GENERAL ENGINEERING SCIENCE I **Sept 2006**

Attempt ALL questions

Marks for each question are shown in brackets.

1. Solve for *x* in the following equation: (8)

   $2 (x + 4) - 2 (x + 5) = x - 7$

2. A sphere has a surface area 1.6 times the curved surface area of a right cone.
   Calculate the diameter of the sphere given that the cone has a base diameter of 10cm and a perpendicular height of 12cm. (10)

3. The periodic time of a pendulum is given by the formula:

$$T = 2\pi\sqrt{\frac{L}{g}}$$

   (a) Transpose the formula to make g the subject. (5)

   (b) Calculate the value of *g* to one decimal place given that
   L = 50cm, $\pi = 3.142$ and T = 1.418 seconds. (3)

4. A body is at rest and is then uniformly accelerated for 75 seconds during which it covers a distance of 1406m.

   Calculate EACH of the following:

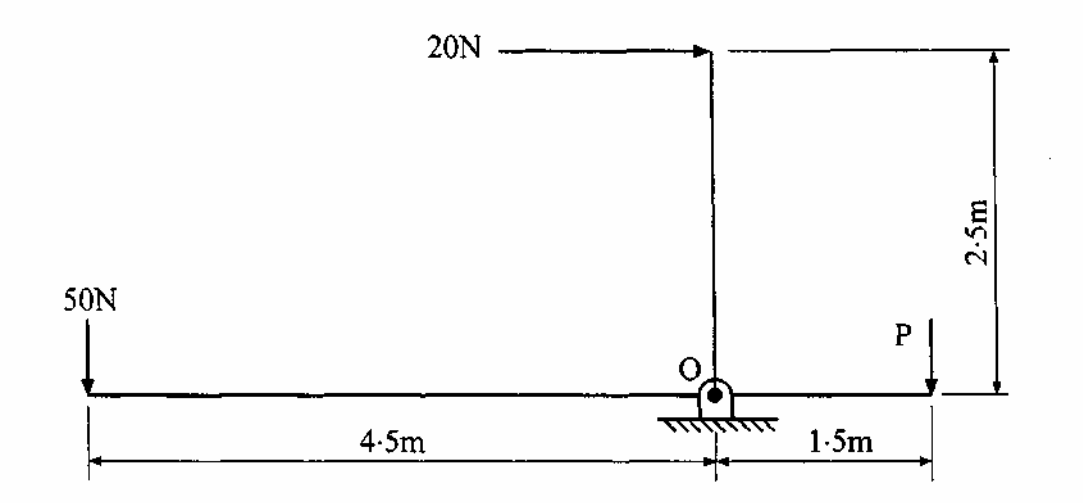
   (a) the value of the uniform acceleration in m/s^2; (4)

   (b) the velocity of the body after 75 seconds. (4)

5. If *y* varies inversely as the square of *x*, and $y = 12$ when $x = 3.1$, calculate the value of *y* when $x = 0.93$. (8)

6. (a) Define the moment of a force about a point. (3)

(b) Determine the value of P, the force necessary to maintain equilibrium of the moments of force about point O shown in Fig Q6. (5)



FigQ6

7. A simple wheel and axle lifting machine has an efficiency of 68%.

Calculate the effort required to just lift a mass of 330kg given that the diameters of the pulley wheel and axle are 450mm and 75mm respectively. (8)

8. A box barge is 42m long and 18m beam and floats in water of density 1021kg/m^3.

Calculate EACH of the following:

(a) the draught of the barge if the displacement is 1540 tonne; (4)

(b) the pressure on the outer bottom plating when the barge is floating at the draught calculated in Q8(a). (4)

9. A vessel has an underwater volume of 7805m^3 when floating in water density 1025kg/m .
A mass of 45 tonne is now loaded on the centre line and is then moved 5m to starboard.
KG = 6.5m and KM = 7.3m.

Calculate the angle of heel generated to the nearest degree. (8)

Note: $m \times d = \Delta GM \tan \theta$

10. A ship has a displacement of 7000 tonne when floating in water of density 1023kg/m^3, with KG = 3.8m.

Two double bottom tanks measuring 15m long x 3.5m wide x 2.3m deep are equally spaced either side of the centre line. These tanks are now completely filled with slurry having a density of 1800kg/m^3.

Calculate the change in the position of G in the ship in millimetres. (10)

11. A rectangular bulkhead is 16.5m wide and when flooded to the top on one side only with water of density 1020kg/m^3 supports a hydrostatic load of 32MN.

Calculate the height of the bulkhead to the nearest metre. (8)

12. A uniform beam simply supported at each end is 4.6m long and has a mass of 2 tonne. Point loads of 30kN are applied at 1.5m and 2.5m from the left hand end.

(a) Sketch a labelled diagram of the loaded beam. (2)

(b) Calculate the values of the reactions at the supports. (6)