MAGNETIC EFFECTS OF ELECTRIC CURRENT

Very Short Answer Type Questions:

1. A strong bar magnet is placed vertically above a horizontal wooden board. The magnetic lines of force will be:

(a) only in horizontal plane around the magnet
(b) only in vertical plane around the magnet
(c) in horizontal as well as in vertical planes around the magnet
(d) in all the planes around the magnet

Answer: (d) in all the planes around the magnet

2. Which of the following is not attracted by a magnet?

(a) steel
(b) cobalt
(c) brass
(d) nickel

Answer: (c) brass

3. A plotting compass is placed near the south pole of a bar magnet. The pointer of plotting compass will:

(a) point away from the south pole (b) point parallel to the south pole
(c) point towards the south pole (d) point at right angles to the south pole

Answer: (c) point towards the south pole

4. Which of the following statements is incorrect regarding magnetic field lines?

(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 points.
(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.

Answer: (c) If magnetic field lines are parallel and equidistant, they represent zero field strength.

5. Name the technique by which doctors can produce pictures showing insides of the human body. What is the full form of MRI?

Answer: A technique called Magnetic Resonance Imaging (MRI) which is used to obtain images (or pictures) of the internal parts of our body.

6. Assertion (A): As the speed of the coil in the motor increases, there is reduction in the current flowing through it.

Reason (R): During rotation in electric motor, some induced current is produced.

(a) (A) is incorrect and (R) is correct.
(b) (A) is correct and (R) is incorrect.
(c) Both (A) and (R) are correct but (R) is not the correct explanation of (A).
(d) Both (A) and (R) are correct but (R) is the correct explanation of (A).

Answer: (d) Both (A) and (R) are correct but (R) is the correct explanation of (A).

Short Answer Type Questions:

7. When an electric current is passed through any wire, a magnetic field is produced around it. Then why an electric iron connecting cable does not attract nearby iron objects when electric current is switched on through it?

Answer: When an electric current is passed through a wire, it is true that a magnetic field is produced around it. However, such magnetic fields are very weak.

The magnetic field produced by an electric iron connecting cable is very weak and is not enough to attract nearby objects. Moreover, metallic wires of cables are shielded with a cover that prevents magnetic field to show its effect outside the cable.

8. Fill in the following blanks with suitable words:
   (a) The magnetic effect of a coil can be increased by increasing the number of....., increasing the ....., or inserting an.....core.
   (b) If a coil is viewed from one end and the current flows in an anticlockwise direction, then this end is a.....pole.
   (c) If a coil is viewed from one end, and the current flows in a clockwise direction, then this end is a .....pole.
   (d) The two main organs of the human body where the magnetic field produced is quite significant are the……. and the…….

Answer:

(a) Turns in the coil, current flow, soft iron.
(b) North
(c) South
(d) Heart, brain

9. You are given the magnetic field pattern of a magnet. How will you find out from it where the magnetic field is the strongest?

Answer: Magnetic field is the strongest at the place where the magnetic field lines are closest together.

10. **How is the strength of magnetic field near a straight current-conductor**
    (i) related to the strength of current in the conductor?
    (ii) is affected by changing the direction of flow of current in the conductor?
    Answer:
    (i) The strength of magnetic field around a straight current conductor increases on increasing the strength of current in the conductor or vice versa.
    (ii)The direction of magnetic field around a straight current carrying conductor gets reversed if the direction of current through that conductor is reversed.

Long Answer Type Question:

11. Define magnetic field lines. Describe an activity to draw a magnetic field line outside a bar magnet from one pole to another pole.

Answer: The path traced by a north magnetic pole free to move under the influence of a magnetic field is called a magnetic field line.

The bar magnet M whose magnetic field pattern is to be traced is placed on a sheet of paper and its boundary is marked with a pencil (see Figure 7). A plotting compass is now brought near the N-pole of the bar magnet (see position X in Figure 7). In this position, the N-pole of magnet repels the n-pole of compass needle due to which the tip of the compass needle moves away from the N-pole of

the magnet. On the other hand, the N-pole of magnet attracts the s-pole of compass needle due to which the tail of compass needle comes near the N-pole of the magnet (see position X in Figure 7). We mark the positions of the tip and the tail of compass needle by pencil dots B and A. That is, we mark the positions of the two poles of the compass needle by pencil dots B and A (tip representing north pole and tail representing south pole).

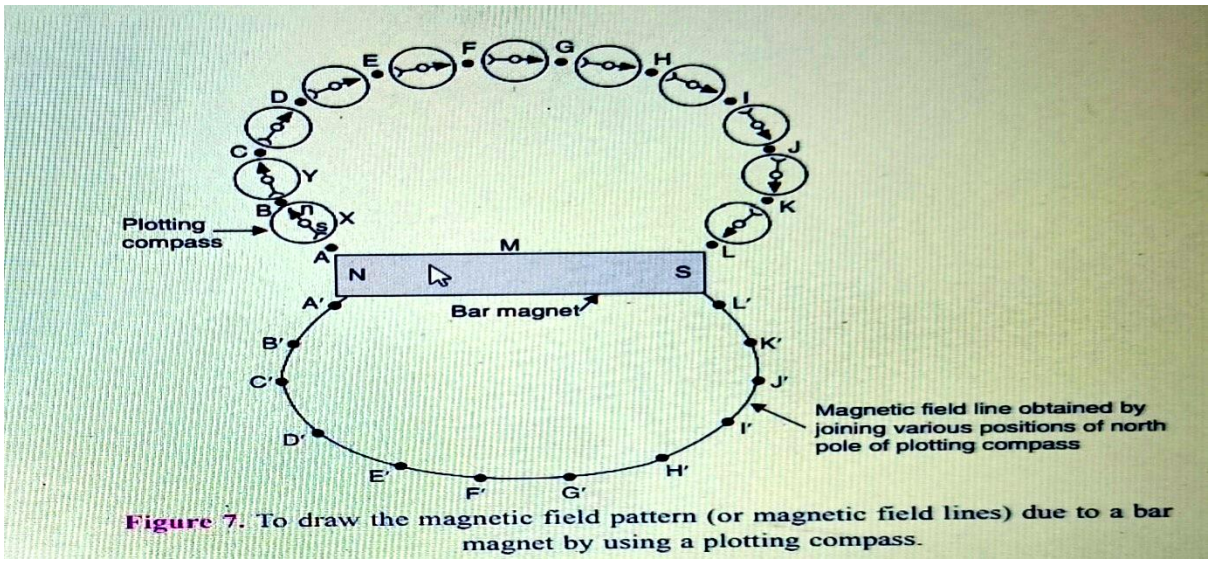


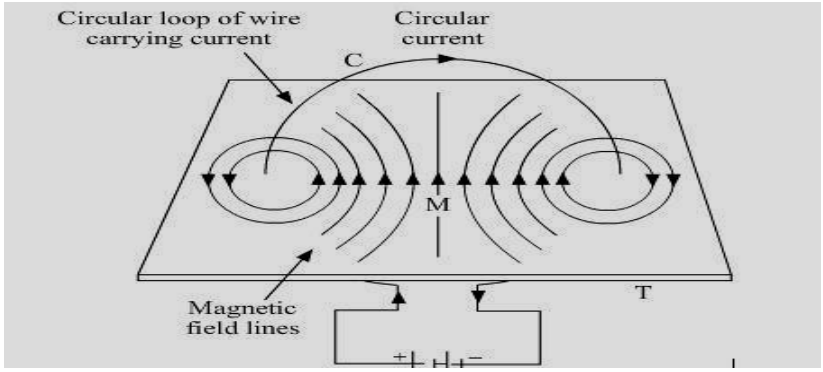
Figure 7. To draw the magnetic field pattern (or magnetic field lines) due to a bar magnet by using a plotting compass.

We now move the compass to position Y so that the tail of compass needle (or south pole) points at dot B (previously occupied by n-pole of compass needle). We mark a dot C at the tip of the compass needle to show the position of its north pole. In this manner we go on step by step till we reach the south pole of the magnet. By doing this we get the various dots A, B, C, D, E, F, G, H, I, J, K and L, all denoting the path in which the north pole of the compass needle moves. By joining the various dots, we get a smooth curve representing a magnetic field line, which begins on the north pole of the bar magnet and ends on its south pole (see Figure 7). We can draw a large number of lines of force in the same way by starting from different points near the magnet. Every line is labelled with an arrow to indicate its direction. In this way we will get the complete pattern of the magnetic field around a bar magnet.

12. (a) Draw the magnetic lines of force due to a circular wire carrying current.

(b) What are the various ways in which the strength of magnetic field produced by a current-carrying circular coil can be increased?

Answer:

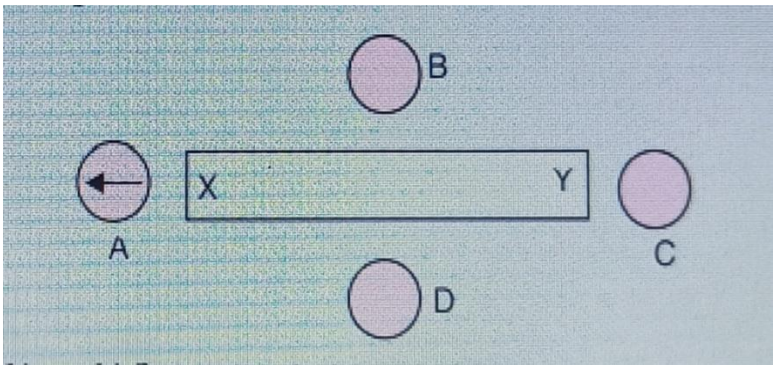


(b) The magnitude of magnetic field produced by a current carrying coil at a given point is:

(i) directly proportional to the current passing through the circular loop (or circular wire), and

(ii) inversely proportional to the radius of circular loop (or circular wire).

13. (a) The diagram shows a bar magnet surrounded by four plotting compasses. Copy the diagram and mark in it the direction of the compass needle for each of the cases B, C and D.

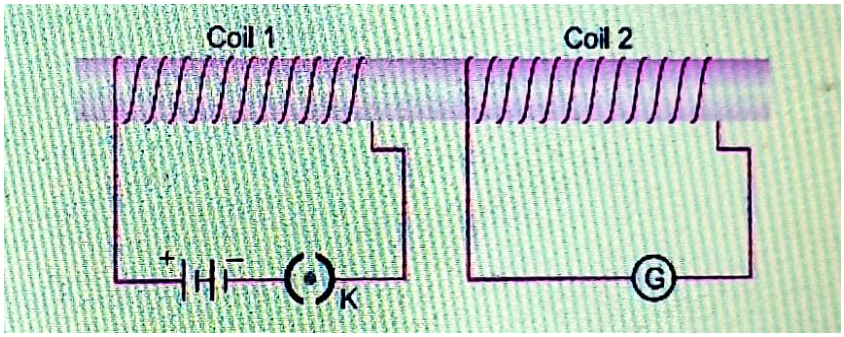


(b) Which is the north pole, X or Y?

Answer: (a) In B and D, needle points towards right. In C, needle points towards left.

(b) North -X

14. Two coils of insulated copper wire are wound over a non-conducting cylinder as shown. Coil 1 has comparative large number of turns. State your observations,



when

(i) Key K is closed.

(ii) Key K is opened.

Give reason for each of your observations.

Answer: (i) When key K is closed, a momentary deflection is shown by the galvanometer.

(ii) When key is opened, a momentary deflection in shown by the galvanometer but in the opposite direction.

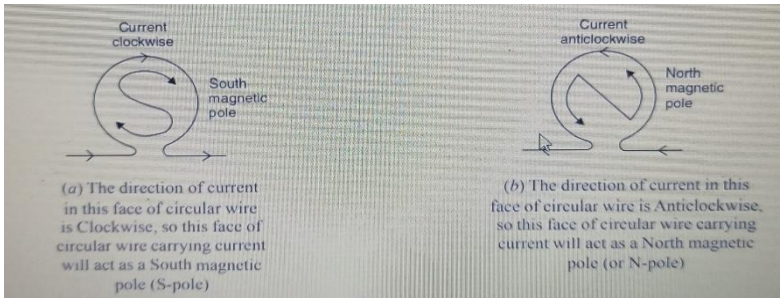
Reason: When key is closed or opened, the current in the coil I changes and hence the magnetic field associated with it also changes. Thus, the magnetic field lines around the coil II also change. Hence the change in magnetic field lines associated with the coil II is the cause of induced electric current in it.

15. State and explain the Clock face rule for determining the polarities of a circular wire carrying current.

Answer: According to Clock face rule, look at one face of a circular wire (or coil) through which a current is passing:

(i) if the current around the face of circular wire (or coil) flows in the Clockwise direction, then that face of the circular wire (or coil) will be South pole (S-pole).

(ii) if the current around the face of circular wire (or coil) flows in the Anticlockwise direction, then that face of circular wire (or coil) will be a North pole (N-pole)



(*a*) The direction of current in this face of circular wire is Clockwise, so this face of circular wire carrying current will act as a South magnetic pole (S-pole)

(*b*) The direction of current in this face of circular wire is Anticlockwise, so this face of circular wire carrying current will act as a North magnetic pole (or N-pole)

16. On what factors does the strength of magnetic field depends for a current carrying solenoid?

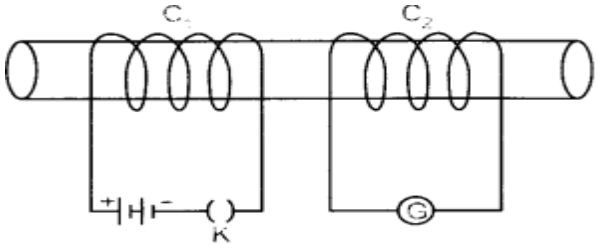
Answer: The strength of magnetic field produced by a current carrying solenoid depends on:

(i) The number of turns in the solenoid. Larger the number of turns in the solenoid, greater will be the magnetism produced.

(ii) The strength of current in the solenoid. Larger the current passed through solenoid, stronger will be the magnetic field produced.

(iii) The nature of "core material" used in making solenoid. The use of soft iron rod as core in a solenoid produces the strongest magnetism.

17. Two coils C_1 and C_2 are wrapped around a non-conducting cylinder. Coil C_1 is connected to a battery and key and C_2 with galvanometer G. On pressing the key (K), current starts flowing in the coil C_1 State your observation in the galvanometer:



(i) When key K is pressed on

(ii) When current in the coil C_1 is switched off.

(iii) When the current is passed continuously through coil C_1

(iv) Name and state the phenomenon responsible for the above observation. Write the name of the rule that is used to determine the direction of current produced in the phenomena.

Answer: (i) When key is pressed on, the galvanometer needle deflects momentarily in one direction.

(ii) When the current in the coil C_1 is switched off, the galvanometer needle deflects again momentarily but in opposite direction to that in the previous case.

(iii) When current is passed continuously through coil C_1 , no deflection is observed in the galvanometer.

(iv) The phenomenon responsible for the above observations is electromagnetic induction.

Electromagnetic Induction: The process, by which a changing magnetic field in a conductor induces a current in another conductor placed nearby, is called electromagnetic induction.

• Fleming's right hand rule is used to determine the direction of current produced in the phenomena of electromagnetic induction.

18. (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 coils P and Q are kept close to each other, of which coil P carries a current. What will you observe in Q

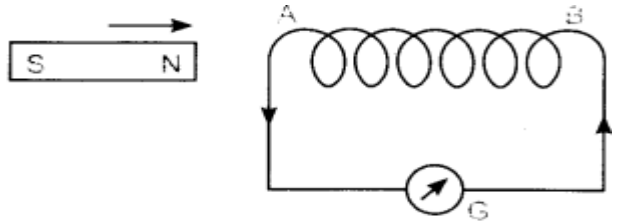
(a) if current in the coil P is changed?

(b) if both the coils are moved in the same direction with the same speed? Give reason.

Answer:

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

Connect the ends of coil to a sensitive galvanometer as shown in figure.



Take a strong bar magnet and move its north pole towards the end 'A' of coil. The deflection in the needle of galvanometer indicates that the induced current flows in the circuit in anticlockwise direction. The end A of the coil behaves as a north pole.

When north pole of the magnet moves away from the coil, the deflection in the galvanometer occurs but in opposite direction.

Similar observations can be made when south pole of the magnet is moved towards the coil or away from it.

When magnet is kept at rest with respect to the coil, th deflection in the needle of galvanometer drops to zero.

Thus, the motion of a magnet, with respect to the coil, produces an induced potential difference which sets up an induced electric current in the circuit.

The direction of electric current thus generated in the coil can be found by using the Fleming's right-hand rule.

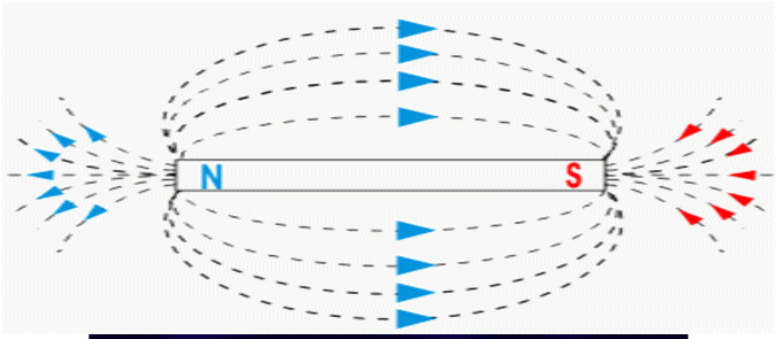
(ii)Fleming's right-hand rule: Stretch the thumb, forefinger and middle finger of right hand in such a way that they are mutually perpendicular to each other. If the forefinger indicates the direction of magnetic field and thumb shows the direction of motion of the conductor, then the middle finger will indicate the direction of induced current.

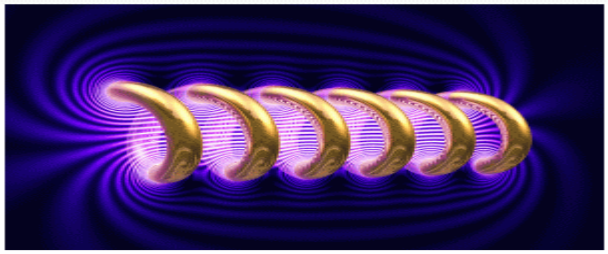
(a) If current in the coil P is changed, the magnetic field lines of forces linked with coil Q also change. So, induced potential difference is set up in the coil Q. This results in induced electric current in coil Q which opposes the change in current in coil P.

(b) If both the coils are moved in the same direction with the same speed, there will be no relative motion between them and hence, there will be no change in magnetic field lines of force associated with the secondary coil. Hence, no current will be induced in the coil.

19. Distinguish between a solenoid and a bar magnet. Draw the magnetic lines for both

Answer:





The solenoid is a long coil containing a large number of close turns of insulated copper wire. The magnetic field produced by the current carrying solenoid is similar to the magnetic field produced by a bar magnet. A solenoid is used for making electromagnets.

Differences between a bar magnet and solenoid:

Bar magnet

It is a permanent magnet.

The strength of a bar magnet cannot be changed.

The polarity (North – South) of a bar magnet cannot be changed.

Solenoid

It is a temporary magnet. It acts as a magnet only as long as the current passes through it.

The strength of a solenoid can be changed by changing the number of turns in its coil or by changing the current passing through it.

The polarity of a solenoid can be changed by changing the direction of current in its coil.

20. Arun while studying the force experienced by a current carrying conductor in a magnetic Field records the following observation

1	The force experienced by the conductor is increases as the current in the conductor is decreased
2	The force experienced by the conductor is decreases as the strength of magnetic field is decreased
3	Direction of the force on the current carrying conductor is determined suing Fleming Left hand rule

Which of these observations is correct? Explain.

Answer:

F=iLB

(a) So as current is decreased, Force also decreases. Observation is Incorrect

(b) Again, Force experience is decreased as strength of magnetic field is decreased. Observation is correct

(c) Observation is correct