Lesson Plan for
Introduction to Electricity

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Updated by: Science For Kids

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Lesson Summary

Lesson name	Introduction to Electricity
Audience	Fourth Grade students
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 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 3, Concept 2, PO 1: Describe how science and technology have improved the lives of many people. • Strand 5, Concept 3, PO 1-5: Introductory information needed for the Energy and Magnetism PO's: 1. Investigate the characteristics of magnets 2. State cause and effect relationships between magnets and circuitry
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
Lesson duration	45 minutes
Lesson materials	• 2 rubber balloons & pieces of wool • Small bits of torn paper or rice puffs or small pieces of Styrofoam • Optional: o Velcro o Colored Styrofoam balls (blue and red)
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 familiar the students are with the concepts of static electricity.

Q: How you can tell if static electricity is around you?

A: Encourage students to describe any experiences they may have had with static electricity such as their hair standing on end after they have brushed it a lot, or clothes clinging to their bodies when they have been dried in a dryer without conditioner, or shocking themselves when they shuffle across a carpet and touch a doorknob.

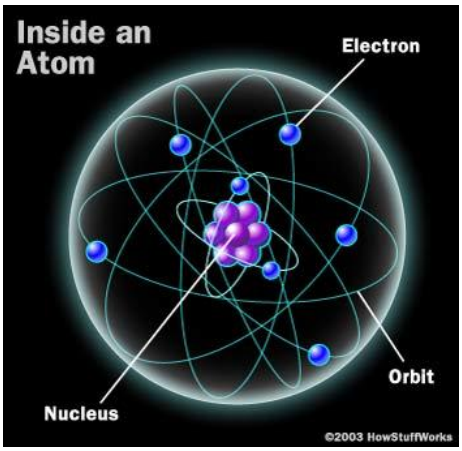
1. *What is static electricity? Everyday applications.*

- The shock you can get from rubbing your shoes on the carpet and then touching something metal like a door knob
- A bolt of lightning

Now that the students have a frame of reference on the topic, transition into the presentation concepts. How is static electricity created? Have the students heard of atoms before?

2. *What is an Atom?*

- The smallest component in all things
- Made up of three smaller particles
    - Nucleus
        - Protons (+)
        - Neutrons (no charge)
    - Electrons (-)
- Opposite charges have an attractive force
- Thrives for stability



Teacher Notes: discuss attraction and repulsion, emphasizing protons and electrons. Demonstrate atoms using colored Styrofoam balls or some other representation of an atom. Or use Velcro to demonstrate attraction (positive and negative charges)

3. *What does a "charged atom" mean?*

- More electrons than protons
- Electrons flow toward positively charged objects = current
- Force of attraction = voltage
- Static electricity = build up of electrons

If necessary continue a short inquiry discussion about the concepts of charge and static electricity.

Q: How is static electricity different from an electric current?
A: Static electricity is electrons that are transferred from one place to another without flowing in a current. If some of the electrons are transferred from one object to another by, for example, vigorous rubbing and separation, the other object becomes negatively charged while the object that loses electrons becomes positively charged. Remember, electrons are negatively charged particles. Unlike charges—one negative and one positive—always attract each other, and like charges—either negative or positive—always repel each other. Rubbing or brushing objects transfers electrons, creating a charge and, therefore, an electric field. The field affects objects nearby, producing an unlike charge in them, and the unlike charges are drawn together.

4. Why is there a spark?
Once a few electrons start to move across the gap, they heat up the air, such that more and more will jump across the gap. This heats the air even more. It all happens very fast, and the air gets so hot that it glows for a short time. That is a spark.

The same thing happens with lightning, except on a much larger scale, with higher voltages and current.

5. History and Ben Franklin

Benjamin Franklin (1706-1790)
1740's – Proposed the notion of positive and negative charges maintain a balance except when influenced by some means.
1752 – Famous kite experiments identify lightning as a form of electrical discharge.

6. Safety notes:
- Lightening is dangerous. Never go swimming when it looks stormy outside. Water is a good conductor for lightening. Never go hiking when it looks stormy out side.

Activity Descriptions and Discussions

Describe the step by step procedures for the activities; if possible use visual pictures to demonstrate the steps. Also include what inquiry activities will be included, such as having the students make hypothesis or discuss what they might know about the topic. List all discussion questions and appropriate discussion points.

Activity 1: Opposites Attract

Materials:
Styrofoam balls of different color (red and blue)
Or use strips of Velcro (one half represents + and the other – charge)

Premise:
Have the students holding the colored balls (blue and red, symbolizing + / - charges [this can also be used in the magnetism lesson]) and have them match up protons and electrons (electrons walking symbolized the flow of electrons = current)

Steps:

1. Each student is given one colored Styrofoam ball. Those holding the protons should be split into 2 groups
2. The students are informed that opposite charges attract and the different colors represent the opposite charges (positive and negative).
3. Have one group of students holding the protons match up with students holding the electrons
4. Have the other group of students holding the protons standing over on the other side of the room.
5. If the paired students represent the surface of the balloon, simulate the actions of the electrons when the balloon is rubbed against another surface. (the students holding the electrons should separate from the other student holding the proton and match up to protons standing on the other side of the room)
6. Discuss the concepts of this activity with the students.

Activity 2

Stuck On You: Static Electricity Demonstration – Teacher demonstration with student involvement

Materials:
2 rubber balloons
Pieces of Wool

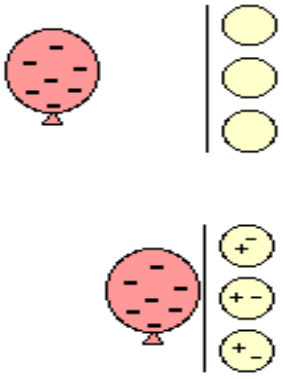
Step 1: Blow up your balloon and tie the neck

Step 2: Rub balloon against a piece of wool, fur or sweater.

Step 3: Place the balloon against the wall: the balloon should stick to the wall.

Step 4: Now blow up the other balloon and repeat step 2. Place it next to the balloon.

Q: What happens?
The friction from the rubbing transfers free electrons from the wool and makes the balloon negatively charged. When held against the positively charged wall, the unlike charges attract, the two objects will stick together.



Extension Activity: Static Electricity will also pick up small particles.

Hold the statically charge balloon over a pile of small bits of paper (or rice) and observe how many pieces the balloon attracts.

Use different types of materials (wool, nylon, cotton) and have the students write down how many pieces of paper the different material picked up with the balloon

Evaluation Measures

How will the student's progress be measured? Include any worksheets or assessment activities within the lesson plan

Have the students complete the following worksheet as record of the group's involvement.

Static Electricity Questions

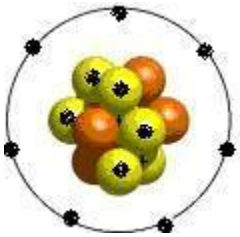
Name:

_____

Questions:

1. What is the charge of electron? _____
2. What is the charge of a proton? _____
3. Would 2 electrons attract or repel? _____
4. What is the flow of electrons called? _____
5. What is the force of attraction called? _____

On the diagram to the right:

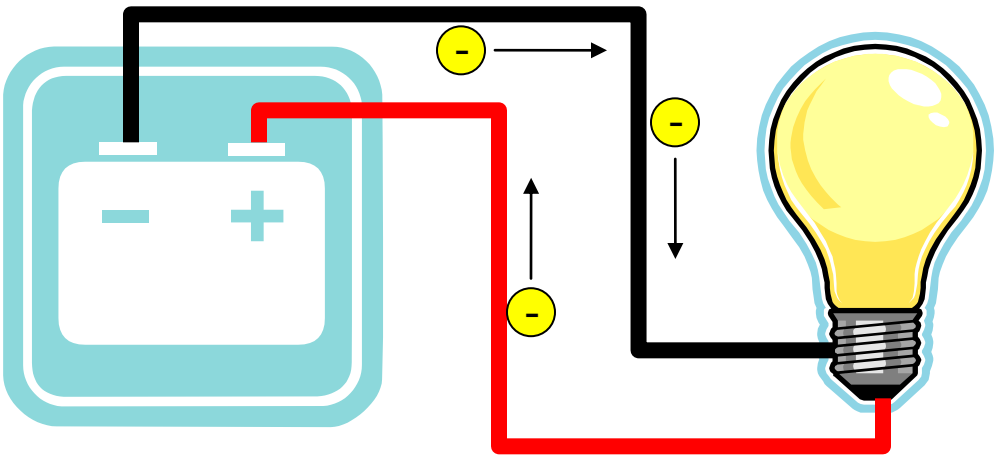


6. Label the electrons with a (-) sign
7. Label the protons with a (+) sign

8. Right before lightening strikes, negative charges build up. On the diagram below, label the charges of the cloud and of the ground that would create a lightening bolt.

Q: What do we mean by current electricity?

Electrons that have been "knocked" out of the outer shell of an atom are known as free electrons. These free electrons can exist by themselves outside of the atom, and it these electrons which are responsible for most electrical phenomena. The movement of free electrons constitutes an **electric current.** When an electromotive force is applied, such as that provided by a battery or electric power plant generator, the free electrons in the conductor (wire) are guided in an orderly fashion, atom to atom. Electric current then is the transport of electric charge (electrons). Electric current is measured in **amperes** and is the number of electrons passing a given point in one second.



Activity 3: Current Electricity Demonstration

Materials:
Hand-crank generators (Genecons)
Circuit beds

Premise: A demonstration of electromotive force and the flow of electrons.

Steps:
1. Pass out GENECONS, explaining that it is a small DC generator with a handle for turning it. At SRP we produce electricity using generators that are essentially large quantities of copper wire spinning around inside very large magnets, at very high speeds. In this small generator, basically, all you have to do is to get magnets to spin inside a coil of copper wire.

Hold up the GENECON. (Indicate visible silver housing). That's where the magnets and the coil of wire are.

Q: Ask students, "How can you get the magnets to spin inside that coil of wire?"

(Respondents will say 'by turning the handle')

Q: Yes, but how do we get it to turn?

Lead group toward understanding that muscular energy must be transformed into work.

2. Leader: Now, let's test your theory. Gently, turn the handles. (If you turn too hard, you'll strip the gears. That's why we recommend that teacher controls the Genecon in class.) If your Genecon works, you should be producing a current of electrons. But you are not producing any desired result. That's not good enough for you! Let's make something work!

3. Remove your plastic test bed from its wrapper, and firmly tighten all the red and black thumbscrews on the sides. Insert one light bulb into the socket at one end. Now, slightly unscrew the red and the black thumbscrew on that end, and clip the Genecon leads to each one, metal to metal. Now, ask your students to guess what will happen when you turn the handle of the Genecon. Turn it. What happens? Vary the turning speed. What differences did you notice? Now stop cranking. Why did the light bulb "go out"? (The faster you turn, the brighter the bulb. The bulb requires energy to light up, more energy when it is bright than dim.)

4. Discuss concepts of this activity with students.

Teacher Notes: By turning the handle of the hand crank generators, you are turning a shaft that rotates magnets in the wires, thereby creating an electric current. When the light bulb is hooked up to a power supply (the generator),the **electric current** flows from one contact to the other, through the wires and the filament of the light bulb. Electric current in a solid conductor is the mass movement of **free electrons** (electrons that are not tightly bound to an atom) from a negatively charged area to a positively charged area. This creates a circuit.

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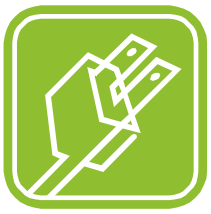
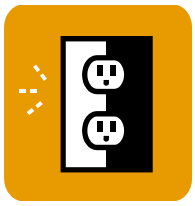
Extensions

If available include additional topic information, materials or contact information

More information about static electricity:

1. http://www.mos.org/sln/toe/staticintro.html
2. Show students the SRP video program *Electricity :Making the Connection.* Use accompanying student worksheet for discussion.





Electricity: Making the Connection
Student Worksheet

1. Electricity first is generated/made at a _____then it travels all the way to your house.

2. How does electricity get from the power plant to your house?

3. What are the moving particles that make up electricity?

4. Electrons move through the wires. What is the pressure that pushes the electrons called?

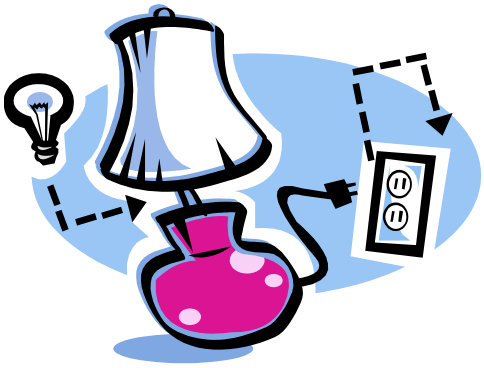
5. You can measure milk by the cup. You can measure sugar by a teaspoon. How is the flow of electricity measured?

6. Before the electricity gets to your meter, it goes through a transformer. Not like the ones in the Transformers movie, but transformer does mean change. What does a transformer do?

7. Why are there 2 prongs on a plug?

8. True or false: During a storm you should stand near a tall object.

General Discussion:
Where do you see static electricity?
How do you use electricity in your everyday life?



Answer Key:

1. Power plant.
2. Wires
3. Electrons
4. Volts
5. Amps (short for Amperes)
6. The transformer changes voltage of the electricity.
7. You need a closed circuit
8. False