July 1998

GENERAL ENGINEERING SCIENCE I

Attempt ALL questions

Marks for each part question are shown in brackets

1. Solve for x in the following equation using logarithms and showing ALL workings:

$$18.1 = 12.3 + 10^{2x}$$ (8)

2. Fig. Q.2 shows a right angled triangle ABC.

   Determine the values of the remaining sides and angle. (8)

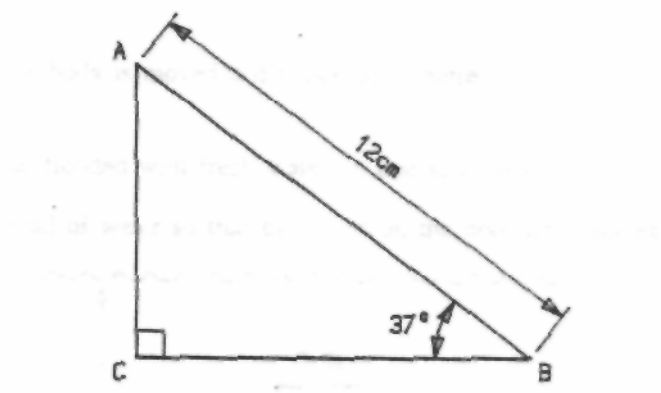

Fig. Q.2

3. Calculate the total surface area of a truncated cone having a base diameter of 120 mm, a top diameter of 60 mm, and a perpendicular height of 105 mm. (10)

4. A steel bar is 50 mm in diameter and is 1.8 metre long.

   It is placed in a centre lathe for turning down.

   Determine the reduction in the mass of the bar when it has been machined down to 35 mm in diameter. (10)

   Note: Relative density of steel= 7.7

5. Evaluate the following in fractional form:

   (a) $6\frac{3}{8} - 1\frac{9}{16} + 2\frac{1}{2}$ (4)

   (b) $3\frac{5}{8} + \left(1\frac{3}{4} \times 2\frac{1}{2}\right) - \left(1\frac{2}{3} \div 5\right)$ (4)

6. A solid sphere of lead has a diameter of 100 mm. The sphere is melted down and recast into a solid cone.

   Determine the height of the cone if the base diameter is to be 75 mm and only 80% of the molten lead is used. (8)

7. A steel piston rod is 600mm long. When subjected to a compressive stress of 11 N/mm^2 its length decreases by 0.033 mm.

Determine the Modulus of Elasticity E of the material in GN/m^2. (8)

8. A screw jack can lift a mass of 5 tonne with an applied effort of 230 N. The pitch of the screw thread is 3 mm and the efficiency of the machine under these conditions is 58%.

Determine the effective length of the operating handle. (8)

9. A body has a mass of 70kg.
Calculate:

(a) the least horizontal force to just cause motion when the coefficient of friction between the body and the surface is 0.67; (4)

(b) the work done when the body is moved a distance of 7 metre. (2)

10. Fig. Q.10 shows a bulkhead flooded with fresh water on one side only.

Determine the maximum head of water so that the thrust on the door does not exceed 46.63 kN. (8)

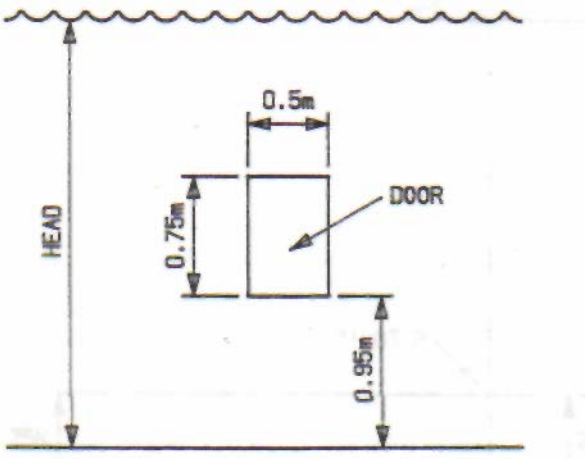

Fig. Q.10

11. *(a)* Plot a graph of diameter against rev/min using the data in Table Q. 11. (7)

(b) Determine from the curve obtained in Q.11(a) the required speed for a diameter of 55 mm. (3)

Diameter (mm)	25	37.5	50	62.5	75
N rev/min	233	155	116	93	77

Table Q.11

Suggested scales: X: 4 cm = 25 mm
Y: 1cm = 10 rev/min