IV. Calcul de pH

1) anion NO_3^- : neutre
cation $[V(H_2O)_6]^{3+}$: acide

$x^2 + K_a x - K_a c_0 = 0$ avec $K_a = 10^{-2,92} = 1,2 \cdot 10^{-3}$
$c_0 = 0,2 \text{ mol.L}^{-1}$

$x_1 = 0,0149 \text{ mol.L}^{-1} = [H_3O^+]$; $(x_2 < 0)$

$pH = -\log 0,0149 = \underline{1,83}$

2) cation Na^+ : neutre
anion BrO^- : basique

$n(NaBrO) = \frac{m(NaBrO)}{M(NaBrO)} = \frac{2,38 \text{ g}}{118,9 \text{ g.mol}^{-1}} = 2 \cdot 10^{-2} \text{ mol}$

$x^2 + K_b x - c_0 K_b = 0$ avec $c_0 = 2 \cdot 10^{-2} \text{ mol.L}^{-1}$
$K_b = 10^{-(14-9,24)} = 1,738 \cdot 10^{-5}$

$x_1 = 5,81 \cdot 10^{-4} \text{ mol.L}^{-1} = [OH^-]$; $(x_2 < 0)$

$pOH = -\log 5,81 \cdot 10^{-4} = 3,23$

$pH = 14 - 3,23 = \underline{10,77}$

3) $c_0 \alpha^2 + K_a \alpha - K_a = 0$

$c_0 = \frac{-K_a \alpha + K_a}{\alpha^2}$ avec $\alpha = 0,029$
$K_a = 10^{-3,87} = 1,349 \cdot 10^{-4}$

$c_0 = [\text{ac. lactique}] = \frac{-0,029 \cdot 1,349 \cdot 10^{-4} + 1,349 \cdot 10^{-4}}{0,029^2}$

$= 0,156 \text{ mol.L}^{-1}$

$x^2 + K_a x - c_0 K_a = 0$ avec $K_a = 1,349 \cdot 10^{-4}$
$c_0 = 0,156 \text{ mol.L}^{-1}$

$x_1 = 4,52 \cdot 10^{-3} \text{ mol.L}^{-1} = [H_3O^+]$; $(x_2 < 0)$
$pH = -\log 4,52 \cdot 10^{-3} = \underline{2,34}$

4) cation NH_4^+ : acide
anion F^- : basique

$pH \simeq \frac{1}{2} pK_a(NH_4^+/NH_3) + \frac{1}{2} pK_a(HF/F^-)$

$pH \simeq \frac{1}{2} \cdot 9,20 + \frac{1}{2} \cdot 3,17 = \underline{6,13}$

2
3
4
1

III. Réactions d'hydrolyse

sept 2012

1) a) $CH_3-CH_2-\overset{O}{\overset{\|}{C}}-O-CH_3$; $CH_3-\overset{O}{\overset{\|}{C}}-O-CH_2-CH_3$

$H-\overset{O}{\overset{\|}{C}}-O-CH_2-CH_2-CH_3$; $H-\overset{O}{\overset{\|}{C}}-O-\underset{CH_3}{\underset{|}{CH}}-CH_3$ 2

b) B = alcool secondaire = $CH_3-\underset{OH}{\underset{|}{CH}}-CH_3$ propan-2-ol 1

A = H-COOH acide méthanoïque 1

c) réd. $Cr_2O_7^{2-} + 14H^+ + 6e^- \longrightarrow 2Cr^{3+} + 7H_2O$

ox. $CH_3-\underset{OH}{\underset{|}{CH}}-CH_3 \longrightarrow CH_3-\underset{O}{\underset{\|}{C}}-CH_3 + 2H^+ + 2e^- \;/\cdot 3$ 4

$3\,CH_3-\underset{OH}{\underset{|}{CH}}-CH_3 + Cr_2O_7^{2-} + 8H^+ \longrightarrow 3\,CH_3-\underset{O}{\underset{\|}{C}}-CH_3 + 2Cr^{3+} + 7H_2O$

propanone

d) cf. livre p. 56 2

2) a) $CH_2-O-\overset{O}{\overset{\|}{C}}-(CH_2)_7-CH=CH-CH_2-CH=CH-(CH_2)_4-CH_3$

$CH-O-\overset{O}{\overset{\|}{C}}-(CH_2)_7-CH=CH-CH_2-CH=CH-(CH_2)_4-CH_3 \quad + 3K^+ + 3OH^-$

$CH_2-O-\overset{O}{\overset{\|}{C}}-(CH_2)_7-CH=CH-CH_2-CH=CH-(CH_2)_4-CH_3$ 3

$\longrightarrow$ CH_2-OH, $CH-OH$, CH_2-OH (glycérine) $+ 3\,CH_3-(CH_2)_4-CH=CH-CH_2-CH=CH-(CH_2)_7-C(=O)-O^- + K^+$

linoléate de potassium

queue hydrophobe — tête hydrophile 1

b) cf. livre p. 77 2

3) a) $\left(H_2N-CH_2-\underset{O}{\underset{\|}{C}}-NH-\underset{CH(CH_3)_2}{\underset{|}{CH}}-CO_2H + H_2O \longrightarrow\right) H_2N-CH_2-\overset{A}{\underset{O}{\underset{\|}{C}}}-OH + H_2N-\overset{B}{\underset{CH(CH_3)_2}{\underset{|}{CH}}}-CO_2H$ 3

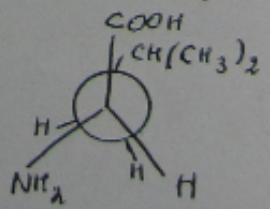
A = ac. α-aminoéthanoïque ; B = ac. 2-amino-4-méthylpentanoïque

b) $H-\overset{H}{\overset{|}{N}}{}^{\oplus}-\overset{H}{\overset{|}{C}}-C(=O)-O-H$; $H-\overset{H}{\overset{|}{N}}-\overset{H}{\overset{|}{C}}-C(=O)-O^{\ominus}$ 1/1

CH_2, $CH(CH_3)_2$

c) $H_2N-\overset{*}{C}(COOH)-H$ L-Leu

CH_2, $CH(CH_3)_2$

d) 

e) Leu - Leu
Gly - Gly
Gly - Leu
Leu - Gly 1/1/1

24

I. (suite)

3) a) d'après méthode des tangentes parallèles : 1

au P.E. : $V \simeq 18{,}2$ mℓ ; $pH \simeq 8{,}2$

$$c_0(C_6H_5COOH) = \frac{c_0(NaOH) \cdot V(NaOH(aq))}{V(\text{échantillon})}$$

$$= \frac{0{,}05 \text{ mol} \cdot \ell^{-1} \cdot 18{,}2 \text{ mℓ}}{50{,}0 \text{ mℓ}} = 0{,}018 \frac{\text{mol}}{\ell}$$

$n(C_6H_5COOH) = c_0 \cdot V = 0{,}018 \text{ mol} \cdot \ell^{-1} \cdot 50 \cdot 10^{-3} \ell = 9{,}0 \cdot 10^{-4} \text{ mol}$

$m(C_6H_5COOH) = n \cdot M = 9{,}0 \cdot 10^{-4} \text{ mol} \cdot 122 \text{ g} \cdot \text{mol}^{-1} = 0{,}11 \text{ g}$

$\beta(C_6H_5COOH) = \frac{m}{V} = \frac{0{,}11 \text{ g}}{50 \cdot 10^{-3} \ell} = 2{,}2 \text{ g} \cdot \ell^{-1}$ 2

b) au PE : pH d'une base faible

$$[\text{benzoate}] = \frac{n_0(\text{ac. benzoïque})}{V_{\text{totale}}}$$

$$= \frac{9 \cdot 10^{-4} \text{ mol}}{(0{,}050 + 0{,}018)\ell} = 1{,}32 \cdot 10^{-2} \text{ mol} \cdot \ell^{-1}$$

$x^2 + K_b x - K_b \cdot c_0 = 0$ avec : $x = [OH^-]$

$K_b = 10^{-(14-4{,}19)}$

$= 1{,}549 \cdot 10^{-10}$

$c_0 = [\text{benzoate}]$ au PE.

$= 1{,}32 \cdot 10^{-2} \text{ mol} \cdot \ell^{-1}$ 3

$x_1 = 1{,}43 \cdot 10^{-6} \text{ mol} \cdot \ell^{-1} = [OH^-]$

$(x_2 = -1{,}43 \cdot 10^{-6})$

$pOH = -\log 1{,}43 \cdot 10^{-6} = 5{,}84$

$pH = 14 - 5{,}84 = \underline{8{,}16}$

/16

II. Ion carbénium

1) cf. livre p. 42 - 43 5

2) cf. livre p. 57 (remplacer $-R'$ par $-CH_3$) 5

/

Epreuve écrite

Examen de fin d'études secondaires 2012

Section: B et C

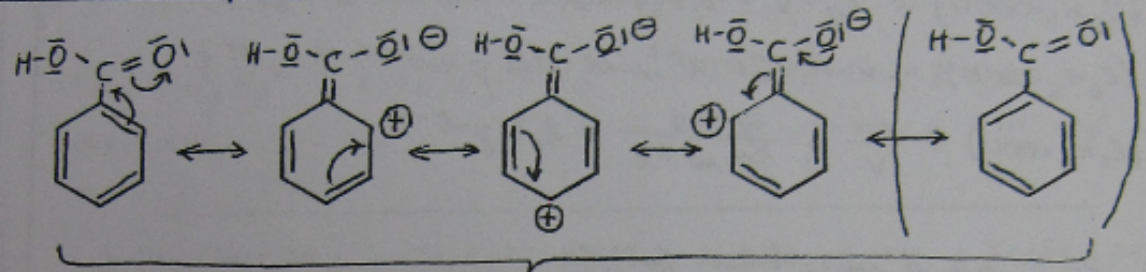
Branche: chimie

Corrigé

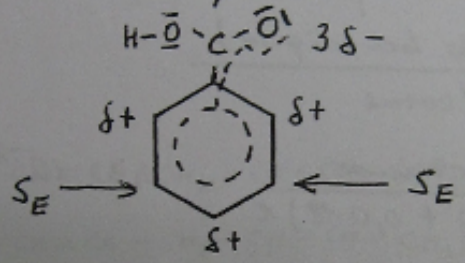
sept 2012

I. Acide benzoïque

1) a)

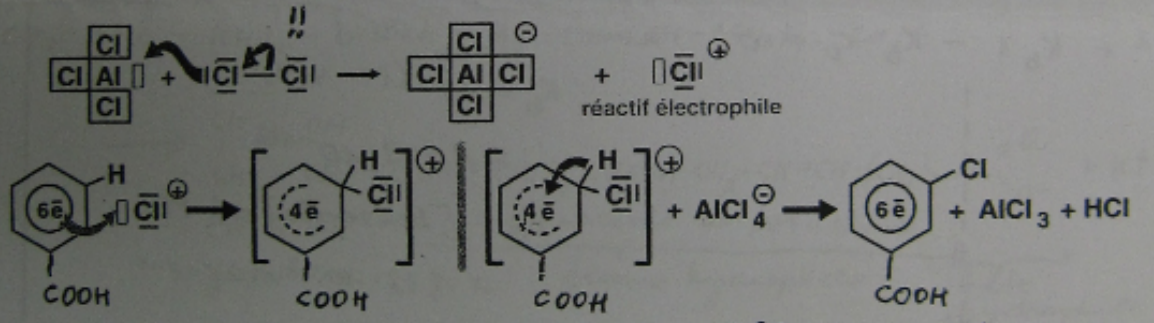


2



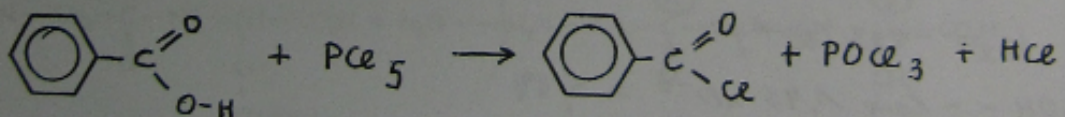
1

b)



4

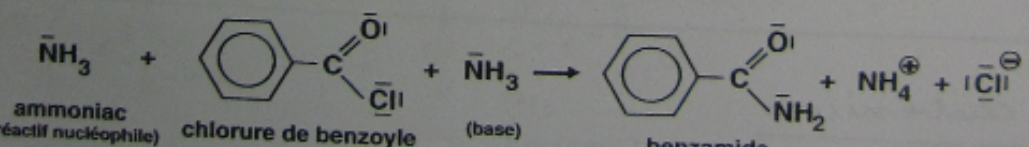
2) a)



chlorure de benzoyle

1,5

b)



1,5