

- 3 (a) State what is meant by the centre of gravity of an object.

..... [1]

- (b) A uniform beam AB is attached by a frictionless hinge to a vertical wall at end A. The beam is held so that it is horizontal by a metal wire CD, as shown in Fig. 3.1.

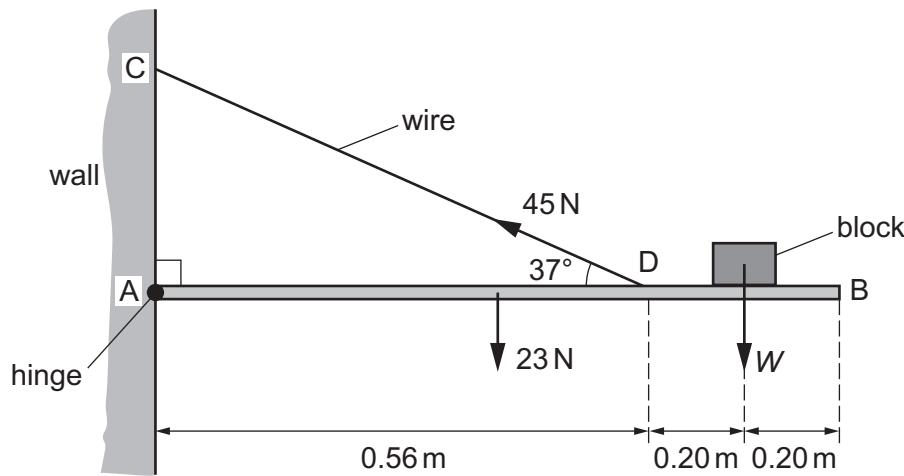


Fig. 3.1 (not to scale)

The beam is of length 0.96 m and weight 23 N. A block of weight W rests on the beam at a distance of 0.20 m from end B. The wire is attached to the beam at point D which is a distance of 0.40 m from end B. The wire exerts a force on the beam of 45 N at an angle of 37° to the horizontal. The beam is in equilibrium.

- (i) Calculate the vertical component of the force exerted by the wire on the beam.

$$\text{vertical component of the force} = \dots \text{N} \quad [1]$$

- (ii) By taking moments about A, calculate the weight W of the block.

$$W = \dots \text{N} \quad [3]$$

- (iii) The hinge exerts a force on the beam at end A.

Calculate the horizontal component of this force.

$$\text{horizontal component of force} = \dots \text{N} [1]$$

- (iv) The block is now placed closer to point D on the beam.

State whether this change will increase, decrease or have no effect on the tension in the wire.

..... [1]

- (v) The stress in the wire is $5.3 \times 10^7 \text{ Pa}$. The wire is now replaced by a second wire that has a radius which is three times greater than that of the original wire. The tension in the wire is unchanged.

Calculate the stress in the second wire.

$$\text{stress} = \dots \text{Pa} [2]$$