Chapter Assessment
Section 2 Applications of Circuits: Mastering Problems

77. A circuit contains six 60-W lamps with a resistance of 240-Ω each and a 10.0-Ω heater connected in parallel. The potential difference across the circuit is 120 V. Find the current in the circuit for the following situations. (Level 2)

a. Four lamps are turned on.
b. All the lamps are turned on.
c. Six lamps and the heater are operating.
d. If the circuit has a 12-A fuse, will the fuse melt if all the lamps and the heater are on?

SOLUTION:

a.

$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \frac{1}{R_4}$$

$$= \frac{1}{240\ \Omega} + \frac{1}{240\ \Omega} + \frac{1}{240\ \Omega} + \frac{1}{240\ \Omega}$$

$$= \frac{4}{240\ \Omega}$$

$$R = \frac{240\ \Omega}{4} = 0.060\ \text{k}\Omega$$

$$I = \frac{\Delta V}{R} = \frac{120\ \text{V}}{0.060\ \text{k}\Omega} = 2.0\ \text{A}$$

b.

$$\frac{1}{R} = \frac{6}{240\ \Omega}$$

$$R = \frac{240\ \Omega}{6} = 0.040\ \text{k}\Omega$$

$$I = \frac{\Delta V}{R} = \frac{120\ \text{V}}{0.040\ \text{k}\Omega} = 3.0\ \text{A}$$

c.

$$\frac{1}{R} = \frac{1}{0.040\ \text{k}\Omega} + \frac{1}{10.0\ \Omega}$$

$$= \frac{5}{4.0 \times 10^1\ \Omega}$$

$$R = \frac{4.0 \times 10^1\ \Omega}{5} = 8.0\ \Omega$$

$$I = \frac{\Delta V}{R} = \frac{120\ \text{V}}{8.0\ \text{k}\Omega} = 15\ \text{A}$$

d. Yes; the current through the circuit is 15 A, which is greater than 12 A and will blow the fuse.

ANSWER:

a. *I* = 2.0 A
b. *I* = 3.0 A
c. *I* = 15 A
d. Yes; the current through the circuit is 15 A, which is greater than 12 A and will blow the fuse.

78. **Ranking Task** Consider the resistors in the circuit in **Figure 24.** Rank them from least to greatest specifically indicating any ties, using the following criteria:

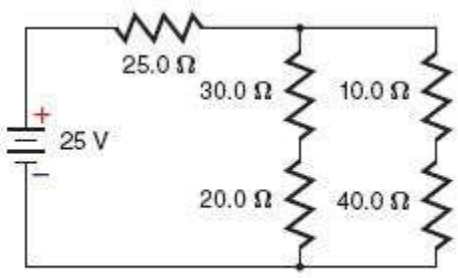

Figure 24

a. the current through each
b. the potential difference across each

SOLUTION:

a. $I_{30.0\ \Omega} = I_{20.0\ \Omega} = I_{10.0\ \Omega} = I_{40.0\ \Omega} < I_{25.0\ \Omega}$
b. $V_{10.0\ \Omega} < V_{20.0\ \Omega} < V_{30.0\ \Omega} < V_{40.0\ \Omega} < V_{25.0\ \Omega}$

ANSWER:

a. $I_{30.0\ \Omega} = I_{20.0\ \Omega} = I_{10.0\ \Omega} = I_{40.0\ \Omega} < I_{25.0\ \Omega}$
b. $V_{10.0\ \Omega} < V_{20.0\ \Omega} < V_{30.0\ \Omega} < V_{40.0\ \Omega} < V_{25.0\ \Omega}$

Chapter Assessment: Applying Concepts

82. What happens to the current in the other two lamps if one lamp in a three-lamp series circuit burns out?

SOLUTION:

If one of the lamp filaments burns out, the current will cease and all the lamps will go out.

ANSWER:

If one of the lamp filaments burns out, the current will cease and all the lamps will go out.

84. Circuit A contains three 60-Ω resistors in series. Circuit B contains three 60-Ω resistors in parallel. How does the current in the second 60-Ω resistor of each circuit change if a switch cuts off the current to the first 60-Ω resistor?

SOLUTION:

Circuit A: There will be no current in the resistor.
Circuit B: The current in the resistor will remain the same.

ANSWER:

Circuit A: There will be no current in the resistor.
Circuit B: The current in the resistor will remain the same.

85. What happens to the current in the other two lamps if one lamp in a three-lamp parallel circuit burns out?

SOLUTION:

If one of the filaments burns out, the resistance and the potential difference across the other lamps will not change; therefore, their currents will remain the same.

ANSWER:

If one of the filaments burns out, the resistance and the potential difference across the other lamps will not change; therefore, their currents will remain the same.

90. For each of the following, write the form of circuit that applies: series or parallel.

a. The current is the same everywhere throughout the entire circuit.
b. The total resistance is equal to the sum of the individual resistances.
c. The potential difference across each resistor in the circuit is the same.
d. The potential difference across the battery is proportional to the sum of the resistances of the resistors.
e. Adding a resistor to the circuit decreases the total resistance.
f. Adding a resistor to the circuit increases the total resistance.

SOLUTION:

a. series
b. series
c. parallel
d. series
e. parallel
f. series

ANSWER:

a. series
b. series
c. parallel
d. series
e. parallel
f. series