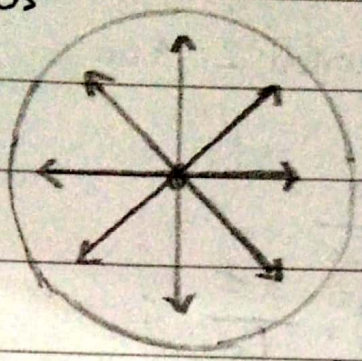
Kalisma No: Date: 25-03-2024

Hukum Gauss

$\oint_S \vec{E}\, da = \int_v (\nabla \cdot \vec{E})\, d\tau$ $\quad T_0 \Rightarrow V$

$\oint$



Muatan rapat pada lamda

$\oint \vec{E} \cdot da = \oint \frac{q}{4\pi\epsilon} \sin\theta\, d\theta\, d\phi$

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

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

$\oint \vec{E} \cdot da = \frac{q}{\sigma}$ → Persamaan Gauss dalam bentuk deferensial

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

$Q = \rho\, d\tau$ $\quad \oint_S \vec{E} \cdot da = \int_v (\nabla \cdot E) = \pi T_0$

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

$\hookrightarrow \quad = \frac{1}{\epsilon_0} \int \rho\, d\tau$

$\nabla \cdot \vec{E} = \frac{\rho}{\epsilon}$ → Hukum gauss dlm bentuk deferensial

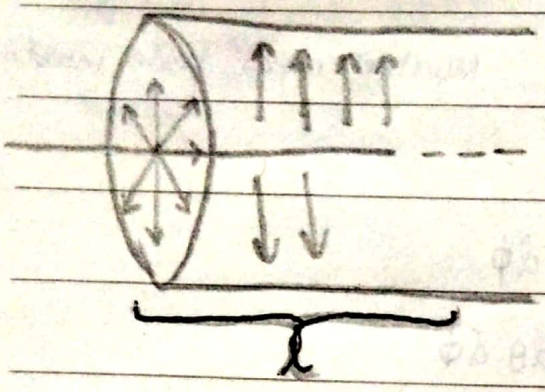
ch soal :

NOTEBOOK

No: Date:

1. Sebuah kawat lurus panjang dgn rapat muatan $\lambda = 0{,}4\ \mu C$, berada di sumbu y, muatan listrik $q = 0{,}2\ \mu C$ terletak pada sumbu $x = 3$ cm. Hitung medan listrik pada sumbu $z = 4$ cm

Jawab:



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

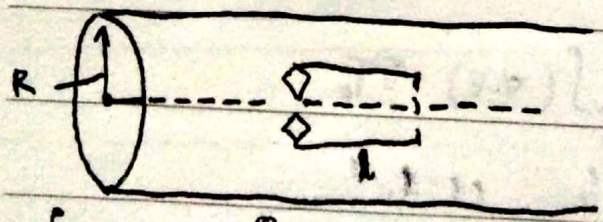
$$\vec{E}\,(2\pi z \cdot l) = \frac{\lambda \cdot l}{\epsilon_0}$$

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

2. ch soal 2.

6 Sebuah silinder pejal panjang sekali, dgn jari" silinder R, rapat muatannya q, hitung medan listrik dalam silinder

Jawab:



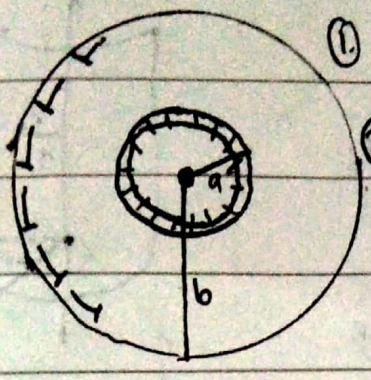
$$\oint \epsilon\, da = \frac{Q}{\epsilon_0}$$

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

$$\vec{E} = \frac{Q}{2\pi \epsilon_0 r l}\, r_0$$

Kalisma

No: Date:



① $\vec{E} = 0$

② $\oint \vec{E} \cdot da = Q$

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

$\vec{E} \cdot (4\pi r^2) = \frac{1}{\epsilon_0} \iiint \rho \, dT_0$

$= \frac{1}{\epsilon_0} \int_0^{2\pi} \int_0^{\pi} \rho \, \rho^2 \sin\theta \, d\theta \, d\phi \, d\rho$

Calculatif $\vec{E}$

1.) $\rho < a$

2) $a < \rho < b$

3) $\rho > b$

$= \frac{4\pi\rho}{\epsilon_0} \int_0^a \rho^2 \, d\rho$

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

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

$E \, (4\pi r^2) = \frac{4\pi}{\epsilon_0} \int_0^a r^2 \, dr$

$= \frac{4\pi}{\epsilon_0} \left(\frac{1}{3} + 2 \right)^4$

$= \frac{1}{3} \frac{\pi a^3}{\epsilon a 3} = \frac{\rho r^3}{3 \epsilon_0 r^2} \hat{r}$

$\frac{4\pi\rho}{\epsilon_0} \left(\frac{1}{3} \rho^3 \Big|_0^a \right)$

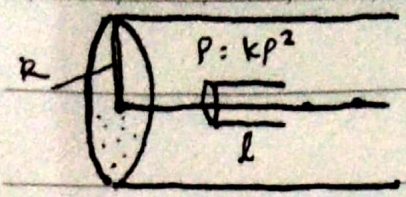
$\oint \vec{E} \cdot da = \frac{1}{\epsilon_0} \iiint \rho \, d\rho$

$= \frac{1}{\epsilon_0} \iiint \rho \cdot r^2 \sin\theta \, d\theta \, d\phi$

$= \frac{4\pi\rho}{\epsilon_0} \int_a^b \rho^2 \, d\rho = \frac{4\pi\rho}{\epsilon_0} \left(\frac{1}{3} \rho^3 \Big|_a^b \right)$

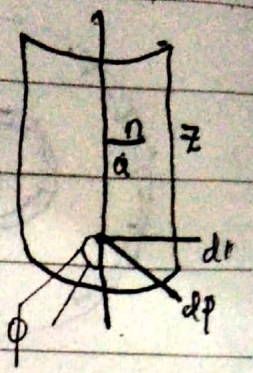
NOTEBOOK

No: Date:



1. $\rho < R$ 3.

2. $\rho > R$ 1.



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

$$\vec{E}(2\pi\rho\cdot l) = \frac{1}{\epsilon_0}\int_0^{2\pi}\int_0^{l}\int_0^{R}(k\rho^2)\,r^2 \sin\theta\, d\theta\, d\phi\, d\rho \qquad d\phi\, dz\, dr$$

$$= \frac{k(4\pi)}{\epsilon_0}\int_0^{a}\rho^2 dr = \frac{2\pi k}{\epsilon_0}\int_0^{l}dz\int_0^{R}\rho^3\, d\rho$$

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

$\vec{E}(2\pi\rho\cdot l) = \frac{1}{\epsilon_0}\int_0^{R}\int_0^{\pi}$

» Potensial
↳ oleh muatan listrik

» Beda Potensial
↳ oleh arus listrik

$W = F\cdot S$

$V = \frac{W}{q} = \frac{F\cdot S}{q} = k\,\frac{q\cdot q}{\frac{\rho}{2}}\,r$

$V = k\,\frac{q}{\rho}$

$V = -\int_{r_1}^{r_2}\vec{E}\,d\rho$

↳ knp min, karena melawan medan

$-\int_{r_1}$

$V_1 - V_2 = \frac{\rho}{}\int \vec{E}\,d\rho$

$\Delta V = -\int^{r_2}\frac{qr_1}{4\pi\epsilon_0\rho^2}\,d\rho$

$= -\frac{r_1 q}{4\pi\epsilon_0}\int_{r_1}^{r_2}\rho\, dr$

$\Delta V \neq dV$

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

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

$V = \frac{1}{4\pi\epsilon_0}\,\frac{q}{\rho} = k\,\frac{q}{\rho}$