

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

EXAMINATIONS ADMINISTERED BY THE
SCOTTISH QUALIFICATIONS AUTHORITY
ON BEHALF OF
MARITIME AND COASTGUARD AGENCY

SECOND ENGINEER (UNLIMITED)

042-27 - ENGINEERING KNOWLEDGE - GENERAL

MONDAY, 15 July 2013

0915-1215 hrs

Examination paper inserts:

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Notes for the guidance of candidates:

Candidates are required to obtain 50% of the total marks allocated to this paper to gain a pass AND also obtain a minimum 40% in Sections A, B and C of the paper.

Materials to be supplied by examination centres:

Candidate's examination workbook

ENGINEERING KNOWLEDGE - GENERAL

Attempt TEN questions only as follows:

SIX questions from section A

TWO questions from section B

TWO questions from section C

Marks for each part question are shown in brackets

Section A

1. With reference to hydraulically loaded bolts.
 - (a) state FOUR applications; (4)
 - (b) state FOUR advantages; (4)
 - (c) explain why regular maintenance of hydraulic tension equipment is essential. (2)

2. With reference to plate type heat exchangers:
 - (a) sketch a sectional view of the flow in both fluid systems, labelling all major components and showing the direction; (6)
 - (b) state TWO reasons for plate relief patterns: (2)
 - (c) state the FOUR advantages of a plate cooler compared to shell and tube type. (2)

3.
 - (a) State why it is essential to sterilise fresh water for potable use on board ship. (1)
 - (b) State why re-mineralisation of potable water is carried out.. (1)
 - (c) Describe, with the aid of a sketch, a method of fresh water purification employing the use of silver ions. (6)
 - (d) State ONE advantage and ONE disadvantage of ultraviolet radiation sterilisation for fresh water. (2)

4. With reference to routine testing of equipment, explain how EACH of the following is tested to ensure it operates at the correct set point:
 - (a) stand-by facility for sea water cooling water pump; (2)
 - (b) high jacket water temperature alarm for generator; (2)
 - (c) auxiliary boiler flame failure; (2)
 - (d) differential pressure across fuel filter; (2)
 - (e) control air pressure low alarm. (2)

5. (a) Sketch a multi bottle CO₂ flooding system suitable for a main machinery space. (5)
- (b) Describe the procedure for releasing the CO₂ into the engine room. (5)
6. (a) Sketch a fully automatic provision refrigeration system incorporating a number of cold rooms. (5)
- (b) Explain the sequence of events from demand for refrigerating effect in a room until the room has reached the desired temperature. (5)
7. Describe, with the aid of a sketch, the operation of a rotary vane steering gear with constant delivery pumps. (10)
8. (a) Explain, with the aid of a sketch, the operation of a centrifuge for removing water and particles from lubrication oil. (8)
- (b) Explain the main differences when the centrifuge is used as a clarifier. (2)

Section B

9. With reference to electrical switchgear:
- (a) explain why it is necessary to keep electrical contactors clean and closed with a firm contact pressure; (5)
 - (b) describe the functions of auxiliary contacts; (3)
 - (c) state how contacts are kept free from oxide formation. (2)
10. Explain, with the aid of a circuit diagram, the operation of ships navigating lights. (10)
11. (a) Explain the term *power factor*. (2)
- (b) Explain why it may be desirable to change the *power factor*. (2)
- (c) Explain how a synchronous motor may be used to assist in power factor correction. (6)

Section C

12. (a) Explain the purpose of *cofferdams*. (3)
- (b) State TWO locations where *cofferdams* may be found. (2)
- (c) State the precautions prior to entry into a *cofferdam*. (5)
13. With reference to ship construction, describe EACH of the following, stating where EACH may be located:
- (a) duct keel; (3)
- (b) bilge keel; (2)
- (c) flare; (2)
- (d) camber. (3)
14. (a) Sketch a bearing which carries the weight of the rudder stock. (5)
- (b) Describe how the bearing sketched in part (a) transmits the load to the hull. (2)
- (c) Explain why a rudder may tend to lift, stating how this tendency is countered. (3)