Cv3/2 poloměr ... R

plošná hustota ... σ

$\varphi = x$ elektrický potenciál

Vně sféry: intenzita:

$$\oint_S \vec{E}\cdot\vec{n}\,dS = \frac{Q}{\varepsilon_0}$$ Gaussova věta

$$E \oint dS = E \cdot 4\pi r^2 = \frac{Q}{\varepsilon_0} \rightarrow E = \frac{Q}{4\pi r^2 \varepsilon_0}$$

($\oint dS$ ... povrch koule, r ... poloměr koule)

$$Q = S\cdot\sigma = 4\pi R^2 \sigma$$

$$E = \frac{4\pi R^2 \sigma}{4\pi r^2 \varepsilon_0} = \frac{R^2\sigma}{r^2\varepsilon_0}$$

Elektrický potenciál

$$\varphi = -\int_\infty^{r_1} E\,dr = -\frac{R^2\sigma}{\varepsilon_0}\int_\infty^{r_1}\frac{1}{r^2}dr = -\frac{R^2\sigma}{\varepsilon_0}\left[-\frac{1}{r}\right]_\infty^{r_1} = -\frac{R^2\sigma}{\varepsilon_0}\cdot\frac{1}{r_1} + \underbrace{\frac{R^2\sigma}{\varepsilon_0}\cdot\frac{1}{\infty}}_{0} = \frac{R^2\sigma}{\varepsilon_0 r_1}$$

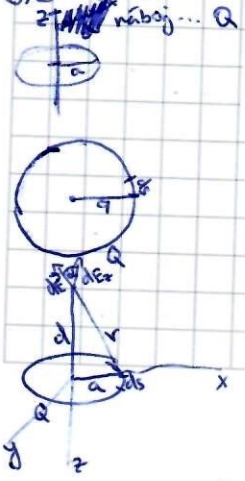
Uvnitř sféry: intenzita je nulová (není uvnitř žádný náboj)

Elektrický potenciál

$$\varphi = -\int_\infty^{r_1} E\,dr = -\int_\infty^{R} E\,dr - \int_R^{a} \underbrace{E}_{=0}\,dr$$ (nulová intenzita)

$$\varphi = -\int_\infty^{R} E\,dr = -\frac{R^2\sigma}{\varepsilon_0}\int_\infty^{R}\frac{1}{a^2}dr = -\frac{R^2\sigma}{\varepsilon_0}\left[-\frac{1}{r_1}\right]_\infty^{R} = \frac{R^2\sigma}{\varepsilon_0 R} = \frac{R\sigma}{\varepsilon_0}$$

3/5 $E = x$



$$dE = \frac{1}{4\pi\varepsilon_0}\cdot\frac{dQ}{r^2}$$

$$dE_z = dE\cdot\cos\alpha \quad \ldots \cos\alpha = \frac{z}{r} \quad \ldots \quad r = \sqrt{R^2+z^2} \rightarrow \cos\alpha = \frac{z}{\sqrt{R^2+z^2}}$$

$$E = \frac{1}{4\pi\varepsilon_0}\frac{Q}{\sqrt{R^2+z^2}}$$

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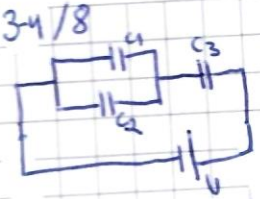

a)

$C_{1,2} = C_1 + C_2$

$\frac{1}{C} = \frac{1}{C_{1,2}} + \frac{1}{C_3} = \frac{1}{C_1+C_2} + \frac{1}{C_3} = \frac{C_1+C_2+C_3}{C_3 \cdot (C_1+C_2)}$

$C = \frac{C_3 \cdot (C_1+C_2)}{C_1+C_2+C_3}$

$Q = U \cdot C = \frac{U \cdot C_3 \cdot (C_1+C_2)}{C_1+C_2+C_3}$

b) $Q = Q_{1,2} = Q_3$

$Q_{1,2} = Q_1 + Q_2$

$U_{1,2} = U_1 = U_2$

$Q_1 = U_1 C_1$

$Q_2 = U_2 C_2$

$Q_3 = U_3 \cdot C_3 \rightarrow U_3 = \frac{Q_3}{C_3} = \frac{Q}{C_3} = \frac{U \cdot C_3 \cdot (C_1+C_2)}{(C_1+C_2+C_3) \cdot C_3} = \frac{U \cdot (C_1+C_2)}{C_1+C_2+C_3}$

$Q_3 = \frac{U \cdot C_3 \cdot (C_1+C_2)}{C_1+C_2+C_3}$

$U = U_{1,2} + U_3 \rightarrow U_{1,2} = U - U_3$

$U_{1,2} = U - \frac{U \cdot (C_1+C_2)}{C_1+C_2+C_3} = \frac{UC_1 + UC_2 + UC_3 - UC_1 - UC_2}{C_1+C_2+C_3} = \frac{UC_3}{C_1+C_2+C_3} = U_1 = U_2$

$Q_1 = U_{1,2} \cdot C_1 = \frac{UC_3 C_1}{C_1+C_2+C_3}$

$Q_2 = U_{1,2} \cdot C_2 = \frac{UC_2 C_3}{C_1+C_2+C_3}$