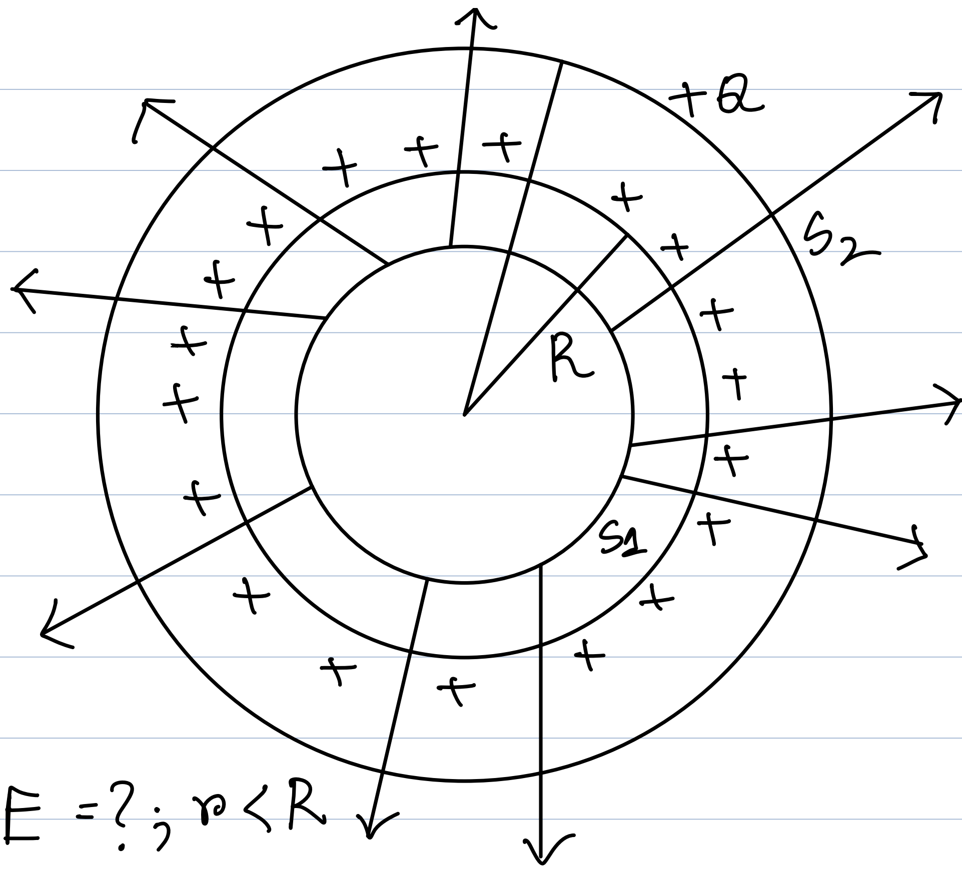


$E = ?\,;\ r < R$

$E = ?\,;\ r \geq R$

$E = 0$ {No Enclosed Charge}

$$\oint \vec{E} \cdot d\vec{s} = \frac{q_{enclosed}}{\epsilon_0}$$

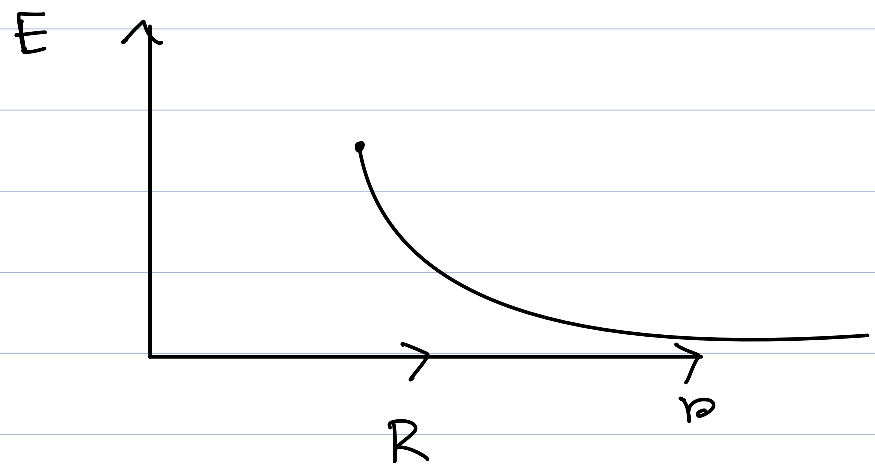
$$\Rightarrow \oint_{S_1} E\, ds = \frac{q_{enclosed}}{\epsilon_0}$$

$$E \oint_{S_2} ds = \frac{q_{enclosed}}{\epsilon_0}$$

$$\Rightarrow E\, 4\pi r^2 = \frac{Q}{\epsilon_0}$$

$$\Rightarrow E = \frac{1}{4\pi\epsilon_0} \frac{Q}{r^2} ; \quad r \geq R$$

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



Chapter 23

17, 24, 25, 27, 28, 29, 34, 47, 49, 52

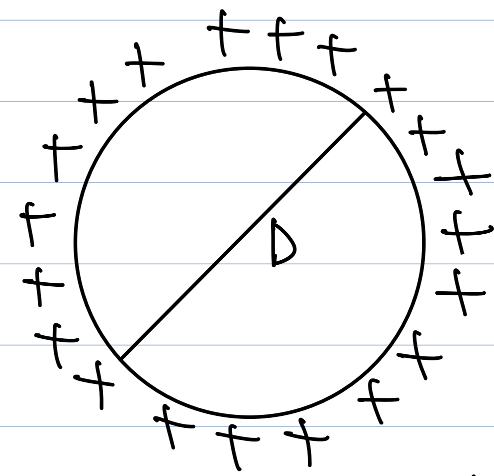
Tuesday Online Class {evening}

17) Conducting Sphere → Surface

a) $D = 1.2m$

$R = 0.6m$

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

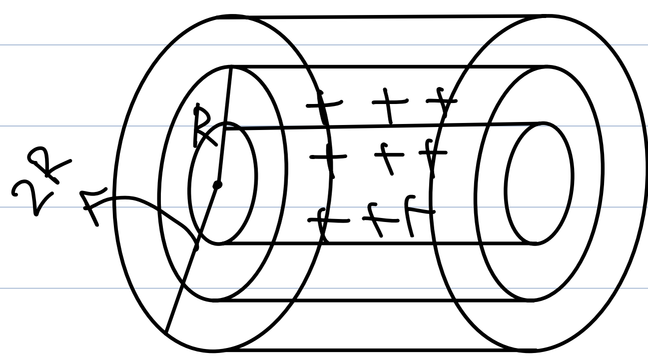


$\Rightarrow 8.1 \times 10^{-6} \, C/m^2 \times 4\pi (0.6)^2$

$= q$

b) $\varphi = \oint \vec{E} \cdot \vec{ds} = \frac{q}{\epsilon_0}$

24|



a) $E = 0$

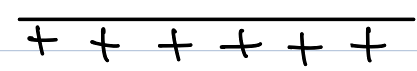
$\oint \vec{E} \cdot \vec{ds} = \frac{q}{\epsilon_0}$

$$\Rightarrow \oint_S E\,ds = \frac{q}{\epsilon_0}$$

$$\Rightarrow \underset{a}{E} \cdot \underbrace{2\pi r l}_{b} = 0$$

$$\therefore E = 0$$

b)



$$E \cdot A = \frac{q}{\epsilon_0}$$

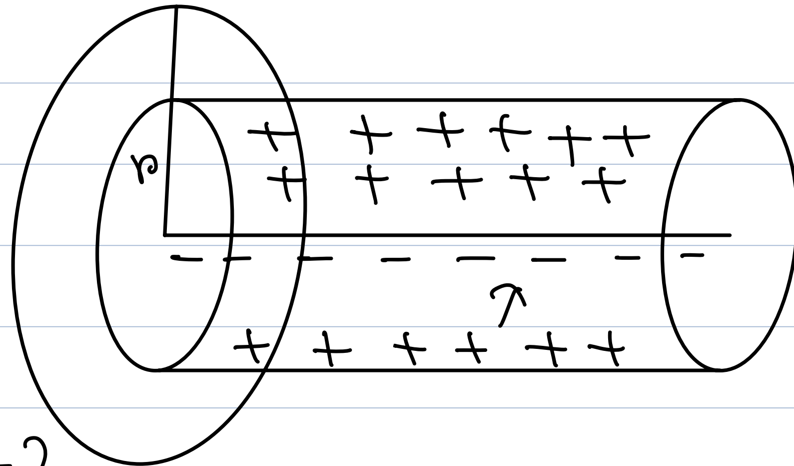
$$\Rightarrow E \cdot 2\pi r L = \frac{\lambda L}{\epsilon_0}$$

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

$$E = \frac{\lambda}{2\pi (2R) \epsilon_0}$$

25) Line of charge → Cylinder

27)



$\sigma = ?$

$$EA = \frac{\lambda L}{\epsilon_0}$$

$$\Rightarrow E \cdot 2\pi r L = \frac{\sigma\, 2\pi r L}{\epsilon_0}$$

$$\Rightarrow E = \frac{\sigma R}{r \epsilon_0}$$

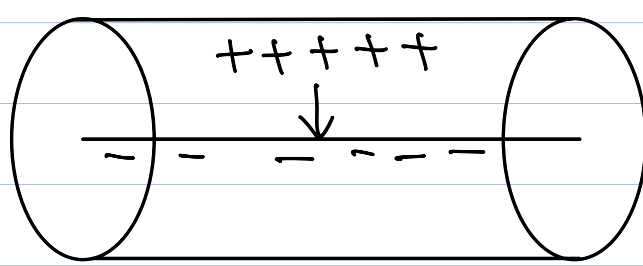
$$\sigma = \frac{q}{A}$$

$$q = \sigma A$$

$$q = \sigma \cdot 2\pi r L$$

$$\vec{E} = 0$$

$$\Rightarrow \vec{E}_{wire} + \vec{E}_{cylinder} = 0$$



$$\Rightarrow E_{wire}(-\hat{i}) + E_{cylinder}(\hat{i}) = 0$$

$$\Rightarrow E_{cylinder} - E_{wire} = 0$$

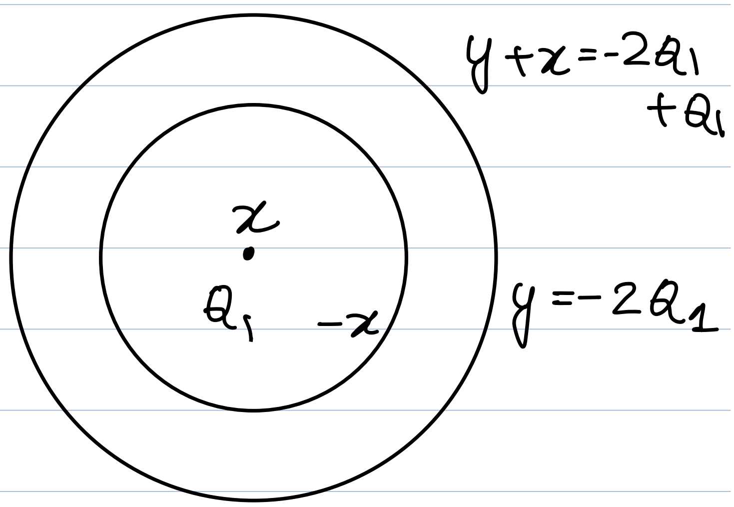
$$\Rightarrow \frac{\sigma R}{r \epsilon_0} - \frac{\lambda}{2\pi r \epsilon_0} = 0$$

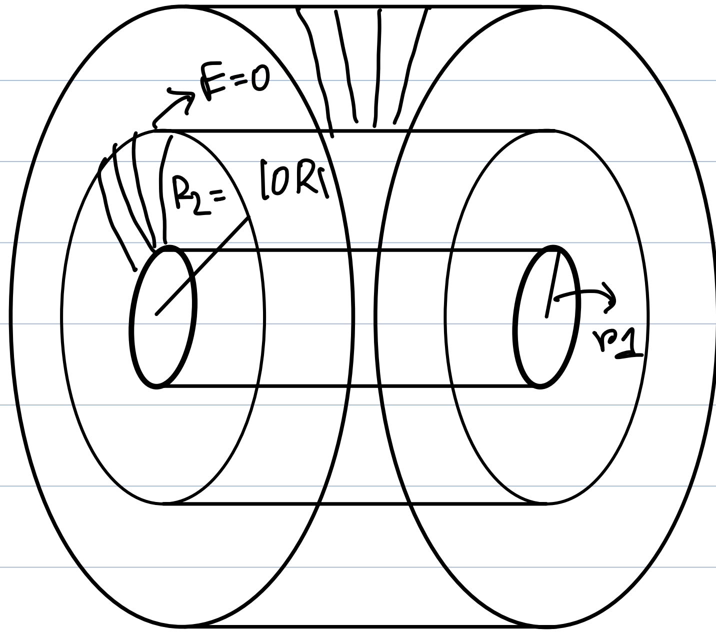
$$\therefore \sigma = \frac{\lambda}{2\pi R}$$

28) Same

29)

a), b)





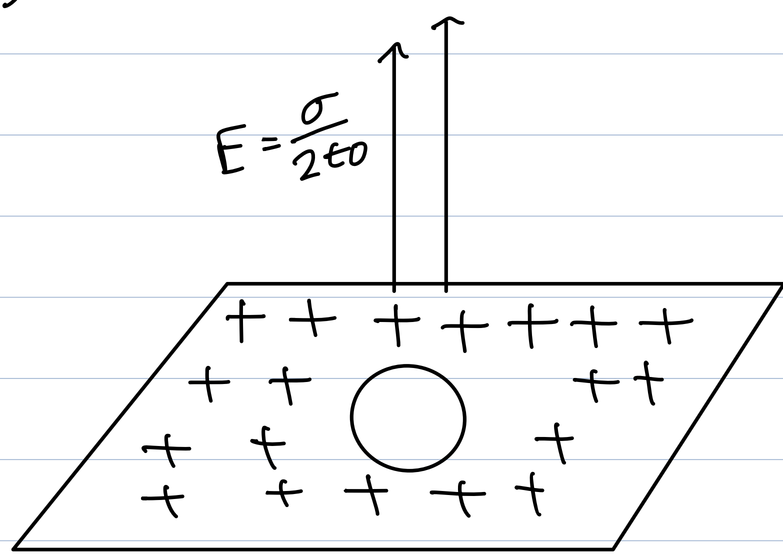
$$E \cdot 2\pi r L = \frac{Q_1}{\epsilon_0}$$

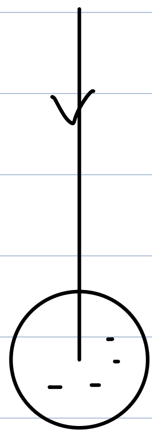
$$\Rightarrow E = \frac{Q_1}{2\pi \times (20R_1)\epsilon_0}$$

$$r = 2R_2$$
$$= 2 \times 10R_1$$
$$= 20R_1$$

c) , d)

34)



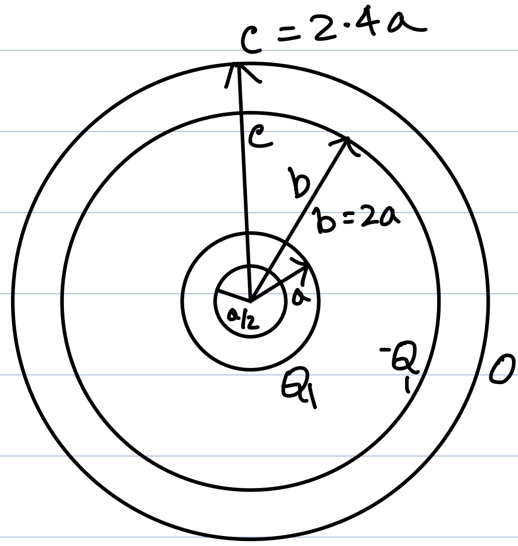


$$E_{total} = E_{plane} - E_{disk}$$

$$E_{disc} = \frac{\sigma}{2\epsilon_0}\left(1 - \frac{z}{\sqrt{z^2+R^2}}\right)$$

47) Try

49)



$$E = \frac{1}{4\pi\epsilon_0}\cdot\frac{qr}{R^3} \quad ; \quad r \leq R$$

$$E = \frac{1}{4\pi\epsilon_0}\cdot\frac{q}{r^2} \quad ; \quad r \geq R$$

a)

b) $E = \dfrac{1}{4\pi\epsilon_0} \dfrac{q_1 \, a/2}{a^3}$

c) $E = \dfrac{1}{4\pi\epsilon_0} \dfrac{q_1}{(ar)}$

d) $E = \dfrac{1}{4\pi\epsilon_0} \cdot \dfrac{q}{(1.5a)^2}$

$R = a$
$1.5a > a$

e)

f) $E = 0$

52) Try