

A wire of cross-sectional area of 0.00006m^2 and length 50cm stretches by 0.2mm under a load of 3000N. Calculate young's modulus for the wire.

Solution.

$$S = 0.00006\text{m}^2 = 6 \cdot 10^{-5}\text{m}^2, l_0 = 50\text{cm} = 0.50\text{m}, \Delta l = 0.2\text{mm} = 0.2 \cdot 10^{-3}\text{m}, F = 3000\text{N}$$

$$E - ?$$

Young's modulus, E, can be calculated by dividing the tensile stress by the tensile strain:

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

$$\sigma = \frac{F}{S} \text{ - the tensile stress;}$$

$$\varepsilon = \frac{\Delta l}{l_0} \text{ - the tensile strain.}$$

$$E = \frac{Fl_0}{S\Delta l}$$

$$E = \frac{3000 \cdot 0.50}{6 \cdot 10^{-5} \cdot 0.2 \cdot 10^{-3}} = 1.25 \cdot 10^{11} \left(\frac{N}{m^2} \right).$$

Answer:

$$E = 1.25 \cdot 10^{11} \frac{N}{m^2}$$