No. 25-03-2024

Date Senin

Hukum Gauss → fluks yang muncul pada daerah tertentu

$\Delta V \neq dV$

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

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

$= \frac{q}{4\pi\varepsilon_0} \int_0^{\pi}\int_0^{2\pi} \sin\theta\, d\theta\, d\phi$

$= \frac{q(2\pi)}{4\pi\varepsilon_0} \int_0^{\pi} \sin\theta\, d\theta$

$\oint \vec{E}\, d\theta = \frac{\phi 2\pi q}{4\pi\varepsilon_0}$

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

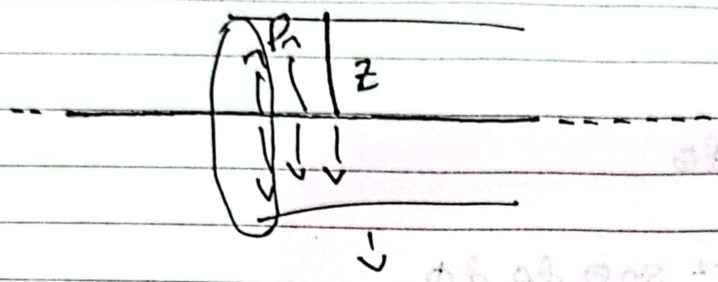
$\int_V (\nabla \cdot \vec{E})\, d\sigma$

$$\left.\begin{aligned} Q_{inc} &= \rho\, d\sigma \\ &= \sigma\, da \\ &= \lambda\, dl \end{aligned}\right\}$$

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

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

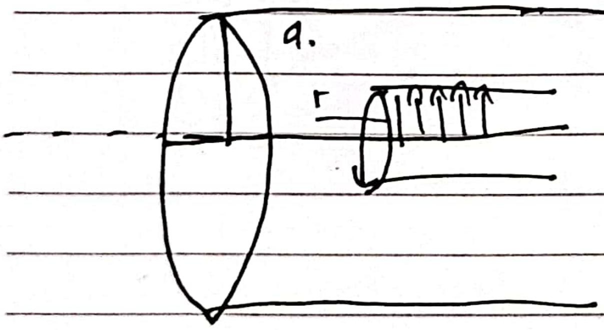
Contoh




$\oint \vec{E} \cdot da = \frac{q}{\varepsilon_0}$ $\lambda . \ell$ $\vec{E}(2\pi r \cdot \ell) = \frac{\lambda \ell}{\varepsilon_0}$

$\oint \vec{E} \cdot d\vec{a} = \frac{\lambda \ell}{\varepsilon_0}$ $\vec{E} = \frac{\lambda}{2\pi\varepsilon_0 r} \cdot \hat{r}_0$

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



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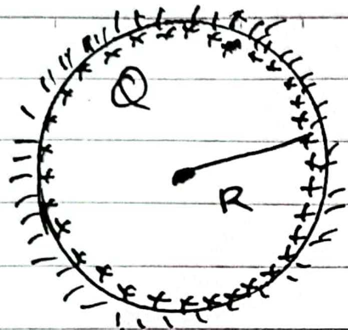



Muatan = 0 (+positif keluar)

Hitung $\vec{E}$ pada

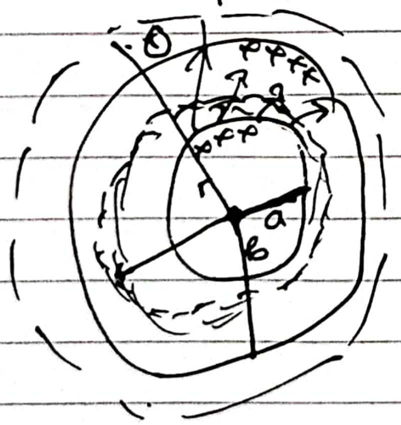
a) $r < R$

b) $r > R$

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

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

$$\vec{E} = \frac{Q}{4\pi\varepsilon_0 r^2}\hat{r}$$




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

$a < r < b$

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

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

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

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

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

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

$P_1$

$r_2$

$q_2$

**Tugas**

Tiga buah muatan masing-masing dua muata pada sudut yang berlawanan pada bujur sangk ...an negatif yang besarnya -4 μC terl... ...ada sudut yang kosong!

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

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

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

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

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

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

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

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

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

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

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