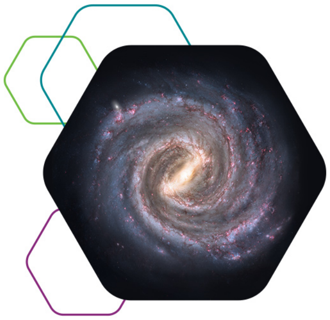

FACILITATOR GUIDE
Static Electricity

Learning objectives

Learners engaged in this activity will explore these main ideas:

- Special tools can help detect invisible forces on Earth and in space.
- Engineers and scientists invent and build tools to answer specific questions.
- Some NASA scientists study how static electricity behaves—here on Earth, in space, and on other worlds.

Materials

- 4-ounce narrow neck plastic bottle
- Scissors
- Needle-nose pliers with wire cutter
- Single-hole punch
- Spool of copper wire
- Heavy duty aluminum foil
- Kitchen sponge
- Foam tray (or Styrofoam egg carton)
- Wool felt
- Sign, sign stand, information sheets, and activity and facilitator guides
- “Build an Electroscope” instructions sheet
- “Tips for Leading Hands-on Activities” sheet

The Explore Science toolkit comes complete with all necessary materials for this activity. Materials are also readily available to create or restock activity kits. Most of the materials in this activity can be purchased through hardware and craft stores, or ordered online. All graphic files can be downloaded from www.nisenet.org.

Safety

Use caution when using scissors with young children. The ends of the copper wire can also be sharp, so it’s a good idea to fold over each end of the wire about ¼ inch using the needle-nose pliers before giving the wire to a child. Engage parents and caregivers in more of the cutting and bending.

Advance preparation

Before doing this activity, follow the "Build an Electroscope" instruction sheet to make a model electroscope that participants can use to see how an electroscope works.
Prepare materials for the activity before you begin:

- Cut each sponge into 8 sections.
- Pre-cut an 8-inch length of copper wire for each anticipated participant.

Notes to the presenter

It's important to note that we don't actually use this tool in space! This simple tool was invented in the late 1700's, when people were first beginning to study and understand electricity. Today, scientists use a more complex and precise version of this tool, called an "electrometer," to measure electrical charge.

How does an electroscope work? When you move the foam tray or wool felt closer to the tool, electrical charges move to the metal and down to the foil leaves. Since each foil leaf has the same charge, positive or negative, they repel each other.

The electroscope will work best if the foil pieces are as flat as possible. If the foil wrinkles while the participant handles it, simply instruct them to flatten the foil against the table with the palm of their hand before hanging it on the wire inside the bottle.

On humid days, you may see a lesser effect from the electroscope. Increased humidity limits static buildup because moisture on materials makes a good conductor. Try charging the foam tray longer (i.e., rub it against your sleeve for 20 seconds instead of 10), or use the opportunity to experiment with a wide variety of ways to create static electricity. For example, rubbing an inflated balloon against your hair is sure to generate a charge, even on the most humid days!

Younger participants may need close supervision and help to assemble their electroscope. Cutting thin rectangles of aluminum foil can be especially tricky. Even young children will enjoy experimenting with different materials, though they may not be ready to understand the concept behind the phenomenon, so focus on the experience itself. Many children will benefit from assistance from an adult while building their own electroscope because they are still developing their fine motor skills. If you are expecting a large number of younger children, you may want to have several pre-made electroscopes prepared for them, and focus on experimenting with different materials rather than on building.

Conversational prompts

This activity engages participants in building their own tool to detect a fundamental phenomenon. Encourage them to use the tool at home by discovering ways they can generate static electricity. Can they think of any toys or objects at home that they could safely rub together (e.g., stuffed animals, plastic food storage containers, wool mittens, Styrofoam coolers, balloons)?

Participants may be familiar with static electricity in practice, but not in name. It is helpful to offer examples of where and when they may have encountered static electricity before. For example, have they ever slid down a plastic playground slide and noticed that their hair was standing on end? Have they ever made their bed with a fluffy blanket in the wintertime and gotten a shock?

Many of the phenomena and processes that we observe here on Earth are also present on other worlds and in the space between them. Static electricity carries dust across airless landscapes, causes particles to congregate in space, and, if we're not careful, can damage the delicate electronic components of spacecraft!

Difficult concepts

Some participants may worry that generating static electricity will hurt them. They may have some reasonable preconceptions about the dangers of playing with electricity, perhaps recalling times that adults have warned them against exploring electrical outlets at home. You can reassure participants that, in this activity, they are generating such a tiny amount of electric charge that they could not possibly get hurt by it. At the very most, they may experience a "tickle" of static charge coming from the foam tray. In more extreme cases, such as while using power tools, static electricity can build up enough to hurt someone, so it is important to always ask the question, "How can I keep myself safe while exploring electricity?"

Examples of static buildup that result in sparks or hair standing up are due to a charge imbalance. Positive and negative charges are separated, putting more positive charges in one area, and more negative charges in another. This happens by rubbing and then pulling apart the two materials, like a foam tray and clothing in this activity, for example. Neutral objects contain an equal number of positive and negative charges. People may think that they have no charge, but it's better to reinforce that they have a balanced amount of positive and negative charges.

Staff training resources

Refer to the "Tips for Leading Hands-on Activities" sheet in your activity materials.

- An activity training video is available at vimeo.com/304241144
- A content training video is available at vimeo.com/304241037
- Additional training videos on misconceptions and facilitation can be found at vimeo.com/album/4249834
- The NISE Network has a curated list of programs, media, and professional development resources that directly relate to the toolkit. These resources can be viewed and downloaded from www.nisenet.org/earthspacekitextensions.

Credits and rights

This activity was adapted from Simple Electroscope, developed by Museum of Science Boston Sciencenter.
Retrieved from: http://cst.mos.org/sln/toe/simpleelectroscope.html.
And was developed for the NISE Network by the Sciencenter.

Images of lightning storms from the ISS and the electrostatic discharge point on the Sojourner Mars Rover courtesy NASA

This material is based on work supported by NASA under cooperative agreement award numbers NNX16AC67A and 80NSSC18M0061. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the view of the National Aeronautics and Space Administration (NASA).