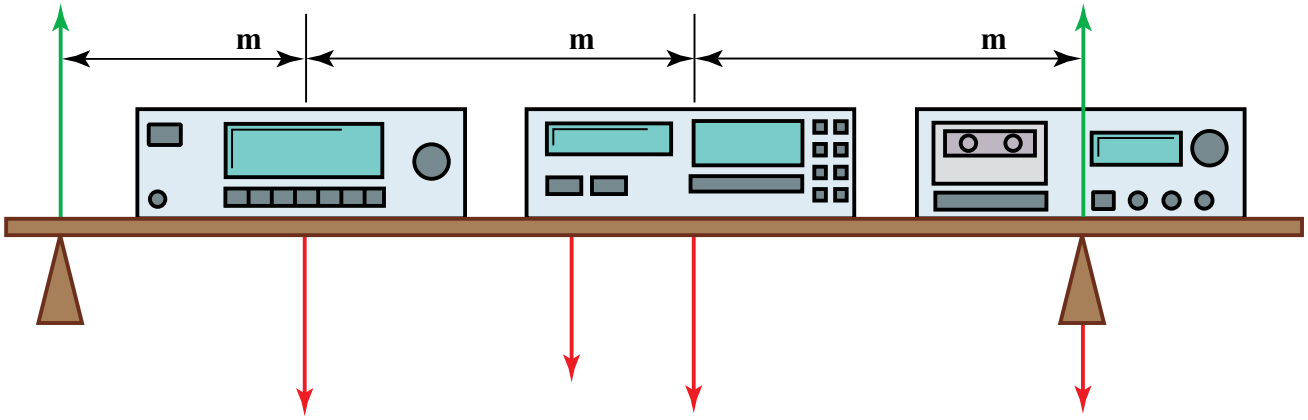
Leave blank

uniform ori ontal ar of mass k as len t m an rests on t o erti al su orts 1 m an m from its left an en in t e ma nitu rea tion for e at ea of t e su orts (4)

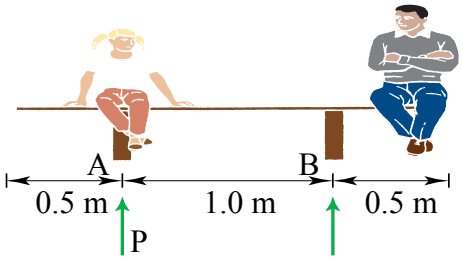
(Total for question is 4 marks)

4 in t e rea tion for es on t e i fi s elf s o n elo T e s elf itself as ei t an its entre of mass is mi a et een an (4)



(Total for question 4 is marks)

5 The diagram shows two people, an adult and a child, sitting on a uniform bench of mass 40 kg; their positions are as shown. The mass of the child is 50 kg, that of the adult is 85 kg.



(a) Find the reaction forces, P and (in N), from the ground on the two supports of the bench. (4)

(b) The child now moves to the mid-point of the bench. What are the new values of P and ? (4)

(c) Is it possible for the child to move to a position where P = 0? What is the significance of a zero value for P ? (4)

(d) What happens if the child leaves the bench? (4)

(Total for question is 4 marks)

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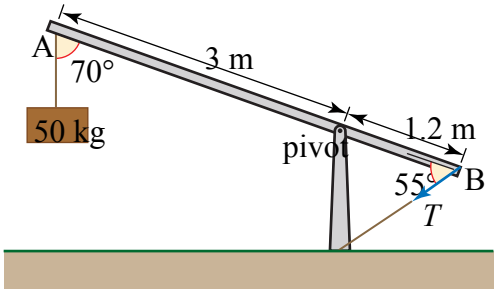
6 The diagram shows a simple crane. The weight of the jib (AB) may be ignored. The crane is in equilibrium in the position shown.



(a) By taking moments about the pivot, find the magnitude of the tension T (in N). **(4)**

(b) Find the reaction of the pivot on the jib in the form of components parallel and perpendicular to the jib. **(4)**

(c) Show that the total moment about the end A of the forces acting on the jib is zero. **(4)**

(d) What would happen if

(i) the rope holding the 50kg mass snapped? **(4)**

(ii) the rope with tenstion T snapped? **(4)**

(Total for question 6 is 4 marks)

7 A uniform plank, AB, of mass 50 kg and length 6 m is in equilibrium leaning against a smooth wall at an angle of 60° to the horizontal. The lower end, A, is on rough horizontal ground.

(a) Draw a diagram showing all the forces acting on the plank. **(4)**

(b) Write down the total moment about A of all the forces acting on the plank. **(4)**

(c) Find the normal reaction of the wall on the plank at point B. **(4)**

(d) Find the frictional force on the foot of the plank. What can you deduce about the coefficient of friction between the ground and the plank? **(4)**

(e) Show that the total moment about B of all the forces acting on the plank is zero. **(4)**

(Total for question 7 is 4 marks)

Leave blank

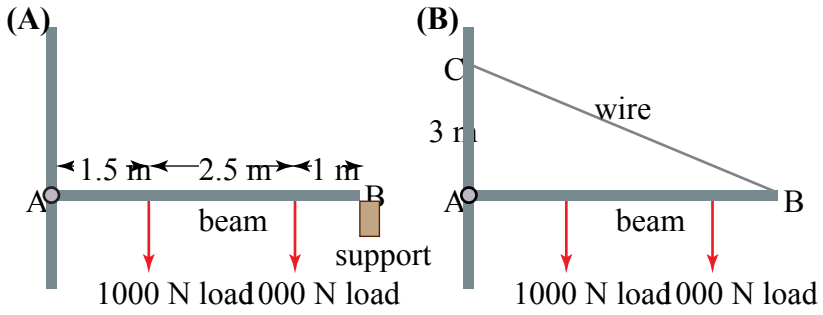
8 A weightlifter's bar in a competition has mass 10 kg and length 1 m. By mistake, 50 kg is placed on one end and 60 kg on the other end. How far is the centre of mass of the bar from the centre of the bar itself? **(4)**

(Total for question 8 is 4 marks)

9 A rod has length 2 m and mass 3 kg. The centre of mass should be in the middle but due to a fault in the manufacturing process it is not. This error is corrected by placing a 200 g mass 5 cm from the centre of the rod. Where is the centre of mass of the rod itself? **(4)**

(Total for question 9 is 4 marks)

10 Overhead cables for a tramway are supported by uniform, rigid, horizontal beams of weight 1500 N and length 5 m. Each beam, AB, is freely pivoted at one end A and supports two cables which may be modelled by vertical loads, each of 1000 N, one 1.5 m from A and the other at 1 m from B.



In one situation, the beam is held in equilibrium by resting on a small horizontal support at B, as shown in figure **(A)**.

(a) Draw a diagram showing all the forces acting on the beam AB. Show that the vertical force acting on the beam at B is 1850 N. **(4)**

In another situation, the beam is supported by a wire, *instead of the support at* B. The wire is light, attached at one end to the beam at B and at the other to the point C which is 3 m vertically above A, as shown in figure **(B)**.

(b) Calculate the tension in the wire. **(4)**

(c) Find the magnitude and direction of the force on the beam at A. **(4)**

(Total for question 10 is 4 marks)