CHAPTER 1

P1.6* The reference direction for i_{ab} points from *a* to *b.* Because i_{ab} has a negative value, the current is equivalent to positive charge moving opposite to the reference direction. Finally since electrons have negative charge, they are moving in the reference direction (i.e., from *a* to *b*).

For a constant (dc) current, charge equals current times the time interval. Thus, $Q = (5\text{ A}) \times (3\text{ s}) = 15\text{ C}$.

P1.14* (a) $P = -v_a i_a = -20$ W Energy is being supplied by the element.
(b) $P = v_b i_b = 50$ W Energy is being absorbed by the element.
(c) $P = -v_c i_c = 40$ W Energy is being absorbed by the element.

P1.19* $\text{Energy} = \dfrac{\text{Cost}}{\text{Rate}} = \dfrac{\$40}{0.1\ \$/\text{kWh}} = 400\text{ kWh}$

$P = \dfrac{\text{Energy}}{\text{Time}} = \dfrac{400\text{ kWh}}{30 \times 24\text{ h}} = 555.5\text{ W}$ $\qquad I = \dfrac{P}{V} = \dfrac{555.5}{120} = 4.630\text{ A}$

$\text{Reduction} = \dfrac{40}{555.5} \times 100\% = 7.20\%$

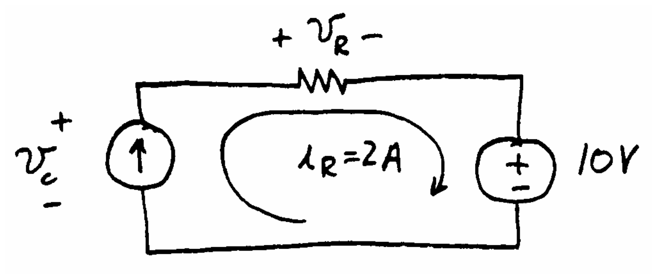
P1.23 The current supplied to the electronics is $i = p/v = 50/12.6 = 3.968$ A. The ampere-hour rating of the battery is the operating time to discharge the battery multiplied by the current. Thus, the operating time is $T = 100/i = 25.2$ hours. The energy delivered by the battery is $W = pT = 50(25.2) = 1260\text{ wh} = 1.26\text{ kWh}$. Neglecting the cost of recharging, the cost of energy for 300 discharge cycles is $Cost = 75/(300 \times 1.26) = 0.1984\ \$/\text{kWh}$.

P1.28* At the node joining elements A and B, we have $i_a + i_b = 0$. Thus, $i_a = -2$ A. For the node at the top end of element C, we have $i_b + i_c = 3$. Thus, $i_c = 1$ A. Finally, at the top right-hand corner node, we have $3 + i_e = i_d$. Thus, $i_d = 4$ A. Elements *A* and B are in series.

P1.33 We are given $v_a = 5\text{ V}$, $v_b = 7\text{ V}$, $v_f = -10\text{ V}$, and $v_h = 6\text{ V}$. Applying KVL, we find

$$v_d = v_a + v_b = 12\text{ V} \qquad v_c = -v_a - v_f - v_h = -1\text{ V}$$
$$v_e = -v_a - v_c + v_d = 8\text{ V} \qquad v_g = v_e - v_h = 2\text{ V}$$
$$v_b = v_c + v_e = 7\text{ V}$$

P1.48*



As shown above, the 2 A current circulates clockwise through all three elements in the circuit. Applying KVL, we have

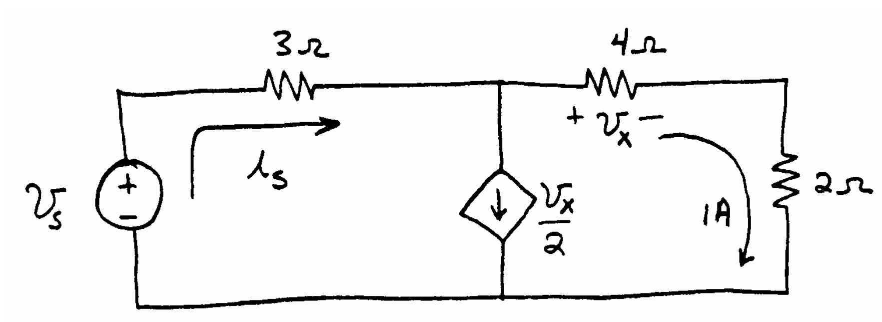
$$v_c = v_R + 10 = 5i_R + 10 = 20\text{ V}$$

$P_{current-source} = -v_c i_R = -40\text{ W}$. Thus, the current source delivers power.

$P_R = (i_R)^2 R = 2^2 \times 5 = 20\text{ W}$. The resistor absorbs power.

$P_{voltage-source} = 10 \times i_R = 20\text{ W}$. The voltage source absorbs power.

P1.57*



$$v_x = (4\ \Omega) \times (1\text{ A}) = 4\text{ V} \qquad i_s = v_x / 2 + 1 = 3\text{ A}$$

Applying KVL around the outside of the circuit:

$$v_s = 3i_s + 4 + 2 = 15\text{ V}$$