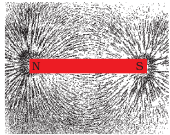


CHAPTER 13

Magnetic Effects of Electric Current



Multiple Choice Questions

- Choose the incorrect statement from the following regarding magnetic lines of field
 - 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
 - Magnetic field lines are closed curves
 - If magnetic field lines are parallel and equidistant, they represent zero field strength
 - Relative strength of magnetic field is shown by the degree of closeness of the field lines
- If the key in the arrangement (Figure 13.1) is taken out (the circuit is made open) and magnetic field lines are drawn over the horizontal plane ABCD, the lines are
 - concentric circles
 - elliptical in shape
 - straight lines parallel to each other
 - concentric circles near the point O but of elliptical shapes as we go away from it

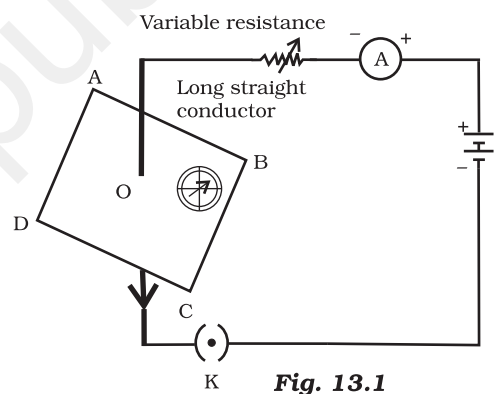


Fig. 13.1

- 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
 - B
 - A if the current is small, and B if the current is large
 - B if the current is small and A if the current is large

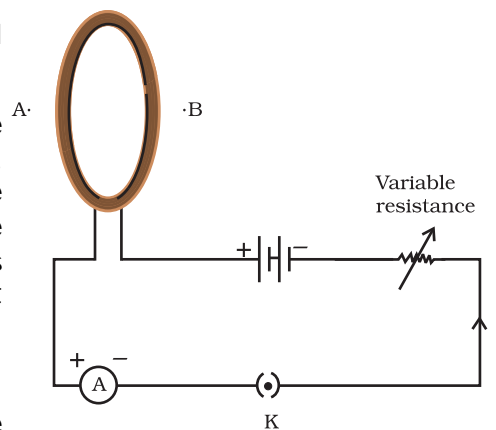


Fig. 13.2

4. For a current in a long straight solenoid N- and S-poles are created at the two ends. Among the following statements, the incorrect statement is
- 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
 - The strong magnetic field produced inside the solenoid can be used to magnetise a piece of magnetic material like soft iron, when placed inside the coil
 - The pattern of the magnetic field associated with the solenoid is different from the pattern of the magnetic field around a bar magnet
 - The N- and S-poles exchange position when the direction of current through the solenoid is reversed

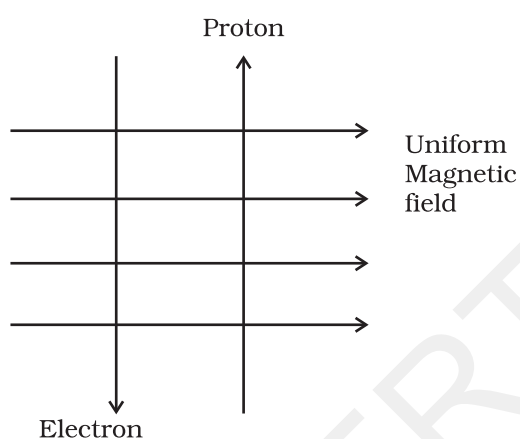


Fig. 13.3

5. A uniform magnetic field exists in the plane of paper pointing from left to right as shown in Figure 13.3. In the field an electron and a proton move as shown. The electron and the proton experience
- forces both pointing into the plane of paper
 - forces both pointing out of the plane of paper
 - forces pointing into the plane of paper and out of the plane of paper, respectively
 - force pointing opposite and along the direction of the uniform magnetic field respectively

6. Commercial electric motors do not use
- an electromagnet to rotate the armature
 - effectively large number of turns of conducting wire in the current carrying coil
 - a permanent magnet to rotate the armature
 - a soft iron core on which the coil is wound

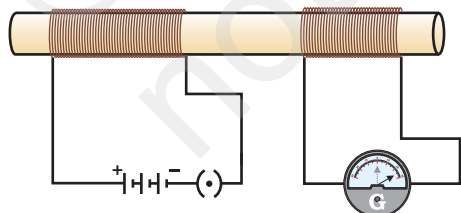


Fig. 13.4

7. In the arrangement shown in Figure 13.4 there are two coils wound on a non-conducting cylindrical rod. Initially the key is not inserted. Then the key is inserted and later removed. Then
- the deflection in the galvanometer remains zero throughout
 - there is a momentary deflection in the galvanometer but it dies out shortly and there is no effect when the key is removed

- (c) there are momentary galvanometer deflections that die out shortly; the deflections are in the same direction
- (d) there are momentary galvanometer deflections that die out shortly; the deflections are in opposite directions
- 8.** Choose the incorrect statement
- (a) Fleming's right-hand rule is a simple rule to know the direction of induced current
- (b) The right-hand thumb rule is used to find the direction of magnetic fields due to current carrying conductors
- (c) The difference between the direct and alternating currents is that the direct current always flows in one direction, whereas the alternating current reverses its direction periodically
- (d) In India, the AC changes direction after every $\frac{1}{50}$ second
- 9.** A constant current flows in a horizontal wire in the plane of the paper from east to west as shown in Figure 13.5. The direction of magnetic field at a point will be North to South
- (a) directly above the wire
- (b) directly below the wire
- (c) at a point located in the plane of the paper, on the north side of the wire
- (d) at a point located in the plane of the paper, on the south side of the wire
- 10.** The strength of magnetic field inside a long current carrying straight solenoid is
- (a) more at the ends than at the centre
- (b) minimum in the middle
- (c) same at all points
- (d) found to increase from one end to the other
- 11.** To convert an AC generator into DC generator
- (a) split-ring type commutator must be used
- (b) slip rings and brushes must be used
- (c) a stronger magnetic field has to be used
- (d) a rectangular wire loop has to be used
- 12.** The most important safety method used for protecting home appliances from short circuiting or overloading is
- (a) earthing
- (b) use of fuse
- (c) use of stabilizers
- (d) use of electric meter

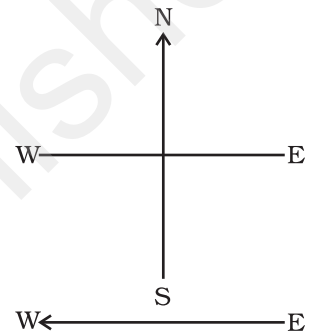


Fig. 13.5

Short Answer Questions

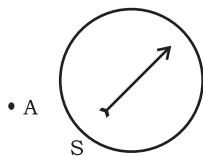


Fig. 13.6

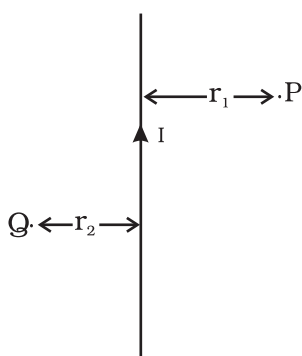


Fig. 13.7

- 13.** A magnetic compass needle is placed in the plane of paper near point A as shown in Figure 13.6. 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 condition is the deflection maximum and why?
- 14.** Under what conditions permanent electromagnet is obtained if a current carrying solenoid is used? Support your answer with the help of a labelled circuit diagram.
- 15.** AB is a current carrying conductor **in** the plane of the paper as shown in Figure 13.7. What are the directions of magnetic fields produced by it at points P and Q? Given $r_1 > r_2$, where will the strength of the magnetic field be larger?
- 16.** A magnetic compass shows a deflection when placed near a current carrying wire. How will the deflection of the compass get affected if the current in the wire is increased? Support your answer with a reason.
- 17.** 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.
- 18.** What does the direction of thumb indicate in the right-hand thumb rule. In what way this rule is different from Fleming's left-hand rule?
- 19.** 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.
- 20.** What does the divergence of magnetic field lines near the ends of a current carrying straight solenoid indicate?
- 21.** Name four appliances wherein an electric motor, a rotating device that converts electrical energy to mechanical energy, is used as an important component. In what respect motors are different from generators?
- 22.** What is the role of the two conducting stationary brushes in a simple electric motor?
- 23.** What is the difference between a direct current and an alternating current? How many times does AC used in India change direction in one second?

- 24.** What is the role of fuse, used in series with any electrical appliance? Why should a fuse with defined rating not be replaced by one with a larger rating?

Long Answer Questions

- 25.** Why does a magnetic compass needle pointing North and South in the absence of a nearby magnet get deflected when a bar magnet or a current carrying loop is brought near it. Describe some salient features of magnetic lines of field concept.
- 26.** With the help of a labelled circuit diagram illustrate the pattern of field lines of the magnetic field around a current carrying straight long conducting wire. How is the right hand thumb rule useful to find direction of magnetic field associated with a current carrying conductor?
- 27.** Explain with the help of a labelled diagram the distribution of magnetic field due to a current through a circular loop. Why is it that if a current carrying coil has n turns the field produced at any point is n times as large as that produced by a single turn?
- 28.** Describe the activity that shows that a current-carrying conductor experiences a force perpendicular to its length and the external magnetic field. How does Fleming's left-hand rule help us to find the direction of the force acting on the current carrying conductor?
- 29.** Draw a labelled circuit diagram of a simple electric motor and explain its working. In what way these simple electric motors are different from commercial motors?
- 30.** Explain the phenomenon of electromagnetic induction. Describe an experiment to show that a current is set up in a closed loop when an external magnetic field passing through the loop increases or decreases.
- 31.** Describe the working of an AC generator with the help of a labelled circuit diagram. What changes must be made in the arrangement to convert it to a DC generator?
- 32.** Draw an appropriate schematic diagram showing common domestic circuits and discuss the importance of fuse. Why is it that a burnt out fuse should be replaced by another fuse of identical rating?