



LESSON 7:

Let's Throw an Electric Science Party!

OVERVIEW

Throughout his life, Franklin's curiosity and hands-on approach to his surroundings attracted him to science. Franklin's reasoning was practical and observation-based, and he shared his theories in letters to international contemporaries and colleagues.

Franklin's studies of electricity, including the legendary kite and key experiment, remain his most important and best known scientific achievements. Through his electrical investigations, Franklin developed important new theories and instruments to describe and demonstrate them. Franklin also introduced several new words into our scientific vocabulary, including "battery," "positive and negative," "conductor," and "discharge."

OBJECTIVES

Students will:

- Learn about the basic concepts of electricity observed and discovered by Franklin.
- Conduct simple experiments similar to those conducted by Franklin.
- Apply skills of observation and deductive reasoning to draw conclusions about the basic properties of electricity.
- Interpret their conclusions and reproduce their findings through the creation of games and activities based on their experiments.

McREL STANDARDS

Science

Standard 9. Understands the sources and properties of energy

Standard 10. Understands forces and motion

Standard 12. Understands the nature of scientific inquiry

TIME

This lesson and activity require three class periods.

MATERIALS

- Reading: The Franklin Institute, "The Lightning Rod...Point of Invention."
Available at <http://fi.edu/pieces/hongell/>
- "Experiment Packet" (included)

LESSON AND ACTIVITY

1. Homework

Assign students to read the handout, "Lightning Rod...Point of Invention," and answer the following questions:

- What was the connection between the lightning rod and electricity?
- How did Franklin perform his kite experiment?
- How did Franklin prove that a lightning rod worked?

2. Discussion

Review the previous night's assignment, stressing the concept of "experiment." Ask students to pair with another student and together write down a definition of "experiment." Students report back to the class with their definitions. On the blackboard or overhead projector, teacher notes the salient points of the definitions. Teacher then reads or asks a student to read the dictionary definition of an experiment. Does the class definition agree with the dictionary definition?

3. Further Discussion

Explain that Franklin was a keen observer and a skilled experimenter. Franklin's experiments began with a question, followed by a hypothesis that possibly answered the question and then an experiment to test out the hypothesis, which often led to revised hypotheses and additional experiments. It was Franklin's experimentation with electricity that led to his revolutionary idea to conduct electricity into the ground through a simple metal rod. The lightning rod, which saved countless structures from lightning-induced fires, made Franklin famous throughout the colonies and Europe.

4. Experiments

Explain to students that the class will be working in groups to conduct experiments similar to those performed by Franklin in the 1700s. Instructions for four experiments are included in the "Experiment Packet." The teacher may choose any or all of the experiments and break the class into groups as needed. All experiments use simple and widely available supplies. The experiments include:

- When Sparks Fly
- Static Electricity Detector
- Water Bends
- Lemon Batteries

5. The Science Party

Ask students to devise a way to illustrate a principle demonstrated in one of the experiments through a game, fun activity, or a presentation of their choosing. The goal is for groups to reproduce the results or findings of the experiments in a creative manner for the other class members.

ASSESSMENT

Students will be assessed on the quality of their participation in class discussion and small group work and on the quality of their presentation.

EXTENSION ACTIVITIES

Ask students to investigate the history of science in the 1700s and create a timeline of scientific events. They should be sure to feature Franklin.

FURTHER RESOURCES

- Franklin, Benjamin. *Experiments and Observations on Electricity*, 1751.
- Birch, Beverly. *Benjamin Franklin's Adventures with Electricity*. (Hauppauge, NY: Barron's, 1995).
- www.ushistory.org/franklin/index.htm
- <http://sln.fi.edu>
- <http://edtech.kennesaw.edu/web/electric.html>

Experiment Packet

EXPERIMENT 1

WHEN SPARKS FLY

INTRODUCTION

Have you ever been surprised by sparks after you walked across a floor. Did you wonder what made that happen and why?

- What materials can you touch that will cause sparks?
- Does the type of shoe you wear matter? Sneaker, sandals, loafers?
- How can you prevent sparks?

CAUTION: This experiment involves creating static electricity. Don't go anywhere near flammable material that could explode or catch on fire. Steer clear of sensitive electronics; electricity can damage computers. Stay away from electrical appliances. Most are ground safely, but...

EXPERIMENT A: LET'S TRY WALKING ACROSS A RUG

PROCEDURE

1. The weather should be dry.
2. Take a stroll across the rug and try touching various objects.
3. Make a chart with three columns: one for the object that you touch; another for the material of the object (wood, plastic, metal); and the third for results. Record your findings.

CONCLUSION

Can you reach any conclusions? What resulted in sparks?

EXPERIMENT B: LET'S CHANGE SHOES

PROCEDURE

1. Get out a few pairs of shoes, put them on and walk across the rug and touch the same things in the same order you touched the first time.
2. Make a chart with three columns: one for the shoes you were wearing; the second for the object that you touched; and the third for the results (did you get a spark?).

CONCLUSION

Can you reach any conclusions about the best shoes to wear to ignite a spark?

EXPERIMENT C: PREVENTING SPARKS

PROCEDURE

Look at the results of Experiment A. Which material did not create sparks?

1. Take a stroll on the rug to create some static electricity.
2. Touch one of the materials that did not create a spark.
3. Now touch a material that sparked. What happens? Did it spark again?

CONCLUSIONS

Can you reach any conclusions about the best shoes to wear to ignite a spark? Are some materials better than others for creating sparks?

Experiment Packet (continued)

EXPERIMENT 2

A STATIC ELECTRICITY DETECTOR

When you created static electricity, did you ask yourself if static electricity could be detected? A device that detects static electricity is called an electroscope. In this experiment we make one.

MATERIALS

- A one-quart glass jar
- A cardboard lid
- A two-inch common nail
- Two strips of thin metal foil

PROCEDURE

1. Cut a cardboard disc slightly larger than the jar's top.
2. Pierce the cardboard lid right in the middle with the nail.
3. Attach the strips of foil to the tip of the nail.
4. Screw the lid onto the jar.
5. Now place a charged object near the jar. The foil strips should separate. Repeat with different objects.

CONCLUSIONS

Why do you think the strips of foil separate?

Experiment Packet (continued)

EXPERIMENT 3

WATER BENDS

MATERIALS

- A sink with faucet
- A plastic comb, wand, or other static collector
- A blanket or other woolen article

PROCEDURE

1. Run the water from a faucet so that it flows slowly and evenly with no breaks.
2. Work up some static electricity by rubbing a plastic wand on a wool blanket or just comb your hair with an ordinary plastic pocket comb.
3. Bring your comb, wand, or whatever you used close to the running tap water.
4. Does the running water bend? Why?

Other experiments with bending water

- Run the water so slowly that it has breaks and then try bringing a charged object close to it.
- Run the water in a strong fast stream and see what happens. Try two combs in different positions.
- Apply two charged objects. What happens?

CONCLUSIONS

Can you each any conclusions?

Experiment Packet (continued)

EXPERIMENT 4

LEMON BATTERIES

MATERIALS

- One lemon
- One copper penny
- Strip of zinc (you can get this from a hardware store)
- Steel wool
- Knife
- A current meter (measures the current flowing in the circuit; available from an electronics supply store)

PROCEDURE

1. Shine the surfaces of the penny and the zinc strip with steel wool. With adult help, cut two small slits into the lemon's skin about a $\frac{1}{2}$ inch long and about $\frac{1}{4}$ inch apart.
2. Insert a penny into one of the slits and insert the zinc strip into the other slit. Be sure the metals don't touch! Touch the leads of the current meter to the exposed metals. Watch the meter. The needle in the current meter moves.

CONCLUSIONS

Ben Franklin observed this in his experiments! Why does the meter move?