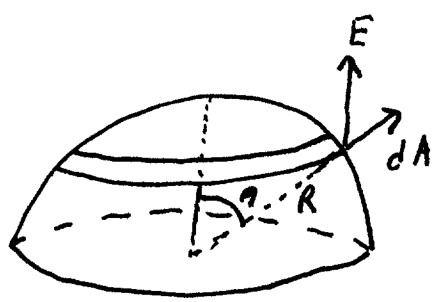
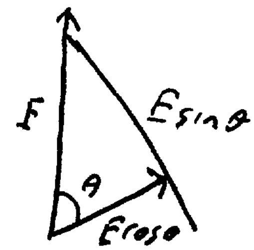
24 - 8

Home Work #4





$E_{\perp \text{ to surface}} = E\cos\theta$

$dA = (2\pi R\sin\theta)R\,d\theta = 2\pi R^2\sin\theta\,d\theta$

$\phi = \iint E\cdot dA = \int_0^{\pi/2} E\cos\theta\, 2\pi R^2 \sin\theta\, d\theta$

$u = \sin\theta$

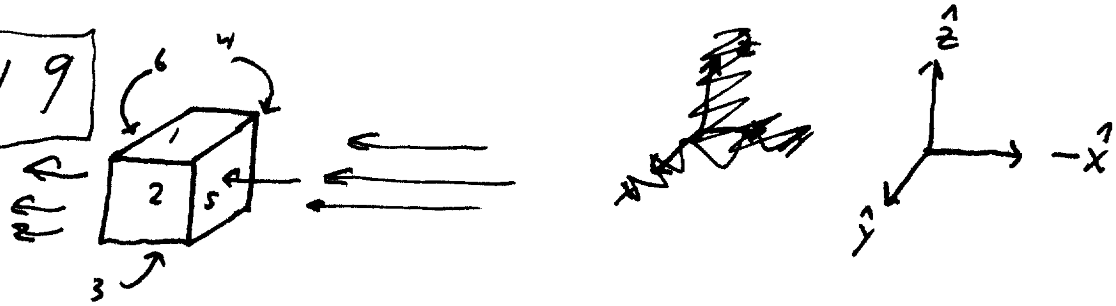
$du = \cos\theta\, d\theta$

$= \int_0^{\pi/2} \underbrace{E\,2\pi R^2}_{\text{constant}}\, u\, d\theta$

$E\,2\pi R^2 \cdot \left.\frac{\sin^2\theta}{2}\right|_0^{\pi/2}$

$$\boxed{\phi = E\pi R^2}$$

$\boxed{24-19}$



$$\phi_1 = \frac{1}{6}\phi_{charge} = \frac{1}{6}\frac{Q}{\epsilon_0}$$

$$\left(\frac{1}{6}\right)(5 \times 10^{-8}\,C)/(8.85 \times 10^{-12}\,C^2/N\cdot m^2) = 9.4 \times 10^2\,N\cdot m^2/C$$

ϕ_1 is the only flux through sideds 1, 2, 3, and 4/
The 2 sides in the ~~yzx~~ y-z plane have an additional ϕ_2 componet

$$\phi_2 = EA = (3000\,N/C)(.20\,m)^2 = 1.2 \times 10^2\,Nm^2/C$$

$9.4 \times 10^2\,Nm^2/C$ for sides parallel to xy or xz planes

$10.6 \times 10^2\,N\,m^2/C$ out of the side $\perp$ to the $-x$-axis

$8.2 \times 10^2\,Nm^2/C$ " " " " " " " $+x$-axis

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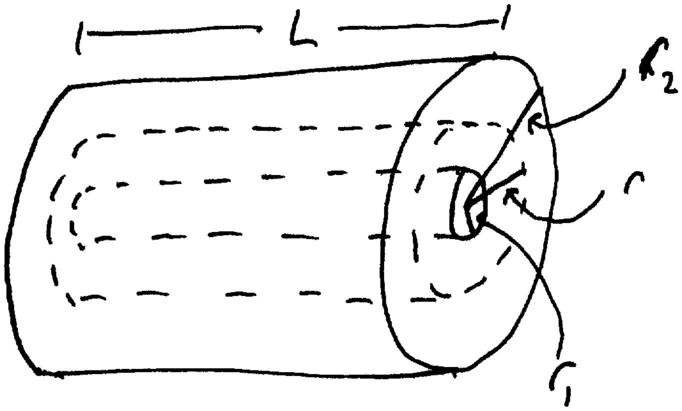


$$\oiint \underline{E} \cdot dA = \iint_{ends} E \cdot dA + \iint_{sides} E \cdot dA = 0 + EA = Q/\epsilon_0$$

$\boxed{r < r_1 \quad E = 0}$

$$E\, 2\pi r L = 0$$

$\boxed{r_1 < r < r_2}$

$$E\, 2\pi r L = \rho\left(\pi r^2 - \pi r_1^2\right)L/\epsilon_0$$

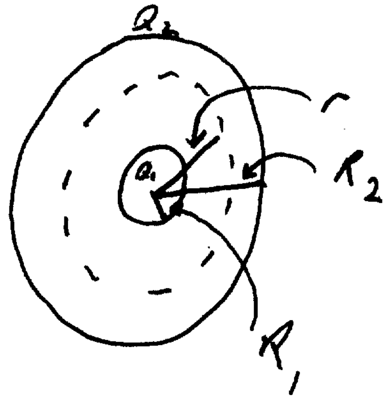
$$\boxed{E = \left[\rho(r^2 - r_1^2)/2\epsilon_0 r\right]\hat{r}}$$

$\boxed{r > r_2}$

$$E\, 2\pi r L = \rho(\pi(r_2^2 - r_1^2)L/\epsilon_0$$

$$\boxed{E = \left[\rho(r_2^2 - r_1^2)/2\epsilon_0 r\right]\hat{r}}$$

$\boxed{24-35}$



$$\rho_1 = Q_1 / \tfrac{4}{3}\pi R_1^3$$

$$= 3(-2\times10^{-6}C)/4\pi(.03\,m)^3 = -1.77\times10^{-2}\,C/m^3$$

$$\oiint E\cdot dA = EA = q/\epsilon_0$$

$\boxed{r < r_1}$

$$E\,4\pi r^2 = \rho_1\left(\tfrac{4}{3}\pi r^3\right)/\epsilon_0$$

$$E = \rho_1 r/3\epsilon_0 = \left[-1.77\times10^{-2}\,C/m^3 / 3(8.85\times10^{-12}\,C^2/Nm^2)\right] r$$

$$\boxed{E = (-6.7\times10^8)\,r\,\hat{r}\ N/C}$$

$\boxed{R_1 < r < R_2}$

$$E\cdot(4\pi r^2) = Q_1/\epsilon_0$$

$$E = \frac{1}{4\pi\epsilon_0}\frac{Q_1}{r^2} = 9\times10^9\,N\cdot m^2/C^2\,(-2\times10^{-6}C)/r^2$$

$$\boxed{E = \left[(-1.8\times10^4)/r^2\right]\hat{r}\ N/C}$$

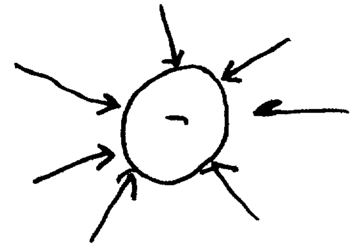
$\boxed{r > R_2}$

$$E\,4\pi r^2 = (Q_1+Q_2)/\epsilon_0 \qquad E = (Q_1+Q_2)/4\pi\epsilon_0 r^2$$

$$E = (9\times10^9\,N\cdot m^2/C^2)\left[(-2\times10^{-6}\,C)+(5\times10^{-6}\,C)\right]/r^2\ N/C$$

$$\boxed{E = \left[2.7\times10^4/r^2\right]\hat{r}\ N/C}$$

$\boxed{24 - 46}$



$$\oint \vec{E}\cdot d\vec{A} = -EA = Q/\epsilon_0$$

$$Q = -\epsilon_0 4\pi R_e^2 E$$

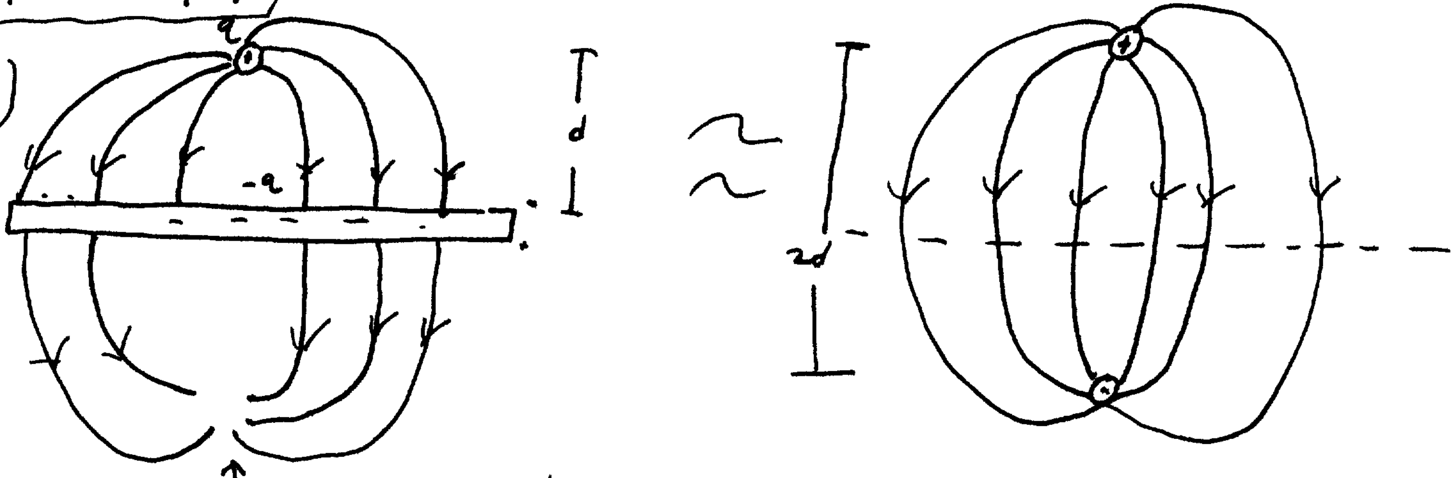
$$= -\left[\frac{1}{(9\times10^9\ N\cdot m^2/C^2)}\right](6.37\times10^6\ m)^2(100\ N/C)$$

$$\boxed{Q = -4.5\times10^5\ C}$$

Hw 5

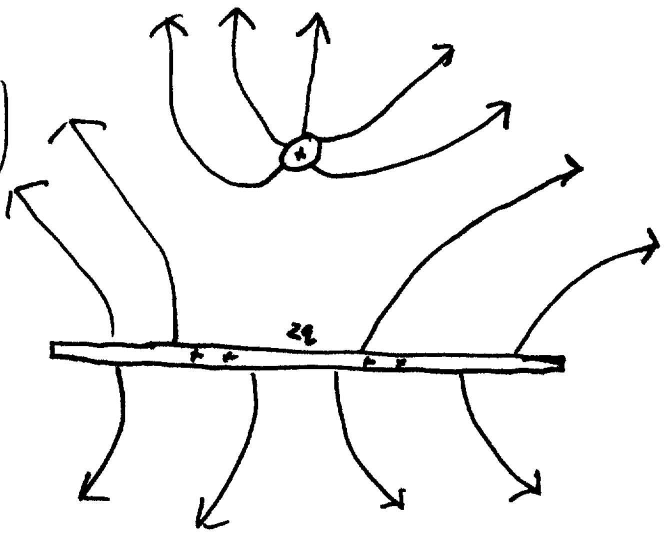
$\boxed{24-47}$

a)



Location of "Image" charge

b)



HW 6