The Mad Science® Electricity Workshop Pre & Post

Mad Science Sparks imaginative learning with inquiry-based science for children.

www.madscience.org/wsTampaBay **727-895-5595**

This package includes activities for you to do with your class before and after the workshop to reinforce the concepts and terms presented in the lesson. It also contains extension activities and suggested resources for a variety of subject areas related to the topic.

NATIONAL SCIENCE EDUCATION STANDARDS

The activities in the Electricity workshop have been specially designed to build skills and develop understanding in critical areas of science as outlined in the National Science Education Standards**.**

Science as Inquiry
- Abilities necessary to do scientific inquiry
- Understanding about scientific inquiry

Physical Science
- Light, heat, electricity, and magnetism

Science and Technology
- Understanding about science and technology

History and Nature of Science
- Science as a human endeavor

NOTE: There is a separate document for correlations to Florida's Sunshine State Standards for Science. If interested please give us a call.

BEFORE THE WORKSHOP

To maximize the workshop's impact and educational value, it is recommended that you introduce your students to the topic of electricity prior to the Mad Science workshop. Included are several fun, easy and educational activities that will prepare your class for the workshop. These experiments will also help your students become familiar with the concepts of **observation**, **hypothesis, experimentation** and the scientific method.

Spinning Static

This experiment will demonstrate to students the power of static electricity. This experiment will work best on a dry day.

Materials:

- Ping pong ball
- Rubber comb
- Wool sweater or blanket

Procedure:

1. Ask the class if they have ever had hair that had a lot of static in the winter or if their clothes have ever come out of the dryer and stuck together. This will help them to start thinking about static electricity.
2. Take the comb and rub it on a woolen sweater or blanket so that the static electricity has a chance to build up between the teeth of the comb.
3. Ask the students what they think, or **hypothesize**, will happen if you place the comb near the ball.
4. Place the ping-pong ball on a flat surface. Position the comb above the ball, keeping it vertical, and place it beside the ball, without touching it.
5. Instruct your students to **observe** what happens as you move the comb.
6. Begin to draw imaginary circles with the comb and the ball will follow.

Explanation:

Everything is made up of atoms. Each atom has protons, neutrons and electrons. Rubbing the comb on the sweater causes electrons from the sweater to be transferred to the surface of the comb resulting in a negative charge. When you take the comb and hold it close to the ball the comb is attracted to the temporary positive charge of the ball. The attraction of these two opposite charges causes the ball to follow the circular motion of the comb.

Note:

Do not worry if they do not fully understand the reason why the ball follows the comb. Electricity is an abstract idea and the interactions of protons, neutrons and electrons will be covered in the workshop. It is more important that the students have an opportunity to see static electricity. The more opportunities they have to interact with the concept the better.

Static Piles

This activity will provide students will an opportunity to explore materials that are affected by static electricity. This experiment will work best on a dry day.

Materials:

- Inflated balloon
- Pepper
- Pieces of paper
- Pieces of wool
- Additional materials

Procedure:

1. This experiment can be conducted as a class or in groups. Alter the procedure as necessary.
2. Lay out the materials at the front of the class. Make a pile of pepper, a pile of small pieces of paper, a pile of pieces of wool and any other materials you may want to include (those that are or are not attracted by static electricity.)
3. Rub the balloon on your hair or a woolen sweater. If you rubbed it on your hair hold the balloon close to your head so that your hair sticks out.
4. Hold the balloon close to the arm of a student or two, ask them to describe to the class what they feel. The tingling the feel is the static electric charge, or the build up of electrons on the surface of the balloon.
5. Ask the class to **hypothesize**, or make their best guesses, about what they think will happen if you hold the charged balloon close to the pepper. Ask them to explain their answers.
6. Instruct the class to **observe**, or watch carefully. Rub the balloon on your hair or sweater again and hold it above the pile of pepper.
7. Ask the class what they observed.
8. Repeat steps 4 through 6 with the other piles you have formed.

Explanation:

By rubbing the balloon on your hair you caused electrons from your hair to be transferred to the surface of the balloon resulting in a negative charge. When you take the balloon and hold it close to the pepper, which is a neutral object, the electrons in the balloon are attracted to the neutral atoms in the pepper.

AFTER THE WORKSHOP

Here are some activities you may wish to do with your class after the workshop to reinforce and expand the concepts introduced that were introduced.

Electrifying Examination

Challenge your students to write the quiz questions for this game and to develop the electrical circuitry.

Materials:

- Set of ten questions and ten answers (each question and answer should be written on separate pieces of paper, you should have twenty pieces of paper when you are done.)
- Heavy piece of cardboard
- Hole punch
- Paper clips
- Paper fasteners
- Battery holder
- D cell battery
- Light bulb (1.5 volt)
- Brass bulb holder
- Wires
- 3 alligator clips

Procedure:

1. Challenge your students to develop a set of ten quiz type questions related to electricity.
2. Ask them to write each question on a separate piece of paper and each answer on a separate piece of paper. They should have twenty pieces of paper when they are done.
3. These instructions can be written out for students to follow as a group. Take the cardboard and punch ten holes along each side and a larger hole on top. Tape a question and answer beside each hole (except the large hole at the top), make sure they are scattered so the response does not stay next to the question.
4. Place a paper fastener through each hole.
5. Since the students have already participated in the Mad Science Electricity workshop they should understand how an electrical circuit is formed. Distribute the battery holder, batter, bulb holder, light bulb, paper clips and wire. Challenge the students to connect the wires so that when the question is connected with the correct answer the light at the top of the cardboard will light. You may need to provide them with additional information such as; “Make sure that not all the wires connect together otherwise the light will be illuminated each time the paper fasteners are touched.” “Attach a paper clip to each end of a short wire that they will use to connect the question with the answer.” “Put the light bulb in the large hole at the top of your board, it will illuminate when you answer correctly.”

   For Your Information: The wires should be connected at the back of the board and should join the questions with the correct answer. One alligator clip should connect the battery to the light bulb; another should connect the light bulb and would then touch an answer on the board. The third alligator clip should

connect the other side of the battery and the question. If the question and answer are correct the light should illuminate.

6. They can then circulate their quizzes through the class.

Explanation:

When the wires connect the question and the correct answer the circuit is completed and the light at the top will illuminate.

MORE TO DO

Math

- Set up a number of lights and use a variety of brands of light bulbs. Turn them all on at the same time and see which one lasts the longest. Ask the students to graph the results.
- Develop word problems using electricity vocabulary.

Language Arts

- Challenge your class to write a story about life without electricity.
- Challenge your class to write a story about the way in which electrons, neutrons and protons interact to produce electricity.
- Write a story about the life of a light bulb, or a battery.
- Have your students conduct research projects on inventions related to electricity.
- Ask your students to pick something that works with electricity and then write a poem about all its uses, or problems. This could also be done with electricity it general. For example, "Electricity seems to be everywhere. It cooks my food and dries my hair."

Social Studies

- Locate various power plants in your area on maps and compile research regarding their effects on the community.
- Have your students learn about and conduct research projects on Benjamin Franklin and other scientists who studied electricity.
- Your students can study the amount of electricity used by your community or country. They can also research ways to reduce energy consumption.
- Scan the paper for articles on energy consumption and issues related to electricity. Introduce these to your students and have a discussion on current events related to electricity.
- Ask your students to research historical accounts of life before electricity, or when it was not such a prominent factor in daily life. Your students may have grandparents or great grandparents who remember what it was like to have minimal access to electricity.

Art

- Ask your students to collect and bring in (over a month or so) burnt out lightbulbs, used batteries, old electrical appliances, any materials related to electricity. Have them take these objects and create sculptures.
- Collect books and pictures related to electricity. Challenge your students to create a series of pictures related to electricity. The idea is that they will draw a sequence, such as a light bulb lighting, and these pictures will be placed in order and stapled at the top. The end product is a book that can be flipped through by placing your thumb on the top sheet and letting the pages flip and the images run together like an animated cartoon.

Field Trip Suggestions

- Visit a local power generation plant and discuss how electricity is generated in your area. If there are no electric plants in your area, check your science video library for videos explaining power generation.

BOOKS

Here are some suggested resources on electricity that will help to reinforce the concept to your students.

Title: Aftershock (Mindwarp Mo. 6)
Author: Chris Archer and Jeffery Archer
Publisher: Minstrel Books
ISBN #: 0-671-01487-0
Description: *This chapter book is appropriate for ages 9-12 (Grades 4 to 6). It is the story of a young girl who discovers she has the super human ability to control anything that runs on electricity. The real surprise is to learn that she is not the only student with amazing abilities.*

Title: Batteries, Bulbs and Wires
Author: David Glover
Publisher: Kingfisher Books
ISBN #: 1-856-97933-4
Description: *This reference book is intended for students aged 4-8 but may serve to help any weak students to read and learn about electricity.*

Title: Benjamin Franklin's Adventures with Electricity
Author: Beverly Birch
Illustrator: Robin Bell Corfield
Publisher: Barrons Juveniles
ISBN #: 0-812-06622-7
Description: *This reference book has been written for ages 9 to 12 and is full of facts and descriptions about Benjamin Franklin and his early experiments with electricity.*

Title: Electric Gadgets and Gizmos: Battery-Powered Buildable Gadgets that Go!
Author: Alan Bartholomew
Illustrator: Lynn Bartholomew
Publisher: Kids Can Press
ISBN #: 1-550-74439-9
Description: *This book, written for ages 9 to 12, clearly explains the process required to create gadgets with batteries and connections. The types of activities outlined in the book will reinforce what was learned during the "Black Box Electricity" section of the workshop.*

Title: The Magic School Bus and the Electric Field Trip
Author: Joanna Cole
Illustrator: Bruce Degen
Publisher: Scholastic
ISBN #: 0-590-44683-5
Description: *This book may be a little young for Grades 5 and 6 depending on their maturity but is ideal for Grades 3 and 4. It is part of the popular series which takes a concept like electricity and places the students in the middle of the action by blending fact with fictional storytelling and cartoon style illustrations.*

Title: Where Does Electricity Come From?
Author: C. Vance Cast
Illustrator: Sue Wilkinson
Publisher: Barrons
ISBN #: 0-8120-4835-0
Description: *This book is ideal for Grades 3 and 4 and is an excellent blend of fact and fiction. The central character, Clever Calvin, explains where electricity comes from and what it can do.*

Title: Switch On, Switch Off
Author: Melvin Berger
Illustrator: Carolyn Croll
Publisher: Harper Collins
ISBN #: 0-06-445097-X
Description: *This book is ideally suited for students aged 5 to 9. It may be useful for students in grades 3 and 4 as it provides a clear and well illustrated explanation of what electricity is and relates it to their daily lives.*

VOCABULARY

Circuit: A circuit is formed when electrons can make a complete trip from its source to a device and back to its source again.

Conductor: A material which allows electrons to flow.

Electricity: Any effect resulting from the existence of stationary or moving electric charges.

Electron: The part of an atom which orbits the nucleus and has a negative charge.

Hypothesis: Technically, a hypothesis is a tentative explanation that accounts for a set of facts, and can be tested by further investigation; a theory. Put simply, it's a scientist's "educated guess." The scientist would then perform experiments to determine if the guess was correct.

Insulator: A material that does not allow electrons to flow.

Observation: The act of noting and recording something.

Parallel Circuit: A more complex circuit that, because of the properties of electricity, allows the electron flow to be split evenly between two or more devices.

Series Circuit: A simple circuit in which all devices and sources are in sequential order (a simple loop).