2

Playing with Magnets

All of you would have seen a pin holder in your school office (see Fig. 1 (a)). You may have seen that in this pin holder, some pins are attached to the top or cap.

Fig. 1(a)

• Why do the pins get attached to the cap of the pin holder?

• What could be there in that cap?

• Does it attract objects other than pins?

You might have seen some metal stickers stuck to the door of an iron almirah or a refrigerator (see Fig 1 (b)).

• What is there in those stickers which makes them stick to the iron doors?

• Do they stick to wooden doors or plastic doors too?

Activity-1: Finding objects that get stuck to the cap of the pin holder.

Take a pin holder from your school office. Drop some pins, jump-clips, iron nails into it. What do you observe? Do the same with a piece of paper, a pencil and an eraser. What do you observe?

You would notice that some of these objects (pins, jump-clips, nails) get stuck to the top of the pin holder while the other objects (paper, pencil, eraser) fall into the pin holder.

Why does this happen so?

The cap of the pin holder contains a **magnet** which attracts substances like iron pins, iron nails etc.

Similarly, the metal stickers also have a magnet at the back so that they can stick to iron doors.

• What material is needed for making magnets?

• How were these magnets discovered?

Let us try to find the answers to these questions.

Story of Magnet

Around 2500 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 dipped his stick

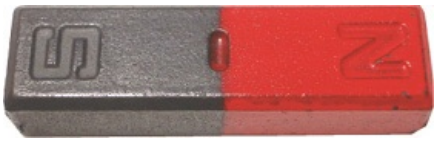
into a spring of water and poked at the pebbles and stones at the bottom with it. Suddenly he felt something pulling his stick. When he took it out of water, he saw a stone stuck to the iron cap. The stone which Magnus pulled out was called Lode stone. *It is a natural magnet and possesses the property of attracting iron.*

The magnets we discussed are not natural magnets. These magnets are man-made magnets.

Magnets of different shapes

The magnets we see and use in our daily life possess different shapes. Some of the usual shapes of magnets are shown in Fig. 2.

Ring Magnet



Bar Magnet

Disc Magnet

Horse Shoe Magnet

Fig. 2

Think: Can we make a magnet in a required shape?**Activity-2: Finding materials attracted by magnets.**

Take a bar magnet, nail, jump-clip, plastic scale, a piece of glass, key, paper, iron bolt, pen, blade, pencil, knife, stainless steel spoon, piece of chalk, wood and touch the magnet to each item. Does the magnet attract every object? Observe and record your observations duly mentioning the name of the material of which the object is made in table 1.

Table 1

Name of the object	**Material of which the object is made**	**Attracted By Magnet (Yes/No)**
Jump Clip	Iron	Yes
Scale	Plastic	No

• Which materials are attracted by a magnet?

• Which materials are not attracted by a magnet?

The materials that are attracted by magnets are called **magnetic materials**. The materials that are not attracted by magnets are called **non-magnetic materials**.

• Give your own examples for magnetic materials.

• Give your own examples for non-magnetic materials.

Magnets have the property of attracting materials like Iron. Based on this property of magnets they can be used to separate some mixtures.

Activity-3: Can we separate iron filings from soil?

Take a bar magnet and roll it in the soil in your school ground for some time. Pull out the magnet. What do you find? Does anything get attached to the magnet?

You may find some dark particles of soil sticking to the magnet.

Now gently remove these dark particles from the magnet and collect them in a sheet of

paper. These are iron filings.

(Keep these iron filings in a box to use in further activities.)

• Which part of magnet attracts more iron filings?

• From which part of the magnet do you feel more difficulty in removing iron filings ?

Poles of a Bar Magnet

Does the property of attracting iron filings remain same for all parts of a bar magnet?

Activity-4:

Spread some iron filings uniformly on a sheet of paper. Place a bar magnet below this sheet.

• What do you observe?

• Do you observe any change in the pattern of iron filings spread over the sheet?

You will observe that the uniformly spread iron filings concentrate at two points of the paper sheet. At some distance you will find some scattered iron filings between these two points. (see Fig. 3)

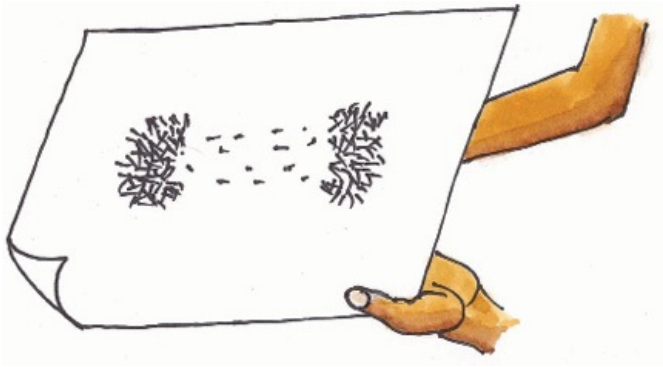


Fig. 3

This change in the spread of iron filings on the sheet of paper is due to the magnet present below it. The iron filings move towards its ends because of this magnet. Thus the ends of the bar magnet attract more iron filings than the middle part of the magnet.

By this activity we can conclude that every bar magnet always has two ends whose attracting capacity is more than its other parts. These ends are called **poles** of the magnet .

Activity-5: Finding directions with a bar magnet.

Suspend the bar magnet freely with the help of a thread tied around its center as shown in Fig. 4. Does the magnet remain stationary? Wait for some time. What do you find now?

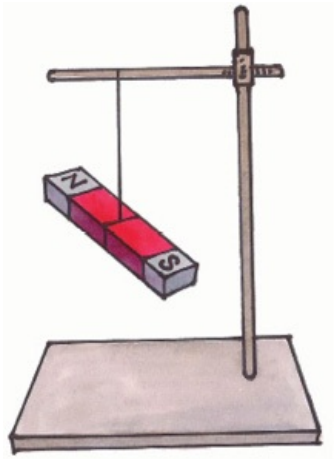


Fig. 4

You will notice that the magnet finally takes a position in the North-South direction. Mark the end that points towards the North with some colour. Now disturb the magnet and again wait for some time.

• Where does the coloured portion come to rest?

• Repeat this experiment at another place. What do you observe?

Magnets always come to rest in the North-South direction. In each case the marked end points towards North. This end is known as North pole of the magnet. The other end, which points towards the South is known as South pole of the magnet. This property of magnets is called **directional property**. It is exhibited only by magnets. We use this property to make the *magnetic compass*.

Magnetic Compass

A compass is usually a small box with a glass covering it. A magnetized needle is pivoted inside the box in such a way that it can rotate freely. The compass also has a dial with directions marked on it. The compass is kept at the place where we wish to know the direction. Its needle indicates the North-South direction when it comes to rest. The compass is then rotated until the north and south marked on the dial are exactly below the two ends of the needle. To identify the North pole of the magnetic needle, it is usually painted in a different colour (see Fig. 5). Then we identify north and south at that place. After that we can also identify the East and West between them.

Fig. 5

A compass is used to find directions. It is mostly used in ships and airplanes. Mountaineers and army people also carry a compass with them so that they do not lose their way in an unknown place.

Note: Don't place compass and magnets together.

Activity-6: Attraction and Repulsion Between Two Magnets

Take two similar magnets, place them in four different ways as shown in Fig. 6 and record your observations.

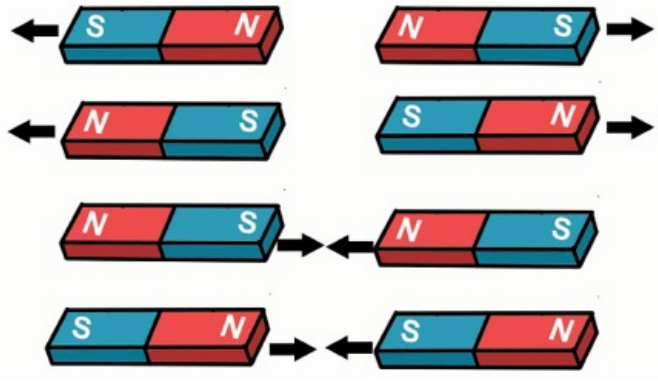


Fig. 6

• What do you observe?

• When do the magnets attract each other?

• When do the magnets repel each other?

You notice that **like poles repel each other and unlike poles attract each other.**

Earth as a Magnet:

We saw that a suspended bar magnet always comes to rest in the North-South direction.

• Why does it come to rest in that particular direction only?

• What force is acting on it?

Activity-7:

Place a bar magnet on a table in any direction. Suspend another bar magnet over it as shown in Fig. 7. The suspended bar magnet should be fairly close to the one kept

on the table. Observe in which direction the suspended bar magnet comes to rest.

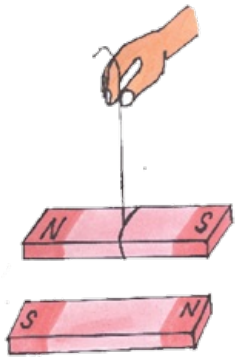


Fig. 7

Change the direction of the bar magnet placed on the table.

• Do you find any change in the direction of suspended bar magnet?

• Is there a change in the direction it comes to rest? What is that change?

The suspended bar magnet always comes to rest in the direction of the bar magnet placed on the table. But the north pole of the suspended bar magnet points towards the south pole of the bar magnet placed on the table and south pole of the suspended bar magnet points towards the north pole of the bar magnet placed on the table.

• What happens if you remove the bar magnet placed on the table?

In this case the suspended magnet comes to rest in the North-South direction. We can say that there is some magnet below the suspended bar magnet which compels it to come to rest in that particular direction (as in above two cases). Where does this invisible magnet come from? The earth possesses magnetic property which acts upon the suspended bar magnet (see Fig. 8).

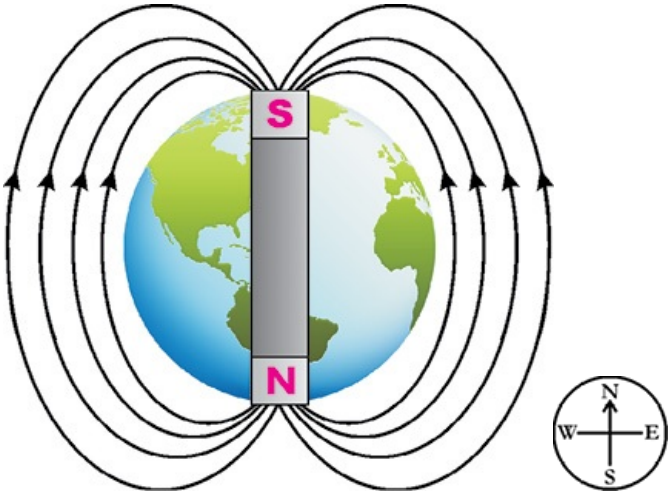


Fig. 8

Activity-8: Finding out whether the given object is a magnet or not

You have been given three objects of same size, shape and colour and a bar magnet. You have to decide which one among them is a magnet, which is not a magnet but made up of a magnetic material or a non-magnetic material. Bring three objects one after the other close to one pole of the bar magnet and observe whether they get attracted, repelled or not attracted. Record your observation in table 2. After that bring those objects close to the other pole of the bar magnet in the same way and record your observations.

Table 2

Observation	Object - 1	Object - 2	Object - 3
Changes observed when brought close to one pole of the bar magnet.	Attracted / Repelled /Not Attracted	Attracted / Repelled /Not Attracted	Attracted / Repelled /Not Attracted
Changes observed when brought close to other pole of the bar magnet.			

What do you conclude by comparing the recorded observations?

By the above observations we conclude the following:

If an object is attracted by one pole of the bar magnet and repelled by the its other pole, then you can say that it is a magnet.

If an object is attracted by both the poles of a bar magnet and not repelled by any pole, then you can say that it is not a magnet but a magnetic substance.

If an object is neither attracted by magnet nor repelled by it, then you can say that it is neither a magnet nor a magnetic substance.

Activity-9: Make your own magnet

Take an iron nail and place it on a table. Make sure that the nail neither attracts nor repels iron pins or iron filings. Take a bar magnet and place one of its poles near one edge of the nail. Without lifting the bar magnet, move it along the length of the iron nail till you reach

the other end. Then lift the bar magnet, bring it to the first end of the nail and move along the length again as shown in Fig. 9. Repeat this process 20-30 times. Always move the magnet in one direction, don't drag the magnet back and forth.

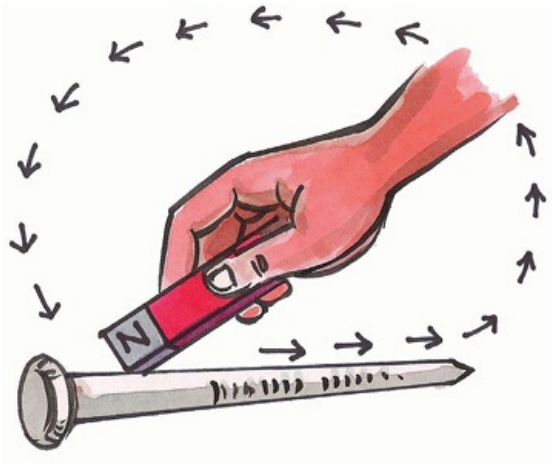


Fig. 9

Now remove the bar magnet and bring some iron filings or alpins close to the nail. What do you notice?

The iron filings or alpins get attracted by the nail. Thus you have succeeded in making your own magnet by magnetizing the nail. What will happen if the nail is now suspended freely?

Activity-10: Make your own magnetic compass

Take a magnetized needle. Tape the needle to a light cork. Float the cork in a glass of water as shown in Fig. 10.

Add a little detergent to water to help the cork float freely. In what direction does your magnetized needle point?

It points in North- South direction. Thus it acts as a magnetic compass.

Fig. 10

Activity-11: Magnetic induction

Take a safety pin and bring it close to an alpin. Does it attract the alpin? Why?

Bring the safety pin close to one pole of a bar magnet and see how it gets attached to the magnet. Now bring an alpin and touch it to the safety pin as shown in Fig. 11 (a). Does safety pin attract the alpin? Why?

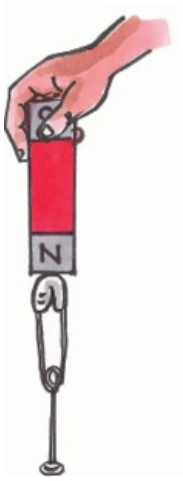


Fig. 11(a)

In the above two cases, we notice that the safety pin acts as a magnet when it is in contact with another magnet. Magnetic property is induced in safety pin due to the bar magnet.

Magnetic property possessed by a magnetic substance due to the presence of a magnet near it, is called magnetic induction.

- If the safety pin is not in contact with the bar magnet, can it attract the alpin?
- What happens if we place the bar magnet very close to the safety pin but not touching it?

Let us find out.

Take a bar magnet in one hand and a safety pin in the other hand, hold them in such a way that they are close to each other but not in contact as shown in Fig. 11 (b).

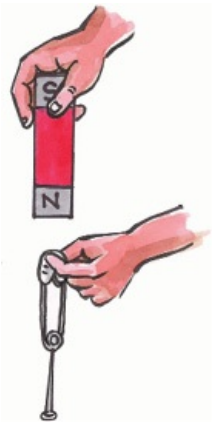


Fig. 11(b)

Ask your friend to bring an alpin and touch the safety pin. You will notice that the alpin will stick to the safety pin. This shows that due to magnetic induction safety pin acts as a magnet.

Keywords

Magnet, magnetic material, non-magnetic material, North Pole, South Pole, Magnetic compass, like poles, unlike poles, attraction, repulsion, magnetic induction

What we have learnt

- Lode stone is a natural magnet.
- Magnets are of different shapes i.e. bar magnets, horse shoe magnets, ring type magnets, etc.
- The materials that are attracted by magnets are called magnetic materials. The materials

that are not attracted by magnets are called non-magnetic materials.

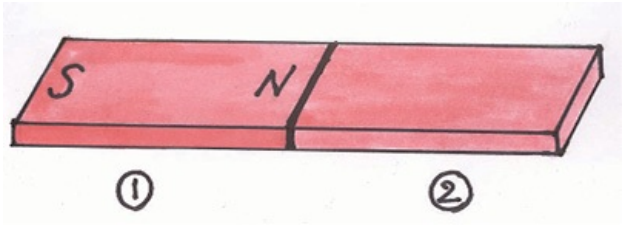
- A bar magnet always has two ends whose attracting capacity is more than other parts of it. The poles of the magnet lie at these ends.
- Each magnet has two magnetic poles : North and South.
- A freely suspended magnet always aligns in the North-South direction.
- Unlike poles of two magnets attract each other; whereas like poles repel each other.
- Magnetic property possessed by a magnetic substance due to the presence of a magnet near to it, is called magnetic induction.

Improve your learning

1. Predict which of the following material are magnetic and non-magnetic material. Test with a bar magnet and check your predictions. What do you say after testing all materials?

Plastic, Iron, Stainless steel, Wood, Aluminium, Gold, Silver, Copper, Paper, Cloth.

2. List out the magnetic and non magnetic materials in your class room.
3. For which purposes do people use magnets in their daily life? Ask your family members and other elders and collect the information and prepare a list of uses of magnets.
4. Draw a bar magnet and locate the poles.
5. Observe and locate North and South poles for the second bar magnet shown in the figure given below.



6. Think and say, in which direction your house is facing? Use the compass and findout the exact direction of your house and compare it with your prediction. Similarly predict and findout in which direction you keep your head while sleeping at night, the directions you face while you are reading, eating etc.
7. Prepare a toy using magnets and write the procedure of preparation briefly.
8. Think and say where the poles will be located in a ring magnet? Try to find out its poles using a bar magnet and check your prediction.
9. Magnetize a needle using a bar magnet. Make a compass with that needle by following the process explained in activity 10.
10. Sometimes people use magnets to keep the doors open and some times to close the doors firmly. Think and say how is it possible and how we should arrange the magnets in each case.
11. Does the Earth behave as a magnet? How do you prove it?
12. If you have two similar bars, one a magnet and another a piece of iron. can you findout which one of these is a magnet? Explain the process.
13. Teacher said that Earth is a magnet. But Sreevidya has some doubts and she asked her teacher some questions. What may be the questions?
14. Surya was wonderstruck to know that Earth is a big magnet and appreciated efforts of scientistis to discover this. Do you notice any such things in magnets to appreciate? Explain.

15. Kiran wants to prepare a toy using some magnets to make people understand the slogan "Reject bad food and accept only good food". Can you help him to prepare the toy? If yes, how?

* * * *

Usually, magnets are made of steel or iron. However, special alloys of iron, nickel, copper, cobalt, and aluminum can be made into powerful magnets.

Once the Greek scientist Archimedes of the "Eureka" used londstone to win enimies in batteles by using lodstone to get the nails from the ship. So the ship would sink

Electromagnets are made up of an arrangement of wire coils; often, the wire is wound around a ferromagnetic substance such as steel.

Some vets use magnets to retrieve wire and metal from animals stomachs.
Magnet attracts only magnetic objects.
The compass was used hundreds of years ago by chinese sailors.
The earth's magnetic field is like a bar magnet at the center.

Right now, the Neodymium is the strongest magnet currently known.Earth magnets can be 20 times more powerful than a fridge magnet.

It is believed that the earth's magnet power comes from a current in the liquid center of the Earth causing it to become a gigantic electromagnet!