08 Electricity for a Comfortable Life

8.1 Electricity for Day-to-Day Life

We need energy to do our daily activities. In the past people used human labour to do many work. Today we use different types of energy sources to make our work easier. Electricity is one such type.

Assignment 8.1

Fig. 8.1 and 8.2 show how people do different household activities in different ways.

Fig 8.1

Fig 8.2

- Prepare two separate lists to show the different activities done by people in each figure.
- Which figure shows the easiest ways of doing work? Discuss the reason with your friends.
- Prepare a small booklet about commonly used electrical appliances including their photos, pictures and other details.

There are so many other day-to-day activities where electricity is used.

Electricity is used in some vehicles to operate machines in factories, operate air conditioners and communication purposes etc.

Uses of electricity are unlimited.

8.2 Generating Electricity

Simple ways of generating electricity

Electricity is very useful to human beings. Let's find out the ways of generating electricity. People use different methods to generate electricity in different instances. Now let's do the following activity to find out ways of generating electricity.

Assignment 8.2

Mention the methods of generating electricity in following instances.

- Operate a wall clock
- For solar powered calculators
- Operate fans at home
- Light bulbs in an area where there is no electricity.

Dynamo, solar cells and dry cells are commonly used methods of generating electricity.

A bicycle dynamo

A solar cell

Dry cells

Fig 8.3

Let's find more about methods of generating eletricity.

Activity 8.1

Generating electricity with a lime fruit.

You will need :- A musical birthday card, a pieces of copper and zinc sheets, a lime, a galvanometer.

Method :-

- Fix the two sheets of copper and zinc to the lime fruit as shown in the figure.
- Remove the circuit in the birthday card carefully. Then remove the battery from it.

Fig 8.4

- Next connect the copper sheet to the place where the possitive terminal and the zinc sheet to the negative terminal of the battery was connected.
- Record your observations.
- Connect the galvanometer instead of the circuit and record your observations.

You can do the above activity easily even at home. You will understand that electricity can be generated easily from it. Electricity is generated in electric cells through a similar process as above.

Galvanometer is a sensitive device used to identify and measure a small current in the laboratory.

Fig. 8.5 ▲ Galvanometer

Activity 8.2

Let's generate electricity with a coil of wire.

You will need :- Insulating copper wire / 3 m of winding wire, a bar magnet, a galvanometer

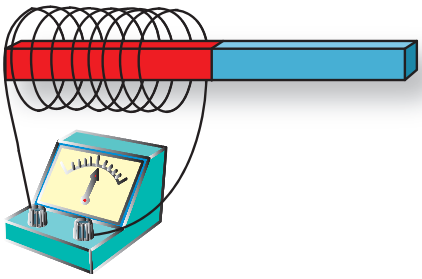


Fig. 8.6

Method :-

- Wind the insulated copper wire as a coil around a cardboard / PVC tube with a diameter of 3 cm.
- Scratch well and clean the two ends of the coil. Fix two wires to the ends of the coil and connect it to the galvanometer.
- Move the bar magnet inside the coil and record your observations.

You may have understood that an electric current was generated by moving magnet inside the coil of wire in the above activity. In bicycle dynamo, generators, hydropower stations, wind power stations, electricity is generated in the same manner as above.

For your Extra Knowledge

An eletric current is generated by moving a magnet inside a coil of wire. The scientist Michael Faraday was the first to discover this.

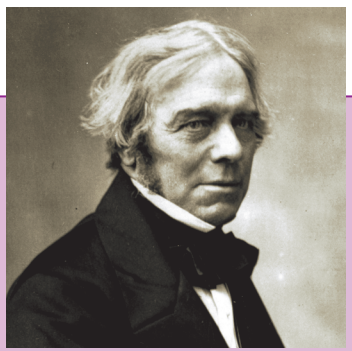


Fig. 8.7 ▲ Michael Faraday

Let's do another activity to generate electricity.

We obtain electricity from hydropower stations. Let's simply demonstrate the process that takes place in a hydropower station.

Activity 8.3

Let's make a small hydropower station

You will need :- a small electric motor, a galvanometer, a cork, yoghurt spoons, an empty pen tube, a small bulb.

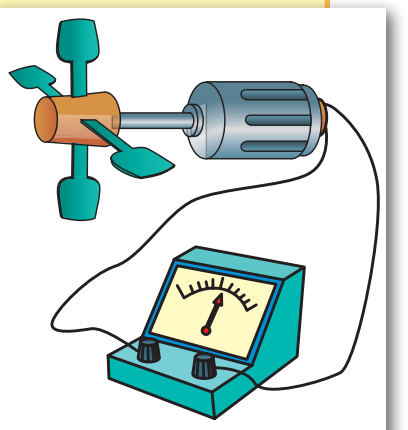


Fig 8.8

Method :-

- Prepare the set up as shown in the figure. Open the tap and hold the turbine to the running water. Do not wet the motor.
- Fix the galvanometer and then the bulb to the terminals of the motor. Record your observations.
- Then fix a wind vane instead of the turbine and hold it to the wind.
- Record your observations.

In this activity the motor operates as a simple dynamo.

The simple activity we did above is used in power stations to generate electricity at a large scale. Following are some methods used to generate electricity at a large scale.

Power Stations

Table 8.1.shows different types of power stations and methods they use to generate electricity in Sri Lanka.

Table 8.1

Type of power station	Method of Production	Location
1. Hydropower station	Fix a dynamo to a large turbine and rotate the turbine with the help of a stream of water.	Kothmale Laxapana Victoria Rantambe Randenigala
2. Wind power station	Rotate a dynamo with the help of a wind vane	Hambanthota Puttalam
3. Coal power plant	Fix a dynamo to a turbine and rotate the turbine with the help of steam.	Norochchole
4. Fuel power plants	Rotate a dynamo with an engine	Kelanitissa

Fig 8.9 ▲ Structure of a hydropower station

Fig 8.10 ▲ A wind power plant

For your Extra Knowledge

Mr. D.J. Wimalasurendra was the first to find that it was possible to generate hydropower in Sri Lanka. One of the hydro power station in Sri Lanka was named by his name.

Fig 8.11 ▶ Mr. D.J. Wimalasurendra

Some countries in the world use nuclear power, solar power and sea waves to generate electricity.

Electric cells

Activity 8.4

Let's make a simple cell.

You will need :- copper and zinc sheets, dilute sulphuric acid (battery acid), several pieces of wire, a beaker, a bulb or a small electric motor

Method :-

- Prepare the set up as shown in the figure with the help of your teacher.
- What can you see happening immediately after fixing the bulb to the circuit ? Record your obsevations.

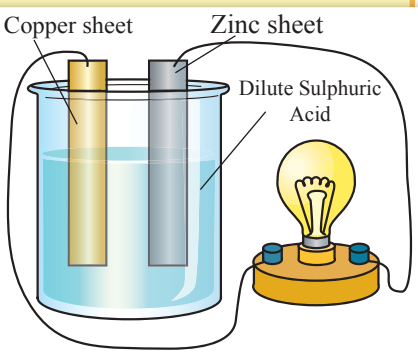


Fig. 8.12 ▲ A simple cell

- Discuss the weaknesses of the simple cell in the classroom.

The above set up demonstrates a simple cell. Here, the bulb lights up. But after sometime the brightness of the bulb decreases.

To overcome the weaknesses of the simple cell various types of cells were invented.

1 Chemical Cells

There are two types of chemical cells.

a. Primary cells

b. Secondary cells

Fig. 8.13

a. Primary cells

Chemical in these cells are exhausted in use and after a certain period of time, they become inactive. This type of cells cannot be recharged. The simple cell used in activity 8.4 belongs to this type.

Eg:- dry cells, wrist watch batteries, certain camera batteries

b. Secondary cells

Chemical of these cells too get exhausted and become inactive after a certain period of time. They can be recharged by supplying electricity to them. So, we can use them for a longer period.

Eg:- car batteries (lead acid accumulator), mobile phone batteries, certain torch batteries

Fig. 8.14 ▲ Lead-Acid accumulator

Fig. 8.15 ▲ Mobile phone & Torch batteries

For your Extra Knowledge

Volt (V) is the unit used to measure electricity. The domestic current is about 230 V and the voltage of a dry cell is 1.5 V.

2. Solar cells

When sunlight falls on solar cells, electricity is generated. Large solar panels are made out of a collection of small solar cells.

Fig. 8.16 ▲ A solar panel

For your Extra Knowledge

The improper disposal of lead-acid accumulators and other rechargeable cells is harmful to the environment. It is very important to recycle them and dispose them correctly.

8.3 Preparation of Circuits

Let's connect an electric appliance to an electric cell with conductive wires.

Activity 8.5

You will need :- Two dry cells, several pieces of wire, a switch, a torch bulb

Method :-

- First draw a rough sketch of each of the above materials.
- Prepare a suitable circuit with the above objects to light up the bulb.
- Then draw the circuit in your book.
- Can you explain why does the bulb light up?

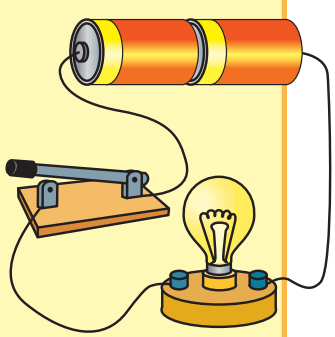


Fig. 8.17

When we switch on the circuit, an electric current flows through conductive wires that lights up the torch bulb.

A system which allows to flow an electric current through it, is known as an electric circuit.

How long did you take to draw the sketch in activity 8.5 ?

Find out an easy way to draw this circuit by discussing with your friends.

The accessories you used to prepare the circuit are known as electrical appliances. Apart from them, there are various other appliances used in different types of circuits.

Fig. 8.18 shows some different types of electric appliances used in electric circuits.

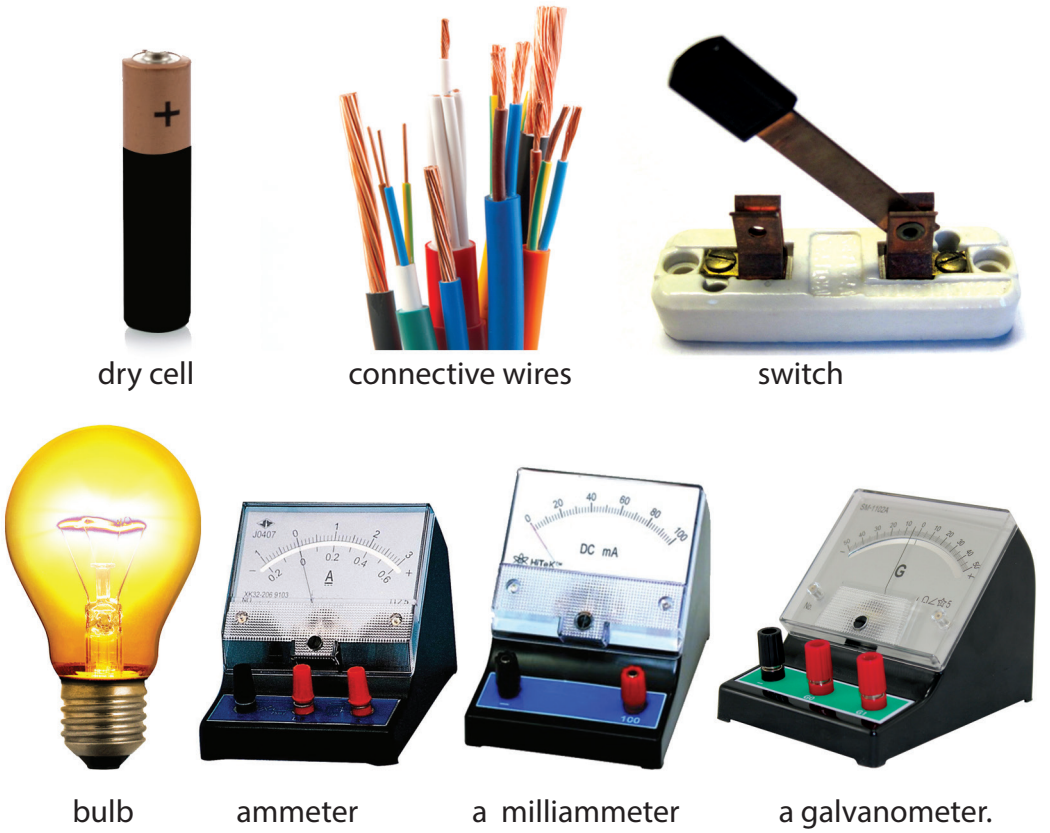


Fig. 8.18 ▲ Different type of electric appliances

Using symbols for electric appliances in circuits

Let's pay our attention to activity 8.5 again.You must have taken a lot of time to draw this circuit in your book. To overcome this problem, we can use standard symbols for electric appliances.

Table 8.2 shows some of the common standard symbols used to draw electric circuits.

Appliance	Use	Symbol
Wire	To conduct electricity	
Switch	To brake the connection when necessary	
Bulb	To get light/to identify the presence of electricity	
ammeter/ milliammeter	To measure the current	A
Galvanometer	To identify a small flow of current	G
Electric cells	To supply electricity	+ -

Table 8.2 ▲ Electric appliances and their standard symbols

You can draw the same circuit in activity 8.5 as below, by using the standard symbols.

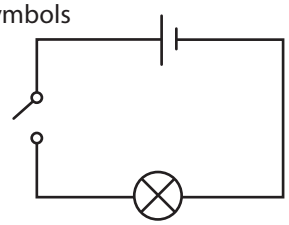


Fig. 8.19

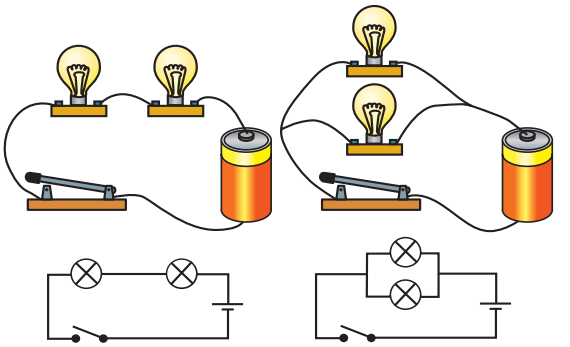
Activity 8.6

You will need :- A dry cell, connective wires, a switch and two similar bulbs

Method :-

- Prepare circuits in different ways to light up the two bulbs at the same time. Draw each circuit using the standard symbols.
- Check the brightness of bulbs at each time.
- Was the brightness of the bulbs similar at each time?

Check whether the circuits you made in activity 8.6 were as the diagram 8.20



8.20 ▲ Diagram

The terminals of cells and batteries are named as positive (+) and negative (-). A current always flows from the positive terminal to the negative terminal. When fixing an ammeter to a circuit, the positive terminal of the ammeter should be fixed to the positive terminal of the battery / cell.

Activity 8.7

Identify the symbols in the circuit. Find the neccessary appliances and construct the given circuit. Draw the way that you can see the circuit in your book. Record two observations that you can see when the switch is on.

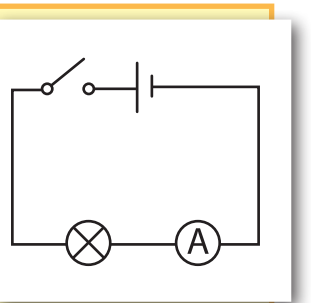


Fig 8.21

For your Extra Knowledge

Ammeter shows the amount of current that flows through the circuit. Ampere is the unit used to measure the amount of current. To get an accurate measurement, you have to connect the positive and negative terminals of the ammeter or milliammeter correctly.

8.4 Conductors and Insulators

Activity 8.8

You will need :- a dry cell, a small bulb, a milliammeter, several pieces of wire.

Method :-

- Prepare the circuit as shown in the figure.
- Then connect the materials given in the below table between the terminals A and B.
- Check whether the bulb lights up.
- Tabulate your observations.
- Remember to clean the materials before use.

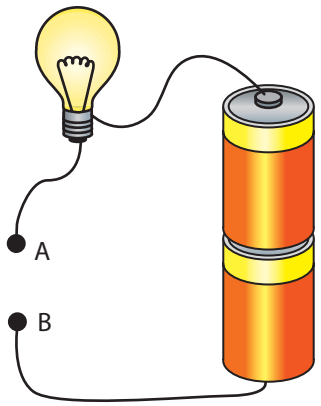


Fig 8.22

Material	Bulb lights up /does not light up
Outer casing of the wire	
Wire in the core of the wire	
A coin	
Dry papers	
Shiny wrapping of a slab of chocolate	
Carbon rod of a dry cell	
Dry wooden logs	
Rod of a pencil	
Plastic	
Polythene	

You can divide the materials in activity 8.8 into two categories.

- **Materials which carry electricity**
- **Materials which do not carry electricity**

Assignment 8.3

Divide the materials in the table of activity 8.8 into two categories as above.

- **Materials that conduct electricity, are known as conductors.**
- **Materials that do not conduct electricity, are known as insulators.**

Aluminum, silver and copper are some examples for good conductors. Ceramic, mica, ebonite, glass, plastic and rubber are some good insulators.

For your Extra Knowledge

Mercury which is a metal in liquid, is a good conductor. Salt water, lime juice are also conductive liquids. But electricity does not flow through kerosene oil and petrol. As there is salt mixed in drinking water, electricity conducts slightly through water.

8.5 Electronic appliances

Have you ever seen the interior of a computer, a radio or a DVD player ? Figure 8.23 shows an internal view of a such appliance.

These are called electronic circuits. Can you identify the things inside it ?

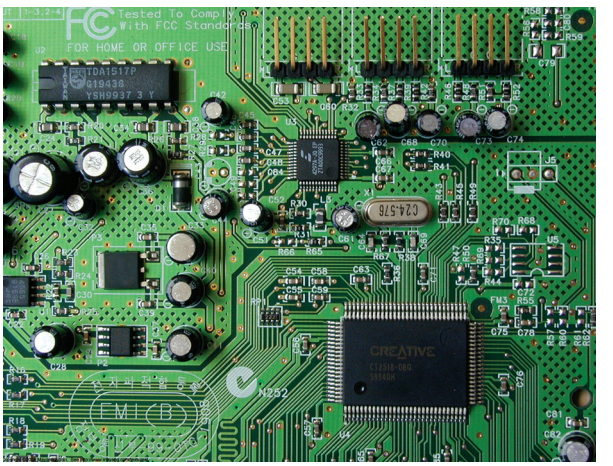


Fig 8.23

Activity 8.9

Find some discarded circuit parts of a radio, CD player and circuits of decorative bulbs. Find and list the appliances in them in groups.

The accessories used in electronic circuits are called electronic appliances.

Now let's learn about some electronic appliances that are used in day to day life.

01. Diode

Let's do the following activity to learn about diodes.

Activity 8.10

You will need :a rectifying diode, a small bulb, a dry cell, some pieces of wire

- Make the circuit as shown in the figure. Observe the illumination of the bulb by changing the terminals A, B of the diode.
- What is your conclusion?

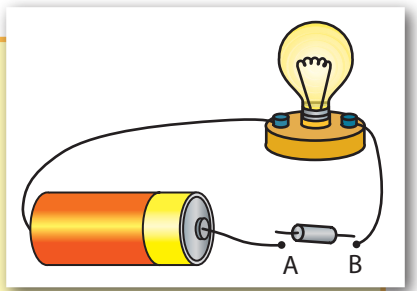


Fig 8.24

You will observe that the bulb lights up only when the diode is kept in a specific way. Accordingly, we can say that the current flows through a diode only in a particular direction.

There are various types of diodes available in the market. Rectifying diodes are the most commonly used type. Given below is the outer appearance of a rectifying diode.

The main function of a diode is to let the current flow in one direction only.

In a diode, the current flows from the positive terminal of the diode to the negative terminal. Therefore, a diode's positive terminal must be connected to the positive terminal of the dry cell and the negative terminal to the negative terminal of the dry cell.


Fig. 8.25 ▲ Rectifying diodes

The standard symbol of the diode 

Activity 8.11

You will need :- Two dry cells, two torch bulbs, pieces of wire, a switch, two rectifying diodes.

- Prepare the circuit as in Fig. 8.26.
- Do the activity by changing the terminals of the battery. Record your observations. Discuss the reasons with your friends.

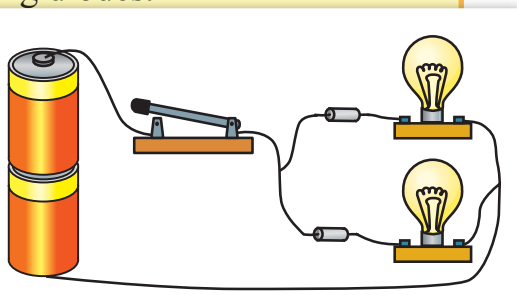


Fig. 8.26

Assignment 8.4

Draw the circuit in Fig. 8.26 in Activity 8.12 using the standard symbols.

2. Light emitting diode

You may have seen a small bulb lighting up in radios, televisions etc, when they are switched on. They are not really bulbs. They are called light emitting diodes(LED).

Activity 8.12

You will need :- an LED, two dry cells, connective wires.

- Arrange the circuit as shown in the figure.
- Connect the LED between A and B.

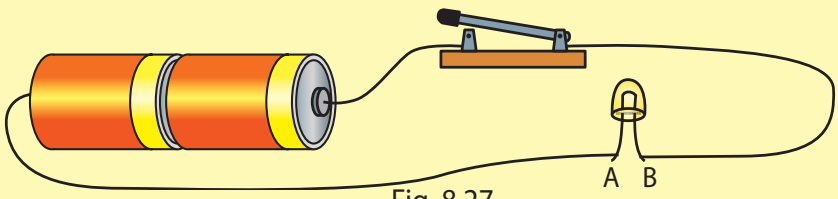


Fig. 8.27

- Repeat the activity by changing the terminals. Record your observations.
- Discuss the reasons with your friends.

You will observe that the LED illuminates only at one occasion. LED is also a type of a diode. It emits light when there is a small current passing through it. Therefore, it is named as light emitting diode.

Out of the two terminals of the diode one is longer than the other. The longer terminal is the positive terminal of the diode and the shorter one is the negative terminal. Fig. 8.28 shows some different shapes of LEDs.

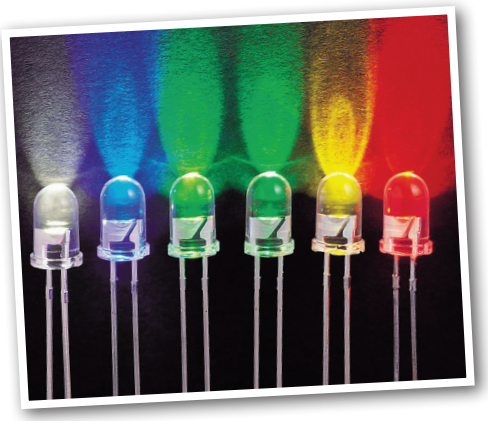
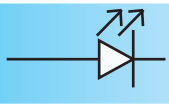


Fig. 8.28 ▲ Light emittng diodes

Standard symbol of LED 

3. Resistors

There is a loss of current when lengthy electric wires are used in circuits . That is because of the barrier to the flow of current in the conductor.

Let's do the activity 8.13 to observe how this can happen in a conductor.

Activity 8.13

You will need : Two dry cells, connective wires, a LED, three carbon rods taken from used dry cells, a switch

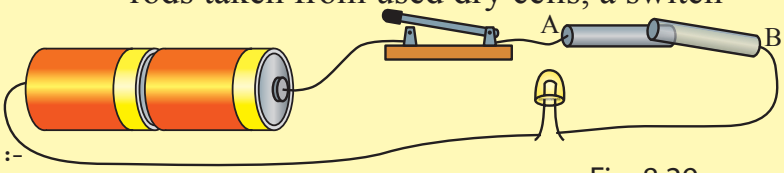


Fig. 8.29

Method :-

- Prepare the circuit as shown in the figure.
- First keep one carbon rod between A and B. Observe the brightness of the bulb. Then, increase the number of carbon rods and repeat the experiment.
- Discuss the reasons for your observations with your friends.

The barrier to the flow of current is named as electric resistance. The unit used to measure resistance is Ohm (Ω).

You can buy resistors of different values from the market.

Activity 8.14

You will need : two resistors of 10 Ω and 5 Ω, a torch bulb, two dry cells

Method :-

- Prepare the circuit as shown in the figure.
- Keep resistors one at a time between A and B and continue the experiment.
- Observe the brightness of the bulb.
- Discuss the reason for your observations.

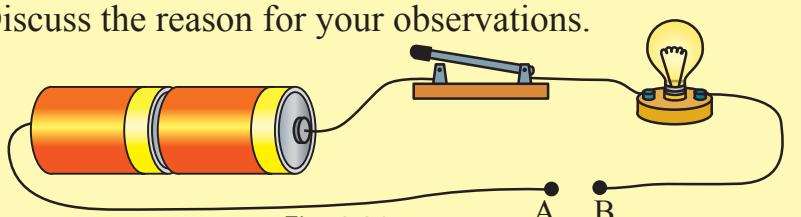


Fig. 8.30

You will understand that the flow of current decreases with the increase of resistance.

There are various types of resistors with different shapes in the market. Following are some of them.

- Permanent resistors - Value cannot be changed.
- Variable resistors - Value can be changed.
- Light sensitive resistors - Resistance depends on the amount of light falling on it.

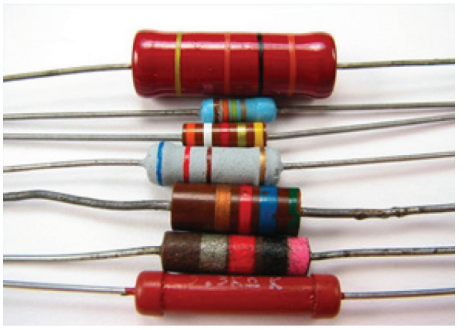


Fig. 8.31 ▲ Various types of resistors

The standard symbol of Resistors

For your Extra Knowledge

In the laboratory for different experiments, we need to change the current flowing through a circuit. Rheostat is a kind of variable resistor which helps to change the resistance.

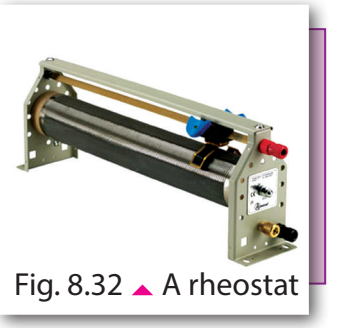


Fig. 8.32 ▲ A rheostat

4. Light Depending Resistors (LDR)

By doing the following activity, you can understand the function of an LDR.

Activity 8.15

You will need :- LDR, LED two dry cells, connective wires, a switch, a milliammeter

Method :-

- Prepare the circuit as shown in the figure.
- Switch it on.
- Expose the LDR to the sun light.
- Get the reading of the milliammeter.
- Then, cover the LDR with the hand and get the reading again.

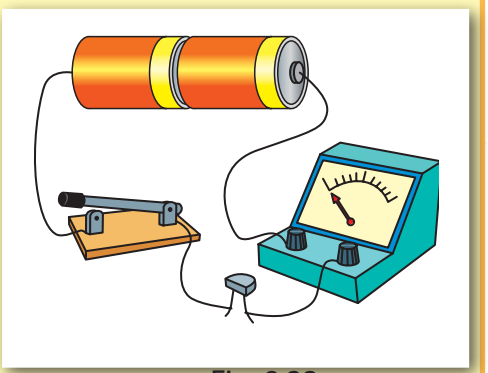


Fig. 8.33

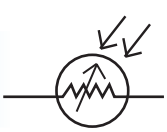
- Repeat the experiment by using an LED instead of the milliammeter.
- Conduct a discussion about the observations. It is necessary to fix the positive and negitive terminals of the LED correctly.

When light falls on LDR, a high current flows through the circuit. By shading the light, the flow of current through the circuit reduces gradually. Can you suggest the reason for this?

When the light falls on the LDR the resistance of it reduces, and when there is less light falling on the LDR the resistance increases.

Therefore, light depending resistors (LDR) are resistors, that change based on the amount of light falling on it.

The standard symbol of LDR



8.6 Conservation of Electricity and Prevention of Accidents

The consumption of electricity is increasing day by day. At present, the generated electricity is not sufficient. Therefore, there is an energy crisis in the world.

> The highest usage of electricity is from 7.00 p.m. to 9.00 p.m.

Conservation of electricity

It's time to use electricity economically. Here are some ways of conserving electricity.

1. Use efficient bulbs.

   The amount of current used in CFL and LED bulbs is even less than $1/5^{th}$ of the current used in normal bulbs. Also, their life span is ten times more than a normal bulb.

For your Extra Knowledge

There is mercury in many CFL bulbs and this can harm the environment when CFL bulbs are disposed.

Assignment 8.5

List out the ways of minimizing the amount of current used for bulbs in your home.

2. Switch off the appliances when they are not in use.

   Keeping televisions, Computers, telephone chargers in by stand mode is a waste of electricity.

3. Do not increase the sound of televisions and radios unnecessarily.

4 At present, there are televisions and computers with LCD and LED screens. They minimize the consumption of electricity.

5. At present, there are refrigerators which minimize the consumption of electricity.

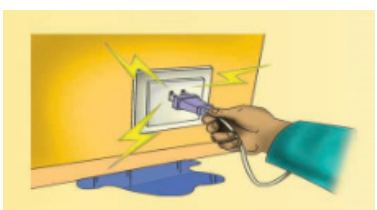
   We can save electricity according to the way we use the refrigerator at home.

   - Minimize the number of times you open the door of the refrigerator.
   - Cool the warm food items before putting them into the refrigerator.
   - Place the refrigerator in a place without light.
   - Keep a space between the wall and the refrigerator.
   - Avoid putting unnecessary things in the refrigerator.

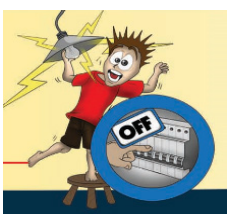
6. By ironing many clothes at once than ironing one at a time, we can minimize the wastage of electricity.

Prevention of accidents cause by electricity

Electricity is sometimes a good servant but sometimes a bad lord too. Careless use of electricity may cause damages to the property, serious accidents and sometimes even death.



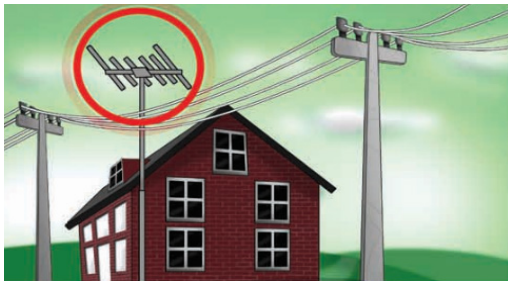
Do not use electrical circuits and appliances in places where there is water. Follow protective measures when necessary.



Disconnect the electricity supply of the circuit before any maintenance related to electric circuits.

Do not cut trees in a manner as to fall on current wires.

Do not fly kites or toy planes near current wires. Do not spray water towards current wires.

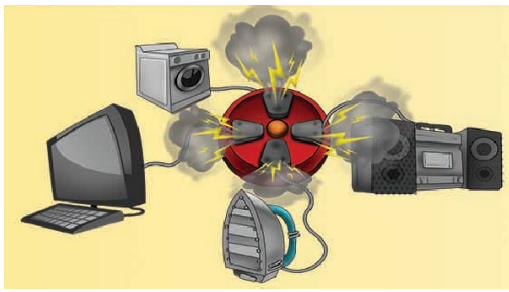


Do not fix antennas near current wires.

If ladders are used near electric wires use wooden ladders or ladders made up of non conductive materials.

If a broken current wire is found on the ground, do not touch it although it is insulating. Inform an adult immediately.

Without permission do not try to get electricity using common electric wires.



Do not plug several electric appliances to one socket.

Do not draw unprotected electric wires in your premises.

Apart from the above facts, we must pay attention to these facts as well.

- Keep electric wires and extension cords out of reach of childern.
- Do not let children to go near electric sockets.
- Un plug multi sockets when not in use.
- Do not let childern to use electric appliances without the inspection of an adult.
- Do not touch electric circuits & appliances with wet hand.
- When using electric irons or other appliances, wear rubber slippers or stand on a rubber door - mat.
- If you notice some unusual nature of an electric appliance or a circuit, call your electrcity service provider immediately.
- Disconnect the main switch in your house during flood.

Assignment 8.6

Prepare a booklet including the ways that accidents may occur due to electricity and how to prevent them.

Summary

- Electricity makes our day to day activities easier.
- At different occasions, we use different appliances to generate electricity.
- Electro chemical cells, solar cells and dynamo are some of the ways of generating electricity.
- A circuit is a system in which a current flows.
- Some of the simple components of electric circuits are bulbs, switches, ammeters, wires and dry cells.
- Materials that allow to flow current through them are called conductors and ones that do not allow to flow a current are known as insulators.

- There are many electronic appliances used in circuits too. Some of them and their uses are given below.
  - Diode – allows the current to flow only in one direction.
  - Light emitting diode – emits a light when a current flows through it.
  - Resistor - controls the current which flows through a circuit.
  - Light sensitive resistors – changes the resistance according to the amount of light.
- We can make small electronic circuits using electronic appliances.
- The careless use of electricity may cause serious accidents.
- It is our responsibility to use electricity efficiently and productively.

Exercises

01. Match the appropriate way of generating electricity with the things used for it.

Way of generation	Things used
Hydropower stations	chemicals
Coal power stations	sunlight
Dry cells	coal
Solar cells	flowing water

02. Draw a sketch of a wire and show how the conducting and insulating parts are placed.

03. Why is it not safe to touch electric equipment with wet hands?

Glossary

Electricity	- විදුලිය	- மின்னோட்டம்
Circuits	- පරිපථ	- மின்சுற்று
Symbols	- සංකේත	- குறியீடு
Insulators	- පරිවාරක	- காவலி
Conductors	- සන්නායක	- கடத்தி
Diode	- දියෝඩ	- இருவாயி
Light Emitting Diode	- ආලෝක විමෝචක දියෝඩ	- ஒளிகாலும் இருவாயி
Light Depending Resistor	- ආලෝක සංවේදී ප්‍රතිරෝධක	- ஒளியுணர்த்தடையி
Electronic Circuits	- ඉලෙක්ට්‍රෝනික පරිපථ	- இலத்திரனியல் சுற்று