Entrance Exam (2020 – 2021)

Chemistry
Duration: 40 min
September 2020

This Test consists of two Multiple-choice Exercises (MCQs).
Each Exercise consists of 10 MCQs.

1- ***Post your answer on the grille.***
2- ***For each question correspond 3 proposals a, b, c.***
3- ***For each question, there is ONLY one true answer.***
4- ***Select the correct proposal and mark" X" in the corresponding case in the GRILLE associated with the exercise.***
5- ***You must answer all the questions.***
6- ***Each correct answer provides you 1 point.***
7- ***The use of a non programmable calculate is authorized.***

Exercise – 1
Ester and pH

A mono-functional organic compound (A) of formula $C_xH_yO_2$ having the following percentage by mass: oxygen 36.37 % and carbon 54.55 %.

Given: Molar mass in $g.mol^{-1}$: M(H) =1, M(C) =12, M(O) =16

1- The molar mass of (A) is:
   a- 90 $g.mol^{-1}$
   b- 88 $g.mol^{-1}$
   c- 64 $g.mol^{-1}$

2- The molecular formula of (A) is:
   a- $C_4H_8O_2$
   b- $C_4H_{10}O_2$
   c- $C_3H_6O_2$

3- A solution (S) was prepared by adding distilled water at 1×10^{-2} mol of (A) placed in a volumetric flask of 1 L to reach the line mark and shake. The compound A reacts with water according the equilibrium of the following equation: $A + H_2O \rightleftarrows B + C$.
   The pH of the freshly solution (S) prepared of (A) is neutral. The function of (A) is an:
   a- Alcohol
   b- Ester
   c- Acid

4- Over time the pH of solution (S):
   a- Doses not varie
   b- Decreases
   c- Increases

5- The analysis of solution (S) shows that it contains among others 2-propanol, the compound (A) is:
   a- Propyl methanoate
   b- Ethyl ethanoate
   c- 1-methylethyl methanoate

6- The initial molar concentration of (S) is 1×10^{-2} mol.L^{-1}, the pH of the solution (S) after a long time will be:
   a- pH = 2
   b- pH > 2
   c- pH < 2

7- The equilibrium is strongly advanced towards the formation of B and C

$$A + H_2O \leftrightarrows B + C$$

The factor influencing the equilibrium is:
a- High water concentration
b- Temperature rise
c- Another factor

8- An acid-base neutralization of a volume V(S) requires an equal volume of NaOH 1×10^{-2} mol.L^{-1}. The yield Y of the reaction: $A + H_2O \leftrightarrows B + C$ is:
   a- Y = 80%
   b- Y = 90%
   c- Y = 100%

9- To achieve a colorimetric neutralization and to detect the equivalence point the most indicator to be used is:
   a- Helianthine of pH range $3,2 < pH < 4,4$
   b- Bromocresol green of pH range $3,8 < pH < 5,4$
   c- Phenolphtalein of pH range $8,2 < pH < 9,8$

10- The equation of the acid-base neutralization reaction is:
   a- $HCOOH + HO^- \leftrightarrows HCOO^- + H_2O$
   b- $HCOOH + HO^- \rightarrow HCOO^- + H_2O$
   c- $HCOOH + H_2O \leftrightarrows HCOO^- + H_3O^+$

Grille of exercise -1

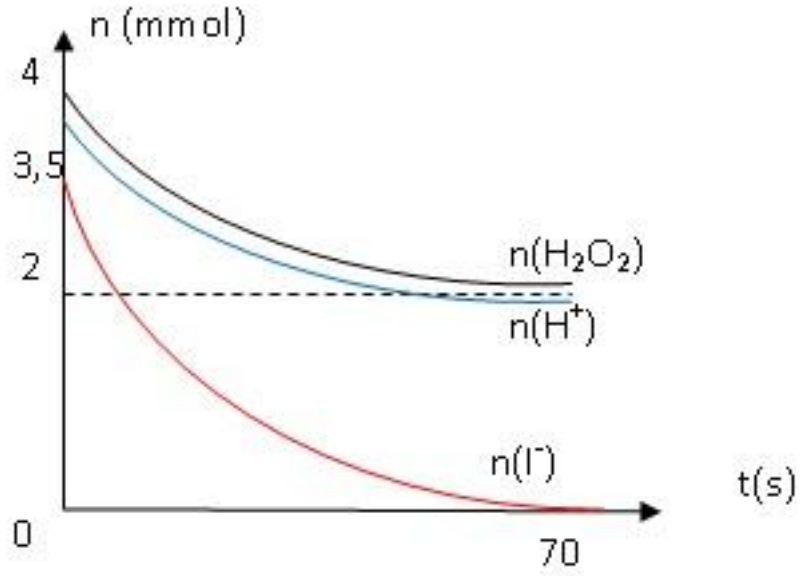
QCM N°	a	b	c
1		X	
2	X		
3		X	
4		X	
5			X
6		X	
7	X		
8			X
9			X
10		X	

Exercise – 2
Kinetic and number of moles

In a laboratory of a polytechnic school, the kinetic study of the complete transformation betw een hydrogen peroxide and iodide ions $I^-(aq)$ in the presence of $H^+(aq)$ ions is undertaken.
The chemical equation modeling this transformation is written:

$$H_2O_2(aq) + 2\ I^-(aq) + 2\ H^+(aq) \rightarrow I_2(aq) + 2\ H_2O(l).$$

The following document presents the results of the kinetics studied: changes in the amount of number of moles for the three reagents versus time.



1- The limiting reagent is:

a- H_2O_2
b- I^-
c- H^+

2- The curve $n(I^-) = f(t)$ is correct, then:
   a- The curve $n(H_2O_2) = f(t)$ is wrong
   b- The curve $n(H^+) = f(t)$ s wrong
   c- Neither of the two curves is wrong
3- The mass of iodine obtained (Molar mass: $M(I_2) = 254\ g.mol^{-1}$) is approximately equal to:
   a- 0.18 g
   b- 0.44 g
   c- 0.60g

4- The half-time of the reaction is:
   a- 60 s
   b- 35 s
   c- 10 s

5- The rates of disappearance of reagents at instant t are such as:
a- $R_{disappearance\ (H_2O_2)} = R_{disappearance\ (I^-)} = R_{disappearance\ (H^+)}$
b- $R_{disappearance\ (I^-)} = 2\ R_{disappearance\ (H+)}$
c- $2\ R_{disappearance\ (H_2O_2)} = R_{disappearance\ (I^-)}$

6- The rate of formation of product I_2 at instant t aresuch as : Vitesse de formation du produit I_2 à un instant t est tel que :
a- $R_{formation\ (I_2)} = 2\ R_{disappereance\ (H^+)}$
b- $R_{formation\ (I_2)} = R_{disappereance\ (H2O2)}$
c- $R_{formation\ (I_2)} = 2\ R_{disappereance\ (H^+)}$

7- The initial amount of H^+, $n(H^+)_{initial} = 3.8$ mmol then the amount $n(I_2)$, expressed in mmol, of iodine formed during time is giving by the relation:
   a- $n(I_2)_t = 3.5 - 2n(I^-)_t$
   b- $n(I_2)_t = \frac{1}{2}(3.8 - n(H^+)_t)$
   c- $n(I_2)_t = 4 - n(H_2O_2)_t$

8- The final composition of the mixture, expressed in mmol, is:

	H_2O_2	I^-	H^+	I_2	H_2O
a	2. 25	0	2.05	1.75	Large amount
b	2. 25	0	0.75	1.75	Large amount
c	2.25	0	0.30	1.75	Large amount

9- The final composition of the mixture at instant $t_{1/2}$, expressed in mmol, is:

	H_2O_2	I^-	H^+	I_2	H_2O
a	2.0	1.75	1.9	0.875	Large amount
b	3.125	1.75	2.05	0.875	Large amount
c	2.25	1.75	0.30	1.75	Large amount

10- The shape of the curve $n(I_2) = f''(t)$, passes through the points:

	t= 0s	$t_{½}$	t final
a	0 mmol	2 mmol	4 mmol
b	0 mmol	1.9 mmol	3.8 mmol
c	0 mmol	0.875 mmol	1.75 mmol

Grille of exercise -2

QCM N°	a	b	c
1		X	
2		X	
3		X	
4			X
5			X
6		X	
7		X	
8			X
9		X	
10			X