MAGNETISM

Natural Magnets: The magnets (i.e., the pieces of lodestone) found in nature are called natural magnets.

- The first known magnet – lodestone is an an ore of iron oxide.
- Natural magnets are quite irregular and odd in shapes.
- They are not magnetically strong enough for use.

Artificial Magnets:

- An artificial magnet is a magnetised piece of iron or other magnetic material.
- Bar magnet, horseshoe magnet, magnetic compass needle etc, are some examples of artificial magnets.

Properties of magnets

Directive property -The end of the magnet which points towards the north is called the north seeking pole or simply the **north pole** (N).

- The end which points towards the south is called the south seeking pole or simply the **south pole (S)**.
- A freely suspended magnet always aligns itself in geographic north south direction.

Attractive property – The points of a magnet where the attraction appears to be maximum, are called the poles of the magnet.

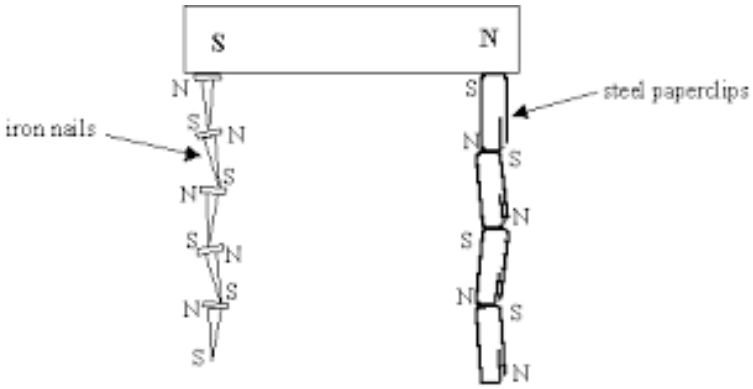
- The poles are located slightly inside the magnet and not at the ends. The distance between the poles of a magnet is called its effective length.
- A magnet can attract other magnets or magnetic substances.

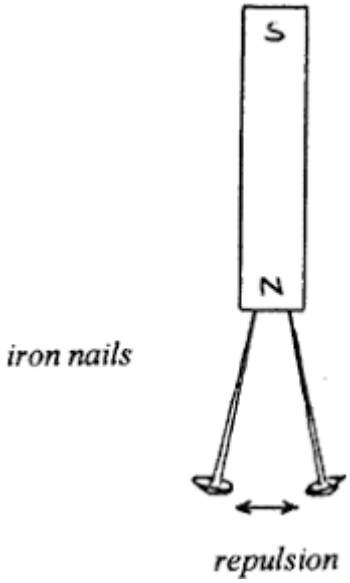
Magnetic Poles

- Each magnet has **two poles** i.e., poles exist in pairs.
- Magnetic monopole does not exist separately.
- Like poles **repel** each other and unlike poles **attract** each other.

Induced Magnetism

- The process in which a piece of magnetic material acquires magnetic properties temporarily due to the presence of another magnet near it is called *magnetic induction*.
- A magnetic pole induces opposite polarity on the nearest end and a similar polarity on the farther end of the iron bar.
- Induction precedes attraction.
- Induced magnetism is temporary.

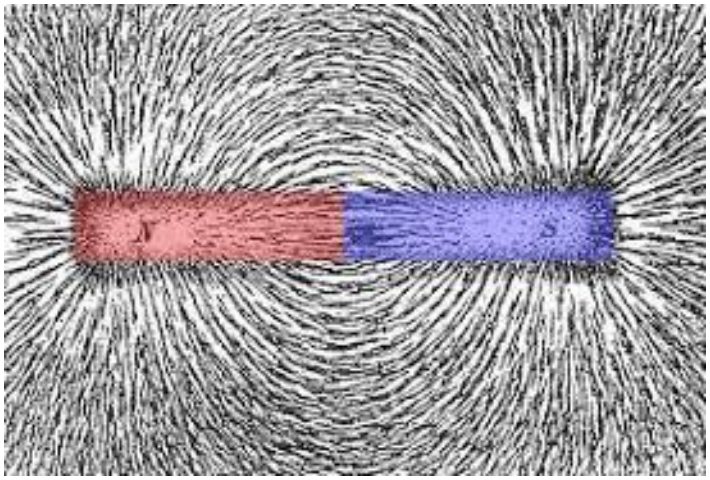


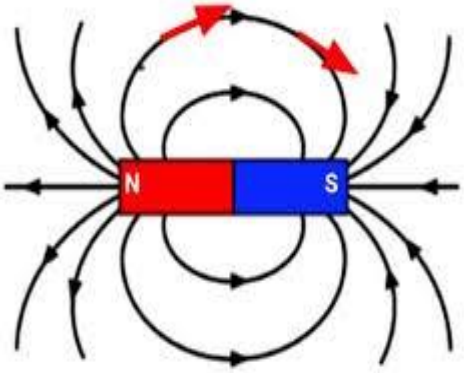


Magnetic Field

- The space around a magnet in which the needle of a compass rests in a direction other than the geographic north-south direction, is called magnetic field.
- As the distance of a point from the magnet increases, magnetic field decreases.

- A magnetic field line is a continuous curve in a magnetic field such that a tangent at any point of it gives the direction of magnetic field at that point.





Properties of Magnetic Field Lines

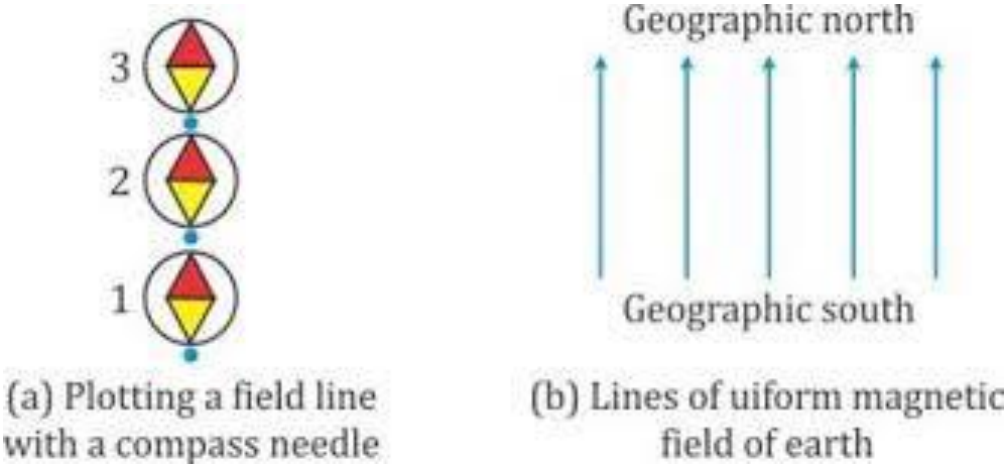
- They are closed and continuous curves.
- Outside the magnet, they are directed from north pole to south pole.
- The tangent at any point on a field line gives direction of magnetic field at that point.
- They never intersect each other.
- They are crowded near the poles where the magnetic field is stronger, and far separated near the centre of a magnet where the magnetic field is weak.
- Uniform magnetic field is represented by parallel and equi-distant field lines.

Magnetic Field of Earth - Evidences

- A freely suspended magnetic needle always rests in geographic north-south direction.

- An iron rod buried inside earth along N-S direction becomes a magnet.
- Neutral points exist inside the earth.
- A magnetic needle rests with its geometric axis making different angles with the horizontal at different places on earth.
- The two poles where the magnetic needle becomes vertical are called the magnetic poles and the line joining the two places where the magnetic needle becomes horizontal, is called the *magnetic equator.*
- The magnetic field lines of the earth are *normal t*o the earth's surface near the magnetic poles and *parallel* to the earth's surface near the magnetic equator.

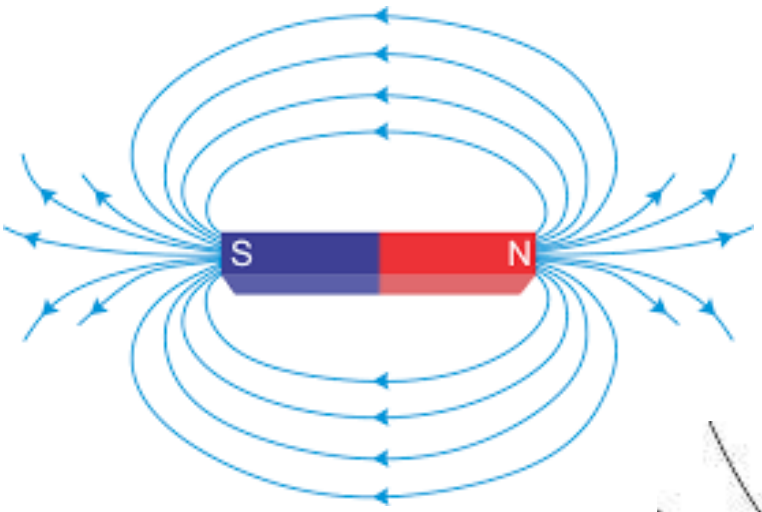
Plotting uniform magnetic field of earth



(a) Plotting a field line with a compass needle

(b) Lines of uiform magnetic field of earth

Plotting of non-uniform magnetic field of a strong bar magnet


S
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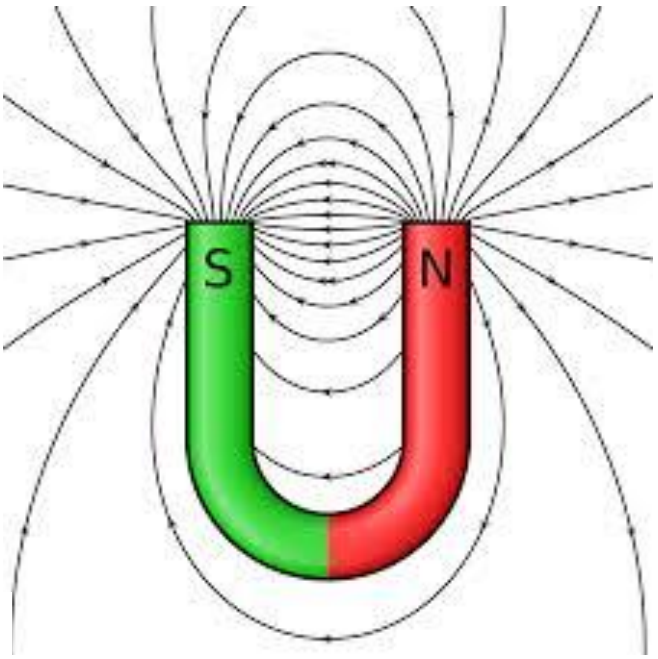
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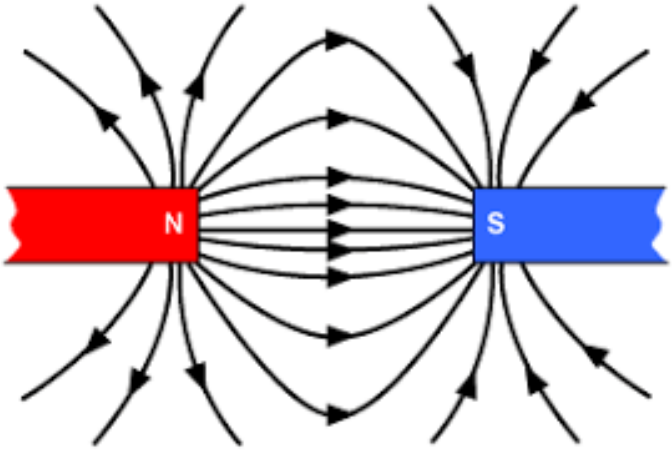
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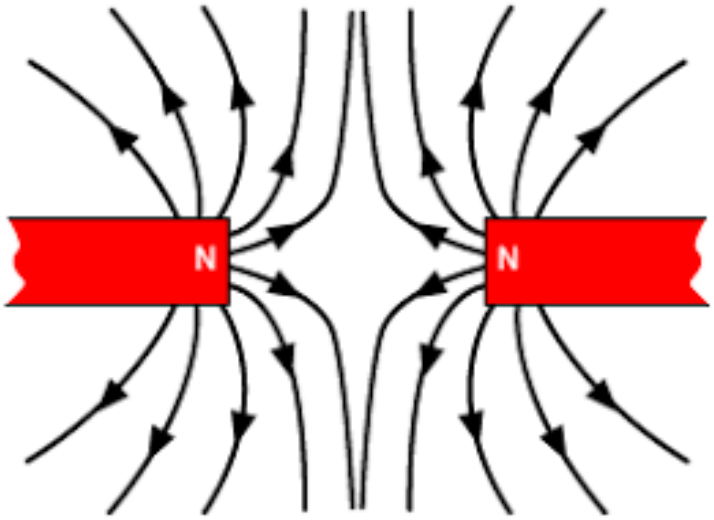
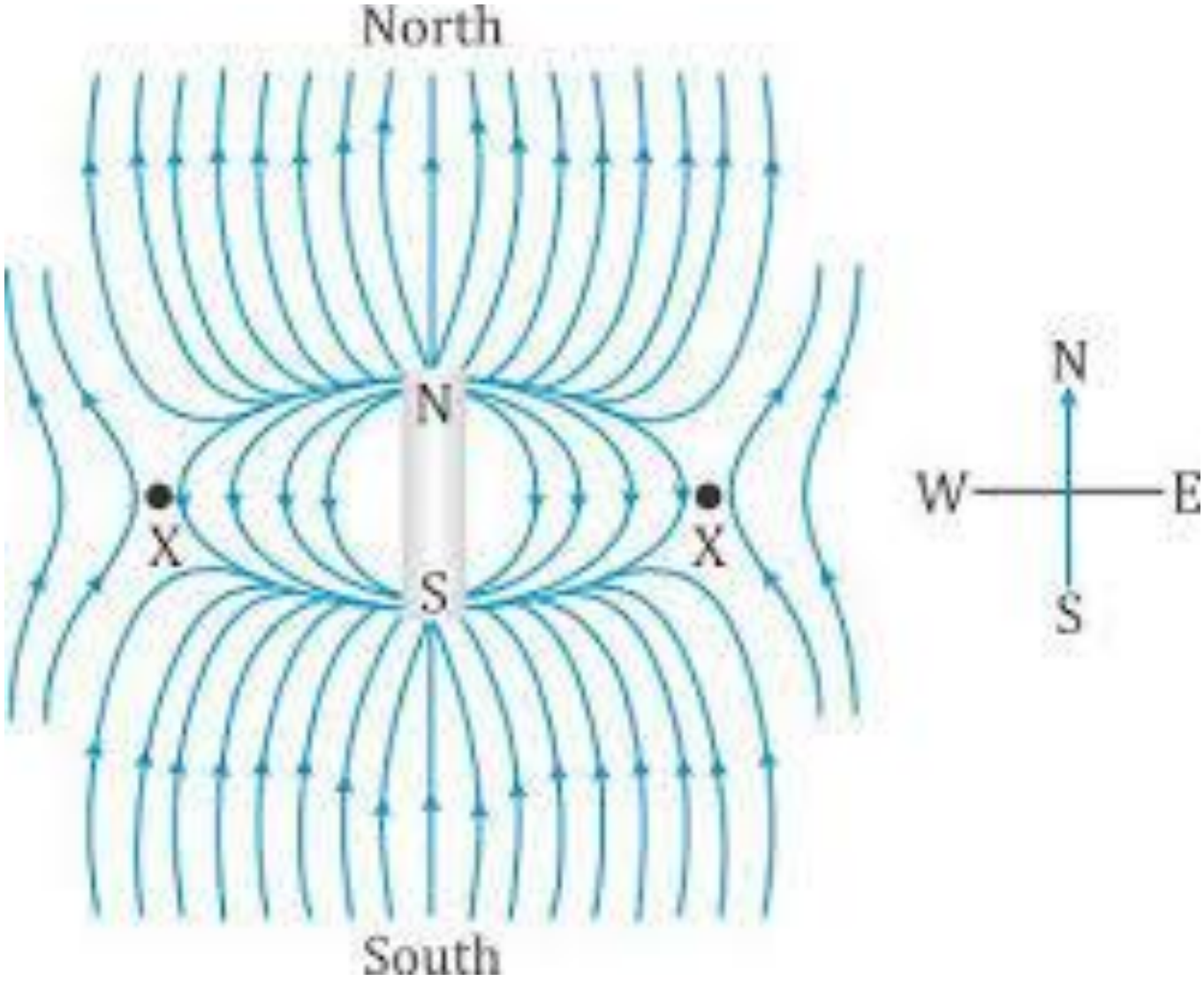
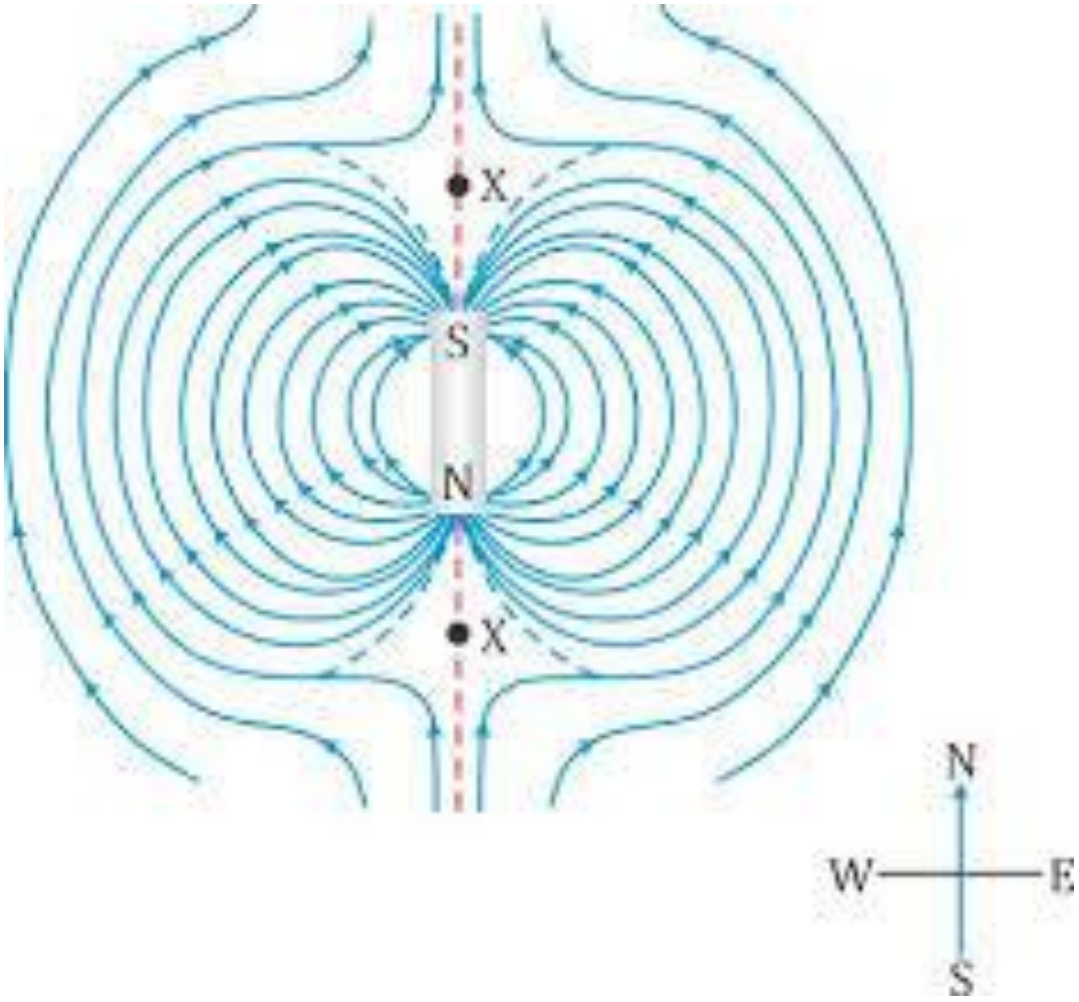

N
N

When the given magnet is placed with its north pole pointing towards north



When the given magnet is placed with its south pole pointing towards north



Neutral Points

- Neutral points are the points where the magnetic field of the magnet is equal in magnitude to the earth's horizontal magnetic field, but it in the opposite direction.
- Thus the resultant (or net) magnetic field at the neutral points is zero.
- When the magnet is placed with its north pole pointing towards north, neutral points are obtained in the east – west direction.
- When the magnet is placed with its south pole pointing towards north, neutral points are obtained in the north – south direction.
- Neutral points are situated symmetrically on either side of a magnet at equal distances from the centre of the magnet.