Natural vs Human-harnessed Electricity

Reflect

What is static electricity? Why do you sometimes get shocked when you touch something metal? Why is static electricity more common in the winter?

What do you think of when you think of static electricity? Maybe the shock it can cause? Have you ever tried to touch the wall when coming inside from the cold? Did you get zapped? You have probably felt this electric shock when touching other objects such as another person or a doorknob. This is caused when electrons rub off onto your body, leaving you with a negative static charge. When you reach for a light switch, you get a shock as electrons jump from you to the switch. If the room is dark, you might have even seen the spark or heard the crackle. Static electricity is more noticeable during the winter months because the air is very dry. The humidity during the summer helps electrons move more quickly, which makes it harder to build up a big static charge.

Everything you can think of is made up of tiny particles. These are called atoms. Atoms have even smaller pieces called protons, neutrons, and electrons.

A **proton** has a positive charge and is found in the nucleus. An **electron** has a negative charge that orbits around the nucleus. Electrons orbit so fast that you can never really be sure where they are located. When an atom has the same number of electrons and protons, then it has a neutral charge. The **neutron** doesn't have any charge. The buildup of electric charge is called **static electricity**.

Look Out!

When things have the same charge, they try to get as far away from each other as possible. Have you ever rubbed a balloon on your hair? What happens? Static electricity makes your hair stand up. Each hair has a negative charge and repels the other hairs.

Lightning is one of the best examples of static or stationary electricity. Static electricity can happen during a storm when wind moves the air around really fast, causing the charge in the clouds and on the ground to separate. The top of the clouds and the ground both get a positive charge. The bottom of the cloud gets a negative charge. When the change in charges happens, the static electricity comes out in the form of lightning. This is what you see with thunderstorms.

Static electricity is unpredictable and random so it isn't harnessed as a power source for consumer use.

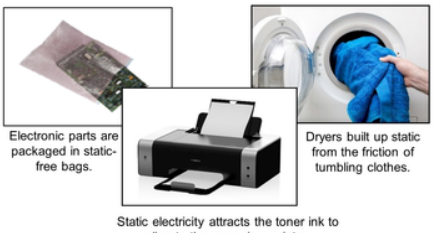
Natural vs Human-harnessed Electricity

Static electricity can be harmful to many things—especially electronics. You may have noticed that some people will unplug some major electronics like TVs, computers, and microwaves during a heavy thunderstorm. That is because these things have electronic chips that can be damaged if not protected.

Protective bags are used to store electronics.

This is why it is important to keep electronics grounded. This is when electrons are transferred between objects to remove the excess charge. When something is grounded, the excess charge is balanced between the electronics and the ground. There are many different ways of grounding things, and it is important to keep electronics from being damaged. When buying a piece of electronic equipment, take notice of the special bags in which it is packaged to prevent the buildup of static electricity. Also, people that work with electronics often wear special straps that keep them "grounded" so that they will not build up a charge and ruin the electronic components.

There are many things around your house that need to be "grounded." Things like lights, ceiling fans, air conditioners, and antennas. Basically, anything that has electricity running through it. When clothes are in the dryer, they rub against each other, and the friction causes a buildup of electrons on the clothes, giving the clothes a charge. Fabric softener will put a thin layer of chemicals on the clothes to keep them from building up the charge. Anti-static sheets can be added to the dry cycle to prevent the clothes and towels from clinging static electricity.



Static electricity has many uses in everyday life. Printers and photocopiers use charged particles to create the words and images they print on paper. Air filters, paint sprayers, and dusters all work by using static electricity.

Getting Technical: Lightning Rods Being struck by lightning can be a very dangerous problem. When electrical energy builds up in clouds, the electrons can suddenly pass between the air and the ground. Electrical energy will take the shortest path between two points, so the lightning will strike the highest point on the ground. If the high point is a building, the lightning strike could cause a power outage or even set the building on fire.

Buildings that might be struck by lightning are protected by copper lightning rods. These rods are connected to the ground by thick copper wires. If lightning strikes the building, the energy will be conducted through the wire, away from the building, and into the ground. This protects the rest of the building from that energy.

Natural vs Human-harnessed Electricity

How is human-harnessed electricity produced and controlled?

Current, or moving electricity, is produced at power plants using mechanical and chemical energy to move copper discs between the poles of magnets. Different forms of chemical energy provide the fuel for the generators to convert mechanical energy into electric energy.

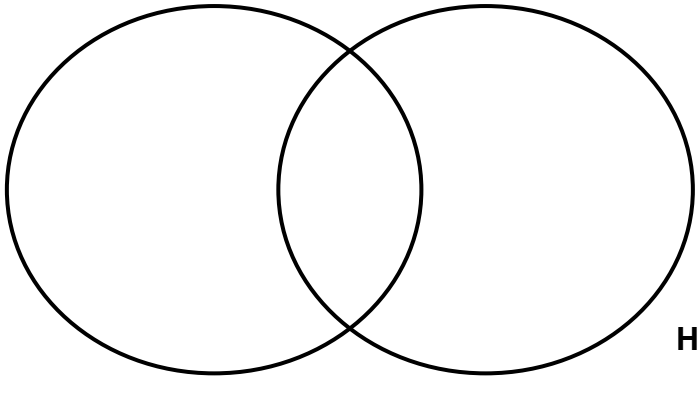
Once the electricity is generated, it is transmitted and distributed through conductive wiring to consumers on the grid, or system of wires. The flow of electricity is harnessed or controlled as it moves through the grid of cables, sub-stations, and storage facilities.

The burning of fossil fuels—coal, oil, and natural gas—and nuclear fusion are most commonly used to power the turbines that drive the electric generators. However, alternative power sources are being developed. Wind, water, geothermal, and solar energy are all viable power sources for generating electricity.

Humans rely heavily on the predictability of current electricity to be available whenever a device is clicked on or whenever a switch is flipped. How many different electric devices have you used today? How would your day have been different if current electricity wasn't there when you closed the circuit?

What Do You Think?

Complete the Venn diagram to compare static and human harnessed electricity.



Static Electricity

Human-Harnessed Electricity

Try Now

With a few basic items, you can cause static electricity and observe the results.

Materials

- Two inflated balloons
- Piece of fabric (wool works well)
- Hair
- An empty aluminum can

Directions

1. Rub the two balloons with fabric to build up an electrical charge. Try moving the balloons together. Observe the reaction. Are they attracted to each other or do they repel each other?
2. While standing in front of a mirror, rub one of the balloons back and forth on your hair, and then slowly pull it away. What do you observe? Exhale on the palm of your hand and rub your hand down your hair. What do you observe?
3. Put the empty aluminum can on its side on a table or the floor. Rub the balloon on the fabric or on your hair again, and then hold the balloon close to the can. What do you observe? Move the balloon away from the can. What do you observe?

What's happening?

Rubbing the balloons against fabric or your hair creates static electricity when negatively charged particles jump to more positively charged objects. The balloons become negatively charged, taking some of the electrons from your hair or the fabric and leaving them positively charged.

In activity 1, both the balloons become negatively charged after rubbing them against the fabric. Because of this, they repel each other.

In activity 2, opposites are attracting as your positively charged hair is attracted to the negatively charged balloon. When you exhaled on your palm, you left some moisture on your hand. Rubbing it on your hair disrupted the static electricity.

In activity 3, the aluminum can is attracted to the negatively charged balloon as the air near it becomes positively charged. Once again, opposites attract.

Connecting With Your Child

Your child has been learning about **static electricity**.

The atom is the basic building block of all matter. Matter is all of the "stuff" in the universe. Matter is made up of atoms. **Atoms** have a **nucleus**, an inner core that is made up of **neutrons** that have no charge and **protons** that have a positive charge. Atoms also have orbitals containing particles that are located around the **nucleus**. These are called **electrons**, and these have a negative charge.

There are opportunities at home to observe static electricity.

- When clothes are removed from the dryer, they will cling to each other. When pulled apart, you can hear the crackle of the static electricity as the charge jumps between the clothes. This works best if there has been no fabric softener or dryer sheets used since they are designed to coat the articles of clothing to reduce static cling.
- Tear a square of toilet tissue into tiny pieces. Rub a comb on a piece of fabric and hold it near the tissue pieces. How do the pieces react? This is the same static electricity reaction hair has when it is combed and becomes flyaway.

Kitchen Science

Discuss how you think static electricity can be used to separate the salt and pepper.

Materials

- Salt
- Pepper
- Plastic spoon
- A piece of fabric (wool works well)
- Bowl

Directions

1. Mix together a small amount of salt and pepper in a bowl.
2. Rub the plastic spoon on a piece of cloth to give the plastic spoon a negative charge.
3. Hold the spoon about an inch above the salt and pepper. What do you observe happening?

Both salt and pepper will be attracted to the spoon; However, pepper is lighter, so the pepper should cling to the spoon.