

Ohm's Law Lab

Name _____

In this lab you will learn how to:

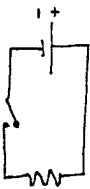
- A. Read a banded resistor rating
- B. Measure resistance in Ohms
- C. Measure current in Amperes
- D. Create an equation that describes Ohm's Law.

1. Use the chart on page 4-22 to figure out the resistor ratings (column 1). Each color stands for one digit in resistor value. The last color gives the error range.

2. Now you will determine the actual value of the resistor.

- a. Place each resistor on the breadboard.
- b. Turn the handheld digital multimeter to **20k Ω** .
- c. Touch the leads to the wires on the side of the first resistor.
- d. Record the actual value of the resistor (column 2).
- e. This is the value of the resistor in kiloOhms. Convert this number to Ohms (column 3)... k Ω =1000.

3. Using the materials at your desk, create the circuit below using the first resistor:



What type of circuit is this? _____

- a. On the High Current Power Supply, turn the 'Voltage Adjust' knob all the way to the left. Push in the blue **0-24V DC** button.
- b. Connect the red and black leads to (+) and (-) output below the knob.
- c. Push the power button.
- d. Turn the knob to **10.0 V** and leave it at this setting for the remainder of the lab.

5. To measure the current in the circuit, electricity must flow through the multimeter. To do this, you will use the countertop digital multimeter.

- a. Plug the remaining leads into the 'input' terminals below the Current knob. It is okay that the color do not match.
- b. Remove the single wire from the circuit and insert the ends of the leads in its place.
- c. Turn the current setting knob to **200mA**. Push the blue **DCA** button because you want to measure A (amps) in a DC (direct current) circuit.
- d. Push the power button.
- e. Record the current flowing through the circuit (column 4).
- f. This is the current in milliamperes. Convert this number to Amperes (column 5) ... mill = 1/1000.

Resistor	Resistor Rating	Actual Value k Ω	Actual Value Ω	Milliamperes (mA)	Amperes (A)	Current (A) x Resistance (actual)
A						
B						
C						
D						
E						
F						
G						
H						

Questions:

- 1. What are the units of measurement for Resistance?
- 2. What are the units of measurement for Current?

3. In the chart below, put the resistors in order from highest rating to lowest rating. Fill in the resistance and current through each resistor.

Resistor	Value	Current

4. As the resistance decreases, what happens to the current?

5. Anything that uses electricity is a resistor. Would you expect higher current in a lamp cord or a microwave cord? Why?

6. In the last column on the first table, multiply the actual resistance value in ohms and the current in amperes. What do you notice about the answers? What else in this lab had the same value?

7. A high gauge wire has a small diameter and a low gauge wire has a large diameter. Which wire do you think will have the most resistance, a 12-gauge or a 14-gauge? Why?

Ohm's Law

READ

A German physicist, Georg S. Ohm, developed this mathematical relationship, which is present in most circuits. This relationship is known as Ohm's law. This relationship states that if the voltage (energy) in a circuit increases, so does the current (flow of charges). If the resistance increases, the current flow decreases.

$$\text{Current (amps)} = \frac{\text{Voltage (volts)}}{\text{Resistance (ohms, } \Omega)}$$

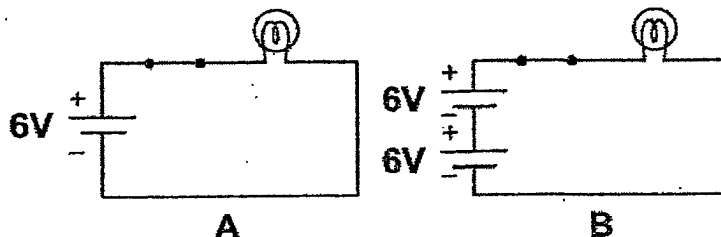
If a problem asks you to calculate the voltage or resistance, you must rearrange the equation $I=V/R$ to solve for V or R . All three forms of the equation are listed below.

$$I = \frac{V}{R} \quad V = IR \quad R = \frac{V}{I}$$

PRACTICE

In this section, you will find some problems based on diagrams and others without diagrams. In all cases, show your work.

1. How much current is in a circuit that includes a 9-volt battery and a bulb with a resistance of 3 ohms?
2. How much current is in a circuit that includes a 9-volt battery and a bulb with a resistance of 12 ohms?
3. A circuit contains a 1.5 volt battery and a bulb with a resistance of 3 ohms. Calculate the current.
4. A circuit contains two 1.5 volt batteries and a bulb with a resistance of 3 ohms. Calculate the current.
5. What is the voltage of a circuit with 15 amps of current and toaster with 8 ohms of resistance?
6. A light bulb has a resistance of 4 ohms and a current of 2 A. What is the voltage across the bulb?
7. How much voltage would be necessary to generate 10 amps of current in a circuit that has 5 ohms of resistance?
8. How many ohms of resistance must be present in a circuit that has 120 volts and a current of 10 amps?
9. An alarm clock draws 0.5 A of current when connected to a 120 volt circuit. Calculate its resistance.
10. A portable CD player uses two 1.5 V batteries. If the current in the CD player is 2 A, what is its resistance?
11. You have a large flashlight that takes 4 D-cell batteries. If the current in the flashlight is 2 amps, what is the resistance of the light bulb? (Hint: A D-cell battery has 1.5 volts.)
12. Use the diagram below to answer the following problems.



- a. What is the total voltage in each circuit?
- b. How much current would be measured in each circuit if the light bulb has a resistance of 6 ohms?
- c. How much current would be measured in each circuit if the light bulb has a resistance of 12 ohms?