Answer on question #84174, Engineering / Electrical Engineering

The density of copper is 3 3 8.93 10 / kg m. . Calculate the number of free electrons per cubic meter and hence their drift velocity when a current is flowing whose density is 21 / A cm . Take Avogadro's number as 23 6.022 10 / atoms mole and the molar mass of cupper is 63.55g

Solution

The number of free electron is:

$$n = \frac{N_A}{M} \cdot m = \frac{N_A}{M} \cdot \rho V = \frac{6.022 \cdot 10^{23} \cdot 8.93 \cdot 10^3 \cdot 1}{63.5 \cdot 10^{-3}} = 0.847 \cdot 10^{29} \text{ free electrons}$$

Their drift velocity is:

$$v = \frac{I/S}{e \cdot n_0} = \frac{10^4}{1.6 \cdot 10^{-19} \cdot 0.847 \cdot 10^{29}} = 0.738 \cdot 10^{-6} \text{ meter/sec}$$

Answer: $n = 0.847 \cdot 10^{29}$ free electrons, $v = 0.738 \cdot 10^{-6}$ meter/sec