LESSON MAKER PRO

Circuit Power Paths

Use voltage, current, and resistance to analyze direct current circuits.

HIGH SCHOOL · P.6

P.6 "Obtain, evaluate, and communicate information concerning static and current electricity. a. Develop and use a model to describe the mathematical relationship among charge, distance, and force as expressed by Coulomb's law. b. Obtain..."

NAME _____ DATE _____

THE CIRCUIT RULES

Use V = I * R to connect voltage V, current I, and resistance R. Use P = V * I to find power P. In series, current stays the same and resistances add. In parallel, voltage stays the same across each branch and branch currents add.

WORKED EXAMPLE

A 26 V source powers one 13 Ω resistor. Find the current and the power.

1. Use I = V / R.
2. I = 26 / 13 = 2 A.
3. Use P = V * I.
4. P = 26 * 2 = 52 W.

Answer: Current: 2 A. Power: 52 W.

PRACTICE 6 problems

1 A 12 V source powers one 4 Ω resistor. What is the current?

ANSWER _____

2 A resistor has a current of 6 A and a resistance of 8 Ω. What is the voltage across it?

ANSWER _____

3 A resistor has 63 V across it and carries 9 A. What is its resistance?

ANSWER _____

4 A device has 24 V across it and draws 4 A. What power does it use?

ANSWER _____

5 A 10 Ω resistor and a 20 Ω resistor are in series with a 90 V source. Find the total resistance and the current.

ANSWER _____

_____

6 A 6 Ω resistor and a 12 Ω resistor are in parallel across a 36 V source. Find the total current and the equivalent resistance.

ANSWER _____

_____

APPLY IT Show your work

1 Two resistive heating strips in a hand warmer are connected in parallel to a 12 V battery pack. One strip has a resistance of 12 Ω, and the other has a resistance of 6 Ω. What total current does the pack supply, and what is the warmer's total power?

WORK SPACE

ANSWER _____

2 A portable food warmer has a 4 Ω heating element and an 8 Ω heating element in series with a 36 V battery. What current flows through the elements, and what voltage is across the 8 Ω element?

WORK SPACE

ANSWER _____

CHALLENGE One step up

A 36 V source powers an 8 Ω resistor in series with a parallel pair of 6 Ω and 12 Ω resistors. Find the source current and the current in each parallel branch. Explain why the branch currents add to the source current.

WORK SPACE AND ANSWER

Circuit Power Paths

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	A 12 V source powers one 4 Ω resistor. What is the current?	**3 A**
2	A resistor has a current of 6 A and a resistance of 8 Ω. What is the voltage across it?	**48 V**
3	A resistor has 63 V across it and carries 9 A. What is its resistance?	**7 Ω**
4	A device has 24 V across it and draws 4 A. What power does it use?	**96 W**
5	A 10 Ω resistor and a 20 Ω resistor are in series with a 90 V source. Find the total resistance and the current.	**Total resistance: 30 Ω. Current: 3 A.**
6	A 6 Ω resistor and a 12 Ω resistor are in parallel across a 36 V source. Find the total current and the equivalent resistance.	**Total current: 9 A. Equivalent resistance: 4 Ω.**

PART 2 · APPLY IT

1. **Total current: 3 A. Total power: 36 W.** The branch currents are 12 / 12 = 1 A and 12 / 6 = 2 A, so the pack supplies 3 A. Power is 12 * 3 = 36 W.
2. **Current: 3 A. Voltage across the 8 Ω element: 24 V.** The total resistance is 4 + 8 = 12 Ω, so the current is 36 / 12 = 3 A. The voltage across the 8 Ω element is 3 * 8 = 24 V.

CHALLENGE

The parallel pair has an equivalent resistance of 4 Ω, so total resistance is 12 Ω and source current is 3 A. The 8 Ω resistor drops 24 V, leaving 12 V across each branch. The 6 Ω branch carries 2 A and the 12 Ω branch carries 1 A. They add to the source current because current splits at the junction and rejoins: 2 A + 1 A = 3 A.

Accept equivalent calculations using Ohm's law or circuit rules. For the challenge, the explanation must account for both branch currents and their sum.