'GEOMAGNETISM'

Magnetic niddle + Direction of magnetic field.

* Earth magnetic field

(i) → At poles

$B_H = 0$

$B_V = B_e = 0.5$ Gauss

→ NHS $B_V \otimes$

→ SHS $B_V \odot$

(ii) → At equator

$B_V = 0$

$B_H = 0.3$ Gauss.

(Parallel to Earth surface)

(South to North direction)

(iii) → At other place

$B_H \neq 0$ (South to North direction // to Earth surface)

$B_V \neq$ → NHS $B_V \otimes$

→ SHS $B_V \odot$

Geographical Meridian (GM)

It is imaganany vertical plane passing through geographical axis of Earth.

Magnetic Meridian (MM)

Imagnary vertical plane is passing through magnetic axis of earth.

Decllination or, variation (θ)

Angle b/w GM & MM.

* Angle b/w Geographical axis & Magnetic axis or, Angle b/w GM & MM.
* $\theta = 11.50$

Dip angle (ϕ)

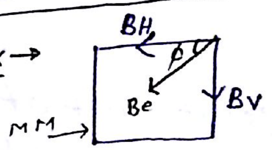
Angle of Be with horizontal direction called dip angle.

*
$\phi_{poles} = 90°$

$\phi_{equator} = 0°$

$\phi_{other\ place}$ = Acute Angle.

Ex →



$B_H = B_e \cos\phi$

$B_V = B_e \sin\phi$

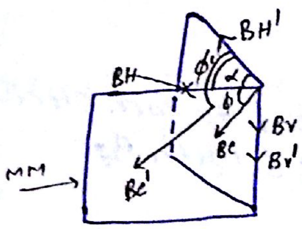
*
$\frac{B_V}{B_H} = \tan\phi$

$B_e = \sqrt{B_V^2 + B_H^2}$

Dip

→ Real (ϕ) [In MM dip angle is known as]

→ Apperent (ϕ') [In other than MM dip angle is known as]



In other vertical plane

$$\frac{B_V'}{B_H'} = \tan\phi' = \frac{B_V}{B_H \cos\alpha}$$

ϕ = Real dip measured in MM

ϕ' = Apperent dip measured in other than MM.

α = angle of other vertical plane with MM.

(i) → $\alpha \neq 0$

$\therefore \cos\alpha < 1$

$\tan\phi' = \frac{\tan\phi}{(<1)}$

$\tan\phi' > \tan\phi$

$\boxed{\phi' > \phi}$

* Apparent dip always More than Real dip.

(ii) → If $\alpha = 90^\circ$

$\cos\alpha = 0^\circ$

$\boxed{\tan\phi' = \frac{\tan\phi}{0} = \infty}$

$\boxed{\phi = 90^\circ}$

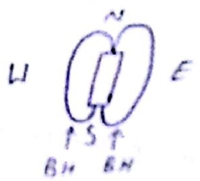
* $\boxed{T = 2\pi\sqrt{\frac{I}{MB}}}$

NOTE →

* If Magnet vibrate in horizontal plane. $(B = B_H)$
* If Magnet vibrate in vertical plane of magnetic meridian $(B = B_e)$
* If Magnet vibrate in vertical plane ⊥ to MM $(B = B_V)$.
* Isogonic lines → same θ
* Aclinic lines → $\theta = 0^\circ$
* Isoclinic lines → same ϕ
* Aclinic lines → $\phi = 0^\circ$
* Isodynamic lines → same B_H
* Dynamic lines → $B_H = 0^\circ$

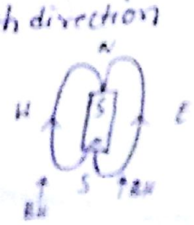
Neutral point

(i) → Bar magnet is placed in horizontal plane having its noth pole towards Geographical north pole.



* Neutral point exist at equator only.
* Two neutral point each one side & Both are same distance from magnet.

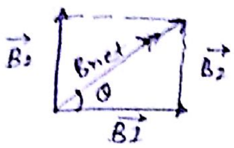
(ii) → Magnet is placed in Horizontal plane having its magnetic North pole towards South direction



* Neutral point exist at axis.
* Two neutral point each at one side at same distance from magnet.

Tangent Law

At a point if two magnetic field B_1 & B_2 are ⊥ to each other then net magnetic field makes some angle θ with B_2



$$\tan\theta = \frac{B_2}{B_1}$$

$$* \ B_2 = B_1 \tan\theta$$

($\theta \rightarrow$ जिसके साथ बनेगा $\tan\theta$ उसके साथ होगा)

Tangent Galvanometer

* Use to Measure small current
* Based on tangent law
* It has Non-Linear scale [b/c $I \propto \phi$]
* It this Galvanometer coil Remain stationary & magnet moves so called Moving magnet Galvanometer.

Imp * It is Most sensitive for detection of $45°$

* If deflection is ϕ for I current.

$$B_{coil} = B_H \tan\theta$$

$r \rightarrow$ Radius of coil
$N \rightarrow$ No. of turns.

$$\frac{\mu_0 N I}{2R} = B_H \tan\phi$$

$$I = \frac{B_H}{\left(\frac{\mu_0 N}{2R}\right)} \tan\phi$$

Galvanometer const (G) $= \frac{\mu_0 N}{2R}$

Reduction factor (K) $= \frac{B_H}{G}$

$$I = \frac{B_H}{G} \tan\phi$$

$$I = K \tan\theta$$

$$I \propto \tan\phi \leftarrow \text{sensitivity.}$$

Deflection Magnetometer

(i) → Tan 'A' position (Axial)

* Arm of the magnetometer ↓ Along East - West.
* magnet kept ⇒ || to arm

$$\frac{\mu_0}{4\pi}\frac{2M}{r^3} = B_H \tan\theta$$

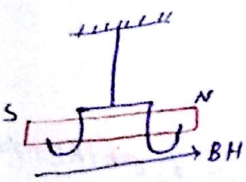
(ii) → Tan 'B' position (Broad on)

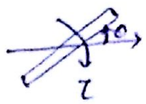
* Along South-North
* ⊥r to Arm.

$$\frac{\mu_0}{4\pi}\frac{M}{r^3} = B_H \tan\theta$$

Vibration Magnetometer

(i) → In this bar magnet does not osscilate in Horizontal plane in earth magnetic field.





$$\omega = \sqrt{\frac{MB_H}{I}}$$

$$T = 2\pi\sqrt{\frac{I}{MB_H}}$$

$$I = \frac{ML^2}{12}$$

(ii) → If Magnet is cut in 'n' part ⊥ to length & one part is kept at vibration Magnetometer then time period will be.

$$T' = T/n$$

$$I' = \frac{\left(\frac{m}{n}\right)\left(\frac{l}{n}\right)^2}{12} = I/n^3$$

NOTE → If magnet is cut into 'n' part along axis then 'T' same.

|iii| → comparision of Magnetic Moment.

$$T_1 = 2\pi\sqrt{\frac{I_1+I_2}{(M_1+M_2)B_H}}$$

$$T_2 = 2\pi\sqrt{\frac{I_1+I_2}{(M_1-M_2)B_H}}$$

$$\frac{T_1}{T_2} = \sqrt{\frac{M_1-M_2}{M_1+M_2}}$$

* $$\frac{M_1}{M_2} = \frac{T_2^2+T_1^2}{T_2^2-T_1^2}$$

|iv| → comparion of Earth Mag. Field.

Let, T_1 $ T_2 → Time period of Magnet at two diff place.

θ_1 $ θ_2 → Dip angle at that place.

* $$\frac{B_{e1}}{B_{e2}} = \frac{T_2^2}{T_1^2} = \frac{\cos\theta_2}{\cos\theta_1}$$

AIIMS

#cyclotron

* It is used to produced highly Accelerated ⊕ve ions.
* For this ⊕ve ion are produced Incide cyclotron by Ionisition of Gas.
* This ~~mechan~~ Machines have 2 Magnetic Dees (D) having some gap having big magnetic field (UTF) is applied $ Alternating electric field is Applied the Gap of Dees.
* Imp Electric field of Gap Accelerate charge particle $ magnetic field is used to send charge particle in Gap again and again.
* In this way charge particle is highly accelerated by pasing It through Electric field Many times.
* For proper synchronisation freq of Applied Electric field should be equal to circulating Freq of charge particle.

$$F_{AC} = \frac{qB}{2\pi M}$$

* $$KE_{max} = \frac{q^2B^2r^2_{max}}{2M}$$

* Where r_{max} = Radius of Dees

3e AIIMS
* e^- can't be Accelerated by cyclotron b/c its Mass is very small so require freq. of AC voltage Would be very high.

Imp
* e^- are accelerated by B-Tron.
* If PD of Gap = V

If particle values 'n' Revolution

∴ $K.E$ Gained $= 2n(qV)$

cosmic Rays (⊕ve charge)

Have high energy proton so when it approches towards Earth surface.

|i| → At pole $V \parallel B_V \Rightarrow F_m = 0 \Rightarrow$ come to pole [$\theta = 180°$]

|ii| → At equator $V \perp B_H \Rightarrow F_m \neq 0 \Rightarrow (max) \Rightarrow$ can't come to equator.

AIIMS

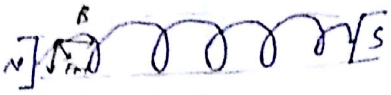
Aurora Boralise (colourfull curtain)

At poles there is high density of cosmic Rays wich ionise the gases. When this ion move parallel to earth surface due to Bv magnetic force exist & Ion move in circular path & This circulating Ion emit colourfull light.

** Excited oxygen atom emit green light & Exited nitrogen atom emit pink light.

Bottling Phenomeon

* B/w magnetic pole non-uniform magnetic field is there so, If a charge particle is projected at acute angle then particle perform Helical path of non-uniform plate & behave like mirror for charge particle so, It is traped as shown.



* Use to store high temp. plasma.