57.6′
14	30°43.3	16.4	170°28.4	5.5′	27°55.8	3.2′	57.6′
15	45°43.3	·· 16.8	184°53.0	5.6′	27°52.6	3.5′	57.6′
16	60°43.2	17.2	199°17.5	5.6′	27°49.1	3.6′	57.6′
17	75°43.1	17.7	213°42.1	5.6′	27°45.5	3.8′	57.6′
18	90°43.0	N21°18.1	228°06.7	5.6′	S27°41.7	4.0′	57.7′
19	105°43.0	18.5	242°31.3	5.6′	27°37.7	4.2′	57.7′
20	120°42.9	18.9	256°55.9	5.7′	27°33.5	4.3′	57.7′
21	135°42.8	·· 19.3	271°20.6	5.7′	27°29.2	4.5′	57.7′
22	150°42.8	19.7	285°45.3	5.7′	27°24.7	4.7′	57.7′
23	165°42.7	20.2	300°10.0	5.8′	27°20.0	4.8′	57.8′
	SD = 15.8′	d = 0.4′	SD = 15.6′				

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

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

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	Lower hh:mm	Age 16-18 100-93%
24	03:09	03:07	11:57	00:16	12:43	
25	03:04	03:00	11:57	01:12	13:41	
26	02:57	02:54	11:57	02:10	14:40	

May 27, 28, 29 UT (Mon., Tue., Wed.)

	Aries	Venus		Mars		Jupiter		Saturn	
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	245°02.5	183°05.8	N20°31.9	226°00.7	N06°45.2	186°48.5	N19°29.7	254°53.8	S06°14.5
1	260°05.0	198°05.1	32.6	241°01.4	45.9	201°50.4	29.8	269°56.1	14.4
2	275°07.4	213°04.3	33.2	256°02.1	46.7	216°52.3	30.0	284°58.5	14.4
3	290°09.9	228°03.6	·· 33.9	271°02.8	·· 47.4	231°54.1	·· 30.1	300°00.8	·· 14.3
4	305°12.4	243°02.8	34.6	286°03.5	48.1	246°56.0	30.2	315°03.1	14.3
5	320°14.8	258°02.1	35.2	301°04.2	48.8	261°57.8	30.3	330°05.5	14.3
6	335°17.3	273°01.4	N20°35.9	316°04.9	N06°49.5	276°59.7	N19°30.5	345°07.8	S06°14.2
7	350°19.7	288°00.6	36.6	331°05.6	50.3	292°01.5	30.6	0°10.1	14.2
8	5°22.2	302°59.9	37.2	346°06.3	51.0	307°03.4	30.7	15°12.5	14.1
9	20°24.7	317°59.1	·· 37.9	1°07.1	·· 51.7	322°05.2	·· 30.8	30°14.8	·· 14.1
10	35°27.1	332°58.4	38.5	16°07.8	52.4	337°07.1	31.0	45°17.1	14.0
11	50°29.6	347°57.6	39.2	31°08.5	53.1	352°09.0	31.1	60°19.5	14.0
12	65°32.1	2°56.9	N20°39.9	46°09.2	N06°53.9	7°10.8	N19°31.2	75°21.8	S06°14.0
13	80°34.5	17°56.1	40.5	61°09.9	54.6	22°12.7	31.4	90°24.2	13.9
14	95°37.0	32°55.4	41.2	76°10.6	55.3	37°14.5	31.5	105°26.5	13.9
15	110°39.5	47°54.7	·· 41.8	91°11.3	·· 56.0	52°16.4	·· 31.6	120°28.8	·· 13.8
16	125°41.9	62°53.9	42.5	106°12.0	56.7	67°18.2	31.7	135°31.2	13.8
17	140°44.4	77°53.2	43.1	121°12.7	57.4	82°20.1	31.9	150°33.5	13.7
18	155°46.9	92°52.4	N20°43.8	136°13.4	N06°58.2	97°21.9	N19°32.0	165°35.8	S06°13.7
19	170°49.3	107°51.7	44.4	151°14.1	58.9	112°23.8	32.1	180°38.2	13.7
20	185°51.8	122°50.9	45.1	166°14.8	06°59.6	127°25.7	32.2	195°40.5	13.6
21	200°54.2	137°50.2	·· 45.7	181°15.6	07°00.3	142°27.5	·· 32.4	210°42.9	·· 13.6
22	215°56.7	152°49.4	46.4	196°16.3	01.0	157°29.4	32.5	225°45.2	13.5
23	230°59.2	167°48.7	47.0	211°17.0	01.7	172°31.2	32.6	240°47.5	13.5
Mer.pass. 07:39		ν -0.7′	d 0.7′	m -3.92	ν 0.7′	d 0.7′	m 1.06	ν 1.9′	d 0.1′ m -2.00	ν 2.3′	d 0.0′ m 1.03

Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	246°01.6	182°47.9	N20°47.7	226°17.7	N07°02.5	187°33.1	N19°32.7	255°49.9	S06°13.4
1	261°04.1	197°47.2	48.3	241°18.4	03.2	202°34.9	32.9	270°52.2	13.4
2	276°06.6	212°46.4	49.0	256°19.1	03.9	217°36.8	33.0	285°54.6	13.4
3	291°09.0	227°45.7	·· 49.6	271°19.8	·· 04.6	232°38.6	·· 33.1	300°56.9	·· 13.3
4	306°11.5	242°44.9	50.2	286°20.5	05.3	247°40.5	33.2	315°59.2	13.3
5	321°14.0	257°44.1	50.9	301°21.2	06.0	262°42.4	33.3	331°01.6	13.2
6	336°16.4	272°43.4	N20°51.5	316°21.9	N07°06.8	277°44.2	N19°33.5	346°03.9	S06°13.2
7	351°18.9	287°42.6	52.2	331°22.6	07.5	292°46.1	33.6	1°06.3	13.1
8	6°21.4	302°41.9	52.8	346°23.3	08.2	307°47.9	33.7	16°08.6	13.1
9	21°23.8	317°41.1	·· 53.4	1°24.1	·· 08.9	322°49.8	·· 33.8	31°10.9	·· 13.1
10	36°26.3	332°40.4	54.1	16°24.8	09.6	337°51.6	34.0	46°13.3	13.0
11	51°28.7	347°39.6	54.7	31°25.5	10.3	352°53.5	34.1	61°15.6	13.0
12	66°31.2	2°38.9	N20°55.3	46°26.2	N07°11.0	7°55.3	N19°34.2	76°18.0	S06°12.9
13	81°33.7	17°38.1	56.0	61°26.9	11.8	22°57.2	34.3	91°20.3	12.9
14	96°36.1	32°37.4	56.6	76°27.6	12.5	37°59.1	34.5	106°22.6	12.9
15	111°38.6	47°36.6	·· 57.2	91°28.3	·· 13.2	53°00.9	·· 34.6	121°25.0	·· 12.8
16	126°41.1	62°35.8	57.9	106°29.0	13.9	68°02.8	34.7	136°27.3	12.8
17	141°43.5	77°35.1	58.5	121°29.7	14.6	83°04.6	34.8	151°29.7	12.7
18	156°46.0	92°34.3	N20°59.1	136°30.4	N07°15.3	98°06.5	N19°35.0	166°32.0	S06°12.7
19	171°48.5	107°33.6	20°59.8	151°31.1	16.0	113°08.3	35.1	181°34.3	12.6
20	186°50.9	122°32.8	21°00.4	166°31.8	16.8	128°10.2	35.2	196°36.7	12.6
21	201°53.4	137°32.0	·· 01.0	181°32.6	·· 17.5	143°12.0	·· 35.3	211°39.0	·· 12.6
22	216°55.8	152°31.3	01.6	196°33.3	18.2	158°13.9	35.5	226°41.4	12.5
23	231°58.3	167°30.5	02.3	211°34.0	18.9	173°15.8	35.6	241°43.7	12.5
Mer.pass. 07:35		ν -0.8′	d 0.6′	m -3.92	ν 0.7′	d 0.7′	m 1.05	ν 1.9′	d 0.1′ m -2.00	ν 2.3′	d 0.0′ m 1.03

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	247°00.8	182°29.8	N21°02.9	226°34.7	N07°19.6	188°17.6	N19°35.7	256°46.0	S06°12.4
1	262°03.2	197°29.0	03.5	241°35.4	20.3	203°19.5	35.8	271°48.4	12.4
2	277°05.7	212°28.2	04.1	256°36.1	21.0	218°21.3	36.0	286°50.7	12.4
3	292°08.2	227°27.5	·· 04.7	271°36.8	·· 21.8	233°23.2	·· 36.1	301°53.1	·· 12.3
4	307°10.6	242°26.7	05.4	286°37.5	22.5	248°25.0	36.2	316°55.4	12.3
5	322°13.1	257°25.9	06.0	301°38.2	23.2	263°26.9	36.3	331°57.8	12.2
6	337°15.6	272°25.2	N21°06.6	316°38.9	N07°23.9	278°28.7	N19°36.4	347°00.1	S06°12.2
7	352°18.0	287°24.4	07.2	331°39.6	24.6	293°30.6	36.6	2°02.4	12.2
8	7°20.5	302°23.6	07.8	346°40.3	25.3	308°32.5	36.7	17°04.8	12.1
9	22°23.0	317°22.9	·· 08.4	1°41.0	·· 26.0	323°34.3	·· 36.8	32°07.1	·· 12.1
10	37°25.4	332°22.1	09.0	16°41.7	26.7	338°36.2	36.9	47°09.5	12.0
11	52°27.9	347°21.3	09.7	31°42.5	27.4	353°38.0	37.1	62°11.8	12.0
12	67°30.3	2°20.6	N21°10.3	46°43.2	N07°28.2	8°39.9	N19°37.2	77°14.2	S06°12.0
13	82°32.8	17°19.8	10.9	61°43.9	28.9	23°41.7	37.3	92°16.5	11.9
14	97°35.3	32°19.0	11.5	76°44.6	29.6	38°43.6	37.4	107°18.9	11.9
15	112°37.7	47°18.3	·· 12.1	91°45.3	·· 30.3	53°45.4	·· 37.6	122°21.2	·· 11.8
16	127°40.2	62°17.5	12.7	106°46.0	31.0	68°47.3	37.7	137°23.5	11.8
17	142°42.7	77°16.7	13.3	121°46.7	31.7	83°49.2	37.8	152°25.9	11.8
18	157°45.1	92°16.0	N21°13.9	136°47.4	N07°32.4	98°51.0	N19°37.9	167°28.2	S06°11.7
19	172°47.6	107°15.2	14.5	151°48.1	33.1	113°52.9	38.1	182°30.6	11.7
20	187°50.1	122°14.4	15.1	166°48.8	33.8	128°54.7	38.2	197°32.9	11.6
21	202°52.5	137°13.7	·· 15.7	181°49.5	·· 34.6	143°56.6	·· 38.3	212°35.3	·· 11.6
22	217°55.0	152°12.9	16.3	196°50.2	35.3	158°58.4	38.4	227°37.6	11.6
23	232°57.5	167°12.1	16.9	211°50.9	36.0	174°00.3	38.5	242°40.0	11.5
Mer.pass. 07:31		ν -0.8′	d 0.6′	m -3.92	ν 0.7′	d 0.7′	m 1.05	ν 1.9′	d 0.1′ m -2.00	ν 2.3′	d 0.0′ m 1.03

Stars

	SHA	Dec
Alpheratz	357°35.5	29°13.3
Ankaa	353°07.9	-42°10.3
Schedar	349°32.0	56°40.0
Diphda	348°48.0	-17°51.1
Achernar	335°21.0	-57°06.6
Hamal	327°52.1	23°34.5
Polaris	314°45.4	89°21.9
Acamar	315°12.6	-40°12.4
Menkar	314°07.0	4°11.1
Mirfak	308°29.5	49°56.7
Aldebaran	290°40.6	16°33.5
Rigel	281°04.7	-8°10.4
Capella	280°23.2	46°01.3
Bellatrix	278°23.8	6°22.3
Elnath	278°02.9	28°37.7
Alnilam	275°38.6	-1°11.2
Betelgeuse	270°53.0	7°24.7
Canopus	263°53.1	-52°42.6
Sirius	258°27.0	-16°45.0
Adhara	255°06.6	-29°00.4
Procyon	244°51.6	5°09.7
Pollux	243°18.2	27°58.1
Avior	234°15.3	-59°35.5
Suhail	222°46.9	-43°32.1
Miaplacidus	221°38.8	-69°49.3
Alphard	217°48.4	-8°45.9
Regulus	207°35.0	11°50.9
Dubhe	193°41.5	61°37.5
Denebola	182°25.4	14°26.2
Gienah	175°44.0	-17°40.8
Acrux	173°00.4	-63°14.3
Gacrux	171°52.0	-57°15.2
Alioth	166°13.1	55°49.9
Spica	158°22.6	-11°17.4
Alkaid	152°52.0	49°11.6
Hadar	148°36.2	-60°29.6
Menkent	147°57.9	-36°29.5
Arcturus	145°48.1	19°03.3
Rigil Kent.	139°40.5	-60°56.3
Kochab	137°18.7	74°03.4
Zuben'ubi	136°56.3	-16°08.7
Alphecca	126°03.8	26°37.9
Antares	112°16.1	-26°29.2
Atria	107°10.3	-69°04.2
Sabik	102°03.0	-15°45.3
Shaula	96°10.7	-37°07.3
Rasalhague	95°58.7	12°32.4
Eltanin	90°41.9	51°28.9
Kaus Aust.	83°32.9	-34°22.3
Vega	80°33.2	38°48.2
Nunki	75°48.1	-26°16.0
Altair	62°00.3	8°55.8
Peacock	53°06.2	-56°39.2
Deneb	49°25.9	45°21.7
Enif	33°39.2	9°59.1
Al Na'ir	27°33.5	-46°50.4
Fomalhaut	15°15.1	-29°29.5
Scheat	13°45.8	28°12.7
Markab	13°30.5	15°20.0

May 27 Mon	SHA	Mer.pass
Venus	298°03.3	11:48
Mars	340°58.2	08:56
Jupiter	301°46.1	11:31
Saturn	9°51.3	06:59

May 28 Tue	SHA	Mer.pass
Venus	296°46.3	11:49
Mars	340°16.0	08:54
Jupiter	301°31.4	11:28
Saturn	9°48.2	06:56

May 29 Wed	SHA	Mer.pass
Venus	295°29.0	11:51
Mars	339°33.9	08:53
Jupiter	301°16.8	11:25
Saturn	9°45.3	06:52

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°42.6	N21°20.6	314°34.8	5.8′	S27°15.2	5.1′	57.8′
1	195°42.5	21.0	328°59.6	5.8′	27°10.1	5.1′	57.8′
2	210°42.5	21.4	343°24.4	5.9′	27°05.0	5.4′	57.8′
3	225°42.4	·· 21.8	357°49.3	5.9′	26°59.6	5.5′	57.8′
4	240°42.3	22.2	12°14.2	5.9′	26°54.1	5.7′	57.8′
5	255°42.2	22.6	26°39.1	6.0′	26°48.4	5.9′	57.9′
6	270°42.2	N21°23.0	41°04.1	6.0′	S26°42.5	6.0′	57.9′
7	285°42.1	23.5	55°29.2	6.1′	26°36.5	6.2′	57.9′
8	300°42.0	23.9	69°54.3	6.1′	26°30.3	6.4′	57.9′
9	315°41.9	·· 24.3	84°19.4	6.2′	26°23.9	6.5′	57.9′
10	330°41.9	24.7	98°44.6	6.2′	26°17.4	6.7′	58.0′
11	345°41.8	25.1	113°09.8	6.3′	26°10.7	6.9′	58.0′
12	0°41.7	N21°25.5	127°35.1	6.3′	S26°03.8	7.0′	58.0′
13	15°41.6	25.9	142°00.4	6.4′	25°56.8	7.2′	58.0′
14	30°41.6	26.3	156°25.8	6.4′	25°49.6	7.3′	58.0′
15	45°41.5	·· 26.7	170°51.2	6.5′	25°42.3	7.5′	58.0′
16	60°41.4	27.1	185°16.7	6.6′	25°34.8	7.7′	58.1′
17	75°41.3	27.5	199°42.3	6.6′	25°27.1	7.8′	58.1′
18	90°41.3	N21°27.9	214°07.9	6.7′	S25°19.3	8.0′	58.1′
19	105°41.2	28.3	228°33.6	6.7′	25°11.3	8.1′	58.1′
20	120°41.1	28.7	242°59.3	6.8′	25°03.2	8.3′	58.1′
21	135°41.0	·· 29.1	257°25.1	6.9′	24°54.9	8.4′	58.1′
22	150°40.9	29.5	271°51.0	6.9′	24°46.5	8.6′	58.2′
23	165°40.9	29.9	286°16.9	7.0′	24°37.9	8.8′	58.2′
	SD = 15.8′	d = 0.4′	SD = 15.8′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°40.8	N21°30.3	300°42.9	7.1′	S24°29.1	8.9′	58.2′
1	195°40.7	30.7	315°09.0	7.1′	24°20.2	9.0′	58.2′
2	210°40.6	31.1	329°35.1	7.2′	24°11.2	9.2′	58.2′
3	225°40.6	·· 31.5	344°01.3	7.3′	24°02.0	9.3′	58.3′
4	240°40.5	31.9	358°27.6	7.3′	23°52.7	9.5′	58.3′
5	255°40.4	32.3	12°53.9	7.4′	23°43.2	9.6′	58.3′
6	270°40.3	N21°32.7	27°20.3	7.5′	S23°33.6	9.8′	58.3′
7	285°40.2	33.1	41°46.8	7.5′	23°23.8	9.9′	58.3′
8	300°40.2	33.5	56°13.4	7.6′	23°13.9	10.1′	58.3′
9	315°40.1	·· 33.9	70°40.0	7.7′	23°03.8	10.2′	58.4′
10	330°40.0	34.3	85°06.7	7.8′	22°53.6	10.3′	58.4′
11	345°39.9	34.7	99°33.5	7.8′	22°43.3	10.5′	58.4′
12	0°39.8	N21°35.0	114°00.3	7.9′	S22°32.8	10.6′	58.4′
13	15°39.8	35.4	128°27.2	8.0′	22°22.2	10.7′	58.4′
14	30°39.7	35.8	142°54.2	8.1′	22°11.5	10.9′	58.4′
15	45°39.6	·· 36.2	157°21.2	8.1′	22°00.6	11.0′	58.4′
16	60°39.5	36.6	171°48.4	8.2′	21°49.6	11.1′	58.5′
17	75°39.4	37.0	186°15.6	8.3′	21°38.5	11.3′	58.5′
18	90°39.3	N21°37.4	200°42.9	8.4′	S21°27.2	11.4′	58.5′
19	105°39.3	37.8	215°10.2	8.4′	21°15.8	11.5′	58.5′
20	120°39.2	38.1	229°37.7	8.5′	21°04.3	11.7′	58.5′
21	135°39.1	·· 38.5	244°05.2	8.6′	20°52.6	11.7′	58.5′
22	150°39.0	38.9	258°32.7	8.7′	20°40.9	11.9′	58.6′
23	165°38.9	39.3	273°00.4	8.7′	20°29.0	12.0′	58.6′
	SD = 15.8′	d = 0.4′	SD = 15.9′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°38.9	N21°39.7	287°28.1	8.8′	S20°17.0	12.2′	58.6′
1	195°38.8	40.1	301°55.9	8.9′	20°04.8	12.2′	58.6′
2	210°38.7	40.4	316°23.8	8.9′	19°52.6	12.4′	58.6′
3	225°38.6	·· 40.8	330°51.7	9.0′	19°40.2	12.5′	58.6′
4	240°38.5	41.2	345°19.8	9.1′	19°27.7	12.6′	58.6′
5	255°38.4	41.6	359°47.9	9.2′	19°15.1	12.7′	58.7′
6	270°38.3	N21°42.0	14°16.0	9.2′	S19°02.4	12.8′	58.7′
7	285°38.3	42.3	28°44.3	9.3′	18°49.6	12.9′	58.7′
8	300°38.2	42.7	43°12.6	9.4′	18°36.7	13.1′	58.7′
9	315°38.1	·· 43.1	57°41.0	9.5′	18°23.6	13.1′	58.7′
10	330°38.0	43.5	72°09.4	9.5′	18°10.5	13.3′	58.7′
11	345°37.9	43.9	86°37.9	9.6′	17°57.2	13.3′	58.7′
12	0°37.8	N21°44.2	101°06.5	9.7′	S17°43.9	13.5′	58.8′
13	15°37.8	44.6	115°35.2	9.7′	17°30.4	13.5′	58.8′
14	30°37.7	45.0	130°03.9	9.8′	17°16.9	13.7′	58.8′
15	45°37.6	·· 45.3	144°32.7	9.9′	17°03.2	13.7′	58.8′
16	60°37.5	45.7	159°01.6	9.9′	16°49.5	13.9′	58.8′
17	75°37.4	46.1	173°30.6	10.0′	16°35.6	13.9′	58.8′
18	90°37.3	N21°46.5	187°59.6	10.1′	S16°21.7	14.1′	58.8′
19	105°37.2	46.8	202°28.6	10.1′	16°07.6	14.1′	58.9′
20	120°37.1	47.2	216°57.8	10.2′	15°53.5	14.2′	58.9′
21	135°37.1	·· 47.6	231°27.0	10.3′	15°39.3	14.4′	58.9′
22	150°37.0	47.9	245°56.2	10.3′	15°24.9	14.4′	58.9′
23	165°36.9	48.3	260°25.6	10.4′	15°10.5	14.4′	58.9′
	SD = 15.8′	d = 0.4′	SD = 16.0′				

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

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

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 19-21 87-69%
27	02:50	02:47	11:57	03:09	15:38	
28	02:43	02:39	11:57	04:06	16:34	
29	02:35	02:31	11:57	05:01	17:27	

May 30, 31, 01 UT (Thu., Fri., Sat.)

	Aries	Venus		Mars		Jupiter		Saturn	
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	247°59.9	182°11.3	N21°17.5	226°51.7	N07°36.7	189°02.1	N19°38.7	257°42.3	S06°11.5
1	263°02.4	197°10.6	18.1	241°52.4	37.4	204°04.0	38.8	272°44.6	11.4
2	278°04.8	212°09.8	18.7	256°53.1	38.1	219°05.9	38.9	287°47.0	11.4
3	293°07.3	227°09.0	·· 19.3	271°53.8	·· 38.8	234°07.7	·· 39.0	302°49.3	·· 11.4
4	308°09.8	242°08.2	19.9	286°54.5	39.5	249°09.6	39.2	317°51.7	11.3
5	323°12.2	257°07.5	20.5	301°55.2	40.2	264°11.4	39.3	332°54.0	11.3
6	338°14.7	272°06.7	N21°21.1	316°55.9	N07°40.9	279°13.3	N19°39.4	347°56.4	S06°11.2
7	353°17.2	287°05.9	21.7	331°56.6	41.6	294°15.1	39.5	2°58.7	11.2
8	8°19.6	302°05.1	22.2	346°57.3	42.4	309°17.0	39.6	18°01.1	11.2
9	23°22.1	317°04.4	·· 22.8	1°58.0	·· 43.1	324°18.8	·· 39.8	33°03.4	·· 11.1
10	38°24.6	332°03.6	23.4	16°58.7	43.8	339°20.7	39.9	48°05.8	11.1
11	53°27.0	347°02.8	24.0	31°59.4	44.5	354°22.6	40.0	63°08.1	11.0
12	68°29.5	2°02.0	N21°24.6	47°00.1	N07°45.2	9°24.4	N19°40.1	78°10.5	S06°11.0
13	83°32.0	17°01.3	25.2	62°00.8	45.9	24°26.3	40.3	93°12.8	11.0
14	98°34.4	32°00.5	25.8	77°01.5	46.6	39°28.1	40.4	108°15.2	10.9
15	113°36.9	46°59.7	·· 26.3	92°02.3	·· 47.3	54°30.0	·· 40.5	123°17.5	·· 10.9
16	128°39.3	61°58.9	26.9	107°03.0	48.0	69°31.8	40.6	138°19.8	10.8
17	143°41.8	76°58.1	27.5	122°03.7	48.7	84°33.7	40.7	153°22.2	10.8
18	158°44.3	91°57.4	N21°28.1	137°04.4	N07°49.4	99°35.6	N19°40.9	168°24.5	S06°10.8
19	173°46.7	106°56.6	28.7	152°05.1	50.1	114°37.4	41.0	183°26.9	10.7
20	188°49.2	121°55.8	29.2	167°05.8	50.8	129°39.3	41.1	198°29.2	10.7
21	203°51.7	136°55.0	·· 29.8	182°06.5	·· 51.5	144°41.1	·· 41.2	213°31.6	·· 10.7
22	218°54.1	151°54.2	30.4	197°07.2	52.3	159°43.0	41.4	228°33.9	10.6
23	233°56.6	166°53.5	31.0	212°07.9	53.0	174°44.8	41.5	243°36.3	10.6
Mer.pass. 07:27		ν -0.8′	d 0.6′	m -3.92	ν 0.7′	d 0.7′	m 1.05	ν 1.9′	d 0.1′ m -2.00	ν 2.3′	d 0.0′ m 1.02

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	248°59.1	181°52.7	N21°31.5	227°08.6	N07°53.7	189°46.7	N19°41.6	258°38.6	S06°10.5
1	264°01.5	196°51.9	32.1	242°09.3	54.4	204°48.5	41.7	273°41.0	10.5
2	279°04.0	211°51.1	32.7	257°10.0	55.1	219°50.4	41.8	288°43.3	10.5
3	294°06.4	226°50.3	·· 33.2	272°10.7	·· 55.8	234°52.3	·· 42.0	303°45.7	·· 10.4
4	309°08.9	241°49.5	33.8	287°11.4	56.5	249°54.1	42.1	318°48.0	10.4
5	324°11.4	256°48.7	34.4	302°12.1	57.2	264°56.0	42.2	333°50.4	10.4
6	339°13.8	271°48.0	N21°34.9	317°12.9	N07°57.9	279°57.8	N19°42.3	348°52.7	S06°10.3
7	354°16.3	286°47.2	35.5	332°13.6	58.6	294°59.7	42.4	3°55.1	10.3
8	9°18.8	301°46.4	36.1	347°14.3	07°59.3	310°01.5	42.6	18°57.4	10.2
9	24°21.2	316°45.6	·· 36.6	2°15.0	08°00.0	325°03.4	·· 42.7	33°59.8	·· 10.2
10	39°23.7	331°44.8	37.2	17°15.7	00.7	340°05.2	42.8	49°02.1	10.2
11	54°26.2	346°44.0	37.8	32°16.4	01.4	355°07.1	42.9	64°04.5	10.1
12	69°28.6	1°43.2	N21°38.3	47°17.1	N08°02.1	10°09.0	N19°43.1	79°06.8	S06°10.1
13	84°31.1	16°42.5	38.9	62°17.8	02.8	25°10.8	43.2	94°09.2	10.1
14	99°33.6	31°41.7	39.4	77°18.5	03.5	40°12.7	43.3	109°11.5	10.0
15	114°36.0	46°40.9	·· 40.0	92°19.2	·· 04.2	55°14.5	·· 43.4	124°13.9	·· 10.0
16	129°38.5	61°40.1	40.6	107°19.9	04.9	70°16.4	43.5	139°16.2	09.9
17	144°40.9	76°39.3	41.1	122°20.6	05.6	85°18.2	43.7	154°18.6	09.9
18	159°43.4	91°38.5	N21°41.7	137°21.3	N08°06.3	100°20.1	N19°43.8	169°20.9	S06°09.9
19	174°45.9	106°37.7	42.2	152°22.0	07.0	115°22.0	43.9	184°23.3	09.8
20	189°48.3	121°36.9	42.8	167°22.7	07.7	130°23.8	44.0	199°25.6	09.8
21	204°50.8	136°36.1	·· 43.3	182°23.4	·· 08.4	145°25.7	·· 44.1	214°28.0	·· 09.8
22	219°53.3	151°35.3	43.9	197°24.2	09.1	160°27.5	44.3	229°30.3	09.7
23	234°55.7	166°34.5	44.4	212°24.9	09.8	175°29.4	44.4	244°32.7	09.7
Mer.pass. 07:23		ν -0.8′	d 0.6′	m -3.92	ν 0.7′	d 0.7′	m 1.05	ν 1.9′	d 0.1′ m -2.00	ν 2.3′	d 0.0′ m 1.02

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	249°58.2	181°33.8	N21°45.0	227°25.6	N08°10.6	190°31.2	N19°44.5	259°35.1	S06°09.7
1	265°00.7	196°33.0	45.5	242°26.3	11.3	205°33.1	44.6	274°37.4	09.6
2	280°03.1	211°32.2	46.1	257°27.0	12.0	220°34.9	44.7	289°39.8	09.6
3	295°05.6	226°31.4	·· 46.6	272°27.7	·· 12.7	235°36.8	·· 44.9	304°42.1	·· 09.5
4	310°08.0	241°30.6	47.1	287°28.4	13.4	250°38.7	45.0	319°44.5	09.5
5	325°10.5	256°29.8	47.7	302°29.1	14.1	265°40.5	45.1	334°46.8	09.5
6	340°13.0	271°29.0	N21°48.2	317°29.8	N08°14.8	280°42.4	N19°45.2	349°49.2	S06°09.4
7	355°15.4	286°28.2	48.8	332°30.5	15.5	295°44.2	45.3	4°51.5	09.4
8	10°17.9	301°27.4	49.3	347°31.2	16.2	310°46.1	45.5	19°53.9	09.4
9	25°20.4	316°26.6	·· 49.8	2°31.9	·· 16.9	325°47.9	·· 45.6	34°56.2	·· 09.3
10	40°22.8	331°25.8	50.4	17°32.6	17.6	340°49.8	45.7	49°58.6	09.3
11	55°25.3	346°25.0	50.9	32°33.3	18.3	355°51.7	45.8	65°00.9	09.3
12	70°27.8	1°24.2	N21°51.5	47°34.0	N08°19.0	10°53.5	N19°45.9	80°03.3	S06°09.2
13	85°30.2	16°23.4	52.0	62°34.7	19.7	25°55.4	46.1	95°05.6	09.2
14	100°32.7	31°22.6	52.5	77°35.4	20.4	40°57.2	46.2	110°08.0	09.1
15	115°35.2	46°21.8	·· 53.1	92°36.2	·· 21.1	55°59.1	·· 46.3	125°10.4	·· 09.1
16	130°37.6	61°21.0	53.6	107°36.9	21.8	71°00.9	46.4	140°12.7	09.1
17	145°40.1	76°20.2	54.1	122°37.6	22.5	86°02.8	46.5	155°15.1	09.0
18	160°42.5	91°19.4	N21°54.6	137°38.3	N08°23.2	101°04.7	N19°46.7	170°17.4	S06°09.0
19	175°45.0	106°18.6	55.2	152°39.0	23.9	116°06.5	46.8	185°19.8	09.0
20	190°47.5	121°17.8	55.7	167°39.7	24.6	131°08.4	46.9	200°22.1	08.9
21	205°49.9	136°17.0	·· 56.2	182°40.4	·· 25.2	146°10.2	·· 47.0	215°24.5	·· 08.9
22	220°52.4	151°16.2	56.7	197°41.1	25.9	161°12.1	47.1	230°26.8	08.9
23	235°54.9	166°15.4	57.3	212°41.8	26.6	176°13.9	47.3	245°29.2	08.8
Mer.pass. 07:19		ν -0.8′	d 0.5′	m -3.92	ν 0.7′	d 0.7′	m 1.04	ν 1.9′	d 0.1′ m -2.00	ν 2.4′	d 0.0′ m 1.02

Stars

	SHA	Dec
Alpheratz	357°35.5	29°13.3
Ankaa	353°07.8	-42°10.2
Schedar	349°32.0	56°40.0
Diphda	348°48.0	-17°51.1
Achernar	335°21.0	-57°06.6
Hamal	327°52.1	23°34.5
Polaris	314°44.8	89°21.9
Acamar	315°12.6	-40°12.3
Menkar	314°07.0	4°11.1
Mirfak	308°29.5	49°56.7
Aldebaran	290°40.6	16°33.5
Rigel	281°04.7	-8°10.4
Capella	280°23.1	46°01.3
Bellatrix	278°23.8	6°22.3
Elnath	278°02.9	28°37.7
Alnilam	275°38.6	-1°11.2
Betelgeuse	270°53.0	7°24.7
Canopus	263°53.1	-52°42.6
Sirius	258°27.0	-16°45.0
Adhara	255°06.6	-29°00.4
Procyon	244°51.6	5°09.8
Pollux	243°18.2	27°58.1
Avior	234°15.4	-59°35.4
Suhail	222°46.9	-43°32.0
Miaplacidus	221°38.8	-69°49.3
Alphard	217°48.4	-8°45.9
Regulus	207°35.1	11°50.9
Dubhe	193°41.6	61°37.5
Denebola	182°25.4	14°26.2
Gienah	175°44.0	-17°40.8
Acrux	173°00.4	-63°14.3
Gacrux	171°52.0	-57°15.2
Alioth	166°13.1	55°49.9
Spica	158°22.6	-11°17.4
Alkaid	152°52.0	49°11.6
Hadar	148°36.3	-60°29.6
Menkent	147°57.9	-36°29.5
Arcturus	145°48.1	19°03.3
Rigil Kent.	139°40.5	-60°56.3
Kochab	137°18.7	74°03.4
Zuben'ubi	136°56.3	-16°08.7
Alphecca	126°03.8	26°37.9
Antares	112°16.1	-26°29.2
Atria	107°10.2	-69°04.3
Sabik	102°03.0	-15°45.3
Shaula	96°10.7	-37°07.3
Rasalhague	95°58.7	12°32.4
Eltanin	90°41.9	51°29.0
Kaus Aust.	83°32.8	-34°22.3
Vega	80°33.2	38°48.2
Nunki	75°48.1	-26°16.0
Altair	62°00.2	8°55.8
Peacock	53°06.2	-56°39.2
Deneb	49°25.9	45°21.7
Enif	33°39.2	9°59.1
Al Na'ir	27°33.5	-46°50.4
Fomalhaut	15°15.1	-29°29.5
Scheat	13°45.8	28°12.7
Markab	13°30.5	15°20.0

May 30 Thu	SHA	Mer.pass
Venus	294°11.4	11:52
Mars	338°51.7	08:52
Jupiter	301°02.2	11:22
Saturn	9°42.4	06:48

May 31 Fri	SHA	Mer.pass
Venus	292°53.6	11:53
Mars	338°09.6	08:51
Jupiter	300°47.6	11:19
Saturn	9°39.6	06:44

Jun 01 Sat	SHA	Mer.pass
Venus	291°35.6	11:54
Mars	337°27.4	08:50
Jupiter	300°33.0	11:17
Saturn	9°36.9	06:41

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°36.8	N21°48.7	274°54.9	10.4′	S14°56.1	14.6′	58.9′
1	195°36.7	49.0	289°24.4	10.5′	14°41.5	14.7′	58.9′
2	210°36.6	49.4	303°53.9	10.6′	14°26.8	14.7′	58.9′
3	225°36.5	·· 49.8	318°23.5	10.6′	14°12.1	14.8′	59.0′
4	240°36.4	50.1	332°53.1	10.7′	13°57.3	14.9′	59.0′
5	255°36.4	50.5	347°22.8	10.7′	13°42.4	15.0′	59.0′
6	270°36.3	N21°50.9	1°52.5	10.8′	S13°27.4	15.1′	59.0′
7	285°36.2	51.2	16°22.3	10.8′	13°12.3	15.1′	59.0′
8	300°36.1	51.6	30°52.1	10.9′	12°57.2	15.2′	59.0′
9	315°36.0	·· 51.9	45°22.1	11.0′	12°42.0	15.3′	59.0′
10	330°35.9	52.3	59°52.0	11.0′	12°26.7	15.3′	59.0′
11	345°35.8	52.7	74°22.0	11.1′	12°11.4	15.4′	59.1′
12	0°35.7	N21°53.0	88°52.1	11.1′	S11°56.0	15.5′	59.1′
13	15°35.6	53.4	103°22.2	11.2′	11°40.5	15.6′	59.1′
14	30°35.6	53.7	117°52.3	11.2′	11°24.9	15.6′	59.1′
15	45°35.5	·· 54.1	132°22.5	11.2′	11°09.3	15.7′	59.1′
16	60°35.4	54.5	146°52.8	11.3′	10°53.6	15.7′	59.1′
17	75°35.3	54.8	161°23.1	11.3′	10°37.9	15.8′	59.1′
18	90°35.2	N21°55.2	175°53.4	11.4′	S10°22.1	15.9′	59.1′
19	105°35.1	55.5	190°23.8	11.4′	10°06.2	15.9′	59.1′
20	120°35.0	55.9	204°54.2	11.5′	09°50.3	15.9′	59.2′
21	135°34.9	·· 56.2	219°24.6	11.5′	09°34.4	16.1′	59.2′
22	150°34.8	56.6	233°55.1	11.5′	09°18.3	16.0′	59.2′
23	165°34.7	56.9	248°25.7	11.6′	09°02.3	16.2′	59.2′
	SD = 15.8′	d = 0.4′	SD = 16.1′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°34.6	N21°57.3	262°56.2	11.6′	S08°46.1	16.2′	59.2′
1	195°34.5	57.6	277°26.9	11.6′	08°29.9	16.2′	59.2′
2	210°34.5	58.0	291°57.5	11.7′	08°13.7	16.3′	59.2′
3	225°34.4	·· 58.3	306°28.2	11.7′	07°57.4	16.3′	59.2′
4	240°34.3	58.7	320°58.9	11.7′	07°41.1	16.3′	59.2′
5	255°34.2	59.0	335°29.6	11.8′	07°24.8	16.5′	59.2′
6	270°34.1	N21°59.4	350°00.4	11.8′	S07°08.3	16.4′	59.3′
7	285°34.0	21°59.7	4°31.2	11.8′	06°51.9	16.5′	59.3′
8	300°33.9	22°00.1	19°02.0	11.8′	06°35.4	16.5′	59.3′
9	315°33.8	·· 00.4	33°32.8	11.9′	06°18.9	16.6′	59.3′
10	330°33.7	00.8	48°03.7	11.9′	06°02.3	16.6′	59.3′
11	345°33.6	01.1	62°34.6	11.9′	05°45.7	16.6′	59.3′
12	0°33.5	N22°01.5	77°05.5	11.9′	S05°29.1	16.7′	59.3′
13	15°33.4	01.8	91°36.4	11.9′	05°12.4	16.7′	59.3′
14	30°33.3	02.1	106°07.3	12.0′	04°55.7	16.7′	59.3′
15	45°33.2	·· 02.5	120°38.3	12.0′	04°39.0	16.8′	59.3′
16	60°33.1	02.8	135°09.3	12.0′	04°22.2	16.8′	59.3′
17	75°33.0	03.2	149°40.3	12.0′	04°05.4	16.8′	59.3′
18	90°32.9	N22°03.5	164°11.3	12.0′	S03°48.6	16.8′	59.4′
19	105°32.8	03.8	178°42.3	12.0′	03°31.8	16.9′	59.4′
20	120°32.8	04.2	193°13.3	12.0′	03°14.9	16.8′	59.4′
21	135°32.7	·· 04.5	207°44.4	12.0′	02°58.1	16.9′	59.4′
22	150°32.6	04.8	222°15.4	12.1′	02°41.2	16.9′	59.4′
23	165°32.5	05.2	236°46.5	12.1′	02°24.3	17.0′	59.4′
	SD = 15.8′	d = 0.4′	SD = 16.1′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°32.4	N22°05.5	251°17.5	12.1′	S02°07.3	16.9′	59.4′
1	195°32.3	05.9	265°48.6	12.1′	01°50.4	17.0′	59.4′
2	210°32.2	06.2	280°19.6	12.1′	01°33.4	16.9′	59.4′
3	225°32.1	·· 06.5	294°50.7	12.1′	01°16.5	17.0′	59.4′
4	240°32.0	06.9	309°21.8	12.1′	00°59.5	17.0′	59.4′
5	255°31.9	07.2	323°52.8	12.1′	00°42.5	17.0′	59.4′
6	270°31.8	N22°07.5	338°23.9	12.1′	S00°25.5	17.0′	59.4′
7	285°31.7	07.8	352°54.9	12.0′	S00°08.5	17.0′	59.4′
8	300°31.6	08.2	7°26.0	12.0′	N00°08.5	17.0′	59.4′
9	315°31.5	·· 08.5	21°57.0	12.0′	00°25.5	17.0′	59.4′
10	330°31.4	08.8	36°28.0	12.0′	00°42.5	17.0′	59.4′
11	345°31.3	09.2	50°59.1	12.0′	00°59.5	17.0′	59.5′
12	0°31.2	N22°09.5	65°30.1	12.0′	N01°16.5	17.0′	59.5′
13	15°31.1	09.8	80°01.1	12.0′	01°33.5	17.0′	59.5′
14	30°31.0	10.1	94°32.0	12.0′	01°50.5	17.0′	59.5′
15	45°30.9	·· 10.5	109°03.0	11.9′	02°07.5	17.0′	59.5′
16	60°30.8	10.8	123°34.0	11.9′	02°24.5	17.0′	59.5′
17	75°30.7	11.1	138°04.9	11.9′	02°41.5	16.9′	59.5′
18	90°30.6	N22°11.4	152°35.8	11.9′	N02°58.4	17.0′	59.5′
19	105°30.5	11.8	167°06.7	11.9′	03°15.4	16.9′	59.5′
20	120°30.4	12.1	181°37.5	11.8′	03°32.3	16.9′	59.5′
21	135°30.3	·· 12.4	196°08.4	11.8′	03°49.2	17.0′	59.5′
22	150°30.2	12.7	210°39.2	11.8′	04°06.2	16.8′	59.5′
23	165°30.1	13.0	225°10.0	11.8′	04°23.0	16.9′	59.5′
	SD = 15.8′	d = 0.3′	SD = 16.2′				

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

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

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 58-35%
30	02:27	02:23	11:58	05:52	18:17	
31	02:19	02:14	11:58	06:41	19:05	
01	02:09	02:05	11:58	07:29	19:53	

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

	Aries	Venus		Mars		Jupiter		Saturn	
Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	250°57.3	181°14.6	N21°57.8	227°42.5	N08°27.3	191°15.8	N19°47.4	260°31.6	S06°08.8
1	265°59.8	196°13.8	58.3	242°43.2	28.0	206°17.6	47.5	275°33.9	08.8
2	281°02.3	211°13.0	58.8	257°43.9	28.7	221°19.5	47.6	290°36.3	08.7
3	296°04.7	226°12.2	·· 59.4	272°44.6	·· 29.4	236°21.4	·· 47.7	305°38.6	·· 08.7
4	311°07.2	241°11.4	21°59.9	287°45.3	30.1	251°23.2	47.9	320°41.0	08.7
5	326°09.7	256°10.6	22°00.4	302°46.0	30.8	266°25.1	48.0	335°43.3	08.6
6	341°12.1	271°09.8	N22°00.9	317°46.7	N08°31.5	281°26.9	N19°48.1	350°45.7	S06°08.6
7	356°14.6	286°09.0	01.4	332°47.4	32.2	296°28.8	48.2	5°48.1	08.6
8	11°17.0	301°08.2	01.9	347°48.1	32.9	311°30.6	48.3	20°50.4	08.5
9	26°19.5	316°07.4	·· 02.4	2°48.9	·· 33.6	326°32.5	·· 48.5	35°52.8	·· 08.5
10	41°22.0	331°06.6	03.0	17°49.6	34.3	341°34.4	48.6	50°55.1	08.4
11	56°24.4	346°05.8	03.5	32°50.3	35.0	356°36.2	48.7	65°57.5	08.4
12	71°26.9	1°04.9	N22°04.0	47°51.0	N08°35.7	11°38.1	N19°48.8	80°59.8	S06°08.4
13	86°29.4	16°04.1	04.5	62°51.7	36.4	26°39.9	48.9	96°02.2	08.3
14	101°31.8	31°03.3	05.0	77°52.4	37.1	41°41.8	49.1	111°04.6	08.3
15	116°34.3	46°02.5	·· 05.5	92°53.1	·· 37.8	56°43.6	·· 49.2	126°06.9	·· 08.3
16	131°36.8	61°01.7	06.0	107°53.8	38.5	71°45.5	49.3	141°09.3	08.2
17	146°39.2	76°00.9	06.5	122°54.5	39.2	86°47.4	49.4	156°11.6	08.2
18	161°41.7	91°00.1	N22°07.0	137°55.2	N08°39.9	101°49.2	N19°49.5	171°14.0	S06°08.2
19	176°44.1	105°59.3	07.5	152°55.9	40.6	116°51.1	49.7	186°16.3	08.1
20	191°46.6	120°58.5	08.0	167°56.6	41.3	131°52.9	49.8	201°18.7	08.1
21	206°49.1	135°57.7	·· 08.5	182°57.3	·· 42.0	146°54.8	·· 49.9	216°21.1	·· 08.1
22	221°51.5	150°56.9	09.0	197°58.0	42.7	161°56.6	50.0	231°23.4	08.0
23	236°54.0	165°56.0	09.5	212°58.7	43.3	176°58.5	50.1	246°25.8	08.0
Mer.pass. 07:15		ν -0.8′	d 0.5′	ν 0.7′	d 0.7′	ν 1.9′	d 0.1′	ν 2.4′	d 0.0′
		m -3.92		m 1.04		m -2.00		m 1.02	

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	251°56.5	180°55.2	N22°10.0	227°59.4	N08°44.0	192°00.4	N19°50.2	261°28.1	S06°08.0
1	266°58.9	195°54.4	10.5	243°00.1	44.7	207°02.2	50.4	276°30.5	07.9
2	282°01.4	210°53.6	11.0	258°00.8	45.4	222°04.1	50.5	291°32.9	07.9
3	297°03.9	225°52.8	·· 11.5	273°01.5	·· 46.1	237°05.9	·· 50.6	306°35.2	·· 07.9
4	312°06.3	240°52.0	12.0	288°02.2	46.8	252°07.8	50.7	321°37.6	07.8
5	327°08.8	255°51.2	12.5	303°02.9	47.5	267°09.6	50.8	336°39.9	07.8
6	342°11.3	270°50.3	N22°13.0	318°03.7	N08°48.2	282°11.5	N19°51.0	351°42.3	S06°07.8
7	357°13.7	285°49.5	13.4	333°04.4	48.9	297°13.4	51.1	6°44.7	07.7
8	12°16.2	300°48.7	13.9	348°05.1	49.6	312°15.2	51.2	21°47.0	07.7
9	27°18.6	315°47.9	·· 14.4	3°05.8	·· 50.3	327°17.1	·· 51.3	36°49.4	·· 07.7
10	42°21.1	330°47.1	14.9	18°06.5	51.0	342°18.9	51.4	51°51.7	07.6
11	57°23.6	345°46.3	15.4	33°07.2	51.7	357°20.8	51.5	66°54.1	07.6
12	72°26.0	0°45.5	N22°15.9	48°07.9	N08°52.4	12°22.6	N19°51.7	81°56.5	S06°07.6
13	87°28.5	15°44.6	16.3	63°08.6	53.0	27°24.5	51.8	96°58.8	07.5
14	102°31.0	30°43.8	16.8	78°09.3	53.7	42°26.4	51.9	112°01.2	07.5
15	117°33.4	45°43.0	·· 17.3	93°10.0	·· 54.4	57°28.2	·· 52.0	127°03.6	·· 07.5
16	132°35.9	60°42.2	17.8	108°10.7	55.1	72°30.1	52.1	142°05.9	07.4
17	147°38.4	75°41.4	18.3	123°11.4	55.8	87°31.9	52.3	157°08.3	07.4
18	162°40.8	90°40.6	N22°18.7	138°12.1	N08°56.5	102°33.8	N19°52.4	172°10.6	S06°07.4
19	177°43.3	105°39.7	19.2	153°12.8	57.2	117°35.6	52.5	187°13.0	07.3
20	192°45.8	120°38.9	19.7	168°13.5	57.9	132°37.5	52.6	202°15.4	07.3
21	207°48.2	135°38.1	·· 20.2	183°14.2	·· 58.6	147°39.4	·· 52.7	217°17.7	·· 07.3
22	222°50.7	150°37.3	20.6	198°14.9	59.3	162°41.2	52.8	232°20.1	07.3
23	237°53.1	165°36.5	21.1	213°15.6	59.9	177°43.1	53.0	247°22.5	07.2
Mer.pass. 07:11		ν -0.8′	d 0.5′	ν 0.7′	d 0.7′	ν 1.9′	d 0.1′	ν 2.4′	d 0.0′
		m -3.92		m 1.04		m -2.00		m 1.01	

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	252°55.6	180°35.6	N22°21.6	228°16.3	N09°00.6	192°44.9	N19°53.1	262°24.8	S06°07.2
1	267°58.1	195°34.8	22.0	243°17.0	01.3	207°46.8	53.2	277°27.2	07.2
2	283°00.5	210°34.0	22.5	258°17.7	02.0	222°48.6	53.3	292°29.5	07.1
3	298°03.0	225°33.2	·· 23.0	273°18.4	·· 02.7	237°50.5	·· 53.4	307°31.9	·· 07.1
4	313°05.5	240°32.3	23.4	288°19.1	03.4	252°52.4	53.5	322°34.3	07.1
5	328°07.9	255°31.5	23.9	303°19.9	04.1	267°54.2	53.7	337°36.6	07.0
6	343°10.4	270°30.7	N22°24.4	318°20.6	N09°04.8	282°56.1	N19°53.8	352°39.0	S06°07.0
7	358°12.9	285°29.9	24.8	333°21.3	05.5	297°57.9	53.9	7°41.4	07.0
8	13°15.3	300°29.1	25.3	348°22.0	06.1	312°59.8	54.0	22°43.7	06.9
9	28°17.8	315°28.2	·· 25.7	3°22.7	·· 06.8	328°01.6	·· 54.1	37°46.1	·· 06.9
10	43°20.2	330°27.4	26.2	18°23.4	07.5	343°03.5	54.2	52°48.5	06.9
11	58°22.7	345°26.6	26.6	33°24.1	08.2	358°05.4	54.4	67°50.8	06.8
12	73°25.2	0°25.8	N22°27.1	48°24.8	N09°08.9	13°07.2	N19°54.5	82°53.2	S06°06.8
13	88°27.6	15°24.9	27.5	63°25.5	09.6	28°09.1	54.6	97°55.5	06.8
14	103°30.1	30°24.1	28.0	78°26.2	10.3	43°10.9	54.7	112°57.9	06.7
15	118°32.6	45°23.3	·· 28.4	93°26.9	·· 11.0	58°12.8	·· 54.8	128°00.3	·· 06.7
16	133°35.0	60°22.4	28.9	108°27.6	11.6	73°14.7	54.9	143°02.6	06.7
17	148°37.5	75°21.6	29.3	123°28.3	12.3	88°16.5	55.1	158°05.0	06.7
18	163°40.0	90°20.7	N22°29.8	138°29.0	N09°13.0	103°18.4	N19°55.2	173°07.4	S06°06.6
19	178°42.4	105°19.9	30.3	153°29.7	13.7	118°20.2	55.3	188°09.7	06.6
20	193°44.9	120°19.1	30.7	168°30.4	14.4	133°22.1	55.4	203°12.1	06.6
21	208°47.4	135°18.3	·· 31.2	183°31.1	·· 15.1	148°23.9	·· 55.5	218°14.5	·· 06.5
22	223°49.8	150°17.4	31.6	198°31.8	15.8	163°25.8	55.6	233°16.8	06.5
23	238°52.3	165°16.6	32.1	213°32.5	16.4	178°27.7	55.8	248°19.2	06.5
Mer.pass. 07:07		ν -0.8′	d 0.5′	ν 0.7′	d 0.7′	ν 1.9′	d 0.1′	ν 2.4′	d 0.0′
		m -3.92		m 1.04		m -2.00		m 1.01	

Stars

	SHA	**Dec**
Alpheratz	357°35.4	29°13.3
Ankaa	353°07.8	-42°10.2
Schedar	349°31.9	56°40.0
Diphda	348°48.0	-17°51.1
Achernar	335°21.0	-57°06.6
Hamal	327°52.1	23°34.5
Polaris	314°44.1	89°21.8
Acamar	315°12.5	-40°12.3
Menkar	314°07.0	4°11.1
Mirfak	308°29.5	49°56.7
Aldebaran	290°40.6	16°33.5
Rigel	281°04.7	-8°10.4
Capella	280°23.1	46°01.3
Bellatrix	278°23.8	6°22.3
Elnath	278°02.9	28°37.7
Alnilam	275°38.6	-1°11.2
Betelgeuse	270°53.0	7°24.7
Canopus	263°53.1	-52°42.6
Sirius	258°27.0	-16°45.0
Adhara	255°06.6	-29°00.4
Procyon	244°51.6	5°09.8
Pollux	243°18.2	27°58.1
Avior	234°15.4	-59°35.4
Suhail	222°46.9	-43°32.0
Miaplacidus	221°38.9	-69°49.3
Alphard	217°48.4	-8°45.9
Regulus	207°35.1	11°50.9
Dubhe	193°41.6	61°37.5
Denebola	182°25.4	14°26.2
Gienah	175°44.0	-17°40.8
Acrux	173°00.4	-63°14.3
Gacrux	171°52.0	-57°15.2
Alioth	166°13.1	55°49.9
Spica	158°22.6	-11°17.4
Alkaid	152°52.0	49°11.6
Hadar	148°36.3	-60°29.6
Menkent	147°57.9	-36°29.6
Arcturus	145°48.1	19°03.4
Rigil Kent.	139°40.5	-60°56.3
Kochab	137°18.7	74°03.4
Zuben'ubi	136°56.3	-16°08.7
Alphecca	126°03.8	26°37.9
Antares	112°16.1	-26°29.2
Atria	107°10.2	-69°04.3
Sabik	102°03.0	-15°45.3
Shaula	96°10.7	-37°07.3
Rasalhague	95°58.7	12°32.5
Eltanin	90°41.9	51°29.0
Kaus Aust.	83°32.8	-34°22.3
Vega	80°33.2	38°48.2
Nunki	75°48.1	-26°16.0
Altair	62°00.2	8°55.9
Peacock	53°06.2	-56°39.2
Deneb	49°25.9	45°21.8
Enif	33°39.2	9°59.1
Al Na'ir	27°33.4	-46°50.4
Fomalhaut	15°15.1	-29°29.5
Scheat	13°45.7	28°12.7
Markab	13°30.4	15°20.0

Jun 02 Sun	**SHA**	**Mer.pass**
Venus	290°17.3	11:56
Mars	336°45.2	08:49
Jupiter	300°18.5	11:14
Saturn	9°34.2	06:37

Jun 03 Mon	**SHA**	**Mer.pass**
Venus	288°58.8	11:57
Mars	336°03.0	08:48
Jupiter	300°03.9	11:11
Saturn	9°31.7	06:33

Jun 04 Tue	**SHA**	**Mer.pass**
Venus	287°40.0	11:58
Mars	335°20.7	08:46
Jupiter	299°49.3	11:08
Saturn	9°29.2	06:29

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.1305 sec ΔT = TT-UT1 = +69.0535 sec

2024 June 02 to Jun. 04 UT

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Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	180°30.0	N22°13.4	239°40.8	11.7′	N04°39.9	16.8′	59.5′
1	195°29.9	13.7	254°11.5	11.7′	04°56.7	16.9′	59.5′
2	210°29.8	14.0	268°42.2	11.7′	05°13.6	16.8′	59.5′
3	225°29.7	·· 14.3	283°12.9	11.6′	05°30.4	16.7′	59.5′
4	240°29.6	14.6	297°43.5	11.6′	05°47.1	16.8′	59.5′
5	255°29.5	15.0	312°14.1	11.6′	06°03.9	16.7′	59.5′
6	270°29.4	N22°15.3	326°44.7	11.5′	N06°20.6	16.7′	59.5′
7	285°29.3	15.6	341°15.2	11.5′	06°37.3	16.6′	59.5′
8	300°29.2	15.9	355°45.7	11.5′	06°53.9	16.6′	59.5′
9	315°29.1	·· 16.2	10°16.1	11.4′	07°10.5	16.6′	59.5′
10	330°29.0	16.5	24°46.6	11.4′	07°27.1	16.5′	59.5′
11	345°28.9	16.8	39°16.9	11.3′	07°43.6	16.5′	59.5′
12	0°28.8	N22°17.1	53°47.3	11.3′	N08°00.1	16.5′	59.5′
13	15°28.7	17.5	68°17.5	11.2′	08°16.6	16.4′	59.5′
14	30°28.6	17.8	82°47.8	11.2′	08°33.0	16.4′	59.5′
15	45°28.5	·· 18.1	97°18.0	11.1′	08°49.4	16.3′	59.5′
16	60°28.4	18.4	111°48.1	11.1′	09°05.7	16.2′	59.5′
17	75°28.2	18.7	126°18.2	11.0′	09°21.9	16.3′	59.5′
18	90°28.1	N22°19.0	140°48.2	11.0′	N09°38.2	16.1′	59.5′
19	105°28.0	19.3	155°18.2	10.9′	09°54.3	16.2′	59.5′
20	120°27.9	19.6	169°48.2	10.9′	10°10.5	16.0′	59.5′
21	135°27.8	·· 19.9	184°18.1	10.8′	10°26.5	16.0′	59.5′
22	150°27.7	20.2	198°47.9	10.8′	10°42.5	16.0′	59.5′
23	165°27.6	20.5	213°17.7	10.7′	10°58.5	15.9′	59.5′
	SD = 15.8′	d = 0.3′		SD = 16.2′			

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	180°27.5	N22°20.8	227°47.4	10.7′	N11°14.4	15.8′	59.5′
1	195°27.4	21.1	242°17.0	10.6′	11°30.2	15.8′	59.5′
2	210°27.3	21.4	256°46.6	10.5′	11°46.0	15.7′	59.5′
3	225°27.2	·· 21.7	271°16.2	10.5′	12°01.7	15.6′	59.5′
4	240°27.1	22.0	285°45.6	10.4′	12°17.3	15.6′	59.4′
5	255°27.0	22.3	300°15.1	10.4′	12°32.9	15.5′	59.4′
6	270°26.9	N22°22.6	314°44.4	10.3′	N12°48.4	15.4′	59.4′
7	285°26.8	22.9	329°13.7	10.2′	13°03.8	15.4′	59.4′
8	300°26.7	23.2	343°42.9	10.2′	13°19.2	15.3′	59.4′
9	315°26.6	·· 23.5	358°12.1	10.1′	13°34.5	15.2′	59.4′
10	330°26.5	23.8	12°41.2	10.0′	13°49.7	15.1′	59.4′
11	345°26.4	24.1	27°10.2	10.0′	14°04.8	15.1′	59.4′
12	0°26.2	N22°24.4	41°39.2	9.9′	N14°19.9	14.9′	59.4′
13	15°26.1	24.7	56°08.0	9.8′	14°34.8	14.9′	59.4′
14	30°26.0	25.0	70°36.9	9.7′	14°49.7	14.8′	59.4′
15	45°25.9	·· 25.3	85°05.6	9.7′	15°04.5	14.7′	59.4′
16	60°25.8	25.6	99°34.3	9.6′	15°19.2	14.7′	59.4′
17	75°25.7	25.9	114°02.9	9.5′	15°33.9	14.5′	59.4′
18	90°25.6	N22°26.2	128°31.4	9.5′	N15°48.4	14.5′	59.3′
19	105°25.5	26.5	142°59.9	9.4′	16°02.9	14.3′	59.3′
20	120°25.4	26.7	157°28.2	9.3′	16°17.2	14.3′	59.3′
21	135°25.3	·· 27.0	171°56.6	9.2′	16°31.5	14.1′	59.3′
22	150°25.2	27.3	186°24.8	9.2′	16°45.6	14.1′	59.3′
23	165°25.1	27.6	200°52.9	9.1′	16°59.7	13.9′	59.3′
	SD = 15.8′	d = 0.3′		SD = 16.2′			

Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	180°25.0	N22°27.9	215°21.0	9.0′	N17°13.6	13.9′	59.3′
1	195°24.8	28.2	229°49.0	8.9′	17°27.5	13.8′	59.3′
2	210°24.7	28.5	244°17.0	8.8′	17°41.3	13.6′	59.3′
3	225°24.6	·· 28.7	258°44.8	8.8′	17°54.9	13.6′	59.3′
4	240°24.5	29.0	273°12.6	8.7′	18°08.5	13.4′	59.2′
5	255°24.4	29.3	287°40.3	8.6′	18°21.9	13.3′	59.2′
6	270°24.3	N22°29.6	302°07.9	8.5′	N18°35.2	13.2′	59.2′
7	285°24.2	29.9	316°35.4	8.5′	18°48.4	13.1′	59.2′
8	300°24.1	30.2	331°02.9	8.4′	19°01.5	13.0′	59.2′
9	315°24.0	·· 30.4	345°30.3	8.3′	19°14.5	12.9′	59.2′
10	330°23.9	30.7	359°57.6	8.2′	19°27.4	12.7′	59.2′
11	345°23.7	31.0	14°24.8	8.1′	19°40.1	12.7′	59.2′
12	0°23.6	N22°31.3	28°51.9	8.1′	N19°52.8	12.5′	59.1′
13	15°23.5	31.6	43°19.0	8.0′	20°05.3	12.4′	59.1′
14	30°23.4	31.8	57°46.0	7.9′	20°17.7	12.2′	59.1′
15	45°23.3	·· 32.1	72°12.9	7.8′	20°29.9	12.1′	59.1′
16	60°23.2	32.4	86°39.7	7.7′	20°42.0	12.1′	59.1′
17	75°23.1	32.7	101°06.4	7.7′	20°54.1	11.8′	59.1′
18	90°23.0	N22°32.9	115°33.1	7.6′	N21°05.9	11.8′	59.1′
19	105°22.9	33.2	129°59.7	7.5′	21°17.7	11.6′	59.0′
20	120°22.7	33.5	144°26.2	7.4′	21°29.3	11.5′	59.0′
21	135°22.6	·· 33.8	158°52.6	7.4′	21°40.8	11.3′	59.0′
22	150°22.5	34.0	173°19.0	7.3′	21°52.1	11.2′	59.0′
23	165°22.4	34.3	187°45.2	7.2′	22°03.3	11.1′	59.0′
	SD = 15.8′	d = 0.3′		SD = 16.2′			

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

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

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 25-27 25-8%
02	02:00	01:55	11:58	08:18	20:42	
03	01:50	01:45	11:58	09:07	21:33	
04	01:40	01:35	11:58	10:00	22:28	

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

	Aries	Venus		Mars		Jupiter		Saturn	
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	253°54.7	180°15.8	N22°32.5	228°33.2	N09°17.1	193°29.5	N19°55.9	263°21.6	S06°06.4
1	268°57.2	195°14.9	33.0	243°33.9	17.8	208°31.4	56.0	278°23.9	06.4
2	283°59.7	210°14.1	33.4	258°34.6	18.5	223°33.2	56.1	293°26.3	06.4
3	299°02.1	225°13.3	·· 33.8	273°35.3	·· 19.2	238°35.1	·· 56.2	308°28.7	·· 06.4
4	314°04.6	240°12.5	34.3	288°36.0	19.9	253°36.9	56.3	323°31.0	06.3
5	329°07.1	255°11.6	34.7	303°36.7	20.6	268°38.8	56.5	338°33.4	06.3
6	344°09.5	270°10.8	N22°35.2	318°37.4	N09°21.2	283°40.7	N19°56.6	353°35.8	S06°06.3
7	359°12.0	285°10.0	35.6	333°38.1	21.9	298°42.5	56.7	8°38.1	06.2
8	14°14.5	300°09.1	36.0	348°38.8	22.6	313°44.4	56.8	23°40.5	06.2
9	29°16.9	315°08.3	·· 36.5	3°39.6	·· 23.3	328°46.2	·· 56.9	38°42.9	·· 06.2
10	44°19.4	330°07.5	36.9	18°40.3	24.0	343°48.1	57.0	53°45.2	06.1
11	59°21.9	345°06.6	37.3	33°41.0	24.7	358°50.0	57.2	68°47.6	06.1
12	74°24.3	0°05.8	N22°37.8	48°41.7	N09°25.3	13°51.8	N19°57.3	83°50.0	S06°06.1
13	89°26.8	15°05.0	38.2	63°42.4	26.0	28°53.7	57.4	98°52.4	06.1
14	104°29.2	30°04.1	38.6	78°43.1	26.7	43°55.5	57.5	113°54.7	06.0
15	119°31.7	45°03.3	·· 39.0	93°43.8	·· 27.4	58°57.4	·· 57.6	128°57.1	·· 06.0
16	134°34.2	60°02.5	39.5	108°44.5	28.1	73°59.2	57.7	143°59.5	06.0
17	149°36.6	75°01.6	39.9	123°45.2	28.8	89°01.1	57.9	159°01.8	05.9
18	164°39.1	90°00.8	N22°40.3	138°45.9	N09°29.4	104°03.0	N19°58.0	174°04.2	S06°05.9
19	179°41.6	105°00.0	40.7	153°46.6	30.1	119°04.8	58.1	189°06.6	05.9
20	194°44.0	119°59.1	41.2	168°47.3	30.8	134°06.7	58.2	204°08.9	05.8
21	209°46.5	134°58.3	·· 41.6	183°48.0	·· 31.5	149°08.5	·· 58.3	219°11.3	·· 05.8
22	224°49.0	149°57.5	42.0	198°48.7	32.2	164°10.4	58.4	234°13.7	05.8
23	239°51.4	164°56.6	42.4	213°49.4	32.8	179°12.3	58.5	249°16.0	05.8
Mer.pass. 07:03		ν -0.8′	d 0.4′	ν 0.7′	d 0.7′	ν 1.9′	d 0.1′	ν 2.4′	d 0.0′
		m -3.92		m 1.04		m -2.00		m 1.01	

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	254°53.9	179°55.8	N22°42.8	228°50.1	N09°33.5	194°14.1	N19°58.7	264°18.4	S06°05.7
1	269°56.4	194°54.9	43.2	243°50.8	34.2	209°16.0	58.8	279°20.8	05.7
2	284°58.8	209°54.1	43.7	258°51.5	34.9	224°17.8	58.9	294°23.2	05.7
3	300°01.3	224°53.3	·· 44.1	273°52.2	·· 35.6	239°19.7	·· 59.0	309°25.5	·· 05.6
4	315°03.7	239°52.4	44.5	288°52.9	36.2	254°21.5	59.1	324°27.9	05.6
5	330°06.2	254°51.6	44.9	303°53.6	36.9	269°23.4	59.2	339°30.3	05.6
6	345°08.7	269°50.7	N22°45.3	318°54.3	N09°37.6	284°25.3	N19°59.4	354°32.6	S06°05.6
7	0°11.1	284°49.9	45.7	333°55.0	38.3	299°27.1	59.5	9°35.0	05.5
8	15°13.6	299°49.1	46.1	348°55.7	39.0	314°29.0	59.6	24°37.4	05.5
9	30°16.1	314°48.2	·· 46.5	3°56.4	·· 39.6	329°30.8	·· 59.7	39°39.8	·· 05.5
10	45°18.5	329°47.4	46.9	18°57.1	40.3	344°32.7	59.8	54°42.1	05.4
11	60°21.0	344°46.5	47.3	33°57.8	41.0	359°34.6	19°59.9	69°44.5	05.4
12	75°23.5	359°45.7	N22°47.7	48°58.5	N09°41.7	14°36.4	N20°00.0	84°46.9	S06°05.4
13	90°25.9	14°44.9	48.1	63°59.2	42.4	29°38.3	00.2	99°49.2	05.4
14	105°28.4	29°44.0	48.5	78°59.9	43.0	44°40.1	00.3	114°51.6	05.3
15	120°30.9	44°43.2	·· 48.9	94°00.6	·· 43.7	59°42.0	·· 00.4	129°54.0	·· 05.3
16	135°33.3	59°42.3	49.3	109°01.3	44.4	74°43.9	00.5	144°56.4	05.3
17	150°35.8	74°41.5	49.7	124°02.0	45.1	89°45.7	00.6	159°58.7	05.3
18	165°38.2	89°40.6	N22°50.1	139°02.7	N09°45.7	104°47.6	N20°00.7	175°01.1	S06°05.2
19	180°40.7	104°39.8	50.5	154°03.4	46.4	119°49.4	00.8	190°03.5	05.2
20	195°43.2	119°39.0	50.9	169°04.1	47.1	134°51.3	01.0	205°05.9	05.2
21	210°45.6	134°38.1	·· 51.3	184°04.9	·· 47.8	149°53.2	·· 01.1	220°08.2	·· 05.1
22	225°48.1	149°37.3	51.7	199°05.6	48.5	164°55.0	01.2	235°10.6	05.1
23	240°50.6	164°36.4	52.1	214°06.3	49.1	179°56.9	01.3	250°13.0	05.1
Mer.pass. 06:59		ν -0.8′	d 0.4′	ν 0.7′	d 0.7′	ν 1.9′	d 0.1′	ν 2.4′	d 0.0′
		m -3.92		m 1.03		m -2.00		m 1.00	

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	255°53.0	179°35.6	N22°52.5	229°07.0	N09°49.8	194°58.7	N20°01.4	265°15.3	S06°05.1
1	270°55.5	194°34.7	52.9	244°07.7	50.5	210°00.6	01.5	280°17.7	05.0
2	285°58.0	209°33.9	53.3	259°08.4	51.2	225°02.4	01.6	295°20.1	05.0
3	301°00.4	224°33.0	·· 53.6	274°09.1	·· 51.8	240°04.3	·· 01.8	310°22.5	·· 05.0
4	316°02.9	239°32.2	54.0	289°09.8	52.5	255°06.2	01.9	325°24.8	05.0
5	331°05.4	254°31.3	54.4	304°10.5	53.2	270°08.0	02.0	340°27.2	04.9
6	346°07.8	269°30.5	N22°54.8	319°11.2	N09°53.9	285°09.9	N20°02.1	355°29.6	S06°04.9
7	1°10.3	284°29.7	55.2	334°11.9	54.5	300°11.7	02.2	10°32.0	04.9
8	16°12.7	299°28.8	55.5	349°12.6	55.2	315°13.6	02.3	25°34.3	04.8
9	31°15.2	314°28.0	·· 55.9	4°13.3	·· 55.9	330°15.5	·· 02.4	40°36.7	·· 04.8
10	46°17.7	329°27.1	56.3	19°14.0	56.6	345°17.3	02.6	55°39.1	04.8
11	61°20.1	344°26.3	56.7	34°14.7	57.2	0°19.2	02.7	70°41.5	04.8
12	76°22.6	359°25.4	N22°57.1	49°15.4	N09°57.9	15°21.0	N20°02.8	85°43.8	S06°04.7
13	91°25.1	14°24.6	57.4	64°16.1	58.6	30°22.9	02.9	100°46.2	04.7
14	106°27.5	29°23.7	57.8	79°16.8	59.3	45°24.8	03.0	115°48.6	04.7
15	121°30.0	44°22.9	·· 58.2	94°17.5	09°59.9	60°26.6	·· 03.1	130°51.0	·· 04.7
16	136°32.5	59°22.0	58.5	109°18.2	10°00.6	75°28.5	03.2	145°53.3	04.6
17	151°34.9	74°21.2	58.9	124°18.9	01.3	90°30.3	03.4	160°55.7	04.6
18	166°37.4	89°20.3	N22°59.3	139°19.6	N10°01.9	105°32.2	N20°03.5	175°58.1	S06°04.6
19	181°39.9	104°19.5	22°59.6	154°20.3	02.6	120°34.1	03.6	191°00.5	04.6
20	196°42.3	119°18.6	23°00.0	169°21.0	03.3	135°35.9	03.7	206°02.9	04.5
21	211°44.8	134°17.8	·· 00.4	184°21.7	·· 04.0	150°37.8	·· 03.8	221°05.2	·· 04.5
22	226°47.2	149°16.9	00.7	199°22.4	04.6	165°39.6	03.9	236°07.6	04.5
23	241°49.7	164°16.0	01.1	214°23.1	05.3	180°41.5	04.0	251°10.0	04.5
Mer.pass. 06:55		ν -0.8′	d 0.4′	ν 0.7′	d 0.7′	ν 1.9′	d 0.1′	ν 2.4′	d 0.0′
		m -3.92		m 1.03		m -2.00		m 1.00	

Stars

	SHA	Dec
Alpheratz	357°35.4	29°13.3
Ankaa	353°07.8	-42°10.2
Schedar	349°31.9	56°40.0
Diphda	348°48.0	-17°51.1
Achernar	335°20.9	-57°06.6
Hamal	327°52.0	23°34.5
Polaris	314°42.9	89°21.8
Acamar	315°12.5	-40°12.3
Menkar	314°07.0	4°11.1
Mirfak	308°29.5	49°56.7
Aldebaran	290°40.6	16°33.5
Rigel	281°04.7	-8°10.4
Capella	280°23.1	46°01.3
Bellatrix	278°23.8	6°22.3
Elnath	278°02.9	28°37.7
Alnilam	275°38.6	-1°11.2
Betelgeuse	270°53.0	7°24.7
Canopus	263°53.2	-52°42.6
Sirius	258°27.0	-16°45.0
Adhara	255°06.6	-29°00.4
Procyon	244°51.6	5°09.8
Pollux	243°18.2	27°58.1
Avior	234°15.4	-59°35.4
Suhail	222°46.9	-43°32.0
Miaplacidus	221°38.9	-69°49.3
Alphard	217°48.4	-8°45.9
Regulus	207°35.1	11°50.9
Dubhe	193°41.6	61°37.5
Denebola	182°25.4	14°26.2
Gienah	175°44.0	-17°40.8
Acrux	173°00.4	-63°14.3
Gacrux	171°52.0	-57°15.3
Alioth	166°13.1	55°49.9
Spica	158°22.6	-11°17.4
Alkaid	152°52.1	49°11.7
Hadar	148°36.3	-60°29.6
Menkent	147°57.9	-36°29.6
Arcturus	145°48.1	19°03.4
Rigil Kent.	139°40.5	-60°56.3
Kochab	137°18.7	74°03.4
Zuben'ubi	136°56.3	-16°08.7
Alphecca	126°03.8	26°38.0
Antares	112°16.1	-26°29.2
Atria	107°10.2	-69°04.3
Sabik	102°03.0	-15°45.3
Shaula	96°10.6	-37°07.3
Rasalhague	95°58.7	12°32.5
Eltanin	90°41.9	51°29.0
Kaus Aust.	83°32.8	-34°22.3
Vega	80°33.2	38°48.2
Nunki	75°48.1	-26°16.0
Altair	62°00.2	8°55.9
Peacock	53°06.1	-56°39.2
Deneb	49°25.9	45°21.8
Enif	33°39.2	9°59.1
Al Na'ir	27°33.4	-46°50.4
Fomalhaut	15°15.1	-29°29.5
Scheat	13°45.7	28°12.7
Markab	13°30.4	15°20.0

Jun 05 Wed	SHA	Mer.pass
Venus	286°21.0	12:00
Mars	334°38.5	08:45
Jupiter	299°34.8	11:05
Saturn	9°26.8	06:26

Jun 06 Thu	SHA	Mer.pass
Venus	285°01.9	12:01
Mars	333°56.2	08:44
Jupiter	299°20.2	11:02
Saturn	9°24.5	06:22

Jun 07 Fri	SHA	Mer.pass
Venus	283°42.5	12:02
Mars	333°13.9	08:43
Jupiter	299°05.7	10:59
Saturn	9°22.3	06:18

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.1313 sec ΔT = TT-UT1 = +69.0527 sec

2024 June 05 to Jun. 07 UT

h	Sun		Moon				
Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°22.3	N22°34.6	202°11.4	7.1′	N22°14.4	10.9′	59.0′
1	195°22.2	34.8	216°37.6	7.0′	22°25.3	10.8′	58.9′
2	210°22.1	35.1	231°03.6	7.0′	22°36.1	10.6′	58.9′
3	225°22.0	·· 35.4	245°29.6	6.9′	22°46.7	10.5′	58.9′
4	240°21.8	35.6	259°55.5	6.8′	22°57.2	10.3′	58.9′
5	255°21.7	35.9	274°21.3	6.8′	23°07.5	10.2′	58.9′
6	270°21.6	N22°36.2	288°47.1	6.7′	N23°17.7	10.1′	58.9′
7	285°21.5	36.4	303°12.8	6.6′	23°27.8	9.9′	58.8′
8	300°21.4	36.7	317°38.4	6.5′	23°37.7	9.7′	58.8′
9	315°21.3	·· 37.0	332°03.9	6.5′	23°47.4	9.6′	58.8′
10	330°21.2	37.2	346°29.4	6.4′	23°57.0	9.5′	58.8′
11	345°21.1	37.5	0°54.8	6.3′	24°06.5	9.3′	58.8′
12	0°20.9	N22°37.8	15°20.1	6.3′	N24°15.8	9.1′	58.7′
13	15°20.8	38.0	29°45.4	6.2′	24°24.9	9.0′	58.7′
14	30°20.7	38.3	44°10.6	6.1′	24°33.9	8.8′	58.7′
15	45°20.6	·· 38.5	58°35.7	6.1′	24°42.7	8.6′	58.7′
16	60°20.5	38.8	73°00.8	6.0′	24°51.3	8.5′	58.7′
17	75°20.4	39.1	87°25.8	6.0′	24°59.8	8.4′	58.6′
18	90°20.3	N22°39.3	101°50.8	5.9′	N25°08.2	8.1′	58.6′
19	105°20.1	39.6	116°15.7	5.8′	25°16.3	8.0′	58.6′
20	120°20.0	39.8	130°40.5	5.8′	25°24.3	7.9′	58.6′
21	135°19.9	·· 40.1	145°05.3	5.7′	25°32.2	7.6′	58.6′
22	150°19.8	40.3	159°30.1	5.7′	25°39.8	7.5′	58.5′
23	165°19.7	40.6	173°54.7	5.6′	25°47.3	7.3′	58.5′
	SD = 15.8′	d = 0.3′	SD = 16.1′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°19.6	N22°40.8	188°19.4	5.6′	N25°54.6	7.2′	58.5′
1	195°19.4	41.1	202°43.9	5.5′	26°01.8	7.0′	58.5′
2	210°19.3	41.4	217°08.5	5.5′	26°08.8	6.8′	58.4′
3	225°19.2	·· 41.6	231°33.0	5.4′	26°15.6	6.7′	58.4′
4	240°19.1	41.9	245°57.4	5.4′	26°22.3	6.4′	58.4′
5	255°19.0	42.1	260°21.8	5.4′	26°28.7	6.3′	58.4′
6	270°18.9	N22°42.4	274°46.2	5.3′	N26°35.0	6.2′	58.3′
7	285°18.7	42.6	289°10.5	5.3′	26°41.2	5.9′	58.3′
8	300°18.6	42.9	303°34.8	5.3′	26°47.1	5.8′	58.3′
9	315°18.5	·· 43.1	317°59.0	5.2′	26°52.9	5.6′	58.3′
10	330°18.4	43.3	332°23.3	5.2′	26°58.5	5.4′	58.3′
11	345°18.3	43.6	346°47.5	5.2′	27°03.9	5.2′	58.2′
12	0°18.2	N22°43.8	1°11.6	5.1′	N27°09.1	5.1′	58.2′
13	15°18.0	44.1	15°35.7	5.1′	27°14.2	4.9′	58.2′
14	30°17.9	44.3	29°59.9	5.1′	27°19.1	4.7′	58.2′
15	45°17.8	·· 44.6	44°23.9	5.1′	27°23.8	4.5′	58.1′
16	60°17.7	44.8	58°48.0	5.1′	27°28.3	4.4′	58.1′
17	75°17.6	45.1	73°12.1	5.0′	27°32.7	4.1′	58.1′
18	90°17.5	N22°45.3	87°36.1	5.0′	N27°36.8	4.0′	58.1′
19	105°17.3	45.5	102°00.1	5.0′	27°40.8	3.8′	58.0′
20	120°17.2	45.8	116°24.1	5.0′	27°44.6	3.6′	58.0′
21	135°17.1	·· 46.0	130°48.1	5.0′	27°48.2	3.5′	58.0′
22	150°17.0	46.3	145°12.1	5.0′	27°51.7	3.3′	57.9′
23	165°16.9	46.5	159°36.1	5.0′	27°55.0	3.0′	57.9′
	SD = 15.8′	d = 0.3′	SD = 16.0′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°16.7	N22°46.7	174°00.1	5.0′	N27°58.0	2.9′	57.9′
1	195°16.6	47.0	188°24.1	5.0′	28°00.9	2.7′	57.9′
2	210°16.5	47.2	202°48.1	5.0′	28°03.6	2.6′	57.8′
3	225°16.4	·· 47.4	217°12.1	5.0′	28°06.2	2.3′	57.8′
4	240°16.3	47.7	231°36.1	5.0′	28°08.5	2.2′	57.8′
5	255°16.2	47.9	246°00.1	5.0′	28°10.7	2.0′	57.8′
6	270°16.0	N22°48.1	260°24.2	5.0′	N28°12.7	1.8′	57.7′
7	285°15.9	48.4	274°48.2	5.1′	28°14.5	1.6′	57.7′
8	300°15.8	48.6	289°12.3	5.1′	28°16.1	1.5′	57.7′
9	315°15.7	·· 48.8	303°36.3	5.1′	28°17.6	1.3′	57.6′
10	330°15.6	49.1	318°00.4	5.1′	28°18.9	1.0′	57.6′
11	345°15.4	49.3	332°24.6	5.2′	28°19.9	0.9′	57.6′
12	0°15.3	N22°49.5	346°48.7	5.2′	N28°20.8	0.8′	57.6′
13	15°15.2	49.7	1°12.9	5.2′	28°21.6	0.5′	57.5′
14	30°15.1	50.0	15°37.1	5.2′	28°22.1	0.4′	57.5′
15	45°15.0	·· 50.2	30°01.4	5.3′	28°22.5	0.2′	57.5′
16	60°14.8	50.4	44°25.6	5.3′	28°22.7	0.0′	57.4′
17	75°14.7	50.6	58°50.0	5.4′	28°22.7	0.2′	57.4′
18	90°14.6	N22°50.9	73°14.3	5.4′	N28°22.5	0.3′	57.4′
19	105°14.5	51.1	87°38.7	5.4′	28°22.2	0.5′	57.4′
20	120°14.3	51.3	102°03.2	5.5′	28°21.7	0.7′	57.3′
21	135°14.2	·· 51.5	116°27.7	5.5′	28°21.0	0.9′	57.3′
22	150°14.1	51.8	130°52.2	5.6′	28°20.1	1.0′	57.3′
23	165°14.0	52.0	145°16.8	5.6′	28°19.1	1.2′	57.2′
	SD = 15.8′	d = 0.2′	SD = 15.8′				

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

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

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 28-1 3-0%
05	01:29	01:24	11:59	10:56	23:25	
06	01:18	01:13	11:59	11:55	–:–	
07	01:07	01:01	11:59	12:55	00:25	

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

	Aries	Venus		Mars		Jupiter		Saturn	
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	256°52.2	179°15.2	N23°01.5	229°23.8	N10°06.0	195°43.4	N20°04.1	266°12.4	S06°04.4
1	271°54.6	194°14.3	01.8	244°24.5	06.7	210°45.2	04.3	281°14.7	04.4
2	286°57.1	209°13.5	02.2	259°25.2	07.3	225°47.1	04.4	296°17.1	04.4
3	301°59.6	224°12.6	·· 02.5	274°25.9	·· 08.0	240°48.9	·· 04.5	311°19.5	·· 04.4
4	317°02.0	239°11.8	02.9	289°26.6	08.7	255°50.8	04.6	326°21.9	04.3
5	332°04.5	254°10.9	03.3	304°27.3	09.3	270°52.7	04.7	341°24.3	04.3
6	347°07.0	269°10.1	N23°03.6	319°28.0	N10°10.0	285°54.5	N20°04.8	356°26.6	S06°04.3
7	2°09.4	284°09.2	04.0	334°28.7	10.7	300°56.4	04.9	11°29.0	04.2
8	17°11.9	299°08.4	04.3	349°29.4	11.3	315°58.2	05.0	26°31.4	04.2
9	32°14.3	314°07.5	·· 04.7	4°30.1	·· 12.0	331°00.1	·· 05.2	41°33.8	·· 04.2
10	47°16.8	329°06.6	05.0	19°30.8	12.7	346°02.0	05.3	56°36.1	04.2
11	62°19.3	344°05.8	05.4	34°31.5	13.4	1°03.8	05.4	71°38.5	04.1
12	77°21.7	359°04.9	N23°05.7	49°32.2	N10°14.0	16°05.7	N20°05.5	86°40.9	S06°04.1
13	92°24.2	14°04.1	06.1	64°32.9	14.7	31°07.5	05.6	101°43.3	04.1
14	107°26.7	29°03.2	06.4	79°33.6	15.4	46°09.4	05.7	116°45.7	04.1
15	122°29.1	44°02.4	·· 06.8	94°34.3	·· 16.0	61°11.3	·· 05.8	131°48.0	·· 04.1
16	137°31.6	59°01.5	07.1	109°35.0	16.7	76°13.1	05.9	146°50.4	04.0
17	152°34.1	74°00.7	07.4	124°35.7	17.4	91°15.0	06.1	161°52.8	04.0
18	167°36.5	88°59.8	N23°07.8	139°36.4	N10°18.0	106°16.8	N20°06.2	176°55.2	S06°04.0
19	182°39.0	103°58.9	08.1	154°37.1	18.7	121°18.7	06.3	191°57.6	04.0
20	197°41.5	118°58.1	08.5	169°37.8	19.4	136°20.6	06.4	206°59.9	03.9
21	212°43.9	133°57.2	·· 08.8	184°38.5	·· 20.0	151°22.4	·· 06.5	222°02.3	·· 03.9
22	227°46.4	148°56.4	09.1	199°39.2	20.7	166°24.3	06.6	237°04.7	03.9
23	242°48.8	163°55.5	09.5	214°39.9	21.4	181°26.1	06.7	252°07.1	03.9
Mer.pass. 06:51		ν -0.9′	d 0.4′	m -3.92	ν 0.7′	d 0.7′	m 1.03	ν 1.9′	d 0.1′ m -2.00	ν 2.4′	d 0.0′ m 1.00

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	257°51.3	178°54.6	N23°09.8	229°40.6	N10°22.0	196°28.0	N20°06.8	267°09.5	S06°03.8
1	272°53.8	193°53.8	10.1	244°41.3	22.7	211°29.9	07.0	282°11.8	03.8
2	287°56.2	208°52.9	10.5	259°42.0	23.4	226°31.7	07.1	297°14.2	03.8
3	302°58.7	223°52.1	·· 10.8	274°42.7	·· 24.0	241°33.6	·· 07.2	312°16.6	·· 03.8
4	318°01.2	238°51.2	11.1	289°43.4	24.7	256°35.5	07.3	327°19.0	03.7
5	333°03.6	253°50.3	11.4	304°44.1	25.4	271°37.3	07.4	342°21.4	03.7
6	348°06.1	268°49.5	N23°11.8	319°44.8	N10°26.0	286°39.2	N20°07.5	357°23.8	S06°03.7
7	3°08.6	283°48.6	12.1	334°45.5	26.7	301°41.0	07.6	12°26.1	03.7
8	18°11.0	298°47.8	12.4	349°46.2	27.4	316°42.9	07.7	27°28.5	03.6
9	33°13.5	313°46.9	·· 12.7	4°46.9	·· 28.0	331°44.8	·· 07.9	42°30.9	·· 03.6
10	48°16.0	328°46.0	13.1	19°47.6	28.7	346°46.6	08.0	57°33.3	03.6
11	63°18.4	343°45.2	13.4	34°48.3	29.4	1°48.5	08.1	72°35.7	03.6
12	78°20.9	358°44.3	N23°13.7	49°49.0	N10°30.0	16°50.3	N20°08.2	87°38.1	S06°03.5
13	93°23.3	13°43.4	14.0	64°49.7	30.7	31°52.2	08.3	102°40.4	03.5
14	108°25.8	28°42.6	14.3	79°50.4	31.4	46°54.1	08.4	117°42.8	03.5
15	123°28.3	43°41.7	·· 14.7	94°51.1	·· 32.0	61°55.9	·· 08.5	132°45.2	·· 03.5
16	138°30.7	58°40.9	15.0	109°51.8	32.7	76°57.8	08.6	147°47.6	03.5
17	153°33.2	73°40.0	15.3	124°52.5	33.3	91°59.6	08.7	162°50.0	03.4
18	168°35.7	88°39.1	N23°15.6	139°53.2	N10°34.0	107°01.5	N20°08.9	177°52.4	S06°03.4
19	183°38.1	103°38.3	15.9	154°53.9	34.7	122°03.4	09.0	192°54.7	03.4
20	198°40.6	118°37.4	16.2	169°54.6	35.3	137°05.2	09.1	207°57.1	03.4
21	213°43.1	133°36.5	·· 16.5	184°55.3	·· 36.0	152°07.1	·· 09.2	222°59.5	·· 03.3
22	228°45.5	148°35.7	16.8	199°56.0	36.7	167°09.0	09.3	238°01.9	03.3
23	243°48.0	163°34.8	17.1	214°56.7	37.3	182°10.8	09.4	253°04.3	03.3
Mer.pass. 06:47		ν -0.9′	d 0.3′	m -3.92	ν 0.7′	d 0.7′	m 1.03	ν 1.9′	d 0.1′ m -2.00	ν 2.4′	d 0.0′ m 1.00

Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	258°50.5	178°33.9	N23°17.5	229°57.4	N10°38.0	197°12.7	N20°09.5	268°06.7	S06°03.3
1	273°52.9	193°33.1	17.8	244°58.1	38.6	212°14.5	09.6	283°09.0	03.3
2	288°55.4	208°32.2	18.1	259°58.8	39.3	227°16.4	09.7	298°11.4	03.2
3	303°57.8	223°31.3	·· 18.4	274°59.5	·· 40.0	242°18.3	·· 09.9	313°13.8	·· 03.2
4	319°00.3	238°30.5	18.7	290°00.2	40.6	257°20.1	10.0	328°16.2	03.2
5	334°02.8	253°29.6	19.0	305°00.9	41.3	272°22.0	10.1	343°18.6	03.2
6	349°05.2	268°28.7	N23°19.3	320°01.6	N10°41.9	287°23.8	N20°10.2	358°21.0	S06°03.1
7	4°07.7	283°27.9	19.6	335°02.3	42.6	302°25.7	10.3	13°23.4	03.1
8	19°10.2	298°27.0	19.9	350°03.0	43.3	317°27.6	10.4	28°25.7	03.1
9	34°12.6	313°26.1	·· 20.2	5°03.7	·· 43.9	332°29.4	·· 10.5	43°28.1	·· 03.1
10	49°15.1	328°25.3	20.4	20°04.4	44.6	347°31.3	10.6	58°30.5	03.1
11	64°17.6	343°24.4	20.7	35°05.1	45.2	2°33.2	10.7	73°32.9	03.0
12	79°20.0	358°23.5	N23°21.0	50°05.8	N10°45.9	17°35.0	N20°10.9	88°35.3	S06°03.0
13	94°22.5	13°22.7	21.3	65°06.5	46.6	32°36.9	11.0	103°37.7	03.0
14	109°25.0	28°21.8	21.6	80°07.2	47.2	47°38.7	11.1	118°40.1	03.0
15	124°27.4	43°20.9	·· 21.9	95°07.9	·· 47.9	62°40.6	·· 11.2	133°42.5	·· 02.9
16	139°29.9	58°20.0	22.2	110°08.6	48.5	77°42.5	11.3	148°44.8	02.9
17	154°32.3	73°19.2	22.5	125°09.3	49.2	92°44.3	11.4	163°47.2	02.9
18	169°34.8	88°18.3	N23°22.8	140°10.0	N10°49.9	107°46.2	N20°11.5	178°49.6	S06°02.9
19	184°37.3	103°17.4	23.0	155°10.7	50.5	122°48.1	11.6	193°52.0	02.9
20	199°39.7	118°16.6	23.3	170°11.4	51.2	137°49.9	11.7	208°54.4	02.8
21	214°42.2	133°15.7	·· 23.6	185°12.1	·· 51.8	152°51.8	·· 11.8	223°56.8	·· 02.8
22	229°44.7	148°14.8	23.9	200°12.8	52.5	167°53.6	12.0	238°59.2	02.8
23	244°47.1	163°14.0	24.2	215°13.5	53.2	182°55.5	12.1	254°01.6	02.8
Mer.pass. 06:44		ν -0.9′	d 0.3′	m -3.92	ν 0.7′	d 0.7′	m 1.02	ν 1.9′	d 0.1′ m -2.00	ν 2.4′	d 0.0′ m 0.99

Stars

	SHA	Dec
Alpheratz	357°35.4	29°13.3
Ankaa	353°07.8	-42°10.2
Schedar	349°31.8	56°40.0
Diphda	348°47.9	-17°51.1
Achernar	335°20.9	-57°06.5
Hamal	327°52.0	23°34.5
Polaris	314°41.7	89°21.8
Acamar	315°12.5	-40°12.3
Menkar	314°07.0	4°11.1
Mirfak	308°29.4	49°56.7
Aldebaran	290°40.5	16°33.5
Rigel	281°04.7	-8°10.4
Capella	280°23.1	46°01.3
Bellatrix	278°23.8	6°22.3
Elnath	278°02.9	28°37.7
Alnilam	275°38.6	-1°11.2
Betelgeuse	270°53.0	7°24.7
Canopus	263°53.2	-52°42.5
Sirius	258°27.0	-16°45.0
Adhara	255°06.6	-29°00.4
Procyon	244°51.6	5°09.8
Pollux	243°18.2	27°58.1
Avior	234°15.4	-59°35.4
Suhail	222°46.9	-43°32.0
Miaplacidus	221°38.9	-69°49.3
Alphard	217°48.4	-8°45.9
Regulus	207°35.1	11°50.9
Dubhe	193°41.6	61°37.5
Denebola	182°25.4	14°26.2
Gienah	175°44.0	-17°40.8
Acrux	173°00.5	-63°14.3
Gacrux	171°52.0	-57°15.3
Alioth	166°13.1	55°49.9
Spica	158°22.6	-11°17.4
Alkaid	152°52.1	49°11.7
Hadar	148°36.3	-60°29.7
Menkent	147°57.9	-36°29.6
Arcturus	145°48.1	19°03.4
Rigil Kent.	139°40.5	-60°56.4
Kochab	137°18.8	74°03.4
Zuben'ubi	136°56.3	-16°08.7
Alphecca	126°03.8	26°38.0
Antares	112°16.1	-26°29.2
Atria	107°10.2	-69°04.3
Sabik	102°03.0	-15°45.3
Shaula	96°10.6	-37°07.3
Rasalhague	95°58.7	12°32.5
Eltanin	90°41.9	51°29.0
Kaus Aust.	83°32.8	-34°22.3
Vega	80°33.2	38°48.2
Nunki	75°48.0	-26°16.0
Altair	62°00.2	8°55.9
Peacock	53°06.1	-56°39.2
Deneb	49°25.8	45°21.8
Enif	33°39.2	9°59.1
Al Na'ir	27°33.4	-46°50.4
Fomalhaut	15°15.0	-29°29.5
Scheat	13°45.7	28°12.7
Markab	13°30.4	15°20.1

Jun 08 Sat	SHA	Mer.pass
Venus	282°23.0	12:04
Mars	332°31.6	08:42
Jupiter	298°51.2	10:56
Saturn	9°20.2	06:14

Jun 09 Sun	SHA	Mer.pass
Venus	281°03.3	12:05
Mars	331°49.3	08:41
Jupiter	298°36.7	10:53
Saturn	9°18.2	06:10

Jun 10 Mon	SHA	Mer.pass
Venus	279°43.5	12:06
Mars	331°07.0	08:40
Jupiter	298°22.2	10:50
Saturn	9°16.2	06:07

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	180°13.9	N22°52.2	159°41.5	5.7′	N28°17.9	1.4′	57.2′
1	195°13.7	52.4	174°06.2	5.8′	28°16.5	1.6′	57.2′
2	210°13.6	52.6	188°30.9	5.8′	28°14.9	1.7′	57.2′
3	225°13.5	·· 52.9	202°55.7	5.9′	28°13.2	1.9′	57.1′
4	240°13.4	53.1	217°20.6	5.9′	28°11.3	2.1′	57.1′
5	255°13.3	53.3	231°45.6	6.0′	28°09.2	2.2′	57.1′
6	270°13.1	N22°53.5	246°10.6	6.1′	N28°07.0	2.4′	57.0′
7	285°13.0	53.7	260°35.6	6.1′	28°04.6	2.6′	57.0′
8	300°12.9	53.9	275°00.8	6.2′	28°02.0	2.7′	57.0′
9	315°12.8	·· 54.2	289°26.0	6.3′	27°59.3	2.9′	57.0′
10	330°12.6	54.4	303°51.3	6.4′	27°56.4	3.1′	56.9′
11	345°12.5	54.6	318°16.7	6.4′	27°53.3	3.2′	56.9′
12	0°12.4	N22°54.8	332°42.1	6.5′	N27°50.1	3.4′	56.9′
13	15°12.3	55.0	347°07.6	6.6′	27°46.7	3.5′	56.8′
14	30°12.2	55.2	1°33.2	6.7′	27°43.2	3.7′	56.8′
15	45°12.0	·· 55.4	15°58.9	6.8′	27°39.5	3.9′	56.8′
16	60°11.9	55.6	30°24.7	6.8′	27°35.6	4.0′	56.8′
17	75°11.8	55.8	44°50.5	6.9′	27°31.6	4.2′	56.7′
18	90°11.7	N22°56.1	59°16.4	7.0′	N27°27.4	4.3′	56.7′
19	105°11.5	56.3	73°42.5	7.1′	27°23.1	4.5′	56.7′
20	120°11.4	56.5	88°08.6	7.2′	27°18.6	4.6′	56.6′
21	135°11.3	·· 56.7	102°34.8	7.3′	27°14.0	4.8′	56.6′
22	150°11.2	56.9	117°01.1	7.4′	27°09.2	4.9′	56.6′
23	165°11.0	57.1	131°27.4	7.5′	27°04.3	5.1′	56.5′
	SD = 15.8′	d = 0.2′		SD = 15.6′			

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	180°10.9	N22°57.3	145°53.9	7.6′	N26°59.2	5.2′	56.5′
1	195°10.8	57.5	160°20.5	7.7′	26°54.0	5.4′	56.5′
2	210°10.7	57.7	174°47.1	7.8′	26°48.6	5.5′	56.5′
3	225°10.5	·· 57.9	189°13.9	7.9′	26°43.1	5.6′	56.4′
4	240°10.4	58.1	203°40.8	8.0′	26°37.5	5.8′	56.4′
5	255°10.3	58.3	218°07.7	8.1′	26°31.7	6.0′	56.4′
6	270°10.2	N22°58.5	232°34.8	8.2′	N26°25.7	6.1′	56.3′
7	285°10.0	58.7	247°01.9	8.3′	26°19.6	6.2′	56.3′
8	300°09.9	58.9	261°29.2	8.4′	26°13.4	6.3′	56.3′
9	315°09.8	·· 59.1	275°56.5	8.5′	26°07.1	6.5′	56.3′
10	330°09.7	59.3	290°24.0	8.6′	26°00.6	6.6′	56.2′
11	345°09.5	59.5	304°51.5	8.7′	25°54.0	6.8′	56.2′
12	0°09.4	N22°59.7	319°19.2	8.8′	N25°47.2	6.9′	56.2′
13	15°09.3	22°59.9	333°47.0	8.9′	25°40.3	7.0′	56.1′
14	30°09.2	23°00.1	348°14.9	9.0′	25°33.3	7.1′	56.1′
15	45°09.0	·· 00.3	2°42.8	9.1′	25°26.2	7.3′	56.1′
16	60°08.9	00.4	17°10.9	9.2′	25°18.9	7.4′	56.1′
17	75°08.8	00.6	31°39.1	9.3′	25°11.5	7.5′	56.0′
18	90°08.7	N23°00.8	46°07.4	9.4′	N25°04.0	7.6′	56.0′
19	105°08.5	01.0	60°35.8	9.5′	24°56.4	7.8′	56.0′
20	120°08.4	01.2	75°04.3	9.6′	24°48.6	7.8′	55.9′
21	135°08.3	·· 01.4	89°32.9	9.7′	24°40.8	8.0′	55.9′
22	150°08.2	01.6	104°01.7	9.8′	24°32.8	8.1′	55.9′
23	165°08.0	01.8	118°30.5	9.9′	24°24.7	8.3′	55.9′
	SD = 15.7′	d = 0.2′		SD = 15.4′			

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	180°07.9	N23°02.0	132°59.4	10.0′	N24°16.4	8.3′	55.8′
1	195°07.8	02.1	147°28.5	10.2′	24°08.1	8.5′	55.8′
2	210°07.7	02.3	161°57.6	10.3′	23°59.6	8.5′	55.8′
3	225°07.5	·· 02.5	176°26.9	10.4′	23°51.1	8.7′	55.8′
4	240°07.4	02.7	190°56.3	10.5′	23°42.4	8.8′	55.7′
5	255°07.3	02.9	205°25.8	10.6′	23°33.6	8.9′	55.7′
6	270°07.2	N23°03.1	219°55.4	10.7′	N23°24.7	8.9′	55.7′
7	285°07.0	03.2	234°25.0	10.8′	23°15.8	9.1′	55.7′
8	300°06.9	03.4	248°54.9	10.9′	23°06.7	9.2′	55.6′
9	315°06.8	·· 03.6	263°24.8	11.0′	22°57.5	9.3′	55.6′
10	330°06.6	03.8	277°54.8	11.1′	22°48.2	9.4′	55.6′
11	345°06.5	04.0	292°24.9	11.2′	22°38.8	9.5′	55.6′
12	0°06.4	N23°04.1	306°55.1	11.3′	N22°29.3	9.6′	55.5′
13	15°06.3	04.3	321°25.5	11.4′	22°19.7	9.7′	55.5′
14	30°06.1	04.5	335°55.9	11.5′	22°10.0	9.8′	55.5′
15	45°06.0	·· 04.7	350°26.4	11.6′	22°00.2	9.9′	55.5′
16	60°05.9	04.8	4°57.1	11.8′	21°50.3	10.0′	55.4′
17	75°05.8	05.0	19°27.9	11.9′	21°40.3	10.0′	55.4′
18	90°05.6	N23°05.2	33°58.7	12.0′	N21°30.3	10.2′	55.4′
19	105°05.5	05.4	48°29.7	12.1′	21°20.1	10.2′	55.4′
20	120°05.4	05.5	63°00.7	12.2′	21°09.9	10.3′	55.3′
21	135°05.2	·· 05.7	77°31.9	12.3′	20°59.6	10.5′	55.3′
22	150°05.1	05.9	92°03.2	12.4′	20°49.1	10.5′	55.3′
23	165°05.0	06.1	106°34.5	12.5′	20°38.6	10.5′	55.3′
	SD = 15.7′	d = 0.2′		SD = 15.2′			

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

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

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 2-4 3-13%
08	00:55	00:50	11:59	13:54	01:25	
09	00:44	00:38	11:59	14:49	02:22	
10	00:32	00:26	12:00	15:40	03:15	

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

	Aries	Venus		Mars		Jupiter		Saturn	
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	259°49.6	178°13.1	N23°24.4	230°14.2	N10°53.8	197°57.4	N20°12.2	269°03.9	S06°02.8
1	274°52.1	193°12.2	24.7	245°14.9	54.5	212°59.2	12.3	284°06.3	02.7
2	289°54.5	208°11.3	25.0	260°15.6	55.1	228°01.1	12.4	299°08.7	02.7
3	304°57.0	223°10.5	·· 25.3	275°16.3	·· 55.8	243°03.0	·· 12.5	314°11.1	·· 02.7
4	319°59.5	238°09.6	25.5	290°17.0	56.4	258°04.8	12.6	329°13.5	02.7
5	335°01.9	253°08.7	25.8	305°17.7	57.1	273°06.7	12.7	344°15.9	02.7
6	350°04.4	268°07.8	N23°26.1	320°18.4	N10°57.7	288°08.5	N20°12.8	359°18.3	S06°02.6
7	5°06.8	283°07.0	26.3	335°19.1	58.4	303°10.4	12.9	14°20.7	02.6
8	20°09.3	298°06.1	26.6	350°19.8	59.1	318°12.3	13.0	29°23.1	02.6
9	35°11.8	313°05.2	·· 26.9	5°20.5	10°59.7	333°14.1	·· 13.2	44°25.4	·· 02.6
10	50°14.2	328°04.4	27.1	20°21.2	11°00.4	348°16.0	13.3	59°27.8	02.6
11	65°16.7	343°03.5	27.4	35°21.9	01.0	3°17.9	13.4	74°30.2	02.5
12	80°19.2	358°02.6	N23°27.7	50°22.6	N11°01.7	18°19.7	N20°13.5	89°32.6	S06°02.5
13	95°21.6	13°01.7	27.9	65°23.3	02.3	33°21.6	13.6	104°35.0	02.5
14	110°24.1	28°00.9	28.2	80°24.0	03.0	48°23.4	13.7	119°37.4	02.5
15	125°26.6	43°00.0	·· 28.4	95°24.7	·· 03.6	63°25.3	·· 13.8	134°39.8	·· 02.5
16	140°29.0	57°59.1	28.7	110°25.4	04.3	78°27.2	13.9	149°42.2	02.4
17	155°31.5	72°58.2	29.0	125°26.1	04.9	93°29.0	14.0	164°44.6	02.4
18	170°33.9	87°57.4	N23°29.2	140°26.8	N11°05.6	108°30.9	N20°14.1	179°47.0	S06°02.4
19	185°36.4	102°56.5	29.5	155°27.5	06.3	123°32.8	14.3	194°49.4	02.4
20	200°38.9	117°55.6	29.7	170°28.2	06.9	138°34.6	14.4	209°51.7	02.4
21	215°41.3	132°54.7	·· 30.0	185°28.9	·· 07.6	153°36.5	·· 14.5	224°54.1	·· 02.3
22	230°43.8	147°53.9	30.2	200°29.6	08.2	168°38.3	14.6	239°56.5	02.3
23	245°46.3	162°53.0	30.5	215°30.3	08.9	183°40.2	14.7	254°58.9	02.3
Mer.pass. 06:40		ν -0.9′	d 0.3′	m -3.92	ν 0.7′	d 0.7′	m 1.02	ν 1.9′	d 0.1′ m -2.00	ν 2.4′	d 0.0′ m 0.99

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	260°48.7	177°52.1	N23°30.7	230°31.0	N11°09.5	198°42.1	N20°14.8	270°01.3	S06°02.3
1	275°51.2	192°51.2	31.0	245°31.7	10.2	213°43.9	14.9	285°03.7	02.3
2	290°53.7	207°50.3	31.2	260°32.4	10.8	228°45.8	15.0	300°06.1	02.2
3	305°56.1	222°49.5	·· 31.5	275°33.1	·· 11.5	243°47.7	·· 15.1	315°08.5	·· 02.2
4	320°58.6	237°48.6	31.7	290°33.8	12.1	258°49.5	15.2	330°10.9	02.2
5	336°01.1	252°47.7	32.0	305°34.5	12.8	273°51.4	15.3	345°13.3	02.2
6	351°03.5	267°46.8	N23°32.2	320°35.2	N11°13.4	288°53.3	N20°15.4	0°15.7	S06°02.2
7	6°06.0	282°46.0	32.4	335°35.9	14.1	303°55.1	15.6	15°18.1	02.1
8	21°08.4	297°45.1	32.7	350°36.6	14.7	318°57.0	15.7	30°20.5	02.1
9	36°10.9	312°44.2	·· 32.9	5°37.3	·· 15.4	333°58.8	·· 15.8	45°22.9	·· 02.1
10	51°13.4	327°43.3	33.2	20°38.0	16.0	349°00.7	15.9	60°25.2	02.1
11	66°15.8	342°42.4	33.4	35°38.7	16.7	4°02.6	16.0	75°27.6	02.1
12	81°18.3	357°41.6	N23°33.6	50°39.4	N11°17.3	19°04.4	N20°16.1	90°30.0	S06°02.1
13	96°20.8	12°40.7	33.9	65°40.1	18.0	34°06.3	16.2	105°32.4	02.0
14	111°23.2	27°39.8	34.1	80°40.8	18.6	49°08.2	16.3	120°34.8	02.0
15	126°25.7	42°38.9	·· 34.3	95°41.5	·· 19.3	64°10.0	·· 16.4	135°37.2	·· 02.0
16	141°28.2	57°38.0	34.5	110°42.2	19.9	79°11.9	16.5	150°39.6	02.0
17	156°30.6	72°37.2	34.8	125°42.9	20.6	94°13.8	16.6	165°42.0	02.0
18	171°33.1	87°36.3	N23°35.0	140°43.6	N11°21.2	109°15.6	N20°16.7	180°44.4	S06°01.9
19	186°35.6	102°35.4	35.2	155°44.3	21.9	124°17.5	16.8	195°46.8	01.9
20	201°38.0	117°34.5	35.5	170°45.0	22.5	139°19.4	17.0	210°49.2	01.9
21	216°40.5	132°33.6	·· 35.7	185°45.7	·· 23.2	154°21.2	·· 17.1	225°51.6	·· 01.9
22	231°42.9	147°32.8	35.9	200°46.4	23.8	169°23.1	17.2	240°54.0	01.9
23	246°45.4	162°31.9	36.1	215°47.1	24.4	184°24.9	17.3	255°56.4	01.9
Mer.pass. 06:36		ν -0.9′	d 0.2′	m -3.92	ν 0.7′	d 0.7′	m 1.02	ν 1.9′	d 0.1′ m -2.00	ν 2.4′	d 0.0′ m 0.98

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	261°47.9	177°31.0	N23°36.3	230°47.8	N11°25.1	199°26.8	N20°17.4	270°58.8	S06°01.8
1	276°50.3	192°30.1	36.6	245°48.5	25.7	214°28.7	17.5	286°01.2	01.8
2	291°52.8	207°29.2	36.8	260°49.2	26.4	229°30.5	17.6	301°03.6	01.8
3	306°55.3	222°28.4	·· 37.0	275°49.9	·· 27.0	244°32.4	·· 17.7	316°06.0	·· 01.8
4	321°57.7	237°27.5	37.2	290°50.6	27.7	259°34.3	17.8	331°08.4	01.8
5	337°00.2	252°26.6	37.4	305°51.2	28.3	274°36.1	17.9	346°10.8	01.7
6	352°02.7	267°25.7	N23°37.6	320°51.9	N11°29.0	289°38.0	N20°18.0	1°13.2	S06°01.7
7	7°05.1	282°24.8	37.8	335°52.6	29.6	304°39.9	18.1	16°15.5	01.7
8	22°07.6	297°23.9	38.1	350°53.3	30.3	319°41.7	18.2	31°17.9	01.7
9	37°10.0	312°23.1	·· 38.3	5°54.0	·· 30.9	334°43.6	·· 18.4	46°20.3	·· 01.7
10	52°12.5	327°22.2	38.5	20°54.7	31.6	349°45.5	18.5	61°22.7	01.7
11	67°15.0	342°21.3	38.7	35°55.4	32.2	4°47.3	18.6	76°25.1	01.6
12	82°17.4	357°20.4	N23°38.9	50°56.1	N11°32.8	19°49.2	N20°18.7	91°27.5	S06°01.6
13	97°19.9	12°19.5	39.1	65°56.8	33.5	34°51.1	18.8	106°29.9	01.6
14	112°22.4	27°18.6	39.3	80°57.5	34.1	49°52.9	18.9	121°32.3	01.6
15	127°24.8	42°17.8	·· 39.5	95°58.2	·· 34.8	64°54.8	·· 19.0	136°34.7	·· 01.6
16	142°27.3	57°16.9	39.7	110°58.9	35.4	79°56.6	19.1	151°37.1	01.6
17	157°29.8	72°16.0	39.9	125°59.6	36.1	94°58.5	19.2	166°39.5	01.5
18	172°32.2	87°15.1	N23°40.1	141°00.3	N11°36.7	110°00.4	N20°19.3	181°41.9	S06°01.5
19	187°34.7	102°14.2	40.3	156°01.0	37.3	125°02.2	19.4	196°44.3	01.5
20	202°37.2	117°13.3	40.5	171°01.7	38.0	140°04.1	19.5	211°46.7	01.5
21	217°39.6	132°12.5	·· 40.7	186°02.4	·· 38.6	155°06.0	·· 19.6	226°49.1	·· 01.5
22	232°42.1	147°11.6	40.9	201°03.1	39.3	170°07.8	19.7	241°51.5	01.5
23	247°44.5	162°10.7	41.1	216°03.8	39.9	185°09.7	19.8	256°53.9	01.5
Mer.pass. 06:32		ν -0.9′	d 0.2′	m -3.91	ν 0.7′	d 0.6′	m 1.02	ν 1.9′	d 0.1′ m -2.00	ν 2.4′	d 0.0′ m 0.98

Stars

	SHA	Dec
Alpheratz	357°35.4	29°13.3
Ankaa	353°07.7	-42°10.2
Schedar	349°31.8	56°40.0
Diphda	348°47.9	-17°51.1
Achernar	335°20.9	-57°06.5
Hamal	327°52.0	23°34.5
Polaris	314°40.8	89°21.8
Acamar	315°12.5	-40°12.3
Menkar	314°06.9	4°11.1
Mirfak	308°29.4	49°56.7
Aldebaran	290°40.5	16°33.5
Rigel	281°04.7	-8°10.4
Capella	280°23.1	46°01.3
Bellatrix	278°23.7	6°22.3
Elnath	278°02.9	28°37.7
Alnilam	275°38.6	-1°11.2
Betelgeuse	270°53.0	7°24.7
Canopus	263°53.2	-52°42.5
Sirius	258°27.0	-16°45.0
Adhara	255°06.6	-29°00.3
Procyon	244°51.6	5°09.8
Pollux	243°18.2	27°58.1
Avior	234°15.4	-59°35.4
Suhail	222°47.0	-43°32.0
Miaplacidus	221°39.0	-69°49.2
Alphard	217°48.4	-8°45.9
Regulus	207°35.1	11°50.9
Dubhe	193°41.7	61°37.5
Denebola	182°25.4	14°26.2
Gienah	175°44.0	-17°40.8
Acrux	173°00.5	-63°14.4
Gacrux	171°52.0	-57°15.3
Alioth	166°13.2	55°49.9
Spica	158°22.7	-11°17.4
Alkaid	152°52.1	49°11.7
Hadar	148°36.3	-60°29.7
Menkent	147°57.9	-36°29.6
Arcturus	145°48.1	19°03.4
Rigil Kent.	139°40.5	-60°56.4
Kochab	137°18.8	74°03.5
Zuben'ubi	136°56.3	-16°08.7
Alphecca	126°03.8	26°38.0
Antares	112°16.1	-26°29.2
Atria	107°10.2	-69°04.3
Sabik	102°03.0	-15°45.3
Shaula	96°10.6	-37°07.3
Rasalhague	95°58.7	12°32.5
Eltanin	90°41.9	51°29.0
Kaus Aust.	83°32.8	-34°22.4
Vega	80°33.1	38°48.2
Nunki	75°48.0	-26°16.0
Altair	62°00.2	8°55.9
Peacock	53°06.0	-56°39.2
Deneb	49°25.8	45°21.8
Enif	33°39.1	9°59.1
Al Na'ir	27°33.3	-46°50.4
Fomalhaut	15°15.0	-29°29.4
Scheat	13°45.6	28°12.7
Markab	13°30.4	15°20.1

Jun 11 Tue	SHA	Mer.pass
Venus	278°23.5	12:08
Mars	330°24.6	08:39
Jupiter	298°07.8	10:47
Saturn	9°14.3	06:03

Jun 12 Wed	SHA	Mer.pass
Venus	277°03.4	12:09
Mars	329°42.3	08:38
Jupiter	297°53.3	10:44
Saturn	9°12.6	05:59

Jun 13 Thu	SHA	Mer.pass
Venus	275°43.1	12:11
Mars	328°59.9	08:36
Jupiter	297°38.9	10:41
Saturn	9°10.9	05:55

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Tue	**GHA**	**Dec**	**GHA**	*ν*	**Dec**	*d*	**HP**
0	180°04.9	N23°06.2	121°06.0	12.6′	N20°28.1	10.7′	55.2′
1	195°04.7	06.4	135°37.6	12.7′	20°17.4	10.7′	55.2′
2	210°04.6	06.6	150°09.2	12.8′	20°06.7	10.9′	55.2′
3	225°04.5	·· 06.7	164°41.0	12.9′	19°55.8	10.9′	55.2′
4	240°04.3	06.9	179°12.9	13.0′	19°44.9	10.9′	55.1′
5	255°04.2	07.1	193°44.8	13.1′	19°34.0	11.1′	55.1′
6	270°04.1	N23°07.2	208°16.9	13.2′	N19°22.9	11.1′	55.1′
7	285°04.0	07.4	222°49.0	13.2′	19°11.8	11.2′	55.1′
8	300°03.8	07.6	237°21.3	13.3′	19°00.6	11.3′	55.1′
9	315°03.7	·· 07.7	251°53.6	13.4′	18°49.3	11.3′	55.0′
10	330°03.6	07.9	266°26.0	13.5′	18°38.0	11.5′	55.0′
11	345°03.4	08.0	280°58.6	13.6′	18°26.5	11.4′	55.0′
12	0°03.3	N23°08.2	295°31.2	13.7′	N18°15.1	11.6′	55.0′
13	15°03.2	08.4	310°03.9	13.8′	18°03.5	11.6′	55.0′
14	30°03.1	08.5	324°36.7	13.9′	17°51.9	11.7′	54.9′
15	45°02.9	·· 08.7	339°09.6	14.0′	17°40.2	11.7′	54.9′
16	60°02.8	08.8	353°42.5	14.1′	17°28.5	11.8′	54.9′
17	75°02.7	09.0	8°15.6	14.1′	17°16.7	11.9′	54.9′
18	90°02.5	N23°09.2	22°48.7	14.2′	N17°04.8	11.9′	54.9′
19	105°02.4	09.3	37°22.0	14.3′	16°52.9	12.0′	54.8′
20	120°02.3	09.5	51°55.3	14.4′	16°40.9	12.1′	54.8′
21	135°02.1	·· 09.6	66°28.7	14.5′	16°28.8	12.1′	54.8′
22	150°02.0	09.8	81°02.1	14.6′	16°16.7	12.2′	54.8′
23	165°01.9	09.9	95°35.7	14.6′	16°04.5	12.2′	54.8′
	SD = 15.7′	*d* = 0.2′	SD = 15.1′				

Wed	**GHA**	**Dec**	**GHA**	*ν*	**Dec**	*d*	**HP**
0	180°01.8	N23°10.1	110°09.3	14.7′	N15°52.3	12.3′	54.7′
1	195°01.6	10.2	124°43.0	14.8′	15°40.0	12.3′	54.7′
2	210°01.5	10.4	139°16.8	14.9′	15°27.7	12.4′	54.7′
3	225°01.4	·· 10.5	153°50.7	14.9′	15°15.3	12.4′	54.7′
4	240°01.2	10.7	168°24.6	15.0′	15°02.9	12.5′	54.7′
5	255°01.1	10.8	182°58.7	15.1′	14°50.4	12.6′	54.7′
6	270°01.0	N23°11.0	197°32.8	15.2′	N14°37.8	12.5′	54.6′
7	285°00.8	11.1	212°06.9	15.2′	14°25.3	12.7′	54.6′
8	300°00.7	11.3	226°41.1	15.3′	14°12.6	12.7′	54.6′
9	315°00.6	·· 11.4	241°15.5	15.4′	13°59.9	12.7′	54.6′
10	330°00.5	11.6	255°49.8	15.4′	13°47.2	12.8′	54.6′
11	345°00.3	11.7	270°24.3	15.5′	13°34.4	12.8′	54.6′
12	0°00.2	N23°11.9	284°58.8	15.6′	N13°21.6	12.8′	54.6′
13	15°00.1	12.0	299°33.4	15.6′	13°08.8	13.0′	54.5′
14	29°59.9	12.1	314°08.0	15.7′	12°55.8	12.9′	54.5′
15	44°59.8	·· 12.3	328°42.7	15.8′	12°42.9	13.0′	54.5′
16	59°59.7	12.4	343°17.5	15.8′	12°29.9	13.0′	54.5′
17	74°59.5	12.6	357°52.3	15.9′	12°16.9	13.1′	54.5′
18	89°59.4	N23°12.7	12°27.2	15.9′	N12°03.8	13.1′	54.5′
19	104°59.3	12.8	27°02.1	16.0′	11°50.7	13.1′	54.5′
20	119°59.1	13.0	41°37.1	16.1′	11°37.6	13.2′	54.4′
21	134°59.0	·· 13.1	56°12.2	16.1′	11°24.4	13.2′	54.4′
22	149°58.9	13.3	70°47.3	16.2′	11°11.2	13.3′	54.4′
23	164°58.8	13.4	85°22.5	16.2′	10°57.9	13.3′	54.4′
	SD = 15.7′	*d* = 0.2′	SD = 14.9′				

Thu	**GHA**	**Dec**	**GHA**	*ν*	**Dec**	*d*	**HP**
0	179°58.6	N23°13.5	99°57.7	16.3′	N10°44.6	13.3′	54.4′
1	194°58.5	13.7	114°33.0	16.3′	10°31.3	13.4′	54.4′
2	209°58.4	13.8	129°08.3	16.4′	10°17.9	13.3′	54.4′
3	224°58.2	·· 13.9	143°43.7	16.4′	10°04.6	13.5′	54.4′
4	239°58.1	14.1	158°19.1	16.5′	09°51.1	13.4′	54.4′
5	254°58.0	14.2	172°54.6	16.5′	09°37.7	13.5′	54.4′
6	269°57.8	N23°14.3	187°30.1	16.6′	N09°24.2	13.5′	54.3′
7	284°57.7	14.5	202°05.7	16.6′	09°10.7	13.5′	54.3′
8	299°57.6	14.6	216°41.3	16.7′	08°57.2	13.6′	54.3′
9	314°57.4	·· 14.7	231°16.9	16.7′	08°43.6	13.6′	54.3′
10	329°57.3	14.8	245°52.6	16.7′	08°30.0	13.6′	54.3′
11	344°57.2	15.0	260°28.3	16.8′	08°16.4	13.6′	54.3′
12	359°57.0	N23°15.1	275°04.1	16.8′	N08°02.8	13.7′	54.3′
13	14°56.9	15.2	289°39.9	16.8′	07°49.1	13.7′	54.3′
14	29°56.8	15.4	304°15.8	16.9′	07°35.4	13.7′	54.3′
15	44°56.6	·· 15.5	318°51.7	16.9′	07°21.7	13.7′	54.3′
16	59°56.5	15.6	333°27.6	17.0′	07°08.0	13.8′	54.3′
17	74°56.4	15.7	348°03.5	17.0′	06°54.2	13.8′	54.3′
18	89°56.2	N23°15.8	2°39.5	17.0′	N06°40.4	13.8′	54.2′
19	104°56.1	16.0	17°15.5	17.0′	06°26.6	13.8′	54.2′
20	119°56.0	16.1	31°51.6	17.1′	06°12.8	13.8′	54.2′
21	134°55.8	·· 16.2	46°27.6	17.1′	05°59.0	13.9′	54.2′
22	149°55.7	16.3	61°03.7	17.1′	05°45.1	13.8′	54.2′
23	164°55.6	16.4	75°39.9	17.2′	05°31.3	13.9′	54.2′
	SD = 15.7′	*d* = 0.1′	SD = 14.8′				

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

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

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 5-7 21-38%
11	00:19	00:13	12:00	16:26	04:03	
12	00:07	00:01	12:00	17:09	04:48	
13	00:06	00:12	12:00	17:49	05:29	

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

	Aries	Venus		Mars		Jupiter		Saturn	
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	262°47.0	177°09.8	N23°41.3	231°04.5	N11°40.6	200°11.6	N20°20.0	271°56.3	S06°01.4
1	277°49.5	192°08.9	41.4	246°05.2	41.2	215°13.4	20.1	286°58.7	01.4
2	292°51.9	207°08.0	41.6	261°05.9	41.8	230°15.3	20.2	302°01.1	01.4
3	307°54.4	222°07.1	·· 41.8	276°06.6	·· 42.5	245°17.2	·· 20.3	317°03.5	·· 01.4
4	322°56.9	237°06.3	42.0	291°07.3	43.1	260°19.0	20.4	332°05.9	01.4
5	337°59.3	252°05.4	42.2	306°08.0	43.8	275°20.9	20.5	347°08.3	01.4
6	353°01.8	267°04.5	N23°42.4	321°08.7	N11°44.4	290°22.8	N20°20.6	2°10.7	S06°01.3
7	8°04.3	282°03.6	42.6	336°09.4	45.0	305°24.6	20.7	17°13.1	01.3
8	23°06.7	297°02.7	42.7	351°10.1	45.7	320°26.5	20.8	32°15.5	01.3
9	38°09.2	312°01.8	·· 42.9	6°10.8	·· 46.3	335°28.4	·· 20.9	47°17.9	·· 01.3
10	53°11.7	327°00.9	43.1	21°11.5	47.0	350°30.2	21.0	62°20.3	01.3
11	68°14.1	342°00.0	43.3	36°12.2	47.6	5°32.1	21.1	77°22.7	01.3
12	83°16.6	356°59.2	N23°43.5	51°12.9	N11°48.2	20°34.0	N20°21.2	92°25.1	S06°01.2
13	98°19.0	11°58.3	43.6	66°13.6	48.9	35°35.8	21.3	107°27.5	01.2
14	113°21.5	26°57.4	43.8	81°14.3	49.5	50°37.7	21.4	122°29.9	01.2
15	128°24.0	41°56.5	·· 44.0	96°14.9	·· 50.1	65°39.6	·· 21.5	137°32.3	·· 01.2
16	143°26.4	56°55.6	44.1	111°15.6	50.8	80°41.4	21.7	152°34.7	01.2
17	158°28.9	71°54.7	44.3	126°16.3	51.4	95°43.3	21.8	167°37.1	01.2
18	173°31.4	86°53.8	N23°44.5	141°17.0	N11°52.1	110°45.2	N20°21.9	182°39.5	S06°01.2
19	188°33.8	101°52.9	44.7	156°17.7	52.7	125°47.0	22.0	197°41.9	01.1
20	203°36.3	116°52.1	44.8	171°18.4	53.3	140°48.9	22.1	212°44.3	01.1
21	218°38.8	131°51.2	·· 45.0	186°19.1	·· 54.0	155°50.8	·· 22.2	227°46.8	·· 01.1
22	233°41.2	146°50.3	45.2	201°19.8	54.6	170°52.6	22.3	242°49.2	01.1
23	248°43.7	161°49.4	45.3	216°20.5	55.2	185°54.5	22.4	257°51.6	01.1
Mer.pass. 06:28		ν -0.9′	d 0.2′	m -3.91	ν 0.7′	d 0.6′	m 1.01	ν 1.9′	d 0.1′ m -2.01	ν 2.4′	d 0.0′ m 0.98

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	263°46.1	176°48.5	N23°45.5	231°21.2	N11°55.9	200°56.4	N20°22.5	272°54.0	S06°01.1
1	278°48.6	191°47.6	45.6	246°21.9	56.5	215°58.2	22.6	287°56.4	01.1
2	293°51.1	206°46.7	45.8	261°22.6	57.2	231°00.1	22.7	302°58.8	01.0
3	308°53.5	221°45.8	·· 46.0	276°23.3	·· 57.8	246°02.0	·· 22.8	318°01.2	·· 01.0
4	323°56.0	236°44.9	46.1	291°24.0	58.4	261°03.8	22.9	333°03.6	01.0
5	338°58.5	251°44.1	46.3	306°24.7	59.1	276°05.7	23.0	348°06.0	01.0
6	354°00.9	266°43.2	N23°46.4	321°25.4	N11°59.7	291°07.6	N20°23.1	3°08.4	S06°01.0
7	9°03.4	281°42.3	46.6	336°26.1	12°00.3	306°09.4	23.2	18°10.8	01.0
8	24°05.9	296°41.4	46.7	351°26.8	01.0	321°11.3	23.3	33°13.2	01.0
9	39°08.3	311°40.5	·· 46.9	6°27.5	·· 01.6	336°13.2	·· 23.4	48°15.6	·· 00.9
10	54°10.8	326°39.6	47.0	21°28.2	02.2	351°15.0	23.5	63°18.0	00.9
11	69°13.3	341°38.7	47.2	36°28.9	02.9	6°16.9	23.6	78°20.4	00.9
12	84°15.7	356°37.8	N23°47.3	51°29.6	N12°03.5	21°18.8	N20°23.8	93°22.8	S06°00.9
13	99°18.2	11°36.9	47.5	66°30.3	04.1	36°20.6	23.9	108°25.2	00.9
14	114°20.6	26°36.0	47.6	81°31.0	04.8	51°22.5	24.0	123°27.6	00.9
15	129°23.1	41°35.2	·· 47.8	96°31.7	·· 05.4	66°24.4	·· 24.1	138°30.0	·· 00.9
16	144°25.6	56°34.3	47.9	111°32.3	06.0	81°26.2	24.2	153°32.4	00.9
17	159°28.0	71°33.4	48.0	126°33.0	06.7	96°28.1	24.3	168°34.8	00.8
18	174°30.5	86°32.5	N23°48.2	141°33.7	N12°07.3	111°30.0	N20°24.4	183°37.3	S06°00.8
19	189°33.0	101°31.6	48.3	156°34.4	07.9	126°31.8	24.5	198°39.7	00.8
20	204°35.4	116°30.7	48.5	171°35.1	08.6	141°33.7	24.6	213°42.1	00.8
21	219°37.9	131°29.8	·· 48.6	186°35.8	·· 09.2	156°35.6	·· 24.7	228°44.5	·· 00.8
22	234°40.4	146°28.9	48.7	201°36.5	09.8	171°37.4	24.8	243°46.9	00.8
23	249°42.8	161°28.0	48.9	216°37.2	10.5	186°39.3	24.9	258°49.3	00.8
Mer.pass. 06:24		ν -0.9′	d 0.2′	m -3.91	ν 0.7′	d 0.6′	m 1.01	ν 1.9′	d 0.1′ m -2.01	ν 2.4′	d 0.0′ m 0.97

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	264°45.3	176°27.1	N23°49.0	231°37.9	N12°11.1	201°41.2	N20°25.0	273°51.7	S06°00.7
1	279°47.7	191°26.2	49.1	246°38.6	11.7	216°43.0	25.1	288°54.1	00.7
2	294°50.2	206°25.4	49.3	261°39.3	12.3	231°44.9	25.2	303°56.5	00.7
3	309°52.7	221°24.5	·· 49.4	276°40.0	·· 13.0	246°46.8	·· 25.3	318°58.9	·· 00.7
4	324°55.1	236°23.6	49.5	291°40.7	13.6	261°48.6	25.4	334°01.3	00.7
5	339°57.6	251°22.7	49.6	306°41.4	14.2	276°50.5	25.5	349°03.7	00.7
6	355°00.1	266°21.8	N23°49.8	321°42.1	N12°14.9	291°52.4	N20°25.6	4°06.1	S06°00.7
7	10°02.5	281°20.9	49.9	336°42.8	15.5	306°54.2	25.7	19°08.5	00.7
8	25°05.0	296°20.0	50.0	351°43.5	16.1	321°56.1	25.8	34°11.0	00.6
9	40°07.5	311°19.1	·· 50.1	6°44.2	·· 16.8	336°58.0	·· 25.9	49°13.4	·· 00.6
10	55°09.9	326°18.2	50.3	21°44.9	17.4	351°59.8	26.0	64°15.8	00.6
11	70°12.4	341°17.3	50.4	36°45.6	18.0	7°01.7	26.1	79°18.2	00.6
12	85°14.9	356°16.4	N23°50.5	51°46.2	N12°18.6	22°03.6	N20°26.3	94°20.6	S06°00.6
13	100°17.3	11°15.5	50.6	66°46.9	19.3	37°05.5	26.4	109°23.0	00.6
14	115°19.8	26°14.6	50.7	81°47.6	19.9	52°07.3	26.5	124°25.4	00.6
15	130°22.2	41°13.7	·· 50.8	96°48.3	·· 20.5	67°09.2	·· 26.6	139°27.8	·· 00.6
16	145°24.7	56°12.9	51.0	111°49.0	21.1	82°11.1	26.7	154°30.2	00.6
17	160°27.2	71°12.0	51.1	126°49.7	21.8	97°12.9	26.8	169°32.6	00.5
18	175°29.6	86°11.1	N23°51.2	141°50.4	N12°22.4	112°14.8	N20°26.9	184°35.0	S06°00.5
19	190°32.1	101°10.2	51.3	156°51.1	23.0	127°16.7	27.0	199°37.5	00.5
20	205°34.6	116°09.3	51.4	171°51.8	23.7	142°18.5	27.1	214°39.9	00.5
21	220°37.0	131°08.4	·· 51.5	186°52.5	·· 24.3	157°20.4	·· 27.2	229°42.3	·· 00.5
22	235°39.5	146°07.5	51.6	201°53.2	24.9	172°22.3	27.3	244°44.7	00.5
23	250°42.0	161°06.6	51.7	216°53.9	25.5	187°24.1	27.4	259°47.1	00.5
Mer.pass. 06:20		ν -0.9′	d 0.1′	m -3.91	ν 0.7′	d 0.6′	m 1.01	ν 1.9′	d 0.1′ m -2.01	ν 2.4′	d 0.0′ m 0.97

Stars

	SHA	Dec
Alpheratz	357°35.3	29°13.3
Ankaa	353°07.7	-42°10.2
Schedar	349°31.8	56°40.0
Diphda	348°47.9	-17°51.1
Achernar	335°20.8	-57°06.5
Hamal	327°52.0	23°34.5
Polaris	314°39.9	89°21.8
Acamar	315°12.5	-40°12.3
Menkar	314°06.9	4°11.1
Mirfak	308°29.4	49°56.7
Aldebaran	290°40.5	16°33.5
Rigel	281°04.7	-8°10.4
Capella	280°23.1	46°01.3
Bellatrix	278°23.7	6°22.3
Elnath	278°02.9	28°37.7
Alnilam	275°38.6	-1°11.2
Betelgeuse	270°53.0	7°24.7
Canopus	263°53.2	-52°42.5
Sirius	258°27.0	-16°45.0
Adhara	255°06.6	-29°00.3
Procyon	244°51.6	5°09.8
Pollux	243°18.2	27°58.1
Avior	234°15.5	-59°35.4
Suhail	222°47.0	-43°32.0
Miaplacidus	221°39.0	-69°49.2
Alphard	217°48.4	-8°45.9
Regulus	207°35.1	11°50.9
Dubhe	193°41.7	61°37.5
Denebola	182°25.4	14°26.2
Gienah	175°44.0	-17°40.8
Acrux	173°00.5	-63°14.4
Gacrux	171°52.1	-57°15.3
Alioth	166°13.2	55°49.9
Spica	158°22.7	-11°17.4
Alkaid	152°52.1	49°11.7
Hadar	148°36.3	-60°29.7
Menkent	147°57.9	-36°29.6
Arcturus	145°48.1	19°03.4
Rigil Kent.	139°40.5	-60°56.4
Kochab	137°18.8	74°03.5
Zuben'ubi	136°56.3	-16°08.7
Alphecca	126°03.8	26°38.0
Antares	112°16.1	-26°29.2
Atria	107°10.2	-69°04.3
Sabik	102°03.0	-15°45.3
Shaula	96°10.6	-37°07.3
Rasalhague	95°58.6	12°32.5
Eltanin	90°41.9	51°29.0
Kaus Aust.	83°32.8	-34°22.4
Vega	80°33.1	38°48.3
Nunki	75°48.0	-26°16.0
Altair	62°00.1	8°55.9
Peacock	53°06.0	-56°39.2
Deneb	49°25.8	45°21.8
Enif	33°39.1	9°59.1
Al Na'ir	27°33.3	-46°50.4
Fomalhaut	15°15.0	-29°29.4
Scheat	13°45.6	28°12.7
Markab	13°30.3	15°20.1

Jun 14 Fri	SHA	Mer.pass
Venus	274°22.8	12:12
Mars	328°17.5	08:35
Jupiter	297°24.6	10:38
Saturn	9°09.3	05:51

Jun 15 Sat	SHA	Mer.pass
Venus	273°02.4	12:13
Mars	327°35.1	08:34
Jupiter	297°10.2	10:35
Saturn	9°07.8	05:47

Jun 16 Sun	SHA	Mer.pass
Venus	271°41.9	12:15
Mars	326°52.6	08:33
Jupiter	296°55.9	10:32
Saturn	9°06.4	05:44

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	179°55.5	N23°16.6	90°16.0	17.2′	N05°17.4	13.9′	54.2′
1	194°55.3	16.7	104°52.2	17.2′	05°03.5	14.0′	54.2′
2	209°55.2	16.8	119°28.4	17.2′	04°49.5	13.9′	54.2′
3	224°55.1	·· 16.9	134°04.6	17.2′	04°35.6	13.9′	54.2′
4	239°54.9	17.0	148°40.8	17.3′	04°21.7	14.0′	54.2′
5	254°54.8	17.1	163°17.1	17.3′	04°07.7	14.0′	54.2′
6	269°54.7	N23°17.3	177°53.4	17.3′	N03°53.7	14.0′	54.2′
7	284°54.5	17.4	192°29.7	17.3′	03°39.7	14.0′	54.2′
8	299°54.4	17.5	207°06.0	17.3′	03°25.7	14.0′	54.2′
9	314°54.3	·· 17.6	221°42.3	17.3′	03°11.7	14.0′	54.2′
10	329°54.1	17.7	236°18.6	17.3′	02°57.7	14.0′	54.2′
11	344°54.0	17.8	250°55.0	17.4′	02°43.7	14.1′	54.2′
12	359°53.9	N23°17.9	265°31.3	17.4′	N02°29.6	14.0′	54.2′
13	14°53.7	18.0	280°07.7	17.4′	02°15.6	14.1′	54.2′
14	29°53.6	18.1	294°44.1	17.4′	02°01.5	14.0′	54.2′
15	44°53.5	·· 18.3	309°20.5	17.4′	01°47.5	14.1′	54.2′
16	59°53.3	18.4	323°56.8	17.4′	01°33.4	14.1′	54.2′
17	74°53.2	18.5	338°33.2	17.4′	01°19.3	14.1′	54.2′
18	89°53.1	N23°18.6	353°09.6	17.4′	N01°05.2	14.1′	54.2′
19	104°52.9	18.7	7°46.0	17.4′	00°51.1	14.1′	54.2′
20	119°52.8	18.8	22°22.4	17.4′	00°37.0	14.1′	54.2′
21	134°52.7	·· 18.9	36°58.8	17.4′	00°22.9	14.0′	54.2′
22	149°52.5	19.0	51°35.2	17.4′	N00°08.9	14.1′	54.2′
23	164°52.4	19.1	66°11.6	17.4′	S00°05.2	14.2′	54.2′
	SD = 15.7′	d = 0.1′	SD = 14.8′				

Sat	GHA	Dec	GHA	ν	Dec	d	HP
0	179°52.3	N23°19.2	80°48.0	17.4′	S00°19.4	14.1′	54.2′
1	194°52.1	19.3	95°24.4	17.4′	00°33.5	14.1′	54.2′
2	209°52.0	19.4	110°00.8	17.4′	00°47.6	14.1′	54.2′
3	224°51.9	·· 19.5	124°37.2	17.4′	01°01.7	14.1′	54.2′
4	239°51.7	19.6	139°13.5	17.4′	01°15.8	14.1′	54.2′
5	254°51.6	19.7	153°49.9	17.3′	01°29.9	14.0′	54.2′
6	269°51.4	N23°19.8	168°26.2	17.3′	S01°43.9	14.1′	54.2′
7	284°51.3	19.9	183°02.6	17.3′	01°58.0	14.1′	54.2′
8	299°51.2	20.0	197°38.9	17.3′	02°12.1	14.1′	54.2′
9	314°51.0	·· 20.1	212°15.2	17.3′	02°26.2	14.1′	54.2′
10	329°50.9	20.2	226°51.5	17.3′	02°40.3	14.1′	54.3′
11	344°50.8	20.3	241°27.8	17.3′	02°54.4	14.0′	54.3′
12	359°50.6	N23°20.4	256°04.0	17.2′	S03°08.4	14.1′	54.3′
13	14°50.5	20.4	270°40.3	17.2′	03°22.5	14.1′	54.3′
14	29°50.4	20.5	285°16.5	17.2′	03°36.6	14.0′	54.3′
15	44°50.2	·· 20.6	299°52.7	17.2′	03°50.6	14.0′	54.3′
16	59°50.1	20.7	314°28.8	17.1′	04°04.6	14.1′	54.3′
17	74°50.0	20.8	329°05.0	17.1′	04°18.7	14.0′	54.3′
18	89°49.8	N23°20.9	343°41.1	17.1′	S04°32.7	14.0′	54.3′
19	104°49.7	21.0	358°17.2	17.1′	04°46.7	14.0′	54.3′
20	119°49.6	21.1	12°53.3	17.0′	05°00.7	13.9′	54.3′
21	134°49.4	·· 21.2	27°29.3	17.0′	05°14.6	14.0′	54.3′
22	149°49.3	21.2	42°05.3	17.0′	05°28.6	14.0′	54.3′
23	164°49.2	21.3	56°41.3	16.9′	05°42.6	13.9′	54.4′
	SD = 15.7′	d = 0.1′	SD = 14.8′				

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	179°49.0	N23°21.4	71°17.2	16.9′	S05°56.5	13.9′	54.4′
1	194°48.9	21.5	85°53.2	16.9′	06°10.4	13.9′	54.4′
2	209°48.8	21.6	100°29.0	16.8′	06°24.3	13.9′	54.4′
3	224°48.6	·· 21.7	115°04.9	16.8′	06°38.2	13.9′	54.4′
4	239°48.5	21.7	129°40.7	16.8′	06°52.1	13.8′	54.4′
5	254°48.4	21.8	144°16.4	16.7′	07°05.9	13.9′	54.4′
6	269°48.2	N23°21.9	158°52.2	16.7′	S07°19.8	13.8′	54.4′
7	284°48.1	22.0	173°27.9	16.6′	07°33.6	13.8′	54.4′
8	299°48.0	22.1	188°03.5	16.6′	07°47.4	13.8′	54.5′
9	314°47.8	·· 22.1	202°39.1	16.6′	08°01.2	13.7′	54.5′
10	329°47.7	22.2	217°14.7	16.5′	08°14.9	13.7′	54.5′
11	344°47.5	22.3	231°50.2	16.5′	08°28.6	13.7′	54.5′
12	359°47.4	N23°22.4	246°25.6	16.4′	S08°42.3	13.7′	54.5′
13	14°47.3	22.4	261°01.0	16.4′	08°56.0	13.7′	54.5′
14	29°47.1	22.5	275°36.4	16.3′	09°09.7	13.6′	54.5′
15	44°47.0	·· 22.6	290°11.7	16.3′	09°23.3	13.6′	54.5′
16	59°46.9	22.7	304°47.0	16.2′	09°36.9	13.6′	54.6′
17	74°46.7	22.7	319°22.2	16.2′	09°50.5	13.5′	54.6′
18	89°46.6	N23°22.8	333°57.4	16.1′	S10°04.0	13.5′	54.6′
19	104°46.5	22.9	348°32.5	16.0′	10°17.5	13.5′	54.6′
20	119°46.3	22.9	3°07.5	16.0′	10°31.0	13.5′	54.6′
21	134°46.2	·· 23.0	17°42.5	15.9′	10°44.5	13.4′	54.6′
22	149°46.1	23.1	32°17.4	15.9′	10°57.9	13.4′	54.7′
23	164°45.9	23.1	46°52.3	15.8′	11°11.3	13.4′	54.7′
	SD = 15.7′	d = 0.1′	SD = 14.8′				

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

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

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 8-10 48-67%
14	00:18	00:25	12:00	18:28	06:09	
15	00:31	00:37	12:01	19:07	06:47	
16	00:44	00:50	12:01	19:47	07:27	

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

	Aries	Venus		Mars		Jupiter		Saturn	
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	265°44.4	176°05.7	N23°51.8	231°54.6	N12°26.2	202°26.0	N20°27.5	274°49.5	S06°00.5
1	280°46.9	191°04.8	51.9	246°55.3	26.8	217°27.9	27.6	289°51.9	00.5
2	295°49.4	206°03.9	52.0	261°56.0	27.4	232°29.7	27.7	304°54.3	00.4
3	310°51.8	221°03.0	·· 52.1	276°56.7	·· 28.0	247°31.6	·· 27.8	319°56.7	·· 00.4
4	325°54.3	236°02.1	52.2	291°57.4	28.7	262°33.5	27.9	334°59.2	00.4
5	340°56.7	251°01.2	52.3	306°58.1	29.3	277°35.4	28.0	350°01.6	00.4
6	355°59.2	266°00.3	N23°52.4	321°58.7	N12°29.9	292°37.2	N20°28.1	5°04.0	S06°00.4
7	11°01.7	280°59.4	52.5	336°59.4	30.5	307°39.1	28.2	20°06.4	00.4
8	26°04.1	295°58.6	52.6	352°00.1	31.1	322°41.0	28.3	35°08.8	00.4
9	41°06.6	310°57.7	·· 52.7	7°00.8	·· 31.8	337°42.8	·· 28.4	50°11.2	·· 00.4
10	56°09.1	325°56.8	52.8	22°01.5	32.4	352°44.7	28.5	65°13.6	00.4
11	71°11.5	340°55.9	52.9	37°02.2	33.0	7°46.6	28.6	80°16.0	00.3
12	86°14.0	355°55.0	N23°53.0	52°02.9	N12°33.6	22°48.4	N20°28.7	95°18.5	S06°00.3
13	101°16.5	10°54.1	53.1	67°03.6	34.3	37°50.3	28.8	110°20.9	00.3
14	116°18.9	25°53.2	53.1	82°04.3	34.9	52°52.2	28.9	125°23.3	00.3
15	131°21.4	40°52.3	·· 53.2	97°05.0	·· 35.5	67°54.1	·· 29.0	140°25.7	·· 00.3
16	146°23.8	55°51.4	53.3	112°05.7	36.1	82°55.9	29.1	155°28.1	00.3
17	161°26.3	70°50.5	53.4	127°06.4	36.7	97°57.8	29.2	170°30.5	00.3
18	176°28.8	85°49.6	N23°53.5	142°07.1	N12°37.4	112°59.7	N20°29.3	185°32.9	S06°00.3
19	191°31.2	100°48.7	53.6	157°07.8	38.0	128°01.5	29.4	200°35.3	00.3
20	206°33.7	115°47.8	53.6	172°08.5	38.6	143°03.4	29.5	215°37.8	00.3
21	221°36.2	130°46.9	·· 53.7	187°09.2	·· 39.2	158°05.3	·· 29.6	230°40.2	·· 00.2
22	236°38.6	145°46.0	53.8	202°09.8	39.9	173°07.1	29.7	245°42.6	00.2
23	251°41.1	160°45.1	53.9	217°10.5	40.5	188°09.0	29.8	260°45.0	00.2
Mer.pass. 06:16		ν -0.9′	d 0.1′	m -3.91	ν 0.7′	d 0.6′	m 1.01	ν 1.9′	d 0.1′ m -2.01	ν 2.4′	d 0.0′ m 0.97

Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	266°43.6	175°44.2	N23°53.9	232°11.2	N12°41.1	203°10.9	N20°29.9	275°47.4	S06°00.2
1	281°46.0	190°43.3	54.0	247°11.9	41.7	218°12.8	30.0	290°49.8	00.2
2	296°48.5	205°42.4	54.1	262°12.6	42.3	233°14.6	30.1	305°52.3	00.2
3	311°51.0	220°41.5	·· 54.1	277°13.3	·· 42.9	248°16.5	·· 30.2	320°54.7	·· 00.2
4	326°53.4	235°40.6	54.2	292°14.0	43.6	263°18.4	30.4	335°57.1	00.2
5	341°55.9	250°39.7	54.3	307°14.7	44.2	278°20.2	30.5	350°59.5	00.2
6	356°58.3	265°38.9	N23°54.4	322°15.4	N12°44.8	293°22.1	N20°30.6	6°01.9	S06°00.2
7	12°00.8	280°38.0	54.4	337°16.1	45.4	308°24.0	30.7	21°04.3	00.2
8	27°03.3	295°37.1	54.5	352°16.8	46.0	323°25.8	30.8	36°06.7	00.1
9	42°05.7	310°36.2	·· 54.5	7°17.5	·· 46.7	338°27.7	·· 30.9	51°09.2	·· 00.1
10	57°08.2	325°35.3	54.6	22°18.2	47.3	353°29.6	31.0	66°11.6	00.1
11	72°10.7	340°34.4	54.7	37°18.9	47.9	8°31.5	31.1	81°14.0	00.1
12	87°13.1	355°33.5	N23°54.7	52°19.6	N12°48.5	23°33.3	N20°31.2	96°16.4	S06°00.1
13	102°15.6	10°32.6	54.8	67°20.2	49.1	38°35.2	31.3	111°18.8	00.1
14	117°18.1	25°31.7	54.8	82°20.9	49.7	53°37.1	31.4	126°21.2	00.1
15	132°20.5	40°30.8	·· 54.9	97°21.6	·· 50.4	68°38.9	·· 31.5	141°23.7	·· 00.1
16	147°23.0	55°29.9	55.0	112°22.3	51.0	83°40.8	31.6	156°26.1	00.1
17	162°25.5	70°29.0	55.0	127°23.0	51.6	98°42.7	31.7	171°28.5	00.1
18	177°27.9	85°28.1	N23°55.1	142°23.7	N12°52.2	113°44.6	N20°31.8	186°30.9	S06°00.1
19	192°30.4	100°27.2	55.1	157°24.4	52.8	128°46.4	31.9	201°33.3	00.0
20	207°32.8	115°26.3	55.2	172°25.1	53.4	143°48.3	32.0	216°35.7	00.0
21	222°35.3	130°25.4	·· 55.2	187°25.8	·· 54.1	158°50.2	·· 32.1	231°38.2	·· 00.0
22	237°37.8	145°24.5	55.3	202°26.5	54.7	173°52.0	32.2	246°40.6	00.0
23	252°40.2	160°23.6	55.3	217°27.2	55.3	188°53.9	32.3	261°43.0	00.0
Mer.pass. 06:12		ν -0.9′	d 0.1′	m -3.91	ν 0.7′	d 0.6′	m 1.00	ν 1.9′	d 0.1′ m -2.01	ν 2.4′	d 0.0′ m 0.96

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	267°42.7	175°22.7	N23°55.3	232°27.9	N12°55.9	203°55.8	N20°32.4	276°45.4	S06°00.0
1	282°45.2	190°21.8	55.4	247°28.6	56.5	218°57.7	32.5	291°47.8	00.0
2	297°47.6	205°20.9	55.4	262°29.3	57.1	233°59.5	32.6	306°50.3	00.0
3	312°50.1	220°20.0	·· 55.5	277°29.9	·· 57.7	249°01.4	·· 32.7	321°52.7	·· 00.0
4	327°52.6	235°19.1	55.5	292°30.6	58.3	264°03.3	32.8	336°55.1	00.0
5	342°55.0	250°18.2	55.5	307°31.3	59.0	279°05.1	32.9	351°57.5	00.0
6	357°57.5	265°17.3	N23°55.6	322°32.0	N12°59.6	294°07.0	N20°33.0	6°59.9	S06°00.0
7	13°00.0	280°16.4	55.6	337°32.7	13°00.2	309°08.9	33.1	22°02.4	06°00.0
8	28°02.4	295°15.5	55.7	352°33.4	00.8	324°10.8	33.2	37°04.8	05°59.9
9	43°04.9	310°14.6	·· 55.7	7°34.1	·· 01.4	339°12.6	·· 33.3	52°07.2	·· 59.9
10	58°07.3	325°13.7	55.7	22°34.8	02.0	354°14.5	33.4	67°09.6	59.9
11	73°09.8	340°12.9	55.8	37°35.5	02.6	9°16.4	33.5	82°12.0	59.9
12	88°12.3	355°12.0	N23°55.8	52°36.2	N13°03.2	24°18.2	N20°33.6	97°14.5	S05°59.9
13	103°14.7	10°11.1	55.8	67°36.9	03.9	39°20.1	33.7	112°16.9	59.9
14	118°17.2	25°10.2	55.8	82°37.6	04.5	54°22.0	33.8	127°19.3	59.9
15	133°19.7	40°09.3	·· 55.9	97°38.2	·· 05.1	69°23.9	·· 33.9	142°21.7	·· 59.9
16	148°22.1	55°08.4	55.9	112°38.9	05.7	84°25.7	34.0	157°24.1	59.9
17	163°24.6	70°07.5	55.9	127°39.6	06.3	99°27.6	34.1	172°26.6	59.9
18	178°27.1	85°06.6	N23°55.9	142°40.3	N13°06.9	114°29.5	N20°34.2	187°29.0	S05°59.9
19	193°29.5	100°05.7	56.0	157°41.0	07.5	129°31.4	34.3	202°31.4	59.9
20	208°32.0	115°04.8	56.0	172°41.7	08.1	144°33.2	34.4	217°33.8	59.9
21	223°34.4	130°03.9	·· 56.0	187°42.4	·· 08.7	159°35.1	·· 34.5	232°36.2	·· 59.9
22	238°36.9	145°03.0	56.0	202°43.1	09.3	174°37.0	34.6	247°38.7	59.9
23	253°39.4	160°02.1	56.0	217°43.8	10.0	189°38.8	34.7	262°41.1	59.8
Mer.pass. 06:08		ν -0.9′	d 0.0′	m -3.91	ν 0.7′	d 0.6′	m 1.00	ν 1.9′	d 0.1′ m -2.01	ν 2.4′	d 0.0′ m 0.96

Stars

	SHA	Dec
Alpheratz	357°35.3	29°13.3
Ankaa	353°07.7	-42°10.2
Schedar	349°31.7	56°40.0
Diphda	348°47.9	-17°51.1
Achernar	335°20.8	-57°06.5
Hamal	327°52.0	23°34.6
Polaris	314°38.7	89°21.8
Acamar	315°12.5	-40°12.2
Menkar	314°06.9	4°11.1
Mirfak	308°29.4	49°56.7
Aldebaran	290°40.5	16°33.5
Rigel	281°04.7	-8°10.4
Capella	280°23.1	46°01.3
Bellatrix	278°23.7	6°22.3
Elnath	278°02.9	28°37.7
Alnilam	275°38.6	-1°11.2
Betelgeuse	270°52.9	7°24.7
Canopus	263°53.2	-52°42.5
Sirius	258°27.0	-16°45.0
Adhara	255°06.6	-29°00.3
Procyon	244°51.6	5°09.8
Pollux	243°18.2	27°58.1
Avior	234°15.5	-59°35.4
Suhail	222°47.0	-43°32.0
Miaplacidus	221°39.0	-69°49.2
Alphard	217°48.4	-8°45.9
Regulus	207°35.1	11°50.9
Dubhe	193°41.7	61°37.5
Denebola	182°25.4	14°26.2
Gienah	175°44.0	-17°40.7
Acrux	173°00.5	-63°14.4
Gacrux	171°52.1	-57°15.3
Alioth	166°13.2	55°49.9
Spica	158°22.7	-11°17.4
Alkaid	152°52.1	49°11.7
Hadar	148°36.3	-60°29.7
Menkent	147°58.0	-36°29.6
Arcturus	145°48.1	19°03.4
Rigil Kent.	139°40.5	-60°56.4
Kochab	137°18.9	74°03.5
Zuben'ubi	136°56.3	-16°08.7
Alphecca	126°03.8	26°38.0
Antares	112°16.1	-26°29.2
Atria	107°10.2	-69°04.3
Sabik	102°03.0	-15°45.3
Shaula	96°10.6	-37°07.3
Rasalhague	95°58.6	12°32.5
Eltanin	90°41.9	51°29.1
Kaus Aust.	83°32.7	-34°22.4
Vega	80°33.1	38°48.3
Nunki	75°48.0	-26°16.0
Altair	62°00.1	8°55.9
Peacock	53°06.0	-56°39.2
Deneb	49°25.8	45°21.8
Enif	33°39.1	9°59.1
Al Na'ir	27°33.3	-46°50.4
Fomalhaut	15°14.9	-29°29.4
Scheat	13°45.6	28°12.7
Markab	13°30.3	15°20.1

Jun 17 Mon	SHA	Mer.pass
Venus	270°21.3	12:16
Mars	326°10.2	08:32
Jupiter	296°41.6	10:29
Saturn	9°05.1	05:40

Jun 18 Tue	SHA	Mer.pass
Venus	269°00.7	12:18
Mars	325°27.7	08:31
Jupiter	296°27.3	10:26
Saturn	9°03.9	05:36

Jun 19 Wed	SHA	Mer.pass
Venus	267°40.0	12:19
Mars	324°45.2	08:30
Jupiter	296°13.1	10:23
Saturn	9°02.7	05:32

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°45.8	N23°23.2	61°27.1	15.8′	S11°24.7	13.3′	54.7′
1	194°45.7	23.3	76°01.9	15.7′	11°38.0	13.3′	54.7′
2	209°45.5	23.3	90°36.6	15.6′	11°51.3	13.2′	54.7′
3	224°45.4	·· 23.4	105°11.2	15.6′	12°04.5	13.2′	54.7′
4	239°45.3	23.5	119°45.7	15.5′	12°17.7	13.2′	54.7′
5	254°45.1	23.5	134°20.2	15.4′	12°30.9	13.1′	54.8′
6	269°45.0	N23°23.6	148°54.7	15.4′	S12°44.0	13.1′	54.8′
7	284°44.8	23.7	163°29.0	15.3′	12°57.1	13.1′	54.8′
8	299°44.7	23.7	178°03.3	15.2′	13°10.2	13.0′	54.8′
9	314°44.6	·· 23.8	192°37.5	15.1′	13°23.2	13.0′	54.8′
10	329°44.4	23.8	207°11.7	15.1′	13°36.2	12.9′	54.9′
11	344°44.3	23.9	221°45.7	15.0′	13°49.1	12.9′	54.9′
12	359°44.2	N23°24.0	236°19.7	14.9′	S14°02.0	12.8′	54.9′
13	14°44.0	24.0	250°53.7	14.8′	14°14.8	12.8′	54.9′
14	29°43.9	24.1	265°27.5	14.8′	14°27.6	12.7′	54.9′
15	44°43.8	·· 24.1	280°01.3	14.7′	14°40.3	12.7′	55.0′
16	59°43.6	24.2	294°35.0	14.6′	14°53.0	12.7′	55.0′
17	74°43.5	24.2	309°08.6	14.5′	15°05.7	12.6′	55.0′
18	89°43.4	N23°24.3	323°42.1	14.4′	S15°18.3	12.5′	55.0′
19	104°43.2	24.3	338°15.5	14.4′	15°30.8	12.5′	55.0′
20	119°43.1	24.4	352°48.9	14.3′	15°43.3	12.4′	55.1′
21	134°43.0	·· 24.4	7°22.2	14.2′	15°55.7	12.4′	55.1′
22	149°42.8	24.5	21°55.4	14.1′	16°08.1	12.3′	55.1′
23	164°42.7	24.5	36°28.5	14.0′	16°20.4	12.3′	55.1′
	SD = 15.7′	d = 0.1′	SD = 14.9′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°42.5	N23°24.6	51°01.5	13.9′	S16°32.7	12.2′	55.1′
1	194°42.4	24.6	65°34.4	13.8′	16°44.9	12.1′	55.2′
2	209°42.3	24.7	80°07.3	13.8′	16°57.0	12.1′	55.2′
3	224°42.1	·· 24.7	94°40.1	13.7′	17°09.1	12.0′	55.2′
4	239°42.0	24.8	109°12.7	13.6′	17°21.1	11.9′	55.2′
5	254°41.9	24.8	123°45.3	13.5′	17°33.0	11.9′	55.2′
6	269°41.7	N23°24.9	138°17.8	13.4′	S17°44.9	11.9′	55.3′
7	284°41.6	24.9	152°50.2	13.3′	17°56.8	11.7′	55.3′
8	299°41.5	25.0	167°22.5	13.2′	18°08.5	11.7′	55.3′
9	314°41.3	·· 25.0	181°54.7	13.1′	18°20.2	11.6′	55.3′
10	329°41.2	25.1	196°26.8	13.0′	18°31.8	11.6′	55.4′
11	344°41.1	25.1	210°58.8	12.9′	18°43.4	11.4′	55.4′
12	359°40.9	N23°25.1	225°30.7	12.8′	S18°54.8	11.4′	55.4′
13	14°40.8	25.2	240°02.5	12.7′	19°06.2	11.4′	55.4′
14	29°40.7	25.2	254°34.2	12.6′	19°17.6	11.2′	55.5′
15	44°40.5	·· 25.3	269°05.8	12.5′	19°28.8	11.2′	55.5′
16	59°40.4	25.3	283°37.4	12.4′	19°40.0	11.1′	55.5′
17	74°40.2	25.3	298°08.8	12.3′	19°51.1	11.0′	55.5′
18	89°40.1	N23°25.4	312°40.1	12.2′	S20°02.1	10.9′	55.5′
19	104°40.0	25.4	327°11.3	12.1′	20°13.0	10.9′	55.6′
20	119°39.8	25.4	341°42.4	12.0′	20°23.9	10.8′	55.6′
21	134°39.7	·· 25.5	356°13.4	11.9′	20°34.7	10.7′	55.6′
22	149°39.6	25.5	10°44.3	11.8′	20°45.4	10.5′	55.6′
23	164°39.4	25.5	25°15.1	11.7′	20°55.9	10.6′	55.7′
	SD = 15.7′	d = 0.0′	SD = 15.0′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°39.3	N23°25.6	39°45.8	11.6′	S21°06.5	10.4′	55.7′
1	194°39.2	25.6	54°16.4	11.5′	21°16.9	10.3′	55.7′
2	209°39.0	25.6	68°46.9	11.4′	21°27.2	10.2′	55.7′
3	224°38.9	·· 25.7	83°17.2	11.3′	21°37.4	10.2′	55.8′
4	239°38.8	25.7	97°47.5	11.2′	21°47.6	10.0′	55.8′
5	254°38.6	25.7	112°17.6	11.0′	21°57.6	10.0′	55.8′
6	269°38.5	N23°25.8	126°47.7	10.9′	S22°07.6	9.9′	55.8′
7	284°38.3	25.8	141°17.6	10.8′	22°17.5	9.7′	55.9′
8	299°38.2	25.8	155°47.5	10.7′	22°27.2	9.7′	55.9′
9	314°38.1	·· 25.8	170°17.2	10.6′	22°36.9	9.5′	55.9′
10	329°37.9	25.9	184°46.8	10.5′	22°46.4	9.5′	55.9′
11	344°37.8	25.9	199°16.3	10.4′	22°55.9	9.3′	56.0′
12	359°37.7	N23°25.9	213°45.7	10.3′	S23°05.2	9.3′	56.0′
13	14°37.5	25.9	228°15.0	10.2′	23°14.5	9.1′	56.0′
14	29°37.4	26.0	242°44.2	10.1′	23°23.6	9.0′	56.1′
15	44°37.3	·· 26.0	257°13.2	10.0′	23°32.6	8.9′	56.1′
16	59°37.1	26.0	271°42.2	9.8′	23°41.5	8.8′	56.1′
17	74°37.0	26.0	286°11.0	9.7′	23°50.3	8.7′	56.1′
18	89°36.9	N23°26.0	300°39.8	9.6′	S23°59.0	8.6′	56.2′
19	104°36.7	26.1	315°08.4	9.5′	24°07.6	8.5′	56.2′
20	119°36.6	26.1	329°36.9	9.4′	24°16.1	8.3′	56.2′
21	134°36.4	·· 26.1	344°05.3	9.3′	24°24.4	8.2′	56.2′
22	149°36.3	26.1	358°33.6	9.2′	24°32.6	8.1′	56.3′
23	164°36.2	26.1	13°01.8	9.1′	24°40.7	8.0′	56.3′
	SD = 15.7′	d = 0.0′	SD = 15.2′				

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

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

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 11-13 75-90%
17	00:57	01:03	12:01	20:30	08:08	
18	01:10	01:16	12:01	21:16	08:52	
19	01:23	01:29	12:01	22:06	09:40	

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

	Aries	Venus		Mars		Jupiter		Saturn	
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	268°41.8	175°01.2	N23°56.0	232°44.5	N13°10.6	204°40.7	N20°34.8	277°43.5	S05°59.8
1	283°44.3	190°00.3	56.1	247°45.2	11.2	219°42.6	34.9	292°45.9	59.8
2	298°46.8	204°59.4	56.1	262°45.9	11.8	234°44.5	35.0	307°48.4	59.8
3	313°49.2	219°58.5	·· 56.1	277°46.5	·· 12.4	249°46.3	·· 35.1	322°50.8	·· 59.8
4	328°51.7	234°57.6	56.1	292°47.2	13.0	264°48.2	35.2	337°53.2	59.8
5	343°54.2	249°56.7	56.1	307°47.9	13.6	279°50.1	35.3	352°55.6	59.8
6	358°56.6	264°55.8	N23°56.1	322°48.6	N13°14.2	294°52.0	N20°35.4	7°58.1	S05°59.8
7	13°59.1	279°54.9	56.1	337°49.3	14.8	309°53.8	35.5	23°00.5	59.8
8	29°01.6	294°54.0	56.1	352°50.0	15.4	324°55.7	35.6	38°02.9	59.8
9	44°04.0	309°53.1	·· 56.1	7°50.7	·· 16.0	339°57.6	·· 35.7	53°05.3	·· 59.8
10	59°06.5	324°52.2	56.1	22°51.4	16.6	354°59.5	35.8	68°07.7	59.8
11	74°08.9	339°51.3	56.1	37°52.1	17.2	10°01.3	35.9	83°10.2	59.8
12	89°11.4	354°50.4	N23°56.1	52°52.8	N13°17.8	25°03.2	N20°36.0	98°12.6	S05°59.8
13	104°13.9	9°49.5	56.1	67°53.5	18.4	40°05.1	36.1	113°15.0	59.8
14	119°16.3	24°48.6	56.1	82°54.2	19.1	55°06.9	36.2	128°17.4	59.8
15	134°18.8	39°47.7	·· 56.1	97°54.8	·· 19.7	70°08.8	·· 36.3	143°19.9	·· 59.8
16	149°21.3	54°46.8	56.1	112°55.5	20.3	85°10.7	36.4	158°22.3	59.7
17	164°23.7	69°45.9	56.1	127°56.2	20.9	100°12.6	36.5	173°24.7	59.7
18	179°26.2	84°45.0	N23°56.1	142°56.9	N13°21.5	115°14.4	N20°36.6	188°27.1	S05°59.7
19	194°28.7	99°44.1	56.1	157°57.6	22.1	130°16.3	36.7	203°29.6	59.7
20	209°31.1	114°43.2	56.1	172°58.3	22.7	145°18.2	36.8	218°32.0	59.7
21	224°33.6	129°42.3	·· 56.1	187°59.0	·· 23.3	160°20.1	·· 36.9	233°34.4	·· 59.7
22	239°36.1	144°41.4	56.1	202°59.7	23.9	175°21.9	36.9	248°36.8	59.7
23	254°38.5	159°40.6	56.0	218°00.4	24.5	190°23.8	37.0	263°39.3	59.7
Mer.pass. 06:04		ν -0.9′	d 0.0′	m -3.91	ν 0.7′	d 0.6′	m 1.00	ν 1.9′	d 0.1′ m -2.01	ν 2.4′	d 0.0′ m 0.95

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	269°41.0	174°39.7	N23°56.0	233°01.1	N13°25.1	205°25.7	N20°37.1	278°41.7	S05°59.7
1	284°43.4	189°38.8	56.0	248°01.7	25.7	220°27.6	37.2	293°44.1	59.7
2	299°45.9	204°37.9	56.0	263°02.4	26.3	235°29.4	37.3	308°46.6	59.7
3	314°48.4	219°37.0	·· 56.0	278°03.1	·· 26.9	250°31.3	·· 37.4	323°49.0	·· 59.7
4	329°50.8	234°36.1	56.0	293°03.8	27.5	265°33.2	37.5	338°51.4	59.7
5	344°53.3	249°35.2	55.9	308°04.5	28.1	280°35.1	37.6	353°53.8	59.7
6	359°55.8	264°34.3	N23°55.9	323°05.2	N13°28.7	295°36.9	N20°37.7	8°56.3	S05°59.7
7	14°58.2	279°33.4	55.9	338°05.9	29.3	310°38.8	37.8	23°58.7	59.7
8	30°00.7	294°32.5	55.9	353°06.6	29.9	325°40.7	37.9	39°01.1	59.7
9	45°03.2	309°31.6	·· 55.8	8°07.3	·· 30.5	340°42.6	·· 38.0	54°03.5	·· 59.7
10	60°05.6	324°30.7	55.8	23°08.0	31.1	355°44.4	38.1	69°06.0	59.7
11	75°08.1	339°29.8	55.8	38°08.7	31.7	10°46.3	38.2	84°08.4	59.7
12	90°10.6	354°28.9	N23°55.8	53°09.3	N13°32.3	25°48.2	N20°38.3	99°10.8	S05°59.7
13	105°13.0	9°28.0	55.7	68°10.0	32.9	40°50.1	38.4	114°13.3	59.7
14	120°15.5	24°27.1	55.7	83°10.7	33.5	55°51.9	38.5	129°15.7	59.6
15	135°17.9	39°26.2	·· 55.7	98°11.4	·· 34.1	70°53.8	·· 38.6	144°18.1	·· 59.6
16	150°20.4	54°25.3	55.6	113°12.1	34.7	85°55.7	38.7	159°20.5	59.6
17	165°22.9	69°24.4	55.6	128°12.8	35.3	100°57.6	38.8	174°23.0	59.6
18	180°25.3	84°23.5	N23°55.6	143°13.5	N13°35.9	115°59.4	N20°38.9	189°25.4	S05°59.6
19	195°27.8	99°22.6	55.5	158°14.2	36.5	131°01.3	39.0	204°27.8	59.6
20	210°30.3	114°21.7	55.5	173°14.9	37.1	146°03.2	39.1	219°30.3	59.6
21	225°32.7	129°20.8	·· 55.4	188°15.5	·· 37.7	161°05.1	·· 39.2	234°32.7	·· 59.6
22	240°35.2	144°19.9	55.4	203°16.2	38.3	176°06.9	39.3	249°35.1	59.6
23	255°37.7	159°19.0	55.4	218°16.9	38.9	191°08.8	39.4	264°37.5	59.6
Mer.pass. 06:00		ν -0.9′	d -0.0′	m -3.91	ν 0.7′	d 0.6′	m 0.99	ν 1.9′	d 0.1′ m -2.01	ν 2.4′	d 0.0′ m 0.95

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	270°40.1	174°18.1	N23°55.3	233°17.6	N13°39.5	206°10.7	N20°39.5	279°40.0	S05°59.6
1	285°42.6	189°17.2	55.3	248°18.3	40.1	221°12.6	39.6	294°42.4	59.6
2	300°45.1	204°16.3	55.2	263°19.0	40.7	236°14.4	39.7	309°44.8	59.6
3	315°47.5	219°15.4	·· 55.2	278°19.7	·· 41.3	251°16.3	·· 39.8	324°47.3	·· 59.6
4	330°50.0	234°14.5	55.1	293°20.4	41.9	266°18.2	39.9	339°49.7	59.6
5	345°52.4	249°13.6	55.1	308°21.1	42.5	281°20.1	40.0	354°52.1	59.6
6	0°54.9	264°12.7	N23°55.0	323°21.8	N13°43.1	296°21.9	N20°40.1	9°54.6	S05°59.6
7	15°57.4	279°11.9	55.0	338°22.4	43.6	311°23.8	40.2	24°57.0	59.6
8	30°59.8	294°11.0	54.9	353°23.1	44.2	326°25.7	40.3	39°59.4	59.6
9	46°02.3	309°10.1	·· 54.9	8°23.8	·· 44.8	341°27.6	·· 40.4	55°01.8	·· 59.6
10	61°04.8	324°09.2	54.8	23°24.5	45.4	356°29.5	40.5	70°04.3	59.6
11	76°07.2	339°08.3	54.7	38°25.2	46.0	11°31.3	40.6	85°06.7	59.6
12	91°09.7	354°07.4	N23°54.7	53°25.9	N13°46.6	26°33.2	N20°40.7	100°09.1	S05°59.6
13	106°12.2	9°06.5	54.6	68°26.6	47.2	41°35.1	40.8	115°11.6	59.6
14	121°14.6	24°05.6	54.6	83°27.3	47.8	56°37.0	40.8	130°14.0	59.6
15	136°17.1	39°04.7	·· 54.5	98°28.0	·· 48.4	71°38.8	·· 40.9	145°16.4	·· 59.6
16	151°19.6	54°03.8	54.4	113°28.6	49.0	86°40.7	41.0	160°18.9	59.6
17	166°22.0	69°02.9	54.4	128°29.3	49.6	101°42.6	41.1	175°21.3	59.6
18	181°24.5	84°02.0	N23°54.3	143°30.0	N13°50.2	116°44.5	N20°41.2	190°23.7	S05°59.6
19	196°26.9	99°01.1	54.2	158°30.7	50.8	131°46.3	41.3	205°26.2	59.6
20	211°29.4	114°00.2	54.2	173°31.4	51.4	146°48.2	41.4	220°28.6	59.6
21	226°31.9	128°59.3	·· 54.1	188°32.1	·· 52.0	161°50.1	·· 41.5	235°31.0	·· 59.6
22	241°34.3	143°58.4	54.0	203°32.8	52.5	176°52.0	41.6	250°33.5	59.6
23	256°36.8	158°57.5	54.0	218°33.5	53.1	191°53.8	41.7	265°35.9	59.6
Mer.pass. 05:56		ν -0.9′	d -0.0′	m -3.91	ν 0.7′	d 0.6′	m 0.99	ν 1.9′	d 0.1′ m -2.02	ν 2.4′	d 0.0′ m 0.95

Stars

	SHA	Dec
Alpheratz	357°35.3	29°13.3
Ankaa	353°07.6	-42°10.2
Schedar	349°31.7	56°40.0
Diphda	348°47.8	-17°51.1
Achernar	335°20.8	-57°06.5
Hamal	327°51.9	23°34.6
Polaris	314°37.3	89°21.8
Acamar	315°12.4	-40°12.2
Menkar	314°06.9	4°11.1
Mirfak	308°29.3	49°56.7
Aldebaran	290°40.5	16°33.5
Rigel	281°04.7	-8°10.4
Capella	280°23.1	46°01.3
Bellatrix	278°23.7	6°22.3
Elnath	278°02.8	28°37.7
Alnilam	275°38.5	-1°11.2
Betelgeuse	270°52.9	7°24.7
Canopus	263°53.2	-52°42.5
Sirius	258°27.0	-16°45.0
Adhara	255°06.6	-29°00.3
Procyon	244°51.6	5°09.8
Pollux	243°18.2	27°58.1
Avior	234°15.5	-59°35.4
Suhail	222°47.0	-43°32.0
Miaplacidus	221°39.1	-69°49.2
Alphard	217°48.4	-8°45.9
Regulus	207°35.1	11°50.9
Dubhe	193°41.7	61°37.5
Denebola	182°25.4	14°26.2
Gienah	175°44.1	-17°40.7
Acrux	173°00.6	-63°14.4
Gacrux	171°52.1	-57°15.3
Alioth	166°13.2	55°49.9
Spica	158°22.7	-11°17.4
Alkaid	152°52.1	49°11.7
Hadar	148°36.3	-60°29.7
Menkent	147°58.0	-36°29.6
Arcturus	145°48.1	19°03.4
Rigil Kent.	139°40.5	-60°56.4
Kochab	137°18.9	74°03.5
Zuben'ubi	136°56.3	-16°08.7
Alphecca	126°03.8	26°38.0
Antares	112°16.1	-26°29.2
Atria	107°10.2	-69°04.4
Sabik	102°03.0	-15°45.3
Shaula	96°10.6	-37°07.3
Rasalhague	95°58.6	12°32.5
Eltanin	90°41.9	51°29.1
Kaus Aust.	83°32.7	-34°22.4
Vega	80°33.1	38°48.3
Nunki	75°48.0	-26°15.9
Altair	62°00.1	8°55.9
Peacock	53°06.0	-56°39.2
Deneb	49°25.8	45°21.8
Enif	33°39.1	9°59.1
Al Na'ir	27°33.3	-46°50.4
Fomalhaut	15°14.9	-29°29.4
Scheat	13°45.6	28°12.7
Markab	13°30.3	15°20.1

Jun 20 Thu	SHA	Mer.pass
Venus	266°19.3	12:21
Mars	324°02.6	08:29
Jupiter	295°58.9	10:20
Saturn	9°01.7	05:28

Jun 21 Fri	SHA	Mer.pass
Venus	264°58.7	12:22
Mars	323°20.1	08:28
Jupiter	295°44.7	10:17
Saturn	9°00.7	05:24

Jun 22 Sat	SHA	Mer.pass
Venus	263°38.0	12:24
Mars	322°37.5	08:26
Jupiter	295°30.6	10:14
Saturn	8°59.8	05:20

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.1352 sec ΔT = TT-UT1 = +69.0488 sec

2024 June 20 to Jun. 22 UT

h	Sun		Moon				
Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°36.0	N23°26.1	27°29.9	9.0′	S24°48.7	7.8′	56.3′
1	194°35.9	26.2	41°57.8	8.9′	24°56.5	7.8′	56.3′
2	209°35.8	26.2	56°25.7	8.8′	25°04.3	7.6′	56.4′
3	224°35.6	·· 26.2	70°53.5	8.6′	25°11.9	7.5′	56.4′
4	239°35.5	26.2	85°21.1	8.5′	25°19.4	7.3′	56.4′
5	254°35.4	26.2	99°48.6	8.4′	25°26.7	7.2′	56.5′
6	269°35.2	N23°26.2	114°16.1	8.3′	S25°33.9	7.1′	56.5′
7	284°35.1	26.2	128°43.4	8.2′	25°41.0	6.9′	56.5′
8	299°35.0	26.2	143°10.6	8.1′	25°47.9	6.8′	56.5′
9	314°34.8	·· 26.2	157°37.8	8.0′	25°54.7	6.7′	56.6′
10	329°34.7	26.3	172°04.8	7.9′	26°01.4	6.6′	56.6′
11	344°34.6	26.3	186°31.7	7.8′	26°08.0	6.3′	56.6′
12	359°34.4	N23°26.3	200°58.5	7.7′	S26°14.3	6.3′	56.6′
13	14°34.3	26.3	215°25.2	7.6′	26°20.6	6.1′	56.7′
14	29°34.1	26.3	229°51.8	7.5′	26°26.7	6.0′	56.7′
15	44°34.0	·· 26.3	244°18.4	7.4′	26°32.7	5.8′	56.7′
16	59°33.9	26.3	258°44.8	7.3′	26°38.5	5.7′	56.8′
17	74°33.7	26.3	273°11.1	7.2′	26°44.2	5.5′	56.8′
18	89°33.6	N23°26.3	287°37.3	7.1′	S26°49.7	5.4′	56.8′
19	104°33.5	26.3	302°03.5	7.0′	26°55.1	5.2′	56.8′
20	119°33.3	26.3	316°29.5	6.9′	27°00.3	5.1′	56.9′
21	134°33.2	·· 26.3	330°55.4	6.9′	27°05.4	4.9′	56.9′
22	149°33.1	26.3	345°21.3	6.8′	27°10.3	4.8′	56.9′
23	164°32.9	26.3	359°47.1	6.7′	27°15.1	4.6′	56.9′
	SD = 15.7′	d = 0.0′	SD = 15.4′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°32.8	N23°26.3	14°12.7	6.6′	S27°19.7	4.5′	57.0′
1	194°32.7	26.3	28°38.3	6.5′	27°24.2	4.3′	57.0′
2	209°32.5	26.3	43°03.8	6.4′	27°28.5	4.1′	57.0′
3	224°32.4	·· 26.3	57°29.3	6.3′	27°32.6	4.0′	57.1′
4	239°32.3	26.3	71°54.6	6.3′	27°36.6	3.8′	57.1′
5	254°32.1	26.3	86°19.9	6.2′	27°40.4	3.6′	57.1′
6	269°32.0	N23°26.3	100°45.1	6.1′	S27°44.0	3.5′	57.1′
7	284°31.8	26.3	115°10.2	6.0′	27°47.5	3.4′	57.2′
8	299°31.7	26.2	129°35.2	6.0′	27°50.9	3.1′	57.2′
9	314°31.6	·· 26.2	144°00.2	5.9′	27°54.0	3.0′	57.2′
10	329°31.4	26.2	158°25.1	5.8′	27°57.0	2.8′	57.2′
11	344°31.3	26.2	172°49.9	5.8′	27°59.8	2.7′	57.3′
12	359°31.2	N23°26.2	187°14.6	5.7′	S28°02.5	2.5′	57.3′
13	14°31.0	26.2	201°39.3	5.6′	28°05.0	2.3′	57.3′
14	29°30.9	26.2	216°04.0	5.6′	28°07.3	2.1′	57.3′
15	44°30.8	·· 26.2	230°28.5	5.5′	28°09.4	2.0′	57.4′
16	59°30.6	26.2	244°53.0	5.4′	28°11.4	1.8′	57.4′
17	74°30.5	26.1	259°17.5	5.4′	28°13.2	1.6′	57.4′
18	89°30.4	N23°26.1	273°41.9	5.3′	S28°14.8	1.5′	57.4′
19	104°30.2	26.1	288°06.2	5.3′	28°16.3	1.3′	57.5′
20	119°30.1	26.1	302°30.5	5.2′	28°17.6	1.0′	57.5′
21	134°30.0	·· 26.1	316°54.7	5.2′	28°18.6	1.0′	57.5′
22	149°29.8	26.1	331°18.9	5.2′	28°19.6	0.7′	57.5′
23	164°29.7	26.0	345°43.1	5.1′	28°20.3	0.6′	57.6′
	SD = 15.7′	d = -0.0′	SD = 15.5′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°29.6	N23°26.0	0°07.2	5.1′	S28°20.9	0.4′	57.6′
1	194°29.4	26.0	14°31.3	5.0′	28°21.3	0.2′	57.6′
2	209°29.3	26.0	28°55.3	5.0′	28°21.5	0.0′	57.6′
3	224°29.2	·· 26.0	43°19.3	5.0′	28°21.5	0.2′	57.7′
4	239°29.0	25.9	57°43.3	4.9′	28°21.3	0.3′	57.7′
5	254°28.9	25.9	72°07.2	4.9′	28°21.0	0.5′	57.7′
6	269°28.8	N23°25.9	86°31.1	4.9′	S28°20.5	0.7′	57.7′
7	284°28.6	25.9	100°55.0	4.9′	28°19.8	0.9′	57.8′
8	299°28.5	25.8	115°18.9	4.8′	28°18.9	1.1′	57.8′
9	314°28.3	·· 25.8	129°42.7	4.8′	28°17.8	1.2′	57.8′
10	329°28.2	25.8	144°06.6	4.8′	28°16.6	1.5′	57.8′
11	344°28.1	25.8	158°30.4	4.8′	28°15.1	1.6′	57.9′
12	359°27.9	N23°25.7	172°54.2	4.8′	S28°13.5	1.8′	57.9′
13	14°27.8	25.7	187°18.0	4.8′	28°11.7	2.0′	57.9′
14	29°27.7	25.7	201°41.8	4.8′	28°09.7	2.1′	57.9′
15	44°27.5	·· 25.7	216°05.5	4.8′	28°07.6	2.4′	58.0′
16	59°27.4	25.6	230°29.3	4.8′	28°05.2	2.5′	58.0′
17	74°27.3	25.6	244°53.1	4.8′	28°02.7	2.7′	58.0′
18	89°27.1	N23°25.6	259°16.9	4.8′	S28°00.0	2.9′	58.0′
19	104°27.0	25.5	273°40.6	4.8′	27°57.1	3.1′	58.0′
20	119°26.9	25.5	288°04.4	4.8′	27°54.0	3.2′	58.1′
21	134°26.7	·· 25.5	302°28.2	4.8′	27°50.8	3.5′	58.1′
22	149°26.6	25.4	316°52.0	4.8′	27°47.3	3.6′	58.1′
23	164°26.5	25.4	331°15.9	4.8′	27°43.7	3.8′	58.1′
	SD = 15.7′	d = -0.0′	SD = 15.7′				

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

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	Lower hh:mm	Age 14-16 95-100%
20	01:36	01:42	12:02	23:01	10:33	
21	01:49	01:55	12:02	23:59	11:30	
22	02:02	02:08	12:02	–:–	12:30	

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

	Aries	Venus		Mars		Jupiter		Saturn	
Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	271°39.3	173°56.6	N23°53.9	233°34.2	N13°53.7	206°55.7	N20°41.8	280°38.3	S05°59.6
1	286°41.7	188°55.7	53.8	248°34.8	54.3	221°57.6	41.9	295°40.8	59.6
2	301°44.2	203°54.8	53.7	263°35.5	54.9	236°59.5	42.0	310°43.2	59.6
3	316°46.7	218°53.9	·· 53.7	278°36.2	·· 55.5	252°01.4	·· 42.1	325°45.6	·· 59.6
4	331°49.1	233°53.0	53.6	293°36.9	56.1	267°03.2	42.2	340°48.1	59.6
5	346°51.6	248°52.2	53.5	308°37.6	56.7	282°05.1	42.3	355°50.5	59.6
6	1°54.1	263°51.3	N23°53.4	323°38.3	N13°57.3	297°07.0	N20°42.4	10°52.9	S05°59.6
7	16°56.5	278°50.4	53.3	338°39.0	57.9	312°08.9	42.5	25°55.4	59.6
8	31°59.0	293°49.5	53.3	353°39.7	58.4	327°10.7	42.6	40°57.8	59.6
9	47°01.4	308°48.6	·· 53.2	8°40.3	·· 59.0	342°12.6	·· 42.7	56°00.2	·· 59.6
10	62°03.9	323°47.7	53.1	23°41.0	13°59.6	357°14.5	42.8	71°02.7	59.6
11	77°06.4	338°46.8	53.0	38°41.7	14°00.2	12°16.4	42.9	86°05.1	59.6
12	92°08.8	353°45.9	N23°52.9	53°42.4	N14°00.8	27°18.3	N20°43.0	101°07.6	S05°59.5
13	107°11.3	8°45.0	52.8	68°43.1	01.4	42°20.1	43.1	116°10.0	59.5
14	122°13.8	23°44.1	52.7	83°43.8	02.0	57°22.0	43.1	131°12.4	59.5
15	137°16.2	38°43.2	·· 52.6	98°44.5	·· 02.6	72°23.9	·· 43.2	146°14.9	·· 59.5
16	152°18.7	53°42.3	52.5	113°45.2	03.1	87°25.8	43.3	161°17.3	59.5
17	167°21.2	68°41.4	52.4	128°45.8	03.7	102°27.7	43.4	176°19.7	59.5
18	182°23.6	83°40.5	N23°52.3	143°46.5	N14°04.3	117°29.5	N20°43.5	191°22.2	S05°59.5
19	197°26.1	98°39.6	52.3	158°47.2	04.9	132°31.4	43.6	206°24.6	59.5
20	212°28.6	113°38.7	52.2	173°47.9	05.5	147°33.3	43.7	221°27.0	59.5
21	227°31.0	128°37.8	·· 52.1	188°48.6	·· 06.1	162°35.2	·· 43.8	236°29.5	·· 59.5
22	242°33.5	143°37.0	52.0	203°49.3	06.7	177°37.0	43.9	251°31.9	59.5
23	257°35.9	158°36.1	51.9	218°50.0	07.2	192°38.9	44.0	266°34.4	59.5
Mer.pass. 05:52		ν -0.9′	d -0.1′	m -3.91	ν 0.7′	d 0.6′	m 0.99	ν 1.9′	d 0.1′ m -2.02	ν 2.4′	d 0.0′ m 0.94

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	272°38.4	173°35.2	N23°51.7	233°50.7	N14°07.8	207°40.8	N20°44.1	281°36.8	S05°59.5
1	287°40.9	188°34.3	51.6	248°51.4	08.4	222°42.7	44.2	296°39.2	59.5
2	302°43.3	203°33.4	51.5	263°52.0	09.0	237°44.6	44.3	311°41.7	59.5
3	317°45.8	218°32.5	·· 51.4	278°52.7	·· 09.6	252°46.4	·· 44.4	326°44.1	·· 59.5
4	332°48.3	233°31.6	51.3	293°53.4	10.2	267°48.3	44.5	341°46.5	59.5
5	347°50.7	248°30.7	51.2	308°54.1	10.7	282°50.2	44.6	356°49.0	59.5
6	2°53.2	263°29.8	N23°51.1	323°54.8	N14°11.3	297°52.1	N20°44.7	11°51.4	S05°59.6
7	17°55.7	278°28.9	51.0	338°55.5	11.9	312°54.0	44.8	26°53.9	59.6
8	32°58.1	293°28.0	50.9	353°56.2	12.5	327°55.8	44.9	41°56.3	59.6
9	48°00.6	308°27.1	·· 50.8	8°56.8	·· 13.1	342°57.7	·· 45.0	56°58.7	·· 59.6
10	63°03.0	323°26.2	50.6	23°57.5	13.7	357°59.6	45.0	72°01.2	59.6
11	78°05.5	338°25.3	50.5	38°58.2	14.2	13°01.5	45.1	87°03.6	59.6
12	93°08.0	353°24.5	N23°50.4	53°58.9	N14°14.8	28°03.4	N20°45.2	102°06.1	S05°59.6
13	108°10.4	8°23.6	50.3	68°59.6	15.4	43°05.2	45.3	117°08.5	59.6
14	123°12.9	23°22.7	50.2	84°00.3	16.0	58°07.1	45.4	132°10.9	59.6
15	138°15.4	38°21.8	·· 50.1	99°01.0	·· 16.6	73°09.0	·· 45.5	147°13.4	·· 59.6
16	153°17.8	53°20.9	49.9	114°01.7	17.1	88°10.9	45.6	162°15.8	59.6
17	168°20.3	68°20.0	49.8	129°02.3	17.7	103°12.8	45.7	177°18.3	59.6
18	183°22.8	83°19.1	N23°49.7	144°03.0	N14°18.3	118°14.6	N20°45.8	192°20.7	S05°59.6
19	198°25.2	98°18.2	49.6	159°03.7	18.9	133°16.5	45.9	207°23.1	59.6
20	213°27.7	113°17.3	49.4	174°04.4	19.5	148°18.4	46.0	222°25.6	59.6
21	228°30.2	128°16.4	·· 49.3	189°05.1	·· 20.0	163°20.3	·· 46.1	237°28.0	·· 59.6
22	243°32.6	143°15.5	49.2	204°05.8	20.6	178°22.2	46.2	252°30.5	59.6
23	258°35.1	158°14.6	49.0	219°06.5	21.2	193°24.0	46.3	267°32.9	59.6
Mer.pass. 05:48		ν -0.9′	d -0.1′	m -3.91	ν 0.7′	d 0.6′	m 0.99	ν 1.9′	d 0.1′ m -2.02	ν 2.4′	d -0.0′ m 0.94

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	273°37.5	173°13.8	N23°48.9	234°07.1	N14°21.8	208°25.9	N20°46.4	282°35.3	S05°59.6
1	288°40.0	188°12.9	48.8	249°07.8	22.4	223°27.8	46.5	297°37.8	59.6
2	303°42.5	203°12.0	48.6	264°08.5	22.9	238°29.7	46.6	312°40.2	59.6
3	318°44.9	218°11.1	·· 48.5	279°09.2	·· 23.5	253°31.6	·· 46.6	327°42.7	·· 59.6
4	333°47.4	233°10.2	48.4	294°09.9	24.1	268°33.4	46.7	342°45.1	59.6
5	348°49.9	248°09.3	48.2	309°10.6	24.7	283°35.3	46.8	357°47.6	59.6
6	3°52.3	263°08.4	N23°48.1	324°11.3	N14°25.3	298°37.2	N20°46.9	12°50.0	S05°59.6
7	18°54.8	278°07.5	47.9	339°12.0	25.8	313°39.1	47.0	27°52.4	59.6
8	33°57.3	293°06.6	47.8	354°12.6	26.4	328°41.0	47.1	42°54.9	59.6
9	48°59.7	308°05.7	·· 47.7	9°13.3	·· 27.0	343°42.8	·· 47.2	57°57.3	·· 59.6
10	64°02.2	323°04.9	47.5	24°14.0	27.6	358°44.7	47.3	72°59.8	59.6
11	79°04.7	338°04.0	47.4	39°14.7	28.1	13°46.6	47.4	88°02.2	59.6
12	94°07.1	353°03.1	N23°47.2	54°15.4	N14°28.7	28°48.5	N20°47.5	103°04.7	S05°59.6
13	109°09.6	8°02.2	47.1	69°16.1	29.3	43°50.4	47.6	118°07.1	59.6
14	124°12.0	23°01.3	46.9	84°16.8	29.9	58°52.2	47.7	133°09.5	59.6
15	139°14.5	38°00.4	·· 46.8	99°17.4	·· 30.4	73°54.1	·· 47.8	148°12.0	·· 59.6
16	154°17.0	52°59.5	46.6	114°18.1	31.0	88°56.0	47.9	163°14.4	59.6
17	169°19.4	67°58.6	46.5	129°18.8	31.6	103°57.9	48.0	178°16.9	59.6
18	184°21.9	82°57.7	N23°46.3	144°19.5	N14°32.2	118°59.8	N20°48.0	193°19.3	S05°59.6
19	199°24.4	97°56.8	46.1	159°20.2	32.7	134°01.7	48.1	208°21.8	59.6
20	214°26.8	112°56.0	46.0	174°20.9	33.3	149°03.5	48.2	223°24.2	59.6
21	229°29.3	127°55.1	·· 45.8	189°21.6	·· 33.9	164°05.4	·· 48.3	238°26.6	·· 59.6
22	244°31.8	142°54.2	45.7	204°22.2	34.4	179°07.3	48.4	253°29.1	59.6
23	259°34.2	157°53.3	45.5	219°22.9	35.0	194°09.2	48.5	268°31.5	59.6
Mer.pass. 05:45		ν -0.9′	d -0.1′	m -3.91	ν 0.7′	d 0.6′	m 0.98	ν 1.9′	d 0.1′ m -2.02	ν 2.4′	d -0.0′ m 0.93

Stars

	SHA	**Dec**
Alpheratz	357°35.2	29°13.4
Ankaa	353°07.6	-42°10.2
Schedar	349°31.7	56°40.0
Diphda	348°47.8	-17°51.0
Achernar	335°20.7	-57°06.5
Hamal	327°51.9	23°34.6
Polaris	314°36.0	89°21.8
Acamar	315°12.4	-40°12.2
Menkar	314°06.9	4°11.1
Mirfak	308°29.3	49°56.7
Aldebaran	290°40.5	16°33.5
Rigel	281°04.6	-8°10.4
Capella	280°23.0	46°01.3
Bellatrix	278°23.7	6°22.3
Elnath	278°02.8	28°37.7
Alnilam	275°38.5	-1°11.1
Betelgeuse	270°52.9	7°24.7
Canopus	263°53.2	-52°42.5
Sirius	258°27.0	-16°45.0
Adhara	255°06.6	-29°00.3
Procyon	244°51.6	5°09.8
Pollux	243°18.2	27°58.1
Avior	234°15.5	-59°35.4
Suhail	222°47.0	-43°32.0
Miaplacidus	221°39.1	-69°49.2
Alphard	217°48.4	-8°45.9
Regulus	207°35.1	11°50.9
Dubhe	193°41.7	61°37.4
Denebola	182°25.4	14°26.2
Gienah	175°44.1	-17°40.7
Acrux	173°00.6	-63°14.4
Gacrux	171°52.1	-57°15.3
Alioth	166°13.2	55°49.9
Spica	158°22.7	-11°17.4
Alkaid	152°52.1	49°11.7
Hadar	148°36.3	-60°29.7
Menkent	147°58.0	-36°29.6
Arcturus	145°48.1	19°03.4
Rigil Kent.	139°40.5	-60°56.4
Kochab	137°19.0	74°03.5
Zuben'ubi	136°56.3	-16°08.7
Alphecca	126°03.8	26°38.0
Antares	112°16.1	-26°29.2
Atria	107°10.1	-69°04.4
Sabik	102°03.0	-15°45.3
Shaula	96°10.6	-37°07.3
Rasalhague	95°58.6	12°32.5
Eltanin	90°41.8	51°29.1
Kaus Aust.	83°32.7	-34°22.4
Vega	80°33.1	38°48.3
Nunki	75°48.0	-26°15.9
Altair	62°00.1	8°55.9
Peacock	53°05.9	-56°39.2
Deneb	49°25.7	45°21.9
Enif	33°39.0	9°59.2
Al Na'ir	27°33.2	-46°50.3
Fomalhaut	15°14.9	-29°29.4
Scheat	13°45.5	28°12.8
Markab	13°30.3	15°20.1

Jun 23 Sun	**SHA**	**Mer.pass**
Venus	262°17.4	12:25
Mars	321°54.9	08:25
Jupiter	295°16.5	10:11
Saturn	8°59.1	05:17

Jun 24 Mon	**SHA**	**Mer.pass**
Venus	260°56.8	12:26
Mars	321°12.3	08:24
Jupiter	295°02.4	10:08
Saturn	8°58.4	05:13

Jun 25 Tue	**SHA**	**Mer.pass**
Venus	259°36.2	12:28
Mars	320°29.6	08:23
Jupiter	294°48.4	10:05
Saturn	8°57.8	05:09

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°26.3	N23°25.4	345°39.7	4.9′	S27°39.9	4.0′	58.2′
1	194°26.2	25.3	0°03.6	4.9′	27°35.9	4.2′	58.2′
2	209°26.1	25.3	14°27.4	4.9′	27°31.7	4.3′	58.2′
3	224°25.9	·· 25.2	28°51.3	4.9′	27°27.4	4.6′	58.2′
4	239°25.8	25.2	43°15.3	5.0′	27°22.8	4.7′	58.2′
5	254°25.7	25.2	57°39.2	5.0′	27°18.1	4.9′	58.3′
6	269°25.5	N23°25.1	72°03.2	5.0′	S27°13.2	5.0′	58.3′
7	284°25.4	25.1	86°27.2	5.0′	27°08.2	5.3′	58.3′
8	299°25.3	25.0	100°51.3	5.1′	27°02.9	5.4′	58.3′
9	314°25.1	·· 25.0	115°15.3	5.1′	26°57.5	5.6′	58.3′
10	329°25.0	25.0	129°39.5	5.2′	26°51.9	5.8′	58.4′
11	344°24.9	24.9	144°03.6	5.2′	26°46.1	5.9′	58.4′
12	359°24.7	N23°24.9	158°27.8	5.2′	S26°40.2	6.2′	58.4′
13	14°24.6	24.8	172°52.1	5.3′	26°34.0	6.3′	58.4′
14	29°24.5	24.8	187°16.4	5.3′	26°27.7	6.4′	58.4′
15	44°24.3	·· 24.7	201°40.7	5.4′	26°21.3	6.7′	58.5′
16	59°24.2	24.7	216°05.1	5.4′	26°14.6	6.8′	58.5′
17	74°24.1	24.6	230°29.6	5.5′	26°07.8	7.0′	58.5′
18	89°23.9	N23°24.6	244°54.1	5.6′	S26°00.8	7.2′	58.5′
19	104°23.8	24.5	259°18.6	5.6′	25°53.6	7.3′	58.5′
20	119°23.7	24.5	273°43.2	5.7′	25°46.3	7.5′	58.6′
21	134°23.5	·· 24.4	288°07.9	5.7′	25°38.8	7.6′	58.6′
22	149°23.4	24.4	302°32.6	5.8′	25°31.2	7.9′	58.6′
23	164°23.3	24.3	316°57.4	5.8′	25°23.3	8.0′	58.6′
	SD = 15.7′	d = -0.0′	SD = 15.9′				

Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°23.1	N23°24.3	331°22.2	5.9′	S25°15.3	8.1′	58.6′
1	194°23.0	24.2	345°47.2	6.0′	25°07.2	8.3′	58.6′
2	209°22.9	24.2	0°12.1	6.0′	24°58.9	8.5′	58.7′
3	224°22.7	·· 24.1	14°37.2	6.1′	24°50.4	8.6′	58.7′
4	239°22.6	24.0	29°02.3	6.2′	24°41.8	8.8′	58.7′
5	254°22.5	24.0	43°27.5	6.2′	24°33.0	9.0′	58.7′
6	269°22.3	N23°23.9	57°52.7	6.3′	S24°24.0	9.1′	58.7′
7	284°22.2	23.9	72°18.0	6.4′	24°14.9	9.3′	58.7′
8	299°22.1	23.8	86°43.4	6.5′	24°05.6	9.4′	58.8′
9	314°21.9	·· 23.8	101°08.9	6.5′	23°56.2	9.5′	58.8′
10	329°21.8	23.7	115°34.4	6.6′	23°46.7	9.8′	58.8′
11	344°21.7	23.6	130°00.0	6.7′	23°36.9	9.8′	58.8′
12	359°21.5	N23°23.6	144°25.7	6.8′	S23°27.1	10.0′	58.8′
13	14°21.4	23.5	158°51.5	6.8′	23°17.1	10.2′	58.8′
14	29°21.3	23.4	173°17.3	6.9′	23°06.9	10.3′	58.8′
15	44°21.1	·· 23.4	187°43.3	7.0′	22°56.6	10.5′	58.9′
16	59°21.0	23.3	202°09.3	7.1′	22°46.1	10.6′	58.9′
17	74°20.9	23.3	216°35.3	7.2′	22°35.5	10.7′	58.9′
18	89°20.7	N23°23.2	231°01.5	7.2′	S22°24.8	10.9′	58.9′
19	104°20.6	23.1	245°27.8	7.3′	22°13.9	11.0′	58.9′
20	119°20.5	23.1	259°54.1	7.4′	22°02.9	11.1′	58.9′
21	134°20.4	·· 23.0	274°20.5	7.5′	21°51.8	11.3′	58.9′
22	149°20.2	22.9	288°47.0	7.6′	21°40.5	11.4′	58.9′
23	164°20.1	22.8	303°13.5	7.6′	21°29.1	11.6′	59.0′
	SD = 15.7′	d = -0.1′	SD = 16.0′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°20.0	N23°22.8	317°40.2	7.7′	S21°17.5	11.6′	59.0′
1	194°19.8	22.7	332°06.9	7.8′	21°05.9	11.9′	59.0′
2	209°19.7	22.6	346°33.7	7.9′	20°54.0	11.9′	59.0′
3	224°19.6	·· 22.6	1°00.6	8.0′	20°42.1	12.0′	59.0′
4	239°19.4	22.5	15°27.6	8.1′	20°30.1	12.2′	59.0′
5	254°19.3	22.4	29°54.7	8.1′	20°17.9	12.3′	59.0′
6	269°19.2	N23°22.3	44°21.8	8.2′	S20°05.6	12.5′	59.0′
7	284°19.0	22.3	58°49.0	8.3′	19°53.1	12.5′	59.0′
8	299°18.9	22.2	73°16.3	8.4′	19°40.6	12.7′	59.1′
9	314°18.8	·· 22.1	87°43.7	8.5′	19°27.9	12.7′	59.1′
10	329°18.6	22.0	102°11.2	8.6′	19°15.2	12.9′	59.1′
11	344°18.5	22.0	116°38.8	8.6′	19°02.3	13.0′	59.1′
12	359°18.4	N23°21.9	131°06.4	8.7′	S18°49.3	13.1′	59.1′
13	14°18.2	21.8	145°34.1	8.8′	18°36.2	13.3′	59.1′
14	29°18.1	21.7	160°01.9	8.9′	18°22.9	13.3′	59.1′
15	44°18.0	·· 21.6	174°29.8	9.0′	18°09.6	13.4′	59.1′
16	59°17.9	21.5	188°57.8	9.0′	17°56.2	13.6′	59.1′
17	74°17.7	21.5	203°25.8	9.1′	17°42.6	13.6′	59.1′
18	89°17.6	N23°21.4	217°54.0	9.2′	S17°29.0	13.8′	59.1′
19	104°17.5	21.3	232°22.2	9.3′	17°15.2	13.8′	59.2′
20	119°17.3	21.2	246°50.4	9.4′	17°01.4	14.0′	59.2′
21	134°17.2	·· 21.1	261°18.8	9.4′	16°47.4	14.0′	59.2′
22	149°17.1	21.0	275°47.2	9.5′	16°33.4	14.1′	59.2′
23	164°16.9	21.0	290°15.8	9.6′	16°19.3	14.3′	59.2′
	SD = 15.7′	d = -0.1′	SD = 16.1′				

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

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

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 99-89%
23	02:15	02:21	12:02	01:00	13:30	
24	02:27	02:34	12:03	01:59	14:28	
25	02:40	02:46	12:03	02:56	15:23	

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

	Aries	Venus		Mars		Jupiter		Saturn	
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	274°36.7	172°52.4	N23°45.4	234°23.6	N14°35.6	209°11.1	N20°48.6	283°34.0	S05°59.6
1	289°39.2	187°51.5	45.2	249°24.3	36.2	224°13.0	48.7	298°36.4	59.6
2	304°41.6	202°50.6	45.0	264°25.0	36.7	239°14.8	48.8	313°38.9	59.6
3	319°44.1	217°49.7	·· 44.9	279°25.7	·· 37.3	254°16.7	·· 48.9	328°41.3	·· 59.6
4	334°46.5	232°48.9	44.7	294°26.4	37.9	269°18.6	49.0	343°43.8	59.7
5	349°49.0	247°48.0	44.5	309°27.0	38.4	284°20.5	49.1	358°46.2	59.7
6	4°51.5	262°47.1	N23°44.4	324°27.7	N14°39.0	299°22.4	N20°49.2	13°48.7	S05°59.7
7	19°53.9	277°46.2	44.2	339°28.4	39.6	314°24.2	49.2	28°51.1	59.7
8	34°56.4	292°45.3	44.0	354°29.1	40.2	329°26.1	49.3	43°53.6	59.7
9	49°58.9	307°44.4	·· 43.8	9°29.8	·· 40.7	344°28.0	·· 49.4	58°56.0	·· 59.7
10	65°01.3	322°43.5	43.7	24°30.5	41.3	359°29.9	49.5	73°58.4	59.7
11	80°03.8	337°42.7	43.5	39°31.1	41.9	14°31.8	49.6	89°00.9	59.7
12	95°06.3	352°41.8	N23°43.3	54°31.8	N14°42.4	29°33.7	N20°49.7	104°03.3	S05°59.7
13	110°08.7	7°40.9	43.1	69°32.5	43.0	44°35.5	49.8	119°05.8	59.7
14	125°11.2	22°40.0	43.0	84°33.2	43.6	59°37.4	49.9	134°08.2	59.7
15	140°13.6	37°39.1	·· 42.8	99°33.9	·· 44.1	74°39.3	·· 50.0	149°10.7	·· 59.7
16	155°16.1	52°38.2	42.6	114°34.6	44.7	89°41.2	50.1	164°13.1	59.7
17	170°18.6	67°37.3	42.4	129°35.3	45.3	104°43.1	50.2	179°15.6	59.7
18	185°21.0	82°36.5	N23°42.2	144°35.9	N14°45.8	119°45.0	N20°50.3	194°18.0	S05°59.7
19	200°23.5	97°35.6	42.0	159°36.6	46.4	134°46.8	50.3	209°20.5	59.7
20	215°26.0	112°34.7	41.9	174°37.3	47.0	149°48.7	50.4	224°22.9	59.7
21	230°28.4	127°33.8	·· 41.7	189°38.0	·· 47.6	164°50.6	·· 50.5	239°25.4	·· 59.7
22	245°30.9	142°32.9	41.5	204°38.7	48.1	179°52.5	50.6	254°27.8	59.7
23	260°33.4	157°32.0	41.3	219°39.4	48.7	194°54.4	50.7	269°30.3	59.7
Mer.pass. 05:41		ν -0.9′	d -0.2′	m -3.91	ν 0.7′	d 0.6′	m 0.98	ν 1.9′	d 0.1′ m -2.02	ν 2.4′	d -0.0′ m 0.93

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	275°35.8	172°31.1	N23°41.1	234°40.0	N14°49.2	209°56.3	N20°50.8	284°32.7	S05°59.7
1	290°38.3	187°30.3	40.9	249°40.7	49.8	224°58.1	50.9	299°35.2	59.7
2	305°40.8	202°29.4	40.7	264°41.4	50.4	240°00.0	51.0	314°37.6	59.8
3	320°43.2	217°28.5	·· 40.5	279°42.1	·· 50.9	255°01.9	·· 51.1	329°40.1	·· 59.8
4	335°45.7	232°27.6	40.3	294°42.8	51.5	270°03.8	51.2	344°42.5	59.8
5	350°48.1	247°26.7	40.1	309°43.5	52.1	285°05.7	51.3	359°45.0	59.8
6	5°50.6	262°25.8	N23°39.9	324°44.2	N14°52.6	300°07.6	N20°51.4	14°47.4	S05°59.8
7	20°53.1	277°25.0	39.7	339°44.8	53.2	315°09.5	51.4	29°49.9	59.8
8	35°55.5	292°24.1	39.5	354°45.5	53.8	330°11.3	51.5	44°52.3	59.8
9	50°58.0	307°23.2	·· 39.3	9°46.2	·· 54.3	345°13.2	·· 51.6	59°54.8	·· 59.8
10	66°00.5	322°22.3	39.1	24°46.9	54.9	0°15.1	51.7	74°57.2	59.8
11	81°02.9	337°21.4	38.9	39°47.6	55.5	15°17.0	51.8	89°59.7	59.8
12	96°05.4	352°20.5	N23°38.7	54°48.3	N14°56.0	30°18.9	N20°51.9	105°02.1	S05°59.8
13	111°07.9	7°19.7	38.5	69°48.9	56.6	45°20.8	52.0	120°04.6	59.8
14	126°10.3	22°18.8	38.3	84°49.6	57.1	60°22.6	52.1	135°07.0	59.8
15	141°12.8	37°17.9	·· 38.1	99°50.3	·· 57.7	75°24.5	·· 52.2	150°09.5	·· 59.8
16	156°15.3	52°17.0	37.9	114°51.0	58.3	90°26.4	52.3	165°11.9	59.8
17	171°17.7	67°16.1	37.7	129°51.7	58.8	105°28.3	52.4	180°14.4	59.8
18	186°20.2	82°15.3	N23°37.4	144°52.4	N14°59.4	120°30.2	N20°52.4	195°16.8	S05°59.8
19	201°22.6	97°14.4	37.2	159°53.0	15°00.0	135°32.1	52.5	210°19.3	59.9
20	216°25.1	112°13.5	37.0	174°53.7	00.5	150°34.0	52.6	225°21.7	59.9
21	231°27.6	127°12.6	·· 36.8	189°54.4	·· 01.1	165°35.8	·· 52.7	240°24.2	·· 59.9
22	246°30.0	142°11.7	36.6	204°55.1	01.6	180°37.7	52.8	255°26.6	59.9
23	261°32.5	157°10.9	36.4	219°55.8	02.2	195°39.6	52.9	270°29.1	59.9
Mer.pass. 05:37		ν -0.9′	d -0.2′	m -3.91	ν 0.7′	d 0.6′	m 0.98	ν 1.9′	d 0.1′ m -2.02	ν 2.4′	d -0.0′ m 0.93

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	276°35.0	172°10.0	N23°36.1	234°56.5	N15°02.8	210°41.5	N20°53.0	285°31.5	S05°59.9
1	291°37.4	187°09.1	35.9	249°57.1	03.3	225°43.4	53.1	300°34.0	59.9
2	306°39.9	202°08.2	35.7	264°57.8	03.9	240°45.3	53.2	315°36.4	59.9
3	321°42.4	217°07.3	·· 35.5	279°58.5	·· 04.4	255°47.2	·· 53.3	330°38.9	·· 59.9
4	336°44.8	232°06.5	35.2	294°59.2	05.0	270°49.0	53.3	345°41.4	59.9
5	351°47.3	247°05.6	35.0	309°59.9	05.5	285°50.9	53.4	0°43.8	59.9
6	6°49.7	262°04.7	N23°34.8	325°00.6	N15°06.1	300°52.8	N20°53.5	15°46.3	S05°59.9
7	21°52.2	277°03.8	34.6	340°01.2	06.7	315°54.7	53.6	30°48.7	59.9
8	36°54.7	292°02.9	34.3	355°01.9	07.2	330°56.6	53.7	45°51.2	59.9
9	51°57.1	307°02.1	·· 34.1	10°02.6	·· 07.8	345°58.5	·· 53.8	60°53.6	05°59.9
10	66°59.6	322°01.2	33.9	25°03.3	08.3	1°00.4	53.9	75°56.1	06°00.0
11	82°02.1	337°00.3	33.6	40°04.0	08.9	16°02.2	54.0	90°58.5	00.0
12	97°04.5	351°59.4	N23°33.4	55°04.7	N15°09.4	31°04.1	N20°54.1	106°01.0	S06°00.0
13	112°07.0	6°58.5	33.2	70°05.3	10.0	46°06.0	54.2	121°03.4	00.0
14	127°09.5	21°57.7	32.9	85°06.0	10.6	61°07.9	54.2	136°05.9	00.0
15	142°11.9	36°56.8	·· 32.7	100°06.7	·· 11.1	76°09.8	·· 54.3	151°08.4	·· 00.0
16	157°14.4	51°55.9	32.4	115°07.4	11.7	91°11.7	54.4	166°10.8	00.0
17	172°16.9	66°55.0	32.2	130°08.1	12.2	106°13.6	54.5	181°13.3	00.0
18	187°19.3	81°54.2	N23°32.0	145°08.8	N15°12.8	121°15.5	N20°54.6	196°15.7	S06°00.0
19	202°21.8	96°53.3	31.7	160°09.4	13.3	136°17.3	54.7	211°18.2	00.0
20	217°24.2	111°52.4	31.5	175°10.1	13.9	151°19.2	54.8	226°20.6	00.0
21	232°26.7	126°51.5	·· 31.2	190°10.8	·· 14.4	166°21.1	·· 54.9	241°23.1	·· 00.0
22	247°29.2	141°50.7	31.0	205°11.5	15.0	181°23.0	55.0	256°25.5	00.1
23	262°31.6	156°49.8	30.7	220°12.2	15.6	196°24.9	55.0	271°28.0	00.1
Mer.pass. 05:33		ν -0.9′	d -0.2′	m -3.90	ν 0.7′	d 0.6′	m 0.98	ν 1.9′	d 0.1′ m -2.02	ν 2.5′	d -0.0′ m 0.92

Stars

	SHA	Dec
Alpheratz	357°35.2	29°13.4
Ankaa	353°07.6	-42°10.1
Schedar	349°31.6	56°40.0
Diphda	348°47.8	-17°51.0
Achernar	335°20.7	-57°06.5
Hamal	327°51.9	23°34.6
Polaris	314°34.8	89°21.8
Acamar	315°12.4	-40°12.2
Menkar	314°06.8	4°11.1
Mirfak	308°29.3	49°56.7
Aldebaran	290°40.5	16°33.5
Rigel	281°04.6	-8°10.3
Capella	280°23.0	46°01.3
Bellatrix	278°23.7	6°22.3
Elnath	278°02.8	28°37.7
Alnilam	275°38.5	-1°11.1
Betelgeuse	270°52.9	7°24.7
Canopus	263°53.2	-52°42.4
Sirius	258°27.0	-16°44.9
Adhara	255°06.6	-29°00.3
Procyon	244°51.6	5°09.8
Pollux	243°18.2	27°58.1
Avior	234°15.5	-59°35.3
Suhail	222°47.0	-43°32.0
Miaplacidus	221°39.1	-69°49.2
Alphard	217°48.4	-8°45.9
Regulus	207°35.1	11°50.9
Dubhe	193°41.8	61°37.4
Denebola	182°25.5	14°26.2
Gienah	175°44.1	-17°40.7
Acrux	173°00.6	-63°14.4
Gacrux	171°52.1	-57°15.3
Alioth	166°13.3	55°49.9
Spica	158°22.7	-11°17.4
Alkaid	152°52.2	49°11.7
Hadar	148°36.4	-60°29.7
Menkent	147°58.0	-36°29.6
Arcturus	145°48.1	19°03.4
Rigil Kent.	139°40.6	-60°56.4
Kochab	137°19.0	74°03.5
Zuben'ubi	136°56.3	-16°08.7
Alphecca	126°03.8	26°38.0
Antares	112°16.1	-26°29.2
Atria	107°10.1	-69°04.4
Sabik	102°03.0	-15°45.3
Shaula	96°10.6	-37°07.3
Rasalhague	95°58.6	12°32.5
Eltanin	90°41.8	51°29.1
Kaus Aust.	83°32.7	-34°22.4
Vega	80°33.1	38°48.3
Nunki	75°47.9	-26°16.0
Altair	62°00.1	8°55.9
Peacock	53°05.9	-56°39.2
Deneb	49°25.7	45°21.9
Enif	33°39.0	9°59.2
Al Na'ir	27°33.2	-46°50.3
Fomalhaut	15°14.9	-29°29.4
Scheat	13°45.5	28°12.8
Markab	13°30.2	15°20.1

Jun 26 Wed	SHA	Mer.pass
Venus	258°15.7	12:29
Mars	319°46.9	08:22
Jupiter	294°34.4	10:02
Saturn	8°57.3	05:05

Jun 27 Thu	SHA	Mer.pass
Venus	256°55.3	12:31
Mars	319°04.2	08:21
Jupiter	294°20.4	09:59
Saturn	8°56.9	05:01

Jun 28 Fri	SHA	Mer.pass
Venus	255°35.0	12:32
Mars	318°21.5	08:20
Jupiter	294°06.5	09:56
Saturn	8°56.6	04:57

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°16.8	N23°20.9	304°44.4	9.7′	S16°05.0	14.3′	59.2′
1	194°16.7	20.8	319°13.0	9.7′	15°50.7	14.4′	59.2′
2	209°16.5	20.7	333°41.8	9.8′	15°36.3	14.5′	59.2′
3	224°16.4	·· 20.6	348°10.6	9.9′	15°21.8	14.6′	59.2′
4	239°16.3	20.5	2°39.5	10.0′	15°07.2	14.6′	59.2′
5	254°16.2	20.4	17°08.4	10.0′	14°52.6	14.8′	59.2′
6	269°16.0	N23°20.3	31°37.5	10.1′	S14°37.8	14.8′	59.2′
7	284°15.9	20.2	46°06.6	10.2′	14°23.0	14.9′	59.2′
8	299°15.8	20.1	60°35.8	10.2′	14°08.1	15.0′	59.2′
9	314°15.6	·· 20.0	75°05.0	10.3′	13°53.1	15.1′	59.2′
10	329°15.5	20.0	89°34.3	10.4′	13°38.0	15.1′	59.2′
11	344°15.4	19.9	104°03.7	10.5′	13°22.9	15.2′	59.3′
12	359°15.2	N23°19.8	118°33.2	10.5′	S13°07.7	15.3′	59.3′
13	14°15.1	19.7	133°02.7	10.6′	12°52.4	15.3′	59.3′
14	29°15.0	19.6	147°32.3	10.6′	12°37.1	15.5′	59.3′
15	44°14.9	·· 19.5	162°01.9	10.7′	12°21.6	15.5′	59.3′
16	59°14.7	19.4	176°31.6	10.8′	12°06.1	15.5′	59.3′
17	74°14.6	19.3	191°01.4	10.8′	11°50.6	15.6′	59.3′
18	89°14.5	N23°19.2	205°31.2	10.9′	S11°35.0	15.7′	59.3′
19	104°14.3	19.1	220°01.1	10.9′	11°19.3	15.7′	59.3′
20	119°14.2	19.0	234°31.0	11.0′	11°03.6	15.8′	59.3′
21	134°14.1	·· 18.9	249°01.1	11.1′	10°47.8	15.9′	59.3′
22	149°13.9	18.8	263°31.1	11.1′	10°31.9	15.9′	59.3′
23	164°13.8	18.7	278°01.2	11.2′	10°16.0	16.0′	59.3′
	SD = 15.7′	d = -0.1′	SD = 16.1′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°13.7	N23°18.6	292°31.4	11.2′	S10°00.0	16.0′	59.3′
1	194°13.6	18.4	307°01.6	11.3′	09°44.0	16.0′	59.3′
2	209°13.4	18.3	321°31.9	11.3′	09°28.0	16.2′	59.3′
3	224°13.3	·· 18.2	336°02.2	11.4′	09°11.8	16.1′	59.3′
4	239°13.2	18.1	350°32.6	11.4′	08°55.7	16.2′	59.3′
5	254°13.0	18.0	5°03.0	11.5′	08°39.5	16.3′	59.3′
6	269°12.9	N23°17.9	19°33.5	11.5′	S08°23.2	16.3′	59.3′
7	284°12.8	17.8	34°04.0	11.6′	08°06.9	16.3′	59.3′
8	299°12.7	17.7	48°34.5	11.6′	07°50.6	16.4′	59.3′
9	314°12.5	·· 17.6	63°05.1	11.6′	07°34.2	16.4′	59.3′
10	329°12.4	17.5	77°35.8	11.7′	07°17.8	16.4′	59.3′
11	344°12.3	17.4	92°06.4	11.7′	07°01.4	16.5′	59.3′
12	359°12.1	N23°17.2	106°37.2	11.8′	S06°44.9	16.5′	59.3′
13	14°12.0	17.1	121°07.9	11.8′	06°28.4	16.6′	59.3′
14	29°11.9	17.0	135°38.7	11.8′	06°11.8	16.6′	59.3′
15	44°11.8	·· 16.9	150°09.5	11.9′	05°55.2	16.6′	59.3′
16	59°11.6	16.8	164°40.4	11.9′	05°38.6	16.6′	59.3′
17	74°11.5	16.7	179°11.3	11.9′	05°22.0	16.7′	59.3′
18	89°11.4	N23°16.5	193°42.2	12.0′	S05°05.3	16.7′	59.3′
19	104°11.3	16.4	208°13.2	12.0′	04°48.6	16.7′	59.3′
20	119°11.1	16.3	222°44.1	12.0′	04°31.9	16.7′	59.3′
21	134°11.0	·· 16.2	237°15.2	12.0′	04°15.2	16.8′	59.3′
22	149°10.9	16.1	251°46.2	12.1′	03°58.4	16.7′	59.3′
23	164°10.7	15.9	266°17.2	12.1′	03°41.7	16.8′	59.3′
	SD = 15.7′	d = -0.1′	SD = 16.2′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°10.6	N23°15.8	280°48.3	12.1′	S03°24.9	16.8′	59.3′
1	194°10.5	15.7	295°19.4	12.1′	03°08.1	16.9′	59.3′
2	209°10.4	15.6	309°50.6	12.1′	02°51.2	16.8′	59.3′
3	224°10.2	·· 15.5	324°21.7	12.2′	02°34.4	16.8′	59.3′
4	239°10.1	15.3	338°52.9	12.2′	02°17.6	16.9′	59.3′
5	254°10.0	15.2	353°24.0	12.2′	02°00.7	16.8′	59.3′
6	269°09.9	N23°15.1	7°55.2	12.2′	S01°43.9	16.9′	59.3′
7	284°09.7	15.0	22°26.4	12.2′	01°27.0	16.9′	59.3′
8	299°09.6	14.8	36°57.6	12.2′	01°10.1	16.8′	59.3′
9	314°09.5	·· 14.7	51°28.9	12.2′	00°53.3	16.9′	59.3′
10	329°09.3	14.6	66°00.1	12.2′	00°36.4	16.9′	59.3′
11	344°09.2	14.4	80°31.3	12.2′	00°19.5	16.9′	59.3′
12	359°09.1	N23°14.3	95°02.6	12.3′	S00°02.6	16.8′	59.3′
13	14°09.0	14.2	109°33.8	12.3′	N00°14.2	16.9′	59.3′
14	29°08.8	14.0	124°05.1	12.3′	00°31.1	16.9′	59.3′
15	44°08.7	·· 13.9	138°36.3	12.3′	00°48.0	16.8′	59.2′
16	59°08.6	13.8	153°07.6	12.3′	01°04.8	16.9′	59.2′
17	74°08.5	13.6	167°38.8	12.3′	01°21.7	16.8′	59.2′
18	89°08.3	N23°13.5	182°10.1	12.3′	N01°38.5	16.9′	59.2′
19	104°08.2	13.4	196°41.4	12.2′	01°55.4	16.8′	59.2′
20	119°08.1	13.2	211°12.6	12.2′	02°12.2	16.8′	59.2′
21	134°08.0	·· 13.1	225°43.8	12.2′	02°29.0	16.8′	59.2′
22	149°07.8	13.0	240°15.1	12.2′	02°45.8	16.7′	59.2′
23	164°07.7	12.8	254°46.3	12.2′	03°02.5	16.8′	59.2′
	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°	–:–	–:–	01:36	22:30	–:–	–:–
62°	–:–	–:–	02:13	21:53	–:–	–:–
60°	–:–	00:56	02:39	21:27	23:09	–:–
N 58°	–:–	01:44	02:59	21:07	22:21	–:–
56°	–:–	02:14	03:16	20:50	21:52	–:–
54°	00:51	02:36	03:30	20:36	21:30	23:14
52°	01:36	02:53	03:42	20:24	21:13	22:30
50°	02:03	03:08	03:53	20:13	20:58	22:03
45°	02:48	03:38	04:15	19:51	20:28	21:18
N 40°	03:19	04:00	04:33	19:33	20:06	20:47
35°	03:42	04:19	04:48	19:18	19:48	20:24
30°	04:00	04:34	05:01	19:05	19:33	20:06
20°	04:29	04:59	05:23	18:43	19:08	19:37
N 10°	04:52	05:19	05:42	18:24	18:47	19:14
0°	05:11	05:37	06:00	18:07	18:29	18:56
S 10°	05:28	05:54	06:17	17:50	18:12	18:39
20°	05:44	06:11	06:35	17:31	17:55	18:23
30°	06:00	06:30	06:56	17:10	17:36	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	17:48
45°	06:29	07:06	07:40	16:27	17:01	17:38
S 50°	06:40	07:22	08:00	16:06	16:45	17:26
52°	06:45	07:29	08:10	15:57	16:37	17:21
54°	06:51	07:37	08:21	15:46	16:29	17:15
56°	06:57	07:46	08:34	15:33	16:20	17:09
58°	07:04	07:56	08:48	15:18	16:10	17:03
S 60°	07:11	08:08	09:05	15:01	15:59	16:55

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

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 81-60%
26	02:53	02:59	12:03	03:49	16:14	
27	03:05	03:11	12:03	04:39	17:03	
28	03:18	03:24	12:03	05:27	17:51	

June 29, 30, 01 UT (Sat., Sun., Mon.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	277°34.1	171°48.9	N23°30.5	235°12.9	N15°16.1	211°26.8	N20°55.1	286°30.5	S06°00.1
1	292°36.6	186°48.0	30.2	250°13.5	16.7	226°28.7	55.2	301°32.9	00.1
2	307°39.0	201°47.2	30.0	265°14.2	17.2	241°30.6	55.3	316°35.4	00.1
3	322°41.5	216°46.3	·· 29.7	280°14.9	·· 17.8	256°32.4	·· 55.4	331°37.8	·· 00.1
4	337°44.0	231°45.4	29.5	295°15.6	18.3	271°34.3	55.5	346°40.3	00.1
5	352°46.4	246°44.5	29.2	310°16.3	18.9	286°36.2	55.6	1°42.7	00.1
6	7°48.9	261°43.7	N23°29.0	325°16.9	N15°19.4	301°38.1	N20°55.7	16°45.2	S06°00.1
7	22°51.4	276°42.8	28.7	340°17.6	20.0	316°40.0	55.8	31°47.7	00.1
8	37°53.8	291°41.9	28.4	355°18.3	20.5	331°41.9	55.8	46°50.1	00.1
9	52°56.3	306°41.0	·· 28.2	10°19.0	·· 21.1	346°43.8	·· 55.9	61°52.6	·· 00.1
10	67°58.7	321°40.2	27.9	25°19.7	21.6	1°45.7	56.0	76°55.0	00.2
11	83°01.2	336°39.3	27.7	40°20.4	22.2	16°47.5	56.1	91°57.5	00.2
12	98°03.7	351°38.4	N23°27.4	55°21.0	N15°22.7	31°49.4	N20°56.2	107°00.0	S06°00.2
13	113°06.1	6°37.5	27.1	70°21.7	23.3	46°51.3	56.3	122°02.4	00.2
14	128°08.6	21°36.7	26.9	85°22.4	23.8	61°53.2	56.4	137°04.9	00.2
15	143°11.1	36°35.8	·· 26.6	100°23.1	·· 24.4	76°55.1	·· 56.5	152°07.3	·· 00.2
16	158°13.5	51°34.9	26.3	115°23.8	24.9	91°57.0	56.6	167°09.8	00.2
17	173°16.0	66°34.1	26.0	130°24.4	25.5	106°58.9	56.6	182°12.2	00.2
18	188°18.5	81°33.2	N23°25.8	145°25.1	N15°26.0	122°00.8	N20°56.7	197°14.7	S06°00.2
19	203°20.9	96°32.3	25.5	160°25.8	26.6	137°02.7	56.8	212°17.2	00.2
20	218°23.4	111°31.4	25.2	175°26.5	27.1	152°04.5	56.9	227°19.6	00.3
21	233°25.8	126°30.6	·· 25.0	190°27.2	·· 27.7	167°06.4	·· 57.0	242°22.1	·· 00.3
22	248°28.3	141°29.7	24.7	205°27.9	28.2	182°08.3	57.1	257°24.5	00.3
23	263°30.8	156°28.8	24.4	220°28.5	28.8	197°10.2	57.2	272°27.0	00.3
Mer.pass. 05:29		ν -0.9′	d -0.3′	m -3.90	ν 0.7′	d 0.6′	m 0.97	ν 1.9′	d 0.1′ m -2.03	ν 2.5′	d -0.0′ m 0.92

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	278°33.2	171°28.0	N23°24.1	235°29.2	N15°29.3	212°12.1	N20°57.3	287°29.5	S06°00.3
1	293°35.7	186°27.1	23.8	250°29.9	29.8	227°14.0	57.3	302°31.9	00.3
2	308°38.2	201°26.2	23.6	265°30.6	30.4	242°15.9	57.4	317°34.4	00.3
3	323°40.6	216°25.4	·· 23.3	280°31.3	·· 30.9	257°17.8	·· 57.5	332°36.9	·· 00.3
4	338°43.1	231°24.5	23.0	295°31.9	31.5	272°19.7	57.6	347°39.3	00.3
5	353°45.6	246°23.6	22.7	310°32.6	32.0	287°21.5	57.7	2°41.8	00.3
6	8°48.0	261°22.8	N23°22.4	325°33.3	N15°32.6	302°23.4	N20°57.8	17°44.2	S06°00.4
7	23°50.5	276°21.9	22.1	340°34.0	33.1	317°25.3	57.9	32°46.7	00.4
8	38°53.0	291°21.0	21.9	355°34.7	33.7	332°27.2	58.0	47°49.2	00.4
9	53°55.4	306°20.1	·· 21.6	10°35.4	·· 34.2	347°29.1	·· 58.0	62°51.6	·· 00.4
10	68°57.9	321°19.3	21.3	25°36.0	34.7	2°31.0	58.1	77°54.1	00.4
11	84°00.3	336°18.4	21.0	40°36.7	35.3	17°32.9	58.2	92°56.5	00.4
12	99°02.8	351°17.5	N23°20.7	55°37.4	N15°35.8	32°34.8	N20°58.3	107°59.0	S06°00.4
13	114°05.3	6°16.7	20.4	70°38.1	36.4	47°36.7	58.4	123°01.5	00.4
14	129°07.7	21°15.8	20.1	85°38.8	36.9	62°38.6	58.5	138°03.9	00.4
15	144°10.2	36°14.9	·· 19.8	100°39.4	·· 37.5	77°40.5	·· 58.6	153°06.4	·· 00.4
16	159°12.7	51°14.1	19.5	115°40.1	38.0	92°42.3	58.7	168°08.9	00.5
17	174°15.1	66°13.2	19.2	130°40.8	38.5	107°44.2	58.7	183°11.3	00.5
18	189°17.6	81°12.3	N23°18.9	145°41.5	N15°39.1	122°46.1	N20°58.8	198°13.8	S06°00.5
19	204°20.1	96°11.5	18.6	160°42.2	39.6	137°48.0	58.9	213°16.3	00.5
20	219°22.5	111°10.6	18.3	175°42.8	40.2	152°49.9	59.0	228°18.7	00.5
21	234°25.0	126°09.8	·· 18.0	190°43.5	·· 40.7	167°51.8	·· 59.1	243°21.2	·· 00.5
22	249°27.5	141°08.9	17.7	205°44.2	41.3	182°53.7	59.2	258°23.6	00.5
23	264°29.9	156°08.0	17.4	220°44.9	41.8	197°55.6	59.3	273°26.1	00.5
Mer.pass. 05:25		ν -0.9′	d -0.3′	m -3.90	ν 0.7′	d 0.5′	m 0.97	ν 1.9′	d 0.1′ m -2.03	ν 2.5′	d -0.0′ m 0.91

Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	279°32.4	171°07.2	N23°17.1	235°45.6	N15°42.3	212°57.5	N20°59.3	288°28.6	S06°00.6
1	294°34.8	186°06.3	16.8	250°46.2	42.9	227°59.4	59.4	303°31.0	00.6
2	309°37.3	201°05.4	16.5	265°46.9	43.4	243°01.3	59.5	318°33.5	00.6
3	324°39.8	216°04.6	·· 16.1	280°47.6	·· 44.0	258°03.1	·· 59.6	333°36.0	·· 00.6
4	339°42.2	231°03.7	15.8	295°48.3	44.5	273°05.0	59.7	348°38.4	00.6
5	354°44.7	246°02.8	15.5	310°49.0	45.0	288°06.9	59.8	3°40.9	00.6
6	9°47.2	261°02.0	N23°15.2	325°49.7	N15°45.6	303°08.8	N20°59.9	18°43.4	S06°00.6
7	24°49.6	276°01.1	14.9	340°50.3	46.1	318°10.7	21°00.0	33°45.8	00.6
8	39°52.1	291°00.3	14.6	355°51.0	46.6	333°12.6	00.0	48°48.3	00.6
9	54°54.6	305°59.4	·· 14.3	10°51.7	·· 47.2	348°14.5	·· 00.1	63°50.8	·· 00.7
10	69°57.0	320°58.5	13.9	25°52.4	47.7	3°16.4	00.2	78°53.2	00.7
11	84°59.5	335°57.7	13.6	40°53.1	48.3	18°18.3	00.3	93°55.7	00.7
12	100°01.9	350°56.8	N23°13.3	55°53.7	N15°48.8	33°20.2	N21°00.4	108°58.2	S06°00.7
13	115°04.4	5°55.9	13.0	70°54.4	49.3	48°22.1	00.5	124°00.6	00.7
14	130°06.9	20°55.1	12.6	85°55.1	49.9	63°24.0	00.6	139°03.1	00.7
15	145°09.3	35°54.2	·· 12.3	100°55.8	·· 50.4	78°25.9	·· 00.6	154°05.6	·· 00.7
16	160°11.8	50°53.4	12.0	115°56.5	50.9	93°27.7	00.7	169°08.0	00.7
17	175°14.3	65°52.5	11.7	130°57.1	51.5	108°29.6	00.8	184°10.5	00.8
18	190°16.7	80°51.6	N23°11.3	145°57.8	N15°52.0	123°31.5	N21°00.9	199°13.0	S06°00.8
19	205°19.2	95°50.8	11.0	160°58.5	52.5	138°33.4	01.0	214°15.4	00.8
20	220°21.7	110°49.9	10.7	175°59.2	53.1	153°35.3	01.1	229°17.9	00.8
21	235°24.1	125°49.1	·· 10.3	190°59.9	·· 53.6	168°37.2	·· 01.2	244°20.4	·· 00.8
22	250°26.6	140°48.2	10.0	206°00.5	54.1	183°39.1	01.2	259°22.8	00.8
23	265°29.1	155°47.4	09.7	221°01.2	54.7	198°41.0	01.3	274°25.3	00.8
Mer.pass. 05:21		ν -0.9′	d -0.3′	m -3.90	ν 0.7′	d 0.5′	m 0.97	ν 1.9′	d 0.1′ m -2.03	ν 2.5′	d -0.0′ m 0.91

Stars

	SHA	Dec
Alpheratz	357°35.2	29°13.4
Ankaa	353°07.6	-42°10.1
Schedar	349°31.6	56°40.0
Diphda	348°47.8	-17°51.0
Achernar	335°20.7	-57°06.5
Hamal	327°51.9	23°34.6
Polaris	314°33.6	89°21.8
Acamar	315°12.4	-40°12.2
Menkar	314°06.8	4°11.2
Mirfak	308°29.3	49°56.7
Aldebaran	290°40.4	16°33.5
Rigel	281°04.6	-8°10.3
Capella	280°23.0	46°01.3
Bellatrix	278°23.7	6°22.3
Elnath	278°02.8	28°37.7
Alnilam	275°38.5	-1°11.1
Betelgeuse	270°52.9	7°24.7
Canopus	263°53.2	-52°42.4
Sirius	258°27.0	-16°44.9
Adhara	255°06.6	-29°00.3
Procyon	244°51.6	5°09.8
Pollux	243°18.2	27°58.1
Avior	234°15.5	-59°35.3
Suhail	222°47.0	-43°32.0
Miaplacidus	221°39.2	-69°49.2
Alphard	217°48.4	-8°45.9
Regulus	207°35.1	11°51.0
Dubhe	193°41.8	61°37.4
Denebola	182°25.5	14°26.2
Gienah	175°44.1	-17°40.7
Acrux	173°00.6	-63°14.4
Gacrux	171°52.2	-57°15.3
Alioth	166°13.3	55°49.9
Spica	158°22.7	-11°17.4
Alkaid	152°52.2	49°11.7
Hadar	148°36.4	-60°29.7
Menkent	147°58.0	-36°29.6
Arcturus	145°48.2	19°03.4
Rigil Kent.	139°40.6	-60°56.4
Kochab	137°19.0	74°03.5
Zuben'ubi	136°56.3	-16°08.7
Alphecca	126°03.8	26°38.0
Antares	112°16.1	-26°29.2
Atria	107°10.2	-69°04.4
Sabik	102°03.0	-15°45.3
Shaula	96°10.6	-37°07.3
Rasalhague	95°58.6	12°32.5
Eltanin	90°41.8	51°29.1
Kaus Aust.	83°32.7	-34°22.4
Vega	80°33.1	38°48.3
Nunki	75°47.9	-26°16.0
Altair	62°00.1	8°55.9
Peacock	53°05.9	-56°39.2
Deneb	49°25.7	45°21.9
Enif	33°39.0	9°59.2
Al Na'ir	27°33.2	-46°50.3
Fomalhaut	15°14.8	-29°29.4
Scheat	13°45.5	28°12.8
Markab	13°30.2	15°20.1

Jun 29 Sat	SHA	Mer.pass
Venus	254°14.8	12:33
Mars	317°38.7	08:19
Jupiter	293°52.7	09:53
Saturn	8°56.4	04:53

Jun 30 Sun	SHA	Mer.pass
Venus	252°54.7	12:35
Mars	316°56.0	08:18
Jupiter	293°38.9	09:50
Saturn	8°56.2	04:49

Jul 01 Mon	SHA	Mer.pass
Venus	251°34.8	12:36
Mars	316°13.2	08:17
Jupiter	293°25.1	09:47
Saturn	8°56.2	04:45

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.1376 sec ΔT = TT-UT1 = +69.0464 sec

2024 June 29 to Jul. 01 UT

h

Sat	Sun GHA	Sun Dec	Moon GHA	Moon ν	Moon Dec	Moon d	Moon HP
0	179°07.6	N23°12.7	269°17.5	12.2′	N03°19.3	16.7′	59.2′
1	194°07.5	12.5	283°48.7	12.2′	03°36.0	16.7′	59.2′
2	209°07.3	12.4	298°19.9	12.2′	03°52.7	16.7′	59.2′
3	224°07.2	·· 12.3	312°51.1	12.2′	04°09.4	16.7′	59.2′
4	239°07.1	12.1	327°22.2	12.1′	04°26.1	16.6′	59.2′
5	254°07.0	12.0	341°53.4	12.1′	04°42.7	16.7′	59.2′
6	269°06.8	N23°11.8	356°24.5	12.1′	N04°59.4	16.6′	59.2′
7	284°06.7	11.7	10°55.6	12.1′	05°16.0	16.5′	59.2′
8	299°06.6	11.6	25°26.7	12.1′	05°32.5	16.5′	59.2′
9	314°06.5	·· 11.4	39°57.7	12.0′	05°49.0	16.5′	59.1′
10	329°06.3	11.3	54°28.7	12.0′	06°05.5	16.5′	59.1′
11	344°06.2	11.1	68°59.7	12.0′	06°22.0	16.4′	59.1′
12	359°06.1	N23°11.0	83°30.7	12.0′	N06°38.4	16.4′	59.1′
13	14°06.0	10.8	98°01.7	11.9′	06°54.8	16.3′	59.1′
14	29°05.8	10.7	112°32.6	11.9′	07°11.1	16.4′	59.1′
15	44°05.7	·· 10.5	127°03.5	11.9′	07°27.5	16.2′	59.1′
16	59°05.6	10.4	141°34.4	11.8′	07°43.7	16.3′	59.1′
17	74°05.5	10.2	156°05.2	11.8′	08°00.0	16.1′	59.1′
18	89°05.3	N23°10.1	170°36.0	11.8′	N08°16.1	16.2′	59.1′
19	104°05.2	09.9	185°06.7	11.7′	08°32.3	16.1′	59.1′
20	119°05.1	09.8	199°37.5	11.7′	08°48.4	16.0′	59.1′
21	134°05.0	·· 09.6	214°08.1	11.6′	09°04.4	16.0′	59.1′
22	149°04.8	09.5	228°38.8	11.6′	09°20.4	15.9′	59.0′
23	164°04.7	09.3	243°09.4	11.6′	09°36.3	15.9′	59.0′
	SD = 15.7′	d = -0.1′		SD = 16.1′			

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	179°04.6	N23°09.1	257°39.9	11.5′	N09°52.2	15.8′	59.0′
1	194°04.5	09.0	272°10.5	11.5′	10°08.0	15.8′	59.0′
2	209°04.4	08.8	286°40.9	11.4′	10°23.8	15.7′	59.0′
3	224°04.2	·· 08.7	301°11.4	11.4′	10°39.5	15.7′	59.0′
4	239°04.1	08.5	315°41.7	11.3′	10°55.2	15.6′	59.0′
5	254°04.0	08.4	330°12.1	11.3′	11°10.8	15.5′	59.0′
6	269°03.9	N23°08.2	344°42.4	11.2′	N11°26.3	15.5′	59.0′
7	284°03.7	08.0	359°12.6	11.2′	11°41.8	15.4′	59.0′
8	299°03.6	07.9	13°42.8	11.1′	11°57.2	15.4′	59.0′
9	314°03.5	·· 07.7	28°12.9	11.1′	12°12.6	15.2′	58.9′
10	329°03.4	07.6	42°43.0	11.0′	12°27.8	15.2′	58.9′
11	344°03.3	07.4	57°13.0	11.0′	12°43.0	15.2′	58.9′
12	359°03.1	N23°07.2	71°43.0	10.9′	N12°58.2	15.0′	58.9′
13	14°03.0	07.1	86°12.9	10.9′	13°13.2	15.0′	58.9′
14	29°02.9	06.9	100°42.8	10.8′	13°28.2	15.0′	58.9′
15	44°02.8	·· 06.7	115°12.6	10.7′	13°43.2	14.8′	58.9′
16	59°02.6	06.6	129°42.3	10.7′	13°58.0	14.8′	58.9′
17	74°02.5	06.4	144°12.0	10.6′	14°12.8	14.6′	58.9′
18	89°02.4	N23°06.2	158°41.6	10.6′	N14°27.4	14.6′	58.9′
19	104°02.3	06.1	173°11.2	10.5′	14°42.0	14.6′	58.8′
20	119°02.2	05.9	187°40.7	10.4′	14°56.6	14.4′	58.8′
21	134°02.0	·· 05.7	202°10.1	10.4′	15°11.0	14.4′	58.8′
22	149°01.9	05.5	216°39.5	10.3′	15°25.4	14.2′	58.8′
23	164°01.8	05.4	231°08.8	10.2′	15°39.6	14.2′	58.8′
	SD = 15.7′	d = -0.2′		SD = 16.1′			

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	179°01.7	N23°05.2	245°38.0	10.2′	N15°53.8	14.1′	58.8′
1	194°01.6	05.0	260°07.2	10.1′	16°07.9	14.0′	58.8′
2	209°01.4	04.9	274°36.3	10.0′	16°21.9	13.9′	58.8′
3	224°01.3	·· 04.7	289°05.3	10.0′	16°35.8	13.8′	58.7′
4	239°01.2	04.5	303°34.3	9.9′	16°49.6	13.7′	58.7′
5	254°01.1	04.3	318°03.2	9.8′	17°03.3	13.6′	58.7′
6	269°01.0	N23°04.1	332°32.0	9.8′	N17°16.9	13.5′	58.7′
7	284°00.8	04.0	347°00.8	9.7′	17°30.4	13.4′	58.7′
8	299°00.7	03.8	1°29.4	9.6′	17°43.8	13.4′	58.7′
9	314°00.6	·· 03.6	15°58.1	9.5′	17°57.2	13.2′	58.7′
10	329°00.5	03.4	30°26.6	9.5′	18°10.4	13.1′	58.7′
11	344°00.4	03.3	44°55.1	9.4′	18°23.5	13.0′	58.6′
12	359°00.2	N23°03.1	59°23.5	9.3′	N18°36.5	12.9′	58.6′
13	14°00.1	02.9	73°51.8	9.2′	18°49.4	12.7′	58.6′
14	29°00.0	02.7	88°20.0	9.2′	19°02.1	12.7′	58.6′
15	43°59.9	·· 02.5	102°48.2	9.1′	19°14.8	12.6′	58.6′
16	58°59.8	02.3	117°16.3	9.0′	19°27.4	12.4′	58.6′
17	73°59.6	02.2	131°44.3	8.9′	19°39.8	12.4′	58.6′
18	88°59.5	N23°02.0	146°12.3	8.9′	N19°52.2	12.2′	58.6′
19	103°59.4	01.8	160°40.2	8.8′	20°04.4	12.1′	58.5′
20	118°59.3	01.6	175°08.0	8.7′	20°16.5	12.0′	58.5′
21	133°59.2	·· 01.4	189°35.7	8.6′	20°28.5	11.8′	58.5′
22	148°59.0	01.2	204°03.3	8.6′	20°40.3	11.8′	58.5′
23	163°58.9	01.0	218°30.9	8.5′	20°52.1	11.6′	58.5′
	SD = 15.7′	d = -0.2′		SD = 16.0′			

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

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

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 23-25 49-27%
29	03:30	03:36	12:04	06:15	18:39	
30	03:42	03:47	12:04	07:03	19:28	
01	03:53	03:59	12:04	07:54	20:20	

July 02, 03, 04 UT (Tue., Wed., Thu.)

	Aries	Venus		Mars		Jupiter		Saturn	
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	280°31.5	170°46.5	N23°09.3	236°01.9	N15°55.2	213°42.9	N21°01.4	289°27.8	S06°00.8
1	295°34.0	185°45.6	09.0	251°02.6	55.7	228°44.8	01.5	304°30.2	00.9
2	310°36.4	200°44.8	08.7	266°03.3	56.3	243°46.7	01.6	319°32.7	00.9
3	325°38.9	215°43.9	·· 08.3	281°03.9	·· 56.8	258°48.6	·· 01.7	334°35.2	·· 00.9
4	340°41.4	230°43.1	08.0	296°04.6	57.3	273°50.5	01.8	349°37.6	00.9
5	355°43.8	245°42.2	07.6	311°05.3	57.9	288°52.4	01.8	4°40.1	00.9
6	10°46.3	260°41.4	N23°07.3	326°06.0	N15°58.4	303°54.3	N21°01.9	19°42.6	S06°00.9
7	25°48.8	275°40.5	07.0	341°06.7	58.9	318°56.1	02.0	34°45.1	00.9
8	40°51.2	290°39.6	06.6	356°07.3	15°59.5	333°58.0	02.1	49°47.5	01.0
9	55°53.7	305°38.8	·· 06.3	11°08.0	16°00.0	348°59.9	·· 02.2	64°50.0	·· 01.0
10	70°56.2	320°37.9	05.9	26°08.7	00.5	4°01.8	02.3	79°52.5	01.0
11	85°58.6	335°37.1	05.6	41°09.4	01.1	19°03.7	02.3	94°54.9	01.0
12	101°01.1	350°36.2	N23°05.2	56°10.1	N16°01.6	34°05.6	N21°02.4	109°57.4	S06°01.0
13	116°03.6	5°35.4	04.9	71°10.7	02.1	49°07.5	02.5	124°59.9	01.0
14	131°06.0	20°34.5	04.5	86°11.4	02.6	64°09.4	02.6	140°02.3	01.0
15	146°08.5	35°33.7	·· 04.2	101°12.1	·· 03.2	79°11.3	·· 02.7	155°04.8	·· 01.1
16	161°10.9	50°32.8	03.8	116°12.8	03.7	94°13.2	02.8	170°07.3	01.1
17	176°13.4	65°32.0	03.5	131°13.5	04.2	109°15.1	02.9	185°09.8	01.1
18	191°15.9	80°31.1	N23°03.1	146°14.1	N16°04.8	124°17.0	N21°02.9	200°12.2	S06°01.1
19	206°18.3	95°30.3	02.7	161°14.8	05.3	139°18.9	03.0	215°14.7	01.1
20	221°20.8	110°29.4	02.4	176°15.5	05.8	154°20.8	03.1	230°17.2	01.1
21	236°23.3	125°28.5	·· 02.0	191°16.2	·· 06.3	169°22.7	·· 03.2	245°19.6	·· 01.1
22	251°25.7	140°27.7	01.7	206°16.8	06.9	184°24.6	03.3	260°22.1	01.2
23	266°28.2	155°26.8	01.3	221°17.5	07.4	199°26.5	03.4	275°24.6	01.2
Mer.pass. 05:17		ν -0.9′	d -0.3′	m -3.90	ν 0.7′	d 0.5′	m 0.96	ν 1.9′	d 0.1′ m -2.03	ν 2.5′	d -0.0′ m 0.90

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	281°30.7	170°26.0	N23°00.9	236°18.2	N16°07.9	214°28.4	N21°03.4	290°27.1	S06°01.2
1	296°33.1	185°25.1	00.6	251°18.9	08.4	229°30.3	03.5	305°29.5	01.2
2	311°35.6	200°24.3	23°00.2	266°19.6	09.0	244°32.2	03.6	320°32.0	01.2
3	326°38.1	215°23.4	22°59.8	281°20.2	·· 09.5	259°34.0	·· 03.7	335°34.5	·· 01.2
4	341°40.5	230°22.6	59.5	296°20.9	10.0	274°35.9	03.8	350°36.9	01.2
5	356°43.0	245°21.7	59.1	311°21.6	10.5	289°37.8	03.9	5°39.4	01.3
6	11°45.4	260°20.9	N22°58.7	326°22.3	N16°11.1	304°39.7	N21°04.0	20°41.9	S06°01.3
7	26°47.9	275°20.0	58.3	341°23.0	11.6	319°41.6	04.0	35°44.4	01.3
8	41°50.4	290°19.2	58.0	356°23.6	12.1	334°43.5	04.1	50°46.8	01.3
9	56°52.8	305°18.4	·· 57.6	11°24.3	·· 12.6	349°45.4	·· 04.2	65°49.3	·· 01.3
10	71°55.3	320°17.5	57.2	26°25.0	13.2	4°47.3	04.3	80°51.8	01.3
11	86°57.8	335°16.7	56.8	41°25.7	13.7	19°49.2	04.4	95°54.3	01.4
12	102°00.2	350°15.8	N22°56.5	56°26.4	N16°14.2	34°51.1	N21°04.5	110°56.7	S06°01.4
13	117°02.7	5°15.0	56.1	71°27.0	14.7	49°53.0	04.5	125°59.2	01.4
14	132°05.2	20°14.1	55.7	86°27.7	15.3	64°54.9	04.6	141°01.7	01.4
15	147°07.6	35°13.3	·· 55.3	101°28.4	·· 15.8	79°56.8	·· 04.7	156°04.2	·· 01.4
16	162°10.1	50°12.4	54.9	116°29.1	16.3	94°58.7	04.8	171°06.6	01.4
17	177°12.6	65°11.6	54.6	131°29.7	16.8	110°00.6	04.9	186°09.1	01.4
18	192°15.0	80°10.7	N22°54.2	146°30.4	N16°17.3	125°02.5	N21°05.0	201°11.6	S06°01.5
19	207°17.5	95°09.9	53.8	161°31.1	17.9	140°04.4	05.0	216°14.1	01.5
20	222°19.9	110°09.0	53.4	176°31.8	18.4	155°06.3	05.1	231°16.5	01.5
21	237°22.4	125°08.2	·· 53.0	191°32.5	·· 18.9	170°08.2	·· 05.2	246°19.0	·· 01.5
22	252°24.9	140°07.4	52.6	206°33.1	19.4	185°10.1	05.3	261°21.5	01.5
23	267°27.3	155°06.5	52.2	221°33.8	20.0	200°12.0	05.4	276°24.0	01.5
Mer.pass. 05:13		ν -0.9′	d -0.4′	m -3.90	ν 0.7′	d 0.5′	m 0.96	ν 1.9′	d 0.1′ m -2.03	ν 2.5′	d -0.0′ m 0.90

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	282°29.8	170°05.7	N22°51.8	236°34.5	N16°20.5	215°13.9	N21°05.5	291°26.4	S06°01.6
1	297°32.3	185°04.8	51.4	251°35.2	21.0	230°15.8	05.5	306°28.9	01.6
2	312°34.7	200°04.0	51.0	266°35.9	21.5	245°17.7	05.6	321°31.4	01.6
3	327°37.2	215°03.1	·· 50.6	281°36.5	·· 22.0	260°19.6	·· 05.7	336°33.9	·· 01.6
4	342°39.7	230°02.3	50.3	296°37.2	22.5	275°21.5	05.8	351°36.3	01.6
5	357°42.1	245°01.5	49.9	311°37.9	23.1	290°23.4	05.9	6°38.8	01.6
6	12°44.6	260°00.6	N22°49.5	326°38.6	N16°23.6	305°25.3	N21°06.0	21°41.3	S06°01.7
7	27°47.1	274°59.8	49.1	341°39.2	24.1	320°27.2	06.0	36°43.8	01.7
8	42°49.5	289°58.9	48.7	356°39.9	24.6	335°29.1	06.1	51°46.3	01.7
9	57°52.0	304°58.1	·· 48.2	11°40.6	·· 25.1	350°31.0	·· 06.2	66°48.7	·· 01.7
10	72°54.4	319°57.3	47.8	26°41.3	25.7	5°32.9	06.3	81°51.2	01.7
11	87°56.9	334°56.4	47.4	41°42.0	26.2	20°34.8	06.4	96°53.7	01.7
12	102°59.4	349°55.6	N22°47.0	56°42.6	N16°26.7	35°36.7	N21°06.5	111°56.2	S06°01.8
13	118°01.8	4°54.7	46.6	71°43.3	27.2	50°38.6	06.5	126°58.6	01.8
14	133°04.3	19°53.9	46.2	86°44.0	27.7	65°40.5	06.6	142°01.1	01.8
15	148°06.8	34°53.1	·· 45.8	101°44.7	·· 28.2	80°42.4	·· 06.7	157°03.6	·· 01.8
16	163°09.2	49°52.2	45.4	116°45.4	28.7	95°44.3	06.8	172°06.1	01.8
17	178°11.7	64°51.4	45.0	131°46.0	29.3	110°46.2	06.9	187°08.6	01.9
18	193°14.2	79°50.5	N22°44.6	146°46.7	N16°29.8	125°48.1	N21°06.9	202°11.0	S06°01.9
19	208°16.6	94°49.7	44.2	161°47.4	30.3	140°50.0	07.0	217°13.5	01.9
20	223°19.1	109°48.9	43.7	176°48.1	30.8	155°51.9	07.1	232°16.0	01.9
21	238°21.5	124°48.0	·· 43.3	191°48.7	·· 31.3	170°53.8	·· 07.2	247°18.5	·· 01.9
22	253°24.0	139°47.2	42.9	206°49.4	31.8	185°55.7	07.3	262°21.0	01.9
23	268°26.5	154°46.4	42.5	221°50.1	32.3	200°57.6	07.4	277°23.4	02.0
Mer.pass. 05:09		ν -0.8′	d -0.4′	m -3.90	ν 0.7′	d 0.5′	m 0.96	ν 1.9′	d 0.1′ m -2.04	ν 2.5′	d -0.0′ m 0.89

Stars

	SHA	Dec
Alpheratz	357°35.2	29°13.4
Ankaa	353°07.5	-42°10.1
Schedar	349°31.6	56°40.0
Diphda	348°47.7	-17°51.0
Achernar	335°20.6	-57°06.4
Hamal	327°51.8	23°34.6
Polaris	314°32.1	89°21.8
Acamar	315°12.3	-40°12.2
Menkar	314°06.8	4°11.2
Mirfak	308°29.2	49°56.7
Aldebaran	290°40.4	16°33.5
Rigel	281°04.6	-8°10.3
Capella	280°23.0	46°01.3
Bellatrix	278°23.7	6°22.3
Elnath	278°02.8	28°37.7
Alnilam	275°38.5	-1°11.1
Betelgeuse	270°52.9	7°24.7
Canopus	263°53.1	-52°42.4
Sirius	258°27.0	-16°44.9
Adhara	255°06.6	-29°00.3
Procyon	244°51.6	5°09.8
Pollux	243°18.2	27°58.1
Avior	234°15.5	-59°35.3
Suhail	222°47.0	-43°32.0
Miaplacidus	221°39.2	-69°49.2
Alphard	217°48.4	-8°45.9
Regulus	207°35.1	11°51.0
Dubhe	193°41.8	61°37.4
Denebola	182°25.5	14°26.2
Gienah	175°44.1	-17°40.7
Acrux	173°00.7	-63°14.4
Gacrux	171°52.2	-57°15.3
Alioth	166°13.3	55°49.9
Spica	158°22.7	-11°17.4
Alkaid	152°52.2	49°11.7
Hadar	148°36.4	-60°29.7
Menkent	147°58.0	-36°29.6
Arcturus	145°48.2	19°03.4
Rigil Kent.	139°40.6	-60°56.4
Kochab	137°19.1	74°03.5
Zuben'ubi	136°56.3	-16°08.7
Alphecca	126°03.8	26°38.0
Antares	112°16.1	-26°29.2
Atria	107°10.2	-69°04.4
Sabik	102°03.0	-15°45.3
Shaula	96°10.6	-37°07.3
Rasalhague	95°58.6	12°32.5
Eltanin	90°41.9	51°29.1
Kaus Aust.	83°32.7	-34°22.4
Vega	80°33.1	38°48.4
Nunki	75°47.9	-26°16.0
Altair	62°00.1	8°56.0
Peacock	53°05.8	-56°39.2
Deneb	49°25.7	45°21.9
Enif	33°39.0	9°59.2
Al Na'ir	27°33.1	-46°50.3
Fomalhaut	15°14.8	-29°29.4
Scheat	13°45.5	28°12.8
Markab	13°30.2	15°20.1

Jul 02 Tue	SHA	Mer.pass
Venus	250°15.0	12:38
Mars	315°30.4	08:15
Jupiter	293°11.4	09:44
Saturn	8°56.2	04:41

Jul 03 Wed	SHA	Mer.pass
Venus	248°55.3	12:39
Mars	314°47.5	08:14
Jupiter	292°57.7	09:41
Saturn	8°56.4	04:37

Jul 04 Thu	SHA	Mer.pass
Venus	247°35.9	12:40
Mars	314°04.7	08:13
Jupiter	292°44.1	09:38
Saturn	8°56.6	04:33

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h

Tue	Sun GHA	Sun Dec	Moon GHA	ν	Moon Dec	d	HP
0	178°58.8	N23°00.8	232°58.4	8.4′	N21°03.7	11.5′	58.5′
1	193°58.7	00.7	247°25.8	8.3′	21°15.2	11.3′	58.5′
2	208°58.6	00.5	261°53.2	8.3′	21°26.5	11.3′	58.4′
3	223°58.5	·· 00.3	276°20.4	8.2′	21°37.8	11.1′	58.4′
4	238°58.3	23°00.1	290°47.6	8.1′	21°48.9	10.9′	58.4′
5	253°58.2	22°59.9	305°14.7	8.0′	21°59.8	10.9′	58.4′
6	268°58.1	N22°59.7	319°41.8	8.0′	N22°10.7	10.7′	58.4′
7	283°58.0	59.5	334°08.8	7.9′	22°21.4	10.6′	58.4′
8	298°57.9	59.3	348°35.7	7.8′	22°32.0	10.4′	58.3′
9	313°57.7	·· 59.1	3°02.5	7.7′	22°42.4	10.3′	58.3′
10	328°57.6	58.9	17°29.2	7.7′	22°52.7	10.2′	58.3′
11	343°57.5	58.7	31°55.9	7.6′	23°02.9	10.0′	58.3′
12	358°57.4	N22°58.5	46°22.5	7.5′	N23°12.9	9.9′	58.3′
13	13°57.3	58.3	60°49.0	7.5′	23°22.8	9.8′	58.3′
14	28°57.2	58.1	75°15.5	7.4′	23°32.6	9.6′	58.2′
15	43°57.1	·· 57.9	89°41.9	7.3′	23°42.2	9.4′	58.2′
16	58°56.9	57.7	104°08.2	7.3′	23°51.6	9.3′	58.2′
17	73°56.8	57.5	118°34.5	7.2′	24°00.9	9.2′	58.2′
18	88°56.7	N22°57.3	133°00.6	7.1′	N24°10.1	9.0′	58.2′
19	103°56.6	57.1	147°26.8	7.0′	24°19.1	8.9′	58.2′
20	118°56.5	56.9	161°52.8	7.0′	24°28.0	8.7′	58.1′
21	133°56.4	·· 56.7	176°18.8	6.9′	24°36.7	8.5′	58.1′
22	148°56.2	56.5	190°44.7	6.9′	24°45.2	8.4′	58.1′
23	163°56.1	56.3	205°10.6	6.8′	24°53.6	8.3′	58.1′
	SD = 15.7′	d = -0.2′		SD = 15.9′			

Wed	GHA	Dec	GHA	ν	Dec	d	HP
0	178°56.0	N22°56.1	219°36.3	6.7′	N25°01.9	8.1′	58.1′
1	193°55.9	55.9	234°02.1	6.7′	25°10.0	8.0′	58.1′
2	208°55.8	55.7	248°27.7	6.6′	25°18.0	7.7′	58.0′
3	223°55.7	·· 55.5	262°53.3	6.5′	25°25.7	7.7′	58.0′
4	238°55.5	55.3	277°18.9	6.5′	25°33.4	7.4′	58.0′
5	253°55.4	55.0	291°44.4	6.4′	25°40.8	7.4′	58.0′
6	268°55.3	N22°54.8	306°09.8	6.4′	N25°48.2	7.1′	58.0′
7	283°55.2	54.6	320°35.2	6.3′	25°55.3	7.0′	58.0′
8	298°55.1	54.4	335°00.5	6.3′	26°02.3	6.8′	57.9′
9	313°55.0	·· 54.2	349°25.8	6.2′	26°09.1	6.7′	57.9′
10	328°54.9	54.0	3°51.0	6.2′	26°15.8	6.5′	57.9′
11	343°54.7	53.8	18°16.2	6.1′	26°22.3	6.3′	57.9′
12	358°54.6	N22°53.6	32°41.3	6.1′	N26°28.6	6.2′	57.9′
13	13°54.5	53.3	47°06.4	6.0′	26°34.8	6.0′	57.8′
14	28°54.4	53.1	61°31.4	6.0′	26°40.8	5.8′	57.8′
15	43°54.3	·· 52.9	75°56.4	6.0′	26°46.6	5.7′	57.8′
16	58°54.2	52.7	90°21.4	5.9′	26°52.3	5.5′	57.8′
17	73°54.1	52.5	104°46.3	5.9′	26°57.8	5.3′	57.8′
18	88°54.0	N22°52.3	119°11.2	5.8′	N27°03.1	5.1′	57.7′
19	103°53.8	52.0	133°36.0	5.8′	27°08.2	5.0′	57.7′
20	118°53.7	51.8	148°00.8	5.8′	27°13.2	4.8′	57.7′
21	133°53.6	·· 51.6	162°25.6	5.7′	27°18.0	4.7′	57.7′
22	148°53.5	51.4	176°50.4	5.7′	27°22.7	4.4′	57.7′
23	163°53.4	51.2	191°15.1	5.7′	27°27.1	4.3′	57.6′
	SD = 15.7′	d = -0.2′		SD = 15.8′			

Thu	GHA	Dec	GHA	ν	Dec	d	HP
0	178°53.3	N22°50.9	205°39.8	5.7′	N27°31.4	4.2′	57.6′
1	193°53.2	50.7	220°04.5	5.6′	27°35.6	3.9′	57.6′
2	208°53.1	50.5	234°29.1	5.6′	27°39.5	3.8′	57.6′
3	223°52.9	·· 50.3	248°53.7	5.6′	27°43.3	3.6′	57.6′
4	238°52.8	50.0	263°18.4	5.6′	27°46.9	3.4′	57.5′
5	253°52.7	49.8	277°42.9	5.6′	27°50.3	3.3′	57.5′
6	268°52.6	N22°49.6	292°07.5	5.6′	N27°53.6	3.0′	57.5′
7	283°52.5	49.4	306°32.1	5.6′	27°56.6	2.9′	57.5′
8	298°52.4	49.1	320°56.7	5.6′	27°59.5	2.8′	57.5′
9	313°52.3	·· 48.9	335°21.2	5.5′	28°02.3	2.5′	57.4′
10	328°52.2	48.7	349°45.8	5.5′	28°04.8	2.4′	57.4′
11	343°52.1	48.4	4°10.3	5.5′	28°07.2	2.2′	57.4′
12	358°51.9	N22°48.2	18°34.9	5.5′	N28°09.4	2.0′	57.4′
13	13°51.8	48.0	32°59.4	5.6′	28°11.4	1.8′	57.4′
14	28°51.7	47.7	47°24.0	5.6′	28°13.2	1.7′	57.3′
15	43°51.6	·· 47.5	61°48.5	5.6′	28°14.9	1.5′	57.3′
16	58°51.5	47.3	76°13.1	5.6′	28°16.4	1.3′	57.3′
17	73°51.4	47.0	90°37.7	5.6′	28°17.7	1.2′	57.3′
18	88°51.3	N22°46.8	105°02.2	5.6′	N28°18.9	0.9′	57.2′
19	103°51.2	46.6	119°26.9	5.6′	28°19.8	0.8′	57.2′
20	118°51.1	46.3	133°51.5	5.6′	28°20.6	0.6′	57.2′
21	133°51.0	·· 46.1	148°16.1	5.7′	28°21.2	0.5′	57.2′
22	148°50.9	45.9	162°40.8	5.7′	28°21.7	0.2′	57.2′
23	163°50.7	45.6	177°05.5	5.7′	28°21.9	0.1′	57.1′
	SD = 15.7′	d = -0.2′		SD = 15.7′			

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

Lat.	Moonrise Tue	Moonrise Wed	Moonrise Thu	Moonset Tue	Moonset Wed	Moonset Thu
N 72°	▭	▭	▭	▭	▭	▭
N 70°	▭	▭	▭	▭	▭	▭
68°	▭	▭	▭	▭	▭	▭
66°	▭	▭	▭	▭	▭	▭
64°	22:36	▭	▭	19:43	▭	▭
62°	23:19	23:10	▭	19:01	21:11	▭
60°	23:48	·· ··	00:02	18:32	20:19	21:42
N 58°	·· ··	00:10	00:34	18:11	19:47	21:04
56°	00:10	00:28	00:58	17:53	19:23	20:37
54°	00:22	00:44	01:18	17:38	19:04	20:16
52°	00:32	00:57	01:34	17:25	18:48	19:58
50°	00:41	01:09	01:48	17:14	18:34	19:43
45°	01:00	01:34	02:17	16:50	18:05	19:12
N 40°	01:15	01:53	02:40	16:31	17:43	18:48
35°	01:29	02:10	02:59	16:16	17:25	18:29
30°	01:40	02:24	03:15	16:02	17:09	18:12
20°	02:00	02:49	03:43	15:39	16:42	17:44
N 10°	02:18	03:10	04:06	15:19	16:19	17:19
0°	02:34	03:30	04:28	15:01	15:58	16:57
S 10°	02:51	03:50	04:51	14:42	15:37	16:34
20°	03:09	04:12	05:15	14:23	15:14	16:10
30°	03:30	04:37	05:43	14:00	14:47	15:41
35°	03:42	04:52	05:59	13:47	14:32	15:25
40°	03:56	05:10	06:19	13:32	14:14	15:05
45°	04:13	05:31	06:42	13:14	13:52	14:41
S 50°	04:34	05:57	07:12	12:51	13:25	14:11
52°	04:44	06:10	07:27	12:41	13:11	13:55
54°	04:55	06:25	07:45	12:29	12:56	13:38
56°	05:08	06:43	08:06	12:15	12:38	13:16
58°	05:23	07:04	08:33	12:00	12:16	12:49
S 60°	05:41	07:31	09:11	11:41	11:48	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	Moon Age 26-28 18-5%
02	04:05	04:10	12:04	08:47	21:15	
03	04:16	04:21	12:04	09:44	22:13	
04	04:27	04:32	12:05	10:43	23:12	

July 05, 06, 07 UT (Fri., Sat., Sun.)

	Aries	Venus		Mars		Jupiter		Saturn	
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	283°28.9	169°45.5	N22°42.1	236°50.8	N16°32.9	215°59.5	N21°07.4	292°25.9	S06°02.0
1	298°31.4	184°44.7	41.6	251°51.5	33.4	231°01.4	07.5	307°28.4	02.0
2	313°33.9	199°43.9	41.2	266°52.1	33.9	246°03.3	07.6	322°30.9	02.0
3	328°36.3	214°43.0	·· 40.8	281°52.8	·· 34.4	261°05.2	·· 07.7	337°33.4	·· 02.0
4	343°38.8	229°42.2	40.4	296°53.5	34.9	276°07.1	07.8	352°35.8	02.1
5	358°41.3	244°41.4	39.9	311°54.2	35.4	291°09.0	07.8	7°38.3	02.1
6	13°43.7	259°40.5	N22°39.5	326°54.8	N16°35.9	306°10.9	N21°07.9	22°40.8	S06°02.1
7	28°46.2	274°39.7	39.1	341°55.5	36.4	321°12.8	08.0	37°43.3	02.1
8	43°48.7	289°38.9	38.7	356°56.2	36.9	336°14.7	08.1	52°45.8	02.1
9	58°51.1	304°38.0	·· 38.2	11°56.9	·· 37.5	351°16.6	·· 08.2	67°48.2	·· 02.1
10	73°53.6	319°37.2	37.8	26°57.6	38.0	6°18.5	08.3	82°50.7	02.2
11	88°56.0	334°36.4	37.4	41°58.2	38.5	21°20.4	08.3	97°53.2	02.2
12	103°58.5	349°35.5	N22°36.9	56°58.9	N16°39.0	36°22.3	N21°08.4	112°55.7	S06°02.2
13	119°01.0	4°34.7	36.5	71°59.6	39.5	51°24.2	08.5	127°58.2	02.2
14	134°03.4	19°33.9	36.1	87°00.3	40.0	66°26.1	08.6	143°00.6	02.2
15	149°05.9	34°33.0	·· 35.6	102°00.9	·· 40.5	81°28.0	·· 08.7	158°03.1	·· 02.3
16	164°08.4	49°32.2	35.2	117°01.6	41.0	96°29.9	08.7	173°05.6	02.3
17	179°10.8	64°31.4	34.7	132°02.3	41.5	111°31.8	08.8	188°08.1	02.3
18	194°13.3	79°30.5	N22°34.3	147°03.0	N16°42.0	126°33.7	N21°08.9	203°10.6	S06°02.3
19	209°15.8	94°29.7	33.9	162°03.7	42.5	141°35.6	09.0	218°13.1	02.3
20	224°18.2	109°28.9	33.4	177°04.3	43.0	156°37.5	09.1	233°15.5	02.4
21	239°20.7	124°28.1	·· 33.0	192°05.0	·· 43.6	171°39.4	·· 09.1	248°18.0	·· 02.4
22	254°23.2	139°27.2	32.5	207°05.7	44.1	186°41.3	09.2	263°20.5	02.4
23	269°25.6	154°26.4	32.1	222°06.4	44.6	201°43.2	09.3	278°23.0	02.4
Mer.pass. 05:05		ν -0.8′	d -0.4′	m -3.90	ν 0.7′	d 0.5′	m 0.96	ν 1.9′	d 0.1′ m -2.04	ν 2.5′	d -0.0′ m 0.89

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	284°28.1	169°25.6	N22°31.6	237°07.0	N16°45.1	216°45.1	N21°09.4	293°25.5	S06°02.4
1	299°30.5	184°24.8	31.2	252°07.7	45.6	231°47.0	09.5	308°28.0	02.5
2	314°33.0	199°23.9	30.7	267°08.4	46.1	246°48.9	09.6	323°30.4	02.5
3	329°35.5	214°23.1	·· 30.3	282°09.1	·· 46.6	261°50.8	·· 09.6	338°32.9	·· 02.5
4	344°37.9	229°22.3	29.8	297°09.8	47.1	276°52.7	09.7	353°35.4	02.5
5	359°40.4	244°21.4	29.4	312°10.4	47.6	291°54.6	09.8	8°37.9	02.5
6	14°42.9	259°20.6	N22°28.9	327°11.1	N16°48.1	306°56.5	N21°09.9	23°40.4	S06°02.6
7	29°45.3	274°19.8	28.5	342°11.8	48.6	321°58.4	10.0	38°42.9	02.6
8	44°47.8	289°19.0	28.0	357°12.5	49.1	337°00.3	10.0	53°45.4	02.6
9	59°50.3	304°18.2	·· 27.6	12°13.1	·· 49.6	352°02.2	·· 10.1	68°47.8	·· 02.6
10	74°52.7	319°17.3	27.1	27°13.8	50.1	7°04.1	10.2	83°50.3	02.6
11	89°55.2	334°16.5	26.6	42°14.5	50.6	22°06.0	10.3	98°52.8	02.7
12	104°57.7	349°15.7	N22°26.2	57°15.2	N16°51.1	37°07.9	N21°10.4	113°55.3	S06°02.7
13	120°00.1	4°14.9	25.7	72°15.8	51.6	52°09.8	10.4	128°57.8	02.7
14	135°02.6	19°14.0	25.2	87°16.5	52.1	67°11.7	10.5	144°00.3	02.7
15	150°05.0	34°13.2	·· 24.8	102°17.2	·· 52.6	82°13.6	·· 10.6	159°02.8	·· 02.7
16	165°07.5	49°12.4	24.3	117°17.9	53.1	97°15.5	10.7	174°05.2	02.8
17	180°10.0	64°11.6	23.9	132°18.6	53.6	112°17.4	10.8	189°07.7	02.8
18	195°12.4	79°10.8	N22°23.4	147°19.2	N16°54.1	127°19.3	N21°10.8	204°10.2	S06°02.8
19	210°14.9	94°09.9	22.9	162°19.9	54.6	142°21.2	10.9	219°12.7	02.8
20	225°17.4	109°09.1	22.4	177°20.6	55.1	157°23.2	11.0	234°15.2	02.8
21	240°19.8	124°08.3	·· 22.0	192°21.3	·· 55.6	172°25.1	·· 11.1	249°17.7	·· 02.9
22	255°22.3	139°07.5	21.5	207°21.9	56.1	187°27.0	11.2	264°20.2	02.9
23	270°24.8	154°06.7	21.0	222°22.6	56.6	202°28.9	11.2	279°22.7	02.9
Mer.pass. 05:01		ν -0.8′	d -0.4′	m -3.90	ν 0.7′	d 0.5′	m 0.95	ν 1.9′	d 0.1′ m -2.04	ν 2.5′	d -0.0′ m 0.88

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	285°27.2	169°05.8	N22°20.6	237°23.3	N16°57.1	217°30.8	N21°11.3	294°25.1	S06°02.9
1	300°29.7	184°05.0	20.1	252°24.0	57.6	232°32.7	11.4	309°27.6	02.9
2	315°32.2	199°04.2	19.6	267°24.7	58.1	247°34.6	11.5	324°30.1	03.0
3	330°34.6	214°03.4	·· 19.1	282°25.3	·· 58.6	262°36.5	·· 11.6	339°32.6	·· 03.0
4	345°37.1	229°02.6	18.6	297°26.0	59.1	277°38.4	11.6	354°35.1	03.0
5	0°39.5	244°01.8	18.2	312°26.7	16°59.6	292°40.3	11.7	9°37.6	03.0
6	15°42.0	259°00.9	N22°17.7	327°27.4	N17°00.1	307°42.2	N21°11.8	24°40.1	S06°03.1
7	30°44.5	274°00.1	17.2	342°28.0	00.6	322°44.1	11.9	39°42.6	03.1
8	45°46.9	288°59.3	16.7	357°28.7	01.1	337°46.0	11.9	54°45.0	03.1
9	60°49.4	303°58.5	·· 16.2	12°29.4	·· 01.6	352°47.9	·· 12.0	69°47.5	·· 03.1
10	75°51.9	318°57.7	15.7	27°30.1	02.1	7°49.8	12.1	84°50.0	03.1
11	90°54.3	333°56.9	15.3	42°30.7	02.6	22°51.7	12.2	99°52.5	03.2
12	105°56.8	348°56.1	N22°14.8	57°31.4	N17°03.1	37°53.6	N21°12.3	114°55.0	S06°03.2
13	120°59.3	3°55.2	14.3	72°32.1	03.6	52°55.5	12.3	129°57.5	03.2
14	136°01.7	18°54.4	13.8	87°32.8	04.1	67°57.4	12.4	145°00.0	03.2
15	151°04.2	33°53.6	·· 13.3	102°33.5	·· 04.6	82°59.4	·· 12.5	160°02.5	·· 03.3
16	166°06.7	48°52.8	12.8	117°34.1	05.1	98°01.3	12.6	175°05.0	03.3
17	181°09.1	63°52.0	12.3	132°34.8	05.5	113°03.2	12.7	190°07.5	03.3
18	196°11.6	78°51.2	N22°11.8	147°35.5	N17°06.0	128°05.1	N21°12.7	205°09.9	S06°03.3
19	211°14.0	93°50.4	11.3	162°36.2	06.5	143°07.0	12.8	220°12.4	03.3
20	226°16.5	108°49.6	10.8	177°36.8	07.0	158°08.9	12.9	235°14.9	03.4
21	241°19.0	123°48.8	·· 10.3	192°37.5	·· 07.5	173°10.8	·· 13.0	250°17.4	·· 03.4
22	256°21.4	138°47.9	09.8	207°38.2	08.0	188°12.7	13.1	265°19.9	03.4
23	271°23.9	153°47.1	09.3	222°38.9	08.5	203°14.6	13.1	280°22.4	03.4
Mer.pass. 04:57		ν -0.8′	d -0.5′	m -3.90	ν 0.7′	d 0.5′	m 0.95	ν 1.9′	d 0.1′ m -2.04	ν 2.5′	d -0.0′ m 0.88

Stars

	SHA	Dec
Alpheratz	357°35.1	29°13.4
Ankaa	353°07.5	-42°10.1
Schedar	349°31.5	56°40.0
Diphda	348°47.7	-17°51.0
Achernar	335°20.6	-57°06.4
Hamal	327°51.8	23°34.6
Polaris	314°30.5	89°21.8
Acamar	315°12.3	-40°12.2
Menkar	314°06.8	4°11.2
Mirfak	308°29.2	49°56.7
Aldebaran	290°40.4	16°33.5
Rigel	281°04.6	-8°10.3
Capella	280°23.0	46°01.3
Bellatrix	278°23.6	6°22.3
Elnath	278°02.8	28°37.7
Alnilam	275°38.5	-1°11.1
Betelgeuse	270°52.9	7°24.7
Canopus	263°53.1	-52°42.4
Sirius	258°27.0	-16°44.9
Adhara	255°06.6	-29°00.2
Procyon	244°51.6	5°09.8
Pollux	243°18.2	27°58.1
Avior	234°15.5	-59°35.3
Suhail	222°47.0	-43°31.9
Miaplacidus	221°39.2	-69°49.2
Alphard	217°48.4	-8°45.9
Regulus	207°35.1	11°51.0
Dubhe	193°41.8	61°37.4
Denebola	182°25.5	14°26.2
Gienah	175°44.1	-17°40.7
Acrux	173°00.7	-63°14.4
Gacrux	171°52.2	-57°15.3
Alioth	166°13.3	55°49.9
Spica	158°22.7	-11°17.4
Alkaid	152°52.2	49°11.7
Hadar	148°36.4	-60°29.7
Menkent	147°58.0	-36°29.6
Arcturus	145°48.2	19°03.4
Rigil Kent.	139°40.6	-60°56.4
Kochab	137°19.2	74°03.5
Zuben'ubi	136°56.3	-16°08.7
Alphecca	126°03.9	26°38.1
Antares	112°16.0	-26°29.2
Atria	107°10.1	-69°04.4
Sabik	102°02.9	-15°45.3
Shaula	96°10.5	-37°07.3
Rasalhague	95°58.6	12°32.6
Eltanin	90°41.9	51°29.2
Kaus Aust.	83°32.7	-34°22.4
Vega	80°33.1	38°48.4
Nunki	75°47.9	-26°15.9
Altair	62°00.0	8°56.0
Peacock	53°05.8	-56°39.2
Deneb	49°25.7	45°21.9
Enif	33°39.0	9°59.2
Al Na'ir	27°33.1	-46°50.3
Fomalhaut	15°14.8	-29°29.4
Scheat	13°45.4	28°12.8
Markab	13°30.2	15°20.2

Jul 05 Fri	SHA	Mer.pass
Venus	246°16.6	12:42
Mars	313°21.8	08:12
Jupiter	292°30.5	09:35
Saturn	8°57.0	04:30

Jul 06 Sat	SHA	Mer.pass
Venus	244°57.5	12:43
Mars	312°39.0	08:11
Jupiter	292°17.0	09:32
Saturn	8°57.4	04:26

Jul 07 Sun	SHA	Mer.pass
Venus	243°38.6	12:44
Mars	311°56.1	08:10
Jupiter	292°03.5	09:29
Saturn	8°57.9	04:22

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°50.6	N22°45.4	191°30.2	5.7′	N28°22.0	0.0′	57.1′
1	193°50.5	45.1	205°54.9	5.8′	28°22.0	0.3′	57.1′
2	208°50.4	44.9	220°19.7	5.8′	28°21.7	0.4′	57.1′
3	223°50.3	·· 44.7	234°44.5	5.8′	28°21.3	0.6′	57.0′
4	238°50.2	44.4	249°09.3	5.9′	28°20.7	0.8′	57.0′
5	253°50.1	44.2	263°34.2	5.9′	28°19.9	0.9′	57.0′
6	268°50.0	N22°43.9	277°59.1	6.0′	N28°19.0	1.1′	57.0′
7	283°49.9	43.7	292°24.1	6.0′	28°17.9	1.3′	57.0′
8	298°49.8	43.4	306°49.1	6.0′	28°16.6	1.5′	56.9′
9	313°49.7	·· 43.2	321°14.1	6.1′	28°15.1	1.6′	56.9′
10	328°49.6	42.9	335°39.2	6.1′	28°13.5	1.8′	56.9′
11	343°49.5	42.7	350°04.3	6.2′	28°11.7	1.9′	56.9′
12	358°49.3	N22°42.5	4°29.5	6.2′	N28°09.8	2.2′	56.8′
13	13°49.2	42.2	18°54.8	6.3′	28°07.6	2.3′	56.8′
14	28°49.1	42.0	33°20.1	6.4′	28°05.3	2.4′	56.8′
15	43°49.0	·· 41.7	47°45.4	6.4′	28°02.9	2.6′	56.8′
16	58°48.9	41.5	62°10.8	6.5′	28°00.3	2.8′	56.7′
17	73°48.8	41.2	76°36.3	6.5′	27°57.5	3.0′	56.7′
18	88°48.7	N22°41.0	91°01.8	6.6′	N27°54.5	3.1′	56.7′
19	103°48.6	40.7	105°27.4	6.7′	27°51.4	3.2′	56.7′
20	118°48.5	40.4	119°53.1	6.7′	27°48.2	3.5′	56.7′
21	133°48.4	·· 40.2	134°18.8	6.8′	27°44.7	3.5′	56.6′
22	148°48.3	39.9	148°44.7	6.9′	27°41.2	3.8′	56.6′
23	163°48.2	39.7	163°10.5	6.9′	27°37.4	3.9′	56.6′
	SD = 15.7′	d = -0.2′	SD = 15.6′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°48.1	N22°39.4	177°36.5	7.0′	N27°33.5	4.0′	56.6′
1	193°48.0	39.2	192°02.5	7.1′	27°29.5	4.3′	56.5′
2	208°47.9	38.9	206°28.6	7.2′	27°25.2	4.3′	56.5′
3	223°47.8	·· 38.7	220°54.8	7.3′	27°20.9	4.5′	56.5′
4	238°47.7	38.4	235°21.0	7.3′	27°16.4	4.7′	56.5′
5	253°47.6	38.1	249°47.4	7.4′	27°11.7	4.8′	56.4′
6	268°47.4	N22°37.9	264°13.8	7.5′	N27°06.9	5.0′	56.4′
7	283°47.3	37.6	278°40.3	7.6′	27°01.9	5.1′	56.4′
8	298°47.2	37.4	293°06.9	7.7′	26°56.8	5.3′	56.4′
9	313°47.1	·· 37.1	307°33.5	7.8′	26°51.5	5.4′	56.4′
10	328°47.0	36.8	322°00.3	7.8′	26°46.1	5.6′	56.3′
11	343°46.9	36.6	336°27.1	7.9′	26°40.5	5.7′	56.3′
12	358°46.8	N22°36.3	350°54.1	8.0′	N26°34.8	5.8′	56.3′
13	13°46.7	36.0	5°21.1	8.1′	26°29.0	6.0′	56.3′
14	28°46.6	35.8	19°48.2	8.2′	26°23.0	6.1′	56.2′
15	43°46.5	·· 35.5	34°15.4	8.3′	26°16.9	6.3′	56.2′
16	58°46.4	35.2	48°42.7	8.4′	26°10.6	6.4′	56.2′
17	73°46.3	35.0	63°10.1	8.5′	26°04.2	6.5′	56.2′
18	88°46.2	N22°34.7	77°37.6	8.6′	N25°57.7	6.7′	56.1′
19	103°46.1	34.4	92°05.1	8.7′	25°51.0	6.8′	56.1′
20	118°46.0	34.2	106°32.8	8.8′	25°44.2	6.9′	56.1′
21	133°45.9	·· 33.9	121°00.6	8.9′	25°37.3	7.1′	56.1′
22	148°45.8	33.6	135°28.5	9.0′	25°30.2	7.1′	56.0′
23	163°45.7	33.4	149°56.4	9.1′	25°23.1	7.4′	56.0′
	SD = 15.7′	d = -0.3′	SD = 15.4′				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°45.6	N22°33.1	164°24.5	9.2′	N25°15.7	7.4′	56.0′
1	193°45.5	32.8	178°52.7	9.3′	25°08.3	7.6′	56.0′
2	208°45.4	32.5	193°20.9	9.4′	25°00.7	7.7′	56.0′
3	223°45.3	·· 32.3	207°49.3	9.5′	24°53.0	7.8′	55.9′
4	238°45.2	32.0	222°17.8	9.6′	24°45.2	7.9′	55.9′
5	253°45.1	31.7	236°46.3	9.7′	24°37.3	8.1′	55.9′
6	268°45.0	N22°31.4	251°15.0	9.8′	N24°29.2	8.2′	55.9′
7	283°44.9	31.2	265°43.8	9.9′	24°21.0	8.3′	55.8′
8	298°44.8	30.9	280°12.6	10.0′	24°12.7	8.4′	55.8′
9	313°44.7	·· 30.6	294°41.6	10.1′	24°04.3	8.5′	55.8′
10	328°44.6	30.3	309°10.7	10.2′	23°55.8	8.6′	55.8′
11	343°44.5	30.1	323°39.9	10.3′	23°47.2	8.8′	55.7′
12	358°44.4	N22°29.8	338°09.2	10.4′	N23°38.4	8.8′	55.7′
13	13°44.3	29.5	352°38.5	10.5′	23°29.6	9.0′	55.7′
14	28°44.2	29.2	7°08.0	10.6′	23°20.6	9.1′	55.7′
15	43°44.1	·· 28.9	21°37.6	10.7′	23°11.5	9.2′	55.7′
16	58°44.0	28.6	36°07.3	10.8′	23°02.3	9.2′	55.6′
17	73°43.9	28.4	50°37.1	10.9′	22°53.1	9.4′	55.6′
18	88°43.8	N22°28.1	65°07.0	11.0′	N22°43.7	9.5′	55.6′
19	103°43.7	27.8	79°37.0	11.1′	22°34.2	9.6′	55.6′
20	118°43.6	27.5	94°07.1	11.2′	22°24.6	9.7′	55.5′
21	133°43.5	·· 27.2	108°37.3	11.3′	22°14.9	9.8′	55.5′
22	148°43.4	26.9	123°07.6	11.4′	22°05.1	9.9′	55.5′
23	163°43.3	26.6	137°38.1	11.5′	21°55.2	10.0′	55.5′
	SD = 15.7′	d = -0.3′	SD = 15.3′				

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

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

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 0-2 1-1%
05	04:37	04:43	12:05	11:41	–:–	
06	04:48	04:53	12:05	12:38	00:10	
07	04:58	05:02	12:05	13:30	01:05	

July 08, 09, 10 UT (Mon., Tue., Wed.)

	Aries	Venus		Mars		Jupiter		Saturn	
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	286°26.4	168°46.3	N22°08.8	237°39.5	N17°09.0	218°16.5	N21°13.2	295°24.9	S06°03.5
1	301°28.8	183°45.5	08.3	252°40.2	09.5	233°18.4	13.3	310°27.4	03.5
2	316°31.3	198°44.7	07.8	267°40.9	10.0	248°20.3	13.4	325°29.9	03.5
3	331°33.8	213°43.9	·· 07.3	282°41.6	·· 10.5	263°22.2	·· 13.4	340°32.4	·· 03.5
4	346°36.2	228°43.1	06.8	297°42.2	11.0	278°24.1	13.5	355°34.9	03.5
5	1°38.7	243°42.3	06.3	312°42.9	11.4	293°26.1	13.6	10°37.3	03.6
6	16°41.1	258°41.5	N22°05.8	327°43.6	N17°11.9	308°28.0	N21°13.7	25°39.8	S06°03.6
7	31°43.6	273°40.7	05.3	342°44.3	12.4	323°29.9	13.8	40°42.3	03.6
8	46°46.1	288°39.9	04.8	357°45.0	12.9	338°31.8	13.8	55°44.8	03.6
9	61°48.5	303°39.1	·· 04.2	12°45.6	·· 13.4	353°33.7	·· 13.9	70°47.3	·· 03.7
10	76°51.0	318°38.3	03.7	27°46.3	13.9	8°35.6	14.0	85°49.8	03.7
11	91°53.5	333°37.5	03.2	42°47.0	14.4	23°37.5	14.1	100°52.3	03.7
12	106°55.9	348°36.6	N22°02.7	57°47.7	N17°14.9	38°39.4	N21°14.1	115°54.8	S06°03.7
13	121°58.4	3°35.8	02.2	72°48.3	15.4	53°41.3	14.2	130°57.3	03.8
14	137°00.9	18°35.0	01.7	87°49.0	15.8	68°43.2	14.3	145°59.8	03.8
15	152°03.3	33°34.2	·· 01.2	102°49.7	·· 16.3	83°45.1	·· 14.4	161°02.3	·· 03.8
16	167°05.8	48°33.4	00.6	117°50.4	16.8	98°47.0	14.5	176°04.8	03.8
17	182°08.3	63°32.6	22°00.1	132°51.0	17.3	113°49.0	14.5	191°07.3	03.9
18	197°10.7	78°31.8	N21°59.6	147°51.7	N17°17.8	128°50.9	N21°14.6	206°09.8	S06°03.9
19	212°13.2	93°31.0	59.1	162°52.4	18.3	143°52.8	14.7	221°12.3	03.9
20	227°15.6	108°30.2	58.5	177°53.1	18.8	158°54.7	14.8	236°14.8	03.9
21	242°18.1	123°29.4	·· 58.0	192°53.7	·· 19.2	173°56.6	·· 14.8	251°17.2	·· 04.0
22	257°20.6	138°28.6	57.5	207°54.4	19.7	188°58.5	14.9	266°19.7	04.0
23	272°23.0	153°27.8	57.0	222°55.1	20.2	204°00.4	15.0	281°22.2	04.0
Mer.pass. 04:53		ν -0.8′	d -0.5′	m -3.89	ν 0.7′	d 0.5′	m 0.95	ν 1.9′	d 0.1′ m -2.04	ν 2.5′	d -0.0′ m 0.87

Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	287°25.5	168°27.0	N21°56.4	237°55.8	N17°20.7	219°02.3	N21°15.1	296°24.7	S06°04.0
1	302°28.0	183°26.2	55.9	252°56.5	21.2	234°04.2	15.2	311°27.2	04.0
2	317°30.4	198°25.4	55.4	267°57.1	21.7	249°06.1	15.2	326°29.7	04.1
3	332°32.9	213°24.6	·· 54.8	282°57.8	·· 22.1	264°08.1	·· 15.3	341°32.2	·· 04.1
4	347°35.4	228°23.8	54.3	297°58.5	22.6	279°10.0	15.4	356°34.7	04.1
5	2°37.8	243°23.0	53.8	312°59.2	23.1	294°11.9	15.5	11°37.2	04.1
6	17°40.3	258°22.2	N21°53.2	327°59.8	N17°23.6	309°13.8	N21°15.5	26°39.7	S06°04.2
7	32°42.8	273°21.5	52.7	343°00.5	24.1	324°15.7	15.6	41°42.2	04.2
8	47°45.2	288°20.7	52.2	358°01.2	24.6	339°17.6	15.7	56°44.7	04.2
9	62°47.7	303°19.9	·· 51.6	13°01.9	·· 25.0	354°19.5	·· 15.8	71°47.2	·· 04.2
10	77°50.1	318°19.1	51.1	28°02.5	25.5	9°21.4	15.8	86°49.7	04.3
11	92°52.6	333°18.3	50.5	43°03.2	26.0	24°23.3	15.9	101°52.2	04.3
12	107°55.1	348°17.5	N21°50.0	58°03.9	N17°26.5	39°25.2	N21°16.0	116°54.7	S06°04.3
13	122°57.5	3°16.7	49.5	73°04.6	27.0	54°27.2	16.1	131°57.2	04.3
14	138°00.0	18°15.9	48.9	88°05.2	27.4	69°29.1	16.2	146°59.7	04.4
15	153°02.5	33°15.1	·· 48.4	103°05.9	·· 27.9	84°31.0	·· 16.2	162°02.2	·· 04.4
16	168°04.9	48°14.3	47.8	118°06.6	28.4	99°32.9	16.3	177°04.7	04.4
17	183°07.4	63°13.5	47.3	133°07.3	28.9	114°34.8	16.4	192°07.2	04.5
18	198°09.9	78°12.7	N21°46.7	148°07.9	N17°29.4	129°36.7	N21°16.5	207°09.7	S06°04.5
19	213°12.3	93°11.9	46.2	163°08.6	29.8	144°38.6	16.5	222°12.2	04.5
20	228°14.8	108°11.1	45.6	178°09.3	30.3	159°40.5	16.6	237°14.7	04.5
21	243°17.3	123°10.4	·· 45.1	193°10.0	·· 30.8	174°42.5	·· 16.7	252°17.2	·· 04.6
22	258°19.7	138°09.6	44.5	208°10.6	31.3	189°44.4	16.8	267°19.7	04.6
23	273°22.2	153°08.8	44.0	223°11.3	31.8	204°46.3	16.8	282°22.2	04.6
Mer.pass. 04:50		ν -0.8′	d -0.5′	m -3.89	ν 0.7′	d 0.5′	m 0.94	ν 1.9′	d 0.1′ m -2.05	ν 2.5′	d -0.0′ m 0.87

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	288°24.6	168°08.0	N21°43.4	238°12.0	N17°32.2	219°48.2	N21°16.9	297°24.7	S06°04.6
1	303°27.1	183°07.2	42.9	253°12.7	32.7	234°50.1	17.0	312°27.2	04.7
2	318°29.6	198°06.4	42.3	268°13.4	33.2	249°52.0	17.1	327°29.7	04.7
3	333°32.0	213°05.6	·· 41.7	283°14.0	·· 33.7	264°53.9	·· 17.1	342°32.2	·· 04.7
4	348°34.5	228°04.8	41.2	298°14.7	34.1	279°55.8	17.2	357°34.7	04.7
5	3°37.0	243°04.0	40.6	313°15.4	34.6	294°57.8	17.3	12°37.2	04.8
6	18°39.4	258°03.3	N21°40.1	328°16.1	N17°35.1	309°59.7	N21°17.4	27°39.7	S06°04.8
7	33°41.9	273°02.5	39.5	343°16.7	35.6	325°01.6	17.4	42°42.2	04.8
8	48°44.4	288°01.7	38.9	358°17.4	36.0	340°03.5	17.5	57°44.7	04.8
9	63°46.8	303°00.9	·· 38.4	13°18.1	·· 36.5	355°05.4	·· 17.6	72°47.2	·· 04.9
10	78°49.3	318°00.1	37.8	28°18.8	37.0	10°07.3	17.7	87°49.7	04.9
11	93°51.7	332°59.3	37.2	43°19.4	37.5	25°09.2	17.7	102°52.2	04.9
12	108°54.2	347°58.6	N21°36.7	58°20.1	N17°37.9	40°11.1	N21°17.8	117°54.7	S06°05.0
13	123°56.7	2°57.8	36.1	73°20.8	38.4	55°13.1	17.9	132°57.2	05.0
14	138°59.1	17°57.0	35.5	88°21.5	38.9	70°15.0	18.0	147°59.7	05.0
15	154°01.6	32°56.2	·· 35.0	103°22.1	·· 39.3	85°16.9	·· 18.1	163°02.2	·· 05.0
16	169°04.1	47°55.4	34.4	118°22.8	39.8	100°18.8	18.1	178°04.7	05.1
17	184°06.5	62°54.6	33.8	133°23.5	40.3	115°20.7	18.2	193°07.2	05.1
18	199°09.0	77°53.9	N21°33.2	148°24.2	N17°40.8	130°22.6	N21°18.3	208°09.7	S06°05.1
19	214°11.5	92°53.1	32.7	163°24.8	41.2	145°24.5	18.4	223°12.2	05.1
20	229°13.9	107°52.3	32.1	178°25.5	41.7	160°26.5	18.4	238°14.7	05.2
21	244°16.4	122°51.5	·· 31.5	193°26.2	·· 42.2	175°28.4	·· 18.5	253°17.2	·· 05.2
22	259°18.9	137°50.7	30.9	208°26.9	42.6	190°30.3	18.6	268°19.7	05.2
23	274°21.3	152°50.0	30.4	223°27.5	43.1	205°32.2	18.7	283°22.2	05.2
Mer.pass. 04:46		ν -0.8′	d -0.6′	m -3.89	ν 0.7′	d 0.5′	m 0.94	ν 1.9′	d 0.1′ m -2.05	ν 2.5′	d -0.0′ m 0.86

Stars

	SHA	Dec
Alpheratz	357°35.1	29°13.4
Ankaa	353°07.5	-42°10.1
Schedar	349°31.5	56°40.0
Diphda	348°47.7	-17°51.0
Achernar	335°20.6	-57°06.4
Hamal	327°51.8	23°34.6
Polaris	314°29.1	89°21.7
Acamar	315°12.3	-40°12.1
Menkar	314°06.7	4°11.2
Mirfak	308°29.2	49°56.7
Aldebaran	290°40.4	16°33.5
Rigel	281°04.6	-8°10.3
Capella	280°22.9	46°01.3
Bellatrix	278°23.6	6°22.4
Elnath	278°02.7	28°37.7
Alnilam	275°38.5	-1°11.1
Betelgeuse	270°52.9	7°24.7
Canopus	263°53.1	-52°42.4
Sirius	258°27.0	-16°44.9
Adhara	255°06.6	-29°00.2
Procyon	244°51.6	5°09.8
Pollux	243°18.2	27°58.1
Avior	234°15.6	-59°35.3
Suhail	222°47.0	-43°31.9
Miaplacidus	221°39.2	-69°49.2
Alphard	217°48.4	-8°45.9
Regulus	207°35.1	11°51.0
Dubhe	193°41.8	61°37.4
Denebola	182°25.5	14°26.2
Gienah	175°44.1	-17°40.7
Acrux	173°00.7	-63°14.4
Gacrux	171°52.2	-57°15.3
Alioth	166°13.3	55°49.9
Spica	158°22.7	-11°17.4
Alkaid	152°52.2	49°11.7
Hadar	148°36.4	-60°29.7
Menkent	147°58.0	-36°29.6
Arcturus	145°48.2	19°03.4
Rigil Kent.	139°40.6	-60°56.4
Kochab	137°19.2	74°03.5
Zuben'ubi	136°56.3	-16°08.7
Alphecca	126°03.9	26°38.1
Antares	112°16.0	-26°29.2
Atria	107°10.2	-69°04.4
Sabik	102°02.9	-15°45.3
Shaula	96°10.5	-37°07.3
Rasalhague	95°58.6	12°32.6
Eltanin	90°41.9	51°29.2
Kaus Aust.	83°32.7	-34°22.4
Vega	80°33.1	38°48.4
Nunki	75°47.9	-26°16.0
Altair	62°00.0	8°56.0
Peacock	53°05.8	-56°39.3
Deneb	49°25.7	45°21.9
Enif	33°38.9	9°59.2
Al Na'ir	27°33.1	-46°50.3
Fomalhaut	15°14.8	-29°29.4
Scheat	13°45.4	28°12.8
Markab	13°30.1	15°20.2

Jul 08 Mon	SHA	Mer.pass
Venus	242°20.0	12:46
Mars	311°13.2	08:09
Jupiter	291°50.2	09:26
Saturn	8°58.5	04:18

Jul 09 Tue	SHA	Mer.pass
Venus	241°01.5	12:47
Mars	310°30.3	08:08
Jupiter	291°36.8	09:23
Saturn	8°59.2	04:14

Jul 10 Wed	SHA	Mer.pass
Venus	239°43.3	12:48
Mars	309°47.4	08:07
Jupiter	291°23.5	09:20
Saturn	9°00.0	04:10

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	178°43.2	N22°26.4	152°08.6	11.6′	N21°45.2	10.0′	55.5′
1	193°43.1	26.1	166°39.2	11.7′	21°35.2	10.2′	55.4′
2	208°43.0	25.8	181°09.9	11.8′	21°25.0	10.3′	55.4′
3	223°42.9	·· 25.5	195°40.7	11.9′	21°14.7	10.3′	55.4′
4	238°42.8	25.2	210°11.6	12.0′	21°04.4	10.4′	55.4′
5	253°42.8	24.9	224°42.6	12.1′	20°54.0	10.6′	55.4′
6	268°42.7	N22°24.6	239°13.8	12.2′	N20°43.4	10.6′	55.3′
7	283°42.6	24.3	253°45.0	12.3′	20°32.8	10.7′	55.3′
8	298°42.5	24.0	268°16.3	12.4′	20°22.1	10.7′	55.3′
9	313°42.4	·· 23.7	282°47.7	12.5′	20°11.4	10.9′	55.3′
10	328°42.3	23.4	297°19.2	12.6′	20°00.5	10.9′	55.2′
11	343°42.2	23.1	311°50.8	12.7′	19°49.6	11.1′	55.2′
12	358°42.1	N22°22.8	326°22.5	12.8′	N19°38.5	11.1′	55.2′
13	13°42.0	22.5	340°54.3	12.9′	19°27.4	11.1′	55.2′
14	28°41.9	22.2	355°26.2	13.0′	19°16.3	11.3′	55.2′
15	43°41.8	·· 21.9	9°58.2	13.1′	19°05.0	11.3′	55.1′
16	58°41.7	21.6	24°30.2	13.2′	18°53.7	11.4′	55.1′
17	73°41.6	21.4	39°02.4	13.3′	18°42.3	11.5′	55.1′
18	88°41.5	N22°21.0	53°34.7	13.4′	N18°30.8	11.5′	55.1′
19	103°41.4	20.7	68°07.0	13.4′	18°19.3	11.6′	55.1′
20	118°41.3	20.4	82°39.5	13.5′	18°07.7	11.7′	55.0′
21	133°41.2	·· 20.1	97°12.0	13.6′	17°56.0	11.8′	55.0′
22	148°41.2	19.8	111°44.6	13.7′	17°44.2	11.8′	55.0′
23	163°41.1	19.5	126°17.3	13.8′	17°32.4	11.9′	55.0′
	SD = 15.7′	d = -0.3′		SD = 15.1′			

Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	178°41.0	N22°19.2	140°50.1	13.9′	N17°20.5	11.9′	55.0′
1	193°40.9	18.9	155°23.0	14.0′	17°08.6	12.0′	55.0′
2	208°40.8	18.6	169°56.0	14.1′	16°56.6	12.1′	54.9′
3	223°40.7	·· 18.3	184°29.0	14.1′	16°44.5	12.1′	54.9′
4	238°40.6	18.0	199°02.2	14.2′	16°32.4	12.2′	54.9′
5	253°40.5	17.7	213°35.4	14.3′	16°20.2	12.3′	54.9′
6	268°40.4	N22°17.4	228°08.7	14.4′	N16°07.9	12.3′	54.9′
7	283°40.3	17.1	242°42.1	14.5′	15°55.6	12.3′	54.8′
8	298°40.2	16.8	257°15.5	14.5′	15°43.3	12.4′	54.8′
9	313°40.1	·· 16.5	271°49.1	14.6′	15°30.9	12.5′	54.8′
10	328°40.1	16.2	286°22.7	14.7′	15°18.4	12.5′	54.8′
11	343°40.0	15.8	300°56.4	14.8′	15°05.9	12.6′	54.8′
12	358°39.9	N22°15.5	315°30.2	14.9′	N14°53.3	12.6′	54.8′
13	13°39.8	15.2	330°04.0	14.9′	14°40.7	12.7′	54.7′
14	28°39.7	14.9	344°38.0	15.0′	14°28.0	12.7′	54.7′
15	43°39.6	·· 14.6	359°12.0	15.1′	14°15.3	12.8′	54.7′
16	58°39.5	14.3	13°46.0	15.1′	14°02.5	12.8′	54.7′
17	73°39.4	14.0	28°20.2	15.2′	13°49.7	12.9′	54.7′
18	88°39.3	N22°13.6	42°54.4	15.3′	N13°36.8	12.9′	54.7′
19	103°39.2	13.3	57°28.7	15.4′	13°23.9	12.9′	54.6′
20	118°39.2	13.0	72°03.0	15.4′	13°11.0	13.0′	54.6′
21	133°39.1	·· 12.7	86°37.5	15.5′	12°58.0	13.1′	54.6′
22	148°39.0	12.4	101°11.9	15.6′	12°44.9	13.1′	54.6′
23	163°38.9	12.0	115°46.5	15.6′	12°31.8	13.1′	54.6′
	SD = 15.7′	d = -0.3′		SD = 15.0′			

Wed	GHA	Dec	GHA	ν	Dec	d	HP
0	178°38.8	N22°11.7	130°21.1	15.7′	N12°18.7	13.1′	54.6′
1	193°38.7	11.4	144°55.8	15.7′	12°05.6	13.2′	54.6′
2	208°38.6	11.1	159°30.5	15.8′	11°52.4	13.3′	54.5′
3	223°38.5	·· 10.8	174°05.3	15.9′	11°39.1	13.2′	54.5′
4	238°38.5	10.4	188°40.2	15.9′	11°25.9	13.4′	54.5′
5	253°38.4	10.1	203°15.1	16.0′	11°12.5	13.3′	54.5′
6	268°38.3	N22°09.8	217°50.1	16.0′	N10°59.2	13.4′	54.5′
7	283°38.2	09.5	232°25.2	16.1′	10°45.8	13.4′	54.5′
8	298°38.1	09.1	247°00.3	16.1′	10°32.4	13.4′	54.5′
9	313°38.0	·· 08.8	261°35.4	16.2′	10°19.0	13.5′	54.5′
10	328°37.9	08.5	276°10.6	16.3′	10°05.5	13.5′	54.4′
11	343°37.9	08.2	290°45.9	16.3′	09°52.0	13.5′	54.4′
12	358°37.8	N22°07.8	305°21.2	16.4′	N09°38.5	13.6′	54.4′
13	13°37.7	07.5	319°56.5	16.4′	09°24.9	13.6′	54.4′
14	28°37.6	07.2	334°31.9	16.5′	09°11.3	13.6′	54.4′
15	43°37.5	·· 06.8	349°07.4	16.5′	08°57.7	13.6′	54.4′
16	58°37.4	06.5	3°42.9	16.5′	08°44.1	13.7′	54.4′
17	73°37.3	06.2	18°18.4	16.6′	08°30.4	13.7′	54.4′
18	88°37.3	N22°05.8	32°54.0	16.6′	N08°16.7	13.7′	54.4′
19	103°37.2	05.5	47°29.7	16.7′	08°03.0	13.7′	54.3′
20	118°37.1	05.2	62°05.3	16.7′	07°49.3	13.8′	54.3′
21	133°37.0	·· 04.8	76°41.1	16.8′	07°35.5	13.8′	54.3′
22	148°36.9	04.5	91°16.8	16.8′	07°21.7	13.8′	54.3′
23	163°36.8	04.2	105°52.6	16.8′	07°07.9	13.8′	54.3′
	SD = 15.7′	d = -0.3′		SD = 14.9′			

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

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

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 3-5 5-16%
08	05:07	05:12	12:05	14:19	01:55	
09	05:16	05:21	12:05	15:03	02:42	
10	05:25	05:29	12:05	15:45	03:24	

July 11, 12, 13 UT (Thu., Fri., Sat.)

	Aries	Venus		Mars		Jupiter		Saturn	
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	289°23.8	167°49.2	N21°29.8	238°28.2	N17°43.6	220°34.1	N21°18.7	298°24.7	S06°05.3
1	304°26.2	182°48.4	29.2	253°28.9	44.1	235°36.0	18.8	313°27.2	05.3
2	319°28.7	197°47.6	28.6	268°29.6	44.5	250°38.0	18.9	328°29.7	05.3
3	334°31.2	212°46.9	·· 28.0	283°30.2	·· 45.0	265°39.9	·· 19.0	343°32.2	·· 05.4
4	349°33.6	227°46.1	27.4	298°30.9	45.5	280°41.8	19.0	358°34.7	05.4
5	4°36.1	242°45.3	26.9	313°31.6	45.9	295°43.7	19.1	13°37.2	05.4
6	19°38.6	257°44.5	N21°26.3	328°32.3	N17°46.4	310°45.6	N21°19.2	28°39.7	S06°05.4
7	34°41.0	272°43.7	25.7	343°32.9	46.9	325°47.5	19.2	43°42.2	05.5
8	49°43.5	287°43.0	25.1	358°33.6	47.3	340°49.4	19.3	58°44.7	05.5
9	64°46.0	302°42.2	·· 24.5	13°34.3	·· 47.8	355°51.4	·· 19.4	73°47.2	·· 05.5
10	79°48.4	317°41.4	23.9	28°35.0	48.3	10°53.3	19.5	88°49.7	05.6
11	94°50.9	332°40.7	23.3	43°35.7	48.7	25°55.2	19.5	103°52.2	05.6
12	109°53.3	347°39.9	N21°22.7	58°36.3	N17°49.2	40°57.1	N21°19.6	118°54.7	S06°05.6
13	124°55.8	2°39.1	22.1	73°37.0	49.7	55°59.0	19.7	133°57.2	05.6
14	139°58.3	17°38.3	21.5	88°37.7	50.1	71°00.9	19.8	148°59.7	05.7
15	155°00.7	32°37.6	·· 20.9	103°38.4	·· 50.6	86°02.9	·· 19.8	164°02.2	·· 05.7
16	170°03.2	47°36.8	20.3	118°39.0	51.1	101°04.8	19.9	179°04.8	05.7
17	185°05.7	62°36.0	19.7	133°39.7	51.5	116°06.7	20.0	194°07.3	05.8
18	200°08.1	77°35.2	N21°19.1	148°40.4	N17°52.0	131°08.6	N21°20.1	209°09.8	S06°05.8
19	215°10.6	92°34.5	18.5	163°41.1	52.4	146°10.5	20.1	224°12.3	05.8
20	230°13.1	107°33.7	17.9	178°41.7	52.9	161°12.4	20.2	239°14.8	05.8
21	245°15.5	122°32.9	·· 17.3	193°42.4	·· 53.4	176°14.4	·· 20.3	254°17.3	·· 05.9
22	260°18.0	137°32.2	16.7	208°43.1	53.8	191°16.3	20.4	269°19.8	05.9
23	275°20.5	152°31.4	16.1	223°43.8	54.3	206°18.2	20.4	284°22.3	05.9
Mer.pass. 04:42		ν -0.8′	d -0.6′	m -3.89	ν 0.7′	d 0.5′	m 0.94	ν 1.9′	d 0.1′ m -2.05	ν 2.5′	d -0.0′ m 0.86

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	290°22.9	167°30.6	N21°15.5	238°44.4	N17°54.8	221°20.1	N21°20.5	299°24.8	S06°06.0
1	305°25.4	182°29.9	14.9	253°45.1	55.2	236°22.0	20.6	314°27.3	06.0
2	320°27.8	197°29.1	14.3	268°45.8	55.7	251°24.0	20.7	329°29.8	06.0
3	335°30.3	212°28.3	·· 13.7	283°46.5	·· 56.1	266°25.9	·· 20.7	344°32.3	·· 06.0
4	350°32.8	227°27.6	13.1	298°47.1	56.6	281°27.8	20.8	359°34.8	06.1
5	5°35.2	242°26.8	12.5	313°47.8	57.1	296°29.7	20.9	14°37.3	06.1
6	20°37.7	257°26.0	N21°11.9	328°48.5	N17°57.5	311°31.6	N21°20.9	29°39.8	S06°06.1
7	35°40.2	272°25.3	11.2	343°49.2	58.0	326°33.5	21.0	44°42.4	06.2
8	50°42.6	287°24.5	10.6	358°49.8	58.5	341°35.5	21.1	59°44.9	06.2
9	65°45.1	302°23.8	·· 10.0	13°50.5	·· 58.9	356°37.4	·· 21.2	74°47.4	·· 06.2
10	80°47.6	317°23.0	09.4	28°51.2	59.4	11°39.3	21.2	89°49.9	06.3
11	95°50.0	332°22.2	08.8	43°51.9	17°59.8	26°41.2	21.3	104°52.4	06.3
12	110°52.5	347°21.5	N21°08.2	58°52.5	N18°00.3	41°43.1	N21°21.4	119°54.9	S06°06.3
13	125°55.0	2°20.7	07.5	73°53.2	00.7	56°45.1	21.5	134°57.4	06.3
14	140°57.4	17°19.9	06.9	88°53.9	01.2	71°47.0	21.5	149°59.9	06.4
15	155°59.9	32°19.2	·· 06.3	103°54.6	·· 01.7	86°48.9	·· 21.6	165°02.4	·· 06.4
16	171°02.3	47°18.4	05.7	118°55.2	02.1	101°50.8	21.7	180°04.9	06.4
17	186°04.8	62°17.7	05.0	133°55.9	02.6	116°52.7	21.8	195°07.4	06.5
18	201°07.3	77°16.9	N21°04.4	148°56.6	N18°03.0	131°54.7	N21°21.8	210°09.9	S06°06.5
19	216°09.7	92°16.1	03.8	163°57.3	03.5	146°56.6	21.9	225°12.5	06.5
20	231°12.2	107°15.4	03.2	178°57.9	03.9	161°58.5	22.0	240°15.0	06.6
21	246°14.7	122°14.6	·· 02.5	193°58.6	·· 04.4	177°00.4	·· 22.0	255°17.5	·· 06.6
22	261°17.1	137°13.9	01.9	208°59.3	04.9	192°02.3	22.1	270°20.0	06.6
23	276°19.6	152°13.1	01.3	224°00.0	05.3	207°04.3	22.2	285°22.5	06.6
Mer.pass. 04:38		ν -0.8′	d -0.6′	m -3.89	ν 0.7′	d 0.5′	m 0.93	ν 1.9′	d 0.1′ m -2.05	ν 2.5′	d -0.0′ m 0.85

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	291°22.1	167°12.4	N21°00.6	239°00.6	N18°05.8	222°06.2	N21°22.3	300°25.0	S06°06.7
1	306°24.5	182°11.6	21°00.0	254°01.3	06.2	237°08.1	22.3	315°27.5	06.7
2	321°27.0	197°10.8	20°59.4	269°02.0	06.7	252°10.0	22.4	330°30.0	06.7
3	336°29.4	212°10.1	·· 58.7	284°02.7	·· 07.1	267°11.9	·· 22.5	345°32.5	·· 06.8
4	351°31.9	227°09.3	58.1	299°03.3	07.6	282°13.9	22.6	0°35.0	06.8
5	6°34.4	242°08.6	57.5	314°04.0	08.0	297°15.8	22.6	15°37.6	06.8
6	21°36.8	257°07.8	N20°56.8	329°04.7	N18°08.5	312°17.7	N21°22.7	30°40.1	S06°06.9
7	36°39.3	272°07.1	56.2	344°05.4	08.9	327°19.6	22.8	45°42.6	06.9
8	51°41.8	287°06.3	55.6	359°06.0	09.4	342°21.5	22.8	60°45.1	06.9
9	66°44.2	302°05.6	·· 54.9	14°06.7	·· 09.8	357°23.5	·· 22.9	75°47.6	·· 07.0
10	81°46.7	317°04.8	54.3	29°07.4	10.3	12°25.4	23.0	90°50.1	07.0
11	96°49.2	332°04.1	53.6	44°08.1	10.7	27°27.3	23.1	105°52.6	07.0
12	111°51.6	347°03.3	N20°53.0	59°08.7	N18°11.2	42°29.2	N21°23.1	120°55.1	S06°07.1
13	126°54.1	2°02.6	52.3	74°09.4	11.6	57°31.2	23.2	135°57.7	07.1
14	141°56.6	17°01.8	51.7	89°10.1	12.1	72°33.1	23.3	151°00.2	07.1
15	156°59.0	32°01.1	·· 51.0	104°10.8	·· 12.6	87°35.0	·· 23.3	166°02.7	·· 07.1
16	172°01.5	47°00.3	50.4	119°11.4	13.0	102°36.9	23.4	181°05.2	07.2
17	187°03.9	61°59.6	49.8	134°12.1	13.5	117°38.8	23.5	196°07.7	07.2
18	202°06.4	76°58.8	N20°49.1	149°12.8	N18°13.9	132°40.8	N21°23.6	211°10.2	S06°07.2
19	217°08.9	91°58.1	48.5	164°13.5	14.3	147°42.7	23.6	226°12.7	07.3
20	232°11.3	106°57.3	47.8	179°14.1	14.8	162°44.6	23.7	241°15.2	07.3
21	247°13.8	121°56.6	·· 47.1	194°14.8	·· 15.2	177°46.5	·· 23.8	256°17.8	·· 07.3
22	262°16.3	136°55.8	46.5	209°15.5	15.7	192°48.5	23.8	271°20.3	07.4
23	277°18.7	151°55.1	45.8	224°16.2	16.1	207°50.4	23.9	286°22.8	07.4
Mer.pass. 04:34		ν -0.8′	d -0.6′	m -3.89	ν 0.7′	d 0.5′	m 0.93	ν 1.9′	d 0.1′ m -2.06	ν 2.5′	d -0.0′ m 0.85

Stars

	SHA	Dec
Alpheratz	357°35.1	29°13.4
Ankaa	353°07.4	-42°10.1
Schedar	349°31.4	56°40.0
Diphda	348°47.7	-17°51.0
Achernar	335°20.5	-57°06.4
Hamal	327°51.7	23°34.6
Polaris	314°27.8	89°21.7
Acamar	315°12.3	-40°12.1
Menkar	314°06.7	4°11.2
Mirfak	308°29.1	49°56.7
Aldebaran	290°40.4	16°33.5
Rigel	281°04.6	-8°10.3
Capella	280°22.9	46°01.3
Bellatrix	278°23.6	6°22.4
Elnath	278°02.7	28°37.7
Alnilam	275°38.4	-1°11.1
Betelgeuse	270°52.8	7°24.8
Canopus	263°53.1	-52°42.4
Sirius	258°26.9	-16°44.9
Adhara	255°06.6	-29°00.2
Procyon	244°51.6	5°09.8
Pollux	243°18.2	27°58.1
Avior	234°15.6	-59°35.3
Suhail	222°47.0	-43°31.9
Miaplacidus	221°39.3	-69°49.1
Alphard	217°48.4	-8°45.8
Regulus	207°35.1	11°51.0
Dubhe	193°41.9	61°37.4
Denebola	182°25.5	14°26.2
Gienah	175°44.1	-17°40.7
Acrux	173°00.8	-63°14.4
Gacrux	171°52.2	-57°15.3
Alioth	166°13.4	55°49.9
Spica	158°22.7	-11°17.4
Alkaid	152°52.2	49°11.7
Hadar	148°36.5	-60°29.7
Menkent	147°58.0	-36°29.6
Arcturus	145°48.2	19°03.4
Rigil Kent.	139°40.7	-60°56.4
Kochab	137°19.2	74°03.5
Zuben'ubi	136°56.3	-16°08.7
Alphecca	126°03.9	26°38.1
Antares	112°16.1	-26°29.2
Atria	107°10.2	-69°04.4
Sabik	102°02.9	-15°45.3
Shaula	96°10.5	-37°07.3
Rasalhague	95°58.6	12°32.6
Eltanin	90°41.9	51°29.2
Kaus Aust.	83°32.7	-34°22.4
Vega	80°33.1	38°48.4
Nunki	75°47.9	-26°16.0
Altair	62°00.0	8°56.0
Peacock	53°05.8	-56°39.3
Deneb	49°25.6	45°22.0
Enif	33°38.9	9°59.2
Al Na'ir	27°33.0	-46°50.3
Fomalhaut	15°14.7	-29°29.4
Scheat	13°45.4	28°12.8
Markab	13°30.1	15°20.2

Jul 11 Thu	SHA	Mer.pass
Venus	238°25.4	12:49
Mars	309°04.4	08:06
Jupiter	291°10.3	09:17
Saturn	9°00.9	04:06

Jul 12 Fri	SHA	Mer.pass
Venus	237°07.7	12:51
Mars	308°21.5	08:05
Jupiter	290°57.2	09:13
Saturn	9°01.9	04:02

Jul 13 Sat	SHA	Mer.pass
Venus	235°50.3	12:52
Mars	307°38.6	08:04
Jupiter	290°44.1	09:10
Saturn	9°02.9	03:58

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h — Sun — Moon

Thu	GHA	Dec	GHA	ν	Dec	d	HP
0	178°36.8	N22°03.8	120°28.4	16.9′	N06°54.1	13.9′	54.3′
1	193°36.7	03.5	135°04.3	16.9′	06°40.2	13.8′	54.3′
2	208°36.6	03.2	149°40.2	16.9′	06°26.4	13.9′	54.3′
3	223°36.5	·· 02.8	164°16.2	17.0′	06°12.5	13.9′	54.3′
4	238°36.4	02.5	178°52.1	17.0′	05°58.6	13.9′	54.3′
5	253°36.3	02.1	193°28.1	17.0′	05°44.7	13.9′	54.3′
6	268°36.3	N22°01.8	208°04.2	17.1′	N05°30.8	14.0′	54.3′
7	283°36.2	01.5	222°40.2	17.1′	05°16.8	13.9′	54.2′
8	298°36.1	01.1	237°16.3	17.1′	05°02.9	14.0′	54.2′
9	313°36.0	·· 00.8	251°52.5	17.1′	04°48.9	14.0′	54.2′
10	328°35.9	00.4	266°28.6	17.2′	04°34.9	14.0′	54.2′
11	343°35.9	22°00.1	281°04.8	17.2′	04°20.9	14.0′	54.2′
12	358°35.8	N21°59.8	295°41.0	17.2′	N04°06.9	14.0′	54.2′
13	13°35.7	59.4	310°17.2	17.2′	03°52.9	14.0′	54.2′
14	28°35.6	59.1	324°53.4	17.3′	03°38.9	14.1′	54.2′
15	43°35.5	·· 58.7	339°29.7	17.3′	03°24.8	14.0′	54.2′
16	58°35.5	58.4	354°06.0	17.3′	03°10.8	14.1′	54.2′
17	73°35.4	58.0	8°42.3	17.3′	02°56.7	14.0′	54.2′
18	88°35.3	N21°57.7	23°18.6	17.3′	N02°42.7	14.1′	54.2′
19	103°35.2	57.3	37°54.9	17.3′	02°28.6	14.1′	54.2′
20	118°35.1	57.0	52°31.3	17.4′	02°14.5	14.1′	54.2′
21	133°35.1	·· 56.6	67°07.6	17.4′	02°00.4	14.1′	54.2′
22	148°35.0	56.3	81°44.0	17.4′	01°46.3	14.0′	54.2′
23	163°34.9	55.9	96°20.4	17.4′	01°32.3	14.1′	54.2′
	SD = 15.7′	d = -0.3′		SD = 14.8′			

Fri	GHA	Dec	GHA	ν	Dec	d	HP
0	178°34.8	N21°55.6	110°56.8	17.4′	N01°18.2	14.1′	54.2′
1	193°34.7	55.2	125°33.2	17.4′	01°04.1	14.1′	54.2′
2	208°34.7	54.9	140°09.6	17.4′	00°50.0	14.1′	54.2′
3	223°34.6	·· 54.5	154°46.0	17.4′	00°35.9	14.1′	54.2′
4	238°34.5	54.2	169°22.4	17.4′	00°21.8	14.1′	54.2′
5	253°34.4	53.8	183°58.9	17.4′	N00°07.7	14.1′	54.2′
6	268°34.4	N21°53.4	198°35.3	17.4′	S00°06.4	14.1′	54.2′
7	283°34.3	53.1	213°11.7	17.4′	00°20.5	14.1′	54.2′
8	298°34.2	52.7	227°48.1	17.4′	00°34.6	14.1′	54.2′
9	313°34.1	·· 52.4	242°24.6	17.4′	00°48.7	14.1′	54.2′
10	328°34.1	52.0	257°01.0	17.4′	01°02.8	14.1′	54.2′
11	343°34.0	51.7	271°37.4	17.4′	01°16.9	14.0′	54.2′
12	358°33.9	N21°51.3	286°13.8	17.4′	S01°30.9	14.1′	54.2′
13	13°33.8	50.9	300°50.3	17.4′	01°45.0	14.1′	54.2′
14	28°33.8	50.6	315°26.7	17.4′	01°59.1	14.0′	54.2′
15	43°33.7	·· 50.2	330°03.1	17.4′	02°13.1	14.1′	54.2′
16	58°33.6	49.9	344°39.5	17.4′	02°27.2	14.0′	54.2′
17	73°33.5	49.5	359°15.8	17.4′	02°41.2	14.1′	54.2′
18	88°33.5	N21°49.1	13°52.2	17.4′	S02°55.3	14.0′	54.2′
19	103°33.4	48.8	28°28.6	17.3′	03°09.3	14.0′	54.2′
20	118°33.3	48.4	43°04.9	17.3′	03°23.3	14.0′	54.2′
21	133°33.2	·· 48.0	57°41.2	17.3′	03°37.3	14.0′	54.2′
22	148°33.2	47.7	72°17.5	17.3′	03°51.3	14.0′	54.2′
23	163°33.1	47.3	86°53.8	17.3′	04°05.3	14.0′	54.2′
	SD = 15.7′	d = -0.4′		SD = 14.8′			

Sat	GHA	Dec	GHA	ν	Dec	d	HP
0	178°33.0	N21°46.9	101°30.1	17.3′	S04°19.3	14.0′	54.2′
1	193°32.9	46.6	116°06.4	17.2′	04°33.3	13.9′	54.2′
2	208°32.9	46.2	130°42.6	17.2′	04°47.2	13.9′	54.2′
3	223°32.8	·· 45.8	145°18.8	17.2′	05°01.1	14.0′	54.2′
4	238°32.7	45.5	159°55.0	17.2′	05°15.1	13.9′	54.2′
5	253°32.7	45.1	174°31.2	17.1′	05°29.0	13.9′	54.2′
6	268°32.6	N21°44.7	189°07.3	17.1′	S05°42.9	13.8′	54.2′
7	283°32.5	44.3	203°43.4	17.1′	05°56.7	13.9′	54.2′
8	298°32.4	44.0	218°19.5	17.1′	06°10.6	13.8′	54.2′
9	313°32.4	·· 43.6	232°55.5	17.0′	06°24.4	13.8′	54.2′
10	328°32.3	43.2	247°31.6	17.0′	06°38.2	13.8′	54.3′
11	343°32.2	42.8	262°07.6	17.0′	06°52.0	13.8′	54.3′
12	358°32.2	N21°42.5	276°43.5	16.9′	S07°05.8	13.7′	54.3′
13	13°32.1	42.1	291°19.4	16.9′	07°19.5	13.8′	54.3′
14	28°32.0	41.7	305°55.3	16.9′	07°33.3	13.7′	54.3′
15	43°31.9	·· 41.3	320°31.2	16.8′	07°47.0	13.7′	54.3′
16	58°31.9	41.0	335°07.0	16.8′	08°00.7	13.6′	54.3′
17	73°31.8	40.6	349°42.8	16.7′	08°14.3	13.7′	54.3′
18	88°31.7	N21°40.2	4°18.5	16.7′	S08°28.0	13.6′	54.3′
19	103°31.7	39.8	18°54.2	16.7′	08°41.6	13.6′	54.3′
20	118°31.6	39.4	33°29.9	16.6′	08°55.2	13.5′	54.3′
21	133°31.5	·· 39.1	48°05.5	16.6′	09°08.7	13.6′	54.4′
22	148°31.5	38.7	62°41.0	16.5′	09°22.3	13.5′	54.4′
23	163°31.4	38.3	77°16.6	16.5′	09°35.8	13.4′	54.4′
	SD = 15.7′	d = -0.4′		SD = 14.8′			

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

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

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 6-8 23-41%
11	05:33	05:37	12:06	16:24	04:05	
12	05:41	05:44	12:06	17:03	04:44	
13	05:48	05:51	12:06	17:42	05:23	

July 14, 15, 16 UT (Sun., Mon., Tue.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	292°21.2	166°54.3	N20°45.2	239°16.8	N18°16.6	222°52.3	N21°24.0	301°25.3	S06°07.4
1	307°23.7	181°53.6	44.5	254°17.5	17.0	237°54.2	24.1	316°27.8	07.5
2	322°26.1	196°52.9	43.9	269°18.2	17.5	252°56.2	24.1	331°30.3	07.5
3	337°28.6	211°52.1	·· 43.2	284°18.9	·· 17.9	267°58.1	·· 24.2	346°32.8	·· 07.5
4	352°31.1	226°51.4	42.5	299°19.5	18.4	283°00.0	24.3	1°35.4	07.6
5	7°33.5	241°50.6	41.9	314°20.2	18.8	298°01.9	24.3	16°37.9	07.6
6	22°36.0	256°49.9	N20°41.2	329°20.9	N18°19.3	313°03.9	N21°24.4	31°40.4	S06°07.6
7	37°38.4	271°49.1	40.6	344°21.6	19.7	328°05.8	24.5	46°42.9	07.7
8	52°40.9	286°48.4	39.9	359°22.2	20.2	343°07.7	24.6	61°45.4	07.7
9	67°43.4	301°47.7	·· 39.2	14°22.9	·· 20.6	358°09.6	·· 24.6	76°47.9	·· 07.7
10	82°45.8	316°46.9	38.6	29°23.6	21.0	13°11.6	24.7	91°50.4	07.8
11	97°48.3	331°46.2	37.9	44°24.3	21.5	28°13.5	24.8	106°53.0	07.8
12	112°50.8	346°45.4	N20°37.2	59°24.9	N18°21.9	43°15.4	N21°24.8	121°55.5	S06°07.8
13	127°53.2	1°44.7	36.6	74°25.6	22.4	58°17.3	24.9	136°58.0	07.9
14	142°55.7	16°44.0	35.9	89°26.3	22.8	73°19.3	25.0	152°00.5	07.9
15	157°58.2	31°43.2	·· 35.2	104°27.0	·· 23.3	88°21.2	·· 25.1	167°03.0	·· 07.9
16	173°00.6	46°42.5	34.5	119°27.7	23.7	103°23.1	25.1	182°05.5	08.0
17	188°03.1	61°41.8	33.9	134°28.3	24.1	118°25.0	25.2	197°08.1	08.0
18	203°05.5	76°41.0	N20°33.2	149°29.0	N18°24.6	133°27.0	N21°25.3	212°10.6	S06°08.0
19	218°08.0	91°40.3	32.5	164°29.7	25.0	148°28.9	25.3	227°13.1	08.1
20	233°10.5	106°39.5	31.8	179°30.4	25.5	163°30.8	25.4	242°15.6	08.1
21	248°12.9	121°38.8	·· 31.2	194°31.0	·· 25.9	178°32.7	·· 25.5	257°18.1	·· 08.1
22	263°15.4	136°38.1	30.5	209°31.7	26.4	193°34.7	25.5	272°20.6	08.2
23	278°17.9	151°37.3	29.8	224°32.4	26.8	208°36.6	25.6	287°23.2	08.2
Mer.pass. 04:30		ν -0.7′	d -0.7′	m -3.89	ν 0.7′	d 0.4′	m 0.93	ν 1.9′	d 0.1′ m -2.06	ν 2.5′	d -0.0′ m 0.84

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	293°20.3	166°36.6	N20°29.1	239°33.1	N18°27.2	223°38.5	N21°25.7	302°25.7	S06°08.2
1	308°22.8	181°35.9	28.4	254°33.7	27.7	238°40.4	25.8	317°28.2	08.3
2	323°25.3	196°35.1	27.8	269°34.4	28.1	253°42.4	25.8	332°30.7	08.3
3	338°27.7	211°34.4	·· 27.1	284°35.1	·· 28.6	268°44.3	·· 25.9	347°33.2	·· 08.3
4	353°30.2	226°33.7	26.4	299°35.8	29.0	283°46.2	26.0	2°35.7	08.4
5	8°32.7	241°32.9	25.7	314°36.4	29.4	298°48.1	26.0	17°38.3	08.4
6	23°35.1	256°32.2	N20°25.0	329°37.1	N18°29.9	313°50.1	N21°26.1	32°40.8	S06°08.4
7	38°37.6	271°31.5	24.3	344°37.8	30.3	328°52.0	26.2	47°43.3	08.5
8	53°40.0	286°30.8	23.6	359°38.5	30.7	343°53.9	26.2	62°45.8	08.5
9	68°42.5	301°30.0	·· 22.9	14°39.1	·· 31.2	358°55.9	·· 26.3	77°48.3	·· 08.5
10	83°45.0	316°29.3	22.3	29°39.8	31.6	13°57.8	26.4	92°50.9	08.6
11	98°47.4	331°28.6	21.6	44°40.5	32.1	28°59.7	26.5	107°53.4	08.6
12	113°49.9	346°27.8	N20°20.9	59°41.2	N18°32.5	44°01.6	N21°26.5	122°55.9	S06°08.6
13	128°52.4	1°27.1	20.2	74°41.8	32.9	59°03.6	26.6	137°58.4	08.7
14	143°54.8	16°26.4	19.5	89°42.5	33.4	74°05.5	26.7	153°00.9	08.7
15	158°57.3	31°25.7	·· 18.8	104°43.2	·· 33.8	89°07.4	·· 26.7	168°03.5	·· 08.7
16	173°59.8	46°24.9	18.1	119°43.9	34.2	104°09.4	26.8	183°06.0	08.8
17	189°02.2	61°24.2	17.4	134°44.5	34.7	119°11.3	26.9	198°08.5	08.8
18	204°04.7	76°23.5	N20°16.7	149°45.2	N18°35.1	134°13.2	N21°26.9	213°11.0	S06°08.8
19	219°07.2	91°22.8	16.0	164°45.9	35.5	149°15.1	27.0	228°13.5	08.9
20	234°09.6	106°22.0	15.3	179°46.6	36.0	164°17.1	27.1	243°16.1	08.9
21	249°12.1	121°21.3	·· 14.6	194°47.2	·· 36.4	179°19.0	·· 27.1	258°18.6	·· 08.9
22	264°14.5	136°20.6	13.9	209°47.9	36.8	194°20.9	27.2	273°21.1	09.0
23	279°17.0	151°19.9	13.2	224°48.6	37.3	209°22.9	27.3	288°23.6	09.0
Mer.pass. 04:26		ν -0.7′	d -0.7′	m -3.89	ν 0.7′	d 0.4′	m 0.92	ν 1.9′	d 0.1′ m -2.06	ν 2.5′	d -0.0′ m 0.84

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	294°19.5	166°19.2	N20°12.5	239°49.3	N18°37.7	224°24.8	N21°27.4	303°26.1	S06°09.0
1	309°21.9	181°18.4	11.8	254°49.9	38.1	239°26.7	27.4	318°28.7	09.1
2	324°24.4	196°17.7	11.1	269°50.6	38.6	254°28.6	27.5	333°31.2	09.1
3	339°26.9	211°17.0	·· 10.4	284°51.3	·· 39.0	269°30.6	·· 27.6	348°33.7	·· 09.2
4	354°29.3	226°16.3	09.7	299°52.0	39.4	284°32.5	27.6	3°36.2	09.2
5	9°31.8	241°15.6	08.9	314°52.6	39.9	299°34.4	27.7	18°38.8	09.2
6	24°34.3	256°14.8	N20°08.2	329°53.3	N18°40.3	314°36.4	N21°27.8	33°41.3	S06°09.3
7	39°36.7	271°14.1	07.5	344°54.0	40.7	329°38.3	27.8	48°43.8	09.3
8	54°39.2	286°13.4	06.8	359°54.7	41.1	344°40.2	27.9	63°46.3	09.3
9	69°41.6	301°12.7	·· 06.1	14°55.3	·· 41.6	359°42.2	·· 28.0	78°48.8	·· 09.4
10	84°44.1	316°12.0	05.4	29°56.0	42.0	14°44.1	28.0	93°51.4	09.4
11	99°46.6	331°11.3	04.7	44°56.7	42.4	29°46.0	28.1	108°53.9	09.4
12	114°49.0	346°10.5	N20°03.9	59°57.4	N18°42.9	44°47.9	N21°28.2	123°56.4	S06°09.5
13	129°51.5	1°09.8	03.2	74°58.0	43.3	59°49.9	28.2	138°58.9	09.5
14	144°54.0	16°09.1	02.5	89°58.7	43.7	74°51.8	28.3	154°01.5	09.5
15	159°56.4	31°08.4	·· 01.8	104°59.4	·· 44.1	89°53.7	·· 28.4	169°04.0	·· 09.6
16	174°58.9	46°07.7	01.1	120°00.1	44.6	104°55.7	28.5	184°06.5	09.6
17	190°01.4	61°07.0	20°00.4	135°00.7	45.0	119°57.6	28.5	199°09.0	09.7
18	205°03.8	76°06.3	N19°59.6	150°01.4	N18°45.4	134°59.5	N21°28.6	214°11.6	S06°09.7
19	220°06.3	91°05.5	58.9	165°02.1	45.9	150°01.5	28.7	229°14.1	09.7
20	235°08.8	106°04.8	58.2	180°02.8	46.3	165°03.4	28.7	244°16.6	09.8
21	250°11.2	121°04.1	·· 57.5	195°03.4	·· 46.7	180°05.3	·· 28.8	259°19.1	·· 09.8
22	265°13.7	136°03.4	56.7	210°04.1	47.1	195°07.3	28.9	274°21.7	09.8
23	280°16.1	151°02.7	56.0	225°04.8	47.6	210°09.2	28.9	289°24.2	09.9
Mer.pass. 04:22		ν -0.7′	d -0.7′	m -3.88	ν 0.7′	d 0.4′	m 0.92	ν 1.9′	d 0.1′ m -2.06	ν 2.5′	d -0.0′ m 0.83

Stars

	SHA	**Dec**
Alpheratz	357°35.1	29°13.4
Ankaa	353°07.4	-42°10.1
Schedar	349°31.4	56°40.1
Diphda	348°47.6	-17°51.0
Achernar	335°20.5	-57°06.4
Hamal	327°51.7	23°34.6
Polaris	314°26.3	89°21.7
Acamar	315°12.2	-40°12.1
Menkar	314°06.7	4°11.2
Mirfak	308°29.1	49°56.7
Aldebaran	290°40.3	16°33.5
Rigel	281°04.5	-8°10.3
Capella	280°22.9	46°01.3
Bellatrix	278°23.6	6°22.4
Elnath	278°02.7	28°37.7
Alnilam	275°38.4	-1°11.1
Betelgeuse	270°52.8	7°24.8
Canopus	263°53.1	-52°42.3
Sirius	258°26.9	-16°44.9
Adhara	255°06.6	-29°00.2
Procyon	244°51.6	5°09.8
Pollux	243°18.2	27°58.1
Avior	234°15.6	-59°35.3
Suhail	222°47.0	-43°31.9
Miaplacidus	221°39.3	-69°49.1
Alphard	217°48.4	-8°45.8
Regulus	207°35.1	11°51.0
Dubhe	193°41.9	61°37.4
Denebola	182°25.5	14°26.2
Gienah	175°44.1	-17°40.7
Acrux	173°00.8	-63°14.4
Gacrux	171°52.3	-57°15.3
Alioth	166°13.4	55°49.9
Spica	158°22.7	-11°17.4
Alkaid	152°52.3	49°11.7
Hadar	148°36.5	-60°29.7
Menkent	147°58.0	-36°29.6
Arcturus	145°48.2	19°03.4
Rigil Kent.	139°40.7	-60°56.4
Kochab	137°19.3	74°03.5
Zuben'ubi	136°56.3	-16°08.7
Alphecca	126°03.9	26°38.1
Antares	112°16.1	-26°29.2
Atria	107°10.2	-69°04.4
Sabik	102°03.0	-15°45.3
Shaula	96°10.5	-37°07.3
Rasalhague	95°58.6	12°32.6
Eltanin	90°41.9	51°29.2
Kaus Aust.	83°32.7	-34°22.4
Vega	80°33.1	38°48.4
Nunki	75°47.9	-26°16.0
Altair	62°00.0	8°56.0
Peacock	53°05.8	-56°39.3
Deneb	49°25.6	45°22.0
Enif	33°38.9	9°59.2
Al Na'ir	27°33.0	-46°50.4
Fomalhaut	15°14.7	-29°29.4
Scheat	13°45.4	28°12.8
Markab	13°30.1	15°20.2

Jul 14 Sun	**SHA**	**Mer.pass**
Venus	234°33.1	12:53
Mars	306°55.7	08:03
Jupiter	290°31.1	09:07
Saturn	9°04.1	03:54

Jul 15 Mon	**SHA**	**Mer.pass**
Venus	233°16.3	12:54
Mars	306°12.7	08:01
Jupiter	290°18.2	09:04
Saturn	9°05.3	03:50

Jul 16 Tue	**SHA**	**Mer.pass**
Venus	231°59.7	12:55
Mars	305°29.8	08:00
Jupiter	290°05.3	09:01
Saturn	9°06.7	03:46

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h — Sun — Moon

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	178°31.3	N21°37.9	91°52.0	16.4′	S09°49.2	13.5′	54.4′
1	193°31.3	37.5	106°27.5	16.4′	10°02.7	13.4′	54.4′
2	208°31.2	37.1	121°02.8	16.3′	10°16.1	13.4′	54.4′
3	223°31.1	·· 36.8	135°38.2	16.3′	10°29.5	13.3′	54.4′
4	238°31.1	36.4	150°13.4	16.2′	10°42.8	13.3′	54.4′
5	253°31.0	36.0	164°48.7	16.2′	10°56.1	13.3′	54.4′
6	268°30.9	N21°35.6	179°23.8	16.1′	S11°09.4	13.3′	54.5′
7	283°30.9	35.2	193°58.9	16.1′	11°22.7	13.2′	54.5′
8	298°30.8	34.8	208°34.0	16.0′	11°35.9	13.2′	54.5′
9	313°30.7	·· 34.4	223°09.0	15.9′	11°49.1	13.1′	54.5′
10	328°30.7	34.1	237°43.9	15.9′	12°02.2	13.1′	54.5′
11	343°30.6	33.7	252°18.8	15.8′	12°15.3	13.1′	54.5′
12	358°30.5	N21°33.3	266°53.6	15.8′	S12°28.4	13.0′	54.5′
13	13°30.5	32.9	281°28.4	15.7′	12°41.4	13.0′	54.6′
14	28°30.4	32.5	296°03.0	15.6′	12°54.4	12.9′	54.6′
15	43°30.3	·· 32.1	310°37.7	15.6′	13°07.3	12.9′	54.6′
16	58°30.3	31.7	325°12.2	15.5′	13°20.2	12.9′	54.6′
17	73°30.2	31.3	339°46.7	15.4′	13°33.1	12.8′	54.6′
18	88°30.1	N21°30.9	354°21.1	15.4′	S13°45.9	12.8′	54.6′
19	103°30.1	30.5	8°55.5	15.3′	13°58.7	12.7′	54.7′
20	118°30.0	30.1	23°29.8	15.2′	14°11.4	12.7′	54.7′
21	133°30.0	·· 29.7	38°04.0	15.1′	14°24.1	12.6′	54.7′
22	148°29.9	29.3	52°38.1	15.1′	14°36.7	12.6′	54.7′
23	163°29.8	28.9	67°12.2	15.0′	14°49.3	12.5′	54.7′
	SD = 15.7′	d = -0.4′	SD = 14.8′				

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	178°29.8	N21°28.5	81°46.2	14.9′	S15°01.8	12.5′	54.8′
1	193°29.7	28.1	96°20.1	14.8′	15°14.3	12.4′	54.8′
2	208°29.6	27.7	110°53.9	14.8′	15°26.7	12.4′	54.8′
3	223°29.6	·· 27.3	125°27.7	14.7′	15°39.1	12.3′	54.8′
4	238°29.5	26.9	140°01.4	14.6′	15°51.4	12.3′	54.8′
5	253°29.5	26.5	154°35.0	14.5′	16°03.7	12.2′	54.8′
6	268°29.4	N21°26.1	169°08.5	14.4′	S16°15.9	12.1′	54.9′
7	283°29.3	25.7	183°41.9	14.4′	16°28.0	12.1′	54.9′
8	298°29.3	25.3	198°15.3	14.3′	16°40.1	12.1′	54.9′
9	313°29.2	·· 24.9	212°48.5	14.2′	16°52.2	12.0′	54.9′
10	328°29.2	24.5	227°21.7	14.1′	17°04.2	11.9′	55.0′
11	343°29.1	24.1	241°54.8	14.0′	17°16.1	11.9′	55.0′
12	358°29.0	N21°23.7	256°27.8	13.9′	S17°28.0	11.7′	55.0′
13	13°29.0	23.3	271°00.7	13.8′	17°39.7	11.8′	55.0′
14	28°28.9	22.9	285°33.6	13.7′	17°51.5	11.7′	55.0′
15	43°28.9	·· 22.5	300°06.3	13.6′	18°03.2	11.6′	55.1′
16	58°28.8	22.1	314°39.0	13.6′	18°14.8	11.5′	55.1′
17	73°28.7	21.7	329°11.5	13.5′	18°26.3	11.5′	55.1′
18	88°28.7	N21°21.3	343°44.0	13.4′	S18°37.8	11.4′	55.1′
19	103°28.6	20.8	358°16.3	13.3′	18°49.2	11.3′	55.2′
20	118°28.6	20.4	12°48.6	13.2′	19°00.5	11.2′	55.2′
21	133°28.5	·· 20.0	27°20.8	13.1′	19°11.7	11.2′	55.2′
22	148°28.5	19.6	41°52.9	13.0′	19°22.9	11.1′	55.2′
23	163°28.4	19.2	56°24.8	12.9′	19°34.0	11.1′	55.2′
	SD = 15.7′	d = -0.4′	SD = 14.9′				

Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	178°28.3	N21°18.8	70°56.7	12.8′	S19°45.1	10.9′	55.3′
1	193°28.3	18.4	85°28.5	12.7′	19°56.0	10.9′	55.3′
2	208°28.2	18.0	100°00.2	12.6′	20°06.9	10.8′	55.3′
3	223°28.2	·· 17.5	114°31.8	12.5′	20°17.7	10.7′	55.3′
4	238°28.1	17.1	129°03.2	12.4′	20°28.4	10.7′	55.4′
5	253°28.1	16.7	143°34.6	12.3′	20°39.1	10.5′	55.4′
6	268°28.0	N21°16.3	158°05.9	12.2′	S20°49.6	10.5′	55.4′
7	283°28.0	15.9	172°37.1	12.1′	21°00.1	10.4′	55.5′
8	298°27.9	15.5	187°08.1	12.0′	21°10.5	10.3′	55.5′
9	313°27.8	·· 15.0	201°39.1	11.9′	21°20.8	10.2′	55.5′
10	328°27.8	14.6	216°09.9	11.7′	21°31.0	10.1′	55.5′
11	343°27.7	14.2	230°40.7	11.6′	21°41.1	10.0′	55.6′
12	358°27.7	N21°13.8	245°11.3	11.5′	S21°51.1	10.0′	55.6′
13	13°27.6	13.4	259°41.8	11.4′	22°01.1	9.8′	55.6′
14	28°27.6	12.9	274°12.3	11.3′	22°10.9	9.8′	55.6′
15	43°27.5	·· 12.5	288°42.6	11.2′	22°20.7	9.6′	55.7′
16	58°27.5	12.1	303°12.8	11.1′	22°30.3	9.6′	55.7′
17	73°27.4	11.7	317°42.9	11.0′	22°39.9	9.4′	55.7′
18	88°27.4	N21°11.2	332°12.8	10.9′	S22°49.3	9.4′	55.8′
19	103°27.3	10.8	346°42.7	10.8′	22°58.7	9.3′	55.8′
20	118°27.3	10.4	1°12.5	10.6′	23°08.0	9.1′	55.8′
21	133°27.2	·· 10.0	15°42.1	10.5′	23°17.1	9.1′	55.8′
22	148°27.2	09.5	30°11.7	10.4′	23°26.2	8.9′	55.9′
23	163°27.1	09.1	44°41.1	10.3′	23°35.1	8.9′	55.9′
	SD = 15.7′	d = -0.4′	SD = 15.1′				

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

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

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 9-11 50-69%
14	05:55	05:58	12:06	18:23	06:02	
15	06:01	06:04	12:06	19:07	06:45	
16	06:07	06:09	12:06	19:55	07:31	

July 17, 18, 19 UT (Wed., Thu., Fri.)

	Aries	Venus		Mars		Jupiter		Saturn	
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	295°18.6	166°02.0	N19°55.3	240°05.5	N18°48.0	225°11.1	N21°29.0	304°26.7	S06°09.9
1	310°21.1	181°01.3	54.5	255°06.1	48.4	240°13.1	29.1	319°29.2	09.9
2	325°23.5	196°00.6	53.8	270°06.8	48.8	255°15.0	29.1	334°31.8	10.0
3	340°26.0	210°59.9	·· 53.1	285°07.5	·· 49.3	270°16.9	·· 29.2	349°34.3	·· 10.0
4	355°28.5	225°59.2	52.3	300°08.2	49.7	285°18.9	29.3	4°36.8	10.1
5	10°30.9	240°58.4	51.6	315°08.8	50.1	300°20.8	29.3	19°39.3	10.1
6	25°33.4	255°57.7	N19°50.9	330°09.5	N18°50.5	315°22.7	N21°29.4	34°41.9	S06°10.1
7	40°35.9	270°57.0	50.1	345°10.2	50.9	330°24.7	29.5	49°44.4	10.2
8	55°38.3	285°56.3	49.4	0°10.9	51.4	345°26.6	29.5	64°46.9	10.2
9	70°40.8	300°55.6	·· 48.7	15°11.5	·· 51.8	0°28.5	·· 29.6	79°49.4	·· 10.2
10	85°43.3	315°54.9	47.9	30°12.2	52.2	15°30.5	29.7	94°52.0	10.3
11	100°45.7	330°54.2	47.2	45°12.9	52.6	30°32.4	29.7	109°54.5	10.3
12	115°48.2	345°53.5	N19°46.5	60°13.6	N18°53.1	45°34.3	N21°29.8	124°57.0	S06°10.4
13	130°50.6	0°52.8	45.7	75°14.2	53.5	60°36.3	29.9	139°59.5	10.4
14	145°53.1	15°52.1	45.0	90°14.9	53.9	75°38.2	29.9	155°02.1	10.4
15	160°55.6	30°51.4	·· 44.2	105°15.6	·· 54.3	90°40.1	·· 30.0	170°04.6	·· 10.5
16	175°58.0	45°50.7	43.5	120°16.3	54.7	105°42.1	30.1	185°07.1	10.5
17	191°00.5	60°50.0	42.7	135°16.9	55.2	120°44.0	30.1	200°09.6	10.5
18	206°03.0	75°49.3	N19°42.0	150°17.6	N18°55.6	135°45.9	N21°30.2	215°12.2	S06°10.6
19	221°05.4	90°48.6	41.3	165°18.3	56.0	150°47.9	30.3	230°14.7	10.6
20	236°07.9	105°47.9	40.5	180°19.0	56.4	165°49.8	30.3	245°17.2	10.7
21	251°10.4	120°47.2	·· 39.8	195°19.6	·· 56.8	180°51.7	·· 30.4	260°19.8	·· 10.7
22	266°12.8	135°46.5	39.0	210°20.3	57.3	195°53.7	30.5	275°22.3	10.7
23	281°15.3	150°45.8	38.3	225°21.0	57.7	210°55.6	30.5	290°24.8	10.8
Mer.pass. 04:18		ν -0.7′	d -0.7′	m -3.88	ν 0.7′	d 0.4′	m 0.92	ν 1.9′	d 0.1′ m -2.07	ν 2.5′	d -0.0′ m 0.83

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	296°17.8	165°45.1	N19°37.5	240°21.7	N18°58.1	225°57.5	N21°30.6	305°27.3	S06°10.8
1	311°20.2	180°44.4	36.8	255°22.3	58.5	240°59.5	30.7	320°29.9	10.8
2	326°22.7	195°43.7	36.0	270°23.0	58.9	256°01.4	30.7	335°32.4	10.9
3	341°25.1	210°43.0	·· 35.2	285°23.7	·· 59.3	271°03.4	·· 30.8	350°34.9	·· 10.9
4	356°27.6	225°42.3	34.5	300°24.4	18°59.8	286°05.3	30.9	5°37.5	11.0
5	11°30.1	240°41.6	33.7	315°25.0	19°00.2	301°07.2	30.9	20°40.0	11.0
6	26°32.5	255°40.9	N19°33.0	330°25.7	N19°00.6	316°09.2	N21°31.0	35°42.5	S06°11.0
7	41°35.0	270°40.2	32.2	345°26.4	01.0	331°11.1	31.1	50°45.0	11.1
8	56°37.5	285°39.6	31.5	0°27.1	01.4	346°13.0	31.1	65°47.6	11.1
9	71°39.9	300°38.9	·· 30.7	15°27.7	·· 01.8	1°15.0	·· 31.2	80°50.1	·· 11.2
10	86°42.4	315°38.2	29.9	30°28.4	02.2	16°16.9	31.3	95°52.6	11.2
11	101°44.9	330°37.5	29.2	45°29.1	02.7	31°18.8	31.3	110°55.2	11.2
12	116°47.3	345°36.8	N19°28.4	60°29.8	N19°03.1	46°20.8	N21°31.4	125°57.7	S06°11.3
13	131°49.8	0°36.1	27.6	75°30.4	03.5	61°22.7	31.5	141°00.2	11.3
14	146°52.3	15°35.4	26.9	90°31.1	03.9	76°24.7	31.5	156°02.8	11.3
15	161°54.7	30°34.7	·· 26.1	105°31.8	·· 04.3	91°26.6	·· 31.6	171°05.3	·· 11.4
16	176°57.2	45°34.0	25.4	120°32.5	04.7	106°28.5	31.7	186°07.8	11.4
17	191°59.6	60°33.3	24.6	135°33.1	05.1	121°30.5	31.7	201°10.4	11.5
18	207°02.1	75°32.6	N19°23.8	150°33.8	N19°05.5	136°32.4	N21°31.8	216°12.9	S06°11.5
19	222°04.6	90°32.0	23.0	165°34.5	06.0	151°34.3	31.9	231°15.4	11.5
20	237°07.0	105°31.3	22.3	180°35.2	06.4	166°36.3	31.9	246°17.9	11.6
21	252°09.5	120°30.6	·· 21.5	195°35.8	·· 06.8	181°38.2	·· 32.0	261°20.5	·· 11.6
22	267°12.0	135°29.9	20.7	210°36.5	07.2	196°40.2	32.1	276°23.0	11.7
23	282°14.4	150°29.2	20.0	225°37.2	07.6	211°42.1	32.1	291°25.5	11.7
Mer.pass. 04:14		ν -0.7′	d -0.8′	m -3.88	ν 0.7′	d 0.4′	m 0.91	ν 1.9′	d 0.1′ m -2.07	ν 2.5′	d -0.0′ m 0.82

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	297°16.9	165°28.5	N19°19.2	240°37.9	N19°08.0	226°44.0	N21°32.2	306°28.1	S06°11.7
1	312°19.4	180°27.8	18.4	255°38.5	08.4	241°46.0	32.3	321°30.6	11.8
2	327°21.8	195°27.2	17.6	270°39.2	08.8	256°47.9	32.3	336°33.1	11.8
3	342°24.3	210°26.5	·· 16.9	285°39.9	·· 09.2	271°49.9	·· 32.4	351°35.7	·· 11.9
4	357°26.7	225°25.8	16.1	300°40.6	09.6	286°51.8	32.5	6°38.2	11.9
5	12°29.2	240°25.1	15.3	315°41.2	10.1	301°53.7	32.5	21°40.7	11.9
6	27°31.7	255°24.4	N19°14.5	330°41.9	N19°10.5	316°55.7	N21°32.6	36°43.3	S06°12.0
7	42°34.1	270°23.7	13.7	345°42.6	10.9	331°57.6	32.7	51°45.8	12.0
8	57°36.6	285°23.1	13.0	0°43.3	11.3	346°59.6	32.7	66°48.3	12.1
9	72°39.1	300°22.4	·· 12.2	15°43.9	·· 11.7	2°01.5	·· 32.8	81°50.9	·· 12.1
10	87°41.5	315°21.7	11.4	30°44.6	12.1	17°03.4	32.8	96°53.4	12.1
11	102°44.0	330°21.0	10.6	45°45.3	12.5	32°05.4	32.9	111°55.9	12.2
12	117°46.5	345°20.3	N19°09.8	60°46.0	N19°12.9	47°07.3	N21°33.0	126°58.5	S06°12.2
13	132°48.9	0°19.7	09.0	75°46.6	13.3	62°09.3	33.0	142°01.0	12.3
14	147°51.4	15°19.0	08.3	90°47.3	13.7	77°11.2	33.1	157°03.5	12.3
15	162°53.9	30°18.3	·· 07.5	105°48.0	·· 14.1	92°13.1	·· 33.2	172°06.1	·· 12.3
16	177°56.3	45°17.6	06.7	120°48.7	14.5	107°15.1	33.2	187°08.6	12.4
17	192°58.8	60°17.0	05.9	135°49.4	14.9	122°17.0	33.3	202°11.1	12.4
18	208°01.2	75°16.3	N19°05.1	150°50.0	N19°15.3	137°19.0	N21°33.4	217°13.7	S06°12.5
19	223°03.7	90°15.6	04.3	165°50.7	15.7	152°20.9	33.4	232°16.2	12.5
20	238°06.2	105°14.9	03.5	180°51.4	16.1	167°22.8	33.5	247°18.7	12.5
21	253°08.6	120°14.3	·· 02.7	195°52.1	·· 16.5	182°24.8	·· 33.6	262°21.3	·· 12.6
22	268°11.1	135°13.6	01.9	210°52.7	16.9	197°26.7	33.6	277°23.8	12.6
23	283°13.6	150°12.9	01.1	225°53.4	17.3	212°28.7	33.7	292°26.3	12.7
Mer.pass. 04:10		ν -0.7′	d -0.8′	m -3.88	ν 0.7′	d 0.4′	m 0.91	ν 1.9′	d 0.1′ m -2.07	ν 2.5′	d -0.0′ m 0.82

Stars	SHA	Dec
Alpheratz	357°35.0	29°13.4
Ankaa	353°07.4	-42°10.1
Schedar	349°31.4	56°40.1
Diphda	348°47.6	-17°51.0
Achernar	335°20.5	-57°06.4
Hamal	327°51.7	23°34.6
Polaris	314°24.6	89°21.7
Acamar	315°12.2	-40°12.1
Menkar	314°06.7	4°11.2
Mirfak	308°29.1	49°56.7
Aldebaran	290°40.3	16°33.5
Rigel	281°04.5	-8°10.3
Capella	280°22.9	46°01.3
Bellatrix	278°23.6	6°22.4
Elnath	278°02.7	28°37.7
Alnilam	275°38.4	-1°11.1
Betelgeuse	270°52.8	7°24.8
Canopus	263°53.1	-52°42.3
Sirius	258°26.9	-16°44.9
Adhara	255°06.6	-29°00.2
Procyon	244°51.6	5°09.8
Pollux	243°18.2	27°58.1
Avior	234°15.6	-59°35.2
Suhail	222°47.0	-43°31.9
Miaplacidus	221°39.3	-69°49.1
Alphard	217°48.4	-8°45.8
Regulus	207°35.1	11°51.0
Dubhe	193°41.9	61°37.4
Denebola	182°25.5	14°26.2
Gienah	175°44.1	-17°40.7
Acrux	173°00.8	-63°14.3
Gacrux	171°52.3	-57°15.3
Alioth	166°13.4	55°49.9
Spica	158°22.7	-11°17.4
Alkaid	152°52.3	49°11.7
Hadar	148°36.5	-60°29.7
Menkent	147°58.0	-36°29.6
Arcturus	145°48.2	19°03.4
Rigil Kent.	139°40.7	-60°56.4
Kochab	137°19.4	74°03.5
Zuben'ubi	136°56.3	-16°08.7
Alphecca	126°03.9	26°38.1
Antares	112°16.1	-26°29.2
Atria	107°10.2	-69°04.5
Sabik	102°03.0	-15°45.3
Shaula	96°10.5	-37°07.3
Rasalhague	95°58.6	12°32.6
Eltanin	90°41.9	51°29.2
Kaus Aust.	83°32.6	-34°22.4
Vega	80°33.1	38°48.4
Nunki	75°47.9	-26°16.0
Altair	62°00.0	8°56.0
Peacock	53°05.7	-56°39.3
Deneb	49°25.6	45°22.0
Enif	33°38.9	9°59.2
Al Na'ir	27°33.0	-46°50.4
Fomalhaut	15°14.7	-29°29.4
Scheat	13°45.4	28°12.9
Markab	13°30.1	15°20.2

Jul 17 Wed	SHA	Mer.pass
Venus	230°43.4	12:56
Mars	304°46.8	07:59
Jupiter	289°52.5	08:58
Saturn	9°08.1	03:42

Jul 18 Thu	SHA	Mer.pass
Venus	229°27.4	12:58
Mars	304°03.9	07:58
Jupiter	289°39.8	08:55
Saturn	9°09.6	03:38

Jul 19 Fri	SHA	Mer.pass
Venus	228°11.6	12:59
Mars	303°21.0	07:57
Jupiter	289°27.1	08:52
Saturn	9°11.2	03:34

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	178°27.1	N21°08.7	59°10.4	10.2′	S23°44.0	8.7′	55.9′
1	193°27.0	08.2	73°39.6	10.1′	23°52.7	8.6′	56.0′
2	208°27.0	07.8	88°08.7	10.0′	24°01.3	8.5′	56.0′
3	223°26.9	·· 07.4	102°37.7	9.9′	24°09.8	8.4′	56.0′
4	238°26.9	07.0	117°06.5	9.8′	24°18.2	8.3′	56.0′
5	253°26.8	06.5	131°35.3	9.6′	24°26.5	8.2′	56.1′
6	268°26.8	N21°06.1	146°03.9	9.5′	S24°34.7	8.0′	56.1′
7	283°26.7	05.7	160°32.5	9.4′	24°42.7	8.0′	56.1′
8	298°26.7	05.2	175°00.9	9.3′	24°50.7	7.8′	56.2′
9	313°26.6	·· 04.8	189°29.2	9.2′	24°58.5	7.7′	56.2′
10	328°26.6	04.4	203°57.4	9.1′	25°06.2	7.5′	56.2′
11	343°26.5	03.9	218°25.4	9.0′	25°13.7	7.5′	56.3′
12	358°26.5	N21°03.5	232°53.4	8.9′	S25°21.2	7.3′	56.3′
13	13°26.4	03.1	247°21.3	8.7′	25°28.5	7.2′	56.3′
14	28°26.4	02.6	261°49.0	8.6′	25°35.7	7.0′	56.4′
15	43°26.3	·· 02.2	276°16.6	8.5′	25°42.7	7.0′	56.4′
16	58°26.3	01.7	290°44.2	8.4′	25°49.7	6.8′	56.4′
17	73°26.2	01.3	305°11.6	8.3′	25°56.5	6.6′	56.5′
18	88°26.2	N21°00.9	319°38.9	8.2′	S26°03.1	6.6′	56.5′
19	103°26.1	00.4	334°06.1	8.1′	26°09.7	6.4′	56.5′
20	118°26.1	21°00.0	348°33.2	8.0′	26°16.1	6.2′	56.5′
21	133°26.0	20°59.5	3°00.1	7.9′	26°22.3	6.1′	56.6′
22	148°26.0	59.1	17°27.0	7.8′	26°28.4	6.0′	56.6′
23	163°25.9	58.7	31°53.8	7.7′	26°34.4	5.8′	56.6′
	SD = 15.7′	d = -0.4′	SD = 15.3′				

Thu	GHA	Dec	GHA	ν	Dec	d	HP
0	178°25.9	N20°58.2	46°20.4	7.6′	S26°40.2	5.7′	56.7′
1	193°25.9	57.8	60°47.0	7.5′	26°45.9	5.6′	56.7′
2	208°25.8	57.3	75°13.5	7.4′	26°51.5	5.4′	56.7′
3	223°25.8	·· 56.9	89°39.8	7.2′	26°56.9	5.2′	56.8′
4	238°25.7	56.4	104°06.1	7.1′	27°02.1	5.1′	56.8′
5	253°25.7	56.0	118°32.2	7.0′	27°07.2	5.0′	56.8′
6	268°25.6	N20°55.5	132°58.3	7.0′	S27°12.2	4.8′	56.9′
7	283°25.6	55.1	147°24.2	6.9′	27°17.0	4.7′	56.9′
8	298°25.5	54.6	161°50.1	6.8′	27°21.7	4.5′	56.9′
9	313°25.5	·· 54.2	176°15.8	6.7′	27°26.2	4.3′	57.0′
10	328°25.5	53.7	190°41.5	6.6′	27°30.5	4.2′	57.0′
11	343°25.4	53.3	205°07.1	6.5′	27°34.7	4.0′	57.0′
12	358°25.4	N20°52.8	219°32.5	6.4′	S27°38.7	3.9′	57.1′
13	13°25.3	52.4	233°57.9	6.3′	27°42.6	3.7′	57.1′
14	28°25.3	51.9	248°23.2	6.2′	27°46.3	3.5′	57.1′
15	43°25.2	·· 51.5	262°48.4	6.1′	27°49.8	3.4′	57.2′
16	58°25.2	51.0	277°13.6	6.0′	27°53.2	3.2′	57.2′
17	73°25.2	50.6	291°38.6	6.0′	27°56.4	3.1′	57.2′
18	88°25.1	N20°50.1	306°03.6	5.9′	S27°59.5	2.9′	57.3′
19	103°25.1	49.7	320°28.4	5.8′	28°02.4	2.7′	57.3′
20	118°25.0	49.2	334°53.2	5.7′	28°05.1	2.5′	57.3′
21	133°25.0	·· 48.8	349°18.0	5.6′	28°07.6	2.4′	57.4′
22	148°25.0	48.3	3°42.6	5.6′	28°10.0	2.2′	57.4′
23	163°24.9	47.9	18°07.2	5.5′	28°12.2	2.0′	57.4′
	SD = 15.7′	d = -0.4′	SD = 15.5′				

Fri	GHA	Dec	GHA	ν	Dec	d	HP
0	178°24.9	N20°47.4	32°31.7	5.4′	S28°14.2	1.9′	57.5′
1	193°24.8	46.9	46°56.1	5.4′	28°16.1	1.7′	57.5′
2	208°24.8	46.5	61°20.5	5.3′	28°17.8	1.5′	57.5′
3	223°24.8	·· 46.0	75°44.8	5.2′	28°19.3	1.3′	57.6′
4	238°24.7	45.6	90°09.0	5.2′	28°20.6	1.2′	57.6′
5	253°24.7	45.1	104°33.2	5.1′	28°21.8	1.0′	57.6′
6	268°24.7	N20°44.6	118°57.3	5.1′	S28°22.8	0.8′	57.7′
7	283°24.6	44.2	133°21.4	5.0′	28°23.6	0.6′	57.7′
8	298°24.6	43.7	147°45.4	5.0′	28°24.2	0.5′	57.7′
9	313°24.5	·· 43.2	162°09.3	4.9′	28°24.7	0.2′	57.8′
10	328°24.5	42.8	176°33.2	4.9′	28°24.9	0.1′	57.8′
11	343°24.5	42.3	190°57.1	4.8′	28°25.0	0.1′	57.8′
12	358°24.4	N20°41.9	205°20.9	4.8′	S28°24.9	0.3′	57.9′
13	13°24.4	41.4	219°44.7	4.7′	28°24.6	0.4′	57.9′
14	28°24.4	40.9	234°08.4	4.7′	28°24.2	0.7′	57.9′
15	43°24.3	·· 40.5	248°32.1	4.7′	28°23.5	0.8′	58.0′
16	58°24.3	40.0	262°55.7	4.6′	28°22.7	1.0′	58.0′
17	73°24.3	39.5	277°19.4	4.6′	28°21.7	1.2′	58.0′
18	88°24.2	N20°39.1	291°42.9	4.6′	S28°20.5	1.4′	58.1′
19	103°24.2	38.6	306°06.5	4.5′	28°19.1	1.6′	58.1′
20	118°24.1	38.1	320°30.0	4.5′	28°17.5	1.8′	58.1′
21	133°24.1	·· 37.6	334°53.5	4.5′	28°15.7	1.9′	58.2′
22	148°24.1	37.2	349°17.0	4.5′	28°13.8	2.1′	58.2′
23	163°24.0	36.7	3°40.5	4.4′	28°11.7	2.4′	58.2′
	SD = 15.7′	d = -0.5′	SD = 15.7′				

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

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

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 78-92%
17	06:12	06:14	12:06	20:48	08:21	
18	06:16	06:18	12:06	21:45	09:16	
19	06:20	06:22	12:06	22:45	10:14	

July 20, 21, 22 UT (Sat., Sun., Mon.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	298°16.0	165°12.2	N19°00.3	240°54.1	N19°17.7	227°30.6	N21°33.8	307°28.9	S06°12.7
1	313°18.5	180°11.6	18°59.5	255°54.8	18.1	242°32.6	33.8	322°31.4	12.7
2	328°21.0	195°10.9	58.7	270°55.4	18.5	257°34.5	33.9	337°34.0	12.8
3	343°23.4	210°10.2	·· 57.9	285°56.1	·· 18.9	272°36.4	·· 33.9	352°36.5	·· 12.8
4	358°25.9	225°09.6	57.1	300°56.8	19.3	287°38.4	34.0	7°39.0	12.9
5	13°28.4	240°08.9	56.3	315°57.5	19.8	302°40.3	34.1	22°41.6	12.9
6	28°30.8	255°08.2	N18°55.5	330°58.1	N19°20.2	317°42.3	N21°34.1	37°44.1	S06°12.9
7	43°33.3	270°07.5	54.7	345°58.8	20.6	332°44.2	34.2	52°46.6	13.0
8	58°35.7	285°06.9	53.9	0°59.5	20.9	347°46.2	34.3	67°49.2	13.0
9	73°38.2	300°06.2	·· 53.1	16°00.2	·· 21.3	2°48.1	·· 34.3	82°51.7	·· 13.1
10	88°40.7	315°05.5	52.3	31°00.8	21.7	17°50.0	34.4	97°54.2	13.1
11	103°43.1	330°04.9	51.5	46°01.5	22.1	32°52.0	34.5	112°56.8	13.2
12	118°45.6	345°04.2	N18°50.7	61°02.2	N19°22.5	47°53.9	N21°34.5	127°59.3	S06°13.2
13	133°48.1	0°03.5	49.9	76°02.9	22.9	62°55.9	34.6	143°01.9	13.2
14	148°50.5	15°02.9	49.1	91°03.5	23.3	77°57.8	34.7	158°04.4	13.3
15	163°53.0	30°02.2	·· 48.3	106°04.2	·· 23.7	92°59.8	·· 34.7	173°06.9	·· 13.3
16	178°55.5	45°01.6	47.5	121°04.9	24.1	108°01.7	34.8	188°09.5	13.4
17	193°57.9	60°00.9	46.7	136°05.6	24.5	123°03.6	34.8	203°12.0	13.4
18	209°00.4	75°00.2	N18°45.8	151°06.2	N19°24.9	138°05.6	N21°34.9	218°14.6	S06°13.4
19	224°02.9	89°59.6	45.0	166°06.9	25.3	153°07.5	35.0	233°17.1	13.5
20	239°05.3	104°58.9	44.2	181°07.6	25.7	168°09.5	35.0	248°19.6	13.5
21	254°07.8	119°58.2	·· 43.4	196°08.3	·· 26.1	183°11.4	·· 35.1	263°22.2	·· 13.6
22	269°10.2	134°57.6	42.6	211°08.9	26.5	198°13.4	35.2	278°24.7	13.6
23	284°12.7	149°56.9	41.8	226°09.6	26.9	213°15.3	35.2	293°27.2	13.7
Mer.pass. 04:06		ν -0.7′	d -0.8′	m -3.88	ν 0.7′	d 0.4′	m 0.91	ν 1.9′	d 0.1′ m -2.07	ν 2.5′	d -0.0′ m 0.81

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	299°15.2	164°56.3	N18°40.9	241°10.3	N19°27.3	228°17.3	N21°35.3	308°29.8	S06°13.7
1	314°17.6	179°55.6	40.1	256°11.0	27.7	243°19.2	35.4	323°32.3	13.7
2	329°20.1	194°54.9	39.3	271°11.6	28.1	258°21.1	35.4	338°34.9	13.8
3	344°22.6	209°54.3	·· 38.5	286°12.3	·· 28.5	273°23.1	·· 35.5	353°37.4	·· 13.8
4	359°25.0	224°53.6	37.7	301°13.0	28.9	288°25.0	35.5	8°39.9	13.9
5	14°27.5	239°53.0	36.8	316°13.7	29.3	303°27.0	35.6	23°42.5	13.9
6	29°30.0	254°52.3	N18°36.0	331°14.3	N19°29.7	318°28.9	N21°35.7	38°45.0	S06°14.0
7	44°32.4	269°51.6	35.2	346°15.0	30.1	333°30.9	35.7	53°47.6	14.0
8	59°34.9	284°51.0	34.4	1°15.7	30.4	348°32.8	35.8	68°50.1	14.0
9	74°37.4	299°50.3	·· 33.5	16°16.4	·· 30.8	3°34.8	·· 35.9	83°52.6	·· 14.1
10	89°39.8	314°49.7	32.7	31°17.1	31.2	18°36.7	35.9	98°55.2	14.1
11	104°42.3	329°49.0	31.9	46°17.7	31.6	33°38.7	36.0	113°57.7	14.2
12	119°44.7	344°48.4	N18°31.1	61°18.4	N19°32.0	48°40.6	N21°36.0	129°00.3	S06°14.2
13	134°47.2	359°47.7	30.2	76°19.1	32.4	63°42.6	36.1	144°02.8	14.3
14	149°49.7	14°47.1	29.4	91°19.8	32.8	78°44.5	36.2	159°05.3	14.3
15	164°52.1	29°46.4	·· 28.6	106°20.4	·· 33.2	93°46.5	·· 36.2	174°07.9	·· 14.3
16	179°54.6	44°45.8	27.7	121°21.1	33.6	108°48.4	36.3	189°10.4	14.4
17	194°57.1	59°45.1	26.9	136°21.8	34.0	123°50.4	36.4	204°13.0	14.4
18	209°59.5	74°44.5	N18°26.1	151°22.5	N19°34.3	138°52.3	N21°36.4	219°15.5	S06°14.5
19	225°02.0	89°43.8	25.2	166°23.1	34.7	153°54.2	36.5	234°18.1	14.5
20	240°04.5	104°43.2	24.4	181°23.8	35.1	168°56.2	36.5	249°20.6	14.6
21	255°06.9	119°42.5	·· 23.6	196°24.5	·· 35.5	183°58.1	·· 36.6	264°23.1	·· 14.6
22	270°09.4	134°41.9	22.7	211°25.2	35.9	199°00.1	36.7	279°25.7	14.6
23	285°11.9	149°41.2	21.9	226°25.8	36.3	214°02.0	36.7	294°28.2	14.7
Mer.pass. 04:02		ν -0.7′	d -0.8′	m -3.88	ν 0.7′	d 0.4′	m 0.90	ν 1.9′	d 0.1′ m -2.08	ν 2.5′	d -0.0′ m 0.81

Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	300°14.3	164°40.6	N18°21.0	241°26.5	N19°36.7	229°04.0	N21°36.8	309°30.8	S06°14.7
1	315°16.8	179°39.9	20.2	256°27.2	37.1	244°05.9	36.9	324°33.3	14.8
2	330°19.2	194°39.3	19.4	271°27.9	37.4	259°07.9	36.9	339°35.8	14.8
3	345°21.7	209°38.6	·· 18.5	286°28.5	·· 37.8	274°09.8	·· 37.0	354°38.4	·· 14.9
4	0°24.2	224°38.0	17.7	301°29.2	38.2	289°11.8	37.0	9°40.9	14.9
5	15°26.6	239°37.3	16.8	316°29.9	38.6	304°13.7	37.1	24°43.5	14.9
6	30°29.1	254°36.7	N18°16.0	331°30.6	N19°39.0	319°15.7	N21°37.2	39°46.0	S06°15.0
7	45°31.6	269°36.0	15.1	346°31.3	39.4	334°17.6	37.2	54°48.6	15.0
8	60°34.0	284°35.4	14.3	1°31.9	39.8	349°19.6	37.3	69°51.1	15.1
9	75°36.5	299°34.8	·· 13.5	16°32.6	·· 40.1	4°21.5	·· 37.4	84°53.7	·· 15.1
10	90°39.0	314°34.1	12.6	31°33.3	40.5	19°23.5	37.4	99°56.2	15.2
11	105°41.4	329°33.5	11.8	46°34.0	40.9	34°25.4	37.5	114°58.7	15.2
12	120°43.9	344°32.8	N18°10.9	61°34.6	N19°41.3	49°27.4	N21°37.5	130°01.3	S06°15.3
13	135°46.4	359°32.2	10.1	76°35.3	41.7	64°29.3	37.6	145°03.8	15.3
14	150°48.8	14°31.6	09.2	91°36.0	42.1	79°31.3	37.7	160°06.4	15.3
15	165°51.3	29°30.9	·· 08.4	106°36.7	·· 42.4	94°33.2	·· 37.7	175°08.9	·· 15.4
16	180°53.7	44°30.3	07.5	121°37.3	42.8	109°35.2	37.8	190°11.5	15.4
17	195°56.2	59°29.6	06.6	136°38.0	43.2	124°37.1	37.8	205°14.0	15.5
18	210°58.7	74°29.0	N18°05.8	151°38.7	N19°43.6	139°39.1	N21°37.9	220°16.6	S06°15.5
19	226°01.1	89°28.4	04.9	166°39.4	44.0	154°41.0	38.0	235°19.1	15.6
20	241°03.6	104°27.7	04.1	181°40.0	44.3	169°43.0	38.0	250°21.6	15.6
21	256°06.1	119°27.1	·· 03.2	196°40.7	·· 44.7	184°44.9	·· 38.1	265°24.2	·· 15.7
22	271°08.5	134°26.4	02.4	211°41.4	45.1	199°46.9	38.2	280°26.7	15.7
23	286°11.0	149°25.8	01.5	226°42.1	45.5	214°48.8	38.2	295°29.3	15.7
Mer.pass. 03:58		ν -0.6′	d -0.8′	m -3.88	ν 0.7′	d 0.4′	m 0.90	ν 1.9′	d 0.1′ m -2.08	ν 2.5′	d -0.0′ m 0.80

Stars	SHA	Dec
Alpheratz	357°35.0	29°13.5
Ankaa	353°07.4	-42°10.1
Schedar	349°31.3	56°40.1
Diphda	348°47.6	-17°51.0
Achernar	335°20.4	-57°06.4
Hamal	327°51.7	23°34.6
Polaris	314°22.9	89°21.7
Acamar	315°12.2	-40°12.1
Menkar	314°06.7	4°11.2
Mirfak	308°29.0	49°56.7
Aldebaran	290°40.3	16°33.5
Rigel	281°04.5	-8°10.3
Capella	280°22.8	46°01.3
Bellatrix	278°23.6	6°22.4
Elnath	278°02.7	28°37.7
Alnilam	275°38.4	-1°11.1
Betelgeuse	270°52.8	7°24.8
Canopus	263°53.1	-52°42.3
Sirius	258°26.9	-16°44.9
Adhara	255°06.5	-29°00.2
Procyon	244°51.6	5°09.8
Pollux	243°18.1	27°58.1
Avior	234°15.6	-59°35.2
Suhail	222°47.0	-43°31.9
Miaplacidus	221°39.3	-69°49.1
Alphard	217°48.4	-8°45.8
Regulus	207°35.1	11°51.0
Dubhe	193°41.9	61°37.4
Denebola	182°25.5	14°26.2
Gienah	175°44.1	-17°40.7
Acrux	173°00.8	-63°14.3
Gacrux	171°52.3	-57°15.3
Alioth	166°13.4	55°49.9
Spica	158°22.7	-11°17.4
Alkaid	152°52.3	49°11.7
Hadar	148°36.5	-60°29.7
Menkent	147°58.0	-36°29.6
Arcturus	145°48.2	19°03.4
Rigil Kent.	139°40.7	-60°56.4
Kochab	137°19.4	74°03.5
Zuben'ubi	136°56.3	-16°08.7
Alphecca	126°03.9	26°38.1
Antares	112°16.1	-26°29.2
Atria	107°10.2	-69°04.5
Sabik	102°03.0	-15°45.3
Shaula	96°10.5	-37°07.4
Rasalhague	95°58.6	12°32.6
Eltanin	90°41.9	51°29.2
Kaus Aust.	83°32.6	-34°22.4
Vega	80°33.1	38°48.4
Nunki	75°47.9	-26°16.0
Altair	62°00.0	8°56.0
Peacock	53°05.7	-56°39.3
Deneb	49°25.6	45°22.0
Enif	33°38.9	9°59.3
Al Na'ir	27°33.0	-46°50.4
Fomalhaut	15°14.7	-29°29.4
Scheat	13°45.3	28°12.9
Markab	13°30.1	15°20.2

Jul 20 Sat	SHA	Mer.pass
Venus	226°56.2	13:00
Mars	302°38.0	07:56
Jupiter	289°14.6	08:49
Saturn	9°12.9	03:29

Jul 21 Sun	SHA	Mer.pass
Venus	225°41.1	13:01
Mars	301°55.1	07:55
Jupiter	289°02.1	08:46
Saturn	9°14.6	03:25

Jul 22 Mon	SHA	Mer.pass
Venus	224°26.2	13:02
Mars	301°12.2	07:54
Jupiter	288°49.7	08:43
Saturn	9°16.4	03:21

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°24.0	N20°36.2	18°03.9	4.4′	S28°09.3	2.5′	58.2′
1	193°24.0	35.8	32°27.4	4.4′	28°06.8	2.7′	58.3′
2	208°23.9	35.3	46°50.8	4.4′	28°04.1	2.9′	58.3′
3	223°23.9	·· 34.8	61°14.2	4.4′	28°01.2	3.0′	58.3′
4	238°23.9	34.3	75°37.6	4.4′	27°58.2	3.3′	58.4′
5	253°23.8	33.9	90°01.0	4.4′	27°54.9	3.4′	58.4′
6	268°23.8	N20°33.4	104°24.4	4.4′	S27°51.5	3.7′	58.4′
7	283°23.8	32.9	118°47.8	4.4′	27°47.8	3.8′	58.5′
8	298°23.7	32.4	133°11.2	4.4′	27°44.0	4.0′	58.5′
9	313°23.7	·· 32.0	147°34.7	4.4′	27°40.0	4.2′	58.5′
10	328°23.7	31.5	161°58.1	4.4′	27°35.8	4.4′	58.6′
11	343°23.7	31.0	176°21.5	4.4′	27°31.4	4.6′	58.6′
12	358°23.6	N20°30.5	190°45.0	4.5′	S27°26.8	4.7′	58.6′
13	13°23.6	30.0	205°08.4	4.5′	27°22.1	5.0′	58.6′
14	28°23.6	29.6	219°31.9	4.5′	27°17.1	5.1′	58.7′
15	43°23.5	·· 29.1	233°55.4	4.5′	27°12.0	5.3′	58.7′
16	58°23.5	28.6	248°18.9	4.5′	27°06.7	5.5′	58.7′
17	73°23.5	28.1	262°42.5	4.6′	27°01.2	5.7′	58.8′
18	88°23.4	N20°27.6	277°06.0	4.6′	S26°55.5	5.8′	58.8′
19	103°23.4	27.1	291°29.6	4.6′	26°49.7	6.1′	58.8′
20	118°23.4	26.7	305°53.3	4.7′	26°43.6	6.2′	58.8′
21	133°23.4	·· 26.2	320°16.9	4.7′	26°37.4	6.4′	58.9′
22	148°23.3	25.7	334°40.6	4.7′	26°31.0	6.6′	58.9′
23	163°23.3	25.2	349°04.4	4.8′	26°24.4	6.8′	58.9′
	SD = 15.7′	d = -0.5′	SD = 15.9′				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°23.3	N20°24.7	3°28.1	4.8′	S26°17.6	6.9′	58.9′
1	193°23.2	24.2	17°52.0	4.9′	26°10.7	7.2′	59.0′
2	208°23.2	23.7	32°15.8	4.9′	26°03.5	7.3′	59.0′
3	223°23.2	·· 23.3	46°39.7	5.0′	25°56.2	7.5′	59.0′
4	238°23.2	22.8	61°03.7	5.0′	25°48.7	7.6′	59.0′
5	253°23.1	22.3	75°27.7	5.1′	25°41.1	7.9′	59.1′
6	268°23.1	N20°21.8	89°51.7	5.1′	S25°33.2	8.0′	59.1′
7	283°23.1	21.3	104°15.8	5.2′	25°25.2	8.2′	59.1′
8	298°23.1	20.8	118°40.0	5.2′	25°17.0	8.3′	59.1′
9	313°23.0	·· 20.3	133°04.2	5.3′	25°08.7	8.5′	59.2′
10	328°23.0	19.8	147°28.5	5.3′	25°00.2	8.7′	59.2′
11	343°23.0	19.3	161°52.8	5.4′	24°51.5	8.9′	59.2′
12	358°23.0	N20°18.8	176°17.2	5.5′	S24°42.6	9.0′	59.2′
13	13°22.9	18.3	190°41.7	5.5′	24°33.6	9.2′	59.3′
14	28°22.9	17.8	205°06.2	5.6′	24°24.4	9.4′	59.3′
15	43°22.9	·· 17.4	219°30.8	5.6′	24°15.0	9.5′	59.3′
16	58°22.9	16.9	233°55.4	5.7′	24°05.5	9.7′	59.3′
17	73°22.8	16.4	248°20.1	5.8′	23°55.8	9.8′	59.4′
18	88°22.8	N20°15.9	262°44.9	5.9′	S23°46.0	10.0′	59.4′
19	103°22.8	15.4	277°09.7	5.9′	23°36.0	10.2′	59.4′
20	118°22.8	14.9	291°34.7	6.0′	23°25.8	10.3′	59.4′
21	133°22.8	·· 14.4	305°59.7	6.1′	23°15.5	10.5′	59.4′
22	148°22.7	13.9	320°24.7	6.1′	23°05.0	10.6′	59.5′
23	163°22.7	13.4	334°49.9	6.2′	22°54.4	10.8′	59.5′
	SD = 15.7′	d = -0.5′	SD = 16.1′				

Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°22.7	N20°12.9	349°15.1	6.3′	S22°43.6	10.9′	59.5′
1	193°22.7	12.4	3°40.4	6.4′	22°32.7	11.1′	59.5′
2	208°22.6	11.9	18°05.7	6.4′	22°21.6	11.3′	59.5′
3	223°22.6	·· 11.4	32°31.2	6.5′	22°10.3	11.3′	59.6′
4	238°22.6	10.9	46°56.7	6.6′	21°59.0	11.6′	59.6′
5	253°22.6	10.4	61°22.3	6.7′	21°47.4	11.6′	59.6′
6	268°22.6	N20°09.9	75°48.0	6.8′	S21°35.8	11.8′	59.6′
7	283°22.5	09.3	90°13.7	6.8′	21°24.0	12.0′	59.6′
8	298°22.5	08.8	104°39.6	6.9′	21°12.0	12.1′	59.6′
9	313°22.5	·· 08.3	119°05.5	7.0′	20°59.9	12.2′	59.7′
10	328°22.5	07.8	133°31.5	7.1′	20°47.7	12.3′	59.7′
11	343°22.5	07.3	147°57.5	7.2′	20°35.4	12.5′	59.7′
12	358°22.4	N20°06.8	162°23.7	7.2′	S20°22.9	12.6′	59.7′
13	13°22.4	06.3	176°49.9	7.3′	20°10.3	12.8′	59.7′
14	28°22.4	05.8	191°16.3	7.4′	19°57.5	12.9′	59.7′
15	43°22.4	·· 05.3	205°42.7	7.5′	19°44.6	13.0′	59.7′
16	58°22.4	04.8	220°09.2	7.6′	19°31.6	13.1′	59.8′
17	73°22.4	04.3	234°35.7	7.6′	19°18.5	13.2′	59.8′
18	88°22.3	N20°03.8	249°02.4	7.7′	S19°05.3	13.4′	59.8′
19	103°22.3	03.2	263°29.1	7.8′	18°51.9	13.5′	59.8′
20	118°22.3	02.7	277°55.9	7.9′	18°38.4	13.6′	59.8′
21	133°22.3	·· 02.2	292°22.8	8.0′	18°24.8	13.7′	59.8′
22	148°22.3	01.7	306°49.8	8.1′	18°11.1	13.8′	59.8′
23	163°22.3	01.2	321°16.8	8.1′	17°57.3	14.0′	59.8′
	SD = 15.7′	d = -0.5′	SD = 16.2′				

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

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

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 15-17 97-99%
20	06:24	06:25	12:06	23:46	11:15	◯
21	06:27	06:28	12:06	–:–	12:15	
22	06:29	06:30	12:07	00:45	13:13	

July 23, 24, 25 UT (Tue., Wed., Thu.)

	Aries	Venus		Mars		Jupiter		Saturn	
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	301°13.5	164°25.2	N18°00.6	241°42.7	N19°45.9	229°50.8	N21°38.3	310°31.8	S06°15.8
1	316°15.9	179°24.5	17°59.8	256°43.4	46.2	244°52.8	38.3	325°34.4	15.8
2	331°18.4	194°23.9	58.9	271°44.1	46.6	259°54.7	38.4	340°36.9	15.9
3	346°20.8	209°23.3	·· 58.1	286°44.8	·· 47.0	274°56.7	·· 38.5	355°39.5	·· 15.9
4	1°23.3	224°22.6	57.2	301°45.5	47.4	289°58.6	38.5	10°42.0	16.0
5	16°25.8	239°22.0	56.3	316°46.1	47.7	305°00.6	38.6	25°44.6	16.0
6	31°28.2	254°21.4	N17°55.5	331°46.8	N19°48.1	320°02.5	N21°38.6	40°47.1	S06°16.1
7	46°30.7	269°20.7	54.6	346°47.5	48.5	335°04.5	38.7	55°49.7	16.1
8	61°33.2	284°20.1	53.7	1°48.2	48.9	350°06.4	38.8	70°52.2	16.2
9	76°35.6	299°19.5	·· 52.9	16°48.8	·· 49.3	5°08.4	·· 38.8	85°54.7	·· 16.2
10	91°38.1	314°18.9	52.0	31°49.5	49.6	20°10.3	38.9	100°57.3	16.2
11	106°40.6	329°18.2	51.1	46°50.2	50.0	35°12.3	38.9	115°59.8	16.3
12	121°43.0	344°17.6	N17°50.3	61°50.9	N19°50.4	50°14.2	N21°39.0	131°02.4	S06°16.3
13	136°45.5	359°17.0	49.4	76°51.5	50.8	65°16.2	39.1	146°04.9	16.4
14	151°48.0	14°16.3	48.5	91°52.2	51.1	80°18.1	39.1	161°07.5	16.4
15	166°50.4	29°15.7	·· 47.6	106°52.9	·· 51.5	95°20.1	·· 39.2	176°10.0	·· 16.5
16	181°52.9	44°15.1	46.8	121°53.6	51.9	110°22.1	39.2	191°12.6	16.5
17	196°55.3	59°14.5	45.9	136°54.3	52.2	125°24.0	39.3	206°15.1	16.6
18	211°57.8	74°13.8	N17°45.0	151°54.9	N19°52.6	140°26.0	N21°39.4	221°17.7	S06°16.6
19	227°00.3	89°13.2	44.1	166°55.6	53.0	155°27.9	39.4	236°20.2	16.7
20	242°02.7	104°12.6	43.3	181°56.3	53.4	170°29.9	39.5	251°22.8	16.7
21	257°05.2	119°12.0	·· 42.4	196°57.0	·· 53.7	185°31.8	·· 39.5	266°25.3	·· 16.8
22	272°07.7	134°11.3	41.5	211°57.6	54.1	200°33.8	39.6	281°27.9	16.8
23	287°10.1	149°10.7	40.6	226°58.3	54.5	215°35.7	39.7	296°30.4	16.8
Mer.pass. 03:54		ν -0.6′	d -0.9′	m -3.88	ν 0.7′	d 0.4′	m 0.90	ν 2.0′	d 0.1′ m -2.08	ν 2.5′	d -0.0′ m 0.80

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	302°12.6	164°10.1	N17°39.7	241°59.0	N19°54.9	230°37.7	N21°39.7	311°33.0	S06°16.9
1	317°15.1	179°09.5	38.9	256°59.7	55.2	245°39.6	39.8	326°35.5	16.9
2	332°17.5	194°08.8	38.0	272°00.3	55.6	260°41.6	39.8	341°38.1	17.0
3	347°20.0	209°08.2	·· 37.1	287°01.0	·· 56.0	275°43.6	·· 39.9	356°40.6	·· 17.0
4	2°22.5	224°07.6	36.2	302°01.7	56.3	290°45.5	40.0	11°43.2	17.1
5	17°24.9	239°07.0	35.3	317°02.4	56.7	305°47.5	40.0	26°45.7	17.1
6	32°27.4	254°06.4	N17°34.4	332°03.1	N19°57.1	320°49.4	N21°40.1	41°48.3	S06°17.2
7	47°29.8	269°05.7	33.6	347°03.7	57.4	335°51.4	40.1	56°50.8	17.2
8	62°32.3	284°05.1	32.7	2°04.4	57.8	350°53.3	40.2	71°53.4	17.3
9	77°34.8	299°04.5	·· 31.8	17°05.1	·· 58.2	5°55.3	·· 40.3	86°55.9	·· 17.3
10	92°37.2	314°03.9	30.9	32°05.8	58.5	20°57.3	40.3	101°58.5	17.4
11	107°39.7	329°03.3	30.0	47°06.4	58.9	35°59.2	40.4	117°01.0	17.4
12	122°42.2	344°02.7	N17°29.1	62°07.1	N19°59.3	51°01.2	N21°40.4	132°03.6	S06°17.5
13	137°44.6	359°02.0	28.2	77°07.8	19°59.6	66°03.1	40.5	147°06.1	17.5
14	152°47.1	14°01.4	27.3	92°08.5	20°00.0	81°05.1	40.6	162°08.7	17.5
15	167°49.6	29°00.8	·· 26.4	107°09.1	·· 00.4	96°07.0	·· 40.6	177°11.2	·· 17.6
16	182°52.0	44°00.2	25.5	122°09.8	00.7	111°09.0	40.7	192°13.8	17.6
17	197°54.5	58°59.6	24.6	137°10.5	01.1	126°11.0	40.7	207°16.3	17.7
18	212°56.9	73°59.0	N17°23.7	152°11.2	N20°01.5	141°12.9	N21°40.8	222°18.9	S06°17.7
19	227°59.4	88°58.4	22.9	167°11.9	01.8	156°14.9	40.9	237°21.4	17.8
20	243°01.9	103°57.7	22.0	182°12.5	02.2	171°16.8	40.9	252°24.0	17.8
21	258°04.3	118°57.1	·· 21.1	197°13.2	·· 02.6	186°18.8	·· 41.0	267°26.5	·· 17.9
22	273°06.8	133°56.5	20.2	212°13.9	02.9	201°20.8	41.0	282°29.1	17.9
23	288°09.3	148°55.9	19.3	227°14.6	03.3	216°22.7	41.1	297°31.6	18.0
Mer.pass. 03:51		ν -0.6′	d -0.9′	m -3.88	ν 0.7′	d 0.4′	m 0.89	ν 2.0′	d 0.1′ m -2.09	ν 2.5′	d -0.0′ m 0.79

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	303°11.7	163°55.3	N17°18.4	242°15.2	N20°03.7	231°24.7	N21°41.2	312°34.2	S06°18.0
1	318°14.2	178°54.7	17.5	257°15.9	04.0	246°26.6	41.2	327°36.8	18.1
2	333°16.7	193°54.1	16.6	272°16.6	04.4	261°28.6	41.3	342°39.3	18.1
3	348°19.1	208°53.5	·· 15.6	287°17.3	·· 04.8	276°30.5	·· 41.3	357°41.9	·· 18.2
4	3°21.6	223°52.9	14.7	302°18.0	05.1	291°32.5	41.4	12°44.4	18.2
5	18°24.1	238°52.3	13.8	317°18.6	05.5	306°34.5	41.4	27°47.0	18.3
6	33°26.5	253°51.6	N17°12.9	332°19.3	N20°05.8	321°36.4	N21°41.5	42°49.5	S06°18.3
7	48°29.0	268°51.0	12.0	347°20.0	06.2	336°38.4	41.6	57°52.1	18.4
8	63°31.4	283°50.4	11.1	2°20.7	06.6	351°40.3	41.6	72°54.6	18.4
9	78°33.9	298°49.8	·· 10.2	17°21.3	·· 06.9	6°42.3	·· 41.7	87°57.2	·· 18.5
10	93°36.4	313°49.2	09.3	32°22.0	07.3	21°44.3	41.7	102°59.7	18.5
11	108°38.8	328°48.6	08.4	47°22.7	07.6	36°46.2	41.8	118°02.3	18.5
12	123°41.3	343°48.0	N17°07.5	62°23.4	N20°08.0	51°48.2	N21°41.9	133°04.8	S06°18.6
13	138°43.8	358°47.4	06.6	77°24.1	08.4	66°50.2	41.9	148°07.4	18.6
14	153°46.2	13°46.8	05.7	92°24.7	08.7	81°52.1	42.0	163°10.0	18.7
15	168°48.7	28°46.2	·· 04.7	107°25.4	·· 09.1	96°54.1	·· 42.0	178°12.5	·· 18.7
16	183°51.2	43°45.6	03.8	122°26.1	09.4	111°56.0	42.1	193°15.1	18.8
17	198°53.6	58°45.0	02.9	137°26.8	09.8	126°58.0	42.1	208°17.6	18.8
18	213°56.1	73°44.4	N17°02.0	152°27.4	N20°10.2	142°00.0	N21°42.2	223°20.2	S06°18.9
19	228°58.5	88°43.8	01.1	167°28.1	10.5	157°01.9	42.3	238°22.7	18.9
20	244°01.0	103°43.2	17°00.2	182°28.8	10.9	172°03.9	42.3	253°25.3	19.0
21	259°03.5	118°42.6	16°59.3	197°29.5	·· 11.2	187°05.8	·· 42.4	268°27.8	·· 19.0
22	274°05.9	133°42.0	58.3	212°30.2	11.6	202°07.8	42.4	283°30.4	19.1
23	289°08.4	148°41.4	57.4	227°30.8	11.9	217°09.8	42.5	298°33.0	19.1
Mer.pass. 03:47		ν -0.6′	d -0.9′	m -3.87	ν 0.7′	d 0.4′	m 0.89	ν 2.0′	d 0.1′ m -2.09	ν 2.6′	d -0.0′ m 0.79

Stars

	SHA	Dec
Alpheratz	357°35.0	29°13.5
Ankaa	353°07.3	-42°10.1
Schedar	349°31.3	56°40.1
Diphda	348°47.6	-17°51.0
Achernar	335°20.4	-57°06.4
Hamal	327°51.6	23°34.6
Polaris	314°21.5	89°21.7
Acamar	315°12.2	-40°12.1
Menkar	314°06.6	4°11.2
Mirfak	308°29.0	49°56.7
Aldebaran	290°40.3	16°33.5
Rigel	281°04.5	-8°10.3
Capella	280°22.8	46°01.3
Bellatrix	278°23.5	6°22.4
Elnath	278°02.6	28°37.7
Alnilam	275°38.4	-1°11.1
Betelgeuse	270°52.8	7°24.8
Canopus	263°53.1	-52°42.3
Sirius	258°26.9	-16°44.8
Adhara	255°06.5	-29°00.2
Procyon	244°51.6	5°09.8
Pollux	243°18.1	27°58.1
Avior	234°15.6	-59°35.2
Suhail	222°47.0	-43°31.9
Miaplacidus	221°39.3	-69°49.1
Alphard	217°48.4	-8°45.8
Regulus	207°35.1	11°51.0
Dubhe	193°41.9	61°37.4
Denebola	182°25.5	14°26.2
Gienah	175°44.1	-17°40.7
Acrux	173°00.8	-63°14.3
Gacrux	171°52.3	-57°15.3
Alioth	166°13.4	55°49.9
Spica	158°22.7	-11°17.4
Alkaid	152°52.3	49°11.7
Hadar	148°36.5	-60°29.7
Menkent	147°58.1	-36°29.6
Arcturus	145°48.2	19°03.4
Rigil Kent.	139°40.7	-60°56.4
Kochab	137°19.5	74°03.5
Zuben'ubi	136°56.4	-16°08.7
Alphecca	126°03.9	26°38.1
Antares	112°16.1	-26°29.2
Atria	107°10.2	-69°04.5
Sabik	102°03.0	-15°45.3
Shaula	96°10.5	-37°07.4
Rasalhague	95°58.6	12°32.6
Eltanin	90°41.9	51°29.2
Kaus Aust.	83°32.6	-34°22.4
Vega	80°33.1	38°48.5
Nunki	75°47.9	-26°16.0
Altair	62°00.0	8°56.0
Peacock	53°05.7	-56°39.3
Deneb	49°25.6	45°22.0
Enif	33°38.9	9°59.3
Al Na'ir	27°33.0	-46°50.4
Fomalhaut	15°14.6	-29°29.4
Scheat	13°45.3	28°12.9
Markab	13°30.0	15°20.2

Jul 23 Tue	SHA	Mer.pass
Venus	223°11.7	13:03
Mars	300°29.3	07:53
Jupiter	288°37.3	08:39
Saturn	9°18.4	03:17

Jul 24 Wed	SHA	Mer.pass
Venus	221°57.5	13:04
Mars	299°46.4	07:52
Jupiter	288°25.1	08:36
Saturn	9°20.4	03:13

Jul 25 Thu	SHA	Mer.pass
Venus	220°43.6	13:05
Mars	299°03.5	07:51
Jupiter	288°12.9	08:33
Saturn	9°22.5	03:09

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Tue	**GHA**	**Dec**	**GHA**	*ν*	**Dec**	*d*	**HP**
0	178°22.2	N20°00.7	335°44.0	8.2′	S17°43.3	14.0′	59.9′
1	193°22.2	20°00.2	350°11.2	8.3′	17°29.3	14.2′	59.9′
2	208°22.2	19°59.7	4°38.5	8.4′	17°15.1	14.3′	59.9′
3	223°22.2	·· 59.1	19°05.9	8.5′	17°00.8	14.3′	59.9′
4	238°22.2	58.6	33°33.3	8.5′	16°46.5	14.5′	59.9′
5	253°22.2	58.1	48°00.9	8.6′	16°32.0	14.6′	59.9′
6	268°22.1	N19°57.6	62°28.5	8.7′	S16°17.4	14.7′	59.9′
7	283°22.1	57.1	76°56.2	8.8′	16°02.7	14.7′	59.9′
8	298°22.1	56.5	91°24.0	8.9′	15°48.0	14.9′	59.9′
9	313°22.1	·· 56.0	105°51.8	8.9′	15°33.1	15.0′	59.9′
10	328°22.1	55.5	120°19.7	9.0′	15°18.1	15.0′	59.9′
11	343°22.1	55.0	134°47.7	9.1′	15°03.1	15.1′	60.0′
12	358°22.1	N19°54.5	149°15.8	9.2′	S14°48.0	15.3′	60.0′
13	13°22.1	53.9	163°44.0	9.2′	14°32.7	15.3′	60.0′
14	28°22.0	53.4	178°12.2	9.3′	14°17.4	15.4′	60.0′
15	43°22.0	·· 52.9	192°40.5	9.4′	14°02.0	15.5′	60.0′
16	58°22.0	52.4	207°08.9	9.4′	13°46.5	15.5′	60.0′
17	73°22.0	51.8	221°37.3	9.5′	13°31.0	15.6′	60.0′
18	88°22.0	N19°51.3	236°05.9	9.6′	S13°15.4	15.8′	60.0′
19	103°22.0	50.8	250°34.4	9.7′	12°59.6	15.7′	60.0′
20	118°22.0	50.3	265°03.1	9.7′	12°43.9	15.9′	60.0′
21	133°22.0	·· 49.7	279°31.8	9.8′	12°28.0	15.9′	60.0′
22	148°22.0	49.2	294°00.6	9.9′	12°12.1	16.0′	60.0′
23	163°21.9	48.7	308°29.5	9.9′	11°56.1	16.1′	60.0′
	SD = 15.7′	*d* = -0.5′	SD = 16.3′				

Wed	**GHA**	**Dec**	**GHA**	*ν*	**Dec**	*d*	**HP**
0	178°21.9	N19°48.2	322°58.4	10.0′	S11°40.0	16.1′	60.0′
1	193°21.9	47.6	337°27.4	10.1′	11°23.9	16.2′	60.0′
2	208°21.9	47.1	351°56.5	10.1′	11°07.7	16.3′	60.0′
3	223°21.9	·· 46.6	6°25.6	10.2′	10°51.4	16.3′	60.0′
4	238°21.9	46.0	20°54.8	10.2′	10°35.1	16.4′	60.0′
5	253°21.9	45.5	35°24.0	10.3′	10°18.7	16.4′	60.0′
6	268°21.9	N19°45.0	49°53.3	10.4′	S10°02.3	16.5′	60.0′
7	283°21.9	44.4	64°22.7	10.4′	09°45.8	16.5′	60.0′
8	298°21.9	43.9	78°52.1	10.5′	09°29.3	16.6′	60.0′
9	313°21.9	·· 43.4	93°21.6	10.5′	09°12.7	16.6′	60.0′
10	328°21.9	42.8	107°51.1	10.6′	08°56.1	16.7′	60.0′
11	343°21.8	42.3	122°20.7	10.6′	08°39.4	16.7′	60.0′
12	358°21.8	N19°41.8	136°50.3	10.7′	S08°22.7	16.8′	60.0′
13	13°21.8	41.2	151°20.0	10.7′	08°05.9	16.8′	60.0′
14	28°21.8	40.7	165°49.8	10.8′	07°49.1	16.8′	60.0′
15	43°21.8	·· 40.2	180°19.5	10.8′	07°32.3	16.9′	60.0′
16	58°21.8	39.6	194°49.4	10.9′	07°15.4	16.9′	60.0′
17	73°21.8	39.1	209°19.3	10.9′	06°58.5	17.0′	60.0′
18	88°21.8	N19°38.6	223°49.2	11.0′	S06°41.5	17.0′	60.0′
19	103°21.8	38.0	238°19.2	11.0′	06°24.5	17.0′	60.0′
20	118°21.8	37.5	252°49.2	11.1′	06°07.5	17.0′	60.0′
21	133°21.8	·· 36.9	267°19.2	11.1′	05°50.5	17.1′	60.0′
22	148°21.8	36.4	281°49.3	11.1′	05°33.4	17.1′	60.0′
23	163°21.8	35.9	296°19.5	11.2′	05°16.3	17.1′	60.0′
	SD = 15.7′	*d* = -0.5′	SD = 16.4′				

Thu	**GHA**	**Dec**	**GHA**	*ν*	**Dec**	*d*	**HP**
0	178°21.8	N19°35.3	310°49.7	11.2′	S04°59.2	17.2′	60.0′
1	193°21.8	34.8	325°19.9	11.3′	04°42.0	17.1′	60.0′
2	208°21.8	34.2	339°50.1	11.3′	04°24.9	17.2′	59.9′
3	223°21.8	·· 33.7	354°20.4	11.3′	04°07.7	17.2′	59.9′
4	238°21.8	33.1	8°50.7	11.3′	03°50.5	17.2′	59.9′
5	253°21.8	32.6	23°21.1	11.4′	03°33.3	17.3′	59.9′
6	268°21.8	N19°32.0	37°51.5	11.4′	S03°16.0	17.2′	59.9′
7	283°21.8	31.5	52°21.9	11.4′	02°58.8	17.3′	59.9′
8	298°21.8	31.0	66°52.3	11.5′	02°41.5	17.2′	59.9′
9	313°21.8	·· 30.4	81°22.8	11.5′	02°24.3	17.3′	59.9′
10	328°21.8	29.9	95°53.3	11.5′	02°07.0	17.2′	59.9′
11	343°21.8	29.3	110°23.8	11.5′	01°49.8	17.3′	59.9′
12	358°21.8	N19°28.8	124°54.3	11.6′	S01°32.5	17.3′	59.9′
13	13°21.8	28.2	139°24.8	11.6′	01°15.2	17.3′	59.9′
14	28°21.8	27.7	153°55.4	11.6′	00°57.9	17.2′	59.8′
15	43°21.8	·· 27.1	168°26.0	11.6′	00°40.7	17.3′	59.8′
16	58°21.8	26.6	182°56.6	11.6′	00°23.4	17.3′	59.8′
17	73°21.8	26.0	197°27.2	11.6′	S00°06.1	17.2′	59.8′
18	88°21.8	N19°25.5	211°57.9	11.7′	N00°11.1	17.3′	59.8′
19	103°21.8	24.9	226°28.5	11.7′	00°28.4	17.2′	59.8′
20	118°21.8	24.4	240°59.2	11.7′	00°45.6	17.2′	59.8′
21	133°21.8	·· 23.8	255°29.9	11.7′	01°02.8	17.3′	59.8′
22	148°21.8	23.2	270°00.6	11.7′	01°20.1	17.2′	59.8′
23	163°21.8	22.7	284°31.2	11.7′	01°37.3	17.1′	59.7′
	SD = 15.7′	*d* = -0.5′	SD = 16.4′				

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

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

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 18-20 97-83%
23	06:31	06:32	12:07	01:41	14:07	
24	06:32	06:33	12:07	02:33	14:59	
25	06:33	06:33	12:07	03:23	15:48	

July 26, 27, 28 UT (Fri., Sat., Sun.)

	Aries	Venus		Mars		Jupiter		Saturn	
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	304°10.9	163°40.8	N16°56.5	242°31.5	N20°12.3	232°11.7	N21°42.6	313°35.5	S06°19.2
1	319°13.3	178°40.2	55.6	257°32.2	12.6	247°13.7	42.6	328°38.1	19.2
2	334°15.8	193°39.6	54.7	272°32.9	13.0	262°15.7	42.7	343°40.6	19.3
3	349°18.3	208°39.0	·· 53.7	287°33.5	·· 13.4	277°17.6	·· 42.7	358°43.2	·· 19.3
4	4°20.7	223°38.4	52.8	302°34.2	13.7	292°19.6	42.8	13°45.7	19.4
5	19°23.2	238°37.8	51.9	317°34.9	14.1	307°21.5	42.8	28°48.3	19.4
6	34°25.7	253°37.2	N16°51.0	332°35.6	N20°14.4	322°23.5	N21°42.9	43°50.8	S06°19.5
7	49°28.1	268°36.6	50.0	347°36.3	14.8	337°25.5	43.0	58°53.4	19.5
8	64°30.6	283°36.0	49.1	2°36.9	15.1	352°27.4	43.0	73°56.0	19.6
9	79°33.0	298°35.4	·· 48.2	17°37.6	·· 15.5	7°29.4	·· 43.1	88°58.5	·· 19.6
10	94°35.5	313°34.9	47.3	32°38.3	15.8	22°31.4	43.1	104°01.1	19.7
11	109°38.0	328°34.3	46.3	47°39.0	16.2	37°33.3	43.2	119°03.6	19.7
12	124°40.4	343°33.7	N16°45.4	62°39.6	N20°16.5	52°35.3	N21°43.2	134°06.2	S06°19.8
13	139°42.9	358°33.1	44.5	77°40.3	16.9	67°37.3	43.3	149°08.8	19.8
14	154°45.4	13°32.5	43.5	92°41.0	17.2	82°39.2	43.4	164°11.3	19.9
15	169°47.8	28°31.9	·· 42.6	107°41.7	·· 17.6	97°41.2	·· 43.4	179°13.9	·· 19.9
16	184°50.3	43°31.3	41.7	122°42.4	17.9	112°43.2	43.5	194°16.4	20.0
17	199°52.8	58°30.7	40.7	137°43.0	18.3	127°45.1	43.5	209°19.0	20.0
18	214°55.2	73°30.1	N16°39.8	152°43.7	N20°18.6	142°47.1	N21°43.6	224°21.5	S06°20.1
19	229°57.7	88°29.5	38.9	167°44.4	19.0	157°49.1	43.6	239°24.1	20.1
20	245°00.2	103°29.0	37.9	182°45.1	19.3	172°51.0	43.7	254°26.7	20.2
21	260°02.6	118°28.4	·· 37.0	197°45.8	·· 19.7	187°53.0	·· 43.8	269°29.2	·· 20.2
22	275°05.1	133°27.8	36.1	212°46.4	20.0	202°55.0	43.8	284°31.8	20.3
23	290°07.5	148°27.2	35.1	227°47.1	20.4	217°56.9	43.9	299°34.3	20.3
Mer.pass. 03:43		ν -0.6′	d -0.9′	m -3.87	ν 0.7′	d 0.4′	m 0.89	ν 2.0′	d 0.1′ m -2.09	ν 2.6′	d -0.0′ m 0.78

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	305°10.0	163°26.6	N16°34.2	242°47.8	N20°20.7	232°58.9	N21°43.9	314°36.9	S06°20.4
1	320°12.5	178°26.0	33.2	257°48.5	21.1	248°00.9	44.0	329°39.5	20.4
2	335°14.9	193°25.4	32.3	272°49.1	21.4	263°02.8	44.0	344°42.0	20.5
3	350°17.4	208°24.9	·· 31.4	287°49.8	·· 21.8	278°04.8	·· 44.1	359°44.6	·· 20.5
4	5°19.9	223°24.3	30.4	302°50.5	22.1	293°06.8	44.2	14°47.1	20.6
5	20°22.3	238°23.7	29.5	317°51.2	22.5	308°08.7	44.2	29°49.7	20.6
6	35°24.8	253°23.1	N16°28.5	332°51.9	N20°22.8	323°10.7	N21°44.3	44°52.3	S06°20.7
7	50°27.3	268°22.5	27.6	347°52.5	23.1	338°12.7	44.3	59°54.8	20.7
8	65°29.7	283°21.9	26.6	2°53.2	23.5	353°14.6	44.4	74°57.4	20.8
9	80°32.2	298°21.4	·· 25.7	17°53.9	·· 23.8	8°16.6	·· 44.4	89°59.9	·· 20.8
10	95°34.6	313°20.8	24.7	32°54.6	24.2	23°18.6	44.5	105°02.5	20.9
11	110°37.1	328°20.2	23.8	47°55.3	24.5	38°20.5	44.5	120°05.1	20.9
12	125°39.6	343°19.6	N16°22.9	62°55.9	N20°24.9	53°22.5	N21°44.6	135°07.6	S06°21.0
13	140°42.0	358°19.0	21.9	77°56.6	25.2	68°24.5	44.7	150°10.2	21.0
14	155°44.5	13°18.5	21.0	92°57.3	25.6	83°26.4	44.7	165°12.7	21.1
15	170°47.0	28°17.9	·· 20.0	107°58.0	·· 25.9	98°28.4	·· 44.8	180°15.3	·· 21.1
16	185°49.4	43°17.3	19.1	122°58.7	26.2	113°30.4	44.8	195°17.9	21.2
17	200°51.9	58°16.7	18.1	137°59.3	26.6	128°32.3	44.9	210°20.4	21.2
18	215°54.4	73°16.2	N16°17.1	153°00.0	N20°26.9	143°34.3	N21°44.9	225°23.0	S06°21.3
19	230°56.8	88°15.6	16.2	168°00.7	27.3	158°36.3	45.0	240°25.6	21.3
20	245°59.3	103°15.0	15.2	183°01.4	27.6	173°38.2	45.0	255°28.1	21.4
21	261°01.8	118°14.4	·· 14.3	198°02.1	·· 28.0	188°40.2	·· 45.1	270°30.7	·· 21.4
22	276°04.2	133°13.9	13.3	213°02.7	28.3	203°42.2	45.2	285°33.2	21.5
23	291°06.7	148°13.3	12.4	228°03.4	28.6	218°44.2	45.2	300°35.8	21.5
Mer.pass. 03:39		ν -0.6′	d -0.9′	m -3.87	ν 0.7′	d 0.3′	m 0.88	ν 2.0′	d 0.1′ m -2.10	ν 2.6′	d -0.1′ m 0.78

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	306°09.1	163°12.7	N16°11.4	243°04.1	N20°29.0	233°46.1	N21°45.3	315°38.4	S06°21.6
1	321°11.6	178°12.1	10.5	258°04.8	29.3	248°48.1	45.3	330°40.9	21.7
2	336°14.1	193°11.6	09.5	273°05.5	29.7	263°50.1	45.4	345°43.5	21.7
3	351°16.5	208°11.0	·· 08.5	288°06.1	·· 30.0	278°52.0	·· 45.4	0°46.1	·· 21.8
4	6°19.0	223°10.4	07.6	303°06.8	30.3	293°54.0	45.5	15°48.6	21.8
5	21°21.5	238°09.8	06.6	318°07.5	30.7	308°56.0	45.5	30°51.2	21.9
6	36°23.9	253°09.3	N16°05.7	333°08.2	N20°31.0	323°58.0	N21°45.6	45°53.7	S06°21.9
7	51°26.4	268°08.7	04.7	348°08.9	31.3	338°59.9	45.7	60°56.3	22.0
8	66°28.9	283°08.1	03.7	3°09.5	31.7	354°01.9	45.7	75°58.9	22.0
9	81°31.3	298°07.6	·· 02.8	18°10.2	·· 32.0	9°03.9	·· 45.8	91°01.4	·· 22.1
10	96°33.8	313°07.0	01.8	33°10.9	32.4	24°05.8	45.8	106°04.0	22.1
11	111°36.3	328°06.4	16°00.8	48°11.6	32.7	39°07.8	45.9	121°06.6	22.2
12	126°38.7	343°05.9	N15°59.9	63°12.3	N20°33.0	54°09.8	N21°45.9	136°09.1	S06°22.2
13	141°41.2	358°05.3	58.9	78°12.9	33.4	69°11.8	46.0	151°11.7	22.3
14	156°43.6	13°04.7	57.9	93°13.6	33.7	84°13.7	46.0	166°14.3	22.3
15	171°46.1	28°04.2	·· 57.0	108°14.3	·· 34.0	99°15.7	·· 46.1	181°16.8	·· 22.4
16	186°48.6	43°03.6	56.0	123°15.0	34.4	114°17.7	46.2	196°19.4	22.4
17	201°51.0	58°03.0	55.0	138°15.7	34.7	129°19.6	46.2	211°22.0	22.5
18	216°53.5	73°02.5	N15°54.0	153°16.3	N20°35.0	144°21.6	N21°46.3	226°24.5	S06°22.5
19	231°56.0	88°01.9	53.1	168°17.0	35.4	159°23.6	46.3	241°27.1	22.6
20	246°58.4	103°01.3	52.1	183°17.7	35.7	174°25.6	46.4	256°29.6	22.6
21	262°00.9	118°00.8	·· 51.1	198°18.4	·· 36.0	189°27.5	·· 46.4	271°32.2	·· 22.7
22	277°03.4	133°00.2	50.2	213°19.1	36.4	204°29.5	46.5	286°34.8	22.7
23	292°05.8	147°59.7	49.2	228°19.7	36.7	219°31.5	46.5	301°37.3	22.8
Mer.pass. 03:35		ν -0.6′	d -1.0′	m -3.87	ν 0.7′	d 0.3′	m 0.88	ν 2.0′	d 0.1′ m -2.10	ν 2.6′	d -0.1′ m 0.77

Stars

	SHA	Dec
Alpheratz	357°35.0	29°13.5
Ankaa	353°07.3	-42°10.1
Schedar	349°31.3	56°40.1
Diphda	348°47.5	-17°50.9
Achernar	335°20.3	-57°06.4
Hamal	327°51.6	23°34.7
Polaris	314°20.1	89°21.7
Acamar	315°12.1	-40°12.1
Menkar	314°06.6	4°11.2
Mirfak	308°29.0	49°56.7
Aldebaran	290°40.3	16°33.5
Rigel	281°04.5	-8°10.3
Capella	280°22.8	46°01.2
Bellatrix	278°23.5	6°22.4
Elnath	278°02.6	28°37.7
Alnilam	275°38.4	-1°11.1
Betelgeuse	270°52.8	7°24.8
Canopus	263°53.1	-52°42.3
Sirius	258°26.9	-16°44.8
Adhara	255°06.5	-29°00.2
Procyon	244°51.6	5°09.8
Pollux	243°18.1	27°58.1
Avior	234°15.6	-59°35.2
Suhail	222°47.0	-43°31.9
Miaplacidus	221°39.3	-69°49.1
Alphard	217°48.4	-8°45.8
Regulus	207°35.1	11°51.0
Dubhe	193°41.9	61°37.4
Denebola	182°25.5	14°26.2
Gienah	175°44.1	-17°40.7
Acrux	173°00.9	-63°14.3
Gacrux	171°52.3	-57°15.2
Alioth	166°13.5	55°49.9
Spica	158°22.8	-11°17.4
Alkaid	152°52.3	49°11.7
Hadar	148°36.6	-60°29.7
Menkent	147°58.1	-36°29.6
Arcturus	145°48.2	19°03.4
Rigil Kent.	139°40.8	-60°56.4
Kochab	137°19.5	74°03.5
Zuben'ubi	136°56.4	-16°08.7
Alphecca	126°03.9	26°38.1
Antares	112°16.1	-26°29.2
Atria	107°10.3	-69°04.5
Sabik	102°03.0	-15°45.3
Shaula	96°10.5	-37°07.4
Rasalhague	95°58.6	12°32.6
Eltanin	90°41.9	51°29.3
Kaus Aust.	83°32.6	-34°22.4
Vega	80°33.1	38°48.5
Nunki	75°47.9	-26°16.0
Altair	62°00.0	8°56.0
Peacock	53°05.7	-56°39.3
Deneb	49°25.6	45°22.0
Enif	33°38.9	9°59.3
Al Na'ir	27°32.9	-46°50.4
Fomalhaut	15°14.6	-29°29.4
Scheat	13°45.3	28°12.9
Markab	13°30.0	15°20.2

Jul 26 Fri	SHA	Mer.pass
Venus	219°29.9	13:06
Mars	298°20.6	07:50
Jupiter	288°00.9	08:30
Saturn	9°24.6	03:05

Jul 27 Sat	SHA	Mer.pass
Venus	218°16.6	13:07
Mars	297°37.8	07:48
Jupiter	287°48.9	08:27
Saturn	9°26.9	03:01

Jul 28 Sun	SHA	Mer.pass
Venus	217°03.6	13:08
Mars	296°54.9	07:47
Jupiter	287°37.0	08:24
Saturn	9°29.2	02:57

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°21.8	N19°22.1	299°01.9	11.7′	N01°54.4	17.2′	59.7′
1	193°21.8	21.6	313°32.6	11.7′	02°11.6	17.1′	59.7′
2	208°21.8	21.0	328°03.3	11.7′	02°28.7	17.2′	59.7′
3	223°21.8	·· 20.5	342°34.0	11.7′	02°45.9	17.1′	59.7′
4	238°21.8	19.9	357°04.7	11.7′	03°03.0	17.1′	59.7′
5	253°21.8	19.3	11°35.5	11.7′	03°20.1	17.0′	59.7′
6	268°21.8	N19°18.8	26°06.2	11.7′	N03°37.1	17.0′	59.7′
7	283°21.8	18.2	40°36.9	11.7′	03°54.1	17.0′	59.6′
8	298°21.8	17.7	55°07.5	11.7′	04°11.1	17.0′	59.6′
9	313°21.8	·· 17.1	69°38.2	11.7′	04°28.1	16.9′	59.6′
10	328°21.8	16.5	84°08.9	11.7′	04°45.0	16.9′	59.6′
11	343°21.8	16.0	98°39.6	11.7′	05°01.9	16.9′	59.6′
12	358°21.8	N19°15.4	113°10.3	11.7′	N05°18.8	16.8′	59.6′
13	13°21.8	14.9	127°40.9	11.6′	05°35.6	16.8′	59.6′
14	28°21.8	14.3	142°11.5	11.6′	05°52.4	16.8′	59.5′
15	43°21.8	·· 13.7	156°42.2	11.6′	06°09.2	16.7′	59.5′
16	58°21.8	13.2	171°12.8	11.6′	06°25.9	16.7′	59.5′
17	73°21.8	12.6	185°43.4	11.6′	06°42.6	16.6′	59.5′
18	88°21.8	N19°12.0	200°13.9	11.6′	N06°59.2	16.6′	59.5′
19	103°21.9	11.5	214°44.5	11.5′	07°15.8	16.5′	59.5′
20	118°21.9	10.9	229°15.0	11.5′	07°32.3	16.5′	59.4′
21	133°21.9	·· 10.3	243°45.5	11.5′	07°48.8	16.4′	59.4′
22	148°21.9	09.8	258°16.0	11.5′	08°05.2	16.4′	59.4′
23	163°21.9	09.2	272°46.5	11.4′	08°21.6	16.4′	59.4′
	SD = 15.7′	d = -0.6′	SD = 16.3′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°21.9	N19°08.6	287°16.9	11.4′	N08°38.0	16.2′	59.4′
1	193°21.9	08.1	301°47.4	11.4′	08°54.2	16.3′	59.4′
2	208°21.9	07.5	316°17.7	11.4′	09°10.5	16.1′	59.3′
3	223°21.9	·· 06.9	330°48.1	11.3′	09°26.6	16.1′	59.3′
4	238°21.9	06.4	345°18.4	11.3′	09°42.7	16.1′	59.3′
5	253°21.9	05.8	359°48.7	11.3′	09°58.8	16.0′	59.3′
6	268°21.9	N19°05.2	14°19.0	11.2′	N10°14.8	15.9′	59.3′
7	283°22.0	04.6	28°49.2	11.2′	10°30.7	15.8′	59.3′
8	298°22.0	04.1	43°19.4	11.2′	10°46.5	15.8′	59.2′
9	313°22.0	·· 03.5	57°49.6	11.1′	11°02.3	15.8′	59.2′
10	328°22.0	02.9	72°19.7	11.1′	11°18.1	15.6′	59.2′
11	343°22.0	02.3	86°49.8	11.0′	11°33.7	15.6′	59.2′
12	358°22.0	N19°01.8	101°19.8	11.0′	N11°49.3	15.5′	59.2′
13	13°22.0	01.2	115°49.9	11.0′	12°04.8	15.5′	59.1′
14	28°22.0	00.6	130°19.8	10.9′	12°20.3	15.3′	59.1′
15	43°22.0	19°00.0	144°49.7	10.9′	12°35.6	15.3′	59.1′
16	58°22.1	18°59.5	159°19.6	10.8′	12°50.9	15.2′	59.1′
17	73°22.1	58.9	173°49.5	10.8′	13°06.1	15.2′	59.1′
18	88°22.1	N18°58.3	188°19.2	10.7′	N13°21.3	15.0′	59.0′
19	103°22.1	57.7	202°49.0	10.7′	13°36.3	15.0′	59.0′
20	118°22.1	57.1	217°18.7	10.6′	13°51.3	14.9′	59.0′
21	133°22.1	·· 56.6	231°48.3	10.6′	14°06.2	14.8′	59.0′
22	148°22.1	56.0	246°17.9	10.6′	14°21.0	14.7′	59.0′
23	163°22.2	55.4	260°47.5	10.5′	14°35.7	14.7′	58.9′
	SD = 15.7′	d = -0.6′	SD = 16.2′				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°22.2	N18°54.8	275°17.0	10.4′	N14°50.4	14.5′	58.9′
1	193°22.2	54.2	289°46.4	10.4′	15°04.9	14.5′	58.9′
2	208°22.2	53.7	304°15.8	10.3′	15°19.4	14.3′	58.9′
3	223°22.2	·· 53.1	318°45.2	10.3′	15°33.7	14.3′	58.9′
4	238°22.2	52.5	333°14.5	10.2′	15°48.0	14.2′	58.8′
5	253°22.2	51.9	347°43.7	10.2′	16°02.2	14.1′	58.8′
6	268°22.3	N18°51.3	2°12.9	10.1′	N16°16.3	14.0′	58.8′
7	283°22.3	50.7	16°42.0	10.1′	16°30.3	13.9′	58.8′
8	298°22.3	50.1	31°11.1	10.0′	16°44.2	13.7′	58.8′
9	313°22.3	·· 49.6	45°40.1	9.9′	16°57.9	13.7′	58.7′
10	328°22.3	49.0	60°09.0	9.9′	17°11.6	13.6′	58.7′
11	343°22.3	48.4	74°37.9	9.8′	17°25.2	13.5′	58.7′
12	358°22.4	N18°47.8	89°06.7	9.8′	N17°38.7	13.4′	58.7′
13	13°22.4	47.2	103°35.5	9.7′	17°52.1	13.3′	58.7′
14	28°22.4	46.6	118°04.2	9.6′	18°05.4	13.1′	58.6′
15	43°22.4	·· 46.0	132°32.9	9.6′	18°18.5	13.1′	58.6′
16	58°22.4	45.4	147°01.5	9.5′	18°31.6	12.9′	58.6′
17	73°22.5	44.8	161°30.0	9.5′	18°44.5	12.9′	58.6′
18	88°22.5	N18°44.3	175°58.4	9.4′	N18°57.4	12.7′	58.6′
19	103°22.5	43.7	190°26.8	9.3′	19°10.1	12.6′	58.5′
20	118°22.5	43.1	204°55.2	9.3′	19°22.7	12.5′	58.5′
21	133°22.5	·· 42.5	219°23.4	9.2′	19°35.2	12.4′	58.5′
22	148°22.5	41.9	233°51.7	9.1′	19°47.6	12.2′	58.5′
23	163°22.6	41.3	248°19.8	9.1′	19°59.8	12.2′	58.4′
	SD = 15.7′	d = -0.6′	SD = 16.1′				

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

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

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 21-23 74-51%
26	06:33	06:33	12:07	04:12	16:36	
27	06:32	06:32	12:07	05:01	17:26	
28	06:31	06:31	12:07	05:51	18:17	

July 29, 30, 31 UT (Mon., Tue., Wed.)

	Aries	Venus		Mars		Jupiter		Saturn	
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	307°08.3	162°59.1	N15°48.2	243°20.4	N20°37.0	234°33.5	N21°46.6	316°39.9	S06°22.9
1	322°10.7	177°58.5	47.2	258°21.1	37.4	249°35.4	46.6	331°42.5	22.9
2	337°13.2	192°58.0	46.3	273°21.8	37.7	264°37.4	46.7	346°45.0	23.0
3	352°15.7	207°57.4	·· 45.3	288°22.5	·· 38.0	279°39.4	·· 46.8	1°47.6	·· 23.0
4	7°18.1	222°56.9	44.3	303°23.1	38.4	294°41.4	46.8	16°50.2	23.1
5	22°20.6	237°56.3	43.3	318°23.8	38.7	309°43.3	46.9	31°52.7	23.1
6	37°23.1	252°55.7	N15°42.3	333°24.5	N20°39.0	324°45.3	N21°46.9	46°55.3	S06°23.2
7	52°25.5	267°55.2	41.4	348°25.2	39.3	339°47.3	47.0	61°57.9	23.2
8	67°28.0	282°54.6	40.4	3°25.9	39.7	354°49.3	47.0	77°00.4	23.3
9	82°30.5	297°54.1	·· 39.4	18°26.5	·· 40.0	9°51.2	·· 47.1	92°03.0	·· 23.3
10	97°32.9	312°53.5	38.4	33°27.2	40.3	24°53.2	47.1	107°05.6	23.4
11	112°35.4	327°53.0	37.4	48°27.9	40.7	39°55.2	47.2	122°08.1	23.4
12	127°37.9	342°52.4	N15°36.4	63°28.6	N20°41.0	54°57.2	N21°47.2	137°10.7	S06°23.5
13	142°40.3	357°51.8	35.5	78°29.3	41.3	69°59.1	47.3	152°13.3	23.5
14	157°42.8	12°51.3	34.5	93°30.0	41.6	85°01.1	47.3	167°15.8	23.6
15	172°45.2	27°50.7	·· 33.5	108°30.6	·· 42.0	100°03.1	·· 47.4	182°18.4	·· 23.7
16	187°47.7	42°50.2	32.5	123°31.3	42.3	115°05.1	47.5	197°21.0	23.7
17	202°50.2	57°49.6	31.5	138°32.0	42.6	130°07.0	47.5	212°23.6	23.8
18	217°52.6	72°49.1	N15°30.5	153°32.7	N20°42.9	145°09.0	N21°47.6	227°26.1	S06°23.8
19	232°55.1	87°48.5	29.5	168°33.4	43.3	160°11.0	47.6	242°28.7	23.9
20	247°57.6	102°48.0	28.5	183°34.0	43.6	175°13.0	47.7	257°31.3	23.9
21	263°00.0	117°47.4	·· 27.5	198°34.7	·· 43.9	190°15.0	·· 47.7	272°33.8	·· 24.0
22	278°02.5	132°46.9	26.6	213°35.4	44.2	205°16.9	47.8	287°36.4	24.0
23	293°05.0	147°46.3	25.6	228°36.1	44.6	220°18.9	47.8	302°39.0	24.1
Mer.pass. 03:31		ν -0.6′	d -1.0′	m -3.87	ν 0.7′	d 0.3′	m 0.87	ν 2.0′	d 0.1′ m -2.10	ν 2.6′	d -0.1′ m 0.77

Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	308°07.4	162°45.8	N15°24.6	243°36.8	N20°44.9	235°20.9	N21°47.9	317°41.5	S06°24.1
1	323°09.9	177°45.2	23.6	258°37.5	45.2	250°22.9	47.9	332°44.1	24.2
2	338°12.4	192°44.7	22.6	273°38.1	45.5	265°24.8	48.0	347°46.7	24.2
3	353°14.8	207°44.1	·· 21.6	288°38.8	·· 45.9	280°26.8	·· 48.0	2°49.2	·· 24.3
4	8°17.3	222°43.6	20.6	303°39.5	46.2	295°28.8	48.1	17°51.8	24.4
5	23°19.7	237°43.0	19.6	318°40.2	46.5	310°30.8	48.2	32°54.4	24.4
6	38°22.2	252°42.5	N15°18.6	333°40.9	N20°46.8	325°32.8	N21°48.2	47°57.0	S06°24.5
7	53°24.7	267°41.9	17.6	348°41.5	47.2	340°34.7	48.3	62°59.5	24.5
8	68°27.1	282°41.4	16.6	3°42.2	47.5	355°36.7	48.3	78°02.1	24.6
9	83°29.6	297°40.9	·· 15.6	18°42.9	·· 47.8	10°38.7	·· 48.4	93°04.7	·· 24.6
10	98°32.1	312°40.3	14.6	33°43.6	48.1	25°40.7	48.4	108°07.2	24.7
11	113°34.5	327°39.8	13.6	48°44.3	48.4	40°42.7	48.5	123°09.8	24.7
12	128°37.0	342°39.2	N15°12.6	63°45.0	N20°48.8	55°44.6	N21°48.5	138°12.4	S06°24.8
13	143°39.5	357°38.7	11.6	78°45.6	49.1	70°46.6	48.6	153°14.9	24.8
14	158°41.9	12°38.1	10.6	93°46.3	49.4	85°48.6	48.6	168°17.5	24.9
15	173°44.4	27°37.6	·· 09.6	108°47.0	·· 49.7	100°50.6	·· 48.7	183°20.1	·· 25.0
16	188°46.9	42°37.1	08.6	123°47.7	50.0	115°52.6	48.7	198°22.7	25.0
17	203°49.3	57°36.5	07.6	138°48.4	50.4	130°54.5	48.8	213°25.2	25.1
18	218°51.8	72°36.0	N15°06.6	153°49.1	N20°50.7	145°56.5	N21°48.8	228°27.8	S06°25.1
19	233°54.2	87°35.4	05.6	168°49.7	51.0	160°58.5	48.9	243°30.4	25.2
20	248°56.7	102°34.9	04.6	183°50.4	51.3	176°00.5	48.9	258°32.9	25.2
21	263°59.2	117°34.4	·· 03.6	198°51.1	·· 51.6	191°02.5	·· 49.0	273°35.5	·· 25.3
22	279°01.6	132°33.8	02.5	213°51.8	51.9	206°04.4	49.0	288°38.1	25.3
23	294°04.1	147°33.3	01.5	228°52.5	52.3	221°06.4	49.1	303°40.7	25.4
Mer.pass. 03:27		ν -0.5′	d -1.0′	m -3.87	ν 0.7′	d 0.3′	m 0.87	ν 2.0′	d 0.1′ m -2.11	ν 2.6′	d -0.1′ m 0.76

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	309°06.6	162°32.7	N15°00.5	243°53.2	N20°52.6	236°08.4	N21°49.2	318°43.2	S06°25.4
1	324°09.0	177°32.2	14°59.5	258°53.8	52.9	251°10.4	49.2	333°45.8	25.5
2	339°11.5	192°31.7	58.5	273°54.5	53.2	266°12.4	49.3	348°48.4	25.6
3	354°14.0	207°31.1	·· 57.5	288°55.2	·· 53.5	281°14.4	·· 49.3	3°51.0	·· 25.6
4	9°16.4	222°30.6	56.5	303°55.9	53.8	296°16.3	49.4	18°53.5	25.7
5	24°18.9	237°30.1	55.5	318°56.6	54.2	311°18.3	49.4	33°56.1	25.7
6	39°21.4	252°29.5	N14°54.4	333°57.3	N20°54.5	326°20.3	N21°49.5	48°58.7	S06°25.8
7	54°23.8	267°29.0	53.4	348°57.9	54.8	341°22.3	49.5	64°01.2	25.8
8	69°26.3	282°28.5	52.4	3°58.6	55.1	356°24.3	49.6	79°03.8	25.9
9	84°28.7	297°27.9	·· 51.4	18°59.3	·· 55.4	11°26.3	·· 49.6	94°06.4	·· 25.9
10	99°31.2	312°27.4	50.4	34°00.0	55.7	26°28.2	49.7	109°09.0	26.0
11	114°33.7	327°26.9	49.4	49°00.7	56.0	41°30.2	49.7	124°11.5	26.1
12	129°36.1	342°26.3	N14°48.3	64°01.4	N20°56.3	56°32.2	N21°49.8	139°14.1	S06°26.1
13	144°38.6	357°25.8	47.3	79°02.0	56.7	71°34.2	49.8	154°16.7	26.2
14	159°41.1	12°25.3	46.3	94°02.7	57.0	86°36.2	49.9	169°19.3	26.2
15	174°43.5	27°24.7	·· 45.3	109°03.4	·· 57.3	101°38.2	·· 49.9	184°21.8	·· 26.3
16	189°46.0	42°24.2	44.3	124°04.1	57.6	116°40.1	50.0	199°24.4	26.3
17	204°48.5	57°23.7	43.2	139°04.8	57.9	131°42.1	50.0	214°27.0	26.4
18	219°50.9	72°23.1	N14°42.2	154°05.5	N20°58.2	146°44.1	N21°50.1	229°29.6	S06°26.5
19	234°53.4	87°22.6	41.2	169°06.1	58.5	161°46.1	50.1	244°32.1	26.5
20	249°55.8	102°22.1	40.2	184°06.8	58.8	176°48.1	50.2	259°34.7	26.6
21	264°58.3	117°21.6	·· 39.2	199°07.5	·· 59.1	191°50.1	·· 50.2	274°37.3	·· 26.6
22	280°00.8	132°21.0	38.1	214°08.2	59.4	206°52.1	50.3	289°39.9	26.7
23	295°03.2	147°20.5	37.1	229°08.9	59.8	221°54.0	50.3	304°42.4	26.7
Mer.pass. 03:23		ν -0.5′	d -1.0′	m -3.87	ν 0.7′	d 0.3′	m 0.87	ν 2.0′	d 0.1′ m -2.11	ν 2.6′	d -0.1′ m 0.76

Stars

	SHA	Dec
Alpheratz	357°35.0	29°13.5
Ankaa	353°07.3	-42°10.1
Schedar	349°31.2	56°40.1
Diphda	348°47.5	-17°50.9
Achernar	335°20.3	-57°06.4
Hamal	327°51.6	23°34.7
Polaris	314°18.3	89°21.7
Acamar	315°12.1	-40°12.1
Menkar	314°06.6	4°11.2
Mirfak	308°28.9	49°56.7
Aldebaran	290°40.2	16°33.5
Rigel	281°04.4	-8°10.2
Capella	280°22.8	46°01.2
Bellatrix	278°23.5	6°22.4
Elnath	278°02.6	28°37.7
Alnilam	275°38.3	-1°11.1
Betelgeuse	270°52.7	7°24.8
Canopus	263°53.0	-52°42.3
Sirius	258°26.9	-16°44.8
Adhara	255°06.5	-29°00.1
Procyon	244°51.5	5°09.8
Pollux	243°18.1	27°58.1
Avior	234°15.6	-59°35.2
Suhail	222°47.0	-43°31.8
Miaplacidus	221°39.3	-69°49.1
Alphard	217°48.4	-8°45.8
Regulus	207°35.1	11°51.0
Dubhe	193°41.9	61°37.4
Denebola	182°25.5	14°26.2
Gienah	175°44.1	-17°40.7
Acrux	173°00.9	-63°14.3
Gacrux	171°52.4	-57°15.2
Alioth	166°13.5	55°49.9
Spica	158°22.8	-11°17.4
Alkaid	152°52.3	49°11.7
Hadar	148°36.6	-60°29.7
Menkent	147°58.1	-36°29.6
Arcturus	145°48.2	19°03.4
Rigil Kent.	139°40.8	-60°56.4
Kochab	137°19.6	74°03.5
Zuben'ubi	136°56.4	-16°08.7
Alphecca	126°03.9	26°38.1
Antares	112°16.1	-26°29.2
Atria	107°10.3	-69°04.5
Sabik	102°03.0	-15°45.3
Shaula	96°10.6	-37°07.4
Rasalhague	95°58.6	12°32.6
Eltanin	90°41.9	51°29.3
Kaus Aust.	83°32.6	-34°22.4
Vega	80°33.1	38°48.5
Nunki	75°47.9	-26°16.0
Altair	62°00.0	8°56.0
Peacock	53°05.7	-56°39.3
Deneb	49°25.6	45°22.1
Enif	33°38.8	9°59.3
Al Na'ir	27°32.9	-46°50.4
Fomalhaut	15°14.6	-29°29.4
Scheat	13°45.3	28°12.9
Markab	13°30.0	15°20.3

Jul 29 Mon	SHA	Mer.pass
Venus	215°50.8	13:09
Mars	296°12.1	07:46
Jupiter	287°25.2	08:21
Saturn	9°31.6	02:53

Jul 30 Tue	SHA	Mer.pass
Venus	214°38.4	13:09
Mars	295°29.3	07:45
Jupiter	287°13.5	08:18
Saturn	9°34.1	02:49

Jul 31 Wed	SHA	Mer.pass
Venus	213°26.2	13:10
Mars	294°46.6	07:44
Jupiter	287°01.8	08:14
Saturn	9°36.7	02:45

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°22.6	N18°40.7	262°47.9	9.0′	N20°12.0	12.0′	58.4′
1	193°22.6	40.1	277°15.9	9.0′	20°24.0	11.9′	58.4′
2	208°22.6	39.5	291°43.8	8.9′	20°35.9	11.8′	58.4′
3	223°22.7	·· 38.9	306°11.7	8.8′	20°47.7	11.6′	58.4′
4	238°22.7	38.3	320°39.5	8.8′	20°59.3	11.6′	58.3′
5	253°22.7	37.7	335°07.3	8.7′	21°10.9	11.4′	58.3′
6	268°22.7	N18°37.1	349°35.0	8.6′	N21°22.3	11.2′	58.3′
7	283°22.7	36.5	4°02.6	8.6′	21°33.5	11.2′	58.3′
8	298°22.8	35.9	18°30.2	8.5′	21°44.7	11.0′	58.3′
9	313°22.8	·· 35.3	32°57.7	8.4′	21°55.7	10.9′	58.2′
10	328°22.8	34.7	47°25.1	8.4′	22°06.6	10.7′	58.2′
11	343°22.8	34.1	61°52.5	8.3′	22°17.3	10.7′	58.2′
12	358°22.9	N18°33.5	76°19.8	8.2′	N22°28.0	10.4′	58.2′
13	13°22.9	32.9	90°47.0	8.2′	22°38.4	10.4′	58.1′
14	28°22.9	32.3	105°14.2	8.1′	22°48.8	10.2′	58.1′
15	43°22.9	·· 31.7	119°41.3	8.0′	22°59.0	10.1′	58.1′
16	58°23.0	31.1	134°08.3	8.0′	23°09.1	9.9′	58.1′
17	73°23.0	30.5	148°35.3	7.9′	23°19.0	9.8′	58.1′
18	88°23.0	N18°29.9	163°02.2	7.9′	N23°28.8	9.6′	58.0′
19	103°23.0	29.3	177°29.1	7.8′	23°38.4	9.6′	58.0′
20	118°23.1	28.7	191°55.9	7.7′	23°48.0	9.3′	58.0′
21	133°23.1	·· 28.1	206°22.6	7.7′	23°57.3	9.2′	58.0′
22	148°23.1	27.5	220°49.3	7.6′	24°06.5	9.1′	57.9′
23	163°23.1	26.9	235°15.9	7.6′	24°15.6	8.9′	57.9′
	SD = 15.7′	d = -0.6′	SD = 15.9′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°23.2	N18°26.3	249°42.4	7.5′	N24°24.5	8.8′	57.9′
1	193°23.2	25.6	264°08.9	7.4′	24°33.3	8.6′	57.9′
2	208°23.2	25.0	278°35.4	7.4′	24°41.9	8.5′	57.9′
3	223°23.2	·· 24.4	293°01.7	7.3′	24°50.4	8.4′	57.8′
4	238°23.3	23.8	307°28.1	7.3′	24°58.8	8.1′	57.8′
5	253°23.3	23.2	321°54.3	7.2′	25°06.9	8.1′	57.8′
6	268°23.3	N18°22.6	336°20.5	7.2′	N25°15.0	7.8′	57.8′
7	283°23.4	22.0	350°46.7	7.1′	25°22.8	7.7′	57.7′
8	298°23.4	21.4	5°12.8	7.1′	25°30.5	7.6′	57.7′
9	313°23.4	·· 20.8	19°38.9	7.0′	25°38.1	7.4′	57.7′
10	328°23.4	20.1	34°04.9	7.0′	25°45.5	7.3′	57.7′
11	343°23.5	19.5	48°30.8	6.9′	25°52.8	7.1′	57.7′
12	358°23.5	N18°18.9	62°56.7	6.9′	N25°59.9	6.9′	57.6′
13	13°23.5	18.3	77°22.6	6.8′	26°06.8	6.8′	57.6′
14	28°23.6	17.7	91°48.4	6.8′	26°13.6	6.6′	57.6′
15	43°23.6	·· 17.1	106°14.2	6.7′	26°20.2	6.4′	57.6′
16	58°23.6	16.5	120°39.9	6.7′	26°26.6	6.3′	57.6′
17	73°23.6	15.8	135°05.6	6.6′	26°32.9	6.1′	57.5′
18	88°23.7	N18°15.2	149°31.2	6.6′	N26°39.0	6.0′	57.5′
19	103°23.7	14.6	163°56.8	6.6′	26°45.0	5.8′	57.5′
20	118°23.7	14.0	178°22.4	6.5′	26°50.8	5.7′	57.5′
21	133°23.8	·· 13.4	192°47.9	6.5′	26°56.5	5.4′	57.4′
22	148°23.8	12.8	207°13.4	6.5′	27°01.9	5.3′	57.4′
23	163°23.8	12.1	221°38.8	6.4′	27°07.2	5.2′	57.4′
	SD = 15.7′	d = -0.6′	SD = 15.8′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°23.9	N18°11.5	236°04.3	6.4′	N27°12.4	5.0′	57.4′
1	193°23.9	10.9	250°29.7	6.4′	27°17.4	4.8′	57.4′
2	208°23.9	10.3	264°55.0	6.3′	27°22.2	4.6′	57.3′
3	223°24.0	·· 09.6	279°20.4	6.3′	27°26.8	4.5′	57.3′
4	238°24.0	09.0	293°45.7	6.3′	27°31.3	4.3′	57.3′
5	253°24.0	08.4	308°11.0	6.3′	27°35.6	4.1′	57.3′
6	268°24.1	N18°07.8	322°36.2	6.2′	N27°39.7	4.0′	57.2′
7	283°24.1	07.2	337°01.5	6.2′	27°43.7	3.8′	57.2′
8	298°24.1	06.5	351°26.7	6.2′	27°47.5	3.7′	57.2′
9	313°24.2	·· 05.9	5°51.9	6.2′	27°51.2	3.4′	57.2′
10	328°24.2	05.3	20°17.1	6.2′	27°54.6	3.3′	57.2′
11	343°24.3	04.7	34°42.3	6.2′	27°57.9	3.1′	57.1′
12	358°24.3	N18°04.0	49°07.5	6.2′	N28°01.0	3.0′	57.1′
13	13°24.3	03.4	63°32.6	6.2′	28°04.0	2.8′	57.1′
14	28°24.4	02.8	77°57.8	6.1′	28°06.8	2.6′	57.1′
15	43°24.4	·· 02.1	92°22.9	6.1′	28°09.4	2.4′	57.0′
16	58°24.4	01.5	106°48.1	6.1′	28°11.8	2.3′	57.0′
17	73°24.5	00.9	121°13.2	6.1′	28°14.1	2.1′	57.0′
18	88°24.5	N18°00.3	135°38.3	6.1′	N28°16.2	1.9′	57.0′
19	103°24.5	17°59.6	150°03.5	6.1′	28°18.1	1.8′	57.0′
20	118°24.6	59.0	164°28.6	6.2′	28°19.9	1.6′	56.9′
21	133°24.6	·· 58.4	178°53.8	6.2′	28°21.5	1.4′	56.9′
22	148°24.7	57.7	193°19.0	6.2′	28°22.9	1.3′	56.9′
23	163°24.7	57.1	207°44.1	6.2′	28°24.2	1.0′	56.9′
	SD = 15.7′	d = -0.6′	SD = 15.6′				

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

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

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 24-26 40-20%
29	06:30	06:29	12:06	06:43	19:10	
30	06:27	06:26	12:06	07:38	20:07	
31	06:25	06:23	12:06	08:36	21:05	

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

	Aries	Venus		Mars		Jupiter		Saturn	
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	310°05.7	162°20.0	N14°36.1	244°09.6	N21°00.1	236°56.0	N21°50.4	319°45.0	S06°26.8
1	325°08.2	177°19.5	35.0	259°10.2	00.4	251°58.0	50.4	334°47.6	26.8
2	340°10.6	192°18.9	34.0	274°10.9	00.7	267°00.0	50.5	349°50.2	26.9
3	355°13.1	207°18.4	·· 33.0	289°11.6	·· 01.0	282°02.0	·· 50.5	4°52.7	·· 27.0
4	10°15.6	222°17.9	32.0	304°12.3	01.3	297°04.0	50.6	19°55.3	27.0
5	25°18.0	237°17.4	30.9	319°13.0	01.6	312°06.0	50.6	34°57.9	27.1
6	40°20.5	252°16.8	N14°29.9	334°13.7	N21°01.9	327°08.0	N21°50.7	50°00.5	S06°27.1
7	55°23.0	267°16.3	28.9	349°14.4	02.2	342°09.9	50.8	65°03.0	27.2
8	70°25.4	282°15.8	27.8	4°15.0	02.5	357°11.9	50.8	80°05.6	27.2
9	85°27.9	297°15.3	·· 26.8	19°15.7	·· 02.8	12°13.9	·· 50.9	95°08.2	·· 27.3
10	100°30.3	312°14.8	25.8	34°16.4	03.1	27°15.9	50.9	110°10.8	27.4
11	115°32.8	327°14.2	24.7	49°17.1	03.4	42°17.9	51.0	125°13.3	27.4
12	130°35.3	342°13.7	N14°23.7	64°17.8	N21°03.7	57°19.9	N21°51.0	140°15.9	S06°27.5
13	145°37.7	357°13.2	22.7	79°18.5	04.0	72°21.9	51.1	155°18.5	27.5
14	160°40.2	12°12.7	21.6	94°19.2	04.3	87°23.9	51.1	170°21.1	27.6
15	175°42.7	27°12.2	·· 20.6	109°19.8	·· 04.6	102°25.8	·· 51.2	185°23.7	·· 27.6
16	190°45.1	42°11.6	19.6	124°20.5	04.9	117°27.8	51.2	200°26.2	27.7
17	205°47.6	57°11.1	18.5	139°21.2	05.2	132°29.8	51.3	215°28.8	27.8
18	220°50.1	72°10.6	N14°17.5	154°21.9	N21°05.6	147°31.8	N21°51.3	230°31.4	S06°27.8
19	235°52.5	87°10.1	16.4	169°22.6	05.9	162°33.8	51.4	245°34.0	27.9
20	250°55.0	102°09.6	15.4	184°23.3	06.2	177°35.8	51.4	260°36.5	27.9
21	265°57.5	117°09.1	·· 14.4	199°24.0	·· 06.5	192°37.8	·· 51.5	275°39.1	·· 28.0
22	280°59.9	132°08.5	13.3	214°24.6	06.8	207°39.8	51.5	290°41.7	28.0
23	296°02.4	147°08.0	12.3	229°25.3	07.1	222°41.8	51.6	305°44.3	28.1
Mer.pass. 03:19		ν -0.5′	d -1.0′	m -3.87	ν 0.7′	d 0.3′	m 0.86	ν 2.0′	d 0.1′ m -2.11	ν 2.6′	d -0.1′ m 0.75

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	311°04.8	162°07.5	N14°11.2	244°26.0	N21°07.4	237°43.8	N21°51.6	320°46.9	S06°28.2
1	326°07.3	177°07.0	10.2	259°26.7	07.7	252°45.7	51.7	335°49.4	28.2
2	341°09.8	192°06.5	09.1	274°27.4	08.0	267°47.7	51.7	350°52.0	28.3
3	356°12.2	207°06.0	·· 08.1	289°28.1	·· 08.3	282°49.7	·· 51.8	5°54.6	·· 28.3
4	11°14.7	222°05.5	07.1	304°28.8	08.6	297°51.7	51.8	20°57.2	28.4
5	26°17.2	237°04.9	06.0	319°29.4	08.9	312°53.7	51.9	35°59.7	28.4
6	41°19.6	252°04.4	N14°05.0	334°30.1	N21°09.2	327°55.7	N21°51.9	51°02.3	S06°28.5
7	56°22.1	267°03.9	03.9	349°30.8	09.5	342°57.7	52.0	66°04.9	28.6
8	71°24.6	282°03.4	02.9	4°31.5	09.7	357°59.7	52.0	81°07.5	28.6
9	86°27.0	297°02.9	·· 01.8	19°32.2	·· 10.0	13°01.7	·· 52.1	96°10.1	·· 28.7
10	101°29.5	312°02.4	14°00.8	34°32.9	10.3	28°03.7	52.1	111°12.6	28.7
11	116°32.0	327°01.9	13°59.7	49°33.6	10.6	43°05.7	52.2	126°15.2	28.8
12	131°34.4	342°01.4	N13°58.7	64°34.3	N21°10.9	58°07.7	N21°52.2	141°17.8	S06°28.9
13	146°36.9	357°00.9	57.6	79°34.9	11.2	73°09.6	52.3	156°20.4	28.9
14	161°39.3	12°00.4	56.6	94°35.6	11.5	88°11.6	52.3	171°23.0	29.0
15	176°41.8	26°59.9	·· 55.5	109°36.3	·· 11.8	103°13.6	·· 52.4	186°25.5	·· 29.0
16	191°44.3	41°59.3	54.5	124°37.0	12.1	118°15.6	52.4	201°28.1	29.1
17	206°46.7	56°58.8	53.4	139°37.7	12.4	133°17.6	52.5	216°30.7	29.1
18	221°49.2	71°58.3	N13°52.4	154°38.4	N21°12.7	148°19.6	N21°52.5	231°33.3	S06°29.2
19	236°51.7	86°57.8	51.3	169°39.1	13.0	163°21.6	52.6	246°35.9	29.3
20	251°54.1	101°57.3	50.2	184°39.8	13.3	178°23.6	52.6	261°38.5	29.3
21	266°56.6	116°56.8	·· 49.2	199°40.4	·· 13.6	193°25.6	·· 52.7	276°41.0	·· 29.4
22	281°59.1	131°56.3	48.1	214°41.1	13.9	208°27.6	52.7	291°43.6	29.4
23	297°01.5	146°55.8	47.1	229°41.8	14.2	223°29.6	52.8	306°46.2	29.5
Mer.pass. 03:15		ν -0.5′	d -1.0′	m -3.87	ν 0.7′	d 0.3′	m 0.86	ν 2.0′	d 0.1′ m -2.12	ν 2.6′	d -0.1′ m 0.75

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	312°04.0	161°55.3	N13°46.0	244°42.5	N21°14.5	238°31.6	N21°52.8	321°48.8	S06°29.6
1	327°06.5	176°54.8	45.0	259°43.2	14.8	253°33.6	52.9	336°51.4	29.6
2	342°08.9	191°54.3	43.9	274°43.9	15.0	268°35.6	52.9	351°53.9	29.7
3	357°11.4	206°53.8	·· 42.8	289°44.6	·· 15.3	283°37.6	·· 53.0	6°56.5	·· 29.7
4	12°13.8	221°53.3	41.8	304°45.3	15.6	298°39.6	53.0	21°59.1	29.8
5	27°16.3	236°52.8	40.7	319°45.9	15.9	313°41.6	53.0	37°01.7	29.8
6	42°18.8	251°52.3	N13°39.7	334°46.6	N21°16.2	328°43.6	N21°53.1	52°04.3	S06°29.9
7	57°21.2	266°51.8	38.6	349°47.3	16.5	343°45.5	53.1	67°06.8	30.0
8	72°23.7	281°51.3	37.5	4°48.0	16.8	358°47.5	53.2	82°09.4	30.0
9	87°26.2	296°50.8	·· 36.5	19°48.7	·· 17.1	13°49.5	·· 53.2	97°12.0	·· 30.1
10	102°28.6	311°50.3	35.4	34°49.4	17.4	28°51.5	53.3	112°14.6	30.1
11	117°31.1	326°49.8	34.3	49°50.1	17.7	43°53.5	53.3	127°17.2	30.2
12	132°33.6	341°49.3	N13°33.3	64°50.8	N21°17.9	58°55.5	N21°53.4	142°19.8	S06°30.3
13	147°36.0	356°48.8	32.2	79°51.5	18.2	73°57.5	53.4	157°22.3	30.3
14	162°38.5	11°48.3	31.1	94°52.1	18.5	88°59.5	53.5	172°24.9	30.4
15	177°41.0	26°47.8	·· 30.1	109°52.8	·· 18.8	104°01.5	·· 53.5	187°27.5	·· 30.4
16	192°43.4	41°47.3	29.0	124°53.5	19.1	119°03.5	53.6	202°30.1	30.5
17	207°45.9	56°46.8	27.9	139°54.2	19.4	134°05.5	53.6	217°32.7	30.6
18	222°48.3	71°46.3	N13°26.9	154°54.9	N21°19.7	149°07.5	N21°53.7	232°35.3	S06°30.6
19	237°50.8	86°45.8	25.8	169°55.6	20.0	164°09.5	53.7	247°37.8	30.7
20	252°53.3	101°45.3	24.7	184°56.3	20.2	179°11.5	53.8	262°40.4	30.7
21	267°55.7	116°44.9	·· 23.7	199°57.0	·· 20.5	194°13.5	·· 53.8	277°43.0	·· 30.8
22	282°58.2	131°44.4	22.6	214°57.7	20.8	209°15.5	53.9	292°45.6	30.9
23	298°00.7	146°43.9	21.5	229°58.3	21.1	224°17.5	53.9	307°48.2	30.9
Mer.pass. 03:11		ν -0.5′	d -1.1′	m -3.87	ν 0.7′	d 0.3′	m 0.85	ν 2.0′	d 0.0′ m -2.12	ν 2.6′	d -0.1′ m 0.74

Stars

	SHA	Dec
Alpheratz	357°34.9	29°13.5
Ankaa	353°07.2	-42°10.1
Schedar	349°31.2	56°40.1
Diphda	348°47.5	-17°50.9
Achernar	335°20.3	-57°06.4
Hamal	327°51.6	23°34.7
Polaris	314°16.5	89°21.7
Acamar	315°12.1	-40°12.1
Menkar	314°06.6	4°11.2
Mirfak	308°28.9	49°56.7
Aldebaran	290°40.2	16°33.5
Rigel	281°04.4	-8°10.2
Capella	280°22.7	46°01.2
Bellatrix	278°23.5	6°22.4
Elnath	278°02.6	28°37.7
Alnilam	275°38.3	-1°11.1
Betelgeuse	270°52.7	7°24.8
Canopus	263°53.0	-52°42.3
Sirius	258°26.9	-16°44.8
Adhara	255°06.5	-29°00.1
Procyon	244°51.5	5°09.8
Pollux	243°18.1	27°58.1
Avior	234°15.6	-59°35.2
Suhail	222°47.0	-43°31.8
Miaplacidus	221°39.3	-69°49.0
Alphard	217°48.4	-8°45.8
Regulus	207°35.1	11°51.0
Dubhe	193°41.9	61°37.3
Denebola	182°25.5	14°26.2
Gienah	175°44.1	-17°40.7
Acrux	173°00.9	-63°14.3
Gacrux	171°52.4	-57°15.2
Alioth	166°13.5	55°49.9
Spica	158°22.8	-11°17.4
Alkaid	152°52.4	49°11.7
Hadar	148°36.6	-60°29.7
Menkent	147°58.1	-36°29.6
Arcturus	145°48.3	19°03.4
Rigil Kent.	139°40.8	-60°56.4
Kochab	137°19.6	74°03.5
Zuben'ubi	136°56.4	-16°08.7
Alphecca	126°03.9	26°38.1
Antares	112°16.1	-26°29.2
Atria	107°10.3	-69°04.5
Sabik	102°03.0	-15°45.3
Shaula	96°10.6	-37°07.4
Rasalhague	95°58.6	12°32.6
Eltanin	90°41.9	51°29.3
Kaus Aust.	83°32.6	-34°22.4
Vega	80°33.1	38°48.5
Nunki	75°47.9	-26°16.0
Altair	62°00.0	8°56.1
Peacock	53°05.7	-56°39.3
Deneb	49°25.6	45°22.1
Enif	33°38.8	9°59.3
Al Na'ir	27°32.9	-46°50.4
Fomalhaut	15°14.6	-29°29.4
Scheat	13°45.3	28°12.9
Markab	13°30.0	15°20.3

Aug 01 Thu	SHA	Mer.pass
Venus	212°14.3	13:11
Mars	294°03.9	07:43
Jupiter	286°50.3	08:11
Saturn	9°39.3	02:41

Aug 02 Fri	SHA	Mer.pass
Venus	211°02.7	13:12
Mars	293°21.2	07:42
Jupiter	286°38.9	08:08
Saturn	9°42.0	02:36

Aug 03 Sat	SHA	Mer.pass
Venus	209°51.3	13:13
Mars	292°38.5	07:41
Jupiter	286°27.6	08:05
Saturn	9°44.8	02:32

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.1462 sec ΔT = TT-UT1 = +69.0378 sec

2024 August 01 to Aug. 03 UT

h	Sun		Moon				
Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°24.7	N17°56.5	222°09.3	6.2′	N28°25.2	0.9′	56.9′
1	193°24.8	55.8	236°34.5	6.2′	28°26.1	0.8′	56.8′
2	208°24.8	55.2	250°59.7	6.2′	28°26.9	0.6′	56.8′
3	223°24.9	·· 54.6	265°24.9	6.2′	28°27.5	0.4′	56.8′
4	238°24.9	53.9	279°50.2	6.3′	28°27.9	0.2′	56.8′
5	253°24.9	53.3	294°15.5	6.3′	28°28.1	0.0′	56.7′
6	268°25.0	N17°52.7	308°40.8	6.3′	N28°28.1	0.1′	56.7′
7	283°25.0	52.0	323°06.1	6.3′	28°28.0	0.2′	56.7′
8	298°25.1	51.4	337°31.4	6.4′	28°27.8	0.5′	56.7′
9	313°25.1	·· 50.8	351°56.8	6.4′	28°27.3	0.6′	56.7′
10	328°25.1	50.1	6°22.2	6.4′	28°26.7	0.8′	56.6′
11	343°25.2	49.5	20°47.6	6.5′	28°25.9	0.9′	56.6′
12	358°25.2	N17°48.8	35°13.1	6.5′	N28°25.0	1.1′	56.6′
13	13°25.3	48.2	49°38.6	6.6′	28°23.9	1.3′	56.6′
14	28°25.3	47.6	64°04.2	6.6′	28°22.6	1.4′	56.6′
15	43°25.4	·· 46.9	78°29.8	6.6′	28°21.2	1.6′	56.5′
16	58°25.4	46.3	92°55.4	6.7′	28°19.6	1.8′	56.5′
17	73°25.4	45.6	107°21.1	6.7′	28°17.8	1.9′	56.5′
18	88°25.5	N17°45.0	121°46.8	6.8′	N28°15.9	2.1′	56.5′
19	103°25.5	44.4	136°12.6	6.8′	28°13.8	2.3′	56.4′
20	118°25.6	43.7	150°38.4	6.9′	28°11.5	2.4′	56.4′
21	133°25.6	·· 43.1	165°04.3	6.9′	28°09.1	2.6′	56.4′
22	148°25.7	42.4	179°30.2	7.0′	28°06.5	2.7′	56.4′
23	163°25.7	41.8	193°56.2	7.0′	28°03.8	2.9′	56.4′
	SD = 15.8′	d = -0.6′	SD = 15.5′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°25.8	N17°41.1	208°22.2	7.1′	N28°00.9	3.1′	56.3′
1	193°25.8	40.5	222°48.3	7.2′	27°57.8	3.2′	56.3′
2	208°25.8	39.8	237°14.5	7.2′	27°54.6	3.4′	56.3′
3	223°25.9	·· 39.2	251°40.7	7.3′	27°51.2	3.5′	56.3′
4	238°25.9	38.6	266°07.0	7.3′	27°47.7	3.7′	56.3′
5	253°26.0	37.9	280°33.3	7.4′	27°44.0	3.8′	56.2′
6	268°26.0	N17°37.3	294°59.7	7.5′	N27°40.2	4.0′	56.2′
7	283°26.1	36.6	309°26.2	7.5′	27°36.2	4.1′	56.2′
8	298°26.1	36.0	323°52.7	7.6′	27°32.1	4.3′	56.2′
9	313°26.2	·· 35.3	338°19.3	7.7′	27°27.8	4.4′	56.2′
10	328°26.2	34.7	352°46.0	7.8′	27°23.4	4.6′	56.1′
11	343°26.3	34.0	7°12.8	7.8′	27°18.8	4.8′	56.1′
12	358°26.3	N17°33.4	21°39.6	7.9′	N27°14.0	4.9′	56.1′
13	13°26.4	32.7	36°06.5	8.0′	27°09.1	5.0′	56.1′
14	28°26.4	32.1	50°33.5	8.1′	27°04.1	5.2′	56.1′
15	43°26.5	·· 31.4	65°00.6	8.1′	26°58.9	5.3′	56.0′
16	58°26.5	30.8	79°27.7	8.2′	26°53.6	5.4′	56.0′
17	73°26.6	30.1	93°54.9	8.3′	26°48.2	5.6′	56.0′
18	88°26.6	N17°29.4	108°22.2	8.4′	N26°42.6	5.8′	56.0′
19	103°26.7	28.8	122°49.6	8.5′	26°36.8	5.9′	56.0′
20	118°26.7	28.1	137°17.1	8.5′	26°30.9	6.0′	55.9′
21	133°26.8	·· 27.5	151°44.6	8.6′	26°24.9	6.1′	55.9′
22	148°26.8	26.8	166°12.3	8.7′	26°18.8	6.3′	55.9′
23	163°26.9	26.2	180°40.0	8.8′	26°12.5	6.5′	55.9′
	SD = 15.8′	d = -0.6′	SD = 15.4′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°26.9	N17°25.5	195°07.8	8.9′	N26°06.0	6.5′	55.9′
1	193°27.0	24.9	209°35.7	9.0′	25°59.5	6.7′	55.8′
2	208°27.0	24.2	224°03.7	9.1′	25°52.8	6.9′	55.8′
3	223°27.1	·· 23.5	238°31.7	9.2′	25°45.9	6.9′	55.8′
4	238°27.1	22.9	252°59.9	9.3′	25°39.0	7.1′	55.8′
5	253°27.2	22.2	267°28.2	9.3′	25°31.9	7.2′	55.8′
6	268°27.2	N17°21.6	281°56.5	9.4′	N25°24.7	7.4′	55.7′
7	283°27.3	20.9	296°24.9	9.5′	25°17.3	7.4′	55.7′
8	298°27.3	20.2	310°53.5	9.6′	25°09.9	7.6′	55.7′
9	313°27.4	·· 19.6	325°22.1	9.7′	25°02.3	7.7′	55.7′
10	328°27.4	18.9	339°50.8	9.8′	24°54.6	7.9′	55.7′
11	343°27.5	18.3	354°19.6	9.9′	24°46.7	7.9′	55.6′
12	358°27.6	N17°17.6	8°48.5	10.0′	N24°38.8	8.1′	55.6′
13	13°27.6	16.9	23°17.5	10.1′	24°30.7	8.2′	55.6′
14	28°27.7	16.3	37°46.6	10.2′	24°22.5	8.3′	55.6′
15	43°27.7	·· 15.6	52°15.7	10.3′	24°14.2	8.4′	55.6′
16	58°27.8	14.9	66°45.0	10.4′	24°05.8	8.5′	55.5′
17	73°27.8	14.3	81°14.4	10.5′	23°57.3	8.7′	55.5′
18	88°27.9	N17°13.6	95°43.8	10.6′	N23°48.6	8.7′	55.5′
19	103°27.9	12.9	110°13.4	10.7′	23°39.9	8.9′	55.5′
20	118°28.0	12.3	124°43.1	10.8′	23°31.0	9.0′	55.5′
21	133°28.1	·· 11.6	139°12.8	10.8′	23°22.0	9.1′	55.4′
22	148°28.1	10.9	153°42.7	10.9′	23°12.9	9.2′	55.4′
23	163°28.2	10.3	168°12.6	11.0′	23°03.7	9.3′	55.4′
	SD = 15.8′	d = -0.7′	SD = 15.2′				

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

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

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 27-29 12-2%
01	06:21	06:19	12:06	09:34	22:02	
02	06:17	06:15	12:06	10:30	22:57	
03	06:12	06:10	12:06	11:24	23:49	

No IERS EOP prediction data available

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

	Aries	Venus		Mars		Jupiter		Saturn	
Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	313°03.1	161°43.4	N13°20.4	244°59.0	N21°21.4	239°19.5	N21°54.0	322°50.8	S06°31.0
1	328°05.6	176°42.9	19.4	259°59.7	21.7	254°21.5	54.0	337°53.4	31.0
2	343°08.1	191°42.4	18.3	275°00.4	21.9	269°23.5	54.1	352°55.9	31.1
3	358°10.5	206°41.9	·· 17.2	290°01.1	·· 22.2	284°25.5	·· 54.1	7°58.5	·· 31.2
4	13°13.0	221°41.4	16.1	305°01.8	22.5	299°27.5	54.2	23°01.1	31.2
5	28°15.4	236°40.9	15.1	320°02.5	22.8	314°29.5	54.2	38°03.7	31.3
6	43°17.9	251°40.4	N13°14.0	335°03.2	N21°23.1	329°31.5	N21°54.3	53°06.3	S06°31.3
7	58°20.4	266°39.9	12.9	350°03.9	23.4	344°33.5	54.3	68°08.9	31.4
8	73°22.8	281°39.5	11.8	5°04.6	23.6	359°35.5	54.4	83°11.4	31.5
9	88°25.3	296°39.0	·· 10.7	20°05.2	·· 23.9	14°37.5	·· 54.4	98°14.0	·· 31.5
10	103°27.8	311°38.5	09.7	35°05.9	24.2	29°39.5	54.4	113°16.6	31.6
11	118°30.2	326°38.0	08.6	50°06.6	24.5	44°41.5	54.5	128°19.2	31.6
12	133°32.7	341°37.5	N13°07.5	65°07.3	N21°24.8	59°43.5	N21°54.5	143°21.8	S06°31.7
13	148°35.2	356°37.0	06.4	80°08.0	25.0	74°45.5	54.6	158°24.4	31.8
14	163°37.6	11°36.5	05.3	95°08.7	25.3	89°47.5	54.6	173°27.0	31.8
15	178°40.1	26°36.1	·· 04.3	110°09.4	·· 25.6	104°49.5	·· 54.7	188°29.5	·· 31.9
16	193°42.6	41°35.6	03.2	125°10.1	25.9	119°51.5	54.7	203°32.1	31.9
17	208°45.0	56°35.1	02.1	140°10.8	26.2	134°53.5	54.8	218°34.7	32.0
18	223°47.5	71°34.6	N13°01.0	155°11.5	N21°26.4	149°55.5	N21°54.8	233°37.3	S06°32.1
19	238°49.9	86°34.1	12°59.9	170°12.2	26.7	164°57.5	54.9	248°39.9	32.1
20	253°52.4	101°33.6	58.8	185°12.8	27.0	179°59.5	54.9	263°42.5	32.2
21	268°54.9	116°33.2	·· 57.8	200°13.5	·· 27.3	195°01.5	·· 55.0	278°45.1	·· 32.2
22	283°57.3	131°32.7	56.7	215°14.2	27.5	210°03.5	55.0	293°47.7	32.3
23	298°59.8	146°32.2	55.6	230°14.9	27.8	225°05.5	55.1	308°50.2	32.4
Mer.pass. 03:07		ν -0.5′	d -1.1′	m -3.86	ν 0.7′	d 0.3′	m 0.85	ν 2.0′	d 0.0′ m -2.13	ν 2.6′	d -0.1′ m 0.74

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	314°02.3	161°31.7	N12°54.5	245°15.6	N21°28.1	240°07.5	N21°55.1	323°52.8	S06°32.4
1	329°04.7	176°31.2	53.4	260°16.3	28.4	255°09.5	55.2	338°55.4	32.5
2	344°07.2	191°30.8	52.3	275°17.0	28.7	270°11.5	55.2	353°58.0	32.5
3	359°09.7	206°30.3	·· 51.2	290°17.7	·· 28.9	285°13.6	·· 55.3	9°00.6	·· 32.6
4	14°12.1	221°29.8	50.1	305°18.4	29.2	300°15.6	55.3	24°03.2	32.7
5	29°14.6	236°29.3	49.1	320°19.1	29.5	315°17.6	55.3	39°05.8	32.7
6	44°17.1	251°28.8	N12°48.0	335°19.8	N21°29.8	330°19.6	N21°55.4	54°08.4	S06°32.8
7	59°19.5	266°28.4	46.9	350°20.5	30.0	345°21.6	55.4	69°10.9	32.9
8	74°22.0	281°27.9	45.8	5°21.1	30.3	0°23.6	55.5	84°13.5	32.9
9	89°24.4	296°27.4	·· 44.7	20°21.8	·· 30.6	15°25.6	·· 55.5	99°16.1	·· 33.0
10	104°26.9	311°26.9	43.6	35°22.5	30.8	30°27.6	55.6	114°18.7	33.0
11	119°29.4	326°26.5	42.5	50°23.2	31.1	45°29.6	55.6	129°21.3	33.1
12	134°31.8	341°26.0	N12°41.4	65°23.9	N21°31.4	60°31.6	N21°55.7	144°23.9	S06°33.2
13	149°34.3	356°25.5	40.3	80°24.6	31.7	75°33.6	55.7	159°26.5	33.2
14	164°36.8	11°25.0	39.2	95°25.3	31.9	90°35.6	55.8	174°29.1	33.3
15	179°39.2	26°24.6	·· 38.1	110°26.0	·· 32.2	105°37.6	·· 55.8	189°31.7	·· 33.3
16	194°41.7	41°24.1	37.0	125°26.7	32.5	120°39.6	55.9	204°34.2	33.4
17	209°44.2	56°23.6	35.9	140°27.4	32.7	135°41.6	55.9	219°36.8	33.5
18	224°46.6	71°23.1	N12°34.8	155°28.1	N21°33.0	150°43.6	N21°56.0	234°39.4	S06°33.5
19	239°49.1	86°22.7	33.7	170°28.8	33.3	165°45.6	56.0	249°42.0	33.6
20	254°51.5	101°22.2	32.6	185°29.5	33.6	180°47.7	56.0	264°44.6	33.7
21	269°54.0	116°21.7	·· 31.5	200°30.2	·· 33.8	195°49.7	·· 56.1	279°47.2	·· 33.7
22	284°56.5	131°21.2	30.4	215°30.9	34.1	210°51.7	56.1	294°49.8	33.8
23	299°58.9	146°20.8	29.3	230°31.5	34.4	225°53.7	56.2	309°52.4	33.8
Mer.pass. 03:03		ν -0.5′	d -1.1′	m -3.86	ν 0.7′	d 0.3′	m 0.85	ν 2.0′	d 0.0′ m -2.13	ν 2.6′	d -0.1′ m 0.73

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	315°01.4	161°20.3	N12°28.2	245°32.2	N21°34.6	240°55.7	N21°56.2	324°55.0	S06°33.9
1	330°03.9	176°19.8	27.1	260°32.9	34.9	255°57.7	56.3	339°57.5	34.0
2	345°06.3	191°19.4	26.0	275°33.6	35.2	270°59.7	56.3	355°00.1	34.0
3	0°08.8	206°18.9	·· 24.9	290°34.3	·· 35.4	286°01.7	·· 56.4	10°02.7	·· 34.1
4	15°11.3	221°18.4	23.8	305°35.0	35.7	301°03.7	56.4	25°05.3	34.2
5	30°13.7	236°18.0	22.7	320°35.7	36.0	316°05.7	56.5	40°07.9	34.2
6	45°16.2	251°17.5	N12°21.6	335°36.4	N21°36.2	331°07.7	N21°56.5	55°10.5	S06°34.3
7	60°18.7	266°17.0	20.5	350°37.1	36.5	346°09.7	56.5	70°13.1	34.3
8	75°21.1	281°16.6	19.4	5°37.8	36.8	1°11.8	56.6	85°15.7	34.4
9	90°23.6	296°16.1	·· 18.3	20°38.5	·· 37.0	16°13.8	·· 56.6	100°18.3	·· 34.5
10	105°26.0	311°15.6	17.2	35°39.2	37.3	31°15.8	56.7	115°20.9	34.5
11	120°28.5	326°15.2	16.1	50°39.9	37.6	46°17.8	56.7	130°23.5	34.6
12	135°31.0	341°14.7	N12°15.0	65°40.6	N21°37.8	61°19.8	N21°56.8	145°26.0	S06°34.7
13	150°33.4	356°14.2	13.9	80°41.3	38.1	76°21.8	56.8	160°28.6	34.7
14	165°35.9	11°13.8	12.7	95°42.0	38.4	91°23.8	56.9	175°31.2	34.8
15	180°38.4	26°13.3	·· 11.6	110°42.7	·· 38.6	106°25.8	·· 56.9	190°33.8	·· 34.8
16	195°40.8	41°12.8	10.5	125°43.4	38.9	121°27.8	57.0	205°36.4	34.9
17	210°43.3	56°12.4	09.4	140°44.0	39.1	136°29.9	57.0	220°39.0	35.0
18	225°45.8	71°11.9	N12°08.3	155°44.7	N21°39.4	151°31.9	N21°57.0	235°41.6	S06°35.0
19	240°48.2	86°11.5	07.2	170°45.4	39.7	166°33.9	57.1	250°44.2	35.1
20	255°50.7	101°11.0	06.1	185°46.1	39.9	181°35.9	57.1	265°46.8	35.2
21	270°53.2	116°10.5	·· 05.0	200°46.8	·· 40.2	196°37.9	·· 57.2	280°49.4	·· 35.2
22	285°55.6	131°10.1	03.8	215°47.5	40.5	211°39.9	57.2	295°52.0	35.3
23	300°58.1	146°09.6	02.7	230°48.2	40.7	226°41.9	57.3	310°54.6	35.3
Mer.pass. 02:59		ν -0.5′	d -1.1′	m -3.86	ν 0.7′	d 0.3′	m 0.84	ν 2.0′	d 0.0′ m -2.13	ν 2.6′	d -0.1′ m 0.73

Stars

	SHA	**Dec**
Alpheratz	357°34.9	29°13.5
Ankaa	353°07.2	-42°10.1
Schedar	349°31.2	56°40.1
Diphda	348°47.5	-17°50.9
Achernar	335°20.2	-57°06.4
Hamal	327°51.5	23°34.7
Polaris	314°15.0	89°21.7
Acamar	315°12.0	-40°12.1
Menkar	314°06.5	4°11.3
Mirfak	308°28.9	49°56.7
Aldebaran	290°40.2	16°33.5
Rigel	281°04.4	-8°10.2
Capella	280°22.7	46°01.2
Bellatrix	278°23.5	6°22.4
Elnath	278°02.5	28°37.7
Alnilam	275°38.3	-1°11.0
Betelgeuse	270°52.7	7°24.8
Canopus	263°53.0	-52°42.2
Sirius	258°26.8	-16°44.8
Adhara	255°06.5	-29°00.1
Procyon	244°51.5	5°09.8
Pollux	243°18.1	27°58.1
Avior	234°15.5	-59°35.2
Suhail	222°47.0	-43°31.8
Miaplacidus	221°39.3	-69°49.0
Alphard	217°48.4	-8°45.8
Regulus	207°35.1	11°51.0
Dubhe	193°41.9	61°37.3
Denebola	182°25.5	14°26.2
Gienah	175°44.2	-17°40.7
Acrux	173°00.9	-63°14.3
Gacrux	171°52.4	-57°15.2
Alioth	166°13.5	55°49.9
Spica	158°22.8	-11°17.4
Alkaid	152°52.4	49°11.7
Hadar	148°36.6	-60°29.7
Menkent	147°58.1	-36°29.6
Arcturus	145°48.3	19°03.4
Rigil Kent.	139°40.8	-60°56.5
Kochab	137°19.7	74°03.5
Zuben'ubi	136°56.4	-16°08.7
Alphecca	126°03.9	26°38.1
Antares	112°16.1	-26°29.2
Atria	107°10.3	-69°04.5
Sabik	102°03.0	-15°45.3
Shaula	96°10.6	-37°07.4
Rasalhague	95°58.6	12°32.6
Eltanin	90°41.9	51°29.3
Kaus Aust.	83°32.6	-34°22.4
Vega	80°33.1	38°48.5
Nunki	75°47.9	-26°16.0
Altair	62°00.0	8°56.1
Peacock	53°05.6	-56°39.3
Deneb	49°25.6	45°22.1
Enif	33°38.8	9°59.3
Al Na'ir	27°32.9	-46°50.4
Fomalhaut	15°14.6	-29°29.4
Scheat	13°45.2	28°12.9
Markab	13°30.0	15°20.3

Aug 04 Sun	**SHA**	**Mer.pass**
Venus	208°40.3	13:14
Mars	291°55.9	07:40
Jupiter	286°16.4	08:02
Saturn	9°47.6	02:28

Aug 05 Mon	**SHA**	**Mer.pass**
Venus	207°29.4	13:14
Mars	291°13.3	07:39
Jupiter	286°05.3	07:58
Saturn	9°50.6	02:24

Aug 06 Tue	**SHA**	**Mer.pass**
Venus	206°18.9	13:15
Mars	290°30.8	07:37
Jupiter	285°54.3	07:55
Saturn	9°53.6	02:20

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h — Sun — Moon

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	178°28.2	N17°09.6	182°42.6	11.1′	N22°54.4	9.4′	55.4′
1	193°28.3	08.9	197°12.8	11.2′	22°45.0	9.5′	55.4′
2	208°28.3	08.3	211°43.0	11.3′	22°35.5	9.6′	55.4′
3	223°28.4	·· 07.6	226°13.3	11.4′	22°25.9	9.7′	55.3′
4	238°28.5	06.9	240°43.7	11.5′	22°16.2	9.8′	55.3′
5	253°28.5	06.3	255°14.3	11.6′	22°06.4	9.9′	55.3′
6	268°28.6	N17°05.6	269°44.9	11.7′	N21°56.5	10.0′	55.3′
7	283°28.6	04.9	284°15.6	11.8′	21°46.5	10.1′	55.3′
8	298°28.7	04.2	298°46.4	11.9′	21°36.4	10.1′	55.2′
9	313°28.8	·· 03.6	313°17.3	12.0′	21°26.3	10.3′	55.2′
10	328°28.8	02.9	327°48.3	12.1′	21°16.0	10.4′	55.2′
11	343°28.9	02.2	342°19.3	12.2′	21°05.6	10.4′	55.2′
12	358°28.9	N17°01.6	356°50.5	12.3′	N20°55.2	10.6′	55.2′
13	13°29.0	00.9	11°21.8	12.4′	20°44.6	10.6′	55.2′
14	28°29.1	17°00.2	25°53.2	12.5′	20°34.0	10.7′	55.1′
15	43°29.1	16°59.5	40°24.6	12.5′	20°23.3	10.8′	55.1′
16	58°29.2	58.9	54°56.2	12.6′	20°12.5	10.9′	55.1′
17	73°29.2	58.2	69°27.8	12.7′	20°01.6	11.0′	55.1′
18	88°29.3	N16°57.5	83°59.5	12.8′	N19°50.6	11.0′	55.1′
19	103°29.4	56.8	98°31.3	12.9′	19°39.6	11.2′	55.1′
20	118°29.4	56.1	113°03.2	13.0′	19°28.4	11.2′	55.0′
21	133°29.5	·· 55.5	127°35.2	13.1′	19°17.2	11.2′	55.0′
22	148°29.6	54.8	142°07.3	13.2′	19°06.0	11.4′	55.0′
23	163°29.6	54.1	156°39.5	13.3′	18°54.6	11.4′	55.0′
	SD = 15.8′	d = -0.7′	SD = 15.1′				

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	178°29.7	N16°53.4	171°11.8	13.4′	N18°43.2	11.5′	55.0′
1	193°29.8	52.7	185°44.1	13.4′	18°31.7	11.6′	54.9′
2	208°29.8	52.1	200°16.6	13.5′	18°20.1	11.7′	54.9′
3	223°29.9	·· 51.4	214°49.1	13.6′	18°08.4	11.7′	54.9′
4	238°29.9	50.7	229°21.7	13.7′	17°56.7	11.8′	54.9′
5	253°30.0	50.0	243°54.4	13.8′	17°44.9	11.8′	54.9′
6	268°30.1	N16°49.3	258°27.2	13.9′	N17°33.1	12.0′	54.9′
7	283°30.1	48.7	273°00.0	13.9′	17°21.1	11.9′	54.9′
8	298°30.2	48.0	287°33.0	14.0′	17°09.2	12.1′	54.8′
9	313°30.3	·· 47.3	302°06.0	14.1′	16°57.1	12.1′	54.8′
10	328°30.3	46.6	316°39.1	14.2′	16°45.0	12.2′	54.8′
11	343°30.4	45.9	331°12.3	14.3′	16°32.8	12.2′	54.8′
12	358°30.5	N16°45.2	345°45.5	14.3′	N16°20.6	12.3′	54.8′
13	13°30.5	44.5	0°18.9	14.4′	16°08.3	12.4′	54.8′
14	28°30.6	43.9	14°52.3	14.5′	15°55.9	12.4′	54.7′
15	43°30.7	·· 43.2	29°25.8	14.6′	15°43.5	12.5′	54.7′
16	58°30.7	42.5	43°59.4	14.6′	15°31.0	12.5′	54.7′
17	73°30.8	41.8	58°33.0	14.7′	15°18.5	12.6′	54.7′
18	88°30.9	N16°41.1	73°06.7	14.8′	N15°05.9	12.6′	54.7′
19	103°31.0	40.4	87°40.5	14.9′	14°53.3	12.7′	54.7′
20	118°31.0	39.7	102°14.4	14.9′	14°40.6	12.8′	54.7′
21	133°31.1	·· 39.0	116°48.3	15.0′	14°27.8	12.7′	54.6′
22	148°31.2	38.4	131°22.4	15.1′	14°15.1	12.9′	54.6′
23	163°31.2	37.7	145°56.4	15.2′	14°02.2	12.9′	54.6′
	SD = 15.8′	d = -0.7′	SD = 15.0′				

Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	178°31.3	N16°37.0	160°30.6	15.2′	N13°49.3	12.9′	54.6′
1	193°31.4	36.3	175°04.8	15.3′	13°36.4	13.0′	54.6′
2	208°31.4	35.6	189°39.1	15.4′	13°23.4	13.0′	54.6′
3	223°31.5	·· 34.9	204°13.4	15.4′	13°10.4	13.1′	54.6′
4	238°31.6	34.2	218°47.9	15.5′	12°57.3	13.1′	54.5′
5	253°31.7	33.5	233°22.3	15.5′	12°44.2	13.1′	54.5′
6	268°31.7	N16°32.8	247°56.9	15.6′	N12°31.1	13.2′	54.5′
7	283°31.8	32.1	262°31.5	15.7′	12°17.9	13.3′	54.5′
8	298°31.9	31.4	277°06.2	15.7′	12°04.6	13.3′	54.5′
9	313°31.9	·· 30.7	291°40.9	15.8′	11°51.3	13.3′	54.5′
10	328°32.0	30.0	306°15.7	15.8′	11°38.0	13.3′	54.5′
11	343°32.1	29.3	320°50.5	15.9′	11°24.7	13.4′	54.5′
12	358°32.2	N16°28.6	335°25.4	16.0′	N11°11.3	13.4′	54.4′
13	13°32.2	27.9	350°00.4	16.0′	10°57.9	13.5′	54.4′
14	28°32.3	27.3	4°35.4	16.1′	10°44.4	13.5′	54.4′
15	43°32.4	·· 26.6	19°10.5	16.1′	10°30.9	13.5′	54.4′
16	58°32.5	25.9	33°45.6	16.2′	10°17.4	13.6′	54.4′
17	73°32.5	25.2	48°20.8	16.2′	10°03.8	13.5′	54.4′
18	88°32.6	N16°24.5	62°56.0	16.3′	N09°50.3	13.7′	54.4′
19	103°32.7	23.8	77°31.3	16.3′	09°36.6	13.6′	54.4′
20	118°32.8	23.1	92°06.6	16.4′	09°23.0	13.7′	54.3′
21	133°32.8	·· 22.4	106°42.0	16.4′	09°09.3	13.7′	54.3′
22	148°32.9	21.7	121°17.4	16.5′	08°55.6	13.7′	54.3′
23	163°33.0	21.0	135°52.9	16.5′	08°41.9	13.8′	54.3′
	SD = 15.8′	d = -0.7′	SD = 14.9′				

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

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

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	0-2 0-2%
04	06:07	06:04	12:06	12:13	–:–	
05	06:01	05:58	12:06	12:59	00:36	
06	05:55	05:51	12:06	13:41	01:20	

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

	Aries	Venus		Mars		Jupiter		Saturn	
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	316°00.5	161°09.2	N12°01.6	245°48.9	N21°41.0	241°43.9	N21°57.3	325°57.2	S06°35.4
1	331°03.0	176°08.7	12°00.5	260°49.6	41.2	256°45.9	57.4	340°59.7	35.5
2	346°05.5	191°08.2	11°59.4	275°50.3	41.5	271°48.0	57.4	356°02.3	35.5
3	1°07.9	206°07.8	·· 58.3	290°51.0	·· 41.8	286°50.0	·· 57.5	11°04.9	·· 35.6
4	16°10.4	221°07.3	57.2	305°51.7	42.0	301°52.0	57.5	26°07.5	35.7
5	31°12.9	236°06.9	56.0	320°52.4	42.3	316°54.0	57.5	41°10.1	35.7
6	46°15.3	251°06.4	N11°54.9	335°53.1	N21°42.5	331°56.0	N21°57.6	56°12.7	S06°35.8
7	61°17.8	266°05.9	53.8	350°53.8	42.8	346°58.0	57.6	71°15.3	35.8
8	76°20.3	281°05.5	52.7	5°54.5	43.0	2°00.0	57.7	86°17.9	35.9
9	91°22.7	296°05.0	·· 51.6	20°55.2	·· 43.3	17°02.1	·· 57.7	101°20.5	·· 36.0
10	106°25.2	311°04.6	50.4	35°55.9	43.6	32°04.1	57.8	116°23.1	36.0
11	121°27.6	326°04.1	49.3	50°56.6	43.8	47°06.1	57.8	131°25.7	36.1
12	136°30.1	341°03.7	N11°48.2	65°57.3	N21°44.1	62°08.1	N21°57.9	146°28.3	S06°36.2
13	151°32.6	356°03.2	47.1	80°58.0	44.3	77°10.1	57.9	161°30.9	36.2
14	166°35.0	11°02.8	46.0	95°58.7	44.6	92°12.1	57.9	176°33.5	36.3
15	181°37.5	26°02.3	·· 44.8	110°59.4	·· 44.8	107°14.1	·· 58.0	191°36.1	·· 36.4
16	196°40.0	41°01.9	43.7	126°00.1	45.1	122°16.2	58.0	206°38.7	36.4
17	211°42.4	56°01.4	42.6	141°00.8	45.4	137°18.2	58.1	221°41.2	36.5
18	226°44.9	71°01.0	N11°41.5	156°01.5	N21°45.6	152°20.2	N21°58.1	236°43.8	S06°36.5
19	241°47.4	86°00.5	40.3	171°02.2	45.9	167°22.2	58.2	251°46.4	36.6
20	256°49.8	101°00.1	39.2	186°02.9	46.1	182°24.2	58.2	266°49.0	36.7
21	271°52.3	115°59.6	·· 38.1	201°03.6	·· 46.4	197°26.2	·· 58.3	281°51.6	·· 36.7
22	286°54.8	130°59.1	37.0	216°04.3	46.6	212°28.3	58.3	296°54.2	36.8
23	301°57.2	145°58.7	35.8	231°05.0	46.9	227°30.3	58.3	311°56.8	36.9
Mer.pass. 02:55		ν -0.5′	d -1.1′	m -3.86	ν 0.7′	d 0.3′	m 0.84	ν 2.0′	d 0.0′ m -2.14	ν 2.6′	d -0.1′ m 0.72

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	316°59.7	160°58.3	N11°34.7	246°05.7	N21°47.1	242°32.3	N21°58.4	326°59.4	S06°36.9
1	332°02.1	175°57.8	33.6	261°06.4	47.4	257°34.3	58.4	342°02.0	37.0
2	347°04.6	190°57.4	32.4	276°07.1	47.6	272°36.3	58.5	357°04.6	37.1
3	2°07.1	205°56.9	·· 31.3	291°07.7	·· 47.9	287°38.4	·· 58.5	12°07.2	·· 37.1
4	17°09.5	220°56.5	30.2	306°08.4	48.1	302°40.4	58.6	27°09.8	37.2
5	32°12.0	235°56.0	29.0	321°09.1	48.4	317°42.4	58.6	42°12.4	37.2
6	47°14.5	250°55.6	N11°27.9	336°09.8	N21°48.6	332°44.4	N21°58.6	57°15.0	S06°37.3
7	62°16.9	265°55.1	26.8	351°10.5	48.9	347°46.4	58.7	72°17.6	37.4
8	77°19.4	280°54.7	25.7	6°11.2	49.1	2°48.4	58.7	87°20.2	37.4
9	92°21.9	295°54.2	·· 24.5	21°11.9	·· 49.4	17°50.5	·· 58.8	102°22.8	·· 37.5
10	107°24.3	310°53.8	23.4	36°12.6	49.6	32°52.5	58.8	117°25.4	37.6
11	122°26.8	325°53.3	22.3	51°13.3	49.9	47°54.5	58.9	132°28.0	37.6
12	137°29.2	340°52.9	N11°21.1	66°14.0	N21°50.1	62°56.5	N21°58.9	147°30.6	S06°37.7
13	152°31.7	355°52.4	20.0	81°14.7	50.4	77°58.5	59.0	162°33.2	37.8
14	167°34.2	10°52.0	18.8	96°15.4	50.6	93°00.6	59.0	177°35.8	37.8
15	182°36.6	25°51.6	·· 17.7	111°16.1	·· 50.9	108°02.6	·· 59.0	192°38.4	·· 37.9
16	197°39.1	40°51.1	16.6	126°16.8	51.1	123°04.6	59.1	207°41.0	38.0
17	212°41.6	55°50.7	15.4	141°17.5	51.4	138°06.6	59.1	222°43.6	38.0
18	227°44.0	70°50.2	N11°14.3	156°18.2	N21°51.6	153°08.6	N21°59.2	237°46.2	S06°38.1
19	242°46.5	85°49.8	13.2	171°18.9	51.9	168°10.7	59.2	252°48.7	38.2
20	257°49.0	100°49.3	12.0	186°19.6	52.1	183°12.7	59.3	267°51.3	38.2
21	272°51.4	115°48.9	·· 10.9	201°20.3	·· 52.4	198°14.7	·· 59.3	282°53.9	·· 38.3
22	287°53.9	130°48.5	09.7	216°21.0	52.6	213°16.7	59.3	297°56.5	38.3
23	302°56.4	145°48.0	08.6	231°21.7	52.8	228°18.8	59.4	312°59.1	38.4
Mer.pass. 02:52		ν -0.4′	d -1.1′	m -3.86	ν 0.7′	d 0.3′	m 0.83	ν 2.0′	d 0.0′ m -2.14	ν 2.6′	d -0.1′ m 0.72

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	317°58.8	160°47.6	N11°07.5	246°22.4	N21°53.1	243°20.8	N21°59.4	328°01.7	S06°38.5
1	333°01.3	175°47.1	06.3	261°23.1	53.3	258°22.8	59.5	343°04.3	38.5
2	348°03.7	190°46.7	05.2	276°23.8	53.6	273°24.8	59.5	358°06.9	38.6
3	3°06.2	205°46.3	·· 04.0	291°24.5	·· 53.8	288°26.8	·· 59.6	13°09.5	·· 38.7
4	18°08.7	220°45.8	02.9	306°25.3	54.1	303°28.9	59.6	28°12.1	38.7
5	33°11.1	235°45.4	01.8	321°26.0	54.3	318°30.9	59.6	43°14.7	38.8
6	48°13.6	250°45.0	N11°00.6	336°26.7	N21°54.5	333°32.9	N21°59.7	58°17.3	S06°38.9
7	63°16.1	265°44.5	10°59.5	351°27.4	54.8	348°34.9	59.7	73°19.9	38.9
8	78°18.5	280°44.1	58.3	6°28.1	55.0	3°37.0	59.8	88°22.5	39.0
9	93°21.0	295°43.7	·· 57.2	21°28.8	·· 55.3	18°39.0	·· 59.8	103°25.1	·· 39.1
10	108°23.5	310°43.2	56.0	36°29.5	55.5	33°41.0	59.9	118°27.7	39.1
11	123°25.9	325°42.8	54.9	51°30.2	55.8	48°43.0	59.9	133°30.3	39.2
12	138°28.4	340°42.3	N10°53.7	66°30.9	N21°56.0	63°45.1	N21°59.9	148°32.9	S06°39.3
13	153°30.8	355°41.9	52.6	81°31.6	56.2	78°47.1	22°00.0	163°35.5	39.3
14	168°33.3	10°41.5	51.5	96°32.3	56.5	93°49.1	00.0	178°38.1	39.4
15	183°35.8	25°41.0	·· 50.3	111°33.0	·· 56.7	108°51.1	·· 00.1	193°40.7	·· 39.5
16	198°38.2	40°40.6	49.2	126°33.7	57.0	123°53.2	00.1	208°43.3	39.5
17	213°40.7	55°40.2	48.0	141°34.4	57.2	138°55.2	00.1	223°45.9	39.6
18	228°43.2	70°39.7	N10°46.9	156°35.1	N21°57.4	153°57.2	N22°00.2	238°48.5	S06°39.7
19	243°45.6	85°39.3	45.7	171°35.8	57.7	168°59.2	00.2	253°51.1	39.7
20	258°48.1	100°38.9	44.6	186°36.5	57.9	184°01.3	00.3	268°53.7	39.8
21	273°50.6	115°38.5	·· 43.4	201°37.2	·· 58.1	199°03.3	·· 00.3	283°56.3	·· 39.8
22	288°53.0	130°38.0	42.3	216°37.9	58.4	214°05.3	00.4	298°58.9	39.9
23	303°55.5	145°37.6	41.1	231°38.6	58.6	229°07.3	00.4	314°01.5	40.0
Mer.pass. 02:48		ν -0.4′	d -1.1′	m -3.86	ν 0.7′	d 0.2′	m 0.83	ν 2.0′	d 0.0′ m -2.15	ν 2.6′	d -0.1′ m 0.71

Stars

	SHA	Dec
Alpheratz	357°34.9	29°13.5
Ankaa	353°07.2	-42°10.1
Schedar	349°31.1	56°40.2
Diphda	348°47.4	-17°50.9
Achernar	335°20.2	-57°06.4
Hamal	327°51.5	23°34.7
Polaris	314°13.6	89°21.7
Acamar	315°12.0	-40°12.0
Menkar	314°06.5	4°11.3
Mirfak	308°28.8	49°56.7
Aldebaran	290°40.2	16°33.6
Rigel	281°04.4	-8°10.2
Capella	280°22.7	46°01.2
Bellatrix	278°23.4	6°22.4
Elnath	278°02.5	28°37.7
Alnilam	275°38.3	-1°11.0
Betelgeuse	270°52.7	7°24.8
Canopus	263°53.0	-52°42.2
Sirius	258°26.8	-16°44.8
Adhara	255°06.5	-29°00.1
Procyon	244°51.5	5°09.8
Pollux	243°18.1	27°58.1
Avior	234°15.5	-59°35.1
Suhail	222°47.0	-43°31.8
Miaplacidus	221°39.3	-69°49.0
Alphard	217°48.4	-8°45.8
Regulus	207°35.1	11°51.0
Dubhe	193°42.0	61°37.3
Denebola	182°25.5	14°26.2
Gienah	175°44.2	-17°40.7
Acrux	173°01.0	-63°14.3
Gacrux	171°52.4	-57°15.2
Alioth	166°13.5	55°49.9
Spica	158°22.8	-11°17.3
Alkaid	152°52.4	49°11.7
Hadar	148°36.7	-60°29.7
Menkent	147°58.1	-36°29.6
Arcturus	145°48.3	19°03.4
Rigil Kent.	139°40.9	-60°56.4
Kochab	137°19.7	74°03.5
Zuben'ubi	136°56.4	-16°08.6
Alphecca	126°04.0	26°38.1
Antares	112°16.1	-26°29.3
Atria	107°10.4	-69°04.5
Sabik	102°03.0	-15°45.3
Shaula	96°10.6	-37°07.4
Rasalhague	95°58.6	12°32.6
Eltanin	90°42.0	51°29.3
Kaus Aust.	83°32.6	-34°22.4
Vega	80°33.1	38°48.5
Nunki	75°47.9	-26°16.0
Altair	62°00.0	8°56.1
Peacock	53°05.6	-56°39.3
Deneb	49°25.6	45°22.1
Enif	33°38.8	9°59.3
Al Na'ir	27°32.9	-46°50.4
Fomalhaut	15°14.6	-29°29.4
Scheat	13°45.2	28°13.0
Markab	13°30.0	15°20.3

Aug 07 Wed	SHA	Mer.pass
Venus	205°08.6	13:16
Mars	289°48.4	07:36
Jupiter	285°43.4	07:52
Saturn	9°56.6	02:16

Aug 08 Thu	SHA	Mer.pass
Venus	203°58.6	13:17
Mars	289°06.0	07:35
Jupiter	285°32.6	07:49
Saturn	9°59.7	02:12

Aug 09 Fri	SHA	Mer.pass
Venus	202°48.8	13:17
Mars	288°23.6	07:34
Jupiter	285°22.0	07:46
Saturn	10°02.9	02:08

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°33.1	N16°20.2	150°28.4	16.6′	N08°28.1	13.7′	54.3′
1	193°33.1	19.5	165°04.0	16.6′	08°14.4	13.8′	54.3′
2	208°33.2	18.8	179°39.6	16.6′	08°00.6	13.9′	54.3′
3	223°33.3	·· 18.1	194°15.3	16.7′	07°46.7	13.8′	54.3′
4	238°33.4	17.4	208°50.9	16.7′	07°32.9	13.9′	54.3′
5	253°33.5	16.7	223°26.7	16.8′	07°19.0	13.9′	54.3′
6	268°33.5	N16°16.0	238°02.4	16.8′	N07°05.1	13.9′	54.2′
7	283°33.6	15.3	252°38.3	16.8′	06°51.2	13.9′	54.2′
8	298°33.7	14.6	267°14.1	16.9′	06°37.3	13.9′	54.2′
9	313°33.8	·· 13.9	281°50.0	16.9′	06°23.4	14.0′	54.2′
10	328°33.8	13.2	296°25.9	16.9′	06°09.4	14.0′	54.2′
11	343°33.9	12.5	311°01.8	17.0′	05°55.4	14.0′	54.2′
12	358°34.0	N16°11.8	325°37.8	17.0′	N05°41.4	14.0′	54.2′
13	13°34.1	11.1	340°13.8	17.0′	05°27.4	14.0′	54.2′
14	28°34.2	10.4	354°49.9	17.1′	05°13.4	14.1′	54.2′
15	43°34.2	·· 09.7	9°26.0	17.1′	04°59.3	14.0′	54.2′
16	58°34.3	09.0	24°02.1	17.1′	04°45.3	14.1′	54.2′
17	73°34.4	08.2	38°38.2	17.2′	04°31.2	14.0′	54.2′
18	88°34.5	N16°07.5	53°14.3	17.2′	N04°17.2	14.1′	54.1′
19	103°34.6	06.8	67°50.5	17.2′	04°03.1	14.1′	54.1′
20	118°34.7	06.1	82°26.7	17.2′	03°49.0	14.1′	54.1′
21	133°34.7	·· 05.4	97°03.0	17.3′	03°34.9	14.1′	54.1′
22	148°34.8	04.7	111°39.2	17.3′	03°20.8	14.2′	54.1′
23	163°34.9	04.0	126°15.5	17.3′	03°06.6	14.1′	54.1′
	SD = 15.8′	d = -0.7′	SD = 14.8′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°35.0	N16°03.3	140°51.8	17.3′	N02°52.5	14.1′	54.1′
1	193°35.1	02.6	155°28.1	17.3′	02°38.4	14.1′	54.1′
2	208°35.1	01.8	170°04.4	17.3′	02°24.3	14.2′	54.1′
3	223°35.2	·· 01.1	184°40.7	17.4′	02°10.1	14.1′	54.1′
4	238°35.3	16°00.4	199°17.1	17.4′	01°56.0	14.2′	54.1′
5	253°35.4	15°59.7	213°53.5	17.4′	01°41.8	14.1′	54.1′
6	268°35.5	N15°59.0	228°29.9	17.4′	N01°27.7	14.2′	54.1′
7	283°35.6	58.3	243°06.3	17.4′	01°13.5	14.1′	54.1′
8	298°35.7	57.5	257°42.7	17.4′	00°59.4	14.2′	54.1′
9	313°35.7	·· 56.8	272°19.1	17.4′	00°45.2	14.2′	54.1′
10	328°35.8	56.1	286°55.5	17.4′	00°31.0	14.1′	54.1′
11	343°35.9	55.4	301°32.0	17.4′	00°16.9	14.2′	54.1′
12	358°36.0	N15°54.7	316°08.4	17.4′	N00°02.7	14.1′	54.1′
13	13°36.1	54.0	330°44.9	17.5′	S00°11.4	14.1′	54.0′
14	28°36.2	53.2	345°21.3	17.5′	00°25.5	14.2′	54.0′
15	43°36.3	·· 52.5	359°57.8	17.5′	00°39.7	14.1′	54.0′
16	58°36.3	51.8	14°34.2	17.5′	00°53.8	14.2′	54.0′
17	73°36.4	51.1	29°10.7	17.5′	01°08.0	14.1′	54.0′
18	88°36.5	N15°50.4	43°47.1	17.5′	S01°22.1	14.1′	54.0′
19	103°36.6	49.6	58°23.6	17.5′	01°36.2	14.1′	54.0′
20	118°36.7	48.9	73°00.1	17.5′	01°50.3	14.1′	54.0′
21	133°36.8	·· 48.2	87°36.5	17.4′	02°04.4	14.1′	54.0′
22	148°36.9	47.5	102°13.0	17.4′	02°18.5	14.1′	54.0′
23	163°37.0	46.7	116°49.4	17.4′	02°32.6	14.1′	54.0′
	SD = 15.8′	d = -0.7′	SD = 14.8′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°37.0	N15°46.0	131°25.8	17.4′	S02°46.7	14.0′	54.0′
1	193°37.1	45.3	146°02.3	17.4′	03°00.7	14.1′	54.0′
2	208°37.2	44.6	160°38.7	17.4′	03°14.8	14.0′	54.0′
3	223°37.3	·· 43.8	175°15.1	17.4′	03°28.8	14.1′	54.0′
4	238°37.4	43.1	189°51.5	17.4′	03°42.9	14.0′	54.0′
5	253°37.5	42.4	204°27.9	17.4′	03°56.9	14.0′	54.0′
6	268°37.6	N15°41.7	219°04.3	17.4′	S04°10.9	14.0′	54.0′
7	283°37.7	40.9	233°40.6	17.3′	04°24.9	13.9′	54.0′
8	298°37.8	40.2	248°17.0	17.3′	04°38.8	14.0′	54.0′
9	313°37.9	·· 39.5	262°53.3	17.3′	04°52.8	13.9′	54.0′
10	328°38.0	38.8	277°29.6	17.3′	05°06.7	13.9′	54.0′
11	343°38.0	38.0	292°05.9	17.3′	05°20.6	13.9′	54.0′
12	358°38.1	N15°37.3	306°42.2	17.3′	S05°34.5	13.9′	54.0′
13	13°38.2	36.6	321°18.4	17.2′	05°48.4	13.9′	54.0′
14	28°38.3	35.8	335°54.7	17.2′	06°02.3	13.8′	54.0′
15	43°38.4	·· 35.1	350°30.9	17.2′	06°16.1	13.9′	54.1′
16	58°38.5	34.4	5°07.0	17.2′	06°30.0	13.8′	54.1′
17	73°38.6	33.7	19°43.2	17.1′	06°43.8	13.7′	54.1′
18	88°38.7	N15°32.9	34°19.3	17.1′	S06°57.5	13.8′	54.1′
19	103°38.8	32.2	48°55.4	17.1′	07°11.3	13.7′	54.1′
20	118°38.9	31.5	63°31.5	17.0′	07°25.0	13.7′	54.1′
21	133°39.0	·· 30.7	78°07.5	17.0′	07°38.7	13.7′	54.1′
22	148°39.1	30.0	92°43.6	17.0′	07°52.4	13.7′	54.1′
23	163°39.2	29.3	107°19.5	16.9′	08°06.1	13.6′	54.1′
	SD = 15.8′	d = -0.7′	SD = 14.7′				

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

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

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 3-5 6-18%
07	05:48	05:44	12:06	14:21	02:01	
08	05:40	05:36	12:06	15:00	02:41	
09	05:32	05:27	12:05	15:39	03:20	

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

	Aries	Venus		Mars		Jupiter		Saturn	
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	318°58.0	160°37.2	N10°40.0	246°39.3	N21°58.9	244°09.4	N22°00.4	329°04.1	S06°40.0
1	334°00.4	175°36.7	38.8	261°40.0	59.1	259°11.4	00.5	344°06.7	40.1
2	349°02.9	190°36.3	37.6	276°40.7	59.3	274°13.4	00.5	359°09.3	40.2
3	4°05.3	205°35.9	·· 36.5	291°41.4	·· 59.6	289°15.5	·· 00.6	14°11.9	·· 40.2
4	19°07.8	220°35.4	35.3	306°42.1	21°59.8	304°17.5	00.6	29°14.5	40.3
5	34°10.3	235°35.0	34.2	321°42.8	22°00.0	319°19.5	00.7	44°17.1	40.4
6	49°12.7	250°34.6	N10°33.0	336°43.5	N22°00.3	334°21.5	N22°00.7	59°19.7	S06°40.4
7	64°15.2	265°34.2	31.9	351°44.2	00.5	349°23.6	00.7	74°22.3	40.5
8	79°17.7	280°33.7	30.7	6°44.9	00.7	4°25.6	00.8	89°24.9	40.6
9	94°20.1	295°33.3	·· 29.6	21°45.6	·· 01.0	19°27.6	·· 00.8	104°27.5	·· 40.6
10	109°22.6	310°32.9	28.4	36°46.3	01.2	34°29.7	00.9	119°30.1	40.7
11	124°25.1	325°32.5	27.2	51°47.0	01.4	49°31.7	00.9	134°32.7	40.8
12	139°27.5	340°32.0	N10°26.1	66°47.8	N22°01.7	64°33.7	N22°00.9	149°35.3	S06°40.8
13	154°30.0	355°31.6	24.9	81°48.5	01.9	79°35.7	01.0	164°37.9	40.9
14	169°32.5	10°31.2	23.8	96°49.2	02.1	94°37.8	01.0	179°40.5	41.0
15	184°34.9	25°30.8	·· 22.6	111°49.9	·· 02.4	109°39.8	·· 01.1	194°43.1	·· 41.0
16	199°37.4	40°30.3	21.5	126°50.6	02.6	124°41.8	01.1	209°45.7	41.1
17	214°39.8	55°29.9	20.3	141°51.3	02.8	139°43.9	01.1	224°48.4	41.2
18	229°42.3	70°29.5	N10°19.1	156°52.0	N22°03.1	154°45.9	N22°01.2	239°51.0	S06°41.2
19	244°44.8	85°29.1	18.0	171°52.7	03.3	169°47.9	01.2	254°53.6	41.3
20	259°47.2	100°28.6	16.8	186°53.4	03.5	184°50.0	01.3	269°56.2	41.4
21	274°49.7	115°28.2	·· 15.6	201°54.1	·· 03.7	199°52.0	·· 01.3	284°58.8	·· 41.4
22	289°52.2	130°27.8	14.5	216°54.8	04.0	214°54.0	01.4	300°01.4	41.5
23	304°54.6	145°27.4	13.3	231°55.5	04.2	229°56.1	01.4	315°04.0	41.6
Mer.pass. 02:44		ν -0.4′	d -1.2′	m -3.86	ν 0.7′	d 0.2′	m 0.82	ν 2.0′	d 0.0′ m -2.15	ν 2.6′	d -0.1′ m 0.71

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	319°57.1	160°27.0	N10°12.2	246°56.2	N22°04.4	244°58.1	N22°01.4	330°06.6	S06°41.6
1	334°59.6	175°26.5	11.0	261°56.9	04.7	260°00.1	01.5	345°09.2	41.7
2	350°02.0	190°26.1	09.8	276°57.6	04.9	275°02.1	01.5	0°11.8	41.8
3	5°04.5	205°25.7	·· 08.7	291°58.3	·· 05.1	290°04.2	·· 01.6	15°14.4	·· 41.8
4	20°06.9	220°25.3	07.5	306°59.0	05.3	305°06.2	01.6	30°17.0	41.9
5	35°09.4	235°24.9	06.3	321°59.8	05.6	320°08.2	01.6	45°19.6	42.0
6	50°11.9	250°24.4	N10°05.2	337°00.5	N22°05.8	335°10.3	N22°01.7	60°22.2	S06°42.0
7	65°14.3	265°24.0	04.0	352°01.2	06.0	350°12.3	01.7	75°24.8	42.1
8	80°16.8	280°23.6	02.8	7°01.9	06.3	5°14.3	01.8	90°27.4	42.2
9	95°19.3	295°23.2	·· 01.7	22°02.6	·· 06.5	20°16.4	·· 01.8	105°30.0	·· 42.2
10	110°21.7	310°22.8	10°00.5	37°03.3	06.7	35°18.4	01.8	120°32.6	42.3
11	125°24.2	325°22.4	09°59.3	52°04.0	06.9	50°20.4	01.9	135°35.2	42.4
12	140°26.7	340°21.9	N09°58.2	67°04.7	N22°07.2	65°22.5	N22°01.9	150°37.8	S06°42.4
13	155°29.1	355°21.5	57.0	82°05.4	07.4	80°24.5	02.0	165°40.4	42.5
14	170°31.6	10°21.1	55.8	97°06.1	07.6	95°26.6	02.0	180°43.0	42.6
15	185°34.1	25°20.7	·· 54.6	112°06.8	·· 07.8	110°28.6	·· 02.0	195°45.6	·· 42.6
16	200°36.5	40°20.3	53.5	127°07.5	08.1	125°30.6	02.1	210°48.2	42.7
17	215°39.0	55°19.9	52.3	142°08.2	08.3	140°32.7	02.1	225°50.8	42.8
18	230°41.4	70°19.5	N09°51.1	157°08.9	N22°08.5	155°34.7	N22°02.2	240°53.4	S06°42.8
19	245°43.9	85°19.0	50.0	172°09.7	08.7	170°36.7	02.2	255°56.1	42.9
20	260°46.4	100°18.6	48.8	187°10.4	08.9	185°38.8	02.2	270°58.7	43.0
21	275°48.8	115°18.2	·· 47.6	202°11.1	·· 09.2	200°40.8	·· 02.3	286°01.3	·· 43.0
22	290°51.3	130°17.8	46.4	217°11.8	09.4	215°42.8	02.3	301°03.9	43.1
23	305°53.8	145°17.4	45.3	232°12.5	09.6	230°44.9	02.4	316°06.5	43.2
Mer.pass. 02:40		ν -0.4′	d -1.2′	m -3.86	ν 0.7′	d 0.2′	m 0.82	ν 2.0′	d 0.0′ m -2.15	ν 2.6′	d -0.1′ m 0.70

Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	320°56.2	160°17.0	N09°44.1	247°13.2	N22°09.8	245°46.9	N22°02.4	331°09.1	S06°43.2
1	335°58.7	175°16.6	42.9	262°13.9	10.0	260°49.0	02.4	346°11.7	43.3
2	351°01.2	190°16.2	41.7	277°14.6	10.3	275°51.0	02.5	1°14.3	43.4
3	6°03.6	205°15.8	·· 40.6	292°15.3	·· 10.5	290°53.0	·· 02.5	16°16.9	·· 43.4
4	21°06.1	220°15.3	39.4	307°16.0	10.7	305°55.1	02.6	31°19.5	43.5
5	36°08.6	235°14.9	38.2	322°16.7	10.9	320°57.1	02.6	46°22.1	43.6
6	51°11.0	250°14.5	N09°37.0	337°17.5	N22°11.1	335°59.1	N22°02.6	61°24.7	S06°43.7
7	66°13.5	265°14.1	35.9	352°18.2	11.4	351°01.2	02.7	76°27.3	43.7
8	81°15.9	280°13.7	34.7	7°18.9	11.6	6°03.2	02.7	91°29.9	43.8
9	96°18.4	295°13.3	·· 33.5	22°19.6	·· 11.8	21°05.3	·· 02.8	106°32.5	·· 43.9
10	111°20.9	310°12.9	32.3	37°20.3	12.0	36°07.3	02.8	121°35.1	43.9
11	126°23.3	325°12.5	31.1	52°21.0	12.2	51°09.3	02.8	136°37.7	44.0
12	141°25.8	340°12.1	N09°30.0	67°21.7	N22°12.5	66°11.4	N22°02.9	151°40.4	S06°44.1
13	156°28.3	355°11.7	28.8	82°22.4	12.7	81°13.4	02.9	166°43.0	44.1
14	171°30.7	10°11.3	27.6	97°23.1	12.9	96°15.5	03.0	181°45.6	44.2
15	186°33.2	25°10.9	·· 26.4	112°23.9	·· 13.1	111°17.5	·· 03.0	196°48.2	·· 44.3
16	201°35.7	40°10.5	25.2	127°24.6	13.3	126°19.5	03.0	211°50.8	44.3
17	216°38.1	55°10.0	24.1	142°25.3	13.5	141°21.6	03.1	226°53.4	44.4
18	231°40.6	70°09.6	N09°22.9	157°26.0	N22°13.7	156°23.6	N22°03.1	241°56.0	S06°44.5
19	246°43.0	85°09.2	21.7	172°26.7	14.0	171°25.7	03.2	256°58.6	44.5
20	261°45.5	100°08.8	20.5	187°27.4	14.2	186°27.7	03.2	272°01.2	44.6
21	276°48.0	115°08.4	·· 19.3	202°28.1	·· 14.4	201°29.7	·· 03.2	287°03.8	·· 44.7
22	291°50.4	130°08.0	18.1	217°28.8	14.6	216°31.8	03.3	302°06.4	44.7
23	306°52.9	145°07.6	17.0	232°29.5	14.8	231°33.8	03.3	317°09.0	44.8
Mer.pass. 02:36		ν -0.4′	d -1.2′	m -3.86	ν 0.7′	d 0.2′	m 0.81	ν 2.0′	d 0.0′ m -2.16	ν 2.6′	d -0.1′ m 0.70

Stars

	SHA	Dec
Alpheratz	357°34.9	29°13.5
Ankaa	353°07.2	-42°10.1
Schedar	349°31.1	56°40.2
Diphda	348°47.4	-17°50.9
Achernar	335°20.2	-57°06.4
Hamal	327°51.5	23°34.7
Polaris	314°12.0	89°21.7
Acamar	315°12.0	-40°12.0
Menkar	314°06.5	4°11.3
Mirfak	308°28.8	49°56.7
Aldebaran	290°40.1	16°33.6
Rigel	281°04.4	-8°10.2
Capella	280°22.6	46°01.2
Bellatrix	278°23.4	6°22.4
Elnath	278°02.5	28°37.7
Alnilam	275°38.3	-1°11.0
Betelgeuse	270°52.7	7°24.8
Canopus	263°53.0	-52°42.2
Sirius	258°26.8	-16°44.8
Adhara	255°06.5	-29°00.1
Procyon	244°51.5	5°09.8
Pollux	243°18.1	27°58.1
Avior	234°15.5	-59°35.1
Suhail	222°47.0	-43°31.8
Miaplacidus	221°39.3	-69°49.0
Alphard	217°48.4	-8°45.8
Regulus	207°35.1	11°51.0
Dubhe	193°42.0	61°37.3
Denebola	182°25.5	14°26.2
Gienah	175°44.2	-17°40.7
Acrux	173°01.0	-63°14.3
Gacrux	171°52.4	-57°15.2
Alioth	166°13.5	55°49.9
Spica	158°22.8	-11°17.3
Alkaid	152°52.4	49°11.7
Hadar	148°36.7	-60°29.7
Menkent	147°58.1	-36°29.6
Arcturus	145°48.3	19°03.4
Rigil Kent.	139°40.9	-60°56.4
Kochab	137°19.8	74°03.5
Zuben'ubi	136°56.4	-16°08.6
Alphecca	126°04.0	26°38.1
Antares	112°16.1	-26°29.2
Atria	107°10.4	-69°04.5
Sabik	102°03.0	-15°45.3
Shaula	96°10.6	-37°07.4
Rasalhague	95°58.7	12°32.6
Eltanin	90°42.0	51°29.3
Kaus Aust.	83°32.7	-34°22.4
Vega	80°33.1	38°48.5
Nunki	75°47.9	-26°16.0
Altair	62°00.0	8°56.1
Peacock	53°05.7	-56°39.4
Deneb	49°25.6	45°22.1
Enif	33°38.8	9°59.3
Al Na'ir	27°32.9	-46°50.4
Fomalhaut	15°14.5	-29°29.4
Scheat	13°45.2	28°13.0
Markab	13°29.9	15°20.3

Aug 10 Sat	SHA	Mer.pass
Venus	201°39.2	13:18
Mars	287°41.3	07:33
Jupiter	285°11.4	07:42
Saturn	10°06.2	02:03

Aug 11 Sun	SHA	Mer.pass
Venus	200°29.9	13:19
Mars	286°59.1	07:32
Jupiter	285°01.0	07:39
Saturn	10°09.5	01:59

Aug 12 Mon	SHA	Mer.pass
Venus	199°20.8	13:19
Mars	286°17.0	07:31
Jupiter	284°50.7	07:36
Saturn	10°12.8	01:55

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°39.3	N15°28.5	121°55.5	16.9′	S08°19.7	13.6′	54.1′
1	193°39.4	27.8	136°31.4	16.9′	08°33.3	13.6′	54.1′
2	208°39.4	27.1	151°07.3	16.8′	08°46.9	13.5′	54.1′
3	223°39.5	·· 26.3	165°43.1	16.8′	09°00.4	13.5′	54.1′
4	238°39.6	25.6	180°18.9	16.8′	09°13.9	13.5′	54.1′
5	253°39.7	24.9	194°54.7	16.7′	09°27.4	13.5′	54.1′
6	268°39.8	N15°24.1	209°30.4	16.7′	S09°40.9	13.4′	54.1′
7	283°39.9	23.4	224°06.1	16.6′	09°54.3	13.4′	54.1′
8	298°40.0	22.6	238°41.7	16.6′	10°07.7	13.3′	54.1′
9	313°40.1	·· 21.9	253°17.3	16.6′	10°21.0	13.4′	54.2′
10	328°40.2	21.2	267°52.9	16.5′	10°34.4	13.3′	54.2′
11	343°40.3	20.4	282°28.4	16.5′	10°47.7	13.2′	54.2′
12	358°40.4	N15°19.7	297°03.8	16.4′	S11°00.9	13.2′	54.2′
13	13°40.5	18.9	311°39.2	16.4′	11°14.1	13.2′	54.2′
14	28°40.6	18.2	326°14.6	16.3′	11°27.3	13.2′	54.2′
15	43°40.7	·· 17.5	340°49.9	16.3′	11°40.5	13.1′	54.2′
16	58°40.8	16.7	355°25.2	16.2′	11°53.6	13.0′	54.2′
17	73°40.9	16.0	10°00.4	16.2′	12°06.6	13.1′	54.2′
18	88°41.0	N15°15.2	24°35.5	16.1′	S12°19.7	12.9′	54.2′
19	103°41.1	14.5	39°10.6	16.0′	12°32.6	13.0′	54.3′
20	118°41.2	13.8	53°45.7	16.0′	12°45.6	12.9′	54.3′
21	133°41.3	·· 13.0	68°20.7	15.9′	12°58.5	12.8′	54.3′
22	148°41.4	12.3	82°55.6	15.9′	13°11.3	12.9′	54.3′
23	163°41.5	11.5	97°30.5	15.8′	13°24.2	12.7′	54.3′
	SD = 15.8′	d = -0.7′	SD = 14.8′				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°41.6	N15°10.8	112°05.3	15.8′	S13°36.9	12.7′	54.3′
1	193°41.7	10.0	126°40.0	15.7′	13°49.6	12.7′	54.3′
2	208°41.8	09.3	141°14.7	15.6′	14°02.3	12.7′	54.3′
3	223°41.9	·· 08.6	155°49.3	15.6′	14°15.0	12.5′	54.4′
4	238°42.0	07.8	170°23.9	15.5′	14°27.5	12.6′	54.4′
5	253°42.1	07.1	184°58.4	15.4′	14°40.1	12.4′	54.4′
6	268°42.2	N15°06.3	199°32.8	15.4′	S14°52.5	12.5′	54.4′
7	283°42.3	05.6	214°07.2	15.3′	15°05.0	12.4′	54.4′
8	298°42.4	04.8	228°41.5	15.2′	15°17.4	12.3′	54.4′
9	313°42.5	·· 04.1	243°15.7	15.2′	15°29.7	12.3′	54.4′
10	328°42.6	03.3	257°49.9	15.1′	15°42.0	12.2′	54.5′
11	343°42.7	02.6	272°24.0	15.0′	15°54.2	12.1′	54.5′
12	358°42.9	N15°01.8	286°58.0	14.9′	S16°06.3	12.1′	54.5′
13	13°43.0	01.1	301°31.9	14.9′	16°18.4	12.1′	54.5′
14	28°43.1	15°00.3	316°05.8	14.8′	16°30.5	12.0′	54.5′
15	43°43.2	14°59.6	330°39.5	14.7′	16°42.5	11.9′	54.5′
16	58°43.3	58.8	345°13.3	14.6′	16°54.4	11.9′	54.5′
17	73°43.4	58.1	359°46.9	14.6′	17°06.3	11.8′	54.6′
18	88°43.5	N14°57.3	14°20.4	14.5′	S17°18.1	11.8′	54.6′
19	103°43.6	56.6	28°53.9	14.4′	17°29.9	11.6′	54.6′
20	118°43.7	55.8	43°27.3	14.3′	17°41.5	11.7′	54.6′
21	133°43.8	·· 55.1	58°00.6	14.2′	17°53.2	11.5′	54.6′
22	148°43.9	54.3	72°33.8	14.1′	18°04.7	11.5′	54.7′
23	163°44.0	53.6	87°07.0	14.1′	18°16.2	11.4′	54.7′
	SD = 15.8′	d = -0.7′	SD = 14.8′				

Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°44.1	N14°52.8	101°40.1	14.0′	S18°27.6	11.4′	54.7′
1	193°44.2	52.0	116°13.0	13.9′	18°39.0	11.3′	54.7′
2	208°44.3	51.3	130°45.9	13.8′	18°50.3	11.2′	54.7′
3	223°44.4	·· 50.5	145°18.7	13.7′	19°01.5	11.2′	54.8′
4	238°44.6	49.8	159°51.4	13.6′	19°12.7	11.0′	54.8′
5	253°44.7	49.0	174°24.1	13.5′	19°23.7	11.0′	54.8′
6	268°44.8	N14°48.3	188°56.6	13.4′	S19°34.7	11.0′	54.8′
7	283°44.9	47.5	203°29.0	13.4′	19°45.7	10.8′	54.8′
8	298°45.0	46.8	218°01.4	13.3′	19°56.5	10.8′	54.9′
9	313°45.1	·· 46.0	232°33.6	13.2′	20°07.3	10.7′	54.9′
10	328°45.2	45.2	247°05.8	13.1′	20°18.0	10.6′	54.9′
11	343°45.3	44.5	261°37.9	13.0′	20°28.6	10.6′	54.9′
12	358°45.4	N14°43.7	276°09.9	12.9′	S20°39.2	10.4′	54.9′
13	13°45.5	43.0	290°41.8	12.8′	20°49.6	10.4′	55.0′
14	28°45.6	42.2	305°13.5	12.7′	21°00.0	10.3′	55.0′
15	43°45.8	·· 41.4	319°45.2	12.6′	21°10.3	10.2′	55.0′
16	58°45.9	40.7	334°16.8	12.5′	21°20.5	10.1′	55.0′
17	73°46.0	39.9	348°48.3	12.4′	21°30.6	10.1′	55.1′
18	88°46.1	N14°39.2	3°19.7	12.3′	S21°40.7	9.9′	55.1′
19	103°46.2	38.4	17°51.0	12.2′	21°50.6	9.9′	55.1′
20	118°46.3	37.6	32°22.2	12.1′	22°00.5	9.8′	55.1′
21	133°46.4	·· 36.9	46°53.3	12.0′	22°10.3	9.6′	55.2′
22	148°46.5	36.1	61°24.3	11.9′	22°19.9	9.6′	55.2′
23	163°46.7	35.3	75°55.2	11.8′	22°29.5	9.5′	55.2′
	SD = 15.8′	d = -0.8′	SD = 14.9′				

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

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

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 6-8 26-44%
10	05:23	05:18	12:05	16:19	03:59	
11	05:14	05:09	12:05	17:01	04:40	
12	05:04	04:58	12:05	17:46	05:23	

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

	Aries	Venus		Mars		Jupiter		Saturn	
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	321°55.4	160°07.2	N09°15.8	247°30.3	N22°15.0	246°35.9	N22°03.4	332°11.6	S06°44.9
1	336°57.8	175°06.8	14.6	262°31.0	15.2	261°37.9	03.4	347°14.2	44.9
2	352°00.3	190°06.4	13.4	277°31.7	15.5	276°40.0	03.4	2°16.9	45.0
3	7°02.8	205°06.0	·· 12.2	292°32.4	·· 15.7	291°42.0	·· 03.5	17°19.5	·· 45.1
4	22°05.2	220°05.6	11.0	307°33.1	15.9	306°44.0	03.5	32°22.1	45.2
5	37°07.7	235°05.2	09.8	322°33.8	16.1	321°46.1	03.5	47°24.7	45.2
6	52°10.2	250°04.8	N09°08.7	337°34.5	N22°16.3	336°48.1	N22°03.6	62°27.3	S06°45.3
7	67°12.6	265°04.4	07.5	352°35.2	16.5	351°50.2	03.6	77°29.9	45.4
8	82°15.1	280°04.0	06.3	7°36.0	16.7	6°52.2	03.7	92°32.5	45.4
9	97°17.5	295°03.6	·· 05.1	22°36.7	·· 16.9	21°54.3	·· 03.7	107°35.1	·· 45.5
10	112°20.0	310°03.2	03.9	37°37.4	17.1	36°56.3	03.7	122°37.7	45.6
11	127°22.5	325°02.8	02.7	52°38.1	17.4	51°58.3	03.8	137°40.3	45.6
12	142°24.9	340°02.4	N09°01.5	67°38.8	N22°17.6	67°00.4	N22°03.8	152°42.9	S06°45.7
13	157°27.4	355°02.0	09°00.3	82°39.5	17.8	82°02.4	03.9	167°45.6	45.8
14	172°29.9	10°01.6	08°59.1	97°40.2	18.0	97°04.5	03.9	182°48.2	45.8
15	187°32.3	25°01.2	·· 57.9	112°41.0	·· 18.2	112°06.5	·· 03.9	197°50.8	·· 45.9
16	202°34.8	40°00.8	56.8	127°41.7	18.4	127°08.6	04.0	212°53.4	46.0
17	217°37.3	55°00.4	55.6	142°42.4	18.6	142°10.6	04.0	227°56.0	46.0
18	232°39.7	70°00.0	N08°54.4	157°43.1	N22°18.8	157°12.7	N22°04.0	242°58.6	S06°46.1
19	247°42.2	84°59.6	53.2	172°43.8	19.0	172°14.7	04.1	258°01.2	46.2
20	262°44.7	99°59.2	52.0	187°44.5	19.2	187°16.8	04.1	273°03.8	46.3
21	277°47.1	114°58.8	·· 50.8	202°45.2	·· 19.4	202°18.8	·· 04.2	288°06.4	·· 46.3
22	292°49.6	129°58.4	49.6	217°46.0	19.6	217°20.8	04.2	303°09.0	46.4
23	307°52.0	144°58.1	48.4	232°46.7	19.8	232°22.9	04.2	318°11.6	46.5
Mer.pass. 02:32		ν -0.4′	d -1.2′	m -3.86	ν 0.7′	d 0.2′	m 0.81	ν 2.0′	d 0.0′ m -2.16	ν 2.6′	d -0.1′ m 0.69

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	322°54.5	159°57.7	N08°47.2	247°47.4	N22°20.0	247°24.9	N22°04.3	333°14.3	S06°46.5
1	337°57.0	174°57.3	46.0	262°48.1	20.3	262°27.0	04.3	348°16.9	46.6
2	352°59.4	189°56.9	44.8	277°48.8	20.5	277°29.0	04.4	3°19.5	46.7
3	8°01.9	204°56.5	·· 43.6	292°49.5	·· 20.7	292°31.1	·· 04.4	18°22.1	·· 46.7
4	23°04.4	219°56.1	42.4	307°50.2	20.9	307°33.1	04.4	33°24.7	46.8
5	38°06.8	234°55.7	41.2	322°51.0	21.1	322°35.2	04.5	48°27.3	46.9
6	53°09.3	249°55.3	N08°40.0	337°51.7	N22°21.3	337°37.2	N22°04.5	63°29.9	S06°46.9
7	68°11.8	264°54.9	38.8	352°52.4	21.5	352°39.3	04.5	78°32.5	47.0
8	83°14.2	279°54.5	37.6	7°53.1	21.7	7°41.3	04.6	93°35.1	47.1
9	98°16.7	294°54.1	·· 36.4	22°53.8	·· 21.9	22°43.4	·· 04.6	108°37.8	·· 47.1
10	113°19.2	309°53.7	35.2	37°54.5	22.1	37°45.4	04.7	123°40.4	47.2
11	128°21.6	324°53.3	34.0	52°55.3	22.3	52°47.5	04.7	138°43.0	47.3
12	143°24.1	339°53.0	N08°32.8	67°56.0	N22°22.5	67°49.5	N22°04.7	153°45.6	S06°47.4
13	158°26.5	354°52.6	31.6	82°56.7	22.7	82°51.6	04.8	168°48.2	47.4
14	173°29.0	9°52.2	30.4	97°57.4	22.9	97°53.6	04.8	183°50.8	47.5
15	188°31.5	24°51.8	·· 29.2	112°58.1	·· 23.1	112°55.7	·· 04.8	198°53.4	·· 47.6
16	203°33.9	39°51.4	28.0	127°58.8	23.3	127°57.7	04.9	213°56.0	47.6
17	218°36.4	54°51.0	26.8	142°59.6	23.5	142°59.8	04.9	228°58.6	47.7
18	233°38.9	69°50.6	N08°25.6	158°00.3	N22°23.7	158°01.8	N22°05.0	244°01.3	S06°47.8
19	248°41.3	84°50.2	24.4	173°01.0	23.9	173°03.9	05.0	259°03.9	47.8
20	263°43.8	99°49.8	23.2	188°01.7	24.1	188°05.9	05.0	274°06.5	47.9
21	278°46.3	114°49.5	·· 22.0	203°02.4	·· 24.3	203°08.0	·· 05.1	289°09.1	·· 48.0
22	293°48.7	129°49.1	20.8	218°03.1	24.5	218°10.0	05.1	304°11.7	48.1
23	308°51.2	144°48.7	19.6	233°03.9	24.7	233°12.1	05.1	319°14.3	48.1
Mer.pass. 02:28		ν -0.4′	d -1.2′	m -3.86	ν 0.7′	d 0.2′	m 0.80	ν 2.0′	d 0.0′ m -2.17	ν 2.6′	d -0.1′ m 0.69

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	323°53.6	159°48.3	N08°18.4	248°04.6	N22°24.9	248°14.1	N22°05.2	334°16.9	S06°48.2
1	338°56.1	174°47.9	17.2	263°05.3	25.1	263°16.2	05.2	349°19.5	48.3
2	353°58.6	189°47.5	16.0	278°06.0	25.3	278°18.2	05.2	4°22.2	48.3
3	9°01.0	204°47.1	·· 14.8	293°06.7	·· 25.5	293°20.3	·· 05.3	19°24.8	·· 48.4
4	24°03.5	219°46.8	13.6	308°07.5	25.7	308°22.4	05.3	34°27.4	48.5
5	39°06.0	234°46.4	12.4	323°08.2	25.9	323°24.4	05.4	49°30.0	48.5
6	54°08.4	249°46.0	N08°11.2	338°08.9	N22°26.1	338°26.5	N22°05.4	64°32.6	S06°48.6
7	69°10.9	264°45.6	10.0	353°09.6	26.3	353°28.5	05.4	79°35.2	48.7
8	84°13.4	279°45.2	08.8	8°10.3	26.4	8°30.6	05.5	94°37.8	48.8
9	99°15.8	294°44.8	·· 07.6	23°11.1	·· 26.6	23°32.6	·· 05.5	109°40.4	·· 48.8
10	114°18.3	309°44.5	06.4	38°11.8	26.8	38°34.7	05.5	124°43.1	48.9
11	129°20.8	324°44.1	05.1	53°12.5	27.0	53°36.7	05.6	139°45.7	49.0
12	144°23.2	339°43.7	N08°03.9	68°13.2	N22°27.2	68°38.8	N22°05.6	154°48.3	S06°49.0
13	159°25.7	354°43.3	02.7	83°13.9	27.4	83°40.8	05.7	169°50.9	49.1
14	174°28.1	9°42.9	01.5	98°14.7	27.6	98°42.9	05.7	184°53.5	49.2
15	189°30.6	24°42.5	08°00.3	113°15.4	·· 27.8	113°45.0	·· 05.7	199°56.1	·· 49.2
16	204°33.1	39°42.2	07°59.1	128°16.1	28.0	128°47.0	05.8	214°58.7	49.3
17	219°35.5	54°41.8	57.9	143°16.8	28.2	143°49.1	05.8	230°01.4	49.4
18	234°38.0	69°41.4	N07°56.7	158°17.5	N22°28.4	158°51.1	N22°05.8	245°04.0	S06°49.5
19	249°40.5	84°41.0	55.5	173°18.3	28.6	173°53.2	05.9	260°06.6	49.5
20	264°42.9	99°40.6	54.3	188°19.0	28.8	188°55.2	05.9	275°09.2	49.6
21	279°45.4	114°40.3	·· 53.0	203°19.7	·· 29.0	203°57.3	·· 05.9	290°11.8	·· 49.7
22	294°47.9	129°39.9	51.8	218°20.4	29.1	218°59.4	06.0	305°14.4	49.7
23	309°50.3	144°39.5	50.6	233°21.1	29.3	234°01.4	06.0	320°17.0	49.8
Mer.pass. 02:24		ν -0.4′	d -1.2′	m -3.86	ν 0.7′	d 0.2′	m 0.80	ν 2.1′	d 0.0′ m -2.17	ν 2.6′	d -0.1′ m 0.68

Stars

	SHA	Dec
Alpheratz	357°34.9	29°13.6
Ankaa	353°07.2	-42°10.1
Schedar	349°31.1	56°40.2
Diphda	348°47.4	-17°50.9
Achernar	335°20.1	-57°06.4
Hamal	327°51.5	23°34.7
Polaris	314°10.3	89°21.8
Acamar	315°12.0	-40°12.0
Menkar	314°06.5	4°11.3
Mirfak	308°28.8	49°56.7
Aldebaran	290°40.1	16°33.6
Rigel	281°04.3	-8°10.2
Capella	280°22.6	46°01.2
Bellatrix	278°23.4	6°22.4
Elnath	278°02.5	28°37.7
Alnilam	275°38.2	-1°11.0
Betelgeuse	270°52.7	7°24.8
Canopus	263°52.9	-52°42.2
Sirius	258°26.8	-16°44.8
Adhara	255°06.4	-29°00.1
Procyon	244°51.5	5°09.8
Pollux	243°18.0	27°58.1
Avior	234°15.5	-59°35.1
Suhail	222°47.0	-43°31.8
Miaplacidus	221°39.3	-69°49.0
Alphard	217°48.4	-8°45.8
Regulus	207°35.1	11°51.0
Dubhe	193°42.0	61°37.3
Denebola	182°25.5	14°26.2
Gienah	175°44.2	-17°40.7
Acrux	173°01.0	-63°14.3
Gacrux	171°52.5	-57°15.2
Alioth	166°13.6	55°49.8
Spica	158°22.8	-11°17.3
Alkaid	152°52.4	49°11.7
Hadar	148°36.7	-60°29.7
Menkent	147°58.1	-36°29.6
Arcturus	145°48.3	19°03.4
Rigil Kent.	139°40.9	-60°56.4
Kochab	137°19.9	74°03.5
Zuben'ubi	136°56.4	-16°08.6
Alphecca	126°04.0	26°38.1
Antares	112°16.1	-26°29.2
Atria	107°10.4	-69°04.5
Sabik	102°03.0	-15°45.3
Shaula	96°10.6	-37°07.4
Rasalhague	95°58.7	12°32.6
Eltanin	90°42.0	51°29.3
Kaus Aust.	83°32.7	-34°22.4
Vega	80°33.1	38°48.5
Nunki	75°47.9	-26°16.0
Altair	62°00.0	8°56.1
Peacock	53°05.7	-56°39.4
Deneb	49°25.6	45°22.1
Enif	33°38.8	9°59.3
Al Na'ir	27°32.8	-46°50.4
Fomalhaut	15°14.5	-29°29.4
Scheat	13°45.2	28°13.0
Markab	13°29.9	15°20.3

Aug 13 Tue	SHA	Mer.pass
Venus	198°11.9	13:20
Mars	285°34.9	07:30
Jupiter	284°40.5	07:33
Saturn	10°16.3	01:51

Aug 14 Wed	SHA	Mer.pass
Venus	197°03.2	13:21
Mars	284°52.9	07:28
Jupiter	284°30.4	07:29
Saturn	10°19.8	01:47

Aug 15 Thu	SHA	Mer.pass
Venus	195°54.6	13:21
Mars	284°10.9	07:27
Jupiter	284°20.5	07:26
Saturn	10°23.3	01:43

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°46.8	N14°34.6	90°26.0	11.7′	S22°39.0	9.4′	55.2′
1	193°46.9	33.8	104°56.7	11.6′	22°48.4	9.3′	55.3′
2	208°47.0	33.1	119°27.2	11.5′	22°57.7	9.2′	55.3′
3	223°47.1	·· 32.3	133°57.7	11.4′	23°06.9	9.1′	55.3′
4	238°47.2	31.5	148°28.1	11.3′	23°16.0	9.0′	55.3′
5	253°47.3	30.8	162°58.4	11.2′	23°25.0	8.9′	55.4′
6	268°47.5	N14°30.0	177°28.5	11.1′	S23°33.9	8.8′	55.4′
7	283°47.6	29.2	191°58.6	11.0′	23°42.7	8.7′	55.4′
8	298°47.7	28.5	206°28.5	10.8′	23°51.4	8.6′	55.5′
9	313°47.8	·· 27.7	220°58.4	10.7′	24°00.0	8.5′	55.5′
10	328°47.9	26.9	235°28.1	10.6′	24°08.5	8.4′	55.5′
11	343°48.0	26.2	249°57.8	10.5′	24°16.9	8.3′	55.5′
12	358°48.1	N14°25.4	264°27.3	10.4′	S24°25.2	8.1′	55.6′
13	13°48.3	24.6	278°56.7	10.3′	24°33.3	8.1′	55.6′
14	28°48.4	23.9	293°26.0	10.2′	24°41.4	7.9′	55.6′
15	43°48.5	·· 23.1	307°55.2	10.1′	24°49.3	7.8′	55.7′
16	58°48.6	22.3	322°24.3	10.0′	24°57.1	7.7′	55.7′
17	73°48.7	21.5	336°53.3	9.9′	25°04.8	7.6′	55.7′
18	88°48.8	N14°20.8	351°22.2	9.8′	S25°12.4	7.5′	55.7′
19	103°49.0	20.0	5°51.0	9.7′	25°19.9	7.3′	55.8′
20	118°49.1	19.2	20°19.6	9.6′	25°27.2	7.3′	55.8′
21	133°49.2	·· 18.5	34°48.2	9.5′	25°34.5	7.1′	55.8′
22	148°49.3	17.7	49°16.7	9.3′	25°41.6	7.0′	55.9′
23	163°49.4	16.9	63°45.0	9.2′	25°48.6	6.8′	55.9′
	SD = 15.8′	d = -0.8′	SD = 15.1′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°49.6	N14°16.1	78°13.3	9.1′	S25°55.4	6.7′	55.9′
1	193°49.7	15.4	92°41.4	9.0′	26°02.1	6.6′	56.0′
2	208°49.8	14.6	107°09.4	8.9′	26°08.7	6.5′	56.0′
3	223°49.9	·· 13.8	121°37.3	8.8′	26°15.2	6.4′	56.0′
4	238°50.0	13.0	136°05.2	8.7′	26°21.6	6.2′	56.1′
5	253°50.2	12.3	150°32.9	8.6′	26°27.8	6.0′	56.1′
6	268°50.3	N14°11.5	165°00.5	8.5′	S26°33.8	6.0′	56.1′
7	283°50.4	10.7	179°28.0	8.4′	26°39.8	5.8′	56.2′
8	298°50.5	09.9	193°55.4	8.3′	26°45.6	5.7′	56.2′
9	313°50.6	·· 09.2	208°22.7	8.2′	26°51.3	5.5′	56.2′
10	328°50.8	08.4	222°49.9	8.1′	26°56.8	5.4′	56.3′
11	343°50.9	07.6	237°17.0	8.0′	27°02.2	5.2′	56.3′
12	358°51.0	N14°06.8	251°44.0	7.9′	S27°07.4	5.2′	56.3′
13	13°51.1	06.0	266°10.9	7.8′	27°12.6	4.9′	56.4′
14	28°51.2	05.3	280°37.7	7.7′	27°17.5	4.8′	56.4′
15	43°51.4	·· 04.5	295°04.4	7.6′	27°22.3	4.7′	56.4′
16	58°51.5	03.7	309°31.0	7.5′	27°27.0	4.5′	56.5′
17	73°51.6	02.9	323°57.5	7.4′	27°31.5	4.4′	56.5′
18	88°51.7	N14°02.2	338°23.9	7.3′	S27°35.9	4.2′	56.5′
19	103°51.9	01.4	352°50.2	7.2′	27°40.1	4.1′	56.6′
20	118°52.0	14°00.6	7°16.4	7.1′	27°44.2	3.9′	56.6′
21	133°52.1	13°59.8	21°42.6	7.0′	27°48.1	3.8′	56.6′
22	148°52.2	59.0	36°08.6	6.9′	27°51.9	3.6′	56.7′
23	163°52.4	58.2	50°34.6	6.9′	27°55.5	3.5′	56.7′
	SD = 15.8′	d = -0.8′	SD = 15.3′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°52.5	N13°57.5	65°00.4	6.8′	S27°59.0	3.3′	56.8′
1	193°52.6	56.7	79°26.2	6.7′	28°02.3	3.1′	56.8′
2	208°52.7	55.9	93°51.9	6.6′	28°05.4	3.0′	56.8′
3	223°52.9	·· 55.1	108°17.5	6.5′	28°08.4	2.8′	56.9′
4	238°53.0	54.3	122°43.0	6.4′	28°11.2	2.7′	56.9′
5	253°53.1	53.5	137°08.4	6.4′	28°13.9	2.5′	56.9′
6	268°53.2	N13°52.8	151°33.8	6.3′	S28°16.4	2.3′	57.0′
7	283°53.4	52.0	165°59.1	6.2′	28°18.7	2.2′	57.0′
8	298°53.5	51.2	180°24.3	6.1′	28°20.9	2.0′	57.0′
9	313°53.6	·· 50.4	194°49.4	6.1′	28°22.9	1.8′	57.1′
10	328°53.7	49.6	209°14.5	6.0′	28°24.7	1.7′	57.1′
11	343°53.9	48.8	223°39.4	5.9′	28°26.4	1.5′	57.2′
12	358°54.0	N13°48.0	238°04.3	5.8′	S28°27.9	1.3′	57.2′
13	13°54.1	47.3	252°29.2	5.8′	28°29.2	1.1′	57.2′
14	28°54.3	46.5	266°54.0	5.7′	28°30.3	1.0′	57.3′
15	43°54.4	·· 45.7	281°18.7	5.6′	28°31.3	0.8′	57.3′
16	58°54.5	44.9	295°43.3	5.6′	28°32.1	0.6′	57.3′
17	73°54.6	44.1	310°07.9	5.5′	28°32.7	0.5′	57.4′
18	88°54.8	N13°43.3	324°32.4	5.5′	S28°33.2	0.3′	57.4′
19	103°54.9	42.5	338°56.9	5.4′	28°33.5	0.1′	57.5′
20	118°55.0	41.7	353°21.3	5.4′	28°33.6	0.1′	57.5′
21	133°55.2	·· 40.9	7°45.7	5.3′	28°33.5	0.2′	57.5′
22	148°55.3	40.2	22°10.0	5.3′	28°33.3	0.5′	57.6′
23	163°55.4	39.4	36°34.2	5.2′	28°32.8	0.6′	57.6′
	SD = 15.8′	d = -0.8′	SD = 15.5′				

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

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

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 9-11 54-73%
13	04:53	04:47	12:05	18:36	06:10	
14	04:42	04:36	12:05	19:30	07:02	
15	04:30	04:24	12:04	20:28	07:58	

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

	Aries	Venus		Mars		Jupiter		Saturn	
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	324°52.8	159°39.1	N07°49.4	248°21.9	N22°29.5	249°03.5	N22°06.1	335°19.7	S06°49.9
1	339°55.3	174°38.7	48.2	263°22.6	29.7	264°05.5	06.1	350°22.3	49.9
2	354°57.7	189°38.4	47.0	278°23.3	29.9	279°07.6	06.1	5°24.9	50.0
3	10°00.2	204°38.0	·· 45.8	293°24.0	·· 30.1	294°09.6	·· 06.2	20°27.5	·· 50.1
4	25°02.6	219°37.6	44.6	308°24.7	30.3	309°11.7	06.2	35°30.1	50.2
5	40°05.1	234°37.2	43.3	323°25.5	30.5	324°13.8	06.2	50°32.7	50.2
6	55°07.6	249°36.9	N07°42.1	338°26.2	N22°30.7	339°15.8	N22°06.3	65°35.3	S06°50.3
7	70°10.0	264°36.5	40.9	353°26.9	30.8	354°17.9	06.3	80°38.0	50.4
8	85°12.5	279°36.1	39.7	8°27.6	31.0	9°19.9	06.3	95°40.6	50.4
9	100°15.0	294°35.7	·· 38.5	23°28.4	·· 31.2	24°22.0	·· 06.4	110°43.2	·· 50.5
10	115°17.4	309°35.4	37.3	38°29.1	31.4	39°24.1	06.4	125°45.8	50.6
11	130°19.9	324°35.0	36.0	53°29.8	31.6	54°26.1	06.4	140°48.4	50.7
12	145°22.4	339°34.6	N07°34.8	68°30.5	N22°31.8	69°28.2	N22°06.5	155°51.0	S06°50.7
13	160°24.8	354°34.2	33.6	83°31.3	32.0	84°30.2	06.5	170°53.7	50.8
14	175°27.3	9°33.9	32.4	98°32.0	32.1	99°32.3	06.6	185°56.3	50.9
15	190°29.8	24°33.5	·· 31.2	113°32.7	·· 32.3	114°34.4	·· 06.6	200°58.9	·· 50.9
16	205°32.2	39°33.1	30.0	128°33.4	32.5	129°36.4	06.6	216°01.5	51.0
17	220°34.7	54°32.7	28.7	143°34.1	32.7	144°38.5	06.7	231°04.1	51.1
18	235°37.1	69°32.4	N07°27.5	158°34.9	N22°32.9	159°40.5	N22°06.7	246°06.7	S06°51.2
19	250°39.6	84°32.0	26.3	173°35.6	33.1	174°42.6	06.7	261°09.3	51.2
20	265°42.1	99°31.6	25.1	188°36.3	33.3	189°44.7	06.8	276°12.0	51.3
21	280°44.5	114°31.2	·· 23.9	203°37.0	·· 33.4	204°46.7	·· 06.8	291°14.6	·· 51.4
22	295°47.0	129°30.9	22.6	218°37.8	33.6	219°48.8	06.8	306°17.2	51.4
23	310°49.5	144°30.5	21.4	233°38.5	33.8	234°50.9	06.9	321°19.8	51.5
Mer.pass. 02:20		ν -0.4′	d -1.2′	m -3.86	ν 0.7′	d 0.2′	m 0.79	ν 2.1′	d 0.0′ m -2.18	ν 2.6′	d -0.1′ m 0.68

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	325°51.9	159°30.1	N07°20.2	248°39.2	N22°34.0	249°52.9	N22°06.9	336°22.4	S06°51.6
1	340°54.4	174°29.8	19.0	263°39.9	34.2	264°55.0	06.9	351°25.0	51.7
2	355°56.9	189°29.4	17.7	278°40.7	34.3	279°57.0	07.0	6°27.7	51.7
3	10°59.3	204°29.0	·· 16.5	293°41.4	·· 34.5	294°59.1	·· 07.0	21°30.3	·· 51.8
4	26°01.8	219°28.6	15.3	308°42.1	34.7	310°01.2	07.1	36°32.9	51.9
5	41°04.3	234°28.3	14.1	323°42.8	34.9	325°03.2	07.1	51°35.5	51.9
6	56°06.7	249°27.9	N07°12.9	338°43.6	N22°35.1	340°05.3	N22°07.1	66°38.1	S06°52.0
7	71°09.2	264°27.5	11.6	353°44.3	35.3	355°07.4	07.2	81°40.7	52.1
8	86°11.6	279°27.2	10.4	8°45.0	35.4	10°09.4	07.2	96°43.4	52.1
9	101°14.1	294°26.8	·· 09.2	23°45.7	·· 35.6	25°11.5	·· 07.2	111°46.0	·· 52.2
10	116°16.6	309°26.4	08.0	38°46.5	35.8	40°13.6	07.3	126°48.6	52.3
11	131°19.0	324°26.1	06.7	53°47.2	36.0	55°15.6	07.3	141°51.2	52.4
12	146°21.5	339°25.7	N07°05.5	68°47.9	N22°36.1	70°17.7	N22°07.3	156°53.8	S06°52.4
13	161°24.0	354°25.3	04.3	83°48.7	36.3	85°19.8	07.4	171°56.5	52.5
14	176°26.4	9°25.0	03.1	98°49.4	36.5	100°21.8	07.4	186°59.1	52.6
15	191°28.9	24°24.6	·· 01.8	113°50.1	·· 36.7	115°23.9	·· 07.4	202°01.7	·· 52.7
16	206°31.4	39°24.2	07°00.6	128°50.8	36.9	130°26.0	07.5	217°04.3	52.7
17	221°33.8	54°23.9	06°59.4	143°51.6	37.0	145°28.0	07.5	232°06.9	52.8
18	236°36.3	69°23.5	N06°58.2	158°52.3	N22°37.2	160°30.1	N22°07.5	247°09.5	S06°52.9
19	251°38.8	84°23.1	56.9	173°53.0	37.4	175°32.2	07.6	262°12.2	52.9
20	266°41.2	99°22.8	55.7	188°53.7	37.6	190°34.2	07.6	277°14.8	53.0
21	281°43.7	114°22.4	·· 54.5	203°54.5	·· 37.7	205°36.3	·· 07.6	292°17.4	·· 53.1
22	296°46.1	129°22.0	53.2	218°55.2	37.9	220°38.4	07.7	307°20.0	53.2
23	311°48.6	144°21.7	52.0	233°55.9	38.1	235°40.4	07.7	322°22.6	53.2
Mer.pass. 02:16		ν -0.4′	d -1.2′	m -3.86	ν 0.7′	d 0.2′	m 0.79	ν 2.1′	d 0.0′ m -2.18	ν 2.6′	d -0.1′ m 0.67

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	326°51.1	159°21.3	N06°50.8	248°56.7	N22°38.3	250°42.5	N22°07.7	337°25.2	S06°53.3
1	341°53.5	174°20.9	49.6	263°57.4	38.4	265°44.6	07.8	352°27.9	53.4
2	356°56.0	189°20.6	48.3	278°58.1	38.6	280°46.6	07.8	7°30.5	53.4
3	11°58.5	204°20.2	·· 47.1	293°58.8	·· 38.8	295°48.7	·· 07.8	22°33.1	·· 53.5
4	27°00.9	219°19.8	45.9	308°59.6	39.0	310°50.8	07.9	37°35.7	53.6
5	42°03.4	234°19.5	44.6	324°00.3	39.1	325°52.9	07.9	52°38.3	53.7
6	57°05.9	249°19.1	N06°43.4	339°01.0	N22°39.3	340°54.9	N22°08.0	67°41.0	S06°53.7
7	72°08.3	264°18.8	42.2	354°01.8	39.5	355°57.0	08.0	82°43.6	53.8
8	87°10.8	279°18.4	40.9	9°02.5	39.6	10°59.1	08.0	97°46.2	53.9
9	102°13.2	294°18.0	·· 39.7	24°03.2	·· 39.8	26°01.1	·· 08.1	112°48.8	·· 53.9
10	117°15.7	309°17.7	38.5	39°04.0	40.0	41°03.2	08.1	127°51.4	54.0
11	132°18.2	324°17.3	37.2	54°04.7	40.2	56°05.3	08.1	142°54.1	54.1
12	147°20.6	339°16.9	N06°36.0	69°05.4	N22°40.3	71°07.3	N22°08.2	157°56.7	S06°54.2
13	162°23.1	354°16.6	34.8	84°06.1	40.5	86°09.4	08.2	172°59.3	54.2
14	177°25.6	9°16.2	33.5	99°06.9	40.7	101°11.5	08.2	188°01.9	54.3
15	192°28.0	24°15.9	·· 32.3	114°07.6	·· 40.8	116°13.6	·· 08.3	203°04.5	·· 54.4
16	207°30.5	39°15.5	31.1	129°08.3	41.0	131°15.6	08.3	218°07.2	54.4
17	222°33.0	54°15.1	29.8	144°09.1	41.2	146°17.7	08.3	233°09.8	54.5
18	237°35.4	69°14.8	N06°28.6	159°09.8	N22°41.4	161°19.8	N22°08.4	248°12.4	S06°54.6
19	252°37.9	84°14.4	27.4	174°10.5	41.5	176°21.9	08.4	263°15.0	54.7
20	267°40.4	99°14.1	26.1	189°11.3	41.7	191°23.9	08.4	278°17.6	54.7
21	282°42.8	114°13.7	·· 24.9	204°12.0	·· 41.9	206°26.0	·· 08.5	293°20.3	·· 54.8
22	297°45.3	129°13.3	23.7	219°12.7	42.0	221°28.1	08.5	308°22.9	54.9
23	312°47.7	144°13.0	22.4	234°13.5	42.2	236°30.1	08.5	323°25.5	55.0
Mer.pass. 02:12		ν -0.4′	d -1.2′	m -3.86	ν 0.7′	d 0.2′	m 0.78	ν 2.1′	d 0.0′ m -2.19	ν 2.6′	d -0.1′ m 0.67

Stars

	SHA	Dec
Alpheratz	357°34.8	29°13.6
Ankaa	353°07.1	-42°10.1
Schedar	349°31.0	56°40.2
Diphda	348°47.4	-17°50.9
Achernar	335°20.1	-57°06.4
Hamal	327°51.4	23°34.7
Polaris	314°08.5	89°21.8
Acamar	315°11.9	-40°12.0
Menkar	314°06.4	4°11.3
Mirfak	308°28.7	49°56.7
Aldebaran	290°40.1	16°33.6
Rigel	281°04.3	-8°10.2
Capella	280°22.6	46°01.2
Bellatrix	278°23.4	6°22.4
Elnath	278°02.5	28°37.7
Alnilam	275°38.2	-1°11.0
Betelgeuse	270°52.6	7°24.8
Canopus	263°52.9	-52°42.2
Sirius	258°26.8	-16°44.8
Adhara	255°06.4	-29°00.1
Procyon	244°51.5	5°09.8
Pollux	243°18.0	27°58.1
Avior	234°15.5	-59°35.1
Suhail	222°47.0	-43°31.8
Miaplacidus	221°39.3	-69°49.0
Alphard	217°48.4	-8°45.8
Regulus	207°35.1	11°51.0
Dubhe	193°42.0	61°37.3
Denebola	182°25.5	14°26.2
Gienah	175°44.2	-17°40.7
Acrux	173°01.0	-63°14.3
Gacrux	171°52.5	-57°15.2
Alioth	166°13.6	55°49.8
Spica	158°22.8	-11°17.3
Alkaid	152°52.4	49°11.7
Hadar	148°36.7	-60°29.7
Menkent	147°58.2	-36°29.6
Arcturus	145°48.3	19°03.4
Rigil Kent.	139°40.9	-60°56.4
Kochab	137°19.9	74°03.5
Zuben'ubi	136°56.4	-16°08.6
Alphecca	126°04.0	26°38.1
Antares	112°16.1	-26°29.2
Atria	107°10.4	-69°04.5
Sabik	102°03.0	-15°45.3
Shaula	96°10.6	-37°07.4
Rasalhague	95°58.7	12°32.7
Eltanin	90°42.0	51°29.3
Kaus Aust.	83°32.7	-34°22.4
Vega	80°33.1	38°48.5
Nunki	75°47.9	-26°16.0
Altair	62°00.0	8°56.1
Peacock	53°05.6	-56°39.4
Deneb	49°25.6	45°22.2
Enif	33°38.8	9°59.3
Al Na'ir	27°32.8	-46°50.4
Fomalhaut	15°14.5	-29°29.4
Scheat	13°45.2	28°13.0
Markab	13°29.9	15°20.3

Aug 16 Fri	SHA	Mer.pass
Venus	194°46.3	13:22
Mars	283°29.1	07:26
Jupiter	284°10.7	07:23
Saturn	10°26.9	01:38

Aug 17 Sat	SHA	Mer.pass
Venus	193°38.2	13:22
Mars	282°47.3	07:25
Jupiter	284°01.0	07:19
Saturn	10°30.5	01:34

Aug 18 Sun	SHA	Mer.pass
Venus	192°30.2	13:23
Mars	282°05.6	07:24
Jupiter	283°51.4	07:16
Saturn	10°34.2	01:30

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°55.5	N13°38.6	50°58.5	5.2′	S28°32.2	0.8′	57.7′
1	193°55.7	37.8	65°22.6	5.1′	28°31.4	0.9′	57.7′
2	208°55.8	37.0	79°46.7	5.1′	28°30.5	1.2′	57.7′
3	223°55.9	·· 36.2	94°10.8	5.0′	28°29.3	1.3′	57.8′
4	238°56.1	35.4	108°34.9	5.0′	28°28.0	1.5′	57.8′
5	253°56.2	34.6	122°58.9	5.0′	28°26.5	1.7′	57.8′
6	268°56.3	N13°33.8	137°22.9	4.9′	S28°24.8	1.9′	57.9′
7	283°56.5	33.0	151°46.8	4.9′	28°22.9	2.1′	57.9′
8	298°56.6	32.2	166°10.7	4.9′	28°20.8	2.2′	58.0′
9	313°56.7	·· 31.4	180°34.6	4.9′	28°18.6	2.4′	58.0′
10	328°56.9	30.6	194°58.5	4.8′	28°16.2	2.7′	58.0′
11	343°57.0	29.8	209°22.3	4.8′	28°13.5	2.8′	58.1′
12	358°57.1	N13°29.0	223°46.1	4.8′	S28°10.7	3.0′	58.1′
13	13°57.3	28.2	238°09.9	4.8′	28°07.7	3.1′	58.1′
14	28°57.4	27.5	252°33.7	4.8′	28°04.6	3.4′	58.2′
15	43°57.5	·· 26.7	266°57.5	4.8′	28°01.2	3.5′	58.2′
16	58°57.7	25.9	281°21.2	4.7′	27°57.7	3.8′	58.3′
17	73°57.8	25.1	295°45.0	4.7′	27°53.9	3.9′	58.3′
18	88°57.9	N13°24.3	310°08.7	4.7′	S27°50.0	4.1′	58.3′
19	103°58.1	23.5	324°32.4	4.7′	27°45.9	4.3′	58.4′
20	118°58.2	22.7	338°56.1	4.7′	27°41.6	4.4′	58.4′
21	133°58.3	·· 21.9	353°19.9	4.7′	27°37.2	4.7′	58.4′
22	148°58.5	21.1	7°43.6	4.7′	27°32.5	4.8′	58.5′
23	163°58.6	20.3	22°07.3	4.7′	27°27.7	5.1′	58.5′
	SD = 15.8′	d = -0.8′	SD = 15.7′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	178°58.7	N13°19.5	36°31.1	4.7′	S27°22.6	5.2′	58.6′
1	193°58.9	18.7	50°54.8	4.8′	27°17.4	5.4′	58.6′
2	208°59.0	17.9	65°18.6	4.8′	27°12.0	5.6′	58.6′
3	223°59.2	·· 17.1	79°42.3	4.8′	27°06.4	5.7′	58.7′
4	238°59.3	16.3	94°06.1	4.8′	27°00.7	6.0′	58.7′
5	253°59.4	15.5	108°29.9	4.8′	26°54.7	6.1′	58.7′
6	268°59.6	N13°14.7	122°53.7	4.8′	S26°48.6	6.3′	58.8′
7	283°59.7	13.9	137°17.6	4.9′	26°42.3	6.6′	58.8′
8	298°59.8	13.0	151°41.4	4.9′	26°35.7	6.6′	58.9′
9	314°00.0	·· 12.2	166°05.3	4.9′	26°29.1	6.9′	58.9′
10	329°00.1	11.4	180°29.2	4.9′	26°22.2	7.1′	58.9′
11	344°00.3	10.6	194°53.2	5.0′	26°15.1	7.2′	59.0′
12	359°00.4	N13°09.8	209°17.1	5.0′	S26°07.9	7.4′	59.0′
13	14°00.5	09.0	223°41.1	5.0′	26°00.5	7.6′	59.0′
14	29°00.7	08.2	238°05.2	5.1′	25°52.9	7.7′	59.1′
15	44°00.8	·· 07.4	252°29.2	5.1′	25°45.2	8.0′	59.1′
16	59°00.9	06.6	266°53.3	5.1′	25°37.2	8.1′	59.1′
17	74°01.1	05.8	281°17.5	5.2′	25°29.1	8.3′	59.2′
18	89°01.2	N13°05.0	295°41.7	5.2′	S25°20.8	8.5′	59.2′
19	104°01.4	04.2	310°05.9	5.3′	25°12.3	8.6′	59.2′
20	119°01.5	03.4	324°30.2	5.3′	25°03.7	8.8′	59.3′
21	134°01.6	·· 02.6	338°54.5	5.4′	24°54.9	9.0′	59.3′
22	149°01.8	01.8	353°18.9	5.4′	24°45.9	9.2′	59.3′
23	164°01.9	01.0	7°43.3	5.5′	24°36.7	9.3′	59.4′
	SD = 15.8′	d = -0.8′	SD = 16.0′				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°02.1	N13°00.1	22°07.7	5.5′	S24°27.4	9.5′	59.4′
1	194°02.2	12°59.3	36°32.2	5.6′	24°17.9	9.7′	59.4′
2	209°02.4	58.5	50°56.8	5.6′	24°08.2	9.8′	59.5′
3	224°02.5	·· 57.7	65°21.4	5.7′	23°58.4	10.0′	59.5′
4	239°02.6	56.9	79°46.1	5.7′	23°48.4	10.2′	59.5′
5	254°02.8	56.1	94°10.8	5.8′	23°38.2	10.3′	59.6′
6	269°02.9	N12°55.3	108°35.6	5.8′	S23°27.9	10.5′	59.6′
7	284°03.1	54.5	123°00.4	5.9′	23°17.4	10.7′	59.6′
8	299°03.2	53.7	137°25.3	6.0′	23°06.7	10.8′	59.7′
9	314°03.4	·· 52.9	151°50.3	6.0′	22°55.9	11.0′	59.7′
10	329°03.5	52.0	166°15.3	6.1′	22°44.9	11.1′	59.7′
11	344°03.6	51.2	180°40.4	6.1′	22°33.8	11.3′	59.8′
12	359°03.8	N12°50.4	195°05.5	6.2′	S22°22.5	11.4′	59.8′
13	14°03.9	49.6	209°30.7	6.3′	22°11.1	11.6′	59.8′
14	29°04.1	48.8	223°56.0	6.3′	21°59.5	11.8′	59.8′
15	44°04.2	·· 48.0	238°21.3	6.4′	21°47.7	11.9′	59.9′
16	59°04.4	47.2	252°46.8	6.5′	21°35.8	12.0′	59.9′
17	74°04.5	46.3	267°12.2	6.5′	21°23.8	12.2′	59.9′
18	89°04.6	N12°45.5	281°37.8	6.6′	S21°11.6	12.3′	60.0′
19	104°04.8	44.7	296°03.4	6.7′	20°59.3	12.5′	60.0′
20	119°04.9	43.9	310°29.0	6.7′	20°46.8	12.6′	60.0′
21	134°05.1	·· 43.1	324°54.8	6.8′	20°34.2	12.8′	60.0′
22	149°05.2	42.3	339°20.6	6.9′	20°21.4	12.9′	60.1′
23	164°05.4	41.4	353°46.5	6.9′	20°08.5	13.0′	60.1′
	SD = 15.8′	d = -0.8′	SD = 16.2′				

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

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

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 82-95%
16	04:18	04:11	12:04	21:28	08:58	
17	04:05	03:58	12:04	22:28	09:58	
18	03:52	03:45	12:04	23:26	10:57	

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

	Aries	Venus		Mars		Jupiter		Saturn	
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	327°50.2	159°12.6	N06°21.2	249°14.2	N22°42.4	251°32.2	N22°08.6	338°28.1	S06°55.0
1	342°52.7	174°12.3	20.0	264°14.9	42.5	266°34.3	08.6	353°30.7	55.1
2	357°55.1	189°11.9	18.7	279°15.6	42.7	281°36.4	08.6	8°33.4	55.2
3	12°57.6	204°11.6	·· 17.5	294°16.4	·· 42.9	296°38.4	·· 08.7	23°36.0	·· 55.2
4	28°00.1	219°11.2	16.2	309°17.1	43.0	311°40.5	08.7	38°38.6	55.3
5	43°02.5	234°10.8	15.0	324°17.8	43.2	326°42.6	08.7	53°41.2	55.4
6	58°05.0	249°10.5	N06°13.8	339°18.6	N22°43.4	341°44.7	N22°08.8	68°43.8	S06°55.5
7	73°07.5	264°10.1	12.5	354°19.3	43.5	356°46.7	08.8	83°46.5	55.5
8	88°09.9	279°09.8	11.3	9°20.0	43.7	11°48.8	08.8	98°49.1	55.6
9	103°12.4	294°09.4	·· 10.0	24°20.8	·· 43.8	26°50.9	·· 08.9	113°51.7	·· 55.7
10	118°14.9	309°09.1	08.8	39°21.5	44.0	41°53.0	08.9	128°54.3	55.8
11	133°17.3	324°08.7	07.6	54°22.2	44.2	56°55.1	08.9	143°56.9	55.8
12	148°19.8	339°08.4	N06°06.3	69°23.0	N22°44.3	71°57.1	N22°09.0	158°59.6	S06°55.9
13	163°22.2	354°08.0	05.1	84°23.7	44.5	86°59.2	09.0	174°02.2	56.0
14	178°24.7	9°07.6	03.8	99°24.4	44.7	102°01.3	09.0	189°04.8	56.0
15	193°27.2	24°07.3	·· 02.6	114°25.2	·· 44.8	117°03.4	·· 09.1	204°07.4	·· 56.1
16	208°29.6	39°06.9	01.4	129°25.9	45.0	132°05.4	09.1	219°10.1	56.2
17	223°32.1	54°06.6	06°00.1	144°26.7	45.1	147°07.5	09.1	234°12.7	56.3
18	238°34.6	69°06.2	N05°58.9	159°27.4	N22°45.3	162°09.6	N22°09.2	249°15.3	S06°56.3
19	253°37.0	84°05.9	57.6	174°28.1	45.5	177°11.7	09.2	264°17.9	56.4
20	268°39.5	99°05.5	56.4	189°28.9	45.6	192°13.8	09.2	279°20.5	56.5
21	283°42.0	114°05.2	·· 55.2	204°29.6	·· 45.8	207°15.8	·· 09.3	294°23.2	·· 56.6
22	298°44.4	129°04.8	53.9	219°30.3	46.0	222°17.9	09.3	309°25.8	56.6
23	313°46.9	144°04.5	52.7	234°31.1	46.1	237°20.0	09.3	324°28.4	56.7
Mer.pass. 02:08		ν -0.4′	d -1.2′	m -3.86	ν 0.7′	d 0.2′	m 0.78	ν 2.1′	d 0.0′ m -2.19	ν 2.6′	d -0.1′ m 0.66

Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	328°49.3	159°04.1	N05°51.4	249°31.8	N22°46.3	252°22.1	N22°09.4	339°31.0	S06°56.8
1	343°51.8	174°03.8	50.2	264°32.5	46.4	267°24.1	09.4	354°33.7	56.8
2	358°54.3	189°03.4	48.9	279°33.3	46.6	282°26.2	09.4	9°36.3	56.9
3	13°56.7	204°03.1	·· 47.7	294°34.0	·· 46.7	297°28.3	·· 09.4	24°38.9	·· 57.0
4	28°59.2	219°02.7	46.5	309°34.7	46.9	312°30.4	09.5	39°41.5	57.1
5	44°01.7	234°02.4	45.2	324°35.5	47.1	327°32.5	09.5	54°44.1	57.1
6	59°04.1	249°02.0	N05°44.0	339°36.2	N22°47.2	342°34.6	N22°09.5	69°46.8	S06°57.2
7	74°06.6	264°01.7	42.7	354°37.0	47.4	357°36.6	09.6	84°49.4	57.3
8	89°09.1	279°01.3	41.5	9°37.7	47.5	12°38.7	09.6	99°52.0	57.4
9	104°11.5	294°01.0	·· 40.2	24°38.4	·· 47.7	27°40.8	·· 09.6	114°54.6	·· 57.4
10	119°14.0	309°00.6	39.0	39°39.2	47.8	42°42.9	09.7	129°57.3	57.5
11	134°16.5	324°00.3	37.7	54°39.9	48.0	57°45.0	09.7	144°59.9	57.6
12	149°18.9	338°59.9	N05°36.5	69°40.6	N22°48.2	72°47.0	N22°09.7	160°02.5	S06°57.7
13	164°21.4	353°59.6	35.2	84°41.4	48.3	87°49.1	09.8	175°05.1	57.7
14	179°23.8	8°59.2	34.0	99°42.1	48.5	102°51.2	09.8	190°07.7	57.8
15	194°26.3	23°58.9	·· 32.7	114°42.9	·· 48.6	117°53.3	·· 09.8	205°10.4	·· 57.9
16	209°28.8	38°58.5	31.5	129°43.6	48.8	132°55.4	09.9	220°13.0	57.9
17	224°31.2	53°58.2	30.2	144°44.3	48.9	147°57.5	09.9	235°15.6	58.0
18	239°33.7	68°57.8	N05°29.0	159°45.1	N22°49.1	162°59.5	N22°09.9	250°18.2	S06°58.1
19	254°36.2	83°57.5	27.8	174°45.8	49.2	178°01.6	10.0	265°20.9	58.2
20	269°38.6	98°57.1	26.5	189°46.5	49.4	193°03.7	10.0	280°23.5	58.2
21	284°41.1	113°56.8	·· 25.3	204°47.3	·· 49.5	208°05.8	·· 10.0	295°26.1	·· 58.3
22	299°43.6	128°56.4	24.0	219°48.0	49.7	223°07.9	10.1	310°28.7	58.4
23	314°46.0	143°56.1	22.8	234°48.8	49.9	238°10.0	10.1	325°31.4	58.5
Mer.pass. 02:04		ν -0.4′	d -1.2′	m -3.86	ν 0.7′	d 0.2′	m 0.77	ν 2.1′	d 0.0′ m -2.20	ν 2.6′	d -0.1′ m 0.66

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	329°48.5	158°55.7	N05°21.5	249°49.5	N22°50.0	253°12.1	N22°10.1	340°34.0	S06°58.5
1	344°51.0	173°55.4	20.3	264°50.2	50.2	268°14.1	10.2	355°36.6	58.6
2	359°53.4	188°55.0	19.0	279°51.0	50.3	283°16.2	10.2	10°39.2	58.7
3	14°55.9	203°54.7	·· 17.8	294°51.7	·· 50.5	298°18.3	·· 10.2	25°41.9	·· 58.8
4	29°58.3	218°54.4	16.5	309°52.5	50.6	313°20.4	10.2	40°44.5	58.8
5	45°00.8	233°54.0	15.3	324°53.2	50.8	328°22.5	10.3	55°47.1	58.9
6	60°03.3	248°53.7	N05°14.0	339°53.9	N22°50.9	343°24.6	N22°10.3	70°49.7	S06°59.0
7	75°05.7	263°53.3	12.8	354°54.7	51.1	358°26.7	10.3	85°52.4	59.1
8	90°08.2	278°53.0	11.5	9°55.4	51.2	13°28.7	10.4	100°55.0	59.1
9	105°10.7	293°52.6	·· 10.2	24°56.2	·· 51.4	28°30.8	·· 10.4	115°57.6	·· 59.2
10	120°13.1	308°52.3	09.0	39°56.9	51.5	43°32.9	10.4	131°00.2	59.3
11	135°15.6	323°51.9	07.7	54°57.6	51.7	58°35.0	10.5	146°02.9	59.3
12	150°18.1	338°51.6	N05°06.5	69°58.4	N22°51.8	73°37.1	N22°10.5	161°05.5	S06°59.4
13	165°20.5	353°51.3	05.2	84°59.1	51.9	88°39.2	10.5	176°08.1	59.5
14	180°23.0	8°50.9	04.0	99°59.9	52.1	103°41.3	10.6	191°10.7	59.6
15	195°25.4	23°50.6	·· 02.7	115°00.6	·· 52.2	118°43.4	·· 10.6	206°13.4	·· 59.6
16	210°27.9	38°50.2	01.5	130°01.4	52.4	133°45.5	10.6	221°16.0	59.7
17	225°30.4	53°49.9	05°00.2	145°02.1	52.5	148°47.5	10.7	236°18.6	59.8
18	240°32.8	68°49.5	N04°59.0	160°02.8	N22°52.7	163°49.6	N22°10.7	251°21.2	S06°59.9
19	255°35.3	83°49.2	57.7	175°03.6	52.8	178°51.7	10.7	266°23.9	06°59.9
20	270°37.8	98°48.9	56.5	190°04.3	53.0	193°53.8	10.7	281°26.5	07°00.0
21	285°40.2	113°48.5	·· 55.2	205°05.1	·· 53.1	208°55.9	·· 10.8	296°29.1	·· 00.1
22	300°42.7	128°48.2	53.9	220°05.8	53.3	223°58.0	10.8	311°31.7	00.2
23	315°45.2	143°47.8	52.7	235°06.6	53.4	239°00.1	10.8	326°34.4	00.2
Mer.pass. 02:00		ν -0.3′	d -1.3′	m -3.86	ν 0.7′	d 0.2′	m 0.77	ν 2.1′	d 0.0′ m -2.20	ν 2.6′	d -0.1′ m 0.65

Stars

	SHA	Dec
Alpheratz	357°34.8	29°13.6
Ankaa	353°07.1	-42°10.1
Schedar	349°31.0	56°40.2
Diphda	348°47.4	-17°50.9
Achernar	335°20.1	-57°06.4
Hamal	327°51.4	23°34.7
Polaris	314°07.0	89°21.8
Acamar	315°11.9	-40°12.0
Menkar	314°06.4	4°11.3
Mirfak	308°28.7	49°56.8
Aldebaran	290°40.1	16°33.6
Rigel	281°04.3	-8°10.2
Capella	280°22.5	46°01.2
Bellatrix	278°23.4	6°22.4
Elnath	278°02.4	28°37.7
Alnilam	275°38.2	-1°11.0
Betelgeuse	270°52.6	7°24.8
Canopus	263°52.9	-52°42.2
Sirius	258°26.8	-16°44.8
Adhara	255°06.4	-29°00.1
Procyon	244°51.4	5°09.8
Pollux	243°18.0	27°58.0
Avior	234°15.5	-59°35.1
Suhail	222°47.0	-43°31.8
Miaplacidus	221°39.3	-69°48.9
Alphard	217°48.4	-8°45.8
Regulus	207°35.1	11°51.0
Dubhe	193°42.0	61°37.3
Denebola	182°25.5	14°26.2
Gienah	175°44.2	-17°40.7
Acrux	173°01.0	-63°14.3
Gacrux	171°52.5	-57°15.2
Alioth	166°13.6	55°49.8
Spica	158°22.8	-11°17.3
Alkaid	152°52.5	49°11.7
Hadar	148°36.8	-60°29.7
Menkent	147°58.2	-36°29.6
Arcturus	145°48.3	19°03.4
Rigil Kent.	139°41.0	-60°56.4
Kochab	137°20.0	74°03.5
Zuben'ubi	136°56.4	-16°08.6
Alphecca	126°04.0	26°38.1
Antares	112°16.1	-26°29.2
Atria	107°10.5	-69°04.5
Sabik	102°03.0	-15°45.3
Shaula	96°10.6	-37°07.4
Rasalhague	95°58.7	12°32.7
Eltanin	90°42.0	51°29.3
Kaus Aust.	83°32.7	-34°22.4
Vega	80°33.2	38°48.6
Nunki	75°47.9	-26°16.0
Altair	62°00.0	8°56.1
Peacock	53°05.6	-56°39.4
Deneb	49°25.6	45°22.2
Enif	33°38.8	9°59.4
Al Na'ir	27°32.8	-46°50.4
Fomalhaut	15°14.5	-29°29.4
Scheat	13°45.2	28°13.0
Markab	13°29.9	15°20.3

Aug 19 Mon	SHA	Mer.pass
Venus	191°22.4	13:23
Mars	281°24.0	07:23
Jupiter	283°42.0	07:13
Saturn	10°37.9	01:26

Aug 20 Tue	SHA	Mer.pass
Venus	190°14.8	13:24
Mars	280°42.4	07:22
Jupiter	283°32.7	07:10
Saturn	10°41.7	01:22

Aug 21 Wed	SHA	Mer.pass
Venus	189°07.3	13:25
Mars	280°01.0	07:20
Jupiter	283°23.6	07:06
Saturn	10°45.5	01:18

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h — Sun — Moon

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	179°05.5	N12°40.6	8°12.4	7.0′	S19°55.5	13.2′	60.1′
1	194°05.7	39.8	22°38.4	7.1′	19°42.3	13.3′	60.1′
2	209°05.8	39.0	37°04.5	7.2′	19°29.0	13.4′	60.2′
3	224°06.0	·· 38.2	51°30.7	7.2′	19°15.6	13.6′	60.2′
4	239°06.1	37.4	65°56.9	7.3′	19°02.0	13.7′	60.2′
5	254°06.3	36.5	80°23.2	7.4′	18°48.3	13.8′	60.2′
6	269°06.4	N12°35.7	94°49.6	7.4′	S18°34.5	14.0′	60.3′
7	284°06.6	34.9	109°16.0	7.5′	18°20.5	14.1′	60.3′
8	299°06.7	34.1	123°42.5	7.6′	18°06.4	14.1′	60.3′
9	314°06.9	·· 33.3	138°09.1	7.6′	17°52.3	14.4′	60.3′
10	329°07.0	32.4	152°35.7	7.7′	17°37.9	14.4′	60.3′
11	344°07.1	31.6	167°02.5	7.8′	17°23.5	14.5′	60.4′
12	359°07.3	N12°30.8	181°29.3	7.9′	S17°09.0	14.7′	60.4′
13	14°07.4	30.0	195°56.1	7.9′	16°54.3	14.8′	60.4′
14	29°07.6	29.2	210°23.0	8.0′	16°39.5	14.9′	60.4′
15	44°07.7	·· 28.3	224°50.0	8.1′	16°24.6	15.0′	60.4′
16	59°07.9	27.5	239°17.1	8.1′	16°09.6	15.1′	60.5′
17	74°08.0	26.7	253°44.2	8.2′	15°54.5	15.2′	60.5′
18	89°08.2	N12°25.9	268°11.4	8.3′	S15°39.3	15.3′	60.5′
19	104°08.3	25.0	282°38.7	8.3′	15°24.0	15.4′	60.5′
20	119°08.5	24.2	297°06.1	8.4′	15°08.6	15.5′	60.5′
21	134°08.6	·· 23.4	311°33.5	8.5′	14°53.1	15.6′	60.5′
22	149°08.8	22.6	326°00.9	8.5′	14°37.5	15.7′	60.6′
23	164°08.9	21.7	340°28.5	8.6′	14°21.8	15.8′	60.6′
	SD = 15.8′	d = -0.8′		SD = 16.4′			

Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	179°09.1	N12°20.9	354°56.1	8.7′	S14°06.0	15.9′	60.6′
1	194°09.3	20.1	9°23.7	8.7′	13°50.1	15.9′	60.6′
2	209°09.4	19.3	23°51.5	8.8′	13°34.2	16.1′	60.6′
3	224°09.6	·· 18.4	38°19.3	8.9′	13°18.1	16.1′	60.6′
4	239°09.7	17.6	52°47.1	8.9′	13°02.0	16.3′	60.6′
5	254°09.9	16.8	67°15.0	9.0′	12°45.7	16.3′	60.7′
6	269°10.0	N12°15.9	81°43.0	9.0′	S12°29.4	16.4′	60.7′
7	284°10.2	15.1	96°11.0	9.1′	12°13.0	16.4′	60.7′
8	299°10.3	14.3	110°39.1	9.2′	11°56.6	16.6′	60.7′
9	314°10.5	·· 13.5	125°07.3	9.2′	11°40.0	16.6′	60.7′
10	329°10.6	12.6	139°35.5	9.3′	11°23.4	16.7′	60.7′
11	344°10.8	11.8	154°03.8	9.3′	11°06.7	16.7′	60.7′
12	359°10.9	N12°11.0	168°32.1	9.4′	S10°50.0	16.8′	60.7′
13	14°11.1	10.1	183°00.5	9.4′	10°33.2	16.9′	60.7′
14	29°11.2	09.3	197°28.9	9.5′	10°16.3	17.0′	60.7′
15	44°11.4	·· 08.5	211°57.4	9.5′	09°59.3	17.0′	60.8′
16	59°11.5	07.7	226°26.0	9.6′	09°42.3	17.0′	60.8′
17	74°11.7	06.8	240°54.6	9.6′	09°25.3	17.2′	60.8′
18	89°11.9	N12°06.0	255°23.2	9.7′	S09°08.1	17.1′	60.8′
19	104°12.0	05.2	269°51.9	9.7′	08°51.0	17.3′	60.8′
20	119°12.2	04.3	284°20.6	9.8′	08°33.7	17.3′	60.8′
21	134°12.3	·· 03.5	298°49.4	9.8′	08°16.4	17.3′	60.8′
22	149°12.5	02.7	313°18.3	9.9′	07°59.1	17.4′	60.8′
23	164°12.6	01.8	327°47.1	9.9′	07°41.7	17.4′	60.8′
	SD = 15.8′	d = -0.8′		SD = 16.5′			

Wed	GHA	Dec	GHA	ν	Dec	d	HP
0	179°12.8	N12°01.0	342°16.1	10.0′	S07°24.3	17.5′	60.8′
1	194°12.9	12°00.2	356°45.0	10.0′	07°06.8	17.5′	60.8′
2	209°13.1	11°59.3	11°14.0	10.0′	06°49.3	17.5′	60.8′
3	224°13.3	·· 58.5	25°43.1	10.1′	06°31.8	17.6′	60.8′
4	239°13.4	57.7	40°12.2	10.1′	06°14.2	17.6′	60.8′
5	254°13.6	56.8	54°41.3	10.2′	05°56.6	17.7′	60.8′
6	269°13.7	N11°56.0	69°10.5	10.2′	S05°38.9	17.7′	60.8′
7	284°13.9	55.2	83°39.7	10.2′	05°21.2	17.7′	60.8′
8	299°14.0	54.3	98°08.9	10.3′	05°03.5	17.7′	60.8′
9	314°14.2	·· 53.5	112°38.2	10.3′	04°45.8	17.8′	60.8′
10	329°14.4	52.6	127°07.5	10.3′	04°28.0	17.8′	60.8′
11	344°14.5	51.8	141°36.8	10.4′	04°10.2	17.8′	60.8′
12	359°14.7	N11°51.0	156°06.1	10.4′	S03°52.4	17.8′	60.8′
13	14°14.8	50.1	170°35.5	10.4′	03°34.6	17.8′	60.8′
14	29°15.0	49.3	185°05.0	10.4′	03°16.8	17.9′	60.8′
15	44°15.2	·· 48.5	199°34.4	10.5′	02°58.9	17.8′	60.8′
16	59°15.3	47.6	214°03.9	10.5′	02°41.1	17.9′	60.8′
17	74°15.5	46.8	228°33.4	10.5′	02°23.2	17.9′	60.8′
18	89°15.6	N11°45.9	243°02.9	10.5′	S02°05.3	17.9′	60.8′
19	104°15.8	45.1	257°32.4	10.6′	01°47.4	17.9′	60.8′
20	119°16.0	44.3	272°02.0	10.6′	01°29.5	17.9′	60.7′
21	134°16.1	·· 43.4	286°31.5	10.6′	01°11.6	17.9′	60.7′
22	149°16.3	42.6	301°01.1	10.6′	00°53.7	17.9′	60.7′
23	164°16.4	41.7	315°30.7	10.6′	00°35.8	17.9′	60.7′
	SD = 15.8′	d = -0.8′		SD = 16.6′			

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

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

Day	Sun Eqn.of Time 00h	Sun Eqn.of Time 12h	Sun Mer. Pass	Moon Mer.Pass. Upper	Moon Mer.Pass. Lower	Age 15-17
	mm:ss	mm:ss	hh:mm	hh:mm	hh:mm	99-98%
19	03:38	03:31	12:04	–:–	11:54	
20	03:24	03:16	12:03	00:21	12:48	
21	03:09	03:01	12:03	01:13	13:39	

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

	Aries	Venus		Mars		Jupiter		Saturn	
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	330°47.6	158°47.5	N04°51.4	250°07.3	N22°53.6	254°02.2	N22°10.9	341°37.0	S07°00.3
1	345°50.1	173°47.2	50.2	265°08.0	53.7	269°04.3	10.9	356°39.6	00.4
2	0°52.6	188°46.8	48.9	280°08.8	53.8	284°06.4	10.9	11°42.2	00.5
3	15°55.0	203°46.5	·· 47.7	295°09.5	·· 54.0	299°08.5	·· 11.0	26°44.9	·· 00.5
4	30°57.5	218°46.1	46.4	310°10.3	54.1	314°10.5	11.0	41°47.5	00.6
5	45°59.9	233°45.8	45.2	325°11.0	54.3	329°12.6	11.0	56°50.1	00.7
6	61°02.4	248°45.5	N04°43.9	340°11.8	N22°54.4	344°14.7	N22°11.1	71°52.7	S07°00.8
7	76°04.9	263°45.1	42.6	355°12.5	54.6	359°16.8	11.1	86°55.4	00.8
8	91°07.3	278°44.8	41.4	10°13.3	54.7	14°18.9	11.1	101°58.0	00.9
9	106°09.8	293°44.4	·· 40.1	25°14.0	·· 54.8	29°21.0	·· 11.1	117°00.6	·· 01.0
10	121°12.3	308°44.1	38.9	40°14.7	55.0	44°23.1	11.2	132°03.2	01.0
11	136°14.7	323°43.8	37.6	55°15.5	55.1	59°25.2	11.2	147°05.9	01.1
12	151°17.2	338°43.4	N04°36.4	70°16.2	N22°55.3	74°27.3	N22°11.2	162°08.5	S07°01.2
13	166°19.7	353°43.1	35.1	85°17.0	55.4	89°29.4	11.3	177°11.1	01.3
14	181°22.1	8°42.7	33.8	100°17.7	55.5	104°31.5	11.3	192°13.7	01.3
15	196°24.6	23°42.4	·· 32.6	115°18.5	·· 55.7	119°33.6	·· 11.3	207°16.4	·· 01.4
16	211°27.0	38°42.1	31.3	130°19.2	55.8	134°35.7	11.4	222°19.0	01.5
17	226°29.5	53°41.7	30.1	145°20.0	56.0	149°37.8	11.4	237°21.6	01.6
18	241°32.0	68°41.4	N04°28.8	160°20.7	N22°56.1	164°39.9	N22°11.4	252°24.3	S07°01.6
19	256°34.4	83°41.1	27.5	175°21.5	56.2	179°42.0	11.4	267°26.9	01.7
20	271°36.9	98°40.7	26.3	190°22.2	56.4	194°44.1	11.5	282°29.5	01.8
21	286°39.4	113°40.4	·· 25.0	205°23.0	·· 56.5	209°46.1	·· 11.5	297°32.1	·· 01.9
22	301°41.8	128°40.0	23.8	220°23.7	56.7	224°48.2	11.5	312°34.8	01.9
23	316°44.3	143°39.7	22.5	235°24.4	56.8	239°50.3	11.6	327°37.4	02.0
Mer.pass. 01:57		ν -0.3′	d -1.3′	m -3.86	ν 0.7′	d 0.1′	m 0.76	ν 2.1′	d 0.0′ m -2.21	ν 2.6′	d -0.1′ m 0.65

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	331°46.8	158°39.4	N04°21.2	250°25.2	N22°56.9	254°52.4	N22°11.6	342°40.0	S07°02.1
1	346°49.2	173°39.0	20.0	265°25.9	57.1	269°54.5	11.6	357°42.6	02.2
2	1°51.7	188°38.7	18.7	280°26.7	57.2	284°56.6	11.7	12°45.3	02.2
3	16°54.2	203°38.4	·· 17.4	295°27.4	·· 57.3	299°58.7	·· 11.7	27°47.9	·· 02.3
4	31°56.6	218°38.0	16.2	310°28.2	57.5	315°00.8	11.7	42°50.5	02.4
5	46°59.1	233°37.7	14.9	325°28.9	57.6	330°02.9	11.7	57°53.2	02.5
6	62°01.5	248°37.4	N04°13.7	340°29.7	N22°57.7	345°05.0	N22°11.8	72°55.8	S07°02.5
7	77°04.0	263°37.0	12.4	355°30.4	57.9	0°07.1	11.8	87°58.4	02.6
8	92°06.5	278°36.7	11.1	10°31.2	58.0	15°09.2	11.8	103°01.0	02.7
9	107°08.9	293°36.4	·· 09.9	25°31.9	·· 58.1	30°11.3	·· 11.9	118°03.7	·· 02.8
10	122°11.4	308°36.0	08.6	40°32.7	58.3	45°13.4	11.9	133°06.3	02.8
11	137°13.9	323°35.7	07.3	55°33.4	58.4	60°15.5	11.9	148°08.9	02.9
12	152°16.3	338°35.3	N04°06.1	70°34.2	N22°58.5	75°17.6	N22°12.0	163°11.6	S07°03.0
13	167°18.8	353°35.0	04.8	85°34.9	58.7	90°19.7	12.0	178°14.2	03.1
14	182°21.3	8°34.7	03.6	100°35.7	58.8	105°21.8	12.0	193°16.8	03.1
15	197°23.7	23°34.3	·· 02.3	115°36.4	·· 58.9	120°23.9	·· 12.0	208°19.4	·· 03.2
16	212°26.2	38°34.0	04°01.0	130°37.2	59.1	135°26.0	12.1	223°22.1	03.3
17	227°28.6	53°33.7	03°59.8	145°37.9	59.2	150°28.1	12.1	238°24.7	03.4
18	242°31.1	68°33.3	N03°58.5	160°38.7	N22°59.3	165°30.2	N22°12.1	253°27.3	S07°03.4
19	257°33.6	83°33.0	57.2	175°39.4	59.5	180°32.3	12.2	268°29.9	03.5
20	272°36.0	98°32.7	56.0	190°40.2	59.6	195°34.4	12.2	283°32.6	03.6
21	287°38.5	113°32.3	·· 54.7	205°40.9	·· 59.7	210°36.5	·· 12.2	298°35.2	·· 03.7
22	302°41.0	128°32.0	53.4	220°41.7	22°59.9	225°38.6	12.2	313°37.8	03.7
23	317°43.4	143°31.7	52.2	235°42.4	23°00.0	240°40.7	12.3	328°40.5	03.8
Mer.pass. 01:53		ν -0.3′	d -1.3′	m -3.86	ν 0.7′	d 0.1′	m 0.76	ν 2.1′	d 0.0′ m -2.21	ν 2.6′	d -0.1′ m 0.64

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	332°45.9	158°31.4	N03°50.9	250°43.2	N23°00.1	255°42.8	N22°12.3	343°43.1	S07°03.9
1	347°48.4	173°31.0	49.6	265°43.9	00.2	270°44.9	12.3	358°45.7	04.0
2	2°50.8	188°30.7	48.4	280°44.7	00.4	285°47.0	12.4	13°48.4	04.0
3	17°53.3	203°30.4	·· 47.1	295°45.4	·· 00.5	300°49.2	·· 12.4	28°51.0	·· 04.1
4	32°55.8	218°30.0	45.8	310°46.2	00.6	315°51.3	12.4	43°53.6	04.2
5	47°58.2	233°29.7	44.6	325°47.0	00.8	330°53.4	12.4	58°56.2	04.3
6	63°00.7	248°29.4	N03°43.3	340°47.7	N23°00.9	345°55.5	N22°12.5	73°58.9	S07°04.3
7	78°03.1	263°29.0	42.0	355°48.5	01.0	0°57.6	12.5	89°01.5	04.4
8	93°05.6	278°28.7	40.8	10°49.2	01.1	15°59.7	12.5	104°04.1	04.5
9	108°08.1	293°28.4	·· 39.5	25°50.0	·· 01.3	31°01.8	·· 12.6	119°06.8	·· 04.6
10	123°10.5	308°28.0	38.2	40°50.7	01.4	46°03.9	12.6	134°09.4	04.6
11	138°13.0	323°27.7	37.0	55°51.5	01.5	61°06.0	12.6	149°12.0	04.7
12	153°15.5	338°27.4	N03°35.7	70°52.2	N23°01.7	76°08.1	N22°12.6	164°14.6	S07°04.8
13	168°17.9	353°27.1	34.4	85°53.0	01.8	91°10.2	12.7	179°17.3	04.9
14	183°20.4	8°26.7	33.2	100°53.7	01.9	106°12.3	12.7	194°19.9	04.9
15	198°22.9	23°26.4	·· 31.9	115°54.5	·· 02.0	121°14.4	·· 12.7	209°22.5	·· 05.0
16	213°25.3	38°26.1	30.6	130°55.2	02.2	136°16.5	12.8	224°25.2	05.1
17	228°27.8	53°25.7	29.3	145°56.0	02.3	151°18.6	12.8	239°27.8	05.2
18	243°30.3	68°25.4	N03°28.1	160°56.8	N23°02.4	166°20.7	N22°12.8	254°30.4	S07°05.2
19	258°32.7	83°25.1	26.8	175°57.5	02.5	181°22.8	12.8	269°33.1	05.3
20	273°35.2	98°24.7	25.5	190°58.3	02.6	196°25.0	12.9	284°35.7	05.4
21	288°37.6	113°24.4	·· 24.3	205°59.0	·· 02.8	211°27.1	·· 12.9	299°38.3	·· 05.5
22	303°40.1	128°24.1	23.0	220°59.8	02.9	226°29.2	12.9	314°40.9	05.5
23	318°42.6	143°23.8	21.7	236°00.5	03.0	241°31.3	13.0	329°43.6	05.6
Mer.pass. 01:49		ν -0.3′	d -1.3′	m -3.86	ν 0.8′	d 0.1′	m 0.75	ν 2.1′	d 0.0′ m -2.22	ν 2.6′	d -0.1′ m 0.64

Stars

	SHA	Dec
Alpheratz	357°34.8	29°13.6
Ankaa	353°07.1	-42°10.1
Schedar	349°31.0	56°40.2
Diphda	348°47.4	-17°50.9
Achernar	335°20.0	-57°06.4
Hamal	327°51.4	23°34.7
Polaris	314°05.6	89°21.8
Acamar	315°11.9	-40°12.0
Menkar	314°06.4	4°11.3
Mirfak	308°28.7	49°56.8
Aldebaran	290°40.0	16°33.6
Rigel	281°04.3	-8°10.2
Capella	280°22.5	46°01.2
Bellatrix	278°23.3	6°22.4
Elnath	278°02.4	28°37.7
Alnilam	275°38.2	-1°11.0
Betelgeuse	270°52.6	7°24.8
Canopus	263°52.9	-52°42.2
Sirius	258°26.7	-16°44.8
Adhara	255°06.4	-29°00.1
Procyon	244°51.4	5°09.8
Pollux	243°18.0	27°58.0
Avior	234°15.5	-59°35.1
Suhail	222°47.0	-43°31.7
Miaplacidus	221°39.3	-69°48.9
Alphard	217°48.4	-8°45.8
Regulus	207°35.1	11°51.0
Dubhe	193°42.0	61°37.2
Denebola	182°25.5	14°26.2
Gienah	175°44.2	-17°40.7
Acrux	173°01.1	-63°14.3
Gacrux	171°52.5	-57°15.2
Alioth	166°13.6	55°49.8
Spica	158°22.8	-11°17.3
Alkaid	152°52.5	49°11.7
Hadar	148°36.8	-60°29.7
Menkent	147°58.2	-36°29.5
Arcturus	145°48.3	19°03.4
Rigil Kent.	139°41.0	-60°56.4
Kochab	137°20.0	74°03.5
Zuben'ubi	136°56.5	-16°08.6
Alphecca	126°04.0	26°38.1
Antares	112°16.2	-26°29.2
Atria	107°10.5	-69°04.5
Sabik	102°03.0	-15°45.3
Shaula	96°10.6	-37°07.4
Rasalhague	95°58.7	12°32.7
Eltanin	90°42.1	51°29.3
Kaus Aust.	83°32.7	-34°22.4
Vega	80°33.2	38°48.6
Nunki	75°47.9	-26°16.0
Altair	62°00.0	8°56.1
Peacock	53°05.6	-56°39.4
Deneb	49°25.6	45°22.2
Enif	33°38.8	9°59.4
Al Na'ir	27°32.8	-46°50.4
Fomalhaut	15°14.5	-29°29.4
Scheat	13°45.2	28°13.0
Markab	13°29.9	15°20.3

Aug 22 Thu	SHA	Mer.pass
Venus	187°59.9	13:25
Mars	279°19.7	07:19
Jupiter	283°14.6	07:03
Saturn	10°49.4	01:13

Aug 23 Fri	SHA	Mer.pass
Venus	186°52.6	13:26
Mars	278°38.4	07:18
Jupiter	283°05.7	07:00
Saturn	10°53.3	01:09

Aug 24 Sat	SHA	Mer.pass
Venus	185°45.5	13:26
Mars	277°57.3	07:17
Jupiter	282°56.9	06:56
Saturn	10°57.2	01:05

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°16.6	N11°40.9	330°00.4	10.6′	S00°17.9	17.9′	60.7′
1	194°16.8	40.1	344°30.0	10.6′	N00°00.0	17.9′	60.7′
2	209°16.9	39.2	358°59.6	10.7′	00°17.9	17.9′	60.7′
3	224°17.1	·· 38.4	13°29.3	10.7′	00°35.8	17.9′	60.7′
4	239°17.2	37.5	27°59.0	10.7′	00°53.7	17.8′	60.7′
5	254°17.4	36.7	42°28.7	10.7′	01°11.5	17.9′	60.7′
6	269°17.6	N11°35.8	56°58.3	10.7′	N01°29.4	17.8′	60.7′
7	284°17.7	35.0	71°28.0	10.7′	01°47.2	17.8′	60.6′
8	299°17.9	34.2	85°57.7	10.7′	02°05.0	17.8′	60.6′
9	314°18.1	·· 33.3	100°27.4	10.7′	02°22.8	17.8′	60.6′
10	329°18.2	32.5	114°57.1	10.7′	02°40.6	17.7′	60.6′
11	344°18.4	31.6	129°26.8	10.7′	02°58.3	17.8′	60.6′
12	359°18.5	N11°30.8	143°56.5	10.7′	N03°16.1	17.6′	60.6′
13	14°18.7	29.9	158°26.2	10.7′	03°33.7	17.7′	60.6′
14	29°18.9	29.1	172°55.9	10.7′	03°51.4	17.6′	60.5′
15	44°19.0	·· 28.2	187°25.6	10.7′	04°09.0	17.6′	60.5′
16	59°19.2	27.4	201°55.3	10.7′	04°26.6	17.6′	60.5′
17	74°19.4	26.5	216°25.0	10.7′	04°44.2	17.6′	60.5′
18	89°19.5	N11°25.7	230°54.7	10.7′	N05°01.8	17.4′	60.5′
19	104°19.7	24.8	245°24.4	10.7′	05°19.2	17.5′	60.5′
20	119°19.9	24.0	259°54.0	10.6′	05°36.7	17.4′	60.4′
21	134°20.0	·· 23.1	274°23.7	10.6′	05°54.1	17.4′	60.4′
22	149°20.2	22.3	288°53.3	10.6′	06°11.5	17.3′	60.4′
23	164°20.3	21.5	303°22.9	10.6′	06°28.8	17.3′	60.4′
	SD = 15.8′	d = -0.8′	SD = 16.6′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°20.5	N11°20.6	317°52.5	10.6′	N06°46.1	17.2′	60.4′
1	194°20.7	19.8	332°22.1	10.6′	07°03.3	17.2′	60.4′
2	209°20.8	18.9	346°51.7	10.5′	07°20.5	17.1′	60.3′
3	224°21.0	·· 18.1	1°21.2	10.5′	07°37.6	17.1′	60.3′
4	239°21.2	17.2	15°50.7	10.5′	07°54.7	17.0′	60.3′
5	254°21.3	16.4	30°20.2	10.5′	08°11.7	17.0′	60.3′
6	269°21.5	N11°15.5	44°49.7	10.5′	N08°28.7	16.9′	60.3′
7	284°21.7	14.7	59°19.2	10.4′	08°45.6	16.8′	60.2′
8	299°21.8	13.8	73°48.6	10.4′	09°02.4	16.8′	60.2′
9	314°22.0	·· 12.9	88°18.0	10.4′	09°19.2	16.7′	60.2′
10	329°22.2	12.1	102°47.4	10.4′	09°35.9	16.7′	60.2′
11	344°22.3	11.2	117°16.8	10.3′	09°52.6	16.5′	60.2′
12	359°22.5	N11°10.4	131°46.1	10.3′	N10°09.1	16.6′	60.1′
13	14°22.7	09.5	146°15.4	10.3′	10°25.7	16.4′	60.1′
14	29°22.8	08.7	160°44.7	10.2′	10°42.1	16.4′	60.1′
15	44°23.0	·· 07.8	175°13.9	10.2′	10°58.5	16.3′	60.1′
16	59°23.2	07.0	189°43.1	10.2′	11°14.8	16.2′	60.0′
17	74°23.4	06.1	204°12.3	10.1′	11°31.0	16.1′	60.0′
18	89°23.5	N11°05.3	218°41.4	10.1′	N11°47.1	16.1′	60.0′
19	104°23.7	04.4	233°10.5	10.1′	12°03.2	16.0′	60.0′
20	119°23.9	03.6	247°39.6	10.0′	12°19.2	15.9′	59.9′
21	134°24.0	·· 02.7	262°08.6	10.0′	12°35.1	15.8′	59.9′
22	149°24.2	01.8	276°37.6	9.9′	12°50.9	15.7′	59.9′
23	164°24.4	01.0	291°06.6	9.9′	13°06.6	15.7′	59.9′
	SD = 15.8′	d = -0.8′	SD = 16.5′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°24.5	N11°00.1	305°35.5	9.9′	N13°22.3	15.6′	59.8′
1	194°24.7	10°59.3	320°04.3	9.8′	13°37.9	15.4′	59.8′
2	209°24.9	58.4	334°33.2	9.8′	13°53.3	15.4′	59.8′
3	224°25.0	·· 57.6	349°01.9	9.7′	14°08.7	15.3′	59.8′
4	239°25.2	56.7	3°30.7	9.7′	14°24.0	15.2′	59.7′
5	254°25.4	55.8	17°59.4	9.6′	14°39.2	15.1′	59.7′
6	269°25.6	N10°55.0	32°28.0	9.6′	N14°54.3	15.0′	59.7′
7	284°25.7	54.1	46°56.6	9.6′	15°09.3	14.9′	59.7′
8	299°25.9	53.3	61°25.2	9.5′	15°24.2	14.8′	59.6′
9	314°26.1	·· 52.4	75°53.7	9.5′	15°39.0	14.7′	59.6′
10	329°26.2	51.6	90°22.1	9.4′	15°53.7	14.6′	59.6′
11	344°26.4	50.7	104°50.5	9.4′	16°08.3	14.5′	59.5′
12	359°26.6	N10°49.8	119°18.9	9.3′	N16°22.8	14.4′	59.5′
13	14°26.8	49.0	133°47.2	9.3′	16°37.2	14.2′	59.5′
14	29°26.9	48.1	148°15.5	9.2′	16°51.4	14.2′	59.5′
15	44°27.1	·· 47.2	162°43.7	9.2′	17°05.6	14.1′	59.4′
16	59°27.3	46.4	177°11.8	9.1′	17°19.7	13.9′	59.4′
17	74°27.4	45.5	191°39.9	9.0′	17°33.6	13.9′	59.4′
18	89°27.6	N10°44.7	206°08.0	9.0′	N17°47.5	13.7′	59.3′
19	104°27.8	43.8	220°36.0	8.9′	18°01.2	13.6′	59.3′
20	119°28.0	42.9	235°03.9	8.9′	18°14.8	13.5′	59.3′
21	134°28.1	·· 42.1	249°31.8	8.8′	18°28.3	13.3′	59.3′
22	149°28.3	41.2	263°59.6	8.8′	18°41.6	13.3′	59.2′
23	164°28.5	40.4	278°27.4	8.7′	18°54.9	13.1′	59.2′
	SD = 15.8′	d = -0.9′	SD = 16.3′				

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

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

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 93-76%
22	02:54	02:46	12:03	02:04	14:29	
23	02:38	02:30	12:02	02:54	15:20	
24	02:22	02:14	12:02	03:45	16:12	

August 25, 26, 27 UT (Sun., Mon., Tue.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	333°45.0	158°23.4	N03°20.5	251°01.3	N23°03.1	256°33.4	N22°13.0	344°46.2	S07°05.7
1	348°47.5	173°23.1	19.2	266°02.0	03.3	271°35.5	13.0	359°48.8	05.8
2	3°50.0	188°22.8	17.9	281°02.8	03.4	286°37.6	13.0	14°51.5	05.8
3	18°52.4	203°22.4	·· 16.6	296°03.6	·· 03.5	301°39.7	·· 13.1	29°54.1	·· 05.9
4	33°54.9	218°22.1	15.4	311°04.3	03.6	316°41.8	13.1	44°56.7	06.0
5	48°57.4	233°21.8	14.1	326°05.1	03.7	331°43.9	13.1	59°59.4	06.1
6	63°59.8	248°21.5	N03°12.8	341°05.8	N23°03.9	346°46.0	N22°13.2	75°02.0	S07°06.1
7	79°02.3	263°21.1	11.6	356°06.6	04.0	1°48.2	13.2	90°04.6	06.2
8	94°04.7	278°20.8	10.3	11°07.3	04.1	16°50.3	13.2	105°07.2	06.3
9	109°07.2	293°20.5	·· 09.0	26°08.1	·· 04.2	31°52.4	·· 13.2	120°09.9	·· 06.4
10	124°09.7	308°20.2	07.7	41°08.9	04.3	46°54.5	13.3	135°12.5	06.4
11	139°12.1	323°19.8	06.5	56°09.6	04.5	61°56.6	13.3	150°15.1	06.5
12	154°14.6	338°19.5	N03°05.2	71°10.4	N23°04.6	76°58.7	N22°13.3	165°17.8	S07°06.6
13	169°17.1	353°19.2	03.9	86°11.1	04.7	92°00.8	13.3	180°20.4	06.7
14	184°19.5	8°18.9	02.7	101°11.9	04.8	107°02.9	13.4	195°23.0	06.7
15	199°22.0	23°18.5	·· 01.4	116°12.7	·· 04.9	122°05.1	·· 13.4	210°25.7	·· 06.8
16	214°24.5	38°18.2	03°00.1	131°13.4	05.1	137°07.2	13.4	225°28.3	06.9
17	229°26.9	53°17.9	02°58.8	146°14.2	05.2	152°09.3	13.5	240°30.9	07.0
18	244°29.4	68°17.6	N02°57.6	161°14.9	N23°05.3	167°11.4	N22°13.5	255°33.6	S07°07.0
19	259°31.9	83°17.2	56.3	176°15.7	05.4	182°13.5	13.5	270°36.2	07.1
20	274°34.3	98°16.9	55.0	191°16.5	05.5	197°15.6	13.5	285°38.8	07.2
21	289°36.8	113°16.6	·· 53.7	206°17.2	·· 05.6	212°17.7	·· 13.6	300°41.5	·· 07.3
22	304°39.2	128°16.3	52.5	221°18.0	05.7	227°19.8	13.6	315°44.1	07.4
23	319°41.7	143°15.9	51.2	236°18.7	05.9	242°22.0	13.6	330°46.7	07.4
Mer.pass. 01:45		ν -0.3′	d -1.3′	m -3.86	ν 0.8′	d 0.1′	m 0.74	ν 2.1′	d 0.0′ m -2.22	ν 2.6′	d -0.1′ m 0.64

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	334°44.2	158°15.6	N02°49.9	251°19.5	N23°06.0	257°24.1	N22°13.7	345°49.3	S07°07.5
1	349°46.6	173°15.3	48.6	266°20.3	06.1	272°26.2	13.7	0°52.0	07.6
2	4°49.1	188°15.0	47.4	281°21.0	06.2	287°28.3	13.7	15°54.6	07.7
3	19°51.6	203°14.6	·· 46.1	296°21.8	·· 06.3	302°30.4	·· 13.7	30°57.2	·· 07.7
4	34°54.0	218°14.3	44.8	311°22.5	06.4	317°32.5	13.8	45°59.9	07.8
5	49°56.5	233°14.0	43.5	326°23.3	06.5	332°34.7	13.8	61°02.5	07.9
6	64°59.0	248°13.7	N02°42.3	341°24.1	N23°06.7	347°36.8	N22°13.8	76°05.1	S07°08.0
7	80°01.4	263°13.3	41.0	356°24.8	06.8	2°38.9	13.8	91°07.8	08.0
8	95°03.9	278°13.0	39.7	11°25.6	06.9	17°41.0	13.9	106°10.4	08.1
9	110°06.4	293°12.7	·· 38.4	26°26.4	·· 07.0	32°43.1	·· 13.9	121°13.0	·· 08.2
10	125°08.8	308°12.4	37.2	41°27.1	07.1	47°45.2	13.9	136°15.7	08.3
11	140°11.3	323°12.0	35.9	56°27.9	07.2	62°47.4	13.9	151°18.3	08.3
12	155°13.7	338°11.7	N02°34.6	71°28.6	N23°07.3	77°49.5	N22°14.0	166°20.9	S07°08.4
13	170°16.2	353°11.4	33.3	86°29.4	07.4	92°51.6	14.0	181°23.6	08.5
14	185°18.7	8°11.1	32.1	101°30.2	07.6	107°53.7	14.0	196°26.2	08.6
15	200°21.1	23°10.7	·· 30.8	116°30.9	·· 07.7	122°55.8	·· 14.1	211°28.8	·· 08.6
16	215°23.6	38°10.4	29.5	131°31.7	07.8	137°58.0	14.1	226°31.5	08.7
17	230°26.1	53°10.1	28.2	146°32.5	07.9	153°00.1	14.1	241°34.1	08.8
18	245°28.5	68°09.8	N02°26.9	161°33.2	N23°08.0	168°02.2	N22°14.1	256°36.7	S07°08.9
19	260°31.0	83°09.5	25.7	176°34.0	08.1	183°04.3	14.2	271°39.4	08.9
20	275°33.5	98°09.1	24.4	191°34.8	08.2	198°06.4	14.2	286°42.0	09.0
21	290°35.9	113°08.8	·· 23.1	206°35.5	·· 08.3	213°08.6	·· 14.2	301°44.6	·· 09.1
22	305°38.4	128°08.5	21.8	221°36.3	08.4	228°10.7	14.2	316°47.3	09.2
23	320°40.9	143°08.2	20.6	236°37.1	08.5	243°12.8	14.3	331°49.9	09.2
Mer.pass. 01:41		ν -0.3′	d -1.3′	m -3.86	ν 0.8′	d 0.1′	m 0.74	ν 2.1′	d 0.0′ m -2.23	ν 2.6′	d -0.1′ m 0.63

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	335°43.3	158°07.8	N02°19.3	251°37.8	N23°08.6	258°14.9	N22°14.3	346°52.5	S07°09.3
1	350°45.8	173°07.5	18.0	266°38.6	08.8	273°17.0	14.3	1°55.2	09.4
2	5°48.2	188°07.2	16.7	281°39.4	08.9	288°19.2	14.3	16°57.8	09.5
3	20°50.7	203°06.9	·· 15.4	296°40.1	·· 09.0	303°21.3	·· 14.4	32°00.4	·· 09.6
4	35°53.2	218°06.6	14.2	311°40.9	09.1	318°23.4	14.4	47°03.1	09.6
5	50°55.6	233°06.2	12.9	326°41.7	09.2	333°25.5	14.4	62°05.7	09.7
6	65°58.1	248°05.9	N02°11.6	341°42.4	N23°09.3	348°27.6	N22°14.5	77°08.3	S07°09.8
7	81°00.6	263°05.6	10.3	356°43.2	09.4	3°29.8	14.5	92°11.0	09.9
8	96°03.0	278°05.3	09.0	11°44.0	09.5	18°31.9	14.5	107°13.6	09.9
9	111°05.5	293°05.0	·· 07.8	26°44.7	·· 09.6	33°34.0	·· 14.5	122°16.2	·· 10.0
10	126°08.0	308°04.6	06.5	41°45.5	09.7	48°36.1	14.6	137°18.9	10.1
11	141°10.4	323°04.3	05.2	56°46.3	09.8	63°38.3	14.6	152°21.5	10.2
12	156°12.9	338°04.0	N02°03.9	71°47.0	N23°09.9	78°40.4	N22°14.6	167°24.1	S07°10.2
13	171°15.4	353°03.7	02.6	86°47.8	10.0	93°42.5	14.6	182°26.8	10.3
14	186°17.8	8°03.4	01.4	101°48.6	10.1	108°44.6	14.7	197°29.4	10.4
15	201°20.3	23°03.0	02°00.1	116°49.3	·· 10.2	123°46.8	·· 14.7	212°32.0	·· 10.5
16	216°22.7	38°02.7	01°58.8	131°50.1	10.3	138°48.9	14.7	227°34.7	10.5
17	231°25.2	53°02.4	57.5	146°50.9	10.4	153°51.0	14.7	242°37.3	10.6
18	246°27.7	68°02.1	N01°56.2	161°51.6	N23°10.5	168°53.1	N22°14.8	257°39.9	S07°10.7
19	261°30.1	83°01.8	55.0	176°52.4	10.6	183°55.3	14.8	272°42.6	10.8
20	276°32.6	98°01.4	53.7	191°53.2	10.7	198°57.4	14.8	287°45.2	10.8
21	291°35.1	113°01.1	·· 52.4	206°54.0	·· 10.8	213°59.5	·· 14.8	302°47.8	·· 10.9
22	306°37.5	128°00.8	51.1	221°54.7	10.9	229°01.7	14.9	317°50.5	11.0
23	321°40.0	143°00.5	49.8	236°55.5	11.0	244°03.8	14.9	332°53.1	11.1
Mer.pass. 01:37		ν -0.3′	d -1.3′	m -3.86	ν 0.8′	d 0.1′	m 0.73	ν 2.1′	d 0.0′ m -2.23	ν 2.6′	d -0.1′ m 0.63

Stars

	SHA	**Dec**
Alpheratz	357°34.8	29°13.6
Ankaa	353°07.1	-42°10.1
Schedar	349°31.0	56°40.2
Diphda	348°47.3	-17°50.9
Achernar	335°20.0	-57°06.4
Hamal	327°51.4	23°34.7
Polaris	314°03.9	89°21.8
Acamar	315°11.9	-40°12.0
Menkar	314°06.4	4°11.3
Mirfak	308°28.6	49°56.8
Aldebaran	290°40.0	16°33.6
Rigel	281°04.3	-8°10.2
Capella	280°22.5	46°01.2
Bellatrix	278°23.3	6°22.4
Elnath	278°02.4	28°37.7
Alnilam	275°38.2	-1°11.0
Betelgeuse	270°52.6	7°24.8
Canopus	263°52.8	-52°42.2
Sirius	258°26.7	-16°44.8
Adhara	255°06.4	-29°00.1
Procyon	244°51.4	5°09.8
Pollux	243°18.0	27°58.0
Avior	234°15.5	-59°35.0
Suhail	222°47.0	-43°31.7
Miaplacidus	221°39.3	-69°48.9
Alphard	217°48.4	-8°45.8
Regulus	207°35.1	11°50.9
Dubhe	193°42.0	61°37.2
Denebola	182°25.6	14°26.2
Gienah	175°44.2	-17°40.7
Acrux	173°01.1	-63°14.2
Gacrux	171°52.5	-57°15.2
Alioth	166°13.6	55°49.8
Spica	158°22.8	-11°17.3
Alkaid	152°52.5	49°11.7
Hadar	148°36.8	-60°29.7
Menkent	147°58.2	-36°29.5
Arcturus	145°48.3	19°03.4
Rigil Kent.	139°41.0	-60°56.4
Kochab	137°20.1	74°03.5
Zuben'ubi	136°56.5	-16°08.6
Alphecca	126°04.0	26°38.1
Antares	112°16.2	-26°29.2
Atria	107°10.6	-69°04.5
Sabik	102°03.0	-15°45.3
Shaula	96°10.6	-37°07.4
Rasalhague	95°58.7	12°32.7
Eltanin	90°42.1	51°29.4
Kaus Aust.	83°32.7	-34°22.4
Vega	80°33.2	38°48.6
Nunki	75°47.9	-26°16.0
Altair	62°00.0	8°56.1
Peacock	53°05.7	-56°39.4
Deneb	49°25.6	45°22.2
Enif	33°38.8	9°59.4
Al Na'ir	27°32.8	-46°50.4
Fomalhaut	15°14.5	-29°29.4
Scheat	13°45.2	28°13.0
Markab	13°29.9	15°20.3

Aug 25 Sun	**SHA**	**Mer.pass**
Venus	184°38.4	13:27
Mars	277°16.3	07:16
Jupiter	282°48.3	06:53
Saturn	11°01.2	01:01

Aug 26 Mon	**SHA**	**Mer.pass**
Venus	183°31.4	13:27
Mars	276°35.3	07:14
Jupiter	282°39.9	06:49
Saturn	11°05.2	00:57

Aug 27 Tue	**SHA**	**Mer.pass**
Venus	182°24.5	13:28
Mars	275°54.5	07:13
Jupiter	282°31.6	06:46
Saturn	11°09.2	00:52

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.1524 sec ΔT = TT-UT1 = +69.0316 sec

2024 August 25 to Aug. 27 UT

h	Sun		Moon				
Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°28.7	N10°39.5	292°55.1	8.7′	N19°08.0	13.0′	59.2′
1	194°28.8	38.6	307°22.8	8.6′	19°21.0	12.9′	59.1′
2	209°29.0	37.8	321°50.4	8.6′	19°33.9	12.8′	59.1′
3	224°29.2	·· 36.9	336°18.0	8.5′	19°46.7	12.6′	59.1′
4	239°29.4	36.0	350°45.5	8.4′	19°59.3	12.5′	59.0′
5	254°29.5	35.2	5°12.9	8.4′	20°11.8	12.4′	59.0′
6	269°29.7	N10°34.3	19°40.3	8.3′	N20°24.2	12.2′	59.0′
7	284°29.9	33.4	34°07.7	8.3′	20°36.4	12.1′	59.0′
8	299°30.0	32.6	48°34.9	8.2′	20°48.5	12.0′	58.9′
9	314°30.2	·· 31.7	63°02.2	8.2′	21°00.5	11.9′	58.9′
10	329°30.4	30.8	77°29.3	8.1′	21°12.4	11.7′	58.9′
11	344°30.6	30.0	91°56.4	8.1′	21°24.1	11.5′	58.8′
12	359°30.8	N10°29.1	106°23.5	8.0′	N21°35.6	11.5′	58.8′
13	14°30.9	28.2	120°50.5	7.9′	21°47.1	11.3′	58.8′
14	29°31.1	27.4	135°17.4	7.9′	21°58.4	11.1′	58.7′
15	44°31.3	·· 26.5	149°44.3	7.8′	22°09.5	11.1′	58.7′
16	59°31.5	25.6	164°11.1	7.8′	22°20.6	10.8′	58.7′
17	74°31.6	24.8	178°37.9	7.7′	22°31.4	10.8′	58.6′
18	89°31.8	N10°23.9	193°04.6	7.7′	N22°42.2	10.6′	58.6′
19	104°32.0	23.0	207°31.3	7.6′	22°52.8	10.4′	58.6′
20	119°32.2	22.2	221°57.9	7.6′	23°03.2	10.3′	58.6′
21	134°32.3	·· 21.3	236°24.5	7.5′	23°13.5	10.1′	58.5′
22	149°32.5	20.4	250°51.0	7.5′	23°23.6	10.1′	58.5′
23	164°32.7	19.5	265°17.4	7.4′	23°33.7	9.8′	58.5′
	SD = 15.8′	d = -0.9′	SD = 16.1′				

Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°32.9	N10°18.7	279°43.8	7.4′	N23°43.5	9.7′	58.4′
1	194°33.0	17.8	294°10.2	7.3′	23°53.2	9.6′	58.4′
2	209°33.2	16.9	308°36.5	7.2′	24°02.8	9.4′	58.4′
3	224°33.4	·· 16.1	323°02.7	7.2′	24°12.2	9.2′	58.3′
4	239°33.6	15.2	337°28.9	7.2′	24°21.4	9.1′	58.3′
5	254°33.8	14.3	351°55.1	7.1′	24°30.5	9.0′	58.3′
6	269°33.9	N10°13.4	6°21.2	7.1′	N24°39.5	8.7′	58.2′
7	284°34.1	12.6	20°47.2	7.0′	24°48.2	8.7′	58.2′
8	299°34.3	11.7	35°13.3	7.0′	24°56.9	8.4′	58.2′
9	314°34.5	·· 10.8	49°39.2	6.9′	25°05.3	8.4′	58.2′
10	329°34.7	09.9	64°05.1	6.9′	25°13.7	8.1′	58.1′
11	344°34.8	09.1	78°31.0	6.8′	25°21.8	8.0′	58.1′
12	359°35.0	N10°08.2	92°56.9	6.8′	N25°29.8	7.8′	58.1′
13	14°35.2	07.3	107°22.6	6.8′	25°37.6	7.7′	58.0′
14	29°35.4	06.4	121°48.4	6.7′	25°45.3	7.5′	58.0′
15	44°35.6	·· 05.6	136°14.1	6.7′	25°52.8	7.4′	58.0′
16	59°35.7	04.7	150°39.8	6.6′	26°00.2	7.2′	57.9′
17	74°35.9	03.8	165°05.4	6.6′	26°07.4	7.0′	57.9′
18	89°36.1	N10°02.9	179°31.0	6.6′	N26°14.4	6.9′	57.9′
19	104°36.3	02.1	193°56.6	6.5′	26°21.3	6.6′	57.8′
20	119°36.5	01.2	208°22.1	6.5′	26°27.9	6.6′	57.8′
21	134°36.6	10°00.3	222°47.6	6.5′	26°34.5	6.3′	57.8′
22	149°36.8	09°59.4	237°13.1	6.4′	26°40.8	6.2′	57.8′
23	164°37.0	58.6	251°38.5	6.4′	26°47.0	6.1′	57.7′
	SD = 15.8′	d = -0.9′	SD = 15.9′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°37.2	N09°57.7	266°03.9	6.4′	N26°53.1	5.8′	57.7′
1	194°37.4	56.8	280°29.3	6.4′	26°58.9	5.7′	57.7′
2	209°37.5	55.9	294°54.7	6.3′	27°04.6	5.6′	57.6′
3	224°37.7	·· 55.1	309°20.0	6.3′	27°10.2	5.3′	57.6′
4	239°37.9	54.2	323°45.3	6.3′	27°15.5	5.2′	57.6′
5	254°38.1	53.3	338°10.6	6.3′	27°20.7	5.0′	57.5′
6	269°38.3	N09°52.4	352°35.9	6.3′	N27°25.7	4.9′	57.5′
7	284°38.5	51.5	7°01.1	6.2′	27°30.6	4.7′	57.5′
8	299°38.6	50.7	21°26.3	6.2′	27°35.3	4.5′	57.5′
9	314°38.8	·· 49.8	35°51.6	6.2′	27°39.8	4.3′	57.4′
10	329°39.0	48.9	50°16.8	6.2′	27°44.1	4.2′	57.4′
11	344°39.2	48.0	64°42.0	6.2′	27°48.3	4.0′	57.4′
12	359°39.4	N09°47.1	79°07.2	6.2′	N27°52.3	3.8′	57.3′
13	14°39.6	46.3	93°32.3	6.2′	27°56.1	3.7′	57.3′
14	29°39.7	45.4	107°57.5	6.2′	27°59.8	3.4′	57.3′
15	44°39.9	·· 44.5	122°22.7	6.2′	28°03.2	3.4′	57.2′
16	59°40.1	43.6	136°47.8	6.2′	28°06.6	3.1′	57.2′
17	74°40.3	42.7	151°13.0	6.2′	28°09.7	3.0′	57.2′
18	89°40.5	N09°41.8	165°38.2	6.2′	N28°12.7	2.8′	57.2′
19	104°40.7	41.0	180°03.3	6.2′	28°15.5	2.6′	57.1′
20	119°40.8	40.1	194°28.5	6.2′	28°18.1	2.5′	57.1′
21	134°41.0	·· 39.2	208°53.7	6.2′	28°20.6	2.2′	57.1′
22	149°41.2	38.3	223°18.9	6.2′	28°22.8	2.2′	57.0′
23	164°41.4	37.4	237°44.0	6.2′	28°25.0	1.9′	57.0′
	SD = 15.8′	d = -0.9′	SD = 15.7′				

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

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

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 21-23 65-43%
25	02:05	01:57	12:02	04:38	17:06	
26	01:49	01:40	12:02	05:34	18:02	
27	01:31	01:23	12:01	06:31	19:00	

August 28, 29, 30 UT (Wed., Thu., Fri.)

	Aries	Venus		Mars		Jupiter		Saturn	
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	336°42.5	158°00.2	N01°48.6	251°56.3	N23°11.1	259°05.9	N22°14.9	347°55.7	S07°11.2
1	351°44.9	172°59.8	47.3	266°57.0	11.2	274°08.0	14.9	2°58.4	11.2
2	6°47.4	187°59.5	46.0	281°57.8	11.3	289°10.2	15.0	18°01.0	11.3
3	21°49.8	202°59.2	·· 44.7	296°58.6	·· 11.4	304°12.3	·· 15.0	33°03.6	·· 11.4
4	36°52.3	217°58.9	43.4	311°59.4	11.5	319°14.4	15.0	48°06.3	11.5
5	51°54.8	232°58.6	42.2	327°00.1	11.6	334°16.5	15.0	63°08.9	11.5
6	66°57.2	247°58.2	N01°40.9	342°00.9	N23°11.7	349°18.7	N22°15.1	78°11.5	S07°11.6
7	81°59.7	262°57.9	39.6	357°01.7	11.8	4°20.8	15.1	93°14.2	11.7
8	97°02.2	277°57.6	38.3	12°02.4	11.9	19°22.9	15.1	108°16.8	11.8
9	112°04.6	292°57.3	·· 37.0	27°03.2	·· 12.0	34°25.1	·· 15.2	123°19.4	·· 11.8
10	127°07.1	307°57.0	35.7	42°04.0	12.1	49°27.2	15.2	138°22.1	11.9
11	142°09.6	322°56.7	34.5	57°04.8	12.2	64°29.3	15.2	153°24.7	12.0
12	157°12.0	337°56.3	N01°33.2	72°05.5	N23°12.3	79°31.5	N22°15.2	168°27.3	S07°12.1
13	172°14.5	352°56.0	31.9	87°06.3	12.4	94°33.6	15.3	183°30.0	12.1
14	187°17.0	7°55.7	30.6	102°07.1	12.5	109°35.7	15.3	198°32.6	12.2
15	202°19.4	22°55.4	·· 29.3	117°07.9	·· 12.6	124°37.9	·· 15.3	213°35.2	·· 12.3
16	217°21.9	37°55.1	28.0	132°08.6	12.7	139°40.0	15.3	228°37.9	12.4
17	232°24.3	52°54.7	26.8	147°09.4	12.8	154°42.1	15.4	243°40.5	12.5
18	247°26.8	67°54.4	N01°25.5	162°10.2	N23°12.9	169°44.2	N22°15.4	258°43.2	S07°12.5
19	262°29.3	82°54.1	24.2	177°11.0	13.0	184°46.4	15.4	273°45.8	12.6
20	277°31.7	97°53.8	22.9	192°11.7	13.1	199°48.5	15.4	288°48.4	12.7
21	292°34.2	112°53.5	·· 21.6	207°12.5	·· 13.2	214°50.6	·· 15.5	303°51.1	·· 12.8
22	307°36.7	127°53.2	20.3	222°13.3	13.3	229°52.8	15.5	318°53.7	12.8
23	322°39.1	142°52.8	19.1	237°14.1	13.4	244°54.9	15.5	333°56.3	12.9
Mer.pass. 01:33		ν -0.3′	d -1.3′	m -3.86	ν 0.8′	d 0.1′	m 0.73	ν 2.1′	d 0.0′ m -2.24	ν 2.6′	d -0.1′ m 0.62

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	337°41.6	157°52.5	N01°17.8	252°14.8	N23°13.5	259°57.0	N22°15.5	348°59.0	S07°13.0
1	352°44.1	172°52.2	16.5	267°15.6	13.6	274°59.2	15.6	4°01.6	13.1
2	7°46.5	187°51.9	15.2	282°16.4	13.7	290°01.3	15.6	19°04.2	13.1
3	22°49.0	202°51.6	·· 13.9	297°17.2	·· 13.7	305°03.5	·· 15.6	34°06.9	·· 13.2
4	37°51.5	217°51.3	12.6	312°17.9	13.8	320°05.6	15.6	49°09.5	13.3
5	52°53.9	232°50.9	11.4	327°18.7	13.9	335°07.7	15.7	64°12.1	13.4
6	67°56.4	247°50.6	N01°10.1	342°19.5	N23°14.0	350°09.9	N22°15.7	79°14.8	S07°13.4
7	82°58.8	262°50.3	08.8	357°20.3	14.1	5°12.0	15.7	94°17.4	13.5
8	98°01.3	277°50.0	07.5	12°21.0	14.2	20°14.1	15.7	109°20.0	13.6
9	113°03.8	292°49.7	·· 06.2	27°21.8	·· 14.3	35°16.3	·· 15.8	124°22.7	·· 13.7
10	128°06.2	307°49.4	04.9	42°22.6	14.4	50°18.4	15.8	139°25.3	13.8
11	143°08.7	322°49.0	03.7	57°23.4	14.5	65°20.5	15.8	154°28.0	13.8
12	158°11.2	337°48.7	N01°02.4	72°24.2	N23°14.6	80°22.7	N22°15.8	169°30.6	S07°13.9
13	173°13.6	352°48.4	01°01.1	87°24.9	14.7	95°24.8	15.8	184°33.2	14.0
14	188°16.1	7°48.1	00°59.8	102°25.7	14.7	110°27.0	15.9	199°35.9	14.1
15	203°18.6	22°47.8	·· 58.5	117°26.5	·· 14.8	125°29.1	·· 15.9	214°38.5	·· 14.1
16	218°21.0	37°47.5	57.2	132°27.3	14.9	140°31.2	15.9	229°41.1	14.2
17	233°23.5	52°47.1	55.9	147°28.1	15.0	155°33.4	15.9	244°43.8	14.3
18	248°26.0	67°46.8	N00°54.7	162°28.8	N23°15.1	170°35.5	N22°16.0	259°46.4	S07°14.4
19	263°28.4	82°46.5	53.4	177°29.6	15.2	185°37.6	16.0	274°49.0	14.4
20	278°30.9	97°46.2	52.1	192°30.4	15.3	200°39.8	16.0	289°51.7	14.5
21	293°33.3	112°45.9	·· 50.8	207°31.2	·· 15.4	215°41.9	·· 16.0	304°54.3	·· 14.6
22	308°35.8	127°45.6	49.5	222°32.0	15.4	230°44.1	16.1	319°56.9	14.7
23	323°38.3	142°45.3	48.2	237°32.7	15.5	245°46.2	16.1	334°59.6	14.8
Mer.pass. 01:29		ν -0.3′	d -1.3′	m -3.86	ν 0.8′	d 0.1′	m 0.72	ν 2.1′	d 0.0′ m -2.25	ν 2.6′	d -0.1′ m 0.62

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	338°40.7	157°44.9	N00°46.9	252°33.5	N23°15.6	260°48.3	N22°16.1	350°02.2	S07°14.8
1	353°43.2	172°44.6	45.7	267°34.3	15.7	275°50.5	16.1	5°04.9	14.9
2	8°45.7	187°44.3	44.4	282°35.1	15.8	290°52.6	16.2	20°07.5	15.0
3	23°48.1	202°44.0	·· 43.1	297°35.9	·· 15.9	305°54.8	·· 16.2	35°10.1	·· 15.1
4	38°50.6	217°43.7	41.8	312°36.7	16.0	320°56.9	16.2	50°12.8	15.1
5	53°53.1	232°43.4	40.5	327°37.4	16.0	335°59.1	16.2	65°15.4	15.2
6	68°55.5	247°43.0	N00°39.2	342°38.2	N23°16.1	351°01.2	N22°16.3	80°18.0	S07°15.3
7	83°58.0	262°42.7	37.9	357°39.0	16.2	6°03.3	16.3	95°20.7	15.4
8	99°00.4	277°42.4	36.7	12°39.8	16.3	21°05.5	16.3	110°23.3	15.4
9	114°02.9	292°42.1	·· 35.4	27°40.6	·· 16.4	36°07.6	·· 16.3	125°25.9	·· 15.5
10	129°05.4	307°41.8	34.1	42°41.4	16.5	51°09.8	16.4	140°28.6	15.6
11	144°07.8	322°41.5	32.8	57°42.1	16.6	66°11.9	16.4	155°31.2	15.7
12	159°10.3	337°41.2	N00°31.5	72°42.9	N23°16.6	81°14.1	N22°16.4	170°33.9	S07°15.7
13	174°12.8	352°40.8	30.2	87°43.7	16.7	96°16.2	16.4	185°36.5	15.8
14	189°15.2	7°40.5	28.9	102°44.5	16.8	111°18.3	16.4	200°39.1	15.9
15	204°17.7	22°40.2	·· 27.7	117°45.3	·· 16.9	126°20.5	·· 16.5	215°41.8	·· 16.0
16	219°20.2	37°39.9	26.4	132°46.1	17.0	141°22.6	16.5	230°44.4	16.1
17	234°22.6	52°39.6	25.1	147°46.8	17.0	156°24.8	16.5	245°47.0	16.1
18	249°25.1	67°39.3	N00°23.8	162°47.6	N23°17.1	171°26.9	N22°16.5	260°49.7	S07°16.2
19	264°27.6	82°39.0	22.5	177°48.4	17.2	186°29.1	16.6	275°52.3	16.3
20	279°30.0	97°38.6	21.2	192°49.2	17.3	201°31.2	16.6	290°55.0	16.4
21	294°32.5	112°38.3	·· 19.9	207°50.0	·· 17.4	216°33.4	·· 16.6	305°57.6	·· 16.4
22	309°34.9	127°38.0	18.6	222°50.8	17.5	231°35.5	16.6	321°00.2	16.5
23	324°37.4	142°37.7	17.4	237°51.6	17.5	246°37.7	16.7	336°02.9	16.6
Mer.pass. 01:25		ν -0.3′	d -1.3′	m -3.86	ν 0.8′	d 0.1′	m 0.71	ν 2.1′	d 0.0′ m -2.25	ν 2.6′	d -0.1′ m 0.61

Stars

	SHA	Dec
Alpheratz	357°34.8	29°13.6
Ankaa	353°07.0	-42°10.1
Schedar	349°30.9	56°40.3
Diphda	348°47.3	-17°50.9
Achernar	335°20.0	-57°06.4
Hamal	327°51.4	23°34.8
Polaris	314°02.2	89°21.8
Acamar	315°11.8	-40°12.0
Menkar	314°06.4	4°11.3
Mirfak	308°28.6	49°56.8
Aldebaran	290°40.0	16°33.6
Rigel	281°04.2	-8°10.2
Capella	280°22.4	46°01.2
Bellatrix	278°23.3	6°22.4
Elnath	278°02.3	28°37.7
Alnilam	275°38.1	-1°11.0
Betelgeuse	270°52.5	7°24.8
Canopus	263°52.8	-52°42.2
Sirius	258°26.7	-16°44.8
Adhara	255°06.3	-29°00.0
Procyon	244°51.4	5°09.8
Pollux	243°17.9	27°58.0
Avior	234°15.4	-59°35.0
Suhail	222°47.0	-43°31.7
Miaplacidus	221°39.3	-69°48.9
Alphard	217°48.4	-8°45.8
Regulus	207°35.1	11°50.9
Dubhe	193°42.0	61°37.2
Denebola	182°25.5	14°26.2
Gienah	175°44.2	-17°40.7
Acrux	173°01.1	-63°14.2
Gacrux	171°52.5	-57°15.1
Alioth	166°13.6	55°49.8
Spica	158°22.8	-11°17.3
Alkaid	152°52.5	49°11.7
Hadar	148°36.8	-60°29.7
Menkent	147°58.2	-36°29.5
Arcturus	145°48.3	19°03.4
Rigil Kent.	139°41.0	-60°56.4
Kochab	137°20.2	74°03.5
Zuben'ubi	136°56.5	-16°08.6
Alphecca	126°04.1	26°38.1
Antares	112°16.2	-26°29.2
Atria	107°10.6	-69°04.5
Sabik	102°03.0	-15°45.3
Shaula	96°10.6	-37°07.4
Rasalhague	95°58.7	12°32.7
Eltanin	90°42.1	51°29.4
Kaus Aust.	83°32.7	-34°22.4
Vega	80°33.2	38°48.6
Nunki	75°47.9	-26°16.0
Altair	62°00.0	8°56.1
Peacock	53°05.7	-56°39.4
Deneb	49°25.6	45°22.2
Enif	33°38.8	9°59.4
Al Na'ir	27°32.8	-46°50.4
Fomalhaut	15°14.5	-29°29.4
Scheat	13°45.2	28°13.1
Markab	13°29.9	15°20.4

Aug 28 Wed	SHA	Mer.pass
Venus	181°17.7	13:28
Mars	275°13.8	07:12
Jupiter	282°23.4	06:43
Saturn	11°13.3	00:48

Aug 29 Thu	SHA	Mer.pass
Venus	180°10.9	13:29
Mars	274°33.2	07:11
Jupiter	282°15.5	06:39
Saturn	11°17.4	00:44

Aug 30 Fri	SHA	Mer.pass
Venus	179°04.2	13:29
Mars	273°52.8	07:09
Jupiter	282°07.6	06:36
Saturn	11°21.5	00:40

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Wed	**GHA**	**Dec**	**GHA**	*ν*	**Dec**	*d*	**HP**
0	179°41.6	N09°36.5	252°09.3	6.2′	N28°26.9	1.8′	57.0′
1	194°41.8	35.7	266°34.5	6.2′	28°28.7	1.6′	57.0′
2	209°42.0	34.8	280°59.7	6.2′	28°30.3	1.4′	56.9′
3	224°42.1	·· 33.9	295°25.0	6.3′	28°31.7	1.3′	56.9′
4	239°42.3	33.0	309°50.2	6.3′	28°33.0	1.1′	56.9′
5	254°42.5	32.1	324°15.5	6.3′	28°34.1	0.9′	56.9′
6	269°42.7	N09°31.2	338°40.8	6.3′	N28°35.0	0.7′	56.8′
7	284°42.9	30.3	353°06.1	6.4′	28°35.7	0.6′	56.8′
8	299°43.1	29.5	7°31.5	6.4′	28°36.3	0.4′	56.8′
9	314°43.3	·· 28.6	21°56.9	6.4′	28°36.7	0.3′	56.7′
10	329°43.4	27.7	36°22.3	6.4′	28°37.0	0.1′	56.7′
11	344°43.6	26.8	50°47.8	6.5′	28°37.1	0.1′	56.7′
12	359°43.8	N09°25.9	65°13.2	6.5′	N28°37.0	0.3′	56.7′
13	14°44.0	25.0	79°38.8	6.6′	28°36.7	0.4′	56.6′
14	29°44.2	24.1	94°04.3	6.6′	28°36.3	0.6′	56.6′
15	44°44.4	·· 23.2	108°29.9	6.6′	28°35.7	0.8′	56.6′
16	59°44.6	22.4	122°55.5	6.7′	28°34.9	0.9′	56.6′
17	74°44.7	21.5	137°21.2	6.7′	28°34.0	1.1′	56.5′
18	89°44.9	N09°20.6	151°46.9	6.8′	N28°32.9	1.2′	56.5′
19	104°45.1	19.7	166°12.7	6.8′	28°31.7	1.4′	56.5′
20	119°45.3	18.8	180°38.5	6.9′	28°30.3	1.6′	56.5′
21	134°45.5	·· 17.9	195°04.3	6.9′	28°28.7	1.7′	56.4′
22	149°45.7	17.0	209°30.2	7.0′	28°27.0	1.9′	56.4′
23	164°45.9	16.1	223°56.2	7.0′	28°25.1	2.1′	56.4′
	SD = 15.8′	*d* = -0.9′	SD = 15.5′				

Thu	**GHA**	**Dec**	**GHA**	*ν*	**Dec**	*d*	**HP**
0	179°46.1	N09°15.2	238°22.2	7.1′	N28°23.0	2.2′	56.4′
1	194°46.3	14.4	252°48.3	7.1′	28°20.8	2.4′	56.3′
2	209°46.4	13.5	267°14.4	7.2′	28°18.4	2.5′	56.3′
3	224°46.6	·· 12.6	281°40.5	7.2′	28°15.9	2.7′	56.3′
4	239°46.8	11.7	296°06.8	7.3′	28°13.2	2.9′	56.3′
5	254°47.0	10.8	310°33.1	7.4′	28°10.3	3.0′	56.2′
6	269°47.2	N09°09.9	324°59.4	7.4′	N28°07.3	3.1′	56.2′
7	284°47.4	09.0	339°25.9	7.5′	28°04.2	3.3′	56.2′
8	299°47.6	08.1	353°52.3	7.6′	28°00.9	3.5′	56.2′
9	314°47.8	·· 07.2	8°18.9	7.6′	27°57.4	3.6′	56.1′
10	329°48.0	06.3	22°45.5	7.7′	27°53.8	3.8′	56.1′
11	344°48.1	05.4	37°12.2	7.8′	27°50.0	3.9′	56.1′
12	359°48.3	N09°04.5	51°39.0	7.8′	N27°46.1	4.1′	56.1′
13	14°48.5	03.6	66°05.8	7.9′	27°42.0	4.2′	56.0′
14	29°48.7	02.8	80°32.7	8.0′	27°37.8	4.4′	56.0′
15	44°48.9	·· 01.9	94°59.7	8.0′	27°33.4	4.5′	56.0′
16	59°49.1	01.0	109°26.7	8.1′	27°28.9	4.7′	56.0′
17	74°49.3	09°00.1	123°53.8	8.2′	27°24.2	4.8′	55.9′
18	89°49.5	N08°59.2	138°21.0	8.3′	N27°19.4	4.9′	55.9′
19	104°49.7	58.3	152°48.3	8.4′	27°14.5	5.1′	55.9′
20	119°49.9	57.4	167°15.7	8.4′	27°09.4	5.3′	55.9′
21	134°50.1	·· 56.5	181°43.1	8.5′	27°04.1	5.3′	55.8′
22	149°50.2	55.6	196°10.6	8.6′	26°58.8	5.5′	55.8′
23	164°50.4	54.7	210°38.2	8.7′	26°53.3	5.7′	55.8′
	SD = 15.8′	*d* = -0.9′	SD = 15.4′				

Fri	**GHA**	**Dec**	**GHA**	*ν*	**Dec**	*d*	**HP**
0	179°50.6	N08°53.8	225°05.9	8.8′	N26°47.6	5.8′	55.8′
1	194°50.8	52.9	239°33.7	8.8′	26°41.8	5.9′	55.8′
2	209°51.0	52.0	254°01.5	8.9′	26°35.9	6.1′	55.7′
3	224°51.2	·· 51.1	268°29.5	9.0′	26°29.8	6.2′	55.7′
4	239°51.4	50.2	282°57.5	9.1′	26°23.6	6.3′	55.7′
5	254°51.6	49.3	297°25.6	9.2′	26°17.3	6.5′	55.7′
6	269°51.8	N08°48.4	311°53.8	9.3′	N26°10.8	6.5′	55.6′
7	284°52.0	47.5	326°22.1	9.4′	26°04.3	6.8′	55.6′
8	299°52.2	46.6	340°50.4	9.5′	25°57.5	6.8′	55.6′
9	314°52.4	·· 45.7	355°18.9	9.5′	25°50.7	7.0′	55.6′
10	329°52.6	44.8	9°47.4	9.6′	25°43.7	7.1′	55.6′
11	344°52.8	43.9	24°16.1	9.7′	25°36.6	7.2′	55.5′
12	359°52.9	N08°43.0	38°44.8	9.8′	N25°29.4	7.4′	55.5′
13	14°53.1	42.1	53°13.6	9.9′	25°22.0	7.4′	55.5′
14	29°53.3	41.2	67°42.5	10.0′	25°14.6	7.6′	55.5′
15	44°53.5	·· 40.3	82°11.5	10.1′	25°07.0	7.7′	55.5′
16	59°53.7	39.4	96°40.6	10.2′	24°59.3	7.9′	55.4′
17	74°53.9	38.5	111°09.8	10.3′	24°51.4	7.9′	55.4′
18	89°54.1	N08°37.6	125°39.1	10.4′	N24°43.5	8.1′	55.4′
19	104°54.3	36.7	140°08.4	10.5′	24°35.4	8.2′	55.4′
20	119°54.5	35.8	154°37.9	10.5′	24°27.2	8.3′	55.4′
21	134°54.7	·· 34.9	169°07.4	10.6′	24°18.9	8.4′	55.3′
22	149°54.9	34.0	183°37.1	10.7′	24°10.5	8.5′	55.3′
23	164°55.1	33.1	198°06.8	10.8′	24°02.0	8.6′	55.3′
	SD = 15.8′	*d* = -0.9′	SD = 15.2′				

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

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

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 33-15%
28	01:14	01:05	12:01	07:29	19:57	
29	00:56	00:47	12:01	08:25	20:53	
30	00:37	00:28	12:00	09:19	21:45	

August 31, 01, 02 UT (Sat., Sun., Mon.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	339°39.9	157°37.4	N00°16.1	252°52.3	N23°17.6	261°39.8	N22°16.7	351°05.5	S07°16.7
1	354°42.3	172°37.1	14.8	267°53.1	17.7	276°41.9	16.7	6°08.1	16.7
2	9°44.8	187°36.8	13.5	282°53.9	17.8	291°44.1	16.7	21°10.8	16.8
3	24°47.3	202°36.4	·· 12.2	297°54.7	·· 17.8	306°46.2	·· 16.8	36°13.4	·· 16.9
4	39°49.7	217°36.1	10.9	312°55.5	17.9	321°48.4	16.8	51°16.1	17.0
5	54°52.2	232°35.8	09.6	327°56.3	18.0	336°50.5	16.8	66°18.7	17.1
6	69°54.7	247°35.5	N00°08.3	342°57.1	N23°18.1	351°52.7	N22°16.8	81°21.3	S07°17.1
7	84°57.1	262°35.2	07.1	357°57.9	18.2	6°54.8	16.8	96°24.0	17.2
8	99°59.6	277°34.9	05.8	12°58.7	18.2	21°57.0	16.9	111°26.6	17.3
9	115°02.1	292°34.6	·· 04.5	27°59.4	·· 18.3	36°59.1	·· 16.9	126°29.2	·· 17.4
10	130°04.5	307°34.2	03.2	43°00.2	18.4	52°01.3	16.9	141°31.9	17.4
11	145°07.0	322°33.9	01.9	58°01.0	18.5	67°03.4	16.9	156°34.5	17.5
12	160°09.4	337°33.6	N00°00.6	73°01.8	N23°18.5	82°05.6	N22°17.0	171°37.2	S07°17.6
13	175°11.9	352°33.3	S00°00.7	88°02.6	18.6	97°07.7	17.0	186°39.8	17.7
14	190°14.4	7°33.0	02.0	103°03.4	18.7	112°09.9	17.0	201°42.4	17.8
15	205°16.8	22°32.7	·· 03.2	118°04.2	·· 18.8	127°12.0	·· 17.0	216°45.1	·· 17.8
16	220°19.3	37°32.4	04.5	133°05.0	18.8	142°14.2	17.1	231°47.7	17.9
17	235°21.8	52°32.1	05.8	148°05.8	18.9	157°16.3	17.1	246°50.3	18.0
18	250°24.2	67°31.7	S00°07.1	163°06.6	N23°19.0	172°18.5	N22°17.1	261°53.0	S07°18.1
19	265°26.7	82°31.4	08.4	178°07.3	19.1	187°20.6	17.1	276°55.6	18.1
20	280°29.2	97°31.1	09.7	193°08.1	19.1	202°22.8	17.1	291°58.3	18.2
21	295°31.6	112°30.8	·· 11.0	208°08.9	·· 19.2	217°25.0	·· 17.2	307°00.9	·· 18.3
22	310°34.1	127°30.5	12.3	223°09.7	19.3	232°27.1	17.2	322°03.5	18.4
23	325°36.6	142°30.2	13.6	238°10.5	19.4	247°29.3	17.2	337°06.2	18.4
Mer.pass. 01:21		ν -0.3′	d -1.3′	m -3.86	ν 0.8′	d 0.1′	m 0.71	ν 2.1′	d 0.0′ m -2.26	ν 2.6′	d -0.1′ m 0.61

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	340°39.0	157°29.9	S00°14.8	253°11.3	N23°19.4	262°31.4	N22°17.2	352°08.8	S07°18.5
1	355°41.5	172°29.5	16.1	268°12.1	19.5	277°33.6	17.3	7°11.4	18.6
2	10°43.9	187°29.2	17.4	283°12.9	19.6	292°35.7	17.3	22°14.1	18.7
3	25°46.4	202°28.9	·· 18.7	298°13.7	·· 19.6	307°37.9	·· 17.3	37°16.7	·· 18.8
4	40°48.9	217°28.6	20.0	313°14.5	19.7	322°40.0	17.3	52°19.4	18.8
5	55°51.3	232°28.3	21.3	328°15.3	19.8	337°42.2	17.3	67°22.0	18.9
6	70°53.8	247°28.0	S00°22.6	343°16.1	N23°19.9	352°44.3	N22°17.4	82°24.6	S07°19.0
7	85°56.3	262°27.7	23.9	358°16.9	19.9	7°46.5	17.4	97°27.3	19.1
8	100°58.7	277°27.4	25.1	13°17.7	20.0	22°48.7	17.4	112°29.9	19.1
9	116°01.2	292°27.0	·· 26.4	28°18.5	·· 20.1	37°50.8	·· 17.4	127°32.5	·· 19.2
10	131°03.7	307°26.7	27.7	43°19.3	20.1	52°53.0	17.5	142°35.2	19.3
11	146°06.1	322°26.4	29.0	58°20.0	20.2	67°55.1	17.5	157°37.8	19.4
12	161°08.6	337°26.1	S00°30.3	73°20.8	N23°20.3	82°57.3	N22°17.5	172°40.5	S07°19.4
13	176°11.0	352°25.8	31.6	88°21.6	20.3	97°59.4	17.5	187°43.1	19.5
14	191°13.5	7°25.5	32.9	103°22.4	20.4	113°01.6	17.5	202°45.7	19.6
15	206°16.0	22°25.2	·· 34.2	118°23.2	·· 20.5	128°03.8	·· 17.6	217°48.4	·· 19.7
16	221°18.4	37°24.9	35.5	133°24.0	20.6	143°05.9	17.6	232°51.0	19.8
17	236°20.9	52°24.5	36.7	148°24.8	20.6	158°08.1	17.6	247°53.7	19.8
18	251°23.4	67°24.2	S00°38.0	163°25.6	N23°20.7	173°10.2	N22°17.6	262°56.3	S07°19.9
19	266°25.8	82°23.9	39.3	178°26.4	20.8	188°12.4	17.7	277°58.9	20.0
20	281°28.3	97°23.6	40.6	193°27.2	20.8	203°14.5	17.7	293°01.6	20.1
21	296°30.8	112°23.3	·· 41.9	208°28.0	·· 20.9	218°16.7	·· 17.7	308°04.2	·· 20.1
22	311°33.2	127°23.0	43.2	223°28.8	21.0	233°18.9	17.7	323°06.8	20.2
23	326°35.7	142°22.7	44.5	238°29.6	21.0	248°21.0	17.7	338°09.5	20.3
Mer.pass. 01:17		ν -0.3′	d -1.3′	m -3.86	ν 0.8′	d 0.1′	m 0.70	ν 2.2′	d 0.0′ m -2.26	ν 2.6′	d -0.1′ m 0.61

Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	341°38.2	157°22.3	S00°45.8	253°30.4	N23°21.1	263°23.2	N22°17.8	353°12.1	S07°20.4
1	356°40.6	172°22.0	47.1	268°31.2	21.2	278°25.4	17.8	8°14.8	20.4
2	11°43.1	187°21.7	48.3	283°32.0	21.2	293°27.5	17.8	23°17.4	20.5
3	26°45.5	202°21.4	·· 49.6	298°32.8	·· 21.3	308°29.7	·· 17.8	38°20.0	·· 20.6
4	41°48.0	217°21.1	50.9	313°33.6	21.3	323°31.8	17.9	53°22.7	20.7
5	56°50.5	232°20.8	52.2	328°34.4	21.4	338°34.0	17.9	68°25.3	20.8
6	71°52.9	247°20.5	S00°53.5	343°35.2	N23°21.5	353°36.2	N22°17.9	83°28.0	S07°20.8
7	86°55.4	262°20.2	54.8	358°36.0	21.5	8°38.3	17.9	98°30.6	20.9
8	101°57.9	277°19.8	56.1	13°36.8	21.6	23°40.5	17.9	113°33.2	21.0
9	117°00.3	292°19.5	·· 57.4	28°37.6	·· 21.7	38°42.6	·· 18.0	128°35.9	·· 21.1
10	132°02.8	307°19.2	58.7	43°38.4	21.7	53°44.8	18.0	143°38.5	21.1
11	147°05.3	322°18.9	00°59.9	58°39.2	21.8	68°47.0	18.0	158°41.2	21.2
12	162°07.7	337°18.6	S01°01.2	73°40.0	N23°21.9	83°49.1	N22°18.0	173°43.8	S07°21.3
13	177°10.2	352°18.3	02.5	88°40.8	21.9	98°51.3	18.0	188°46.4	21.4
14	192°12.6	7°18.0	03.8	103°41.6	22.0	113°53.5	18.1	203°49.1	21.5
15	207°15.1	22°17.7	·· 05.1	118°42.4	·· 22.0	128°55.6	·· 18.1	218°51.7	·· 21.5
16	222°17.6	37°17.3	06.4	133°43.2	22.1	143°57.8	18.1	233°54.4	21.6
17	237°20.0	52°17.0	07.7	148°44.0	22.2	159°00.0	18.1	248°57.0	21.7
18	252°22.5	67°16.7	S01°09.0	163°44.8	N23°22.2	174°02.1	N22°18.1	263°59.6	S07°21.8
19	267°25.0	82°16.4	10.3	178°45.6	22.3	189°04.3	18.2	279°02.3	21.8
20	282°27.4	97°16.1	11.5	193°46.4	22.3	204°06.5	18.2	294°04.9	21.9
21	297°29.9	112°15.8	·· 12.8	208°47.2	·· 22.4	219°08.6	·· 18.2	309°07.5	·· 22.0
22	312°32.4	127°15.5	14.1	223°48.0	22.5	234°10.8	18.2	324°10.2	22.1
23	327°34.8	142°15.2	15.4	238°48.9	22.5	249°13.0	18.3	339°12.8	22.1
Mer.pass. 01:13		ν -0.3′	d -1.3′	m -3.86	ν 0.8′	d 0.1′	m 0.69	ν 2.2′	d 0.0′ m -2.27	ν 2.6′	d -0.1′ m 0.60

Stars

	SHA	Dec
Alpheratz	357°34.8	29°13.6
Ankaa	353°07.0	-42°10.1
Schedar	349°30.9	56°40.3
Diphda	348°47.3	-17°50.9
Achernar	335°20.0	-57°06.4
Hamal	327°51.3	23°34.8
Polaris	314°00.7	89°21.8
Acamar	315°11.8	-40°12.0
Menkar	314°06.3	4°11.3
Mirfak	308°28.5	49°56.8
Aldebaran	290°40.0	16°33.6
Rigel	281°04.2	-8°10.2
Capella	280°22.4	46°01.2
Bellatrix	278°23.3	6°22.4
Elnath	278°02.3	28°37.7
Alnilam	275°38.1	-1°11.0
Betelgeuse	270°52.5	7°24.8
Canopus	263°52.8	-52°42.1
Sirius	258°26.7	-16°44.7
Adhara	255°06.3	-29°00.0
Procyon	244°51.4	5°09.8
Pollux	243°17.9	27°58.0
Avior	234°15.4	-59°35.0
Suhail	222°47.0	-43°31.7
Miaplacidus	221°39.3	-69°48.9
Alphard	217°48.4	-8°45.8
Regulus	207°35.1	11°50.9
Dubhe	193°42.0	61°37.2
Denebola	182°25.5	14°26.2
Gienah	175°44.2	-17°40.6
Acrux	173°01.1	-63°14.2
Gacrux	171°52.5	-57°15.1
Alioth	166°13.6	55°49.8
Spica	158°22.8	-11°17.3
Alkaid	152°52.5	49°11.6
Hadar	148°36.8	-60°29.7
Menkent	147°58.2	-36°29.5
Arcturus	145°48.4	19°03.4
Rigil Kent.	139°41.1	-60°56.4
Kochab	137°20.2	74°03.5
Zuben'ubi	136°56.5	-16°08.6
Alphecca	126°04.1	26°38.1
Antares	112°16.2	-26°29.2
Atria	107°10.6	-69°04.5
Sabik	102°03.1	-15°45.3
Shaula	96°10.6	-37°07.4
Rasalhague	95°58.7	12°32.7
Eltanin	90°42.1	51°29.4
Kaus Aust.	83°32.7	-34°22.4
Vega	80°33.2	38°48.6
Nunki	75°47.9	-26°16.0
Altair	62°00.0	8°56.1
Peacock	53°05.7	-56°39.4
Deneb	49°25.6	45°22.2
Enif	33°38.8	9°59.4
Al Na'ir	27°32.8	-46°50.4
Fomalhaut	15°14.5	-29°29.4
Scheat	13°45.1	28°13.1
Markab	13°29.9	15°20.4

Aug 31 Sat	SHA	Mer.pass
Venus	177°57.5	13:30
Mars	273°12.5	07:08
Jupiter	281°59.9	06:32
Saturn	11°25.6	00:36

Sep 01 Sun	SHA	Mer.pass
Venus	176°50.8	13:30
Mars	272°32.3	07:07
Jupiter	281°52.4	06:29
Saturn	11°29.8	00:31

Sep 02 Mon	SHA	Mer.pass
Venus	175°44.2	13:31
Mars	271°52.3	07:06
Jupiter	281°45.0	06:26
Saturn	11°34.0	00:27

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.1539 sec ΔT = TT-UT1 = +69.0301 sec

2024 August 31 to Sep. 02 UT

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	Sun		Moon				
Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°55.3	N08°32.2	212°36.6	10.9′	N23°53.4	8.8′	55.3′
1	194°55.5	31.3	227°06.5	11.0′	23°44.6	8.8′	55.3′
2	209°55.7	30.4	241°36.6	11.1′	23°35.8	9.0′	55.2′
3	224°55.9	·· 29.5	256°06.7	11.2′	23°26.8	9.0′	55.2′
4	239°56.1	28.6	270°36.9	11.3′	23°17.8	9.2′	55.2′
5	254°56.3	27.7	285°07.2	11.4′	23°08.6	9.3′	55.2′
6	269°56.5	N08°26.8	299°37.5	11.5′	N22°59.3	9.3′	55.2′
7	284°56.6	25.9	314°08.0	11.6′	22°50.0	9.5′	55.2′
8	299°56.8	25.0	328°38.6	11.7′	22°40.5	9.6′	55.1′
9	314°57.0	·· 24.1	343°09.3	11.8′	22°30.9	9.7′	55.1′
10	329°57.2	23.2	357°40.0	11.8′	22°21.2	9.7′	55.1′
11	344°57.4	22.3	12°10.9	11.9′	22°11.5	9.9′	55.1′
12	359°57.6	N08°21.4	26°41.8	12.0′	N22°01.6	9.9′	55.1′
13	14°57.8	20.5	41°12.8	12.1′	21°51.7	10.1′	55.0′
14	29°58.0	19.5	55°43.9	12.2′	21°41.6	10.1′	55.0′
15	44°58.2	·· 18.6	70°15.2	12.3′	21°31.5	10.3′	55.0′
16	59°58.4	17.7	84°46.5	12.4′	21°21.2	10.3′	55.0′
17	74°58.6	16.8	99°17.8	12.5′	21°10.9	10.4′	55.0′
18	89°58.8	N08°15.9	113°49.3	12.6′	N21°00.5	10.5′	55.0′
19	104°59.0	15.0	128°20.9	12.7′	20°50.0	10.6′	54.9′
20	119°59.2	14.1	142°52.5	12.7′	20°39.4	10.7′	54.9′
21	134°59.4	·· 13.2	157°24.3	12.8′	20°28.7	10.7′	54.9′
22	149°59.6	12.3	171°56.1	12.9′	20°18.0	10.9′	54.9′
23	164°59.8	11.4	186°28.1	13.0′	20°07.1	10.9′	54.9′
	SD = 15.8′	d = -0.9′	SD = 15.1′				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°00.0	N08°10.5	201°00.1	13.1′	N19°56.2	11.0′	54.9′
1	195°00.2	09.6	215°32.2	13.2′	19°45.2	11.1′	54.8′
2	210°00.4	08.7	230°04.3	13.3′	19°34.1	11.1′	54.8′
3	225°00.6	·· 07.8	244°36.6	13.3′	19°23.0	11.3′	54.8′
4	240°00.8	06.8	259°08.9	13.4′	19°11.7	11.3′	54.8′
5	255°01.0	05.9	273°41.4	13.5′	19°00.4	11.4′	54.8′
6	270°01.2	N08°05.0	288°13.9	13.6′	N18°49.0	11.5′	54.8′
7	285°01.4	04.1	302°46.5	13.7′	18°37.5	11.5′	54.8′
8	300°01.6	03.2	317°19.2	13.8′	18°26.0	11.6′	54.7′
9	315°01.8	·· 02.3	331°51.9	13.8′	18°14.4	11.7′	54.7′
10	330°02.0	01.4	346°24.8	13.9′	18°02.7	11.7′	54.7′
11	345°02.2	08°00.5	0°57.7	14.0′	17°51.0	11.8′	54.7′
12	0°02.4	N07°59.6	15°30.7	14.1′	N17°39.2	11.9′	54.7′
13	15°02.6	58.7	30°03.8	14.2′	17°27.3	12.0′	54.7′
14	30°02.8	57.7	44°37.0	14.2′	17°15.3	12.0′	54.7′
15	45°03.0	·· 56.8	59°10.2	14.3′	17°03.3	12.1′	54.6′
16	60°03.2	55.9	73°43.5	14.4′	16°51.2	12.1′	54.6′
17	75°03.4	55.0	88°16.9	14.5′	16°39.1	12.2′	54.6′
18	90°03.6	N07°54.1	102°50.4	14.5′	N16°26.9	12.3′	54.6′
19	105°03.8	53.2	117°23.9	14.6′	16°14.6	12.3′	54.6′
20	120°04.0	52.3	131°57.5	14.7′	16°02.3	12.4′	54.6′
21	135°04.2	·· 51.4	146°31.2	14.8′	15°49.9	12.4′	54.6′
22	150°04.4	50.4	161°05.0	14.8′	15°37.5	12.5′	54.5′
23	165°04.6	49.5	175°38.8	14.9′	15°25.0	12.6′	54.5′
	SD = 15.8′	d = -0.9′	SD = 15.0′				

Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°04.8	N07°48.6	190°12.7	15.0′	N15°12.4	12.6′	54.5′
1	195°05.0	47.7	204°46.7	15.0′	14°59.8	12.6′	54.5′
2	210°05.2	46.8	219°20.7	15.1′	14°47.2	12.8′	54.5′
3	225°05.4	·· 45.9	233°54.8	15.2′	14°34.4	12.7′	54.5′
4	240°05.6	45.0	248°29.0	15.2′	14°21.7	12.8′	54.5′
5	255°05.8	44.0	263°03.2	15.3′	14°08.9	12.9′	54.5′
6	270°06.0	N07°43.1	277°37.5	15.4′	N13°56.0	12.9′	54.4′
7	285°06.2	42.2	292°11.9	15.4′	13°43.1	13.0′	54.4′
8	300°06.4	41.3	306°46.3	15.5′	13°30.1	13.0′	54.4′
9	315°06.6	·· 40.4	321°20.8	15.6′	13°17.1	13.0′	54.4′
10	330°06.8	39.5	335°55.4	15.6′	13°04.1	13.1′	54.4′
11	345°07.0	38.6	350°30.0	15.7′	12°51.0	13.2′	54.4′
12	0°07.2	N07°37.6	5°04.7	15.7′	N12°37.8	13.2′	54.4′
13	15°07.4	36.7	19°39.4	15.8′	12°24.6	13.2′	54.4′
14	30°07.6	35.8	34°14.2	15.8′	12°11.4	13.3′	54.3′
15	45°07.8	·· 34.9	48°49.0	15.9′	11°58.1	13.3′	54.3′
16	60°08.0	34.0	63°23.9	16.0′	11°44.8	13.3′	54.3′
17	75°08.2	33.1	77°58.9	16.0′	11°31.5	13.4′	54.3′
18	90°08.4	N07°32.1	92°33.9	16.1′	N11°18.1	13.4′	54.3′
19	105°08.6	31.2	107°09.0	16.1′	11°04.7	13.5′	54.3′
20	120°08.8	30.3	121°44.1	16.2′	10°51.2	13.5′	54.3′
21	135°09.0	·· 29.4	136°19.3	16.2′	10°37.7	13.5′	54.3′
22	150°09.2	28.5	150°54.5	16.3′	10°24.2	13.6′	54.3′
23	165°09.5	27.5	165°29.8	16.3′	10°10.6	13.6′	54.3′
	SD = 15.8′	d = -0.9′	SD = 14.9′				

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

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

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 27-29 9-1%
31	00:19	00:09	12:00	10:10	22:33	
01	00:00	00:10	12:00	10:56	23:18	
02	00:19	00:29	12:00	11:39	–:–	

September 03, 04, 05 UT (Tue., Wed., Thu.)

	Aries	Venus		Mars		Jupiter		Saturn	
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	342°37.3	157°14.8	S01°16.7	253°49.7	N23°22.6	264°15.1	N22°18.3	354°15.5	S07°22.2
1	357°39.8	172°14.5	18.0	268°50.5	22.6	279°17.3	18.3	9°18.1	22.3
2	12°42.2	187°14.2	19.3	283°51.3	22.7	294°19.5	18.3	24°20.7	22.4
3	27°44.7	202°13.9	·· 20.6	298°52.1	·· 22.8	309°21.6	·· 18.3	39°23.4	·· 22.5
4	42°47.1	217°13.6	21.9	313°52.9	22.8	324°23.8	18.4	54°26.0	22.5
5	57°49.6	232°13.3	23.1	328°53.7	22.9	339°26.0	18.4	69°28.7	22.6
6	72°52.1	247°13.0	S01°24.4	343°54.5	N23°22.9	354°28.1	N22°18.4	84°31.3	S07°22.7
7	87°54.5	262°12.7	25.7	358°55.3	23.0	9°30.3	18.4	99°33.9	22.8
8	102°57.0	277°12.3	27.0	13°56.1	23.0	24°32.5	18.4	114°36.6	22.8
9	117°59.5	292°12.0	·· 28.3	28°56.9	·· 23.1	39°34.6	·· 18.5	129°39.2	·· 22.9
10	133°01.9	307°11.7	29.6	43°57.7	23.2	54°36.8	18.5	144°41.9	23.0
11	148°04.4	322°11.4	30.9	58°58.5	23.2	69°39.0	18.5	159°44.5	23.1
12	163°06.9	337°11.1	S01°32.2	73°59.3	N23°23.3	84°41.2	N22°18.5	174°47.1	S07°23.2
13	178°09.3	352°10.8	33.5	89°00.1	23.3	99°43.3	18.5	189°49.8	23.2
14	193°11.8	7°10.5	34.7	104°01.0	23.4	114°45.5	18.6	204°52.4	23.3
15	208°14.3	22°10.1	·· 36.0	119°01.8	·· 23.4	129°47.7	·· 18.6	219°55.1	·· 23.4
16	223°16.7	37°09.8	37.3	134°02.6	23.5	144°49.8	18.6	234°57.7	23.5
17	238°19.2	52°09.5	38.6	149°03.4	23.5	159°52.0	18.6	250°00.3	23.5
18	253°21.6	67°09.2	S01°39.9	164°04.2	N23°23.6	174°54.2	N22°18.6	265°03.0	S07°23.6
19	268°24.1	82°08.9	41.2	179°05.0	23.7	189°56.4	18.7	280°05.6	23.7
20	283°26.6	97°08.6	42.5	194°05.8	23.7	204°58.5	18.7	295°08.3	23.8
21	298°29.0	112°08.3	·· 43.8	209°06.6	·· 23.8	220°00.7	·· 18.7	310°10.9	·· 23.8
22	313°31.5	127°08.0	45.1	224°07.4	23.8	235°02.9	18.7	325°13.5	23.9
23	328°34.0	142°07.6	46.3	239°08.2	23.9	250°05.1	18.7	340°16.2	24.0
Mer.pass. 01:09		ν -0.3′	d -1.3′	m -3.86	ν 0.8′	d 0.1′	m 0.69	ν 2.2′	d 0.0′ m -2.27	ν 2.6′	d -0.1′ m 0.60

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	343°36.4	157°07.3	S01°47.6	254°09.1	N23°23.9	265°07.2	N22°18.8	355°18.8	S07°24.1
1	358°38.9	172°07.0	48.9	269°09.9	24.0	280°09.4	18.8	10°21.5	24.2
2	13°41.4	187°06.7	50.2	284°10.7	24.0	295°11.6	18.8	25°24.1	24.2
3	28°43.8	202°06.4	·· 51.5	299°11.5	·· 24.1	310°13.8	·· 18.8	40°26.7	·· 24.3
4	43°46.3	217°06.1	52.8	314°12.3	24.1	325°15.9	18.9	55°29.4	24.4
5	58°48.7	232°05.8	54.1	329°13.1	24.2	340°18.1	18.9	70°32.0	24.5
6	73°51.2	247°05.4	S01°55.4	344°13.9	N23°24.2	355°20.3	N22°18.9	85°34.7	S07°24.5
7	88°53.7	262°05.1	56.6	359°14.7	24.3	10°22.5	18.9	100°37.3	24.6
8	103°56.1	277°04.8	57.9	14°15.5	24.3	25°24.6	18.9	115°39.9	24.7
9	118°58.6	292°04.5	01°59.2	29°16.4	·· 24.4	40°26.8	·· 19.0	130°42.6	·· 24.8
10	134°01.1	307°04.2	02°00.5	44°17.2	24.4	55°29.0	19.0	145°45.2	24.9
11	149°03.5	322°03.9	01.8	59°18.0	24.5	70°31.2	19.0	160°47.9	24.9
12	164°06.0	337°03.6	S02°03.1	74°18.8	N23°24.5	85°33.4	N22°19.0	175°50.5	S07°25.0
13	179°08.5	352°03.3	04.4	89°19.6	24.6	100°35.5	19.0	190°53.1	25.1
14	194°10.9	7°02.9	05.7	104°20.4	24.6	115°37.7	19.0	205°55.8	25.2
15	209°13.4	22°02.6	·· 07.0	119°21.2	·· 24.7	130°39.9	·· 19.1	220°58.4	·· 25.2
16	224°15.9	37°02.3	08.2	134°22.1	24.7	145°42.1	19.1	236°01.1	25.3
17	239°18.3	52°02.0	09.5	149°22.9	24.8	160°44.2	19.1	251°03.7	25.4
18	254°20.8	67°01.7	S02°10.8	164°23.7	N23°24.8	175°46.4	N22°19.1	266°06.3	S07°25.5
19	269°23.2	82°01.4	12.1	179°24.5	24.9	190°48.6	19.1	281°09.0	25.5
20	284°25.7	97°01.1	13.4	194°25.3	24.9	205°50.8	19.2	296°11.6	25.6
21	299°28.2	112°00.7	·· 14.7	209°26.1	·· 25.0	220°53.0	·· 19.2	311°14.3	·· 25.7
22	314°30.6	127°00.4	16.0	224°27.0	25.0	235°55.1	19.2	326°16.9	25.8
23	329°33.1	142°00.1	17.3	239°27.8	25.0	250°57.3	19.2	341°19.5	25.9
Mer.pass. 01:05		ν -0.3′	d -1.3′	m -3.86	ν 0.8′	d 0.1′	m 0.68	ν 2.2′	d 0.0′ m -2.28	ν 2.6′	d -0.1′ m 0.59

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	344°35.6	156°59.8	S02°18.5	254°28.6	N23°25.1	265°59.5	N22°19.2	356°22.2	S07°25.9
1	359°38.0	171°59.5	19.8	269°29.4	25.1	281°01.7	19.3	11°24.8	26.0
2	14°40.5	186°59.2	21.1	284°30.2	25.2	296°03.9	19.3	26°27.5	26.1
3	29°43.0	201°58.9	·· 22.4	299°31.1	·· 25.2	311°06.1	·· 19.3	41°30.1	·· 26.2
4	44°45.4	216°58.5	23.7	314°31.9	25.3	326°08.2	19.3	56°32.7	26.2
5	59°47.9	231°58.2	25.0	329°32.7	25.3	341°10.4	19.3	71°35.4	26.3
6	74°50.3	246°57.9	S02°26.3	344°33.5	N23°25.4	356°12.6	N22°19.4	86°38.0	S07°26.4
7	89°52.8	261°57.6	27.6	359°34.3	25.4	11°14.8	19.4	101°40.7	26.5
8	104°55.3	276°57.3	28.8	14°35.1	25.5	26°17.0	19.4	116°43.3	26.5
9	119°57.7	291°57.0	·· 30.1	29°36.0	·· 25.5	41°19.2	·· 19.4	131°45.9	·· 26.6
10	135°00.2	306°56.7	31.4	44°36.8	25.5	56°21.3	19.4	146°48.6	26.7
11	150°02.7	321°56.3	32.7	59°37.6	25.6	71°23.5	19.5	161°51.2	26.8
12	165°05.1	336°56.0	S02°34.0	74°38.4	N23°25.6	86°25.7	N22°19.5	176°53.9	S07°26.9
13	180°07.6	351°55.7	35.3	89°39.3	25.7	101°27.9	19.5	191°56.5	26.9
14	195°10.1	6°55.4	36.6	104°40.1	25.7	116°30.1	19.5	206°59.1	27.0
15	210°12.5	21°55.1	·· 37.8	119°40.9	·· 25.7	131°32.3	·· 19.5	222°01.8	·· 27.1
16	225°15.0	36°54.8	39.1	134°41.7	25.8	146°34.5	19.6	237°04.4	27.2
17	240°17.5	51°54.5	40.4	149°42.5	25.8	161°36.6	19.6	252°07.1	27.2
18	255°19.9	66°54.1	S02°41.7	164°43.4	N23°25.9	176°38.8	N22°19.6	267°09.7	S07°27.3
19	270°22.4	81°53.8	43.0	179°44.2	25.9	191°41.0	19.6	282°12.4	27.4
20	285°24.8	96°53.5	44.3	194°45.0	26.0	206°43.2	19.6	297°15.0	27.5
21	300°27.3	111°53.2	·· 45.6	209°45.8	·· 26.0	221°45.4	·· 19.6	312°17.6	·· 27.6
22	315°29.8	126°52.9	46.9	224°46.7	26.0	236°47.6	19.7	327°20.3	27.6
23	330°32.2	141°52.6	48.1	239°47.5	26.1	251°49.8	19.7	342°22.9	27.7
Mer.pass. 01:01		ν -0.3′	d -1.3′	m -3.86	ν 0.8′	d 0.0′	m 0.67	ν 2.2′	d 0.0′ m -2.29	ν 2.6′	d -0.1′ m 0.59

Stars

	SHA	Dec
Alpheratz	357°34.7	29°13.6
Ankaa	353°07.0	-42°10.1
Schedar	349°30.9	56°40.3
Diphda	348°47.3	-17°50.9
Achernar	335°19.9	-57°06.4
Hamal	327°51.3	23°34.8
Polaris	313°59.4	89°21.8
Acamar	315°11.8	-40°12.0
Menkar	314°06.3	4°11.3
Mirfak	308°28.5	49°56.8
Aldebaran	290°39.9	16°33.6
Rigel	281°04.2	-8°10.2
Capella	280°22.4	46°01.2
Bellatrix	278°23.2	6°22.5
Elnath	278°02.3	28°37.7
Alnilam	275°38.1	-1°11.0
Betelgeuse	270°52.5	7°24.8
Canopus	263°52.7	-52°42.1
Sirius	258°26.7	-16°44.7
Adhara	255°06.3	-29°00.0
Procyon	244°51.4	5°09.9
Pollux	243°17.9	27°58.0
Avior	234°15.4	-59°35.0
Suhail	222°46.9	-43°31.7
Miaplacidus	221°39.3	-69°48.9
Alphard	217°48.3	-8°45.8
Regulus	207°35.1	11°50.9
Dubhe	193°42.0	61°37.2
Denebola	182°25.5	14°26.2
Gienah	175°44.2	-17°40.6
Acrux	173°01.1	-63°14.2
Gacrux	171°52.5	-57°15.1
Alioth	166°13.6	55°49.8
Spica	158°22.9	-11°17.3
Alkaid	152°52.5	49°11.6
Hadar	148°36.9	-60°29.7
Menkent	147°58.2	-36°29.5
Arcturus	145°48.4	19°03.4
Rigil Kent.	139°41.1	-60°56.4
Kochab	137°20.3	74°03.5
Zuben'ubi	136°56.5	-16°08.6
Alphecca	126°04.1	26°38.1
Antares	112°16.2	-26°29.2
Atria	107°10.7	-69°04.6
Sabik	102°03.1	-15°45.3
Shaula	96°10.7	-37°07.4
Rasalhague	95°58.7	12°32.7
Eltanin	90°42.2	51°29.4
Kaus Aust.	83°32.7	-34°22.4
Vega	80°33.2	38°48.6
Nunki	75°47.9	-26°16.0
Altair	62°00.0	8°56.1
Peacock	53°05.7	-56°39.4
Deneb	49°25.6	45°22.2
Enif	33°38.8	9°59.4
Al Na'ir	27°32.8	-46°50.5
Fomalhaut	15°14.5	-29°29.4
Scheat	13°45.1	28°13.1
Markab	13°29.9	15°20.4

Sep 03 Tue	SHA	Mer.pass
Venus	174°37.6	13:31
Mars	271°12.4	07:04
Jupiter	281°37.8	06:22
Saturn	11°38.2	00:23

Sep 04 Wed	SHA	Mer.pass
Venus	173°30.9	13:32
Mars	270°32.6	07:03
Jupiter	281°30.8	06:19
Saturn	11°42.4	00:19

Sep 05 Thu	SHA	Mer.pass
Venus	172°24.2	13:32
Mars	269°53.0	07:02
Jupiter	281°23.9	06:15
Saturn	11°46.6	00:14

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.1547 sec ΔT = TT-UT1 = +69.0293 sec

2024 September 03 to Sep. 05 UT

h	Sun		Moon				
Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°09.7	N07°26.6	180°05.1	16.4′	N09°57.0	13.6′	54.2′
1	195°09.9	25.7	194°40.5	16.4′	09°43.4	13.6′	54.2′
2	210°10.1	24.8	209°15.9	16.5′	09°29.8	13.7′	54.2′
3	225°10.3	·· 23.9	223°51.3	16.5′	09°16.1	13.7′	54.2′
4	240°10.5	23.0	238°26.8	16.5′	09°02.4	13.8′	54.2′
5	255°10.7	22.0	253°02.4	16.6′	08°48.6	13.7′	54.2′
6	270°10.9	N07°21.1	267°38.0	16.6′	N08°34.9	13.8′	54.2′
7	285°11.1	20.2	282°13.6	16.7′	08°21.1	13.9′	54.2′
8	300°11.3	19.3	296°49.3	16.7′	08°07.2	13.8′	54.2′
9	315°11.5	·· 18.4	311°25.0	16.8′	07°53.4	13.9′	54.2′
10	330°11.7	17.4	326°00.8	16.8′	07°39.5	13.9′	54.1′
11	345°11.9	16.5	340°36.5	16.8′	07°25.6	13.9′	54.1′
12	0°12.1	N07°15.6	355°12.4	16.9′	N07°11.7	13.9′	54.1′
13	15°12.3	14.7	9°48.2	16.9′	06°57.8	14.0′	54.1′
14	30°12.5	13.7	24°24.1	16.9′	06°43.8	14.0′	54.1′
15	45°12.7	·· 12.8	39°00.1	17.0′	06°29.8	14.0′	54.1′
16	60°12.9	11.9	53°36.0	17.0′	06°15.8	14.0′	54.1′
17	75°13.1	11.0	68°12.0	17.0′	06°01.8	14.0′	54.1′
18	90°13.3	N07°10.1	82°48.0	17.1′	N05°47.8	14.1′	54.1′
19	105°13.6	09.1	97°24.1	17.1′	05°33.7	14.0′	54.1′
20	120°13.8	08.2	112°00.2	17.1′	05°19.7	14.1′	54.1′
21	135°14.0	·· 07.3	126°36.3	17.1′	05°05.6	14.1′	54.1′
22	150°14.2	06.4	141°12.4	17.2′	04°51.5	14.1′	54.1′
23	165°14.4	05.4	155°48.6	17.2′	04°37.4	14.1′	54.0′
	SD = 15.8′	d = -0.9′	SD = 14.8′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°14.6	N07°04.5	170°24.8	17.2′	N04°23.3	14.2′	54.0′
1	195°14.8	03.6	185°01.0	17.2′	04°09.1	14.1′	54.0′
2	210°15.0	02.7	199°37.2	17.3′	03°55.0	14.1′	54.0′
3	225°15.2	·· 01.7	214°13.5	17.3′	03°40.9	14.2′	54.0′
4	240°15.4	07°00.8	228°49.8	17.3′	03°26.7	14.2′	54.0′
5	255°15.6	06°59.9	243°26.1	17.3′	03°12.5	14.2′	54.0′
6	270°15.8	N06°59.0	258°02.4	17.3′	N02°58.3	14.1′	54.0′
7	285°16.0	58.1	272°38.7	17.4′	02°44.2	14.2′	54.0′
8	300°16.2	57.1	287°15.1	17.4′	02°30.0	14.2′	54.0′
9	315°16.4	·· 56.2	301°51.4	17.4′	02°15.8	14.2′	54.0′
10	330°16.7	55.3	316°27.8	17.4′	02°01.6	14.2′	54.0′
11	345°16.9	54.3	331°04.2	17.4′	01°47.4	14.2′	54.0′
12	0°17.1	N06°53.4	345°40.6	17.4′	N01°33.2	14.2′	54.0′
13	15°17.3	52.5	0°17.0	17.4′	01°19.0	14.3′	54.0′
14	30°17.5	51.6	14°53.5	17.4′	01°04.7	14.2′	54.0′
15	45°17.7	·· 50.6	29°29.9	17.4′	00°50.5	14.2′	54.0′
16	60°17.9	49.7	44°06.4	17.5′	00°36.3	14.2′	54.0′
17	75°18.1	48.8	58°42.8	17.5′	00°22.1	14.2′	54.0′
18	90°18.3	N06°47.9	73°19.3	17.5′	N00°07.9	14.2′	54.0′
19	105°18.5	46.9	87°55.7	17.5′	S00°06.3	14.2′	53.9′
20	120°18.7	46.0	102°32.2	17.5′	00°20.5	14.2′	53.9′
21	135°18.9	·· 45.1	117°08.7	17.5′	00°34.7	14.2′	53.9′
22	150°19.2	44.2	131°45.2	17.5′	00°48.9	14.2′	53.9′
23	165°19.4	43.2	146°21.6	17.5′	01°03.1	14.2′	53.9′
	SD = 15.9′	d = -0.9′	SD = 14.7′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°19.6	N06°42.3	160°58.1	17.5′	S01°17.3	14.2′	53.9′
1	195°19.8	41.4	175°34.6	17.5′	01°31.5	14.2′	53.9′
2	210°20.0	40.4	190°11.1	17.5′	01°45.7	14.1′	53.9′
3	225°20.2	·· 39.5	204°47.6	17.5′	01°59.8	14.2′	53.9′
4	240°20.4	38.6	219°24.0	17.5′	02°14.0	14.1′	53.9′
5	255°20.6	37.7	234°00.5	17.5′	02°28.1	14.2′	53.9′
6	270°20.8	N06°36.7	248°37.0	17.5′	S02°42.3	14.1′	53.9′
7	285°21.0	35.8	263°13.4	17.4′	02°56.4	14.1′	53.9′
8	300°21.2	34.9	277°49.8	17.4′	03°10.5	14.1′	53.9′
9	315°21.5	·· 33.9	292°26.3	17.4′	03°24.6	14.1′	53.9′
10	330°21.7	33.0	307°02.7	17.4′	03°38.7	14.1′	53.9′
11	345°21.9	32.1	321°39.1	17.4′	03°52.8	14.0′	53.9′
12	0°22.1	N06°31.1	336°15.5	17.4′	S04°06.8	14.1′	53.9′
13	15°22.3	30.2	350°51.9	17.4′	04°20.9	14.0′	53.9′
14	30°22.5	29.3	5°28.3	17.4′	04°34.9	14.0′	53.9′
15	45°22.7	·· 28.4	20°04.7	17.3′	04°48.9	14.0′	53.9′
16	60°22.9	27.4	34°41.0	17.3′	05°02.9	14.0′	53.9′
17	75°23.1	26.5	49°17.3	17.3′	05°16.9	14.0′	53.9′
18	90°23.4	N06°25.6	63°53.6	17.3′	S05°30.9	13.9′	53.9′
19	105°23.6	24.6	78°29.9	17.3′	05°44.8	13.9′	53.9′
20	120°23.8	23.7	93°06.2	17.3′	05°58.7	13.9′	53.9′
21	135°24.0	·· 22.8	107°42.5	17.2′	06°12.6	13.9′	53.9′
22	150°24.2	21.8	122°18.7	17.2′	06°26.5	13.8′	53.9′
23	165°24.4	20.9	136°54.9	17.2′	06°40.3	13.9′	53.9′
	SD = 15.9′	d = -0.9′	SD = 14.7′				

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

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

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 0-2 0-3%
03	00:39	00:48	11:59	12:20	00:00	
04	00:58	01:08	11:59	12:59	00:39	
05	01:18	01:28	11:59	13:38	01:18	

September 06, 07, 08 UT (Fri., Sat., Sun.)

	Aries	Venus		Mars		Jupiter		Saturn	
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	345°34.7	156°52.2	S02°49.4	254°48.3	N23°26.1	266°52.0	N22°19.7	357°25.6	S07°27.8
1	0°37.2	171°51.9	50.7	269°49.1	26.2	281°54.1	19.7	12°28.2	27.9
2	15°39.6	186°51.6	52.0	284°50.0	26.2	296°56.3	19.7	27°30.8	27.9
3	30°42.1	201°51.3	·· 53.3	299°50.8	·· 26.2	311°58.5	·· 19.8	42°33.5	·· 28.0
4	45°44.6	216°51.0	54.6	314°51.6	26.3	327°00.7	19.8	57°36.1	28.1
5	60°47.0	231°50.7	55.9	329°52.4	26.3	342°02.9	19.8	72°38.8	28.2
6	75°49.5	246°50.4	S02°57.1	344°53.3	N23°26.3	357°05.1	N22°19.8	87°41.4	S07°28.2
7	90°51.9	261°50.0	58.4	359°54.1	26.4	12°07.3	19.8	102°44.0	28.3
8	105°54.4	276°49.7	02°59.7	14°54.9	26.4	27°09.5	19.9	117°46.7	28.4
9	120°56.9	291°49.4	03°01.0	29°55.7	·· 26.5	42°11.7	·· 19.9	132°49.3	·· 28.5
10	135°59.3	306°49.1	02.3	44°56.6	26.5	57°13.9	19.9	147°52.0	28.6
11	151°01.8	321°48.8	03.6	59°57.4	26.5	72°16.0	19.9	162°54.6	28.6
12	166°04.3	336°48.5	S03°04.8	74°58.2	N23°26.6	87°18.2	N22°19.9	177°57.2	S07°28.7
13	181°06.7	351°48.1	06.1	89°59.0	26.6	102°20.4	19.9	192°59.9	28.8
14	196°09.2	6°47.8	07.4	104°59.9	26.6	117°22.6	20.0	208°02.5	28.9
15	211°11.7	21°47.5	·· 08.7	120°00.7	·· 26.7	132°24.8	·· 20.0	223°05.2	·· 28.9
16	226°14.1	36°47.2	10.0	135°01.5	26.7	147°27.0	20.0	238°07.8	29.0
17	241°16.6	51°46.9	11.3	150°02.4	26.7	162°29.2	20.0	253°10.4	29.1
18	256°19.1	66°46.6	S03°12.6	165°03.2	N23°26.8	177°31.4	N22°20.0	268°13.1	S07°29.2
19	271°21.5	81°46.2	13.8	180°04.0	26.8	192°33.6	20.1	283°15.7	29.2
20	286°24.0	96°45.9	15.1	195°04.8	26.8	207°35.8	20.1	298°18.4	29.3
21	301°26.4	111°45.6	·· 16.4	210°05.7	·· 26.9	222°38.0	·· 20.1	313°21.0	·· 29.4
22	316°28.9	126°45.3	17.7	225°06.5	26.9	237°40.2	20.1	328°23.7	29.5
23	331°31.4	141°45.0	19.0	240°07.3	26.9	252°42.4	20.1	343°26.3	29.6
Mer.pass. 00:58		ν -0.3′	d -1.3′	m -3.86	ν 0.8′	d 0.0′	m 0.67	ν 2.2′	d 0.0′ m -2.29	ν 2.6′	d -0.1′ m 0.58

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	346°33.8	156°44.7	S03°20.3	255°08.2	N23°27.0	267°44.6	N22°20.1	358°28.9	S07°29.6
1	1°36.3	171°44.3	21.5	270°09.0	27.0	282°46.8	20.2	13°31.6	29.7
2	16°38.8	186°44.0	22.8	285°09.8	27.0	297°49.0	20.2	28°34.2	29.8
3	31°41.2	201°43.7	·· 24.1	300°10.7	·· 27.1	312°51.2	·· 20.2	43°36.9	·· 29.9
4	46°43.7	216°43.4	25.4	315°11.5	27.1	327°53.4	20.2	58°39.5	29.9
5	61°46.2	231°43.1	26.7	330°12.3	27.1	342°55.5	20.2	73°42.1	30.0
6	76°48.6	246°42.8	S03°28.0	345°13.2	N23°27.2	357°57.7	N22°20.3	88°44.8	S07°30.1
7	91°51.1	261°42.4	29.2	0°14.0	27.2	12°59.9	20.3	103°47.4	30.2
8	106°53.5	276°42.1	30.5	15°14.8	27.2	28°02.1	20.3	118°50.1	30.2
9	121°56.0	291°41.8	·· 31.8	30°15.7	·· 27.3	43°04.3	·· 20.3	133°52.7	·· 30.3
10	136°58.5	306°41.5	33.1	45°16.5	27.3	58°06.5	20.3	148°55.3	30.4
11	152°00.9	321°41.2	34.4	60°17.3	27.3	73°08.7	20.3	163°58.0	30.5
12	167°03.4	336°40.8	S03°35.7	75°18.2	N23°27.4	88°10.9	N22°20.4	179°00.6	S07°30.6
13	182°05.9	351°40.5	36.9	90°19.0	27.4	103°13.1	20.4	194°03.3	30.6
14	197°08.3	6°40.2	38.2	105°19.8	27.4	118°15.3	20.4	209°05.9	30.7
15	212°10.8	21°39.9	·· 39.5	120°20.7	·· 27.4	133°17.5	·· 20.4	224°08.6	·· 30.8
16	227°13.3	36°39.6	40.8	135°21.5	27.5	148°19.7	20.4	239°11.2	30.9
17	242°15.7	51°39.3	42.1	150°22.3	27.5	163°21.9	20.4	254°13.8	30.9
18	257°18.2	66°38.9	S03°43.4	165°23.2	N23°27.5	178°24.1	N22°20.5	269°16.5	S07°31.0
19	272°20.7	81°38.6	44.6	180°24.0	27.6	193°26.3	20.5	284°19.1	31.1
20	287°23.1	96°38.3	45.9	195°24.8	27.6	208°28.5	20.5	299°21.8	31.2
21	302°25.6	111°38.0	·· 47.2	210°25.7	·· 27.6	223°30.7	·· 20.5	314°24.4	·· 31.2
22	317°28.0	126°37.7	48.5	225°26.5	27.6	238°32.9	20.5	329°27.0	31.3
23	332°30.5	141°37.3	49.8	240°27.4	27.7	253°35.1	20.5	344°29.7	31.4
Mer.pass. 00:54		ν -0.3′	d -1.3′	m -3.86	ν 0.8′	d 0.0′	m 0.66	ν 2.2′	d 0.0′ m -2.30	ν 2.6′	d -0.1′ m 0.58

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	347°33.0	156°37.0	S03°51.0	255°28.2	N23°27.7	268°37.4	N22°20.6	359°32.3	S07°31.5
1	2°35.4	171°36.7	52.3	270°29.0	27.7	283°39.6	20.6	14°35.0	31.6
2	17°37.9	186°36.4	53.6	285°29.9	27.7	298°41.8	20.6	29°37.6	31.6
3	32°40.4	201°36.1	·· 54.9	300°30.7	·· 27.8	313°44.0	·· 20.6	44°40.2	·· 31.7
4	47°42.8	216°35.7	56.2	315°31.6	27.8	328°46.2	20.6	59°42.9	31.8
5	62°45.3	231°35.4	57.5	330°32.4	27.8	343°48.4	20.7	74°45.5	31.9
6	77°47.8	246°35.1	S03°58.7	345°33.2	N23°27.8	358°50.6	N22°20.7	89°48.2	S07°31.9
7	92°50.2	261°34.8	04°00.0	0°34.1	27.9	13°52.8	20.7	104°50.8	32.0
8	107°52.7	276°34.5	01.3	15°34.9	27.9	28°55.0	20.7	119°53.5	32.1
9	122°55.2	291°34.1	·· 02.6	30°35.8	·· 27.9	43°57.2	·· 20.7	134°56.1	·· 32.2
10	137°57.6	306°33.8	03.9	45°36.6	27.9	58°59.4	20.7	149°58.7	32.2
11	153°00.1	321°33.5	05.1	60°37.4	28.0	74°01.6	20.8	165°01.4	32.3
12	168°02.5	336°33.2	S04°06.4	75°38.3	N23°28.0	89°03.8	N22°20.8	180°04.0	S07°32.4
13	183°05.0	351°32.9	07.7	90°39.1	28.0	104°06.0	20.8	195°06.7	32.5
14	198°07.5	6°32.5	09.0	105°40.0	28.0	119°08.2	20.8	210°09.3	32.5
15	213°09.9	21°32.2	·· 10.3	120°40.8	·· 28.1	134°10.4	·· 20.8	225°11.9	·· 32.6
16	228°12.4	36°31.9	11.5	135°41.6	28.1	149°12.6	20.8	240°14.6	32.7
17	243°14.9	51°31.6	12.8	150°42.5	28.1	164°14.8	20.9	255°17.2	32.8
18	258°17.3	66°31.3	S04°14.1	165°43.3	N23°28.1	179°17.1	N22°20.9	270°19.9	S07°32.9
19	273°19.8	81°30.9	15.4	180°44.2	28.2	194°19.3	20.9	285°22.5	32.9
20	288°22.3	96°30.6	16.7	195°45.0	28.2	209°21.5	20.9	300°25.1	33.0
21	303°24.7	111°30.3	·· 17.9	210°45.9	·· 28.2	224°23.7	·· 20.9	315°27.8	·· 33.1
22	318°27.2	126°30.0	19.2	225°46.7	28.2	239°25.9	20.9	330°30.4	33.2
23	333°29.6	141°29.6	20.5	240°47.5	28.2	254°28.1	21.0	345°33.1	33.2
Mer.pass. 00:50		ν -0.3′	d -1.3′	m -3.86	ν 0.8′	d 0.0′	m 0.65	ν 2.2′	d 0.0′ m -2.31	ν 2.6′	d -0.1′ m 0.57

Stars

	SHA	Dec
Alpheratz	357°34.7	29°13.7
Ankaa	353°07.0	-42°10.1
Schedar	349°30.9	56°40.3
Diphda	348°47.3	-17°50.9
Achernar	335°19.9	-57°06.4
Hamal	327°51.3	23°34.8
Polaris	313°58.0	89°21.8
Acamar	315°11.8	-40°12.0
Menkar	314°06.3	4°11.3
Mirfak	308°28.5	49°56.8
Aldebaran	290°39.9	16°33.6
Rigel	281°04.2	-8°10.2
Capella	280°22.4	46°01.2
Bellatrix	278°23.2	6°22.5
Elnath	278°02.3	28°37.7
Alnilam	275°38.1	-1°11.0
Betelgeuse	270°52.5	7°24.8
Canopus	263°52.7	-52°42.1
Sirius	258°26.6	-16°44.7
Adhara	255°06.3	-29°00.0
Procyon	244°51.3	5°09.9
Pollux	243°17.9	27°58.0
Avior	234°15.4	-59°35.0
Suhail	222°46.9	-43°31.7
Miaplacidus	221°39.2	-69°48.9
Alphard	217°48.3	-8°45.7
Regulus	207°35.1	11°50.9
Dubhe	193°42.0	61°37.2
Denebola	182°25.5	14°26.2
Gienah	175°44.2	-17°40.6
Acrux	173°01.1	-63°14.2
Gacrux	171°52.6	-57°15.1
Alioth	166°13.7	55°49.7
Spica	158°22.9	-11°17.3
Alkaid	152°52.5	49°11.6
Hadar	148°36.9	-60°29.7
Menkent	147°58.2	-36°29.5
Arcturus	145°48.4	19°03.4
Rigil Kent.	139°41.1	-60°56.4
Kochab	137°20.3	74°03.5
Zuben'ubi	136°56.5	-16°08.6
Alphecca	126°04.1	26°38.1
Antares	112°16.2	-26°29.2
Atria	107°10.7	-69°04.6
Sabik	102°03.1	-15°45.3
Shaula	96°10.7	-37°07.4
Rasalhague	95°58.8	12°32.7
Eltanin	90°42.2	51°29.4
Kaus Aust.	83°32.7	-34°22.4
Vega	80°33.2	38°48.6
Nunki	75°47.9	-26°16.0
Altair	62°00.0	8°56.1
Peacock	53°05.7	-56°39.4
Deneb	49°25.6	45°22.3
Enif	33°38.8	9°59.4
Al Na'ir	27°32.8	-46°50.5
Fomalhaut	15°14.5	-29°29.4
Scheat	13°45.1	28°13.1
Markab	13°29.9	15°20.4

Sep 06 Fri	SHA	Mer.pass
Venus	171°17.5	13:33
Mars	269°13.6	07:00
Jupiter	281°17.3	06:12
Saturn	11°50.9	00:10

Sep 07 Sat	SHA	Mer.pass
Venus	170°10.8	13:33
Mars	268°34.3	06:59
Jupiter	281°10.7	06:08
Saturn	11°55.1	00:06

Sep 08 Sun	SHA	Mer.pass
Venus	169°04.0	13:34
Mars	267°55.2	06:58
Jupiter	281°04.4	06:05
Saturn	11°59.3	00:02

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.1555 sec ΔT = TT-UT1 = +69.0285 sec

2024 September 06 to Sep. 08 UT

h	Sun		Moon				
Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°24.6	N06°20.0	151°31.1	17.2′	S06°54.2	13.8′	53.9′
1	195°24.8	19.0	166°07.2	17.1′	07°08.0	13.8′	53.9′
2	210°25.0	18.1	180°43.4	17.1′	07°21.8	13.7′	53.9′
3	225°25.3	·· 17.2	195°19.5	17.1′	07°35.5	13.7′	53.9′
4	240°25.5	16.2	209°55.5	17.0′	07°49.2	13.7′	53.9′
5	255°25.7	15.3	224°31.6	17.0′	08°02.9	13.7′	53.9′
6	270°25.9	N06°14.4	239°07.6	17.0′	S08°16.6	13.7′	53.9′
7	285°26.1	13.4	253°43.6	17.0′	08°30.3	13.6′	53.9′
8	300°26.3	12.5	268°19.5	16.9′	08°43.9	13.6′	53.9′
9	315°26.5	·· 11.6	282°55.5	16.9′	08°57.5	13.5′	53.9′
10	330°26.7	10.6	297°31.3	16.8′	09°11.0	13.6′	53.9′
11	345°26.9	09.7	312°07.2	16.8′	09°24.6	13.4′	53.9′
12	0°27.2	N06°08.8	326°43.0	16.8′	S09°38.0	13.5′	54.0′
13	15°27.4	07.8	341°18.8	16.7′	09°51.5	13.4′	54.0′
14	30°27.6	06.9	355°54.5	16.7′	10°04.9	13.4′	54.0′
15	45°27.8	·· 06.0	10°30.2	16.7′	10°18.3	13.4′	54.0′
16	60°28.0	05.0	25°05.9	16.6′	10°31.7	13.3′	54.0′
17	75°28.2	04.1	39°41.5	16.6′	10°45.0	13.3′	54.0′
18	90°28.4	N06°03.1	54°17.1	16.5′	S10°58.3	13.2′	54.0′
19	105°28.6	02.2	68°52.6	16.5′	11°11.5	13.2′	54.0′
20	120°28.9	01.3	83°28.1	16.4′	11°24.7	13.2′	54.0′
21	135°29.1	06°00.3	98°03.5	16.4′	11°37.9	13.1′	54.0′
22	150°29.3	05°59.4	112°38.9	16.3′	11°51.0	13.1′	54.0′
23	165°29.5	58.5	127°14.3	16.3′	12°04.1	13.1′	54.0′
	SD = 15.9′	d = -0.9′	SD = 14.7′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°29.7	N05°57.5	141°49.6	16.2′	S12°17.2	13.0′	54.0′
1	195°29.9	56.6	156°24.8	16.2′	12°30.2	12.9′	54.0′
2	210°30.1	55.7	171°00.0	16.1′	12°43.1	12.9′	54.0′
3	225°30.4	·· 54.7	185°35.2	16.1′	12°56.0	12.9′	54.0′
4	240°30.6	53.8	200°10.2	16.0′	13°08.9	12.8′	54.0′
5	255°30.8	52.8	214°45.3	16.0′	13°21.7	12.8′	54.1′
6	270°31.0	N05°51.9	229°20.3	15.9′	S13°34.5	12.7′	54.1′
7	285°31.2	51.0	243°55.2	15.9′	13°47.2	12.7′	54.1′
8	300°31.4	50.0	258°30.1	15.8′	13°59.9	12.6′	54.1′
9	315°31.6	·· 49.1	273°04.9	15.8′	14°12.5	12.6′	54.1′
10	330°31.9	48.2	287°39.7	15.7′	14°25.1	12.6′	54.1′
11	345°32.1	47.2	302°14.4	15.6′	14°37.7	12.4′	54.1′
12	0°32.3	N05°46.3	316°49.0	15.6′	S14°50.1	12.5′	54.1′
13	15°32.5	45.3	331°23.6	15.5′	15°02.6	12.3′	54.1′
14	30°32.7	44.4	345°58.1	15.5′	15°14.9	12.4′	54.1′
15	45°32.9	·· 43.5	0°32.6	15.4′	15°27.3	12.2′	54.1′
16	60°33.1	42.5	15°07.0	15.3′	15°39.5	12.2′	54.2′
17	75°33.4	41.6	29°41.3	15.3′	15°51.7	12.2′	54.2′
18	90°33.6	N05°40.6	44°15.6	15.2′	S16°03.9	12.1′	54.2′
19	105°33.8	39.7	58°49.8	15.1′	16°16.0	12.0′	54.2′
20	120°34.0	38.8	73°23.9	15.1′	16°28.0	12.0′	54.2′
21	135°34.2	·· 37.8	87°58.0	15.0′	16°40.0	11.9′	54.2′
22	150°34.4	36.9	102°32.0	14.9′	16°51.9	11.9′	54.2′
23	165°34.6	35.9	117°05.9	14.9′	17°03.8	11.8′	54.2′
	SD = 15.9′	d = -0.9′	SD = 14.7′				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°34.9	N05°35.0	131°39.7	14.8′	S17°15.6	11.7′	54.2′
1	195°35.1	34.1	146°13.5	14.7′	17°27.3	11.7′	54.3′
2	210°35.3	33.1	160°47.2	14.6′	17°39.0	11.6′	54.3′
3	225°35.5	·· 32.2	175°20.9	14.6′	17°50.6	11.5′	54.3′
4	240°35.7	31.2	189°54.4	14.5′	18°02.1	11.5′	54.3′
5	255°35.9	30.3	204°27.9	14.4′	18°13.6	11.4′	54.3′
6	270°36.2	N05°29.3	219°01.3	14.3′	S18°25.0	11.3′	54.3′
7	285°36.4	28.4	233°34.7	14.3′	18°36.3	11.3′	54.3′
8	300°36.6	27.5	248°07.9	14.2′	18°47.6	11.2′	54.4′
9	315°36.8	·· 26.5	262°41.1	14.1′	18°58.8	11.1′	54.4′
10	330°37.0	25.6	277°14.2	14.0′	19°09.9	11.0′	54.4′
11	345°37.2	24.6	291°47.2	13.9′	19°20.9	11.0′	54.4′
12	0°37.5	N05°23.7	306°20.2	13.9′	S19°31.9	10.9′	54.4′
13	15°37.7	22.8	320°53.0	13.8′	19°42.8	10.8′	54.4′
14	30°37.9	21.8	335°25.8	13.7′	19°53.6	10.8′	54.4′
15	45°38.1	·· 20.9	349°58.5	13.6′	20°04.4	10.6′	54.5′
16	60°38.3	19.9	4°31.1	13.5′	20°15.0	10.6′	54.5′
17	75°38.5	19.0	19°03.6	13.4′	20°25.6	10.5′	54.5′
18	90°38.8	N05°18.0	33°36.1	13.4′	S20°36.1	10.5′	54.5′
19	105°39.0	17.1	48°08.4	13.3′	20°46.6	10.3′	54.5′
20	120°39.2	16.1	62°40.7	13.2′	20°56.9	10.3′	54.5′
21	135°39.4	·· 15.2	77°12.9	13.1′	21°07.2	10.2′	54.6′
22	150°39.6	14.3	91°45.0	13.0′	21°17.4	10.0′	54.6′
23	165°39.8	13.3	106°17.0	12.9′	21°27.4	10.1′	54.6′
	SD = 15.9′	d = -0.9′	SD = 14.8′				

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

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

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 3-5 7-20%
06	01:38	01:49	11:58	14:17	01:57	
07	01:59	02:09	11:58	14:58	02:37	
08	02:19	02:30	11:58	15:41	03:19	

September 09, 10, 11 UT (Mon., Tue., Wed.)

	Aries	Venus		Mars		Jupiter		Saturn	
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	348°32.1	156°29.3	S04°21.8	255°48.4	N23°28.3	269°30.3	N22°21.0	0°35.7	S07°33.3
1	3°34.6	171°29.0	23.0	270°49.2	28.3	284°32.5	21.0	15°38.4	33.4
2	18°37.0	186°28.7	24.3	285°50.1	28.3	299°34.7	21.0	30°41.0	33.5
3	33°39.5	201°28.4	·· 25.6	300°50.9	·· 28.3	314°36.9	·· 21.0	45°43.6	·· 33.5
4	48°42.0	216°28.0	26.9	315°51.8	28.3	329°39.2	21.0	60°46.3	33.6
5	63°44.4	231°27.7	28.2	330°52.6	28.4	344°41.4	21.1	75°48.9	33.7
6	78°46.9	246°27.4	S04°29.4	345°53.5	N23°28.4	359°43.6	N22°21.1	90°51.6	S07°33.8
7	93°49.4	261°27.1	30.7	0°54.3	28.4	14°45.8	21.1	105°54.2	33.8
8	108°51.8	276°26.7	32.0	15°55.2	28.4	29°48.0	21.1	120°56.8	33.9
9	123°54.3	291°26.4	·· 33.3	30°56.0	·· 28.4	44°50.2	·· 21.1	135°59.5	·· 34.0
10	138°56.8	306°26.1	34.5	45°56.9	28.4	59°52.4	21.1	151°02.1	34.1
11	153°59.2	321°25.8	35.8	60°57.7	28.5	74°54.6	21.2	166°04.8	34.2
12	169°01.7	336°25.5	S04°37.1	75°58.6	N23°28.5	89°56.9	N22°21.2	181°07.4	S07°34.2
13	184°04.1	351°25.1	38.4	90°59.4	28.5	104°59.1	21.2	196°10.0	34.3
14	199°06.6	6°24.8	39.7	106°00.3	28.5	120°01.3	21.2	211°12.7	34.4
15	214°09.1	21°24.5	·· 40.9	121°01.1	·· 28.5	135°03.5	·· 21.2	226°15.3	·· 34.5
16	229°11.5	36°24.2	42.2	136°02.0	28.6	150°05.7	21.2	241°18.0	34.5
17	244°14.0	51°23.8	43.5	151°02.8	28.6	165°07.9	21.3	256°20.6	34.6
18	259°16.5	66°23.5	S04°44.8	166°03.7	N23°28.6	180°10.2	N22°21.3	271°23.3	S07°34.7
19	274°18.9	81°23.2	46.0	181°04.5	28.6	195°12.4	21.3	286°25.9	34.8
20	289°21.4	96°22.9	47.3	196°05.4	28.6	210°14.6	21.3	301°28.5	34.8
21	304°23.9	111°22.5	·· 48.6	211°06.2	·· 28.6	225°16.8	·· 21.3	316°31.2	·· 34.9
22	319°26.3	126°22.2	49.9	226°07.1	28.6	240°19.0	21.3	331°33.8	35.0
23	334°28.8	141°21.9	51.1	241°07.9	28.7	255°21.2	21.3	346°36.5	35.1
Mer.pass. 00:46		ν -0.3′	d -1.3′	m -3.87	ν 0.8′	d 0.0′	m 0.65	ν 2.2′	d 0.0′ m -2.31	ν 2.6′	d -0.1′ m 0.57

Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	349°31.3	156°21.6	S04°52.4	256°08.8	N23°28.7	270°23.5	N22°21.4	1°39.1	S07°35.1
1	4°33.7	171°21.2	53.7	271°09.6	28.7	285°25.7	21.4	16°41.7	35.2
2	19°36.2	186°20.9	55.0	286°10.5	28.7	300°27.9	21.4	31°44.4	35.3
3	34°38.6	201°20.6	·· 56.2	301°11.3	·· 28.7	315°30.1	·· 21.4	46°47.0	·· 35.4
4	49°41.1	216°20.3	57.5	316°12.2	28.7	330°32.3	21.4	61°49.7	35.4
5	64°43.6	231°19.9	04°58.8	331°13.0	28.7	345°34.5	21.4	76°52.3	35.5
6	79°46.0	246°19.6	S05°00.1	346°13.9	N23°28.8	0°36.8	N22°21.5	91°54.9	S07°35.6
7	94°48.5	261°19.3	01.3	1°14.7	28.8	15°39.0	21.5	106°57.6	35.7
8	109°51.0	276°19.0	02.6	16°15.6	28.8	30°41.2	21.5	122°00.2	35.8
9	124°53.4	291°18.6	·· 03.9	31°16.4	·· 28.8	45°43.4	·· 21.5	137°02.9	·· 35.8
10	139°55.9	306°18.3	05.2	46°17.3	28.8	60°45.6	21.5	152°05.5	35.9
11	154°58.4	321°18.0	06.4	61°18.2	28.8	75°47.9	21.5	167°08.2	36.0
12	170°00.8	336°17.7	S05°07.7	76°19.0	N23°28.8	90°50.1	N22°21.6	182°10.8	S07°36.1
13	185°03.3	351°17.3	09.0	91°19.9	28.8	105°52.3	21.6	197°13.4	36.1
14	200°05.8	6°17.0	10.2	106°20.7	28.9	120°54.5	21.6	212°16.1	36.2
15	215°08.2	21°16.7	·· 11.5	121°21.6	·· 28.9	135°56.8	·· 21.6	227°18.7	·· 36.3
16	230°10.7	36°16.4	12.8	136°22.4	28.9	150°59.0	21.6	242°21.4	36.4
17	245°13.1	51°16.0	14.1	151°23.3	28.9	166°01.2	21.6	257°24.0	36.4
18	260°15.6	66°15.7	S05°15.3	166°24.2	N23°28.9	181°03.4	N22°21.6	272°26.6	S07°36.5
19	275°18.1	81°15.4	16.6	181°25.0	28.9	196°05.7	21.7	287°29.3	36.6
20	290°20.5	96°15.0	17.9	196°25.9	28.9	211°07.9	21.7	302°31.9	36.7
21	305°23.0	111°14.7	·· 19.2	211°26.7	·· 28.9	226°10.1	·· 21.7	317°34.6	·· 36.7
22	320°25.5	126°14.4	20.4	226°27.6	28.9	241°12.3	21.7	332°37.2	36.8
23	335°27.9	141°14.1	21.7	241°28.4	28.9	256°14.5	21.7	347°39.8	36.9
Mer.pass. 00:42		ν -0.3′	d -1.3′	m -3.87	ν 0.9′	d 0.0′	m 0.64	ν 2.2′	d 0.0′ m -2.32	ν 2.6′	d -0.1′ m 0.58

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	350°30.4	156°13.7	S05°23.0	256°29.3	N23°28.9	271°16.8	N22°21.7	2°42.5	S07°37.0
1	5°32.9	171°13.4	24.2	271°30.2	29.0	286°19.0	21.8	17°45.1	37.0
2	20°35.3	186°13.1	25.5	286°31.0	29.0	301°21.2	21.8	32°47.8	37.1
3	35°37.8	201°12.7	·· 26.8	301°31.9	·· 29.0	316°23.5	·· 21.8	47°50.4	·· 37.2
4	50°40.2	216°12.4	28.0	316°32.7	29.0	331°25.7	21.8	62°53.0	37.3
5	65°42.7	231°12.1	29.3	331°33.6	29.0	346°27.9	21.8	77°55.7	37.4
6	80°45.2	246°11.8	S05°30.6	346°34.5	N23°29.0	1°30.1	N22°21.8	92°58.3	S07°37.4
7	95°47.6	261°11.4	31.9	1°35.3	29.0	16°32.4	21.8	108°01.0	37.5
8	110°50.1	276°11.1	33.1	16°36.2	29.0	31°34.6	21.9	123°03.6	37.6
9	125°52.6	291°10.8	·· 34.4	31°37.1	·· 29.0	46°36.8	·· 21.9	138°06.3	·· 37.7
10	140°55.0	306°10.4	35.7	46°37.9	29.0	61°39.0	21.9	153°08.9	37.7
11	155°57.5	321°10.1	36.9	61°38.8	29.0	76°41.3	21.9	168°11.5	37.8
12	171°00.0	336°09.8	S05°38.2	76°39.6	N23°29.0	91°43.5	N22°21.9	183°14.2	S07°37.9
13	186°02.4	351°09.5	39.5	91°40.5	29.0	106°45.7	21.9	198°16.8	38.0
14	201°04.9	6°09.1	40.7	106°41.4	29.0	121°48.0	21.9	213°19.5	38.0
15	216°07.4	21°08.8	·· 42.0	121°42.2	·· 29.0	136°50.2	·· 22.0	228°22.1	·· 38.1
16	231°09.8	36°08.5	43.3	136°43.1	29.1	151°52.4	22.0	243°24.7	38.2
17	246°12.3	51°08.1	44.5	151°44.0	29.1	166°54.7	22.0	258°27.4	38.3
18	261°14.7	66°07.8	S05°45.8	166°44.8	N23°29.1	181°56.9	N22°22.0	273°30.0	S07°38.3
19	276°17.2	81°07.5	47.1	181°45.7	29.1	196°59.1	22.0	288°32.7	38.4
20	291°19.7	96°07.1	48.4	196°46.6	29.1	212°01.3	22.0	303°35.3	38.5
21	306°22.1	111°06.8	·· 49.6	211°47.4	·· 29.1	227°03.6	·· 22.1	318°37.9	·· 38.6
22	321°24.6	126°06.5	50.9	226°48.3	29.1	242°05.8	22.1	333°40.6	38.6
23	336°27.1	141°06.1	52.2	241°49.2	29.1	257°08.0	22.1	348°43.2	38.7
Mer.pass. 00:38		ν -0.3′	d -1.3′	m -3.87	ν 0.9′	d 0.0′	m 0.63	ν 2.2′	d 0.0′ m -2.32	ν 2.6′	d -0.1′ m 0.58

Stars

	SHA	Dec
Alpheratz	357°34.7	29°13.7
Ankaa	353°07.0	-42°10.1
Schedar	349°30.9	56°40.3
Diphda	348°47.3	-17°50.9
Achernar	335°19.9	-57°06.4
Hamal	327°51.3	23°34.8
Polaris	313°56.4	89°21.8
Acamar	315°11.7	-40°12.0
Menkar	314°06.3	4°11.3
Mirfak	308°28.5	49°56.8
Aldebaran	290°39.9	16°33.6
Rigel	281°04.1	-8°10.2
Capella	280°22.3	46°01.2
Bellatrix	278°23.2	6°22.5
Elnath	278°02.3	28°37.7
Alnilam	275°38.1	-1°11.0
Betelgeuse	270°52.5	7°24.8
Canopus	263°52.7	-52°42.1
Sirius	258°26.6	-16°44.7
Adhara	255°06.3	-29°00.0
Procyon	244°51.3	5°09.8
Pollux	243°17.9	27°58.0
Avior	234°15.4	-59°35.0
Suhail	222°46.9	-43°31.7
Miaplacidus	221°39.2	-69°48.8
Alphard	217°48.3	-8°45.7
Regulus	207°35.0	11°50.9
Dubhe	193°42.0	61°37.1
Denebola	182°25.5	14°26.2
Gienah	175°44.2	-17°40.6
Acrux	173°01.1	-63°14.2
Gacrux	171°52.6	-57°15.1
Alioth	166°13.7	55°49.7
Spica	158°22.9	-11°17.3
Alkaid	152°52.6	49°11.6
Hadar	148°36.9	-60°29.6
Menkent	147°58.2	-36°29.5
Arcturus	145°48.4	19°03.4
Rigil Kent.	139°41.1	-60°56.4
Kochab	137°20.4	74°03.5
Zuben'ubi	136°56.5	-16°08.6
Alphecca	126°04.1	26°38.1
Antares	112°16.2	-26°29.2
Atria	107°10.7	-69°04.5
Sabik	102°03.1	-15°45.3
Shaula	96°10.7	-37°07.4
Rasalhague	95°58.8	12°32.7
Eltanin	90°42.2	51°29.4
Kaus Aust.	83°32.8	-34°22.4
Vega	80°33.3	38°48.6
Nunki	75°47.9	-26°16.0
Altair	62°00.0	8°56.1
Peacock	53°05.7	-56°39.4
Deneb	49°25.7	45°22.3
Enif	33°38.8	9°59.4
Al Na'ir	27°32.8	-46°50.5
Fomalhaut	15°14.4	-29°29.4
Scheat	13°45.1	28°13.1
Markab	13°29.9	15°20.4

Sep 09 Mon	SHA	Mer.pass
Venus	167°57.2	13:34
Mars	267°16.3	06:56
Jupiter	280°58.2	06:01
Saturn	12°03.6	23:53

Sep 10 Tue	SHA	Mer.pass
Venus	166°50.3	13:35
Mars	266°37.5	06:55
Jupiter	280°52.2	05:58
Saturn	12°07.8	23:49

Sep 11 Wed	SHA	Mer.pass
Venus	165°43.3	13:35
Mars	265°58.9	06:54
Jupiter	280°46.4	05:54
Saturn	12°12.1	23:45

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°40.1	N05°12.4	120°48.9	12.8′	S21°37.5	9.9′	54.6′
1	195°40.3	11.4	135°20.7	12.7′	21°47.4	9.8′	54.6′
2	210°40.5	10.5	149°52.5	12.7′	21°57.2	9.8′	54.7′
3	225°40.7	·· 09.5	164°24.1	12.6′	22°07.0	9.6′	54.7′
4	240°40.9	08.6	178°55.7	12.5′	22°16.6	9.6′	54.7′
5	255°41.1	07.6	193°27.2	12.4′	22°26.2	9.5′	54.7′
6	270°41.4	N05°06.7	207°58.5	12.3′	S22°35.7	9.3′	54.7′
7	285°41.6	05.8	222°29.8	12.2′	22°45.0	9.3′	54.8′
8	300°41.8	04.8	237°01.0	12.1′	22°54.3	9.2′	54.8′
9	315°42.0	·· 03.9	251°32.1	12.0′	23°03.5	9.1′	54.8′
10	330°42.2	02.9	266°03.1	11.9′	23°12.6	9.0′	54.8′
11	345°42.5	02.0	280°34.0	11.8′	23°21.6	8.9′	54.8′
12	0°42.7	N05°01.0	295°04.9	11.7′	S23°30.5	8.8′	54.9′
13	15°42.9	05°00.1	309°35.6	11.6′	23°39.3	8.7′	54.9′
14	30°43.1	04°59.1	324°06.2	11.5′	23°48.0	8.5′	54.9′
15	45°43.3	·· 58.2	338°36.8	11.4′	23°56.5	8.5′	54.9′
16	60°43.5	57.2	353°07.2	11.3′	24°05.0	8.4′	54.9′
17	75°43.8	56.3	7°37.5	11.3′	24°13.4	8.3′	55.0′
18	90°44.0	N04°55.3	22°07.8	11.2′	S24°21.7	8.2′	55.0′
19	105°44.2	54.4	36°38.0	11.1′	24°29.9	8.0′	55.0′
20	120°44.4	53.5	51°08.0	11.0′	24°37.9	8.0′	55.0′
21	135°44.6	·· 52.5	65°38.0	10.9′	24°45.9	7.8′	55.1′
22	150°44.9	51.6	80°07.8	10.8′	24°53.7	7.7′	55.1′
23	165°45.1	50.6	94°37.6	10.7′	25°01.4	7.6′	55.1′
	SD = 15.9′	d = -0.9′	SD = 14.9′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°45.3	N04°49.7	109°07.3	10.6′	S25°09.0	7.5′	55.1′
1	195°45.5	48.7	123°36.9	10.5′	25°16.5	7.4′	55.2′
2	210°45.7	47.8	138°06.4	10.4′	25°23.9	7.3′	55.2′
3	225°45.9	·· 46.8	152°35.8	10.3′	25°31.2	7.1′	55.2′
4	240°46.2	45.9	167°05.0	10.2′	25°38.3	7.1′	55.2′
5	255°46.4	44.9	181°34.2	10.1′	25°45.4	6.9′	55.3′
6	270°46.6	N04°44.0	196°03.3	10.0′	S25°52.3	6.8′	55.3′
7	285°46.8	43.0	210°32.3	9.9′	25°59.1	6.6′	55.3′
8	300°47.0	42.1	225°01.3	9.8′	26°05.7	6.6′	55.3′
9	315°47.3	·· 41.1	239°30.1	9.7′	26°12.3	6.4′	55.4′
10	330°47.5	40.2	253°58.8	9.6′	26°18.7	6.3′	55.4′
11	345°47.7	39.2	268°27.4	9.5′	26°25.0	6.2′	55.4′
12	0°47.9	N04°38.3	282°56.0	9.4′	S26°31.2	6.0′	55.5′
13	15°48.1	37.3	297°24.4	9.3′	26°37.2	5.9′	55.5′
14	30°48.4	36.4	311°52.7	9.3′	26°43.1	5.8′	55.5′
15	45°48.6	·· 35.4	326°21.0	9.2′	26°48.9	5.6′	55.5′
16	60°48.8	34.5	340°49.2	9.1′	26°54.5	5.6′	55.6′
17	75°49.0	33.5	355°17.2	9.0′	27°00.1	5.3′	55.6′
18	90°49.2	N04°32.6	9°45.2	8.9′	S27°05.4	5.3′	55.6′
19	105°49.5	31.6	24°13.1	8.8′	27°10.7	5.1′	55.7′
20	120°49.7	30.7	38°40.9	8.7′	27°15.8	5.0′	55.7′
21	135°49.9	·· 29.7	53°08.6	8.6′	27°20.8	4.8′	55.7′
22	150°50.1	28.8	67°36.2	8.5′	27°25.6	4.7′	55.7′
23	165°50.3	27.8	82°03.8	8.4′	27°30.3	4.6′	55.8′
	SD = 15.9′	d = -0.9′	SD = 15.0′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°50.6	N04°26.9	96°31.2	8.4′	S27°34.9	4.4′	55.8′
1	195°50.8	25.9	110°58.6	8.3′	27°39.3	4.2′	55.8′
2	210°51.0	25.0	125°25.8	8.2′	27°43.5	4.2′	55.9′
3	225°51.2	·· 24.0	139°53.0	8.1′	27°47.7	3.9′	55.9′
4	240°51.4	23.1	154°20.1	8.0′	27°51.6	3.9′	55.9′
5	255°51.7	22.1	168°47.2	7.9′	27°55.5	3.7′	56.0′
6	270°51.9	N04°21.2	183°14.1	7.9′	S27°59.2	3.5′	56.0′
7	285°52.1	20.2	197°41.0	7.8′	28°02.7	3.4′	56.0′
8	300°52.3	19.3	212°07.7	7.7′	28°06.1	3.2′	56.1′
9	315°52.5	·· 18.3	226°34.4	7.6′	28°09.3	3.1′	56.1′
10	330°52.8	17.3	241°01.1	7.5′	28°12.4	2.9′	56.1′
11	345°53.0	16.4	255°27.6	7.5′	28°15.3	2.8′	56.2′
12	0°53.2	N04°15.4	269°54.1	7.4′	S28°18.1	2.7′	56.2′
13	15°53.4	14.5	284°20.5	7.3′	28°20.8	2.4′	56.2′
14	30°53.7	13.5	298°46.8	7.3′	28°23.2	2.3′	56.3′
15	45°53.9	·· 12.6	313°13.1	7.2′	28°25.5	2.2′	56.3′
16	60°54.1	11.6	327°39.3	7.1′	28°27.7	2.0′	56.3′
17	75°54.3	10.7	342°05.4	7.1′	28°29.7	1.8′	56.4′
18	90°54.5	N04°09.7	356°31.4	7.0′	S28°31.5	1.7′	56.4′
19	105°54.8	08.8	10°57.4	6.9′	28°33.2	1.5′	56.4′
20	120°55.0	07.8	25°23.3	6.9′	28°34.7	1.4′	56.5′
21	135°55.2	·· 06.9	39°49.2	6.8′	28°36.1	1.2′	56.5′
22	150°55.4	05.9	54°15.0	6.7′	28°37.3	1.0′	56.5′
23	165°55.6	05.0	68°40.7	6.7′	28°38.3	0.9′	56.6′
	SD = 15.9′	d = -1.0′	SD = 15.2′				

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

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

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 6-8 28-47%
09	02:40	02:51	11:57	16:28	04:04	
10	03:01	03:12	11:57	17:20	04:53	
11	03:22	03:33	11:56	18:14	05:47	

September 12, 13, 14 UT (Thu., Fri., Sat.)

	Aries	Venus		Mars		Jupiter		Saturn	
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	351°29.5	156°05.8	S05°53.4	256°50.0	N23°29.1	272°10.3	N22°22.1	3°45.9	S07°38.8
1	6°32.0	171°05.5	54.7	271°50.9	29.1	287°12.5	22.1	18°48.5	38.9
2	21°34.5	186°05.1	56.0	286°51.8	29.1	302°14.7	22.1	33°51.1	38.9
3	36°36.9	201°04.8	·· 57.2	301°52.6	·· 29.1	317°17.0	·· 22.1	48°53.8	·· 39.0
4	51°39.4	216°04.5	58.5	316°53.5	29.1	332°19.2	22.2	63°56.4	39.1
5	66°41.9	231°04.1	05°59.7	331°54.4	29.1	347°21.4	22.2	78°59.1	39.2
6	81°44.3	246°03.8	S06°01.0	346°55.2	N23°29.1	2°23.7	N22°22.2	94°01.7	S07°39.2
7	96°46.8	261°03.5	02.3	1°56.1	29.1	17°25.9	22.2	109°04.4	39.3
8	111°49.2	276°03.1	03.5	16°57.0	29.1	32°28.1	22.2	124°07.0	39.4
9	126°51.7	291°02.8	·· 04.8	31°57.8	·· 29.1	47°30.4	·· 22.2	139°09.6	·· 39.5
10	141°54.2	306°02.5	06.1	46°58.7	29.1	62°32.6	22.2	154°12.3	39.5
11	156°56.6	321°02.1	07.3	61°59.6	29.1	77°34.9	22.3	169°14.9	39.6
12	171°59.1	336°01.8	S06°08.6	77°00.5	N23°29.1	92°37.1	N22°22.3	184°17.6	S07°39.7
13	187°01.6	351°01.5	09.9	92°01.3	29.1	107°39.3	22.3	199°20.2	39.8
14	202°04.0	6°01.1	11.1	107°02.2	29.1	122°41.6	22.3	214°22.8	39.8
15	217°06.5	21°00.8	·· 12.4	122°03.1	·· 29.1	137°43.8	·· 22.3	229°25.5	·· 39.9
16	232°09.0	36°00.5	13.7	137°03.9	29.1	152°46.0	22.3	244°28.1	40.0
17	247°11.4	51°00.1	14.9	152°04.8	29.1	167°48.3	22.3	259°30.8	40.1
18	262°13.9	65°59.8	S06°16.2	167°05.7	N23°29.1	182°50.5	N22°22.4	274°33.4	S07°40.1
19	277°16.4	80°59.5	17.4	182°06.6	29.1	197°52.8	22.4	289°36.0	40.2
20	292°18.8	95°59.1	18.7	197°07.4	29.1	212°55.0	22.4	304°38.7	40.3
21	307°21.3	110°58.8	·· 20.0	212°08.3	·· 29.1	227°57.2	·· 22.4	319°41.3	·· 40.4
22	322°23.7	125°58.5	21.2	227°09.2	29.1	242°59.5	22.4	334°44.0	40.4
23	337°26.2	140°58.1	22.5	242°10.0	29.1	258°01.7	22.4	349°46.6	40.5
Mer.pass. 00:34		ν -0.3′	d -1.3′	m -3.87	ν 0.9′	d 0.0′	m 0.62	ν 2.2′	d 0.0′ m -2.33	ν 2.6′	d -0.1′ m 0.58

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	352°28.7	155°57.8	S06°23.8	257°10.9	N23°29.1	273°04.0	N22°22.4	4°49.2	S07°40.6
1	7°31.1	170°57.5	25.0	272°11.8	29.1	288°06.2	22.5	19°51.9	40.7
2	22°33.6	185°57.1	26.3	287°12.7	29.1	303°08.4	22.5	34°54.5	40.7
3	37°36.1	200°56.8	·· 27.5	302°13.5	·· 29.1	318°10.7	·· 22.5	49°57.2	·· 40.8
4	52°38.5	215°56.4	28.8	317°14.4	29.1	333°12.9	22.5	64°59.8	40.9
5	67°41.0	230°56.1	30.1	332°15.3	29.1	348°15.2	22.5	80°02.4	41.0
6	82°43.5	245°55.8	S06°31.3	347°16.2	N23°29.1	3°17.4	N22°22.5	95°05.1	S07°41.0
7	97°45.9	260°55.4	32.6	2°17.1	29.0	18°19.6	22.5	110°07.7	41.1
8	112°48.4	275°55.1	33.8	17°17.9	29.0	33°21.9	22.5	125°10.4	41.2
9	127°50.8	290°54.8	·· 35.1	32°18.8	·· 29.0	48°24.1	·· 22.6	140°13.0	·· 41.3
10	142°53.3	305°54.4	36.4	47°19.7	29.0	63°26.4	22.6	155°15.6	41.3
11	157°55.8	320°54.1	37.6	62°20.6	29.0	78°28.6	22.6	170°18.3	41.4
12	172°58.2	335°53.7	S06°38.9	77°21.4	N23°29.0	93°30.9	N22°22.6	185°20.9	S07°41.5
13	188°00.7	350°53.4	40.1	92°22.3	29.0	108°33.1	22.6	200°23.6	41.6
14	203°03.2	5°53.1	41.4	107°23.2	29.0	123°35.4	22.6	215°26.2	41.6
15	218°05.6	20°52.7	·· 42.7	122°24.1	·· 29.0	138°37.6	·· 22.6	230°28.8	·· 41.7
16	233°08.1	35°52.4	43.9	137°25.0	29.0	153°39.8	22.7	245°31.5	41.8
17	248°10.6	50°52.1	45.2	152°25.8	29.0	168°42.1	22.7	260°34.1	41.9
18	263°13.0	65°51.7	S06°46.4	167°26.7	N23°29.0	183°44.3	N22°22.7	275°36.8	S07°41.9
19	278°15.5	80°51.4	47.7	182°27.6	29.0	198°46.6	22.7	290°39.4	42.0
20	293°18.0	95°51.0	48.9	197°28.5	29.0	213°48.8	22.7	305°42.0	42.1
21	308°20.4	110°50.7	·· 50.2	212°29.4	·· 29.0	228°51.1	·· 22.7	320°44.7	·· 42.2
22	323°22.9	125°50.4	51.5	227°30.2	29.0	243°53.3	22.7	335°47.3	42.2
23	338°25.3	140°50.0	52.7	242°31.1	28.9	258°55.6	22.8	350°50.0	42.3
Mer.pass. 00:30		ν -0.3′	d -1.3′	m -3.87	ν 0.9′	d -0.0′	m 0.62	ν 2.2′	d 0.0′ m -2.34	ν 2.6′	d -0.1′ m 0.59

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	353°27.8	155°49.7	S06°54.0	257°32.0	N23°28.9	273°57.8	N22°22.8	5°52.6	S07°42.4
1	8°30.3	170°49.3	55.2	272°32.9	28.9	289°00.1	22.8	20°55.2	42.5
2	23°32.7	185°49.0	56.5	287°33.8	28.9	304°02.3	22.8	35°57.9	42.5
3	38°35.2	200°48.6	·· 57.7	302°34.7	·· 28.9	319°04.6	·· 22.8	51°00.5	·· 42.6
4	53°37.7	215°48.3	06°59.0	317°35.5	28.9	334°06.8	22.8	66°03.2	42.7
5	68°40.1	230°48.0	07°00.2	332°36.4	28.9	349°09.1	22.8	81°05.8	42.8
6	83°42.6	245°47.6	S07°01.5	347°37.3	N23°28.9	4°11.3	N22°22.8	96°08.4	S07°42.8
7	98°45.1	260°47.3	02.8	2°38.2	28.9	19°13.6	22.9	111°11.1	42.9
8	113°47.5	275°46.9	04.0	17°39.1	28.9	34°15.8	22.9	126°13.7	43.0
9	128°50.0	290°46.6	·· 05.3	32°40.0	·· 28.8	49°18.1	·· 22.9	141°16.4	·· 43.1
10	143°52.5	305°46.3	06.5	47°40.8	28.8	64°20.3	22.9	156°19.0	43.1
11	158°54.9	320°45.9	07.8	62°41.7	28.8	79°22.6	22.9	171°21.6	43.2
12	173°57.4	335°45.6	S07°09.0	77°42.6	N23°28.8	94°24.8	N22°22.9	186°24.3	S07°43.3
13	188°59.8	350°45.2	10.3	92°43.5	28.8	109°27.1	22.9	201°26.9	43.4
14	204°02.3	5°44.9	11.5	107°44.4	28.8	124°29.3	22.9	216°29.6	43.4
15	219°04.8	20°44.5	·· 12.8	122°45.3	·· 28.8	139°31.6	·· 23.0	231°32.2	·· 43.5
16	234°07.2	35°44.2	14.0	137°46.2	28.8	154°33.8	23.0	246°34.8	43.6
17	249°09.7	50°43.8	15.3	152°47.1	28.8	169°36.1	23.0	261°37.5	43.7
18	264°12.2	65°43.5	S07°16.5	167°47.9	N23°28.7	184°38.3	N22°23.0	276°40.1	S07°43.7
19	279°14.6	80°43.2	17.8	182°48.8	28.7	199°40.6	23.0	291°42.8	43.8
20	294°17.1	95°42.8	19.0	197°49.7	28.7	214°42.8	23.0	306°45.4	43.9
21	309°19.6	110°42.5	·· 20.3	212°50.6	·· 28.7	229°45.1	·· 23.0	321°48.0	·· 44.0
22	324°22.0	125°42.1	21.5	227°51.5	28.7	244°47.4	23.1	336°50.7	44.0
23	339°24.5	140°41.8	22.8	242°52.4	28.7	259°49.6	23.1	351°53.3	44.1
Mer.pass. 00:26		ν -0.3′	d -1.3′	m -3.87	ν 0.9′	d -0.0′	m 0.61	ν 2.2′	d 0.0′ m -2.34	ν 2.6′	d -0.1′ m 0.59

Stars

	SHA	Dec
Alpheratz	357°34.7	29°13.7
Ankaa	353°07.0	-42°10.1
Schedar	349°30.9	56°40.3
Diphda	348°47.3	-17°50.9
Achernar	335°19.9	-57°06.4
Hamal	327°51.3	23°34.8
Polaris	313°54.8	89°21.8
Acamar	315°11.7	-40°12.0
Menkar	314°06.3	4°11.3
Mirfak	308°28.4	49°56.8
Aldebaran	290°39.9	16°33.6
Rigel	281°04.1	-8°10.2
Capella	280°22.3	46°01.2
Bellatrix	278°23.2	6°22.5
Elnath	278°02.2	28°37.7
Alnilam	275°38.0	-1°11.0
Betelgeuse	270°52.4	7°24.8
Canopus	263°52.7	-52°42.1
Sirius	258°26.6	-16°44.7
Adhara	255°06.2	-29°00.0
Procyon	244°51.3	5°09.8
Pollux	243°17.8	27°58.0
Avior	234°15.3	-59°35.0
Suhail	222°46.9	-43°31.7
Miaplacidus	221°39.2	-69°48.8
Alphard	217°48.3	-8°45.7
Regulus	207°35.0	11°50.9
Dubhe	193°41.9	61°37.1
Denebola	182°25.5	14°26.2
Gienah	175°44.2	-17°40.6
Acrux	173°01.1	-63°14.2
Gacrux	171°52.6	-57°15.1
Alioth	166°13.7	55°49.7
Spica	158°22.9	-11°17.3
Alkaid	152°52.6	49°11.6
Hadar	148°36.9	-60°29.6
Menkent	147°58.3	-36°29.5
Arcturus	145°48.4	19°03.4
Rigil Kent.	139°41.2	-60°56.4
Kochab	137°20.4	74°03.4
Zuben'ubi	136°56.5	-16°08.6
Alphecca	126°04.1	26°38.1
Antares	112°16.3	-26°29.2
Atria	107°10.8	-69°04.5
Sabik	102°03.1	-15°45.3
Shaula	96°10.7	-37°07.4
Rasalhague	95°58.8	12°32.7
Eltanin	90°42.2	51°29.4
Kaus Aust.	83°32.8	-34°22.4
Vega	80°33.3	38°48.6
Nunki	75°47.9	-26°16.0
Altair	62°00.0	8°56.1
Peacock	53°05.7	-56°39.5
Deneb	49°25.7	45°22.3
Enif	33°38.8	9°59.4
Al Na'ir	27°32.8	-46°50.5
Fomalhaut	15°14.4	-29°29.4
Scheat	13°45.1	28°13.1
Markab	13°29.9	15°20.4

Sep 12 Thu	SHA	Mer.pass
Venus	164°36.3	13:36
Mars	265°20.5	06:52
Jupiter	280°40.7	05:50
Saturn	12°16.3	23:41

Sep 13 Fri	SHA	Mer.pass
Venus	163°29.1	13:36
Mars	264°42.3	06:51
Jupiter	280°35.3	05:47
Saturn	12°20.6	23:37

Sep 14 Sat	SHA	Mer.pass
Venus	162°21.9	13:37
Mars	264°04.2	06:49
Jupiter	280°30.0	05:43
Saturn	12°24.8	23:32

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h — Sun — Moon

Thu	GHA	Dec	GHA	ν	Dec	d	HP
0	180°55.9	N04°04.0	83°06.4	6.6′	S28°39.2	0.7′	56.6′
1	195°56.1	03.0	97°32.0	6.6′	28°39.9	0.5′	56.6′
2	210°56.3	02.1	111°57.6	6.5′	28°40.4	0.4′	56.7′
3	225°56.5	·· 01.1	126°23.1	6.5′	28°40.8	0.2′	56.7′
4	240°56.8	04°00.2	140°48.6	6.4′	28°41.0	0.0′	56.8′
5	255°57.0	03°59.2	155°14.0	6.4′	28°41.0	0.1′	56.8′
6	270°57.2	N03°58.3	169°39.3	6.3′	S28°40.9	0.3′	56.8′
7	285°57.4	57.3	184°04.6	6.3′	28°40.6	0.5′	56.9′
8	300°57.6	56.4	198°29.9	6.2′	28°40.1	0.6′	56.9′
9	315°57.9	·· 55.4	212°55.1	6.2′	28°39.5	0.8′	56.9′
10	330°58.1	54.5	227°20.3	6.1′	28°38.7	1.0′	57.0′
11	345°58.3	53.5	241°45.5	6.1′	28°37.7	1.1′	57.0′
12	0°58.5	N03°52.5	256°10.6	6.1′	S28°36.6	1.4′	57.1′
13	15°58.7	51.6	270°35.6	6.0′	28°35.2	1.5′	57.1′
14	30°59.0	50.6	285°00.7	6.0′	28°33.7	1.7′	57.1′
15	45°59.2	·· 49.7	299°25.7	6.0′	28°32.0	1.8′	57.2′
16	60°59.4	48.7	313°50.6	5.9′	28°30.2	2.0′	57.2′
17	75°59.6	47.8	328°15.6	5.9′	28°28.2	2.2′	57.2′
18	90°59.9	N03°46.8	342°40.5	5.9′	S28°26.0	2.4′	57.3′
19	106°00.1	45.8	357°05.4	5.9′	28°23.6	2.5′	57.3′
20	121°00.3	44.9	11°30.2	5.8′	28°21.1	2.8′	57.4′
21	136°00.5	·· 43.9	25°55.1	5.8′	28°18.3	2.9′	57.4′
22	151°00.7	43.0	40°19.9	5.8′	28°15.4	3.0′	57.4′
23	166°01.0	42.0	54°44.7	5.8′	28°12.4	3.3′	57.5′
	SD = 15.9′	d = -1.0′	SD = 15.4′				

Fri	GHA	Dec	GHA	ν	Dec	d	HP
0	181°01.2	N03°41.1	69°09.5	5.8′	S28°09.1	3.4′	57.5′
1	196°01.4	40.1	83°34.3	5.8′	28°05.7	3.6′	57.6′
2	211°01.6	39.1	97°59.0	5.7′	28°02.1	3.8′	57.6′
3	226°01.9	·· 38.2	112°23.8	5.7′	27°58.3	4.0′	57.6′
4	241°02.1	37.2	126°48.5	5.7′	27°54.3	4.1′	57.7′
5	256°02.3	36.3	141°13.2	5.7′	27°50.2	4.3′	57.7′
6	271°02.5	N03°35.3	155°38.0	5.7′	S27°45.9	4.5′	57.8′
7	286°02.8	34.4	170°02.7	5.7′	27°41.4	4.7′	57.8′
8	301°03.0	33.4	184°27.4	5.7′	27°36.7	4.8′	57.8′
9	316°03.2	·· 32.4	198°52.2	5.7′	27°31.9	5.1′	57.9′
10	331°03.4	31.5	213°16.9	5.7′	27°26.8	5.2′	57.9′
11	346°03.6	30.5	227°41.6	5.7′	27°21.6	5.3′	58.0′
12	1°03.9	N03°29.6	242°06.3	5.7′	S27°16.3	5.6′	58.0′
13	16°04.1	28.6	256°31.1	5.8′	27°10.7	5.7′	58.0′
14	31°04.3	27.7	270°55.8	5.8′	27°05.0	5.9′	58.1′
15	46°04.5	·· 26.7	285°20.6	5.8′	26°59.1	6.1′	58.1′
16	61°04.8	25.7	299°45.4	5.8′	26°53.0	6.3′	58.2′
17	76°05.0	24.8	314°10.2	5.8′	26°46.7	6.4′	58.2′
18	91°05.2	N03°23.8	328°35.0	5.8′	S26°40.3	6.6′	58.2′
19	106°05.4	22.9	342°59.8	5.8′	26°33.7	6.8′	58.3′
20	121°05.7	21.9	357°24.6	5.9′	26°26.9	6.9′	58.3′
21	136°05.9	·· 20.9	11°49.5	5.9′	26°20.0	7.2′	58.4′
22	151°06.1	20.0	26°14.4	5.9′	26°12.8	7.3′	58.4′
23	166°06.3	19.0	40°39.3	5.9′	26°05.5	7.5′	58.4′
	SD = 15.9′	d = -1.0′	SD = 15.7′				

Sat	GHA	Dec	GHA	ν	Dec	d	HP
0	181°06.5	N03°18.1	55°04.2	6.0′	S25°58.0	7.6′	58.5′
1	196°06.8	17.1	69°29.1	6.0′	25°50.4	7.8′	58.5′
2	211°07.0	16.1	83°54.1	6.0′	25°42.6	8.0′	58.6′
3	226°07.2	·· 15.2	98°19.1	6.0′	25°34.6	8.2′	58.6′
4	241°07.4	14.2	112°44.2	6.1′	25°26.4	8.3′	58.6′
5	256°07.7	13.3	127°09.3	6.1′	25°18.1	8.5′	58.7′
6	271°07.9	N03°12.3	141°34.4	6.1′	S25°09.6	8.7′	58.7′
7	286°08.1	11.3	155°59.5	6.2′	25°00.9	8.8′	58.8′
8	301°08.3	10.4	170°24.7	6.2′	24°52.1	9.0′	58.8′
9	316°08.6	·· 09.4	184°49.9	6.2′	24°43.1	9.2′	58.8′
10	331°08.8	08.5	199°15.1	6.3′	24°33.9	9.3′	58.9′
11	346°09.0	07.5	213°40.4	6.3′	24°24.6	9.5′	58.9′
12	1°09.2	N03°06.5	228°05.8	6.4′	S24°15.1	9.7′	59.0′
13	16°09.5	05.6	242°31.1	6.4′	24°05.4	9.8′	59.0′
14	31°09.7	04.6	256°56.5	6.5′	23°55.6	10.0′	59.0′
15	46°09.9	·· 03.7	271°22.0	6.5′	23°45.6	10.2′	59.1′
16	61°10.1	02.7	285°47.5	6.5′	23°35.4	10.3′	59.1′
17	76°10.3	01.7	300°13.0	6.6′	23°25.1	10.4′	59.2′
18	91°10.6	N03°00.8	314°38.6	6.6′	S23°14.7	10.7′	59.2′
19	106°10.8	02°59.8	329°04.2	6.7′	23°04.0	10.7′	59.2′
20	121°11.0	58.9	343°29.9	6.7′	22°53.3	11.0′	59.3′
21	136°11.2	·· 57.9	357°55.7	6.8′	22°42.3	11.1′	59.3′
22	151°11.5	56.9	12°21.4	6.8′	22°31.2	11.2′	59.4′
23	166°11.7	56.0	26°47.3	6.9′	22°20.0	11.4′	59.4′
	SD = 15.9′	d = -1.0′	SD = 15.9′				

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

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

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 58-78%
12	03:43	03:54	11:56	19:12	06:43	
13	04:05	04:15	11:56	20:11	07:41	
14	04:26	04:37	11:55	21:09	08:40	

September 15, 16, 17 UT (Sun., Monday., Tue.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	354°27.0	155°41.4	S07°24.0	257°53.3	N23°28.7	274°51.9	N22°23.1	6°56.0	S07°44.2
1	9°29.4	170°41.1	25.3	272°54.2	28.6	289°54.1	23.1	21°58.6	44.3
2	24°31.9	185°40.7	26.5	287°55.1	28.6	304°56.4	23.1	37°01.2	44.3
3	39°34.3	200°40.4	·· 27.8	302°56.0	·· 28.6	319°58.6	·· 23.1	52°03.9	·· 44.4
4	54°36.8	215°40.0	29.0	317°56.8	28.6	335°00.9	23.1	67°06.5	44.5
5	69°39.3	230°39.7	30.3	332°57.7	28.6	350°03.2	23.1	82°09.2	44.6
6	84°41.7	245°39.4	S07°31.5	347°58.6	N23°28.6	5°05.4	N22°23.2	97°11.8	S07°44.6
7	99°44.2	260°39.0	32.8	2°59.5	28.6	20°07.7	23.2	112°14.4	44.7
8	114°46.7	275°38.7	34.0	18°00.4	28.5	35°09.9	23.2	127°17.1	44.8
9	129°49.1	290°38.3	·· 35.3	33°01.3	·· 28.5	50°12.2	·· 23.2	142°19.7	·· 44.9
10	144°51.6	305°38.0	36.5	48°02.2	28.5	65°14.4	23.2	157°22.4	44.9
11	159°54.1	320°37.6	37.8	63°03.1	28.5	80°16.7	23.2	172°25.0	45.0
12	174°56.5	335°37.3	S07°39.0	78°04.0	N23°28.5	95°19.0	N22°23.2	187°27.6	S07°45.1
13	189°59.0	350°36.9	40.3	93°04.9	28.5	110°21.2	23.2	202°30.3	45.2
14	205°01.4	5°36.6	41.5	108°05.8	28.4	125°23.5	23.3	217°32.9	45.2
15	220°03.9	20°36.2	·· 42.8	123°06.7	·· 28.4	140°25.7	·· 23.3	232°35.6	·· 45.3
16	235°06.4	35°35.9	44.0	138°07.6	28.4	155°28.0	23.3	247°38.2	45.4
17	250°08.8	50°35.5	45.2	153°08.5	28.4	170°30.3	23.3	262°40.8	45.4
18	265°11.3	65°35.2	S07°46.5	168°09.4	N23°28.4	185°32.5	N22°23.3	277°43.5	S07°45.5
19	280°13.8	80°34.8	47.7	183°10.3	28.3	200°34.8	23.3	292°46.1	45.6
20	295°16.2	95°34.5	49.0	198°11.2	28.3	215°37.1	23.3	307°48.7	45.7
21	310°18.7	110°34.1	·· 50.2	213°12.1	·· 28.3	230°39.3	·· 23.3	322°51.4	·· 45.7
22	325°21.2	125°33.8	51.5	228°12.9	28.3	245°41.6	23.4	337°54.0	45.8
23	340°23.6	140°33.4	52.7	243°13.8	28.3	260°43.8	23.4	352°56.7	45.9
Mer.pass. 00:22		ν -0.3′	d -1.2′	m -3.87	ν 0.9′	d -0.0′	m 0.60	ν 2.3′	d 0.0′ m -2.35	ν 2.6′	d -0.1′ m 0.60

Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	355°26.1	155°33.1	S07°54.0	258°14.7	N23°28.2	275°46.1	N22°23.4	7°59.3	S07°46.0
1	10°28.6	170°32.7	55.2	273°15.6	28.2	290°48.4	23.4	23°01.9	46.0
2	25°31.0	185°32.4	56.4	288°16.5	28.2	305°50.6	23.4	38°04.6	46.1
3	40°33.5	200°32.0	·· 57.7	303°17.4	·· 28.2	320°52.9	·· 23.4	53°07.2	·· 46.2
4	55°35.9	215°31.7	07°58.9	318°18.3	28.2	335°55.2	23.4	68°09.9	46.3
5	70°38.4	230°31.3	08°00.2	333°19.2	28.1	350°57.4	23.4	83°12.5	46.3
6	85°40.9	245°31.0	S08°01.4	348°20.1	N23°28.1	5°59.7	N22°23.4	98°15.1	S07°46.4
7	100°43.3	260°30.6	02.7	3°21.0	28.1	21°02.0	23.5	113°17.8	46.5
8	115°45.8	275°30.3	03.9	18°21.9	28.1	36°04.2	23.5	128°20.4	46.6
9	130°48.3	290°29.9	·· 05.1	33°22.8	·· 28.1	51°06.5	·· 23.5	143°23.1	·· 46.6
10	145°50.7	305°29.5	06.4	48°23.7	28.0	66°08.8	23.5	158°25.7	46.7
11	160°53.2	320°29.2	07.6	63°24.6	28.0	81°11.0	23.5	173°28.3	46.8
12	175°55.7	335°28.8	S08°08.9	78°25.5	N23°28.0	96°13.3	N22°23.5	188°31.0	S07°46.9
13	190°58.1	350°28.5	10.1	93°26.5	28.0	111°15.6	23.5	203°33.6	46.9
14	206°00.6	5°28.1	11.3	108°27.4	28.0	126°17.8	23.5	218°36.2	47.0
15	221°03.1	20°27.8	·· 12.6	123°28.3	·· 27.9	141°20.1	·· 23.6	233°38.9	·· 47.1
16	236°05.5	35°27.4	13.8	138°29.2	27.9	156°22.4	23.6	248°41.5	47.1
17	251°08.0	50°27.1	15.1	153°30.1	27.9	171°24.6	23.6	263°44.2	47.2
18	266°10.4	65°26.7	S08°16.3	168°31.0	N23°27.9	186°26.9	N22°23.6	278°46.8	S07°47.3
19	281°12.9	80°26.4	17.5	183°31.9	27.8	201°29.2	23.6	293°49.4	47.4
20	296°15.4	95°26.0	18.8	198°32.8	27.8	216°31.4	23.6	308°52.1	47.4
21	311°17.8	110°25.6	·· 20.0	213°33.7	·· 27.8	231°33.7	·· 23.6	323°54.7	·· 47.5
22	326°20.3	125°25.3	21.2	228°34.6	27.8	246°36.0	23.6	338°57.4	47.6
23	341°22.8	140°24.9	22.5	243°35.5	27.7	261°38.3	23.6	354°00.0	47.7
Mer.pass. 00:18		ν -0.4′	d -1.2′	m -3.87	ν 0.9′	d -0.0′	m 0.59	ν 2.3′	d 0.0′ m -2.36	ν 2.6′	d -0.1′ m 0.60

Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	356°25.2	155°24.6	S08°23.7	258°36.4	N23°27.7	276°40.5	N22°23.7	9°02.6	S07°47.7
1	11°27.7	170°24.2	25.0	273°37.3	27.7	291°42.8	23.7	24°05.3	47.8
2	26°30.2	185°23.9	26.2	288°38.2	27.7	306°45.1	23.7	39°07.9	47.9
3	41°32.6	200°23.5	·· 27.4	303°39.1	·· 27.6	321°47.3	·· 23.7	54°10.5	·· 48.0
4	56°35.1	215°23.1	28.7	318°40.0	27.6	336°49.6	23.7	69°13.2	48.0
5	71°37.5	230°22.8	29.9	333°40.9	27.6	351°51.9	23.7	84°15.8	48.1
6	86°40.0	245°22.4	S08°31.1	348°41.8	N23°27.6	6°54.2	N22°23.7	99°18.5	S07°48.2
7	101°42.5	260°22.1	32.4	3°42.8	27.5	21°56.4	23.7	114°21.1	48.2
8	116°44.9	275°21.7	33.6	18°43.7	27.5	36°58.7	23.7	129°23.7	48.3
9	131°47.4	290°21.3	·· 34.8	33°44.6	·· 27.5	52°01.0	·· 23.8	144°26.4	·· 48.4
10	146°49.9	305°21.0	36.1	48°45.5	27.5	67°03.3	23.8	159°29.0	48.5
11	161°52.3	320°20.6	37.3	63°46.4	27.4	82°05.5	23.8	174°31.6	48.5
12	176°54.8	335°20.3	S08°38.5	78°47.3	N23°27.4	97°07.8	N22°23.8	189°34.3	S07°48.6
13	191°57.3	350°19.9	39.8	93°48.2	27.4	112°10.1	23.8	204°36.9	48.7
14	206°59.7	5°19.5	41.0	108°49.1	27.3	127°12.4	23.8	219°39.6	48.8
15	222°02.2	20°19.2	·· 42.2	123°50.0	·· 27.3	142°14.6	·· 23.8	234°42.2	·· 48.8
16	237°04.7	35°18.8	43.5	138°50.9	27.3	157°16.9	23.8	249°44.8	48.9
17	252°07.1	50°18.5	44.7	153°51.9	27.3	172°19.2	23.8	264°47.5	49.0
18	267°09.6	65°18.1	S08°45.9	168°52.8	N23°27.2	187°21.5	N22°23.9	279°50.1	S07°49.1
19	282°12.0	80°17.7	47.1	183°53.7	27.2	202°23.8	23.9	294°52.7	49.1
20	297°14.5	95°17.4	48.4	198°54.6	27.2	217°26.0	23.9	309°55.4	49.2
21	312°17.0	110°17.0	·· 49.6	213°55.5	·· 27.1	232°28.3	·· 23.9	324°58.0	·· 49.3
22	327°19.4	125°16.7	50.8	228°56.4	27.1	247°30.6	23.9	340°00.7	49.3
23	342°21.9	140°16.3	52.1	243°57.3	27.1	262°32.9	23.9	355°03.3	49.4
Mer.pass. 00:14		ν -0.4′	d -1.2′	m -3.88	ν 0.9′	d -0.0′	m 0.58	ν 2.3′	d 0.0′ m -2.36	ν 2.6′	d -0.1′ m 0.60

Stars

	SHA	Dec
Alpheratz	357°34.7	29°13.7
Ankaa	353°07.0	-42°10.2
Schedar	349°30.8	56°40.4
Diphda	348°47.2	-17°50.9
Achernar	335°19.8	-57°06.5
Hamal	327°51.2	23°34.8
Polaris	313°53.5	89°21.9
Acamar	315°11.7	-40°12.0
Menkar	314°06.2	4°11.3
Mirfak	308°28.4	49°56.8
Aldebaran	290°39.8	16°33.6
Rigel	281°04.1	-8°10.2
Capella	280°22.3	46°01.2
Bellatrix	278°23.2	6°22.5
Elnath	278°02.2	28°37.7
Alnilam	275°38.0	-1°11.0
Betelgeuse	270°52.4	7°24.8
Canopus	263°52.6	-52°42.1
Sirius	258°26.6	-16°44.7
Adhara	255°06.2	-29°00.0
Procyon	244°51.3	5°09.8
Pollux	243°17.8	27°58.0
Avior	234°15.3	-59°35.0
Suhail	222°46.9	-43°31.7
Miaplacidus	221°39.2	-69°48.8
Alphard	217°48.3	-8°45.7
Regulus	207°35.0	11°50.9
Dubhe	193°41.9	61°37.1
Denebola	182°25.5	14°26.2
Gienah	175°44.2	-17°40.6
Acrux	173°01.1	-63°14.2
Gacrux	171°52.6	-57°15.1
Alioth	166°13.7	55°49.7
Spica	158°22.9	-11°17.3
Alkaid	152°52.6	49°11.6
Hadar	148°36.9	-60°29.6
Menkent	147°58.3	-36°29.5
Arcturus	145°48.4	19°03.4
Rigil Kent.	139°41.2	-60°56.4
Kochab	137°20.5	74°03.4
Zuben'ubi	136°56.5	-16°08.6
Alphecca	126°04.1	26°38.1
Antares	112°16.3	-26°29.2
Atria	107°10.8	-69°04.5
Sabik	102°03.1	-15°45.3
Shaula	96°10.7	-37°07.4
Rasalhague	95°58.8	12°32.7
Eltanin	90°42.3	51°29.4
Kaus Aust.	83°32.8	-34°22.5
Vega	80°33.3	38°48.6
Nunki	75°48.0	-26°16.0
Altair	62°00.0	8°56.1
Peacock	53°05.7	-56°39.5
Deneb	49°25.7	45°22.3
Enif	33°38.8	9°59.4
Al Na'ir	27°32.8	-46°50.5
Fomalhaut	15°14.4	-29°29.4
Scheat	13°45.1	28°13.1
Markab	13°29.8	15°20.4

Sep 15 Sun	SHA	Mer.pass
Venus	161°14.5	13:38
Mars	263°26.3	06:48
Jupiter	280°24.9	05:40
Saturn	12°29.0	23:28

Sep 16 Mon	SHA	Mer.pass
Venus	160°07.0	13:38
Mars	262°48.7	06:47
Jupiter	280°20.0	05:36
Saturn	12°33.2	23:24

Sep 17 Tue	SHA	Mer.pass
Venus	158°59.3	13:39
Mars	262°11.2	06:45
Jupiter	280°15.3	05:32
Saturn	12°37.4	23:20

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	181°11.9	N02°55.0	41°13.1	6.9′	S22°08.6	11.6′	59.4′
1	196°12.1	54.0	55°39.1	7.0′	21°57.0	11.7′	59.5′
2	211°12.4	53.1	70°05.0	7.0′	21°45.3	11.8′	59.5′
3	226°12.6	·· 52.1	84°31.1	7.1′	21°33.5	12.0′	59.5′
4	241°12.8	51.2	98°57.1	7.1′	21°21.5	12.1′	59.6′
5	256°13.0	50.2	113°23.3	7.2′	21°09.4	12.3′	59.6′
6	271°13.3	N02°49.2	127°49.5	7.2′	S20°57.1	12.5′	59.6′
7	286°13.5	48.3	142°15.7	7.3′	20°44.6	12.5′	59.7′
8	301°13.7	47.3	156°42.0	7.3′	20°32.1	12.8′	59.7′
9	316°13.9	·· 46.3	171°08.3	7.4′	20°19.3	12.8′	59.8′
10	331°14.2	45.4	185°34.7	7.5′	20°06.5	13.0′	59.8′
11	346°14.4	44.4	200°01.2	7.5′	19°53.5	13.1′	59.8′
12	1°14.6	N02°43.5	214°27.7	7.6′	S19°40.4	13.3′	59.9′
13	16°14.8	42.5	228°54.3	7.6′	19°27.1	13.4′	59.9′
14	31°15.0	41.5	243°20.9	7.7′	19°13.7	13.5′	59.9′
15	46°15.3	·· 40.6	257°47.5	7.7′	19°00.2	13.7′	60.0′
16	61°15.5	39.6	272°14.3	7.8′	18°46.5	13.8′	60.0′
17	76°15.7	38.6	286°41.1	7.8′	18°32.7	13.9′	60.0′
18	91°15.9	N02°37.7	301°07.9	7.9′	S18°18.8	14.1′	60.1′
19	106°16.2	36.7	315°34.8	7.9′	18°04.7	14.1′	60.1′
20	121°16.4	35.7	330°01.7	8.0′	17°50.6	14.3′	60.1′
21	136°16.6	·· 34.8	344°28.7	8.0′	17°36.3	14.4′	60.2′
22	151°16.8	33.8	358°55.8	8.1′	17°21.9	14.6′	60.2′
23	166°17.1	32.9	13°22.9	8.2′	17°07.3	14.6′	60.2′
	SD = 15.9′	d = -1.0′	SD = 16.2′				

Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	181°17.3	N02°31.9	27°50.0	8.2′	S16°52.7	14.8′	60.3′
1	196°17.5	30.9	42°17.2	8.3′	16°37.9	14.9′	60.3′
2	211°17.7	30.0	56°44.5	8.3′	16°23.0	15.0′	60.3′
3	226°18.0	·· 29.0	71°11.8	8.4′	16°08.0	15.1′	60.4′
4	241°18.2	28.0	85°39.2	8.4′	15°52.9	15.2′	60.4′
5	256°18.4	27.1	100°06.6	8.5′	15°37.7	15.3′	60.4′
6	271°18.6	N02°26.1	114°34.1	8.5′	S15°22.4	15.5′	60.4′
7	286°18.9	25.1	129°01.6	8.6′	15°06.9	15.5′	60.5′
8	301°19.1	24.2	143°29.2	8.6′	14°51.4	15.7′	60.5′
9	316°19.3	·· 23.2	157°56.8	8.7′	14°35.7	15.7′	60.5′
10	331°19.5	22.2	172°24.4	8.7′	14°20.0	15.9′	60.6′
11	346°19.8	21.3	186°52.2	8.8′	14°04.1	15.9′	60.6′
12	1°20.0	N02°20.3	201°19.9	8.8′	S13°48.2	16.0′	60.6′
13	16°20.2	19.4	215°47.7	8.9′	13°32.2	16.2′	60.6′
14	31°20.4	18.4	230°15.6	8.9′	13°16.0	16.2′	60.7′
15	46°20.7	·· 17.4	244°43.5	9.0′	12°59.8	16.3′	60.7′
16	61°20.9	16.5	259°11.5	9.0′	12°43.5	16.4′	60.7′
17	76°21.1	15.5	273°39.5	9.0′	12°27.1	16.5′	60.7′
18	91°21.3	N02°14.5	288°07.5	9.1′	S12°10.6	16.6′	60.8′
19	106°21.6	13.6	302°35.6	9.1′	11°54.0	16.6′	60.8′
20	121°21.8	12.6	317°03.7	9.2′	11°37.4	16.8′	60.8′
21	136°22.0	·· 11.6	331°31.9	9.2′	11°20.6	16.8′	60.8′
22	151°22.2	10.7	346°00.1	9.2′	11°03.8	16.9′	60.9′
23	166°22.5	09.7	0°28.3	9.3′	10°46.9	17.0′	60.9′
	SD = 15.9′	d = -1.0′	SD = 16.4′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	181°22.7	N02°08.7	14°56.6	9.3′	S10°29.9	17.0′	60.9′
1	196°22.9	07.8	29°24.9	9.4′	10°12.9	17.1′	60.9′
2	211°23.1	06.8	43°53.3	9.4′	09°55.8	17.2′	60.9′
3	226°23.3	·· 05.8	58°21.7	9.4′	09°38.6	17.3′	61.0′
4	241°23.6	04.9	72°50.1	9.5′	09°21.3	17.3′	61.0′
5	256°23.8	03.9	87°18.6	9.5′	09°04.0	17.4′	61.0′
6	271°24.0	N02°02.9	101°47.1	9.5′	S08°46.6	17.4′	61.0′
7	286°24.2	02.0	116°15.6	9.6′	08°29.2	17.5′	61.0′
8	301°24.5	01.0	130°44.2	9.6′	08°11.7	17.5′	61.0′
9	316°24.7	02°00.0	145°12.8	9.6′	07°54.2	17.7′	61.1′
10	331°24.9	01°59.1	159°41.4	9.7′	07°36.5	17.6′	61.1′
11	346°25.1	58.1	174°10.1	9.7′	07°18.9	17.7′	61.1′
12	1°25.4	N01°57.1	188°38.7	9.7′	S07°01.2	17.8′	61.1′
13	16°25.6	56.2	203°07.5	9.7′	06°43.4	17.8′	61.1′
14	31°25.8	55.2	217°36.2	9.8′	06°25.6	17.9′	61.1′
15	46°26.0	·· 54.2	232°04.9	9.8′	06°07.7	17.9′	61.1′
16	61°26.3	53.3	246°33.7	9.8′	05°49.8	17.9′	61.2′
17	76°26.5	52.3	261°02.5	9.8′	05°31.9	18.0′	61.2′
18	91°26.7	N01°51.3	275°31.3	9.8′	S05°13.9	18.0′	61.2′
19	106°26.9	50.4	290°00.2	9.9′	04°55.9	18.1′	61.2′
20	121°27.2	49.4	304°29.0	9.9′	04°37.8	18.1′	61.2′
21	136°27.4	·· 48.4	318°57.9	9.9′	04°19.7	18.1′	61.2′
22	151°27.6	47.5	333°26.8	9.9′	04°01.6	18.1′	61.2′
23	166°27.8	46.5	347°55.7	9.9′	03°43.5	18.2′	61.2′
	SD = 15.9′	d = -1.0′	SD = 16.6′				

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

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

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 12-14 86-98%
15	04:48	04:58	11:55	22:04	09:37	
16	05:09	05:20	11:55	22:58	10:32	
17	05:31	05:41	11:54	23:50	11:24	

September 18, 19, 20 UT (Wed., Thu., Fri.)

	Aries	Venus		Mars		Jupiter		Saturn	
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	357°24.4	155°15.9	S08°53.3	258°58.3	N23°27.0	277°35.1	N22°23.9	10°05.9	S07°49.5
1	12°26.8	170°15.6	54.5	273°59.2	27.0	292°37.4	23.9	25°08.6	49.6
2	27°29.3	185°15.2	55.8	289°00.1	27.0	307°39.7	23.9	40°11.2	49.6
3	42°31.8	200°14.8	·· 57.0	304°01.0	·· 27.0	322°42.0	·· 24.0	55°13.8	·· 49.7
4	57°34.2	215°14.5	58.2	319°01.9	26.9	337°44.3	24.0	70°16.5	49.8
5	72°36.7	230°14.1	08°59.4	334°02.8	26.9	352°46.6	24.0	85°19.1	49.9
6	87°39.1	245°13.7	S09°00.7	349°03.7	N23°26.9	7°48.8	N22°24.0	100°21.8	S07°49.9
7	102°41.6	260°13.4	01.9	4°04.7	26.8	22°51.1	24.0	115°24.4	50.0
8	117°44.1	275°13.0	03.1	19°05.6	26.8	37°53.4	24.0	130°27.0	50.1
9	132°46.5	290°12.6	·· 04.3	34°06.5	·· 26.8	52°55.7	·· 24.0	145°29.7	·· 50.1
10	147°49.0	305°12.3	05.6	49°07.4	26.7	67°58.0	24.0	160°32.3	50.2
11	162°51.5	320°11.9	06.8	64°08.3	26.7	83°00.2	24.0	175°34.9	50.3
12	177°53.9	335°11.5	S09°08.0	79°09.3	N23°26.7	98°02.5	N22°24.1	190°37.6	S07°50.4
13	192°56.4	350°11.2	09.2	94°10.2	26.6	113°04.8	24.1	205°40.2	50.4
14	207°58.9	5°10.8	10.5	109°11.1	26.6	128°07.1	24.1	220°42.9	50.5
15	223°01.3	20°10.4	·· 11.7	124°12.0	·· 26.6	143°09.4	·· 24.1	235°45.5	·· 50.6
16	238°03.8	35°10.1	12.9	139°12.9	26.5	158°11.7	24.1	250°48.1	50.7
17	253°06.3	50°09.7	14.1	154°13.9	26.5	173°14.0	24.1	265°50.8	50.7
18	268°08.7	65°09.3	S09°15.4	169°14.8	N23°26.5	188°16.2	N22°24.1	280°53.4	S07°50.8
19	283°11.2	80°09.0	16.6	184°15.7	26.4	203°18.5	24.1	295°56.0	50.9
20	298°13.6	95°08.6	17.8	199°16.6	26.4	218°20.8	24.1	310°58.7	50.9
21	313°16.1	110°08.2	·· 19.0	214°17.5	·· 26.4	233°23.1	·· 24.1	326°01.3	·· 51.0
22	328°18.6	125°07.9	20.3	229°18.5	26.3	248°25.4	24.2	341°04.0	51.1
23	343°21.0	140°07.5	21.5	244°19.4	26.3	263°27.7	24.2	356°06.6	51.2
Mer.pass. 00:10		ν -0.4′	d -1.2′	m -3.88	ν 0.9′	d -0.0′	m 0.58	ν 2.3′	d 0.0′ m -2.37	ν 2.6′	d -0.1′ m 0.61

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	358°23.5	155°07.1	S09°22.7	259°20.3	N23°26.3	278°30.0	N22°24.2	11°09.2	S07°51.2
1	13°26.0	170°06.8	23.9	274°21.2	26.2	293°32.2	24.2	26°11.9	51.3
2	28°28.4	185°06.4	25.1	289°22.2	26.2	308°34.5	24.2	41°14.5	51.4
3	43°30.9	200°06.0	·· 26.4	304°23.1	·· 26.2	323°36.8	·· 24.2	56°17.1	·· 51.4
4	58°33.4	215°05.6	27.6	319°24.0	26.1	338°39.1	24.2	71°19.8	51.5
5	73°35.8	230°05.3	28.8	334°24.9	26.1	353°41.4	24.2	86°22.4	51.6
6	88°38.3	245°04.9	S09°30.0	349°25.9	N23°26.0	8°43.7	N22°24.2	101°25.0	S07°51.7
7	103°40.7	260°04.5	31.2	4°26.8	26.0	23°46.0	24.2	116°27.7	51.7
8	118°43.2	275°04.2	32.4	19°27.7	26.0	38°48.3	24.3	131°30.3	51.8
9	133°45.7	290°03.8	·· 33.7	34°28.6	·· 25.9	53°50.6	·· 24.3	146°33.0	·· 51.9
10	148°48.1	305°03.4	34.9	49°29.6	25.9	68°52.8	24.3	161°35.6	51.9
11	163°50.6	320°03.0	36.1	64°30.5	25.9	83°55.1	24.3	176°38.2	52.0
12	178°53.1	335°02.7	S09°37.3	79°31.4	N23°25.8	98°57.4	N22°24.3	191°40.9	S07°52.1
13	193°55.5	350°02.3	38.5	94°32.3	25.8	113°59.7	24.3	206°43.5	52.2
14	208°58.0	5°01.9	39.7	109°33.3	25.7	129°02.0	24.3	221°46.1	52.2
15	224°00.5	20°01.5	·· 41.0	124°34.2	·· 25.7	144°04.3	·· 24.3	236°48.8	·· 52.3
16	239°02.9	35°01.2	42.2	139°35.1	25.7	159°06.6	24.3	251°51.4	52.4
17	254°05.4	50°00.8	43.4	154°36.0	25.6	174°08.9	24.3	266°54.0	52.5
18	269°07.9	65°00.4	S09°44.6	169°37.0	N23°25.6	189°11.2	N22°24.4	281°56.7	S07°52.5
19	284°10.3	80°00.0	45.8	184°37.9	25.6	204°13.5	24.4	296°59.3	52.6
20	299°12.8	94°59.7	47.0	199°38.8	25.5	219°15.8	24.4	312°02.0	52.7
21	314°15.2	109°59.3	·· 48.3	214°39.8	·· 25.5	234°18.1	·· 24.4	327°04.6	·· 52.7
22	329°17.7	124°58.9	49.5	229°40.7	25.4	249°20.4	24.4	342°07.2	52.8
23	344°20.2	139°58.5	50.7	244°41.6	25.4	264°22.7	24.4	357°09.9	52.9
Mer.pass. 00:06		ν -0.4′	d -1.2′	m -3.88	ν 0.9′	d -0.0′	m 0.57	ν 2.3′	d 0.0′ m -2.38	ν 2.6′	d -0.1′ m 0.61

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	359°22.6	154°58.2	S09°51.9	259°42.6	N23°25.4	279°25.0	N22°24.4	12°12.5	S07°53.0
1	14°25.1	169°57.8	53.1	274°43.5	25.3	294°27.3	24.4	27°15.1	53.0
2	29°27.6	184°57.4	54.3	289°44.4	25.3	309°29.5	24.4	42°17.8	53.1
3	44°30.0	199°57.0	·· 55.5	304°45.4	·· 25.2	324°31.8	·· 24.4	57°20.4	·· 53.2
4	59°32.5	214°56.6	56.7	319°46.3	25.2	339°34.1	24.5	72°23.0	53.2
5	74°35.0	229°56.3	57.9	334°47.2	25.1	354°36.4	24.5	87°25.7	53.3
6	89°37.4	244°55.9	S09°59.2	349°48.2	N23°25.1	9°38.7	N22°24.5	102°28.3	S07°53.4
7	104°39.9	259°55.5	10°00.4	4°49.1	25.1	24°41.0	24.5	117°30.9	53.5
8	119°42.4	274°55.1	01.6	19°50.0	25.0	39°43.3	24.5	132°33.6	53.5
9	134°44.8	289°54.8	·· 02.8	34°51.0	·· 25.0	54°45.6	·· 24.5	147°36.2	·· 53.6
10	149°47.3	304°54.4	04.0	49°51.9	24.9	69°47.9	24.5	162°38.8	53.7
11	164°49.7	319°54.0	05.2	64°52.8	24.9	84°50.2	24.5	177°41.5	53.7
12	179°52.2	334°53.6	S10°06.4	79°53.8	N23°24.9	99°52.5	N22°24.5	192°44.1	S07°53.8
13	194°54.7	349°53.2	07.6	94°54.7	24.8	114°54.8	24.5	207°46.8	53.9
14	209°57.1	4°52.8	08.8	109°55.6	24.8	129°57.1	24.5	222°49.4	54.0
15	224°59.6	19°52.5	·· 10.0	124°56.6	·· 24.7	144°59.4	·· 24.6	237°52.0	·· 54.0
16	240°02.1	34°52.1	11.2	139°57.5	24.7	160°01.7	24.6	252°54.7	54.1
17	255°04.5	49°51.7	12.4	154°58.5	24.6	175°04.0	24.6	267°57.3	54.2
18	270°07.0	64°51.3	S10°13.6	169°59.4	N23°24.6	190°06.3	N22°24.6	282°59.9	S07°54.2
19	285°09.5	79°50.9	14.9	185°00.3	24.5	205°08.6	24.6	298°02.6	54.3
20	300°11.9	94°50.6	16.1	200°01.3	24.5	220°10.9	24.6	313°05.2	54.4
21	315°14.4	109°50.2	·· 17.3	215°02.2	·· 24.5	235°13.2	·· 24.6	328°07.8	·· 54.5
22	330°16.8	124°49.8	18.5	230°03.1	24.4	250°15.5	24.6	343°10.5	54.5
23	345°19.3	139°49.4	19.7	245°04.1	24.4	265°17.8	24.6	358°13.1	54.6
Mer.pass. 23:59		ν -0.4′	d -1.2′	m -3.88	ν 0.9′	d -0.0′	m 0.56	ν 2.3′	d 0.0′ m -2.39	ν 2.6′	d -0.1′ m 0.61

Stars

	SHA	Dec
Alpheratz	357°34.7	29°13.7
Ankaa	353°07.0	-42°10.2
Schedar	349°30.8	56°40.4
Diphda	348°47.2	-17°50.9
Achernar	335°19.8	-57°06.5
Hamal	327°51.2	23°34.8
Polaris	313°52.4	89°21.9
Acamar	315°11.7	-40°12.0
Menkar	314°06.2	4°11.3
Mirfak	308°28.4	49°56.8
Aldebaran	290°39.8	16°33.6
Rigel	281°04.1	-8°10.2
Capella	280°22.2	46°01.3
Bellatrix	278°23.1	6°22.5
Elnath	278°02.2	28°37.7
Alnilam	275°38.0	-1°11.0
Betelgeuse	270°52.4	7°24.8
Canopus	263°52.6	-52°42.1
Sirius	258°26.6	-16°44.7
Adhara	255°06.2	-29°00.0
Procyon	244°51.3	5°09.8
Pollux	243°17.8	27°58.0
Avior	234°15.3	-59°35.0
Suhail	222°46.9	-43°31.6
Miaplacidus	221°39.1	-69°48.8
Alphard	217°48.3	-8°45.7
Regulus	207°35.0	11°50.9
Dubhe	193°41.9	61°37.1
Denebola	182°25.5	14°26.2
Gienah	175°44.2	-17°40.6
Acrux	173°01.2	-63°14.1
Gacrux	171°52.6	-57°15.1
Alioth	166°13.7	55°49.7
Spica	158°22.9	-11°17.3
Alkaid	152°52.6	49°11.6
Hadar	148°37.0	-60°29.6
Menkent	147°58.3	-36°29.5
Arcturus	145°48.4	19°03.4
Rigil Kent.	139°41.2	-60°56.4
Kochab	137°20.5	74°03.4
Zuben'ubi	136°56.5	-16°08.6
Alphecca	126°04.1	26°38.1
Antares	112°16.3	-26°29.2
Atria	107°10.9	-69°04.5
Sabik	102°03.1	-15°45.3
Shaula	96°10.7	-37°07.4
Rasalhague	95°58.8	12°32.7
Eltanin	90°42.3	51°29.4
Kaus Aust.	83°32.8	-34°22.5
Vega	80°33.3	38°48.6
Nunki	75°48.0	-26°16.0
Altair	62°00.1	8°56.1
Peacock	53°05.7	-56°39.5
Deneb	49°25.7	45°22.3
Enif	33°38.8	9°59.4
Al Na'ir	27°32.8	-46°50.5
Fomalhaut	15°14.4	-29°29.4
Scheat	13°45.1	28°13.1
Markab	13°29.8	15°20.4

Sep 18 Wed	SHA	Mer.pass
Venus	157°51.6	13:39
Mars	261°33.9	06:44
Jupiter	280°10.8	05:29
Saturn	12°41.6	23:16

Sep 19 Thu	SHA	Mer.pass
Venus	156°43.6	13:40
Mars	260°56.8	06:42
Jupiter	280°06.5	05:25
Saturn	12°45.7	23:11

Sep 20 Fri	SHA	Mer.pass
Venus	155°35.5	13:40
Mars	260°19.9	06:41
Jupiter	280°02.3	05:22
Saturn	12°49.9	23:07

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.1585 sec ΔT = TT-UT1 = +69.0255 sec

2024 September 18 to Sep. 20 UT

h

	Sun		Moon				
Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	181°28.1	N01°45.5	2°24.6	9.9′	S03°25.3	18.2′	61.2′
1	196°28.3	44.6	16°53.6	9.9′	03°07.1	18.2′	61.2′
2	211°28.5	43.6	31°22.5	10.0′	02°48.9	18.2′	61.3′
3	226°28.7	·· 42.6	45°51.5	10.0′	02°30.7	18.3′	61.3′
4	241°29.0	41.7	60°20.4	10.0′	02°12.4	18.3′	61.3′
5	256°29.2	40.7	74°49.4	10.0′	01°54.1	18.2′	61.3′
6	271°29.4	N01°39.7	89°18.4	10.0′	S01°35.9	18.3′	61.3′
7	286°29.6	38.8	103°47.4	10.0′	01°17.6	18.3′	61.3′
8	301°29.9	37.8	118°16.3	10.0′	00°59.3	18.4′	61.3′
9	316°30.1	·· 36.8	132°45.3	10.0′	00°40.9	18.3′	61.3′
10	331°30.3	35.9	147°14.3	10.0′	00°22.6	18.3′	61.3′
11	346°30.5	34.9	161°43.3	10.0′	S00°04.3	18.3′	61.3′
12	1°30.7	N01°33.9	176°12.3	10.0′	N00°14.0	18.3′	61.3′
13	16°31.0	32.9	190°41.3	10.0′	00°32.3	18.4′	61.3′
14	31°31.2	32.0	205°10.3	10.0′	00°50.7	18.3′	61.3′
15	46°31.4	·· 31.0	219°39.3	10.0′	01°09.0	18.3′	61.3′
16	61°31.6	30.0	234°08.3	10.0′	01°27.3	18.3′	61.3′
17	76°31.9	29.1	248°37.2	10.0′	01°45.6	18.3′	61.3′
18	91°32.1	N01°28.1	263°06.2	10.0′	N02°03.9	18.2′	61.3′
19	106°32.3	27.1	277°35.1	9.9′	02°22.1	18.3′	61.3′
20	121°32.5	26.2	292°04.1	9.9′	02°40.4	18.2′	61.3′
21	136°32.8	·· 25.2	306°33.0	9.9′	02°58.6	18.2′	61.3′
22	151°33.0	24.2	321°01.9	9.9′	03°16.8	18.2′	61.3′
23	166°33.2	23.3	335°30.8	9.9′	03°35.0	18.2′	61.3′
	SD = 15.9′	d = -1.0′	SD = 16.7′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	181°33.4	N01°22.3	349°59.7	9.9′	N03°53.2	18.2′	61.3′
1	196°33.7	21.3	4°28.6	9.9′	04°11.4	18.1′	61.3′
2	211°33.9	20.4	18°57.5	9.8′	04°29.5	18.1′	61.2′
3	226°34.1	·· 19.4	33°26.3	9.8′	04°47.6	18.0′	61.2′
4	241°34.3	18.4	47°55.1	9.8′	05°05.6	18.0′	61.2′
5	256°34.6	17.4	62°23.9	9.8′	05°23.6	18.0′	61.2′
6	271°34.8	N01°16.5	76°52.7	9.8′	N05°41.6	18.0′	61.2′
7	286°35.0	15.5	91°21.4	9.7′	05°59.6	17.9′	61.2′
8	301°35.2	14.5	105°50.2	9.7′	06°17.5	17.8′	61.2′
9	316°35.5	·· 13.6	120°18.9	9.7′	06°35.3	17.8′	61.2′
10	331°35.7	12.6	134°47.5	9.6′	06°53.1	17.8′	61.2′
11	346°35.9	11.6	149°16.2	9.6′	07°10.9	17.7′	61.2′
12	1°36.1	N01°10.7	163°44.8	9.6′	N07°28.6	17.7′	61.1′
13	16°36.3	09.7	178°13.4	9.6′	07°46.3	17.6′	61.1′
14	31°36.6	08.7	192°41.9	9.5′	08°03.9	17.6′	61.1′
15	46°36.8	·· 07.7	207°10.5	9.5′	08°21.5	17.5′	61.1′
16	61°37.0	06.8	221°39.0	9.5′	08°39.0	17.4′	61.1′
17	76°37.2	05.8	236°07.4	9.4′	08°56.4	17.4′	61.1′
18	91°37.5	N01°04.8	250°35.8	9.4′	N09°13.8	17.3′	61.1′
19	106°37.7	03.9	265°04.2	9.3′	09°31.1	17.3′	61.0′
20	121°37.9	02.9	279°32.6	9.3′	09°48.4	17.1′	61.0′
21	136°38.1	·· 01.9	294°00.9	9.3′	10°05.5	17.2′	61.0′
22	151°38.4	01.0	308°29.2	9.2′	10°22.7	17.0′	61.0′
23	166°38.6	00.0	322°57.4	9.2′	10°39.7	17.0′	61.0′
	SD = 15.9′	d = -1.0′	SD = 16.7′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	181°38.8	N00°59.0	337°25.6	9.1′	N10°56.7	16.9′	61.0′
1	196°39.0	58.0	351°53.7	9.1′	11°13.6	16.8′	60.9′
2	211°39.2	57.1	6°21.8	9.1′	11°30.4	16.7′	60.9′
3	226°39.5	·· 56.1	20°49.9	9.0′	11°47.1	16.7′	60.9′
4	241°39.7	55.1	35°17.9	9.0′	12°03.8	16.6′	60.9′
5	256°39.9	54.2	49°45.9	8.9′	12°20.4	16.5′	60.9′
6	271°40.1	N00°53.2	64°13.8	8.9′	N12°36.9	16.4′	60.8′
7	286°40.4	52.2	78°41.7	8.8′	12°53.3	16.3′	60.8′
8	301°40.6	51.3	93°09.5	8.8′	13°09.6	16.2′	60.8′
9	316°40.8	·· 50.3	107°37.3	8.7′	13°25.8	16.1′	60.8′
10	331°41.0	49.3	122°05.0	8.7′	13°41.9	16.1′	60.7′
11	346°41.3	48.3	136°32.7	8.6′	13°58.0	15.9′	60.7′
12	1°41.5	N00°47.4	151°00.3	8.6′	N14°13.9	15.9′	60.7′
13	16°41.7	46.4	165°27.9	8.5′	14°29.8	15.7′	60.7′
14	31°41.9	45.4	179°55.4	8.5′	14°45.5	15.6′	60.6′
15	46°42.1	·· 44.5	194°22.9	8.4′	15°01.1	15.6′	60.6′
16	61°42.4	43.5	208°50.3	8.4′	15°16.7	15.4′	60.6′
17	76°42.6	42.5	223°17.7	8.3′	15°32.1	15.3′	60.6′
18	91°42.8	N00°41.5	237°45.0	8.3′	N15°47.4	15.3′	60.5′
19	106°43.0	40.6	252°12.3	8.2′	16°02.7	15.1′	60.5′
20	121°43.3	39.6	266°39.5	8.1′	16°17.8	15.0′	60.5′
21	136°43.5	·· 38.6	281°06.6	8.1′	16°32.8	14.8′	60.5′
22	151°43.7	37.7	295°33.7	8.0′	16°47.6	14.8′	60.4′
23	166°43.9	36.7	310°00.7	8.0′	17°02.4	14.7′	60.4′
	SD = 15.9′	d = -1.0′	SD = 16.6′				

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

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

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 15-17 100-95%
18	05:52	06:03	11:54	–:–	12:16	
19	06:14	06:24	11:54	00:41	13:07	
20	06:35	06:46	11:53	01:34	14:00	

September 21, 22, 23 UT (Sat., Sun., Mon.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	0°21.8	154°49.0	S10°20.9	260°05.0	N23°24.3	280°20.2	N22°24.6	13°15.7	S07°54.7
1	15°24.2	169°48.6	22.1	275°06.0	24.3	295°22.5	24.6	28°18.4	54.7
2	30°26.7	184°48.2	23.3	290°06.9	24.2	310°24.8	24.7	43°21.0	54.8
3	45°29.2	199°47.9	·· 24.5	305°07.9	·· 24.2	325°27.1	·· 24.7	58°23.6	·· 54.9
4	60°31.6	214°47.5	25.7	320°08.8	24.1	340°29.4	24.7	73°26.3	54.9
5	75°34.1	229°47.1	26.9	335°09.7	24.1	355°31.7	24.7	88°28.9	55.0
6	90°36.6	244°46.7	S10°28.1	350°10.7	N23°24.0	10°34.0	N22°24.7	103°31.5	S07°55.1
7	105°39.0	259°46.3	29.3	5°11.6	24.0	25°36.3	24.7	118°34.2	55.2
8	120°41.5	274°45.9	30.5	20°12.6	24.0	40°38.6	24.7	133°36.8	55.2
9	135°44.0	289°45.5	·· 31.7	35°13.5	·· 23.9	55°40.9	·· 24.7	148°39.4	·· 55.3
10	150°46.4	304°45.2	32.9	50°14.5	23.9	70°43.2	24.7	163°42.1	55.4
11	165°48.9	319°44.8	34.1	65°15.4	23.8	85°45.5	24.7	178°44.7	55.4
12	180°51.3	334°44.4	S10°35.3	80°16.3	N23°23.8	100°47.8	N22°24.7	193°47.3	S07°55.5
13	195°53.8	349°44.0	36.5	95°17.3	23.7	115°50.1	24.8	208°50.0	55.6
14	210°56.3	4°43.6	37.7	110°18.2	23.7	130°52.4	24.8	223°52.6	55.7
15	225°58.7	19°43.2	·· 38.9	125°19.2	·· 23.6	145°54.8	·· 24.8	238°55.3	·· 55.7
16	241°01.2	34°42.8	40.1	140°20.1	23.6	160°57.1	24.8	253°57.9	55.8
17	256°03.7	49°42.4	41.3	155°21.1	23.5	175°59.4	24.8	269°00.5	55.9
18	271°06.1	64°42.0	S10°42.5	170°22.0	N23°23.5	191°01.7	N22°24.8	284°03.2	S07°55.9
19	286°08.6	79°41.7	43.7	185°23.0	23.4	206°04.0	24.8	299°05.8	56.0
20	301°11.1	94°41.3	44.9	200°23.9	23.4	221°06.3	24.8	314°08.4	56.1
21	316°13.5	109°40.9	·· 46.1	215°24.9	·· 23.3	236°08.6	·· 24.8	329°11.1	·· 56.1
22	331°16.0	124°40.5	47.3	230°25.8	23.3	251°10.9	24.8	344°13.7	56.2
23	346°18.5	139°40.1	48.4	245°26.8	23.2	266°13.2	24.8	359°16.3	56.3
Mer.pass. 23:55		ν -0.4′	d -1.2′	m -3.88	ν 0.9′	d -0.0′	m 0.55	ν 2.3′	d 0.0′ m -2.39	ν 2.6′	d -0.1′ m 0.62

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	1°20.9	154°39.7	S10°49.6	260°27.7	N23°23.2	281°15.5	N22°24.8	14°19.0	S07°56.4
1	16°23.4	169°39.3	50.8	275°28.7	23.1	296°17.9	24.9	29°21.6	56.4
2	31°25.8	184°38.9	52.0	290°29.6	23.1	311°20.2	24.9	44°24.2	56.5
3	46°28.3	199°38.5	·· 53.2	305°30.6	·· 23.0	326°22.5	·· 24.9	59°26.9	·· 56.6
4	61°30.8	214°38.1	54.4	320°31.5	23.0	341°24.8	24.9	74°29.5	56.6
5	76°33.2	229°37.7	55.6	335°32.5	22.9	356°27.1	24.9	89°32.1	56.7
6	91°35.7	244°37.3	S10°56.8	350°33.4	N23°22.9	11°29.4	N22°24.9	104°34.8	S07°56.8
7	106°38.2	259°36.9	58.0	5°34.4	22.8	26°31.7	24.9	119°37.4	56.8
8	121°40.6	274°36.5	10°59.2	20°35.3	22.8	41°34.1	24.9	134°40.0	56.9
9	136°43.1	289°36.1	11°00.4	35°36.3	·· 22.7	56°36.4	·· 24.9	149°42.7	·· 57.0
10	151°45.6	304°35.8	01.6	50°37.2	22.7	71°38.7	24.9	164°45.3	57.1
11	166°48.0	319°35.4	02.7	65°38.2	22.6	86°41.0	24.9	179°47.9	57.1
12	181°50.5	334°35.0	S11°03.9	80°39.1	N23°22.6	101°43.3	N22°24.9	194°50.6	S07°57.2
13	196°52.9	349°34.6	05.1	95°40.1	22.5	116°45.6	25.0	209°53.2	57.3
14	211°55.4	4°34.2	06.3	110°41.0	22.5	131°47.9	25.0	224°55.8	57.3
15	226°57.9	19°33.8	·· 07.5	125°42.0	·· 22.4	146°50.3	·· 25.0	239°58.5	·· 57.4
16	242°00.3	34°33.4	08.7	140°42.9	22.4	161°52.6	25.0	255°01.1	57.5
17	257°02.8	49°33.0	09.9	155°43.9	22.3	176°54.9	25.0	270°03.7	57.5
18	272°05.3	64°32.6	S11°11.1	170°44.9	N23°22.3	191°57.2	N22°25.0	285°06.3	S07°57.6
19	287°07.7	79°32.2	12.2	185°45.8	22.2	206°59.5	25.0	300°09.0	57.7
20	302°10.2	94°31.8	13.4	200°46.8	22.1	222°01.9	25.0	315°11.6	57.8
21	317°12.7	109°31.4	·· 14.6	215°47.7	·· 22.1	237°04.2	·· 25.0	330°14.2	·· 57.8
22	332°15.1	124°31.0	15.8	230°48.7	22.0	252°06.5	25.0	345°16.9	57.9
23	347°17.6	139°30.6	17.0	245°49.6	22.0	267°08.8	25.0	0°19.5	58.0
Mer.pass. 23:51		ν -0.4′	d -1.2′	m -3.89	ν 0.9′	d -0.1′	m 0.54	ν 2.3′	d 0.0′ m -2.40	ν 2.6′	d -0.1′ m 0.62

Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	2°20.1	154°30.2	S11°18.2	260°50.6	N23°21.9	282°11.1	N22°25.0	15°22.1	S07°58.0
1	17°22.5	169°29.8	19.4	275°51.6	21.9	297°13.5	25.1	30°24.8	58.1
2	32°25.0	184°29.4	20.5	290°52.5	21.8	312°15.8	25.1	45°27.4	58.2
3	47°27.4	199°29.0	·· 21.7	305°53.5	·· 21.8	327°18.1	·· 25.1	60°30.0	·· 58.2
4	62°29.9	214°28.6	22.9	320°54.4	21.7	342°20.4	25.1	75°32.7	58.3
5	77°32.4	229°28.2	24.1	335°55.4	21.7	357°22.7	25.1	90°35.3	58.4
6	92°34.8	244°27.8	S11°25.3	350°56.4	N23°21.6	12°25.1	N22°25.1	105°37.9	S07°58.4
7	107°37.3	259°27.4	26.4	5°57.3	21.5	27°27.4	25.1	120°40.6	58.5
8	122°39.8	274°27.0	27.6	20°58.3	21.5	42°29.7	25.1	135°43.2	58.6
9	137°42.2	289°26.6	·· 28.8	35°59.2	·· 21.4	57°32.0	·· 25.1	150°45.8	·· 58.7
10	152°44.7	304°26.1	30.0	51°00.2	21.4	72°34.4	25.1	165°48.5	58.7
11	167°47.2	319°25.7	31.2	66°01.2	21.3	87°36.7	25.1	180°51.1	58.8
12	182°49.6	334°25.3	S11°32.3	81°02.1	N23°21.3	102°39.0	N22°25.1	195°53.7	S07°58.9
13	197°52.1	349°24.9	33.5	96°03.1	21.2	117°41.3	25.1	210°56.4	58.9
14	212°54.6	4°24.5	34.7	111°04.1	21.1	132°43.7	25.2	225°59.0	59.0
15	227°57.0	19°24.1	·· 35.9	126°05.0	·· 21.1	147°46.0	·· 25.2	241°01.6	·· 59.1
16	242°59.5	34°23.7	37.1	141°06.0	21.0	162°48.3	25.2	256°04.3	59.1
17	258°01.9	49°23.3	38.2	156°07.0	21.0	177°50.6	25.2	271°06.9	59.2
18	273°04.4	64°22.9	S11°39.4	171°07.9	N23°20.9	192°53.0	N22°25.2	286°09.5	S07°59.3
19	288°06.9	79°22.5	40.6	186°08.9	20.9	207°55.3	25.2	301°12.1	59.3
20	303°09.3	94°22.1	41.8	201°09.8	20.8	222°57.6	25.2	316°14.8	59.4
21	318°11.8	109°21.7	·· 42.9	216°10.8	·· 20.7	237°59.9	·· 25.2	331°17.4	·· 59.5
22	333°14.3	124°21.3	44.1	231°11.8	20.7	253°02.3	25.2	346°20.0	59.6
23	348°16.7	139°20.9	45.3	246°12.8	20.6	268°04.6	25.2	1°22.7	59.6
Mer.pass. 23:47		ν -0.4′	d -1.2′	m -3.89	ν 1.0′	d -0.1′	m 0.53	ν 2.3′	d 0.0′ m -2.41	ν 2.6′	d -0.1′ m 0.63

Stars

	SHA	Dec
Alpheratz	357°34.7	29°13.7
Ankaa	353°07.0	-42°10.2
Schedar	349°30.8	56°40.4
Diphda	348°47.2	-17°50.9
Achernar	335°19.8	-57°06.5
Hamal	327°51.2	23°34.8
Polaris	313°51.0	89°21.9
Acamar	315°11.7	-40°12.1
Menkar	314°06.2	4°11.3
Mirfak	308°28.3	49°56.8
Aldebaran	290°39.8	16°33.6
Rigel	281°04.1	-8°10.2
Capella	280°22.2	46°01.2
Bellatrix	278°23.1	6°22.5
Elnath	278°02.1	28°37.7
Alnilam	275°38.0	-1°11.0
Betelgeuse	270°52.4	7°24.8
Canopus	263°52.6	-52°42.1
Sirius	258°26.5	-16°44.7
Adhara	255°06.2	-29°00.0
Procyon	244°51.2	5°09.8
Pollux	243°17.8	27°58.0
Avior	234°15.2	-59°35.0
Suhail	222°46.8	-43°31.6
Miaplacidus	221°39.1	-69°48.8
Alphard	217°48.3	-8°45.7
Regulus	207°35.0	11°50.9
Dubhe	193°41.9	61°37.1
Denebola	182°25.5	14°26.2
Gienah	175°44.2	-17°40.6
Acrux	173°01.2	-63°14.1
Gacrux	171°52.6	-57°15.0
Alioth	166°13.7	55°49.7
Spica	158°22.9	-11°17.3
Alkaid	152°52.6	49°11.6
Hadar	148°37.0	-60°29.6
Menkent	147°58.3	-36°29.5
Arcturus	145°48.4	19°03.4
Rigil Kent.	139°41.2	-60°56.3
Kochab	137°20.5	74°03.4
Zuben'ubi	136°56.6	-16°08.6
Alphecca	126°04.2	26°38.1
Antares	112°16.3	-26°29.2
Atria	107°10.9	-69°04.5
Sabik	102°03.1	-15°45.3
Shaula	96°10.8	-37°07.4
Rasalhague	95°58.8	12°32.7
Eltanin	90°42.3	51°29.4
Kaus Aust.	83°32.8	-34°22.5
Vega	80°33.3	38°48.6
Nunki	75°48.0	-26°16.0
Altair	62°00.1	8°56.1
Peacock	53°05.8	-56°39.5
Deneb	49°25.7	45°22.3
Enif	33°38.8	9°59.4
Al Na'ir	27°32.8	-46°50.5
Fomalhaut	15°14.4	-29°29.4
Scheat	13°45.1	28°13.1
Markab	13°29.8	15°20.4

Sep 21 Sat	SHA	Mer.pass
Venus	154°27.2	13:41
Mars	259°43.3	06:39
Jupiter	279°58.4	05:18
Saturn	12°54.0	23:03

Sep 22 Sun	SHA	Mer.pass
Venus	153°18.8	13:42
Mars	259°06.8	06:38
Jupiter	279°54.6	05:14
Saturn	12°58.0	22:59

Sep 23 Mon	SHA	Mer.pass
Venus	152°10.1	13:42
Mars	258°30.5	06:36
Jupiter	279°51.1	05:10
Saturn	13°02.1	22:55

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	181°44.1	N00°35.7	324°27.7	7.9′	N17°17.1	14.5′	60.4′
1	196°44.4	34.7	338°54.6	7.9′	17°31.6	14.4′	60.3′
2	211°44.6	33.8	353°21.5	7.8′	17°46.0	14.3′	60.3′
3	226°44.8	·· 32.8	7°48.3	7.7′	18°00.3	14.1′	60.3′
4	241°45.0	31.8	22°15.0	7.7′	18°14.4	14.1′	60.3′
5	256°45.3	30.9	36°41.7	7.6′	18°28.5	13.9′	60.2′
6	271°45.5	N00°29.9	51°08.4	7.6′	N18°42.4	13.8′	60.2′
7	286°45.7	28.9	65°34.9	7.5′	18°56.2	13.6′	60.2′
8	301°45.9	27.9	80°01.4	7.5′	19°09.8	13.5′	60.1′
9	316°46.1	·· 27.0	94°27.9	7.4′	19°23.3	13.4′	60.1′
10	331°46.4	26.0	108°54.3	7.3′	19°36.7	13.3′	60.1′
11	346°46.6	25.0	123°20.6	7.3′	19°50.0	13.1′	60.0′
12	1°46.8	N00°24.1	137°46.9	7.2′	N20°03.1	13.0′	60.0′
13	16°47.0	23.1	152°13.1	7.2′	20°16.1	12.8′	60.0′
14	31°47.3	22.1	166°39.3	7.1′	20°28.9	12.7′	59.9′
15	46°47.5	·· 21.1	181°05.4	7.0′	20°41.6	12.5′	59.9′
16	61°47.7	20.2	195°31.4	7.0′	20°54.1	12.5′	59.9′
17	76°47.9	19.2	209°57.4	6.9′	21°06.6	12.2′	59.8′
18	91°48.1	N00°18.2	224°23.4	6.9′	N21°18.8	12.1′	59.8′
19	106°48.4	17.2	238°49.2	6.8′	21°30.9	12.0′	59.8′
20	121°48.6	16.3	253°15.0	6.8′	21°42.9	11.8′	59.7′
21	136°48.8	·· 15.3	267°40.8	6.7′	21°54.7	11.7′	59.7′
22	151°49.0	14.3	282°06.5	6.7′	22°06.4	11.5′	59.7′
23	166°49.2	13.4	296°32.2	6.6′	22°17.9	11.4′	59.6′
	SD = 15.9′	d = -1.0′	SD = 16.5′				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	181°49.5	N00°12.4	310°57.8	6.5′	N22°29.3	11.2′	59.6′
1	196°49.7	11.4	325°23.3	6.5′	22°40.5	11.1′	59.6′
2	211°49.9	10.4	339°48.8	6.4′	22°51.6	10.9′	59.5′
3	226°50.1	·· 09.5	354°14.2	6.4′	23°02.5	10.7′	59.5′
4	241°50.3	08.5	8°39.6	6.3′	23°13.2	10.6′	59.5′
5	256°50.6	07.5	23°04.9	6.3′	23°23.8	10.4′	59.4′
6	271°50.8	N00°06.6	37°30.2	6.2′	N23°34.2	10.3′	59.4′
7	286°51.0	05.6	51°55.4	6.2′	23°44.5	10.1′	59.4′
8	301°51.2	04.6	66°20.6	6.1′	23°54.6	9.9′	59.3′
9	316°51.5	·· 03.6	80°45.8	6.1′	24°04.5	9.8′	59.3′
10	331°51.7	02.7	95°10.8	6.0′	24°14.3	9.6′	59.2′
11	346°51.9	01.7	109°35.9	6.0′	24°23.9	9.4′	59.2′
12	1°52.1	N00°00.7	124°00.9	6.0′	N24°33.3	9.3′	59.2′
13	16°52.3	S00°00.3	138°25.8	5.9′	24°42.6	9.1′	59.1′
14	31°52.6	01.2	152°50.7	5.9′	24°51.7	9.0′	59.1′
15	46°52.8	·· 02.2	167°15.6	5.8′	25°00.7	8.7′	59.1′
16	61°53.0	03.2	181°40.4	5.8′	25°09.4	8.6′	59.0′
17	76°53.2	04.1	196°05.2	5.7′	25°18.0	8.5′	59.0′
18	91°53.4	S00°05.1	210°30.0	5.7′	N25°26.5	8.2′	58.9′
19	106°53.7	06.1	224°54.7	5.7′	25°34.7	8.1′	58.9′
20	121°53.9	07.1	239°19.4	5.6′	25°42.8	7.9′	58.9′
21	136°54.1	·· 08.0	253°44.0	5.6′	25°50.7	7.8′	58.8′
22	151°54.3	09.0	268°08.6	5.6′	25°58.5	7.5′	58.8′
23	166°54.5	10.0	282°33.2	5.5′	26°06.0	7.4′	58.8′
	SD = 15.9′	d = -1.0′	SD = 16.3′				

Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	181°54.8	S00°11.0	296°57.7	5.5′	N26°13.4	7.2′	58.7′
1	196°55.0	11.9	311°22.2	5.5′	26°20.6	7.1′	58.7′
2	211°55.2	12.9	325°46.7	5.5′	26°27.7	6.8′	58.6′
3	226°55.4	·· 13.9	340°11.2	5.4′	26°34.5	6.7′	58.6′
4	241°55.6	14.8	354°35.6	5.4′	26°41.2	6.5′	58.6′
5	256°55.8	15.8	9°00.1	5.4′	26°47.7	6.4′	58.5′
6	271°56.1	S00°16.8	23°24.5	5.4′	N26°54.1	6.1′	58.5′
7	286°56.3	17.8	37°48.8	5.4′	27°00.2	6.0′	58.5′
8	301°56.5	18.7	52°13.2	5.3′	27°06.2	5.8′	58.4′
9	316°56.7	·· 19.7	66°37.5	5.3′	27°12.0	5.6′	58.4′
10	331°56.9	20.7	81°01.9	5.3′	27°17.6	5.4′	58.3′
11	346°57.2	21.7	95°26.2	5.3′	27°23.0	5.3′	58.3′
12	1°57.4	S00°22.6	109°50.5	5.3′	N27°28.3	5.0′	58.3′
13	16°57.6	23.6	124°14.8	5.3′	27°33.3	4.9′	58.2′
14	31°57.8	24.6	138°39.1	5.3′	27°38.2	4.7′	58.2′
15	46°58.0	·· 25.6	153°03.4	5.3′	27°42.9	4.6′	58.2′
16	61°58.3	26.5	167°27.7	5.3′	27°47.5	4.3′	58.1′
17	76°58.5	27.5	181°52.0	5.3′	27°51.8	4.2′	58.1′
18	91°58.7	S00°28.5	196°16.3	5.3′	N27°56.0	4.0′	58.0′
19	106°58.9	29.4	210°40.5	5.3′	28°00.0	3.8′	58.0′
20	121°59.1	30.4	225°04.8	5.3′	28°03.8	3.6′	58.0′
21	136°59.3	·· 31.4	239°29.1	5.3′	28°07.4	3.5′	57.9′
22	151°59.6	32.4	253°53.5	5.3′	28°10.9	3.2′	57.9′
23	166°59.8	33.3	268°17.8	5.3′	28°14.1	3.1′	57.9′
	SD = 15.9′	d = -1.0′	SD = 16.0′				

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

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

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 18-20 88-69%
21	06:57	07:07	11:53	02:28	14:55	
22	07:18	07:28	11:53	03:24	15:53	
23	07:39	07:50	11:52	04:23	16:52	

September 24, 25, 26 UT (Tue., Wed., Thu.)

	Aries	Venus		Mars		Jupiter		Saturn	
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	3°19.2	154°20.5	S11°46.5	261°13.7	N23°20.6	283°06.9	N22°25.2	16°25.3	S07°59.7
1	18°21.7	169°20.0	47.6	276°14.7	20.5	298°09.3	25.2	31°27.9	59.8
2	33°24.1	184°19.6	48.8	291°15.7	20.4	313°11.6	25.2	46°30.6	59.8
3	48°26.6	199°19.2	·· 50.0	306°16.6	·· 20.4	328°13.9	·· 25.2	61°33.2	07°59.9
4	63°29.1	214°18.8	51.1	321°17.6	20.3	343°16.2	25.3	76°35.8	08°00.0
5	78°31.5	229°18.4	52.3	336°18.6	20.3	358°18.6	25.3	91°38.5	00.0
6	93°34.0	244°18.0	S11°53.5	351°19.5	N23°20.2	13°20.9	N22°25.3	106°41.1	S08°00.1
7	108°36.4	259°17.6	54.7	6°20.5	20.1	28°23.2	25.3	121°43.7	00.2
8	123°38.9	274°17.2	55.8	21°21.5	20.1	43°25.6	25.3	136°46.3	00.2
9	138°41.4	289°16.8	·· 57.0	36°22.4	·· 20.0	58°27.9	·· 25.3	151°49.0	·· 00.3
10	153°43.8	304°16.3	58.2	51°23.4	20.0	73°30.2	25.3	166°51.6	00.4
11	168°46.3	319°15.9	11°59.3	66°24.4	19.9	88°32.6	25.3	181°54.2	00.4
12	183°48.8	334°15.5	S12°00.5	81°25.4	N23°19.8	103°34.9	N22°25.3	196°56.9	S08°00.5
13	198°51.2	349°15.1	01.7	96°26.3	19.8	118°37.2	25.3	211°59.5	00.6
14	213°53.7	4°14.7	02.8	111°27.3	19.7	133°39.6	25.3	227°02.1	00.6
15	228°56.2	19°14.3	·· 04.0	126°28.3	·· 19.7	148°41.9	·· 25.3	242°04.8	·· 00.7
16	243°58.6	34°13.9	05.2	141°29.3	19.6	163°44.2	25.3	257°07.4	00.8
17	259°01.1	49°13.4	06.3	156°30.2	19.5	178°46.6	25.3	272°10.0	00.9
18	274°03.5	64°13.0	S12°07.5	171°31.2	N23°19.5	193°48.9	N22°25.4	287°12.7	S08°00.9
19	289°06.0	79°12.6	08.7	186°32.2	19.4	208°51.2	25.4	302°15.3	01.0
20	304°08.5	94°12.2	09.8	201°33.2	19.3	223°53.6	25.4	317°17.9	01.1
21	319°10.9	109°11.8	·· 11.0	216°34.1	·· 19.3	238°55.9	·· 25.4	332°20.5	·· 01.1
22	334°13.4	124°11.4	12.2	231°35.1	19.2	253°58.3	25.4	347°23.2	01.2
23	349°15.9	139°10.9	13.3	246°36.1	19.2	269°00.6	25.4	2°25.8	01.3
Mer.pass. 23:43		ν -0.4′	d -1.2′	m -3.89	ν 1.0′	d -0.1′	m 0.52	ν 2.3′	d 0.0′ m -2.41	ν 2.6′	d -0.1′ m 0.63

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	4°18.3	154°10.5	S12°14.5	261°37.1	N23°19.1	284°02.9	N22°25.4	17°28.4	S08°01.3
1	19°20.8	169°10.1	15.6	276°38.0	19.0	299°05.3	25.4	32°31.1	01.4
2	34°23.3	184°09.7	16.8	291°39.0	19.0	314°07.6	25.4	47°33.7	01.5
3	49°25.7	199°09.3	·· 18.0	306°40.0	·· 18.9	329°09.9	·· 25.4	62°36.3	·· 01.5
4	64°28.2	214°08.8	19.1	321°41.0	18.8	344°12.3	25.4	77°38.9	01.6
5	79°30.7	229°08.4	20.3	336°42.0	18.8	359°14.6	25.4	92°41.6	01.7
6	94°33.1	244°08.0	S12°21.4	351°42.9	N23°18.7	14°17.0	N22°25.4	107°44.2	S08°01.7
7	109°35.6	259°07.6	22.6	6°43.9	18.6	29°19.3	25.4	122°46.8	01.8
8	124°38.0	274°07.2	23.8	21°44.9	18.6	44°21.6	25.4	137°49.5	01.9
9	139°40.5	289°06.7	·· 24.9	36°45.9	·· 18.5	59°24.0	·· 25.5	152°52.1	·· 01.9
10	154°43.0	304°06.3	26.1	51°46.9	18.4	74°26.3	25.5	167°54.7	02.0
11	169°45.4	319°05.9	27.2	66°47.8	18.4	89°28.7	25.5	182°57.4	02.1
12	184°47.9	334°05.5	S12°28.4	81°48.8	N23°18.3	104°31.0	N22°25.5	198°00.0	S08°02.1
13	199°50.4	349°05.0	29.5	96°49.8	18.3	119°33.3	25.5	213°02.6	02.2
14	214°52.8	4°04.6	30.7	111°50.8	18.2	134°35.7	25.5	228°05.2	02.3
15	229°55.3	19°04.2	·· 31.9	126°51.8	·· 18.1	149°38.0	·· 25.5	243°07.9	·· 02.3
16	244°57.8	34°03.8	33.0	141°52.8	18.1	164°40.4	25.5	258°10.5	02.4
17	260°00.2	49°03.3	34.2	156°53.7	18.0	179°42.7	25.5	273°13.1	02.5
18	275°02.7	64°02.9	S12°35.3	171°54.7	N23°17.9	194°45.1	N22°25.5	288°15.8	S08°02.5
19	290°05.2	79°02.5	36.5	186°55.7	17.9	209°47.4	25.5	303°18.4	02.6
20	305°07.6	94°02.1	37.6	201°56.7	17.8	224°49.7	25.5	318°21.0	02.7
21	320°10.1	109°01.6	·· 38.8	216°57.7	·· 17.7	239°52.1	·· 25.5	333°23.6	·· 02.7
22	335°12.5	124°01.2	39.9	231°58.7	17.7	254°54.4	25.5	348°26.3	02.8
23	350°15.0	139°00.8	41.1	246°59.7	17.6	269°56.8	25.5	3°28.9	02.9
Mer.pass. 23:39		ν -0.4′	d -1.2′	m -3.89	ν 1.0′	d -0.1′	m 0.51	ν 2.3′	d 0.0′ m -2.42	ν 2.6′	d -0.1′ m 0.63

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	5°17.5	154°00.4	S12°42.2	262°00.6	N23°17.5	284°59.1	N22°25.6	18°31.5	S08°02.9
1	20°19.9	168°59.9	43.4	277°01.6	17.5	300°01.5	25.6	33°34.2	03.0
2	35°22.4	183°59.5	44.5	292°02.6	17.4	315°03.8	25.6	48°36.8	03.1
3	50°24.9	198°59.1	·· 45.7	307°03.6	·· 17.3	330°06.2	·· 25.6	63°39.4	·· 03.1
4	65°27.3	213°58.6	46.8	322°04.6	17.2	345°08.5	25.6	78°42.0	03.2
5	80°29.8	228°58.2	48.0	337°05.6	17.2	0°10.9	25.6	93°44.7	03.3
6	95°32.3	243°57.8	S12°49.1	352°06.6	N23°17.1	15°13.2	N22°25.6	108°47.3	S08°03.3
7	110°34.7	258°57.4	50.3	7°07.6	17.0	30°15.6	25.6	123°49.9	03.4
8	125°37.2	273°56.9	51.4	22°08.6	17.0	45°17.9	25.6	138°52.5	03.5
9	140°39.7	288°56.5	·· 52.6	37°09.5	·· 16.9	60°20.3	·· 25.6	153°55.2	·· 03.5
10	155°42.1	303°56.1	53.7	52°10.5	16.8	75°22.6	25.6	168°57.8	03.6
11	170°44.6	318°55.6	54.9	67°11.5	16.8	90°25.0	25.6	184°00.4	03.7
12	185°47.0	333°55.2	S12°56.0	82°12.5	N23°16.7	105°27.3	N22°25.6	199°03.1	S08°03.7
13	200°49.5	348°54.8	57.1	97°13.5	16.6	120°29.7	25.6	214°05.7	03.8
14	215°52.0	3°54.3	58.3	112°14.5	16.6	135°32.0	25.6	229°08.3	03.9
15	230°54.4	18°53.9	12°59.4	127°15.5	·· 16.5	150°34.4	·· 25.6	244°10.9	·· 03.9
16	245°56.9	33°53.5	13°00.6	142°16.5	16.4	165°36.7	25.6	259°13.6	04.0
17	260°59.4	48°53.0	01.7	157°17.5	16.3	180°39.1	25.7	274°16.2	04.1
18	276°01.8	63°52.6	S13°02.9	172°18.5	N23°16.3	195°41.4	N22°25.7	289°18.8	S08°04.1
19	291°04.3	78°52.2	04.0	187°19.5	16.2	210°43.8	25.7	304°21.4	04.2
20	306°06.8	93°51.7	05.1	202°20.5	16.1	225°46.1	25.7	319°24.1	04.3
21	321°09.2	108°51.3	·· 06.3	217°21.5	·· 16.1	240°48.5	·· 25.7	334°26.7	·· 04.3
22	336°11.7	123°50.9	07.4	232°22.5	16.0	255°50.8	25.7	349°29.3	04.4
23	351°14.1	138°50.4	08.6	247°23.5	15.9	270°53.2	25.7	4°32.0	04.5
Mer.pass. 23:35		ν -0.4′	d -1.2′	m -3.89	ν 1.0′	d -0.1′	m 0.50	ν 2.3′	d 0.0′ m -2.43	ν 2.6′	d -0.1′ m 0.64

Stars

	SHA	Dec
Alpheratz	357°34.7	29°13.7
Ankaa	353°06.9	-42°10.2
Schedar	349°30.8	56°40.4
Diphda	348°47.2	-17°50.9
Achernar	335°19.8	-57°06.5
Hamal	327°51.2	23°34.8
Polaris	313°49.5	89°21.9
Acamar	315°11.6	-40°12.1
Menkar	314°06.2	4°11.3
Mirfak	308°28.3	49°56.8
Aldebaran	290°39.8	16°33.6
Rigel	281°04.0	-8°10.2
Capella	280°22.2	46°01.3
Bellatrix	278°23.1	6°22.5
Elnath	278°02.1	28°37.7
Alnilam	275°37.9	-1°11.0
Betelgeuse	270°52.3	7°24.8
Canopus	263°52.5	-52°42.1
Sirius	258°26.5	-16°44.7
Adhara	255°06.1	-29°00.0
Procyon	244°51.2	5°09.8
Pollux	243°17.7	27°58.0
Avior	234°15.2	-59°34.9
Suhail	222°46.8	-43°31.6
Miaplacidus	221°39.0	-69°48.8
Alphard	217°48.2	-8°45.7
Regulus	207°35.0	11°50.9
Dubhe	193°41.9	61°37.1
Denebola	182°25.5	14°26.2
Gienah	175°44.2	-17°40.6
Acrux	173°01.1	-63°14.1
Gacrux	171°52.6	-57°15.0
Alioth	166°13.7	55°49.7
Spica	158°22.9	-11°17.3
Alkaid	152°52.6	49°11.6
Hadar	148°37.0	-60°29.6
Menkent	147°58.3	-36°29.5
Arcturus	145°48.4	19°03.4
Rigil Kent.	139°41.2	-60°56.3
Kochab	137°20.6	74°03.4
Zuben'ubi	136°56.6	-16°08.6
Alphecca	126°04.2	26°38.1
Antares	112°16.3	-26°29.2
Atria	107°10.9	-69°04.5
Sabik	102°03.2	-15°45.3
Shaula	96°10.8	-37°07.4
Rasalhague	95°58.8	12°32.7
Eltanin	90°42.3	51°29.4
Kaus Aust.	83°32.8	-34°22.5
Vega	80°33.4	38°48.6
Nunki	75°48.0	-26°16.0
Altair	62°00.1	8°56.1
Peacock	53°05.8	-56°39.5
Deneb	49°25.7	45°22.3
Enif	33°38.8	9°59.4
Al Na'ir	27°32.8	-46°50.5
Fomalhaut	15°14.4	-29°29.4
Scheat	13°45.1	28°13.2
Markab	13°29.8	15°20.4

Sep 24 Tue	SHA	Mer.pass
Venus	151°01.3	13:43
Mars	257°54.5	06:35
Jupiter	279°47.7	05:07
Saturn	13°06.1	22:50

Sep 25 Wed	SHA	Mer.pass
Venus	149°52.2	13:44
Mars	257°18.7	06:33
Jupiter	279°44.6	05:03
Saturn	13°10.1	22:46

Sep 26 Thu	SHA	Mer.pass
Venus	148°42.9	13:44
Mars	256°43.2	06:32
Jupiter	279°41.6	04:59
Saturn	13°14.0	22:42

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.1601 sec ΔT = TT-UT1 = +69.0239 sec

2024 September 24 to Sep. 26 UT

h	Sun		Moon				
Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	182°00.0	S00°34.3	282°42.1	5.3′	N28°17.2	2.9′	57.8′
1	197°00.2	35.3	297°06.5	5.4′	28°20.1	2.7′	57.8′
2	212°00.4	36.3	311°30.8	5.4′	28°22.8	2.6′	57.7′
3	227°00.7	·· 37.2	325°55.2	5.4′	28°25.4	2.3′	57.7′
4	242°00.9	38.2	340°19.6	5.4′	28°27.7	2.2′	57.7′
5	257°01.1	39.2	354°44.0	5.4′	28°29.9	2.0′	57.6′
6	272°01.3	S00°40.2	9°08.5	5.5′	N28°31.9	1.9′	57.6′
7	287°01.5	41.1	23°32.9	5.5′	28°33.8	1.6′	57.6′
8	302°01.7	42.1	37°57.4	5.5′	28°35.4	1.5′	57.5′
9	317°02.0	·· 43.1	52°22.0	5.6′	28°36.9	1.3′	57.5′
10	332°02.2	44.1	66°46.5	5.6′	28°38.2	1.1′	57.4′
11	347°02.4	45.0	81°11.1	5.6′	28°39.3	0.9′	57.4′
12	2°02.6	S00°46.0	95°35.8	5.7′	N28°40.2	0.8′	57.4′
13	17°02.8	47.0	110°00.4	5.7′	28°41.0	0.6′	57.3′
14	32°03.0	47.9	124°25.2	5.8′	28°41.6	0.4′	57.3′
15	47°03.3	·· 48.9	138°49.9	5.8′	28°42.0	0.2′	57.3′
16	62°03.5	49.9	153°14.7	5.8′	28°42.2	0.1′	57.2′
17	77°03.7	50.9	167°39.5	5.9′	28°42.3	0.1′	57.2′
18	92°03.9	S00°51.8	182°04.4	5.9′	N28°42.2	0.3′	57.2′
19	107°04.1	52.8	196°29.4	6.0′	28°41.9	0.5′	57.1′
20	122°04.3	53.8	210°54.3	6.0′	28°41.4	0.6′	57.1′
21	137°04.6	·· 54.8	225°19.4	6.1′	28°40.8	0.8′	57.1′
22	152°04.8	55.7	239°44.5	6.1′	28°40.0	0.9′	57.0′
23	167°05.0	56.7	254°09.6	6.2′	28°39.1	1.2′	57.0′
	SD = 15.9′	d = -1.0′	SD = 15.8′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	182°05.2	S00°57.7	268°34.8	6.3′	N28°37.9	1.3′	57.0′
1	197°05.4	58.7	283°00.1	6.3′	28°36.6	1.4′	56.9′
2	212°05.6	00°59.6	297°25.4	6.4′	28°35.2	1.7′	56.9′
3	227°05.9	01°00.6	311°50.8	6.5′	28°33.5	1.8′	56.8′
4	242°06.1	01.6	326°16.3	6.5′	28°31.7	1.9′	56.8′
5	257°06.3	02.5	340°41.8	6.6′	28°29.8	2.2′	56.8′
6	272°06.5	S01°03.5	355°07.4	6.7′	N28°27.6	2.3′	56.7′
7	287°06.7	04.5	9°33.0	6.7′	28°25.3	2.4′	56.7′
8	302°06.9	05.5	23°58.7	6.8′	28°22.9	2.6′	56.7′
9	317°07.2	·· 06.4	38°24.5	6.9′	28°20.3	2.8′	56.6′
10	332°07.4	07.4	52°50.4	6.9′	28°17.5	3.0′	56.6′
11	347°07.6	08.4	67°16.3	7.0′	28°14.5	3.0′	56.6′
12	2°07.8	S01°09.4	81°42.3	7.1′	N28°11.5	3.3′	56.6′
13	17°08.0	10.3	96°08.4	7.2′	28°08.2	3.4′	56.5′
14	32°08.2	11.3	110°34.6	7.2′	28°04.8	3.6′	56.5′
15	47°08.4	·· 12.3	125°00.9	7.3′	28°01.2	3.7′	56.5′
16	62°08.7	13.3	139°27.2	7.4′	27°57.5	3.8′	56.4′
17	77°08.9	14.2	153°53.6	7.5′	27°53.7	4.1′	56.4′
18	92°09.1	S01°15.2	168°20.1	7.6′	N27°49.6	4.1′	56.4′
19	107°09.3	16.2	182°46.7	7.7′	27°45.5	4.4′	56.3′
20	122°09.5	17.2	197°13.3	7.7′	27°41.1	4.4′	56.3′
21	137°09.7	·· 18.1	211°40.1	7.8′	27°36.7	4.6′	56.3′
22	152°09.9	19.1	226°06.9	7.9′	27°32.1	4.8′	56.2′
23	167°10.2	20.1	240°33.8	8.0′	27°27.3	4.9′	56.2′
	SD = 15.9′	d = -1.0′	SD = 15.5′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	182°10.4	S01°21.0	255°00.8	8.1′	N27°22.4	5.1′	56.2′
1	197°10.6	22.0	269°28.0	8.2′	27°17.3	5.1′	56.1′
2	212°10.8	23.0	283°55.1	8.3′	27°12.2	5.4′	56.1′
3	227°11.0	·· 24.0	298°22.4	8.4′	27°06.8	5.5′	56.1′
4	242°11.2	24.9	312°49.8	8.5′	27°01.3	5.6′	56.1′
5	257°11.4	25.9	327°17.3	8.6′	26°55.7	5.7′	56.0′
6	272°11.7	S01°26.9	341°44.8	8.7′	N26°50.0	5.9′	56.0′
7	287°11.9	27.9	356°12.5	8.8′	26°44.1	6.0′	56.0′
8	302°12.1	28.8	10°40.2	8.8′	26°38.1	6.2′	55.9′
9	317°12.3	·· 29.8	25°08.1	8.9′	26°31.9	6.3′	55.9′
10	332°12.5	30.8	39°36.0	9.0′	26°25.6	6.4′	55.9′
11	347°12.7	31.8	54°04.1	9.1′	26°19.2	6.6′	55.9′
12	2°12.9	S01°32.7	68°32.2	9.2′	N26°12.6	6.6′	55.8′
13	17°13.2	33.7	83°00.4	9.3′	26°06.0	6.8′	55.8′
14	32°13.4	34.7	97°28.8	9.4′	25°59.2	7.0′	55.8′
15	47°13.6	·· 35.6	111°57.2	9.5′	25°52.2	7.0′	55.7′
16	62°13.8	36.6	126°25.7	9.6′	25°45.2	7.2′	55.7′
17	77°14.0	37.6	140°54.3	9.7′	25°38.0	7.3′	55.7′
18	92°14.2	S01°38.6	155°23.1	9.8′	N25°30.7	7.5′	55.7′
19	107°14.4	39.5	169°51.9	9.9′	25°23.2	7.5′	55.6′
20	122°14.6	40.5	184°20.8	10.0′	25°15.7	7.7′	55.6′
21	137°14.9	·· 41.5	198°49.8	10.1′	25°08.0	7.8′	55.6′
22	152°15.1	42.5	213°18.9	10.2′	25°00.2	7.9′	55.6′
23	167°15.3	43.4	227°48.2	10.3′	24°52.3	8.0′	55.5′
	SD = 15.9′	d = -1.0′	SD = 15.3′				

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

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

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 21-23 58-37%
24	08:00	08:10	11:52	05:22	17:51	
25	08:21	08:31	11:51	06:20	18:48	
26	08:42	08:52	11:51	07:16	19:42	

September 27, 28, 29 UT (Fri., Sat., Sun.)

	Aries	Venus		Mars		Jupiter		Saturn	
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	6°16.6	153°50.0	S13°09.7	262°24.5	N23°15.8	285°55.5	N22°25.7	19°34.6	S08°04.5
1	21°19.1	168°49.5	10.8	277°25.5	15.8	300°57.9	25.7	34°37.2	04.6
2	36°21.5	183°49.1	12.0	292°26.5	15.7	316°00.2	25.7	49°39.8	04.7
3	51°24.0	198°48.7	·· 13.1	307°27.5	·· 15.6	331°02.6	·· 25.7	64°42.5	·· 04.7
4	66°26.5	213°48.2	14.3	322°28.5	15.6	346°05.0	25.7	79°45.1	04.8
5	81°28.9	228°47.8	15.4	337°29.5	15.5	1°07.3	25.7	94°47.7	04.9
6	96°31.4	243°47.3	S13°16.5	352°30.5	N23°15.4	16°09.7	N22°25.7	109°50.3	S08°04.9
7	111°33.9	258°46.9	17.7	7°31.5	15.3	31°12.0	25.7	124°53.0	05.0
8	126°36.3	273°46.5	18.8	22°32.5	15.3	46°14.4	25.7	139°55.6	05.1
9	141°38.8	288°46.0	·· 19.9	37°33.5	·· 15.2	61°16.7	·· 25.7	154°58.2	·· 05.1
10	156°41.3	303°45.6	21.1	52°34.5	15.1	76°19.1	25.8	170°00.8	05.2
11	171°43.7	318°45.1	22.2	67°35.5	15.1	91°21.5	25.8	185°03.5	05.3
12	186°46.2	333°44.7	S13°23.3	82°36.5	N23°15.0	106°23.8	N22°25.8	200°06.1	S08°05.3
13	201°48.6	348°44.3	24.5	97°37.5	14.9	121°26.2	25.8	215°08.7	05.4
14	216°51.1	3°43.8	25.6	112°38.5	14.8	136°28.5	25.8	230°11.3	05.5
15	231°53.6	18°43.4	·· 26.7	127°39.5	·· 14.8	151°30.9	·· 25.8	245°14.0	·· 05.5
16	246°56.0	33°42.9	27.9	142°40.5	14.7	166°33.2	25.8	260°16.6	05.6
17	261°58.5	48°42.5	29.0	157°41.5	14.6	181°35.6	25.8	275°19.2	05.7
18	277°01.0	63°42.0	S13°30.1	172°42.5	N23°14.5	196°38.0	N22°25.8	290°21.8	S08°05.7
19	292°03.4	78°41.6	31.2	187°43.5	14.5	211°40.3	25.8	305°24.5	05.8
20	307°05.9	93°41.1	32.4	202°44.5	14.4	226°42.7	25.8	320°27.1	05.9
21	322°08.4	108°40.7	·· 33.5	217°45.5	·· 14.3	241°45.1	·· 25.8	335°29.7	·· 05.9
22	337°10.8	123°40.3	34.6	232°46.5	14.2	256°47.4	25.8	350°32.3	06.0
23	352°13.3	138°39.8	35.7	247°47.5	14.2	271°49.8	25.8	5°35.0	06.1
Mer.pass.	23:31	ν -0.4′	d -1.1′	m -3.90	ν 1.0′	d -0.1′	m 0.50	ν 2.4′	d 0.0′ m -2.44	ν 2.6′	d -0.1′ m 0.64

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	7°15.8	153°39.4	S13°36.9	262°48.5	N23°14.1	286°52.1	N22°25.8	20°37.6	S08°06.1
1	22°18.2	168°38.9	38.0	277°49.5	14.0	301°54.5	25.8	35°40.2	06.2
2	37°20.7	183°38.5	39.1	292°50.5	13.9	316°56.9	25.8	50°42.8	06.3
3	52°23.1	198°38.0	·· 40.3	307°51.6	·· 13.9	331°59.2	·· 25.8	65°45.5	·· 06.3
4	67°25.6	213°37.6	41.4	322°52.6	13.8	347°01.6	25.8	80°48.1	06.4
5	82°28.1	228°37.1	42.5	337°53.6	13.7	2°04.0	25.9	95°50.7	06.4
6	97°30.5	243°36.7	S13°43.6	352°54.6	N23°13.6	17°06.3	N22°25.9	110°53.3	S08°06.5
7	112°33.0	258°36.2	44.7	7°55.6	13.6	32°08.7	25.9	125°56.0	06.6
8	127°35.5	273°35.8	45.9	22°56.6	13.5	47°11.1	25.9	140°58.6	06.6
9	142°37.9	288°35.3	·· 47.0	37°57.6	·· 13.4	62°13.4	·· 25.9	156°01.2	·· 06.7
10	157°40.4	303°34.9	48.1	52°58.6	13.3	77°15.8	25.9	171°03.8	06.8
11	172°42.9	318°34.4	49.2	67°59.6	13.2	92°18.2	25.9	186°06.5	06.8
12	187°45.3	333°34.0	S13°50.3	83°00.6	N23°13.2	107°20.5	N22°25.9	201°09.1	S08°06.9
13	202°47.8	348°33.5	51.5	98°01.7	13.1	122°22.9	25.9	216°11.7	07.0
14	217°50.3	3°33.1	52.6	113°02.7	13.0	137°25.3	25.9	231°14.3	07.0
15	232°52.7	18°32.6	·· 53.7	128°03.7	·· 12.9	152°27.6	·· 25.9	246°17.0	·· 07.1
16	247°55.2	33°32.1	54.8	143°04.7	12.9	167°30.0	25.9	261°19.6	07.2
17	262°57.6	48°31.7	55.9	158°05.7	12.8	182°32.4	25.9	276°22.2	07.2
18	278°00.1	63°31.2	S13°57.1	173°06.7	N23°12.7	197°34.7	N22°25.9	291°24.8	S08°07.3
19	293°02.6	78°30.8	58.2	188°07.8	12.6	212°37.1	25.9	306°27.5	07.4
20	308°05.0	93°30.3	13°59.3	203°08.8	12.5	227°39.5	25.9	321°30.1	07.4
21	323°07.5	108°29.9	14°00.4	218°09.8	·· 12.5	242°41.9	·· 25.9	336°32.7	·· 07.5
22	338°10.0	123°29.4	01.5	233°10.8	12.4	257°44.2	25.9	351°35.3	07.5
23	353°12.4	138°29.0	02.6	248°11.8	12.3	272°46.6	25.9	6°37.9	07.6
Mer.pass.	23:27	ν -0.4′	d -1.1′	m -3.90	ν 1.0′	d -0.1′	m 0.49	ν 2.4′	d 0.0′ m -2.44	ν 2.6′	d -0.1′ m 0.64

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	8°14.9	153°28.5	S14°03.7	263°12.8	N23°12.2	287°49.0	N22°25.9	21°40.6	S08°07.7
1	23°17.4	168°28.0	04.9	278°13.9	12.1	302°51.3	25.9	36°43.2	07.7
2	38°19.8	183°27.6	06.0	293°14.9	12.1	317°53.7	26.0	51°45.8	07.8
3	53°22.3	198°27.1	·· 07.1	308°15.9	·· 12.0	332°56.1	·· 26.0	66°48.4	·· 07.9
4	68°24.7	213°26.7	08.2	323°16.9	11.9	347°58.5	26.0	81°51.1	07.9
5	83°27.2	228°26.2	09.3	338°17.9	11.8	3°00.8	26.0	96°53.7	08.0
6	98°29.7	243°25.7	S14°10.4	353°19.0	N23°11.7	18°03.2	N22°26.0	111°56.3	S08°08.1
7	113°32.1	258°25.3	11.5	8°20.0	11.7	33°05.6	26.0	126°58.9	08.1
8	128°34.6	273°24.8	12.6	23°21.0	11.6	48°08.0	26.0	142°01.6	08.2
9	143°37.1	288°24.4	·· 13.7	38°22.0	·· 11.5	63°10.3	·· 26.0	157°04.2	·· 08.3
10	158°39.5	303°23.9	14.8	53°23.0	11.4	78°12.7	26.0	172°06.8	08.3
11	173°42.0	318°23.4	15.9	68°24.1	11.3	93°15.1	26.0	187°09.4	08.4
12	188°44.5	333°23.0	S14°17.1	83°25.1	N23°11.3	108°17.5	N22°26.0	202°12.0	S08°08.4
13	203°46.9	348°22.5	18.2	98°26.1	11.2	123°19.8	26.0	217°14.7	08.5
14	218°49.4	3°22.1	19.3	113°27.1	11.1	138°22.2	26.0	232°17.3	08.6
15	233°51.9	18°21.6	·· 20.4	128°28.2	·· 11.0	153°24.6	·· 26.0	247°19.9	·· 08.6
16	248°54.3	33°21.1	21.5	143°29.2	10.9	168°27.0	26.0	262°22.5	08.7
17	263°56.8	48°20.7	22.6	158°30.2	10.9	183°29.3	26.0	277°25.2	08.8
18	278°59.2	63°20.2	S14°23.7	173°31.2	N23°10.8	198°31.7	N22°26.0	292°27.8	S08°08.8
19	294°01.7	78°19.7	24.8	188°32.3	10.7	213°34.1	26.0	307°30.4	08.9
20	309°04.2	93°19.3	25.9	203°33.3	10.6	228°36.5	26.0	322°33.0	09.0
21	324°06.6	108°18.8	·· 27.0	218°34.3	·· 10.5	243°38.9	·· 26.0	337°35.6	·· 09.0
22	339°09.1	123°18.3	28.1	233°35.3	10.4	258°41.2	26.0	352°38.3	09.1
23	354°11.6	138°17.9	29.2	248°36.4	10.4	273°43.6	26.0	7°40.9	09.1
Mer.pass.	23:23	ν -0.5′	d -1.1′	m -3.90	ν 1.0′	d -0.1′	m 0.48	ν 2.4′	d 0.0′ m -2.45	ν 2.6′	d -0.1′ m 0.65

Stars

	SHA	Dec
Alpheratz	357°34.7	29°13.7
Ankaa	353°06.9	-42°10.2
Schedar	349°30.8	56°40.4
Diphda	348°47.2	-17°50.9
Achernar	335°19.8	-57°06.5
Hamal	327°51.2	23°34.8
Polaris	313°48.3	89°21.9
Acamar	315°11.6	-40°12.1
Menkar	314°06.2	4°11.3
Mirfak	308°28.3	49°56.9
Aldebaran	290°39.8	16°33.6
Rigel	281°04.0	-8°10.2
Capella	280°22.1	46°01.3
Bellatrix	278°23.1	6°22.5
Elnath	278°02.1	28°37.7
Alnilam	275°37.9	-1°11.0
Betelgeuse	270°52.3	7°24.8
Canopus	263°52.5	-52°42.1
Sirius	258°26.5	-16°44.7
Adhara	255°06.1	-29°00.0
Procyon	244°51.2	5°09.8
Pollux	243°17.7	27°58.0
Avior	234°15.2	-59°34.9
Suhail	222°46.8	-43°31.6
Miaplacidus	221°39.0	-69°48.8
Alphard	217°48.2	-8°45.7
Regulus	207°35.0	11°50.9
Dubhe	193°41.9	61°37.0
Denebola	182°25.5	14°26.2
Gienah	175°44.2	-17°40.6
Acrux	173°01.1	-63°14.1
Gacrux	171°52.6	-57°15.0
Alioth	166°13.7	55°49.6
Spica	158°22.9	-11°17.3
Alkaid	152°52.6	49°11.5
Hadar	148°37.0	-60°29.6
Menkent	147°58.3	-36°29.5
Arcturus	145°48.4	19°03.4
Rigil Kent.	139°41.2	-60°56.3
Kochab	137°20.6	74°03.4
Zuben'ubi	136°56.6	-16°08.6
Alphecca	126°04.2	26°38.1
Antares	112°16.3	-26°29.2
Atria	107°10.9	-69°04.5
Sabik	102°03.2	-15°45.3
Shaula	96°10.8	-37°07.4
Rasalhague	95°58.8	12°32.7
Eltanin	90°42.4	51°29.4
Kaus Aust.	83°32.8	-34°22.5
Vega	80°33.4	38°48.6
Nunki	75°48.0	-26°16.0
Altair	62°00.1	8°56.1
Peacock	53°05.8	-56°39.5
Deneb	49°25.7	45°22.3
Enif	33°38.8	9°59.4
Al Na'ir	27°32.8	-46°50.5
Fomalhaut	15°14.4	-29°29.4
Scheat	13°45.1	28°13.2
Markab	13°29.8	15°20.4

Sep 27 Fri	SHA	Mer.pass
Venus	147°33.4	13:45
Mars	256°07.8	06:30
Jupiter	279°38.9	04:56
Saturn	13°18.0	22:38

Sep 28 Sat	SHA	Mer.pass
Venus	146°23.6	13:46
Mars	255°32.8	06:28
Jupiter	279°36.4	04:52
Saturn	13°21.8	22:34

Sep 29 Sun	SHA	Mer.pass
Venus	145°13.6	13:47
Mars	254°57.9	06:27
Jupiter	279°34.1	04:48
Saturn	13°25.7	22:29

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	182°15.5	S01°44.4	242°17.5	10.4′	N24°44.3	8.1′	55.5′
1	197°15.7	45.4	256°46.9	10.5′	24°36.2	8.3′	55.5′
2	212°15.9	46.4	271°16.4	10.6′	24°27.9	8.4′	55.5′
3	227°16.1	·· 47.3	285°46.0	10.7′	24°19.5	8.4′	55.4′
4	242°16.3	48.3	300°15.7	10.8′	24°11.1	8.6′	55.4′
5	257°16.5	49.3	314°45.5	10.9′	24°02.5	8.7′	55.4′
6	272°16.8	S01°50.2	329°15.5	11.0′	N23°53.8	8.8′	55.4′
7	287°17.0	51.2	343°45.5	11.1′	23°45.0	8.9′	55.3′
8	302°17.2	52.2	358°15.6	11.2′	23°36.1	9.0′	55.3′
9	317°17.4	·· 53.2	12°45.8	11.3′	23°27.1	9.1′	55.3′
10	332°17.6	54.1	27°16.1	11.4′	23°18.0	9.2′	55.3′
11	347°17.8	55.1	41°46.5	11.5′	23°08.8	9.3′	55.2′
12	2°18.0	S01°56.1	56°17.0	11.6′	N22°59.5	9.4′	55.2′
13	17°18.2	57.1	70°47.6	11.7′	22°50.1	9.5′	55.2′
14	32°18.4	58.0	85°18.3	11.8′	22°40.6	9.7′	55.2′
15	47°18.7	01°59.0	99°49.1	11.9′	22°30.9	9.7′	55.2′
16	62°18.9	02°00.0	114°20.0	12.0′	22°21.2	9.8′	55.1′
17	77°19.1	00.9	128°51.0	12.1′	22°11.4	9.8′	55.1′
18	92°19.3	S02°01.9	143°22.1	12.2′	N22°01.6	10.0′	55.1′
19	107°19.5	02.9	157°53.3	12.3′	21°51.6	10.1′	55.1′
20	122°19.7	03.9	172°24.5	12.4′	21°41.5	10.2′	55.1′
21	137°19.9	·· 04.8	186°55.9	12.5′	21°31.3	10.2′	55.0′
22	152°20.1	05.8	201°27.4	12.6′	21°21.1	10.4′	55.0′
23	167°20.3	06.8	215°58.9	12.6′	21°10.7	10.4′	55.0′
	SD = 15.9′	d = -1.0′	SD = 15.1′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	182°20.5	S02°07.8	230°30.6	12.7′	N21°00.3	10.5′	55.0′
1	197°20.8	08.7	245°02.3	12.8′	20°49.8	10.6′	54.9′
2	212°21.0	09.7	259°34.1	12.9′	20°39.2	10.7′	54.9′
3	227°21.2	·· 10.7	274°06.0	13.0′	20°28.5	10.7′	54.9′
4	242°21.4	11.6	288°38.1	13.1′	20°17.8	10.9′	54.9′
5	257°21.6	12.6	303°10.2	13.2′	20°06.9	10.9′	54.9′
6	272°21.8	S02°13.6	317°42.3	13.3′	N19°56.0	11.0′	54.9′
7	287°22.0	14.6	332°14.6	13.4′	19°45.0	11.1′	54.8′
8	302°22.2	15.5	346°47.0	13.5′	19°33.9	11.1′	54.8′
9	317°22.4	·· 16.5	1°19.4	13.5′	19°22.8	11.3′	54.8′
10	332°22.6	17.5	15°52.0	13.6′	19°11.5	11.3′	54.8′
11	347°22.8	18.5	30°24.6	13.7′	19°00.2	11.4′	54.8′
12	2°23.0	S02°19.4	44°57.3	13.8′	N18°48.8	11.4′	54.7′
13	17°23.3	20.4	59°30.1	13.9′	18°37.4	11.5′	54.7′
14	32°23.5	21.4	74°03.0	14.0′	18°25.9	11.6′	54.7′
15	47°23.7	·· 22.3	88°35.9	14.0′	18°14.3	11.7′	54.7′
16	62°23.9	23.3	103°09.0	14.1′	18°02.6	11.7′	54.7′
17	77°24.1	24.3	117°42.1	14.2′	17°50.9	11.8′	54.7′
18	92°24.3	S02°25.3	132°15.3	14.3′	N17°39.1	11.9′	54.6′
19	107°24.5	26.2	146°48.6	14.4′	17°27.2	11.9′	54.6′
20	122°24.7	27.2	161°21.9	14.4′	17°15.3	12.0′	54.6′
21	137°24.9	·· 28.2	175°55.3	14.5′	17°03.3	12.0′	54.6′
22	152°25.1	29.1	190°28.9	14.6′	16°51.3	12.1′	54.6′
23	167°25.3	30.1	205°02.4	14.7′	16°39.2	12.2′	54.6′
	SD = 16.0′	d = -1.0′	SD = 15.0′				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	182°25.5	S02°31.1	219°36.1	14.7′	N16°27.0	12.3′	54.5′
1	197°25.7	32.1	234°09.8	14.8′	16°14.7	12.2′	54.5′
2	212°25.9	33.0	248°43.6	14.9′	16°02.5	12.4′	54.5′
3	227°26.2	·· 34.0	263°17.5	15.0′	15°50.1	12.4′	54.5′
4	242°26.4	35.0	277°51.5	15.0′	15°37.7	12.5′	54.5′
5	257°26.6	36.0	292°25.5	15.1′	15°25.2	12.5′	54.5′
6	272°26.8	S02°36.9	306°59.6	15.2′	N15°12.7	12.5′	54.5′
7	287°27.0	37.9	321°33.7	15.2′	15°00.2	12.7′	54.4′
8	302°27.2	38.9	336°08.0	15.3′	14°47.5	12.6′	54.4′
9	317°27.4	·· 39.8	350°42.3	15.4′	14°34.9	12.8′	54.4′
10	332°27.6	40.8	5°16.6	15.4′	14°22.1	12.7′	54.4′
11	347°27.8	41.8	19°51.0	15.5′	14°09.4	12.9′	54.4′
12	2°28.0	S02°42.8	34°25.5	15.6′	N13°56.5	12.8′	54.4′
13	17°28.2	43.7	49°00.1	15.6′	13°43.7	13.0′	54.4′
14	32°28.4	44.7	63°34.7	15.7′	13°30.7	12.9′	54.3′
15	47°28.6	·· 45.7	78°09.4	15.7′	13°17.8	13.0′	54.3′
16	62°28.8	46.6	92°44.1	15.8′	13°04.8	13.1′	54.3′
17	77°29.0	47.6	107°18.9	15.9′	12°51.7	13.1′	54.3′
18	92°29.2	S02°48.6	121°53.7	15.9′	N12°38.6	13.1′	54.3′
19	107°29.4	49.5	136°28.6	16.0′	12°25.5	13.2′	54.3′
20	122°29.6	50.5	151°03.6	16.0′	12°12.3	13.2′	54.3′
21	137°29.8	·· 51.5	165°38.6	16.1′	11°59.1	13.3′	54.3′
22	152°30.1	52.5	180°13.7	16.1′	11°45.8	13.3′	54.3′
23	167°30.3	53.4	194°48.8	16.2′	11°32.5	13.3′	54.2′
	SD = 16.0′	d = -1.0′	SD = 14.9′				

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

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

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 24-26 28-12%
27	09:02	09:12	11:51	08:07	20:31	
28	09:22	09:32	11:50	08:55	21:17	
29	09:42	09:52	11:50	09:38	21:59	

September 30, 01, 02 UT (Mon., Tue., Wed.)

	Aries	Venus		Mars		Jupiter		Saturn	
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	9°14.0	153°17.4	S14°30.3	263°37.4	N23°10.3	288°46.0	N22°26.0	22°43.5	S08°09.2
1	24°16.5	168°16.9	31.4	278°38.4	10.2	303°48.4	26.0	37°46.1	09.3
2	39°19.0	183°16.5	32.5	293°39.5	10.1	318°50.8	26.1	52°48.7	09.3
3	54°21.4	198°16.0	·· 33.6	308°40.5	·· 10.0	333°53.1	·· 26.1	67°51.4	·· 09.4
4	69°23.9	213°15.5	34.7	323°41.5	09.9	348°55.5	26.1	82°54.0	09.5
5	84°26.3	228°15.0	35.8	338°42.6	09.9	3°57.9	26.1	97°56.6	09.5
6	99°28.8	243°14.6	S14°36.9	353°43.6	N23°09.8	19°00.3	N22°26.1	112°59.2	S08°09.6
7	114°31.3	258°14.1	38.0	8°44.6	09.7	34°02.7	26.1	128°01.9	09.7
8	129°33.7	273°13.6	39.1	23°45.7	09.6	49°05.1	26.1	143°04.5	09.7
9	144°36.2	288°13.2	·· 40.1	38°46.7	·· 09.5	64°07.4	·· 26.1	158°07.1	·· 09.8
10	159°38.7	303°12.7	41.2	53°47.7	09.4	79°09.8	26.1	173°09.7	09.8
11	174°41.1	318°12.2	42.3	68°48.7	09.4	94°12.2	26.1	188°12.3	09.9
12	189°43.6	333°11.7	S14°43.4	83°49.8	N23°09.3	109°14.6	N22°26.1	203°15.0	S08°10.0
13	204°46.1	348°11.3	44.5	98°50.8	09.2	124°17.0	26.1	218°17.6	10.0
14	219°48.5	3°10.8	45.6	113°51.9	09.1	139°19.4	26.1	233°20.2	10.1
15	234°51.0	18°10.3	·· 46.7	128°52.9	·· 09.0	154°21.7	·· 26.1	248°22.8	·· 10.2
16	249°53.5	33°09.8	47.8	143°53.9	08.9	169°24.1	26.1	263°25.4	10.2
17	264°55.9	48°09.4	48.9	158°55.0	08.8	184°26.5	26.1	278°28.1	10.3
18	279°58.4	63°08.9	S14°50.0	173°56.0	N23°08.8	199°28.9	N22°26.1	293°30.7	S08°10.3
19	295°00.8	78°08.4	51.1	188°57.0	08.7	214°31.3	26.1	308°33.3	10.4
20	310°03.3	93°07.9	52.1	203°58.1	08.6	229°33.7	26.1	323°35.9	10.5
21	325°05.8	108°07.5	·· 53.2	218°59.1	·· 08.5	244°36.1	·· 26.1	338°38.5	·· 10.5
22	340°08.2	123°07.0	54.3	234°00.2	08.4	259°38.5	26.1	353°41.2	10.6
23	355°10.7	138°06.5	55.4	249°01.2	08.3	274°40.9	26.1	8°43.8	10.7
Mer.pass. 23:19		ν -0.5′	d -1.1′	m -3.90	ν 1.0′	d -0.1′	m 0.47	ν 2.4′	d 0.0′ m -2.46	ν 2.6′	d -0.1′ m 0.65

Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	10°13.2	153°06.0	S14°56.5	264°02.2	N23°08.2	289°43.2	N22°26.1	23°46.4	S08°10.7
1	25°15.6	168°05.6	57.6	279°03.3	08.2	304°45.6	26.1	38°49.0	10.8
2	40°18.1	183°05.1	58.7	294°04.3	08.1	319°48.0	26.1	53°51.6	10.8
3	55°20.6	198°04.6	14°59.7	309°05.4	·· 08.0	334°50.4	·· 26.1	68°54.2	·· 10.9
4	70°23.0	213°04.1	15°00.8	324°06.4	07.9	349°52.8	26.1	83°56.9	11.0
5	85°25.5	228°03.6	01.9	339°07.4	07.8	4°55.2	26.2	98°59.5	11.0
6	100°27.9	243°03.2	S15°03.0	354°08.5	N23°07.7	19°57.6	N22°26.2	114°02.1	S08°11.1
7	115°30.4	258°02.7	04.1	9°09.5	07.6	35°00.0	26.2	129°04.7	11.2
8	130°32.9	273°02.2	05.1	24°10.6	07.5	50°02.4	26.2	144°07.3	11.2
9	145°35.3	288°01.7	·· 06.2	39°11.6	·· 07.5	65°04.8	·· 26.2	159°10.0	·· 11.3
10	160°37.8	303°01.2	07.3	54°12.7	07.4	80°07.2	26.2	174°12.6	11.3
11	175°40.3	318°00.7	08.4	69°13.7	07.3	95°09.5	26.2	189°15.2	11.4
12	190°42.7	333°00.3	S15°09.5	84°14.7	N23°07.2	110°11.9	N22°26.2	204°17.8	S08°11.5
13	205°45.2	347°59.8	10.5	99°15.8	07.1	125°14.3	26.2	219°20.4	11.5
14	220°47.7	2°59.3	11.6	114°16.8	07.0	140°16.7	26.2	234°23.1	11.6
15	235°50.1	17°58.8	·· 12.7	129°17.9	·· 06.9	155°19.1	·· 26.2	249°25.7	·· 11.6
16	250°52.6	32°58.3	13.8	144°18.9	06.8	170°21.5	26.2	264°28.3	11.7
17	265°55.1	47°57.8	14.8	159°20.0	06.8	185°23.9	26.2	279°30.9	11.8
18	280°57.5	62°57.3	S15°15.9	174°21.0	N23°06.7	200°26.3	N22°26.2	294°33.5	S08°11.8
19	296°00.0	77°56.9	17.0	189°22.1	06.6	215°28.7	26.2	309°36.1	11.9
20	311°02.4	92°56.4	18.1	204°23.1	06.5	230°31.1	26.2	324°38.8	12.0
21	326°04.9	107°55.9	·· 19.1	219°24.2	·· 06.4	245°33.5	·· 26.2	339°41.4	·· 12.0
22	341°07.4	122°55.4	20.2	234°25.2	06.3	260°35.9	26.2	354°44.0	12.1
23	356°09.8	137°54.9	21.3	249°26.3	06.2	275°38.3	26.2	9°46.6	12.1
Mer.pass. 23:15		ν -0.5′	d -1.1′	m -3.91	ν 1.0′	d -0.1′	m 0.46	ν 2.4′	d 0.0′ m -2.47	ν 2.6′	d -0.1′ m 0.66

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	11°12.3	152°54.4	S15°22.3	264°27.3	N23°06.1	290°40.7	N22°26.2	24°49.2	S08°12.2
1	26°14.8	167°53.9	23.4	279°28.4	06.0	305°43.1	26.2	39°51.8	12.3
2	41°17.2	182°53.4	24.5	294°29.4	06.0	320°45.5	26.2	54°54.5	12.3
3	56°19.7	197°52.9	·· 25.5	309°30.5	·· 05.9	335°47.9	·· 26.2	69°57.1	·· 12.4
4	71°22.2	212°52.4	26.6	324°31.5	05.8	350°50.3	26.2	84°59.7	12.4
5	86°24.6	227°52.0	27.7	339°32.6	05.7	5°52.7	26.2	100°02.3	12.5
6	101°27.1	242°51.5	S15°28.7	354°33.6	N23°05.6	20°55.1	N22°26.2	115°04.9	S08°12.6
7	116°29.5	257°51.0	29.8	9°34.7	05.5	35°57.5	26.2	130°07.6	12.6
8	131°32.0	272°50.5	30.9	24°35.7	05.4	50°59.9	26.2	145°10.2	12.7
9	146°34.5	287°50.0	·· 31.9	39°36.8	·· 05.3	66°02.3	·· 26.2	160°12.8	·· 12.8
10	161°36.9	302°49.5	33.0	54°37.9	05.2	81°04.7	26.2	175°15.4	12.8
11	176°39.4	317°49.0	34.1	69°38.9	05.1	96°07.1	26.2	190°18.0	12.9
12	191°41.9	332°48.5	S15°35.1	84°40.0	N23°05.0	111°09.5	N22°26.2	205°20.6	S08°12.9
13	206°44.3	347°48.0	36.2	99°41.0	05.0	126°11.9	26.2	220°23.2	13.0
14	221°46.8	2°47.5	37.3	114°42.1	04.9	141°14.3	26.3	235°25.9	13.1
15	236°49.3	17°47.0	·· 38.3	129°43.1	·· 04.8	156°16.7	·· 26.3	250°28.5	·· 13.1
16	251°51.7	32°46.5	39.4	144°44.2	04.7	171°19.1	26.3	265°31.1	13.2
17	266°54.2	47°46.0	40.4	159°45.3	04.6	186°21.5	26.3	280°33.7	13.2
18	281°56.7	62°45.5	S15°41.5	174°46.3	N23°04.5	201°23.9	N22°26.3	295°36.3	S08°13.3
19	296°59.1	77°45.0	42.6	189°47.4	04.4	216°26.3	26.3	310°38.9	13.4
20	312°01.6	92°44.5	43.6	204°48.4	04.3	231°28.7	26.3	325°41.6	13.4
21	327°04.0	107°44.0	·· 44.7	219°49.5	·· 04.2	246°31.1	·· 26.3	340°44.2	·· 13.5
22	342°06.5	122°43.5	45.7	234°50.6	04.1	261°33.6	26.3	355°46.8	13.5
23	357°09.0	137°43.0	46.8	249°51.6	04.0	276°36.0	26.3	10°49.4	13.6
Mer.pass. 23:11		ν -0.5′	d -1.1′	m -3.91	ν 1.1′	d -0.1′	m 0.45	ν 2.4′	d 0.0′ m -2.47	ν 2.6′	d -0.1′ m 0.66

Stars

	SHA	Dec
Alpheratz	357°34.7	29°13.7
Ankaa	353°06.9	-42°10.2
Schedar	349°30.8	56°40.4
Diphda	348°47.2	-17°50.9
Achernar	335°19.8	-57°06.5
Hamal	327°51.2	23°34.8
Polaris	313°47.3	89°21.9
Acamar	315°11.6	-40°12.1
Menkar	314°06.1	4°11.3
Mirfak	308°28.3	49°56.9
Aldebaran	290°39.7	16°33.6
Rigel	281°04.0	-8°10.2
Capella	280°22.1	46°01.3
Bellatrix	278°23.0	6°22.5
Elnath	278°02.1	28°37.7
Alnilam	275°37.9	-1°11.0
Betelgeuse	270°52.3	7°24.8
Canopus	263°52.5	-52°42.1
Sirius	258°26.5	-16°44.7
Adhara	255°06.1	-29°00.0
Procyon	244°51.2	5°09.8
Pollux	243°17.7	27°58.0
Avior	234°15.1	-59°34.9
Suhail	222°46.8	-43°31.6
Miaplacidus	221°39.0	-69°48.8
Alphard	217°48.2	-8°45.7
Regulus	207°34.9	11°50.9
Dubhe	193°41.9	61°37.0
Denebola	182°25.5	14°26.2
Gienah	175°44.2	-17°40.6
Acrux	173°01.1	-63°14.1
Gacrux	171°52.6	-57°15.0
Alioth	166°13.7	55°49.6
Spica	158°22.9	-11°17.3
Alkaid	152°52.6	49°11.5
Hadar	148°37.0	-60°29.6
Menkent	147°58.3	-36°29.5
Arcturus	145°48.4	19°03.4
Rigil Kent.	139°41.3	-60°56.3
Kochab	137°20.7	74°03.4
Zuben'ubi	136°56.6	-16°08.6
Alphecca	126°04.2	26°38.1
Antares	112°16.3	-26°29.2
Atria	107°11.0	-69°04.5
Sabik	102°03.2	-15°45.3
Shaula	96°10.8	-37°07.4
Rasalhague	95°58.9	12°32.7
Eltanin	90°42.4	51°29.4
Kaus Aust.	83°32.8	-34°22.5
Vega	80°33.4	38°48.6
Nunki	75°48.0	-26°16.0
Altair	62°00.1	8°56.1
Peacock	53°05.8	-56°39.5
Deneb	49°25.8	45°22.3
Enif	33°38.8	9°59.4
Al Na'ir	27°32.8	-46°50.5
Fomalhaut	15°14.4	-29°29.4
Scheat	13°45.1	28°13.2
Markab	13°29.8	15°20.4

Sep 30 Mon	SHA	Mer.pass
Venus	144°03.4	13:47
Mars	254°23.4	06:25
Jupiter	279°32.0	04:44
Saturn	13°29.5	22:25

Oct 01 Tue	SHA	Mer.pass
Venus	142°52.9	13:48
Mars	253°49.1	06:23
Jupiter	279°30.1	04:40
Saturn	13°33.2	22:21

Oct 02 Wed	SHA	Mer.pass
Venus	141°42.1	13:49
Mars	253°15.0	06:22
Jupiter	279°28.4	04:37
Saturn	13°36.9	22:17

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	182°30.5	S02°54.4	209°24.0	16.2′	N11°19.2	13.4′	54.2′
1	197°30.7	55.4	223°59.2	16.3′	11°05.8	13.4′	54.2′
2	212°30.9	56.3	238°34.5	16.3′	10°52.4	13.5′	54.2′
3	227°31.1	·· 57.3	253°09.8	16.4′	10°38.9	13.5′	54.2′
4	242°31.3	58.3	267°45.2	16.4′	10°25.4	13.5′	54.2′
5	257°31.5	02°59.3	282°20.6	16.5′	10°11.9	13.5′	54.2′
6	272°31.7	S03°00.2	296°56.1	16.5′	N09°58.4	13.6′	54.2′
7	287°31.9	01.2	311°31.6	16.6′	09°44.8	13.6′	54.2′
8	302°32.1	02.2	326°07.2	16.6′	09°31.2	13.7′	54.1′
9	317°32.3	·· 03.1	340°42.8	16.6′	09°17.5	13.7′	54.1′
10	332°32.5	04.1	355°18.4	16.7′	09°03.8	13.7′	54.1′
11	347°32.7	05.1	9°54.1	16.7′	08°50.1	13.7′	54.1′
12	2°32.9	S03°06.0	24°29.8	16.8′	N08°36.4	13.8′	54.1′
13	17°33.1	07.0	39°05.6	16.8′	08°22.6	13.7′	54.1′
14	32°33.3	08.0	53°41.4	16.8′	08°08.9	13.9′	54.1′
15	47°33.5	·· 09.0	68°17.2	16.9′	07°55.0	13.8′	54.1′
16	62°33.7	09.9	82°53.1	16.9′	07°41.2	13.9′	54.1′
17	77°33.9	10.9	97°29.0	16.9′	07°27.3	13.8′	54.1′
18	92°34.1	S03°11.9	112°05.0	17.0′	N07°13.5	13.9′	54.1′
19	107°34.3	12.8	126°41.0	17.0′	06°59.6	14.0′	54.1′
20	122°34.5	13.8	141°17.0	17.0′	06°45.6	13.9′	54.0′
21	137°34.7	·· 14.8	155°53.0	17.1′	06°31.7	14.0′	54.0′
22	152°34.9	15.7	170°29.1	17.1′	06°17.7	14.0′	54.0′
23	167°35.1	16.7	185°05.2	17.1′	06°03.7	14.0′	54.0′
	SD = 16.0′	d = -1.0′	SD = 14.8′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	182°35.3	S03°17.7	199°41.3	17.2′	N05°49.7	14.0′	54.0′
1	197°35.5	18.7	214°17.5	17.2′	05°35.7	14.0′	54.0′
2	212°35.7	19.6	228°53.7	17.2′	05°21.7	14.1′	54.0′
3	227°35.9	·· 20.6	243°29.9	17.2′	05°07.6	14.1′	54.0′
4	242°36.1	21.6	258°06.1	17.3′	04°53.5	14.1′	54.0′
5	257°36.3	22.5	272°42.3	17.3′	04°39.4	14.1′	54.0′
6	272°36.5	S03°23.5	287°18.6	17.3′	N04°25.3	14.1′	54.0′
7	287°36.7	24.5	301°54.9	17.3′	04°11.2	14.1′	54.0′
8	302°36.9	25.4	316°31.2	17.3′	03°57.1	14.1′	54.0′
9	317°37.1	·· 26.4	331°07.6	17.4′	03°43.0	14.2′	54.0′
10	332°37.3	27.4	345°43.9	17.4′	03°28.8	14.1′	54.0′
11	347°37.5	28.3	0°20.3	17.4′	03°14.7	14.2′	54.0′
12	2°37.7	S03°29.3	14°56.7	17.4′	N03°00.5	14.2′	53.9′
13	17°37.9	30.3	29°33.1	17.4′	02°46.3	14.2′	53.9′
14	32°38.1	31.3	44°09.5	17.4′	02°32.1	14.1′	53.9′
15	47°38.3	·· 32.2	58°45.9	17.4′	02°18.0	14.2′	53.9′
16	62°38.5	33.2	73°22.4	17.5′	02°03.8	14.2′	53.9′
17	77°38.7	34.2	87°58.8	17.5′	01°49.6	14.2′	53.9′
18	92°38.9	S03°35.1	102°35.3	17.5′	N01°35.4	14.3′	53.9′
19	107°39.1	36.1	117°11.7	17.5′	01°21.1	14.2′	53.9′
20	122°39.3	37.1	131°48.2	17.5′	01°06.9	14.2′	53.9′
21	137°39.5	·· 38.0	146°24.7	17.5′	00°52.7	14.2′	53.9′
22	152°39.7	39.0	161°01.2	17.5′	00°38.5	14.2′	53.9′
23	167°39.9	40.0	175°37.7	17.5′	00°24.3	14.2′	53.9′
	SD = 16.0′	d = -1.0′	SD = 14.7′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	182°40.1	S03°40.9	190°14.2	17.5′	N00°10.1	14.3′	53.9′
1	197°40.3	41.9	204°50.7	17.5′	S00°04.2	14.2′	53.9′
2	212°40.5	42.9	219°27.2	17.5′	00°18.4	14.2′	53.9′
3	227°40.7	·· 43.8	234°03.7	17.5′	00°32.6	14.2′	53.9′
4	242°40.9	44.8	248°40.2	17.5′	00°46.8	14.2′	53.9′
5	257°41.1	45.8	263°16.7	17.5′	01°01.0	14.2′	53.9′
6	272°41.3	S03°46.7	277°53.2	17.5′	S01°15.2	14.2′	53.9′
7	287°41.5	47.7	292°29.7	17.5′	01°29.4	14.2′	53.9′
8	302°41.7	48.7	307°06.2	17.5′	01°43.6	14.2′	53.9′
9	317°41.9	·· 49.6	321°42.7	17.5′	01°57.8	14.2′	53.9′
10	332°42.1	50.6	336°19.2	17.5′	02°12.0	14.1′	53.9′
11	347°42.3	51.6	350°55.6	17.5′	02°26.1	14.2′	53.9′
12	2°42.5	S03°52.5	5°32.1	17.5′	S02°40.3	14.1′	53.9′
13	17°42.7	53.5	20°08.6	17.4′	02°54.4	14.2′	53.9′
14	32°42.9	54.5	34°45.0	17.4′	03°08.6	14.1′	53.9′
15	47°43.1	·· 55.4	49°21.4	17.4′	03°22.7	14.1′	53.9′
16	62°43.2	56.4	63°57.9	17.4′	03°36.8	14.1′	53.9′
17	77°43.4	57.4	78°34.3	17.4′	03°50.9	14.1′	53.9′
18	92°43.6	S03°58.3	93°10.7	17.4′	S04°05.0	14.1′	53.9′
19	107°43.8	03°59.3	107°47.0	17.4′	04°19.1	14.1′	53.9′
20	122°44.0	04°00.3	122°23.4	17.3′	04°33.2	14.0′	53.9′
21	137°44.2	·· 01.2	136°59.8	17.3′	04°47.2	14.0′	53.9′
22	152°44.4	02.2	151°36.1	17.3′	05°01.2	14.0′	53.9′
23	167°44.6	03.2	166°12.4	17.3′	05°15.2	14.0′	53.9′
	SD = 16.0′	d = -1.0′	SD = 14.7′				

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

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

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 7-1%
30	10:02	10:12	11:50	10:19	22:39	
01	10:21	10:31	11:49	10:59	23:18	
02	10:40	10:50	11:49	11:37	23:57	

October 03, 04, 05 UT (Thu., Fri., Sat.)

	Aries	Venus		Mars		Jupiter		Saturn	
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	12°11.4	152°42.5	S15°47.8	264°52.7	N23°03.9	291°38.4	N22°26.3	25°52.0	S08°13.7
1	27°13.9	167°42.0	48.9	279°53.7	03.8	306°40.8	26.3	40°54.6	13.7
2	42°16.4	182°41.5	49.9	294°54.8	03.8	321°43.2	26.3	55°57.3	13.8
3	57°18.8	197°41.0	·· 51.0	309°55.9	·· 03.7	336°45.6	·· 26.3	70°59.9	·· 13.8
4	72°21.3	212°40.5	52.1	324°56.9	03.6	351°48.0	26.3	86°02.5	13.9
5	87°23.8	227°40.0	53.1	339°58.0	03.5	6°50.4	26.3	101°05.1	14.0
6	102°26.2	242°39.5	S15°54.2	354°59.1	N23°03.4	21°52.8	N22°26.3	116°07.7	S08°14.0
7	117°28.7	257°39.0	55.2	10°00.1	03.3	36°55.2	26.3	131°10.3	14.1
8	132°31.2	272°38.5	56.3	25°01.2	03.2	51°57.6	26.3	146°12.9	14.1
9	147°33.6	287°38.0	·· 57.3	40°02.3	·· 03.1	67°00.1	·· 26.3	161°15.6	·· 14.2
10	162°36.1	302°37.5	58.4	55°03.3	03.0	82°02.5	26.3	176°18.2	14.3
11	177°38.5	317°37.0	15°59.4	70°04.4	02.9	97°04.9	26.3	191°20.8	14.3
12	192°41.0	332°36.5	S16°00.4	85°05.5	N23°02.8	112°07.3	N22°26.3	206°23.4	S08°14.4
13	207°43.5	347°36.0	01.5	100°06.5	02.7	127°09.7	26.3	221°26.0	14.4
14	222°45.9	2°35.5	02.5	115°07.6	02.6	142°12.1	26.3	236°28.6	14.5
15	237°48.4	17°35.0	·· 03.6	130°08.7	·· 02.5	157°14.5	·· 26.3	251°31.2	·· 14.6
16	252°50.9	32°34.4	04.6	145°09.7	02.4	172°16.9	26.3	266°33.9	14.6
17	267°53.3	47°33.9	05.7	160°10.8	02.3	187°19.3	26.3	281°36.5	14.7
18	282°55.8	62°33.4	S16°06.7	175°11.9	N23°02.2	202°21.8	N22°26.3	296°39.1	S08°14.7
19	297°58.3	77°32.9	07.8	190°13.0	02.2	217°24.2	26.3	311°41.7	14.8
20	313°00.7	92°32.4	08.8	205°14.0	02.1	232°26.6	26.3	326°44.3	14.9
21	328°03.2	107°31.9	·· 09.8	220°15.1	·· 02.0	247°29.0	·· 26.3	341°46.9	·· 14.9
22	343°05.6	122°31.4	10.9	235°16.2	01.9	262°31.4	26.3	356°49.5	15.0
23	358°08.1	137°30.9	11.9	250°17.2	01.8	277°33.8	26.3	11°52.1	15.0
Mer.pass. 23:07		ν -0.5′	d -1.1′	m -3.91	ν 1.1′	d -0.1′	m 0.44	ν 2.4′	d 0.0′ m -2.48	ν 2.6′	d -0.1′ m 0.66

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	13°10.6	152°30.4	S16°13.0	265°18.3	N23°01.7	292°36.3	N22°26.3	26°54.8	S08°15.1
1	28°13.0	167°29.8	14.0	280°19.4	01.6	307°38.7	26.3	41°57.4	15.2
2	43°15.5	182°29.3	15.0	295°20.5	01.5	322°41.1	26.3	57°00.0	15.2
3	58°18.0	197°28.8	·· 16.1	310°21.5	·· 01.4	337°43.5	·· 26.3	72°02.6	·· 15.3
4	73°20.4	212°28.3	17.1	325°22.6	01.3	352°45.9	26.3	87°05.2	15.3
5	88°22.9	227°27.8	18.1	340°23.7	01.2	7°48.3	26.3	102°07.8	15.4
6	103°25.4	242°27.3	S16°19.2	355°24.8	N23°01.1	22°50.8	N22°26.3	117°10.4	S08°15.4
7	118°27.8	257°26.8	20.2	10°25.8	01.0	37°53.2	26.3	132°13.1	15.5
8	133°30.3	272°26.2	21.2	25°26.9	00.9	52°55.6	26.3	147°15.7	15.6
9	148°32.8	287°25.7	·· 22.3	40°28.0	·· 00.8	67°58.0	·· 26.3	162°18.3	·· 15.6
10	163°35.2	302°25.2	23.3	55°29.1	00.7	83°00.4	26.3	177°20.9	15.7
11	178°37.7	317°24.7	24.3	70°30.2	00.6	98°02.9	26.3	192°23.5	15.7
12	193°40.1	332°24.2	S16°25.4	85°31.2	N23°00.5	113°05.3	N22°26.4	207°26.1	S08°15.8
13	208°42.6	347°23.7	26.4	100°32.3	00.4	128°07.7	26.4	222°28.7	15.9
14	223°45.1	2°23.1	27.4	115°33.4	00.3	143°10.1	26.4	237°31.3	15.9
15	238°47.5	17°22.6	·· 28.5	130°34.5	·· 00.2	158°12.5	·· 26.4	252°33.9	·· 16.0
16	253°50.0	32°22.1	29.5	145°35.6	00.1	173°15.0	26.4	267°36.6	16.0
17	268°52.5	47°21.6	30.5	160°36.6	23°00.0	188°17.4	26.4	282°39.2	16.1
18	283°54.9	62°21.1	S16°31.5	175°37.7	N22°59.9	203°19.8	N22°26.4	297°41.8	S08°16.1
19	298°57.4	77°20.5	32.6	190°38.8	59.8	218°22.2	26.4	312°44.4	16.2
20	313°59.9	92°20.0	33.6	205°39.9	59.7	233°24.7	26.4	327°47.0	16.3
21	329°02.3	107°19.5	·· 34.6	220°41.0	·· 59.6	248°27.1	·· 26.4	342°49.6	·· 16.3
22	344°04.8	122°19.0	35.6	235°42.1	59.5	263°29.5	26.4	357°52.2	16.4
23	359°07.2	137°18.5	36.7	250°43.1	59.4	278°31.9	26.4	12°54.8	16.4
Mer.pass. 23:04		ν -0.5′	d -1.0′	m -3.91	ν 1.1′	d -0.1′	m 0.42	ν 2.4′	d 0.0′ m -2.49	ν 2.6′	d -0.1′ m 0.67

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	14°09.7	152°17.9	S16°37.7	265°44.2	N22°59.3	293°34.4	N22°26.4	27°57.4	S08°16.5
1	29°12.2	167°17.4	38.7	280°45.3	59.2	308°36.8	26.4	43°00.1	16.6
2	44°14.6	182°16.9	39.7	295°46.4	59.1	323°39.2	26.4	58°02.7	16.6
3	59°17.1	197°16.4	·· 40.8	310°47.5	·· 59.0	338°41.6	·· 26.4	73°05.3	·· 16.7
4	74°19.6	212°15.8	41.8	325°48.6	58.9	353°44.1	26.4	88°07.9	16.7
5	89°22.0	227°15.3	42.8	340°49.7	58.8	8°46.5	26.4	103°10.5	16.8
6	104°24.5	242°14.8	S16°43.8	355°50.8	N22°58.7	23°48.9	N22°26.4	118°13.1	S08°16.8
7	119°27.0	257°14.2	44.8	10°51.8	58.6	38°51.3	26.4	133°15.7	16.9
8	134°29.4	272°13.7	45.9	25°52.9	58.5	53°53.8	26.4	148°18.3	17.0
9	149°31.9	287°13.2	·· 46.9	40°54.0	·· 58.4	68°56.2	·· 26.4	163°20.9	·· 17.0
10	164°34.4	302°12.7	47.9	55°55.1	58.3	83°58.6	26.4	178°23.5	17.1
11	179°36.8	317°12.1	48.9	70°56.2	58.2	99°01.1	26.4	193°26.2	17.1
12	194°39.3	332°11.6	S16°49.9	85°57.3	N22°58.1	114°03.5	N22°26.4	208°28.8	S08°17.2
13	209°41.7	347°11.1	50.9	100°58.4	58.0	129°05.9	26.4	223°31.4	17.2
14	224°44.2	2°10.5	51.9	115°59.5	57.9	144°08.3	26.4	238°34.0	17.3
15	239°46.7	17°10.0	·· 53.0	131°00.6	·· 57.8	159°10.8	·· 26.4	253°36.6	·· 17.4
16	254°49.1	32°09.5	54.0	146°01.7	57.7	174°13.2	26.4	268°39.2	17.4
17	269°51.6	47°09.0	55.0	161°02.8	57.6	189°15.6	26.4	283°41.8	17.5
18	284°54.1	62°08.4	S16°56.0	176°03.8	N22°57.5	204°18.1	N22°26.4	298°44.4	S08°17.5
19	299°56.5	77°07.9	57.0	191°04.9	57.4	219°20.5	26.4	313°47.0	17.6
20	314°59.0	92°07.4	58.0	206°06.0	57.3	234°22.9	26.4	328°49.6	17.6
21	330°01.5	107°06.8	16°59.0	221°07.1	·· 57.2	249°25.4	·· 26.4	343°52.3	·· 17.7
22	345°03.9	122°06.3	17°00.0	236°08.2	57.1	264°27.8	26.4	358°54.9	17.8
23	0°06.4	137°05.8	01.0	251°09.3	57.0	279°30.2	26.4	13°57.5	17.8
Mer.pass. 23:00		ν -0.5′	d -1.0′	m -3.92	ν 1.1′	d -0.1′	m 0.41	ν 2.4′	d 0.0′ m -2.50	ν 2.6′	d -0.1′ m 0.67

Stars

	SHA	Dec
Alpheratz	357°34.7	29°13.8
Ankaa	353°06.9	-42°10.2
Schedar	349°30.8	56°40.5
Diphda	348°47.2	-17°50.9
Achernar	335°19.7	-57°06.5
Hamal	327°51.2	23°34.9
Polaris	313°46.3	89°21.9
Acamar	315°11.6	-40°12.1
Menkar	314°06.1	4°11.3
Mirfak	308°28.2	49°56.9
Aldebaran	290°39.7	16°33.6
Rigel	281°04.0	-8°10.2
Capella	280°22.1	46°01.3
Bellatrix	278°23.0	6°22.5
Elnath	278°02.0	28°37.7
Alnilam	275°37.9	-1°11.0
Betelgeuse	270°52.3	7°24.8
Canopus	263°52.4	-52°42.1
Sirius	258°26.4	-16°44.7
Adhara	255°06.1	-29°00.0
Procyon	244°51.2	5°09.8
Pollux	243°17.7	27°58.0
Avior	234°15.1	-59°34.9
Suhail	222°46.8	-43°31.6
Miaplacidus	221°38.9	-69°48.8
Alphard	217°48.2	-8°45.7
Regulus	207°34.9	11°50.9
Dubhe	193°41.8	61°37.0
Denebola	182°25.5	14°26.1
Gienah	175°44.2	-17°40.6
Acrux	173°01.1	-63°14.1
Gacrux	171°52.6	-57°15.0
Alioth	166°13.7	55°49.6
Spica	158°22.9	-11°17.3
Alkaid	152°52.6	49°11.5
Hadar	148°37.0	-60°29.6
Menkent	147°58.3	-36°29.5
Arcturus	145°48.4	19°03.4
Rigil Kent.	139°41.3	-60°56.3
Kochab	137°20.7	74°03.3
Zuben'ubi	136°56.6	-16°08.6
Alphecca	126°04.2	26°38.1
Antares	112°16.3	-26°29.2
Atria	107°11.0	-69°04.5
Sabik	102°03.2	-15°45.3
Shaula	96°10.8	-37°07.4
Rasalhague	95°58.9	12°32.7
Eltanin	90°42.4	51°29.4
Kaus Aust.	83°32.9	-34°22.5
Vega	80°33.4	38°48.6
Nunki	75°48.0	-26°16.0
Altair	62°00.1	8°56.1
Peacock	53°05.8	-56°39.5
Deneb	49°25.8	45°22.3
Enif	33°38.8	9°59.4
Al Na'ir	27°32.8	-46°50.6
Fomalhaut	15°14.4	-29°29.4
Scheat	13°45.1	28°13.2
Markab	13°29.9	15°20.4

Oct 03 Thu	SHA	Mer.pass
Venus	140°31.1	13:50
Mars	252°41.2	06:20
Jupiter	279°26.9	04:33
Saturn	13°40.6	22:13

Oct 04 Fri	SHA	Mer.pass
Venus	139°19.8	13:50
Mars	252°07.7	06:18
Jupiter	279°25.7	04:29
Saturn	13°44.2	22:08

Oct 05 Sat	SHA	Mer.pass
Venus	138°08.2	13:51
Mars	251°34.5	06:17
Jupiter	279°24.6	04:25
Saturn	13°47.7	22:04

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.1624 sec ΔT = TT-UT1 = +69.0216 sec

2024 October 03 to Oct. 05 UT

h	Sun		Moon				
Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	182°44.8	S04°04.1	180°48.7	17.3′	S05°29.2	14.0′	53.9′
1	197°45.0	05.1	195°25.0	17.2′	05°43.2	14.0′	53.9′
2	212°45.2	06.1	210°01.2	17.2′	05°57.2	13.9′	53.9′
3	227°45.4	·· 07.0	224°37.4	17.2′	06°11.1	13.9′	53.9′
4	242°45.6	08.0	239°13.6	17.2′	06°25.0	13.9′	53.9′
5	257°45.8	09.0	253°49.8	17.2′	06°38.9	13.9′	53.9′
6	272°46.0	S04°09.9	268°26.0	17.1′	S06°52.8	13.8′	53.9′
7	287°46.2	10.9	283°02.1	17.1′	07°06.6	13.9′	53.9′
8	302°46.4	11.9	297°38.2	17.1′	07°20.5	13.7′	53.9′
9	317°46.5	·· 12.8	312°14.3	17.0′	07°34.2	13.8′	53.9′
10	332°46.7	13.8	326°50.3	17.0′	07°48.0	13.8′	53.9′
11	347°46.9	14.8	341°26.3	17.0′	08°01.8	13.7′	53.9′
12	2°47.1	S04°15.7	356°02.3	16.9′	S08°15.5	13.7′	53.9′
13	17°47.3	16.7	10°38.2	16.9′	08°29.2	13.6′	53.9′
14	32°47.5	17.7	25°14.1	16.9′	08°42.8	13.7′	53.9′
15	47°47.7	·· 18.6	39°50.0	16.8′	08°56.5	13.6′	53.9′
16	62°47.9	19.6	54°25.8	16.8′	09°10.1	13.5′	53.9′
17	77°48.1	20.5	69°01.7	16.8′	09°23.6	13.6′	53.9′
18	92°48.3	S04°21.5	83°37.4	16.7′	S09°37.2	13.5′	53.9′
19	107°48.5	22.5	98°13.1	16.7′	09°50.7	13.4′	53.9′
20	122°48.7	23.4	112°48.8	16.7′	10°04.1	13.5′	53.9′
21	137°48.9	·· 24.4	127°24.5	16.6′	10°17.6	13.4′	53.9′
22	152°49.0	25.4	142°00.1	16.6′	10°31.0	13.3′	53.9′
23	167°49.2	26.3	156°35.7	16.5′	10°44.3	13.4′	53.9′
	SD = 16.0′	d = -1.0′	SD = 14.7′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	182°49.4	S04°27.3	171°11.2	16.5′	S10°57.7	13.3′	53.9′
1	197°49.6	28.3	185°46.7	16.4′	11°11.0	13.2′	53.9′
2	212°49.8	29.2	200°22.1	16.4′	11°24.2	13.2′	53.9′
3	227°50.0	·· 30.2	214°57.5	16.3′	11°37.4	13.2′	53.9′
4	242°50.2	31.1	229°32.8	16.3′	11°50.6	13.1′	54.0′
5	257°50.4	32.1	244°08.1	16.2′	12°03.7	13.1′	54.0′
6	272°50.6	S04°33.1	258°43.4	16.2′	S12°16.8	13.1′	54.0′
7	287°50.8	34.0	273°18.6	16.1′	12°29.9	13.0′	54.0′
8	302°50.9	35.0	287°53.7	16.1′	12°42.9	12.9′	54.0′
9	317°51.1	·· 36.0	302°28.8	16.0′	12°55.8	12.9′	54.0′
10	332°51.3	36.9	317°03.9	16.0′	13°08.7	12.9′	54.0′
11	347°51.5	37.9	331°38.9	15.9′	13°21.6	12.8′	54.0′
12	2°51.7	S04°38.9	346°13.8	15.9′	S13°34.4	12.8′	54.0′
13	17°51.9	39.8	0°48.7	15.8′	13°47.2	12.7′	54.0′
14	32°52.1	40.8	15°23.5	15.8′	13°59.9	12.7′	54.0′
15	47°52.3	·· 41.7	29°58.3	15.7′	14°12.6	12.6′	54.0′
16	62°52.5	42.7	44°33.0	15.7′	14°25.2	12.5′	54.0′
17	77°52.6	43.7	59°07.7	15.6′	14°37.7	12.6′	54.0′
18	92°52.8	S04°44.6	73°42.3	15.5′	S14°50.3	12.4′	54.0′
19	107°53.0	45.6	88°16.8	15.5′	15°02.7	12.4′	54.0′
20	122°53.2	46.5	102°51.3	15.4′	15°15.1	12.4′	54.0′
21	137°53.4	·· 47.5	117°25.7	15.4′	15°27.5	12.3′	54.1′
22	152°53.6	48.5	132°00.1	15.3′	15°39.8	12.2′	54.1′
23	167°53.8	49.4	146°34.4	15.2′	15°52.0	12.2′	54.1′
	SD = 16.0′	d = -1.0′	SD = 14.7′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	182°54.0	S04°50.4	161°08.6	15.2′	S16°04.2	12.1′	54.1′
1	197°54.1	51.4	175°42.8	15.1′	16°16.3	12.1′	54.1′
2	212°54.3	52.3	190°16.9	15.0′	16°28.4	12.0′	54.1′
3	227°54.5	·· 53.3	204°50.9	15.0′	16°40.4	11.9′	54.1′
4	242°54.7	54.2	219°24.9	14.9′	16°52.3	11.9′	54.1′
5	257°54.9	55.2	233°58.8	14.8′	17°04.2	11.8′	54.1′
6	272°55.1	S04°56.2	248°32.6	14.8′	S17°16.0	11.7′	54.1′
7	287°55.3	57.1	263°06.4	14.7′	17°27.7	11.7′	54.1′
8	302°55.4	58.1	277°40.1	14.6′	17°39.4	11.6′	54.2′
9	317°55.6	04°59.0	292°13.7	14.6′	17°51.0	11.6′	54.2′
10	332°55.8	05°00.0	306°47.3	14.5′	18°02.6	11.5′	54.2′
11	347°56.0	01.0	321°20.8	14.4′	18°14.1	11.4′	54.2′
12	2°56.2	S05°01.9	335°54.2	14.3′	S18°25.5	11.3′	54.2′
13	17°56.4	02.9	350°27.5	14.3′	18°36.8	11.3′	54.2′
14	32°56.6	03.8	5°00.8	14.2′	18°48.1	11.2′	54.2′
15	47°56.7	·· 04.8	19°34.0	14.1′	18°59.3	11.1′	54.2′
16	62°56.9	05.8	34°07.1	14.0′	19°10.4	11.0′	54.2′
17	77°57.1	06.7	48°40.1	14.0′	19°21.4	11.0′	54.2′
18	92°57.3	S05°07.7	63°13.1	13.9′	S19°32.4	10.9′	54.3′
19	107°57.5	08.6	77°46.0	13.8′	19°43.3	10.8′	54.3′
20	122°57.7	09.6	92°18.8	13.7′	19°54.1	10.8′	54.3′
21	137°57.8	·· 10.6	106°51.5	13.7′	20°04.9	10.6′	54.3′
22	152°58.0	11.5	121°24.2	13.6′	20°15.5	10.6′	54.3′
23	167°58.2	12.5	135°56.8	13.5′	20°26.1	10.5′	54.3′
	SD = 16.0′	d = -1.0′	SD = 14.7′				

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

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

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 1-3 0-4%
03	10:59	11:09	11:49	12:16	–:–	
04	11:18	11:27	11:49	12:57	00:36	
05	11:36	11:45	11:48	13:39	01:18	

October 06, 07, 08 UT (Sun., Mon., Tue.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	15°08.9	152°05.2	S17°02.0	266°10.4	N22°56.9	294°32.7	N22°26.4	29°00.1	S08°17.9
1	30°11.3	167°04.7	03.0	281°11.5	56.8	309°35.1	26.4	44°02.7	17.9
2	45°13.8	182°04.1	04.0	296°12.6	56.7	324°37.5	26.4	59°05.3	18.0
3	60°16.2	197°03.6	·· 05.0	311°13.7	·· 56.6	339°40.0	·· 26.4	74°07.9	·· 18.0
4	75°18.7	212°03.1	06.0	326°14.8	56.5	354°42.4	26.4	89°10.5	18.1
5	90°21.2	227°02.5	07.0	341°15.9	56.4	9°44.8	26.4	104°13.1	18.2
6	105°23.6	242°02.0	S17°08.1	356°17.0	N22°56.3	24°47.3	N22°26.4	119°15.7	S08°18.2
7	120°26.1	257°01.5	09.1	11°18.1	56.2	39°49.7	26.4	134°18.3	18.3
8	135°28.6	272°00.9	10.1	26°19.2	56.1	54°52.2	26.4	149°20.9	18.3
9	150°31.0	287°00.4	·· 11.1	41°20.3	·· 56.0	69°54.6	·· 26.4	164°23.5	·· 18.4
10	165°33.5	301°59.8	12.0	56°21.4	55.9	84°57.0	26.4	179°26.2	18.4
11	180°36.0	316°59.3	13.0	71°22.5	55.8	99°59.5	26.4	194°28.8	18.5
12	195°38.4	331°58.8	S17°14.0	86°23.6	N22°55.7	115°01.9	N22°26.4	209°31.4	S08°18.6
13	210°40.9	346°58.2	15.0	101°24.7	55.6	130°04.3	26.4	224°34.0	18.6
14	225°43.3	1°57.7	16.0	116°25.8	55.5	145°06.8	26.4	239°36.6	18.7
15	240°45.8	16°57.1	·· 17.0	131°26.9	·· 55.4	160°09.2	·· 26.4	254°39.2	·· 18.7
16	255°48.3	31°56.6	18.0	146°28.0	55.3	175°11.7	26.4	269°41.8	18.8
17	270°50.7	46°56.0	19.0	161°29.2	55.2	190°14.1	26.4	284°44.4	18.8
18	285°53.2	61°55.5	S17°20.0	176°30.3	N22°55.1	205°16.5	N22°26.4	299°47.0	S08°18.9
19	300°55.7	76°55.0	21.0	191°31.4	55.0	220°19.0	26.4	314°49.6	18.9
20	315°58.1	91°54.4	22.0	206°32.5	54.9	235°21.4	26.4	329°52.2	19.0
21	331°00.6	106°53.9	·· 23.0	221°33.6	·· 54.8	250°23.9	·· 26.4	344°54.8	·· 19.1
22	346°03.1	121°53.3	24.0	236°34.7	54.7	265°26.3	26.4	359°57.4	19.1
23	1°05.5	136°52.8	25.0	251°35.8	54.6	280°28.8	26.4	15°00.0	19.2
Mer.pass. 22:56		ν -0.5′	d -1.0′	m -3.92	ν 1.1′	d -0.1′	m 0.40	ν 2.4′	d 0.0′ m -2.50	ν 2.6′	d -0.1′ m 0.68

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	16°08.0	151°52.2	S17°26.0	266°36.9	N22°54.5	295°31.2	N22°26.4	30°02.6	S08°19.2
1	31°10.5	166°51.7	26.9	281°38.0	54.4	310°33.6	26.4	45°05.3	19.3
2	46°12.9	181°51.1	27.9	296°39.1	54.3	325°36.1	26.4	60°07.9	19.3
3	61°15.4	196°50.6	·· 28.9	311°40.2	·· 54.2	340°38.5	·· 26.4	75°10.5	·· 19.4
4	76°17.8	211°50.0	29.9	326°41.4	54.1	355°41.0	26.4	90°13.1	19.4
5	91°20.3	226°49.5	30.9	341°42.5	54.0	10°43.4	26.4	105°15.7	19.5
6	106°22.8	241°48.9	S17°31.9	356°43.6	N22°53.8	25°45.9	N22°26.4	120°18.3	S08°19.6
7	121°25.2	256°48.4	32.9	11°44.7	53.7	40°48.3	26.4	135°20.9	19.6
8	136°27.7	271°47.8	33.8	26°45.8	53.6	55°50.8	26.4	150°23.5	19.7
9	151°30.2	286°47.3	·· 34.8	41°46.9	·· 53.5	70°53.2	·· 26.4	165°26.1	·· 19.7
10	166°32.6	301°46.7	35.8	56°48.0	53.4	85°55.7	26.4	180°28.7	19.8
11	181°35.1	316°46.2	36.8	71°49.1	53.3	100°58.1	26.4	195°31.3	19.8
12	196°37.6	331°45.6	S17°37.8	86°50.3	N22°53.2	116°00.6	N22°26.4	210°33.9	S08°19.9
13	211°40.0	346°45.1	38.7	101°51.4	53.1	131°03.0	26.4	225°36.5	19.9
14	226°42.5	1°44.5	39.7	116°52.5	53.0	146°05.4	26.4	240°39.1	20.0
15	241°45.0	16°44.0	·· 40.7	131°53.6	·· 52.9	161°07.9	·· 26.4	255°41.7	·· 20.0
16	256°47.4	31°43.4	41.7	146°54.7	52.8	176°10.3	26.4	270°44.3	20.1
17	271°49.9	46°42.9	42.6	161°55.8	52.7	191°12.8	26.4	285°46.9	20.2
18	286°52.3	61°42.3	S17°43.6	176°57.0	N22°52.6	206°15.2	N22°26.4	300°49.5	S08°20.2
19	301°54.8	76°41.7	44.6	191°58.1	52.5	221°17.7	26.4	315°52.1	20.3
20	316°57.3	91°41.2	45.6	206°59.2	52.4	236°20.1	26.4	330°54.7	20.3
21	331°59.7	106°40.6	·· 46.5	222°00.3	·· 52.3	251°22.6	·· 26.4	345°57.4	·· 20.4
22	347°02.2	121°40.1	47.5	237°01.4	52.2	266°25.0	26.4	1°00.0	20.4
23	2°04.7	136°39.5	48.5	252°02.6	52.1	281°27.5	26.4	16°02.6	20.5
Mer.pass. 22:52		ν -0.5′	d -1.0′	m -3.92	ν 1.1′	d -0.1′	m 0.39	ν 2.4′	d 0.0′ m -2.51	ν 2.6′	d -0.1′ m 0.68

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	17°07.1	151°39.0	S17°49.5	267°03.7	N22°52.0	296°30.0	N22°26.4	31°05.2	S08°20.5
1	32°09.6	166°38.4	50.4	282°04.8	51.8	311°32.4	26.4	46°07.8	20.6
2	47°12.1	181°37.8	51.4	297°05.9	51.7	326°34.9	26.4	61°10.4	20.6
3	62°14.5	196°37.3	·· 52.4	312°07.1	·· 51.6	341°37.3	·· 26.4	76°13.0	·· 20.7
4	77°17.0	211°36.7	53.3	327°08.2	51.5	356°39.8	26.4	91°15.6	20.8
5	92°19.4	226°36.2	54.3	342°09.3	51.4	11°42.2	26.4	106°18.2	20.8
6	107°21.9	241°35.6	S17°55.3	357°10.4	N22°51.3	26°44.7	N22°26.4	121°20.8	S08°20.9
7	122°24.4	256°35.0	56.2	12°11.6	51.2	41°47.1	26.4	136°23.4	20.9
8	137°26.8	271°34.5	57.2	27°12.7	51.1	56°49.6	26.4	151°26.0	21.0
9	152°29.3	286°33.9	·· 58.2	42°13.8	·· 51.0	71°52.0	·· 26.4	166°28.6	·· 21.0
10	167°31.8	301°33.3	17°59.1	57°14.9	50.9	86°54.5	26.4	181°31.2	21.1
11	182°34.2	316°32.8	18°00.1	72°16.1	50.8	101°57.0	26.4	196°33.8	21.1
12	197°36.7	331°32.2	S18°01.0	87°17.2	N22°50.7	116°59.4	N22°26.4	211°36.4	S08°21.2
13	212°39.2	346°31.6	02.0	102°18.3	50.6	132°01.9	26.4	226°39.0	21.2
14	227°41.6	1°31.1	03.0	117°19.4	50.5	147°04.3	26.4	241°41.6	21.3
15	242°44.1	16°30.5	·· 03.9	132°20.6	·· 50.3	162°06.8	·· 26.4	256°44.2	·· 21.3
16	257°46.6	31°29.9	04.9	147°21.7	50.2	177°09.2	26.4	271°46.8	21.4
17	272°49.0	46°29.4	05.8	162°22.8	50.1	192°11.7	26.4	286°49.4	21.5
18	287°51.5	61°28.8	S18°06.8	177°24.0	N22°50.0	207°14.2	N22°26.4	301°52.0	S08°21.5
19	302°53.9	76°28.2	07.7	192°25.1	49.9	222°16.6	26.4	316°54.6	21.6
20	317°56.4	91°27.7	08.7	207°26.2	49.8	237°19.1	26.4	331°57.2	21.6
21	332°58.9	106°27.1	·· 09.7	222°27.4	·· 49.7	252°21.5	·· 26.4	346°59.8	·· 21.7
22	348°01.3	121°26.5	10.6	237°28.5	49.6	267°24.0	26.4	2°02.4	21.7
23	3°03.8	136°26.0	11.6	252°29.6	49.5	282°26.5	26.4	17°05.0	21.8
Mer.pass. 22:48		ν -0.6′	d -1.0′	m -3.93	ν 1.1′	d -0.1′	m 0.38	ν 2.5′	d -0.0′ m -2.52	ν 2.6′	d -0.1′ m 0.69

Stars

	SHA	Dec
Alpheratz	357°34.7	29°13.8
Ankaa	353°06.9	-42°10.2
Schedar	349°30.8	56°40.5
Diphda	348°47.2	-17°50.9
Achernar	335°19.7	-57°06.5
Hamal	327°51.1	23°34.9
Polaris	313°45.1	89°21.9
Acamar	315°11.6	-40°12.1
Menkar	314°06.1	4°11.3
Mirfak	308°28.2	49°56.9
Aldebaran	290°39.7	16°33.6
Rigel	281°03.9	-8°10.2
Capella	280°22.0	46°01.3
Bellatrix	278°23.0	6°22.5
Elnath	278°02.0	28°37.7
Alnilam	275°37.9	-1°11.0
Betelgeuse	270°52.2	7°24.8
Canopus	263°52.4	-52°42.1
Sirius	258°26.4	-16°44.7
Adhara	255°06.1	-29°00.0
Procyon	244°51.1	5°09.8
Pollux	243°17.7	27°58.0
Avior	234°15.1	-59°34.9
Suhail	222°46.7	-43°31.6
Miaplacidus	221°38.9	-69°48.8
Alphard	217°48.2	-8°45.7
Regulus	207°34.9	11°50.9
Dubhe	193°41.8	61°37.0
Denebola	182°25.5	14°26.1
Gienah	175°44.2	-17°40.6
Acrux	173°01.1	-63°14.1
Gacrux	171°52.5	-57°15.0
Alioth	166°13.7	55°49.6
Spica	158°22.9	-11°17.3
Alkaid	152°52.6	49°11.5
Hadar	148°37.0	-60°29.5
Menkent	147°58.3	-36°29.4
Arcturus	145°48.4	19°03.3
Rigil Kent.	139°41.3	-60°56.3
Kochab	137°20.7	74°03.3
Zuben'ubi	136°56.6	-16°08.6
Alphecca	126°04.2	26°38.0
Antares	112°16.3	-26°29.2
Atria	107°11.1	-69°04.5
Sabik	102°03.2	-15°45.3
Shaula	96°10.8	-37°07.4
Rasalhague	95°58.9	12°32.7
Eltanin	90°42.4	51°29.4
Kaus Aust.	83°32.9	-34°22.5
Vega	80°33.4	38°48.6
Nunki	75°48.1	-26°16.0
Altair	62°00.1	8°56.2
Peacock	53°05.9	-56°39.5
Deneb	49°25.8	45°22.4
Enif	33°38.8	9°59.4
Al Na'ir	27°32.8	-46°50.6
Fomalhaut	15°14.4	-29°29.5
Scheat	13°45.1	28°13.2
Markab	13°29.9	15°20.4

Oct 06 Sun	**SHA**	**Mer.pass**
Venus	136°56.4	13:52
Mars	251°01.6	06:15
Jupiter	279°23.8	04:21
Saturn	13°51.2	22:00

Oct 07 Mon	**SHA**	**Mer.pass**
Venus	135°44.2	13:53
Mars	250°28.9	06:13
Jupiter	279°23.2	04:17
Saturn	13°54.7	21:56

Oct 08 Tue	**SHA**	**Mer.pass**
Venus	134°31.8	13:54
Mars	249°56.6	06:11
Jupiter	279°22.8	04:13
Saturn	13°58.0	21:52

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	182°58.4	S05°13.4	150°29.3	13.4′	S20°36.6	10.4′	54.3′
1	197°58.6	14.4	165°01.7	13.3′	20°47.0	10.4′	54.3′
2	212°58.8	15.4	179°34.0	13.3′	20°57.4	10.2′	54.4′
3	227°58.9	·· 16.3	194°06.3	13.2′	21°07.6	10.2′	54.4′
4	242°59.1	17.3	208°38.4	13.1′	21°17.8	10.1′	54.4′
5	257°59.3	18.2	223°10.5	13.0′	21°27.9	9.9′	54.4′
6	272°59.5	S05°19.2	237°42.5	12.9′	S21°37.8	9.9′	54.4′
7	287°59.7	20.1	252°14.5	12.8′	21°47.7	9.9′	54.4′
8	302°59.9	21.1	266°46.3	12.8′	21°57.6	9.7′	54.4′
9	318°00.0	·· 22.1	281°18.1	12.7′	22°07.3	9.6′	54.4′
10	333°00.2	23.0	295°49.8	12.6′	22°16.9	9.5′	54.5′
11	348°00.4	24.0	310°21.3	12.5′	22°26.4	9.5′	54.5′
12	3°00.6	S05°24.9	324°52.9	12.4′	S22°35.9	9.3′	54.5′
13	18°00.8	25.9	339°24.3	12.3′	22°45.2	9.3′	54.5′
14	33°00.9	26.8	353°55.6	12.3′	22°54.5	9.1′	54.5′
15	48°01.1	·· 27.8	8°26.9	12.2′	23°03.6	9.1′	54.5′
16	63°01.3	28.8	22°58.0	12.1′	23°12.7	8.9′	54.6′
17	78°01.5	29.7	37°29.1	12.0′	23°21.6	8.9′	54.6′
18	93°01.7	S05°30.7	52°00.1	11.9′	S23°30.5	8.8′	54.6′
19	108°01.8	31.6	66°31.0	11.8′	23°39.3	8.6′	54.6′
20	123°02.0	32.6	81°01.9	11.7′	23°47.9	8.6′	54.6′
21	138°02.2	·· 33.5	95°32.6	11.7′	23°56.5	8.4′	54.6′
22	153°02.4	34.5	110°03.2	11.6′	24°04.9	8.3′	54.6′
23	168°02.6	35.5	124°33.8	11.5′	24°13.2	8.3′	54.7′
	SD = 16.0′	d = -1.0′	SD = 14.8′				

Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°02.7	S05°36.4	139°04.3	11.4′	S24°21.5	8.1′	54.7′
1	198°02.9	37.4	153°34.7	11.3′	24°29.6	8.0′	54.7′
2	213°03.1	38.3	168°05.0	11.2′	24°37.6	7.9′	54.7′
3	228°03.3	·· 39.3	182°35.2	11.1′	24°45.5	7.8′	54.7′
4	243°03.5	40.2	197°05.4	11.0′	24°53.3	7.7′	54.8′
5	258°03.6	41.2	211°35.4	11.0′	25°01.0	7.6′	54.8′
6	273°03.8	S05°42.1	226°05.4	10.9′	S25°08.6	7.4′	54.8′
7	288°04.0	43.1	240°35.2	10.8′	25°16.0	7.4′	54.8′
8	303°04.2	44.1	255°05.0	10.7′	25°23.4	7.2′	54.8′
9	318°04.3	·· 45.0	269°34.7	10.6′	25°30.6	7.1′	54.8′
10	333°04.5	46.0	284°04.4	10.5′	25°37.7	7.0′	54.9′
11	348°04.7	46.9	298°33.9	10.5′	25°44.7	6.9′	54.9′
12	3°04.9	S05°47.9	313°03.4	10.4′	S25°51.6	6.7′	54.9′
13	18°05.1	48.8	327°32.7	10.3′	25°58.3	6.6′	54.9′
14	33°05.2	49.8	342°02.0	10.2′	26°04.9	6.5′	54.9′
15	48°05.4	·· 50.7	356°31.2	10.1′	26°11.4	6.4′	55.0′
16	63°05.6	51.7	11°00.3	10.0′	26°17.8	6.3′	55.0′
17	78°05.8	52.6	25°29.4	10.0′	26°24.1	6.1′	55.0′
18	93°05.9	S05°53.6	39°58.3	9.9′	S26°30.2	6.0′	55.0′
19	108°06.1	54.6	54°27.2	9.8′	26°36.2	5.9′	55.0′
20	123°06.3	55.5	68°56.0	9.7′	26°42.1	5.7′	55.1′
21	138°06.5	·· 56.5	83°24.7	9.6′	26°47.8	5.7′	55.1′
22	153°06.6	57.4	97°53.3	9.5′	26°53.5	5.4′	55.1′
23	168°06.8	58.4	112°21.9	9.5′	26°58.9	5.4′	55.1′
	SD = 16.0′	d = -1.0′	SD = 14.9′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°07.0	S05°59.3	126°50.3	9.4′	S27°04.3	5.2′	55.2′
1	198°07.2	06°00.3	141°18.7	9.3′	27°09.5	5.1′	55.2′
2	213°07.3	01.2	155°47.0	9.2′	27°14.6	5.0′	55.2′
3	228°07.5	·· 02.2	170°15.3	9.2′	27°19.6	4.8′	55.2′
4	243°07.7	03.1	184°43.4	9.1′	27°24.4	4.7′	55.2′
5	258°07.9	04.1	199°11.5	9.0′	27°29.1	4.5′	55.3′
6	273°08.0	S06°05.0	213°39.5	8.9′	S27°33.6	4.4′	55.3′
7	288°08.2	06.0	228°07.5	8.9′	27°38.0	4.3′	55.3′
8	303°08.4	06.9	242°35.3	8.8′	27°42.3	4.1′	55.3′
9	318°08.5	·· 07.9	257°03.1	8.7′	27°46.4	4.0′	55.4′
10	333°08.7	08.8	271°30.8	8.7′	27°50.4	3.8′	55.4′
11	348°08.9	09.8	285°58.5	8.6′	27°54.2	3.7′	55.4′
12	3°09.1	S06°10.7	300°26.1	8.5′	S27°57.9	3.6′	55.4′
13	18°09.2	11.7	314°53.6	8.4′	28°01.5	3.4′	55.5′
14	33°09.4	12.6	329°21.0	8.4′	28°04.9	3.3′	55.5′
15	48°09.6	·· 13.6	343°48.4	8.3′	28°08.2	3.1′	55.5′
16	63°09.8	14.5	358°15.8	8.3′	28°11.3	3.0′	55.5′
17	78°09.9	15.5	12°43.0	8.2′	28°14.3	2.8′	55.6′
18	93°10.1	S06°16.4	27°10.2	8.1′	S28°17.1	2.6′	55.6′
19	108°10.3	17.4	41°37.3	8.1′	28°19.7	2.6′	55.6′
20	123°10.4	18.3	56°04.4	8.0′	28°22.3	2.3′	55.6′
21	138°10.6	·· 19.3	70°31.4	8.0′	28°24.6	2.3′	55.7′
22	153°10.8	20.2	84°58.4	7.9′	28°26.9	2.0′	55.7′
23	168°11.0	21.2	99°25.3	7.8′	28°28.9	2.0′	55.7′
	SD = 16.0′	d = -1.0′	SD = 15.0′				

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

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

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 4-6 9-23%
06	11:54	12:02	11:48	14:25	02:02	
07	12:11	12:20	11:48	15:14	02:49	
08	12:28	12:36	11:47	16:07	03:40	

October 09, 10, 11 UT (Wed., Thu., Fri.)

	Aries	Venus		Mars		Jupiter		Saturn	
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	18°06.3	151°25.4	S18°12.5	267°30.8	N22°49.4	297°28.9	N22°26.4	32°07.6	S08°21.8
1	33°08.7	166°24.8	13.5	282°31.9	49.3	312°31.4	26.4	47°10.2	21.9
2	48°11.2	181°24.2	14.4	297°33.0	49.2	327°33.8	26.4	62°12.8	21.9
3	63°13.7	196°23.7	·· 15.4	312°34.2	·· 49.0	342°36.3	·· 26.4	77°15.4	·· 22.0
4	78°16.1	211°23.1	16.3	327°35.3	48.9	357°38.8	26.4	92°18.0	22.0
5	93°18.6	226°22.5	17.3	342°36.4	48.8	12°41.2	26.4	107°20.6	22.1
6	108°21.1	241°22.0	S18°18.2	357°37.6	N22°48.7	27°43.7	N22°26.4	122°23.2	S08°22.1
7	123°23.5	256°21.4	19.2	12°38.7	48.6	42°46.2	26.4	137°25.8	22.2
8	138°26.0	271°20.8	20.1	27°39.9	48.5	57°48.6	26.4	152°28.4	22.2
9	153°28.4	286°20.2	·· 21.0	42°41.0	·· 48.4	72°51.1	·· 26.4	167°31.0	·· 22.3
10	168°30.9	301°19.7	22.0	57°42.1	48.3	87°53.6	26.4	182°33.6	22.4
11	183°33.4	316°19.1	22.9	72°43.3	48.2	102°56.0	26.4	197°36.2	22.4
12	198°35.8	331°18.5	S18°23.9	87°44.4	N22°48.1	117°58.5	N22°26.4	212°38.8	S08°22.5
13	213°38.3	346°17.9	24.8	102°45.6	48.0	133°00.9	26.4	227°41.4	22.5
14	228°40.8	1°17.3	25.8	117°46.7	47.8	148°03.4	26.4	242°44.0	22.6
15	243°43.2	16°16.8	·· 26.7	132°47.8	·· 47.7	163°05.9	·· 26.4	257°46.6	·· 22.6
16	258°45.7	31°16.2	27.6	147°49.0	47.6	178°08.3	26.4	272°49.2	22.7
17	273°48.2	46°15.6	28.6	162°50.1	47.5	193°10.8	26.4	287°51.8	22.7
18	288°50.6	61°15.0	S18°29.5	177°51.3	N22°47.4	208°13.3	N22°26.4	302°54.4	S08°22.8
19	303°53.1	76°14.5	30.4	192°52.4	47.3	223°15.8	26.4	317°57.0	22.8
20	318°55.6	91°13.9	31.4	207°53.6	47.2	238°18.2	26.4	332°59.6	22.9
21	333°58.0	106°13.3	·· 32.3	222°54.7	·· 47.1	253°20.7	·· 26.4	348°02.2	·· 22.9
22	349°00.5	121°12.7	33.3	237°55.8	47.0	268°23.2	26.4	3°04.8	23.0
23	4°02.9	136°12.1	34.2	252°57.0	46.9	283°25.6	26.4	18°07.4	23.0
Mer.pass. 22:44		ν -0.6′	d -1.0′	m -3.93	ν 1.1′	d -0.1′	m 0.37	ν 2.5′	d -0.0′ m -2.53	ν 2.6′	d -0.1′ m 0.69

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	19°05.4	151°11.5	S18°35.1	267°58.1	N22°46.7	298°28.1	N22°26.4	33°10.0	S08°23.1
1	34°07.9	166°11.0	36.1	282°59.3	46.6	313°30.6	26.4	48°12.6	23.1
2	49°10.3	181°10.4	37.0	298°00.4	46.5	328°33.0	26.4	63°15.2	23.2
3	64°12.8	196°09.8	·· 37.9	313°01.6	·· 46.4	343°35.5	·· 26.4	78°17.8	·· 23.2
4	79°15.3	211°09.2	38.8	328°02.7	46.3	358°38.0	26.4	93°20.4	23.3
5	94°17.7	226°08.6	39.8	343°03.9	46.2	13°40.5	26.4	108°23.0	23.3
6	109°20.2	241°08.0	S18°40.7	358°05.0	N22°46.1	28°42.9	N22°26.4	123°25.6	S08°23.4
7	124°22.7	256°07.5	41.6	13°06.2	46.0	43°45.4	26.4	138°28.2	23.4
8	139°25.1	271°06.9	42.6	28°07.3	45.9	58°47.9	26.4	153°30.8	23.5
9	154°27.6	286°06.3	·· 43.5	43°08.5	·· 45.8	73°50.4	·· 26.4	168°33.4	·· 23.5
10	169°30.1	301°05.7	44.4	58°09.6	45.6	88°52.8	26.4	183°36.0	23.6
11	184°32.5	316°05.1	45.3	73°10.8	45.5	103°55.3	26.4	198°38.6	23.6
12	199°35.0	331°04.5	S18°46.3	88°11.9	N22°45.4	118°57.8	N22°26.4	213°41.2	S08°23.7
13	214°37.4	346°03.9	47.2	103°13.1	45.3	134°00.3	26.4	228°43.8	23.7
14	229°39.9	1°03.3	48.1	118°14.3	45.2	149°02.7	26.4	243°46.4	23.8
15	244°42.4	16°02.7	·· 49.0	133°15.4	·· 45.1	164°05.2	·· 26.4	258°49.0	·· 23.9
16	259°44.8	31°02.2	49.9	148°16.6	45.0	179°07.7	26.4	273°51.6	23.9
17	274°47.3	46°01.6	50.9	163°17.7	44.9	194°10.2	26.4	288°54.2	24.0
18	289°49.8	61°01.0	S18°51.8	178°18.9	N22°44.8	209°12.6	N22°26.4	303°56.7	S08°24.0
19	304°52.2	76°00.4	52.7	193°20.0	44.6	224°15.1	26.4	318°59.3	24.1
20	319°54.7	90°59.8	53.6	208°21.2	44.5	239°17.6	26.4	334°01.9	24.1
21	334°57.2	105°59.2	·· 54.5	223°22.3	·· 44.4	254°20.1	·· 26.4	349°04.5	·· 24.2
22	349°59.6	120°58.6	55.4	238°23.5	44.3	269°22.5	26.4	4°07.1	24.2
23	5°02.1	135°58.0	56.4	253°24.7	44.2	284°25.0	26.4	19°09.7	24.3
Mer.pass. 22:40		ν -0.6′	d -0.9′	m -3.93	ν 1.1′	d -0.1′	m 0.36	ν 2.5′	d -0.0′ m -2.53	ν 2.6′	d -0.1′ m 0.69

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	20°04.5	150°57.4	S18°57.3	268°25.8	N22°44.1	299°27.5	N22°26.4	34°12.3	S08°24.3
1	35°07.0	165°56.8	58.2	283°27.0	44.0	314°30.0	26.4	49°14.9	24.4
2	50°09.5	180°56.2	18°59.1	298°28.1	43.9	329°32.5	26.4	64°17.5	24.4
3	65°11.9	195°55.6	19°00.0	313°29.3	·· 43.7	344°34.9	·· 26.4	79°20.1	·· 24.5
4	80°14.4	210°55.0	00.9	328°30.5	43.6	359°37.4	26.3	94°22.7	24.5
5	95°16.9	225°54.4	01.8	343°31.6	43.5	14°39.9	26.3	109°25.3	24.6
6	110°19.3	240°53.8	S19°02.7	358°32.8	N22°43.4	29°42.4	N22°26.3	124°27.9	S08°24.6
7	125°21.8	255°53.2	03.6	13°34.0	43.3	44°44.9	26.3	139°30.5	24.7
8	140°24.3	270°52.6	04.5	28°35.1	43.2	59°47.4	26.3	154°33.1	24.7
9	155°26.7	285°52.0	·· 05.4	43°36.3	·· 43.1	74°49.8	·· 26.3	169°35.7	·· 24.8
10	170°29.2	300°51.4	06.4	58°37.4	43.0	89°52.3	26.3	184°38.3	24.8
11	185°31.7	315°50.8	07.3	73°38.6	42.8	104°54.8	26.3	199°40.9	24.9
12	200°34.1	330°50.2	S19°08.2	88°39.8	N22°42.7	119°57.3	N22°26.3	214°43.5	S08°24.9
13	215°36.6	345°49.6	09.1	103°40.9	42.6	134°59.8	26.3	229°46.1	25.0
14	230°39.0	0°49.0	10.0	118°42.1	42.5	150°02.3	26.3	244°48.6	25.0
15	245°41.5	15°48.4	·· 10.9	133°43.3	·· 42.4	165°04.7	·· 26.3	259°51.2	·· 25.1
16	260°44.0	30°47.8	11.8	148°44.4	42.3	180°07.2	26.3	274°53.8	25.1
17	275°46.4	45°47.2	12.7	163°45.6	42.2	195°09.7	26.3	289°56.4	25.2
18	290°48.9	60°46.6	S19°13.6	178°46.8	N22°42.0	210°12.2	N22°26.3	304°59.0	S08°25.2
19	305°51.4	75°46.0	14.5	193°48.0	41.9	225°14.7	26.3	320°01.6	25.3
20	320°53.8	90°45.4	15.4	208°49.1	41.8	240°17.2	26.3	335°04.2	25.3
21	335°56.3	105°44.8	·· 16.3	223°50.3	·· 41.7	255°19.7	·· 26.3	350°06.8	·· 25.4
22	350°58.8	120°44.2	17.1	238°51.5	41.6	270°22.1	26.3	5°09.4	25.4
23	6°01.2	135°43.6	18.0	253°52.6	41.5	285°24.6	26.3	20°12.0	25.5
Mer.pass. 22:36		ν -0.6′	d -0.9′	m -3.94	ν 1.2′	d -0.1′	m 0.35	ν 2.5′	d -0.0′ m -2.54	ν 2.6′	d -0.1′ m 0.70

Stars

	SHA	Dec
Alpheratz	357°34.7	29°13.8
Ankaa	353°06.9	-42°10.2
Schedar	349°30.8	56°40.5
Diphda	348°47.2	-17°50.9
Achernar	335°19.7	-57°06.6
Hamal	327°51.1	23°34.9
Polaris	313°43.9	89°22.0
Acamar	315°11.6	-40°12.1
Menkar	314°06.1	4°11.3
Mirfak	308°28.2	49°56.9
Aldebaran	290°39.7	16°33.6
Rigel	281°03.9	-8°10.2
Capella	280°22.0	46°01.3
Bellatrix	278°23.0	6°22.5
Elnath	278°02.0	28°37.7
Alnilam	275°37.8	-1°11.0
Betelgeuse	270°52.2	7°24.8
Canopus	263°52.4	-52°42.1
Sirius	258°26.4	-16°44.7
Adhara	255°06.0	-29°00.0
Procyon	244°51.1	5°09.8
Pollux	243°17.6	27°58.0
Avior	234°15.0	-59°34.9
Suhail	222°46.7	-43°31.6
Miaplacidus	221°38.8	-69°48.7
Alphard	217°48.2	-8°45.7
Regulus	207°34.9	11°50.9
Dubhe	193°41.8	61°37.0
Denebola	182°25.5	14°26.1
Gienah	175°44.2	-17°40.6
Acrux	173°01.1	-63°14.0
Gacrux	171°52.5	-57°15.0
Alioth	166°13.7	55°49.6
Spica	158°22.9	-11°17.3
Alkaid	152°52.6	49°11.5
Hadar	148°37.0	-60°29.5
Menkent	147°58.3	-36°29.4
Arcturus	145°48.4	19°03.3
Rigil Kent.	139°41.3	-60°56.3
Kochab	137°20.8	74°03.3
Zuben'ubi	136°56.6	-16°08.6
Alphecca	126°04.2	26°38.0
Antares	112°16.4	-26°29.2
Atria	107°11.1	-69°04.5
Sabik	102°03.2	-15°45.3
Shaula	96°10.8	-37°07.4
Rasalhague	95°58.9	12°32.7
Eltanin	90°42.5	51°29.4
Kaus Aust.	83°32.9	-34°22.5
Vega	80°33.5	38°48.6
Nunki	75°48.1	-26°16.0
Altair	62°00.1	8°56.2
Peacock	53°05.9	-56°39.5
Deneb	49°25.8	45°22.4
Enif	33°38.8	9°59.4
Al Na'ir	27°32.9	-46°50.6
Fomalhaut	15°14.5	-29°29.5
Scheat	13°45.1	28°13.2
Markab	13°29.9	15°20.5

Oct 09 Wed	SHA	Mer.pass
Venus	133°19.1	13:55
Mars	249°24.5	06:09
Jupiter	279°22.6	04:09
Saturn	14°01.3	21:48

Oct 10 Thu	SHA	Mer.pass
Venus	132°06.1	13:56
Mars	248°52.7	06:08
Jupiter	279°22.7	04:05
Saturn	14°04.6	21:44

Oct 11 Fri	SHA	Mer.pass
Venus	130°52.9	13:57
Mars	248°21.3	06:06
Jupiter	279°23.0	04:01
Saturn	14°07.8	21:39

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.1639 sec ΔT = TT-UT1 = +69.0201 sec

2024 October 09 to Oct. 11 UT

h	Sun		Moon				
Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°11.1	S06°22.1	113°52.1	7.8′	S28°30.9	1.7′	55.7′
1	198°11.3	23.1	128°18.9	7.7′	28°32.6	1.6′	55.8′
2	213°11.5	24.0	142°45.7	7.7′	28°34.2	1.5′	55.8′
3	228°11.6	·· 25.0	157°12.3	7.6′	28°35.7	1.3′	55.8′
4	243°11.8	25.9	171°39.0	7.6′	28°37.0	1.1′	55.9′
5	258°12.0	26.9	186°05.6	7.5′	28°38.1	1.0′	55.9′
6	273°12.1	S06°27.8	200°32.1	7.5′	S28°39.1	0.9′	55.9′
7	288°12.3	28.8	214°58.6	7.5′	28°40.0	0.6′	55.9′
8	303°12.5	29.7	229°25.1	7.4′	28°40.6	0.5′	56.0′
9	318°12.6	·· 30.7	243°51.5	7.4′	28°41.1	0.4′	56.0′
10	333°12.8	31.6	258°17.9	7.3′	28°41.5	0.2′	56.0′
11	348°13.0	32.6	272°44.2	7.3′	28°41.7	0.0′	56.1′
12	3°13.2	S06°33.5	287°10.5	7.3′	S28°41.7	0.1′	56.1′
13	18°13.3	34.5	301°36.7	7.2′	28°41.6	0.3′	56.1′
14	33°13.5	35.4	316°03.0	7.2′	28°41.3	0.4′	56.1′
15	48°13.7	·· 36.4	330°29.2	7.2′	28°40.9	0.6′	56.2′
16	63°13.8	37.3	344°55.3	7.1′	28°40.3	0.8′	56.2′
17	78°14.0	38.3	359°21.4	7.1′	28°39.5	0.9′	56.2′
18	93°14.2	S06°39.2	13°47.5	7.1′	S28°38.6	1.1′	56.3′
19	108°14.3	40.1	28°13.6	7.0′	28°37.5	1.3′	56.3′
20	123°14.5	41.1	42°39.7	7.0′	28°36.2	1.4′	56.3′
21	138°14.7	·· 42.0	57°05.7	7.0′	28°34.8	1.6′	56.4′
22	153°14.8	43.0	71°31.7	7.0′	28°33.2	1.8′	56.4′
23	168°15.0	43.9	85°57.7	7.0′	28°31.4	1.9′	56.4′
	SD = 16.0′	d = -0.9′	SD = 15.2′				

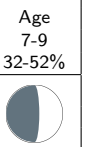
Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°15.2	S06°44.9	100°23.6	6.9′	S28°29.5	2.1′	56.5′
1	198°15.3	45.8	114°49.6	6.9′	28°27.4	2.2′	56.5′
2	213°15.5	46.8	129°15.5	6.9′	28°25.2	2.4′	56.5′
3	228°15.6	·· 47.7	143°41.4	6.9′	28°22.8	2.6′	56.6′
4	243°15.8	48.7	158°07.3	6.9′	28°20.2	2.7′	56.6′
5	258°16.0	49.6	172°33.2	6.9′	28°17.5	2.9′	56.6′
6	273°16.1	S06°50.5	186°59.1	6.9′	S28°14.6	3.1′	56.7′
7	288°16.3	51.5	201°25.0	6.9′	28°11.5	3.3′	56.7′
8	303°16.5	52.4	215°50.8	6.9′	28°08.2	3.4′	56.7′
9	318°16.6	·· 53.4	230°16.7	6.9′	28°04.8	3.5′	56.8′
10	333°16.8	54.3	244°42.6	6.9′	28°01.3	3.8′	56.8′
11	348°17.0	55.3	259°08.4	6.9′	27°57.5	3.9′	56.8′
12	3°17.1	S06°56.2	273°34.3	6.9′	S27°53.6	4.0′	56.9′
13	18°17.3	57.2	288°00.1	6.9′	27°49.6	4.3′	56.9′
14	33°17.4	58.1	302°26.0	6.9′	27°45.3	4.4′	56.9′
15	48°17.6	06°59.0	316°51.9	6.9′	27°40.9	4.5′	57.0′
16	63°17.8	07°00.0	331°17.7	6.9′	27°36.4	4.8′	57.0′
17	78°17.9	00.9	345°43.6	6.9′	27°31.6	4.9′	57.0′
18	93°18.1	S07°01.9	0°09.5	6.9′	S27°26.7	5.0′	57.1′
19	108°18.3	02.8	14°35.4	6.9′	27°21.7	5.3′	57.1′
20	123°18.4	03.8	29°01.3	6.9′	27°16.4	5.4′	57.1′
21	138°18.6	·· 04.7	43°27.2	6.9′	27°11.0	5.5′	57.2′
22	153°18.7	05.6	57°53.2	7.0′	27°05.5	5.7′	57.2′
23	168°18.9	06.6	72°19.1	7.0′	26°59.8	5.9′	57.2′
	SD = 16.0′	d = -0.9′	SD = 15.4′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°19.1	S07°07.5	86°45.1	7.0′	S26°53.9	6.1′	57.3′
1	198°19.2	08.5	101°11.1	7.0′	26°47.8	6.2′	57.3′
2	213°19.4	09.4	115°37.1	7.0′	26°41.6	6.4′	57.3′
3	228°19.5	·· 10.3	130°03.1	7.1′	26°35.2	6.5′	57.4′
4	243°19.7	11.3	144°29.2	7.1′	26°28.7	6.7′	57.4′
5	258°19.9	12.2	158°55.2	7.1′	26°22.0	6.9′	57.5′
6	273°20.0	S07°13.2	173°21.3	7.1′	S26°15.1	7.0′	57.5′
7	288°20.2	14.1	187°47.5	7.2′	26°08.1	7.2′	57.5′
8	303°20.3	15.0	202°13.6	7.2′	26°00.9	7.3′	57.6′
9	318°20.5	·· 16.0	216°39.8	7.2′	25°53.6	7.5′	57.6′
10	333°20.7	16.9	231°06.0	7.2′	25°46.1	7.7′	57.6′
11	348°20.8	17.9	245°32.2	7.3′	25°38.4	7.8′	57.7′
12	3°21.0	S07°18.8	259°58.5	7.3′	S25°30.6	8.0′	57.7′
13	18°21.1	19.7	274°24.8	7.3′	25°22.6	8.1′	57.8′
14	33°21.3	20.7	288°51.1	7.4′	25°14.5	8.3′	57.8′
15	48°21.5	·· 21.6	303°17.5	7.4′	25°06.2	8.5′	57.8′
16	63°21.6	22.6	317°43.9	7.4′	24°57.7	8.6′	57.9′
17	78°21.8	23.5	332°10.3	7.5′	24°49.1	8.8′	57.9′
18	93°21.9	S07°24.4	346°36.8	7.5′	S24°40.3	8.9′	57.9′
19	108°22.1	25.4	1°03.3	7.5′	24°31.4	9.1′	58.0′
20	123°22.2	26.3	15°29.9	7.6′	24°22.3	9.2′	58.0′
21	138°22.4	·· 27.3	29°56.5	7.6′	24°13.1	9.4′	58.1′
22	153°22.6	28.2	44°23.1	7.7′	24°03.7	9.5′	58.1′
23	168°22.7	29.1	58°49.7	7.7′	23°54.2	9.7′	58.1′
	SD = 16.0′	d = -0.9′	SD = 15.6′				

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

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

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 7-9 32-52%
09	12:44	12:53	11:47	17:03	04:35	
10	13:01	13:08	11:47	17:59	05:31	
11	13:16	13:24	11:47	18:56	06:28	



No IERS EOP prediction data available

October 12, 13, 14 UT (Sat., Sun., Mon.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	21°03.7	150°43.0	S19°18.9	268°53.8	N22°41.4	300°27.1	N22°26.3	35°14.6	S08°25.5
1	36°06.2	165°42.4	19.8	283°55.0	41.3	315°29.6	26.3	50°17.2	25.6
2	51°08.6	180°41.8	20.7	298°56.2	41.1	330°32.1	26.3	65°19.8	25.6
3	66°11.1	195°41.2	·· 21.6	313°57.3	·· 41.0	345°34.6	·· 26.3	80°22.4	·· 25.6
4	81°13.5	210°40.6	22.5	328°58.5	40.9	0°37.1	26.3	95°25.0	25.7
5	96°16.0	225°39.9	23.4	343°59.7	40.8	15°39.6	26.3	110°27.5	25.7
6	111°18.5	240°39.3	S19°24.3	359°00.9	N22°40.7	30°42.1	N22°26.3	125°30.1	S08°25.8
7	126°20.9	255°38.7	25.2	14°02.0	40.6	45°44.6	26.3	140°32.7	25.8
8	141°23.4	270°38.1	26.1	29°03.2	40.5	60°47.0	26.3	155°35.3	25.9
9	156°25.9	285°37.5	·· 26.9	44°04.4	·· 40.3	75°49.5	·· 26.3	170°37.9	·· 25.9
10	171°28.3	300°36.9	27.8	59°05.6	40.2	90°52.0	26.3	185°40.5	26.0
11	186°30.8	315°36.3	28.7	74°06.8	40.1	105°54.5	26.3	200°43.1	26.0
12	201°33.3	330°35.7	S19°29.6	89°07.9	N22°40.0	120°57.0	N22°26.3	215°45.7	S08°26.1
13	216°35.7	345°35.1	30.5	104°09.1	39.9	135°59.5	26.3	230°48.3	26.1
14	231°38.2	0°34.4	31.4	119°10.3	39.8	151°02.0	26.3	245°50.9	26.2
15	246°40.7	15°33.8	·· 32.2	134°11.5	·· 39.7	166°04.5	·· 26.3	260°53.5	·· 26.2
16	261°43.1	30°33.2	33.1	149°12.7	39.5	181°07.0	26.3	275°56.0	26.3
17	276°45.6	45°32.6	34.0	164°13.8	39.4	196°09.5	26.3	290°58.6	26.3
18	291°48.0	60°32.0	S19°34.9	179°15.0	N22°39.3	211°12.0	N22°26.3	306°01.2	S08°26.4
19	306°50.5	75°31.4	35.7	194°16.2	39.2	226°14.5	26.3	321°03.8	26.4
20	321°53.0	90°30.8	36.6	209°17.4	39.1	241°17.0	26.3	336°06.4	26.5
21	336°55.4	105°30.1	·· 37.5	224°18.6	·· 39.0	256°19.5	·· 26.3	351°09.0	·· 26.5
22	351°57.9	120°29.5	38.4	239°19.8	38.8	271°22.0	26.3	6°11.6	26.6
23	7°00.4	135°28.9	39.2	254°20.9	38.7	286°24.5	26.3	21°14.2	26.6
Mer.pass. 22:32		ν -0.6′	d -0.9′	m -3.94	ν 1.2′	d -0.1′	m 0.33	ν 2.5′	d -0.0′ m -2.55	ν 2.6′	d -0.0′ m 0.70

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	22°02.8	150°28.3	S19°40.1	269°22.1	N22°38.6	301°27.0	N22°26.3	36°16.8	S08°26.7
1	37°05.3	165°27.7	41.0	284°23.3	38.5	316°29.5	26.3	51°19.4	26.7
2	52°07.8	180°27.0	41.9	299°24.5	38.4	331°32.0	26.3	66°22.0	26.8
3	67°10.2	195°26.4	·· 42.7	314°25.7	·· 38.3	346°34.5	·· 26.3	81°24.5	·· 26.8
4	82°12.7	210°25.8	43.6	329°26.9	38.2	1°36.9	26.2	96°27.1	26.9
5	97°15.1	225°25.2	44.5	344°28.1	38.0	16°39.4	26.2	111°29.7	26.9
6	112°17.6	240°24.6	S19°45.3	359°29.2	N22°37.9	31°41.9	N22°26.2	126°32.3	S08°26.9
7	127°20.1	255°23.9	46.2	14°30.4	37.8	46°44.4	26.2	141°34.9	27.0
8	142°22.5	270°23.3	47.1	29°31.6	37.7	61°46.9	26.2	156°37.5	27.0
9	157°25.0	285°22.7	·· 47.9	44°32.8	·· 37.6	76°49.5	·· 26.2	171°40.1	·· 27.1
10	172°27.5	300°22.1	48.8	59°34.0	37.5	91°52.0	26.2	186°42.7	27.1
11	187°29.9	315°21.4	49.7	74°35.2	37.3	106°54.5	26.2	201°45.3	27.2
12	202°32.4	330°20.8	S19°50.5	89°36.4	N22°37.2	121°57.0	N22°26.2	216°47.8	S08°27.2
13	217°34.9	345°20.2	51.4	104°37.6	37.1	136°59.5	26.2	231°50.4	27.3
14	232°37.3	0°19.6	52.2	119°38.8	37.0	152°02.0	26.2	246°53.0	27.3
15	247°39.8	15°18.9	·· 53.1	134°40.0	·· 36.9	167°04.5	·· 26.2	261°55.6	·· 27.4
16	262°42.3	30°18.3	54.0	149°41.2	36.8	182°07.0	26.2	276°58.2	27.4
17	277°44.7	45°17.7	54.8	164°42.4	36.6	197°09.5	26.2	292°00.8	27.5
18	292°47.2	60°17.1	S19°55.7	179°43.6	N22°36.5	212°12.0	N22°26.2	307°03.4	S08°27.5
19	307°49.6	75°16.4	56.5	194°44.8	36.4	227°14.5	26.2	322°06.0	27.6
20	322°52.1	90°15.8	57.4	209°46.0	36.3	242°17.0	26.2	337°08.5	27.6
21	337°54.6	105°15.2	·· 58.2	224°47.2	·· 36.2	257°19.5	·· 26.2	352°11.1	·· 27.7
22	352°57.0	120°14.5	59.1	239°48.4	36.1	272°22.0	26.2	7°13.7	27.7
23	7°59.5	135°13.9	59.9	254°49.5	35.9	287°24.5	26.2	22°16.3	27.7
Mer.pass. 22:28		ν -0.6′	d -0.9′	m -3.94	ν 1.2′	d -0.1′	m 0.32	ν 2.5′	d -0.0′ m -2.56	ν 2.6′	d -0.0′ m 0.71

Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	23°02.0	150°13.3	S20°00.8	269°50.7	N22°35.8	302°27.0	N22°26.2	37°18.9	S08°27.8
1	38°04.4	165°12.7	01.6	284°51.9	35.7	317°29.5	26.2	52°21.5	27.8
2	53°06.9	180°12.0	02.5	299°53.1	35.6	332°32.0	26.2	67°24.1	27.9
3	68°09.4	195°11.4	·· 03.3	314°54.3	·· 35.5	347°34.5	·· 26.2	82°26.7	·· 27.9
4	83°11.8	210°10.8	04.2	329°55.6	35.4	2°37.0	26.2	97°29.2	28.0
5	98°14.3	225°10.1	05.0	344°56.8	35.2	17°39.5	26.2	112°31.8	28.0
6	113°16.8	240°09.5	S20°05.9	359°58.0	N22°35.1	32°42.1	N22°26.2	127°34.4	S08°28.1
7	128°19.2	255°08.9	06.7	14°59.2	35.0	47°44.6	26.2	142°37.0	28.1
8	143°21.7	270°08.2	07.6	30°00.4	34.9	62°47.1	26.2	157°39.6	28.2
9	158°24.1	285°07.6	·· 08.4	45°01.6	·· 34.8	77°49.6	·· 26.2	172°42.2	·· 28.2
10	173°26.6	300°07.0	09.3	60°02.8	34.7	92°52.1	26.2	187°44.8	28.3
11	188°29.1	315°06.3	10.1	75°04.0	34.5	107°54.6	26.2	202°47.3	28.3
12	203°31.5	330°05.7	S20°10.9	90°05.2	N22°34.4	122°57.1	N22°26.2	217°49.9	S08°28.3
13	218°34.0	345°05.0	11.8	105°06.4	34.3	137°59.6	26.2	232°52.5	28.4
14	233°36.5	0°04.4	12.6	120°07.6	34.2	153°02.1	26.1	247°55.1	28.4
15	248°38.9	15°03.8	·· 13.5	135°08.8	·· 34.1	168°04.7	·· 26.1	262°57.7	·· 28.5
16	263°41.4	30°03.1	14.3	150°10.0	34.0	183°07.2	26.1	278°00.3	28.5
17	278°43.9	45°02.5	15.1	165°11.2	33.8	198°09.7	26.1	293°02.8	28.6
18	293°46.3	60°01.9	S20°16.0	180°12.4	N22°33.7	213°12.2	N22°26.1	308°05.4	S08°28.6
19	308°48.8	75°01.2	16.8	195°13.6	33.6	228°14.7	26.1	323°08.0	28.7
20	323°51.2	90°00.6	17.6	210°14.9	33.5	243°17.2	26.1	338°10.6	28.7
21	338°53.7	104°59.9	·· 18.5	225°16.1	·· 33.4	258°19.7	·· 26.1	353°13.2	·· 28.8
22	353°56.2	119°59.3	19.3	240°17.3	33.3	273°22.2	26.1	8°15.8	28.8
23	8°58.6	134°58.6	20.1	255°18.5	33.1	288°24.8	26.1	23°18.4	28.8
Mer.pass. 22:24		ν -0.6′	d -0.9′	m -3.95	ν 1.2′	d -0.1′	m 0.31	ν 2.5′	d -0.0′ m -2.56	ν 2.6′	d -0.0′ m 0.71

Stars

	SHA	Dec
Alpheratz	357°34.7	29°13.8
Ankaa	353°06.9	-42°10.2
Schedar	349°30.8	56°40.5
Diphda	348°47.2	-17°50.9
Achernar	335°19.7	-57°06.6
Hamal	327°51.1	23°34.9
Polaris	313°43.0	89°22.0
Acamar	315°11.5	-40°12.1
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°10.2
Capella	280°22.0	46°01.3
Bellatrix	278°23.0	6°22.5
Elnath	278°02.0	28°37.7
Alnilam	275°37.8	-1°11.0
Betelgeuse	270°52.2	7°24.8
Canopus	263°52.4	-52°42.1
Sirius	258°26.4	-16°44.7
Adhara	255°06.0	-29°00.0
Procyon	244°51.1	5°09.8
Pollux	243°17.6	27°58.0
Avior	234°15.0	-59°34.9
Suhail	222°46.7	-43°31.6
Miaplacidus	221°38.8	-69°48.7
Alphard	217°48.1	-8°45.8
Regulus	207°34.9	11°50.9
Dubhe	193°41.8	61°37.0
Denebola	182°25.5	14°26.1
Gienah	175°44.1	-17°40.6
Acrux	173°01.1	-63°14.0
Gacrux	171°52.5	-57°15.0
Alioth	166°13.7	55°49.5
Spica	158°22.9	-11°17.3
Alkaid	152°52.6	49°11.5
Hadar	148°37.0	-60°29.5
Menkent	147°58.3	-36°29.4
Arcturus	145°48.4	19°03.3
Rigil Kent.	139°41.3	-60°56.3
Kochab	137°20.8	74°03.3
Zuben'ubi	136°56.6	-16°08.6
Alphecca	126°04.2	26°38.0
Antares	112°16.4	-26°29.2
Atria	107°11.1	-69°04.5
Sabik	102°03.2	-15°45.3
Shaula	96°10.9	-37°07.4
Rasalhague	95°58.9	12°32.7
Eltanin	90°42.5	51°29.4
Kaus Aust.	83°32.9	-34°22.5
Vega	80°33.5	38°48.6
Nunki	75°48.1	-26°16.0
Altair	62°00.1	8°56.2
Peacock	53°05.9	-56°39.5
Deneb	49°25.8	45°22.4
Enif	33°38.8	9°59.4
Al Na'ir	27°32.9	-46°50.6
Fomalhaut	15°14.5	-29°29.5
Scheat	13°45.1	28°13.2
Markab	13°29.9	15°20.5

Oct 12 Sat	SHA	Mer.pass
Venus	129°39.3	13:58
Mars	247°50.1	06:04
Jupiter	279°23.4	03:58
Saturn	14°10.9	21:35

Oct 13 Sun	SHA	Mer.pass
Venus	128°25.5	13:59
Mars	247°19.3	06:02
Jupiter	279°24.1	03:54
Saturn	14°13.9	21:31

Oct 14 Mon	SHA	Mer.pass
Venus	127°11.3	14:00
Mars	246°48.8	06:00
Jupiter	279°25.0	03:50
Saturn	14°16.9	21:27

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°22.9	S07°30.1	73°16.5	7.7′	S23°44.5	9.8′	58.2′
1	198°23.0	31.0	87°43.2	7.8′	23°34.7	10.0′	58.2′
2	213°23.2	31.9	102°10.0	7.8′	23°24.7	10.1′	58.2′
3	228°23.3	·· 32.9	116°36.8	7.9′	23°14.6	10.3′	58.3′
4	243°23.5	33.8	131°03.7	7.9′	23°04.3	10.4′	58.3′
5	258°23.6	34.7	145°30.6	8.0′	22°53.9	10.6′	58.4′
6	273°23.8	S07°35.7	159°57.6	8.0′	S22°43.3	10.7′	58.4′
7	288°23.9	36.6	174°24.6	8.0′	22°32.6	10.9′	58.4′
8	303°24.1	37.6	188°51.6	8.1′	22°21.7	11.0′	58.5′
9	318°24.3	·· 38.5	203°18.7	8.1′	22°10.7	11.1′	58.5′
10	333°24.4	39.4	217°45.9	8.2′	21°59.6	11.3′	58.5′
11	348°24.6	40.4	232°13.0	8.2′	21°48.3	11.4′	58.6′
12	3°24.7	S07°41.3	246°40.3	8.3′	S21°36.9	11.6′	58.6′
13	18°24.9	42.2	261°07.5	8.3′	21°25.3	11.7′	58.7′
14	33°25.0	43.2	275°34.9	8.4′	21°13.6	11.8′	58.7′
15	48°25.2	·· 44.1	290°02.2	8.4′	21°01.8	12.0′	58.7′
16	63°25.3	45.0	304°29.6	8.5′	20°49.8	12.1′	58.8′
17	78°25.5	46.0	318°57.1	8.5′	20°37.7	12.2′	58.8′
18	93°25.6	S07°46.9	333°24.6	8.6′	S20°25.5	12.4′	58.8′
19	108°25.8	47.8	347°52.2	8.6′	20°13.1	12.5′	58.9′
20	123°25.9	48.8	2°19.8	8.6′	20°00.6	12.7′	58.9′
21	138°26.1	·· 49.7	16°47.4	8.7′	19°47.9	12.7′	59.0′
22	153°26.2	50.6	31°15.1	8.7′	19°35.2	12.9′	59.0′
23	168°26.4	51.6	45°42.8	8.8′	19°22.3	13.0′	59.0′
	SD = 16.0′	d = -0.9′	SD = 15.9′				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°26.5	S07°52.5	60°10.6	8.8′	S19°09.3	13.2′	59.1′
1	198°26.7	53.4	74°38.4	8.9′	18°56.1	13.3′	59.1′
2	213°26.8	54.4	89°06.3	8.9′	18°42.8	13.3′	59.2′
3	228°27.0	·· 55.3	103°34.2	9.0′	18°29.5	13.6′	59.2′
4	243°27.1	56.2	118°02.2	9.0′	18°15.9	13.6′	59.2′
5	258°27.3	57.2	132°30.2	9.1′	18°02.3	13.8′	59.3′
6	273°27.4	S07°58.1	146°58.2	9.1′	S17°48.5	13.8′	59.3′
7	288°27.6	07°59.0	161°26.3	9.1′	17°34.7	14.0′	59.3′
8	303°27.7	08°00.0	175°54.5	9.2′	17°20.7	14.1′	59.4′
9	318°27.9	·· 00.9	190°22.7	9.2′	17°06.6	14.2′	59.4′
10	333°28.0	01.8	204°50.9	9.3′	16°52.4	14.4′	59.4′
11	348°28.2	02.8	219°19.1	9.3′	16°38.0	14.4′	59.5′
12	3°28.3	S08°03.7	233°47.4	9.3′	S16°23.6	14.6′	59.5′
13	18°28.5	04.6	248°15.8	9.4′	16°09.0	14.6′	59.6′
14	33°28.6	05.5	262°44.2	9.4′	15°54.4	14.8′	59.6′
15	48°28.8	·· 06.5	277°12.6	9.5′	15°39.6	14.9′	59.6′
16	63°28.9	07.4	291°41.1	9.5′	15°24.7	15.0′	59.7′
17	78°29.1	08.3	306°09.6	9.5′	15°09.7	15.1′	59.7′
18	93°29.2	S08°09.3	320°38.1	9.6′	S14°54.6	15.2′	59.7′
19	108°29.4	10.2	335°06.7	9.6′	14°39.4	15.2′	59.8′
20	123°29.5	11.1	349°35.3	9.7′	14°24.2	15.4′	59.8′
21	138°29.6	·· 12.0	4°04.0	9.7′	14°08.8	15.5′	59.8′
22	153°29.8	13.0	18°32.7	9.7′	13°53.3	15.6′	59.9′
23	168°29.9	13.9	33°01.4	9.8′	13°37.7	15.7′	59.9′
	SD = 16.0′	d = -0.9′	SD = 16.1′				

Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°30.1	S08°14.8	47°30.2	9.8′	S13°22.0	15.7′	59.9′
1	198°30.2	15.8	61°59.0	9.8′	13°06.3	15.9′	60.0′
2	213°30.4	16.7	76°27.8	9.9′	12°50.4	15.9′	60.0′
3	228°30.5	·· 17.6	90°56.7	9.9′	12°34.5	16.1′	60.0′
4	243°30.7	18.5	105°25.5	9.9′	12°18.4	16.1′	60.1′
5	258°30.8	19.5	119°54.5	9.9′	12°02.3	16.2′	60.1′
6	273°31.0	S08°20.4	134°23.4	10.0′	S11°46.1	16.3′	60.1′
7	288°31.1	21.3	148°52.4	10.0′	11°29.8	16.4′	60.2′
8	303°31.2	22.3	163°21.4	10.0′	11°13.4	16.4′	60.2′
9	318°31.4	·· 23.2	177°50.4	10.1′	10°57.0	16.6′	60.2′
10	333°31.5	24.1	192°19.5	10.1′	10°40.4	16.6′	60.3′
11	348°31.7	25.0	206°48.5	10.1′	10°23.8	16.6′	60.3′
12	3°31.8	S08°26.0	221°17.7	10.1′	S10°07.2	16.8′	60.3′
13	18°32.0	26.9	235°46.8	10.1′	09°50.4	16.8′	60.3′
14	33°32.1	27.8	250°15.9	10.2′	09°33.6	16.9′	60.4′
15	48°32.2	·· 28.7	264°45.1	10.2′	09°16.7	17.0′	60.4′
16	63°32.4	29.7	279°14.3	10.2′	08°59.7	17.0′	60.4′
17	78°32.5	30.6	293°43.5	10.2′	08°42.7	17.1′	60.5′
18	93°32.7	S08°31.5	308°12.7	10.2′	S08°25.6	17.2′	60.5′
19	108°32.8	32.4	322°41.9	10.3′	08°08.4	17.2′	60.5′
20	123°32.9	33.4	337°11.2	10.3′	07°51.2	17.3′	60.5′
21	138°33.1	·· 34.3	351°40.4	10.3′	07°33.9	17.4′	60.6′
22	153°33.2	35.2	6°09.7	10.3′	07°16.5	17.4′	60.6′
23	168°33.4	36.1	20°39.0	10.3′	06°59.1	17.4′	60.6′
	SD = 16.0′	d = -0.9′	SD = 16.3′				

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

Lat.	**Moonrise** Sat	Sun	Mon	**Moonset** Sat	Sun	Mon
N 72°	▬	18:20	17:19	▬	23:36	·· ··
N 70°	▬	17:49	17:07	▬	▬	00:05
68°	18:18	17:26	16:56	21:42	·· ··	00:26
66°	17:37	17:07	16:48	22:22	·· ··	00:43
64°	17:08	16:52	16:40	22:50	·· ··	00:56
62°	16:46	16:40	16:34	23:11	·· ··	01:07
60°	16:29	16:29	16:28	23:27	·· ··	01:17
N 58°	16:14	16:19	16:23	23:42	·· ··	01:25
56°	16:01	16:11	16:19	23:54	·· ··	01:32
54°	15:49	16:04	16:15	·· ··	00:04	01:39
52°	15:39	15:57	16:11	·· ··	00:13	01:44
50°	15:31	15:51	16:08	·· ··	00:22	01:49
45°	15:11	15:38	16:00	·· ··	00:39	02:01
N 40°	14:56	15:27	15:54	·· ··	00:53	02:10
35°	14:43	15:18	15:49	·· ··	01:05	02:17
30°	14:31	15:09	15:44	00:08	01:16	02:24
20°	14:11	14:55	15:36	00:31	01:33	02:36
N 10°	13:54	14:43	15:29	00:50	01:49	02:46
0°	13:37	14:31	15:22	01:09	02:03	02:55
S 10°	13:21	14:19	15:16	01:27	02:17	03:05
20°	13:03	14:06	15:08	01:47	02:32	03:15
30°	12:43	13:52	15:00	02:09	02:49	03:26
35°	12:31	13:43	14:55	02:22	02:59	03:32
40°	12:17	13:33	14:50	02:37	03:10	03:39
45°	12:01	13:22	14:43	02:54	03:23	03:48
S 50°	11:41	13:08	14:36	03:16	03:39	03:57
52°	11:31	13:01	14:32	03:26	03:47	04:02
54°	11:20	12:54	14:28	03:38	03:55	04:07
56°	11:07	12:46	14:24	03:51	04:04	04:13
58°	10:53	12:36	14:19	04:06	04:14	04:19
S 60°	10:36	12:26	14:13	04:24	04:26	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 10-12 63-83%
12	13:31	13:39	11:46	19:50	07:23	
13	13:46	13:53	11:46	20:43	08:17	
14	14:00	14:07	11:46	21:34	09:09	

October 15, 16, 17 UT (Tue., Wed., Thu.)

	Aries	Venus		Mars		Jupiter		Saturn	
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	24°01.1	149°58.0	S20°21.0	270°19.7	N22°33.0	303°27.3	N22°26.1	38°20.9	S08°28.9
1	39°03.6	164°57.4	21.8	285°20.9	32.9	318°29.8	26.1	53°23.5	28.9
2	54°06.0	179°56.7	22.6	300°22.1	32.8	333°32.3	26.1	68°26.1	29.0
3	69°08.5	194°56.1	·· 23.4	315°23.3	·· 32.7	348°34.8	·· 26.1	83°28.7	·· 29.0
4	84°11.0	209°55.4	24.3	330°24.6	32.5	3°37.3	26.1	98°31.3	29.1
5	99°13.4	224°54.8	25.1	345°25.8	32.4	18°39.9	26.1	113°33.9	29.1
6	114°15.9	239°54.1	S20°25.9	0°27.0	N22°32.3	33°42.4	N22°26.1	128°36.4	S08°29.2
7	129°18.4	254°53.5	26.7	15°28.2	32.2	48°44.9	26.1	143°39.0	29.2
8	144°20.8	269°52.9	27.6	30°29.4	32.1	63°47.4	26.1	158°41.6	29.2
9	159°23.3	284°52.2	·· 28.4	45°30.6	·· 32.0	78°49.9	·· 26.1	173°44.2	·· 29.3
10	174°25.7	299°51.6	29.2	60°31.9	31.8	93°52.5	26.1	188°46.8	29.3
11	189°28.2	314°50.9	30.0	75°33.1	31.7	108°55.0	26.1	203°49.4	29.4
12	204°30.7	329°50.3	S20°30.8	90°34.3	N22°31.6	123°57.5	N22°26.1	218°51.9	S08°29.4
13	219°33.1	344°49.6	31.7	105°35.5	31.5	139°00.0	26.1	233°54.5	29.5
14	234°35.6	359°49.0	32.5	120°36.7	31.4	154°02.5	26.1	248°57.1	29.5
15	249°38.1	14°48.3	·· 33.3	135°38.0	·· 31.2	169°05.1	·· 26.1	263°59.7	·· 29.6
16	264°40.5	29°47.7	34.1	150°39.2	31.1	184°07.6	26.1	279°02.3	29.6
17	279°43.0	44°47.0	34.9	165°40.4	31.0	199°10.1	26.1	294°04.8	29.6
18	294°45.5	59°46.4	S20°35.7	180°41.6	N22°30.9	214°12.6	N22°26.0	309°07.4	S08°29.7
19	309°47.9	74°45.7	36.6	195°42.8	30.8	229°15.1	26.0	324°10.0	29.7
20	324°50.4	89°45.1	37.4	210°44.1	30.6	244°17.7	26.0	339°12.6	29.8
21	339°52.8	104°44.4	·· 38.2	225°45.3	·· 30.5	259°20.2	·· 26.0	354°15.2	·· 29.8
22	354°55.3	119°43.8	39.0	240°46.5	30.4	274°22.7	26.0	9°17.8	29.9
23	9°57.8	134°43.1	39.8	255°47.7	30.3	289°25.2	26.0	24°20.3	29.9
Mer.pass. 22:20		ν -0.6′	d -0.8′	m -3.95	ν 1.2′	d -0.1′	m 0.30	ν 2.5′	d -0.0′ m -2.57	ν 2.6′	d -0.0′ m 0.72

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	25°00.2	149°42.4	S20°40.6	270°49.0	N22°30.2	304°27.8	N22°26.0	39°22.9	S08°30.0
1	40°02.7	164°41.8	41.4	285°50.2	30.1	319°30.3	26.0	54°25.5	30.0
2	55°05.2	179°41.1	42.2	300°51.4	29.9	334°32.8	26.0	69°28.1	30.0
3	70°07.6	194°40.5	·· 43.0	315°52.7	·· 29.8	349°35.3	·· 26.0	84°30.7	·· 30.1
4	85°10.1	209°39.8	43.8	330°53.9	29.7	4°37.9	26.0	99°33.2	30.1
5	100°12.6	224°39.2	44.6	345°55.1	29.6	19°40.4	26.0	114°35.8	30.2
6	115°15.0	239°38.5	S20°45.4	0°56.3	N22°29.5	34°42.9	N22°26.0	129°38.4	S08°30.2
7	130°17.5	254°37.9	46.2	15°57.6	29.3	49°45.4	26.0	144°41.0	30.3
8	145°20.0	269°37.2	47.0	30°58.8	29.2	64°48.0	26.0	159°43.6	30.3
9	160°22.4	284°36.5	·· 47.8	46°00.0	·· 29.1	79°50.5	·· 26.0	174°46.1	·· 30.3
10	175°24.9	299°35.9	48.6	61°01.3	29.0	94°53.0	26.0	189°48.7	30.4
11	190°27.3	314°35.2	49.4	76°02.5	28.9	109°55.6	26.0	204°51.3	30.4
12	205°29.8	329°34.6	S20°50.2	91°03.7	N22°28.7	124°58.1	N22°26.0	219°53.9	S08°30.5
13	220°32.3	344°33.9	51.0	106°05.0	28.6	140°00.6	26.0	234°56.5	30.5
14	235°34.7	359°33.2	51.8	121°06.2	28.5	155°03.1	26.0	249°59.0	30.6
15	250°37.2	14°32.6	·· 52.6	136°07.4	·· 28.4	170°05.7	·· 26.0	265°01.6	·· 30.6
16	265°39.7	29°31.9	53.4	151°08.7	28.3	185°08.2	26.0	280°04.2	30.6
17	280°42.1	44°31.2	54.2	166°09.9	28.1	200°10.7	26.0	295°06.8	30.7
18	295°44.6	59°30.6	S20°55.0	181°11.2	N22°28.0	215°13.3	N22°25.9	310°09.4	S08°30.7
19	310°47.1	74°29.9	55.8	196°12.4	27.9	230°15.8	25.9	325°11.9	30.8
20	325°49.5	89°29.3	56.6	211°13.6	27.8	245°18.3	25.9	340°14.5	30.8
21	340°52.0	104°28.6	·· 57.4	226°14.9	·· 27.7	260°20.9	·· 25.9	355°17.1	·· 30.9
22	355°54.4	119°27.9	58.1	241°16.1	27.5	275°23.4	25.9	10°19.7	30.9
23	10°56.9	134°27.3	58.9	256°17.3	27.4	290°25.9	25.9	25°22.2	30.9
Mer.pass. 22:16		ν -0.7′	d -0.8′	m -3.95	ν 1.2′	d -0.1′	m 0.29	ν 2.5′	d -0.0′ m -2.58	ν 2.6′	d -0.0′ m 0.72

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	25°59.4	149°26.6	S20°59.7	271°18.6	N22°27.3	305°28.5	N22°25.9	40°24.8	S08°31.0
1	41°01.8	164°25.9	21°00.5	286°19.8	27.2	320°31.0	25.9	55°27.4	31.0
2	56°04.3	179°25.3	01.3	301°21.1	27.1	335°33.5	25.9	70°30.0	31.1
3	71°06.8	194°24.6	·· 02.1	316°22.3	·· 26.9	350°36.1	·· 25.9	85°32.6	·· 31.1
4	86°09.2	209°23.9	02.8	331°23.6	26.8	5°38.6	25.9	100°35.1	31.1
5	101°11.7	224°23.3	03.6	346°24.8	26.7	20°41.1	25.9	115°37.7	31.2
6	116°14.2	239°22.6	S21°04.4	1°26.0	N22°26.6	35°43.7	N22°25.9	130°40.3	S08°31.2
7	131°16.6	254°21.9	05.2	16°27.3	26.5	50°46.2	25.9	145°42.9	31.3
8	146°19.1	269°21.3	06.0	31°28.5	26.3	65°48.7	25.9	160°45.4	31.3
9	161°21.6	284°20.6	·· 06.7	46°29.8	·· 26.2	80°51.3	·· 25.9	175°48.0	·· 31.4
10	176°24.0	299°19.9	07.5	61°31.0	26.1	95°53.8	25.9	190°50.6	31.4
11	191°26.5	314°19.2	08.3	76°32.3	26.0	110°56.4	25.9	205°53.2	31.4
12	206°28.9	329°18.6	S21°09.1	91°33.5	N22°25.9	125°58.9	N22°25.9	220°55.7	S08°31.5
13	221°31.4	344°17.9	09.8	106°34.8	25.7	141°01.4	25.9	235°58.3	31.5
14	236°33.9	359°17.2	10.6	121°36.0	25.6	156°04.0	25.9	251°00.9	31.6
15	251°36.3	14°16.6	·· 11.4	136°37.3	·· 25.5	171°06.5	·· 25.9	266°03.5	·· 31.6
16	266°38.8	29°15.9	12.1	151°38.5	25.4	186°09.1	25.8	281°06.0	31.6
17	281°41.3	44°15.2	12.9	166°39.8	25.3	201°11.6	25.8	296°08.6	31.7
18	296°43.7	59°14.5	S21°13.7	181°41.0	N22°25.1	216°14.1	N22°25.8	311°11.2	S08°31.7
19	311°46.2	74°13.9	14.4	196°42.3	25.0	231°16.7	25.8	326°13.8	31.8
20	326°48.7	89°13.2	15.2	211°43.5	24.9	246°19.2	25.8	341°16.4	31.8
21	341°51.1	104°12.5	·· 16.0	226°44.8	·· 24.8	261°21.8	·· 25.8	356°18.9	·· 31.9
22	356°53.6	119°11.8	16.7	241°46.0	24.7	276°24.3	25.8	11°21.5	31.9
23	11°56.1	134°11.2	17.5	256°47.3	24.5	291°26.8	25.8	26°24.1	31.9
Mer.pass. 22:12		ν -0.7′	d -0.8′	m -3.96	ν 1.2′	d -0.1′	m 0.27	ν 2.5′	d -0.0′ m -2.59	ν 2.6′	d -0.0′ m 0.73

Stars

	SHA	Dec
Alpheratz	357°34.7	29°13.8
Ankaa	353°06.9	-42°10.3
Schedar	349°30.8	56°40.5
Diphda	348°47.2	-17°51.0
Achernar	335°19.7	-57°06.6
Hamal	327°51.1	23°34.9
Polaris	313°42.4	89°22.0
Acamar	315°11.5	-40°12.1
Menkar	314°06.1	4°11.3
Mirfak	308°28.1	49°56.9
Aldebaran	290°39.6	16°33.6
Rigel	281°03.9	-8°10.2
Capella	280°21.9	46°01.3
Bellatrix	278°22.9	6°22.5
Elnath	278°01.9	28°37.7
Alnilam	275°37.8	-1°11.0
Betelgeuse	270°52.2	7°24.8
Canopus	263°52.3	-52°42.1
Sirius	258°26.3	-16°44.7
Adhara	255°06.0	-29°00.0
Procyon	244°51.1	5°09.8
Pollux	243°17.6	27°58.0
Avior	234°15.0	-59°34.9
Suhail	222°46.7	-43°31.6
Miaplacidus	221°38.8	-69°48.7
Alphard	217°48.1	-8°45.8
Regulus	207°34.9	11°50.9
Dubhe	193°41.7	61°36.9
Denebola	182°25.5	14°26.1
Gienah	175°44.1	-17°40.6
Acrux	173°01.1	-63°14.0
Gacrux	171°52.5	-57°15.0
Alioth	166°13.7	55°49.5
Spica	158°22.9	-11°17.3
Alkaid	152°52.6	49°11.4
Hadar	148°37.0	-60°29.5
Menkent	147°58.3	-36°29.4
Arcturus	145°48.4	19°03.3
Rigil Kent.	139°41.3	-60°56.3
Kochab	137°20.8	74°03.3
Zuben'ubi	136°56.6	-16°08.6
Alphecca	126°04.2	26°38.0
Antares	112°16.4	-26°29.2
Atria	107°11.1	-69°04.5
Sabik	102°03.2	-15°45.3
Shaula	96°10.9	-37°07.4
Rasalhague	95°58.9	12°32.7
Eltanin	90°42.5	51°29.4
Kaus Aust.	83°32.9	-34°22.5
Vega	80°33.5	38°48.6
Nunki	75°48.1	-26°16.0
Altair	62°00.2	8°56.1
Peacock	53°05.9	-56°39.5
Deneb	49°25.9	45°22.4
Enif	33°38.8	9°59.4
Al Na'ir	27°32.9	-46°50.6
Fomalhaut	15°14.5	-29°29.5
Scheat	13°45.1	28°13.2
Markab	13°29.9	15°20.5

Oct 15 Tue	SHA	Mer.pass
Venus	125°56.9	14:01
Mars	246°18.6	05:58
Jupiter	279°26.2	03:46
Saturn	14°19.8	21:23

Oct 16 Wed	SHA	Mer.pass
Venus	124°42.2	14:02
Mars	245°48.7	05:56
Jupiter	279°27.5	03:42
Saturn	14°22.7	21:19

Oct 17 Thu	SHA	Mer.pass
Venus	123°27.2	14:03
Mars	245°19.2	05:54
Jupiter	279°29.1	03:37
Saturn	14°25.4	21:15

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°33.5	S08°37.0	35°08.3	10.3′	S06°41.7	17.5′	60.6′
1	198°33.6	38.0	49°37.6	10.3′	06°24.2	17.6′	60.7′
2	213°33.8	38.9	64°06.9	10.3′	06°06.6	17.6′	60.7′
3	228°33.9	·· 39.8	78°36.3	10.3′	05°49.0	17.7′	60.7′
4	243°34.1	40.7	93°05.6	10.3′	05°31.3	17.7′	60.7′
5	258°34.2	41.7	107°34.9	10.3′	05°13.6	17.7′	60.8′
6	273°34.3	S08°42.6	122°04.3	10.3′	S04°55.9	17.8′	60.8′
7	288°34.5	43.5	136°33.6	10.3′	04°38.1	17.8′	60.8′
8	303°34.6	44.4	151°03.0	10.3′	04°20.3	17.9′	60.8′
9	318°34.7	·· 45.3	165°32.3	10.3′	04°02.4	17.9′	60.9′
10	333°34.9	46.3	180°01.6	10.3′	03°44.5	17.9′	60.9′
11	348°35.0	47.2	194°31.0	10.3′	03°26.6	18.0′	60.9′
12	3°35.2	S08°48.1	209°00.3	10.3′	S03°08.6	18.0′	60.9′
13	18°35.3	49.0	223°29.7	10.3′	02°50.6	18.0′	60.9′
14	33°35.4	49.9	237°59.0	10.3′	02°32.6	18.1′	61.0′
15	48°35.6	·· 50.9	252°28.3	10.3′	02°14.5	18.0′	61.0′
16	63°35.7	51.8	266°57.6	10.3′	01°56.5	18.1′	61.0′
17	78°35.8	52.7	281°26.9	10.3′	01°38.4	18.2′	61.0′
18	93°36.0	S08°53.6	295°56.2	10.3′	S01°20.2	18.1′	61.0′
19	108°36.1	54.5	310°25.5	10.3′	01°02.1	18.2′	61.1′
20	123°36.2	55.5	324°54.7	10.2′	00°43.9	18.1′	61.1′
21	138°36.4	·· 56.4	339°24.0	10.2′	00°25.8	18.2′	61.1′
22	153°36.5	57.3	353°53.2	10.2′	S00°07.6	18.2′	61.1′
23	168°36.6	58.2	8°22.4	10.2′	N00°10.6	18.2′	61.1′
	SD = 16.0′	d = -0.9′	SD = 16.5′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°36.8	S08°59.1	22°51.6	10.2′	N00°28.8	18.2′	61.1′
1	198°36.9	09°00.0	37°20.8	10.2′	00°47.0	18.2′	61.1′
2	213°37.0	01.0	51°49.9	10.1′	01°05.2	18.2′	61.2′
3	228°37.2	·· 01.9	66°19.1	10.1′	01°23.4	18.2′	61.2′
4	243°37.3	02.8	80°48.2	10.1′	01°41.6	18.3′	61.2′
5	258°37.4	03.7	95°17.3	10.1′	01°59.9	18.2′	61.2′
6	273°37.6	S09°04.6	109°46.3	10.0′	N02°18.1	18.2′	61.2′
7	288°37.7	05.6	124°15.3	10.0′	02°36.3	18.2′	61.2′
8	303°37.8	06.5	138°44.3	10.0′	02°54.5	18.2′	61.2′
9	318°38.0	·· 07.4	153°13.3	9.9′	03°12.7	18.1′	61.2′
10	333°38.1	08.3	167°42.2	9.9′	03°30.8	18.2′	61.2′
11	348°38.2	09.2	182°11.2	9.9′	03°49.0	18.1′	61.3′
12	3°38.4	S09°10.1	196°40.0	9.8′	N04°07.1	18.2′	61.3′
13	18°38.5	11.0	211°08.9	9.8′	04°25.3	18.1′	61.3′
14	33°38.6	12.0	225°37.7	9.8′	04°43.4	18.0′	61.3′
15	48°38.8	·· 12.9	240°06.4	9.7′	05°01.4	18.1′	61.3′
16	63°38.9	13.8	254°35.1	9.7′	05°19.5	18.0′	61.3′
17	78°39.0	14.7	269°03.8	9.6′	05°37.5	18.0′	61.3′
18	93°39.1	S09°15.6	283°32.5	9.6′	N05°55.5	18.0′	61.3′
19	108°39.3	16.5	298°01.1	9.6′	06°13.5	17.9′	61.3′
20	123°39.4	17.4	312°29.6	9.5′	06°31.4	17.9′	61.3′
21	138°39.5	·· 18.4	326°58.2	9.5′	06°49.3	17.9′	61.3′
22	153°39.7	19.3	341°26.6	9.4′	07°07.2	17.8′	61.3′
23	168°39.8	20.2	355°55.0	9.4′	07°25.0	17.8′	61.3′
	SD = 16.0′	d = -0.9′	SD = 16.7′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°39.9	S09°21.1	10°23.4	9.3′	N07°42.8	17.7′	61.3′
1	198°40.0	22.0	24°51.7	9.3′	08°00.5	17.7′	61.3′
2	213°40.2	22.9	39°20.0	9.2′	08°18.2	17.6′	61.3′
3	228°40.3	·· 23.8	53°48.2	9.2′	08°35.8	17.6′	61.3′
4	243°40.4	24.7	68°16.4	9.1′	08°53.4	17.5′	61.3′
5	258°40.5	25.6	82°44.5	9.1′	09°10.9	17.5′	61.3′
6	273°40.7	S09°26.6	97°12.6	9.0′	N09°28.4	17.4′	61.3′
7	288°40.8	27.5	111°40.6	9.0′	09°45.8	17.4′	61.3′
8	303°40.9	28.4	126°08.6	8.9′	10°03.2	17.3′	61.3′
9	318°41.0	·· 29.3	140°36.5	8.8′	10°20.5	17.2′	61.3′
10	333°41.2	30.2	155°04.3	8.8′	10°37.7	17.2′	61.3′
11	348°41.3	31.1	169°32.1	8.7′	10°54.9	17.1′	61.3′
12	3°41.4	S09°32.0	183°59.8	8.7′	N11°12.0	17.0′	61.3′
13	18°41.5	32.9	198°27.5	8.6′	11°29.0	17.0′	61.3′
14	33°41.7	33.8	212°55.1	8.5′	11°46.0	16.8′	61.3′
15	48°41.8	·· 34.7	227°22.6	8.5′	12°02.8	16.8′	61.3′
16	63°41.9	35.7	241°50.1	8.4′	12°19.6	16.8′	61.2′
17	78°42.0	36.6	256°17.5	8.3′	12°36.4	16.6′	61.2′
18	93°42.2	S09°37.5	270°44.8	8.3′	N12°53.0	16.6′	61.2′
19	108°42.3	38.4	285°12.1	8.2′	13°09.6	16.4′	61.2′
20	123°42.4	39.3	299°39.3	8.1′	13°26.0	16.4′	61.2′
21	138°42.5	·· 40.2	314°06.4	8.1′	13°42.4	16.3′	61.2′
22	153°42.7	41.1	328°33.5	8.0′	13°58.7	16.2′	61.2′
23	168°42.8	42.0	343°00.5	7.9′	14°14.9	16.1′	61.2′
	SD = 16.0′	d = -0.9′	SD = 16.7′				

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

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

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 13-15 91-100%
15	14:14	14:21	11:46	22:25	10:00	
16	14:27	14:33	11:45	23:17	10:51	
17	14:40	14:46	11:45	–:–	11:43	

October 18, 19, 20 UT (Fri., Sat., Sun.)

	Aries	Venus		Mars		Jupiter		Saturn	
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	26°58.5	149°10.5	S21°18.3	271°48.5	N22°24.4	306°29.4	N22°25.8	41°26.7	S08°32.0
1	42°01.0	164°09.8	19.0	286°49.8	24.3	321°31.9	25.8	56°29.2	32.0
2	57°03.4	179°09.1	19.8	301°51.0	24.2	336°34.5	25.8	71°31.8	32.1
3	72°05.9	194°08.4	·· 20.5	316°52.3	·· 24.1	351°37.0	·· 25.8	86°34.4	·· 32.1
4	87°08.4	209°07.8	21.3	331°53.6	23.9	6°39.6	25.8	101°36.9	32.1
5	102°10.8	224°07.1	22.1	346°54.8	23.8	21°42.1	25.8	116°39.5	32.2
6	117°13.3	239°06.4	S21°22.8	1°56.1	N22°23.7	36°44.6	N22°25.8	131°42.1	S08°32.2
7	132°15.8	254°05.7	23.6	16°57.3	23.6	51°47.2	25.8	146°44.7	32.3
8	147°18.2	269°05.0	24.3	31°58.6	23.5	66°49.7	25.8	161°47.2	32.3
9	162°20.7	284°04.4	·· 25.1	46°59.9	·· 23.3	81°52.3	·· 25.8	176°49.8	·· 32.3
10	177°23.2	299°03.7	25.8	62°01.1	23.2	96°54.8	25.8	191°52.4	32.4
11	192°25.6	314°03.0	26.6	77°02.4	23.1	111°57.4	25.7	206°55.0	32.4
12	207°28.1	329°02.3	S21°27.3	92°03.6	N22°23.0	126°59.9	N22°25.7	221°57.5	S08°32.5
13	222°30.5	344°01.6	28.1	107°04.9	22.9	142°02.5	25.7	237°00.1	32.5
14	237°33.0	359°00.9	28.8	122°06.2	22.7	157°05.0	25.7	252°02.7	32.5
15	252°35.5	14°00.3	·· 29.6	137°07.4	·· 22.6	172°07.6	·· 25.7	267°05.3	·· 32.6
16	267°37.9	28°59.6	30.3	152°08.7	22.5	187°10.1	25.7	282°07.8	32.6
17	282°40.4	43°58.9	31.1	167°10.0	22.4	202°12.7	25.7	297°10.4	32.7
18	297°42.9	58°58.2	S21°31.8	182°11.2	N22°22.3	217°15.2	N22°25.7	312°13.0	S08°32.7
19	312°45.3	73°57.5	32.6	197°12.5	22.1	232°17.8	25.7	327°15.5	32.7
20	327°47.8	88°56.8	33.3	212°13.8	22.0	247°20.3	25.7	342°18.1	32.8
21	342°50.3	103°56.1	·· 34.0	227°15.0	·· 21.9	262°22.9	·· 25.7	357°20.7	·· 32.8
22	357°52.7	118°55.5	34.8	242°16.3	21.8	277°25.4	25.7	12°23.3	32.9
23	12°55.2	133°54.8	35.5	257°17.6	21.7	292°28.0	25.7	27°25.8	32.9
Mer.pass. 22:08		ν -0.7′	d -0.8′	m -3.96	ν 1.3′	d -0.1′	m 0.26	ν 2.5′	d -0.0′ m -2.59	ν 2.6′	d -0.0′ m 0.73

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	27°57.7	148°54.1	S21°36.3	272°18.8	N22°21.5	307°30.5	N22°25.7	42°28.4	S08°32.9
1	43°00.1	163°53.4	37.0	287°20.1	21.4	322°33.1	25.7	57°31.0	33.0
2	58°02.6	178°52.7	37.7	302°21.4	21.3	337°35.6	25.7	72°33.5	33.0
3	73°05.0	193°52.0	·· 38.5	317°22.6	·· 21.2	352°38.2	·· 25.7	87°36.1	·· 33.1
4	88°07.5	208°51.3	39.2	332°23.9	21.0	7°40.7	25.7	102°38.7	33.1
5	103°10.0	223°50.6	39.9	347°25.2	20.9	22°43.3	25.7	117°41.3	33.1
6	118°12.4	238°49.9	S21°40.7	2°26.5	N22°20.8	37°45.8	N22°25.6	132°43.8	S08°33.2
7	133°14.9	253°49.2	41.4	17°27.7	20.7	52°48.4	25.6	147°46.4	33.2
8	148°17.4	268°48.5	42.1	32°29.0	20.6	67°50.9	25.6	162°49.0	33.2
9	163°19.8	283°47.9	·· 42.9	47°30.3	·· 20.4	82°53.5	·· 25.6	177°51.5	·· 33.3
10	178°22.3	298°47.2	43.6	62°31.5	20.3	97°56.0	25.6	192°54.1	33.3
11	193°24.8	313°46.5	44.3	77°32.8	20.2	112°58.6	25.6	207°56.7	33.4
12	208°27.2	328°45.8	S21°45.1	92°34.1	N22°20.1	128°01.2	N22°25.6	222°59.3	S08°33.4
13	223°29.7	343°45.1	45.8	107°35.4	20.0	143°03.7	25.6	238°01.8	33.4
14	238°32.2	358°44.4	46.5	122°36.7	19.8	158°06.3	25.6	253°04.4	33.5
15	253°34.6	13°43.7	·· 47.2	137°37.9	·· 19.7	173°08.8	·· 25.6	268°07.0	·· 33.5
16	268°37.1	28°43.0	47.9	152°39.2	19.6	188°11.4	25.6	283°09.5	33.6
17	283°39.5	43°42.3	48.7	167°40.5	19.5	203°13.9	25.6	298°12.1	33.6
18	298°42.0	58°41.6	S21°49.4	182°41.8	N22°19.4	218°16.5	N22°25.6	313°14.7	S08°33.6
19	313°44.5	73°40.9	50.1	197°43.1	19.2	233°19.1	25.6	328°17.2	33.7
20	328°46.9	88°40.2	50.8	212°44.3	19.1	248°21.6	25.6	343°19.8	33.7
21	343°49.4	103°39.5	·· 51.5	227°45.6	·· 19.0	263°24.2	·· 25.6	358°22.4	·· 33.7
22	358°51.9	118°38.8	52.3	242°46.9	18.9	278°26.7	25.6	13°24.9	33.8
23	13°54.3	133°38.1	53.0	257°48.2	18.7	293°29.3	25.5	28°27.5	33.8
Mer.pass. 22:05		ν -0.7′	d -0.7′	m -3.96	ν 1.3′	d -0.1′	m 0.25	ν 2.6′	d -0.0′ m -2.60	ν 2.6′	d -0.0′ m 0.74

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	28°56.8	148°37.4	S21°53.7	272°49.5	N22°18.6	308°31.9	N22°25.5	43°30.1	S08°33.9
1	43°59.3	163°36.7	54.4	287°50.8	18.5	323°34.4	25.5	58°32.6	33.9
2	59°01.7	178°36.0	55.1	302°52.0	18.4	338°37.0	25.5	73°35.2	33.9
3	74°04.2	193°35.3	·· 55.8	317°53.3	·· 18.3	353°39.5	·· 25.5	88°37.8	·· 34.0
4	89°06.6	208°34.6	56.5	332°54.6	18.1	8°42.1	25.5	103°40.4	34.0
5	104°09.1	223°33.9	57.3	347°55.9	18.0	23°44.7	25.5	118°42.9	34.0
6	119°11.6	238°33.2	S21°58.0	2°57.2	N22°17.9	38°47.2	N22°25.5	133°45.5	S08°34.1
7	134°14.0	253°32.5	58.7	17°58.5	17.8	53°49.8	25.5	148°48.1	34.1
8	149°16.5	268°31.8	21°59.4	32°59.8	17.7	68°52.4	25.5	163°50.6	34.2
9	164°19.0	283°31.1	22°00.1	48°01.0	·· 17.5	83°54.9	·· 25.5	178°53.2	·· 34.2
10	179°21.4	298°30.4	00.8	63°02.3	17.4	98°57.5	25.5	193°55.8	34.2
11	194°23.9	313°29.7	01.5	78°03.6	17.3	114°00.0	25.5	208°58.3	34.3
12	209°26.4	328°29.0	S22°02.2	93°04.9	N22°17.2	129°02.6	N22°25.5	224°00.9	S08°34.3
13	224°28.8	343°28.3	02.9	108°06.2	17.0	144°05.2	25.5	239°03.5	34.3
14	239°31.3	358°27.5	03.6	123°07.5	16.9	159°07.7	25.5	254°06.0	34.4
15	254°33.8	13°26.8	·· 04.3	138°08.8	·· 16.8	174°10.3	·· 25.4	269°08.6	·· 34.4
16	269°36.2	28°26.1	05.0	153°10.1	16.7	189°12.9	25.4	284°11.2	34.5
17	284°38.7	43°25.4	05.7	168°11.4	16.6	204°15.4	25.4	299°13.7	34.5
18	299°41.1	58°24.7	S22°06.4	183°12.7	N22°16.4	219°18.0	N22°25.4	314°16.3	S08°34.5
19	314°43.6	73°24.0	07.1	198°14.0	16.3	234°20.6	25.4	329°18.9	34.6
20	329°46.1	88°23.3	07.8	213°15.3	16.2	249°23.1	25.4	344°21.4	34.6
21	344°48.5	103°22.6	·· 08.5	228°16.6	·· 16.1	264°25.7	·· 25.4	359°24.0	·· 34.6
22	359°51.0	118°21.9	09.2	243°17.9	16.0	279°28.3	25.4	14°26.5	34.7
23	14°53.5	133°21.2	09.9	258°19.2	15.8	294°30.8	25.4	29°29.1	34.7
Mer.pass. 22:01		ν -0.7′	d -0.7′	m -3.97	ν 1.3′	d -0.1′	m 0.23	ν 2.6′	d -0.0′ m -2.61	ν 2.6′	d -0.0′ m 0.74

Stars

	SHA	Dec
Alpheratz	357°34.7	29°13.8
Ankaa	353°06.9	-42°10.3
Schedar	349°30.8	56°40.5
Diphda	348°47.2	-17°51.0
Achernar	335°19.7	-57°06.6
Hamal	327°51.1	23°34.9
Polaris	313°41.5	89°22.0
Acamar	315°11.5	-40°12.1
Menkar	314°06.1	4°11.3
Mirfak	308°28.1	49°56.9
Aldebaran	290°39.6	16°33.6
Rigel	281°03.9	-8°10.2
Capella	280°21.9	46°01.3
Bellatrix	278°22.9	6°22.5
Elnath	278°01.9	28°37.7
Alnilam	275°37.8	-1°11.0
Betelgeuse	270°52.2	7°24.8
Canopus	263°52.3	-52°42.1
Sirius	258°26.3	-16°44.8
Adhara	255°06.0	-29°00.0
Procyon	244°51.0	5°09.8
Pollux	243°17.6	27°58.0
Avior	234°14.9	-59°34.9
Suhail	222°46.6	-43°31.6
Miaplacidus	221°38.7	-69°48.7
Alphard	217°48.1	-8°45.8
Regulus	207°34.8	11°50.9
Dubhe	193°41.7	61°36.9
Denebola	182°25.4	14°26.1
Gienah	175°44.1	-17°40.6
Acrux	173°01.1	-63°14.0
Gacrux	171°52.5	-57°14.9
Alioth	166°13.7	55°49.5
Spica	158°22.9	-11°17.3
Alkaid	152°52.6	49°11.4
Hadar	148°37.0	-60°29.5
Menkent	147°58.3	-36°29.4
Arcturus	145°48.4	19°03.3
Rigil Kent.	139°41.3	-60°56.2
Kochab	137°20.8	74°03.3
Zuben'ubi	136°56.6	-16°08.6
Alphecca	126°04.2	26°38.0
Antares	112°16.4	-26°29.2
Atria	107°11.2	-69°04.5
Sabik	102°03.2	-15°45.3
Shaula	96°10.9	-37°07.4
Rasalhague	95°58.9	12°32.6
Eltanin	90°42.5	51°29.3
Kaus Aust.	83°32.9	-34°22.5
Vega	80°33.5	38°48.6
Nunki	75°48.1	-26°16.0
Altair	62°00.2	8°56.1
Peacock	53°06.0	-56°39.5
Deneb	49°25.9	45°22.4
Enif	33°38.9	9°59.4
Al Na'ir	27°32.9	-46°50.6
Fomalhaut	15°14.5	-29°29.5
Scheat	13°45.2	28°13.2
Markab	13°29.9	15°20.5

Oct 18 Fri	SHA	Mer.pass
Venus	122°12.0	14:04
Mars	244°50.0	05:52
Jupiter	279°30.9	03:33
Saturn	14°28.1	21:11

Oct 19 Sat	SHA	Mer.pass
Venus	120°56.4	14:05
Mars	244°21.2	05:50
Jupiter	279°32.9	03:29
Saturn	14°30.8	21:06

Oct 20 Sun	SHA	Mer.pass
Venus	119°40.6	14:06
Mars	243°52.7	05:48
Jupiter	279°35.1	03:25
Saturn	14°33.3	21:02

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h

	Sun		Moon				
Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°42.9	S09°42.9	357°27.4	7.9′	N14°31.0	16.0′	61.2′
1	198°43.0	43.8	11°54.3	7.8′	14°47.0	15.9′	61.1′
2	213°43.1	44.7	26°21.1	7.7′	15°02.9	15.8′	61.1′
3	228°43.3	·· 45.6	40°47.8	7.7′	15°18.7	15.7′	61.1′
4	243°43.4	46.5	55°14.5	7.6′	15°34.4	15.6′	61.1′
5	258°43.5	47.4	69°41.1	7.5′	15°50.0	15.5′	61.1′
6	273°43.6	S09°48.4	84°07.6	7.4′	N16°05.5	15.4′	61.1′
7	288°43.7	49.3	98°34.0	7.4′	16°20.9	15.3′	61.0′
8	303°43.9	50.2	113°00.4	7.3′	16°36.2	15.1′	61.0′
9	318°44.0	·· 51.1	127°26.7	7.2′	16°51.3	15.1′	61.0′
10	333°44.1	52.0	141°52.9	7.1′	17°06.4	14.9′	61.0′
11	348°44.2	52.9	156°19.0	7.1′	17°21.3	14.8′	61.0′
12	3°44.3	S09°53.8	170°45.1	7.0′	N17°36.1	14.7′	61.0′
13	18°44.4	54.7	185°11.1	6.9′	17°50.8	14.5′	60.9′
14	33°44.6	55.6	199°37.0	6.8′	18°05.3	14.5′	60.9′
15	48°44.7	·· 56.5	214°02.9	6.8′	18°19.8	14.3′	60.9′
16	63°44.8	57.4	228°28.6	6.7′	18°34.1	14.2′	60.9′
17	78°44.9	58.3	242°54.3	6.6′	18°48.3	14.0′	60.9′
18	93°45.0	S09°59.2	257°19.9	6.5′	N19°02.3	13.9′	60.8′
19	108°45.1	10°00.1	271°45.5	6.5′	19°16.2	13.8′	60.8′
20	123°45.3	01.0	286°11.0	6.4′	19°30.0	13.6′	60.8′
21	138°45.4	·· 01.9	300°36.4	6.3′	19°43.6	13.5′	60.8′
22	153°45.5	02.8	315°01.7	6.3′	19°57.1	13.4′	60.7′
23	168°45.6	03.7	329°26.9	6.2′	20°10.5	13.2′	60.7′
	SD = 16.0′	d = -0.9′	SD = 16.7′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°45.7	S10°04.6	343°52.1	6.1′	N20°23.7	13.1′	60.7′
1	198°45.8	05.5	358°17.2	6.0′	20°36.8	12.9′	60.7′
2	213°46.0	06.4	12°42.3	6.0′	20°49.7	12.8′	60.6′
3	228°46.1	·· 07.3	27°07.2	5.9′	21°02.5	12.6′	60.6′
4	243°46.2	08.2	41°32.1	5.8′	21°15.1	12.5′	60.6′
5	258°46.3	09.1	55°56.9	5.8′	21°27.6	12.3′	60.6′
6	273°46.4	S10°10.0	70°21.7	5.7′	N21°39.9	12.2′	60.5′
7	288°46.5	10.9	84°46.4	5.6′	21°52.1	12.0′	60.5′
8	303°46.6	11.8	99°11.0	5.5′	22°04.1	11.9′	60.5′
9	318°46.7	·· 12.7	113°35.5	5.5′	22°16.0	11.7′	60.4′
10	333°46.9	13.6	128°00.0	5.4′	22°27.7	11.5′	60.4′
11	348°47.0	14.5	142°24.4	5.3′	22°39.2	11.4′	60.4′
12	3°47.1	S10°15.4	156°48.8	5.3′	N22°50.6	11.2′	60.3′
13	18°47.2	16.3	171°13.0	5.2′	23°01.8	11.1′	60.3′
14	33°47.3	17.2	185°37.3	5.2′	23°12.9	10.8′	60.3′
15	48°47.4	·· 18.1	200°01.4	5.1′	23°23.7	10.7′	60.3′
16	63°47.5	19.0	214°25.5	5.0′	23°34.4	10.6′	60.2′
17	78°47.6	19.9	228°49.5	5.0′	23°45.0	10.4′	60.2′
18	93°47.7	S10°20.8	243°13.5	4.9′	N23°55.4	10.2′	60.2′
19	108°47.9	21.7	257°37.4	4.9′	24°05.6	10.0′	60.1′
20	123°48.0	22.6	272°01.3	4.8′	24°15.6	9.8′	60.1′
21	138°48.1	·· 23.5	286°25.1	4.7′	24°25.4	9.7′	60.1′
22	153°48.2	24.4	300°48.8	4.7′	24°35.1	9.5′	60.0′
23	168°48.3	25.2	315°12.5	4.6′	24°44.6	9.3′	60.0′
	SD = 16.1′	d = -0.9′	SD = 16.6′				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°48.4	S10°26.1	329°36.2	4.6′	N24°53.9	9.2′	60.0′
1	198°48.5	27.0	343°59.8	4.5′	25°03.1	9.0′	59.9′
2	213°48.6	27.9	358°23.3	4.5′	25°12.1	8.7′	59.9′
3	228°48.7	·· 28.8	12°46.8	4.5′	25°20.8	8.6′	59.9′
4	243°48.8	29.7	27°10.3	4.4′	25°29.4	8.5′	59.8′
5	258°48.9	30.6	41°33.7	4.4′	25°37.9	8.2′	59.8′
6	273°49.0	S10°31.5	55°57.1	4.3′	N25°46.1	8.0′	59.7′
7	288°49.1	32.4	70°20.4	4.3′	25°54.1	7.9′	59.7′
8	303°49.2	33.3	84°43.7	4.3′	26°02.0	7.7′	59.7′
9	318°49.4	·· 34.2	99°07.0	4.2′	26°09.7	7.5′	59.6′
10	333°49.5	35.1	113°30.2	4.2′	26°17.2	7.3′	59.6′
11	348°49.6	36.0	127°53.4	4.2′	26°24.5	7.1′	59.6′
12	3°49.7	S10°36.9	142°16.6	4.1′	N26°31.6	6.9′	59.5′
13	18°49.8	37.7	156°39.7	4.1′	26°38.5	6.7′	59.5′
14	33°49.9	38.6	171°02.8	4.1′	26°45.2	6.6′	59.4′
15	48°50.0	·· 39.5	185°25.9	4.1′	26°51.8	6.3′	59.4′
16	63°50.1	40.4	199°49.0	4.0′	26°58.1	6.2′	59.4′
17	78°50.2	41.3	214°12.0	4.0′	27°04.3	6.0′	59.3′
18	93°50.3	S10°42.2	228°35.0	4.0′	N27°10.3	5.7′	59.3′
19	108°50.4	43.1	242°58.1	4.0′	27°16.0	5.6′	59.3′
20	123°50.5	44.0	257°21.1	4.0′	27°21.6	5.4′	59.2′
21	138°50.6	·· 44.9	271°44.1	4.0′	27°27.0	5.2′	59.2′
22	153°50.7	45.8	286°07.0	4.0′	27°32.2	5.0′	59.1′
23	168°50.8	46.6	300°30.0	4.0′	27°37.2	4.9′	59.1′
	SD = 16.1′	d = -0.9′	SD = 16.4′				

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

Lat.	**Moonrise** Fri	Sat	Sun	**Moonset** Fri	Sat	Sun
N 72°	13:19	▭	▭	11:30	▭	▭
N 70°	14:29	▭	▭	10:22	▭	▭
68°	15:07	▭	▭	09:47	▭	▭
66°	15:33	14:43	▭	09:21	12:14	▭
64°	15:54	15:33	▭	09:02	11:25	▭
62°	16:11	16:04	15:53	08:46	10:54	13:13
60°	16:26	16:28	16:37	08:33	10:31	12:30
N 58°	16:38	16:47	17:06	08:22	10:13	12:01
56°	16:48	17:04	17:29	08:12	09:57	11:39
54°	16:58	17:17	17:47	08:04	09:44	11:21
52°	17:06	17:30	18:03	07:56	09:33	11:05
50°	17:14	17:40	18:17	07:49	09:23	10:52
45°	17:30	18:03	18:45	07:35	09:01	10:25
N 40°	17:44	18:21	19:07	07:23	08:44	10:03
35°	17:56	18:37	19:25	07:13	08:30	09:45
30°	18:06	18:50	19:41	07:04	08:17	09:30
20°	18:23	19:13	20:08	06:49	07:56	09:04
N 10°	18:39	19:33	20:32	06:36	07:38	08:42
0°	18:53	19:52	20:53	06:24	07:21	08:21
S 10°	19:08	20:11	21:15	06:11	07:04	08:01
20°	19:24	20:32	21:39	05:59	06:46	07:39
30°	19:42	20:56	22:07	05:44	06:25	07:13
35°	19:53	21:10	22:23	05:35	06:13	06:58
40°	20:06	21:26	22:42	05:26	06:00	06:41
45°	20:20	21:46	23:06	05:15	05:43	06:20
S 50°	20:39	22:11	23:35	05:01	05:24	05:54
52°	20:47	22:23	23:50	04:55	05:14	05:42
54°	20:57	22:37	·· ··	04:48	05:04	05:27
56°	21:08	22:53	·· ··	04:40	04:52	05:11
58°	21:21	23:12	·· ··	04:32	04:38	04:51
S 60°	21:36	23:36	·· ··	04:22	04:23	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 16-18 100-91%
18	14:52	14:57	11:45	00:11	12:38	
19	15:03	15:08	11:45	01:07	13:37	
20	15:14	15:19	11:45	02:07	14:37	

October 21, 22, 23 UT (Mon., Tue., Wed.)

	Aries	Venus		Mars		Jupiter		Saturn	
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	29°55.9	148°20.5	S22°10.5	273°20.5	N22°15.7	309°33.4	N22°25.4	44°31.7	S08°34.7
1	44°58.4	163°19.7	11.2	288°21.8	15.6	324°36.0	25.4	59°34.2	34.8
2	60°00.9	178°19.0	11.9	303°23.1	15.5	339°38.6	25.4	74°36.8	34.8
3	75°03.3	193°18.3	·· 12.6	318°24.4	·· 15.3	354°41.1	·· 25.4	89°39.4	·· 34.9
4	90°05.8	208°17.6	13.3	333°25.7	15.2	9°43.7	25.4	104°41.9	34.9
5	105°08.3	223°16.9	14.0	348°27.0	15.1	24°46.3	25.4	119°44.5	34.9
6	120°10.7	238°16.2	S22°14.7	3°28.3	N22°15.0	39°48.8	N22°25.3	134°47.1	S08°35.0
7	135°13.2	253°15.5	15.3	18°29.6	14.9	54°51.4	25.3	149°49.6	35.0
8	150°15.6	268°14.8	16.0	33°30.9	14.7	69°54.0	25.3	164°52.2	35.0
9	165°18.1	283°14.0	·· 16.7	48°32.2	·· 14.6	84°56.6	·· 25.3	179°54.8	·· 35.1
10	180°20.6	298°13.3	17.4	63°33.5	14.5	99°59.1	25.3	194°57.3	35.1
11	195°23.0	313°12.6	18.1	78°34.8	14.4	115°01.7	25.3	209°59.9	35.1
12	210°25.5	328°11.9	S22°18.7	93°36.1	N22°14.3	130°04.3	N22°25.3	225°02.4	S08°35.2
13	225°28.0	343°11.2	19.4	108°37.4	14.1	145°06.9	25.3	240°05.0	35.2
14	240°30.4	358°10.5	20.1	123°38.7	14.0	160°09.4	25.3	255°07.6	35.2
15	255°32.9	13°09.7	·· 20.8	138°40.0	·· 13.9	175°12.0	·· 25.3	270°10.1	·· 35.3
16	270°35.4	28°09.0	21.4	153°41.3	13.8	190°14.6	25.3	285°12.7	35.3
17	285°37.8	43°08.3	22.1	168°42.6	13.7	205°17.2	25.3	300°15.3	35.3
18	300°40.3	58°07.6	S22°22.8	183°44.0	N22°13.5	220°19.7	N22°25.3	315°17.8	S08°35.4
19	315°42.8	73°06.9	23.5	198°45.3	13.4	235°22.3	25.3	330°20.4	35.4
20	330°45.2	88°06.1	24.1	213°46.6	13.3	250°24.9	25.3	345°22.9	35.5
21	345°47.7	103°05.4	·· 24.8	228°47.9	·· 13.2	265°27.5	·· 25.2	0°25.5	·· 35.5
22	0°50.1	118°04.7	25.5	243°49.2	13.0	280°30.0	25.2	15°28.1	35.5
23	15°52.6	133°04.0	26.1	258°50.5	12.9	295°32.6	25.2	30°30.6	35.6
Mer.pass. 21:57		ν -0.7′	d -0.7′	m -3.97	ν 1.3′	d -0.1′	m 0.22	ν 2.6′	d -0.0′ m -2.61	ν 2.6′	d -0.0′ m 0.75

Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	30°55.1	148°03.3	S22°26.8	273°51.8	N22°12.8	310°35.2	N22°25.2	45°33.2	S08°35.6
1	45°57.5	163°02.5	27.5	288°53.1	12.7	325°37.8	25.2	60°35.8	35.6
2	61°00.0	178°01.8	28.1	303°54.5	12.6	340°40.3	25.2	75°38.3	35.7
3	76°02.5	193°01.1	·· 28.8	318°55.8	·· 12.4	355°42.9	·· 25.2	90°40.9	·· 35.7
4	91°04.9	208°00.4	29.5	333°57.1	12.3	10°45.5	25.2	105°43.4	35.7
5	106°07.4	222°59.6	30.1	348°58.4	12.2	25°48.1	25.2	120°46.0	35.8
6	121°09.9	237°58.9	S22°30.8	3°59.7	N22°12.1	40°50.7	N22°25.2	135°48.6	S08°35.8
7	136°12.3	252°58.2	31.4	19°01.0	12.0	55°53.2	25.2	150°51.1	35.8
8	151°14.8	267°57.5	32.1	34°02.4	11.8	70°55.8	25.2	165°53.7	35.9
9	166°17.3	282°56.7	·· 32.7	49°03.7	·· 11.7	85°58.4	·· 25.2	180°56.2	·· 35.9
10	181°19.7	297°56.0	33.4	64°05.0	11.6	101°01.0	25.2	195°58.8	35.9
11	196°22.2	312°55.3	34.1	79°06.3	11.5	116°03.6	25.1	211°01.4	36.0
12	211°24.6	327°54.6	S22°34.7	94°07.6	N22°11.4	131°06.2	N22°25.1	226°03.9	S08°36.0
13	226°27.1	342°53.8	35.4	109°09.0	11.2	146°08.7	25.1	241°06.5	36.0
14	241°29.6	357°53.1	36.0	124°10.3	11.1	161°11.3	25.1	256°09.0	36.1
15	256°32.0	12°52.4	·· 36.7	139°11.6	·· 11.0	176°13.9	·· 25.1	271°11.6	·· 36.1
16	271°34.5	27°51.6	37.3	154°12.9	10.9	191°16.5	25.1	286°14.2	36.1
17	286°37.0	42°50.9	38.0	169°14.3	10.7	206°19.1	25.1	301°16.7	36.2
18	301°39.4	57°50.2	S22°38.6	184°15.6	N22°10.6	221°21.7	N22°25.1	316°19.3	S08°36.2
19	316°41.9	72°49.4	39.2	199°16.9	10.5	236°24.2	25.1	331°21.8	36.2
20	331°44.4	87°48.7	39.9	214°18.2	10.4	251°26.8	25.1	346°24.4	36.3
21	346°46.8	102°48.0	·· 40.5	229°19.6	·· 10.3	266°29.4	·· 25.1	1°27.0	·· 36.3
22	1°49.3	117°47.3	41.2	244°20.9	10.1	281°32.0	25.1	16°29.5	36.3
23	16°51.8	132°46.5	41.8	259°22.2	10.0	296°34.6	25.1	31°32.1	36.4
Mer.pass. 21:53		ν -0.7′	d -0.7′	m -3.98	ν 1.3′	d -0.1′	m 0.21	ν 2.6′	d -0.0′ m -2.62	ν 2.6′	d -0.0′ m 0.75

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	31°54.2	147°45.8	S22°42.5	274°23.6	N22°09.9	311°37.2	N22°25.1	46°34.6	S08°36.4
1	46°56.7	162°45.1	43.1	289°24.9	09.8	326°39.8	25.0	61°37.2	36.4
2	61°59.1	177°44.3	43.7	304°26.2	09.7	341°42.4	25.0	76°39.7	36.5
3	77°01.6	192°43.6	·· 44.4	319°27.6	·· 09.5	356°44.9	·· 25.0	91°42.3	·· 36.5
4	92°04.1	207°42.9	45.0	334°28.9	09.4	11°47.5	25.0	106°44.9	36.5
5	107°06.5	222°42.1	45.6	349°30.2	09.3	26°50.1	25.0	121°47.4	36.6
6	122°09.0	237°41.4	S22°46.3	4°31.6	N22°09.2	41°52.7	N22°25.0	136°50.0	S08°36.6
7	137°11.5	252°40.6	46.9	19°32.9	09.1	56°55.3	25.0	151°52.5	36.6
8	152°13.9	267°39.9	47.5	34°34.2	08.9	71°57.9	25.0	166°55.1	36.7
9	167°16.4	282°39.2	·· 48.2	49°35.6	·· 08.8	87°00.5	·· 25.0	181°57.6	·· 36.7
10	182°18.9	297°38.4	48.8	64°36.9	08.7	102°03.1	25.0	197°00.2	36.7
11	197°21.3	312°37.7	49.4	79°38.2	08.6	117°05.7	25.0	212°02.8	36.8
12	212°23.8	327°37.0	S22°50.1	94°39.6	N22°08.5	132°08.3	N22°25.0	227°05.3	S08°36.8
13	227°26.2	342°36.2	50.7	109°40.9	08.3	147°10.8	25.0	242°07.9	36.8
14	242°28.7	357°35.5	51.3	124°42.3	08.2	162°13.4	24.9	257°10.4	36.9
15	257°31.2	12°34.7	·· 51.9	139°43.6	·· 08.1	177°16.0	·· 24.9	272°13.0	·· 36.9
16	272°33.6	27°34.0	52.6	154°44.9	08.0	192°18.6	24.9	287°15.5	36.9
17	287°36.1	42°33.3	53.2	169°46.3	07.8	207°21.2	24.9	302°18.1	37.0
18	302°38.6	57°32.5	S22°53.8	184°47.6	N22°07.7	222°23.8	N22°24.9	317°20.7	S08°37.0
19	317°41.0	72°31.8	54.4	199°49.0	07.6	237°26.4	24.9	332°23.2	37.0
20	332°43.5	87°31.0	55.0	214°50.3	07.5	252°29.0	24.9	347°25.8	37.1
21	347°46.0	102°30.3	·· 55.7	229°51.6	·· 07.4	267°31.6	·· 24.9	2°28.3	·· 37.1
22	2°48.4	117°29.6	56.3	244°53.0	07.2	282°34.2	24.9	17°30.9	37.1
23	17°50.9	132°28.8	56.9	259°54.3	07.1	297°36.8	24.9	32°33.4	37.2
Mer.pass. 21:49		ν -0.7′	d -0.6′	m -3.98	ν 1.3′	d -0.1′	m 0.19	ν 2.6′	d -0.0′ m -2.63	ν 2.6′	d -0.0′ m 0.76

Stars

	SHA	Dec
Alpheratz	357°34.7	29°13.8
Ankaa	353°06.9	-42°10.3
Schedar	349°30.8	56°40.6
Diphda	348°47.2	-17°51.0
Achernar	335°19.7	-57°06.6
Hamal	327°51.1	23°34.9
Polaris	313°40.4	89°22.0
Acamar	315°11.5	-40°12.1
Menkar	314°06.0	4°11.3
Mirfak	308°28.1	49°56.9
Aldebaran	290°39.6	16°33.6
Rigel	281°03.8	-8°10.2
Capella	280°21.9	46°01.3
Bellatrix	278°22.9	6°22.4
Elnath	278°01.9	28°37.7
Alnilam	275°37.7	-1°11.0
Betelgeuse	270°52.1	7°24.8
Canopus	263°52.3	-52°42.1
Sirius	258°26.3	-16°44.8
Adhara	255°05.9	-29°00.0
Procyon	244°51.0	5°09.8
Pollux	243°17.5	27°58.0
Avior	234°14.9	-59°34.9
Suhail	222°46.6	-43°31.6
Miaplacidus	221°38.7	-69°48.7
Alphard	217°48.1	-8°45.8
Regulus	207°34.8	11°50.8
Dubhe	193°41.7	61°36.9
Denebola	182°25.4	14°26.1
Gienah	175°44.1	-17°40.6
Acrux	173°01.0	-63°14.0
Gacrux	171°52.5	-57°14.9
Alioth	166°13.7	55°49.5
Spica	158°22.8	-11°17.3
Alkaid	152°52.6	49°11.4
Hadar	148°37.0	-60°29.5
Menkent	147°58.3	-36°29.4
Arcturus	145°48.4	19°03.3
Rigil Kent.	139°41.3	-60°56.2
Kochab	137°20.9	74°03.2
Zuben'ubi	136°56.6	-16°08.6
Alphecca	126°04.2	26°38.0
Antares	112°16.4	-26°29.2
Atria	107°11.2	-69°04.5
Sabik	102°03.2	-15°45.3
Shaula	96°10.9	-37°07.4
Rasalhague	95°58.9	12°32.6
Eltanin	90°42.6	51°29.3
Kaus Aust.	83°32.9	-34°22.4
Vega	80°33.5	38°48.6
Nunki	75°48.1	-26°16.0
Altair	62°00.2	8°56.2
Peacock	53°06.0	-56°39.5
Deneb	49°25.9	45°22.4
Enif	33°38.9	9°59.5
Al Na'ir	27°32.9	-46°50.6
Fomalhaut	15°14.5	-29°29.5
Scheat	13°45.2	28°13.2
Markab	13°29.9	15°20.5

Oct 21 Mon	SHA	Mer.pass
Venus	118°24.5	14:07
Mars	243°24.5	05:46
Jupiter	279°37.5	03:21
Saturn	14°35.7	20:58

Oct 22 Tue	SHA	Mer.pass
Venus	117°08.2	14:08
Mars	242°56.8	05:44
Jupiter	279°40.1	03:17
Saturn	14°38.1	20:54

Oct 23 Wed	SHA	Mer.pass
Venus	115°51.6	14:10
Mars	242°29.3	05:42
Jupiter	279°43.0	03:13
Saturn	14°40.4	20:50

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.1669 sec ΔT = TT-UT1 = +69.0171 sec

2024 October 21 to Oct. 23 UT

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	Sun		Moon				
Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°50.9	S10°47.5	314°53.0	4.0′	N27°42.1	4.6′	59.1′
1	198°51.0	48.4	329°16.0	4.0′	27°46.7	4.4′	59.0′
2	213°51.1	49.3	343°38.9	4.0′	27°51.1	4.2′	59.0′
3	228°51.2	·· 50.2	358°01.9	4.0′	27°55.3	4.1′	58.9′
4	243°51.3	51.1	12°24.9	4.0′	27°59.4	3.8′	58.9′
5	258°51.4	52.0	26°47.9	4.0′	28°03.2	3.7′	58.9′
6	273°51.5	S10°52.9	41°10.9	4.0′	N28°06.9	3.4′	58.8′
7	288°51.6	53.7	55°33.9	4.0′	28°10.3	3.3′	58.8′
8	303°51.7	54.6	69°57.0	4.1′	28°13.6	3.1′	58.7′
9	318°51.8	·· 55.5	84°20.0	4.1′	28°16.7	2.8′	58.7′
10	333°51.9	56.4	98°43.1	4.1′	28°19.5	2.7′	58.7′
11	348°52.0	57.3	113°06.2	4.1′	28°22.2	2.5′	58.6′
12	3°52.1	S10°58.2	127°29.3	4.1′	N28°24.7	2.3′	58.6′
13	18°52.2	59.0	141°52.4	4.2′	28°27.0	2.1′	58.5′
14	33°52.3	10°59.9	156°15.6	4.2′	28°29.1	2.0′	58.5′
15	48°52.4	11°00.8	170°38.8	4.2′	28°31.1	1.7′	58.5′
16	63°52.5	01.7	185°02.1	4.3′	28°32.8	1.5′	58.4′
17	78°52.6	02.6	199°25.3	4.3′	28°34.3	1.4′	58.4′
18	93°52.7	S11°03.5	213°48.7	4.4′	N28°35.7	1.1′	58.3′
19	108°52.8	04.3	228°12.0	4.4′	28°36.8	1.0′	58.3′
20	123°52.9	05.2	242°35.4	4.5′	28°37.8	0.8′	58.3′
21	138°53.0	·· 06.1	256°58.9	4.5′	28°38.6	0.6′	58.2′
22	153°53.0	07.0	271°22.4	4.5′	28°39.2	0.4′	58.2′
23	168°53.1	07.9	285°45.9	4.6′	28°39.6	0.2′	58.1′
	SD = 16.1′	d = -0.9′	SD = 16.1′				

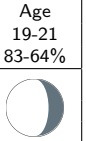
Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°53.2	S11°08.8	300°09.5	4.7′	N28°39.8	0.1′	58.1′
1	198°53.3	09.6	314°33.2	4.7′	28°39.9	0.2′	58.1′
2	213°53.4	10.5	328°56.9	4.8′	28°39.7	0.3′	58.0′
3	228°53.5	·· 11.4	343°20.7	4.8′	28°39.4	0.5′	58.0′
4	243°53.6	12.3	357°44.5	4.9′	28°38.9	0.7′	57.9′
5	258°53.7	13.2	12°08.4	5.0′	28°38.2	0.9′	57.9′
6	273°53.8	S11°14.0	26°32.4	5.0′	N28°37.3	1.0′	57.9′
7	288°53.9	14.9	40°56.4	5.1′	28°36.3	1.2′	57.8′
8	303°54.0	15.8	55°20.5	5.2′	28°35.1	1.4′	57.8′
9	318°54.1	·· 16.7	69°44.7	5.2′	28°33.7	1.6′	57.7′
10	333°54.2	17.6	84°08.9	5.3′	28°32.1	1.8′	57.7′
11	348°54.2	18.4	98°33.3	5.4′	28°30.3	1.9′	57.7′
12	3°54.3	S11°19.3	112°57.6	5.5′	N28°28.4	2.1′	57.6′
13	18°54.4	20.2	127°22.1	5.6′	28°26.3	2.3′	57.6′
14	33°54.5	21.1	141°46.7	5.6′	28°24.0	2.5′	57.5′
15	48°54.6	·· 21.9	156°11.3	5.7′	28°21.5	2.6′	57.5′
16	63°54.7	22.8	170°36.1	5.8′	28°18.9	2.8′	57.5′
17	78°54.8	23.7	185°00.9	5.9′	28°16.1	2.9′	57.4′
18	93°54.9	S11°24.6	199°25.8	6.0′	N28°13.2	3.2′	57.4′
19	108°55.0	25.4	213°50.7	6.1′	28°10.0	3.2′	57.3′
20	123°55.1	26.3	228°15.8	6.2′	28°06.8	3.5′	57.3′
21	138°55.1	·· 27.2	242°41.0	6.3′	28°03.3	3.6′	57.3′
22	153°55.2	28.1	257°06.3	6.4′	27°59.7	3.8′	57.2′
23	168°55.3	28.9	271°31.6	6.5′	27°55.9	3.9′	57.2′
	SD = 16.1′	d = -0.9′	SD = 15.8′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°55.4	S11°29.8	285°57.1	6.5′	N27°52.0	4.1′	57.1′
1	198°55.5	30.7	300°22.6	6.6′	27°47.9	4.3′	57.1′
2	213°55.6	31.6	314°48.3	6.7′	27°43.6	4.4′	57.1′
3	228°55.7	·· 32.4	329°14.0	6.8′	27°39.2	4.5′	57.0′
4	243°55.7	33.3	343°39.8	6.9′	27°34.7	4.8′	57.0′
5	258°55.8	34.2	358°05.8	7.1′	27°29.9	4.8′	57.0′
6	273°55.9	S11°35.1	12°31.8	7.2′	N27°25.1	5.1′	56.9′
7	288°56.0	35.9	26°58.0	7.3′	27°20.0	5.1′	56.9′
8	303°56.1	36.8	41°24.3	7.4′	27°14.9	5.3′	56.8′
9	318°56.2	·· 37.7	55°50.6	7.5′	27°09.6	5.5′	56.8′
10	333°56.2	38.5	70°17.1	7.6′	27°04.1	5.6′	56.8′
11	348°56.3	39.4	84°43.7	7.7′	26°58.5	5.8′	56.7′
12	3°56.4	S11°40.3	99°10.3	7.8′	N26°52.7	5.9′	56.7′
13	18°56.5	41.2	113°37.1	7.9′	26°46.8	6.0′	56.7′
14	33°56.6	42.0	128°04.0	8.0′	26°40.8	6.2′	56.6′
15	48°56.7	·· 42.9	142°31.0	8.1′	26°34.6	6.3′	56.6′
16	63°56.7	43.8	156°58.2	8.2′	26°28.3	6.4′	56.5′
17	78°56.8	44.6	171°25.4	8.3′	26°21.9	6.6′	56.5′
18	93°56.9	S11°45.5	185°52.7	8.5′	N26°15.3	6.7′	56.5′
19	108°57.0	46.4	200°20.2	8.6′	26°08.6	6.9′	56.4′
20	123°57.1	47.2	214°47.8	8.7′	26°01.7	6.9′	56.4′
21	138°57.1	·· 48.1	229°15.4	8.8′	25°54.8	7.2′	56.4′
22	153°57.2	49.0	243°43.2	8.9′	25°47.6	7.2′	56.3′
23	168°57.3	49.8	258°11.1	9.0′	25°40.4	7.4′	56.3′
	SD = 16.1′	d = -0.9′	SD = 15.6′				

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

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

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 83-64%
21	15:24	15:28	11:45	03:08	15:39	
22	15:33	15:37	11:44	04:09	16:39	
23	15:42	15:46	11:44	05:08	17:36	



October 24, 25, 26 UT (Thu., Fri., Sat.)

	Aries	Venus		Mars		Jupiter		Saturn	
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	32°53.4	147°28.1	S22°57.5	274°55.7	N22°07.0	312°39.4	N22°24.9	47°36.0	S08°37.2
1	47°55.8	162°27.3	58.1	289°57.0	06.9	327°42.0	24.9	62°38.5	37.2
2	62°58.3	177°26.6	58.7	304°58.4	06.8	342°44.6	24.8	77°41.1	37.2
3	78°00.7	192°25.8	·· 59.3	319°59.7	·· 06.6	357°47.2	·· 24.8	92°43.6	·· 37.3
4	93°03.2	207°25.1	22°59.9	335°01.1	06.5	12°49.8	24.8	107°46.2	37.3
5	108°05.7	222°24.4	23°00.6	350°02.4	06.4	27°52.4	24.8	122°48.8	37.3
6	123°08.1	237°23.6	S23°01.2	5°03.8	N22°06.3	42°55.0	N22°24.8	137°51.3	S08°37.4
7	138°10.6	252°22.9	01.8	20°05.1	06.2	57°57.6	24.8	152°53.9	37.4
8	153°13.1	267°22.1	02.4	35°06.5	06.0	73°00.2	24.8	167°56.4	37.4
9	168°15.5	282°21.4	·· 03.0	50°07.8	·· 05.9	88°02.8	·· 24.8	182°59.0	·· 37.5
10	183°18.0	297°20.6	03.6	65°09.2	05.8	103°05.4	24.8	198°01.5	37.5
11	198°20.5	312°19.9	04.2	80°10.5	05.7	118°08.0	24.8	213°04.1	37.5
12	213°22.9	327°19.1	S23°04.8	95°11.9	N22°05.6	133°10.6	N22°24.8	228°06.6	S08°37.6
13	228°25.4	342°18.4	05.4	110°13.2	05.4	148°13.2	24.8	243°09.2	37.6
14	243°27.9	357°17.6	06.0	125°14.6	05.3	163°15.8	24.8	258°11.7	37.6
15	258°30.3	12°16.9	·· 06.6	140°15.9	·· 05.2	178°18.4	·· 24.7	273°14.3	·· 37.6
16	273°32.8	27°16.1	07.2	155°17.3	05.1	193°21.0	24.7	288°16.8	37.7
17	288°35.2	42°15.4	07.8	170°18.7	05.0	208°23.6	24.7	303°19.4	37.7
18	303°37.7	57°14.6	S23°08.4	185°20.0	N22°04.8	223°26.2	N22°24.7	318°21.9	S08°37.7
19	318°40.2	72°13.9	09.0	200°21.4	04.7	238°28.8	24.7	333°24.5	37.8
20	333°42.6	87°13.1	09.6	215°22.7	04.6	253°31.4	24.7	348°27.0	37.8
21	348°45.1	102°12.4	·· 10.2	230°24.1	·· 04.5	268°34.0	·· 24.7	3°29.6	·· 37.8
22	3°47.6	117°11.6	10.7	245°25.5	04.4	283°36.6	24.7	18°32.2	37.9
23	18°50.0	132°10.9	11.3	260°26.8	04.2	298°39.2	24.7	33°34.7	37.9
Mer.pass. 21:45		ν -0.7′	d -0.6′	m -3.98	ν 1.3′	d -0.1′	m 0.18	ν 2.6′	d -0.0′ m -2.64	ν 2.6′	d -0.0′ m 0.76

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	33°52.5	147°10.1	S23°11.9	275°28.2	N22°04.1	313°41.8	N22°24.7	48°37.3	S08°37.9
1	48°55.0	162°09.4	12.5	290°29.5	04.0	328°44.4	24.7	63°39.8	38.0
2	63°57.4	177°08.6	13.1	305°30.9	03.9	343°47.0	24.6	78°42.4	38.0
3	78°59.9	192°07.9	·· 13.7	320°32.3	·· 03.8	358°49.6	·· 24.6	93°44.9	·· 38.0
4	94°02.4	207°07.1	14.3	335°33.6	03.7	13°52.2	24.6	108°47.5	38.0
5	109°04.8	222°06.3	14.9	350°35.0	03.5	28°54.8	24.6	123°50.0	38.1
6	124°07.3	237°05.6	S23°15.4	5°36.4	N22°03.4	43°57.4	N22°24.6	138°52.6	S08°38.1
7	139°09.7	252°04.8	16.0	20°37.7	03.3	59°00.0	24.6	153°55.1	38.1
8	154°12.2	267°04.1	16.6	35°39.1	03.2	74°02.6	24.6	168°57.7	38.2
9	169°14.7	282°03.3	·· 17.2	50°40.5	·· 03.1	89°05.2	·· 24.6	184°00.2	·· 38.2
10	184°17.1	297°02.6	17.8	65°41.8	02.9	104°07.9	24.6	199°02.8	38.2
11	199°19.6	312°01.8	18.3	80°43.2	02.8	119°10.5	24.6	214°05.3	38.2
12	214°22.1	327°01.0	S23°18.9	95°44.6	N22°02.7	134°13.1	N22°24.6	229°07.9	S08°38.3
13	229°24.5	342°00.3	19.5	110°46.0	02.6	149°15.7	24.6	244°10.4	38.3
14	244°27.0	356°59.5	20.0	125°47.3	02.5	164°18.3	24.5	259°13.0	38.3
15	259°29.5	11°58.8	·· 20.6	140°48.7	·· 02.3	179°20.9	·· 24.5	274°15.5	·· 38.4
16	274°31.9	26°58.0	21.2	155°50.1	02.2	194°23.5	24.5	289°18.1	38.4
17	289°34.4	41°57.3	21.8	170°51.4	02.1	209°26.1	24.5	304°20.6	38.4
18	304°36.8	56°56.5	S23°22.3	185°52.8	N22°02.0	224°28.7	N22°24.5	319°23.1	S08°38.5
19	319°39.3	71°55.7	22.9	200°54.2	01.9	239°31.3	24.5	334°25.7	38.5
20	334°41.8	86°55.0	23.5	215°55.6	01.7	254°34.0	24.5	349°28.2	38.5
21	349°44.2	101°54.2	·· 24.0	230°56.9	·· 01.6	269°36.6	·· 24.5	4°30.8	·· 38.5
22	4°46.7	116°53.4	24.6	245°58.3	01.5	284°39.2	24.5	19°33.3	38.6
23	19°49.2	131°52.7	25.2	260°59.7	01.4	299°41.8	24.5	34°35.9	38.6
Mer.pass. 21:41		ν -0.8′	d -0.6′	m -3.99	ν 1.4′	d -0.1′	m 0.17	ν 2.6′	d -0.0′ m -2.64	ν 2.6′	d -0.0′ m 0.76

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	34°51.6	146°51.9	S23°25.7	276°01.1	N22°01.3	314°44.4	N22°24.5	49°38.4	S08°38.6
1	49°54.1	161°51.2	26.3	291°02.5	01.2	329°47.0	24.4	64°41.0	38.7
2	64°56.6	176°50.4	26.8	306°03.8	01.0	344°49.6	24.4	79°43.5	38.7
3	79°59.0	191°49.6	·· 27.4	321°05.2	·· 00.9	359°52.2	·· 24.4	94°46.1	·· 38.7
4	95°01.5	206°48.9	28.0	336°06.6	00.8	14°54.9	24.4	109°48.6	38.7
5	110°04.0	221°48.1	28.5	351°08.0	00.7	29°57.5	24.4	124°51.2	38.8
6	125°06.4	236°47.3	S23°29.1	6°09.4	N22°00.6	45°00.1	N22°24.4	139°53.7	S08°38.8
7	140°08.9	251°46.6	29.6	21°10.8	00.4	60°02.7	24.4	154°56.3	38.8
8	155°11.3	266°45.8	30.2	36°12.1	00.3	75°05.3	24.4	169°58.8	38.8
9	170°13.8	281°45.0	·· 30.7	51°13.5	·· 00.2	90°07.9	·· 24.4	185°01.4	·· 38.9
10	185°16.3	296°44.3	31.3	66°14.9	00.1	105°10.6	24.4	200°03.9	38.9
11	200°18.7	311°43.5	31.8	81°16.3	22°00.0	120°13.2	24.4	215°06.5	38.9
12	215°21.2	326°42.7	S23°32.4	96°17.7	N21°59.9	135°15.8	N22°24.3	230°09.0	S08°39.0
13	230°23.7	341°42.0	32.9	111°19.1	59.7	150°18.4	24.3	245°11.5	39.0
14	245°26.1	356°41.2	33.5	126°20.5	59.6	165°21.0	24.3	260°14.1	39.0
15	260°28.6	11°40.4	·· 34.0	141°21.9	·· 59.5	180°23.6	·· 24.3	275°16.6	·· 39.0
16	275°31.1	26°39.7	34.6	156°23.2	59.4	195°26.3	24.3	290°19.2	39.1
17	290°33.5	41°38.9	35.1	171°24.6	59.3	210°28.9	24.3	305°21.7	39.1
18	305°36.0	56°38.1	S23°35.6	186°26.0	N21°59.1	225°31.5	N22°24.3	320°24.3	S08°39.1
19	320°38.5	71°37.4	36.2	201°27.4	59.0	240°34.1	24.3	335°26.8	39.2
20	335°40.9	86°36.6	36.7	216°28.8	58.9	255°36.7	24.3	350°29.4	39.2
21	350°43.4	101°35.8	·· 37.3	231°30.2	·· 58.8	270°39.4	·· 24.3	5°31.9	·· 39.2
22	5°45.8	116°35.0	37.8	246°31.6	58.7	285°42.0	24.3	20°34.4	39.2
23	20°48.3	131°34.3	38.3	261°33.0	58.6	300°44.6	24.2	35°37.0	39.3
Mer.pass. 21:37		ν -0.8′	d -0.6′	m -3.99	ν 1.4′	d -0.1′	m 0.15	ν 2.6′	d -0.0′ m -2.65	ν 2.5′	d -0.0′ m 0.77

Stars

	SHA	Dec
Alpheratz	357°34.7	29°13.8
Ankaa	353°06.9	-42°10.3
Schedar	349°30.8	56°40.6
Diphda	348°47.2	-17°51.0
Achernar	335°19.7	-57°06.6
Hamal	327°51.1	23°34.9
Polaris	313°39.7	89°22.1
Acamar	315°11.5	-40°12.2
Menkar	314°06.0	4°11.3
Mirfak	308°28.1	49°57.0
Aldebaran	290°39.6	16°33.6
Rigel	281°03.8	-8°10.2
Capella	280°21.8	46°01.3
Bellatrix	278°22.9	6°22.4
Elnath	278°01.9	28°37.7
Alnilam	275°37.7	-1°11.0
Betelgeuse	270°52.1	7°24.8
Canopus	263°52.2	-52°42.2
Sirius	258°26.3	-16°44.8
Adhara	255°05.9	-29°00.0
Procyon	244°51.0	5°09.8
Pollux	243°17.5	27°57.9
Avior	234°14.9	-59°34.9
Suhail	222°46.6	-43°31.6
Miaplacidus	221°38.6	-69°48.7
Alphard	217°48.1	-8°45.8
Regulus	207°34.8	11°50.8
Dubhe	193°41.6	61°36.9
Denebola	182°25.4	14°26.1
Gienah	175°44.1	-17°40.6
Acrux	173°01.0	-63°14.0
Gacrux	171°52.4	-57°14.9
Alioth	166°13.6	55°49.5
Spica	158°22.8	-11°17.3
Alkaid	152°52.6	49°11.4
Hadar	148°37.0	-60°29.5
Menkent	147°58.3	-36°29.4
Arcturus	145°48.4	19°03.3
Rigil Kent.	139°41.3	-60°56.2
Kochab	137°20.9	74°03.2
Zuben'ubi	136°56.6	-16°08.6
Alphecca	126°04.2	26°38.0
Antares	112°16.4	-26°29.2
Atria	107°11.2	-69°04.5
Sabik	102°03.3	-15°45.3
Shaula	96°10.9	-37°07.4
Rasalhague	95°58.9	12°32.6
Eltanin	90°42.6	51°29.3
Kaus Aust.	83°33.0	-34°22.4
Vega	80°33.5	38°48.6
Nunki	75°48.1	-26°16.0
Altair	62°00.2	8°56.1
Peacock	53°06.0	-56°39.5
Deneb	49°25.9	45°22.4
Enif	33°38.9	9°59.5
Al Na'ir	27°32.9	-46°50.6
Fomalhaut	15°14.5	-29°29.5
Scheat	13°45.2	28°13.2
Markab	13°29.9	15°20.5

Oct 24 Thu	SHA	Mer.pass
Venus	114°34.7	14:11
Mars	242°02.3	05:40
Jupiter	279°46.0	03:09
Saturn	14°42.6	20:46

Oct 25 Fri	SHA	Mer.pass
Venus	113°17.6	14:12
Mars	241°35.7	05:38
Jupiter	279°49.3	03:05
Saturn	14°44.8	20:42

Oct 26 Sat	SHA	Mer.pass
Venus	112°00.3	14:13
Mars	241°09.5	05:35
Jupiter	279°52.8	03:01
Saturn	14°46.8	20:38

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.1677 sec ΔT = TT-UT1 = +69.0163 sec

2024 October 24 to Oct. 26 UT

h	Sun		Moon				
Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°57.4	S11°50.7	272°39.2	9.1′	N25°33.0	7.4′	56.3′
1	198°57.5	51.6	287°07.3	9.2′	25°25.6	7.6′	56.2′
2	213°57.5	52.4	301°35.5	9.4′	25°18.0	7.8′	56.2′
3	228°57.6	·· 53.3	316°03.9	9.5′	25°10.2	7.8′	56.2′
4	243°57.7	54.2	330°32.3	9.6′	25°02.4	8.0′	56.1′
5	258°57.8	55.0	345°00.9	9.7′	24°54.4	8.1′	56.1′
6	273°57.9	S11°55.9	359°29.6	9.8′	N24°46.3	8.2′	56.1′
7	288°57.9	56.8	13°58.4	9.9′	24°38.1	8.3′	56.0′
8	303°58.0	57.6	28°27.4	10.0′	24°29.8	8.5′	56.0′
9	318°58.1	·· 58.5	42°56.4	10.1′	24°21.3	8.5′	56.0′
10	333°58.2	11°59.4	57°25.5	10.3′	24°12.8	8.7′	55.9′
11	348°58.2	12°00.2	71°54.8	10.4′	24°04.1	8.7′	55.9′
12	3°58.3	S12°01.1	86°24.2	10.5′	N23°55.4	8.9′	55.9′
13	18°58.4	02.0	100°53.7	10.6′	23°46.5	9.0′	55.8′
14	33°58.5	02.8	115°23.3	10.7′	23°37.5	9.1′	55.8′
15	48°58.5	·· 03.7	129°53.0	10.8′	23°28.4	9.1′	55.8′
16	63°58.6	04.5	144°22.8	10.9′	23°19.3	9.3′	55.8′
17	78°58.7	05.4	158°52.7	11.0′	23°10.0	9.4′	55.7′
18	93°58.8	S12°06.3	173°22.7	11.1′	N23°00.6	9.5′	55.7′
19	108°58.8	07.1	187°52.9	11.3′	22°51.1	9.6′	55.7′
20	123°58.9	08.0	202°23.2	11.4′	22°41.5	9.7′	55.6′
21	138°59.0	·· 08.9	216°53.5	11.5′	22°31.8	9.8′	55.6′
22	153°59.0	09.7	231°24.0	11.6′	22°22.0	9.9′	55.6′
23	168°59.1	10.6	245°54.6	11.7′	22°12.1	9.9′	55.5′
	SD = 16.1′	d = -0.9′	SD = 15.3′				

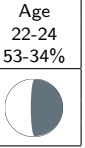
Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°59.2	S12°11.4	260°25.3	11.8′	N22°02.2	10.1′	55.5′
1	198°59.3	12.3	274°56.1	11.9′	21°52.1	10.1′	55.5′
2	213°59.3	13.2	289°27.0	12.0′	21°42.0	10.3′	55.5′
3	228°59.4	·· 14.0	303°58.0	12.1′	21°31.7	10.3′	55.4′
4	243°59.5	14.9	318°29.1	12.2′	21°21.4	10.4′	55.4′
5	258°59.5	15.7	333°00.3	12.3′	21°11.0	10.5′	55.4′
6	273°59.6	S12°16.6	347°31.6	12.4′	N21°00.5	10.6′	55.4′
7	288°59.7	17.4	2°03.1	12.5′	20°49.9	10.7′	55.3′
8	303°59.7	18.3	16°34.6	12.6′	20°39.2	10.7′	55.3′
9	318°59.8	·· 19.2	31°06.2	12.7′	20°28.5	10.9′	55.3′
10	333°59.9	20.0	45°37.9	12.8′	20°17.6	10.9′	55.2′
11	349°00.0	20.9	60°09.8	12.9′	20°06.7	11.0′	55.2′
12	4°00.0	S12°21.7	74°41.7	13.0′	N19°55.7	11.0′	55.2′
13	19°00.1	22.6	89°13.7	13.1′	19°44.7	11.2′	55.2′
14	34°00.2	23.4	103°45.8	13.2′	19°33.5	11.2′	55.1′
15	49°00.2	·· 24.3	118°18.0	13.3′	19°22.3	11.3′	55.1′
16	64°00.3	25.1	132°50.3	13.4′	19°11.0	11.3′	55.1′
17	79°00.4	26.0	147°22.8	13.5′	18°59.7	11.5′	55.1′
18	94°00.4	S12°26.8	161°55.3	13.6′	N18°48.2	11.5′	55.0′
19	109°00.5	27.7	176°27.8	13.7′	18°36.7	11.5′	55.0′
20	124°00.6	28.6	191°00.5	13.8′	18°25.2	11.7′	55.0′
21	139°00.6	·· 29.4	205°33.3	13.9′	18°13.5	11.7′	55.0′
22	154°00.7	30.3	220°06.2	13.9′	18°01.8	11.7′	55.0′
23	169°00.7	31.1	234°39.1	14.0′	17°50.1	11.9′	54.9′
	SD = 16.1′	d = -0.9′	SD = 15.1′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	184°00.8	S12°32.0	249°12.1	14.1′	N17°38.2	11.9′	54.9′
1	199°00.9	32.8	263°45.3	14.2′	17°26.3	11.9′	54.9′
2	214°00.9	33.7	278°18.5	14.3′	17°14.4	12.1′	54.9′
3	229°01.0	·· 34.5	292°51.8	14.4′	17°02.3	12.0′	54.8′
4	244°01.1	35.4	307°25.1	14.5′	16°50.3	12.2′	54.8′
5	259°01.1	36.2	321°58.6	14.5′	16°38.1	12.2′	54.8′
6	274°01.2	S12°37.1	336°32.1	14.6′	N16°25.9	12.2′	54.8′
7	289°01.2	37.9	351°05.8	14.7′	16°13.7	12.4′	54.8′
8	304°01.3	38.8	5°39.5	14.8′	16°01.3	12.3′	54.7′
9	319°01.4	·· 39.6	20°13.2	14.9′	15°49.0	12.5′	54.7′
10	334°01.4	40.5	34°47.1	14.9′	15°36.5	12.4′	54.7′
11	349°01.5	41.3	49°21.0	15.0′	15°24.1	12.6′	54.7′
12	4°01.5	S12°42.2	63°55.0	15.1′	N15°11.5	12.5′	54.7′
13	19°01.6	43.0	78°29.1	15.2′	14°59.0	12.7′	54.6′
14	34°01.7	43.9	93°03.3	15.2′	14°46.3	12.7′	54.6′
15	49°01.7	·· 44.7	107°37.5	15.3′	14°33.6	12.7′	54.6′
16	64°01.8	45.5	122°11.8	15.4′	14°20.9	12.8′	54.6′
17	79°01.8	46.4	136°46.2	15.4′	14°08.1	12.8′	54.6′
18	94°01.9	S12°47.2	151°20.6	15.5′	N13°55.3	12.9′	54.6′
19	109°02.0	48.1	165°55.1	15.6′	13°42.4	12.9′	54.5′
20	124°02.0	48.9	180°29.7	15.6′	13°29.5	12.9′	54.5′
21	139°02.1	·· 49.8	195°04.3	15.7′	13°16.6	13.0′	54.5′
22	154°02.1	50.6	209°39.0	15.8′	13°03.6	13.1′	54.5′
23	169°02.2	51.5	224°13.8	15.8′	12°50.5	13.1′	54.5′
	SD = 16.1′	d = -0.9′	SD = 15.0′				

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

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

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 22-24 53-34%
24	15:50	15:53	11:44	06:02	18:27	
25	15:57	16:00	11:44	06:52	19:15	
26	16:03	16:06	11:44	07:37	19:58	



October 27, 28, 29 UT (Sun., Mon., Tue.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	35°50.8	146°33.5	S23°38.9	276°34.4	N21°58.4	315°47.2	N22°24.2	50°39.5	S08°39.3
1	50°53.2	161°32.7	39.4	291°35.8	58.3	330°49.9	24.2	65°42.1	39.3
2	65°55.7	176°32.0	39.9	306°37.2	58.2	345°52.5	24.2	80°44.6	39.3
3	80°58.2	191°31.2	·· 40.5	321°38.6	·· 58.1	0°55.1	·· 24.2	95°47.2	·· 39.4
4	96°00.6	206°30.4	41.0	336°40.0	58.0	15°57.7	24.2	110°49.7	39.4
5	111°03.1	221°29.6	41.5	351°41.4	57.9	31°00.3	24.2	125°52.3	39.4
6	126°05.6	236°28.9	S23°42.1	6°42.8	N21°57.7	46°03.0	N22°24.2	140°54.8	S08°39.4
7	141°08.0	251°28.1	42.6	21°44.2	57.6	61°05.6	24.2	155°57.3	39.5
8	156°10.5	266°27.3	43.1	36°45.6	57.5	76°08.2	24.2	170°59.9	39.5
9	171°12.9	281°26.5	·· 43.6	51°47.0	·· 57.4	91°10.8	·· 24.1	186°02.4	·· 39.5
10	186°15.4	296°25.8	44.2	66°48.4	57.3	106°13.5	24.1	201°05.0	39.6
11	201°17.9	311°25.0	44.7	81°49.8	57.2	121°16.1	24.1	216°07.5	39.6
12	216°20.3	326°24.2	S23°45.2	96°51.2	N21°57.0	136°18.7	N22°24.1	231°10.1	S08°39.6
13	231°22.8	341°23.4	45.7	111°52.6	56.9	151°21.3	24.1	246°12.6	39.6
14	246°25.3	356°22.7	46.2	126°54.0	56.8	166°24.0	24.1	261°15.1	39.7
15	261°27.7	11°21.9	·· 46.8	141°55.4	·· 56.7	181°26.6	·· 24.1	276°17.7	·· 39.7
16	276°30.2	26°21.1	47.3	156°56.8	56.6	196°29.2	24.1	291°20.2	39.7
17	291°32.7	41°20.3	47.8	171°58.2	56.5	211°31.9	24.1	306°22.8	39.7
18	306°35.1	56°19.5	S23°48.3	186°59.6	N21°56.3	226°34.5	N22°24.1	321°25.3	S08°39.8
19	321°37.6	71°18.8	48.8	202°01.0	56.2	241°37.1	24.0	336°27.8	39.8
20	336°40.1	86°18.0	49.3	217°02.5	56.1	256°39.7	24.0	351°30.4	39.8
21	351°42.5	101°17.2	·· 49.8	232°03.9	·· 56.0	271°42.4	·· 24.0	6°32.9	·· 39.8
22	6°45.0	116°16.4	50.4	247°05.3	55.9	286°45.0	24.0	21°35.5	39.9
23	21°47.4	131°15.7	50.9	262°06.7	55.8	301°47.6	24.0	36°38.0	39.9
Mer.pass. 21:33		ν -0.8′	d -0.5′	m -4.00	ν 1.4′	d -0.1′	m 0.14	ν 2.6′	d -0.0′ m -2.66	ν 2.5′	d -0.0′ m 0.77

Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	36°49.9	146°14.9	S23°51.4	277°08.1	N21°55.6	316°50.3	N22°24.0	51°40.5	S08°39.9
1	51°52.4	161°14.1	51.9	292°09.5	55.5	331°52.9	24.0	66°43.1	39.9
2	66°54.8	176°13.3	52.4	307°10.9	55.4	346°55.5	24.0	81°45.6	40.0
3	81°57.3	191°12.5	·· 52.9	322°12.3	·· 55.3	1°58.2	·· 24.0	96°48.2	·· 40.0
4	96°59.8	206°11.7	53.4	337°13.8	55.2	17°00.8	24.0	111°50.7	40.0
5	112°02.2	221°11.0	53.9	352°15.2	55.1	32°03.4	23.9	126°53.2	40.0
6	127°04.7	236°10.2	S23°54.4	7°16.6	N21°54.9	47°06.1	N22°23.9	141°55.8	S08°40.1
7	142°07.2	251°09.4	54.9	22°18.0	54.8	62°08.7	23.9	156°58.3	40.1
8	157°09.6	266°08.6	55.4	37°19.4	54.7	77°11.3	23.9	172°00.9	40.1
9	172°12.1	281°07.8	·· 55.9	52°20.9	·· 54.6	92°14.0	·· 23.9	187°03.4	·· 40.1
10	187°14.5	296°07.0	56.4	67°22.3	54.5	107°16.6	23.9	202°05.9	40.2
11	202°17.0	311°06.3	56.9	82°23.7	54.4	122°19.2	23.9	217°08.5	40.2
12	217°19.5	326°05.5	S23°57.4	97°25.1	N21°54.3	137°21.9	N22°23.9	232°11.0	S08°40.2
13	232°21.9	341°04.7	57.9	112°26.5	54.1	152°24.5	23.9	247°13.6	40.2
14	247°24.4	356°03.9	58.4	127°28.0	54.0	167°27.1	23.8	262°16.1	40.3
15	262°26.9	11°03.1	·· 58.8	142°29.4	·· 53.9	182°29.8	·· 23.8	277°18.6	·· 40.3
16	277°29.3	26°02.3	59.3	157°30.8	53.8	197°32.4	23.8	292°21.2	40.3
17	292°31.8	41°01.5	23°59.8	172°32.2	53.7	212°35.0	23.8	307°23.7	40.3
18	307°34.3	56°00.8	S24°00.3	187°33.7	N21°53.6	227°37.7	N22°23.8	322°26.2	S08°40.4
19	322°36.7	71°00.0	00.8	202°35.1	53.4	242°40.3	23.8	337°28.8	40.4
20	337°39.2	85°59.2	01.3	217°36.5	53.3	257°42.9	23.8	352°31.3	40.4
21	352°41.7	100°58.4	·· 01.8	232°37.9	·· 53.2	272°45.6	·· 23.8	7°33.9	·· 40.4
22	7°44.1	115°57.6	02.3	247°39.4	53.1	287°48.2	23.8	22°36.4	40.5
23	22°46.6	130°56.8	02.7	262°40.8	53.0	302°50.9	23.8	37°38.9	40.5
Mer.pass. 21:29		ν -0.8′	d -0.5′	m -4.00	ν 1.4′	d -0.1′	m 0.12	ν 2.6′	d -0.0′ m -2.66	ν 2.5′	d -0.0′ m 0.78

Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	37°49.0	145°56.0	S24°03.2	277°42.2	N21°52.9	317°53.5	N22°23.7	52°41.5	S08°40.5
1	52°51.5	160°55.2	03.7	292°43.7	52.8	332°56.1	23.7	67°44.0	40.5
2	67°54.0	175°54.5	04.2	307°45.1	52.6	347°58.8	23.7	82°46.5	40.5
3	82°56.4	190°53.7	·· 04.6	322°46.5	·· 52.5	3°01.4	·· 23.7	97°49.1	·· 40.6
4	97°58.9	205°52.9	05.1	337°48.0	52.4	18°04.1	23.7	112°51.6	40.6
5	113°01.4	220°52.1	05.6	352°49.4	52.3	33°06.7	23.7	127°54.2	40.6
6	128°03.8	235°51.3	S24°06.1	7°50.8	N21°52.2	48°09.3	N22°23.7	142°56.7	S08°40.6
7	143°06.3	250°50.5	06.5	22°52.3	52.1	63°12.0	23.7	157°59.2	40.7
8	158°08.8	265°49.7	07.0	37°53.7	52.0	78°14.6	23.7	173°01.8	40.7
9	173°11.2	280°48.9	·· 07.5	52°55.2	·· 51.8	93°17.3	·· 23.6	188°04.3	·· 40.7
10	188°13.7	295°48.1	08.0	67°56.6	51.7	108°19.9	23.6	203°06.8	40.7
11	203°16.1	310°47.3	08.4	82°58.0	51.6	123°22.6	23.6	218°09.4	40.8
12	218°18.6	325°46.5	S24°08.9	97°59.5	N21°51.5	138°25.2	N22°23.6	233°11.9	S08°40.8
13	233°21.1	340°45.7	09.3	113°00.9	51.4	153°27.8	23.6	248°14.4	40.8
14	248°23.5	355°45.0	09.8	128°02.3	51.3	168°30.5	23.6	263°17.0	40.8
15	263°26.0	10°44.2	·· 10.3	143°03.8	·· 51.2	183°33.1	·· 23.6	278°19.5	·· 40.8
16	278°28.5	25°43.4	10.7	158°05.2	51.1	198°35.8	23.6	293°22.0	40.9
17	293°30.9	40°42.6	11.2	173°06.7	50.9	213°38.4	23.6	308°24.6	40.9
18	308°33.4	55°41.8	S24°11.7	188°08.1	N21°50.8	228°41.1	N22°23.5	323°27.1	S08°40.9
19	323°35.9	70°41.0	12.1	203°09.6	50.7	243°43.7	23.5	338°29.6	40.9
20	338°38.3	85°40.2	12.6	218°11.0	50.6	258°46.4	23.5	353°32.2	41.0
21	353°40.8	100°39.4	·· 13.0	233°12.5	·· 50.5	273°49.0	·· 23.5	8°34.7	·· 41.0
22	8°43.3	115°38.6	13.5	248°13.9	50.4	288°51.6	23.5	23°37.2	41.0
23	23°45.7	130°37.8	13.9	263°15.4	50.3	303°54.3	23.5	38°39.8	41.0
Mer.pass. 21:25		ν -0.8′	d -0.5′	m -4.01	ν 1.4′	d -0.1′	m 0.11	ν 2.6′	d -0.0′ m -2.67	ν 2.5′	d -0.0′ m 0.78

Stars

	SHA	Dec
Alpheratz	357°34.7	29°13.8
Ankaa	353°06.9	-42°10.3
Schedar	349°30.8	56°40.6
Diphda	348°47.2	-17°51.0
Achernar	335°19.7	-57°06.6
Hamal	327°51.1	23°34.9
Polaris	313°39.2	89°22.1
Acamar	315°11.5	-40°12.2
Menkar	314°06.0	4°11.3
Mirfak	308°28.1	49°57.0
Aldebaran	290°39.6	16°33.6
Rigel	281°03.8	-8°10.2
Capella	280°21.8	46°01.3
Bellatrix	278°22.8	6°22.4
Elnath	278°01.8	28°37.7
Alnilam	275°37.7	-1°11.0
Betelgeuse	270°52.1	7°24.8
Canopus	263°52.2	-52°42.2
Sirius	258°26.3	-16°44.8
Adhara	255°05.9	-29°00.0
Procyon	244°51.0	5°09.8
Pollux	243°17.5	27°57.9
Avior	234°14.8	-59°34.9
Suhail	222°46.5	-43°31.6
Miaplacidus	221°38.6	-69°48.7
Alphard	217°48.0	-8°45.8
Regulus	207°34.8	11°50.8
Dubhe	193°41.6	61°36.9
Denebola	182°25.4	14°26.1
Gienah	175°44.1	-17°40.6
Acrux	173°01.0	-63°14.0
Gacrux	171°52.4	-57°14.9
Alioth	166°13.6	55°49.5
Spica	158°22.8	-11°17.3
Alkaid	152°52.6	49°11.4
Hadar	148°37.0	-60°29.5
Menkent	147°58.3	-36°29.4
Arcturus	145°48.4	19°03.3
Rigil Kent.	139°41.3	-60°56.2
Kochab	137°20.9	74°03.2
Zuben'ubi	136°56.6	-16°08.6
Alphecca	126°04.2	26°38.0
Antares	112°16.4	-26°29.2
Atria	107°11.2	-69°04.4
Sabik	102°03.3	-15°45.3
Shaula	96°10.9	-37°07.4
Rasalhague	95°59.0	12°32.6
Eltanin	90°42.6	51°29.3
Kaus Aust.	83°33.0	-34°22.4
Vega	80°33.6	38°48.6
Nunki	75°48.1	-26°16.0
Altair	62°00.2	8°56.1
Peacock	53°06.0	-56°39.5
Deneb	49°25.9	45°22.4
Enif	33°38.9	9°59.5
Al Na'ir	27°32.9	-46°50.6
Fomalhaut	15°14.5	-29°29.5
Scheat	13°45.2	28°13.2
Markab	13°29.9	15°20.5

Oct 27 Sun	SHA	Mer.pass
Venus	110°42.7	14:14
Mars	240°43.6	05:33
Jupiter	279°56.5	02:56
Saturn	14°48.8	20:34

Oct 28 Mon	SHA	Mer.pass
Venus	109°25.0	14:16
Mars	240°18.2	05:31
Jupiter	280°00.4	02:52
Saturn	14°50.6	20:30

Oct 29 Tue	SHA	Mer.pass
Venus	108°07.0	14:17
Mars	239°53.2	05:29
Jupiter	280°04.5	02:48
Saturn	14°52.4	20:26

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	184°02.2	S12°52.3	238°48.6	15.9′	N12°37.4	13.1′	54.5′
1	199°02.3	53.1	253°23.5	15.9′	12°24.3	13.2′	54.4′
2	214°02.4	54.0	267°58.4	16.0′	12°11.1	13.2′	54.4′
3	229°02.4	·· 54.8	282°33.5	16.1′	11°57.9	13.2′	54.4′
4	244°02.5	55.7	297°08.5	16.1′	11°44.7	13.3′	54.4′
5	259°02.5	56.5	311°43.6	16.2′	11°31.4	13.3′	54.4′
6	274°02.6	S12°57.4	326°18.8	16.2′	N11°18.1	13.4′	54.4′
7	289°02.6	58.2	340°54.0	16.3′	11°04.7	13.4′	54.3′
8	304°02.7	59.0	355°29.3	16.3′	10°51.3	13.4′	54.3′
9	319°02.7	12°59.9	10°04.7	16.4′	10°37.9	13.4′	54.3′
10	334°02.8	13°00.7	24°40.1	16.4′	10°24.5	13.5′	54.3′
11	349°02.8	01.6	39°15.5	16.5′	10°11.0	13.5′	54.3′
12	4°02.9	S13°02.4	53°51.0	16.5′	N09°57.5	13.6′	54.3′
13	19°02.9	03.2	68°26.5	16.6′	09°43.9	13.6′	54.3′
14	34°03.0	04.1	83°02.1	16.6′	09°30.3	13.6′	54.3′
15	49°03.0	·· 04.9	97°37.7	16.7′	09°16.7	13.6′	54.2′
16	64°03.1	05.8	112°13.4	16.7′	09°03.1	13.7′	54.2′
17	79°03.1	06.6	126°49.1	16.8′	08°49.4	13.7′	54.2′
18	94°03.2	S13°07.4	141°24.8	16.8′	N08°35.7	13.7′	54.2′
19	109°03.2	08.3	156°00.6	16.8′	08°22.0	13.7′	54.2′
20	124°03.3	09.1	170°36.5	16.9′	08°08.3	13.8′	54.2′
21	139°03.3	·· 09.9	185°12.3	16.9′	07°54.5	13.8′	54.2′
22	154°03.4	10.8	199°48.3	16.9′	07°40.7	13.8′	54.2′
23	169°03.4	11.6	214°24.2	17.0′	07°26.9	13.8′	54.2′
	SD = 16.1′	d = -0.8′	SD = 14.9′				

Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	184°03.5	S13°12.4	229°00.2	17.0′	N07°13.1	13.9′	54.1′
1	199°03.5	13.3	243°36.2	17.1′	06°59.2	13.9′	54.1′
2	214°03.6	14.1	258°12.3	17.1′	06°45.3	13.9′	54.1′
3	229°03.6	·· 14.9	272°48.3	17.1′	06°31.4	13.9′	54.1′
4	244°03.7	15.8	287°24.4	17.1′	06°17.5	13.9′	54.1′
5	259°03.7	16.6	302°00.6	17.2′	06°03.6	14.0′	54.1′
6	274°03.8	S13°17.4	316°36.8	17.2′	N05°49.6	13.9′	54.1′
7	289°03.8	18.3	331°13.0	17.2′	05°35.7	14.0′	54.1′
8	304°03.9	19.1	345°49.2	17.3′	05°21.7	14.0′	54.1′
9	319°03.9	·· 19.9	0°25.4	17.3′	05°07.7	14.0′	54.1′
10	334°03.9	20.8	15°01.7	17.3′	04°53.7	14.1′	54.1′
11	349°04.0	21.6	29°38.0	17.3′	04°39.6	14.0′	54.1′
12	4°04.0	S13°22.4	44°14.3	17.3′	N04°25.6	14.1′	54.0′
13	19°04.1	23.3	58°50.7	17.4′	04°11.5	14.0′	54.0′
14	34°04.1	24.1	73°27.0	17.4′	03°57.5	14.1′	54.0′
15	49°04.2	·· 24.9	88°03.4	17.4′	03°43.4	14.1′	54.0′
16	64°04.2	25.8	102°39.8	17.4′	03°29.3	14.1′	54.0′
17	79°04.2	26.6	117°16.2	17.4′	03°15.2	14.1′	54.0′
18	94°04.3	S13°27.4	131°52.7	17.4′	N03°01.1	14.1′	54.0′
19	109°04.3	28.2	146°29.1	17.5′	02°47.0	14.1′	54.0′
20	124°04.4	29.1	161°05.6	17.5′	02°32.9	14.2′	54.0′
21	139°04.4	·· 29.9	175°42.0	17.5′	02°18.7	14.1′	54.0′
22	154°04.5	30.7	190°18.5	17.5′	02°04.6	14.2′	54.0′
23	169°04.5	31.5	204°55.0	17.5′	01°50.4	14.1′	54.0′
	SD = 16.1′	d = -0.8′	SD = 14.8′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	184°04.5	S13°32.4	219°31.5	17.5′	N01°36.3	14.2′	54.0′
1	199°04.6	33.2	234°08.0	17.5′	01°22.1	14.1′	54.0′
2	214°04.6	34.0	248°44.5	17.5′	01°08.0	14.2′	54.0′
3	229°04.6	·· 34.9	263°21.0	17.5′	00°53.8	14.1′	54.0′
4	244°04.7	35.7	277°57.6	17.5′	00°39.7	14.2′	54.0′
5	259°04.7	36.5	292°34.1	17.5′	00°25.5	14.2′	54.0′
6	274°04.8	S13°37.3	307°10.6	17.5′	N00°11.3	14.1′	53.9′
7	289°04.8	38.2	321°47.2	17.5′	S00°02.8	14.2′	53.9′
8	304°04.8	39.0	336°23.7	17.5′	00°17.0	14.2′	53.9′
9	319°04.9	·· 39.8	351°00.2	17.5′	00°31.2	14.1′	53.9′
10	334°04.9	40.6	5°36.8	17.5′	00°45.3	14.2′	53.9′
11	349°04.9	41.4	20°13.3	17.5′	00°59.5	14.1′	53.9′
12	4°05.0	S13°42.3	34°49.8	17.5′	S01°13.6	14.2′	53.9′
13	19°05.0	43.1	49°26.3	17.5′	01°27.8	14.1′	53.9′
14	34°05.1	43.9	64°02.8	17.5′	01°41.9	14.2′	53.9′
15	49°05.1	·· 44.7	78°39.3	17.5′	01°56.1	14.1′	53.9′
16	64°05.1	45.5	93°15.8	17.5′	02°10.2	14.1′	53.9′
17	79°05.2	46.4	107°52.3	17.5′	02°24.3	14.1′	53.9′
18	94°05.2	S13°47.2	122°28.8	17.5′	S02°38.4	14.1′	53.9′
19	109°05.2	48.0	137°05.3	17.5′	02°52.5	14.1′	53.9′
20	124°05.3	48.8	151°41.7	17.4′	03°06.6	14.1′	53.9′
21	139°05.3	·· 49.6	166°18.2	17.4′	03°20.7	14.1′	53.9′
22	154°05.3	50.5	180°54.6	17.4′	03°34.8	14.1′	53.9′
23	169°05.4	51.3	195°31.0	17.4′	03°48.9	14.0′	53.9′
	SD = 16.1′	d = -0.8′	SD = 14.7′				

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

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

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 25-27 25-11%
27	16:09	16:12	11:44	08:19	20:39	
28	16:14	16:16	11:44	08:58	21:18	
29	16:18	16:20	11:44	09:37	21:56	

October 30, 31, 01 UT (Wed., Thu., Fri.)

	Aries	Venus		Mars		Jupiter		Saturn	
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	38°48.2	145°37.0	S24°14.4	278°16.8	N21°50.1	318°56.9	N22°23.5	53°42.3	S08°41.0
1	53°50.6	160°36.2	14.8	293°18.3	50.0	333°59.6	23.5	68°44.8	41.1
2	68°53.1	175°35.4	15.3	308°19.7	49.9	349°02.2	23.5	83°47.4	41.1
3	83°55.6	190°34.6	·· 15.7	323°21.2	·· 49.8	4°04.9	·· 23.4	98°49.9	·· 41.1
4	98°58.0	205°33.8	16.2	338°22.6	49.7	19°07.5	23.4	113°52.4	41.1
5	114°00.5	220°33.0	16.6	353°24.1	49.6	34°10.2	23.4	128°55.0	41.2
6	129°03.0	235°32.2	S24°17.1	8°25.5	N21°49.5	49°12.8	N22°23.4	143°57.5	S08°41.2
7	144°05.4	250°31.4	17.5	23°27.0	49.4	64°15.5	23.4	159°00.0	41.2
8	159°07.9	265°30.6	18.0	38°28.4	49.2	79°18.1	23.4	174°02.6	41.2
9	174°10.4	280°29.8	·· 18.4	53°29.9	·· 49.1	94°20.8	·· 23.4	189°05.1	·· 41.2
10	189°12.8	295°29.0	18.8	68°31.3	49.0	109°23.4	23.4	204°07.6	41.3
11	204°15.3	310°28.2	19.3	83°32.8	48.9	124°26.1	23.4	219°10.2	41.3
12	219°17.8	325°27.4	S24°19.7	98°34.2	N21°48.8	139°28.7	N22°23.3	234°12.7	S08°41.3
13	234°20.2	340°26.6	20.2	113°35.7	48.7	154°31.4	23.3	249°15.2	41.3
14	249°22.7	355°25.8	20.6	128°37.2	48.6	169°34.0	23.3	264°17.8	41.3
15	264°25.1	10°25.0	·· 21.0	143°38.6	·· 48.5	184°36.7	·· 23.3	279°20.3	·· 41.4
16	279°27.6	25°24.2	21.5	158°40.1	48.4	199°39.3	23.3	294°22.8	41.4
17	294°30.1	40°23.4	21.9	173°41.5	48.2	214°42.0	23.3	309°25.3	41.4
18	309°32.5	55°22.6	S24°22.3	188°43.0	N21°48.1	229°44.7	N22°23.3	324°27.9	S08°41.4
19	324°35.0	70°21.8	22.8	203°44.5	48.0	244°47.3	23.3	339°30.4	41.5
20	339°37.5	85°21.0	23.2	218°45.9	47.9	259°50.0	23.3	354°32.9	41.5
21	354°39.9	100°20.2	·· 23.6	233°47.4	·· 47.8	274°52.6	·· 23.2	9°35.5	·· 41.5
22	9°42.4	115°19.4	24.0	248°48.9	47.7	289°55.3	23.2	24°38.0	41.5
23	24°44.9	130°18.6	24.5	263°50.3	47.6	304°57.9	23.2	39°40.5	41.5
Mer.pass. 21:21		ν -0.8′	d -0.5′	m -4.01	ν 1.4′	d -0.1′	m 0.09	ν 2.6′	d -0.0′ m -2.68	ν 2.5′	d -0.0′ m 0.79

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	39°47.3	145°17.8	S24°24.9	278°51.8	N21°47.5	320°00.6	N22°23.2	54°43.1	S08°41.6
1	54°49.8	160°17.0	25.3	293°53.3	47.4	335°03.2	23.2	69°45.6	41.6
2	69°52.2	175°16.2	25.7	308°54.7	47.2	350°05.9	23.2	84°48.1	41.6
3	84°54.7	190°15.4	·· 26.2	323°56.2	·· 47.1	5°08.5	·· 23.2	99°50.6	·· 41.6
4	99°57.2	205°14.6	26.6	338°57.7	47.0	20°11.2	23.2	114°53.2	41.6
5	114°59.6	220°13.8	27.0	353°59.2	46.9	35°13.9	23.1	129°55.7	41.7
6	130°02.1	235°13.0	S24°27.4	9°00.6	N21°46.8	50°16.5	N22°23.1	144°58.2	S08°41.7
7	145°04.6	250°12.1	27.8	24°02.1	46.7	65°19.2	23.1	160°00.8	41.7
8	160°07.0	265°11.3	28.2	39°03.6	46.6	80°21.8	23.1	175°03.3	41.7
9	175°09.5	280°10.5	·· 28.6	54°05.0	·· 46.5	95°24.5	·· 23.1	190°05.8	·· 41.7
10	190°12.0	295°09.7	29.1	69°06.5	46.4	110°27.2	23.1	205°08.3	41.8
11	205°14.4	310°08.9	29.5	84°08.0	46.3	125°29.8	23.1	220°10.9	41.8
12	220°16.9	325°08.1	S24°29.9	99°09.5	N21°46.1	140°32.5	N22°23.1	235°13.4	S08°41.8
13	235°19.4	340°07.3	30.3	114°10.9	46.0	155°35.1	23.1	250°15.9	41.8
14	250°21.8	355°06.5	30.7	129°12.4	45.9	170°37.8	23.0	265°18.4	41.8
15	265°24.3	10°05.7	·· 31.1	144°13.9	·· 45.8	185°40.5	·· 23.0	280°21.0	·· 41.9
16	280°26.7	25°04.9	31.5	159°15.4	45.7	200°43.1	23.0	295°23.5	41.9
17	295°29.2	40°04.1	31.9	174°16.9	45.6	215°45.8	23.0	310°26.0	41.9
18	310°31.7	55°03.3	S24°32.3	189°18.3	N21°45.5	230°48.4	N22°23.0	325°28.5	S08°41.9
19	325°34.1	70°02.5	32.7	204°19.8	45.4	245°51.1	23.0	340°31.1	41.9
20	340°36.6	85°01.6	33.1	219°21.3	45.3	260°53.8	23.0	355°33.6	41.9
21	355°39.1	100°00.8	·· 33.5	234°22.8	·· 45.2	275°56.4	·· 23.0	10°36.1	·· 42.0
22	10°41.5	115°00.0	33.9	249°24.3	45.1	290°59.1	22.9	25°38.7	42.0
23	25°44.0	129°59.2	34.3	264°25.8	44.9	306°01.8	22.9	40°41.2	42.0
Mer.pass. 21:17		ν -0.8′	d -0.4′	m -4.02	ν 1.5′	d -0.1′	m 0.08	ν 2.7′	d -0.0′ m -2.68	ν 2.5′	d -0.0′ m 0.79

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	40°46.5	144°58.4	S24°34.7	279°27.2	N21°44.8	321°04.4	N22°22.9	55°43.7	S08°42.0
1	55°48.9	159°57.6	35.1	294°28.7	44.7	336°07.1	22.9	70°46.2	42.0
2	70°51.4	174°56.8	35.5	309°30.2	44.6	351°09.7	22.9	85°48.8	42.1
3	85°53.8	189°56.0	·· 35.9	324°31.7	·· 44.5	6°12.4	·· 22.9	100°51.3	·· 42.1
4	100°56.3	204°55.2	36.3	339°33.2	44.4	21°15.1	22.9	115°53.8	42.1
5	115°58.8	219°54.3	36.7	354°34.7	44.3	36°17.7	22.9	130°56.3	42.1
6	131°01.2	234°53.5	S24°37.0	9°36.2	N21°44.2	51°20.4	N22°22.8	145°58.9	S08°42.1
7	146°03.7	249°52.7	37.4	24°37.7	44.1	66°23.1	22.8	161°01.4	42.2
8	161°06.2	264°51.9	37.8	39°39.2	44.0	81°25.7	22.8	176°03.9	42.2
9	176°08.6	279°51.1	·· 38.2	54°40.7	·· 43.9	96°28.4	·· 22.8	191°06.4	·· 42.2
10	191°11.1	294°50.3	38.6	69°42.1	43.8	111°31.1	22.8	206°08.9	42.2
11	206°13.6	309°49.5	39.0	84°43.6	43.7	126°33.7	22.8	221°11.5	42.2
12	221°16.0	324°48.7	S24°39.4	99°45.1	N21°43.5	141°36.4	N22°22.8	236°14.0	S08°42.2
13	236°18.5	339°47.8	39.7	114°46.6	43.4	156°39.1	22.8	251°16.5	42.3
14	251°21.0	354°47.0	40.1	129°48.1	43.3	171°41.7	22.7	266°19.0	42.3
15	266°23.4	9°46.2	·· 40.5	144°49.6	·· 43.2	186°44.4	·· 22.7	281°21.6	·· 42.3
16	281°25.9	24°45.4	40.9	159°51.1	43.1	201°47.1	22.7	296°24.1	42.3
17	296°28.3	39°44.6	41.2	174°52.6	43.0	216°49.8	22.7	311°26.6	42.3
18	311°30.8	54°43.8	S24°41.6	189°54.1	N21°42.9	231°52.4	N22°22.7	326°29.1	S08°42.3
19	326°33.3	69°42.9	42.0	204°55.6	42.8	246°55.1	22.7	341°31.7	42.4
20	341°35.7	84°42.1	42.4	219°57.1	42.7	261°57.8	22.7	356°34.2	42.4
21	356°38.2	99°41.3	·· 42.7	234°58.6	·· 42.6	277°00.4	·· 22.7	11°36.7	·· 42.4
22	11°40.7	114°40.5	43.1	250°00.1	42.5	292°03.1	22.6	26°39.2	42.4
23	26°43.1	129°39.7	43.5	265°01.6	42.4	307°05.8	22.6	41°41.7	42.4
Mer.pass. 21:13		ν -0.8′	d -0.4′	m -4.02	ν 1.5′	d -0.1′	m 0.06	ν 2.7′	d -0.0′ m -2.69	ν 2.5′	d -0.0′ m 0.80

Stars

	SHA	Dec
Alpheratz	357°34.7	29°13.8
Ankaa	353°06.9	-42°10.3
Schedar	349°30.8	56°40.6
Diphda	348°47.2	-17°51.0
Achernar	335°19.7	-57°06.7
Hamal	327°51.1	23°34.9
Polaris	313°38.8	89°22.1
Acamar	315°11.5	-40°12.2
Menkar	314°06.0	4°11.3
Mirfak	308°28.0	49°57.0
Aldebaran	290°39.5	16°33.6
Rigel	281°03.8	-8°10.2
Capella	280°21.8	46°01.3
Bellatrix	278°22.8	6°22.4
Elnath	278°01.8	28°37.7
Alnilam	275°37.7	-1°11.0
Betelgeuse	270°52.1	7°24.8
Canopus	263°52.2	-52°42.2
Sirius	258°26.2	-16°44.8
Adhara	255°05.9	-29°00.0
Procyon	244°50.9	5°09.8
Pollux	243°17.4	27°57.9
Avior	234°14.8	-59°34.9
Suhail	222°46.5	-43°31.6
Miaplacidus	221°38.5	-69°48.7
Alphard	217°48.0	-8°45.8
Regulus	207°34.8	11°50.8
Dubhe	193°41.6	61°36.9
Denebola	182°25.4	14°26.1
Gienah	175°44.1	-17°40.6
Acrux	173°01.0	-63°14.0
Gacrux	171°52.4	-57°14.9
Alioth	166°13.6	55°49.4
Spica	158°22.8	-11°17.3
Alkaid	152°52.6	49°11.4
Hadar	148°37.0	-60°29.5
Menkent	147°58.3	-36°29.4
Arcturus	145°48.4	19°03.3
Rigil Kent.	139°41.3	-60°56.2
Kochab	137°20.9	74°03.2
Zuben'ubi	136°56.6	-16°08.6
Alphecca	126°04.2	26°38.0
Antares	112°16.4	-26°29.2
Atria	107°11.3	-69°04.4
Sabik	102°03.3	-15°45.3
Shaula	96°10.9	-37°07.4
Rasalhague	95°59.0	12°32.6
Eltanin	90°42.6	51°29.3
Kaus Aust.	83°33.0	-34°22.4
Vega	80°33.6	38°48.6
Nunki	75°48.2	-26°16.0
Altair	62°00.2	8°56.1
Peacock	53°06.0	-56°39.5
Deneb	49°26.0	45°22.4
Enif	33°38.9	9°59.5
Al Na'ir	27°32.9	-46°50.6
Fomalhaut	15°14.5	-29°29.5
Scheat	13°45.2	28°13.2
Markab	13°29.9	15°20.5

Oct 30 Wed	SHA	Mer.pass
Venus	106°48.8	14:18
Mars	239°28.6	05:26
Jupiter	280°08.8	02:44
Saturn	14°54.1	20:22

Oct 31 Thu	SHA	Mer.pass
Venus	105°30.5	14:20
Mars	239°04.5	05:24
Jupiter	280°13.3	02:39
Saturn	14°55.7	20:18

Nov 01 Fri	SHA	Mer.pass
Venus	104°11.9	14:21
Mars	238°40.8	05:22
Jupiter	280°18.0	02:35
Saturn	14°57.2	20:14

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	184°05.4	S13°52.1	210°07.4	17.4′	S04°02.9	14.1′	53.9′
1	199°05.4	52.9	224°43.8	17.4′	04°17.0	14.0′	53.9′
2	214°05.4	53.7	239°20.2	17.3′	04°31.0	14.0′	53.9′
3	229°05.5	·· 54.5	253°56.5	17.3′	04°45.0	14.0′	53.9′
4	244°05.5	55.4	268°32.8	17.3′	04°59.0	14.0′	53.9′
5	259°05.5	56.2	283°09.1	17.3′	05°13.0	14.0′	53.9′
6	274°05.6	S13°57.0	297°45.4	17.3′	S05°27.0	13.9′	53.9′
7	289°05.6	57.8	312°21.7	17.2′	05°40.9	13.9′	53.9′
8	304°05.6	58.6	326°57.9	17.2′	05°54.8	13.9′	53.9′
9	319°05.7	13°59.4	341°34.1	17.2′	06°08.7	13.9′	53.9′
10	334°05.7	14°00.2	356°10.3	17.2′	06°22.6	13.9′	53.9′
11	349°05.7	01.1	10°46.4	17.1′	06°36.5	13.9′	53.9′
12	4°05.7	S14°01.9	25°22.5	17.1′	S06°50.4	13.8′	53.9′
13	19°05.8	02.7	39°58.6	17.1′	07°04.2	13.8′	53.9′
14	34°05.8	03.5	54°34.7	17.0′	07°18.0	13.8′	53.9′
15	49°05.8	·· 04.3	69°10.7	17.0′	07°31.8	13.7′	53.9′
16	64°05.8	05.1	83°46.7	17.0′	07°45.5	13.8′	53.9′
17	79°05.9	05.9	98°22.7	16.9′	07°59.3	13.7′	54.0′
18	94°05.9	S14°06.7	112°58.6	16.9′	S08°13.0	13.6′	54.0′
19	109°05.9	07.6	127°34.5	16.9′	08°26.6	13.7′	54.0′
20	124°05.9	08.4	142°10.4	16.8′	08°40.3	13.6′	54.0′
21	139°06.0	·· 09.2	156°46.2	16.8′	08°53.9	13.6′	54.0′
22	154°06.0	10.0	171°22.0	16.7′	09°07.5	13.6′	54.0′
23	169°06.0	10.8	185°57.7	16.7′	09°21.1	13.5′	54.0′
	SD = 16.1′	d = -0.8′	SD = 14.7′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	184°06.0	S14°11.6	200°33.4	16.7′	S09°34.6	13.5′	54.0′
1	199°06.1	12.4	215°09.1	16.6′	09°48.1	13.5′	54.0′
2	214°06.1	13.2	229°44.7	16.6′	10°01.6	13.4′	54.0′
3	229°06.1	·· 14.0	244°20.3	16.5′	10°15.0	13.4′	54.0′
4	244°06.1	14.8	258°55.8	16.5′	10°28.4	13.4′	54.0′
5	259°06.2	15.6	273°31.3	16.4′	10°41.8	13.3′	54.0′
6	274°06.2	S14°16.4	288°06.7	16.4′	S10°55.1	13.3′	54.0′
7	289°06.2	17.2	302°42.1	16.3′	11°08.4	13.3′	54.0′
8	304°06.2	18.0	317°17.5	16.3′	11°21.7	13.2′	54.0′
9	319°06.2	·· 18.9	331°52.8	16.2′	11°34.9	13.2′	54.0′
10	334°06.3	19.7	346°28.0	16.2′	11°48.1	13.1′	54.0′
11	349°06.3	20.5	1°03.2	16.1′	12°01.2	13.1′	54.0′
12	4°06.3	S14°21.3	15°38.4	16.1′	S12°14.3	13.0′	54.0′
13	19°06.3	22.1	30°13.5	16.0′	12°27.3	13.1′	54.0′
14	34°06.3	22.9	44°48.5	16.0′	12°40.4	12.9′	54.1′
15	49°06.3	·· 23.7	59°23.5	15.9′	12°53.3	13.0′	54.1′
16	64°06.4	24.5	73°58.4	15.9′	13°06.3	12.8′	54.1′
17	79°06.4	25.3	88°33.3	15.8′	13°19.1	12.9′	54.1′
18	94°06.4	S14°26.1	103°08.1	15.8′	S13°32.0	12.8′	54.1′
19	109°06.4	26.9	117°42.9	15.7′	13°44.8	12.7′	54.1′
20	124°06.4	27.7	132°17.6	15.6′	13°57.5	12.7′	54.1′
21	139°06.5	·· 28.5	146°52.2	15.6′	14°10.2	12.6′	54.1′
22	154°06.5	29.3	161°26.8	15.5′	14°22.8	12.6′	54.1′
23	169°06.5	30.1	176°01.3	15.5′	14°35.4	12.5′	54.1′
	SD = 16.1′	d = -0.8′	SD = 14.7′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	184°06.5	S14°30.9	190°35.8	15.4′	S14°47.9	12.5′	54.1′
1	199°06.5	31.7	205°10.2	15.3′	15°00.4	12.4′	54.1′
2	214°06.5	32.5	219°44.5	15.3′	15°12.8	12.4′	54.1′
3	229°06.5	·· 33.3	234°18.8	15.2′	15°25.2	12.3′	54.1′
4	244°06.6	34.1	248°53.0	15.1′	15°37.5	12.3′	54.2′
5	259°06.6	34.9	263°27.1	15.1′	15°49.8	12.2′	54.2′
6	274°06.6	S14°35.7	278°01.2	15.0′	S16°02.0	12.1′	54.2′
7	289°06.6	36.5	292°35.2	14.9′	16°14.1	12.1′	54.2′
8	304°06.6	37.2	307°09.1	14.9′	16°26.2	12.1′	54.2′
9	319°06.6	·· 38.0	321°43.0	14.8′	16°38.3	11.9′	54.2′
10	334°06.6	38.8	336°16.8	14.7′	16°50.2	11.9′	54.2′
11	349°06.6	39.6	350°50.5	14.7′	17°02.1	11.9′	54.2′
12	4°06.6	S14°40.4	5°24.2	14.6′	S17°14.0	11.7′	54.2′
13	19°06.7	41.2	19°57.8	14.5′	17°25.7	11.7′	54.2′
14	34°06.7	42.0	34°31.3	14.4′	17°37.4	11.7′	54.2′
15	49°06.7	·· 42.8	49°04.7	14.4′	17°49.1	11.5′	54.3′
16	64°06.7	43.6	63°38.1	14.3′	18°00.6	11.6′	54.3′
17	79°06.7	44.4	78°11.4	14.2′	18°12.2	11.4′	54.3′
18	94°06.7	S14°45.2	92°44.6	14.1′	S18°23.6	11.3′	54.3′
19	109°06.7	46.0	107°17.8	14.1′	18°34.9	11.3′	54.3′
20	124°06.7	46.8	121°50.8	14.0′	18°46.2	11.3′	54.3′
21	139°06.7	·· 47.5	136°23.8	13.9′	18°57.5	11.1′	54.3′
22	154°06.7	48.3	150°56.7	13.8′	19°08.6	11.1′	54.3′
23	169°06.7	49.1	165°29.6	13.8′	19°19.7	11.0′	54.3′
	SD = 16.1′	d = -0.8′	SD = 14.8′				

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

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

Day	**Sun** Eqn.of Time 00h mm:ss	12h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 28-0 6-0%
30	16:22	16:23	11:44	10:16	22:35	
31	16:24	16:25	11:44	10:56	23:16	
01	16:26	16:27	11:44	11:38	–:–	

November 02, 03, 04 UT (Sat., Sun., Mon.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	41°45.6	144°38.9	S24°43.8	280°03.1	N21°42.3	322°08.4	N22°22.6	56°44.3	S08°42.4
1	56°48.1	159°38.1	44.2	295°04.7	42.2	337°11.1	22.6	71°46.8	42.5
2	71°50.5	174°37.2	44.6	310°06.2	42.1	352°13.8	22.6	86°49.3	42.5
3	86°53.0	189°36.4	·· 44.9	325°07.7	·· 42.0	7°16.5	·· 22.6	101°51.8	·· 42.5
4	101°55.5	204°35.6	45.3	340°09.2	41.8	22°19.1	22.6	116°54.3	42.5
5	116°57.9	219°34.8	45.6	355°10.7	41.7	37°21.8	22.6	131°56.9	42.5
6	132°00.4	234°34.0	S24°46.0	10°12.2	N21°41.6	52°24.5	N22°22.5	146°59.4	S08°42.5
7	147°02.8	249°33.1	46.4	25°13.7	41.5	67°27.2	22.5	162°01.9	42.6
8	162°05.3	264°32.3	46.7	40°15.2	41.4	82°29.8	22.5	177°04.4	42.6
9	177°07.8	279°31.5	·· 47.1	55°16.7	·· 41.3	97°32.5	·· 22.5	192°06.9	·· 42.6
10	192°10.2	294°30.7	47.4	70°18.2	41.2	112°35.2	22.5	207°09.5	42.6
11	207°12.7	309°29.9	47.8	85°19.8	41.1	127°37.9	22.5	222°12.0	42.6
12	222°15.2	324°29.0	S24°48.1	100°21.3	N21°41.0	142°40.5	N22°22.5	237°14.5	S08°42.6
13	237°17.6	339°28.2	48.5	115°22.8	40.9	157°43.2	22.4	252°17.0	42.7
14	252°20.1	354°27.4	48.8	130°24.3	40.8	172°45.9	22.4	267°19.5	42.7
15	267°22.6	9°26.6	·· 49.2	145°25.8	·· 40.7	187°48.6	·· 22.4	282°22.1	·· 42.7
16	282°25.0	24°25.8	49.5	160°27.3	40.6	202°51.2	22.4	297°24.6	42.7
17	297°27.5	39°24.9	49.9	175°28.8	40.5	217°53.9	22.4	312°27.1	42.7
18	312°29.9	54°24.1	S24°50.2	190°30.4	N21°40.4	232°56.6	N22°22.4	327°29.6	S08°42.7
19	327°32.4	69°23.3	50.6	205°31.9	40.3	247°59.3	22.4	342°32.1	42.8
20	342°34.9	84°22.5	50.9	220°33.4	40.2	263°02.0	22.4	357°34.7	42.8
21	357°37.3	99°21.7	·· 51.2	235°34.9	·· 40.1	278°04.6	·· 22.3	12°37.2	·· 42.8
22	12°39.8	114°20.8	51.6	250°36.5	40.0	293°07.3	22.3	27°39.7	42.8
23	27°42.3	129°20.0	51.9	265°38.0	39.9	308°10.0	22.3	42°42.2	42.8
Mer.pass. 21:09		ν -0.8′	d -0.4′	m -4.03	ν 1.5′	d -0.1′	m 0.04	ν 2.7′	d -0.0′ m -2.70	ν 2.5′	d -0.0′ m 0.80

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	42°44.7	144°19.2	S24°52.3	280°39.5	N21°39.8	323°12.7	N22°22.3	57°44.7	S08°42.8
1	57°47.2	159°18.4	52.6	295°41.0	39.7	338°15.3	22.3	72°47.2	42.9
2	72°49.7	174°17.5	52.9	310°42.6	39.6	353°18.0	22.3	87°49.8	42.9
3	87°52.1	189°16.7	·· 53.3	325°44.1	·· 39.4	8°20.7	·· 22.3	102°52.3	·· 42.9
4	102°54.6	204°15.9	53.6	340°45.6	39.3	23°23.4	22.2	117°54.8	42.9
5	117°57.1	219°15.1	53.9	355°47.1	39.2	38°26.1	22.2	132°57.3	42.9
6	132°59.5	234°14.3	S24°54.3	10°48.7	N21°39.1	53°28.8	N22°22.2	147°59.8	S08°42.9
7	148°02.0	249°13.4	54.6	25°50.2	39.0	68°31.4	22.2	163°02.4	42.9
8	163°04.4	264°12.6	54.9	40°51.7	38.9	83°34.1	22.2	178°04.9	43.0
9	178°06.9	279°11.8	·· 55.2	55°53.3	·· 38.8	98°36.8	·· 22.2	193°07.4	·· 43.0
10	193°09.4	294°11.0	55.6	70°54.8	38.7	113°39.5	22.2	208°09.9	43.0
11	208°11.8	309°10.1	55.9	85°56.3	38.6	128°42.2	22.2	223°12.4	43.0
12	223°14.3	324°09.3	S24°56.2	100°57.9	N21°38.5	143°44.8	N22°22.1	238°14.9	S08°43.0
13	238°16.8	339°08.5	56.5	115°59.4	38.4	158°47.5	22.1	253°17.4	43.0
14	253°19.2	354°07.7	56.9	131°00.9	38.3	173°50.2	22.1	268°20.0	43.0
15	268°21.7	9°06.8	·· 57.2	146°02.5	·· 38.2	188°52.9	·· 22.1	283°22.5	·· 43.1
16	283°24.2	24°06.0	57.5	161°04.0	38.1	203°55.6	22.1	298°25.0	43.1
17	298°26.6	39°05.2	57.8	176°05.5	38.0	218°58.3	22.1	313°27.5	43.1
18	313°29.1	54°04.4	S24°58.1	191°07.1	N21°37.9	234°01.0	N22°22.1	328°30.0	S08°43.1
19	328°31.6	69°03.5	58.4	206°08.6	37.8	249°03.6	22.0	343°32.5	43.1
20	343°34.0	84°02.7	58.7	221°10.2	37.7	264°06.3	22.0	358°35.0	43.1
21	358°36.5	99°01.9	·· 59.1	236°11.7	·· 37.6	279°09.0	·· 22.0	13°37.6	·· 43.1
22	13°38.9	114°01.0	59.4	251°13.2	37.5	294°11.7	22.0	28°40.1	43.2
23	28°41.4	129°00.2	59.7	266°14.8	37.4	309°14.4	22.0	43°42.6	43.2
Mer.pass. 21:06		ν -0.8′	d -0.3′	m -4.03	ν 1.5′	d -0.1′	m 0.03	ν 2.7′	d -0.0′ m -2.70	ν 2.5′	d -0.0′ m 0.81

Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	43°43.9	143°59.4	S25°00.0	281°16.3	N21°37.3	324°17.1	N22°22.0	58°45.1	S08°43.2
1	58°46.3	158°58.6	00.3	296°17.9	37.2	339°19.8	22.0	73°47.6	43.2
2	73°48.8	173°57.7	00.6	311°19.4	37.1	354°22.5	21.9	88°50.1	43.2
3	88°51.3	188°56.9	·· 00.9	326°21.0	·· 37.0	9°25.1	·· 21.9	103°52.6	·· 43.2
4	103°53.7	203°56.1	01.2	341°22.5	36.9	24°27.8	21.9	118°55.2	43.2
5	118°56.2	218°55.3	01.5	356°24.1	36.8	39°30.5	21.9	133°57.7	43.2
6	133°58.7	233°54.4	S25°01.8	11°25.6	N21°36.7	54°33.2	N22°21.9	149°00.2	S08°43.3
7	149°01.1	248°53.6	02.1	26°27.2	36.6	69°35.9	21.9	164°02.7	43.3
8	164°03.6	263°52.8	02.4	41°28.7	36.5	84°38.6	21.9	179°05.2	43.3
9	179°06.1	278°51.9	·· 02.7	56°30.3	·· 36.4	99°41.3	·· 21.8	194°07.7	·· 43.3
10	194°08.5	293°51.1	03.0	71°31.8	36.3	114°44.0	21.8	209°10.2	43.3
11	209°11.0	308°50.3	03.3	86°33.4	36.2	129°46.7	21.8	224°12.7	43.3
12	224°13.4	323°49.5	S25°03.6	101°34.9	N21°36.1	144°49.4	N22°21.8	239°15.3	S08°43.3
13	239°15.9	338°48.6	03.9	116°36.5	36.0	159°52.0	21.8	254°17.8	43.4
14	254°18.4	353°47.8	04.2	131°38.0	35.9	174°54.7	21.8	269°20.3	43.4
15	269°20.8	8°47.0	·· 04.5	146°39.6	·· 35.8	189°57.4	·· 21.8	284°22.8	·· 43.4
16	284°23.3	23°46.1	04.7	161°41.1	35.7	205°00.1	21.7	299°25.3	43.4
17	299°25.8	38°45.3	05.0	176°42.7	35.6	220°02.8	21.7	314°27.8	43.4
18	314°28.2	53°44.5	S25°05.3	191°44.3	N21°35.5	235°05.5	N22°21.7	329°30.3	S08°43.4
19	329°30.7	68°43.6	05.6	206°45.8	35.4	250°08.2	21.7	344°32.8	43.4
20	344°33.2	83°42.8	05.9	221°47.4	35.3	265°10.9	21.7	359°35.3	43.4
21	359°35.6	98°42.0	·· 06.2	236°48.9	·· 35.2	280°13.6	·· 21.7	14°37.9	·· 43.4
22	14°38.1	113°41.2	06.4	251°50.5	35.1	295°16.3	21.7	29°40.4	43.5
23	29°40.6	128°40.3	06.7	266°52.1	35.0	310°19.0	21.6	44°42.9	43.5
Mer.pass. 21:02		ν -0.8′	d -0.3′	m -4.04	ν 1.5′	d -0.1′	m 0.01	ν 2.7′	d -0.0′ m -2.71	ν 2.5′	d -0.0′ m 0.81

Stars

	SHA	Dec
Alpheratz	357°34.7	29°13.8
Ankaa	353°07.0	-42°10.3
Schedar	349°30.8	56°40.6
Diphda	348°47.2	-17°51.0
Achernar	335°19.7	-57°06.7
Hamal	327°51.1	23°34.9
Polaris	313°38.2	89°22.1
Acamar	315°11.5	-40°12.2
Menkar	314°06.0	4°11.3
Mirfak	308°28.0	49°57.0
Aldebaran	290°39.5	16°33.6
Rigel	281°03.8	-8°10.2
Capella	280°21.8	46°01.3
Bellatrix	278°22.8	6°22.4
Elnath	278°01.8	28°37.7
Alnilam	275°37.7	-1°11.0
Betelgeuse	270°52.1	7°24.8
Canopus	263°52.1	-52°42.2
Sirius	258°26.2	-16°44.8
Adhara	255°05.8	-29°00.1
Procyon	244°50.9	5°09.8
Pollux	243°17.4	27°57.9
Avior	234°14.8	-59°34.9
Suhail	222°46.5	-43°31.6
Miaplacidus	221°38.4	-69°48.7
Alphard	217°48.0	-8°45.8
Regulus	207°34.7	11°50.8
Dubhe	193°41.6	61°36.9
Denebola	182°25.4	14°26.1
Gienah	175°44.1	-17°40.6
Acrux	173°00.9	-63°14.0
Gacrux	171°52.4	-57°14.9
Alioth	166°13.6	55°49.4
Spica	158°22.8	-11°17.3
Alkaid	152°52.6	49°11.3
Hadar	148°37.0	-60°29.4
Menkent	147°58.3	-36°29.4
Arcturus	145°48.4	19°03.3
Rigil Kent.	139°41.3	-60°56.2
Kochab	137°20.9	74°03.2
Zuben'ubi	136°56.6	-16°08.6
Alphecca	126°04.3	26°37.9
Antares	112°16.4	-26°29.2
Atria	107°11.3	-69°04.4
Sabik	102°03.3	-15°45.3
Shaula	96°10.9	-37°07.4
Rasalhague	95°59.0	12°32.6
Eltanin	90°42.6	51°29.3
Kaus Aust.	83°33.0	-34°22.4
Vega	80°33.6	38°48.6
Nunki	75°48.2	-26°16.0
Altair	62°00.2	8°56.1
Peacock	53°06.1	-56°39.5
Deneb	49°26.0	45°22.4
Enif	33°38.9	9°59.5
Al Na'ir	27°33.0	-46°50.6
Fomalhaut	15°14.5	-29°29.5
Scheat	13°45.2	28°13.2
Markab	13°29.9	15°20.5

Nov 02 Sat	SHA	Mer.pass
Venus	102°53.3	14:22
Mars	238°17.5	05:19
Jupiter	280°22.9	02:31
Saturn	14°58.7	20:10

Nov 03 Sun	SHA	Mer.pass
Venus	101°34.5	14:24
Mars	237°54.8	05:17
Jupiter	280°27.9	02:27
Saturn	15°00.0	20:06

Nov 04 Mon	SHA	Mer.pass
Venus	100°15.5	14:25
Mars	237°32.5	05:14
Jupiter	280°33.2	02:22
Saturn	15°01.2	20:02

Horizontal parallax	
Venus:	0.1
Mars:	0.1

h	Sun		Moon				
Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	184°06.8	S14°49.9	180°02.3	13.7′	S19°30.7	10.9′	54.3′
1	199°06.8	50.7	194°35.0	13.6′	19°41.6	10.8′	54.4′
2	214°06.8	51.5	209°07.6	13.5′	19°52.4	10.8′	54.4′
3	229°06.8	·· 52.3	223°40.1	13.4′	20°03.2	10.7′	54.4′
4	244°06.8	53.1	238°12.6	13.4′	20°13.9	10.6′	54.4′
5	259°06.8	53.9	252°44.9	13.3′	20°24.5	10.5′	54.4′
6	274°06.8	S14°54.6	267°17.2	13.2′	S20°35.0	10.4′	54.4′
7	289°06.8	55.4	281°49.4	13.1′	20°45.4	10.3′	54.4′
8	304°06.8	56.2	296°21.5	13.0′	20°55.7	10.3′	54.4′
9	319°06.8	·· 57.0	310°53.6	13.0′	21°06.0	10.2′	54.4′
10	334°06.8	57.8	325°25.5	12.9′	21°16.2	10.1′	54.5′
11	349°06.8	58.6	339°57.4	12.8′	21°26.3	10.0′	54.5′
12	4°06.8	S14°59.3	354°29.2	12.7′	S21°36.3	9.9′	54.5′
13	19°06.8	15°00.1	9°00.9	12.6′	21°46.2	9.8′	54.5′
14	34°06.8	00.9	23°32.5	12.5′	21°56.0	9.7′	54.5′
15	49°06.8	·· 01.7	38°04.0	12.5′	22°05.7	9.6′	54.5′
16	64°06.8	02.5	52°35.5	12.4′	22°15.3	9.6′	54.5′
17	79°06.8	03.3	67°06.9	12.3′	22°24.9	9.4′	54.5′
18	94°06.8	S15°04.0	81°38.1	12.2′	S22°34.3	9.4′	54.6′
19	109°06.8	04.8	96°09.3	12.1′	22°43.7	9.2′	54.6′
20	124°06.8	05.6	110°40.4	12.0′	22°52.9	9.2′	54.6′
21	139°06.8	·· 06.4	125°11.5	11.9′	23°02.1	9.0′	54.6′
22	154°06.8	07.2	139°42.4	11.9′	23°11.1	9.0′	54.6′
23	169°06.8	07.9	154°13.3	11.8′	23°20.1	8.8′	54.6′
	SD = 16.1′	d = -0.8′	SD = 14.8′				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	184°06.8	S15°08.7	168°44.0	11.7′	S23°28.9	8.7′	54.6′
1	199°06.8	09.5	183°14.7	11.6′	23°37.6	8.7′	54.7′
2	214°06.8	10.3	197°45.3	11.5′	23°46.3	8.5′	54.7′
3	229°06.8	·· 11.0	212°15.8	11.4′	23°54.8	8.4′	54.7′
4	244°06.8	11.8	226°46.3	11.3′	24°03.2	8.4′	54.7′
5	259°06.8	12.6	241°16.6	11.3′	24°11.6	8.2′	54.7′
6	274°06.8	S15°13.4	255°46.9	11.2′	S24°19.8	8.1′	54.7′
7	289°06.8	14.2	270°17.1	11.1′	24°27.9	7.9′	54.7′
8	304°06.8	14.9	284°47.2	11.0′	24°35.8	7.9′	54.8′
9	319°06.8	·· 15.7	299°17.2	10.9′	24°43.7	7.8′	54.8′
10	334°06.8	16.5	313°47.1	10.8′	24°51.5	7.6′	54.8′
11	349°06.8	17.2	328°16.9	10.8′	24°59.1	7.6′	54.8′
12	4°06.8	S15°18.0	342°46.7	10.7′	S25°06.7	7.4′	54.8′
13	19°06.7	18.8	357°16.4	10.6′	25°14.1	7.3′	54.8′
14	34°06.7	19.6	11°46.0	10.5′	25°21.4	7.2′	54.8′
15	49°06.7	·· 20.3	26°15.5	10.4′	25°28.6	7.0′	54.9′
16	64°06.7	21.1	40°44.9	10.3′	25°35.6	7.0′	54.9′
17	79°06.7	21.9	55°14.2	10.3′	25°42.6	6.8′	54.9′
18	94°06.7	S15°22.7	69°43.5	10.2′	S25°49.4	6.7′	54.9′
19	109°06.7	23.4	84°12.7	10.1′	25°56.1	6.5′	54.9′
20	124°06.7	24.2	98°41.8	10.0′	26°02.6	6.5′	54.9′
21	139°06.7	·· 25.0	113°10.8	9.9′	26°09.1	6.3′	55.0′
22	154°06.7	25.7	127°39.8	9.9′	26°15.4	6.2′	55.0′
23	169°06.7	26.5	142°08.6	9.8′	26°21.6	6.1′	55.0′
	SD = 16.1′	d = -0.8′	SD = 14.9′				

Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	184°06.7	S15°27.3	156°37.4	9.7′	S26°27.7	5.9′	55.0′
1	199°06.6	28.0	171°06.1	9.6′	26°33.6	5.8′	55.0′
2	214°06.6	28.8	185°34.8	9.6′	26°39.4	5.7′	55.0′
3	229°06.6	·· 29.6	200°03.3	9.5′	26°45.1	5.5′	55.1′
4	244°06.6	30.3	214°31.8	9.4′	26°50.6	5.4′	55.1′
5	259°06.6	31.1	229°00.3	9.3′	26°56.0	5.3′	55.1′
6	274°06.6	S15°31.9	243°28.6	9.3′	S27°01.3	5.2′	55.1′
7	289°06.6	32.6	257°56.9	9.2′	27°06.5	5.0′	55.1′
8	304°06.6	33.4	272°25.1	9.1′	27°11.5	4.8′	55.1′
9	319°06.5	·· 34.2	286°53.2	9.1′	27°16.3	4.8′	55.2′
10	334°06.5	34.9	301°21.3	9.0′	27°21.1	4.6′	55.2′
11	349°06.5	35.7	315°49.3	8.9′	27°25.7	4.4′	55.2′
12	4°06.5	S15°36.4	330°17.2	8.9′	S27°30.1	4.3′	55.2′
13	19°06.5	37.2	344°45.0	8.8′	27°34.4	4.2′	55.2′
14	34°06.5	38.0	359°12.8	8.7′	27°38.6	4.0′	55.3′
15	49°06.5	·· 38.7	13°40.6	8.7′	27°42.6	3.9′	55.3′
16	64°06.4	39.5	28°08.2	8.6′	27°46.5	3.8′	55.3′
17	79°06.4	40.3	42°35.8	8.5′	27°50.3	3.6′	55.3′
18	94°06.4	S15°41.0	57°03.4	8.5′	S27°53.9	3.4′	55.3′
19	109°06.4	41.8	71°30.9	8.4′	27°57.3	3.3′	55.3′
20	124°06.4	42.5	85°58.3	8.4′	28°00.6	3.2′	55.4′
21	139°06.4	·· 43.3	100°25.7	8.3′	28°03.8	3.0′	55.4′
22	154°06.3	44.0	114°53.0	8.3′	28°06.8	2.9′	55.4′
23	169°06.3	44.8	129°20.3	8.2′	28°09.7	2.7′	55.4′
	SD = 16.1′	d = -0.8′	SD = 15.0′				

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

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

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%
02	16:27	16:27	11:44	12:23	00:00	
03	16:27	16:27	11:44	13:11	00:47	
04	16:27	16:26	11:44	14:03	01:37	

November 05, 06, 07 UT (Tue., Wed., Thu.)

	Aries	Venus		Mars		Jupiter		Saturn	
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	44°43.0	143°39.5	S25°07.0	281°53.6	N21°34.9	325°21.7	N22°21.6	59°45.4	S08°43.5
1	59°45.5	158°38.7	07.3	296°55.2	34.8	340°24.4	21.6	74°47.9	43.5
2	74°47.9	173°37.8	07.6	311°56.8	34.8	355°27.1	21.6	89°50.4	43.5
3	89°50.4	188°37.0	·· 07.8	326°58.3	·· 34.7	10°29.8	·· 21.6	104°52.9	·· 43.5
4	104°52.9	203°36.2	08.1	341°59.9	34.6	25°32.5	21.6	119°55.4	43.5
5	119°55.3	218°35.3	08.4	357°01.5	34.5	40°35.2	21.6	134°57.9	43.5
6	134°57.8	233°34.5	S25°08.6	12°03.0	N21°34.4	55°37.8	N22°21.5	150°00.4	S08°43.6
7	150°00.3	248°33.7	08.9	27°04.6	34.3	70°40.5	21.5	165°02.9	43.6
8	165°02.7	263°32.8	09.2	42°06.2	34.2	85°43.2	21.5	180°05.5	43.6
9	180°05.2	278°32.0	·· 09.5	57°07.7	·· 34.1	100°45.9	·· 21.5	195°08.0	·· 43.6
10	195°07.7	293°31.2	09.7	72°09.3	34.0	115°48.6	21.5	210°10.5	43.6
11	210°10.1	308°30.3	10.0	87°10.9	33.9	130°51.3	21.5	225°13.0	43.6
12	225°12.6	323°29.5	S25°10.2	102°12.5	N21°33.8	145°54.0	N22°21.5	240°15.5	S08°43.6
13	240°15.0	338°28.7	10.5	117°14.0	33.7	160°56.7	21.4	255°18.0	43.6
14	255°17.5	353°27.8	10.8	132°15.6	33.6	175°59.4	21.4	270°20.5	43.6
15	270°20.0	8°27.0	·· 11.0	147°17.2	·· 33.5	191°02.1	·· 21.4	285°23.0	·· 43.7
16	285°22.4	23°26.2	11.3	162°18.8	33.4	206°04.8	21.4	300°25.5	43.7
17	300°24.9	38°25.3	11.5	177°20.3	33.3	221°07.5	21.4	315°28.0	43.7
18	315°27.4	53°24.5	S25°11.8	192°21.9	N21°33.2	236°10.2	N22°21.4	330°30.5	S08°43.7
19	330°29.8	68°23.7	12.1	207°23.5	33.1	251°12.9	21.4	345°33.0	43.7
20	345°32.3	83°22.8	12.3	222°25.1	33.0	266°15.6	21.3	0°35.5	43.7
21	0°34.8	98°22.0	·· 12.6	237°26.7	·· 32.9	281°18.3	·· 21.3	15°38.1	·· 43.7
22	15°37.2	113°21.2	12.8	252°28.3	32.8	296°21.0	21.3	30°40.6	43.7
23	30°39.7	128°20.3	13.1	267°29.8	32.7	311°23.7	21.3	45°43.1	43.7
Mer.pass. 20:58		ν -0.8′	d -0.3′	m -4.04	ν 1.6′	d -0.1′	m -0.00	ν 2.7′	d -0.0′ m -2.71	ν 2.5′	d -0.0′ m 0.82

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	45°42.2	143°19.5	S25°13.3	282°31.4	N21°32.7	326°26.4	N22°21.3	60°45.6	S08°43.7
1	60°44.6	158°18.7	13.6	297°33.0	32.6	341°29.1	21.3	75°48.1	43.8
2	75°47.1	173°17.8	13.8	312°34.6	32.5	356°31.9	21.3	90°50.6	43.8
3	90°49.5	188°17.0	·· 14.0	327°36.2	·· 32.4	11°34.6	·· 21.2	105°53.1	·· 43.8
4	105°52.0	203°16.2	14.3	342°37.8	32.3	26°37.3	21.2	120°55.6	43.8
5	120°54.5	218°15.3	14.5	357°39.4	32.2	41°40.0	21.2	135°58.1	43.8
6	135°56.9	233°14.5	S25°14.8	12°40.9	N21°32.1	56°42.7	N22°21.2	151°00.6	S08°43.8
7	150°59.4	248°13.6	15.0	27°42.5	32.0	71°45.4	21.2	166°03.1	43.8
8	166°01.9	263°12.8	15.3	42°44.1	31.9	86°48.1	21.2	181°05.6	43.8
9	181°04.3	278°12.0	·· 15.5	57°45.7	·· 31.8	101°50.8	·· 21.1	196°08.1	·· 43.8
10	196°06.8	293°11.1	15.7	72°47.3	31.7	116°53.5	21.1	211°10.6	43.8
11	211°09.3	308°10.3	16.0	87°48.9	31.6	131°56.2	21.1	226°13.1	43.9
12	226°11.7	323°09.5	S25°16.2	102°50.5	N21°31.5	146°58.9	N22°21.1	241°15.6	S08°43.9
13	241°14.2	338°08.6	16.4	117°52.1	31.4	162°01.6	21.1	256°18.1	43.9
14	256°16.7	353°07.8	16.7	132°53.7	31.4	177°04.3	21.1	271°20.6	43.9
15	271°19.1	8°07.0	·· 16.9	147°55.3	·· 31.3	192°07.0	·· 21.1	286°23.1	·· 43.9
16	286°21.6	23°06.1	17.1	162°56.9	31.2	207°09.7	21.0	301°25.6	43.9
17	301°24.0	38°05.3	17.3	177°58.5	31.1	222°12.4	21.0	316°28.1	43.9
18	316°26.5	53°04.4	S25°17.6	193°00.1	N21°31.0	237°15.1	N22°21.0	331°30.6	S08°43.9
19	331°29.0	68°03.6	17.8	208°01.7	30.9	252°17.9	21.0	346°33.1	43.9
20	346°31.4	83°02.8	18.0	223°03.3	30.8	267°20.6	21.0	1°35.7	43.9
21	1°33.9	98°01.9	·· 18.2	238°04.9	·· 30.7	282°23.3	·· 21.0	16°38.2	·· 43.9
22	16°36.4	113°01.1	18.5	253°06.5	30.6	297°26.0	20.9	31°40.7	44.0
23	31°38.8	128°00.3	18.7	268°08.1	30.5	312°28.7	20.9	46°43.2	44.0
Mer.pass. 20:54		ν -0.8′	d -0.2′	m -4.05	ν 1.6′	d -0.1′	m -0.02	ν 2.7′	d -0.0′ m -2.72	ν 2.5′	d -0.0′ m 0.82

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	46°41.3	142°59.4	S25°18.9	283°09.7	N21°30.4	327°31.4	N22°20.9	61°45.7	S08°44.0
1	61°43.8	157°58.6	19.1	298°11.3	30.4	342°34.1	20.9	76°48.2	44.0
2	76°46.2	172°57.7	19.3	313°12.9	30.3	357°36.8	20.9	91°50.7	44.0
3	91°48.7	187°56.9	·· 19.5	328°14.5	·· 30.2	12°39.5	·· 20.9	106°53.2	·· 44.0
4	106°51.2	202°56.1	19.8	343°16.1	30.1	27°42.2	20.9	121°55.7	44.0
5	121°53.6	217°55.2	20.0	358°17.7	30.0	42°45.0	20.8	136°58.2	44.0
6	136°56.1	232°54.4	S25°20.2	13°19.3	N21°29.9	57°47.7	N22°20.8	152°00.7	S08°44.0
7	151°58.5	247°53.6	20.4	28°21.0	29.8	72°50.4	20.8	167°03.2	44.0
8	167°01.0	262°52.7	20.6	43°22.6	29.7	87°53.1	20.8	182°05.7	44.0
9	182°03.5	277°51.9	·· 20.8	58°24.2	·· 29.6	102°55.8	·· 20.8	197°08.2	·· 44.0
10	197°05.9	292°51.0	21.0	73°25.8	29.6	117°58.5	20.8	212°10.7	44.1
11	212°08.4	307°50.2	21.2	88°27.4	29.5	133°01.2	20.7	227°13.2	44.1
12	227°10.9	322°49.4	S25°21.4	103°29.0	N21°29.4	148°03.9	N22°20.7	242°15.7	S08°44.1
13	242°13.3	337°48.5	21.6	118°30.6	29.3	163°06.7	20.7	257°18.2	44.1
14	257°15.8	352°47.7	21.8	133°32.3	29.2	178°09.4	20.7	272°20.7	44.1
15	272°18.3	7°46.8	·· 22.0	148°33.9	·· 29.1	193°12.1	·· 20.7	287°23.2	·· 44.1
16	287°20.7	22°46.0	22.2	163°35.5	29.0	208°14.8	20.7	302°25.7	44.1
17	302°23.2	37°45.2	22.4	178°37.1	28.9	223°17.5	20.7	317°28.2	44.1
18	317°25.7	52°44.3	S25°22.6	193°38.7	N21°28.8	238°20.2	N22°20.6	332°30.7	S08°44.1
19	332°28.1	67°43.5	22.8	208°40.4	28.8	253°22.9	20.6	347°33.2	44.1
20	347°30.6	82°42.7	23.0	223°42.0	28.7	268°25.7	20.6	2°35.7	44.1
21	2°33.0	97°41.8	·· 23.2	238°43.6	·· 28.6	283°28.4	·· 20.6	17°38.2	·· 44.1
22	17°35.5	112°41.0	23.4	253°45.2	28.5	298°31.1	20.6	32°40.7	44.1
23	32°38.0	127°40.1	23.6	268°46.9	28.4	313°33.8	20.6	47°43.2	44.1
Mer.pass. 20:50		ν -0.8′	d -0.2′	m -4.05	ν 1.6′	d -0.1′	m -0.04	ν 2.7′	d -0.0′ m -2.73	ν 2.5′	d -0.0′ m 0.83

Stars

	SHA	Dec
Alpheratz	357°34.7	29°13.8
Ankaa	353°07.0	-42°10.3
Schedar	349°30.8	56°40.6
Diphda	348°47.2	-17°51.0
Achernar	335°19.7	-57°06.7
Hamal	327°51.1	23°34.9
Polaris	313°37.6	89°22.1
Acamar	315°11.5	-40°12.2
Menkar	314°06.0	4°11.3
Mirfak	308°28.0	49°57.0
Aldebaran	290°39.5	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°01.8	28°37.7
Alnilam	275°37.6	-1°11.0
Betelgeuse	270°52.0	7°24.8
Canopus	263°52.1	-52°42.2
Sirius	258°26.2	-16°44.8
Adhara	255°05.8	-29°00.1
Procyon	244°50.9	5°09.8
Pollux	243°17.4	27°57.9
Avior	234°14.7	-59°34.9
Suhail	222°46.5	-43°31.6
Miaplacidus	221°38.4	-69°48.7
Alphard	217°48.0	-8°45.8
Regulus	207°34.7	11°50.8
Dubhe	193°41.5	61°36.8
Denebola	182°25.3	14°26.0
Gienah	175°44.0	-17°40.6
Acrux	173°00.9	-63°14.0
Gacrux	171°52.4	-57°14.9
Alioth	166°13.6	55°49.4
Spica	158°22.8	-11°17.3
Alkaid	152°52.6	49°11.3
Hadar	148°36.9	-60°29.4
Menkent	147°58.2	-36°29.4
Arcturus	145°48.4	19°03.2
Rigil Kent.	139°41.2	-60°56.2
Kochab	137°20.9	74°03.1
Zuben'ubi	136°56.6	-16°08.6
Alphecca	126°04.2	26°37.9
Antares	112°16.4	-26°29.2
Atria	107°11.3	-69°04.4
Sabik	102°03.3	-15°45.3
Shaula	96°10.9	-37°07.4
Rasalhague	95°59.0	12°32.6
Eltanin	90°42.7	51°29.3
Kaus Aust.	83°33.0	-34°22.4
Vega	80°33.6	38°48.6
Nunki	75°48.2	-26°16.0
Altair	62°00.2	8°56.1
Peacock	53°06.1	-56°39.5
Deneb	49°26.0	45°22.4
Enif	33°38.9	9°59.5
Al Na'ir	27°33.0	-46°50.6
Fomalhaut	15°14.5	-29°29.5
Scheat	13°45.2	28°13.2
Markab	13°29.9	15°20.5

Nov 05 Tue	SHA	Mer.pass
Venus	98°56.5	14:26
Mars	237°10.6	05:12
Jupiter	280°38.7	02:18
Saturn	15°02.4	19:58

Nov 06 Wed	SHA	Mer.pass
Venus	97°37.3	14:28
Mars	236°49.3	05:09
Jupiter	280°44.3	02:14
Saturn	15°03.4	19:54

Nov 07 Thu	SHA	Mer.pass
Venus	96°18.1	14:29
Mars	236°28.4	05:07
Jupiter	280°50.1	02:10
Saturn	15°04.4	19:50

Horizontal parallax	
Venus:	0.1
Mars:	0.2

h	Sun		Moon				
Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	184°06.3	S15°45.6	143°47.5	8.2′	S28°12.4	2.6′	55.4′
1	199°06.3	46.3	158°14.6	8.1′	28°15.0	2.4′	55.5′
2	214°06.3	47.1	172°41.8	8.1′	28°17.4	2.3′	55.5′
3	229°06.2	·· 47.8	187°08.8	8.0′	28°19.7	2.1′	55.5′
4	244°06.2	48.6	201°35.8	8.0′	28°21.8	2.0′	55.5′
5	259°06.2	49.3	216°02.8	7.9′	28°23.8	1.8′	55.5′
6	274°06.2	S15°50.1	230°29.7	7.9′	S28°25.6	1.6′	55.6′
7	289°06.2	50.9	244°56.6	7.8′	28°27.2	1.6′	55.6′
8	304°06.1	51.6	259°23.5	7.8′	28°28.8	1.3′	55.6′
9	319°06.1	·· 52.4	273°50.3	7.8′	28°30.1	1.2′	55.6′
10	334°06.1	53.1	288°17.0	7.7′	28°31.3	1.1′	55.6′
11	349°06.1	53.9	302°43.8	7.7′	28°32.4	0.8′	55.7′
12	4°06.0	S15°54.6	317°10.4	7.7′	S28°33.2	0.8′	55.7′
13	19°06.0	55.4	331°37.1	7.6′	28°34.0	0.6′	55.7′
14	34°06.0	56.1	346°03.7	7.6′	28°34.6	0.4′	55.7′
15	49°06.0	·· 56.9	0°30.3	7.6′	28°35.0	0.2′	55.8′
16	64°06.0	57.6	14°56.9	7.5′	28°35.2	0.1′	55.8′
17	79°05.9	58.4	29°23.4	7.5′	28°35.3	0.0′	55.8′
18	94°05.9	S15°59.1	43°50.0	7.5′	S28°35.3	0.2′	55.8′
19	109°05.9	15°59.9	58°16.4	7.5′	28°35.1	0.4′	55.8′
20	124°05.8	16°00.6	72°42.9	7.4′	28°34.7	0.5′	55.9′
21	139°05.8	·· 01.4	87°09.4	7.4′	28°34.2	0.7′	55.9′
22	154°05.8	02.1	101°35.8	7.4′	28°33.5	0.9′	55.9′
23	169°05.8	02.9	116°02.2	7.4′	28°32.6	1.0′	55.9′
	SD = 16.1′	d = -0.8′	SD = 15.1′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	184°05.7	S16°03.6	130°28.6	7.4′	S28°31.6	1.1′	56.0′
1	199°05.7	04.3	144°55.0	7.4′	28°30.5	1.4′	56.0′
2	214°05.7	05.1	159°21.4	7.4′	28°29.1	1.5′	56.0′
3	229°05.7	·· 05.8	173°47.7	7.4′	28°27.6	1.6′	56.0′
4	244°05.6	06.6	188°14.1	7.3′	28°26.0	1.8′	56.0′
5	259°05.6	07.3	202°40.4	7.3′	28°24.2	2.0′	56.1′
6	274°05.6	S16°08.1	217°06.8	7.3′	S28°22.2	2.1′	56.1′
7	289°05.5	08.8	231°33.1	7.3′	28°20.1	2.3′	56.1′
8	304°05.5	09.6	245°59.4	7.3′	28°17.8	2.4′	56.1′
9	319°05.5	·· 10.3	260°25.7	7.3′	28°15.4	2.7′	56.2′
10	334°05.4	11.0	274°52.1	7.3′	28°12.7	2.7′	56.2′
11	349°05.4	11.8	289°18.4	7.3′	28°10.0	3.0′	56.2′
12	4°05.4	S16°12.5	303°44.7	7.3′	S28°07.0	3.1′	56.2′
13	19°05.4	13.3	318°11.1	7.3′	28°03.9	3.2′	56.3′
14	34°05.3	14.0	332°37.4	7.4′	28°00.7	3.4′	56.3′
15	49°05.3	·· 14.7	347°03.8	7.4′	27°57.3	3.6′	56.3′
16	64°05.3	15.5	1°30.2	7.4′	27°53.7	3.7′	56.3′
17	79°05.2	16.2	15°56.5	7.4′	27°50.0	3.9′	56.4′
18	94°05.2	S16°17.0	30°22.9	7.4′	S27°46.1	4.1′	56.4′
19	109°05.2	17.7	44°49.3	7.4′	27°42.0	4.2′	56.4′
20	124°05.1	18.4	59°15.7	7.4′	27°37.8	4.3′	56.4′
21	139°05.1	·· 19.2	73°42.2	7.5′	27°33.5	4.6′	56.5′
22	154°05.0	19.9	88°08.6	7.5′	27°28.9	4.7′	56.5′
23	169°05.0	20.6	102°35.1	7.5′	27°24.2	4.8′	56.5′
	SD = 16.1′	d = -0.7′	SD = 15.3′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	184°05.0	S16°21.4	117°01.6	7.5′	S27°19.4	5.0′	56.5′
1	199°04.9	22.1	131°28.1	7.5′	27°14.4	5.2′	56.6′
2	214°04.9	22.8	145°54.7	7.6′	27°09.2	5.3′	56.6′
3	229°04.9	·· 23.6	160°21.2	7.6′	27°03.9	5.5′	56.6′
4	244°04.8	24.3	174°47.8	7.6′	26°58.4	5.6′	56.6′
5	259°04.8	25.0	189°14.5	7.7′	26°52.8	5.8′	56.7′
6	274°04.8	S16°25.8	203°41.1	7.7′	S26°47.0	5.9′	56.7′
7	289°04.7	26.5	218°07.8	7.7′	26°41.1	6.1′	56.7′
8	304°04.7	27.2	232°34.5	7.7′	26°35.0	6.3′	56.7′
9	319°04.6	·· 28.0	247°01.3	7.8′	26°28.7	6.4′	56.8′
10	334°04.6	28.7	261°28.0	7.8′	26°22.3	6.5′	56.8′
11	349°04.6	29.4	275°54.9	7.9′	26°15.8	6.7′	56.8′
12	4°04.5	S16°30.1	290°21.7	7.9′	S26°09.1	6.9′	56.9′
13	19°04.5	30.9	304°48.6	7.9′	26°02.2	7.0′	56.9′
14	34°04.4	31.6	319°15.5	8.0′	25°55.2	7.2′	56.9′
15	49°04.4	·· 32.3	333°42.5	8.0′	25°48.0	7.3′	56.9′
16	64°04.4	33.1	348°09.5	8.0′	25°40.7	7.4′	57.0′
17	79°04.3	33.8	2°36.5	8.1′	25°33.3	7.6′	57.0′
18	94°04.3	S16°34.5	17°03.6	8.1′	S25°25.7	7.8′	57.0′
19	109°04.2	35.2	31°30.7	8.2′	25°17.9	7.9′	57.1′
20	124°04.2	36.0	45°57.9	8.2′	25°10.0	8.1′	57.1′
21	139°04.1	·· 36.7	60°25.1	8.3′	25°01.9	8.2′	57.1′
22	154°04.1	37.4	74°52.4	8.3′	24°53.7	8.3′	57.1′
23	169°04.0	38.1	89°19.7	8.3′	24°45.4	8.5′	57.2′
	SD = 16.1′	d = -0.7′	SD = 15.4′				

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

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

Day	**Sun**			**Moon**		
	Eqn.of Time		Mer.	Mer.Pass.		Age
	00^h	12^h	Pass	Upper	Lower	4-6
	mm:ss	mm:ss	hh:mm	hh:mm	hh:mm	11-27%
05	16:25	16:24	11:44	14:58	02:30	
06	16:23	16:22	11:44	15:54	03:26	
07	16:20	16:18	11:44	16:49	04:22	

November 08, 09, 10 UT (Fri., Sat., Sun.)

	Aries	Venus		Mars		Jupiter		Saturn	
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	47°40.4	142°39.3	S25°23.8	283°48.5	N21°28.3	328°36.5	N22°20.5	62°45.7	S08°44.2
1	62°42.9	157°38.5	24.0	298°50.1	28.2	343°39.2	20.5	77°48.1	44.2
2	77°45.4	172°37.6	24.1	313°51.7	28.2	358°42.0	20.5	92°50.6	44.2
3	92°47.8	187°36.8	·· 24.3	328°53.4	·· 28.1	13°44.7	·· 20.5	107°53.1	·· 44.2
4	107°50.3	202°35.9	24.5	343°55.0	28.0	28°47.4	20.5	122°55.6	44.2
5	122°52.8	217°35.1	24.7	358°56.6	27.9	43°50.1	20.5	137°58.1	44.2
6	137°55.2	232°34.3	S25°24.9	13°58.3	N21°27.8	58°52.8	N22°20.4	153°00.6	S08°44.2
7	152°57.7	247°33.4	25.0	28°59.9	27.7	73°55.6	20.4	168°03.1	44.2
8	168°00.1	262°32.6	25.2	44°01.5	27.6	88°58.3	20.4	183°05.6	44.2
9	183°02.6	277°31.7	·· 25.4	59°03.2	·· 27.6	104°01.0	·· 20.4	198°08.1	·· 44.2
10	198°05.1	292°30.9	25.6	74°04.8	27.5	119°03.7	20.4	213°10.6	44.2
11	213°07.5	307°30.1	25.8	89°06.4	27.4	134°06.4	20.4	228°13.1	44.2
12	228°10.0	322°29.2	S25°25.9	104°08.1	N21°27.3	149°09.2	N22°20.3	243°15.6	S08°44.2
13	243°12.5	337°28.4	26.1	119°09.7	27.2	164°11.9	20.3	258°18.1	44.2
14	258°14.9	352°27.5	26.3	134°11.3	27.1	179°14.6	20.3	273°20.6	44.2
15	273°17.4	7°26.7	·· 26.4	149°13.0	·· 27.0	194°17.3	·· 20.3	288°23.1	·· 44.2
16	288°19.9	22°25.9	26.6	164°14.6	27.0	209°20.0	20.3	303°25.6	44.2
17	303°22.3	37°25.0	26.8	179°16.3	26.9	224°22.8	20.3	318°28.1	44.3
18	318°24.8	52°24.2	S25°26.9	194°17.9	N21°26.8	239°25.5	N22°20.2	333°30.6	S08°44.3
19	333°27.3	67°23.3	27.1	209°19.5	26.7	254°28.2	20.2	348°33.1	44.3
20	348°29.7	82°22.5	27.3	224°21.2	26.6	269°30.9	20.2	3°35.6	44.3
21	3°32.2	97°21.6	·· 27.4	239°22.8	·· 26.5	284°33.6	·· 20.2	18°38.1	·· 44.3
22	18°34.6	112°20.8	27.6	254°24.5	26.5	299°36.4	20.2	33°40.6	44.3
23	33°37.1	127°20.0	27.7	269°26.1	26.4	314°39.1	20.2	48°43.1	44.3
Mer.pass. 20:46		ν -0.8′	d -0.2′	m -4.06	ν 1.6′	d -0.1′	m -0.05	ν 2.7′	d -0.0′ m -2.73	ν 2.5′	d -0.0′ m 0.83

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	48°39.6	142°19.1	S25°27.9	284°27.8	N21°26.3	329°41.8	N22°20.2	63°45.5	S08°44.3
1	63°42.0	157°18.3	28.1	299°29.4	26.2	344°44.5	20.1	78°48.0	44.3
2	78°44.5	172°17.4	28.2	314°31.1	26.1	359°47.3	20.1	93°50.5	44.3
3	93°47.0	187°16.6	·· 28.4	329°32.7	·· 26.1	14°50.0	·· 20.1	108°53.0	·· 44.3
4	108°49.4	202°15.8	28.5	344°34.4	26.0	29°52.7	20.1	123°55.5	44.3
5	123°51.9	217°14.9	28.7	359°36.0	25.9	44°55.4	20.1	138°58.0	44.3
6	138°54.4	232°14.1	S25°28.8	14°37.7	N21°25.8	59°58.2	N22°20.1	154°00.5	S08°44.3
7	153°56.8	247°13.2	29.0	29°39.3	25.7	75°00.9	20.0	169°03.0	44.3
8	168°59.3	262°12.4	29.1	44°41.0	25.6	90°03.6	20.0	184°05.5	44.3
9	184°01.8	277°11.6	·· 29.3	59°42.6	·· 25.6	105°06.3	·· 20.0	199°08.0	·· 44.3
10	199°04.2	292°10.7	29.4	74°44.3	25.5	120°09.1	20.0	214°10.5	44.3
11	214°06.7	307°09.9	29.6	89°46.0	25.4	135°11.8	20.0	229°13.0	44.3
12	229°09.1	322°09.0	S25°29.7	104°47.6	N21°25.3	150°14.5	N22°20.0	244°15.5	S08°44.3
13	244°11.6	337°08.2	29.8	119°49.3	25.2	165°17.3	19.9	259°18.0	44.4
14	259°14.1	352°07.4	30.0	134°50.9	25.2	180°20.0	19.9	274°20.4	44.4
15	274°16.5	7°06.5	·· 30.1	149°52.6	·· 25.1	195°22.7	·· 19.9	289°22.9	·· 44.4
16	289°19.0	22°05.7	30.3	164°54.3	25.0	210°25.4	19.9	304°25.4	44.4
17	304°21.5	37°04.8	30.4	179°55.9	24.9	225°28.2	19.9	319°27.9	44.4
18	319°23.9	52°04.0	S25°30.5	194°57.6	N21°24.8	240°30.9	N22°19.9	334°30.4	S08°44.4
19	334°26.4	67°03.1	30.7	209°59.2	24.8	255°33.6	19.8	349°32.9	44.4
20	349°28.9	82°02.3	30.8	225°00.9	24.7	270°36.4	19.8	4°35.4	44.4
21	4°31.3	97°01.5	·· 30.9	240°02.6	·· 24.6	285°39.1	·· 19.8	19°37.9	·· 44.4
22	19°33.8	112°00.6	31.1	255°04.2	24.5	300°41.8	19.8	34°40.4	44.4
23	34°36.3	126°59.8	31.2	270°05.9	24.5	315°44.5	19.8	49°42.9	44.4
Mer.pass. 20:42		ν -0.8′	d -0.2′	m -4.06	ν 1.6′	d -0.1′	m -0.07	ν 2.7′	d -0.0′ m -2.74	ν 2.5′	d -0.0′ m 0.84

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	49°38.7	141°58.9	S25°31.3	285°07.6	N21°24.4	330°47.3	N22°19.7	64°45.3	S08°44.4
1	64°41.2	156°58.1	31.4	300°09.3	24.3	345°50.0	19.7	79°47.8	44.4
2	79°43.6	171°57.3	31.6	315°10.9	24.2	0°52.7	19.7	94°50.3	44.4
3	94°46.1	186°56.4	·· 31.7	330°12.6	·· 24.1	15°55.5	·· 19.7	109°52.8	·· 44.4
4	109°48.6	201°55.6	31.8	345°14.3	24.1	30°58.2	19.7	124°55.3	44.4
5	124°51.0	216°54.7	31.9	0°15.9	24.0	46°00.9	19.7	139°57.8	44.4
6	139°53.5	231°53.9	S25°32.1	15°17.6	N21°23.9	61°03.7	N22°19.6	155°00.3	S08°44.4
7	154°56.0	246°53.1	32.2	30°19.3	23.8	76°06.4	19.6	170°02.8	44.4
8	169°58.4	261°52.2	32.3	45°21.0	23.8	91°09.1	19.6	185°05.3	44.4
9	185°00.9	276°51.4	·· 32.4	60°22.6	·· 23.7	106°11.9	·· 19.6	200°07.7	·· 44.4
10	200°03.4	291°50.5	32.5	75°24.3	23.6	121°14.6	19.6	215°10.2	44.4
11	215°05.8	306°49.7	32.6	90°26.0	23.5	136°17.3	19.6	230°12.7	44.4
12	230°08.3	321°48.8	S25°32.8	105°27.7	N21°23.4	151°20.1	N22°19.5	245°15.2	S08°44.4
13	245°10.7	336°48.0	32.9	120°29.4	23.4	166°22.8	19.5	260°17.7	44.4
14	260°13.2	351°47.2	33.0	135°31.0	23.3	181°25.5	19.5	275°20.2	44.4
15	275°15.7	6°46.3	·· 33.1	150°32.7	·· 23.2	196°28.3	·· 19.5	290°22.7	·· 44.4
16	290°18.1	21°45.5	33.2	165°34.4	23.1	211°31.0	19.5	305°25.2	44.4
17	305°20.6	36°44.6	33.3	180°36.1	23.1	226°33.7	19.5	320°27.6	44.4
18	320°23.1	51°43.8	S25°33.4	195°37.8	N21°23.0	241°36.5	N22°19.4	335°30.1	S08°44.4
19	335°25.5	66°43.0	33.5	210°39.5	22.9	256°39.2	19.4	350°32.6	44.4
20	350°28.0	81°42.1	33.6	225°41.2	22.8	271°42.0	19.4	5°35.1	44.4
21	5°30.5	96°41.3	·· 33.7	240°42.8	·· 22.8	286°44.7	·· 19.4	20°37.6	·· 44.4
22	20°32.9	111°40.4	33.8	255°44.5	22.7	301°47.4	19.4	35°40.1	44.4
23	35°35.4	126°39.6	33.9	270°46.2	22.6	316°50.2	19.4	50°42.6	44.4
Mer.pass. 20:38		ν -0.8′	d -0.1′	m -4.07	ν 1.7′	d -0.1′	m -0.09	ν 2.7′	d -0.0′ m -2.74	ν 2.5′	d -0.0′ m 0.84

Stars

	SHA	Dec
Alpheratz	357°34.7	29°13.8
Ankaa	353°07.0	-42°10.3
Schedar	349°30.8	56°40.6
Diphda	348°47.2	-17°51.0
Achernar	335°19.7	-57°06.7
Hamal	327°51.0	23°34.9
Polaris	313°37.2	89°22.1
Acamar	315°11.5	-40°12.2
Menkar	314°06.0	4°11.3
Mirfak	308°28.0	49°57.0
Aldebaran	290°39.5	16°33.6
Rigel	281°03.7	-8°10.2
Capella	280°21.7	46°01.3
Bellatrix	278°22.8	6°22.4
Elnath	278°01.8	28°37.7
Alnilam	275°37.6	-1°11.0
Betelgeuse	270°52.0	7°24.8
Canopus	263°52.1	-52°42.2
Sirius	258°26.2	-16°44.8
Adhara	255°05.8	-29°00.1
Procyon	244°50.9	5°09.8
Pollux	243°17.4	27°57.9
Avior	234°14.7	-59°34.9
Suhail	222°46.4	-43°31.6
Miaplacidus	221°38.3	-69°48.7
Alphard	217°47.9	-8°45.8
Regulus	207°34.7	11°50.8
Dubhe	193°41.5	61°36.8
Denebola	182°25.3	14°26.0
Gienah	175°44.0	-17°40.6
Acrux	173°00.9	-63°14.0
Gacrux	171°52.3	-57°14.9
Alioth	166°13.6	55°49.4
Spica	158°22.8	-11°17.3
Alkaid	152°52.6	49°11.3
Hadar	148°36.9	-60°29.4
Menkent	147°58.2	-36°29.4
Arcturus	145°48.4	19°03.2
Rigil Kent.	139°41.2	-60°56.2
Kochab	137°20.9	74°03.1
Zuben'ubi	136°56.5	-16°08.6
Alphecca	126°04.2	26°37.9
Antares	112°16.4	-26°29.2
Atria	107°11.3	-69°04.4
Sabik	102°03.3	-15°45.3
Shaula	96°10.9	-37°07.4
Rasalhague	95°59.0	12°32.6
Eltanin	90°42.7	51°29.3
Kaus Aust.	83°33.0	-34°22.4
Vega	80°33.6	38°48.6
Nunki	75°48.2	-26°16.0
Altair	62°00.2	8°56.1
Peacock	53°06.1	-56°39.5
Deneb	49°26.0	45°22.4
Enif	33°38.9	9°59.5
Al Na'ir	27°33.0	-46°50.6
Fomalhaut	15°14.5	-29°29.5
Scheat	13°45.2	28°13.3
Markab	13°29.9	15°20.5

Nov 08 Fri	SHA	Mer.pass
Venus	94°58.9	14:30
Mars	236°08.0	05:04
Jupiter	280°56.1	02:05
Saturn	15°05.2	19:46

Nov 09 Sat	SHA	Mer.pass
Venus	93°39.6	14:32
Mars	235°48.2	05:02
Jupiter	281°02.2	02:01
Saturn	15°06.0	19:42

Nov 10 Sun	SHA	Mer.pass
Venus	92°20.2	14:33
Mars	235°28.9	04:59
Jupiter	281°08.6	01:56
Saturn	15°06.6	19:38

Horizontal parallax	
Venus:	0.1
Mars:	0.2

h	Sun		Moon				
Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	184°04.0	S16°38.9	103°47.0	8.4′	S24°36.9	8.6′	57.2′
1	199°04.0	39.6	118°14.4	8.4′	24°28.3	8.8′	57.2′
2	214°03.9	40.3	132°41.9	8.5′	24°19.5	8.9′	57.3′
3	229°03.9	·· 41.0	147°09.3	8.5′	24°10.6	9.1′	57.3′
4	244°03.8	41.7	161°36.9	8.6′	24°01.5	9.2′	57.3′
5	259°03.8	42.5	176°04.5	8.6′	23°52.3	9.4′	57.3′
6	274°03.7	S16°43.2	190°32.1	8.7′	S23°42.9	9.4′	57.4′
7	289°03.7	43.9	204°59.8	8.7′	23°33.5	9.7′	57.4′
8	304°03.6	44.6	219°27.5	8.8′	23°23.8	9.7′	57.4′
9	319°03.6	·· 45.3	233°55.3	8.8′	23°14.1	9.9′	57.5′
10	334°03.5	46.1	248°23.1	8.9′	23°04.2	10.0′	57.5′
11	349°03.5	46.8	262°51.0	8.9′	22°54.2	10.2′	57.5′
12	4°03.4	S16°47.5	277°19.0	9.0′	S22°44.0	10.3′	57.5′
13	19°03.4	48.2	291°46.9	9.0′	22°33.7	10.4′	57.6′
14	34°03.3	48.9	306°15.0	9.1′	22°23.3	10.6′	57.6′
15	49°03.3	·· 49.6	320°43.1	9.1′	22°12.7	10.7′	57.6′
16	64°03.2	50.4	335°11.2	9.2′	22°02.0	10.8′	57.7′
17	79°03.2	51.1	349°39.4	9.2′	21°51.2	11.0′	57.7′
18	94°03.1	S16°51.8	4°07.6	9.3′	S21°40.2	11.1′	57.7′
19	109°03.1	52.5	18°35.9	9.3′	21°29.1	11.2′	57.8′
20	124°03.0	53.2	33°04.3	9.4′	21°17.9	11.3′	57.8′
21	139°03.0	·· 53.9	47°32.7	9.5′	21°06.6	11.5′	57.8′
22	154°02.9	54.6	62°01.1	9.5′	20°55.1	11.5′	57.8′
23	169°02.9	55.4	76°29.6	9.6′	20°43.6	11.7′	57.9′
	SD = 16.1′	d = -0.7′	SD = 15.6′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	184°02.8	S16°56.1	90°58.2	9.6′	S20°31.9	11.9′	57.9′
1	199°02.8	56.8	105°26.8	9.7′	20°20.0	11.9′	57.9′
2	214°02.7	57.5	119°55.5	9.7′	20°08.1	12.1′	58.0′
3	229°02.7	·· 58.2	134°24.2	9.8′	19°56.0	12.2′	58.0′
4	244°02.6	58.9	148°52.9	9.8′	19°43.8	12.3′	58.0′
5	259°02.6	16°59.6	163°21.7	9.9′	19°31.5	12.4′	58.1′
6	274°02.5	S17°00.3	177°50.6	9.9′	S19°19.1	12.6′	58.1′
7	289°02.4	01.0	192°19.5	10.0′	19°06.5	12.6′	58.1′
8	304°02.4	01.7	206°48.5	10.0′	18°53.9	12.8′	58.2′
9	319°02.3	·· 02.4	221°17.5	10.1′	18°41.1	12.9′	58.2′
10	334°02.3	03.1	235°46.5	10.1′	18°28.2	13.0′	58.2′
11	349°02.2	03.9	250°15.6	10.2′	18°15.2	13.1′	58.2′
12	4°02.2	S17°04.6	264°44.8	10.2′	S18°02.1	13.2′	58.3′
13	19°02.1	05.3	279°14.0	10.2′	17°48.9	13.3′	58.3′
14	34°02.0	06.0	293°43.2	10.3′	17°35.6	13.4′	58.3′
15	49°02.0	·· 06.7	308°12.5	10.3′	17°22.2	13.5′	58.4′
16	64°01.9	07.4	322°41.8	10.4′	17°08.7	13.7′	58.4′
17	79°01.9	08.1	337°11.2	10.4′	16°55.0	13.7′	58.4′
18	94°01.8	S17°08.8	351°40.7	10.5′	S16°41.3	13.9′	58.5′
19	109°01.7	09.5	6°10.1	10.5′	16°27.4	13.9′	58.5′
20	124°01.7	10.2	20°39.6	10.6′	16°13.5	14.0′	58.5′
21	139°01.6	·· 10.9	35°09.2	10.6′	15°59.5	14.2′	58.6′
22	154°01.6	11.6	49°38.8	10.6′	15°45.3	14.2′	58.6′
23	169°01.5	12.3	64°08.4	10.7′	15°31.1	14.4′	58.6′
	SD = 16.1′	d = -0.7′	SD = 15.8′				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	184°01.4	S17°13.0	78°38.1	10.7′	S15°16.7	14.4′	58.7′
1	199°01.4	13.7	93°07.8	10.8′	15°02.3	14.5′	58.7′
2	214°01.3	14.4	107°37.6	10.8′	14°47.8	14.6′	58.7′
3	229°01.3	·· 15.1	122°07.4	10.8′	14°33.2	14.7′	58.7′
4	244°01.2	15.8	136°37.2	10.9′	14°18.5	14.8′	58.8′
5	259°01.1	16.5	151°07.1	10.9′	14°03.7	14.9′	58.8′
6	274°01.1	S17°17.2	165°37.0	10.9′	S13°48.8	15.0′	58.8′
7	289°01.0	17.9	180°06.9	11.0′	13°33.8	15.0′	58.9′
8	304°00.9	18.6	194°36.9	11.0′	13°18.8	15.2′	58.9′
9	319°00.9	·· 19.3	209°06.9	11.0′	13°03.6	15.2′	58.9′
10	334°00.8	19.9	223°36.9	11.1′	12°48.4	15.3′	59.0′
11	349°00.7	20.6	238°07.0	11.1′	12°33.1	15.4′	59.0′
12	4°00.7	S17°21.3	252°37.1	11.1′	S12°17.7	15.5′	59.0′
13	19°00.6	22.0	267°07.2	11.2′	12°02.2	15.5′	59.1′
14	34°00.5	22.7	281°37.3	11.2′	11°46.7	15.6′	59.1′
15	49°00.5	·· 23.4	296°07.5	11.2′	11°31.1	15.7′	59.1′
16	64°00.4	24.1	310°37.7	11.2′	11°15.4	15.8′	59.1′
17	79°00.3	24.8	325°08.0	11.3′	10°59.6	15.9′	59.2′
18	94°00.3	S17°25.5	339°38.2	11.3′	S10°43.7	15.9′	59.2′
19	109°00.2	26.2	354°08.5	11.3′	10°27.8	16.0′	59.2′
20	124°00.1	26.9	8°38.8	11.3′	10°11.8	16.0′	59.3′
21	139°00.1	·· 27.5	23°09.1	11.3′	09°55.8	16.2′	59.3′
22	154°00.0	28.2	37°39.4	11.4′	09°39.6	16.2′	59.3′
23	168°59.9	28.9	52°09.8	11.4′	09°23.4	16.2′	59.3′
	SD = 16.1′	d = -0.7′	SD = 16.0′				

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

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

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%
08	16:16	16:14	11:44	17:43	05:16	
09	16:11	16:09	11:44	18:34	06:09	
10	16:06	16:03	11:44	19:24	07:00	

November 11, 12, 13 UT (Mon., Tue., Wed.)

	Aries	Venus		Mars		Jupiter		Saturn	
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	50°37.9	141°38.8	S25°34.0	285°47.9	N21°22.5	331°52.9	N22°19.3	65°45.0	S08°44.4
1	65°40.3	156°37.9	34.1	300°49.6	22.5	346°55.6	19.3	80°47.5	44.5
2	80°42.8	171°37.1	34.2	315°51.3	22.4	1°58.4	19.3	95°50.0	44.5
3	95°45.2	186°36.2	·· 34.3	330°53.0	·· 22.3	17°01.1	·· 19.3	110°52.5	·· 44.5
4	110°47.7	201°35.4	34.4	345°54.7	22.3	32°03.9	19.3	125°55.0	44.5
5	125°50.2	216°34.6	34.5	0°56.4	22.2	47°06.6	19.2	140°57.5	44.5
6	140°52.6	231°33.7	S25°34.6	15°58.1	N21°22.1	62°09.3	N22°19.2	156°00.0	S08°44.5
7	155°55.1	246°32.9	34.6	30°59.8	22.0	77°12.1	19.2	171°02.4	44.5
8	170°57.6	261°32.0	34.7	46°01.5	22.0	92°14.8	19.2	186°04.9	44.5
9	186°00.0	276°31.2	·· 34.8	61°03.2	·· 21.9	107°17.5	·· 19.2	201°07.4	·· 44.5
10	201°02.5	291°30.3	34.9	76°04.9	21.8	122°20.3	19.2	216°09.9	44.5
11	216°05.0	306°29.5	35.0	91°06.6	21.7	137°23.0	19.1	231°12.4	44.5
12	231°07.4	321°28.7	S25°35.1	106°08.3	N21°21.7	152°25.8	N22°19.1	246°14.9	S08°44.5
13	246°09.9	336°27.8	35.2	121°10.0	21.6	167°28.5	19.1	261°17.3	44.5
14	261°12.4	351°27.0	35.2	136°11.7	21.5	182°31.3	19.1	276°19.8	44.5
15	276°14.8	6°26.1	·· 35.3	151°13.4	·· 21.5	197°34.0	·· 19.1	291°22.3	·· 44.5
16	291°17.3	21°25.3	35.4	166°15.1	21.4	212°36.7	19.0	306°24.8	44.5
17	306°19.7	36°24.5	35.5	181°16.8	21.3	227°39.5	19.0	321°27.3	44.5
18	321°22.2	51°23.6	S25°35.5	196°18.5	N21°21.3	242°42.2	N22°19.0	336°29.8	S08°44.5
19	336°24.7	66°22.8	35.6	211°20.2	21.2	257°45.0	19.0	351°32.2	44.5
20	351°27.1	81°21.9	35.7	226°21.9	21.1	272°47.7	19.0	6°34.7	44.5
21	6°29.6	96°21.1	·· 35.8	241°23.7	·· 21.0	287°50.4	·· 19.0	21°37.2	·· 44.5
22	21°32.1	111°20.3	35.8	256°25.4	21.0	302°53.2	18.9	36°39.7	44.5
23	36°34.5	126°19.4	35.9	271°27.1	20.9	317°55.9	18.9	51°42.2	44.5
Mer.pass. 20:34		ν -0.8′	d -0.1′	m -4.07	ν 1.7′	d -0.1′	m -0.11	ν 2.7′	d -0.0′ m -2.75	ν 2.5′	d -0.0′ m 0.85

Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	51°37.0	141°18.6	S25°36.0	286°28.8	N21°20.8	332°58.7	N22°18.9	66°44.7	S08°44.5
1	66°39.5	156°17.7	36.0	301°30.5	20.8	348°01.4	18.9	81°47.1	44.5
2	81°41.9	171°16.9	36.1	316°32.2	20.7	3°04.2	18.9	96°49.6	44.5
3	96°44.4	186°16.1	·· 36.1	331°33.9	·· 20.6	18°06.9	·· 18.9	111°52.1	·· 44.5
4	111°46.8	201°15.2	36.2	346°35.7	20.6	33°09.7	18.8	126°54.6	44.5
5	126°49.3	216°14.4	36.3	1°37.4	20.5	48°12.4	18.8	141°57.1	44.5
6	141°51.8	231°13.5	S25°36.3	16°39.1	N21°20.4	63°15.1	N22°18.8	156°59.5	S08°44.5
7	156°54.2	246°12.7	36.4	31°40.8	20.4	78°17.9	18.8	172°02.0	44.5
8	171°56.7	261°11.9	36.4	46°42.5	20.3	93°20.6	18.8	187°04.5	44.5
9	186°59.2	276°11.0	·· 36.5	61°44.3	·· 20.2	108°23.4	·· 18.7	202°07.0	·· 44.5
10	202°01.6	291°10.2	36.6	76°46.0	20.1	123°26.1	18.7	217°09.5	44.5
11	217°04.1	306°09.4	36.6	91°47.7	20.1	138°28.9	18.7	232°11.9	44.5
12	232°06.6	321°08.5	S25°36.7	106°49.4	N21°20.0	153°31.6	N22°18.7	247°14.4	S08°44.5
13	247°09.0	336°07.7	36.7	121°51.2	19.9	168°34.4	18.7	262°16.9	44.5
14	262°11.5	351°06.8	36.8	136°52.9	19.9	183°37.1	18.6	277°19.4	44.5
15	277°14.0	6°06.0	·· 36.8	151°54.6	·· 19.8	198°39.9	·· 18.6	292°21.9	·· 44.5
16	292°16.4	21°05.2	36.8	166°56.3	19.7	213°42.6	18.6	307°24.3	44.5
17	307°18.9	36°04.3	36.9	181°58.1	19.7	228°45.4	18.6	322°26.8	44.5
18	322°21.3	51°03.5	S25°36.9	196°59.8	N21°19.6	243°48.1	N22°18.6	337°29.3	S08°44.5
19	337°23.8	66°02.6	37.0	212°01.5	19.6	258°50.9	18.6	352°31.8	44.5
20	352°26.3	81°01.8	37.0	227°03.3	19.5	273°53.6	18.5	7°34.2	44.4
21	7°28.7	96°01.0	·· 37.1	242°05.0	·· 19.4	288°56.4	·· 18.5	22°36.7	·· 44.4
22	22°31.2	111°00.1	37.1	257°06.7	19.4	303°59.1	18.5	37°39.2	44.4
23	37°33.7	125°59.3	37.1	272°08.5	19.3	319°01.9	18.5	52°41.7	44.4
Mer.pass. 20:30		ν -0.8′	d -0.1′	m -4.08	ν 1.7′	d -0.1′	m -0.12	ν 2.7′	d -0.0′ m -2.75	ν 2.5′	d 0.0′ m 0.85

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	52°36.1	140°58.5	S25°37.2	287°10.2	N21°19.2	334°04.6	N22°18.5	67°44.2	S08°44.4
1	67°38.6	155°57.6	37.2	302°11.9	19.2	349°07.4	18.4	82°46.6	44.4
2	82°41.1	170°56.8	37.2	317°13.7	19.1	4°10.1	18.4	97°49.1	44.4
3	97°43.5	185°55.9	·· 37.3	332°15.4	·· 19.0	19°12.9	·· 18.4	112°51.6	·· 44.4
4	112°46.0	200°55.1	37.3	347°17.2	19.0	34°15.6	18.4	127°54.1	44.4
5	127°48.4	215°54.3	37.3	2°18.9	18.9	49°18.4	18.4	142°56.5	44.4
6	142°50.9	230°53.4	S25°37.4	17°20.6	N21°18.8	64°21.1	N22°18.3	157°59.0	S08°44.4
7	157°53.4	245°52.6	37.4	32°22.4	18.8	79°23.9	18.3	173°01.5	44.4
8	172°55.8	260°51.8	37.4	47°24.1	18.7	94°26.6	18.3	188°04.0	44.4
9	187°58.3	275°50.9	·· 37.4	62°25.9	·· 18.7	109°29.4	·· 18.3	203°06.5	·· 44.4
10	203°00.8	290°50.1	37.5	77°27.6	18.6	124°32.1	18.3	218°08.9	44.4
11	218°03.2	305°49.2	37.5	92°29.4	18.5	139°34.9	18.3	233°11.4	44.4
12	233°05.7	320°48.4	S25°37.5	107°31.1	N21°18.5	154°37.6	N22°18.2	248°13.9	S08°44.4
13	248°08.2	335°47.6	37.5	122°32.9	18.4	169°40.4	18.2	263°16.4	44.4
14	263°10.6	350°46.7	37.5	137°34.6	18.3	184°43.1	18.2	278°18.8	44.4
15	278°13.1	5°45.9	·· 37.6	152°36.4	·· 18.3	199°45.9	·· 18.2	293°21.3	·· 44.4
16	293°15.6	20°45.1	37.6	167°38.1	18.2	214°48.6	18.2	308°23.8	44.4
17	308°18.0	35°44.2	37.6	182°39.9	18.2	229°51.4	18.1	323°26.3	44.4
18	323°20.5	50°43.4	S25°37.6	197°41.6	N21°18.1	244°54.1	N22°18.1	338°28.7	S08°44.4
19	338°22.9	65°42.6	37.6	212°43.4	18.0	259°56.9	18.1	353°31.2	44.4
20	353°25.4	80°41.7	37.6	227°45.1	18.0	274°59.7	18.1	8°33.7	44.4
21	8°27.9	95°40.9	·· 37.6	242°46.9	·· 17.9	290°02.4	·· 18.1	23°36.1	·· 44.4
22	23°30.3	110°40.0	37.6	257°48.7	17.9	305°05.2	18.0	38°38.6	44.4
23	38°32.8	125°39.2	37.7	272°50.4	17.8	320°07.9	18.0	53°41.1	44.4
Mer.pass. 20:26		ν -0.8′	d -0.0′	m -4.08	ν 1.7′	d -0.1′	m -0.14	ν 2.8′	d -0.0′ m -2.76	ν 2.5′	d 0.0′ m 0.86

Stars

	SHA	Dec
Alpheratz	357°34.7	29°13.8
Ankaa	353°07.0	-42°10.4
Schedar	349°30.8	56°40.6
Diphda	348°47.2	-17°51.0
Achernar	335°19.7	-57°06.7
Hamal	327°51.0	23°34.9
Polaris	313°37.2	89°22.2
Acamar	315°11.4	-40°12.2
Menkar	314°06.0	4°11.3
Mirfak	308°28.0	49°57.0
Aldebaran	290°39.5	16°33.6
Rigel	281°03.7	-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°11.0
Betelgeuse	270°52.0	7°24.8
Canopus	263°52.1	-52°42.2
Sirius	258°26.1	-16°44.8
Adhara	255°05.8	-29°00.1
Procyon	244°50.8	5°09.8
Pollux	243°17.3	27°57.9
Avior	234°14.6	-59°35.0
Suhail	222°46.4	-43°31.6
Miaplacidus	221°38.3	-69°48.7
Alphard	217°47.9	-8°45.8
Regulus	207°34.7	11°50.8
Dubhe	193°41.4	61°36.8
Denebola	182°25.3	14°26.0
Gienah	175°44.0	-17°40.6
Acrux	173°00.8	-63°13.9
Gacrux	171°52.3	-57°14.9
Alioth	166°13.5	55°49.4
Spica	158°22.8	-11°17.3
Alkaid	152°52.6	49°11.3
Hadar	148°36.9	-60°29.4
Menkent	147°58.2	-36°29.4
Arcturus	145°48.4	19°03.2
Rigil Kent.	139°41.2	-60°56.2
Kochab	137°20.9	74°03.1
Zuben'ubi	136°56.5	-16°08.6
Alphecca	126°04.2	26°37.9
Antares	112°16.4	-26°29.2
Atria	107°11.3	-69°04.4
Sabik	102°03.3	-15°45.3
Shaula	96°10.9	-37°07.3
Rasalhague	95°59.0	12°32.6
Eltanin	90°42.7	51°29.3
Kaus Aust.	83°33.0	-34°22.4
Vega	80°33.6	38°48.6
Nunki	75°48.2	-26°16.0
Altair	62°00.3	8°56.1
Peacock	53°06.1	-56°39.5
Deneb	49°26.0	45°22.4
Enif	33°38.9	9°59.4
Al Na'ir	27°33.0	-46°50.6
Fomalhaut	15°14.5	-29°29.5
Scheat	13°45.2	28°13.3
Markab	13°29.9	15°20.5

Nov 11 Mon	SHA	Mer.pass
Venus	91°00.9	14:34
Mars	235°10.1	04:56
Jupiter	281°15.0	01:52
Saturn	15°07.2	19:34

Nov 12 Tue	SHA	Mer.pass
Venus	89°41.6	14:36
Mars	234°51.8	04:54
Jupiter	281°21.7	01:48
Saturn	15°07.7	19:30

Nov 13 Wed	SHA	Mer.pass
Venus	88°22.3	14:37
Mars	234°34.1	04:51
Jupiter	281°28.5	01:43
Saturn	15°08.0	19:26

Horizontal parallax	
Venus:	0.1
Mars:	0.2

h	Sun		Moon				
Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°59.9	S17°29.6	66°40.1	11.4′	S09°07.2	16.3′	59.4′
1	198°59.8	30.3	81°10.5	11.4′	08°50.9	16.4′	59.4′
2	213°59.7	31.0	95°40.9	11.4′	08°34.5	16.5′	59.4′
3	228°59.6	·· 31.7	110°11.3	11.4′	08°18.0	16.5′	59.5′
4	243°59.6	32.3	124°41.8	11.4′	08°01.5	16.5′	59.5′
5	258°59.5	33.0	139°12.2	11.4′	07°45.0	16.7′	59.5′
6	273°59.4	S17°33.7	153°42.6	11.5′	S07°28.3	16.6′	59.5′
7	288°59.3	34.4	168°13.1	11.5′	07°11.7	16.8′	59.6′
8	303°59.3	35.1	182°43.6	11.5′	06°54.9	16.7′	59.6′
9	318°59.2	·· 35.8	197°14.0	11.5′	06°38.2	16.9′	59.6′
10	333°59.1	36.4	211°44.5	11.5′	06°21.3	16.9′	59.7′
11	348°59.1	37.1	226°15.0	11.5′	06°04.4	16.9′	59.7′
12	3°59.0	S17°37.8	240°45.5	11.5′	S05°47.5	17.0′	59.7′
13	18°58.9	38.5	255°15.9	11.5′	05°30.5	17.0′	59.7′
14	33°58.8	39.2	269°46.4	11.5′	05°13.5	17.0′	59.8′
15	48°58.8	·· 39.8	284°16.9	11.5′	04°56.5	17.1′	59.8′
16	63°58.7	40.5	298°47.4	11.5′	04°39.4	17.2′	59.8′
17	78°58.6	41.2	313°17.8	11.5′	04°22.2	17.2′	59.8′
18	93°58.5	S17°41.9	327°48.3	11.5′	S04°05.0	17.2′	59.9′
19	108°58.4	42.5	342°18.8	11.4′	03°47.8	17.2′	59.9′
20	123°58.4	43.2	356°49.2	11.4′	03°30.6	17.3′	59.9′
21	138°58.3	·· 43.9	11°19.6	11.4′	03°13.3	17.3′	59.9′
22	153°58.2	44.6	25°50.1	11.4′	02°56.0	17.4′	60.0′
23	168°58.1	45.2	40°20.5	11.4′	02°38.6	17.4′	60.0′
	SD = 16.1′	d = -0.7′	SD = 16.2′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°58.1	S17°45.9	54°50.9	11.4′	S02°21.2	17.4′	60.0′
1	198°58.0	46.6	69°21.3	11.4′	02°03.8	17.4′	60.0′
2	213°57.9	47.3	83°51.7	11.4′	01°46.4	17.5′	60.1′
3	228°57.8	·· 47.9	98°22.0	11.3′	01°28.9	17.4′	60.1′
4	243°57.7	48.6	112°52.3	11.3′	01°11.5	17.5′	60.1′
5	258°57.7	49.3	127°22.7	11.3′	00°54.0	17.6′	60.1′
6	273°57.6	S17°50.0	141°53.0	11.3′	S00°36.4	17.5′	60.2′
7	288°57.5	50.6	156°23.2	11.2′	00°18.9	17.5′	60.2′
8	303°57.4	51.3	170°53.5	11.2′	S00°01.4	17.6′	60.2′
9	318°57.3	·· 52.0	185°23.7	11.2′	N00°16.2	17.6′	60.2′
10	333°57.2	52.6	199°53.9	11.2′	00°33.8	17.6′	60.3′
11	348°57.2	53.3	214°24.1	11.1′	00°51.4	17.6′	60.3′
12	3°57.1	S17°54.0	228°54.2	11.1′	N01°09.0	17.6′	60.3′
13	18°57.0	54.6	243°24.3	11.1′	01°26.6	17.6′	60.3′
14	33°56.9	55.3	257°54.4	11.0′	01°44.2	17.6′	60.3′
15	48°56.8	·· 56.0	272°24.4	11.0′	02°01.8	17.6′	60.4′
16	63°56.7	56.6	286°54.4	11.0′	02°19.4	17.6′	60.4′
17	78°56.7	57.3	301°24.4	10.9′	02°37.0	17.6′	60.4′
18	93°56.6	S17°58.0	315°54.3	10.9′	N02°54.6	17.6′	60.4′
19	108°56.5	58.6	330°24.2	10.8′	03°12.2	17.6′	60.4′
20	123°56.4	59.3	344°54.1	10.8′	03°29.8	17.6′	60.4′
21	138°56.3	17°59.9	359°23.9	10.8′	03°47.4	17.6′	60.5′
22	153°56.2	18°00.6	13°53.6	10.7′	04°05.0	17.6′	60.5′
23	168°56.1	01.3	28°23.3	10.7′	04°22.6	17.6′	60.5′
	SD = 16.2′	d = -0.7′	SD = 16.4′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°56.0	S18°01.9	42°53.0	10.6′	N04°40.2	17.5′	60.5′
1	198°56.0	02.6	57°22.6	10.6′	04°57.7	17.5′	60.5′
2	213°55.9	03.3	71°52.2	10.5′	05°15.2	17.5′	60.5′
3	228°55.8	·· 03.9	86°21.7	10.5′	05°32.7	17.5′	60.6′
4	243°55.7	04.6	100°51.2	10.4′	05°50.2	17.5′	60.6′
5	258°55.6	05.2	115°20.6	10.4′	06°07.7	17.4′	60.6′
6	273°55.5	S18°05.9	129°50.0	10.3′	N06°25.1	17.4′	60.6′
7	288°55.4	06.5	144°19.3	10.3′	06°42.5	17.4′	60.6′
8	303°55.3	07.2	158°48.6	10.2′	06°59.9	17.4′	60.6′
9	318°55.2	·· 07.9	173°17.8	10.1′	07°17.3	17.3′	60.6′
10	333°55.1	08.5	187°46.9	10.1′	07°34.6	17.3′	60.7′
11	348°55.1	09.2	202°16.0	10.0′	07°51.9	17.3′	60.7′
12	3°55.0	S18°09.8	216°45.0	10.0′	N08°09.2	17.2′	60.7′
13	18°54.9	10.5	231°14.0	9.9′	08°26.4	17.1′	60.7′
14	33°54.8	11.1	245°42.9	9.8′	08°43.5	17.2′	60.7′
15	48°54.7	·· 11.8	260°11.7	9.8′	09°00.7	17.1′	60.7′
16	63°54.6	12.4	274°40.4	9.7′	09°17.8	17.0′	60.7′
17	78°54.5	13.1	289°09.1	9.6′	09°34.8	17.0′	60.7′
18	93°54.4	S18°13.7	303°37.8	9.6′	N09°51.8	16.9′	60.7′
19	108°54.3	14.4	318°06.3	9.5′	10°08.7	16.9′	60.7′
20	123°54.2	15.0	332°34.8	9.4′	10°25.6	16.8′	60.8′
21	138°54.1	·· 15.7	347°03.2	9.3′	10°42.4	16.8′	60.8′
22	153°54.0	16.3	1°31.5	9.3′	10°59.2	16.7′	60.8′
23	168°53.9	17.0	15°59.8	9.2′	11°15.9	16.7′	60.8′
	SD = 16.2′	d = -0.7′	SD = 16.5′				

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

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

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 10-12 69-88%
11	15:59	15:56	11:44	20:13	07:49	
12	15:52	15:48	11:44	21:02	08:38	
13	15:44	15:40	11:44	21:54	09:28	

November 14, 15, 16 UT (Thu., Fri., Sat.)

	Aries	Venus		Mars		Jupiter		Saturn	
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	53°35.3	140°38.4	S25°37.7	287°52.2	N21°17.7	335°10.7	N22°18.0	68°43.6	S08°44.4
1	68°37.7	155°37.5	37.7	302°53.9	17.7	350°13.4	18.0	83°46.0	44.4
2	83°40.2	170°36.7	37.7	317°55.7	17.6	5°16.2	18.0	98°48.5	44.4
3	98°42.7	185°35.9	·· 37.7	332°57.5	·· 17.6	20°19.0	·· 17.9	113°51.0	·· 44.4
4	113°45.1	200°35.0	37.7	347°59.2	17.5	35°21.7	17.9	128°53.5	44.4
5	128°47.6	215°34.2	37.7	3°01.0	17.4	50°24.5	17.9	143°55.9	44.4
6	143°50.1	230°33.4	S25°37.7	18°02.7	N21°17.4	65°27.2	N22°17.9	158°58.4	S08°44.4
7	158°52.5	245°32.5	37.7	33°04.5	17.3	80°30.0	17.9	174°00.9	44.3
8	173°55.0	260°31.7	37.7	48°06.3	17.3	95°32.7	17.9	189°03.4	44.3
9	188°57.4	275°30.9	·· 37.7	63°08.1	·· 17.2	110°35.5	·· 17.8	204°05.8	·· 44.3
10	203°59.9	290°30.0	37.6	78°09.8	17.2	125°38.3	17.8	219°08.3	44.3
11	219°02.4	305°29.2	37.6	93°11.6	17.1	140°41.0	17.8	234°10.8	44.3
12	234°04.8	320°28.4	S25°37.6	108°13.4	N21°17.0	155°43.8	N22°17.8	249°13.2	S08°44.3
13	249°07.3	335°27.5	37.6	123°15.1	17.0	170°46.5	17.8	264°15.7	44.3
14	264°09.8	350°26.7	37.6	138°16.9	16.9	185°49.3	17.7	279°18.2	44.3
15	279°12.2	5°25.9	·· 37.6	153°18.7	·· 16.9	200°52.1	·· 17.7	294°20.7	·· 44.3
16	294°14.7	20°25.0	37.6	168°20.5	16.8	215°54.8	17.7	309°23.1	44.3
17	309°17.2	35°24.2	37.6	183°22.2	16.8	230°57.6	17.7	324°25.6	44.3
18	324°19.6	50°23.4	S25°37.5	198°24.0	N21°16.7	246°00.3	N22°17.7	339°28.1	S08°44.3
19	339°22.1	65°22.5	37.5	213°25.8	16.7	261°03.1	17.6	354°30.5	44.3
20	354°24.5	80°21.7	37.5	228°27.6	16.6	276°05.9	17.6	9°33.0	44.3
21	9°27.0	95°20.9	·· 37.5	243°29.4	·· 16.5	291°08.6	·· 17.6	24°35.5	·· 44.3
22	24°29.5	110°20.0	37.5	258°31.1	16.5	306°11.4	17.6	39°37.9	44.3
23	39°31.9	125°19.2	37.4	273°32.9	16.4	321°14.1	17.6	54°40.4	44.3
Mer.pass.	20:22	ν -0.8′	d -0.0′	m -4.09	ν 1.8′	d -0.1′	m -0.16	ν 2.8′	d -0.0′ m -2.76	ν 2.5′	d 0.0′ m 0.86

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	54°34.4	140°18.4	S25°37.4	288°34.7	N21°16.4	336°16.9	N22°17.5	69°42.9	S08°44.3
1	69°36.9	155°17.5	37.4	303°36.5	16.3	351°19.7	17.5	84°45.4	44.3
2	84°39.3	170°16.7	37.4	318°38.3	16.3	6°22.4	17.5	99°47.8	44.3
3	99°41.8	185°15.9	·· 37.3	333°40.1	·· 16.2	21°25.2	·· 17.5	114°50.3	·· 44.3
4	114°44.3	200°15.0	37.3	348°41.8	16.2	36°28.0	17.5	129°52.8	44.2
5	129°46.7	215°14.2	37.3	3°43.6	16.1	51°30.7	17.4	144°55.2	44.2
6	144°49.2	230°13.4	S25°37.2	18°45.4	N21°16.1	66°33.5	N22°17.4	159°57.7	S08°44.2
7	159°51.7	245°12.5	37.2	33°47.2	16.0	81°36.2	17.4	175°00.2	44.2
8	174°54.1	260°11.7	37.2	48°49.0	15.9	96°39.0	17.4	190°02.6	44.2
9	189°56.6	275°10.9	·· 37.1	63°50.8	·· 15.9	111°41.8	·· 17.4	205°05.1	·· 44.2
10	204°59.0	290°10.1	37.1	78°52.6	15.8	126°44.5	17.3	220°07.6	44.2
11	220°01.5	305°09.2	37.1	93°54.4	15.8	141°47.3	17.3	235°10.0	44.2
12	235°04.0	320°08.4	S25°37.0	108°56.2	N21°15.7	156°50.1	N22°17.3	250°12.5	S08°44.2
13	250°06.4	335°07.6	37.0	123°58.0	15.7	171°52.8	17.3	265°15.0	44.2
14	265°08.9	350°06.7	36.9	138°59.8	15.6	186°55.6	17.3	280°17.4	44.2
15	280°11.4	5°05.9	·· 36.9	154°01.6	·· 15.6	201°58.4	·· 17.2	295°19.9	·· 44.2
16	295°13.8	20°05.1	36.8	169°03.4	15.5	217°01.1	17.2	310°22.4	44.2
17	310°16.3	35°04.2	36.8	184°05.2	15.5	232°03.9	17.2	325°24.8	44.2
18	325°18.8	50°03.4	S25°36.7	199°07.0	N21°15.4	247°06.7	N22°17.2	340°27.3	S08°44.2
19	340°21.2	65°02.6	36.7	214°08.8	15.4	262°09.4	17.2	355°29.8	44.2
20	355°23.7	80°01.8	36.6	229°10.6	15.3	277°12.2	17.1	10°32.2	44.1
21	10°26.2	95°00.9	·· 36.6	244°12.4	·· 15.3	292°15.0	·· 17.1	25°34.7	·· 44.1
22	25°28.6	110°00.1	36.5	259°14.2	15.2	307°17.7	17.1	40°37.2	44.1
23	40°31.1	124°59.3	36.5	274°16.0	15.2	322°20.5	17.1	55°39.6	44.1
Mer.pass.	20:18	ν -0.8′	d 0.0′	m -4.09	ν 1.8′	d -0.1′	m -0.18	ν 2.8′	d -0.0′ m -2.77	ν 2.5′	d 0.0′ m 0.87

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	55°33.5	139°58.4	S25°36.4	289°17.8	N21°15.1	337°23.3	N22°17.1	70°42.1	S08°44.1
1	70°36.0	154°57.6	36.4	304°19.6	15.1	352°26.0	17.0	85°44.6	44.1
2	85°38.5	169°56.8	36.3	319°21.4	15.0	7°28.8	17.0	100°47.0	44.1
3	100°40.9	184°56.0	·· 36.3	334°23.2	·· 15.0	22°31.6	·· 17.0	115°49.5	·· 44.1
4	115°43.4	199°55.1	36.2	349°25.0	14.9	37°34.3	17.0	130°52.0	44.1
5	130°45.9	214°54.3	36.1	4°26.9	14.9	52°37.1	17.0	145°54.4	44.1
6	145°48.3	229°53.5	S25°36.1	19°28.7	N21°14.9	67°39.9	N22°16.9	160°56.9	S08°44.1
7	160°50.8	244°52.7	36.0	34°30.5	14.8	82°42.6	16.9	175°59.3	44.1
8	175°53.3	259°51.8	35.9	49°32.3	14.8	97°45.4	16.9	191°01.8	44.1
9	190°55.7	274°51.0	·· 35.9	64°34.1	·· 14.7	112°48.2	·· 16.9	206°04.3	·· 44.1
10	205°58.2	289°50.2	35.8	79°35.9	14.7	127°50.9	16.9	221°06.7	44.0
11	221°00.7	304°49.4	35.7	94°37.7	14.6	142°53.7	16.8	236°09.2	44.0
12	236°03.1	319°48.5	S25°35.7	109°39.6	N21°14.6	157°56.5	N22°16.8	251°11.7	S08°44.0
13	251°05.6	334°47.7	35.6	124°41.4	14.5	172°59.3	16.8	266°14.1	44.0
14	266°08.0	349°46.9	35.5	139°43.2	14.5	188°02.0	16.8	281°16.6	44.0
15	281°10.5	4°46.1	·· 35.4	154°45.0	·· 14.4	203°04.8	·· 16.8	296°19.1	·· 44.0
16	296°13.0	19°45.2	35.4	169°46.9	14.4	218°07.6	16.7	311°21.5	44.0
17	311°15.4	34°44.4	35.3	184°48.7	14.3	233°10.3	16.7	326°24.0	44.0
18	326°17.9	49°43.6	S25°35.2	199°50.5	N21°14.3	248°13.1	N22°16.7	341°26.4	S08°44.0
19	341°20.4	64°42.8	35.1	214°52.3	14.3	263°15.9	16.7	356°28.9	44.0
20	356°22.8	79°41.9	35.1	229°54.2	14.2	278°18.7	16.6	11°31.4	44.0
21	11°25.3	94°41.1	·· 35.0	244°56.0	·· 14.2	293°21.4	·· 16.6	26°33.8	·· 44.0
22	26°27.8	109°40.3	34.9	259°57.8	14.1	308°24.2	16.6	41°36.3	43.9
23	41°30.2	124°39.5	34.8	274°59.7	14.1	323°27.0	16.6	56°38.8	43.9
Mer.pass.	20:14	ν -0.8′	d 0.1′	m -4.10	ν 1.8′	d -0.0′	m -0.20	ν 2.8′	d -0.0′ m -2.77	ν 2.5′	d 0.0′ m 0.87

Stars

	SHA	Dec
Alpheratz	357°34.7	29°13.8
Ankaa	353°07.0	-42°10.4
Schedar	349°30.8	56°40.7
Diphda	348°47.2	-17°51.0
Achernar	335°19.7	-57°06.7
Hamal	327°51.0	23°34.9
Polaris	313°37.0	89°22.2
Acamar	315°11.4	-40°12.3
Menkar	314°06.0	4°11.3
Mirfak	308°28.0	49°57.0
Aldebaran	290°39.5	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°11.0
Betelgeuse	270°52.0	7°24.8
Canopus	263°52.0	-52°42.2
Sirius	258°26.1	-16°44.8
Adhara	255°05.7	-29°00.1
Procyon	244°50.8	5°09.8
Pollux	243°17.3	27°57.9
Avior	234°14.6	-59°35.0
Suhail	222°46.4	-43°31.6
Miaplacidus	221°38.2	-69°48.7
Alphard	217°47.9	-8°45.8
Regulus	207°34.6	11°50.8
Dubhe	193°41.4	61°36.8
Denebola	182°25.3	14°26.0
Gienah	175°44.0	-17°40.6
Acrux	173°00.8	-63°13.9
Gacrux	171°52.3	-57°14.9
Alioth	166°13.5	55°49.4
Spica	158°22.8	-11°17.3
Alkaid	152°52.6	49°11.3
Hadar	148°36.9	-60°29.4
Menkent	147°58.2	-36°29.4
Arcturus	145°48.4	19°03.2
Rigil Kent.	139°41.2	-60°56.1
Kochab	137°20.9	74°03.1
Zuben'ubi	136°56.5	-16°08.6
Alphecca	126°04.2	26°37.9
Antares	112°16.4	-26°29.2
Atria	107°11.3	-69°04.4
Sabik	102°03.3	-15°45.3
Shaula	96°10.9	-37°07.3
Rasalhague	95°59.0	12°32.6
Eltanin	90°42.7	51°29.3
Kaus Aust.	83°33.0	-34°22.4
Vega	80°33.6	38°48.5
Nunki	75°48.2	-26°16.0
Altair	62°00.3	8°56.1
Peacock	53°06.1	-56°39.5
Deneb	49°26.0	45°22.4
Enif	33°38.9	9°59.4
Al Na'ir	27°33.0	-46°50.6
Fomalhaut	15°14.6	-29°29.5
Scheat	13°45.2	28°13.3
Markab	13°29.9	15°20.5

Nov 14 Thu	SHA	Mer.pass
Venus	87°03.1	14:38
Mars	234°16.9	04:48
Jupiter	281°35.4	01:39
Saturn	15°08.3	19:22

Nov 15 Fri	SHA	Mer.pass
Venus	85°44.0	14:40
Mars	234°00.3	04:45
Jupiter	281°42.5	01:35
Saturn	15°08.5	19:18

Nov 16 Sat	SHA	Mer.pass
Venus	84°24.9	14:41
Mars	233°44.3	04:42
Jupiter	281°49.7	01:30
Saturn	15°08.6	19:14

Horizontal parallax	
Venus:	0.1
Mars:	0.2

DUT1 = UT1-UTC = +0.1730 sec ΔT = TT-UT1 = +69.0110 sec

2024 November 14 to Nov. 16 UT

h	Sun		Moon				
Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°53.8	S18°17.6	30°28.0	9.1′	N11°32.6	16.6′	60.8′
1	198°53.7	18.3	44°56.1	9.0′	11°49.2	16.5′	60.8′
2	213°53.6	18.9	59°24.2	9.0′	12°05.7	16.5′	60.8′
3	228°53.5	·· 19.6	73°52.1	8.9′	12°22.2	16.3′	60.8′
4	243°53.4	20.2	88°20.0	8.8′	12°38.5	16.4′	60.8′
5	258°53.3	20.9	102°47.8	8.7′	12°54.9	16.2′	60.8′
6	273°53.2	S18°21.5	117°15.5	8.6′	N13°11.1	16.2′	60.8′
7	288°53.1	22.1	131°43.1	8.6′	13°27.3	16.1′	60.8′
8	303°53.0	22.8	146°10.7	8.5′	13°43.4	16.0′	60.8′
9	318°52.9	·· 23.4	160°38.2	8.4′	13°59.4	15.9′	60.8′
10	333°52.8	24.1	175°05.5	8.3′	14°15.3	15.8′	60.8′
11	348°52.7	24.7	189°32.8	8.2′	14°31.1	15.8′	60.8′
12	3°52.6	S18°25.4	204°00.1	8.1′	N14°46.9	15.6′	60.8′
13	18°52.5	26.0	218°27.2	8.0′	15°02.5	15.6′	60.8′
14	33°52.4	26.6	232°54.2	8.0′	15°18.1	15.5′	60.8′
15	48°52.3	·· 27.3	247°21.2	7.9′	15°33.6	15.4′	60.8′
16	63°52.2	27.9	261°48.0	7.8′	15°49.0	15.3′	60.8′
17	78°52.1	28.6	276°14.8	7.7′	16°04.3	15.1′	60.8′
18	93°52.0	S18°29.2	290°41.5	7.6′	N16°19.4	15.1′	60.8′
19	108°51.9	29.8	305°08.1	7.5′	16°34.5	15.0′	60.8′
20	123°51.8	30.5	319°34.6	7.4′	16°49.5	14.9′	60.8′
21	138°51.7	·· 31.1	334°01.0	7.3′	17°04.4	14.7′	60.8′
22	153°51.6	31.7	348°27.4	7.2′	17°19.1	14.7′	60.8′
23	168°51.5	32.4	2°53.6	7.1′	17°33.8	14.5′	60.8′
	SD = 16.2′	d = -0.6′	SD = 16.6′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°51.4	S18°33.0	17°19.7	7.1′	N17°48.3	14.5′	60.8′
1	198°51.3	33.6	31°45.8	7.0′	18°02.8	14.3′	60.8′
2	213°51.2	34.3	46°11.7	6.9′	18°17.1	14.1′	60.8′
3	228°51.1	·· 34.9	60°37.6	6.8′	18°31.2	14.1′	60.7′
4	243°51.0	35.5	75°03.4	6.7′	18°45.3	14.0′	60.7′
5	258°50.9	36.2	89°29.1	6.6′	18°59.3	13.8′	60.7′
6	273°50.8	S18°36.8	103°54.7	6.5′	N19°13.1	13.7′	60.7′
7	288°50.7	37.4	118°20.1	6.4′	19°26.8	13.5′	60.7′
8	303°50.6	38.1	132°45.6	6.3′	19°40.3	13.5′	60.7′
9	318°50.4	·· 38.7	147°10.9	6.2′	19°53.8	13.2′	60.7′
10	333°50.3	39.3	161°36.1	6.1′	20°07.0	13.2′	60.7′
11	348°50.2	39.9	176°01.2	6.0′	20°20.2	13.0′	60.7′
12	3°50.1	S18°40.6	190°26.3	5.9′	N20°33.2	12.9′	60.7′
13	18°50.0	41.2	204°51.2	5.9′	20°46.1	12.8′	60.6′
14	33°49.9	41.8	219°16.1	5.8′	20°58.9	12.5′	60.6′
15	48°49.8	·· 42.4	233°40.8	5.7′	21°11.4	12.5′	60.6′
16	63°49.7	43.1	248°05.5	5.6′	21°23.9	12.3′	60.6′
17	78°49.6	43.7	262°30.1	5.5′	21°36.2	12.2′	60.6′
18	93°49.5	S18°44.3	276°54.6	5.4′	N21°48.4	12.0′	60.6′
19	108°49.3	44.9	291°19.0	5.3′	22°00.4	11.8′	60.6′
20	123°49.2	45.6	305°43.3	5.2′	22°12.2	11.7′	60.5′
21	138°49.1	·· 46.2	320°07.6	5.2′	22°23.9	11.5′	60.5′
22	153°49.0	46.8	334°31.7	5.1′	22°35.4	11.4′	60.5′
23	168°48.9	47.4	348°55.8	5.0′	22°46.8	11.2′	60.5′
	SD = 16.2′	d = -0.6′	SD = 16.6′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°48.8	S18°48.0	3°19.8	4.9′	N22°58.0	11.1′	60.5′
1	198°48.7	48.7	17°43.7	4.8′	23°09.1	10.9′	60.5′
2	213°48.5	49.3	32°07.5	4.7′	23°20.0	10.7′	60.4′
3	228°48.4	·· 49.9	46°31.2	4.7′	23°30.7	10.6′	60.4′
4	243°48.3	50.5	60°54.9	4.6′	23°41.3	10.3′	60.4′
5	258°48.2	51.1	75°18.5	4.5′	23°51.6	10.3′	60.4′
6	273°48.1	S18°51.8	89°42.0	4.4′	N24°01.9	10.0′	60.4′
7	288°48.0	52.4	104°05.4	4.4′	24°11.9	9.9′	60.3′
8	303°47.8	53.0	118°28.8	4.3′	24°21.8	9.7′	60.3′
9	318°47.7	·· 53.6	132°52.1	4.2′	24°31.5	9.5′	60.3′
10	333°47.6	54.2	147°15.3	4.1′	24°41.0	9.4′	60.3′
11	348°47.5	54.8	161°38.4	4.1′	24°50.4	9.1′	60.2′
12	3°47.4	S18°55.4	176°01.5	4.0′	N24°59.5	9.0′	60.2′
13	18°47.3	56.1	190°24.5	4.0′	25°08.5	8.8′	60.2′
14	33°47.1	56.7	204°47.5	3.9′	25°17.3	8.6′	60.2′
15	48°47.0	·· 57.3	219°10.4	3.8′	25°25.9	8.5′	60.1′
16	63°46.9	57.9	233°33.2	3.8′	25°34.4	8.2′	60.1′
17	78°46.8	58.5	247°56.0	3.7′	25°42.6	8.1′	60.1′
18	93°46.7	S18°59.1	262°18.7	3.7′	N25°50.7	7.8′	60.1′
19	108°46.5	18°59.7	276°41.4	3.6′	25°58.5	7.7′	60.0′
20	123°46.4	19°00.3	291°04.0	3.6′	26°06.2	7.5′	60.0′
21	138°46.3	·· 00.9	305°26.5	3.5′	26°13.7	7.3′	60.0′
22	153°46.2	01.5	319°49.1	3.5′	26°21.0	7.1′	60.0′
23	168°46.1	02.2	334°11.5	3.4′	26°28.1	6.9′	59.9′
	SD = 16.2′	d = -0.6′	SD = 16.5′				

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

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

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 13-15 95-100%
14	15:35	15:31	11:44	22:48	10:20	◯
15	15:26	15:20	11:45	23:46	11:17	
16	15:15	15:10	11:45	–:–	12:17	

November 17, 18, 19 UT (Sun., Mon., Tue.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	56°32.7	139°38.6	S25°34.7	290°01.5	N21°14.0	338°29.7	N22°16.6	71°41.2	S08°43.9
1	71°35.1	154°37.8	34.6	305°03.3	14.0	353°32.5	16.5	86°43.7	43.9
2	86°37.6	169°37.0	34.5	320°05.2	14.0	8°35.3	16.5	101°46.1	43.9
3	101°40.1	184°36.2	·· 34.5	335°07.0	·· 13.9	23°38.1	·· 16.5	116°48.6	·· 43.9
4	116°42.5	199°35.3	34.4	350°08.8	13.9	38°40.8	16.5	131°51.1	43.9
5	131°45.0	214°34.5	34.3	5°10.7	13.8	53°43.6	16.5	146°53.5	43.9
6	146°47.5	229°33.7	S25°34.2	20°12.5	N21°13.8	68°46.4	N22°16.4	161°56.0	S08°43.9
7	161°49.9	244°32.9	34.1	35°14.3	13.7	83°49.2	16.4	176°58.4	43.9
8	176°52.4	259°32.1	34.0	50°16.2	13.7	98°51.9	16.4	192°00.9	43.9
9	191°54.9	274°31.2	·· 33.9	65°18.0	·· 13.7	113°54.7	·· 16.4	207°03.4	·· 43.8
10	206°57.3	289°30.4	33.8	80°19.9	13.6	128°57.5	16.4	222°05.8	43.8
11	221°59.8	304°29.6	33.7	95°21.7	13.6	144°00.3	16.3	237°08.3	43.8
12	237°02.3	319°28.8	S25°33.6	110°23.6	N21°13.5	159°03.0	N22°16.3	252°10.7	S08°43.8
13	252°04.7	334°28.0	33.5	125°25.4	13.5	174°05.8	16.3	267°13.2	43.8
14	267°07.2	349°27.1	33.4	140°27.2	13.5	189°08.6	16.3	282°15.7	43.8
15	282°09.6	4°26.3	·· 33.3	155°29.1	·· 13.4	204°11.4	·· 16.2	297°18.1	·· 43.8
16	297°12.1	19°25.5	33.2	170°30.9	13.4	219°14.1	16.2	312°20.6	43.8
17	312°14.6	34°24.7	33.1	185°32.8	13.3	234°16.9	16.2	327°23.0	43.8
18	327°17.0	49°23.9	S25°33.0	200°34.6	N21°13.3	249°19.7	N22°16.2	342°25.5	S08°43.8
19	342°19.5	64°23.0	32.8	215°36.5	13.3	264°22.5	16.2	357°27.9	43.7
20	357°22.0	79°22.2	32.7	230°38.3	13.2	279°25.3	16.1	12°30.4	43.7
21	12°24.4	94°21.4	·· 32.6	245°40.2	·· 13.2	294°28.0	·· 16.1	27°32.9	·· 43.7
22	27°26.9	109°20.6	32.5	260°42.1	13.1	309°30.8	16.1	42°35.3	43.7
23	42°29.4	124°19.8	32.4	275°43.9	13.1	324°33.6	16.1	57°37.8	43.7
Mer.pass. 20:11		ν -0.8′	d 0.1′	m -4.11	ν 1.8′	d -0.0′	m -0.22	ν 2.8′	d -0.0′ m -2.77	ν 2.5′	d 0.0′ m 0.88

Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	57°31.8	139°19.0	S25°32.3	290°45.8	N21°13.1	339°36.4	N22°16.1	72°40.2	S08°43.7
1	72°34.3	154°18.1	32.2	305°47.6	13.0	354°39.1	16.0	87°42.7	43.7
2	87°36.8	169°17.3	32.0	320°49.5	13.0	9°41.9	16.0	102°45.1	43.7
3	102°39.2	184°16.5	·· 31.9	335°51.3	·· 13.0	24°44.7	·· 16.0	117°47.6	·· 43.7
4	117°41.7	199°15.7	31.8	350°53.2	12.9	39°47.5	16.0	132°50.1	43.7
5	132°44.1	214°14.9	31.7	5°55.1	12.9	54°50.3	16.0	147°52.5	43.6
6	147°46.6	229°14.1	S25°31.6	20°56.9	N21°12.9	69°53.0	N22°15.9	162°55.0	S08°43.6
7	162°49.1	244°13.2	31.4	35°58.8	12.8	84°55.8	15.9	177°57.4	43.6
8	177°51.5	259°12.4	31.3	51°00.7	12.8	99°58.6	15.9	192°59.9	43.6
9	192°54.0	274°11.6	·· 31.2	66°02.5	·· 12.7	115°01.4	·· 15.9	208°02.3	·· 43.6
10	207°56.5	289°10.8	31.0	81°04.4	12.7	130°04.2	15.8	223°04.8	43.6
11	222°58.9	304°10.0	30.9	96°06.3	12.7	145°06.9	15.8	238°07.2	43.6
12	238°01.4	319°09.2	S25°30.8	111°08.1	N21°12.6	160°09.7	N22°15.8	253°09.7	S08°43.6
13	253°03.9	334°08.4	30.7	126°10.0	12.6	175°12.5	15.8	268°12.2	43.6
14	268°06.3	349°07.5	30.5	141°11.9	12.6	190°15.3	15.8	283°14.6	43.5
15	283°08.8	4°06.7	·· 30.4	156°13.8	·· 12.5	205°18.1	·· 15.7	298°17.1	·· 43.5
16	298°11.3	19°05.9	30.2	171°15.6	12.5	220°20.8	15.7	313°19.5	43.5
17	313°13.7	34°05.1	30.1	186°17.5	12.5	235°23.6	15.7	328°22.0	43.5
18	328°16.2	49°04.3	S25°30.0	201°19.4	N21°12.4	250°26.4	N22°15.7	343°24.4	S08°43.5
19	343°18.6	64°03.5	29.8	216°21.3	12.4	265°29.2	15.6	358°26.9	43.5
20	358°21.1	79°02.7	29.7	231°23.1	12.4	280°32.0	15.6	13°29.3	43.5
21	13°23.6	94°01.8	·· 29.5	246°25.0	·· 12.3	295°34.8	·· 15.6	28°31.8	·· 43.5
22	28°26.0	109°01.0	29.4	261°26.9	12.3	310°37.5	15.6	43°34.2	43.4
23	43°28.5	124°00.2	29.3	276°28.8	12.3	325°40.3	15.6	58°36.7	43.4
Mer.pass. 20:07		ν -0.8′	d 0.1′	m -4.11	ν 1.9′	d -0.0′	m -0.23	ν 2.8′	d -0.0′ m -2.78	ν 2.5′	d 0.0′ m 0.88

Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	58°31.0	138°59.4	S25°29.1	291°30.7	N21°12.3	340°43.1	N22°15.5	73°39.1	S08°43.4
1	73°33.4	153°58.6	29.0	306°32.5	12.2	355°45.9	15.5	88°41.6	43.4
2	88°35.9	168°57.8	28.8	321°34.4	12.2	10°48.7	15.5	103°44.1	43.4
3	103°38.4	183°57.0	·· 28.7	336°36.3	·· 12.2	25°51.5	·· 15.5	118°46.5	·· 43.4
4	118°40.8	198°56.2	28.5	351°38.2	12.1	40°54.2	15.5	133°49.0	43.4
5	133°43.3	213°55.4	28.4	6°40.1	12.1	55°57.0	15.4	148°51.4	43.4
6	148°45.8	228°54.6	S25°28.2	21°42.0	N21°12.1	70°59.8	N22°15.4	163°53.9	S08°43.4
7	163°48.2	243°53.7	28.1	36°43.9	12.0	86°02.6	15.4	178°56.3	43.3
8	178°50.7	258°52.9	27.9	51°45.8	12.0	101°05.4	15.4	193°58.8	43.3
9	193°53.1	273°52.1	·· 27.7	66°47.7	·· 12.0	116°08.2	·· 15.3	209°01.2	·· 43.3
10	208°55.6	288°51.3	27.6	81°49.5	12.0	131°11.0	15.3	224°03.7	43.3
11	223°58.1	303°50.5	27.4	96°51.4	11.9	146°13.7	15.3	239°06.1	43.3
12	239°00.5	318°49.7	S25°27.3	111°53.3	N21°11.9	161°16.5	N22°15.3	254°08.6	S08°43.3
13	254°03.0	333°48.9	27.1	126°55.2	11.9	176°19.3	15.3	269°11.0	43.3
14	269°05.5	348°48.1	26.9	141°57.1	11.8	191°22.1	15.2	284°13.5	43.2
15	284°07.9	3°47.3	·· 26.8	156°59.0	·· 11.8	206°24.9	·· 15.2	299°15.9	·· 43.2
16	299°10.4	18°46.5	26.6	172°00.9	11.8	221°27.7	15.2	314°18.4	43.2
17	314°12.9	33°45.7	26.4	187°02.8	11.8	236°30.5	15.2	329°20.8	43.2
18	329°15.3	48°44.9	S25°26.3	202°04.7	N21°11.7	251°33.2	N22°15.1	344°23.3	S08°43.2
19	344°17.8	63°44.1	26.1	217°06.6	11.7	266°36.0	15.1	359°25.7	43.2
20	359°20.3	78°43.2	25.9	232°08.5	11.7	281°38.8	15.1	14°28.2	43.2
21	14°22.7	93°42.4	·· 25.8	247°10.4	·· 11.7	296°41.6	·· 15.1	29°30.6	·· 43.2
22	29°25.2	108°41.6	25.6	262°12.4	11.6	311°44.4	15.1	44°33.1	43.1
23	44°27.6	123°40.8	25.4	277°14.3	11.6	326°47.2	15.0	59°35.5	43.1
Mer.pass. 20:03		ν -0.8′	d 0.1′	m -4.12	ν 1.9′	d -0.0′	m -0.25	ν 2.8′	d -0.0′ m -2.78	ν 2.5′	d 0.0′ m 0.89

Stars

	SHA	Dec
Alpheratz	357°34.7	29°13.9
Ankaa	353°07.0	-42°10.4
Schedar	349°30.8	56°40.7
Diphda	348°47.2	-17°51.0
Achernar	335°19.8	-57°06.7
Hamal	327°51.0	23°34.9
Polaris	313°36.6	89°22.2
Acamar	315°11.4	-40°12.3
Menkar	314°06.0	4°11.3
Mirfak	308°28.0	49°57.0
Aldebaran	290°39.4	16°33.6
Rigel	281°03.7	-8°10.3
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°52.0	-52°42.3
Sirius	258°26.1	-16°44.8
Adhara	255°05.7	-29°00.1
Procyon	244°50.8	5°09.7
Pollux	243°17.3	27°57.9
Avior	234°14.6	-59°35.0
Suhail	222°46.3	-43°31.6
Miaplacidus	221°38.2	-69°48.7
Alphard	217°47.9	-8°45.8
Regulus	207°34.6	11°50.8
Dubhe	193°41.4	61°36.8
Denebola	182°25.3	14°26.0
Gienah	175°43.9	-17°40.6
Acrux	173°00.8	-63°13.9
Gacrux	171°52.2	-57°14.9
Alioth	166°13.5	55°49.3
Spica	158°22.7	-11°17.4
Alkaid	152°52.5	49°11.2
Hadar	148°36.8	-60°29.4
Menkent	147°58.2	-36°29.4
Arcturus	145°48.4	19°03.2
Rigil Kent.	139°41.2	-60°56.1
Kochab	137°20.9	74°03.1
Zuben'ubi	136°56.5	-16°08.6
Alphecca	126°04.2	26°37.9
Antares	112°16.4	-26°29.2
Atria	107°11.3	-69°04.4
Sabik	102°03.3	-15°45.3
Shaula	96°10.9	-37°07.3
Rasalhague	95°59.0	12°32.6
Eltanin	90°42.7	51°29.2
Kaus Aust.	83°33.0	-34°22.4
Vega	80°33.6	38°48.5
Nunki	75°48.2	-26°16.0
Altair	62°00.3	8°56.1
Peacock	53°06.2	-56°39.5
Deneb	49°26.1	45°22.4
Enif	33°39.0	9°59.4
Al Na'ir	27°33.0	-46°50.6
Fomalhaut	15°14.6	-29°29.5
Scheat	13°45.2	28°13.3
Markab	13°29.9	15°20.5

Nov 17 Sun	SHA	Mer.pass
Venus	83°06.0	14:42
Mars	233°28.8	04:39
Jupiter	281°57.1	01:26
Saturn	15°08.5	19:10

Nov 18 Mon	SHA	Mer.pass
Venus	81°47.1	14:44
Mars	233°13.9	04:36
Jupiter	282°04.5	01:21
Saturn	15°08.4	19:06

Nov 19 Tue	SHA	Mer.pass
Venus	80°28.4	14:45
Mars	232°59.7	04:33
Jupiter	282°12.1	01:17
Saturn	15°08.2	19:02

Horizontal parallax	
Venus:	0.1
Mars:	0.2

h	Sun		Moon				
Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°45.9	S19°02.8	348°34.0	3.4′	N26°35.0	6.8′	59.9′
1	198°45.8	03.4	2°56.3	3.4′	26°41.8	6.5′	59.9′
2	213°45.7	04.0	17°18.7	3.3′	26°48.3	6.3′	59.9′
3	228°45.6	·· 04.6	31°41.0	3.3′	26°54.6	6.2′	59.8′
4	243°45.4	05.2	46°03.3	3.3′	27°00.8	5.9′	59.8′
5	258°45.3	05.8	60°25.5	3.2′	27°06.7	5.8′	59.8′
6	273°45.2	S19°06.4	74°47.8	3.2′	N27°12.5	5.5′	59.7′
7	288°45.1	07.0	89°10.0	3.2′	27°18.0	5.3′	59.7′
8	303°44.9	07.6	103°32.1	3.2′	27°23.3	5.2′	59.7′
9	318°44.8	·· 08.2	117°54.3	3.1′	27°28.5	4.9′	59.6′
10	333°44.7	08.8	132°16.4	3.1′	27°33.4	4.8′	59.6′
11	348°44.6	09.4	146°38.6	3.1′	27°38.2	4.5′	59.6′
12	3°44.4	S19°10.0	161°00.7	3.1′	N27°42.7	4.4′	59.5′
13	18°44.3	10.6	175°22.8	3.1′	27°47.1	4.1′	59.5′
14	33°44.2	11.2	189°44.9	3.1′	27°51.2	4.0′	59.5′
15	48°44.0	·· 11.8	204°07.0	3.1′	27°55.2	3.7′	59.4′
16	63°43.9	12.4	218°29.1	3.1′	27°58.9	3.6′	59.4′
17	78°43.8	13.0	232°51.2	3.1′	28°02.5	3.3′	59.4′
18	93°43.7	S19°13.6	247°13.3	3.1′	N28°05.8	3.2′	59.3′
19	108°43.5	14.2	261°35.4	3.1′	28°09.0	2.9′	59.3′
20	123°43.4	14.8	275°57.5	3.1′	28°11.9	2.7′	59.3′
21	138°43.3	·· 15.4	290°19.6	3.1′	28°14.6	2.6′	59.2′
22	153°43.1	16.0	304°41.8	3.2′	28°17.2	2.3′	59.2′
23	168°43.0	16.5	319°03.9	3.2′	28°19.5	2.2′	59.2′
	SD = 16.2′	d = -0.6′	SD = 16.3′				

Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°42.9	S19°17.1	333°26.1	3.2′	N28°21.7	1.9′	59.1′
1	198°42.7	17.7	347°48.3	3.2′	28°23.6	1.7′	59.1′
2	213°42.6	18.3	2°10.6	3.3′	28°25.3	1.6′	59.1′
3	228°42.5	·· 18.9	16°32.8	3.3′	28°26.9	1.3′	59.0′
4	243°42.3	19.5	30°55.1	3.3′	28°28.2	1.2′	59.0′
5	258°42.2	20.1	45°17.5	3.4′	28°29.4	0.9′	59.0′
6	273°42.1	S19°20.7	59°39.9	3.4′	N28°30.3	0.7′	58.9′
7	288°41.9	21.3	74°02.3	3.5′	28°31.0	0.6′	58.9′
8	303°41.8	21.9	88°24.7	3.5′	28°31.6	0.4′	58.9′
9	318°41.7	·· 22.4	102°47.3	3.6′	28°32.0	0.1′	58.8′
10	333°41.5	23.0	117°09.8	3.6′	28°32.1	0.0′	58.8′
11	348°41.4	23.6	131°32.4	3.7′	28°32.1	0.2′	58.7′
12	3°41.3	S19°24.2	145°55.1	3.7′	N28°31.9	0.5′	58.7′
13	18°41.1	24.8	160°17.8	3.8′	28°31.4	0.6′	58.7′
14	33°41.0	25.4	174°40.6	3.8′	28°30.8	0.8′	58.6′
15	48°40.9	·· 26.0	189°03.5	3.9′	28°30.0	1.0′	58.6′
16	63°40.7	26.5	203°26.4	4.0′	28°29.0	1.2′	58.6′
17	78°40.6	27.1	217°49.3	4.0′	28°27.8	1.3′	58.5′
18	93°40.4	S19°27.7	232°12.4	4.1′	N28°26.5	1.6′	58.5′
19	108°40.3	28.3	246°35.5	4.2′	28°24.9	1.7′	58.4′
20	123°40.2	28.9	260°58.7	4.3′	28°23.2	2.0′	58.4′
21	138°40.0	·· 29.4	275°22.0	4.4′	28°21.2	2.1′	58.4′
22	153°39.9	30.0	289°45.3	4.4′	28°19.1	2.3′	58.3′
23	168°39.8	30.6	304°08.8	4.5′	28°16.8	2.5′	58.3′
	SD = 16.2′	d = -0.6′	SD = 16.1′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°39.6	S19°31.2	318°32.3	4.6′	N28°14.3	2.6′	58.3′
1	198°39.5	31.7	332°55.9	4.7′	28°11.7	2.9′	58.2′
2	213°39.3	32.3	347°19.6	4.8′	28°08.8	3.0′	58.2′
3	228°39.2	·· 32.9	1°43.4	4.9′	28°05.8	3.2′	58.1′
4	243°39.0	33.5	16°07.2	5.0′	28°02.6	3.3′	58.1′
5	258°38.9	34.1	30°31.2	5.1′	27°59.3	3.6′	58.1′
6	273°38.8	S19°34.6	44°55.3	5.2′	N27°55.7	3.7′	58.0′
7	288°38.6	35.2	59°19.4	5.3′	27°52.0	3.9′	58.0′
8	303°38.5	35.8	73°43.7	5.4′	27°48.1	4.0′	57.9′
9	318°38.3	·· 36.3	88°08.0	5.5′	27°44.1	4.2′	57.9′
10	333°38.2	36.9	102°32.5	5.6′	27°39.9	4.4′	57.9′
11	348°38.0	37.5	116°57.1	5.7′	27°35.5	4.6′	57.8′
12	3°37.9	S19°38.1	131°21.7	5.8′	N27°30.9	4.7′	57.8′
13	18°37.8	38.6	145°46.5	5.9′	27°26.2	4.9′	57.8′
14	33°37.6	39.2	160°11.4	6.0′	27°21.3	5.0′	57.7′
15	48°37.5	·· 39.8	174°36.4	6.1′	27°16.3	5.2′	57.7′
16	63°37.3	40.3	189°01.5	6.2′	27°11.1	5.4′	57.6′
17	78°37.2	40.9	203°26.7	6.3′	27°05.7	5.5′	57.6′
18	93°37.0	S19°41.5	217°52.0	6.4′	N27°00.2	5.6′	57.6′
19	108°36.9	42.0	232°17.5	6.6′	26°54.6	5.9′	57.5′
20	123°36.7	42.6	246°43.0	6.7′	26°48.7	5.9′	57.5′
21	138°36.6	·· 43.2	261°08.7	6.8′	26°42.8	6.1′	57.4′
22	153°36.4	43.7	275°34.5	6.9′	26°36.7	6.3′	57.4′
23	168°36.3	44.3	290°00.4	7.0′	26°30.4	6.4′	57.4′
	SD = 16.2′	d = -0.6′	SD = 15.9′				

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

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

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 98-87%
17	15:04	14:58	11:45	00:48	13:19	
18	14:52	14:45	11:45	01:51	14:22	
19	14:38	14:32	11:45	02:53	15:22	

November 20, 21, 22 UT (Wed., Thu., Fri.)

	Aries	Venus		Mars		Jupiter		Saturn	
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	59°30.1	138°40.0	S25°25.2	292°16.2	N21°11.6	341°50.0	N22°15.0	74°38.0	S08°43.1
1	74°32.6	153°39.2	25.0	307°18.1	11.6	356°52.8	15.0	89°40.4	43.1
2	89°35.0	168°38.4	24.9	322°20.0	11.5	11°55.5	15.0	104°42.9	43.1
3	104°37.5	183°37.6	·· 24.7	337°21.9	·· 11.5	26°58.3	·· 14.9	119°45.3	·· 43.1
4	119°40.0	198°36.8	24.5	352°23.8	11.5	42°01.1	14.9	134°47.8	43.1
5	134°42.4	213°36.0	24.3	7°25.7	11.5	57°03.9	14.9	149°50.2	43.0
6	149°44.9	228°35.2	S25°24.1	22°27.7	N21°11.4	72°06.7	N22°14.9	164°52.7	S08°43.0
7	164°47.4	243°34.4	24.0	37°29.6	11.4	87°09.5	14.9	179°55.1	43.0
8	179°49.8	258°33.6	23.8	52°31.5	11.4	102°12.3	14.8	194°57.6	43.0
9	194°52.3	273°32.8	·· 23.6	67°33.4	·· 11.4	117°15.1	·· 14.8	210°00.0	·· 43.0
10	209°54.8	288°32.0	23.4	82°35.3	11.4	132°17.9	14.8	225°02.5	43.0
11	224°57.2	303°31.2	23.2	97°37.2	11.3	147°20.7	14.8	240°04.9	43.0
12	239°59.7	318°30.4	S25°23.0	112°39.2	N21°11.3	162°23.4	N22°14.7	255°07.3	S08°42.9
13	255°02.1	333°29.6	22.8	127°41.1	11.3	177°26.2	14.7	270°09.8	42.9
14	270°04.6	348°28.8	22.6	142°43.0	11.3	192°29.0	14.7	285°12.2	42.9
15	285°07.1	3°28.0	·· 22.4	157°44.9	·· 11.2	207°31.8	·· 14.7	300°14.7	·· 42.9
16	300°09.5	18°27.2	22.2	172°46.9	11.2	222°34.6	14.7	315°17.1	42.9
17	315°12.0	33°26.4	22.0	187°48.8	11.2	237°37.4	14.6	330°19.6	42.9
18	330°14.5	48°25.6	S25°21.8	202°50.7	N21°11.2	252°40.2	N22°14.6	345°22.0	S08°42.9
19	345°16.9	63°24.8	21.6	217°52.7	11.2	267°43.0	14.6	0°24.5	42.8
20	0°19.4	78°24.0	21.4	232°54.6	11.1	282°45.8	14.6	15°26.9	42.8
21	15°21.9	93°23.2	·· 21.2	247°56.5	·· 11.1	297°48.6	·· 14.5	30°29.4	·· 42.8
22	30°24.3	108°22.4	21.0	262°58.5	11.1	312°51.4	14.5	45°31.8	42.8
23	45°26.8	123°21.6	20.8	278°00.4	11.1	327°54.1	14.5	60°34.2	42.8
Mer.pass. 19:59		ν -0.8′	d 0.2′	m -4.12	ν 1.9′	d -0.0′	m -0.27	ν 2.8′	d -0.0′ m -2.78	ν 2.4′	d 0.0′ m 0.89

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	60°29.3	138°20.8	S25°20.6	293°02.3	N21°11.1	342°56.9	N22°14.5	75°36.7	S08°42.8
1	75°31.7	153°20.0	20.4	308°04.3	11.1	357°59.7	14.4	90°39.1	42.7
2	90°34.2	168°19.2	20.2	323°06.2	11.0	13°02.5	14.4	105°41.6	42.7
3	105°36.6	183°18.4	·· 20.0	338°08.1	·· 11.0	28°05.3	·· 14.4	120°44.0	·· 42.7
4	120°39.1	198°17.6	19.8	353°10.1	11.0	43°08.1	14.4	135°46.5	42.7
5	135°41.6	213°16.8	19.6	8°12.0	11.0	58°10.9	14.4	150°48.9	42.7
6	150°44.0	228°16.1	S25°19.4	23°14.0	N21°11.0	73°13.7	N22°14.3	165°51.4	S08°42.7
7	165°46.5	243°15.3	19.1	38°15.9	10.9	88°16.5	14.3	180°53.8	42.6
8	180°49.0	258°14.5	18.9	53°17.8	10.9	103°19.3	14.3	195°56.2	42.6
9	195°51.4	273°13.7	·· 18.7	68°19.8	·· 10.9	118°22.1	·· 14.3	210°58.7	·· 42.6
10	210°53.9	288°12.9	18.5	83°21.7	10.9	133°24.9	14.2	226°01.1	42.6
11	225°56.4	303°12.1	18.3	98°23.7	10.9	148°27.7	14.2	241°03.6	42.6
12	240°58.8	318°11.3	S25°18.0	113°25.6	N21°10.9	163°30.5	N22°14.2	256°06.0	S08°42.6
13	256°01.3	333°10.5	17.8	128°27.6	10.9	178°33.3	14.2	271°08.5	42.5
14	271°03.7	348°09.7	17.6	143°29.5	10.8	193°36.1	14.1	286°10.9	42.5
15	286°06.2	3°08.9	·· 17.4	158°31.5	·· 10.8	208°38.9	·· 14.1	301°13.3	·· 42.5
16	301°08.7	18°08.1	17.1	173°33.4	10.8	223°41.7	14.1	316°15.8	42.5
17	316°11.1	33°07.3	16.9	188°35.4	10.8	238°44.4	14.1	331°18.2	42.5
18	331°13.6	48°06.5	S25°16.7	203°37.4	N21°10.8	253°47.2	N22°14.1	346°20.7	S08°42.5
19	346°16.1	63°05.8	16.5	218°39.3	10.8	268°50.0	14.0	1°23.1	42.4
20	1°18.5	78°05.0	16.2	233°41.3	10.8	283°52.8	14.0	16°25.6	42.4
21	16°21.0	93°04.2	·· 16.0	248°43.2	·· 10.8	298°55.6	·· 14.0	31°28.0	·· 42.4
22	31°23.5	108°03.4	15.8	263°45.2	10.7	313°58.4	14.0	46°30.4	42.4
23	46°25.9	123°02.6	15.5	278°47.2	10.7	329°01.2	13.9	61°32.9	42.4
Mer.pass. 19:55		ν -0.8′	d 0.2′	m -4.13	ν 1.9′	d -0.0′	m -0.29	ν 2.8′	d -0.0′ m -2.79	ν 2.4′	d 0.0′ m 0.90

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	61°28.4	138°01.8	S25°15.3	293°49.1	N21°10.7	344°04.0	N22°13.9	76°35.3	S08°42.4
1	76°30.9	153°01.0	15.1	308°51.1	10.7	359°06.8	13.9	91°37.8	42.3
2	91°33.3	168°00.2	14.8	323°53.0	10.7	14°09.6	13.9	106°40.2	42.3
3	106°35.8	182°59.4	·· 14.6	338°55.0	·· 10.7	29°12.4	·· 13.8	121°42.6	·· 42.3
4	121°38.2	197°58.7	14.3	353°57.0	10.7	44°15.2	13.8	136°45.1	42.3
5	136°40.7	212°57.9	14.1	8°58.9	10.7	59°18.0	13.8	151°47.5	42.3
6	151°43.2	227°57.1	S25°13.9	24°00.9	N21°10.7	74°20.8	N22°13.8	166°50.0	S08°42.3
7	166°45.6	242°56.3	13.6	39°02.9	10.6	89°23.6	13.8	181°52.4	42.2
8	181°48.1	257°55.5	13.4	54°04.9	10.6	104°26.4	13.7	196°54.8	42.2
9	196°50.6	272°54.7	·· 13.1	69°06.8	·· 10.6	119°29.2	·· 13.7	211°57.3	·· 42.2
10	211°53.0	287°53.9	12.9	84°08.8	10.6	134°32.0	13.7	226°59.7	42.2
11	226°55.5	302°53.2	12.6	99°10.8	10.6	149°34.8	13.7	242°02.2	42.2
12	241°58.0	317°52.4	S25°12.4	114°12.8	N21°10.6	164°37.6	N22°13.6	257°04.6	S08°42.2
13	257°00.4	332°51.6	12.1	129°14.7	10.6	179°40.4	13.6	272°07.0	42.1
14	272°02.9	347°50.8	11.9	144°16.7	10.6	194°43.2	13.6	287°09.5	42.1
15	287°05.4	2°50.0	·· 11.6	159°18.7	·· 10.6	209°46.0	·· 13.6	302°11.9	·· 42.1
16	302°07.8	17°49.2	11.3	174°20.7	10.6	224°48.8	13.5	317°14.3	42.1
17	317°10.3	32°48.5	11.1	189°22.7	10.6	239°51.6	13.5	332°16.8	42.1
18	332°12.7	47°47.7	S25°10.8	204°24.6	N21°10.6	254°54.4	N22°13.5	347°19.2	S08°42.0
19	347°15.2	62°46.9	10.6	219°26.6	10.6	269°57.2	13.5	2°21.7	42.0
20	2°17.7	77°46.1	10.3	234°28.6	10.5	285°00.0	13.4	17°24.1	42.0
21	17°20.1	92°45.3	·· 10.1	249°30.6	·· 10.5	300°02.8	·· 13.4	32°26.5	·· 42.0
22	32°22.6	107°44.6	09.8	264°32.6	10.5	315°05.6	13.4	47°29.0	42.0
23	47°25.1	122°43.8	09.5	279°34.6	10.5	330°08.4	13.4	62°31.4	41.9
Mer.pass. 19:51		ν -0.8′	d 0.2′	m -4.14	ν 2.0′	d -0.0′	m -0.31	ν 2.8′	d -0.0′ m -2.79	ν 2.4′	d 0.0′ m 0.90

Stars

	SHA	Dec
Alpheratz	357°34.7	29°13.9
Ankaa	353°07.0	-42°10.4
Schedar	349°30.8	56°40.7
Diphda	348°47.2	-17°51.0
Achernar	335°19.8	-57°06.7
Hamal	327°51.0	23°34.9
Polaris	313°36.5	89°22.2
Acamar	315°11.4	-40°12.3
Menkar	314°06.0	4°11.3
Mirfak	308°27.9	49°57.1
Aldebaran	290°39.4	16°33.6
Rigel	281°03.7	-8°10.3
Capella	280°21.6	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°52.0	-52°42.3
Sirius	258°26.1	-16°44.8
Adhara	255°05.7	-29°00.1
Procyon	244°50.8	5°09.7
Pollux	243°17.2	27°57.9
Avior	234°14.5	-59°35.0
Suhail	222°46.3	-43°31.7
Miaplacidus	221°38.1	-69°48.8
Alphard	217°47.8	-8°45.8
Regulus	207°34.6	11°50.8
Dubhe	193°41.3	61°36.8
Denebola	182°25.2	14°26.0
Gienah	175°43.9	-17°40.6
Acrux	173°00.7	-63°13.9
Gacrux	171°52.2	-57°14.9
Alioth	166°13.5	55°49.3
Spica	158°22.7	-11°17.4
Alkaid	152°52.5	49°11.2
Hadar	148°36.8	-60°29.4
Menkent	147°58.2	-36°29.4
Arcturus	145°48.3	19°03.2
Rigil Kent.	139°41.1	-60°56.1
Kochab	137°20.9	74°03.0
Zuben'ubi	136°56.5	-16°08.6
Alphecca	126°04.2	26°37.9
Antares	112°16.4	-26°29.2
Atria	107°11.3	-69°04.3
Sabik	102°03.3	-15°45.3
Shaula	96°10.9	-37°07.3
Rasalhague	95°59.0	12°32.6
Eltanin	90°42.7	51°29.2
Kaus Aust.	83°33.0	-34°22.4
Vega	80°33.7	38°48.5
Nunki	75°48.2	-26°16.0
Altair	62°00.3	8°56.1
Peacock	53°06.2	-56°39.5
Deneb	49°26.1	45°22.4
Enif	33°39.0	9°59.4
Al Na'ir	27°33.1	-46°50.6
Fomalhaut	15°14.6	-29°29.5
Scheat	13°45.2	28°13.3
Markab	13°29.9	15°20.5

Nov 20 Wed	SHA	Mer.pass
Venus	79°09.9	14:46
Mars	232°46.1	04:30
Jupiter	282°19.9	01:12
Saturn	15°07.9	18:58

Nov 21 Thu	SHA	Mer.pass
Venus	77°51.6	14:47
Mars	232°33.1	04:27
Jupiter	282°27.7	01:08
Saturn	15°07.4	18:54

Nov 22 Fri	SHA	Mer.pass
Venus	76°33.4	14:49
Mars	232°20.7	04:24
Jupiter	282°35.6	01:04
Saturn	15°06.9	18:51

Horizontal parallax	
Venus:	0.1
Mars:	0.2

h	Sun		Moon				
Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°36.1	S19°44.9	304°26.4	7.1′	N26°24.0	6.6′	57.3′
1	198°36.0	45.4	318°52.6	7.3′	26°17.4	6.7′	57.3′
2	213°35.8	46.0	333°18.8	7.4′	26°10.7	6.8′	57.3′
3	228°35.7	·· 46.5	347°45.2	7.5′	26°03.9	7.0′	57.2′
4	243°35.5	47.1	2°11.7	7.6′	25°56.9	7.1′	57.2′
5	258°35.4	47.7	16°38.4	7.8′	25°49.8	7.3′	57.1′
6	273°35.2	S19°48.2	31°05.1	7.9′	N25°42.5	7.3′	57.1′
7	288°35.1	48.8	45°32.0	8.0′	25°35.2	7.6′	57.1′
8	303°34.9	49.3	59°59.0	8.1′	25°27.6	7.6′	57.0′
9	318°34.8	·· 49.9	74°26.1	8.2′	25°20.0	7.8′	57.0′
10	333°34.6	50.4	88°53.4	8.4′	25°12.2	7.9′	57.0′
11	348°34.5	51.0	103°20.7	8.5′	25°04.3	8.0′	56.9′
12	3°34.3	S19°51.6	117°48.2	8.6′	N24°56.3	8.2′	56.9′
13	18°34.2	52.1	132°15.8	8.7′	24°48.1	8.3′	56.8′
14	33°34.0	52.7	146°43.6	8.9′	24°39.8	8.4′	56.8′
15	48°33.9	·· 53.2	161°11.4	9.0′	24°31.4	8.5′	56.8′
16	63°33.7	53.8	175°39.4	9.1′	24°22.9	8.6′	56.7′
17	78°33.6	54.3	190°07.6	9.2′	24°14.3	8.8′	56.7′
18	93°33.4	S19°54.9	204°35.8	9.4′	N24°05.5	8.9′	56.7′
19	108°33.2	55.4	219°04.2	9.5′	23°56.6	8.9′	56.6′
20	123°33.1	56.0	233°32.7	9.6′	23°47.7	9.1′	56.6′
21	138°32.9	·· 56.5	248°01.3	9.7′	23°38.6	9.3′	56.6′
22	153°32.8	57.1	262°30.0	9.9′	23°29.3	9.3′	56.5′
23	168°32.6	57.6	276°58.9	10.0′	23°20.0	9.4′	56.5′
	SD = 16.2′	d = -0.6′	SD = 15.6′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°32.5	S19°58.2	291°27.9	10.1′	N23°10.6	9.5′	56.4′
1	198°32.3	58.7	305°57.0	10.2′	23°01.1	9.6′	56.4′
2	213°32.1	59.3	320°26.2	10.4′	22°51.5	9.8′	56.4′
3	228°32.0	19°59.8	334°55.5	10.5′	22°41.7	9.8′	56.3′
4	243°31.8	20°00.4	349°25.0	10.6′	22°31.9	9.9′	56.3′
5	258°31.7	00.9	3°54.6	10.7′	22°22.0	10.1′	56.3′
6	273°31.5	S20°01.5	18°24.3	10.8′	N22°11.9	10.1′	56.2′
7	288°31.4	02.0	32°54.1	11.0′	22°01.8	10.2′	56.2′
8	303°31.2	02.5	47°24.1	11.1′	21°51.6	10.3′	56.2′
9	318°31.0	·· 03.1	61°54.2	11.2′	21°41.3	10.4′	56.1′
10	333°30.9	03.6	76°24.4	11.3′	21°30.9	10.5′	56.1′
11	348°30.7	04.2	90°54.7	11.4′	21°20.4	10.6′	56.1′
12	3°30.5	S20°04.7	105°25.1	11.5′	N21°09.8	10.7′	56.0′
13	18°30.4	05.2	119°55.6	11.7′	20°59.1	10.8′	56.0′
14	33°30.2	05.8	134°26.3	11.8′	20°48.3	10.8′	56.0′
15	48°30.1	·· 06.3	148°57.0	11.9′	20°37.5	10.9′	55.9′
16	63°29.9	06.9	163°27.9	12.0′	20°26.6	11.0′	55.9′
17	78°29.7	07.4	177°58.9	12.1′	20°15.6	11.1′	55.9′
18	93°29.6	S20°07.9	192°30.0	12.2′	N20°04.5	11.2′	55.8′
19	108°29.4	08.5	207°01.2	12.3′	19°53.3	11.2′	55.8′
20	123°29.2	09.0	221°32.6	12.4′	19°42.1	11.4′	55.8′
21	138°29.1	·· 09.5	236°04.0	12.5′	19°30.7	11.4′	55.8′
22	153°28.9	10.1	250°35.5	12.6′	19°19.3	11.4′	55.7′
23	168°28.7	10.6	265°07.2	12.8′	19°07.9	11.6′	55.7′
	SD = 16.2′	d = -0.5′	SD = 15.4′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°28.6	S20°11.1	279°38.9	12.9′	N18°56.3	11.6′	55.7′
1	198°28.4	11.7	294°10.8	13.0′	18°44.7	11.7′	55.6′
2	213°28.3	12.2	308°42.8	13.1′	18°33.0	11.7′	55.6′
3	228°28.1	·· 12.7	323°14.8	13.2′	18°21.3	11.8′	55.6′
4	243°27.9	13.3	337°47.0	13.3′	18°09.5	11.9′	55.5′
5	258°27.7	13.8	352°19.3	13.4′	17°57.6	12.0′	55.5′
6	273°27.6	S20°14.3	6°51.6	13.5′	N17°45.6	12.0′	55.5′
7	288°27.4	14.9	21°24.1	13.6′	17°33.6	12.1′	55.5′
8	303°27.2	15.4	35°56.7	13.7′	17°21.5	12.1′	55.4′
9	318°27.1	·· 15.9	50°29.3	13.8′	17°09.4	12.2′	55.4′
10	333°26.9	16.4	65°02.1	13.9′	16°57.2	12.2′	55.4′
11	348°26.7	17.0	79°34.9	13.9′	16°45.0	12.4′	55.3′
12	3°26.6	S20°17.5	94°07.9	14.0′	N16°32.6	12.3′	55.3′
13	18°26.4	18.0	108°40.9	14.1′	16°20.3	12.5′	55.3′
14	33°26.2	18.5	123°14.1	14.2′	16°07.8	12.4′	55.3′
15	48°26.1	·· 19.1	137°47.3	14.3′	15°55.4	12.6′	55.2′
16	63°25.9	19.6	152°20.6	14.4′	15°42.8	12.6′	55.2′
17	78°25.7	20.1	166°54.0	14.5′	15°30.2	12.6′	55.2′
18	93°25.5	S20°20.6	181°27.5	14.6′	N15°17.6	12.7′	55.2′
19	108°25.4	21.1	196°01.0	14.7′	15°04.9	12.7′	55.1′
20	123°25.2	21.7	210°34.7	14.7′	14°52.2	12.8′	55.1′
21	138°25.0	·· 22.2	225°08.4	14.8′	14°39.4	12.8′	55.1′
22	153°24.8	22.7	239°42.2	14.9′	14°26.6	12.9′	55.1′
23	168°24.7	23.2	254°16.1	15.0′	14°13.7	12.9′	55.0′
	SD = 16.2′	d = -0.5′	SD = 15.2′				

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

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

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 19-21 79-60%
20	14:25	14:17	11:46	03:51	16:18	
21	14:10	14:02	11:46	04:44	17:08	
22	13:54	13:46	11:46	05:32	17:54	

November 23, 24, 25 UT (Sat., Sun., Mon.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	62°27.5	137°43.0	S25°09.3	294°36.6	N21°10.5	345°11.2	N22°13.3	77°33.8	S08°41.9
1	77°30.0	152°42.2	09.0	309°38.6	10.5	0°14.0	13.3	92°36.3	41.9
2	92°32.5	167°41.4	08.7	324°40.6	10.5	15°16.8	13.3	107°38.7	41.9
3	107°34.9	182°40.7	·· 08.5	339°42.6	·· 10.5	30°19.6	·· 13.3	122°41.2	·· 41.9
4	122°37.4	197°39.9	08.2	354°44.5	10.5	45°22.4	13.3	137°43.6	41.9
5	137°39.8	212°39.1	07.9	9°46.5	10.5	60°25.2	13.2	152°46.0	41.8
6	152°42.3	227°38.3	S25°07.6	24°48.5	N21°10.5	75°28.0	N22°13.2	167°48.5	S08°41.8
7	167°44.8	242°37.6	07.4	39°50.5	10.5	90°30.8	13.2	182°50.9	41.8
8	182°47.2	257°36.8	07.1	54°52.5	10.5	105°33.6	13.2	197°53.3	41.8
9	197°49.7	272°36.0	·· 06.8	69°54.5	·· 10.5	120°36.4	·· 13.1	212°55.8	·· 41.8
10	212°52.2	287°35.2	06.5	84°56.5	10.5	135°39.2	13.1	227°58.2	41.7
11	227°54.6	302°34.5	06.3	99°58.5	10.5	150°42.0	13.1	243°00.6	41.7
12	242°57.1	317°33.7	S25°06.0	115°00.6	N21°10.5	165°44.8	N22°13.1	258°03.1	S08°41.7
13	257°59.6	332°32.9	05.7	130°02.6	10.5	180°47.6	13.0	273°05.5	41.7
14	273°02.0	347°32.1	05.4	145°04.6	10.5	195°50.4	13.0	288°07.9	41.7
15	288°04.5	2°31.4	·· 05.1	160°06.6	·· 10.5	210°53.2	·· 13.0	303°10.4	·· 41.6
16	303°07.0	17°30.6	04.8	175°08.6	10.5	225°56.1	13.0	318°12.8	41.6
17	318°09.4	32°29.8	04.6	190°10.6	10.5	240°58.9	12.9	333°15.2	41.6
18	333°11.9	47°29.1	S25°04.3	205°12.6	N21°10.5	256°01.7	N22°12.9	348°17.7	S08°41.6
19	348°14.3	62°28.3	04.0	220°14.6	10.5	271°04.5	12.9	3°20.1	41.6
20	3°16.8	77°27.5	03.7	235°16.6	10.5	286°07.3	12.9	18°22.5	41.5
21	18°19.3	92°26.7	·· 03.4	250°18.6	·· 10.5	301°10.1	·· 12.8	33°25.0	·· 41.5
22	33°21.7	107°26.0	03.1	265°20.7	10.5	316°12.9	12.8	48°27.4	41.5
23	48°24.2	122°25.2	02.8	280°22.7	10.5	331°15.7	12.8	63°29.8	41.5
Mer.pass. 19:47		ν -0.8′	d 0.3′	m -4.14	ν 2.0′	d -0.0′	m -0.33	ν 2.8′	d -0.0′ m -2.79	ν 2.4′	d 0.0′ m 0.91

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	63°26.7	137°24.4	S25°02.5	295°24.7	N21°10.5	346°18.5	N22°12.8	78°32.3	S08°41.5
1	78°29.1	152°23.7	02.2	310°26.7	10.5	1°21.3	12.7	93°34.7	41.4
2	93°31.6	167°22.9	01.9	325°28.7	10.5	16°24.1	12.7	108°37.1	41.4
3	108°34.1	182°22.1	·· 01.6	340°30.8	·· 10.5	31°26.9	·· 12.7	123°39.6	·· 41.4
4	123°36.5	197°21.4	01.3	355°32.8	10.5	46°29.7	12.7	138°42.0	41.4
5	138°39.0	212°20.6	01.0	10°34.8	10.5	61°32.5	12.6	153°44.4	41.3
6	153°41.5	227°19.8	S25°00.7	25°36.8	N21°10.5	76°35.3	N22°12.6	168°46.9	S08°41.3
7	168°43.9	242°19.1	00.4	40°38.9	10.5	91°38.1	12.6	183°49.3	41.3
8	183°46.4	257°18.3	25°00.1	55°40.9	10.5	106°40.9	12.6	198°51.7	41.3
9	198°48.8	272°17.5	24°59.8	70°42.9	·· 10.6	121°43.7	·· 12.6	213°54.2	·· 41.3
10	213°51.3	287°16.8	59.5	85°45.0	10.6	136°46.6	12.5	228°56.6	41.2
11	228°53.8	302°16.0	59.2	100°47.0	10.6	151°49.4	12.5	243°59.0	41.2
12	243°56.2	317°15.2	S24°58.9	115°49.0	N21°10.6	166°52.2	N22°12.5	259°01.4	S08°41.2
13	258°58.7	332°14.5	58.6	130°51.1	10.6	181°55.0	12.5	274°03.9	41.2
14	274°01.2	347°13.7	58.3	145°53.1	10.6	196°57.8	12.4	289°06.3	41.2
15	289°03.6	2°12.9	·· 57.9	160°55.1	·· 10.6	212°00.6	·· 12.4	304°08.7	·· 41.1
16	304°06.1	17°12.2	57.6	175°57.2	10.6	227°03.4	12.4	319°11.2	41.1
17	319°08.6	32°11.4	57.3	190°59.2	10.6	242°06.2	12.4	334°13.6	41.1
18	334°11.0	47°10.7	S24°57.0	206°01.2	N21°10.6	257°09.0	N22°12.3	349°16.0	S08°41.1
19	349°13.5	62°09.9	56.7	221°03.3	10.6	272°11.8	12.3	4°18.5	41.0
20	4°15.9	77°09.1	56.4	236°05.3	10.6	287°14.6	12.3	19°20.9	41.0
21	19°18.4	92°08.4	·· 56.0	251°07.4	·· 10.6	302°17.4	·· 12.3	34°23.3	·· 41.0
22	34°20.9	107°07.6	55.7	266°09.4	10.7	317°20.2	12.2	49°25.7	41.0
23	49°23.3	122°06.9	55.4	281°11.5	10.7	332°23.1	12.2	64°28.2	41.0
Mer.pass. 19:43		ν -0.8′	d 0.3′	m -4.15	ν 2.0′	d 0.0′	m -0.35	ν 2.8′	d -0.0′ m -2.80	ν 2.4′	d 0.0′ m 0.91

Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	64°25.8	137°06.1	S24°55.1	296°13.5	N21°10.7	347°25.9	N22°12.2	79°30.6	S08°40.9
1	79°28.3	152°05.3	54.7	311°15.6	10.7	2°28.7	12.2	94°33.0	40.9
2	94°30.7	167°04.6	54.4	326°17.6	10.7	17°31.5	12.1	109°35.5	40.9
3	109°33.2	182°03.8	·· 54.1	341°19.7	·· 10.7	32°34.3	·· 12.1	124°37.9	·· 40.9
4	124°35.7	197°03.1	53.8	356°21.7	10.7	47°37.1	12.1	139°40.3	40.8
5	139°38.1	212°02.3	53.4	11°23.8	10.7	62°39.9	12.1	154°42.7	40.8
6	154°40.6	227°01.6	S24°53.1	26°25.8	N21°10.7	77°42.7	N22°12.0	169°45.2	S08°40.8
7	169°43.1	242°00.8	52.8	41°27.9	10.8	92°45.5	12.0	184°47.6	40.8
8	184°45.5	257°00.0	52.4	56°29.9	10.8	107°48.3	12.0	199°50.0	40.8
9	199°48.0	271°59.3	·· 52.1	71°32.0	·· 10.8	122°51.1	·· 12.0	214°52.4	·· 40.7
10	214°50.4	286°58.5	51.8	86°34.1	10.8	137°54.0	11.9	229°54.9	40.7
11	229°52.9	301°57.8	51.4	101°36.1	10.8	152°56.8	11.9	244°57.3	40.7
12	244°55.4	316°57.0	S24°51.1	116°38.2	N21°10.8	167°59.6	N22°11.9	259°59.7	S08°40.7
13	259°57.8	331°56.3	50.8	131°40.3	10.8	183°02.4	11.9	275°02.1	40.6
14	275°00.3	346°55.5	50.4	146°42.3	10.8	198°05.2	11.8	290°04.6	40.6
15	290°02.8	1°54.8	·· 50.1	161°44.4	·· 10.9	213°08.0	·· 11.8	305°07.0	·· 40.6
16	305°05.2	16°54.0	49.7	176°46.5	10.9	228°10.8	11.8	320°09.4	40.6
17	320°07.7	31°53.3	49.4	191°48.5	10.9	243°13.6	11.8	335°11.9	40.5
18	335°10.2	46°52.5	S24°49.0	206°50.6	N21°10.9	258°16.4	N22°11.7	350°14.3	S08°40.5
19	350°12.6	61°51.8	48.7	221°52.7	10.9	273°19.3	11.7	5°16.7	40.5
20	5°15.1	76°51.0	48.3	236°54.7	10.9	288°22.1	11.7	20°19.1	40.5
21	20°17.5	91°50.3	·· 48.0	251°56.8	·· 11.0	303°24.9	·· 11.7	35°21.6	·· 40.5
22	35°20.0	106°49.5	47.6	266°58.9	11.0	318°27.7	11.6	50°24.0	40.4
23	50°22.5	121°48.8	47.3	282°01.0	11.0	333°30.5	11.6	65°26.4	40.4
Mer.pass. 19:39		ν -0.8′	d 0.3′	m -4.16	ν 2.0′	d 0.0′	m -0.37	ν 2.8′	d -0.0′ m -2.80	ν 2.4′	d 0.0′ m 0.92

Stars

	SHA	Dec
Alpheratz	357°34.7	29°13.9
Ankaa	353°07.0	-42°10.4
Schedar	349°30.8	56°40.7
Diphda	348°47.2	-17°51.0
Achernar	335°19.8	-57°06.8
Hamal	327°51.0	23°34.9
Polaris	313°36.7	89°22.2
Acamar	315°11.4	-40°12.3
Menkar	314°06.0	4°11.3
Mirfak	308°27.9	49°57.1
Aldebaran	290°39.4	16°33.6
Rigel	281°03.7	-8°10.3
Capella	280°21.6	46°01.4
Bellatrix	278°22.7	6°22.4
Elnath	278°01.7	28°37.7
Alnilam	275°37.5	-1°11.1
Betelgeuse	270°51.9	7°24.8
Canopus	263°52.0	-52°42.3
Sirius	258°26.1	-16°44.9
Adhara	255°05.7	-29°00.1
Procyon	244°50.7	5°09.7
Pollux	243°17.2	27°57.9
Avior	234°14.5	-59°35.0
Suhail	222°46.3	-43°31.7
Miaplacidus	221°38.1	-69°48.8
Alphard	217°47.8	-8°45.8
Regulus	207°34.6	11°50.7
Dubhe	193°41.3	61°36.8
Denebola	182°25.2	14°26.0
Gienah	175°43.9	-17°40.6
Acrux	173°00.7	-63°13.9
Gacrux	171°52.2	-57°14.9
Alioth	166°13.4	55°49.3
Spica	158°22.7	-11°17.4
Alkaid	152°52.5	49°11.2
Hadar	148°36.8	-60°29.4
Menkent	147°58.1	-36°29.4
Arcturus	145°48.3	19°03.2
Rigil Kent.	139°41.1	-60°56.1
Kochab	137°20.9	74°03.0
Zuben'ubi	136°56.5	-16°08.6
Alphecca	126°04.2	26°37.8
Antares	112°16.4	-26°29.2
Atria	107°11.3	-69°04.3
Sabik	102°03.3	-15°45.3
Shaula	96°10.9	-37°07.3
Rasalhague	95°59.0	12°32.6
Eltanin	90°42.7	51°29.2
Kaus Aust.	83°33.0	-34°22.4
Vega	80°33.7	38°48.5
Nunki	75°48.2	-26°16.0
Altair	62°00.3	8°56.1
Peacock	53°06.2	-56°39.5
Deneb	49°26.1	45°22.4
Enif	33°39.0	9°59.4
Al Na'ir	27°33.1	-46°50.6
Fomalhaut	15°14.6	-29°29.5
Scheat	13°45.3	28°13.3
Markab	13°30.0	15°20.5

Nov 23 Sat	SHA	Mer.pass
Venus	75°15.5	14:50
Mars	232°09.0	04:21
Jupiter	282°43.7	00:59
Saturn	15°06.3	18:47

Nov 24 Sun	SHA	Mer.pass
Venus	73°57.8	14:51
Mars	231°58.0	04:18
Jupiter	282°51.8	00:55
Saturn	15°05.6	18:43

Nov 25 Mon	SHA	Mer.pass
Venus	72°40.3	14:52
Mars	231°47.7	04:15
Jupiter	283°00.1	00:50
Saturn	15°04.8	18:39

Horizontal parallax	
Venus:	0.1
Mars:	0.2

h	Sun		Moon				
Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°24.5	S20°23.7	268°50.1	15.1′	N14°00.8	13.0′	55.0′
1	198°24.3	24.2	283°24.2	15.1′	13°47.8	13.0′	55.0′
2	213°24.1	24.8	297°58.3	15.2′	13°34.8	13.1′	55.0′
3	228°24.0	·· 25.3	312°32.5	15.3′	13°21.7	13.1′	54.9′
4	243°23.8	25.8	327°06.8	15.4′	13°08.6	13.1′	54.9′
5	258°23.6	26.3	341°41.1	15.4′	12°55.5	13.2′	54.9′
6	273°23.4	S20°26.8	356°15.6	15.5′	N12°42.3	13.2′	54.9′
7	288°23.3	27.3	10°50.1	15.6′	12°29.1	13.2′	54.9′
8	303°23.1	27.8	25°24.6	15.6′	12°15.9	13.3′	54.8′
9	318°22.9	·· 28.4	39°59.3	15.7′	12°02.6	13.3′	54.8′
10	333°22.7	28.9	54°34.0	15.8′	11°49.3	13.4′	54.8′
11	348°22.6	29.4	69°08.7	15.8′	11°35.9	13.4′	54.8′
12	3°22.4	S20°29.9	83°43.6	15.9′	N11°22.5	13.4′	54.7′
13	18°22.2	30.4	98°18.5	16.0′	11°09.1	13.5′	54.7′
14	33°22.0	30.9	112°53.4	16.0′	10°55.6	13.5′	54.7′
15	48°21.8	·· 31.4	127°28.4	16.1′	10°42.1	13.5′	54.7′
16	63°21.7	31.9	142°03.5	16.1′	10°28.6	13.5′	54.7′
17	78°21.5	32.4	156°38.7	16.2′	10°15.1	13.6′	54.7′
18	93°21.3	S20°32.9	171°13.9	16.2′	N10°01.5	13.6′	54.6′
19	108°21.1	33.4	185°49.1	16.3′	09°47.9	13.6′	54.6′
20	123°20.9	33.9	200°24.4	16.4′	09°34.3	13.7′	54.6′
21	138°20.8	·· 34.4	214°59.8	16.4′	09°20.6	13.7′	54.6′
22	153°20.6	34.9	229°35.2	16.5′	09°06.9	13.7′	54.6′
23	168°20.4	35.4	244°10.6	16.5′	08°53.2	13.7′	54.5′
	SD = 16.2′	d = -0.5′	SD = 15.0′				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°20.2	S20°35.9	258°46.1	16.6′	N08°39.5	13.8′	54.5′
1	198°20.0	36.5	273°21.7	16.6′	08°25.7	13.8′	54.5′
2	213°19.8	37.0	287°57.3	16.7′	08°11.9	13.8′	54.5′
3	228°19.7	·· 37.5	302°33.0	16.7′	07°58.1	13.8′	54.5′
4	243°19.5	37.9	317°08.7	16.7′	07°44.3	13.8′	54.5′
5	258°19.3	38.4	331°44.4	16.8′	07°30.5	13.9′	54.4′
6	273°19.1	S20°38.9	346°20.2	16.8′	N07°16.6	13.9′	54.4′
7	288°18.9	39.4	0°56.0	16.9′	07°02.7	13.9′	54.4′
8	303°18.7	39.9	15°31.9	16.9′	06°48.8	13.9′	54.4′
9	318°18.6	·· 40.4	30°07.8	16.9′	06°34.9	13.9′	54.4′
10	333°18.4	40.9	44°43.7	17.0′	06°21.0	14.0′	54.4′
11	348°18.2	41.4	59°19.7	17.0′	06°07.0	13.9′	54.4′
12	3°18.0	S20°41.9	73°55.7	17.0′	N05°53.1	14.0′	54.3′
13	18°17.8	42.4	88°31.7	17.1′	05°39.1	14.0′	54.3′
14	33°17.6	42.9	103°07.8	17.1′	05°25.1	14.0′	54.3′
15	48°17.4	·· 43.4	117°43.9	17.1′	05°11.1	14.0′	54.3′
16	63°17.3	43.9	132°20.1	17.2′	04°57.1	14.1′	54.3′
17	78°17.1	44.4	146°56.2	17.2′	04°43.0	14.0′	54.3′
18	93°16.9	S20°44.9	161°32.4	17.2′	N04°29.0	14.0′	54.3′
19	108°16.7	45.4	176°08.6	17.2′	04°15.0	14.1′	54.3′
20	123°16.5	45.8	190°44.9	17.3′	04°00.9	14.1′	54.2′
21	138°16.3	·· 46.3	205°21.2	17.3′	03°46.8	14.0′	54.2′
22	153°16.1	46.8	219°57.4	17.3′	03°32.8	14.1′	54.2′
23	168°15.9	47.3	234°33.8	17.3′	03°18.7	14.1′	54.2′
	SD = 16.2′	d = -0.5′	SD = 14.9′				

Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°15.7	S20°47.8	249°10.1	17.4′	N03°04.6	14.1′	54.2′
1	198°15.5	48.3	263°46.5	17.4′	02°50.5	14.1′	54.2′
2	213°15.4	48.8	278°22.8	17.4′	02°36.4	14.1′	54.2′
3	228°15.2	·· 49.2	292°59.2	17.4′	02°22.3	14.2′	54.2′
4	243°15.0	49.7	307°35.6	17.4′	02°08.1	14.1′	54.2′
5	258°14.8	50.2	322°12.0	17.4′	01°54.0	14.1′	54.2′
6	273°14.6	S20°50.7	336°48.5	17.4′	N01°39.9	14.1′	54.2′
7	288°14.4	51.2	351°24.9	17.5′	01°25.8	14.1′	54.1′
8	303°14.2	51.6	6°01.4	17.5′	01°11.7	14.2′	54.1′
9	318°14.0	·· 52.1	20°37.8	17.5′	00°57.5	14.1′	54.1′
10	333°13.8	52.6	35°14.3	17.5′	00°43.4	14.1′	54.1′
11	348°13.6	53.1	49°50.8	17.5′	00°29.3	14.1′	54.1′
12	3°13.4	S20°53.6	64°27.3	17.5′	N00°15.2	14.2′	54.1′
13	18°13.2	54.0	79°03.8	17.5′	N00°01.0	14.1′	54.1′
14	33°13.0	54.5	93°40.3	17.5′	S00°13.1	14.1′	54.1′
15	48°12.8	·· 55.0	108°16.8	17.5′	00°27.2	14.1′	54.1′
16	63°12.6	55.5	122°53.2	17.5′	00°41.3	14.1′	54.1′
17	78°12.4	55.9	137°29.7	17.5′	00°55.4	14.1′	54.1′
18	93°12.2	S20°56.4	152°06.2	17.5′	S01°09.5	14.1′	54.1′
19	108°12.1	56.9	166°42.7	17.5′	01°23.6	14.1′	54.1′
20	123°11.9	57.4	181°19.2	17.5′	01°37.7	14.1′	54.1′
21	138°11.7	·· 57.8	195°55.7	17.5′	01°51.8	14.1′	54.1′
22	153°11.5	58.3	210°32.2	17.5′	02°05.9	14.1′	54.1′
23	168°11.3	58.8	225°08.7	17.5′	02°20.0	14.0′	54.1′
	SD = 16.2′	d = -0.5′	SD = 14.8′				

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

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

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 22-24 51-32%
23	13:38	13:30	11:47	06:15	18:36	
24	13:21	13:12	11:47	06:56	19:16	
25	13:03	12:54	11:47	07:35	19:55	

November 26, 27, 28 UT (Tue., Wed., Thu.)

	Aries	Venus		Mars		Jupiter		Saturn	
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	65°24.9	136°48.0	S24°46.9	297°03.0	N21°11.0	348°33.3	N22°11.6	80°28.8	S08°40.4
1	80°27.4	151°47.3	46.6	312°05.1	11.0	3°36.1	11.6	95°31.2	40.4
2	95°29.9	166°46.5	46.2	327°07.2	11.0	18°38.9	11.5	110°33.7	40.3
3	110°32.3	181°45.8	·· 45.9	342°09.3	·· 11.1	33°41.8	·· 11.5	125°36.1	·· 40.3
4	125°34.8	196°45.0	45.5	357°11.4	11.1	48°44.6	11.5	140°38.5	40.3
5	140°37.3	211°44.3	45.2	12°13.4	11.1	63°47.4	11.5	155°40.9	40.3
6	155°39.7	226°43.5	S24°44.8	27°15.5	N21°11.1	78°50.2	N22°11.4	170°43.4	S08°40.2
7	170°42.2	241°42.8	44.4	42°17.6	11.1	93°53.0	11.4	185°45.8	40.2
8	185°44.7	256°42.1	44.1	57°19.7	11.2	108°55.8	11.4	200°48.2	40.2
9	200°47.1	271°41.3	·· 43.7	72°21.8	·· 11.2	123°58.6	·· 11.4	215°50.6	·· 40.2
10	215°49.6	286°40.6	43.3	87°23.9	11.2	139°01.4	11.3	230°53.1	40.1
11	230°52.0	301°39.8	43.0	102°26.0	11.2	154°04.3	11.3	245°55.5	40.1
12	245°54.5	316°39.1	S24°42.6	117°28.1	N21°11.3	169°07.1	N22°11.3	260°57.9	S08°40.1
13	260°57.0	331°38.3	42.2	132°30.2	11.3	184°09.9	11.3	276°00.3	40.1
14	275°59.4	346°37.6	41.9	147°32.2	11.3	199°12.7	11.2	291°02.7	40.0
15	291°01.9	1°36.9	·· 41.5	162°34.3	·· 11.3	214°15.5	·· 11.2	306°05.2	·· 40.0
16	306°04.4	16°36.1	41.1	177°36.4	11.3	229°18.3	11.2	321°07.6	40.0
17	321°06.8	31°35.4	40.8	192°38.5	11.4	244°21.1	11.1	336°10.0	40.0
18	336°09.3	46°34.6	S24°40.4	207°40.6	N21°11.4	259°24.0	N22°11.1	351°12.4	S08°39.9
19	351°11.8	61°33.9	40.0	222°42.7	11.4	274°26.8	11.1	6°14.9	39.9
20	6°14.2	76°33.2	39.6	237°44.8	11.4	289°29.6	11.1	21°17.3	39.9
21	21°16.7	91°32.4	·· 39.2	252°46.9	·· 11.5	304°32.4	·· 11.0	36°19.7	·· 39.9
22	36°19.2	106°31.7	38.9	267°49.1	11.5	319°35.2	11.0	51°22.1	39.8
23	51°21.6	121°31.0	38.5	282°51.2	11.5	334°38.0	11.0	66°24.5	39.8
Mer.pass. 19:35		ν -0.7′	d 0.4′	ν 2.1′	d 0.0′	ν 2.8′	d -0.0′	ν 2.4′	d 0.0′
		m -4.16		m -0.39		m -2.80		m 0.92	

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	66°24.1	136°30.2	S24°38.1	297°53.3	N21°11.5	349°40.8	N22°11.0	81°27.0	S08°39.8
1	81°26.5	151°29.5	37.7	312°55.4	11.6	4°43.7	10.9	96°29.4	39.8
2	96°29.0	166°28.7	37.3	327°57.5	11.6	19°46.5	10.9	111°31.8	39.7
3	111°31.5	181°28.0	·· 37.0	342°59.6	·· 11.6	34°49.3	·· 10.9	126°34.2	·· 39.7
4	126°33.9	196°27.3	36.6	358°01.7	11.6	49°52.1	10.9	141°36.6	39.7
5	141°36.4	211°26.5	36.2	13°03.8	11.7	64°54.9	10.8	156°39.1	39.7
6	156°38.9	226°25.8	S24°35.8	28°05.9	N21°11.7	79°57.7	N22°10.8	171°41.5	S08°39.6
7	171°41.3	241°25.1	35.4	43°08.1	11.7	95°00.6	10.8	186°43.9	39.6
8	186°43.8	256°24.3	35.0	58°10.2	11.8	110°03.4	10.8	201°46.3	39.6
9	201°46.3	271°23.6	·· 34.6	73°12.3	·· 11.8	125°06.2	·· 10.7	216°48.7	·· 39.5
10	216°48.7	286°22.9	34.2	88°14.4	11.8	140°09.0	10.7	231°51.1	39.5
11	231°51.2	301°22.2	33.8	103°16.5	11.8	155°11.8	10.7	246°53.6	39.5
12	246°53.6	316°21.4	S24°33.4	118°18.7	N21°11.9	170°14.6	N22°10.7	261°56.0	S08°39.5
13	261°56.1	331°20.7	33.0	133°20.8	11.9	185°17.5	10.6	276°58.4	39.4
14	276°58.6	346°20.0	32.6	148°22.9	11.9	200°20.3	10.6	292°00.8	39.4
15	292°01.0	1°19.2	·· 32.2	163°25.0	·· 12.0	215°23.1	·· 10.6	307°03.2	·· 39.4
16	307°03.5	16°18.5	31.8	178°27.2	12.0	230°25.9	10.6	322°05.7	39.4
17	322°06.0	31°17.8	31.4	193°29.3	12.0	245°28.7	10.5	337°08.1	39.3
18	337°08.4	46°17.1	S24°31.0	208°31.4	N21°12.1	260°31.5	N22°10.5	352°10.5	S08°39.3
19	352°10.9	61°16.3	30.6	223°33.5	12.1	275°34.4	10.5	7°12.9	39.3
20	7°13.4	76°15.6	30.2	238°35.7	12.1	290°37.2	10.5	22°15.3	39.3
21	22°15.8	91°14.9	·· 29.8	253°37.8	·· 12.2	305°40.0	·· 10.4	37°17.7	·· 39.2
22	37°18.3	106°14.2	29.4	268°39.9	12.2	320°42.8	10.4	52°20.2	39.2
23	52°20.8	121°13.4	29.0	283°42.1	12.2	335°45.6	10.4	67°22.6	39.2
Mer.pass. 19:31		ν -0.7′	d 0.4′	ν 2.1′	d 0.0′	ν 2.8′	d -0.0′	ν 2.4′	d 0.0′
		m -4.17		m -0.42		m -2.80		m 0.92	

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	67°23.2	136°12.7	S24°28.6	298°44.2	N21°12.2	350°48.5	N22°10.3	82°25.0	S08°39.1
1	82°25.7	151°12.0	28.2	313°46.4	12.3	5°51.3	10.3	97°27.4	39.1
2	97°28.1	166°11.3	27.8	328°48.5	12.3	20°54.1	10.3	112°29.8	39.1
3	112°30.6	181°10.5	·· 27.4	343°50.6	·· 12.4	35°56.9	·· 10.3	127°32.2	·· 39.1
4	127°33.1	196°09.8	26.9	358°52.8	12.4	50°59.7	10.2	142°34.7	39.0
5	142°35.5	211°09.1	26.5	13°54.9	12.4	66°02.5	10.2	157°37.1	39.0
6	157°38.0	226°08.4	S24°26.1	28°57.1	N21°12.5	81°05.4	N22°10.2	172°39.5	S08°39.0
7	172°40.5	241°07.7	25.7	43°59.2	12.5	96°08.2	10.2	187°41.9	38.9
8	187°42.9	256°06.9	25.3	59°01.4	12.5	111°11.0	10.1	202°44.3	38.9
9	202°45.4	271°06.2	·· 24.9	74°03.5	·· 12.6	126°13.8	·· 10.1	217°46.7	·· 38.9
10	217°47.9	286°05.5	24.4	89°05.7	12.6	141°16.6	10.1	232°49.1	38.9
11	232°50.3	301°04.8	24.0	104°07.8	12.6	156°19.5	10.1	247°51.6	38.8
12	247°52.8	316°04.1	S24°23.6	119°10.0	N21°12.7	171°22.3	N22°10.0	262°54.0	S08°38.8
13	262°55.3	331°03.3	23.2	134°12.1	12.7	186°25.1	10.0	277°56.4	38.8
14	277°57.7	346°02.6	22.7	149°14.3	12.8	201°27.9	10.0	292°58.8	38.8
15	293°00.2	1°01.9	·· 22.3	164°16.4	·· 12.8	216°30.7	·· 10.0	308°01.2	·· 38.7
16	308°02.6	16°01.2	21.9	179°18.6	12.8	231°33.6	09.9	323°03.6	38.7
17	323°05.1	31°00.5	21.5	194°20.8	12.9	246°36.4	09.9	338°06.0	38.7
18	338°07.6	45°59.8	S24°21.0	209°22.9	N21°12.9	261°39.2	N22°09.9	353°08.4	S08°38.6
19	353°10.0	60°59.1	20.6	224°25.1	13.0	276°42.0	09.8	8°10.9	38.6
20	8°12.5	75°58.3	20.2	239°27.2	13.0	291°44.8	09.8	23°13.3	38.6
21	23°15.0	90°57.6	·· 19.7	254°29.4	·· 13.0	306°47.7	·· 09.8	38°15.7	·· 38.5
22	38°17.4	105°56.9	19.3	269°31.6	13.1	321°50.5	09.8	53°18.1	38.5
23	53°19.9	120°56.2	18.9	284°33.7	13.1	336°53.3	09.7	68°20.5	38.5
Mer.pass. 19:27		ν -0.7′	d 0.4′	ν 2.1′	d 0.0′	ν 2.8′	d -0.0′	ν 2.4′	d 0.0′
		m -4.18		m -0.44		m -2.81		m 0.93	

Stars

	SHA	Dec
Alpheratz	357°34.7	29°13.9
Ankaa	353°07.0	-42°10.4
Schedar	349°30.9	56°40.7
Diphda	348°47.2	-17°51.0
Achernar	335°19.8	-57°06.8
Hamal	327°51.0	23°34.9
Polaris	313°36.9	89°22.3
Acamar	315°11.4	-40°12.3
Menkar	314°06.0	4°11.3
Mirfak	308°27.9	49°57.1
Aldebaran	290°39.4	16°33.6
Rigel	281°03.6	-8°10.3
Capella	280°21.6	46°01.4
Bellatrix	278°22.7	6°22.4
Elnath	278°01.6	28°37.7
Alnilam	275°37.5	-1°11.1
Betelgeuse	270°51.9	7°24.8
Canopus	263°52.0	-52°42.3
Sirius	258°26.1	-16°44.9
Adhara	255°05.7	-29°00.2
Procyon	244°50.7	5°09.7
Pollux	243°17.2	27°57.9
Avior	234°14.5	-59°35.0
Suhail	222°46.3	-43°31.7
Miaplacidus	221°38.0	-69°48.8
Alphard	217°47.8	-8°45.9
Regulus	207°34.5	11°50.7
Dubhe	193°41.2	61°36.8
Denebola	182°25.2	14°26.0
Gienah	175°43.9	-17°40.7
Acrux	173°00.7	-63°13.9
Gacrux	171°52.1	-57°14.9
Alioth	166°13.4	55°49.3
Spica	158°22.7	-11°17.4
Alkaid	152°52.5	49°11.2
Hadar	148°36.8	-60°29.4
Menkent	147°58.1	-36°29.4
Arcturus	145°48.3	19°03.1
Rigil Kent.	139°41.1	-60°56.1
Kochab	137°20.9	74°03.0
Zuben'ubi	136°56.5	-16°08.6
Alphecca	126°04.2	26°37.8
Antares	112°16.4	-26°29.2
Atria	107°11.3	-69°04.3
Sabik	102°03.3	-15°45.3
Shaula	96°10.9	-37°07.3
Rasalhague	95°59.0	12°32.6
Eltanin	90°42.7	51°29.2
Kaus Aust.	83°33.0	-34°22.4
Vega	80°33.7	38°48.5
Nunki	75°48.2	-26°16.0
Altair	62°00.3	8°56.1
Peacock	53°06.2	-56°39.5
Deneb	49°26.1	45°22.4
Enif	33°39.0	9°59.4
Al Na'ir	27°33.1	-46°50.6
Fomalhaut	15°14.6	-29°29.6
Scheat	13°45.3	28°13.3
Markab	13°30.0	15°20.5

Nov 26 Tue	SHA	Mer.pass
Venus	71°23.1	14:54
Mars	231°38.1	04:11
Jupiter	283°08.4	00:46
Saturn	15°03.9	18:35

Nov 27 Wed	SHA	Mer.pass
Venus	70°06.1	14:55
Mars	231°29.2	04:08
Jupiter	283°16.8	00:41
Saturn	15°02.9	18:31

Nov 28 Thu	SHA	Mer.pass
Venus	68°49.5	14:56
Mars	231°21.0	04:04
Jupiter	283°25.2	00:37
Saturn	15°01.8	18:27

Horizontal parallax	
Venus:	0.1
Mars:	0.2

h	Sun		Moon				
Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°11.1	S20°59.2	239°45.2	17.5′	S02°34.0	14.1′	54.1′
1	198°10.9	20°59.7	254°21.6	17.5′	02°48.1	14.0′	54.1′
2	213°10.7	21°00.2	268°58.1	17.4′	03°02.1	14.1′	54.0′
3	228°10.5	·· 00.6	283°34.5	17.4′	03°16.2	14.0′	54.0′
4	243°10.3	01.1	298°10.9	17.4′	03°30.2	14.0′	54.0′
5	258°10.1	01.6	312°47.4	17.4′	03°44.2	14.0′	54.0′
6	273°09.9	S21°02.0	327°23.8	17.4′	S03°58.2	14.0′	54.0′
7	288°09.7	02.5	342°00.1	17.4′	04°12.2	13.9′	54.0′
8	303°09.5	03.0	356°36.5	17.3′	04°26.1	14.0′	54.0′
9	318°09.3	·· 03.4	11°12.9	17.3′	04°40.1	13.9′	54.0′
10	333°09.1	03.9	25°49.2	17.3′	04°54.0	14.0′	54.0′
11	348°08.9	04.4	40°25.5	17.3′	05°08.0	13.9′	54.0′
12	3°08.7	S21°04.8	55°01.8	17.3′	S05°21.9	13.9′	54.0′
13	18°08.5	05.3	69°38.0	17.2′	05°35.8	13.8′	54.0′
14	33°08.3	05.7	84°14.3	17.2′	05°49.6	13.9′	54.0′
15	48°08.0	·· 06.2	98°50.5	17.2′	06°03.5	13.8′	54.0′
16	63°07.8	06.6	113°26.7	17.2′	06°17.3	13.8′	54.0′
17	78°07.6	07.1	128°02.9	17.1′	06°31.1	13.8′	54.0′
18	93°07.4	S21°07.6	142°39.0	17.1′	S06°44.9	13.8′	54.0′
19	108°07.2	08.0	157°15.1	17.1′	06°58.7	13.7′	54.0′
20	123°07.0	08.5	171°51.2	17.0′	07°12.4	13.7′	54.0′
21	138°06.8	·· 08.9	186°27.2	17.0′	07°26.1	13.7′	54.0′
22	153°06.6	09.4	201°03.3	17.0′	07°39.8	13.7′	54.0′
23	168°06.4	09.8	215°39.2	16.9′	07°53.5	13.7′	54.1′
	SD = 16.2′	d = -0.5′	SD = 14.7′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°06.2	S21°10.3	230°15.2	16.9′	S08°07.2	13.6′	54.1′
1	198°06.0	10.7	244°51.1	16.9′	08°20.8	13.6′	54.1′
2	213°05.8	11.2	259°27.0	16.8′	08°34.4	13.5′	54.1′
3	228°05.6	·· 11.6	274°02.8	16.8′	08°47.9	13.6′	54.1′
4	243°05.4	12.1	288°38.6	16.8′	09°01.5	13.5′	54.1′
5	258°05.2	12.5	303°14.4	16.7′	09°15.0	13.5′	54.1′
6	273°05.0	S21°13.0	317°50.1	16.7′	S09°28.5	13.4′	54.1′
7	288°04.8	13.4	332°25.8	16.6′	09°41.9	13.4′	54.1′
8	303°04.5	13.9	347°01.4	16.6′	09°55.3	13.4′	54.1′
9	318°04.3	·· 14.3	1°37.0	16.5′	10°08.7	13.4′	54.1′
10	333°04.1	14.8	16°12.5	16.5′	10°22.1	13.3′	54.1′
11	348°03.9	15.2	30°48.0	16.5′	10°35.4	13.3′	54.1′
12	3°03.7	S21°15.7	45°23.5	16.4′	S10°48.7	13.2′	54.1′
13	18°03.5	16.1	59°58.9	16.4′	11°01.9	13.2′	54.1′
14	33°03.3	16.6	74°34.3	16.3′	11°15.1	13.2′	54.1′
15	48°03.1	·· 17.0	89°09.6	16.3′	11°28.3	13.2′	54.1′
16	63°02.9	17.4	103°44.8	16.2′	11°41.5	13.1′	54.1′
17	78°02.7	17.9	118°20.0	16.1′	11°54.6	13.0′	54.1′
18	93°02.4	S21°18.3	132°55.2	16.1′	S12°07.6	13.0′	54.1′
19	108°02.2	18.8	147°30.3	16.0′	12°20.6	13.0′	54.1′
20	123°02.0	19.2	162°05.3	16.0′	12°33.6	12.9′	54.2′
21	138°01.8	·· 19.6	176°40.3	15.9′	12°46.5	12.9′	54.2′
22	153°01.6	20.1	191°15.2	15.9′	12°59.4	12.9′	54.2′
23	168°01.4	20.5	205°50.1	15.8′	13°12.3	12.8′	54.2′
	SD = 16.2′	d = -0.5′	SD = 14.7′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	183°01.2	S21°20.9	220°24.9	15.7′	S13°25.1	12.7′	54.2′
1	198°00.9	21.4	234°59.6	15.7′	13°37.8	12.8′	54.2′
2	213°00.7	21.8	249°34.3	15.6′	13°50.6	12.6′	54.2′
3	228°00.5	·· 22.3	264°08.9	15.6′	14°03.2	12.6′	54.2′
4	243°00.3	22.7	278°43.5	15.5′	14°15.8	12.6′	54.2′
5	258°00.1	23.1	293°18.0	15.4′	14°28.4	12.5′	54.2′
6	272°59.9	S21°23.6	307°52.5	15.4′	S14°40.9	12.5′	54.2′
7	287°59.7	24.0	322°26.8	15.3′	14°53.4	12.4′	54.2′
8	302°59.4	24.4	337°01.1	15.2′	15°05.8	12.3′	54.3′
9	317°59.2	·· 24.8	351°35.4	15.2′	15°18.1	12.3′	54.3′
10	332°59.0	25.3	6°09.5	15.1′	15°30.4	12.3′	54.3′
11	347°58.8	25.7	20°43.6	15.0′	15°42.7	12.2′	54.3′
12	2°58.6	S21°26.1	35°17.7	15.0′	S15°54.9	12.1′	54.3′
13	17°58.4	26.6	49°51.6	14.9′	16°07.0	12.1′	54.3′
14	32°58.1	27.0	64°25.5	14.8′	16°19.1	12.0′	54.3′
15	47°57.9	·· 27.4	78°59.3	14.7′	16°31.1	12.0′	54.3′
16	62°57.7	27.8	93°33.1	14.7′	16°43.1	11.9′	54.3′
17	77°57.5	28.3	108°06.7	14.6′	16°55.0	11.8′	54.3′
18	92°57.3	S21°28.7	122°40.3	14.5′	S17°06.8	11.8′	54.4′
19	107°57.0	29.1	137°13.9	14.4′	17°18.6	11.7′	54.4′
20	122°56.8	29.5	151°47.3	14.4′	17°30.3	11.6′	54.4′
21	137°56.6	·· 29.9	166°20.7	14.3′	17°41.9	11.6′	54.4′
22	152°56.4	30.4	180°53.9	14.2′	17°53.5	11.5′	54.4′
23	167°56.2	30.8	195°27.2	14.1′	18°05.0	11.5′	54.4′
	SD = 16.2′	d = -0.4′	SD = 14.8′				

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

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

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 24-10%
26	12:44	12:35	11:47	08:14	20:33	
27	12:25	12:15	11:48	08:53	21:14	
28	12:05	11:54	11:48	09:35	21:56	

November 29, 30, 01 UT (Fri., Sat., Sun.)

	Aries	Venus		Mars		Jupiter		Saturn	
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	68°22.4	135°55.5	S24°18.4	299°35.9	N21°13.2	351°56.1	N22°09.7	83°22.9	S08°38.5
1	83°24.8	150°54.8	18.0	314°38.1	13.2	6°58.9	09.7	98°25.3	38.4
2	98°27.3	165°54.1	17.5	329°40.3	13.2	22°01.8	09.7	113°27.7	38.4
3	113°29.7	180°53.4	·· 17.1	344°42.4	·· 13.3	37°04.6	·· 09.6	128°30.2	·· 38.4
4	128°32.2	195°52.7	16.7	359°44.6	13.3	52°07.4	09.6	143°32.6	38.3
5	143°34.7	210°52.0	16.2	14°46.8	13.4	67°10.2	09.6	158°35.0	38.3
6	158°37.1	225°51.3	S24°15.8	29°49.0	N21°13.4	82°13.0	N22°09.6	173°37.4	S08°38.3
7	173°39.6	240°50.5	15.3	44°51.1	13.5	97°15.9	09.5	188°39.8	38.3
8	188°42.1	255°49.8	14.9	59°53.3	13.5	112°18.7	09.5	203°42.2	38.2
9	203°44.5	270°49.1	·· 14.4	74°55.5	·· 13.5	127°21.5	·· 09.5	218°44.6	·· 38.2
10	218°47.0	285°48.4	14.0	89°57.7	13.6	142°24.3	09.4	233°47.0	38.2
11	233°49.5	300°47.7	13.5	104°59.9	13.6	157°27.2	09.4	248°49.4	38.1
12	248°51.9	315°47.0	S24°13.1	120°02.0	N21°13.7	172°30.0	N22°09.4	263°51.9	S08°38.1
13	263°54.4	330°46.3	12.6	135°04.2	13.7	187°32.8	09.4	278°54.3	38.1
14	278°56.9	345°45.6	12.2	150°06.4	13.8	202°35.6	09.3	293°56.7	38.0
15	293°59.3	0°44.9	·· 11.7	165°08.6	·· 13.8	217°38.4	·· 09.3	308°59.1	·· 38.0
16	309°01.8	15°44.2	11.3	180°10.8	13.9	232°41.3	09.3	324°01.5	38.0
17	324°04.2	30°43.5	10.8	195°13.0	13.9	247°44.1	09.3	339°03.9	38.0
18	339°06.7	45°42.8	S24°10.3	210°15.2	N21°14.0	262°46.9	N22°09.2	354°06.3	S08°37.9
19	354°09.2	60°42.1	09.9	225°17.4	14.0	277°49.7	09.2	9°08.7	37.9
20	9°11.6	75°41.4	09.4	240°19.6	14.1	292°52.6	09.2	24°11.1	37.9
21	24°14.1	90°40.7	·· 09.0	255°21.8	·· 14.1	307°55.4	·· 09.2	39°13.5	·· 37.8
22	39°16.6	105°40.0	08.5	270°24.0	14.2	322°58.2	09.1	54°15.9	37.8
23	54°19.0	120°39.3	08.0	285°26.2	14.2	338°01.0	09.1	69°18.3	37.8
Mer.pass. 19:23		ν -0.7′ d 0.4′		m -4.18	ν 2.2′ d 0.0′		m -0.46	ν 2.8′ d -0.0′	m -2.81	ν 2.4′ d 0.0′	m 0.93

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	69°21.5	135°38.6	S24°07.6	300°28.4	N21°14.3	353°03.8	N22°09.1	84°20.8	S08°37.7
1	84°24.0	150°37.9	07.1	315°30.6	14.3	8°06.7	09.0	99°23.2	37.7
2	99°26.4	165°37.2	06.6	330°32.8	14.4	23°09.5	09.0	114°25.6	37.7
3	114°28.9	180°36.5	·· 06.2	345°35.0	·· 14.4	38°12.3	·· 09.0	129°28.0	·· 37.6
4	129°31.4	195°35.8	05.7	0°37.2	14.5	53°15.1	09.0	144°30.4	37.6
5	144°33.8	210°35.1	05.2	15°39.4	14.5	68°18.0	08.9	159°32.8	37.6
6	159°36.3	225°34.4	S24°04.8	30°41.6	N21°14.6	83°20.8	N22°08.9	174°35.2	S08°37.6
7	174°38.7	240°33.8	04.3	45°43.8	14.6	98°23.6	08.9	189°37.6	37.5
8	189°41.2	255°33.1	03.8	60°46.0	14.7	113°26.4	08.9	204°40.0	37.5
9	204°43.7	270°32.4	·· 03.3	75°48.2	·· 14.7	128°29.3	·· 08.8	219°42.4	·· 37.5
10	219°46.1	285°31.7	02.9	90°50.4	14.8	143°32.1	08.8	234°44.8	37.4
11	234°48.6	300°31.0	02.4	105°52.6	14.8	158°34.9	08.8	249°47.2	37.4
12	249°51.1	315°30.3	S24°01.9	120°54.9	N21°14.9	173°37.7	N22°08.8	264°49.6	S08°37.4
13	264°53.5	330°29.6	01.4	135°57.1	14.9	188°40.6	08.7	279°52.0	37.3
14	279°56.0	345°28.9	00.9	150°59.3	15.0	203°43.4	08.7	294°54.5	37.3
15	294°58.5	0°28.2	·· 00.5	166°01.5	·· 15.1	218°46.2	·· 08.7	309°56.9	·· 37.3
16	310°00.9	15°27.5	24°00.0	181°03.7	15.1	233°49.0	08.6	324°59.3	37.2
17	325°03.4	30°26.9	23°59.5	196°06.0	15.2	248°51.9	08.6	340°01.7	37.2
18	340°05.9	45°26.2	S23°59.0	211°08.2	N21°15.2	263°54.7	N22°08.6	355°04.1	S08°37.2
19	355°08.3	60°25.5	58.5	226°10.4	15.3	278°57.5	08.6	10°06.5	37.1
20	10°10.8	75°24.8	58.0	241°12.6	15.3	294°00.3	08.5	25°08.9	37.1
21	25°13.2	90°24.1	·· 57.5	256°14.9	·· 15.4	309°03.2	·· 08.5	40°11.3	·· 37.1
22	40°15.7	105°23.4	57.0	271°17.1	15.4	324°06.0	08.5	55°13.7	37.0
23	55°18.2	120°22.7	56.6	286°19.3	15.5	339°08.8	08.5	70°16.1	37.0
Mer.pass. 19:19		ν -0.7′ d 0.5′		m -4.19	ν 2.2′ d 0.1′		m -0.48	ν 2.8′ d -0.0′	m -2.81	ν 2.4′ d 0.0′	m 0.94

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	70°20.6	135°22.1	S23°56.1	301°21.6	N21°15.6	354°11.6	N22°08.4	85°18.5	S08°37.0
1	85°23.1	150°21.4	55.6	316°23.8	15.6	9°14.5	08.4	100°20.9	36.9
2	100°25.6	165°20.7	55.1	331°26.0	15.7	24°17.3	08.4	115°23.3	36.9
3	115°28.0	180°20.0	·· 54.6	346°28.3	·· 15.7	39°20.1	·· 08.3	130°25.7	·· 36.9
4	130°30.5	195°19.3	54.1	1°30.5	15.8	54°22.9	08.3	145°28.1	36.9
5	145°33.0	210°18.7	53.6	16°32.7	15.9	69°25.8	08.3	160°30.5	36.8
6	160°35.4	225°18.0	S23°53.1	31°35.0	N21°15.9	84°28.6	N22°08.3	175°32.9	S08°36.8
7	175°37.9	240°17.3	52.6	46°37.2	16.0	99°31.4	08.2	190°35.3	36.8
8	190°40.4	255°16.6	52.1	61°39.5	16.0	114°34.2	08.2	205°37.7	36.7
9	205°42.8	270°15.9	·· 51.6	76°41.7	·· 16.1	129°37.1	·· 08.2	220°40.1	·· 36.7
10	220°45.3	285°15.3	51.1	91°44.0	16.2	144°39.9	08.2	235°42.5	36.7
11	235°47.7	300°14.6	50.6	106°46.2	16.2	159°42.7	08.1	250°44.9	36.6
12	250°50.2	315°13.9	S23°50.1	121°48.4	N21°16.3	174°45.5	N22°08.1	265°47.3	S08°36.6
13	265°52.7	330°13.2	49.6	136°50.7	16.4	189°48.4	08.1	280°49.7	36.6
14	280°55.1	345°12.6	49.1	151°52.9	16.4	204°51.2	08.0	295°52.1	36.5
15	295°57.6	0°11.9	·· 48.5	166°55.2	·· 16.5	219°54.0	·· 08.0	310°54.5	·· 36.5
16	311°00.1	15°11.2	48.0	181°57.5	16.5	234°56.8	08.0	325°56.9	36.5
17	326°02.5	30°10.6	47.5	196°59.7	16.6	249°59.7	08.0	340°59.3	36.4
18	341°05.0	45°09.9	S23°47.0	212°02.0	N21°16.7	265°02.5	N22°07.9	356°01.7	S08°36.4
19	356°07.5	60°09.2	46.5	227°04.2	16.7	280°05.3	07.9	11°04.1	36.4
20	11°09.9	75°08.5	46.0	242°06.5	16.8	295°08.1	07.9	26°06.5	36.3
21	26°12.4	90°07.9	·· 45.5	257°08.7	·· 16.9	310°11.0	·· 07.8	41°08.9	·· 36.3
22	41°14.8	105°07.2	44.9	272°11.0	16.9	325°13.8	07.8	56°11.3	36.2
23	56°17.3	120°06.5	44.4	287°13.3	17.0	340°16.6	07.8	71°13.7	36.2
Mer.pass. 19:15		ν -0.7′ d 0.5′		m -4.20	ν 2.2′ d 0.1′		m -0.50	ν 2.8′ d -0.0′	m -2.81	ν 2.4′ d 0.0′	m 0.94

Stars

	SHA	Dec
Alpheratz	357°34.8	29°13.9
Ankaa	353°07.0	-42°10.4
Schedar	349°30.9	56°40.7
Diphda	348°47.2	-17°51.0
Achernar	335°19.8	-57°06.8
Hamal	327°51.0	23°34.9
Polaris	313°37.0	89°22.3
Acamar	315°11.4	-40°12.3
Menkar	314°06.0	4°11.3
Mirfak	308°27.9	49°57.1
Aldebaran	290°39.4	16°33.6
Rigel	281°03.6	-8°10.3
Capella	280°21.6	46°01.4
Bellatrix	278°22.7	6°22.4
Elnath	278°01.6	28°37.7
Alnilam	275°37.5	-1°11.1
Betelgeuse	270°51.9	7°24.8
Canopus	263°51.9	-52°42.3
Sirius	258°26.0	-16°44.9
Adhara	255°05.6	-29°00.2
Procyon	244°50.7	5°09.7
Pollux	243°17.2	27°57.9
Avior	234°14.4	-59°35.0
Suhail	222°46.2	-43°31.7
Miaplacidus	221°38.0	-69°48.8
Alphard	217°47.8	-8°45.9
Regulus	207°34.5	11°50.7
Dubhe	193°41.2	61°36.7
Denebola	182°25.2	14°26.0
Gienah	175°43.9	-17°40.7
Acrux	173°00.6	-63°13.9
Gacrux	171°52.1	-57°14.9
Alioth	166°13.4	55°49.3
Spica	158°22.7	-11°17.4
Alkaid	152°52.5	49°11.2
Hadar	148°36.7	-60°29.4
Menkent	147°58.1	-36°29.4
Arcturus	145°48.3	19°03.1
Rigil Kent.	139°41.1	-60°56.1
Kochab	137°20.9	74°03.0
Zuben'ubi	136°56.5	-16°08.6
Alphecca	126°04.2	26°37.8
Antares	112°16.4	-26°29.2
Atria	107°11.3	-69°04.3
Sabik	102°03.3	-15°45.3
Shaula	96°10.9	-37°07.3
Rasalhague	95°59.0	12°32.5
Eltanin	90°42.8	51°29.2
Kaus Aust.	83°33.0	-34°22.4
Vega	80°33.7	38°48.5
Nunki	75°48.2	-26°16.0
Altair	62°00.3	8°56.1
Peacock	53°06.2	-56°39.5
Deneb	49°26.1	45°22.3
Enif	33°39.0	9°59.4
Al Na'ir	27°33.1	-46°50.6
Fomalhaut	15°14.6	-29°29.6
Scheat	13°45.3	28°13.3
Markab	13°30.0	15°20.5

Nov 29 Fri	SHA	Mer.pass
Venus	67°33.1	14:57
Mars	231°13.6	04:01
Jupiter	283°33.8	00:32
Saturn	15°00.6	18:24

Nov 30 Sat	SHA	Mer.pass
Venus	66°17.1	14:58
Mars	231°06.9	03:58
Jupiter	283°42.4	00:28
Saturn	14°59.3	18:20

Dec 01 Sun	SHA	Mer.pass
Venus	65°01.4	14:59
Mars	231°00.9	03:54
Jupiter	283°51.0	00:23
Saturn	14°57.9	18:16

Horizontal parallax	
Venus:	0.2
Mars:	0.2

DUT1 = UT1-UTC = +0.1767 sec ΔT = TT-UT1 = +69.0073 sec

2024 November 29 to Dec. 01 UT

h	Sun		Moon				
Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	182°55.9	S21°31.2	210°00.3	14.1′	S18°16.5	11.4′	54.4′
1	197°55.7	31.6	224°33.3	14.0′	18°27.9	11.3′	54.4′
2	212°55.5	32.0	239°06.3	13.9′	18°39.2	11.2′	54.5′
3	227°55.3	·· 32.5	253°39.2	13.8′	18°50.4	11.2′	54.5′
4	242°55.1	32.9	268°12.0	13.7′	19°01.6	11.0′	54.5′
5	257°54.8	33.3	282°44.7	13.6′	19°12.6	11.1′	54.5′
6	272°54.6	S21°33.7	297°17.4	13.6′	S19°23.7	10.9′	54.5′
7	287°54.4	34.1	311°49.9	13.5′	19°34.6	10.9′	54.5′
8	302°54.2	34.5	326°22.4	13.4′	19°45.5	10.7′	54.5′
9	317°53.9	·· 34.9	340°54.8	13.3′	19°56.2	10.7′	54.5′
10	332°53.7	35.4	355°27.1	13.2′	20°06.9	10.7′	54.6′
11	347°53.5	35.8	9°59.3	13.1′	20°17.6	10.5′	54.6′
12	2°53.3	S21°36.2	24°31.5	13.0′	S20°28.1	10.5′	54.6′
13	17°53.0	36.6	39°03.5	13.0′	20°38.6	10.3′	54.6′
14	32°52.8	37.0	53°35.5	12.9′	20°48.9	10.3′	54.6′
15	47°52.6	·· 37.4	68°07.3	12.8′	20°59.2	10.2′	54.6′
16	62°52.4	37.8	82°39.1	12.7′	21°09.4	10.2′	54.6′
17	77°52.1	38.2	97°10.8	12.6′	21°19.6	10.0′	54.7′
18	92°51.9	S21°38.6	111°42.4	12.5′	S21°29.6	9.9′	54.7′
19	107°51.7	39.0	126°14.0	12.4′	21°39.5	9.9′	54.7′
20	122°51.5	39.4	140°45.4	12.3′	21°49.4	9.7′	54.7′
21	137°51.2	·· 39.8	155°16.7	12.3′	21°59.1	9.7′	54.7′
22	152°51.0	40.2	169°48.0	12.2′	22°08.8	9.6′	54.7′
23	167°50.8	40.6	184°19.1	12.1′	22°18.4	9.4′	54.7′
	SD = 16.2′	d = -0.4′	SD = 14.8′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	182°50.5	S21°41.1	198°50.2	12.0′	S22°27.8	9.4′	54.8′
1	197°50.3	41.5	213°21.2	11.9′	22°37.2	9.3′	54.8′
2	212°50.1	41.9	227°52.1	11.8′	22°46.5	9.2′	54.8′
3	227°49.9	·· 42.3	242°22.9	11.7′	22°55.7	9.1′	54.8′
4	242°49.6	42.7	256°53.6	11.6′	23°04.8	9.0′	54.8′
5	257°49.4	43.1	271°24.2	11.5′	23°13.8	8.8′	54.8′
6	272°49.2	S21°43.4	285°54.7	11.4′	S23°22.6	8.8′	54.9′
7	287°48.9	43.8	300°25.2	11.3′	23°31.4	8.7′	54.9′
8	302°48.7	44.2	314°55.5	11.3′	23°40.1	8.6′	54.9′
9	317°48.5	·· 44.6	329°25.8	11.2′	23°48.7	8.4′	54.9′
10	332°48.2	45.0	343°55.9	11.1′	23°57.1	8.4′	54.9′
11	347°48.0	45.4	358°26.0	11.0′	24°05.5	8.2′	54.9′
12	2°47.8	S21°45.8	12°56.0	10.9′	S24°13.7	8.2′	54.9′
13	17°47.6	46.2	27°25.9	10.8′	24°21.9	8.0′	55.0′
14	32°47.3	46.6	41°55.7	10.7′	24°29.9	7.9′	55.0′
15	47°47.1	·· 47.0	56°25.4	10.6′	24°37.8	7.8′	55.0′
16	62°46.9	47.4	70°55.0	10.5′	24°45.6	7.7′	55.0′
17	77°46.6	47.8	85°24.6	10.4′	24°53.3	7.5′	55.0′
18	92°46.4	S21°48.2	99°54.0	10.4′	S25°00.8	7.5′	55.0′
19	107°46.2	48.6	114°23.4	10.3′	25°08.3	7.3′	55.1′
20	122°45.9	48.9	128°52.7	10.2′	25°15.6	7.2′	55.1′
21	137°45.7	·· 49.3	143°21.8	10.1′	25°22.8	7.1′	55.1′
22	152°45.5	49.7	157°50.9	10.0′	25°29.9	7.0′	55.1′
23	167°45.2	50.1	172°19.9	9.9′	25°36.9	6.8′	55.1′
	SD = 16.2′	d = -0.4′	SD = 14.9′				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	182°45.0	S21°50.5	186°48.9	9.8′	S25°43.7	6.7′	55.2′
1	197°44.7	50.9	201°17.7	9.8′	25°50.4	6.6′	55.2′
2	212°44.5	51.3	215°46.5	9.7′	25°57.0	6.5′	55.2′
3	227°44.3	·· 51.6	230°15.1	9.6′	26°03.5	6.3′	55.2′
4	242°44.0	52.0	244°43.7	9.5′	26°09.8	6.2′	55.2′
5	257°43.8	52.4	259°12.2	9.4′	26°16.0	6.1′	55.2′
6	272°43.6	S21°52.8	273°40.6	9.3′	S26°22.1	5.9′	55.3′
7	287°43.3	53.2	288°09.0	9.3′	26°28.0	5.9′	55.3′
8	302°43.1	53.5	302°37.2	9.2′	26°33.9	5.6′	55.3′
9	317°42.9	·· 53.9	317°05.4	9.1′	26°39.5	5.6′	55.3′
10	332°42.6	54.3	331°33.5	9.0′	26°45.1	5.4′	55.3′
11	347°42.4	54.7	346°01.5	8.9′	26°50.5	5.3′	55.3′
12	2°42.1	S21°55.0	0°29.5	8.9′	S26°55.8	5.1′	55.4′
13	17°41.9	55.4	14°57.4	8.8′	27°00.9	5.0′	55.4′
14	32°41.7	55.8	29°25.2	8.7′	27°05.9	4.9′	55.4′
15	47°41.4	·· 56.2	43°52.9	8.7′	27°10.8	4.7′	55.4′
16	62°41.2	56.5	58°20.5	8.6′	27°15.5	4.6′	55.4′
17	77°40.9	56.9	72°48.1	8.5′	27°20.1	4.4′	55.5′
18	92°40.7	S21°57.3	87°15.6	8.4′	S27°24.5	4.3′	55.5′
19	107°40.5	57.7	101°43.1	8.4′	27°28.8	4.2′	55.5′
20	122°40.2	58.0	116°10.4	8.3′	27°33.0	4.0′	55.5′
21	137°40.0	·· 58.4	130°37.7	8.2′	27°37.0	3.8′	55.5′
22	152°39.7	58.8	145°05.0	8.2′	27°40.8	3.7′	55.5′
23	167°39.5	59.1	159°32.2	8.1′	27°44.5	3.6′	55.6′
	SD = 16.2′	d = -0.4′	SD = 15.0′				

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

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

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 28-0 5-0%
29	11:44	11:33	11:48	10:19	22:42	
30	11:22	11:11	11:49	11:06	23:32	
01	11:00	10:49	11:49	11:58	–:–	

No IERS EOP prediction data available

https://pypi.org/project/skyalmanac/

December 02, 03, 04 UT (Mon., Tue., Wed.)

	Aries	Venus		Mars		Jupiter		Saturn	
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	71°19.8	135°05.9	S23°43.9	302°15.5	N21°17.1	355°19.4	N22°07.8	86°16.1	S08°36.2
1	86°22.2	150°05.2	43.4	317°17.8	17.1	10°22.3	07.7	101°18.5	36.1
2	101°24.7	165°04.5	42.9	332°20.1	17.2	25°25.1	07.7	116°20.9	36.1
3	116°27.2	180°03.9	·· 42.3	347°22.3	·· 17.3	40°27.9	·· 07.7	131°23.3	·· 36.1
4	131°29.6	195°03.2	41.8	2°24.6	17.3	55°30.8	07.7	146°25.7	36.0
5	146°32.1	210°02.5	41.3	17°26.9	17.4	70°33.6	07.6	161°28.1	36.0
6	161°34.6	225°01.9	S23°40.8	32°29.2	N21°17.5	85°36.4	N22°07.6	176°30.5	S08°36.0
7	176°37.0	240°01.2	40.2	47°31.4	17.6	100°39.2	07.6	191°32.9	35.9
8	191°39.5	255°00.5	39.7	62°33.7	17.6	115°42.1	07.5	206°35.3	35.9
9	206°42.0	269°59.9	·· 39.2	77°36.0	·· 17.7	130°44.9	·· 07.5	221°37.7	·· 35.9
10	221°44.4	284°59.2	38.7	92°38.3	17.8	145°47.7	07.5	236°40.1	35.8
11	236°46.9	299°58.6	38.1	107°40.5	17.8	160°50.5	07.5	251°42.5	35.8
12	251°49.3	314°57.9	S23°37.6	122°42.8	N21°17.9	175°53.4	N22°07.4	266°44.9	S08°35.8
13	266°51.8	329°57.2	37.1	137°45.1	18.0	190°56.2	07.4	281°47.3	35.7
14	281°54.3	344°56.6	36.5	152°47.4	18.0	205°59.0	07.4	296°49.7	35.7
15	296°56.7	359°55.9	·· 36.0	167°49.7	·· 18.1	221°01.9	·· 07.4	311°52.1	·· 35.7
16	311°59.2	14°55.3	35.4	182°52.0	18.2	236°04.7	07.3	326°54.5	35.6
17	327°01.7	29°54.6	34.9	197°54.2	18.3	251°07.5	07.3	341°56.9	35.6
18	342°04.1	44°54.0	S23°34.4	212°56.5	N21°18.3	266°10.3	N22°07.3	356°59.3	S08°35.6
19	357°06.6	59°53.3	33.8	227°58.8	18.4	281°13.2	07.2	12°01.7	35.5
20	12°09.1	74°52.6	33.3	243°01.1	18.5	296°16.0	07.2	27°04.1	35.5
21	27°11.5	89°52.0	·· 32.7	258°03.4	·· 18.6	311°18.8	·· 07.2	42°06.5	·· 35.4
22	42°14.0	104°51.3	32.2	273°05.7	18.6	326°21.7	07.2	57°08.9	35.4
23	57°16.5	119°50.7	31.7	288°08.0	18.7	341°24.5	07.1	72°11.3	35.4
Mer.pass. 19:12		ν -0.7′	d 0.5′	m -4.20	ν 2.3′	d 0.1′	m -0.52	ν 2.8′	d -0.0′ m -2.81	ν 2.4′	d 0.0′ m 0.95

Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	72°18.9	134°50.0	S23°31.1	303°10.3	N21°18.8	356°27.3	N22°07.1	87°13.7	S08°35.3
1	87°21.4	149°49.4	30.6	318°12.6	18.9	11°30.1	07.1	102°16.1	35.3
2	102°23.8	164°48.7	30.0	333°14.9	18.9	26°33.0	07.0	117°18.5	35.3
3	117°26.3	179°48.1	·· 29.5	348°17.2	·· 19.0	41°35.8	·· 07.0	132°20.9	·· 35.2
4	132°28.8	194°47.4	28.9	3°19.5	19.1	56°38.6	07.0	147°23.3	35.2
5	147°31.2	209°46.8	28.4	18°21.8	19.2	71°41.4	07.0	162°25.7	35.2
6	162°33.7	224°46.1	S23°27.8	33°24.1	N21°19.2	86°44.3	N22°06.9	177°28.1	S08°35.1
7	177°36.2	239°45.5	27.3	48°26.4	19.3	101°47.1	06.9	192°30.4	35.1
8	192°38.6	254°44.8	26.7	63°28.7	19.4	116°49.9	06.9	207°32.8	35.1
9	207°41.1	269°44.2	·· 26.2	78°31.0	·· 19.5	131°52.8	·· 06.8	222°35.2	·· 35.0
10	222°43.6	284°43.5	25.6	93°33.3	19.6	146°55.6	06.8	237°37.6	35.0
11	237°46.0	299°42.9	25.0	108°35.7	19.6	161°58.4	06.8	252°40.0	34.9
12	252°48.5	314°42.2	S23°24.5	123°38.0	N21°19.7	177°01.2	N22°06.8	267°42.4	S08°34.9
13	267°51.0	329°41.6	23.9	138°40.3	19.8	192°04.1	06.7	282°44.8	34.9
14	282°53.4	344°41.0	23.4	153°42.6	19.9	207°06.9	06.7	297°47.2	34.8
15	297°55.9	359°40.3	·· 22.8	168°44.9	·· 20.0	222°09.7	·· 06.7	312°49.6	·· 34.8
16	312°58.3	14°39.7	22.2	183°47.2	20.0	237°12.6	06.7	327°52.0	34.8
17	328°00.8	29°39.0	21.7	198°49.6	20.1	252°15.4	06.6	342°54.4	34.7
18	343°03.3	44°38.4	S23°21.1	213°51.9	N21°20.2	267°18.2	N22°06.6	357°56.8	S08°34.7
19	358°05.7	59°37.8	20.5	228°54.2	20.3	282°21.0	06.6	12°59.2	34.6
20	13°08.2	74°37.1	20.0	243°56.5	20.4	297°23.9	06.5	28°01.6	34.6
21	28°10.7	89°36.5	·· 19.4	258°58.9	·· 20.5	312°26.7	·· 06.5	43°04.0	·· 34.6
22	43°13.1	104°35.8	18.8	274°01.2	20.5	327°29.5	06.5	58°06.3	34.5
23	58°15.6	119°35.2	18.3	289°03.5	20.6	342°32.4	06.5	73°08.7	34.5
Mer.pass. 19:08		ν -0.7′	d 0.5′	m -4.21	ν 2.3′	d 0.1′	m -0.55	ν 2.8′	d -0.0′ m -2.81	ν 2.4′	d 0.0′ m 0.95

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	73°18.1	134°34.6	S23°17.7	304°05.9	N21°20.7	357°35.2	N22°06.4	88°11.1	S08°34.5
1	88°20.5	149°33.9	17.1	319°08.2	20.8	12°38.0	06.4	103°13.5	34.4
2	103°23.0	164°33.3	16.5	334°10.5	20.9	27°40.9	06.4	118°15.9	34.4
3	118°25.5	179°32.7	·· 16.0	349°12.9	·· 21.0	42°43.7	·· 06.3	133°18.3	·· 34.3
4	133°27.9	194°32.0	15.4	4°15.2	21.1	57°46.5	06.3	148°20.7	34.3
5	148°30.4	209°31.4	14.8	19°17.5	21.1	72°49.3	06.3	163°23.1	34.3
6	163°32.8	224°30.8	S23°14.2	34°19.9	N21°21.2	87°52.2	N22°06.3	178°25.5	S08°34.2
7	178°35.3	239°30.1	13.7	49°22.2	21.3	102°55.0	06.2	193°27.9	34.2
8	193°37.8	254°29.5	13.1	64°24.5	21.4	117°57.8	06.2	208°30.3	34.2
9	208°40.2	269°28.9	·· 12.5	79°26.9	·· 21.5	133°00.7	·· 06.2	223°32.6	·· 34.1
10	223°42.7	284°28.2	11.9	94°29.2	21.6	148°03.5	06.1	238°35.0	34.1
11	238°45.2	299°27.6	11.3	109°31.6	21.7	163°06.3	06.1	253°37.4	34.0
12	253°47.6	314°27.0	S23°10.7	124°33.9	N21°21.8	178°09.1	N22°06.1	268°39.8	S08°34.0
13	268°50.1	329°26.3	10.2	139°36.3	21.8	193°12.0	06.1	283°42.2	34.0
14	283°52.6	344°25.7	09.6	154°38.6	21.9	208°14.8	06.0	298°44.6	33.9
15	298°55.0	359°25.1	·· 09.0	169°41.0	·· 22.0	223°17.6	·· 06.0	313°47.0	·· 33.9
16	313°57.5	14°24.5	08.4	184°43.3	22.1	238°20.5	06.0	328°49.4	33.9
17	329°00.0	29°23.8	07.8	199°45.7	22.2	253°23.3	05.9	343°51.8	33.8
18	344°02.4	44°23.2	S23°07.2	214°48.0	N21°22.3	268°26.1	N22°05.9	358°54.1	S08°33.8
19	359°04.9	59°22.6	06.6	229°50.4	22.4	283°29.0	05.9	13°56.5	33.7
20	14°07.3	74°22.0	06.0	244°52.8	22.5	298°31.8	05.9	28°58.9	33.7
21	29°09.8	89°21.4	·· 05.4	259°55.1	·· 22.6	313°34.6	·· 05.8	44°01.3	·· 33.7
22	44°12.3	104°20.7	04.8	274°57.5	22.7	328°37.4	05.8	59°03.7	33.6
23	59°14.7	119°20.1	04.2	289°59.8	22.8	343°40.3	05.8	74°06.1	33.6
Mer.pass. 19:04		ν -0.6′	d 0.6′	m -4.22	ν 2.3′	d 0.1′	m -0.57	ν 2.8′	d -0.0′ m -2.81	ν 2.4′	d 0.0′ m 0.95

Stars

	SHA	Dec
Alpheratz	357°34.8	29°13.9
Ankaa	353°07.0	-42°10.4
Schedar	349°30.9	56°40.7
Diphda	348°47.2	-17°51.0
Achernar	335°19.8	-57°06.8
Hamal	327°51.0	23°34.9
Polaris	313°37.1	89°22.3
Acamar	315°11.4	-40°12.3
Menkar	314°06.0	4°11.3
Mirfak	308°27.9	49°57.1
Aldebaran	290°39.4	16°33.6
Rigel	281°03.6	-8°10.3
Capella	280°21.6	46°01.4
Bellatrix	278°22.7	6°22.4
Elnath	278°01.6	28°37.7
Alnilam	275°37.5	-1°11.1
Betelgeuse	270°51.9	7°24.8
Canopus	263°51.9	-52°42.3
Sirius	258°26.0	-16°44.9
Adhara	255°05.6	-29°00.2
Procyon	244°50.7	5°09.7
Pollux	243°17.2	27°57.9
Avior	234°14.4	-59°35.0
Suhail	222°46.2	-43°31.7
Miaplacidus	221°37.9	-69°48.8
Alphard	217°47.7	-8°45.9
Regulus	207°34.5	11°50.7
Dubhe	193°41.2	61°36.7
Denebola	182°25.1	14°25.9
Gienah	175°43.8	-17°40.7
Acrux	173°00.6	-63°13.9
Gacrux	171°52.1	-57°14.9
Alioth	166°13.4	55°49.3
Spica	158°22.6	-11°17.4
Alkaid	152°52.4	49°11.2
Hadar	148°36.7	-60°29.4
Menkent	147°58.1	-36°29.4
Arcturus	145°48.3	19°03.1
Rigil Kent.	139°41.0	-60°56.1
Kochab	137°20.8	74°03.0
Zuben'ubi	136°56.4	-16°08.6
Alphecca	126°04.2	26°37.8
Antares	112°16.3	-26°29.2
Atria	107°11.2	-69°04.3
Sabik	102°03.3	-15°45.3
Shaula	96°10.9	-37°07.3
Rasalhague	95°59.0	12°32.5
Eltanin	90°42.8	51°29.2
Kaus Aust.	83°33.0	-34°22.4
Vega	80°33.7	38°48.5
Nunki	75°48.2	-26°16.0
Altair	62°00.3	8°56.1
Peacock	53°06.2	-56°39.5
Deneb	49°26.1	45°22.3
Enif	33°39.0	9°59.4
Al Na'ir	27°33.1	-46°50.6
Fomalhaut	15°14.6	-29°29.6
Scheat	13°45.3	28°13.3
Markab	13°30.0	15°20.5

Dec 02 Mon	SHA	Mer.pass
Venus	63°46.1	15:00
Mars	230°55.8	03:50
Jupiter	283°59.7	00:19
Saturn	14°56.4	18:12

Dec 03 Tue	SHA	Mer.pass
Venus	62°31.1	15:01
Mars	230°51.4	03:47
Jupiter	284°08.4	00:14
Saturn	14°54.8	18:08

Dec 04 Wed	SHA	Mer.pass
Venus	61°16.5	15:02
Mars	230°47.8	03:43
Jupiter	284°17.1	00:10
Saturn	14°53.1	18:04

Horizontal parallax	
Venus:	0.2
Mars:	0.2

DUT1 = UT1-UTC = +0.1774 sec ΔT = TT-UT1 = +69.0066 sec

2024 December 02 to Dec. 04 UT

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Mon	Sun GHA	Sun Dec	Moon GHA	Moon ν	Moon Dec	Moon d	Moon HP
0	182°39.3	S21°59.5	173°59.3	8.1′	S27°48.1	3.4′	55.6′
1	197°39.0	21°59.9	188°26.3	8.0′	27°51.5	3.3′	55.6′
2	212°38.8	22°00.2	202°53.3	7.9′	27°54.8	3.1′	55.6′
3	227°38.5	·· 00.6	217°20.3	7.9′	27°57.9	3.0′	55.6′
4	242°38.3	01.0	231°47.1	7.8′	28°00.9	2.8′	55.7′
5	257°38.0	01.3	246°14.0	7.8′	28°03.7	2.7′	55.7′
6	272°37.8	S22°01.7	260°40.7	7.7′	S28°06.4	2.5′	55.7′
7	287°37.6	02.0	275°07.4	7.7′	28°08.9	2.3′	55.7′
8	302°37.3	02.4	289°34.1	7.6′	28°11.2	2.2′	55.7′
9	317°37.1	·· 02.8	304°00.7	7.6′	28°13.4	2.1′	55.8′
10	332°36.8	03.1	318°27.3	7.5′	28°15.5	1.9′	55.8′
11	347°36.6	03.5	332°53.8	7.5′	28°17.4	1.7′	55.8′
12	2°36.3	S22°03.8	347°20.3	7.4′	S28°19.1	1.6′	55.8′
13	17°36.1	04.2	1°46.8	7.4′	28°20.7	1.4′	55.8′
14	32°35.9	04.6	16°13.2	7.4′	28°22.1	1.3′	55.9′
15	47°35.6	·· 04.9	30°39.5	7.3′	28°23.4	1.1′	55.9′
16	62°35.4	05.3	45°05.8	7.3′	28°24.5	0.9′	55.9′
17	77°35.1	05.6	59°32.1	7.3′	28°25.4	0.8′	55.9′
18	92°34.9	S22°06.0	73°58.4	7.2′	S28°26.2	0.6′	55.9′
19	107°34.6	06.3	88°24.6	7.2′	28°26.8	0.5′	56.0′
20	122°34.4	06.7	102°50.8	7.2′	28°27.3	0.3′	56.0′
21	137°34.1	·· 07.0	117°17.0	7.1′	28°27.6	0.1′	56.0′
22	152°33.9	07.4	131°43.1	7.1′	28°27.7	0.0′	56.0′
23	167°33.6	07.7	146°09.2	7.1′	28°27.7	0.2′	56.0′
	SD = 16.2′	d = -0.4′		SD = 15.2′			

Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	182°33.4	S22°08.1	160°35.3	7.1′	S28°27.5	0.3′	56.0′
1	197°33.1	08.4	175°01.4	7.1′	28°27.2	0.5′	56.1′
2	212°32.9	08.8	189°27.5	7.0′	28°26.7	0.7′	56.1′
3	227°32.6	·· 09.1	203°53.5	7.0′	28°26.0	0.8′	56.1′
4	242°32.4	09.5	218°19.5	7.0′	28°25.2	1.0′	56.1′
5	257°32.1	09.8	232°45.5	7.0′	28°24.2	1.1′	56.1′
6	272°31.9	S22°10.2	247°11.5	7.0′	S28°23.1	1.3′	56.2′
7	287°31.6	10.5	261°37.5	7.0′	28°21.8	1.5′	56.2′
8	302°31.4	10.9	276°03.5	7.0′	28°20.3	1.7′	56.2′
9	317°31.1	·· 11.2	290°29.5	7.0′	28°18.6	1.8′	56.2′
10	332°30.9	11.5	304°55.5	7.0′	28°16.8	1.9′	56.2′
11	347°30.6	11.9	319°21.4	7.0′	28°14.9	2.2′	56.3′
12	2°30.4	S22°12.2	333°47.4	7.0′	S28°12.7	2.3′	56.3′
13	17°30.1	12.6	348°13.4	7.0′	28°10.4	2.4′	56.3′
14	32°29.9	12.9	2°39.4	7.0′	28°08.0	2.6′	56.3′
15	47°29.6	·· 13.2	17°05.3	7.0′	28°05.4	2.8′	56.3′
16	62°29.4	13.6	31°31.3	7.0′	28°02.6	3.0′	56.4′
17	77°29.1	13.9	45°57.3	7.0′	27°59.6	3.1′	56.4′
18	92°28.9	S22°14.2	60°23.3	7.0′	S27°56.5	3.2′	56.4′
19	107°28.6	14.6	74°49.4	7.0′	27°53.3	3.5′	56.4′
20	122°28.4	14.9	89°15.4	7.1′	27°49.8	3.6′	56.4′
21	137°28.1	·· 15.3	103°41.5	7.1′	27°46.2	3.7′	56.5′
22	152°27.9	15.6	118°07.5	7.1′	27°42.5	4.0′	56.5′
23	167°27.6	15.9	132°33.6	7.1′	27°38.5	4.0′	56.5′
	SD = 16.2′	d = -0.3′		SD = 15.3′			

Wed	GHA	Dec	GHA	ν	Dec	d	HP
0	182°27.4	S22°16.2	146°59.7	7.1′	S27°34.5	4.3′	56.5′
1	197°27.1	16.6	161°25.9	7.2′	27°30.2	4.4′	56.5′
2	212°26.9	16.9	175°52.0	7.2′	27°25.8	4.5′	56.6′
3	227°26.6	·· 17.2	190°18.2	7.2′	27°21.3	4.7′	56.6′
4	242°26.3	17.6	204°44.4	7.2′	27°16.6	4.9′	56.6′
5	257°26.1	17.9	219°10.7	7.3′	27°11.7	5.1′	56.6′
6	272°25.8	S22°18.2	233°36.9	7.3′	S27°06.6	5.2′	56.6′
7	287°25.6	18.5	248°03.2	7.3′	27°01.4	5.3′	56.7′
8	302°25.3	18.9	262°29.6	7.4′	26°56.1	5.5′	56.7′
9	317°25.1	·· 19.2	276°56.0	7.4′	26°50.6	5.7′	56.7′
10	332°24.8	19.5	291°22.4	7.4′	26°44.9	5.8′	56.7′
11	347°24.6	19.8	305°48.8	7.5′	26°39.1	6.0′	56.7′
12	2°24.3	S22°20.2	320°15.3	7.5′	S26°33.1	6.1′	56.8′
13	17°24.0	20.5	334°41.8	7.6′	26°27.0	6.3′	56.8′
14	32°23.8	20.8	349°08.4	7.6′	26°20.7	6.4′	56.8′
15	47°23.5	·· 21.1	3°35.0	7.7′	26°14.3	6.6′	56.8′
16	62°23.3	21.5	18°01.7	7.7′	26°07.7	6.8′	56.9′
17	77°23.0	21.8	32°28.4	7.7′	26°00.9	6.9′	56.9′
18	92°22.7	S22°22.1	46°55.1	7.8′	S25°54.0	7.0′	56.9′
19	107°22.5	22.4	61°21.9	7.8′	25°47.0	7.2′	56.9′
20	122°22.2	22.7	75°48.8	7.9′	25°39.8	7.4′	56.9′
21	137°22.0	·· 23.0	90°15.7	7.9′	25°32.4	7.4′	57.0′
22	152°21.7	23.4	104°42.6	8.0′	25°25.0	7.7′	57.0′
23	167°21.5	23.7	119°09.6	8.0′	25°17.3	7.8′	57.0′
	SD = 16.2′	d = -0.3′		SD = 15.4′			

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

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

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 1-8%
02	10:37	10:25	11:50	12:53	00:25	
03	10:14	10:02	11:50	13:49	01:21	
04	09:49	09:37	11:50	14:45	02:17	

No IERS EOP prediction data available

December 05, 06, 07 UT (Thu., Fri., Sat.)

	Aries	Venus		Mars		Jupiter		Saturn	
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	74°17.2	134°19.5	S23°03.7	305°02.2	N21°22.8	358°43.1	N22°05.7	89°08.5	S08°33.5
1	89°19.7	149°18.9	03.1	320°04.6	22.9	13°45.9	05.7	104°10.9	33.5
2	104°22.1	164°18.3	02.5	335°06.9	23.0	28°48.8	05.7	119°13.3	33.5
3	119°24.6	179°17.6	·· 01.9	350°09.3	·· 23.1	43°51.6	·· 05.7	134°15.6	·· 33.4
4	134°27.1	194°17.0	01.3	5°11.7	23.2	58°54.4	05.6	149°18.0	33.4
5	149°29.5	209°16.4	00.6	20°14.1	23.3	73°57.3	05.6	164°20.4	33.3
6	164°32.0	224°15.8	S23°00.0	35°16.4	N21°23.4	89°00.1	N22°05.6	179°22.8	S08°33.3
7	179°34.5	239°15.2	22°59.4	50°18.8	23.5	104°02.9	05.6	194°25.2	33.3
8	194°36.9	254°14.6	58.8	65°21.2	23.6	119°05.7	05.5	209°27.6	33.2
9	209°39.4	269°13.9	·· 58.2	80°23.6	·· 23.7	134°08.6	·· 05.5	224°30.0	·· 33.2
10	224°41.8	284°13.3	57.6	95°25.9	23.8	149°11.4	05.5	239°32.3	33.1
11	239°44.3	299°12.7	57.0	110°28.3	23.9	164°14.2	05.4	254°34.7	33.1
12	254°46.8	314°12.1	S22°56.4	125°30.7	N21°24.0	179°17.1	N22°05.4	269°37.1	S08°33.1
13	269°49.2	329°11.5	55.8	140°33.1	24.1	194°19.9	05.4	284°39.5	33.0
14	284°51.7	344°10.9	55.2	155°35.5	24.2	209°22.7	05.4	299°41.9	33.0
15	299°54.2	359°10.3	·· 54.6	170°37.8	·· 24.3	224°25.6	·· 05.3	314°44.3	·· 32.9
16	314°56.6	14°09.7	54.0	185°40.2	24.4	239°28.4	05.3	329°46.7	32.9
17	329°59.1	29°09.1	53.3	200°42.6	24.5	254°31.2	05.3	344°49.0	32.9
18	345°01.6	44°08.4	S22°52.7	215°45.0	N21°24.6	269°34.1	N22°05.2	359°51.4	S08°32.8
19	0°04.0	59°07.8	52.1	230°47.4	24.7	284°36.9	05.2	14°53.8	32.8
20	15°06.5	74°07.2	51.5	245°49.8	24.8	299°39.7	05.2	29°56.2	32.7
21	30°08.9	89°06.6	·· 50.9	260°52.2	·· 24.9	314°42.5	·· 05.2	44°58.6	·· 32.7
22	45°11.4	104°06.0	50.2	275°54.6	25.0	329°45.4	05.1	60°01.0	32.7
23	60°13.9	119°05.4	49.6	290°57.0	25.1	344°48.2	05.1	75°03.3	32.6
Mer.pass. 19:00		ν -0.6′ d 0.6′	m -4.22	ν 2.4′ d 0.1′	m -0.59	ν 2.8′ d -0.0′	m -2.81	ν 2.4′ d 0.0′	m 0.96

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	75°16.3	134°04.8	S22°49.0	305°59.4	N21°25.2	359°51.0	N22°05.1	90°05.7	S08°32.6
1	90°18.8	149°04.2	48.4	321°01.8	25.3	14°53.9	05.0	105°08.1	32.5
2	105°21.3	164°03.6	47.8	336°04.2	25.4	29°56.7	05.0	120°10.5	32.5
3	120°23.7	179°03.0	·· 47.1	351°06.6	·· 25.5	44°59.5	·· 05.0	135°12.9	·· 32.5
4	135°26.2	194°02.4	46.5	6°09.0	25.6	60°02.4	04.9	150°15.3	32.4
5	150°28.7	209°01.8	45.9	21°11.4	25.7	75°05.2	04.9	165°17.6	32.4
6	165°31.1	224°01.2	S22°45.2	36°13.8	N21°25.8	90°08.0	N22°04.9	180°20.0	S08°32.3
7	180°33.6	239°00.6	44.6	51°16.2	25.9	105°10.8	04.9	195°22.4	32.3
8	195°36.1	254°00.0	44.0	66°18.6	26.0	120°13.7	04.8	210°24.8	32.3
9	210°38.5	268°59.4	·· 43.4	81°21.0	·· 26.1	135°16.5	·· 04.8	225°27.2	·· 32.2
10	225°41.0	283°58.8	42.7	96°23.4	26.2	150°19.3	04.8	240°29.6	32.2
11	240°43.4	298°58.2	42.1	111°25.9	26.3	165°22.2	04.7	255°31.9	32.1
12	255°45.9	313°57.6	S22°41.5	126°28.3	N21°26.4	180°25.0	N22°04.7	270°34.3	S08°32.1
13	270°48.4	328°57.0	40.8	141°30.7	26.5	195°27.8	04.7	285°36.7	32.0
14	285°50.8	343°56.4	40.2	156°33.1	26.7	210°30.7	04.7	300°39.1	32.0
15	300°53.3	358°55.9	·· 39.5	171°35.5	·· 26.8	225°33.5	·· 04.6	315°41.5	·· 32.0
16	315°55.8	13°55.3	38.9	186°38.0	26.9	240°36.3	04.6	330°43.8	31.9
17	330°58.2	28°54.7	38.3	201°40.4	27.0	255°39.2	04.6	345°46.2	31.9
18	346°00.7	43°54.1	S22°37.6	216°42.8	N21°27.1	270°42.0	N22°04.5	0°48.6	S08°31.8
19	1°03.2	58°53.5	37.0	231°45.2	27.2	285°44.8	04.5	15°51.0	31.8
20	16°05.6	73°52.9	36.3	246°47.7	27.3	300°47.6	04.5	30°53.4	31.8
21	31°08.1	88°52.3	·· 35.7	261°50.1	·· 27.4	315°50.5	·· 04.5	45°55.8	·· 31.7
22	46°10.6	103°51.7	35.1	276°52.5	27.5	330°53.3	04.4	60°58.1	31.7
23	61°13.0	118°51.1	34.4	291°54.9	27.6	345°56.1	04.4	76°00.5	31.6
Mer.pass. 18:56		ν -0.6′ d 0.6′	m -4.23	ν 2.4′ d 0.1′	m -0.61	ν 2.8′ d -0.0′	m -2.81	ν 2.4′ d 0.0′	m 0.96

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	76°15.5	133°50.6	S22°33.8	306°57.4	N21°27.7	0°59.0	N22°04.4	91°02.9	S08°31.6
1	91°17.9	148°50.0	33.1	321°59.8	27.9	16°01.8	04.3	106°05.3	31.5
2	106°20.4	163°49.4	32.5	337°02.3	28.0	31°04.6	04.3	121°07.7	31.5
3	121°22.9	178°48.8	·· 31.8	352°04.7	·· 28.1	46°07.5	·· 04.3	136°10.0	·· 31.5
4	136°25.3	193°48.2	31.2	7°07.1	28.2	61°10.3	04.3	151°12.4	31.4
5	151°27.8	208°47.6	30.5	22°09.6	28.3	76°13.1	04.2	166°14.8	31.4
6	166°30.3	223°47.1	S22°29.9	37°12.0	N21°28.4	91°16.0	N22°04.2	181°17.2	S08°31.3
7	181°32.7	238°46.5	29.2	52°14.5	28.5	106°18.8	04.2	196°19.5	31.3
8	196°35.2	253°45.9	28.5	67°16.9	28.6	121°21.6	04.1	211°21.9	31.2
9	211°37.7	268°45.3	·· 27.9	82°19.3	·· 28.8	136°24.4	·· 04.1	226°24.3	·· 31.2
10	226°40.1	283°44.7	27.2	97°21.8	28.9	151°27.3	04.1	241°26.7	31.2
11	241°42.6	298°44.2	26.6	112°24.2	29.0	166°30.1	04.1	256°29.1	31.1
12	256°45.1	313°43.6	S22°25.9	127°26.7	N21°29.1	181°32.9	N22°04.0	271°31.4	S08°31.1
13	271°47.5	328°43.0	25.3	142°29.1	29.2	196°35.8	04.0	286°33.8	31.0
14	286°50.0	343°42.4	24.6	157°31.6	29.3	211°38.6	04.0	301°36.2	31.0
15	301°52.4	358°41.9	·· 23.9	172°34.0	·· 29.5	226°41.4	·· 03.9	316°38.6	·· 30.9
16	316°54.9	13°41.3	23.3	187°36.5	29.6	241°44.3	03.9	331°40.9	30.9
17	331°57.4	28°40.7	22.6	202°39.0	29.7	256°47.1	03.9	346°43.3	30.9
18	346°59.8	43°40.1	S22°21.9	217°41.4	N21°29.8	271°49.9	N22°03.9	1°45.7	S08°30.8
19	2°02.3	58°39.6	21.3	232°43.9	29.9	286°52.8	03.8	16°48.1	30.8
20	17°04.8	73°39.0	20.6	247°46.3	30.0	301°55.6	03.8	31°50.5	30.7
21	32°07.2	88°38.4	·· 19.9	262°48.8	·· 30.2	316°58.4	·· 03.8	46°52.8	·· 30.7
22	47°09.7	103°37.9	19.3	277°51.3	30.3	332°01.2	03.7	61°55.2	30.6
23	62°12.2	118°37.3	18.6	292°53.7	30.4	347°04.1	03.7	76°57.6	30.6
Mer.pass. 18:52		ν -0.6′ d 0.6′	m -4.24	ν 2.4′ d 0.1′	m -0.64	ν 2.8′ d -0.0′	m -2.81	ν 2.4′ d 0.0′	m 0.97

Stars

	SHA	Dec
Alpheratz	357°34.8	29°13.9
Ankaa	353°07.1	-42°10.4
Schedar	349°30.9	56°40.7
Diphda	348°47.2	-17°51.1
Achernar	335°19.8	-57°06.8
Hamal	327°51.0	23°34.9
Polaris	313°37.5	89°22.3
Acamar	315°11.4	-40°12.3
Menkar	314°05.9	4°11.3
Mirfak	308°27.9	49°57.1
Aldebaran	290°39.4	16°33.6
Rigel	281°03.6	-8°10.3
Capella	280°21.5	46°01.4
Bellatrix	278°22.6	6°22.4
Elnath	278°01.6	28°37.7
Alnilam	275°37.5	-1°11.1
Betelgeuse	270°51.8	7°24.7
Canopus	263°51.9	-52°42.3
Sirius	258°26.0	-16°44.9
Adhara	255°05.6	-29°00.2
Procyon	244°50.7	5°09.7
Pollux	243°17.1	27°57.9
Avior	234°14.4	-59°35.1
Suhail	222°46.2	-43°31.7
Miaplacidus	221°37.9	-69°48.8
Alphard	217°47.7	-8°45.9
Regulus	207°34.5	11°50.7
Dubhe	193°41.1	61°36.7
Denebola	182°25.1	14°25.9
Gienah	175°43.8	-17°40.7
Acrux	173°00.5	-63°13.9
Gacrux	171°52.0	-57°14.9
Alioth	166°13.3	55°49.2
Spica	158°22.6	-11°17.4
Alkaid	152°52.4	49°11.1
Hadar	148°36.7	-60°29.4
Menkent	147°58.0	-36°29.4
Arcturus	145°48.3	19°03.1
Rigil Kent.	139°41.0	-60°56.1
Kochab	137°20.8	74°03.0
Zuben'ubi	136°56.4	-16°08.6
Alphecca	126°04.2	26°37.8
Antares	112°16.3	-26°29.2
Atria	107°11.2	-69°04.3
Sabik	102°03.2	-15°45.3
Shaula	96°10.9	-37°07.3
Rasalhague	95°59.0	12°32.5
Eltanin	90°42.8	51°29.2
Kaus Aust.	83°33.0	-34°22.4
Vega	80°33.7	38°48.5
Nunki	75°48.2	-26°16.0
Altair	62°00.3	8°56.1
Peacock	53°06.2	-56°39.5
Deneb	49°26.2	45°22.3
Enif	33°39.0	9°59.4
Al Na'ir	27°33.1	-46°50.6
Fomalhaut	15°14.6	-29°29.6
Scheat	13°45.3	28°13.3
Markab	13°30.0	15°20.5

Dec 05 Thu	SHA	Mer.pass
Venus	60°02.3	15:03
Mars	230°45.0	03:39
Jupiter	284°25.9	00:05
Saturn	14°51.3	18:01

Dec 06 Fri	SHA	Mer.pass
Venus	58°48.5	15:04
Mars	230°43.0	03:35
Jupiter	284°34.7	00:01
Saturn	14°49.4	17:57

Dec 07 Sat	SHA	Mer.pass
Venus	57°35.1	15:05
Mars	230°41.9	03:32
Jupiter	284°43.5	23:52
Saturn	14°47.4	17:53

Horizontal parallax	
Venus:	0.2
Mars:	0.2

h	Sun		Moon				
Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	182°21.2	S22°24.0	133°36.6	8.1′	S25°09.5	7.9′	57.0′
1	197°20.9	24.3	148°03.8	8.2′	25°01.6	8.1′	57.0′
2	212°20.7	24.6	162°30.9	8.2′	24°53.5	8.2′	57.1′
3	227°20.4	·· 24.9	176°58.1	8.3′	24°45.3	8.4′	57.1′
4	242°20.2	25.2	191°25.4	8.3′	24°36.9	8.5′	57.1′
5	257°19.9	25.5	205°52.7	8.4′	24°28.4	8.6′	57.1′
6	272°19.6	S22°25.8	220°20.1	8.4′	S24°19.8	8.8′	57.1′
7	287°19.4	26.2	234°47.5	8.5′	24°11.0	8.9′	57.2′
8	302°19.1	26.5	249°15.0	8.6′	24°02.1	9.1′	57.2′
9	317°18.8	·· 26.8	263°42.6	8.6′	23°53.0	9.2′	57.2′
10	332°18.6	27.1	278°10.2	8.7′	23°43.8	9.3′	57.2′
11	347°18.3	27.4	292°37.9	8.7′	23°34.5	9.5′	57.2′
12	2°18.1	S22°27.7	307°05.6	8.8′	S23°25.0	9.6′	57.3′
13	17°17.8	28.0	321°33.4	8.9′	23°15.4	9.7′	57.3′
14	32°17.5	28.3	336°01.3	8.9′	23°05.7	9.9′	57.3′
15	47°17.3	·· 28.6	350°29.2	9.0′	22°55.8	10.0′	57.3′
16	62°17.0	28.9	4°57.2	9.0′	22°45.8	10.1′	57.3′
17	77°16.7	29.2	19°25.3	9.1′	22°35.7	10.3′	57.4′
18	92°16.5	S22°29.5	33°53.4	9.2′	S22°25.4	10.4′	57.4′
19	107°16.2	29.8	48°21.5	9.2′	22°15.0	10.5′	57.4′
20	122°16.0	30.1	62°49.8	9.3′	22°04.5	10.6′	57.4′
21	137°15.7	·· 30.4	77°18.1	9.4′	21°53.9	10.8′	57.4′
22	152°15.4	30.7	91°46.4	9.4′	21°43.1	10.9′	57.5′
23	167°15.2	31.0	106°14.9	9.5′	21°32.2	11.0′	57.5′
	SD = 16.2′	d = -0.3′	SD = 15.5′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	182°14.9	S22°31.3	120°43.4	9.6′	S21°21.2	11.1′	57.5′
1	197°14.6	31.6	135°11.9	9.6′	21°10.1	11.3′	57.5′
2	212°14.4	31.9	149°40.5	9.7′	20°58.8	11.3′	57.6′
3	227°14.1	·· 32.2	164°09.2	9.7′	20°47.5	11.5′	57.6′
4	242°13.8	32.4	178°38.0	9.8′	20°36.0	11.6′	57.6′
5	257°13.6	32.7	193°06.8	9.9′	20°24.4	11.7′	57.6′
6	272°13.3	S22°33.0	207°35.7	9.9′	S20°12.7	11.9′	57.6′
7	287°13.0	33.3	222°04.6	10.0′	20°00.8	11.9′	57.7′
8	302°12.8	33.6	236°33.6	10.1′	19°48.9	12.1′	57.7′
9	317°12.5	·· 33.9	251°02.6	10.1′	19°36.8	12.1′	57.7′
10	332°12.2	34.2	265°31.8	10.2′	19°24.7	12.3′	57.7′
11	347°12.0	34.5	280°01.0	10.2′	19°12.4	12.4′	57.7′
12	2°11.7	S22°34.8	294°30.2	10.3′	S19°00.0	12.5′	57.8′
13	17°11.4	35.0	308°59.5	10.4′	18°47.5	12.6′	57.8′
14	32°11.2	35.3	323°28.9	10.4′	18°34.9	12.7′	57.8′
15	47°10.9	·· 35.6	337°58.3	10.5′	18°22.2	12.8′	57.8′
16	62°10.6	35.9	352°27.8	10.5′	18°09.4	12.9′	57.8′
17	77°10.4	36.2	6°57.3	10.6′	17°56.5	13.0′	57.9′
18	92°10.1	S22°36.5	21°26.9	10.7′	S17°43.5	13.1′	57.9′
19	107°09.8	36.7	35°56.6	10.7′	17°30.4	13.2′	57.9′
20	122°09.6	37.0	50°26.3	10.8′	17°17.2	13.3′	57.9′
21	137°09.3	·· 37.3	64°56.1	10.8′	17°03.9	13.4′	57.9′
22	152°09.0	37.6	79°25.9	10.9′	16°50.5	13.5′	58.0′
23	167°08.7	37.9	93°55.8	10.9′	16°37.0	13.6′	58.0′
	SD = 16.2′	d = -0.3′	SD = 15.7′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	182°08.5	S22°38.1	108°25.8	11.0′	S16°23.4	13.7′	58.0′
1	197°08.2	38.4	122°55.8	11.1′	16°09.7	13.8′	58.0′
2	212°07.9	38.7	137°25.8	11.1′	15°55.9	13.8′	58.1′
3	227°07.7	·· 39.0	151°55.9	11.2′	15°42.1	14.0′	58.1′
4	242°07.4	39.2	166°26.1	11.2′	15°28.1	14.0′	58.1′
5	257°07.1	39.5	180°56.3	11.3′	15°14.1	14.1′	58.1′
6	272°06.8	S22°39.8	195°26.5	11.3′	S15°00.0	14.2′	58.1′
7	287°06.6	40.0	209°56.8	11.4′	14°45.8	14.3′	58.2′
8	302°06.3	40.3	224°27.2	11.4′	14°31.5	14.4′	58.2′
9	317°06.0	·· 40.6	238°57.6	11.5′	14°17.1	14.5′	58.2′
10	332°05.8	40.9	253°28.1	11.5′	14°02.6	14.5′	58.2′
11	347°05.5	41.1	267°58.6	11.5′	13°48.1	14.6′	58.2′
12	2°05.2	S22°41.4	282°29.1	11.6′	S13°33.5	14.7′	58.3′
13	17°04.9	41.7	296°59.7	11.6′	13°18.8	14.8′	58.3′
14	32°04.7	41.9	311°30.3	11.7′	13°04.0	14.8′	58.3′
15	47°04.4	·· 42.2	326°01.0	11.7′	12°49.2	14.9′	58.3′
16	62°04.1	42.4	340°31.7	11.8′	12°34.3	15.0′	58.3′
17	77°03.9	42.7	355°02.5	11.8′	12°19.3	15.1′	58.4′
18	92°03.6	S22°43.0	9°33.3	11.8′	S12°04.2	15.1′	58.4′
19	107°03.3	43.2	24°04.1	11.9′	11°49.1	15.2′	58.4′
20	122°03.0	43.5	38°35.0	11.9′	11°33.9	15.3′	58.4′
21	137°02.8	·· 43.8	53°05.9	11.9′	11°18.6	15.3′	58.4′
22	152°02.5	44.0	67°36.8	12.0′	11°03.3	15.4′	58.5′
23	167°02.2	44.3	82°07.8	12.0′	10°47.9	15.5′	58.5′
	SD = 16.2′	d = -0.3′	SD = 15.8′				

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

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

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 4-6 14-32%
05	09:25	09:12	11:51	15:39	03:13	
06	09:00	08:47	11:51	16:31	04:06	
07	08:34	08:21	11:52	17:21	04:56	

December 08, 09, 10 UT (Sun., Mon., Tue.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	77°14.6	133°36.7	S22°17.9	307°56.2	N21°30.5	2°06.9	N22°03.7	92°00.0	S08°30.6
1	92°17.1	148°36.2	17.3	322°58.7	30.6	17°09.7	03.6	107°02.3	30.5
2	107°19.5	163°35.6	16.6	338°01.1	30.8	32°12.6	03.6	122°04.7	30.5
3	122°22.0	178°35.0	·· 15.9	353°03.6	·· 30.9	47°15.4	·· 03.6	137°07.1	·· 30.4
4	137°24.5	193°34.5	15.2	8°06.1	31.0	62°18.2	03.6	152°09.5	30.4
5	152°26.9	208°33.9	14.6	23°08.6	31.1	77°21.1	03.5	167°11.8	30.3
6	167°29.4	223°33.3	S22°13.9	38°11.0	N21°31.2	92°23.9	N22°03.5	182°14.2	S08°30.3
7	182°31.9	238°32.8	13.2	53°13.5	31.4	107°26.7	03.5	197°16.6	30.2
8	197°34.3	253°32.2	12.5	68°16.0	31.5	122°29.6	03.4	212°19.0	30.2
9	212°36.8	268°31.6	·· 11.8	83°18.5	·· 31.6	137°32.4	·· 03.4	227°21.3	·· 30.2
10	227°39.3	283°31.1	11.2	98°21.0	31.7	152°35.2	03.4	242°23.7	30.1
11	242°41.7	298°30.5	10.5	113°23.4	31.9	167°38.0	03.4	257°26.1	30.1
12	257°44.2	313°30.0	S22°09.8	128°25.9	N21°32.0	182°40.9	N22°03.3	272°28.5	S08°30.0
13	272°46.7	328°29.4	09.1	143°28.4	32.1	197°43.7	03.3	287°30.8	30.0
14	287°49.1	343°28.9	08.4	158°30.9	32.2	212°46.5	03.3	302°33.2	29.9
15	302°51.6	358°28.3	·· 07.7	173°33.4	·· 32.4	227°49.4	·· 03.2	317°35.6	·· 29.9
16	317°54.0	13°27.7	07.1	188°35.9	32.5	242°52.2	03.2	332°37.9	29.8
17	332°56.5	28°27.2	06.4	203°38.4	32.6	257°55.0	03.2	347°40.3	29.8
18	347°59.0	43°26.6	S22°05.7	218°40.9	N21°32.7	272°57.9	N22°03.2	2°42.7	S08°29.8
19	3°01.4	58°26.1	05.0	233°43.4	32.9	288°00.7	03.1	17°45.1	29.7
20	18°03.9	73°25.5	04.3	248°45.9	33.0	303°03.5	03.1	32°47.4	29.7
21	33°06.4	88°25.0	·· 03.6	263°48.4	·· 33.1	318°06.3	·· 03.1	47°49.8	·· 29.6
22	48°08.8	103°24.4	02.9	278°50.9	33.2	333°09.2	03.0	62°52.2	29.6
23	63°11.3	118°23.9	02.2	293°53.4	33.4	348°12.0	03.0	77°54.6	29.5
Mer.pass. 18:48		ν -0.6′	d 0.7′	m -4.25	ν 2.5′	d 0.1′	m -0.66	ν 2.8′	d -0.0′ m -2.81	ν 2.4′	d 0.0′ m 0.97

Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	78°13.8	133°23.3	S22°01.5	308°55.9	N21°33.5	3°14.8	N22°03.0	92°56.9	S08°29.5
1	93°16.2	148°22.8	00.8	323°58.4	33.6	18°17.7	02.9	107°59.3	29.4
2	108°18.7	163°22.2	22°00.1	339°00.9	33.8	33°20.5	02.9	123°01.7	29.4
3	123°21.2	178°21.7	21°59.4	354°03.4	·· 33.9	48°23.3	·· 02.9	138°04.0	·· 29.3
4	138°23.6	193°21.1	58.7	9°05.9	34.0	63°26.2	02.9	153°06.4	29.3
5	153°26.1	208°20.6	58.0	24°08.4	34.2	78°29.0	02.8	168°08.8	29.3
6	168°28.5	223°20.0	S21°57.3	39°10.9	N21°34.3	93°31.8	N22°02.8	183°11.2	S08°29.2
7	183°31.0	238°19.5	56.6	54°13.4	34.4	108°34.7	02.8	198°13.5	29.2
8	198°33.5	253°19.0	55.9	69°15.9	34.5	123°37.5	02.7	213°15.9	29.1
9	213°35.9	268°18.4	·· 55.2	84°18.5	·· 34.7	138°40.3	·· 02.7	228°18.3	·· 29.1
10	228°38.4	283°17.9	54.5	99°21.0	34.8	153°43.1	02.7	243°20.6	29.0
11	243°40.9	298°17.3	53.8	114°23.5	34.9	168°46.0	02.7	258°23.0	29.0
12	258°43.3	313°16.8	S21°53.1	129°26.0	N21°35.1	183°48.8	N22°02.6	273°25.4	S08°28.9
13	273°45.8	328°16.3	52.4	144°28.5	35.2	198°51.6	02.6	288°27.7	28.9
14	288°48.3	343°15.7	51.7	159°31.1	35.3	213°54.5	02.6	303°30.1	28.8
15	303°50.7	358°15.2	·· 51.0	174°33.6	·· 35.5	228°57.3	·· 02.5	318°32.5	·· 28.8
16	318°53.2	13°14.6	50.3	189°36.1	35.6	244°00.1	02.5	333°34.9	28.7
17	333°55.6	28°14.1	49.6	204°38.6	35.7	259°03.0	02.5	348°37.2	28.7
18	348°58.1	43°13.6	S21°48.8	219°41.2	N21°35.9	274°05.8	N22°02.4	3°39.6	S08°28.7
19	4°00.6	58°13.0	48.1	234°43.7	36.0	289°08.6	02.4	18°42.0	28.6
20	19°03.0	73°12.5	47.4	249°46.2	36.2	304°11.4	02.4	33°44.3	28.6
21	34°05.5	88°12.0	·· 46.7	264°48.8	·· 36.3	319°14.3	·· 02.4	48°46.7	·· 28.5
22	49°08.0	103°11.4	46.0	279°51.3	36.4	334°17.1	02.3	63°49.1	28.5
23	64°10.4	118°10.9	45.3	294°53.8	36.6	349°19.9	02.3	78°51.4	28.4
Mer.pass. 18:44		ν -0.5′	d 0.7′	m -4.25	ν 2.5′	d 0.1′	m -0.68	ν 2.8′	d -0.0′ m -2.81	ν 2.4′	d 0.0′ m 0.98

Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	79°12.9	133°10.4	S21°44.6	309°56.4	N21°36.7	4°22.8	N22°02.3	93°53.8	S08°28.4
1	94°15.4	148°09.8	43.8	324°58.9	36.8	19°25.6	02.2	108°56.2	28.3
2	109°17.8	163°09.3	43.1	340°01.5	37.0	34°28.4	02.2	123°58.5	28.3
3	124°20.3	178°08.8	·· 42.4	355°04.0	·· 37.1	49°31.2	·· 02.2	139°00.9	·· 28.2
4	139°22.8	193°08.3	41.7	10°06.5	37.3	64°34.1	02.2	154°03.3	28.2
5	154°25.2	208°07.7	41.0	25°09.1	37.4	79°36.9	02.1	169°05.6	28.1
6	169°27.7	223°07.2	S21°40.2	40°11.6	N21°37.5	94°39.7	N22°02.1	184°08.0	S08°28.1
7	184°30.1	238°06.7	39.5	55°14.2	37.7	109°42.6	02.1	199°10.4	28.0
8	199°32.6	253°06.2	38.8	70°16.7	37.8	124°45.4	02.0	214°12.7	28.0
9	214°35.1	268°05.6	·· 38.0	85°19.3	·· 38.0	139°48.2	·· 02.0	229°15.1	·· 27.9
10	229°37.5	283°05.1	37.3	100°21.8	38.1	154°51.1	02.0	244°17.5	27.9
11	244°40.0	298°04.6	36.6	115°24.4	38.2	169°53.9	01.9	259°19.8	27.8
12	259°42.5	313°04.1	S21°35.9	130°27.0	N21°38.4	184°56.7	N22°01.9	274°22.2	S08°27.8
13	274°44.9	328°03.5	35.1	145°29.5	38.5	199°59.5	01.9	289°24.6	27.8
14	289°47.4	343°03.0	34.4	160°32.1	38.7	215°02.4	01.9	304°26.9	27.7
15	304°49.9	358°02.5	·· 33.7	175°34.6	·· 38.8	230°05.2	·· 01.8	319°29.3	·· 27.7
16	319°52.3	13°02.0	32.9	190°37.2	38.9	245°08.0	01.8	334°31.7	27.6
17	334°54.8	28°01.5	32.2	205°39.8	39.1	260°10.9	01.8	349°34.0	27.6
18	349°57.3	43°01.0	S21°31.5	220°42.3	N21°39.2	275°13.7	N22°01.7	4°36.4	S08°27.5
19	4°59.7	58°00.4	30.7	235°44.9	39.4	290°16.5	01.7	19°38.8	27.5
20	20°02.2	72°59.9	30.0	250°47.5	39.5	305°19.3	01.7	34°41.1	27.4
21	35°04.6	87°59.4	·· 29.3	265°50.0	·· 39.7	320°22.2	·· 01.7	49°43.5	·· 27.4
22	50°07.1	102°58.9	28.5	280°52.6	39.8	335°25.0	01.6	64°45.9	27.3
23	65°09.6	117°58.4	27.8	295°55.2	40.0	350°27.8	01.6	79°48.2	27.3
Mer.pass. 18:40		ν -0.5′	d 0.7′	m -4.26	ν 2.5′	d 0.1′	m -0.70	ν 2.8′	d -0.0′ m -2.81	ν 2.4′	d 0.0′ m 0.98

Stars

	SHA	Dec
Alpheratz	357°34.8	29°13.9
Ankaa	353°07.1	-42°10.4
Schedar	349°30.9	56°40.7
Diphda	348°47.2	-17°51.1
Achernar	335°19.9	-57°06.8
Hamal	327°51.0	23°34.9
Polaris	313°38.1	89°22.3
Acamar	315°11.5	-40°12.4
Menkar	314°05.9	4°11.3
Mirfak	308°27.9	49°57.1
Aldebaran	290°39.4	16°33.6
Rigel	281°03.6	-8°10.3
Capella	280°21.5	46°01.4
Bellatrix	278°22.6	6°22.4
Elnath	278°01.6	28°37.7
Alnilam	275°37.5	-1°11.1
Betelgeuse	270°51.8	7°24.7
Canopus	263°51.9	-52°42.4
Sirius	258°26.0	-16°44.9
Adhara	255°05.6	-29°00.2
Procyon	244°50.6	5°09.7
Pollux	243°17.1	27°57.9
Avior	234°14.3	-59°35.1
Suhail	222°46.1	-43°31.7
Miaplacidus	221°37.8	-69°48.8
Alphard	217°47.7	-8°45.9
Regulus	207°34.4	11°50.7
Dubhe	193°41.1	61°36.7
Denebola	182°25.1	14°25.9
Gienah	175°43.8	-17°40.7
Acrux	173°00.5	-63°13.9
Gacrux	171°52.0	-57°14.9
Alioth	166°13.3	55°49.2
Spica	158°22.6	-11°17.4
Alkaid	152°52.4	49°11.1
Hadar	148°36.6	-60°29.4
Menkent	147°58.0	-36°29.4
Arcturus	145°48.2	19°03.1
Rigil Kent.	139°41.0	-60°56.1
Kochab	137°20.8	74°02.9
Zuben'ubi	136°56.4	-16°08.6
Alphecca	126°04.2	26°37.8
Antares	112°16.3	-26°29.2
Atria	107°11.2	-69°04.3
Sabik	102°03.2	-15°45.3
Shaula	96°10.9	-37°07.3
Rasalhague	95°59.0	12°32.5
Eltanin	90°42.8	51°29.1
Kaus Aust.	83°33.0	-34°22.4
Vega	80°33.7	38°48.4
Nunki	75°48.2	-26°16.0
Altair	62°00.3	8°56.1
Peacock	53°06.3	-56°39.5
Deneb	49°26.2	45°22.3
Enif	33°39.0	9°59.4
Al Na'ir	27°33.1	-46°50.6
Fomalhaut	15°14.6	-29°29.6
Scheat	13°45.3	28°13.3
Markab	13°30.0	15°20.5

Dec 08 Sun	SHA	Mer.pass
Venus	56°22.1	15:06
Mars	230°41.6	03:28
Jupiter	284°52.3	23:47
Saturn	14°45.3	17:49

Dec 09 Mon	SHA	Mer.pass
Venus	55°09.6	15:07
Mars	230°42.1	03:24
Jupiter	285°01.1	23:43
Saturn	14°43.2	17:45

Dec 10 Tue	SHA	Mer.pass
Venus	53°57.5	15:08
Mars	230°43.5	03:20
Jupiter	285°09.9	23:38
Saturn	14°40.9	17:42

Horizontal parallax	
Venus:	0.2
Mars:	0.2

h	Sun		Moon				
Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	182°01.9	S22°44.5	96°38.8	12.0′	S10°32.4	15.5′	58.5′
1	197°01.7	44.8	111°09.8	12.1′	10°16.9	15.6′	58.5′
2	212°01.4	45.0	125°40.9	12.1′	10°01.3	15.6′	58.5′
3	227°01.1	·· 45.3	140°12.0	12.1′	09°45.7	15.7′	58.6′
4	242°00.8	45.6	154°43.1	12.2′	09°30.0	15.8′	58.6′
5	257°00.6	45.8	169°14.3	12.2′	09°14.2	15.8′	58.6′
6	272°00.3	S22°46.1	183°45.5	12.2′	S08°58.4	15.8′	58.6′
7	287°00.0	46.3	198°16.7	12.2′	08°42.6	16.0′	58.6′
8	301°59.7	46.6	212°47.9	12.3′	08°26.6	15.9′	58.7′
9	316°59.5	·· 46.8	227°19.2	12.3′	08°10.7	16.1′	58.7′
10	331°59.2	47.1	241°50.4	12.3′	07°54.6	16.0′	58.7′
11	346°58.9	47.3	256°21.7	12.3′	07°38.6	16.1′	58.7′
12	1°58.6	S22°47.6	270°53.0	12.3′	S07°22.5	16.2′	58.7′
13	16°58.3	47.8	285°24.4	12.3′	07°06.3	16.2′	58.8′
14	31°58.1	48.1	299°55.7	12.4′	06°50.1	16.3′	58.8′
15	46°57.8	·· 48.3	314°27.1	12.4′	06°33.8	16.3′	58.8′
16	61°57.5	48.6	328°58.4	12.4′	06°17.5	16.3′	58.8′
17	76°57.2	48.8	343°29.8	12.4′	06°01.2	16.4′	58.8′
18	91°57.0	S22°49.0	358°01.2	12.4′	S05°44.8	16.4′	58.9′
19	106°56.7	49.3	12°32.6	12.4′	05°28.4	16.5′	58.9′
20	121°56.4	49.5	27°04.0	12.4′	05°11.9	16.5′	58.9′
21	136°56.1	·· 49.8	41°35.4	12.4′	04°55.4	16.5′	58.9′
22	151°55.8	50.0	56°06.9	12.4′	04°38.9	16.6′	58.9′
23	166°55.6	50.3	70°38.3	12.4′	04°22.3	16.5′	59.0′
	SD = 16.2′	d = -0.3′	SD = 16.0′				

Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	181°55.3	S22°50.5	85°09.7	12.4′	S04°05.8	16.7′	59.0′
1	196°55.0	50.7	99°41.1	12.4′	03°49.1	16.6′	59.0′
2	211°54.7	51.0	114°12.6	12.4′	03°32.5	16.7′	59.0′
3	226°54.4	·· 51.2	128°44.0	12.4′	03°15.8	16.7′	59.0′
4	241°54.2	51.4	143°15.4	12.4′	02°59.1	16.7′	59.0′
5	256°53.9	51.7	157°46.9	12.4′	02°42.4	16.8′	59.1′
6	271°53.6	S22°51.9	172°18.3	12.4′	S02°25.6	16.8′	59.1′
7	286°53.3	52.2	186°49.7	12.4′	02°08.8	16.8′	59.1′
8	301°53.0	52.4	201°21.1	12.4′	01°52.0	16.8′	59.1′
9	316°52.8	·· 52.6	215°52.5	12.4′	01°35.2	16.8′	59.1′
10	331°52.5	52.8	230°23.9	12.4′	01°18.4	16.9′	59.2′
11	346°52.2	53.1	244°55.2	12.4′	01°01.5	16.9′	59.2′
12	1°51.9	S22°53.3	259°26.6	12.3′	S00°44.6	16.9′	59.2′
13	16°51.6	53.5	273°57.9	12.3′	00°27.7	16.8′	59.2′
14	31°51.4	53.8	288°29.2	12.3′	S00°10.9	17.0′	59.2′
15	46°51.1	·· 54.0	303°00.5	12.3′	N00°06.1	16.9′	59.2′
16	61°50.8	54.2	317°31.8	12.3′	00°23.0	16.9′	59.3′
17	76°50.5	54.4	332°03.1	12.2′	00°39.9	16.9′	59.3′
18	91°50.2	S22°54.7	346°34.3	12.2′	N00°56.8	17.0′	59.3′
19	106°49.9	54.9	1°05.5	12.2′	01°13.8	16.9′	59.3′
20	121°49.7	55.1	15°36.7	12.2′	01°30.7	17.0′	59.3′
21	136°49.4	·· 55.3	30°07.9	12.1′	01°47.7	16.9′	59.3′
22	151°49.1	55.6	44°39.0	12.1′	02°04.6	17.0′	59.4′
23	166°48.8	55.8	59°10.1	12.1′	02°21.6	16.9′	59.4′
	SD = 16.2′	d = -0.2′	SD = 16.1′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	181°48.5	S22°56.0	73°41.2	12.0′	N02°38.5	16.9′	59.4′
1	196°48.2	56.2	88°12.3	12.0′	02°55.4	17.0′	59.4′
2	211°48.0	56.4	102°43.3	12.0′	03°12.4	16.9′	59.4′
3	226°47.7	·· 56.7	117°14.3	11.9′	03°29.3	16.9′	59.4′
4	241°47.4	56.9	131°45.2	11.9′	03°46.2	16.9′	59.5′
5	256°47.1	57.1	146°16.1	11.9′	04°03.1	16.9′	59.5′
6	271°46.8	S22°57.3	160°46.9	11.8′	N04°20.0	16.9′	59.5′
7	286°46.5	57.5	175°17.8	11.8′	04°36.9	16.9′	59.5′
8	301°46.3	57.7	189°48.5	11.7′	04°53.8	16.8′	59.5′
9	316°46.0	·· 58.0	204°19.3	11.7′	05°10.6	16.9′	59.5′
10	331°45.7	58.2	218°50.0	11.6′	05°27.5	16.8′	59.5′
11	346°45.4	58.4	233°20.6	11.6′	05°44.3	16.8′	59.6′
12	1°45.1	S22°58.6	247°51.2	11.5′	N06°01.1	16.8′	59.6′
13	16°44.8	58.8	262°21.7	11.5′	06°17.9	16.7′	59.6′
14	31°44.5	59.0	276°52.2	11.4′	06°34.6	16.7′	59.6′
15	46°44.3	·· 59.2	291°22.7	11.4′	06°51.3	16.7′	59.6′
16	61°44.0	59.4	305°53.1	11.3′	07°08.0	16.7′	59.6′
17	76°43.7	59.6	320°23.4	11.3′	07°24.7	16.7′	59.6′
18	91°43.4	S22°59.8	334°53.7	11.2′	N07°41.4	16.6′	59.6′
19	106°43.1	23°00.0	349°23.9	11.2′	07°58.0	16.5′	59.7′
20	121°42.8	00.3	3°54.1	11.1′	08°14.5	16.6′	59.7′
21	136°42.5	·· 00.5	18°24.2	11.0′	08°31.1	16.5′	59.7′
22	151°42.2	00.7	32°54.2	11.0′	08°47.6	16.4′	59.7′
23	166°42.0	00.9	47°24.2	10.9′	09°04.0	16.5′	59.7′
	SD = 16.2′	d = -0.2′	SD = 16.2′				

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

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

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 7-9 43-65%
08	08:08	07:54	11:52	18:08	05:44	
09	07:41	07:28	11:53	18:55	06:32	
10	07:14	07:00	11:53	19:44	07:19	

December 11, 12, 13 UT (Wed., Thu., Fri.)

	Aries	Venus		Mars		Jupiter		Saturn	
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	80°12.0	132°57.9	S21°27.0	310°57.7	N21°40.1	5°30.7	N22°01.6	94°50.6	S08°27.2
1	95°14.5	147°57.4	26.3	326°00.3	40.3	20°33.5	01.5	109°53.0	27.2
2	110°17.0	162°56.9	25.6	341°02.9	40.4	35°36.3	01.5	124°55.3	27.1
3	125°19.4	177°56.3	·· 24.8	356°05.5	·· 40.5	50°39.1	·· 01.5	139°57.7	·· 27.1
4	140°21.9	192°55.8	24.1	11°08.0	40.7	65°42.0	01.4	155°00.0	27.0
5	155°24.4	207°55.3	23.3	26°10.6	40.8	80°44.8	01.4	170°02.4	27.0
6	170°26.8	222°54.8	S21°22.6	41°13.2	N21°41.0	95°47.6	N22°01.4	185°04.8	S08°26.9
7	185°29.3	237°54.3	21.8	56°15.8	41.1	110°50.5	01.4	200°07.1	26.9
8	200°31.7	252°53.8	21.1	71°18.4	41.3	125°53.3	01.3	215°09.5	26.8
9	215°34.2	267°53.3	·· 20.3	86°21.0	·· 41.4	140°56.1	·· 01.3	230°11.9	·· 26.8
10	230°36.7	282°52.8	19.6	101°23.6	41.6	155°58.9	01.3	245°14.2	26.7
11	245°39.1	297°52.3	18.8	116°26.1	41.7	171°01.8	01.2	260°16.6	26.7
12	260°41.6	312°51.8	S21°18.1	131°28.7	N21°41.9	186°04.6	N22°01.2	275°19.0	S08°26.6
13	275°44.1	327°51.3	17.3	146°31.3	42.0	201°07.4	01.2	290°21.3	26.6
14	290°46.5	342°50.8	16.6	161°33.9	42.2	216°10.3	01.1	305°23.7	26.5
15	305°49.0	357°50.3	·· 15.8	176°36.5	·· 42.3	231°13.1	·· 01.1	320°26.0	·· 26.5
16	320°51.5	12°49.8	15.1	191°39.1	42.5	246°15.9	01.1	335°28.4	26.4
17	335°53.9	27°49.3	14.3	206°41.7	42.6	261°18.7	01.1	350°30.8	26.4
18	350°56.4	42°48.8	S21°13.5	221°44.3	N21°42.8	276°21.6	N22°01.0	5°33.1	S08°26.3
19	5°58.9	57°48.3	12.8	236°46.9	43.0	291°24.4	01.0	20°35.5	26.3
20	21°01.3	72°47.8	12.0	251°49.5	43.1	306°27.2	01.0	35°37.8	26.2
21	36°03.8	87°47.3	·· 11.3	266°52.1	·· 43.3	321°30.1	·· 00.9	50°40.2	·· 26.2
22	51°06.2	102°46.8	10.5	281°54.7	43.4	336°32.9	00.9	65°42.6	26.1
23	66°08.7	117°46.3	09.7	296°57.3	43.6	351°35.7	00.9	80°44.9	26.1
Mer.pass. 18:36		ν -0.5′	d 0.7′	m -4.27	ν 2.6′	d 0.1′	m -0.73	ν 2.8′	d -0.0′ m -2.81	ν 2.4′	d 0.0′ m 0.98

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	81°11.2	132°45.8	S21°09.0	312°00.0	N21°43.7	6°38.5	N22°00.9	95°47.3	S08°26.0
1	96°13.6	147°45.3	08.2	327°02.6	43.9	21°41.4	00.8	110°49.6	26.0
2	111°16.1	162°44.9	07.5	342°05.2	44.0	36°44.2	00.8	125°52.0	25.9
3	126°18.6	177°44.4	·· 06.7	357°07.8	·· 44.2	51°47.0	·· 00.8	140°54.4	·· 25.9
4	141°21.0	192°43.9	05.9	12°10.4	44.3	66°49.8	00.7	155°56.7	25.8
5	156°23.5	207°43.4	05.2	27°13.0	44.5	81°52.7	00.7	170°59.1	25.8
6	171°26.0	222°42.9	S21°04.4	42°15.6	N21°44.7	96°55.5	N22°00.7	186°01.4	S08°25.7
7	186°28.4	237°42.4	03.6	57°18.3	44.8	111°58.3	00.6	201°03.8	25.7
8	201°30.9	252°41.9	02.8	72°20.9	45.0	127°01.2	00.6	216°06.2	25.6
9	216°33.4	267°41.4	·· 02.1	87°23.5	·· 45.1	142°04.0	·· 00.6	231°08.5	·· 25.6
10	231°35.8	282°41.0	01.3	102°26.1	45.3	157°06.8	00.6	246°10.9	25.5
11	246°38.3	297°40.5	21°00.5	117°28.8	45.4	172°09.6	00.5	261°13.2	25.5
12	261°40.7	312°40.0	S20°59.8	132°31.4	N21°45.6	187°12.5	N22°00.5	276°15.6	S08°25.4
13	276°43.2	327°39.5	59.0	147°34.0	45.8	202°15.3	00.5	291°18.0	25.4
14	291°45.7	342°39.0	58.2	162°36.6	45.9	217°18.1	00.4	306°20.3	25.3
15	306°48.1	357°38.6	·· 57.4	177°39.3	·· 46.1	232°20.9	·· 00.4	321°22.7	·· 25.3
16	321°50.6	12°38.1	56.7	192°41.9	46.2	247°23.8	00.4	336°25.0	25.2
17	336°53.1	27°37.6	55.9	207°44.5	46.4	262°26.6	00.3	351°27.4	25.2
18	351°55.5	42°37.1	S20°55.1	222°47.2	N21°46.6	277°29.4	N22°00.3	6°29.7	S08°25.1
19	6°58.0	57°36.6	54.3	237°49.8	46.7	292°32.2	00.3	21°32.1	25.1
20	22°00.5	72°36.2	53.5	252°52.5	46.9	307°35.1	00.3	36°34.5	25.0
21	37°02.9	87°35.7	·· 52.8	267°55.1	·· 47.1	322°37.9	·· 00.2	51°36.8	·· 25.0
22	52°05.4	102°35.2	52.0	282°57.7	47.2	337°40.7	00.2	66°39.2	24.9
23	67°07.8	117°34.8	51.2	298°00.4	47.4	352°43.6	00.2	81°41.5	24.9
Mer.pass. 18:32		ν -0.5′	d 0.8′	m -4.28	ν 2.6′	d 0.2′	m -0.75	ν 2.8′	d -0.0′ m -2.81	ν 2.4′	d 0.1′ m 0.99

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	82°10.3	132°34.3	S20°50.4	313°03.0	N21°47.5	7°46.4	N22°00.1	96°43.9	S08°24.8
1	97°12.8	147°33.8	49.6	328°05.7	47.7	22°49.2	00.1	111°46.2	24.8
2	112°15.2	162°33.3	48.8	343°08.3	47.9	37°52.0	00.1	126°48.6	24.7
3	127°17.7	177°32.9	·· 48.0	358°11.0	·· 48.0	52°54.9	·· 00.0	141°51.0	·· 24.7
4	142°20.2	192°32.4	47.3	13°13.6	48.2	67°57.7	00.0	156°53.3	24.6
5	157°22.6	207°31.9	46.5	28°16.3	48.4	83°00.5	00.0	171°55.7	24.6
6	172°25.1	222°31.5	S20°45.7	43°18.9	N21°48.5	98°03.3	N22°00.0	186°58.0	S08°24.5
7	187°27.6	237°31.0	44.9	58°21.6	48.7	113°06.2	21°59.9	202°00.4	24.5
8	202°30.0	252°30.5	44.1	73°24.3	48.9	128°09.0	59.9	217°02.7	24.4
9	217°32.5	267°30.1	·· 43.3	88°26.9	·· 49.0	143°11.8	·· 59.9	232°05.1	·· 24.3
10	232°35.0	282°29.6	42.5	103°29.6	49.2	158°14.6	59.8	247°07.4	24.3
11	247°37.4	297°29.1	41.7	118°32.2	49.4	173°17.5	59.8	262°09.8	24.2
12	262°39.9	312°28.7	S20°40.9	133°34.9	N21°49.5	188°20.3	N21°59.8	277°12.2	S08°24.2
13	277°42.3	327°28.2	40.1	148°37.6	49.7	203°23.1	59.8	292°14.5	24.1
14	292°44.8	342°27.8	39.3	163°40.2	49.9	218°25.9	59.7	307°16.9	24.1
15	307°47.3	357°27.3	·· 38.5	178°42.9	·· 50.0	233°28.8	·· 59.7	322°19.2	·· 24.0
16	322°49.7	12°26.8	37.7	193°45.6	50.2	248°31.6	59.7	337°21.6	24.0
17	337°52.2	27°26.4	36.9	208°48.2	50.4	263°34.4	59.6	352°23.9	23.9
18	352°54.7	42°25.9	S20°36.1	223°50.9	N21°50.5	278°37.2	N21°59.6	7°26.3	S08°23.9
19	7°57.1	57°25.5	35.3	238°53.6	50.7	293°40.1	59.6	22°28.6	23.8
20	22°59.6	72°25.0	34.5	253°56.3	50.9	308°42.9	59.5	37°31.0	23.8
21	38°02.1	87°24.6	·· 33.7	268°58.9	·· 51.1	323°45.7	·· 59.5	52°33.3	·· 23.7
22	53°04.5	102°24.1	32.9	284°01.6	51.2	338°48.5	59.5	67°35.7	23.7
23	68°07.0	117°23.6	32.1	299°04.3	51.4	353°51.4	59.5	82°38.1	23.6
Mer.pass. 18:28		ν -0.5′	d 0.8′	m -4.29	ν 2.6′	d 0.2′	m -0.77	ν 2.8′	d -0.0′ m -2.81	ν 2.4′	d 0.1′ m 0.99

Stars

	SHA	Dec
Alpheratz	357°34.8	29°13.9
Ankaa	353°07.1	-42°10.4
Schedar	349°30.9	56°40.7
Diphda	348°47.2	-17°51.1
Achernar	335°19.9	-57°06.8
Hamal	327°51.0	23°34.9
Polaris	313°38.7	89°22.3
Acamar	315°11.5	-40°12.4
Menkar	314°06.0	4°11.3
Mirfak	308°27.9	49°57.1
Aldebaran	290°39.4	16°33.6
Rigel	281°03.6	-8°10.3
Capella	280°21.5	46°01.4
Bellatrix	278°22.6	6°22.4
Elnath	278°01.6	28°37.7
Alnilam	275°37.5	-1°11.1
Betelgeuse	270°51.8	7°24.7
Canopus	263°51.9	-52°42.4
Sirius	258°26.0	-16°44.9
Adhara	255°05.6	-29°00.2
Procyon	244°50.6	5°09.7
Pollux	243°17.1	27°57.9
Avior	234°14.3	-59°35.1
Suhail	222°46.1	-43°31.7
Miaplacidus	221°37.8	-69°48.8
Alphard	217°47.7	-8°45.9
Regulus	207°34.4	11°50.7
Dubhe	193°41.0	61°36.7
Denebola	182°25.1	14°25.9
Gienah	175°43.8	-17°40.7
Acrux	173°00.4	-63°13.9
Gacrux	171°51.9	-57°14.9
Alioth	166°13.3	55°49.2
Spica	158°22.6	-11°17.4
Alkaid	152°52.4	49°11.1
Hadar	148°36.6	-60°29.3
Menkent	147°58.0	-36°29.4
Arcturus	145°48.2	19°03.1
Rigil Kent.	139°41.0	-60°56.1
Kochab	137°20.7	74°02.9
Zuben'ubi	136°56.4	-16°08.6
Alphecca	126°04.1	26°37.8
Antares	112°16.3	-26°29.2
Atria	107°11.2	-69°04.3
Sabik	102°03.2	-15°45.3
Shaula	96°10.9	-37°07.3
Rasalhague	95°59.0	12°32.5
Eltanin	90°42.8	51°29.1
Kaus Aust.	83°33.0	-34°22.4
Vega	80°33.7	38°48.4
Nunki	75°48.2	-26°16.0
Altair	62°00.3	8°56.1
Peacock	53°06.3	-56°39.5
Deneb	49°26.2	45°22.3
Enif	33°39.0	9°59.4
Al Na'ir	27°33.2	-46°50.6
Fomalhaut	15°14.6	-29°29.6
Scheat	13°45.3	28°13.3
Markab	13°30.0	15°20.5

Dec 11 Wed	SHA	Mer.pass
Venus	52°45.8	15:09
Mars	230°45.7	03:16
Jupiter	285°18.6	23:34
Saturn	14°38.6	17:38

Dec 12 Thu	SHA	Mer.pass
Venus	51°34.7	15:09
Mars	230°48.8	03:11
Jupiter	285°27.4	23:29
Saturn	14°36.1	17:34

Dec 13 Fri	SHA	Mer.pass
Venus	50°24.0	15:10
Mars	230°52.7	03:07
Jupiter	285°36.1	23:24
Saturn	14°33.6	17:30

Horizontal parallax	
Venus:	0.2
Mars:	0.2

DUT1 = UT1-UTC = +0.1797 sec ΔT = TT-UT1 = +69.0043 sec

2024 December 11 to Dec. 13 UT

h	Sun		Moon				
Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	181°41.7	S23°01.1	61°54.1	10.8′	N09°20.5	16.3′	59.7′
1	196°41.4	01.3	76°23.9	10.8′	09°36.8	16.4′	59.7′
2	211°41.1	01.5	90°53.7	10.7′	09°53.2	16.3′	59.7′
3	226°40.8	·· 01.7	105°23.4	10.6′	10°09.5	16.2′	59.7′
4	241°40.5	01.9	119°53.1	10.6′	10°25.7	16.2′	59.8′
5	256°40.2	02.1	134°22.6	10.5′	10°41.9	16.1′	59.8′
6	271°39.9	S23°02.3	148°52.1	10.4′	N10°58.0	16.1′	59.8′
7	286°39.7	02.5	163°21.6	10.4′	11°14.1	16.0′	59.8′
8	301°39.4	02.6	177°50.9	10.3′	11°30.1	16.0′	59.8′
9	316°39.1	·· 02.8	192°20.2	10.2′	11°46.1	15.9′	59.8′
10	331°38.8	03.0	206°49.4	10.1′	12°02.0	15.9′	59.8′
11	346°38.5	03.2	221°18.5	10.0′	12°17.9	15.8′	59.8′
12	1°38.2	S23°03.4	235°47.6	10.0′	N12°33.7	15.7′	59.8′
13	16°37.9	03.6	250°16.5	9.9′	12°49.4	15.7′	59.8′
14	31°37.6	03.8	264°45.4	9.8′	13°05.1	15.6′	59.8′
15	46°37.3	·· 04.0	279°14.2	9.7′	13°20.7	15.5′	59.9′
16	61°37.1	04.2	293°42.9	9.6′	13°36.2	15.4′	59.9′
17	76°36.8	04.4	308°11.6	9.6′	13°51.6	15.4′	59.9′
18	91°36.5	S23°04.6	322°40.1	9.5′	N14°07.0	15.3′	59.9′
19	106°36.2	04.7	337°08.6	9.4′	14°22.3	15.3′	59.9′
20	121°35.9	04.9	351°36.9	9.3′	14°37.6	15.1′	59.9′
21	136°35.6	·· 05.1	6°05.2	9.2′	14°52.7	15.1′	59.9′
22	151°35.3	05.3	20°33.4	9.1′	15°07.8	15.0′	59.9′
23	166°35.0	05.5	35°01.5	9.0′	15°22.8	14.9′	59.9′
	SD = 16.2′	d = -0.2′	SD = 16.3′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	181°34.7	S23°05.7	49°29.6	8.9′	N15°37.7	14.8′	59.9′
1	196°34.4	05.8	63°57.5	8.8′	15°52.5	14.7′	59.9′
2	211°34.1	06.0	78°25.3	8.7′	16°07.2	14.6′	59.9′
3	226°33.9	·· 06.2	92°53.1	8.7′	16°21.8	14.6′	59.9′
4	241°33.6	06.4	107°20.7	8.6′	16°36.4	14.4′	59.9′
5	256°33.3	06.6	121°48.3	8.5′	16°50.8	14.4′	59.9′
6	271°33.0	S23°06.7	136°15.8	8.4′	N17°05.2	14.2′	59.9′
7	286°32.7	06.9	150°43.1	8.3′	17°19.4	14.2′	59.9′
8	301°32.4	07.1	165°10.4	8.2′	17°33.6	14.0′	59.9′
9	316°32.1	·· 07.3	179°37.6	8.1′	17°47.6	14.0′	59.9′
10	331°31.8	07.4	194°04.7	8.0′	18°01.6	13.8′	59.9′
11	346°31.5	07.6	208°31.6	7.9′	18°15.4	13.7′	59.9′
12	1°31.2	S23°07.8	222°58.5	7.8′	N18°29.1	13.6′	59.9′
13	16°30.9	08.0	237°25.3	7.7′	18°42.7	13.6′	59.9′
14	31°30.6	08.1	251°52.0	7.6′	18°56.3	13.3′	59.9′
15	46°30.3	·· 08.3	266°18.6	7.5′	19°09.6	13.3′	59.9′
16	61°30.1	08.5	280°45.1	7.4′	19°22.9	13.2′	59.9′
17	76°29.8	08.6	295°11.5	7.3′	19°36.1	13.0′	59.9′
18	91°29.5	S23°08.8	309°37.8	7.2′	N19°49.1	12.9′	59.9′
19	106°29.2	09.0	324°03.9	7.1′	20°02.0	12.8′	59.9′
20	121°28.9	09.2	338°30.0	7.0′	20°14.8	12.7′	59.9′
21	136°28.6	·· 09.3	352°56.0	6.9′	20°27.5	12.5′	59.9′
22	151°28.3	09.5	7°21.9	6.8′	20°40.0	12.5′	59.9′
23	166°28.0	09.6	21°47.7	6.7′	20°52.5	12.2′	59.9′
	SD = 16.2′	d = -0.2′	SD = 16.3′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	181°27.7	S23°09.8	36°13.4	6.6′	N21°04.7	12.2′	59.9′
1	196°27.4	10.0	50°39.0	6.5′	21°16.9	12.0′	59.9′
2	211°27.1	10.1	65°04.5	6.4′	21°28.9	11.9′	59.9′
3	226°26.8	·· 10.3	79°29.9	6.3′	21°40.8	11.7′	59.9′
4	241°26.5	10.5	93°55.2	6.2′	21°52.5	11.6′	59.9′
5	256°26.2	10.6	108°20.4	6.1′	22°04.1	11.4′	59.9′
6	271°25.9	S23°10.8	122°45.5	6.0′	N22°15.5	11.4′	59.9′
7	286°25.6	10.9	137°10.5	5.9′	22°26.9	11.1′	59.9′
8	301°25.3	11.1	151°35.4	5.8′	22°38.0	11.0′	59.9′
9	316°25.1	·· 11.2	166°00.3	5.7′	22°49.0	10.9′	59.9′
10	331°24.8	11.4	180°25.0	5.6′	22°59.9	10.7′	59.9′
11	346°24.5	11.6	194°49.6	5.5′	23°10.6	10.6′	59.9′
12	1°24.2	S23°11.7	209°14.2	5.4′	N23°21.2	10.4′	59.8′
13	16°23.9	11.9	223°38.6	5.4′	23°31.6	10.2′	59.8′
14	31°23.6	12.0	238°03.0	5.3′	23°41.8	10.1′	59.8′
15	46°23.3	·· 12.2	252°27.2	5.2′	23°51.9	9.9′	59.8′
16	61°23.0	12.3	266°51.4	5.1′	24°01.8	9.8′	59.8′
17	76°22.7	12.5	281°15.5	5.0′	24°11.6	9.6′	59.8′
18	91°22.4	S23°12.6	295°39.5	4.9′	N24°21.2	9.4′	59.8′
19	106°22.1	12.8	310°03.4	4.8′	24°30.6	9.3′	59.8′
20	121°21.8	12.9	324°27.3	4.8′	24°39.9	9.1′	59.8′
21	136°21.5	·· 13.1	338°51.0	4.7′	24°49.0	8.9′	59.8′
22	151°21.2	13.2	353°14.7	4.6′	24°57.9	8.8′	59.7′
23	166°20.9	13.3	7°38.3	4.5′	25°06.7	8.5′	59.7′
	SD = 16.2′	d = -0.2′	SD = 16.3′				

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

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

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 10-12 76-92%
11	06:47	06:33	11:53	20:35	08:09	
12	06:19	06:05	11:54	21:29	09:02	
13	05:51	05:37	11:54	22:28	09:58	

December 14, 15, 16 UT (Sat., Sun., Mon.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	83°09.5	132°23.2	S20°31.3	314°07.0	N21°51.6	8°54.2	N21°59.4	97°40.4	S08°23.6
1	98°11.9	147°22.7	30.5	329°09.7	51.7	23°57.0	59.4	112°42.8	23.5
2	113°14.4	162°22.3	29.7	344°12.4	51.9	38°59.8	59.4	127°45.1	23.4
3	128°16.8	177°21.8	·· 28.9	359°15.0	·· 52.1	54°02.7	·· 59.3	142°47.5	·· 23.4
4	143°19.3	192°21.4	28.1	14°17.7	52.3	69°05.5	59.3	157°49.8	23.3
5	158°21.8	207°20.9	27.3	29°20.4	52.4	84°08.3	59.3	172°52.2	23.3
6	173°24.2	222°20.5	S20°26.5	44°23.1	N21°52.6	99°11.1	N21°59.2	187°54.5	S08°23.2
7	188°26.7	237°20.1	25.7	59°25.8	52.8	114°14.0	59.2	202°56.9	23.2
8	203°29.2	252°19.6	24.8	74°28.5	53.0	129°16.8	59.2	217°59.2	23.1
9	218°31.6	267°19.2	·· 24.0	89°31.2	·· 53.1	144°19.6	·· 59.2	233°01.6	·· 23.1
10	233°34.1	282°18.7	23.2	104°33.9	53.3	159°22.4	59.1	248°03.9	23.0
11	248°36.6	297°18.3	22.4	119°36.6	53.5	174°25.2	59.1	263°06.3	23.0
12	263°39.0	312°17.8	S20°21.6	134°39.3	N21°53.7	189°28.1	N21°59.1	278°08.6	S08°22.9
13	278°41.5	327°17.4	20.8	149°42.0	53.8	204°30.9	59.0	293°11.0	22.9
14	293°44.0	342°17.0	19.9	164°44.7	54.0	219°33.7	59.0	308°13.3	22.8
15	308°46.4	357°16.5	·· 19.1	179°47.4	·· 54.2	234°36.5	·· 59.0	323°15.7	·· 22.7
16	323°48.9	12°16.1	18.3	194°50.1	54.4	249°39.4	58.9	338°18.0	22.7
17	338°51.3	27°15.6	17.5	209°52.8	54.5	264°42.2	58.9	353°20.4	22.6
18	353°53.8	42°15.2	S20°16.7	224°55.5	N21°54.7	279°45.0	N21°58.9	8°22.7	S08°22.6
19	8°56.3	57°14.8	15.8	239°58.2	54.9	294°47.8	58.9	23°25.1	22.5
20	23°58.7	72°14.3	15.0	255°00.9	55.1	309°50.7	58.8	38°27.4	22.5
21	39°01.2	87°13.9	·· 14.2	270°03.7	·· 55.3	324°53.5	·· 58.8	53°29.8	·· 22.4
22	54°03.7	102°13.5	13.4	285°06.4	55.4	339°56.3	58.8	68°32.1	22.4
23	69°06.1	117°13.0	12.6	300°09.1	55.6	354°59.1	58.7	83°34.5	22.3
Mer.pass. 18:24		ν -0.5′	d 0.8′	m -4.29	ν 2.7′	d 0.2′	m -0.80	ν 2.8′	d -0.0′ m -2.81	ν 2.4′	d 0.1′ m 0.99

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	84°08.6	132°12.6	S20°11.7	315°11.8	N21°55.8	10°01.9	N21°58.7	98°36.8	S08°22.3
1	99°11.1	147°12.2	10.9	330°14.5	56.0	25°04.8	58.7	113°39.2	22.2
2	114°13.5	162°11.7	10.1	345°17.3	56.2	40°07.6	58.7	128°41.5	22.1
3	129°16.0	177°11.3	·· 09.2	0°20.0	·· 56.3	55°10.4	·· 58.6	143°43.9	·· 22.1
4	144°18.5	192°10.9	08.4	15°22.7	56.5	70°13.2	58.6	158°46.2	22.0
5	159°20.9	207°10.5	07.6	30°25.4	56.7	85°16.1	58.6	173°48.6	22.0
6	174°23.4	222°10.0	S20°06.8	45°28.2	N21°56.9	100°18.9	N21°58.5	188°50.9	S08°21.9
7	189°25.8	237°09.6	05.9	60°30.9	57.1	115°21.7	58.5	203°53.3	21.9
8	204°28.3	252°09.2	05.1	75°33.6	57.3	130°24.5	58.5	218°55.6	21.8
9	219°30.8	267°08.7	·· 04.3	90°36.3	·· 57.4	145°27.3	·· 58.4	233°58.0	·· 21.8
10	234°33.2	282°08.3	03.4	105°39.1	57.6	160°30.2	58.4	249°00.3	21.7
11	249°35.7	297°07.9	02.6	120°41.8	57.8	175°33.0	58.4	264°02.7	21.7
12	264°38.2	312°07.5	S20°01.7	135°44.6	N21°58.0	190°35.8	N21°58.4	279°05.0	S08°21.6
13	279°40.6	327°07.1	00.9	150°47.3	58.2	205°38.6	58.3	294°07.4	21.5
14	294°43.1	342°06.6	20°00.1	165°50.0	58.4	220°41.4	58.3	309°09.7	21.5
15	309°45.6	357°06.2	19°59.2	180°52.8	·· 58.5	235°44.3	·· 58.3	324°12.0	·· 21.4
16	324°48.0	12°05.8	58.4	195°55.5	58.7	250°47.1	58.2	339°14.4	21.4
17	339°50.5	27°05.4	57.6	210°58.3	58.9	265°49.9	58.2	354°16.7	21.3
18	354°53.0	42°05.0	S19°56.7	226°01.0	N21°59.1	280°52.7	N21°58.2	9°19.1	S08°21.3
19	9°55.4	57°04.6	55.9	241°03.8	59.3	295°55.5	58.1	24°21.4	21.2
20	24°57.9	72°04.1	55.0	256°06.5	59.5	310°58.4	58.1	39°23.8	21.2
21	40°00.3	87°03.7	·· 54.2	271°09.3	·· 59.7	326°01.2	·· 58.1	54°26.1	·· 21.1
22	55°02.8	102°03.3	53.3	286°12.0	21°59.8	341°04.0	58.1	69°28.5	21.0
23	70°05.3	117°02.9	52.5	301°14.8	22°00.0	356°06.8	58.0	84°30.8	21.0
Mer.pass. 18:20		ν -0.4′	d 0.8′	m -4.30	ν 2.7′	d 0.2′	m -0.82	ν 2.8′	d -0.0′ m -2.80	ν 2.3′	d 0.1′ m 1.00

Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	85°07.7	132°02.5	S19°51.7	316°17.5	N22°00.2	11°09.6	N21°58.0	99°33.2	S08°20.9
1	100°10.2	147°02.1	50.8	331°20.3	00.4	26°12.5	58.0	114°35.5	20.9
2	115°12.7	162°01.7	50.0	346°23.0	00.6	41°15.3	57.9	129°37.9	20.8
3	130°15.1	177°01.3	·· 49.1	1°25.8	·· 00.8	56°18.1	·· 57.9	144°40.2	·· 20.8
4	145°17.6	192°00.9	48.3	16°28.6	01.0	71°20.9	57.9	159°42.5	20.7
5	160°20.1	207°00.4	47.4	31°31.3	01.2	86°23.7	57.8	174°44.9	20.6
6	175°22.5	222°00.0	S19°46.6	46°34.1	N22°01.4	101°26.6	N21°57.8	189°47.2	S08°20.6
7	190°25.0	236°59.6	45.7	61°36.8	01.6	116°29.4	57.8	204°49.6	20.5
8	205°27.5	251°59.2	44.9	76°39.6	01.7	131°32.2	57.8	219°51.9	20.5
9	220°29.9	266°58.8	·· 44.0	91°42.4	·· 01.9	146°35.0	·· 57.7	234°54.3	·· 20.4
10	235°32.4	281°58.4	43.1	106°45.2	02.1	161°37.8	57.7	249°56.6	20.4
11	250°34.8	296°58.0	42.3	121°47.9	02.3	176°40.7	57.7	264°59.0	20.3
12	265°37.3	311°57.6	S19°41.4	136°50.7	N22°02.5	191°43.5	N21°57.6	280°01.3	S08°20.2
13	280°39.8	326°57.2	40.6	151°53.5	02.7	206°46.3	57.6	295°03.6	20.2
14	295°42.2	341°56.8	39.7	166°56.2	02.9	221°49.1	57.6	310°06.0	20.1
15	310°44.7	356°56.4	·· 38.9	181°59.0	·· 03.1	236°51.9	·· 57.6	325°08.3	·· 20.1
16	325°47.2	11°56.0	38.0	197°01.8	03.3	251°54.8	57.5	340°10.7	20.0
17	340°49.6	26°55.6	37.1	212°04.6	03.5	266°57.6	57.5	355°13.0	20.0
18	355°52.1	41°55.2	S19°36.3	227°07.4	N22°03.7	282°00.4	N21°57.5	10°15.4	S08°19.9
19	10°54.6	56°54.8	35.4	242°10.2	03.9	297°03.2	57.4	25°17.7	19.8
20	25°57.0	71°54.4	34.6	257°12.9	04.1	312°06.0	57.4	40°20.0	19.8
21	40°59.5	86°54.1	·· 33.7	272°15.7	·· 04.3	327°08.8	·· 57.4	55°22.4	·· 19.7
22	56°02.0	101°53.7	32.8	287°18.5	04.5	342°11.7	57.3	70°24.7	19.7
23	71°04.4	116°53.3	32.0	302°21.3	04.7	357°14.5	57.3	85°27.1	19.6
Mer.pass. 18:16		ν -0.4′	d 0.8′	m -4.31	ν 2.8′	d 0.2′	m -0.84	ν 2.8′	d -0.0′ m -2.80	ν 2.3′	d 0.1′ m 1.00

Stars

	SHA	Dec
Alpheratz	357°34.8	29°13.9
Ankaa	353°07.1	-42°10.4
Schedar	349°31.0	56°40.7
Diphda	348°47.3	-17°51.1
Achernar	335°19.9	-57°06.8
Hamal	327°51.0	23°34.9
Polaris	313°39.0	89°22.4
Acamar	315°11.5	-40°12.4
Menkar	314°05.9	4°11.3
Mirfak	308°27.9	49°57.1
Aldebaran	290°39.4	16°33.6
Rigel	281°03.6	-8°10.3
Capella	280°21.5	46°01.4
Bellatrix	278°22.6	6°22.4
Elnath	278°01.6	28°37.7
Alnilam	275°37.5	-1°11.1
Betelgeuse	270°51.8	7°24.7
Canopus	263°51.9	-52°42.4
Sirius	258°26.0	-16°44.9
Adhara	255°05.6	-29°00.2
Procyon	244°50.6	5°09.7
Pollux	243°17.1	27°57.9
Avior	234°14.3	-59°35.1
Suhail	222°46.1	-43°31.8
Miaplacidus	221°37.7	-69°48.8
Alphard	217°47.6	-8°45.9
Regulus	207°34.4	11°50.7
Dubhe	193°41.0	61°36.7
Denebola	182°25.0	14°25.9
Gienah	175°43.7	-17°40.7
Acrux	173°00.4	-63°13.9
Gacrux	171°51.9	-57°14.9
Alioth	166°13.2	55°49.2
Spica	158°22.5	-11°17.4
Alkaid	152°52.3	49°11.1
Hadar	148°36.5	-60°29.3
Menkent	147°58.0	-36°29.4
Arcturus	145°48.2	19°03.1
Rigil Kent.	139°40.9	-60°56.1
Kochab	137°20.7	74°02.9
Zuben'ubi	136°56.4	-16°08.7
Alphecca	126°04.1	26°37.7
Antares	112°16.3	-26°29.2
Atria	107°11.2	-69°04.2
Sabik	102°03.2	-15°45.3
Shaula	96°10.9	-37°07.3
Rasalhague	95°59.0	12°32.5
Eltanin	90°42.8	51°29.1
Kaus Aust.	83°33.0	-34°22.4
Vega	80°33.7	38°48.4
Nunki	75°48.2	-26°16.0
Altair	62°00.3	8°56.1
Peacock	53°06.3	-56°39.5
Deneb	49°26.2	45°22.3
Enif	33°39.0	9°59.4
Al Na'ir	27°33.2	-46°50.6
Fomalhaut	15°14.7	-29°29.6
Scheat	13°45.3	28°13.2
Markab	13°30.0	15°20.5

Dec 14 Sat	SHA	Mer.pass
Venus	49°13.7	15:11
Mars	230°57.5	03:03
Jupiter	285°44.7	23:20
Saturn	14°30.9	17:27

Dec 15 Sun	SHA	Mer.pass
Venus	48°04.0	15:12
Mars	231°03.2	02:59
Jupiter	285°53.3	23:15
Saturn	14°28.2	17:23

Dec 16 Mon	SHA	Mer.pass
Venus	46°54.8	15:12
Mars	231°09.8	02:54
Jupiter	286°01.9	23:11
Saturn	14°25.4	17:19

Horizontal parallax	
Venus:	0.2
Mars:	0.2

h

Sat	Sun GHA	Sun Dec	Moon GHA	Moon ν	Moon Dec	Moon d	Moon HP
0	181°20.6	S23°13.5	22°01.8	4.4′	N25°15.2	8.5′	59.7′
1	196°20.3	13.6	36°25.2	4.4′	25°23.7	8.2′	59.7′
2	211°20.0	13.8	50°48.6	4.3′	25°31.9	8.1′	59.7′
3	226°19.7	·· 13.9	65°11.9	4.2′	25°40.0	7.8′	59.7′
4	241°19.4	14.1	79°35.1	4.1′	25°47.8	7.7′	59.7′
5	256°19.1	14.2	93°58.2	4.1′	25°55.5	7.6′	59.7′
6	271°18.8	S23°14.3	108°21.3	4.0′	N26°03.1	7.3′	59.6′
7	286°18.5	14.5	122°44.3	3.9′	26°10.4	7.1′	59.6′
8	301°18.2	14.6	137°07.3	3.9′	26°17.5	7.0′	59.6′
9	316°17.9	·· 14.8	151°30.1	3.8′	26°24.5	6.8′	59.6′
10	331°17.6	14.9	165°53.0	3.8′	26°31.3	6.6′	59.6′
11	346°17.3	15.0	180°15.8	3.7′	26°37.9	6.4′	59.6′
12	1°17.0	S23°15.2	194°38.5	3.7′	N26°44.3	6.2′	59.5′
13	16°16.7	15.3	209°01.1	3.6′	26°50.5	6.1′	59.5′
14	31°16.4	15.4	223°23.7	3.6′	26°56.6	5.8′	59.5′
15	46°16.1	·· 15.6	237°46.3	3.5′	27°02.4	5.6′	59.5′
16	61°15.8	15.7	252°08.8	3.5′	27°08.0	5.5′	59.5′
17	76°15.5	15.8	266°31.3	3.4′	27°13.5	5.3′	59.5′
18	91°15.2	S23°16.0	280°53.8	3.4′	N27°18.8	5.0′	59.4′
19	106°14.9	16.1	295°16.2	3.4′	27°23.8	4.9′	59.4′
20	121°14.6	16.2	309°38.5	3.3′	27°28.7	4.7′	59.4′
21	136°14.3	·· 16.3	324°00.9	3.3′	27°33.4	4.5′	59.4′
22	151°14.0	16.5	338°23.2	3.3′	27°37.9	4.3′	59.4′
23	166°13.7	16.6	352°45.4	3.3′	27°42.2	4.1′	59.3′
	SD = 16.2′	d = -0.1′		SD = 16.3′			

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	181°13.4	S23°16.7	7°07.7	3.2′	N27°46.3	3.8′	59.3′
1	196°13.1	16.8	21°29.9	3.2′	27°50.1	3.7′	59.3′
2	211°12.8	17.0	35°52.1	3.2′	27°53.8	3.5′	59.3′
3	226°12.5	·· 17.1	50°14.3	3.2′	27°57.3	3.3′	59.3′
4	241°12.2	17.2	64°36.5	3.2′	28°00.6	3.1′	59.2′
5	256°11.9	17.3	78°58.7	3.2′	28°03.7	2.9′	59.2′
6	271°11.6	S23°17.4	93°20.8	3.2′	N28°06.6	2.8′	59.2′
7	286°11.3	17.6	107°43.0	3.2′	28°09.4	2.5′	59.2′
8	301°11.0	17.7	122°05.2	3.2′	28°11.9	2.3′	59.1′
9	316°10.7	·· 17.8	136°27.3	3.2′	28°14.2	2.1′	59.1′
10	331°10.4	17.9	150°49.5	3.2′	28°16.3	1.9′	59.1′
11	346°10.1	18.0	165°11.7	3.2′	28°18.2	1.7′	59.1′
12	1°09.8	S23°18.2	179°33.8	3.2′	N28°19.9	1.5′	59.1′
13	16°09.5	18.3	193°56.0	3.2′	28°21.4	1.3′	59.0′
14	31°09.2	18.4	208°18.2	3.2′	28°22.7	1.1′	59.0′
15	46°08.9	·· 18.5	222°40.5	3.3′	28°23.8	0.9′	59.0′
16	61°08.6	18.6	237°02.7	3.3′	28°24.7	0.7′	59.0′
17	76°08.3	18.7	251°25.0	3.3′	28°25.4	0.6′	58.9′
18	91°08.0	S23°18.8	265°47.3	3.3′	N28°26.0	0.3′	58.9′
19	106°07.7	18.9	280°09.6	3.4′	28°26.3	0.1′	58.9′
20	121°07.4	19.0	294°32.0	3.4′	28°26.4	0.1′	58.8′
21	136°07.1	·· 19.2	308°54.4	3.4′	28°26.3	0.2′	58.8′
22	151°06.8	19.3	323°16.8	3.5′	28°26.1	0.5′	58.8′
23	166°06.5	19.4	337°39.3	3.5′	28°25.6	0.6′	58.8′
	SD = 16.2′	d = -0.1′		SD = 16.2′			

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	181°06.2	S23°19.5	352°01.9	3.6′	N28°25.0	0.9′	58.7′
1	196°05.9	19.6	6°24.4	3.6′	28°24.1	1.0′	58.7′
2	211°05.6	19.7	20°47.1	3.7′	28°23.1	1.3′	58.7′
3	226°05.3	·· 19.8	35°09.8	3.7′	28°21.8	1.4′	58.7′
4	241°05.0	19.9	49°32.5	3.8′	28°20.4	1.6′	58.6′
5	256°04.7	20.0	63°55.3	3.9′	28°18.8	1.8′	58.6′
6	271°04.4	S23°20.1	78°18.1	3.9′	N28°17.0	2.0′	58.6′
7	286°04.1	20.2	92°41.1	4.0′	28°15.0	2.2′	58.5′
8	301°03.8	20.3	107°04.1	4.1′	28°12.8	2.4′	58.5′
9	316°03.5	·· 20.4	121°27.1	4.1′	28°10.4	2.5′	58.5′
10	331°03.2	20.5	135°50.2	4.2′	28°07.9	2.8′	58.5′
11	346°02.9	20.6	150°13.4	4.3′	28°05.1	2.9′	58.4′
12	1°02.6	S23°20.7	164°36.7	4.4′	N28°02.2	3.1′	58.4′
13	16°02.3	20.8	179°00.1	4.4′	27°59.1	3.3′	58.4′
14	31°02.0	20.9	193°23.5	4.5′	27°55.8	3.4′	58.3′
15	46°01.7	·· 21.0	207°47.0	4.6′	27°52.4	3.7′	58.3′
16	61°01.4	21.1	222°10.6	4.7′	27°48.7	3.8′	58.3′
17	76°01.0	21.1	236°34.3	4.8′	27°44.9	4.0′	58.2′
18	91°00.7	S23°21.2	250°58.1	4.9′	N27°40.9	4.2′	58.2′
19	106°00.4	21.3	265°22.0	5.0′	27°36.7	4.3′	58.2′
20	121°00.1	21.4	279°45.9	5.1′	27°32.4	4.5′	58.2′
21	135°59.8	·· 21.5	294°10.0	5.2′	27°27.9	4.7′	58.1′
22	150°59.5	21.6	308°34.2	5.3′	27°23.2	4.9′	58.1′
23	165°59.2	21.7	322°58.4	5.4′	27°18.3	5.0′	58.1′
	SD = 16.2′	d = -0.1′		SD = 16.0′			

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

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

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	Age 13-15 97-99%
14	05:22	05:08	11:55	23:30	10:59	
15	04:54	04:39	11:55	–:–	12:02	
16	04:25	04:10	11:56	00:33	13:04	

December 17, 18, 19 UT (Tue., Wed., Thu.)

	Aries	Venus		Mars		Jupiter		Saturn	
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	86°06.9	131°52.9	S19°31.1	317°24.1	N22°04.8	12°17.3	N21°57.3	100°29.4	S08°19.6
1	101°09.3	146°52.5	30.2	332°26.9	05.0	27°20.1	57.3	115°31.7	19.5
2	116°11.8	161°52.1	29.4	347°29.7	05.2	42°22.9	57.2	130°34.1	19.4
3	131°14.3	176°51.7	·· 28.5	2°32.5	·· 05.4	57°25.8	·· 57.2	145°36.4	·· 19.4
4	146°16.7	191°51.3	27.6	17°35.3	05.6	72°28.6	57.2	160°38.8	19.3
5	161°19.2	206°50.9	26.8	32°38.1	05.8	87°31.4	57.1	175°41.1	19.3
6	176°21.7	221°50.6	S19°25.9	47°40.9	N22°06.0	102°34.2	N21°57.1	190°43.5	S08°19.2
7	191°24.1	236°50.2	25.0	62°43.7	06.2	117°37.0	57.1	205°45.8	19.2
8	206°26.6	251°49.8	24.2	77°46.5	06.4	132°39.8	57.0	220°48.1	19.1
9	221°29.1	266°49.4	·· 23.3	92°49.3	·· 06.6	147°42.7	·· 57.0	235°50.5	·· 19.0
10	236°31.5	281°49.0	22.4	107°52.1	06.8	162°45.5	57.0	250°52.8	19.0
11	251°34.0	296°48.6	21.5	122°54.9	07.0	177°48.3	57.0	265°55.2	18.9
12	266°36.5	311°48.3	S19°20.7	137°57.7	N22°07.2	192°51.1	N21°56.9	280°57.5	S08°18.9
13	281°38.9	326°47.9	19.8	153°00.5	07.4	207°53.9	56.9	295°59.8	18.8
14	296°41.4	341°47.5	18.9	168°03.4	07.6	222°56.7	56.9	311°02.2	18.7
15	311°43.8	356°47.1	·· 18.0	183°06.2	·· 07.8	237°59.5	·· 56.8	326°04.5	·· 18.7
16	326°46.3	11°46.7	17.2	198°09.0	08.0	253°02.4	56.8	341°06.9	18.6
17	341°48.8	26°46.4	16.3	213°11.8	08.2	268°05.2	56.8	356°09.2	18.6
18	356°51.2	41°46.0	S19°15.4	228°14.6	N22°08.4	283°08.0	N21°56.7	11°11.5	S08°18.5
19	11°53.7	56°45.6	14.5	243°17.4	08.6	298°10.8	56.7	26°13.9	18.5
20	26°56.2	71°45.2	13.6	258°20.3	08.8	313°13.6	56.7	41°16.2	18.4
21	41°58.6	86°44.9	·· 12.8	273°23.1	·· 09.1	328°16.4	·· 56.7	56°18.6	·· 18.3
22	57°01.1	101°44.5	11.9	288°25.9	09.3	343°19.3	56.6	71°20.9	18.3
23	72°03.6	116°44.1	11.0	303°28.7	09.5	358°22.1	56.6	86°23.2	18.2
Mer.pass. 18:13		ν -0.4′	d 0.9′	m -4.32	ν 2.8′	d 0.2′	m -0.87	ν 2.8′	d -0.0′ m -2.80	ν 2.3′	d 0.1′ m 1.01

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	87°06.0	131°43.8	S19°10.1	318°31.6	N22°09.7	13°24.9	N21°56.6	101°25.6	S08°18.2
1	102°08.5	146°43.4	09.2	333°34.4	09.9	28°27.7	56.5	116°27.9	18.1
2	117°10.9	161°43.0	08.3	348°37.2	10.1	43°30.5	56.5	131°30.2	18.0
3	132°13.4	176°42.7	·· 07.4	3°40.1	·· 10.3	58°33.3	·· 56.5	146°32.6	·· 18.0
4	147°15.9	191°42.3	06.6	18°42.9	10.5	73°36.1	56.5	161°34.9	17.9
5	162°18.3	206°41.9	05.7	33°45.7	10.7	88°39.0	56.4	176°37.3	17.9
6	177°20.8	221°41.6	S19°04.8	48°48.6	N22°10.9	103°41.8	N21°56.4	191°39.6	S08°17.8
7	192°23.3	236°41.2	03.9	63°51.4	11.1	118°44.6	56.4	206°41.9	17.7
8	207°25.7	251°40.8	03.0	78°54.3	11.3	133°47.4	56.3	221°44.3	17.7
9	222°28.2	266°40.5	·· 02.1	93°57.1	·· 11.5	148°50.2	·· 56.3	236°46.6	·· 17.6
10	237°30.7	281°40.1	01.2	108°59.9	11.7	163°53.0	56.3	251°48.9	17.6
11	252°33.1	296°39.8	19°00.3	124°02.8	11.9	178°55.8	56.2	266°51.3	17.5
12	267°35.6	311°39.4	S18°59.4	139°05.6	N22°12.1	193°58.7	N21°56.2	281°53.6	S08°17.4
13	282°38.1	326°39.0	58.5	154°08.5	12.3	209°01.5	56.2	296°55.9	17.4
14	297°40.5	341°38.7	57.6	169°11.3	12.6	224°04.3	56.2	311°58.3	17.3
15	312°43.0	356°38.3	·· 56.7	184°14.2	·· 12.8	239°07.1	·· 56.1	327°00.6	·· 17.3
16	327°45.4	11°38.0	55.8	199°17.0	13.0	254°09.9	56.1	342°03.0	17.2
17	342°47.9	26°37.6	55.0	214°19.9	13.2	269°12.7	56.1	357°05.3	17.1
18	357°50.4	41°37.3	S18°54.1	229°22.8	N22°13.4	284°15.5	N21°56.0	12°07.6	S08°17.1
19	12°52.8	56°36.9	53.2	244°25.6	13.6	299°18.3	56.0	27°10.0	17.0
20	27°55.3	71°36.6	52.3	259°28.5	13.8	314°21.2	56.0	42°12.3	17.0
21	42°57.8	86°36.2	·· 51.4	274°31.3	·· 14.0	329°24.0	·· 56.0	57°14.6	·· 16.9
22	58°00.2	101°35.8	50.5	289°34.2	14.2	344°26.8	55.9	72°17.0	16.8
23	73°02.7	116°35.5	49.6	304°37.1	14.5	359°29.6	55.9	87°19.3	16.8
Mer.pass. 18:09		ν -0.4′	d 0.9′	m -4.33	ν 2.8′	d 0.2′	m -0.89	ν 2.8′	d -0.0′ m -2.80	ν 2.3′	d 0.1′ m 1.01

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	88°05.2	131°35.2	S18°48.6	319°39.9	N22°14.7	14°32.4	N21°55.9	102°21.6	S08°16.7
1	103°07.6	146°34.8	47.7	334°42.8	14.9	29°35.2	55.8	117°24.0	16.7
2	118°10.1	161°34.5	46.8	349°45.7	15.1	44°38.0	55.8	132°26.3	16.6
3	133°12.6	176°34.1	·· 45.9	4°48.5	·· 15.3	59°40.8	·· 55.8	147°28.6	·· 16.5
4	148°15.0	191°33.8	45.0	19°51.4	15.5	74°43.7	55.7	162°31.0	16.5
5	163°17.5	206°33.4	44.1	34°54.3	15.7	89°46.5	55.7	177°33.3	16.4
6	178°19.9	221°33.1	S18°43.2	49°57.2	N22°15.9	104°49.3	N21°55.7	192°35.6	S08°16.4
7	193°22.4	236°32.7	42.3	65°00.0	16.2	119°52.1	55.7	207°38.0	16.3
8	208°24.9	251°32.4	41.4	80°02.9	16.4	134°54.9	55.6	222°40.3	16.2
9	223°27.3	266°32.1	·· 40.5	95°05.8	·· 16.6	149°57.7	·· 55.6	237°42.6	·· 16.2
10	238°29.8	281°31.7	39.6	110°08.7	16.8	165°00.5	55.6	252°45.0	16.1
11	253°32.3	296°31.4	38.7	125°11.6	17.0	180°03.3	55.5	267°47.3	16.1
12	268°34.7	311°31.0	S18°37.8	140°14.4	N22°17.2	195°06.1	N21°55.5	282°49.6	S08°16.0
13	283°37.2	326°30.7	36.8	155°17.3	17.4	210°08.9	55.5	297°52.0	15.9
14	298°39.7	341°30.4	35.9	170°20.2	17.7	225°11.8	55.5	312°54.3	15.9
15	313°42.1	356°30.0	·· 35.0	185°23.1	·· 17.9	240°14.6	·· 55.4	327°56.6	·· 15.8
16	328°44.6	11°29.7	34.1	200°26.0	18.1	255°17.4	55.4	342°59.0	15.7
17	343°47.1	26°29.4	33.2	215°28.9	18.3	270°20.2	55.4	358°01.3	15.7
18	358°49.5	41°29.0	S18°32.3	230°31.8	N22°18.5	285°23.0	N21°55.3	13°03.6	S08°15.6
19	13°52.0	56°28.7	31.4	245°34.7	18.7	300°25.8	55.3	28°06.0	15.6
20	28°54.4	71°28.4	30.4	260°37.6	19.0	315°28.6	55.3	43°08.3	15.5
21	43°56.9	86°28.0	·· 29.5	275°40.5	·· 19.2	330°31.4	·· 55.2	58°10.6	·· 15.4
22	58°59.4	101°27.7	28.6	290°43.4	19.4	345°34.2	55.2	73°13.0	15.4
23	74°01.8	116°27.4	27.7	305°46.3	19.6	0°37.0	55.2	88°15.3	15.3
Mer.pass. 18:05		ν -0.3′	d 0.9′	m -4.33	ν 2.9′	d 0.2′	m -0.92	ν 2.8′	d -0.0′ m -2.79	ν 2.3′	d 0.1′ m 1.01

Stars

	SHA	Dec
Alpheratz	357°34.8	29°13.9
Ankaa	353°07.1	-42°10.4
Schedar	349°31.0	56°40.7
Diphda	348°47.3	-17°51.1
Achernar	335°19.9	-57°06.8
Hamal	327°51.0	23°35.0
Polaris	313°39.6	89°22.4
Acamar	315°11.5	-40°12.4
Menkar	314°05.9	4°11.3
Mirfak	308°27.9	49°57.1
Aldebaran	290°39.3	16°33.6
Rigel	281°03.6	-8°10.3
Capella	280°21.5	46°01.4
Bellatrix	278°22.6	6°22.4
Elnath	278°01.5	28°37.7
Alnilam	275°37.4	-1°11.1
Betelgeuse	270°51.8	7°24.7
Canopus	263°51.9	-52°42.4
Sirius	258°25.9	-16°45.0
Adhara	255°05.5	-29°00.3
Procyon	244°50.6	5°09.7
Pollux	243°17.0	27°57.9
Avior	234°14.2	-59°35.1
Suhail	222°46.1	-43°31.8
Miaplacidus	221°37.7	-69°48.9
Alphard	217°47.6	-8°45.9
Regulus	207°34.4	11°50.7
Dubhe	193°40.9	61°36.7
Denebola	182°25.0	14°25.9
Gienah	175°43.7	-17°40.7
Acrux	173°00.3	-63°13.9
Gacrux	171°51.9	-57°14.9
Alioth	166°13.2	55°49.2
Spica	158°22.5	-11°17.4
Alkaid	152°52.3	49°11.1
Hadar	148°36.5	-60°29.3
Menkent	147°57.9	-36°29.4
Arcturus	145°48.2	19°03.0
Rigil Kent.	139°40.9	-60°56.1
Kochab	137°20.7	74°02.9
Zuben'ubi	136°56.3	-16°08.7
Alphecca	126°04.1	26°37.7
Antares	112°16.3	-26°29.2
Atria	107°11.1	-69°04.2
Sabik	102°03.2	-15°45.3
Shaula	96°10.9	-37°07.3
Rasalhague	95°58.9	12°32.5
Eltanin	90°42.8	51°29.1
Kaus Aust.	83°33.0	-34°22.4
Vega	80°33.7	38°48.4
Nunki	75°48.2	-26°16.0
Altair	62°00.3	8°56.1
Peacock	53°06.3	-56°39.5
Deneb	49°26.2	45°22.3
Enif	33°39.0	9°59.4
Al Na'ir	27°33.2	-46°50.6
Fomalhaut	15°14.7	-29°29.6
Scheat	13°45.3	28°13.2
Markab	13°30.0	15°20.5

Dec 17 Tue	SHA	Mer.pass
Venus	45°46.0	15:13
Mars	231°17.2	02:50
Jupiter	286°10.4	23:07
Saturn	14°22.5	17:15

Dec 18 Wed	SHA	Mer.pass
Venus	44°37.7	15:13
Mars	231°25.6	02:45
Jupiter	286°18.9	23:02
Saturn	14°19.5	17:12

Dec 19 Thu	SHA	Mer.pass
Venus	43°30.0	15:14
Mars	231°34.8	02:41
Jupiter	286°27.2	22:58
Saturn	14°16.5	17:08

Horizontal parallax	
Venus:	0.2
Mars:	0.2

h	Sun		Moon				
Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°58.9	S23°21.8	337°22.8	5.5′	N27°13.3	5.2′	58.0′
1	195°58.6	21.9	351°47.2	5.6′	27°08.1	5.4′	58.0′
2	210°58.3	21.9	6°11.8	5.7′	27°02.7	5.5′	58.0′
3	225°58.0	·· 22.0	20°36.4	5.8′	26°57.2	5.7′	57.9′
4	240°57.7	22.1	35°01.2	5.9′	26°51.5	5.8′	57.9′
5	255°57.4	22.2	49°26.1	6.0′	26°45.7	6.0′	57.9′
6	270°57.1	S23°22.3	63°51.1	6.1′	N26°39.7	6.1′	57.8′
7	285°56.8	22.3	78°16.2	6.2′	26°33.6	6.4′	57.8′
8	300°56.5	22.4	92°41.4	6.3′	26°27.2	6.4′	57.8′
9	315°56.2	·· 22.5	107°06.7	6.4′	26°20.8	6.6′	57.7′
10	330°55.9	22.6	121°32.2	6.6′	26°14.2	6.8′	57.7′
11	345°55.6	22.7	135°57.7	6.7′	26°07.4	6.9′	57.7′
12	0°55.3	S23°22.7	150°23.4	6.8′	N26°00.5	7.1′	57.6′
13	15°54.9	22.8	164°49.2	6.9′	25°53.4	7.2′	57.6′
14	30°54.6	22.9	179°15.1	7.0′	25°46.2	7.3′	57.6′
15	45°54.3	·· 23.0	193°41.1	7.1′	25°38.9	7.5′	57.5′
16	60°54.0	23.0	208°07.3	7.3′	25°31.4	7.6′	57.5′
17	75°53.7	23.1	222°33.5	7.4′	25°23.8	7.8′	57.5′
18	90°53.4	S23°23.2	236°59.9	7.5′	N25°16.0	7.9′	57.4′
19	105°53.1	23.3	251°26.4	7.6′	25°08.1	8.0′	57.4′
20	120°52.8	23.3	265°53.1	7.8′	25°00.1	8.2′	57.4′
21	135°52.5	·· 23.4	280°19.8	7.9′	24°51.9	8.3′	57.3′
22	150°52.2	23.5	294°46.7	8.0′	24°43.6	8.4′	57.3′
23	165°51.9	23.5	309°13.7	8.1′	24°35.2	8.6′	57.3′
	SD = 16.2′	d = -0.1′	SD = 15.8′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°51.6	S23°23.6	323°40.8	8.2′	N24°26.6	8.7′	57.2′
1	195°51.3	23.7	338°08.1	8.4′	24°17.9	8.8′	57.2′
2	210°51.0	23.7	352°35.4	8.5′	24°09.1	8.9′	57.2′
3	225°50.7	·· 23.8	7°02.9	8.6′	24°00.2	9.1′	57.1′
4	240°50.4	23.9	21°30.6	8.7′	23°51.1	9.1′	57.1′
5	255°50.0	23.9	35°58.3	8.9′	23°42.0	9.3′	57.1′
6	270°49.7	S23°24.0	50°26.2	9.0′	N23°32.7	9.4′	57.0′
7	285°49.4	24.0	64°54.2	9.1′	23°23.3	9.6′	57.0′
8	300°49.1	24.1	79°22.3	9.2′	23°13.7	9.6′	57.0′
9	315°48.8	·· 24.2	93°50.6	9.4′	23°04.1	9.7′	56.9′
10	330°48.5	24.2	108°18.9	9.5′	22°54.4	9.9′	56.9′
11	345°48.2	24.3	122°47.4	9.6′	22°44.5	9.9′	56.9′
12	0°47.9	S23°24.3	137°16.1	9.7′	N22°34.6	10.1′	56.8′
13	15°47.6	24.4	151°44.8	9.9′	22°24.5	10.2′	56.8′
14	30°47.3	24.4	166°13.7	10.0′	22°14.3	10.2′	56.8′
15	45°47.0	·· 24.5	180°42.7	10.1′	22°04.1	10.4′	56.7′
16	60°46.7	24.6	195°11.8	10.2′	21°53.7	10.5′	56.7′
17	75°46.4	24.6	209°41.0	10.4′	21°43.2	10.5′	56.7′
18	90°46.1	S23°24.7	224°10.4	10.5′	N21°32.7	10.7′	56.6′
19	105°45.7	24.7	238°39.9	10.6′	21°22.0	10.8′	56.6′
20	120°45.4	24.8	253°09.5	10.7′	21°11.2	10.8′	56.6′
21	135°45.1	·· 24.8	267°39.2	10.8′	21°00.4	10.9′	56.5′
22	150°44.8	24.9	282°09.0	11.0′	20°49.5	11.1′	56.5′
23	165°44.5	24.9	296°39.0	11.1′	20°38.4	11.1′	56.5′
	SD = 16.2′	d = -0.1′	SD = 15.6′				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°44.2	S23°25.0	311°09.1	11.2′	N20°27.3	11.2′	56.5′
1	195°43.9	25.0	325°39.3	11.3′	20°16.1	11.3′	56.4′
2	210°43.6	25.0	340°09.6	11.4′	20°04.8	11.4′	56.4′
3	225°43.3	·· 25.1	354°40.0	11.5′	19°53.4	11.4′	56.4′
4	240°43.0	25.1	9°10.6	11.7′	19°42.0	11.5′	56.3′
5	255°42.7	25.2	23°41.2	11.8′	19°30.5	11.7′	56.3′
6	270°42.4	S23°25.2	38°12.0	11.9′	N19°18.8	11.6′	56.3′
7	285°42.0	25.3	52°42.9	12.0′	19°07.2	11.8′	56.2′
8	300°41.7	25.3	67°13.9	12.1′	18°55.4	11.8′	56.2′
9	315°41.4	·· 25.3	81°45.0	12.2′	18°43.6	12.0′	56.2′
10	330°41.1	25.4	96°16.2	12.3′	18°31.6	11.9′	56.1′
11	345°40.8	25.4	110°47.6	12.4′	18°19.7	12.1′	56.1′
12	0°40.5	S23°25.5	125°19.0	12.6′	N18°07.6	12.1′	56.1′
13	15°40.2	25.5	139°50.6	12.7′	17°55.5	12.2′	56.0′
14	30°39.9	25.5	154°22.2	12.8′	17°43.3	12.2′	56.0′
15	45°39.6	·· 25.6	168°54.0	12.9′	17°31.1	12.4′	56.0′
16	60°39.3	25.6	183°25.9	13.0′	17°18.7	12.3′	56.0′
17	75°39.0	25.6	197°57.8	13.1′	17°06.4	12.5′	55.9′
18	90°38.6	S23°25.7	212°29.9	13.2′	N16°53.9	12.5′	55.9′
19	105°38.3	25.7	227°02.1	13.3′	16°41.4	12.6′	55.9′
20	120°38.0	25.7	241°34.4	13.4′	16°28.8	12.6′	55.8′
21	135°37.7	·· 25.8	256°06.7	13.5′	16°16.2	12.7′	55.8′
22	150°37.4	25.8	270°39.2	13.6′	16°03.5	12.7′	55.8′
23	165°37.1	25.8	285°11.8	13.7′	15°50.8	12.8′	55.7′
	SD = 16.2′	d = -0.0′	SD = 15.4′				

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

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

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 16-18 96-85%
17	03:56	03:41	11:56	01:34	14:03	
18	03:26	03:12	11:57	02:31	14:57	
19	02:57	02:42	11:57	03:22	15:46	

December 20, 21, 22 UT (Fri., Sat., Sun.)

	Aries	Venus		Mars		Jupiter		Saturn	
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	89°04.3	131°27.0	S18°26.8	320°49.2	N22°19.8	15°39.8	N21°55.2	103°17.6	S08°15.3
1	104°06.8	146°26.7	25.8	335°52.1	20.1	30°42.7	55.1	118°20.0	15.2
2	119°09.2	161°26.4	24.9	350°55.0	20.3	45°45.5	55.1	133°22.3	15.1
3	134°11.7	176°26.1	·· 24.0	5°57.9	·· 20.5	60°48.3	·· 55.1	148°24.6	·· 15.1
4	149°14.2	191°25.7	23.1	21°00.8	20.7	75°51.1	55.0	163°26.9	15.0
5	164°16.6	206°25.4	22.2	36°03.7	20.9	90°53.9	55.0	178°29.3	14.9
6	179°19.1	221°25.1	S18°21.2	51°06.6	N22°21.2	105°56.7	N21°55.0	193°31.6	S08°14.9
7	194°21.5	236°24.8	20.3	66°09.5	21.4	120°59.5	55.0	208°33.9	14.8
8	209°24.0	251°24.5	19.4	81°12.5	21.6	136°02.3	54.9	223°36.3	14.8
9	224°26.5	266°24.1	·· 18.4	96°15.4	·· 21.8	151°05.1	·· 54.9	238°38.6	·· 14.7
10	239°28.9	281°23.8	17.5	111°18.3	22.1	166°07.9	54.9	253°40.9	14.6
11	254°31.4	296°23.5	16.6	126°21.2	22.3	181°10.7	54.8	268°43.3	14.6
12	269°33.9	311°23.2	S18°15.7	141°24.1	N22°22.5	196°13.5	N21°54.8	283°45.6	S08°14.5
13	284°36.3	326°22.9	14.7	156°27.1	22.7	211°16.3	54.8	298°47.9	14.4
14	299°38.8	341°22.6	13.8	171°30.0	22.9	226°19.2	54.7	313°50.2	14.4
15	314°41.3	356°22.2	·· 12.9	186°32.9	·· 23.2	241°22.0	·· 54.7	328°52.6	·· 14.3
16	329°43.7	11°21.9	11.9	201°35.8	23.4	256°24.8	54.7	343°54.9	14.3
17	344°46.2	26°21.6	11.0	216°38.8	23.6	271°27.6	54.7	358°57.2	14.2
18	359°48.7	41°21.3	S18°10.1	231°41.7	N22°23.8	286°30.4	N21°54.6	13°59.6	S08°14.1
19	14°51.1	56°21.0	09.1	246°44.6	24.1	301°33.2	54.6	29°01.9	14.1
20	29°53.6	71°20.7	08.2	261°47.6	24.3	316°36.0	54.6	44°04.2	14.0
21	44°56.0	86°20.4	·· 07.3	276°50.5	·· 24.5	331°38.8	·· 54.5	59°06.5	·· 13.9
22	59°58.5	101°20.1	06.3	291°53.4	24.7	346°41.6	54.5	74°08.9	13.9
23	75°01.0	116°19.8	05.4	306°56.4	25.0	1°44.4	54.5	89°11.2	13.8
Mer.pass. 18:01		ν -0.3′ d 0.9′	m -4.34	ν 2.9′ d 0.2′	m -0.94	ν 2.8′ d -0.0′	m -2.79	ν 2.3′ d 0.1′	m 1.02

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	90°03.4	131°19.4	S18°04.5	321°59.3	N22°25.2	16°47.2	N21°54.5	104°13.5	S08°13.7
1	105°05.9	146°19.1	03.5	337°02.2	25.4	31°50.0	54.4	119°15.9	13.7
2	120°08.4	161°18.8	02.6	352°05.2	25.6	46°52.8	54.4	134°18.2	13.6
3	135°10.8	176°18.5	·· 01.6	7°08.1	·· 25.9	61°55.6	·· 54.4	149°20.5	·· 13.6
4	150°13.3	191°18.2	18°00.7	22°11.1	26.1	76°58.4	54.3	164°22.8	13.5
5	165°15.8	206°17.9	17°59.8	37°14.0	26.3	92°01.2	54.3	179°25.2	13.4
6	180°18.2	221°17.6	S17°58.8	52°17.0	N22°26.6	107°04.0	N21°54.3	194°27.5	S08°13.4
7	195°20.7	236°17.3	57.9	67°19.9	26.8	122°06.8	54.3	209°29.8	13.3
8	210°23.2	251°17.0	56.9	82°22.9	27.0	137°09.6	54.2	224°32.1	13.2
9	225°25.6	266°16.7	·· 56.0	97°25.8	·· 27.2	152°12.4	·· 54.2	239°34.5	·· 13.2
10	240°28.1	281°16.4	55.0	112°28.8	27.5	167°15.2	54.2	254°36.8	13.1
11	255°30.5	296°16.1	54.1	127°31.7	27.7	182°18.1	54.1	269°39.1	13.0
12	270°33.0	311°15.8	S17°53.2	142°34.7	N22°27.9	197°20.9	N21°54.1	284°41.4	S08°13.0
13	285°35.5	326°15.5	52.2	157°37.7	28.2	212°23.7	54.1	299°43.8	12.9
14	300°37.9	341°15.3	51.3	172°40.6	28.4	227°26.5	54.0	314°46.1	12.9
15	315°40.4	356°15.0	·· 50.3	187°43.6	·· 28.6	242°29.3	·· 54.0	329°48.4	·· 12.8
16	330°42.9	11°14.7	49.4	202°46.5	28.9	257°32.1	54.0	344°50.7	12.7
17	345°45.3	26°14.4	48.4	217°49.5	29.1	272°34.9	54.0	359°53.1	12.7
18	0°47.8	41°14.1	S17°47.5	232°52.5	N22°29.3	287°37.7	N21°53.9	14°55.4	S08°12.6
19	15°50.3	56°13.8	46.5	247°55.4	29.5	302°40.5	53.9	29°57.7	12.5
20	30°52.7	71°13.5	45.6	262°58.4	29.8	317°43.3	53.9	45°00.0	12.5
21	45°55.2	86°13.2	·· 44.6	278°01.4	·· 30.0	332°46.1	·· 53.8	60°02.4	·· 12.4
22	60°57.6	101°12.9	43.7	293°04.4	30.2	347°48.9	53.8	75°04.7	12.3
23	76°00.1	116°12.7	42.7	308°07.3	30.5	2°51.7	53.8	90°07.0	12.3
Mer.pass. 17:57		ν -0.3′ d 0.9′	m -4.35	ν 2.9′ d 0.2′	m -0.96	ν 2.8′ d -0.0′	m -2.79	ν 2.3′ d 0.1′	m 1.02

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	91°02.6	131°12.4	S17°41.7	323°10.3	N22°30.7	17°54.5	N21°53.8	105°09.3	S08°12.2
1	106°05.0	146°12.1	40.8	338°13.3	30.9	32°57.3	53.7	120°11.7	12.1
2	121°07.5	161°11.8	39.8	353°16.3	31.2	48°00.1	53.7	135°14.0	12.1
3	136°10.0	176°11.5	·· 38.9	8°19.3	·· 31.4	63°02.9	·· 53.7	150°16.3	·· 12.0
4	151°12.4	191°11.2	37.9	23°22.2	31.6	78°05.7	53.6	165°18.6	11.9
5	166°14.9	206°11.0	37.0	38°25.2	31.9	93°08.5	53.6	180°21.0	11.9
6	181°17.4	221°10.7	S17°36.0	53°28.2	N22°32.1	108°11.3	N21°53.6	195°23.3	S08°11.8
7	196°19.8	236°10.4	35.0	68°31.2	32.3	123°14.1	53.6	210°25.6	11.8
8	211°22.3	251°10.1	34.1	83°34.2	32.6	138°16.9	53.5	225°27.9	11.7
9	226°24.8	266°09.8	·· 33.1	98°37.2	·· 32.8	153°19.7	·· 53.5	240°30.2	·· 11.6
10	241°27.2	281°09.6	32.2	113°40.2	33.1	168°22.5	53.5	255°32.6	11.6
11	256°29.7	296°09.3	31.2	128°43.2	33.3	183°25.3	53.4	270°34.9	11.5
12	271°32.1	311°09.0	S17°30.2	143°46.2	N22°33.5	198°28.1	N21°53.4	285°37.2	S08°11.4
13	286°34.6	326°08.7	29.3	158°49.1	33.8	213°30.9	53.4	300°39.5	11.4
14	301°37.1	341°08.5	28.3	173°52.1	34.0	228°33.7	53.4	315°41.9	11.3
15	316°39.5	356°08.2	·· 27.3	188°55.1	·· 34.2	243°36.5	·· 53.3	330°44.2	·· 11.2
16	331°42.0	11°07.9	26.4	203°58.1	34.5	258°39.3	53.3	345°46.5	11.2
17	346°44.5	26°07.7	25.4	219°01.1	34.7	273°42.1	53.3	0°48.8	11.1
18	1°46.9	41°07.4	S17°24.4	234°04.1	N22°35.0	288°44.9	N21°53.2	15°51.1	S08°11.0
19	16°49.4	56°07.1	23.5	249°07.2	35.2	303°47.7	53.2	30°53.5	11.0
20	31°51.9	71°06.9	22.5	264°10.2	35.4	318°50.5	53.2	45°55.8	10.9
21	46°54.3	86°06.6	·· 21.5	279°13.2	·· 35.7	333°53.3	·· 53.2	60°58.1	·· 10.8
22	61°56.8	101°06.3	20.6	294°16.2	35.9	348°56.1	53.1	76°00.4	10.8
23	76°59.3	116°06.1	19.6	309°19.2	36.1	3°58.9	53.1	91°02.7	10.7
Mer.pass. 17:53		ν -0.3′ d 1.0′	m -4.36	ν 3.0′ d 0.2′	m -0.99	ν 2.8′ d -0.0′	m -2.79	ν 2.3′ d 0.1′	m 1.02

Stars

	SHA	Dec
Alpheratz	357°34.8	29°13.9
Ankaa	353°07.1	-42°10.4
Schedar	349°31.0	56°40.7
Diphda	348°47.3	-17°51.1
Achernar	335°19.9	-57°06.8
Hamal	327°51.1	23°35.0
Polaris	313°40.5	89°22.4
Acamar	315°11.5	-40°12.4
Menkar	314°05.9	4°11.3
Mirfak	308°27.9	49°57.1
Aldebaran	290°39.3	16°33.6
Rigel	281°03.6	-8°10.3
Capella	280°21.5	46°01.4
Bellatrix	278°22.6	6°22.4
Elnath	278°01.5	28°37.7
Alnilam	275°37.4	-1°11.1
Betelgeuse	270°51.8	7°24.7
Canopus	263°51.9	-52°42.4
Sirius	258°25.9	-16°45.0
Adhara	255°05.5	-29°00.3
Procyon	244°50.6	5°09.7
Pollux	243°17.0	27°57.9
Avior	234°14.2	-59°35.1
Suhail	222°46.0	-43°31.8
Miaplacidus	221°37.7	-69°48.9
Alphard	217°47.6	-8°45.9
Regulus	207°34.3	11°50.7
Dubhe	193°40.9	61°36.7
Denebola	182°25.0	14°25.9
Gienah	175°43.7	-17°40.7
Acrux	173°00.3	-63°13.9
Gacrux	171°51.8	-57°14.9
Alioth	166°13.1	55°49.2
Spica	158°22.5	-11°17.4
Alkaid	152°52.3	49°11.1
Hadar	148°36.5	-60°29.3
Menkent	147°57.9	-36°29.4
Arcturus	145°48.2	19°03.0
Rigil Kent.	139°40.8	-60°56.1
Kochab	137°20.6	74°02.9
Zuben'ubi	136°56.3	-16°08.7
Alphecca	126°04.1	26°37.7
Antares	112°16.3	-26°29.2
Atria	107°11.1	-69°04.2
Sabik	102°03.2	-15°45.3
Shaula	96°10.9	-37°07.3
Rasalhague	95°58.9	12°32.5
Eltanin	90°42.8	51°29.1
Kaus Aust.	83°33.0	-34°22.4
Vega	80°33.7	38°48.4
Nunki	75°48.2	-26°16.0
Altair	62°00.3	8°56.1
Peacock	53°06.3	-56°39.5
Deneb	49°26.2	45°22.3
Enif	33°39.0	9°59.4
Al Na'ir	27°33.2	-46°50.6
Fomalhaut	15°14.7	-29°29.6
Scheat	13°45.3	28°13.2
Markab	13°30.0	15°20.5

Dec 20 Fri	SHA	Mer.pass
Venus	42°22.7	15:15
Mars	231°44.9	02:36
Jupiter	286°35.5	22:53
Saturn	14°13.3	17:04

Dec 21 Sat	SHA	Mer.pass
Venus	41°16.0	15:15
Mars	231°55.9	02:32
Jupiter	286°43.8	22:49
Saturn	14°10.1	17:00

Dec 22 Sun	SHA	Mer.pass
Venus	40°09.8	15:15
Mars	232°07.7	02:27
Jupiter	286°51.9	22:44
Saturn	14°06.8	16:57

Horizontal parallax	
Venus:	0.2
Mars:	0.2

DUT1 = UT1-UTC = +0.1819 sec ΔT = TT-UT1 = +69.0021 sec

2024 December 20 to Dec. 22 UT

h	Sun		Moon				
Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°36.8	S23°25.8	299°44.5	13.8′	N15°38.0	12.8′	55.7′
1	195°36.5	25.9	314°17.2	13.9′	15°25.2	12.9′	55.7′
2	210°36.2	25.9	328°50.1	14.0′	15°12.3	12.9′	55.7′
3	225°35.9	·· 25.9	343°23.0	14.0′	14°59.4	13.0′	55.6′
4	240°35.6	25.9	357°56.1	14.1′	14°46.4	13.1′	55.6′
5	255°35.2	26.0	12°29.2	14.2′	14°33.3	13.1′	55.6′
6	270°34.9	S23°26.0	27°02.4	14.3′	N14°20.2	13.1′	55.6′
7	285°34.6	26.0	41°35.7	14.4′	14°07.1	13.2′	55.5′
8	300°34.3	26.0	56°09.1	14.5′	13°53.9	13.2′	55.5′
9	315°34.0	·· 26.1	70°42.6	14.6′	13°40.7	13.2′	55.5′
10	330°33.7	26.1	85°16.2	14.7′	13°27.5	13.3′	55.4′
11	345°33.4	26.1	99°49.8	14.7′	13°14.2	13.4′	55.4′
12	0°33.1	S23°26.1	114°23.6	14.8′	N13°00.8	13.4′	55.4′
13	15°32.8	26.1	128°57.4	14.9′	12°47.4	13.4′	55.4′
14	30°32.5	26.1	143°31.3	15.0′	12°34.0	13.5′	55.3′
15	45°32.2	·· 26.2	158°05.2	15.0′	12°20.5	13.4′	55.3′
16	60°31.8	26.2	172°39.3	15.1′	12°07.1	13.6′	55.3′
17	75°31.5	26.2	187°13.4	15.2′	11°53.5	13.5′	55.3′
18	90°31.2	S23°26.2	201°47.6	15.3′	N11°40.0	13.6′	55.2′
19	105°30.9	26.2	216°21.9	15.3′	11°26.4	13.7′	55.2′
20	120°30.6	26.2	230°56.2	15.4′	11°12.7	13.6′	55.2′
21	135°30.3	·· 26.2	245°30.6	15.5′	10°59.1	13.7′	55.2′
22	150°30.0	26.3	260°05.1	15.6′	10°45.4	13.7′	55.1′
23	165°29.7	26.3	274°39.7	15.6′	10°31.7	13.8′	55.1′
	SD = 16.2′	d = -0.0′	SD = 15.2′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°29.4	S23°26.3	289°14.3	15.7′	N10°17.9	13.7′	55.1′
1	195°29.1	26.3	303°49.0	15.7′	10°04.2	13.8′	55.1′
2	210°28.7	26.3	318°23.7	15.8′	09°50.4	13.9′	55.1′
3	225°28.4	·· 26.3	332°58.6	15.9′	09°36.5	13.8′	55.0′
4	240°28.1	26.3	347°33.4	15.9′	09°22.7	13.9′	55.0′
5	255°27.8	26.3	2°08.4	16.0′	09°08.8	13.9′	55.0′
6	270°27.5	S23°26.3	16°43.4	16.1′	N08°54.9	13.9′	55.0′
7	285°27.2	26.3	31°18.4	16.1′	08°41.0	14.0′	54.9′
8	300°26.9	26.3	45°53.5	16.2′	08°27.0	13.9′	54.9′
9	315°26.6	·· 26.3	60°28.7	16.2′	08°13.1	14.0′	54.9′
10	330°26.3	26.3	75°03.9	16.3′	07°59.1	14.0′	54.9′
11	345°25.9	26.3	89°39.2	16.3′	07°45.1	14.0′	54.9′
12	0°25.6	S23°26.3	104°14.5	16.4′	N07°31.1	14.0′	54.8′
13	15°25.3	26.3	118°49.9	16.4′	07°17.1	14.1′	54.8′
14	30°25.0	26.3	133°25.3	16.5′	07°03.0	14.0′	54.8′
15	45°24.7	·· 26.3	148°00.8	16.5′	06°49.0	14.1′	54.8′
16	60°24.4	26.3	162°36.3	16.6′	06°34.9	14.1′	54.8′
17	75°24.1	26.3	177°11.9	16.6′	06°20.8	14.1′	54.7′
18	90°23.8	S23°26.3	191°47.5	16.7′	N06°06.7	14.1′	54.7′
19	105°23.5	26.3	206°23.1	16.7′	05°52.6	14.2′	54.7′
20	120°23.2	26.3	220°58.8	16.7′	05°38.4	14.1′	54.7′
21	135°22.8	·· 26.2	235°34.5	16.8′	05°24.3	14.2′	54.7′
22	150°22.5	26.2	250°10.3	16.8′	05°10.1	14.1′	54.6′
23	165°22.2	26.2	264°46.1	16.8′	04°56.0	14.2′	54.6′
	SD = 16.3′	d = -0.0′	SD = 15.0′				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°21.9	S23°26.2	279°22.0	16.9′	N04°41.8	14.2′	54.6′
1	195°21.6	26.2	293°57.8	16.9′	04°27.6	14.1′	54.6′
2	210°21.3	26.2	308°33.8	16.9′	04°13.5	14.2′	54.6′
3	225°21.0	·· 26.2	323°09.7	17.0′	03°59.3	14.2′	54.6′
4	240°20.7	26.2	337°45.7	17.0′	03°45.1	14.2′	54.5′
5	255°20.4	26.1	352°21.7	17.0′	03°30.9	14.2′	54.5′
6	270°20.0	S23°26.1	6°57.7	17.1′	N03°16.7	14.2′	54.5′
7	285°19.7	26.1	21°33.8	17.1′	03°02.5	14.2′	54.5′
8	300°19.4	26.1	36°09.9	17.1′	02°48.3	14.2′	54.5′
9	315°19.1	·· 26.1	50°46.0	17.1′	02°34.1	14.3′	54.5′
10	330°18.8	26.1	65°22.2	17.2′	02°19.8	14.2′	54.5′
11	345°18.5	26.0	79°58.3	17.2′	02°05.6	14.2′	54.4′
12	0°18.2	S23°26.0	94°34.5	17.2′	N01°51.4	14.2′	54.4′
13	15°17.9	26.0	109°10.7	17.2′	01°37.2	14.2′	54.4′
14	30°17.6	26.0	123°46.9	17.2′	01°23.0	14.2′	54.4′
15	45°17.2	·· 25.9	138°23.2	17.3′	01°08.8	14.2′	54.4′
16	60°16.9	25.9	152°59.4	17.3′	00°54.6	14.2′	54.4′
17	75°16.6	25.9	167°35.7	17.3′	00°40.4	14.2′	54.4′
18	90°16.3	S23°25.9	182°12.0	17.3′	N00°26.2	14.2′	54.4′
19	105°16.0	25.8	196°48.3	17.3′	N00°12.0	14.2′	54.3′
20	120°15.7	25.8	211°24.6	17.3′	S00°02.2	14.2′	54.3′
21	135°15.4	·· 25.8	226°00.9	17.3′	00°16.4	14.2′	54.3′
22	150°15.1	25.8	240°37.3	17.3′	00°30.6	14.1′	54.3′
23	165°14.8	25.7	255°13.6	17.3′	00°44.7	14.2′	54.3′
	SD = 16.3′	d = 0.0′	SD = 14.9′				

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

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

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 19-21 77-59%
20	02:27	02:12	11:58	04:09	16:30	
21	01:57	01:43	11:58	04:51	17:12	
22	01:28	01:13	11:59	05:31	17:51	

December 23, 24, 25 UT (Mon., Tue., Wed.)

	Aries	Venus		Mars		Jupiter		Saturn	
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	92°01.7	131°05.8	S17°18.6	324°22.2	N22°36.4	19°01.7	N21°53.1	106°05.1	S08°10.6
1	107°04.2	146°05.5	17.7	339°25.2	36.6	34°04.5	53.0	121°07.4	10.6
2	122°06.6	161°05.3	16.7	354°28.2	36.9	49°07.2	53.0	136°09.7	10.5
3	137°09.1	176°05.0	·· 15.7	9°31.3	·· 37.1	64°10.0	·· 53.0	151°12.0	·· 10.4
4	152°11.6	191°04.8	14.7	24°34.3	37.3	79°12.8	53.0	166°14.3	10.4
5	167°14.0	206°04.5	13.8	39°37.3	37.6	94°15.6	52.9	181°16.7	10.3
6	182°16.5	221°04.2	S17°12.8	54°40.3	N22°37.8	109°18.4	N21°52.9	196°19.0	S08°10.2
7	197°19.0	236°04.0	11.8	69°43.3	38.1	124°21.2	52.9	211°21.3	10.2
8	212°21.4	251°03.7	10.8	84°46.4	38.3	139°24.0	52.8	226°23.6	10.1
9	227°23.9	266°03.5	·· 09.9	99°49.4	·· 38.5	154°26.8	·· 52.8	241°25.9	·· 10.0
10	242°26.4	281°03.2	08.9	114°52.4	38.8	169°29.6	52.8	256°28.3	10.0
11	257°28.8	296°03.0	07.9	129°55.4	39.0	184°32.4	52.8	271°30.6	09.9
12	272°31.3	311°02.7	S17°06.9	144°58.5	N22°39.3	199°35.2	N21°52.7	286°32.9	S08°09.8
13	287°33.7	326°02.5	06.0	160°01.5	39.5	214°38.0	52.7	301°35.2	09.8
14	302°36.2	341°02.2	05.0	175°04.5	39.8	229°40.8	52.7	316°37.5	09.7
15	317°38.7	356°02.0	·· 04.0	190°07.6	·· 40.0	244°43.6	·· 52.6	331°39.9	·· 09.6
16	332°41.1	11°01.7	03.0	205°10.6	40.2	259°46.4	52.6	346°42.2	09.6
17	347°43.6	26°01.5	02.0	220°13.6	40.5	274°49.2	52.6	1°44.5	09.5
18	2°46.1	41°01.2	S17°01.1	235°16.7	N22°40.7	289°52.0	N21°52.6	16°46.8	S08°09.4
19	17°48.5	56°01.0	17°00.1	250°19.7	41.0	304°54.8	52.5	31°49.1	09.4
20	32°51.0	71°00.7	16°59.1	265°22.8	41.2	319°57.6	52.5	46°51.4	09.3
21	47°53.5	86°00.5	·· 58.1	280°25.8	·· 41.5	335°00.4	·· 52.5	61°53.8	·· 09.2
22	62°55.9	101°00.2	57.1	295°28.9	41.7	350°03.1	52.4	76°56.1	09.2
23	77°58.4	116°00.0	56.1	310°31.9	42.0	5°05.9	52.4	91°58.4	09.1
Mer.pass. 17:49		ν -0.3′	d 1.0′	m -4.37	ν 3.0′	d 0.2′	m -1.01	ν 2.8′	d -0.0′ m -2.78	ν 2.3′	d 0.1′ m 1.03

Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	93°00.9	130°59.7	S16°55.1	325°35.0	N22°42.2	20°08.7	N21°52.4	107°00.7	S08°09.0
1	108°03.3	145°59.5	54.2	340°38.0	42.4	35°11.5	52.4	122°03.0	09.0
2	123°05.8	160°59.3	53.2	355°41.1	42.7	50°14.3	52.3	137°05.4	08.9
3	138°08.2	175°59.0	·· 52.2	10°44.1	·· 42.9	65°17.1	·· 52.3	152°07.7	·· 08.8
4	153°10.7	190°58.8	51.2	25°47.2	43.2	80°19.9	52.3	167°10.0	08.8
5	168°13.2	205°58.6	50.2	40°50.2	43.4	95°22.7	52.2	182°12.3	08.7
6	183°15.6	220°58.3	S16°49.2	55°53.3	N22°43.7	110°25.5	N21°52.2	197°14.6	S08°08.6
7	198°18.1	235°58.1	48.2	70°56.3	43.9	125°28.3	52.2	212°16.9	08.6
8	213°20.6	250°57.8	47.2	85°59.4	44.2	140°31.1	52.2	227°19.2	08.5
9	228°23.0	265°57.6	·· 46.2	101°02.5	·· 44.4	155°33.9	·· 52.1	242°21.6	·· 08.4
10	243°25.5	280°57.4	45.3	116°05.5	44.7	170°36.7	52.1	257°23.9	08.4
11	258°28.0	295°57.1	44.3	131°08.6	44.9	185°39.4	52.1	272°26.2	08.3
12	273°30.4	310°56.9	S16°43.3	146°11.7	N22°45.2	200°42.2	N21°52.0	287°28.5	S08°08.2
13	288°32.9	325°56.7	42.3	161°14.7	45.4	215°45.0	52.0	302°30.8	08.1
14	303°35.4	340°56.5	41.3	176°17.8	45.7	230°47.8	52.0	317°33.1	08.1
15	318°37.8	355°56.2	·· 40.3	191°20.9	·· 45.9	245°50.6	·· 52.0	332°35.5	·· 08.0
16	333°40.3	10°56.0	39.3	206°23.9	46.2	260°53.4	51.9	347°37.8	07.9
17	348°42.7	25°55.8	38.3	221°27.0	46.4	275°56.2	51.9	2°40.1	07.9
18	3°45.2	40°55.5	S16°37.3	236°30.1	N22°46.7	290°59.0	N21°51.9	17°42.4	S08°07.8
19	18°47.7	55°55.3	36.3	251°33.2	46.9	306°01.8	51.8	32°44.7	07.7
20	33°50.1	70°55.1	35.3	266°36.2	47.2	321°04.5	51.8	47°47.0	07.7
21	48°52.6	85°54.9	·· 34.3	281°39.3	·· 47.4	336°07.3	·· 51.8	62°49.3	·· 07.6
22	63°55.1	100°54.7	33.3	296°42.4	47.7	351°10.1	51.8	77°51.7	07.5
23	78°57.5	115°54.4	32.3	311°45.5	47.9	6°12.9	51.7	92°54.0	07.5
Mer.pass. 17:45		ν -0.2′	d 1.0′	m -4.38	ν 3.1′	d 0.2′	m -1.03	ν 2.8′	d -0.0′ m -2.78	ν 2.3′	d 0.1′ m 1.03

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	94°00.0	130°54.2	S16°31.3	326°48.6	N22°48.2	21°15.7	N21°51.7	107°56.3	S08°07.4
1	109°02.5	145°54.0	30.3	341°51.7	48.4	36°18.5	51.7	122°58.6	07.3
2	124°04.9	160°53.8	29.3	356°54.7	48.7	51°21.3	51.6	138°00.9	07.3
3	139°07.4	175°53.6	·· 28.3	11°57.8	·· 48.9	66°24.1	·· 51.6	153°03.2	·· 07.2
4	154°09.8	190°53.3	27.3	27°00.9	49.2	81°26.9	51.6	168°05.5	07.1
5	169°12.3	205°53.1	26.3	42°04.0	49.4	96°29.6	51.6	183°07.8	07.0
6	184°14.8	220°52.9	S16°25.3	57°07.1	N22°49.7	111°32.4	N21°51.5	198°10.2	S08°07.0
7	199°17.2	235°52.7	24.3	72°10.2	49.9	126°35.2	51.5	213°12.5	06.9
8	214°19.7	250°52.5	23.3	87°13.3	50.2	141°38.0	51.5	228°14.8	06.8
9	229°22.2	265°52.3	·· 22.3	102°16.4	·· 50.4	156°40.8	·· 51.5	243°17.1	·· 06.8
10	244°24.6	280°52.1	21.2	117°19.5	50.7	171°43.6	51.4	258°19.4	06.7
11	259°27.1	295°51.9	20.2	132°22.6	50.9	186°46.4	51.4	273°21.7	06.6
12	274°29.6	310°51.6	S16°19.2	147°25.7	N22°51.2	201°49.1	N21°51.4	288°24.0	S08°06.6
13	289°32.0	325°51.4	18.2	162°28.8	51.4	216°51.9	51.3	303°26.3	06.5
14	304°34.5	340°51.2	17.2	177°31.9	51.7	231°54.7	51.3	318°28.7	06.4
15	319°37.0	355°51.0	·· 16.2	192°35.0	·· 52.0	246°57.5	·· 51.3	333°31.0	·· 06.3
16	334°39.4	10°50.8	15.2	207°38.1	52.2	262°00.3	51.3	348°33.3	06.3
17	349°41.9	25°50.6	14.2	222°41.2	52.5	277°03.1	51.2	3°35.6	06.2
18	4°44.3	40°50.4	S16°13.2	237°44.3	N22°52.7	292°05.9	N21°51.2	18°37.9	S08°06.1
19	19°46.8	55°50.2	12.2	252°47.4	53.0	307°08.6	51.2	33°40.2	06.1
20	34°49.3	70°50.0	11.1	267°50.6	53.2	322°11.4	51.1	48°42.5	06.0
21	49°51.7	85°49.8	·· 10.1	282°53.7	·· 53.5	337°14.2	·· 51.1	63°44.8	·· 05.9
22	64°54.2	100°49.6	09.1	297°56.8	53.7	352°17.0	51.1	78°47.1	05.9
23	79°56.7	115°49.4	08.1	312°59.9	54.0	7°19.8	51.1	93°49.5	05.8
Mer.pass. 17:41		ν -0.2′	d 1.0′	m -4.38	ν 3.1′	d 0.3′	m -1.06	ν 2.8′	d -0.0′ m -2.77	ν 2.3′	d 0.1′ m 1.03

Stars

	SHA	Dec
Alpheratz	357°34.8	29°13.9
Ankaa	353°07.1	-42°10.4
Schedar	349°31.0	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°41.4	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°21.5	46°01.4
Bellatrix	278°22.6	6°22.4
Elnath	278°01.5	28°37.7
Alnilam	275°37.4	-1°11.1
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°50.6	5°09.7
Pollux	243°17.0	27°57.9
Avior	234°14.2	-59°35.1
Suhail	222°46.0	-43°31.8
Miaplacidus	221°37.6	-69°48.9
Alphard	217°47.6	-8°46.0
Regulus	207°34.3	11°50.7
Dubhe	193°40.8	61°36.7
Denebola	182°25.0	14°25.9
Gienah	175°43.6	-17°40.7
Acrux	173°00.2	-63°13.9
Gacrux	171°51.8	-57°14.9
Alioth	166°13.1	55°49.2
Spica	158°22.5	-11°17.4
Alkaid	152°52.2	49°11.1
Hadar	148°36.4	-60°29.3
Menkent	147°57.9	-36°29.4
Arcturus	145°48.1	19°03.0
Rigil Kent.	139°40.8	-60°56.1
Kochab	137°20.6	74°02.8
Zuben'ubi	136°56.3	-16°08.7
Alphecca	126°04.1	26°37.7
Antares	112°16.2	-26°29.2
Atria	107°11.1	-69°04.2
Sabik	102°03.2	-15°45.3
Shaula	96°10.9	-37°07.3
Rasalhague	95°58.9	12°32.5
Eltanin	90°42.8	51°29.0
Kaus Aust.	83°33.0	-34°22.4
Vega	80°33.7	38°48.4
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°22.3
Enif	33°39.0	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°30.0	15°20.4

Dec 23 Mon	SHA	Mer.pass
Venus	39°04.1	15:16
Mars	232°20.5	02:22
Jupiter	286°59.9	22:40
Saturn	14°03.4	16:53

Dec 24 Tue	SHA	Mer.pass
Venus	37°58.9	15:16
Mars	232°34.1	02:17
Jupiter	287°07.9	22:35
Saturn	13°59.9	16:49

Dec 25 Wed	SHA	Mer.pass
Venus	36°54.2	15:17
Mars	232°48.6	02:12
Jupiter	287°15.7	22:31
Saturn	13°56.3	16:46

Horizontal parallax	
Venus:	0.2
Mars:	0.2

h	Sun		Moon				
Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°14.4	S23°25.7	269°50.0	17.4′	S00°58.9	14.2′	54.3′
1	195°14.1	25.7	284°26.3	17.4′	01°13.1	14.1′	54.3′
2	210°13.8	25.6	299°02.7	17.4′	01°27.2	14.1′	54.3′
3	225°13.5	·· 25.6	313°39.0	17.4′	01°41.3	14.2′	54.3′
4	240°13.2	25.6	328°15.4	17.4′	01°55.5	14.1′	54.3′
5	255°12.9	25.5	342°51.7	17.4′	02°09.6	14.1′	54.3′
6	270°12.6	S23°25.5	357°28.1	17.4′	S02°23.7	14.1′	54.2′
7	285°12.3	25.5	12°04.5	17.4′	02°37.8	14.1′	54.2′
8	300°12.0	25.4	26°40.8	17.4′	02°51.9	14.0′	54.2′
9	315°11.7	·· 25.4	41°17.2	17.3′	03°05.9	14.1′	54.2′
10	330°11.3	25.3	55°53.5	17.3′	03°20.0	14.0′	54.2′
11	345°11.0	25.3	70°29.9	17.3′	03°34.0	14.0′	54.2′
12	0°10.7	S23°25.3	85°06.2	17.3′	S03°48.0	14.0′	54.2′
13	15°10.4	25.2	99°42.5	17.3′	04°02.0	14.0′	54.2′
14	30°10.1	25.2	114°18.8	17.3′	04°16.0	14.0′	54.2′
15	45°09.8	·· 25.1	128°55.1	17.3′	04°30.0	13.9′	54.2′
16	60°09.5	25.1	143°31.4	17.3′	04°43.9	14.0′	54.2′
17	75°09.2	25.0	158°07.7	17.3′	04°57.9	13.9′	54.2′
18	90°08.9	S23°25.0	172°44.0	17.2′	S05°11.8	13.9′	54.2′
19	105°08.5	25.0	187°20.2	17.2′	05°25.7	13.9′	54.2′
20	120°08.2	24.9	201°56.4	17.2′	05°39.6	13.8′	54.2′
21	135°07.9	·· 24.9	216°32.6	17.2′	05°53.4	13.9′	54.2′
22	150°07.6	24.8	231°08.8	17.2′	06°07.3	13.8′	54.2′
23	165°07.3	24.8	245°45.0	17.1′	06°21.1	13.8′	54.2′
	SD = 16.3′	d = 0.0′	SD = 14.8′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	180°07.0	S23°24.7	260°21.1	17.1′	S06°34.9	13.7′	54.2′
1	195°06.7	24.7	274°57.3	17.1′	06°48.6	13.8′	54.2′
2	210°06.4	24.6	289°33.4	17.1′	07°02.4	13.7′	54.2′
3	225°06.1	·· 24.5	304°09.4	17.0′	07°16.1	13.7′	54.2′
4	240°05.7	24.5	318°45.5	17.0′	07°29.8	13.6′	54.2′
5	255°05.4	24.4	333°21.5	17.0′	07°43.4	13.7′	54.1′
6	270°05.1	S23°24.4	347°57.5	17.0′	S07°57.1	13.6′	54.1′
7	285°04.8	24.3	2°33.4	16.9′	08°10.7	13.5′	54.1′
8	300°04.5	24.3	17°09.4	16.9′	08°24.2	13.6′	54.1′
9	315°04.2	·· 24.2	31°45.3	16.9′	08°37.8	13.5′	54.1′
10	330°03.9	24.2	46°21.1	16.8′	08°51.3	13.5′	54.1′
11	345°03.6	24.1	60°57.0	16.8′	09°04.8	13.5′	54.2′
12	0°03.3	S23°24.0	75°32.7	16.8′	S09°18.3	13.4′	54.2′
13	15°03.0	24.0	90°08.5	16.7′	09°31.7	13.4′	54.2′
14	30°02.6	23.9	104°44.2	16.7′	09°45.1	13.3′	54.2′
15	45°02.3	·· 23.8	119°19.9	16.6′	09°58.4	13.4′	54.2′
16	60°02.0	23.8	133°55.5	16.6′	10°11.8	13.3′	54.2′
17	75°01.7	23.7	148°31.1	16.6′	10°25.1	13.2′	54.2′
18	90°01.4	S23°23.7	163°06.7	16.5′	S10°38.3	13.2′	54.2′
19	105°01.1	23.6	177°42.2	16.5′	10°51.5	13.2′	54.2′
20	120°00.8	23.5	192°17.6	16.4′	11°04.7	13.2′	54.2′
21	135°00.5	·· 23.5	206°53.1	16.4′	11°17.9	13.1′	54.2′
22	150°00.2	23.4	221°28.4	16.3′	11°31.0	13.1′	54.2′
23	164°59.8	23.3	236°03.8	16.3′	11°44.1	13.0′	54.2′
	SD = 16.3′	d = 0.1′	SD = 14.8′				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°59.5	S23°23.2	250°39.0	16.2′	S11°57.1	13.0′	54.2′
1	194°59.2	23.2	265°14.3	16.2′	12°10.1	12.9′	54.2′
2	209°58.9	23.1	279°49.4	16.1′	12°23.0	12.9′	54.2′
3	224°58.6	·· 23.0	294°24.5	16.1′	12°35.9	12.9′	54.2′
4	239°58.3	23.0	308°59.6	16.0′	12°48.8	12.8′	54.2′
5	254°58.0	22.9	323°34.6	16.0′	13°01.6	12.8′	54.2′
6	269°57.7	S23°22.8	338°09.6	15.9′	S13°14.4	12.7′	54.2′
7	284°57.4	22.7	352°44.5	15.8′	13°27.1	12.7′	54.2′
8	299°57.1	22.6	7°19.3	15.8′	13°39.8	12.6′	54.2′
9	314°56.7	·· 22.6	21°54.1	15.7′	13°52.4	12.6′	54.2′
10	329°56.4	22.5	36°28.8	15.7′	14°05.0	12.6′	54.3′
11	344°56.1	22.4	51°03.5	15.6′	14°17.6	12.4′	54.3′
12	359°55.8	S23°22.3	65°38.1	15.5′	S14°30.0	12.5′	54.3′
13	14°55.5	22.3	80°12.6	15.5′	14°42.5	12.4′	54.3′
14	29°55.2	22.2	94°47.1	15.4′	14°54.9	12.3′	54.3′
15	44°54.9	·· 22.1	109°21.5	15.3′	15°07.2	12.3′	54.3′
16	59°54.6	22.0	123°55.8	15.3′	15°19.5	12.2′	54.3′
17	74°54.3	21.9	138°30.1	15.2′	15°31.7	12.2′	54.3′
18	89°54.0	S23°21.8	153°04.3	15.1′	S15°43.9	12.1′	54.3′
19	104°53.7	21.8	167°38.5	15.1′	15°56.0	12.1′	54.3′
20	119°53.3	21.7	182°12.5	15.0′	16°08.1	12.0′	54.3′
21	134°53.0	·· 21.6	196°46.5	14.9′	16°20.1	11.9′	54.3′
22	149°52.7	21.5	211°20.5	14.9′	16°32.0	11.9′	54.4′
23	164°52.4	21.4	225°54.3	14.8′	16°43.9	11.8′	54.4′
	SD = 16.3′	d = 0.1′	SD = 14.8′				

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

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

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 22-24 49-31%
23	00:58	00:43	11:59	06:10	18:30	
24	00:28	00:13	12:00	06:49	19:09	
25	00:02	00:17	12:00	07:30	19:51	

December 26, 27, 28 UT (Thu., Fri., Sat.)

	Aries	Venus		Mars		Jupiter		Saturn	
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	94°59.1	130°49.2	S16°07.1	328°03.0	N22°54.2	22°22.6	N21°51.0	108°51.8	S08°05.7
1	110°01.6	145°49.0	06.1	343°06.1	54.5	37°25.3	51.0	123°54.1	05.6
2	125°04.1	160°48.8	05.1	358°09.3	54.8	52°28.1	51.0	138°56.4	05.6
3	140°06.5	175°48.6	·· 04.0	13°12.4	·· 55.0	67°30.9	·· 51.0	153°58.7	·· 05.5
4	155°09.0	190°48.4	03.0	28°15.5	55.3	82°33.7	50.9	169°01.0	05.4
5	170°11.5	205°48.2	02.0	43°18.6	55.5	97°36.5	50.9	184°03.3	05.4
6	185°13.9	220°48.0	S16°01.0	58°21.8	N22°55.8	112°39.3	N21°50.9	199°05.6	S08°05.3
7	200°16.4	235°47.8	16°00.0	73°24.9	56.0	127°42.0	50.8	214°07.9	05.2
8	215°18.8	250°47.7	15°58.9	88°28.0	56.3	142°44.8	50.8	229°10.2	05.2
9	230°21.3	265°47.5	·· 57.9	103°31.2	·· 56.6	157°47.6	·· 50.8	244°12.6	·· 05.1
10	245°23.8	280°47.3	56.9	118°34.3	56.8	172°50.4	50.8	259°14.9	05.0
11	260°26.2	295°47.1	55.9	133°37.4	57.1	187°53.2	50.7	274°17.2	04.9
12	275°28.7	310°46.9	S15°54.9	148°40.6	N22°57.3	202°55.9	N21°50.7	289°19.5	S08°04.9
13	290°31.2	325°46.7	53.8	163°43.7	57.6	217°58.7	50.7	304°21.8	04.8
14	305°33.6	340°46.5	52.8	178°46.8	57.8	233°01.5	50.6	319°24.1	04.7
15	320°36.1	355°46.3	·· 51.8	193°50.0	·· 58.1	248°04.3	·· 50.6	334°26.4	·· 04.7
16	335°38.6	10°46.2	50.8	208°53.1	58.4	263°07.1	50.6	349°28.7	04.6
17	350°41.0	25°46.0	49.7	223°56.3	58.6	278°09.8	50.6	4°31.0	04.5
18	5°43.5	40°45.8	S15°48.7	238°59.4	N22°58.9	293°12.6	N21°50.5	19°33.3	S08°04.4
19	20°45.9	55°45.6	47.7	254°02.6	59.1	308°15.4	50.5	34°35.6	04.4
20	35°48.4	70°45.4	46.7	269°05.7	59.4	323°18.2	50.5	49°37.9	04.3
21	50°50.9	85°45.3	·· 45.6	284°08.9	·· 59.7	338°21.0	·· 50.5	64°40.2	·· 04.2
22	65°53.3	100°45.1	44.6	299°12.0	22°59.9	353°23.7	50.4	79°42.6	04.2
23	80°55.8	115°44.9	43.6	314°15.2	23°00.2	8°26.5	50.4	94°44.9	04.1
Mer.pass. 17:37		ν -0.2′	d 1.0′	m -4.39	ν 3.1′	d 0.3′	m -1.08	ν 2.8′	d -0.0′ m -2.77	ν 2.3′	d 0.1′ m 1.04

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	95°58.3	130°44.7	S15°42.5	329°18.3	N23°00.4	23°29.3	N21°50.4	109°47.2	S08°04.0
1	111°00.7	145°44.6	41.5	344°21.5	00.7	38°32.1	50.3	124°49.5	03.9
2	126°03.2	160°44.4	40.5	359°24.6	01.0	53°34.9	50.3	139°51.8	03.9
3	141°05.7	175°44.2	·· 39.4	14°27.8	·· 01.2	68°37.6	·· 50.3	154°54.1	·· 03.8
4	156°08.1	190°44.0	38.4	29°30.9	01.5	83°40.4	50.3	169°56.4	03.7
5	171°10.6	205°43.9	37.4	44°34.1	01.8	98°43.2	50.2	184°58.7	03.7
6	186°13.1	220°43.7	S15°36.3	59°37.3	N23°02.0	113°46.0	N21°50.2	200°01.0	S08°03.6
7	201°15.5	235°43.5	35.3	74°40.4	02.3	128°48.7	50.2	215°03.3	03.5
8	216°18.0	250°43.3	34.3	89°43.6	02.5	143°51.5	50.2	230°05.6	03.4
9	231°20.4	265°43.2	·· 33.2	104°46.7	·· 02.8	158°54.3	·· 50.1	245°07.9	·· 03.4
10	246°22.9	280°43.0	32.2	119°49.9	03.1	173°57.1	50.1	260°10.2	03.3
11	261°25.4	295°42.8	31.2	134°53.1	03.3	188°59.9	50.1	275°12.5	03.2
12	276°27.8	310°42.7	S15°30.1	149°56.3	N23°03.6	204°02.6	N21°50.0	290°14.8	S08°03.1
13	291°30.3	325°42.5	29.1	164°59.4	03.8	219°05.4	50.0	305°17.1	03.1
14	306°32.8	340°42.4	28.1	180°02.6	04.1	234°08.2	50.0	320°19.4	03.0
15	321°35.2	355°42.2	·· 27.0	195°05.8	·· 04.4	249°11.0	·· 50.0	335°21.8	·· 02.9
16	336°37.7	10°42.0	26.0	210°08.9	04.6	264°13.7	49.9	350°24.1	02.9
17	351°40.2	25°41.9	24.9	225°12.1	04.9	279°16.5	49.9	5°26.4	02.8
18	6°42.6	40°41.7	S15°23.9	240°15.3	N23°05.2	294°19.3	N21°49.9	20°28.7	S08°02.7
19	21°45.1	55°41.6	22.9	255°18.5	05.4	309°22.1	49.9	35°31.0	02.6
20	36°47.6	70°41.4	21.8	270°21.7	05.7	324°24.8	49.8	50°33.3	02.6
21	51°50.0	85°41.2	·· 20.8	285°24.8	·· 06.0	339°27.6	·· 49.8	65°35.6	·· 02.5
22	66°52.5	100°41.1	19.7	300°28.0	06.2	354°30.4	49.8	80°37.9	02.4
23	81°54.9	115°40.9	18.7	315°31.2	06.5	9°33.1	49.8	95°40.2	02.3
Mer.pass. 17:33		ν -0.2′	d 1.0′	m -4.40	ν 3.2′	d 0.3′	m -1.10	ν 2.8′	d -0.0′ m -2.77	ν 2.3′	d 0.1′ m 1.04

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	96°57.4	130°40.8	S15°17.7	330°34.4	N23°06.7	24°35.9	N21°49.7	110°42.5	S08°02.3
1	111°59.9	145°40.6	16.6	345°37.6	07.0	39°38.7	49.7	125°44.8	02.2
2	127°02.3	160°40.5	15.6	0°40.8	07.3	54°41.5	49.7	140°47.1	02.1
3	142°04.8	175°40.3	·· 14.5	15°44.0	·· 07.5	69°44.2	·· 49.6	155°49.4	·· 02.1
4	157°07.3	190°40.2	13.5	30°47.2	07.8	84°47.0	49.6	170°51.7	02.0
5	172°09.7	205°40.0	12.4	45°50.4	08.1	99°49.8	49.6	185°54.0	01.9
6	187°12.2	220°39.9	S15°11.4	60°53.5	N23°08.3	114°52.6	N21°49.6	200°56.3	S08°01.8
7	202°14.7	235°39.7	10.3	75°56.7	08.6	129°55.3	49.5	215°58.6	01.8
8	217°17.1	250°39.6	09.3	90°59.9	08.9	144°58.1	49.5	231°00.9	01.7
9	232°19.6	265°39.4	·· 08.3	106°03.1	·· 09.1	160°00.9	·· 49.5	246°03.2	·· 01.6
10	247°22.1	280°39.3	07.2	121°06.3	09.4	175°03.6	49.5	261°05.5	01.5
11	262°24.5	295°39.1	06.2	136°09.5	09.7	190°06.4	49.4	276°07.8	01.5
12	277°27.0	310°39.0	S15°05.1	151°12.7	N23°09.9	205°09.2	N21°49.4	291°10.1	S08°01.4
13	292°29.4	325°38.9	04.1	166°15.9	10.2	220°12.0	49.4	306°12.4	01.3
14	307°31.9	340°38.7	03.0	181°19.2	10.5	235°14.7	49.3	321°14.7	01.2
15	322°34.4	355°38.6	·· 02.0	196°22.4	·· 10.7	250°17.5	·· 49.3	336°17.0	·· 01.2
16	337°36.8	10°38.4	15°00.9	211°25.6	11.0	265°20.3	49.3	351°19.3	01.1
17	352°39.3	25°38.3	14°59.9	226°28.8	11.3	280°23.0	49.3	6°21.6	01.0
18	7°41.8	40°38.2	S14°58.8	241°32.0	N23°11.5	295°25.8	N21°49.2	21°23.9	S08°00.9
19	22°44.2	55°38.0	57.7	256°35.2	11.8	310°28.6	49.2	36°26.2	00.9
20	37°46.7	70°37.9	56.7	271°38.4	12.1	325°31.3	49.2	51°28.5	00.8
21	52°49.2	85°37.7	·· 55.6	286°41.6	·· 12.3	340°34.1	·· 49.2	66°30.8	·· 00.7
22	67°51.6	100°37.6	54.6	301°44.8	12.6	355°36.9	49.1	81°33.1	00.7
23	82°54.1	115°37.5	53.5	316°48.1	12.9	10°39.6	49.1	96°35.4	00.6
Mer.pass. 17:29		ν -0.2′	d 1.0′	m -4.41	ν 3.2′	d 0.3′	m -1.13	ν 2.8′	d -0.0′ m -2.76	ν 2.3′	d 0.1′ m 1.04

Stars

	SHA	Dec
Alpheratz	357°34.8	29°13.9
Ankaa	353°07.2	-42°10.4
Schedar	349°31.0	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°42.3	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°21.5	46°01.4
Bellatrix	278°22.6	6°22.4
Elnath	278°01.5	28°37.7
Alnilam	275°37.4	-1°11.1
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°17.0	27°57.9
Avior	234°14.2	-59°35.2
Suhail	222°46.0	-43°31.8
Miaplacidus	221°37.6	-69°48.9
Alphard	217°47.6	-8°46.0
Regulus	207°34.3	11°50.6
Dubhe	193°40.8	61°36.7
Denebola	182°24.9	14°25.8
Gienah	175°43.6	-17°40.7
Acrux	173°00.2	-63°13.9
Gacrux	171°51.7	-57°14.9
Alioth	166°13.1	55°49.2
Spica	158°22.4	-11°17.5
Alkaid	152°52.2	49°11.0
Hadar	148°36.4	-60°29.3
Menkent	147°57.9	-36°29.4
Arcturus	145°48.1	19°03.0
Rigil Kent.	139°40.8	-60°56.1
Kochab	137°20.5	74°02.8
Zuben'ubi	136°56.3	-16°08.7
Alphecca	126°04.1	26°37.7
Antares	112°16.2	-26°29.2
Atria	107°11.0	-69°04.2
Sabik	102°03.2	-15°45.3
Shaula	96°10.8	-37°07.3
Rasalhague	95°58.9	12°32.4
Eltanin	90°42.7	51°29.0
Kaus Aust.	83°33.0	-34°22.4
Vega	80°33.7	38°48.4
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°22.3
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

Dec 26 Thu	SHA	Mer.pass
Venus	35°50.1	15:17
Mars	233°03.9	02:07
Jupiter	287°23.4	22:26
Saturn	13°52.6	16:42

Dec 27 Fri	SHA	Mer.pass
Venus	34°46.5	15:17
Mars	233°20.0	02:02
Jupiter	287°31.0	22:22
Saturn	13°48.9	16:38

Dec 28 Sat	SHA	Mer.pass
Venus	33°43.4	15:17
Mars	233°37.0	01:57
Jupiter	287°38.5	22:17
Saturn	13°45.1	16:35

Horizontal parallax	
Venus:	0.2
Mars:	0.2

DUT1 = UT1-UTC = +0.1834 sec ΔT = TT-UT1 = +69.0006 sec

2024 December 26 to Dec. 28 UT

h	Sun		Moon				
Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°52.1	S23°21.3	240°28.1	14.7′	S16°55.7	11.8′	54.4′
1	194°51.8	21.2	255°01.8	14.6′	17°07.5	11.7′	54.4′
2	209°51.5	21.1	269°35.4	14.6′	17°19.2	11.6′	54.4′
3	224°51.2	·· 21.0	284°09.0	14.5′	17°30.8	11.6′	54.4′
4	239°50.9	20.9	298°42.5	14.4′	17°42.4	11.5′	54.4′
5	254°50.6	20.8	313°15.9	14.3′	17°53.9	11.5′	54.4′
6	269°50.3	S23°20.8	327°49.2	14.2′	S18°05.4	11.3′	54.5′
7	284°49.9	20.7	342°22.4	14.2′	18°16.7	11.3′	54.5′
8	299°49.6	20.6	356°55.6	14.1′	18°28.0	11.3′	54.5′
9	314°49.3	·· 20.5	11°28.7	14.0′	18°39.3	11.2′	54.5′
10	329°49.0	20.4	26°01.7	13.9′	18°50.5	11.1′	54.5′
11	344°48.7	20.3	40°34.6	13.8′	19°01.6	11.0′	54.5′
12	359°48.4	S23°20.2	55°07.4	13.7′	S19°12.6	10.9′	54.5′
13	14°48.1	20.1	69°40.1	13.7′	19°23.5	10.9′	54.5′
14	29°47.8	20.0	84°12.8	13.6′	19°34.4	10.8′	54.6′
15	44°47.5	·· 19.9	98°45.4	13.5′	19°45.2	10.7′	54.6′
16	59°47.2	19.8	113°17.9	13.4′	19°55.9	10.7′	54.6′
17	74°46.9	19.7	127°50.3	13.3′	20°06.6	10.6′	54.6′
18	89°46.5	S23°19.6	142°22.6	13.2′	S20°17.2	10.5′	54.6′
19	104°46.2	19.4	156°54.8	13.1′	20°27.7	10.4′	54.6′
20	119°45.9	19.3	171°27.0	13.0′	20°38.1	10.3′	54.7′
21	134°45.6	·· 19.2	185°59.0	13.0′	20°48.4	10.2′	54.7′
22	149°45.3	19.1	200°31.0	12.9′	20°58.6	10.2′	54.7′
23	164°45.0	19.0	215°02.8	12.8′	21°08.8	10.1′	54.7′
	SD = 16.3′	d = 0.1′	SD = 14.8′				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°44.7	S23°18.9	229°34.6	12.7′	S21°18.9	10.0′	54.7′
1	194°44.4	18.8	244°06.3	12.6′	21°28.9	9.9′	54.7′
2	209°44.1	18.7	258°37.9	12.5′	21°38.8	9.8′	54.8′
3	224°43.8	·· 18.6	273°09.4	12.4′	21°48.6	9.7′	54.8′
4	239°43.5	18.5	287°40.8	12.3′	21°58.3	9.6′	54.8′
5	254°43.2	18.3	302°12.1	12.2′	22°07.9	9.6′	54.8′
6	269°42.9	S23°18.2	316°43.4	12.1′	S22°17.5	9.4′	54.8′
7	284°42.5	18.1	331°14.5	12.0′	22°26.9	9.4′	54.8′
8	299°42.2	18.0	345°45.5	11.9′	22°36.3	9.2′	54.9′
9	314°41.9	·· 17.9	0°16.5	11.8′	22°45.5	9.2′	54.9′
10	329°41.6	17.8	14°47.3	11.7′	22°54.7	9.1′	54.9′
11	344°41.3	17.6	29°18.0	11.7′	23°03.8	8.9′	54.9′
12	359°41.0	S23°17.5	43°48.7	11.6′	S23°12.7	8.9′	54.9′
13	14°40.7	17.4	58°19.3	11.5′	23°21.6	8.8′	54.9′
14	29°40.4	17.3	72°49.7	11.4′	23°30.4	8.6′	55.0′
15	44°40.1	·· 17.2	87°20.1	11.3′	23°39.0	8.6′	55.0′
16	59°39.8	17.0	101°50.4	11.2′	23°47.6	8.4′	55.0′
17	74°39.5	16.9	116°20.5	11.1′	23°56.0	8.4′	55.0′
18	89°39.2	S23°16.8	130°50.6	11.0′	S24°04.4	8.2′	55.0′
19	104°38.9	16.7	145°20.6	10.9′	24°12.6	8.1′	55.1′
20	119°38.6	16.5	159°50.5	10.8′	24°20.7	8.0′	55.1′
21	134°38.2	·· 16.4	174°20.3	10.7′	24°28.7	7.9′	55.1′
22	149°37.9	16.3	188°50.0	10.6′	24°36.6	7.8′	55.1′
23	164°37.6	16.2	203°19.6	10.5′	24°44.4	7.7′	55.1′
	SD = 16.3′	d = 0.1′	SD = 14.9′				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°37.3	S23°16.0	217°49.1	10.4′	S24°52.1	7.6′	55.2′
1	194°37.0	15.9	232°18.5	10.3′	24°59.7	7.4′	55.2′
2	209°36.7	15.8	246°47.8	10.2′	25°07.1	7.4′	55.2′
3	224°36.4	·· 15.6	261°17.0	10.1′	25°14.5	7.2′	55.2′
4	239°36.1	15.5	275°46.1	10.0′	25°21.7	7.1′	55.2′
5	254°35.8	15.4	290°15.2	9.9′	25°28.8	6.9′	55.3′
6	269°35.5	S23°15.2	304°44.1	9.8′	S25°35.7	6.9′	55.3′
7	284°35.2	15.1	319°12.9	9.7′	25°42.6	6.7′	55.3′
8	299°34.9	15.0	333°41.7	9.7′	25°49.3	6.6′	55.3′
9	314°34.6	·· 14.8	348°10.3	9.6′	25°55.9	6.5′	55.4′
10	329°34.3	14.7	2°38.9	9.5′	26°02.4	6.3′	55.4′
11	344°34.0	14.6	17°07.4	9.4′	26°08.7	6.2′	55.4′
12	359°33.7	S23°14.4	31°35.8	9.3′	S26°14.9	6.1′	55.4′
13	14°33.3	14.3	46°04.0	9.2′	26°21.0	6.0′	55.4′
14	29°33.0	14.1	60°32.2	9.1′	26°27.0	5.8′	55.5′
15	44°32.7	·· 14.0	75°00.4	9.0′	26°32.8	5.7′	55.5′
16	59°32.4	13.9	89°28.4	8.9′	26°38.5	5.6′	55.5′
17	74°32.1	13.7	103°56.3	8.9′	26°44.1	5.4′	55.5′
18	89°31.8	S23°13.6	118°24.2	8.8′	S26°49.5	5.3′	55.6′
19	104°31.5	13.4	132°51.9	8.7′	26°54.8	5.1′	55.6′
20	119°31.2	13.3	147°19.6	8.6′	26°59.9	5.1′	55.6′
21	134°30.9	·· 13.1	161°47.2	8.5′	27°05.0	4.8′	55.6′
22	149°30.6	13.0	176°14.7	8.4′	27°09.8	4.8′	55.6′
23	164°30.3	12.8	190°42.2	8.4′	27°14.6	4.6′	55.7′
	SD = 16.3′	d = 0.1′	SD = 15.0′				

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

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

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 25-27 23-9%
26	00:32	00:46	12:01	08:13	20:35	
27	01:01	01:16	12:01	08:59	21:23	
28	01:31	01:45	12:02	09:49	22:16	

December 29, 30, 31 UT (Sun., Mon., Tue.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	97°56.6	130°37.3	S14°52.5	331°51.3	N23°13.1	25°42.4	N21°49.1	111°37.7	S08°00.5
1	112°59.0	145°37.2	51.4	346°54.5	13.4	40°45.2	49.1	126°40.0	00.4
2	128°01.5	160°37.1	50.4	1°57.7	13.7	55°47.9	49.0	141°42.3	00.4
3	143°03.9	175°37.0	·· 49.3	17°00.9	·· 13.9	70°50.7	·· 49.0	156°44.6	·· 00.3
4	158°06.4	190°36.8	48.2	32°04.2	14.2	85°53.5	49.0	171°46.9	00.2
5	173°08.9	205°36.7	47.2	47°07.4	14.5	100°56.2	49.0	186°49.2	00.1
6	188°11.3	220°36.6	S14°46.1	62°10.6	N23°14.7	115°59.0	N21°48.9	201°51.5	S08°00.1
7	203°13.8	235°36.4	45.1	77°13.9	15.0	131°01.8	48.9	216°53.8	08°00.0
8	218°16.3	250°36.3	44.0	92°17.1	15.3	146°04.5	48.9	231°56.1	07°59.9
9	233°18.7	265°36.2	·· 43.0	107°20.3	·· 15.6	161°07.3	·· 48.8	246°58.4	·· 59.8
10	248°21.2	280°36.1	41.9	122°23.5	15.8	176°10.1	48.8	262°00.7	59.8
11	263°23.7	295°36.0	40.8	137°26.8	16.1	191°12.8	48.8	277°03.0	59.7
12	278°26.1	310°35.8	S14°39.8	152°30.0	N23°16.4	206°15.6	N21°48.8	292°05.3	S07°59.6
13	293°28.6	325°35.7	38.7	167°33.3	16.6	221°18.4	48.7	307°07.6	59.5
14	308°31.1	340°35.6	37.6	182°36.5	16.9	236°21.1	48.7	322°09.9	59.5
15	323°33.5	355°35.5	·· 36.6	197°39.7	·· 17.2	251°23.9	·· 48.7	337°12.2	·· 59.4
16	338°36.0	10°35.4	35.5	212°43.0	17.4	266°26.7	48.7	352°14.5	59.3
17	353°38.4	25°35.2	34.5	227°46.2	17.7	281°29.4	48.6	7°16.8	59.2
18	8°40.9	40°35.1	S14°33.4	242°49.5	N23°18.0	296°32.2	N21°48.6	22°19.1	S07°59.2
19	23°43.4	55°35.0	32.3	257°52.7	18.3	311°34.9	48.6	37°21.4	59.1
20	38°45.8	70°34.9	31.3	272°55.9	18.5	326°37.7	48.6	52°23.7	59.0
21	53°48.3	85°34.8	·· 30.2	287°59.2	·· 18.8	341°40.5	·· 48.5	67°26.0	·· 58.9
22	68°50.8	100°34.7	29.1	303°02.4	19.1	356°43.2	48.5	82°28.3	58.9
23	83°53.2	115°34.6	28.1	318°05.7	19.3	11°46.0	48.5	97°30.6	58.8
Mer.pass. 17:25		ν -0.1′	d 1.1′	m -4.42	ν 3.2′	d 0.3′	m -1.15	ν 2.8′	d -0.0′ m -2.76	ν 2.3′	d 0.1′ m 1.05

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	98°55.7	130°34.5	S14°27.0	333°08.9	N23°19.6	26°48.8	N21°48.5	112°32.9	S07°58.7
1	113°58.2	145°34.3	25.9	348°12.2	19.9	41°51.5	48.4	127°35.2	58.6
2	129°00.6	160°34.2	24.9	3°15.4	20.1	56°54.3	48.4	142°37.5	58.5
3	144°03.1	175°34.1	·· 23.8	18°18.7	·· 20.4	71°57.0	·· 48.4	157°39.8	·· 58.5
4	159°05.6	190°34.0	22.7	33°21.9	20.7	86°59.8	48.4	172°42.1	58.4
5	174°08.0	205°33.9	21.6	48°25.2	21.0	102°02.6	48.3	187°44.4	58.3
6	189°10.5	220°33.8	S14°20.6	63°28.5	N23°21.2	117°05.3	N21°48.3	202°46.7	S07°58.2
7	204°12.9	235°33.7	19.5	78°31.7	21.5	132°08.1	48.3	217°49.0	58.2
8	219°15.4	250°33.6	18.4	93°35.0	21.8	147°10.8	48.3	232°51.3	58.1
9	234°17.9	265°33.5	·· 17.4	108°38.2	·· 22.0	162°13.6	·· 48.2	247°53.6	·· 58.0
10	249°20.3	280°33.4	16.3	123°41.5	22.3	177°16.4	48.2	262°55.9	57.9
11	264°22.8	295°33.3	15.2	138°44.8	22.6	192°19.1	48.2	277°58.2	57.9
12	279°25.3	310°33.2	S14°14.1	153°48.0	N23°22.9	207°21.9	N21°48.1	293°00.4	S07°57.8
13	294°27.7	325°33.1	13.1	168°51.3	23.1	222°24.6	48.1	308°02.7	57.7
14	309°30.2	340°33.0	12.0	183°54.6	23.4	237°27.4	48.1	323°05.0	57.6
15	324°32.7	355°32.9	·· 10.9	198°57.8	·· 23.7	252°30.2	·· 48.1	338°07.3	·· 57.6
16	339°35.1	10°32.8	09.8	214°01.1	24.0	267°32.9	48.0	353°09.6	57.5
17	354°37.6	25°32.7	08.8	229°04.4	24.2	282°35.7	48.0	8°11.9	57.4
18	9°40.0	40°32.6	S14°07.7	244°07.7	N23°24.5	297°38.4	N21°48.0	23°14.2	S07°57.3
19	24°42.5	55°32.5	06.6	259°10.9	24.8	312°41.2	48.0	38°16.5	57.3
20	39°45.0	70°32.5	05.5	274°14.2	25.0	327°43.9	47.9	53°18.8	57.2
21	54°47.4	85°32.4	·· 04.5	289°17.5	·· 25.3	342°46.7	·· 47.9	68°21.1	·· 57.1
22	69°49.9	100°32.3	03.4	304°20.8	25.6	357°49.5	47.9	83°23.4	57.0
23	84°52.4	115°32.2	02.3	319°24.0	25.9	12°52.2	47.9	98°25.7	56.9
Mer.pass. 17:21		ν -0.1′	d 1.1′	m -4.43	ν 3.3′	d 0.3′	m -1.17	ν 2.8′	d -0.0′ m -2.75	ν 2.3′	d 0.1′ m 1.05

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	99°54.8	130°32.1	S14°01.2	334°27.3	N23°26.1	27°55.0	N21°47.8	113°28.0	S07°56.9
1	114°57.3	145°32.0	14°00.1	349°30.6	26.4	42°57.7	47.8	128°30.3	56.8
2	129°59.8	160°31.9	13°59.1	4°33.9	26.7	58°00.5	47.8	143°32.6	56.7
3	145°02.2	175°31.8	·· 58.0	19°37.2	·· 27.0	73°03.2	·· 47.8	158°34.9	·· 56.6
4	160°04.7	190°31.8	56.9	34°40.5	27.2	88°06.0	47.7	173°37.2	56.6
5	175°07.2	205°31.7	55.8	49°43.7	27.5	103°08.7	47.7	188°39.4	56.5
6	190°09.6	220°31.6	S13°54.7	64°47.0	N23°27.8	118°11.5	N21°47.7	203°41.7	S07°56.4
7	205°12.1	235°31.5	53.7	79°50.3	28.1	133°14.3	47.7	218°44.0	56.3
8	220°14.5	250°31.4	52.6	94°53.6	28.3	148°17.0	47.6	233°46.3	56.3
9	235°17.0	265°31.4	·· 51.5	109°56.9	·· 28.6	163°19.8	·· 47.6	248°48.6	·· 56.2
10	250°19.5	280°31.3	50.4	125°00.2	28.9	178°22.5	47.6	263°50.9	56.1
11	265°21.9	295°31.2	49.3	140°03.5	29.1	193°25.3	47.6	278°53.2	56.0
12	280°24.4	310°31.1	S13°48.2	155°06.8	N23°29.4	208°28.0	N21°47.5	293°55.5	S07°55.9
13	295°26.9	325°31.1	47.2	170°10.1	29.7	223°30.8	47.5	308°57.8	55.9
14	310°29.3	340°31.0	46.1	185°13.4	30.0	238°33.5	47.5	324°00.1	55.8
15	325°31.8	355°30.9	·· 45.0	200°16.7	·· 30.2	253°36.3	·· 47.5	339°02.4	·· 55.7
16	340°34.3	10°30.8	43.9	215°20.0	30.5	268°39.0	47.4	354°04.7	55.6
17	355°36.7	25°30.8	42.8	230°23.3	30.8	283°41.8	47.4	9°07.0	55.6
18	10°39.2	40°30.7	S13°41.7	245°26.6	N23°31.1	298°44.5	N21°47.4	24°09.2	S07°55.5
19	25°41.7	55°30.6	40.6	260°29.9	31.3	313°47.3	47.4	39°11.5	55.4
20	40°44.1	70°30.6	39.5	275°33.2	31.6	328°50.0	47.3	54°13.8	55.3
21	55°46.6	85°30.5	·· 38.5	290°36.5	·· 31.9	343°52.8	·· 47.3	69°16.1	·· 55.2
22	70°49.0	100°30.4	37.4	305°39.8	32.2	358°55.5	47.3	84°18.4	55.2
23	85°51.5	115°30.4	36.3	320°43.1	32.4	13°58.3	47.3	99°20.7	55.1
Mer.pass. 17:18		ν -0.1′	d 1.1′	m -4.44	ν 3.3′	d 0.3′	m -1.19	ν 2.8′	d -0.0′ m -2.75	ν 2.3′	d 0.1′ m 1.05

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°43.0	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°21.5	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°17.0	27°57.9
Avior	234°14.2	-59°35.2
Suhail	222°46.0	-43°31.8
Miaplacidus	221°37.6	-69°48.9
Alphard	217°47.5	-8°46.0
Regulus	207°34.3	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°52.2	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°20.5	74°02.8
Zuben'ubi	136°56.3	-16°08.7
Alphecca	126°04.0	26°37.7
Antares	112°16.2	-26°29.2
Atria	107°11.0	-69°04.2
Sabik	102°03.1	-15°45.3
Shaula	96°10.8	-37°07.3
Rasalhague	95°58.9	12°32.4
Eltanin	90°42.7	51°29.0
Kaus Aust.	83°33.0	-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

Dec 29 Sun	**SHA**	**Mer.pass**
Venus	32°40.8	15:18
Mars	233°54.7	01:52
Jupiter	287°45.9	22:13
Saturn	13°41.2	16:31

Dec 30 Mon	**SHA**	**Mer.pass**
Venus	31°38.8	15:18
Mars	234°13.2	01:47
Jupiter	287°53.1	22:09
Saturn	13°37.2	16:27

Dec 31 Tue	**SHA**	**Mer.pass**
Venus	30°37.3	15:18
Mars	234°32.5	01:42
Jupiter	288°00.1	22:04
Saturn	13°33.1	16:24

Horizontal parallax	
Venus:	0.2
Mars:	0.2

h	Sun		Moon				
Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°30.0	S23°12.7	205°09.5	8.3′	S27°19.2	4.4′	55.7′
1	194°29.7	12.5	219°36.8	8.2′	27°23.6	4.3′	55.7′
2	209°29.4	12.4	234°04.0	8.1′	27°27.9	4.2′	55.7′
3	224°29.1	·· 12.2	248°31.1	8.0′	27°32.1	4.0′	55.8′
4	239°28.8	12.1	262°58.2	8.0′	27°36.1	3.8′	55.8′
5	254°28.5	11.9	277°25.2	7.9′	27°39.9	3.8′	55.8′
6	269°28.2	S23°11.8	291°52.0	7.8′	S27°43.7	3.5′	55.8′
7	284°27.9	11.6	306°18.9	7.8′	27°47.2	3.4′	55.9′
8	299°27.6	11.5	320°45.6	7.7′	27°50.6	3.3′	55.9′
9	314°27.3	·· 11.3	335°12.3	7.6′	27°53.9	3.1′	55.9′
10	329°27.0	11.2	349°38.9	7.6′	27°57.0	3.0′	55.9′
11	344°26.7	11.0	4°05.5	7.5′	28°00.0	2.8′	56.0′
12	359°26.4	S23°10.9	18°32.0	7.4′	S28°02.8	2.6′	56.0′
13	14°26.0	10.7	32°58.4	7.4′	28°05.4	2.5′	56.0′
14	29°25.7	10.5	47°24.8	7.3′	28°07.9	2.4′	56.0′
15	44°25.4	·· 10.4	61°51.1	7.2′	28°10.3	2.2′	56.0′
16	59°25.1	10.2	76°17.3	7.2′	28°12.5	2.0′	56.1′
17	74°24.8	10.0	90°43.5	7.1′	28°14.5	1.9′	56.1′
18	89°24.5	S23°09.9	105°09.7	7.1′	S28°16.4	1.7′	56.1′
19	104°24.2	09.7	119°35.7	7.0′	28°18.1	1.5′	56.1′
20	119°23.9	09.6	134°01.8	7.0′	28°19.6	1.4′	56.2′
21	134°23.6	·· 09.4	148°27.8	6.9′	28°21.0	1.3′	56.2′
22	149°23.3	09.2	162°53.7	6.9′	28°22.3	1.0′	56.2′
23	164°23.0	09.1	177°19.6	6.8′	28°23.3	0.9′	56.2′
	SD = 16.3′	d = 0.1′	SD = 15.2′				

Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°22.7	S23°08.9	191°45.4	6.8′	S28°24.2	0.8′	56.3′
1	194°22.4	08.7	206°11.2	6.8′	28°25.0	0.5′	56.3′
2	209°22.1	08.6	220°37.0	6.7′	28°25.5	0.5′	56.3′
3	224°21.8	·· 08.4	235°02.7	6.7′	28°26.0	0.2′	56.3′
4	239°21.5	08.2	249°28.4	6.7′	28°26.2	0.1′	56.4′
5	254°21.2	08.0	263°54.1	6.6′	28°26.3	0.1′	56.4′
6	269°20.9	S23°07.9	278°19.7	6.6′	S28°26.2	0.2′	56.4′
7	284°20.6	07.7	292°45.3	6.6′	28°26.0	0.5′	56.4′
8	299°20.3	07.5	307°10.8	6.5′	28°25.5	0.5′	56.5′
9	314°20.0	·· 07.3	321°36.4	6.5′	28°25.0	0.8′	56.5′
10	329°19.7	07.2	336°01.9	6.5′	28°24.2	0.9′	56.5′
11	344°19.4	07.0	350°27.4	6.5′	28°23.3	1.1′	56.5′
12	359°19.1	S23°06.8	4°52.9	6.5′	S28°22.2	1.2′	56.5′
13	14°18.8	06.6	19°18.3	6.4′	28°21.0	1.5′	56.6′
14	29°18.5	06.5	33°43.8	6.4′	28°19.5	1.6′	56.6′
15	44°18.2	·· 06.3	48°09.2	6.4′	28°17.9	1.7′	56.6′
16	59°17.9	06.1	62°34.6	6.4′	28°16.2	1.9′	56.6′
17	74°17.6	05.9	77°00.0	6.4′	28°14.3	2.1′	56.7′
18	89°17.3	S23°05.7	91°25.4	6.4′	S28°12.2	2.3′	56.7′
19	104°17.0	05.5	105°50.8	6.4′	28°09.9	2.4′	56.7′
20	119°16.7	05.4	120°16.2	6.4′	28°07.5	2.6′	56.7′
21	134°16.4	·· 05.2	134°41.5	6.4′	28°04.9	2.8′	56.8′
22	149°16.1	05.0	149°06.9	6.4′	28°02.1	2.9′	56.8′
23	164°15.8	04.8	163°32.3	6.4′	27°59.2	3.1′	56.8′
	SD = 16.3′	d = 0.2′	SD = 15.3′				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	d	**HP**
0	179°15.5	S23°04.6	177°57.7	6.4′	S27°56.1	3.3′	56.8′
1	194°15.2	04.4	192°23.1	6.4′	27°52.8	3.5′	56.9′
2	209°14.9	04.2	206°48.5	6.4′	27°49.3	3.6′	56.9′
3	224°14.6	·· 04.1	221°13.9	6.4′	27°45.7	3.8′	56.9′
4	239°14.3	03.9	235°39.3	6.4′	27°41.9	3.9′	56.9′
5	254°14.0	03.7	250°04.8	6.5′	27°38.0	4.1′	56.9′
6	269°13.7	S23°03.5	264°30.2	6.5′	S27°33.9	4.3′	57.0′
7	284°13.4	03.3	278°55.7	6.5′	27°29.6	4.5′	57.0′
8	299°13.1	03.1	293°21.2	6.5′	27°25.1	4.6′	57.0′
9	314°12.8	·· 02.9	307°46.7	6.5′	27°20.5	4.8′	57.0′
10	329°12.5	02.7	322°12.2	6.6′	27°15.7	4.9′	57.1′
11	344°12.2	02.5	336°37.8	6.6′	27°10.8	5.1′	57.1′
12	359°11.9	S23°02.3	351°03.4	6.6′	S27°05.7	5.3′	57.1′
13	14°11.6	02.1	5°29.0	6.6′	27°00.4	5.4′	57.1′
14	29°11.3	01.9	19°54.6	6.7′	26°55.0	5.7′	57.1′
15	44°11.0	·· 01.7	34°20.3	6.7′	26°49.3	5.7′	57.2′
16	59°10.7	01.5	48°46.0	6.7′	26°43.6	6.0′	57.2′
17	74°10.4	01.3	63°11.8	6.8′	26°37.6	6.0′	57.2′
18	89°10.1	S23°01.1	77°37.6	6.8′	S26°31.6	6.3′	57.2′
19	104°09.9	00.9	92°03.4	6.9′	26°25.3	6.4′	57.3′
20	119°09.6	00.7	106°29.3	6.9′	26°18.9	6.6′	57.3′
21	134°09.3	·· 00.5	120°55.2	7.0′	26°12.3	6.7′	57.3′
22	149°09.0	00.3	135°21.1	7.0′	26°05.6	6.9′	57.3′
23	164°08.7	00.1	149°47.1	7.0′	25°58.7	7.1′	57.3′
	SD = 16.3′	d = 0.2′	SD = 15.5′				

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

Lat.	**Moonrise** Sun	Mon	Tue	**Moonset** Sun	Mon	Tue
N 72°	▬	▬	▬	▬	▬	▬
N 70°	▬	▬	▬	▬	▬	▬
68°	▬	▬	▬	▬	▬	▬
66°	▬	▬	▬	▬	▬	▬
64°	▬	▬	▬	▬	▬	▬
62°	▬	▬	11:37	▬	▬	13:44
60°	09:08	10:18	10:47	12:14	13:03	14:34
N 58°	08:31	09:37	10:16	12:51	13:44	15:05
56°	08:05	09:09	09:52	13:18	14:12	15:28
54°	07:44	08:47	09:33	13:39	14:34	15:47
52°	07:27	08:29	09:16	13:56	14:52	16:03
50°	07:12	08:14	09:02	14:11	15:07	16:17
45°	06:42	07:43	08:34	14:42	15:38	16:45
N 40°	06:19	07:19	08:11	15:05	16:02	17:07
35°	06:00	06:59	07:52	15:25	16:21	17:25
30°	05:43	06:42	07:36	15:41	16:38	17:41
20°	05:15	06:13	07:09	16:10	17:07	18:07
N 10°	04:52	05:49	06:45	16:34	17:31	18:30
0°	04:30	05:26	06:23	16:56	17:54	18:51
S 10°	04:08	05:03	06:01	17:19	18:16	19:12
20°	03:44	04:39	05:38	17:43	18:40	19:34
30°	03:17	04:10	05:10	18:12	19:08	20:00
35°	03:01	03:53	04:54	18:28	19:25	20:15
40°	02:42	03:34	04:35	18:48	19:44	20:32
45°	02:20	03:10	04:12	19:12	20:07	20:53
S 50°	01:51	02:39	03:43	19:42	20:37	21:19
52°	01:37	02:24	03:28	19:57	20:52	21:32
54°	01:21	02:06	03:11	20:15	21:09	21:47
56°	01:02	01:45	02:51	20:36	21:30	22:03
58°	00:39	01:18	02:26	21:03	21:55	22:24
S 60°	00:08	00:39	01:51	21:42	22:30	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 28-1 4-0%
29	02:00	02:15	12:02	10:43	23:11	
30	02:29	02:44	12:03	11:40	–:–	
31	02:58	03:12	12:03	12:37	00:08	

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	Sun	Aries	Moon	v and d corr		
6	Plan.					
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	Sun	Aries	Moon	v and d corr		
7	Plan.					
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	Sun	Aries	Moon	v and d corr		
8	Plan.					
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	Sun	Aries	Moon	v and d corr		
24	Plan.					
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	Sun	Aries	Moon	v and d corr		
25	Plan.					
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	Sun	Aries	Moon	v and d corr		
26	Plan.					
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	Sun	Aries	Moon	v and d corr		
57	Plan.					
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	Sun	Aries	Moon	v and d corr		
58	Plan.					
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	Sun	Aries	Moon	v and d corr		
59	Plan.					
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 subtracted from 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		
18.4	**– 7.6**	60.5	130	**– 11.1**
18.8	**– 7.7**	62.1	135	**– 11.3**
19.3	**– 7.8**	63.8	140	**– 11.5**
19.8	**– 7.9**	65.4	145	**– 11.7**
20.4	**– 8.0**	67.1	150	**– 11.9**
20.9	**– 8.1**	68.8	155	**– 12.1**
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.

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

Penumbral Lunar Eclipse of 2024 Mar 25

Ecliptic Conjunction = 07:01:28.5 TD (= 07:00:14.6 UT)
Greatest Eclipse = 07:13:59.2 TD (= 07:12:45.2 UT)

Penumbral Magnitude = 0.9557 P. Radius = 1.1803° Gamma = 1.0609
Umbral Magnitude = -0.1325 U. Radius = 0.6457° Axis = 0.9564°

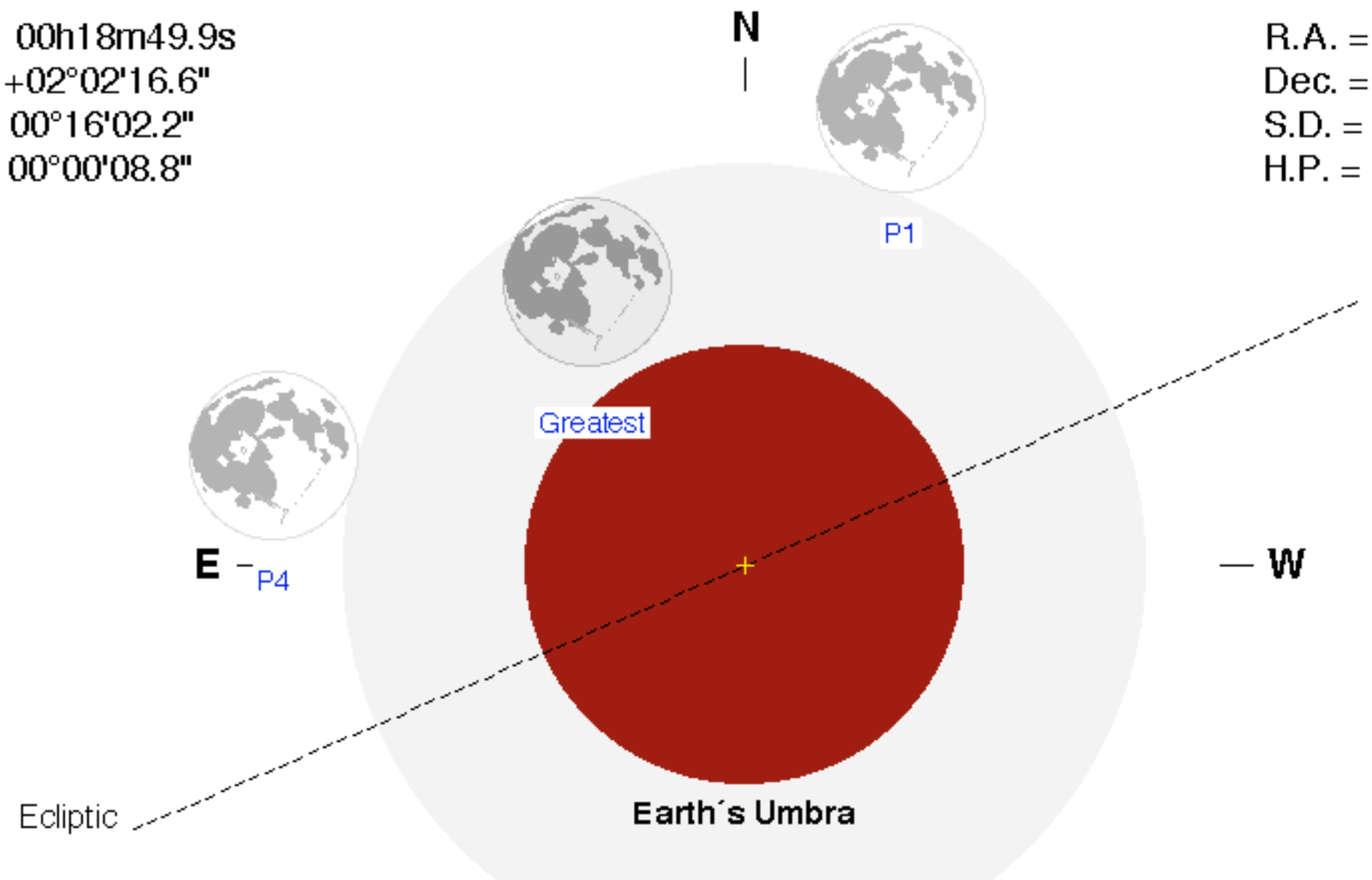
Saros Series = 113 Member = 64 of 71

<u>Sun at Greatest Eclipse</u>
(Geocentric Coordinates)

R.A. = 00h18m49.9s
Dec. = +02°02'16.6"
S.D. = 00°16'02.2"
H.P. = 00°00'08.8"

<u>Moon at Greatest Eclipse</u>
(Geocentric Coordinates)

R.A. = 12h20m41.3s
Dec. = -01°12'05.4"
S.D. = 00°14'44.3"
H.P. = 00°54'05.4"



<u>Eclipse Durations</u>

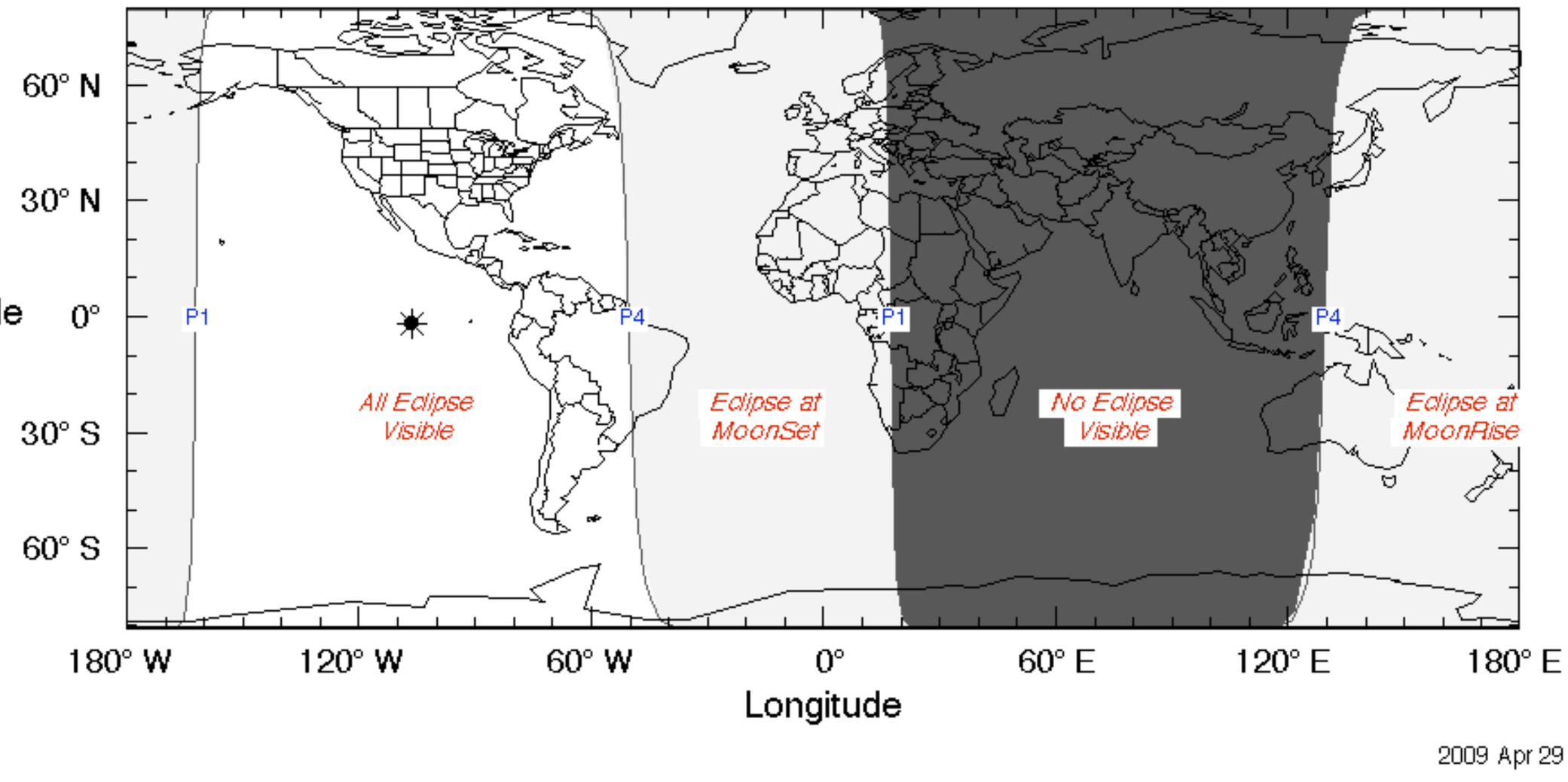
Penumbral = 04h39m07s

<u>Eclipse Contacts</u>

P1 = 04:53:11 UT
P4 = 09:32:18 UT

ΔT = 74 s
Rule = CdT (Danjon)
Eph. = VSOP87/ELP2000-85

F. Espenak, NASA's GSFC
eclipse.gsfc.nasa.gov/eclipse.html



2009 Apr 29

Partial Lunar Eclipse of 2024 Sep 18

Ecliptic Conjunction = 02:35:37.1 TD (= 02:34:22.9 UT)
Greatest Eclipse = 02:45:24.7 TD (= 02:44:10.5 UT)

Penumbral Magnitude = 1.0372 P. Radius = 1.3003° Gamma = -0.9792
Umbral Magnitude = 0.0848 U. Radius = 0.7697° Axis = 1.0010°

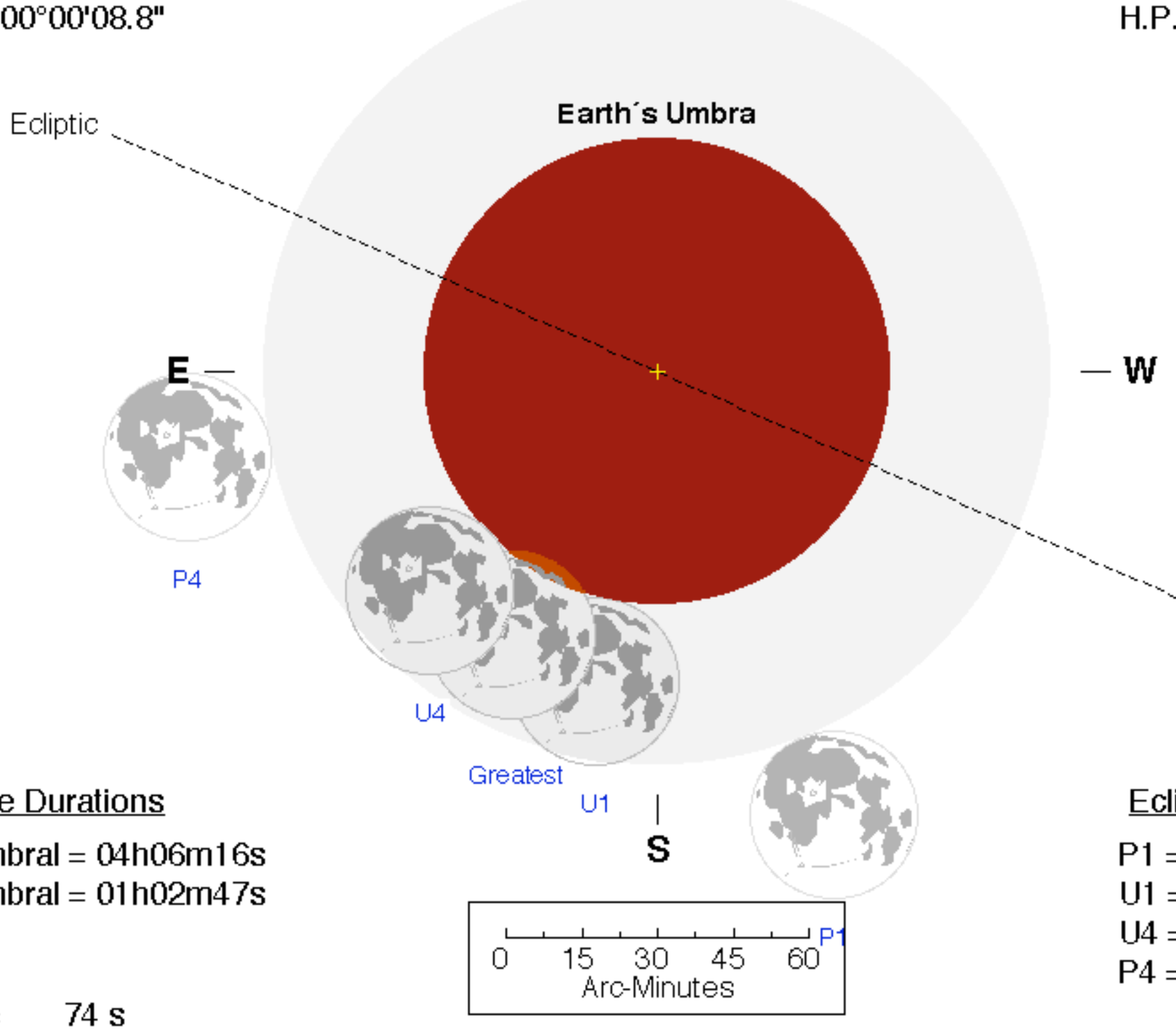
Saros Series = 118 Member = 52 of 74

<u>Sun at Greatest Eclipse</u>
(Geocentric Coordinates)

R.A. = 11h44m09.8s
Dec. = +01°42'52.9"
S.D. = 00°15'55.0"
H.P. = 00°00'08.8"

<u>Moon at Greatest Eclipse</u>
(Geocentric Coordinates)

R.A. = 23h46m06.0s
Dec. = -02°35'26.8"
S.D. = 00°16'42.8"
H.P. = 01°01'20.4"



<u>Eclipse Durations</u>

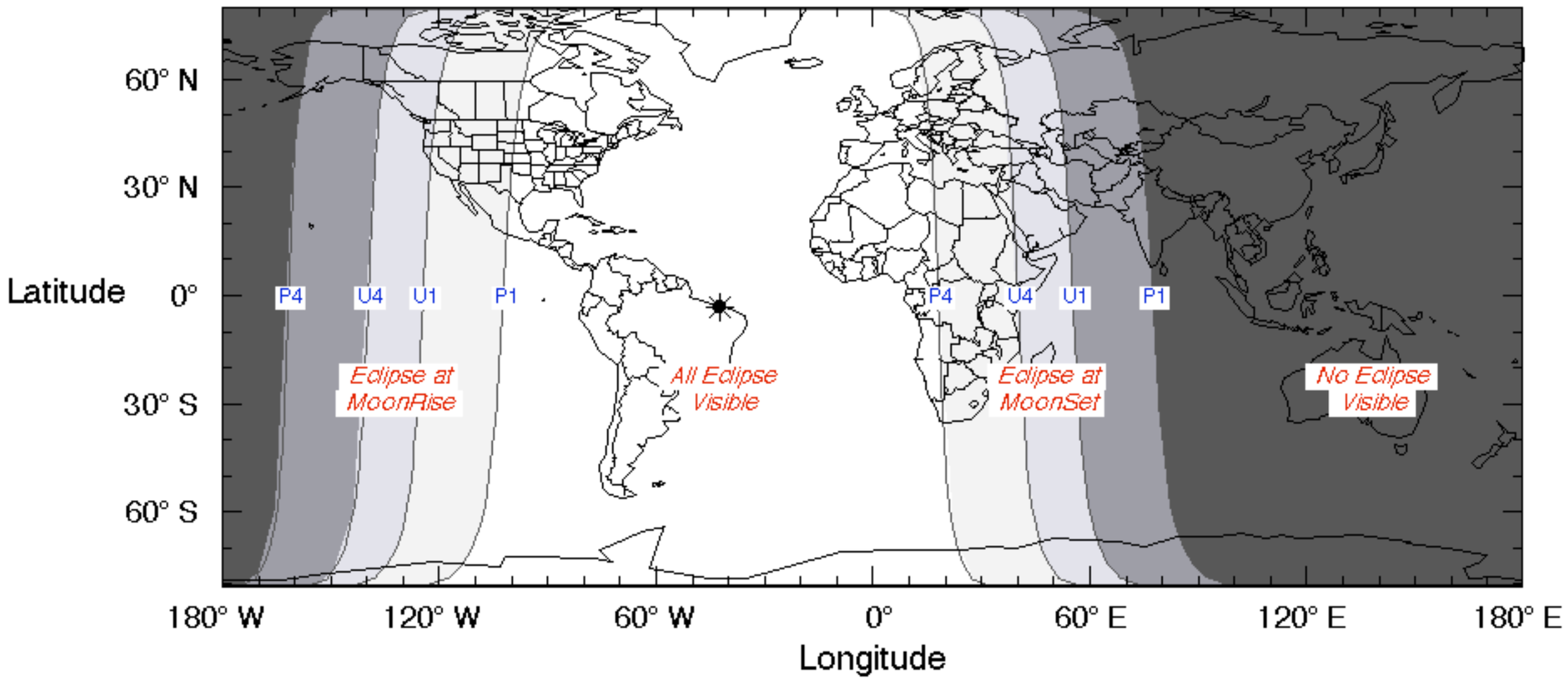
Penumbral = 04h06m16s
Umbral = 01h02m47s

<u>Eclipse Contacts</u>

P1 = 00:41:02 UT
U1 = 02:12:48 UT
U4 = 03:15:35 UT
P4 = 04:47:18 UT

ΔT = 74 s
Rule = CdT (Danjon)
Eph. = VSOP87/ELP2000-85

F. Espenak, NASA's GSFC
eclipse.gsfc.nasa.gov/eclipse.html



2009 Apr 29

Total Solar Eclipse of 2024 Apr 08

Geocentric Conjunction = 18:36:02.5 UT J.D. = 2460409.275029
Greatest Eclipse = 18:17:13.1 UT J.D. = 2460409.261957

Eclipse Magnitude = 1.0565 Gamma = 0.3432

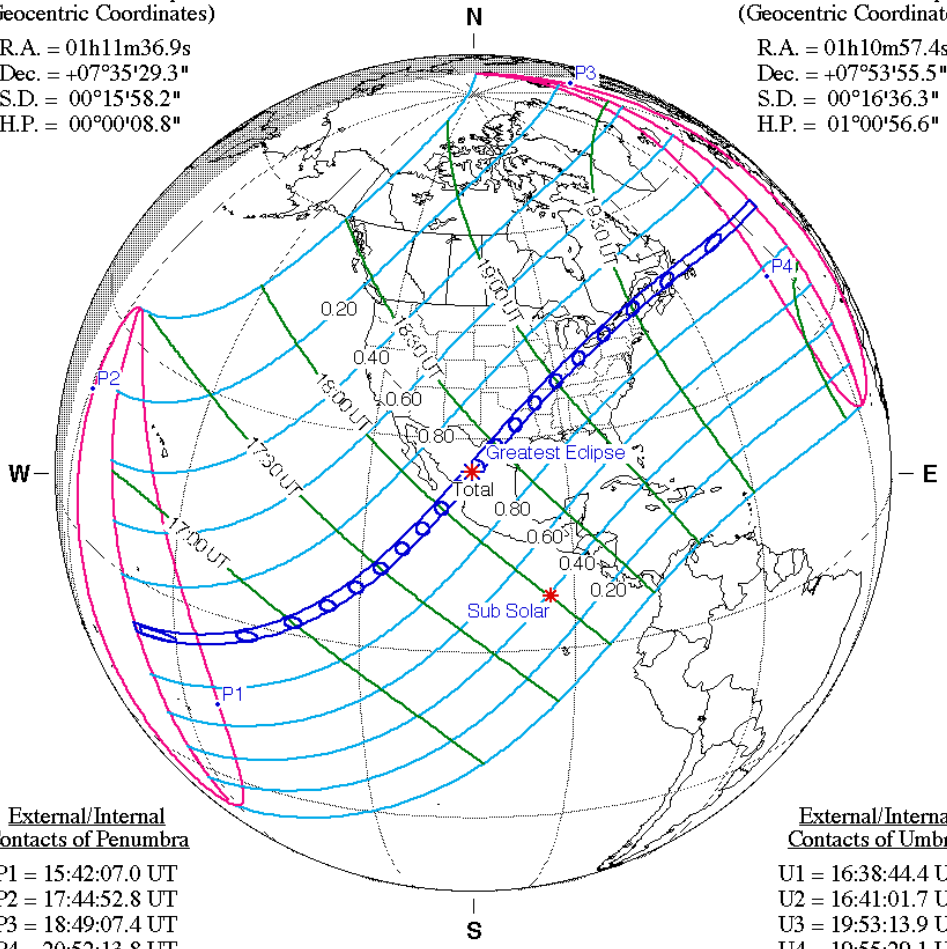
Saros Series = 139 Member = 30 of 71

Sun at Greatest Eclipse
(Geocentric Coordinates)

R.A. = 01h11m36.9s
Dec. = +07°35'29.3"
S.D. = 00°15'58.2"
H.P. = 00°00'08.8"

Moon at Greatest Eclipse
(Geocentric Coordinates)

R.A. = 01h10m57.4s
Dec. = +07°53'55.5"
S.D. = 00°16'36.3"
H.P. = 01°00'56.6"



External/Internal Contacts of Penumbra

P1 = 15:42:07.0 UT
P2 = 17:44:52.8 UT
P3 = 18:49:07.4 UT
P4 = 20:52:13.8 UT

External/Internal Contacts of Umbra

U1 = 16:38:44.4 UT
U2 = 16:41:01.7 UT
U3 = 19:53:13.9 UT
U4 = 19:55:29.1 UT

Local Circumstances at Greatest Eclipse

Lat. = 25°17.5'N Sun Alt. = 69.8°
Long. = 104°07.2'W Sun Azm. = 149.4°
Path Width = 197.5 km Duration = 04m28.1s

Ephemeris & Constants

Eph. = Newcomb/ILE
ΔT = 81.2 s
k1 = 0.2724880
k2 = 0.2722810
Δb = 0.0" Δl = 0.0"

Geocentric Libration
(Optical + Physical)

l = 2.00°
b = -0.46°
c = -20.75°
Brown Lun. No. = 1253

0 1000 2000 3000 4000 5000
Kilometers

F. Espenak, NASA's GSFC - Fri, Jul 2,
sunearth.gsfc.nasa.gov/eclipse/eclipse.html

Annular Solar Eclipse of 2024 Oct 02

Geocentric Conjunction = 19:07:53.1 UT J.D. = 2460586.297142
Greatest Eclipse = 18:44:51.3 UT J.D. = 2460586.281150

Eclipse Magnitude = 0.9326 Gamma = -0.3510

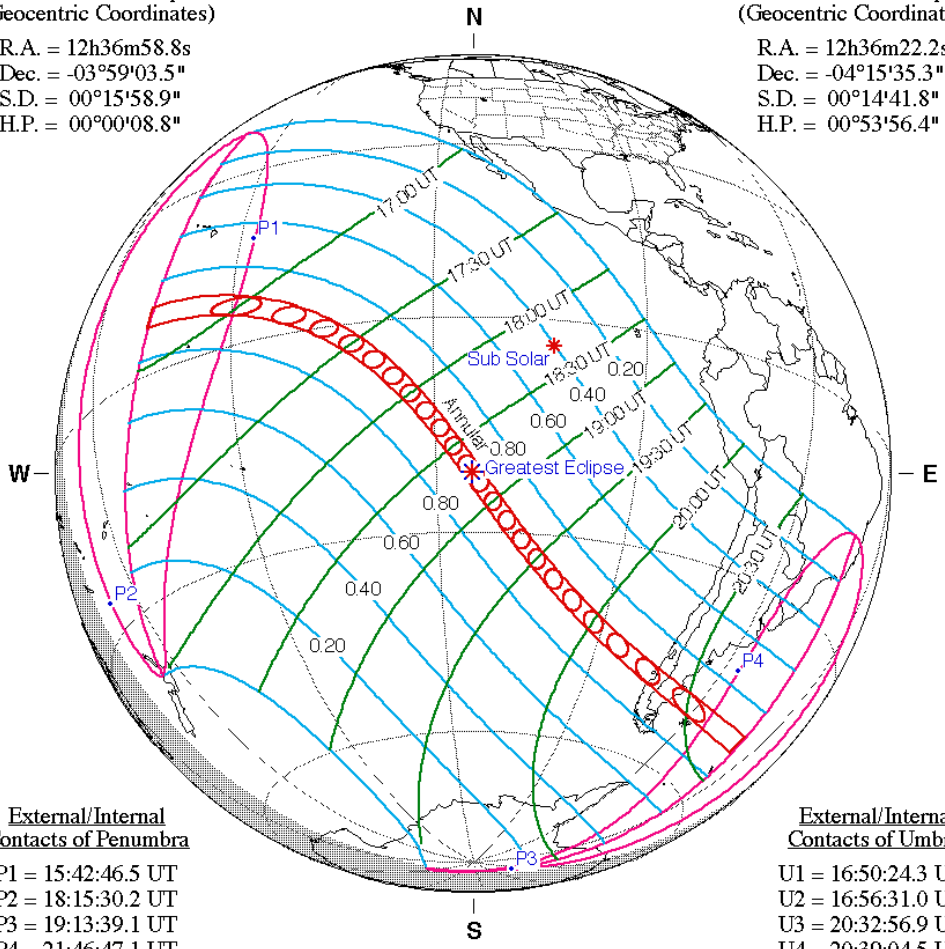
Saros Series = 144 Member = 17 of 70

Sun at Greatest Eclipse
(Geocentric Coordinates)

R.A. = 12h36m58.8s
Dec. = -03°59'03.5"
S.D. = 00°15'58.9"
H.P. = 00°00'08.8"

Moon at Greatest Eclipse
(Geocentric Coordinates)

R.A. = 12h36m22.2s
Dec. = -04°15'35.3"
S.D. = 00°14'41.8"
H.P. = 00°53'56.4"



External/Internal Contacts of Penumbra

P1 = 15:42:46.5 UT
P2 = 18:15:30.2 UT
P3 = 19:13:39.1 UT
P4 = 21:46:47.1 UT

External/Internal Contacts of Umbra

U1 = 16:50:24.3 UT
U2 = 16:56:31.0 UT
U3 = 20:32:56.9 UT
U4 = 20:39:04.5 UT

Local Circumstances at Greatest Eclipse

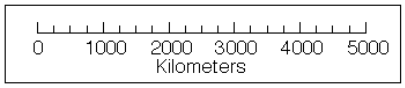
Lat. = 21°57.5'S Sun Alt. = 69.3°
Long. = 114°28.2'W Sun Azm. = 31.1°
Path Width = 266.5 km Duration = 07m25.1s

Ephemeris & Constants

Eph. = Newcomb/ILE
ΔT = 81.8 s
k1 = 0.2724880
k2 = 0.2722810
Δb = 0.0" Δl = 0.0"

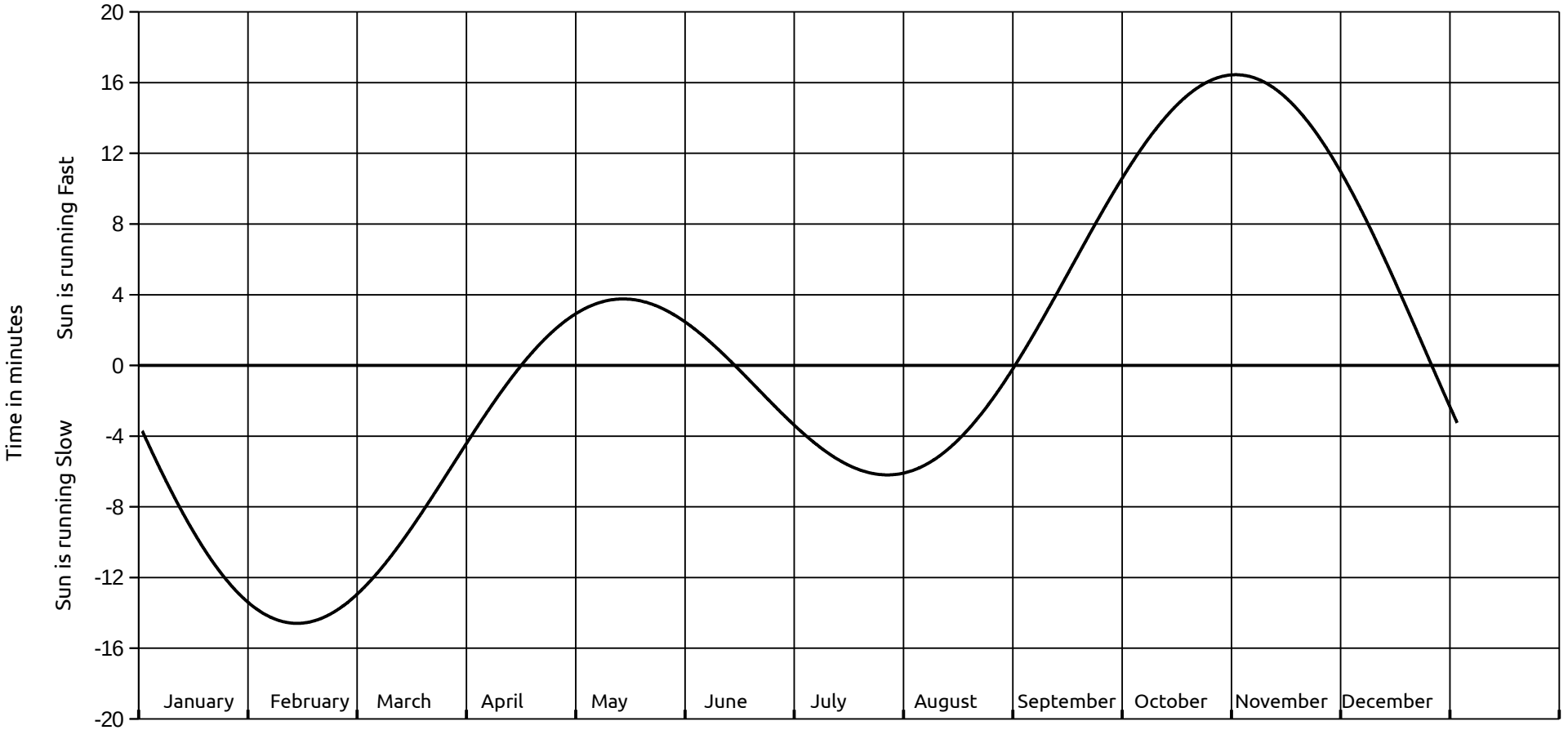
Geocentric Libration
(Optical + Physical)

l = 0.19°
b = 0.42°
c = 21.58°
Brown Lun. No. = 1259



F. Espenak, NASA's GSFC - Fri, Jul 2,
sunearth.gsfc.nasa.gov/eclipse/eclipse.html

Equation of Time
for the Sun



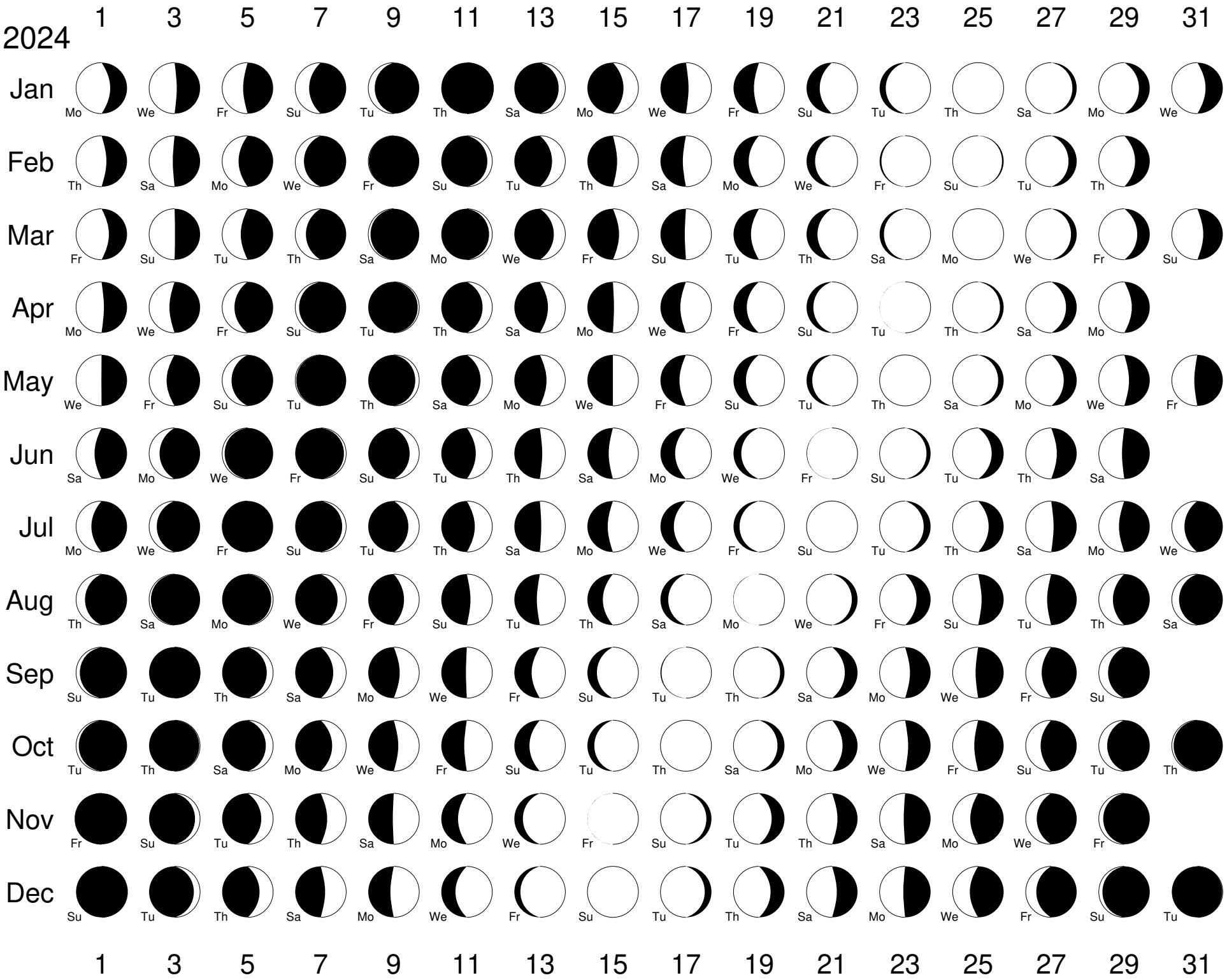
Equation_of_Time_Curve.odt

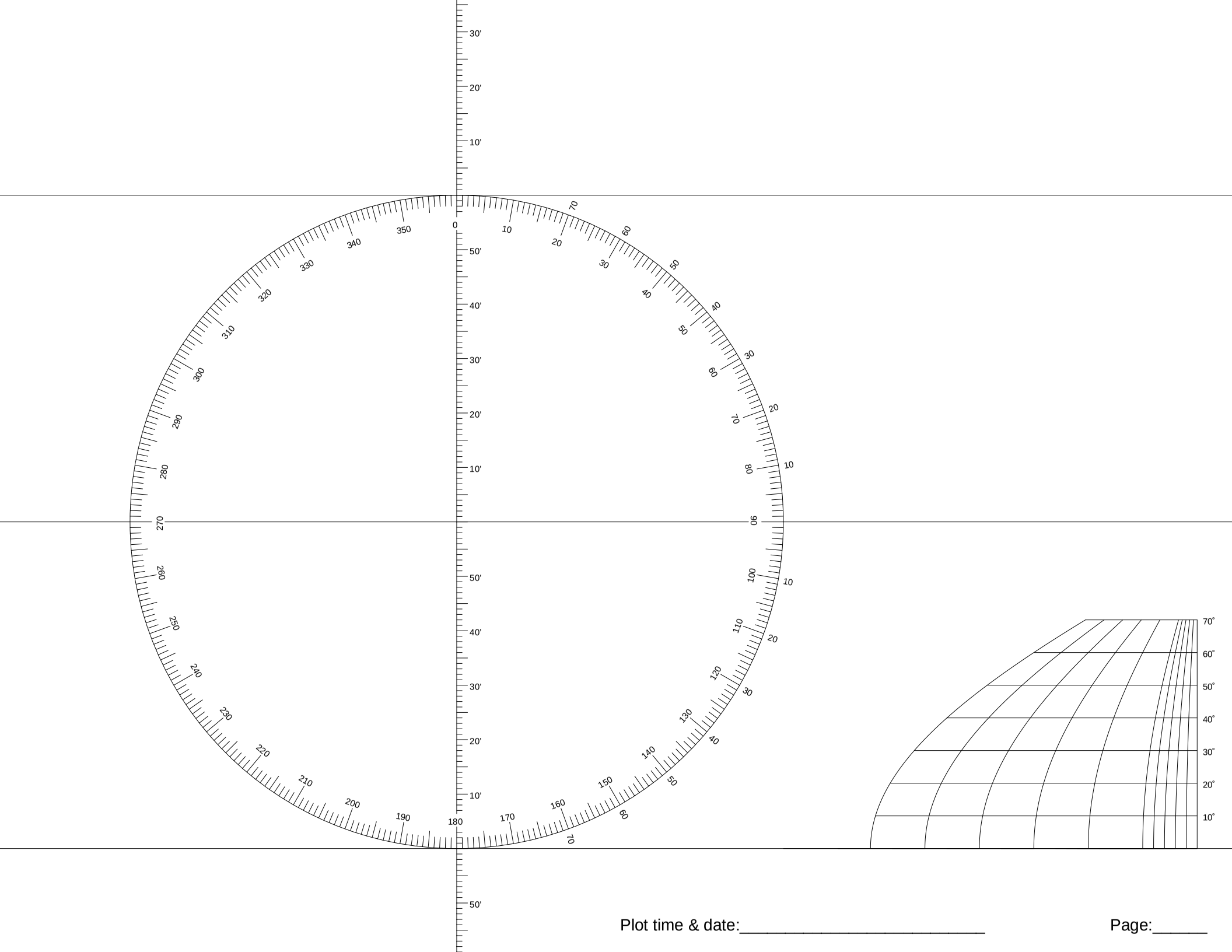
2024 Moon Phases

Date and Time (GMT/Universal Time)

New Moon	First Quarter	Full Moon	Last Quarter
--	--	--	January 04 03:30
January 11 11:57	January 18 03:52	January 25 17:54	February 02 23:18
February 09 22:59	February 16 15:01	February 24 12:30	March 03 15:23
March 10 09:00	March 17 04:11	March 25 07:00	April 02 03:15
April 08 18:21	April 15 19:13	April 23 23:49	May 01 11:27
May 08 03:22	May 15 11:48	May 23 13:53	May 30 17:13
June 06 12:38	June 14 05:18	June 22 01:08	June 28 21:53
July 05 22:57	July 13 22:49	July 21 10:17	July 28 02:51
August 04 11:13	August 12 15:19	August 19 18:26	August 26 09:26
September 03 01:55	September 11 06:05	September 18 02:34	September 24 18:50
October 02 18:49	October 10 18:55	October 17 11:26	October 24 08:03
November 01 12:47	November 09 05:55	November 15 21:28	November 23 01:28
December 01 06:21	December 08 15:26	December 15 09:02	December 22 22:18
December 30 22:27	--	--	--

Add or subtract your time difference from Greenwich to determine local time and date of Moon phase.


2024
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31
Jan Mo We Fr Su Tu Th Sa Mo We Fr Su Tu Th Sa Mo We
Feb Th Sa Mo We Fr Su Tu Th Sa Mo We Fr Su Tu Th
Mar Fr Su Tu Th Sa Mo We Fr Su Tu Th Sa Mo We Fr Su
Apr Mo We Fr Su Tu Th Sa Mo We Fr Su Tu Th Sa Mo
May We Fr Su Tu Th Sa Mo We Fr Su Tu Th Sa Mo We Fr
Jun Sa Mo We Fr Su Tu Th Sa Mo We Fr Su Tu Th Sa
Jul Mo We Fr Su Tu Th Sa Mo We Fr Su Tu Th Sa Mo We
Aug Th Sa Mo We Fr Su Tu Th Sa Mo We Fr Su Tu Th Sa
Sep Su Tu Th Sa Mo We Fr Su Tu Th Sa Mo We Fr Su
Oct Tu Th Sa Mo We Fr Su Tu Th Sa Mo We Fr Su Tu Th
Nov Fr Su Tu Th Sa Mo We Fr Su Tu Th Sa Mo We Fr
Dec Su Tu Th Sa Mo We Fr Su Tu Th Sa Mo We Fr Su Tu
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31



Plot time & date:_____

Page:_____

NAVIGATIONAL STAR CHART

U.S. Naval Observatory / Astronomical Applications Dept.