Multiple-Choice Questions

1. Which of the following does **not** make use of moments to help perform daily tasks?
   A A driver uses a screwdriver to tighten a screw.
   B A student opens a door for her teacher.
   C A caveman pushes a rock down the hill.
   D A fisherman turns the reel to reel in a fish. ( )

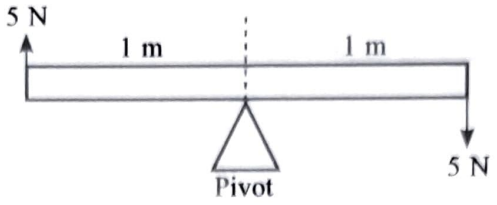
2. A racing sports car is stable because _____.
   A it has small tyres
   B it has a large base area
   C it has a high centre of gravity
   D it can travel at a high velocity ( )

3. If an object is said to be in equilibrium, then _____.
   A the resultant moment on the object cannot be zero
   B there can be a resultant moment but no resultant force
   C there can be a resultant force but no resultant moment
   D the resultant moment and resultant force on the object are zero ( )

4. A stable object has _____.
   A a low centre of gravity only
   B a large mass and a low centre of gravity
   C a small weight and a large base area
   D a large base area and a low centre of gravity ( )

5. A body in equilibrium will _____.
   A rotate at an increasing speed
   B move at an increasing speed
   C rotate at a constant speed
   D None of the above ( )

6. What can be concluded about the body in the diagram below?



A There is a net force of 5 N acting on it.
B The net moment is 5 N m.
C It is not in equilibrium.
D It is in equilibrium. ( )

7. Which of the following statements is true?
A The centre of gravity may lie either inside or outside an object.
B We cannot find the centre of gravity of an irregular-shaped object.
C The centre of gravity is any random point in an object.
D There is more than one centre of gravity for every object. ( )

8. Which of the following objects is in neutral equilibrium?

A

B

A

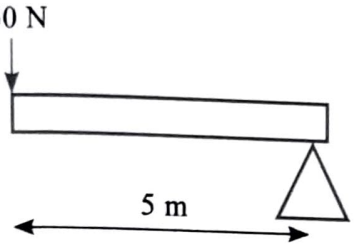
B

( )

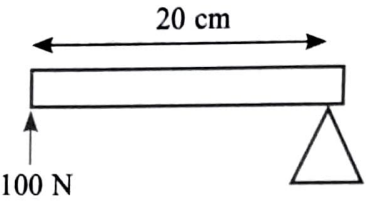
9. Which of the following statements is **not** true about an object in stable equilibrium?
A The position of its centre of gravity remains unchanged after it is slightly tilted.
B The position of its centre of gravity is raised when it is slightly tilted.
C The object tends to return to its original position if it is tilted slightly.
D Its centre of gravity tends to return to the lower position. (

10. Which of the following produces the greatest turning effect of force?

A



B



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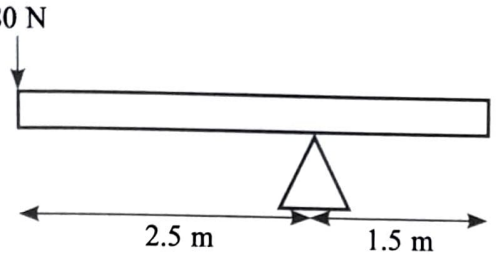

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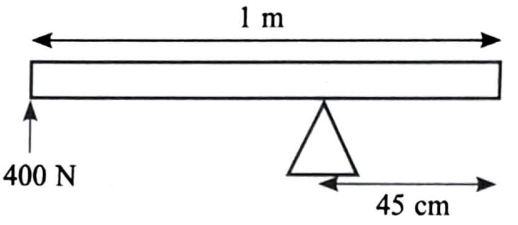
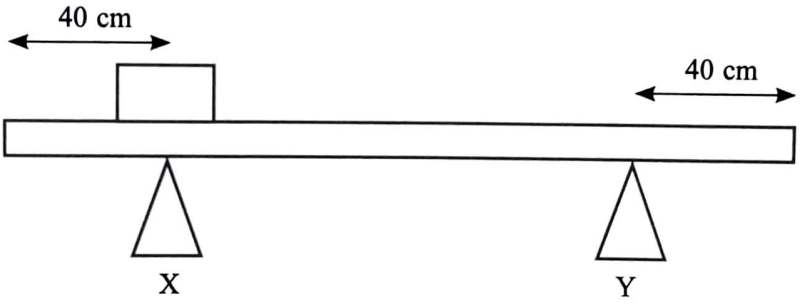


( )

11. The diagram below shows a uniform 2 metre long table of weight 100 N supported on two trestles, X and Y, 40 cm from each end. A box that weighs 50 N is placed directly on top of trestle X.

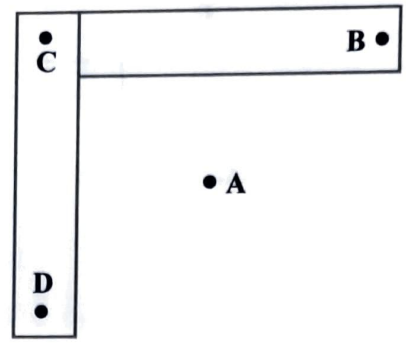


What is the force exerted by trestle X on the table?

A 50 N
B 75 N
C 100 N
D 150 N

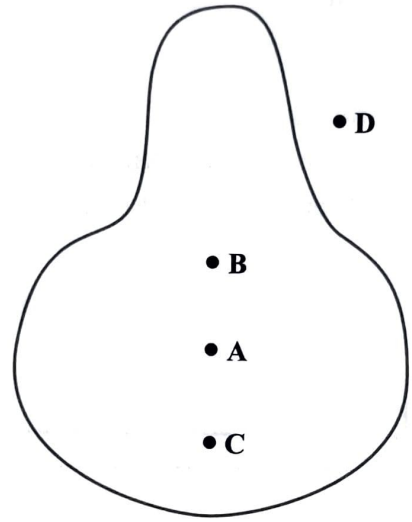
( )

12. The diagram below shows an object.



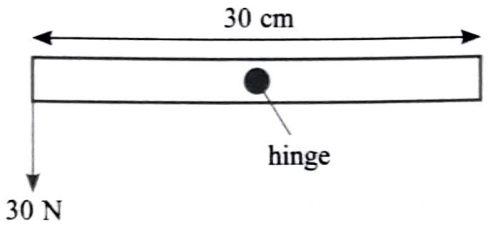
Which point can be its centre of gravity?

13. Which point can be the centre of gravity of the object shown below?



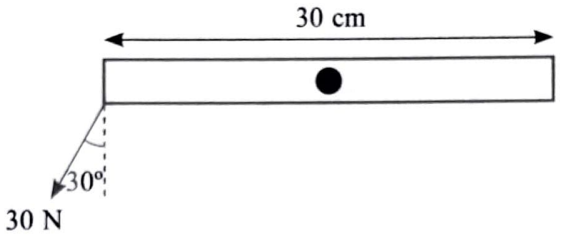
Structured Questions

1. (a) In the diagram below, the length of the object is 30 cm and the object rotates about the hinge, which is in the middle of the object.

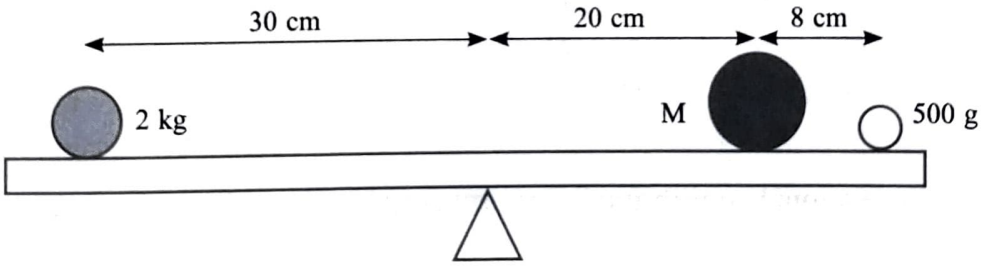


What is the moment of the force on the object due to a 30 N force?

(b) What is the moment of the force on the object due to a 30 N force applied at the same position as in (a) but tilted at an angle of 30°, as shown in the diagram below?

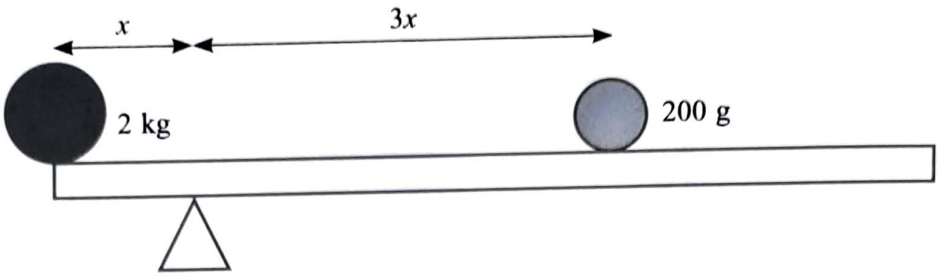


2. In the diagram below, the balls are in equilibrium and the pivot is at the centre of the plank.



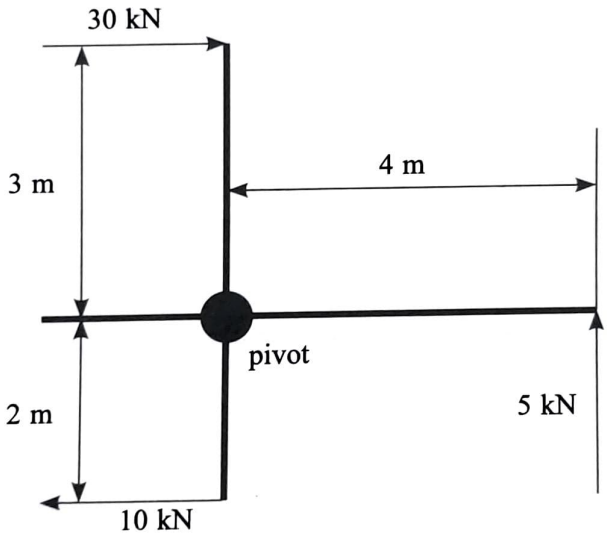
What is the mass of ball M?

3. In the diagram below, the weight of a plank is 500 g and the system is in equilibrium. The distance between the two balls is 2 m. (You may assume that the black ball at the left edge of the plank will not topple over. You may also assume that the plank is uniform and that the centre of gravity acts at the centre of the plank.)



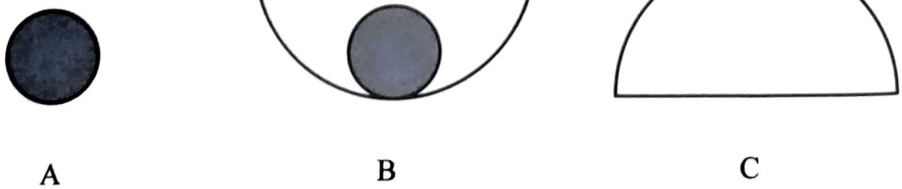
Find the distance between the centre of gravity of the plank to the pivot. (Note that the pivot is towards the left of the centre of gravity of the plank.)

4. In the diagram below, three forces are acting on the object.



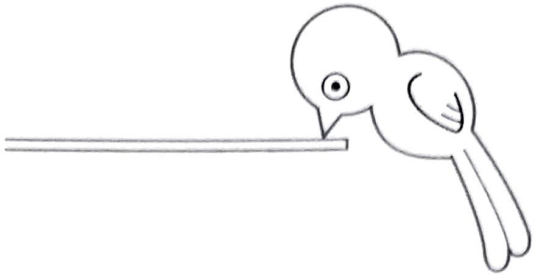
Is the object in rotational equilibrium? Perform simple calculations to prove your answer.

5. (a) Label each of the following diagrams according to their state of stability — stable, unstable or neutral.



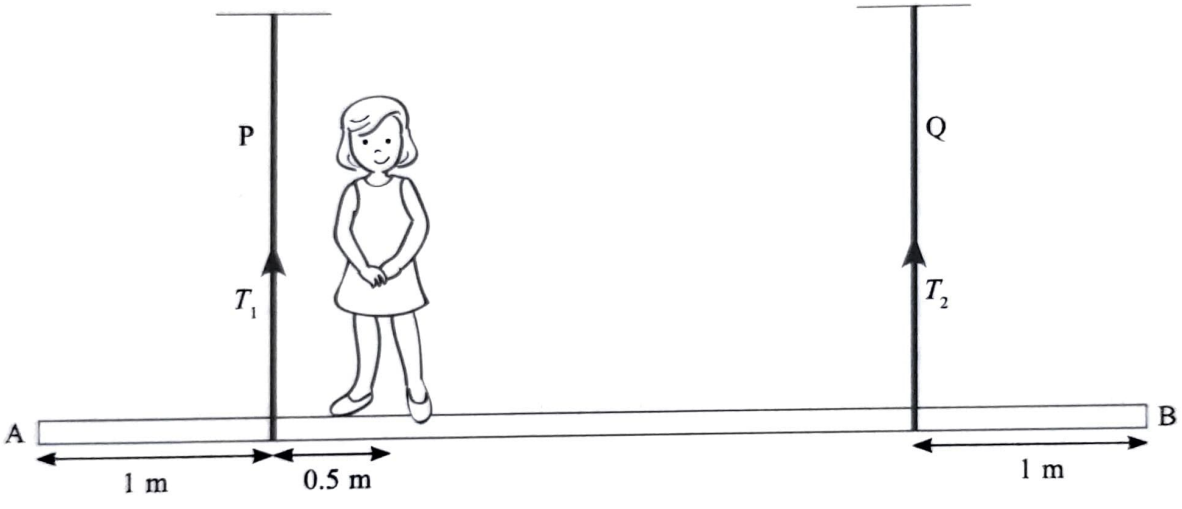
A B C

(b) Explain how the toy bird shown in the diagram below is balanced on the stick.



(c) State the Principle of Moments for a body in equilibrium.

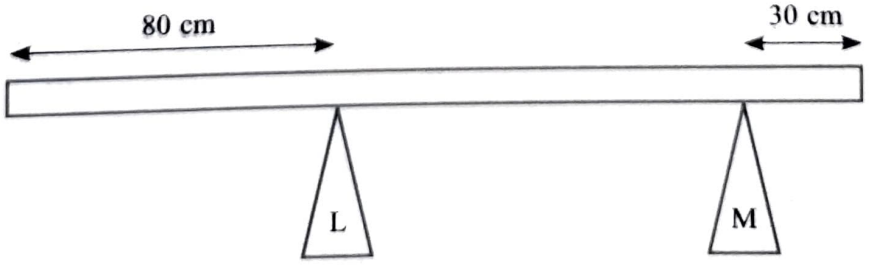
6. The diagram below shows a uniform wooden plank suspended on two fixed vertical ropes, P and Q. A woman who weighs 50 kg is standing on the plank 0.5 m away from rope P. The plank that measures 4 m has a mass of 60 kg.



(a) There are four forces acting on the plank. Two of them, the tensions of ropes, T_1 and T_2, are shown in the diagram. On the diagram above, draw and label the other two forces.

(b) Calculate the value of T_1.

7. In the diagram below, a uniform 2 m long table of weight 50 N is supported on two trestles, L and M, which are located 80 cm and 30 cm from each end of the table.



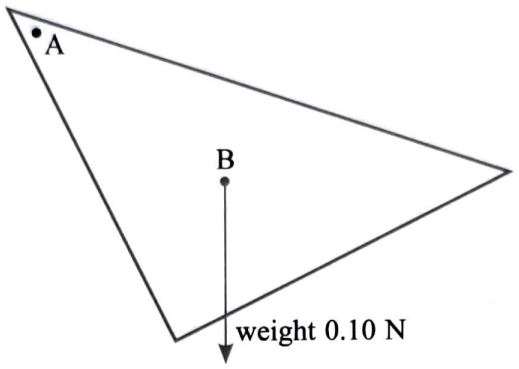
(a) Indicate on the diagram, the position and direction of the three forces that act on the table.

(b) Which trestle will exert a greater force on the table? Explain your answer.

(c) By taking moments about any suitable points (or otherwise), find the force exerted by each trestle on the table.

Free Response Question

1. The diagram below shows a thin sheet of metal suspended from a hole in one corner at A. The weight of the metal is 0.10 N and the centre of gravity is at B.



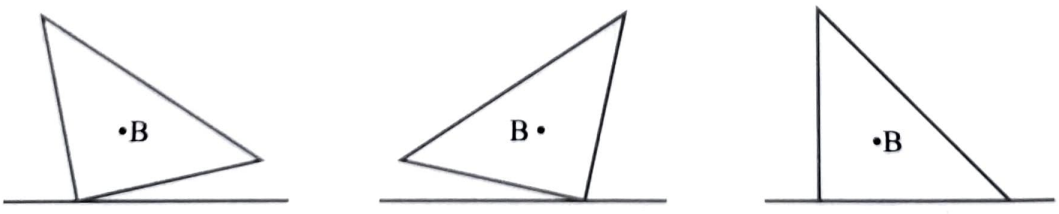
(a) Describe in detail how you would experimentally determine the position of the centre of gravity of the sheet of metal.

(b) The sheet turns because of the moment of the weight about point A.

(i) Define what is meant by 'the moment of a force'.

(ii) Calculate the moment of the weight about point A. State or illustrate clearly which distance to be measured and give the unit of your final answer.

(c) The diagrams below show the positions of three thick pieces of wood on a table. Diagram III shows the same piece of wood balanced on the table. B is the centre of gravity for each piece of wood.



I II III

(i) Explain why the piece of wood in diagram I falls to the right whereas the piece of wood in diagram II falls to the left.

(ii) Explain why the piece of wood in diagram III does not fall over.

(iii) Suggest how the thickness of the piece of wood in diagram III affects its stability.