1. What is the most accurate and precise method to measure the thickness of a coin?

A Use a micrometer screw gauge.

B Use a ruler and look at the scale perpendicularly.

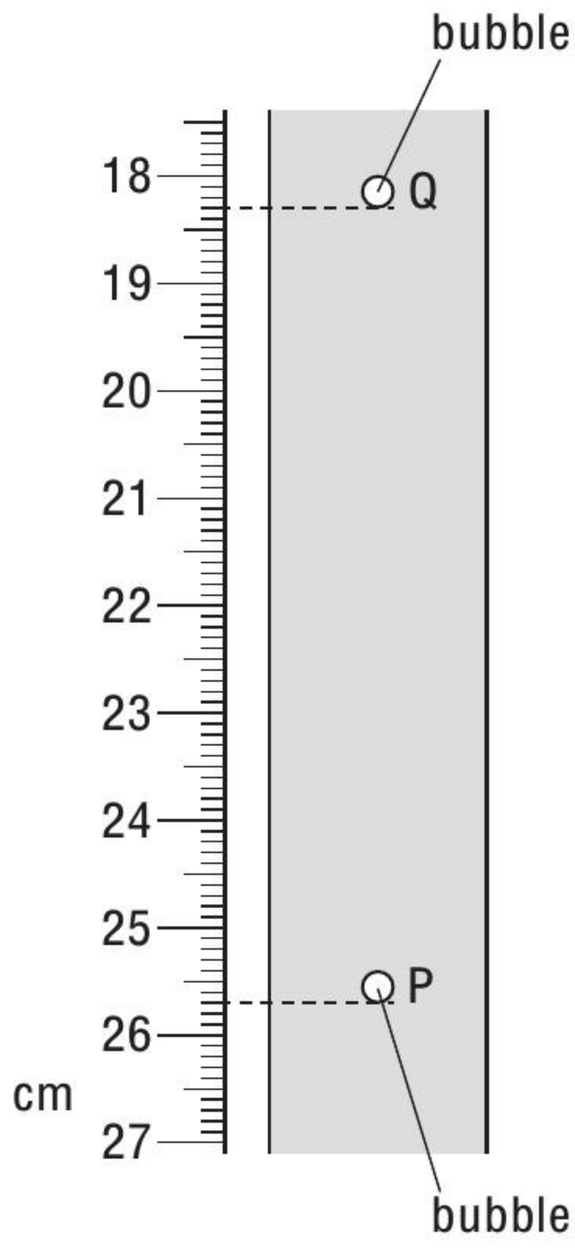
C Use a top pan balance.

D Use the displacement method with water in a measuring cylinder.

2. A student determines the average speed of a bubble rising through a liquid at constant speed.

When the student starts the stopwatch the bubble is at position P.

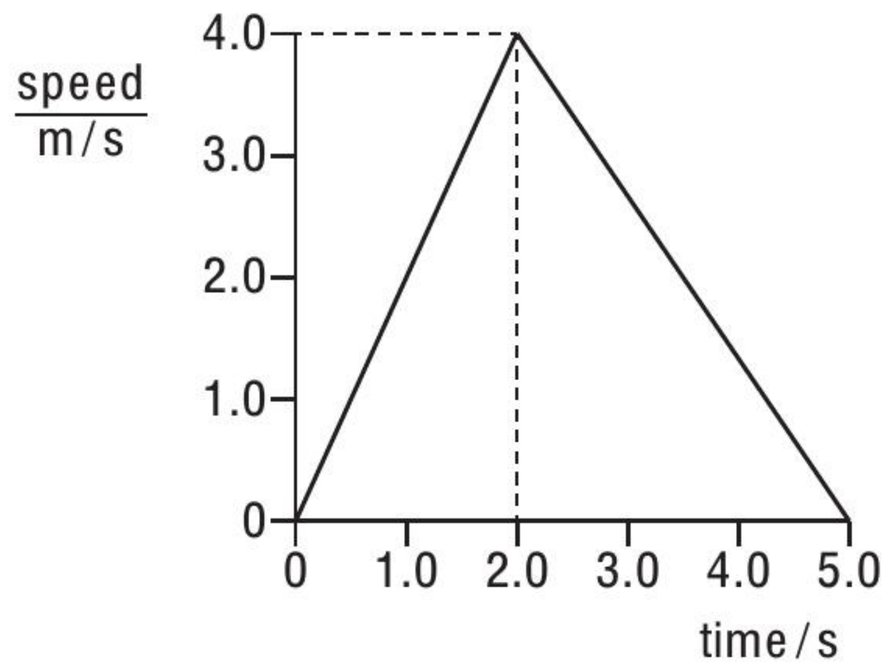
After 2.0 s the bubble is at position Q.



What is the speed of the bubble between P and Q?

A 3.2 cm / s **B** 3.7 cm / s **C** 6.4 cm / s **D** 7.4 cm / s

3. The diagram shows the speed-time graph for a toy car travelling in a straight line.



What is the acceleration of the car during the first two seconds and what is the total distance that it travels?

	acceleration / m/s^2	total distance / m
A	0.50	10
B	0.50	20
C	2.0	10
D	2.0	20

4. In which pair are both quantities measured in newtons?

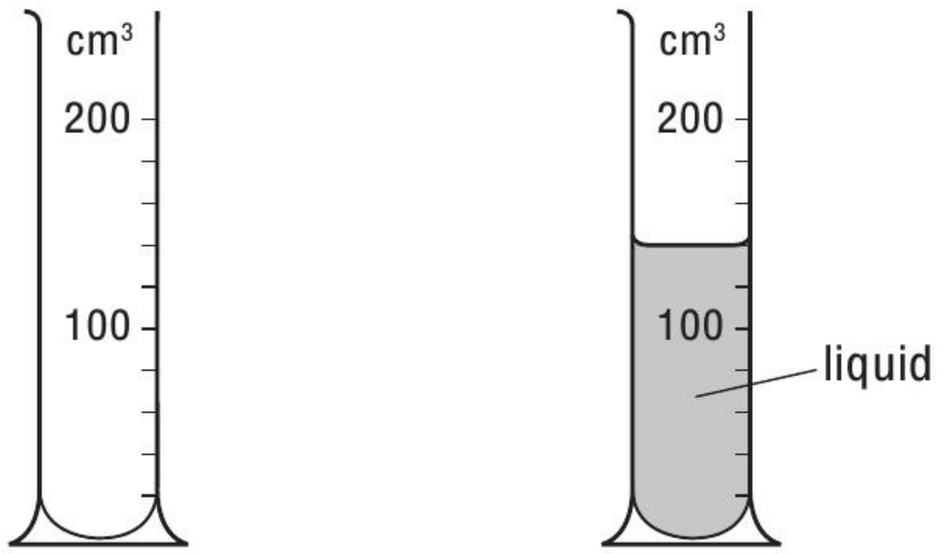
A force and pressure

B force and weight

C mass and pressure

D mass and weight

5. The masses of a measuring cylinder before and after pouring some liquid into it are shown in the diagram.



What is the density of the liquid?

A $\frac{100}{120}$ g/cm³ **B** $\frac{100}{140}$ g/cm³ **C** $\frac{180}{120}$ g/cm³ **D** $\frac{180}{140}$ g/cm³

6. A spring which obeys Hooke's Law has an unstretched length of 10 cm.

A load of 20 N is hung from the spring.

The new length of the spring is 36 cm.

What is the spring constant *k* of the spring?

A 0.56 N/cm **B** 0.77 N/cm **C** 1.3 N/cm **D** 1.8 N/cm

7. A car travels forwards along a straight horizontal road. Only the horizontal forces acting on it are shown.

The length of each arrow represents the size of each force.

How do these forces affect the motion of the car?

A The car moves at constant speed.

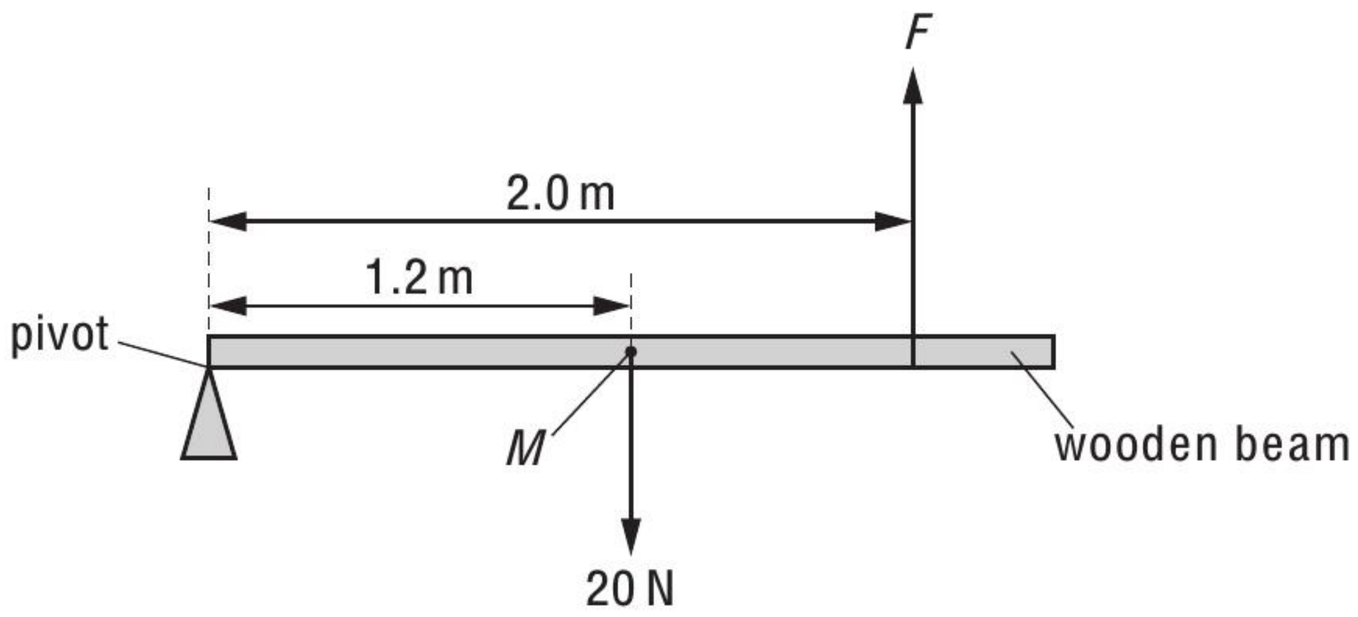
B The car moves backwards.

C The car slows down.

D The car's forward speed increases.

8. The diagram shows a wooden beam of weight 20 N. The centre of mass of the beam is labelled *M*.

There is a pivot at one end of the beam. The beam is kept horizontal by an upward force, *F*.



What is the magnitude of *F*?

A 12 N **B** 20 N **C** 30 N **D** 33 N

9. A ball of mass 2.0 kg is travelling at a speed of 12 m/s. It moves towards an object of mass 3.0 kg which is at rest.

The ball hits the object and sticks to it.

Which row gives the total momentum, and the speed of both objects immediately after the collision?

	total momentum / kg m/s	speed / m/s
A	0	4.8
B	0	8.0
C	24	4.8
D	24	8.0

10. Which statement is correct?

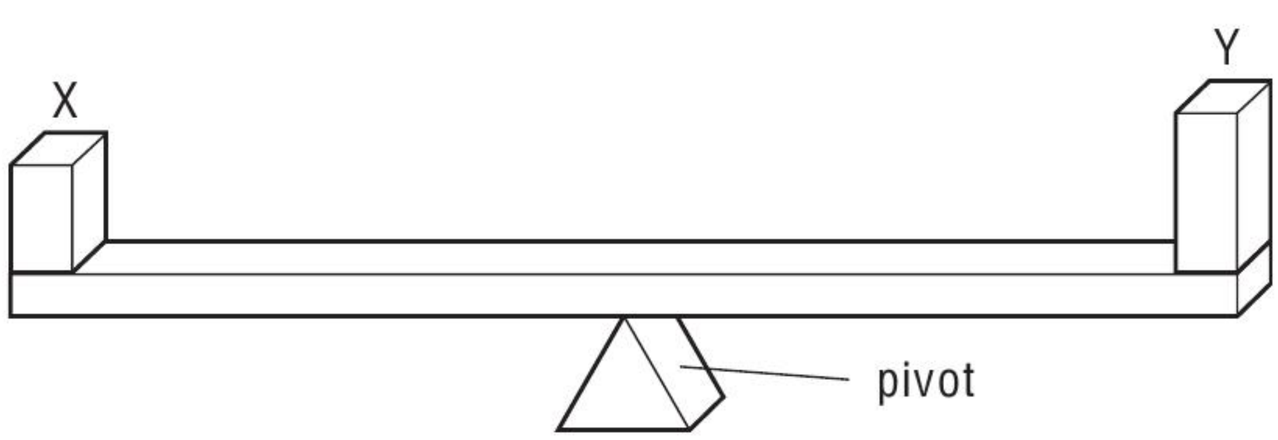
A The mass of a bottle of water at the North Pole is different from its mass at the Equator.

B The mass of a bottle of water is measured in newtons.

C The weight of a bottle of water and its mass are the same thing.

D The weight of a bottle of water is one of the forces acting on it.

11. Two blocks X and Y are placed on a beam as shown. The beam balances on a pivot at its centre.



What does this show about X and Y?

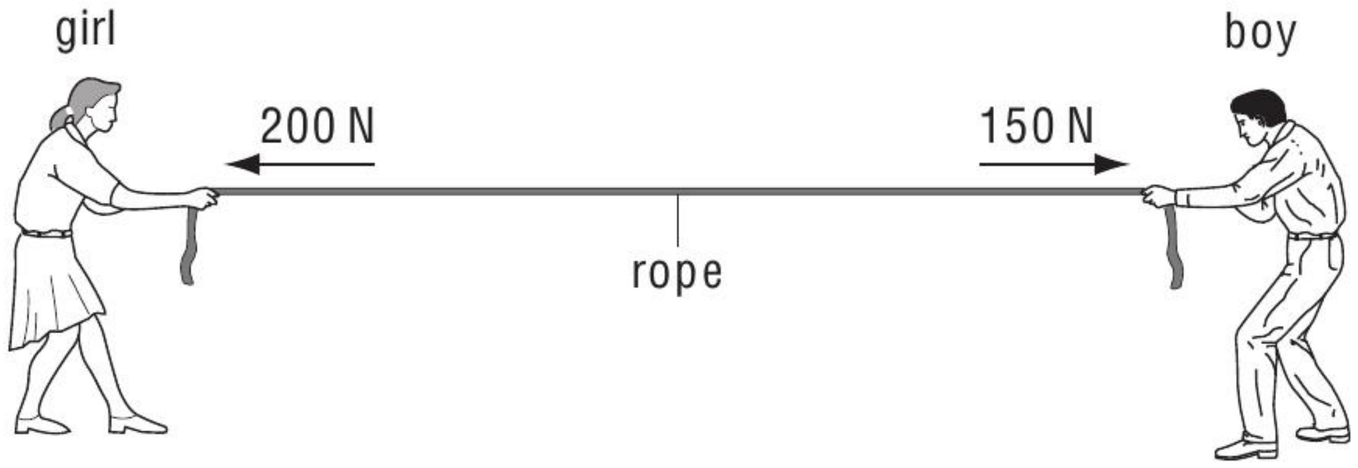
A They have the same mass and the same density.

B They have the same mass and the same weight.

C They have the same volume and the same density.

D They have the same volume and the same weight.

12. A girl and a boy are pulling in opposite directions on a rope. The forces acting on the rope are shown in the diagram.



Which single force has the same effect as the two forces shown?

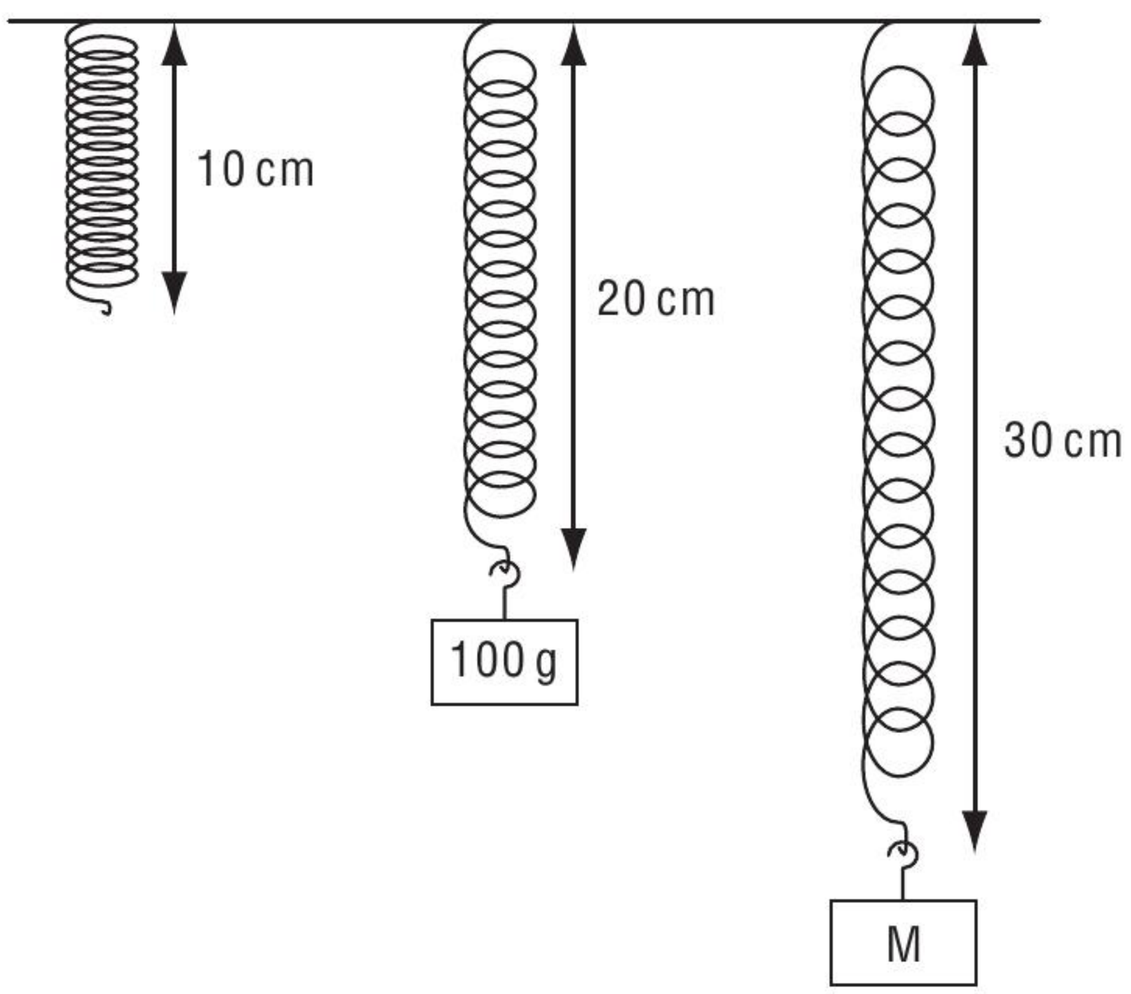
A 50 N acting towards the girl

B 350 N acting towards the girl

C 50 N acting towards the boy

D 350 N acting towards the boy

13. Objects with different masses are hung on a 10 cm spring. The diagram shows how much the spring stretches.

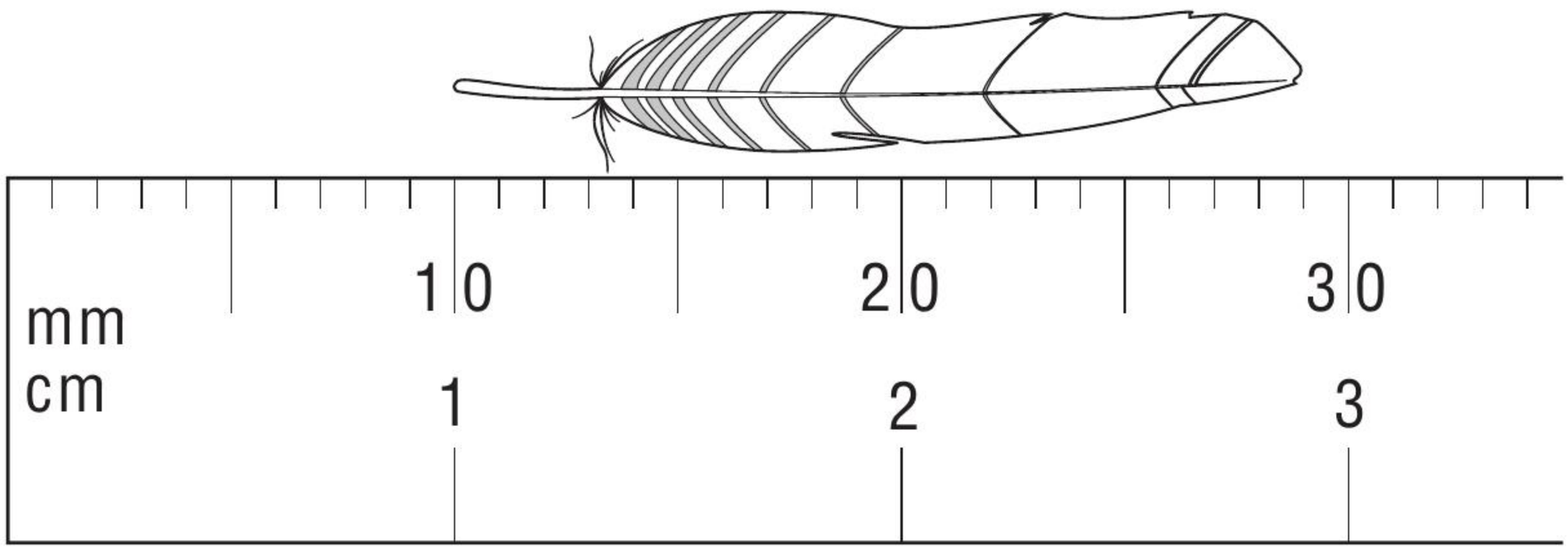


The extension of the spring is directly proportional to the mass hung on it.

What is the mass of object M?

A 110 g **B** 150 g **C** 200 g **D** 300 g

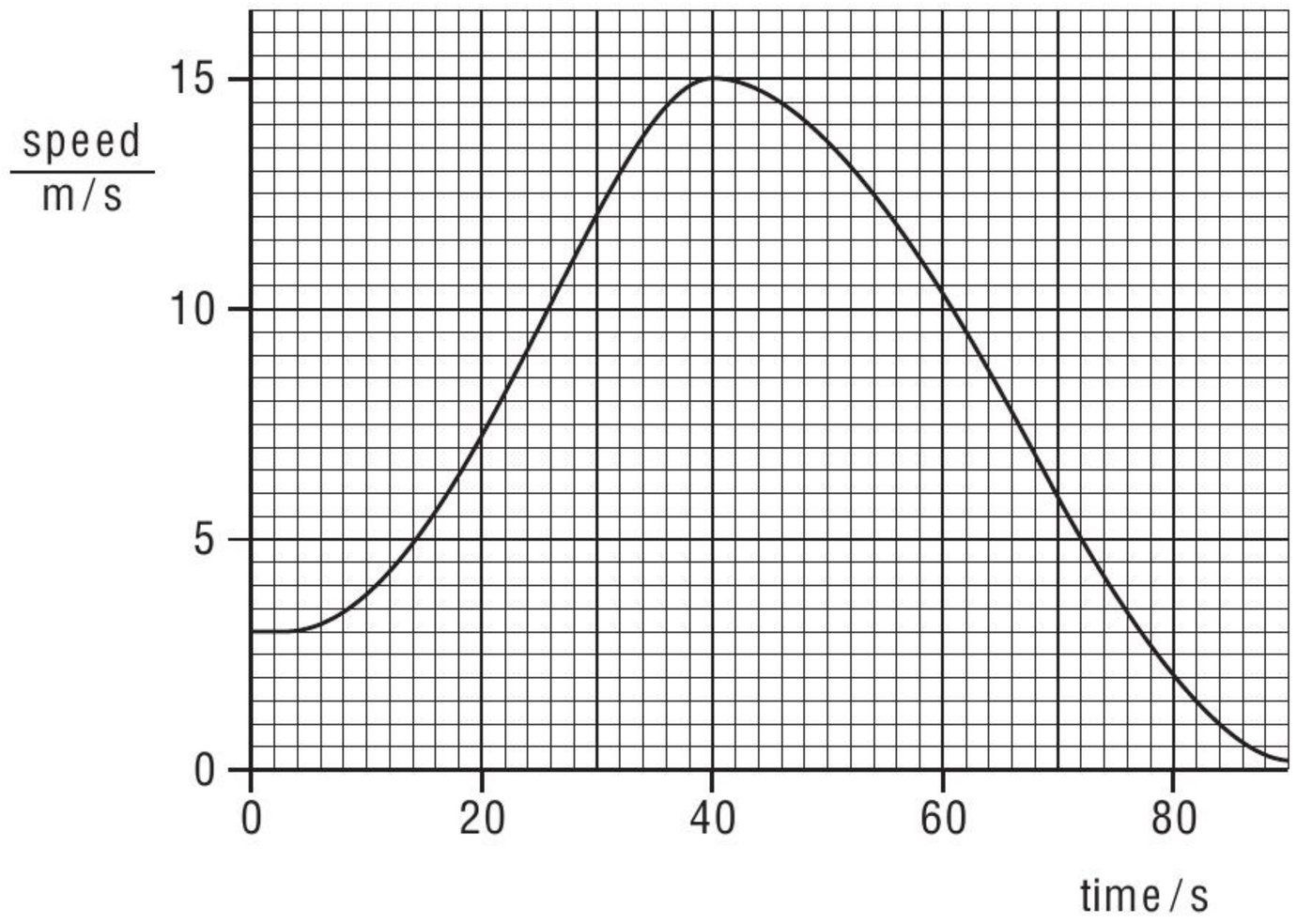
14. The diagram shows an enlarged drawing of the end of a metre rule. It is being used to measure the length of a small feather.



What is the length of the feather?

A 19 mm **B** 29 mm **C** 19 cm **D** 29 cm

15. The speed-time graph shown is for a car moving in a straight line.

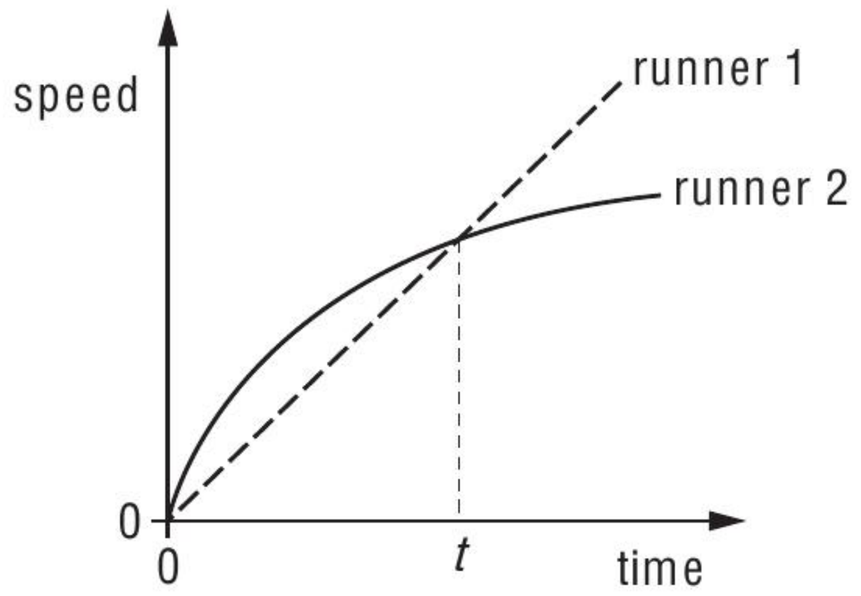


What is the acceleration of the car when the time is 40 s?

A $0\,m/s^2$ **B** $\frac{15-3}{40}\,m/s^2$ **C** $\frac{15}{40}\,m/s^2$ **D** $(15-3)\,m/s^2$

16. Two runners take part in a race.

The graph shows how the speed of each runner changes with time.



What does the graph show about the runners at time *t*?

A Both runners are moving at the same speed.

B Runner 1 has zero acceleration.

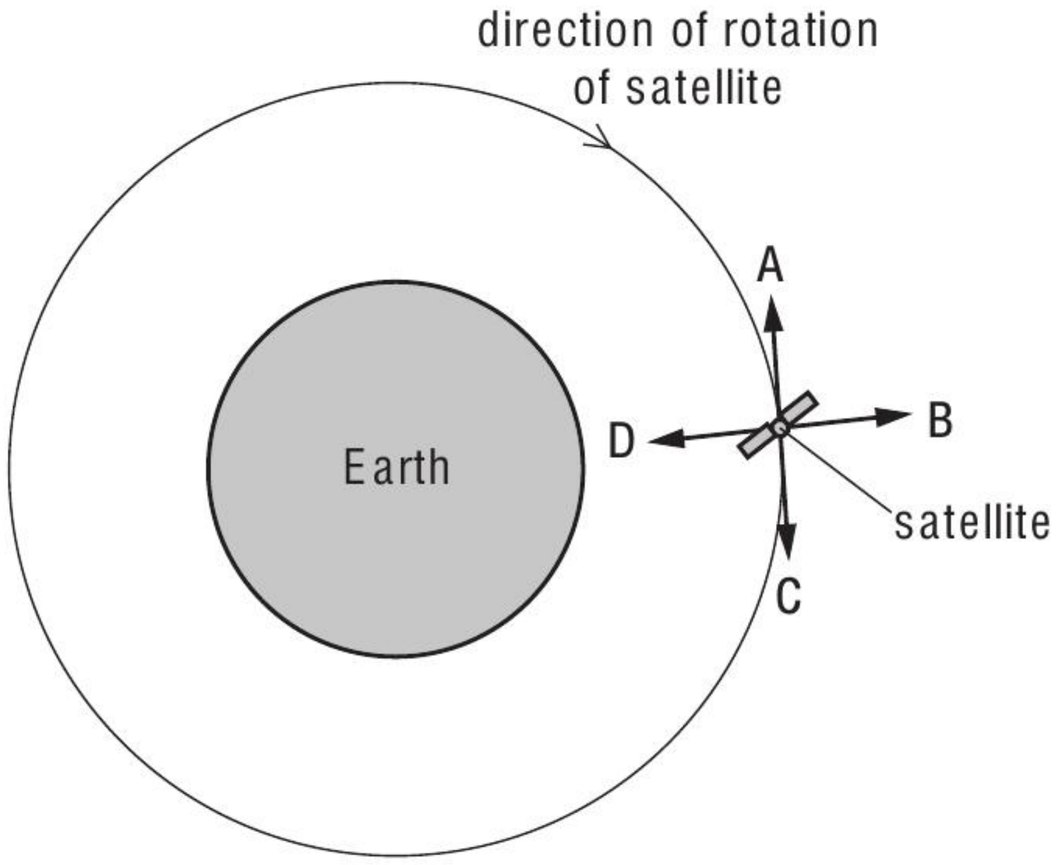
C Runner 1 is overtaking runner 2.

D Runner 2 is slowing down.

17. A satellite orbits the Earth above the atmosphere at a constant speed.

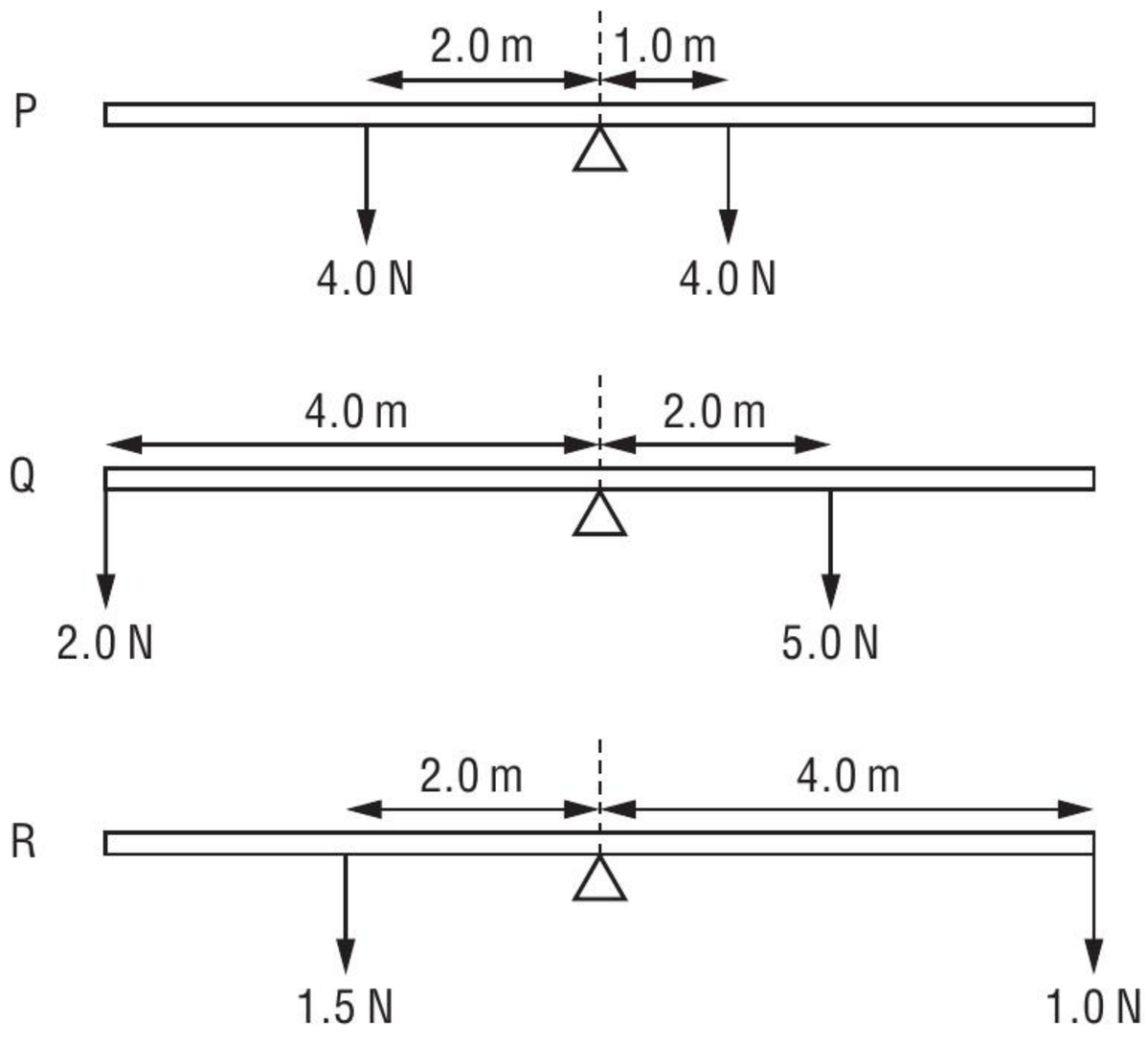
The diagram shows the satellite at one point in its circular orbit around the Earth.

Which labelled arrow shows the direction of the resultant force on the satellite at the position shown?



18. 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

19. What is the most accurate and precise method to measure the thickness of a coin?

A Use a micrometer screw gauge.

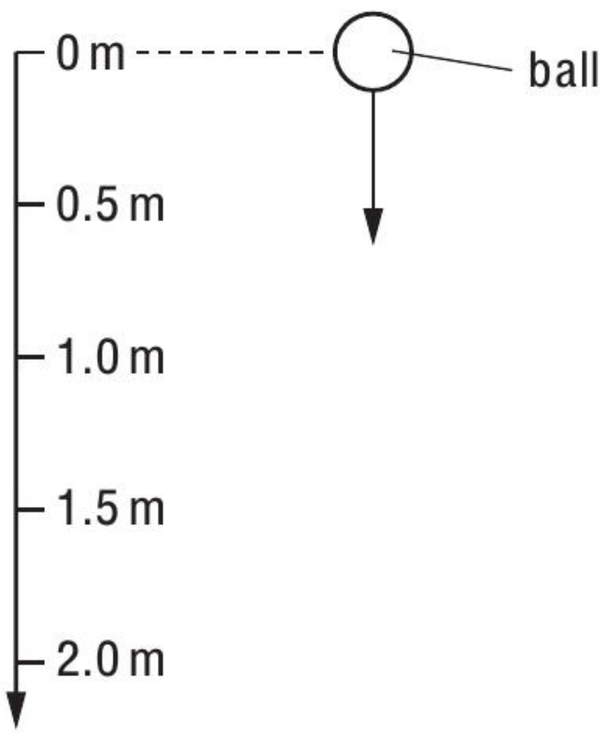
B Use a ruler and look at the scale perpendicularly.

C Use a top pan balance.

D Use the displacement method with water in a measuring cylinder.

20. On Earth, a ball is dropped and falls 2.0 m in a vacuum.

The acceleration of the ball at 1.0 m is 10 m/s^2.



What is the acceleration of the ball at 0.5 m?

A 5.0 m/s^2 **B** 10 m/s^2 **C** 15 m/s^2 **D** 20 m/s^2

21. A skydiver reaches terminal velocity. Then he opens his parachute.

What happens to the skydiver as the parachute opens?

A There is a decrease in weight.

B There is acceleration upwards.

C There is an increase in speed.

D There is movement upwards.

22. A piece of steel is taken from the Earth to the Moon for an experiment. The gravitational field strength on the Moon is smaller than on the Earth.

Which statement about the piece of steel is correct?

A It has less mass on the Moon than on the Earth.

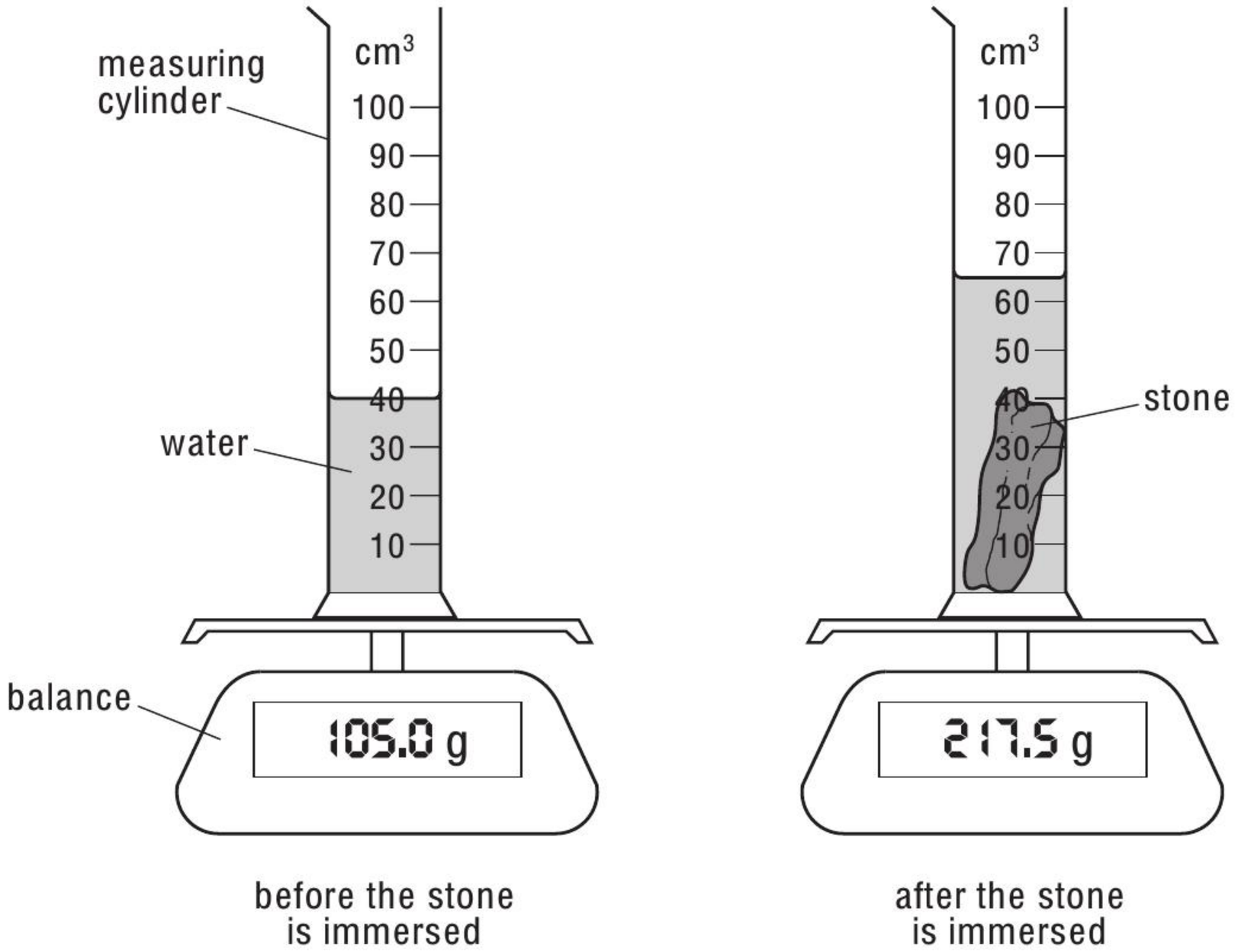
B It has more mass on the Moon than on the Earth.

C It weighs less on the Moon than on the Earth.

D It weighs more on the Moon than on the Earth.

23. A measuring cylinder containing only water is placed on an electronic balance. A small, irregularly shaped stone is now completely immersed in the water.

The diagrams show the equipment before and after the stone is immersed.



What is the density of the material of the stone?

A $1.7\,g/cm^3$ **B** $3.3\,g/cm^3$ **C** $4.5\,g/cm^3$ **D** $8.7\,g/cm^3$

24. A boat is travelling at a steady speed in a straight line across the surface of a lake.

Which statement about the boat is correct?

A The resultant force on the boat is in the direction of motion.

B The resultant force on the boat is in the opposite direction to its motion.

C The resultant force on the boat is vertically downwards.

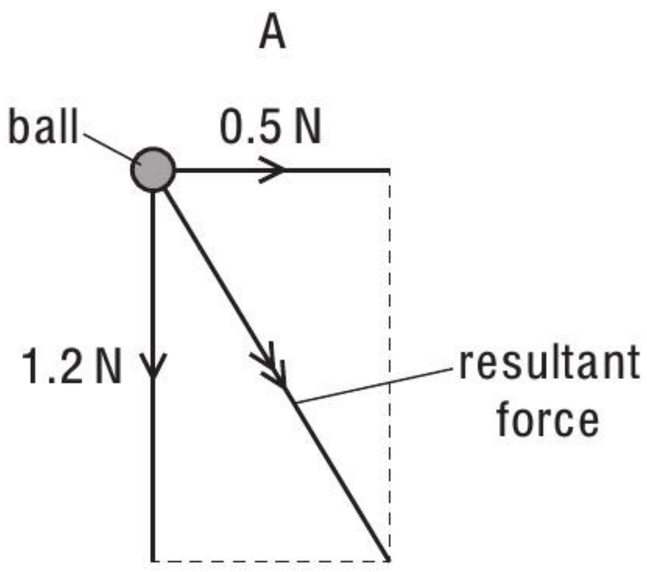
D The resultant force on the boat is zero.

25. A ball of weight 1.2 N drops through the air at terminal velocity.

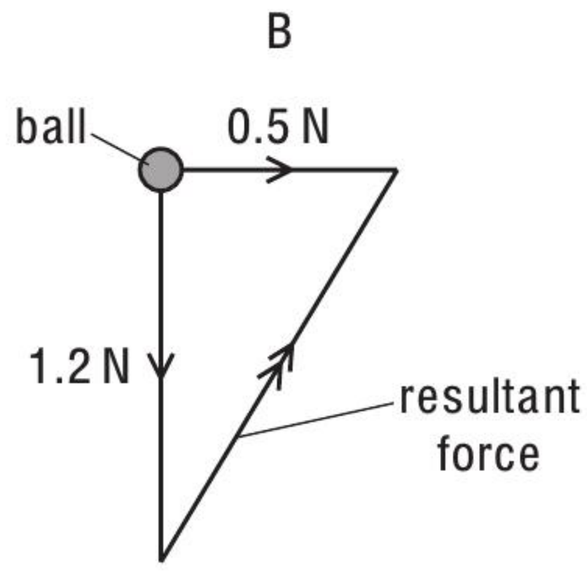
A sudden gust of wind exerts a horizontal force of 0.5 N on the ball from the left.

Which diagram shows the resultant force on the ball while the wind is blowing?

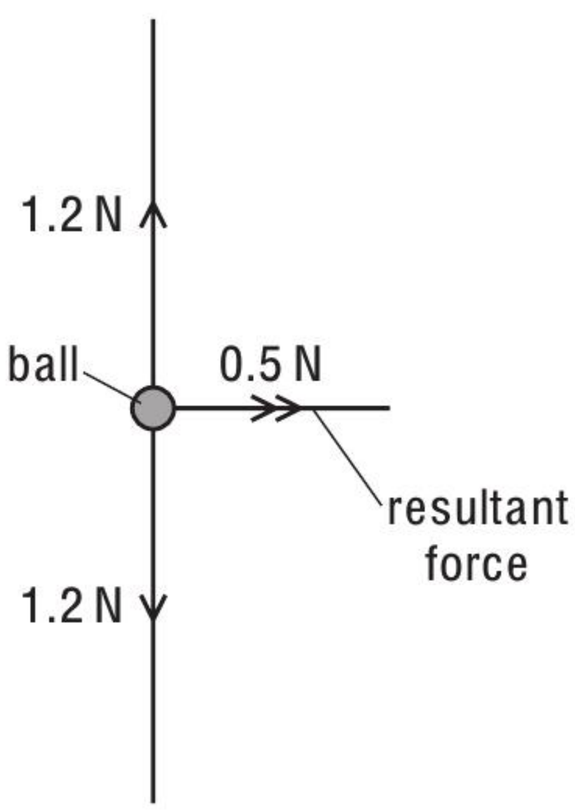
A



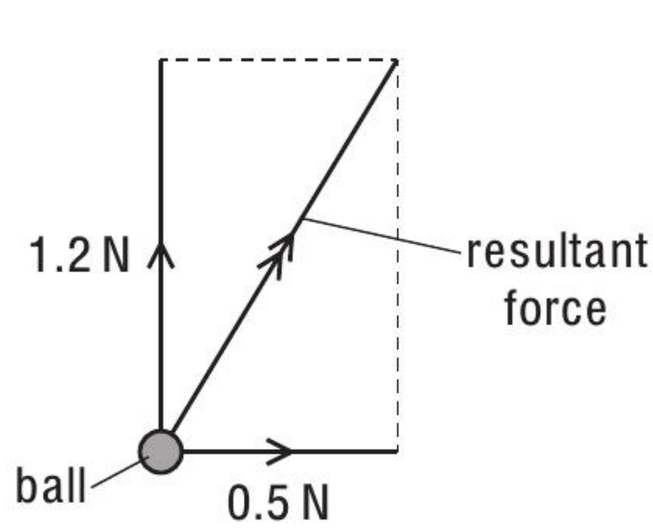
B



C

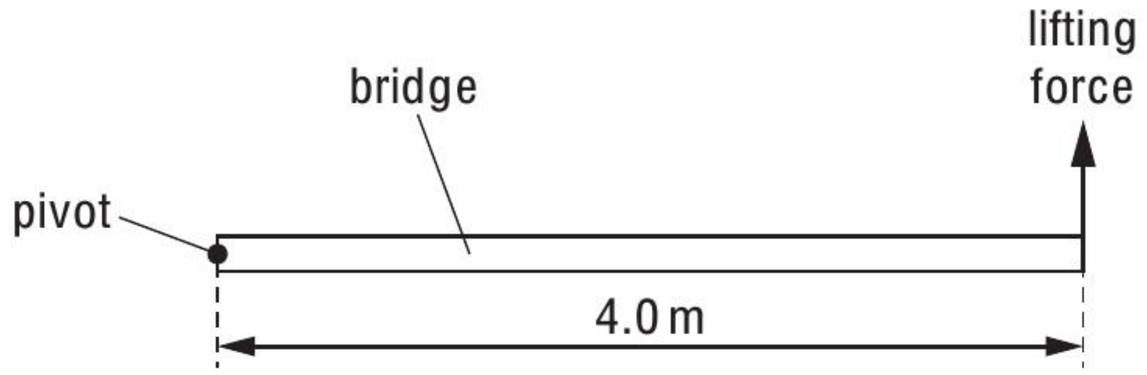


D



26. The diagram shows a uniform bridge, 4.0 m long and weighing 10 000 N.

The bridge is pivoted at one end. A force at the other end gradually increases until the bridge begins to lift.



What is the lifting force as the bridge starts to move upwards?

A 2500 N **B** 5000 N **C** 10 000 N **D** 20 000 N

27. A bullet of mass 0.10 kg travels horizontally at a speed of 600 m / s. It strikes a stationary wooden block of mass 1.90 kg resting on a frictionless, horizontal surface.

The bullet stays in the block.

What is the speed of the bullet and the block immediately after the impact?

A 30 m / s **B** 32 m / s **C** 60 m / s **D** 134 m / s

28. A truck accelerates uniformly along a straight, horizontal road. The mass of the truck is 2.0×10^4 kg.

(a) The speed of the truck increases from rest to 12 m/s in 30 s.

Calculate

(i) the distance travelled by the truck during this time,

distance = ...[2]

(ii) the resultant force on the truck.

resultant force = ...[4]

(b) To maintain a uniform acceleration, the forward force on the truck must change.
Explain why.

.....

.....

.....[2]

[Total: 8]

29. Fig. 1.1 shows the speed-time graph for the motion of a car.

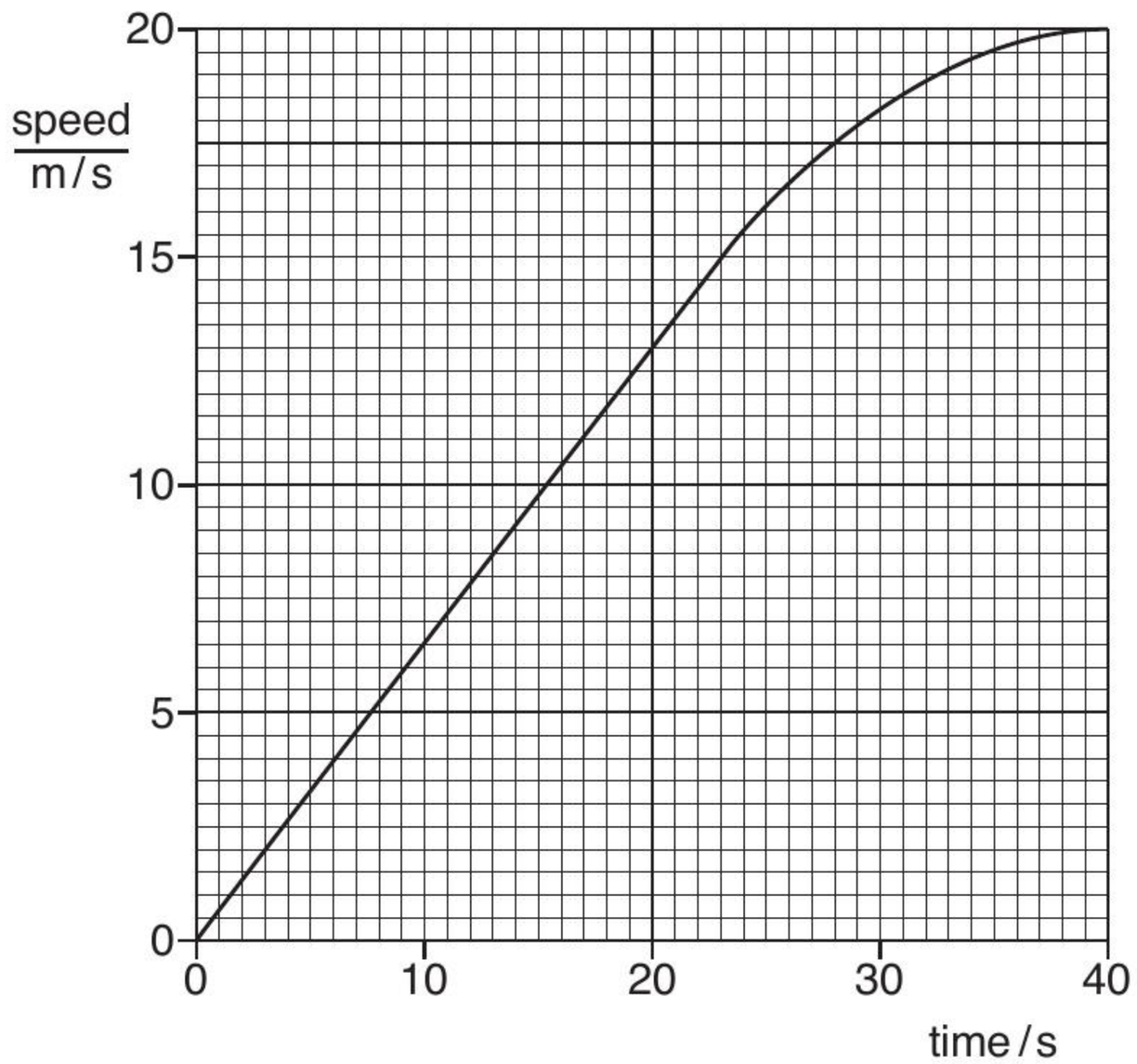


Fig. 1.1

The mass of the car is 1200 kg.

(a) Calculate, for the first 20 s of the motion,

(i) the distance travelled by the car,

distance = ...[2]

(ii) the acceleration of the car,

acceleration = ...[2]

(iii) the resultant force acting on the car.

resultant force = ...[2]

(b) Describe the motion of the car in the period of time from 25 s to 40 s.

.....

.....[1]

30. **(a)** State Hooke's Law.

.....

.....[1]

(b) For forces up to 120 N, a spring obeys Hooke's Law.

A force of 120 N causes an extension of 64 mm.

(i) On Fig. 2.1, draw the force-extension graph for the spring for loads up to 120 N. [1]

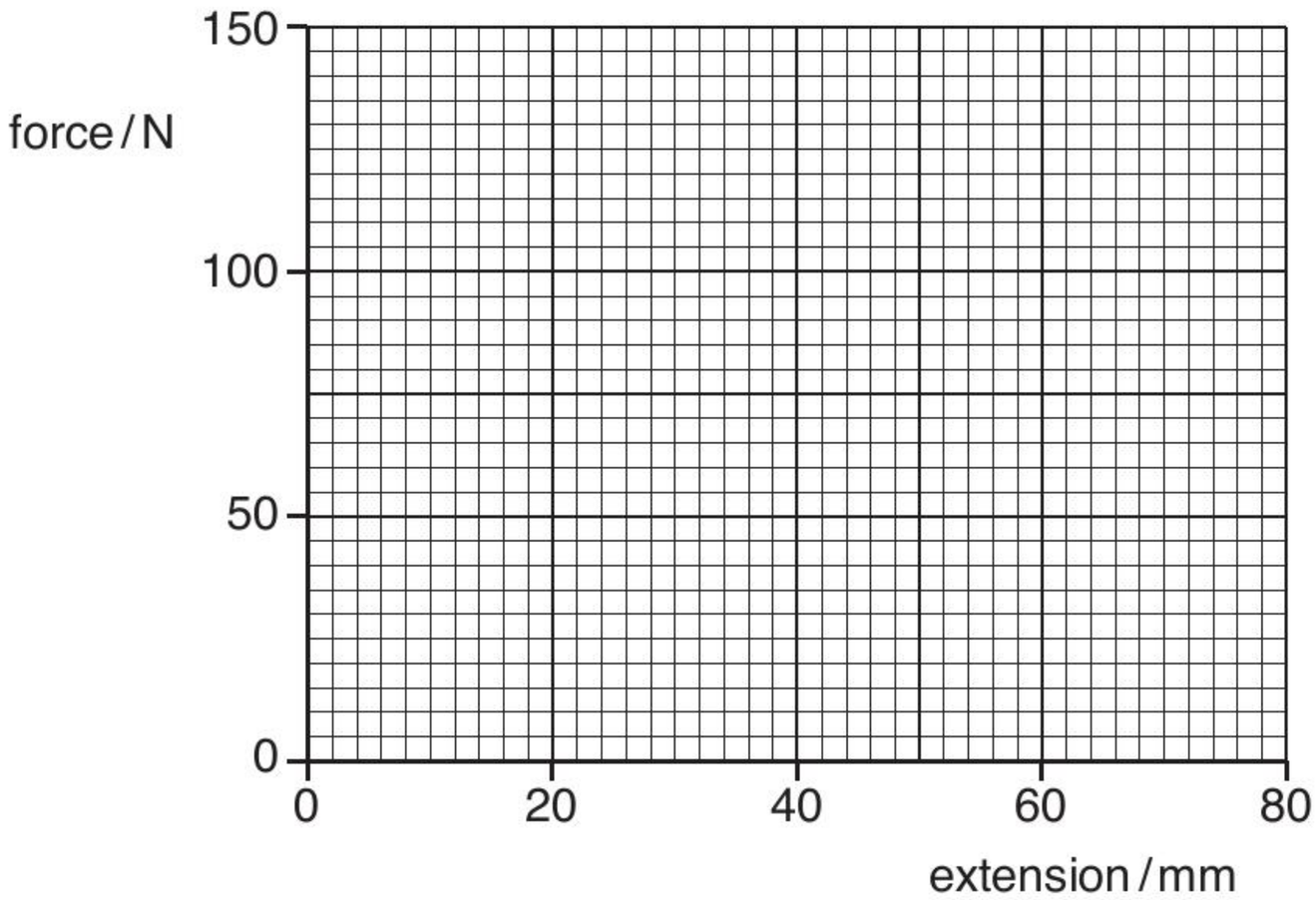


Fig. 2.1

(ii) Calculate the spring constant *k* of the spring.

k = ...[2]

(c) A student makes a spring balance using the spring in **(b)**. The maximum reading of this balance is 150 N.

The student tests his balance with a known weight of 140 N. He observes that the reading of the balance is not 140 N.

Suggest and explain why the reading is **not** 140 N.

.....

.....

.....[2]

[Total: 6]

31. All the sides of a plastic cube are 8.0 cm long. Fig. 3.1 shows the cube.

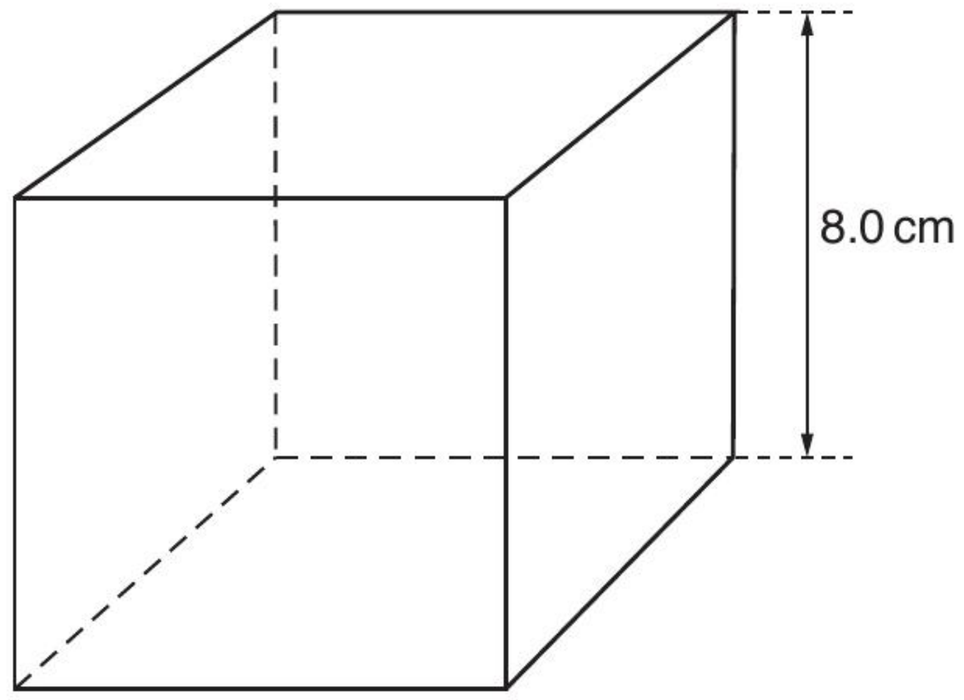


Fig. 3.1 (not to scale)

The mass of the cube is 0.44 kg.

(a) Explain what is meant by *mass*.

.....[1]

(b) **(i)** Calculate the density of the plastic from which the cube is made.

density = ...[2]

(ii) The density of one type of oil is 850 kg / m^3.

State and explain whether the cube floats or sinks when placed in a container of this oil.

.....

.....[1]

(c) On the Moon, the weight of the cube is 0.70 N.

(i) Calculate the gravitational field strength on the Moon.

gravitational field strength = ...[2]

32. Fig. 2.1 shows a uniform plank AB of length 2.0 m suspended from two ropes X and Y.

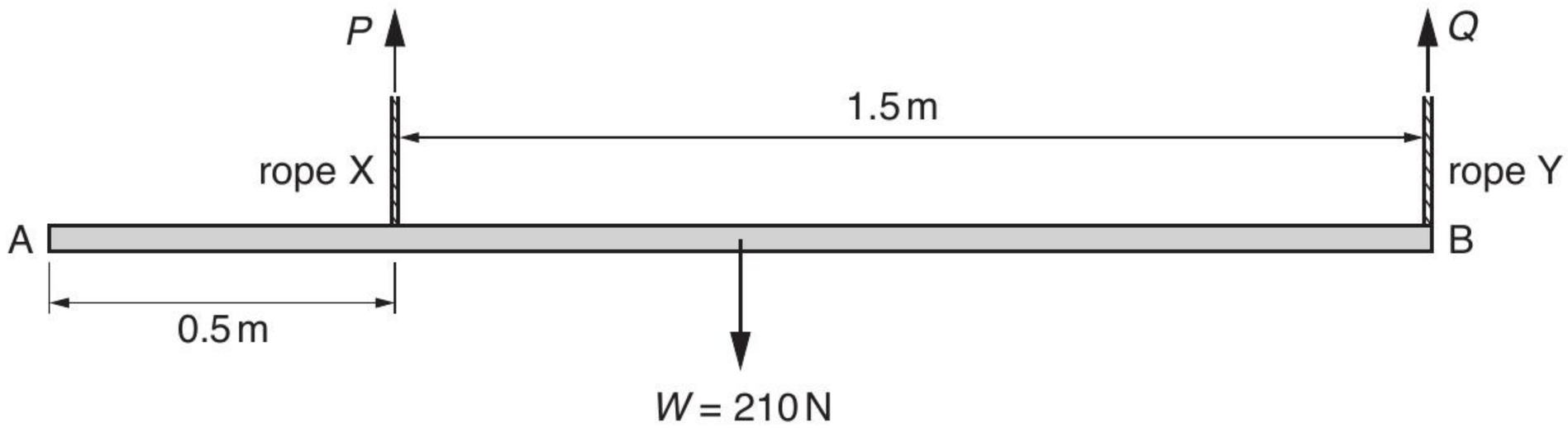


Fig. 2.1

The weight *W* of the plank is 210 N. The force in rope X is *P*. The force in rope Y is *Q*.

(a) State, in terms of *P*, the moment of force *P* about B.

.....[1]

(b) Calculate:

(i) the moment of *W* about B

moment = ...[1]

(ii) the force *P*

force *P* = ...[2]

(iii) the force *Q*.

force *Q* = ...[2]

[Total: 6]