Electric Current And Its Effects 15

IN THIS CHAPTER

- *What is current?*
- *Heating effect of electric current*
- *Electric fuse*
- *Magnetic effect of electric current*
- *Electromagnet*
- *Electric bell*

We cannot imagine life without electricity. We need it at homes, in offices, in industries, in fact, everywhere. For example, electricity is used at homes for lighting, operating fans and heating purposes. In industry, electricity is used to run different types of machines and in transport sector electricity is being used to run electric trains. A number of electrical appliances such as electric kettle, toaster, heater, air-conditioners, etc. Work because electricity flows through them. In this chapter, we will discuss about electric circuit and its heating and magnetic effect.

As the sun sets down in the evening, the street lights as well as the lights in our homes are put on. They dispel away the darkness and help people to keep on doing their work.

The budget session of the Parliament is on and people are keen to know the policies and plans of the government. The TV sets are everywhere and people can see and hear the Finance Minister giving details of his plans and policies to the Members of Parliament.

We all encounter many such situations in our day-to-day life. We are using electricity in all such and many other situations. It is electricity or the flow of electric current that runs our fans.

It is electricity that helps us watch the TV, listen to music, get cold water from the refrigerator, operate the washing machine, use mixers, toasters and grinders and announce our arrival by ringing up the doorbell. Electricity or flowing electric current is now a very important and integral part of our life.

Appliances that work on the heating effect of current

Electric Circuits

The electric current flows from its source (cell or battery) through conducting materials only. It is assumed that electric current starts from the positive pole of the cell or the battery. It then flows through different conducting materials and finally reaches the negative pole so as to complete an electrical circuit. Such a path taken by the electric current is called closed electric circuit. The various devices/wires, which are placed in between the positive and negative terminal of the cell or the battery are called elements of electric circuit.

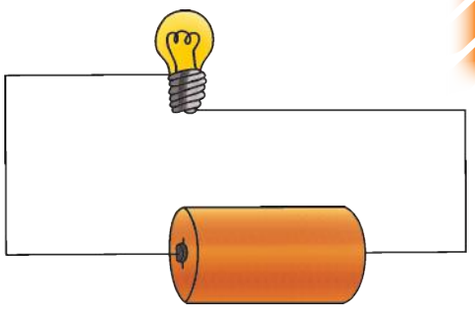


Fig. 14.2 : A simple electric circuit

We all have had the chance of using a torch. The bulb of the torch starts glowing when we press its switch on.

A switch is normally a part of the circuit. It is a device that allows us to complete or break the circuit. In other words, it enables us to switch ON or switch OFF the electric appliance. Electricity flows, through a circuit when it forms a complete loop, this happens when the switch is in the ON position.

For example, when you push the switch to ON position, electricity flows through the circuit and heats the filament of the bulb and so the bulb begins to glow. When you push the switch to OFF position, the circuit breaks and the bulb stops emitting light.

Activity Time

To check electric circuit.

Connect an electric cell or battery to a bulb using copper wires. The bulb light up because an electric current flows from the positive terminal of the cell, through the wires and the bulb, to the negative terminal of the cell.

A circuit diagram is drawn using standard symbols. To be able to read a circuit diagram, it is necessary to know these symbols. Some common symbols used in drawing electric circuits are illustrated below. Learn to recognize these symbols.

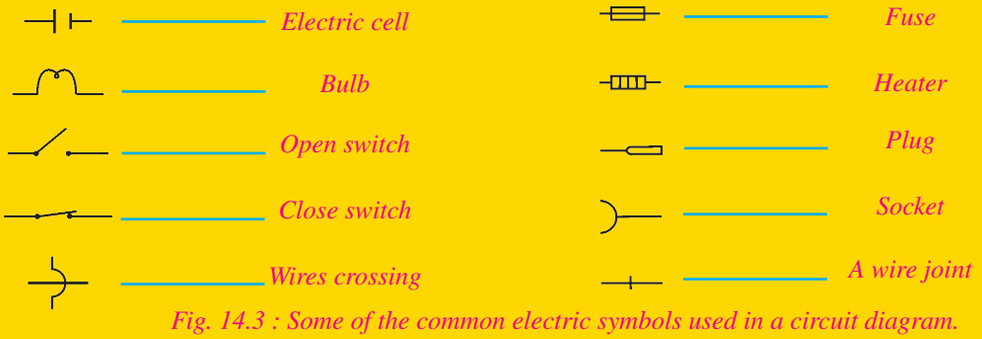


Fig. 14.3 : Some of the common electric symbols used in a circuit diagram.

Electric appliances such as the torch, transistor, walkman,TV remote and some toys work on electric cells. Many of these appliances use more than one electric cell. When more than one cell is

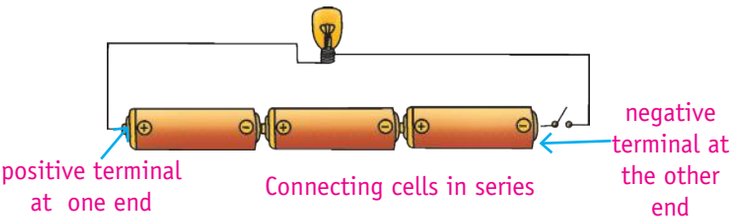
An electric cell

used in an electric circuit, they have to be connected in a proper manner, for electricity to flow through the circuit.

Electric cells can be connected in an electric circuit in two ways.

Connecting Cells in Series

Every cell has a positive and negative terminal. The terminals are clearly printed on each cell. When you connect cell in series, the negative terminal of one cell is connected to the positive terminal of the next cell. You can connect as many cells as you need as shown.



Connecting cells in series

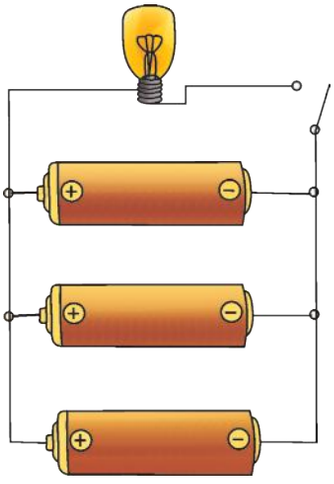
When you complete connecting cells in this manner, you will have a positive terminal at one end and a negative terminal at the other end.

Connecting Cells in Parallel

To connect cells in parallel, connect the negative terminals of all the cells. Similarly, connect the positive terminals of all the cells with the help of wires. You can connect as many cells as you need as shown. To hold the cells, you may use a battery holder.

To make simple circuits, you can arrange cells in series or parallel.

When you complete connecting cells in this manner, you will have positive terminal at one end and a negative terminal at the other end.

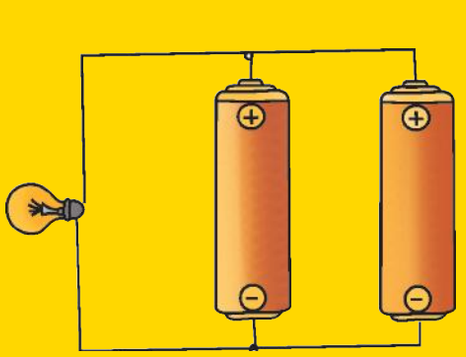

Connecting cells in parallel

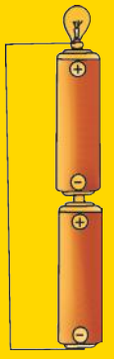
Activity Time

Making electric circuits.

You will need two small sized cells, a torch bulb, pieces of insulated wire and adhesive tape.

Expose the wires at both the ends of each piece. Complete the circuits turn by turn by connecting the cells and a bulb in series and parallel.


Parallel


Series

Heating Effects of Electric Current

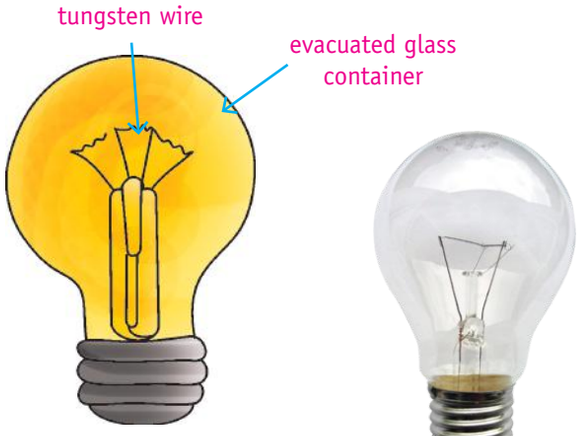
When an electric current flows through a conductor some of it gets converted into heat energy. Some appliances are specially designed for heating purpose such as heater, room heaters, press, geyser, toaster, kettle, oven etc.. In these appliances a heating filament is used. Which offers

a high resistance to the flow of current therefore, this filament gets heated up to a high temperature on passing an electric current that's why these appliances consume more electricity.

The amount of heat produced in a wire depends on its material, length and thickness. Thus for different requirements the wires of different materials and different lengths and thickness are used. Normally wires used for making electric circuits do not become very hot but element of some electric appliances become so hot that they are easily visible. The filament of an electric gets heated to such a high temperature that it starts glowing. That's why bulb consumes more electricity due to light and heating effect so we should use tube lights or C.F.L for lighting only so they save wastage of electricity.

What Makes a Bulb Glow?

A bulb consists of an evacuated glass container, with conducting supports to hold a coil of fine tungsten wire. Tungsten metal has a higher resistance and abnormally high melting point. When an electric current passes through the filament, due to its high resistance, it heats up quickly to about 2500^{0}C. At this temperature, the tungsten filament begins to glow and emits light.

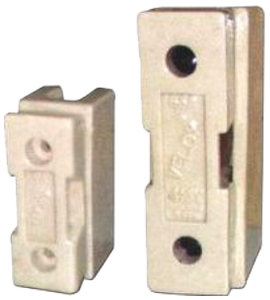


Electric bulb

ELECTRIC FUSE

The heating effect of current is also used in electric fuse which is a safety device to prevent damage in an electric appliance if suddenly a very high current passes through. It is made up of an alloy which has very low melting point the heat produced due to the high current or any fault melts the fuse wire and breaks the circuit. This fuse is used to prevent damages to electrical circuits and possible fires.


Fuse


Electric Fuse

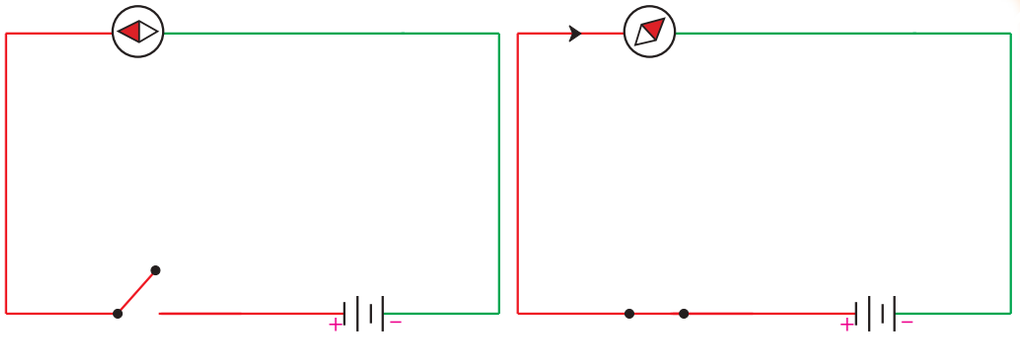
MCB

These days miniature circuit breaker (MCB) is used in place of fuses. It is a switch that automatically switches off a circuit if the current in it exceeds the specified maximum limit when we turn them 'on' then circuit is once again complete.

Magnetic Effects of Electric Current

Take a cardboard and wrap an electric wire a few times around the cardboard. Now place a compass needle inside it. Now connect the compass needle with a battery and switch with the help of wire. When the current is switched on then needle deflects when the current is switched off the needle comes back to its original position (N-S direction). If we reverse the direction of current by changing

the connections, the magnetic needle will get deflected in the opposite direction. On increasing the current deflection will be more in needle.



Magnetic effect of current

We know that a compass needle is deflected only by a magnet but in this experiment compass needle is defected therefore the experiment shows that a current wire acts as a magnet.

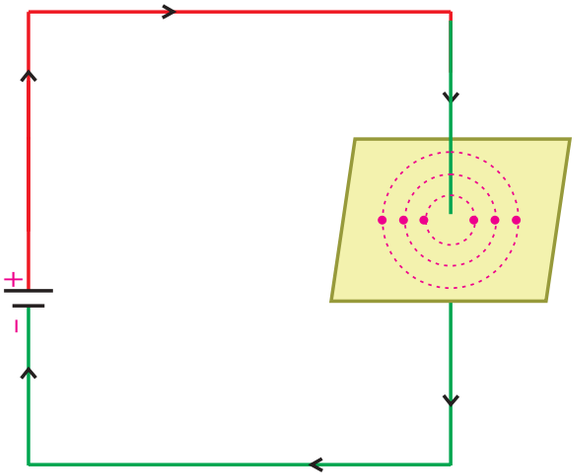
This experiment was first performed by (Hanschristian Ocrsted) in 1820 to show the magnetic effect of current. He concluded that a wire carrying an electric current possesses a magnetic field around it. The strength of the magnetic field depends on the strength of the current.

Magnetic Field due to Current in a Straight Conductor

It can be seen by the following experiment.

Take a smooth piece of cardboard. Hold it horizontal and pass an electric wire through its center so that wire may be vertical, sprinkle fine iron fillings uniformly on the cardboard. Now connect the wire to the two ends of a battery so that the current passes through the wire.

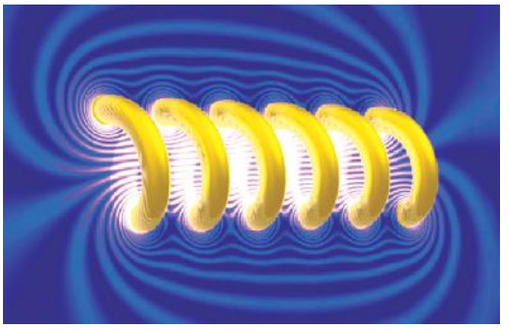
Tap the cardboard gently. The iron fillings arrange themselves in concentric circles with their center lying on the wire showing the magnetic lines of force around the wire.



Magnetic field

ELECTRO MAGNET

A magnet consisting of a coil of insulated wire around a piece of a magnetic substance such as soft iron which acts as a magnet only as long as the current is following in the wire is called an electro magnet. The magnetic material around which the coil is wound is called the core. The core increases the magnetic effect of the solenoid several times.



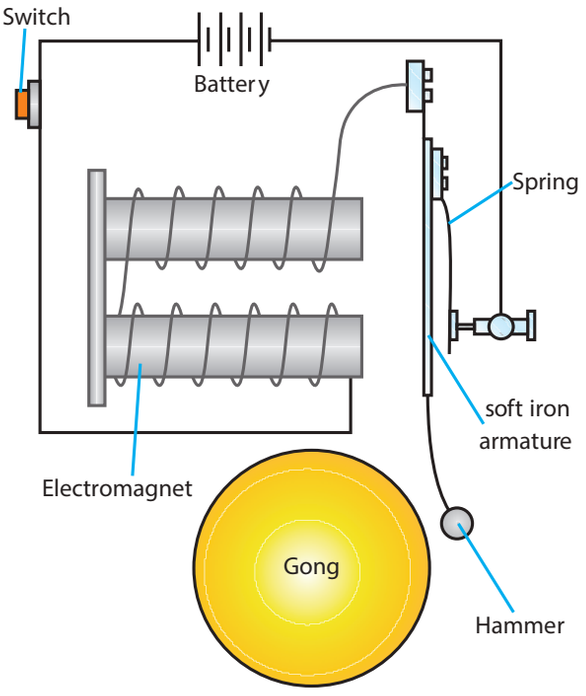
An electromagnet

Make a solenoid by winding closely 30-40 turns of an insulated copper wire around a cylindrical object like a gum tube connect the two ends of wire with a battery. Now switch on and place some pins on or near it because it now acts as electromagnet. When the electric current is switched off the coil loses its magnetism.

ELECTRIC BELL

It consists of an electromagnet an armature a contact adjusting screw, a gong and a hammer the armature consists of a soft iron rod mounted on a spring. One end of the iron rod presses against the top of the contact adjusting screw.

When the switch is pressed current flows in the electromagnet. It then attracts the iron rod towards itself causing the hammer to strike the gong at the screw and the current is switched off. This cause the electromagnet to close the circuit once again. Current flows once again and the cycle repeats itself till the current is switched off.



An electric bell

Uses of Electromagnets

- In electric bells and buzzers.
- In electric motors such as in fans, washing machines, refrigerators etc.
- To seprate magnetic material from the junk.
- Doctors use tiny electromagnets to take small pieces of magnetic material that have accidentally fallen in the eye.
- In cranes for lifting heavy iron pieces.

Know the Keywords :

Electric current : The rate of flow charge.
Electric circuit : The path along which electric current flows.
Resistance : A component that reduces the flow of current.
Filament : Very thin wire in a light bulb.
Electromagnet : An electric wire coiled around a metal.
Electric fuse : The weakest part in an electric circuit which results in melting and hence breaks an electric circuit in use.

Point to Remember

- The various device/wires, which are placed in between the positive and negative terminal of the cell or the battery are called elements of electric circuit.
- A bulb consists of an evacuated glass container, with conducting supports to hold a coil of fine tungsten wire.
- A magnet consisting of a coil of insulated wire around a piece of a magnetic substance such as soft iron which acts as a magnet only as long as the current is following in the wire is called an electro magnet.

EXERCISE TIME

A. Answer the following questions :

1. What is an electrical circuit ? Draw diagram of it.
2. What is resistor?
3. Explain the heating effect of the electrical current ?
4. What is the use of electric fuse ?
5. What is a MCB ?
6. What is meant by magnetic effect of current ?
7. What is electromagnet and what are its uses ?
8. Explain the working of a simple electric bell.

B. Fill in the blanks :

1. The electric fuse uses the _____ effect of electric current.
2. The combination of two or more cells is called a _____.
3. An _____ wire carrying current produces magnetic lines of force which are concentric circles.
4. An _____ behaves as magnet only when an electric current passes through it.
5. _____ automatically turn off when circuit exceeds the safe limit.
6. An electric bell has an _____.

C. Match the following :

Column A	Column B
1. 	(i) Socket
2. 	(ii) Plug
3. 	(iii) Fuse
4. 	(iv) Heater
5. 	(v) A wire joint

D. Tick (✓) the correct option :

1. To measure voltage we use :

(i) ammeter ◯ (ii) voltmeter ◯ (iii) circuit ◯

2. Filament of bulb made up of tungsten offers high :

(i) current ◯ (ii) circuit ◯ (iii) resistance ◯

3. These days mainiature circuit breaker (MCB) is used in place of :

(i) c.f.l ◯ (ii) current ◯ (iii) fuses ◯

4. A very thin wire coiled around a metal is called :

(i) resistance ◯ (ii) electric current ◯ (iii) filament ◯

5. An electric wire coiled around a metal is called :

(i) electric current ◯ (ii) fuse ◯ (iii) electromagnet ◯

Creative Work

- **Make an alarm clock in your class with the help of teacher. Draw a circuit diagram for it in the space provided below.**

- **Making a Toy Electromagnet.**

You will need two cells of 1.5 volts,2m thin insulated wire, a long iron nail or a bolt, strong thread, two wooden rulers, a small empty box, a spoon, a paper clip, a pencil, an adhesive tape, two small nut bolts. Place the cells side by side and do the necessary connections. Complete the circuit of an electromagnet as discussed in the lesson. Assemble the circuit in a box.