CHAPTER.3. ELECTROMAGNETIC INDUCTION

Video Class.1 & Video Class.2

Electromagnetic induction is the phenomenon of inducing an emf/electric current in a coil when magnetic flux linked with it is changed. The current and voltage so produced are called induced current and induced emf respectively.

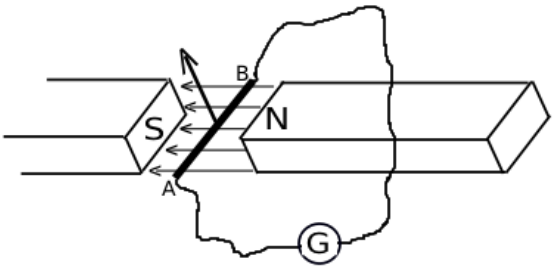
Methods to increase induced current.

*** Use powerful magnet. * Increase number of turns of the solenoid. * Increase the relative motion between magnet & solenoid.**
(Rate of change in flux is increased)

Fleming's right hand rule.

It is the rule for finding out direction of induced current.

Stretch the forefinger, middle finger and the thumb of the right hand in mutually perpendicular direction. If the forefinger represents the direction of magnetic field, and the thumb represents the direction of motion of the conductor, then, the middle finger represents the direction of the induced current.



Explanation:As in figure, arrange the north& south pole of the magnet face to face on a table. Insert a conducting wire 'AB' in between the poles as its length is perpendicular to the axes of the magnets. The ends of the conductor 'AB' are connected to a sensitive galvanometer. If the conductor is quickly raised vertically up, the direction of induced current through the wire will be from B to A. (When stretch out your forefinger and thumb of right hand according to the Fleming's right hand rule, the middle finger will be directing from B to A).
Similarly, if the conductor AB moves downwards, the current will be from A to B.

Alternating Current(AC) & Direct Current (DC)

A current that continuously flows only in one direction is direct current. The current obtained from a cell is direct current. If the direction of current changes at regular interval of time, the current is alternating current. It is AC we get in our house from distribution line.

PRACTICE QUESTIONS & ANSWERS

1. How is Fleming's right hand rule beneficial to us?
Answer: With the help of this law, we can predict the direction of induced current.
2.The process of inducing emf in a conductor due the change in magnetic flux linked with it is electromagnetic induction.
a. Name the scientist who discovered this phenomenon.
b. List out the materials required for the experimentation of this phenomenon.
c. Suggest two methods to increase induced emf.
d. Give the names of two devices works on this principle.
Answer: a. Michael Faraday.
b. Bar magnet, coil made of insulated copper wire, Galvanometer.
c. Use powerful magnet, increase turns of the coil, increase the speed of magnet or coil.
d. Generator and Moving coil microphone.
3. The direction of earth's magnetic field is from south to north. If a conductor aligned along east-west direction is allowed to fall free, a current will be induced in it.
a. What will be direction of current induced in the conductor?
b. State the law that helps to detect the direction of the induced current.
Answer:a. The current through the conductor is from west to east direction. (Stretch out right forefinger along north and thumb vertically downward, then middle finger will be towards east)
b. Fleming's right hand rule: Stretch the forefinger, middle finger and the thumb of the right hand in

mutually perpendicular direction. If the forefinger represents the direction of magnetic field, and the thumb represents the direction of motion of the conductor, then, the middle finger represents the direction of the induced current.

4. The direction of magnetic field lines is …..... (From north pole to the south pole / From south pole to the north pole)

Answer: From north pole to the south pole.

5. The experimental arrangement in respect of electromagnetic induction is shown in the figure.

a. Which device is used here to know the presence of induced current?

b. "In this experiment, when the magnet is kept stationary inside the coil, current is not induced as there is no magnetic flux linked with the coil." Comment to this statement.

c. "When magnet is moved towards the coil, current is induced. But current is not induced when coil is moved towards magnet instead." Do you agree to this statement. Explain.

Answer:a. Galvanometer.

b. The statement is incorrect. The non induction of current is not due to the absence of magnetic field but due to the absence **variable magnetic field**.

c. This statement is wrong. In both situations, current will be induced.

6. Rasheed and Shinoj are demonstrating an experiment on electromagnetic induction.

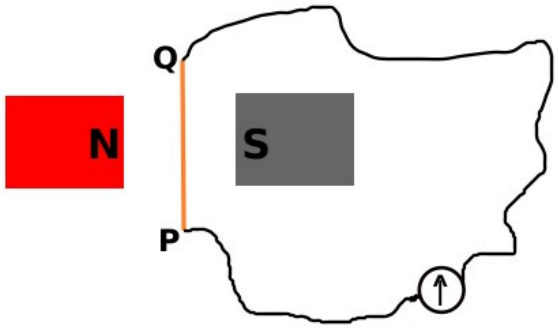
a. What might be the device they use for detecting the presence of induced current?

b. If they use a torch bulb instead of galvanometer, will the experiment be success? Justify.

c. On the basis of experimental observation, what might be their suggestions to make available more current from a generator?

Answer: a. Galvanometer. b. As the magnitude of induced current is very small, it may not be sufficient to make light the bulb. c. Use powerful magnet, increase number of turns of the armature, increase the rotational speed of armature or field magnet.

7. A conductor PQ is placed in a plane in between two magnetic poles as shown. If the conductor is moved up perpendicular to the plane, what will be the direction of induced current.



Ans. When the fingers are stretched according to the Fleming's Right Hand Rule, the middle finger will be along PQ. Hence the current through the conductor will be from P to Q.