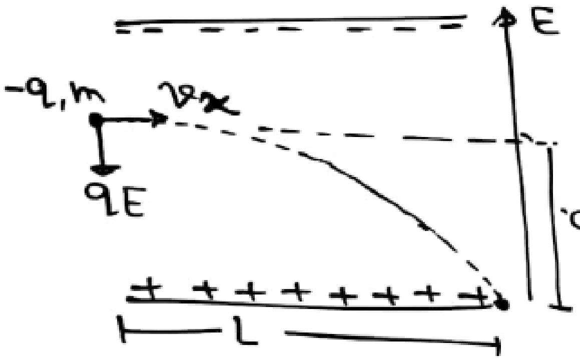
Ex 33) A particle of mass m & charge (−q) enters the region b/w two charged plates, initially moving along x-axis with velocity v_x. The length of plate is L and uniform electric field $\vec{E}$ is maintained b/w the plates. Show that the vertical deflection of the particle at the far edge of the plate is $\frac{qEL^2}{2mv_x^2}$



$$S = ut + \frac{1}{2}at^2$$

$$S_x = u_x t + \frac{1}{2}a_x t^2$$

$$L = v_x t + 0$$

$$t = \frac{L}{v_x}$$

X-dirn

$u_x = v_x$

$a_x = 0$, $F_x = 0$

$S_x = L$

$$t = \frac{L}{v_x}$$

Y-dirn

$u_y = 0$, $F_y = qE$

$a_y = \frac{qE}{m}$

$$S_y = u_y t + \frac{1}{2}a_y t^2$$

$$d = 0 + \frac{1}{2}\frac{qE}{m} \times \left(\frac{L}{v_x}\right)^2$$

$$d = \frac{qEL^2}{2mv_x^2}$$

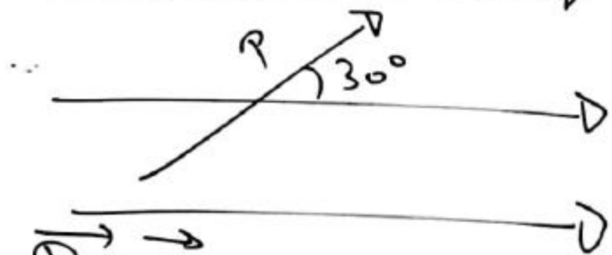
Q) NEET 2016) An electric dipole is placed at an angle of 30° with an Electric field intensity 2×10^5 N/c. It experience a torque equal to 4 N-m. The charge on the dipole, if the dipole length 2cm.

(a) 8mc.

(b) 2mc ✓

(c) 5mc.

(d) 7mc.



$2\times10^5 N/c = E$

$\tau = 4$ N-m

$l = 2\times10^{-2}$ m

$q = ?$

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

$\tau = PE\sin\theta$

4 N-m $= (q\times l)\, 2\times10^{+5}\times\frac{1}{2}$

$\frac{4}{10^{+5}} = q\times2\times10^{-2}$

$q = \frac{4^{2}}{2\times10^{-2}\times10^{5}}$

$q = 2\times10^{-3}$

$q = 2mC$

NEET2020)

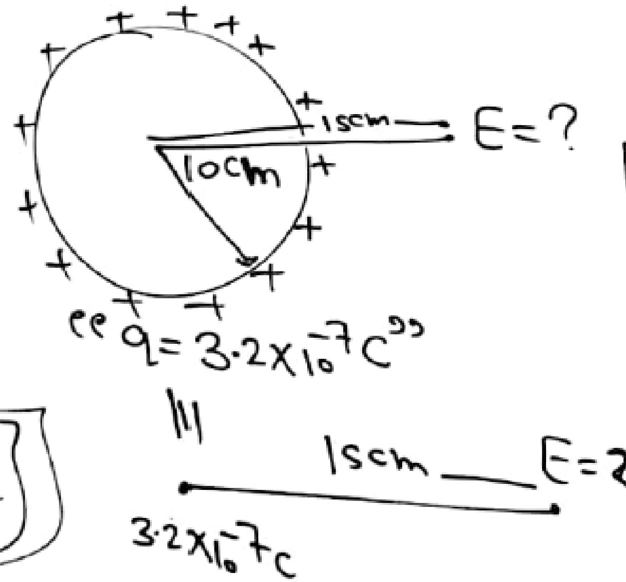
Q2) A spherical conductor of radius 10cm has a charge of 3.2×10^{-7} C distributed uniformly. What is the magnitude of electric field at a point 15cm from the sphere $\left[\frac{1}{4\pi\varepsilon_0} = 9\times10^9\right]$ [NEET-2020]

(a) 1.28×10^4 N/C.

(b) 1.28×10^5 N/C.

(c) 1.28×10^6 N/C

(d) 1.28×10^7 N/C



$$E = \frac{Kq}{r^2}$$

$$E = \frac{9\times10^9 \times 3.2\times10^{-7}}{(15\times10^{-2})^2}$$

$$E = \frac{9\times3.2\times10^2}{225\times10^{-4}}$$

$$E = \frac{3.2}{25}\times10^6$$

$$E = \frac{32}{25}\times10^5$$

$$\boxed{E = 1.28\times10^5 \text{ N/C}}$$

AIPMT 2010

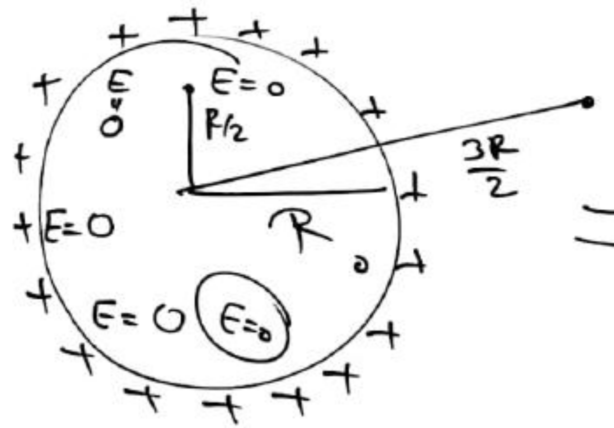
Q) The electric field at a distance $\frac{3R}{2}$ from the centre of a charged conducting spherical shell of radius R is E. The electric field at a distance $\frac{R}{2}$ from the centre of sphere.

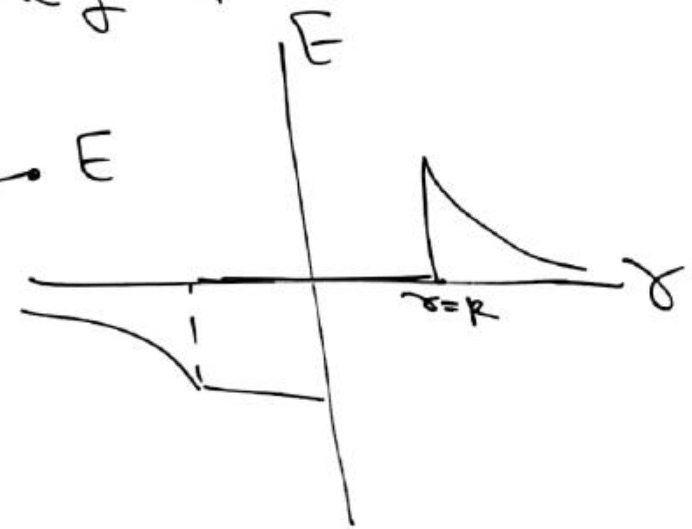
(a) E.

(b) $\frac{E}{2}$.

(c) $\frac{E}{3}$.

(d) zero.



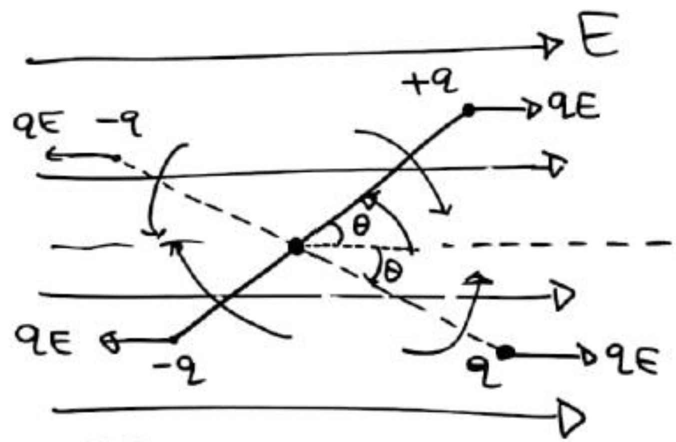


⇒ Time period of dipole in uniform electric field :

$$\vec{F} = -k\vec{x}$$

$$\vec{\tau} = -k\theta$$

$$F_{net} = 0$$



$\tau = \vec{p} \times \vec{E} = pE\sin\theta$

$\tau = 0$, $F = 0$

$$\vec{\tau} = 0$$

$\theta \rightarrow$ very small

$$\sin\theta = \theta$$

$$\vec{\tau} = -pE\sin\theta$$

$$\vec{\tau} = -pE\vec{\theta}$$

$$I\alpha = -pE\theta$$

$$\alpha = \frac{pE}{I}\theta$$

$$\alpha = -\omega^2\theta$$

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

$$T = \frac{2\pi}{\omega} = \frac{2\pi}{\sqrt{\frac{pE}{I}}}$$

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

$$\vec{F} = -k\vec{x}$$

$$\vec{a} = -\omega^2\vec{x}$$