Suite exercice 1 du chapitre 9

	CH_3COO^-	$+ HCOOH$	$\rightleftarrows CH_3COOH$	$+ HCOO^-$
EI	$n^i_{CH_3COO^-}$	n^i_{HCOOH}	$n^i_{CH_3COOH}$	$n^i_{HCOO^-}$
E inter	$n^i_{CH_3COO^-} - x$	$n^i_{HCOOH} - x$	$n^i_{CH_3COOH} + x$	$n^i_{HCOO^-} + x$
EF	$n^f_{CH_3COO^-} = n^i_{CH_3COO^-} - x_f$	$n^f_{HCOOH} = n^i_{HCOOH} - x_f$	$n^f_{CH_3COOH} = n^i_{CH_3COOH} + x_f$	$n^f_{HCOO^-} = n^i_{HCOO^-} + x_f$

Calcul de x_f

$$[CH_3COO^-]_f = \frac{n^f_{CH_3COO^-}}{4V_0} = \frac{n^i_{CH_3COO^-} - x_f}{4V_0} = \frac{C \times V_0 - x_f}{4V_0}$$

Etat final ? A l'état final, $Q_{r,f} = Q_{r,éq} = K$

$$Q_{r,f} = Q_{r,éq} = \boxed{K = \frac{[CH_3COOH]_f \times [HCOO^-]_f}{[CH_3COO^-]_f \times [HCOOH]_f}}$$

$$\Rightarrow K = \frac{\frac{CV_0 + x_f}{\cancel{4V_0}} \times \frac{CV_0 + x_f}{\cancel{4V_0}}}{\frac{CV_0 - x_f}{\cancel{4V_0}} \times \frac{CV_0 - x_f}{\cancel{4V_0}}} = \boxed{\frac{(CV_0 + x_f)^2}{(CV_0 - x_f)^2} = K} \quad (X)$$

$$\Rightarrow (CV_0 + x_f)^2 = K \times (CV_0 - x_f)^2$$

$a+$

$$\Rightarrow (CV_0)^2 + 2CV_0 x_f + x_f^2 = K\left[(CV_0)^2 - 2CV_0 x_f + x_f^2\right]$$

$$= K \times (CV_0)^2 \cancel{- 2KCV_0 x_f} \cancel{+ K x_f^2}$$

$$\Rightarrow x_f^2 - Kx_f^2 + 2C_0V x_f + 2KCV_0 x_f + (CV_0)^2 - K(CV_0)^2 = 0$$

$$\Rightarrow (1-K) \times x_f^2 + (2C_0V + 2KCV_0)x_f + (CV_0)^2(1-K) = 0$$

$C \times V_0 = 0{,}100 \times 25.10^{-3} = 2{,}5.10^{-3}$ mol

AN : $(1-10{,}0)\, x_f^2 + (2 \times 2{,}5.10^{-3} + 2 \times 10 \times 2{,}5.10^{-3})\, x_f + (2{,}5.10^{-3})^2 \times (1-10) = 0$

$$\Rightarrow -9 \times x_f^2 + 5{,}5 \times 10^{-2} \times x_f - 5{,}6.10^{-5} = 0$$

$$\Delta = b^2 - 4ac = 1{,}0.10^{-3}$$

$$= (5{,}5.10^{-2})^2 - 4 \times (-9) \times (-5{,}6.10^{-5})$$

$$\begin{cases} x_f = \dfrac{-b - \sqrt{\Delta}}{2a} = \dfrac{-5{,}5.10^{-2} - \sqrt{1{,}0.10^{-3}}}{2 \times (-9)} = \cancel{4{,}8}.10^{-3} \text{ mol.} \\[2ex] x_f = \dfrac{-b + \sqrt{\Delta}}{2a} = \dfrac{-5{,}5.10^{-2} + \sqrt{1{,}0.10^{-3}}}{2 \times (-9)} = \underline{1{,}3.10^{-3}} \text{ mol.} \end{cases}$$

or $x_f < \underline{x_{max}}$ $\qquad$ $x_{max} =$

Si réaction totale

$$n^f_{CH_3COO^-} = n^i_{CH_3COO^-} - x_{max} = 0 \Rightarrow x_{max} = n^i_{CH_3COO^-} = C \times V_0$$

$$\Rightarrow \boxed{x_{max} = 0{,}100 \times 25.10^{-3} = \underline{2{,}5.10^{-3}} \text{ mol.}}$$

$\Rightarrow$ donc $x_f = 1{,}3.10^{-3}$ mol

* taux d'avancement

$$\tau = \frac{x_f}{x_{max}} = \frac{1{,}3.\cancel{10^{-3}}}{2{,}5.\cancel{10^{-3}}} = 0{,}52 = 52\%$$

Remarque

$$K = \frac{(CV_0 + x_f)^2}{(CV_0 - x_f)^2}$$

$$\boxed{\begin{aligned} &\Rightarrow K = \left(\frac{CV_0 + x_f}{CV_0 - x_f}\right)^2 \\ &\Rightarrow \sqrt{K} = \frac{CV_0 + x_f}{CV_0 - x_f} \end{aligned}}$$

$$\Rightarrow CV_0 + x_f = \sqrt{K} \times (CV_0 - x_f)$$

$$\Rightarrow CV_0 + x_f = \sqrt{K} \times CV_0 - \sqrt{K} \times x_f$$

$$\Rightarrow x_f + \sqrt{K}\, x_f = \sqrt{K} \times CV_0 - CV_0$$

$$\Rightarrow \quad x_f(1+\sqrt{K}) = cV_0(\sqrt{K}-1)$$

$$\Rightarrow \quad x_f = \frac{cV_0(\sqrt{K}-1)}{1+\sqrt{K}}$$

$$\Rightarrow \quad x_f = \frac{0{,}100 \times 25 \cdot 10^{-3}(\sqrt{10}-1)}{1+\sqrt{10}}$$

$$x_f = 1{,}3 \cdot 10^{-3} \text{ mol}$$