No 25, Maret
Date

Hukum Gauss

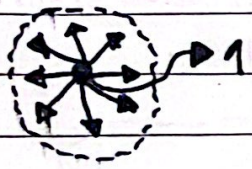
→ integral lipat 3 bila dihitung dengan integral lipat 2 simetri tinggi

$$\Delta V \neq dV$$

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

$$\oint \vec{E}\, d\vec{a} = \oint \frac{1}{4\pi\varepsilon_0 r^2} r^2 \sin\theta\, d\theta\, d\phi$$

$$\oint \vec{E}\, d\vec{a} = \frac{1}{4\pi\varepsilon_0} \int_0^{\pi} \int_0^{2\pi} \sin\theta\, d\theta\, d\phi$$



$$\oint \vec{E}\, d\vec{a} = \frac{1\,(2\pi)}{4\pi\varepsilon_0} \int_0^{\pi} \sin\theta\, d\theta$$

$$\oint \vec{E}\, d\vec{a} = \frac{4\pi 1}{4\pi\varepsilon_0} = \frac{1}{\varepsilon_0}$$

Gaya listrik distrik → penangkal listrik, EC, cerobong asap

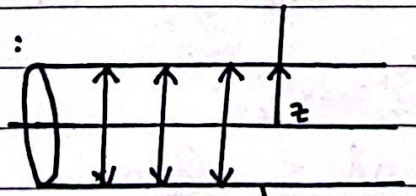
$$\int_v (\nabla \cdot \vec{E})\, d\tau$$

$$Q_{inc} = \rho\, d\tau$$
$$= \sigma\, da$$
$$= \lambda\, dl$$

$$\iiint \nabla E\, d\tau = \iiint \frac{\rho\, d\tau}{\varepsilon_0}$$

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

Contoh:



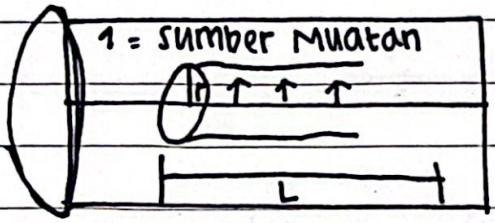
Permukaan Gaus

$$\oint \vec{E} \cdot d\vec{a} = \frac{1}{\varepsilon_0}$$
$$\oint \vec{E} \cdot d\vec{a} = \frac{\lambda l}{\varepsilon_0}$$
$$\vec{E}(2\pi r l) = \frac{\lambda l}{\varepsilon_0}$$
$$\vec{E} = \frac{\lambda}{2\pi\varepsilon_0} \hat{r}.$$

No
Date

Jarak → Kecepatan → percepatan : GLBB (differensiai)
Hukum → Terjadi perubahan dari bawah ke atas.

→ Jawaban soal no. 2 hal 61
∴ Panjang sekali → hukum gauss



$$\oint \vec{E} d\vec{A} = \frac{1}{\varepsilon_0}$$

$r < R$

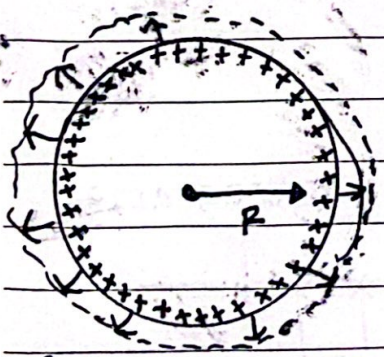
$$\oiint \vec{E} \cdot dA = \frac{1}{\varepsilon_0}$$

$$\vec{E} \cdot (2\pi r L) = \frac{1}{\varepsilon_0}$$

$$\vec{E} = \frac{1}{2\pi\varepsilon_0 r L} \hat{r}_0, \text{ dimana } r < R$$

→ Pada r = R, maka $\vec{E}(2\pi r l) = \frac{1}{\varepsilon_0} r_0$, sehingga :

$$\vec{E} = \frac{1}{2\pi\varepsilon_0 R l} \hat{r}_0$$

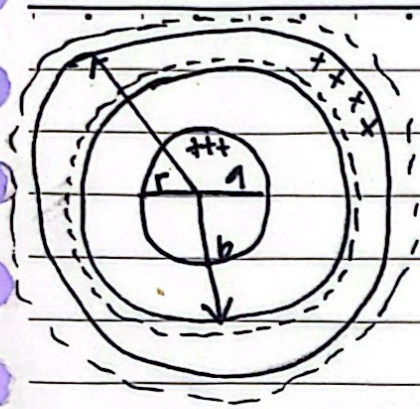


Hitung $\vec{E}$ pada :
a). $r < R$
b). $r > R$

$$\oint \vec{E} \cdot d\vec{A} = \frac{Q_{inc}}{\varepsilon_0}$$

$$\vec{E}(4\pi r^2) = \frac{Q_{inc}}{\varepsilon_0} = \frac{Q}{4\pi\varepsilon_0 r^2} \hat{r}_0$$

No
Date



$r < a \rightarrow \vec{E} = 0$

$a < r < b$

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

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

$$\vec{E}(4\pi r^2) = \frac{\rho}{\varepsilon_0} \int_0^{\pi} \int_0^{a} \int_0^{2\pi} r^2 \sin\theta \, d\theta \, d\phi \, dr$$

$$\vec{E}(4\pi r^2) = \frac{4\pi}{\varepsilon_0} \int_0^{a} r^2 \, dr$$

$$\vec{E}(4\pi r^2) = \frac{4\pi}{\varepsilon_0} \left(\frac{1}{3} r^3 \right) \Big|_0^{a}$$

$$\vec{E}(4\pi r^2) = \frac{4\pi}{\varepsilon_0} \frac{a^3}{3}$$

$$E = \frac{\rho a^3}{3\varepsilon_0 r^2} \hat{r}_0$$

$\vec{E} \rightarrow r > b$

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

$$\vec{E}(4\pi r^2) = \frac{1}{\varepsilon_0} \int_a^{b} \int_0^{2\pi} \int_0^{\pi} \rho\, r^2 \sin\theta \, d\theta \, d\phi \, dr$$

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

$$\vec{E}(4\pi r^2) = \frac{\rho 4\pi}{\varepsilon_0} \left(\frac{1}{3} r^3 \Big|_a^{b} \right)$$

$$\vec{E}(4\pi r^2) = \frac{\rho 4\pi}{3\varepsilon_0} (b^3 - a^3)$$

$$\vec{E} = \frac{\rho}{3\varepsilon_0 r^2} (b^3 - a^3)$$