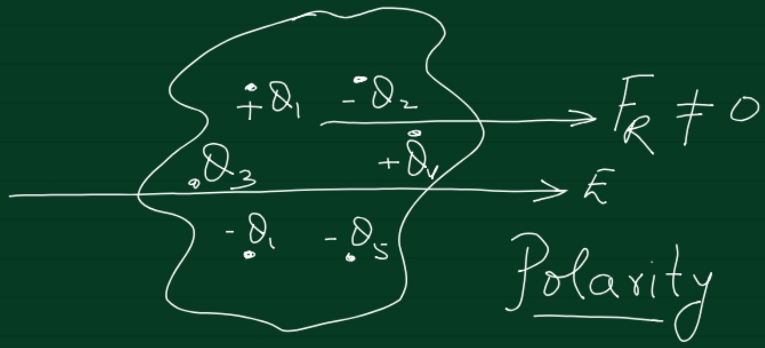
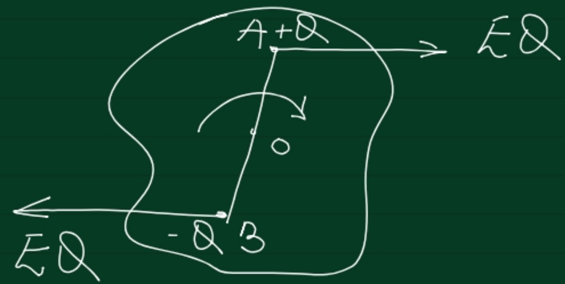
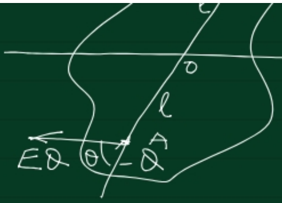
E & V at any point in field of electric Dipole System:-





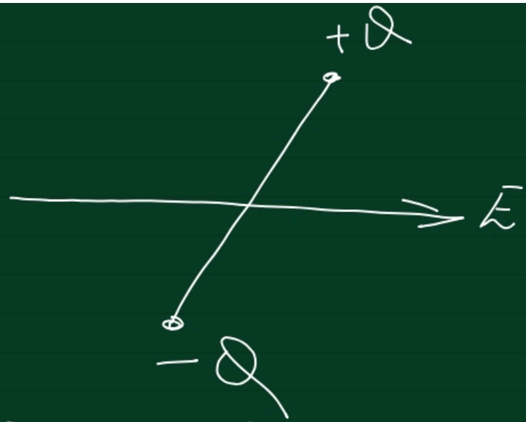


$\tau_A = l E Q \sin(-\theta)$

$\tau_B = l E Q \sin(-\theta)$

$\tau_R = -\underline{2lQ} \cdot E \sin\theta$

$\downarrow \quad \downarrow \quad \downarrow$



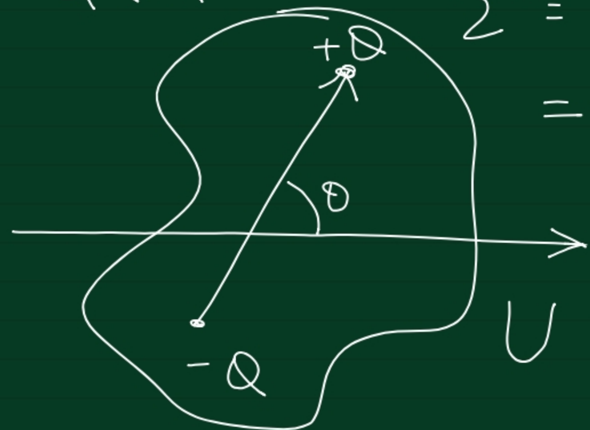
$E = 1\ N/C$ & $\theta = 90^\circ$

$|\tau|_{max} = 2lQ$

$p = 2lQ$

$\vec{\tau} = \vec{p} \times \vec{E}$

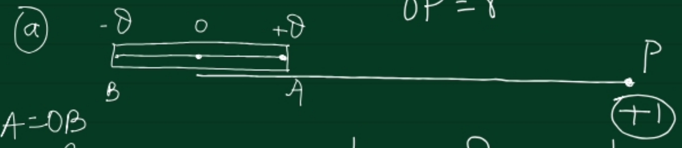
$= -pE\sin\theta$



$U = -pE\cos\theta$

Expression for Potential & Intensity of the field at any axial point of the dipole system:

$OP = r$



$OA = OB = l$

$AB = 2l$

$$V_{P_A} = \frac{1}{4\pi\epsilon_0}\frac{q}{PA} = \frac{1}{4\pi\epsilon_0}\frac{q}{OP - OA} = \frac{1}{4\pi\epsilon_0}\frac{q}{r - l} \quad \text{— (1)}$$

$$V_{P_B} = -\frac{1}{4\pi\epsilon_0}\frac{q}{PB} = -\frac{1}{4\pi\epsilon_0}\frac{q}{OP + OB} = -\frac{1}{4\pi\epsilon_0}\frac{q}{r + l} \quad \text{— (2)}$$

$$V_P = \frac{q}{4\pi\epsilon_0}\left[\frac{1}{r-l} - \frac{1}{r+l}\right]$$

$$V_P = \frac{q}{4\pi\epsilon_0}\frac{r + l - r + l}{r^2 - l^2}$$

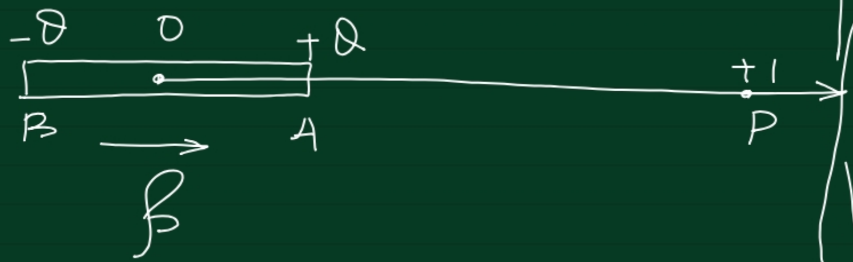
$$\boxed{V_P = \frac{1}{4\pi\epsilon_0}\frac{2lq}{r^2 - l^2}}$$

$r >> l$

$$\boxed{V_P = \frac{1}{4\pi\epsilon_0}\frac{p}{r^2}}$$

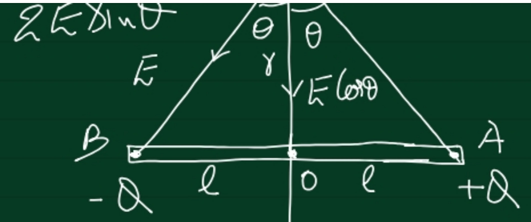
$$V_P = f(r)$$

$$E_P = -\frac{dV_P}{dr} = \frac{1}{4\pi\epsilon_0}\frac{2p}{r^3}$$



$$E = \frac{1}{4\pi\epsilon_0}\,\frac{2p}{r^3}$$

$$V_p = \frac{1}{4\pi\epsilon_0}\,\frac{p}{r^2}$$



Repulsion is a type of interaction which when allowed results the separation of particles increase

$V_0 = 0$

$r = -q$

$$E = \frac{1}{4\pi\epsilon_0}\frac{Q}{(PB)^2} = \frac{1}{4\pi\epsilon_0}\frac{Q}{r^2+l^2}$$

$$E = \frac{1}{4\pi\epsilon_0}\frac{Q}{(PA)^2}$$

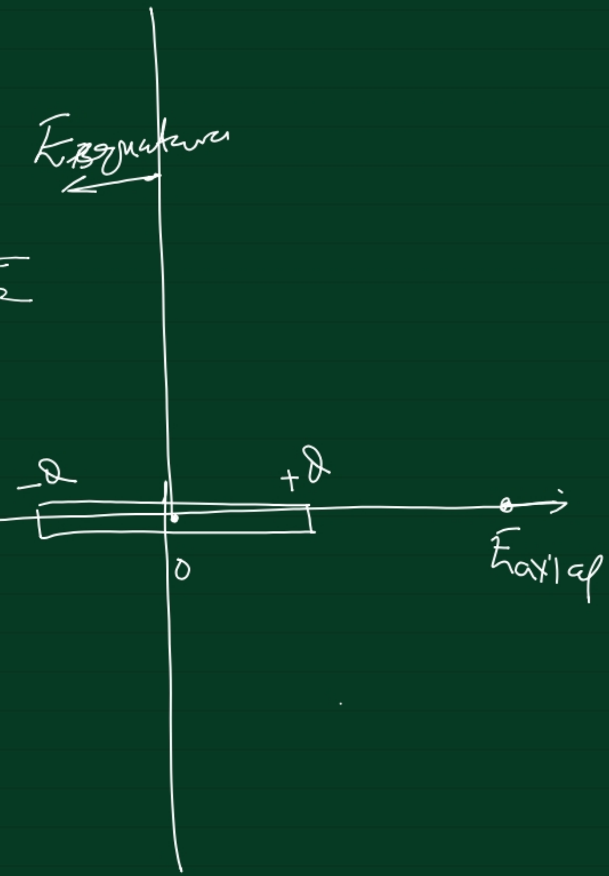
$$E_{PA} = \frac{1}{4\pi\epsilon_0}\frac{Q}{r^2+l^2}$$

$$E_P = 2E\sin\theta = 2\times\frac{1}{4\pi\epsilon_0}\frac{Q}{r^2+l^2}\cdot\frac{l}{\sqrt{r^2+l^2}}$$

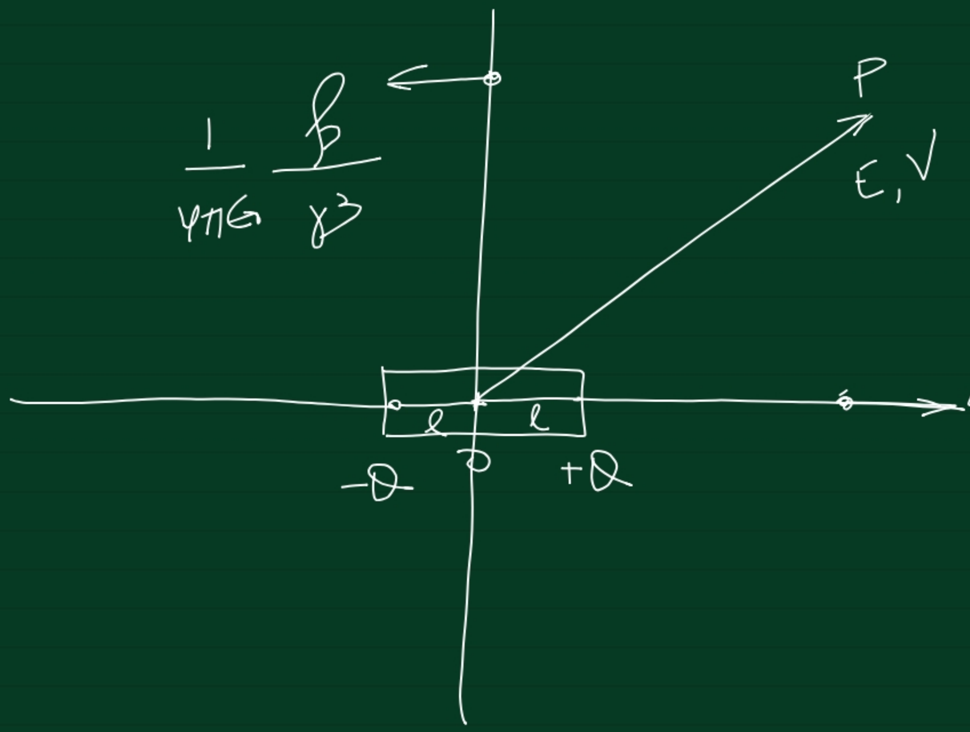
$$E_P = \frac{1}{4\pi\epsilon_0}\frac{p}{(r^2+l^2)^{3/2}}$$

Since $r \gg l$

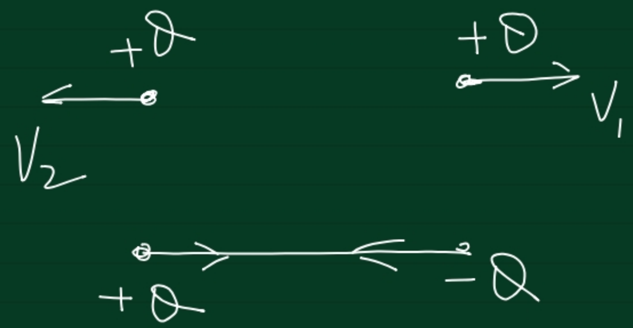
$$E_P = \frac{1}{4\pi\epsilon_0}\frac{p}{r^3}$$



$$\frac{1}{4\pi\epsilon_0}\frac{p}{r^3}$$



$$E_{axial} = \frac{1}{4\pi\epsilon_0}\frac{2p}{r^3}$$


+Q
+Q
V1
V2
+Q
-Q