

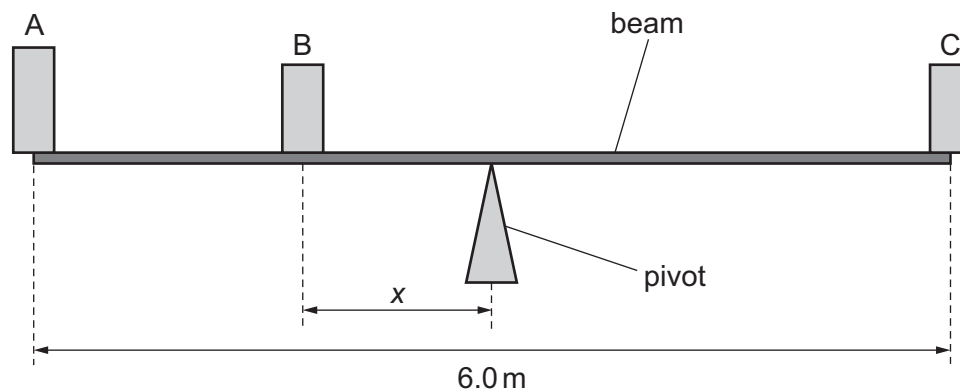
2 (a) State the principle of moments.

.....

.....

..... [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.

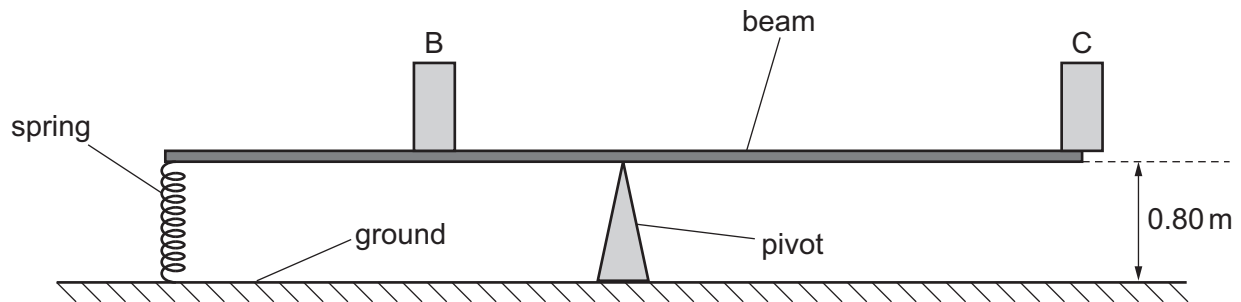


Fig. 2.2

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 = .....  $\text{Nm}^{-1}$  [3]

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

elastic potential energy = ..... J [2]