13

Magnetic Effects of Electric Current

In the Chapter

- A compass needle is a small magnet. Its one end, which points out towards north, is known as a north pole, and the other end, which points out towards south, is known as a south pole.
- A magnetic field exists in the region around a magnet, in which the force of the magnet can be detected.
- The pattern of the magnetic field around a conductor due to an electric current flowing through it depends on the shape of the conductor. The magnetic field of a solenoid carrying a current is similar to that of a bar magnet.
- Field lines are used to show a magnetic field. A field line is the path along which a hypothetical free north pole would tend to move. The direction of the magnetic field at a point is given by the direction that a north pole placed at that point would take. Field lines are shown closer together where the magnetic field is greater.
- A metallic wire having an electric current has associated with it a magnetic field. The field lines about the wire consist of a series of concentric circles whose direction is given by the right-hand rule.
- An electromagnet consists of a core of soft iron wrapped around with a coil of insulated copper wire.
- A current-carrying conductor when carried in a magnetic field experiences a force. If the direction of the field and that of the current are mutually perpendicular to each other, then the force acting on the conductor will be perpendicular to both and will be shown by Fleming's left-hand rule. This is the basis of an electric motor. An electric motor is a device which converts electric energy into mechanical energy.
- The phenomenon of electromagnetic induction is the production of induced current in a coil put in a region where the magnetic field changes with time. The magnetic field can change due to a relative motion between the coil and a magnet placed near to the coil. If the coil is placed near to a current-carrying conductor, then the magnetic field may change either due to a change in the current through the conductor

or due to the relative motion between the coil and conductor. The direction of the induced current is given by using the Fleming's right-hand rule.

- A generator changes mechanical energy into electrical energy. It works on the principle of electromagnetic induction.
- In our houses we receive AC electric power of 220 V with a frequency of 50 Hz. One of the wires in this supply is with red insulation, known as live wire. The other one is of black insulation, which is a neutral wire. The potential difference between the two is 220 V. The third is the earth wire which has green insulation and this is attached to a metallic body deep inside earth. It is used as a safety measure to make sure that any leakage of current to a metallic body does not give any severe shock to a user.
- Fuse is the most important safety device, used for preventing the circuits due to short-circuiting or overloading of the circuits.

Intext Exercises

Page No. 224

1. Why does a compass needle get deflected when brought near a bar magnet?

Ans. Compass needle is a tiny magnet, therefore, due to force of repulsion or attraction between the poles of a magnet, there is deflection in the compass needle.

Page No. 228

1. Draw magnetic field lines around a bar magnet.

Ans.

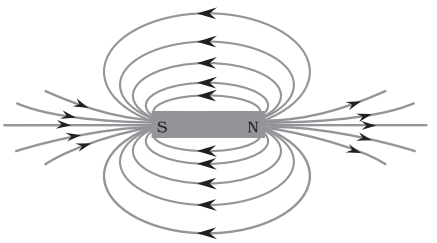


Fig. Field lines around a bar magnet.

2. List the properties of magnetic lines of force.

Ans. The magnetic field lines have the following properties :

(a) These imaginary lines originate from the north pole and terminate at the south pole.

(b) The direction of tangent at a point on a magnetic field line indicates the direction of magnetic field at that point.

(c) These lines are parallel to each other and do not interact.

3. Why don't two magnetic lines of force intersect each other?

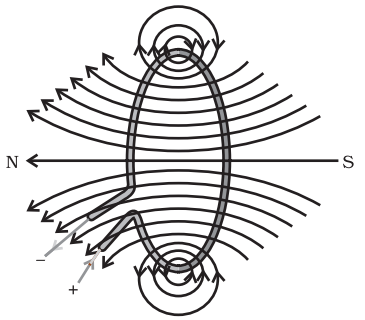
Ans. Two magnetic lines of force cannot interest because we cannot have two directions of the magnetic field at the same point.

Page no. 229-230

1. Consider a circular loop of wire lying in the plane of the table. Let the current

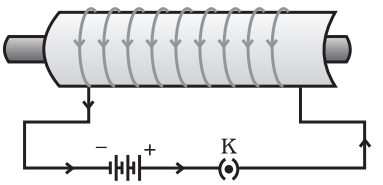
pass through the loop clockwise. Apply the right-hand rule to find out the direction of the magnetic field inside and outside the loop.

Ans.



2. The magnetic field in a given region is uniform. Draw a diagram to represent it.

Ans.



Magnetic field lines are parallel straight line inside the solenoid. Therefore, the magnetic field is uniform inside the solenoid.

3. Choose the correct option.

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.

Ans. (d) is the same at all points.

Page No. 231-232

1. Which of the following property of a proton can change while it moves freely in a magnetic field? (There may be more than one correct answer.)

(a) mass **(b) speed**

(c) velocity **(d) momentum**

Ans. (c) velocity (d) momentum

2. In Activity 13.7, how do we think the displacement of rod AB will be affected if (i) current in rod AB is increased; (ii) a stronger horse-shoe magnet is used; and (iii) length of the rod AB is increased?

Ans. We know that when a current carrying conductor is placed in a magnetic field, the force acting on it is given by the expression : $F = B.I.L.$

So, (i) $F \propto I$.

As the value of current will increase in conductor, the value of force acting on it is increased. So there will be more displacement.

(ii) $F \propto B$.

As the value of B will increase, there will be more displacement in the rod AB.

(iii) $F \propto L$.

More the length of the rod AB, more will be the displacement in the rod.

3. A positively-charged particle (alpha-particle) projected towards west is deflected towards north by a magnetic field. The direction of magnetic field is
(a) towards south
(b) towards east
(c) downward (d) upward

Ans. (d) upward

Page No. 233

1. State Fleming's left-hand rule.

Ans. According to this rule, "Stretch the thumb, forefinger and middle finger of your left hand in such a way that they are mutually perpendicular. If the first finger points in the direction of the magnetic field and the second finger in the direction of current, then the thumb will indicate the direction of motion or the force acting on the conductor".

2. What is the principle of an electric motor?

Ans. "An electric motor is a rotating device which converts electrical energy into mechanical energy." It is the principle of an electric motor.

3. What is the role of the split ring in an electric motor?

Ans. In an electric motor, the split ring works as a commutator. The reversal of current also reverses the direction of force acting on the arms of the coil. At this stage, the commutator reverses the direction of current and ensures the flow of current in the same direction. Therefore, the motor continues to rotate the coil.

Page No. 236

1. Explain different ways to induce current in a coil.

Ans. Following are the different ways to induce current in a coil : (a) Either coil or a magnet should be in motion relative to each other, then there will be an induced current in the coil. (b) If there is relative motion between a current carrying coil and a coil without current, then there will be an induced current in the second coil.

Page No. 237

1. State the principle of an electric generator.

Ans. An electric generator is based on the principle of electromagnetic induction. In an electric generator, mechanical energy is used to rotate a conductor in a magnetic field to generate electricity.

2. Name some sources of direct current.

Ans. Some sources of direction current are
(a) Electrochemical cells.
(b) D.C. generator
(c) Lead accumulator (storage battery)

3. Choose the correct option.
A rectangular coil of copper wires is rotated in a magnetic field. The direction of the induced current changes once in each
(a) two revolutions
(b) one revolution
(c) half revolution
(d) one-fourth revolution

Ans. (c) half revolution

Page No. 238

1. Name two safety measures commonly used in electric circuits and appliances.

Ans. Two safety measures used commonly are : (a) electric fuse, (b) use of earth wire.

2. An electric oven of 2 kW power rating is operated in a domestic electric circuit (220 V) that has a current rating of 5 A. What result do you expect? Explain.

Ans. We know,

$$P = \frac{V^2}{R}$$

$$2 \times 10^3 = \frac{220 \times 220}{R}$$

$$R = \frac{220 \times 220}{2 \times 10^3}$$

$$I = \frac{V}{R}$$

$$I = \frac{220 \times 2 \times 10^3}{220 \times 220}$$

$$I = \frac{2000}{220} = \frac{100}{11}$$

$$I = 9.09 \text{ Ampere}$$

At this stage due to very high value of electric current, the oven will not function and would be damaged.

3. What precaution should be taken to avoid the overloading of domestic electric circuits?

Ans. We can avoid overloading by not connecting to many appliances to a single socket.

Exercise

1. Which of the following correctly describes the magnetic field near a long straight wire?
(a) The field consists of straight lines perpendicular to the wire.
(b) The field consists of straight lines parallel to the wire.
(c) The field consists of radial lines originating from the wire.
(d) The field consists of concentric circles centred on the wire.

Ans. (d) The field consists of concentric circles centred on the wire.

2. The phenomenon of electromagnetic induction is
(a) the process of charging a body.
(b) the process of generating magnetic field due to a current passing through a coil.
(c) producing induced current in a coil due to relative motion between a magnet and the coil.

(d) the process of rotating a coil of an electric motor.

Ans. (c) producing induced current in a coil due to relative motion between a magnet and the coil.

3. The device used for producing electric current is called a

(a) generator **(b) galvanometer**

(c) ammeter **(d) motor**

Ans. (a) generator

4. The essential difference between an AC generator and a DC generator is that

(a) AC generator has an electromagnet while a DC generator has permanent magnet.

(b) DC generator will generate a higher voltage.

(c) AC generator will generate a higher voltage.

(d) AC generator has slip rings while the DC generator has a commutator.

Ans. (d) AC generator has slip rings while the DC generator has a commutator.

5. At the time of short circuit, the current in the circuit

(a) reduces substantially.

(b) does not change.

(c) increases heavily.

(d) vary continuously.

Ans. (c) increases heavily.

6. State whether the following statements are true or false.

(a) An electric motor converts mechanical energy into electrical energy.

(b) An electric generator works on the principle of electromagnetic induction.

(c) The field at the centre of a long circular coil carrying current will be parallel straight lines.

(d) A wire with a green insulation is usually the live wire of an electric supply.

Ans. (a) False, (b) True, (c) True, (d) False.

7. List three methods of producing magnetic fields.

Ans. The three methods of producing magnetic field are :

(i) A current carrying straight or circular conductor has magnetic field around it.

(ii) A natural magnet has magnetic field around it.

(iii) A current carrying solenoid has magnetic field around it.

8. How does a solenoid behave like a magnet? Can you determine the north and south poles of a current–carrying solenoid with the help of a bar magnet? Explain.

Ans. A coil of many circular turns of insulated copper wire wrapped closely in the shape of a cylinder is known as a solenoid. One end of the solenoid behaves like the magnetic north pole, while the other end behaves as the south pole. The field lines inside the solenoid are in the form of parallel lines. This suggests that the magnetic field is the same at all points inside the solenoid. So, the field is uniform inside the solenoid.

Yes, we can determine the north and south poles of solenoid by using a magnetic needle which is a magnet. On bringing the magnetic needle towards one end of the solenoid, if the north pole of the magnetic needle is attached, the end under consideration is the south pole and vice-versa.

9. When is the force experienced by a current–carrying conductor placed in a magnetic field largest?

Ans. We know that the force experienced by a current carrying conductor in a magnetic field is expressed as

$F = BIL \sin \theta$

B = magnetic field.
I = strength of current in the conductor
L = length of conductor.
F = force
θ = angles between direction of magnetic field and current carrying conductor.
Therefore, the force is maximum if θ = 90° as sin 90° = 1 is the maximum value of sin q.

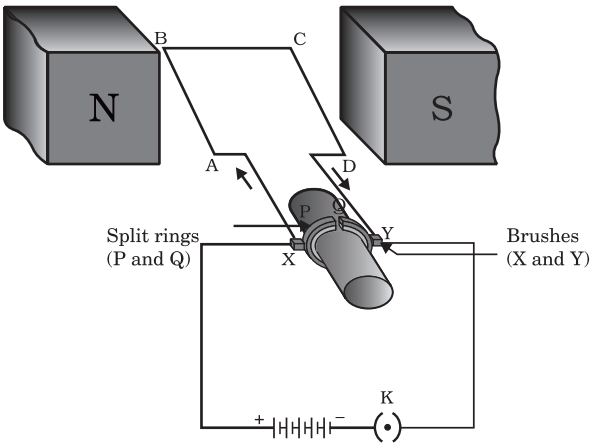
10. Imagine that you are sitting in a chamber with your back to one wall. An electron beam, moving horizontally from back wall towards the front wall, is deflected by a strong magnetic field to your right side. What is the direction of magnetic field?

Ans. The magnetic field will be perpendicular to the plane containing the beam of electrons and the force acting on it.

11. Draw a labelled diagram of an electric motor. Explain its principle and working. What is the function of a split ring in an electric motor?

Ans. **(i) Principle :** When a current carrying conductor is kept in a magnetic field, then it experiences a force in the direction given by Fleming's left hand rule.

Working : In an electric motor, a coil of wire having many turns in wrapped around a cylindrical axle. This rectangular coil is put between the pole pieces of a magnet as shown in fig.



A simple electric motor

When a current passes though the coil, entering at point X and leaving t point Y, the two arms AB and CD, which are perpendicular to the direction of the magnetic field, experience a force according to Fleming's left hand rule. Since the direction of the current in the two arms is opposite to each other, the forces acting on them will also be opposite to each other. These forces push open arm (CD) up and the other arm (AB) down. As the coil is free to rotate about an axis, it will complete half rotation in anti-clockwise direction.

The split rings C_1 and C_2 also rotate with the coil. After half rotation, C_1 comes in contact of brush B_2 and C_2 comes in contact of brush B_1, hence the direction of current in the coil is reversed. The current of the coil is now from D to C and then from B to A. According to Fleming's left hand rule, CD will move down and AB will move up. The coil, therefore, rotates half a turn more where the current in the coil is again reversed. In this way, a reversing process is repeated at each half turn giving rise to a continous rotation.

(ii) The function of the commutator is to alter the direction of current in the coil after every half a rotation.

12. Name some devices in which electric motors are used.

Ans. The name of devices are : (a) cooler, (b) radiator of heavy vehicles, (b) A.C., (c) fan, (e) motor cycle, etc.

13. A coil of insulated copper wire is connected to a galvanometer. What will happen if a bar magnet is (i) pushed into the coil, (ii) withdrawn from inside the coil, (iii) held stationary inside the coil?

Ans. In this case, current will be induced in the coil which will be indicated by deflection in the needle of the galvanometer. For given cases, the explanation is given below :

(i) When a bar magnet with its north pole facing the coil is moved towards the coil, the galvanometer shows a deflection. Deflection in the galvanometer is also observed when the bar magnet, with its south pole facing the coil, moves towards the coil.

(ii) When the bar magnet is moved away from the coil, galvanometer again shows deflection but now in the opposite direction.

(iii) When the bar magnet is stationary near the coil, no deflection in the galvanometer is observed.

14. Two circular coils A and B are placed closed to each other. If the current in the coil A is changed, will some current be induced in the coil B? Give reason.

Ans. Yes, we know that larger the current, stronger will be the magnetic field, i.e., number of magnetic field lines passing through a given area is more. As there is change in current in coil A, there is a decrease in the number of magnetic field lines passing through coil B and hence due to change in the number of magnetic field lines there is an induced current in coil B.

15. State the rule to determine the direction of a
(i) magnetic field produced around a straight conductor-carrying current,
(ii) force experienced by a current-carrying straight conductor placed in a magnetic field which is perpendicular to it, and
(iii) current induced in a coil due to its rotation in a magnetic field.

Ans. Following rules are taken under consideration for given cases :

Case I : Direction of magnetic field at a point near current carrying conductor is given by the right hand thumb rule.

If a current carrying conductor is to be held in the right hand such that the thumb points in the direction of the current, then the curbed fingers of the hand indicate the direction of magnetic field.

Case II : The direction of force on current carrying conductor is given by Fleming's left hand rule, which is stated as below :

"Stretch the left hand such that the thumb, first finger and the central finger are mutually perpendicular to each other. If the first finger points in the direction of magnetic field and central finger points in the direction of current, then the thumb will point in the direction of motion (or force)."

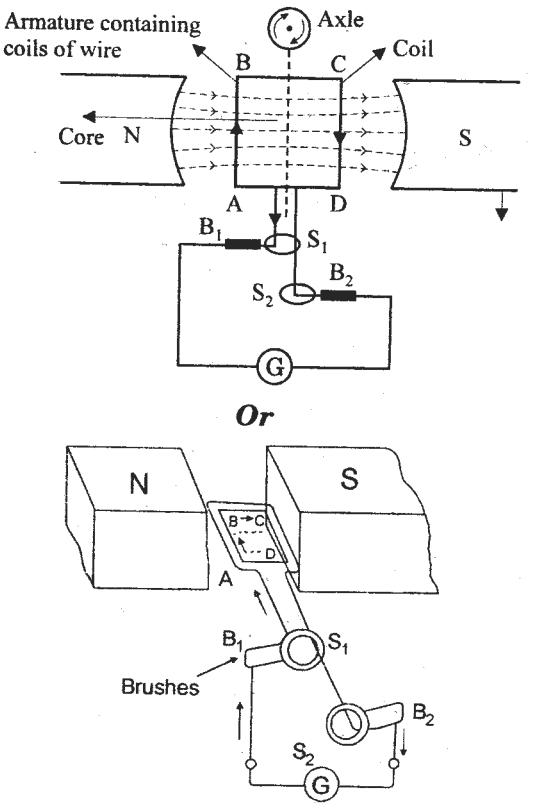
Case III : The direction of induced current in a coil is given by Fleming's right hand rule, which is stated as below :

"Stretch the right hand such that the first finger, the central finger and the thumb are mutually perpendicular to each other. If the first finger points along the direction of the field and the thumb indicates the direction of motion of the conductor, then the direction of induced current is given by the direction of the central finger."

16. Explain the underlying principle and working of an electric generator by drawing a labelled diagram. What is the function of brushes?

Ans. Principle of electric generator : Electric generator is based on the phenomenon of

electromagnetic induction, i.e., a changing magnetic field in a conductor induces an electric current in the conductor. Direction of the induced current is given by Fleming's right hand rule. In an electric generator, the magnetic field in the conductor is changed by moving the conductor in the magnetic field of the magnet.



Construction : It consists of a rotating armature ABCD containing coils of wire, pole pieces, brushes and a commutato. The two ends of the armature ABCD are connected to two metallic rings S_1 and S_2. The two brushes B_1 and B_2 which are connected to a galvanometer G, are in contact with the rings S_1 and S_2 respectively.

Working: In an electric generator, mechanical work is done to turn the armature. As the coil rotates in the magnetic field, the two rings also rotate with the coil but the same brushes keep contact with the rotating rings.

During the rotation of coil, its arm AB moves up and arm CD moves down cutting the magnetic lines of force, so induced current generates in the arms AB and CD in the direction A to B and C to D according to Fleming's right hand rule. Hence we get current flowing in the direction ABCD. As there are a number of turns in the coil, the current generated in each turn adds up to give a large current through the coil. This current will flow in the external circuit in the direction.

After half a rotation, now CD starts moving up and AB moves down. As a result the direction of induced current in both the arms AB and CD changes. This gives rise to induced current in the direction DCBA and the current in the external circuit in the direction DCBA and the current in the external circuit will flow in the opposite direction.

Thus, after every half a rotation, the polarity of the current in the arms AB and CD changes. Such a current which changes direction after equal intervals of time is called an alternating current. Since this electric generator is producing alternating current, it is also called A.C. generator.

Function of the brushes : The carbon brushes are fixed while slip rings rotate along with the armature. These brushes are connected to the load through which the output is obtained.

17. When does an electric short circuit occur?

Ans. When the live and neutral wires come in direct contact with each other, a very large current passes through the circuit. Then it is said that "short circuit" has occurred.

18. What is the function of an earth wire? Why is it necessary to earth metallic appliances?

Ans. Connecting the metal case of an electric appliance to the earth by means of a metal wire is called earthing. It is used as a safety measure specially for those appliances which have a metallic body. The metallic body is earthened which provides a low resistance conducing path for the current. Thus, if there is any leakage of the current, the user doesn't get any severe shock.

Additional Questions

1. What are magnetic lines of force?

Ans. Magnetic lines of force are lines straight or curved along which a unit north pole moves if free to do so.

2. Name an instrument used to determine the direction.

Ans. It is magnetic compass needle.

3. What is SI unit of magnetic flux ?

Ans. Webber.

4. What is an electric motor?

Ans. It is a device used to convert electric energy into mechanical energy.

5. Name an instrument working upon magnetic effect of electric current.

Ans. Electromagnet.

6. Name a device which converts mechanical energy to electric energy.

Ans. An alternator, dynamo or electric generator.

7. Upon what principle an electric generator works ?

Ans. Flemings right hand rule.

8. Upon what principle electric motor works ?

Ans. Fleming's left hand rule.

9. What is a solenoid ?

Ans. Solenoid is a long cylindrical coil having a large number of insulated copper wire.

10. What is the function of electric fuse ?

Ans. It is a safety device used to save the building from fire due to overloading or short circuit.

11. What is material used in making fuse wire ?

Ans. It is made from an alloy of a lead and tin.

12. What should be property of fuse wire ?

Ans. Its melting point should be low.

13. What type of magnetic lines of force constitute uniform field ?

Ans. Parellel and equidistant lines.

14. What alloy is used for making permanent magnets?

Ans. Alnico which is an alloy of aluminium, nickel, cobalt and iron.

15. What is colour code for different wires used in household ?

Ans. Live wire is red, neutral is black and earth wire is green.

16. What is phenomenon of electromagnetic induction ?

Ans. Phenomenon of setting up of an electric current by changing the magnetic lines of force by moving a magnet or current in the neighbouring circuit is called electromagnetic induction.

17. How magnitude of induced current be increased ?

Ans. Magnitude of induced current can be increased by :

(i) increasing the strength of the magnetic field being used.

(ii) increasing the speed of movement of conductor in the magnetic field.

18. What are hazards of electricity ?

Ans. There are number of hazards.

1. If a person touches a live wire, he gets a very severe shock. This may prove fatal.
2. Loose connections, defective switches and sockets can cause sparking which may lead to fire.
3. Short-circuit due to damaged wires or overloading of circuits can cause fires.

19. What are essential precautions to be used while using electricity ?

Ans. Precautions to be followed for using electricity are :

1. Switch off all switches including main switch whenever there is a sparking or fire.
2. All connections must be tight. Wires must be covered with proper insulation of proper thickness. All joints must be covered with insulating tape of a good quality. Defective switches should be immediately replaced.
3. Fuses should be always connected to live wire. The earth wire must be connected to the body of electric appliance.
4. Fuse must be of proper rating and should always be connected to live wire.
5. Whenever repairs are needed, switch off main switch.
6. If inspite of all the precautions, a person gets a shock due to accidental touching a live wire, one should try to provide such a person with support of some non-conducting material like wood, plastic or rubber. Never try to pull away person by your hand.
7. Always put dry rubber shoes while repairing the circuit.

20. Distinguish between terms 'overloading' and 'short circuiting' as used in domestic circuits.

Ans. Short Circuiting. If sometimes a live wire touches neutral wire or earth wire, a large current flows through the circuit due to almost zero resistance of the circuit. This is called short-circuiting.

Over-Loading. The supply wires as well the wires used in household wiring has a specific rating. The rating of 15 A means that if a current upto 15 A is passed though circuit, there is no likely damaged feared to the circuit. But if a current more than maximum allowed limit is passed, there may be excessive heating of the wires and it may damage the wiring due to excessive heating.

To save the circuit from damage feared due to over-loading or short-circuiting, a fuse of proper rating is put in each circuit.

21. Describe the action of a safety fuse.

Ans. When incidentally there is a short-circuiting or over-loading, the current exceeds this maximum permissible value. The wires may get over-heated and catch a fire. Sparking at the points of short-circuit may also cause fire.

The most important safety device used these days is safety fuse or fuse. Fuse is a piece of wire of a material with a low melting point. Good fuse wire is always made of pure. tin.

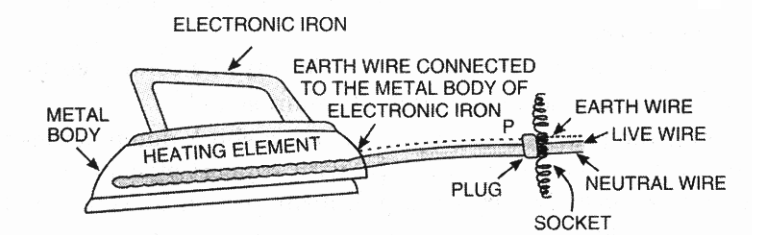
Fuse is always connected to the live wire. When current of value more than maximum permissible is passed through the circuit, the fuse wire melts due to excessive heating. This way the circuit is broken to ensure safety of the circuit. The thickness; length and material of the fuse wire depends upon the maximum current permitted through the circuit. For proper protection, a fuse of proper value is must.

22. What are bifurcated circuits?

Ans. A large number of pairs of wires start from the main switch and are taken to different rooms. Each distribution circuit is provided with a separate fuse so that if a fault occurs in one circuit, only the corresponding fuse blows off but the other circuit remains unaffected. All the distribution circuits are put in parallel. In house, we can have a large number of circuits.

23. What is the necessity of earthing an electric appliance?

Ans. In order to work an electric apparatus, we require two wires, one live wire and the other neutral. Due to wear and tear or due to excessive heating, sometimes live wire touches the body of the apparatus. Due to this one may get shock when we incidently touch the apparatus. To avoid the risk of electric shock, the metal body of the electric appliance is earthed i.e., a wire is connected to the cover of vessel on one side and to the earth point in three pin plug. The one end of the earth point is buried deep in the earth. Earth wire is usually given green or green yellow colour, the live wire is usually red or brown while black or light blue wire acts as a neutral wire.



24. What is the pattern of magnetic field pattern due to current carrying conductor?

Ans. Take a straight conducting wire AB which passes through a horizontal cardboard. The ends of the wire are connected to a battery as shown in Fig. (a). When the key is closed, the current flows through the wire from B to A as shown in Fig. (a), it produces magnetic field around it. The magnetic lines of force can be drawn with the help of a compass needle. The magnetic lines of force can also be visualised by sprinkling iron filings on the cardboard. On tapping the cardboard sheet, the iron filings arrange themselves in circles around the wire. The direction of the field is indicated by compass needle [Fig. (a)] The direction of

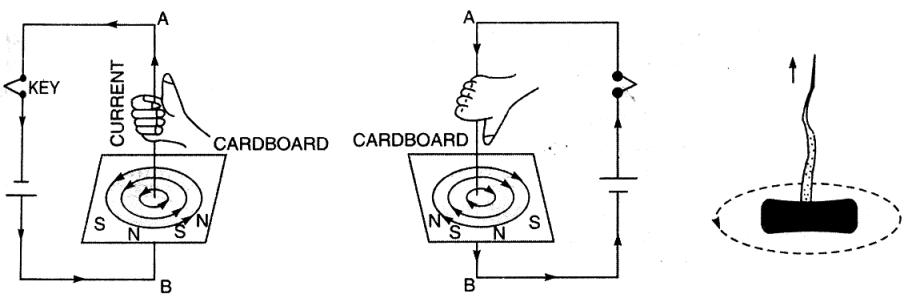


Fig. 7.20. (a) Right hand thumb rule (b) Right hand thumb rule (c) Right cork screw rule

magnetic field is given by right hand grip rule and by right hand cork screw rule.

Right hand grip rule is stated below: Grasp the wire in the right hand so that the thumb points along the wire in the direction of current, the fingers will then point in the direction of magnetic field [Fig. (a) and (b)].

Right Hand Cork-Screw Rule. Imagine a right handed cork-screw to be lying with its direction coinciding with the conductor carrying current and to be revolved so that it travels in the direction in which thumb rotates gives the direction of lines of force (Fig. (c).

25. 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.

Ans. (i) Since alpha particle is charged and hence its motion constitutes a current and magnetic field is produced around it when it is in motion.

(ii) Since neutron does not carry any charge and hence its motion does not constitute a current. Hence no magnetic field is produced around neutron in motion.

26. 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 ?

Ans. According to right hand thumb rule, the direction of thumb indicates the direction of current in the straight conductor held by curled fingers. However the Fleming's left hand rule gives the direction of force experienced by the current carrying conductor placed in the external magnetic field.

27. 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?

Ans. Closeness of lines indicates strong field and diverging lines indicates weak field. Strength of magnetic field falls as the distance increases.

28. What does the divergence of magnetic field lines near the ends of a current carrying straight solenoid indicate ?

Ans. Divergence of magnetic field lines near the end of the current carrying conductor indicate weak field i.e., decrease of straight of the field.

29. 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 ?

Ans. Electric fan, mixture grinder, tape recorder, washing machines, computer drives using electric motor.

Electric motor convert electric energy to mechanical energy whereas electric generator convert mechanical energy to electric energy.

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

Ans. Brushes touch the outer side of two halves of the split ring and connect this to the battery. It maintains contact of rings with the battery.

31. 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?

Ans. Direct current is a single directional current but alternating current reverses its direction after a fixed time.

Frequency of A.C. used in India is 50 Hz. In each cycle, current alternates direction twice. Direction of A.C charges 2 x 50 = 100 times in one second i.e., direction of current gets reversed every 1/100 th of a second.

32. What is the role of fuse used in series with any electric appliance? Why should a fuse of defined rating not be replaced by one with a larger rating?

Ans. Fuse is a safety device for protecting an eletric appliance from getting burnt down by overloading or short circuiting.
Fuses are rated for a specific maximum current. The fuse melts away and circuit is broken when a current more than specific rated value flow through the circuit.
If fuse is replaced by one with a larger rating, the appliance will get damaged/burnt out while the furs will not burn off. It is a dangerous practice to do so. Never use fuse of improper rating.

Multiple Choice Questions

1. Which one of the following is based upon electromagnetic induction ?
(a) Galvanometer (b) Transformer
(c) X-ray (d) Voltmeter.
Ans. (b) Transformer

2. A charge is stationary at a place, its magnetic field will :
(a) be parallel to charge (b) perpendicular to charge
(c) be absent since no magnetic field is produced around stationary charges
(d) both parallel and perpendicular
Ans. (c) be absent since no magnetic field is produced around stationary charges

3. When soft iron bar is introduced inside a current carrying solenoid, the magnetic field inside the solenoid will :
(a) increase (b) decrease
(c) be zero (d) remain unaffected
Ans. (a) increase

4. An electric motor transfers :
(a) electric energy into mechanical energy.
(b) mechanical energy to electric energy.
(c) chemical energy to electric energy.
(d) electric energy to sound energy.
Ans. (a) electric energy into mechanical energy.

5. Material of the core of strong electromagnet is :
(a) soft iron (b) steel
(c) copper (d) laminated steel strips.
Ans. (d) laminated steel strips.

6. When electric current flows in a wire, it produces :
(a) an electric field (b) magnetic field
(c) neither electric nor magnetic field
(d) both electric and magnetic field.
Ans. (d) both electric and magnetic field.

7. Magnetic lines of force inside current carrying solenoid are :
(a) parallel inside the solenoid and circular at the ends.
(b) circular but intersect each other
(c) along the axis and are parallel to each other.
(d) perpendicular to axis and equidistant from each other.
Ans. (c) along the axis and are parallel to each other.

8. The direction of induced current is given by :
(a) Ampere's swimming rule.

(b) Fleming's left hand rule.
(c) Fleming's right hand rule.
(d) Maxwell's cork screw rule.

Ans. (c) Fleming's right hand rule.

9. Choose the incorrect statement from the following regarding magnetic lines of field :

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

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

10. The strength of magnetic field inside a long current carrying straight solenoid is :

(a) more at the ends than at the centre.
(b) found to increase from one end to the other.
(c) same at all points.
(d) minimum in the middle.

Ans. (c) same at all points.

11. The most important safety method used for protecting home appliances from short circuiting or overloading is :

(a) use of electric meter
(b) use of stablizers
(c) use of fuse
(d) earthing

Ans. (c) use of fuse

12. The convert an AC generator into DC generator :

(a) a rectangular wire look has to be used.
(b) a stronger magnetic field has to be used.
(c) split-ring type commutator must be used.
(d) slip rings and brushes must be used.

Ans. (c) split-ring type commutator must be used.