Kalisma

No Senin
Date 25 maret 2024

Hukum Gauss and applud

$$\oint_S \vec{E} \cdot d\vec{a} = \int_V (\nabla \cdot \vec{E})\, dG$$

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

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

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

$$\boxed{\oint_S \vec{E} \cdot da = \frac{q}{\varepsilon_0}} \longrightarrow \text{Persamaan Gauss dalam bentuk differensial}$$

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

$$Q = \int \rho\, dG$$

$$\int_V (\nabla \cdot \vec{E})\, dG = \frac{Q}{\varepsilon_0} \longrightarrow \rho\, d$$

$$\longrightarrow = \frac{1}{\varepsilon_0} \int_V \rho\, d$$

$$\boxed{\nabla \cdot \vec{E} = \frac{\rho}{G}} \longrightarrow \text{H. Gauss dalam bentuk differensial}$$

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

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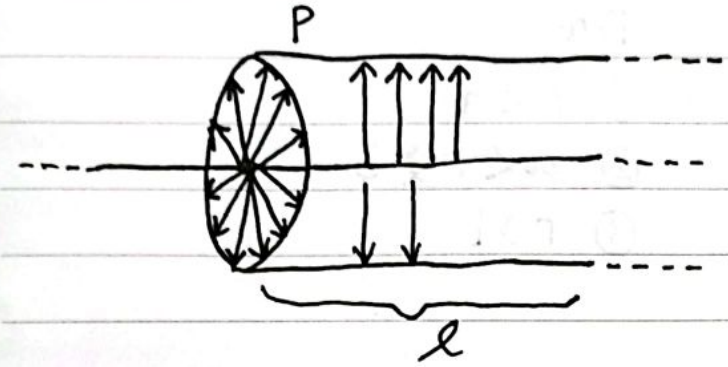
contoh :

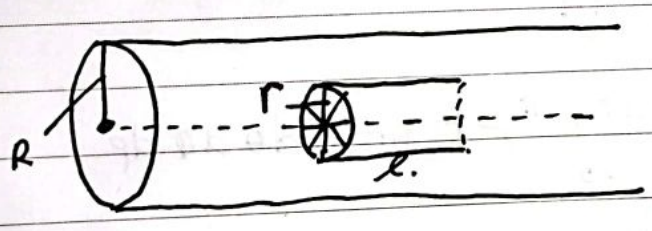


$G = V$

Peny. $\oint \vec{E} \cdot da = \frac{q}{\varepsilon_0}$

$\vec{E} \cdot (2\pi z \cdot \ell) = \frac{\lambda \cdot \ell}{\varepsilon_0}$

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



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

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

$\vec{E} = \frac{Q}{2\pi \varepsilon_0 r \ell} \hat{r}_0$

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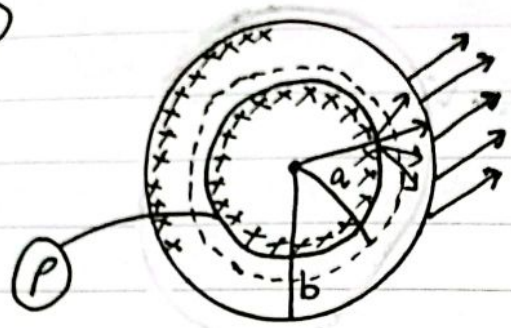
① 

Pert.

① $\rho < a$

② $a < r < b$

③ $r > b$

Peny.

① $\vec{E} = 0$

② $\vec{E} = 0$

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

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

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

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

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

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

③ $r > b$

$$\oint \vec{E} \cdot da = \frac{1}{\varepsilon_0} \iiint r\, dG$$

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

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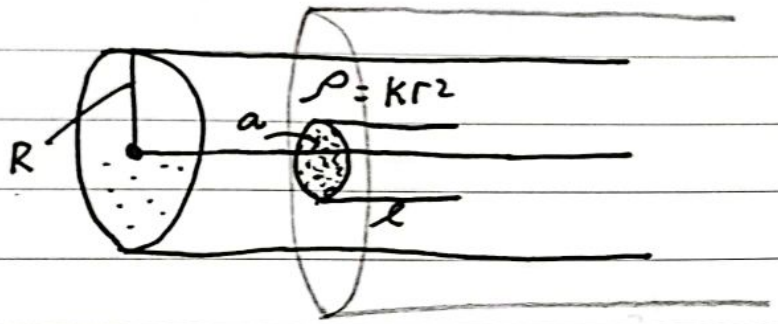
$$= \frac{4\pi\rho}{\varepsilon_0} \int_a^b r^2 \, dr$$

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



Pert. ① $r < R$

② $r > R$

Peny.

① $\oint \vec{E} \, da = \frac{1}{\varepsilon_0} \iiint (kr^2)$

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

② $r > R$

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

$$\vec{E} (2\pi r \ell) = \frac{1}{\varepsilon_0} \int_0^R \int_0^{\ell}$$

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$$W = F \cdot s$$

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

$$dV = -\int_{r_1}^{r_2} \vec{E}\, dr$$

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

$$V_1 - V_2 = -\int \vec{E}\, dr$$

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

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

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

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