Chapter 1

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

$$I = \frac{V}{R} = \frac{36}{20 \times 10^3} = 1.8 \times 10^{-3} \text{ A} = 1.8 \text{ mA}$$

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

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

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

$$I = \frac{V}{R} = \frac{-6}{2 \times 10^3} = -3 \times 10^{-3} \text{ A} = -3 \text{ mA}$$

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

$$I = \frac{V}{R} = \frac{30}{1 \times 10^6} = 30 \times 10^{-6} \text{ A} = 30 \ \mu\text{A}$$

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

$$P = \frac{V^2}{R} = \frac{(36)^2}{20 \times 10^3} = 64.8 \times 10^{-3} \text{ W} = 64.8 \text{ mW}$$

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.

$$P = \frac{V^2}{R} = \frac{(6)^2}{2 \times 10^3} = 18 \times 10^{-3} \text{ W} = 18 \text{ mW}$$

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

$$P = \frac{V^2}{R} = \frac{(30)^2}{1 \times 10^6} = 900 \times 10^{-6} \text{ W} = 0.9 \text{ mW}$$

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

$$V = RI = 3 \times 10^3 \times 2 \times 10^{-3} = 6 \text{ V}$$

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

$$V = RI = 3 \times 10^3 \times (-2 \times 10^{-3}) = -6 \text{ V}$$

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

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

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

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

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.

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

Since $P = \dfrac{V^2}{R}$, then $V = \sqrt{RP} = \sqrt{50 \times 1000} = 223.6$ V

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

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

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

Since $P = \dfrac{V^2}{R}$, then $V = \sqrt{RP} = \sqrt{20 \times 500} = 100$ V

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

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.

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

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!)

$$W(\text{W.hr}) = (10 \text{ W}) \times (365 \text{ days}) \times (24 \text{ hours/day}) \times (1/1000) \text{ kW/W} = 87.6 \text{ kW.hr}$$
$$\text{Cost} = (87.6 \text{ kW.hr}) \times (0.09 / \text{kW.hr}) = \$7.88$$

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

$$W = (10 \text{ W}) \times (3600 \text{ s/hour}) \times (24 \text{ hours/day}) \times (365 \text{ days/year})$$
$$= 315.36 \times 10^6 \text{ J} = 315.36 \text{ MJ}$$

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

$$24 - 6 - 8 - V_1 = 0, \ V_1 = 10 \text{ V}$$
$$32 + 24 - 6 - 8 + V_2 = 0, \ V_2 = -42 \text{ V}$$

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

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