Ohms Law Lab - Guided

PSI Physics

Name:_____

Date:_____ Period:_____

Purpose

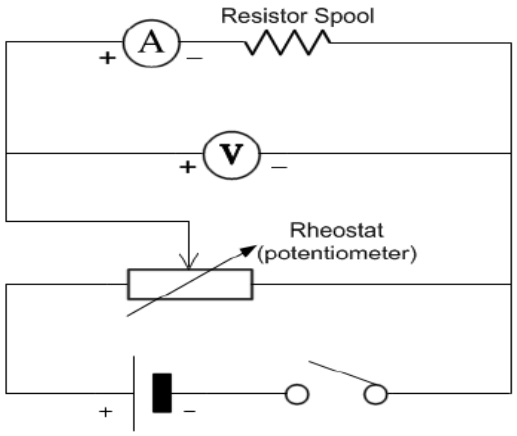
Students will investigate the relationship between current and voltage, creating a graph in order to find the resistance of unknown resisters.

Ohm's law states that if the temperature of a resistor remains constant, the electric current (I) flowing in a circuit is directly proportional to the applied voltage (V) and inversely proportional to the resistance (R) of the circuit: $I = \frac{V}{R}$.

Materials

- Battery (6 or 12 V)
- One voltmeter (or multimeter)
- One ammeter (or multimeter)
- Connecting wires
- Resistance spools
- Switch
- Rheostat / Potentiometer

  For reference, see: http://njc.tl/181



Procedure

1. Construct the circuit as shown in the diagram above. Note the following:
   a) *Connect the ammeter in series and the voltmeter in parallel.*
   b) *Connect the ammeter and voltmeter with corresponding polarity.*
   c) *The arrow on the potentiometer diagram indicates the connection to the sliding piece.*

2. Leave the switch open until your instructor has checked your circuit and given you permission to close it.

3. Slowly move the slider across the potentiometer until the ammeter registers a small current at a mark on the ammeter.

4. For this position, measure and record this current and voltage.

   Note: *Many ammeters measure current in milliamps. Make sure you are reading your meters properly and recording current in amps and voltage in volts.*

5. Increment the current four more times recording both the current and voltage in the table below.

6. Switch to a new resistor spool and repeat steps 3 – 5 for two more resisters.

Data

Resistor 1	
Current (amps)	Voltage (volts)

Resistor 2	
Current (amps)	Voltage (volts)

Resistor 3	
Current (amps)	Voltage (volts)

Analysis

Ohms law states $\mathrm{I} = \frac{\mathrm{V}}{\mathrm{R}}$. This can be rewritten as $V = RI$. Making the analogy to the slope-intercept form of a line ($y = mx + b$), if we plot voltage on the y-axis and current on the x-axis then the slope of the line will be equivalent to resistance, and the intercept will be through the origin.

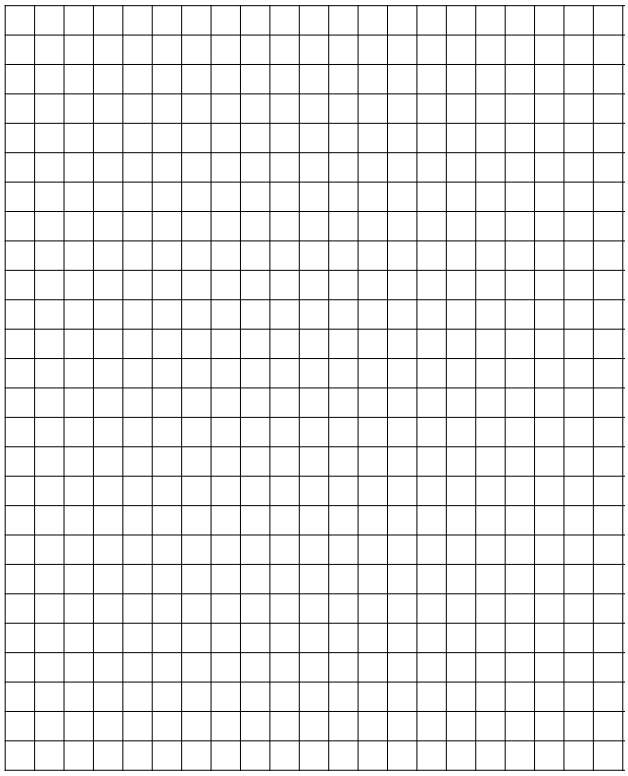
1. Sketch the graph of Voltage vs. Current for each resistor.
   Make sure all 3 graphs have the following:
   - Title
   - Axes Labels with quantities and units
   - A best-fit line - do not connect points

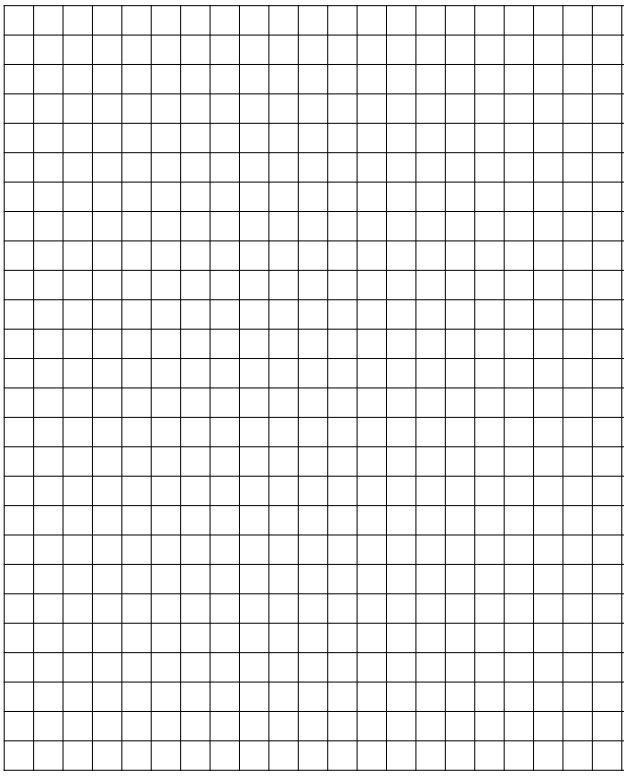
2. If your graph is a straight line, then the relationship described above is true.

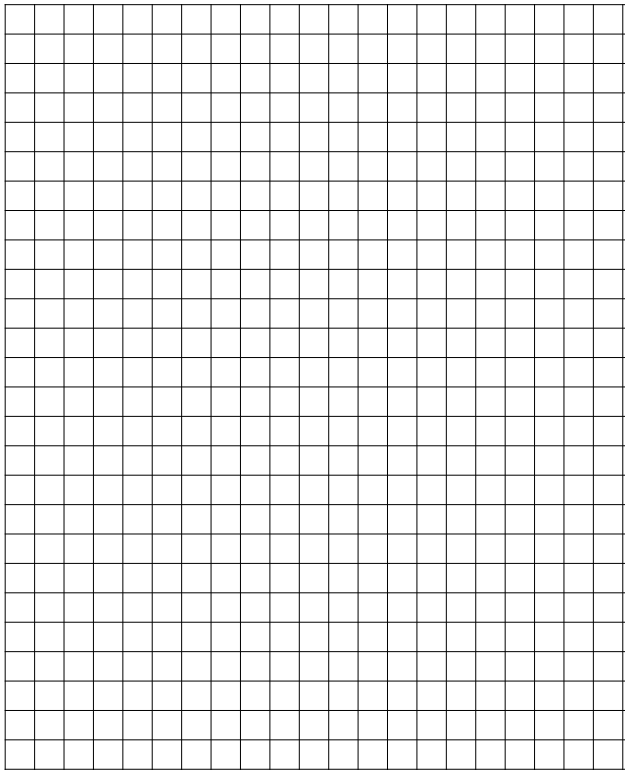
   - Were your graphs straight lines?

   - Are current and voltage directly or inversely proportional?

3. Calculate the slope of each line in the space below:







Slope of Graph 1:

Slope of Graph 2:

Slope of Graph 3:

Conclusion

1. If you know the actual resistances of the resistors you used, how closely did your values match the actual values?

2. Whether your values matched the actual values or not, explain some reasons why the measured values of resistance might not match the actual values.

In 3 – 5, circle the word that best completes the statement.

3. The current that flows through a resistor is *(inversely/directly)* proportional to the applied voltage and *(inversely/directly)* proportional to the resistance of the resistor.

4. While measuring the resistance of a resistor, the voltmeter is always placed in *(series/parallel)* with the resistor. The ammeter is always placed in *(series/parallel)* with the resistor.

5. If the voltage across a resistance is increased, the current flowing through the resistance will *(increase/decrease).* When the resistance of a circuit is increased, the current flowing in the circuit will *(increase/decrease).*

Application

1. A 60-watt light bulb has a voltage of 120 volts applied across it and a current of 0.5 amperes flows through the bulb. What is the resistance of the light bulb?

2. What current will flow through a 120-ohm resistor if the voltage applied to it is 12 volts?

3. A resistance of 60 ohms allows 0.4 amperes of current to flow when it is connected across a battery. What is the voltage of the battery?