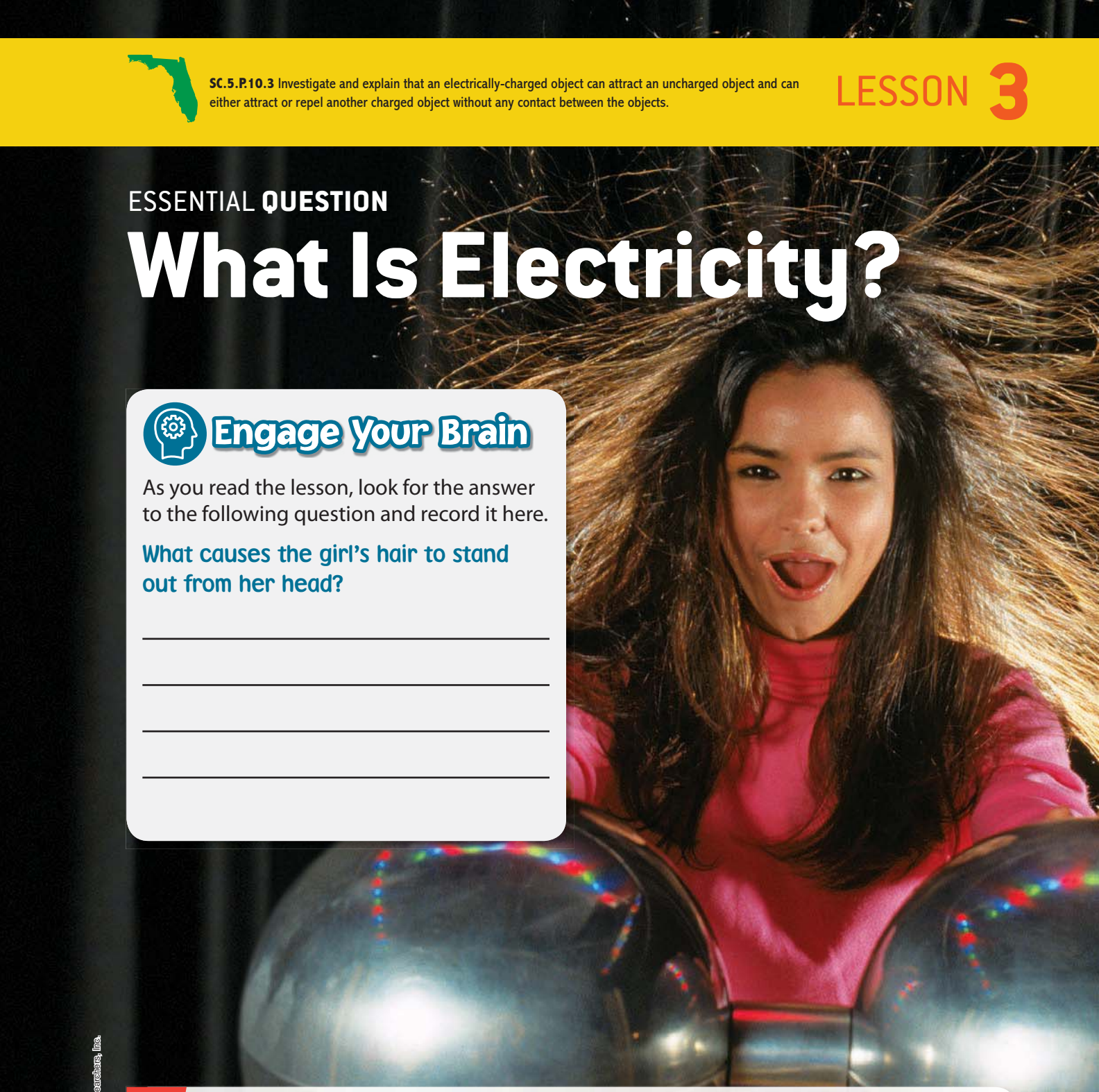
SC.5.P.10.3 Investigate and explain that an electrically-charged object can attract an uncharged object and can either attract or repel another charged object without any contact between the objects.

ESSENTIAL **QUESTION**

What Is Electricity?



Engage Your Brain

As you read the lesson, look for the answer to the following question and record it here.

What causes the girl's hair to stand out from her head?

_____

_____

_____

_____

ACTIVE **READING**

Lesson Vocabulary

List the terms. As you learn about each one, make notes in the Interactive Glossary.

_____

_____

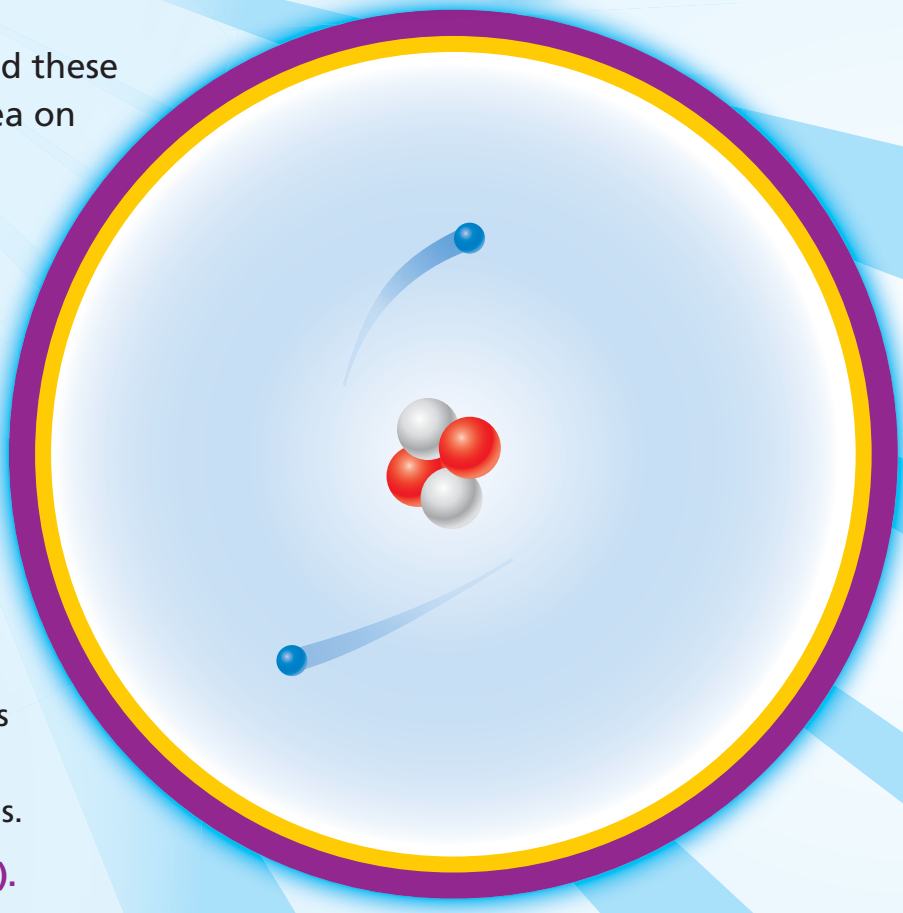
Main Ideas

The main idea of a paragraph is the most important idea. The main idea may be stated in the first sentence, or it may be stated elsewhere. Active readers look for main ideas by asking themselves, What is this section mostly about?

All Charged Up

You can charge a battery. A football player may charge downfield. How is an electric charge different?

ACTIVE READING As you read these two pages, underline the main idea on each page.



What do you, this book, and your desk have in common? You are all made of atoms. Atoms are the building blocks of all matter. An atom is made of even tinier particles called protons, neutrons, and electrons.

The main difference between protons, electrons, and neutrons is their electric charge. *Electric charge* is a property of a particle that affects how it behaves around other particles.

- **Protons have a positive charge (+1).**
- **Electrons have a negative charge (–1).**
- **Neutrons are neutral. They have no charge.**

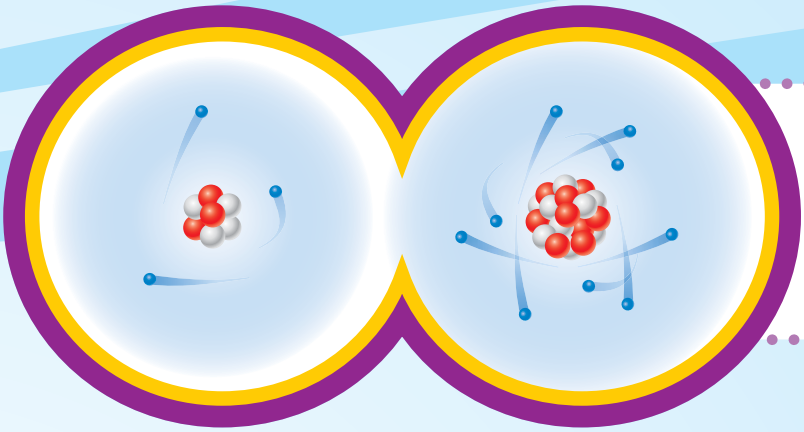
When an atom has equal numbers of protons and electrons, the positive charges and negative charges cancel each other. The atom itself has no charge.

Legend

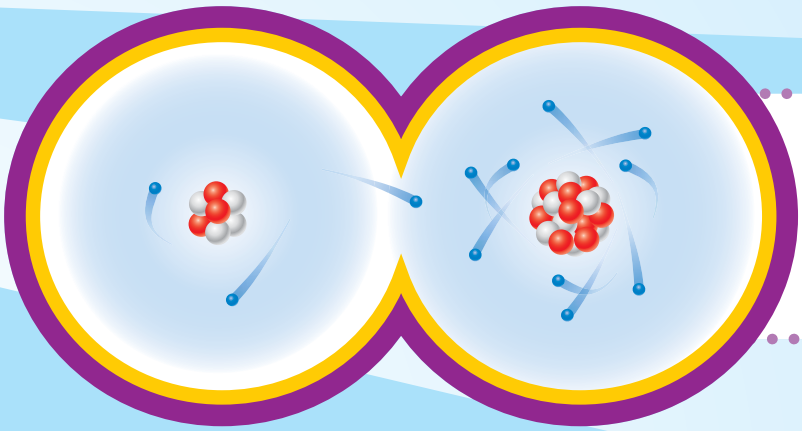
= neutron

= proton

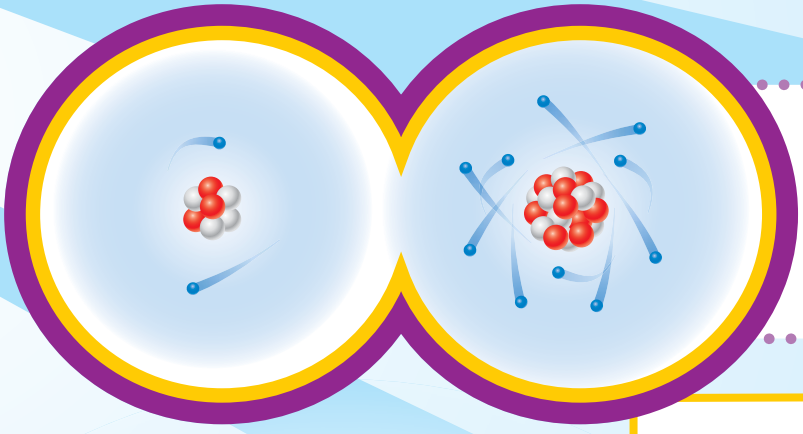
= electron



Each of these atoms has equal numbers of protons and electrons. Both atoms are neutral.



An electron from the atom on the left moves to the atom on the right.



The atom on the left now has a charge of +1. The atom on the right has a charge of –1.

Atoms sometimes gain or lose electrons. Such a gain or loss causes an atom to have an unequal number of positive and negative charges. For example, if an atom with four protons and four electrons gains an electron, the atom will have a charge of –1.

If a neutral atom loses an electron, the number of protons will no longer balance the number of electrons. The atom will have a charge of +1.

▶ Draw an atom with three protons, four neutrons, and four electrons.

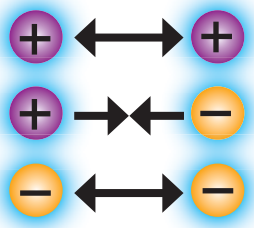
What is the charge of the atom?

_____

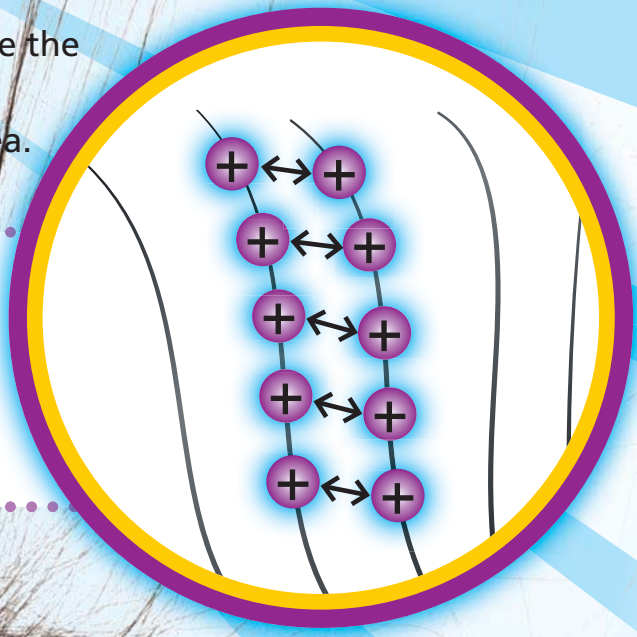
Opposites Attract

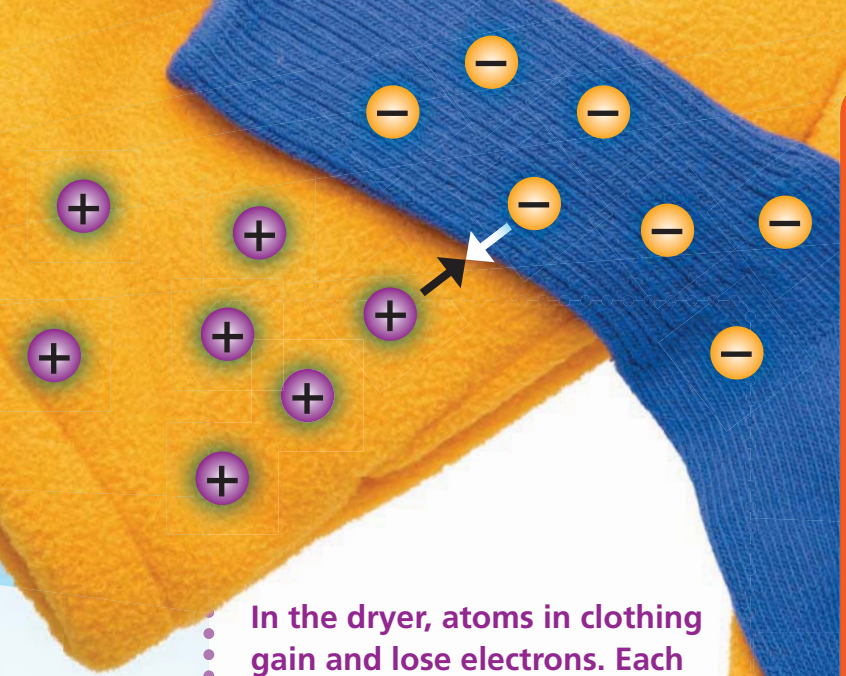
Have you ever had a "bad hair day"? Your hair sticks out in all directions and won't lie flat. What causes that?

ACTIVE READING As you read this page, circle the definitions of *attract* and *repel*. On the next page, draw a box around the sentence with the main idea.



Particles with the same charge repel, or push away from, one another. Particles with opposite charges attract one another, or pull together.





In the dryer, atoms in clothing gain and lose electrons. Each piece of clothing becomes charged. The positively charged surfaces attract the negatively charged surfaces. As a result, the clothes stick together.

DO THE MATH

Positive and Negative Numbers

Fill in the missing squares.

Original Charge on an Object	Electrons Gained or Lost	Final Charge on the Object
+300	Gains 270	
–300	Loses 525	
–270		–500

Electric charges can build up on objects. This buildup of charges is called **static electricity**. Objects with opposite electric charges attract each other. Objects with the same charge repel each other.

When you brush your hair, electrons move from each strand of hair to the brush. Soon all the strands are positively charged. Having the same charge causes the strands to repel one another and stick out.

A charged object can also attract a neutral object. If you rub a balloon on your hair, the balloon picks up extra electrons. They give it a negative charge. When you bring the balloon near a wall, electrons in a small section of the wall are repelled and move away. This leaves a positive charge at the surface of the wall. The balloon sticks to the wall.

Lightning Strikes

Thunderstorms can be scary. Lightning strikes can be deadly. What is lightning, and how can you stay safe during a thunderstorm?

ACTIVE READING As you read these two pages, underline the main idea on each page.

Static electricity is a buildup of charges on an object. The word *static* means "not moving." Charges stay on an object until it comes close to an object with a different charge.

As you walk across a carpet, electrons move from the carpet to you. Because electrons repel each other, they spread out all over your body. When you touch something, the electrons jump from your finger to the object. This jumping is called an electrostatic discharge. You feel it as a tiny shock.

ZAP!
Electrons jump from a person with a negative charge.

▶ **Complete this cause-and-effect graphic organizer.**

Cause: An object with a negative charge is placed near an object with a positive charge.	→	Effect: _____

Not all electrostatic discharges cause small shocks. Some result in huge shocks. During a thunderstorm, tiny raindrops or ice particles bump into each other. These collisions cause an electric charge to build in the clouds.

Positive charges form at the top of a cloud and on the ground. Negative charges form near the bottom of a cloud.

When the difference in charge between a cloud and the ground is great enough, there is a huge electrostatic discharge that we call lightning.

A lightning spark can jump between two clouds, between a cloud and air, or between a cloud and the ground. The temperature inside a lightning bolt can reach 50,000 °F. That's hotter than the surface of the sun!

Lightning Safety

- **Stay inside during thunderstorms.**
- **Turn off electrical appliances and stay away from windows.**
- **If you can't get inside a safe structure, wait in a car with a metal top for the storm to pass.**
- **Know the weather forecast. If you will be outdoors, have a plan in case a thunderstorm develops.**

Objects that lightning strikes can catch on fire. A tree struck by lightning may split.

(bkgd) ©Getty Images Royalty Free; (b) ©Mark Bassett/Alamy

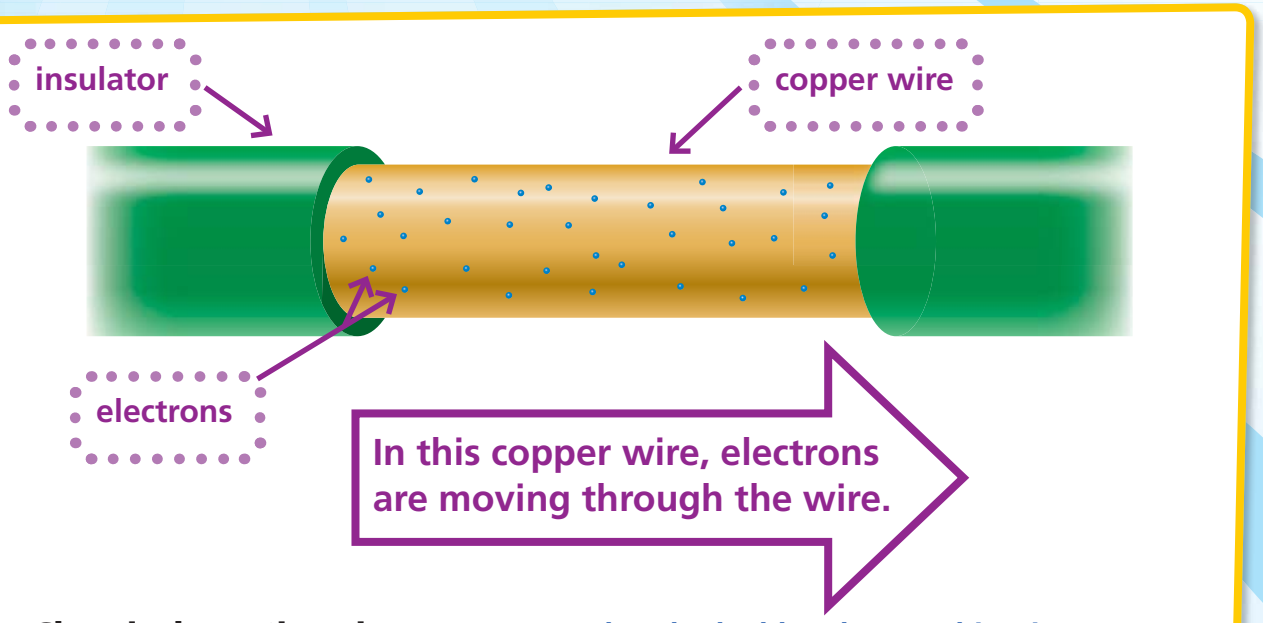
▶ **Draw a cloud above the ground. Then draw positive and negative charges to show what causes lightning.**

Current Events

You can control electrons by making them flow through a wire in the way water flows in a river.

ACTIVE **READING** As you read these two pages, draw a box around the sentence that contains the main idea.

When electric charges have a path to follow, as they do in the wire below, they move in a steady flow. This flow of charges is called an **electric current**.



Chemical reactions in a battery provide the energy that causes the electrons to flow. An energy station is another source of electric current.

▶ What do the blue dots on this wire represent, and what is it called when they flow?

These homes are all connected by wires to an energy station.

Electrostatic discharges may be exciting to watch, but flowing charges are more useful. Electrons can be made to move through a wire. They make up an electric current. You can use an electric current to do many kinds of useful work. We use electric currents for cooking food, lighting a room, and producing sound.

A battery is one source of electric current. Most of the electricity used in schools, homes, and businesses does not come from batteries. Instead, it is provided by an electricity generating station, or energy station.

There are many types of energy stations. They all turn other forms of energy into electrical energy. Wires carry this energy from the station to every outlet in your home. These wires may be on poles above ground or buried below ground.

Never climb or play near wires, and never dig in the ground where wires are present.

▶ **List three devices that use electric current from batteries and three that use regular house current.**

Batteries:	House Current: