

Formler fys1120

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1 Elektrisk felt

$$\vec{F} = \frac{Qq}{4\pi\epsilon_0} \frac{\hat{\mathbf{R}}}{R^2} = \frac{Qq}{4\pi\epsilon_0} \frac{\vec{R}}{R^3}$$

$$\vec{E} = \frac{\vec{F}}{q} = \frac{Q}{4\pi\epsilon_0} \frac{\hat{\mathbf{R}}}{R^2}$$

$$d\vec{E} = \frac{dq}{4\pi\epsilon_0} \frac{\hat{\mathbf{R}}}{R^2}$$

$$\rho_l = \frac{Q}{L}$$

$$V(\vec{r}) = \int_{\vec{r}}^{ref} \vec{E} \cdot d\vec{l}$$

$$\oint_C \vec{E} \cdot d\vec{l} = 0 \Leftrightarrow \iint_S \nabla \times \vec{E} \cdot d\vec{S} = 0$$

2 Elektrisk potensial

$$\vec{E} = -\nabla V$$

$$\vec{E} = \int_V \rho \frac{dV}{4\pi\epsilon_0} \frac{\hat{\mathbf{R}}}{R^2}$$

$$V = \int \frac{\rho dV}{4\pi\epsilon_0 R}$$

$$V(\vec{r}) = \frac{\vec{p} \cdot \hat{\mathbf{r}}}{4\pi\epsilon_0 r^2}$$

3 Gauss lov og dielektriske materialer

$$\Delta v = \Delta s d \cos(\theta)$$

Antall dipoler i Δv

$$Nv\Delta v = Nv\Delta s \vec{d} \cdot \hat{\mathbf{n}}$$

Hvor mye ladning

$$\begin{aligned}
 \Delta Q_b &= -Q \cdot N v \Delta s \vec{d} \cdot \hat{\mathbf{n}} \\
 &= -Q \cdot N v \vec{d} \cdot \Delta \vec{s} \\
 &= -N v \left(Q \vec{d} \right) \cdot \Delta \vec{s} \\
 &= -N v \vec{p} \cdot \Delta \vec{s} \\
 &= -\frac{N \vec{p}}{v} \cdot \Delta \vec{s} \\
 &= -\vec{p} \cdot \Delta \vec{s}
 \end{aligned}$$

$$Q_b = - \oint_S \vec{p} \cdot d\vec{s}$$

Bundet volum-ladningstetthet

$$\begin{aligned}
 Q_b &= \int_v \rho_{v,b} dv = - \oint_s \vec{p} \cdot d\vec{s} \\
 &= - \oint_S \vec{p} \cdot d\vec{s} \\
 &= - \int_v \nabla \cdot \vec{p} dv
 \end{aligned}$$

$$\boxed{\rho_{v,b} = -\nabla \cdot \vec{p}}$$