

2 (a) State the principle of moments.

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

(b) Three objects A, B and C are placed on a horizontal beam. The beam is in equilibrium, as shown in Fig. 2.1.

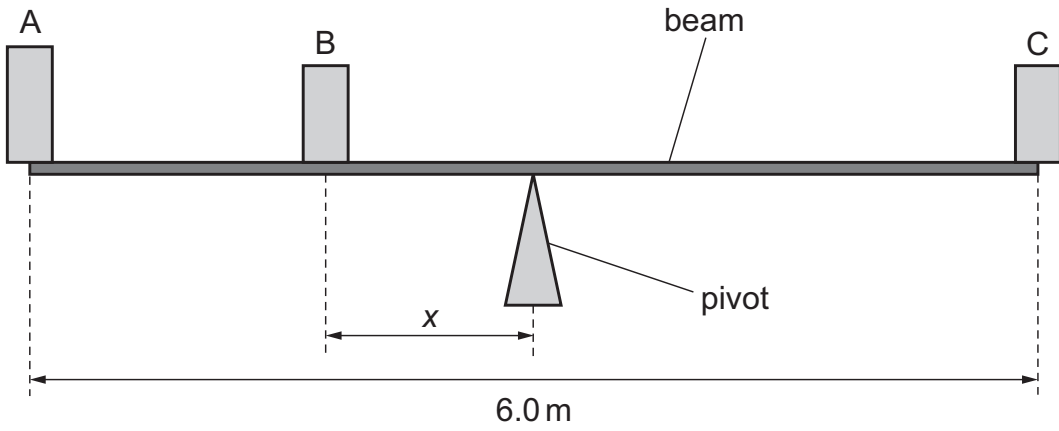


Fig. 2.1 (not to scale)

The beam is uniform and has length 6.0 m.  
 The pivot is at the midpoint of the beam.  
 Object A has mass 60 kg and is at one end of the beam.  
 Object B has mass 45 kg and is at a distance  $x$  from the pivot.  
 Object C has mass 80 kg and is at the other end of the beam.

Calculate  $x$ .

$x = \dots\dots\dots$  m [3]

(c) The beam is 0.80 m above horizontal ground.

Object A is removed and replaced by a spring connected to the ground and the beam, as shown in Fig. 2.2.

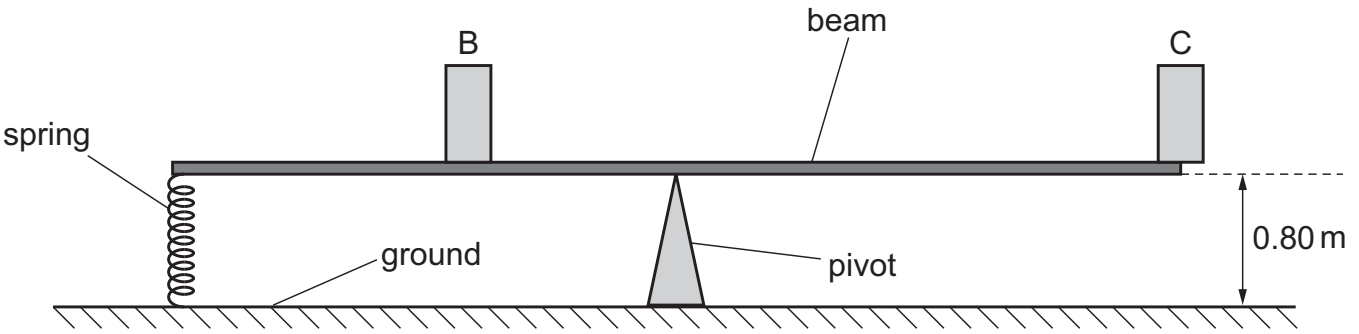


Fig. 2.2

After the change, the beam is again horizontal and in equilibrium. The positions of B and C are unchanged.

The spring has an unstretched length of 0.59 m and obeys Hooke's law.

(i) Calculate the spring constant of the spring.

spring constant =  $\dots\dots\dots$   $\text{Nm}^{-1}$  [3]

(ii) Calculate the elastic potential energy of the spring.

elastic potential energy =  $\dots\dots\dots$  J [2]