1. State 2 conditions for an object to be in equilibrium
   - Resultant force is zero
   - Resultant moment is zero

2.

A uniform beam AB is attached by a hinge to a wall at end A, as shown in Fig. 3.1.

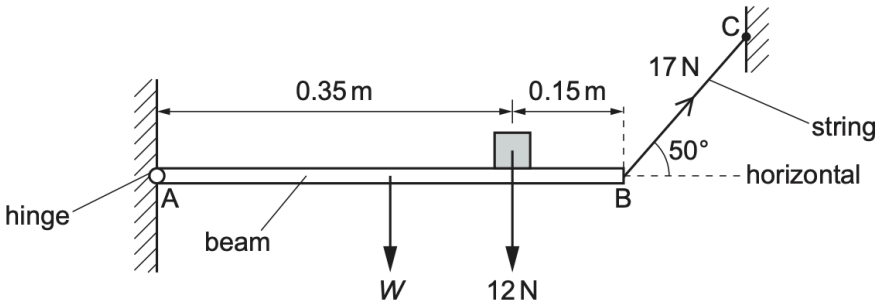


Fig. 3.1 (not to scale)

The beam has length 0.50 m and weight *W*. A block of weight 12 N rests on the beam at a distance of 0.15 m from end B.

The beam is held horizontal and in equilibrium by a string attached between end B and a fixed point C. The string has a tension of 17 N and is at an angle of 50° to the horizontal.

W = 9.2N
Vertical component of 17N = 13N

Calculate the magnitude of the vertical component of the force exerted on the beam by the hinge.

9.2 + 12 = 13 + x
x = 8.2N

The block is now moved closer to end A of the beam. Assume that the beam remains horizontal. State whether this change will increase, decrease or have no effect on the horizontal component of the force exerted on the beam by the hinge.

the horizontal force exerted on beam by hinge balances the horizontal force exerted due to tension.

initially, horizontal component = $17\cos 50$
$= 10.9\,N$

When block is moved closer to hinge, the clockwise moment produced by it decreases

say the distance btwn A & block becomes 0.3m.

CWM = $0.3 \times 12 + 0.25 \times 9.2 = 5.9\,Nm$

Q also says that the beam remains horizontal
$\Rightarrow \theta$ remains 50°. $\therefore$ T changes.

$5.9 = T\sin 50 \times 0.5$

$\Rightarrow T = \dfrac{5.9}{\sin 50 \times 0.5} = 15.4N$

$\therefore$ new horizontal force = $15.4\cos 50 = 9.9N$

$\therefore$ The horizontal force has decreased.

3. State what is meant by the centre of gravity of an object
   - the point where all the weight of the object is taken to act

4. State Newton's 1st law of motion
   - A body continues at rest or constant velocity unless acted upon by an external resultant force.

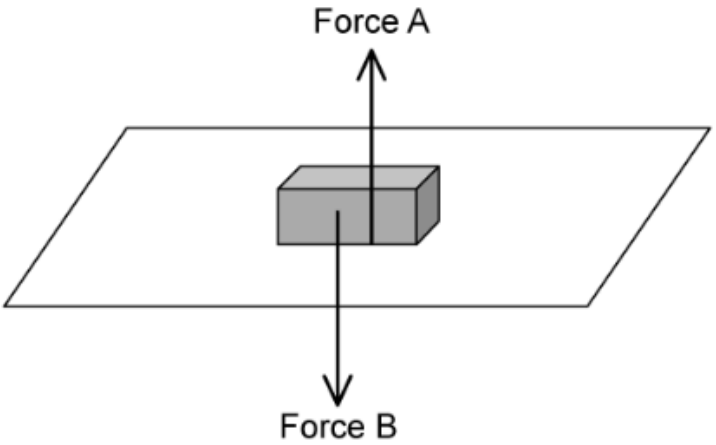
5. State Newton's 2nd law of motion
   - Resultant force on an object is equal to the rate of change of momentum. Equation: F=ma

6. State Newton's 3rd law of motion

- Every action has an equal and opposite reaction: if body A exerts a force on body B, body B exerts a force on body A, of equal magnitude but in the opposite direction.

7.

A brick of mass 2 kg is resting on the floor as shown in Fig. 1.1.



Explain how Newton's 3rd law applies to one of the forces acting on the brick

- The downward force of gravity is exerted by earth on brick
- Is equal and opposite to
- The upward force of gravity exerted by brick on earth
  OR
- The upward contact force exerted by table on brick
- Is equal and opposite to
- The downward contact force exerted by brick on table

8. State the principle of conservation of momentum
   - sum / total momentum before a collision = sum / total momentum after a collision OR sum / total momentum of a system is constant
   - for an isolated system OR if no resultant external force acts on the system

9. Define linear momentum.
   - Product of mass and velocity