

Fun with Magnets

Introduction

The most popular legend accounting for the discovery of magnets is that of an elderly Cretan shepherd named Manges. He was herding his sheep in an area of Northern Greece called Magnesia, about 4000 years ago. Suddenly both, the nails in his shoes and the metal tip of his staff became firmly stuck to the large, black rock on which he was standing. He dug up the Earth and found the source of attraction that was lodestone (lode = lead or attract). It contains magnetite, a natural magnetic material. This type of rock was subsequently named magnetite, after either Magnesia or Manges himself.

A magnet is a material which has an ability to attract objects made of metals like iron, nickel, cobalt and their alloys.



Magnets were believed to have magical healing power. Queen of Greece, Cleopetra used to sleep on a block of magnetite.

Some insects, birds and fishes have extremely small magnets in their bodies.

Magnetic and Non-Magnetic Materials

The materials which are affected by magnets are called magnetic materials. Those materials which are not affected by magnets are called non-magnetic materials. Iron, nickel and cobalt are magnetic materials while copper, zinc, gold and silver etc., are non-magnetic materials.

To identify magnetic and non-magnetic materials.

Collect as many objects around you as possible, such as fork, eraser, needle, scale, thread, metal cap, coin, can, iron scrub. You can add more objects to the list.

Hold a magnet in your hand and bring each object near it. Observe whether the object is attracted by the magnet or not. Note down your observation in given chart.

Name of object	Eraser	Fork	Needle	Plastic scale	Thread	Iron scrub	Coin	Can	Metal cap
Material of object	Rubber		Iron						
Attracted/Repelled (Yes/No)	No		Yes						

• **Observations :** The materials which get attracted towards a magnet are magnetic and the materials which are not attracted towards a magnet are non-magnetic.



Natural and Man-Made Magnets

Naturally occurring magnet, *i.e.*, lodestone is called natural magnet. It cannot be given a desired shape as may be required for a particular use.



Scientists have been able to find methods of making magnets from pieces of iron. These man-made magnets are known as artificial magnets. Man-made magnets can be temporary or permanent depending on the methods of manufacturing used. Temporary magnets attract magnetic materials only for sometime. Permanent magnets always remain magnetic unless they are severely damaged. Permanent magnets are made from alloys containing one or more magnetic substances. Alnico, an alloy of aluminium, nickel and cobalt is used to make powerful permanent magnet.

• Shape of artificial magnets : Artificial magnets are made in many different shapes, like a bar magnet, a cylindrical-shaped magnet, a dumbbell-shaped magnet, a horseshoe magnet, a ring-shaped and a needle-shaped magnet.



Poles of Magnet

Every magnet has two 'poles' at its two ends where the force of attraction is the strongest, *i.e.*, North pole and South pole. If iron filings (fine particles of iron) are sprinkled over a bar magnet, most of the filings stick to the two ends of the bar with very few particles sticking to the middle portion.



North pole and south pole of a magnet

How do you distinguish between a magnet and an iron piece if they look identical?

Ans.: To distinguish between a magnet and an iron piece, hold one of them horizontally, and bring one end of another one very close to first one's centre. If end of another one sticks to the centre

Properties of Magnets

Magnets exert their influence through various media

The effect of magnet works through air, water and even through some solid things. An object very near to the magnet experiences more force as compared to an object kept a little away. The area around magnet in which its effect can be experienced is called magnetic field.

The freely suspended magnet always comes to rest in the North-South direction

One end of the magnet always points towards the North. It is called the North seeking pole or the North pole of the magnet and the end which points towards the South is called the south seeking pole or the South pole of the magnet.

Magnetic poles cannot be isolated

It was found that if we cut a magnet into two parts, we cannot isolate the North and the South poles. Each piece has its own North and South pole. Poles always exist in pairs.



Like poles repel, unlike poles attract each other

Two bar magnets kept on a table end to end either stick to each other with a lot of force, or it will be

difficult to bring them together so that they touch each other. This is because the North pole of one magnet attracts the South pole of the other magnet. On the other hand, North pole of one magnet strongly repels the North pole of the other magnet. Thus, we can say that unlike poles attract each other and like poles repel each other.









Nail

- Metal

Magnet

one is a magnet while first one is ordinary iron

and vice-versa.

Physics | Class 6

The Earth's Magnetism

2 Ram bought some badges that he stuck on the door of his refrigerator. He observed that when he brought the badges close to the door of the refrigerator, there was a force that was pulling them towards it. Why was this happening?

Ans.: The door of a refrigerator is made up of

Experimental Investigation

Suspend a bar magnet (magnet A) freely using a copper wire stirrup. Slowly bring the north pole of another bar magnet (magnet *B*) near the North pole of the suspended magnet. What do you observe? Do the two poles attract or repel each other? Now bring the North pole of magnet *B* near the south pole of the suspended magnet. Write your observations.

Repulsion is a sure test for magnetism.

To test if a metal bar is a magnet or not.

Bring one pole of a magnet close to the ends of a metal bar, one end at a time. If one end is attracted and the other is repelled,

the metal bar is a magnet. If both ends are attracted, the metal bar is not a magnet.

3 Which property of magnets is being used for every magic activity?

Ans.: A magnet is an object that attracts some metals like iron, nickel, etc. This ability of magnet to attract or repel magnetic materials is called magnetism. The area around a magnet in which the effect of magnet can be experienced is called

The Earth itself behaves like a huge bar magnet with its magnetic poles near the geographical North and South poles.









magnetic field. Magnets exert their influence

through various materials. So, the property of

attraction and repulsion of magnetic material

is used in magic activity.







In a freely suspended magnet, therefore, the North pole points towards the geographical North pole since it is attracted by the earth's magnetic South pole. Similarly, the South pole of the suspended magnet is attracted by the earth's magnetic North pole and, therefore, points towards the geographical South pole.





The increased use of electricity in modern appliances is causing a continuous shift in the position of the magnetic poles of the Earth.



It is an instrument which always points to the North direction. It is used to find directions. In a compass, there is a small circular box. A small piece of magnet or needle is allowed to rotate freely inside a small circular box. Since it is a magnet, it comes to rest only in North-South direction. In a compass, red painted point is North and another is South.



To make a simple magnetic compass

Place the magnet on a cork and float the cork in a trough of water. Make sure that there is no magnet or magnetic material placed nearby. Your compass is ready now. You will notice that it comes to rest only in North-South direction. Take it to different places and check whether it always points to North or not.



Methods of Making Your own Magnet

A piece of iron can be magnetized using a magnet by the following methods.

Stroking Method

• It is the simplest method of making a magnet by stroking.

Making magnets

Take a piece of iron and place it on a table. Then stroke it with one pole of a bar magnet in one direction only. Without lifting the bar magnet, move it along the length of the iron piece till you reach the other end. Now lift the bar magnet and bring the same pole to the same point of the iron piece from which you began. Move the bar magnet again along the piece in the same direction, in the same manner, as you did before. Repeat this process 30-40 times. Bring some iron objects near the iron piece to check whether it is magnetised or not.

4 Bhaskar took a bar magnet and moved it lengthwise along a bar of iron many times. He then brought a few iron pins close to the iron bar. What would have happened and why?





Ans.: The iron pins would have stuck to the iron bar. This is because Bhaskar magnetised the iron bar with the bar magnet.

Using Electricity

• An electric current can change an iron nail into an electromagnet. Electromagnets are examples of temporary magnets. When electric current is passed through a coil wound around a steel, the steel rod behaves like a magnet. However, as soon as the electric current is stopped, the steel rod stops behaving like a magnet. Often an electromagnet is wrapped around a core of iron, which increases the strength of the electromagnet.

Making electromagnets

You will need an iron nail about 7-8 cm long, about 2 m of insulated copper wire, a new torch cell, paper clips and an insulating tape.

Remove the insulation for about 2 cm at each end of the wire. Wind the wire tightly around the nail, leaving 15 cm of wire free at each end. Tape one end of the wire to the bottom of the cell. Tape the other end of the wire to the top of the cell. Now, sprinkle a few paper clips around nail. You will observe that the iron nail behaves like an electromagnet.



Uses of Magnet

Magnets are used for a variety of purposes these days. Some of these are as follows:

- In electric motors, used in fans etc. and in bicycle and automobile dynamos for making electricity.
- In self closing pencil boxes, pin holders, etc.
- In fancy stickers and decorations to be fixed on refrigerators and steel almirahs.
- To separate iron or magnetic substances from non-magnetic substances in industries.
- In credit, debit and ATM cards and in audio/video cassettes.



Maglev trains have developed by America. They have no wheels. The trains are pulled by magnetic force acting on the rails. This can move them very fast.

Precautions While Handling Magnets

Certain precautions should be taken while handling magnets, otherwise they lose their magnetic power. Some of the precautions are as follows:

- Never hit or beat a magnet with anything.
- They should not be hammered or dropped from a height.
- Never heat a magnet.
- Keep magnet away from things like television, radio, transistors, tape recorders, remote control, computers, etc.
- Storing a magnet : When magnets are not in use, they should be stored properly. Magnets tend to become weaker after sometime, if their poles are left free. To avoid this, bar magnets should always be stored in pairs between soft iron pieces called





keepers. In between the keepers, they should always be placed in pairs and their poles should be in opposite direction to each other. U-shaped magnet needs only one keeper to store it.



When a magnet loses its power by dropping, hammering and heating, it is called demagnetised.



ESSENTIAL POINTS

for COMPETITIVE EXAMS

- Magnetite is a natural magnet.
- Magnets are used to separate magnetic substances from non-magnetic substances.
- The magnetic poles of a magnet always exist in a pair.
- The power of a magnet is stored (concentrated) at its poles only.
- The magnetic power is almost negligible at its centre.
- Magnetic compass are being used as direction finders by navigators, sailors and pilots.
- A magnet when suspended freely from its centre, it always comes to rest with its poles pointing in the North-South direction.
- Like poles repel and unlike poles attract each other.
- Repulsion, not attraction, is a sure test of magnetism.
- An electromagnet, which is a temporary magnet, is created when electric current is passed through a wire coiled around a steel rod. It ceases to act like a magnet after the current is turned off.
- Earth itself is a huge magnet. Its North pole behaves like the magnetic South pole and its South pole behaves like the magnetic North pole.
- Dropping, heating and hammering can make a magnet demagnetised.
- Magnets can be stored in keepers.

SOLVED EXAMPLES

1. State three examples of each.

- (a) Magnetic material
- (b) Non-magnetic material.
- Ans.: (a) Magnetic materials : iron, nickel, cobalt, etc.
 - (b) Non-Magnetic materials : wood, brass, paper, etc.
- 2. Differentiate between an artificial magnet and a natural magnet.
- **Ans.:** Natural magnet is a natural occurring substance found in the Earth's crust, *i.e.*, magnetite (consists of oxides of iron). *e.g.*, lodestone. An artificial magnet is made by using electrical or mechanical methods. They are made by magnetic substances, *i.e.*, iron, cobalt, nickel and their alloys. *e.g.*, bar magnet.
- 3. Draw the shapes of different types of artificial magnets.



Bar magnet Needle-shaped magnet

- 4. Why does a compass needle get deflected when brought near a bar magnet?
- **Ans.:** A compass needle gets deflected when brought near a bar magnet because the bar magnet exerts a magnetic force on the compass which is itself a tiny pivoted magnet and is free to move in the horizontal plane.
- 5. Why are magnetic keepers used to store magnets?
- Ans.: Magnetic keepers are used to store magnets to prevent them from getting demagnetised.
- 6. How can you store a U-shaped magnet and a bar magnet to prevent them from demagnetisation?
- Ans.: U-shaped magnet : A piece of soft iron, *i.e.*, keeper is placed across the two poles of the U-shaped magnet.

Bar magnet : Two keepers are placed across the poles of a pair of bar magnet and are separated by a wooden block.





- 7. What are the poles of a magnet? How are they different from the other regions of a magnet?
- **Ans.:** The two ends of a magnet are called its poles and are named as North-pole (N) and Southpole (S). The magnetic strength of a magnet is greater at its poles than at any other region of the magnet. So, they are different from the other regions of the magnet.
- 8. How would you classify the objects as magnetic or non-magnetic if you are given with a bar magnet?
- **Ans.**: Touch the bar magnet with the given objects and lift it up. Magnetic objects will stick to the ends of the bar magnet whereas the non-magnetic objects will remain as they are.
- 9. Before the invention of the compass, sailors used to find directions. Explain?
- **Ans.:** Before the invention of the compass, sailors used stars to find directions. As the Sun rises in the east, one can easily identify the east. The west lies opposite to the east. If one stands facing the east, then, the north will be on his/her left side and the south will be on the right. During the night, one can see the Pole star in the sky which is positioned exactly above the north pole of the Earth to identify directions.
- **10.** Encircle the odd one out. Give reason for your choice.

(a) Glass, cotton, Nickel, Copper

(b) Magnetite, Bar magnet, Dumbbell-shaped magnet, Horseshoe magnet.

Ans.: (a) Glass, Cotton, (Nickel), Copper

Nickel is a magnetic substance whereas the others are non-magnetic.

(b) Magnetite, Bar magnet, Dumbbell-shaped magnet, Horseshoe magnet

Magnetite is an iron ore which is a natural magnet while the others are artificial magnets.

NCERT SECTION

1. Fill in the blanks in the following.

- (i) Artificial magnets are made in different shapes such as _____, ____ and
- (ii) The materials which are attracted towards a magnet are called _____.
- (iii) Paper is not a _____ material.
- (iv) In olden days, sailors used to find direction by suspending a piece of _____.
- (v) A magnet always has _____ poles.
- Ans.: (i) Artificial magnets are made in different shapes such as <u>bar magnet</u>, <u>horse-shoe</u> <u>magnet</u> and <u>cylindrical magnet</u>.
 - (ii) The materials which are attracted towards a magnet are called <u>magnetic materials</u>.
 - (iii) Paper is not a <u>magnetic</u> material.
 - (iv) In olden days, sailors used to find direction by suspending a piece of <u>bar magnet</u>.
 - (v) A magnet always has two poles.
- 2. State whether the following statements are true or false.
 - (i) A cylindrical magnet has only one pole.
 - (ii) Artificial magnets were discovered in Greece.
 - (iii) Similar poles of a magnet repel each other.
 - (iv) Maximum iron filings stick in the middle of a bar magnet when it is brought near them.
 - (v) Bar magnets always point towards North-South direction.
 - (vi) A compass can be used to find East-West direction at any place.

(vii) Rubber is a magnetic material.

- Ans.: (i) False. A magnet always has two poles independent of its shape.
 - (ii) False. Natural magnets were discovered in Greece.
 - (iii) True. Like poles repel each other while unlike poles attract each other.
 - (iv) False. Maximum iron filings stick at the ends of a bar magnet when it is brought near them.
 - (v) True. Bar magnets point towards North – South direction, when they are freely suspended.
 - (vi) True. A magnetic compass points towards North-South direction, if it is known,

then the East-west direction can also be determined.

- (vii) False. Rubber is not attracted to a magnet. So, it is not a magnetic material.
- 3. It was observed that a pencil sharpener gets attracted by both the poles of a magnet although its body is made of plastic. Name a material that might have been used to make some part of it.
- **Ans.:** The blade of the pencil sharpener is made of iron. Iron gets attracted by the poles of a magnet as it is a magnetic material.
- 4. Column I shows different positions in which one pole of a magnet is placed near that of the other. Column II indicates the resulting action between them for each situation. Fill in the blanks.

Column I	Column II
N - N	
N	Attraction
S - N	
S	Repulsion

Ans.:

Column I	Column II
N - N	<u>Repulsion</u>
N - <u>S</u>	Attraction
S - N	<u>Attraction</u>
<u>S</u> - S	Repulsion

5. Write any two properties of a magnet.

Ans.: Two properties of a magnet are as follows:

- (i) Magnets attract objects made of magnetic materials like iron.
- (ii) Like magnetic poles repel each other while unlike magnetic poles attract each other.

6. Where are poles of a bar magnet located?

Ans.: Poles of a bar magnet are located at both the ends of bar magnet.

North pole (N) and the South pole (S) of a bar magnet are shown in the figure.



7. A bar magnet has no markings to indicate its poles. How would you find out near which end is its north pole located?

Ans.: A freely suspended bar magnet always comes to rest in the North-South direction.

The geographical North facing end of the magnet is its north pole and the geographical south facing end is its South pole.



Hence, the unknown poles of a bar magnet can be marked by suspending it freely by a string.

- 8. You are given an iron strip. How will you make it into a magnet?
- **Ans.:** 'Touch and stroke' method can be used to make an iron strip into a magnet. For this, a bar magnet is required. The bar magnet is moved along the length of the iron strip starting from one end to the other end.



Then, the bar magnet is lifted from the other end and brought to the starting point again with the same pole of the magnet. On repeating the process for about 30 - 40 times, the iron strip will become a bar magnet with two poles.

9. How is a compass used to find directions?

Ans.: A compass always points towards the North-South direction. The arrow of the compass needle indicates its North pole. The arrow always points in the North direction.



Once we know North direction, we can easily find out the other directions. *e.g.*, if North is upwards, South will be downwards, East will be on right hand side and West will be on left hand side.

10. A magnet was brought from different directions towards a toy boat that has been floating in water in a tub. Affect observed in each case is stated in column I. Possible reasons for the observed affects are mentioned in column II. Match the statements given in column I with those in column II.

Column I	Column II
Boat gets attracted towards the magnet.	Boat is fitted with a magnet with North pole towards its head.
Boat is not affected by the magnet.	Boat is fitted with a magnet with South pole towards its head.
Boat moves towards the magnet if North pole of the magnet is brought near its head.	Boat has a small magnet fixed along its length.
Boat moves away from the magnet when North pole is brought near its head.	Boat is made of magnetic material.
Boat floats without changing its direction.	Boat is made of non-magnetic material.

Ans.:

Column I	Column II
Boat gets attracted	Boat is made of
towards the	magnetic material.
magnet.	
Boat is not affected	Boat is made of
by the magnet.	non-magnetic
	material.
Boat moves towards	Boat is fitted with a
the magnet if North	magnet with South pole
pole of the magnet	towards its head.
is brought near its	
head.	
Boat moves away	Boat is fitted with a
from the magnet	magnet with North
when North pole	pole towards its head.
is brought near its	
head.	
Boat floats without	Boat has a small magnet
changing its	fixed along its length.
direction.	

EXERCISE

Multiple Choice Questions

Level - 1

- **1.** Which of the following is a magnetic material?
 - (a) Copper (b) Nickel
 - (c) Aluminium (d) Silver
- 2. The force that a magnet exerts on iron is called
 - (a) gravitational force (b) frictional force
 - (c) magnetic force (d) none of these.
- 3. Magnetite is made of mainly a chemical called
 - (a) calcium oxide (b) iron oxide
 - (c) sulphur dioxide (d) all of these.
- 4. A magnet has _____ poles.
 - (a) two (b) three
 - (c) one (d) four
- 5. Unlike poles _____ and like poles _____ each other.
 - (a) repel, attract (b) attract, attract
 - (c) attract, repel (d) repel, repel
- 6. A freely suspended magnet comes to rest in the _____ direction.
 - (a) North-South (b) North-East
 - (c) South-North (d) North-West
- 7. The substances that are attracted by a magnet are
 - (a) non-magnetic substances
 - (b) magnetic substances
 - (c) both (a) and (b)
 - (d) neither (a) nor (b).
- 8. The instrument which is used to identify the geographical directions is
 - (a) manometer
 - (b) barometer
 - (c) periscope
 - (d) magnetic compass.
- **9.** Which of the following is used to identity north direction?
 - (a) Pole star (b) Sirius
 - (c) Orion (d) Ursa minor

- **10.** A magnet can induce magnetism in
 - (b) aluminium
 - (c) glass (d) steel
- **11.** A small piece of _____ ore is called a magnet.
 - (a) copper (b) iron
 - (c) silver (d) nickel
- **12.** Which magnet is used in a compass?
 - (a) Bar magnet

(a) brass

- (b) Electromagnet
- (c) Magnetic needle
- (d) Horse-shoe magnet
- **13.** Heating a magnet leads to
 - (a) demagnetisation
 - (b) increase in magnetic strength
 - (c) no change
 - (d) both (a) and (b).
- **14.** The electromagnets used to make electric doorbells are
 - (a) horse-shoe magnets
 - (b) bar magnets
 - (c) cylindrical shaped magnets
 - (d) round shaped magnets.
- **15.** The force by which objects tend to push each other is called
 - (a) repulsion (b) attraction
 - (c) either repulsion or attraction
 - (d) none of these
- **16.** The force by which objects tend to pull each other is called
 - (a) attraction (b) repulsion
 - (c) both (a) and (b) (d) neither (a) nor (b).
- 17. In a bar magnet, magnetic strength is
 - (a) more at both ends of the magnet
 - (b) more in the middle of the magnet
 - (c) same throughout the magnet
 - (d) none of these.

(a) Iron

- **18.** Which of the following is not a magnetic material?
 - (b) Nickel
 - (c) Cobalt (d) Copper

- **19.** The end of the magnet which points towards geographic north is called _____ pole whereas the end of the magnet which points towards geographic south is called _____ pole.
 - (a) north, south (b) south, north
 - (c) north, east (d) south, east
- **20.** Which of the following instruments use magnet?
 - (a) Tape recorders (b) ATM cards
 - (c) Microphones (d) All of these
- **21.** The magnetic north pole of the Earth is near the
 - (a) geographical north pole
 - (b) geographical south pole
 - (c) neither (a) nor (b)
 - (d) sometimes (a) and sometimes (b).
- **22.** The magnetic south pole of the Earth is near the
 - (a) geographical north pole
 - (b) geographical south pole
 - (c) neither (a) nor (b)
 - (d) sometimes (a) and sometimes (b).
- 23. Magnetite is _____.
 - (a) an electromagnet (b) a natural magnet
 - (c) an artificial magnet (d) not a magnet
- **24.** The phenomenon of the attraction of a substance by a magnet is called
 - (a) magnetic field (b) magnetic pole
 - (c) magnetism (d) none of these.
- **25.** Artificial magnets can be made by
 - (a) chemical methods only
 - (b) mechanical methods only
 - (c) electrical methods only
 - (d) both (b) and (c).
- **26.** In ancient times, humans made crude navigational compass by using
 - (a) steel (b) lodestone
 - (c) alnico (d) soft iron
- 27. Parts of magnet which are concentrated in attraction or repulsion are called
 - (a) poles (b) corners
 - (c) fields (d) borders
- **28.** Magnets can make objects move without touching them by using
 - (a) magic (b) magnetic finger
 - (c) magnetic force (d) none of these
- 29. Magnetic force is a (a) contact force
- (b) non-contact force
- (c) muscular force (d) none of these

30. Steel is an alloy of _____

(a) iron

(c) cobalt

(b) aluminium

(b) Comb

(d) all of these

Level - 2

- **31.** Which of the following gets attracted towards a magnet?
 - (a) Book
 - (c) Silver spoon (d) Iron ring
- **32.** _____ is the surest test of magnetisation.
 - (a) Rotation (b) Repulsion
 - (c) Attraction (d) All of these
- **33.** Which of the following gets demagnetised when a powerful magnet is kept near it?
 - (a) Compact disc (b) Cellphone
 - (c) Both (a) and (b) (d) None of these
- **34.** Which of the following do not get demagnetised when a powerful magnet is kept near it?
 - (a) Microphones
 - (b) Glass tumblers
 - (c) Audio and video tapes
 - (d) All of these
- **35.** Magnetic force is _____ when two magnets are kept far apart.
 - (a) increased
 - (b) decreased
 - (c) first decreased, then increased
 - (d) none of these
- **36.** Which of the following is indicated by a magnetic compass?
 - (a) Volcano (b) Altitude
 - (c) Direction (d) Sea-level
- **37.** When a magnet is placed on a wooden plate with some iron nails spread on it, then
 - (a) nails stick all around the magnet in a same manner
 - (b) most of the nails stick at the centre of the magnet
 - (c) most of the nails stick at the ends of the magnet
 - (d) none of these.
- 38. Temporary magnets are made of
 - (a) brass (b) lead
 - (c) soil (d) soft iron
- **39.** Alnico is an alloy of
 - (a) Silver, Nickel, Cobalt
 - (b) Nickel, Aluminium, Copper
 - (c) Aluminium, Silver, Copper
 - (d) Aluminium, Nickel, Cobalt

- **40.** If you break a magnet into 6 pieces, how many north and how many south poles would there be in all?
 - (a) N = 6, S = 6 (b) N = 3, S = 3
 - (c) N = 12, S = 12 (d) N = 6, S = 12
- **41.** Back of credit cards/ATM cards with metal strip is
 - (a) copper (b) gold
 - (c) magnet (d) none of these.
- **42.** How many keepers does a horseshoe magnet need for its storage?
 - (a) 1 (b) 2
 - (c) 5 (d) 8
- **43.** A substance consisting of a coil of wire with an iron core and is only magnetized when electric current flows through it is called
 - (a) permanent magnet (b) electromagnet
 - (c) battery (d) bar magnet.
- **44.** If one stands facing the east, then north will be on his/her ______ side and south will be on the ______
 - (a) left, right (b) right, left
 - (c) both (a) and (b) can be possible
 - (d) can't be explained
- **45.** Artificially designed electromagnets are much ______ than natural magnets.
 - (a) stronger (b) weaker
 - (c) cheaper (d) none of these
- **46.** Magnets now-a-days are made of
 - (a) iron (b) steel
 - (c) both (a) and (b) (d) copper
- **47.** Which of the following is true about magnets?
 - (a) Every magnet has only two poles.
 - (b) Different types of magnets have different number of poles.
 - (c) Poles of the magnet can be isolated.
 - (d) Both (a) and (c) are true.
- 48. Magnets was found in a place called
 - (a) Malaysia (b) Magnesia
 - (c) Mexico (d) Denmark
- **49.** When an iron rod is put inside a current carrying wire, the strength of the electromagnet
 - (a) increases (b) decreases
 - (c) remains same (d) becomes zero.

- **50.** High-speed magnetic levitation trains run without touching the track, on the powers of
 - (a) electromagnets (b) bar magnets
 - (c) natural magnets (d) none of these.

Fill in the Blanks

- The magnets which are not natural are known as _____ magnets.
- 2. The points where the power of the magnet is the strongest are called _____.
- **3.** Two south poles _____ each other.
- **4.** _____ is used for navigation.
- 5. Materials that are not attracted by magnets are known as _____ materials.
- 6. Electromagnets are made by passing _____ through them.
- 7. Loss of magnetism is known as _____.
- 8. _____ is made of Aluminium, Nickel and Cobalt.
- 9. The _____ pole of a freely suspended magnet points towards the geographical north pole.
- **10.** The strips of magnetic material used to store magnets safely are called _____.

True or False

- **1.** Attraction is the sure test of a magnetism.
- 2. Magnetite is an artificial magnet.
- **3.** Different magnets have different number of poles.
- **4.** Magnets should be stored in pairs with their opposite poles lying side by side.
- 5. Hammering strengthens the magnetic properties.
- 6. Permanent magnets are made of soft iron.
- 7. Magnetic force acts from a distance.
- 8. Magnets should be kept away from all the electronic devices.
- **9.** Alloys are used to make magnets to decrease their magnetic strength.
- **10.** Temporary magnets behave like magnets only in the magnetic field produced by a permanent magnet or an electric current.

Match the Following

In this section, each question has two matching lists. Choices for the correct combination from List-I and List-II are given as options (a), (b), (c) and (d) out of which one is correct.

- 1. List-I (P) N - S
 - (Q) Heating
 - (R) Alnico
- 2.

1.

1

Alloy
 Attraction

List-II

List-II

3. Iron ore

1.

2.

4.

Direction finder

Non-magnetic

Electromagnet

Repulsion

- 4. Demagnetisation
- (S) S S **Code :**
 - PQRS
- (a) 1 4 2 3
- (b) 3 4 2 1
- (c) 3 4 1 2
- (d) 2 3 4

2. List-I

- (P) Magnetite
- (Q) Doorbell
- (R) Compass
- (S) Aluminium
- Code :
- PQRS a) 4 3 2 1
- (a) 4 3 2 1 (b) 3 4 2 1
- (c) $3 \ 4 \ 1 \ 2$
- (d) 4 3 1 2

3. List-I

- (P) Poles of magnet
- (Q) Steel
- (R) A giant magnet(S) The property of
 - magnets PQRS
- (a) 2 1 4 3
- (b) 2 1 3 4
- (c) $1 \ 2 \ 4 \ 3$
- (d) 1 2 3 4

Assertion & Reason Type

Directions : In the following questions, a statement of assertion is followed by a statement of reason. Mark the correct choice as :

- (a) If both assertion and reason are true and reason is the correct explanation of assertion
- (b) If both assertion and reason are true but reason is not the correct explanation of assertion
- (c) If assertion is true but reason is false
- (d) If assertion is false but reason is true.

- Assertion : Magnetite is an electromagnet.
 Reason : Artificial magnets are stronger than natural magnets.
- 2. Assertion : We should not rub similar poles of two magnets.
 - **Reason** : Rubbing of similar poles leads to demagnetiation.
- **3. Assertion :** Most of the iron filings stick to the magnet at the ends.
 - **Reason** : Magnetic strength is maximum on the poles of a magnet.
- **4. Assertion :** We can never have an isolated north pole or south pole.
 - **Reason** : Unlike poles attract and like poles repel each other.
- 5. Assertion : The region around a magnet where its magnetic influence is felt is called magnetic field.
 - **Reason** : Magnetic influence of a magnet is maximum at its centre.
- 6. Assertion : Alloys of magnetic substances are used to make artificial magnets.
 - **Reason** : Alloys make the magnets strong.
- 7. Assertion : Repulsion, not attraction is the surest test of magnetism.
 - **Reason** : Like poles of magnets repel each other.
- 8. Assertion : A magnet can attract a copper wire.Reason : Copper is a non-magnetic material.
- 9. Assertion : Magnets should be placed in keepers.

Reason : Keepers prevent self-demagnetisation of magnets.

- **10. Assertion :** Doctors use an electromagnet to remove particles of iron or steel from a patient's eye.
 - **Reason** : An electromagnet is a temporary magnet.

Comprehension Type

PASSAGE-I : A magnetic field is described by drawing the magnetic field lines. The magnetic field lines always begin from the north pole of magnet and end on the south pole of the magnet. They do not intersect one another. They come closer to one another near the poles but they are widely separated at other places.

- List-II
- 1. Magnetic material
- 2. Magnetic strength
- 3. Magnetism
- 4. Core of the Earth
- net 3. 7 of 4.

4.

- **1.** The direction of magnetic field lines is
 - (a) north to south (b) south to north
 - (c) both (a) and (b) (d) neither (a) nor (b)
- 2. The strength of magnetic field is weak at
 - (a) north pole (b) south pole
 - (c) centre (d) both of the poles
- 3. The magnetic field lines
 - (a) intersect at right angles to one another
 - (b) intersect at an angle of 45° to one another
 - (c) do not cross one another
 - (d) cross at an angle of 60° to one another.

PASSAGE-II: The magnetic field of a magnet is an invisible field which is created by magnetism. The force for magnets to attract other objects is caused by moving electrons. Magnets are made by using electrical and mechanical methods. A temporary magnet can be made by passing electricity through a coil.

- Which of the following is a temporary magnet?
 (a) Bar magnet
 - (b) Horseshoe magnet
 - (c) Electromagnet
 - (d) North pole
- 2. The invisible field surrounding a magnet is called
 - (a) a magnetic field (b) the force field
 - (c) an electromagnet (d) none of these
- 3. Moving ______ is the cause of magnets repelling or attracting each other or other objects.
 - (a) protons (b) electrons
 - (c) molecules (d) neutrons

PASSAGE-III: The Earth itself behaves as a magnet. The shape of the earth's magnetic field resembles that of an imaginary bar magnet of length one-fifth of earth's diameter. The axis of earth's magnetic field is inclined at an angle of about 15° with the geographical axis. The earth's magnetism is due to the magnetic effect of current which is flowing in the liquid core at the centre of the Earth. Thus, Earth is a huge electromagnet.

1. The axis of earth's magnetic field is inclined with the geographical axis at an angle of about

(a)	5°	(b)	15°	
(c)	25°	(d)	35°	

- 2. The shape of the earth's magnetic field resembles that of an imaginary
 - (a) U-shaped magnet
 - (b) needle-shaped magnet
 - (c) current-carrying circular coil
 - (d) bar magnet

- Earth is a huge electromagnet because of

 (a) magnetic effect of current
 - (b) electric effect of current
 - (c) magnet buried at its centre
 - (d) all of these.

Subjective Problems

Very Short Answer Type

- **1.** Name the shapes of some artificial magnets.
- 2. What are magnetic substances?
- **3.** Suggest some methods that are used for making artificial magnets.
- **4.** Write the name of an iron ore that shows magnetic properties.
- **5.** Define magnetic induction.
- 6. Name the device which is used for finding the directions and navigation.
- 7. Write the properties of magnetic poles.
- 8. What is magnetism?
- 9. Classify the following substances in magnetic and non-magnetic substances: aluminium, wood, paper, iron, cobalt, brass, nickel
- **10.** Name the materials which are used to make permanent magnets.

Short Answer Type

- 1. A magnetic needle is placed over a strong bar magnet and made to move freely. In which direction the magnetic needle will come to rest?
- 2. What are the different types of magnets? And where are the poles located?
- **3.** How can we find out near which end is south pole located in a bar magnet?
- 4. What are the uses of electromagnets?
- 5. Distinguish between magnetic and non-magnetic substances.
- 6. Write the causes of demagnetisation.
- 7. What will happen if the north pole of a magnet is brought near
 - (a) the south pole
 - (b) the north pole of a freely suspended magnet?
- 8. Distinguish between permanent magnet and temporary magnet.
- 9. Is an electromagnet a temporary magnet or a permanent magnet? Give reason.

- 10. (a) Write the working principle of maglev train.(b) Why is the magnetic strip used in the door of the refrigerators?
- **11.** How can you say that the power of a magnet is the strongest at the poles?
- **12.** What happens if a magnet is broken into two pieces?
- **13.** The property of attraction cannot be used to test whether a given object is a magnet or not. Give reason.
- **14.** It is suggested that electronic devices should be kept away from magnetic objects. Why?
- **15.** Does an object kept near to the magnet experience more force as compared to an object kept a little away? Give reason.

Long Answer Type

- **1.** Suggest some ways to prevent demagnetisation of magnets.
- 2. Explain, why a freely suspended magnet always points in the north-south direction.
- **3.** Describe the construction and working of a magnetic compass.
- 4. Describe a method of making artificial magnets.
- 5. What is a magnet? Explain its basic properties.

Integer Answer Type

In this section, each question, when worked out, will result in one integer from 0 to 9 (both inclusive).

- Write the number of magnetic objects in the following: Iron, wood, plastic, cotton, paper, glass, stainless steel.
- 2. How many keepers does a bar magnet need for its storage?
- **3.** If a magnet is broken into 3 pieces, how many poles would there be in all?
- 4. How many statements are true about a magnet?
 - (i) Different types of magnets have different number of poles.
 - (ii) We can never have an isolated north pole or south pole.
 - (iii) Magnetic force of a magnet is maximum at its poles.
 - (iv) Repulsion is the surest test of magnetisation.
- 5. How many pairs of magnets attract each other in the following cases?







Multiple Choice Questions

- 1. (b) : Nickel is a magnetic substance.
- 2. (c) : The force that the magnet exerts on iron is called magnetic force.
- 3. (b) : Magnetite is made of mainly of a chemical called iron oxide.
- **4.** (a) : A magnet has always two poles.
- 5. (c) : Unlike poles attract and like poles repel each other.
- 6. (a) : If a magnet is freely suspended, its north pole points towards the north and its south pole points towards the south.
- 7. (b) : The substances that are attracted by a magnet are known as magnetic substances.
- 8. (d) : Magnetic compass is used for finding directions and in navigation.
- 9. (a) : Pole star is positioned exactly above the north pole of Earth and is used to identify directions.
- **10.** (d) : A magnet can induce magnetism in magnetic substance only, *i.e.*, steel.
- **11.** (b) : A small piece of iron ore is called a magnet.
- **12.** (c) : A magnetic needle is used in a compass.
- **13.** (a) : A magnet loses its magnetism, *i.e.*, demagnetised if it is heated above a certain temperature.
- **14.** (a) : The electromagnets used to make electric doorbells are horse-shoe magnets.
- **15.** (a) : The force by which objects tend to push or move away from each other is known as repulsion.
- **16.** (a) : The force by which objects tend to pull or come close to each other is known as attraction.
- **17.** (a) : Strength of magnetic field is maximum at both ends of a bar magnet, *i.e.*, poles.
- **18.** (d) : Copper is a non-magnetic material.
- **19.** (a) : The pole of the magnet pointing towards geographic north is called north pole whereas the pole pointing towards geographic south is called south pole.

Fun with Magnets

- **20.** (d) : Magnet is used in tape recorders, ATM cards, microphones, etc.
- **21.** (b) : The magnetic north pole of the Earth is pointed towards geographical south pole.
- **22.** (a) : The magnetic south pole of the Earth is pointed towards geographical north pole.
- 23. (b) : Magnetite is a natural magnet.
- **24.** (c) : The phenomenon of the attraction of a substance by a magnet is called magnetism.
- **25.** (d) : Artificial magnets are made by both mechanical and electrical methods.
- **26.** (b) : Crude navigational compass was made by using lodestone in ancient times.
- **27.** (a) : Poles are the parts of magnet which exert force.
- **28.** (c) : Magnetic force creates motion in the objects without touching them.
- **29.** (b) : Magnetic force is a non-contact force.
- **30.** (a) : Steel is an alloy of iron.
- **31.** (d) : Iron ring gets attracted towards a magnet as it is a magnetic material.
- 32. (b) : Only repulsion is the surest test of magnetisation.
- **33.** (c) : Compact disc and cellphone has magnet inside them which get demagnetised when a powerful magnet is kept near them.
- **34.** (b) : As it does not use magnet.
- **35.** (b) : Greater the distance between two magnets, smaller will be the magnetic force between them.
- **36.** (c) : Magnetic compass is used to find directions.
- **37.** (c) : Nails stick at the ends of the magnet as magnetic field is stronger at the ends (poles).
- **38.** (d) : Temporary magnets are made of soft iron.
- **39.** (d) : Alnico is an alloy of aluminium, nickel and cobalt.
- **40.** (a) : Number of poles in 1 magnet = 2 (1 N, 1 S) Number of poles in 6 magnets = 2 × 6 = 12 *i.e.*, 6 N and 6 S

- **41.** (c) : Information is stored on the magnetic strip on credit cards/ATM cards.
- **42.** (a) : A horse-shoe magnet needs only one keeper across its poles.
- **43.** (b) : Electromagnets are the temporary magnets which consists of a coil of wire with an iron core. It is magnetised only when electric current pass through it.
- 44. (a)
- **45.** (a) : Electromagnets are designed to increase the magnetic strength.
- **46.** (c) : Now-a-days, magnets are made by both iron and steel.
- 47. (a) : Every magnet has only two poles.
- **48.** (b) : Magnets are discovered in Magnesia in Greece.
- **49.** (a) : Soft iron is used to increase the magnetic strength of an electromagnet.
- **50.** (a) : High-speed magnetic levitation trains run on the powers of electromagnets.

6.

8.

Fill in the Blanks

- **1.** Artificial
- 2. Magnetic poles
- 3. Repel

5.

Magnetic poles
 Magnetic compass

Current

Alnico

- Non-magnetic
- 7. Demagnetisation
- 9. North 10. Keepers

True or False

- **1. False :** Not attraction, only repulsion is the sure test of a magnetism.
- 2. False : Magnetite is a natural magnet.
- 3. False : Magnets have only two poles.
- 4. True
- 5. False : Soft iron is a magnetic material.
- 6. False 7. True
- 8. True 9. False
- 10. True

Match the Following

1. (b) 2. (c) 3. (a)

Assertion & Reason Type

- 1. (d) : Artificial magnets are stronger than natural magnets. Magnetite is a natural magnet.
- 2. (a) 3. (a)
- 4. (b) : Magnets only exist in pairs of poles. They can not be isolated.
- 5. (c) : Magnetic influence of a magnet is maximum at its poles.

- 6. (a)
- 7. (b) : Magnetic substances are attracted towards magnets but not repelled. Repulsion is shown only when both are magnets and their like poles are placed close to each other.
- 8. (d) : A magnet cannot attract a copper wire as it is a non-magnetic material.
- 9. (a)
- **10.** (b) : Magnetic strength of electromagnets is controlled by the amount of electric current flowing. Hence, doctor can optimize the instrument according to the need of surgery.

Comprehension Type

2.	(c)	3.	(c)
2.	(a)	3.	(b)
2.	(d)	3.	(a)
	2. 2. 2.	 2. (c) 2. (a) 2. (d) 	2. (c) 3. 2. (a) 3. 2. (d) 3.

Subjective Problems

Very Short Answer Type

- **1.** Bar magnet, horseshoe magnet, ring-shaped magnet and cylindrical-shaped magnet, etc.
- 2. The materials that are attracted by a magnet and can be converted into magnets are known as magnetic materials. *e.g.*, iron, nickel, cobalt, etc.
- 3. Single touch method, double touch method, electrical method, etc.
- **4.** Magnetite is an iron ore that shows magnetic properties.
- 5. The process of magnetising an unmagnetised iron piece by repeatedly bringing a magnet closer to it is known as magnetic induction.
- 6. Magnetic compass is used for finding directions and navigation.
- 7. (i) Poles of a magnet always exist in pairs.
 - (ii) Unlike poles attract and like poles repel each other.
- 8. The phenomenon of the attraction of a substance by a magnet is called magnetism.
- **9.** Magnetic substances : iron, nickel and cobalt Non-magnetic substances : aluminium, wood, paper and brass.
- 10. Alnico (Nickel + Aluminium + Cobalt) and alloys such as steel (Iron + Carbon + Nickel + Aluminium + Titanium) are used for making permanent magnets.

Short Answer Type

1. The magnetic needle will come to rest with its pole in the opposite direction relative to that of the strong bar magnet.



Because opposite magnetic poles attract each other and the magnetic needle is under the effect of the bar magnet.

2. Bar magnet - The poles are located at the ends of the bar.

Horseshoe magnet - The poles are located at the ends of 'U' shape.

Cylindrical magnet - The poles are located at the two circular ends of the cylinder.

3. Hang up the magnet by a cotton thread so that it hangs freely. When it comes to rest, we note that the magnet is lying in north-south direction.



- 4. (i) For lifting heavy loads : Electromagnets are used on cranes to lift heavy loads in scrap yards.
 - (ii) In hospitals : Electromagnets are used for removing splinters of iron or steel from the injured eye.
 - (iii) **In instruments :** Many instruments such as electric bell, loudspeakers, electric motors, etc., use electromagnets.
- **5. Magnetic substances :** The substances attracted by a magnet and can be converted into magnets are called magnetic substances. *e.g.* iron, nickel, cobalt, steel, etc.

Non-magnetic substances : The substances that are not attracted by a magnet are called non-magnetic substance, *e.g.*, rubber, plastic, wood, copper, etc.

- 6. A magnet can be demagnetised by
 - (a) heating, hammering, dropping from a height or rough handling.
 - (b) keeping two magnets side by side with like poles next to each other.
- (a) If the north pole of a magnet is brought near the south pole of another magnet, they will get attracted towards each other.
 - (b) If the north pole of a magnet is brought near the north pole of another magnet, they will repel each other.

It is because like poles of a magnet repel each other and unlike poles of a magnet attract each other.

8.		Permanent magnet	Temporary magnet
	i.	A permanent	A temporary magnet
		magnet produces a	can produce very
		comparatively weak	strong magnetic force.
		force of attraction.	

ii.	The strength of a	The strength of a
	permanent magnet	temporary magnet can
	cannot be changed.	be changed by passing
		current through it.

- 9. An electromagnet is a temporary magnet because its magnetism is only for the duration of current passing through it. So, the magnetism of an electromagnet can be switched on or switched off as desired.
- 10. (a) Maglev train works on the principle of magnetism. It floats above its track by strong magnetic forces produced by computer controlled electromagnets.
 - (b) The magnetic strip is used in the door of the refrigerators to keep it closed properly.
- **11.** Take some iron filings and spread them on a sheet of paper. Roll a bar magnet over them and lift it up. You will notice that most of the iron clips stick near the poles of the magnet. So, we can say that the power of the magnet is the strongest at the poles.



12. If a magnet is broken into two pieces, each part

becomes a magnet with two poles, *i.e.*, north pole and south pole. Magnetic poles always exist in pairs and an isolated pole, either north pole or south pole, cannot exist.

$\left[\right]$	S N
	S N

S

- **13.** A magnet attracts magnetic materials and any unmagnetised piece of magnetic material. Any pole of a magnet also attracts the opposite poles of other magnets. So, the property of attraction cannot be used to test whether a given object is a magnet or not. But a magnet repels only a similar pole of another magnet. Hence, repulsion is the surest test of a magnet.
- 14. Electronic devices should be kept away from the magnetic objects because they use magnet in them. Keeping magnetic objects near electronic devices leads to demagnetisation which may erase all the important information stored in them.
- **15.** Yes, an object kept very near to the magnet experiences more force as compared to an object kept a little away. It is so because the influence of magnetic field is greater near the magnet. It decreases as the distance from the magnet of an object increases.

Long Answer Type

- **1.** The following cautions must be taken to keep magnets safe :
 - (i) Magnets should not be heated, hammered or dropped from a height.
 - (ii) Magnets should be kept away from all the electronic devices such as televisions, mobile phones, ATM/Credit cards, etc.
 - (iii) Bar magnets should be stored in pairs with their opposite poles lying side by side. They must be separated by a piece of wood and two pieces of soft iron called keepers should be place across their ends.
 - (iv) For a horseshoe magnet, a single keeper is placed across the poles.
- The Earth itself behaves like a huge magnet. It 2. is believed that earth's magnetism is due to the magnetic effect of current flowing in the liquid core at the centre of the Earth. The shape of the earth's magnetic field resembles that of an imaginary bar magnet. The south pole of this bar magnet is near the geographical North pole, whereas the north pole of the bar magnet is near the geographical South pole. In a freely suspended magnet, therefore, the north pole points towards the geographical North pole since it is attracted by the earth's magnetic South pole. Similarly, the south pole of the suspended magnet is attracted by the earth's magnetic North pole, and therefore, points towards the geographical South pole.



3. Construction : A magnetic compass is a simple device for finding directions. It consists of a magnetic needle that can turn freely about its centre. The needle is encased in a box with a transparent top. The directions are either printed on a card placed below the needle or marked on top of the box. Usually, the north pole of the needle is painted red or blue. The magnetised needle when comes to rest indicates the north-south direction.



Working : To find the direction of a place, the magnetic compass is taken to that place. The needle of the compass starts rotating till the painted end reaches north marked on the compass. This indicates the direction in which the place is located.

4. Single touch method : Place an iron needle on a table. Hold it firmly and stroke it about 30 times from one end to the other with one pole of a bar magnet. Do not lift the magnet while sliding it over the iron needle. After you reach the other end, lift the magnet high and bring it back to the first end. Now, test the needle to see if it has become a magnet. Suspend it freely. If you stroke with the north pole of the magnet, the end of the iron needle from which the stroking is started becomes the north pole. The other end becomes the south pole or vice-versa.



5. Any material that attracts iron objects is called a magnet. The two ends of a magnet are called its poles, *i.e.*, the north pole (N) and south pole (S).



The basic properties of a magnet are :

- 1. Unlike poles attract each other and like poles repel each other.
- 2. **Attractive property :** The property by which a magnet tends to attract some substances like iron, cobalt and nickel when brought near it is known as attractive property.
- 3. **Directive property :** If a magnet is suspended freely with a thread, then, it always aligns itself in the geographic north-south direction when it comes to rest. This property of a magnet is called a directive property.

Integer Answer Type

- 1. (1) : Only iron is a magnetic substance while others are non-magnetic.
- (2) : A bar magnet needs 2 keepers across its poles.
- **3.** (6) : 3-north poles and 3-south poles.
- **4.** (3) : Only (ii), (iii) and (iv) are true.
- 5. (1) : Only in case (a), the magnets will attract each other. Because like poles repel each other and unlike poles attract each other.

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