OHM'S LAW

Ohm's law is the fundamental relationship between current, voltage, and resistance in a circuit. Devices that measure resistance are based on Ohm's law. These devices apply a known voltage and/or current, and then determine the resistance. In this lab you will determine the relationship between current, voltage, and resistance and use it to predict an unknown resistance.

Objectives

- Create a basic resistor circuit and correctly measure the current and voltage.
- Determine the mathematical relationship between current, voltage, and resistance.
- Use the mathematical relationship to predict an unknown resistance.

Materials and Equipment.

- Data collection system
- Wireless current sensor
- Wireless voltage sensor
- Wireless AC/DC Module
- Basic Modular Circuits Kit

Safety

Follow regular laboratory safety procedures

Procedure

1. Select Sensor Data in SPARKvue.
2. Connect the wireless current sensor, wireless voltage sensor, and the wireless AC/DC module to your device.
3. Create two digital displays, one of current and another of voltage.
4. Construct the circuit shown in Figure 1 using a SPST switch module, a 33 Ω resistor, the wireless AC/DC module, the wireless current sensor, the wireless voltage sensor, and any necessary wire modules. Notice that the current sensor is part of the circuit but not the voltage sensor.

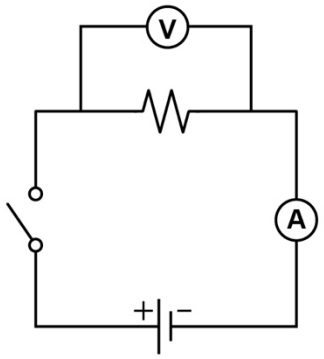


Figure 1

5. Set the output voltage of the AC/DC Module to 0.5 V DC and close the switch on your circuit.
6. Select Start to begin data recording.
7. Record the current and the voltage measured across the resistor in the data table in the Data Collection section.
8. Increase the output voltage of the AC/DC Module by 0.5 V. Repeat steps 7-8 until you have reached an output voltage of 3 V and completed the data table.
9. Stop recording data and open the switch on your circuit.

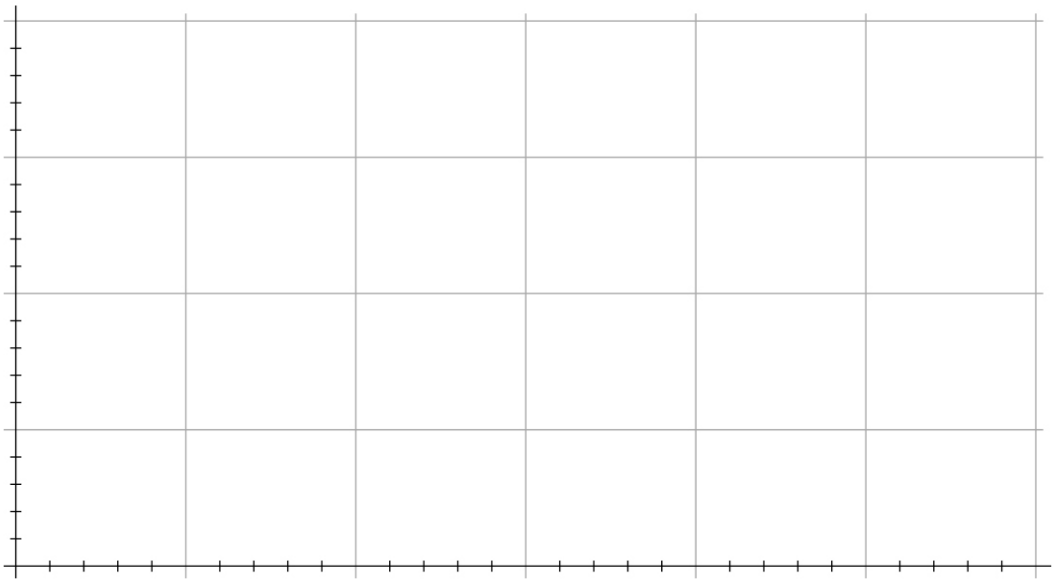
Data Collection

Table 1: Current and voltage for 33 Ω Resistor

Output Voltage (Volts)	Current (Amps)	Voltage (Volts)
0.5		
1.0		
1.5		
2.0		
2.5		
3.0		

1. Plot a graph of *voltage* versus *current* in the blank axes. Put *voltage* on the vertical axis and *current* on the horizontal axis. Label both axes, include units, and use the correct number scale. Draw a best-fit line using a straight edge through your data.

Graph 1: Voltage Vs Current



Questions and Analysis

1. Pick 2 points on your best-fit line and calculate the slope. Show your work below. Include the units of your slope.

2. Look at the numerical value for your slope. What else in the lab has a numerical value very close to the value of your slope?

3. Write an equation for your line using the y = mx + b form, replacing the "y" with a V for volts because that is what is plotted on the y axis. Replace the x with an "I" for current because that is what is plotted on the x axis. Replace the "m" for slope with an "R" because that is what your slope should have been very close in value to. Your y intercept "b" should be very close to zero, it can be left out of your equation. Your resulting equation is known as Ohm's Law. Had you done this experiment before 1827, it might be named after you!

4. Using what you learned from questions 2 and 3, predict the slope of a graph of Voltage Vs Current if you repeated this experiment with a 22 Ω resistor. Sketch a line representing a graph resulting from repeating this experiment with a 22 Ω resistor on the axes in the Data Collection section, use a different color if possible.

5. You may have noticed that your measured values for voltage were slightly different from the output voltage from the AC/DC module. This is because the wireless current sensor, connectors, and wires have a small amount of resistance. Use Ohm's Law and the current measured when the output voltage was 3 V to find this resistance. Show all of your work below.

6. Ohm's Law is often written as V = IR, as you found out in question 3. It is also useful to write it solved for current and solved for resistance. Algebraically rearrange Ohm's Law to solve it for current (I = ?) and resistance (R = ?) below. Show all of your work.

7. Another student group did this experiment but accidentally set the output voltage to 4 V. Predict what current and voltage they measured before they noticed their mistake. Don't forget to include the resistance you found for the wireless current sensor, connectors, and wires in question 5. This is usually about 3.0 Ω. Show all of your work and your answers below.