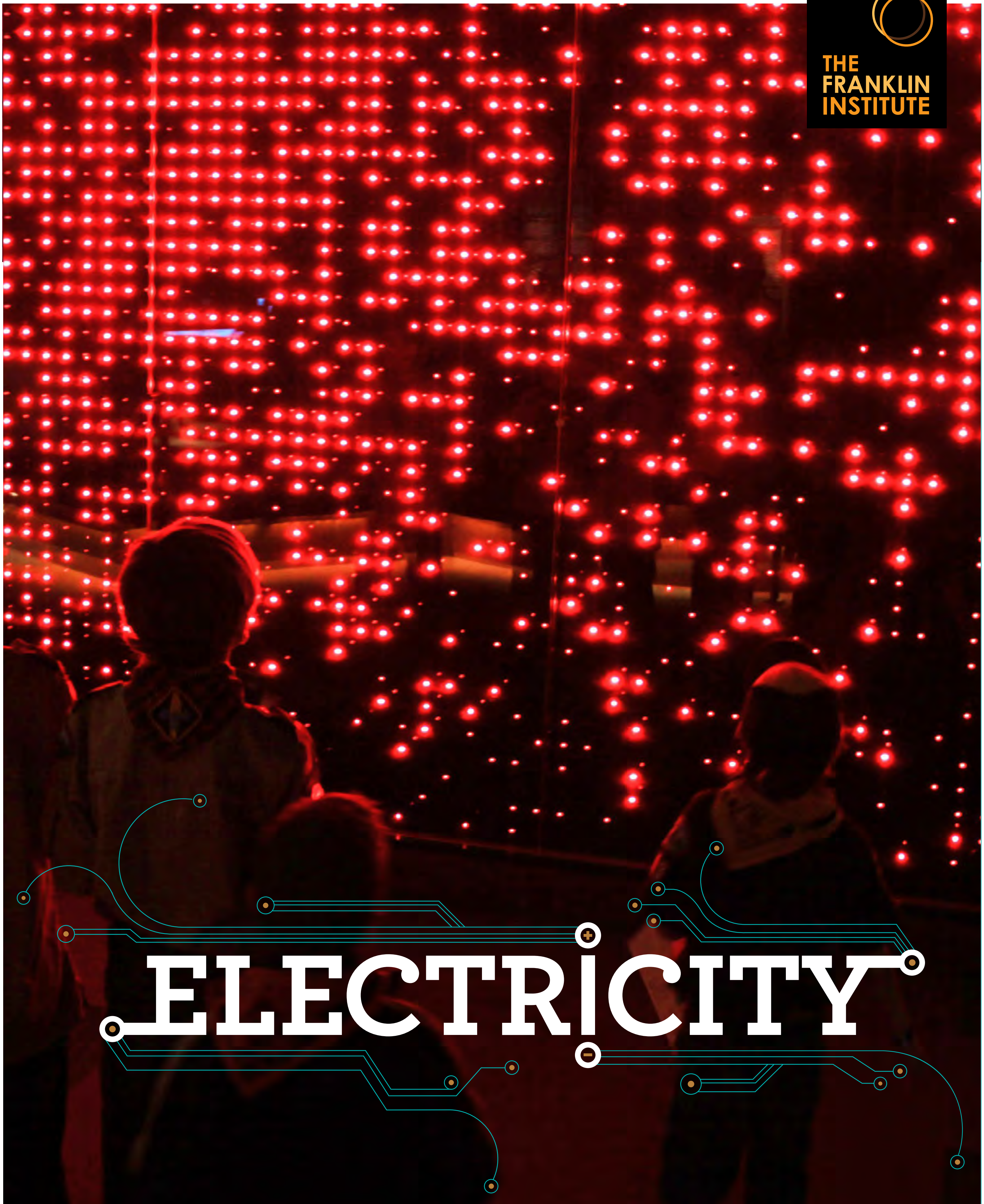
THE FRANKLIN INSTITUTE



ELECTRICITY

K-12 Educator's Guide

Where does electricity come from?

How do we use electricity in our everyday lives?

How can we make more electricity?

The "Electricity" exhibit invites you and your students to consider these questions and find answers.

During your visit, students will:

- Explore how Benjamin Franklin and his contemporaries learned about electricity.
- Investigate sources of electricity.
- Discuss the impacts of using electricity in our everyday lives.

After your visit, students will:

- Understand how charged particles interact.
- Think twice about wasting electricity in their homes.
- Want to conserve electricity in their everyday lives.

QUICK TIPS

✓ The exhibit is located in the main Science Center building on the second floor. Elevator access is via the main elevators located at the front of the building. Use the ramps in the Benjamin Franklin National Memorial to make your way around to the entrance.

✓ The learning experience is greatest when students engage with the hands-on devices and multimedia presentations located throughout the exhibit. For logistical reasons, however, you might recommend that students spread out in small groups in order to enable everyone to see and hear the presentations.

✓ On average, most groups will spend about 40-50 minutes in the exhibit, if interacting with all of the devices.

What to Expect

The exhibit is located in the main Science Center building on the second floor. There are three entrance ways: through “Changing Earth”, from “The Giant Heart,” and through the “Franklin Pathway.” As the name implies, the exhibit invites you to feel the force of Electricity.

The exhibition is organized into seven sections, each of which is highlighted below.

Ben’s Mark

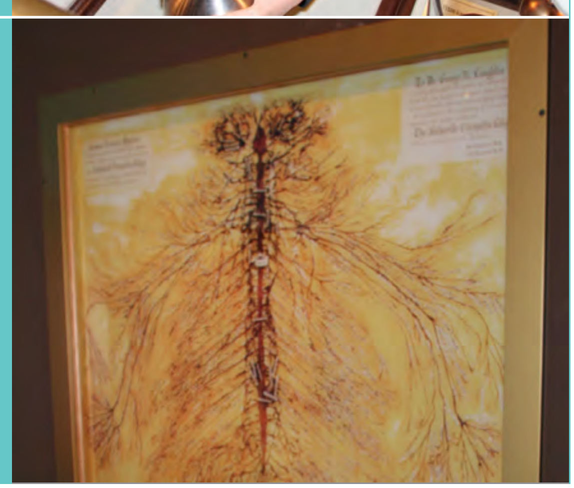
The “electric fire” sparked Ben Franklin’s curiosity, leading him to attach a key to his kite string and venture out one stormy night. Ben experimented with electrical forces for years and artifacts of his investigations are on display in this area of the exhibit.

Lightning Origins

Static charge generators, including a Van de Graaff generator, allow students to experience the feel of static charge. They won’t be struck by lightning, but the intent is to help them understand that lightning is actually a massive build-up of static.

Electricity in Me

The life-size model of the human nervous system might seem out of place in an exhibit about electricity, but students should understand that electricity is essential to human life. This section shows how electrical signals are conducted throughout the human body.

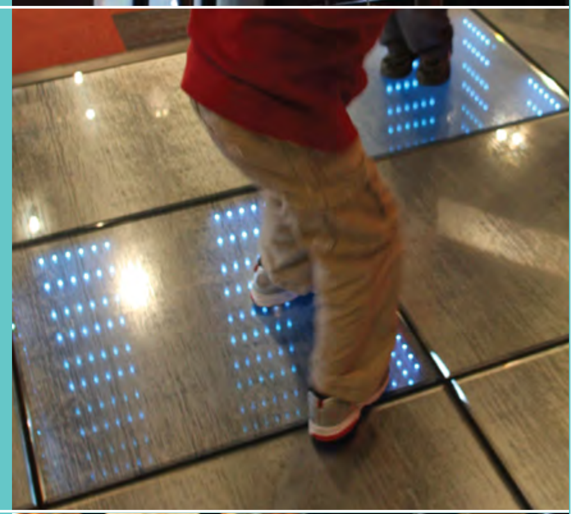


How it Works

Look overhead or you will miss the giant Tesla Coil. Although, with its powerful flash and crackle it would be very hard to miss. The lightning-like plasma filaments will arc out in a display that illuminates the force of electricity. Consult the daily program schedule when you arrive to know when to see the Tesla Coil demonstration.

Altering Our Lives

Sustainability is a key issue in this section. Students can put the power in the party by dancing. The "sustainable dance floor" area uses dance energy to power the lightshow.



Sustaining Supply and Demand

Does replacing one light bulb really make a difference? Students can compare the variety of bulb designs and choices. Replacing incandescent with compact fluorescent will make more sense than ever before.

Making a Difference

"Compromising Choices" demonstrates how sustainable electricity generation requires social decision-making. In this game, each student leads a nation through technological and economic development, balancing energy sources with environmental damage and resource depletion.

Try This!

The "Electricity" exhibit offers several opportunities to learn about static electricity.

For years children at birthday parties have played with static electricity—whether they realized it or not. Bring this fun exercise to your classroom with the following simple experiment that is good for all ages.

Supplies:

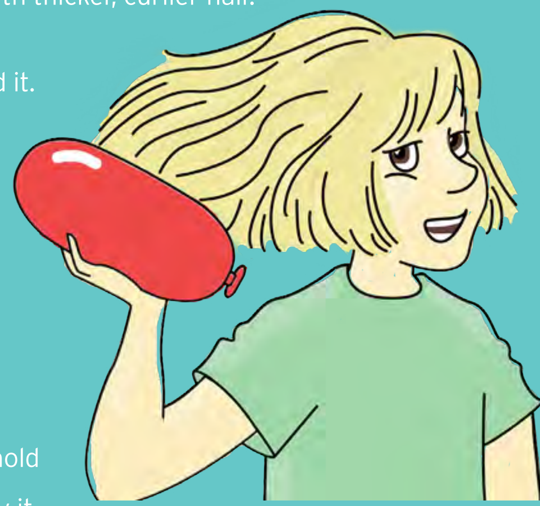
- Latex balloons (oblong shape is better than round) – one for each two students

To Do:

On a cool, dry day inflate the balloon and tie it closed. Rub it on a rug or sweater. Bring the balloon close to a student's hair.

What happens? The hair rises to meet the balloon. Note that fine, straight hair is most easily lifted. The effect may be harder to see with thicker, curlier hair.

By rubbing the balloon, you electrically charged it. The hair rises toward the balloon becuase of that charge.



Students can take turns trying this with a partner's hair and with the hair on their own forearms.

The electrical charge is also strong enough to hold the balloon against the wall for a short time. Try it and see how long the balloon will stay.

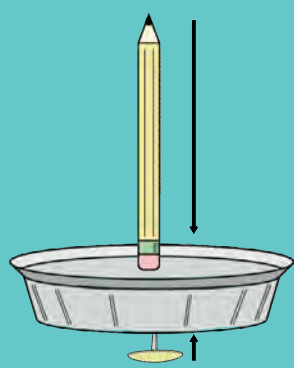
Try This!

Older students can "make" lightning following these simple steps. The build-up of static energy is released suddenly as a "lightning" strike.

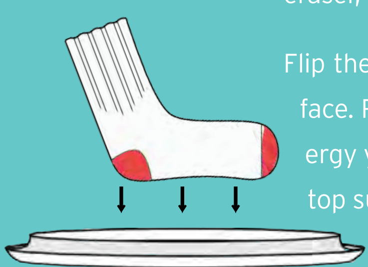
Supplies:

- Styrofoam Dinner Plate
- Disposable Aluminum Pie Pan (thin enough to puncture with a tack)
- Thumbtack
- New Pencil with New Eraser
- Wool Sock, Glove, or Piece of Fabric

To Do:

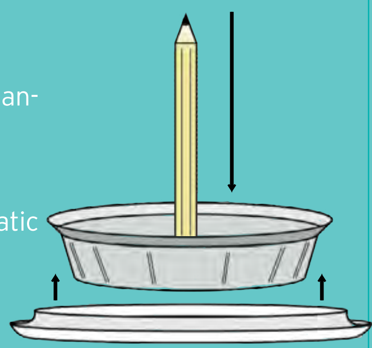


Puncture the bottom of the pie pan so that the tack is sticking up through the center. Attach the pencil to the tack by pushing into the eraser, making a "handle" for the pie pan.



Flip the styrofoam plate so that the "bottom" becomes the top surface. Rub that top surface hard and fast for a minute—the more energy you put into it, the better the effect will be. After a minute, the top surface should be coated with charged particles.

Set the wool aside and pick up the pie pan by its pencil handle. Slowly lower it into position atop the plate's charged surface.



Now, touch the edge of the pie pan to see how a build-up of static charge can be conducted through metal and released into you!

To repeat the effect, simply rub the styrofoam plate again to build up more charge.

Note: If you can darken the room, the sparks should be readily visible when they are released from the charged metal surface.

Franklin & Electricity

Everyone knows the story of Benjamin Franklin's famous kite flight. Although he made important discoveries and advancements, Ben **did not** "invent" electricity. He did, however, invent the lightning rod which protected buildings and ships from lightning damage.

Ben suspected that lightning was an electrical current in nature, and he wanted to see if he was right. One way to test his idea would be to see if the lightning would pass through metal. He decided to use a metal key and looked around for a way to get the key up near the lightning. As you probably already know, he used a child's toy, a kite, to prove that lightning is really a stream of electrified air, known today as plasma. His famous stormy kite flight in June of 1752 led him to develop many of the terms that we still use today when we talk about electricity: battery, conductor, condenser, charge, discharge, uncharged, negative, minus, plus, electric shock, and electrician.

Ben understood that lightning was very powerful, and he also knew that it was dangerous. That's why he also figured out a way to protect people, buildings, and ships from it, the lightning rod. Using the information he learned from his kite and key experiment, he figured out that a metal rod could "capture" a lightning strike and safely transfer it to the ground.

Be sure to alert your students to the cases in the exhibit where you can see original Franklin artifacts from our collection.

Curricular Standards

An exploration of the "Electricity" exhibit can help students achieve learning objectives as called for by the national standards.

Next Generation Science Standards

4: Energy
MS: Forces and Interactions
MS: Energy
MS: Waves and Electromagnetic Radiation
HS: Forces and Interactions
HS: Energy
HS: Waves and Electromagnetic Radiation

Benchmarks for Science Literacy

4. The Physical Setting
4g. Forces of Nature

National Science Education Standards

K-4 A: Science as Inquiry
K-4 B: Physical Science
K-4 F: Science in Personal & Social Perspectives
K-4 G: History & Nature of Science
5-8 A: Science as Inquiry
5-8 B: Physical Science
5-8 F: Science in Personal & Social Perspectives
5-8 G: History & Nature of Science

9-12 A: Science as Inquiry
9-12 B: Physical Science
9-12 E: Science & Technology
9-12 F: Science in Personal & Social Perspectives
9-12 G: History & Nature of Science

Common Core English Language Arts

K-5: Reading Informational Text
6-12: Literacy in Science & Technical Subjects

Common Core Mathematics

K-12: Measurement & Data

An Educational Product of
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