Phys 135B

Activity 6: Electric Potential, Batteries, Bulbs, Resistors, and Electric Current

Name:

Partners:

Before we start dealing with magnetic field, we will learn about the electric circuits.

The objective in this activity is

1. To understand the relationship between electric potential (voltage) and electric current.
2. To learn about electric circuits and various circuit elements such as power supply, wires, bulbs, and resistors, and to draw circuit diagrams using symbols.
3. To understand how current flows through a conductor (copper wire) in an electrical circuit.
4. To understand how to use a digital multi-meter to measure current, voltage, and resistance.
5. To discover Ohm’s Law.

**OVERVIEW**

In the next few lectures, we are going to extend and apply some of the theories about electric charges and potential differences to electric circuits. This will prove to be the most practical part of this course, since electric circuits form the backbone of twentieth century technology. For instance without electric circuits we wouldn’t have electric lights, air conditioners, automobiles, telephones, TV sets, dishwasher, computers, Xerox machines, or electric toothbrushes.

Battery is a term applied to any device that generates an electrical potential difference from other forms of energy. We will use power supplies instead of batteries. They function in the same way, though.

As a result of a potential difference between the two terminals of a power supply, an electric charge can be repelled from one terminal of the power supply and attracted to the other, provided that the terminals are connected via a conducting material. A flow of charge can cause a small light bulb to glow. In this activity, you are going to explore how charge originating in a power supply flows in wires and bulbs. You will be asked to develop and explain some models for how charge is flowing. You will also be asked to devise ways to test the models you come up with using an ammeter, which is a device to measure the rate of flow of charges through it.

**Current as a Measure of the Flow of Charge**

The rate of flow of charge is more commonly called electric current. If charge is flowing through a conductor then the definition of current is given by

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The unit of current is called ampere (A). One ampere represents the flow of one coulomb of charge through a conductor in a time interval of one second. .

**Model of Current Flow in Electric Circuits**

Thinking of a simple circuit of a battery and a resistive element such as a light bulb, develop a model for the electric charge flow in a circuit. Record your model below. Test your idea(s) setting up such a circuit, and using an ammeter and a voltmeter. (Dr. Zorba will describe what ammeter and voltmeter are, and how they work.) Take note of the result(s) of your experiment below.

**Current-Voltage Relationship in a Resistive Circuit**

Now replace the light bulb in the above circuit with a resistor (it will be provided). Vary the voltage in increments of 0.5 volts, measure the corresponding currents for voltage values given in the table below. Record the measured current values in the column provided. Open an Excel spreadsheet and plot electric current versus voltage. Is the relationship linear? What is the exact relationship between current and voltage. This law is called Ohm’s law.

|  |  |
| --- | --- |
| Voltage (volts) | Current( ) |
| 0 |  |
| 0.5 |  |
| 1.0 |  |
| 1.5 |  |
| 2.0 |  |
| 2.5 |  |
| 3.0 |  |
| 3.5 |  |
| 4.0 |  |
| 4.5 |  |
| 5.0 |  |

**Plot of Current vs Voltage:**