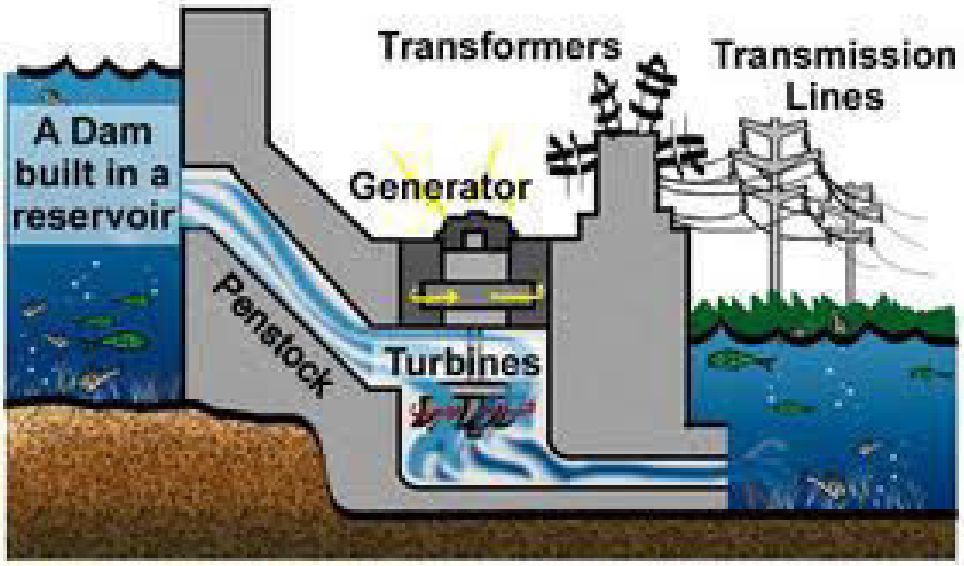
ELECTRICITY UNIT

NAME_____

GRADE _____



Summer Vacation Assignment

Atom

An atom is the smallest particle characterizing an element. All matter in the universe is made up of a combination of different atoms. Atoms are made up of protons, neutrons and electrons.

Electrical charge

An electrical charge is produced when an atom loses or gains an electron. When there are more electrons than protons, the charge is negative. When there are fewer electrons than protons, the charge is positive. The unit of electrical charge is the coulomb (symbol: C).

Electrical current

An electrical current is the movement of negative electrical charges (electrons) through a conductor (electrical wire, metal foil, etc.). In an electrical circuit, the current flows from the point where the electrical potential is highest to the point where it is lowest.

Electrical circuit

An electrical circuit is the complete loop through which an electrical current flows. It is made up of a series of electrical components and conductors (e.g., batteries, electrical wires, light bulbs, etc.). The current only flows in an electrical circuit when the path is completely closed, forming a loop.

Types of electrical circuit

There are two types of electrical circuit, parallel circuits and series circuits. Parallel circuits provide several different paths for the electrical current. Series circuits force the current through a single path; in other words, the electricity flows through all the electrical components of a series circuit one after the other.

Conductors of electricity

Conductors are bodies or materials that allow an electrical current to pass through them. Copper, aluminum, brass, zinc, iron and pewter are examples of metal that conduct electricity well. Salt water is also a good conductor.

Resistance

Resistance is the part of an electrical circuit that resists the flow of electricity (for example, by transforming it into heat or light, as in a light bulb or a buzzer). In an electrical circuit, the presence of a resistor limits the current and prevents damage related to short circuits. The unit used to measure resistance is the ohm (symbol: Ω).

Ampere

The ampere (symbol: A) is the unit used to measure current intensity.

Voltage
Voltage (symbol: V) is the unit used to measure electrical tension, also called “difference of electrical potential.”

Short circuit
A short circuit occurs when two live (i.e., carrying current) conductors accidentally come into contact, either directly or through a conducting object (e.g., when the blade of an electric lawn mower cuts the electrical wire). When this happens, the current can flow with very little restriction because the resistance of the loop formed by the two conductors is very weak. The high amount of current heats up the wires and can cause a fire. Fuses and circuit breakers detect unusually high currents and break the circuit, which helps to prevent fires.

Battery
Batteries are reserves of chemical energy that can be transformed into electrical energy. Small electric cells (commonly called batteries, as in AA batteries) are examples of simple batteries for everyday use.

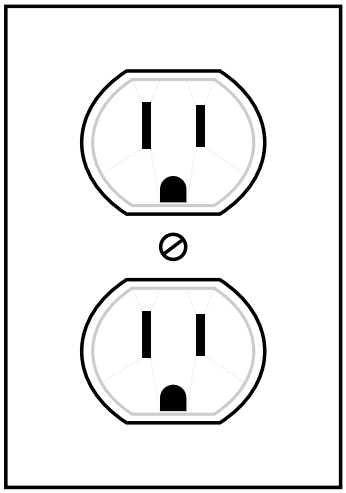
Insulator
Insulators, such as wood and plastic, are materials that do not easily transmit heat, cold or electricity. Electrical wires are covered with an insulator to prevent electrical shocks and short circuits that could cause fires.

People

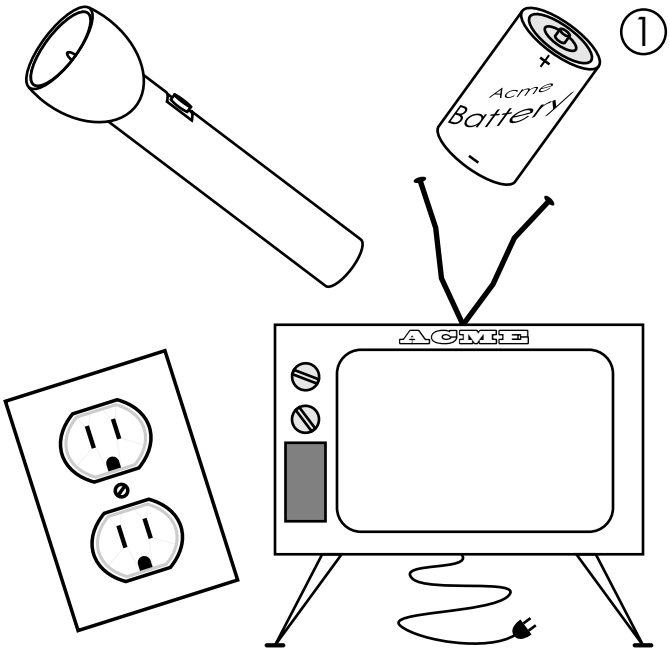
Thomas Alva Edison (1847-1931), a U.S. inventor who designed the first electric light bulb. He also invented many other devices, including the phonograph, ancestor of the gramophone.

Alessandro Volta (1745-1827), an Italian physicist, invented the first electric battery.

CURRENT ELECTRICITY

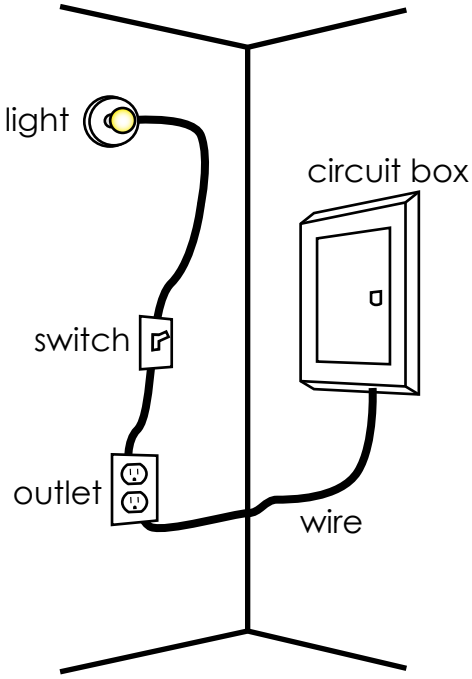


①



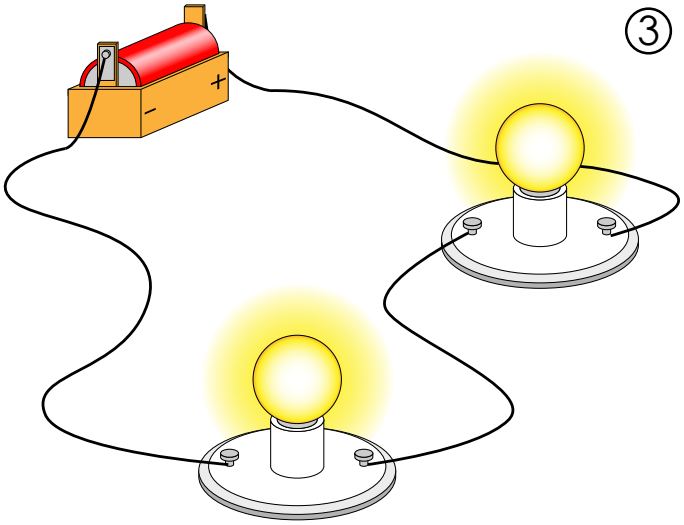
Electricity from the wall outlets in your house powers your television, computer, lights, and microwave. Cell phones, flashlights, and even a car's headlights are powered by the electricity in batteries.

②



The type of electricity that is used to power things we use is called *current electricity*. Current electricity is electricity that flows through wires. The path that electricity follows is called a *circuit*.

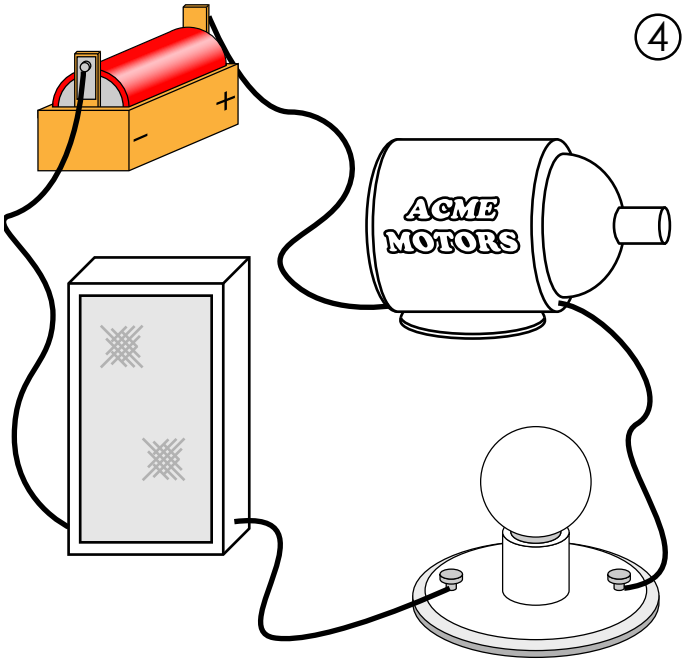
③



The picture above shows a circuit. Electricity flows from the negative side of a battery, through the wires, and lights the bulb. The electricity continues to travel around to the positive side of the battery.

Draw arrows on the picture to show the path of the electricity.

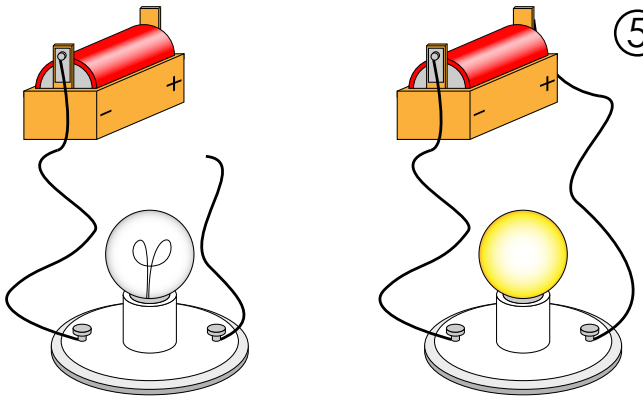
④



Something that uses some of the electricity in a circuit is called a *resistor*. Resistors could also be things like light bulbs, motors or speakers.

Color the resistors in the circuit above.

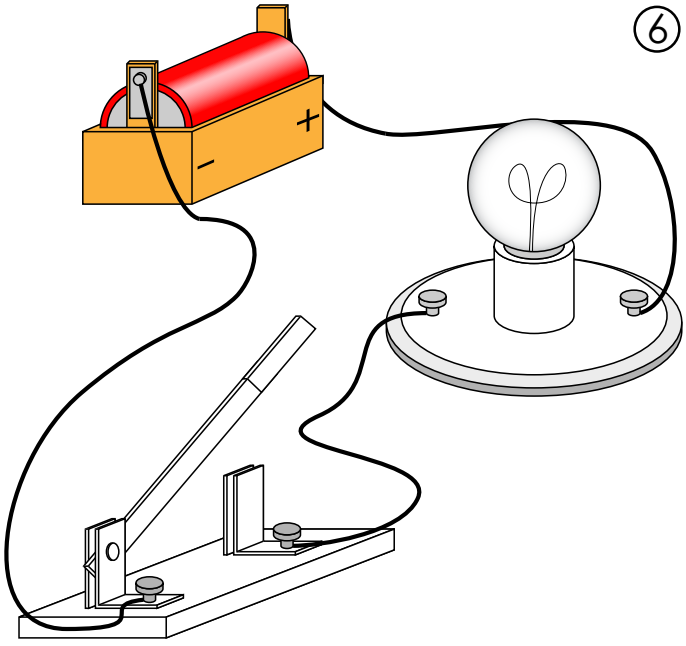
⑤



A circuit can be *open* or *closed*. When a circuit is closed, it is complete and there is no break in the path that the charges must follow. When a circuit is open, it is incomplete and charges can't flow through.

Label the two circuits above with the words "open circuit" and "closed circuit."

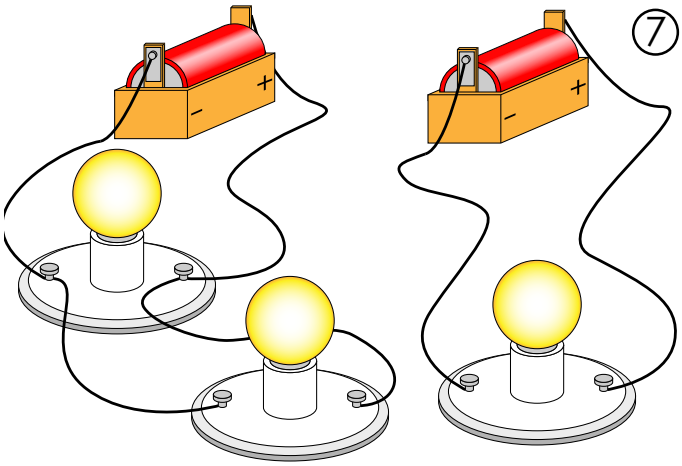
⑥



A *switch* is sometimes added to a circuit. The switch opens and closes a circuit to turn resistors on and off.

Color the switch in the circuit above.

⑦



In a *series circuit*, electricity can follow only one path. In a *parallel circuit*, electricity has more than one path to follow.

Label the two circuits above with the words "series circuit" or "parallel circuit."

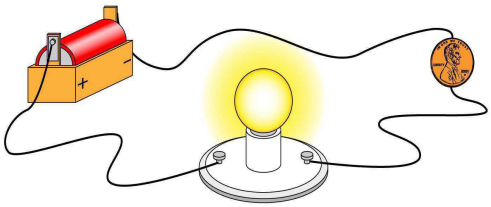
Name: _____

Electricity

Choose the best answer for each question. Write the letter on the line.

_____ **1.** What supplies energy in an electric circuit?

a. a conductor **b.** light bulb
c. a wire **d.** a battery



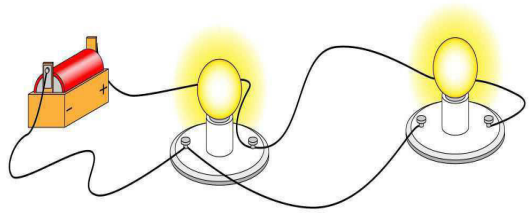
Circuit A

_____ **2.** Which material is a conductor?

a. plastic **b.** silver
c. glass **d.** wood

_____ **3.** Which type of circuit is Circuit A?

a. series **b.** parallel
c. perpendicular **d.** current



Circuit B

_____ **4.** Which item is a resistor in Circuit B?

a. light bulb **b.** wire
c. battery **d.** screws

_____ **5.** Why did the person who made Circuit A probably connect the wires to a penny?

a. They needed to use a penny to make the bulb light.
b. They were testing to see if the penny conducts electricity.
c. They used the penny to supply extra power.
d. The penny will prevent sparks.

_____ **6.** Which of these could be used as a resistor in a circuit?

a. a pencil
b. a gas engine
c. a rubber eraser
d. an electric motor

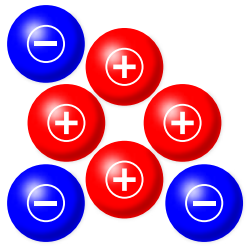
Electrical Charges

If an object has more positive charges (⊕) than negative charges (⊖), its electrical charge is positive (⊕).

If an object has more negative charges (⊖) than positive charges (⊕), its electrical charge is negative (⊖).

If an object has the same number of positive (⊕) and negative (⊖) charges, it has no electrical charge or is neutral.

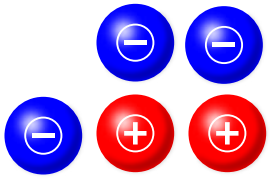
Example:



Electrical charge: positive charge

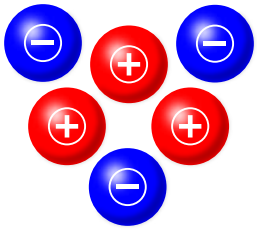
Count the positive and negative charges in each picture. Write *positive charge*, *negative charge*, or *no charge* on each line.

1.



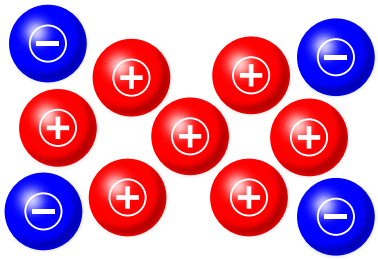
electrical charge: _____

2.



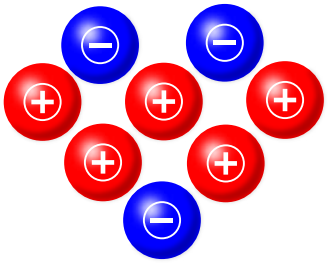
electrical charge: _____

3.



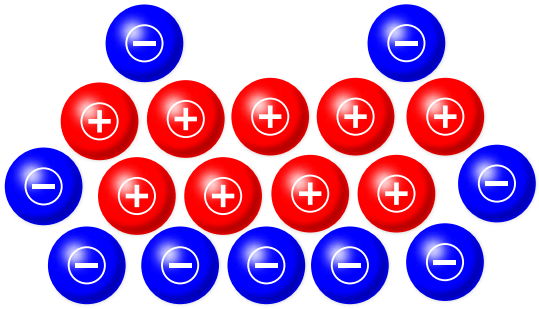
electrical charge: _____

4.



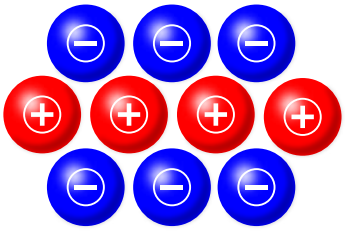
electrical charge: _____

5.



electrical charge: _____

6.

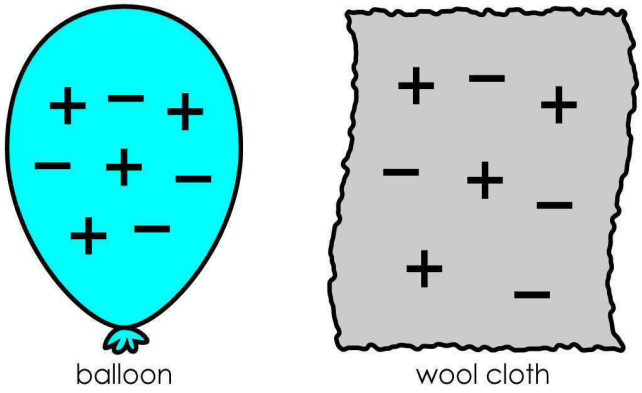


electrical charge: _____

Static Electricity

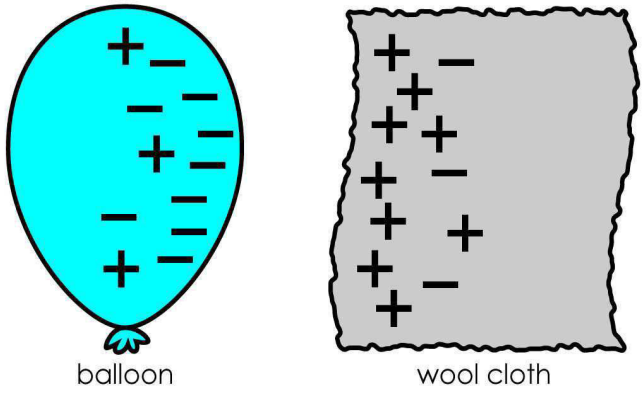
Rubbing a balloon with wool cloth will create static electricity charges.

This balloon has **not** been rubbed with the wool cloth.



Picture 1

This balloon **has** been rubbed with the wool cloth.



Picture 2

In Picture 1, does the balloon have a positive charge, negative charge, or no charge? _____

In Picture 1, does the cloth have a positive charge, negative charge, or no charge? _____

In Picture 2, does the balloon have a positive charge, negative charge, or no charge? _____

In Picture 2, does the cloth have a positive charge, negative charge, or no charge? _____

If you place small pieces of tissue paper near the balloon in Picture 2, they would probably stick to the balloon. Explain why.

_____

_____

_____

_____

Circuits

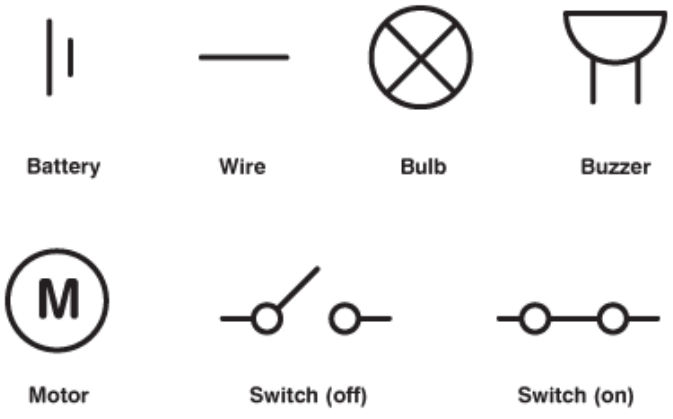
A circuit always needs a power source, such as a **battery**, with wires connected to both the **positive** (**+**) and **negative** (**-**) ends. A battery is also known as a cell.
A circuit can also contain other electrical **components**, such as bulbs, buzzers or motors, which allow electricity to pass through.
Electricity will only travel around a circuit that is **complete**. That means it has no gaps.

Incomplete circuit

Complete circuit

Symbols

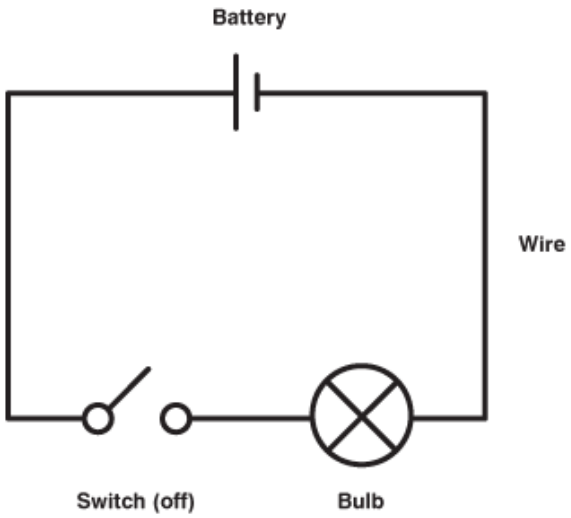
We use these symbols to draw diagrams of circuits:



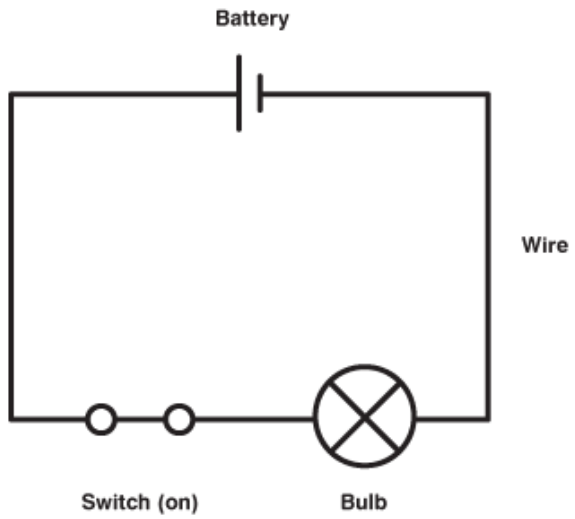
Switches

When a switch is open (off), there is a gap in the circuit.
Electricity **can not** travel around the circuit.
When a switch is closed (on), it makes the circuit complete. Electricity **can** travel around the circuit.

Switch open (off). Bulb doesn't light.

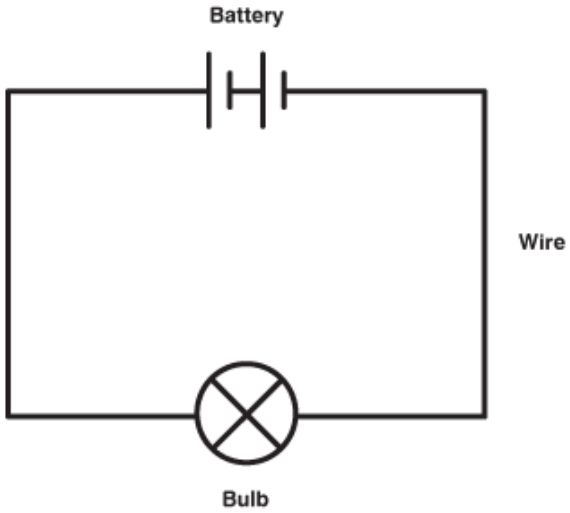


Switch closed (on). Bulb lights.



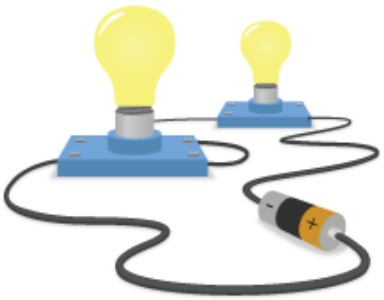
Changing circuits

Adding **more batteries** to a simple circuit will increase the electrical energy, which will make a bulb **brighter**.



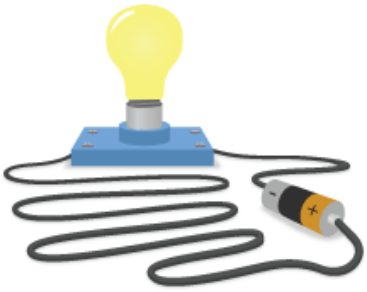
More bulbs

Adding **more bulbs** to a simple circuit will make the bulbs **dimmer**.



Longer wires

Lengthening the wires in a simple circuit will make the bulb **dimmer**.



Electrical circuits - Quiz

1. In a simple series circuit, why does the bulb light when you close the switch?
a-Because the switch produces electricity
b-Because closing the switch completes the circuit
c-Because closing the switch breaks the circuit

2. In a simple series circuit, why does the bulb go out when you open the switch?
a-Because the battery goes flat b-Because opening the switch breaks the circuit
c-Because too much electricity flows through the bulb

3. Imagine a simple series circuit with one 1.5V battery and one bulb. When the 1.5V battery is replaced with a 3V battery ...
A- the bulb gets brighter b- the bulb gets dimmer
c-the bulb stays at the same level of brightness

4. Imagine a circuit with a 1.5V battery and one bulb. Imagine a similar circuit with a 3V battery and two bulbs. Which has the brightest bulbs?
a-The circuit with a 1.5V battery and one bulb
b-The circuit with a 3V battery and two bulbs
c-The bulbs in both circuits are of similar brightness levels

5. Why might a bulb flash and go out when a 1.5V battery and a 3V battery are both connected across it in a simple series circuit?
a-There is not enough electricity flowing around the circuit
b-Too much electricity flows through the bulb's filament and the bulb blows
c-The batteries are flat

6. What is the effect of changing the wire in a circuit from a straight thick wire to a straight thin wire?
a-The bulbs become dimmer b-The bulbs become brighter
c-The bulbs stay at the same level of brightness

7. What is the effect of changing the wire in a circuit from a straight thick wire to a longer (coiled) thick wire?
a-The bulbs become dimmer b-The bulbs become brighter
c-The bulbs stay at the same level of brightness

8. In a circuit diagram, what does a circle with a cross inside it represent?
a-A light bulb b- A motor c- A battery

9. What do the long straight lines represent in a circuit diagram?
a-Motors b-Light bulbs c- Wires

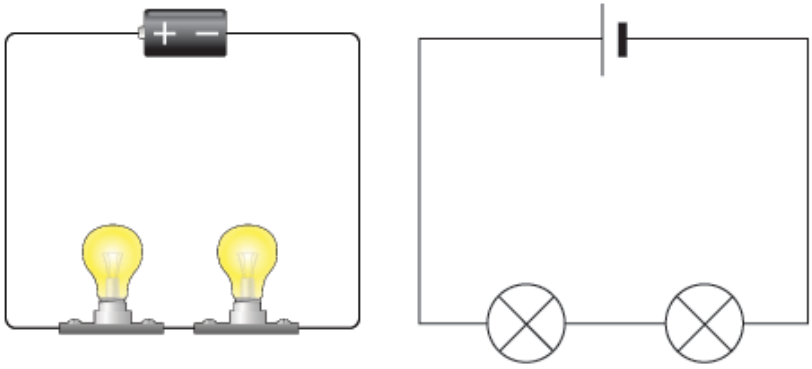
10. How is a battery represented in a circuit diagram?
a-A circle with a cross inside it b- A circle with an M inside it
c-A long line and a short line

Series & parallel circuits

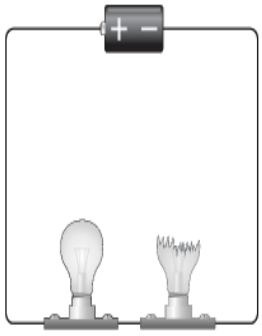
There are two types of circuit we can make,
called **series** and **parallel**.
The components in a circuit are joined by wires.
if there are no branches then it's a series circuit
if there are branches it's a parallel circuit

Series circuits

In a television series, you get several episodes, one after the other. A series circuit is similar. You get several components one after the other. If you follow the circuit diagram from one side of the cell to the other, you should pass through all the different components, one after the other, without any branches.



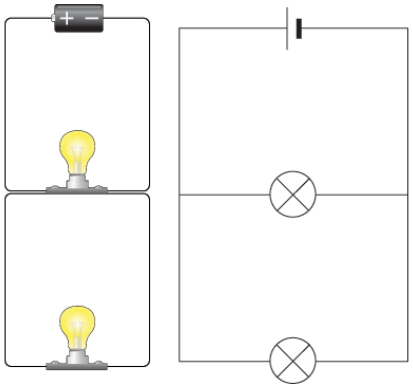
If you put more lamps into a series circuit, the lamps will be dimmer than before.
In a series circuit, if a lamp breaks or a component is disconnected, the circuit is broken and all the components stop working.



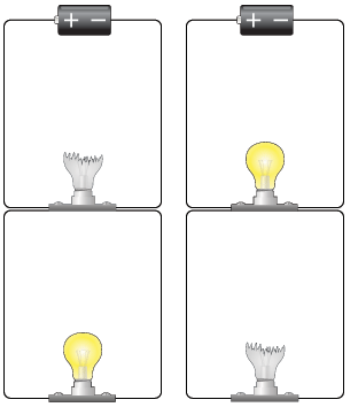
Series circuits are useful if you want a warning that one of the components in the circuit has failed. They also use less wiring than parallel circuits.

Parallel circuits

In parallel circuits different components are connected on different branches of the wire. If you follow the circuit diagram from one side of the cell to the other, you can only pass through all the different components if you follow all the **branches**.



In a parallel circuit, if a lamp breaks or a component is disconnected from one parallel wire, the components on different branches **keep working**. And, unlike a series circuit, the lamps stay bright if you add more lamps in parallel.

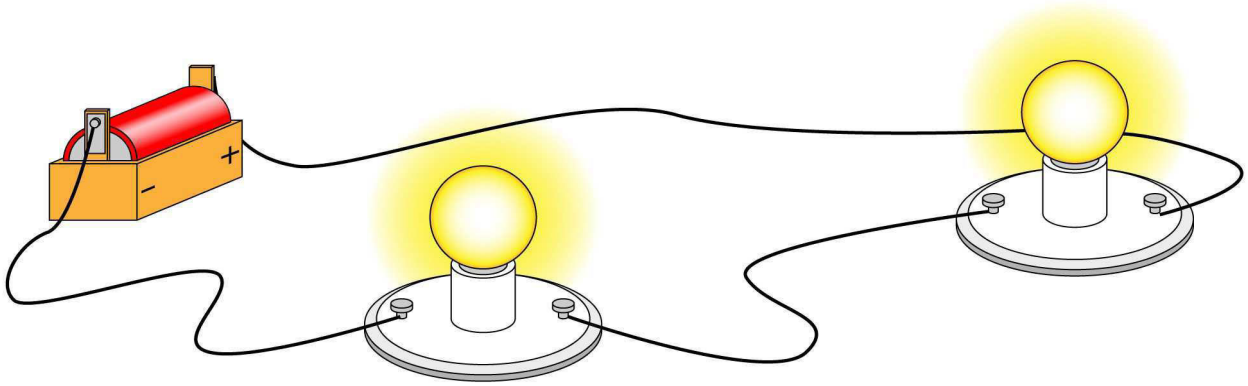


Parallel circuits are useful if you want everything to work, even if one component has failed. This is why our homes are wired up with parallel circuits.

Series and Parallel Circuits

In a **series circuit** electric current has only one path to follow. All parts are connected one after another. Electric current flows from the negative side of the battery around in a loop to the positive side.

Draw arrows to show the path of electric current in this series circuit.



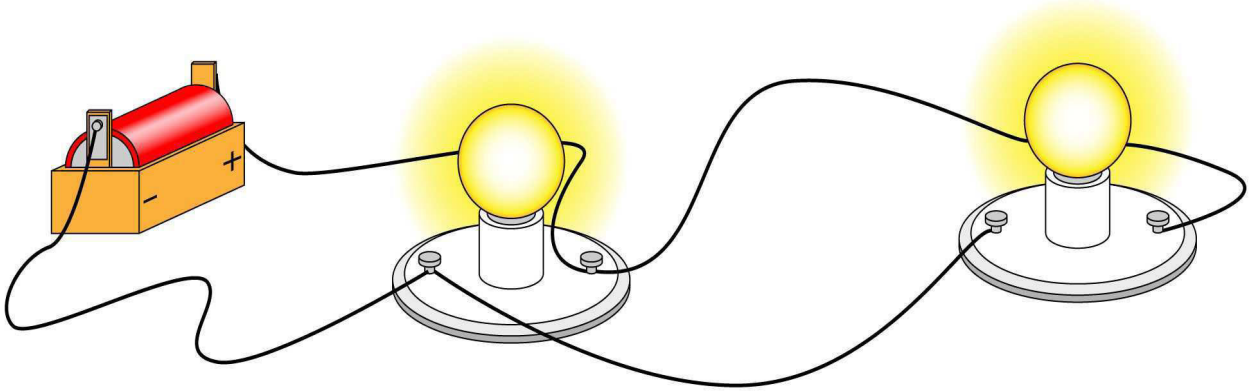
If a light bulb is missing or broken in a series circuit, will the other bulb light? Explain.

_____

_____

In a **parallel circuit**, electric current has more than one path to follow. The electric current can follow different paths as it flows from the negative side of the battery to the positive side.

Draw arrows to show the different paths electric current can travel in this parallel circuit.



If a light bulb is missing or broken in a parallel circuit, will the other bulb light? Explain.

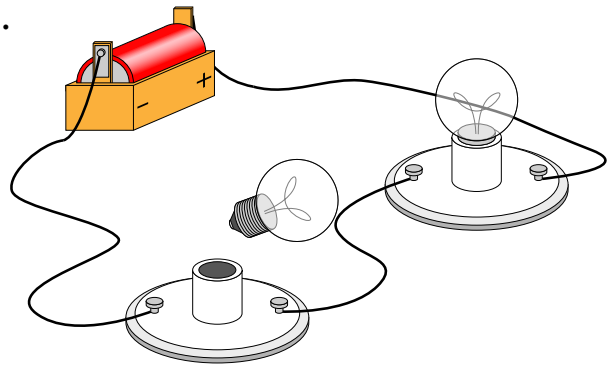
_____

_____

Electrical Circuits

Tell whether the light bulb or bulbs **will light** or **will not light** based on the circuit.

1.



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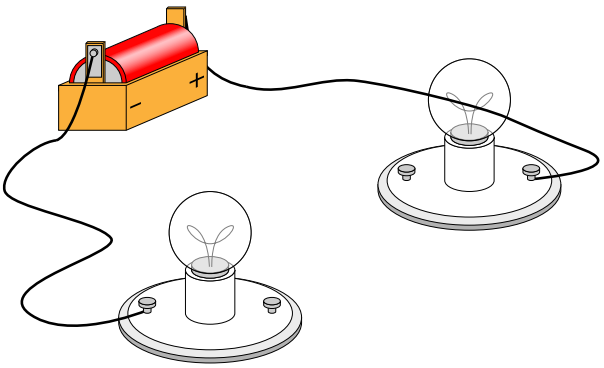

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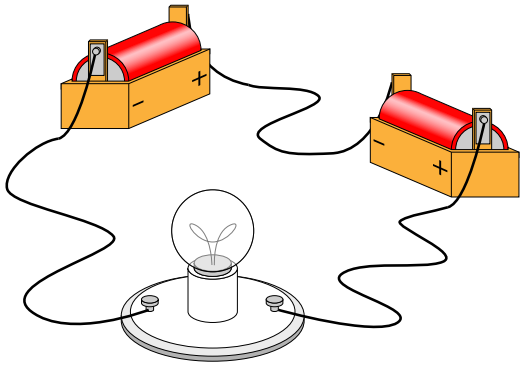
3.



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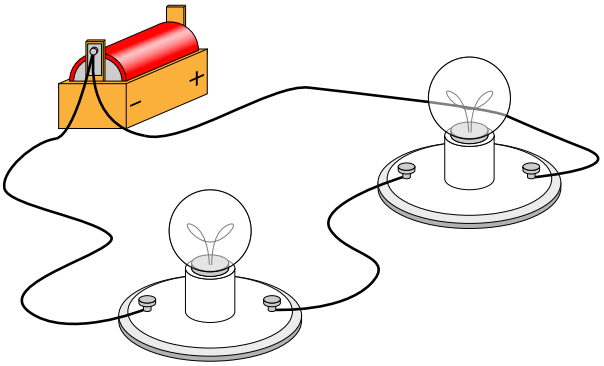

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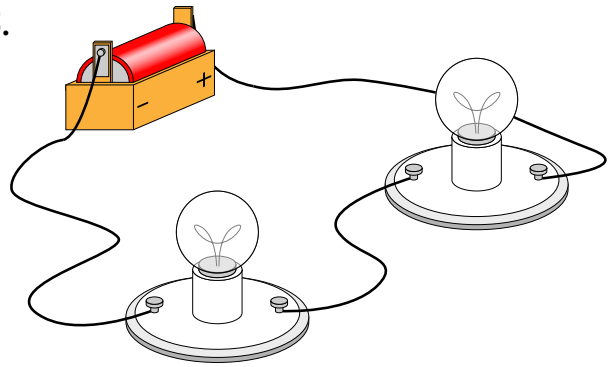
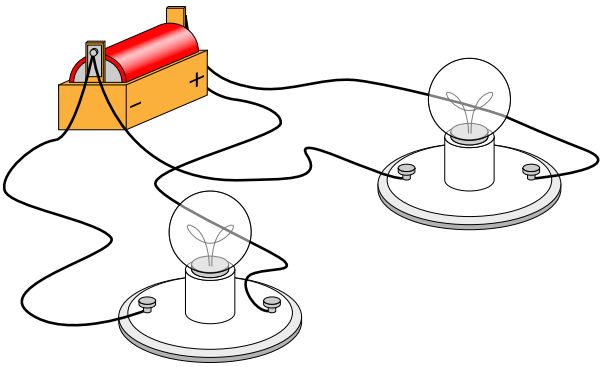


_____

6.

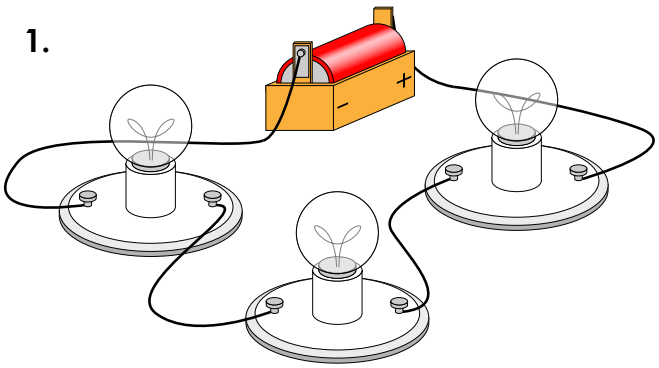


_____

Series & Parallel Circuits

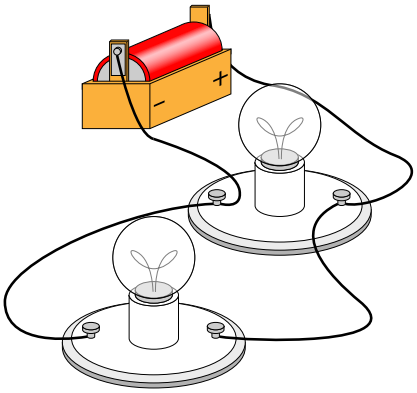
Tell whether each picture shows a **series circuit** or **parallel circuit**.

1.



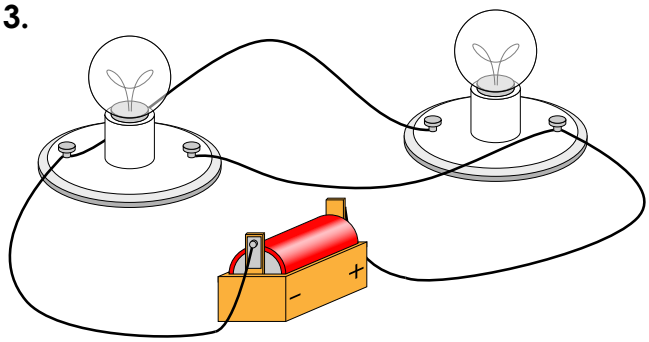
type: _____

2.



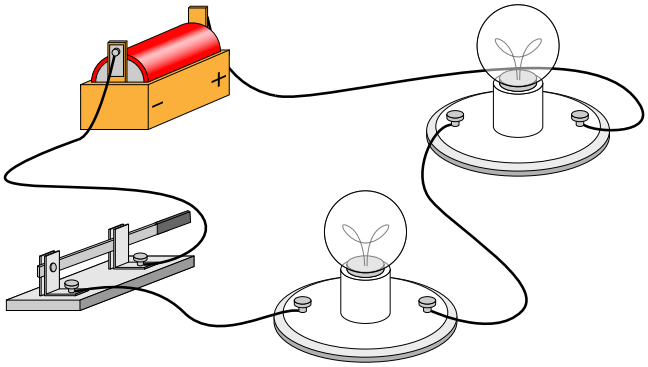
type: _____

3.



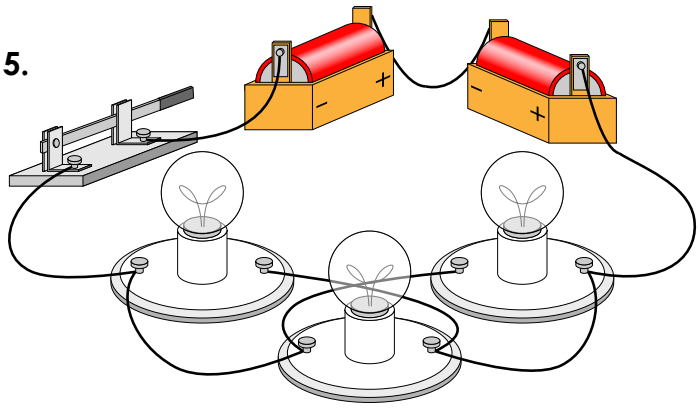
type: _____

4.



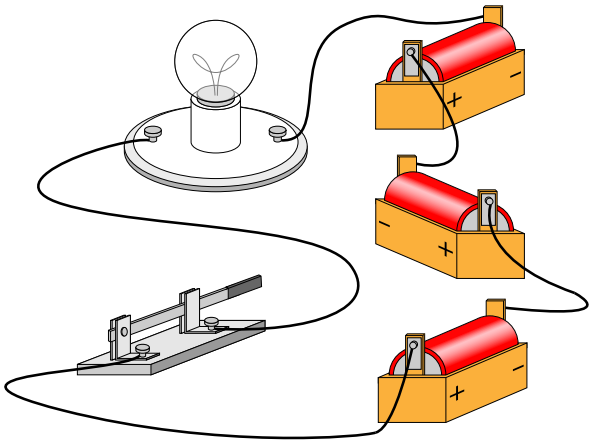
type: _____

5.



type: _____

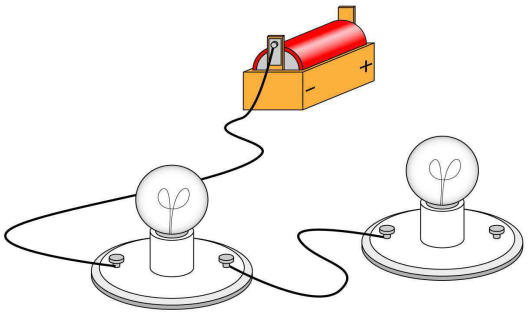
6.



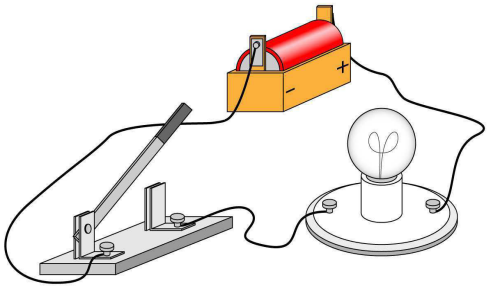
type: _____

What's Wrong With These Circuits?

1. Explain why the light bulbs won't light in the circuit pictured on the right.



2. Explain why the light bulb isn't lighting up in the circuit pictured on the right.



3. Explain why the light bulb isn't lighting up in the circuit pictured on the right.