

\dagger, R, R'

$$J = \frac{[I]}{[C^2]} \quad \text{Diagram: } J \otimes \begin{matrix} A \\ \otimes \\ C \end{matrix} = \begin{matrix} \overline{J} \otimes \\ \overline{A} \\ \downarrow \\ B_A \end{matrix} + \begin{matrix} A \\ \otimes \\ C \end{matrix}$$

$$\overset{\hat{z}}{\otimes} \quad A \quad B_A \perp (OA), \quad B'_A \perp (O'A)$$

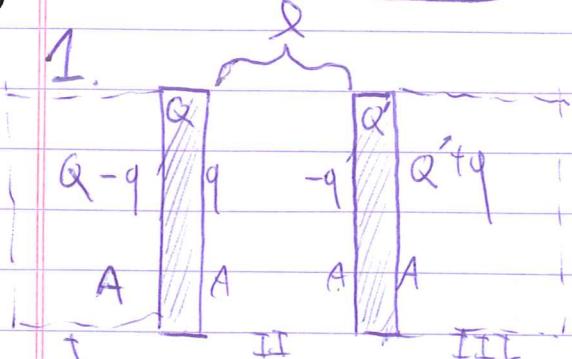
$$B_A = \mu_0 \frac{I}{2} (OA) \quad B'_A = \mu_0 \frac{I}{2} (O'A)$$

$$\vec{B}_A = \frac{\mu_0 I}{2} \hat{z} \times (\vec{OA}) \quad \vec{B}'_A = \mu_0 \frac{I}{2} (-\hat{z}) \times (\vec{O'A})$$

$$\vec{B}_A = \frac{\mu_0 I}{2} \vec{J}(O'A) \Rightarrow \vec{B} = \vec{B}_A + \vec{B}'_A = \frac{\mu_0 I}{2} (\hat{z}) \times [\vec{OA} - \vec{O'A}]$$

$$\oint \vec{B} d\vec{l} \neq 0 \quad \mu_0 \left(\frac{I}{2\pi r^2} \right) r \quad \frac{F}{q} \oint \vec{J} d\vec{l} = 0$$

Aanvóegs 2nd quadratón



$E = f(q)$ \rightarrow even &ca
 $E = \text{minimum}$

$$E_I = \frac{Q - \frac{q}{A}}{\epsilon_0} \quad E_{II} = \frac{q}{A} \quad E_{III} = \frac{(Q' + q)}{A}$$

$$E = \frac{\epsilon_0}{2} \int_V E^2 dV \quad \Rightarrow: E = \frac{\epsilon_0}{2} \left[\left(\frac{Q-q}{A} \right)^2 V + \frac{\epsilon_0}{2} \left(\frac{q}{A} \right)^2 A \cdot l + \frac{\epsilon_0}{2} \left(\frac{Q'+q}{A} \right)^2 V \right]$$

$$\Rightarrow E_0 l = \frac{1}{2\epsilon_0 A^2} [V(Q-q)^2 + q l A + V(Q'+q)^2]$$

$$\Rightarrow \frac{dE_0}{dq} = 0 = \frac{1}{2\epsilon_0 A^2} [-V(2(Q-q)) + l A + 2(Q'+q)] = 0$$

$$\Rightarrow q = \frac{Q-Q'}{2 + \frac{A \cdot l}{V}} \quad \text{energy} \quad \frac{A \cdot l}{V} \rightarrow 0 \quad q = \frac{Q-Q'}{2}$$

$$Q-q = \frac{Q+Q'}{2} = Q' + q$$

$$\text{Apa } E_I = \frac{Q+Q'}{A \cdot \epsilon_0}, \quad E_{II} = \frac{Q-Q'}{A \cdot \epsilon_0}, \quad E_{III} = E_I$$

2.

$$\vec{J} = \vec{E} \quad I = \sin(R \cdot \cos\theta)^2$$



$$E = \frac{\vec{J}}{\sigma} = \frac{\vec{I}}{n \epsilon^2 \cdot \cos^2 \theta \cdot \sigma}$$

$$|\Delta V| = \left| \int_0^{2\pi} \vec{E} \cdot d\vec{l} \right| = \int E dl \quad R = \frac{\Delta V}{I} \quad l = R \cdot \sin\theta \quad dl = R \cos\theta d\theta$$

$$\Rightarrow |\Delta V| = \frac{I}{\sigma} \int \frac{R \cos\theta d\theta}{n \epsilon^2 \cdot \cos^2 \theta} + \frac{I}{n \sigma R} \int_0^{2\pi} \frac{\cos\theta d\theta}{\cos^2 \theta} = \frac{I}{n \sigma R} \int_0^{2\pi} \frac{ds \sin\theta}{(1 - \sin^2 \theta)}$$

$$= \frac{I}{n \sigma R} \int ds \sin\theta \left[\frac{1}{1 + \sin\theta} + \frac{1}{1 - \sin\theta} \right] \frac{1}{2} = \frac{1}{2} \int_0^{2\pi} \ln(1 + \sin\theta) - \ln(1 - \sin\theta)$$

$$= \frac{I}{2} \ln \left[\frac{1 + \sin\theta_0}{1 - \sin\theta_0} \right] = \frac{I}{2} \ln \left[\frac{1 + \sin\theta_0}{1 - \sin\theta_0} \right]$$

$$\text{Apa } |\Delta V| = \frac{I}{n \sigma R} \cdot \frac{1}{2} \left[\ln \frac{1 + \sin\theta_0}{1 - \sin\theta_0} \right]$$

$$\text{Bspw } \frac{R}{R} = \cos\theta_0$$

$$\text{v.a. } R = \frac{1}{2 n \sigma R} \left[\ln \frac{1 + \sin\theta_0}{1 - \sin\theta_0} \right]$$

3.

$$E = k \frac{1}{r^2}$$

$$\Delta V = \left| \int_A^B \vec{E} \cdot d\vec{l} \right| = \left| k \left(\frac{1}{R_1} - \frac{1}{R_2} \right) \right| = k \left(\frac{1}{R_1} - \frac{1}{R_2} \right)$$

$$\Rightarrow k = \frac{\Delta V}{\frac{1}{R_1} - \frac{1}{R_2}}$$

$$\vec{J} = \sigma \vec{E} = \sigma \frac{\Delta V}{\frac{1}{R_1} - \frac{1}{R_2}} \frac{1}{r^2}$$

$$I = \int_R^S \vec{J} \cdot da = \int_R^S J \cdot da = J \int da = \frac{\sigma \Delta V}{\frac{1}{R_1} - \frac{1}{R_2}} \cdot \frac{1}{r^2} \cdot \frac{\pi r^2}{2} = \frac{\sigma \Delta V}{\frac{1}{R_1} - \frac{1}{R_2}} \cdot \frac{\pi}{2}$$

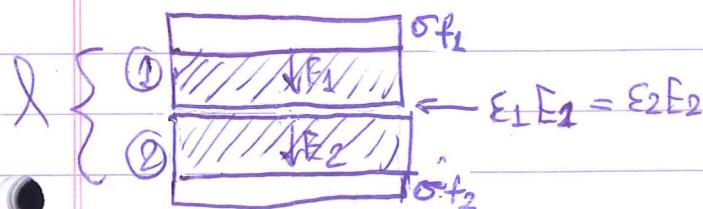
$$\text{II}$$

$$\frac{\Delta V}{I} = \frac{1}{\sigma} \frac{1}{2\pi} \left(\frac{1}{R_1} - \frac{1}{R_2} \right)$$

$$I = J \left(\frac{\pi r^2}{2} \right)$$

$$E = \frac{J}{\sigma} = \frac{1}{\sigma} \frac{I}{2\pi r^2} \rightarrow \Delta V = \int E \cdot dl$$

4.



$$\sigma f_1 = -\sigma f_2$$

$$D_1 = \sigma f_1 \rightarrow \varepsilon_1 F_1 = \sigma f_1$$

$$D_2 = \sigma f_2 \rightarrow \varepsilon_2 F_2 = \sigma f_2$$

$$E_1 = \frac{\sigma_1}{\varepsilon_1} = \frac{\sigma_1}{\varepsilon_0 \varepsilon_1} = \frac{E_0}{\varepsilon_1}$$

$$\Delta V = \int \vec{E} \cdot d\vec{l} = \int E_1 dl + \int E_2 dl$$

$$E_2 = \frac{\sigma_2 f}{\varepsilon_2} = \frac{\sigma_2 f}{\varepsilon_0 \varepsilon_2} = \frac{E_0}{\varepsilon_2}$$

$$= \frac{E_0}{\varepsilon_1} \frac{\lambda}{2} + \frac{E_0}{\varepsilon_2} \frac{\lambda}{2}$$

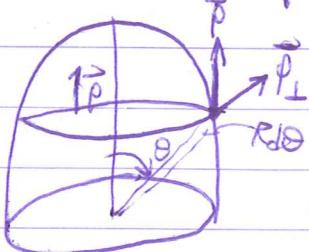
$$= E_0 \cdot \frac{\lambda}{2} \left(\frac{1}{\varepsilon_1} + \frac{1}{\varepsilon_2} \right)$$

$$= \frac{\Delta V_0}{2} \left(\frac{1}{\varepsilon_1} + \frac{1}{\varepsilon_2} \right)$$

$$C = \frac{Q}{\Delta V} = \frac{Q}{\frac{\Delta V_0}{2} \left(\frac{1}{\varepsilon_1} + \frac{1}{\varepsilon_2} \right)} = 2 C_0 \left(\frac{1}{\varepsilon_1} + \frac{1}{\varepsilon_2} \right)$$

5.

$$\vec{P} = \frac{\sum \vec{p}}{\sigma_{\text{geo}}} \quad \sigma_b = P_1$$



$$P_1 = P \cos \theta \Rightarrow \sigma_b = P \cos \theta, \sigma_{b\perp} = -P$$

$$dq = R^2 \sin \theta d\theta \cdot 2\pi = 2\pi R^2 \sin \theta \cos \theta d\theta$$

$$(2\pi R \sin \theta)(\cos \theta) \cdot \sigma dq \quad q = \int dq = 2\pi R^2 \sigma_0 \int_0^{\pi/2} \sin \theta \cos \theta d\theta = 2\pi R^2 \sigma_0 \left[\frac{\sin^2 \theta}{2} \right]_0^{\pi/2} = \pi R^2 \sigma_0$$

$$q^{\text{nr}} = \rho_n R^2, \quad q^{\text{b\perp}} = -\rho_n R^2$$

Aug 7

$$\oint \vec{F} = t - \vec{J}l \times \vec{B} \Rightarrow \vec{F} = \int \vec{dF} = t - \int (\vec{J}l) \times \vec{B}$$

$$= t \left(\int (\vec{J}l) \right) \times \vec{B} = t \cdot (\vec{A}l) \times \vec{B}$$

