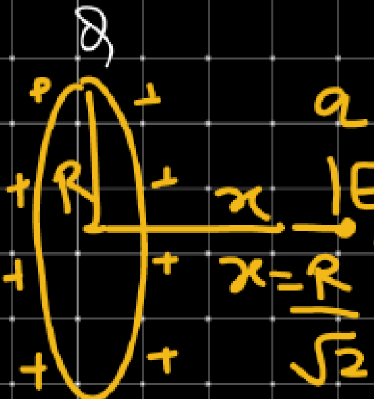
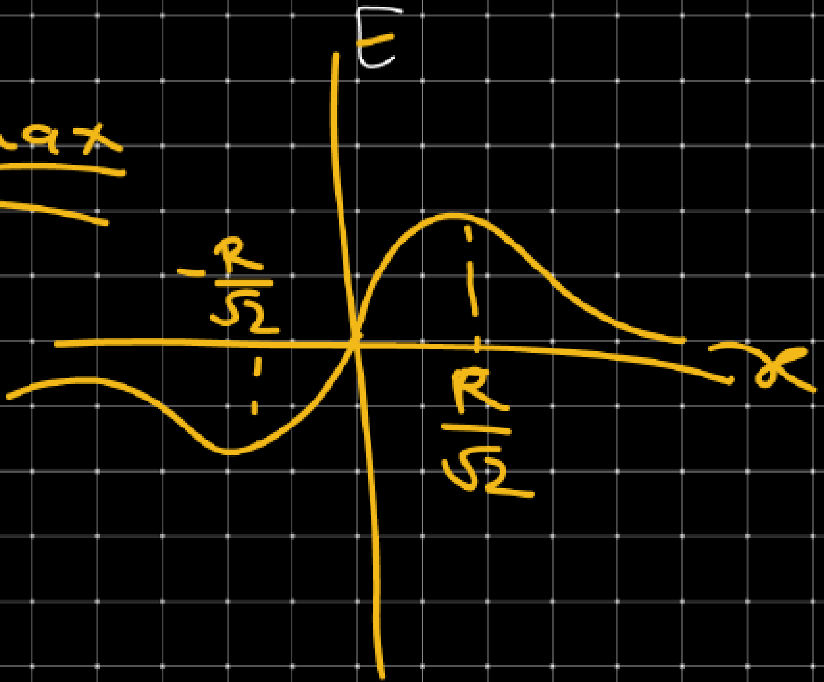
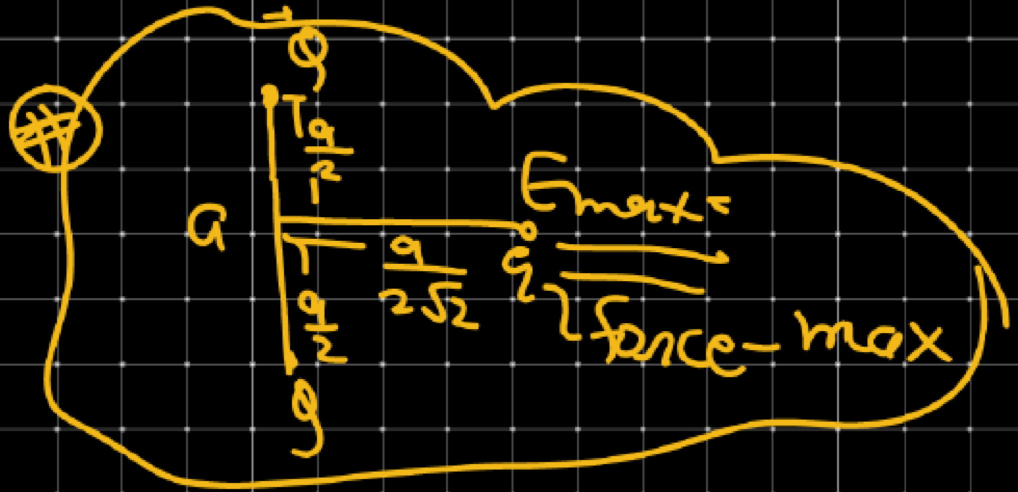


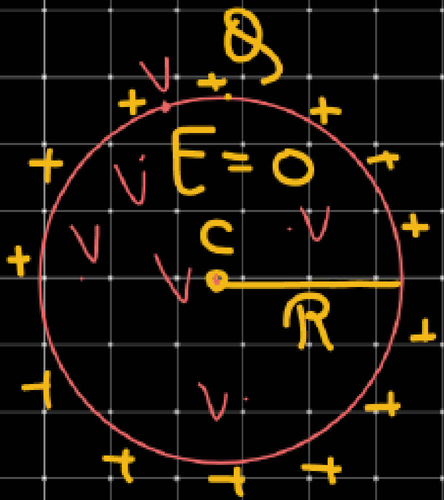
$q \rightarrow$ Force = max

Emax





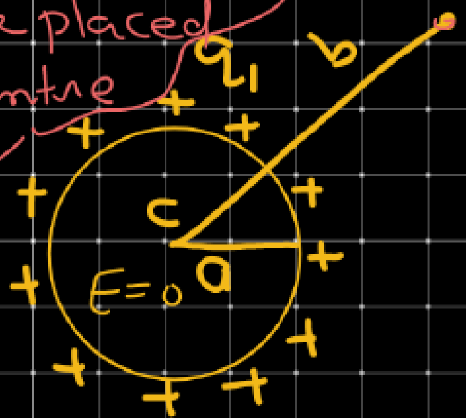
Potential due to Concentric spheres.



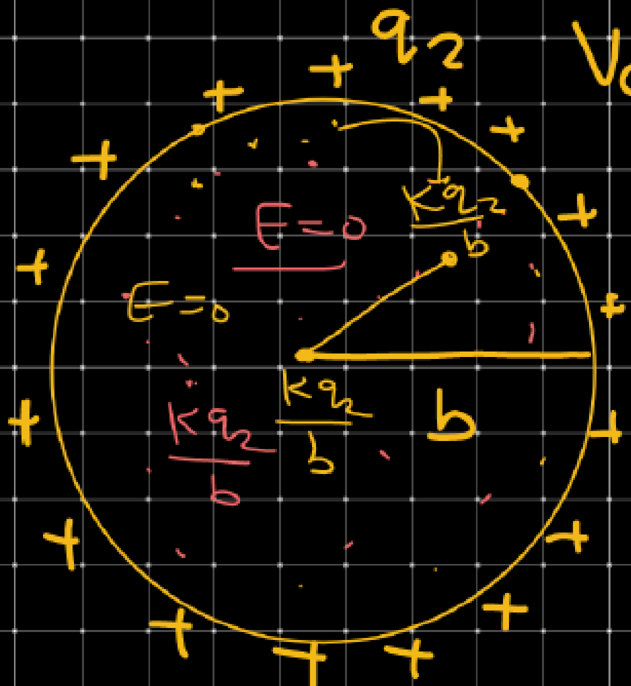
$$V_S = V_C = \frac{KQ}{R}$$

For outer point sphere behave like a point charge placed at centre

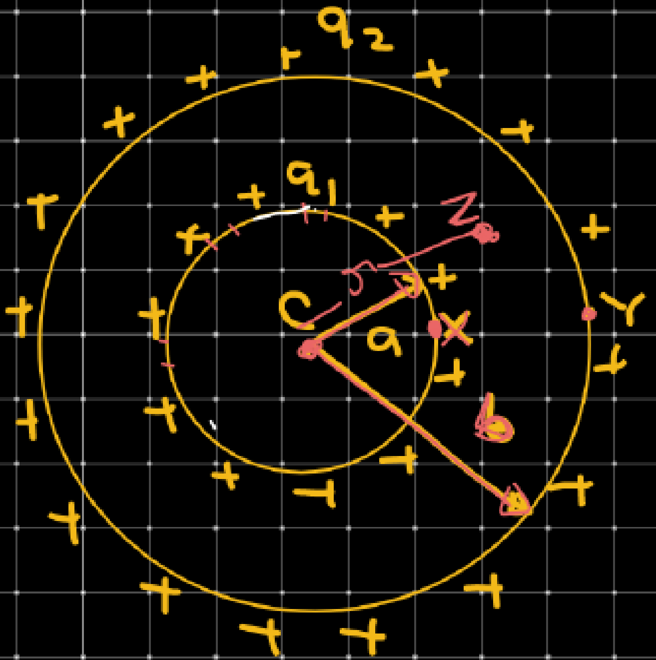
$$V = \frac{kq_1}{b}$$



$$V_C = V_S = \frac{kq_1}{a}$$



$$V_C = V_S = \frac{kq_2}{b}$$



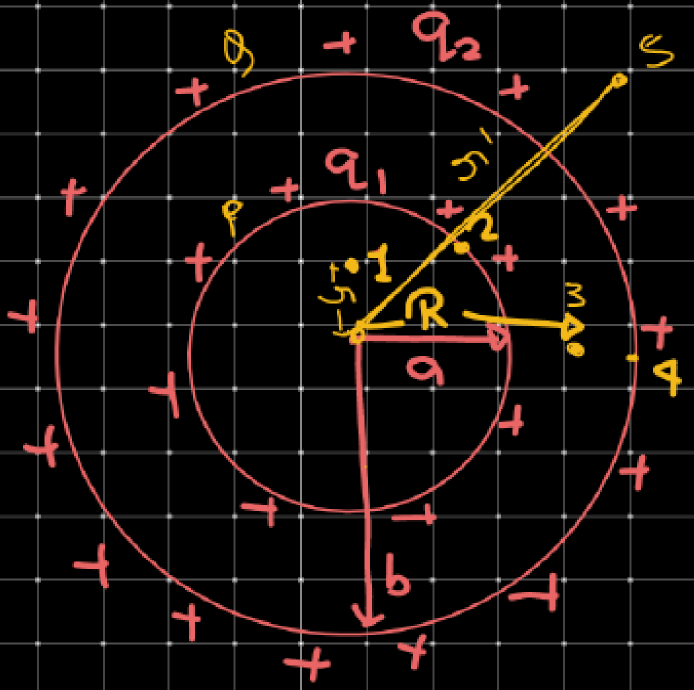
$$V_C = \frac{kq_1}{a} + \frac{kq_2}{b}$$

$$V_x = \frac{kq_1}{a} + \frac{kq_2}{b}$$

$$V_y = \frac{kq_1}{b} + \frac{kq_2}{b}$$

$$V_z = \frac{kq_1}{a} + \frac{kq_2}{b}$$

Find Potential at ①, ②, ③ & 4.

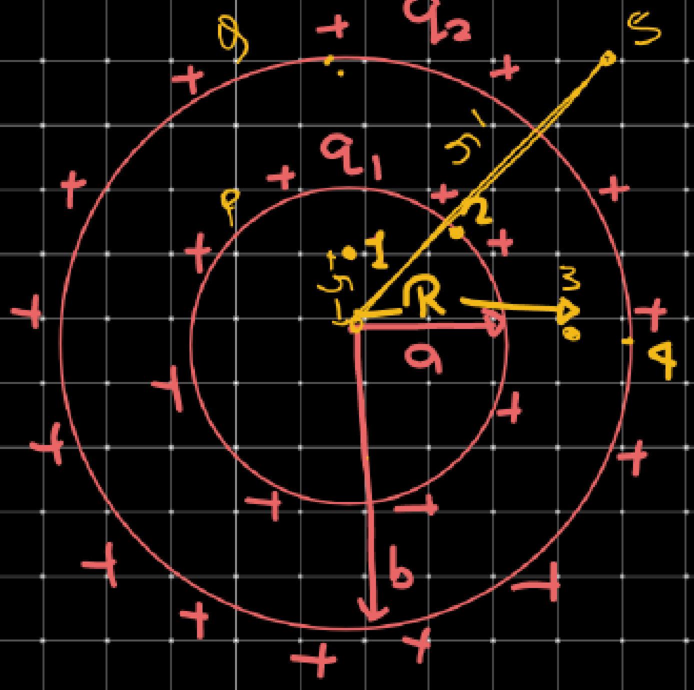


① ⟶ Inter point for sph P & sph Q.

$$V_1 = \frac{Kq_1}{a} + \frac{Kq_2}{b}$$

Point 2 Inter point for sph Q & surface point for sph P.

$$V_2 = \frac{Kq_1}{a} + \frac{Kq_2}{b}$$



Point 3) Inner part for sph (Q) at point For sph (P)

$$V_3 = \frac{Kq_1}{R} + \frac{Kq_2}{b}$$

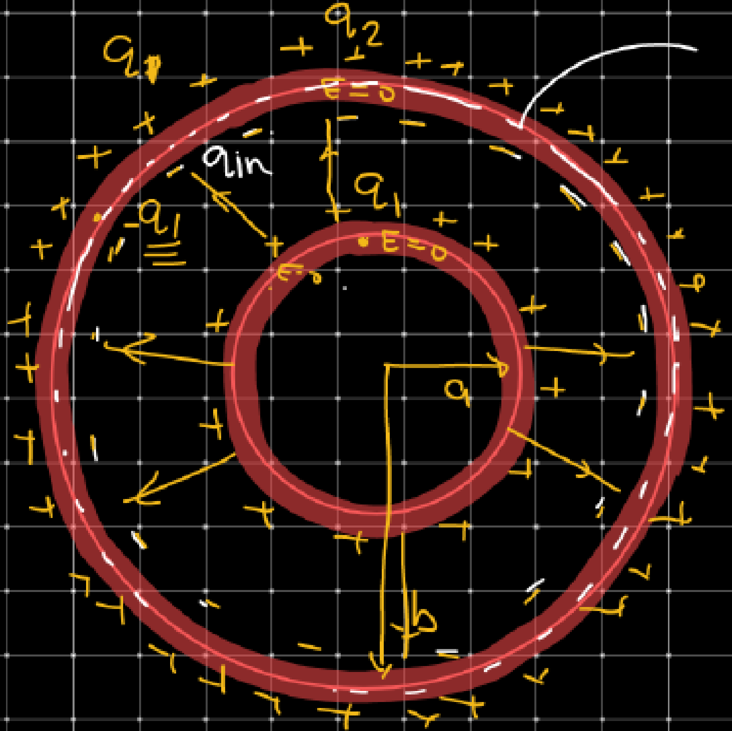
For Point 4 -

$$V_4 = \frac{Kq_1}{b} + \frac{Kq_2}{b}$$

For Point 5) at point for both sph (P) & Q.

$$V_5 = \frac{Kq_1}{r'} + \frac{Kq_2}{r'} = \frac{K(q_1+q_2)}{r'}$$

(#) Electric field Inside the conductor is zero.



G.S

$$\oint \vec{E} \cdot \vec{ds} = \frac{q_{in}}{\varepsilon_0}$$

$$0 = \frac{q_1 + q_{in}}{\varepsilon_0}$$

$$q_1 + q_{in} = 0$$

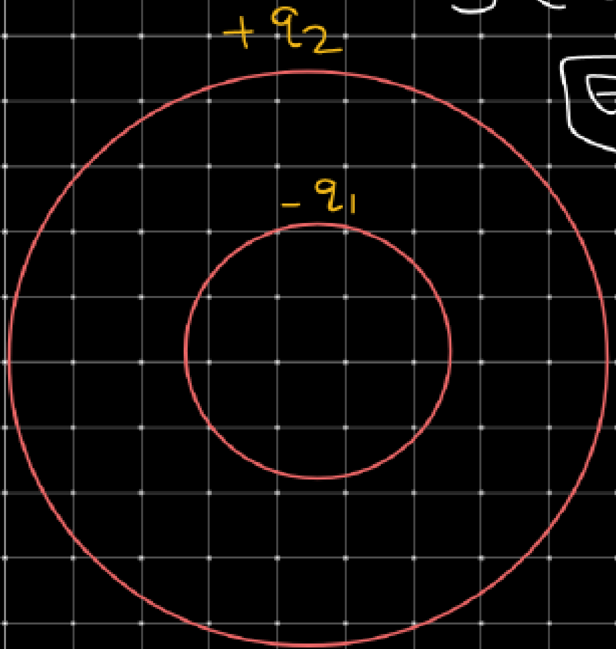
$$q_{in} = -q_1$$

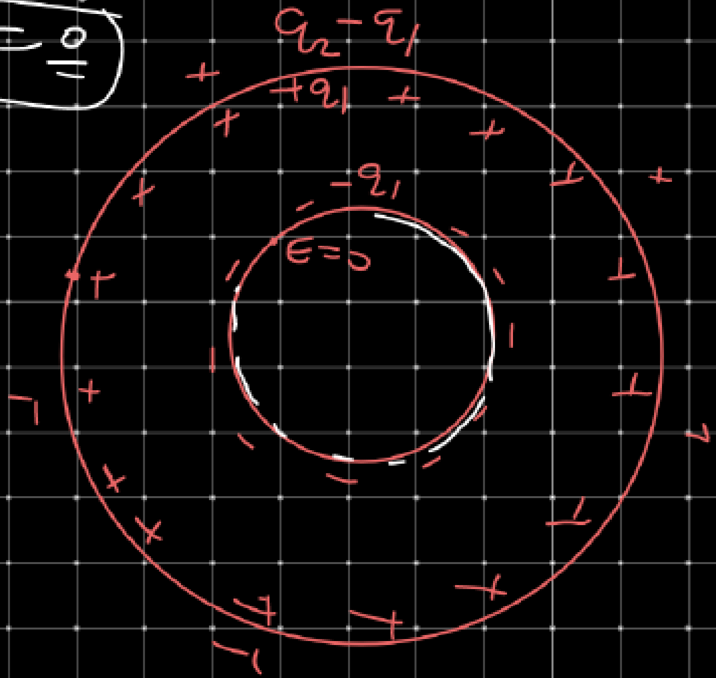
Initial charge $= q_1 + q_2$

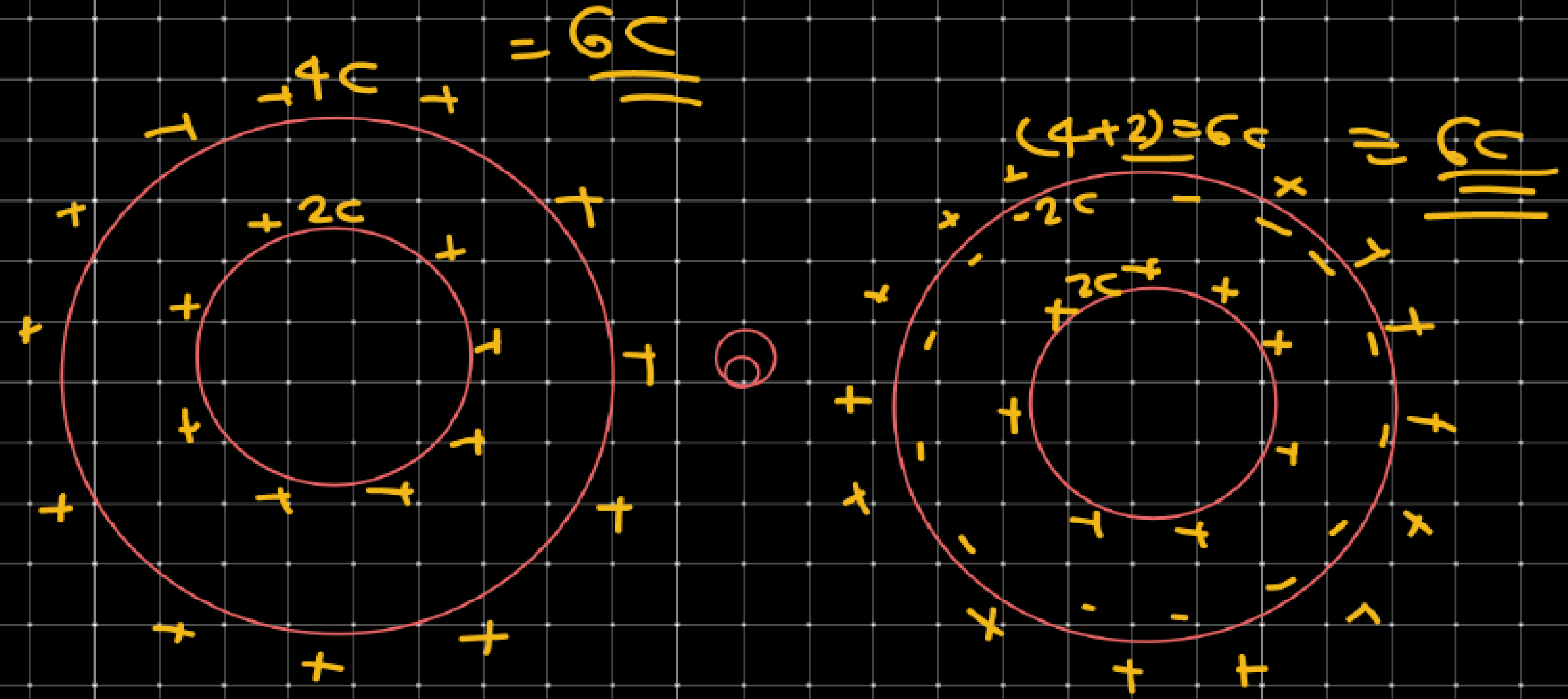
$$\oint \vec{E}\cdot ds = \frac{q_{in}}{\varepsilon_0}$$

$-q_1$ & q_2 swen

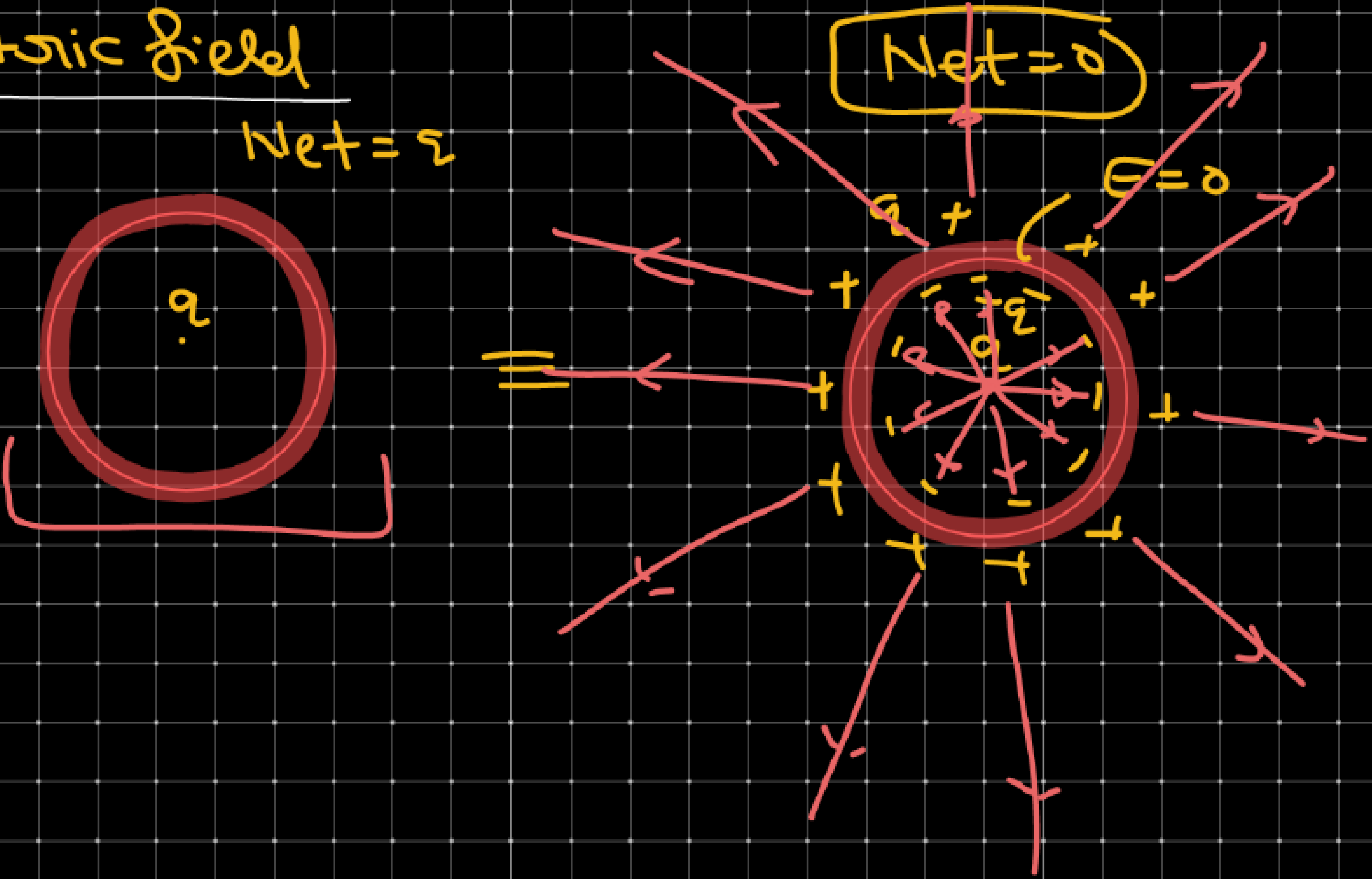
$E = 0$



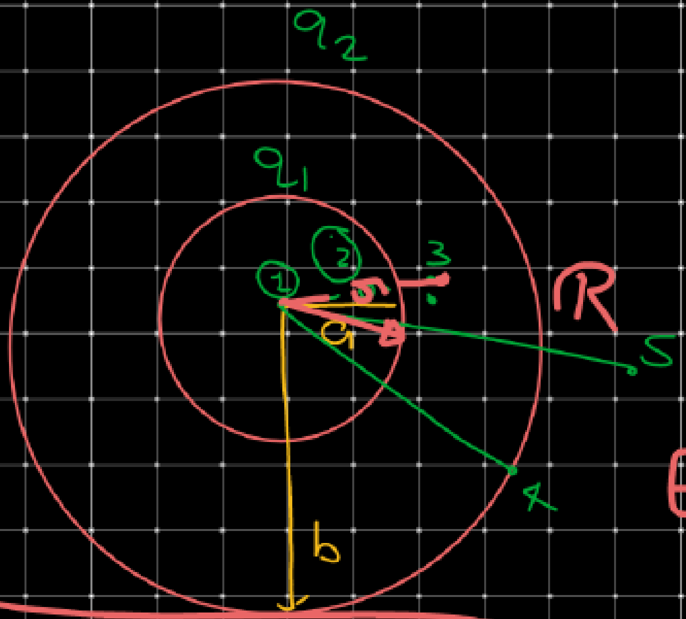



4c
= 6c
2c
(4+2)=6c
= 6c
-2c
2c

Electric field



Electric field due to concentric spheres :-



For point ① $E_1 = 0$

For Point 2 ⇒ $E_2 = 0$

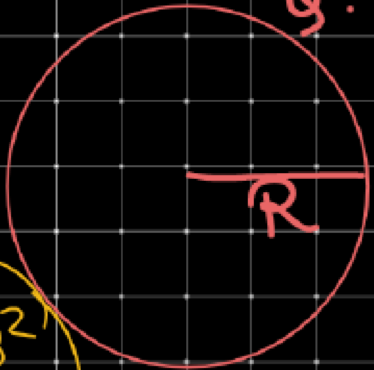
For point 3 ⇒ $E_3 = \frac{kq_1}{r^2}$

For Point 4

$$E_4 = \frac{kq_1}{b^2} + \frac{kq_2}{b^2}$$

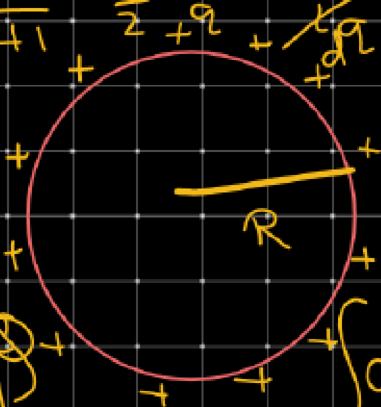
For $E_5 = \frac{kq_1}{R^2} + \frac{kq_2}{R^2}$

Potential Energy of Charged Sphere [Hollow Sphere]



$$\int q^1 dq = \frac{q^{1+1}}{1+1} = \frac{q^2}{2}$$

$$W = U = \frac{KQ^2}{2R}$$



At any instant Charge on sphere is q.

$$dW = dq \cdot V$$

$$dW = dq \times \frac{Kq}{R}$$

$$\int dW = \frac{K}{R}\int_0^Q q\,dq$$

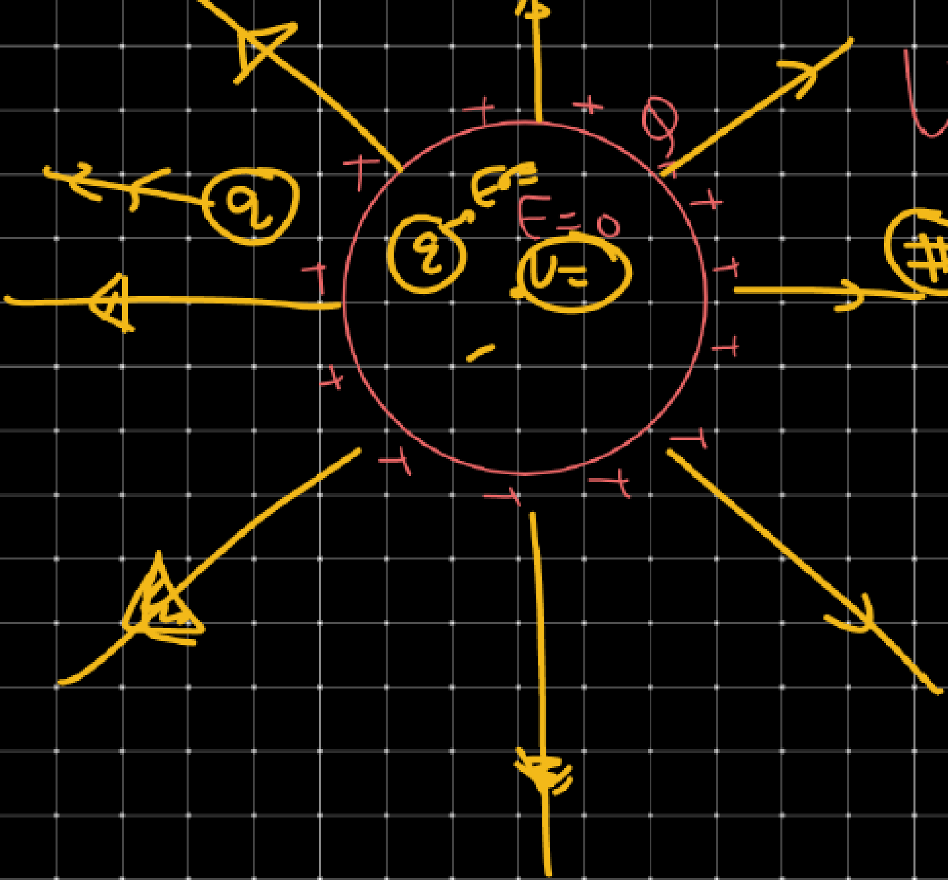
$$W = \frac{K}{R}\left[\frac{q^2}{2}\right]_0^Q$$

$$W = \frac{K}{R}\left[\frac{Q^2}{2} - 0\right]$$

$$W = \frac{KQ^2}{2R}$$

Store in form of potential energy.

Q Potential Energy of Hollow charged sphere.

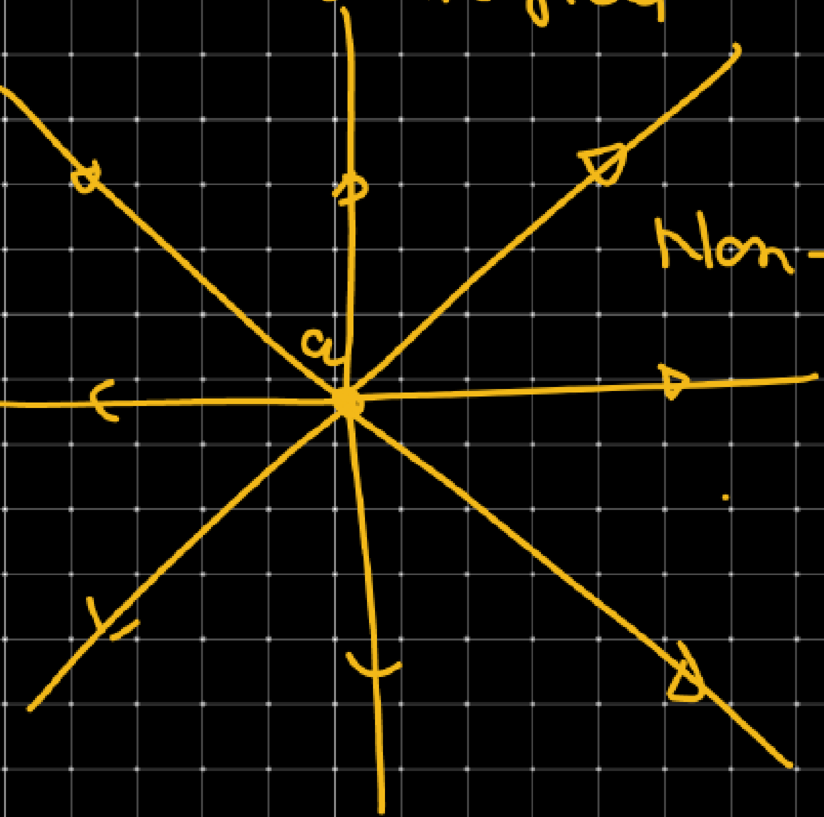


$$U = \frac{KQ^2}{2R}$$

Energy store in form of E.F.L from (R to ∞)

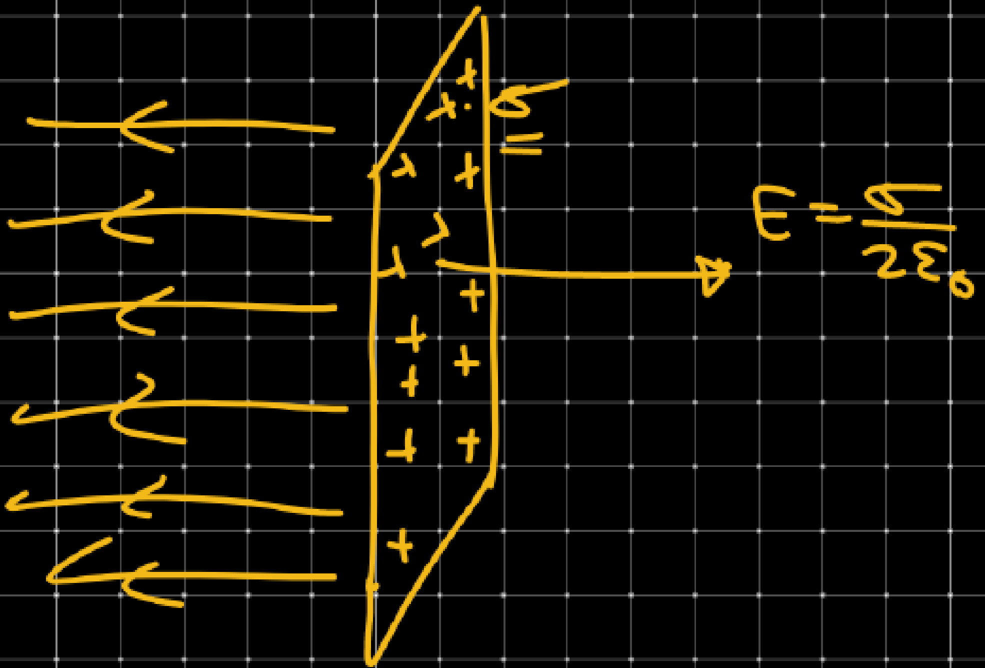
For an charge particle in non-Uniform Electric field.

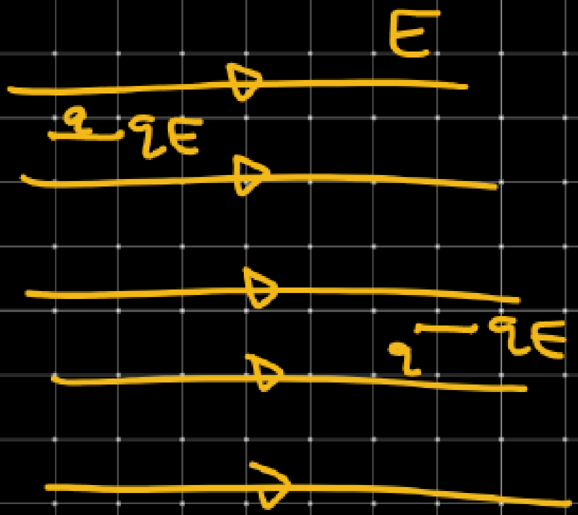
$$E \propto \frac{1}{r^2}$$



Non-Uniform Electric field.

↳ Uniform electric field due to infinite sheet.

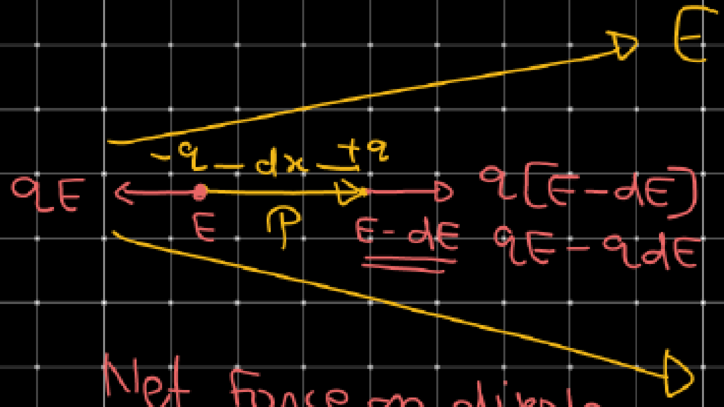




(#) For infinite charge wire.

$$E = \frac{\lambda}{2\pi\varepsilon_0 r} \qquad E \propto \frac{1}{r}$$

For an dipole in non-Uniform electoric field :-



Net Force on dipole

$$= qE - qE + qdE$$

$$= qdE$$

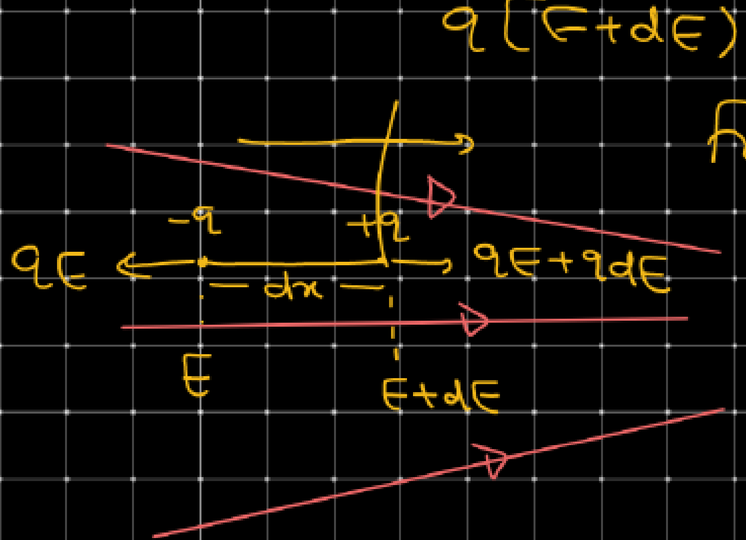
$$\text{Force} = q \cdot dE$$

$$= (q\,dx)\,\frac{dE}{dx}$$

$$= p\,\frac{dE}{dx}$$

$$\boxed{F = p\left|\frac{dE}{dx}\right|}$$

$$E = -\frac{\partial V}{\partial x} \quad (V/m)$$



$$F_{net} = \cancel{qE} + q\,dE - \cancel{qE}$$

$$F_{net} = q\,dE$$

$$F_{net} = (q \times dx)\frac{dE}{dx}$$

$$\boxed{F_{net} = P\left|\frac{dE}{dx}\right|}$$

P – dipole moment

$$V/m^2 \leftarrow \frac{dE}{dx} = N/C\cdot m$$

$$\frac{V/m}{m}$$

AIIMS) 2013)

Q) A dipole of dipole moment 'P' is placed in a non-uniform Electric field along x-axis. Electric field is increases at the rate of 1 V/m². then find Force on dipole.

(a) 0

(b) 2P

(c) P/2

(d) P ✓

(P)

$$\frac{dE}{dx} = 1\,V/m^2$$

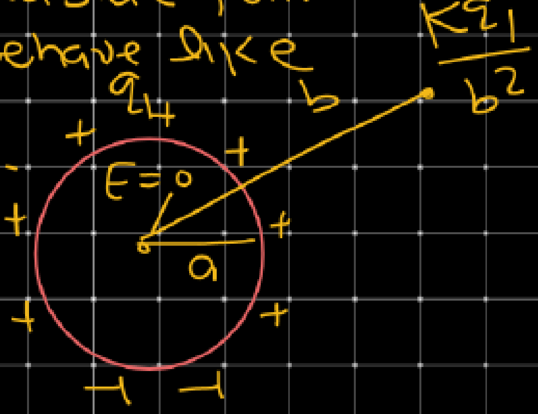
$$F = P\left|\frac{dE}{dx}\right|$$

$$= P \times 1$$

$$= P$$

Electric field due to conducting sphere.

For outside point sphere behave like Point charge.



$E_c = 0$

$r < a$

inside

$E = 0$