No.

Date 25-03-2023

Kalisma

Hukum Gauss

$\Delta V \neq dv$

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

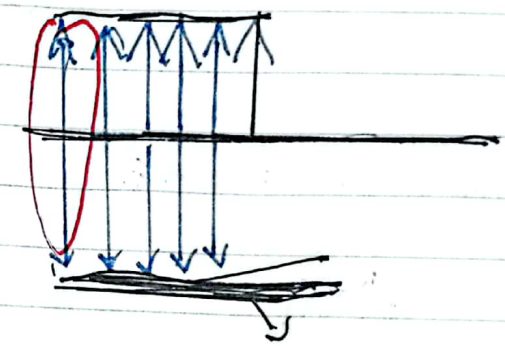
Gaya listrik diskrit penangkal listrik, Mesin potocopy.

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

$= \frac{q}{4\pi\epsilon_0} \int_0^{\pi}\int_0^{2\pi} \sin\theta\, d\theta\, d\phi$

$= \frac{q(2\pi)}{4\pi\epsilon_0} \int_0^{\pi} \sin\theta\, d\theta$

Contoh:



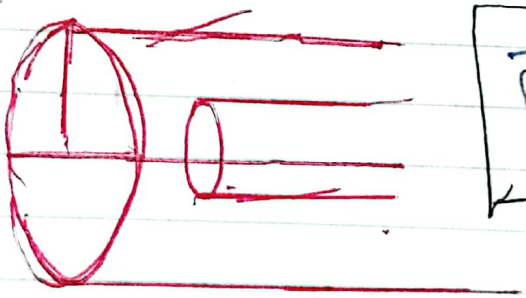
$\oint \vec{E}\, da = \frac{d\pi q}{4\pi\epsilon_0}$

Perpanjangan gauss

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

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

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



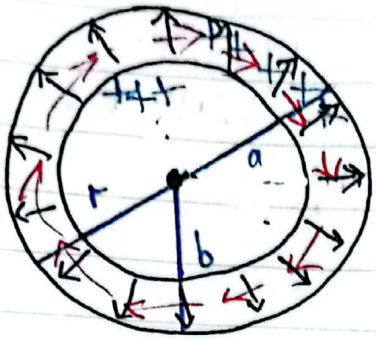
$$\vec{E} = \frac{Q}{4\pi\epsilon_0 r^2}$$

$Q_{me} = \rho\, dG$
$= \sigma\, da$
$= \lambda\, dl$

$\iiint \nabla E\, dG = \frac{\iiint \rho\, dG}{\epsilon_0}$

$$\nabla \cdot \vec{E} = \frac{\rho}{\epsilon_0}$$

Contoh :



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

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

$$\vec{E}(4\pi r^2) = \frac{Q_{inc}}{\varepsilon}$$

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

$a < r < b$ → Medan

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

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

$$= \frac{1}{\varepsilon_0} \int_0^a \int_0^{\pi} \int_{4\pi}^{2\pi} r^2 \sin\theta \, dr \, d\theta \, d\phi$$

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

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

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

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

$$\oint \vec{E} \cdot d\vec{a} = \frac{q}{\varepsilon_0}$$

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

$r > b$

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

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

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

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