25.2: a) Current is given by \( I = \frac{Q}{t} = \frac{420 \, C}{80 \, s} = 8.75 \times 10^{-2} \, A \).

b) \( I = nqv_dA \)

\[ t_d = \frac{I}{nqA} = \frac{8.75 \times 10^{-2}}{(5.8 \times 10^{28})(1.6 \times 10^{-19} \, C)(\pi(1.3 \times 10^{-3} \, m)^2)} \]

\[ = 1.78 \times 10^{-6} \, m/s. \]

\[ R = \frac{\rho L}{A} \Rightarrow L = \frac{RA}{\rho} = \frac{(1.00 \, \Omega)(\pi/4)(0.462 \times 10^{-3} \, m)^2}{1.72 \times 10^{-8} \, \Omega \cdot m} = 9.75 \, m. \]

25.20: The ratio of the current at 20°C to that at the higher temperature is \( (0.860 \, A)/(0.220 \, A) = 3.909 \). Since the current density for a given field is inversely proportional to \( \rho (\rho = E/J) \), the resistivity must be a factor of 3.909 higher at the higher temperature.

\[ \frac{\rho}{\rho_0} = 1 + \alpha(T - T_0) \]

\[ T = T_0 + \frac{\frac{\rho}{\rho_0} - 1}{\alpha} = 20^\circ C + \frac{3.909 - 1}{4.5 \times 10^{-3}/^\circ C} = 666^\circ C. \]

25.33: a) An ideal voltmeter has infinite resistance, so there would be NO current through the 2.0 \, \Omega resister.

b) \( V_{ab} = \mathcal{E} = 5.0 \, V; \) since there is no current there is no voltage lost over the internal resistance.

c) The voltmeter reading is therefore 5.0 \, V since with no current flowing, it measures the terminal voltage of the battery.

25.48: a) \( I = \mathcal{E}/(R + r) = 12 \, V/10 \, \Omega = 1.2 \, A \Rightarrow P = \mathcal{E}I = (12 \, V)(1.2 \, A) = 14.4 \, W. \)

This is less than the previous value of 24 \, W.

b) The work dissipated in the battery is just: \( P = I^2r = (1.2 \, A)^2(2.0 \, \Omega) = 2.9 \, W. \)

This is less than 8 \, W, the amount found in Example (25.9).

c) The net power output of the battery is 14.4 \, W - 2.9 \, W = 11.5 \, W. This is less than 16 \, W, the amount found in Example (25.9).