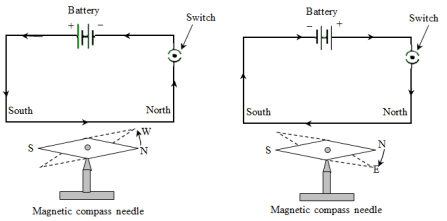
Electro-magnetism

Oersted Experiment :

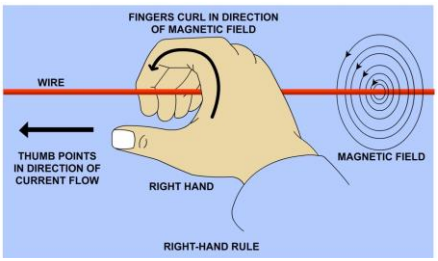
When an electric current is passed through a conducting wire, a magnetic field is produced around it.



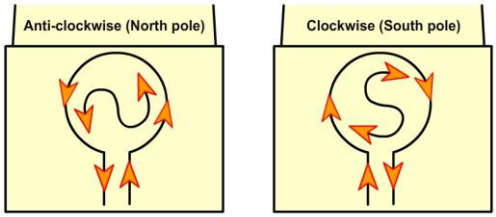
Rules to find the Direction of magnetic field :

In straight current carrying conductor : In a circular coil or loop :

Right hand thumb rule



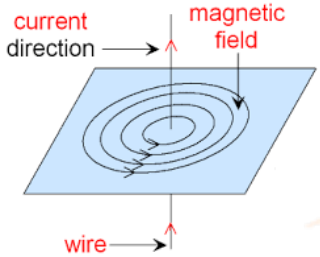
Clock rule



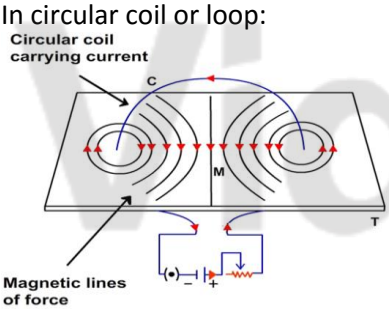
The Clock Rule

Magnetic Field :

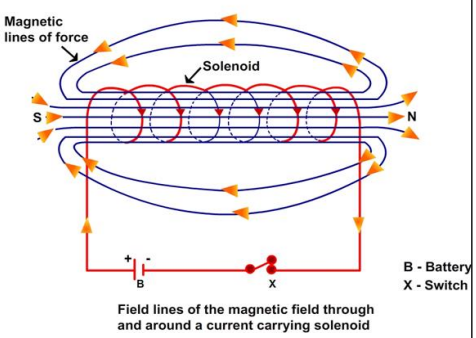
1. In straight current carrying conductor :



2. In circular coil or loop:



3. In solenoid:



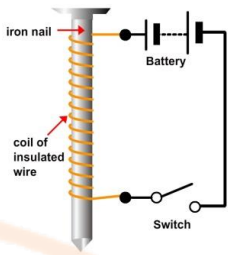
Field lines of the magnetic field through and around a current carrying solenoid

The current carrying solenoid behaves like a bar magnet with one end north & the other south pole.

But the polarity can be reversed by reversing the current direction.

Its magnetic field strength can be increased by a) increasing the current , b) by increasing the number of turns in solenoid and c) by inserting a soft iron core into the solenoid.

Electromagnet



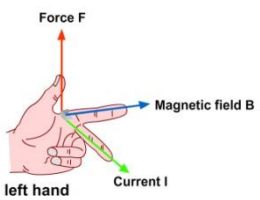
Uses:
lifting and transporting huge mass of iron , loading furnaces with iron, electric bell, relay, microphone etc.

It 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.
The polarity and magnetic field strength can be changed.
Demagnetized by switching off the current.

Force due to Magnetic field on a current carrying conductor :

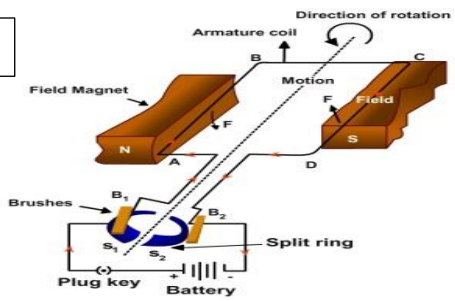
Magnitude of force, F = IBl where, I = current , B = magnetic field strength and l = length of conductor within the magnetic field

Direction of Force: Fleming's Left hand rule



Application of the force due to magnetic field :- D.C. Motor

D.C.Motor



Principle : when electric current is passed through a conductor placed perpendicularly in a magnetic field , a force acts on it and mechanical energy is obtained.
Split Ring Commutator : This helps in reversing the direction of current in the coil, so that the coil continues to rotate in same direction always.
Ways to increase speed of rotation:
(i) Increase the current in the coil (ii) Increase number of turns
(iii) increase area of coil (iv) increase strength of magnetic field

Electromagnetic Induction

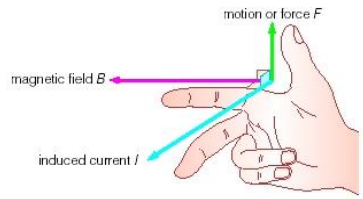
Electromagnetic induction is the phenomenon in which am e.m.f. is induced in the coil if there is a change in the magnetic flux linked with the coil

Faraday's laws of electromagnetic induction

- Whenever there is a change in the magnetic flux linked with a coil, an e.m.f. is induced
- The magnitude of the e.m.f. induced is directly proportional to the rate of change of magnetic flux linked with the coil

Direction of induced e.m.f

- **Fleming's right hand rule :**



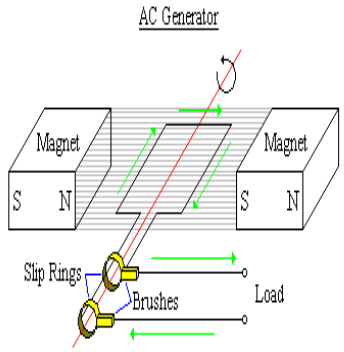
- **Lenz's law :**
  The direction of the induced e.m.f. always tend to oppose the cause which produces it.

Applications:

- **A.C. Generator**
- **Transformer**

A.C. Generator:

Principle : The working of a dynamo is based on the **theory of electromagnetic induction.**
When an armature coil is rotated in a magnetic field, the number of magnetic lines passing through the coil change due to which electricity is produced.



Maximum value of e.m.f. induced can be increased by:
i) Increasing number of turns in armature coil
ii) Increasing area of cross section of the coil
iii) Increasing the speed of rotation of the coil.

To increase frequency of a.c generated:-
Increase the speed of rotation.

Difference between a.c. and d.c.

D.C.	A.C.
It is the current of constant magnitude	It is the current of magnitude varying with time
It flows in one direction in the circuit	It reverses its direction while flowing in a circuit
It is obtained from a cell or battery	It is obtained from a.c. generator or mains

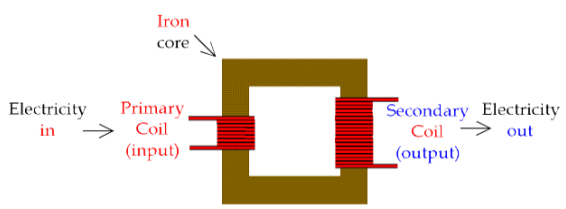
Transformer

It is a device by which the amplitude of an alternating e.m.f can be increased or decreased.

Turns ratio , n = $\frac{Number\ of\ turns\ in\ secondary\ coil\ Ns}{Number\ of\ turns\ in\ primary\ coil\ Np}$

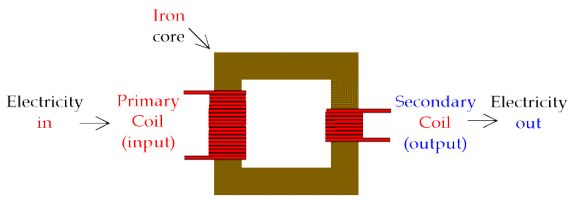
$n = \frac{Es}{Ep} = \frac{Ns}{Np}$
where, Es = E.m.f across secondary coil
Ep = E.m.f across primary coil

Step up Transformer



- Increases a.c voltage and decreases the current
- Turns ratio $N_s/N_p > 1$ i.e more number of turns in secondary coil than in primary coil.
- Primary coil thicker .
- Uses – At Power generating stations, X-ray tubes, TV etc.

Step down Transformer



- Decreases a.c voltage and increases the current
- Turns ratio $N_s/N_p < 1$ i.e less number of turns in secondary coil than in primary coil.
- Secondary coil thicker .
- Uses – At Power Substations, radio sets, mobile phones, computers, transistor etc.

© Vidyanext. All rights reserved.