No 25-3-24
Date

Hukum Gauss and applied

$$\oint_s \vec{E} \cdot \vec{da} = \int_v (\nabla \cdot \vec{E})\, d\sigma.$$

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

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

$$= \frac{\cancel{4\pi} q}{\cancel{4\pi} \epsilon_0}$$

$$\boxed{\oint_s \vec{E} \cdot da = \frac{q}{\epsilon_0}}$$

→ persamaan Gauss dalam bentuk diferensial

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

$$Q = \rho\, d\sigma$$

$$\int (\nabla \cdot \vec{E})\, d\sigma = \frac{Q}{\epsilon_0}$$

$$\oint_s \vec{E}\, da = \int_v (\nabla \cdot \vec{E})\, d\sigma$$

$$\to \rho\, d\sigma$$

$$\to = \frac{1}{\epsilon_0} \int_v \rho\, d\sigma$$

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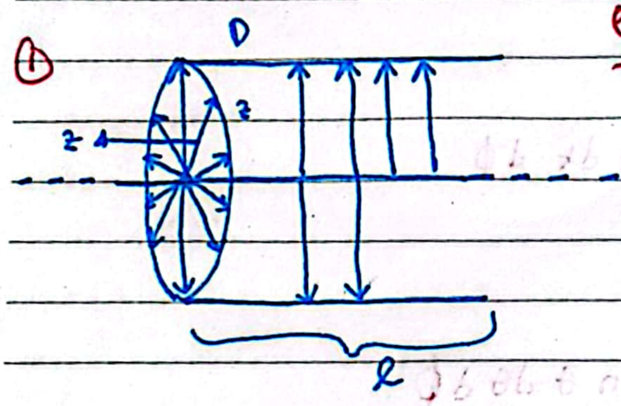
$$\boxed{\nabla \cdot \vec{E} = \frac{\rho}{\epsilon_0}}$$ → Hukum Gauss dalam bentuk deferensial

~~example :~~

example :

(1)

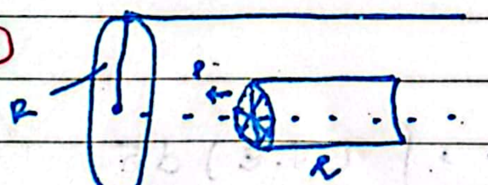


$$\oint \vec{E} \cdot da = \frac{q}{\epsilon_0}$$

$$\vec{E} \cdot (2\pi z \cdot \cancel{l}) = \frac{\lambda \cdot \cancel{l}}{\epsilon_0}$$

$$E = \frac{\lambda}{2\pi \epsilon_0 z} \hat{z}_0$$

(2)



$$\oint \vec{E}\, da = \frac{Q}{\epsilon_0}$$

$$E(2\pi r \cdot l) = \frac{Q}{\epsilon_0}$$

$$\vec{E} = \frac{Q}{2\pi \epsilon r l} \quad \epsilon_0$$

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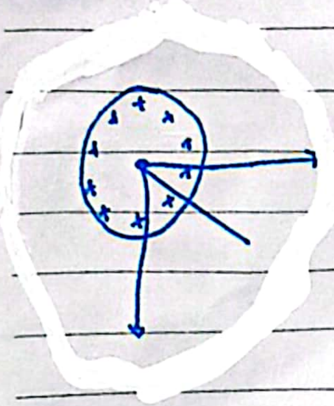

1. $\vec{E} = 0$

2. $\oint \vec{E} \cdot da = \frac{Q}{\epsilon_0}$

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

$\vec{E} \cdot (4\pi r^2) = \frac{1}{\epsilon_0} \iiint \rho \, d\tau.$

Calculatie $\vec{E}$

1. $r < a$
2. $a < r < b$
3. $r > b$

$$= \frac{1}{\epsilon_0} \int_0^a \int_0^{2\pi} \int_0^{\pi} \rho r^2 \sin\theta$$

$d\theta \, d\phi \, dr$

$$= \frac{4\pi\rho}{\epsilon_0} \int_0^a r^2 dr$$

$$\int_0^{\pi} \int_0^{2\pi} \sin\theta \, d\theta \, d\phi = 4\pi \qquad = \frac{4\pi\rho}{\epsilon_0} \left(\frac{1}{3} r^3 \Big|_0^a \right)$$

$\int dx$

$= \int x^0 dx$

$= x \Big|_{\dots}^{\dots}$

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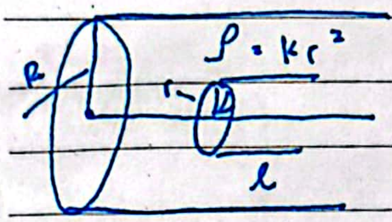

1. $r < R$

2. $r > R$

$$\oint \vec{E} \cdot da = \frac{1}{\epsilon_0} \iiint \rho \, d\tau$$

$$\vec{E} \cdot (2\pi r \cdot l) = \frac{1}{\epsilon_0} \int_0 \int_0^{2\pi} \int_0 (kr^2) \, r \, d\phi \, dz \, dr$$

$$= \frac{4\pi\varphi}{\epsilon_0} \int_0^b r^2 \, dr$$

$$= \frac{4\pi\varphi}{\epsilon_0} \left(\frac{1}{3} r^3 \Big|_a^b \right)$$

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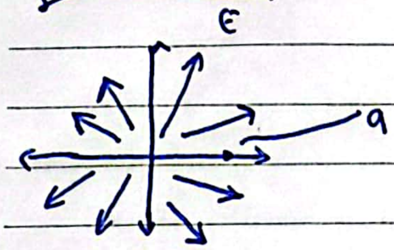
POTENSIAL LISTRIK

$W = F \cdot s$

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

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

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



$= -\int_{r} - r_1$

$V_1 - V_2 = -\int_{r_2}^{r_1} \vec{E}\, d\vec{r}$

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

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

$\Delta V \neq dV$

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

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

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