

**MERCHANT MARINE ACADEMY OF MACEDONIA
SCHOOL OF ENGINEERS**

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Name:

Student number:

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FINAL EXAM

A. Fill in the gaps using the words below. (25 p.)

*neutralized overflows heavy combination alignment gas centrifuging
humidity tolerance knocking corrosion dew-point error salt exhaust
sulphur dismantled air condense deposits*

- Sodium is normally present in the fuel as _____ water contamination and may, as such, be removed by _____.
- Depending on the temperature and _____ of the ambient air and the temperature of the seawater, water may _____ on the coldest air cooler tubes.
- Experience has shown that many of the bunker _____ and spillages that occur during bunkering can be attributed to human _____.
- The formation of sulphuric acid can be _____ by maintaining the liner temperatures above the corresponding _____.
- _____ occurs mainly in engines burning _____ fuels, particularly with high _____ content.
- Vanadium, in _____ with sodium, may lead to _____ valve corrosion and turbocharger _____.
- As _____ fuel enters the combustion space and mixes with _____, there is a risk of uncontrolled combustion called '_____'.
-- If the crankshaft deflection (_____ indicator) is approaching the _____ limits, the bearing shells of the two adjacent main bearings must be _____ and inspected.

B. Complete the sentences using the correct form of the word given. (15 p.)

- The systematic variation in _____ (**alkaline**) may produce uneven _____ (**corrode**) wear on the cylinder wall.
- Marine fuel oils should be _____ (**thorough**) cleaned to remove solid and liquid _____ (**contaminate**).
- The _____ (**convert**) of existing engines for dual-fuel operation will require _____ (**modify**) on the engine and could be completed during class docking.

- As heavy fuel oil is more _____ (**viscosity**) than marine diesel oil, it cannot be pressed through the _____ (**inject**) without proper _____ (**treat**).
- Containment _____ (**arrange**) and available clean-up equipment should be taken into _____ (**consider**) by the companies when they produce the bunkering procedures.
- Owners and operators are taking _____ (**decide**) now on how they will meet the financial and _____ (**comply**) challenges.
- A mixture of _____ (**compatibility**) fuels in the bottom tanks and the settling tanks may lead to _____ (**stratify**).

C. The following list of terms includes the most important parameters of fuel oils for diesel engines. Match the terms with the appropriate explanation. There are two extra terms. (15 p.)

water and sediment heating value density carbon residue flash point
sulphur specific gravity cetane number hydrogen sulphide viscosity
pour point ash content

- Chemical element which can be very injurious to engine parts during combustion because it changes into acid: _____
- Unburned carbon during combustion which can deposit on engine parts: _____
- Non-combustible solid material in the fuel which scratches the rubbing surfaces it comes in contact with: _____
- A measure of the density or weight of the fuel. It also serves as a rough check on viscosity, carbon content and other qualities: _____
- Content in water and solid particles. The higher it is, the more possible it is to cause erratic combustion and corrosion: _____
- The lowest temperature at which the fuel oil is observed to flow: _____
- An indication of the ignition quality of the fuel: _____
- The amount of heat given off on complete combustion of one pound of fuel: _____
- The temperature at which the fuel vapours ignite when a flame is applied to it: _____
- The measure of the resistance of the fuel to movement. The higher it is, the more difficult it is for the fuel to flow: _____

D. Choose the correct option. (10 p.)

- LNG, as compared to HSFO, emits 99% less harmful ____ and provides a 20% reduction in greenhouse gases from the vessel stack.
a. parts b. particulates c. particles
- For efficient removal of water by means of a conventional purifier, the correct choice of ____ disc is of paramount importance.
a. weight b. volume c. gravity

- The acronym CFPP stands for :
 - a. cold filter plugging point
 - b. carbon filter plugging point
 - c. cold filtration pressure point

- The ___ the CCAI, the later the ignition takes place.
 - a. higher b. lower c. clearer

- The element which causes oxidation to the engine is _____.
 - a. carbon b. silicon c. sulphur

- Crankshaft deflection readings should be taken at ___ different positions of the crankshaft by placing a ___ between the crankwebs.
 - a. three b. five c. four
 - a. dial gauge b. feeler c. file

- Hard particles which are caught between the upper horizontal ring/groove surfaces will cause _____.
 - a. peeling b. punching c. pitting

- Abrasive cylinder wear can be caused by hard ___ which enter the cylinder via the fuel oil and/or air or it may be the result of scuffing.
 - a. particles b. parts c. particulates

- The acronym CCAI stands for:
 - a. calculated calcium aromaticity indication
 - b. cracked carbon aroma index
 - c. calculated carbon aromaticity index

E. Match the words to their definitions. There is one extra word. (10 p.)

lack legislation implement idle optimise breakthrough
infrastructure residue catalyst alternative conflict

- a substance which, without itself changing, quickens chemical processes
- an important technological/medical discovery
- put/come into force
- shortage
- serious disagreement and argument
- what is left
- set of laws
- sth that may be chosen instead of one or more others
- make as perfect or as effective as possible
- run slowly so that power is not used for useful work

F. Match the words to their opposites. There is one extra word. (10 p.)

allow uneven accept tight rapid complicated

restricted accuracy rough lose adequate

- unlimited
- simple
- refuse
- imprecision.....
- forbid
- insufficient
- soft
- loose
- slow
- regular

G. Read the following article and answer the questions that follow. (15 p.)

If you want to comply with the EU legislation on sulphur emissions, you need to start acting.

Sulphur is causing a lot of harm, not only to the environment but also to our health. So there is a reason why decision-makers in Brussels are keen on acting.

The next milestone is coming up fast – the EU directive on sulphur states that from January 2015, ships sailing in so called ECAs cannot use fuel containing more than 0.1% sulphur by weight. Next up is 2020, when lower limits in EU waters outside the ECAs will come into force. IMO’s regulations on cutting sulphur content to 0.5% on a global level comes into force by 2025 at the latest, affecting practically all vessels worldwide.

Ship owners basically have two options: switch to cleaner fuel or get rid of the sulphur using scrubbers. The first option means switching to low-sulphur fuel or converting to LNG. Opting for low-sulphur fuel involves high operation costs although the switch itself is not a big investment. Switching to LNG has other environmental benefits and significantly reduces NOx emissions and particulates. But it comes with a heavier price tag. A less costly alternative for now is installing exhaust gas cleaning systems, which also offer a typical payback time of three years, depending on operational profile and trading pattern within the ECAs.

“Installing scrubbers has the lowest lifecycle cost. And with a suitable system the vessel can operate in all corners of the world,” says Aslak Suopanki, Senior Technical Manager and Wärtsilä’s expert on scrubbers.

Wärtsilä has been developing scrubbers for almost 10 years, and further strengthened its offering with the Hamworthy acquisition in 2012. Today Wärtsilä is the market leader with more than a hundred scrubbers sold or on order for over 50 vessels.

Wärtsilä's scrubber systems are compact in size and can be easily retrofitted. With the proper planning and engineering, the installation can be done fairly quickly. The vessel is out of service for no more than a few weeks.

So complying with new legislation on sulphur oxide is not such a big deal after all. Still, a lot of ship owners are dragging their heels.

“Ship owners generally are not too well prepared in regards to the new legislation. Retrofitting scrubbers is a big investment for any ship owner. A lot of ship owners are choosing to wait and see what happens on the market before making this decision,” says Kullas-Nyman.

There is always the option of not doing anything, of course – it is still unclear what kind of sanctions await those who fail to comply. One thing is for sure, though: the environment won't be applauding the decision. And neither will our lungs.

1. When will IMO's regulations on sulphur content concerning the whole globe come into force?
2. What does “switching to cleaner fuel” mean?
3. What are the advantages and disadvantages of LNG as bunker fuel?
4. What are the advantages of scrubber systems over the other alternatives mentioned in the article?
5. What are the reasons behind ship owners' unwillingness to comply with the new legislation?

GOOD LUCK!!!