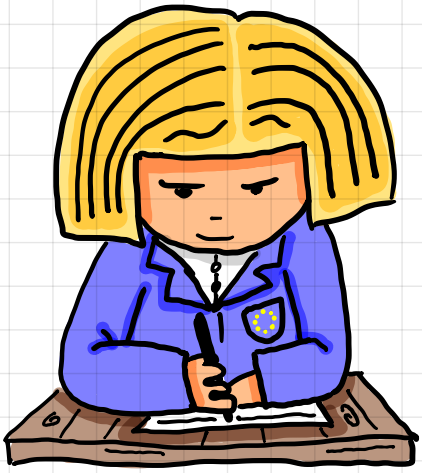


Elastic potential energy

1. Define elastic potential energy.

2. Calculate elastic potential energy in a stretched object e.g. a spring or elastic band.

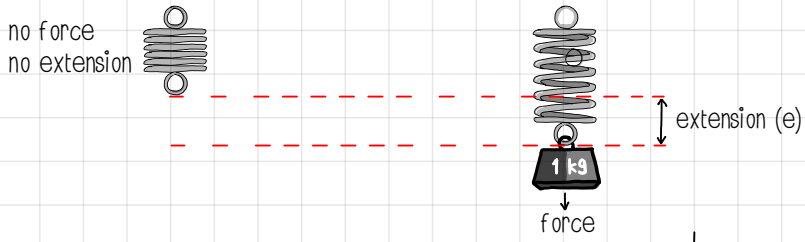
Elastic potential energy

When a force is applied to a spring, the spring will stretch and change the length of the spring.

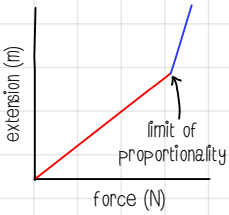
Energy is transferred when stretching the spring. This energy is stored and the stored energy is called elastic potential energy.

Extension

When a force is applied to a spring the change in length is called the extension.



If extension is plotted against force, a straight line is produced which passes through zero. This shows that extension is directly proportional to the force



If too large a force is applied to the spring the extension is no longer proportional to the force. The spring will no longer return to its original length. This point is called the limit of proportionality.

Calculating elastic potential energy

The equation to calculate elastic potential energy is:

Elastic potential energy = 1/2 x spring constant x extension^2 or $E_e = \frac{1}{2}ke^2$

joules (J) — Newtons/metre (N/m) — metres (m)

You DO NOT need to learn this equation for the exam

Spring constant

The spring constant is a measure of how easy it is to stretch a spring. A **high** spring constant is **hard** to stretch and a **low** spring constant is **easy** to stretch. The spring constant is unique to the material used to make the spring.

Elastic potential energy...

Calculating elastic potential energy

A mass is attached to a spring. The spring extends 20cm. Calculate the elastic potential energy stored in the spring (k = 100N/m).

1. First, convert the length in cm into length in m.

   20cm ÷ 100 = 0.2m

2. Use the equation $E_e = \frac{1}{2}ke^2$

3. Substitute the values into the equation. $E_e = 0.5 \times 100 \times (0.2)^2$

4. It is a good idea to calculate 0.2^2 first. $0.2^2 = 0.04$

5. $E_e = 0.5 \times 100 \times 0.04$

6. $E_e = 2$

7. Do not forget to add the units. $E = 2J$

Practice question #1

A mass is attached to a spring causing it to stretch 10cm. The spring now stores 20J of elastic potential energy. Calculate the spring constant of the spring.

1. First, convert the length in cm into length in m. 10cm ÷ 100 = 0.1m

2. Use the equation $E_e = \frac{1}{2}ke^2$

3. Substitute the values into the equation. $20 = 0.5 \times k \times (0.1)^2$

4. It is a good idea to calculate 0.1^2 first. $0.1^2 = 0.01$

5. $20 = 0.5 \times k \times 0.01$

6. Simplify the right side of the equation. $20 = 0.005k$

7. To calculate k, divide the number on the left by the number on the right. $k = 20 \div 0.005$

8. $k = 4000$ N/m

watch video