Problem 1

(a) $R = \frac{V}{I} = \frac{438\,mV}{2.58A} = \frac{0.438\,V}{2.58\,A} = 0.170\ (\Omega)$

(b) new current doubles

$I' = 2 \times 2.58\ (A) = 5.16\ (A)$

Resistance remains the same $R' = R = 0.17 (\Omega)$

(c) $R = \rho \frac{L}{A}$

$R'' = \rho \frac{(4.6\,L)}{(4.6)^2 A} = \frac{1}{4.6} \rho \frac{L}{A} = 0.217\,R$

$= 0.217 \times (0.170\,\Omega) = 0.037\ (\Omega)$

Problem 2

7-3.12 $P = IV$ $I = \frac{P}{V} = \frac{1400W}{120V} = 11.7\ (A)$

$P = \frac{V^2}{R}$ $R = \frac{V^2}{P} = \frac{(120)^2}{1400} = 10.3\ (\Omega)$

Problem 3

7-3.13 (a) Use $\mathcal{P} = (\Delta V)^2/R$, so $R = (\Delta V)^2/\mathcal{P}$.
For home use, $\Delta V = 120$ V, so $R_{120\text{V}} = 240\ \Omega$.
For car use, $\Delta V = 12$ V, so $R_{12\text{V}} = 2.4\ \Omega$.

(b) The resistance of the bulb for home use is higher.

Problem 4

$$P = \frac{V^2}{R} \qquad R = \frac{V^2}{P} \simeq \frac{(120)^2}{1400} = 10.3\,(\Omega)$$

$$I = \frac{V}{R} = \frac{120}{10.3} = 11.7\,(A)$$

work $\quad W = P \cdot \Delta t = (1400\,W) \cdot (2\,h)$

$$= 1.4\,kW \cdot 2h$$

$$= 2.8\,(kW \cdot h)$$

$$\text{cost} = 2.8\,(kW \cdot h) \cdot (8.9\ \text{cents}/kW \cdot h)$$

$$\simeq 27.7\ \text{cents}$$

Problem 5

Solution:

Known quantities:

Battery nominal rate of 100 A-h.

Find:

a) Charge potentially derived from the battery
b) Electrons contained in that charge.

Assumptions:

Battery fully charged.

Analysis:

a)

$$100A \times 1hr = \left(100\frac{C}{s}\right)(1hr)\left(3600\frac{s}{hr}\right) = 360000\ C$$

b)

charge on electron: $-1.602 \times 10^{-19}\ C$

no. of electrons =

$$\frac{360 \times 10^{3} C}{1.602 \times 10^{-19} C} = 224.7 \times 10^{22}$$