FUTURE U.

Sit Down Activity

Objectives

Students will:

- **interpret** the results of several experiments in order to **make inferences** about static electricity and current electricity
- **Compare** static electricity to current electricity
- **Discuss** the role of electricity in the modern world

Chinyere Udoh, Electrical Systems Design Engineer

Grade Range

5–8

Overview

In this activity, students will be inspired by the work of an electrical systems design engineer at Boeing as they investigate electricity. After rotating through stations focused on static electricity, the students will make observations about current electricity during a potato clock demonstration. They will then examine and discuss the importance of electricity in today's world.

Timing

45–60 minutes

Materials

- Device with the ability to project video, one for the teacher
- Chinyere, Electrical System Design Engineer Video, to project
- Capture Sheet, one per student
- Plastic combs, enough for half the class
- Station 1:
    - Station 1 Instructions, five copies
    - Salt, at least 1 cup
    - Pepper, at least 1 cup
    - Spoons, at least five
    - Small bowls or dishes, at least five
    - Balloons, 10 (blown up in advance)
- Station 2:
    - Station 2 Instructions, five copies
    - Access to a sink with running water

- Station 3:
    - Station 3 Instructions, five copies
    - Plastic sheets, five (these, for example)
    - Bubble solution or soapy water, one pitcher
    - Straws, one per student
- Materials for potato clock demonstration:
    - Large russet potatoes, two
    - Knife, one
    - Pieces of copper wire, three
    - Galvanized nails, two
    - Alligator clips, four
    - One small digital clock that takes a 1 volt circular battery

Procedure

1. **Warm-Up:** Show the Chinyere, Electrical System Design Engineer Video; then do the following:
    - Encourage students to summarize what they learned about Chinyere Udoh's career. Be sure students understand that electrical systems design engineers keep our world running in an infinite number of ways. In their careers, they use their knowledge of electricity and electrical systems to power all kinds of infrastructure.
    - Challenge students to consider: What do you already know about electricity? Set a timer to two minutes and create a list on the board as students share.
2. Tell students that today they will be investigating some of the principles of electricity.
3. Divide students into pairs and prepare them for the activity by performing the following:
    - Distribute a Capture Sheet to each student and a plastic comb to each pair.
    - Read the Capture Sheet's "All About Atoms" square together and explain that students will complete this square before beginning the other stations.
    - Show the class where they can find the three stations around the classroom and assign each pair a starting point.
    - Explain that pairs will have 15–20 minutes to make their way through the stations and complete their Capture Sheets before they come back together to discuss what they have learned.
4. As students complete their stations, move among the stations, answering questions as needed. Every five minutes, encourage students to rotate to the next station.
5. Bring the class back together and discuss the observations and conclusions that they made at each station. Points to present and discuss include the following:
    - All three stations dealt with static electricity, which can occur when you rub one object against another.
    - When you rub one object (such as a balloon or comb) over something else (such as your hair), it "steals" electrons. This means the object now has more electrons than protons.

- As these electrons build up, the object becomes negatively charged and static electricity is created on the object's surface. It is called static electricity because it is non-moving.
- The object's negative charge means it is extra-attracted to other objects that are *not* negatively charged and extra-repelled from other objects that *are* negatively charged.
- Scientists are constantly looking into new uses for this "simple" type of electricity, including how to purify water, how to eliminate pollution from air, and how it could be used to power the world.

6. Gather the materials for the potato clock demonstration and explain that you are going to demonstrate another example of electricity. As you do, encourage students to consider how this demonstration compares to the stations they just completed.
7. Invite student volunteers to help you perform the following:
    - Use the knife to cut a small slit in one end of each potato.
    - Insert a copper wire into each of the slits.
    - Insert one galvanized nail into each potato on the end opposite the wire. Explain that these nails are coated in zinc.
    - Remove the battery from the clock and leave the battery compartment open.
    - Use alligator clips to connect the copper wire from one potato to the positive end of the clock battery compartment.
    - Use alligator clips to connect the third (unused) copper wire to the nail in the second potato. Then use another set of alligator clips to connect this copper wire to the negative side of the clock battery compartment.
    - Use the last set of alligator clips to connect the nail on the first potato to the copper wire on the second potato.
8. Once the clock is powered, ask: Is this an example of static electricity? Why or why not?
    - Guide students in understanding that this is **not** static electricity because the electrons are not standing still. It is *current* electricity because the electrons moved, flowing from place to place, and eventually powering the clock. By creating a circuit, you provided a path for the electrons. Electrical energy flows around this circuit.
    - *You may further explain:* Zinc and copper are both metals. Zinc's charge is slightly more positive than copper. For this reason, it likes to give its electrons to copper. The water and salt in the potato makes it serve as an electrolyte, which means electricity can pass through it. By providing an electrolyte and a path (the wires), a circuit is formed that gets the power to the light bulb.
9. **Wrap-Up:** Explain that students just investigated *some* of the principals of electricity. Chinyere Udoh's job uses these principals of electricity, among others, to design electrical systems.
    - Encourage the class to discuss the following questions:
        - How have humans' knowledge and understanding of electricity shaped the world?
        - What opportunities exist for the future of electricity? How may it continue to change the world?

National School Standards

Next Generation Science Standards

MS-PS2-3 Motion and Stability: Forces and Interactions

- MS-PS2-3: Ask questions about data to determine the factors that affect the strength of electric and magnetic forces.
- Disciplinary Core Idea:
    - PS2.B: Types of Interactions: Electric and magnetic (electromagnetic) forces can be attractive or repulsive, and their sizes depend on the magnitudes of the charges, currents, or magnetic strengths involved and on the distances between the interacting objects.

Capture Sheet

All About Atoms All objects are made up of atoms. Inside an atom are protons, electrons, and neutrons. Protons have a positive charge, electrons have a negative charge, and neutrons are neutral. Opposite charges attract each other. Like charges repel each other. Normally, an object has a neutral charge because it is made up of balanced positive and negative charges. **Your job:** Draw an image or cartoon below to help you remember what is described above.	**Station 1** Observations: Why do you think this happened?
Station 2 Observations: Why do you think this happened?	**Station 3** Observations: Why do you think this happened?

Capture Sheet

Station 1 Directions

1. Place a spoonful of salt and a spoonful of pepper in the dish. Stir them together.
2. Choose one partner to rub the blown-up balloon against his or her hair twice (one time in each direction) before slowly lowering the balloon toward the dish. Observe: Does anything happen?
3. This same partner should then rub the balloon against his or her hair several times, until the hair is sticking to the balloon, then slowly lower the balloon to the dish again.

Chat and Jot: What happened? Why do you think this happened? Record your observations and thoughts on your Capture Sheet.

Station 2 Directions

1. Choose one partner to run the plastic comb through his or her hair several times.
2. Have the other partner turn on the faucet so just a little bit of water is flowing.
3. The partner with the comb should then bring the comb close to (but not touching) the water stream.

Chat and Jot: What happened? Why do you think this happened? Record your observations and thoughts on your Capture Sheet.

Station 3 Directions

1. Spread a bit of bubble solution over your plastic sheet.
2. Have one partner use the straw to blow some big bubbles.
3. Have another partner run the plastic comb through his or her hair several times and then slowly bring the comb near the bubbles.

Chat and Jot: What happened? Why do you think this happened? Record your observations and thoughts on your Capture Sheet.