كيمياء

Eng.

مباراة الدخول ٢٠١٢ – ٢٠١٣

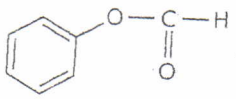
Chemistry A مسابقة في

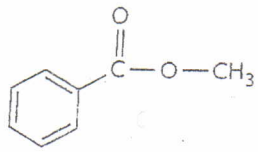
المدة : ساعة واحدة

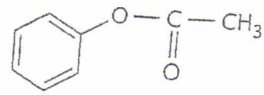
Exercice I : (Multiple Choice) (6 points)

In a round bottom flask, we introduce respectively, 12.2 g benzoic acid of formula C_6H_5-CO_2H, a volume of 40.0 mL of methanol CH_3-OH, some drops of sulfuric acid H_2SO_4 and some grains of boiling stone; the mixture is heated to reflux; we obtain methyl benzoate, strong odor liquid.

1- Which formula is Methyl benzoate?

a 

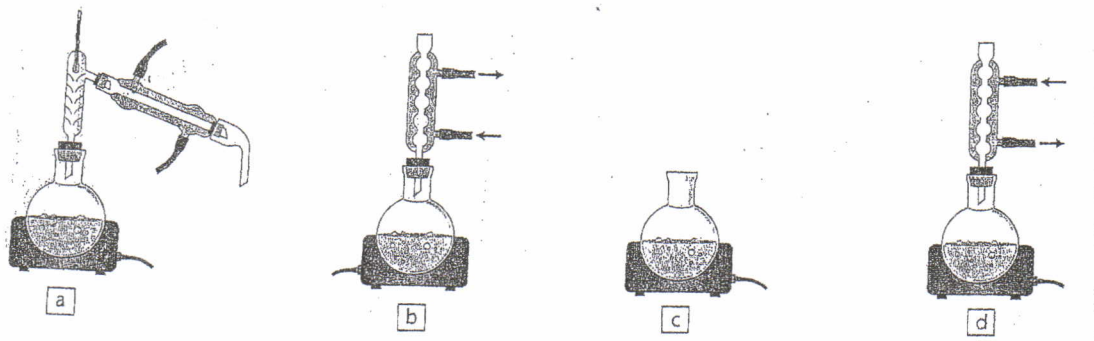
b 

c 

2-Sulfuric acid leads to :

a. increase the reaction yield
b. increase the rate of reaction
c. a total reaction

3- Choose, among the materials giving below, the appropriate assembly :



a b c d

4-The name of the reaction is ;

a. Saponification
b. Hydrolysis
c. Esterification

5-In relate to the reactants :

a. Methanol is in excess
b. Methanol is the limiting reactant
c. Methanol and benzoic acid are in stoichiometric proportions

6-After cooling, we obtain 10.2 g of methyl benzoate. The reaction is :

a. Limited
b. Total
c. Yield of reaction is equal to 67%
d. Yield of reaction is equal to 75%

7-The equilibrium constant K_c is near to :

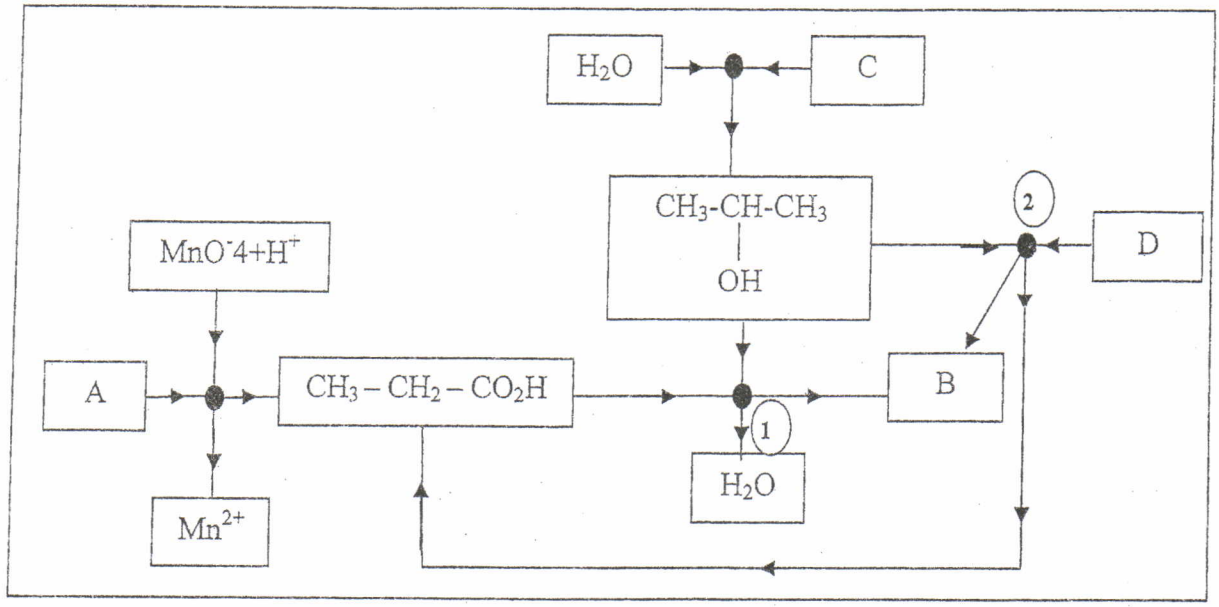
a-4 b-1 c- 0,25

Given :	benzoic acid M = 122 $g.mol^{-1}$	Methanol M = 32 $g.mol^{-1}$
	Methyl benzoate M = 136 $g.mol^{-1}$	Methanol density = 0.80 $g.mL^{-1}$

Turn the paper

Exercice II : (7 points)

1- Identify the missing compounds A, B, C and D in the following diagram, (A) has no reaction on 2,4 D.N.P.H



2- Write, by using, the condensed structural formulas, the over all reactions (1) and (2) (see diagram)

3- Which characteristics differentiate the reaction (2) from the reaction (1) ?

Exercice III : (7 points)

The goal of this exercise is to understand why the pH of distillated water, keeped at free air decreases. Fresh distillated water is keeped at free air in a beaker, at 25°C, has a pH decreasing progressively, then, will be stable at the value 5.7

a- Explain why we observe this decrease of pH.

Given : $(CO_2,H_2O)_{aq}$ / $(HCO_3^-)_{aq}$ pKa = 6.4

b- Write the equation of the reaction between the carbon dioxyde dissolved in water.

c- Give the (acido-basic) couples taking place in this equation

d- Give the name of the ion $(HCO_3^-)_{aq}$; it plays the role of acid or base?

e- Give the expression of the acidity constant Ka associated to the previous equation

f- Show from the expression of Ka, we can write :

$$pH = pKa + \log([HCO_3^-]_{aq} / [CO_2,H_2O])$$

g- Calculate the value of ratio $[HCO_3^-]_{aq} / [CO_2,H_2O]$ for distillated water at pH = 5.7

If pKa of couple $(CO_2,H_2O)/HCO_3^-$ $_{(aq)}$ is equal 6.4, which is the predominate species in distillated water at pH = 7

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كلية الصحة العامة

مباراة الدخول ٢٠١٢ – ٢٠١٣

Chemistry B مسابقة في

45 minutes : المدة

Exercice I (12 points) :

A monoalcohol (A) of non-cyclic saturated chain has a molar mass M_A=74g,mol^{-1}.

1- Show that the carbon number of this alcohol is 4
2- Write the possible condensed structural formulas of (A) and name them.
3- The mild oxidation of (A) by a potassium permanganate solution in acidic medium, produces a compound (B) which reacts with DNPH but never reacts with Fehling's reagent.
   a- Write the condensed structural formulas of (B) and give its name.
   b- Write the equation of the half-reaction, and deduce the equation of the mild oxidation of (A) into (B) by potassium permanganate in acidic medium.
   c- Why we qualify this oxidation by mild oxidation
   d- (A) reacts with ethanoic acid.
   Write the equation. Give its characteristics.
   Given the couple (MnO_4^- /Mn^{2+}).
   Molar masses in g.mol^{-1} ; M(C)=12, M(O)=16, M(H)=1.

Exercice II (8 points) :

Iron Importance in Alimentation

Iron is essential to many proteins and enzymes in our organism.

It is a compound namely essential to hemoglobin, protein used by the red blood cells to transport oxygen; and to myoglobin, protein found in muscles for stock oxygen and liberate it when it is necessary during an activity. Thus, the first symptoms sign of iron deficiency are linked to this air supplies lack in our organs: extreme face paleness extreme pale-face; anomalous and rapid speed tiredness; increase of cardiac rhythm; falling decrease of physical capacities.... are the more frequent symptoms and anemia is the severe form.

Iron takes place too in the immune system and protects organism from infections. The heart and brain state will be very threatened, because these organs are greedy for oxygen. The human body contains 2 to 5 g of iron, the daily needs vary according to the sex.

For an adult, the recommended daily bringing are 10 mg for male; and 25mg for female.

In aliments, Iron exists as 2 forms:

- Hematic iron present in animal source aliments red meat (2mg/100g), fish and sea food (3mg/100g), liver and heart (14mg/100g)
- Unhematic iron present in vegetables (3 mg/100g), eggs (5mg/100g) and milk products.

Questions:

1- Is the iron a macro or an oligoelement? Justify
2- What is the ion provided from iron? It is an anion or a cation?
3- What are the iron mineral supplies of 150g red meat for a male?
4- In case of hemorrhages, high iron deficiency factor; namely for female or adult suffering on hemorrhoids or gastric ulcer; a loss of 10ml of blood induces a loss of 5mg of iron.
   Deduce the iron mass (in mg/ml in the blood
5- Calculate the iron total mass, in 5 liters of blood, in body adults.
   Is this value conform to the values given in the text?

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مباراة الدخول ٢٠١١ – ٢٠١٢

مسابقة في الكيمياء (فئة أ)

المدة : ساعة واحدة

The ethylamine $C_2H_5NH_2$ is very soluble in water. This compound has a basic character in aqueous solution.

A chlorhydric acid solution ($H_3O^+ + Cl^-$) with a molar concentration $C_1 = 1.0 \times 10^{-2}$ mol.L^{-1} is added progressively in a beaker containing a volume V = 20 mL of ethylamine solution. A pH-meter can give us the pH mixture evolution in the beaker. We remark that the equivalence is obtained for an added acid volume $V_{1E} = 40$ mL.

1-Write the reaction between the ethylamine and the ions H_3O^+.

2-Give the molar concentration C of the ethylamine solution.

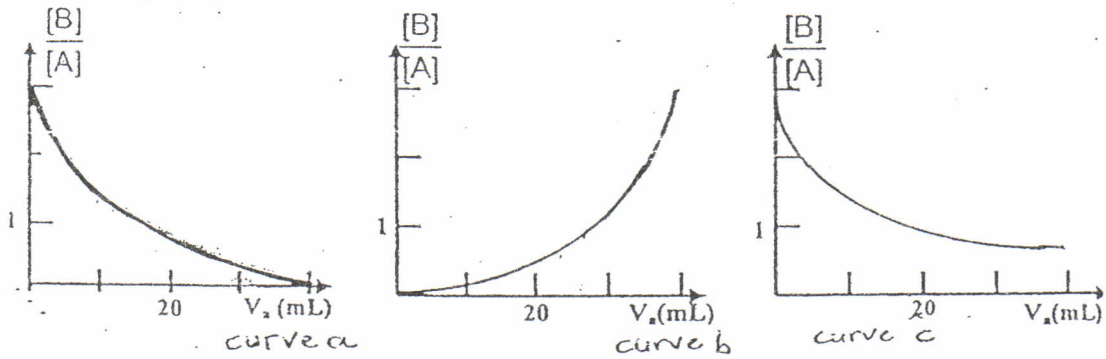
3-For a volume $V_1 = 30$ mL of chlorhydric acid solution added, the pH measured is equal 10.3

a. Without any calculation, identify the chemical species present in the obtained mixture.

b. Determine the pKa of the couple $C_2H_5NH_3^+ / C_2H_5NH_2$.

4-The molar concentrations of ethylamine and its conjugate acid are respectively noted [B] and [A].

We represent graphically the ratio evolution $\frac{[B]}{[A]}$ during the previous titration. Between the three given curves, which is the more near to the reality ? Justify your response.



(12 pts)

Choose the correct answer :

1- The following solutions have same volume and same concentration. In which case the molarity of H_3O^+ is the more elevated ?

A- NaOH ; B- CH_3COOH ; C- HCl ; D- H_2SO_4

2- A monobase solution has a pH = 12; if we dilute it 100 fold, the pH of the solution will be :

A- = 14 ; B- pH < 7 ; C- 7 < pH < 12 ; D- = 12

3- The propen $CH_3–CH=CH_2$ hydration gives as a major product :

A- Propan-2-ol ; B- Propan-1-ol ; C- Propanal ; D- Propanone

(3 pts)

(Turn the paper)

III- In the distillation setup, we introduce 1 mol of methanoïc acid, 1 mol pure ethanol, a little excess of concentrated sulfuric acid and some grains of boiling stone. These affirmations are true or false; in the case of "false" , give the correct response :

a- The grains of boiling stone are catalysts.

b- We obtain ethyl methanoate.

c- If the boiling temperature of the acid is 101°C ; the alcohol 78°C ; the ester 54°C and the water 100°C, the thermometer shows during the ebullition and the ester formation 100°C.

d- The reaction is speed and total.

e- The number of mol of the formed ester at the end of the reaction is 1 mol.

(5 pts)

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مباراة الدخول ٢٠١١ – ٢٠١٢
مسابقة في الكيمياء (فئة ب)

المدة : ٤٥ دقيقة

X- An organic compound (A) with molecular formula C_3H_8O.

a. Give the condensed formula of its isomers and their respective names.
b. One of these isomers gives a compound (B) if he is heating in presence of cupper. (B) reacts with the 2,4 – DNPH to obtain a yellow-orange precipitate and reacts also with the Fehling's solution.
   1- Give the formulas of (A) and (B).
   2- The cupper is not consumed during the reaction. Which role it plays ?
   3- (B) submits to a mild oxidation to obtain a compound (C) ; give the condensed formula and the name of the compound (C).
   4- (A) reacts with (C) to obtain a compound (E). Give the condensed formula and the name of (E).

(6.5 pts)

X- We have a solution (S_0) of sodium hydroxide NaOH with a concentration equal to 0.1 $mol.L^{-1}$.

a. Calculate the volume of (S_0) necessary to prepare 100 mL of a solution (S) with a concentration 10^{-2} $mol.L^{-1}$.
b. Indicate the appropriate glass materials used for this preparation.
c. Calculate the pH of the prepared solution.
d. 20 mL of the solution (S) are used to titrate 10 mL of chlorhydric acid HCl with a concentration Ca :
   1- Write the titration reaction.
   2- Calculate Ca.

(5.5 pts)

XI- Walnuts, hazelnuts, almonds.

The only negative side about them is that they are rich in lipids. Besides this, these foods have interesting properties. Sources of proteins, magnesium and calcium, they can contribute to a balanced diet. Their proteins are rich in arginine (amino acid) which is capable to modulate the cholesterol receptors activity and thus to reduce cholesterol.
This amino acid is equally a precursor to a mediator, nitric oxide (NO) responsible for vessels relaxation. Their lipids are rich in fatty acids (...) capable of lowering cholesterol level because they contain polyunsaturated fats (...) Hazelnuts contain alpha linolenic acid, essential fatty acid that favors platelets aggregation and thus thrombosis.. These oleaginous fruits contain a lot of vitamin E.

a. Extract from the text two essential metals for life :
   1- Give their chemical symbol.
   2- Give their ionic form.
   3- Which kind of chemical bond can they form with chloride ion? Give the formulas of the formed salt.

b. Proteins are rich in amino acids :
   1- Give the general chemical formula of an amino-acid
   2- Which kind of bonds they can form in proteins?
   3- Give two other foods rich in proteins.

(Turn the paper)

c. Give a nitrogen oxide different than NO.

d. The nitric acid (HNO_3) is completely dissociated in water and the nitrous acid (HNO_2) has a $pK_a = 3,35$ are nitrogen oxoacids. Which is strong? Which is weak?

e. Lipids are rich in fatty acids :
   1- Give the general chemical formula of fatty acids.
   2- Define the fatty acid.
   3- Give two other foods rich in lipids.
   4- Vitamin E is liposoluble or hydrosoluble ?

f. The nitric acid is found in rain water. He is formed by the hydration of NO_2 ; this compound is an important atmospheric polluant.

Balance the following chemical reaction :

$$3\,NO_2 + H_2O \rightarrow 2\,HNO_3 + NO$$

6 1 6

(8 pts)

الجامعة اللبنانية

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مباراة الدخول ٢٠١٠ – ٢٠١١

مسابقة في الكيمياء - A –

المدة : ساعة واحدة

I- The amnonitrate is a solid nitrogenous fertilizer often used in the agriculture. It contains ammonium nitrate ($NH_4NO_{3(s)}$). On the bag, we read the massic percent of nitrogen N = 34.4 %.
To verify the manufacturer instruction, we titrate the ammonium ions (NH_4^+) present in the fertilizer with sodium hydroxide NaOH solution.
Given : Couple Acid/Base
NH_4^+/NH_3
H_2O / HO^-
$N = 14\ g.mol^{-1}$ $H = 1\ g.mol^{-1}$ $O = 16\ g.mol^{-1}$
The ammonium nitrate is very soluble in water; the dissolution is total following the reaction :

$$NH_4NO_{3\,(s)} \rightarrow NH_4^+ + NO_3^-$$

1- The ammonium ion is an acid or a base following Bronsted? Justify
2- We introduce in a beaker a volume V1 = 20.0 mL of ammonium ions of molar concentration $c_1 = 0.15$ mol.L-1, and a volume V2 = 10.0 mL of sodium hydroxide of molar concentration $c_2 = 0.15$ mol.L-1. The pH of the solution is equal 9.2
   a. Write the chemical reaction between ammonium ions and hydroxide ions (the reaction is total).
   b. Calculate the initial number of moles introduced in the beaker.
   c. Which is the limiting reactant?
   d. Demonstrate that the obtained solution is a buffer solution. Deduce the value of pKa for the couple NH_4^+/NH_3
   e. Give some characteristic of a buffer solution.
3- We titrate a solution (S) by dissolving a mass m = 6.0 g of this fertilizer in a 250 mL flask by the pH-metric method. We introduce in a beaker 10 mL of the solution (S) which we will titrate with sodium hydroxide of concentration $c_B = 0.2\ mol.L^{-1}$
The volume added at the equivalence is $V_{BE} = 14.1$ mL and the $pH_E = 11.2$
   a- Calculate the concentration of the solution (S).
   b- Deduce the number of moles of ammonium ions in the solution (S).
   c- Calculate the massic percent of nitrogen, compare it to the manufacturer instruction and determine the relative deviation.

(14 pts)

II- Questions multiple choice. Write the good response on your exam paper not on the wording.

1- A chemical reaction which products are a carboxylic acid and an alcohol is a reaction of :
   a. esterification b- hydrolyze
2- If we add water to a reactionnal medium of an esterification reaction, we :
   a. increase b- decrease
   the yield of the reaction.
3- By the definition of pH, the reaction of H_3O^+ ion on HO^- ion is exothermic. The pure water pH at 60 °C is :
   a. Less than 7 b- equal to 7 c- more than 7
4- Saponification reaction is :
   a. total b- limited

Turn the page →

5- We can produce soap with :
   a. ash and vinegar
   b. fat and vinegar
   c. ash and fat

6- we consider the following exothermic equilibrium :

$$A + B \rightleftarrows C$$

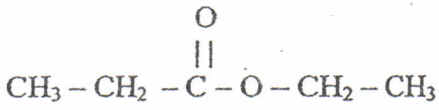
When the equilibrium is reached, we increase the temperature and we add the species A in the reactionnal medium. The equilibrium is shifted :
   a. to the left b. to the right c. we cannot determine it

7- We consider the following endothermic equilibrium

$$A + B \rightleftarrows C$$

When the equilibrium is reached, we increase the temperature and we add the species B in the reactionnal medium. The equilibrium is shifted :
   a. to the left b. to the right c. we cannot determine it

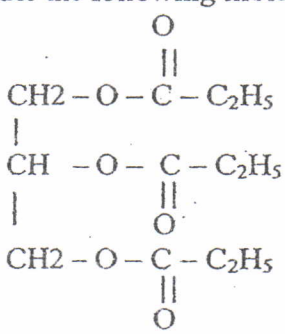
8- What is the name of this molecule :



   a. Ethyle ethanoate b. Propyle ethanoate c. Ethyl propanoate

9- The butanone reacts with :
   a. The DNPH solution b. Fehling's solution c. Tollens reactant

10- We consider the following molecule :

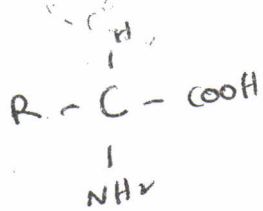


By saponification of this triester, can we obtain a compound having detergent properties?
   a. yes b- no

11- The 3-methylbutan-2-ol is an alcohol :
   a. Primary b. secondary c. tertiary

12- The dehydration in acidic medium and at high temperature gives in major part :
   a. but-1-ene b. but-2-ene c. butanone

(6 pts)



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كلية الصحة العامة

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كلية الصحة العامة

مباراة الدخول ٢٠١٠ – ٢٠١١

مسابقة في الكيمياء - B –

المدة : 45 دقيقة

I- We study the chemical transformation between the ethanoïc acid and the ethanol:

	ethanoïc acid	Ethanol	Ethyle Ethanoate
Molar Mass g. mol^{-1}	60.0	46.0	88.0
Density ρ g/ml	1.05	0.79	0.90

A- At the laboratory, we mix in a flask, a volume V_1= 57ml of ethanoïc acid and a volume V_2 = 58ml of ethanol.
The flask is sealed and placed at the obscurity under room temperature.
The system evolutes during 6 months. After this duration, the final state is not still reached.

A-1- calculate the number of moles n_1 of ethanoïc acid introduced in the flask.

A-2- show that the realized mixture is equimolar.

B- After six months the flask is opened and we take a volume V = 2.0 ml of the mixture. The ethanoïc acid left is titrated with sodium hydroxide Na^+, HO^- of concentration C_B =1.00 mol l^{-1} en presence of phenolphthalein as an indicator of end titration. The volume of the equivalence is V_E = 12.0 ml.

B-1- Write the equation of the reaction between the ethanoïc acid and ethanol.

B-2- Write the equation of the reaction which occurs during the titration.

B-3- Calculate the number of moles (n_R) of ethanoic acid left after 6 months in the essay of 2.0 ml.

B-4- We suppose that the volume of the reactional medium is still constant after 6 months, deduce the number of moles (n'_R) of ethanoïc acid left.

B-5- Calculate the number of moles of all chemical species presents in the flask after 6 months.
(12 pts).

II- February first 1899, a new medicinal drug of performance unequalled up till now was invented: aspirin or acetyl salicylic acid. Aspirin is an analgesic(it relieves pains such as migraines) an antipyretic (it suppresses fever) and also it fluidifies the blood circulation.

Towards the year 400 B.C., Hippocrates gave pregnant women a drink made of brewed willow leaves to reduce labor pains; the beverage was bitter.

Later on it was known that it contains salicylic acid. In 1899, F. Hoffman after several years of research has succeeded to synthesize aspirin, a derivative of salicylic acid.

Turn the page ⟶

1- Indicate the different steps in the history of aspirin discovery.

2- Extract from the text the pharmacological effect of aspirin. Give the class of medicinal drugs to which aspirin belongs.

3- Name the active ingredient of aspirin.

4- List an anti-acid medicinal drug.

5- Classify the following medicinal drugs as anti-inflammatory, anti-acids and antibiotics:
Penicillin, Maalox, Aspirin.

6- Give one effect of aspirin.

(8 pts).

الجامعة اللبنانية

كلية الصحة العامة

مباراة الدخول ٢٠٠٩ – ٢٠١٠

Chimie - Série A مسابقة في

المدة : ساعة واحدة

N.B = Il est obligatoire de rendre cette feuille pour la correction du graphe.

Problème I: (14 points)

On désire réaliser une estérification d'équation générale :

Acide carboxylique + Alcool $\rightleftharpoons$ Ester + Eau

On dispose de deux flacons contenant, le premier un composé A avec la seule mention : monoacide carboxylique à chaîne carbonée saturée, le deuxième un composé B également avec une seule mention : monoalcool saturé.

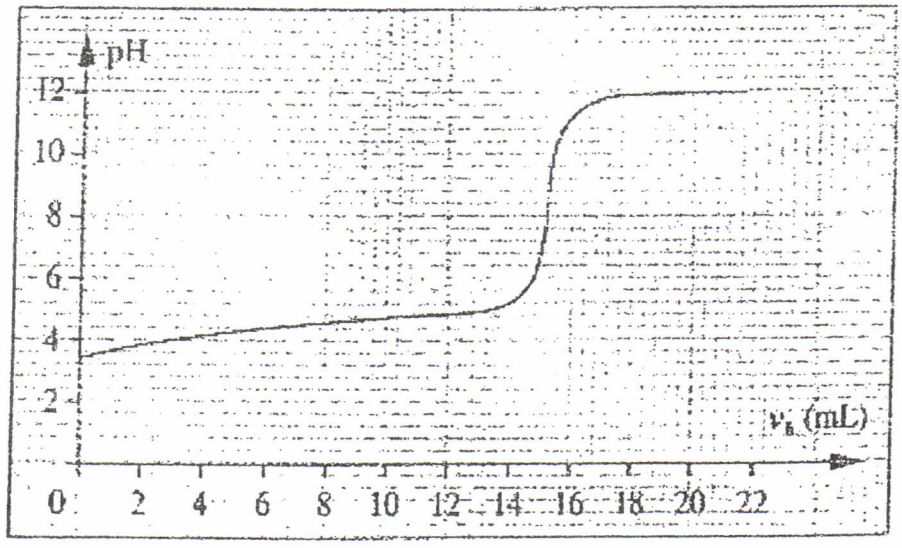
On donne : Les masses molaires en $g.mol^{-1}$:

$M(H) = 1$; $M(C) = 12$; $M(O) = 16$; $M(B) = 74\ g.mol^{-1}$.

1-Recherche de la formule de A

On prépare une solution S, en dissolvant dans de l'eau contenue dans une fiole jaugée de 500 mL, 0,46 g d'acide pur. La préparation de la solution est ensuite terminée en versant de l'eau distillée jusqu'au trait de jauge.

On prélève 10 mL de la solution S que l'on dose par une solution d'hydroxyde de sodium de concentration $C_B = 1{,}0.10^{-2}\ mol.L^{-1}$. Les mesures de pH effectuées permettent de tracer le graphe ci-dessous.



a- Déduire à partir du graphe, le volume équivalent V_{BE}, la valeur du pK_a du couple acide/base mis en jeu, et la valeur du pH_E.

b- Calculer la concentration C_A de la solution S.

c- Déterminer la masse molaire de l'acide A. Ecrire sa formule et son nom.

T.S.V.P

2-Recherche de la formule de B

a- En considérant la valeur de la masse molaire de l'alcool B, en déduire les différentes formules semi-développées possibles de B. Préciser le nom et la classe de chaque alcool.
b- On réalise un test qui permet de dire que l'alcool B est chiral.
Montrer que ce test est suffisant pour établir, sans ambiguïté, la formule semi-développée de B.
c- Pour confirmer le résultat précédent, on réalise l'oxydation ménagée de l'alcool B.
Donner le nom de l'oxydant utilisé ainsi que la formule semi-développée et le nom du produit formé C lors de l'oxydation.
d- Décrire les tests chimiques à effectuer sur le composé C pour aboutir à son identification.

Problème II: (6 points)

Le craquage de l'éthane dans des conditions bien déterminées de P et de T peut mener à un équilibre représenté par l'équation:

$$C_2H_{6(g)} \underset{2}{\overset{1}{\rightleftharpoons}} 2C_{(S)} + 3H_{2(g)} \qquad \Delta H > 0$$

La constante Kc de cet équilibre, à la température T, est Kc = 0.16

a) Sachant que les concentrations des gaz présents à l'équilibre sont égales. Calculer la valeur de chacune d'elles
b) Déduire de ce qui précède, la valeur du degré de dissociation α de C_2H_6.
c) Calculer Kp de cet équilibre sachant que la pression totale à l'équilibre est de 2 atm.
d) Quelles modifications des conditions de P et T sont-elles nécessaires pour augmenter la dissociation de l'éthane (détailler votre réponse).

الجامعة اللبنانية

كلية الصحة العامة

مباراة الدخول ٢٠٠٩ – ٢٠١٠

Chimie - Série B مسابقة في

المدة : ٤٥ دقيقة

Problème I : (8pts)

A freshly squeezed orange juice taken at breakfast is a real pleasure double indeed with benefits for the body because the orange is a real treasure that offers us considerable amount of vitamin C as well as mineral salts and especially the essential calcium. Even at adulthood, we all need calcium since it is essential for the proper functioning of the body and, for the formation and development of bones indeed. It also contributes to keeping healthy teeth, beautiful hair and nails. If our body does not receive the daily dose required, its calcium content decreases and the bones become fragile. This can lead to osteoporosis that threatens one woman out of four after the age of 50.

1- State the different roles of calcium in the human body by referring to the text.

2- Name the disease due to a deficiency in calcium.

3- Give two products rich in calcium and two products rich in vitamin C.

4- Name a mineral needed to form hemoglobin in the human body.

5- Give the class of the vitamin C.

6- The calcium is an oligoelement or a macroelement ?

Problème II : (12pts)

We wish to verify by titration the label of a bottle containing a formic acid solution S_0 HCOOH. This label indicates: "80% in mass of formic acid, specific mass in relate to the water: 1.18".

We prepare 1000 mL of solution S by diluting two hundred fold S_0. We titrate 10.0 mL of S with a sodium hydroxide of concentration C_B=0.100 mol.L^{-1} in the presence of phenolphthalein.

The change in color indicator is obtained at V_{BE} = 10.3 mL.

The formic acid has a pK_a value equal 3.8.

1) Indicate the indispensable and necessary material to use for preparing the solution S.

2) Write the equation of the titration reaction and calculate its constant.

3) Calculate the concentrations of the solution S and the solution S_0. Deduce the pure acid mass contained in one liter of the commercial solution.

4) The indications of the label are they correct?

Données : M(C) = 12 g.mol^{-1} M(O) = 16 g.mol^{-1} M(H) = 1 g.mol^{-1} Ke = 10^{-14}

الجامعة اللبنانية

كلية الصحة العامة

مباراة الدخول ٢٠٠٨ – ٢٠٠٩

مسابقة في الكيمياء (ب)– انكليزي

المدة : ٤٥ دقيقة

Problem I :

Verification of a dilution

1) We wish to prepare by dilution V= 100 mL of a chlorhydric acid solution $C_A = 1.0 \times 10^{-2}$ mol.L^{-1}. From the initial solution $C_0 = 2.5 \times 10^{-1}$ mol.L^{-1}, which volume V_0 of the initial solution must we use?
2) To verify if the dilution is correct, we titrate by the pH-metric method $V_A = 20.0$ mL of the prepared solution by an hydroxyde of sodium solution $C_B = 1.0 \times 10^{-2}$ mol.L^{-1}. We find that we must add a $V_B = 25.0$ mL of base to reach the acid-base equivalence.
   a. What is the concentration C_A of the chlorhydric acid solution titrated?
   b. Which volume V'_0 of the initial solution have we really used if we suppose that the other manipulations are correct?
3) Write the equation of the chemical reaction taking place during the titration.
4) In the previous titration, the pH is equal to 2.4 after an addition of $V'_B(NaOH) = 12.5$ mL.
   a. Enumerate all chemical species present in the solution.
   b. Calculate the concentration of all the present ions.
   c. At which particular stage of the titration we are situated?

Given : Kw water = 10^{-14} (12 pts)

Problème II :

Indomie Instant Noodles

Nutition Facts per bag	
Calories	330 cal
Protein	8 g
Total Carbohydrate	46 g
...of which Dietary Fiber	3 g
...of which Sugars	5 g
Total Fat	13 g
Vitamin A	1350 IU
Vitamin B1	0.5 mg
Vitamin B6	0.4 mg
Vitamin B12	0.8 µg
Vitamin B9	98 µg
Iron	2.3 mg

Calories per gram : Fat 9 calories, Carbohydrate 4 calories, Protein 4 calories.

Questions :

1- Verify the energy value per bag.
2- Classify the vitamins listed in the above table.
3- Give one role of vitamin A and one role of iron.
4- The quantity of iron present in one bag represents 29% of the Recommended Daily Allowance for an adult. Indicate, by justifying, the class of iron.
5- Indomie Instant Noodles is an important source of fibers. Specify the importance of fibers in the human alimentary diet.
6- Proteins are formed from the condensation of α-amino acids. Give the general formula of an α-amino acid. (8 pts)

مسابقة في الكيمياء (ب)
المدة: 45 دقيقة

مباراة إمتحانات الدخول
العام الدراسي 2007_2008

مجلس طلاب الفرع-1

Problem 1:

On the bottle's label of a commercial solution of 1.0 L of Sodium hydroxide, we can read the following informations:

- Specific gravity in relate of water: 1.2.
- Percent in mass of sodium hydroxide: 20%.
- Molar mass of sodium hydroxide: 40 $g.mol^{-1}$.

a) Demonstrate that the molar concentration of the commercial solution is $6mol.L^{-1}$.
b) We realize the titration of 5.0 ml of the obtained solution S_1 by diluting 40 fold commercial solution with a chlorhydric acid solution $C_A = 5.0 . 10^{-2}$ $mol.L^{-1}$.
   1- What are the precautions that we must take to prepare the dilute solution?
   2- A buret of 25 ml can insure this titration? Justify your response.
c) The preparation of S_1 requires diluting a sample of 5.0ml from the commercial solution in a 100ml capacity flask. This affirmation is true or wrong? Justify your response.

(12 pts)

Problem 2:

« Dietary fiber is formed of complex molecules of vegetable origin. Since it resists digestion in the intestinal tract, it was disregarded for many years because it doesn't provide energy and, apparently, is of no value in the diet. Actually, it has several fundamental roles.

Dietary fiber containing insoluble substances absorbs water. Dietary fiber containing soluble substances is used as food for bacteria and allows their development. The increase in the volume of wastes facilitates their progression in the large intestine (intestinal transit).
The average diet in France provides 15 to 20 g of dietary fiber per day while a desirable level of intake is about 30 g.

A diet rich in fiber can treat several cases of constipation! "

1- Name two foods rich in fiber.
2- Name the main constituent of dietary fiber. To which class of chemical substances does it belong?
3- Explain why should our meal be rich in fiber?
4- A diet rich in fiber can fight a dangerous disease. Name this disease.

(8 pts)

مباراة إمتحانات الدخول
العام الدراسي 2006_2007

مسابقة في الكيمياء (ب)
المدة: 45 دقيقة .

مجلس طلاب الفرع-1

I- We dissolve a mass (m) of a benzoic acid C_6H_5COOH in a quantity of water necessary to obtain 100 mL of a solution S.

We realize a titration of the solution S by potassium hydroxide (K^+ , HO^-) solution of concentration $2.0.10^{-2}$ mol.L^{-1}. For an assay of 10.0 mL of the solution S, the equivalence is obtained by a volume of 8.0 mL of potassium hydroxide added.

Given:

- pK_a (benzoic acid/benzoate ion) = 4.2
- Molar mass of bezoic acid = 122 g.mol^{-1}.

a) Write the equation of the reaction.

b) Calculate the concentration C_a of the solution S.

c) Calculate the mass of the benzoic acid dissolved.

d) We prepare a solution by mixing 50 mL of the solution S and 20 mL of potassium hydroxide solution with a concentration $2.0.10^{-2}$ mol.L^{-1}.
Calculate the pH of the obtained solution.

(9 pts)

II- To determine the molecular formula of alcohol (A), a mixture of a sodium hydroxide solution and a certain quantity of ester (E) is heated to prepare the alcohol (A). Knowing that the molar mass of alcohol (A) is 88 g.mol^{-1}, show that its molecular formula is $C_5H_{12}O$. Write a general example for a saponification reaction.

(3 pts)

III- One can find orange juice or kiwi bottles for feeding babies in pharmacies. These two fruit juices are particularly rich in vitamin C.

Lemonade is a beverage that contains, among others, glucose, carbon dioxide and citric acid.

The only carbohydrates found in fresh orange juice are sucrose and a mixture of glucose and fructose.

1- Vitamins are classified as hydrosoluble and liposoluble. To which class does vitamin C belong ?

2- Indicate the function of vitamin C

3- Identify the sugar in lemonade and orange juice. To which class does this sugar belong? How can we know whether this sugar is reducing or not ?

4- Write the molecular formula of glucose.

5- Explain the following sentence: "sugar equivalent energy".

(8pts)

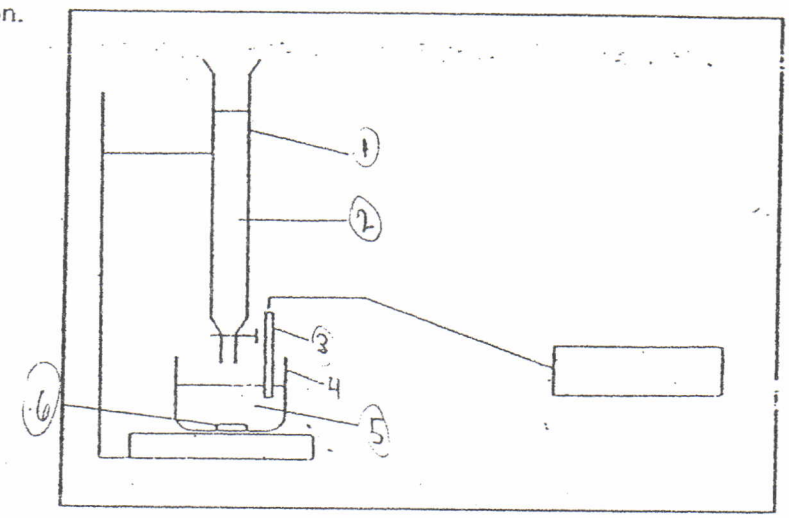
مباراة إمتحانات الدخول
العام الدراسي 2006_2007

مسابقة في الكيمياء (أ)
المدة: ساعة واحدة.

مجلس طلاب الفرع-1

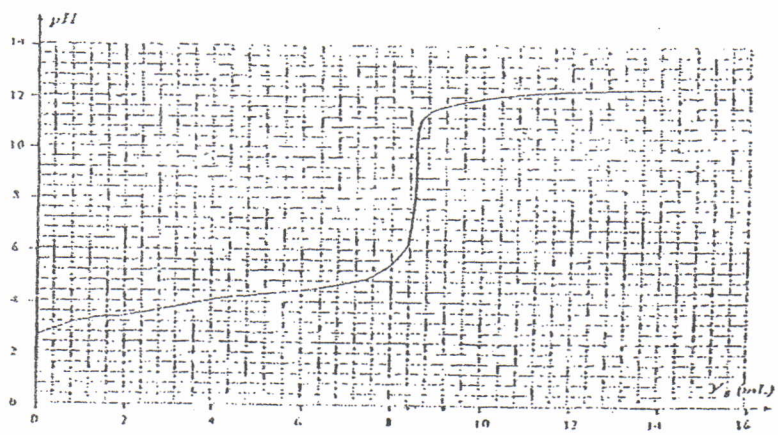
I- It is required to determine the concentration and to identify the conjugate acid-base pair in an unknown solution (S) contained in a flask. 10mL of this solution is titrated against sodium hydroxide solution of concentration $C_B = 1.0 \times 10^{-1}$ mol.L^{-1}.

1- Label the set up of titration.



2- The measurements of the pH recorded during the process allow plot the graph given below:

a) Determine, graphically, the coordinates of the equivalence point, E.



b) Deduce the value of the concentration C_A of the solution (S).

c) Is the acid a strong or a weak acid? Justify.

d) Determine, graphically, the pK_A value for the conjugate acid-base pair present in solution (S) and identify this conjugate pair from the list given below: .

Methanoic acid/methanoate ion: pKA =3.7

Benzoic acid/benzoate ion: pKA = 4.2

Ethanoic acid/ethanôate ion: pKA =4.8

3- a) Use the results of the question 2- a) to select the proper indicator from the following list :

Methyl orange	(pH range : 3.1 – 4.4)
Bromothymol blue	(pH range : 6.2 – 7.6)
Phenolphtalein	(pH range : 8.0 – 10.0)

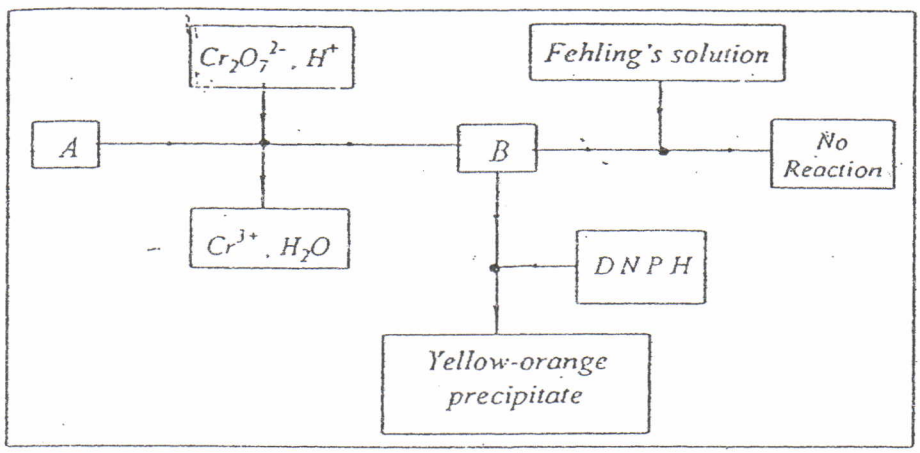
b) Titration of 10 mL solution (S) is performed without using pH meter. We observe a color change when 8.3 mL of sodium hydroxide solution of concentration C_B is added. Deduce the value of concentration C'_A of the solution (S). What do you conclude? (8 pts)

II- Butyl alcohols are used as solvents, raw materials for varnishes, paints, plastics, confectionery...

The molecular formula of a saturated monoalcohol A is $C_4H_{10}O$.

1- Write the condensed structural formulas and give the systematic names and the classes of the isomers of A.

2- Refer to the flow chart given below, to decide the class of alcohol A and give its systematic name.



3- Write the structural formula of compound B and give its systematic name.

4- In a test tube maintained at constant temperature and in the presence of a trace of sulfuric acid, 300 mg of ethanoic acid mixed with 370 mg of A.

a) Write the equation of the reaction which takes place.

b) When the reaction ceases, the ethanoic acid left is titrated with sodium hydroxide solution of concentration $C_B = 0.2$ mol.L^{-1}. The equivalence point is reached upon adding a volume $V_B = 10.0$mL of the basic solution. Determine the percentage of ethanoic acid that has reacted with the alcohol. Assume that the amount of sulfuric acid present is negligible.

c) Specify the role of sulfuric acid in this reaction.

Given : M(H)=1 ; M(C)=12 ; M(O)=16 (g.mol^{-1}). (8 pts)

III- At a certain temperature and a total pressure P_e=1.2 atm, the partial pressures of an equilibrium mixture :

$$2A(g) \rightleftharpoons B(g)$$

are : P(A) = P(B) = 0.6 atm.

1-Calculate the equilibrium constant K_p for the reaction at this temperature T.

2-If the total pressure were increased to P'_e = 1.5 atm, what would be the partial pressure of A and B at equilibrium? (4 pts)

مباراة إمتحانات الدخول
العام الدراسي 2006_2005

مسابقة في الكيمياء (أ)
المدة: ساعة واحدة

مجلس طلاب الفرع-1

PROBLEM 1

Given: Molar mass in $g.mol^{-1}$; C= 12; H = 1; 0=16;
Density of vinegar: 1.02 $g.mL^{-1}$

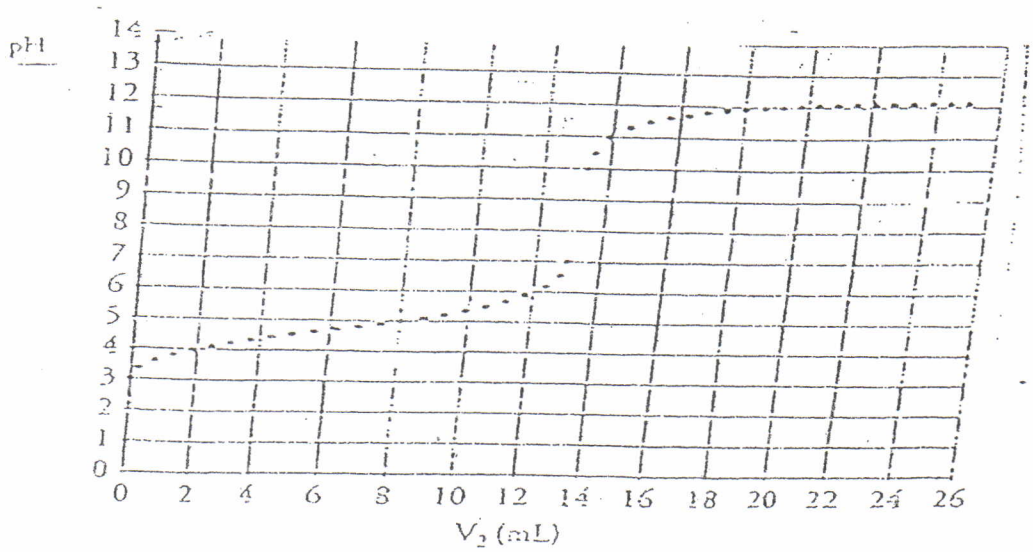
We make by pH-metric method the titration of a commercial vinegar to determine its acidity degree. We read on the vinegar bottle (volume 1 Liter): 7 degrees

The acidity degree corresponds in reality to the mass of acetic acid, in grams, in 100 grams of vinegar.

So, we prepare V = 100ml of a solution (C_1) diluted 10 fold from the vinegar Then, we take a volume V_1= 10mL from the diluted solution, they are put in a beaker on which we add some distillated water for correctly immerge the electrodes of the pH-meter

We realize the titration with sodium hydroxide of concentration C_2 =0.100 $mol.L^{-1}$. The pH is read in relate of the volume V_2 of hydroxide sodium and we obtain the curve pH = f (V_2) given

1. Draw and label the setup used during the titration.
2. Write the equation of the titration reaction.
3. Determine graphically the coordinates of the equivalence point and deduce the approached value of pk_A of the couple ethanoic acid/ ethanoate ion.
4. Justify, from the form of the curve, that the ethanoic acid is a weak acid.
5. To which limit is going the curve titration pH=f (V2).
6. Explain why the pH at the equivalence point is basic.
7. The addition of water modifies
   a. the volume added at the equivalence ?
   b. the pH at the equivalence ? Justify your responses.
8. Calculate the concentration C_1 of the diluted solution, then the concentration of the vinegar.
9. Calculate the acidity degree of the vinegar.



All solutions are considered at 25°C. **(12 pts)**

PROBLEM II:

Five bottles contain respectively the compounds A, B, C, D and E. We know that.

- Every compound is a purish product which the molecule contain only 3 carbon atoms, hydrogen atoms and one or two oxygen atoms.
- The carbon chain doesn't contain multiple bounds.
- Between the 5 compounds, there is two alcohols.

1) The mild oxidation of A and of B by an acidified solution of potassium dichromate gives the following results:

- A gives C or D.
- B gives only E.

- Precise if the above indicate experiences are sufficient to determine the functions of the compounds A, B, C, D and E. Justify.

2) To verify the precedent results, we use the Fehling's solution. We remark that the compound C is oxidized. Describe the experience with the Fehling solution.

3) Write the condensed structural formula of these five compounds. Give their respective names.

4) Write the equation of the reaction between the acidified solution of potassium dichromate and the compound B.

5) Calculate the minimal volume of the oxidant solution of concentration 0.25 $mol.L^{-1}$ necessary for oxidize totally 5 ml of B.

Given: density of B = 785 $g.L^{-1}$ (8 points)

مباراة إمتحانات الدّخول
العام الدراسي 2005_2006

مسابقة في الكيمياء (ب)
المدة: 45 دقيقة.

مجلس طلاب الفرع-1

I- A carbonyl compound A has a molar mass M = 72 g.mol^{-1}.

1- Demonstrate that the molecular formula of A contains four carbon atoms.
Deduce the molecular formula of A.
(M (H) = 1 g.mol^{-1}, M(C) = 12g.mol^{-1}; M (O) = 16 g.mol^{-1})

2- Write the condensed structural formulas of all isomers of A and their corresponding names.

3- Give an experimental test which identifies the carbonyl group.

4- The compound A can be obtained by mild oxidation of the methyl propan-1-ol. Give the condensed structural formula of A.

5- The oxidation of A gives a compound B. Write the condensed structural formula and the name of B.

(7 points)

II- Given: (M (H) = 1 g.mol^{-1}, M(C) = 12 g.mol^{-1}; M (0) = 16 g.mol^{-1})

The ascorbic acid (vitamin C) has a molecular formula $C_6H_8O_6$.

We dissolve a mass m = 0.35g of this acid in a volume V = 2L of distilled water.
We measure the pH of the prepared solution; the pH-meter indicates 3.6.

1-Calculate the molar concentration C of this prepared solution

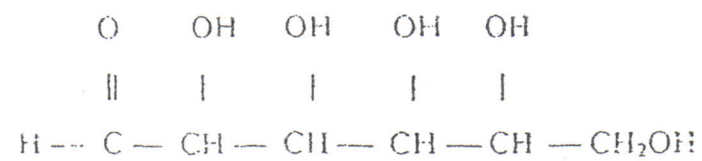
2- What will be the pH of a hydrochloric acid solution with the same concentration?

3- The reaction between the ascorbic acid with water is total?
Write the equation of this reaction

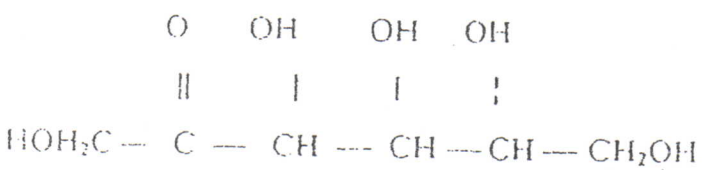
4- Determine the molar concentration of $H3O^+$ ions present in the ascorbic acid solution.

(5 points)

III- Glucose is found in a ripe fruits the nectar of flower, honey, sap, blood, sweets. This is the fuel of biological cells; glucose is considered a "fast sugar" since it remains unchanged in the digestive tract and absorbed as such, so it's immediately available to provide energy to a living organism. It has the molecular formula $C_6H_{12}O_6$, and a condensed formula:



Fructose (word of Latin origin fructus: fruit) is found in fruits, nectar of flowers, honey, some sweetened beverages, candies... This is also a « fast sugar ».
Its molecular formula is $C_6H_{12}O_6$ and its condensed formula is:



Starch and cellulose are two polysaccharides obtained by condensation of a very large number of glucose molecules: These are natural macromolecules.
Starch is found in cereals and potatoes. Starch can be hydrolyzed by heating in an acidic medium, gives glucose. This decomposition, taking place during the digestion of starch, liberates glucose slowly. Therefore starch is a "slow sugar".
Cellulose is abundant in plants and trees. Its hydrolysis, more difficult than that of starch, gives also glucose. Human beings do not digest it but ruminants do.

1. Name the carbohydrates listed in the text.
2. Classify them into monosaccharides and polysaccharides.
3. Classify the monosaccharides into aldohexoses and ketohexoses.
4. State why glucose and fructose are called "fast sugars".
5. Describe the test used to detect starch in foods.
6. Explain why it's advised to eat a meal rich in vegetables.
7. Explain the following sentence: glucose is the fuel of biological cells.
8. Name the product obtained by hydrolysis of starch and cellulose.

(8 points)

مسابقة في الكيمياء (ب)
المدة: 45 دقيقة

مباراة إمتحانات الدخول
العام الدراسي 2004_2005

مجلس طلاب الفرع-1

I - We dispose an ammonia solution S_1 of concentration $C_1 = 1.10$ mol. L^{-1} and pH equal 11.1

a- Demonstrate the ammonia is a weak base

b- Write the equation of the reaction of ammonia with water.

c- Describe the procedure to prepare V_2 =100mL of an ammonia solution S_2 of concentration $C_2 = 2.5.10^{-2}$ mol-L^{-1} from of a volume V_1 of the solution S_1 (You must calculate V_1) (8 points)

II - A gaseous hydrocarbon (A) contains 82.7% of carbon, its density in relate to air (d) is neighbor to 2.

a- Find the molecular formula of (A)

b- Give the possible developed structures of all isomers of (A) and their corresponding names.

c-This hydrocarbon (A) comes from the hydrogenation of an unramified alkene's Write the possible formula of the corresponding alkene and their respective names C=12 H=I (4 points)

III - Vitamins are natural chemical species that can not be synthesized by the human body but are indispensable to life. They must be obtained from the diet. Even if needed in very small quantities.

Deficiencies in vitamins (insufficiency in the nutrition) cause major troubles.

For centuries, several sailors during foreign trades have suffered from scurvy, a disease due to a deficiency in vitamin C. This vitamin is found in oranges, lemons, fruits and fresh vegetables. Scurvy is characterized by a progressive bodily weakness, loose teeth, fever, hemorrhage, this disease could be fatal.

In 1747, James Lind a Scottish doctor who served in the English navy was interested in the problem. On board of Salisbury, he distributed a team of sick sailors suffering from Scurvy into several groups. He prescribed to each group a different preparation; cider; vitriol elixir, vinegar, sea water, a mixture of garlic and mustard grains, two oranges and a lemon. Six days later, he noticed that the diet including citrus fruits (oranges and lemons) lead to a remarkable alteration of the health of the patient. Lind couldn't explain why. However the British and French navy forced the crew to eat fresh food, despite the skepticism of the doctors of the time. At that time nobody knew the existence of vitamins.

1- What is the name of the disease due to a deficiency in vitamin C?

2- Give the two classes of vitamins and indicate to which class belong vitamins C.

3- List the main functions of this vitamin.

4- Names two foods rich in vitamin C.

5- Explain the following sentence: the food diet containing citrus, fruits lead to a remarkable alteration of the health of English sailors. ,

6- State why since 1747, the British and French navy forced their to eat fresh food (8 points)

Good Luck

Calculate the energy value of 100g of pasta.

2- List the foods rich in carbohydrates, in lipids and in proteins.

3- Why is a young athlete advised to eat a meal rich in pasta, potatoes and rice? (5pts)

III- Paracetamol is a new product. It is the active ingredient of Doliprane, for example. It possesses analgesic and antipyretic properties.

Dafalgan contains paracetamol that has close properties to aspirin: analgesic and antipyretic. However it doesn't have anti-inflammatory action and doesn't show the side effects of aspirin.

Rennie is a medicinal drug used to relieve heartburns (excess gastric acid) Chloramphenicol (A) is used against typhoid fever.

1- Classify the medicinal drugs listed in the text.

2- List the side effects of aspirin.

3- Indicate the difference in ingredients between Rennie an Maalox. (5pts)