[Ohm’s Law](http://www.youtube.com/watch?v=J4Vq-xHqUo8)                         Name:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Purpose: To investigate Ohm’s law, measure resistances, and study I-V characteristics.

Apparatus: DC power supply, connecting wires-5 (banana plug), 2-alligator clips, 15-ohm resistor, 10-ohm resistor, light bulb (6.3A, 0.5A), voltage sensor, and [digital multimeter](https://www.youtube.com/watch?v=bF3OyQ3HwfU) (DMM).

Theory: Georg Simon Ohm (1787-1854), a German physicist, discovered Ohm’s law in 1826. This is an experimental law, valid for both alternating current (ac) and direct current (dc) circuits. When you pass an electric current (I) through a resistance (R) there will be an electric potential difference (V) created across the resistance as shown below.


Ohm’s law says that the current (I) is directly proportional to the potential difference (V). The resistance R can be obtained using the following equation:

                                V = I R

Units: V------> volt (V), I------> ampere (A), R-----> ohm (Ω).

Electric power, P is given by the following equation:

                    Power = Voltage x Current. P = V x I

For ohmic resistances, *V versus I* is a linear relationship, and they have a constant resistance. Resistance can be calculated using, R = V/I. The slope of the *V versus I*, line will also give the resistance, R.

For non-ohmic resistances, *V versus I* is a non-linear relationship, and they have a varying resistance. The resistance at a particular point can be calculated using, R = V/I, where V and I are the potential difference (or voltage) and current at that point.

In the first part of this activity, investigate the relationship between current and voltage in a standard 10-ohm and 15-ohm resistors. Then, investigate the relationship between current and voltage in the filament of a small light bulb.

Answer the following:

1. Electricity comes in two types. Name these two types and give an example for each.

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2. Name five quantities and their units, used in electricity.

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| --- |
| **Terms in Electricity** |
| **Physical Quantity** | **Unit (unit abbreviation)** |
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3. Go to the following simulation: <https://phet.colorado.edu/en/simulation/ohms-law>.

a. Keep the resistance constant; change the voltage, observe what happens. Describe the relationship between current and voltage. Also, include a plot.

b. Keep the voltage constant; change the resistance, observe what happens. Describe the relationship between current and resistance. Also, include a plot.

Procedure:

A. Checking the circuit elements:

1. Measure the 10-ohm, 15-ohm, light-bulb resistances with the DMM and record your results below.

|  |  |  |  |
| --- | --- | --- | --- |
| Element | 10-ohm | 15-ohm | Light-bulb |
| Measured Resistance value |  |  |  |

1. Connect the power supply to the DMM (+ to +V and – to COM) and measure the voltage for each of the supply settings.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Setting |  |  |  |  |  |
| Measured voltage value |  |  |  |  |  |

B. Unknown Resistances: 10-ohm and 15-ohm

1. To measure the current the ammeter needs to be in a series circuit with power supply and the unknown resistance. Voltmeter needs to be in a parallel circuit with the unknown resistance.
2. Turn off or unplug the power supply and connect the following in a series circuit: Power supply, 10-ohm resistance, and DMM as ammeter (dc 10A). Connect the voltage sensor across the 10-ohm resistance in a parallel circuit. Call the instructor to check the circuit.
3. Pair the voltage sensor with the computer and set up the PC for manual data collection.
4. Collect the current and voltage data for all the settings of the power supply. Start with the lowest setting.
5. From the V vs I graph obtain a value for the unknown resistance.
6. Repeat the above measurements for the other unknown resistance.

C. Unknown Resistance: Light Bulb

1. In the above circuit replace the light bulb with the unknown resistance.
Collect the current and voltage data for all the settings of the power supply. Start with the lowest setting.
2. Plot V vs I graph, and describe what you observe.
3. Calculate the power and describe what you observe.