

A-Level Physics

Name: _____ Score: _____

1. A load of 12 N stretches a spring by 0.040 m. What is the spring constant?
_____ N/m
2. Past the elastic limit, an object returns to its original length when the load is removed.
☐ True ☐ False
3. Within Hooke's law, doubling the load doubles the extension.
☐ True ☐ False
4. The energy stored in a stretched material equals the _____ under the force-extension graph.

5. The straight-line law $F = kx$ holds only up to the:
☐ limit of proportionality
☐ centre of gravity
☐ breaking point
☐ plastic region
6. A spring of constant $200 \frac{\text{N}}{\text{m}}$ is stretched by 0.10 m. How much elastic PE is stored?
_____ J
7. A complete statement of Hooke's law contains which of these? Select **all** that apply.
☐ the constant of proportionality is the spring constant
☐ provided the limit of proportionality is not exceeded
☐ provided the material is a metal
☐ the extension is directly proportional to the applied force
Tick every correct option.
8. Two springs are pulled with the **same force**. The softer spring (smaller k) stores:
☐ the same energy
☐ less energy
☐ more energy
☐ no energy
9. Two identical springs (each constant k) are joined in series. The combined spring constant is:

☐ $2k$

☐ $4k$

☐ $\frac{1}{2}k$

☐ k

10. When a stretched spring is released onto a mass, its elastic PE becomes _____ energy.

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1. **300 N/m**

$$k = \frac{F}{x} = \frac{12}{0.040} = 300 \frac{\text{N}}{\text{m}}.$$

2. **False**

No – in the plastic region a permanent extension stays after unloading.

3. **True**

Yes – $F = kx$ is a straight-line (proportional) relationship, so x scales with F .

4. **area**

Work done = area under the force–extension graph (a triangle for a Hooke material).

5. **limit of proportionality**

Beyond the limit of proportionality the F – x graph curves and $F = kx$ no longer applies.

6. **1 J**

$$E_P = \frac{1}{2}kx^2 = \frac{1}{2} \times 200 \times 0.10^2 = 1.0 \text{ J}.$$

7. **provided the limit of proportionality is not exceeded; the extension is directly proportional to the applied force**

The condition is part of the law, not an extra. Rubber obeys nothing like it, and a metal stops obeying it beyond the straight line.

8. **more energy**

Same F , smaller $k \rightarrow$ larger extension $x \rightarrow$ larger area $\frac{1}{2}Fx$, so more energy is stored.

9. **$\frac{1}{2}k$**

$$\frac{1}{k_{\text{total}}} = \frac{1}{k} + \frac{1}{k} = \frac{2}{k}, \text{ so } k_{\text{total}} = \frac{1}{2}k - \text{the pair stretches more easily.}$$

10. **kinetic**

Set $\frac{1}{2}kx^2 = \frac{1}{2}mv^2$ (plus mgh if it rises) to find the speed.