Lesson # 7	**Topic: Current Electricity**

Overview & Rationale:
In this lesson the students will prepare for the lab "Current in a Simple Circuit". This lab is intended to give the students the opportunity to explore the properties of electric current and familiarize themselves with simple circuits. They will practice setting up simple circuits in series and parallel and drawing schematic diagrams so that in the lab they can focus on reading current and observing how different circuit connections affect the light intensity. From their lab results the students will gain a general understanding of the relationship between current, voltage and resistance (OHM's law).

Objectives (SWBAT)	**Materials:**
• Set up a simple circuit in series • Set up a simple circuit in parallel • Construct circuit diagrams for the circuits they will be connecting in the lab	• Multimeter, wires, batteries, lamps, switches • Pre-lab WS • Lab handout • Extra handouts of lab report guidelines • OH of procedure • OH of Date Table

Time	**Student Activities**	**Teacher Notes**
10 min	• Introduction to lab activity • Make appropriate changes to procedure and materials	• Handout Lab • Summary of what the lab is all about • Q: What is a circuit? What is current? What does series mean? What does parallel mean? • OH of procedure • Fill in changes and ensure that they are adding changes to their procedures

20 min	• Participate in demo of setting up circuits and using the multimeter
	• Draw schematics for each group
		• Give a set of materials to each table (no batteries!)
		• Set up of multimeter
		• Have the students connect the circuits with you as you go through
		  ◦ one lamp
		  ◦ 2 lamps in series, 3 in series
		  ◦ 2 lamps in parallel, 3 in parallel
		• Have them draw the schematic for each on the data table as you go through
		• Draw the schematic on the WB table for each

15 min	• Pre-lab WS	• Handout pre-lab WS • MUST be done for next class

15 min	• pre-lab report	• Remind them of lab report guidelines • MUST be done for next class • MUST include: Purpose, Hypothesis "Which circuit will have the greatest current?", methods and materials, data table (attach pink sheet)
Assessment: • Pre lab questions • Pre Lab report		**Criteria:** • Completed • Demonstrated understanding and ability to participate in lab activity next class

PRE LAB ACTIVITY:
Answer the following questions on a separate sheet of paper titled pre-lab questions and attach them to your lab report.

"Current in a Simple Circuit"

1. **Prepare the data table on the following page by drawing circuit diagrams for each part of the experiment as outlined in the procedure handout. (use the symbol for ammeter to represent the multimeter you will be using)**

2. **When using the multimeter, which scale must you use for your first reading? Why?**

3. **Predict how the current measured in the series circuits will compare to the current measured in the parallel circuits.**

4. **How is electron flow in a series circuit different from electron flow in a parallel circuit?**

5. **Define RESISTANCE. Which of the circuit components offer resistance to electron flow?**

CURRENT IN A SIMPLE CIRCUIT

PURPOSE: To explore the properties of current and to familiarize yourself with the multimeter and simple circuits.

INTRODUCTION:

A circuit is a path that electrons flow along. In the circuits we will be exploring, electrons leave the battery at the negative terminal, travel through the switch, the multimeter and the light bulb then return to the positive end of the battery. The multimeter is used to measure the flow of electrons in a circuit. Electron flow is measured in amps or milliamps (1/1000 of an Amp) and is represented using the symbol A or mA. One ampere of current is equivalent to the flow of 1 coulomb of electrons per second.

In this experiment we will investigate two types of simple circuits:

Series: In a series connection the electrons travel along a single, direct path through *all* of the light bulbs in the circuit.

Parallel: In a parallel connection the electrons must choose one of several paths and will only travel through *one* of the light bulbs in the circuit.

MATERIALS:

- Multimeter
- Battery
- Battery holder
- 3 light bulbs
- Connecting wires

PROCEDURE:

****NEVER** use an ammeter on a live socket. Voltage from a socket can damage it and hurt you!!
**Construct each circuit with the switch OPEN. Close the switch to read the current and then open it again.

Answer the questions given in the procedure on the table titled "Lab Questions" and include these questions in the observations section of your lab report

1. Construct **CIRCUIT A** which includes a **battery, a single light bulb, a multimeter and a switch.** Determine the current in mA and record it in your data table. Note the light intensity of the light bulb and record your observations in your data table.

   *As shown in the demonstration, make sure you start at the highest plug-in on the ammeter and work your way down to the appropriate setting.

- What would the current be if the light bulb burned out? How do you know this?

2. Construct **CIRCUIT B, two light bulbs in series** by adding a second light bulb two circuit A. Determine the current and record this in your data table.

- Did you observe a change in light intensity when a second bulb was added to the circuit? If so, why? Record your observation in your data table.

3. Predict the current and light intensity when three light bulbs are connected along the same path (series). Record this prediction in your data table.

- What is the relationship between current and light intensity you have observed so far?

4. Construct **CIRCUIT C, three light bulbs in series** by adding a third bulb to circuit B. Determine the current and observe the light intensity and record in your data table.

- How could you make these three light bulbs as bright as the light bulb in circuit A?

5. Construct **CIRCUIT D** which includes **a battery, two light bulbs in parallel, a multimeter and a switch.**

- Is there a difference in the current between the two light bulbs connected in series and the two light bulbs connected in parallel? If so, why?

6. Predict what the current will be if you connect three light bulbs in parallel. Record your prediction and explain you reasoning.

7. Construct **CIRCUIT E, three light bulbs in parallel** by adding a third bulb to circuit D. Record the current and note the light intensity in your data table.

- What conclusions can you make about electron flow after observing series and parallel circuits?

Observations:

Data Tables:

	Circuit A	Circuit B	Circuit C	Circuit D	Circuit E
Circuit Diagram					
Series or Parallel?					
Predictions					
Current (A/mA)					
Observations					

Lab Questions: (To be answered during the lab and included in the observations section of your lab report)

• What would the current be if the light bulb burned out? How do you know this?
• Did you observe a change in light intensity when a second bulb was added to the circuit? If so, why?
• What is the relationship between current and light intensity you have observed so far?
• How could you make these three light bulbs as bright as the light bulb in circuit A?
• Is there a difference in current between the two light bulbs connected in series and the two light bulbs connected in parallel? If so, why?
• What conclusions can you make about electron flow after observing series and parallel circuits?

POST LAB ASSIGNMENT:

Answer the following questions in the DISCUSSION section of your lab report

1. Explain, based on your observations, how current relates to batteries, electrons, and light bulbs.

2. Draw a schematic diagram of a circuit containing a battery, a switch, four light bulbs in parallel, and an ammeter using the appropriate symbols. Use arrows to indicate the direction the direction of electron flow. If one of the lamps in this circuit burnt out, what would happen to the other ones?

3. Based on your observations during the lab explain the changes in current;
    a. In series vs. parallel circuits.
    b. As the number of light bulbs increases

4. Would it be best to connect the bulbs in a string of Christmas tree lights in series or in parallel? Explain your answer.