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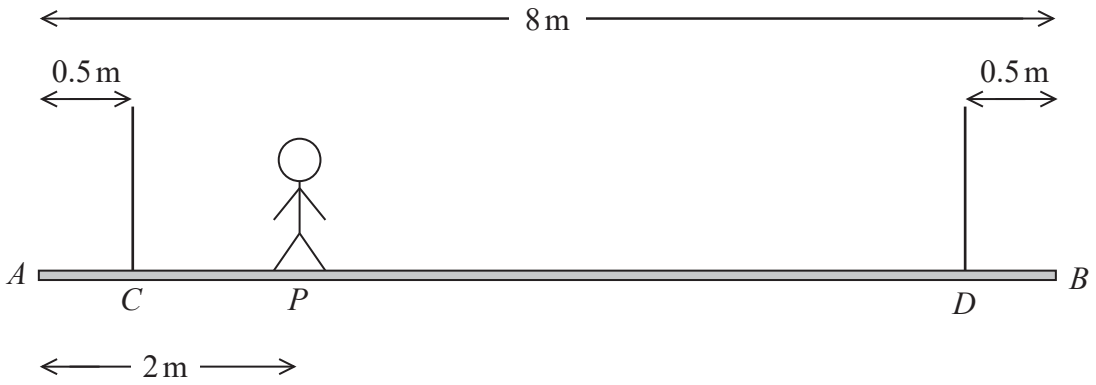


Figure 2

A beam AB has mass 100 kg and length 8 m. The beam is held in equilibrium in a horizontal position by two vertical ropes attached to the beam at C and D, where $AC = 0.5$ m and $BD = 0.5$ m. A gymnast of mass M kg stands on the beam at the point P, where $AP = 2$ m, as shown in Figure 2. The beam remains horizontal and in equilibrium. The tension in the rope attached to the beam at D is 637 N. The gymnast is modelled as a particle, the beam as a uniform rod and the ropes as light inextensible strings.

(a) Find

(i) the value of M,

(ii) the tension in the rope attached to the beam at C.

(6)

(b) State how you have used the fact that the beam is modelled as a rod.

(1)

The gymnast at P now gets off the beam and is replaced by two gymnasts. One gymnast, of mass 60 kg, stands on the beam at P and the other gymnast, of mass 48 kg, stands on the beam at X, where $AX = x$ metres. The beam remains horizontal and in equilibrium but the tensions in the two ropes are now equal. The two gymnasts are modelled as particles.

(c) Find the value of x.

(6)

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Q3