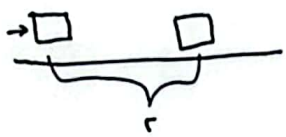
Kalisma.

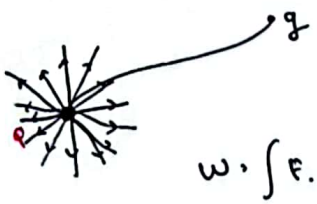
22/24

Usaha dan Energi

Usaha dalam listrik statis :

$W = \int F \, dp \rightarrow d\vec{p}$





$W = \int F . dr$

$= -q \int \epsilon . dr$

$= -q \left[-k \frac{q}{r} \right]$

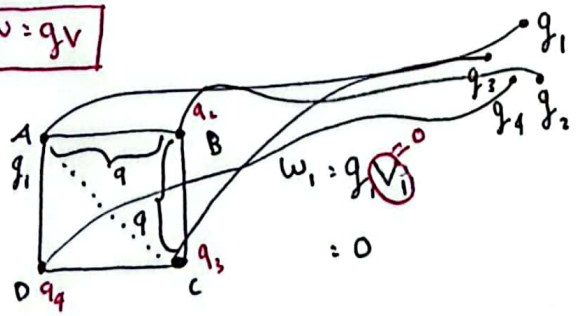
$= qV$

Note :

Jika diam itu adalah energi yg tersembunyi.

Contoh soal :

$W = qV$



karna didalam kotak tidak tersedia muatan.

$W_2 = q_2 V_2$

$V_2 = k \frac{q_1}{a}$

$W_2 = k q_2 \frac{q_1}{2}$

$= k \frac{q_1 q_2}{a}$

dapat $\sqrt{2a}$ dgn

$a^2 = \sqrt{a^2 + a^2}$

$a = a\sqrt{2}$

$W_3 = q_3 V_3$

$= k \frac{q_1}{\sqrt{2a}} + k \frac{q_2}{a}$

$= k \left[\frac{q_1 q_3}{\sqrt{a}} + \frac{q_2 q_3}{a} \right]$

$W_4 = q_4 V_4$

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

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

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

$= \sum_{i=1}^{n} \sum_{j \neq i}^{m} q_i \frac{q_j}{4\pi\epsilon_0 r_{.i}}$

$= \frac{1}{8\pi\epsilon_0} \sum_{i=1}^{n} q_i \sum_{j \neq i}^{n} \frac{q_j}{r_{ij}}$

$= \frac{1}{2} \sum_{i=1}^{n} q_i \Sigma \frac{1}{4a\epsilon_0} q_j$

$W =$

$W = \frac{1}{2} \sum_{i=1}^{n} q_i \sum_{j \neq i}^{n} V_j$

$W = \frac{1}{2} \int \alpha V d\vec{p}$ → potensial oleh muatan pd garis

$W = \frac{1}{2} \int \sigma V d\vec{s}$ → " " " permukaan

$W = \frac{1}{2} \int \rho V d\sigma$ → volume

integral lipat 3 " " 2 " " 1

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

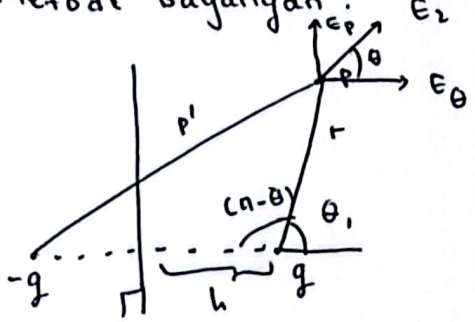
$W = \frac{\varepsilon_0}{2} \int (\nabla \cdot E) V \, d\sigma$

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

$W = \frac{\varepsilon_0}{2} \int (\nabla \cdot E) V \, d\sigma$

$W = \frac{\varepsilon_0}{2} \int E^2 \, d\sigma$

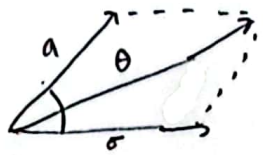
-Metode Bayangan!



$V_P = k \left[\frac{q}{r} + \frac{-q}{r'} \right]$

$= kq \left[\frac{1}{r} - \frac{1}{(r^2+(2h)^2+4hr\cos(\pi-\theta))^{\frac{1}{2}}} \right]$

$V_P = kq \left[\frac{1}{r} - \frac{1}{(r^2+4h^2+4hr\cos\theta)^{\frac{1}{2}}} \right]$



$\vec{E}_r = -\frac{\partial V}{\partial r}$

$= kq \left[\frac{-1}{r^2} - \frac{-\frac{1}{2}(\ldots)^{\frac{1}{2}}(2r+4h\cos\theta)}{r^2+4h^2+4h\cos\theta} \right]$

$= kq \left[\frac{1}{r^2} - \frac{(r+2h\cos\theta)}{(r^2+4h^2+4hr\cos\theta)^{3/2}} \right]$