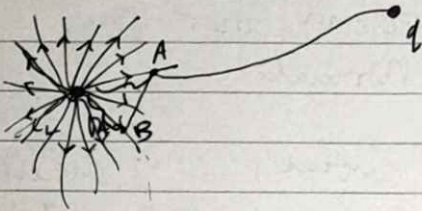


Usaha & energi

-n Karena Yang Melawan Medan Listrik Sumber



gritit judul 3

$$W = \int_A^B \vec{F} \cdot d\vec{r}$$

$$= -q \int \vec{E} \cdot d\vec{r}$$

$$W = -q \left[-\frac{q}{4\pi\epsilon_0 r} \right]$$

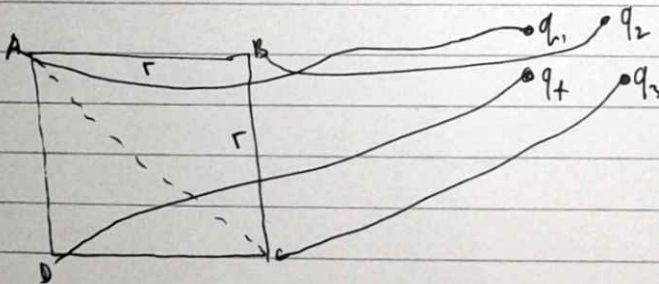
$$= Q [V]$$

$$W = Q \cdot V$$

$$= -q \left[\int \frac{1}{4\pi\epsilon_0} \frac{q}{r^2} dr \right]$$

$$W = W_1 + W_2 + W_3 + W_4$$

0 +



$$W_1 = q_1 V_1 = 0$$

$$W_2 = q_2 V_2 = q_2 \left[k \frac{q_1}{r_1} \right]$$

$$W_3 = q_3 V_3 = q_3 \left[k \frac{q_1}{r_1} + \frac{q_2}{r_2} \right]$$

$$W_4 = q_4 V_4 = q_4 \left[k \frac{q_1}{r} + k \frac{q_2}{\sqrt{2}r} + k \frac{q_3}{r} \right]$$

$$W_{tot} = W_1 + W_2 + W_3 + W_4$$

$$= k \frac{q_1 q_2}{r} + k \frac{q_1 q_3}{r} + k \frac{q_2 q_3}{r} + \dots$$

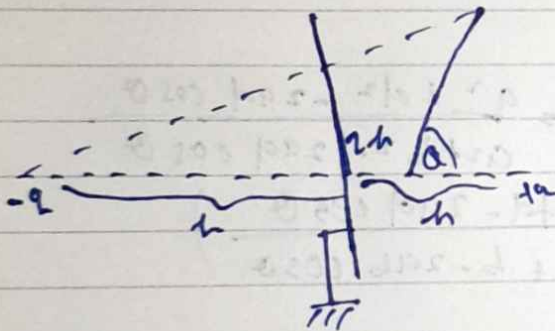
$$W = \frac{1}{2} \sum_{i=1}^n q_i V_i$$

$$\begin{aligned}
 W &= \frac{1}{2} \sum_{i=1}^n q_i v_i \\
 &= \frac{1}{2} \int \lambda v d\lambda \\
 &= \frac{1}{2} \int \rho v d\tau
 \end{aligned}$$

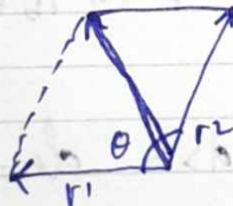
$$P = \epsilon_0 (\nabla \cdot \vec{E})$$

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

$$W = \frac{\epsilon_0}{2} \int \vec{E}^2 d\tau$$



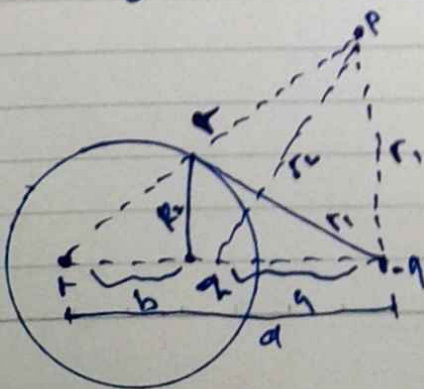
$$\begin{aligned}
 P &= \frac{1}{4\pi\epsilon_0} \frac{1}{r} + \frac{1}{4\pi\epsilon_0} \frac{1}{r'} \\
 &= \frac{1}{4\pi\epsilon_0} \left[\frac{1}{r} + \frac{1}{r'} \right]
 \end{aligned}$$



$$r' = (r^2 + 4h^2 + 4hr \cos \theta)^{1/2}$$

$$\begin{aligned}
 \frac{dv}{dr} &= k \left[\frac{1}{r} \frac{1}{(r^2 + 4h^2 + 4hr \cos \theta)^{1/2}} \right] \\
 &= k \left[\frac{1}{r^2} - \frac{1}{2} \frac{(r^2 + 4h^2 + 4hr \cos \theta)^{-1/2} (2r + 4h \cos \theta)}{(r^2 + 4h^2 + 4hr \cos \theta)} \right]
 \end{aligned}$$

2. Momen titik dengan
kawat konduktor



$$V=0$$

$$V = \frac{1}{4\pi\epsilon_0} \left(\frac{q_1}{R_1} - \frac{q_2}{R_2} \right) = 0$$

$$R_1^2 = a^2 + d^2 - 2ad \cos \theta$$

$$R_2^2 = a^2 + b^2 - 2ab \cos \theta$$

Untuk $V=0$ maka

$$\frac{q_1}{R_1} - \frac{q_2}{R_2} \rightarrow \frac{q_1^2}{R_1^2} = \frac{q_2^2}{R_2^2} = \frac{a^2 + d^2 - 2ad \cos \theta}{a^2 + b^2 - 2ab \cos \theta}$$

$$\left(\frac{q_1}{q_2} \right)^2 = \left(\frac{R_1}{R_2} \right)^2 = \frac{a}{b} \left(\frac{a^2 + d^2 - 2ad \cos \theta}{a^2 + b^2 - 2ab \cos \theta} \right)$$

$$1. q_2 = d/b$$

$$2. \left(\frac{q_1}{q_2} \right)^2 = \frac{d}{b} \quad d > b \quad \text{dan} \quad q_1 > q_2$$

$$\frac{q_1^2}{q_2^2} = \frac{d}{b} \rightarrow -q_2 = +\sqrt{\frac{b}{d}} \cdot q_1 \quad \text{untuk} \quad b = \frac{q_2}{d}$$

$$q_2 = -\frac{b}{a} \cdot q_1$$