

Physics 103 Quiz #12, Thursday (4/11/2018)

Show all work in order to obtain points for problems

Name: _____

1. (2 pts.) If a metallic wire of cross sectional area $3.0 \times 10^{-6} \text{ m}^2$ carries a current of 6.0 A and has a mobile charge density of $4.24 \times 10^{28} \text{ carriers/m}^3$, what is the average drift velocity of the mobile charge carriers? (charge value = $1.6 \times 10^{-19} \text{ C}$)

- a. $3.4 \times 10^3 \text{ m/s}$
- b. $1.7 \times 10^3 \text{ m/s}$
- c. $1.5 \times 10^{-4} \text{ m/s}$
- d. $2.9 \times 10^{-4} \text{ m/s}$

$$I = nqV_d A$$

$$V_d = \frac{I}{nqA} = \frac{6.0 \text{ A}}{4.24 \times 10^{28} (1.6 \times 10^{-19}) 3.0 \times 10^{-6}} = 2.9 \times 10^{-4}$$

2. (2 pts.) A 60-W light bulb is in a socket supplied with 120 V. What is the current in the bulb?

- a. 0.50 A
- b. 2.0 A
- c. 60 A
- d. 7200 A

$$P = I^2 R = IV$$

$$I = P/V = \frac{60}{120} = 0.5$$

3. (4 pts.) Two wires with the same resistance have the same diameter but different lengths. If wire 1 has length L_1 and wire 2 has length L_2 , how do L_1 and L_2 compare if wire 1 is made from copper and wire 2 is made from aluminum? The resistivity of copper is $1.7 \times 10^{-5} \Omega \cdot \text{m}$ and the resistivity of aluminum is $2.82 \times 10^{-5} \Omega \cdot \text{m}$.

- a. $L_1 = 1.7 L_2$
- b. $L_1 = 0.60 L_2$
- c. $L_1 = 2.8 L_2$
- d. $L_1 = 0.36 L_2$

$$R_1 = \frac{\rho L_1}{A_1}$$

$$R_2 = \frac{\rho L_2}{A_2}$$

$$A_1 = A_2$$
$$R_1 = R_2$$

$$\frac{R_1}{R_2} = \frac{\rho L_1 / A_1}{\rho L_2 / A_2}$$

$$L_1 = \frac{\rho_2}{\rho_1} L_2 = \frac{2.82 \times 10^{-5}}{1.7 \times 10^{-5}} L_2$$
$$L_1 = 1.7 L_2$$