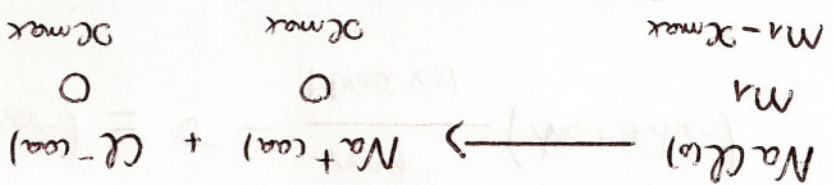
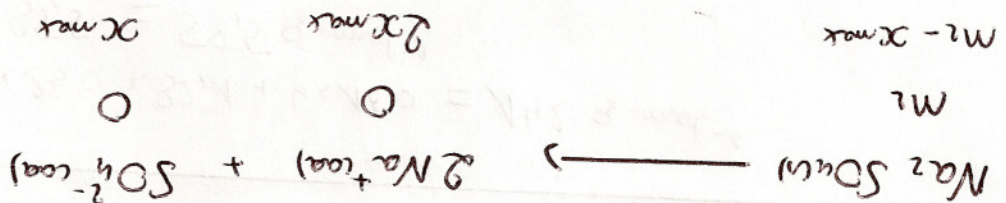


Exercice 29 p. 90 :

a) Expression des concentrations effectives :



$$\Rightarrow x_{\text{max}} = m_1 \Rightarrow m_{\text{Na}^+} = m_{\text{Cl}^-} = m_1$$



$$\Rightarrow x_{\text{max}} = m_2 \Rightarrow m_{\text{Na}^+} = 2m_{\text{SO}_4^{2-}} = 2m_2$$

Soit au final : $m_{\text{Na}^+} = m_1 + 2m_2$

$$m_{\text{SO}_4^{2-}} = m_2$$

$$m_{\text{Cl}^-} = m_1$$

Soit

$$[\text{Na}^+] = \frac{m_1 + 2m_2}{V_{\text{solution}}} = \frac{m_{\text{NaCl}} \times V_{\text{NaCl}}}{m_1} + \frac{m_{\text{Na}_2\text{SO}_4} \times V_{\text{Na}_2\text{SO}_4}}{2m_2}$$

$$[\text{Cl}^-] = \frac{m_1}{V_{\text{solution}}} = \frac{m_{\text{NaCl}} \times V_{\text{NaCl}}}{m_1}$$

$$[\text{SO}_4^{2-}] = \frac{m_2}{V_{\text{solution}}} = \frac{m_{\text{Na}_2\text{SO}_4} \times V_{\text{Na}_2\text{SO}_4}}{2m_2}$$

b) Calcul de m_2 :

$$\sigma = [\text{Na}^+] \lambda_{\text{Na}^+} + [\text{SO}_4^{2-}] \lambda_{\text{SO}_4^{2-}} + [\text{Cl}^-] \lambda_{\text{Cl}^-}$$

$$\sigma = \left(\frac{m_1}{m_1} \frac{M_{\text{NaCl}} \times V_{\text{NaCl}}}{V_{\text{solution}}} + \frac{2m_2}{2m_2} \frac{M_{\text{Na}_2\text{SO}_4} \times V_{\text{Na}_2\text{SO}_4}}{V_{\text{solution}}} \right) \lambda_{\text{Na}^+} + \frac{M_{\text{NaCl}} \times V_{\text{NaCl}}}{m_1} \lambda_{\text{Cl}^-} + \frac{M_{\text{Na}_2\text{SO}_4} \times V_{\text{Na}_2\text{SO}_4}}{2m_2} \lambda_{\text{SO}_4^{2-}}$$

On factorise cette expression

Soit
$$\sigma = \frac{m_1}{M_{NaCl} \times V} (\lambda_{Na^+} + \lambda_{Cl^-}) + \frac{m_2}{M_{Na_2SO_4} \times V} (2\lambda_{Na^+} + \lambda_{SO_4^{2-}})$$

$$\Rightarrow \frac{m_2}{M_{Na_2SO_4} \times V} (2\lambda_{Na^+} + \lambda_{SO_4^{2-}}) = \sigma - \frac{m_1}{M_{NaCl} \times V} (\lambda_{Na^+} + \lambda_{Cl^-})$$

$$\Rightarrow m_2 = \frac{M_{Na_2SO_4} \times V}{2\lambda_{Na^+} + \lambda_{SO_4^{2-}}} \left(\sigma - \frac{m_1}{M_{NaCl} \times V} (\lambda_{Na^+} + \lambda_{Cl^-}) \right)$$

AN: $M_{Na_2SO_4} = 2 \times 23,0 + 32,1 + 4 \times 16,0 = 142 \text{ g} \cdot \text{mol}^{-1}$

$$M_{NaCl} = 23,0 + 35,5 = 58,5 \text{ g} \cdot \text{mol}^{-1}$$

$$\sigma = 40 \text{ mS} \cdot \text{cm}^{-1} = 40 \cdot 10^{-3} \text{ S} \cdot \text{m}^{-1}$$

$$\lambda_{Na^+} = 5,008 \cdot 10^{-3} \text{ S m}^2 \text{ mol}^{-1}$$

$$\lambda_{Cl^-} = 7,631 \cdot 10^{-3} \text{ S m}^2 \text{ mol}^{-1}$$

$$\lambda_{SO_4^{2-}} = 16,0 \cdot 10^{-3} \text{ S m}^2 \text{ mol}^{-1}$$

$$V = 2,0 \text{ L} = 2,0 \cdot 10^{-3} \text{ m}^3$$

$$m_1 = 200 \cdot 10^{-3} \text{ g}$$

$$m_2 = \frac{142 \times 2,0 \cdot 10^{-3}}{2 \times 5,008 \cdot 10^{-3} + 16,0 \cdot 10^{-3}} \left(40 \cdot 10^{-3} - \frac{200 \cdot 10^{-3}}{58,5 \times 2,0 \cdot 10^{-3}} (5,008 \cdot 10^{-3} + 7,631 \cdot 10^{-3}) \right)$$

$$m_2 = 2,0 \cdot 10^{-1} \text{ g}$$

c) Diminution de volume:

On a
$$\sigma = \frac{m_1}{M_{NaCl} \times V} (\lambda_{Na^+} + \lambda_{Cl^-}) + \frac{m_2}{M_{Na_2SO_4} \times V} (2\lambda_{Na^+} + \lambda_{SO_4^{2-}})$$

On constate donc que σ est proportionnel à $\frac{1}{V}$

Donc si V diminue de 20%, alors σ augmente de 20%.

Soit
$$\sigma' = \sigma + \frac{\sigma \times 20}{100} = \underline{\underline{48 \text{ mS} \cdot \text{m}^{-1}}}$$