Trace the Current

Read circuit descriptions and calculate current from resistance and voltage.

PHY.5.6 "Use schematic diagrams to analyze the current flow in series and parallel electric circuits, given the component resistances and the imposed electric potential."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline the battery voltage and resistor values for each circuit, circle statements about where current stays the same or splits, and number the steps for finding current in Circuit C.

Three Circuits at the Museum

1. A museum model has a battery and several lamps represented by resistors in a schematic. A line between symbols stands for a wire; a junction shows where current can split. To analyze a path, start at one battery terminal, trace the wires through each resistor, and return to the other terminal. In a series path, every resistor carries the same current. Add the resistances on that path, then divide the battery voltage by the total resistance to find current. In Circuit A, a 15 V battery is connected to a 2 Ω resistor and a 3 Ω resistor in one unbroken loop.

2. For another exhibit, the schematic shows Circuit B: a 24 V battery connected across two separate branches. One branch contains an 8 Ω resistor, and the other contains a 12 Ω resistor. Both branches start at the same junction and end at the same second junction, so each has the full battery voltage across it. Divide that voltage by each branch's resistance to find its current. At the first junction, battery current divides between the branches; at the second, those currents join again. Add the branch currents to find the current flowing through the battery.

3. Circuit C combines both patterns. An 18 V battery sends current through a 3 Ω resistor before the wire splits into two branches, each with one 6 Ω resistor. The branches reconnect before reaching the battery. To analyze the circuit, first replace the parallel pair with its equivalent resistance: for two equal resistors in parallel, the equivalent resistance is half of either one. Add that equivalent resistance to the 3 Ω series resistance. Battery voltage divided by this total gives the current in the 3 Ω resistor. The two identical branches then share that current equally.

2 ANSWER WITH EVIDENCE

Use the passage

1. In Circuit A, what current flows through each resistor? Show how you found it.

2. In Circuit A, what is the voltage across the 3 Ω resistor? Use the current you found.

3. In Circuit B, find the current in each branch and the current through the battery. Show your calculations.

4. In Circuit C, what current flows through the 3 Ω resistor and through each 6 Ω resistor? Show how you found it.

3 YOUR TURN

Your own words

Design a different circuit with a 12 V battery and three resistors you choose. Sketch and label a schematic that has both a series connection and a parallel split, then calculate the current through the battery and each resistor.

ANSWER KEY

Trace the Current

PART 1 · READ AND MARK

Underline the battery voltage and resistor values for each circuit, circle statements about where current stays the same or splits, and number the steps for finding current in Circuit C. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	In Circuit A, what current flows through each resistor? Show how you found it.	**The total resistance is 2 Ω + 3 Ω = 5 Ω. The current is 15 V ÷ 5 Ω = 3 A through each resistor.**
2	In Circuit A, what is the voltage across the 3 Ω resistor? Use the current you found.	**The voltage is 3 A × 3 Ω = 9 V.**
3	In Circuit B, find the current in each branch and the current through the battery. Show your calculations.	**The 8 Ω branch carries 24 V ÷ 8 Ω = 3 A. The 12 Ω branch carries 24 V ÷ 12 Ω = 2 A. Battery current is 3 A + 2 A = 5 A.**
4	In Circuit C, what current flows through the 3 Ω resistor and through each 6 Ω resistor? Show how you found it.	**The parallel pair has an equivalent resistance of 3 Ω, making 6 Ω total. Battery current is 18 V ÷ 6 Ω = 3 A through the 3 Ω resistor. Each 6 Ω branch carries 1.5 A.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

A labeled schematic shows a 12 V battery connected to a 2 Ω resistor. The wire then splits into two branches with one 4 Ω resistor in each branch; the branches rejoin and return to the battery. The parallel pair has an equivalent resistance of 2 Ω, so total resistance is 4 Ω. The battery and 2 Ω resistor each carry 3 A. Each 4 Ω resistor carries 1.5 A.

Accept any clearly connected schematic with three labeled resistors, a 12 V battery, a series connection, and a parallel split. Check that the stated currents follow from the student's chosen resistances and that branch currents add to the battery current.