NAME ____________________________

EET 1150 Lab 1
Measuring Resistance, Voltage, and Current

OBJECTIVES

-Compute tolerance ranges for resistors.
-Build a simple circuit on a solderless breadboard.
-Use a digital multimeter to measure resistance, voltage, and current, selecting the meter's best range for each measurement.

EQUIPMENT and COMPONENTS

Safety glasses
Digital multimeter
Resistors: 27 Ω, 680 Ω, 1.2 kΩ, 2.2 kΩ, 5.6 kΩ, 10 kΩ

Part 1. Measuring Resistance

Data Table A (below) lists six resistor values, and also tells you the first three colors of their color codes. Get these resistors from the supply cabinet in the lab. The resistors will be in drawers labeled with the nominal value, but some resistors may be in the wrong drawers. So double-check the value by using the color codes given in the data table.

All of our resistors have **5% tolerance**. Calculate the minimum value and the maximum value in each resistor's tolerance range, and record your values in Data Table A. The first resistor in the table is done for you. When recording your values, be sure to include the proper unit (Ω, kΩ, or MΩ).

After calculating the minimum and maximum values, use the multimeter to measure each resistor. Record your measured values in the table, including the proper unit for each measurement.

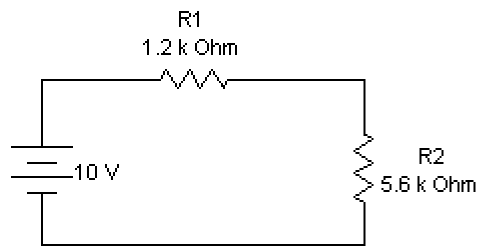
Decide whether each resistor falls within tolerance, and record your answer ("yes" or "no") in the Data Table. **If you find a resistor that falls outside of its tolerance range, call me over so that I can check your measurement.**

Data Table A: Measuring Resistors

Nominal Value	Color Code	Tolerance Range (5% tolerance)		Measured Value	Within Tolerance? (Yes or No)
		Minimum	Maximum		
27 Ω	Red, violet, black	25.65 Ω	28.35 Ω		
680 Ω	Blue, gray, brown				
1.2 kΩ	Brown, red, red				
5.6 kΩ	Green, blue, red				
10 kΩ	Brown, black, orange				

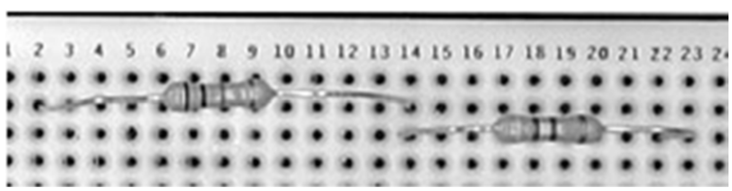
Part 2. Measuring Voltages and Currents in a Simple Circuit

Consider the simple circuit shown below. A simple "one-loop" circuit like this, in which all components are connected end-to-end, is called a **series circuit**.



Here we have a 10 V voltage source, a 1.2 kΩ resistor, and a 5.6 kΩ resistor. Our goal is to build the circuit and then to use the multimeter to measure several voltages and currents

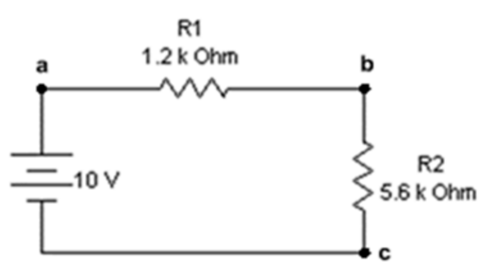
To build the circuit, start by placing a 1.2-kΩ resistor (which we're calling R1) and a 5.6-kΩ resistor (R2) on the breadboard in such a way that one of R1's legs is connected to one of R2's legs, as in the picture below. The exact placement is not important. In other words, you don't need to use column 14 on the breadboard as the column where these two resistors meet.



Now let's finish building the circuit by connecting the power supply:

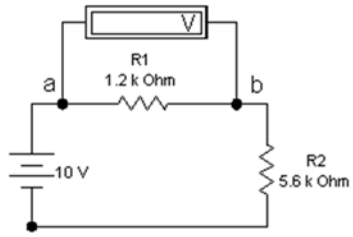
- **With the power turned off**, run a red wire from the power supply's positive terminal (the socket labeled "0~+15V") to the free end of resistor R1, and run a black wire from the negative terminal (the socket labeled "GND") to the free end of resistor R2. Of course, any color of wire would work just as well, but we'll always follow the standard electronics convention of using red for the positive voltage connection and black for the ground connection.
- Next, turn the power switch on.
- Then measure the voltage across the power supply's terminals, and **adjust it until it equals 10 V**, the value called for in the schematic diagram.

We're ready to measure some voltages and currents. Shown below is the schematic diagram again, but this time with three points (or "nodes," to use the proper term) labeled *a*, *b*, and *c*.



After reading the two following notes, measure and record the voltages listed in Data Table B below.

- **Note 1.** Recall from class that to measure the voltage v_{ab}, you simply touch the multimeter's red test lead to node *a* (which in this case is R1's leg that is connected to the power supply's positive terminal), and touch the meter's black test lead to node *b* (which in this case is R1's other leg). Here's a diagram showing the correct meter placement:

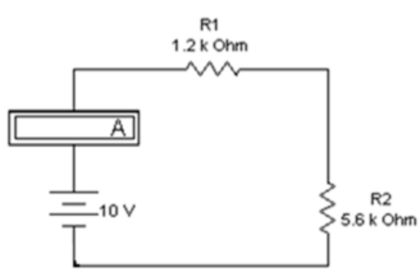


- **Note 2.** For all measurements, be sure to include the proper unit, and round all values to three significant digits. Also be sure you're using the multiemter's best range, and record that range in the table.

Data Table B: Measured Voltages in Circuit #1

Quantity	Measured Value	Multimeter Range Used
v_{ab}		
v_{ac}		
v_{bc}		
v_{ba}		
v_{cb}		
v_{ca}		

Next you'll measure the current at several points in the circuit. Measuring current is trickier than measuring voltage. To measure current, you must physically break the circuit open at some point, and then insert the meter into the circuit. For example, suppose we wish to measure i_a, the current at node *a*. Here's a diagram, followed by the steps you must follow:



- First, set the multimeter to measure current. (Remember, this means selecting DC Current as the measurement type and plugging the red test lead into the 100 mA jack.)
- Next, turn off the trainer's power supply. **You should always have power turned off while connecting or disconnecting any component in a circuit.**

- Break open your circuit by physically disconnecting the voltage source's positive terminal from R1. Now you must use the meter to "patch up" the break that you have made. To do this, connect the meter's red test lead to the voltage source's positive terminal, and connect the meter's black lead to the disconnected leg of R1.
- Now turn the power back on. Measure and record i_a, Record the value in Data Table C.
- In similar fashion, measure and record i_b and i_c. Record these values in Data Table C.

Data Table C: Measured Currents in Circuit #1

Quantity	Measured Value	Multimeter Range Used
i_a		
i_b		
i_c		

REVIEW QUESTIONS

Use complete, grammatically correct sentences in answering the following questions.

1. Suppose you measure voltage v_{ab} in a circuit and find the value to be 4.75 V. What value would you get if you measured v_{ba}?
2. From the data in Data Table B, what observations can you make about the voltages in our simple circuit?
3. From the data in Data Table C, what observations can you make about the currents in our simple circuit?

TECHNICAL CONCLUSION: Re-read the objectives at the beginning of this lab. For each objective, briefly state what you've learned from the lab. Include some discussion of how far off (percentage errors) your measured values were from your calculated values.