March 2001

GENERAL ENGINEERING SCIENCE I

Attempt ALL questions

Marks for each part question are shown in brackets

1. *(a)* Multiply $2x + 4$ by $3x - 2$ (3)

   (b) Simplify $\frac{4a}{3b} + \frac{5b}{2a}$ (5)

2. An isosceles triangle ABC has a base BC = 8.75 cm and an area of 49 cm^2.

   Determine the length of the other sides to 3 significant figures. (8)

3. A cargo lift, having an efficiency of 0.63, takes 0.32 minutes to raise a mass of 2240 kg through a vertical distance of 7.8 metres.

   Calculate the power required. (8)

4. Fig. Q.4 shows the section of a piece of steel 2.36 m long.

   Determine the mass of steel to the nearest kilogram, given that 1 cm^3 has a mass of 8.5 grams. (8)

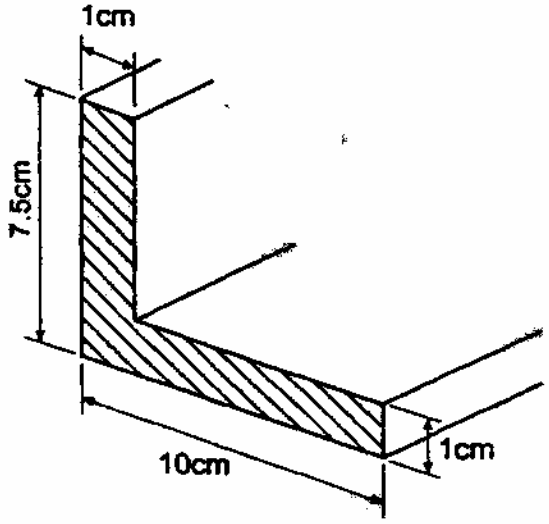

Fig. Q.4

5. Given that y varies directly as the square of x, and y = 12.8 when $x = 4.4$, calculate the value of y when $x = 2.95$. (8)

6. The following formula relates volume to radius and perpendicular height:

$$V = \pi r^2 h$$

   (a) Transpose the formula to make r the subject. (4)

   (b) Calculate the value of r when $V = 1428$ cm^3 and $h = 24$ cm. (4)

7. A cube of lead having sides of 18cm is melted down and is recast into three equal spheres. Calculate the diameter of the spheres. (8)

8. A simple machine has an efficiency of 52% and a velocity ratio of 27.

Determine the mass in kilograms that can be lifted with an effort of 40 N. (8)

9. A box barge 35 metre long with 18 metre beam is floating in water of density 1020kg/m^3.

(a) Determine the draught of the barge if its displacement is 1480 tonne. (5)

(b) Calculate the pressure on the outer bottom plating when the barge is floating at the draught determined in Q.9(a). (5)

10. A ship of displacement 5050 tonne has its centre of gravity G positioned 5.1 metre above the keel.

995 tonne of cargo is now loaded on the centreline at 2.1 metre above the keel.

Calculate the new position of the ship's centre of gravity KG. (8)

11. A vessel has an underwater volume of 4878 m^3 in sea water of density 1025kg/m^3 with KG = 3.95 m and KM = 4.3 m.

Determine the distance an 8 tonne mass must be moved across the deck to cause the vessel to heel exactly 1°.

Given $m \times d = \Delta\, GM \tan\theta$. (8)

12. Fig. Q.12 shows a mass of 150 kg suspended from points A and B by chains.

Determine the tensile force in chains AC and BC by any suitable means. (10)

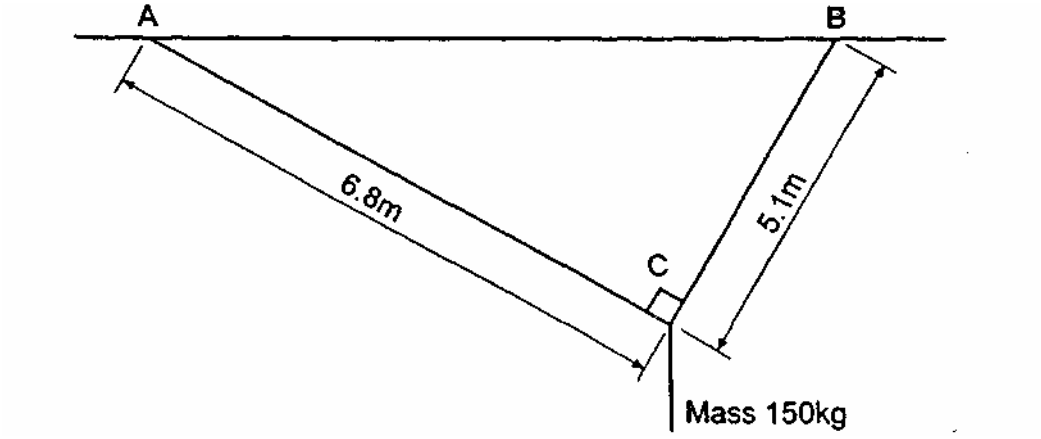

Fig. Q.12