

Key

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of scores - 144
Mean - 17.0
S.d. - 7.2

PROBLEM 3B

Copper has a density of 8.92 g/cm^3 and an atomic mass of 63.6. Assume that it has one free electron per atom. If a copper wire of cross section $3 \times 10^{-6} \text{ m}^2$ carries a current of 10.0 amperes find (a) the drift velocity (b) the current density.

$$a) J = n_e v_d = \frac{I}{A}$$

$$3 \times 10^{-6} \text{ m}^2 = 3 \times 10^{-2} \text{ cm}^2$$

$$v_d = \frac{I}{n_e A}$$

$$n = \frac{N_A}{63.6} \cdot 8.92 = \frac{6.022 \times 10^{23}}{63.6} \cdot 8.92 = 8.45 \times 10^{22} \text{ atoms/cm}^3$$

$$v_d = \frac{10}{8.45 \times 10^{22} (1.6 \times 10^{-19}) (3 \times 10^{-2})} = 2.47 \times 10^{-2} \approx 2 \times 10^{-2} \text{ cm/sec} = 1 \text{ sig. Fig.} \\ = 2 \times 10^{-4} \text{ m/sec.}$$

$$b) J = \frac{I}{A}$$

$$J = \frac{10.0}{3 \times 10^{-6}} = 3.33 \times 10^6 \text{ A/m}^2 = 3 \times 10^6 \text{ A} - 1 \text{ sig. Fig.}$$