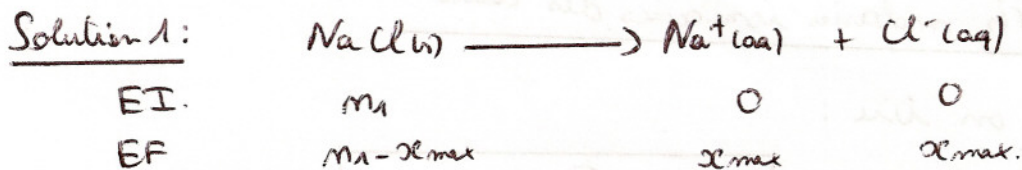


Exercice 34 p 91:

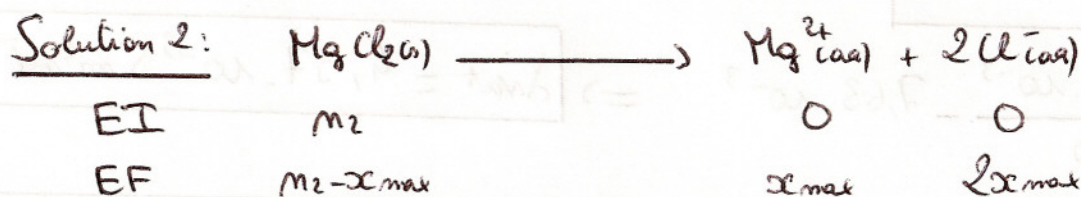
a - Expression des concentrations effectives:



A l'état final : $m_1 - x_{\max} = 0 \Rightarrow x_{\max} = m_1$

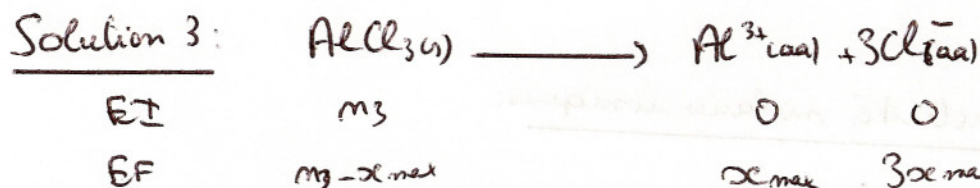
$$\text{Soit } [\text{Na}^+] = \frac{m_{\text{Na}^+}}{V} = \frac{x_{\max}}{V} = \frac{m_1}{V} = \boxed{C = [\text{Na}^+]}$$

$$\text{et } [\text{Cl}^-] = \frac{m_{\text{Cl}^-}}{V} = \frac{m_1}{V} = \boxed{C = [\text{Cl}^-]}$$



$$\text{Soit } [\text{Mg}^{2+}] = \frac{m_{\text{Mg}^{2+}}}{V} = \frac{x_{\max}}{V} = \frac{m_2}{V} \Rightarrow \boxed{[\text{Mg}^{2+}] = C}$$

$$\text{et } [\text{Cl}^-] = \frac{2x_{\max}}{V} = \frac{2m_2}{V} \Rightarrow [\text{Cl}^-] = 2C$$



$$\Rightarrow \boxed{\begin{aligned} [\text{Al}^{3+}] &= C \\ [\text{Cl}^-] &= 3C \end{aligned}}$$

b) Expression des conductivités de chaque solution:

$$\begin{aligned} S_1: \quad \sigma_1 &= [\text{Na}^+] \lambda_{\text{Na}^+} + [\text{Cl}^-] \lambda_{\text{Cl}^-} \quad \text{or } [\text{Na}^+] = [\text{Cl}^-] = C \\ &\Rightarrow \boxed{\sigma_1 = (\lambda_{\text{Na}^+} + \lambda_{\text{Cl}^-}) \times C} \quad (1) \end{aligned}$$

$$\begin{aligned} S_2: \quad \sigma_2 &= [\text{Mg}^{2+}] \lambda_{\text{Mg}^{2+}} + [\text{Cl}^-] \lambda_{\text{Cl}^-} \quad \text{avec } [\text{Cl}^-] = 2[\text{Mg}^{2+}] = 2C \\ &\Rightarrow \boxed{\sigma_2 = (\lambda_{\text{Mg}^{2+}} + 2\lambda_{\text{Cl}^-}) C} \quad (2) \end{aligned}$$

$$S_3: \boxed{\sigma_3 = (\lambda_{Al^{3+}} + 3\lambda_{Cl^-}) C} \quad (3)$$

c) Calcul des conductivités molaires ioniques des cations:

Des relations précédentes on tire :

$$(1) \rightarrow \frac{\sigma_1}{C} = \lambda_{Na^+} + \lambda_{Cl^-} \Rightarrow \boxed{\lambda_{Na^+} = \frac{\sigma_1}{C} - \lambda_{Cl^-}}$$

$$(2) \rightarrow \boxed{\lambda_{Mg^{2+}} = \frac{\sigma_2}{C} - 2\lambda_{Cl^-}}$$

$$(3) \rightarrow \boxed{\lambda_{Al^{3+}} = \frac{\sigma_3}{C} - 3\lambda_{Cl^-}}$$

$$\underline{AN:} \quad \lambda_{Na^+} = \frac{1,260 \cdot 10^{-3}}{0,100} - 7,63 \cdot 10^{-3} \Rightarrow \boxed{\lambda_{Na^+} = 4,97 \cdot 10^{-3} \text{ S m}^2 \text{ mol}^{-1}}$$

$$\lambda_{Mg^{2+}} = \frac{2,59 \cdot 10^{-3}}{0,100} - 2 \times 7,63 \cdot 10^{-3} \Rightarrow \boxed{\lambda_{Mg^{2+}} = 1,06 \cdot 10^{-2} \text{ S m}^2 \text{ mol}^{-1}}$$

$$\lambda_{Al^{3+}} = \frac{4,12 \cdot 10^{-3}}{0,100} - 3 \times 7,63 \cdot 10^{-3} \Rightarrow \boxed{\lambda_{Al^{3+}} = 1,83 \cdot 10^{-2} \text{ S m}^2 \text{ mol}^{-1}}$$

d) Ordre croissant des conductivités molaires ioniques:

$$\text{On a} \quad \lambda_{Al^{3+}} > \lambda_{Mg^{2+}} > \lambda_{Na^+}$$

La conductivité molaire ionique augmente bien lorsque la valeur absolue de la charge augmente.