SAMPLE PROBLEM B

Resistors in Parallel

PROBLEM

A 9.0 V battery is connected to four resistors, as shown at right. Find the equivalent resistance for the circuit and the total current in the circuit.

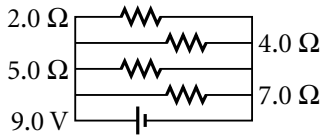
SOLUTION

1. DEFINE

Given: $\Delta V = 9.0\ \text{V}$ $R_1 = 2.0\ \Omega$
$R_2 = 4.0\ \Omega$ $R_3 = 5.0\ \Omega$
$R_4 = 7.0\ \Omega$

Unknown: $R_{eq} = ?$ $I = ?$

Diagram:



2. PLAN

Choose an equation or situation:

Because both sides of each resistor are connected to common points, they are in parallel. Thus, the equivalent resistance can be calculated with the equation for resistors in parallel.

$$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} \ldots \text{ for parallel}$$

The following equation can be used to calculate the total current.

$$\Delta V = IR_{eq}$$

Rearrange the equation to isolate the unknown:

No rearrangement is necessary to calculate R_{eq}; rearrange $\Delta V = IR_{eq}$ to calculate the total current delivered by the battery.

$$I = \frac{\Delta V}{R_{eq}}$$

3. CALCULATE

Substitute the values into the equation and solve:

$$\frac{1}{R_{eq}} = \frac{1}{2.0\ \Omega} + \frac{1}{4.0\ \Omega} + \frac{1}{5.0\ \Omega} + \frac{1}{7.0\ \Omega}$$

$$\frac{1}{R_{eq}} = \frac{0.50}{1\ \Omega} + \frac{0.25}{1\ \Omega} + \frac{0.20}{1\ \Omega} + \frac{0.14}{1\ \Omega} = \frac{1.09}{1\ \Omega}$$

$$R_{eq} = \frac{1\ \Omega}{1.09}$$

$$\boxed{R_{eq} = 0.917\ \Omega}$$

TIP

The equation for resistors in parallel gives you the reciprocal of the equivalent resistance. Be sure to take the reciprocal of this value in the final step to find the equivalent resistance.