SCIENCE FOUNDATIONS

Current, voltage, and resistance

Difficulty level: Intermediate

Science Foundations

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Overview of the concept

This is how you work out why a phone charger gets hot or why a dimmer switch changes a light, because the push, the flow, and the resistance in a circuit decide how much energy moves. An electrician uses this to pick a wire thick enough to carry the current without overheating. A mechanic testing a car battery checks whether the circuit is letting enough current through to turn the starter. Knowing how these three fit together tells you why a circuit behaves the way it does when you change any one of them.



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Worked examples

EXAMPLE 1

Q A 12 V battery drives a current of 3 A through a resistor. What is the resistance?

SOLUTION

This is an Ohm's law question, so start with the one rule to remember: V = I x R. Cover up the one you want to find, and the other two tell you what to do.

Resistance is voltage divided by current, so $R = \frac{12}{3}$. Twelve divided by 3 is 4.

So the resistance is 4 ohms.

EXAMPLE 2

Q The voltage across a resistor is doubled, and the resistance stays the same. What happens to the current?

SOLUTION

This is a what-changes question, so use the same rule: $I = \frac{V}{R}$. The current is the voltage divided by the resistance.

The resistance has not changed, so the current changes in the same way as the voltage. Double the top of the fraction and the whole answer doubles.

So the current doubles.

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Practice questions

1. A resistor has 9 V across it and a resistance of 3 ohms. What is the current?

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2. A current of 2 A flows through a 5 ohm resistor. What is the voltage across it?

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3. A voltage of 24 V drives a current of 4 A. What is the resistance?

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4 The voltage across a resistor is doubled and the resistance stays the same. What happens to the current?

- **A** It doubles
- **B** It halves
- **C** It stays the same
- **D** It drops to zero

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5 The resistance in a circuit is doubled and the voltage stays the same. What happens to the current?

- **A** It halves
- **B** It doubles
- **C** It stays the same
- **D** It drops to zero

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6 **Two resistors, 4 ohms and 6 ohms, are connected in series. What is the total resistance?**

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7 **Where does an ammeter go in a circuit, and what does it measure?**

A. In series; the current

B. In parallel; the current

C. In series; the voltage

D. In parallel across the component; the voltage

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8 Where does a voltmeter go in a circuit, and what does it measure?

- **A** In parallel across the component; the voltage
- **B** In series; the voltage
- **C** In parallel; the current
- **D** In series; the current

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9 Which quantity is measured in ohms?

- **A** Resistance
- **B** Current
- **C** Voltage
- **D** Power

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A current of 500 mA is how many amps?

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ANSWER KEY

1. 3 A

2. 10 V

3. 6 ohms

4. It doubles

5. It halves

6. 10 ohms

7. In series; the current

8. In parallel across the component; the voltage

9. Resistance

10. 0.5 A

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