

## Circuits and Circuit Elements

**Problem A****RESISTORS IN SERIES****PROBLEM**

A  $18.0\text{-}\Omega$  resistor is connected in series with another resistor across a  $1.55\text{-V}$  battery. The current in the circuit is  $25\text{ mA}$ . Calculate the value of the unknown resistance.

**SOLUTION**

**Given:**  $\Delta V = 1.55\text{ V}$        $R_1 = 18\ \Omega$        $I = 0.025\text{ A}$

**Unknown:**  $R_2 = ?$

**Choose the equation(s) or situation:**

Use the equation relating the potential difference across the load for resistors in series, given on page 737.

$$\Delta V = IR_1 + IR_2$$

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

$$R_2 = \frac{\Delta V}{I} - R_1 = \frac{1.55\text{ V}}{0.025\text{ A}} - 18\ \Omega = 62\ \Omega - 18\ \Omega = \boxed{44\ \Omega}$$

**ADDITIONAL PRACTICE**

1. A  $16\text{-}\Omega$  resistor is connected in series with another resistor across a  $12\text{-V}$  battery. The current in the circuit is  $0.42\text{ A}$ . Calculate the value of the unknown resistance.
2. A  $24\text{-}\Omega$  resistor is connected in series with another resistor across a  $3.0\text{-V}$  battery. The current in the circuit is  $62\text{ mA}$ . Calculate the value of the unknown resistance.
3. A  $9\text{-}\Omega$  resistor is connected in series with another resistor across a  $9.0\text{-V}$  battery. The current in the circuit is  $0.33\text{ A}$ . Calculate the value of the unknown resistance.
4. A string of holiday lights has 73 light bulbs in series. Each light bulb has a resistance of  $3.0\ \Omega$ . Calculate the equivalent resistance.
5. A movie theater has 25 surround-sound speakers wired in series. Each speaker has a resistance of  $12.0\ \Omega$ . What is the equivalent resistance?
6. In case of an emergency, a corridor on an airplane has 57 lights wired in series. Each light bulb has a resistance of  $2.0\ \Omega$ . Find the equivalent resistance.
7. A quadraphonic car stereo operates on electricity provided by the car's  $12\text{-V}$  battery and is connected in series. Each channel of the stereo, which feeds the electric signal to one of the stereo's four speakers, has a resistance of  $4.1\ \Omega$ . How much current is in the circuit of each stereo channel?

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8. A chandelier has 10 sockets wired in series, each of which holds a  $10\ \Omega$  light bulb. If the voltage across the chandelier's circuit is  $100\ \text{V}$ , what is the current drawn by the chandelier?
9. A portable lamp has three bulbs wired in series: one bulb has a resistance of  $96\ \Omega$ , one bulb has a resistance of  $48\ \Omega$ , and one bulb has a resistance of  $29\ \Omega$ . If the voltage across the lamp is  $115\ \text{V}$ , what is the current through the lamp's circuit?
10. Three bulbs are wired in series: one bulb has a resistance of  $56\ \Omega$ , one bulb has a resistance of  $82\ \Omega$ , and one bulb has a resistance of  $24\ \Omega$ . If the voltage across the circuit is  $9.0\ \text{V}$ , what is the current through the circuit?