Magnetic Effects of Current

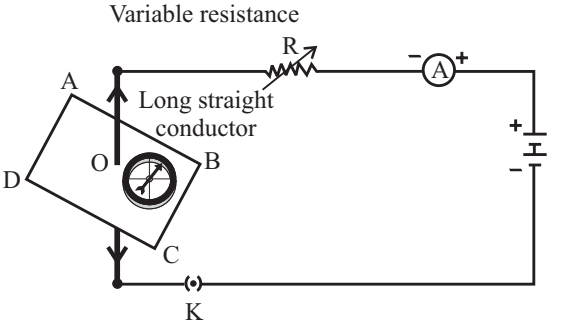
EXERSISE 1.1

I. Multiple Choice Questions (1 Mark)

Choose the correct answer from the given options.

1. Choose the incorrect statement from the following regarding magnetic lines of force
(*a*) The direction of magnetic field at a point is taken to be the direction in which the north pole of a magnetic compass needle will point
(*b*) Magnetic field lines are closed curves
(*c*) If magnetic field lines are parallel and equidistant, they represent zero field strength
(*d*) Relative strength of magnetic field is shown by the degree of closeness of the field lines

2. If the key in the arrangement is taken out (the circuit is made open) and magnetic field lines are drawn over the horizontal plane ABCD, the lines are
(*a*) concentric circles
(*b*) elliptical in shape
(*c*) straight lines parallel to each other
(*d*) concentric circles near the point O but of elliptical shapes as we go away from it



3. A circular loop placed in a plane perpendicular to the plane of paper carries a current when the key is ON. The current as seen from points A and B (in the plane of paper and on the axis of the coil) is anti clockwise and clockwise respectively. The magnetic field lines point from B to A. The N-pole of the resultant magnet is on the face close to
(*a*) A (*b*) B
(*c*) A if the current is small, and B if the current is large
(*d*) B if the current is small and A if the current is large

4. Two organs where magnetic field is produced are
(*a*) Heart and lungs (*b*) Heart and brain
(*c*) Brain and lungs (*d*) Heart and Liver

II. Assertion-Reason Type Questions (1 Mark)

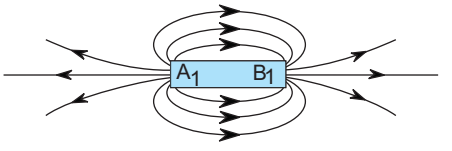
For question numbers 1 and 2, two statements are given-one labeled as **Assertion** (A) and the other labeled **Reason** (R). Select the correct answer to these questions from the codes (*a*), (*b*), (*c*) and (*d*) as given below:
(*a*) Both 'A' and 'R' are true and 'R' is correct explanation of the Assertion.
(*b*) Both 'A' and 'R' are true but 'R' is not correct explanation of the Assertion.

(*c*) 'A' is true but 'R' is false.
(*d*) 'A' is false but 'R' is true.

1. **Assertion:** Magnetic field lines do not intersect.
   Reason: Magnetic field lines are closed curves.
2. **Assertion:** A compass needle gets defected when electric current is passed through the nearly metallic wire.
   Reason: The S.I unit of magnetic field strength is Oersted.

III. Very Short Answer Type Questions (1 Mark)

1. Why does a compass needle get deflected when brought near a bar magnet? [*NCERT*]
2. Why don't two magnetic lines of force intersect each other? [*NCERT*] [*Delhi* 2014]
3. A current through a horizontal power line flows from east to west direction. What is the direction of magnetic field at a point directly below it and at a point directly above it? [*NCERT*]
4. If in a straight wire 'A', current is flowing in vertically downward direction whereas in the straight wire 'B' current is flowing in vertically upward direction. What is the direction of magnetic field (*a*) in wire 'A', (*b*) in wire 'B'.?
5. A bar magnet is placed between two iron bars. Draw a diagram to show the induced poles.
6. Identify the poles of the magnet as shown in the given figure: [*CBSE* **2014**]



7. State the direction of magnetic field inside a bar magnet. [*CBSE* 2014]
8. Mention the special feature regarding the shape of magnetic field lines. [*CBSE* 2014]
9. If magnetic field lines are crossed at a point, what does it indicate? [*CBSE* 2014]

OR

Explain why two magnetic lines of force do not intersect.

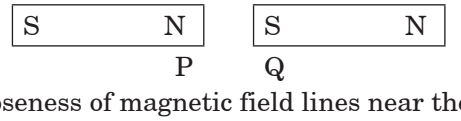
10. Draw a diagram to represent the uniform magnetic field in the region around the magnet. [*CBSE* 2014]
11. What type of core is used in electromagnets? [*CBSE* 2014]
12. Draw the magnetic field lines around a straight current carrying conduction.

IV. Short Answer Type Questions-I (2 Marks)

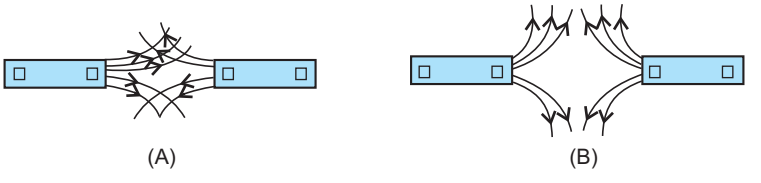
1. Draw magnetic field lines around a bar magnet. [*NCERT*]
2. What are magnetic field lines? Explain why magnetic field lines are closed curves? [*Delhi* 2014]
3. The given magnet is divided into three parts A, B and C as:

A	B	C

   Name the part when the strength of magnetic field is (*i*) maximum, (*ii*) minimum. How will the density of magnetic field lines differ at these parts? [*Delhi* 2012]
4. A compass needle is placed near a current-carrying wire. State your observation for the following cases, and give reason for the same in each case. [*Delhi* 2012]
   (*a*) Magnitude of electric current in the wire is increased.
   (*b*) The compass needle is displaced away from the wire.
5. (*a*) Two magnets are lying side by side as shown below. Draw magnetic field lines between the poles P and Q:

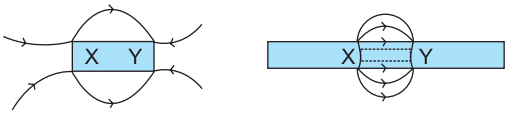


   (*b*) What does the degree of closeness of magnetic field lines near the poles signify?
6. Magnetic field lines of two magnets are shown in figure A and figure B.



   Select the figure that represents the correct pattern of field lines. Give reasons for your answer. Also name the poles of the magnets facing each other. [*Delhi* 2012]

7. Identify the poles of the magnet in the given figure (1) and (2). [*Delhi* 2011]



(1) (2)

8. The magnetic field associated with a current carrying straight conductor is in anticlockwise direction. If the conductor was held along the east-west direction, what will be the direction of current through it? Name and state the rule applied to determine the direction of current. [*Delhi* 2011]

9. (*a*) In a pattern of magnetic field lines due to bar magnet, how can the regions of relative strength be identified?

(*b*) Compare the strength of magnetic field near the poles and the middle of a bar magnet.[*CBSE* 2014]

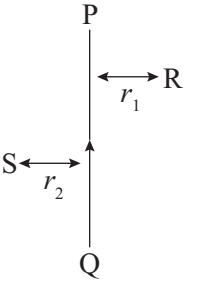
V. Short Answer Type Questions-II (3 Marks)

1. What are magnetic field lines? How is the direction of magnetic field at a point deter- mined?

2. Describe an activity to determine the direction of magnetic field produced by a current carrying straight conductor. Also show that the direction if the magnetic field is reversed on reversing the direction of the current. [*Delhi* 2015]

VI. Long Answer Type Question (5 Marks)

1. PQ is a current carrying conductor in the plane of the paper as shown in the figure below.



(*i*) Find the directions of the magnetic fields produced by it at points R and S?

(*ii*) Given $r_1 > r_2$, where will the strength of the magnetic field be larger? Give reasons.

(*iii*) If the polarity of the battery connected to the wire is reversed, how would the direction of the magnetic field be changed?

(*iv*) Explain the rule that is used to find the direction of the magnetic field for a straight current carrying conductor.

Answers 1.1

I. 1. (*c*) If magnetic field lines are parallel and equidistant, they represent zero field strength

2. (*c*) It is because only earth's magnetic field will be present

3. (*a*) Magnetic field lines emerge out from North pole and enter into south pole.

4. (*b*) In heart and brain magnetic field is produced.

II. 1. (*b*) Both 'A' and 'R' are true but 'R' is not correct explanation of the assertion.

2. (*c*) 'A' is true but 'R' is false.

III. 1. A compass needle behaves like a small bar magnet when it is brought near a bar magnet. Its magnetic field lines interact with that of bar magnet. Hence compass needle gets deflected.

2. No two magnetic field lines intersect each other because if they did, it would mean that at the point of intersection, the compass needle would point towards two direction, which is not possible.

3. At a point below it, the direction is from North to South and at a point above it, the direction is from South to North.

4. (*a*) Anticlockwise, (*b*) Clockwise

5. Both the iron bars get magnetised as shown in the figure

Iron bar 1 Bar Magnet Iron bar 2

6. A_1 represents North pole and B_1 represents South pole.

7. It is from South pole to North pole.

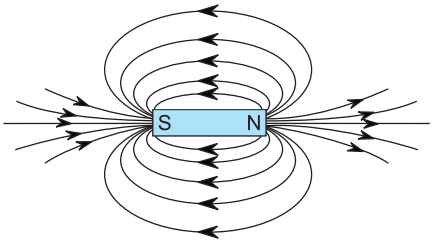
8. Magnetic field lines are closed curves.

9. The magnetic lines of force do not intersect with each another due to the fact that resultant force on the north pole at any point can only be in one direction. But if the two magnetic lines of force intersect one another, then the resultant force on the north pole placed at the point of intersection will be along two directions, which is not possible.

10. 

11. Soft iron core.

IV. 1.



Field lines around a bar magnet

2. The closed path traced by the unit North pole (imaginary) in a magnetic field are called magnetic field lines.

They are continuous closed curves because they diverge from the north pole of a bar magnet and converge to its south pole.

3. (*i*) Maximum of magnetic field strength is at 'A' and 'C'

(*ii*) Minimum of magnetic field strength is at 'B'.

At 'A' and 'C' magnetic field lines are crowded whereas these are spread out at 'B'.

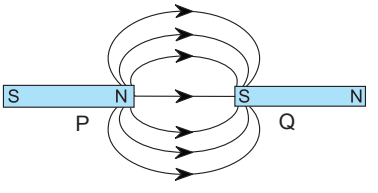
4. (*a*) **Observation:** The compass needle is deflected more.

Reason: Current carrying wire produces magnetic field, ($B \propto I$).

(*b*) **Observation:** The deflection of magnetic needle decreases.

Reason: The strength of magnetic field decreases with increase in distance from the wire. $\left(B \propto \frac{1}{d}\right)$

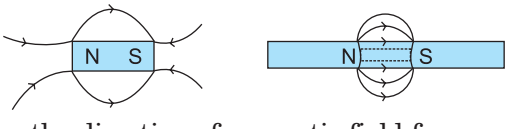
5. (*a*) Magnetic field lines are shown below:



(*b*) It shows that magnetic field is stronger near the poles, *i.e.* the pole of another magnet when placed in the magnetic field of a magnet will experience greater force. That is why field lines are crowded.

6. Figure 'B' represents correct pattern of magnetic field lines because magnetic field lines never intersect each other. If these intersect there will be two directions of the magnetic field at the point of intersection, which is not possible. In figure B. field lines are emerging (going away) from the magnet, so both the poles are north poles.

7. Field lines emerge from North pole and merge at South pole (S). So, X represents North pole and Y represents South pole.



8. When the observer observes the direction of magnetic field from west then the direction of current is from east to west and if observer is at east side then the direction of current is from west to east.

Right hand thumb rule: If we hold a current carrying conductor in our right hand in a such a way that stretched thumb is along the direction of the current, then curls of fingers around the conductor represents the direction of magnetic field lines.

9. (*a*) The closeness of lines measures the relative strength of magnetic field.

(*b*) The strength of magnetic field is highest near the poles whereas minimum in the middle of bar magnet.

V. 1. (*i*) The magnetic field lines produced is into the plane of the paper at R and out of it at S. 1

(*ii*) Field at S > Field at P

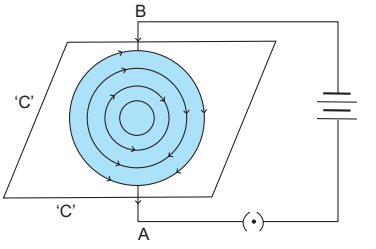
Magnetic field strength for a straight current carrying conductor is inversely proportional to the distance from the wire. 2

(*iii*) The current will be going from top to bottom in the wire shown and the magnetic field lines are now in the clockwise direction on the plane which is perpendicular to the wire carrying current. 1

(*iv*) Right hand thumb rule. The thumb is aligned to the direction of the current and the direction in which the fingers are wrapped around the wire will give the direction of the magnetic field. 1

2. (*i*) Take a straight vertical wire AB passing through a horizontal cardboard 'C'.

(*ii*) The ends of wires are connected to a battery and a switch.



(*iii*) When the current is passed through the wire AB, it produces a magnetic field around it, which can be shown by sprinkling iron filings on the cardboard 'C'.

(*iv*) The iron filings get magnetised and arrange themselves in concentric circles around the wire.

(*v*) It shows that magnetic field of lines are circular in nature.

(*vi*) When current passed in the wire it flows in upward direction, the lines of force are in anticlockwise direction.

(*vii*) Now pass current from B to A, *i.e.* in downward direction, the magnetic lines of force will be clockwise.

VI. 1. (*i*) The Magnetic field lines produced is into the plane of the paper at R and out of it at S.

(*ii*) Field at S > Field at P

Magnetic field strength for a straight current carrying conductor is inversely proportional to the distance from the wire.

(*iii*) The current will be going from top to bottom in the wire shown and the magnetic field lines are now in the clockwise direction on the plane which is perpendicular to the wire carrying current.

(*iv*) Right hand thumb rule. The thumb is aligned to the direction of the current and the direction in which the fingers are wrapped around in wire will give the direction of the magnetic field.

EXERSISE 1.2

I. Multiple Choice Questions (1 Mark)

Choose the correct answer from the given options.

1. The magnetic field inside a long straight solenoid-carrying current
(a) is zero. (b) decreases as we move towards its end.
(c) increases as we move towards its end. (d) is the same at all points. [*NCERT*]

2. Which of the following property of a proton can change while it enters freely in a magnetic field? (There may be more than one correct answer.)
(a) mass (b) speed
(c) velocity (d) momentum [*NCERT*]

3. For the current in a long straight solenoid N- and S-poles are created at the two ends. Among the following statements, the incorrect statement is
(a) The field lines inside the solenoid are in the form of straight lines which indicates that the magnetic field is the same at all points inside the solenoid
(b) The strong magnetic field produced inside the solenoid can be used to magnetise a piece of magnetic material like soft iron core, when placed inside the coil
(c) The pattern of magnetic field associated with the solenoid is different from the pattern of the magnetic field around a bar magnet
(d) The N- and S-poles exchange positions when the direction of current through the solenoid is reversed

II. Assertion-Reason Type Questions (1 Mark)

For question numbers 1 and 2 two statements are given-one labeled as **Assertion** (A) and the other labeled **Reason** (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below:
(a) Both 'A' and 'R' are true and 'R' is correct explanation of the Assertion.
(b) Both 'A' and 'R' are true but 'R' is not correct explanation of the Assertion.
(c) 'A' is true but 'R' is false.
(d) 'A' is false but 'R' is true.

1. **Assertion:** Compass is a small magnet and gives direction of magnetic field lines.
Reason: It gets deflected when brought near a bar magnet.

2. **Assertion:** A current carrying solenoid behaves like a bar magnet.
Reason: When soft iron is placed inside the solenoid it can also be magnetised.

III. Very Short Answer Type Questions (1 Mark)

1. Consider a circular loop of wire lying in the plane of the table. Let the current pass through the loop clockwise. Apply the right-hand rule to find out the direction of the magnetic field inside and outside the loop. [*NCERT*]

2. What type of core is used to make electromagnets? [*CBSE* 2014]

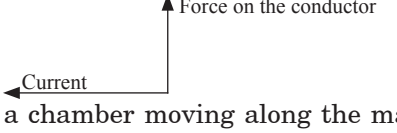
OR

What type of core should be put inside a current-carrying solenoid to make an electromagnet?

3. Give the factors on which magnetic field produced by a current carrying solenoid will depend.

4. Name the factors on which force acting on a current carrying conductor will depend.

5. State the direction of magnetic field in the following case: [*CBSE* 2014]



6. A beam of alpha particles enters a chamber moving along the magnetic field. What is the magnetic force experienced by the beam?

7. When is the force experienced by a current carrying conductor placed in a magnetic field greatest? [*CBSE* 2012]

8. What is the pattern of field lines inside a solenoid? What do they indicate? [*CBSE* 2010]

9. How is magnetic field produced in a solenoid used? [*CBSE* 2010]

10. What does the direction of thumb indicate in the right hand thumb rule? [*CBSE* 2010]

11. Suggest one way to distinguish a wire carrying current from a wire carrying no current. [*CBSE* 2012]

12. Why are magnetic field lines form closed curves? [*CBSE* 2012]

13. Imagine that you are sitting in a chamber with your back to one wall. An electron beam, moving horizontally from the back wall towards the front wall, is deflected by a strong magnetic field to your right side. What is the direction of the magnetic field?

IV. Short Answer Type Questions-I (2 Marks)

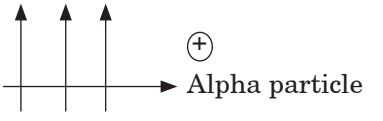
1. (*a*) Draw magnetic field lines of a current carrying circular loop. Identify the region where field is strongest and why?
(*b*) List two properties of magnetic field lines. [*Delhi* 2016]

2. Why and when does a current carrying conductor kept in magnetic field experiences force? List the factors on which direction of force will depend. [*Delhi* 2014] [**HOTS**]

3. How is the strength of magnetic field near a straight current-carrying conductor
(*i*) related to the strength of current in the conductor?
(*ii*) is affected when the direction of flow of current is reversed?

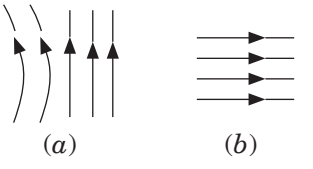
4. State two ways by which the strength of an electromagnet is increased. [*CBSE* 2014]

5. An alpha particle (positively charged) enters a magnetic field at right angle to it as shown in figure. Explain with the help of relevant rule, the direction of force acting on the alpha particle. [*CBSE 2014*]



6. (*i*) A compass needle gets deflected when brought near a current carrying conductor. Why?
(*ii*) What happens to the deflection of needle when current in the conductor is increased? [*CBSE* 2014]

7. Identify the type of magnetic field represented by the magnetic field lines given below and name the type of conductors which can produce them. [*CBSE* 2014]



8. Define a solenoid. Compare the magnetic field produced by a solenoid with that of a bar magnet. [*CBSE* 2019]

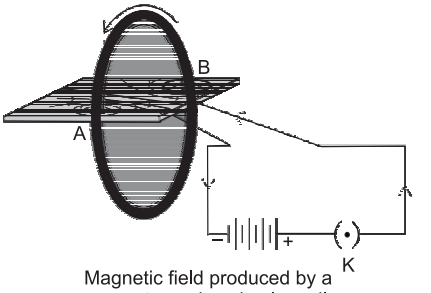
9. Distinguish between a bar magnet and an electromagnet.

10. Can a freely suspended current carrying solenoid stay in any direction? Justify your answer. What will happen when the direction of current in the solenoid is reversed? Explain. [*CBSE* 2015]

11. A uniform magnetic field is directed vertically upwards. In which direction in this field forces an particle (+ve charged) be projected to that it is deflected southward? Name and state the rule you have to use to find the direction in this force. [*CBSE* 2015]

V. Short Answer Type Questions-II (3 Marks)

1. For the circular coil carrying current shown below draw magnetic field lines. Decide which of its face behaves as north pole and which face behaves as south pole. Give reason to justify your answer. [*Delhi* 2016]



Magnetic field produced by a current carrying circular coil

2. You are given three identical looking bars one of which is a magnet, the other made of a magnetic material and the third made of a non magnetic material. Using just these three bars how will you find out which is which? [*Delhi* 2016]

3. Describe an activity to show magnetic field lines are produced when current is passed through circular coil. [*Delhi* 2015]

4. What is meant of solenoid? How does a current carrying solenoid behave? Give its main use. [*Delhi* 2015]

5. With the help of diagram of experimental set up describe an activity to show that the force acting on a current carrying conductor placed on magnetic field increases with increase in field strength. [*Delhi* 2015]

6. Write one application for each of the following:
(*a*) Right-hand Thumb Rule,
(*b*) Fleming's left Hand Rule,
(*c*) Fleming's Right Hand Rule.

7. How will the magnetic field produced at a point due to a current carrying circular coil change if we:
(*i*) increase the current flowing through the coil, (*ii*) reverse direction of current through coil, (*iii*) increase the number of turns in the coil? [*Delhi* 2011]

8. (*a*) Mention the factors on which the direction of force experienced by a current carrying conductor placed in a magnetic field will depend.

(*b*) Under what conditions is the force experienced by a current carrying conductor placed in a magnetic field maximum?

(*c*) A proton beam is moving along the direction of a magnetic field. What force is acting on proton beam? [*Delhi* 2011]

9. List three sources of magnetic field. [*CBSE* 2014]

VI. Long Answer Type Questions **(5 Mark)**

1. (*a*) Draw the pattern of magnetic field lines through a bar-magnet and around a current carrying solenoid.

(*b*) What is the pattern of magnetic field lines inside the solenoid and what does these indicate?

(*c*) How can a solenoid be utilised to make an electromagnet? [*Delhi* 2015]

(*d*) State two ways by which the strength of this electromagnet can be increased.

2. With the help of a labelled circuit diagram describe an activity to illustrate the pattern of the magnetic field lines around a straight current carrying long conducting wire.

(*i*) Name the rule that is used to find the direction of magnetic field associated with a current carrying conductor.

(*ii*) Is there a similar magnetic field produced around a thin beam of moving:

(*a*) alpha particles and (*b*) neutrons? Justify your answer.

3. What is meant by magnetic force? Name and explain the rule to determine the direction of force experienced by a current carrying conductor in a magnetic field. How does this force gets affected on: (*i*)doubling the magnitude of current, (*ii*) reversing the direction of flow of current, (*iii*) reversing the direction of magnetic field. [*Delhi* 2015]

Answers 1.2

I. 1. (*d*) It is same at all points

2. (*b*) The velocity and momentum are changing when a charged particle enters a magnetic field, and it moves in a circular path so that its velocity will change at every point, so also its momentum.

3. (*c*) The pattern of the magnetic field associated with the solenoid is different from the pattern of the magnetic field around a bar magnet

II. 1. (*b*) Both 'A' and 'R' are true but 'R' is not correct explanation of the assertion.

2. (*b*) Both 'A' and 'R' are true but 'R' is not correct explanation of the assertion.

III. 1. The direction of magnetic field will be perpendicular to the plane of paper inwards inside the loop and perpendicular to the plane of paper outwards from inside.

2. Soft Iron

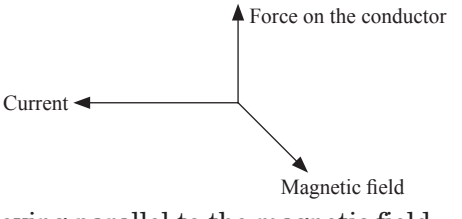
3. (*i*) The current through the solenoid. (*ii*)The number of turns in the solenoid

(*iii*) Nature of core on which wires are wound in solenoid.

4. (*i*) The current through the conductor. (*ii*)The strength of magnetic field.

(*iii*) The length of the conductor.

5. Direction is out of the page.



6. Zero, it is because beam is moving parallel to the magnetic field.

7. When the current in the conductor flows perpendicular (90°) to the direction of the magnetic field, maximum force is generated.

8. The magnetic field is in the form of parallel lines. It indicates a uniform magnetic field because magnetic field lines are parallel.

9. It is used to magnetise a soft iron bar to form an electromagnet.

10. The thumb indicates the direction of current in the straight conductor held by curved fingers of our hand.

11. The magnetic compass needle will get deflected near the wire current carrying but not near the wire with no current.

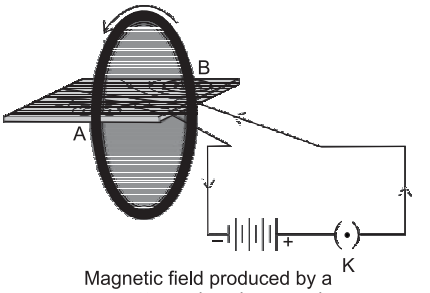
12. It is because outside the magnet, magnetic field lines start from north pole and merge at south pole whereas inside the magnet they start from south pole and merge at north pole, therefore these lines from closed curves.

13. The direction is vertically downwards.

IV. 1. (*a*) On observing the field lines, it shows that magnetic field due to the current carrying circular loop is maximum and normal to the current carrying loop at its center because magnetic field due to each part of loop adds up.

(*b*) (*i*) No two magnetic field lines intersect with each other at any point.

(*ii*) More crowded field lines means a stronger magnetic field.



Magnetic field produced by a current carrying circular coil

2. The movement of electrons takes place in the conductor in a particular direction when current is passed through it. These charged particles are moving in the magnetic field which experiences force. The current carrying conductor has its own magnetic field, when it superimpose the magnetic field of magnet. Due to this, current carrying conducter experiences a force. Thus conductor experiences a force when placed in a uniform magnetic field.

Factors on which direction of force depends:

(*i*) The direction of force depends upon the direction of magnetic field.

(*ii*) It also depends upon the direction of current flowing through the conductor.

3. (*i*) The strength of magnetic field is directly proportional to the strength of current.

(*ii*) If we reverse the direction of current, the direction of magnetic field will also be reversed.

4. (*i*) Increase in number of turns in the solenoid.

(*ii*) Increase in the strength of current flowing in the solenoid.

5. The force will act in upward direction given by thumb, if forefinger points in the direction of magnetic field and the middle finger points in the direction of current, according to Fleming's left hand rule.

6. (*i*) It is because current carrying conductor produces a magnetic field which superimposes with magnetic field of compass needle due to which needle of compass gets deflected.

(*ii*) The deflection in the magnetic needle will increase as the strength of current increases.

7. (*a*) These magnetic field lines are produced by a current carrying loop.

(*b*) These are magnetic field lines produced by solenoid.

8. A coil of many circular turns of copper wire wrapped in the shape of a cylinder, is called a solenoid. The magnetic field lines in a solenoid, through which current is passed, is very similar to that of a bar magnet. One end of the coil acts like the magnetic north pole, while the other acts like the magnetic south pole. The magnetic field produced by a long solenoid has all the properties of the field produced by a bar magnet.

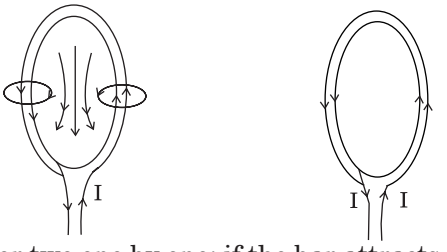
9.

S.No.	Bar Magnet	Electromagnet
1.	The bar magnet is a permanent magnet.	An electromagnet is a temporary magnet.
2.	It produces a comparatively weak magnetic force.	It produces a very strong magnetic force.
3.	The strength of a bar magnet cannot be changed.	The strength of an electromagnet can be changed by changing the number of turns in its coil or by changing the current passing through it.
4.	The polarity of a bar magnet is fixed and cannot be changed.	The polarity of an electromagnet can be changed by changing the direction of current in its coil.

10. A current carrying solenoid behaves like a bar magnet. When it is suspended freely it will stay in north–south direction. On reversing the direction current, it will turn to 180°° because its polarity will be reversed.

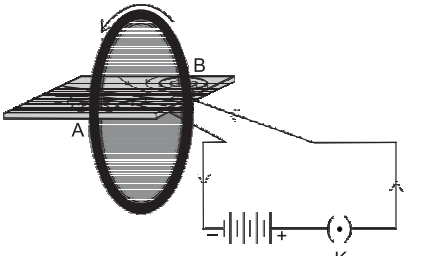
11. The direction of motion of particles is from west to east. Fleming's left hand rule is used to find the direction of force.

V. 1. Front face behaves like a north pole as field emerges out of it. Rear face behaves as south pole as field enters into this face.



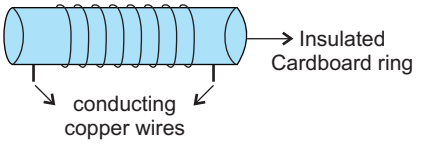
2. Bring one bar close to the other two one by one: if the bar attracts one of these and does not attract the other one, the bar which is not attracted is made of non-magnetic material and the bar in our hand is a magnet or a bar of magnetic material. Keep one bar on the table and move other bar along its length from one end to the other, if uniform attraction is felt the bar in our hand is a magnet and vice versa.

3. (*i*) Take a rectangular cardboard having two holes.
(*ii*) Insert a circular coil through these holes, normal to the plane of paper.
(*iii*) Connect the ends of coil in series with a battery, and key.
(*iv*) Sprinkle iron filings uniformly on the cardboard.
(*v*) Plug the key.
(*vi*) Tap the cardboard gently a few times. Note the pattern of the iron filings.
(*vii*) The pattern of magnetic field lines will be same as the pattern of iron filings.

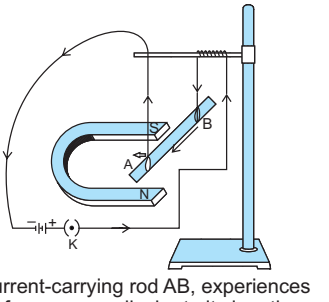


Magnetic field produced by a current carrying circular coil

4. The long coil containing large number of close turns of insulated copper wires wrapped around, is called a solenoid.
Current carrying solenoid behaves like a bar magnet. It is called an electromagnet.
It is used for making electromagnets.



5. (*i*) Take an aluminium rod, AB of size 3 inches.
(*ii*) Suspend it horizontally using connecting wires
(*iii*) Place a horse-shoe magnet in such a way that the rod lies between the two poles with magnetic field directed upwards.
(*iv*) Put north pole of the magnet vertically below and south pole vertically above the rod.
(*v*) Connect aluminium rod in series with the battery and key.
(*vi*) Now pass the current in the rod from B to A.
(*vii*) Aluminium rod will be displaced towards the left.
(*viii*) Now bring a stronger horse-shoe magnet and observe the displacement of rod.
(*ix*) The displacement of rod will increase with the increase in strength of the magnetic field.



A current-carrying rod AB, experiences a force perpendicular to its length and the magnetic field

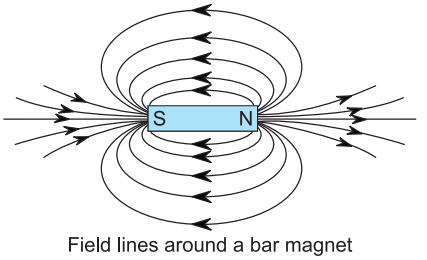
6. (*a*) It is used to find the direction of magnetic field in a coil of wire and electric current in a straight conductor.
(*b*) It is used to find the direction of force exerted on a current carrying conductor in a magnetic field.
(*c*) It is used to find the direction of induced current in a closed circuit placed in a changing magnetic field, *e.g.* in an electric generator.

7. (*i*) The strength of magnetic field will increase. ($\because$ B $\propto$ I)
(*ii*) The direction of magnetic field will be reversed.
(*iii*) The magnetic field produced will increase because magnetic field produced is directly proportional to the number of turns in the coil.

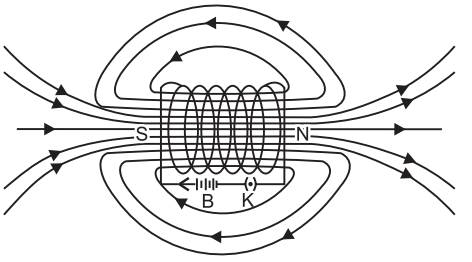
8. (*a*) (*i*) direction of current, (*ii*) direction of magnetic field.
(*b*) When direction of current is perpendicular to the direction of magnetic field, the force experienced will be maximum.
(*c*) No, force is exerted by a proton beam because proton beam is moving along the direction of magnetic field.

10. (*i*) Magnetic field is associated with bar magnet
(*ii*) A current carrying conductor produces magnetic field.
(*iii*) A current carrying curricular loop also produces magnetic field.

VI. 1. (*a*)

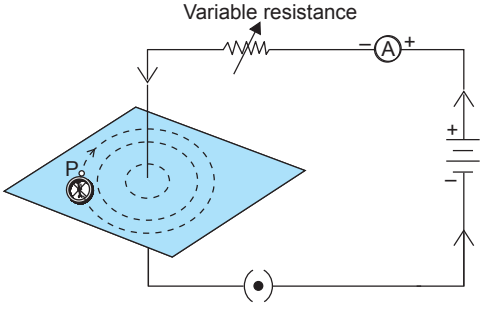


Field lines around a bar magnet



(*b*) These are parallel straight lines indicating that magnetic field is uniform inside the solenoid.
(*c*) By inserting a soft iron rod into the middle part of solenoid it is used to make an electromagnet
(*d*) (*i*) By increasing the number of turns.
(*ii*) By increasing the strength of current.

2. (*i*) Take a battery (12 V), a variable resistor (rheostat), an Ammeter (0.5 A), a plug key, a long thick straight copper conducting wire.
(*ii*) Insert the thick wire through the centre normal to the plane of rectangular cardboard.
(*iii*) Take care that cardboard is fixed and does not slide up or down.
(*iv*) Connect the copper wire vertically between points X and Y as shown in diagram in series with battery, plug and a key.
(*v*) Sprinkle some iron flings unformly on the cardboard.
(*vi*) Keep the variable resistance in fixed position.
(*vii*) Close the key so that current flows through the wire.
(*viii*) Ensure the copper wires placed remains vertically straight.
(*ix*) Gently tap the iron filings.



Pattern of Magnetic field lines

Observation:
Iron filings align themselves showing a pattern of concentric circles around the copper wire which represents magnetic lines of force.
(*i*) Right hand rule.
(*ii*) (*a*) Yes, alpha particle being positively charged constitutes a current in the direction of motion.
(*b*) No, neutrons being electrically neutral constitute no current.

3. The force experienced by a current carrying conductor when placed in a magnetic field or the force experienced by a charged particles moving in a magnetic field is called magnetic force.
Fleming left hand rule: According to this rule, on stretching the thumb, forefinger and the middle finger of your left hand such that these are perpendicular to each other, if the force finger points in the direction of magnetic field and middle finger in the direction of current, then the thumb will point in the direction of motion of force acting on the conductor.
(*i*) If magnitude of current is doubled, then force is doubled.
(*ii*) If direction of flow of current is reversed, the direction of force is also reversed.
(*iii*) If direction of magnetic field is reversed, the direction of force is also reversed.

EXERSISE 1.3

I. Multiple Choice Questions (1 Mark)

Choose the correct answer from the given options.

1. When the speed of rotation of coil is doubled, the frequency of current will be
(a) same (b) doubled (c) half (d) qudrapled times

2. If a rectangular copper wired coil is rotated in magnetic field, in how many revolutions, the direction of induced current will be change?
(a) one (b) two (c) half (d) three

II. Assertion-Reason Type Questions (1 Mark)

For question numbers 1 and 2 two statements are given-one labeled as **Assertion** (A) and the other labeled **Reason** (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below:

(a) Both 'A' and 'R' are true and 'R' is correct explanation of the Assertion.

(b) Both 'A' and 'R' are true but 'R' is not correct explanation of the Assertion.

(c) 'A' is true but 'R' is false.

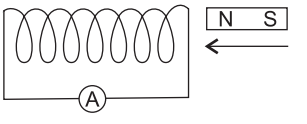
(d) 'A' is false but 'R' is true.

1. Assertion: Galvanometer is used to detect current.
Reason: Ammeter is used measure current generated in A.C. generator

2. Assertion: When the direction of movement of coil is reversed, the direction of induced current is also reversed.
Reason: Fleming's right hand thumb rule detects the direction of induced current.

III. Very Short Answer Type Questions (1 Mark)

1. When a magnet is moved into the coil of wire as shown in the figure, there is small reading in the ammeter. How can we increase the reading?



2. What is the principle of an electric motor? [*NCERT*]

3. Meena draws magnetic field lines of field close to the axis of a current carrying circular loop. As she moves away from the centre of the circular loop, she observes that the lines keep on diverging. How will you explain her observation? [*NCERT Exemplar*]

4. What does the divergence of magnetic field lines near the ends of a current carrying straight solenoid indicate? [*NCERT Exemplar*]

5. What is the role of the two conducting stationary brushes in a simple electric motor?

6. State Faraday's first law of electromagnetic induction.

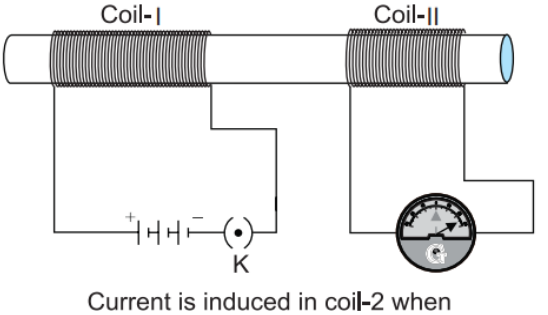
7. A square coil moves in a plane with uniform velocity 'V' parallel to its sides and magnetic field acts at 90°° into the loop. What is the induced current in the coil?

8. How is induced current in a secondary coil related to the current flowing in the primary coil? [*CBSE* 2009]

9. Name any one method to induce current in a coil. [*CBSE* 2013]

10. State Faraday's second law of electromagnetic induction.

11. In the arrangement shown in figure there are two coils wound on a nonconducting cylindrical rod. Initially the key is not inserted in the circuit. Later the key is inserted and then removed shortly after.



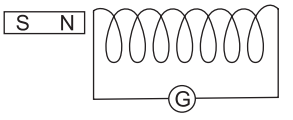
Current is induced in coil-2 when current in coil-1 is changed

What are the two observations that can be noted from the galvanometer reading?

[*CBSE Sample Paper* 2020-21]

IV. Short Answer Type Questions-I (2 Marks)

1. When a magnet was pushed towards a solenoid, the galvanometer connected to the solenoid showed a deflection in right direction. When the same magnet was pulled away from the solenoid at a faster speed, what was the deflection in the galvanometer?



2. What is the role of split rings in an electric motor? [*NCERT*]

3. Explain different ways to induce current in a coil. [*NCERT*]

4. Imagine that you are sitting in a chamber with your back to one wall. An electron beam moves horizontally from back wall towards the front wall and by a strong magnetic field to your right side. What is the direction of magnetic field? [*NCERT*]

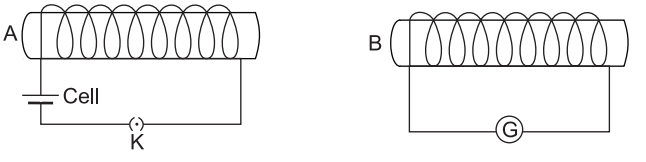
5. Two circular coils A and B are placed closed to each other. If the current in the coil A is changed, will the same current be induced in the coil B? Give reason. [*NCERT*]

6. It is established that an electric current through a metallic conductor produces a magnetic field around it. Is there a similar magnetic field produced around a thin beam of moving (*i*) alpha particles, (*ii*) neutrons? Justify your answer. [*NCERT Exemplar*]

7. State Fleming's right Hand Rule.

V. Short Answer Type Questions-II (3 Marks)

1. Figure shows equipments used to demonstrate electromagnetic induction.



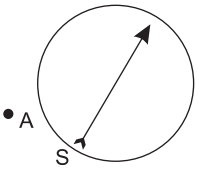
Two pieces of soft iron core 'A' and 'B' each having a coil of insulated wire wrapped around them. The coil around 'A' is connected to a switch and a cell. The coil around 'B' is connected to a galvanometer. When the switch is closed, the galvanometer shows a rapid deflection to the left before returning to zero.

(*i*) Explain why the galvanometer shows a rapid deflection to the left before returning to zero?

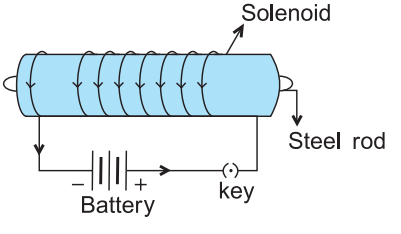
(*ii*) Explain what, if anything, would be observed on the galvanometer as the switch is opened?

2. A coil of insulated copper wire is connected to a galvanometer. What will happen if a bar magnet is (*a*) pushed into the coil, (*b*) withdrawn from inside the coil, (*c*) held stationary inside the coil? [*NCERT*] [*CBSE* 2020]

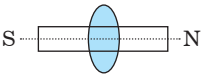
3. A magnetic compass needle is placed in the plane of paper near point A as shown in the figure. In which plane should a straight current carrying conductor be placed so that it passes through A and there is no change in the deflection of the compass? Under what conditions is the deflection maximum and why? [*NCERT Exemplar*]



4. Under what conditions a permanent electromagnet is obtained if a current carrying solenoid is used? Support your answer with the help of a labeled circuit diagram. [*NCERT Exemplar*] [*CBSE* 2020]



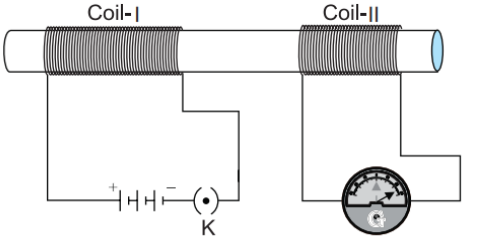
5. What is meant by electromagnetic induction? State the rule which helps to determine the direction of induced current. [*CBSE* 2015]
6. State the condition for electromagnetic induction to take place. A cylindrical bar magnet is kept along the axis of circular coil as shown in the figure. Will there be a current induced in the coil, if the magnet is rotated about its axis? Discuss. [*CBSE* 2014]



VI. Long Answer Type Questions (5 Marks)

1. Explain the principle and working of an electric motor with the help of a labelled diagram. What is the function of a split ring commutator?

2. (*i*) With the help of an activity, explain the method of inducing electric current in a coil with a moving magnet. State the rule used to find the direction of electric current thus generated in the coil.
   (*ii*) Two circular coil-1 and coil-2 are kept close to each other as shown in the diagram.Coil-1 is connected to a battery and key and coil-2 with a galvanometer. State your observation in the galvanometer:
   (*a*) When key K closed;
   (*b*) when key K is opened;
   Give reason for your observations.
   [*CBSE Sample paper* 2018-19]



Current is induced in coil-2 when current in coil-1 is changed

3. (*a*) State Fleming's left hand rule.
   (*b*) Write the principle of working of an electric motor.
   (*c*) Explain the function of the following parts of an electric motor.
   (*i*) Armature (*ii*) Brushes (*iii*) Split ring

Answers 1.3

I. 1. (*b*) Frequency is directly proportional to speed of rotation of coil.

2. (*c*) If rectangular copper wire coil is related in magnetic field, the direction of induced current will be change every half revolution.

II. 1. (*b*) Both 'A' and 'R' are true and 'R' is correct explanation of the assertion.

2. (*c*) 'A' is true but 'R' is false.

III. 1. It can be done by pushing the magnet or coil faster towards, respectively the magnet or coil.

2. It is based on the principle that a force is experienced by the current carrying conductor in a magnetic field. The two forces on the opposite sides of current carrying rectangular coil in a magnetic field will act in different lines, thus bringing the rotational motion.

3. Strength of magnetic field decreases with increase in distance from the from the magnetic substance. That is why magnetic lines keep on diverging due to decrease in magnetic field.

4. It indicates that strength of magnetic field decreases near the end of the solenoid.

5. They make the contact between the two halves of the split rings and the battery. Current from the battery enters a conducting brush and flows back to the battery through the brush.

6. When magnetic field in around a conducting coil is changed, induced emf is produced.

7. Zero, it is because there is no change in magnetic flux.

8. It may be greater than or less than primary coil.

9. It can be done by moving a magnet towards the coil.

10. The induced e.m.f depends directly upon the relative speed between the coil and the magnet.

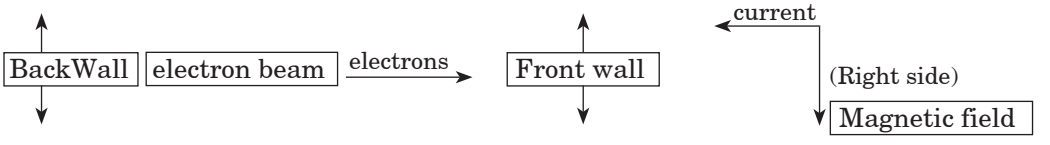
11. There are momentary galvanometer deflections that die out shortly; the deflections are in opposite directions.

IV. 1. Deflection in galvanometer will be towards the left, because when the direction of movement of magnet is reversed, the direction of induced current is also reversed. The induced current is increased but it is flowing in opposite direction when the magnet is moving faster and in opposite direction.

2. It act as a commutator in D.C (direct current) motor. The direction of current through the coil is reversed with the help of split rings after every half rotation of the coil, direction of current in the rotating coil remains the same and the coil continues to rotate in the same direction, thus producing direct current.

3. (*i*) By changing the direction of current in the conductor.
(*ii*) By changing the magnetic field in around the coil.

4.



Current will move in the opposite direction to the flow of electrons. The direction of magnetic field will be downwards as shown in the figure.

5. No, the induced current in coil 'B' will change. It is because magnetic field produced in coil 'A' will change, therefore magnetic field induced in coil 'B' will also change. Hence induced current in the coil will also change.

6. (*i*) Yes, similar magnetic fields are produced. α-particles are positively charged particles, so current will be in the direction of motion of beam of particles.
(*ii*) No, in neutrons no current will be produced, as these are neutral particles.

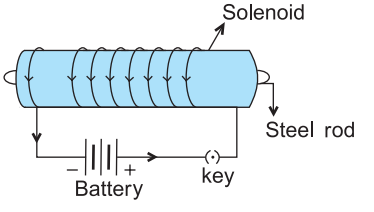
7. According to Fleming's right hand rule, when the thumb, fore finger and the central finger of our right hand are kept perpendicular to each other when the thumb shows the direction of motion of the conductor, the forefinger shows the direction of magnetic field when current induced is in the direction of central finger as shown in the figure.

V. 1. (*i*) When the switch is closed, a changing magnetic field is produced in A which produces a change in magnetic field in 'B' resulting in induced current. However, the magnetic field in A becomes steady after sometime. Therefore, there is no more induced current in B as there is no change in the magnetic flux and the reading is zero.
(*ii*) When the switch is opened, there is deflection in the galvanometer but in the opposite direction. The decreasing magnetic field in A produces an induced current in B. Since the change is reversed, the direction of induced current is also reversed.

2. (*a*) It will show deflection.
(*b*) The deflection will be in the opposite direction.
(*c*) The galvanometer will not show any deflection.

3. Straight current carrying conductor should be placed in the plane of paper. The magnetic field produced will be at 90° to the plane of paper and parallel to the vertical axis of magnetic needle. The deflection will be maximum when current carrying conductor is at 90°°to the plane of paper and magnetic field will be in the direction parallel to the plane of paper.

4. (*i*) Direct current should be used.
(*ii*) Magnitude of current should be large.
(*iii*) The number of turns in solenoid are more and close to each other like windings in an electric motor.
(*iv*) The soft core inside the solenoid should be made up of steel.

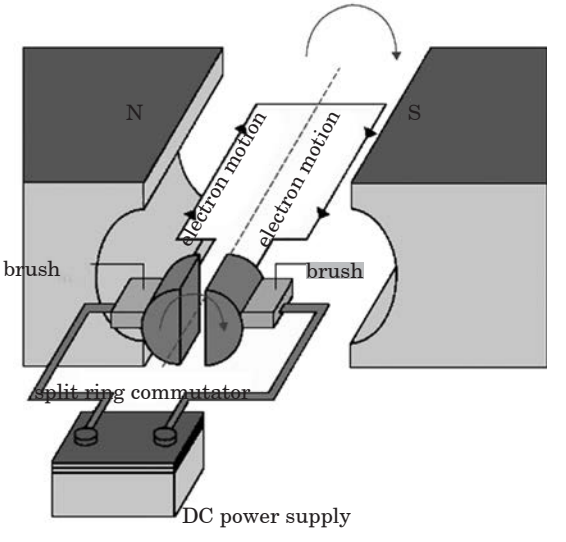


5. It is the phenomena of production of induced current and potential difference in a conductor by moving a magnet or if there is a change in magnetic field or flux.

Fleming's right hand rule for determining the direction of induced current: Hold the thumb, the forefinger and central finger of your right hand perpendicular to each other in such a way that forefinger represents the direction of magnetic field, the thumb points in the direction of motion of conductor, then the central finger will give the direction of induced current in the conductor.

6. • Either the coil or the magnet should be in motion
• If there is relative motion between a coil carrying current and coil not carrying current, there will be induced current in the second coil.
• No current will be induced because there is no change in magnetic field which is essential to produce induced current.

VI. 1. An electric motor converts electrical energy into mechanical energy. It works on the principle that a current carrying conductor placed in a magnetic field experiences a force.
Following are the essential parts of an electric motor.
(*i*) Coil: It is a rectangular coil of insulated copper wire having large number of turns.
(*ii*) A large permanent magnet provides strong magnetic field between its pole pieces. The coil rotates between these pole pieces.
(*iii*) Split rings: The two ends of coil are connected to two split rings, which are two halves of slip rings.



Working

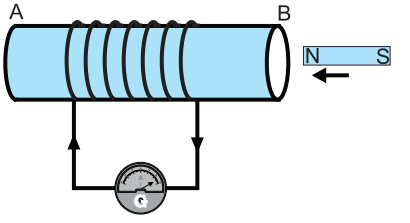
When a current is passed through the coil, the direction of current in AB and CD is in opposite direction but both are perpendicular to magnetic field. Therefore, by Fleming's left hand rule, arm AB of the coil experiences

an upward force and arm CD experiences a downward force. These two forces being equal and opposite to each other form a couple which rotates the coil. Arms BC and DA are parallel to the field and the force between them is zero. The forces on AB and CD turns the coil in clockwise direction. After half revolution, the split rings change their position. So the direction of current in the coil reverses. The couple now acting on the coil again moves it in clockwise direction. Due to the function of split ring commutator and brushes, coil continues to turn in clockwise direction.

Split ring commutator changes direction after every half rotation, so that the direction of current going in the coil also reverses. As a result, the coil continues to rotate in one direction. So, the electrical energy given to the coil changes into mechanical energy.

2. (*i*) • Take a coil of wire AB having a large number of turns.

- Connect the ends of the coil to a galvanometer as shown in figure.
- Take a strong bar magnet and move its north pole towards the end B of the coil.
- There is a momentary deflection in the needle of the galvanometer, say to the right. This indicates the presence of a current in the coil AB. The deflection becomes zero the moment the motion of the magnet stops.
- Now withdraw the north pole of the magnet away from the coil.



Moving a magnet towards a coil sets up a current in the coil circuit, as indicated by deflection in the galvanometer needle

Now the galvanometer is deflected toward the left, showing that the current is now set up in the direction opposite to the first.

Fleming's right hand rule is used find the direction of electric current generated in the coil.

(*ii*) (*a*) The galvanometer needle deflects momentary in one direction because when the key is closed, magnetic field lines around coil-2 increases momentarily that causes induced current in coil-2.

(*b*) The galvanometer needle deflects momentarily but in opposite direction because when the key is opened, magnetic field lines around coil-2 decreases momentarily that causes induced current in coil-2.

3. (*a*) *Fleming's left-hand rule:* Stretch the forefinger, middle finger and thumb of left hand in such a way that they are mutually perpendicular to each other. If the forefinger points in the direction of magnetic field, middle finger points in the direction of current then the thumb shows the direction of force or motion of the current carrying conductor.

(*b*) *Principle of working of electric motor:* A coil carrying electric current placed in an external magnetic field experiences a force or torque.

(*c*) (*i*) *Function of armature:* Enhances the power of the motor/induces motion.

(*ii*) *Function of brushes:* Helps easy transfer of charge between the coil and the external circuit.

(*iii*) *Function of split rings:* Reverses the direction of current after every half rotation of the coil, so that coil can keep rotating continuously.

CASE STUDY QUESTIONS

1. Study this table related to wattage of home appliances and answer the questions that follow.

Home Appliance	Wattage	Home Appliance	Wattage	LED	CFL
1. Air conditioner	3517 per ton	Bulb	100 Watt	12 Watt	23 Watt
2. Blender	350 Watt	Bulb	75 Watt	11 Watt	
3. Washing machine	500 Watt	Bulb	60 Watt	8 Watt	15 Watt
4. Dish washer	1200–1500 Watt	Bulb	40 Watt	6 Watt	11 Watt
5. Geyser	1000–2000 Watt				
6. Iron	500–750 Watt				
7. Coffee maker	800 Watt				
8. Fridge	475–540 Watt				
9. Laptop	20–75 Watt				

10. Desktop	80–200 Watt				
11. Ceiling fan	10–50 Watt				
12. Blow dryer	1000–1500 Watt				
13. Vacuum cleaner	200–700 Watt				
14. Microwave	600–1500 Watt				

(*i*) Which of the following home applicance is not based on magnetic effect of current?
(*a*) Ceiling fan (*b*) Blender (*c*) Geyser (*d*) Washing Machine

(*ii*) Which of the following lighting device is best to use in terms of power consumption?
(*a*) Bulb (*b*) CFL (*c*) Tube light (*d*) LED

(*iii*) Which of the following will to consume least power?
(*a*) Laptop (*b*) Desktop (*c*) Printer (*d*) Blender

(*iv*) Which of the following will consume maximum power?
(*a*) Fridge (*b*) Iron (*c*) Air conditioner (*d*) Coffee maker

(*v*) Many appliance works on the principle of electromagnetic induction. The role which depicts the direction of induced current is as
(*a*) Faraday's rule (*b*) Henery's rule
(*c*) Fleming's rule (*d*) Maxwell's rule

Ans. (*i*) (*c*) (*ii*) (*d*) (*iii*) (*a*) (*iv*) (*c*) (*v*) (*c*)

2. A magnetic stripe card, also referred to as a swipe card or magstripe, is a plastic card with a magnetic strip attached on its surface. This stripe is made of tiny iron-based components whose magnetism can be modified and can therefore be used to store information. A magstripe is quite similar to a magnetic recording tape, which you might find in videotape or a music cassette. The magnetic strip on a card can be 'written' or encoded with information because the tiny iron-based particles that make up the strip can be magnetised in different directions by a device that produces a strong magnetic field. This device is a 'solenoid', which is basically a coil wound into a tightly packed helix. The wire is wound around a high-permeable, metallic core that produces a strong magnetic field when a current is passed through it. This device encodes the required information onto the stripe, which is then pasted on a plastic card. When a card with a magnetic strip is moved back and forth over the 'reader head' , a voltage is induced in the coils of the card reader device. A card reader consists of solenoid too – the same component that is used to write information in the magnetic strip.

This voltage can be amplified and recorded electronically, which is finally read by a computer (or a processor installed within the reader) to authenticate a user (in the case of identity cards) or a transaction (in the case of credit/debit cards).

(*i*) Which of the following are the devices that uses magnetic theory to record data
(*a*) The hotel key cards (*b*) Audio tapes
(*c*) CD's (*d*) All of the above

(*ii*) Name the scientist who gave the principle of electromagnetic field
(*a*) Oersted (*b*) Faraday (*c*) Bohr (*d*) Ampere

(*iii*) The force on a wire inside a magnetic field increase when
(*a*) The current is increased (*b*) Strength of magnetic field increases
(*c*) Length of wire is increased (*d*) All of above

(*iv*) The information of users which are read by the ATM machines are stored on
(*a*) Magnetic box on card (*b*) Magnetic strip on card
(*c*) Inside ATM machine (*d*) None of above

(*v*) The factors on which one magnetic field strength produced by current carrying solenoids depends are
(*a*) Magnitude of current (*b*) Number of turns
(*c*) Heat produced (*d*) Both (*a*) and (*b*)

Ans. (*i*) (*d*) (*ii*) (*a*) (*iii*) (*d*) (*iv*) (*b*) (*v*) (*d*)

3. A solenoid is a long helical coil of wire through which a current is run in order to create a magnetic field. The magnetic field of the solenoid is the superposition of the fields due to the current through each coil. It is nearly uniform inside the solenoid and close to zero outside and is similar to the field of a bar magnet having a north pole at one end and a south pole at the other depending upon the direction of current flow. The magnetic field produced in the solenoid is dependent on a few factors such as, the current in the coil, number of turns per unit length etc.

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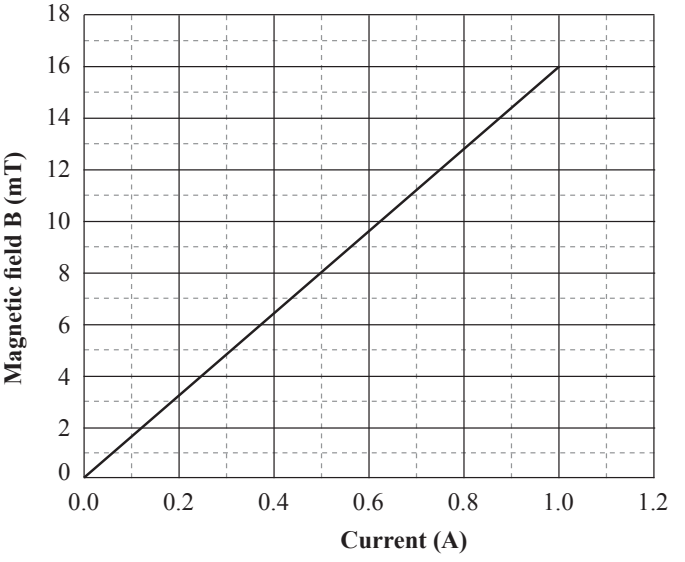
The following graph is obtained by a researcher while doing an experiment to see the variation of the magnetic field with respect to the current in the solenoid.
The unit of magnetic field as given in the graph attached is in milli-Tesla (mT) and the current is given in Ampere.



(*i*) What type of energy conversion is observed in a linear solenoid?

(*a*) Mechanical to Magnetic (*b*) Electrical to Magnetic

(*c*) Electrical to Mechanical (*d*) Magnetic to Mechanical

(*ii*) What will happen if a soft iron bar is placed inside the solenoid?

(*a*) The bar will be electrocuted resulting in short-circuit.

(*b*) The bar will be magnetised as long as there is current in the circuit.

(*c*) The bar will be magnetised permanently.

(*d*) The bar will not be affected by any means.

(*iii*) The magnetic field lines produced inside the solenoid are similar to that of …

(*a*) a bar magnet (*b*) a straight current carrying conductor

(*c*) a circular current carrying loop (*d*) electromagnet of any shape

(*iv*) After analysing the graph a student writes the following statements.

I. The magnetic field produced by the solenoid is inversely proportional to the current.

II. The magnetic field produced by the solenoid is directly proportional to the current.

III. The magnetic field produced by the solenoid is directly proportional to square of the current.

IV. The magnetic field produced by the solenoid is independent of the current.

Choose from the following which of the following would be the correct statement(s).

(*a*) Only IV (*b*) I and III and IV (*c*) I and II (*d*) Only II

(*v*) From the graph deduce which of the following statements is correct.

(*a*) For a current of 0.8A the magnetic field is 13 mT

(*b*) For larger currents, the magnetic field increases non-linearly.

(*c*) For a current of 0.8A the magnetic field is 1.3 mT

(*d*) There is not enough information to find the magnetic field corresponding to 0.8A current.

ASSIGNMENT

Total Marks : 20

I. Multiple Choice Questions (1 mark)

Choose the correct answer from the given options.

1. Fleming's Right-hand rule gives

(a) magnitude of the induced current (b) magnitude of magnetic field

(c) direction of induced current (d) both direction and magnitude of induced current

[*CBSE* 2020]

2. If a rectangular copper wired coil is rotated in magnetic field, in how many revolutions, the direction of induced current will be change?

(a) one (b) two (c) half (d) three

II. Assertion-Reason Type Questions (1 mark)

Note: Use instructions as given in topical exercises of the chapter.

1. Assertion: The energy of charged particles moving at right angles to a uniform magnetic field does not change.

Reason: No work is done by the magnetic field on the charged particles.

2. Assertion: Magnetic field lines do not intersect.

Reason: Magnetic field lines are closed curves.

III. Very Short Answer Type Questions (1 Mark)

1. Define the term induced electric current. [*CBSE* 2020]

2. The change in magnetic field lines in a coil is the cause of induced current in it. Name the underlying phenomenon. [*CBSE* 2020]

IV. Short Answer Type Questions-I (2 Marks)

1. Give four differences between electromagnet and permanent magnet.

2. How can we demagnetise a magnet?

3. Define trophic level. Name the first trophic level. [*Delhi* 2011] [*CBSE* 2020]

V. Short Answer Type Question-II (3 Marks)

1. (a) A coil of insulated wire is connected to a galvanometer. Explain what happens if a bar magnet with its pole towards one face of the coil is (i) moved quickly towards the coil, (ii) kept stationary inside the coil and (iii) moved quickly away from the coil.

(b) Name the phenomenon involved.

(c) State the conclusion based on the observation in (i), (ii) and (iii) [*CBSE* 2020]

VI. Long Answer Type Questions (5 Marks)

1. (a) State Fleming's Left Hand rule.

(b) List three characteristic features of the electric current used in our homes.

(c) What is a fuse? Why is it called a safety device.

(d) Why is it necessary to earth metallic electrical appliances. [*CBSE* 2020]