

CERTIFICATES OF COMPETENCY IN THE MERCHANT NAVY
MARINE ENGINEER OFFICER

STCW 78 as amended SMALL VESSEL CHIEF ENGINEER <3000 GT, <9000 kW UNLIMITED

058-11 - GENERAL ENGINEERING SCIENCE I

FRIDAY, 03 OCTOBER 2025

1400 - 1600 hrs

Materials to be supplied by examination centres

Candidate's examination workbook
Graph paper

Examination Paper Inserts

Notes for the guidance of candidates:

1. Examinations administered by SQA on behalf of the Maritime & Coastguard Agency.
2. 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 and B of the paper.
3. Non-programmable calculators may be used.
4. All formulae used must be stated and the method of working and ALL intermediate steps must be made clear in the answer.



Maritime &
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Attempt ALL questions

Marks for each question are shown in brackets.

Section A

1. Simplify EACH of the following giving the answer as a mixed number:

(a) $\left(2\frac{4}{9} + 4\frac{2}{3}\right) \div 2\frac{4}{7}$ (4)

(b) $\left(2\frac{4}{5} \div 1\frac{4}{9}\right) \times 1\frac{2}{3}$ (4)

2. (a) Rearrange the following expression to make X the subject:

$$Y = \frac{W^3 X^4 Z^3}{X Y^2} \div \frac{W^3 X Y^2}{X^3 Z^2} \quad (4)$$

- (b) Simplify the following expression:

$$\frac{3}{2} \times \frac{2X}{3} + \frac{4X}{5} \quad (4)$$

3. (a) State the law of a straight line graph explaining the terms. (3)
- (b) Plot and join the pairs of points shown in Table Q3. (3)
- (c) From the graph, determine the equation linking X and Y. (2)

X	-2	-1	0	1	2	3
Y	-9	-5.5	-2	1.5	5	8.5

Table Q3

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4. A right cone has a sloping side of 340 mm and a perpendicular height of 300 mm.

(a) Calculate EACH of the following:

- (i) the volume of the cone in m^3 ; (2)
- (ii) the angle of the sloping side; (3)
- (iii) the surface area of the cone in mm^2 (excluding the base). (3)

5. (a) State Pythagoras' theorem. (2)

- (b) 3 circles are shown in Fig Q5 resting on a flat surface. The two larger circles have the same diameter. For the arrangement shown determine the size of the smaller circle relative to the larger circles. (8)

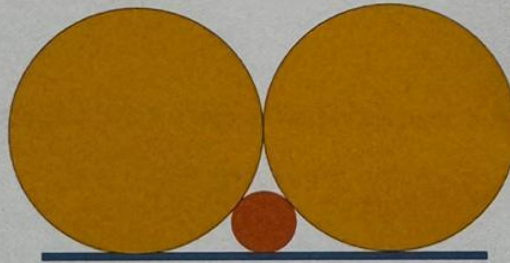


Fig Q5

6. A brass rod of 100 mm diameter is to be melted to cast a sphere and a cube. The diameter of the sphere is to be 6 cm and the cube is to have the same mass as the sphere.

Determine the length of bar stock required with no material wasted. (8)

Section B

7. A vehicle has a maximum acceleration of 5.2 m/s^2 and a maximum deceleration (retardation) of 7.2 m/s^2 .
- (a) Draw a velocity / time diagram representing the maximum distance the vehicle can travel in 10 seconds starting and finishing at rest and never moving at constant velocity. (4)
 - (b) Determine the maximum distance the vehicle can travel in 10 seconds starting and finishing at rest. (3)
 - (c) Determine the maximum velocity of the vehicle. (3)
8. A beam has a mass of 100 kg and is loaded as shown in FIG Q8.
- Determine the reaction forces at the supports A and B. (8)

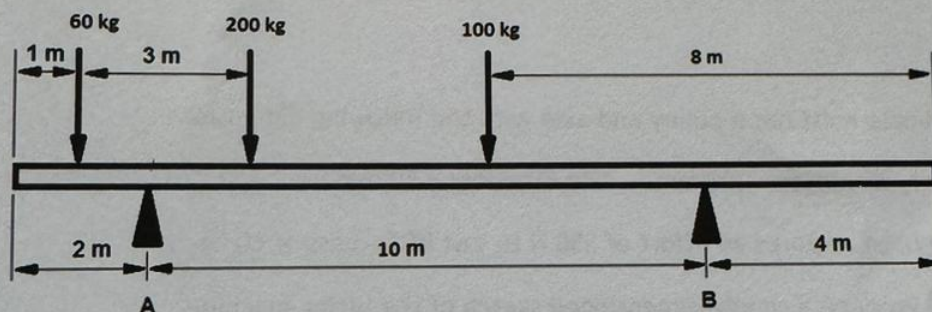


FIG Q8

9. A block with a mass of 1.5 kg is placed at the top of a sloping surface with a length of 3 m. The slope makes an angle of 38° to the horizontal and has a coefficient of friction of 0.3. When the block is released it slides down the slope.

Determine EACH of the following:

- (a) the friction force; (2)
- (b) the accelerating force; (2)
- (c) the time taken to slide down to the bottom of the slope; (2)
- (d) the velocity of the block at the bottom of the slope. (2)

10. A generator flywheel has a diameter of 0.85 m and rotates at 9500 rad/min.

Calculate EACH of the following:

- (a) the linear velocity of a point on the rim in m/s; (3)
- (b) the rotational speed of the flywheel in rev/min; (3)
- (c) the number of radians turned when the flywheel rotates through 150° . (2)

11. (a) State Hookes Law. (2)

- (b) A round hole, 65 mm diameter, is to be punched through a metal plate 1.5 mm thick. The metal has a shear strength of 220 MPa.

Determine EACH of the following:

- (i) the minimum force required to punch the hole; (3)
- (ii) the maximum stress on the punch during this process. (3)

12. A simple hoist has a pulley and axle with the following dimensions:

Pulley diameter = 200 mm Axle diameter = 50 mm

The hoist requires an effort of 550 N to just lift a mass of 60 kg.

- (a) Produce a simple dimensioned sketch of the lifting machine. (2)
- (b) Determine EACH of the following:
 - (i) the movement ratio of the machine; (3)
 - (ii) the efficiency of the machine. (3)