Saturday Science: Grades 2-4 Week 2

Learning Objectives:

1. Students will be able to show how electrons transfer in their drawings, and explain how this affects the static electricity during the salt and pepper experiment
2. Students will be able to record their observations on the effects that a lightning rod and rubber have on the transfer of electrons through the plate experiment
3. Students will be able to describe lightning safety precautions during the safety exercise game.

Indiana Academic Science Standards:

Process Standards (NOS):

- (Grade 4) Keep and report records of investigations and observations using tools, such as journals, charts, graphs, and computers.
- (Grade 2) Use a scientific notebook to record predictions, questions and observations about data with pictures, numbers or in words.
- Conduct investigations that may happen over time as a class, in small groups, or independently.
- Generate questions and make observations about natural processes.
- Make predictions based on observations.
- Discuss observations with peers and be able to support your conclusion with evidence.
- Make and use simple equipment and tools to gather data and extend the senses.
- Recognize a fair test.

Core Standard:

Design and assemble electric circuits that provide a means of transferring energy from one form or place to another.

- 4.1.4 - Experiment with materials to identify conductors and insulators of heat and electricity.

Teacher Content Knowledge:

Static electricity is the buildup of electrons on an object when it is rubbed with another object that gives them up easily. This is what causes your hair to stick up from a balloon rubbing on your head. Atoms make up everything and they consist of a nucleus (center) and an outer shell of electrons. Some materials can have a tight hold on their electrons and not give them up easily. Electrons do not move through them very well.

These things are called insulators. Plastic, cloth, glass and dry air are good insulators. Other materials let go of their electrons easily and they can move through them very easily. These are called conductors. Most metals are good conductors and let electrons flow through them easily. Positive and negative charges (opposite) attract and like charges repel.

Electricity is a form of energy produced by the movement of electrons. The lightning rod, which gave an exit for electrons to be released, was discovered by Benjamin Franklin in the 1740's. His hypothesis concluded that lightning was composed of a natural flow of electrons. During his key experiment he discovered that he was indeed correct; electricity and lightning are the same thing!

Teachers need to know that lightning is formed by water vapor rubbing against each other in the cloud creating positive and negative charges that separate in the cloud similar to static electricity. With the negative (electrons) forming at the bottom of the cloud, the ground under the cloud builds up positive charges since opposites attract. After much build up the charges from the ground and cloud meet creating lightning!

Materials:

- Small spiral notebooks for each student
- Variety of different fabrics for each small group: cotton, polyester, silk, wool – for each group
- Plastic Comb, Plastic Spoon, PVC Pipe, Straw, Glass Rod, Magnet - for each small group
- White board & markers (6) one for each group
- Pie tin, rubber stoppers, Styrofoam plates, metal spoon – for each pair of students (12)
- Question Ball
- Salt
- Pepper
- Masking Tape

Lesson Description:

Introduction:

Review skills that scientists have that help them collaborate with each other. Discuss parts of room and explain why some aspects of the room the students can't use (eye washer, sink, main computer, smart board, gas faucets at each table). Segway into icebreaker.

Ice Breaker: Question Ball

Students will pass or roll a ball around that has questions taped around the ball. Each student will have a chance to answer a question and pass the ball, but the question they must answer is the one facing them when they catch or get the ball.

Review

In order to understand whether or not the students understood the activities from last week, we will start off with an experiment involving static electricity

Salt and Pepper Experiment:

1. Show the students a bowl of mixed Salt and Pepper
2. Give students the problem "How can I separate the Salt and Pepper so that I can put them separately on foods?"
3. "Using the materials that we used last week can your groups figure out a way to separate them for us?"
4. Students will spend 10-15 minutes manipulating the materials (spoon, fabrics, utensils) to try and separate the Salt and Pepper.
5. After students have figured out the way to pull the pepper out by giving a negative charge to a spoon or utensil have them write on their white boards what they think is happening to the materials they used.
6. Use KWL chart to see if the students have anything to add to the "learned" section from the salt and pepper experiment and if they would like to add anything more to the "What to know" section.

Engage:

Video on Ben Franklin, http://www.youtube.com/watch?v=OCsET3spqDw&feature=related

Explore:

The students will explore what they saw in the Ben Franklin Video by participating in the Plate Exercise. The students begin by placing the Styrofoam plate upside down, and then taping the pie tin right side up on top of it. Next, they will tape a rubber stopper in the middle of the pie tin to serve as an insulator, in order to handle the tin without disturbing the electrical charges. The students can experiment by rubbing the Styrofoam plate with the different materials, and try to get an electric charge on the pie tin. They can use their individual notebooks to write down observations from the experiment. Lastly, they can experiment with a paper clip acting as a lightning rod. Because the clip is taped to the edge of the tin, the electric charge becomes concentrated there, rather than around the edge of the tin.

Explain:

With the students in small groups, talk about how the plate exercise works. Discuss how the Styrofoam plate and the pie tin are electrically neutral at the start, but that rubbing the Styrofoam plate with certain materials creates a build up of static electrical charges on the surface of the plate, which, in turn, creates a build up of transferred charges on the pie tin (the tin is a conductor which is in contact with the plate). Then, the built-up negative charges on the outside of the pie tin jump to your finger, thus giving you a shock from the transfer of charges, as the tin seeks to regain the neutral state (no charges). This same thing happens when we see a lightning bolt which is presented in the website below. Ask students to examine which part the pie tin stopped them

from being shocked, and what part shocked them. With this acknowledgement, discuss how the rubber stopper worked as an insulator and the tin worked as a conductor. Ask students to draw pictures of what they think is happening, to assess their learning.

Elaborate:

Safety Exercise from the website, http://www.lightningsafety.noaa.gov/multimedia/Lightning_Game.swf, as a whole group. Split into table groups. Each group will have a white board and will be called upon to come up to the white board and answer the question. Conduct small group discussions on the dangers of Ben Franklin's key experiment.

Evaluate:

To evaluate the students' knowledge, we shall go back to our KWL chart and ask them what we have learned, seeing if we have answered any of our questions yet. We might add more to the W if students have more questions.

Assessment:

Our forms of assessment will include a KWL Chart that we will elaborate with the students as a large group, and keep individual notebooks throughout the entire session in which the students will record any predictions, observations and reflections, as well as general class discussions.

Handouts/Journals: We will not have handouts, but we will have journals available for the students to record observations and make drawings.