1.

$$\text{a)} i = \frac{dq}{dt}$$

$$dq = idt = (5\text{amps})(4 \times 60\text{sec}) = 1200\text{C}$$

$$\text{b)} q = n(Ad)e$$

$$n = \frac{\#\text{electrons}}{\text{unitvolume}}$$

$$1200 = n(1.6 \times 10^{-19})$$

$$n = 7.5 \times 10^{21}$$

8.

$$\text{a) } J = \frac{i}{A} = \frac{i}{\pi d^2/4} = \frac{4(1.2 \times 10^{-10}\text{A})}{\pi(2.5 \times 10^{-3}\text{m})^2} = 2.4 \times 10^{-5}\ \text{A/m}^2$$

$$\text{b) } n = \frac{Nd}{M} = 8.4 \times 10^{22}\ \frac{e}{\text{cm}^3}$$

$$V_d = \frac{J}{Ne} = \frac{2.4 \times 10^{-5}}{(8.4 \times 10^{22})(1.6 \times 10^{-19})}$$

$$V_d = 1.8 \times 10^{-13}\ \frac{\text{cm}}{\text{sec}} = 1.8 \times 10^{-15}\ \frac{\text{m}}{\text{sec}}$$

$$\text{units?} \frac{\left(\frac{\text{amps}}{\text{cm}^2}\right)}{\left(\frac{1}{\text{cm}^3}\right)(\text{coulomb})} = \frac{\text{cm}}{\text{sec}}$$

13.

$$V_d = \frac{i}{nAe}$$

$$V_d = \frac{300}{(8.47 \times 10^{22})(.21)(1.6 \times 10^{-19})} = .105\ \frac{\text{cm}}{\text{sec}}$$

To go .85m takes 807 seconds.

14.

$$I = \frac{V}{R}$$

$$.05 = \frac{V}{2000}$$

$$V = 100\text{volts}$$

20.

$$R = \rho \frac{d}{A} = \rho \frac{d}{\pi r^2}$$

$$\text{New length} = \frac{d}{2}$$

$$\text{New radius} = \frac{r}{2}$$

$$R = \rho \frac{\left(\frac{d}{2}\right)}{\pi\left(\frac{r}{2}\right)^2}$$

$$R = 2\rho \frac{d}{\pi r^2}$$

$$\text{Resistance doubles.}$$

41.

$$a) I = \frac{V}{R} \Rightarrow R = \frac{V}{I}$$

$$R = \frac{120\text{volts}}{I}$$

$$I = ? P = VI$$

$$500 = 120I$$

$$I = 4.2\text{amps}$$

$$R = 28.6\Omega$$

$$b) I = \frac{dq}{dt} = 4.2\text{amps}$$

$$\frac{4.2\text{amps}}{1.6 \times 10^{-19}\text{coul}} = \frac{2.6 \times 10^{19}}{\text{sec}}$$

75.

$$P = EI$$

$$P = \left(8 \times 10^4\right)\left(7 \times 10^{-3}\right)$$

$$P = 560\text{watts}$$

72.

$$\mathbf{R} = \frac{\boldsymbol{\rho}\mathbf{d}}{\mathbf{A}}$$

$$\mathbf{R} = \frac{\left(3\times10^{7}\,\Omega\mathrm{m}\right)\left(10^{4}\,\mathrm{m}\right)}{56\times10^{-4}\,\mathrm{m}^{2}}$$

$$\mathbf{R} = .54\Omega$$