Do not write outside the box

1 9 A load of 50 N is suspended from a wire that has an area of cross-section of 1 mm^2.

The stress in the wire, in Pa, is between

[1 mark]

A 10^0 and 10^3 ☐

B 10^3 and 10^6 ☐

C 10^6 and 10^9 ☐

D 10^9 and 10^{12} ☐

2 0 Which combination of properties would produce the smallest extension of a wire when the same tensile force is applied to the wire?

[1 mark]

	Cross-sectional area	Length	Young modulus of material	
A	X	$3L$	E	☐
B	$2X$	L	E	☐
C	X	$3L$	$4E$	☐
D	$2X$	L	$4E$	☐

Turn over for the next question

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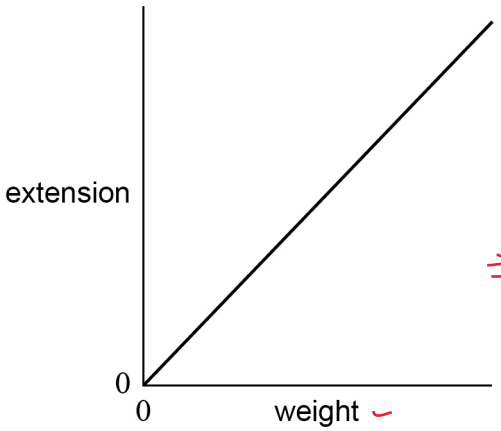
2 6 An experiment is carried out to determine the Young modulus E of steel using a vertical wire of initial length L and cross-sectional area A. Various weights are suspended from the wire. A graph of extension against weight is plotted.



What does the gradient of the graph represent?

[1 mark]

A E ⬭

B $\frac{1}{E}$ ⬭

C $\frac{EA}{L}$ ⬭

D $\frac{L}{EA}$ ⬭

Turn over for the next question

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2 6 Two wires **X** and **Y** have the same extension for the same load.
X has a diameter d and is made of a metal of density ρ and Young modulus E.
Y has the same mass and length as **X** but its diameter is $2d$.

What are the density and the Young modulus of the metal from which **Y** is made?

[1 mark]

	Density	Young modulus	
A	$\frac{\rho}{2}$	$\frac{E}{4}$ ✓	○
B	$\frac{\rho}{2}$	$4E$	○
C	$\frac{\rho}{4}$ ✓	$\frac{E}{4}$ ✓	⊗
D	$\frac{\rho}{4}$	$4E$	○

This is easy physics but the algebra needs careful handling

X	Y
ρ	ρ
d	$2d$
ρ	?
E	?
M	m
L	L

$E_x = \frac{FL}{A_x e}$ $\quad E_y = \frac{FL}{A_y e}$

$E_x A_e = E_y A_y$

$E_y = \frac{E_x A_e}{A_y}$ $\quad \therefore E_y = \frac{E}{4}$

$\rho_x = \frac{M}{V_x}$ $\quad \rho_y = \frac{m}{V_y}$ $\quad \Rightarrow \frac{\rho_x V_x}{V_y} = \rho_y$ $\quad V_x = L\left(\frac{d}{2}\right)^2 = \frac{Ld^2}{4}$

$V_y = L\left(\frac{2d}{2}\right)^2 = Ld^2$

$\rho_y = \rho_x \frac{\left(\frac{Ld^2}{4}\right)}{Ld^2} = \rho \times \frac{1}{4}$