Exercice 2 :

$\boldsymbol{I.1)}$ *On a les couples* $\begin{cases}\boldsymbol{C_6H_5COOH/C_6H_5COO^-} \\ \boldsymbol{H_20\ /OH^-}\end{cases}$ $\quad \begin{matrix} C_6H_5COOH \rightarrow\ C_6H_5COO^- +\ H^+ \\ H_20 +\ \ H^+ \rightarrow\ \ H_30^+ \end{matrix}$

Soit la réaction: $\quad \boldsymbol{C_6H_5COOH_{aq} +\ H_20_{liquide}\ \ =\ \ C_6H_5COO^-{}_{aq} +\ H_30^+{}_{aq}}$

$C(C_6H_5COOH) = 5{,}00.10^{-3}\ mol.L^{-1}$

$\color{red}{\boldsymbol{x\ en\ moles}}$		$C_6H_5COOH_{aq}$	$H_20_l\ \ \rightleftarrows$	$C_6H_5COO^-{}_{aq}$	$H_30^+{}_{aq}$
Etat initial	0	$5{,}00.10^{-3}.V$	excès	0	0
Etat intermédiaire	x	$5{,}00.10^{-3}.V - x$	excès	x	x
Etat équilibre	x_{eq}	$5{,}00.10^{-3}.V - x_{eq}$	excès	x_{eq}	x_{eq}

$\boldsymbol{I.2)}\ \ \sigma = \sum \lambda_i[X_i] \quad$ *donc* $\quad \sigma = \lambda_{C_6H_5COO^-}[C_6H_5COO^-]_{eq} + \lambda_{H_30^+}[H_30^+]_{eq}$

$$or\ \ [C_6H_5COO^-]_{eq} = [H_30^+]_{eq} = \frac{x_{eq}}{V} \ \ \Rightarrow\ \ \frac{x_{eq}}{V}\left(\lambda_{C_6H_5COO^-} + \lambda_{H_30^+}\right) \rightarrow \frac{x_{eq}}{V} = \frac{\sigma}{\lambda_{C_6H_5COO^-} + \lambda_{H_30^+}}$$

$213\mu S.cm^{-1} = 213 * 10^{-3}mS * (10^{-2}m)^{-1} = 213 * 10^{-3}.mS.10^2m^{-1} = 21{,}3\ mS.m^{-1}$

$$\frac{x_{eq}}{V} = \frac{21{,}3}{35 + 3.24} = \frac{21{,}3}{38{,}24} = 5.57.10^{-1}\ mol.m^{-3} = 5.57.10^{-4}\ mol.L^{-1}$$

$$[C_6H_5COO^-] = [H_30^+] = \frac{x_{eq}}{V} = 5.57.10^{-4}\ mol.L^{-1}$$

$$[C_6H_5COOH] = \frac{5V - x_{eq}}{V} = 5 - \frac{x_{eq}}{V} = 5 - 5.57.10^{-4} = 4.44.mol.L^{-1}$$

$$\boldsymbol{I.3)}\ \ K_A = \frac{[C_6H_5COO^-] * [H_30^+]}{[C_6H_5COOH]} = \frac{(5.57.10^{-4})^2}{4.44} = 6.91$$

$\rightarrow\ \ pK_A = -Log(K_A) = -Log(6.91) = 4.16$

$\boldsymbol{II.1)}$ *On a les couples* $\begin{cases}\boldsymbol{C_6H_5COOH/C_6H_5COO^-} \\ \boldsymbol{CH_3COOH/CH_3COO^-}\end{cases}$ $\quad \begin{matrix} C_6H_5COOH \rightarrow\ C_6H_5COO^- +\ H^+ \\ CH_3COO^- +\ H^+\ \rightarrow\ \ CH_3COOH \end{matrix}$

Soit la réaction: $\quad \boldsymbol{C_6H_5COOH_{aq} +\ CH_3COO^-{}_{aq}\ \ =\ \ C_6H_5COO^-{}_{aq} +\ CH_3COOH_{aq}}$

$C(C_6H_5COOH) = \dfrac{1{,}00.10^{-3}}{200.10^{-3}} = 0{,}50\ mol.L^{-1} \qquad C(CH_3COO^-) = \dfrac{1{,}00.10^{-3}}{200.10^{-3}} = 0{,}50\ mol.L^{-1}$

$\color{red}{\boldsymbol{x\ en\ moles}}$		$C_6H_5COOH_{aq}$	$CH_3COO^-{}_{aq}\ \ \rightleftarrows$	$C_6H_5COO^-{}_{aq}$	CH_3COOH_{aq}
Etat initial	0	0,50	0,50	0	0
Etat intermédiaire	x	$0{,}50 - x$	$0{,}50 - x$	x	x
Etat équilibre	x_{eq}	$0{,}50 - x_{eq}$	$0{,}50 - x_{eq}$	x_{eq}	x_{eq}

II.2) $K_{\text{(C\_6 H\_5 COOH)(C\_6 H\_5 COO−)}} = \frac{[C_6H_5COO^-] * [H_30^+]}{[C_6H_5COOH]}$

$K_{\text{(CH\_3 COOH)\textbackslash(CH\_3 COO\^{}−)}} = \frac{[CH_3COO^-] * [H_30^+]}{[CH_3COOH]}$

$Nommons \begin{cases} pK_{A1} = pK_{\text{(C\_6 H\_5 COOH)\textbackslash(C\_6 H\_5 COO−)}} = 4{,}2 \\ pK_{A2} = pK_{\text{(CH\_3 COOH)\textbackslash(CH\_3 COO\^{}−)}} = 4{,}8 \end{cases}$

$$K = \frac{[C_6H_5COO^-] * [CH_3COOH]}{[C_6H_5COOH] * [CH_3COO^-]} = \frac{\frac{[C_6H_5COO^-] * [H_30^+]}{[C_6H_5COOH]}}{\frac{[CH_3COO^-] * [H_30^+]}{[CH_3COOH]}} = \frac{K_{\text{(C\_6 H\_5 COOH)\textbackslash(C\_6 H\_5 COO−)}}}{K_{\text{(CH\_3 COOH)\textbackslash(CH\_3 COO−)}}} = \frac{10^{-pK_{A1}}}{10^{-pK_{A2}}}$$

$\Rightarrow K = 10^{pK_{A2} - pK_{A1}} = 10^{4{,}8-4{,}2} = 10^{0.6} = 3.98$

il est indépendant de la quantité de réactifs apportés à l'état initial