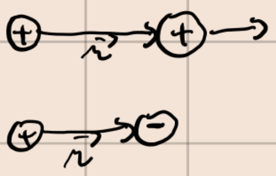
$$\vec{F}_C = \frac{1}{4\pi\varepsilon_0} \frac{Q_1 Q_2}{r^2} \frac{\vec{r}}{r}$$



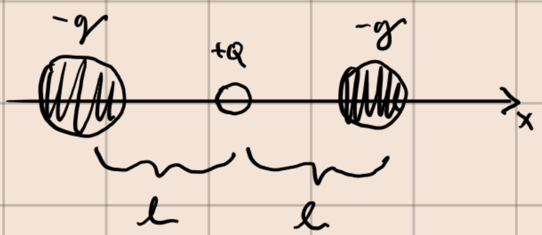
objemová hustota náboje

$$Q = \iiint_V \rho \, dV \qquad [\rho] = C \cdot m^{-3}$$

$$Q = \iint_S \sigma \, dS \qquad [\sigma] = C \cdot m^{-2}$$

$$Q = \int_C \tau \, dl \qquad [\tau] = C \cdot m^{-1}$$

12.3



$$F_{qQ} + F_{qq} = \frac{-1}{4\pi\varepsilon_0} \frac{qQ}{l^2} + \frac{1}{4\pi\varepsilon_0} \cdot \frac{q^2}{4l^2} =$$

$$= \frac{q}{4\pi\varepsilon_0 l^2} \cdot \left( -Q + \frac{1}{4} q \right) = 0$$

$$q = 4Q$$

Stabilní nebo labilní:

$$-\frac{1}{4\pi\varepsilon_0} \frac{4Q^2}{(l+\Delta x)^2} + \frac{1}{4\pi\varepsilon_0} \frac{16}{(2l+\Delta x)^2} =$$

$$= \frac{1}{4\pi\varepsilon_0} \frac{4Q^2}{l^2} \left[ \frac{-1}{\left(1+\frac{\Delta x}{l}\right)^2} + \frac{4}{\left(2+\frac{\Delta x}{l}\right)^2} \right] =$$

$$= \frac{1}{4\pi\varepsilon_0} \frac{4Q^2}{l^2} \left[ -\frac{1}{(\ldots)^2} + \frac{1}{(\ldots)^2} \right] =$$

$$\Big[\underbrace{\left(1+\frac{\Delta x}{\ell}\right)^2}_{1-\frac{2\Delta x}{\ell}} \qquad \underbrace{\left(1+\frac{\Delta x}{2\ell}\right)^2}_{1-\frac{\Delta x}{\ell}}\Big]$$

Taylorův polynom:

$$\frac{1}{(1+z)^2}\Bigg|_{z=0} \doteq 1-2z$$

$$\doteq \frac{Q^2}{\pi\varepsilon_0 \ell^3}\Delta x$$ $\to$ stejné znaménko jako $\Delta x$

$\Rightarrow$ labilní poloha

---

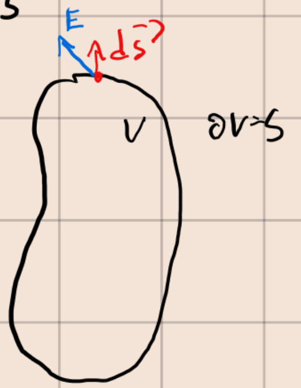
Pole:

$$\vec{E} = \frac{\vec{F}}{Q}$$

$$\vec{F} = Q\cdot\vec{E}$$

Gaussův zákon elektrostatiky:

$$\oiint_S \vec{E}\,d\vec{s} = \frac{Q}{\varepsilon_0}$$




$$\oiint \vec{E}\,d\vec{s} = 0 \qquad \oiint \vec{E}\,d\vec{s} > 0 \qquad \oiint \vec{E}\,d\vec{s} < 0$$

Nekonečná plocha


$$\frac{\sigma S_{podst}}{\varepsilon_0} =$$

$$\frac{Q}{\varepsilon_0} = \oiint \vec{E}\,d\vec{s} = \underbrace{\oiint_{plášť} \vec{E}\,d\vec{s}}_{=0} + \oiint_{podstavy} \vec{E}\,d\vec{s}$$

$$= E\cdot 2S_{podstavy}$$

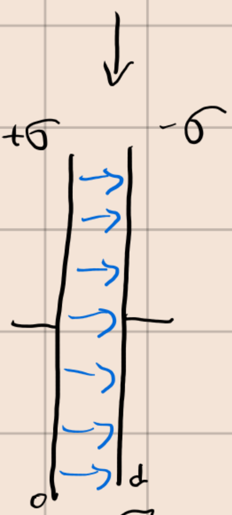
$$\boxed{E = \frac{\sigma}{2\varepsilon_0}}$$ prý občas v písemce

kapacita:

$$C = \frac{Q}{U}$$

$$Q = C \cdot U$$


$$U = \int_{\vec{r}_1}^{\vec{r}_2} \vec{E} \cdot d\vec{r}$$



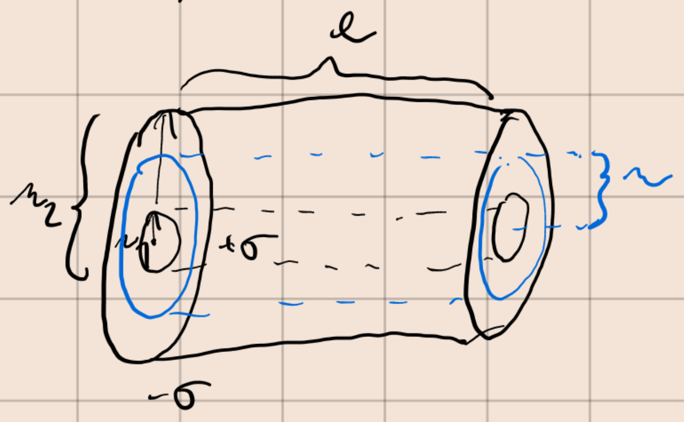

$$E = \frac{\sigma}{2\varepsilon_0}$$

$$U = E \cdot d = \frac{\sigma d}{\varepsilon_0}$$

$$Q = \sigma \cdot S$$

$$C = \frac{Q}{U} = \frac{\sigma \cdot S \cdot \varepsilon_0}{\sigma d} = \varepsilon_0 \cdot \frac{S}{d}$$

12.7 - kapacita válcového kondenzátoru




$$\frac{Q}{\varepsilon_0} = \oiint \vec{E}\, d\vec{S} = \underbrace{\cancel{\oiint \vec{E}\, d\vec{S}}}_{\text{podst.}} + \underbrace{\oiint \vec{E}\, d\vec{S}}_{\text{plášť}} =$$

$$= S_{pl.}(r) \cdot \vec{E} = 2\pi r l \cdot E =$$

$$\frac{Q}{\varepsilon_0} = \frac{\sigma\, S_{pl.}(r_1)}{\varepsilon_0} = \frac{2\pi r_1 l \sigma}{\varepsilon_0}$$

$$E = \frac{\sigma}{\varepsilon_0} \frac{r_1}{r}$$

$$U=\int_{r_1}^{r_2} E\,dr = \frac{\sigma r_1}{\varepsilon_0}\int_{r_1}^{r_2}\frac{1}{r}\,dr = \frac{\sigma r_1}{\varepsilon_0}\cdot\left(-\ln\frac{r_1}{r_2}\right)$$

$$Q = 2\pi r_1 l \sigma$$

$$C=\frac{Q}{U}=\frac{2\pi\varepsilon_0 l}{\ln\left(\frac{r_2}{r_1}\right)}$$

14:30 – 17:45

Hruška