UNIT 2

Magnetic Effect of Electric Current

23/07/2020 – Class 11

Assignments Answer

1. Current is passed from South to North through a conductor placed below a freely pivoted magnetic needle.

a) To which direction will the North Pole of the magnetic needle turn? **Towards East**

b) Which is the rule used to arrive at this inference? **Maxwell's Right hand Thumb Rule**

c) State the rule.

Imagine you are holding a current carrying conductor with the right hand in such a way, that the thumb points in the direction of the current. The direction in which the other fingers encircle the conductor gives the direction of the magnetic field.

d) If the current flows in the conductor in the East West direction, what do you guess about the deflection of the magnetic needle? Explain.

The needle will not deflect. This is because both the magnetic fields (magnetic fields formed on the conductor and the magnetic needle) are parallel to each other.

Magnetic field formed around a circular loop

Activity 1.a

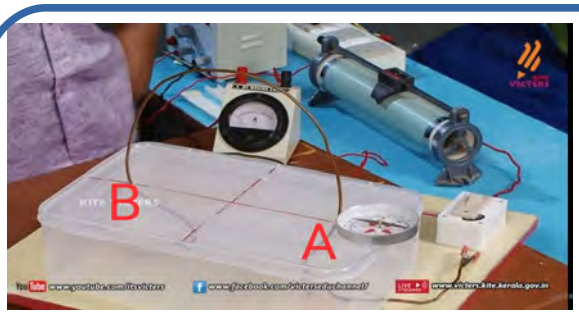
Bend the straight conductor in the shape of a loop. It is arranged such a way that the plane of the loop and the magnetic needle are parallel to each other. The poles of the magnetic needle are marked on the figure.

Discussion

When placed on a horizontal surface, magnetic needle is aliened in which direction? **North south (**north pole pointing to north and south pole to south**)** Which rule is used to find the direction of the magnetic field formed around a current carrying conductor? **Maxwell's Right Hand Thumb Rule.**

Activity 1.b

Magnetic compass is placed at at the end A. Switch on the circuit, so that current is flowing from A to B. Observe the deflection of the North pole of the magnetic needle.



Switch is turned on

Observation

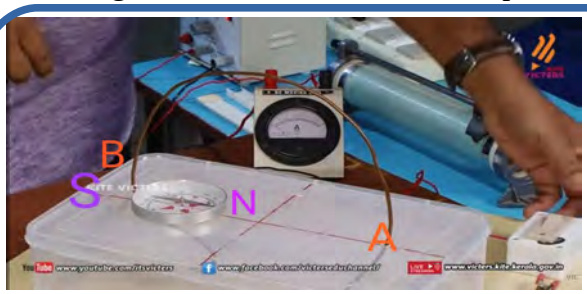
- When current is passed through the loop north pole of the magnetic needle deflects in the anticlockwise direction.
- When current is increased magnetic needle is deflected more.

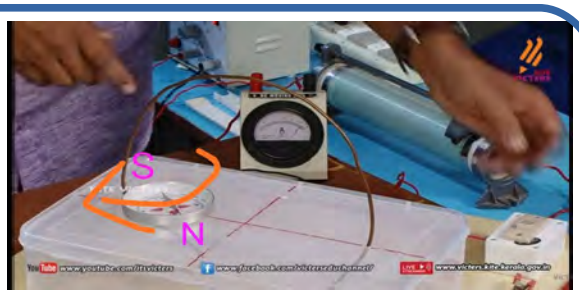
Discussion

- What is the direction of the current through the loop? **From A to B** (Clockwise direction when observing from the side of the teacher)
- North pole of the magnetic needle deflects towards which direction? **Anticlockwise**
- What is the direction of magnetic field formed on the coil? **Into the coil**

Activity 1.c

Now place the magnetic compass as shown in the figure. Observe the deflection of the north pole of the magnetic needle, when current is passed from A to B.





Switch is turned on

Observation

North pole of the magnetic needle deflected in the clockwise direction.

Activity 1.d

Observe the pictures. Maxwell's Right Hand Thumb rule is applied here.

Discussion

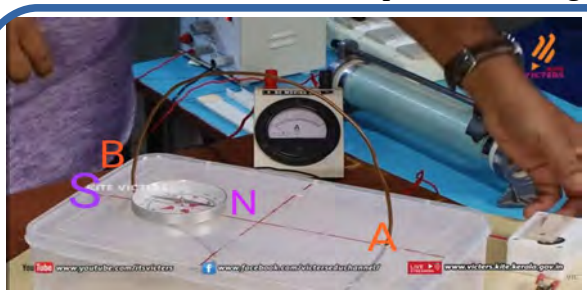
- What is the direction of current through the loop? **From A to B (**clockwise – When observed from the side of the teacher)
- What is the direction of magnetic field formed around the loop? **Into the coil**

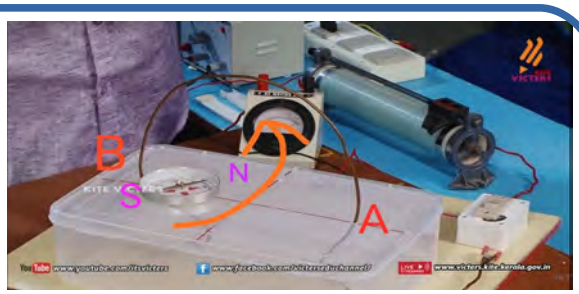
Inference

If current is in clockwise direction, magnetic field lines are – into the coil

Activity 2.a

Change the direction of current. Now current is flowing from B to A. Switch on the circuit and observe the deflection of north pole of the magnetic needle.





Switch is turned on

Observation

North pole of the magnetic needle deflected in the anticlockwise direction.

Discussion

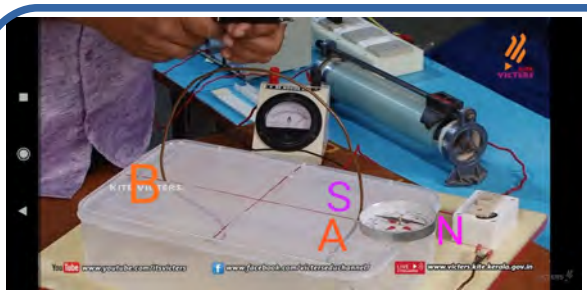
- What is the direction of current through the loop? **From B to A** (Anticlockwise – When observed from the side of the teacher)
- What is the direction of magnetic field formed around the loop? **Out from the coil**

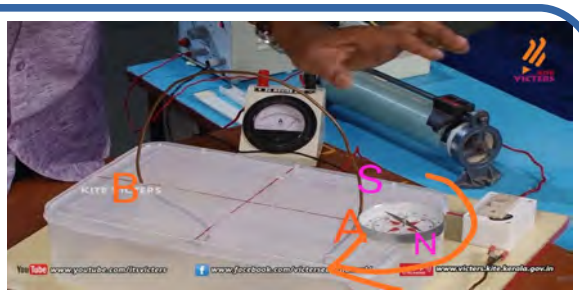
Inference

If current is in anticlockwise direction, then magnetic field lines are –out from the coil

Activity 2.b

Repeat the experiment by placing the magnetic compass at the end A. Direction of current is from B to A





Switch is turned on

Observation

North pole of the magnetic compass is deflected in the clockwise direction.

Discussion

- What is the direction of the current? **From B to A (Anticlockwise)**
- What is the direction of the magnetic field? **Out from the coil**

Activity 3

Place a magnetic compass near the North pole of a bar magnet. Then the compass is moved towards the south pole.

Observation

- South pole of the magnetic needle is attracted towards the North pole of the bar magnet.
- North pole of the magnetic needle is attracted towards the South pole of the bar magnet.

Discussion

- What is the direction of the magnetic field outside a bar magnet? **From North to South**
- What is the direction of the magnetic field inside a bar magnet? **From South to North**
- Magnetic lines of force comes out from which Pole? **North**
- Magnetic lines of force enters into the magnet through which pole? **South**

Inferences

Magnetic lines of force is comes out from the north pole of the magnet and enters through the south pole.

Discussion

- When current is in clockwise direction through a coil, what is the direction of magnetic field formed? **Into the coil.**
- If the magnetic field is into the coil, which pole is there? **South**
- When current is in anticlockwise direction through a coil, what is the direction of magnetic field formed? **Out from the coil.**
- If the magnetic field is out from the coil, which pole is there? **North**
- When current is in clockwise direction, which pole is formed on that side of the coil? **South**
- When current is in anticlockwise direction, which pole is formed on that side of the coil? **North**

Inferences

The end of the coil at which current flows in the clockwise direction will be the South Pole and the end at which current flows in the anticlockwise direction will be the North Pole.

Activity 4

Discussion

- In the first experiment, what happened to the magnetic needle when current is increased? **Magnetic needle deflected more.**
- What is the reason for that? **Strength of the magnetic field is increased.**
- Name a factor which influences the strength of the magnetic field formed around the coil? **Current**

Inferences

When the current is increased the strength of the magnetic field formed around the coil is also increased.

Activity 5.a

Keep a current carrying circular conductor vertically in the North South direction. Pass electricity through the coil. Observe the deflection produced on the magnetic needle.

Observation

- When current is passed through the coil, magnetic needle deflected.
- When current is increased magnetic needle is deflected more
- When the direction of current changes, magnetic needle deflected in the opposite direction.

Activity 5.b

Move the compass along the vertical line in both directions away from the centre of the coil. Find the points at which the magnetic effect of the coil is vanished. At that points magnetic needle will come to rest in the North South direction.

Discussion

- While moving away from the centre of the coil, what happened to the deflections in the magnetic needle? **Deflection is decreasing**
- What is the reason for that? **Strength of the magnetic field is decreasing**.
- When the magnetic effect of the coil is vanished, what is the position of the magnetic needle? **North South direction.**
- Name the points in which the magnetic effect of the coil is vanished? **Null Points** (At that points both the magnetic fields are equal and opposite)
- When current is increased what happened to the distance to the null points? **Increased.**

Inference

When the intensity of the current is increased the strength of the magnetic field produced in the coil will also increased.

Activity 6

Arrange coils and a magnetic compass as shown in the figure. Switch on the circuit and observe the deflection on the magnetic needle.

One turn in the coil

Two turns in the coil

Observation

- When current is passed, magnetic needle is deflected.
- Needle deflected more when two turns are used in the coil.

Inference

When number of turns is increased, the strength of the magnetic field is also increased.

Conclusion

Strength of magnetic field around a current carrying coil depends on

- Number of turns
- Intensity of current.

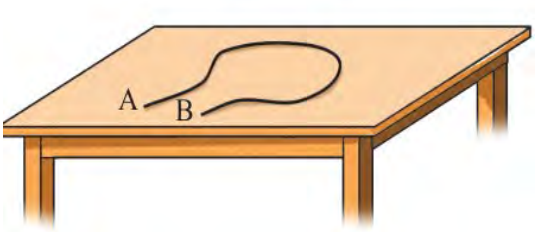
Assignments

1. The figure shows an insulated copper wire AB made into a coil. Suppose current flows from A to B through this.

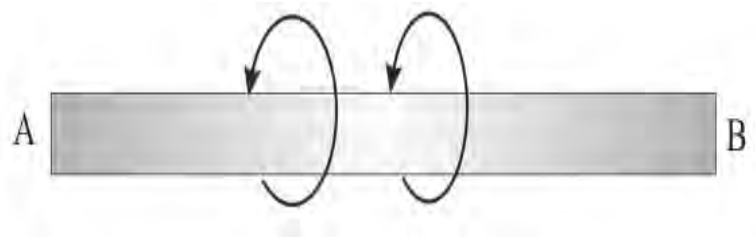
a) What will be the direction of electron flow through it?

b) Can you find out the direction of the magnetic field around the conductor AB? State the rule that substantiates this.

c) Explain how you can find out the direction of the magnetic field inside the coil?



2.The magnetic field around the current carrying conductor AB is depicted.



Based on the Maxwell s Right Hand Cork Screw Rule find out the direction of current and record it.