

**CERTIFICATES OF COMPETENCY IN THE MERCHANT
NAVY - MARINE ENGINEER OFFICER**

EXAMINATIONS ADMINISTERED BY THE
SCOTTISH QUALIFICATIONS AUTHORITY
ON BEHALF OF
MARITIME AND COASTGUARD AGENCY
MANAGEMENT ENGINEER (UNLIMITED)

040-13 - ENGINEERING KNOWLEDGE - MOTOR

TUESDAY, 13 December 2022

0915-1215 hrs

Examination paper inserts:

--

Notes for the guidance of candidates:

Candidates should note that 96 marks are allocated to this paper. To pass candidates must achieve 48 marks.

Materials to be supplied by examination centres:

Candidate's examination workbook

ENGINEERING KNOWLEDGE - MOTOR

Attempt SIX questions only

Marks for each part question are shown in brackets

1. Write a report to the engineering superintendent regarding the failure of a main crosshead engine fuel pump cam and follower where the damage was so severe that the normal pump lifting equipment could not be immediately fitted. The report must explain how the defect was detected, the immediate action taken, the rectifying action taken to ensure that the engine could be operated, and the checks made on the engine before restarting. (16)

2. (a) Describe, with the aid of a sketch, a diesel engine NO_x reduction system using chemical supply, explaining the safety and pollution avoidance systems required. (12)
(b) Explain chemical reactions involved in the NO_x reduction system described in part (a) of the question. (4)

3. With reference to turbocharger systems:
(a) describe how performance of the system is monitored and how the information gathered is used to assess performance; (8)
(b) describe the arrangements for maintaining the systems in good condition. (8)

4. With reference to poor ignition quality fuel:
(a) explain how it can affect combustion in BOTH slow speed and medium speed diesel engines; (8)
(b) explain how the effects on BOTH diesel engine types in part (a) can be reduced. (8)

5. (a) Describe the purpose of a diesel engine crankcase oil mist eliminator / oil box, explaining how such a system operates. (6)
(b) Describe, with reasons, the properties required of a trunk piston diesel engine crankcase lubrication oil stating how the LO is maintained in good condition over an operating period. (10)

6. (a) Describe, with the aid of a sketch, an open loop system for reducing SO_x emissions from engine exhaust gas, explaining how the system operates whilst the vessel is in open waters. (6)
(b) Describe, with the aid of a sketch, a closed loop scrubber system for removing SO_x from engine exhaust gas, explaining the operation of this unit and stating when it would be used. (10)

7. (a) Describe the dangers associated with a main engine starting air system, explaining how these dangers are mitigated. (9)
- (b) State, with reasons, THREE causes of an engine failing to fire on fuel after successfully turning over on starting air. (3)
- (c) Explain how the engine is transferred to local (engine side) control in the event of failure of the main engine remote control system. (4)
8. (a) Describe with the aid of sketches the operation of a four-stroke dual fuel engine, explaining how the correct amount of gaseous and liquid fuels are supplied to the cylinders to meet the power requirement and how the cylinder charge is ignited. (10)
- (b) State, with reasons, three problems associated with the burning of gaseous fuels in a diesel engine, indicating how these problems may be overcome. (6)
9. (a) As the Engineer Manager write standing instructions for the in-service cleaning of the gas side of a waste heat recovery steam generator unit. (8)
- (b) As the Engineer Manager write standing instruction for the action to be taken in the event of an uptake fire in the waste heat recovery steam generating unit and action to be taken to enable operation of the engine after the fire has been extinguished if there is a leak in the tube nest and no exhaust gas bypass is fitted. (8)