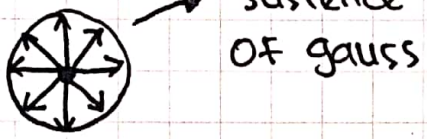
KALISMA

25/03/2024

HUKUM GAUSS AND APPLEID

$\tau \Rightarrow V$

$$\oint_S \vec{E} \cdot d\vec{a} = \oint_V (\nabla \cdot \vec{E})\, d\tau$$



$$\oint \vec{E} \cdot da = \oint \frac{q}{4\pi\epsilon_0 r^2} r^2 \sin\theta \, d\theta \, d\phi$$

$$= \frac{q}{4\pi\epsilon_0} \int_0^{\pi} \int_0^{\pi} \sin\theta \, d\theta \, d\phi$$

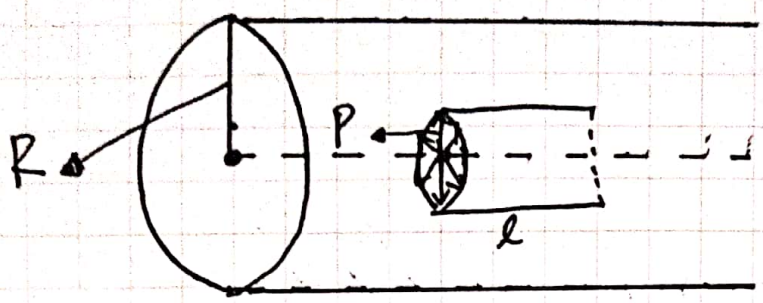
$$= \frac{4\pi q}{4\pi\epsilon_0}$$

$$\oint_S \vec{E} \cdot da = \frac{q}{\epsilon_0} \rightarrow$$ Persamaan gauss dalam bentuk deferensial

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

$$Q = \rho \, d\tau$$

$$\oint_S \vec{E} \cdot da = \int_V (\nabla \cdot E)\, d\tau$$



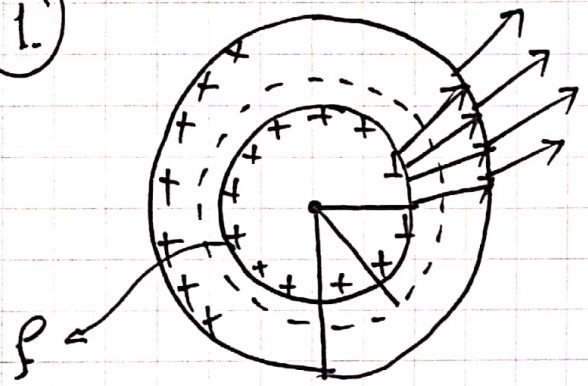
$$\oint \vec{E}\, da = \frac{Q}{\epsilon_0}$$

$$\vec{E}(2\pi r \cdot \ell) = \frac{Q}{\epsilon_0}$$

$$\vec{E} = \frac{Q}{2\pi\epsilon_0 r \ell}\hat{r}_0$$

"Soal"

1.



Hitung $\vec{E}$

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

1. $\vec{E} = 0$
2. $\oint \vec{E} \cdot da = \frac{Q}{\epsilon_0}$

$$\int_0^{\pi}\int_0^{2\pi} \sin\theta\, d\theta\, d\phi = 4\pi$$

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

$$\vec{E}(4\pi r^2) = \frac{1}{\epsilon_0}\iiint \rho\, dV$$

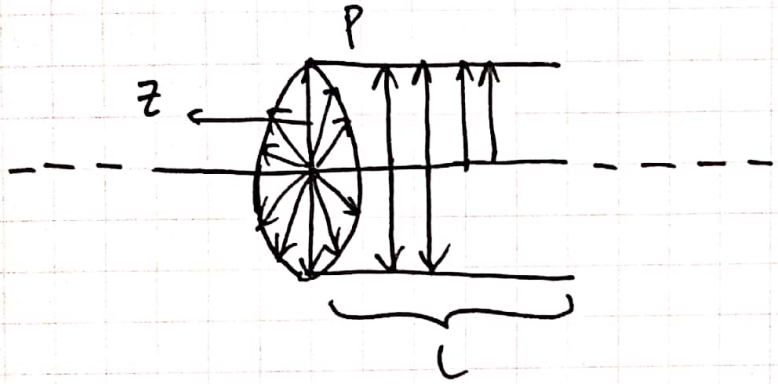
$$= \frac{1}{\epsilon_0}\int_0^{r}\int_0^{\pi}\int_0^{2\pi} \rho \sin\theta\, d\theta\, d\phi\, dr$$

$$= \frac{4\pi\rho}{\epsilon_0}\int_0^{r} r^2\, dr$$

$$\int_V (\nabla \cdot \vec{E})\, d\tau = \frac{Q}{\epsilon_0} \rightarrow \rho\, d\tau$$

$$= \frac{1}{\epsilon_0} \int_V \rho\, d\tau$$

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



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

$$\vec{E} \cdot (2\pi z \cdot d) = \frac{\lambda \cdot d}{\epsilon_0}$$

$$\vec{E} = \frac{\lambda}{2\pi \epsilon_0 z} \hat{z}_0$$

$$\int_0^{\pi}\int_0^{2\pi} \sin\theta \, d\theta \, d\phi = 4\pi$$

→ Lanjutan disebalik

$$= \frac{4\pi\rho}{\epsilon_0}\left(\frac{1}{3}r^3 \Big|_0^a \right)$$

* $r > b$

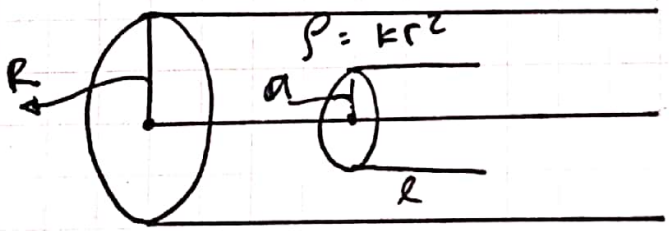
$$\oint \vec{E}.da = \frac{1}{\epsilon_0}\iiint \rho \, d\tau$$

$$= \frac{1}{\epsilon_0}\iiint \rho r^2 \sin\theta \, d\theta \, d\phi \, dr$$

$$= \frac{4\pi\rho}{\epsilon_0}\int_a^b r^2 dr$$

$$= \frac{4\pi\rho}{\epsilon_0}\left(\frac{1}{3}r^3 \Big|_a^b \right)$$

(2.)



1.) $r < R$

2.) $r > R$

1.

$$\oint \vec{E}.da = \frac{1}{\epsilon_0}\iiint \rho \, d\tau$$

$$\vec{E}(2\pi r.\ell) = \frac{1}{\epsilon_0}\int_0^{\pi}\int_0^{2\pi}\int_0^{R} (kr^2) r^2 \sin\theta \, d\theta \, d\phi \, dr$$

$$= \frac{k(4\pi)}{\epsilon_0}\int_0^a r^4 dr \rightarrow = \frac{2\pi k}{\epsilon_0}\int_0^{\ell} dz \int_0^R r^2 dr$$