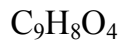
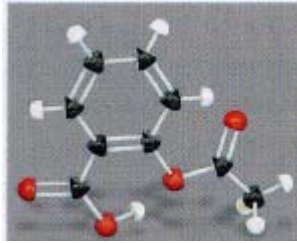


2008/2007 :

3 :

الفرض المحروس الثاني للثلاثي الثاني

الموضوع الأول:



.HA

.1

$$V = 100,0 \text{ mL} \quad .2$$

$$.C = 5,00 \times 10^{-3} \text{ mol.L}^{-1}$$

$$x_{\text{éq}} \quad K \quad .3$$

$$.x_{\text{éq}} \quad 25^\circ\text{C} \quad K = 3,2 \times 10^{-4} \quad .4$$

$$. \quad \text{pH} \quad .5$$

الموضوع الثاني :

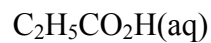
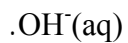
$$V_B = 10,0 \text{ mL}$$

$$C_A = 5,0 \text{ mmol.L}^{-1}$$

$$V_A = 20,0 \text{ mL}$$

$$.4,9 \quad \text{pH}$$

$$.C_B = C_A$$



.1

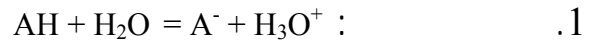
.2



$$. \quad K \quad .3$$

$$pK_A(C_2H_5CO_2H/C_2H_5CO_2^-) = 4,9 ; pK_A(H_2O/HO^-) = 14,0$$

rechid_yacine@yahoo.fr :



$$K = Q_{r, \text{éq}} = \frac{[A^-] \cdot [H_3O^+]}{[AH]} \quad .2$$

| | | AH | + | H ₂ O | = | A ⁻ | + | H ₃ O ⁺ |
|--|-----------------|-----------------------|---|------------------|---|-----------------|---|-------------------------------|
| | (mol)x | (mol) | | | | | | |
| | 0 | C.V | | | | 0 | | 0 |
| | x | C.V - x | | | | x | | X |
| | x _{éq} | C.V - x _{éq} | | | | x _{éq} | | x _{éq} |

$$n(A^-)_{\text{éq}} = n(H_3O^+)_{\text{éq}} = x_{\text{éq}}$$

$$n(AH)_{\text{éq}} = C.V - x_{\text{éq}}$$

: V

$$[A^-]_{\text{éq}} = [H_3O^+]_{\text{éq}} = \frac{x_{\text{éq}}}{V}$$

$$[AH]_{\text{éq}} = C - \frac{x_{\text{éq}}}{V}$$

:

$$K = \frac{[A^-]_{\text{éq}} \cdot [H_3O^+]_{\text{éq}}}{[AH]_{\text{éq}}} \quad .3$$

$$K = \frac{\left(\frac{x_{\text{éq}}}{V}\right)^2}{\left(C - \frac{x_{\text{éq}}}{V}\right)} \quad .2$$

$$\times K = \frac{\left(\frac{x_{\text{éq}}}{0,1}\right)^2}{\left(5 \times 10^{-3} - \frac{x_{\text{éq}}}{0,1}\right)} = \frac{100x_{\text{éq}}^2}{5 \times 10^{-3} - 10x} \quad .4$$

$$100x_{\text{éq}}^2 + 10K \cdot x_{\text{éq}} - 5 \cdot 10^{-3}K = 0$$

$$100x_{\text{éq}}^2 + 10K \cdot x_{\text{éq}} - 5 \cdot 10^{-3}K = 0$$

$$100x_{\text{éq}}^2 + 3,2 \cdot 10^{-3} \cdot x_{\text{éq}} - 6,4 \cdot 10^{-6} = 0$$

$$\Delta = (3,2 \cdot 10^{-3})^2 + 4 \cdot 1,6 \cdot 10^{-6} \cdot 100 = 6,5 \cdot 10^{-4} \Rightarrow \sqrt{\Delta} = 2,55 \cdot 10^{-2}$$

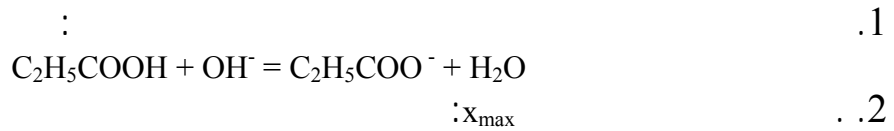
$$x_{\text{éq}} = \frac{-3,2 \times 10^{-3} - 2,55 \times 10^{-2}}{200} < 0$$

$$x_{\text{éq}} = \frac{-3,2 \times 10^{-3} + 2,55 \times 10^{-2}}{200} = 1,11 \cdot 10^{-4} \text{ mol}$$

:pH .5
:2

$$[H_3O^+]_{\acute{e}q} = \frac{x_{\acute{e}q}}{V} = \frac{1,11 \cdot 10^{-4}}{0,1} = 1,11 \cdot 10^{-3} \text{ mol.L}^{-1}$$

$$\text{pH} = -\log(1,11 \cdot 10^{-3}) = 2,95 \Rightarrow \text{pH} = 2,95$$



| | | AH | + | OH ⁻ | = | A ⁻ | + | H ₂ O |
|--|-----------------|--|---|--|---|-----------------|---|------------------|
| | (mol)x | (mol) | | | | | | |
| | 0 | C _A ·V _A | | C _B ·V _B | | 0 | | |
| | x | C _A ·V _A - x | | C _B ·V _B - x | | x | | |
| | x _{éq} | C _A ·V _A - x _{éq} | | C _B ·V _B - x _{éq} | | x _{éq} | | |

$C_B \cdot V_B - x_{\text{max}} = 0$: OH⁻
 $x_{\text{max}} = 5.10^{-5} \text{ mol}$: $x_{\text{max}} = C_B \cdot V_B = 5.10^{-3} \cdot 10.10^{-3}$
 : n(OH⁻)_f .
 :

pH = 4,9 ⇒ [H₃O⁺] = 10^{-4,9} = 1,26 · 10⁻⁵
 $K_e = [H_3O^+] \cdot [OH^-] \Rightarrow [OH^-] = \frac{K_e}{[H_3O^+]} = \frac{10^{-14}}{1,26 \cdot 10^{-5}} = 7,94 \cdot 10^{-10} \text{ mol.L}^{-1}$
 $n(OH^-)_f = [OH^-]_f \cdot V = [OH^-] \cdot (V_A + V_B) = 7,94 \cdot 10^{-10} \cdot (20 + 10) \cdot 10^{-3}$
 $n(OH^-)_f = 2,38 \cdot 10^{-11} \text{ mol}$

: x_f
:

$n(OH^-)_f = C_B \cdot V_B - x_f \Rightarrow x_f = C_B \cdot V_B - n(OH^-)_f$
 $x_f = 5.10^{-3} \cdot 10.10^{-3} - 2,38 \cdot 10^{-11}$
 $x_f \approx 5.10^{-5} \text{ mol}$

: τ

$$\tau = \frac{x_f}{x_{\text{max}}} = \frac{5.10^{-5}}{5.10^{-5}} = 1$$

τ = 1 .

: K .3

: [H₃O⁺]

$$K = \frac{[A^-]}{[AH] \cdot [OH^-]}$$

$$K = \frac{[A^-] \cdot [H_3O^+]}{[AH]} \times \frac{1}{[OH^-] \cdot [H_3O^+]} = \frac{K_A}{K_e} = \frac{10^{-pK_a}}{10^{-14}}$$

$$1,26 \cdot 10^9 > 10^4 \frac{10^{-4,9}}{10^{-14}} = K =$$