Chapter 1

1-1 Determine the current I in the circuit of Figure P1-1.

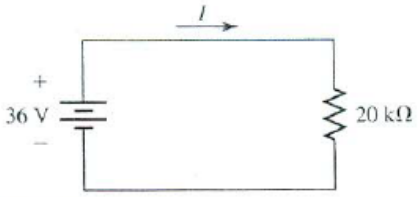

FIGURE P1–1

apply ohm's law

$$I = \frac{V}{R} = \frac{36}{20\times10^{3}} = 1.8\times10^{-3}\ \text{A} = 1.8\ \text{mA}$$

1-2 Determine the current I in the circuit of Figure P1-2.

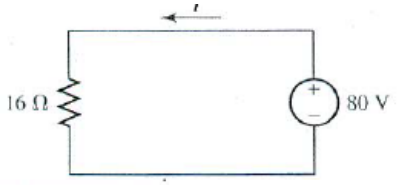

FIGURE P1–2

apply ohm's law

$$I = \frac{V}{R} = \frac{80}{16} = 5\ \text{A}$$

1-3 Determine the current I in the circuit of Figure P1-3.

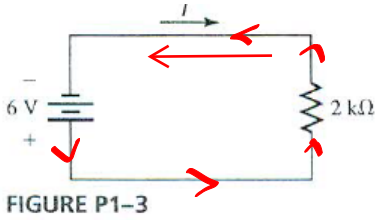

FIGURE P1–3

$$I = \frac{V}{R} = \frac{-6}{2\times10^{3}} = -3\times10^{-3}\ \text{A} = -3\ \text{mA}$$

1-4 Determine the current I in the circuit of Figure P1-4.

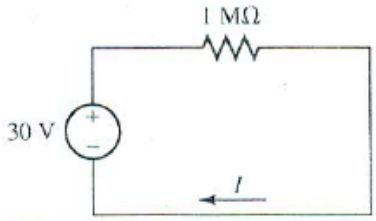

FIGURE P1–4

$$I = \frac{V}{R} = \frac{30}{1\times10^{6}} = 30\times10^{-6}\ \text{A} = 30\ \mu\text{A}$$

1-5 Determine the power delivered by the source in Problem 1-1.

$P = I \cdot V = \frac{V^2}{R} = I^2 R$

$$P = \frac{V^2}{R} = \frac{(36)^2}{20\times10^{3}} = 64.8\times10^{-3}\ \text{W} = 64.8\ \text{mW}$$

1-6 Determine the power delivered by the source in Problem 1-2.

$$P = \frac{V^2}{R} = \frac{(80)^2}{16} = 400\ \text{W}$$

1-7 Determine the power delivered by the source in Problem 1-3.

$$P = \frac{V^2}{R} = \frac{(6)^2}{2\times10^{3}} = 18\times10^{-3}\ \text{W} = 18\ \text{mW}$$

1-8 Determine the power delivered by the source in Problem 1-4.

$$P = \frac{V^2}{R} = \frac{(30)^2}{1\times10^{6}} = 900\times10^{-6}\ \text{W} = 0.9\ \text{mW}$$

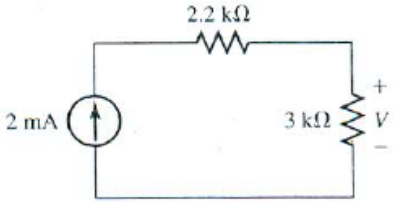

FIGURE P1–9

1-9 Determine the voltage V in the circuit of Figure P1-9.

apply ohm's law

$$V = RI = 3\times10^{3}\times2\times10^{-3} = 6 \text{ V}$$

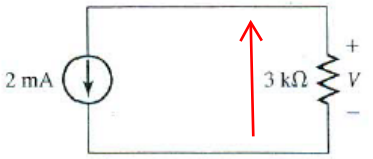

FIGURE P1–10

1-10 Determine the voltage V in the circuit of Figure P1-10.

$$V = RI = 3\times10^{3}\times(-2\times10^{-3}) = -6 \text{ V}$$

P = 20 W V = 12 V

1-11 Determine the resistance of a 20-W bulb operating from a dc voltage of 12 V.

$P = IV = \frac{V^2}{R} = I^2R \Rightarrow R = \frac{V^2}{P}$

$$\text{Since } P = \frac{V^2}{R}, \text{ then } R = \frac{V^2}{P} = \frac{(12)^2}{20} = 7.2\ \Omega$$

P = 500 W

1-12 Determine the resistance of a 500-W heating element operating from an ac effective voltage of 120 V. V = 120 V

$$\text{Since } P = \frac{V^2}{R}, \text{ then } R = \frac{V^2}{P} = \frac{(120)^2}{500} = 28.8\ \Omega$$

I ??, V ??
P = 1000 W, R = 50 Ω

1-13 A radio transmitter has an ac average power input of 1 kW with no modulation and it acts effectively as a resistance of value 50 Ω. Determine the ac effective current and the ac effective voltage.

$$\text{Since } P = I^2R, \text{ then } I = \sqrt{\frac{P}{R}} = \sqrt{\frac{1000}{50}} = 4.472 \text{ A},$$

$$\text{Since } P = \frac{V^2}{R}, \text{ then } V = \sqrt{RP} = \sqrt{50\times1000} = 223.6 \text{ V}$$

$$\text{Check: } R = \frac{V}{I} = \frac{223.6}{4.472} = 50\ \Omega$$

V = IR = 4.472 × 50
R = 20 Ω

1-14 The power dissipated in a certain resistance of 20 Ω is 500 W. Determine the current and the voltage.

P = 500 W

$$\text{Since } P = I^2R, \text{ then } I = \sqrt{\frac{P}{R}} = \sqrt{\frac{500}{20}} = 5 \text{ A}$$

$$\text{Since } P = \frac{V^2}{R}, \text{ then } V = \sqrt{RP} = \sqrt{20\times500} = 100 \text{ V}$$

$$\text{Check: } R = \frac{V}{I} = \frac{100}{5} = 20\ \Omega$$

A = 40 V

V_{AB} =

B = 22 V

1-15 Various voltages in a circuit are measured with respect to a common ground reference. The voltage at point A is 40 V and the voltage at point B is 22 V. Determine the voltage V_{AB}.

$$V_{AB} = V_A - V_B = 40 - 22 = 18 \text{ V}$$

1-16 Repeat the analysis of Problem 1-15 if the voltage at point A is 12 V and the voltage at point B is -20 V.

$$V_{AB} = V_A - V_B = 12 - (-20) = 12 + 20 = 32 \text{ V}$$

1-17 The voltage across a resistance is 15 V and the current is 0.5 mA. Determine the resistance.

$$R = \frac{V}{I} = \frac{15}{0.5 \times 10^{-3}} = 30 \times 10^3 \ \Omega = 30 \text{ k}\Omega$$

1-18 The voltage across a resistance is 10 V and the current is $2\ \mu$A . Determine the resistance.

$$R = \frac{V}{I} = \frac{10}{2 \times 10^{-6}} = 5 \times 10^6 \ \Omega = 5 \text{ M}\Omega$$

E = P t

Cost = E · C

1-19 Determine the cost of leaving a 10-W bulb on for one year if electricity costs \$0.09 per kilowatt-hour. (Assume that it is not a leap year!)

P = 10 * 10^-3 kW

t = 365 * 24 h

W(W.hr) = (10 W) × (365 days) × (24 hours/day) × (1/1000) kW/W = 87.6 kW.hr

Cost = (87.6 kW.hr) × (0.09 / kW.hr) = \$7.88

C = 0.09 $

E

1-20 Determine the energy in joules dissipated in the bulb of Problem 1-19 in one year.

P = 10w, t = 365 * 24 * 60 * 60

W = (10 W) × (3600 s/hour) × (24 hours/day) × (365 days/year)

= 315.36×10^6 J = 315.36 MJ

1-21 Determine the voltages V_1 and V_2 in Figure P1-21.

$$24 - 6 - 8 - V_1 = 0, \ V_1 = 10 \text{ V}$$

$$32 + 24 - 6 - 8 + V_2 = 0, \ V_2 = -42 \text{ V}$$

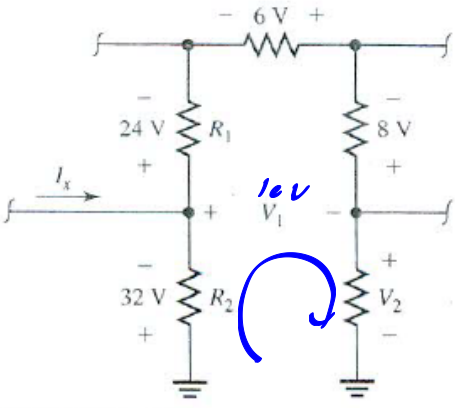

FIGURE P1–21

1-22 Determine the voltage V_x in Figure P1-22.

$$32 - 18 + 20 - 60 + V_x = 0, \ V_x = 26 \text{ V}$$

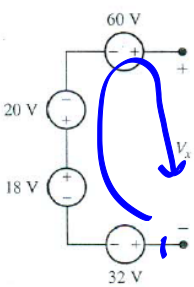

FIGURE P1–22