LESSON MAKER PRO

Circuit Energy Trail

Use resistance and voltage to model current and energy transfer.

HIGH SCHOOL · PHY.5.4

PHY.5.4 "Develop and use models (e.g., circuit drawing and mathematical representation) to explain how electric circuits work by tracing the path of electrons, including concepts of energy transformation, transfer, conservation of energy..."

NAME _____ DATE _____

CURRENT IN A CIRCUIT

Voltage (V) is energy transferred per unit of charge, resistance (R) limits current (I), and I = V/R. In a series circuit, resistances add and the same current passes through every part. A battery gives energy to moving charges, and the voltage drops across the devices add to the battery voltage.

WORKED EXAMPLE

A battery provides 18 V across a circuit with a resistance of 6 Ω. Find the current.

1. Write the rule: I = V/R.
2. Substitute: I = 18 V/6 Ω.
3. Divide: I = 3 A.

Answer: 3 A

PRACTICE 6 problems

1 A circuit has 16 V across a resistance of 4 Ω. Find the current.

ANSWER _____

2 A circuit has 20 V across a resistance of 10 Ω. Find the current.

ANSWER _____

3 A current of 2 A passes through an 8 Ω resistor. Find the voltage across it.

ANSWER _____

4 A circuit has 40 V across it and carries 4 A. Find its resistance.

ANSWER _____

5 The two resistors in the table are connected in series. Find their total resistance and the circuit current.

SERIES CIRCUIT

Component	Value
Battery	24 V
Resistor A	4 Ω
Resistor B	8 Ω

ANSWER _____

6 A current of 2 A passes through both resistors in series. Find the voltage drop across each resistor.

SERIES RESISTORS

Component	Resistance
Resistor A	8 Ω
Resistor B	12 Ω

ANSWER _____

APPLY IT Show your work

1 An LED strip on a gaming desk runs on 12 V and has a total resistance of 4 Ω. Find its current. Name one form of energy it produces from electrical energy.

WORK SPACE

ANSWER _____

2 A portable speaker and a protective resistor are connected in series to a battery. Use the table to find the current, then find the voltage drop across the speaker and the protective resistor.

PORTABLE SPEAKER CIRCUIT

Component	Value
Battery	20 V
Speaker	8 Ω
Protective resistor	2 Ω

ANSWER _____

CHALLENGE One step up

A battery powers devices A, B, and C in series, in that order. Use the table to find the total resistance, current, and voltage drop across each device. Then write one sentence explaining the electron path and how the voltage drops account for the battery voltage.

THREE-DEVICE CIRCUIT

Component	Value
Battery	48 V
Device A	8 Ω
Device B	16 Ω
Device C	24 Ω

WORK SPACE AND ANSWER

Circuit Energy Trail

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	A circuit has 16 V across a resistance of 4 Ω. Find the current.	**4 A**
2	A circuit has 20 V across a resistance of 10 Ω. Find the current.	**2 A**
3	A current of 2 A passes through an 8 Ω resistor. Find the voltage across it.	**16 V**
4	A circuit has 40 V across it and carries 4 A. Find its resistance.	**10 Ω**
5	The two resistors in the table are connected in series. Find their total resistance and the circuit current.	**Total resistance: 12 Ω; current: 2 A**
6	A current of 2 A passes through both resistors in series. Find the voltage drop across each resistor.	**Resistor A: 16 V; resistor B: 24 V**

PART 2 · APPLY IT

1. **3 A; light energy** Use I = V/R = 12 V/4 Ω = 3 A. Accept light or thermal energy.
2. **Current: 2 A; speaker: 16 V; protective resistor: 4 V** The total resistance is 8 Ω + 2 Ω = 10 Ω, so I = 20 V/10 Ω = 2 A. Multiply 2 A by each resistance to get voltage drops of 16 V and 4 V.

CHALLENGE

Total resistance: 48 Ω; current: 1 A; voltage drops: A = 8 V, B = 16 V, C = 24 V. Electrons travel from the battery's negative terminal through A, B, and C to its positive terminal, and the voltage drops add to the battery voltage: 8 V + 16 V + 24 V = 48 V.

Accept equivalent calculations and units. For the challenge, accept an explanation that traces electrons through all three devices from the negative terminal to the positive terminal and shows that the voltage drops total 48 V.