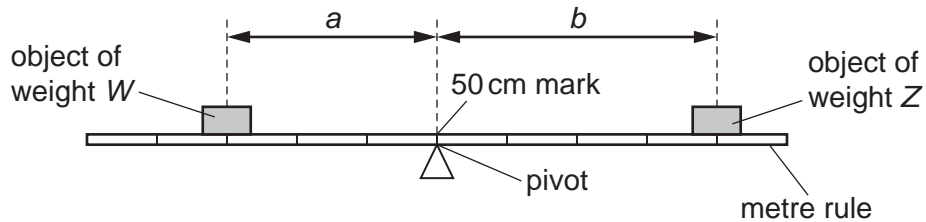1   The diagram shows an object of weight W and an object of weight Z balanced on a uniform metre rule.
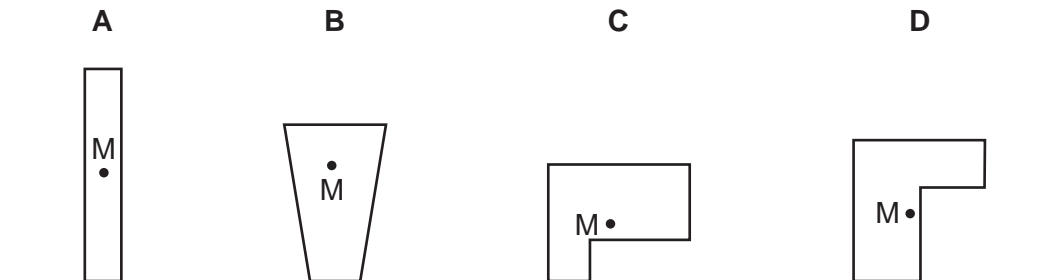

Which equation relating to W, Z, a and b is correct?

A $\dfrac{W}{a}$ $\dfrac{Z}{b}$

B $W \times Z = a \times b$

C $W \times a = Z \times b$

D $W \times (a + b) = Z$

2   The diagrams show four objects **A**, **B**, **C** and **D**. The centre of mass M of each object is marked on the diagrams.

Which object is **not** in equilibrium?

3   The diagram shows an L-shaped piece of card suspended freely from a pin at **B**.

When the card is pushed, it swings and then comes to a stop in the position shown.

At which labelled point is the centre of mass of the card?

card suspended
from here

A •

B •

C •

D •
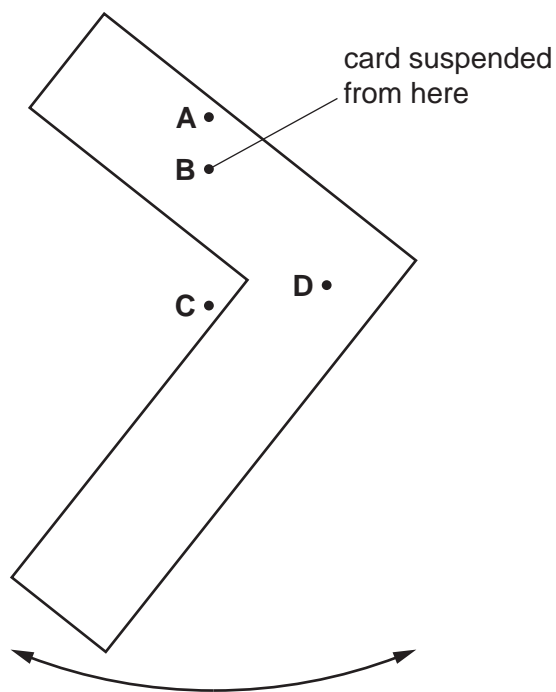
4   Five identical bags of rice are balanced on a uniform beam by an object of mass 10 kg.
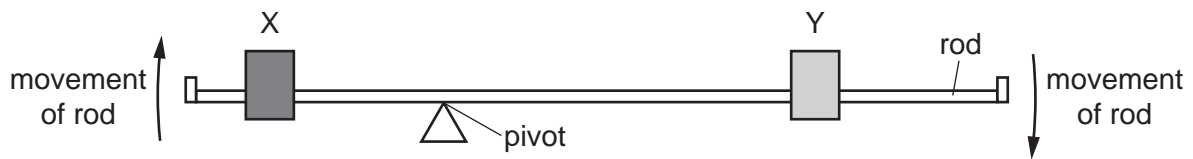
five bags
of rice

10 kg

pivot
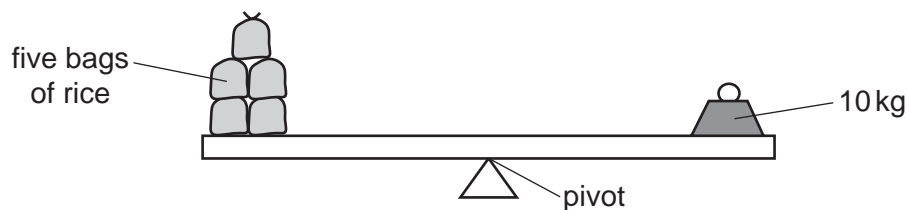
Two more identical bags of rice are added to the other five. The average position of the bags on the beam does not change.

What mass now balances the bags?

A   3.5 kg   B   7.0 kg   C   12 kg   D   14 kg

5   The diagram shows an unbalanced rod. Two loads X and Y can be moved along the rod.

The rod turns in a clockwise direction as shown.

Which action could make the rod balance?

A   moving X to the left

B   moving X to the right

C   moving Y to the right

D   moving the pivot to the left

6   The diagram shows a balance being used to find the weight of a baby. The weight of the basket can be ignored.

At equilibrium, the pivot is nearer to the 40 N balancing weight than to the baby.
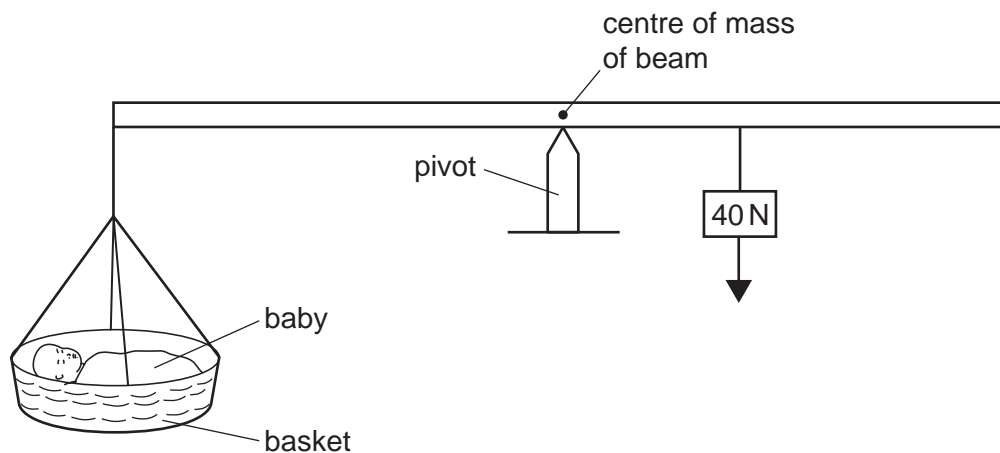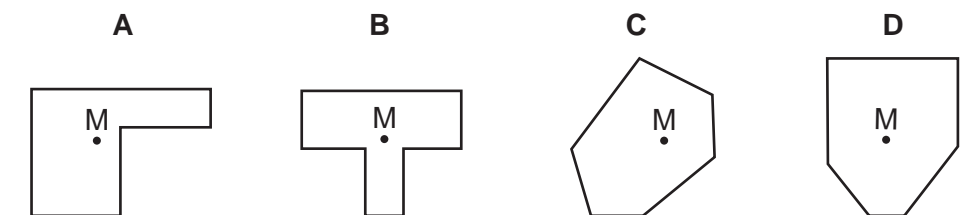

What is the weight of the baby?

A   less than 40 N

B   40 N

C   more than 40 N

D   impossible to tell without a scale on the beam

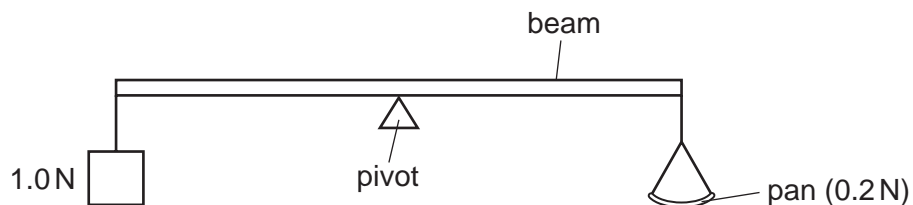7   The diagram shows four objects on a flat surface.

     The centre of mass of each object is marked M.

     Which object is about to fall over?

                 A   **B**   **C**   **D**

8   The diagram shows a uniform beam being used as a balance. The beam is pivoted at its centre.

     A 1.0 N weight is attached to one end of the beam. An empty pan weighing 0.2 N is attached to
     the other end of the beam.

     How many 0.1 N weights must be placed on the pan in order to balance the beam?
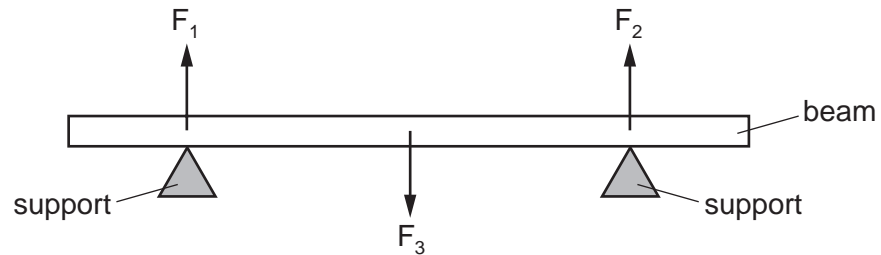
     A   5   **B**   8   **C**   10   **D**   12

9   A heavy beam rests on two supports. The diagram shows the only three forces F_1, F_2 and F_3 acting on the beam.
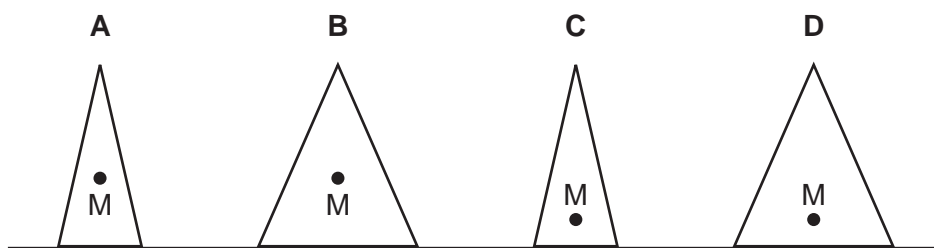

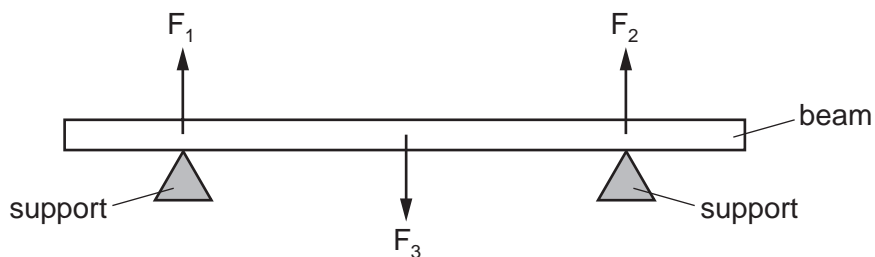The beam is in equilibrium.

Which statement is correct?

A   All the forces are equal in size.

B   The resultant force on the beam is in the opposite direction to the resultant turning effect.

C   The resultant force on the beam is zero and the resultant turning effect on the beam is zero.

D   The total upward force is twice the total downward force.

10 The diagrams show four solid cones. The centre of mass of each cone is marked by a point labelled M.

Which cone is the most stable?

A   B   C   D

11 A heavy beam rests on two supports. The diagram shows the only three forces F_1, F_2 and F_3 acting on the beam.


The beam is in equilibrium.

Which statement is correct?

A   All the forces are equal in size.

B   The resultant force on the beam is in the opposite direction to the resultant turning effect.

C   The resultant force on the beam is zero and the resultant turning effect on the beam is zero.

D   The total upward force is twice the total downward force.

12 A heavy truck on wheels has a platform attached to it.

A man stands on the platform.

The truck does not fall over.

Which position **A**, **B**, **C** or **D** could be the centre of mass of the whole system (truck, platform and man)?
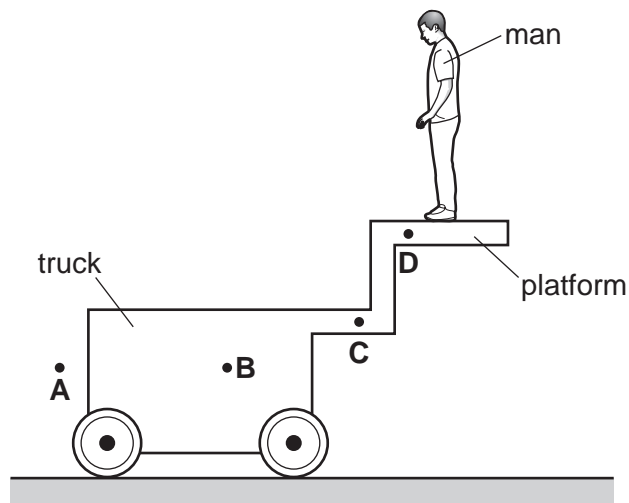
13   A uniform rod rests on a pivot at its centre. The rod is not attached to the pivot. Forces are then
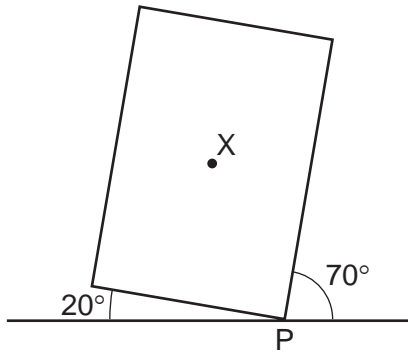   applied to the rod in four different ways, as shown. The weight of the rod can be ignored.

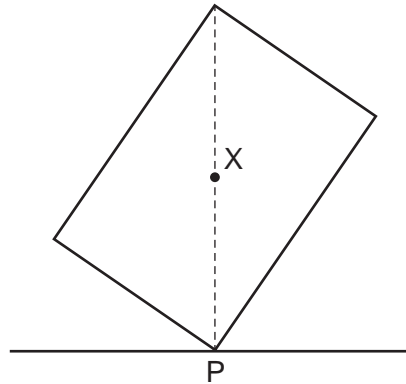   Which diagram shows the rod in equilibrium?

A

100 N   100 N

B

100 N   100 N

C

100 N

100 N

D

100 N

100 N   100 N
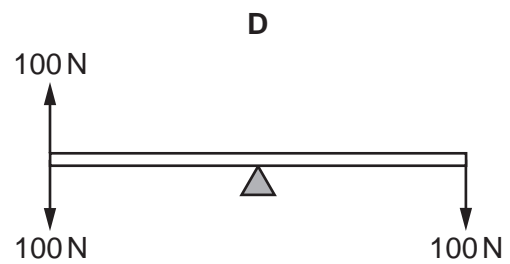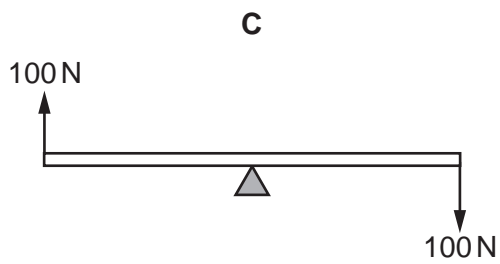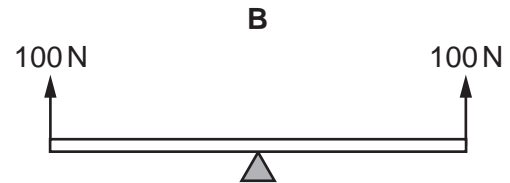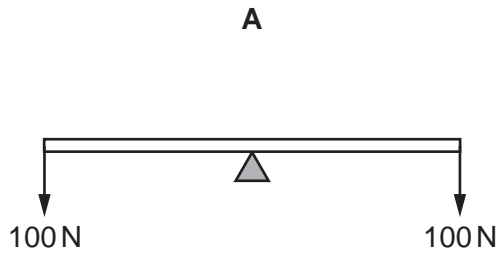
14   A plane lamina with centre of mass X touches the ground at point P.

Which diagram shows the lamina in equilibrium?

A

70°

20°

P

B

X

P

C

X

45°   45°

P

D
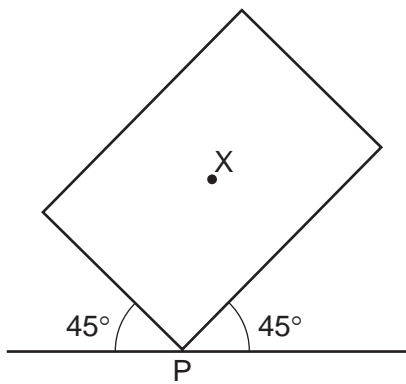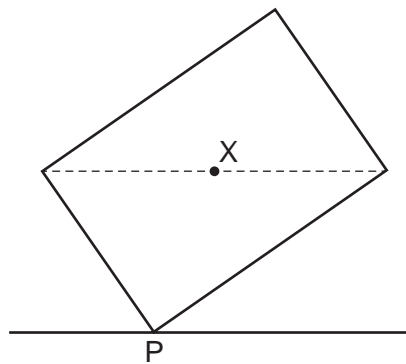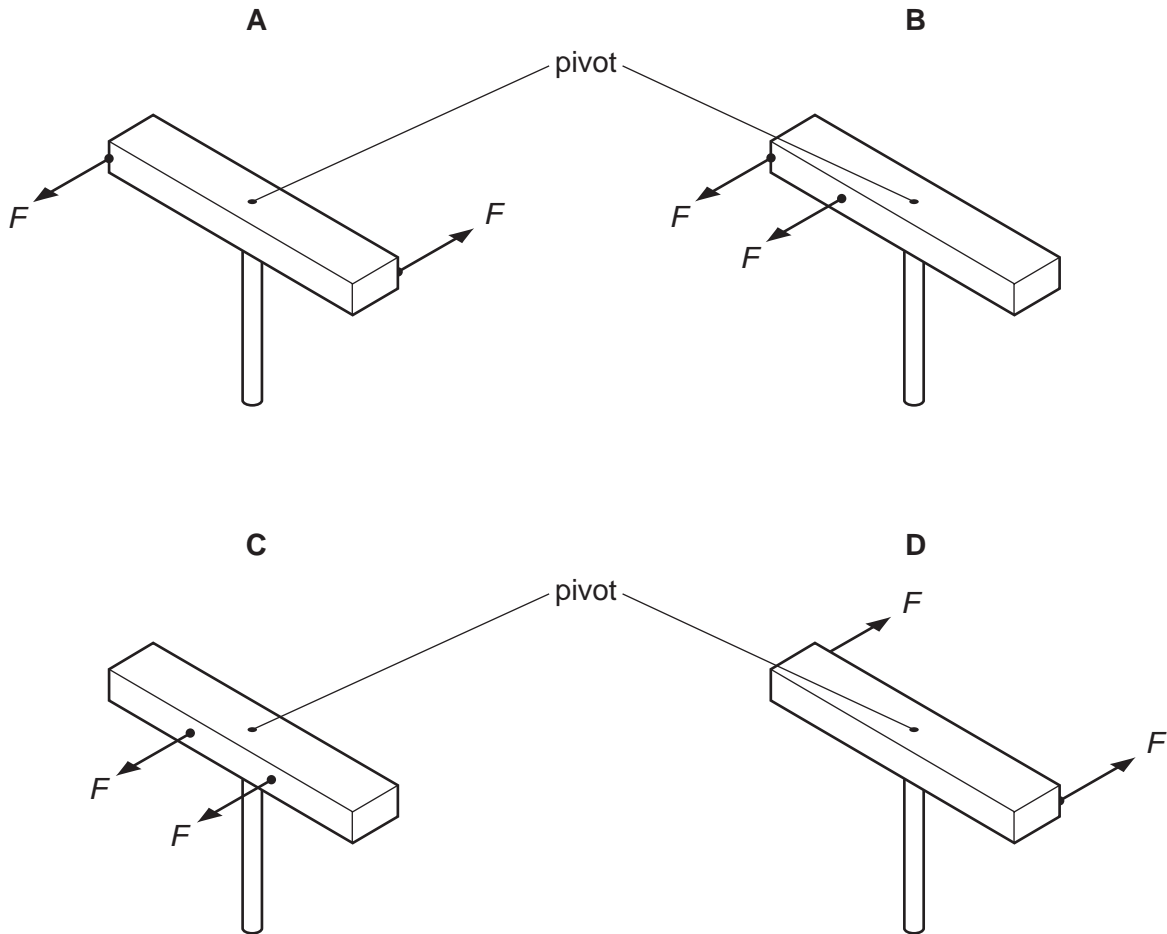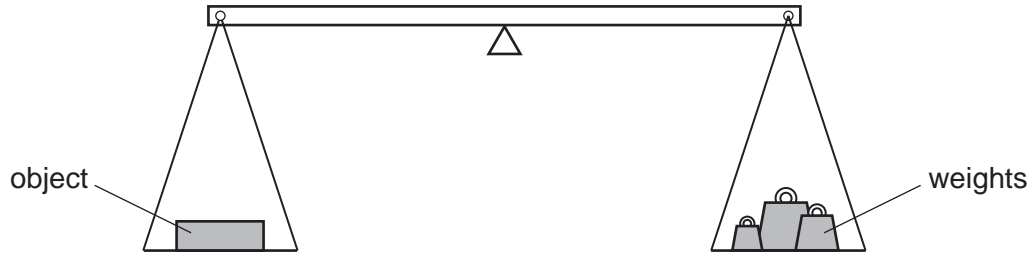

X

P

15   A wooden bar is pivoted at its centre so that it can rotate freely. Two equal forces *F* are applied to the bar.

In which diagram is the turning effect greatest?

A

pivot

F

F

B

F

F

C

F

F

D

pivot

F

F

16 The weight of an object is found using the balance shown in the diagram. The object is put in the left-hand pan and various weights are put in the right-hand pan.


These are the results.

weights in the right-hand pan	effect
0.1 N, 0.1 N, 0.05 N, 0.02 N	balance tips down slightly on the left-hand side
0.2 N, 0.1 N, 0.01 N	balance tips down slightly on the right-hand side

What is the best estimate of the weight of the object?
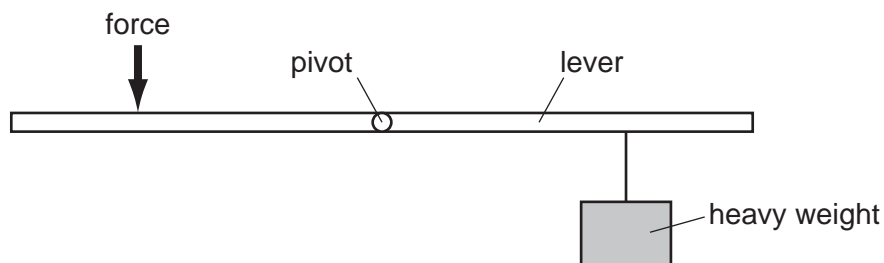
A   0.27 N   **B**   0.29 N   **C**   0.31 N   **D**   0.58 N

17 The diagram shows a uniform, flat metal sheet hanging freely from a nail at point **A**. A weight also hangs freely on a string tied to **A**.

One of the labelled points is at the centre of mass of the metal sheet.

Which point is at the centre of mass?
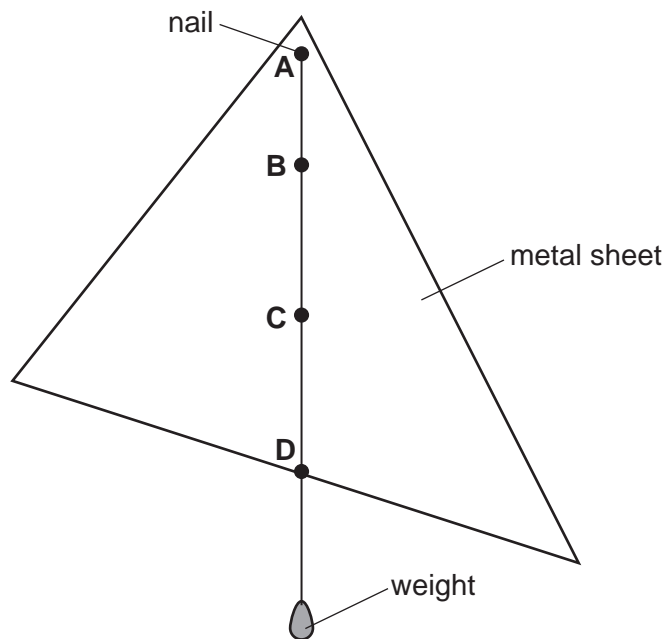
18 The diagram shows a force being applied to a lever to lift a heavy weight.

Which change would enable the heavy weight to be lifted with a smaller force?

A   Move the force to the right.

B   Move the heavy weight to the right.

C   Move the force to the left.

D   Move the pivot to the left.

19 Passengers are **not** allowed to stand on the upper deck of double-decker buses.
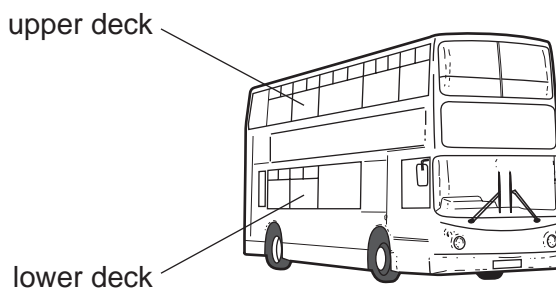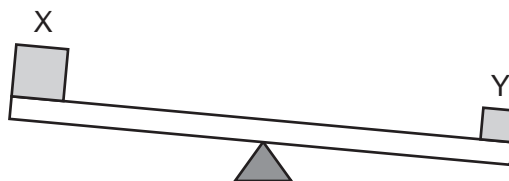

Why is this?

A   They would cause the bus to become less stable.

B   They would cause the bus to slow down.

C   They would increase the kinetic energy of the bus.

D   They would lower the centre of mass of the bus.

20 Two objects X and Y are placed on a balance.

The balance tilts as shown.

What does this show about the masses and weights of objects X and Y?

	masses	weights
A	X has less mass than Y	X has less weight than Y
B	X has less mass than Y	X has more weight than Y
C	X has the same mass as Y	X has less weight than Y
D	X has the same mass as Y	X has more weight than Y

21 The diagram shows a balance being used to find the weight of a baby. The weight of the basket can be ignored.

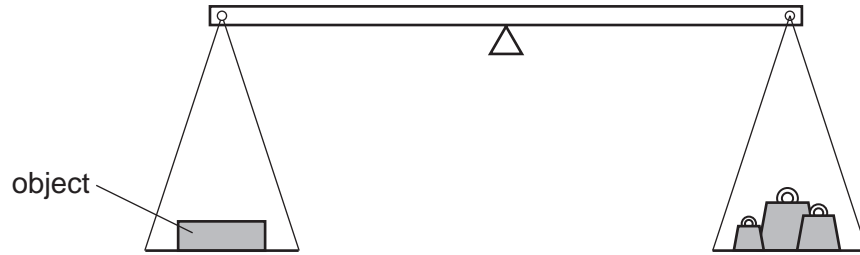At equilibrium, the pivot is nearer to the weight *W* than to the baby.
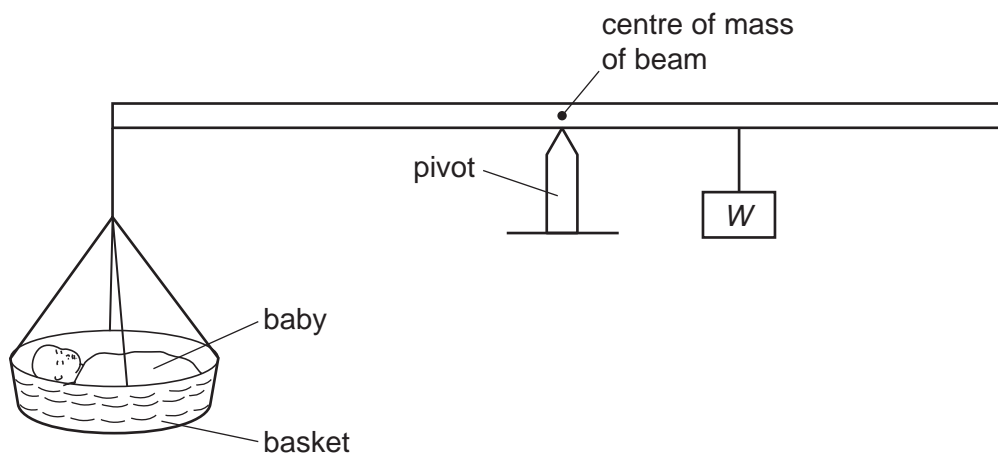
What is the weight of the baby?

A less than *W*

B more than *W*

C *W*

D impossible to tell

22   The weight of an object is to be found using the balance shown in the diagram.

The object is put in the left-hand pan and various standard weights are put in the right-hand pan.
These are the results.

weights in the right-hand pan	effect
0.1 N, 0.1 N, 0.05 N, 0.02 N	balance tips down slightly on the left-hand side
0.2 N, 0.1 N, 0.01 N	balance tips down slightly on the right-hand side

What is the best estimate of the weight of the object?

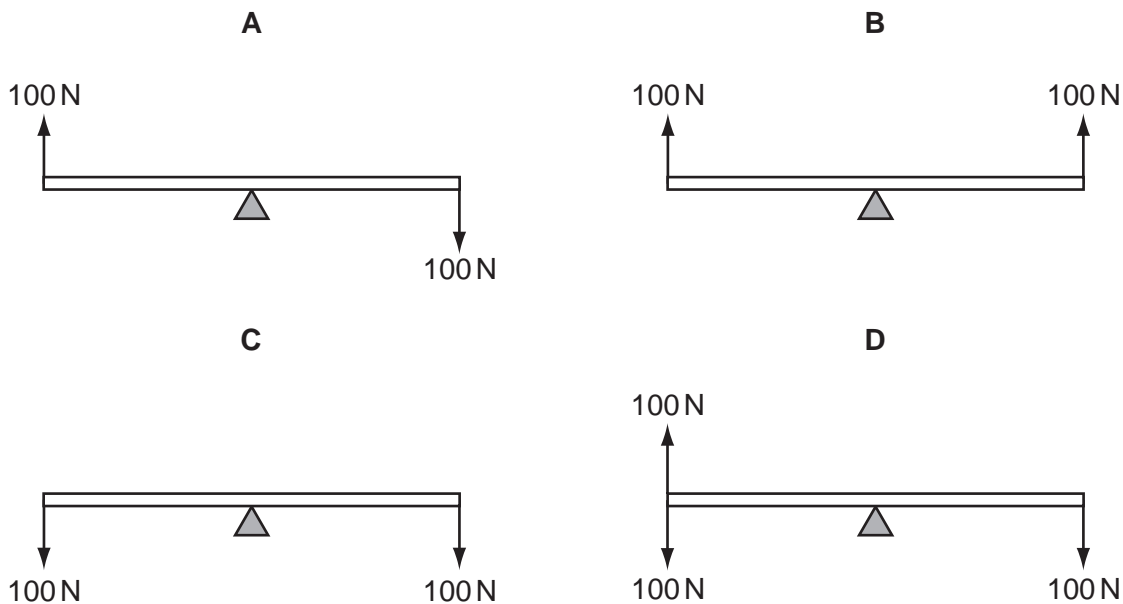**A**   0.27 N   **B**   0.29 N   **C**   0.31 N   **D**   0.58 N

23 A uniform rod rests on a pivot at its centre. The rod is not attached to the pivot. Forces are then applied to the rod in four different ways, as shown. The weight of the rod can be ignored.

Which diagram shows the rod in equilibrium?

A

100 N
100 N

B

100 N   100 N

C

100 N   100 N

D

100 N

100 N   100 N

24 The diagrams show three uniform beams P, Q and R, each pivoted at its centre.
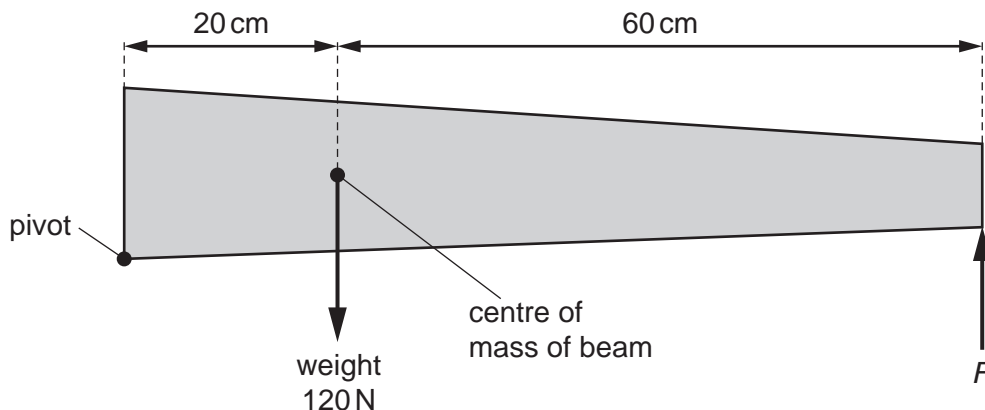
The two forces acting on each beam are also shown.
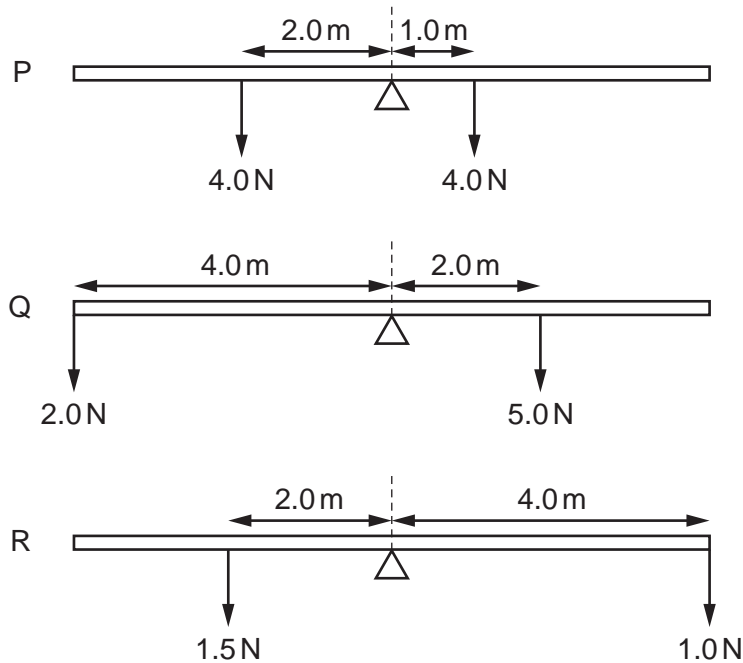
Which beams rotate clockwise?

A   P and Q only

B   P and R only

C   Q and R only

D   P, Q and R

25 The diagram shows a non-uniform beam of weight 120 N, pivoted at one end. The beam is kept in equilibrium by force F.
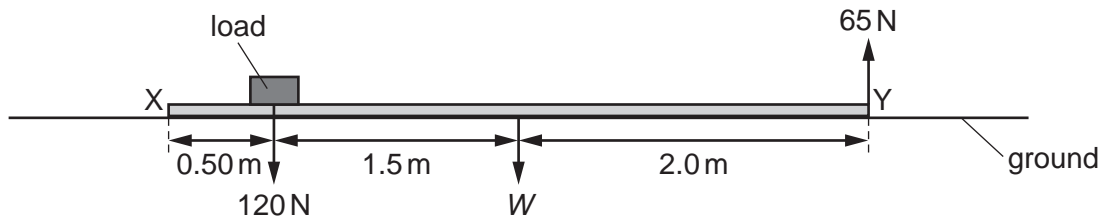

What is the value of force F?

A   30 N   **B**   40 N   **C**   360 N   **D**   480 N

26 A long plank XY lies on the ground. A load of 120 N is placed on it, at a distance of 0.50 m from end X, as shown.
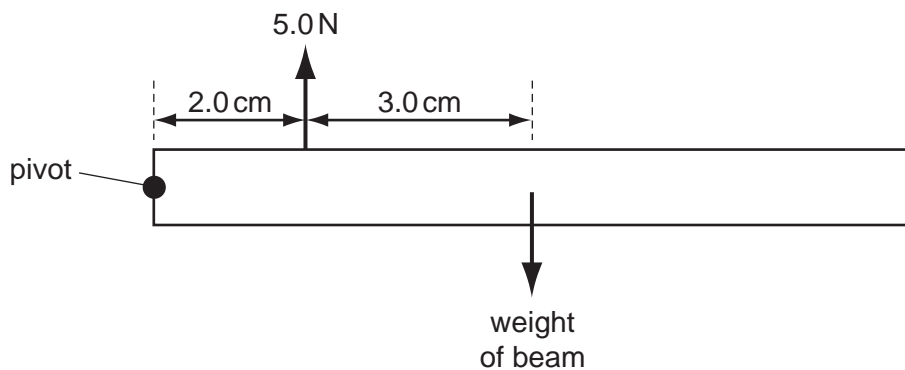
End Y is lifted off the ground. The upward force needed to do this is 65 N.

In the diagram, *W* is the weight of the plank, acting at its mid-point.

What is the value of *W*?

A   35 N   **B**   47 N   **C**   100 N   **D**   133 N

27 A beam pivoted at one end has a force of 5.0 N acting vertically upwards on it as shown. The beam is in equilibrium.

What is the weight of the beam?

A   2.0 N   **B**   3.0 N   **C**   3.3 N   **D**   5.0 N