GENERAL ENGINEERING SCIENCE I

Attempt ALL questions

Marks for each part question are shown in brackets

1. Solve for x in the following equation:

$$\frac{3x}{5} - \left(\frac{x+12}{20}\right) = 3.25$$

(8)

2. A bearing metal contains 18 parts of tin, 1.3 parts of antimony, 1 part copper and 1 part cadmium.

   Calculate the masses of tin, antimony, copper and cadmium to produce 46 kg of bearing metal. (8)

3. A right angled triangle ABC has an hypotenuse AB of 18.2cm which makes an angle of 1.176 radians to the base BC.

   Determine EACH of the following:

   (a) the length of the base BC to the nearest centimetre; (4)

   (b) the area of the triangle. (4)

4. A cylindrical vessel has an internal diameter of 1.85 metres and a maximum internal length of 4.63 metres measured from inside the hemispherical ends.

   Determine the volume of the vessel in m^3. (10)

5. Fig Q.5 shows a solid cone.

   Determine the TOTAL surface area to the nearest cm^2. (8)
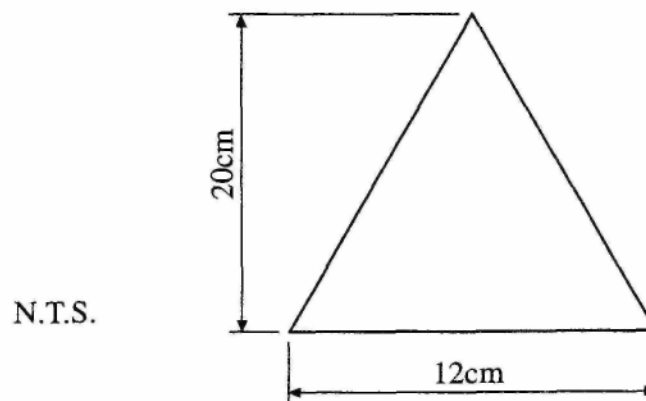

Fig. Q.5

6. Fig. Q.6 shows a simple wheel and axle lifting machine.

   Determine EACH of the following:

   (a) the velocity ratio of the machine; (3)

   (b) the efficiency of the machine if it requires an effort of 240 N to just lift a 54 kg mass. (5)
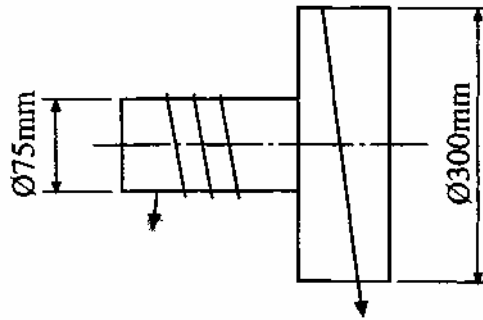

Fig. Q.6

7. Fig. Q.7 shows a simply supported beam AB.

   Determine EACH of the following:

   (a) the maximum value of the uniformly distributed load, given that the reaction R_B is 200 kN; (5)

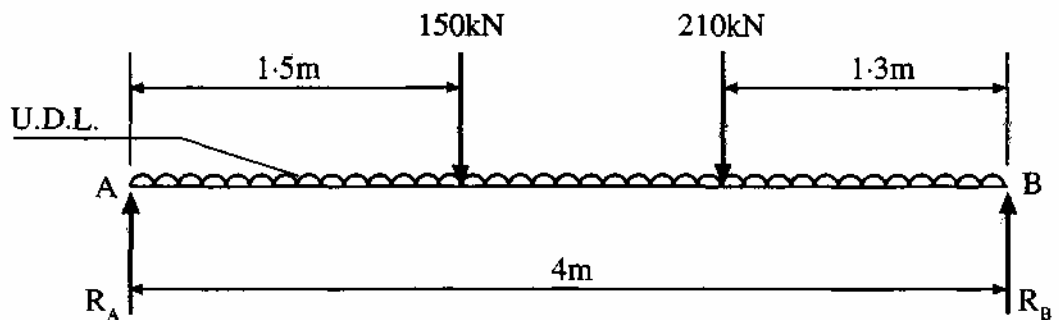   *(b)* the value of the reaction in R_A. (3)

Fig. Q.7

8. A tank has the following dimensions, length 8 metres, width 6 metres and depth 3.1 metres. The tank is filled with water of density 1022 kg /m³.

   Calculate EACH of the following:

   (a) the pressure on the tank bottom. (3)

   (b) the load on the longest side in MN. (5)

9. The electrical resistance R of a wire varies directly as the length l and inversely as the square of the radius r.

   (a) Express the statement in terms of R, l, and r. (4)

   (b) Determine the length of wire 1.6 mm in diameter that has the same resistance as a wire 4 metres long and 2 mm radius. (6)

10. A ship has a displacement of 3118 tonne with a centre of gravity KG 4.3 metres above the keel.

    Determine the new position of the centre of gravity when a mass of 135 tonne is loaded on the centreline as deck cargo at 6.5 metres above the keel. (8)

11. A mass of 6 tonne is moved a distance of 9.4 metres across the deck of a ship and causes 1.7° of heel.

    Determine the underwater volume of the ship given that GM = 0.69 m, and *m x d = Δ GM tan θ*.

    Density of seawater is 1025 kg /m^3. (8)

12. A hole 19 mm diameter is to be punched through a piece of steel plate 19 mm thick.

    Determine the force to be exerted by the punch given that the shear strength of the steel is 380N/mm^2. (8)