

Problem A

RESISTORS IN SERIES

PROBLEM

A $18.0\text{-}\Omega$ resistor is connected in series with another resistor across a 1.55-V battery. The current in the circuit is 25 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-V battery. The current in the circuit is 0.42 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-V battery. The current in the circuit is 62 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-V battery. The current in the circuit is 0.33 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-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?