Delivering More Than Power.℠

Lesson Plan for
Electric Circuits

Last Updated: 11/6/2009
Updated by: Sci4Kids

Lesson Summary

Lesson name	Electric Circuits	
Audience	Fourth Grade students	
Focus Standards (4^{th} grade)	• Strand 5, Concept 3, PO 1: Demonstrate that electricity flowing in circuits can produce light, heat, sound and magnetic effects. • Strand 5, Concept 3, PO 2: Construct series and parallel electric circuits. • Strand 5, Concept 3, PO 3: Explain the purpose of conductors and insulators in various practical applications. • Strand 5, Concept 3, PO 5: State cause and effect relationships between magnets and circuitry.	
Fourth Grade AZ standard(s) applied	• Strand 1, Concept 1, PO 1: Differentiate inferences from observations. • Strand 1, Concept 1, PO 3: Formulate predictions in the realm of science based on observed cause and effect relationships. • Strand 1, Concept 2, PO 1: Demonstrate safe behavior and appropriate procedures in all science inquiry. • Strand 1, Concept 2, PO 3: Conduct controlled investigations in physical sciences. • Strand 1, Concept 2, PO 5: Record data in an organized and appropriate format. • Strand 1, Concept 4, PO 1: Communicate verbally or in writing the results of an inquiry. • Strand 1, Concept 4, PO 3: Communicate with other groups or individuals to compare the results of a common investigation. • Strand 2, Concept 1, PO 1: Identify how diverse people and/or cultures, past and present, have made important contributions to scientific innovations. • Strand 2, Concept 2, PO 2: Describe the interaction of components in a system. • Strand 3, Concept 2, PO 1: Describe how science and technology have improved the lives of many people.	
Lesson objective(s)*	• The students will demonstrate knowledge of basic electricity concepts by discussing the concepts of electricity and by answering questions at the end of the lesson. • The students will demonstrate application of basic electricity concepts by conducting inquiry activities. • The students will demonstrate analysis of circuitry by answering questions about types of circuits and about conductors and insulators.	
Lesson duration	45 minutes	
Lesson materials	Simple Circuits: (one each for seven groups)	Series Circuits Center: • center direction card

	• 2 wires • Battery (in battery holder) • Bulb holder • Light bulb	• 2-battery holder • 2 batteries • 3 bulb holders • 3 bulbs • 4 wires
	Parallel Circuits Center: • center direction card • 2-battery holder • 2 batteries • 3 bulb holders • 3 bulbs • 6 wires	Conductors and Insulators Center: • Center direction card • Battery holder with batteries • 1 card with brads attached • 1 bulb holder and bulb • 2 alligator clip wires (one cut in half) • Bag of 5-10 household items for testing (paper clip, golf tee, paper, coins, pen, utensil, etc.)
Group size	Recommended 3-4 students	

Lesson Information

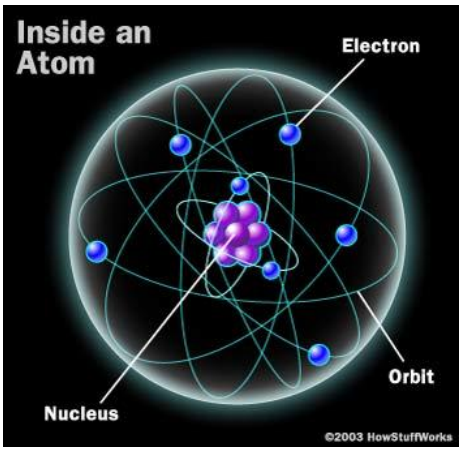
How will the concepts will be introduced, what information will be presented to the students? Include an outline of information and a link to any presentations that will be used.

Class Discussion:

Use a short inquiry discussion to see how much the students recall from the introduction to electricity.

Q: What is electricity?

A: Encourage students to describe any objects in the classroom that use electricity. The obvious answers will be the lights and any sort of TV or monitor that may be in the classroom, but encourage them to come up with things they might not realize use electricity, such as the intercom, clock, bell, exit signs or possibly a pencil sharpener. See if the students recall the components of electricity.

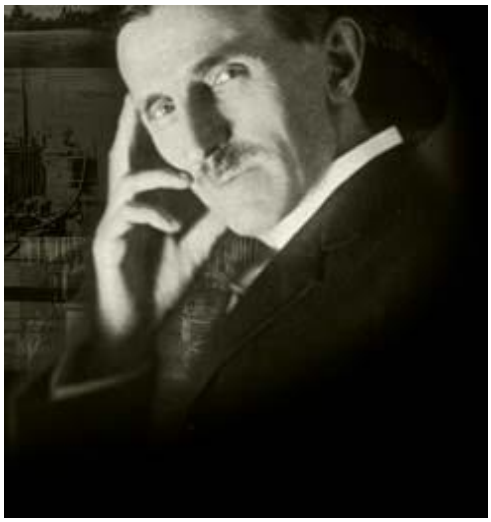


1. *What is an electron?*
- One of the components of an atom.
- A negatively charged particle.

2. *What is electric current?*
- The flow of electrons in an electrical circuit.
- Units are measured in Amperes (amps).
- 1 Amp = 6.24 million trillion electrons moving past one point in one second.

3. *What is voltage?*

- An electric potential difference between two points on a conducting wire.
- A force that pushes electric current (electrons).
- Units are measured in volts and come from sources like batteries and electric wall outlets.



4. History and Nikola Tesla

Nikola Tesla (1856-1943)

A Serb who was born in what is known today as Croatia. He came to The United States on June 6, 1884 and on July 30, 1891 became a naturalized citizen. He was an inventor responsible for many advances in electricity including the AC motor and the basis for the AC power system that we use today.

5. Safety notes:

- **NEVER** put anything into an electrical outlet that is not meant to go there, like a plug. Take cover when there is lightning around you. **DON'T** get under a tree to avoid the rain. It is better to get wet than to be struck by lightning. Lightning will strike the tallest object in the area.

Activity Descriptions and Discussions

Activity 1: Simple Circuits

Do this activity with the entire class before beginning the slide presentation.

Materials:
Simple Circuits: (one each for seven groups)

- 2 wires
- Battery (in battery holder)
- Bulb holder
- Light bulb

Premise:
To review what a circuit is and how electrons flow through wires in a circuit. This will serve as base-level knowledge for the information presented and other activities in this lesson.

Steps:

1. Ask student groups to use the materials in their bags to make the light bulb light. Facilitate as the students try various combinations and ways to try to connect the wires, battery, and light bulb together. Some students may get it right away, while others may take more leading.
2. Once students accomplish the task, praise them saying they have made a circuit. Have them draw a picture and label it "simple circuit" in their lab journals.
3. Explain to students that a circuit is a source for electricity (battery) and a load (light bulb) which are connected in a continuous "circle" of wires or other conductors which electricity can flow through.
4. Movement of electrons: Make the shape of a circuit (battery, wire, and bulb) on the floor of your classroom with masking tape (or out on the playground with sidewalk chalk). Have students with proton balls stand in the positive terminal side of the battery. Have students with electron balls stand in the negative terminal side of the battery. Demonstrate the flow of electrons through the circuit by allowing students with electrons to walk along the "wire" line, through the light bulb, along the other "wire" line, and finally stabilize by matching with a proton ball. Allow all students with electron balls to do this until all electrons are matched with protons (dead battery).
5. Finally explain to students that when electricity if flowing, the circuit is complete (or "closed"), which means electrons can flow through. When there is a break somewhere in the circuit (a light is burned out, a wire is not properly connected), the circuit is called "open" and electricity cannot flow through.

Activity 2: Circuits Centers

Materials:

Series Circuits Center:	Parallel Circuits Center:	Conductors and Insulators Center:
• center direction card • 2-battery holder • 2 batteries • 3 bulb holders • 3 bulbs • 4 wires	• center direction card • 2-battery holder • 2 batteries • 3 bulb holders • 3 bulbs • 6 wires	• Center direction card • Battery holder with batteries • 1 card with brads attached • 1 bulb holder and bulb • 2 alligator clip wires (one cut in half) • Bag of 5-10 household items for testing (paper clip, golf tee, paper, coins, pen, utensil, etc.)

Steps:

1. Explain to the class that they are going to be learning more about circuits, including learning about two different types of circuit wiring and about materials electricity flows easily through.
2. Give students each a worksheet to record their thinking.
3. Split students into teams for working through the centers. Explain each center using the centers cards (see the following three pages)
4. Debrief after all students have a chance to complete all three centers.

   Questions:
   - What is a series circuit? Parallel circuit?
   - What path do the electrons take through each type of circuit?
   - Have you seen any examples of these in real life?
   - What happened in each example when you took a light bulb out of the circuit? Why? What made them different?
   - What is a conductor? Insulator?
   - Why do you think we use copper for wiring?
   - Why do you think we use wood poles for electrical lines?

   Review new vocabulary:
   - Simple Circuit

- Series Circuit
- Parallel Circuit
- Open Circuit
- Closed Circuit
- Conductor
- Insulator

Lesson Closure:

Allow students to share their new learning with a partner, or summarize three things they learned in their science notebook or lab journal.

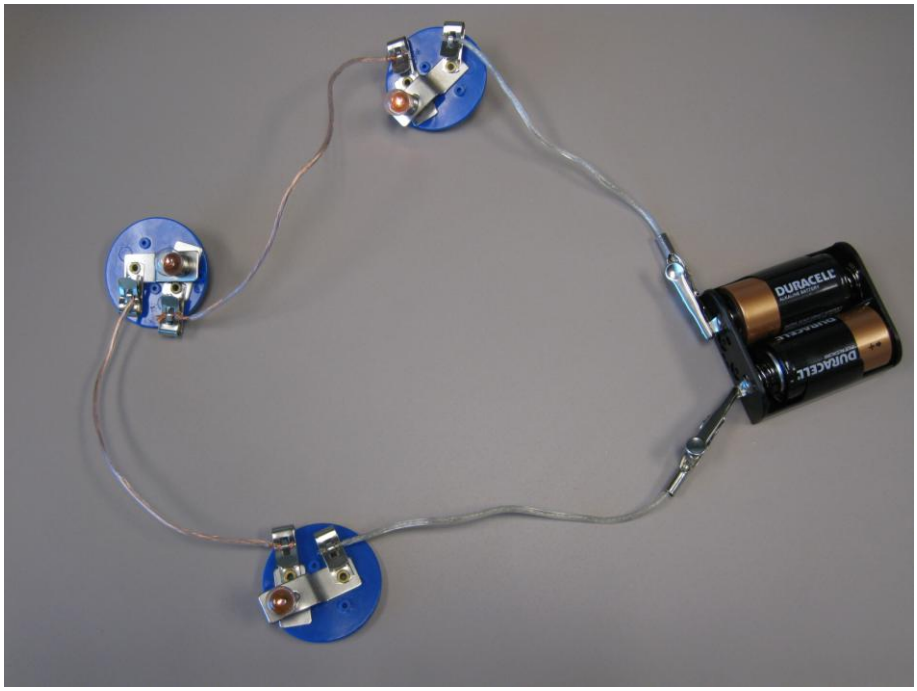
Extensions:

Literacy Connection: Have students write a story about an electron's journey through a circuit. For a challenge, have students specify which type of circuit they are travelling through.

Circuit Center #1- Series Circuits:

Have one member of your team read this passage aloud to the group:
When we wire the light bulbs in our house, we don't connect every single light bulb to the source (generator). Instead, we connect all of our lights and appliances together and connect one line to the source. When we wire many different loads together, we can use one of two different ways of doing it. The first way is in ***series*** *to make a* ***series circuit.*** *Let's learn about what a series circuit is!*

Directions:
Make a series circuit with the materials in the bag. You will be stringing together three light bulbs in one line. Use the picture as a model.



Now, draw a picture of your series circuit and label it on your worksheet.

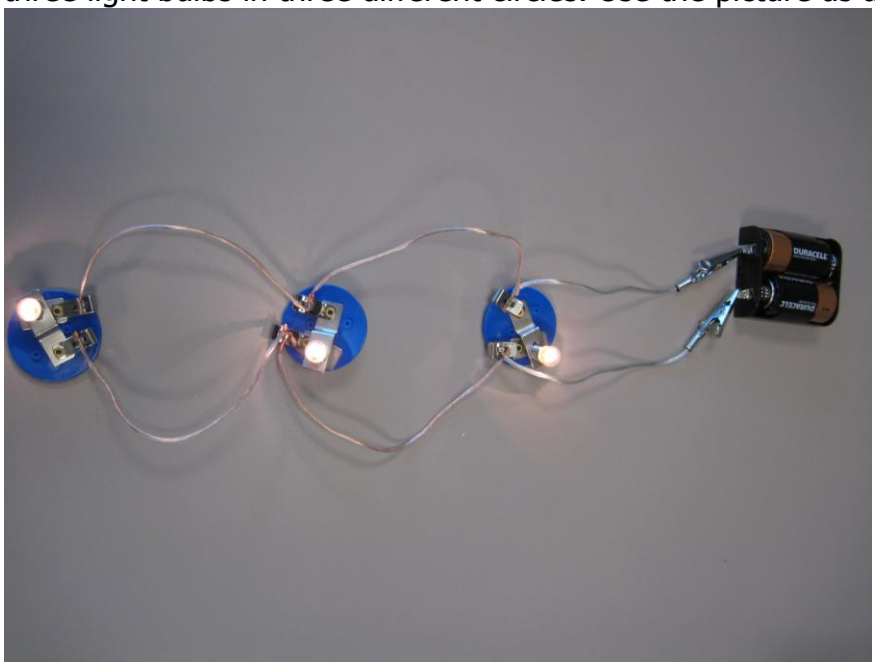
Another person read aloud to the group:
Congratulations! You have made a ***series circuit****! In a series circuit, the electrons all flow through all three light bulbs. Trace the path the electrons will take as they move from the negative terminal of the battery through the series circuit to the positive terminal of the battery.*

*If your group has time:
Predict what you think will happen if you unscrew one of the light bulbs. Then try it to see if your prediction was right? Why do you think that happened?

Circuit Center #2- Parallel Circuits:

Have one member of your team read this passage aloud to the group:
When we wire the light bulbs in our house, we don't connect every single light bulb to the source (generator). Instead, we connect all of our lights and appliances together and connect one line to the source. When we wire many different loads together, we can use one of two different ways of doing it. The first way is in ***parallel*** *to make a* ***parallel circuit.*** *Let's learn about what a parallel circuit is!*

Directions:
Make a parallel circuit with the materials in the bag. You will be stringing together three light bulbs in three different circles. Use the picture as a model.



Now, draw a picture of your parallel circuit and label it on your worksheet.

Another person read aloud to the group:
Congratulations! You have made a ***parallel circuit****! In a parallel circuit, the electrons do* ***NOT*** *all flow through all light bulbs. Instead, the electrons flow through the wires to one of the three light bulbs. Trace the path the electrons will take as they move from the negative terminal of the battery through the parallel circuit to the positive terminal of the battery.*

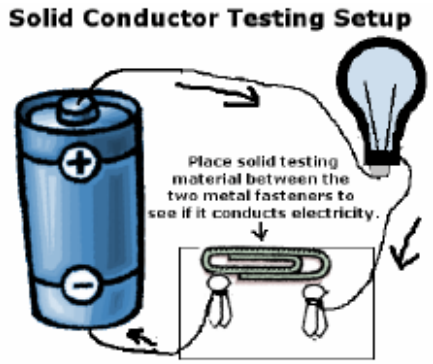
*If your group has time:
Predict what you think will happen if you unscrew one of the light bulbs. Then try it to see if your prediction was right? Why do you think that happened?

Circuit Center #3- Conductors and Insulators:

Have one member of your team read this passage aloud to the group:
Why can electrons flow through a wire? What material CAN electrons flow through? Are there any materials that electrons cannot move through? In this center, we will be learning about ***conductors*** *(materials electricity CAN flow through) and* ***insulators*** *(materials electricity CANNOT flow through).*

Directions:
Make a circuit with the materials in the bag (see the picture below).

Your mission is to test various items to see if they will complete (close) the circuit (like the picture below).



If the object makes the light bulb light up that means it completed (or closed) the circuit. This must mean that electrons can flow through it! If electrons can move easily through the materials, it is called a **conductor.**

For the experiment, first write the names of your objects on your worksheet. Then predict (before you test) whether or not you think the item will be a conductor (complete the circuit). Then test your predictions by placing the item across the two brass fasteners. Record if the light bulb lights up. If it does, it is a conductor! Check if your predictions were right.

Circuits Centers

Student Names:

_____

_____

_____

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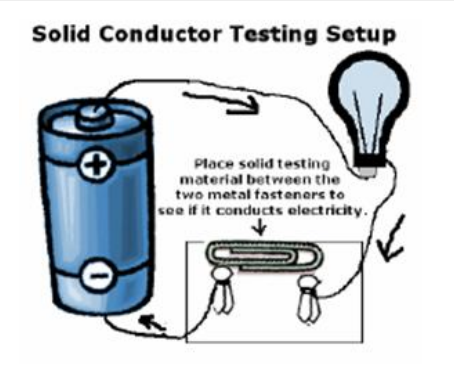
Series Circuits Center

Directions: Follow the directions on the card found with the materials at this center. Draw a picture of the series circuit you build. Then draw arrows to show the path of the electrons through your series circuit.

Parallel Circuits Center

Directions: Follow the directions on the card found with the materials at this center. Draw a picture of the parallel circuit you build. Then draw arrows to show the path of the electrons through your parallel circuit.

Conductors and Insulators Center:



Directions: Follow the directions on the card found with the materials at this center. Predict which objects will conduct electricity. Then place the object between the fasteners and record which objects lit up the light bulb. HINT: Remember that if the object is a conductor, electricity CAN easily flow through it so the light bulb will light. If an object is an insulator, electricity CANNOT easily flow through it so the light bulb will not light.

Name of Object	Material of Object	Prediction:		Actual:	
		Conductor	Insulator	Conductor	Insulator

What did this investigation tell you about conductors?

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