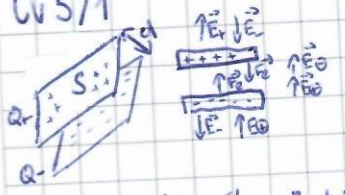
Cv 5/1

$C = \varepsilon_0 \frac{S}{d}$



a) Jaká síla působí na desku kondenzátoru při napětí U_1?
na zápornou nabitou desku: $F^{\ominus} = Q \cdot E^{\ominus}$ $F^{\ominus} = F^{\oplus} = Q \cdot E^{\ominus} = Fe$

$E^{\oplus} = E^{\ominus} = \frac{1}{2}E$

$U = Ed \rightarrow E = \frac{U_1}{d}$

$Fe = \frac{Q \cdot U_1}{2d}$

$Fe = \frac{\varepsilon_0 S U_1^2}{2d}$

$Fe = \frac{\varepsilon_0 S U_1^2}{2d^2}$

$(Q = C_1 U_1 \quad (C_1 = \varepsilon_0 \frac{S}{d}))$

$\leftarrow Q = \frac{\varepsilon_0 S U_1}{d}$

b) Jakou práci vykonáme pokud $d' = 2d$?

$W = Fe \cdot d$

$Fe = \frac{\varepsilon_0 S \cdot Q^2 d^2}{2d^2 \varepsilon^2 S^2} = \frac{Q^2}{2\varepsilon_0 S}$

$U_1 = \frac{Q}{C_1}, \quad C_1 = \varepsilon_0 \frac{S}{d}$

$\Rightarrow U_1 = \frac{Q}{\varepsilon_0 \frac{S}{d}} = \frac{Qd}{\varepsilon_0 S}$

$W = \frac{Q^2 d}{2\varepsilon_0 S} \quad \dots Q = \frac{\varepsilon_0 S U_1}{d}$

$W = \frac{\varepsilon_0^2 S^2 U_1^2 d}{d^2 2\varepsilon_0 S} = \frac{\varepsilon_0 S U_1^2}{2d}$

⑤-4

$S = 10\,cm^2 = 0{,}001\,m^2$
$d = 0{,}001\,m$
$U = 600\,V$
$\Delta E_n = x\,J$

ε_1 ... vzduch = 1 → $\varepsilon = 8{,}85 \cdot 10^{-12}$
ε_r ... olej = 3 → $\varepsilon = 2{,}655 \cdot 10^{-11}$
$\varepsilon = \varepsilon_r \cdot \varepsilon_0$
$\varepsilon_0 = 8{,}85 \cdot 10^{-12}\,A \cdot s \cdot V^{-1} \cdot m^{-1}$

a) $c_1 = \varepsilon \frac{S}{d} = \frac{Q}{U}$

$$\Delta E_n = E_2 - E_1 = \frac{1}{2} C_2 U^2 - \frac{1}{2} C_1 U^2$$
$$= \frac{1}{2} \varepsilon_r \frac{S}{d} \cdot U^2 - \frac{1}{2} \varepsilon_1 \frac{S}{d} U^2$$
$$= \frac{1}{2} \varepsilon_0 \frac{S}{d} U^2 \cdot (\varepsilon_r - \varepsilon_1) = \frac{1}{2} \cdot \frac{0{,}001}{0{,}001} \cdot 600^2 \cdot (3-1) \cdot (8{,}85 \cdot 10^{-12}) = 3{,}186\,10^{-6}\,J$$

b) $Q_1 = Q_2 = konstr.$
$S = 0{,}001\,m^2$
$d = 0{,}001\,m$
$U = 600\,V$
$\Delta E_n = X\,J$

$\varepsilon = \varepsilon_r \cdot \varepsilon_0 \qquad C = \frac{\varepsilon S}{d}$

$$E_1 = \frac{1}{2} C U^2 = \frac{1}{2} Q U = \frac{1}{2} \frac{Q^2}{C} = \frac{\frac{Q^2}{2\varepsilon S}}{d} = \frac{Q^2 \cdot d}{2\varepsilon_1 S}$$

$$E_1 = \frac{Q^2 \cdot d}{2\varepsilon_0 \varepsilon_{r_1} S} = X E_2 = X \frac{Q^2 d}{2\varepsilon_0 \varepsilon_{r_2} S}$$

$\frac{\varepsilon \cdot S}{d} = \frac{Q}{U} \rightarrow Q = \frac{\varepsilon S U}{d}$

$$E_2 = \frac{Q^2 \cdot d}{2\varepsilon_2 S} = \frac{\frac{\varepsilon^2 S^2 U^2}{d^2} \cdot d}{2\varepsilon S} = \frac{\varepsilon \cdot S \cdot U^2}{2d}$$

$3 = X$

$E_1 = 3E_2 \rightarrow \Delta E = E_2 - E_1 = E_2 - 3E_2 = -2E_2 = -2 \cdot \frac{\varepsilon \cdot S \cdot U^2}{2d} =$

$= -9{,}558 \cdot 10^{-6}\,J$