MAGNETIC EFFECT OF ELECTRIC CURRENT
Law of Electromagnetic Induction

Faraday's Laws of Electromagnetic Induction:

Faraday formulated the following two laws of electromagnetic induction:

(i) Whenever there is a change in magnetic flux linked with a conductor, an e.m.f. is induced. The induced e.m.f. lasts so long as there is a change in magnetic flux cut by the conductor.

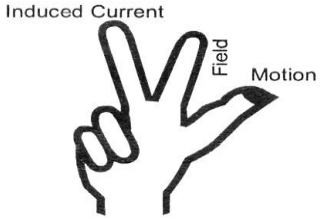
(ii) The magnitude of the e.m.f. induced is directly proportional to the rate of change of magnetic flux cut by the conductor. If the rate of change of magnetic flux remains uniform, a steady e.m.f. is induced. If the circuit of conductor is closed, a current flow in the conductor due to the e.m.f. induced across its ends.

(c) Direction of Induced e.m.f.:

The direction of induced e.m.f. (and hence the direction of induced current) can be obtained by any of the following rules:

(i) Fleming's right hand rule
(ii) Lenz's law

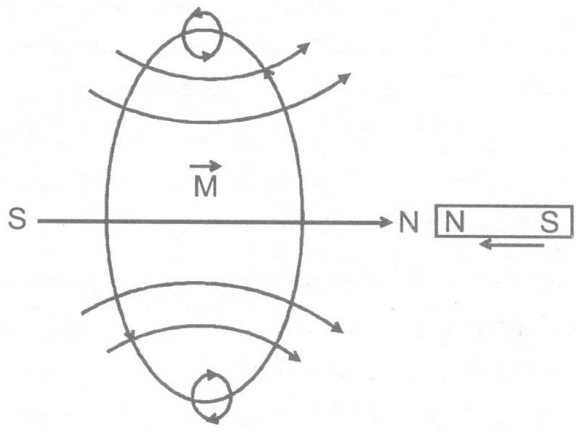
(i) **Fleming's right hand rule:** Stretch the thumb, middle finger and the forefinger of your right hand mutually perpendicular to each other as shown in figure. If the forefinger indicated the direction of the magnetic field and the thumb indicated the direction of motion of the conductor, the middle finger will indicate the direction of induced current.



(ii) **Lenz's law:** This law gives us the direction of current induced in a circuit.

According to Lenz's law, the induced current will appear in such a direction that it opposes the change (in magnetic flux) responsible for its production.
The law refers to induced currents, which means that it applies only to closed circuits. If the circuit is open we would fined the direction of induced e.m.f.
For example, in figure, when the magnet is moved towards the loop, a current is induced in the loop. The

induced current produces its own magnetic field with magnetic dipole moment $\vec{M}$ oriented so as to oppose the motion of the magnet. Thus the induced current must be anticlockwise as shown in figure below.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