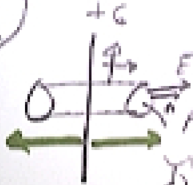
250
22



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

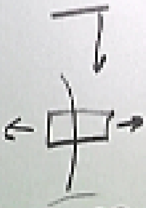
$\Phi_E = \oiint \vec{E}\cdot d\vec{A}$

$= \oiint E\,dA$

$= E\oiint dA$

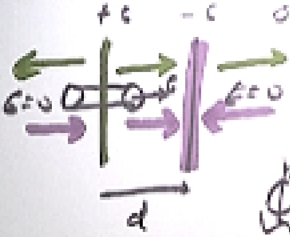
$= EA'\cdot 2$

$q_{enc} = \sigma A'$



$\Delta E = \frac{\sigma}{\varepsilon}$

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



ON ENDS: $\vec{E} \parallel \vec{A}$, ON LSA: $\vec{E} \perp \vec{A}$

E uniform

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

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

$$= EA' \qquad q_{enc} = \sigma A'$$

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

$$= \vec{0} \quad \text{outside}$$

$$\rho = \rho_0 \frac{r}{a}$$

$$Q = \iiint \left(\rho_0 \frac{r}{a}\right) d^3 r$$

Spherical Symmetry

$$= \int_0^a \rho_0 \frac{r}{a} \left(4\pi r^2 dr\right)$$

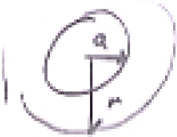
$$= \frac{4\pi\rho_0}{a} \int_0^a r^3 dr$$

$$= \frac{4\pi\rho_0}{a} \left[\frac{r^4}{4} \Big|_0^a \right]$$

$$= \frac{4\pi\rho_0}{\cancel{a}} \cdot \frac{a^{\cancel{4}\,3}}{\cancel{4}}$$

$$Q = \pi\rho_0 a^3 \Rightarrow \rho_0 = \frac{Q}{\pi a^3}$$

$\rho = \left[\frac{Q}{\pi a^3}\right]\frac{r}{a}$



$E_{out}:=$

$\oint E = \frac{Q_{enc}}{\epsilon_0}$

$r > a$

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

E unifm

$Q_{enc} = Q$

$Q_{enc} = \iiint \left[\frac{Q}{\pi a^3}\right]\frac{r}{a}\cdot d^3 r$

$= \frac{Q}{\pi a^3}\cdot\frac{4\pi}{a}\int_0^a r\cdot r^2\,dr$

$= \frac{Q\cdot 4}{a^4}\int_0^a r^3\,dr = \frac{4Q}{a^4}\cdot\frac{a^4}{4}$

$= Q$

$\rho = \left[\frac{Q}{\pi a^3}\right]\frac{r}{a}$

$E_{out}:$ =

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

$r > a$

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

E unifor

$$\oint \vec{E} \cdot d\vec{A} = \frac{Q}{\varepsilon_0}$$

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

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

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

E unifors

$$Q_{enc} = \frac{\rho_0 \cdot 4\pi}{a}\int_0^r r \cdot r^2 dr$$

$$Q_{enc} = \frac{4\pi}{a}\rho_0 \frac{r^4}{4} = \frac{\pi \rho_0 r^4}{a}$$

$$\rho_0 = \frac{Q}{\pi a^3} \Rightarrow \frac{\pi}{a}\frac{Q}{\pi a^3} r^4$$

$$\oint\!\!\oint \vec{E}\cdot d\vec{A} = \frac{q}{\varepsilon_0}$$

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

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

$$\Phi_E = \oint\!\!\oint \vec{E}\cdot d\vec{A} = 4\pi r^2 E$$

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

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

@ $r = a \Rightarrow E_{in} = \frac{Q}{4\pi\varepsilon_0 a^2}\hat{r}$

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

$E = 0$) $E = \frac{Q}{4\pi\varepsilon_0 a^2}$

$$\oiint \vec{E}\cdot d\vec{A} = \frac{q}{\varepsilon_0}$$

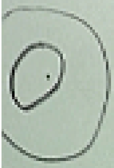
$$4\pi E r^2 = \frac{q}{\varepsilon_0}$$

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

N

$\underline{E}$

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



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

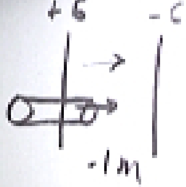
$$4\pi r^2 E = \frac{Q}{\varepsilon_0 a^4} r^4$$

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

@ $r = a \Rightarrow E_{in} = \frac{Q}{4\pi\varepsilon_0 a^2}\,\hat{r}$

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

$E=0$) 6 $E = \frac{Q}{4\pi\varepsilon_0 a^2}$



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

$$A = 1\,m^2$$

$$\sigma = \frac{q}{Area} = \frac{1\mu C}{1m^2}$$

$$\sigma = 1\mu C/m^2$$

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

$\varepsilon_0 = \frac{1}{4\pi k}$

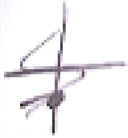
$$\underline{\vec{E} = \frac{1\mu C}{\varepsilon} = 8.52\times10^{+1}\,\frac{N}{C}}$$

$\cancel{\varepsilon_0 = \frac{\mu_0}{c}}$

$$\varepsilon_0 = \cancel{\frac{\mu}{4\pi\mu k} = 8.52\times10^{-1}\times10^{-6}}$$

$$\cancel{= 8.5\times10^{-12}}$$

$$\frac{1\times10^{-6}}{8.5\times10^{-6}\times10^{-6}} = 1.1\times10^{5}\,\frac{N}{C}$$



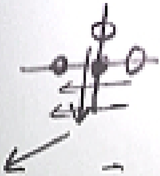
1 (1μ, -1, 0)

2 (-1μ, +1, 0)

3 (1μ, 0, 1)

E@0,0

P(0,0)



$$\vec{E}_p = k\sum_{i=1}^{3} \frac{q_i \hat{r}_{ip}}{r_{ip}^2}$$

$\vec{r}_1 = -1\hat{x} + 0\hat{y}$ $\quad \vec{r}_2 = 1\hat{x} + 0\hat{y}$

$r_3 = 0\hat{x} + 1\hat{y}$ $\quad \vec{r}_p = 0\hat{x} + 0\hat{y}$

$\vec{r}_{1p} = 1\hat{x} + 0\hat{y}$ $\quad \vec{r}_{2p} = -1\hat{x} + 0\hat{y}$

$\vec{r}_{3p} = 0\hat{x} - 1\hat{y}$

$[0^2 + 1^2]^{3/2} = 1$

$$\vec{E}_p = k1\mu\left[\frac{1(1\hat{x}+0\hat{y})}{1} - \frac{(-1\hat{x}+0\hat{y})}{1} + \frac{(0\hat{x}-1\hat{y})}{1}\right]$$

$$= k\mu\left[2\hat{x} - 1\hat{y}\right]$$