CLASS 9TH • PHYSICS

UNIT 08

Magnetism

Complete Revision Booklet — Definitions, Short & Long Questions, MCQs and Numericals

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Q.1. Define magnetic materials.

Magnetic Materials: Magnetism is a force that acts at a distance upon magnetic materials. These materials are attracted to magnets. These materials are called magnetic materials.

Examples: Iron, Nickel and Cobalt.

Q.2. Define magnetic poles. State characteristics of magnetic poles.

Magnetic poles: If a bar magnet is suspended horizontally through a string and allowed to come to rest, it will point in the north-south direction. The end of the magnet that points north is called the north magnetic pole (N). The end that points south is the south magnetic pole (S). Magnetic poles are regions at ends of magnet where magnetic field is strongest.

Characteristics of magnetic poles:

Attraction and Repulsion of Magnetic poles:
When two freely suspended bar magnets are placed close to each other, the two north poles will repel each other. So will the two south poles. However, if the north pole of one is placed near the south pole of the other, the poles will attract. We can say that like poles repel and unlike poles attract.

Q.3. How can you identify that the given object is a magnet or magnetic material?

Identification of a Magnet:
To identify whether an object is a magnet or simply a magnetic material, we can bring its one end close to any pole of a suspended bar magnet. If it is attracted, then we can conclude that the end of the object is either of opposite pole to that of the same end of the object close to the other end of the suspended magnet or it is simply a magnetic material. Then we should bring the same end of the object close to the other end of the suspended magnet. If the object is again attracted, it is not a magnet but it is a magnetic material. If it is repelled by the other end of the suspended magnet, then the object is a magnet.

The repulsion between the like poles is a real test to identify a magnet.

Q.4. Is isolated magnetic pole possible? Explain.

Is Isolated Magnetic Pole Possible?
If we break a bar magnet into two equal pieces, we cannot get N-pole and S-pole separately. Each piece will have its two poles, i.e. N-pole and S-pole. Even if a magnet is divided into thousands of pieces, each piece will be a complete magnet with its N and S-poles.

Q.5. Define magnetization.

Induced Magnetism: It is a measure of how magnetized a material is. A magnetic material such as iron or steel can be made a magnet. This is known as magnetization. In other words, we can say that magnetism has been induced in it.

Q.6. Differentiate between temporary and permanent magnets.

Temporary Magnets: Temporary magnets are the magnets that work in the presence of a magnetic field of permanent magnets. Once the magnetic field vanishes, they lose their magnetic properties. Usually, soft iron is used to make temporary magnets. Paper clips, office pins and iron nails can easily be made temporary magnets. Electromagnets are also good examples of temporary magnets.

Permanent Magnets: Permanent magnets retain their magnetic properties forever. They are either found in nature or artificially made by placing objects made of steel and some special alloys in a strong magnetic field for a sufficient time. There are many types of permanent magnetic materials. For example, cobalt, alnico and ferrite.

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Q.7. **Define and Explain:**

(1) Magnetic Field
(2) Magnetic lines of Force
(3) Strength of magnetic field

(1) Magnetic Field: When a magnet attracts a certain magnetic material, it exerts some force to do so. Similarly, when it attracts or repels a magnetic pole of another magnet, it exerts a force on it. This force can be observed up to a certain distance from the magnet that can be explained by the concept of magnetic field around the magnet.

Definition: A magnetic field is the region around a magnet where another magnetic object experiences a force on it. The pattern of a magnetic field around a bar magnet can be seen very easily by a simple experiment.

If iron filings are sprinkled on a thin glass plate placed over a bar magnet, the filings become tiny magnets through magnetic induction. Now if the glass surface is gently tapped, the filings form a pattern. This is the magnetic field pattern. This pattern can be better shown by lines that correspond to the path of the filings. These lines are called magnetic lines of force.

(2) Magnetic Lines of Force: The magnetic lines of force around a bar magnet can be drawn by using a small compass. The needle of the compass will move along the magnetic lines of force. The magnetic field at a point has both a magnitude and a direction. The direction of the magnetic field at any point in space is the direction indicated by the N-pole of a magnet or a small compass needle placed at that point. The field lines appear to originate from the north pole and end on the south pole.

(3) Strength of Magnetic Field: The strength of the magnetic field is proportional to the number of magnetic lines of force passing through unit area placed perpendicular to the lines. Thus the magnetic field is stronger in regions where the field lines are relatively close together and weaker where these are far apart. For example, the lines are closest together near the north and south poles indicating that the strength of the magnetic field is stronger in these regions. Away from the poles, the magnetic field becomes weaker.

Q.8. **Describe some uses of permanent magnet.**

The uses of permanent magnets include:

(i) They are the essential parts of DC motors, AC and DC electric generators.
(ii) Permanent magnets are used in the moving coil loudspeaker.
(iii) These are very commonly used in door catchers.
(iv) Magnetic strips are fitted to the doors of refrigerators and freezers to keep the door closed tightly.
(v) They are commonly used to separate iron objects from different mixtures. Flour mills use permanent magnets to remove iron nails etc. from the grains before grinding.
(vi) In the medical field, they are used to remove iron splinters from the eyes.
(vii) A piece of permanent magnet is used to reset the iron pointer in a maximum and minimum thermometer.

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Q.9. **Explain working of A.C Generator and moving coil loudspeaker as an application of permanent magnet.**

Applications of permanent magnets:

A.C Generator:
When a coil is rotated between the poles of a permanent magnet, the magnetic field through the coil changes and an emf is induced between the ends of the coil. On connecting these ends to an external circuit, an alternating current (AC) flows through the circuit. Electric motor is the reverse process of electric generator. When an AC is made to pass through the coil between the poles of a permanent magnet, it starts rotating.

Moving Coil Loudspeaker:
A voice coil attached to the cone of the speaker is slipped over one pole (N) of the radial permanent magnet. From a microphone or some other sound source, sound signals in the form of varying (AC) current passes through the voice coil that is inserted in the gap of the permanent magnet. This AC interacts with the magnetic field to generate a varying force that pushes and pulls on the voice coil and the attached cone. The cone vibrates back and forth to produce sound in the air.

Q.10. What are Electromagnets? Explain their important applications.

Electromagnets: Electromagnets are also a kind of temporary magnets which form when current flows through a coil.

Explanation:
Take a battery of two cells, a switch, an iron nail, cotton (or plastic) covered copper wire, thread and a few paper clips. Wind the wire over the iron nail to form a coil. Suspend the coil by means of thread tied to its centre. Connect ends of the wire to the battery through the switch.

Keeping the switch OFF, bring some paper clips near to one end of the nail. Now turn the switch ON and again bring the paper clips near to the end of the nail. The nail has become a magnet. Turn the switch OFF and see what happens to the clips.

An iron nail or rod becomes a magnet when an electric current passes through a coil of wire around it. It is called an electromagnet.

When an electric current passes through the coil of wire, a magnetic field is produced inside the coil that magnetizes the iron nail. The magnetic properties of an electromagnet are temporary. The iron object remains a magnet as long as the electric current passes through the coil. When the current is stopped, it no longer remains a magnet.

If we increase the number of cells in the battery or increase the number of turns of the coil, we will observe that the strength of the magnetic field in each case increases. This will be indicated by the more number of clips held by the nail in these cases.

The uses of Electromagnets:

Electromagnets are used in electric bell, telephone receiver, simple magnetic relay, circuit breaker, reed switch, cranes, tape recorder, maglev trains and many other devices.

(1) Magnetic Relay: This is a type of switch which works with an electromagnet. It is an input circuit which works with a low current for safety purpose. When it is turned on, it activates another circuit which works with a high current. The input circuit supplies a small current to the electromagnet. It attracts the iron armature which is pivoted; the other end of the armature moves up and pushes the metal contacts to join together which turns the large current-circuit ON.

(2) Circuit Breaker: A circuit breaker is designed to pass a certain maximum current through it safely. If the current becomes excessive, it switches off the circuit. Thus, electric appliances are protected from burning. Inside a circuit breaker, the current flows along a copper strip, through the iron armature and coil of electromagnet. The electromagnet attracts the armature. If the current is large enough, the armature is detached from the copper strip and the circuit breaks.

(3) Telephone Receiver: There is an iron diaphragm in the receiver under which an electromagnet is placed. The microphone of the telephone handset on the other side sends varying electric current in accordance with the sound signals. When the varying current passes through the coil of receiver on this side, it causes variation in the force of the electromagnet. As a result, the diaphragm over it moves back and forth to produce sound.

(4) Electromagnetic Cranes: Huge electromagnets are used in cranes at scrapyard, steel works and on ships. They are so powerful that they can lift iron and steel objects such as cars. After moving the heavy objects to the required position, the objects are released by just switching OFF the current of the electromagnet.

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Q.11. Describe Domain theory of Magnetism.

It is observed that the magnetic field of a bar magnet is like the field produced by a solenoid (long coil of wire) carrying current. It suggests that all magnetic effects may be due to moving charges. In case of solenoid, charges are moving in the wire but the motion of the charges through the magnet is not the current passing through it. Instead, the motion responsible for the magnetism in it is that of electrons within the atoms of the material.

We know that an electron is a charged particle. Also, each electron in an atom is revolving about the nucleus and at the same time it is spinning about an axis through it. The rotation and spin both give rise to a magnetic field. Since there are many electrons in an atom, their rotations and spins may be so oriented that if an atom has some resultant magnetic field, it behaves like a tiny magnet. It is called a magnetic dipole.

Q.12. Differentiate between paramagnetic, diamagnetic and ferromagnetic materials with reference to the domain theory.

Paramagnetic Materials: If the orbits and spin axes of the electrons in an atom are so oriented that their fields add up and the atom behaves like a tiny magnet, the materials with such atoms are called paramagnetic materials such as aluminium and lithium.

Diamagnetic Materials: Magnetic fields produced by both orbital and spin motions of the electrons in an atom may add up to zero. In this case, the atom has no resultant field. The materials with such atoms are called diamagnetic materials. Their examples are copper, bismuth, water etc.

Ferromagnetic Materials: There are some solid substances such as iron, steel, nickel, cobalt, etc. in which cancellation of any type does not occur for large groups of neighbouring atoms of the order because they have electron spins that are naturally aligned parallel to each other. These are known as ferromagnetic materials. The group of atoms in this type of material form a region of about 0.1 mm size that is highly magnetized. This region is called a magnetic domain. Each domain behaves as a small magnet with its own north and south poles.

Alignment of Domains:
The domains in a ferromagnetic material are randomly oriented. The magnetic fields of the domains cancel each other so the material does not display any magnetism. However, an unmagnetized piece of iron can be magnetized by placing it in an external magnetic field provided by a permanent magnet or an electromagnet. The external magnetic field penetrates the unmagnetized iron and induces magnetism in domains oriented parallel or nearly parallel to the external magnetic field to grow in size at the expense of other domains that are not oriented. In addition, the magnetic alignment of the other domains rotates and becomes oriented in the direction of the external field. As a result, the iron is magnetized and behaves like a magnet having its own north and south poles.

Q.13. Why ferromagnetic materials are suitable for making magnets?

In soft iron, the domains are easily oriented on applying an external field and return to random position when the field is removed. This is desirable in an electromagnet and also in transformers. On the other hand, steel is not so easily oriented to change; order requires a very strong external field, but once oriented, it retains the alignment. That is why steel is used to make permanent magnets.

In non-ferromagnetic materials, such as aluminium and copper, the formation of magnetic domains does not occur, so magnetism cannot be induced into these substances.

Q.14. Describe methods to magnetize a steel bar.

Magnetization:

There are two methods used for magnetizing a steel bar.

(i) Stroking:
In this method, magnetism is induced in a steel bar by using the magnetic field of a permanent magnet. The steel bar can be stroked in two ways.

(a) Single Touch Method:
The steel bar is placed on a horizontal surface. It is stroked from one end to the other several times in the same direction using the same pole (say N) of the permanent magnet. Every time the magnet is lifted up sufficiently high on reaching the other end of the bar.

(b) Double Touch Method:
In this method, stroking is done from the centre of the steel bar onwards with the unlike poles of two permanent magnets at the same time. This method is more efficient than the first one.

In both cases, the poles produced at the ends of the magnetized steel bar after stroking are of the opposite polarity to that of the stroking pole.

(ii) Making a Magnet using Solenoid:
In this method, a steel bar to be magnetized is placed inside a solenoid (long coil of wire). The solenoid should have several hundred turns of insulated copper wire. When direct current is passed through the solenoid, the steel bar becomes a magnet. The polarity of the magnetized steel bar is found by applying the Right Hand Grip rule which is stated as below:

"Grip the solenoid with the right hand such that fingers are curled along the direction of current (positive to the negative terminal of the battery) in the solenoid, then the thumb points to the N-pole of the bar end."

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Q.15. Describe methods to Demagnetisation of Magnets.

(1) Heating: Thermal vibrations tend to disturb the orderliness of the domains. Therefore, if we heat a magnet strongly, the magnet loses its magnetism very quickly.

(2) Hammering: If we beat a magnet, the domains lose their alignment and the magnet is demagnetised. It is also called hammering.

(3) Alternating Current: When an alternating current (AC) is flowing through a long solenoid, a magnet moved out slowly from inside of the solenoid is demagnetised.

Q.16. Describe applications of Magnets in Recording Technology.

Application of Magnets in Recording Technology:

Electromagnets are widely used in recording technology of sound, video and data in the form of electrical signals through magnetization of portions of a magnetic material. Most common magnetic recording mediums are magnetic tapes and disk recorders which are used not only to produce audio and video signals but also to store computer data. These materials are usually coated with iron oxide. Some other recording mediums are magnetic drums, ferrite cores and magnetic bubble memory.

Magnetic Tape Recording:
Induced magnetism is used in the process of magnetic tape recording. The recording and playing head is a coil of wire wrapped around an iron core. The iron core has a horseshoe shape with a narrow gap between its two ends. Audio and video tapes are synthetic tapes coated with a layer of ferromagnetic material. Sound or picture is converted into electrical forms as varying currents. These currents are sent to the head that becomes an electromagnet with a N-pole at one end and a S-pole at the other end. The magnetic field lines pass through the iron core and cross the gap. Some of the field lines in the gap curve outward. The curved part of the magnetic field as fringe penetrates the magnetic coating on the moving tape and induces magnetism in the coating. This induced magnetism is retained when the tape leaves the vicinity of the recording head. The reverse process changes the varying induced magnetism into varying current which is converted into sound or picture.

Hard Disk Recording:
Hard disks are circular flat plates made of aluminium, glass or plastic and coated on both sides with iron oxide. Hard disks can store terabytes of information. A magnetic head is a small electromagnet which writes a binary digit (1 or 0) by magnetizing tiny spots on the spinning disk in different directions and reads the digit by detecting the magnetization direction of spots. The term hard disk is also used to refer to the whole of a computer's internal data storage.

Magnetic disk devices have an advantage over tape recorders. A disk unit has the ability to read or write a recording instantly while locating a desired information on tape may take many minutes.

Q.17. **Describe Soft Iron as Magnetic Shield.**

Soft Iron as Magnetic Shield:

Soft iron has high magnetic permeability. The permeability is the ability of a material to allow the magnetic flux or lines of force through it when the material is placed inside a magnetic field. When a piece of soft iron is put into a magnetic field, it generates a magnetic field due to magnetization.

If a sensitive magnetic device is enclosed in a casing of soft iron, the magnetic flux gets established in the soft iron rather than the device. Thus, the device is shielded from external magnetic field.

A soft iron casing (shell) is placed inside a magnetic field produced by opposite poles of two bar magnets. Since the magnetic permeability of the iron shell is higher than that of air, so the magnetic flux is established in the soft iron. As a result, the device is protected from the magnetic field. Usually, the casing is made with rounded corners to facilitate the magnetic field lines to pass easily.

Soft iron is generally used in the cores of transformers and electromagnets because of its high permeability. In case of an electromagnet, the core of soft iron can be easily magnetized when current is passed around it and quickly lose magnetism when current is stopped. That is why electromagnets are widely used in electric bells, loud speakers, picking and releasing iron scraps by the cranes and in many more appliances. The sensitivity of a moving coil galvanometer is also increased by placing a soft iron core inside the coil.

Multiple Choice Questions (Exercise)

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

A

(a) Cobalt

B

(b) Iron

C

(c) Aluminium

D

(d) Nickel

Correct Answer: C

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2 Magnetic lines of force:

A

(a) are always directed in a straight line

B

(b) cross one another

C

(c) enter into the north pole

D

(d) enter into the south pole

Correct Answer: D

3 Permanent magnet cannot be made by:

A

(a) soft iron

B

(b) steel

C

(c) neodymium

D

(d) alnico

Correct Answer: A

4 Permanent magnets are used in:

A

(a) circuit breaker

B

(b) loudspeaker

C

(c) electric crane

D

(d) magnetic recording

Correct Answer: B

5 **A common method used to magnetise a material is:**

A

(a) stroking

B

(b) hitting

C

(c) heating

D

(d) placing inside a solenoid having AC current

Correct Answer: A

6 **A magnetic compass is placed around a bar magnet at four points. Which diagram would indicate the correct directions of the field?**

Correct Answer: B

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

Correct Answer: A

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

A

(a) wood

B

(b) plastic

C

(c) steel

D

(d) soft iron

Correct Answer: D

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Multiple Choice Questions

1 **If a bar magnet is cut in half, it will become:**

A

(a) a monopole

B

(b) magnetized

C

(c) the same magnet

D

(d) magnet of less strength

Correct Answer: D

2 **Which one is the quickest method to magnetize a material?**

A

(a) strike with hammer

B

(b) moving into magnetic field

C

(c) stroking with the opposite pole

D

(d) putting inside a current carrying coil

Correct Answer: D

3 **Earth's magnetic field intensity is:**

A

(a) constant everywhere

B

(b) very high at equator

C

(c) very low at poles

D

(d) varies place to place

Correct Answer: D

4 **The cause of the Earth's magnetic field is:**

A

(a) rotational motion of Earth

B

(b) spinning of Earth

C

(c) pull of the sun

D

(d) motion of ions in the core

Correct Answer: D

5 **Material which is the best one for making a permanent magnet:**

A

(a) soft iron

B

(b) nickel

C

(c) cobalt

D

(d) steel

Correct Answer: D

6 **Material which is the best one for making an electromagnet:**

A

(a) soft iron

B

(b) nickel

C

(c) cobalt

D

(d) steel

Correct Answer: A

7 **A sensitive magnetic material is to be shielded from the external magnetic field. It should be kept inside a box of:**

A

(a) wood

B

(b) plastic

C

(c) steel

D

(d) soft iron

Correct Answer: D

8 **Magnetic field lines:**

A

(a) are farthest at poles

B

(b) intersect each other

C

(c) are closed

D

(d) do not pass in vacuum

Correct Answer: C

9 **When two current carrying wires in the same direction are parallel near each other, due to magnetic field produced by each wire, they:**

A

(a) repel each other

B

(b) attract each other

C

(c) have no effect on each other

D

(d) stop moving the current through them

Correct Answer: B

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10 **Which of the following material is ferromagnetic?**

A

(a) silver

B

(b) copper

C

(c) aluminium

D

(d) nickel

Correct Answer: D

Short Answer Questions

8.1 **What are temporary and permanent magnets?**

Answer: See theory of Q No.6.

8.2 **Define magnetic field of a magnet.**

Answer: See theory of Q No.7.

8.3 **What are magnetic lines of force?**

Answer: See theory of Q No.7(ii).

8.4 **Name some uses of permanent magnets and electromagnets.**

Answer: See Q No.8 and 10.

8.5 **What are magnetic domains?**

Answer: The group of atoms in ferromagnetic material form a region of about 0.1 mm size that is highly magnetized. This region is called a magnetic domain. Each domain behaves as a small magnet with its own north and south poles.

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

Answer: A current-carrying long coil forms a solenoidal magnetic field, which is similar to the magnetic field of a bar magnet. When an electric current flows through the coil, a magnetic field is generated, with lines of force emerging from the north pole and entering the south pole. The magnetic field is strongest at the centre of the coil and weakens as you move away from it. The solenoidal magnetic field is nearly uniform and is commonly used in applications such as electromagnets, transformers, and inductors.

8.7 **Differentiate between paramagnetic and diamagnetic materials.**

Answer: See theory of Q No.12.

Additional Short Questions

8.1 **Is isolated magnetic pole possible?**

Answer: No, it is not possible. If we break a bar magnet into two equal pieces, can we get N-pole and S-pole separately? No. It is not possible. Each piece will have its two poles, i.e. N-pole and S-pole. Even if a magnet is divided into thousands of pieces, each piece will be a complete magnet with its N and S-poles.

8.2 **Describe the direction of internal and external magnetic field.**

Answer: The direction of external magnetic field is from North Pole to South Pole. But in case of internal magnetic field, the direction of magnetic field is from South Pole to North Pole.

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8.3 Explain use of electromagnet in maglev train.

Answer: A wonderful use of electromagnet is seen in the Maglev trains. The maglev stands for a magnetically levitated train. A maglev uses forces that arise from induced magnetism to levitate or float a few centimetres above the guideway. That is why, it does not need wheels and faces no friction. In Japan, it is known as a bullet train that can run up to a speed of 400 km per hour.

As described above, magnetic levitation only lifts the train and does not move it forward. To push the train forward, propulsion electromagnets are installed along the guideway and train. By push and pull of these magnets, the train moves forward.

8.4 Why high field electromagnets are made with cores of soft iron?

Answer: The magnetism induced in a ferromagnetic material can be surprisingly large in the presence of a weak external field. In some cases, the induced field is a thousand times stronger than the external field. That is why high field electromagnets are made by using cores of soft iron or some other ferromagnetic material.

8.5 State some uses of electromagnet.

Answer: There are some uses of electromagnet:
(i) Magnetic Relay
(ii) Circuit Breaker
(iii) Telephone Receiver
(iv) Electromagnetic Cranes

8.6 State right hand grip rule.

Answer: Right Hand Grip rule is stated as below:
"Grip the solenoid with the right hand such that fingers are curled along the direction of current (positive to the negative terminal of the battery) in the solenoid, then the thumb points to the N-pole of the bar end."

8.7 Why soft iron is used in cores of transformer?

Answer: Soft iron is generally used in the cores of transformers and electromagnets because of its high permeability. In case of an electromagnet, the core of soft iron can be easily magnetized when current is passed around it and quickly lose magnetism when current is stopped. That is why electromagnets are widely used in electric bells, loud speakers, picking and releasing iron scraps by the cranes and in many more appliances. The sensitivity of a moving coil galvanometer is also increased by placing a soft iron core inside the coil.

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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: Two bar magnets are stored in a wooden box with poles labelled as the North (N) of one magnet faces the South (S) of the other (N-S, S-N). P is the magnet connector used to preserve magnetism and Q is a non-magnetic material like wood or plastic.

8.2 A steel bar has to be magnetised by placing it inside a solenoid such that end A of bar becomes N-pole and end B becomes S-pole. Draw circuit diagram of solenoid showing steel bar inside it.

Answer: A steel bar to be magnetised is placed inside a solenoid (long coil of wire). When direct current is passed through the solenoid, the steel bar becomes a magnet such that end A of the bar becomes N-pole and B becomes S-pole.

8.3 Two bar magnets are lying as shown in 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 points towards the north pole of the magnet. The field lines emerge from the north pole and enter the south pole.

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

Answer: Yes, the reverse process is true: a changing magnetic field can give rise to an electric current. This phenomenon is known as electromagnetic induction and is governed by Faraday's law of induction.

Example: In an electric generator, mechanical energy is converted into electrical energy using electromagnetic induction. When a coil of wire is rotated within a magnetic field, the magnetic field through the coil changes continuously. According to Faraday's law, this change in magnetic field induces an electromotive force (EMF) in the coil, which drives an electric current.

8.5 Four similar solenoids are placed in a circle. The magnitude of current in all of them should be the same. Show by diagram, the direction of current in each solenoid such that when current in each solenoid is switched off, the net magnetic field at the centre O is directed towards that solenoid. Explain your answer.

Answer: For Solenoid 1 (Top): Current should flow in a counterclockwise direction, so the magnetic field at the centre O will point downward when viewed from the top.

For Solenoid 2 (Bottom): Current should flow in a counterclockwise direction, so the magnetic field at the centre O will point upwards when viewed from the bottom.

For Solenoid 3 (Right): Current should flow in a clockwise direction, so the magnetic field at the centre O will point left when viewed from the right.

For Solenoid 4 (Left): Current should flow in a clockwise direction, so the magnetic field at the centre O will point right when viewed from the left.

This arrangement ensures that the magnetic field produced by each solenoid will contribute to pointing towards the solenoid that is switched off, maintaining symmetry and achieving the desired effect.

Comprehensive Questions

8.1 How can you identify whether an object is a magnet or a magnetic material?

Answer: See Q No.3.

8.2 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.

Answer: See Q No.7.

8.3 What is a circuit breaker? Describe its working with the help of a diagram.

Answer: See Q No.10.

8.4 A magnet attracts only a magnet. Explain the statement.

Answer: A magnet attracts certain materials, not just other magnets. These materials include ferromagnetic materials like iron, nickel, and cobalt, as well as paramagnetic materials like aluminium and oxygen. When a magnet is brought near these materials, it induces magnetization in them, causing them to be attracted to the magnet. However, non-magnetic materials like wood, plastic, and glass are not attracted to magnets, and diamagnetic materials like copper and silver are actually repelled by them.

8.5 Differentiate between paramagnetic, diamagnetic and ferromagnetic materials with reference to the domain theory.

Answer: See Q No.12.

8.6 Why ferromagnetic materials are suitable for making magnets?

Answer: See Q No.13.

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