Physics 320 - Fall 2017
LAB 2 - Introduction to the Voltage Divider: Open Circuit and Loaded Circuit

Objectives: Be able to build a simple voltage divider, put a load on it, and measure the output.

To Turn In: The lab sheet with the specified information and the answers to the questions.

You should do the lab in your notebook and only transfer final data and answers to your data sheet when you are happy with it.

Show me your circuit before you apply power to it, i.e. before you hit the BRS (Big Red Switch)

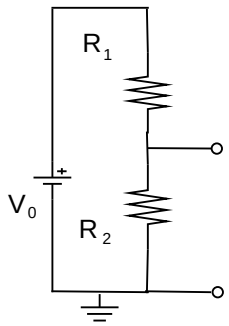

Figure 1: Voltage Divider - Let $R_1 = 1.1$ kΩ, $R_2 = 1.1$ kΩ, and $V_0 = 5$ V.

1. Construct the voltage divider shown above on the protoboard. Connect a ~ 5 V power supply to the divider. Make sure you measure the voltage and resistances. Verify that the divider functions as expected.

2. "Short" across the resistor R_2 with a short length of wire. Measure the voltage drop across R_1.

3. Measure the short-circuit current by replacing the wire with your DMM set to ammeter mode, i.e. the DMM is connected in parallel with R_2. Note: This is *not* the way to measure the current through R_2.

4. Now build the Load Circuit shown below. Use a Resistance Substitution Box as the variable resistor. Before connecting the box, do a random, but reasonably thorough, check that the box works well. This variable resistance is the load resistance, R_L, in the circuit.

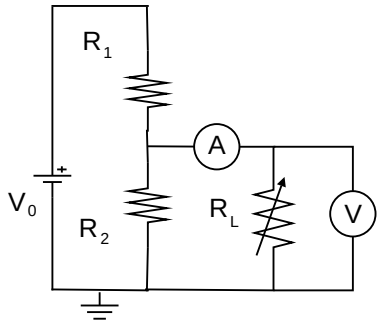

Figure 2: Loaded Voltage Divider - Let $R_1 = 1.1$ kΩ, $R_2 = 1.1$ kΩ, and $V_0 = 5$ V.

5. Measure the I-V curve of the loaded circuit; this is the *load line* for the circuit. Measure the voltage across R_L and the current through R_L for a series of values of R_L. Use your DMM to measure V_L and another meter to measure I. Make a table like the one on the data sheet in your notebook. Fill in the table and make a rough plot in your notebook as you go along. When you have enough data points to produce a smooth plot, fill in the table on the data sheet. You will need to have values of R_L up to and possibly exceeding 25 kΩ.

6. Analyze the circuit theoretically and compare your experimental results with the theory. The theory should be an equation of the form $I_L = f(V_L)$ where f will be paramaterized by V_0, R_1, R_2. To be clear, your expression will have I_L only on the left-hand side and *only* V_0, R_1, R_2, V_L, and numerals on the right-hand side. Remember that you have measured $V = V_0$ in step 2.

Name_____

Date_____

Data Sheet for Electronics Lab 2 - The Voltage Divider: Open Circuit and Loaded Circuit

Step 2 - Measuring the voltage drop across R_1: $V = V_0 =$_____

Step 3 - Measuring the source current: $I = I_{source} =$_____

R_L( )	V_L( )	I_L( )

Write out your derivation of the theoretical expression for $f(V_L)$ described in part 6. You may use the back of this sheet or a separate piece of paper.

Use your *favorite graphing program* to graph the experimental values and the theoretical model. Does the theory agree with experiment? Explain.

Does the load on the power supply increase or decrease with increasing R_L? (Hint: Think in terms of power delivered by the power supply which is the source of power. A voltage source is said to have a larger load on it when it must deliver more power.)