HOMEWORK 5 SOLUTIONS

1. (25.53) a) $\rho = \frac{RA}{L} = 3.65 \times 10^{-8}\ \Omega\cdot m$

b) $I = JA = \frac{EA}{\rho} = 172A$

c) $v_d = \frac{J}{nq} = \frac{E}{\rho nq} = 2.58 \times 10^{-3}\ m/s$

2. (25.65) a) $V_{ab} = \mathcal{E} - Ir \Rightarrow 8.4V = \mathcal{E} - (1.5A)r$

and $9.4V = \mathcal{E} + (3.5A)r$

$\Rightarrow 9.4V = (8.4V + (1.5A)r) + (3.5A)r$

$\Rightarrow r = \frac{9.4V - 8.4V}{5.00A} = 0.2\Omega$

b) $\mathcal{E} = 8.4V + (1.5A)(0.2\Omega) = 8.7V$

3. (25.74) a) Initially: $R_o = V/I_o = 120V / 1.35A = 88.9\Omega$

Finally: $R_f = V/I_f = 120V / 1.23A = 97.6\Omega$

and $R_f/R_o = 1 + \alpha(T_f - T_o) \Rightarrow T_f - T_o = \frac{1}{\alpha}\left(\frac{R_f}{R_o} - 1\right)$

$\Rightarrow T_f - T_o = 217^\circ C \Rightarrow T_f = 217^\circ C + 20^\circ C = 237^\circ C$

b) $P_o = VI_o = (120V)(1.35A) = 162W$

$P_f = VI_f = (120V)(1.23A) = 148W$

4. (26.4) a) False, current divides at junction a

c) True, $V_1 = V_2$, so $I \propto \frac{1}{R}$

b) True, by charge conservation

d) False. $P = IV$. $V_1 = V_2$, but $I_1 \neq I_2$, so $P_1 \neq P_2$.

e) False. $P = IV = \frac{V^2}{R}$. Since $R_2 > R_1$, $P_2 < P_1$

f) True. Potential is independent of path

g) True. Charges lose potential energy (as heat) in R_1

h) False. See answer to (g)

i) False. They are at the <u>same</u> potential.

5. (26.8) $R_{eq} = \left[\left(\frac{1}{3\Omega} + \frac{1}{6\Omega} \right)^{-1} + \left(\frac{1}{12\Omega} + \frac{1}{4\Omega} \right)^{-1} \right] = 5\Omega$

$$I_{total} = \mathcal{E} / R_{total} = 60V / 5\Omega = 12A$$

$$I_{12} = \frac{4}{12+4}(12) = 3A \quad , \quad I_4 = \frac{12}{12+4}(12) = 9A$$

$$I_3 = \frac{6}{3+6}(12) = 8A, \quad I_6 = \frac{3}{3+6}(12) = 4A$$