

Chapter 13: Magnetic Effects of Electric Current

1. State any two properties of magnetic field lines.

Solution:

Properties of magnetic field lines:

- (i) The magnetic field lines originate from the north pole of a magnet and end at its south pole.
- (ii) The strength of magnetic field is indicated by the degree of closeness of the field lines. Where the field lines are closest together, the magnetic field is the strongest there.

2. What are the two ways in which you can trace the magnetic field pattern of a bar magnet?

Solution:

- (i) By using iron filings
- (ii) By using compass

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

Solution:

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

4. State whether the following statement is true or false:

The axis of earth's imaginary magnet and the geographical axis coincide with each other.

Solution:

False

The axis of earth's imaginary magnet is inclined at an angle of 15° with the geographical axis.

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

Solution:

A compass needle gets deflected when brought near a bar magnet because the bar magnet exerts a magnetic force on the compass needle, which is itself a tiny pivoted magnet.

6. Where do the manufacturers use a magnetic strip in the refrigerator? Why is this magnetic strip used?

Solution:

Manufacturers use a magnetic strip in the refrigerator's door to keep it closed properly.

7. Fill in the following blanks with suitable words:

(a) Magnetic field lines leave the..... pole of a bar magnet and enter at its.....

(b) The earth's magnetic field is rather like that of a..... magnet with its..... pole in the northern hemisphere.

Solution:

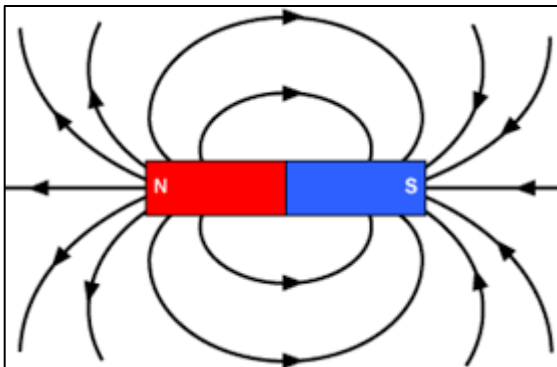
(a) north; south.

(b) bar; south.

8. Draw a diagram to show the magnetic field lines around a bar magnet.

Solution:

Magnetic field lines around a bar magnet.



9. **What is a magnetic field? How can the direction of magnetic field lines at a place be determined?**

Solution:

The space surrounding a magnet in which magnetic force is exerted, is called a magnetic field. The direction of magnetic field lines at a place can be determined by using a compass needle. A compass needle placed near a magnet gets deflected due to the magnetic force exerted by the magnet. The north end of the needle of the compass indicates the direction of magnetic field at the point where it is placed.

10. **Explain why, two magnetic field lines do not intersect each other.**

Solution:

Two magnetic field lines do not intersect each other due to the fact that the resultant force on a north pole at any point can be only in one direction. But if the two magnetic lines get intersect one another, this means that resultant force on a north pole placed at the point of interaction will be along two directions, which is not possible.

11. **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?**

Solution:

Because the strength of magnetic field produced by the cable is quite weak.

12. **(a) Define magnetic field lines. Describe an activity to draw a magnetic field line outside a bar magnet from one pole to another pole.**

(b) Explain why, a freely suspended magnet always points in the north-south direction.

Solution:

(a) The magnetic field lines are the lines drawn in a magnetic field along which a north magnetic pole would move. The magnetic field lines are also known as magnetic lines of forces.

Activity to draw a magnetic field line outside a bar magnet from one pole to another pole:

Take a small compass and a bar magnet.

Place the magnet on a sheet of white paper fixed on a drawing board, using some adhesive material.

Mark the boundary of the magnet.

Place the compass near the north pole of the magnet. The south pole of the needle points towards the north pole of the magnet. The north pole of the compass is directed away from the north pole of the magnet.

Mark the position of two ends of the needle.

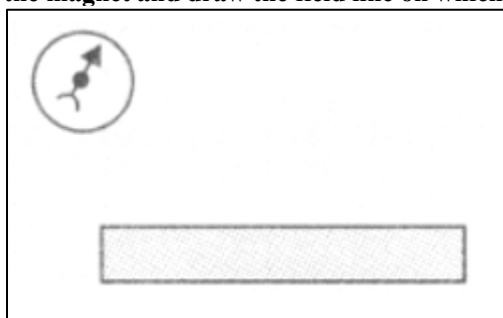
Now move the needle to a new position such that its south pole occupies the position previously occupied by its north pole.

In this way, proceed step by step till you reach the south pole of the magnet.

Join the points marked on the paper by a smooth curve. This curve represents a magnetic field line.

(b) A freely suspended magnet points in the north-south direction because earth behaves as a magnet with its south pole in the geographical north and the north pole in the geographical south.

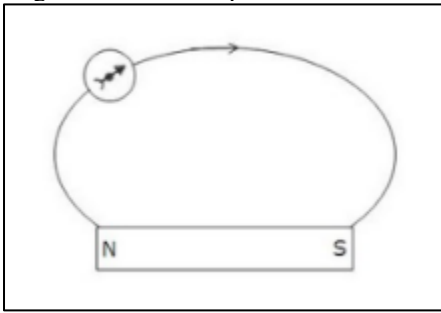
13. **Copy the figure given below which shows a plotting compass and a magnet. Label the N pole of the magnet and draw the field line on which the compass lies.**



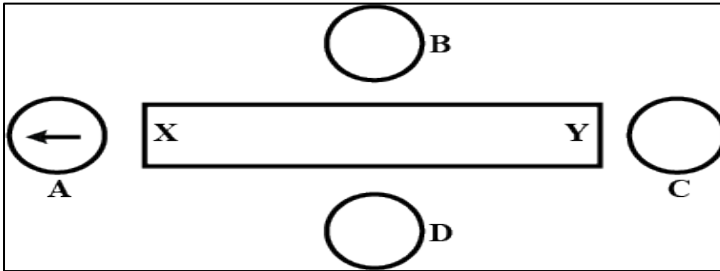
Solution :

As the north pole of the magnetic needle is pointing in the opposite direction, so the nearer end of the

magnet will be north pole.



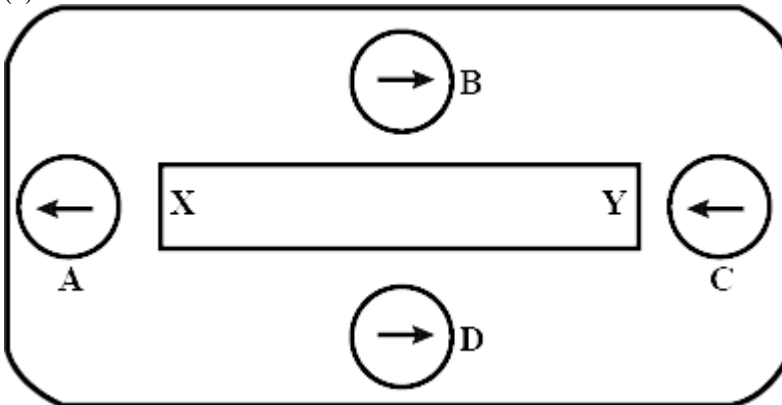
14. (a) The diagram shows a bar magnet surrounded by four plotting compasses. Copy the diagram and mark in it the direction of the compass needle for each of the cases B, C and D.



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

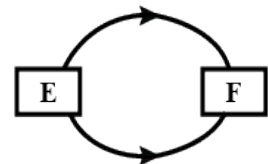
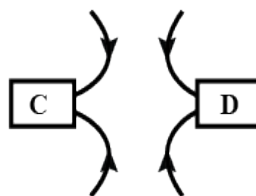
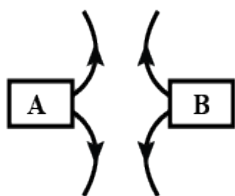
Solution :

(a)



- (b) X, as it repels the north pole (tip) of magnetic needle.

15. The three diagrams in the following figure show the lines of force (field lines) between the poles of two magnets. Identify the poles A, B, C, D, E and F.



Solution:

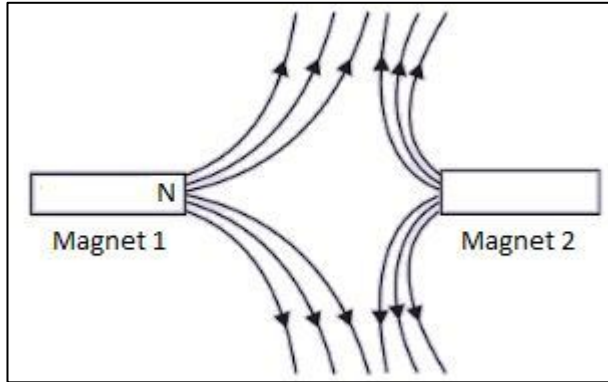
A=N; B=N; C=S; D=S; E=N; F=S

16. The figure given below shows the magnetic field between two magnets:

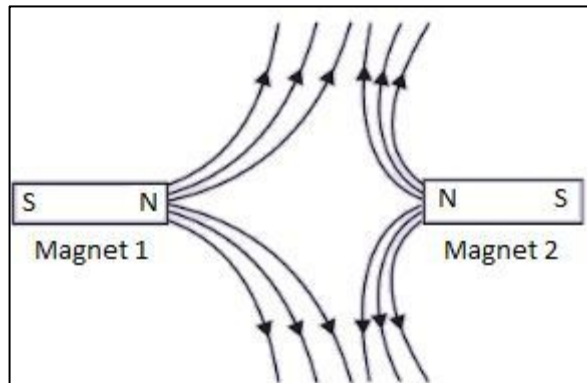
(i) Copy the diagram and label the other poles of the magnets.

(ii) Which is the weaker magnet?

Solution:



(a)



(ii) Magnet 2 is weaker.

17. Which effect of current can be utilised in detecting a current carrying wire concealed in a wall?

Solution:

Magnetic effect.

18. What conclusion do you get from the observation that a current-carrying wire deflects a compass needle placed near it?

Solution:

We conclude that a current carrying wire produces a magnetic field around it.

19. Name the scientist who discovered the magnetic effect of current.

Solution:

Magnetic effect of current was discovered by Oersted.

20. State qualitatively the effect of inserting an iron core into a current-carrying solenoid.

Solution:

Magnetic field becomes very strong.

21. Name the rule for finding the direction of magnetic field produced by a straight current-carrying conductor.

Solution:

Maxwell's right hand thumb rule.

22. State the form, of magnetic field lines around a straight current-carrying conductor.

Solution:

The magnetic field lines around a straight current-carrying conductor are concentric circles whose centres lie on the conductor.

23. **State whether the following statement is true or false :**
The magnetic field inside a long circular coil carrying current will be parallel straight lines.

Solution :

True.

24. **What is the shape of a current-carrying conductor whose magnetic field pattern resembles that of a bar magnet?**

Solution:

Solenoid.

25. **State three ways in which the strength of an electromagnet can be increased.**

Solution:

The strength of an electromagnet can be increased by

- (i) increasing the number of turns in the coil
- (ii) increasing the current flowing in the coil
- (iii) reducing the length of air gap between the poles

26. **Fill in the following blanks with suitable words:**

- (a) The lines of..... round a straight current-carrying conductor are in the shape of.....
- (b) For a current-carrying solenoid, the magnetic field is like that of a.....
- (c) The magnetic effect of a coil can be increased by increasing the number of..... , increasing the..... , or inserting an..... core.
- (d) If a coil is viewed from one end and the current flows in an anticlockwise direction, then this end is a pole.
- (e) If a coil is viewed from one end, and the current flows in a clockwise direction, then this end is a.....

Solution :

- (a) magnetic field; concentric circles
- (b) bar magnet
- (c) turns; current; iron
- (d) north
- (e) south.

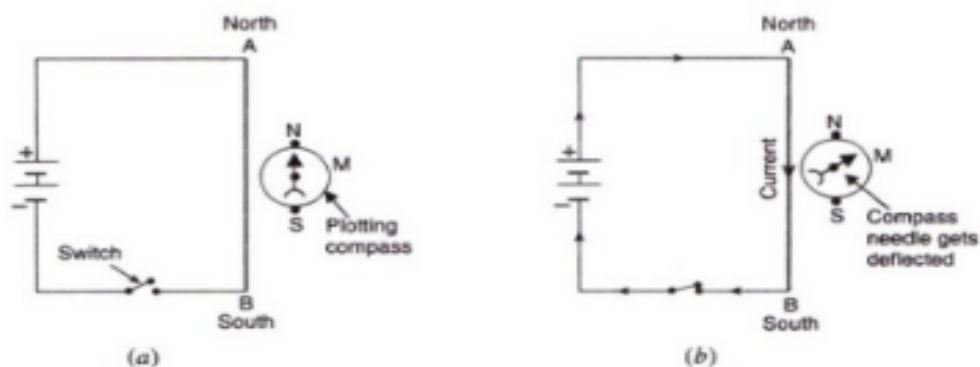
27. **Describe how you will locate a current-carrying wire concealed in a wall.**

Solution:

A current-carrying wire concealed in a wall can be located due to the magnetic effect of current by using a plotting compass. If a plotting compass is moved on a wall, its needle will show deflection at the place where current-carrying wire is concealed.

28. **Describe some experiment to show that the magnetic field is associated with an electric current.**

Solution:

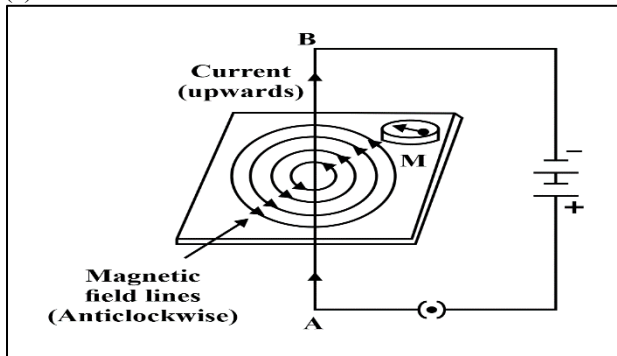


We take a thick insulated copper wire and fix it in such a way that the portion AB of the wire is in the north-south direction as shown in fig. A plotting compass M is placed under the wire AB. The two ends of the wire are connected to a battery through a switch. When no current is flowing in the wire AB, the compass needle is parallel to the wire AB and points in the usual north-south direction. When current is passed through wire AB by closing the switch, we find that the compass needle is deflected from its north-south position. On opening the switch, the compass needle returns to its original position. Thus, the deflection of compass needle by the current carrying wire shows that magnetic field is associated with an electric current.

29. (a) Draw a sketch to show the magnetic lines of force due to a current-carrying straight conductor
 (b) Name and state the rule to determine the direction of magnetic field around a straight current-carrying conductor.

Solution:

(a)



(b) Maxwell's right-hand thumb rule: According to this rule, imagine that you are grasping the current-carrying wire in your right hand so that your thumb points in the direction of current, then the direction in which your fingers encircle the wire will give the direction of magnetic field lines around the wire.

30. State and explain Maxwell's right-hand thumb rule.

Solution:

(b) According to Maxwell's right hand thumb rule: Imagine that you are grasping the current-carrying wire in your right hand so that your thumb points in the direction of current, then the direction in which your fingers encircle the wire will give the direction of magnetic field lines around the wire.

Let AB be the straight wire carrying current in the vertically upward direction from A to B. To find out the direction of the magnetic field lines produced by this current, we imagine that we are grasping the current carrying wire in our right hand as shown in fig. so that our thumb points in the direction of current towards B. Now, the direction in which our fingers are folded gives the direction of magnetic field lines. In this case, the direction of magnetic field lines is in the anticlockwise direction.

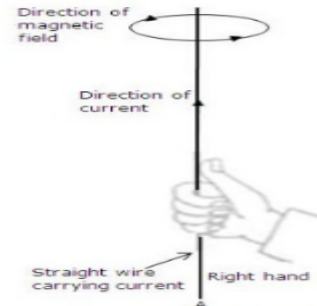
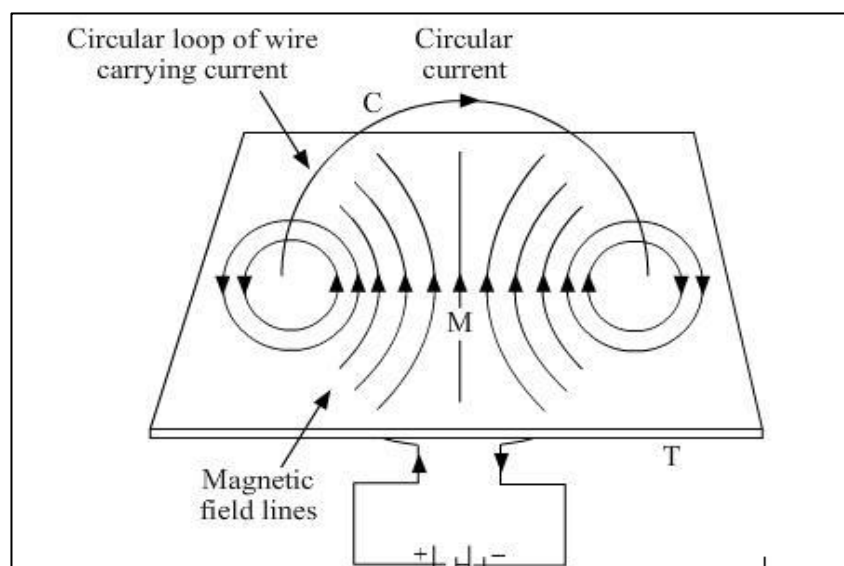


Figure : Right-hand thumb Rule to find the direction of Magnetic field

31. (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?

Solution: (a)



- (b) The strength of magnetic field produced by a current-carrying circular coil can be increased by:
- increasing the number of turns of wire in the coil.
 - increasing the current flowing through the coil.

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

Solution:

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

- (i) If the current around the face of the circular wire (or coil) flows in the clockwise direction, then that face of the circular wire will be South pole (S-pole).
- (ii) If the current around the face of the circular wire (or coil) flows in the anti-clockwise direction, then that face of the circular wire will be North pole (N-pole).

33. **Name any two factors on which the strength of magnetic field produced by a current-carrying solenoid depends. How does it depend on these factors?**

Solution:

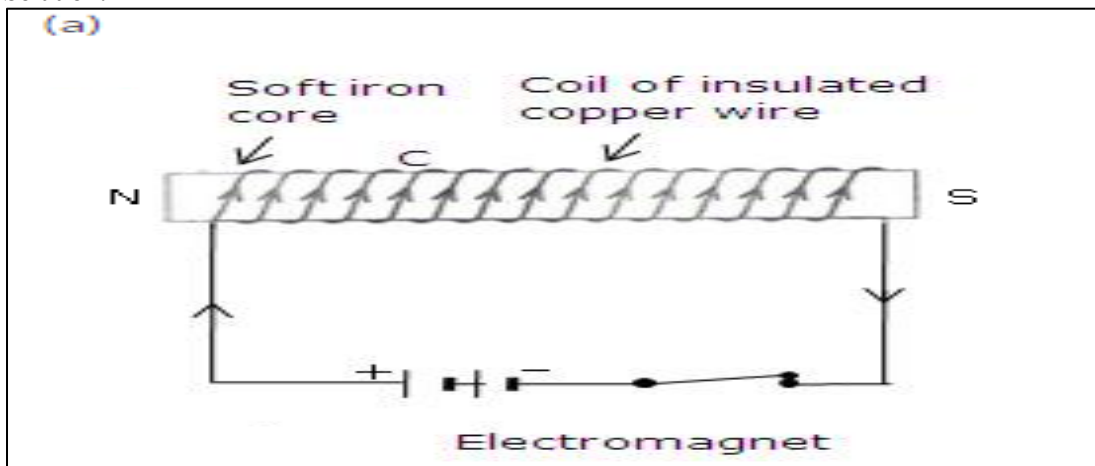
The strength of magnetic field produced by a current-carrying solenoid depends on:

1. The strength of current in the solenoid: Larger the current passed through solenoid, stronger will be the magnetic field produced.
2. The number of turns in the solenoid: Larger the number of turns in the solenoid, greater will be the magnetic field produced.

34. (a) **Draw a circuit diagram to show how a soft iron piece can be transformed into an electromagnet.**

(b) **Describe how an electromagnet could be used to separate copper from iron in a scrap yard.**

Solution:



A coil C of insulated copper wire is wound around a soft iron core NS and the two ends of the copper coil are connected to a battery. Thus, an electromagnet using a soft iron core.

(b) Electromagnetic cranes are used to separate copper from iron in a scrap yard. The current is switched on to energise the electromagnet and pick up the iron pieces from the scrap. Then these iron pieces are moved to another position, the electromagnet is switched off and the iron pieces are released.

35. (a) **How does an electromagnet differ from a permanent magnet?**

(b) **Name two devices in which electromagnets are used and two devices where permanent magnets are used.**

Solution:

(a) An electromagnet produces a magnetic field so long as current flows in its coil i.e., it produces temporary magnetic field.; but a permanent magnet produces a permanent magnetic field.

(b) Electromagnets: Electric bell, electric motors

Permanent magnets: Refrigerator doors, toys

36. (a) **What is a solenoid? Draw a sketch to show the magnetic field pattern produced by a current-carrying solenoid.**

(b) **Name the type of magnet with which the magnetic field pattern of a current-carrying solenoid**

resembles.

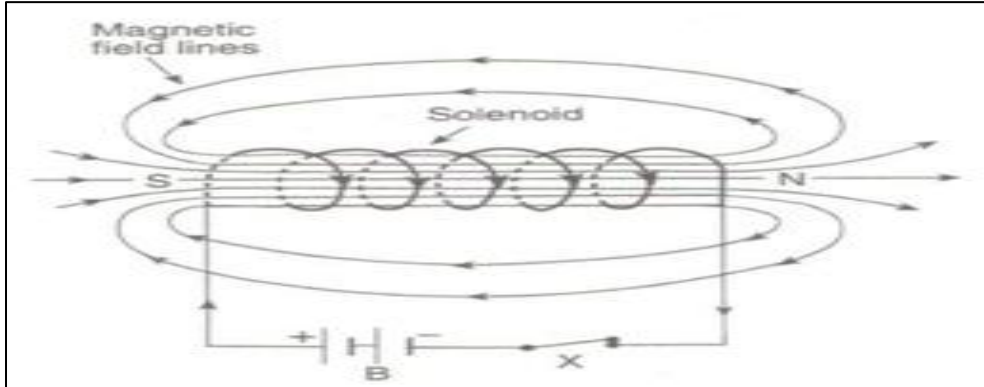
(c) What is the shape of field lines inside a current-carrying solenoid? What does the pattern of field lines inside a current-carrying solenoid indicate ?

(d) List three ways in which the magnetic field strength of a current-carrying solenoid can be increased?

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

Solution :

(a) A solenoid is a long coil containing a large number of close turns of insulated copper wire.



(b) The magnetic field produced by a current-carrying solenoid is similar to the magnetic field produced by a bar magnet.

(c) Magnetic field lines inside a current-carrying solenoid are in the form of parallel straight lines. This indicates that the magnetic field inside the solenoid is uniform.

(d) The magnetic field strength of a current-carrying solenoid can be increased by

- (i) increasing the number of turns in the solenoid.
- (ii) increasing the current flowing through the solenoid.
- (iii) using soft iron as core in the solenoid.

(e) Soft iron core.

37. (a) What is an electromagnet? Describe the construction and working of an electromagnet with the help of a labelled diagram.

(b) Explain why, an electromagnet is called a temporary magnet.

(c) Explain why, the core of an electromagnet should be of soft iron and not of steel.

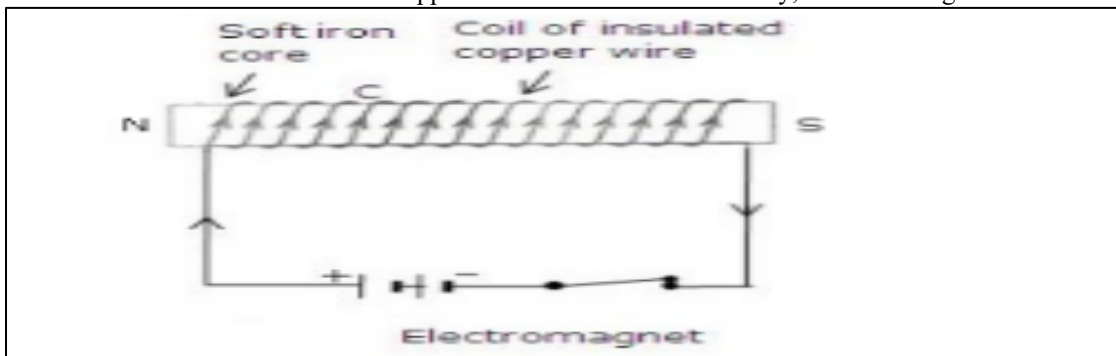
(d) State the factors on which the strength of an electromagnet depends. How does it depend on these factors?

(e) Write some of the important uses of electromagnets.

Solution:

(a) An electromagnet is a temporary magnet that works on the magnetic effect of current. It consists of a long coil of insulated copper wire wrapped around a soft iron core that is magnetised only when electric current is passed through the coil.

To make an electromagnet, we take a rod NS of soft iron and wind a coil C of insulated copper wire around it. When the two ends of the copper coil are connected to a battery, an electromagnet is formed.



(b) An electromagnet is called a temporary magnet because it produces magnetic field so long as current flows in its coil.

(c) Core of an electromagnet should be of soft iron and not of steel because soft iron loses all its magnetism when current in the coil is switched off but steel does not lose its magnetism when the current is stopped.

(d) Strength of electromagnet depends on:

- i. The number of turns in the coil – Increasing the number of turns in the coil increases the strength

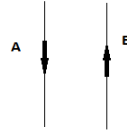
of the electromagnet.

ii. The current flowing in the coil – Increasing the current flowing in the coil increases the strength of the electromagnet.

iii. The length of air gap between its poles: Reducing the length of air gap between the poles of electromagnet increases the strength of the electromagnet.

(e) Electromagnets are used in several electrical devices such as electric bell, electric motor, loudspeaker etc. They are also used by doctors to remove particles of iron or steel from a patient's eye and to remove pieces of iron from wounds.

38. In the straight wire A, current is flowing in the vertically downward direction whereas in wire B the current is flowing in the vertically upward direction. What is the direction of magnetic field:



(a) in wire A?

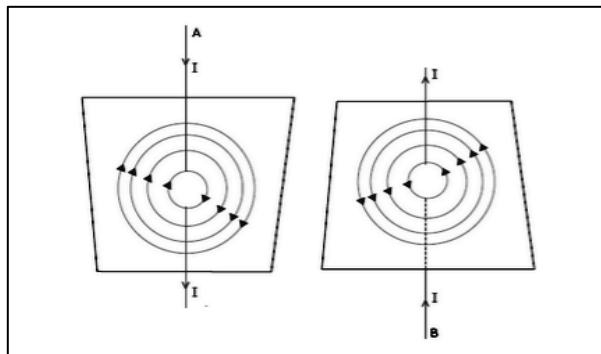
(b) in wire B?

Name the rule which you have used to get the answer.

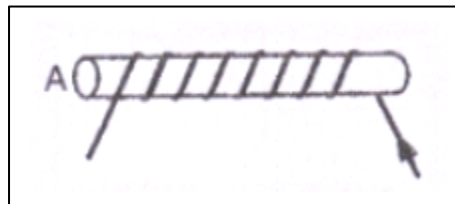
Solution:

Around the wire, the direction of magnetic field will be in clockwise direction whereas around the wire, the magnetic field will be in anti-clockwise direction.

We have used Maxwell's right hand thumb rule here to determine the direction of magnetic field.



39. The figure shows a solenoid wound on a core of soft iron. Will the end A be a N pole or S pole when the current flows in the direction shown?



Solution:

End A will be a S-pole because current flows in the clockwise direction at A.

40. A current-carrying straight wire is held in exactly vertical position. If the current passes through this wire in the vertically upward direction, what is the direction of magnetic field produced by it? Name the rule used to find out the direction of magnetic field.

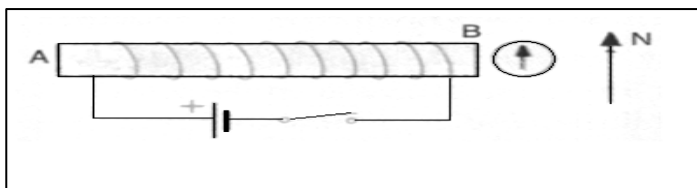
Solution:

Direction of magnetic field is anticlockwise. Maxwell's right hand thumb rule. is used to find out the direction of magnetic field.

41. For the coil in the diagram below, when the switch is pressed:

(a) what is the polarity of end A?

(b) which way will the compass point then?



Solution:

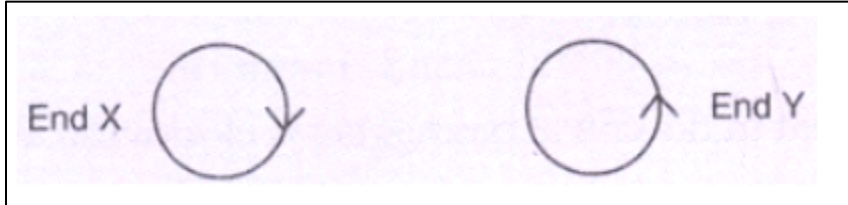
- (a) End A becomes S-pole because current flows in clockwise direction at A.
- (b) When A becomes S-pole, the other end becomes N-pole. So, the tip of the compass (with also has North polarity) moves away from this end i.e., tip moves towards right.

42. **Current flows downwards in a wire that passes vertically through a table top. Will the magnetic field lines around it go clockwise or anticlockwise when viewed from above the table?**

Solution:

Magnetic field lines around it will be clockwise (according to Maxwell's right hand thumb rule).

43. **The directions of current flowing in the coil of an electromagnet at its two ends X and Y are as shown below:**



- (a) **What is the polarity of end X ?**
- (b) **What is the polarity of end Y ?**
- (c) **Name and state the rule which you have used to determine the polarities.**

Solution :

- (a) End X is S-pole (because current flows in clockwise direction).
- (b) End Y is N-pole (because current flows in anticlockwise direction).
- (c) Clock face rule – Looking at the face of a loop, if the current around that face is in anticlockwise direction, the face has north polarity, while if the current at that face is in clockwise direction, the face has south polarity.

44. **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 ?**

Solution:

The direction of current will be from east to west.

We have applied Maxwell's right hand thumb rule here.

According to Maxwell's right hand thumb rule: Imagine that you are grasping the current-carrying wire in your right hand so that your thumb points in the direction of current, then the direction in which your fingers encircle the wire will give the direction of magnetic field lines around the wire.

45. **A current-carrying conductor is held in exactly vertical direction. In order to produce a clockwise magnetic field around the conductor, the current should be passed in the conductor:**
- (a) **from top towards bottom**
 - (b) **from left towards right**
 - (c) **from bottom towards top**
 - (d) **from right towards left**

Solution:

- (a) from top towards bottom.

46. **A thick wire is hanging from a wooden table. An anticlockwise magnetic field is to be produced around the wire by passing current through this wire by using a battery. Which terminal of the battery should be connected to the:**

- (a) **top end of wire?**
- (b) **bottom end of wire?**
- (c) **Give reason for your choice.**

Solution:

- (a) Negative terminal
- (b) Positive terminal

Because the current should be passed into wire upwards.

47. **What happens when a current-carrying conductor is placed in a magnetic field?**

Solution:

When a current-carrying conductor is placed in a magnetic field, a mechanical force is exerted on the conductor which can make the conductor move.

48. **When is the force experienced by a current-carrying conductor placed in a magnetic field largest?**

Solution:

The force experienced by a current-carrying conductor placed in a magnetic field is the largest when the current carrying conductor is at right angles to the magnetic field.

49. **In a statement of Fleming's left-hand rule, what do the following represent?**

(a) direction of centre finger.

(b) direction of forefinger.

(c) direction of thumb.

Solution:

(a) Current.

(b) Magnetic field.

(c) Force acting on the conductor.

50. **Name one device which works on the magnetic effect of current.**

Solution:

Electric bell works on the magnetic effect of current. It uses an electromagnet to produce sound.

51. **State Fleming's left-hand rule.**

Solution:

Fleming's left-hand rule: Hold the forefinger, the centre finger and the thumb of your left hand to right angles to one other. Adjust your hand in such a way that the forefinger points in the direction of magnetic field and the centre finger points in the direction of current, then the direction in which thumb points, gives the direction of force acting on the conductor.

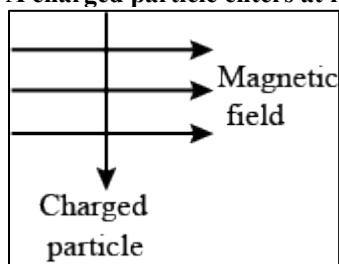
52. **What is the force on a current-carrying wire that is parallel to a magnetic field? Give reason for your answer.**

Solution:

Force on a current-carrying wire that is parallel to magnetic field will be zero.

This is because the magnitude of force depends on the sin of the angle between the direction of current and the direction of magnetic field, so if the current carrying wire is held parallel to the magnetic field, the force will be zero.

53. **A charged particle enters at right angles into a uniform magnetic field as shown:**



What should be the nature of charge on the particle if it begins to move in a direction pointing vertically out of the page due to its interaction with the magnetic field ?

Solution :

Positive charge.

54. **List three sources of magnetic fields.**

Solution:

Electromagnet, permanent magnet, wire carrying current.

55. (a) **What is the difference between alternating current and direct current ?**

(b) **What type of current is given by (i) a dry cell, and (ii) a Power House generator ?**

Solution :

(a) The difference between AC and DC is that DC flows in one direction only while AC reverses direction after equal intervals of time.

- (b)
- (i) DC
- (ii) AC

56. (a) What do you understand by the terms 'direct current' and 'alternating current' ?
(b) Name some sources of direct current and some of alternating current.
(c) State an important advantage of alternating current over direct current.
(d) What is the frequency of A.C. supply in India ?

Solution :

- (a) If the current flows in one direction only, it is known as direct current; and if the current reverses direction after equal intervals of time, it is called alternating current.
- (b) Source of DC are dry cell, car battery, DC generator etc.
Source of AC are AC generator, bicycle dynamos etc.
- (c) An important advantage of AC over DC is that AC can be transmitted over long distances without much loss of electrical energy.
- (d) 50Hz.

57. What name is given to the device which automatically cuts off the electricity supply during short-circuiting in household wiring?

Solution:

Electric fuse.

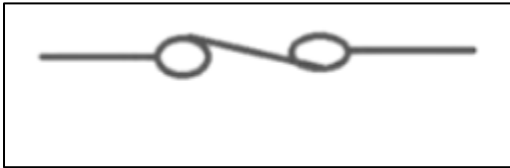
58. What is the usual capacity of an electric fuse used (i) in the lighting circuit, and (ii) in the power circuit, of a small house?

Solution:

- (i) 5A
- (ii) 15A.

59. Give the symbol of an electric fuse used in circuit diagrams.

Solution:



60. State whether the following statements are true or false:

- (a) A wire with a green insulation is usually the live wire.
- (b) A miniature circuit breaker (MCB) works on the heating effect of current.

Solution:

- (a) False.
- (b) False.

61. Along with live wire and neutral wire, a third wire is also used in domestic electric wiring. What name is given to this third wire?

Solution:

Earth wire

62. List the colours of the three wires in the cable connected to the plug of an electric iron.

Solution:

Red wire – Live wire.
Black wire – Neutral wire.
Green wire – Earth wire.

63. What is the electric potential of the neutral wire in a mains supply cable ?

Solution :

Zero volt.

64. If fuses of 250 mA, 500 mA, 1 A, 5 A and 10 A were available, which one would be the most suitable for protecting an amplifier rated at 240 V, 180 W ?

Solution : $P = VI$

$$I = P/V = 180/240 = 0.75\text{A}$$

The fuse wire should be such that it is able to withstand only a little more current than 0.75A. So the fuse of 1A is the most suitable.

65. **When does an electric short circuit occur?**

Solution:

Short circuit occurs when live wire and neutral wire come in contact with each other.

66. **In which wire in an A.C. housing circuit is the switch introduced to operate the lights?**

Solution:

Live wire.

67. **In household circuits, is a fuse wire connected in series or in parallel?**

Solution:

In series.

68. **Usually, three insulated wires of different colours are used in an electrical appliance. Name the three colours.**

Solution:

Red, black and green.

69. **What is the usual colour of the insulation of: (a) live wire, (b) neutral wire, and (c) earth wire?**

Solution:

(a) red

(b) black

(c) green

70. **What is the main purpose of earthing an electrical appliance?**

Solution:

To avoid the risk of electric shocks.

71. **Give two reasons why different electrical appliances in a domestic circuit are connected in parallel.**

Solution:

(i) In case of parallel connection, if one of the appliances is switched off, other appliances keep on operating.

(ii) In case of parallel connection, all the appliances are operated on same voltage i.e., the mains supply voltage.

72. **How should the electric lamps in a building be connected so that the switching on or off in a room has no effect on other lamps in the same building?**

Solution:

Parallel connection.

73. **Fill in the following blanks with suitable words:**

(a) A fuse should always be placed in the..... wire of a mains circuit.

(b) The earth wire should be connected to the..... of an appliance.

Solution:

(a) live

(b) body.

74. (a) **Of what substance is the fuse wire made? Why?**

(b) **Explain why, a copper wire cannot be used as a fuse wire.**

Solution:

(a) The fuse wire is made of tin-plated copper wire because of its low melting point.

(b) Pure copper wire cannot be used as a fuse wire because it has a high melting point due to which it will not melt easily when a short circuit takes place.

75. **Distinguish between the terms ‘overloading’ and ‘short-circuiting’ as used in domestic circuits.**

Solution :

Live wire coming in contact with the neutral wire is known as short circuit.

When too many electrical appliances of high power rating are switched on at the same time or are connected to a single socket, they draw extremely large current. This is known as overloading.

76. (a) **When does a fuse cut off current? How does it do it?**
(b) **What is the maximum number of 60 W bulbs that can be run from the mains supply of 220 volts if you do not want to overload a 5 A fuse?**

Solution:

(a) A fuse cuts off current when the current exceeds a safe value (due to short circuiting or overloading). When the current becomes large, it heats the fuse wire too much. Since the melting point of fuse wire is low, it melts and breaks the circuit. Thus, current in the circuit is cut off.

(b) Let the maximum number of bulbs be n .

Power of y bulbs, $P=60n$

$V=220V$, $I=5A$

We know that

$$P = VI$$

$$60n = 220 \times 5$$

$$60n = 1100$$

$$n=18.33$$

So, number of bulbs required are 18.

77. **Explain the importance of using in a household electric circuit (i) fuse, and (ii) earthing wire.**

Solution:

(i) A fuse is one of most important protection devices, which is used for avoiding the damages happening due to over load or short circuit.

(ii) An earthing wire is used to save us from the risk of electric shock in case the live wire touches the metal case of the electric appliance.

78. (a) **An electric iron is rated at 230 V, 750 W. Calculate (i) the maximum current, and (ii) the number of units of electricity it would use in 30 minutes.**

(b) **Which of the following fuse ratings would be suitable for this electric iron ?**

1 A, 3 A, 5 A, 13 A

Solution :

(a) $V=230V$, $P=750 W$, $t=30/60=0.5hr$

(i) Let max current be I

We have $P=VI$

$$\Rightarrow 750 = 230 \times I$$

$$\Rightarrow I = 3.26 A$$

(ii) Electric energy consumed, $E = P \times t = 0.75kW \times 0.5h = 0.375 kWh$

No. of units used in 30 min = 0.375

(b) 5 A fuse rating will be suitable for this electric iron as the maximum current for this iron is 3.26 A.

79. **What is the function of an earth wire? Why is it necessary to earth the metallic bodies of electrical appliances?**

Solution:

When the live wire of a faulty appliance comes in direct contact with its metallic case, which has been earthed, the large current passes directly to the earth without passing through the user's body. Thus, it is necessary to earth the metallic bodies of electrical appliances so as to avoid fatal electric shocks.

80. (a) **What current is taken by a 3kW electric geyser working on 240 V mains?**

(b) **What size fuse should be used in the geyser circuit?**

Solution:

(a) $P = 3kW = 3000W$

$V = 240V$

$$P = V \times I$$

$$I = P/V$$

$$= 3000/240 = 12.5 A.$$

(b) A 13A fuse should be used in the geyser circuit.

81. (a) **Why are fuses fitted in the fuse box of a domestic electricity supply?**

(b) **What device could be used in place of the fuses?**

Solution:

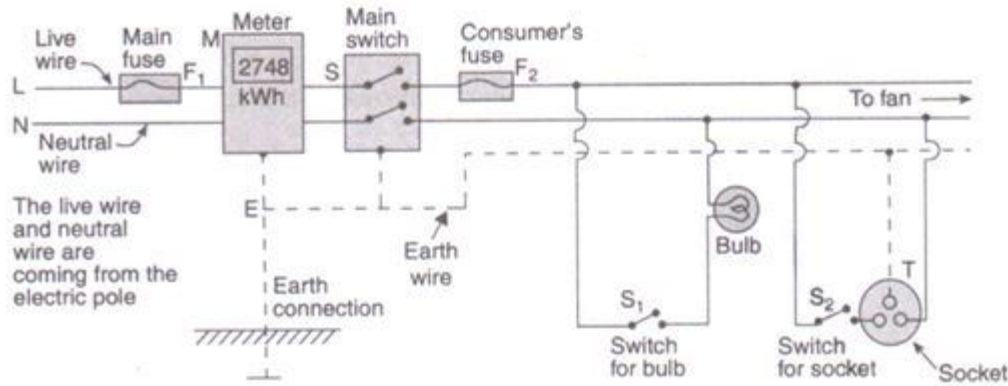
(a) Fuses are fitted in the fuse box of a domestic electricity supply to protect the whole wiring of the

house when excessive current flows in the circuit.
 (b) MCB.

82. (a) Draw a labelled diagram to show the domestic electric wiring from an electric pole to a room. Give the wiring for a bulb and a three-pin socket only.
 (b) State two hazards associated with the use of electricity.
 (c) State the important precautions which should be observed in the use of electricity.
 (d) What will you do if you see a person coming in contact with a live wire ?
 (e) Explain why, electric switches should not be operated with wet hands.

Solution :

(a)



- (b) Two hazards associated with the use of electricity are:
 i. If a person happens to touch a live electric wire, he gets a severe electric shock.
 ii. Short-circuiting due to damaged wiring or overloading of the circuit can cause electrical fire in a building.
 (c) Important precautions which should be observed in the use of electricity are:
 (i) Use of good quality wires
 (ii) Use of fuse and proper earthing.
 (iii) Use of appliances in dry condition only.
 (d) If a person comes in contact with a live wire, we will switch off the main switch immediately so as to cut off the electricity supply..
 (e) Electric switches should not be operated with wet hands because water is a good conductor of electricity, so the user may get electric shock.

83. An air-conditioner of 3.2 kW power rating is connected to a domestic electric circuit having a current rating of 10 A. The voltage of power supply is 220 V. What will happen when this air-conditioner is switched on? Explain your answer.

Solution:

Given: $P=3.2\text{kW}=3200\text{W}$, Fuse current rating= 10 A , $V=220\text{ V}$

We have

$$P=VI$$

$$3200 = 220 \times I$$

$$I=14.54\text{ A}$$

As the required current for the air-conditioner is 14.54A and the rated current of the fuse is 10A, so the fuse will blow cutting off the power supply.

84. A vacuum cleaner draws a current of 2 A from the mains supply.

- (a) What is the appropriate value of the fuse to be fitted in its circuit ?
 (b) What will happen if a 13 A fuse is fitted in its circuit ?

Solution :

(a) The appropriate value of the fuse to be fitted in the circuit is 2.5A or 3A.

(b) If a 13A fuse is fitted in the circuit, it will not protect the vacuum cleaner against the very high current flowing through it. This may damage the appliance.

85. What is the main difference in the wiring of an electric bulb and a socket for using an electric iron in a domestic electric circuit? What is the reason for this difference?

Solution:

No earth connection is required for the bulb connection as it does not draw heavy current and we

hardly touch it. A socket for using an electric iron has an earth connection because electric iron has a metallic body and draws a large current.

86. **(a) Explain why, it is more dangerous to touch the live wire of a mains supply rather than the neutral wire.**

(b) Why is it safe for birds to sit on naked power lines fixed atop tall electric poles ?

Solution :

(a) It is more dangerous to touch the live wire rather than the neutral wire because live wire has a high potential of 220V, where as neutral wire has zero potential.

(b) Bird's body is not connected to the earth, so no current flows through its body into the earth. So, it is safe for birds to sit on naked power lines fixed atop tall electric poles.