

Lesson Four Spring 2011 Grades 2 to 4

Saturday Science: Grades 2-4 Week 4

Learning Objectives:

1. Students will be able to distinguish between a working and non-working circuit using their T charts.
2. Students will be able to understand metal objects can light a bulb and non metal object won't.
3. Students will be able to make a functioning circuit board.

Indiana Academic Science Standards:

Process Standards: These are all NOS Standards. What about Design Process Standards, as well?

- Make predictions and formulate testable questions.
- Perform investigations using appropriate tools and technology that will extend the senses.
- Identify simple patterns in data and propose explanations to account for the patterns.

Core Standard:

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

4.1.3- Construct a complete circuit through which an electrical current can pass as evidenced by the lighting of a bulb or ringing of a bell.

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

4.1.5- Demonstrate that electrical energy can be transformed into heat, light, and sound.

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. Insulators are needed for static electricity because they take on the electrons from the conductors, while current electricity needs conductors to let the electrons flow through them. Electricity is a form of energy produced by the movement of electrons. Current electricity needs a closed circuit for electrons to travel around. Batteries produce electricity through a chemical reaction within the battery, which lets electrons travel out the negative side and back into the positive side.

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 lightening!

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, tweezers, paper clips, - for each small group
- Manila folders
- 24 D batteries
- Battery clips
- Aluminum foil
- Light bulb clips
- Electrical Tape
- Material for a simple circuit (bulb, battery, wire for each student) (12)
- Scotch 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:* "What do we know about how protons and electrons act towards each other?"

We will open the class with an ice breaker in which the students will be divided into "protons" and "electrons" and paired up with one from the opposite group. Each round, we will give them a position to do with their proton/electron partner, for example elbow to knee. We will let them wander and play music for a few seconds, then when the music stops they will have to find their partner (because they are attracted to each other) and perform the position. This will reinforce the idea that protons and electrons are attracted to each other, which was learned in the previous weeks of class, as well as help the students get comfortable with others in the class. This activity can be done with partner that stays the same throughout the game, or with mixing up partners each round. Mixing partners helps the whole class to interact together, but some students may not be as comfortable getting close to everyone and we would need to differentiate between the two groups in a visible way.

Engage:

Before handing out circuits, we will have the students make predictions on the worksheet. They will write a Y or N besides each circuit predicting whether or not they think the light bulb will light. Next, we will hand out the worksheet on testing out different circuits. Each pair of students will have a bulb, battery and 2 wires to test out each hypothetical circuit to see if it works. They will record the data in their journal.

Explore:

We will first model on the board what a T chart is. Each student will write in their journal their T chart separating non-working circuits and completed circuits. Next we will provide the students with a box of various materials and a circuit that includes: bulb, bulb holder, 3 wires, battery, and battery holder. They will explore which materials will transfer the electrons and light the bulb. They will record the information on the T chart.

Explain:

Together we will look at the T chart and try to make inferences about the data, such as: all the working side are conductors and all the non working side are insulators. We will also play a portion of a Bill Nye Video that shows the circuit experiment in detail.

Elaborate:

Circuit board exercise:

Students will be given each a manila folder with 4 holes punched into each side. We will discuss what some good conductors are and then reflect on whether aluminum foil will help complete the circuit. After showing the students a model of what the circuit board questionnaire will look like well will give students materials to make their own. This will involve having each student write 4 things about themselves and with corresponding fact on the other side of the folder. Students will mix up the questions and answers in the rows so that they do not match directly across from the correct one. To make a circuit students will glue or tape strips of aluminum foil that connects the question and answer. *Note: Make sure aluminum is visible through the hole punch.* Once students have connected each question they can see which ones are correct by touching their wires (connected to battery and bulb) to the aluminum foil spots. If the light bulb lights up then the question was correctly matched to the answer.

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 they have thought of. Also, at the end of the lesson we hope to work on a Venn diagram on what similarities and differences there are between static and current electricity. Additionally, we will be able to evaluate the student's progress by looking at their predictions on the circuit handout and the T charts in their journals.

Assessment:

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

Handouts/Journals:

We will provide the students with a handout on circuits and have them test their validity.

Experiment 6-Electric Light Bulb Experiment Report Sheet

Name: _____

Section: _____

Part A Section 1:

1. Please select the configuration(s) of battery, light bulb and copper wire that will produce light from the bulb. More than 1 correct answer is possible. Circle the circuits that work.

