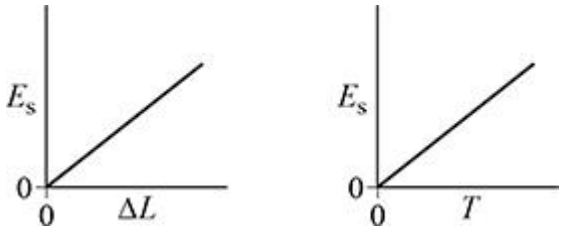
Q1.

A wire obeys Hooke's law.

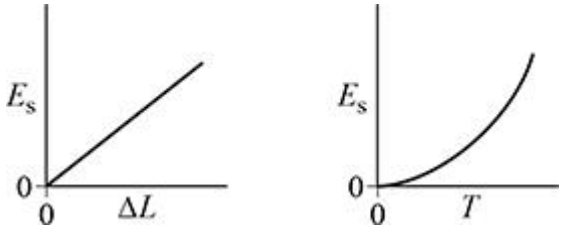
When the wire is extended by ΔL, the elastic strain energy is E_s and the tension in the wire is T.

Which pair of graphs shows the variation of E_s with ΔL and the variation of E_s with T?

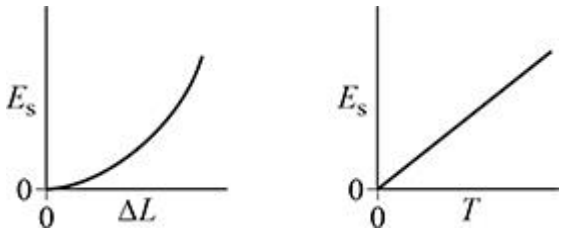
A



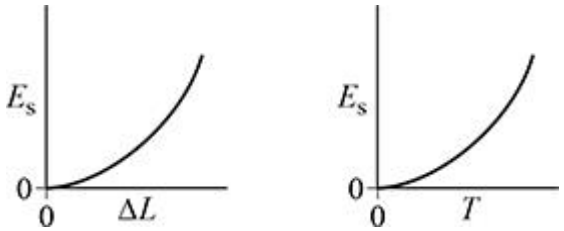
B



C



D



(Total 1 mark)

Q2.

Which statement is true?

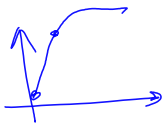
A A brittle fracture occurs after little or no elastic deformation.

B A brittle fracture occurs after little or no plastic deformation.

C In a plastic deformation, energy stored is proportional to stress.

D In a plastic deformation, stress is proportional to strain.

$\sigma = \frac{F}{A}$



(Total 1 mark)

Q3.

A uniform wire is stretched by a load F.
The elastic strain energy stored in the wire is E.

$F = ke \rightarrow 2F = k2e$

$4E = \frac{1}{2} Fe = \frac{1}{2} k(2e)^2$

The load is increased from F to $2F$.
The wire obeys Hooke's law.

$\Delta E = 4E - E = 3E \rightarrow C$

What is the increase in the elastic strain energy stored in the wire?

A E

B $2E$

C $3E$

D $4E$

(Total 1 mark)

Q4.

A spring is compressed by a force F. The spring has stiffness k and its length changes by ΔL during the compression. When the force is removed the spring returns to its original length in time t.

What is the average power developed by the spring as it returns to its original length?

A $\frac{k\Delta L}{2t}$ ⬭

B $\frac{k\Delta L}{t}$ ⬭

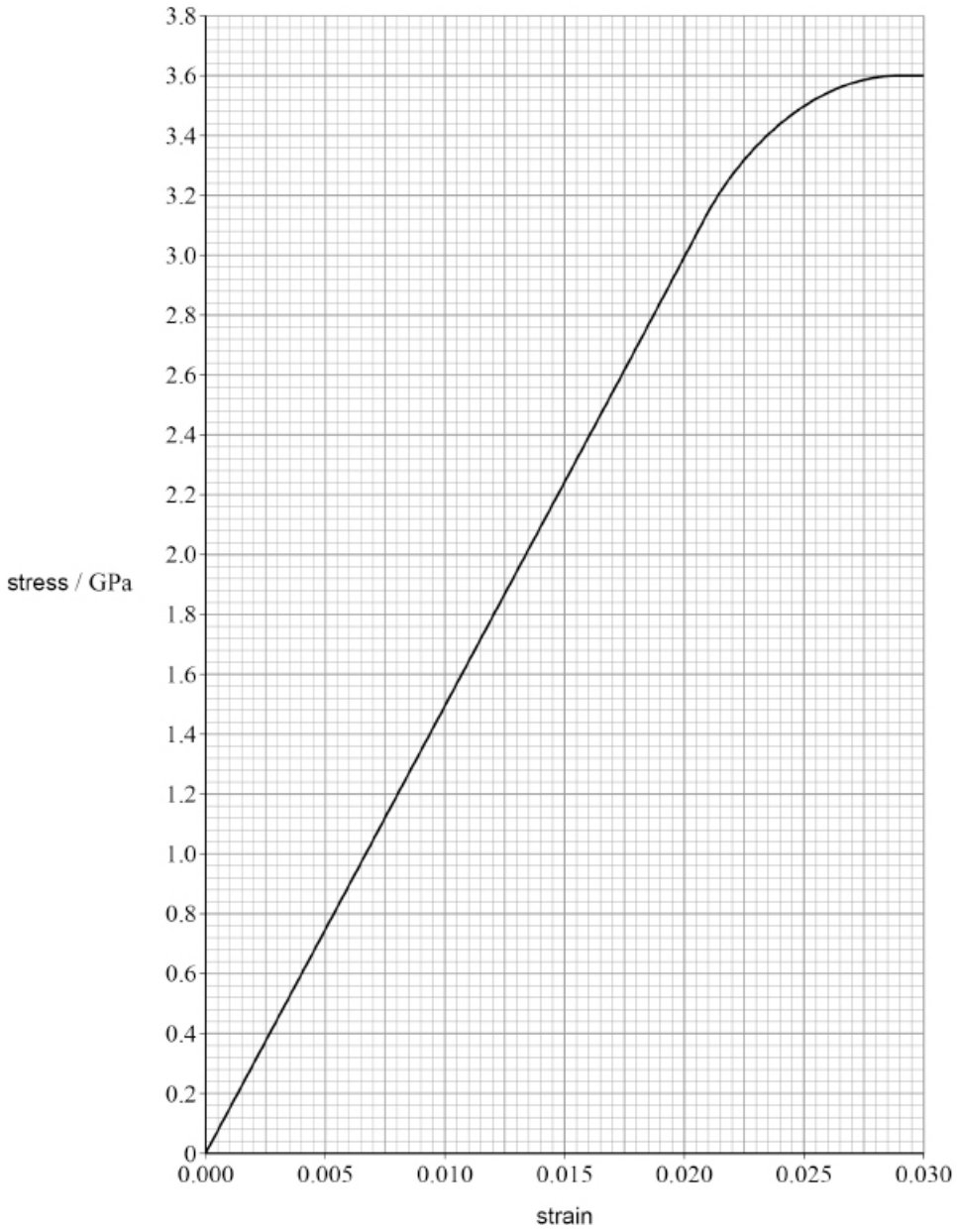
C $\frac{k(\Delta L)^2}{2t}$ ⬭

D $\frac{k(\Delta L)^2}{t}$ ⬭

(Total 1 mark)

Q5.

The graph shows the variation of stress with strain for a material.



What is the Young modulus of the material?

A 1.2×10^5 Pa ⬭

B 1.5×10^5 Pa ⬭

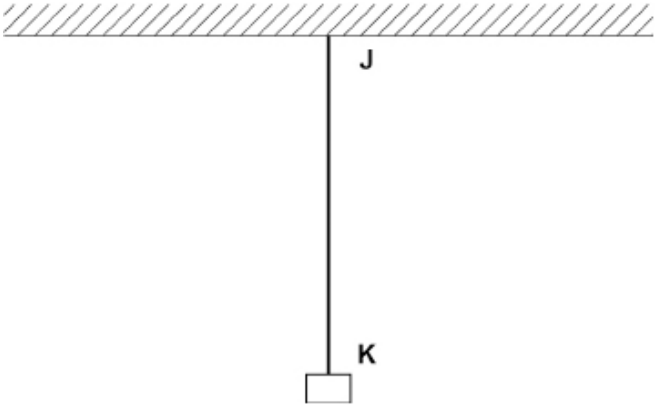
C 1.2×10^{11} Pa ⬭

D 1.5×10^{11} Pa ⬭

(Total 1 mark)

Q6.

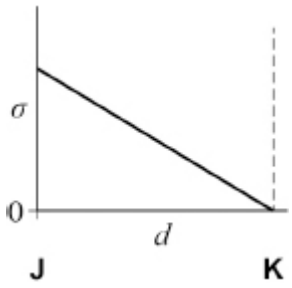
A heavy cable is attached to a fixed support and carries a load at its lower end.



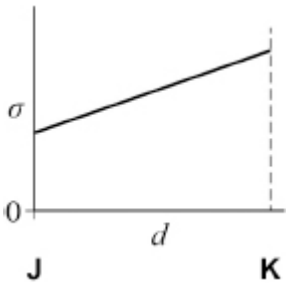
The weight of the cable is **not** negligible.
The cable has constant cross-sectional area and density.

Which graph shows the variation of tensile stress σ in the cable with distance d from **J** to **K**?

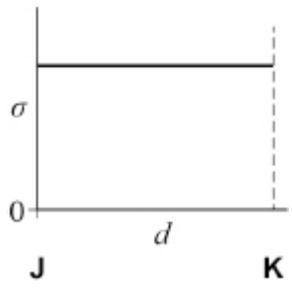
A



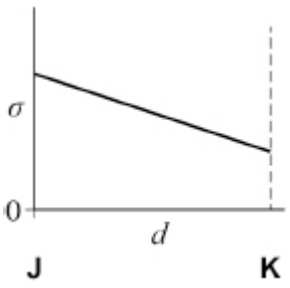
B



C



D



A ⬭

B ⬭

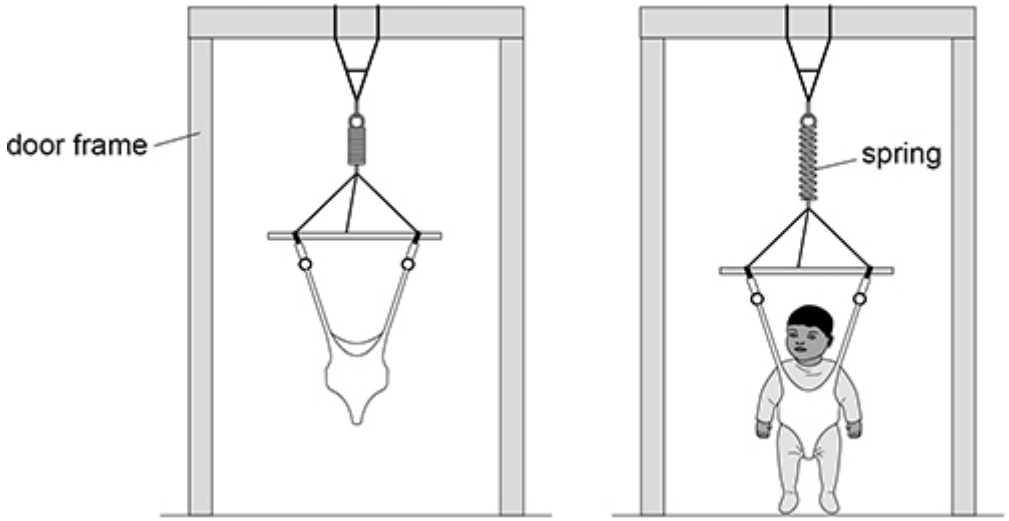
C ⬭

D ⬭

(Total 1 mark)

Q7.

A baby bouncer consists of an inextensible harness attached to a spring.



The stiffness of the spring is in the range:

A 1–10 N m^{-1} ⬭

B 10–100 N m^{-1} ⬭

C 100–1000 N m^{-1} ⬭

D 1000–10 000 N m^{-1} ⬭

(Total 1 mark)

Q8.

A wire is made from a material of Young modulus E.
The wire obeys Hooke's law.
The wire has an unstretched length L and a cross-sectional area A.
When a force is applied to the wire, the extension of the wire is e.

What is the elastic strain energy stored in the wire?

A $\frac{AEe^2}{2L}$ ⬭

B $\frac{L}{2Ae}$ ⬭

C $\frac{Ae^2}{2EL}$ ⬭

D $\frac{AEL}{2e}$ ⬭

(Total 1 mark)

Q9.

Which two quantities have the base unit $\mathrm{kg\ m^2\ s^{-2}}$?

A kinetic energy and momentum ⬭

B kinetic energy and Young modulus ⬭

C work done and the moment of a couple ⬭

D work done and pressure ⬭

(Total 1 mark)

Q10.

A mass M is suspended from a spring. When the mass is at rest at the equilibrium position, the elastic potential energy stored is E.
An extra mass of $2M$ is added to the spring and the spring extends while still obeying Hooke's law.

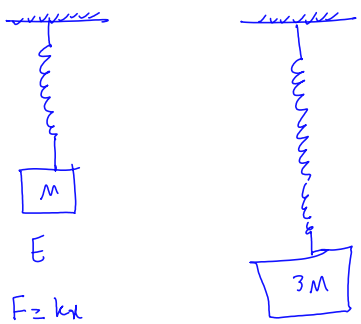
What is the total elastic energy stored when the system is at rest at the new equilibrium position?

A $2E$ ⬭

B $3E$ ⬭

C $4E$ ⬭

D $9E$ ⬭



$E = \frac{1}{2} k x^2$

$F = kx$

$E = \frac{1}{2} F x$

E

$F = kx$

$E_1 = \frac{1}{2} k x_1^2$

$x_1 = \frac{mg}{k}$

$x_2 = \frac{3mg}{k} \rightarrow E_2 = \frac{1}{2} k (3x_1)^2 = 9E_1$

(Total 1 mark)

Q11.

Two wires P and Q are made of the same material and have the same cross-sectional area.
P has an original length L and is subject to a tensile force F. P extends a distance x.
Q has an original length $2L$ and is subject to a tensile force $2F$.

Which statement is correct?

A The stress in P and the stress in Q are the same. ⬭

B The extension of Q is $2x$. ⬭

C The strain of Q is double the strain of P. ⬭

D The value of $\frac{\text{stress}}{\text{strain}}$ for P is half that of Q. ⬭

(Total 1 mark)