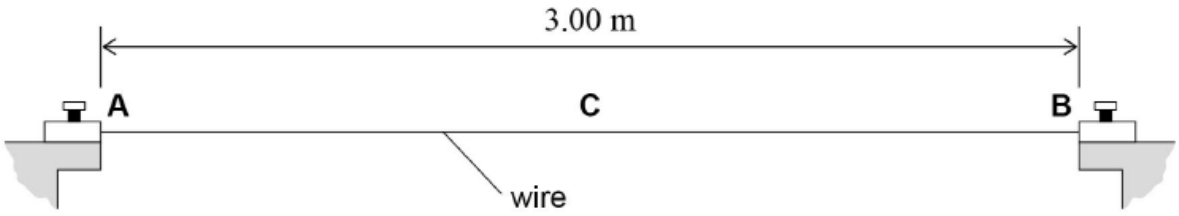
AQA – Materials – AS Physics P2

1. June/2021/Paper_7407_02/No. 02

A student does an experiment to determine the Young modulus of a metal.
Figure 6 shows a wire made from the metal clamped at points **A** and **B** so that the wire is horizontal. The horizontal distance between **A** and **B** = 3.00 m.
C is the mid-point on the wire between **A** and **B**.

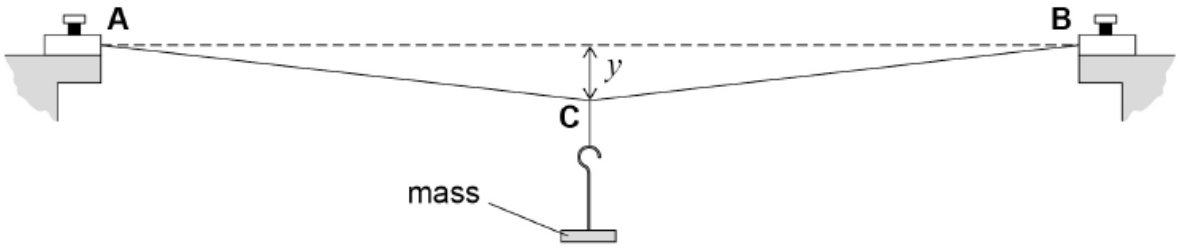
Figure 6



A mass of weight W is suspended at **C** to extend the wire. **Figure 7** shows that **C** moves vertically downwards by a distance y.

Figure 7

not to scale



0 2 . 1 When W is $1.0\ \text{N}$, y is $6.34\ \text{cm}$.

Show that the wire extends by approximately $3\ \text{mm}$.

[1 mark]

0 2 . 2 Calculate the tension in the wire when W is $1.0\ \text{N}$.

[2 marks]

tension = _____ N

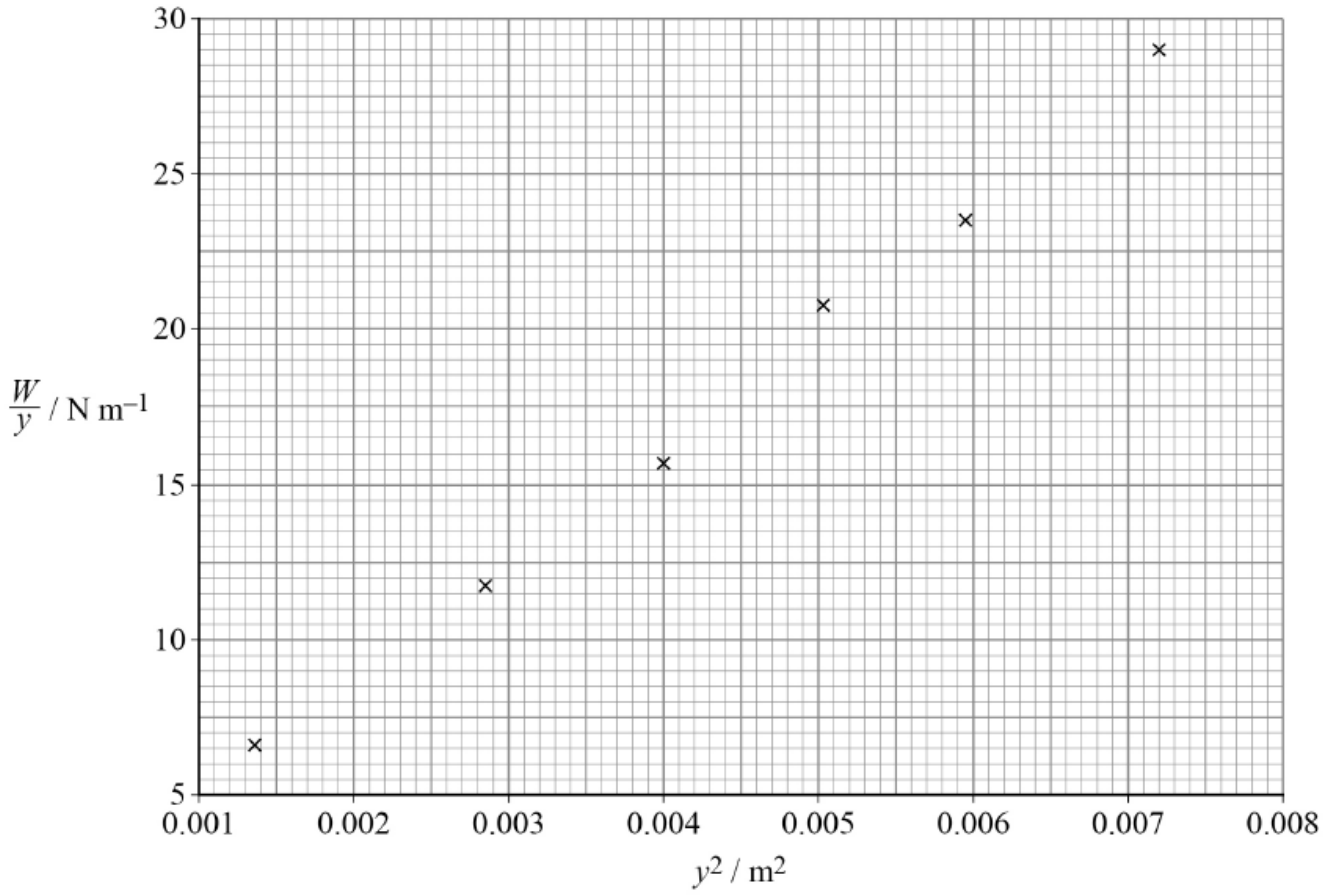
It can be shown that

$$\frac{W}{y} = \frac{EAy^2}{x^3} + k$$

where E = Young modulus of the metal
$A = 1.11 \times 10^{-7}\ \text{m}^2$
$x = 1.50\ \text{m}$
k = a constant.

A student measures y for different values of W and plots the graph shown in **Figure 8**.

Figure 8



0 2 . 3 Determine E using **Figure 8**.

[4 marks]

$E =$ _____ Pa

0 2 . 4 Deduce the fundamental base units for k.

[1 mark]

fundamental base units for $k =$ _____

2. June/2021/Paper_7407_02/No. 32

A wire is made from a material of density ρ.
The wire has a mass m and an initial length L.
When the tensile force in the wire is F the extension of the wire is ΔL.

What is the Young modulus of the material?

[1 mark]

A $\dfrac{F\rho L^2}{m\Delta L}$ ⬭

B $\dfrac{FL^2}{m\rho\Delta L}$ ⬭

C $\dfrac{F\rho}{m\Delta L}$ ⬭

D $\dfrac{FmL^2}{\rho\Delta L}$ ⬭

3. June/2020/Paper_7407_02/No. 26

A tensile force F_1 causes a wire to stretch to length x_1.

When the tensile force is increased to F_2 the length of the wire is x_2.

The wire obeys Hooke's Law.

What is the additional energy stored in the wire as the length increases from x_1 to x_2?

[1 mark]

A $\dfrac{F_1+F_2}{2} \times \dfrac{x_2-x_1}{2}$ ⬭

B $\dfrac{F_1+F_2}{2} \times \dfrac{x_2+x_1}{2}$ ⬭

C $\dfrac{F_1+F_2}{2} \times (x_2-x_1)$ ⬭

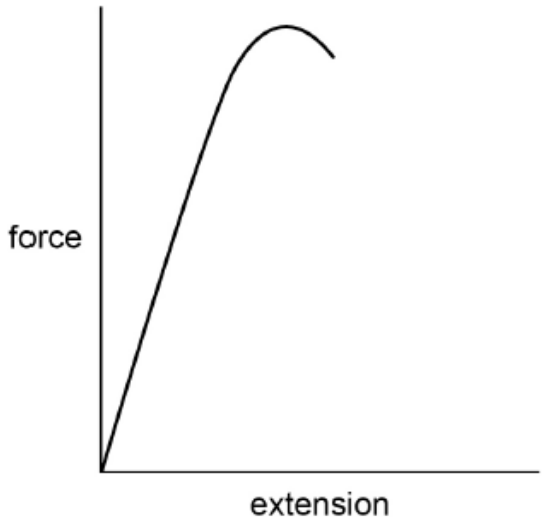
D $\dfrac{F_1+F_2}{2} \times (x_2+x_1)$ ⬭

4. June/2020/Paper_7407_02/No. 27

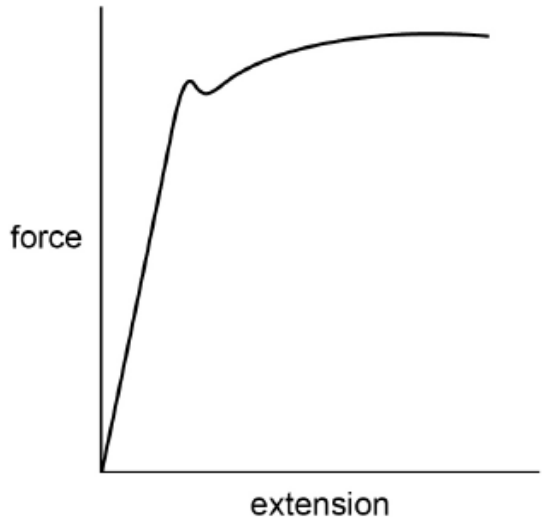
Which is a force–extension graph for a brittle material?

[1 mark]

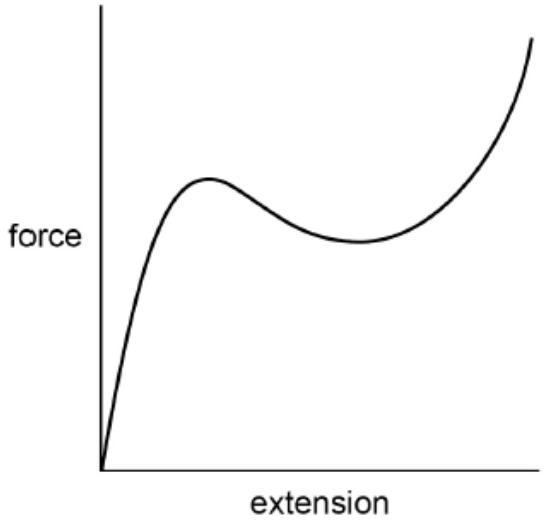
A



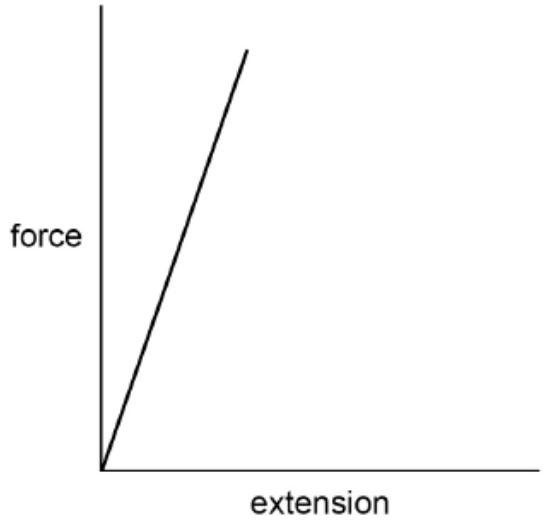
B



C



D



A ⬭

B ⬭

C ⬭

D ⬭