

09

INVESTIGATING ELECTRICITY AND MAGNETISM

In this chapter, we will learn about:

- Conductors and insulators
- Simple circuit
- Switches
- Magnets
- Magnetic and non-magnetic materials



Everyone is familiar with the word 'electricity'. It is used to light up our bulbs, tubes and energy savers. It also provides power to refrigerator, washing machine, computer and TV at our homes. You also like to play with magnets. To ancient people magnets were a magic. Today magnets are widely used in our household appliances such as fans and refrigerators. In higher classes we shall learn that electricity and magnetism have close relationship with each other.

SIMPLE CIRCUIT

To make use of electricity we have to set up an arrangement through which current can pass. This arrangement is called an electric circuit.

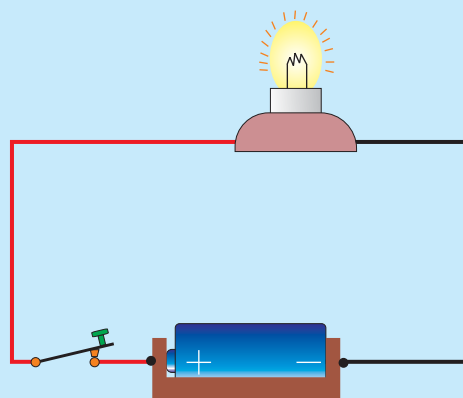
Thus an electric circuit is a closed path through which an electric current can flow. Electric current flows through the things such as bulb or a fan to make them work.



Activity 9.1

1. Take a torch bulb fitted in a holder and a dry cell placed in cell box.
2. Connect both terminals of the cell with the bulb using wires and a switch as shown in Figure.

Observe the bulb. What happens to the bulb and why?



We have designed a simple circuit in the above activity.

OPEN AND CLOSED CIRCUIT

In activity 9.1, if any one end of the wire is detached from its terminal the bulb will stop glowing (Figure 9.1). It is because the path of the current is broken.

A complete path is called as closed circuit and an incomplete or broken path is called an open circuit.

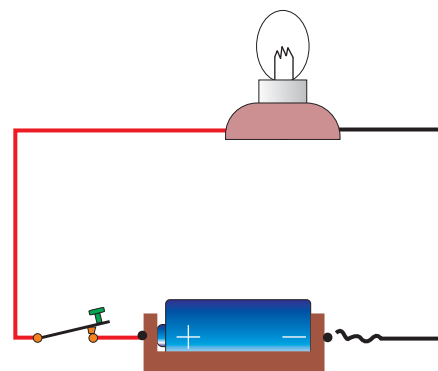


Figure 9.1: An open circuit

USE OF SWITCH

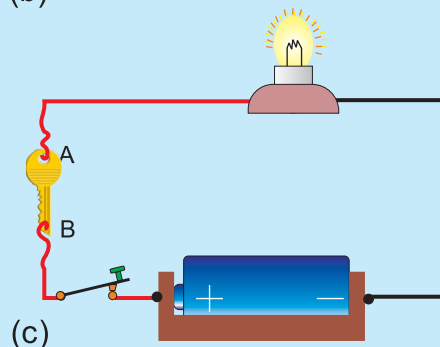
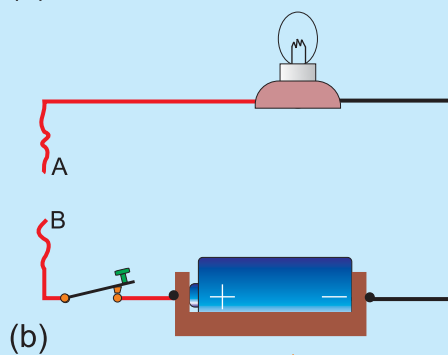
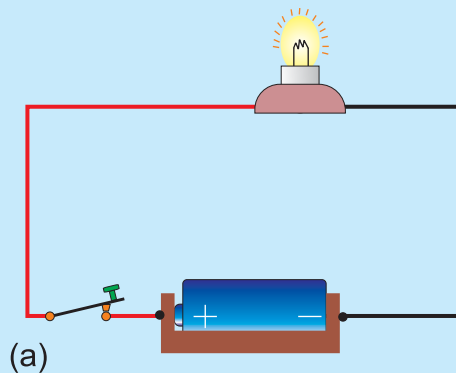
To open and close the path of current easily and safely, we use a switch. These are the switches which make it possible for us to OFF and ON our household electrical appliances safely.



Activity 9.2

- Take some material objects such as a key, a plastic comb, an iron piece, a glass strip or a wooden strip.
- Make a circuit as in activity 9.1. The bulb glows on turning the switch ON. This shows that current is flowing through all parts of the circuit (Figure a).
- Switch OFF the bulb and cut the wire as shown in Figure b.
- Connect free ends A and B of the wire with the above collected objects one by one and observe the bulb (Figure c).

The materials through which current can flow make the bulb glow. The materials through which current cannot flow do not make the bulb glow.



CONDUCTORS AND INSULATORS

We can see in the above activity that in a closed circuit current passes through a certain type of material while through some other type of material it cannot pass.

The materials which allow current to pass through them are called conductors and the materials which do not allow current to pass through them are called insulators.

Metallic objects are usually conductors and materials like plastic, dry wood, glass and rubber are insulators.

MAGNETS

Surely, you have seen or played with a magnet. It is a piece of material which can attract iron objects like nails, clips and common pins. Some stones also attract iron pieces. These stones are natural magnets. They are called loadstones (Figure 9.2). Magnets can also be made artificially by magnetizing a piece of steel.



Figure 9.2 Loadstone

MAGNETIC AND NON-MAGNETIC MATERIALS

We know that a magnet pulls some objects. Does a magnet pull objects made up of all kinds of materials?

Let us perform an activity to distinguish the objects which are either pulled by the magnet or not.

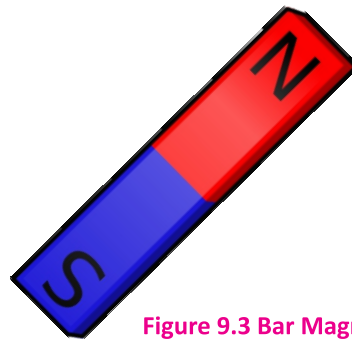


Figure 9.3 Bar Magnet



Activity 9.3

- Collect some light objects made of different materials such as common pins, clips, a coin, a pencil, a plastic comb, a copper wire, a piece of rubber
- Place these objects on a table.
- Bring one end of a strong bar magnet near these objects one by one and observe if the magnet attracts them or not.
- Divide the objects into two groups: one group of those objects which are attracted by the magnet and the other of those ones which are not attracted by the magnet.

Those materials which are attracted by the magnet are called magnetic materials. The other materials are non-magnetic materials.

The iron, nickel and cobalt are the magnetic materials. Copper, plastic and rubber are non- magnetic materials.

? Do you know?

Over 2000 years ago, the Greeks found Loadstones. The Chinese found that a dish carrying a piece of loadstone would float in water such that the loadstone always settled in a North South direction.

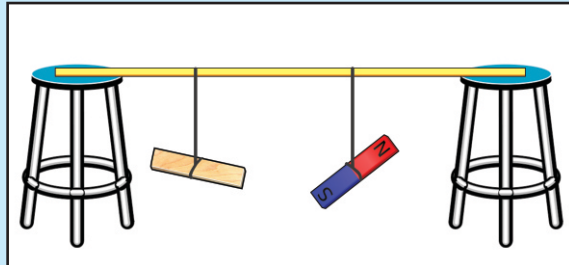
PROPERTIES OF A MAGNET

A magnet has some more properties other than attracting iron objects. Let us perform an activity to explore its properties.



Activity 9.4

- Take a wooden rod and a bar magnet similar in size and shape to each other.
- Suspend them with the help of thread loops to a metre rule whose ends are placed on two tables as shown in Figure.
- Disturb both the wooden rod and bar magnet so that they rotate freely.
- Observe in which direction does the wooden rod come to stop?
- Observe in which direction does the bar magnet come to stop?
- Repeat the above activity several times with the wooden rod and the bar magnet.
- Do you find any difference in the behaviour of the wooden rod and the bar magnet?
- What conclusion would you draw from this activity?



POLES OF A MAGNET

The end of the bar magnet that is pointing towards north is called North Pole of the bar magnet, while the other end that is pointing towards south is called South Pole of the bar magnet. The North Pole is usually

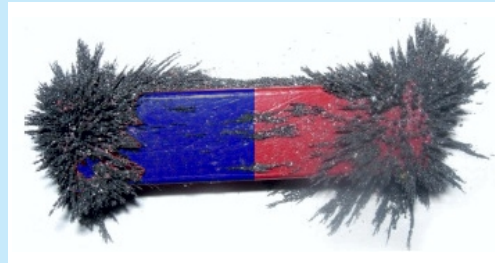
painted red while the South Pole is painted blue. The symbols N and S are engraved at the poles (Figure 9.3).

It is interesting to find where the magnetic force in a magnet is strongest. Let us perform an activity to demonstrate this property of a magnet.



Activity 9.5

- Place a bar magnet on a sheet of paper.
- Sprinkle iron filings all over the bar magnet and then lift it up.
- Now observe the magnet.
- Where are the most of the iron filings sticking?
- Where on the magnet the magnetic force is strongest?

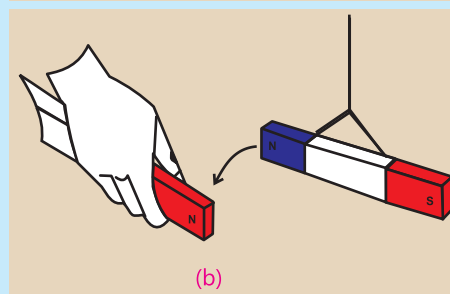
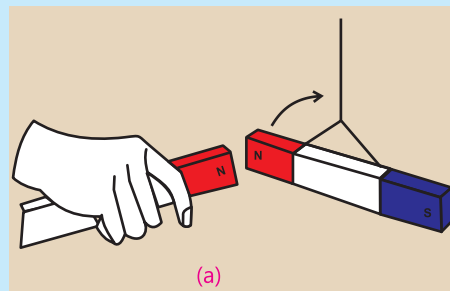


What happens when two bar magnets are brought near each other? Let us find this with the help of the following activity.



Activity 9.6

- Suspend a bar magnet with the help of thread loops as in Figure (a). It is free to rotate.
- Take another bar magnet and bring its N-pole near the N-pole of the suspended magnet (Figure a).
- What happens to the suspended magnet?
- Now bring the N-pole of the magnet near the S-pole of the suspended magnet (Figure b).
- What happens to the suspended magnet now?
- What are your findings?



Like poles repel each other and unlike poles attract each other.

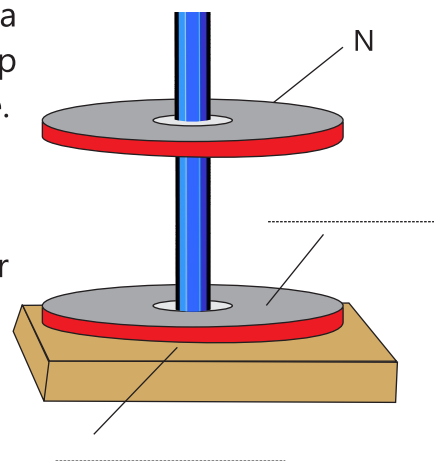
SCIENCE PROJECT

Design an experiment to demonstrate that like poles repel each other and unlike poles attract each other.

CHALLENGE

Two ring magnets are placed on a wooden stand. The upper magnet rises up and is suspended in air as shown in the figure.

- (i) Why does the upper magnet float in the air?
- (ii) Label the N and S-poles of lower magnet.
- (iii) Can you suggest a use for such an arrangement of magnets?



KEY POINTS

- When a bulb is connected to a battery with the help of wires such that a current flows through it, the arrangement is called a simple circuit.
- A switch is used to make or break an electric circuit.
- Electric current can pass through conductors but cannot pass through insulators.
- A magnet is a piece of metal which can attract objects made up of iron, nickel and cobalt.
- Materials can be classified into two groups: magnetic and non-magnetic materials.
- A freely suspended magnet always points in the north-south direction.
- The ends of a magnet are called its magnetic poles.
- Two like magnetic poles repel each other while two unlike poles attract each other.

GLOSSARY

Electric circuit:	The path of flow of current
Battery:	Source of electrical energy
Conductor:	Material through which current can pass
Insulator:	Material through which current cannot pass
Magnet:	A piece of metal which can attract objects made up of iron, nickel and cobalt
Magnetic materials:	Materials which are attracted by a magnet
Magnetic poles:	Opposite ends of a magnet

EXERCISE

9.1 Select correct answer from the following.

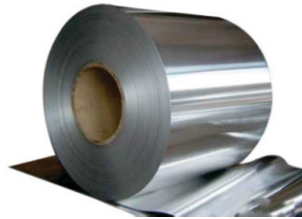
- (i) An electric circuit is the
- (a) collection of bulb and cell.
 - (b) collection of bulb and wires.
 - (c) collection of cell and wires.
 - (d) path of electric current.
- (ii) An electric circuit can be made open or closed by using a
- (a) cell
 - (b) bulb
 - (c) switch
 - (d) magnet
- (iii) Current cannot pass through
- (a) aluminum wire
 - (b) copper plate
 - (c) piece of iron
 - (d) piece of dry wood
- (vi) Which of the following is a magnetic material?
- (a) glass
 - (b) nickel
 - (c) plastic
 - (d) aluminum

- (v) The S-pole of a freely suspended magnet always points towards:
- (a) east (b) west
(c) north (d) south
- (vi) What is the effect on the bulb in a closed circuit when the copper wire is replaced by a plastic string?
- (a) the bulb becomes dim
(b) the bulb becomes brighter
(c) the bulb turns OFF
(d) no effect on the bulb
- (vii) What do thick lines represent in a circuit diagram?
- (a) battery (b) switches
(c) connecting wires (d) bulb
- (viii) Which one of the following materials is a conductor?
- (a) cork (b) plastic comb
(c) silver ring (d) glass rod
- (ix) Why are the connecting wires usually covered with plastic coating to?
- (a) make them look pretty
(b) make the flow of current easier
(c) make the electrical circuit safe
(d) prevent the wastage of current
- (x) The strength of the bar magnet is maximum:
- (a) at the poles
(b) at the centre
(c) between a pole and the centre
(d) all over the magnet
- (xi) Which of the following statements is true?
- (a) North pole attracts North pole.
(b) North pole repels South pole.
(c) North pole attracts South pole.
(d) South pole attracts South pole.

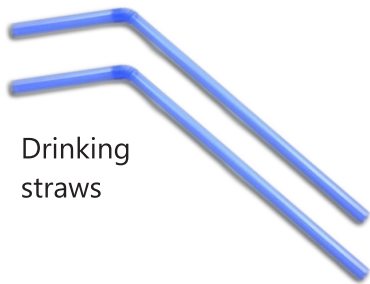
9.2 A girl wants to make a simple closed circuit. She has a bulb, a cell and a switch, but no connecting wires. Tick the objects, which she can use for this purpose.



String



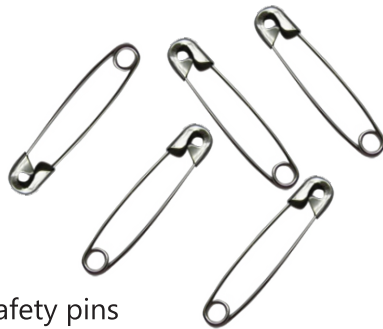
Aluminium foil



Drinking straws



Matchsticks



Safety pins



Scotch tape

9.3. Short Answers Question.

- (i) Name at least three objects that are magnetic materials.
- (ii) Write down three uses of magnets.

9.4. Name at least three materials that are conductors and three materials that are insulators.