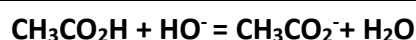
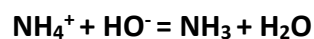
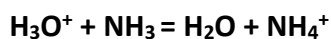
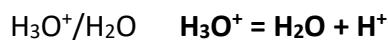


## Séquence 5

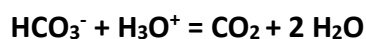
## Les réactions acido-basiques

## Exercices

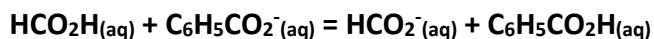
## EX1/



## EX2/



## EX3/



$$1) K_{A1} = \frac{[\text{HCO}_2^-] \times [\text{H}_3\text{O}^+]}{[\text{HCO}_2\text{H}]} = 10^{-3,8} \quad ; \quad K_{A2} = \frac{[\text{C}_6\text{H}_5\text{CO}_2^-] \times [\text{H}_3\text{O}^+]}{[\text{C}_6\text{H}_5\text{CO}_2\text{H}]} = 10^{-4,2}$$

$$K = \frac{[\text{HCO}_2^-] \times [\text{C}_6\text{H}_5\text{CO}_2\text{H}]}{[\text{HCO}_2\text{H}] \times [\text{C}_6\text{H}_5\text{CO}_2^-]}$$

$$K = \frac{[\text{HCO}_2^-] \times [\text{H}_3\text{O}^+]}{[\text{HCO}_2\text{H}]} \times \frac{[\text{C}_6\text{H}_5\text{CO}_2\text{H}]}{[\text{C}_6\text{H}_5\text{CO}_2^-] \times [\text{H}_3\text{O}^+]} = K_{A1} \times \frac{1}{K_{A2}} = \frac{K_{A1}}{K_{A2}}$$

$$K = \frac{K_{A1}}{K_{A2}} = \frac{10^{-3,8}}{10^{-4,2}} = 10^{-3,8+4,2} = 10^{0,4} = 2,5$$

2) Concentrations initiales

$$[\text{HCO}_2\text{H}]_{(i)} = \frac{C_1 \times V_1}{V_{\text{total}}} = \frac{1,0 \cdot 10^{-2} \times 10}{40} = 2,5 \cdot 10^{-3} \text{ mol.L}^{-1}$$

$$[\text{C}_6\text{H}_5\text{CO}_2\text{H}]_{(i)} = \frac{C_2 \times V_2}{V_{\text{total}}} = \frac{1,0 \cdot 10^{-2} \times 10}{40} = 2,5 \cdot 10^{-3} \text{ mol.L}^{-1}$$

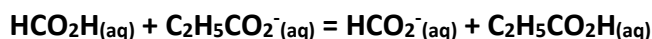
$$[\text{HCO}_2^-]_{(i)} = \frac{C_3 \times V_3}{V_{\text{total}}} = \frac{5,0 \cdot 10^{-3} \times 10}{40} = 1,25 \cdot 10^{-3} \text{ mol.L}^{-1}$$

$$[\text{C}_6\text{H}_5\text{CO}_2\text{H}]_{(i)} = \frac{C_4 \times V_4}{V_{\text{total}}} = \frac{5,0 \cdot 10^{-3} \times 10}{40} = 1,25 \cdot 10^{-3} \text{ mol.L}^{-1}$$

$$Q_{r(\text{initial})} = \frac{[\text{HCO}_2^-]_{(i)} \times [\text{C}_6\text{H}_5\text{CO}_2\text{H}]_{(i)}}{[\text{HCO}_2\text{H}]_{(i)} \times [\text{C}_6\text{H}_5\text{CO}_2^-]_{(i)}} = \frac{(1,25 \cdot 10^{-3})^2}{(2,5 \cdot 10^{-3})^2} = 0,25$$

Evolution du système chimique :  $Q_r(i) < K \rightarrow$  le système va évoluer dans le sens direct de l'équation

### EX4/



#### 1) constante d'équilibre de la réaction

$$K = \frac{[\text{HCO}_2^-] \times [\text{C}_2\text{H}_5\text{CO}_2\text{H}]}{[\text{HCO}_2\text{H}] \times [\text{C}_2\text{H}_5\text{CO}_2^-]} = \frac{K_{a1}}{K_{a2}} = \frac{10^{-3,75}}{10^{-4,87}} = 10^{-3,75+4,87} = 10^{1,12} = 13,2$$

#### 2) Calcul du quotient de réaction initial (après mélange mais avant réaction)

$$Q_r(i) = \frac{[\text{HCO}_2^-]_{(i)} \times [\text{C}_2\text{H}_5\text{CO}_2\text{H}]_{(i)}}{[\text{HCO}_2\text{H}]_{(i)} \times [\text{C}_2\text{H}_5\text{CO}_2^-]_{(i)}}$$

$$[\text{HCO}_2\text{H}]_{(i)} = \frac{C_1 \times V_1}{V_{\text{total}}} = \frac{2,0 \cdot 10^{-2} \times 10}{70} = 2,9 \cdot 10^{-3} \text{ mol.L}^{-1}$$

$$[\text{HCO}_2^-]_{(i)} = \frac{C_2 \times V_2}{V_{\text{total}}} = \frac{1,0 \cdot 10^{-2} \times 30}{70} = 4,3 \cdot 10^{-3} \text{ mol.L}^{-1}$$

$$[\text{C}_2\text{H}_5\text{CO}_2\text{H}]_{(i)} = \frac{C_3 \times V_3}{V_{\text{total}}} = \frac{4,0 \cdot 10^{-2} \times 25}{70} = 1,4 \cdot 10^{-2} \text{ mol.L}^{-1}$$

$$[\text{C}_2\text{H}_5\text{CO}_2^-]_{(i)} = \frac{C_4 \times V_4}{V_{\text{total}}} = \frac{1,0 \cdot 10^{-2} \times 5}{70} = 7,1 \cdot 10^{-4} \text{ mol.L}^{-1}$$

$$Q_r(i) = \frac{[\text{HCO}_2^-]_{(i)} \times [\text{C}_2\text{H}_5\text{CO}_2\text{H}]_{(i)}}{[\text{HCO}_2\text{H}]_{(i)} \times [\text{C}_2\text{H}_5\text{CO}_2^-]_{(i)}} = \frac{4,3 \cdot 10^{-3} \times 1,4 \cdot 10^{-2}}{2,9 \cdot 10^{-3} \times 7,1 \cdot 10^{-4}} = 29 > K$$

Le système va évoluer dans le sens inverse de l'équation choisie.

Les ions méthanoate réagissent avec l'acide propénoïque.

La concentration  $[\text{HCO}_2^-]$  baisse

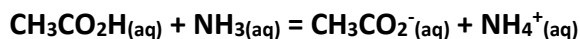
la concentration  $[\text{C}_2\text{H}_5\text{CO}_2\text{H}]$  baisse

la concentration  $[\text{HCO}_2\text{H}]$  augmente

la concentration  $[\text{C}_2\text{H}_5\text{CO}_2^-]$  augmente

**EX5/**

On choisit d'écrire arbitrairement l'équation dans le sens



Constante d'équilibre de la réaction

$$K = \frac{[\text{CH}_3\text{CO}_2^-] \times [\text{NH}_4^+]}{[\text{CH}_3\text{CO}_2\text{H}] \times [\text{NH}_3]} = \frac{K_{a_1}}{K_{a_2}} = \frac{10^{-4,8}}{10^{-9,2}} = 10^{-4,8+9,2} = 10^{4,4} = \mathbf{2,5 \cdot 10^4}$$

Calcul du quotient de réaction initial (après mélange mais avant réaction)

$$Q_{r(i)} = \frac{[\text{CH}_3\text{CO}_2^-]_{(i)} \times [\text{NH}_4^+]_{(i)}}{[\text{CH}_3\text{CO}_2\text{H}]_{(i)} \times [\text{NH}_3]_{(i)}}$$

$$[\text{CH}_3\text{CO}_2\text{H}]_{(i)} = \frac{C_1 \times V_1}{V_{\text{total}}} = \frac{2,0 \cdot 10^{-2} \times 10}{30} = \mathbf{6,7 \cdot 10^{-3} \text{ mol.L}^{-1}}$$

$$[\text{NH}_4^+]_{(i)} = \frac{C_2 \times V_2}{V_{\text{total}}} = \frac{5,0 \cdot 10^{-2} \times 5}{30} = \mathbf{8,3 \cdot 10^{-3} \text{ mol.L}^{-1}}$$

$$[\text{CH}_3\text{CO}_2^-]_{(i)} = \frac{C_3 \times V_3}{V_{\text{total}}} = \frac{5,0 \cdot 10^{-2} \times 5}{30} = \mathbf{8,3 \cdot 10^{-3} \text{ mol.L}^{-1}}$$

$$[\text{NH}_3]_{(i)} = \frac{C_4 \times V_4}{V_{\text{total}}} = \frac{10 \cdot 10^{-2} \times 10}{30} = \mathbf{3,3 \cdot 10^{-2} \text{ mol.L}^{-1}}$$

$$Q_{r(i)} = \frac{[\text{CH}_3\text{CO}_2^-]_{(i)} \times [\text{NH}_4^+]_{(i)}}{[\text{CH}_3\text{CO}_2\text{H}]_{(i)} \times [\text{NH}_3]_{(i)}} = \frac{8,3 \cdot 10^{-3} \times 8,3 \cdot 10^{-3}}{6,7 \cdot 10^{-3} \times 3,3 \cdot 10^{-2}} = \mathbf{0,31 \lll K}$$

**Le système évolue dans le sens direct de l'équation choisie**