

- 3 (a) Define *upthrust*.

.....  
.....  
..... [2]

- (b) A mass  $M$  with a wire attached to it is fully submerged in water as shown in Fig. 3.1. Mass  $M$  is 950 kg with a base area of  $0.40 \text{ m}^2$  and a height of 0.50 m.

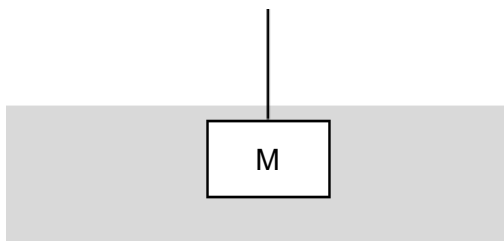


Fig. 3.1

Given that the density of water is  $1000 \text{ kg m}^{-3}$ , show that the tension in the wire is 7360 N.

[2]

- (c) Mass  $M$  is actually being held up by a crane made of a uniform rigid beam  $AB$  hinged to the ground at  $A$ , and held in place by two wires  $CD$  and  $BE$ , as shown in Fig. 3.2.

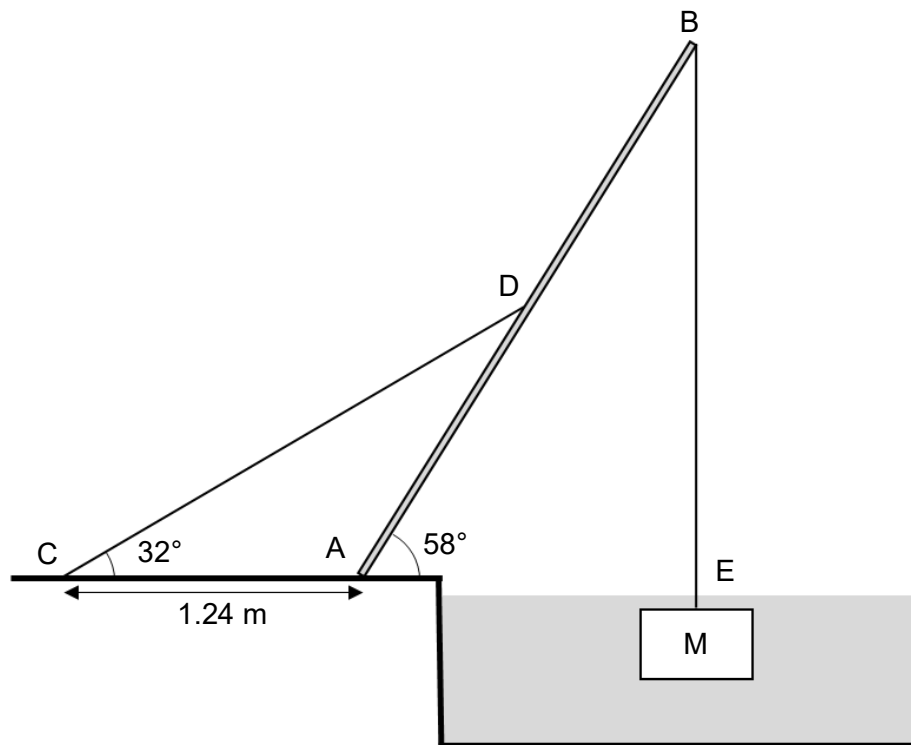


Fig. 3.2

The beam AB has a length of 3.00 m and a mass of 80.0 kg.

D is the midpoint of rod AB.

- (i) Calculate the tension in the wire CD,  $T_{CD}$ .

$$T_{CD} = \dots\dots\dots \text{ N [2]}$$

- (ii) Explain why the hinge must exert a force on the beam at A to keep the beam in equilibrium.

.....  
.....  
.....  
..... [2]

- (iii) With suitable calculations or otherwise, explain whether the direction of the force the hinge exerts on the beam at A is above AB (angle to the horizontal  $> 58^\circ$ ), along AB (angle to the horizontal  $= 58^\circ$ ), or below AB (angle to the horizontal  $< 58^\circ$ ).

.....  
.....  
..... [2]

