UNIT 5

ELECTRICITY

Learning Objectives

T6X2D6

After the completion of this lesson, students will be able to:

- know about the basic properties of electric charges.
- explain the transfer of charges between two objects.
- understand the working of electroscope.
- recognise the effects of electric current.
- assemble different electric circuits.
- list out the applications of electricity.

Introduction

All things we use in our life are made up of elements. Each element is made up of atoms which is the smallest unit. John Dalton, the scientist considered that atoms cannot be divided further. But, it was found out later through Rutherford's gold foil experiment that atoms are made up of particles like proton, electron and neutron. Movement of electrons in a material constitutes electric current and generates an energy called electric energy or electricity. We use this energy in our life for various needs. Electric bulbs, fans, elctric iron box, washing machines and refrigirators are some of the appliances which work with the help of electricity. In this lesson we will study about electric charges and how they are transferred. This lesson will also cover electric circuits and the effects of electric current.

5.1 Atom

An atom consists of proton, electron and neutron which are called sub-atomic particles. Proton and neutron are found inside the nucleus which is at the centre of an atom. Electrons revolve around the nucleus in different paths called orbits. In an atom, the number of protons and the number of electrons will be equal. There is a force of attraction between the protons in the nucleus and the electrons in the orbits. Electrons in the inner orbits are strongly attracted by the protons and they cannot be removed from the atom easily. But, the electrons in the outermost orbits are loosely bound and they can be easily removed from the atom.

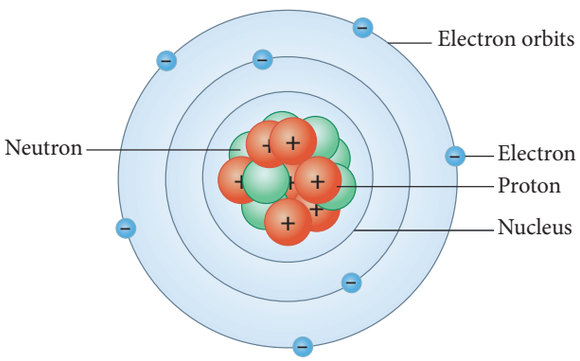


Figure 5.1 Atom model

5.2 Charges

Charge or electric charge is the basic property of matter that causes objects to attract or repel each other. It is carried by the subatomic particles like protons and electrons. Charges can neither be created nor be destroyed. There are two types of charges: positive charge and negative charge. Protons carry positive charge and the electrons carry negative charge. There is a force of attraction or repulsion between the charges. Unlike charges attract each other and like charges repel each other.

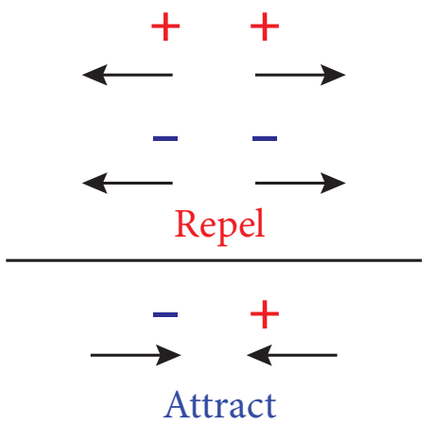


Figure 5.2 Attraction and repulsion between charges

Electric charge is measured in coulomb (C). Small amount of charge that can exist freely is called elementary charge (e). Its value is 1.602×10^{-19} C. This is the amount of charge possessed by each proton and electron. But, protons have positive elementary charge (+e) and electrons have negative elementary charge (-e). Since protons and electrons are equal in number, an atom is electrically neutral.

5.3 Transfer of Charges

As we saw earlier, electrons (negative electric charges) in the outermost orbit of an atom can be easily removed. They can be transferred from one substance to another. The substance which gains electrons become negatively charged and the substance which looses electrons becomes positively charged. Transfer of charges takes place in the following ways.

E5F2F1

- Transfer by Friction
- Transfer by Conduction
- Transfer by Induction

5.3.1 Transfer by Friction

Activity 1

Take a comb and place it near some pieces of paper. Are they attracted by the comb? No. Now comb your dry hair and place it near them. What do you see? You can see that the paper pieces are attracted by the comb now. How is it possible?

Comb rubbed with hair gains electrons from the hair and becomes negatively charged. These electrons are accumulated on the surface of the comb. When a piece of paper is teared into bits, positive and negative charges are present at the edges of the bits. Negative charges in the comb attract positive charges in the bits. So, the paper bits are moving towards the comb. While combing hair, charges are transferred from the hair to comb due to friction. If the hair is wet, the friction between the hair and the comb reduces which will reduce the number of electrons transferring from hair to comb. Hence, rubbing certain materials with one another can cause the build-up of electrical charges on the surfaces. From this it is clear that charges are transferred by friction.

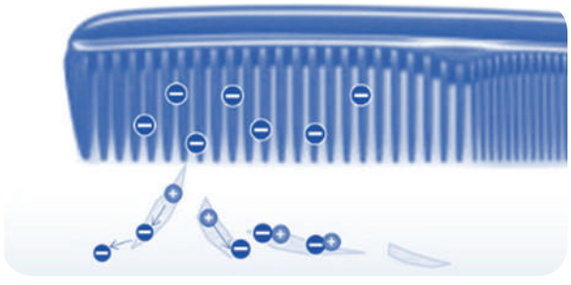


Figure 5.3 Charges in comb.

DO YOU KNOW?

A neutral object can become positively charged when electrons get transferred to another object; not by receiving extra positive charges.

Similar effect can be seen when we rub few materials with one another. When a glass rod is rubbed with a silk cloth the free electrons in the glass rod are transferred to silk cloth. It is because the free electrons in the glass rod are less tightly bound as compared to that is in silk cloth. Since the glass rod looses electrons, it has a deficiency of electrons and hence acquires positive charge. But, the silk cloth has excess of electrons. So, it becomes negatively charged.

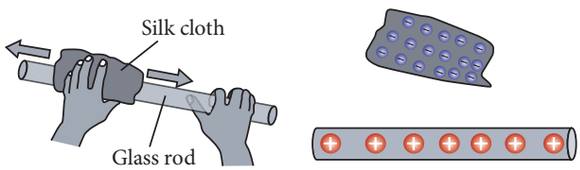


Figure 5.4 Transfer of charges in glass rod

When an ebonite rod (rod made by vulcanized rubber) is rubbed with fur, the fur transfers electrons to the ebonite rod because the electrons in the outermost orbit of the atoms in fur are loosely bound as compared to the ebonite rod. The ebonite rod which has excess electrons becomes negatively charged and the fur which has deficiency of electrons is positively charged.

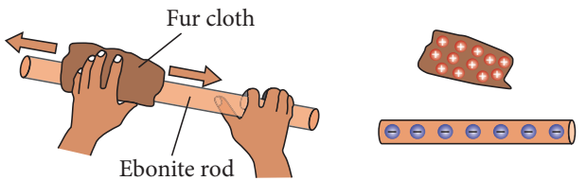
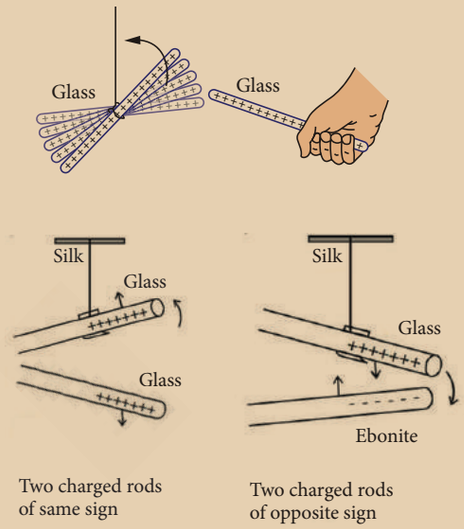


Figure 5.5 Transfer of charges in ebonite rod

From these we know that when two materials are rubbed together, some electrons may be transferred from one material to the other, leaving them both with a net electric charge.

DO YOU KNOW?

If a positively charged glass rod is brought near another glass rod, the rods will move apart as they repel each other. If a positively charged glass rod is brought close to a negatively charged ebonite rod, the rods will move toward each other as they attract. The force of attraction or repulsion is greater when the charged objects are closer.



5.3.2 Transfer by Conduction

Activity 2

Take a sheet of paper. Turn it into a hollow cylinder. Tie one end of the cylinder with a silk thread and hang it from a stand. Now take an ebonite rod and charge it by rubbing it with a woollen cloth. Bring this charged ebonite rod near the paper cylinder. The cylinder will be attracted by the rod. If you touch the paper cylinder by the charged rod, you will see the paper cylinder repelling the rod. Can you say the reason?

When the ebonite rod is rubbed with woollen cloth, electrons from the woollen cloth are transferred to the ebonite rod. Now ebonite rod will be negatively charged. When

it is brought near the paper cylinder, negative charges in the rod are attracted by the positive charges in the cylinder. When the cylinder is touched by the rod, some negative charges are transferred to the paper. Hence, the negative charges in the rod are repelled by the negative charges in the cylinder.

Thus, we can say that charges can be transferred to an object by bringing it in contact with a charged body. This method of transferring charges from one body to other body is called transfer by conduction.

DO YOU KNOW?

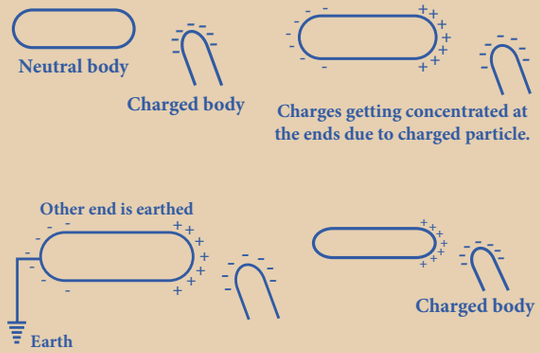
The materials which allow electric charges to pass through them easily are called conductors of electricity. For example, metals like aluminium, copper are good conductors of electricity. Materials which do not allow electric charges to pass through them easily are called insulators. Rubber, wood and plastic are insulators.

5.3.3 Transfer by Induction

We saw that we can charge an uncharged object when we touch it by a charged object. But, it is also possible to obtain charges in a body without any contact with other charged body. The process of charging an uncharged body by bringing a charged body near to it but without touching it is called induction. The uncharged body acquires an opposite charge at the near end and similar charge at the farther end.

Activity 3

Bring a negatively charged plastic rod near a neutral rod. When the negatively charged plastic rod is brought close to the neutral rod, the free electrons move away due to repulsion and start piling up at the farther end. The near end becomes positively charged due to deficit of electrons. When the neutral rod is grounded, the negative charges flow to the ground. The positive charges at the near end remain held due to attractive forces and the electrons inside the metal becomes zero. When the rod is removed from the ground, the positive charges continue to be held at the near end. This makes the neutral rod a positively charged rod.



Similarly, when a positively charged rod is brought near an uncharged rod, negatively charged electrons are attracted towards it. As a result there is excess of electrons at nearer end and deficiency of electrons at the farther end. The nearer end of the uncharged rod becomes negatively charged and far end is positively charged.

5.4 Flow of Charges

Suppose you have two metallic spheres; one having more negative charge (excess of electrons) and the other having more positive charge (deficiency of electrons). When you connect them both with the help of a metallic wire, excess electrons from the negatively charged sphere will start flowing towards the positively charged sphere. This flow continues till the number of electrons in both the sphere is equal. Here, the positively charged sphere is said to be at higher potential and the negatively

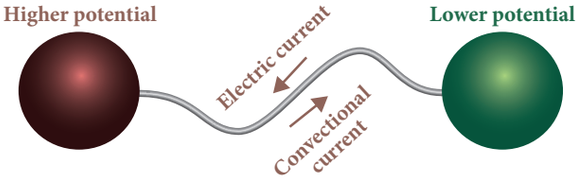


Figure 5.6 Transfer of charges

charged sphere is said to be at lower potential. Hence, electrons flow from lower potential to higher potential. This is known electric current (flow of electrons). The difference between these potentials is known as potential difference, commonly known as voltage.

Before the discovery of electrons, it was considered that electric current is due to the flow of positive charges. Flow of positive charge is called conventional current. Conventional current flows from higher potential to lower potential.

5.5 Electroscope

An electroscope is a scientific instrument used to detect the presence of electric charge on a body. In the year 1600, British physician William Gilbert invented the first electroscope. It is the first electrical instrument. There are two types of electroscope: pith-ball electroscope and gold-leaf electroscope. An electroscope is made out of conducting materials, generally metal. It works on the principle that like charges repel each other. In a simple electroscope two metal sheets are hung in contact with each other. They are connected to a metal rod that extends upwards, and ends in a knob at the end.

The first electroscope developed in 1600 by William Gilbert was called versorium. The versorium was simply a metal needle allowed to pivot freely on a pedestal. The metal would be attracted to charged bodies brought near.

If you bring a charged object near the knob, electrons will either move out of it or into it. This will result in charges accumulating on the metal leaves inside the electroscope. If a negatively charged object is brought near the top knob of the electroscope, it causes free electrons in the electroscope to move down into the leaves, leaving the top positive. Since both the leaves have negative charge, they repel each other and move apart. If a positive object is brought

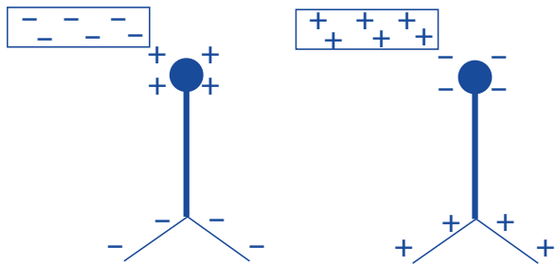


Figure 5.7 Movement of charges in electroscope

near the top knob of the electroscope, the free electrons in the electroscope start to move up towards the knob. This means that the bottom has a net positive charge. The leaves will spread apart again now.

5.5.1 Gold leaf electroscope

The gold-leaf electroscope was developed in 1787 by a British scientist named Abraham Bennet. Gold and silver are used in electroscope because they are the best conductors of electric current.

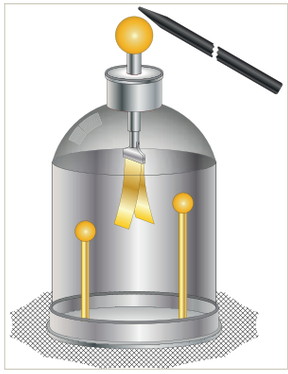


Figure 5.8 Gold leaf electroscope

Structure of Electroscope

It is made up of a glass jar. A vertical brass rod is inserted into the jar through a cork. The top of the brass rod has a horizontal brass rod or a brass disc. Two gold leaves are suspended from the brass rod inside the jar.

Working of Electroscope

When the brass disc of the electroscope is touched by a charged object, electric charge gets transferred to the gold leaf through the rod. This results in gold leaves moving away from each other. This happens because both the leaves have similar charges.

Charging

Transfer of charge from one object to another is called charging. In case of the gold leaves, charge is transferred through the brass rods.

Electrical discharge

The gold leaves resume their normal position after some time. This happens because they lose their charge. This process is called electrical discharge. The gold leaves would also be discharged when someone touches the brass rod with bare hands. In that case, the charge is transferred to the earth through the human body.

5.6 Lightning and Thunder

Activity 4

Rub your foot on a carpet floor and touch a door knob. What do you feel? Do you feel the shock in your hand? Why does this happen?

Getting a shock from a door knob after rubbing your foot on a carpet floor, results from discharge. Discharge occurs when electrons on the hand are quickly pulled to the positively charged doorknob. This movement of electrons, which is felt as a shock, causes the body to lose negative charge. Electric discharge takes place in a medium, mostly gases. Lightning is another example of discharge that takes place in clouds.

Lightning is produced by discharge of electricity from cloud to cloud or from cloud to ground. During thunderstorm air is moving upward rapidly. This air which moves rapidly, carries small ice crystals upward. At the same time, small water drops move downward. When they collide, ice crystals become positively charged and move upward and the water drops become negatively charged and move downward. So the upper part of the cloud is positively charged and the lower part of the cloud is negatively charged. When they come into contact, electrons in the water drops are attracted by the positive charges in the ice crystals. Thus, electricity is generated and lightning is seen.

Sometimes the lower part of the cloud which is negatively charged comes into contact with the positive charges accumulated near the mountains, trees and even people on the earth. This discharge produces lot of heat and sparks that results in what we see as lightning. Huge quantities of electricity are discharged in lightning flashes and temperatures of over 30,000°C or more can be reached. This extreme heating causes the air to expand explosively fast and then they contract. This expansion and contraction create a shock wave that turns into a booming sound wave, known as thunder.

DO YOU KNOW?

Lightning's extreme heat will vaporize the water inside a tree, creating steam that may burn out the tree.

Sometimes lightning may be seen before the thunder is heard. This is because the distance between the clouds and the surface is very long and the speed of light is more than the speed of sound.

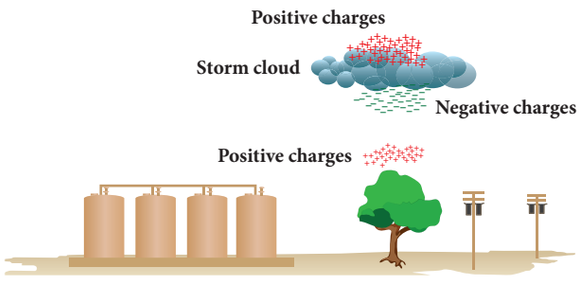


Figure 5.9 Formation of Lightning

DO YOU KNOW?

During lightning and thunder, we should avoid standing in ground or open spaces. You should make yourself as small as possible by squating. It is however safe to stay inside a car because the car acts as a shield and protects us from the electric field generated by the storm.

5.6.1 Earthing

A safety measure devised to prevent people from getting shocked if the insulation inside electrical devices fails is called earthing. Electrical earthing can be defined as the process of transferring the discharge of electrical energy directly to the earth with the help of low-resistance wire.

We get electrical energy from different sources. Battery is one such source. We use it in wall clocks, cell phones etc. For the working of refrigerators, air conditioners, washing machines, televisions, laptops and water heaters we use domestic power supply. Usually an electric appliance such as a heater, an iron box, etc. are fitted with three wires namely live, neutral and earth. The earth wire is connected to the metallic body of the appliance. This is done to avoid accidental shock.

Suppose due to some defect, the insulation of the live wire inside an electric iron is burnt then the live wire may touch the metallic body of the iron. If the earth wire is properly connected to the metallic body, current will pass into the earth through earth wire and it will protect us from electric shock. The earth, being a good conductor of electricity, acts as a convenient path for the flow of electric current that leaks out from the insulation.

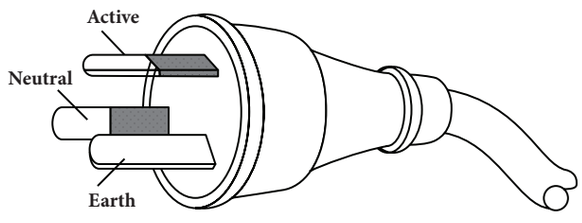


Figure 5.10 Live, neutral and earth wire

5.6.2 Lightning Arresters

Lightning arrestor is a device used to protect buildings from the effects of lightning. Lightning conductor consists of a metallic lightning rod (in the form of spikes) that remains in air at the top of the building. Major portion of the metal rod and copper cable are installed in the walls during its construction. The other end of the rod is placed deep into the soil. When lightning falls, it is attracted by the metallic rods at the top of the building. The rod provides easy route for the transfer of electric charge to the ground. In the absence of lightning arrestors, lightning will fall on the building and the building will be damaged.

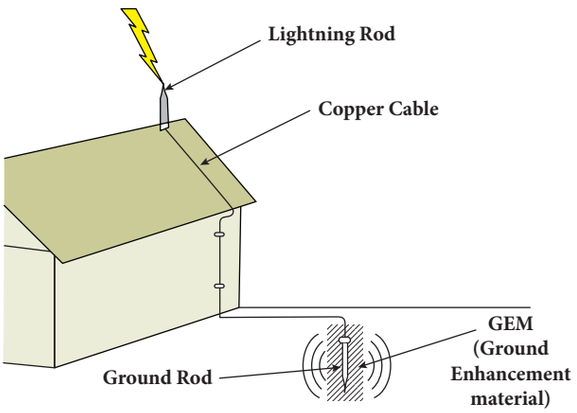


Figure 5.11 Lightning arresters

5.7 Electric Circuits

We saw that when two oppositely charged spheres are connected by a metal wire, electrons flow from the sphere which is at lower potential to the sphere at higher potential. Similarly, if two terminals of a battery which are at different potential are connected by a metallic wire, electrons will flow from negative terminal to positive terminal. The path through which electrons flow from one terminal to another terminal of the source, is called electric circuit.

A simple circuit consists of four elements: a source of electricity (battery), a path or conductor through which electricity flows (wire), a switch to control the circuit and an electrical resistor (lamp) which is any device that requires electricity to operate.

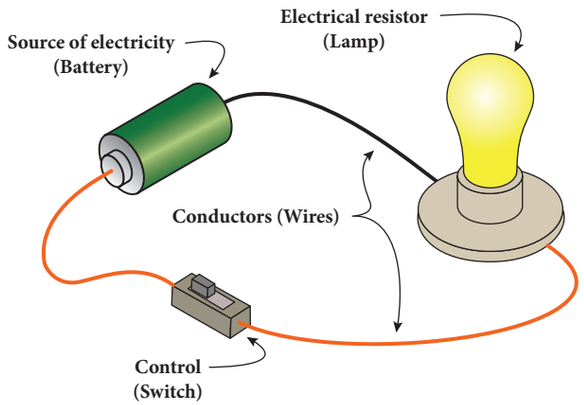


Figure 5.12 Simple electric circuit

The above figure shows a simple circuit containing a battery, two wires, key and an electric bulb. The source can be a battery or the electric outlet in your room. The electrical resistor refers to the device that consumes the energy. Control (key) is the mechanism that is used to start, stop and regulate the electric current. When the key is on, electrons from the battery flow through the circuit from the negative terminal through the wire conductor, then through the bulb and finally back to the positive terminal. The light glows when current is flowing through its filament. There are two basic ways in which we can connect these components. They are: series and parallel.

DO YOU KNOW?

The electric eel is a species of fish which can give electric shocks of upto six hundred fifty watts of electricity. But if the eel repeatedly shocks, its electric organs become completely discharged. Then a person can touch it without being shocked.

5.7.1 Series Circuit

A series circuit is one that has more than one resistor (bulb) but only one path through which the electrons can travel. From one end of the battery the electrons move along one path with no branches through the resistors (bulbs) to the other end of the cell. All the components in a series circuit are connected end to end. So, current through the circuit remains same throughout the circuit. But, the voltage gets divided across the bulbs in the circuit. In the following series circuit two bulbs are used as resistors.

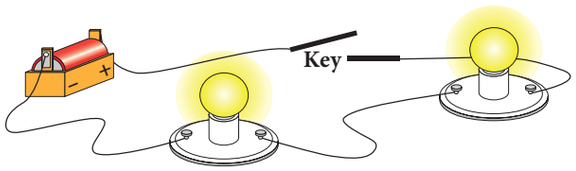


Figure 5.13 Series circuit

In this series circuit, charges (electrons) from the battery have only one path to travel. Here battery, key and two bulbs are connected in series. Charges flow from the battery to each bulb, one at a time, in the order they are wired to the circuit. If one bulb in the circuit is unscrewed, the current flow to another bulb would be interrupted. We put serial lights during festivals. If the lights are in a series circuit, one burned out bulb will keep all the lights off. If the number of bulbs in a circuit with a battery increases, the light will be dimmer because many resistors are acting on the same power from the battery.

We saw that in series circuit same current travels through every resistance and the voltage will be different across each resistance. Let us consider three bulbs connected in series. Let I be the current through the circuit and V_1, V_2, V_3 be the voltage across each bulb. The supply voltage V is the total of the individual voltage drops across the resistances (bulbs).

$$V = V_1 + V_2 + V_3$$

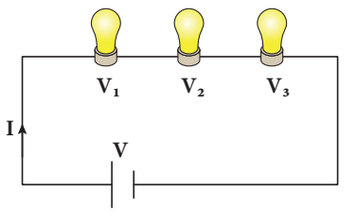


Figure 5.14 Voltage in series circuit

5.7.2 Parallel Circuit

In a parallel circuit, there is more than one resistor (bulb) and they are arranged on many paths. This means charges (electrons) can travel from one end of the cell through many branches to the other end of the cell. Here, voltage across the resistors (bulbs) remains the same but the current flowing through the circuit gets divided across each resistor.

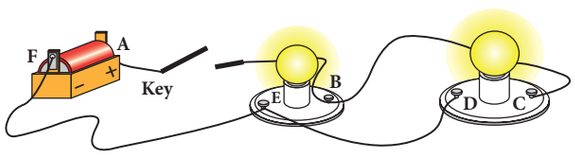


Figure 5.15 Parallel circuit

In the above diagram, current can flow in two paths: ABEFA and ABCDEFA. Here, it is clear that electricity from the cell can take either path ABEFA or path ABCDEFA to return to the cell. From the diagram you will notice that even when one resistor (bulb) burns out, the other bulbs will work because the electricity is not flowing through only one path. All the light bulbs in our homes are connected in parallel circuit. If one bulb burns out, the other bulbs in the rooms will still work. The bulbs in a parallel circuit do not dim out as in series circuits. This is because the voltage across one branch is the same as the voltage across all other branches.

Let us consider three bulbs connected in series. Let V be the voltage across the bulbs and I_1, I_2, I_3 be the current across each bulb. The current I from the battery is the total of the individual current flowing through the resistances (bulbs).

$$I = I_1 + I_2 + I_3$$

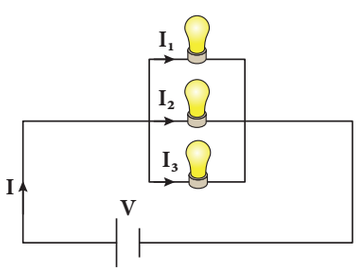


Figure 5.16 Current in parallel circuit

Table 5.1 Difference between series and parallel circuits

Series circuit	Parallel circuit
Same amount of current flows through all the components.	The current flowing through each component combines to form the current flow.
Voltage is different across different components.	Sum of the through each component will be the voltage drawn from the source.
Components are arranged in a line.	Components are arranged parallel to each other.
If one component breaks down, the whole circuit will burn out.	Other components will function even if one component breaks down.

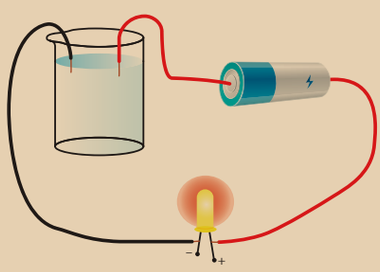
5.8 Effects of Current

When current is flowing through a conductor it produces certain effects. These are known as effects of electric current. These effects result in conversion of electrical energy into different forms of energies such as heat energy, mechanical energy, magnetic energy, chemical energy and so on.

5.8.1 Chemical effect of current

Activity 5

Take two pieces of wire, an LED light and a battery, and make a simple electric circuit. Take some water in a glass and put the wires in the water as shown in the figure. Does the LED bulb glow? What do you understand from this?



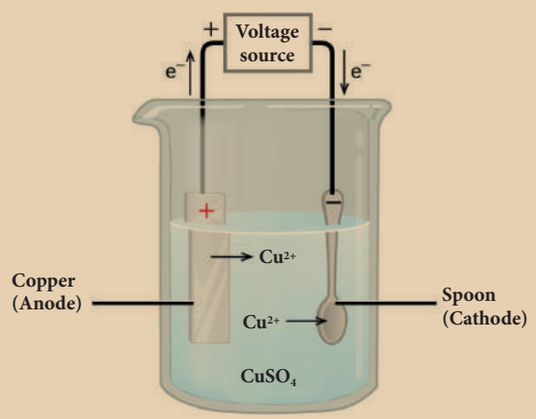
We know that electricity is conducted by metals. This activity shows that liquids also conduct electricity. When electric current is passed through a conducing solution, some chemical reactions take place in the solution. This chemical reactions produce electrons which conduct electricity. This is called chemical effect of electric current. The decomposition of molecules of a solution into positive and negative ions on passing an electric current through it, is called electrolysis. Electrolysis has a number of applications. It is used in extraction and purification of metals. The most general use of electrolyte is electroplating.

Electroplating

Electroplating is one of the most common applications of chemical effects of electric current. The process of depositing a layer of one metal over the surface of another metal by passing electric current in called electroplating.

Activity 6

Take a glass jar and fill it with copper sulphate solution. Take a copper metal plate and connect it to the positive terminal of battery. Connect an iron spoon to the negative terminal of the battery. Now, dip them in the copper sulphate solution. When electric current is passed through the copper sulphate solution, you will find that a thin layer of copper metal is deposited on the iron spoon and an equivalent amount of copper is lost by the copper plate.

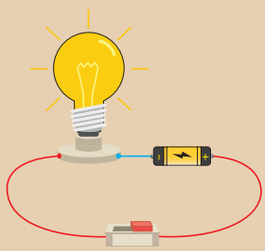


Electro plating is applied in many fields. We use iron in bridges and automobiles to provide strength. However, iron tends to corrode and rust. So, a coating of zinc is deposited on iron to protect it from corrosion and formation of rust. Chromium has a shiny appearance. It does not corrode. It resists scratches. But, chromium is expensive and it may not be economical to make the whole object out of chromium. So, the objects such as car parts, bath taps, kitchen gas burners, bicycle handlebars, wheel rims are made from a cheaper metal and only a coating of chromium is deposited over it.

5.8.2 Heating effect of current

Activity 7

Take a battery, a bulb, a switch and few connecting wires. Make an electric circuit as shown in the figure. Keep the switch in the 'OFF' position. Does the bulb glow? Now move the electric switch to the 'ON' position and let the bulb glow for a minute or so. Touch the bulb now. Do you feel the heat?



When electric current passes through a conductor, there is a considerable 'friction' between the moving electrons and the molecules of the conductor. During this process, electrical energy is transformed to heat energy. This is known as heating effect of electric current. The heat produced depends on the amount of resistance offered by the wire.

Copper wire offers very little resistance and does not get heated up quickly. On the other hand, thin wires of tungsten or nichrome which are used in bulbs offer high resistance and gets heated up quickly. This is

the reason why tungsten wire is used in the filaments of the bulbs and nichrome wire is used as a heating element in household heating appliances. Heating effect of electric current can be seen in many devices. Some of them are given below.

Fuse

Fuse is a strip of alloy wire which is made up of lead and tin with a very low melting point. This can be connected to the circuit. The fuse is usually designed to take specific amount of current. When current passing through the wire exceeds the maximum limit, it gets heated up. Due to low melting point it melts quickly disconnecting the circuit. This prevents damage to the appliances.

Figure 5.17 Fuse wire

Electric cookers

Electric cookers turn red hot when electric current is passed through the coil. The heat energy produced is absorbed by the cooking pot through conduction.

Electric kettles

The heating element is placed at the bottom of the kettle which contains water. The heat is then absorbed by the liquid and distributed throughout the liquid by convection.

Electric irons

When current flows through the heating element, the heat energy developed is conducted to the heavy metal base, raising its temperature. This energy is then used to press clothes.

Points to Remember

- Opposite charges attract each other and like charges repel each other.
- Charges can be transferred from one region to another region by any of the following ways: Transfer by friction, Transfer by conduction and Transfer by induction.
- Friction between objects results in transfer of electrons between them.
- When a charged body touches another body, charges can be transferred from one body to another.
- Induction is a process of charging an uncharged body by bringing a charged body near to it but not touching it.
- Electroscope is an instrument used to detect and measure electric charges.
- Earthing is the process of connecting the exposed metal parts of an electrical circuit to the ground.
- Lightning arrester is a device used to protect buildings from the effects of lightning.
- A simple circuit consists of four elements: a source of electricity (battery), a path or conductor through which electricity flows (wire), a switch to control the circuit and an electrical resistor (lamp) which is any device that requires electricity to operate.
- The decomposition of molecules of a solution into positive and negative ions on passing an electric current through it is called electrolysis.
- A fuse is a strip of alloy wire which is made of lead and tin with a very low melting point.

A-Z GLOSSARY

Battery	A device that stores and produces electricity from chemical cells.
Circuit	The path through which electric current flows.
Electric charge	Basic property of matter carried by some elementary particles. Electric charge can be positive or negative.

Electric current	Flow of electric charges through a material.
Electron	A tiny particle which revolves around the nucleus of an atom. It has a negative charge of electricity.
Electroscope	A scientific instrument used to detect the presence of electric charges on a metal body.
Friction	The resistance that one surface or object encounters when moving over another.
Fuse	A strip of wire that melts and breaks an electric circuit if the current exceeds a safe level.
Volt	Unit of electrical force or electric pressure.
Voltage	An electromotive force that causes electrons to flow.

E7I4T7

TEXTBOOK EXERCISES

I. Choose the best answer.

1. When an ebonite rod is rubbed with fur, the charge acquired by the fur is
   a) negative b) positive
   c) partly positive and partly negative
   d) None of these

2. The electrification of two different bodies on rubbing is because of the transfer of
   a) neutrons b) protons
   c) electrons d) protons and neutrons

3. Which of the following a simple circuit must have?
   a) Energy source, Battery, Load
   b) Energy source, Wire, Load
   c) Energy source, Wire, Switch
   d) Battery, Wire, Switch

4. An electroscope has been charged by induction with the help of charged glassrod. The charge on the electroscope is
   a) negative b) positive
   c) both positive and negative
   d) None of the above

5. Fuse is
   a) a switch
   b) a wire with low resistance
   c) a wire with high resistance
   d) a protective device for breaking an electric circuit

II. Fill in the blanks.

1. _____takes place by rubbing objects together.
2. The body which has lost electrons becomes _____
3. _____ is a device that protects building from lightning strike.
4. _____ has a thin metallic filament that melts and breaks the connection when the circuit is overheated.
5. Three bulbs are connected end to end from the battery. This connection is called _____

III. State true or false. If false, correct the statement.

1. The charge acquired by an ebonite rod rubbed with a piece of flannel is negative.

2. A charged body induces an opposite charge on an uncharged body when they are brought near.
3. Electroscope is a device used to charge a body by induction.
4. Water can conduct electricity.
5. In parallel circuit, current remains the same in all components.

IV. Match the following.

Two similar charges	acquires a positive charge
Two dissimilar charges	prevents a circuit from overheating
When glass rod is rubbed with silk	repel each other
When ebonite rod is rubbed with fur	attract each other
Fuse	acquires a negative charge

V. Give reason for the following.

1. When a glass rod is rubbed with silk cloth both get charged.
2. When a comb is rubbed with dry hair it attracts small bits of paper.
3. When you touch the metal disc of an electroscope with a charged glass rod the metal leaves get diverged.
4. In an electroscope the connecting rod and the leaves are all metals.
5. One should not use an umbrella while crossing an open field during thunderstorm.

VI. Consider the statements given below and choose the correct option.

1. **Assertion:** People struck by lightning receive a severe electrical shock.
   Reason: Lightning carries very high voltage.
2. **Assertion:** It is safer to stand under a tall tree during lightning.
   Reason: It will make you the target for lightning.

a) Both assertion and reason are true and reason is the correct explanation of assertion.

b) Both assertion and reason are true and reason is not the correct explanation of assertion.

c) Assertion is true but reason is false.

d) Assertion is false but reason is true.

VII. Answer briefly.

1. How charges are produced by friction?
2. What is earthing?
3. What is electric circuit?
4. What is electroplating?
5. Give some uses of electroplating.

VIII. Answer in detail.

1. Explain three ways of charge transfer.
2. What is electroscope? Explain how it works.
3. Explain series and parallel circuit.
4. How lightning takes place?
5. What is electroplating? Explain how it is done.

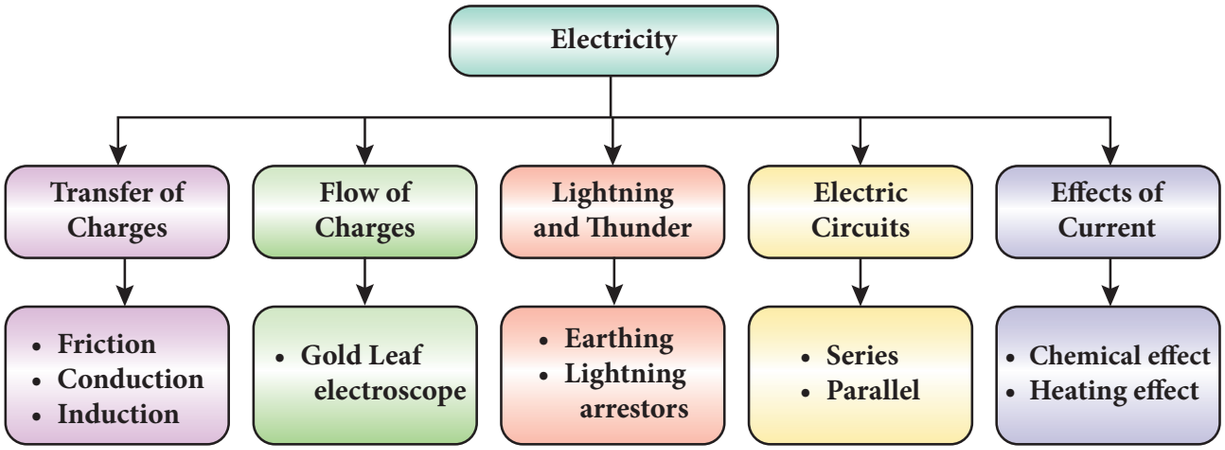
REFERENCE BOOKS

1. Concept of physics - HC Verma
2. A Text-Book on Static Electricity - Hobart Mason
3. Fun With Static Electricity - Joy Cowley
4. Frank New Certificate Physics. McMillan Publishers.

INTERNET RESOURCES

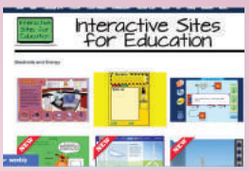
1. http://sciencenetlinks.com/lessons/static-electricity-2/
2. https://www.stem.org.uk/resources/community/collection/13389/static-electricity
3. https://www.physicsclassroom.com/class/estatics

Concept Map



ICT CORNER

Electricity



Through this activity you will learn the usage of electricity through Interactive games.

Step 1 Open the Browser and type the URL given below

Step 2 You will see lot of games which is related to Electricity

Step 3 Click the Electricity circuits activity (First activity), you will see the sub topics, like Electricity in home, Introduction to circuits etc...

Step 4 Select the sub topic and play the game. Likewise play all the games.

Step1

Step2

Step3

Step4

Browse in the link:

http://interactivesites.weebly.com/electricity-and-energy.html

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*Pictures are indicative only