المركز التربوي للبحوث والإنماء	الهيئة الأكاديميّة المشتركة قسم : العلوم	المادة: الكيمياء الشهادة: المتوسطة نموذج رقم -١- المدّة : ساعة واحدة

نموذج مسابقة (يراعي تعليق الدروس والتوصيف المعدّل للعام الدراسي ٢٠١٦-٢٠١٧ وحتى صدور المناهج المطوّرة)

This exam is composed of three exercises. It is inscribed on two pages. The use of a non programmable calculator is allowed.

Answer the questions on the following three exercises.

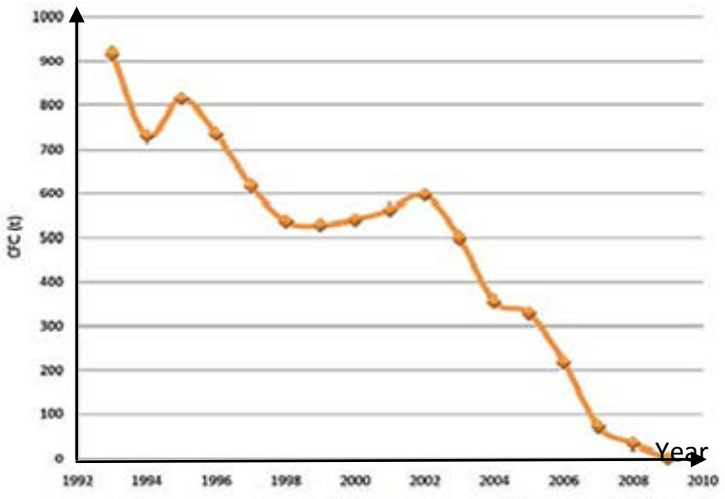
Exercise 1 (7points) Halogenated Derivatives of Methane

The **Montreal Protocol** is an international agreement adopted on 22 March 1985. Its objective is to reduce and eliminate substances that deplete the ozone layer.

This Protocol requires the elimination of the utilization of CFCs and other substances that deplete the ozone layer and cause a global warming such as tetrachloromethane , bromochloromethane and hydrobromofluorocarbons.

HFCs are less stable than CFCs, and therefore less destructive, but still retain a significant impact on the ozone layer and are potent greenhouse gases.

In recognition of the efforts made by the Lebanese Government, Lebanon was awarded by the Montreal Protocol the ≪ Prize for the best implementation of the National Ozone Unit>>.



The consumption of CFCs in Lebanon in tons (1992-2010)

Source: MOE National Ozone Unit. 2011

Document 1

1 - By referring to document 1 and to the text answer the following questions:

1.1. Give the consumption of CFCs in tons in Lebanon in 2002 and in 2009.

1.2. Compare the two values found.

1.3. Why has Lebanon been awarded by the Montreal Protocol?

1.4. Pick out the consequences of the use of HCFC.

2- By referring to document 2:

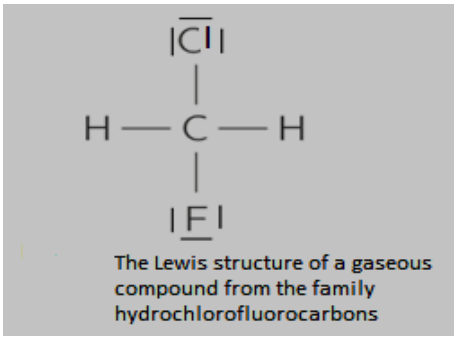
2.1. Choose the right answer. The HCFC belongs to the family of:

a. Alkanes. b. Hydrochlorofluorocarbons.

c. Alkenes. d. Cycloalkanes.

2.2. Write the molecular formula of this HCFC.

2.3. Identify the nature of the bond between the C atom and the F atom.



The Lewis structure of a gaseous compound from the family hydrochlorofluorocarbons

Document 2

3- Other chlorinated derivatives are produced from the reaction of methane with chlorine Cl_2, according to the following equation:

$$CH_4 + 2\ Cl_2 \longrightarrow C_xH_yCl_2 + 2HCl.$$

3.1. Determine the molecular formula of the compound $C_xH_yCl_2$.

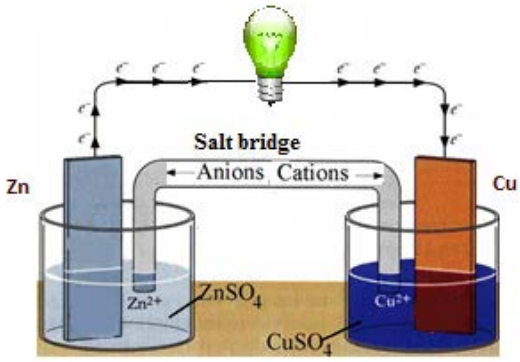
3.2. Deduce that the reaction represented by the above equation is a substitution reaction.

3.3. What is the name of the effect caused by the gases CH_4 and HCFCs?

Exercise 2 (6points) **Daniell Cell**

Document1 represents a Daniell cell that was invented by the British chemist John Daniell in 1836 at the time where the development of the Telegraph revealed an urgent need for safe current sources of constant voltage. When this cell operates, the balanced equation of the reaction is given by:

$Zn_{(s)} + Cu^{2+}_{(aq)} \rightarrow Cu_{(s)} + Zn^{2+}_{(aq)}$



Document 1

1. **Referring to the given balanced net ionic equation answer the following questions:**

1.1. Write the equations of the half- reactions taking place at the electrodes.

1.2. Deduce the cathode of this cell.

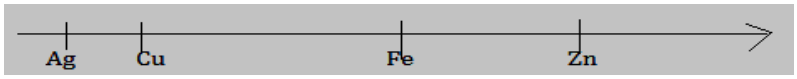
1.3. By using oxidation numbers, show that this reaction is an oxidation reduction one.

2. **Referring to Document 1:**

2.1. Describe the construction of this operating cell.

2.2. Indicate towards which electrode the anions of the salt bridge flow. Justify.

3. **The following axis (Document 2) shows the increasing order of the tendency to lose electrons of certain metals:**



Document 2

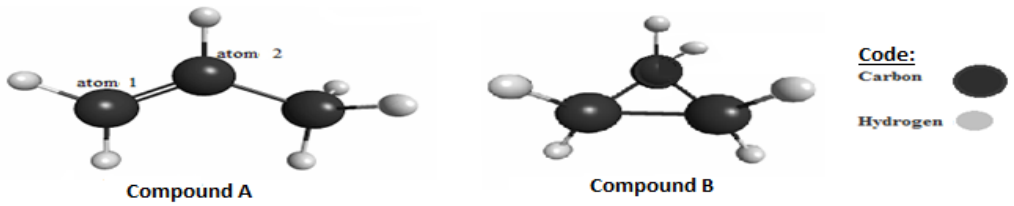
As the difference between the tendency to lose electrons increases, the voltage of the cell increases. Choose among the following four cells, the one that produces the highest voltage:

a- Ag- Cu b- Ag- Fe c- Ag- Zn d- Zn-Zn

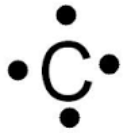
Exercise 3 (7points) **A Particular Alkene: Propene**

Propene, formerly known as propylene, is found in the atmosphere of Titan, the largest moon of Saturn. This compound is used in the petrochemical industry to manufacture plastics and in the synthesis of other more complex compounds.

1. Document 1 below shows the molecular models of two hydrocarbons (A) and (B).



Document 1



Document 2

1.1. Write the condensed structural formulas of each of hydrocarbons (A) and (B) and give the name of compound (B).

1.2. Justify that these two compounds are isomers.

2. Document 2 shows the Lewis dot symbol of carbon atom:

2.1. Determine the atomic number Z of carbon atom knowing that its valence shell is the L shell.

2.2. Write the atomic representation of the carbon atom knowing that the nucleus of the carbon atom contains as many protons as neutrons. **Justify.**

3. Heptane decomposes according to the following word equation:

Heptane ⟶ Butane + Compound (A)

3.1. Translate the word equation into a chemical equation, using molecular formulas.

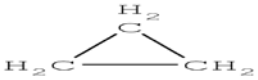
3.2. Copy and **c**omplete the following sentence using suitable words: The previous chemical equation represents a ..... reaction where longer hydrocarbon molecules are broken down into..... hydrocarbon molecules.

أسس التصحيح (تراعي تعليق الدروس والتوصيف المعدّل للعام الدراسي ٢٠١٦-٢٠١٧ وحتى صدور المناهج المطوّرة)

1.	**Exercise 1 (7 points)** **Expected Answers**	**Mark**
1.1	In 2002: 600 (t) **(0.5)** ; In 2009: zero (t) **(0.5)**	**1**
1.2	600 > zero; the consumption in tons of CFC in 2002 is > than that in 2009	**0.5**
1.3	Lebanon has been awarded by the Montreal Protocol in recognition of the efforts made by the Government of Lebanon that led to reduce in the CFCs consumption to zero.	**0.75**
1.4	HCFCs have significant impact on the ozone layer and are potent greenhouse gases.	**0.5**
2.1	b. Hydrochlorofluorocarbons.	**0.5**
2.2	CH_2FCl	**0.5**
2.3	A single covalent bond **(0.25)** because there is sharing of one pair of electrons (or 2 electrons) **(0.5)**	**0.75**
3.1	According to the law of conservation of matter: **(0.25)** for carbon: x = 1 **(0.25)** for hydrogen: 4 = y + 2; y = 2 **(0.5)**; thus the molecular formula: CH_2Cl_2**.(0.25)**	**1.25**
3.2	The reaction represented by the equation is a substitution reaction because chlorine atoms have replaced 2 hydrogen atoms.	**0.75**
3.3	Greenhouse effect.	**0.5**

	Exercise 2 (6 points) **Expected Answers**	**Mark**
1.1.	The equation of the half- reaction at the cathode : $Cu^{2+} + 2e^- \rightarrow Cu$ **(0.5)** The equation of the half- reaction at the anode: $Zn \rightarrow Zn^{2+} + 2e^-$ **(0.5)**	**1**
1.2.	The cathode is the Cu strip **(0.25)** because it is the site of a reduction reaction **(0.25)**	**0.5**
1.3	$Zn + Cu^{2+} \rightarrow Zn^{2+} + Cu$ 0 +II +II 0 The oxidation number of the copper element decreases from + II to 0, so Cu^{2+} is reduced, **(0.5)** the oxidation number of the Zn element increases from 0 to + II, then Zn is oxidized **(0.5)** and as a result this reaction is an oxidation reduction reaction. **(0.5)**	**1.5**
2.1.	The steps for the construction are: -Pour into a beaker, a solution of zinc sulfate ($Zn^{2+} + SO_4^{2-}$) and dip a Zn strip in it.	**1.5**

	(0.5 pt) - Pour into another beaker, a copper II sulfate solution ($Cu^{2+} + SO_4^{2-}$) and dip a Cu strip in it. **(0.5 pt)** - Connect the two solutions by a salt bridge. **(0.25 pt)** - Connect the zinc strip and the copper strip using connecting wires and a lamp **(0.25 pt)**	
2.2	The anions flow towards the anode **(0.25)** to compensate the increase in the amount of Zn^{2+} ions (positive charge)produced during the half-reaction occurring at the anode **(0.5)**	**0.75**
3	c) Ag- Zn	**0.5**

	Exercise 3 (7 points) **Expected Answers**	**Mark**
1.1	(A): CH_2=CH-CH_3 **(0.5)**; (B):  **(0.5)** (B): cyclopropane **(0.5)**	**1.5**
1.2	Molecular formula of (A): C_3H_6. Molecular formula of (B): C_3H_6 **(0.5)**; so (A) and (B) have the same molecular formula but different structural formulas, they are isomers **(0.5)**	**1**
2.1	According to the Lewis representation, the carbon atom has 4 valence electrons **(0.25**), its valence shell is the L shell, thus its electronic configuration is: K^2, L^4; **(0.5)** number of electrons: 2 + 4 = 6; **(0.25)** the atom being neutral, the number of electrons = number protons = atomic number = Z = 6 **(0.5)**	**1.5**
2,2	Z = N ; A = Z + N ; A = 2Z = 2x6 = 12 **(0.5)** Hence the representation of the carbon atom is: $^{12}_{6}C$ **(0.75)**	**1.25**
3,1	$C_7H_{16} \rightarrow C_4H_{10} + C_3H_6$	**0.5**
3.2	Cracking **(0.5)** shorter **(0.5)**	**1**