POPPY SCHOLARS · PHYSICS OF THE UNIVERSE

Home lab 7 · Unit 7 · about 60 minutes

Does the current through a resistor rise in proportion to the voltage, and how do resistors combine?

Name _____ Date _____

MATERIALS

You supply everything. Tick each item as you gather it.

- ☐ A digital multimeter that measures DC volts and milliamps (about $10)
- ☐ Three AA battery holders or four AA batteries with tape and wire, so that you can use 1, 2 and 3 batteries
- ☐ A 220 Ω resistor and a 470 Ω resistor (1/4 watt, from an electronics store), and alligator clip leads or short wires
- ☐ Paper, pencil and calculator

SAFETY

Use only AA batteries. This is low voltage and safe, but never connect the battery directly to itself without a resistor, because that makes a short circuit that heats the wire and drains the battery. Disconnect if anything gets warm. Never use the wall outlet. Keep batteries away from small children.

PROCEDURE

1. Connect one AA battery, the 220 Ω resistor and the multimeter set to measure milliamps in a single loop (a series circuit). Record the current. Then measure the voltage across the resistor with the meter set to volts, connected across the resistor's two ends (in parallel with it).
2. Repeat with two batteries in series (3 V) and with three batteries in series (4.5 V). Record voltage and current each time.
3. Compute R = V ÷ I for each measurement, and graph V (vertical) against I (horizontal). Find the slope, which is the resistance.
4. Check the color bands or the label on the resistor, and compare the value with your slope. Resistors have a tolerance, typically 5 percent.
5. Build a series circuit with both resistors (220 Ω then 470 Ω) at 2 batteries, and measure the current. Predict it first, with $R = R_1 + R_2$.
6. Build a parallel circuit with both resistors side by side at 2 batteries, and measure the total current. Predict it first, with $1 \div R = 1 \div R_1 + 1 \div R_2$.

RECORD YOUR DATA

Batteries	Voltage across resistor (V)	Current (mA)	R = V ÷ I (Ω)
1			
2			
3			

Circuit (2 batteries)	Predicted current (mA)	Measured current (mA)
Series, 220 Ω + 470 Ω		
Parallel, 220 Ω and 470 Ω		

LAB REPORT

Write a report that gives your tables and graph, shows the slope and your calculation of resistance, compares it with the label, and compares your predicted and measured currents for the series and parallel circuits. Explain why a parallel circuit draws more current than either resistor alone, and calculate the power the resistor used with three batteries.

Report the numbers you actually got, even when they disagree with the lesson. Write on the lines, or type your report on the website and send it to a teacher there.

Question and hypothesis *State the question in your own words, what you expect to happen, and why you expect it.*

Method *What you changed, what you measured, what you kept the same, and how many trials you ran.*

Observations *Describe what you saw, including anything unexpected. Your data tables are added to the report automatically.*

Calculations *Show each calculation step by step, with units.*

Claim and reasoning *Answer the question using your numbers, then explain why, using the science from the unit.*

Limits and next step *What could have affected your results, and one change you would make next time.*