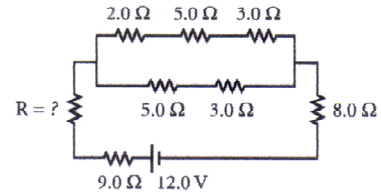
Holt Physics

Problem 20C

ANGULAR ACCELERATION

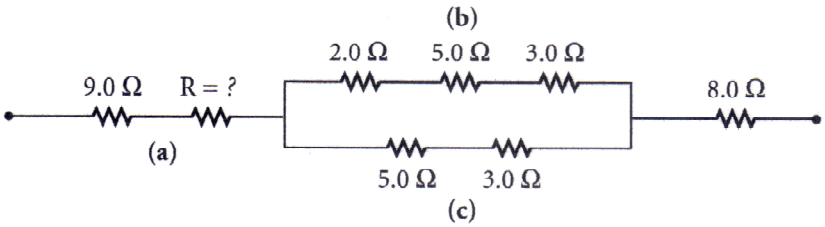
PROBLEM

Determine the unknown resistance in the complex circuit shown at right. The current in the circuit is 0.36 A.



SOLUTION

1. **Redraw the circuit as a group of resistors along one side of the circuit.**



2. **Identify components in series, and calculate their equivalent resistance.**
   Resistors in groups **(a)**, **(b)**, and **(c)** are in series.
   For group **(a)**: $R_{eq} = 9.0\ \Omega + R$
   For group **(b)**: $R_{eq} = 2.0\ \Omega + 5.0\ \Omega + 3.0\ \Omega = 10.0\ \Omega = R_1$ below
   For group **(c)**: $R_{eq} = 5.0\ \Omega + 3.0\ \Omega = 8.0\ \Omega = R_2$ below

3. **Identify components in parallel, and calculate their equivalent resistance.**
   Groups **(b)** and **(c)** combine to become group **(d)**.

   For group **(d)**:

$$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} = \frac{1}{10.0\ \Omega} + \frac{1}{8.0\ \Omega} = \frac{0.10}{1\ \Omega} + \frac{0.13}{1\ \Omega} = \frac{0.23}{1\ \Omega}$$

$$R = 4.4\ \Omega$$

4. **Repeat steps 2 and 3 until the resistors in the circuit are reduced to a single equivalent resistance.** All resistors combine to become group **(e)**. The remainder of the resistors in group **(e)** are in series.
   For group **(e)**: $R_{eq} = 9.0\ \Omega + R + 4.4\ \Omega + 8.0\ \Omega = R + 21.4\ \Omega$

5. **Choose the equation(s) or situation:**
   Use the equation relating equivalent resistance to potential difference and current.

$$R_{eq} = R - 21.4\ \Omega = \frac{\Delta V}{I} - 21.4\ \Omega = \frac{12.0\ \text{V}}{0.36\ \text{A}} - 21.4\ \Omega = 33\ \Omega - 21.4\ \Omega = \boxed{12\ \Omega}$$

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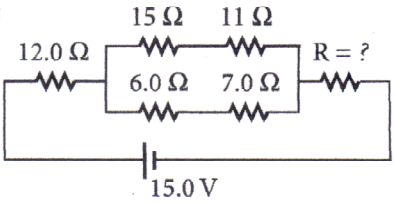
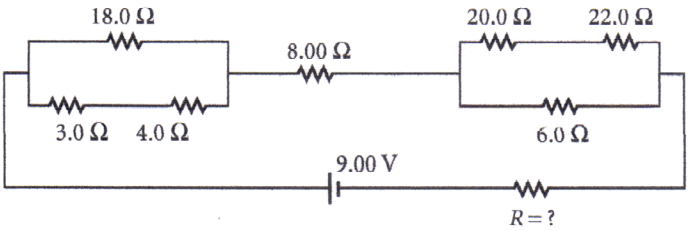
ADDITIONAL PRACTICE

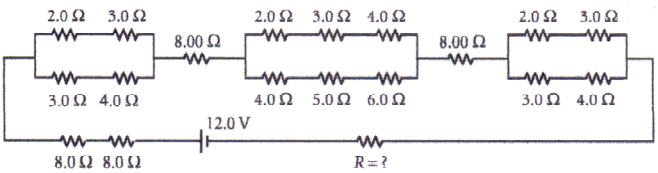
1. Determine the unknown resistance in the complex circuit shown at right. The current in the circuit is 680 mA.



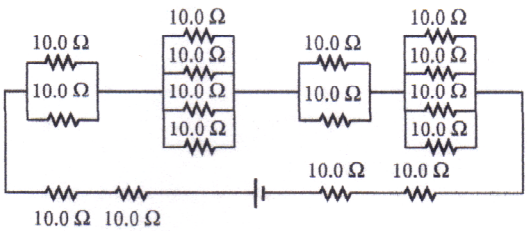
2. Determine the unknown resistance in the complex circuit shown at right. The current in the circuit is 375 mA.



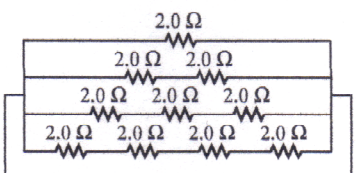
3. Determine the unknown resistance in the complex circuit shown at right. The current in the circuit is 185 mA.



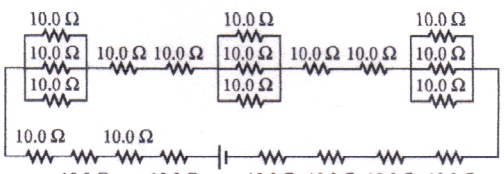
4. Determine the equivalent resistance of the complex circuit shown at right.



5. Determine the equivalent resistance of the complex circuit shown at right.



6. Determine the equivalent resistance of the complex circuit shown at right.



7. What will be the net current for the circuit shown at right?