

A wire of cross-sectional area of  $0.00006\text{m}^2$  and length  $50\text{cm}$  stretches by  $0.2\text{mm}$  under a load of  $3000\text{N}$ . 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:

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

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

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

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

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

**Answer:**

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