LESSON MAKER PRO

Circuit Connections

Find how voltage, current, and resistance work together.

HIGH SCHOOL · PS.3.c

PS.3.c "Use mathematics and computational thinking to represent and determine the quantitative relationships between voltage, current, and resistance in series and parallel circuits in terms of Ohm's law."

NAME _____ **DATE** _____

THE BIG IDEA

Ohm's law is V = I × R, where V is voltage in volts, I is current in amperes, and R is resistance in ohms. In series, resistances add and the same current flows through each resistor. In parallel, each branch has the same voltage, and the branch currents add to give the total current.

WORKED EXAMPLE

An 8 Ω resistor and a 3 Ω resistor are connected in series to a 55 V supply. What is the current?

1. Add the resistances: 8 Ω + 3 Ω = 11 Ω.
2. Use Ohm's law: I = V/R = 55 V/11 Ω = 5 A.

Answer: 5 A

PRACTICE 6 problems

1 A 4 Ω resistor and a 12 Ω resistor are connected in series to a 24 V supply. Find the total resistance and the current.

ANSWER _____

2 A current of 4 A flows through a 10 Ω resistor and a 14 Ω resistor in series. What is the voltage across the 14 Ω resistor?

ANSWER _____

3 Two resistors in series are connected to a 60 V supply. The current is 4 A, and one resistor is 9 Ω. What is the resistance of the other resistor?

ANSWER _____

4 A 12 Ω resistor and a 16 Ω resistor are connected in parallel to a 48 V supply. What is the total current?

ANSWER _____

5 Two resistors are connected in parallel. A current of 4 A flows through the 10 Ω resistor. What current flows through the 20 Ω resistor?

ANSWER _____

6 The total current through two parallel branches is 6 A. One branch carries 2 A. The voltage across each branch is 24 V. Find the current and resistance of the other branch.

ANSWER _____

APPLY IT Show your work

1 Two LED strips on a gaming desk are modeled as resistors of 24 Ω and 48 Ω. They are connected in parallel to a 24 V supply. What is the total current, and what is the equivalent resistance?

WORK SPACE

ANSWER _____

2 For a camping gear project, two heating coils of 4 Ω and 14 Ω are connected in series to a 36 V supply. What current flows through the coils, and what is the voltage across the 14 Ω coil?

WORK SPACE

ANSWER _____

CHALLENGE One step up

Use the table. Find the total current in each circuit. How many times larger is circuit B's current than circuit A's? Explain using equivalent resistance.

TWO CIRCUIT DESIGNS

Circuit	Supply voltage	Resistors
A	24 V	12 Ω and 12 Ω in series
B	24 V	12 Ω and 12 Ω in parallel

WORK SPACE AND ANSWER

Circuit Connections

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	A 4 Ω resistor and a 12 Ω resistor are connected in series to a 24 V supply. Find the total resistance and the current.	**16 Ω; 1.5 A**
2	A current of 4 A flows through a 10 Ω resistor and a 14 Ω resistor in series. What is the voltage across the 14 Ω resistor?	**56 V**
3	Two resistors in series are connected to a 60 V supply. The current is 4 A, and one resistor is 9 Ω. What is the resistance of the other resistor?	**6 Ω**
4	A 12 Ω resistor and a 16 Ω resistor are connected in parallel to a 48 V supply. What is the total current?	**7 A**
5	Two resistors are connected in parallel. A current of 4 A flows through the 10 Ω resistor. What current flows through the 20 Ω resistor?	**2 A**
6	The total current through two parallel branches is 6 A. One branch carries 2 A. The voltage across each branch is 24 V. Find the current and resistance of the other branch.	**4 A; 6 Ω**

PART 2 · APPLY IT

1. **1.5 A; 16 Ω** The branch currents are 24 V/24 Ω = 1 A and 24 V/48 Ω = 0.5 A, giving 1.5 A total. The equivalent resistance is 24 V/1.5 A = 16 Ω.
2. **2 A; 28 V** The total resistance is 4 Ω + 14 Ω = 18 Ω, so the current is 36 V/18 Ω = 2 A. The voltage across the 14 Ω coil is 2 A × 14 Ω = 28 V.

CHALLENGE

Circuit A: 1 A. Circuit B: 4 A. B's current is 4 times A's current because its equivalent resistance is 6 Ω instead of 24 Ω.

Accept equivalent fractions, such as 3/2 A for 1.5 A. In the challenge, accept any explanation that correctly relates the smaller equivalent resistance to the larger current at the same voltage.