Electrical Circuits Lesson Plan using document camera

Unit: Electricity

Grade Level: 8th

Type of Lesson: Introductory lesson for circuits and how to use the multimeter.

Focus of Lesson: Building Series and Parallel Circuits

Time: 3, (50 min.) class periods

Illinois Learning Standards:

The focus of science and this lesson using the document camera is supported by the Illinois Learning Standards

Through Applications of Learning, students demonstrate and deepen their understanding of basic knowledge and skills. In solving problems the students will recognize and investigate problems; formulate and propose solutions supported by reason and evidence.

Asking questions and seeking answers are at the heart of scientific inquiry. Following the steps of scientific inquiry, students learn how to gather evidence, review and understand their findings, and compare their solutions with those of others. They learn that there can be differing solutions to the same problem, some more useful than others. In the process, they learn and apply scientific principles. They also learn to be objective in deciding whether their solutions meet specifications and perform as desired.

Communicating with the assistance of the **Document Camera** the students will be able to express and interpret information and ideas. Scientists must carefully describe their methods and results to a variety of audiences, including other scientists. This requires precise and complete descriptions and the presentation of conclusions supported by evidence. Students gain the ability to organize and study data, to determine its meaning, to translate their findings into clear understandable language and to compare their results with those of other investigators. Use appropriate instruments, electronic equipment, computers and networks to access information, process ideas and communicate results.

Technology is invented and improved by the use of scientific principles. In turn, scientists depend on technology in communicating the results. Science students learn to use a range of technologies: instruments, computer hardware and software, on-line services and equipment, primary source data and images, and communication networks.

Working on teams the students Learn and contribute productively as individuals and as members of groups. The practical application of science requires both individual and group efforts. Individuals bring unique insight and focus to the work of inquiry and problem solving. Working

in groups, scientists pose questions, share hypotheses, divide their experimental efforts, and share data and results. Science students have the opportunity to work both ways—as individuals and as members of teams organized to conduct complex investigations and solve problems.

The students must Recognize and apply connections of important information and ideas within and among learning areas. Science, at its best, provides knowledge and skills that improve the understanding of virtually all subjects, in this case, how it electricity relates to their world.

Specific Science Standards met in this activity are:

11.A.3a Formulate hypotheses that can be tested by collecting data.

11.A.3b Conduct scientific experiments that control all but one variable.

11.A.3c Collect and record data accurately using consistent measuring and recording techniques and media.

11.A.3d Explain the existence of unexpected results in a data set.

11.A.3e Use data manipulation tools and quantitative (e.g., mean, mode, simple equations) and representational methods (e.g., simulations, image processing) to analyze measurements.

11.A.3f Interpret and represent results of analysis to produce findings.

11.A.3g Report and display the process and results of a scientific investigation.

12.C.2a Describe and compare types of energy including light, heat, sound, electrical and mechanical.

12.C.3a Explain interactions of energy with matter including changes of state and conservation of mass and energy.

Lesson Objectives:

By the end of the lesson the students will be able to

1. Describe a series circuit
2. Describe a parallel circuit
3. Describe how current flows in a series and parallel circuit
4. Explain how electrical energy is supplied to devices in a circuit
5. Use electrical symbols to draw a simple circuit
6. Distinguish between open and closed circuit
7. Measure voltage in a battery
8. Measure current in a circuit

Materials:

For the class - Document Camera

For each group – 2, D-cell battery, battery holder, flashlight bulb, 5 wires, circuit board, switch. Day 3 will require 3 bulbs and at least 6 wires

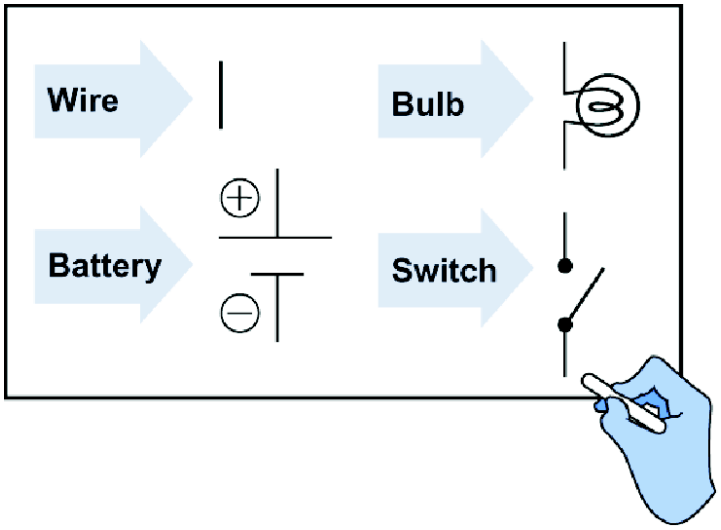
For each student – Student sheet to be placed in their science notebook when complete.

Hook:

Decorate the room with all sorts of electrical lighting and devices. I use laser lights, plasma globe, Christmas lights, music. At the end of the lesson I ask them what circuits they think each device requires.

Procedure Day 1:

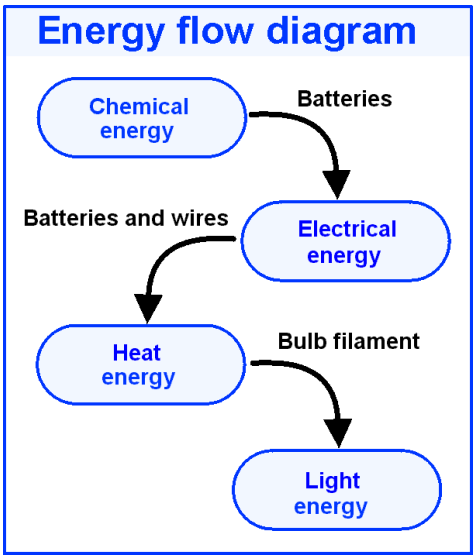
1. Using the, **DOCUMENT CAMERA** show the students the symbols they will need to draw a simple circuit. Have the students record this on the student sheet (#1)



2. Pass out to each group (2-3) the bulb, D-cell battery, battery holder, switch, and 5 wires. (Christmas bulbs and wires may be used) and a student sheet for each person in the group.
3. Challenge the students to "Make the bulb light."
4. Ones they have figured out how to make it light they then are to draw a diagram using the proper symbols of what worked on their student sheet. Their drawing they should show how current flows in their circuit. Student Sheet (#2)
5. Each group will then bring up the circuit board and their diagram to the front of the class and display their circuit board using the **DOCUMENT CAMERA** and explain how current flows through the circuit.

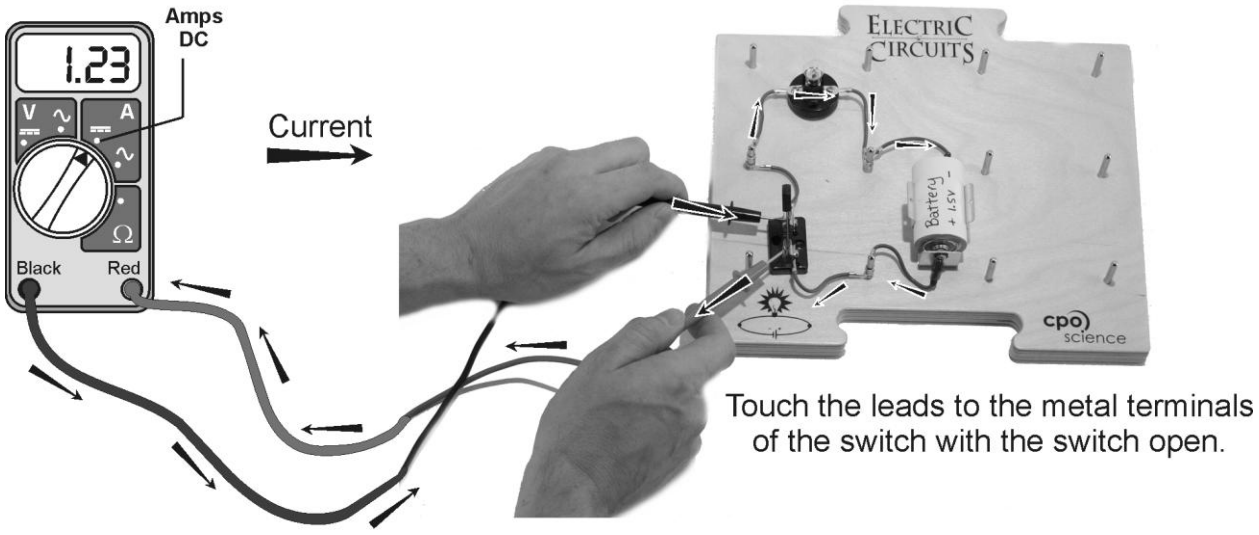
- Each group will project their circuit board using the **DOCUMENT CAMERA** trace the flow of electricity with their finger.
- At this time address any misconceptions the students may have about current.

6. As each group explains their circuit, encourage students to describe the differences and similarity with other groups.
7. Questions to ask:
   - How do you know that the current is flowing in the circuit?
   - Can you see current flow?
   - How does the switch cause the current to stop flowing?
   - Why does the bulb go out when you open the switch?
8. Using the document camera draw a diagram to show how energy flows. Student Sheet (#7)



Procedure Day 2:

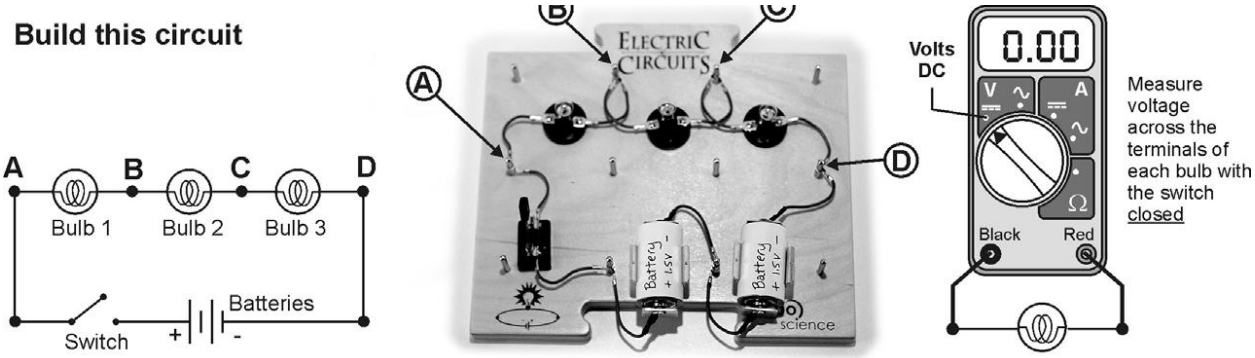
1. Pass out the Multimeters to the groups
2. Using the **DOCUMENT CAMERA** demonstrate while the class follows along on the use of the meter.
3. Measuring Current (Amps)
   - Turn the dial of the meter to DC amps. (each multimeter is slightly different)
   - Red goes to the positive terminal and black to the negative terminal.
   - The meter reads the voltage between the 2 points.
4. Add another battery and repeat the steps above using both batteries.



5. Using the **DOCUMENT CAMERA** show the students the set up above and have them duplicate it. Then ask them to check current (amps) with the switch opened and then closed.
    - Set the multimeter to DC amps (current)
    - Open the switch and touch the red lead to the metal part of the switch closet to the batteries positive terminal
    - Touch the black lead to the metal part on the other side of the switch.
    - The bulb should light, showing that the current is flowing through the meter.
6. The students should follow along as you demonstrate and then record the current that is flowing on the student sheet. (#11)
7. Have the students write definitions for current, amps, and electrical circuit. (#12)

Procedure Day 3:

1. Tell the students that there are 2 types of circuits. Series and Parallel. Yesterday they built a simple series circuit. Ask them what they think series means.
2. Once a definition has been stated have the students write it on the student sheet. (#12)
3. This time ask them to build a series circuit with 3 bulbs and 2 batteries and a switch.
4. Check to see each group has this completed.
5. Have one group bring their electrical board to the front and using the **DOCUMENT CAMERA** review with the class how this fits the definition of a series circuit.
6. Demonstrate how to measure voltage using the multimeter and the **DOCUMENT CAMERA**
    - Set the meter to DC volts.
    - Close the switch and measure the voltage across different places by touching the leads to the bulbs terminals.



7. Next have them measure the voltage of the series circuit following the diagram and recording the information on the student sheet (#13)
8. Parallel circuits have more than one path for electricity to flow. Tell the students to record the definition for parallel circuits on the student sheet (#12)
9. Once the students have the circuits built and record the information on their sheet have one group come up and describe the path the current flows in the parallel circuit using the **DOCUMENT CAMERA** to project their circuit.
10. Call another group un and using the **DOCUMENT CAMERA** remove one bulb and have them explain the flow of current in the parallel circuit.

Conclusion:

This lesson is an introductory lesson for the electricity unit. The students will be using this information as a spring board for studying resistance and power. They will identify the relationships between voltage, resistance and current for series and parallel circuits.

Assessment: The teacher will check for understanding at each step by:

- Asking questions during the student demonstrations of the circuits
- Reviewing the student sheet and checking for misconceptions.

Electrical Circuits Student Sheet

1. Draw the electrical symbols for each below
   Battery

   Bulb

   Switch

   Wire

2. Build a circuit with a battery, bulb and switch. Draw the circuit below.

3. How can you tell the electric current is flowing in the circuit? Can you see current flow?

4. Current flows from positive to negative. Trace the flow of current around the circuit and draw arrows on your diagram above.

5. How does the switch cause the current to stop flowing?

6. Why does the bulb go out when you open the switch?

7. Draw the energy flow diagram of the circuit. Label the forms of energy that appear.

8. What is the voltage of your battery?

9. What is the total voltage of both batteries? Try the 4 possible ways.

+ to +

+ to -

- to +
- to -

10. How do these reading compare to just one battery?

11. How much current is flowing in your circuit?

12. Define the flowing words:

Current

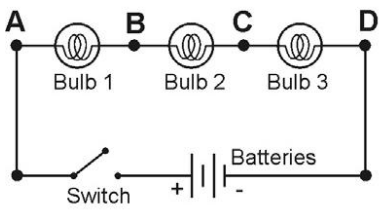
Amps

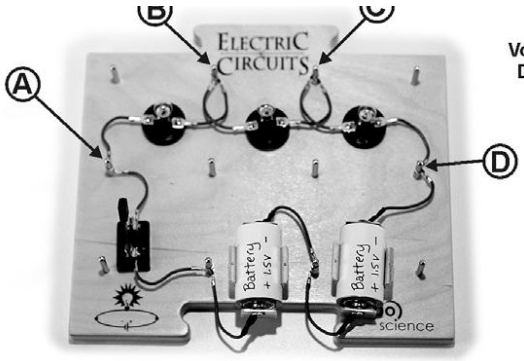
Electric Circuit

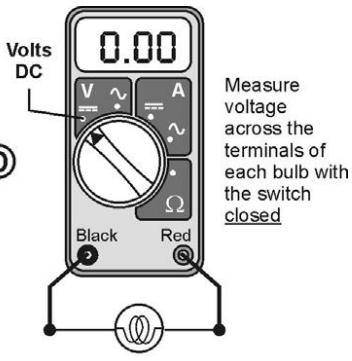
Series Circuit

Parallel Circuit

Build this circuit







Measure voltage across the terminals of each bulb with the switch closed

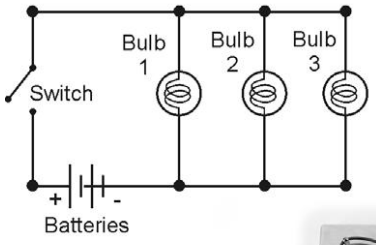
Voltage Measurements (Volts)

Between A and B	Between B and C	Between C and D	Between A and D

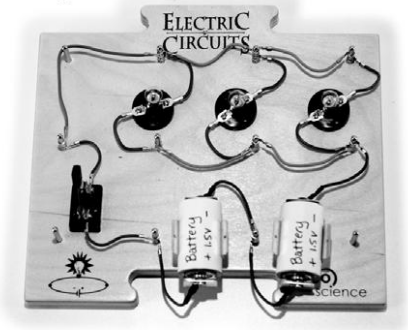
13. What relationships do you see among the voltage measurements?

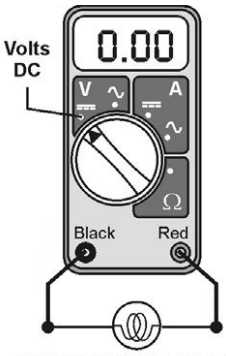
14. What do voltage measurements tell you about the flow of energy in the circuit?

15. If you remove one bulb, do the others still stay lit?

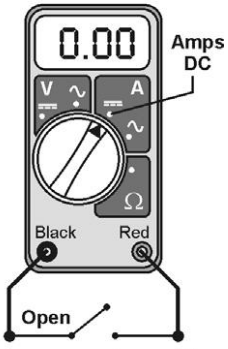


Build this circuit





Measure voltage across the terminals of each bulb with the switch closed



Measure current across the switch terminals with the switch open

Voltage and Current in a parallel circuit

	Total Circuit	Bulb 1	Bulb 2	Bulb 3
Voltage (V)				
Current (A)				

16. How does the brightness of the bulbs compare to the series circuit?

17. How does the total current compare to the single bulb circuit (#8) the 3 bulb series circuit (#13) and the 3 bulb parallel circuit (above)?

18. If one bulb is removed, to the other bulbs still stay lit?

19. Do you think homes are wired in parallel or series circuits? Why?