MAGNETS

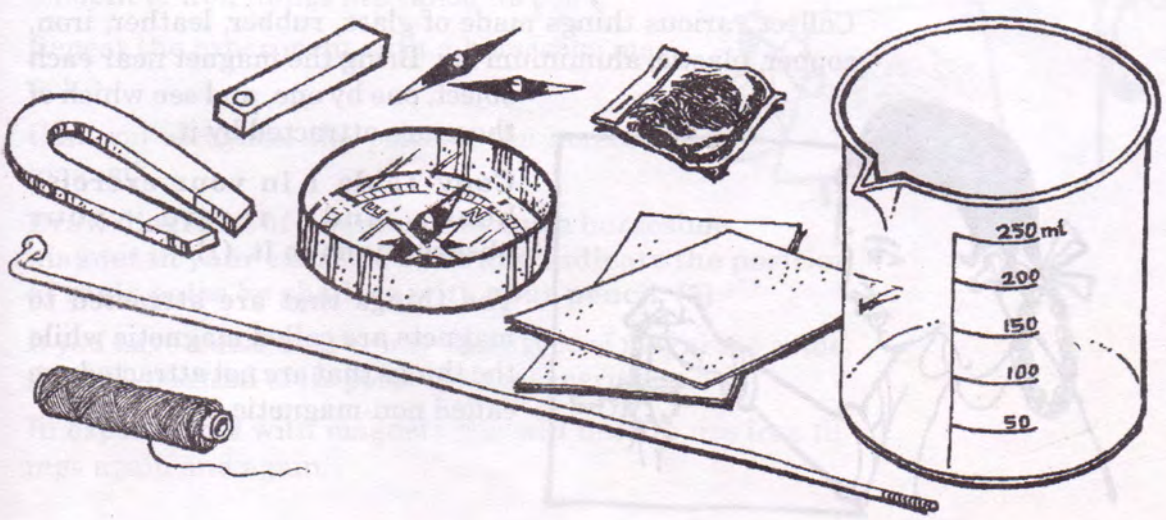
4

Isn't it fun to play with a magnet? It has the power to attract things, pulling them towards itself. In some parts of the world you can find a special kind of stone that has such magnetic properties. From very early times, people had noticed the magnetic properties of this stone.

In this chapter, we will do some experiments with magnets and try to understand their properties. We shall try to understand how a magnet shows us directions and also actually make a magnet ourselves.

There are many ways in which we use magnets. Many instruments and equipment we use depend on magnets, for example electric motors, fans, television, loudspeakers, telephones and radios.

What is so special about a magnet? Let us do some experiments to find out. Many scientists have done similar experiments.



Scientists usually keep a record of their observations in their notebooks. These records (of whatever they observed) are kept in the form of text as well as diagrams.

You should also keep a record of the experiments you do in your exercise book.

Before starting our experiments with magnets, let us read an interesting folk tale about the discovery of magnets.

Story of magnets

Around 2,500 years ago, there lived an old shepherd named Magnus. He used to take his goats and sheep to the hills for grazing.

He always carried a wooden stick which had an iron cap on its lower end. One day, while his goats were grazing, Magnus idly dipped his stick into a spring of water and poked at the pebbles and stones at the bottom with it.

Suddenly he felt something pulling his stick. When he took it out of water, he saw a stone stuck to the iron cap.

The stone which Magnus pulled out is called lodestone. It is a naturally occuring form of iron which has magnetic properties.

Attraction with magnets

Experiment 1

Let us find out what kind of things are attracted by a magnet.

Collect various things made of glass, rubber, leather, iron, copper, plastic, aluminium etc. Bring the magnet near each object, one by one, and see which of these are attracted by it.

Copy Table 1 in your exercise book and record your observations in it. (1)

The things that are attracted to magnets are called magnetic while the things that are not attracted are called non-magnetic.

TABLE 1

Things showing attraction to magnets	Things not showing attraction to magnets

TWO POLES OF A MAGNET

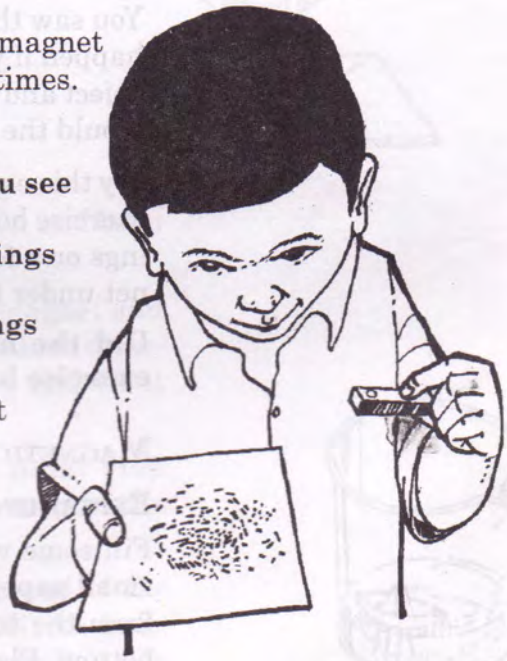
EXPERIMENT 2

Did you observe which part of the magnet things are attracted to most? Does every part of the magnet attract magnetic objects equally?

Do the following experiment to find the answer to this question.

Place some iron filings on a paper. Place a bar magnet horizontally in the filings and turn it over a few times.

Now lift the magnet.



What do you see? Make a drawing of what you see in your exercise book. (2)
Which part of the magnet has more iron filings sticking to it? (3)
Which part of the magnet has almost no filings sticking to it? (4)

The parts of the magnet that attract the largest amount of iron filings are called its poles.

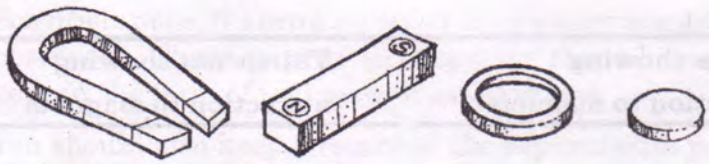
Repeat the experiment with a horseshoe magnet.

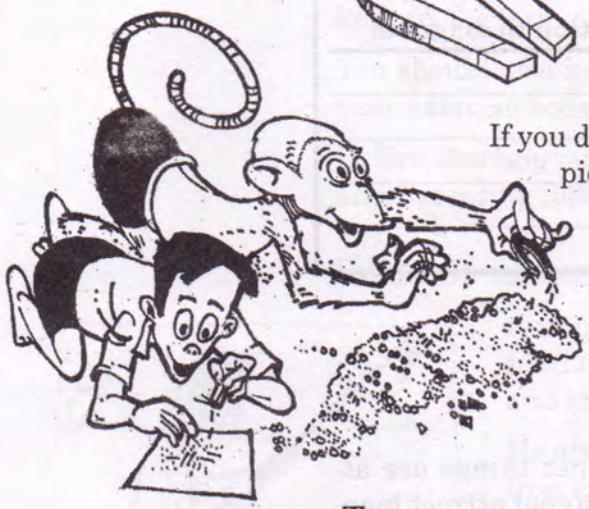
Can you recognise the poles of the horseshoe magnet?

Draw diagrams of a bar magnet and a horseshoe magnet in your exercise book and indicate the position of their poles by shading with your pencil. (5)

If you have a disc, ring or any other type of magnet at home, find the position of its poles by this experiment.

In experiments with magnets you will need to use iron filings again and again.





If you don't have iron filings, you can collect small pieces of iron and they will serve the purpose as well. You can do this by placing a magnet in a pile of sand and turning it around in the sand. The small pieces of iron present in the sand will stick to the magnet.

If you cannot find sand you can look for iron pieces in clayey soil as well.

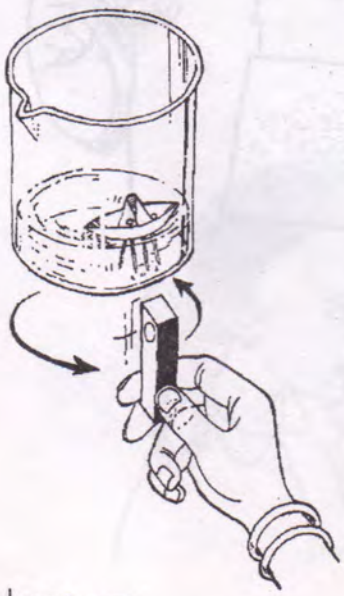
THROUGH WHICH OBJECTS DOES THE MAGNETIC EFFECT WORK?

EXPERIMENT 3

You saw that a magnet attracts several things. What would happen if you place something in between a magnet and an object and do not bring the magnet directly near the object? Would the object still feel the effect of the magnet?

Try this experiment with your exercise book first. Take your exercise book from your schoolbag and spread some iron filings or a few pins on its upper surface. Now hold the magnet under the lower surface of your exercise book.

Did the magnet attract the iron filings through the exercise book placed in between? (6)



MAGNETIC BOAT RACE

EXPERIMENT 4

Fill some water in the beaker provided in the kit. Make a small paper boat and insert a few pins in it. Insert the pins from the top of the boat so that they project out from the bottom. Place the boat in the water in the beaker and try to make it move forward by touching the magnet to the sides or the bottom of the beaker.

Does the magnet attract the pins through water? (7)
Describe this experiment in your own words. (8)

We have already discovered many properties of magnets. In the beginning of the chapter you had read that we can use magnets to find directions. How can a magnet tell us the direction? Let us find out.

Finding directions with a magnet

Experiment 5

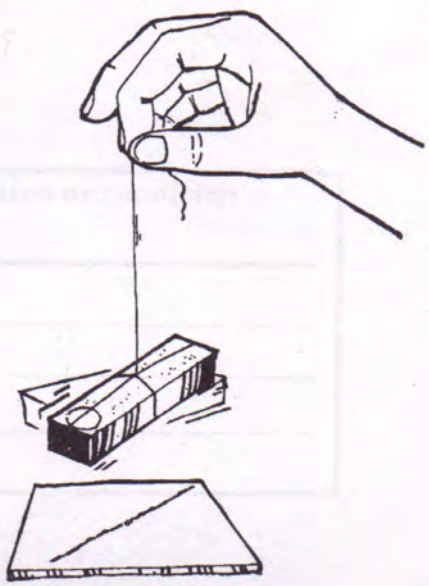
Stick a pin upside down in a cardboard sheet, with its sharp end pointing upwards. Take a magnetic needle from the kit. You have seen bar magnets and horseshoe magnets. A magnetic needle is also a kind of magnet.

Make a mark with a piece of chalk on one end of the magnetic needle and balance it on the top of the pin.

Turn the needle gently and wait for it to stop spinning.

In which direction does the marked end of the needle stop? Does this end stop in the same direction every time the needle is rotated? (9)

Draw a line on a sheet of cardboard or the table along the direction in which the needle stops (i.e. a line parallel to the needle). Remove the magnetic needle from the pin and keep it aside.



Now, tie a piece of thread to the centre of a bar magnet and suspend it over the line you have drawn. See in which direction the magnet stops. Turn the magnet gently and let it come to a stop again.

In which direction did the magnet stop this time? (10) Do the bar magnet and the magnetic needle stop in the same direction? (11)

This is roughly the north-south direction. The end of the magnet that points to the north is called the North Pole. The end that points to the south is called the South Pole. On every magnet there is a sign to indicate which is the north or south pole. What marking has been used on your magnet to indicate the poles? Has the magnetic needle also been marked to indicate its poles?

This property of magnets has been used for centuries to find directions. Around 800 years ago, the Chinese discovered that a suspended lodestone stops in a north-south direction.

The navigators of that country used to keep a piece of lodestone suspended in their boats and during a storm or mist, they used the lodestone to locate directions.

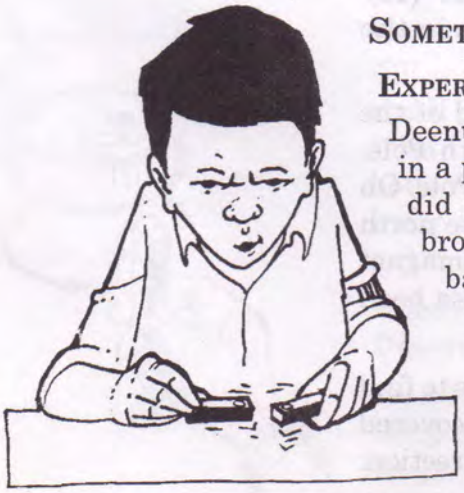
Magnetic compass

A compass is an instrument which is used to find directions. It is mostly used in ships and airplanes. As a rule, mountaineers also carry a compass with them so that they do not lose their way in unknown places.

The compass has a magnetic needle that can rotate easily. The marked end of the needle is the north pole of the magnet.

If you have taken part in scout camps you must have learnt how to use a compass.

Sometimes repulsion, sometimes attraction



Experiment 6

Deenu once tried to bring two magnets close to each other in a particular way. But it seemed that the magnets just did not want to face each other and when they were brought closer they turned their faces away . Take two bar magnets and find out if the same thing happens with you as well.

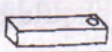
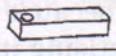
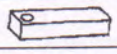
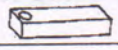
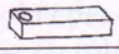
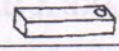
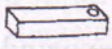
There are many ways of bringing two magnets close to each other. Table-2 indicates some of these ways. Copy this table in your exercise book.

Take two bar magnets and hold one in each hand. Bring them near each other in the different ways shown in the table. Note down in the table whatever you feel - attraction or repulsion.

When the north poles of two magnets face each other, we say that like poles are facing each other. When the north pole of one magnet faces the south pole of the other, we say that unlike poles are facing each other.

Is there always attraction between two magnets? (12)
Do two magnets sometimes push each other away as well? In other words, is there repulsion between them, too? (13)

TABLE 2

Bar magnet in the left hand	Bar magnet in the right hand	Attraction or repulsion
		
		
		
		

FILL IN THE BLANKS

There is attraction between magnets when their _____ poles face each other. (14)

There is repulsion between magnets when their _____ poles face each other. (15)

Have you ever seen a magnet repel a piece of iron? Magnets always attract iron objects. This blow hot - blow cold relationship of attraction and repulsion exists only between two magnets.

A PUZZLE

Which of the following would be attracted to both poles of a magnet:

the north pole of another magnet

the south pole of another magnet

a piece of iron

a spoon made of stainless steel. (16)

MAKE YOUR OWN MAGNET

EXPERIMENT 7

If you have a piece of iron which is not a magnet, you can turn it into a magnet through a simple technique.

Take the cycle spoke in the kit. Put it on a table or on the floor. Hold it to the table by pressing its bent end with your thumb, as shown in Figure 1. Place the north pole of a magnet near the bent end. Drag the magnet along the surface of the spoke from the bent end to the other end. Now lift the magnet and place it again on the bent end and drag it to the other end. Repeat this about 10-20 times.

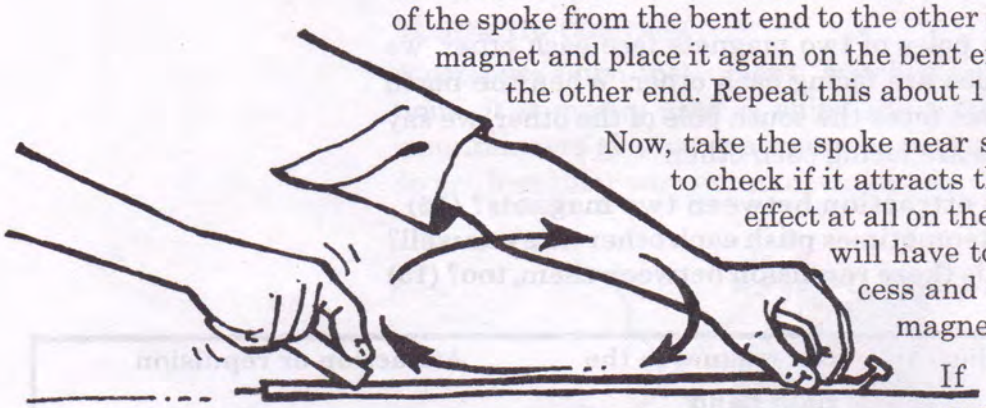


Figure 1

Now, take the spoke near some iron filings to check if it attracts them. If it has no effect at all on the iron filings, you will have to repeat the process and try once more to magnetise the spoke.

If the magnetic needle in your kit has stopped working because of disuse then you should have no problem in magnetising it again now.

Another way to make a magnet

Experiment 8

Take two bar magnets. Place the north pole of one and the south pole of the other together at the centre of a spoke. Now, drag these magnets along the surface of the spoke in opposite directions. (Rub the magnets on the spoke as shown in Figure 2)

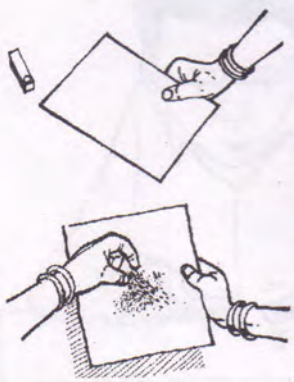
Figure 2

Repeat this process several times until the spoke becomes a magnet. Sprinkle iron filings near the spoke you have rubbed to find out whether it has become a magnet and locate its poles.

Magnetic patterns

Experiment 9

A magnet can create patterns. Let us see how. Place a bar magnet on the floor and put a sheet of cardboard over it. Sprinkle some fine iron filings on the cardboard around the spot where the magnet is. Now tap the board gently with your fingers.



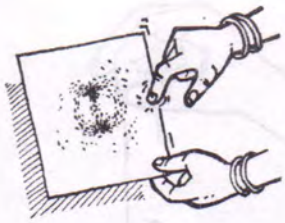
What happens? Do the iron filings occupy a particular shape? (17)

When the *toli* of Kamal, Seema, Gopal and Chandra tried this experiment, they found that the iron filings spread as shown in the figure.

Do you see a similar pattern of iron filings in your experi-

ment too?

Make a drawing of what you see. (18)



Let us have some more fun with magnets. Remove the cardboard sheet from on top of the magnet. Then once again spread the iron filings on the cardboard sheet. Now divide the class into two groups. One group should move a little distance away. Children from the other group should then place the magnet under the cardboard sheet in any position they like. When on tapping the cardboard sheet the iron filings take on a fixed new pattern, the other group should be called to look at the patterns. By looking at the pattern the second group must guess how the magnet is placed under the cardboard sheet and where its poles are.

Magnets are important because of the properties we have learnt about above. You must have seen stickers made with a magnet which people attach to steel cupboards or refrigerators.

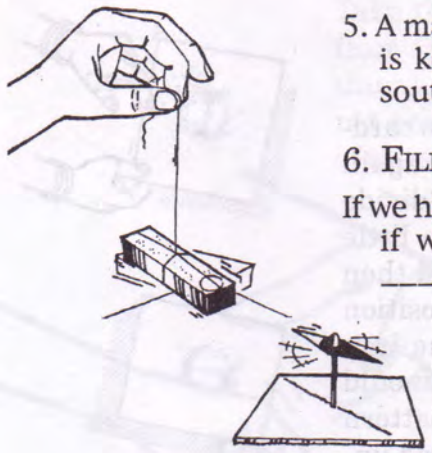
Shopkeepers selling steel utensils usually keep a magnet. Since stainless steel does not show any attraction to a magnet, they use the magnet to show that the utensil is made of stainless steel.

Later you will learn of another method to make magnets by using an electric current. You will also learn how to make an electric motor.

Make a list of properties of magnets that you learnt in this chapter. (19)

Questions for Revision

1. How can the position of the poles of a magnet be found?
2. Put a tick mark against the sentences which are correct :
   a. Magnetic objects are attracted more to the middle of a magnet.
   b. Magnetic objects are attracted more to the two ends of a magnet.
   c. Magnetic objects are attracted to all places of a magnetic equally.
3. How can a magnetic needle be used to find the east direction? Answer in your own words.
4. Gopal saw an interesting magic trick at a fair. There were three statues, one each of Rama, Sita and Ravana. When Ravana's statue was brought near Sita, she would turn away. However, when Rama's statue was brought near her, she would turn towards it. Explain what could be the science behind this magic.

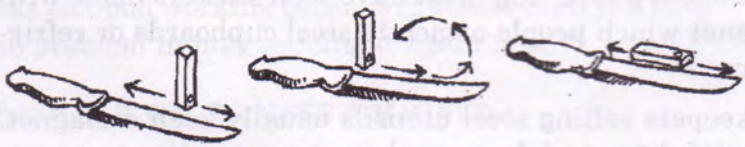


5. A magnet is suspended with a thread. A magnetic needle is kept close by. How can you identify the north and south poles on the needle.

6. FILL IN THE BLANKS :

If we have a magnet, we can use it to find directions because if we suspend it, one end will always point in the _____ direction while the other end will point in the _____ direction. With this information we can also find east and west because if we stand facing north, our right hand will point to the _____ and our left hand will indicate the _____.

7. Kala wants to magnetise a knife. How should she rub it with a magnet? Identify the correct method from among the following pictures :



8. A few iron-filing patterns are given below. Identify the patterns that could have been made by a magnet and indicate how and where the magnet is placed.

9. You are given two bars which look exactly alike. One of them is a magnet. Without using anything else, how would you find out which is the magnet?

NEW WORDS

magnetic	non-magnetic	compass
poles	attraction	repulsion