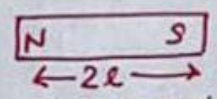
MAGNETISM & MATTER

Coulomb's law:-

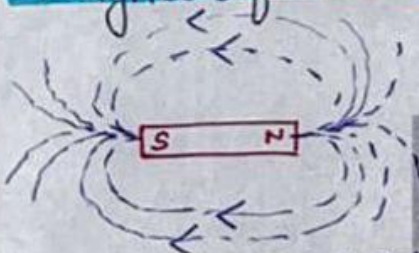
$$F = \frac{\mu_0}{4\pi} \cdot \frac{q_{m_1} \cdot q_{m_2}}{r^2}$$

Magnetic Dipole & moment

$$m = q_m \times 2l$$



Magnetic field:-



→ from N to S out of the bar magnet.
→ S to N in the bar magnetic.
→ Normally to surface

Potential Energy in a Dipole:-

$$U = -mB\cos\theta$$

θ is angle b/w $\vec{B}$ and dipole.

Current loop as a magnetic dipole

$$m = NIA$$

→ Right hand thumb rule.

$$m = IA$$

→ curl fingers in dirn of I and thumb will give dirn of m.

magnetic dipole moment of electron:

$$m = \frac{evr}{2}$$

v = velocity
r = radius

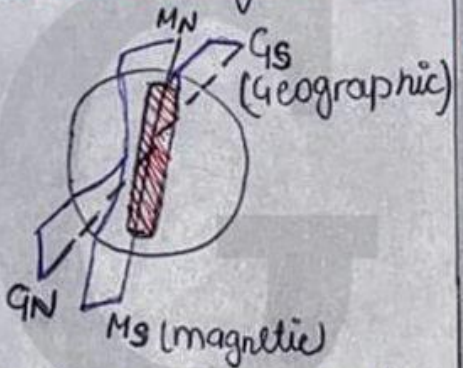
$$M = \frac{e}{2m_e} L$$

$$L = m_e v r$$

Gauss law in Magnet:

$$\oint B \cdot ds = 0$$

Earth's Magnetism:



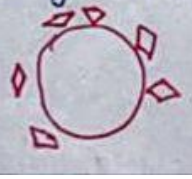
magnetic equator = great circle

Magnetic declination:- α

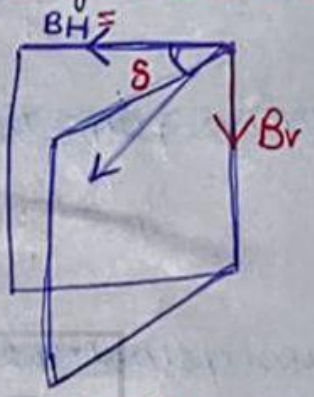
angle b/w magnetic and geographical meridian.

Angle of dip:- δ

angle by earth's total magnetic field in magnetic meridian is angle of inclination



Horizontal Component of Earth's:-



$$B_H = B\cos\theta$$
$$B_V = B\sin\theta$$
$$B = \sqrt{B_H^2 + B_V^2}$$
$$\tan\delta = \frac{B_V}{B_H}$$

Magnetising field:-

$$B_0 = \mu_0 nI$$

Magnetic Induction:-

$$B = B_0 + B_M$$
$$B_0 = \mu_0 nI$$
$$B_M = \mu_0 n I_M$$

Magnetic field intensity:-

$$\vec{H} = \frac{B_0}{\mu_0}$$

Intensity of magnetisation:-

$$\vec{M} = \frac{\vec{m}}{V}$$

$$B = \mu_0(H + M)$$

Work done

$$W = MB(\cos\theta_1 - \cos\theta_2)$$

Magnetic permeability:

$$\mu = \frac{B}{H}$$

Relative permeability:

$$\mu_r = \frac{\mu}{\mu_0}$$

Susceptibility:

$$\chi_m = \frac{M}{H}$$

Permeability & magnetic susceptibility:

$$\boxed{\mu_r = 1 + \chi_m}$$