# TD 4 Propriétés électriques des solutions

## Exo 1

1°) Calculer la résistivité

$$\begin{cases} \rho = \frac{1}{\chi} \\ \lambda = \frac{\chi}{C_{eq}} \Rightarrow \begin{cases} \chi = \lambda . C_{eq} \\ \lambda = \alpha \lambda_0 \end{cases} \end{cases} \quad ; \quad \chi = ? \quad ; \quad C_{eq} = ? \quad \Rightarrow \boxed{\rho = \frac{1}{\lambda . C_{eq}}}$$

$Na_2SO_4 \longrightarrow 2Na^+ + SO_4^{-2}$ $\quad \alpha = a, 1, \beta = 3$

$$C_{eq} = 4 \alpha m_{s2} = 4 \alpha \frac{C_p}{M} = 4 . a,1 \frac{1,42 \text{ g/l}}{142 \text{ g/mol}} = 4.10^{-3} \text{ eq g/l}$$

$$\boxed{C_{eq} = 4 \text{ eq g/m}^3} \quad (1)$$

$$\lambda = \alpha \lambda_0 = \alpha (\lambda^+ + \lambda^-) = 0,1 (5 + 16) . 10^{-3} \Omega^{-1} m^2 eq g^{-1}$$

$$\boxed{\lambda = 2,1 . 10^{-3} \Omega^{-1} m^2 eq g^{-1}} \quad (2)$$

(1) et (2) $\Rightarrow \rho = \frac{1}{\lambda C_{eq}} = \frac{1}{2,1 . 10^{-3} . 4}$

$$\boxed{\rho = 119 \ \Omega . m}$$

exo 2

- Le coefficient $\alpha = ?$

$$\begin{cases} \lambda = \alpha \lambda_0 \Rightarrow \alpha = \dfrac{\lambda}{\lambda_0} \\ \lambda = \dfrac{\chi}{C_{eq}} \\ \lambda_0 = \lambda^+ + \lambda^- \end{cases} \Rightarrow \alpha = \frac{\chi}{C_{eq}} \cdot \frac{1}{\lambda_0} = \frac{\chi}{C_{eq}} \cdot \frac{1}{(\lambda^+ + \lambda^-)}$$

$$C_{eq} = 2\alpha m_2$$

$$\alpha = \frac{\chi}{2\alpha m_2 \cdot \lambda_0} \Rightarrow \alpha^2 = \frac{\chi}{2 m_2 \cdot (\lambda^+ + \lambda^-)}$$

$$\alpha = \sqrt{\frac{\chi}{2 m_2 \cdot (\lambda^+ + \lambda^-)}} = \sqrt{\frac{3,6 \cdot 10^{-4} \ \Omega^{-1} cm^{-1}}{2 \cdot 0,1 \cdot 10^{-3} \ mol/cm^3 \ (73,4 + 198,5)}}$$

$$\boxed{\alpha = 0,08}$$

- Constante de dissociation $K = ?$

$K = ?$

$$K = \frac{[NH_4^+][OH^-]}{[NH_4OH]} = \frac{\alpha m_2 \cdot \alpha m_2}{(1-\alpha) m_2} = \frac{\alpha^2 m_2}{1-\alpha} =$$

$$= \frac{(8 \cdot 10^{-2})^2 \cdot 0,1}{(1 - 8 \cdot 10^{-2})} \Rightarrow \boxed{K = 6,4 \cdot 10^{-4}}$$

**Exo 4**

$$pH = 14 + \log [NaOH] = 14 + \log m_{r_{NaOH}}$$

$m_{r(NaOH)} = ?$

$NaOH \longrightarrow Na^+ + OH^-$ $\quad \alpha = 1$, $\beta = 2$

$C_{eq_{NaOH}} = 2 m_{r_{NaOH}}$ / $m_r = \frac{C_{eq(NaOH)}}{2}$

$\lambda = \frac{\chi}{C_{eq}} \Rightarrow C_{eq_{NaOH}} = \frac{\chi_{NaOH}}{\lambda_{NaOH}}$ ?

? $\rightarrow \lambda = \lambda_0 = \lambda^+ + \lambda^- = (50,1 + 198,5) = 248,6\ \Omega^{-1} cm^2 eqg^{-1}$

? $\rightarrow \chi_{eq_{NaOH}} = ?$

$\Leftrightarrow R = \rho_{Kcl} \frac{l}{S}$ / $R_{NaOH} = \rho_{NaOH} \cdot \frac{l}{S}$ $\quad \left(\frac{l}{S} = A \text{ même pour les 2 solutions}\right)$

$R_{Kcl} = \frac{1}{\chi_{Kcl}} \frac{l}{S}$ $\quad \frac{l}{S} = \frac{R_{Kcl}}{\rho_{Kcl}}$ $\Rightarrow R_{NaOH} = \frac{1}{\chi_{NaOH}} \cdot \frac{l}{S}$

$\frac{l}{S} = R_{Kcl} \chi_{Kcl} = R_{(NaOH)} \chi_{NaOH)} = \frac{l}{S}$

$\Rightarrow \chi_{NaOH} = \frac{R_{Kcl} \cdot \chi_{Kcl}}{R_{NaOH}} = \frac{4.10^{-2}\ 210}{300} = 0,028\ \Omega^{-1} cm^{-1}$

$C_{eq} = \frac{2,8.10^{-2}\ \Omega^{-1} cm^{-1}}{248,6\ \Omega^{-1} cm^2 eqg^{-1}} = 0,01126.10^{-2}\ eqg/cm^3 = 0,1126\ eqg/l$

$m_{r_{NaOH}} = \frac{0,1126}{2} = 5,63.10^{-2}\ mol/l$

$pH = 14 + \log(5,63.10^{-2}) = 14 - 2\log 10 + \log(5,63)$

$= 14 - 2 \times 1 + 0,75$

$\boxed{pH = 12,75}$