Ohm's Law

Name:_____ Date: _____

Instructor: _____

Teammates

1.- _____ 2.- _____

3.- _____ 4.- _____

Instructions: Follow the steps on this worksheet, using your lab manual as a guide, unless directed to do otherwise by your lab instructor. Show at least one sample calculation for each step. Box final mathematical results. Do not forget the units.

1 Common resistor

1.1 Data

1.1.1. Obtain three resistors of nominal values 1, 5, and 10 K Ohms. Using the Digital Multimeter (DMM), measure the actual resistance of each resistor and record them.

1.1.2. Use the DMM to set the power supply to about 1 V (do not believe the gauge in the power supply). Connect the power supply to the 1 K Ohm resistor. Connect the DMM in parallel with the resistor to measure the voltage across it and record the voltage.

1.1.3. Turn off the power supply but do not change its settings. Set the DMM to measure current and connect it in series with the resistor. Next, turn on the power supply and measure the current flowing through the resistor. Record it.

1.1.4. Repeat your measurements for power supply voltages between 1 and 13 V with 2 V increments. Collect the same kind of data for another of the three resistors. Organize the data for each resistor in a table that includes headings and units. (At this point of the course, not including units leads to a significant loss of points.) You should have six pairs of measurements per resistor.

1.2 Analysis

1.2.1. Make a voltage vs. current plot for each resistor. Find a linear fit for each of your resistors. The slope of this line is your experimental resistance value. Compare this value to the value measured for the corresponding resistor.

2 Resistors in Series

2.1 Data

2.1.1. Set the power supply to 10V $\pm$ 0.01V. Connect the power supply to the array of 3 resistors in series. Measure the voltage at the terminals of the power supply. Measure the voltage across each resistor.

2.1.2. Set the DMM to measure Direct Current in mA. Look at figure 1 and insert the DMM in series in location A to measure the current flowing from the power supply into R1. Similarly, measure the current flowing from R1 into R2 (location B), from R2 into R3 (location C), and from R3 back into the power supply (location D).

2.1.3. Construct a table with the following columns for each resistor: a column for the actual value of the resistance, a column for the voltage across the resistor, and another column for the current flowing through it. The columns must have descriptive headings that include units.

2.2 Analysis

2.2.1. For the resistor indicated by your instructor, Use Ohm's Law and your measurements of current and resistance to calculate the voltage drop across the resistor indicated by your instructor. Compare with the measured value.

2.2.2. Calculate the theoretical value of the equivalent resistance for the three resistors connected in series.

2.2.3. Use Ohm's Law and your measurements of Voltage drop of, and current supplied by, the power supply to determine the equivalent resistance and compare with your calculated value in point 2.2.2.

3 Resistors in parallel

3.1 Data

3.1.1. Referring to Figure 1 in the Lab Manual, connect the three resistors in parallel. Set the power supply to only 5V +/- 0.01V and connect it to the circuit. Measure the voltage across the terminals of the power supply. Also, measure the voltage across each resistor (X, Y, Z).

3.1.2. Set the multimeter to measure Direct Current in mA. Measure the current through each resistor (A, B, C) and the current going back into the power supply (location D). Organize your data in a table similar to that of the previous section.

3.2 Analysis

3.2.1. Use your voltage and resistance measurements along with Ohm's Law to calculate the current for the resistor indicated by your instructor. Compare with your measured value.

3.2.2. Calculate the theoretical value of the equivalent resistance for the three resistors connected in parallel.

3.2.3. Use Ohm's Law to determine the equivalent resistance and compare it with your calculated value in point 3.2.2. (Note that here you need the input voltage and current from the power supply.)

4 Questions

4.0.1. According to your graphs for Section 1.2.1, which resistor conducts more charge per unit time per unit volt? Explain.

4.0.2. Examine the value of the currents flowing through the circuit with the resistors in series and determine if the electric charge could accumulate in any of the resistors. Explain.

4.0.3. Based on your data for resistors connected in parallel, determine if it takes the same energy to transport a given amount of charge through any of the resistors. Explain.