

- 3 (a) State what is meant by the *centre of gravity* of a body.

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.....

[1]

- (b) A uniform square sign with sides of length 0.68 m is fixed at its corner points A and B to a wall. The sign is also supported by a wire CD, as shown in Fig. 3.1.

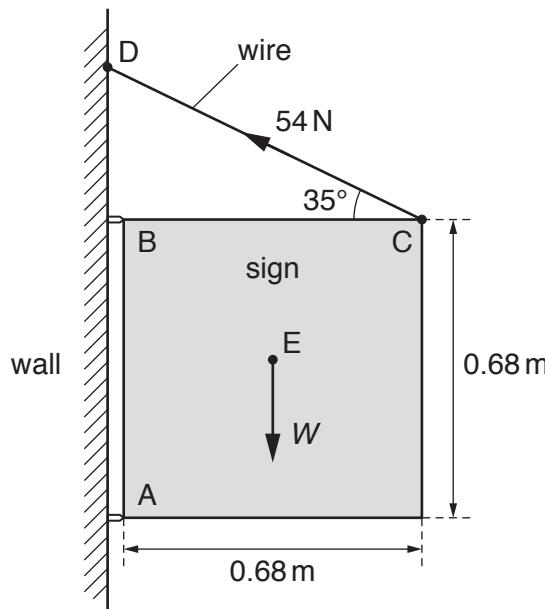


Fig. 3.1 (not to scale)

The sign has weight W and centre of gravity at point E. The sign is held in a vertical plane with side BC horizontal. The wire is at an angle of 35° to side BC. The tension in the wire is 54 N.

The force exerted on the sign at B is only in the vertical direction.

- (i) Calculate the vertical component of the tension in the wire.

vertical component of tension = N [1]

- (ii) Explain why the force on the sign at B does not have a moment about point A.

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[1]

- (iii) By taking moments about point A, show that the weight W of the sign is 150 N.

[2]

- (iv) Calculate the total vertical force exerted by the wall on the sign at points A and B.

total vertical force = N [1]

- (c) The sign in (b) is held together by nuts and bolts. One of the nuts falls vertically from rest through a distance of 4.8 m to the pavement below. The nut lands on the pavement with a speed of 9.2 m s^{-1} .

Determine, for the nut falling from the sign to the pavement, the ratio

$$\frac{\text{change in gravitational potential energy}}{\text{final kinetic energy}}.$$

ratio = [4]

[Total: 10]