

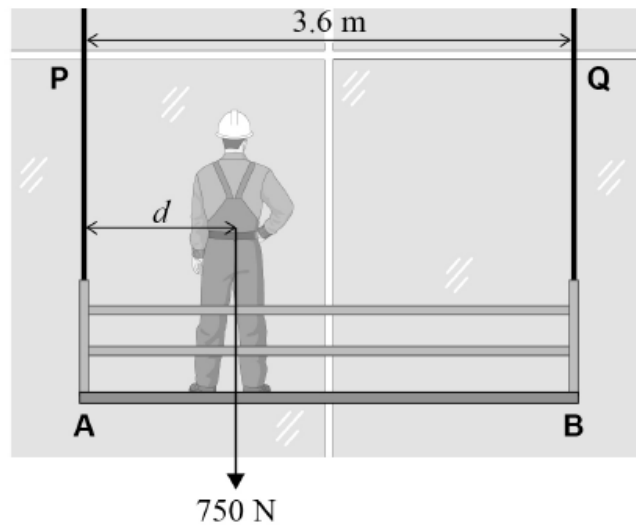
Materials – AS Physics

1. No.6

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

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.

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. 1

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

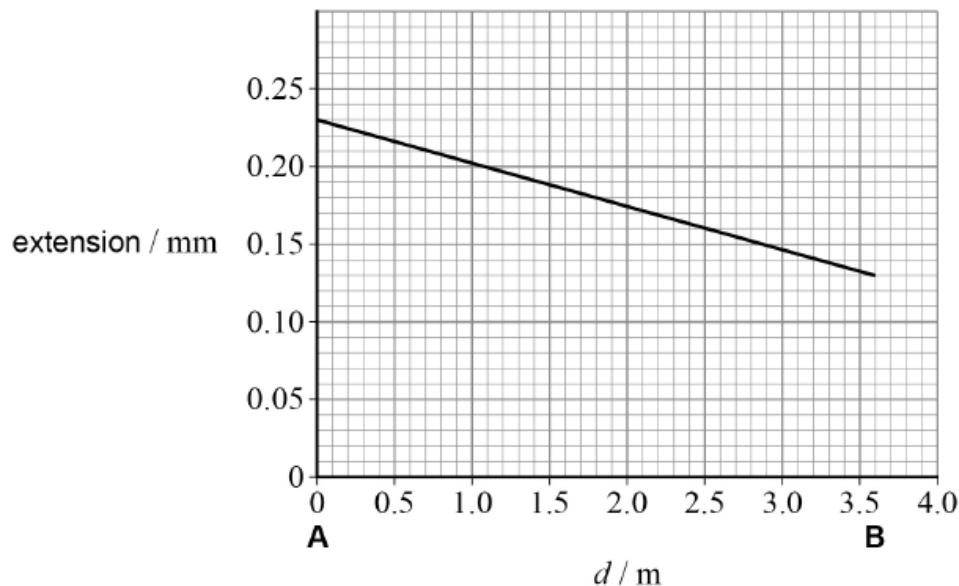
Calculate d for this position.

[3 marks]

$d =$ _____ m

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}

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	$\frac{r}{2}$	$2E$

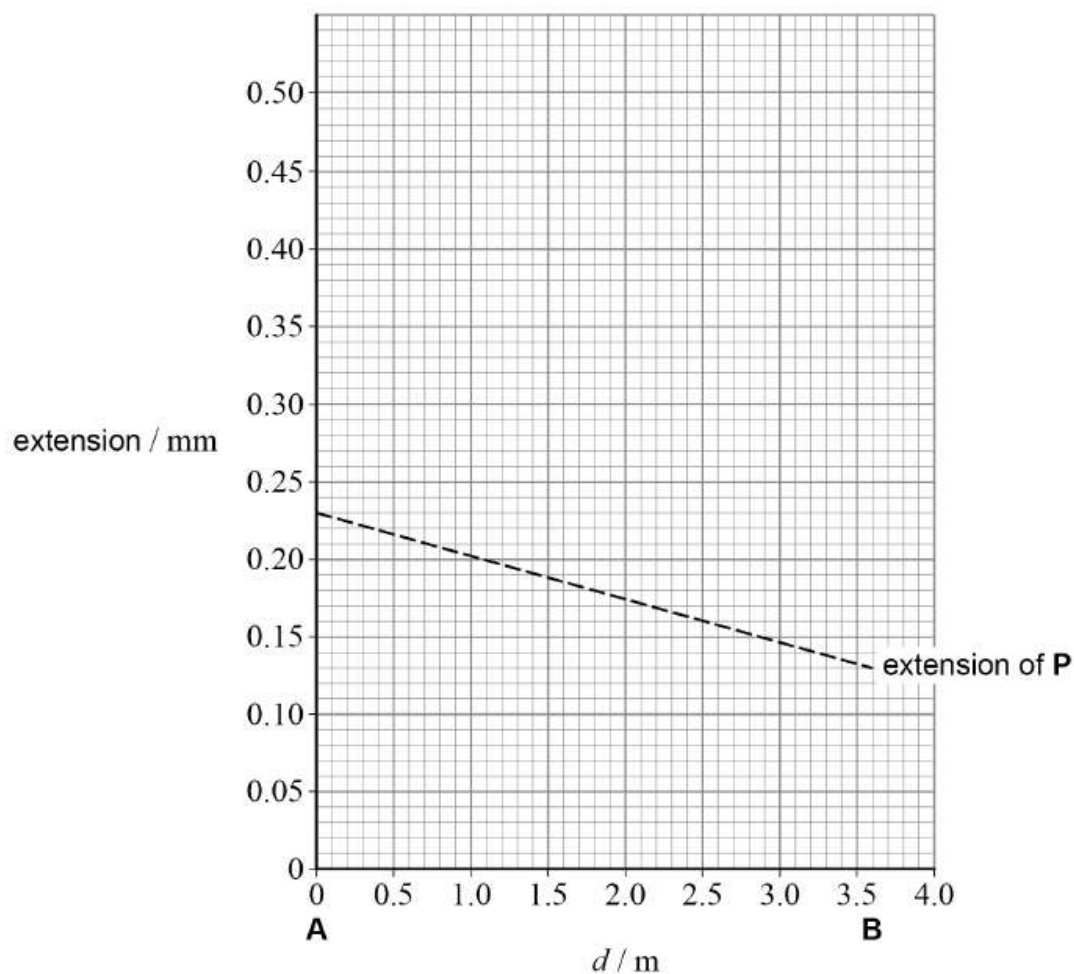
After the cables have been replaced, the worker walks slowly from **A** to **B**.

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.

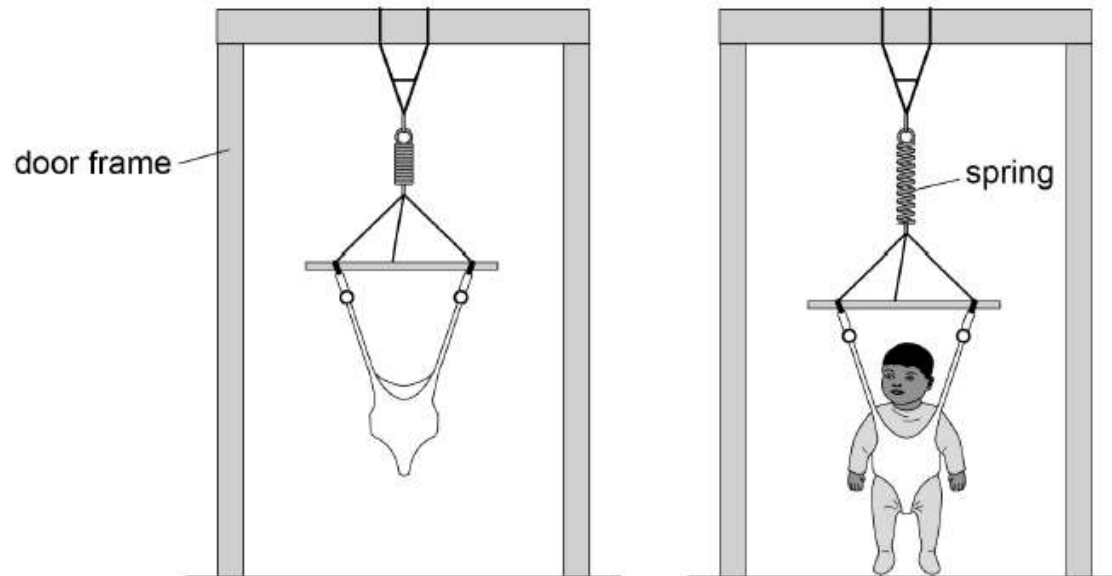
[3 marks]

Figure 7



2. No.6

A baby bouncer consists of an inextensible harness attached to a spring.



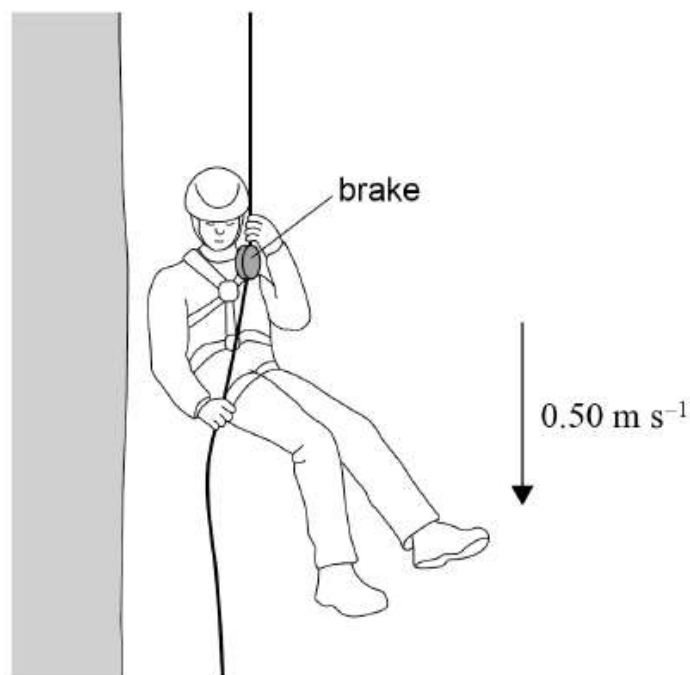
The stiffness of the spring is in the range:

[1 mark]

- A** $1\text{--}10\text{ N m}^{-1}$ ☐
- B** $10\text{--}100\text{ N m}^{-1}$ ☐
- C** $100\text{--}1000\text{ N m}^{-1}$ ☐
- D** $1000\text{--}10\,000\text{ N m}^{-1}$ ☐

3. No.27

A climber wears a harness attached to a rope. The rope passes through a brake. There is friction between the rope and the brake.



The climber uses the brake to descend at a steady speed of 0.50 m s^{-1} . The combined mass of the climber, the harness and the brake is 60 kg .

What is the rate of energy transfer to the brake and rope?

[1 mark]

- | | |
|----------------|--------------------------|
| A 15 W | ☐ |
| B 29 W | ☐ |
| C 150 W | ☐ |
| D 290 W | ☐ |

4. No.29

A wire is made from a material of Young modulus E .

The wire obeys Hooke's law.

The wire has an unstretched length L and a cross-sectional area A .

When a force is applied to the wire, the extension of the wire is e .

What is the elastic strain energy stored in the wire?

[1 mark]

A $\frac{AEe^2}{2L}$



B $\frac{L}{2Ae}$



C $\frac{Ae^2}{2EL}$



D $\frac{AEL}{2e}$

