Name ______Answer Key_________ Date ____________________
Honors Physics Electric Circuits WS #3H
Period __________ Mrs. Nadworny

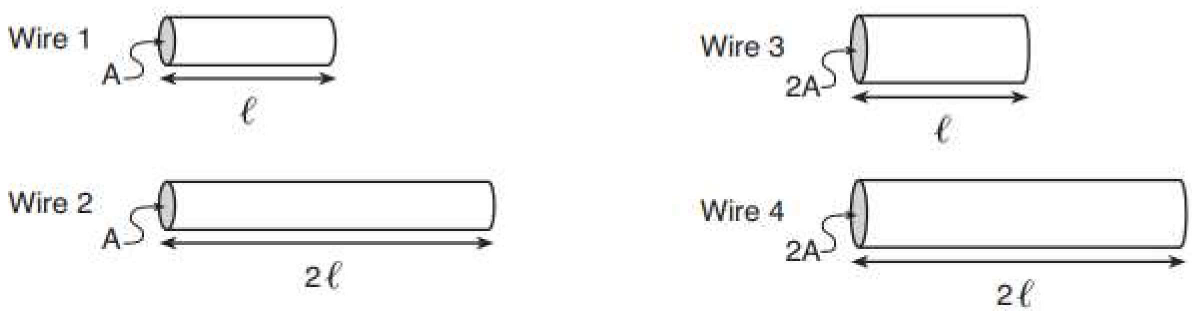
Resistivity

Directions: Read online textbook pages 694 – 699 and p. 701. Solve the following problems using the GUESS method and proper significant figures. Be sure to show ALL work.

1. Compared to the resistivity of a 0.4-meter length of 1-millimeter-diameter copper wire at 0°C, the resistivity of a 0.8-meter length of 1-millimeter-diameter copper wire at 0°C is

   (A) one-fourth as great (B) one-half as great (C) the same (D) four times greater

2. The diagrams below represent four pieces of copper wire at 20.°C. For each piece of wire, ℓ represents a unit of length and A represents a unit of cross-sectional area.



The piece of wire that has the greatest resistance is

   (A) wire 1 (B) wire 2 (C) wire 3 (D) wire 4

3. 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) increases (C) remains the same

4. A tungsten wire has resistance R at 20°C. A second tungsten wire at 20°C has twice the length and half the cross-sectional area of the first wire. In terms of R, the resistance of the second wire is

   (A) $\frac{R}{2}$ (B) R (C) 2R (D) 4R

5. After an incandescent lamp is turned on, the temperature of its filament rapidly increases from room temperature to its operating temperature. As the temperature of the filament increases, what happens to the resistance of the filament and the current through the filament?

   (A) The resistance increases and the current decreases.
   (B) The resistance increases and the current increases.
   (C) The resistance decreases and the current decreases.
   (D) The resistance decreases and the current increases

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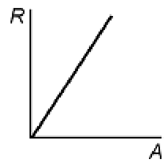
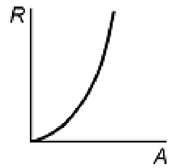
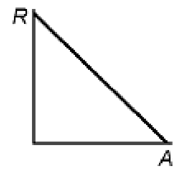
6. Several pieces of copper wire, all having the same length but different diameters, are kept at room temperature. Which graph best represents the resistance, R, of the wires as a function of their cross-sectional area, A?

(A)


(B)


(C)


(D)


7. Calculate the resistance of an aluminum wire that is 8.0 meters long with a *diameter* of 1.5 mm at 20^0 C.

$$R = \frac{\rho L}{A} = \frac{2.82\times10^{-8}\,\Omega\cdot m(8.0m)}{\pi(0.75\times10^{-3}m)^2} = 0.13\Omega$$

$$A = \pi r^2 = \pi(0.75\times10^{-3}m)^2 = 1.8\times10^{-6}m^2$$

$$R = \frac{\rho L}{A} = \frac{2.82\times10^{-8}\,\Omega m(8.0m)}{1.8\times10^{-6}m^2} = 0.13\Omega$$

8. What is the resistance of a 10.0 meter long tungsten wire, at 20^0 C, having a cross sectional area of 2.0×10^{-6} m^2?

$$R = \frac{\rho L}{A} = \frac{(5.60\times10^{-8}\,\Omega\bullet m)(10.0m)}{2.0\times10^{-6}m^2} = 0.28\Omega$$

9. A 25.0-meter length of platinum wire with a cross-sectional area of 3.50×10^{-6} meter^2 has a resistance of 0.757 ohm at 20°C. Calculate the resistivity of the wire.

$$\rho = \frac{RA}{L} = \frac{0.757\ \Omega\cdot m(3.50\times10^{-6}\ m^2)}{25.0\ m} = 1.06 \times 10^{-7}\ \Omega m$$

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10. One particular lightbulb has a 0.22-meter length of the tungsten wire used as its filament. This tungsten wire filament has a resistance of 19 ohms at a temperature of 20°C. The tungsten wire filament has a resistance of 240 ohms when this bulb is operated at a potential difference of 120 volts. Calculate the cross-sectional area of this tungsten wire filament.

$$A = \frac{\rho L}{R} = \frac{5.60\times10^{-8}\Omega\cdot m(0.22\ m)}{19\ \Omega} = 6.5 \times 10^{-10}\ m^2$$

Answers in size order: 6.5×10^{-10}, 1.06×10^{-7}, 0.13, 0.28