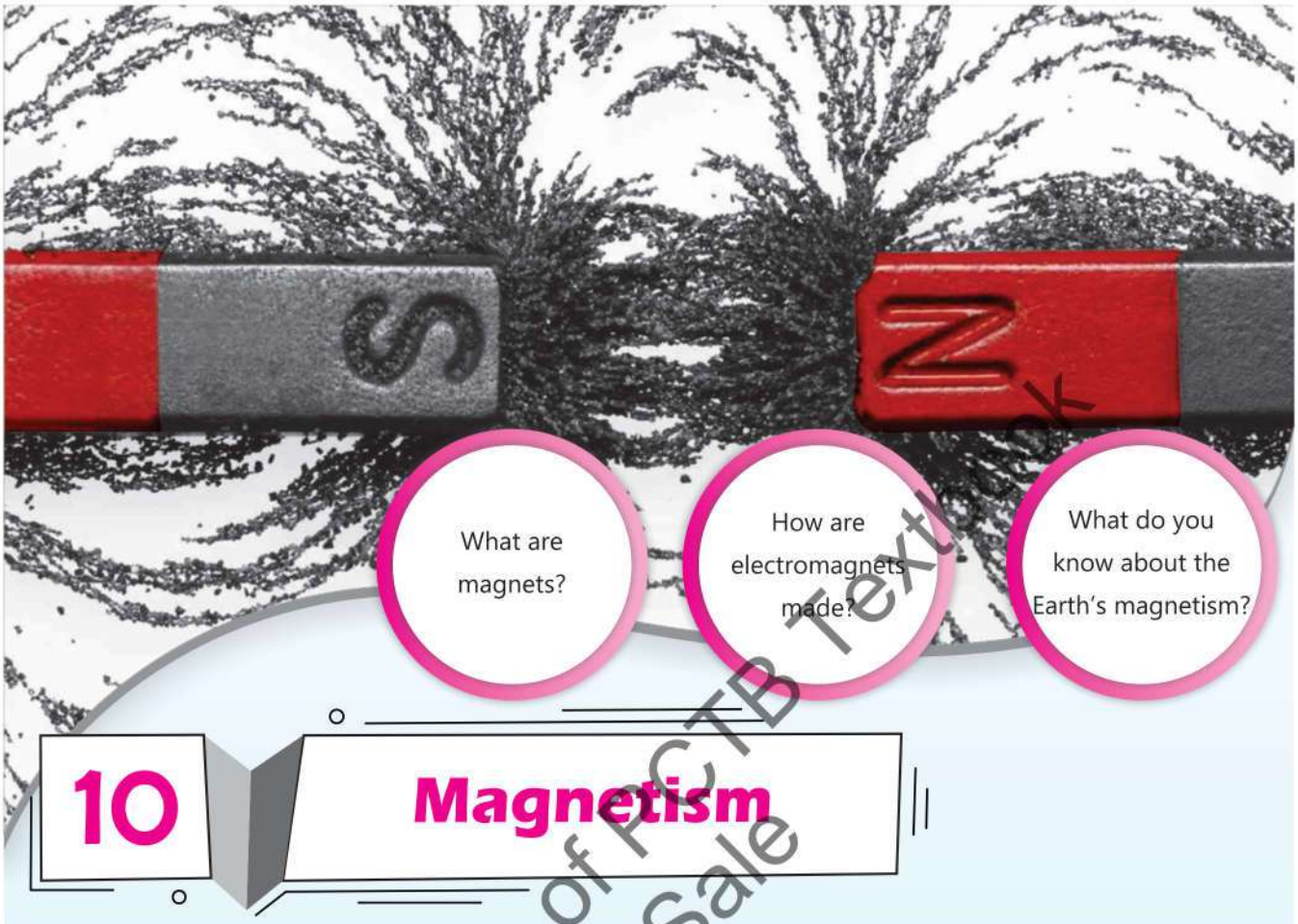


10 Magnetism

Students Learning Outcomes

After studying this chapter, students will be able to:

- Recognize that electric current has a magnetic field around it using a magnetic compass.
- Recognize that a freely-moving magnet comes to rest pointing in a North-South direction.
- Describe how to magnetize a magnetic material. Describe how to de-magnetize a magnet.
- Construct an electromagnet and identify its application in daily life.
- Compare different types of magnets (permanent, temporary and electromagnets).
- Recognize that there is a space around a magnet where effect of magnetic force can be observed.
- Draw magnetic field of a bar magnet using iron filings.
- Recognize Earth's magnetic field which attracts a freely pivoted magnet to line up with it.

VOCABULARY

Magnet	Magnetic field	Electromagnet	Pole	Attractive force	Repulsive force
A material or object that can attract the objects made of iron , nickel and cobalt	The area around a magnet in which its magnetic force is experienced	A material that produces magnetic force with the help of electric current passing through it	Part of the magnet with maximum magnetic force	The force which attracts the objects towards each other	The force which repels the objects away from each other

Recall what you have learnt in previous classes

We have learnt:

- What are magnets?
- What are magnetic materials?
- What are non-magnetic materials?
- Properties of magnets

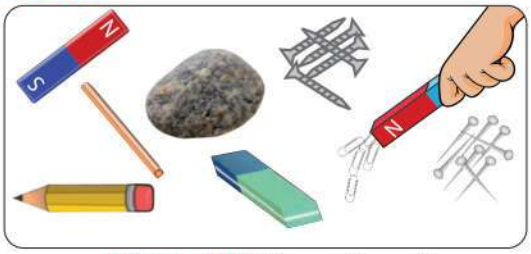


Figure 10.1 Magnetic and non-magnetic materials

Inquiry 10.1

Teacher Guide

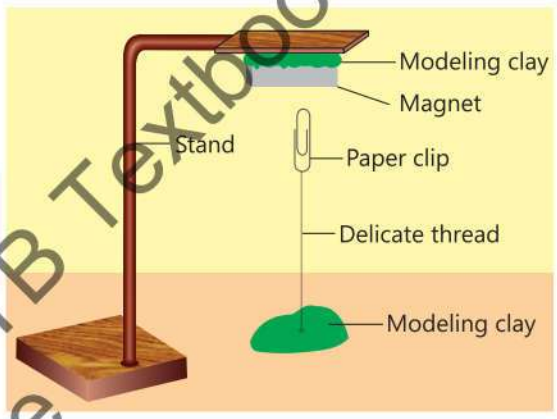
Facilitate students investigate and conduct discussion to conclude about the hypothesis as under:

Hypothesis

"The force of gravity pulls things down, but a magnetic force acting on a small object may be able to pull it up against the gravity."

Investigation and discussion

What will happen to a paper clip (tied with one end of a thread whose other end is tied and fixed in modeling clay is brought close to a magnet, but not touching with it) left free as shown in the Figure.

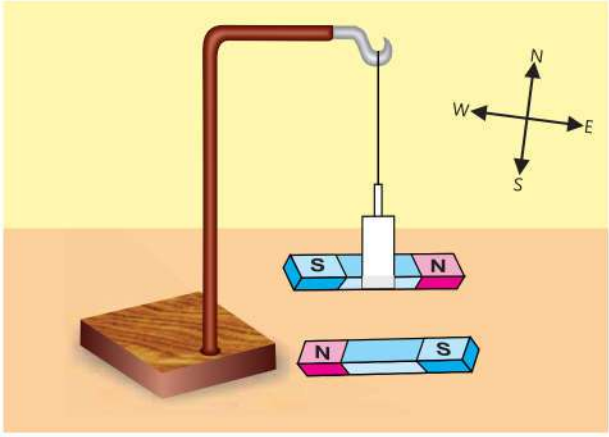


Conclusion

Recall the following activities:

Activity 10.1 Properties of a magnet

- Place a bar magnet along east-west direction on a table.
- Suspend another bar magnet from a stand using a thread over it so that it can rotate freely as shown in the Figure.
- Observe and note the direction of suspended magnet when it comes to rest.
- Now remove the magnet placed on the table.
- Observe and note the direction along which the suspended magnet come to rest.
- Why does it happen?



Activity 10.2 Assessment

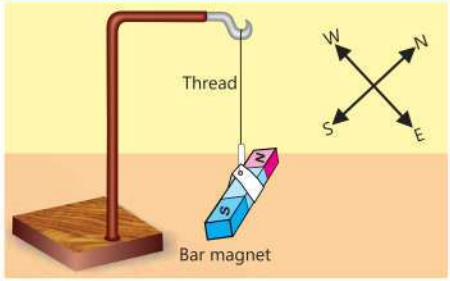
Write **'C'** against the correct and **'I'** against the incorrect statement in the middle column. Also correct the incorrect statement and write it in the next column.

Correct/Incorrect	C/I	Correct statement
Materials which are attracted by the magnet are called magnetic materials		
Materials which are not attracted by the magnet are called non-magnetic materials.		
A freely suspended magnet always points in the North-South direction.		
Like magnetic poles repel each other whereas opposite magnetic poles attract each other.		
The Earth behaves like a huge magnet.		

Inquiry 10.2

Teacher Guide

Facilitate students investigate and conduct discussion to conclude about the hypothesis as under:



Hypothesis

"A freely suspended magnet always points in the north-south direction."

Conclusion

Why does the freely suspended magnet always points in the north-south direction? The answer to this question is a huge Earth's magnetism about which we already have learnt in class-5.

In this chapter we will learn:

- Magnetic field
- Making magnets and demagnetization
- Magnetic effect of electric current
- Electromagnets

10.1 MAGNETIC FIELD

A magnet exerts a force on an object (magnetic material) which is brought close to it. The region around a magnet where it can attract magnetic materials is called **magnetic field**. Magnetic field can be detected using iron filings. The tiny pieces of iron line up in a magnetic field **(Figure 10.2)**.

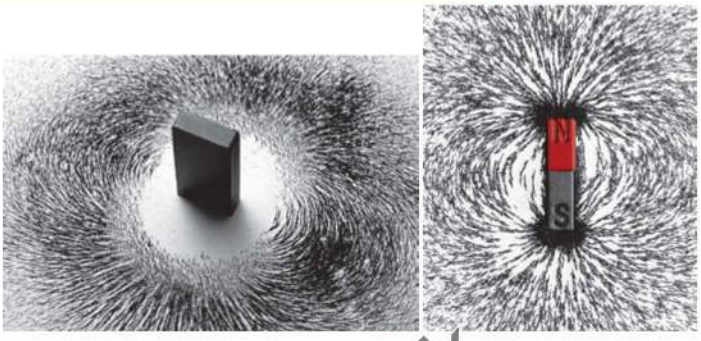
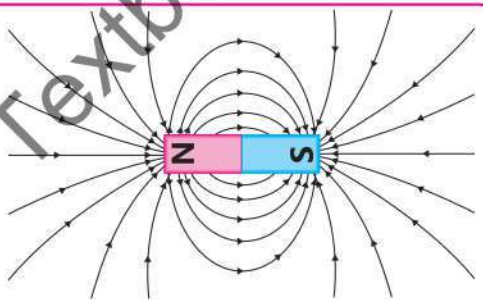


Figure 10.2 Magnetic field

Activity 10.3

- Take a bar magnet and lay a piece of card over it.
- Sprinkle the iron filings over the card and tap it gently.
- What do you observe?
- Lines made by iron filings around the magnet show the magnetic field.
- Draw the magnetic field lines by using magnetic compass as shown in the Figure.



10.1.1 Magnetic Effect of Electric Current

Magnets are of two types, i.e., permanent magnet and temporary magnet.

Permanent magnets

The magnets which don't lose their magnetic property easily are called **permanent magnets (Figure 10.3)**. Naturally occurring magnets, e.g., loadstone are permanent magnets. Alnico (an alloy of aluminium, nickel and cobalt) and ferrites (ceramic-like material made from a mixture of iron oxides with nickel, strontium or cobalt) are also the examples of permanent magnet.

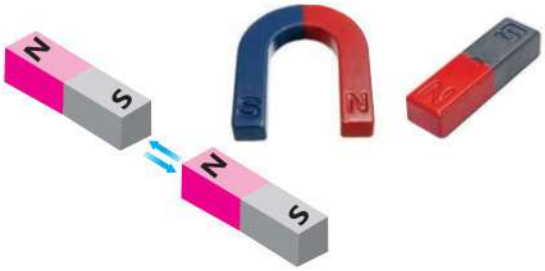


Figure 10.3 Permanent magnet

Temporary magnets

The objects such as iron or steel pieces are magnetized and converted into magnet in the presence of magnetic field or by rubbing permanent magnet on them. They lose their magnetic properties gradually or when magnet field is removed. Such magnets are called **temporary magnets (Figure 10.4)**.

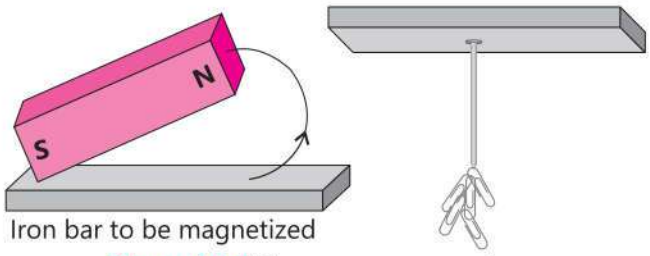
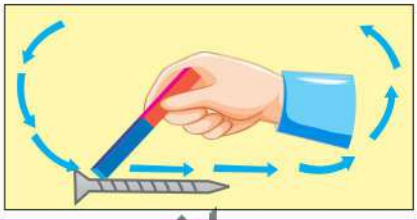


Figure 10.4 Temporary magnet

10.1.2 Magnetization (Making magnets)

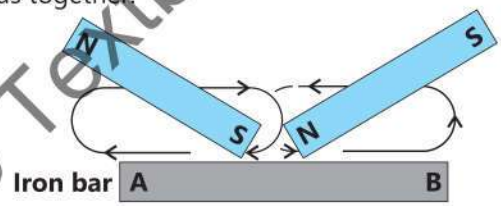
Activity 10.4

- Take a bar magnet and an iron nail.
- Rub or stroke the bar magnet on the iron nail many times in the same direction.
- The iron nail will become temporary magnet.
- Check it by bringing near paper clips or common pins.



Activity 10.5

- Take two bar magnets and an iron bar.
- Place the magnets in the middle of the bar with their opposite ends together.
- Rub the magnets on the bar in opposite directions.
- On reaching at the ends of iron bar, lift the magnets and put them again in the middle of the bar.
- Repeat the process many times.
- The iron bar will become temporary magnet.
- Test its magnetism by bringing it near the paper clips.



10.1.3 Demagnetization (How to demagnetize a magnet)

A magnet can lose its magnetic property by heating or hammering or dropping it. By heating or hammering or dropping, the particles in a magnet are disturbed and lose magnetic property. This process is called **demagnetization (Figure 10.5)**.

If a weak magnet is kept in the magnetic field of a strong magnet, the weaker magnet will lose its magnetism.

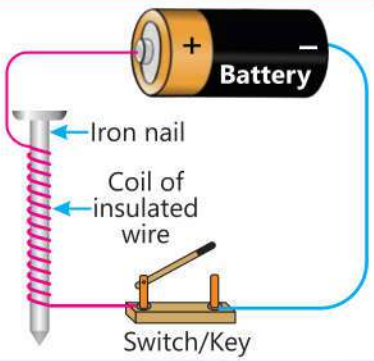
Figure 10.5 Demagnetization

9.2 ELECTROMAGNETS

When electric current flows through an object, it becomes a magnet. Such a magnet is called **electromagnet**. Electromagnet remains a magnet until electric current flows through it. When electric current stops flowing through the object, it is demagnetized. Electromagnets are temporary magnets.

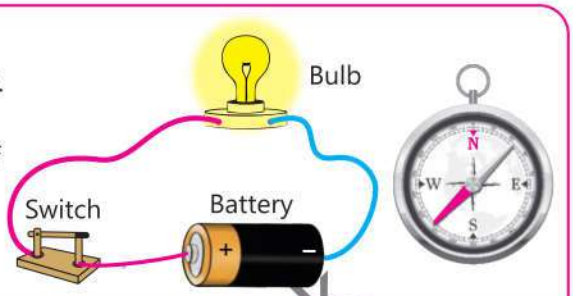
Activity 10.6 How to make an electromagnet

- Take an iron nail, wind insulated copper wire around it and make a coil.
- Connect one end of coil to one terminals of a cell or battery.
- Connect the other end of the coil to the other terminal of the cell or batter through an electric switch/key.
- Turn the switch ON and bring the common pins or paper clips near the tip of the nail.
- Observe what happens with the common pins or paper clips.
- Now turn the switch OFF and observe what happens to the common pins or paper clips.



Activity 10.7

- Design a simple electric circuit as shown in the Figure.
- Bring a compass needle near the wire when the switch is OFF.
- Note the direction of the magnetic needle on the compass.
- Now turn the switch ON and observe the direction of magnetic needle on the compass.
- Turn the switch OFF and observe the compass.
- What do you conclude from this activity?



An electromagnet works as a magnet only when electric current flows through it. While fitted in electric appliances, it can be switched ON and OFF. When current flows through it, it works as a magnet. When current stops flowing through it, it becomes an ordinary piece of metal.

Factors affecting the strength of electromagnets

The following are the factors that affect the strength of electromagnets:

Increasing number of loops

Increasing the more turns or loops of wire increases the strength of electromagnets.

Increase in current

The strength of an electromagnet increases if greater current passes through it.

Metal core

Electromagnets are stronger if they are made by winding the wires around iron core. The iron bearing materials are the best for making electromagnets.

Uses of Magnets

Since a magnet can pick small iron objects, so you may think that it is an ordinary thing to play with. In fact, there are many uses and advantages of magnets in our daily life. The electric bell that we use in our homes works with a magnet. When you enjoy music, you receive sound through speakers. The magnet plays an important role to produce sound in the speaker. A dynamo produces electricity with the help of a magnet **(Figure 10.6)**.

Figure 10.6 Use of magnets

Piece of iron or iron filings mixed with other materials can be separated with the help of a magnet as shown in **Figure 10.7 (a)**. **Figure 10.7 (b)** shows a crane lifting heavy iron objects with the help of a big magnet.

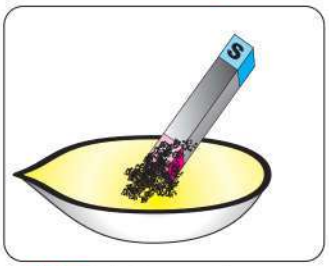


Figure 10.7 (a) Separating materials

Figure 10.7 (b) Crane

KEY POINTS

- A magnet is a piece of metal that can attract the objects made of iron, nickel and cobalt.
- Materials which are attracted by the magnet are called magnetic materials.
- Materials which are not attracted by the magnet are called non-magnetic materials.
- Ends of a magnet are called its magnetic poles.
- A freely suspended magnet always points in the North-South direction.
- Like magnetic poles repel each other whereas opposite magnetic poles attract each other.
- The Earth behaves like a huge magnet.
- The magnets which don't lose their magnetic property easily are called permanent magnets.
- The magnets which lose their magnetic properties gradually or when magnet field is removed are called temporary magnets.
- When electric current flows through an object, it becomes a magnet. Such a magnet is called electromagnet..
- An electromagnet remains a magnet until electric current flows through it.
- When electric current stops flowing through the object, it is demagnetized.

QUESTIONS

10.1 Choose the correct option.

1. A magnet can attract objects made of

a. copper b. iron c. aluminum d. silver

2. The ends of a magnet are called its

a. sides b. heads c. terminals d. poles

3. A freely suspended bar magnet always stays along

a. east-west direction b. north-south direction
c. any direction d. keeps oscillating

4. magnet is not used in

a. a dynamo b. an electric bell c. a speaker d. a heater

5. Which one is the true statement

a. North pole attracts north pole b. North pole repels north pole
c. South pole repels north pole d. South pole attracts south pole

6. To increase the strength of an electromagnet, we can:

a. change the direction of the current. b. insert a wooden core inside a coil.
c. increase the amount of current flowing
d. decrease the amount of current flowing.

7. The space around a magnet where it can attract magnetic materials:

a. electric field b. magnetic field c. magnetic pole d. magnetic core

8. Which will not cause a magnet lose its magnetism?

a. heating it
b. dropping it repeatedly
c. coating it with oil
d. hitting it

9. Which will not increase the strength of an electromagnet?

a. adding an iron core
b. adding a plastic core
c. coiling the wire
d. increasing the current

10.2 Write short answers.

1. What is a magnet?
2. What is the difference between a permanent magnet and temporary magnet?
3. Write strokes method of making a magnet.
4. Define magnetic field.
5. Write names of five things which are made of magnetic material.

10.3 Give answers in detail.

1. Show with the help of an activity that a freely suspended bar magnet always points north to south direction.
2. How can you prove that like poles repel each other while unlike poles attract each other?
3. Describe a few uses of magnets.
4. A, B and C are three similar bars. One is a magnet, another iron bar and the third an aluminum bar. How would you identify which one is which?
5. How can you draw the magnetic field of a bar magnet using iron filings. Write down the procedure.
6. Describe applications of electromagnets in daily life.

10.4 Constructed Response Questions

1. You have a bar magnet without any indication of poles. How will you identify its north and south poles?
2. What causes the Earth's magnetic field?
3. How does metal core affect the strength of electromagnet?
4. How are electricity and magnetism related?

10.5 Investigate:

1. The metals which can be magnetized.
2. Do the other planets have magnetic field like the Earth?

10. 6 Project

Teacher Guide

Facilitate students to construct electromagnets of different strengths.