

$$\textcircled{1} \quad V_1 = 1 \text{ l} = 10^{-3} \text{ m}^3$$

$$V_2 = 0,05 \text{ l} = 5 \cdot 10^{-5} \text{ m}^3$$

$$p_1 = 105 \text{ kPa} = 105\,000 \text{ Pa}$$

$$\alpha = 1,5$$

$$pV^\alpha = \text{konst.}$$

$$W_{\text{ex}} = - \int_{V_1}^{V_2} p \, dV \quad (0,55)$$

$$p_1 V_1^\alpha = p V^\alpha \quad (15)$$

$$p = p_1 V_1^\alpha V^{-\alpha}$$

$$W_{\text{ex}} = - \int_{V_1}^{V_2} p_1 V_1^\alpha V^{-\alpha} \, dV = - p_1 V_1^\alpha \int_{V_1}^{V_2} V^{-\alpha} \, dV = - p_1 V_1^\alpha \left[\frac{V^{-\alpha+1}}{-\alpha+1} \right]_{V_1}^{V_2} =$$

$$= - \frac{p_1 V_1^\alpha}{1-\alpha} \left[V_2^{1-\alpha} - V_1^{1-\alpha} \right] \quad (0,55)$$

$$= - \frac{105\,000 (10^{-3})^{1,5}}{1-1,5} \left[(5 \cdot 10^{-5})^{1-1,5} - (10^{-3})^{1-1,5} \right] =$$

$$= \frac{105\,000 (10^{-3})^{1,5}}{0,5} \left[(5 \cdot 10^{-5})^{-0,5} - (10^{-3})^{-0,5} \right] = \frac{105\,000}{0,5} 10^{-0,75} \left(\frac{1}{\sqrt{5 \cdot 10^{-5}}} - \frac{1}{\sqrt{10^{-3}}} \right)$$

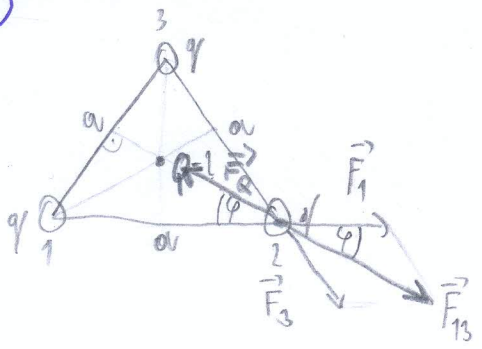
$$= 729,75 \text{ J} - \text{spísta} \quad (15)$$

$$\Delta S = \int \frac{dQ}{T}; \quad dQ=0$$

$$\Delta S = 0 \text{ JK}^{-1} \quad (15)$$

45

2



$$|\vec{F}_1| = |\vec{F}_3|$$

$$F_1 = \frac{1}{4\pi\epsilon_0} \frac{q^2}{a^2}$$

$$\varphi = 30^\circ$$

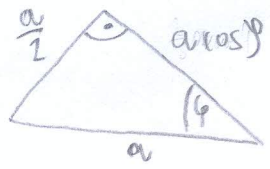
$$F_{13} = 2 F_1 \cos \varphi = 2 \frac{1}{4\pi\epsilon_0} \frac{q^2}{a^2} \cos 30^\circ$$

$$F_{13} = \frac{1}{2\pi\epsilon_0} \frac{q^2}{a^2} \frac{\sqrt{3}}{2} = \frac{1}{4\pi\epsilon_0} \frac{q^2}{a^2} \sqrt{3}$$

1b

$$F_Q = F_{13}$$

$$\frac{1}{4\pi\epsilon_0} \frac{qQ}{\left(\frac{2}{3}a \cos \varphi\right)^2} = \frac{1}{4\pi\epsilon_0} \frac{q^2}{a^2} \sqrt{3}$$



$$\frac{Q}{\frac{4}{3} \cdot \frac{a}{4}} = \sqrt{3} q$$

$$3Q = \sqrt{3} q$$

$$|Q| = \frac{q}{\sqrt{3}}$$

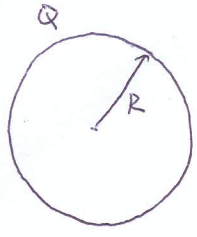
$$\rightarrow Q = -\frac{q}{\sqrt{3}}$$

$$Q = -\frac{0.3 \mu C}{\sqrt{3}} = -\frac{3}{10\sqrt{3}} \mu C = -\frac{\sqrt{3}}{10} \mu C$$

3b



3.



$$\rho = \frac{Q}{V} = \frac{Q}{\frac{4}{3}\pi R^3}$$

$$Q(r) = \rho \frac{4}{3}\pi r^3 = \frac{Q}{\frac{4}{3}\pi R^3} \frac{4}{3}\pi r^3 = \frac{Qr^3}{R^3}$$

$r < R$

$$\oint \vec{E} \cdot d\vec{S} = \frac{Q(r)}{\epsilon_0} \quad (E \parallel dS)$$

$$\oint E \cdot dS = \frac{Qr^3}{R^3 \epsilon_0}$$

$$E \oint dS = \frac{Qr^3}{R^3 \epsilon_0}$$

$$E \cdot 4\pi r^2 = \frac{Qr^3}{R^3 \epsilon_0}$$

$$E = \frac{Q}{4\pi \epsilon_0 R^3} r \quad (1b)$$

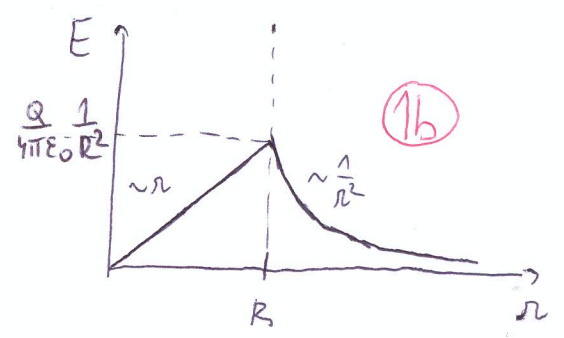
$r > R$

$$\oint \vec{E} \cdot d\vec{S} = \frac{Q}{\epsilon_0}$$

$$E \oint dS = \frac{Q}{\epsilon_0}$$

$$E \cdot 4\pi r^2 = \frac{Q}{\epsilon_0}$$

$$E = \frac{Q}{4\pi \epsilon_0} \frac{1}{r^2} \quad (1b)$$



3b

