Board – CBSE | Class – 10th | Topic – Magnetic Effect of Electric Current

Q.1 State any two properties of magnetic field lines.

Ans. Prop 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 the 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.

Q.2 State whether the following statement is true or false:

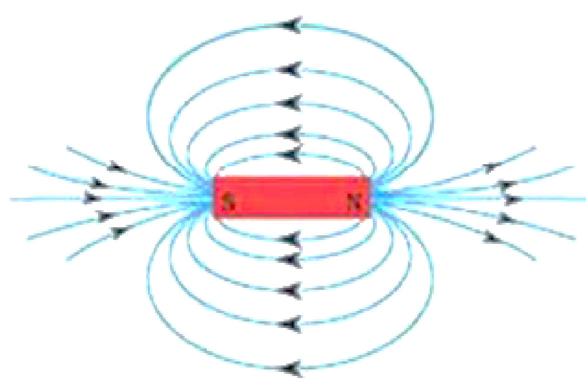
The axis of the earth's imaginary magnet and the geographical axis coincide with each other.

Ans. False

The axis of the earth's imaginary magnet is inclined at an angle of 150 with the geographical axis.

Q.3 Draw a diagram to show the magnetic field lines around a bar magnet.

Ans.



Magnetic field lines around a bar magnet.

Q.4 What is a magnetic field? How can the direction of magnetic field lines at a place be determined?

Ans. 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 compass's needle indicates the direction of the magnetic field at the point where it is placed.

Q.5 Explain why two magnetic field lines do not intersect each other.

Ans. Two magnetic field lines do not intersect each other because the resultant force on a north pole at any point can be only in one direction. But suppose the two magnetic lines get intersect one another. In that case, this means that the resultant force on a north pole placed at the point of intersection will be along two directions, which is not possible.

Q.6 (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.

Ans. (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: Take a small compass and a bar magnet.

Place the magnet on a sheet of white paper fixed on a drawing board, using an 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.

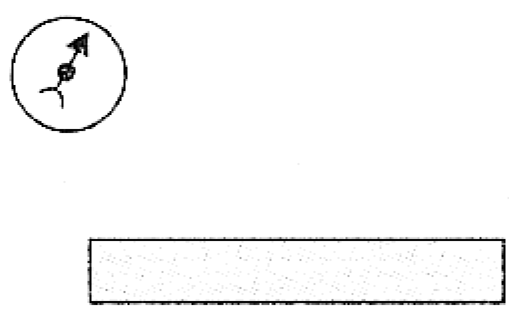
Mark the position of two ends of the needle.

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

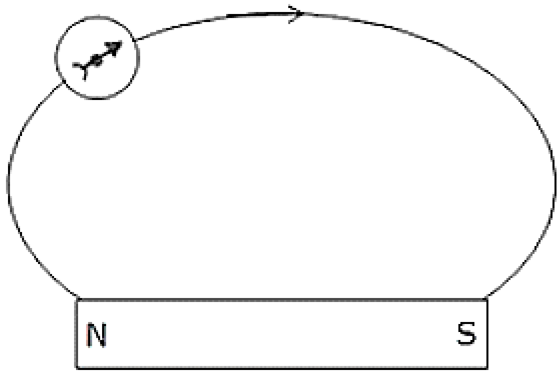
In this way, proceed step by step till you reach the south pole of the magnet. Join the points marked on the paper by a smooth curve. This curve represents a magnetic field line.

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

Q.7 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.



Ans. As the north pole of the magnetic needle is pointing in the opposite direction, the nearer end of the magnet will be the north pole.

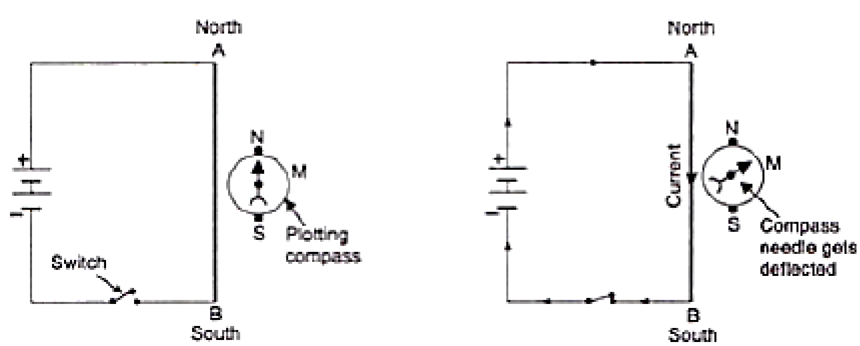


Q.8 Describe how you will locate a current-carrying wire concealed in a wall.

Ans. 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 the current-carrying wire is concealed.

Q.9 Describe some experiments to show that the magnetic field is associated with an electric current.

Ans.



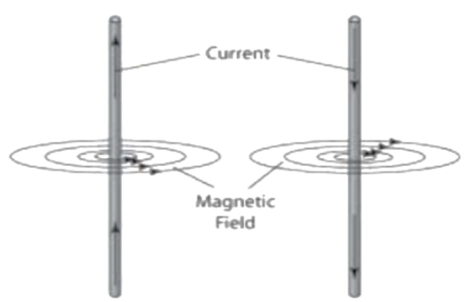
We take a thick insulated copper wire and fix it so that the portion AB of the wire is in the north-south direction, as shown in fig. A plotting compass M is placed under the wire AB. The two ends of the wire are connected to a battery through a switch. When no current flows in the wire AB, the compass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

Q.10 (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 the magnetic field around a straight current-oar-ing conductor.

Ans. (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 the current, then the direction in which your fingers encircle the wire will give the direction of magnetic field lines around the wire.

Q.11 State and explain Maxwell's right-hand thumb rule.

Ans. 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 the 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.

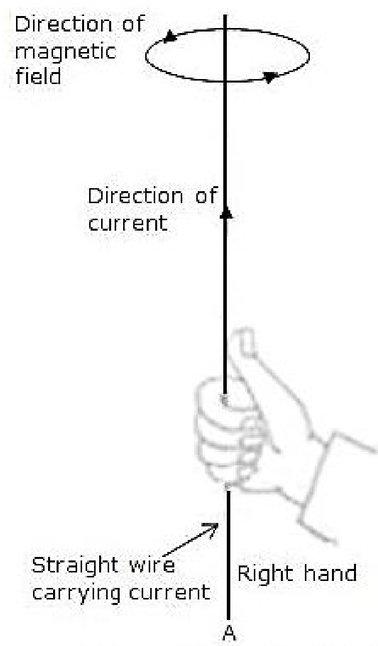


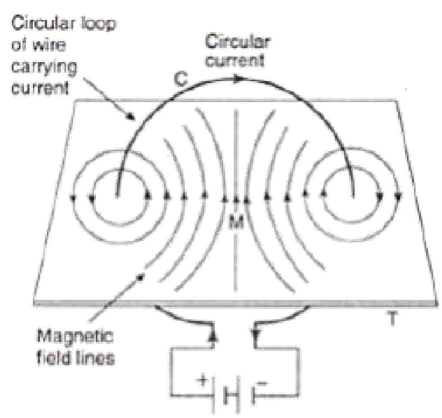
Figure : Right-hand thumb Rule to find the direction of Magnetic field

Q.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 the magnetic field produced by a current-carrying circular coil can be increased?

Ans. (a)

(a)



Magnetic lines of force due to a circular wire carrying current

(b) The strength of the magnetic field produced by a current-carrying circular coil can be increased by:

-increasing the number of turns of wire in the coil.

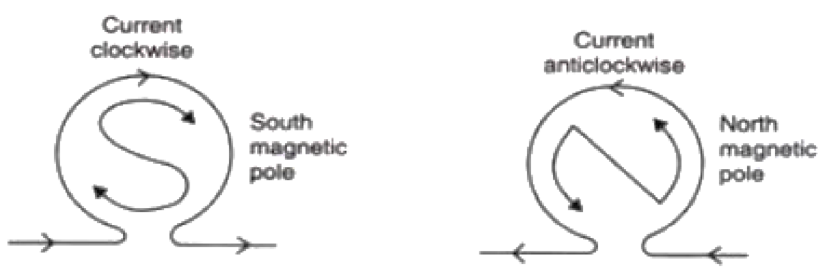
-increasing the current flowing through the coil.

Q.13 State and explain the Clock face rule for determining the polarities of a circular wire carrying current.

Ans. 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 the South pole (S-pole).

(ii) If the current around the face of the circular wire (or coil) flows in the anticlockwise direction, then that face of the circular wire will be the 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)

Q.14 Name any two factors on which the strength of the magnetic field produced by a current-carrying solenoid depends. How does it depend on these factors?

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

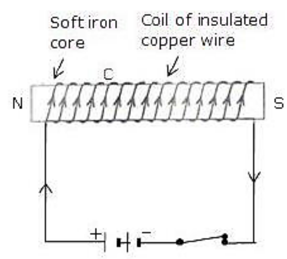
1 The strength of the current in the solenoid: Larger the current passes through the solenoid, the stronger the magnetic field will produce.

2 The number of turns in the solenoid: Larger the number of turns in the solenoid, the greater will be the magnetic field produced.

Q.15 (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 scrapyard.

Ans. (a)



Electromagnet

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 uses a soft iron core.

(b) Electromagnetic cranes are used to separate copper from iron in a scrapyard. 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.

Q.16 (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.

Ans. (a) An electromagnet produces a magnetic field so long as current flows in its coil

, i.e., it produces a temporary magnetic field.; but a permanent magnet produces a permanent magnetic field.

(b) Electromagnets: Electric bell, electric motors Permanent magnets: Refrigerator doors, toys

Q.17 (a) What is a solenoid? Draw a sketch to show the magnetic field pattern produced by a current-carrying solenoid.

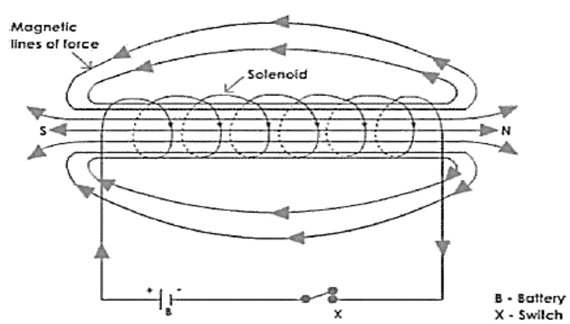
(b) Name the type of magnet with which the magnetic field pattern of a current-carrying solenoid resembles.

(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 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?

Ans. (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 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.

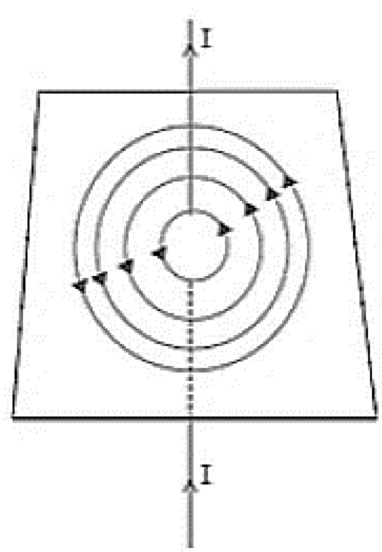
(iii) using soft iron as core in the solenoid.

(e) Soft iron core.

Q.18 A current-carrying straight wire is held in exactly vertical position. Suppose the current passes through this wire in the vertically upward direction. What is the direction of the magnetic field produced by it? Name the rule used to find out the direction of the magnetic field.

Solu. The direction of the magnetic field is anticlockwise.

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



Q.19 The magnetic field associated with a current-carrying straight conductor is in an anticlockwise direction. If the conductor was held along the east-west direction, what would the current direction be through it? Name and state the rule applied to determine the direction of current?

Ans. The direction of the 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 the current, then the direction in which your fingers encircle the wire will give the direction of magnetic field lines around the wire.

Q.20 State Fleming's left-hand rule. Explain it with the help of labelled diagrams.

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