Solutions

Each answer shows the steps, then the **result**.

2.1

- definition of resistance:
$$R = \frac{V}{I} = \frac{12\ \text{V}}{3.0\ \text{A}}$$
- $R = \mathbf{4.0}\ \Omega$

2.2

- it doubles ($R \propto L$)

2.3

- resistivity is a property of the material alone; resistance also depends on the object's length and cross-sectional area

2.4

- how strongly the object opposes the movement of electric charge

3.1 B

- $\dfrac{\rho L}{A}$.

3.2 B

- material.

3.3

(a)

- resistance from resistivity:
$$R = \frac{\rho L}{A} = \frac{(1.7 \times 10^{-8}\ \Omega\,\text{m})(2.0\ \text{m})}{1.0 \times 10^{-6}\ \text{m}^2}$$
- $R = \mathbf{0.034}\ \Omega$

(b)

- $R = \rho L/A$: doubling L doubles R, halving A doubles it again:
$$R' = \frac{\rho\,(2L)}{A/2} = 4R = 4 \times 0.034\ \Omega$$
- $R' = \mathbf{0.136}\ \Omega$

3.4

(a)

- the slope of an I-V graph is $1/R$; at 8.0 V, $I = 0.40$ A
- $R = \dfrac{8.0}{0.40} = \mathbf{20}\ \Omega$

(b)

- **Y**: its line has the smaller slope, so a smaller current flows for each volt

(c)

- $\rho = \dfrac{RA}{L} = \dfrac{20 \times 1.0 \times 10^{-7}}{2.0}$
- $\rho = \mathbf{1.0 \times 10^{-6}}\ \Omega\,\text{m}$

3.5

- the current converts electrical energy to thermal energy, so the filament's temperature rises
- the resistivity of a metal increases with temperature, so the resistance rises

3.6 A

- the resistivity of a conductor typically increases with temperature

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