Lab Report 8– Resistance

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Abstract:

In this experiment our main goal is to experiment with various resistors given to us. Some resistors are of known value, another resistor given is of unknown value. We will measure the resistance of the resistors by connecting them to a voltage source and using a multimeter, we will be able to determine the current going through each of the resistors that we were given. Once we gather the data for two of the known resistors, we will follow the same procedure on the unknown resistor and compare and contrast the data from our known resistors with the data from our unknown resistors. Ultimately using Ohm's law to figure out the resistance of each of the tested resistors.

Introduction:

It is known that in circuits you will be using many tools, one of them being resistors. In this experiment we attempt to expand our knowledge on resistors and how to identify how much resistance a resistor has. We are trying to figure out what the colored labels mean on a resistor, why we would use resistors in a circuit and how do resistors with certain resistance affect Voltage and current in a circuit.

With this lab you will do a pre-lab to get the basic concepts of a resistor using a simulation application which will help you understand circuits and resistors. You will also be using a key to figure out the resistance of given resistors, pick two, connect them to a volt source and gather readings(voltage & current) from a multimeter. Then, you will be given another resistor, except this time, the resistance will be unknown and will follow the same procedure to obtain current and voltage reading to determine the resistance and type of resistor used. Once we finish this lab, we shall become more knowledgeable when working with resistors and able to figure out when to use a certain type of resistor.

Experimental Method:

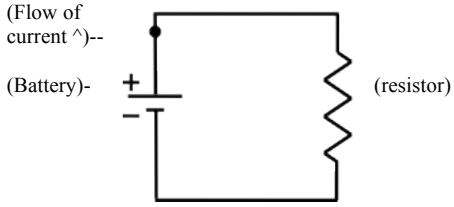
A. Pre-lab

Before you get to Lab, you must first complete a pre-lab to initiate the idea of what a resistor is, and how you will be using them in lab. For this pre-lab, you will use a simulation of a DC circuit.

(link provided below).

http://phet.colorado.edu/new/simulations/sims.php?sim=Circuit_Construction_Kit_DC_Only

Once you download and are able to use the simulation, you will build a simple circuit as shown.



You will drag a battery and resistor into your circuit, and consider the following questions.

1. Which way is the current flowing?

2. Use the ammeter to measure the current through the resistor. Make two current measurements, one on each side of the resistor. Write down both values. How do they compare?

3. What is the voltage across the ammeter when it is in the circuit?

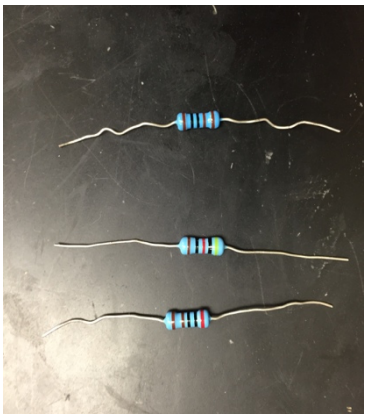
4. Connect the ammeter and voltmeter in such a way so as to read off the voltage across the resistor and the current through the resistor simultaneously. Draw the circuit diagram below, including where and how you connected the meters. The ammeter is represented as a circle with "A" in it, and the voltmeter as a circle with "V" in it.

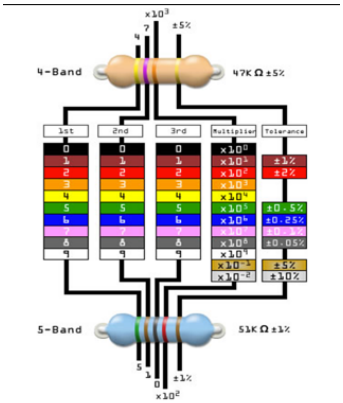
5. What is the internal resistance of an "ideal" voltmeter, namely one which does not disturb the change the circuit when you connect it? What is the internal resistance of an "ideal" ammeter?

This concludes the pre-lab for Lab-08-Resistance, and now you are able to begin the experiment.

B. Lab Experimental

In the first portion of this lab, we are given various resistors with colored bars on each of the resistors bodies.

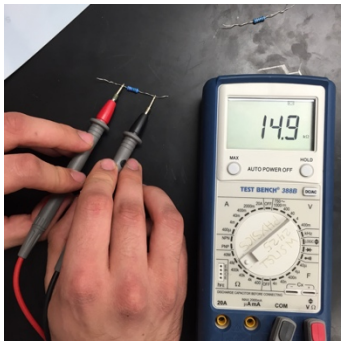




(Diagram1A. 3 resistors of different resistances) (Diagram 1B. key for type of resistor)

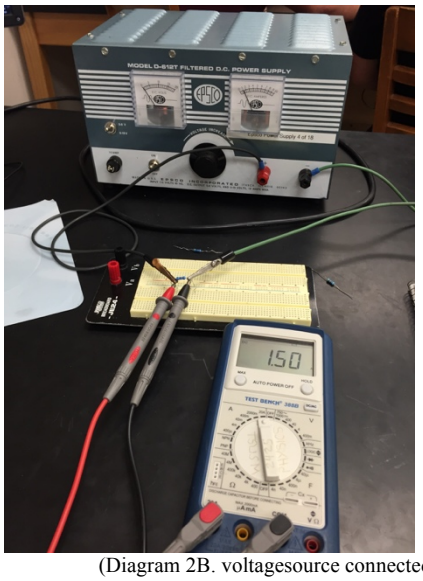
You will determine the Known resistance of each resistor by using the key (key: pictured above) that represents the bars on the resistors to determine the resistivity for the resistors. Once you've obtained the resistance for each resistor, to double check, you will use a digital multimeter to make sure that the resistors are correct according to the colored labels on each resistor.

Then, you will use two of the now known resistors to measure the voltage and current of the known resistor, you will do this a resistor at a time.



(Diagram 2A. multimeter reading the resistance of a resistor. Here we have a 15K ohm resistor.)

Begin to connect one of the resistor's to the breadboard provided by your lab instructor(this is just to keep the resistor in place) and connect the legs to the voltage source, turn on the voltage source slightly in between 0 to 1 volts. Use the multimeter to obtain the volts on the resistor, and change the settings on the multimeter to get the current on that resistor. record these values in a table to keep track of the resistors and their current/voltage. You will do 6 measurements, first from 0-1 Volts, and continuously increasing, BUT do not exceed 6 Volts.



(Diagram 2B. voltagesource connected to a resistor that is mounted on a breadboard. Multimeter used to measure voltage and amperage.)

Once you've done and recorded the data of one of the known resistors, repeat the same process for the other known resistor and record your data.

Here, we have the resistor connected to the breadboard, which is connected to the voltage source, and we use the multimeter to make our measurements,

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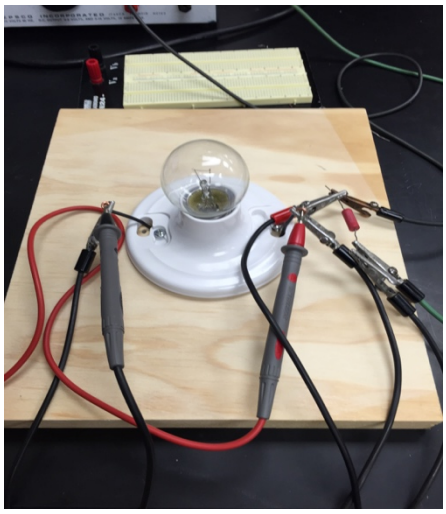
in this particular picture we measured current: 1.50 Amps.

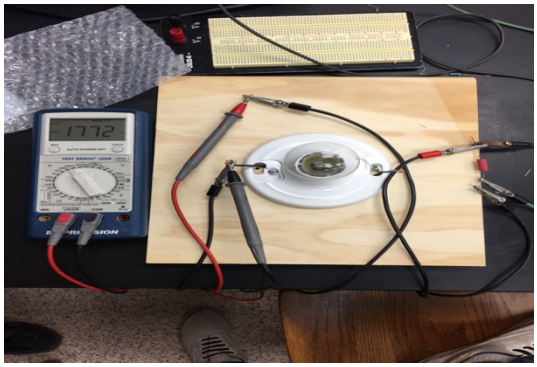
This concludes the first part of the experiment.

Next we will take current and voltage measurements once again, but we will alter the circuit by adding a lightbulb and replacing the known resistor, with an unknown (unlabeled) resistor to the system. First, begin by connecting the following circuit as shown below.

(Diagram 3A. Red resistor is unknown, connected to the voltage source not exceeding 6 volts.)



This setup is similar to our previous one, except we have added a lightbulb, which will also act as another resistor. You will perform the same procedure as before by starting with a low voltage and gradually increase the voltage WITHOUT exceeding 6 volts. But each time you increase the voltage, you will disconnect the right end of the lightbulb and THEN take the data received from the multimeter (current & voltage).



(Diagram 3B. multimeter measurement after current runs through the resistor.)

The readings should indicate the resistance and change in resistance of the unknown resistor. Once you finish record your data and observe the similarity and differences of the resistor measurements and determine the resistance of the unlabeled resistor.

Results:

After performing the experiment, we obtained and recorded our data for our two known resistors (2kohm's & 15kohm's). We also recorded the data for the unknown resistor. The results are the following.

2kohm		15kohm		Unknown	
Voltage	Amps.	Voltage	Amps.	Voltage	Amps.
1.0 V	0.23 amps	1.0 V	0.41 amps	0.9 V	0.03 amps
2.2 V	1.05 amps	2.4 V	1.8 amps	2.5 V	0.06 amps
3.2 V	1.93 amps	3.3 V	2.7 amps	3.2 V	0.67 amps
4.4 V	2.9 amps	4.6 V	4.0 amps	4.2 V	0.08 amps
5.5 V	4.7 amps	5.4 V	4.9 amps	5.4 V	0.088 amps
5.9 V	5.6 amps	5.8 V	5.5 amps	6.0 V	0.093 amps

(Diagram 4A. type of resistor used labeled on top, and voltage and amp measurements taken from the multimeter.)

Discussion & Conclusion:

After we gathered our data our observations describe the type of resistors used in the procedure. You can see from the table that the unknown resistor is more resistant than the other two known resistors. Using Ohm's law I was able to compare the resistance for each of the resistors, which is how I noticed the resistance for the unknown resistor is much greater than the other two resistors.

Ohm's law

$$V = IR$$

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$$R = V / I$$

Where ,

V stands for volts.
I stands for current.
R stands for resistance.

After figuring out the resistance for each of the resistors, I was able to determine the resistance they were depending on the current. I was only uncertain on the way to tell exactly what ohm resistor was used for the unknown resistor, all I got was that it was of much higher resistance according to ohm's law. But in the end, the unknown resistor turned out to be of much higher resistance, using our calculations, the unknow resistor was on average 40 ohms.

References:

- *Calc Conductivity Resistivity Relation Relationship - Sengpielaudio Sengpiel Berlin*. N.p., n.d. Web. 06 Apr. 2016. <http://www.sengpielaudio.com/calculator-ohmslaw.htm>.

- "Circuit Construction Kit (DC Only)." *PhET*. N.p., n.d. Web. 06 Apr. 2016. <http://phet.colorado.edu/new/simulations/sims.php?sim=Circuit_Construction_Kit_DC_Only>.

- "Resistors." *: Ohm's Law*. N.p., n.d. Web. 06 Apr. 2016. <http://www.allaboutcircuits.com/textbook/direct-current/chpt-2/resistors/>.