SUBJECT : SCIENCE (PHY)

CHAPTER-12:

MAGNETIC EFFECT OF ELECTRIC CURRENT

TOPIC-1:

MAGNET,MAGNETIC FIELD AND FIELD LINES

OBJECTIVES:

Upon completion of the topic, you will be able to

1. DEFINE MAGNET
2. DEFINE MAGNETIC FILED
3. EXPLAIN OERSTED EXPERIMENT ON MAGNETIC EFFECT OF ELECTRIC CURRENT
4. DEFINE MAGNETIC FILED LINES OR MAGNETIC LINES OF FORCE
5. WRITE THE PROPERTIES OF MAGNETIC LINES OF FORCE
6. FIND THE DIRECTION OF MAGNETIC FIELD
7. DRAW THE MAGNETIC LINES OF FORCE AROUND BAR MAGNET

1. MAGNET:

The objects that attract magnetic materials like iron and iron ifilings and that produce magnetic field is called magnet.

2. Magnetism : The capacity or power of magnet to attract iron and iron filings is called magnetism.

3. Magnetic field : The space or region around a magnet (or a current carrying wire) within which its influence can be felt is called magnetic field.

*Magnetic field is a vector quantity and it has both:

(a) magnitude(strength)

(b) direction

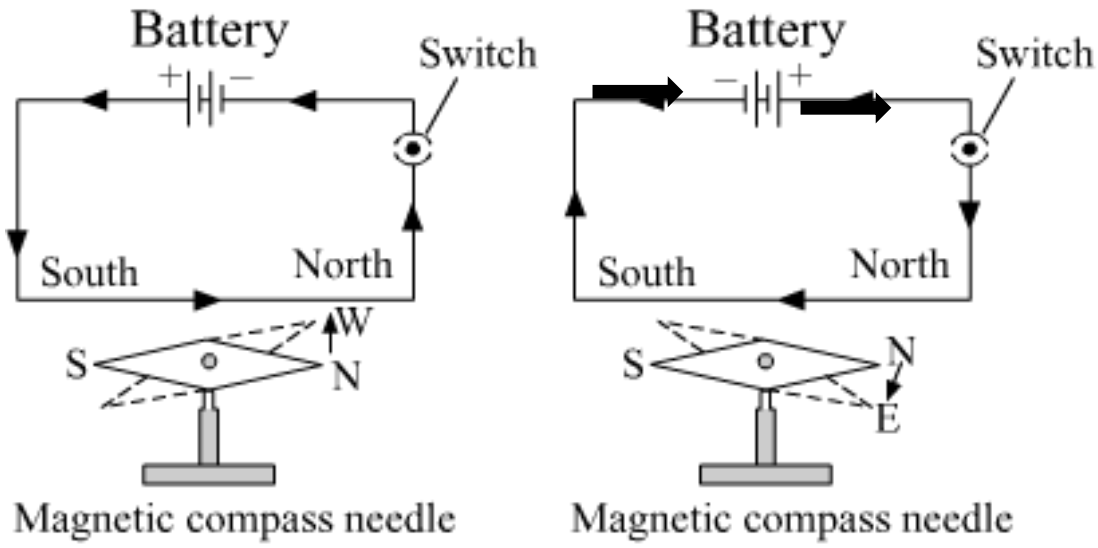
Characteristics of magnet:

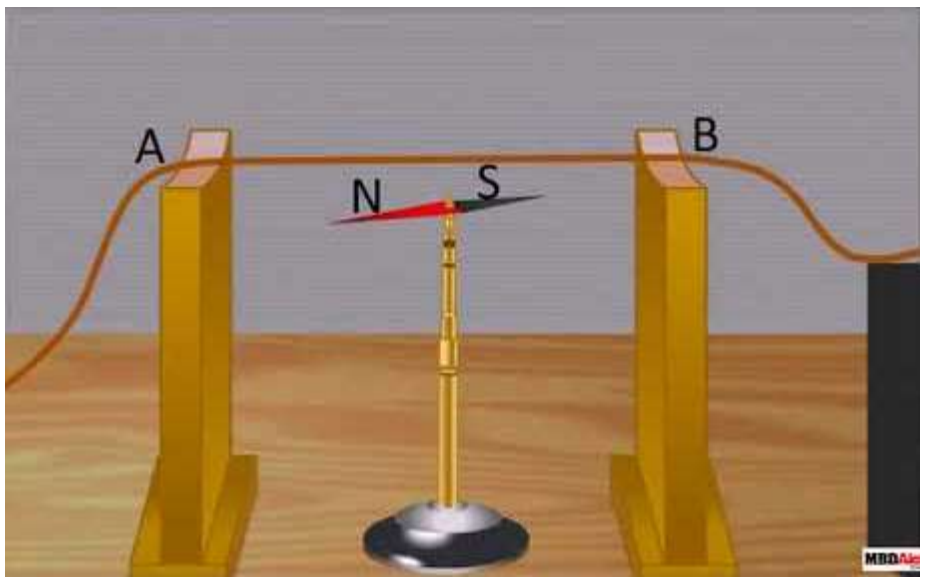
1. Like poles repel each other and unlike poles attract each other.
2. A magnet has two poles namely north pole and south pole. Magnetic monopole does not exist. If we break a magnet into two pieces, each piece becomes magnet.
3. Magnet always align pointing north south direction when suspended freely.
4. Magnet attracts magnetic materials like iron, cobalt , nickel.

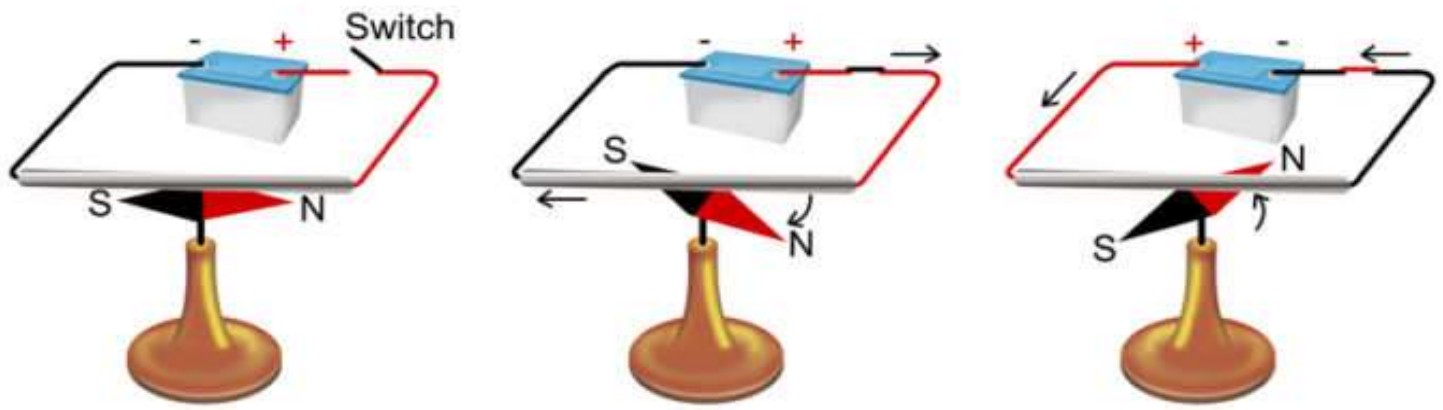
MAGNETIC EFFECT OF ELECTRIC CURRENT:

When electric current is passed through a conducting wire , a magnetic field is produced around it. This is known as magnetic effect of electric current.

Oersted Experiment on magnetic effect of electric current:







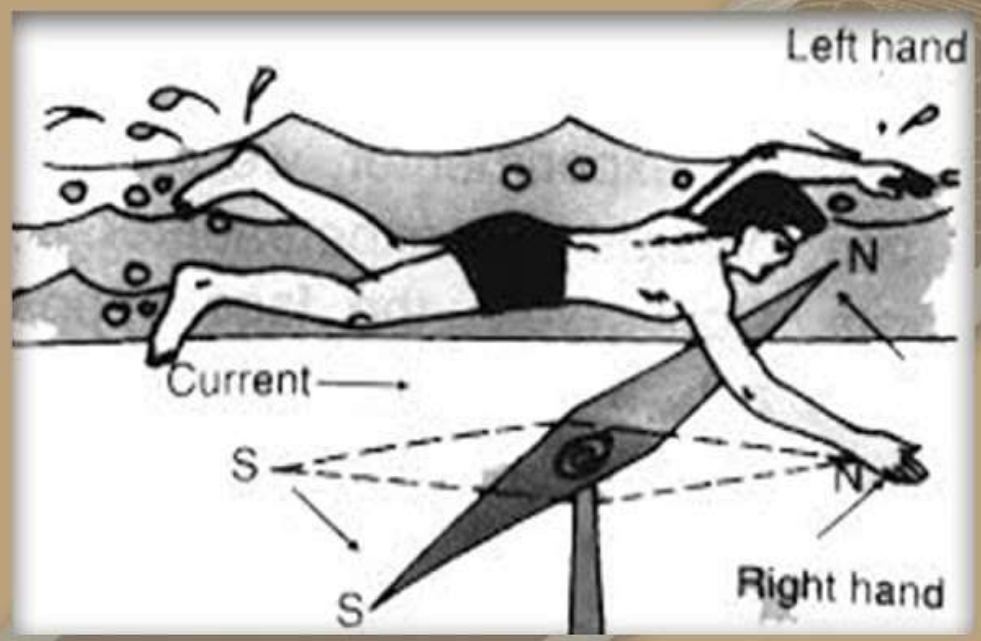
All these diagrams help to understand oersted experiment

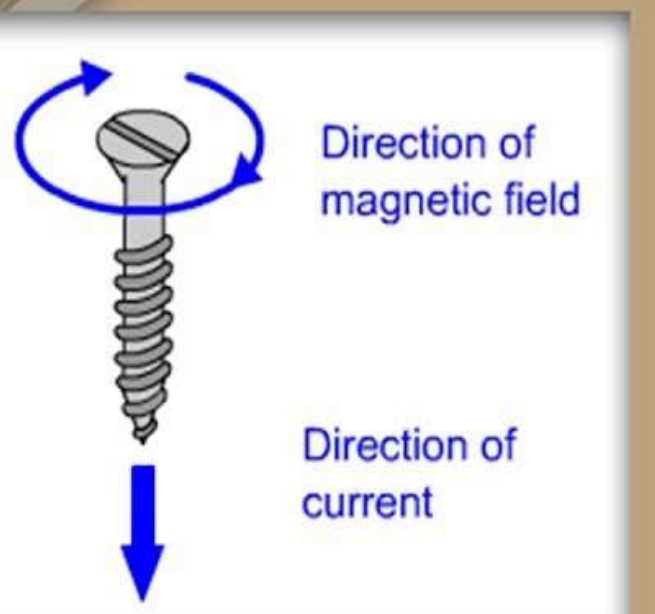
Direction of deflection of needle: The direction of deflection of north pole of needle can be obtained by following two rules:

1. Ampere's swimming Rule or SNOW rule: South to North thr wire kept over compass (deflection towards West)
2. Maxwell's Screw Rule:

(shown in the next slides)

What is AMPERE'S SWIMMING RULE & MAXWELL'S CORK SCREW RULE?





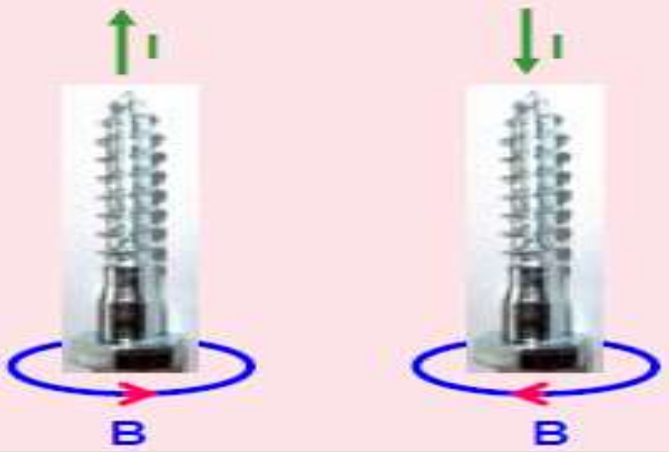
Rules to determine the direction of magnetic field:

Ampere's Swimming Rule:

Imagining a man who swims in the direction of current from south to north facing a magnetic needle kept under him such that current enters his feet then the North pole of the needle will deflect towards his left hand, i.e. towards West.

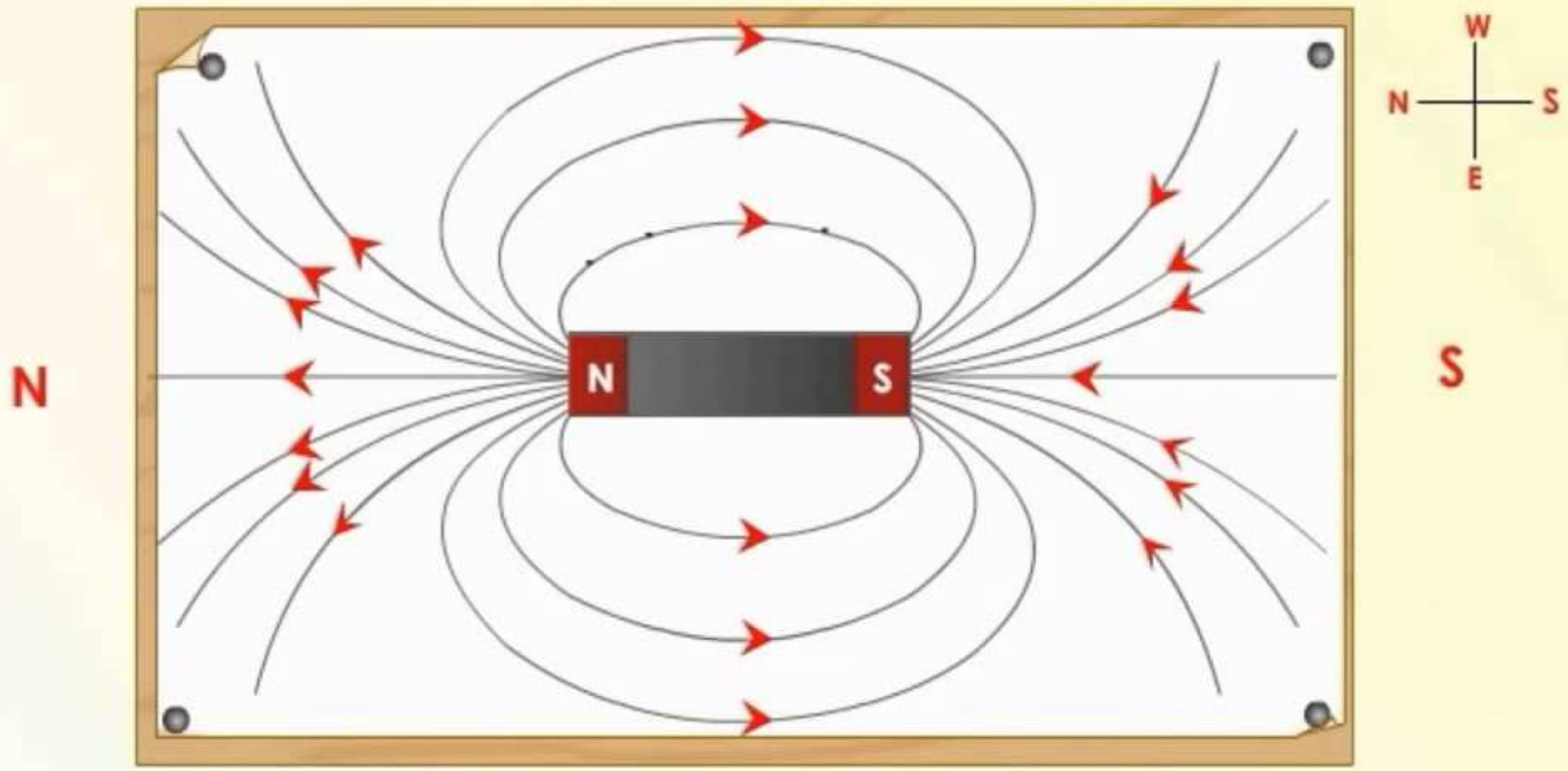
Maxwell's Cork Screw Rule or Right Hand Screw Rule:

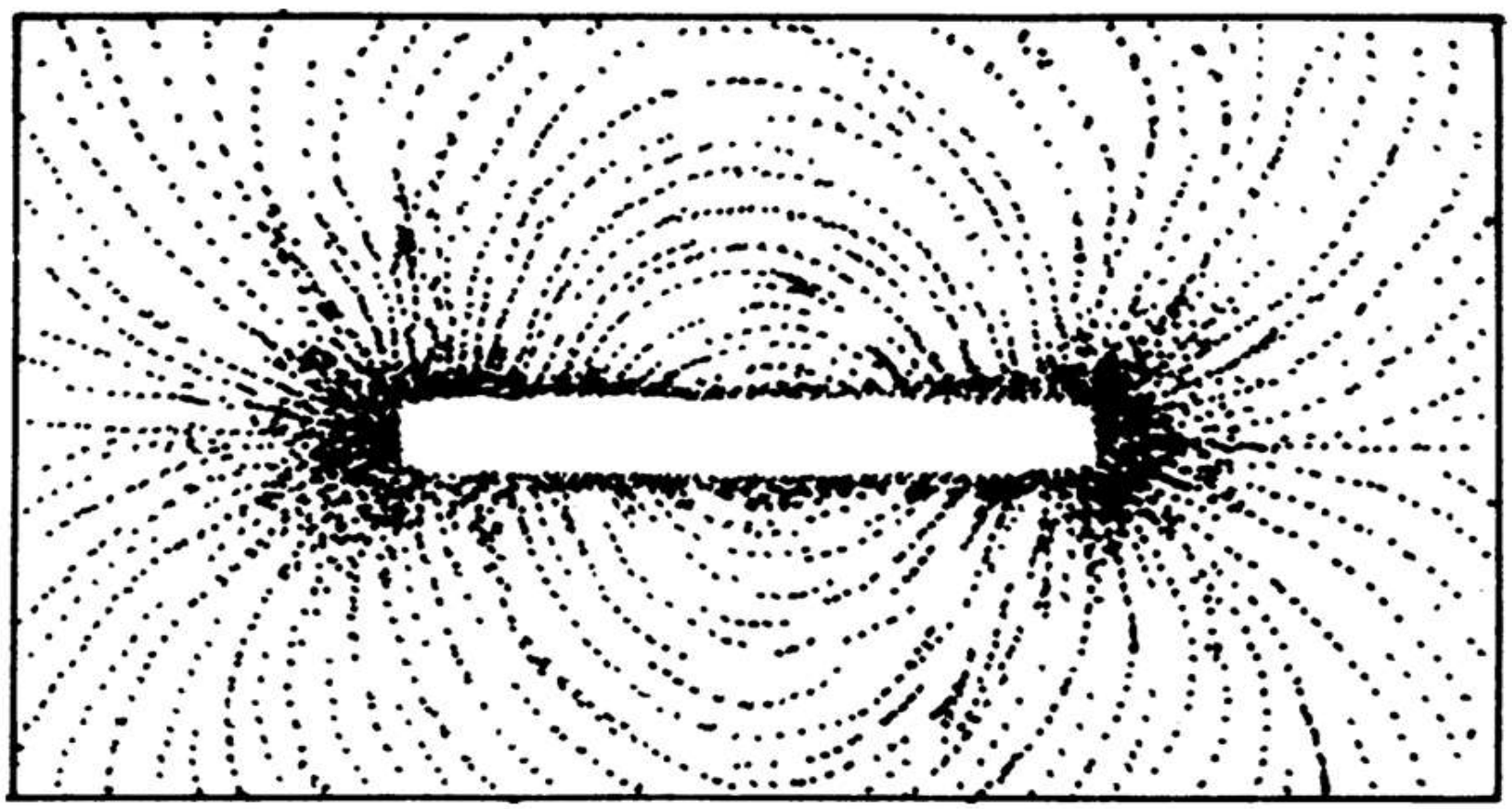
If the forward motion of an imaginary right handed screw is in the direction of the current through a linear conductor, then the direction of rotation of the screw gives the direction of the magnetic lines of force around the conductor.



Magnetic field and magnetic lines of force

Magnetic field around a bar magnet (Pattern of magnetic lines of force)





Filed lines or magnetic lines of force:

Definition of magnetic field line. *The path (straight or curved) along which unit north pole moves in a magnetic field (if free to do so) is called* **magnetic line of force or magnetic field line.** Magnetic lines of force or magnetic field lines are helpful to show the direction and strength (or intensity) of a magnetic field.

The direction of the magnetic field at any particular place is the direction in which the north pole of a magnetic compass needle points if placed at that point. The strength of the magnetic field is shown by how much close these lines are to each other. *If magnetic field lines are very close to each other in a particular region, then the strength of the magnetic field in that region is very large.* On the other hand, if the magnetic *field lines are far from each other in a particular region, then the strength of the magnetic field in that region is very small.*

Magnetic lines of force: These are the closed path that originate from north pole and merge at south pole of magnet externally and internally these go from south to north pole.

Finding direction of magnetic field at a point with the help of magnetic lines of force:

on any point on the magnetic lines of force, we need to draw a tangent. This tangent gives the direction of the magnetic field at that point. The direction of the tangent to be taken in the same direction of lines of force.

CHARACTERISTICS OF LINES OF FORCE:

4.01.1. PROPERTIES OF MAGNETIC LINES OF FORCE OR FIELD LINES

1. *Magnetic lines of force are closed continuous curves.*
Magnetic lines of force emerge from a magnet at N-pole and enter the magnet at S-pole. But magnetic lines of force run from S-pole to N-pole within the magnet (Figure 7).

PT is tangent at A. Direction of field at point A is from A to T.

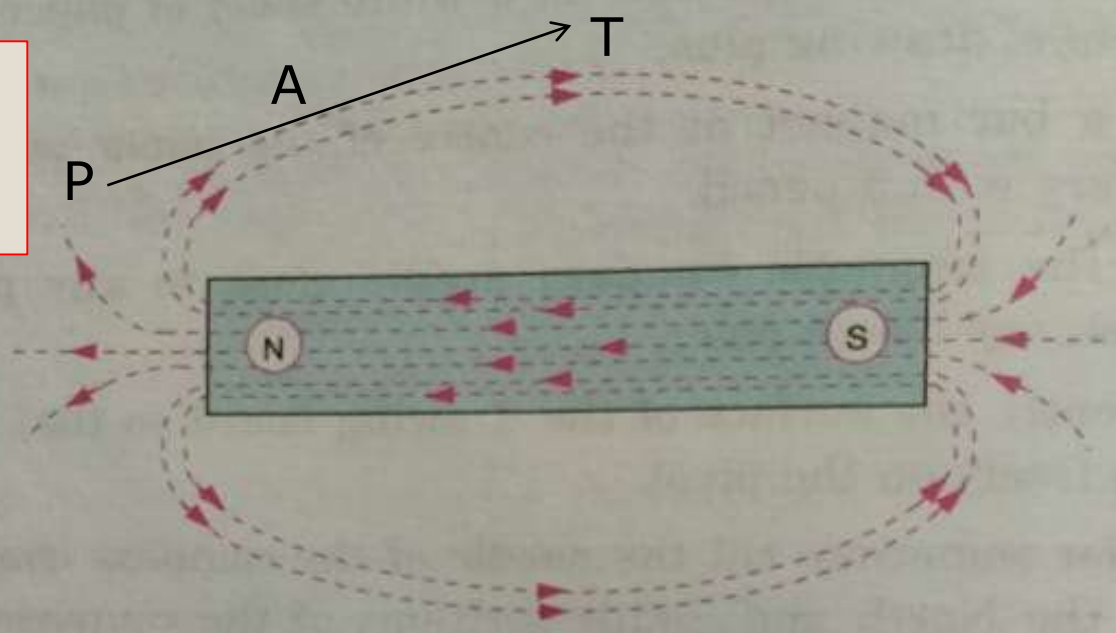
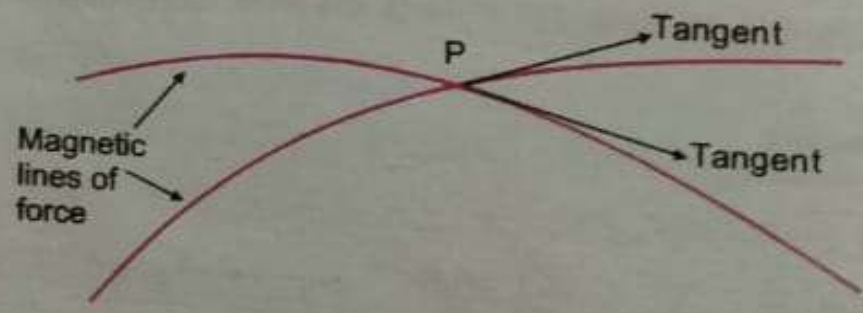


FIGURE 7

2. *The tangent at any point on the magnetic lines of force gives the direction of the magnetic field at that point.*
3. *No two magnetic lines of force can intersect each other.*

If two magnetic lines of force intersect at a point (P) as shown in figure 8, then there will be two tangents at that point. It means, at the point of intersection, there will be two directions of the same magnetic field, which is not possible. Hence, no two magnetic lines of force can intersect each other.



HOME WORK

1. What do you understand by the following

(a) Magnet

(b) Magnetic field

(c) Magnetic field lines or magnetic lines of force

(d) Magnetic effect of electric current

2. Write any three properties of magnet

3. Write any three properties of magnetic field lines.

4. Two magnetic lines of force never intersect each other. Give reason.

5. Can we say that magnetic field has both direction and magnitude?

6. State one way to find out direction of magnetic field at any point inside it.

7. Draw the pattern of magnetic lines of force around a bar magnet.

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

9. With diagram explain Oersted experiment on magnetic effect of electric current