7.1 Deformation: Stress & Strain

Question Paper

Course	CIE A Level Physics (9702) 2019-2021
Section	7. Deformation of Solids
Topic	7.1 Deformation: Stress & Strain
Difficulty	Medium

Time allowed: **10**

Score: **/10**

Percentage: **/100**

Question 1

A steel spring was stretched to a length of 55 cm when a 25 N weight was hung from it. The spring has a spring constant of 150 N m^{-1}.

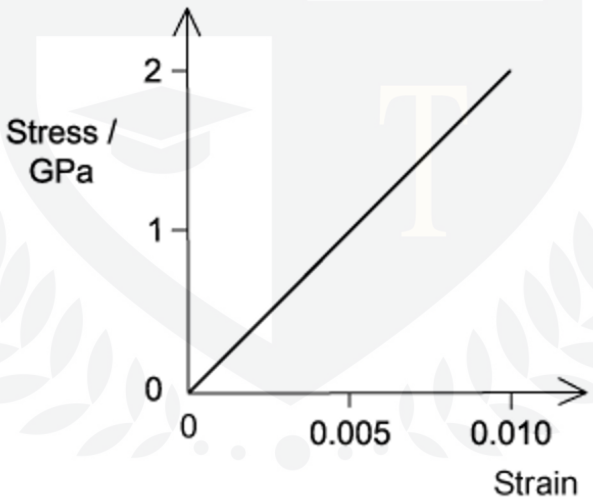
What was the original length of the spring?

A 0.61 m **B** 0.72 m **C** 0.38 m **D** 0.49 m

[1 mark]

Question 2

The graph below shows the stress-strain for a metal.



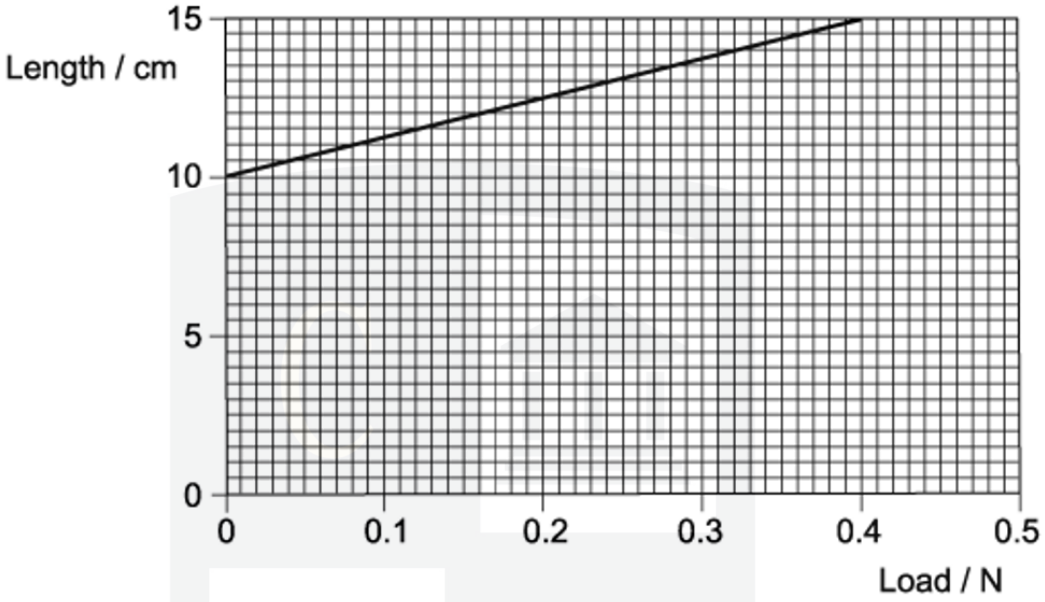
When the strain on the rod is 0.010, what is the strain energy per unit volume of a rod made from this metal?

A 10 kJ m^{-3} **B** 10 MJ m^{-3} **C** 100 kJ m^{-3} **D** 1.0 MJ m^{-3}

[1 mark]

Question 3

A spring was stretched with increasing load. The graph of the results is shown below.



What is the spring constant?

A 0.080 N m^{-1} **B** 0.13 N m^{-1} **C** 2.7 N m^{-1} **D** 8.0 N m^{-1}

[1 mark]

Question 4

A student wanted to find the young modulus of a wire. The equation for the young modulus *E* is:

$$E = \frac{4Fl}{\pi d^2 x}$$

The student extended the wire with a known force and made a series of measurements.

Which measurement has the largest effect on the uncertainty in the value of the calculated Young modulus?

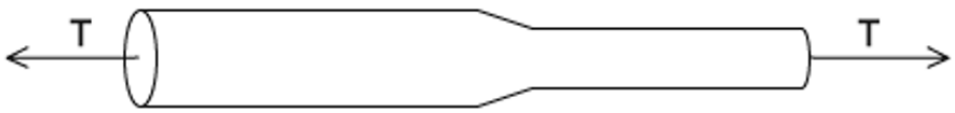
	measurement	symbol	value
A	length of wire before force applied	l	2.043 ± 0.002 m
B	force applied	F	19.62 ± 0.01 N
C	extension of wire with force applied	x	5.2 ± 0.2 mm
D	diameter of wire	d	0.54 ± 0.02 mm

[1 mark]

Question 5

A steel bar, shown in the diagram, has a circular cross-section that is under tension *T*.

The diameter of the thinner portion is half the wider portion.



What is the value of $\frac{\textbf{stress in the wide portion}}{\textbf{stress in the narrow portion}}$?

A 4.0 **B** 2.0 **C** 0.50 **D** 0.25

[1 mark]

Question 6

The Young modulus *E* and the force per unit extension *k* describes the behaviour of a wire under tensile stress.

For a wire of length *L* and cross-sectional area *A*, what is the relationship between *E* and *k*?

A $E = \frac{A}{kL}$ **B** $E = \frac{kA}{L}$ **C** $E = \frac{kL}{A}$ **D** $E = \frac{L}{kA}$

[1 mark]

Question 7

The Young modulus of a metal wire is dependent on which property?

A spring constant

B ductility

C ultimate tensile stress

D elastic limit

[1 mark]

Question 8

A steel metal wire has the following properties:

diameter = 5.0×10^{-4} m

Young modulus = 2.0×10^{11} Pa

tension = 20 N

The string snaps and contracts elastically.

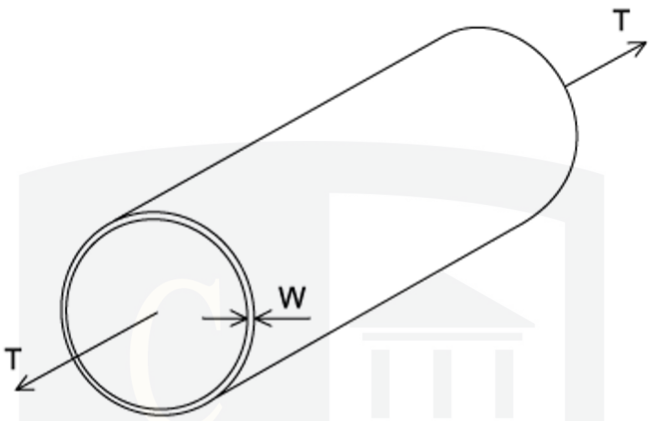
By what percentage does a length l of a piece of the string contract?

A 1.3×10^{-2} % **B** 1.3×10^{-4} % **C** 5.1×10^{-4} % **D** 5.1×10^{-2} %

[1 mark]

Question 9

A metal tube with a thin wall thickness *w* is shown in the diagram. The thickness of the wall is small when compared to the diameter of the tube.



A force T applied parallel to the axis of the tube puts the tube under tension. It is proposed that making the wall thicker would reduce the stress on the tube.

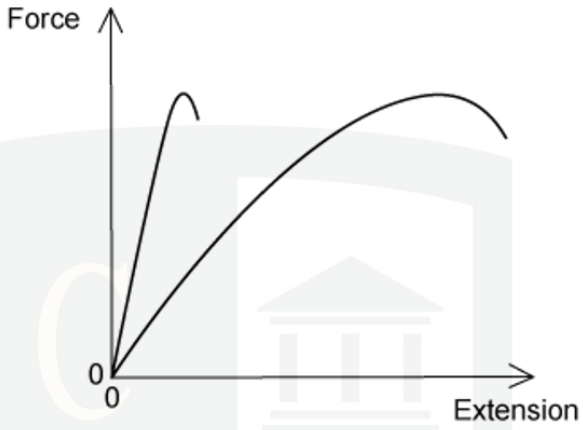
If the tube diameter and the tension remain the same, which wall thickness would half the stress?

A 4w **B** $2w$ **C** $\sqrt{2}w$ **D** $\frac{w}{2}$

[1 mark]

Question 10

Two materials with the same dimensions were loaded to fracture; the graph shows the force-extension of these.



Which of the following would describe the behaviour of the materials?

A both materials are plastic

B both materials have the same ultimate tensile stress

C both materials are brittle

D both materials obey Hooke's law

[1 mark]