

# Deformation of solids

Cambridge International AS &amp; A Level Physics

Unlike IGCSE, 9702 gives you a data sheet: it is page 2 of Papers 1, 2 and 4, with more formulae on page 3 of Paper 4. Everything marked GIVEN is printed for you; everything else you must recall. Compiled by GioPhysics from the published syllabus. This is an independent study aid, not a Cambridge document; the official syllabus is the authority.

## 6.1 Stress and strain

AS

### Hooke's law

$$F = kx$$

$$k = F / x \quad \cdot \quad x = F / k$$

F — load (N)

k — spring constant (N m<sup>-1</sup>)

x — extension (m)

AS

### Tensile stress

$$\sigma = F / A$$

 $\sigma$  — stress (Pa)

F — force (N)

A — cross-sectional area (m<sup>2</sup>)

AS

### Tensile strain

$$\epsilon = x / L$$

 $\epsilon$  — strain (a ratio, no unit)

x — extension (m)

L — original length (m)

AS

### The Young modulus

$$E = \sigma / \epsilon$$

E — Young modulus (Pa)

 $\sigma$  — stress (Pa) $\epsilon$  — strain

## 6.2 Elastic and plastic behaviour

AS

### Elastic potential energy

$$EP = \frac{1}{2}Fx = \frac{1}{2}kx^2$$

EP — strain energy (J)

F — load (N)

x — extension (m)

k — spring constant (N m<sup>-1</sup>)

Within the limit of proportionality. It is the area under a force-extension graph.