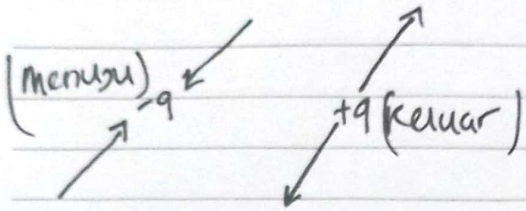
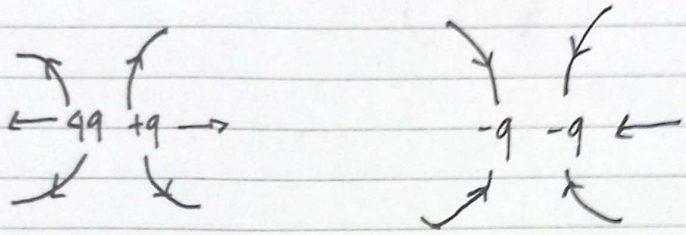
Kelistrikan

1. Statis = Gaya listrik, Medan listrik, Potensial
2. Dinamis = Energi, usaha, Polarisasi, dielektrik

Kemagnetan : Medan magnet, elektromagnet

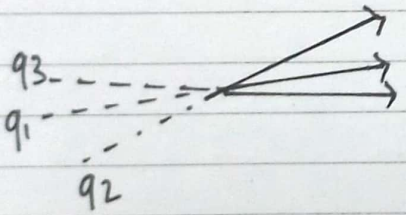
atom → $q = n \cdot e$



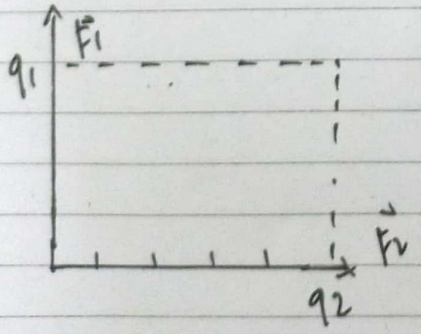


$F = k$

$F = \frac{1}{4\pi\varepsilon_0} \frac{q \cdot q}{r^2}$



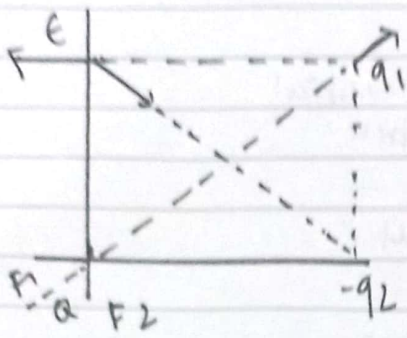
$F_Q = \vec{F}_1 + \vec{F}_2 + \vec{F}_3$



$$\vec{F}_Q = kQ \left[\frac{q_1}{3^2} (\hat{j}) + \frac{q_2}{4^2} (\hat{i}) \right]$$

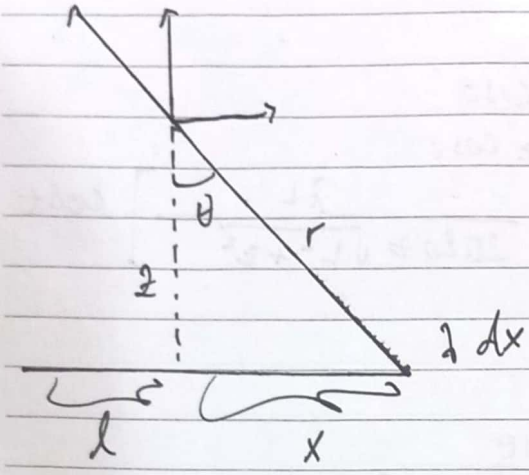
$$= -kq \left[\frac{q_1}{9} \hat{j} + \frac{q_2}{16} \hat{i} \right]$$

No
Date



$$\hat{r} = \frac{\vec{r}}{r}$$

$$F = KQ \left[\frac{q_1}{5^2} \left(\frac{-4\hat{i} - 3\hat{j}}{5} \right) + \frac{q_2}{4^2} \hat{j} \right)$$



$$d\vec{E} = d\vec{E}_x + d\vec{E}_y$$

$$= dE \cos\theta$$

$$= \frac{1}{4\pi\varepsilon_0} \int_{-l}^{l} \frac{\lambda\, dx}{r^2} \cos\theta$$

$$= \frac{1}{4\pi\varepsilon_0} \int_{0}^{l} \frac{2\lambda\, dx}{r^2} \cos\theta$$

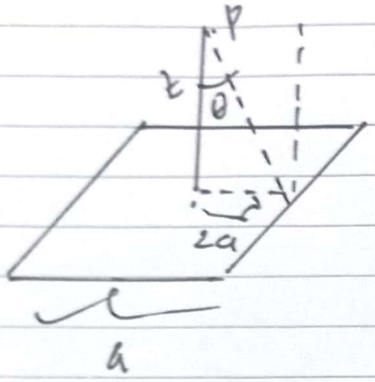
$$= \frac{1}{4\pi\varepsilon_0} \int_{0}^{L} \frac{z\, 2x\, dx}{(x^2+z^2)^{3/2}}$$

$$= \frac{2z\lambda}{4\pi\varepsilon_0} \int_{0}^{L} \frac{dx}{(x^2+z^2)^{3/2}}$$

$$= \frac{2z\lambda}{4\pi\varepsilon_0} \left[\frac{x}{z^2\sqrt{x^2+z^2}} \Big|_0^L \right]$$

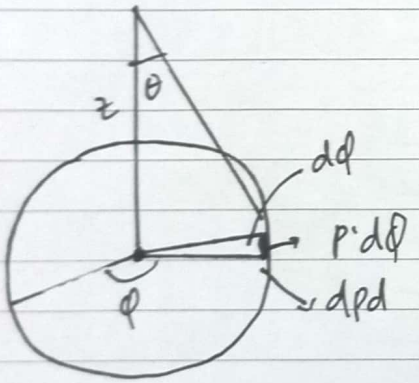
$$= \frac{\lambda}{2\pi\varepsilon_0} = \left[\frac{L}{\sqrt{L^2+z^2}} \right]$$

$$E = \frac{\lambda L}{2\pi\varepsilon_0 z \sqrt{L^2+z^2}}$$



$$\vec{E}_z = \sum E_z' \cos\theta$$
$$= q E_z \cos\theta$$
$$= q\left[\frac{\lambda L}{2\pi\varepsilon_0 z\sqrt{L^2+z^2}}\right]\cos\theta$$

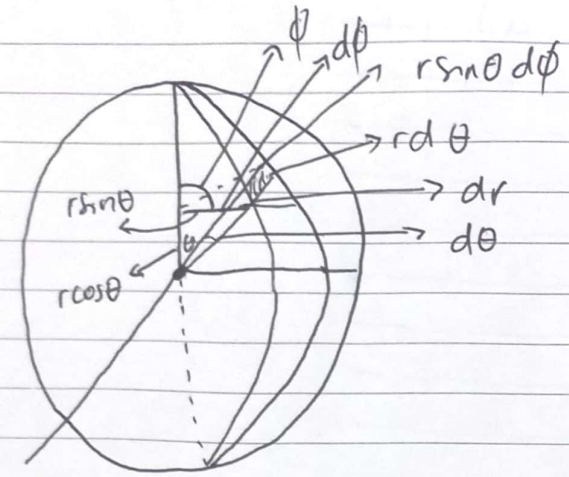
$$\cos\theta = \frac{z}{z'}$$
$$z = z'\cos\theta$$
$$z' = \sqrt{z^2+\left(\frac{1}{2}a\right)^2}$$



$$E = \frac{1}{4\pi\varepsilon_0}\int_0^R\int_0^{2\pi}\frac{\sigma\, dq}{r^2}\cos\theta\,\hat{j}$$

$dq = dr'r'd\phi$ or $r'\,dr'd\phi$

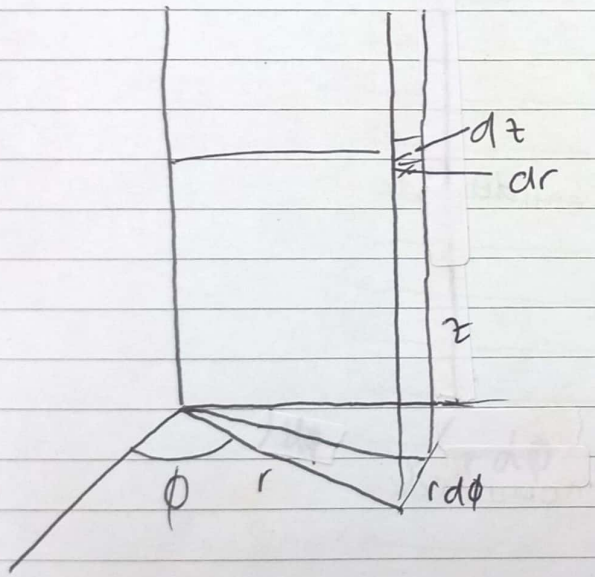
$$E = \frac{\sigma}{4\pi\varepsilon_0}\,2\pi z\int_0^R\frac{r'dr'}{(z'+r'^2)^{3/2}}$$
$$= \frac{2\pi z\sigma}{4\pi\varepsilon_0}\,\frac{1}{2}\int_0^R\frac{d(r'^2+z^2)}{(z^2+r^2)^{3/2}}$$
$$= \frac{2\pi z\sigma}{4\pi\varepsilon_0}\,\frac{1}{2}$$



$V = P \times l \times t$

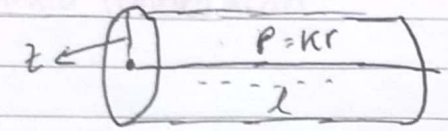
$= r d\theta \cdot r \sin\theta d\phi \cdot dr$

$V = r^2 \sin\theta d\theta \, d\phi dr$



$V = P \times l \times t$

$V = \rho d\phi dr dz$



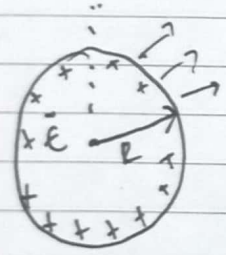
$$\oint \vec{E} \cdot da = \frac{Q_{in}}{\varepsilon_0}$$

$$(2\pi r l) = \frac{1}{\varepsilon_0} \iiint \rho \, dv$$

$$= \frac{1}{\varepsilon_0} \int_0^r \int_0^{2\pi} \int_0^l (kr\hat{r})\, r \, dr\, d\phi\, dz$$

$$= \frac{2\pi l k}{\varepsilon_0} \int_0^r r^2 dr$$

Potensial



$$\vec{E} = \nabla V$$

$$\vec{E} \cdot d\phi = -\Delta V \, d\phi$$

$$\int \vec{E} \, d\phi = -\int \Delta V \, d\phi$$

$$= -dV$$

$$dV = -\int \vec{E} \, d\phi$$

$$\int_a^b dV = -\int \frac{Q}{4\pi\varepsilon_0 r^2} dr$$

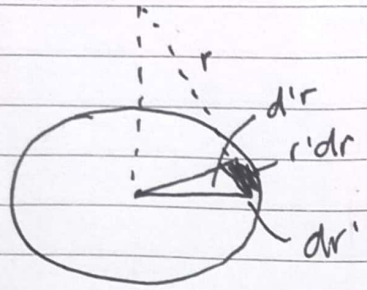
$$V_b - V_a = \frac{Q}{4\pi\varepsilon_0 r}$$

$$V_b = V_a + \frac{Q}{4\pi\varepsilon_0 r}$$

$$V = -\int_\infty^r \frac{Q}{4\pi\varepsilon_0 r} = \frac{Q}{4\pi\varepsilon_0 r} \Big|_\infty^r$$

$$= \frac{Q}{4\pi\varepsilon_0 r}$$

$$= -\int \vec{E} \, d\phi + \int_R^r \vec{E} \, d\phi = \frac{Q}{4\pi\varepsilon_0 R}$$



$$V = \frac{1}{4\pi\varepsilon_0} \iint \frac{\sigma\, da}{r}$$

$$da = r'\,dr$$

$$V = \frac{1}{4\pi\varepsilon_0} \int_0^R \int_0^{2\pi} \frac{r'\,dr'\,d\theta}{(r'^2 + z^2)^{1/2}}$$

$$= \frac{2\pi}{4\pi\varepsilon_0}\,\sigma \int_0^R \frac{r'\,dr'}{(r'^2+z^2)^{1/2}}$$

$$= \frac{2\pi}{4\pi\varepsilon_0}\,\sigma \int_0^R \frac{(r'^2+z^2)^{-1/2}\,dr'^2}{2}$$

$$= \frac{2\pi}{4\pi\varepsilon_0}\,\sigma \int_0^R (r'^2+z^2)^{-1/2}\,dr^2$$

$$\int x^n dx$$

$$= \frac{1}{2}\,\sigma\,\frac{2\pi}{4\pi\varepsilon_0}\left[\frac{(r^2+z^2)^{-1/2+1}}{-1/2+1}\right]$$

$$= \frac{1}{2}\,\sigma\left[\frac{r'^2+z^2}{1/2}\right]^{1/2}$$

$$= \frac{\sigma 2\pi}{4\pi\varepsilon_0}\left[(r'^2+z^2)^{1/2}\right]_0^R$$

$$= \sigma\frac{2\pi}{4\pi\varepsilon_0}\,(R^2+z^2)^{1/2} + (r^2+z^2)^{1/2}$$

$$= \sigma\frac{2\pi}{4\pi\varepsilon_0}\,(R^2+z^2)^{1/2} + z$$