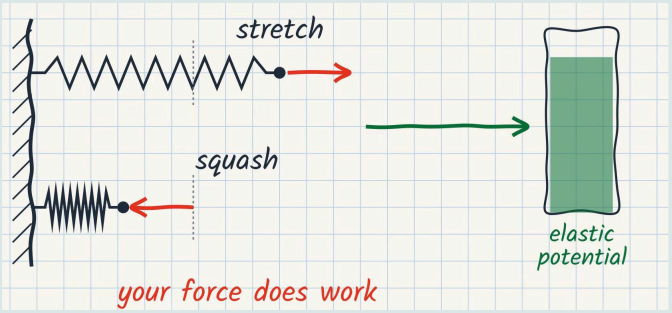
Elastic potential energy

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

sansara academy
Summary sheet

1 The elastic store



- Stretching or squashing a spring means a force **does work** on it.
- So energy moves into the spring's **elastic potential** store. When it springs back, the energy moves on, often to a kinetic store.

2 The equation

elastic potential energy = ½ × spring constant × (extension)²

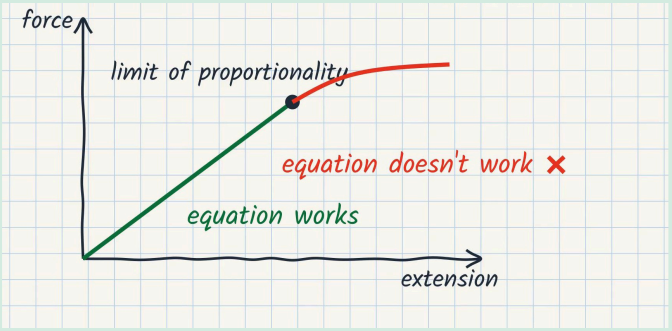
$$E_e = \frac{1}{2} k e^2$$

E in joules (J)
k in newtons per metre (N/m)
e in metres (m)

on the equation sheet

- **k** is the spring constant (how stiff the spring is). **e** is the extension (how far it is stretched).
- Square the extension first, then multiply. Example: k = 40 N/m, e = 10 cm = 0.1 m gives ½ × 40 × 0.01 = 0.2 J.

3 The limit



- Stretched too far, a spring is permanently stretched. This starts at the **limit of proportionality**.
- The equation only works up to that limit.

4 Following the energy



- Elastic → kinetic → gravitational: the total stays the same (0.25 J for the toy).
- Height = energy ÷ (m × g) = 0.25 ÷ 0.196 = 1.3 m (2 s.f.). In real life it goes a little lower: some energy goes to the surroundings.

$E_e = \frac{1}{2} k e^2$

elastic potential energy = ½ × spring constant × (extension)²

E_e	elastic potential energy	joule (J)
k	spring constant	newton per metre (N/m)
e	extension	metre (m)

Works only up to the limit of proportionality. Convert cm to m first.

Exam tip
Extension is the change in length: e = stretched length − original length.

Check yourself

1. A spring with k = 100 N/m is stretched by 0.2 m. How much energy is stored?
2. What happens if a spring is stretched past its limit of proportionality?

Answers: 1. ½ × 100 × 0.2² = ½ × 100 × 0.04 = 2 J. 2. It doesn't return to its original shape, and the equation no longer applies.