Class: 9th

Subject: Physics

Chapter 8: Magnetism

A Exercise MCQs

8.1 Which one of the following is not a magnetic material?

(a) Cobalt

(b) Iron

(c) Aluminium ✅

(d) Nickel

8.2 Magnetic lines of force:

(a) Are always directed in a straight line

(b) Cross one another

(c) Enter into the north pole

(d) Enter into the south pole ✅

8.3 Permanent magnets cannot be made by:

(a) Soft iron ✅

(b) Steel

(c) Neodymium

(d) Alnico

8.4 Permanent magnets are used in:

(a) Circuit breakers

(b) Loudspeakers ✅

(c) Electric cranes

(d) Magnetic recording

8.5 A common method used to magnetise a material is:

(a) Stroking ✅

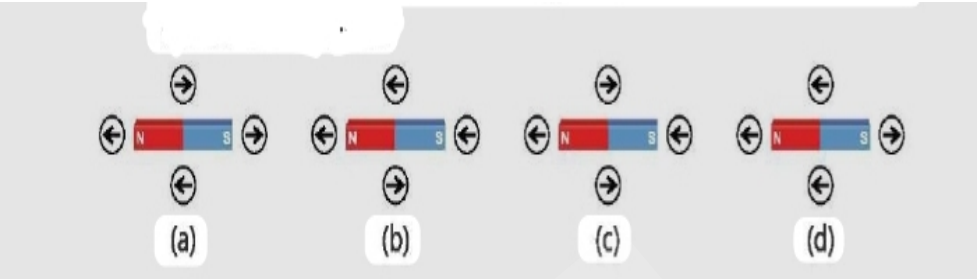
(b) Hitting

(c) Heating

(d) Placing inside a solenoid having A.C

8.6 A magnetic compass is placed around a bar magnet at four points as shown in figure below.

Which diagram would indicate the correct directions of the field?

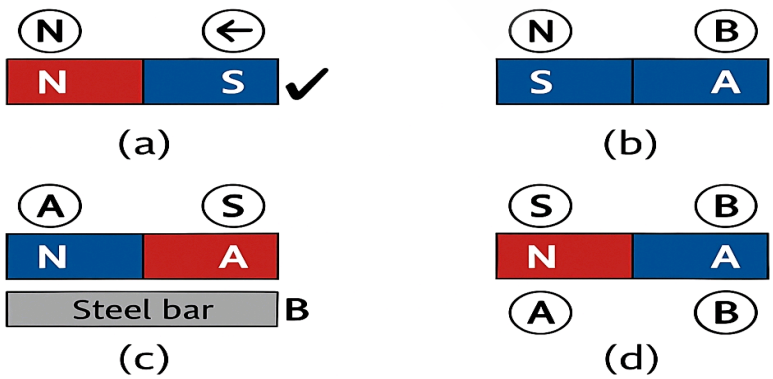


Option (a)correctly represents field lines moving away from the north pole and towards the south pole, which is how magnetic fields behave.

Options (b), (c), and (d) are incorrect because they show field directions opposing this natural movement.

So, the correct answer is (a).

8.7 A steel rod is magnetised by double touch stroking method. Which one would be the correct polarity of the AB magnet?



8.8 The best material to protect a device from external magnetic field is:

(a) Wood

(b) Plastic

(c) Steel

(**d**) Soft iron ✅

Important MCQs:

1. Magnetic materials are:

(a) Repelled by magnets

(b) Not affected by magnets

(**c**) Attracted by magnets ✅

(d) Made of plastic

2. Which of the following is a magnetic material?

(a) Wood

(**b**) Iron ✅

(c) Glass

(d) Plastic

3. A freely suspended bar magnet always aligns itself in which direction?

(a) East-West

(b) North-South ✅

(c) Up-Down

(d) None of these

4. The end of a magnet that points north is called:

(a) South pole

(b) Magnetic end

(c) North pole ✅

(d) Repelling pole

5. What happens when like poles of two magnets are brought close?

(a) They attract

(b) They repel ✅

(c) Nothing happens

(d) They merge

6. Unlike poles of two magnets:

(a) Repel each other

(b) Have no effect

(c) Attract each other ✅

(d) Destroy each other

7. Repulsion between poles is a sure test of:

(a) Magnetism

(b) Magnetic material

(c) A magnet ✅

(d) Attraction

8. If an object is attracted by both ends of a magnet, it is:

(a) A magnet

(b) A magnetic material ✅

(c) A non-magnetic object

(d) A repelling object

9. Can a single isolated magnetic pole be obtained by breaking a magnet?

(a) Yes

(b) No ✅

(c) Sometimes

(d) Only in liquid form

10. The process of making a magnetic material into a magnet is called:

(a) Demagnetization

(b) Polarization

(c) Magnetization ✅

(d) Ionization

11. Induced magnetism occurs when:

(a) A magnet is melted

(b) A magnetic material is placed near a magnet ✅

(c) A magnet is broken

(d) A magnet is frozen

12. Which of the following is used to make temporary magnets?

(a) Wood

(b) Plastic

(c) Soft iron ✅

(d) Alnico

13. Which of the following is a permanent magnet material?

(a) Paper clip

(b) Steel ✅

(c) Glass

(d) Copper

14. Temporary magnets lose their magnetism when:

(a) Heated

(b) Removed from magnetic field ✅

(c) Cooled

(d) Broken

15. Which of the following is an example of a temporary magnet?

(a) Alnico

(b) Ferrite

(c) Electromagnet ✅

(d) Cobalt

16. What is a magnetic field?

(a) A visible region around a magnet

(b) A region where a magnet does not work

(c) A region where a magnetic object feels a force ✅

(d) A region full of air

17. Which experiment shows the pattern of a magnetic field?

(a) Using a thermometer

(b) Sprinkling water on glass

(c) Sprinkling iron filings on a glass plate over a magnet ✅

(d) Placing a magnet in water

18. The lines that represent magnetic field are called:

(a) Electric lines

(b) Magnetic lines of force ✅

(c) Gravity lines

(d) Vibration lines

19. Magnetic field lines appear to originate from:

(a) South to North

(b) West to East

(c) North pole to South pole ✅

(d) Centre of magnet

20. The direction of magnetic field at any point is given by:

(a) South end of compass needle

(b) Any object placed there

(c) North end of compass needle ✅

(d) Movement of the magnet

21. Where is the magnetic field strongest around a bar magnet?

(a) At the centre

(b) Equally everywhere

(c) Near the poles ✅

(d) Away from the poles

22. What is a neutral point in a magnetic field?

(a) Where the magnetic force is maximum

(b) Where both magnetic fields add

(c) Where magnetic fields cancel each other ✅

(d) Where a magnet disappears

23. The magnetic field between poles of a horse-shoe magnet is:

(a) Non-uniform

(b) Zero

(c) Random

(d) Almost uniform ✅

24. Permanent magnets are used in:

(a) Electric motors ✅

(b) Heaters

(c) Solar panels

(d) Wind turbines

25. Why are permanent magnets used in refrigerators?

(a) For cooling

(b) For decoration

(c) To keep the door closed tightly ✅

(d) To produce heat

26. What is an electromagnet?

(a) A natural magnet

(b) A permanent magnet

(c) A magnet made using electric current ✅

(d) A broken magnet

27. The magnetic property of an electromagnet lasts:

(a) Permanently

(b) Until the nail breaks

(c) As long as current flows through the coil ✅

(d) For a few minutes only

28. Which factor increases the strength of an electromagnet?

(a) Decreasing number of coil turns

(b) Increasing current or coil turns ✅

(c) Using a plastic rod

(d) Cooling the wire

29. What is the function of a circuit breaker?

(a) To generate electricity

(b) To increase voltage

(c) To protect appliances by stopping excessive current ✅

(d) To switch on the fan

30. How do electromagnetic cranes release heavy metal objects?

(a) By increasing temperature

(b) By using a pulley

(c) By switching off the electric current ✅

(d) By shaking the crane

31. Which of the following is a ferromagnetic material?

(a) Aluminium

(b) Water

(c) Copper

(d) Iron ✅

32. What is a magnetic domain?

(a) The orbit of an electron

(b) A random arrangement of atoms

(c) A region where atomic magnets are aligned in the same direction ✅

(d) A magnetic field in a vacuum

33. Which material cancels out its internal magnetic fields completely?

(a) Ferromagnetic

(b) Paramagnetic

(c) Diamagnetic ✅

(d) Electromagnetic

34. According to domain theory, what causes magnetism?

(a) Moving charges in wires only

(b) Flow of current in external circuit

(c) Motion and spin of electrons in atoms ✅

(d) Only the nucleus of the atom

35. Which material is used to make temporary magnets?

(a) Steel

(b) Soft iron ✅

(c) Copper

(d) Aluminium

36. In the double-touch method, stroking is done:

(a) With the same pole from one end to the other

(b) With unlike poles from both ends to the center ✅

(c) With current through solenoid

(d) Only with N-pole repeatedly

37. What happens to a magnet when heated strongly?

(a) It becomes stronger

(b) It glows

(c) It loses magnetism ✅

(d) It becomes a permanent magnet

38. Which method uses a solenoid for magnetising a material?

(a) Single-touch method

(b) Hammering method

(c) Magnetic induction

(d) Electromagnetic method ✅

39. What material is used for coating magnetic tapes?

(a) Aluminium

(b) Silicon

(c) Iron oxide ✅

(d) Copper

40. What is the advantage of magnetic disks over tapes?

(a) Lower cost

(b) Faster access to data ✅

(c) Larger size

(d) Easy to erase manually

41. Why is soft iron used for magnetic shielding?

(a) It is a good conductor

(b) It has low density

(c) It has high magnetic permeability ✅

(d) It is a non-magnetic material

42. What happens when a sensitive device is enclosed in a soft iron casing?

(a) The device produces magnetic field

(b) The magnetic field strengthens

(c) The magnetic flux passes through the air

(d) The magnetic flux passes through soft iron instead of the device ✅

43. What is the purpose of using rounded corners in a soft iron casing?

(a) To reduce weight

(b) To look attractive

(c) To help magnetic field lines pass smoothly ✅

(d) To increase strength

44. Why is soft iron used in electromagnets?

(a) It cannot be magnetised

(b) It retains magnetism permanently

(c) It gets magnetised quickly and loses it easily ✅

(d) It is a good insulator

45. How is the sensitivity of a moving coil galvanometer increased?

(a) By cooling it

(b) By using a copper core

(c) By using a soft iron core ✅

(d) By increasing resistance

B Exercise Short Questions

8.1 What are temporary and permanent magnets?

- **Temporary magnets** are materials like soft iron which become magnetized only when placed in a magnetic field and lose magnetism when the field is removed.
- **Permanent magnets** are materials like steel, alnico, or neodymium that retain their magnetism even after the external magnetic field is removed.

8.2 Define magnetic field of a magnet.

The magnetic field is the region around a magnet where its magnetic force can be detected. It is represented by magnetic lines of force that show the direction and strength of the magnetic effect.

8.3 What are magnetic lines of force?

Magnetic lines of force are imaginary lines used to represent the magnetic field. They emerge from the north pole and enter the south pole of a magnet and never cross each other.

8.4 Name some uses of permanent magnets.

Permanent magnets are used in:

- Loudspeakers
- Microphones
- Magnetic recording devices
- Electric meters
- Magnetic locks

8.5 What are magnetic domains?

Magnetic domains are small regions within a magnetic material in which the magnetic moments of atoms are aligned in the same direction. In unmagnetized materials, these domains are randomly oriented.

8.6 Which type of magnetic field is formed by a current-carrying long coil?

A current-carrying long coil (solenoid) produces a uniform magnetic field inside the coil, similar to that of a bar magnet.

8.7 Differentiate between paramagnetic and

diamagnetic materials.

Paramagnetic Materials Diamagnetic Materials

Important Short Questions:

1. What are magnetic materials?

Magnetic materials are substances that are attracted by magnets. Examples include iron, cobalt, and nickel.

2. What happens when a bar magnet is freely suspended?

When a bar magnet is freely suspended, it always comes to rest in the north-south direction.

3. What are magnetic poles?

The ends of a magnet where the magnetic force is strongest are called magnetic poles. One end points towards the north (north pole) and the other towards the south (south pole).

4. State the law of attraction and repulsion of magnetic poles.

Like poles repel each other, and unlike poles attract each other.

5. How can we identify whether an object is a magnet or not?

Bring the object close to both ends of a suspended magnet. If it is repelled by one end and attracted by the other, it is a magnet. If it is only attracted, it is a magnetic material.

6. What happens when a bar magnet is broken into two pieces?

Each piece becomes a complete magnet with both a north and a south pole. Isolated poles cannot be created.

7. What is induced magnetism?

Induced magnetism is the process by which a magnetic material becomes magnetized when placed near or in contact with a magnet.

8. What is meant by magnetization?

Magnetization is the process of making a magnetic material behave like a magnet, usually by placing it

in a magnetic field.

9. Define temporary magnets and give one example.

Temporary magnets are magnets that lose their magnetism when the external magnetic field is removed.

Example: Soft iron.

10. Define permanent magnets and give two examples.

Permanent magnets retain their magnetic properties for a long time.

Examples: Alnico, Cobalt.

11. What is a magnetic field?

A magnetic field is the region around a magnet where another magnetic object experiences a force.

12. How can the magnetic field around a bar magnet be observed?

By sprinkling iron filings on a glass plate placed over the magnet and gently tapping the surface.

13. What are magnetic lines of force?

They are imaginary lines that show the direction and strength of the magnetic field.

14. In which direction do magnetic lines of force travel?

They travel from the north pole to the south pole of a magnet.

15. What does the closeness of magnetic field lines indicate?

It indicates the strength of the magnetic field — closer lines mean a stronger field.

16. What is a neutral point in magnetic fields?

It is a point where the magnetic fields from two magnets cancel each other out.

17. What is the shape of the magnetic field between the poles of a horse-shoe magnet?

It is almost uniform between the poles, except near the edges.

18. Name any two household uses of permanent

magnets.

Used in door catchers and refrigerator doors to keep them closed.

19. How are permanent magnets used in electric generators?

They provide the magnetic field needed to induce current when the coil rotates.

20. What is the function of a permanent magnet in a loudspeaker?

It interacts with the voice coil to produce vibrations that generate sound.

21. Name two fields where permanent magnets are used.

Used in medical field and electrical devices like motors and speakers.

22. What is an electromagnet?

A temporary magnet made by passing electric current through a coil wrapped around an iron object.

23. How can the strength of an electromagnet be increased?

By increasing the number of turns in the coil or increasing the current.

24. Name two devices that use electromagnets.

- **Electric bell** and **magnetic relay**.

25. How does a circuit breaker work using an electromagnet?

If current exceeds the safe limit, the electromagnet attracts the armature and breaks the circuit.

26. What does the magnetic field of a bar magnet resemble?

It resembles the magnetic field produced by a solenoid carrying current.

27. What causes magnetism in materials according to domain theory?

Magnetism is caused by the motion of electrons within atoms.

28. What is a magnetic dipole?

An atom with a resultant magnetic field acts like a tiny magnet and is called a magnetic dipole.

29. What are paramagnetic materials?

Materials whose atomic fields support one another and act like tiny magnets, e.g., aluminium and lithium.

30. What are diamagnetic materials?

Materials whose atomic magnetic fields cancel out and do not produce a net magnetic field, e.g., copper and water.

31. What are ferromagnetic materials?

Materials like iron, steel, and cobalt with naturally aligned electron spins forming magnetic domains.

32. What is a magnetic domain?

A region of about 0.1 mm size in ferromagnetic materials where atoms are magnetically aligned.

33. How can a piece of iron be magnetised?

By placing it in an external magnetic field which aligns its magnetic domains.

34. What is the stroking method of magnetisation?

It is a method where a steel bar is stroked with a permanent magnet to induce magnetism.

35. How can a magnet be demagnetised?

By heating, hammering, or passing alternating current (AC) through a solenoid.

36. What is the function of the recording head in magnetic tape recording?

The recording head acts as an electromagnet that induces magnetism in the magnetic coating of the tape.

37. How is magnetism induced on a magnetic tape during recording?

Varying electric currents pass through the recording head, creating a fringe magnetic field that magnetises the tape.

38. What is the role of a magnetic head in a hard disk?

The magnetic head writes binary data by changing the direction of magnetism on the disk and reads it

by detecting those directions.

39. Why is soft iron used as a magnetic shield?

Soft iron has high magnetic permeability and redirects magnetic field lines, protecting sensitive devices from external magnetic fields.

40. How does soft iron increase the sensitivity of a moving coil galvanometer?

It strengthens the magnetic field inside the coil, making the galvanometer more responsive.

Important Long Questions:

Q1. What are magnetic materials? Describe an activity to test whether a material is magnetic or not.

Answer:

Magnetic materials are substances that are attracted by magnets. These materials have the ability to be influenced by a magnetic field and are pulled towards a magnet. Common examples of

magnetic materials include iron, cobalt, and nickel.

Activity to Test Whether a Material is Magnetic or Not:

Materials needed:

A bar magnet

Different small pieces of materials such as iron nail, copper coin, plastic piece, aluminum foil, steel pin, etc.

Procedure:

1. Take the bar magnet and bring one of its poles close to a small piece of material (for example, an iron nail).

2. Observe if the material is attracted towards the magnet.

3. Repeat this for all the different materials.

Observation:

- If the material is attracted by the magnet, it is a magnetic material.
- If the material is not attracted, it is a

non-magnetic material.

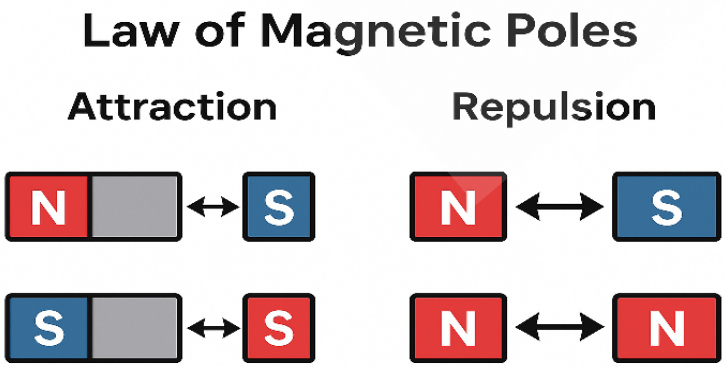
Q2. State and explain the law of magnetic poles with suitable diagrams showing attraction and repulsion.

Answer:

- The Law of Magnetic Poles states that:
- Like magnetic poles repel each other.
- Unlike magnetic poles attract each other.

This means that two north poles (N) will repel each other, and two south poles (S) will also repel each other. But a north pole and a south pole will attract each other.

Explanation with Diagrams:



Repulsion of Like Poles:

When two bar magnets are freely suspended and brought close, the north pole of one magnet repels the north pole of the other magnet. Similarly, south poles also repel each other.

Attraction of Unlike Poles:

- When the north pole of one magnet is brought near the south pole of another magnet, they attract each other.
- This law is fundamental to understanding how magnets interact with each other and how magnetic fields behave.

Q3. Explain the properties of magnets with suitable examples and diagrams.

Answer:

Magnets have several important properties, which can be explained as follows:

1. Magnetic Poles:

Every magnet has two ends called poles — the North Pole (N) and the South Pole (S). When a bar magnet is freely suspended, it aligns itself in the

north-south direction of the Earth's magnetic field. The pole that points north is the north pole of the magnet, and the opposite end is the south pole.

Example: A freely suspended bar magnet always points towards the Earth's north and south poles.

2. Attraction and Repulsion:

Magnets attract magnetic materials such as iron, cobalt, and nickel. Also, two magnets exert forces on each other.

- Like poles repel.
- Unlike poles attract.

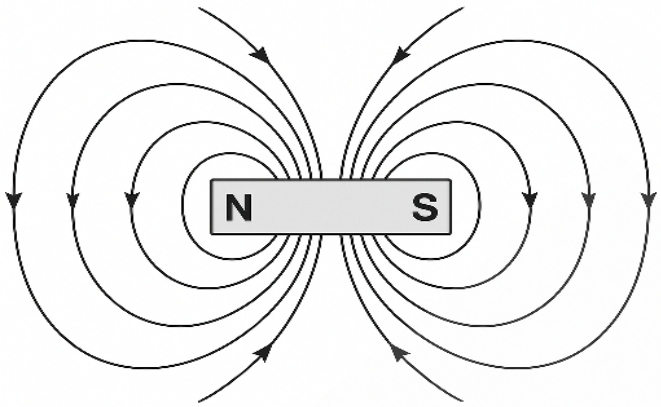
Example: When two north poles of magnets are brought close, they push away from each other.

3. Magnetic Field:

Around every magnet, there is a magnetic field, which is an invisible region where magnetic forces can be detected. The magnetic field lines emerge from the north pole and enter the south pole, forming closed loops.

Diagram: Magnetic field lines around a bar magnet

are shown as curved lines emerging from the north pole and entering the south pole.



4. Effect on Magnetic Materials:

Magnets attract certain metals, known as magnetic materials, while non-magnetic materials like wood, plastic, and copper are not attracted.

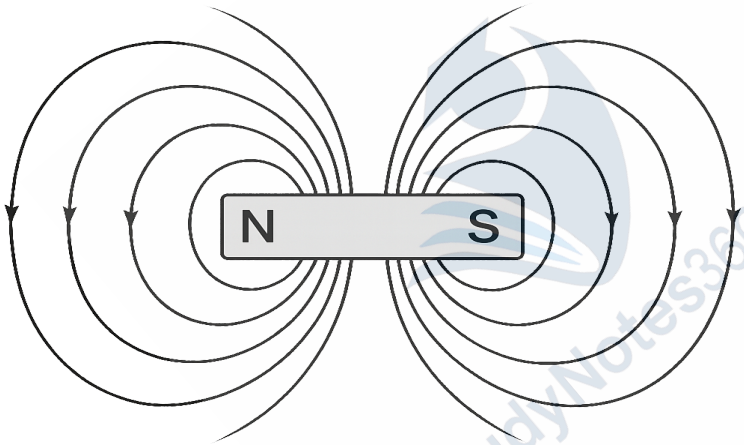
5. No Isolated Magnetic Pole:

If a magnet is broken into two pieces, each piece will still have both a north and a south pole. Isolated single poles (monopoles) do not exist.

Q4. What is a magnetic field? Describe an experiment to show the magnetic field pattern around a bar magnet.

Magnetic Field:

A magnetic field is the region around a magnet in which a magnetic material or another magnet experiences a force. This field cannot be seen directly but its effect can be observed through magnetic materials like iron filings or a magnetic compass.



Experiment: To Show the Magnetic Field Pattern Around a Bar Magnet

Apparatus:

- Bar magnet
- White paper or glass plate

- Iron filings

Procedure:

1. Place a bar magnet on a flat table.
2. Cover it with a thin glass plate or a white paper.
3. Sprinkle iron filings evenly on the glass plate.
4. Now gently tap the glass plate with a pencil or finger.

Observation:

- The iron filings arrange themselves in a definite pattern around the magnet.
- The filings are dense near the poles and sparse farther away.
- The filings form curved lines that appear to start from the North pole and end at the South pole of the bar magnet.

Conclusion:

- This pattern shows the magnetic field lines around the bar magnet.
- It indicates that the magnetic field is strongest

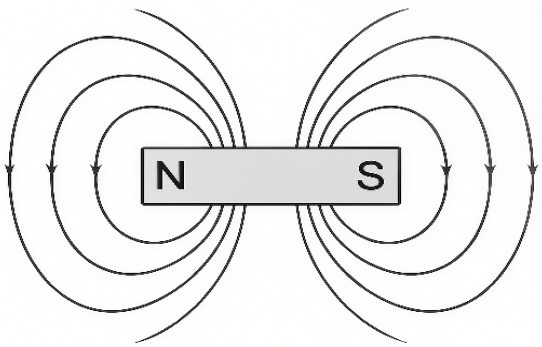
at the poles where lines are closest.

- These lines represent the direction and strength of the magnetic field.

Q5: Describe the combined magnetic field pattern when two bar magnets are placed close to each other in different orientations. What is a neutral point? Explain with diagram.

Combined Magnetic Field:

When two magnets are placed close to each other, their individual magnetic fields interact and form a combined magnetic field pattern. The nature of the pattern depends on the orientation of the poles of the two magnets.



Case 1: Like Poles Facing Each Other (N-N or S-S)

Observation:

- Magnetic field lines repel each other between the like poles.
- A region is created between the magnets where field lines from both magnets cancel out.
- This is called a neutral point.

Neutral Point:

A neutral point is a point where the magnetic field due to one magnet cancels out the magnetic field of the other.

- At this point, net magnetic field is zero.
- A magnetic compass placed at this point will not show any deflection.

Diagram:

Draw two bar magnets with N-N facing each other.

Show the field lines bending away from each other between the magnets.

Mark a point in the middle as 'Neutral Point (X)'.

Case 2: Unlike Poles Facing Each Other (N-S)

Observation:

- Magnetic field lines move smoothly from North pole of one magnet to the South pole of the other.
- The field becomes stronger between the poles as the lines are closer.

Q6. Explain the Domain Theory of Magnetism. How does it help to understand magnetism in ferromagnetic materials? Use diagrams to support your answer.

Answer:

The Domain Theory of Magnetism explains how magnetic properties arise in certain materials due to the alignment of microscopic magnetic regions called domains.

What is a Magnetic Domain?

- A magnetic domain is a small region within a material where a large number of atoms (about 10^{16}) have their electron spins aligned in the same direction.

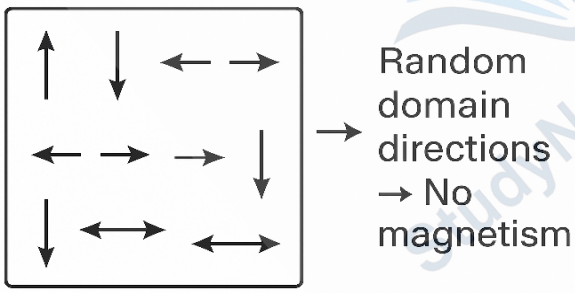
- Each domain acts like a tiny magnet with a north and south pole.

Before Magnetization:

- In an unmagnetized ferromagnetic material (like iron), the domains are randomly oriented.
- As a result, the magnetic fields of different domains cancel each other out and the material shows no net magnetism.

📌 **Diagram:**

Unmagnetized Iron:



After Magnetization:

When the material is placed in an external magnetic field, two changes occur:

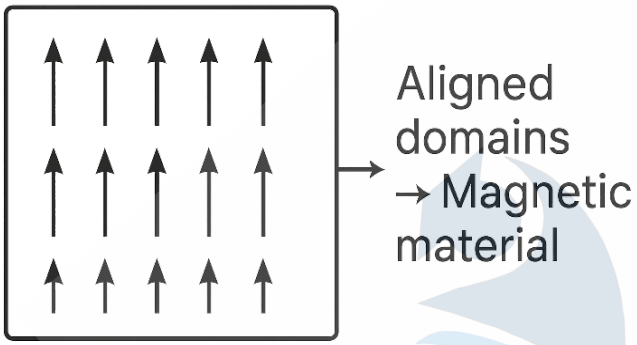
1. Domains aligned with the field grow larger, absorbing neighboring domains.

2. Misaligned domains rotate to align with the field.

This results in the alignment of most domains in the same direction, turning the material into a magnet.

📌 **Diagram**:

Magnetiized Iron:



Use in Ferromagnetic Materials:

- Ferromagnetic materials (like iron, nickel, cobalt) have domains that easily align with external fields.
- Once aligned, especially in materials like steel, they retain this alignment and become permanent magnets.
- In soft iron, domains realign easily but also return to random quickly when the external

field is removed, making it ideal for electromagnets.

Q7. Differentiate between paramagnetic, diamagnetic, and ferromagnetic materials. Give two examples of each and explain their magnetic properties.

Answer:

The classification of materials based on their magnetic behavior depends on how electron spins and magnetic moments behave in atoms.

1. Paramagnetic Materials:

- In these materials, some atoms behave like tiny magnets due to unpaired electrons.
- The magnetic fields of atoms are not completely cancelled, so they show weak magnetism in the direction of an external magnetic field.
- They become weakly magnetized only in the presence of a magnetic field and lose magnetism when it is removed.

- **Examples**:
  - Aluminum (Al)
  - Lithium (Li)

2. Diamagnetic Materials:

These materials have paired electrons; the magnetic fields produced by electrons cancel out completely.

As a result, they do not have a net magnetic moment.

When placed in a magnetic field, they develop a very weak repulsive force, and are slightly repelled.

- **Examples**:
  - Copper (Cu)
  - Bismuth (Bi)

3. Ferromagnetic Materials:

- In these materials, many atoms have unpaired electrons and their spins are naturally aligned.
- These atoms form regions called magnetic domains that align with an external field,

producing strong magnetism.

- They can retain magnetism even after removing the external field (especially steel).

🔹 **Examples**:

- Iron (Fe)
- Nickel (Ni)

C Constructed Response Questions

8.1 Two bar magnets are stored in a wooden box. Label the poles of the magnets and identify P and Q objects.

Answer:

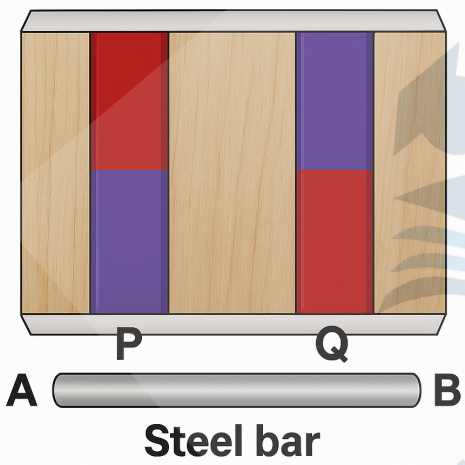
When two bar magnets are placed in a box such that they don't repel or attract excessively, they are often stored with opposite poles facing each other to minimize magnetic interaction.

📌 **Labeling**:

Let's assume:

- The north pole of one magnet is facing the south pole of the other.
- P and Q are usually soft iron keepers (pieces of soft iron) used to preserve magnetism by connecting the poles and completing the magnetic circuit.

📌 **Diagram:**



📌 **Conclusion:**

- P and Q are soft iron keepers.
- They prevent loss of magnetism and reduce stray magnetic fields.

8.2 A steel bar has to be magnetised by placing it inside a solenoid such that end A of the bar

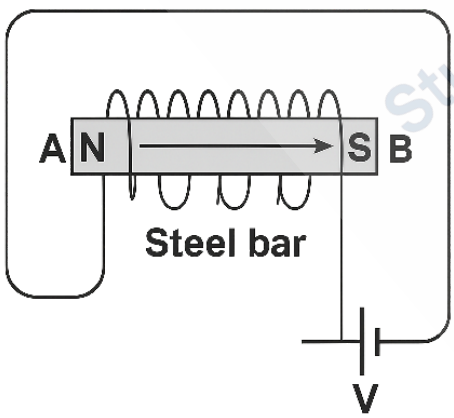
becomes N-pole and end B becomes S-pole. Draw circuit diagram of solenoid showing steel bar inside it.

Answer:

To magnetize a steel bar, we use a current-carrying solenoid. The direction of current determines the polarity of the magnetic field created.

📌 **Right-Hand Rule:** Curl the fingers of your right hand around the solenoid in the direction of current; your thumb points to the N-pole.

📌 **Diagram**:



- If current flows clockwise when viewed from A, then A becomes the N-pole.

- Steel retains magnetism after the current is switched off, making it a permanent magnet.

8.3 Two bar magnets are lying as shown in the figure. A compass is placed at the middle of the gap. Its needle settles in the north-south direction. Label N and S poles of the magnets. Justify your answer by drawing field lines.

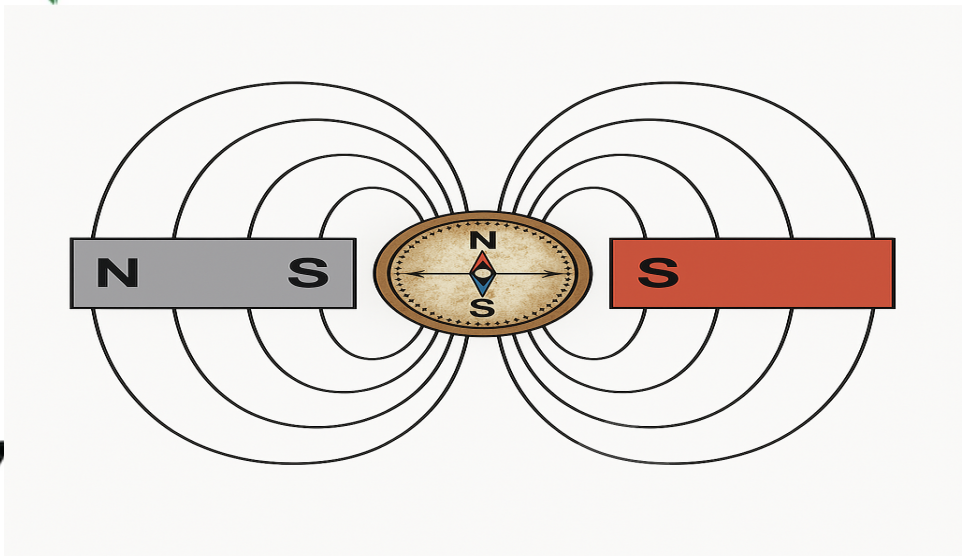
Answer:

The compass needle aligns with the resultant magnetic field in the region. If it points north-south, it must be aligning with the combined magnetic field of the two magnets.

📌 **Justification**:

- Magnetic field lines always emerge from N-pole and enter the S-pole.
- The compass needle aligns tangentially to the field lines.

📌 **Field Line Diagram:**



Compass placed here

- The left magnet is S, and the right magnet is N.
- Field lines flow from right to left, so the compass aligns in that direction.

8.4 Electric current or motion of electrons produce magnetic field. Is the reverse process true, that is, can magnetic field give rise to electric current? If yes, give an example and describe it briefly.

Answer:

Yes, the reverse process is also true. This is known as Electromagnetic Induction, discovered by Michael Faraday.

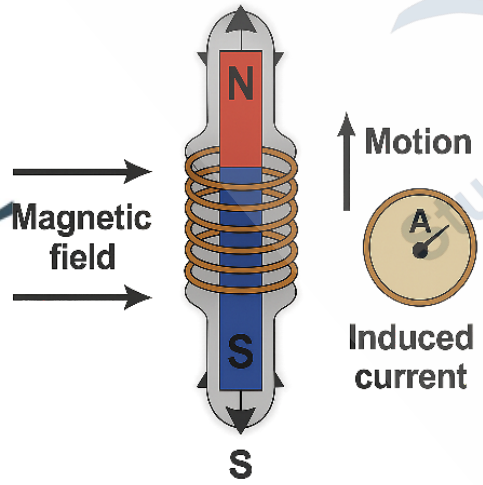
📌 **Explanation**:

When a magnet is moved into or out of a coil, the changing magnetic field induces an electric current in the coil.

📌 **Example**:

- Faraday's Experiment: When a bar magnet is moved into a coil of wire connected to a galvanometer, a current is induced in the coil.
- The current reverses direction if the magnet is moved out of the coil.

📌 **Diagram**:



📌 **Conclusion**:

- A changing magnetic field produces current.
- This principle is used in generators and

transformers.

8.5 Four similar solenoids are placed in a circle. The magnitude of current is the same in all. Show by diagram the direction of current such that when any one solenoid is switched OFF, the net magnetic field at the centre O is directed toward that solenoid. Explain.

Answer:

📌 **Concept:**

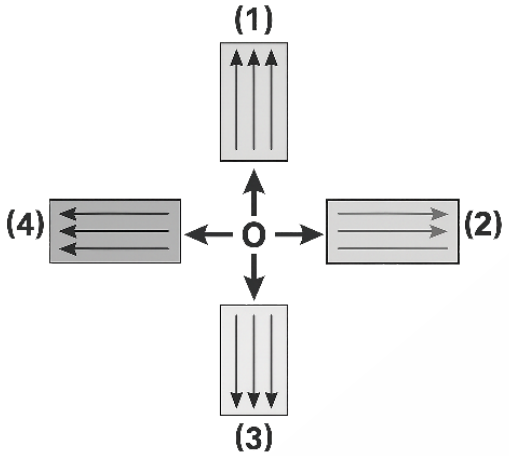
- When all four solenoids are ON, their fields cancel at the centre.
- If one is OFF, the net field points toward it, meaning the field contributions from the others must be directed away from it.

📌 **Requirement:**

- The current direction in each solenoid should be such that the field at centre points outward from each.
- When one is OFF, there's a net imbalance—the remaining fields cause the net field to point

towards the OFF solenoid.

📌 **Diagram (Top View):**



Arrows show field direction at centre due to each solenoid.
When solenoid 2 is OFF, fields from 1, 3, and 4 add up to give a net field toward position 2.

- Arrows show field direction at centre due to each solenoid.
- When Solenoid 2 is OFF, fields from 1, 3, and 4 add up to give a net field toward position 2.

📌 **Explanation**:

This setup ensures directional detection—used in applications like magnetic sensing or triggering based on field imbalance.

D Comprehensive Questions

Q8.1: How can you identify whether an object is a magnet or a magnetic material?

To identify whether an object is a magnet or simply a magnetic material, we use the attraction and repulsion test:

- A magnet not only attracts magnetic materials but also repels or attracts another magnet, depending on the poles.
- Magnetic materials like iron, cobalt, and nickel are only attracted to magnets; they do not repel.
- Identification method: Bring a known magnet close to the object:
- If there is only attraction, the object is likely a magnetic material.
- If there is both attraction and repulsion, then the object is a magnet.

Q8.2: Describe the strength of a magnetic field in terms of magnetic lines of force. Explain it by drawing a few diagrams for the fields as examples.

Magnetic field strength is represented by the

density of magnetic lines of force. These are imaginary lines that indicate the direction and strength of the magnetic field.

- Closer lines = Stronger magnetic field.
- Farther lines = Weaker magnetic field.

Examples:

1. Bar Magnet

Magnetic lines emerge from the North Pole and enter the South Pole:

N --> --> --> --> S

2. Magnetic Field between Two Like Poles

Field lines repel and bend away from each other (showing repulsion):

N <---X---> N

3. Magnetic Field between Two Opposite Poles

Field lines move from North to South directly (showing attraction):

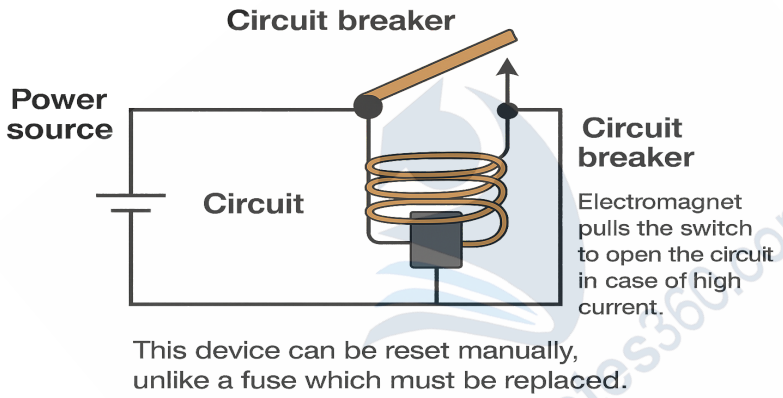
N -------> S

These lines never cross each other and always form

closed loops.

Q8.3: What is a circuit breaker? Describe its working with the help of a diagram.

A circuit breaker is an automatic safety device used to protect electrical circuits from overload or short circuits. It interrupts the flow of current when the current exceeds a safe limit.



Working:

1. It has an electromagnet and a switch.

2. When excessive current flows, the electromagnet becomes strong.

3. It pulls a metallic lever, causing the switch to break the circuit.

4. The circuit opens and current stops flowing,

preventing damage.

Q8.4: A magnet attracts only a magnet. Explain the statement.

- This statement is not entirely correct. A magnet attracts not only other magnets but also magnetic materials such as iron, cobalt, and nickel.
- A magnet attracts magnetic materials due to the alignment of domains.
- A magnet also repels or attracts another magnet based on poles.

So, a better version of the statement would be:

> **"A magnet attracts magnetic materials and either attracts or repels another magnet."**

Q8.5: Differentiate between paramagnetic, diamagnetic and ferromagnetic materials with reference to the domain theory.

Type of Material Behavior in Magnetic Field Domain Structure

- Paramagnetic Weakly attracted Domains

are randomly arranged but slightly align in external field.

- Diamagnetic Weakly repelledDomains oppose the external magnetic field.
- Ferromagnetic Strongly attracted Domains are aligned in the same direction, even without a field.

Domain Theory:

- Ferromagnetic materials have large regions (domains) with aligned magnetic moments.
- Paramagnetic materials have some alignment under an external field.
- Diamagnetic materials create a small opposite magnetic field when placed in one.

Q8.6: Why are ferromagnetic materials suitable for making magnets?

Ferromagnetic materials (like iron, cobalt, and nickel) are suitable for making magnets because:

1. Domain Alignment: Their internal magnetic domains can be easily aligned in one direction.

2. Strong Magnetic Field: They produce a strong and permanent magnetic field.

3. Retain Magnetism: They have the ability to retain magnetism for a long time.

4. High Permeability: They allow magnetic lines to pass through easily.

Because of these properties, ferromagnetic materials are ideal for making permanent magnets and electromagnets.

Note:

This chapter is designed to provide a solid foundation of knowledge, with the goal of deepening understanding and encouraging further exploration of the subject. The content has been

carefully selected to support effective learning and inspire students to engage with the topic more deeply.

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Purpose: To contribute to education by offering insightful, valuable content that enhances learning and understanding.

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