**NOVA Online PHY232-LAB**

**Title: Ohm’s Law using PhET Simulation**

The fundamental relationship among the three important electrical quantities *current*, *voltage*, and *resistance* was discovered by Georg Simon Ohm. The relationship and the unit of electrical resistance were both named for him to commemorate this contribution to physics. One statement of Ohm’s law is that the current through a resistor is proportional to the voltage across the resistor and inversely proportional to the resistance. In this experiment you will see if Ohm’s law is applicable by generating experimental data using a PhET Simulation:

 <http://phet.colorado.edu/en/simulation/ohms-law>

Current and voltage can be difficult to understand, because they cannot be observed directly. To clarify these terms, some people make the comparison between electrical circuits and water flowing in pipes as illustrated in the lecture room. Here is a chart of the three electrical units we will study in this experiment.

|  |  |  |  |
| --- | --- | --- | --- |
| Electrical Quantity | Description | Unit | Water Analogy |
| Voltage or Potential Difference | A measure of the Energy difference per unit charge between two points in a circuit. | Volt (V) | Water Pressure |
| Current | A measure of the flow of charge in a circuit.  | Ampere (A) | Amount of water flowing |
| Resistance | A measure of how difficult it is for current to flow in a circuit. | Ohm (W) | A measure of how difficult it is for water to flow through a pipe. |



Figure 1:

objectives:

* Determine the mathematical relationship between current, potential difference, and resistance in a simple circuit.
* Examine the potential *vs*. current behavior of a resistor and current vs. resistance for a fixed potential.

MATERIALS

|  |  |
| --- | --- |
|  |  |
| 1. PhET Simulation – [Ohms Law](http://phet.colorado.edu/en/simulation/ohms-law)
2. Excel Spreadsheet
 |  |

PRELIMINARY SEtup and QUESTIONS

1. Start up your internet browser. Start up the PhET Simulation at <http://phet.colorado.edu/en/simulation/ohms-law>
2. Click on download and the screen above in figure 1 appear. Minimize your browser.
3. Get Excel Spreadsheet ready.
4. With the Resistance slider set at its default value, move the potential slider, observing what happens to the current.

If the voltage doubles, what happens to the current?

Click here to enter text.

What type of relationship do you believe exists between voltage and current?

Click here to enter text.

1. With the Voltage slider set at 4.5 V, move the resistance slider, observing what happens to the current.

 If the resistance doubles, what happens to the current?

Click here to enter text.

What type of relationship do you believe exists between current and resistance?

 What type of relationship do you believe exists between current and resistance?

**PROCEDURE A:**

1. Set the Resistance slider to 300 ohms, Use the Voltage slider to adjust the Potential to the values in data table 1, also recording the resulting electric currents.

**Data Table 1**

Resistance R = Click here to enter. 

|  |  |
| --- | --- |
| Potential (V) | Current (mA) |
| 1.5 |  |
| 3.0 |  |
| 4.5 |  |
| 6.0 |  |
| 7.5 |  |
| 9.0 |  |

1. Using Excel Spreadsheet, record the data and plot a graph of Potential (V) vs Current(mA) and perform a linear fit.
2. Record the slope of the graph below data table 1. Calculate the resistance value by taking the slope of the graph times 1000. Compare the slope times 1000 value with the value of the resistance set in the simulation by calculating the % error.

**PROCEDURE B:**

1. Switch back to the PhET Simulation. Set the Resistance slider to 600 ohms, Use the Voltage slider to adjust the Potential to the values in data table 2, also recording the resulting electric currents.

**Data Table 2:**

Resistance R = Click here to enter. 

|  |  |
| --- | --- |
| Potential (V) | Current (mA) |
| 1.5 |  |
| 3.0 |  |
| 4.5 |  |
| 6.0 |  |
| 7.5 |  |
| 9.0 |  |

Slope of graph = Click here to enter. V/mA

Slope times x 1000 = Click here to enter. 

% Error of Slope times 1000 with R = Click here to enter. %

% Error of Slope times 1000 with R = Click here to enter. %

1. Enter your data from Table 2 under Data Set 2. Perform a “linear fit” on the data. Record the slope of the graph below data table 2. Calculate the resistance value by taking the slope of the graph times 1000. Compare the slope times 1000 value with the value of the resistance set in the simulation by calculating a % error.

Does a linear Function work well with both data sets of V vs I data? Click here

**PROCEDURE C:**

1. Switch back to the PhET simulation. Return the Voltage Slider to 4.5 V. Now we will use the Resistance slider to set the Resistor to the values in the table. Fill in table 3 with your data:

**Data Table 3:**

Electric Potential V = Click here to enter Volts

|  |  |
| --- | --- |
| R (ohms) | Current (mA) |
| 100 |  |
| 200 |  |
| 300 |  |
| 400 |  |
| 500 |  |
| 600 |  |
| 700 |  |
| 800 |  |
| 900 |  |
| 1000 |  |

Inverse Fit Constant of graph of I vs R = Click here to enter mA

Fit Constant divided by 1000 = Click here to enter Volts

% Error of Fit Constant divided by 1000 with V = Click here to enter %

% Error of Fit Constant divided by 1000 with V = Click here to enter %

1. Enter your Resistance and Current values from Table 3 in Data Set 3.
2. Using Curve Fit, try fitting this data to an “Inverse” function.
3. Calculate the Battery Voltage by taking the Inverse fit constant divided by 1000. Compare this computed value with the value of the battery voltage set in the simulation by calculating a % error

Click here

Does an inverse function provide a good fit to your data?

**ANALYSIS:**

Do the experimental data confirm that the Electric Current in a resistor is directly proportional to the electric potential provided by the batteries?

 Click here to enter text.

Do the experimental data confirm that the electric current is inversely proportional to the Resistance for a fixed electric potential?

concluSION:

**Finally, write a short lab report, attach all plotted graphs, and answer all questions in the experiment as indicated.**

**Please, note this is individual lab report writing**. **You may send your report through Canvas**.