

Content Objectives:

- Static electricity is the buildup of electrical charges on the surface of an object.
- Objects become charged with static electricity when negative charges on one object move to another object. This makes the first object positively charged and the second negatively charged.

Look at all the stuff around you. All that stuff is called matter. **Matter is anything that has mass and takes up space.** This matter is made of tiny particles, and some of these particles have **electric charges**. **Electric charges are units of electricity** that some particles have.

Electric charges can be **positive** or **negative**. Positive charges are shown with a plus sign (+) and negative charges are shown with a minus sign (-). Most matter is **neutral**, which means it does not have a positive or a negative charge. Sometimes matter can become positively charged or negatively charged, but most of the time it is neutral. A neutral object has the same number of positive and negative charges.

Negative charges can move from one object to another. When the negative charges move, it means the object the charges left now has a positive charge and the object the negative charges moved to has a negative charge. The buildup of electrical charges on an object is called static electricity.

For example, imagine you have a balloon and a piece of wool cloth. Both the balloon and the wool are neutral objects: they are not positively or negatively charged. If you rub these objects together, negative charges jump from the wool to the balloon. This means the wool is positively charged and the balloon is negatively charged.

If you rubbed two balloons with a piece of wool, both balloons would become negatively charged. The balloons would then repel each other because like charges repel. The wool will want to stick to a balloon because it is positively charged and the balloon is negative: opposites charges attract.

Over time, the electrically charged objects will go back neutral again and they will not be charged with static electricity. An **electric discharge is when negative electric charges move from a charged object to another object**. When you feel a shock from touching a metal doorknob on a cold, dry day, that is an electric discharge.

- **Matter:** anything that has mass and takes up space.
- **Electric charges** = units of electricity found on particles of matter. Some electric charges are **positive (+)** and some are **negative (-)**.
- **Neutral object:** an object that has the same number of (+) and (-) charges. Most matter is neutral.
- **Static electricity** = the buildup of electric charges on an object
- **Electric discharge:** when static electric charges jump or move from an object

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- A neutral object has the same number of positive and negative charges.
 - **(+)** = Positive charge
 - **(-)** = Negative charge
 - Only negative charges can move from one object to another.
 - Opposite charges **attract**, like charges **repel**.

Content Objective

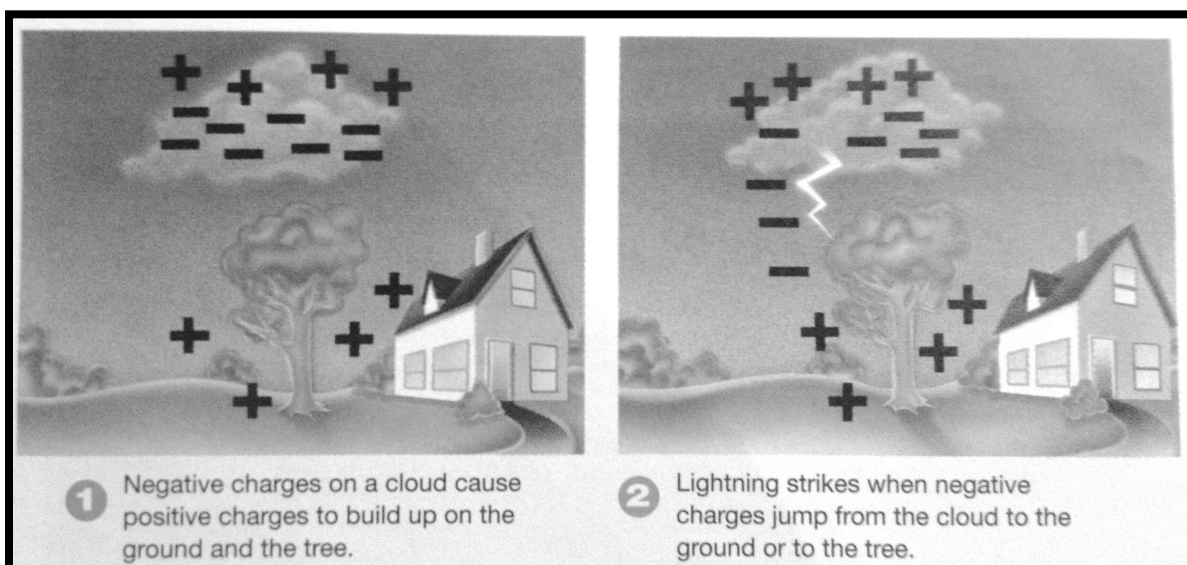
- During a thunderstorm, static electricity builds up inside the storm cloud. When negative charges jump between the cloud and an object on the ground, the static electricity is discharged. This electric discharge is lightning.

Thunderstorms bring heavy rain, strong winds, thunder, and lightning. Lightning is a huge electric discharge created when negative charges from a thundercloud connect with positive charges on the ground or in another cloud.

Scientists still have lots of questions about lightning, but they believe that it is caused by static electricity made inside the cloud. As drops of water are thrown around inside the cloud, some of them turn into ice. The ice and water drops become charged, some positive and some negative. As the storm gets stronger, negative charges build up at the bottom of the cloud. These negative charges want to attract to positive charges on the ground. When a negative bolt from the cloud connects with a positive coming from the ground you see lightning.

Lightning can be very dangerous. If you are outside and there is a chance that there may be a thunderstorm, you should get inside or under cover as soon as possible. Lightning often strikes the tallest object on the ground, so you shouldn't stand near trees or out in an open field. Go inside your house or some other shelter. A car is also a safe spot to be, and don't use any electrical devices that are connected to the wall by a plug.

- **Lightning:** a giant electric discharge created when negative charges in a cloud connect with positive charges on the ground or on another cloud
- **Thunder:** the sound of lightning. When you see lightning and immediately hear thunder, the storm is close. More time between when you see lightning and hear thunder means the storm is farther away.
- **Lightning rod:** a metal rod attached to a building to keep lightning from causing damage.



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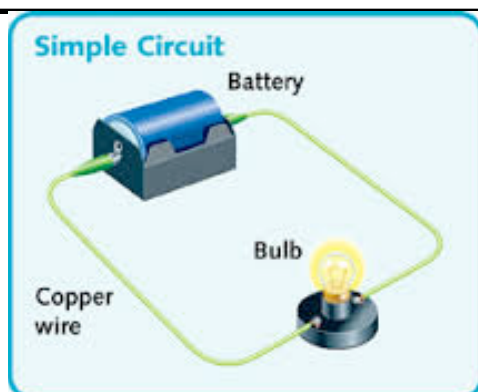
- Electric current flows on an electric circuit from the source of electric charges (like a battery) to a device that needs electricity (like a lightbulb) and then back to the source.
- Electric circuits can be opened or closed with devices like switches.
- Materials that do not conduct electricity well are called insulators. Materials that do conduct electricity well are called conductors.

The electricity used when you turn on your lights at home is different than static electricity. Static electricity does not flow: it stays on an object until it is discharged. The electricity that is used to turn on your lights flows through wires. This electricity is called current electricity. An **electric current is a continuous flow of negative charges**. The electric current flows on an **electric circuit**. The electric circuit is the path that negative charges flow upon.

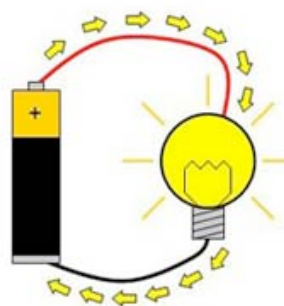
A simple circuit has four parts: a power source, two wires, and something to be powered. The power source is connected to the device being powered by the wires. When the circuit is complete, the electricity can flow. You can control the flow of negative charges by opening and closing the circuit. Opening a circuit turns the current off. (Open = Off). Closing a circuit turns the current on (Closed = On). A **switch** is a device that can open or close an electric circuit.

Electricity flows easily through some materials, and doesn't flow easily through others. Materials that allow electricity to flow are called **conductors**. Most metals are good conductors, which is why wires are made out of metals like copper. **Insulators** are materials that don't allow electricity to flow easily. Plastic, glass, cloth, and rubber are all insulators. Electrical cords use conductors and insulators. The metal wire is a conductor that allows electricity to move, and the cord is wrapped in plastic (an insulator) that protects you from getting a shock.

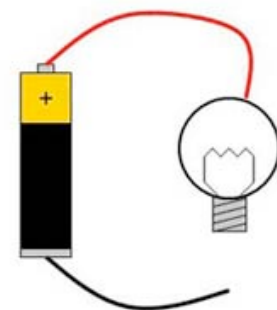
- **Electric current:** a continuous flow of negative charges
 - **Electric circuit:** the path on which negative charges flow or move
 - **Switch:** a device that opens or closes an electric circuit
 - **Conductors:** materials that conduct electricity (most metals are good conductors)
 - **Insulators:** materials that do not conduct electricity well (rubber and plastic are insulators).
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- An "open" circuit means the electricity is **off**.
 - A "closed" circuit means the electricity is **on**.
 - Think of the electric circuit as a track. The runners on the track are the electric current.



Closed circuit



Open circuit



Content Objectives:

- A series circuit is an electrical circuit where the current has only one path to follow. If you remove a device (like a lightbulb) from the circuit, the current cannot flow: the circuit will be open.
- A parallel circuit is an electrical circuit where the current has more than one path to follow. If you remove a device (like a lightbulb) from the circuit, the current can still flow: part of the circuit will be closed and part will be open.

There are different ways to set up electric circuits so that many things are being powered. One way is by setting the parts of the circuit up in a series. A **series circuit** is an electrical circuit that allows electricity to flow in only one direction. If you remove a device that you are trying to run from a series circuit, the other devices in the circuit will not run.

Another way to set up an electrical circuit is in a parallel circuit. A **parallel circuit** is a circuit that has more than one path for the electricity to follow. If you remove one device from the circuit, the other devices will still work because the electricity has another path to take. Sometimes circuits are a combination of series and parallel circuits.

Your house has many circuits in it. The lights and appliances need electricity to run, and circuits allow electric current to flow to these devices. The wiring in your house is done in **parallel**, not in series. This is so that if one of your lights goes out, the other things will still work. Houses need a lot of electricity. Safety devices like fuses and circuit breakers protect you from getting a shock and the wiring in your house from being damaged. **Fuses** have a metal strip that breaks when it becomes overheated. This opens the circuit so electricity won't flow. A **circuit breaker** is a switch that shuts itself off when it gets too much electricity.

- **Series circuit:** an electrical circuit where the current has only one path to follow
- **Parallel circuit:** an electrical circuit where the current has more than one path to follow
- **Fuse:** a electrical safety device that opens a circuit when it becomes overheated with too much electricity
- **Circuit breaker:** a switch that opens or turns off a circuit when the current is too powerful

