A Level · OCR · Physics

13 mins 13 questions

Multiple Choice Questions

Materials

Deformation & Compression / Hooke's Law / Force-Extension Graphs / Elastic Potential Energy / Stress, Strain & Tensile Strength / Young's Modulus / Stress-Strain Graphs / Elastic & Plastic Deformation

Easy (3 questions)	/3
Medium (5 questions)	/5
Hard (5 questions)	/5
Total Marks	**/13**

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Easy Questions

1 One end of a spring is fixed and a force *F* is applied to its other end. The elastic potential energy in the extended spring is *E*. The spring obeys Hooke's law.

What is the extension *x* of the spring?

A. $x = \frac{E}{F}$

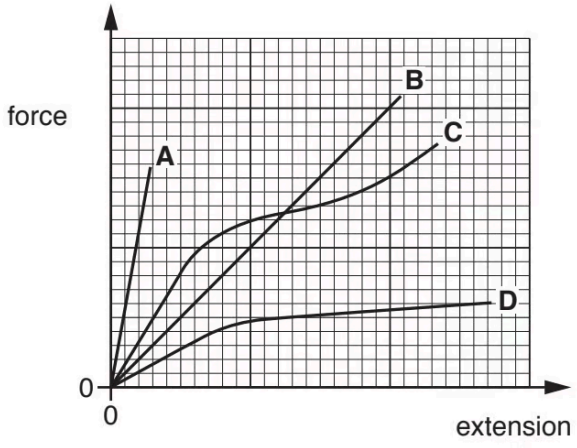
B. $x = \frac{F}{E}$

C. $x = \frac{2E}{F}$

D. $x = \frac{F}{2E}$

(1 mark)

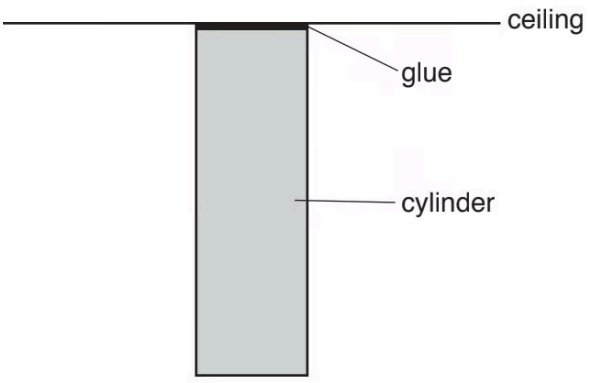
2 Four materials **A**, **B**, **C** and **D** have the same length and cross-sectional area. The force against extension graph for each material up to the breaking point is shown below.



Which material is brittle and has the greatest ultimate tensile strength?

(1 mark)

3 The flat end of a uniform steel cylinder of weight 7.8 N is glued to a horizontal ceiling. The cylinder hangs vertically. The breaking stress for the glue is 130 kPa.



The glue only just holds the cylinder to the ceiling.

What is the cross-sectional area of the cylinder?

A. 6.0×10^{-2} m^2

B. 6.0×10^{-5} m^2

C. 1.7×10^{-2} m^2

D. 1.7×10^{1} m^2

(1 mark)

Medium Questions

1 A tensile force of 4.5 N is applied to a spring. The spring extends elastically by 3.2 cm.

What is the elastic potential energy of the spring?

A. 0.072 J

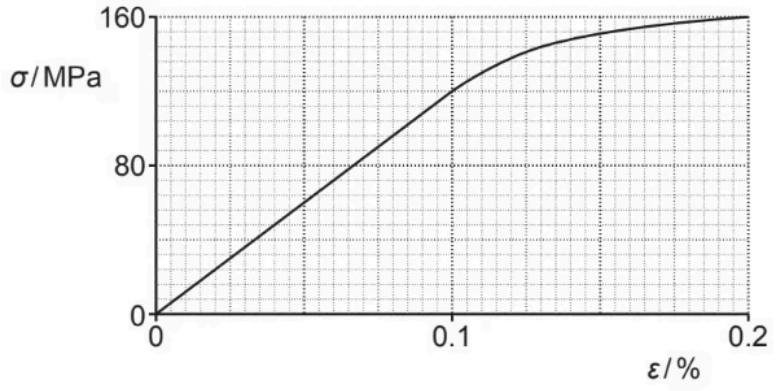
B. 0.14 J

C. 2.4 J

D. 14 J

(1 mark)

2 A graph showing the variation of the stress σ with strain ε for a material is shown below.



What is the Young modulus of the material?

A. 6.0×10^4 Pa

B. 1.2×10^9 Pa

C. 8.0×10^{10} Pa

D. 1.2×10^{11} Pa

(1 mark)

3 A student performed an investigation into how the mass added to a spring affected its length when stationary.

A sample of the student's results is shown in the table below.

Mass / kg	**Length of spring / m**
0.30	0.10
0.60	0.14

The spring obeys Hooke's law.

What is the spring constant of the spring?

A. 7.5 N m^{-1}

B. 42 N m^{-1}

C. 74 N m^{-1}

D. 147 N m^{-1}

(1 mark)

4 Spring A has a spring constant k.

Spring B has a spring constant $2k$.

When a mass of m is hung from the bottom end of spring A, the elastic potential energy in the spring is E.

A mass of $2m$ is hung from the bottom end of spring B.

What is the elastic potential energy stored in spring B?

A. E

B. $2E$

C. $4E$

D. $8E$

(1 mark)

5 One end of a wire is fixed to a ceiling and a mass is suspended from its other end causing it to extend.

The wire does not pass its limit of proportionality.

Which of the following changes to the wire, **made independently**, would result in a greater store of elastic potential energy in the wire?

A. Increasing the Young Modulus of the wire's material.

B. Decreasing the original length of the wire.

C. Decreasing the mass attached to the wire.

D. Decreasing the cross-sectional area of the wire.

(1 mark)

Hard Questions

1 A spring is stretched by hanging on it a variable mass m. The mass m is always at rest.

The spring obeys Hooke's law.

What is the relationship between the elastic potential energy E in the spring and the mass m?

A. $E \propto m^{-1}$

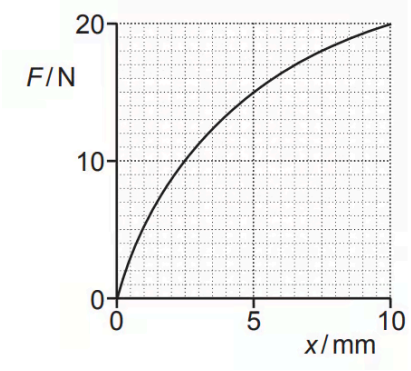
B. $E \propto m^{-2}$

C. $E \propto m$

D. $E \propto m^{2}$

(1 mark)

2 The force F against extension x graph for a material being stretched is shown.



What is best estimate for the energy stored in the material when the extension is 10 mm?

A. 0.07 J

B. 0.10 J

C. 0.13 J

D. 0.20 J

(1 mark)

3 The table below shows some data on two wires **X** and **Y**.

Wire	Young modulus of material / GPa	Cross-sectional area of wire / mm^2
X	120	1.0
Y	200	2.0

The wires **X** and **Y** have the same original length. The tension in each wire is the same. Both wires obey Hooke's law.

What is the value of the ratio $\frac{extension\ of\ X}{extension\ of\ Y}$?

A. 0.30

B. 1.7

C. 2.0

D. 3.3

(1 mark)

4 Wire **P** has radius *r*, and is put under a load *F*. Wire **Q** is put under the same load *F.* and its radius is a third of wire **P**.

What is the value of the ratio $\frac{\sigma_P}{\sigma_Q}$?

A. $\frac{1}{3}$

B. $\frac{1}{9}$

C. 3

D. 9

(1 mark)

5 Spring **X** and Spring **Y** are connected in series. Spring **X** has force constant k and Spring **Y** has force constant $\frac{2}{3}k$ Force F is exerted onto the springs and the total extension on the springs is 0.1 m.

What is the force exerted on the springs?

A. $F = \frac{1}{25}k$

B. $F = \frac{2}{5}k$

C. $F = 4k$

D. $F = \frac{3}{5}k$

(1 mark)