No
Date

25-Maret-2024

"Kalisma"

"Hukum Gauss and applured"

Hukum Gaus dalam bentuk Integral.

$\oint \vec{E} \cdot d\vec{A} = \int (\nabla \cdot \vec{E})\, dE . \quad \tau = \int$

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

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

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

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

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

$Q = \int \rho\, dE$

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

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

$\boxed{\nabla \cdot \vec{E} = \frac{\rho}{\varepsilon_0}}$ ⇒ Hukum Gaus dalam bentuk difrensial

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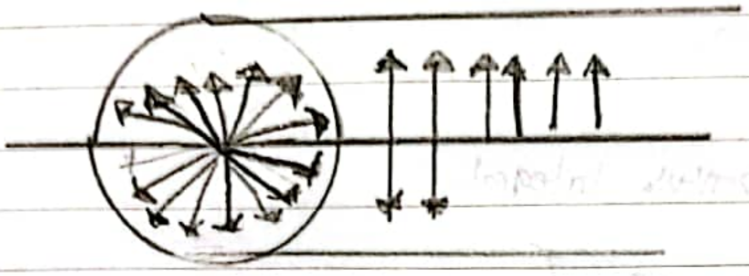


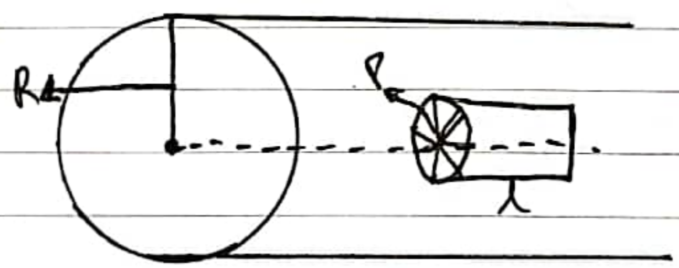
$\lambda \Rightarrow$ Rapat kawat dalam muatan
$\lambda \rightarrow$ Kecepatan dalam muatan

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

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

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

Example



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

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

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

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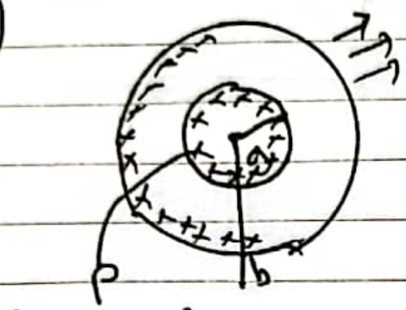
1.)



Hitunglah $\bar{E}$

1.) $\rho < a \rightarrow \bar{E} = 0$

2.) $a < \rho < b$

3.) $\rho > b$

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

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

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

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

$= \frac{4\pi\rho}{\varepsilon_0} \int_0^a r^2 d\rho = \frac{4\pi\rho}{\varepsilon_0} \left(\frac{1}{3} r^3 \Big|_0^a \right)$

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

3) $\oint \bar{E} \, da = \frac{1}{\varepsilon_0} \iiint \rho \, d \varepsilon_0$

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

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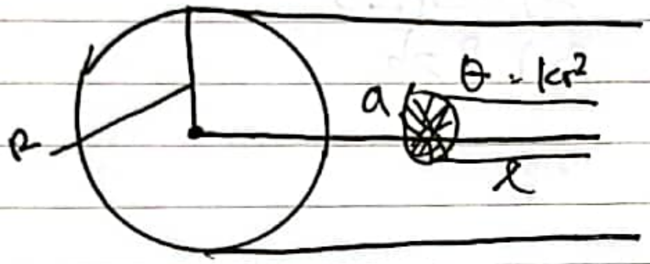
$$= \frac{4\pi P}{\varepsilon_0}\int_a^b p^2\,dp = \frac{4\pi P}{\varepsilon_0}\left(\frac{1}{3}r^3\Big|_a^b\right)$$

Silinder dengan Kerapatan



1). $P < R$

$$\oint \bar{E}\,da = \frac{1}{\varepsilon_0}\iiint P\,d\varepsilon_0$$

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

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

2) $P > R$

$$\oint \bar{E}\,da =$$

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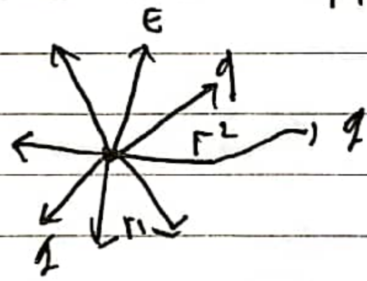
Potensial listrik

Secara Matematis

$W = F \cdot S$

$$V = \frac{W}{q} = \frac{F \cdot S}{q} = \frac{\frac{k\, q_1 q_2}{q}}{q}$$

$$V = k\frac{q}{p} \cdot du = -\int_{r_1}^{r_2} \vec{E}\, dr$$



$= \int_{r} - r_1$

$$V_1 - V_2 = \int^{r} \vec{E}\, d\vec{r}$$

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

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

$\Delta V \int du$

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

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

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

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