Exercise-10(A) Page: 207

1. **What is a lodestone?**
   Solution:
   Lodestone is the first known magnet which is an ore of iron oxide (Fe_3O_4) found in large quantities in Magnesia, in Asia Minor. It was found to possess two properties:
   - It attracts small pieces of iron, and
   - It sets itself along a definite direction when it is suspended freely

2. **What is a natural magnet? State two limitations of a natural magnet?**
   Solution:
   Natural magnet are the pieces of lodestone found in nature.
   The limitations of a natural magnet are as follows:
   - They are not magnetically strong enough for use
   - They occur in irregular and odd shapes

3. **What is an artificial magnet? State two reasons why do we need artificial magnets?**
   Solution:
   It is a magnetized piece of iron or any other magnetic material. We need artificial magnets because of the following two reasons:
   - Natural magnets are not very strong magnetically, artificial magnets can be made strong
   - Natural magnets occur in odd and irregular shapes, artificial magnets on the other hand can be given desired shapes.

4. **How will you test whether a given rod is made of iron or copper?**
   [Hint: Iron rod gets magnetized when placed near a bar magnet by magnetic induction, while copper rod does not get magnetized]
   Solution:
   To test whether a given rod is made of iron or copper, simply place both the rods near a bar magnet. The iron rod gets magnetized when placed near a bar magnet due to magnetic induction while the copper rod does not get magnetized.

5. **You are provided with two similar bars, one is a magnet and the other is a soft iron bar. How will you distinguish between them without the use of any other magnet or bar?**
   [Hint: A magnet when suspended freely will rest only in north-south direction, but soft iron bar will rest in any direction]
   Solution:
   To distinguish between a magnet and soft iron bar, simply suspend both freely. A magnet will come to rest only in north-south direction whereas the soft iron bar will rest in any direction.

6. **Fill in the blanks to complete the sentences:**
   (a) Two ends of a magnet are called _____
   (b) Unlike poles of a magnet _____ each other
   (c) Like poles of a magnet _____ each other
   (d) A freely suspended magnet rests in the geographic _____ direction

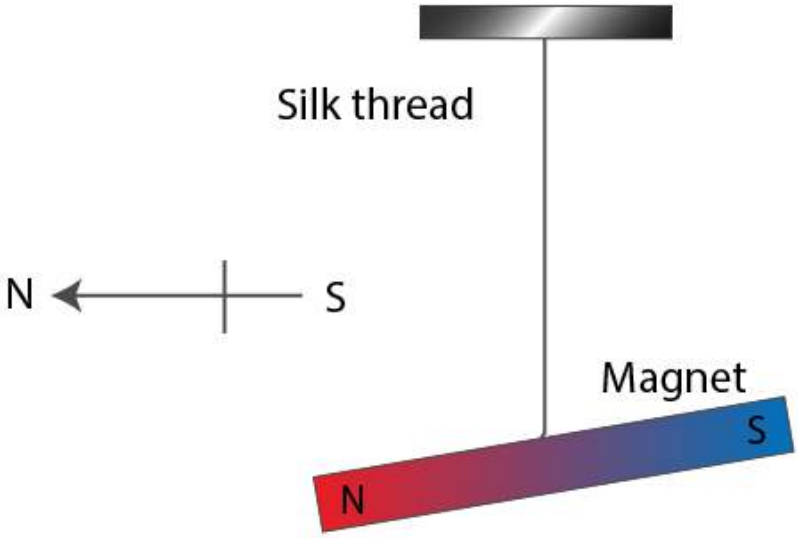
Solution:

(a) Poles
(b) Attract
(c) Repel
(d) North-south

7. **A small magnet is suspended by a silk thread from a rigid support such that the magnet can freely swing. How will it rest? Draw a diagram to show it.**

Solution:

When a magnet is suspended by a thread from a rigid support, and when it swings, it will rest in the geographic north-south direction, with the north pole being towards the geographic north, intending some angle with the horizontal as observed in the figure.



8. **Explain the term induced magnetism.**

Solution:

It is the temporary magnetism acquired by a magnetic material when it is placed near a magnet.
When an unmagnetized bar of a magnetic material is placed near a magnet, the bar turns into a magnet. It acquires the property of attracting iron fillings when brought near its ends. The bar tends to lose its magnetism when the magnet is removed.

9. **Explain what do you understand by magnetic induction. What role does it play in attraction of a piece of iron by a magnet?**

Solution:

Magnetic induction is a process in which a piece of magnetic material acquires the magnetic properties temporarily in the presence of another magnet near it.
When a piece of iron is placed in proximity of a magnet, the piece of iron turns into a magnet. It obtains the property to attract iron fillings when brought closer to it. Therefore, the piece of iron acts like a magnet for as long as it is placed in contact with the magnet.

10. Explain the mechanism of attraction of iron nails by a magnet when brought near them.

Solution:

A magnetic pole induces an opposite polarity on the near end and a similar polarity on the further end of the iron bar, hence when an iron piece is placed close to one end of a magnet, the end of the piece that is near the magnet acquires an opposite polarity through the process of magnetic induction. As unlike poles attract each other, the piece of iron is attracted towards the end of the magnet. Therefore, the iron piece first becomes a magnet through induction and then it gets attracted i.e., induction precedes attraction.

11. 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.

Solution:

(a) This occurs because like poles repel each other. Hence, their pointed ends move apart.

(b) It is because the magnet induces magnetism in the iron nail that gets attracted by the magnet and grips to it. The magnetized nail tends to magnetize other nails around it through the process of magnetic induction and thereby attracts it. The process continues unless the force of attraction on the first nail manages to balance the net weight of all the nails in the chain.

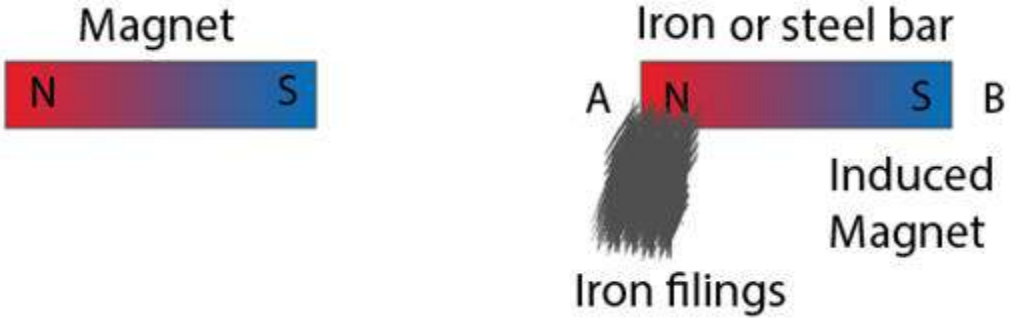
(c) The needle induces magnetism on the piece of soft iron when it is places at some distance from the needle. Consequently, the iron piece acts like a magnet, attracting the magnetic needle towards it.

12. 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?

Solution:

Due to the process of magnetic induction, the iron bar acquires magnetism.

The diagram shows the polarity on the iron bar.



The iron bar will lose its magnetism if the magnet is removed.

13. 'Induced magnetism is temporary'. Comment on this statement.

Solution:

Induced magnetism is temporary because the magnetism lasts as long as the magnet is around causing induction.

14. 'Induction precedes attraction'. Explain the statement.

Solution:

Induction precedes attraction as when a magnetic material is placed near a magnet, it becomes a magnet first through the process of induction and then it is attracted.

15. What do you understand by the term magnetic field lines?

Solution:

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

16. State four properties of magnetic field lines.

Solution:

The four properties of magnetic field lines are as follows:

- They are closed and continuous curves
- They are directed from the north pole outside the magnet towards the south pole of the magnet
- The tangent at any point on a field line gives the direction of magnetic field at that point.
- Parallel and equi-distant filed lines represent a uniform magnetic field. The earth's magnetic field in a limited space is uniform.

17. Explain why iron fillings which are sprinkled on a sheet of cardboard placed over a bar magnet, take up a definite pattern when cardboard is slightly tapped.

Solution:

The iron fillings when sprinkled on a sheet of cardboard placed over a bar magnet take up a definite pattern(curved lines) when the cardboard is slightly tapped because every piece of the iron filling turns into a magnet due to the process of magnetic induction of the magnet. Hence, they experience a force in the direction of magnetic field of the bar magnet at that point and lines up along the curved lines.

18. Explain the method of plotting magnetic field lines by using a small compass needle.

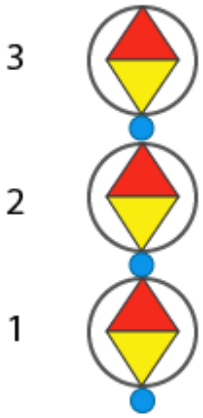
Solution:

The method explained below shows the plotting of magnetic field lines with the help of a small compass needle:

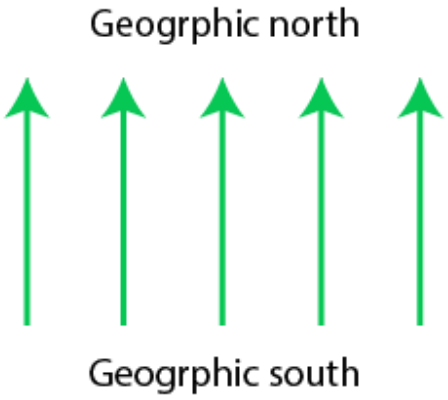
Procedure:

- With the help of some board pins, fix a sheet of paper on a drawing board
- At point 1 as seen in the figure, place a small compass needle. From the top of the needle, mark two pencil dots at exactly two ends of the needle
- Move the needle to the compass to point 2 so that one end of the needle coincides with the second pencil dot
- The process of moving the compass needle to points 3, 4, 5… is continued in order to get a few dots
- When various dots are joined, a straight line is obtained

- Hence, one line of magnetic field of earth is traced.



(a) Plotting a field line with a compass needle



(b) Lines of uniform magnetic field of earth

Starting from a different point, the process is repeated and another line of magnetic field is traced out. This way a few several lines of magnetic field can be traced out. Every line is required to be labelled with the help of an arrow from the south pole of the needle towards the north pole to represent the direction of the magnetic field. The figure below depicts several magnetic lines that are obtained this way.

19. Can two magnetic field lines intersect each other? Give reason to your answer.

Solution:

No, two magnetic field lines do not intersect each other. If they would intersect, there would be two directions of the field at the specific point which is not possible.

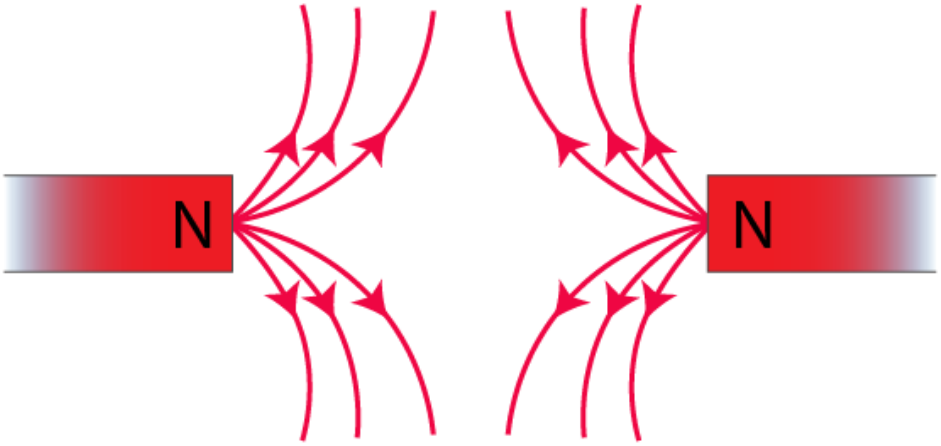
20. In figure, draw at least two magnetic field lines between the two magnets.

(a) S N N S

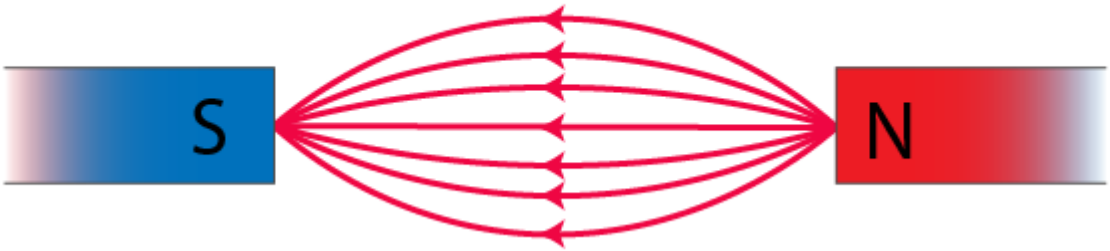
(b) N S N S

Solution:

(a) Since the north poles of both the magnets are facing each other, they repel. Hence the magnetic field lines would look like this



(b) Since the north and south poles of two different magnets are facing each other, the magnets attract each other. The magnetic field lines hence would appear like this:



21. State two evidences of the existence of earth's magnetic field.

Solution:

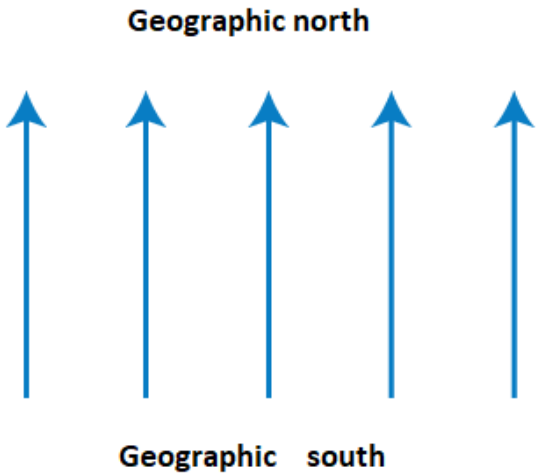
The two evidences of the existence of earth's magnetic field are:

- When a magnetic needle is suspended freely, it always comes to rest in the north-south direction
- In order to obtain neutral points, field lines of a magnet can be plotted

22. Sketch four magnetic field lines as obtained in a limited space on a horizontal plane in the earth's magnetic field alone.

Solution:

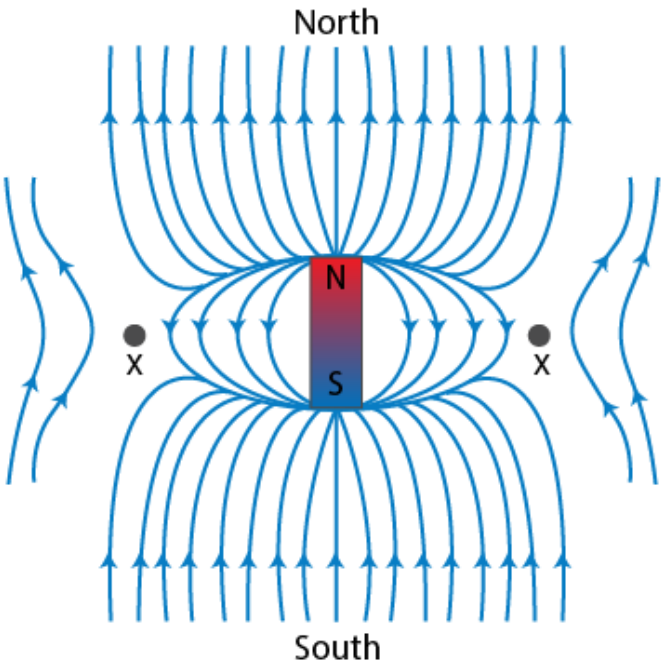
Four magnetic field lines as obtained in a limited space on a horizontal plane in the earth's magnetic field alone are as sketched below:

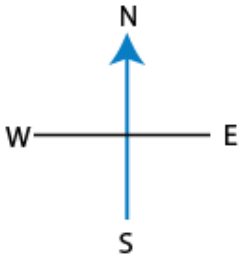


23. (a) Draw the pattern of magnetic field lines near a bar magnet placed with its north pole pointing towards the geographic north. Indicate the position of neutral points by marking x.
(b) State whether the magnetic field lines in part (a) represent a uniform magnetic field or non-uniform magnetic field?

Solution:

(a) The position of neutral points are as follows:





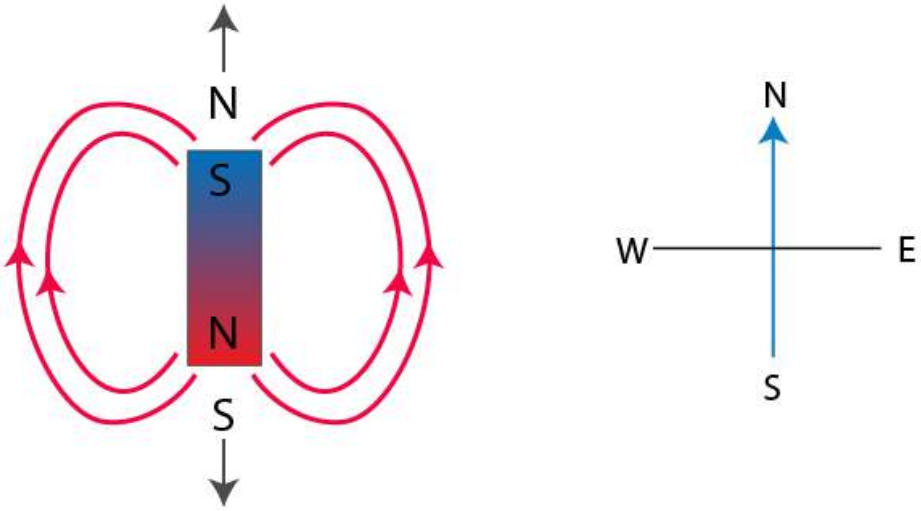
(b) The magnetic field lines as shown in part (a) are non-uniform.

24. Figure shows a bar magnet placed on the table top with its north pole pointing towards south. The arrow shows the north-south direction. There are no other magnets or magnetic material nearby.

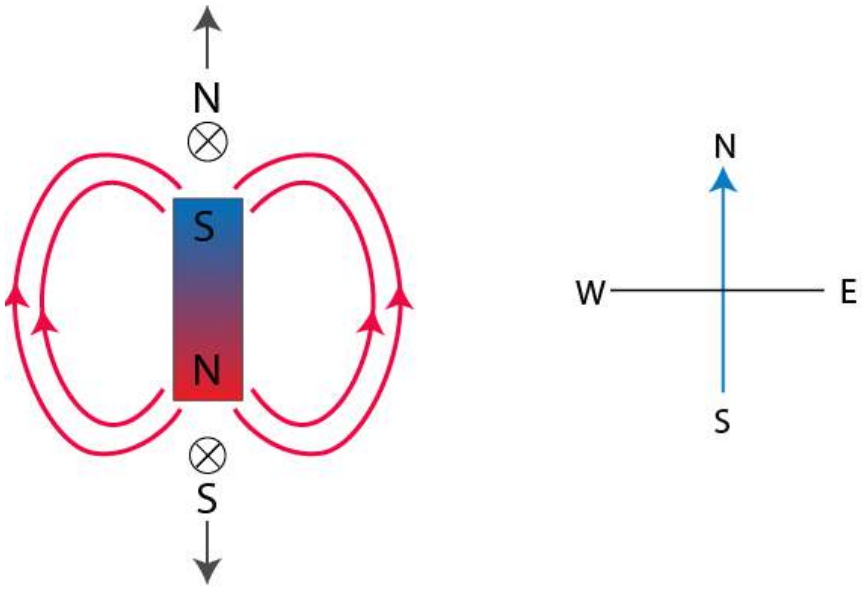
(a) Insert two magnetic field lines on either side of the magnet using arrow head to show the direction of each field line.
(b) Indicate by crosses, the likely position of the neutral points.
(c) What is the magnitude of the magnetic field at each neutral point? Give a reason for your answer.

Solution:

(a) The figure is as shown



(b) The likely position of the neutral points are as shown:



(c) At neutral points, the magnitude of magnetic field is zero as at these points the magnetic field of the magnet is the same as the magnitude of the earth's horizontal magnetic field, but is the opposite in direction thereby cancelling each other.

25. 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.

Solution:

It can be inferred that the magnitude of the magnetic field at that particular point is zero as the magnetic field of the earth at that point is neutralized by the magnetic field of any other magnetized material.

26. What is a neural point? How is the position of a neutral point located with the use of a compass needle?

Solution:

Neutral points are the points at which two magnetic fields are equal in magnitude, but opposite in direction. The net magnetic field at a neutral point is zero. When a compass needle is placed at the neutral point, it will come to rest in any direction, hence the position of a neutral point can be detected with the help of a compass.

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, (ii) pointing towards the geographic south.

Solution:

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 – in east-west direction

(ii) Pointing towards the geographic south – in north-south direction

28. Complete the following sentences:

(a) If the field lines in a magnetic field are parallel and equidistant, the magnetic field is _____

(b) At a neutral point, the resultant magnetic field is _____

(c) The neutral points of a bar magnet kept with its north pole pointing towards geographic north are located _____

Solution:

(a) Uniform

(b) Zero

(c) On either side of the magnet on east and west

Multiple choice type:

1. Two like magnetic poles:

(a) Repel each other

(b) Attract each other

(c) First attract each other, then repel

(d) Neither attract nor repel

Solution:

(a) Repel each other

It is the property of magnets wherein like poles repel each other while unlike poles of two different magnets attract each other.

2. In a uniform magnetic field, the field lines are:

(a) Curved

(b) Parallel and equidistant straight lines

(c) Parallel, but non-equidistant straight lines

(d) Nothing can be said

Solution:

(b) Parallel and equidistant straight lines

The earth's magnetic field in a limited space is uniform.

Exercise-10(B) Page: 211

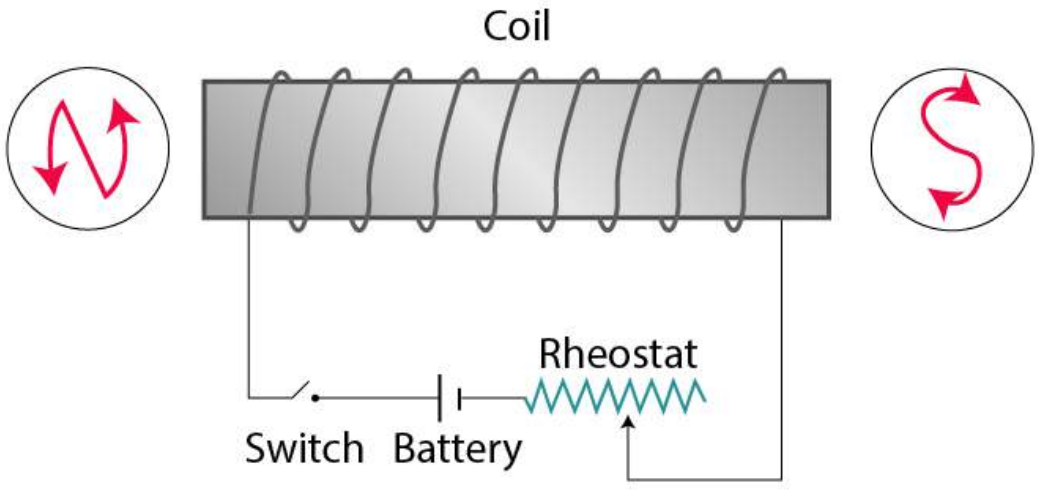
1. **What is an electromagnet?**
   Solution:
   An electromagnet is a temporary strong magnet made from a piece of soft iron when current flows in the coil wound around it. It is an artificial magnet.

2. **Name the material used for preparing an electromagnet.**
   Solution:
   The material used for preparing an electromagnet is a piece of soft iron.

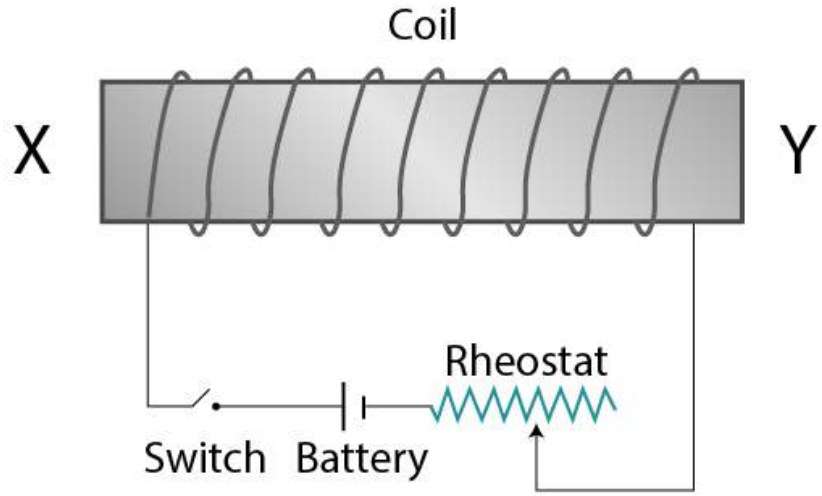
3. **How is an electromagnet made? Name two factors on which the strength of the magnetic field of an electromagnet depends.**
   Solution:
   An electromagnet can be made in the following two shapes:
   - I-shape or bar magnet
   - U-shape or horse-shoe magnet
     The principle behind making both the magnets is the same. An electromagnet can be made by winding an insulated copper wire over a piece of soft iron in U-shape or a solenoid

   The two factors on which the strength of the magnetic field of an electromagnet depends are as follows:
   - It is dependent upon the number of turns of the wire wound over the coil
   - It is also dependent upon the current flowing through the wire

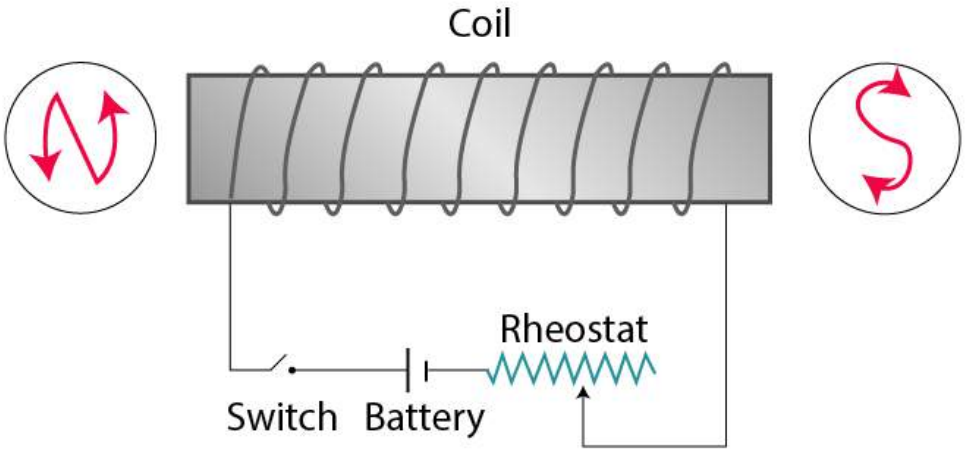
4. **You are required to make an electromagnet from a soft iron bar by using a cell, an insulated coil of copper wire and a switch. (a) Draw a circuit diagram to represent the process. (b) Label the poles of the electromagnet.**
   Solution:
   The labelled circuit is as follows:



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



Solution:



(a) The polarity at the ends are as follows:
X – south pole
Y – north pole

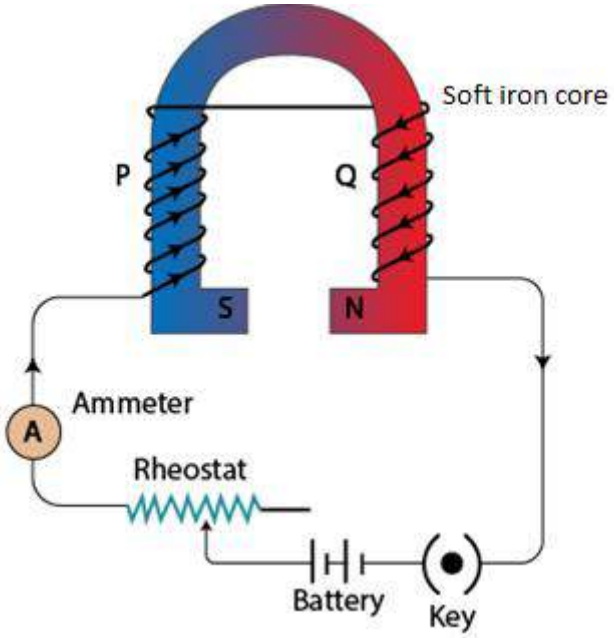
(b) One way to increase the strength of the electromagnet is by increasing the flow of current in the coil.

6. 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.

Solution:

The device so obtained can be named as an electromagnet.
One application of electromagnet is as follows:
Electromagnets are used in electrical devices such as telegraph, electric bell, microphone, loud speaker etc.

7. **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.**
Solution:
The diagram is as follows:



8. **State two ways through which the strength of an electromagnet can be increased**.
Solution:
The strength of a magnet can be increased by the following two ways:
- Increase the number of turns of windings in the solenoid
- Increase the flow of current through the solenoid

9. **Name one device that uses an electromagnet.**
Solution:
A device that uses an electromagnet is a loud speaker.

10. **State two advantages of an electromagnet over a permanent magnet.**
Solution:
Two advantages of an electromagnet over a permanent magnet are listed below:
- In comparison with a permanent magnet, an electromagnet can produce a stronger magnetic field.
- Unlike a permanent magnet, the strength of the magnetic field of an electromagnet can easily be changed by altering the flow of current in its solenoid.

11. State two differences between an electromagnet and a permanent magnet.

Solution:

The two differences are as follows:

Electromagnet	Permanent magnet
Made using soft iron	Made using steel
Produces temporary magnetic field	Produces a permanent magnetic field

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

Solution:

Soft iron can obtain magnetic properties when an electric current flows through the solenoid and has a tendency to lose magnetic properties when it is devoid of any electric current. This is the reason why soft iron is used as the core of the electromagnet in an electric bell.

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

Solution:

If alternating current is used instead of direct current in an electric bell then the core of the electromagnet will get magnetized, the polarity at the ends will change. As polarity of the electromagnet and attraction of armature are not dependent on each other, upon pressing the switch, the bell will continue to ring.

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

Solution:

Soft iron is the material used for making the armature of an electric bell as soft iron has the property to induce magnetism quickly.

Multiple Choice Type

1. Electromagnets are made up of:

(a) Steel
(b) Copper
(c) Soft iron
(d) Aluminum

Solution:

(c) Soft iron

Soft iron can obtain magnetic properties when current flows through the solenoid.

2. The strength of an electromagnet can be increased by

(a) Reversing the directions of current
(b) Using alternating current of high frequency
(c) Increasing the current in the coil
(d) Decreasing the number of turns of coil

Solution:

(c) Increasing the current in the coil

The strength of electromagnet can also be increased by increasing the number of turns of winding in the solenoid.