Hooke's law

- **Hooke's law**

  force applied = stiffness (Nm^{-1}) x extension (m)

  $$\Delta F = k\Delta x$$

- **Elastic strain energy**

  def. the work done in deforming a material sample before it reaches its elastic limit

  $$\Delta E_{el} = \frac{1}{2} F \Delta x$$

Young modulus

- **Stress (σ)**

$$\sigma\,(Pa) = \frac{F\ (N)}{A\ (m^2)}$$

- **Strain (ε)**

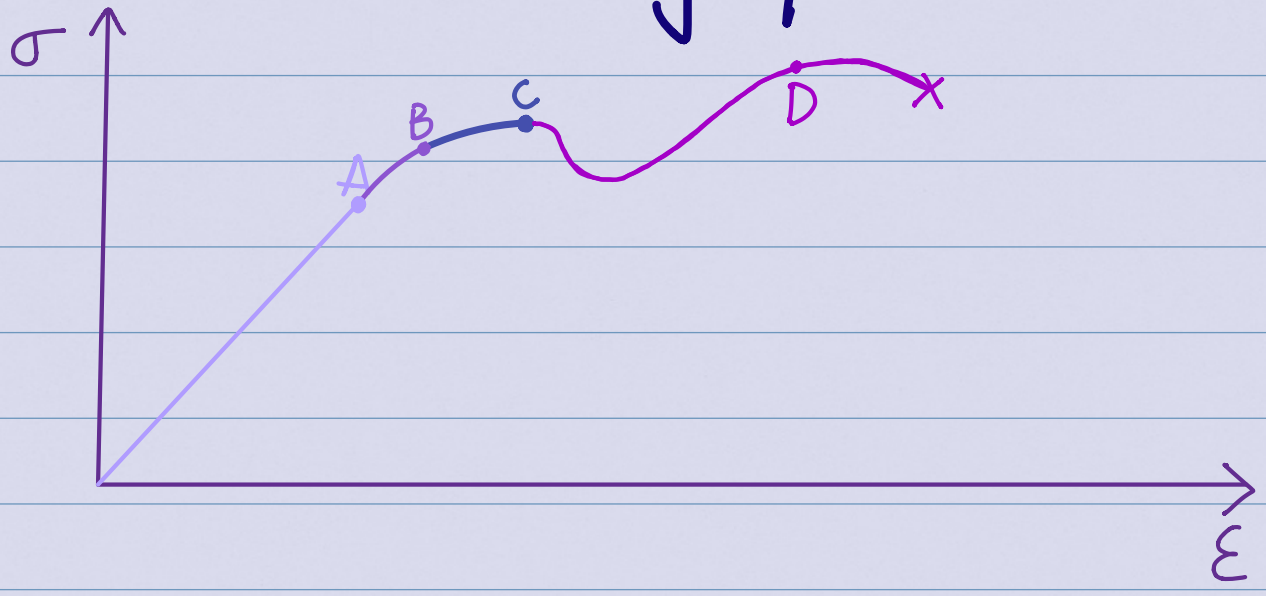
$$\varepsilon = \frac{\Delta x}{x}$$

- **Young modulus**

def. the constant stiffness of a material deforms under a certain stress

$$E\,(Pa) = \frac{\sigma}{\varepsilon}$$

- **Stress-strain graph**



A : limit of proportionality

stress is proportional to strain before this point

B: elastic limit

beyond the point, material is permanently deformed and will not return to its original shape

C: yield point

strain increase a lot with little increase in stress

D: Ultimate tensile stress

Material property

Hard : not easy to scratch or indent

Malleable : large plastic deformation
when force removed the material is permanently deformed

Elastic: when force removed it can return to original shape

Brittle: breaks just after proportionality limit

Stiff:

Tough: undergoes a lot of plastic deformation before breaking

Strong:

Ductile:

eg. copper.