The total resistance is \( R = \frac{3.00 \text{ V}}{0.600 \text{ A}} = 5.00 \Omega \).

(a) \[ R_{\text{total}} = R - R_{\text{batteries}} = 5.00 \Omega - 0.408 \Omega = 4.59 \Omega \]

(b) \[ \frac{P_{\text{batteries}}}{P_{\text{total}}} = \frac{(0.408 \Omega)(5.00 \Omega)^2}{(5.00 \Omega)^2} = 0.0816 = 8.16\% \]

P28.4 (a) Here \( \epsilon = I (R + r) \), so
\[
I = \frac{\epsilon}{R + r} = \frac{12.6 \text{ V}}{(5.00 \Omega + 0.080 \Omega)} = 2.48 \text{ A}
\]
Then,
\[
\Delta V = IR = (2.48 \text{ A})(5.00 \Omega) = 12.4 \text{ V}
\]

(b) Let \( I_1 \) and \( I_2 \) be the currents flowing through the battery and the headlights, respectively. Then, \( I_1 = I_2 + 35.0 \text{ A} \), and \( \epsilon - I_1 r - I_2 r = 0 \)
so \( \epsilon = (I_2 + 35.0 \text{ A})(0.080 \Omega) + I_2 (5.00 \Omega) = 12.6 \text{ V} \)
giving \( I_2 = 1.93 \text{ A} \).
Thus, \( \Delta V_2 = (1.93 \text{ A})(5.00 \Omega) = 9.65 \text{ V} \).

P28.6 (a) \[ R_p = \frac{1}{\left( \frac{1}{5.00 \Omega} \right) + \left( \frac{1}{10.0 \Omega} \right)} = 4.12 \Omega \]
\[ R_s = R_1 + R_2 + R_3 = 4.00 + 4.12 + 9.00 = 17.1 \Omega \]

(b) \[ \Delta V = IR \]
\[ 34.5 \text{ V} = I(17.1 \Omega) \]
\[ I = \frac{1.99 \text{ A}}{4.00 \Omega, 9.00 \Omega \text{ resistors.}} \]
Applying \( \Delta V = IR \), \( (1.99 \text{ A})(4.12 \Omega) = 8.18 \text{ V} \)
\[ 8.18 \text{ V} = I(7.00 \Omega) \]
so \( I = \frac{1.17 \text{ A}}{7.00 \Omega \text{ resistor}} \)
\[ 8.18 \text{ V} = I(10.0 \Omega) \]
so \( I = 0.818 \text{ A} \) for \( 10.0 \Omega \text{ resistor.} \)

*P28.14 When \( S \) is open, \( R_1, R_2, R_3 \) are in series with the battery. Thus:
\[ R_1 + R_2 + R_3 = \frac{6 \text{ V}}{10^{-3} \text{ A}} = 6 \text{ k} \Omega . \] (1)

When \( S \) is closed in position 1, the parallel combination of the two \( R_2 \) 's is in series with \( R_1, R_3 \), and the battery. Thus:
\[ \frac{1}{2} R_1 + R_2 + R_3 = \frac{6 \text{ V}}{12 \times 10^{-3} \text{ A}} = 5 \text{ k} \Omega . \] (2)

When \( S \) is closed in position 2, \( R_1 \) and \( R_2 \) are in series with the battery. \( R_3 \) is shorted. Thus:
\[ R_1 + R_2 = \frac{6 \text{ V}}{2 \times 10^{-3} \text{ A}} = 3 \text{ k} \Omega. \]

From (1) and (3): \[ R_3 = 3 \text{ k} \Omega. \]

Subtract (2) from (1): \[ R_2 = 2 \text{ k} \Omega. \]

From (3): \[ R_3 = 1 \text{ k} \Omega. \]

Answers: \[ R_1 = 1 \text{ k} \Omega, R_2 = 2 \text{ k} \Omega, R_3 = 3 \text{ k} \Omega. \]

P28.21 We name currents \( I_1 \), \( I_2 \), and \( I_3 \) as shown.

From Kirchhoff's current rule, \[ I_3 = I_1 + I_2. \]

Applying Kirchhoff's voltage rule to the loop containing \( I_2 \) and \( I_3 \),
\[ 12.0 \text{ V} - (4.00) I_3 - (6.00) I_2 - 4.00 \text{ V} = 0 \]
\[ -8.00 = (4.00) I_3 + (6.00) I_2 \]

Applying Kirchhoff's voltage rule to the loop containing \( I_1 \) and \( I_2 \),
\[ -(6.00) I_2 - 4.00 \text{ V} + (8.00) I_1 = 0 \]
\[ (8.00) I_2 = 4.00 + (6.00) I_2 \]

P28.24 We name the currents \( I_1 \), \( I_2 \), and \( I_3 \) as shown.

\[ 70.0 - 60.0 - I_2 (3.00 \text{ k} \Omega) - I_1 (2.00 \text{ k} \Omega) = 0 \]
\[ 80.0 - I_2 (4.00 \text{ k} \Omega) - 60.0 - I_2 (3.00 \text{ k} \Omega) = 0 \]
\[ I_2 = I_1 + I_3 \]

(a) Substituting for \( I_2 \) and solving the resulting simultaneous equations yields
\[ I_1 = \frac{0.385 \text{ m} \text{ A}}{\text{ through } R_4} \]
\[ I_2 = \frac{2.69 \text{ m} \text{ A}}{\text{ through } R_3} \]
\[ I_3 = \frac{3.08 \text{ m} \text{ A}}{\text{ through } R_2} \]

(b) \[ \Delta V_{cf} = -60.0 \text{ V} - (3.08 \text{ m} \text{ A})(3.00 \text{ k} \Omega) = -69.2 \text{ V} \]

Point \( c \) is at a higher potential.