March 1998

GENERAL ENGINEERING SCIENCE I

Attempt ALL questions

Marks for each part question are shown in brackets

1. Evaluate the following in fractional form:

   (*a*) $2\frac{1}{4}\times\frac{1}{3}\times 5\times\frac{4}{15}$ (2)

   (*b*) $\left(\frac{1}{2}\text{ of }7\frac{3}{4}\right)-\left(2\frac{4}{7}\div 1\frac{3}{7}\right)$ (6)

2. *(a)* Define the term *moment of a force.* (2)

   (b) Fig. *Q2* shows three forces acting about a pivot P.

   (i) Calculate the resultant turning moment of the system in newton metres. (4)

   (ii) State the direction of rotation of the system. (2)

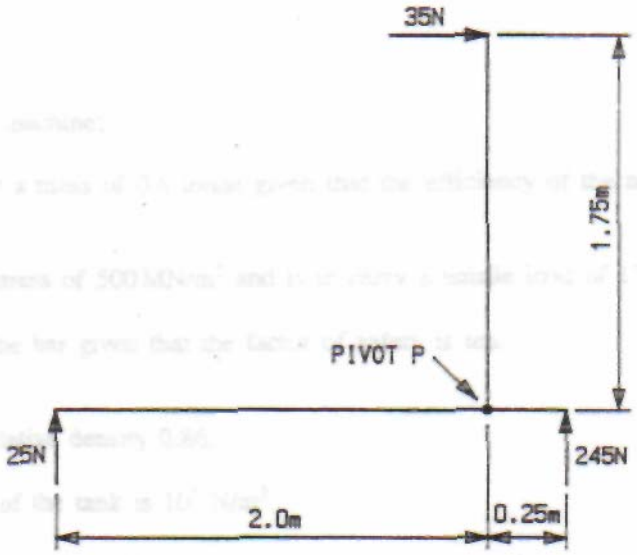

Fig .Q.2

3. A right angled triangle ABC has the hypotenuse AB 13 cm long.

   Determine:

   (a) the length of side AC when the angle ABC is 22.62°; (4)

   (b) the area of the triangle in cm^2. (4)

4. The formula shown relates to electric cells in series.

$$I = \frac{nE}{R + nr}$$

Transpose the formula to make n the subject. (8)

5. A bearing metal contains 21 parts tin, 2 parts copper, and 3 parts antimony.

Calculate the mass of EACH metal in 50 kg of bearing metal. (8)

6. A body has a mass of 13.5 kg and requires a horizontal force of 76 N to just cause motion.

Determine:

(a) the value of the coefficient of friction; (3)

(b) what acceleration would result if a total horizontal force of 108 N was applied. (5)

7. A Weston Differential pulley block has a large drum of 130 mm diameter and a small drum of 120 mm diameter.

Determine:

(a) the velocity ratio of the machine; (4)

(b) the effort required to lift a mass of 0.6 tonne given that the efficiency of the machine is 0.48. (6)

8. A steel bar has a breaking stress of 500MN/m^2 and is to carry a tensile load of 13.5 kN.

Determine the diameter of the bar given that the factor of safety is ten. (8)

9. A tank contains liquid of relative density 0.86.

The pressure at the bottom of the tank is 10^5 N/m^2.

Determine the head of liquid in the tank. (6)

10. Q.10 shows a mass suspended by chains AC and BC.

Determine by any suitable means the force in EACH chain. (10)

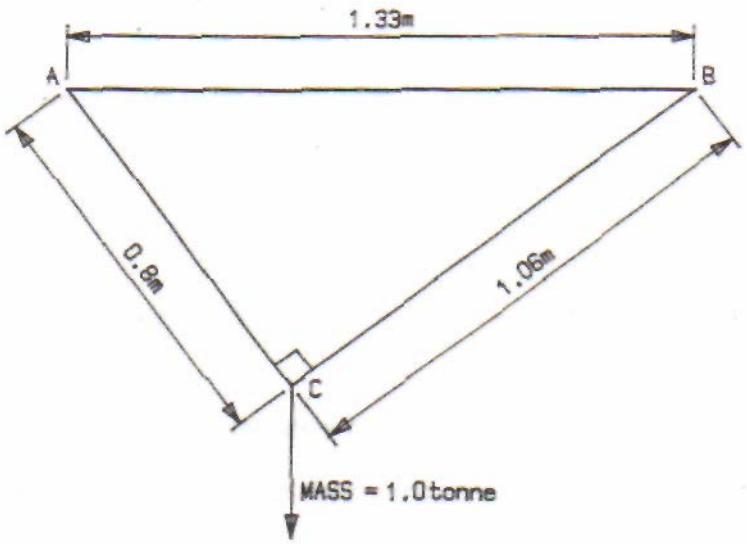

Fig. Q.10

11. A heavy sphere of diameter 5.19 cm is placed into a tank of water.

Determine by how much the water level will rise given that the cross sectional area of the tank is 28 cm^2 and the sphere is totally submerged. (8)

12. Fig. Q.12 shows a loaded simply supported beam.

Determine the value of the reactions R_A and R_B. (10)

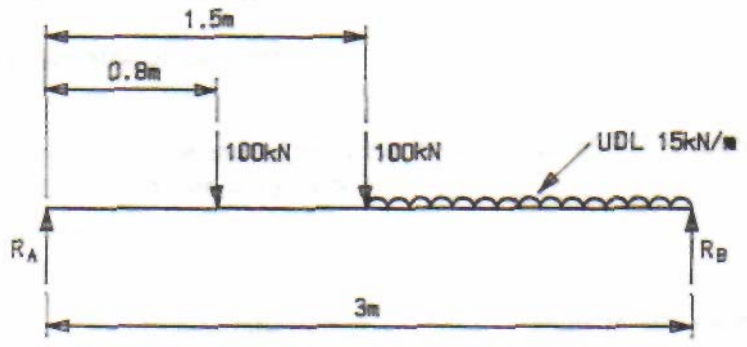

Fig. Q.12