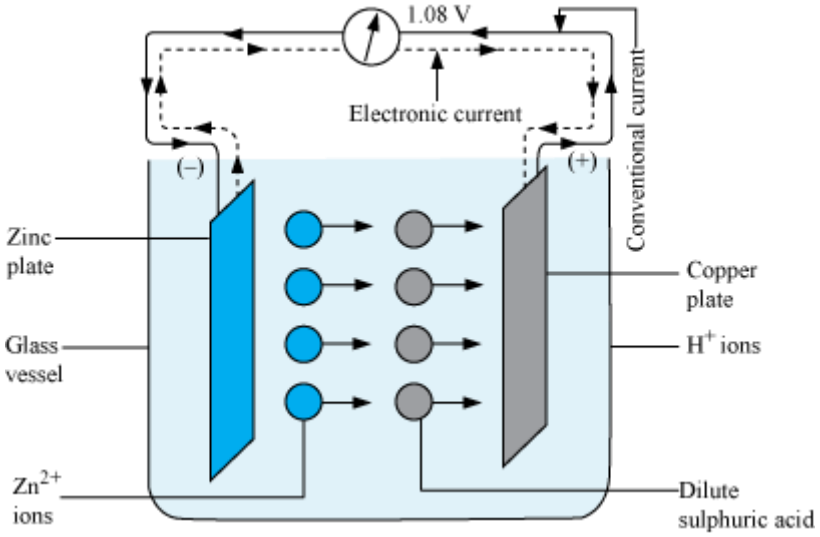
Construction of Electric Cells, Electric Bulbs, and Electric Switches

We use many electrical appliances which work only when electricity flows through them. Electricity is the flow of electric charges when the negative and positive terminals of an electric cell are connected by a certain substance. Let us see the construction of an electric cell.

Construction of an Electric Cell

A simple cell consists of a vessel with two metal rods or plates, known as electrodes, and a chemical substance known as electrolyte.



The chemical energy stored in a cell converts into electrical energy when current is drawn from the cell. A very commonly used cell is a dry cell which cannot be recharged once all its stored energy is consumed.

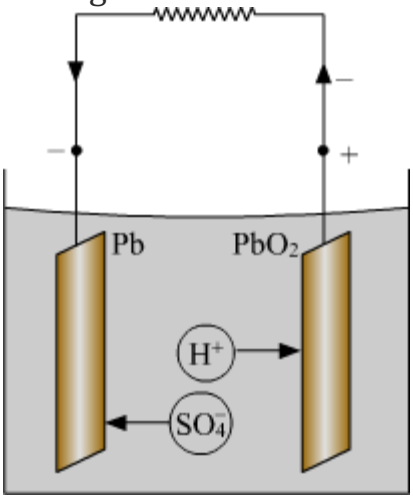
When all the chemicals stored inside it are used, the cell stops generating electricity. Hence, we have to replace the cell with a new one. This type of cell is known as primary cell.

An electric cell generates a very small amount of electricity. However, this electricity is sufficient for the working of many small electrical devices. Some common devices that use electricity from cells are clocks, videogames, wristwatches, etc.

There are other types of cells existing which do not need to be replaced even if the stored chemicals get used up completely. These cells are called secondary cells and can be recharged using electricity. One of the examples of secondary cell is lead-acid cell. Let us understand its construction and how it works.

Lead-Acid Cell

It consists of two electrodes made of lead (Pb) and lead-oxide (PbO_2). Both the electrodes are dipped in dilute sulphuric acid (H_2SO_4). An external load, such as bulb, is connected between the ends of the electrodes. The dilute acid has both positive (H+) and negative ions (SO_{2-4}SO42-). Now, due to reactions between the components of the cell, the positive ions flow towards the lead-oxide electrode and negative ions towards lead electrode. Thus, electric charges are produced on both the electrodes which result in the flow of current through external load.



Another example of secondary cell is nickle-cadmium (Ni-Cd) cell. These are portable; thus are used in different handy electronic gadgets.

Try to locate the filament and the terminals in a torch bulb.	

Some interesting facts:

The current flowing in a filament raises its temperature up to 3,000°C. This generates a large amount of heat and is responsible for the glowing of a light bulb.
The length of the tungsten filament in a light bulb is about 2 meters.

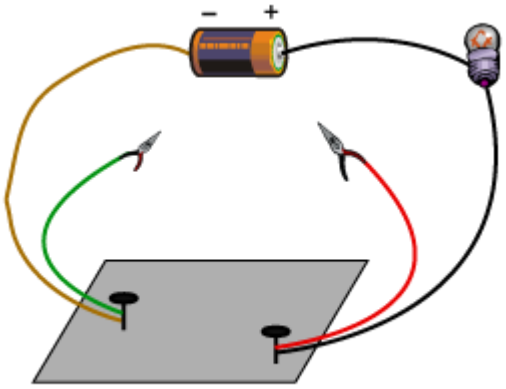
Switching devices

A switch is an electric device that is used to either complete or break an electric circuit. It has two positions 'ON' and 'OFF'. At ON position, the circuit is complete and the circuit breaks when the switch is at OFF position. You can understand the working of a switch by designing your own switch and circuit.

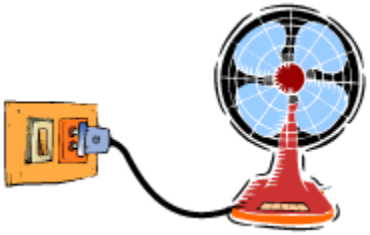
Making your own switch

List some common home appliances that have inbuilt switches.

Complete the given circuit using the clips so that the bulb glows. Label the direction of the current flowing through it.



An electric circuit with switch



A practical switch

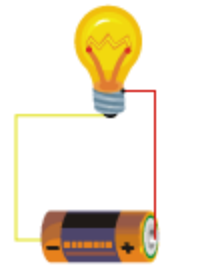
You can make an electric table fan work by switching on the switch connected to the socket board. On

switching it on, the switch allows current to flow through it and through the fan. This makes the fan work.

Construction of Torch

You are given a bulb, two connecting wires, and a cell. **Can you join these components in such a way so that the bulb will start emitting light?**

You have already learned so many things through animation. Let us put them in words.



Simple electric circuit

Simple Electric Circuit

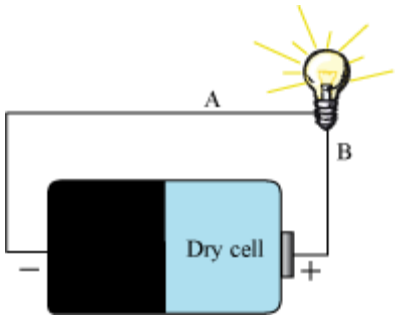
An **electric circuit** is a closed loop consisting of an electricity-producing device (such as a cell) and an electric device (such as a bulb). These are connected to each other using wires, as shown in the given figure.

- You know that the bulb emits light when current flows through its filament.
- It is important to understand the importance of a simple electrical circuit. We use electrical instruments such as TV, fridge, etc. in our daily life. A simple electrical circuit acts as the basic reference to understand these relatively complex circuits.

Do you know that current flows in a circuit because of the flow of charged particles, known as "electrons"?

Closed Circuit

Let us take a dry cell attached with a bulb as shown in the figure.



The bulb is connected to the dry cell by a copper wire. When the copper wire is connected to both the terminals of the cell, electrons start flowing, resulting in a flow of current in the wire. When the current flows through the bulb, the filament of the bulb offers resistance to the electrons, thus converting electrical energy into heat energy and resulting in the glowing of the bulb. This circuit is called closed circuit.

The circuit in which current after starting from the positive terminal of a cell returns to the negative terminal of it, without any break, through a closed loop is called closed circuit.

Open Circuit

Now, take out the wire from one terminal of the bulb. In this situation, current does not have the closed path to return to the negative terminal of the cell. Hence, the bulb does not glow. This is called an open circuit.

This circuit where the current does not have a closed path to complete the circuit is called an open circuit.

Electric circuit of a torch

A torch is a practical example of a simple electric circuit. It is an electric device that emits light. It consists of a bulb, electric cells, a switch, a reflector, and a cylindrical shape casing.

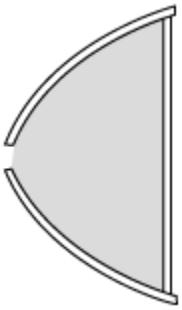
Function of each component of a torch

- **Bulb:** The bulb emits light when electric current flows through its filament.

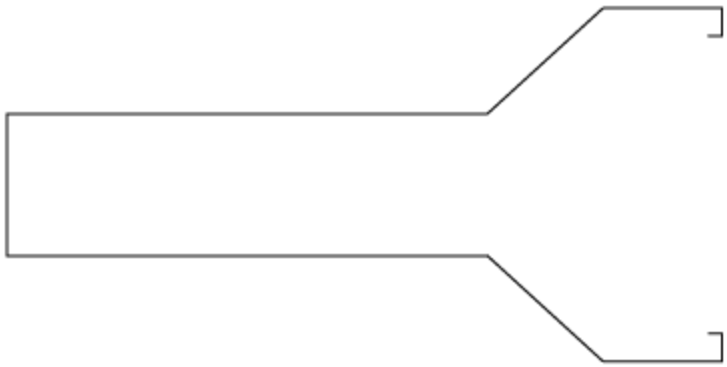
- **Electric cell:** The cell is an electricity-producing device. The required current for the filament of the bulb is supplied by it.

- **Switch:** The switch is used to complete and break the circuit inside the torch. In simple words, it is used to turn the torch on and off.

- **Reflector:** The reflector is a curved, silvered mirror. It is used to focus the light in a particular direction.



- **Casing:** The casing is used to provide covering for the basic components of the torch for protection and safe handling.



Construct your own torch by inverting the terminals of the cells. Does the bulb glow?

Conductors and Insulators

Switches, electrical plugs, wires, and sockets should be made up of materials that allow electricity to pass through them. However, electrical wires, plug tops, switches, and other parts of electrical appliances are covered with rubber and plastic so that a person does not get an electric shock. **How are these two kinds of materials different from each other?**

Precautions while working with electricity

While working with electric appliances or any electric circuit, you are advised to use a screwdriver instead of using your hand. **Have you ever wondered why?**

Let us see what is special about a screwdriver that makes it suitable for working with electrical appliances.

In absence of a screwdriver, you are advised to wear rubber gloves or slippers while working with electricity. **Do you know why?**

It is because rubber does not allow electric current to pass through it. We will not get an electric shock when we touch appliances carrying electricity if we are wearing rubber gloves. If we touch any appliance carrying electricity with naked hands, then we may get an electric shock.

Wet hands

You are advised not to operate electrical appliances with wet hands or when there is water on the surface of an electrical appliance. The reason behind this is

that water allows electricity to pass through it. Though pure water, i.e., distilled water does **not** allow electricity to pass through it, the presence of salts and other impurities turns it into an electrical conductor. *Hence, if you touch any appliance carrying electricity with wet hands, there is a huge risk of getting electrocuted*.

You can see many materials around you. Some of them allow electricity to pass through them, while others do not. Therefore, you can classify them into two categories, i.e., ***electrical conductors*** and ***electrical insulators***. This classification is explained below.

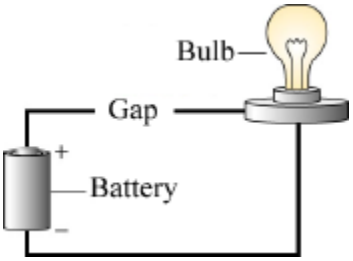
Electrical conductors	**Electrical insulators**
Electricity can pass through certain materials. These materials are known as electrical conductors.	Electricity cannot pass through certain materials. These materials are known as electrical insulators.
All metals (for example, aluminium, copper, iron, and steel) are good conductors of electricity. Therefore, electrical wires are made up of metals such as aluminium and copper.	Few examples of good electrical insulators are plastic, wood, glass, and rubber. Therefore, plastic or rubber is often used to cover electrical wires.

The given table lists a few common objects/materials as electrical conductors and insulators.

Material/Object	**Flow of electricity through it**	**Electrical Conductor or Insulator**
Key	Allows	Conductor
Glass	Does not allow	Insulator
Iron nail	Allows	Conductor

Plastic pen	Does not allow	Insulator
Eraser	Does not allow	Insulator
Coin	Allows	Conductor
Chalk	Does not allow	Insulator
Thermocol	Does not allow	Insulator

Conductor or Insulator

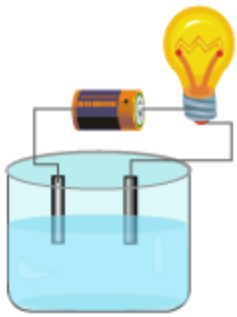


Construct a simple electrical circuit, as shown in the given figure.

Collect samples of different types of materials such as a coin, a cork, rubber, glass, paper, a key, a pin, a plastic scale, a wooden block, a pencil lead, candle wax, etc. Now, insert each of these samples into the gap in the electrical circuit and observe if the bulb glows. Complete the following classification table.

Sample	Does the bulb glow?	Electrical Conductor or Insulator
Coin	Yes	Conductor
Cork	No	Insulator

Is water a good conductor of electricity?



Let us try to find the answer to this question. Construct a circuit, as shown in the given figure.

Now, fill the beaker with distilled water and observe the bulb. **Does the bulb glow?**

No, it will not glow as pure water or distilled water is an electrical insulator.

Now, mix some salt in the water.

Does the bulb glow?

Yes, the bulb will glow as impure water is a good conductor of electricity.

Hence, it can be concluded from this activity that ***impure water is a good conductor of electricity, while pure water is a good insulator of electricity.***