7.2 Deformation: Elastic & Plastic Behaviour

Question Paper

Course	CIE A Level Physics (9702) 2019-2021
Section	7. Deformation of Solids
Topic	7.2 Deformation: Elastic & Plastic Behaviour
Difficulty	Medium

Time allowed: **10**

Score: **/10**

Percentage: **/100**
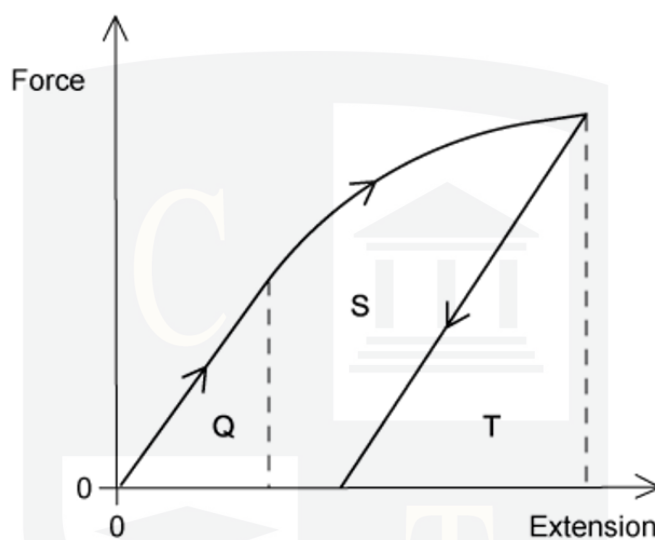
Question 1

A student carried out an experiment on a ductile material; stretching it with a tensile force beyond its elastic limit. The force is removed.

The graph shows the force-extension of this experiment.

Which area represents the net work done on the sample?
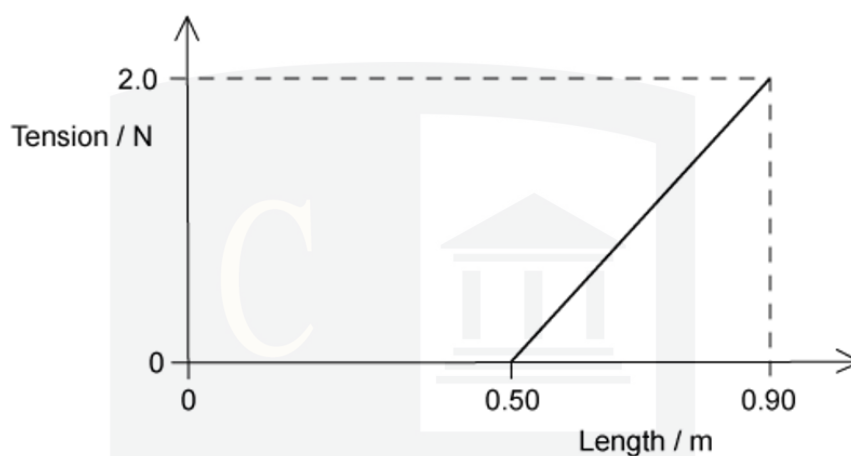
A T **B** $S + T$ **C** $Q + S$ **D** Q

[1 mark]

Question 2

A force of 2.0 N is applied to a spring of unextended length 0.50 m and has a new length of 0.90 m.

A graph shows the variation of its length with tension.
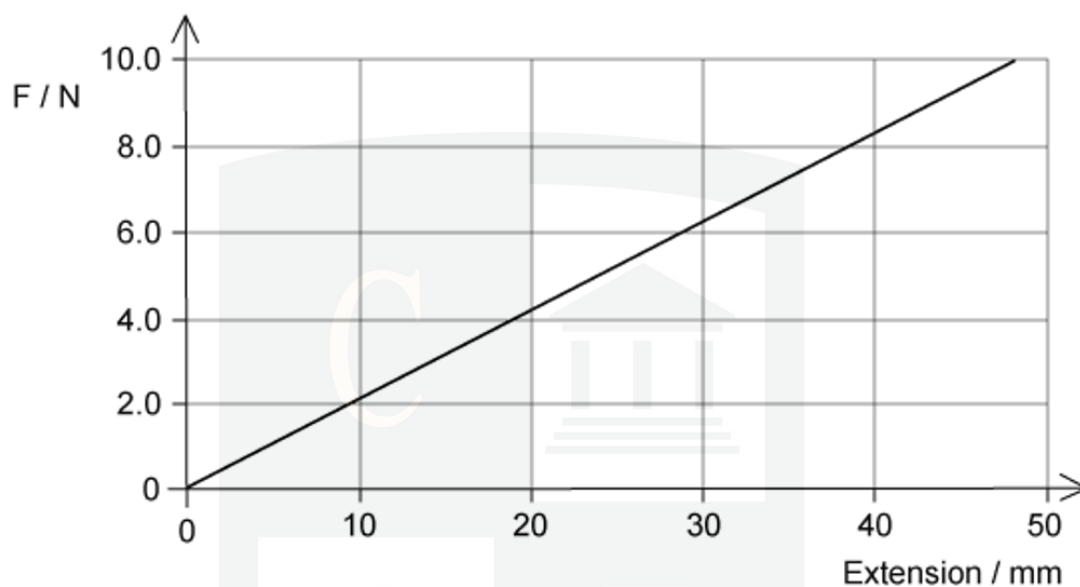

How much strain energy is stored in the spring?

A   1.8 J   **B**   0.90 J   **C**   0.40 J   **D**   0.80 J

[1 mark]

Question 3

A spring is extended due to a force. The graph shows the effect of changing force on the extension of the spring.

What is the elastic potential energy of the spring with a force of 8.0 N?
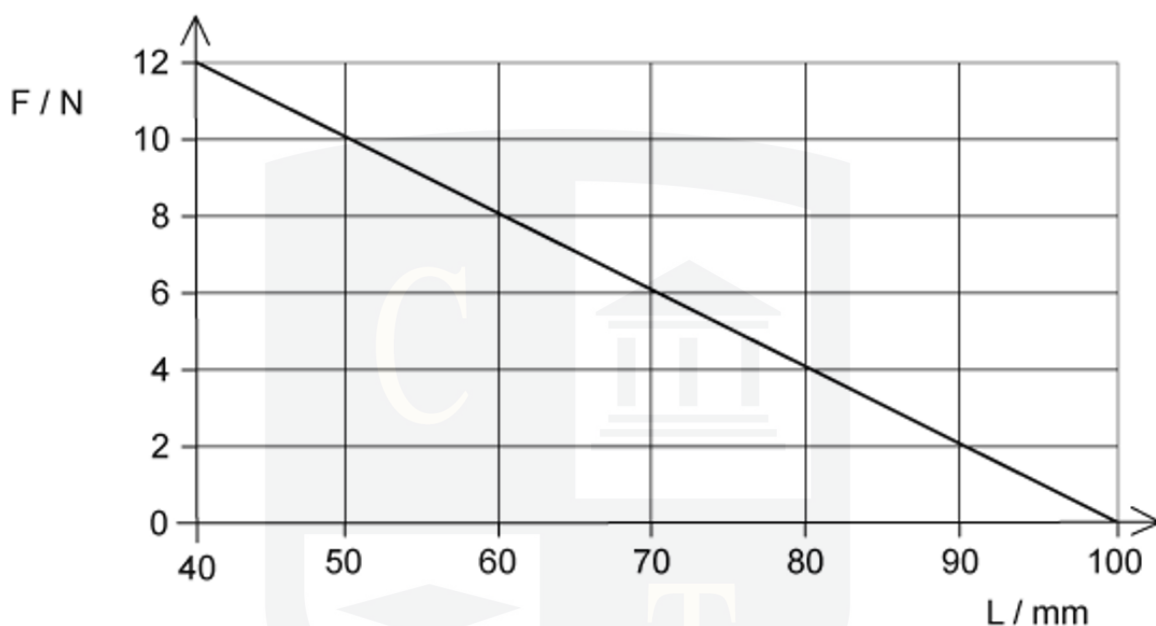
A 152 mJ   **B** 58 J   **C** 85 mJ   **D** 5.8 mJ

[1 mark]

Question 4

A force compresses a mattress spring by 100 mm. The graph shows the effect of the force F on the length l of the spring.

What is the energy stored in the spring when the length is 70 mm?

A 0.63 J   **B** 0.27 J   **C** 0.21 J   **D** 0.090 J

[1 mark]

Question 5

A student was investigating a spring with a spring constant k of 3.0 N cm^{-1}, the spring was stretched over a range in which elastic deformation occurred.
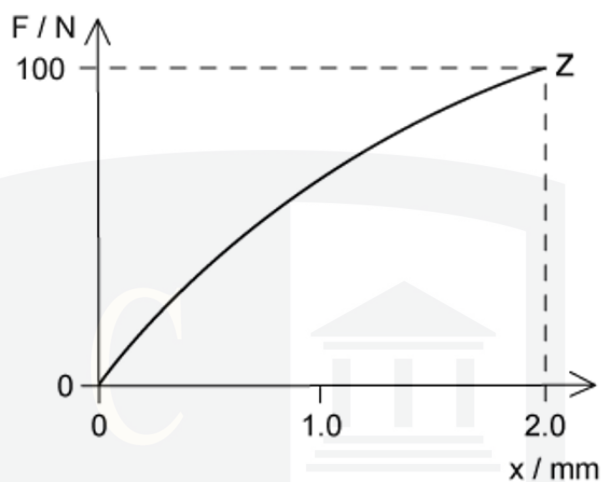
Which row, for the stated applied force, gives the correct extension and strain energy?

	force / N	extension / cm	strain energy / mJ
A	24.0	8.0	960
B	12.0	3.0	200
C	6.0	2.0	120
D	3.0	1.0	1.5

[1 mark]

Question 6

A wire made from a new composite material was loaded with masses and the force-extension curve drawn.

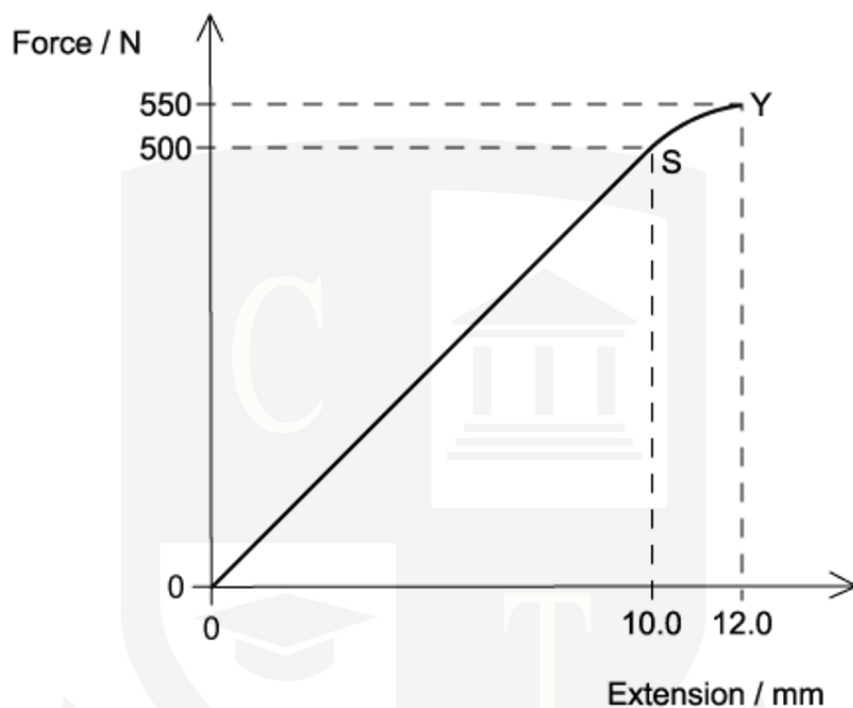What could be the value of the strain energy stored in the wire when it is stretched elastically to point Z?

A   0.20 J   B   0.11 J   C   0.10 J   D   0.09 J

[1 mark]

Question 7

A sample of metal was stretched until it started to go into plastic deformation. The graph below shows the behaviour of the metal.

When the sample was stretched from 0 to 12.0 mm extension, what is the work done? Assume that the curve SY is a straight line to simplify the calculation
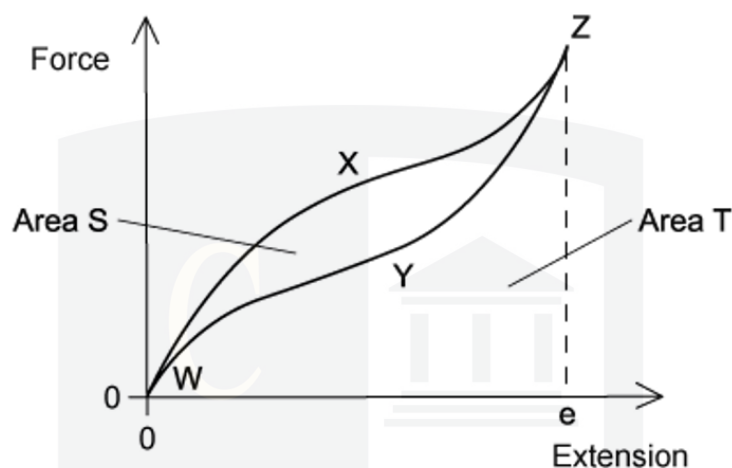
A   6.60 J   B   3.60 J   C   3.55 J   D   3.30 J

[1 mark]

Question 8

A student was investigating a rubber band when stretched and relaxed to its original length. The graph shows the force-extension of the rubber band.

As the force is increased, the curve follows the path WXZ to extension *x*. As the force is reduced, the curve follows the path ZYW to return to zero extension.

The area labelled S is between the curves WXZ and ZYW. The area labelled T is bounded by the curve ZYW and the horizontal axis.

Which statement about the process is correct?

    A   area S is the energy which heats the band as it is stretched to *e*

    B   area S is the elastic potential energy stored in the band when it is stretched to *e*

    C   (area S + area T) is the minimum energy required to stretch the band to *e*

    D   area S is the energy which heats the band as it is stretched to *e*
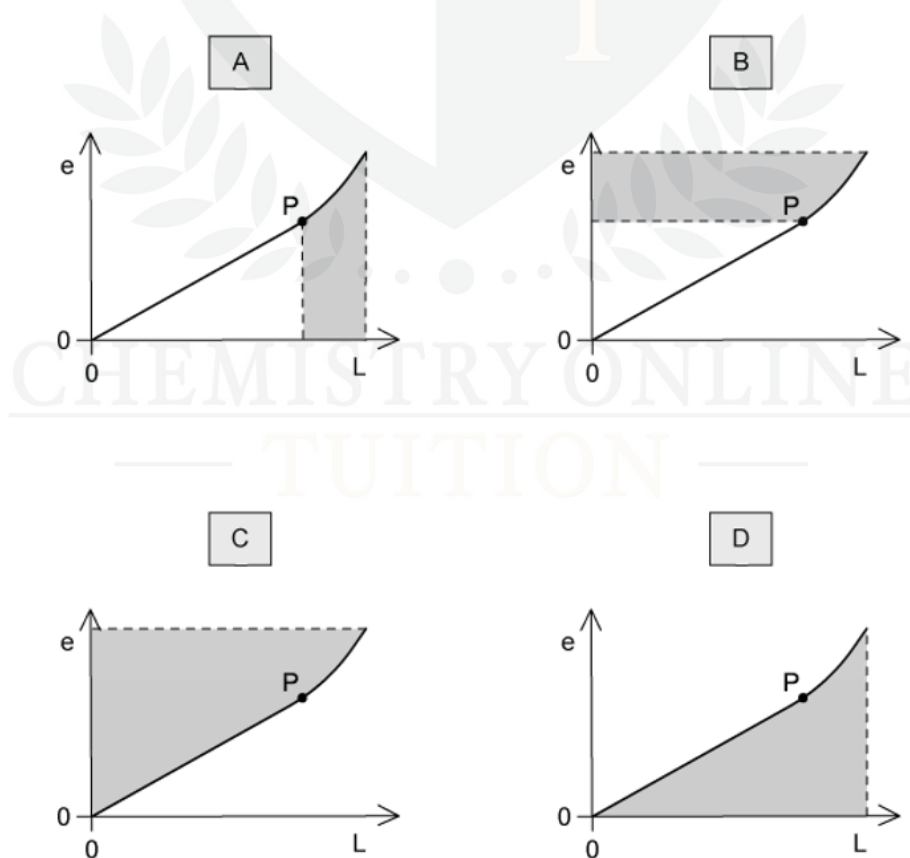
[1 mark]

Question 9

A rod is extended with a force so that its length increases. The variation with load *L* of the extension *e* of the rod is shown in the graph.
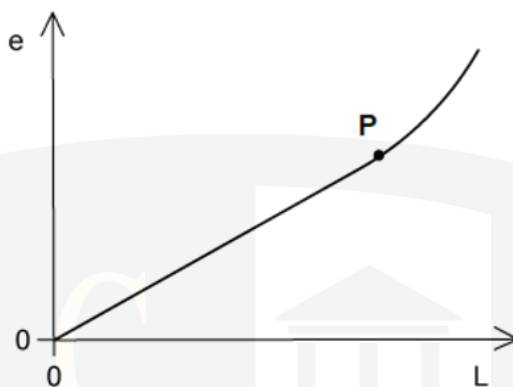
Point **P** is the elastic limit.

Which shaded area represents the work done during the plastic deformation of the rod?

[1 mark]

Question 10

A student was investigating the extension in a long thin metal wire. They suspended the wire from a fixed support, and hung it vertically then hung masses from the lower end.

The load was increased and decreased from zero to the maximum and back again.

The graph shows the force-extension of the wire.
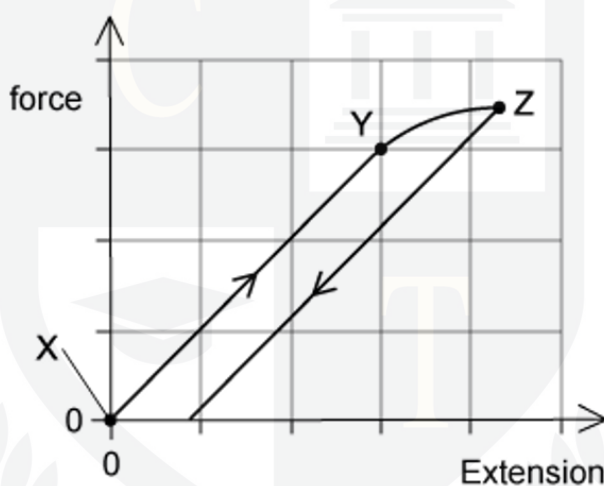
Where on the graph would the elastic limit be found?

    A   exactly at point Z

    B   exactly at point Y

    C   just beyond point Y

    D   anywhere between point X and point Y

[1 mark]