15. Fun with Magnets

Can you tell?

1. Pins in a pin holder do not fall even when it is held upside down. Why is this so?

2. While we are shutting the door of a fridge, we find that it closes automatically from a certain distance and does not open unless pulled again. Why is this so?

A magnet is used in these gadgets. A magnet is fitted in the cap of a pin holder and in the door of a fridge. Iron objects stick to a magnet.

15.1 : A pinholder and a fridge

What is a magnet?

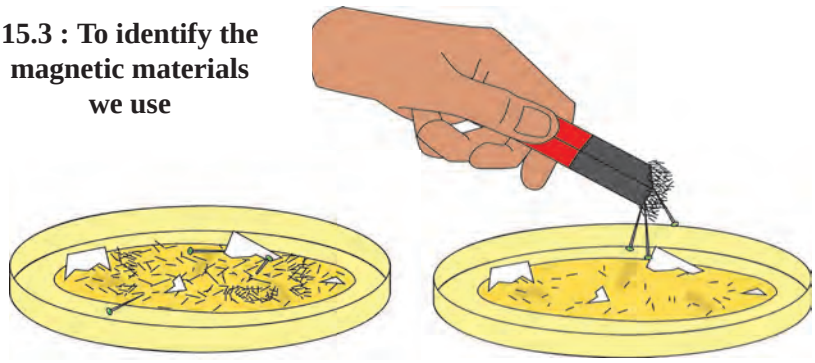
The material to which objects made from iron, nickel, cobalt, etc. get attracted is called a 'magnet'. This property of a material is called 'magnetism'.

Let's try this.

1. Take a magnet from the laboratory and bring it near various objects in your use. Which of them stick to the magnet? What material is each of them made of? Observe these things carefully. Classify the objects into two groups : those which stick to the magnet and those which do not.

2. Take a mixture of sand, pieces of paper, sawdust, iron filings and pins in a saucer and pass a magnet around the mixture. What do you see?

15.2 : A magnet



15.3 : To identify the magnetic materials we use

The materials that stick to a magnet are called **magnetic materials**, while those that do not stick to a magnet are called **non-magnetic materials**. The metals iron, cobalt, nickel are magnetic materials.

In the past...

There is a legend about the discovery of magnets. It is said that a shepherd named Magnes lived in Greece. Once, while his sheep were grazing, he sat down on a big rock. But, what a surprise he got when he tried to get up! His staff and his shoes were stuck to the rock. He had to use great force to pull himself away from the rock.

15.4 : The story of Magnes

He realized that what had happened was because of the iron ferrule on his staff and the iron nails in his shoes. However, other rocks did not stick to his shoes or staff. Later, he showed the rock to everybody.

The rock was named magnetite after Magnes, the shepherd. Magnetite is a natural magnet. It is also possible that the name 'magnet' came from Magnesia, the part of Greece where magnets were discoverd.

Find out. How is a mariner's compass used?

It was known quite long ago to the people in China and Europe that a piece of magnetite, hung freely, always settled in the north-south direction. These rocks then came to be used for finding the directions while travelling through unknown regions. That is why, they are also called **lodestones** (leading stones). This led to the invention of the mariner's compass.

Magnets can have a variety of shapes depending upon their uses. Today, magnets are used in many machines and gadgets or devices. They are all man-made magnets. Find out where the magnets shown in the pictures below are used.

Bar magnets, disc magnets, horseshoe magnets, ring-shaped magnets, cylindrical magnets as also small button magnets are the different shapes of magnets in everyday use.

15.5 : Various man-made magnets

Magnetism

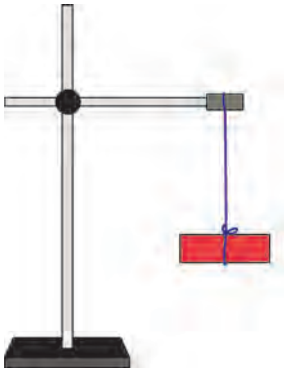
When a magnet attracts an object, that object is displaced due to the magnetic force. In places like factories, ports, garbage depots, large objects are shifted from place to place. For this purpose, cranes with magnets are used. Work is done by magnetic force. This shows that magnetism is a kind of energy.

Characteristics of a magnet

Let's try this.

1. Determine the directions in the class or laboratory. Tie a thread to the centre of a bar magnet and hang it from a stand. Note the direction in which the magnet settles and turn it around again. Let it settle and note the direction. Do this many times.

What do you observe?



15.6 : Direction in which the magnet settles

A magnet always settles in the north-south direction.

The end of a magnet that points to the north is called the **north pole** while the end that points to the south is called the **south pole**. The north pole is indicated by 'N' and the south pole, by 'S'.

2. Place some iron filings on a sheet of paper and pass a bar magnet over them. Pick up the bar magnet by holding it in the centre. What do you see?

To which part of the magnet do most of the iron filings stick? On which part do we see fewer filings?

What can we conclude from this?

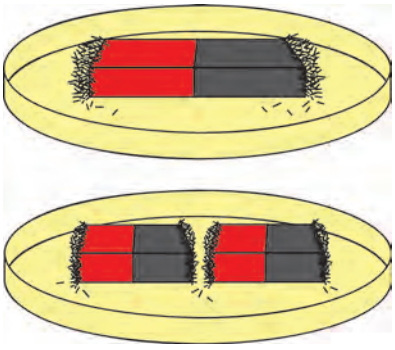
15.7 : Magnetic power

The magnetic force is concentrated at the two ends or poles of a magnet.

3. Take a bar magnet that can be cut with scissors or a knife. Take iron filings on a sheet of paper and place the magnet on it. Most of the iron filings will be seen to stick to its poles.

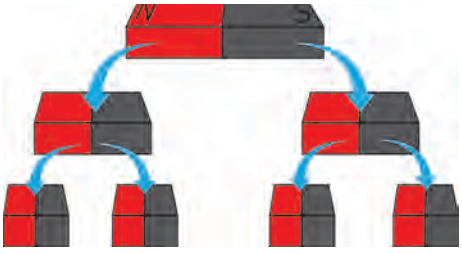
Now cut the magnet into two pieces as shown in the picture and place those pieces on iron filings. Pick up each of the pieces and observe them.

What do you find?



15.8 : Characteristics of magnetic poles

If a magnet is divided into two parts, two independent magnets are formed. It means that the two poles of a magnet cannot be separated from each other.

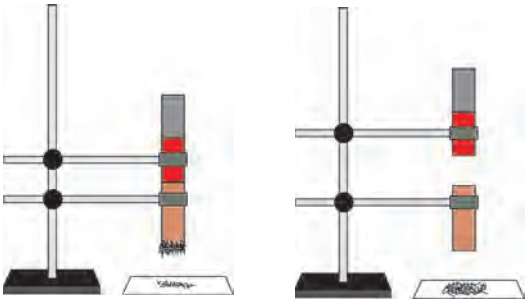


15.9 : More magnets from one

4. Fix a powerful bar magnet to a stand as shown in the figure. Fix an iron bar at a short distance below the magnet. Take iron filings near the iron bar. What do you see?

After some time take the magnet away. What happens now?

Iron filings stick to the iron bar when the magnet is near it and fall off as soon as the magnet is taken away. That is, the magnetism in the bar vanishes.



15.10 : Induced magnetism

A magnetic material acquires magnetism when placed near a magnet. This magnetism is called induced magnetism.

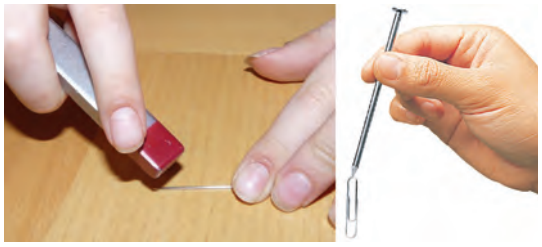
5. Fix a bar magnet to a stand as shown in the figure. Let it become steady. Take another bar magnet near the hanging bar magnet. Observe what happens. Do the same again and again, exchanging the ends of the magnet. What do you see?

15.11 : Attraction and repulsion in magnets

There is repulsion between like poles of a magnet, while there is attraction between the opposite poles.

6. Take a needle or nail. Place it steady on a table. Keep on rubbing a magnet over it from one end to the other. Do this 7-8 times. Now take a few pins near that needle/nail. What is seen?

In this way, magnetic objects acquire magnetism. Magnetism of this kind is temporary. It lasts for a short while.



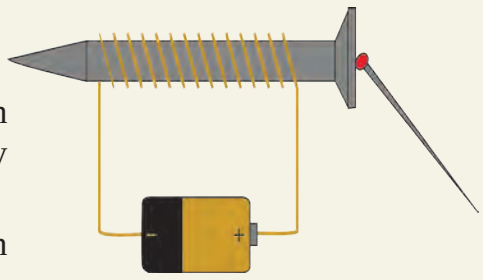
15.12 : Artificial magnet

A little fun!

Make an electromagnet

Apparatus : An iron nail of about 10 cm length and a 1-metre long insulated copper wire, a battery cell, pins or other magnetic objects.

Wind the copper wire around the nail as shown in the figure. Join both the ends of the wire to the cell. Now take the pins near the head of the nail. What do you see?



15.13 : Electromagnet

During the above activity we saw that the pins stick to the nail. Now stop the electric current and see what happens. The pins sticking to the nail fall off. Why does that happen? Magnetism is produced in the nail due to the electric current. When it is put off, the magnetism vanishes. Such a magnet is called an **electromagnet.** This magnetism is temporary.

Electromagnetism is used in many places in our day-to-day life.

15.14 : Use of electromagnet

For example, it is used in instruments such as a door bell and a crane.

On the other hand, the magnets fixed to a pin holder or the door of a cupboard are permanent magnets. Permanent magnets are made from a mixture of nickel, cobalt and iron. For example, the material alnico is a mixture of aluminium, nickel and cobalt.

In the past...

The British scientist Michael Faraday developed the technique of producing electricity with the help of a magnet.

Michael Faraday was born in a poor family. As a young boy, he had to work with a book seller. There, he read many books and developed an interest in science. Later, he went on to do research at the Royal Institution in London. It is due to Faraday's research that today we can use electricity and electromagnetism in innumerable instruments in our day-to-day life.

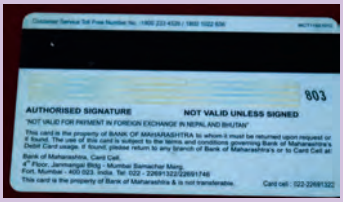
15.15 : Maglev train

The properties of electromagnetism and repulsion between magnets are used in a maglev train. Due to the repulsion between the train and the rail the force of friction does not come into play and the train slides over the rails with great speed. The magnets fixed on the two sides of the train help it to move forward.

To see how the maglev train works, visit **www.youtube.com** type **maglev train, and click.**

Do you know?

There is a strip of magnetic material in ATM cards, credit cards, etc. where necessary information about the user is stored.



Magnetic materials are also used to store data in the hard disk of a computer, an audio or video tape, etc.

How is magnetism destroyed?

Magnetism gets destroyed when a magnet is heated, thrown, knocked about or broken into pieces. Therefore, it is important to store magnets carefully. A piece of soft iron is placed in the box in which a magnet is kept. The bar of soft or pure iron protects a magnet, therefore, such a bar is called a **magnet keeper.**

15.16 : Guarding a magnet

Always remember...

Various scientific discoveries, the knowledge we gain through them, the various instruments or gadgets we develop with its help are all useful for the progress of man. They must be used for the good of mankind.

We have to take precautions while working with electricity or with important devices. We must use them under the guidance of our elders.

What we have learnt–

- Iron, nickel, cobalt are magnetic metals.
- Magnets settle along the north-south direction when suspended freely.
- Magnetism is concentrated near the poles.
- The poles of a magnet cannot be separated.
- Electromagnetic energy is used in our day-to-day life.

Science watch ...

Scientists have made many discoveries and inventions on which our life depends today. Can I become a scientist too? How should I prepare to become a scientist?

Read stories of scientific discoveries and inventions. Try out various activities and different ways of doing them. Ponder over your experiences.

1. How will you do this ?

(a) Determine whether a material is magnetic or non-magnetic.

(b) Explain that a magnet has a certain magnetic field.

(c) Find the north pole of a magnet.

2. Which magnet will you use ?

(a) Iron is to be separated from trash.

(b) You are lost in a forest.

(c) A window shutter opens and shuts continuously in the wind.

3. Fill in the blanks with the appropriate word.

(a) If a bar magnet is hung by a thread tied at its centre, its north pole becomes steady in the direction of the ……. Pole of the earth.
(South, north, east, west)

(b) If a bar magnet is cut into equal pieces by cutting it at right angles to its axis at two places, ... bar magnets are formed, and a total of ..... poles are formed.
(6,3,2)

(c) There is repulsion between the ……. poles of a magnet, and attraction between its …… poles.
(opposite, like.)

(d) When magnetic material is taken close to a magnet, the material acquires …… .
(permanent magnetism, induced magnetism)

(e) If a magnet attracts a piece of metal, that piece must be made of ..... .
(any other metal but iron, magnetic material or iron, non-magnetic material)

(f) A magnet remains steady in a …….. direction.
(east-west, north-south)

4. Write the answers in your words.

(a) How is an electromagnet made ?

(b) Write the properties of a magnet.

(c) What are the practical uses of a magnet ?

Activity :

- Collect information regarding how the various magnets used in our day-to-day tasks are produced.
- Collect information about the magnetism of the earth.