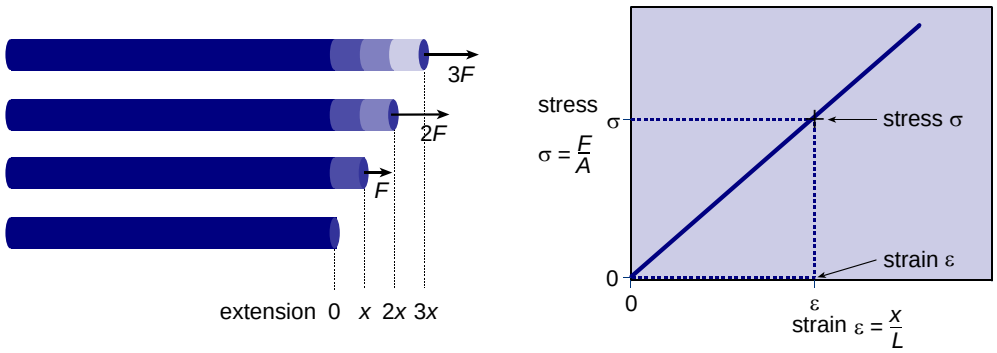
TAP 228- 1: The Young modulus

The Young modulus tells us how a material behaves under stress.

The Young modulus 1

Many materials stretch in a uniform way. Increase the stretching force in equal steps, and the extension increases in equal steps too, in proportion. That is, the strain is proportional to the stress producing it. This is the same as Hooke's law – the stretching of a spring is proportional to the stretching force you apply.



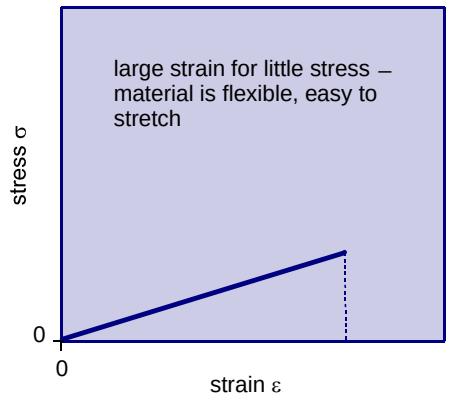
strain ∝ stress ..... graph is straight line

$$\text{ratio } \frac{\text{stress}}{\text{strain}} \text{ is constant}$$

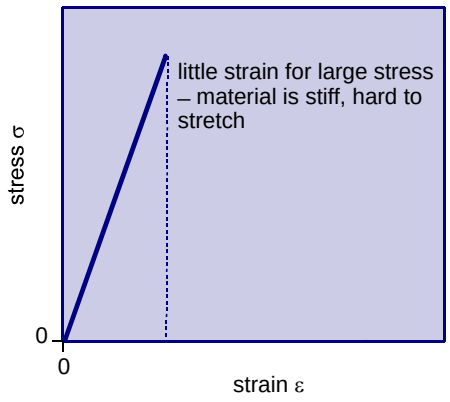
$$\text{Young modulus} = \frac{\text{stress}}{\text{strain}}$$

$$E = \frac{\sigma}{\varepsilon}$$

The Young modulus 2



e.g. polymer



e.g. diamond, steel

The Young modulus is *large* for a stiff material (large stress, small strain). Graph is steep.

The Young modulus is a property of the material not the specimen. Units of the Young modulus MN m^{-2} or MPa; for stiff materials GN m^{-2} or GPa. Same as units of stress, because strain is a ratio of two lengths, e.g. extension is 1% of length

Practical advice

This physics box could be used as an OHT for discussion.

Alternative approaches

The page could be printed out for students to add to their notes for revision.

External references

This activity is taken from Advancing Physics Chapter 4, 50O