4 **(a)** State what is meant by the centre of gravity of an object.

.....

.....

..... [2]

(b) A thin beam AB has a length of 3.0 m.

End A is attached to a vertical wall by a frictionless hinge and the beam is kept horizontal by a force of 12 N applied vertically at B, as shown in Fig. 4.1.

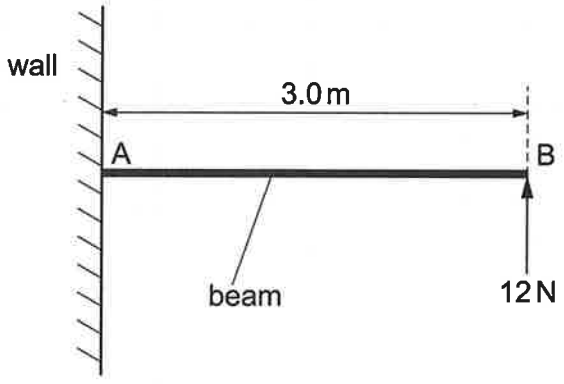

Fig. 4.1

The beam is reversed so that end B is attached to the wall by the hinge.

This causes the force needed to keep the beam horizontal to increase to 16 N, as shown in Fig. 4.2.

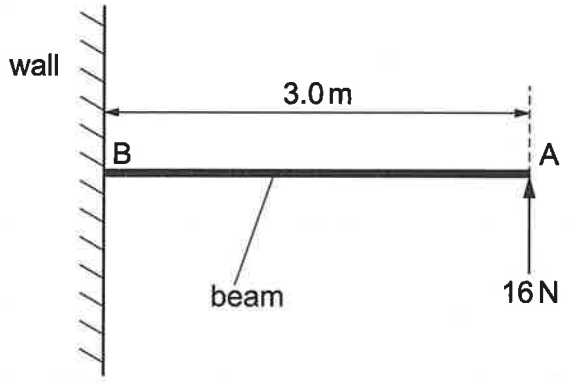

Fig. 4.2

Calculate the weight W of the beam and the distance x of the centre of gravity of the beam from end A.

W = ... N

x = ... m

[4]

(c) The beam in Fig. 4.2 is lowered at end A so that it is at 30° to the horizontal, as shown in Fig. 4.3.

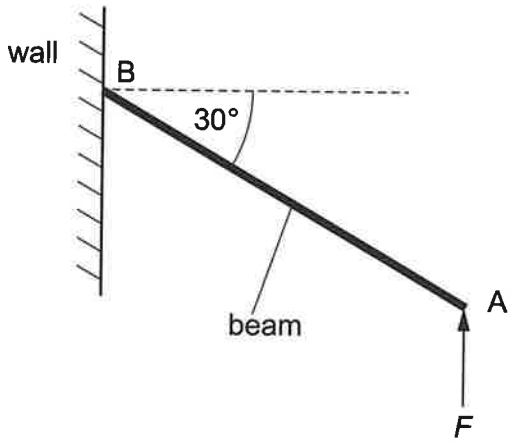

Fig. 4.3

The force now required to keep the beam in equilibrium is F.

State and explain how the magnitude of force F compares with the magnitude of the 16 N force in Fig. 4.2.

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..... [2]