

3 A wire has length L and cross-sectional area A . The wire is made from a metal that has Young modulus E and resistivity ρ .

(a) Define the Young modulus of a material.

.....
..... [1]

(b) (i) State an expression, in terms of some or all of L , A , E and ρ , for the resistance R_0 of the wire.

$R_0 =$ [1]

(ii) Show that the spring constant k_0 of the wire is given by

$$k_0 = \frac{EA}{L}.$$

[2]

(d) Copper has a resistivity of $1.8 \times 10^{-8} \Omega \text{m}$ and a Young modulus of $1.3 \times 10^{11} \text{Pa}$.

A copper wire of diameter 1.6 mm has a resistance of 0.034Ω .

(i) Show that the length of the wire is 3.8 m.

[1]

(ii) Use the equation in (b)(ii) to determine the spring constant of the wire.

spring constant = Nm^{-1} [2]

[Total: 9]