Elektro, øving 4, Vegard G. Jervell

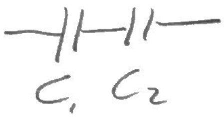
Oppg. 1)

$$dW = \frac{Q}{C} dQ$$

$$W = \int_{Q_0}^{Q_1} \frac{Q}{C} dQ = \frac{Q_1^2}{2C} \quad , \quad Q_0 = 0$$

$$W = 1{,}667 \cdot 10^{-7} \, J$$

Oppg. 2a)



, $\underline{C = \left(\frac{1}{C_1} + \frac{1}{C_2} \right)^{-1}}$

2b)

$\underline{C = C_1 + C_2}$

Oppg. 3) $[\Omega] \cdot [C] = \frac{V}{A} \cdot \frac{C}{V} = \frac{C}{A} = s$ $\square$

$\left(A = \frac{C}{s} \right)$

Oppg. 4a) $C = 2 \mu F$, $\tau = RC$

$\underline{\tau(R=1) = 2 \mu s \quad \tau(R=10) = 10 \mu s}$

Oppg. 5b)

$G_m^{CO} = H_m^{CO} + TS_m^{CO}$

= Står opp. i S.I.

⋮

5c)

$\mu_i = \mu_i^\circ + RT \ln a_i$

$\mu_i = \mu_i^\circ - 5,7 \, kJ/mol$

CO) $\mu_i = -137 \frac{kJ}{mol} - 5,7 \frac{kJ}{mol}$

$= -142,7 \frac{kJ}{mol}$

osv.

5d) $\sum \nu_j \tilde{\mu}_j = 0$

$\tilde{\mu}_j = \mu_j^\circ + RT \ln a_j + \underbrace{z_j}_{=0 \ \forall j} F\Phi$

$\sum \nu_j(\mu_j^\circ + RT \ln a_j) = \sum \nu_j \mu_j^\circ + RT \ln \prod a_j^{\nu_j} = \Delta_{rx} G_m^\circ + RT \ln \prod a_j^{\nu_j} = 0 \ \square$

Oppg. 6) $P = \frac{W}{t} = \frac{mgh}{t} = 7,8 \, kW$

$\Delta_{rx} H \approx -286 \frac{kJ}{mol} = -16 \frac{kJ}{g}$

$\frac{\Delta_{rx} H m}{60 s} = 7,8 \, kW$

$m = 30 g$

Oppg. 8)

Ionestyrke : $\mu = \frac{1}{2}\sum z_i^2 c_i$

Debye-lengde : $\beta = \sqrt{\frac{RT\varepsilon}{2F^2\mu}}$

KCl : $c_i = c$

$\mu(10^{-4}M) = 10^{-4}\frac{e^2 mol}{L} \rightarrow \beta = 9{,}7\cdot 10^{-7} m$

$\mu(10^{-3}M) = 10^{-3}\frac{e^2 mol}{L}$ $\quad \beta = 3{,}1\cdot 10^{-7}$

$\mu(0{,}1M) = 0{,}1\frac{e^2 mol}{L}$ $\quad \beta = 3{,}1\cdot 10^{-8}$

Oppg. 9)

$\gamma_\pm = \exp\left(z_+ z_- \sqrt{\mu/\mu_{DH}}\right)$, $\mu_{DH} = 727\, mM$ ved 25°C

$\gamma_\pm(10^{-4}M) = 0{,}9883$

$\gamma_\pm(10^{-3}M) = 0{,}9636$

$\gamma_\pm(0{,}1M) = 0{,}6901$

Oppg. 10) $\Phi_{cat} + \Phi_{sky} = \Phi_T = \frac{z_c Q_0}{4\pi\varepsilon r}\left(\frac{1}{1+\frac{R_c}{\beta}}\right)\exp\left(\frac{r_c - 1}{\beta}\right)$

$\Phi_{cat}(r) = \frac{z_c Q_0}{4\pi\varepsilon r}$

$\Phi_{sky} = \Phi_T - \Phi_{cat} = \frac{z_c}{4\pi\varepsilon r}\left(\frac{\exp\left(\frac{r_c - 1}{\beta}\right)}{1+\frac{R_c}{\beta}} - 1\right)$

1Ce) $dw = \epsilon E dQ$

$$W = \int_0^{Z_c Q_0} \frac{Q}{4\pi\varepsilon r}\left(\frac{\exp\left(\frac{R_c - r}{\beta}\right)}{1 + \frac{R_c}{\beta}} - 1\right)\Bigg|_{r=R_c} dQ$$

$$W = \int_0^{Z_c Q_0} \frac{Q}{4\pi\varepsilon R_c}\left(\frac{\beta}{\beta + R_c} - 1\right) dQ$$

$$W = \frac{(Z_c Q_0)^2}{8\pi\varepsilon R_c}\left(\frac{\beta}{\beta + R_c} - 1\right)$$

$$W = \frac{(Z_c Q_0)^2(\beta - \beta - R_c)}{8\pi\varepsilon R_c(\beta + R_c)} = \frac{-(Z_c Q_0)}{8\pi\varepsilon(\beta + R_c)}$$

1Pc) $\mu = \mu^\circ + RT(\ln x + \ln \gamma)$ is the potential of the ion.
$RT\ln\gamma$ corresponds to deviation from ideality.
If the only deviation from ideality is the formation of a cloud, this must equal the change in energy resulting from cloud formation.

Oppg. 11) $\frac{\partial^2 \Phi}{\partial x^2} = -\frac{\rho(x)}{\varepsilon}$, $\rho(x) = F(C^+ - C^-)$

$C^+ = C_0 \exp\left(\frac{-F\Phi(x)}{RT}\right)$

$C^- = -C_0 \exp\left(\frac{F\Phi(x)}{RT}\right)$

$$\frac{\partial^2 \Phi}{\partial x^2} = -\frac{C_0}{\varepsilon}\left[\exp\left(\frac{-F\Phi(x)}{RT}\right) - \exp\left(\frac{F\Phi(x)}{RT}\right)\right]$$

$$\frac{\partial^2 \Phi}{\partial x^2} = \frac{C_0}{\varepsilon}\exp\left(\frac{F}{RT}\right)\left[e^{\Phi} - e^{-\Phi}\right]$$

Oppg. (2)

Antar elementær reaksjon:

$r \propto P_{NO_2}$, $r \propto P_{CO}$

$$r = k P_{NO_2} P_{CO}$$