Physics

Activity - Ohm's Law and Simple Circuits

Purpose: To build a simple circuit and investigate the relationship between voltage, resistance, and current.

Background:

Remember that a simple circuit is made up of an emf source, a load, a closed path of conductors, and a control element. When the circuit components are hooked up together and the switch is closed charges will move through the conducting path forming an electrical current. That current (in amps) is proportional to the magnitude of the applied voltage (in volts) and will be opposed by some resistance, R (in ohms).

Materials:

Digital multi meter (2)	12 Ω resistor	22 Ω resistor
100 Ω resistor	220K Ω resistor	1000 Ω resistor
SPST switch	DC power supply	

Procedure:

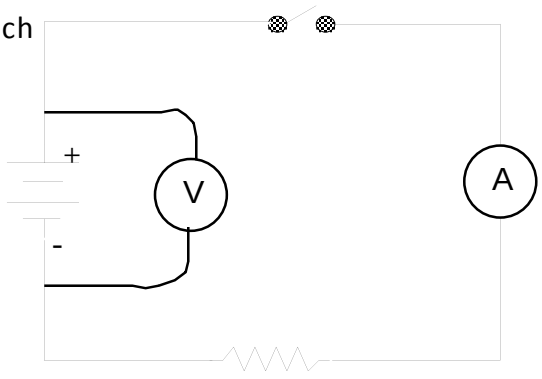
Building a Simple Circuit

• Fill in the symbols in the chart below that represent the various circuit elements:

element	*a cell*	*a battery*	*a resistor*	*a switch*
symbol				

• Use the multi meter set on the *DC function* and *the 20V range* to set the voltage of the power supply (standing alone). Record in your data table (V_{batt}). Once the variable supply is turned on and set to 6V be careful not to touch the leads together!

• Using the 12Ω resistor and the SPST switch build the circuit below. Be sure your multimeter is set to "volts" for the voltmeter and "amps" for the ammeter (*10A range*). You may wish to set your multimeter to ohms and verify the resistance of the resistors.



• Repeat the process for all five resistors.

Current vs. Resistance

• Close the switch. Measure the voltage of the battery and record in your data table as V_{load}.

• Measure and record the experimental current in the circuit.

• Repeat this process for all five resistors.

Current verse Voltage

• Now you will build the circuit with the 100Ω resistor and vary the output of the power supply.

• Adjust the voltage to 5V and measure the current. Repeat for 6V-10V. Record data.

Analysis

• On a Cartesian Coordinate System make a graph of Current vs. Resistance from your battery data. Use V_{load} and I_{exp} for the graph. Similarly, make a graph of Voltage vs. Resistance from the power supply data. Draw best fit lines or curves for each graph.

Data:

R = _____ Ω

Table 1 - Battery Table 2 - Power Supply

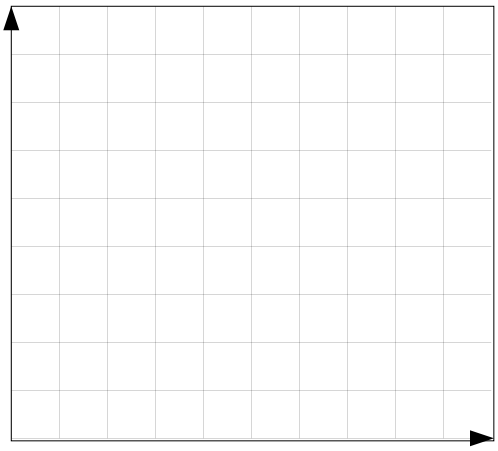
V(batt) (V)	V(load) (V)	Resistance (Ω)	Exp. Current (A)	Theor. Current (A)	% error

Voltage (V)	Current (A)
5	
6	
7	
8	
9	
10	

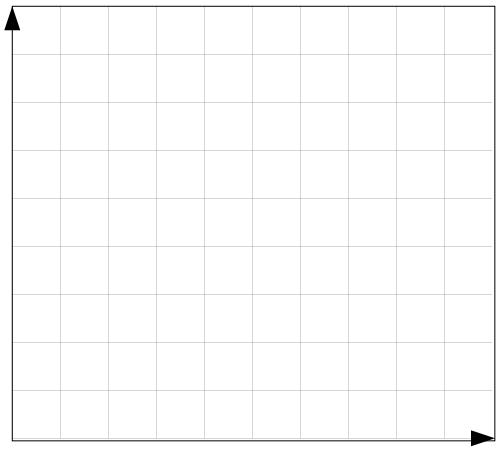
Sample Calculations:

Graphs:

Current vs. Resistance



Current vs. Voltage



Questions:

1.) How did the voltage of the battery before the switch was closed compare to afterward? Can you explain this?

2.) What is the relationship between current and resistance?

3.) What is the relationship between voltage and current? Calculate the slope of the *current vs. voltage* graph. What does it represent?

4.) Look up **Ohm's Law** in your textbook. State it below. Does your data verify Ohm's Law? Explain.

5.) How could a *potentiometer* be used to make this lab go more quickly?

6.) Go back through your data and use Ohm's Law to calculate the theoretical current in each circuit. How do your experimental values of current compare to your theoretical values? Explain.

Error Analysis

Conclusions:

XTRA:

- Replace the resistor in the circuit with a lamp. Measure it's resistance and the current through it. How is it like a resistor? How is it different?

- Place two of the same resistors in *series* in the circuit. Measure the resistance and the current. Measure the voltage drops across each resistor. What can you conclude?

- Repeat the above with a *parallel* circuit.