1 1 An object of mass m is accelerated from rest to a velocity v by a constant resultant force F.

What is the work done on the object during this acceleration?

[1 mark]

A $\dfrac{Fv}{2}$ ⬭

B Fv ⬭

C mv^2 ⬭

D $\dfrac{mv^2}{2}$ ⬭

1 2 Which row describes the nature of the strong nuclear force between two nucleons at separations of 0.25 fm, 2.0 fm and 8.0 fm?
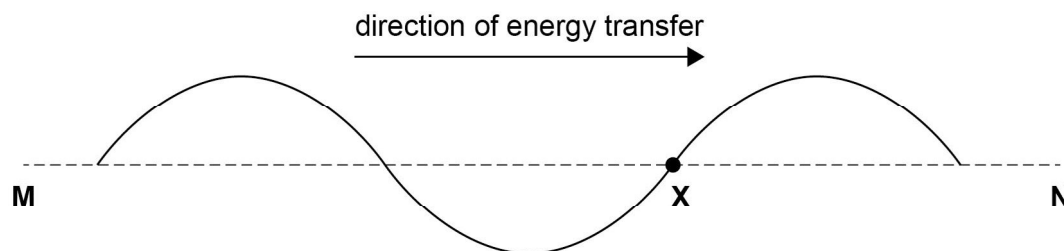
[1 mark]

	At a separation of 0.25 fm	At a separation of 2.0 fm	At a separation of 8.0 fm	
A	attractive	repulsive	negligible	⬭
B	repulsive	attractive	attractive	⬭
C	negligible	repulsive	attractive	⬭
D	repulsive	attractive	negligible	⬭

1 5 A progressive wave travels along a rope in the direction **M** to **N**.

X marks a point on the rope.

direction of energy transfer

The wave has a frequency of 5.0 Hz, a wavelength of 1.0 m and an amplitude of 0.20 m.

Where will **X** be after 0.15 s?

[1 mark]

A below **MN** by 0.20 m ⬭

B above **MN** by 0.20 m ⬭

C nearer **N** by 0.15 m ⬭

D nearer **N** by 0.75 m ⬭

1 6 What is true for an inelastic collision between two isolated objects?

[1 mark]
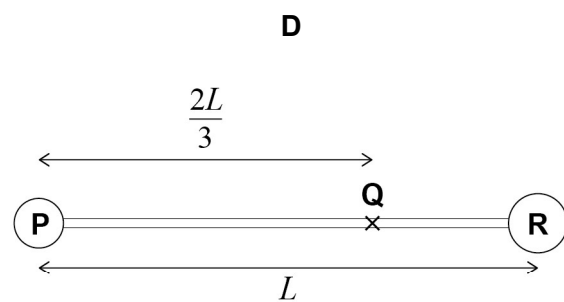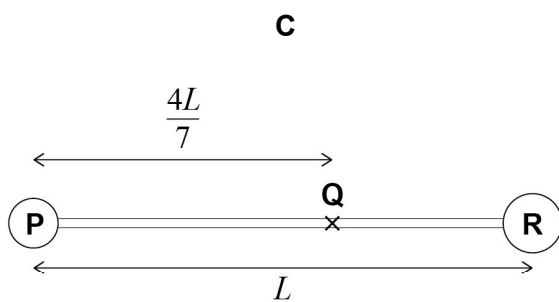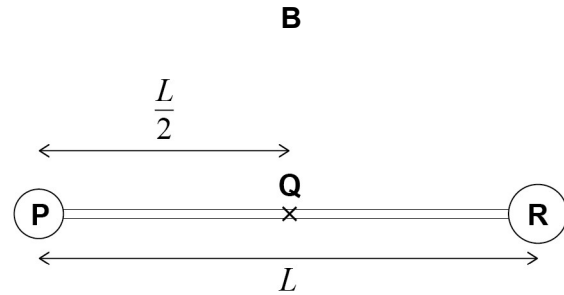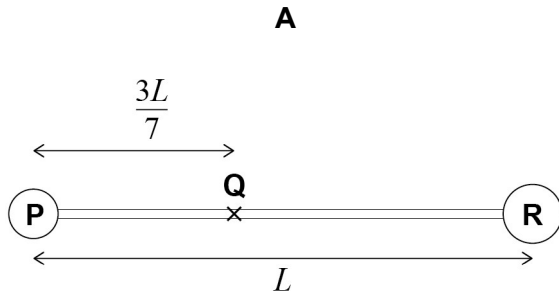
A Both total momentum and total kinetic energy are conserved. ⬭

B Neither total momentum nor total kinetic energy is conserved. ⬭

C Only total kinetic energy is conserved. ⬭

D Only total momentum is conserved. ⬭

2 2 **P** and **R** are uniform spheres of mass $3\ \text{kg}$ and $4\ \text{kg}$ respectively.
P and **R** are joined by a rod of negligible mass.
The distance between their centres is L.
The centre of mass of this system is at **Q**.

Which diagram shows the position of the centre of mass?

[1 mark]

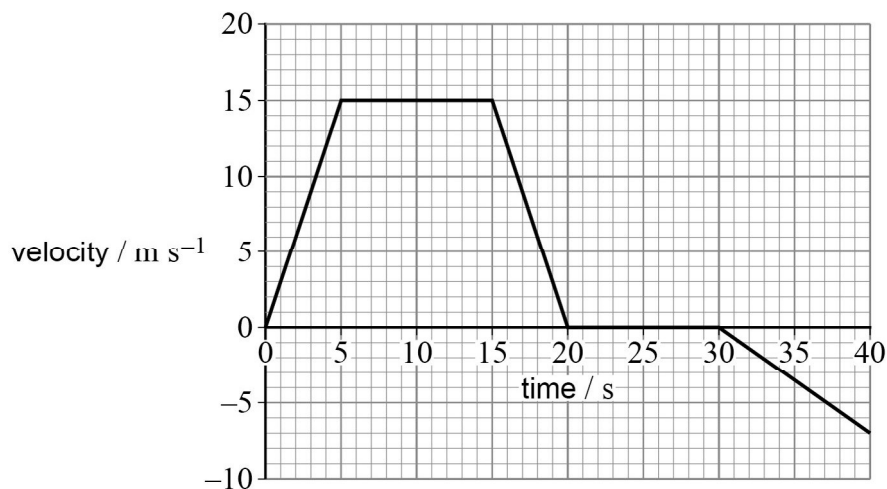**A**

$$\frac{3L}{7}$$

P — Q(×) — R

L

B

$$\frac{L}{2}$$

P — Q(×) — R

L

C

$$\frac{4L}{7}$$

P — Q(×) — R

L

D

$$\frac{2L}{3}$$

P — Q(×) — R

L

A ⬭

B ⬭

C ⬭

D ⬭

Turn over for the next question

Turn over ▶

2 3 A vehicle travels on a straight road, starting at time $t = 0$
The graph shows how its velocity varies with time.

What is the distance of the vehicle from its start position when $t = 40$ s?

[1 mark]

A 115 m

B 190 m

C 260 m

D 370 m

2 4 A suitcase weighing 200 N is placed on a weighing scale in a lift.
The scale reads 180 N when the lift is moving.
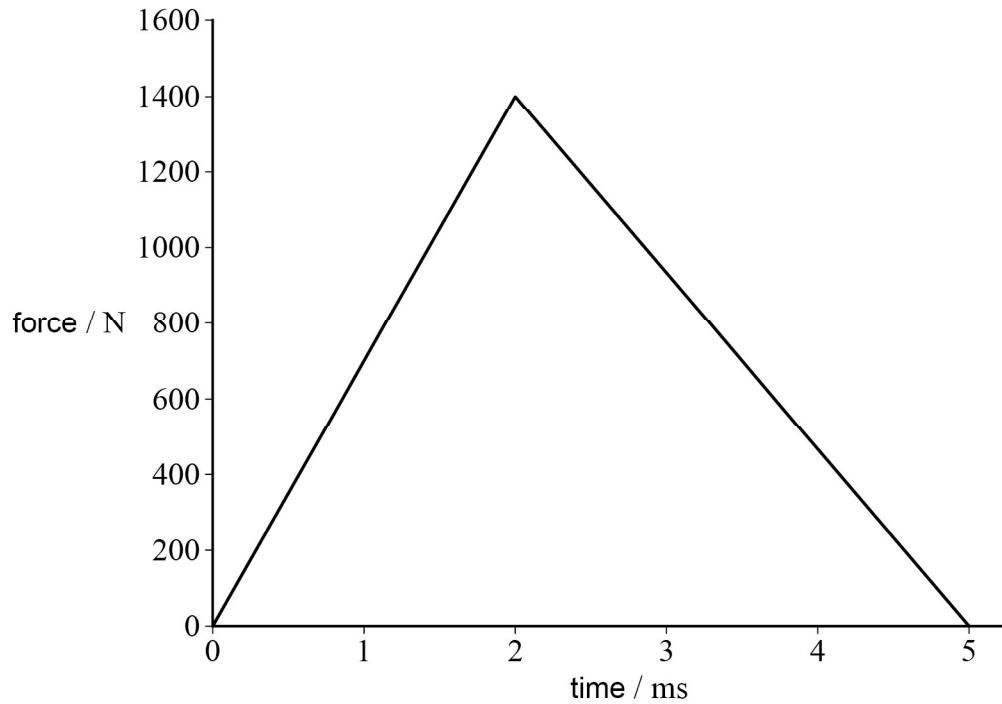
The lift is

[1 mark]

A moving down at a constant velocity.

B moving down with a decreasing velocity.

C moving up at a constant velocity.

D moving up with a decreasing velocity.

2 5 A stationary ball is free to move. The ball is hit with a bat.

The graph shows how the force of the bat on the ball changes with time.

The ball has a mass of 0.044 kg.

What is the speed of the ball immediately after being hit?

[1 mark]

A 13 m s^{-1} ⬭

B 60 m s^{-1} ⬭

C 80 m s^{-1} ⬭

D 160 m s^{-1} ⬭

Turn over for the next question

Turn over ▶

Do not write outside the box

Questions **27** and **28** are about three spheres **X**, **Y** and **Z**.

The relative mass and relative diameter of each sphere are given in the table.

	X	**Y**	**Z**
relative mass	1	5	1
relative diameter	1	1	5

Each sphere is dropped from rest and accelerates to its terminal speed.

2 7   What is true about the accelerations of the spheres at the instant they are released?

[1 mark]

A The acceleration of **X** is less than that of **Y**. ⬭

B The acceleration of **X** is greater than that of **Z**. ⬭

C The acceleration of **X** is the same as that of **Y**. ⬭

D The acceleration of **Y** is less than that of **Z**. ⬭

2 8   What is true about the terminal speeds?

[1 mark]

A The terminal speed of **X** is greater than that of **Y**. ⬭

B The terminal speed of **X** is the same as that of **Y**. ⬭

C The terminal speed of **Y** is greater than that of **Z**. ⬭

D The terminal speed of **X** is less than that of **Z**. ⬭
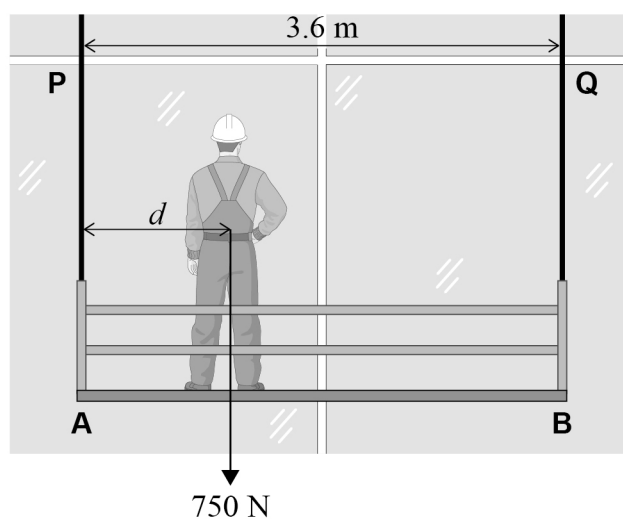
Turn over for the next question

Turn over ▶

0 6 **Figure 5** shows a worker of weight 750 N on a uniform platform. The weight of the worker is acting at a horizontal distance d from end **A**.

Throughout this question, assume that the platform is horizontal and that all cables obey Hooke's law.

Figure 5

750 N

The platform weighs 1800 N and is suspended by vertical cables **P** and **Q**.
Each cable has an unstretched length of 3.0 m.
The horizontal distance between **P** and **Q** is 3.6 m.

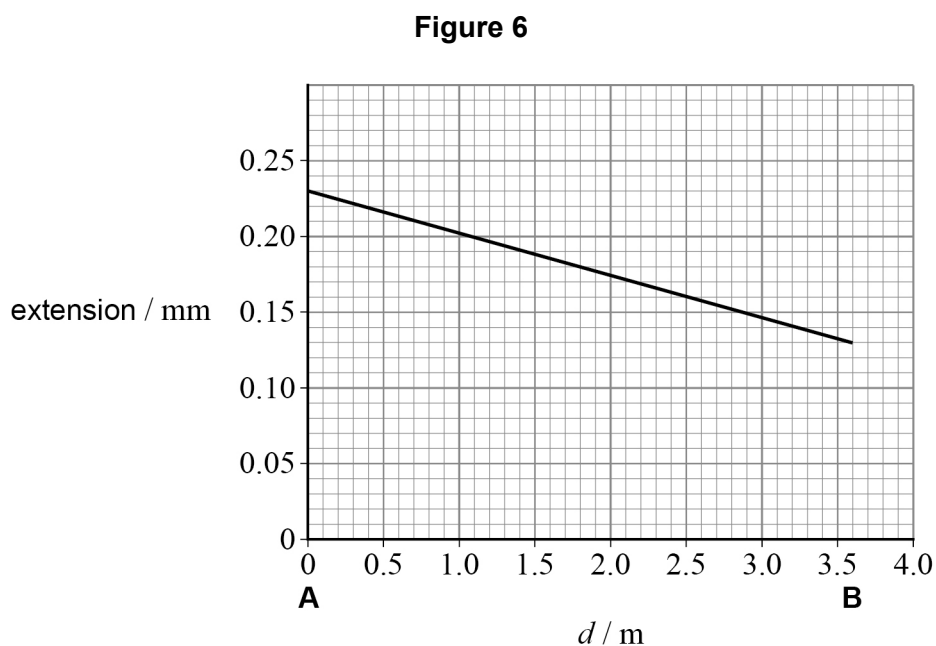**0 6 . 1** The worker moves to a position where the tension in the left-hand cable **P** is 1150 N.

Calculate d for this position.

[3 marks]

$d =$ _____ m

Do not write outside the box

Figure 6 shows how the extension of **P** varies with d as the worker walks slowly along the platform from **A** to **B**.

Figure 6

The worker moves to a position **X** where the strain in **P** is 6.0×10^{-5}.

0 6 . 2   Determine d for position **X**.

[2 marks]

$d =$ _____ m

0 6 . 3   The cable material has a Young modulus of $1.9 \times 10^{11} \text{ N m}^{-2}$.

Calculate the tensile stress in **P** when the worker is at **X**.

[1 mark]

tensile stress = _____ N m^{-2}

Question 6 continues on the next page

Turn over ▶

| 0 | 6 | . | 4 | The original cables **P** and **Q** are replaced.

Table 2 shows how the properties of the original cables compare with the replacement cables.

Table 2

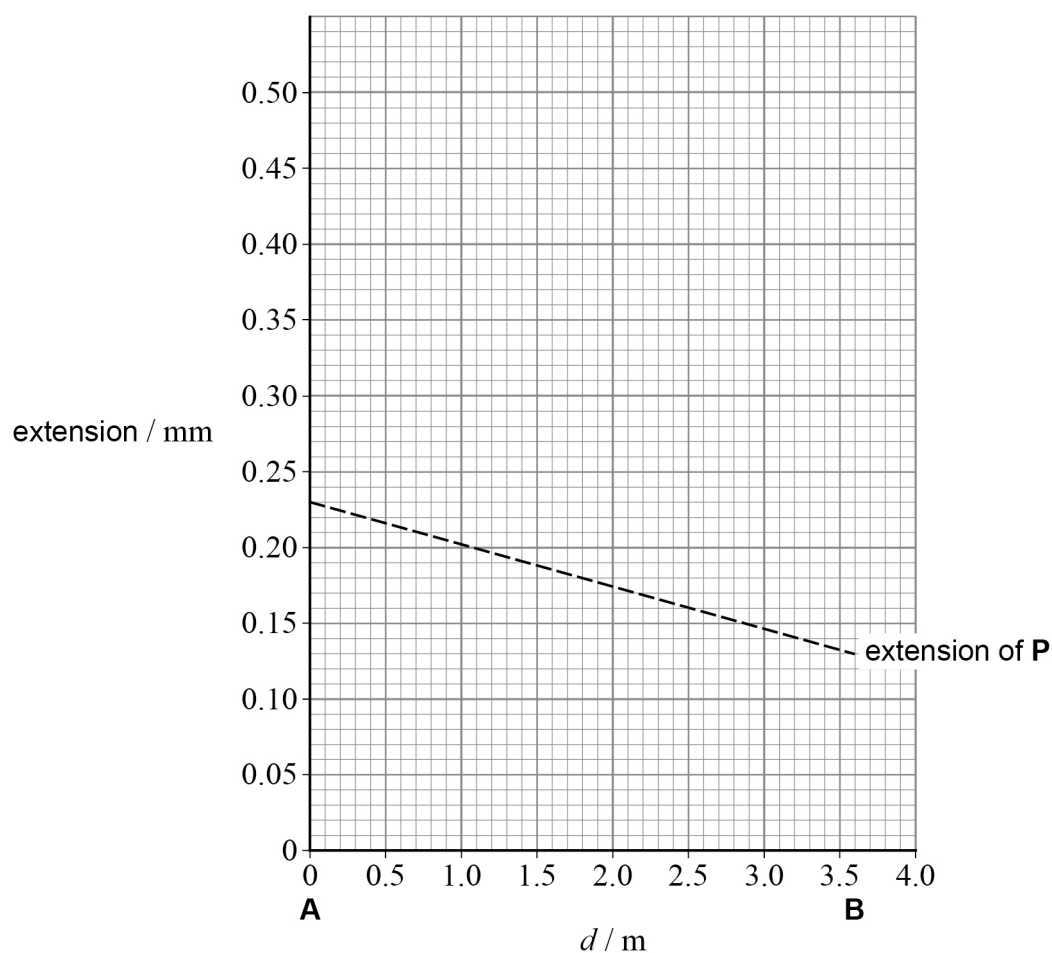|	**Unstretched length**	**Radius**	**Young modulus of cable material**
Original cables	L	r	E
Replacement cables	L	$\dfrac{r}{2}$	$2E$

After the cables have been replaced, the worker walks slowly from **A** to **B**.

Draw on **Figure 7** a line to show the variation of the extension of the replacement left-hand cable with d.
The original line from **Figure 6** is shown on **Figure 7** as a dashed line to help you.

[3 marks]

Figure 7

Turn over for the next question

Turn over ▶