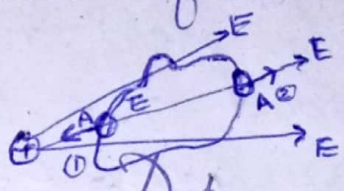
gauss's law mein charge hamesha ~~and~~ Closed Surface k andar hona chahiye.



GAUSS'S LAW

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point 1 or 2 wala flux ek dusre ko cancel out krdenge.

$\phi = 0$

The rate of volume flow through the loop is:

$$\phi = (V\cos\theta)A.$$

$$\phi = VA\cos\theta = \vec{V}.\vec{A}$$

ELECTRIC FLUX:

The ammount of field, material or other physical entity passing through a surface.

$$\phi = E.\Delta A$$

$$\phi = E\Delta\cos\theta$$

Unit → $N\cdot m^2/C$

Dot

$\theta < 90°$

flux is +ve

i.e out of surface

$\theta > 90$

flux is -ve

GAUSS'S Law:

$$\phi = \frac{q_{(net)}}{\varepsilon_0}$$

net charge inside

or $\varepsilon_0 E\cdot\Delta A = q_{(net)}$

size of closed surface doesnot effect gauss's law and also doesnot depend on shape of closed surface.

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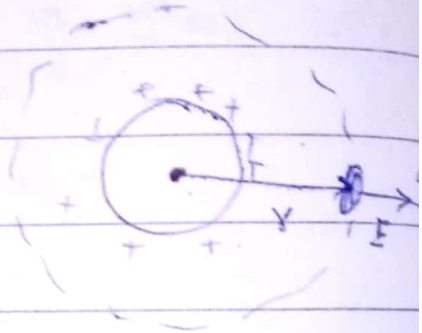
$\frac{1}{2} a \ln\left(\frac{x+1}{x-1}\right)$

electric field due to hollow (conducting / non-conducting) & solid conducting sphere.

inside $\Rightarrow E = 0$ outside $\Rightarrow E = \frac{KQ}{r^2}$ Date

- ELECTRIC FIELD DUE TO POINT CHARGE:

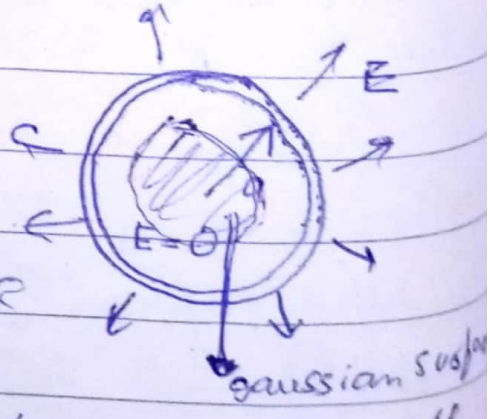
$$E = \frac{KQ}{r^2}$$



- A SPHERICALLY SYMMETRIC CHARGE DISTRIBU

$$E = \frac{Qr}{4\pi\epsilon_0 a^3} = \frac{KQr}{a^3} \qquad r < a$$

- ELECTRIC FIELDS DUE TO A THIN SPHERICAL SHELL : (Hollow sphere)



- A shell of uniform charge attracts, or repels a charge which is outside the shell.
- There is no Electrostatic force inside shell.

outside

$$E = \frac{KQ}{r^2} \qquad r > a$$

$E = 0$ in region $r < a$

inside

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$\frac{Q_{inc}}{\epsilon_0} = E 2\pi r l \rightarrow \lambda = \frac{Q}{l} \Rightarrow Q = \lambda l$

$\frac{\lambda l}{\epsilon_0} = E 2\pi r l$

$\lambda = \frac{\text{charge}}{\text{length}}$ (linear charge density i.e charge per unit length)

$= \frac{\text{Coulomb}}{\text{meter}}$

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- CYLINDRICALLY SYMMETRIC CHARGE DISTRIBUTION

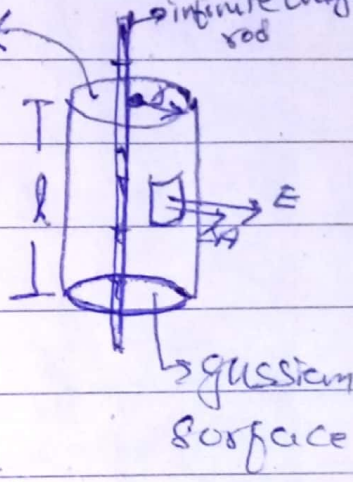
electric field due to infinitely long, straight line of charge at a point r from the line

$$E = \frac{\lambda}{2\pi\epsilon_0 r} = \frac{2k\lambda}{r}$$

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

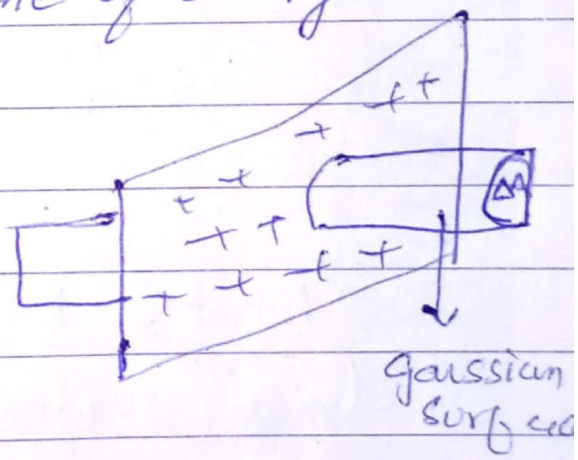
gaussian

r = radius of cylinder



- A Non-Conducting Plane of Charge:

$$E = \frac{\sigma}{2\epsilon_0}$$



An inward piercing is -ve flux.

An outward " is +ve flux

A skiming field is ZERO flux.

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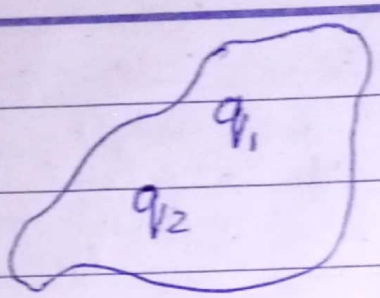

→ ye mathematical form hai flux ki

$$\phi = \frac{q_1 + q_2}{\varepsilon_0} = \oint \vec{E} \cdot d\vec{A}$$

↓ leken gauss law mein sirf inside consider krenge.

↳ This is net $\vec{E}$ due to all charges (inside/outside)

What is the flux if a dipole is inside a closed surface. Ans → $\phi = 0$ bcz there are equal & opp charges

1. The gaussian surface should be symmetric about charge/charge distribution.

2. The $\vec{E}$ field must be symmetric (equal/constant/same) at all points of gaussian surface.
(otherwise gauss's law is valid but not usefull).

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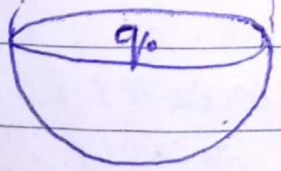
3. The θ (angle between $\vec{E}$ & $\vec{A}$) must be same at all points of the surface. ($\theta = 0$ or $90°$)

4. Gaussian surface must not pass through any point charge.

(In conditions par gauss's law useful hai)

Q: Calculate flux through the following.

1) 

ye humne symmetry k liye khud banaya hai

Flux through hemisphere?

$$\phi = \frac{q_0}{2\epsilon_0}$$

q k poore sphere q/ϵ_0
to half mein ÷ by 2.

2) 

$$\phi = \frac{q}{2\epsilon_0}$$

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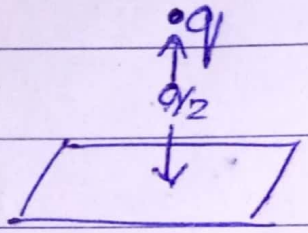
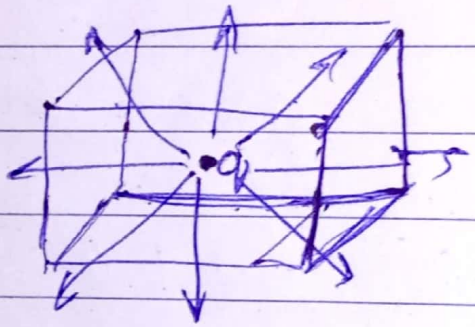
Flux through this plate.



$\phi = ?$



$\phi_{abso} = \frac{q}{6\epsilon_0}$

↳ q k 6 sid
hoti hai. lekn
ye jab hi possible ho
• jab charge equal distance par ho.

• ECE CTRIC FIELD DUE TO CYLINDERS :

→ charge resides surface

1) Solid conducting cylinder / Hollow conduct
cylinder / Hollow non-conducting cylinder.

agr solid conducting cylinder hai to charge surfac
par hoga andar nhi hoga. Or hollow mein
bhi surface par hoga.

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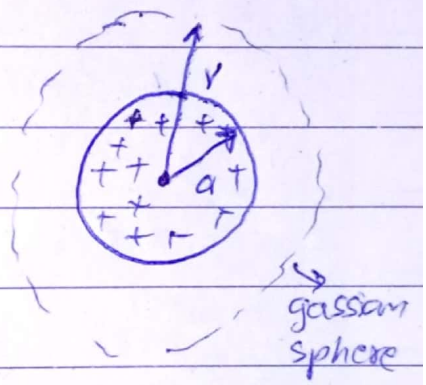
Charge is on the surface → $\sigma = \frac{\text{charge}}{\text{Area}}$

- There is no charge inside a conducting or hollow cylinder.

- SPHERICALLY SYMETRIC CHARGE DISTRIBUTION: (a uniform)

$$E = \frac{KQ}{r^2} \quad (\text{for } r > a)$$

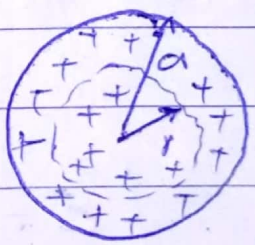


$$\rho = \frac{Q_{in}}{\text{Volume}}$$

ρ is charge per unit volume

$$Q_{in} = \rho(\text{Volume})$$

$$= \rho \frac{4\pi r^3}{3}$$



$$= \rho \frac{4\pi a^3}{3}$$

$$\Phi = E \cdot dA$$

$$\frac{Q_{in}}{\epsilon_0} = E \cdot (4\pi r^2)$$

$$E = \frac{Q_{in}}{\epsilon_0 4\pi r^2} = \frac{\rho \frac{4}{3}\pi r^3}{4\epsilon_0 \pi r^2} = \frac{\rho}{3\epsilon_0} r$$

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of full charge 'Q' enclosed

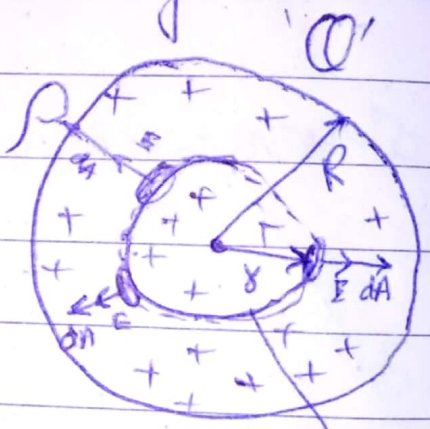
- Electric field inside a non-conducting solid.

$r < R$

$$E = \frac{Q}{4\pi\epsilon_0 R^3}\, r$$

in terms of 'ρ'

$$E = \frac{\rho r}{3\epsilon_0} \qquad E \propto r$$



- Electric field ~~inside~~ outside a non-conducting solid.

$r > R$

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

in terms of ρ

$$E = \frac{\rho R^3}{3\epsilon_0 r^2} \qquad E \propto \frac{1}{r^2}$$

outside

Date

inside non-conducting sph

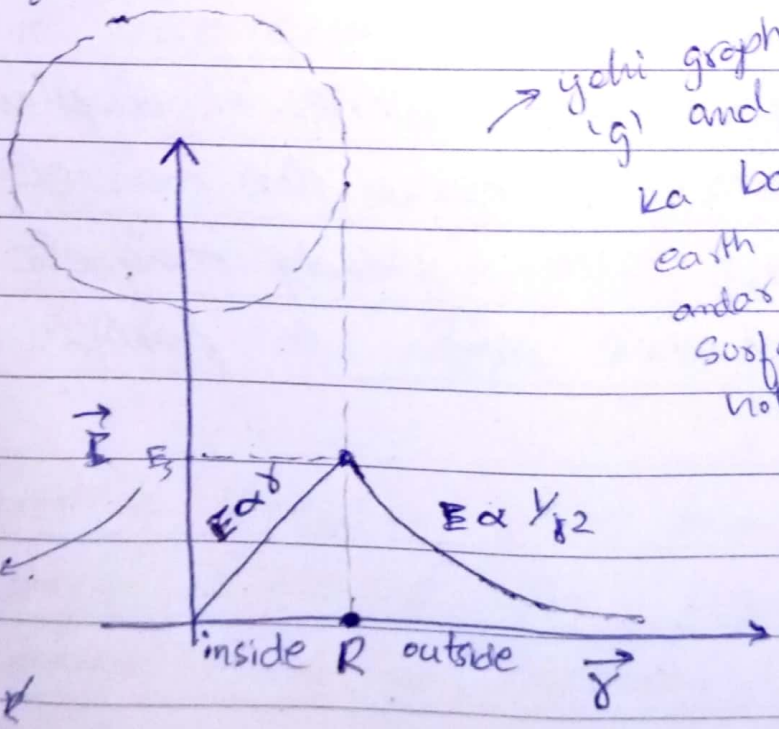
$E = \frac{Q}{4\pi\varepsilon_0 R^3} r$ → these all are constant

$\therefore E \propto r$ (radius of gaussian sphere)

inside or outside mein difference ye hai k:

Inside mein jinside bashta shega center se surface tak or phir surface par max. lekin surface se baahir decr. hoga.

Outside mein jo k charge surface pe sirf decrease hota hai.



→ yahi graph acc due to gravity 'g' and distance from earth ka banta hai (R) bcz earth is also a solid sphere andar 'g' bartha shega or surface par max. phir kam hota shega.

$E = \frac{Q}{4\pi\varepsilon_0 R^2}$

$E = \frac{Q}{4\pi\varepsilon_0 r^2}$

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