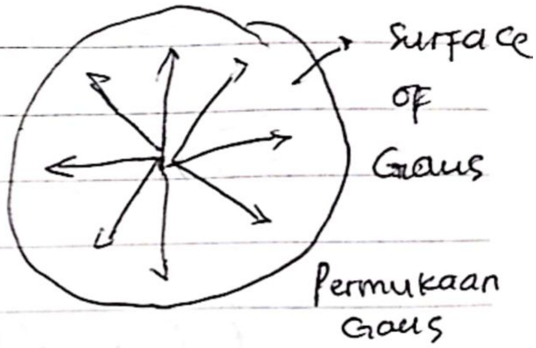
Hukum Gaus and aplikasinya

$$\oint_s \vec{E} \cdot da = \int_v (\nabla \cdot \vec{E})\, d\tau$$

$\tau \Rightarrow V$

lipat 3

$$\oint \vec{E} \cdot da = \oint \frac{q}{4\pi\varepsilon_0 \cancel{r^2}} \cancel{r^2} \sin\theta\, dt\, d\phi$$



$$= \frac{q}{4\pi\varepsilon_0} \int_0^{\pi}\int_0^{2\pi} \sin\theta\, dt\, d\phi$$

E = medan yang muncul pada q

$$= \frac{4\pi q}{4\pi\varepsilon_0}$$

$$\boxed{\oint \vec{E}\, da = \frac{q}{\varepsilon_0}}$$ → Persamaan Gaus dalam bentuk diferensial

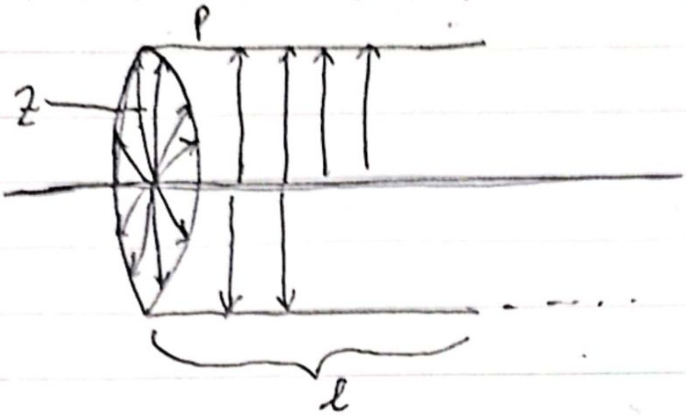
$$\int_v (\nabla \cdot \vec{E})\, d\tau$$

$Q = \rho\, d\tau$ → $\oint \vec{E} \cdot d\vec{a} = \int (\nabla \cdot E) \cdot d\tau$

$$\int (\nabla \cdot \vec{E})\, d\tau = \frac{Q}{\varepsilon_0}$$ → $\rho\, d\tau$

$$= \frac{1}{\varepsilon_0} \int_v \rho\, d\tau$$

$$\boxed{\nabla \cdot \vec{E} = \frac{\rho}{\varepsilon_0}}$$



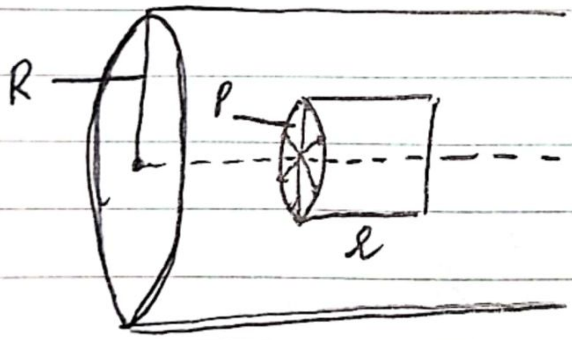
rapat kawat dlm muatan yaitu λ (lamda)

λ Kerapatan dalam muatan

$$\oint \bar{E} \cdot da = \frac{q}{\varepsilon_0}$$

$$\vec{E}\,(2\pi z \cancel{l}) = \frac{\lambda \cancel{l}}{\varepsilon_0}$$

$$\vec{E} = \frac{\lambda}{2\pi \varepsilon_0 z} \; \hat{z}_0$$

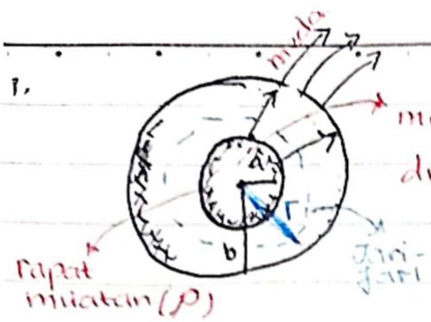


$$\oint \vec{E}\, da = \frac{Q}{\varepsilon_0}$$

$$\vec{E}\,(2\pi r \cdot l) = \frac{Q}{\varepsilon_0}$$

$$\vec{E} = \frac{Q}{2\pi \varepsilon_0 P l} \; \hat{r}_0$$

1.



medan di dlm sama dengan 0

medan sifatnya menyebar

1.) $\vec{E} = 0$.

1. $r < a$
2. $a < r < b$
3. $r > b$

2) $\oint \vec{E} \cdot da = \frac{Q}{\varepsilon_0}$

$\oint \vec{E} \cdot da$

$$E(4\pi r^2) = \frac{1}{\varepsilon_0} \iiint \rho \, d\tau$$

$$= \frac{1}{\varepsilon_0} \int_0^a \int_0^{2\pi} \int_0^{\pi} \rho r^2 \sin\theta \, d\theta \, d\phi \, dr$$

$$= \frac{4\pi\rho}{\varepsilon_0} \int_0^a r^2 dr$$

$$= \frac{4\pi\rho}{\varepsilon_0} \left(\frac{1}{3} r^3 \Big|_0^a \right)$$

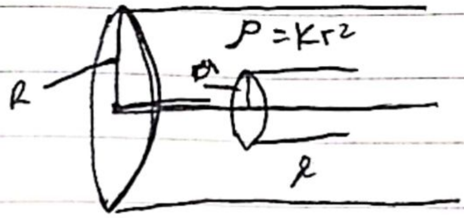
3) $r > b$

$$\oint \vec{E} \cdot da = \frac{1}{\varepsilon_0} \iiint \rho \, d\tau$$

$$= \frac{1}{\varepsilon_0} \iiint \rho r^2 \sin\theta \, d\theta \, d\phi \, dr$$

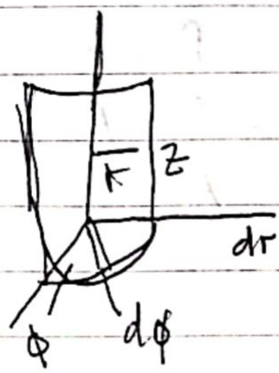
$$= \frac{4\pi\rho}{\varepsilon_0} \int_a^b r^2 dr$$

$$= \frac{4\pi\rho}{\varepsilon_0} \left(\frac{1}{3} r^3 \Big|_a^b \right)$$



1. $r < R$

2. $r > R$



1. $r < R$

$$\oint E \cdot da = \frac{1}{\varepsilon_0} \iiint \rho \, d\tau$$

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

$$= \cancel{\frac{k(2\pi)}{\varepsilon_0}\int_0^{a}}$$

$$= \frac{2\pi k}{\varepsilon_0} \int_0^{l} dz \int_0^{R} r^3 \, dr$$

2. $r > R$

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

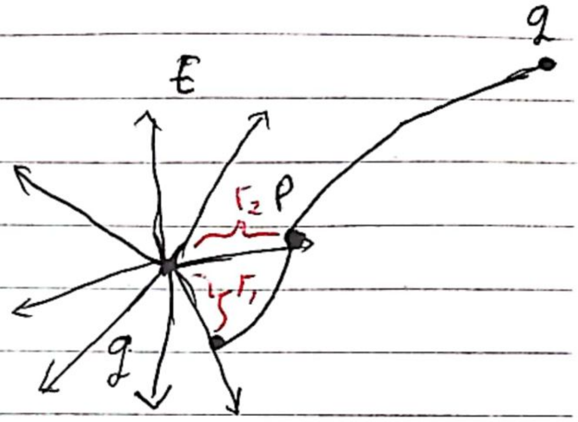
$$E\,(2\pi r \cdot l) = \frac{1}{\varepsilon_0} \int_0^{R} \int_0^{\pi}$$

Potensial = muatan listrik

beda Potensial = arus listrik

Usaha yang memindah muatan ke titik tertentu

$W = F \cdot s$



$V = \frac{W}{q} = \frac{F \cdot s}{q} = \frac{k \frac{q \cdot q}{r} s}{q}$

$$\boxed{V = k \frac{q}{r}}$$

$= -\int_{r} - r_1$

$dv = -\int_{r_1}^{r_2} \bar{E}\, dr$

$V_1 - V_2 = -\int_{r_2}^{r_1} \vec{E}\, d\vec{r}$

$\Delta v = -\int_{r_1}^{r_2} \frac{q}{4\pi\varepsilon_0 r^2}\, dr$

$\Delta v \neq dv$

$= -\square \int_{r_1}^{r_2} r^{-2}\, dr$

$= \frac{q}{4\pi\varepsilon_0} \int_{r_1}^{r_2} r^{-2}\, dr$

$= -\square \left(-\frac{1}{r} \Big|_{r_1}^{r_2} \right)$

$= \square \left(\frac{1}{r_2} - \frac{1}{r_1} \right)$

$V = \frac{1}{4\pi\varepsilon_0} \frac{q}{r} = k \frac{q}{r}$