

Magnetism

Learning Objectives

- **1.** Introduction
- **2.** Magnetic and non-magnetic materials
- **3.** Poles of a magnet
- **4.** Directive properties of magnets
- 5. Types of magnets Permanent, Temporary magnets Electromagnets
- 6. Maglev
- **7.** Loss of Magnetism

INTRODUCTION

Do You Know

The ancient Greeks observed electric and magnetic phenomena as early as 700 B.C. They found that a piece of amber when rubbed attracts pieces of straw or feathers.

Magnet was discovered about 4000 years ago. We observe that filings of some materials like iron, nickel, cobalt etc., cling to magnets, however other things around us like wood, plastic etc. are not affected by the presence of magnet near them. The name magnetite has been derived from magnesia and magnets are named after magnetite.

You must have often observed that when a refrigerator door is opened a little and left, it shuts by itself. Also many cupboard doors also click shut the same way. It happens because they have magnets inside. Thus we can define magnets as the materials which attract certain substances (magnetic) like iron, cobalt, nickel etc.

MAGNETIC AND NON-MAGNETIC MATERIALS

All objects are not attracted to magnets. When we bring a magnet near various objects, some are attracted to the magnet and some are not.

The materials which get attracted to the magnets are called magnetic **materials**.

Iron, Cobalt and Nickel are some examples of magnetic materials.

On the other hand, the materials which are unaffected by magnets are called **non-magnetic materials.** Wood, plastic, gold, silver, cotton etc., are some examples of non-magnetic materials.

Do You Know

Magnets help in case of mental unrest by applying the south pole of a weak magnet to the forehead for about 10 minutes daily.

POLES OF A MAGNET

The magnetic forces are strongest at the two ends of a bar magnet. These ends are called the poles **of a magnet**. There are two poles of every magnet and they are termed as **North Pole** and **South Pole** It is important to note that the two poles cannot exist independently. Poles always exist in pairs. So if a magnet is cut into pieces, then even the smallest piece of a magnet will have both the poles.



North pole

Attraction and Repulsion

It is observed that when the ends of two magnets are brought near each other, they either pull towards or push away from each other. The pulling of magnets towards each other is termed as **attraction** and pushing away from each other is called **repulsion**.

South pole

When North pole of a magnet is brought near the North pole of another magnet or South pole of a magnet is brought near the South pole of another magnet, they repel each other i.e., like poles repel each other.



But when North pole of a magnet is brought near the South pole of another magnet, they attract each other i.e., unlike poles attract each other.



Remember: It is repulsion and not attraction is the sure tests for polarity of a magnet.

DIRECTIVE PROPERTIES OF MAGNETS

Do You Know

In the $13^{\rm th}$ century, sailors using lodestone as a compass to help them find their way across the seas.

When a magnet is allowed to move freely, it comes to rest in such a way that it's North-South lies very close to the earth's South-North direction. This directive property of a magnet can be used to find directions on the surface of earth. Magnetic compass is the instrument used to find directions.



Magnetic compass

A magnetic compass has a magnetic needle at its centre that rotates freely. The magnetic needle always points in the North-South direction.

A freely suspended magnet always comes to rest in the north-south direction.

The earth's magnetism exists due to its molten iron core.

TYPES OF MAGNETS

There are two types of magnets

- 1. Temporary magnets
- 2. Permanent magnets
- 1. **Temporary magnets:** Temporary magnets are those which retain their magnetic properties only over a short interval of time. Temporary magnets are usually made of iron, cobalt or nickel. They behave as magnets under the influence of a strong magnet and lose their magnetism as soon as the strong magnet is removed. Electromagnets are temporary magnets.

Electromagnets: The magnets in which the magnetism has been produced by passing electric current through them are called electromagnets.

Do You Know

Superconductors are the strongest magnets that are made from coils of wire.



Electromagnets behave as magnets so long as the current is flowing through them and the magnetism disappears as soon as the flow of current stops.

The strength of electromagnets depends on the magnitude of current flowing through them.

Do You Know

Eartb's magnetic field helps migration of birds from one place to another.

Uses of electromagnets

- Electromagnets are used to lift tons of scrap metal because the strength of electromagnets can be increased as per the requirement.
- Electromagnets are used in the door bell, electric fan, etc.
- 2. **Permanent magnets:** The magnet whose magnetism lasts for a long time or does not lose its magnetism is called permanent **magnet**.

MAGLEV TRAIN

The word Maglev stands for magnetic levitation. Maglev train is a train that uses magnets to float above a track. **The principle** of a maglev train is that like poles repel and unlike poles attract each other.

The magnets are arranged in a specific manner that moves the train along the guideway. Maglev train floats above the track, so it experiences very less friction. Thus, speed of a maglev train is very high exceeding 500km/h.

LOSS OF MAGNETISM

A permanent magnet can lose its magnetic properties i.e., demagnetised under following conditions:

Mishandling or rough handling.

• Two magnets if stored with North pole alongside the North pole of the other magnet for a long time.

- Hammering or heating.
- Dropping a magnet from a height.

In order to prevent magnet from getting demagnetised, a piece of iron called **keeper** is placed across the poles of the magnet.