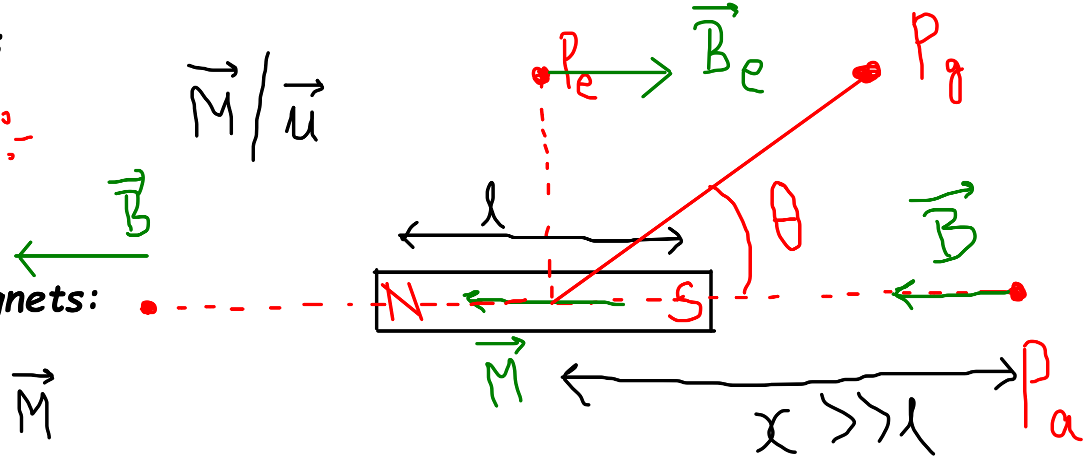
Classical Magnetism:

Bar Magnets :-

$\vec{M} / \vec{\mu}$

field due to bar magnets:

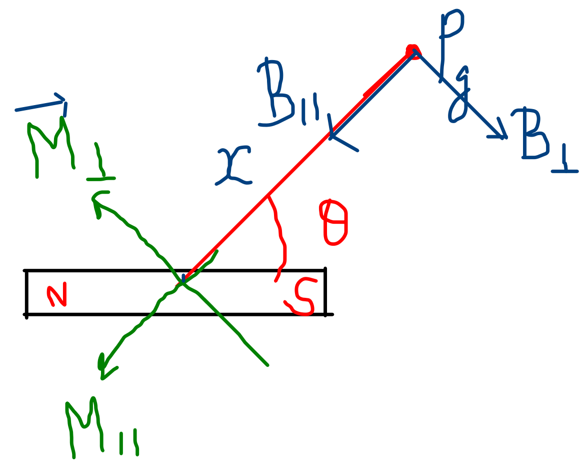


$$\vec{B}_a = \frac{2K\vec{M}}{x^3}$$

$$\vec{B}_e = -\frac{K\vec{M}}{x^3}$$

$$B_{\parallel} = \frac{2KM_{\parallel}}{x^3}$$

$$B_{\perp} = \frac{KM_{\perp}}{x^3}$$



Interaction of a bar magnet with external mag field:

1) Force on a bar magnet in uniform $\vec{B}_{ext}$

$\Rightarrow$ ZERO

2) Torque :- $\vec{\tau} = \vec{M} \times \vec{B}$

if $\tau = 0$ $\Rightarrow$ $\theta = 0^\circ \longrightarrow$ stable

$\theta = 180^\circ \longrightarrow$ unstable

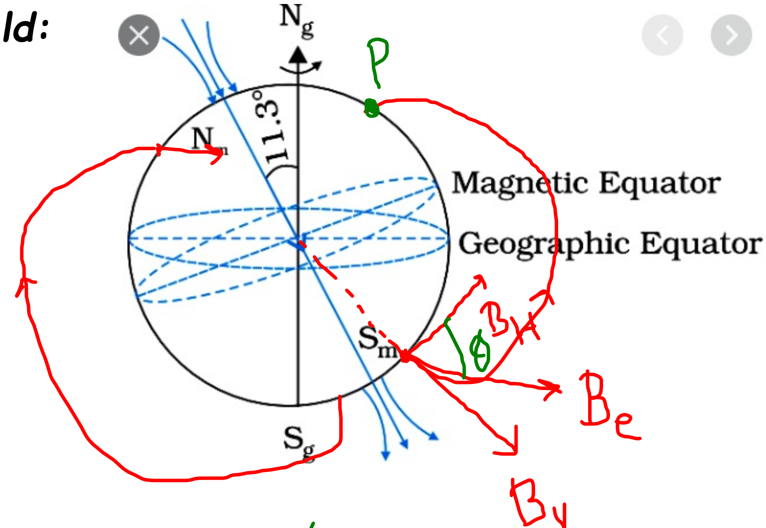
3) P.E. :— $U = -\vec{M}\cdot\vec{B} = -MB\cos\theta$

4) **in non uniform ext mag field**

(a) $U = -\vec{M}\cdot\vec{B}$

(b) $F = -\dfrac{dU}{dr}$

Earth's Magnetic field:



$\underline{\theta}$:- Angle of dip / Inclination angle

$$\tan\theta = \frac{B_V}{B_H}$$

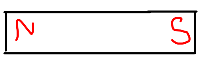
declination angle: Angle b/w GM & MM (δ)

the net B of earth always lies completely in the MM

Magnetic Materials:

Dia	Para	Ferro
1) $\chi < 0$	$\chi > 0$ (small)	$\chi >> 1$
2) $\mu_r = 1 + \chi$	—	—
3) $B_{net} < B_{ext}$	$B_{net} > B_{ext}$	$B_{net} >> B_{ext}$
4) A dia sample is repelled by a bar magnet / It moves from strong field to weak field region	Attracted by a bar magnet (weakly)	Attracted by a bar magnet (strong)
		5 Domains

Fixed



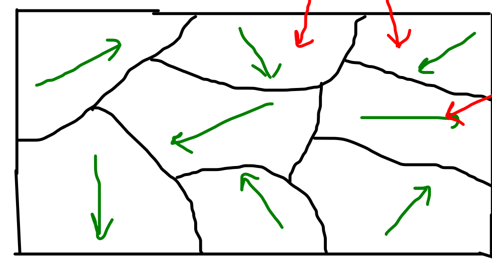
Dia (movable)

$\longrightarrow$ repelled

$\Longrightarrow B_{ext}$

Ferro

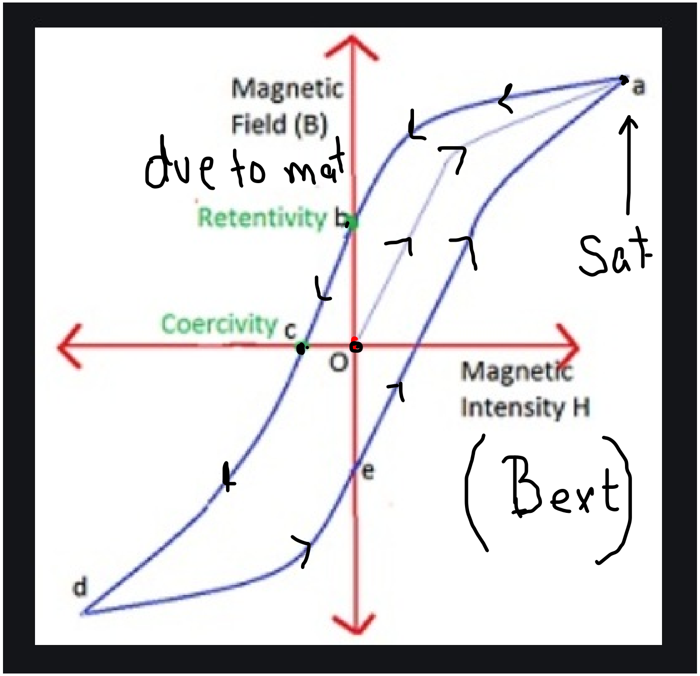
Domains



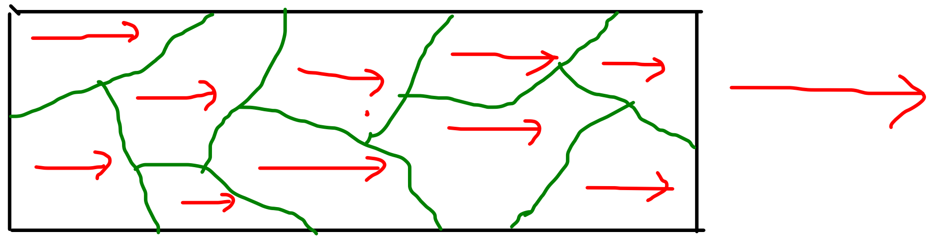
$\vec{M}_{net} = \vec{0}$

demagnetized

$\vec{M} = \vec{0}$


Magnetic Field (B)
due to mat
Retentivity b
Coercivity c
O
a
Sat
Magnetic Intensity H
(Bext)
e
d

$\longrightarrow$ B_{ext} (strong)
$\longrightarrow$



$\vec{M}_{net}$

$$B_{net} = B_{ext} + \underline{\underline{B_{mag}}}$$