Chapter 3   Ohm’s law, energy, and power

Section 3-1 Ohm’s law

2. (a) when the resistance doubles, the current is halved from 100 mA to 50 mA

(b) when the resistance is reduced by 30%, the current increases from 100 mA to

\[ I = \frac{V}{0.7R} = 1.429(V/R) = (1.429)(100mA) \approx 143mA \]

(c) when the resistance is quadrupled, the current decreases from 100 mA to 25 mA

section 3-2 application of ohm’s law

5. \[ I = \frac{V}{R} = \frac{9V}{2.7k\Omega} = 3.33mA \]

11. (a) \[ V = IR = (3mA)(27k\Omega) = 81V \], (b) \[ V = IR = (5\mu A)(100k\Omega) = 500V \]

(c) \[ V = IR = (2.5A)(50\Omega) = 125V \]

15. (a) \[ R = \frac{V}{I} = \frac{8V}{2A} = 4\Omega \], (b) \[ R = \frac{V}{I} = \frac{12V}{4mA} = 3k\Omega \]

(c) \[ R = \frac{V}{I} = \frac{30V}{150\mu A} = 0.2M\Omega = 200k\Omega \]

27. \[ P = \frac{V^2}{R} = \frac{(60V)^2}{620\Omega} = 5.81W \]

29. \[ P = I^2R, \quad R = \frac{P}{I^2} = \frac{100W}{(2A)^2} = 25\Omega \]

45. \[ R_f = \frac{V}{I} = \frac{120V}{0.8A} = 150\Omega \]

49. \[ R_1 = \frac{V}{I} = \frac{1V}{2A} = 0.5\Omega, \quad R_2 = \frac{V}{I} = \frac{1V}{1A} = 1\Omega, \quad R_3 = \frac{V}{I} = \frac{1V}{0.5A} = 2\Omega \]

54. Wire resistance : \[ R_w = \frac{(10.4CM \cdot \Omega/ft)(24ft)}{1624.3CM} = 0.154\Omega \]

(a) \[ I = \frac{V}{R + R_w} = \frac{6V}{100.154\Omega} = 59.9mA \]

(b) \[ V_R = (59.9mA)(100\Omega) = 5.99V \]

(c) \[ V_{RW} = 6V - 5.99V = 0.01V \]

For one length of wire, \[ V = \frac{0.01V}{2} = 0.005V \]

59. \[ V_{R(max)} = 120V - 100V = 20V, \quad I_{max} = \frac{V_{R(max)}}{R_{min}} = \frac{20V}{8\Omega} = 2.5A \]

A fuse with a rating of less than 2.5 A must be used. A 2 A fuse is recommended.