**General Physics eJournal 4**

**Kirchhoff’s Laws**

**Instructions:**

Follow the Writeup and fill out the eJournal as you complete the lab activities. Submit your eJournal report by uploading the completed WORD or PDF document to our class Learninghub site. If the Learninghub site is down, email the completed report file directly to a lab TA.

**Preliminaries:**

* Title:
* Name(s):
* Date:
* Time In & Out:

**Plan:**

**Hypothesis**

Form hypotheses regarding each of Kirchhoff’s Laws – one concerning voltages around a closed loop and the other for currents entering a node. On paper, sketch the circuit you plan to use and insert an image here.

*Insert image of your circuit diagram*

**Experiment Outline**

Briefly describe your plan for testing your hypothesis.

**Equipment List**

* List
* Equipment
* Here

**Action:**

Describe the techniques used to collect data by responding to the bullet point questions:

* How were the resistances measured?
* How were the battery voltages measured?
* How were the voltages in the circuit measured?
* How were the currents in the circuit measured?

*Insert labeled image of your apparatus*

**Results:**

Record the resistances and battery voltages

**Table I: Measured Resistances and Battery Voltages**

|  |  |
| --- | --- |
| **Circuit Element** | **Measurement** |
| R1 (kΩ) |  |
| R2 (kΩ) |  |
| R3 (kΩ) |  |
| VS1 (V) |  |
| VS2 (V) |  |

Measure and record the voltages around each of the three closed loops. Calculate the voltage sum for each loop and verify that it is zero or very close.

**Table II: Measured Voltages around each Loop**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Loop #** | **V1 (V)** | **V2 (V)** | **V3 (V)** | **V4 (V)** | **Voltage Sum (V)** |
| 1 |  |  |  | ----- |  |
| 2 |  |  |  | ----- |  |
| 3 |  |  |  |  |  |

Measure and record the three currents entering the bottom node.

Calculate the current sum and verify that it is zero or very close (i.e. currents entering the node equals currents exiting the node).
In order for the sum to work out, make sure to keep any negative signs in the measurements. Negative currents simply mean that the current is flowing in the opposite direction as drawn.

**Table III: Measured Currents Entering the Bottom Node**

|  |  |
| --- | --- |
|  | **Current (mA)** |
| I1 |  |
| I2 |  |
| I3 |  |
| Current Sum |  |

**Analysis:**

Select three equations to solve for the currents. You must choose the current law equation
(Eq. 3) plus any two of the voltage law equations (Eq. 4a, 4b, 4c).

Enter the coefficients and constants in the Kirchhoff’s Laws Equation Solver to find the theoretical currents. Take a screenshot of the solver with your numbers and the solutions, and insert the screenshot below.

*Insert screenshot of equation solver with entered values and solutions*

Compare the theoretical currents to the measured currents using a percent difference for each.

**Table IV: Measured and Theoretical Current Comparison**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Measured (mA)** | **Theoretical (mA)** | **% Difference** |
| I1 |  |  |  |
| I2 |  |  |  |
| I3 |  |  |  |

**Conclusion:**

Interpret your results in light of your hypothetical predictions. Do the results support your hypotheses? How close to zero were the voltage sums around each of the three loops (Kirchhoff’s Voltage Law)? How close to zero was the current sum for currents entering the bottom node (Kirchhoff’s Current Law)? How well did the theoretical currents predict the measured currents? How might you improve this experiment or explore it further?