Name _____ Date _____ Period _____

LAB: Voltage Circuit Simulator & Ohm's Law

CHAPTER 35: Series and Parallel Circuits

Background: This excercise will help you determine **the relationship between voltage (V), amperage (I) and resistance (R)**. This relationship is called ***Ohm's Law***

Proceedure:

1. Go to the following URL: http://jersey.uoregon.edu/vlab/Voltage/
2. Follow the directions below and answer the questions as you come to them.

This experiment consists of modifying a circuit. The circuit is made up of four parts:

1. A ***battery***  : A battery has a positive and negative terminal that creates a potential difference. This is frequently, but erroneously, taken as being equivalent to potential energy. They are not identical. Potential difference is proportional to potential energy and the two can be related via the work done per unit charge. This measure of energy per unit charge is measured is called *voltage* (**V**) and the unit of measurement is called *volts*.
2. A ***wire***, which has ***resistance*** (**R**). Resistance inhibits the amount of current running along the circuit. The greater the resistance, the lower the current. Resistance is a bit like inertia in mechanics. For a given force, the greater the mass (inertia) the lower the acceleration. Here, for a given voltage, material with high resistivity will inhibit the flow of electrons (e.g. current) through it.
3. A ***lightbulb***  which has an *amperage* (**I**). Amps are the unit of current and current is the amount of electrons that flow down the wire per unit time. This current is converted to power by the resistive element inside the light bulb. The length of time that you leave the light bulb on determines the total amount of energy which has been used.
4. A switch, which turns the system on and off.

The problem consists of two parts:

1. Find the **formula** which describes **Ohm's Law**; that is, find the mathematical relationship between voltage (**V**), amperage (**I**), and resistance (**R**).
2. Determine the ***amperage*** of the **lightbulb**.

The first part will be discovered through a **trial-and-error** experiment. You are given a circuit on which you may vary the voltage by choosing from a variety of batteries and the resistance by adding resistors  to the circuit. You will then turn on the switch, allowing current to flow through the circuit. If the resistance is too low, the lightbulb will receive too much current, and will explode. If the resistance is too great, the lightbulb will not receive enough current, and will not light. If the resistance is just right, the lightbulb will light up. *(Note: real light bulbs are not perfect ohmic resistors as is the case here and will light partially with any amount of current).*

If the lightbulb explodes or fails to light, turn off the switch (which automatically replaces the lightbulb) and try again.

First, concentrate on changing the resistance to get the lightbulb to turn on. Once you get a working circuit write down your values, change the value of the battery, and try again. You should begin to see the relationship between **V**, **I**, an d **R**. You should then be able to derive what the Amperage of the lightbulb is.

Each battery and resistor has a value printed on it which reflects the objects voltage and resistance, respectively.

- To add batteries to the circuit, use the mouse to drag a battery from the toolbox (the box containing the various resistors and batteries) and drop it onto the larger battery on the circuit.
- To add resistors to the circuit, drag a resistor from the toolbox onto the empty box located on the circuit. Multiple resistors may be added to the circuit.
- To remove resistors, simply drag the resistor you wish to remove from the circuit and drop it anywhere outside of the resistor box.
- To turn the circuit on and off, click once on the switch.

Question 1- What is the equation that mathematically describes Ohm's Law? Write out equations and describe what each symbol (***I***, ***V***, and ***R***) represent. You must also list what the units for each of these values are.

Question 2-

a. What combinations of batteries (voltage) and resistors (resistance) provides the correct amount of current (amperage) to make the lightbulb light?

b. Draw a circuit diagram of the circuit you constructed.

Question 3- What causes the lightbulbs to explode?

Question 4- Why do lightbulbs not considered to be perfect ohmic resistors? *(HINT: look on page 512)*

Question 5- What two things can be done to control the current (amperage) in a circuit? Which is directly proportional and which is inversely proportional?

 Now that you know Ohm's law, you can apply it to a circuit where all values are known.

In this next circuit, the lightbulb has a different amperage than in the previous experiment. Furthermore, we will tell you what the amperage of the lightbulb is. Given this information, you should be able to complete the circuit correctly with one try. Click on the link that says "Try this circuit "

Question 6- What combinations of batteries (voltage) and resistors (resistance) did you use to provide the correct amount of current (amperage) to make the lightbulb light?

Question 7- What other combinations will make the lightbulb light? Give three more combinations of batteries (voltage) and resistors (resistance). Put the values into the equation for Ohm's Law and show me why they work.