250
22

$\vec{E} \parallel \vec{A}$

E uniform

$\varepsilon = \frac{1}{4\pi k}$

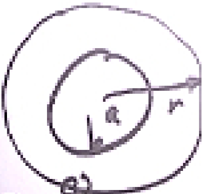
$$\Phi_E = \frac{q_{enc}}{\varepsilon_0}$$

$$q_{enc} = q$$

$$\Phi_E = \oiint \vec{E}\cdot d\vec{A}$$
$$= \oiint E\,dA$$
$$= E \oiint dA$$
$$= E(4\pi r^2)$$

$$E(4\pi r^2) = \frac{q}{\varepsilon_0}$$

$$\vec{E} = \frac{q}{4\pi\varepsilon_0 r^2}\hat{r}$$



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

On GS

$\vec{E} \parallel \vec{A}$

E uniform

$$\Phi_E = \frac{Q_{enc}}{\varepsilon_0} = \frac{Q}{\varepsilon_0}$$

$$\Phi_E = \oiint \vec{E} \cdot d\vec{A}$$

$$= \oiint E\, dA$$

$$= E \oiint dA = E(4\pi r^2)$$

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

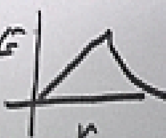
$\rho = \frac{Q}{\frac{4}{3}\pi a^3}$ on GS $\vec{E} \parallel \vec{A}$

$\oint_{G} = \frac{Q_{enc}}{\varepsilon_0}$ | E uniform

$$Q_{enc} = \iiint \rho \cdot d^3 r$$

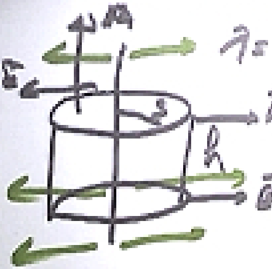
$$= \rho \iiint d^3 r$$

$$= \rho \left[\frac{4}{3}\pi r^3\right]^{G}$$



$$\oint = E(4\pi r^2)$$

$$\vec{E} = \frac{\rho}{3\varepsilon_0}\vec{r} = \frac{Q}{4\pi\varepsilon_0 a^3} r \hat{r}$$



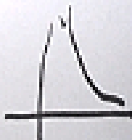
$\lambda = \frac{Q}{L}$

on LSA: $\vec{E} \parallel \vec{A}$

on ends $\vec{E} \perp \vec{A}$

$\vec{E}$ uniform

$$\oint_E = \frac{q_{enc}}{\varepsilon_0} = \frac{\lambda h}{\varepsilon_0}$$



$$\oint_E = \Phi_{E_{ends}} + \oint_{E_{LSA}}$$

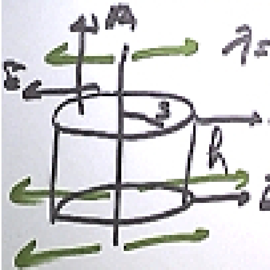
$\vec{E} \cdot d\vec{A} = 0$ $\quad 0$

$$= \oint_{LSA} \vec{E} \cdot d\vec{A}$$

$$= \oint E\, dA$$

$$= E \oint dA = E(2\pi s h)$$

$$E = \frac{\lambda h}{2\pi \varepsilon_0 s h} \Rightarrow \boxed{\frac{\lambda}{2\pi \varepsilon_0 s}\hat{s} = \vec{E}}$$

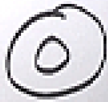


$\lambda = \frac{Q}{L}$

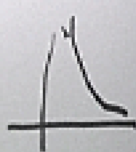
$\vec{A}$ on LSA: $\vec{E} \parallel \vec{A}$

on ends $\vec{E} \perp \vec{A}$

$\vec{E}$ uniform



$$\Phi_E = \frac{Q_{enc}}{\varepsilon_0} = \frac{\lambda h}{\varepsilon_0}$$



$$\Phi_E = \Phi_{E_{ends}} + \Phi_{E_{LSA}}$$

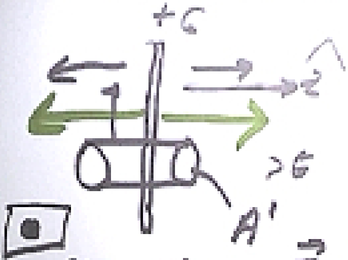
$\frac{\vec{E}\,d\vec{A}}{\varepsilon_0}$ $\quad \oint_{ends} = 0$

$$= \oint_{LSA} \vec{E}\cdot d\vec{A}$$

$$= \oint E\,dA$$

$$= E\oint dA = E(2\pi s h)$$

$$E = \frac{\lambda h}{2\pi\varepsilon_0 s h} \Rightarrow \boxed{\frac{\lambda}{2\pi\varepsilon_0 s}\hat{s} = \vec{E}}$$



$\sigma = \frac{Q}{\text{Area of Plate}}$

On ENDS: $\vec{E} \parallel \vec{A}$; E uniform

On LSA: $\vec{E} \perp \vec{A}$

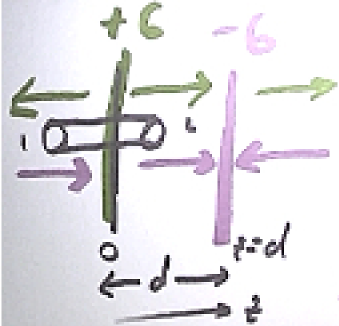
$$\Phi_E = \frac{q_{enc}}{\varepsilon_0} \qquad q_{enc} = \sigma A'$$

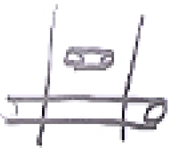
$$\Phi_E = \Phi_{E_{LSA}} + \Phi_{E_{ENDS}}$$

$$= \oiint \vec{E}\cdot d\vec{A} = \oiint E\,dA = E \oiint dA$$

$$= 2EA' \qquad 2EA' = \frac{\sigma A'}{\varepsilon_0}$$

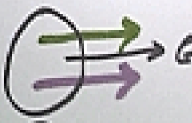
$$\vec{E} = \frac{\sigma}{2\varepsilon_0}\begin{cases} +\hat{z}\,; & z>0 \\ -\hat{z}\,; & z<0 \end{cases}$$





$\Phi_\sigma = 0$

@1



@2

$$\Phi_E = \underbrace{\Phi_{E,①} + \Phi_{E,LSA}}_{0} + \Phi_{E,②}$$

on LSA: $\vec{E} \perp \vec{A}$

on ① : $\vec{E} = \vec{0}$

on ② $\vec{E} \parallel \vec{A}$, E uniform

$$\Phi = \oint \vec{E} \cdot d\vec{A} = \oint E\, dA$$

$$= E \oint dA = EA'$$

$$Q_{enc} = \sigma A'$$

$$EA' = \frac{\sigma A'}{\varepsilon_0} \Rightarrow \vec{E} = \frac{\sigma}{\varepsilon_0}\hat{z}$$

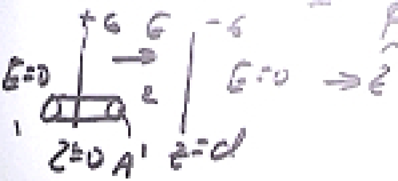
$$Q_{enc} = \sigma A'$$

$$E A' = \frac{\sigma A'}{\varepsilon_0} \Rightarrow \vec{E} = \frac{\sigma}{\varepsilon_0}\hat{z}$$

$$E=0 \quad \left| \; \frac{\sigma}{\varepsilon_0}\hat{z} \; \right| \quad E=0$$

again !!

$\sigma = \frac{Q}{A}$



on GS: @2: $\vec{E} \parallel \vec{A}$; E unif

$$\Phi_E = \oiint \vec{E}\cdot d\vec{A} = \oiint E\,dA$$

$$= E\oiint dA = EA'$$

$$Q_{enc} = \sigma A' \Rightarrow EA' = \frac{\sigma A'}{\varepsilon_0}$$

$\vec{E} = \frac{\sigma}{\varepsilon_0}\hat{z}$ (between)

$\vec{E} = \vec{0}$ outside

1a $\rho = C \cdot r$

$$Q = \iiint \rho \, d^3r$$

if spherical symmetry

$$\iiint \rho \, d^3r = 4\pi \int_0^r \rho \cdot [r^2 dr]$$

$$= 4\pi C \int_0^r r \cdot r^2 dr$$

$$= 4\pi C \int_0^r r^3 dr$$

$$\boxed{\frac{4\pi C r^4}{4} = \pi C r^4} \quad \boxed{C = \frac{Q}{4\pi r^4}}$$

1a $\rho = C \cdot r$

$$Q = \iiint \rho \, d^3 r$$

if Spherical symmetry

$$\iiint \rho \, d^3 r = 4\pi \int_0^r \rho \cdot [r^2 dr]$$

$$= 4\pi C \int_0^a r \cdot r^2 dr$$

$$= 4\pi C \int_0^a r^3 dr$$

$$\frac{4\pi C a^4}{4} = \pi C a^4$$

$$C = \frac{Q}{4\pi a^4}$$

Stop $\div \varepsilon_0 (4\pi r^2)$