

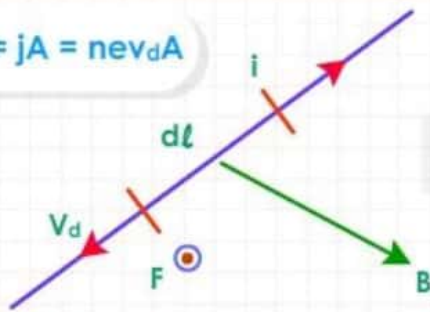


MAGNETIC PROPERTY



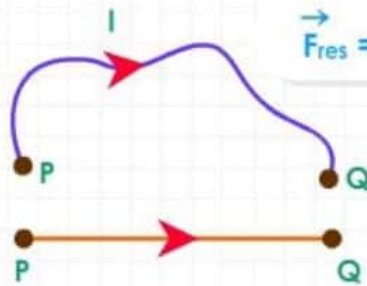
MAGNETIC FORCE ON A CURRENT CARRYING WIRE

$$i = jA = nev_d A$$



v_d = Drift speed
 n = No. of free electrons per unit volume
 j = Current density

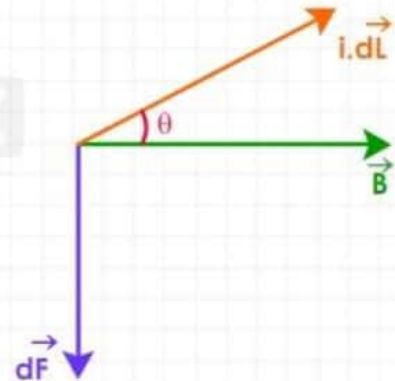
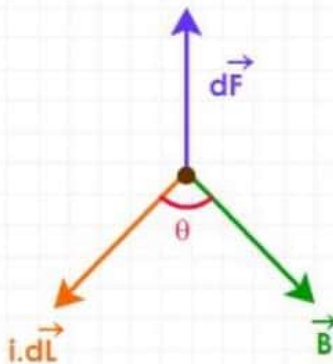
$$\vec{F}_{res} = i\vec{L} \times \vec{B}$$



\vec{L} = Vector length of the wire

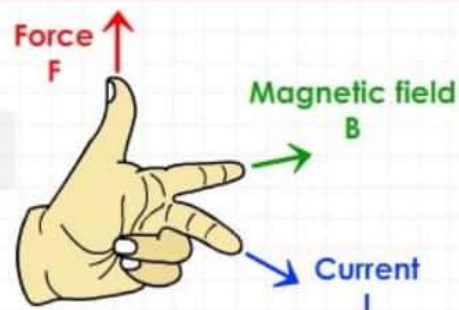
DIRECTION OF FORCE

The direction of force is always perpendicular to the plane containing $i \cdot d\vec{L}$ and \vec{B} and is same as that of cross-product of two vectors ($\vec{a} \times \vec{b}$) with $\vec{a} = i \cdot d\vec{L}$ and $\vec{b} = \vec{B}$

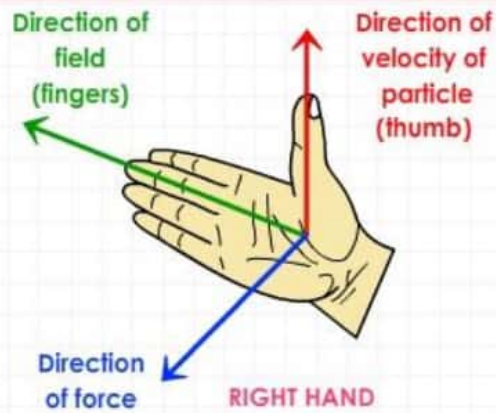


The direction of force when current element $i \cdot d\vec{L}$ and \vec{B} are perpendicular to each other can also be determined by applying either of the following rules:

- Fleming's Left-hand Rule** : Stretch the forefinger, central finger and thumb of the left hand mutually perpendicular. Then if the forefinger points in the direction of the field (\vec{B}) and the central finger is in the direction of current, the thumb will point in the direction of force (or motion).

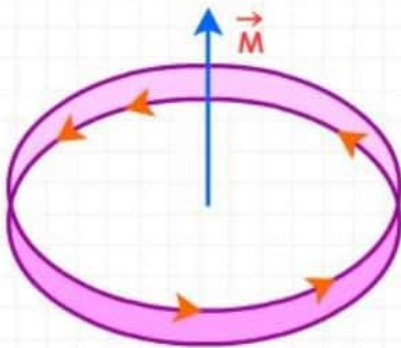


2. **Right-hand Palm rule** : Stretch the fingers and thumb of the right-hand at right angles to each other. To find the direction of the magnetic force on a positive moving charge, the thumb of the right hand points in the direction of velocity of particle v , the fingers in the direction of Magnetic Field B , then the Force F is directed perpendicular to the right hand palm



CURRENT LOOP IN A UNIFORM MAGNETIC FIELD

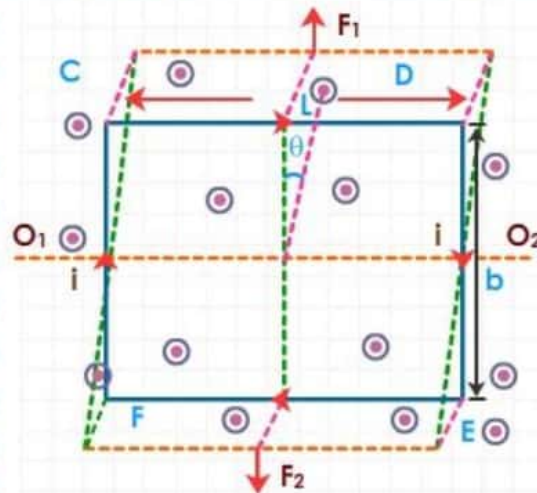
MAGNETIC MOMENT



$$\vec{M} = Ni\pi R^2 = NiA$$

A = Area of loop | R = Radius of loop
N = No. of loops | I = Current

TORQUE ON A CURRENT LOOP

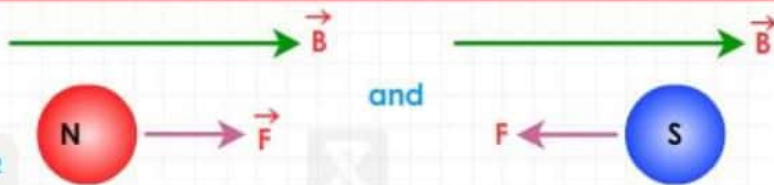


$$\vec{\tau} = \vec{M} \times \vec{B}$$

MAGNETIC FIELD AND STRENGTH OF MAGNETIC FIELD

$$\vec{B} = \frac{\vec{F}}{M}$$

S.I. unit of \vec{B} is Tesla or weber/m²



MAGNETIC IN AN EXTERNAL UNIFORM MAGNETIC FIELD

$F_{res} = 0$ (for any angle)

$$\tau = MB \sin \theta$$

