

Problems

1. Compute the resistance of a hardened copper rod 2 meters long and 8 mm in diameter if the resistivity of the material is 1.756×10^{-8} ohm-meters. $R = \rho \frac{L}{A} = \frac{(1.756 \times 10^{-8} \Omega \cdot m)(2m)}{\pi (0.004m)^2} = 7 \times 10^{-4} \Omega$

2. A 0.500-meter length of wire with a cross-sectional area of 3.14×10^{-6} meters squared is found to have a resistance of 2.53×10^{-3} ohms. According to the resistivity chart, from what material is the wire made? $\rho = \frac{RA}{L} = \frac{(2.53 \times 10^{-3})(3.14 \times 10^{-6})}{0.5} = 1.59 \times 10^{-8} \Omega \cdot m$ **SILVER**

3. The resistance of a uniform copper wire 50.0 meters long and 1.15 mm in diameter is 0.830 ohms at 20°C . What is the resistivity of the copper at this temperature? $\rho = \frac{RA}{L} = \frac{(0.83)(1.04 \times 10^{-6})}{50} = 1.72 \times 10^{-8} \Omega \cdot m$

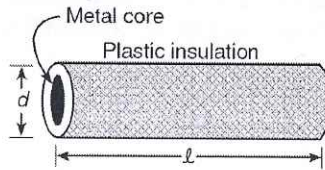
4. At 20°C , 33 meters of copper wire has a resistance of 0.639 ohms. What is the resistance of 165 meters? $\frac{165}{33} = 5 \times \text{longer so } R \text{ will be } 5 \times \text{ more } 0.639 \times 5 = 3.195 \Omega$

5. A 200 m long aluminum wire has the same resistance and cross-sectional area as a carbon wire. What is the length of the carbon wire? $RA = \rho L = (2.82 \times 10^{-8})(200) = 5.64 \times 10^{-6} = \frac{\rho}{L} L = (3.5 \times 10^{-5}) L \Rightarrow L = 0.161m$

6. A wire of radius R and length L has a resistance of 14Ω . What is the resistance of a wire made from the same material that has twice the radius and five times the length?

$$14 \Omega = \frac{\rho L}{\pi R^2} \quad R? = \frac{5\rho \cdot L}{4\pi R^2} \quad R = 14 \Omega \cdot 1.25 = 17.5 \Omega$$

Multiple Choice Questions



7. Plastic insulation surrounds a wire having diameter d and length l as shown below. A decrease in the resistance of the wire would be produced by an increase in the

- A) length l of the wire
- B) diameter d of the wire
- C) temperature of the wire
- D) thickness of the plastic insulation

$$R = \rho \frac{L}{A}$$

8. A manufacturer recommends that the longer the extension cord used with an electric drill, the thicker (heavier gauge) the extension cord should be. This recommendation is made because the resistance of a wire varies

- A) directly with length and inversely with cross-sectional area
- B) inversely with length and directly with cross-sectional area
- C) inversely with both length and cross-sectional area
- D) directly with both length and cross-sectional area

9. A complete circuit is left on for several minutes, causing the connecting copper wire to become hot. As the temperature of the wire increases, the electrical resistance of the wire

- A) decreases
- B) remains the same
- C) increases

13. The four wires shown below are made from the same resistive material. Rank the resistance in the wires from high to low. Explain your answer.

high

B,

A,

D,

low

C

