Magnetism

1. **What is a lodestone?**
   Ans. Lodestone is an ore of iron oxide (Fe_3O_4). This ore attracts small pieces of iron and it sets itself along a definite direction when it is suspended freely. It is a natural magnet which was used for the navigation by the mariners.

2. **What is a natural magnet? State two limitations of a natural magnet.**
   Ans. The pieces of lodestone found in nature are called the natural magnets. Limitations of a natural magnet are as listed below:
   i. They are irregular and odd shaped.
   ii. They are not magnetically very strong.

3. **What is an artificial magnet? State two reasons for the requirement of artificial magnets.**
   Ans. An artificial magnet is a magnetized piece of iron (or other magnetic material). Artificial magnets are required because natural magnets have odd and irregular shape and they are not magnetically very strong. Artificial magnets can be given desired shape and made very strong.

4. **How will you test whether a given rod is made of iron or copper?**
   Ans. Iron rod is magnetized when placed near a bar magnet by magnetic induction, while copper rod is not magnetized.

5. **You are provided with two similar bars; one is a magnet and the other is a soft iron. How will you distinguish between them without the use of any other magnet or bar?**
   Ans. A magnet when suspended freely will rest only in north-south direction, but the soft iron bar will rest in any direction.

6. **What is called Induced Magnetism?**
   Ans. The temporary magnetism acquired by a magnetic material when it is kept near (on in contact with) a magnet, is called induced magnetism.

7. **What is Magnetic Induction?**
   Ans. The process in which a piece of magnetic material acquires the magnetic properties temporary in presence of another magnet near it, is called Magnetic Induction.

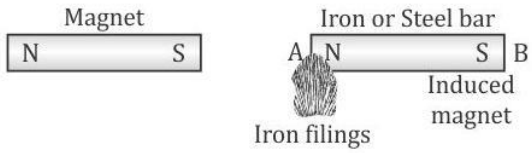
8. **What role does Magnetic Induction play in attraction of a piece of iron by a magnet?**
   Ans. When a piece of iron is placed near or in contact with a magnet, the piece of iron becomes a magnet i.e., it acquires the property of attracting iron filings when they are brought near its ends. Thus, a piece of iron behaves as a magnet as long as it is kept near (or in contact with) a magnet.

9. **Explain the mechanism of attraction of iron nails by a magnet when brought near them.**
Ans. When iron nails are brought near one end of a magnet, the nearer end of piece acquires an opposite polarity by magnetic induction. Since unlike poles attract each other, therefore, iron nails are attracted towards the end of the magnet. Thus, the iron nail first becomes a magnet by induction and then it is attracted.

10. **Explain the following:**
(a) When two pins are hung by their heads from the same pole of a magnet, their pointed ends move apart.
(b) Several soft iron pins can cling, one below the other, from the pole of a magnet.
(c) The north end of a freely suspended magnetic needle gets attracted towards a piece of soft iron placed a little distance away from the needle.

Ans. (a) When two pins are hung by their heads from the same pole of a magnet, they acquire same polarity. Because like poles repel each other, their pointed ends move apart.
(b) Several soft iron pins can cling one below the other from the pole of a magnet because the magnet induces magnetism in an iron nail which gets attracted by the magnet and clings to it. This magnetized nail magnetizes the other nail near it by magnetic induction and attracts it. This process continues until force of attraction on first nail is sufficient to balance the total weight of all nails in chain.
(c) When a piece of soft iron is placed a little distance away from the needle, the needle induces magnetism to the piece of soft iron. Thus, soft iron piece starts behaving like a magnet and it attracts the magnetic needle towards it.

11. **A small iron bar is kept near the north pole of a bar magnet. How does the iron bar acquire magnetism? Draw a diagram to show the polarity on the iron bar. What will happen if the magnet is removed?**
Ans. The iron bar acquires magnetism due to magnetic induction.
If the magnet is removed, the iron bar loses its magnetism.



12. **'Induced magnetism is temporary'. Comment on this statement.**
Ans. Induced magnetism is temporary as it lasts as long as the magnet causing induction remains in its vicinity.

13. **'Induction precedes attraction'. Explain the statement.**
Ans. When a piece of magnetic material is brought near a magnet, it first becomes a magnet by induction and then it is attraction. Thus, we say that induction precedes attraction.

14. What is Magnetic Field?

Ans. 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 the magnetic field of the magnet.
Magnetic Field is a Vector quantity.

15. What is Magnetic Field Line?

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

16. State the Properties of Magnetic Field Line.

Ans. Properties of magnetic field lines:

a. They are closed and continuous curves.
b. They are directed from the North Pole towards the South Pole outside the magnet.
c. The tangent at any point on a field line gives the direction of magnetic field at that point.
d. Two magnetic lines never intersect each other.
e. They are crowded near the poles of the magnet where the magnetic field is strong and are far separated near the middle of the magnet and far from the magnet, where the magnetic field is weak.
f. Parallel and equidistant field lines represent a uniform magnetic field. The earth's magnetic field is limited space is uniform.
g. They behave like stretched elastic rubber strings.

17. The Earth's magnetic field is based on which facts.

Ans. The existence of earth's magnetic field is based on the following facts,

i. A freely suspended magnetic needle always rests in geographic north-south direction.
ii. An iron rod buried inside the earth along north-south direction becomes a magnet.
iii. Natural points are obtained on plotting the field lines of a magnet where the net magnetic field is zero.
iv. The magnetic needle rests with its geometric axis making different angles with horizontal when suspended at different places on earth.

18. What are Magnetic Poles?

Ans. Two places where the magnetic needle becomes vertical are called Magnetic Poles.

19. What is Magnetic Equator?

Ans. The line joining the places where the magnetic needle becomes horizontal, is called Magnetic Equator.

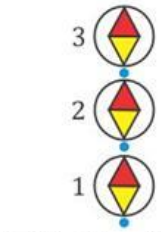
20. What is Magnetic Field Line?

Ans. The Magnetic Field Lines of the earth are normal to the earth surface near the magnetic poles and parallel to the earth surface near the magnetic equator.

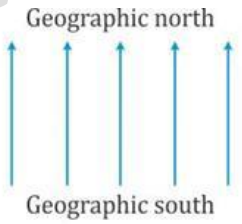
21. **Explain why iron filings which are sprinkled on a sheet of cardboard over a bar magnet take up a definite pattern when cardboard is slightly tapped.**
Ans. The iron filings take up a definite pattern (curved lines). This happens because each piece of iron filing becomes a magnet to the magnetic induction of the magnet. It thus experiences a force in the direction of magnetic field of the bar magnet at that point and aligns itself along curved lines.

22. **Can two magnetic field lines intersect each other? Give reason to your answer.**
Ans. No two magnetic field lines can intersect each other. If they do, there would be two directions of the field at that point which is not possible.

23. **Explain the method of plotting the magnetic field lines by using a small compass needle.**
Ans. Method of plotting the magnetic field lines using a compass needle:
Fix a sheet of paper on a drawing board by means of board pins. Place a small compass needle at position 1 as shown in fig (a) and looking from the top of the needle, mark two pencil dots exactly at two ends of the needle. Then move the compass needle to position 2 in such a way that one end of needle coincides with the second pencil dot. Repeat the process of moving the compass needle to positions 3, 4... to obtain several dots. On joining the different dots, you will get a straight line. Thus, one line of magnetic field of earth is traced.



(a) Plotting a field line with a compass needle



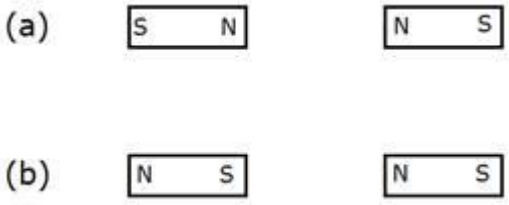
(b) Lines of uiform magnetic field of earth

This process is repeated starting from a different point and tracing out another line of magnetic field. In this manner, several lines of magnetic field can be drawn. Each line should be labelled with an arrow from the south pole of the needle towards the north pole to indicate the direction of the magnetic field. Fig (b) shows several magnetic lines so obtained.

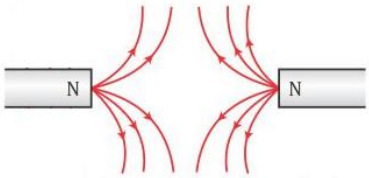
24. **What conclusion is drawn regarding the magnetic field at a point if a compass needle at that point rests in any direction? Give reason for your answer.**
Ans. It can be concluded that magnetic field at that point is zero. This is because the earth's magnetic field at that point is neutralized by the magnetic field of some other magnetized material.

25. **What is a neutral point? How is the position of neutral point located with the use of a compass needle?**
Ans. 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 is in opposite direction. Thus, the net magnetic field at the neutral points is zero.
Since the net magnetic field is zero at neutral points, the compass needle remains unaffected (i.e. it comes to rest pointing in any direction) at these points and hence, they can be detected.

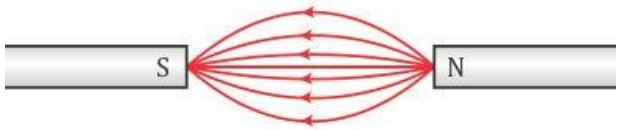
26. In following figure, draw at least two magnetic field lines between the two magnets.



Ans. In (a) The North Pole of two magnets is facing each other. So, the field lines will be



In (b) The North Pole of one magnet is facing the South Pole of the other. So, the field lines will be



27. State the positions of neutral points when a magnet is placed with its axis in the magnetic meridian and with its north pole (i) pointing towards the geographic north and (ii) pointing towards the geographic south.

Ans. (i) Neutral points will be in east-west direction.

(ii) Neutral points will be north-south direction.

28. What is Electromagnet?

Ans. An electromagnet is a temporary strong magnet made from a piece of soft iron when current flows in the coil wound around it. It is an artificial magnet.

29. Name the material used for preparing an electromagnet.

Ans. The material used for preparing an electromagnet is soft iron.

30. How is an electromagnet made?

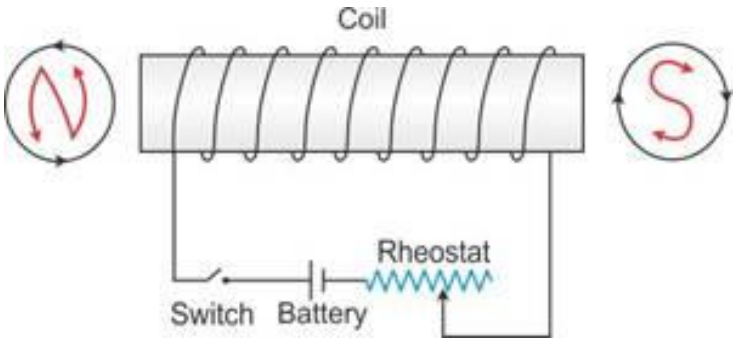
Ans. An electromagnet is made by winding an insulated copper wire around a soft iron core either in the shape of a solenoid or U-shape.

31. How can we increase the magnetic field of an electromagnet?

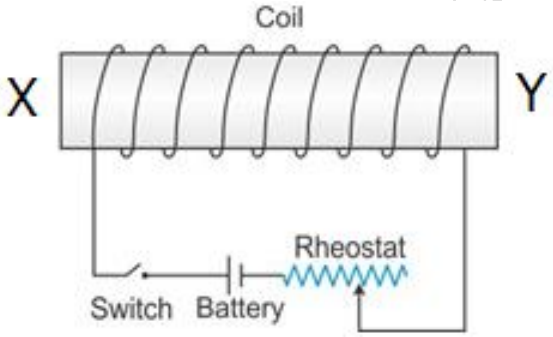
Ans. The magnetic field if an electromagnet can n=be increased by the following two ways:

a. By increasing the number of turns of winding in the solenoid,
b. By increasing the current through the solenoid.

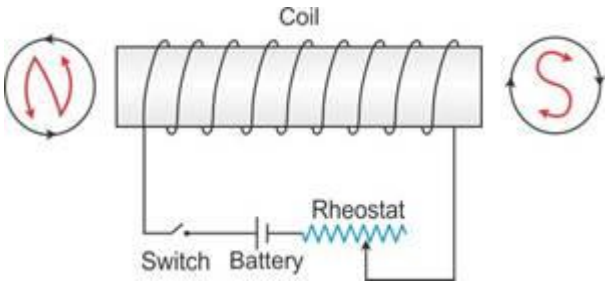
32. You are required to make an electromagnet from a soft iron bar by using a cell, an insulated coil of copper wire and a switch.
a. Draw a circuit diagram to represent the process.
b. Label the poles of the electromagnet.
Ans.



33. Following Figure shows a coil wound around a soft iron bar XY. (a) State the polarity at the ends X and Y as the switch is pressed. (b) Suggest one way of increasing the strength of electromagnet so formed.



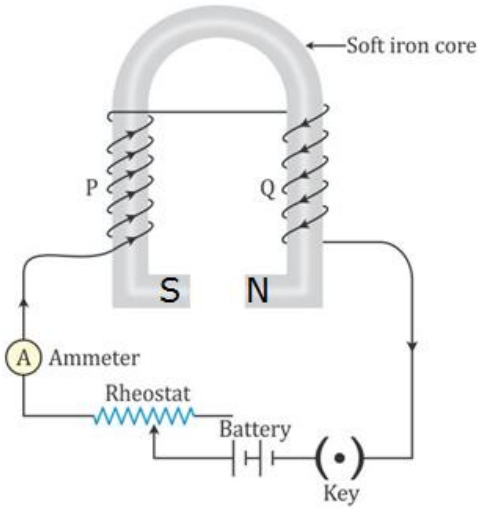
Ans.
The polarity at X is North and at Y is South.
By increasing the number of turns of winding in the solenoid, the strength of the electromagnet can be increased.



34. A coil of insulated copper wire is wound around a piece of soft iron and current is passed in the coil from a battery. What name is given to the device so obtained? Give one use of the device mentioned by you.
Ans. The device formed is an electromagnet.
Use:
For separating the magnetic substances such as iron from other debris.

35. Show with the aid of a diagram how a wire is wound on a U-shaped piece of soft iron in order to make it an electromagnet. Complete the circuit diagram and label the poles of the electromagnet.

Ans.



36. State two ways through which the strength of an electromagnet can be increased.

Ans. The strength of an electromagnet can be increased by following ways:

i. Increasing the number of turns of winding in the solenoid.
ii. ii. Increasing the current through the solenoid.

37. Name one device that uses an electromagnet.

Ans. The electromagnet is used in an electric relay.

38. State two advantages of an electromagnet over a permanent magnet.

Ans.

a. An electromagnet can produce a strong magnetic field.
b. The strength of the magnetic field of an electromagnet can easily be changed by changing the current in its solenoid.

39. What are the advantages of Electromagnet?

Ans. The advantages of Electromagnets are

i. An Electromagnet can produce strong magnetic field.
ii. The strength of magnetic field of an electromagnet can easily be changing the current in its solenoid.
iii. The polarity of electromagnet can be reversed by reversing the direction of current.

40. Why is soft iron used as the core of the electromagnet in an electric bell?

Ans. The soft iron bar acquires the magnetic properties only when an electric current flow through the solenoid and loses the magnetic properties as the current is switched off. Hence, soft iron is used as the core of the electromagnet in an electric bell.

41. Write the Difference between Electro Magnet and Permanent Magnet.

Ans.

Electro Magnet	Permanent Magnet
It is made of Soft Iron	It is made of Steel
It produces magnetic field so long as current flows in the coil i.e. produces temporary magnetic field.	It produces a permanent magnetic field.
The magnetic field strength can be changed	The strength of magnetic field cannot be changed.
Magnetic Field of Electro Magnet can be very strong.	The Magnetic Field of Permanent Magnet cannot be strong.
The polarity of an electromagnet can be reversed.	The polarity of a permanent magnet cannot be reverse.
It can easily be demagnetised by switching off the current.	It cannot be easily demagnetised.

42. How is the working of an electric bell affected, if alternating current be used instead of direct current?

Ans. If an a.c. source is used in place of a battery, the core of the electromagnet will get magnetized, but the polarity at its ends will change. Since attraction of armature does not depend on the polarity of the electromagnet, the bell will still ring on pressing the switch.

43. Name the material used for making the armature of an electric bell. Give a reason for your answer.

Ans. The material used for making the armature of an electric bell is soft iron which can induce magnetism rapidly.