

RESISTORS IN PARALLEL

PROBLEM

A $42.0\ \Omega$ resistor is connected in parallel with another resistor across a $9.0\ \text{V}$ battery. The current in the circuit is $0.41\ \text{A}$. Calculate the value of the unknown resistance.

SOLUTION

Given: $\Delta V = 9.0\ \text{V}$ $R_1 = 42.0\ \Omega$ $I = 0.41\ \text{A}$

Unknown: $R_2 = ?$

Choose an equation(s) or situation:

Use the equation relating potential difference and equivalent resistance for resistors in parallel, given on page 742.

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

$$I = \frac{\Delta V}{R_{eq}} = \frac{\Delta V}{R_1} + \frac{\Delta V}{R_2}$$

Rearrange the equation(s) to isolate the unknown(s): Rearrange to solve for R_2 .

$$\frac{\Delta V}{R_2} = \left(I - \frac{\Delta V}{R_1} \right)$$

$$R_2 = \frac{\Delta V}{\left(I - \frac{\Delta V}{R_1} \right)} = \frac{9.0\ \text{V}}{\left(0.41\ \text{A} - \frac{9.0\ \text{V}}{42\ \Omega} \right)} = \frac{9.0\ \text{V}}{[0.41\ \text{A} - 0.21\ \text{A}]} = \boxed{45\ \Omega}$$

ADDITIONAL PRACTICE

1. A $3.3\ \Omega$ resistor is connected in parallel with another resistor across a $3.0\ \text{V}$ battery. The current in the circuit is $1.41\ \text{A}$. Calculate the value of the unknown resistance.
2. A $56\ \Omega$ resistor is connected in parallel with another resistor across a $12\ \text{V}$ battery. The current in the circuit is $3.21\ \text{A}$. Calculate the value of the unknown resistance.
3. An $18\ \Omega$ resistor is connected in parallel with another resistor across a $1.5\ \text{V}$ battery. The current in the circuit is $103\ \text{mA}$. Calculate the value of the unknown resistance.
4. A $39\ \Omega$ resistor, an $82\ \Omega$ resistor, a $12\ \Omega$ resistor and a $22\ \Omega$ resistor are connected in parallel across a potential difference of $3.0\ \text{V}$. Calculate the equivalent resistance.
5. A $10\ \Omega$ resistor, a $12\ \Omega$ resistor, a $15\ \Omega$ resistor and an $18\ \Omega$ resistor are connected in parallel across a potential difference of $12\ \text{V}$. What is the equivalent resistance?

- 6.** A $33\ \Omega$ resistor, a $39\ \Omega$ resistor, a $47\ \Omega$ resistor and a $68\ \Omega$ resistor are connected in parallel across a potential difference of $1.5\ \text{V}$. Find the equivalent resistance.
- 7.** A refrigerator and an oven are wired in parallel across a potential difference of $120\ \text{V}$. The refrigerator has a resistance of $75\ \Omega$ and the oven has a resistance of $91\ \Omega$. How much current is in the circuit of each appliance?
- 8.** A computer and a printer are wired in parallel across a potential difference of $120\ \text{V}$. The computer has a resistance of $82\ \Omega$ and the printer has a resistance of $24\ \Omega$. How much current is in the circuit of each machine?
- 9.** A lamp and a stereo are wired in parallel across a potential difference of $120\ \text{V}$. The lamp has a resistance of $11\ \Omega$ and the stereo has a resistance of $36\ \Omega$. How much current is in the circuit of each load?
- 10.** Two bulbs are wired in parallel: one bulb has a resistance of $3.3\ \Omega$, and the other bulb has a resistance of $4.3\ \Omega$. If the voltage across the circuit is $1.5\ \text{V}$, what is the current through each bulb?