الجامعة اللبنانية

كلية الصحة العامة

مباراة الدخول 2020– 2021

مسابقة في الكيمياء – Series A

المدة : ٤٥ دقيقة عدد الصفحات: ٥

For each of the following questions circle <u>the right answer</u>. (Only one answer is correct)

1. We perform the oxidation of iodide ions I^- with the peroxydisulfate ions $S_2O_8^{2-}$, this reaction is slow and complete. (1pt)

$$2I^- (aq) + S_2O_8^{2} (aq) \rightarrow I_2 (aq) + 2SO_4^{2-} (aq)$$

a. The curve n (I^-) = f(t) is ascendent.
b. The curve n (I_2) = f (t) is descendent.
c. The curve n(I_2) = f(t) is ascendent.
d. The curve n $(S_2O_8^{2-})$ = f(t) is ascendent.

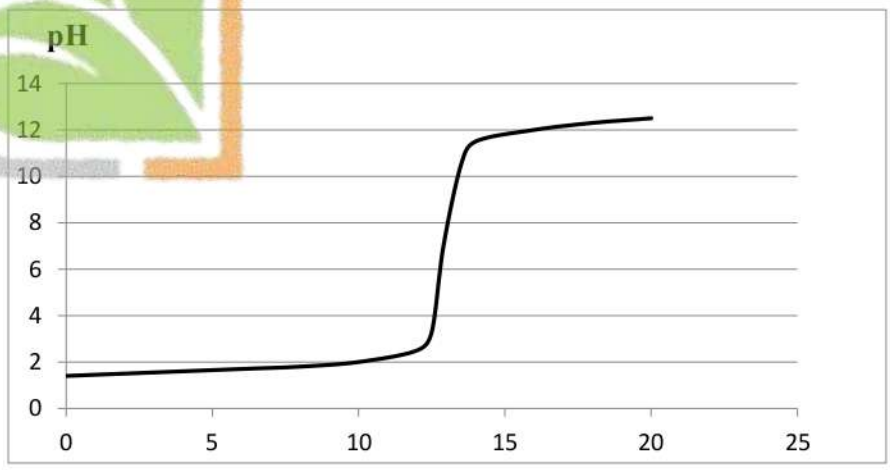
2. For the following equilibrium the forward reaction is exothermic: (1pt)

$$\mathbf{I_{2(g)} + H_{2(g)} \rightleftharpoons 2HI_{(g)}}$$

At a temperature $T_1<T_2$:

a. $\alpha_2< \alpha_1$.
b. $\alpha_2> \alpha_1$.
c. $\alpha_2= \alpha_1$.
d. None of the above.

3. A volume Va of a Ca (mol.L^{-1}) solution of sulfamic acid is taken and titrated with a solution of sodium hydroxide NaOH, the results obtained give the curve below: (1pt)



a. Sulfamic acid is a strong acid since the curve shows one inflection point and $pH_E = 7$.
b. Sulfamic acid is a strong acid since $Ca = 10^{-2} mol.L^{-1}$ and $pH_E = 7$.
c. Sulfamic acid is a weak acid since $Ca < 10^{-2} mol.L^{-1}$ and $pH_E > 7$.
d. Sulfamic acid is a weak acid since the curve shows two inflection point and $pH_E < 7$.

4. In the case of the colorimetric titration of a weak acid by a sodium hydroxide solution, it is necessary to choose an indicator whose change range zone is: (1pt)

a. Between 7 and 10.
b. Between 6 and 7.
c. Between 4 and 6.
d. Between 3 and 5.

5. Quantitative organic analysis of compound A formed of C, H and O gave the following mass percentages: C = 60% and H = 13.3%. Knowing that the molar mass of A is $60 g.mol^{-1}$, the molecular formula of A is: (1pt)

a. $C_4H_{10}O$.
b. C_3H_8O.
c. C_3H_6O.
d. $C_4H_8O_2$

Molar atomic mass in $g.mol^{-1}$: C=12, O=16 and H=1

6. A dilution is carried out by using a commercial hydrogen peroxide solution S_0 of molar concentration $C_0 = 7.5$ mol. L^1. The solution S_0 is diluted 125 times in order to prepare a solution S of volume 1 L. The glassware needed to achieve this dilution are: (1.5pt)

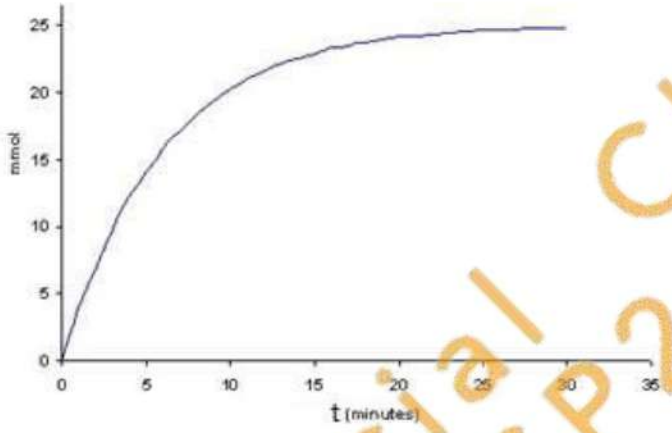
a. 10 mL graduated pipette and 1000 mL volumetric flask.
b. 10 mL volumetric pipette and 1L volumetric flask.
c. 5 mL graduated pipette and 1000 mL volumetric flask.
d. 8 mL graduated cylinder and 1L volumetric flask.

7. (1.5pt)

According to the curve:

a. The initial rate of the reaction is less than the rate of reaction at time t = 2 hours
b. The initial rate of the reaction is twice than the rate of reaction at time t = 2 hours
c. The initial rate of the reaction is equal to the rate of reaction at time t = 2 hours
d. The rate of the reaction at time t = 2 hours is equal to zero

8. For the system of the following graph (n) mole = f (t) that shows the maximum number of moles of product formed when the corresponding reaction ends at t=30 min, the half-life time of this reaction is approximately: (1.5pt)



a. 2 minutes.
b. 15 minutes.
c. 5 minutes.
d. 10 minutes.

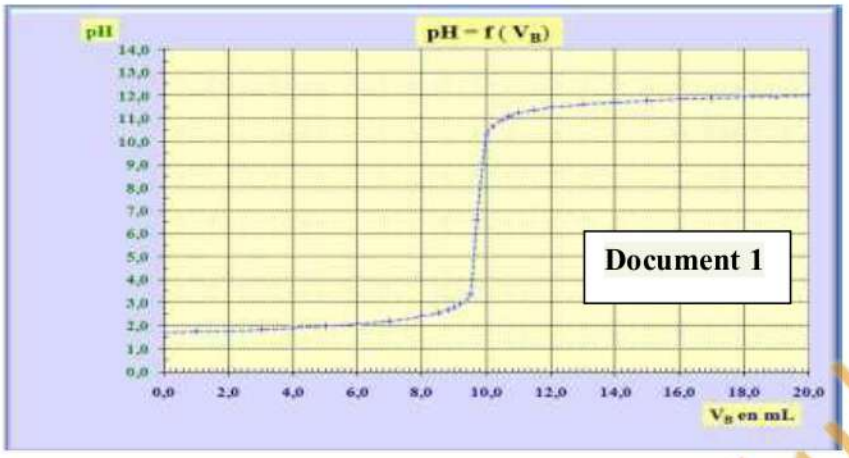
9. In a bulb of volume 15L, we introduce 0.6mol of nitrogen monoxide **NO** and 0.3mol of bromine gas Br_2 at a temperature t_1= 700°C. The following equilibrium is established: (1.5pt)

$$\mathbf{2\ NO_{(g)} + Br_{2\,(g)} \rightleftharpoons 2\ NOBr_{(g)}}$$

At equilibrium the total number of moles of gaseous mixture is 0.85mol.

a. The equilibrium constant Kc = 2.4
b. The equilibrium constant Kc = 4.2
c. The equilibrium constant Kc = 24
d. The equilibrium constant Kc = 42

10. The curve below **(Document 1)** shows the evolution of the pH as a function of the volume of sodium hydroxide solution of concentration C_b poured for the titration of a 20mL of 0.1mol.L^{-1} hydrochloric acid solution. (1.5pt)



a. $C_b = 0.1 mol.L^{-1}$.
b. $C_b = 0.2 mol.L^{-1}$.
c. $C_b > 0.1 mol.L^{-1}$.
d. $C_b > 0.2 mol.L^{-1}$.

11. We dissolve an acid HA ($Ca = 10^{-3}$ mol.L^{-1}) in water. The pH of the solution obtained is pH= 3.9. The value of the Ka, the acidity constant is (1.5pt)

a. 10^{-1}.
b. $<10^{-1}$.
c. $> 10^{-1}$.
d. 10^{-3}.

12. Given : $pK_{a\,(NH_4^+/NH_3)} = 9.2$; $pK_{a(CH_3COOH/CH_3COO^-)} = 4.8$ (1.5pt)

a. The base NH_3 is stronger than the base CH_3COO^-
b. The acid NH_4^+ is stronger than the acid CH_3COOH
c. NH_4^+ and CH_3COOH are two strong acids
d. NH_3 and CH_3COO^- are two strong bases

13. Two solutions S_1 and S_2 of acid of concentration C are available. These solutions are then diluted 100 times. The pH is measured before and after dilution **(Document 1).** (1.5pt)

	C	**C /100**
pH of S_1	2	4
pH of S_2	3	4.5
Document 1		

a. Both acids are strong.
b. The concentration C of the solution S_1 is 0.01 $mol.L^{-1}$.
c. Both acids are weak.
d. The acid of solution $S_2$is stronger than the acid of solution S_1.

14. Given the following condensed structural formula of the alcohol of formula $C_4H_{10}O$: (1.5pt)

$CH_3\text{-}CH_2\text{-}CH_2\text{-}CH_2\text{-}OH$ (a)	$CH_3\text{-}\underset{\displaystyle OH}{\underset{\vert}{CH}}\text{-}CH_2\text{-}CH_3$ (b)	$CH_3\text{-}\underset{\displaystyle CH_3}{\underset{\vert}{CH}}\text{-}CH_2\text{-}OH$ (c)

a. (a) and (c) are positional isomers.
b. (a) and (c) are secondary alcohols.
c. (b) is the functional isomer of (a).
d. The name of the tertiary alcohol isomer of (a), (b) and (c) is 2-methyl,2-propanol.

15. One mole of ethanol reacts with 2 moles of ethanoic acid to an ester. The percentage yield of this esterification is: (1.5pt)

a. 5%
b. 60%
c. 67%
d. 80%

N.B : In an equimolar mixture of alcohol and an acid the % yield of esterification is:

- 67% if the alcohol is primary.
- 60% if the alcohol is secondary.
- 5% if the alcohol is tertiary.

Good Luck