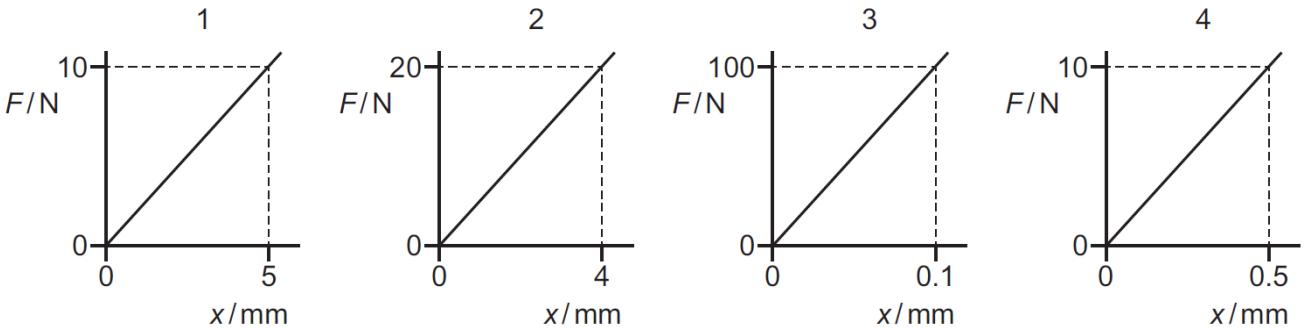
Deformation of Solid – 2021 AS

1. June/2021/Paper_11/No.19

The spring constants of four springs are determined by plotting the following graphs of force F against extension x.



Which order of the graphs shows **decreasing** spring constants?

A 2 → 1 → 3 → 4

B 3 → 4 → 2 → 1

C 4 → 2 → 1 → 3

D 4 → 3 → 2 → 1

2. June/2021/Paper_12/No.19

A steel bar of circular cross-section is under tension T, as shown.

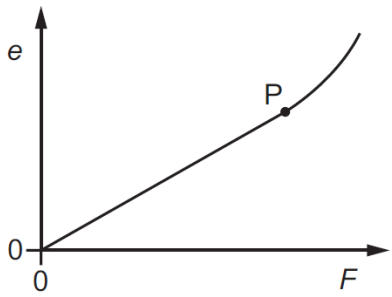
The diameter of the wide portion is double the diameter of the narrow portion.

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

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

3. June/2021/Paper_11/No.20

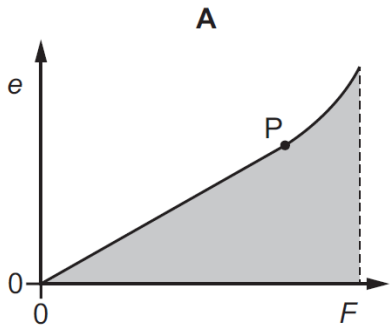
Forces are applied to the ends of a rod so that its length increases. The variation with force F of the extension e of the rod is shown.



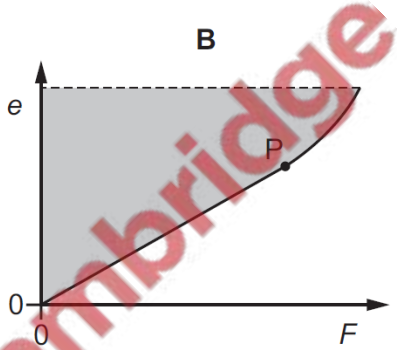
The point P is the elastic limit.

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

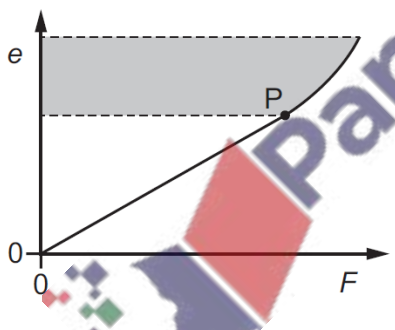
A



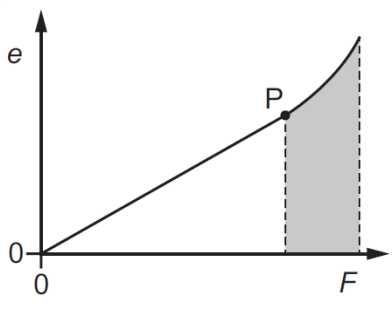
B



C



D



4. June/2021/Paper_12/No.20

Two guitar strings are stretched by tensile forces.

String X is stretched by a tensile force F that causes an extension x.

String Y is stretched by a tensile force $2F$ that causes an extension $2x$.

The strings obey Hooke's law.

What is the ratio $\dfrac{\text{strain energy in stretched string X}}{\text{strain energy in stretched string Y}}$?

A 4 **B** 2 **C** $\frac{1}{2}$ **D** $\frac{1}{4}$

5. Nov/2021/Paper_11/No.19

A metal wire, of cross-sectional area A and unstretched length l, is subjected to stress σ. As a result it has strain ε.

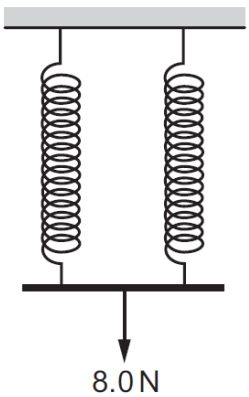
Which expression gives the Young modulus of the metal?

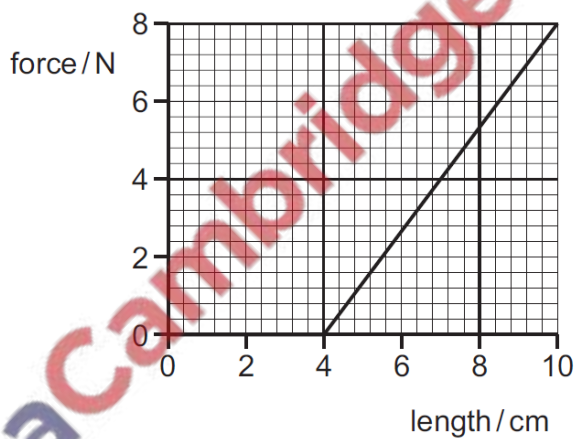
A $\frac{\varepsilon}{\sigma}$ **B** $\frac{\varepsilon A}{\sigma l}$ **C** $\frac{\sigma}{\varepsilon}$ **D** $\frac{\sigma l}{\varepsilon A}$

6. Nov/2021/Paper_11/No.20

Two identical springs are connected in parallel.

A weight of 8.0 N is hung from the combination, as shown.





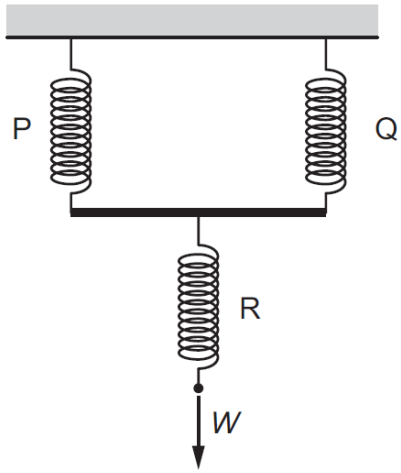
The graph shows the variation with length of the force applied to **one** of the springs.

What is the strain energy in **one** of the springs?

A 0.060 J **B** 0.12 J **C** 0.14 J **D** 0.24 J

7. Nov/2021/Paper_12/No.21

Three springs are arranged vertically as shown.



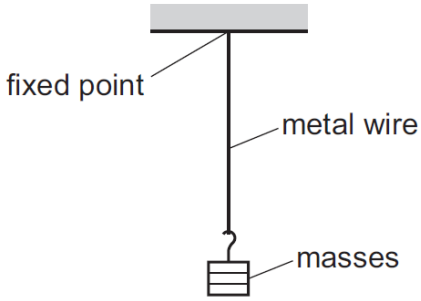
Springs P and Q are identical and each has spring constant k. Spring R has spring constant $3k$.

What is the increase in the overall length of the arrangement when a force W is applied as shown?

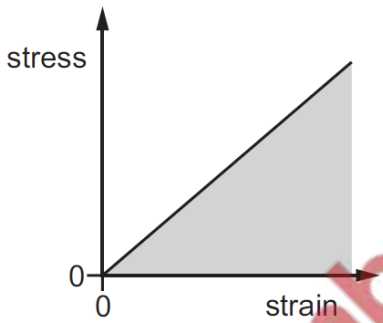
A $\frac{5}{6}\frac{W}{k}$ **B** $\frac{4}{3}\frac{W}{k}$ **C** $\frac{7}{2}kW$ **D** $4kW$

8. Nov/2021/Paper_12/No.22

A length of metal wire is attached to a fixed point and hangs vertically. Masses are then suspended from the wire. Assume that the cross-sectional area of the wire remains constant.



A stress–strain graph for the wire is plotted, as shown.



What is represented by the shaded area under the graph?

A strain energy in the wire

B $\dfrac{\text{strain energy in the wire}}{\text{cross-sectional area of the wire}}$

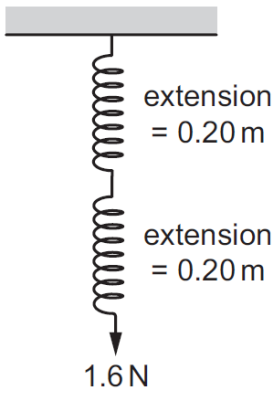
C $\dfrac{\text{strain energy in the wire}}{\text{original length of the wire}}$

D $\dfrac{\text{strain energy in the wire}}{\text{original volume of the wire}}$

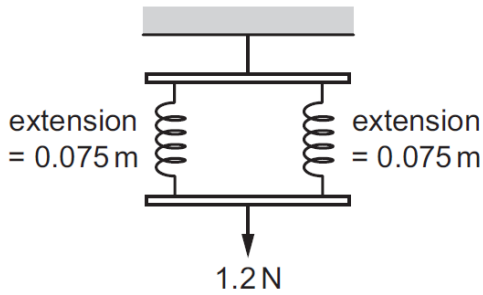
9. Nov/2021/Paper_13/No.20

Which spring combination has an overall spring constant of $8.0\,N\,m^{-1}$?

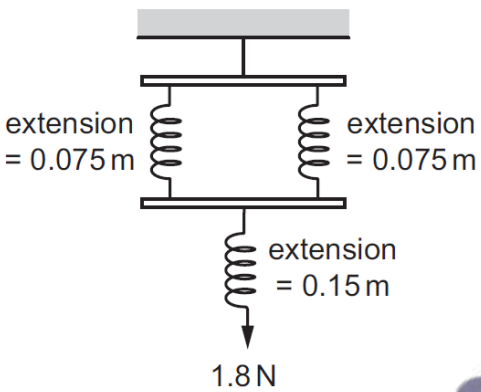
A



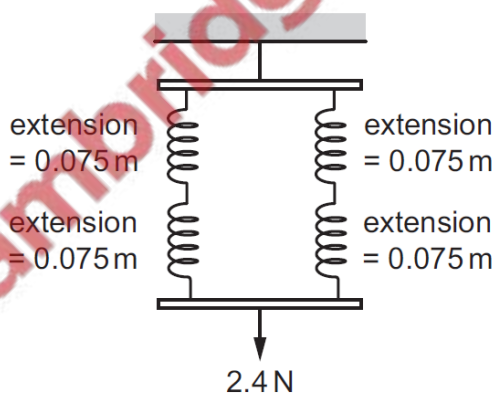
B



C



D

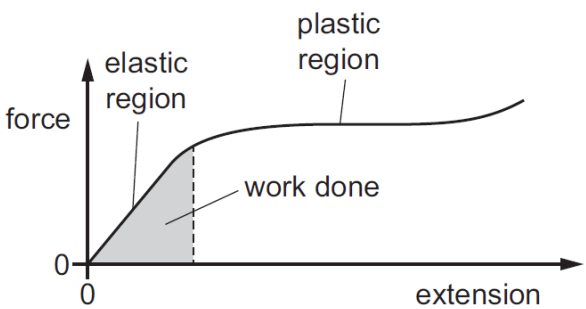


10. Nov/2021/Paper_13/No.21

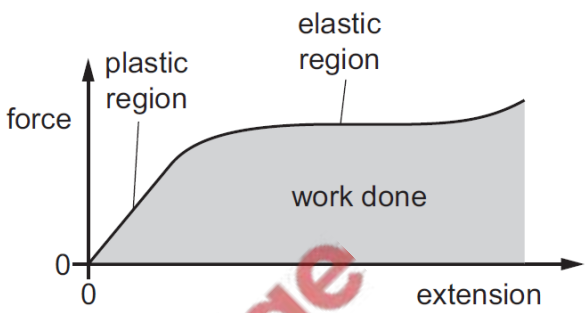
A metal wire is stretched to breaking point and the force–extension graph is plotted.

Which graph is correctly labelled with the elastic region, the plastic region and the area representing the work done to stretch the wire until it breaks?

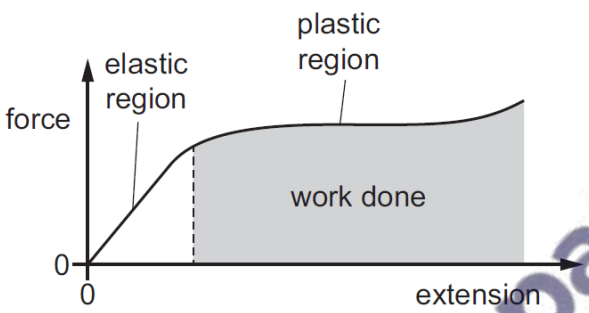
A



B



C



D