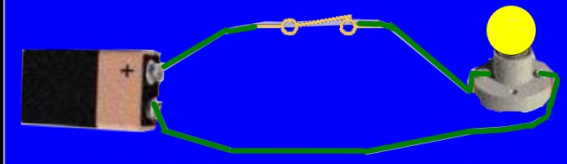
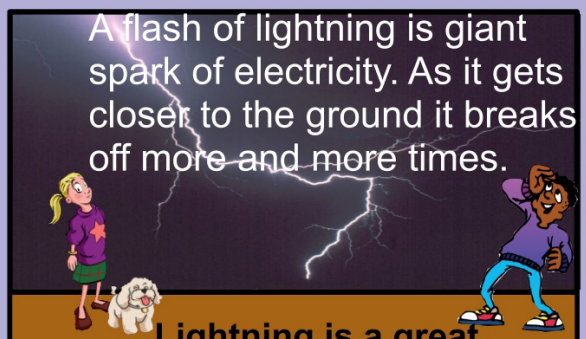
ELECTRICITY



Electricity travels from one pole of the battery, through the light and the switch (which is open or closed), and then back to the other pole of the battery. The path is called a complete circuit.

Giant Photovoltaic Array at Nellis Air Force Base, Nev.

Green Mountain Wind Farm



Lightning is a great example of direct current

Static Electricity

Two girls are "electrified" during an experiment at the Liberty Science Center "Camp-in".

Electricity

Electricity is _____. Every day we all use _____ power in our daily _____ on everything from using an electric toothbrush, to doing our _____ on a _____, to making a piece of toast, or even_____ to school in our new ____ that uses _____ for its main source of _____.

Electricity can easily be _____ into other _____ of energy like _____ , heat or _____ and this makes it a very useful form of energy. _____ is made from the actions of tiny _____ When an electric charge builds up in one place it is called _____ _____. If the charge _____ from one place to another it is known as _____ _____. In this flipchart we will be learning a little about electricity.

car changed computer current electrical electrical electricity

Electricity electricity electrons flows forms light lives

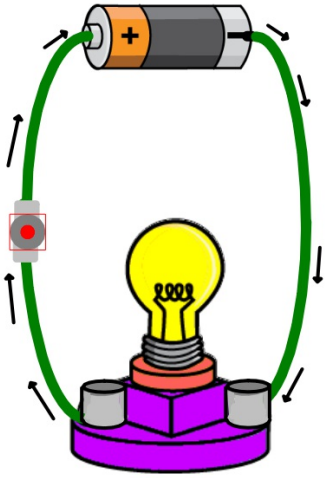
movement power riding static wonderful homework

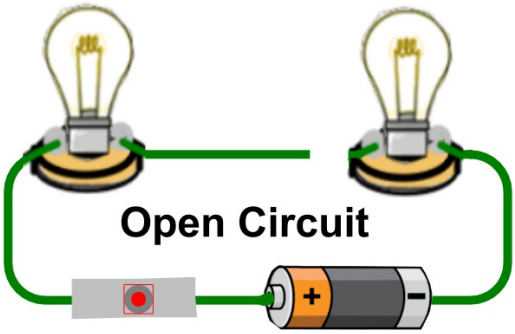
Electricity is wonderful. Every day we all use electrical power in our daily lives on everything from using an electric toothbrush, to doing our homework on a computer, to making a piece of toast, or even riding to school in our new car that uses electricity for its main source of power.

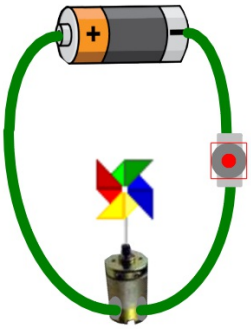
Electricity can easily be changed into other forms of energy like light, heat or movement and this makes it a very useful form of energy. Electricity is made from the actions of tiny electrons. When an electric charge builds up in one place it is called static electricity If the charge flows from one place to another it is known as electrical current. In this flipchart we will be learning a little about electricity.

Answer Check

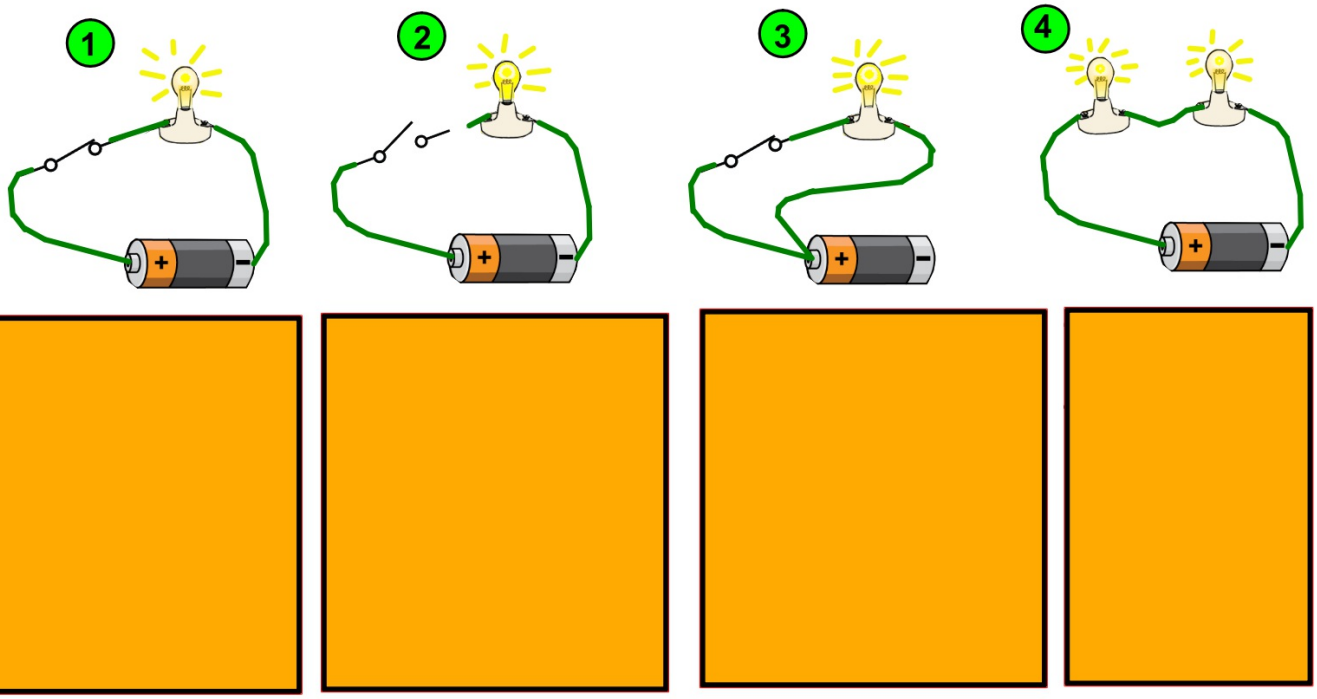
In order to work circuits must be closed or they will not function. We will be working in this flipchart with battery power in exploring circuits. We can add things to our circuit like lights, motors that turn things, switches and more.







Should the bulb be turned on or off in each circuit? Why or why not?
Click on the orange rectangles to check your answers.

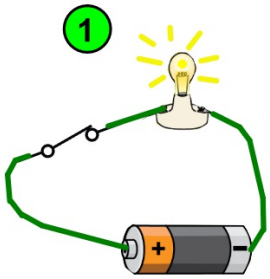


Batteries like these provide direct current through each circult. A switch can looks like this or and can turn a circuit on or off. It does not matter if the switch is on the + or - side of of a direct current. It does matter in household alternating current where it must be on the + side of the circuit.

Should the bulb be turned on or off in each circuit? Why or why not?

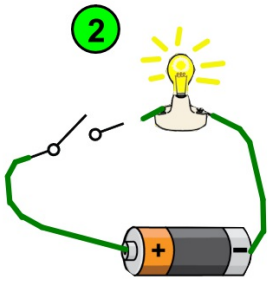
Click on the orange rectangles to check your answers.

1



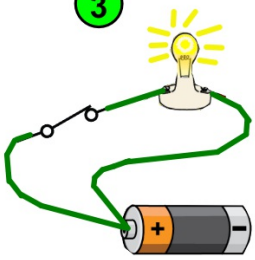
There is a complete loop forming a closed circuit and so the blub will work. Notice the circuit starts on the positive side and ends on the negative side of the battery.

2



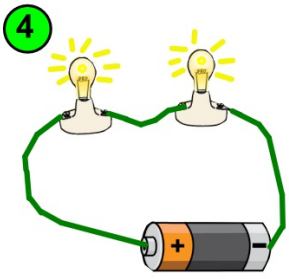
This circuit will not work because there is a hole in the wiring just after the switch. If the switch was closed and the hole in the wire repaired the bulb would work.

3



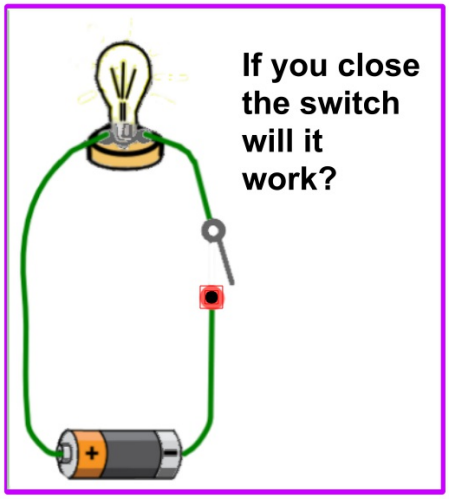
This circuit will not work becaue it is only connected to the positive end of the battery. If one wire connected the negative end of the battery to the other side of the bulb the build would work.

4

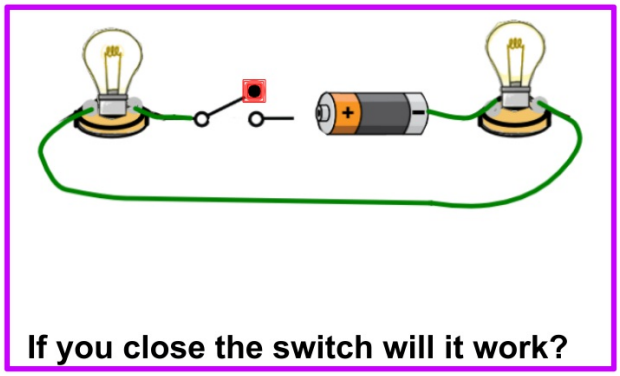


There is a complete loop forming a closed circuit and so the two blub wills work.

①



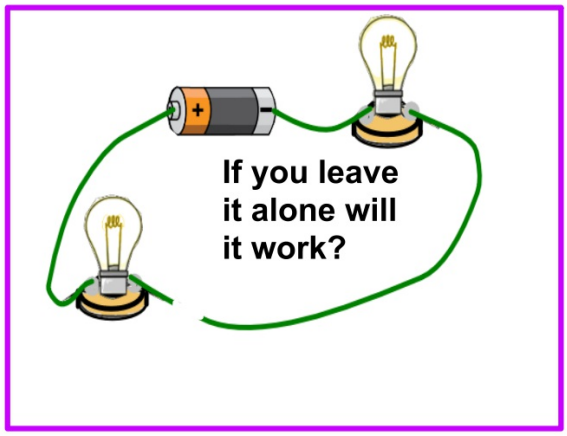
②



If you close the switch will it work?

How about these?

③



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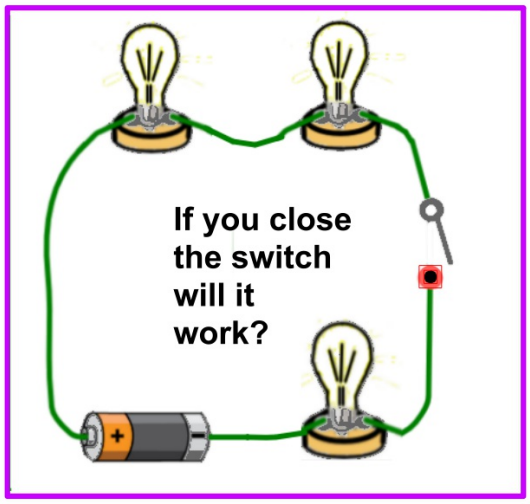

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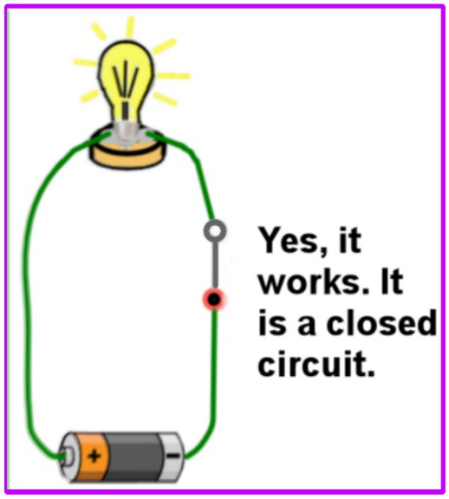

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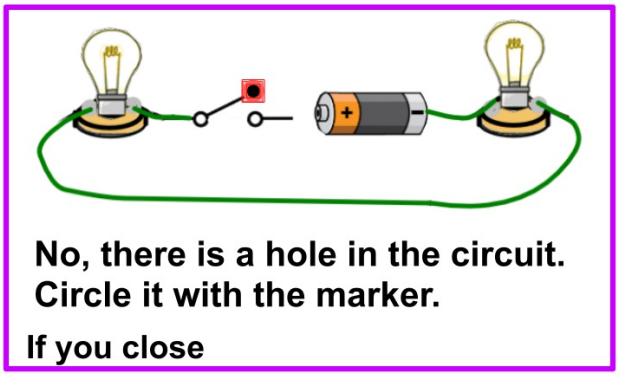
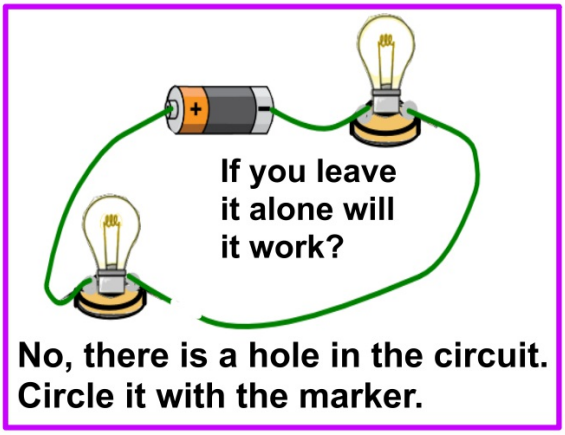


No, there is a hole in the circuit.
Circle it with the marker.

If you close

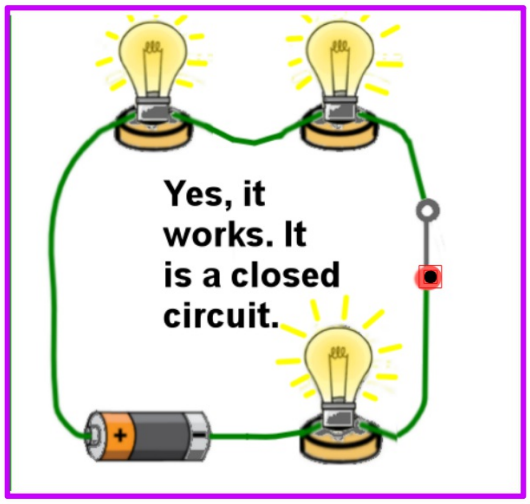
How about these?

③



No, there is a hole in the circuit.
Circle it with the marker.

④

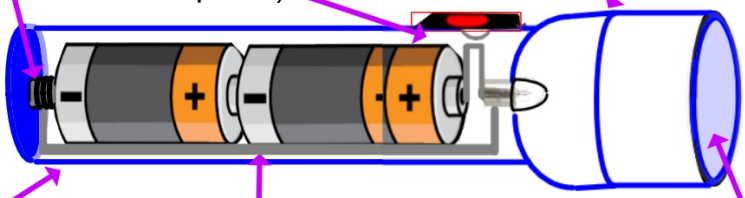


The Flashlight

The spring keeps the connection of the parts of the circuit tight.

The switch turns the flashlight on and off. When it is on the circuit is complete. When it is off the circuit is not complete. (There is a hole here when it is not complete and there is whole when it is complete.)

The light bulb provides the light when the electrical circuit is complete. It reflects off the inside of the circular area above the blub.



The case protects the insides of the flashlight and its various inside parts.

A thin metal strip (usually copper or brass) acts like the wire carrying the charge of a circuit and connects its various parts.

The round lens on the front of the flashlight protects the lamp and reflect the light into a beam (of light).

A flashlight is portable and operated by batteries. It is used to shine light in a dark area or roon Orginally torches and candles were used to light up dark areas. The modern flashlight powered batteries (inventged in 1896) was created by Joshua Lionel Cowen in 1898. He was the orginal owner the American Eveready Battery Company. His idea can from his development of an idea for a decorative lighting fixture for potted plants. His invention consisted of a metal tube, a dry cell batter and a bulb that could be lighted by the battery

Lightning Facts

An estimated 24,000 people are killed by lightning strikes around the world each year and there are about 240,000 are injured. In the US it is the #2 weather killed (#1 is floods).

* If thunder can be heard at all then there is a danger of a lightning strike. Take cover. Risk remains for up to 30 minutes after the lighting lands or you hear the sound of thunder. Light travels faster than sound so you can see it before you hear it. Remember, take cover inside!

* Most strikes are 2-3 miles long and each one can generate 100 milllion to 1 billion volts of electricity. During each second on Earth there are 50-100 lightning strikes at some location in the world.

* When we see a flash of lightning it may be actually 3 or 4 different strikes in the same place or one right after the other. That is why they seem to flicker.

* A lightning flash is smaller than an inch wide and has a temperature of 15,000-60,000 degrees F. The lightning strikes move at a speed of 62,000 miles per second (1/3 the speed of light). A single flash carries a current up to 300,000 ampres. In your house the wiring carries 20-30 ampres.

* The actual size of a lightning bolt is between the size of a quarter and a half dollar. The light is so bright it looks much larger. Its temperature is hotter than the surface of the sun (about 1,000º F).

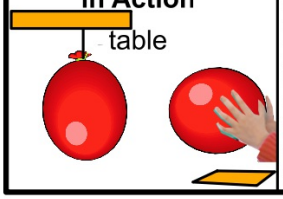
* Florida and the Rocky Mountain states have the most lightning strikes in the US. Outside of the US the countries near the equator get the most. The odds of being struck with lightning in the US in a given year is 1/500,000.

Thunder & Lightning

When ice crystals and water droplets collide inside a cloud it causes a static electricity charge that causes a flash of lightning (spark of electricity). This heats the air. One spark of electricity can measure up to three thousand volts and a bolt of lightning can measure up to three million volts lasting one second. The super-hot air expands (because hot air takes up more space than cold air), and pushes hard against the colder air next to it. That sudden push causes the vibrations in the air that you hear as thunder.

Static electricity is a type of electricity that stays in one place. It is produced when some materials are rubbed together. It is the result of an imbalance of positive and negative charges on an object. These charges can build up on the surface of the object until they find a way to be released or discharged.

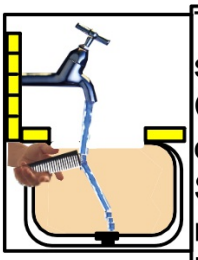
See Static Electricity in Action



Before starting the ballons and rag have an equal number of positive and negative charges. When you rub the rag vigorously over the balloon electrons are transferred from the rag and the rag becomes negatively charged because it lost electrons. When you move the charged balloon close to the non charged balloon the electrons on the hanging balloon move away because like charges repel. This leaves the surface facing the charged balloon more positive. Since opposite charges attract and the positve charge on the hanging balloon is attracted to the hand held balloon. This attraction moves the hanging balloon toward the hanging balloon.

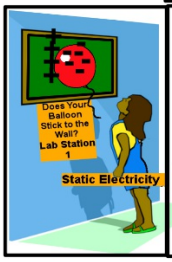
Static Electricity Experiments

Drag your shoes while walking across the carpet. Walk up to a door with a metal handle and touch the door knob. What happens?

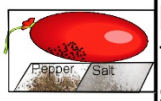


Turn on the facet so a small stream of water comes out. Charge a comb by rubbing it on a sweater several times. Slowly bring the comb near the water. What happens?

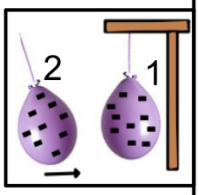
Rub the comb on a sweater about 20 times. Then move it down to some paper clippings what happens?



Rub a sweater on a blown-up balloon 20-30 times. Then place the balloon against the wall and let go. What happens?



Pour salt on one paper and pepper on the other. Charge the balloon by rubbing it on a sweater about 20 times. Hold the balloon over the salt and then the pepper. What happens?



Tape a blown up balloon by a string on the hedge of a table hanging down. Rub the second balloon on a sweater and hold it hanging down by the string. Move balloon 2 close to balloon 1. What happens as it gets close?

Static Electricity Experiments

Blow up a balloon and tie the end. Rub it on your head about 20 times. Hold the balloon close to your head. What happens?

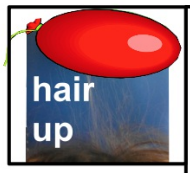
What happens when you stand next to a  ?

Rub two tied balloons together about 20 times. Hold them by the string trying to bring them closer together by the string. What happens?

First, put the ping pong ball on the floor or table.
Next, rub the balloon with the wool sweater vigorously and put it in place. Pull on the balloon slowly towards you. What happens?

Put an empty aluminium can on its side on a table. Rub the balloon on your hair vigorously. Put the balloon close to the can and watch.... What happens?

Static Electricity Experiments



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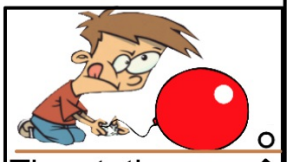


The static electricity pulls the ball toward the balloon.

ping pong ball

First, put the ping pong ball on the floor or table.
Next, rub the balloon with the wool sweater vigorously and put it in place. Pull on the balloon slowly towards you. What happens?

The coke can moves toward the can.

Put an empty aluminium can on its side on a table. Rub the balloon on your hair vigorously. Put the balloon close to the can and watch.... What happens?

Static Electricity Experiments to Try

Rub a plastic pen, or comb, on a wool blanket and drop pieces of paper on the blanket. When you pick up the blanket what happens?

Rub an object (i.e. some sort of plastic scoop) against a piece of cloth like cotton and placing it beside running water

Rub a balloon on your hair, and bring it close to a wall and see what happens.

Rub a balloon on your hair. Does your hair stick onto the balloon?

Shuffle your feet across a carpeted floor and then touch a metal object and see what happens.

Rub a plastic pen or comb on a sweater. Drop tiny pieces of paper on top of the pen or comb. What happens when you pick it up?

Give each student two pieces of scotch tape and have them stick them to their desks or another hard surface. Quickly pull off the take and try to get them to touch. Do they?

Rub two balloons together. Have the students see what happens when one of them puts their hand in between the two balloons.

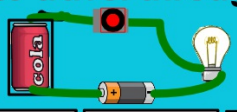
Have the students rub one piece of their tape to change the charge and then see if the pieces will come together.

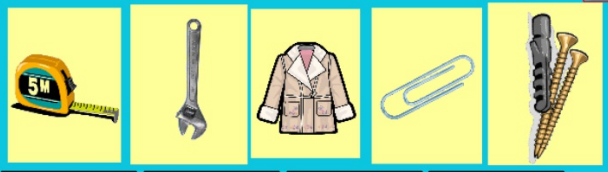
Run a comb through your hair to charge the comb with static electricity. Then see if the comb can then be used to attract neutral pieces of tissue.

Conductors

In a closed circuit a conductor is something that allows electricity to travel through it.

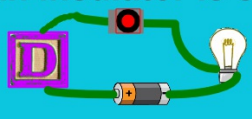
The coke can completes the circuit





Insulators

In a closed circuit an insulator is something that stops electricity from passing through it.



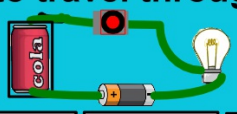
The D block does not let the electricity pass through to complete the circuit

Undo

Conductors

In a closed circuit a conductor is something that allows electricity to travel through it.

The coke can completes the circuit



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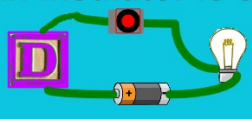
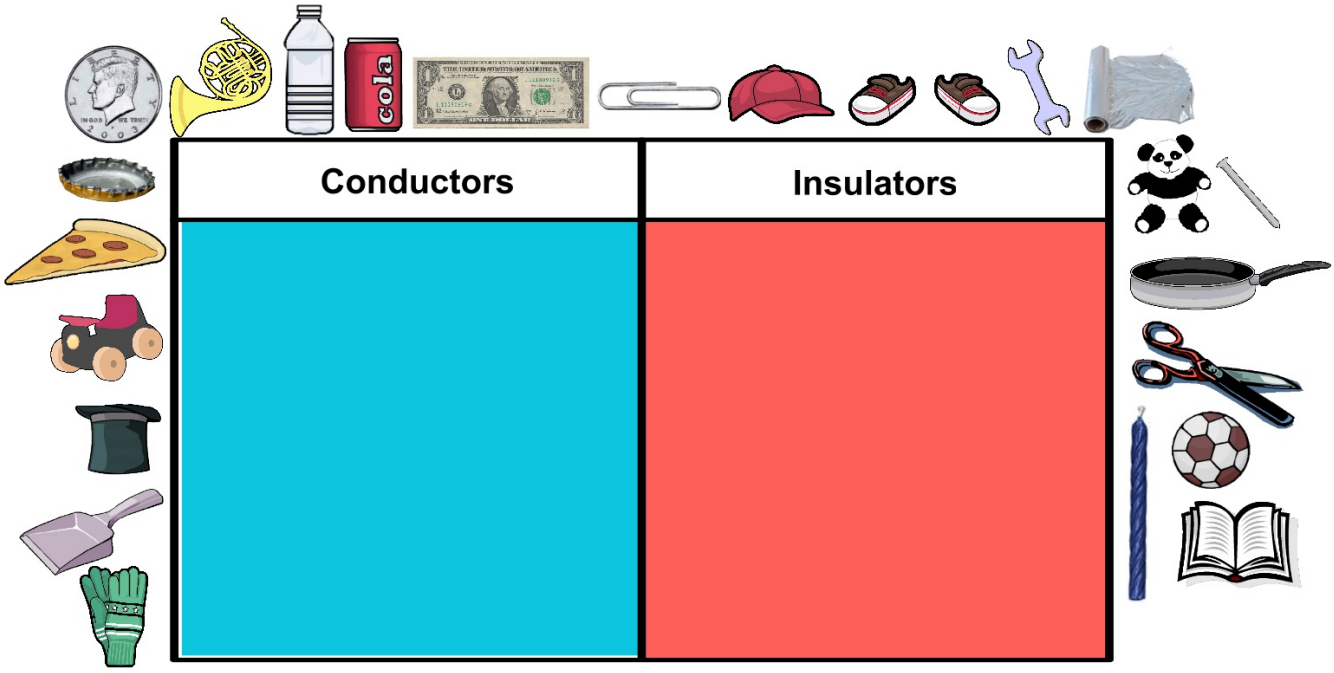


The D block does not let the electricity pass through to complete the circuit

Undo

Electricity does not flow through everything. When a material allows electricity to pass through it easily it is called a **conductor**. When a material does not flow through it easily it is called an **insulator**.

Sort the materials below into those which do let electricity pass through (conductors) and those which don't (insulators).



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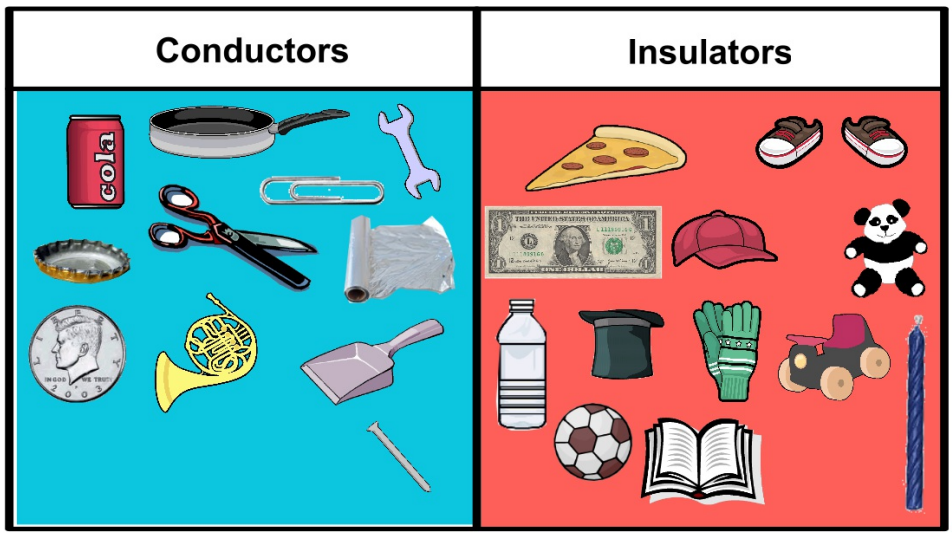
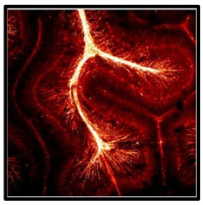




A flash of lightning is a giant spark of electricity (charge). It comes from a build-up inside a cloud of water droplets and ice crystals.

Electricity produced by capturing the energy of sunlight using photovoltaic panels (solar panels) can be converted into other forms of energy like heat or electricity.

Energy produced by utilizing the energy of falling water from dams to power generators to produce electricity.

Geothermal plants like this can convert fossil fuels (coal, gas) to electricity. A harmless water mist is emitted as a waste product into the air instead of smoke.

This is an image of the superhighways in the brain. The huma body has 100 billion nerve cells in the brain and each person's brain works by sending messages to parts of the body in bursts of electricity (impluses).

Benjamin Franklin

Benjamin Franklin experimented extensively with electricity, determining that there are two types of electricity, positive and negative. In 1752, his experiments with a kite in a thunderstorm led to the development of the lightning rod (never do this -- many people have died trying it!). He developed a theory that lightning is really electricity. In 1752 he set up and preformed an experiment with his 21 year old son to prove his theory.

Benjamin made a kit to be used in his experiment. He made the kite used silk as the material because he knew that it would tear apart during the storm. He also knew that silk was not a good conductor of electricity and would give him some protection from being shocked if his theory was true. He attached a metal wire at the tip of the kite and a metal key to the string to attract the lightning. Finally, he attached a silk ribbon to hold on to that would not transmit as much electricity as a true conductor.

Benjamin and his son, William stayed under cover during the experiment providing additional protection from getting the silk ribbon wet during the experiment. Otherwise he might have been shocked and killed by the electricity. During the experiment while it was raining he noticed parts of the string standing up (when there is static electicity in the air). He touched the kite and got shocked (but it did not harm him), thus proving lightning was electricity.

The kite experiment led to the invention of the lightning rod in 1753. Using the knowledge he had learned recently he looked for ways to prevent firest from igniting when struck a building. His invention consisted of a long metal rod (about 10' long) to attach to houses, barns, and other buildings. During a storm the lighning would hit the rod instead of the building. This saved many building from burning down from a hit of lightning.

He then attached the lightning rod to his home and then to a bell. This served as an alert. However, he was gone to England and France for a long period of time and his wife, Deborah, had to listen to the bell each time it rang.

Electricity

Electricity leaves power plants through metal cables on tall pylons. The power is sent out at a much higher voltage than is used in most homes

Solar energy is carried by poles into some cities and towns. Do you see the solar panels in the picture?

Electric wall outlets provide power to everything we need electricity for in our homes. Each home has many outlets. It is important to not overload an outlet because it can be a cause of fire.

Electricity enters a power substation when it gets to a city. The votage drops down. It is then carried underground or on power poles to our neighborhoods. The current is reduced to the level of power used by our homes.

VOCABULARY GAME

When electric charges flow through an object the object is called a _ o _ _ _ c _ _ r

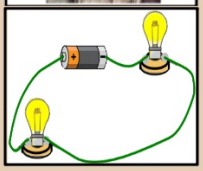
A device that opens or closes a circuit is called a s _ _ t _ h.

A path that electricity follows is called a c _ _ c _ i _.

A famous statesman and scientist who studied electricity was named B _ nj _ m _ n F _ _ n _ _i n

When electric charges do not flow through an object the object is called an I _ s _ _ a _ _ r

The movement of electricity through a wire is called its c _ _ r _ _ t.



Drag the bulb on top of the correct photo

When electric charges flow through an object the object is called a **conductor.**

A device that opens or closes a circuit is called a **switch.**

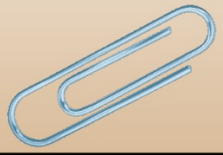
A path that electricity follows is called a **circuit.**

A famous statesman and scientist who studied electricity was named **Benjamin Franklin.**

When electric charges do not flow through an object the object is called an **insulator.**

The movement of electricity through a wire is called its **current.**

1 Which of these is not a conductor?

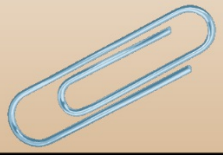
A paper clip 

B quarter 

C football 

D nail 

1 Which of these is not a conductor?

A paper clip 

B quarter 

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2

A scientist and statesman who studied electricity was named:

A — Albert Einstein

B — Thomas Jefferson

C — Patrick Henry

D — Benjamin Franklin

2

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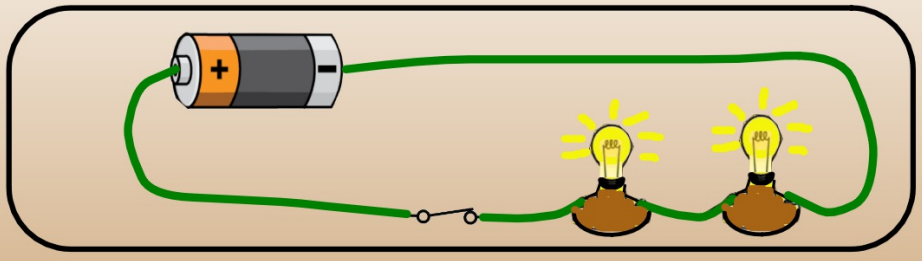
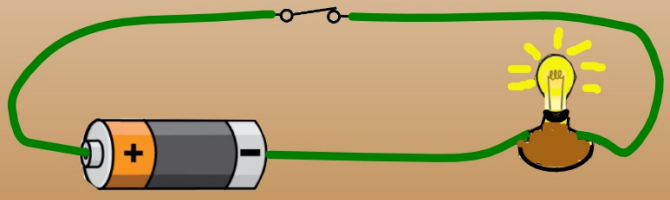
3

Which circuit will not turn on the light bulb/bulbs?

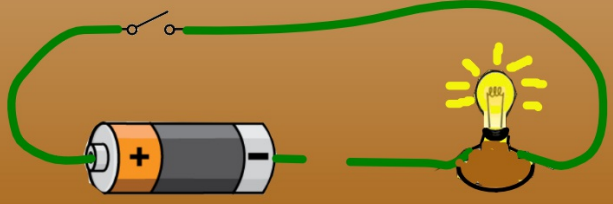
A



B



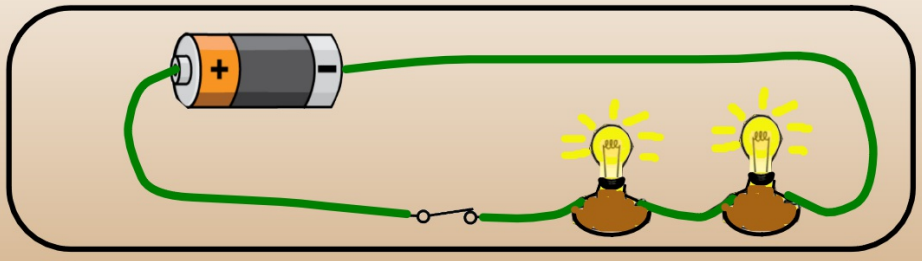
C



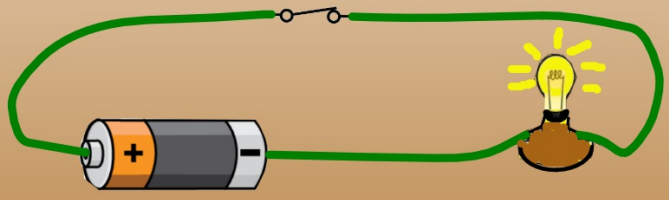
3

Which circuit will not turn on the light bulb/bulbs?

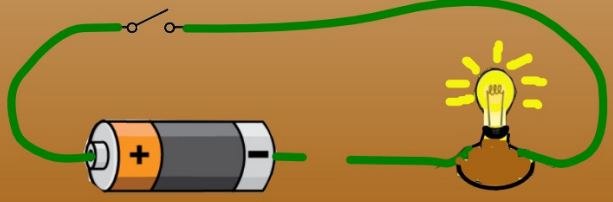
A



B

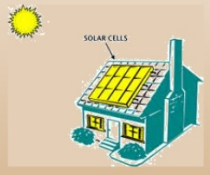


C



5 **When electricity gathers in one place it is called:**

A **Wind power**



B **Static electricity**

C **Solar power**

D **Alternating current**

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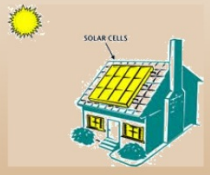

B **Static electricity**

C **Solar power**

D **Alternating current**

6 Static electricity can happen when you rub things together. If you rub a balloon about 20 times on your shirt you will discover:

A Your balloon sticks to the wall.

B The balloon is repelled.

C The balloon will immediately pop.

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8 Which is a parallel circuit?

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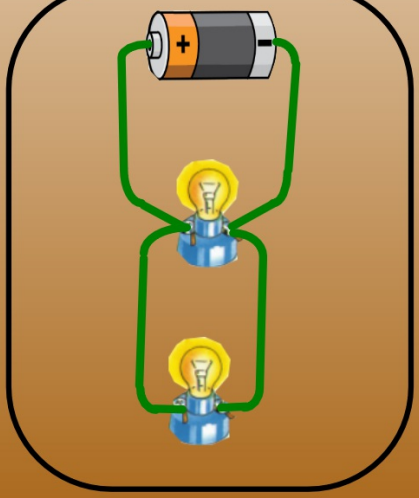
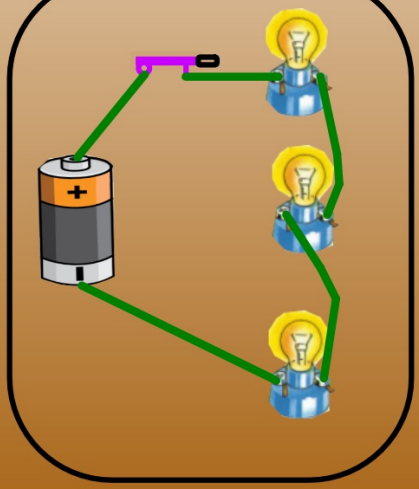
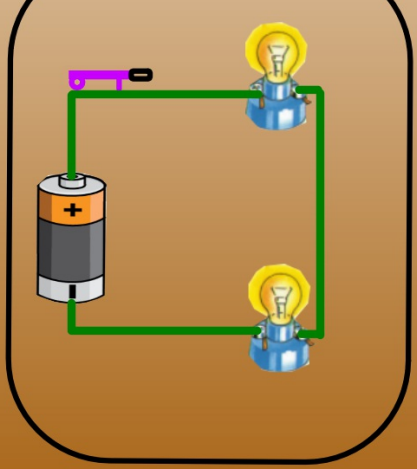


B



C



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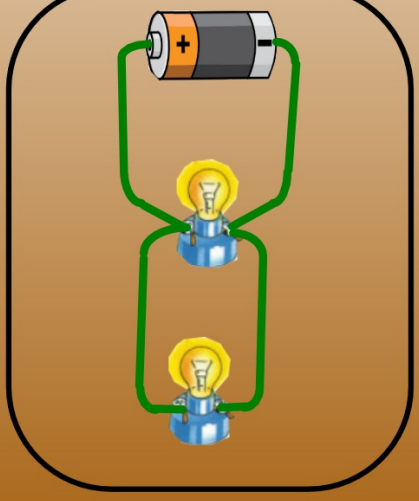
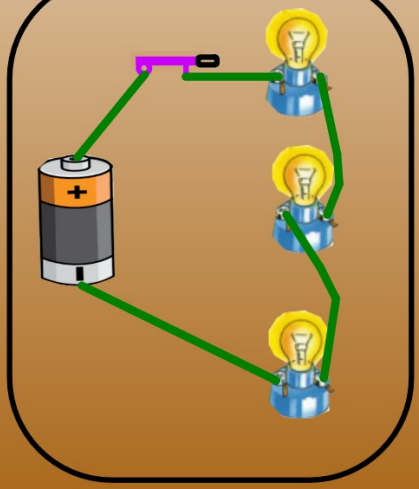
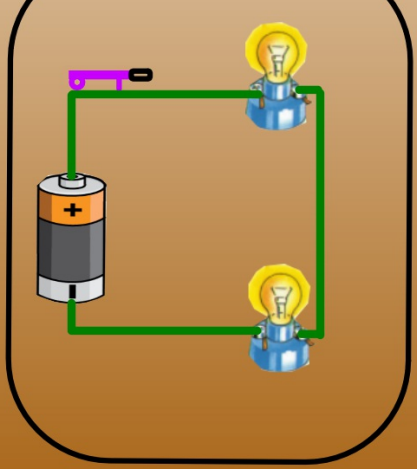


B



C



9 Which of these is not an insulator?

A Plastic ball 

B Teddy Bear 

C Metal Bottle top 

D Cloth 

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