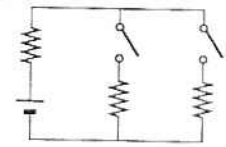
28.4 (a) Here $\mathcal{E} = I(R+r)$, so $I = \dfrac{\mathcal{E}}{R+r} = \dfrac{12.6\text{ V}}{(5.00\ \Omega + 0.0800\ \Omega)} = 2.48\text{ A}$



Then, $\Delta V = IR = (2.48\text{ A})(5.00\ \Omega) = \boxed{12.4\text{ V}}$

(b) Let I_1 and I_2 be the currents flowing through the battery and the headlights, respectively.

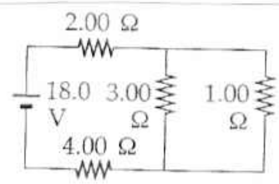
Then, $I_1 = I_2 + 35.0\text{ A}$, and $\mathcal{E} - I_1 r - I_2 R = 0$

so $\mathcal{E} = (I_2 + 35.0\text{ A})(0.0800\ \Omega) + I_2(5.00\ \Omega) = 12.6\text{ V}$

giving $I_2 = 1.93\text{ A}$

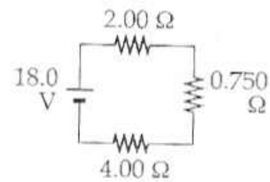
Thus, $\Delta V_2 = (1.93\text{ A})(5.00\ \Omega) = \boxed{9.65\text{ V}}$

28.15 $R_p = \left(\dfrac{1}{3.00} + \dfrac{1}{1.00}\right)^{-1} = 0.750\ \Omega$



$R_s = (2.00 + 0.750 + 4.00)\ \Omega = 6.75\ \Omega$

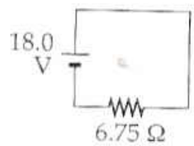
$I_{\text{battery}} = \dfrac{\Delta V}{R_s} = \dfrac{18.0\text{ V}}{6.75\ \Omega} = 2.67\text{ A}$



$\mathcal{P} = I^2 R$: $\mathcal{P}_2 = (2.67\text{ A})^2 (2.00\ \Omega)$

$\mathcal{P}_2 = \boxed{14.2\text{ W}}$ in 2.00 Ω

$\mathcal{P}_4 = (2.67\text{ A})^2 (4.00\ \Omega) = \boxed{28.4\text{ W}}$ in 4.00 Ω



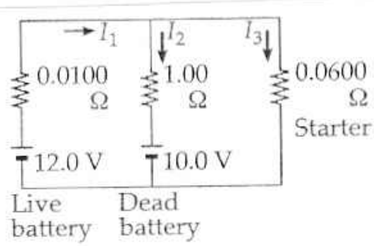
$\Delta V_2 = (2.67\text{ A})(2.00\ \Omega) = 5.33\text{ V}$, $\Delta V_4 = (2.67\text{ A})(4.00\ \Omega) = 10.67\text{ V}$

$\Delta V_p = 18.0\text{ V} - \Delta V_2 - \Delta V_4 = 2.00\text{ V} \quad (= \Delta V_3 = \Delta V_1)$

$\mathcal{P}_3 = \dfrac{(\Delta V_3)^2}{R_3} = \dfrac{(2.00\text{ V})^2}{3.00\ \Omega} = \boxed{1.33\text{ W}}$ in 3.00 Ω

$\mathcal{P}_1 = \dfrac{(\Delta V_1)^2}{R_1} = \dfrac{(2.00\text{ V})^2}{1.00\ \Omega} = \boxed{4.00\text{ W}}$ in 1.00 Ω

28.25 Using Kirchhoff's rules,



$12.0 - (0.0100)I_1 - (0.0600)I_3 = 0$

$10.0 + (1.00)I_2 - (0.0600)I_3 = 0$

and $I_1 = I_2 + I_3$

$12.0 - (0.0100)I_2 - (0.0700)I_3 = 0$

$10.0 + (1.00)I_2 - (0.0600)I_3 = 0$

Solving simultaneously, $I_2 = \boxed{0.283\text{ A downward}}$ in the dead battery,

and $I_3 = \boxed{171\text{ A downward}}$ in the starter.

28.30 (a) $I(t) = -I_0 e^{-t/RC}$

$$I_0 = \frac{Q}{RC} = \frac{5.10 \times 10^{-6}\ \text{C}}{(1300\ \Omega)(2.00 \times 10^{-9}\ \text{F})} = 1.96\ \text{A}$$

$$I(t) = -(1.96\ \text{A}) \exp\left[\frac{-9.00 \times 10^{-6}\ \text{s}}{(1300\ \Omega)(2.00 \times 10^{-9}\ \text{F})}\right] = \boxed{-61.6\ \text{mA}}$$

(b) $$q(t) = Qe^{-t/RC} = (5.10\ \mu\text{C}) \exp\left[\frac{-8.00 \times 10^{-6}\ \text{s}}{(1300\ \Omega)(2.00 \times 10^{-9}\ \text{F})}\right] = \boxed{0.235\ \mu\text{C}}$$

(c) The magnitude of the current is $\boxed{I_0 = 1.96\ \text{A}}$

28.48 (a) $$\mathcal{P} = I^2 R = I^2\left(\frac{\rho \ell}{A}\right) = \frac{(1.00\ \text{A})^2 (1.70 \times 10^{-8}\ \Omega \cdot \text{m})(16.0\ \text{ft})(0.3048\ \text{m/ft})}{\pi (0.512 \times 10^{-3}\ \text{m})^2} = \boxed{0.101\ \text{W}}$$

(b) $\mathcal{P} = I^2 R = 100(0.101\ \Omega) = \boxed{10.1\ \text{W}}$