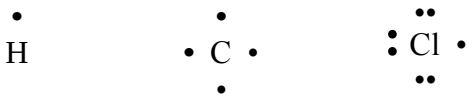
وزارة التربية والتعليم العالي المديرية العامة للتربية دائرة الامتحانات	الشهادة المتوسطة	دورة سنة ٢٠٠٨ الإكمالية الإستثنائية
	مسابقة في مادة الكيمياء المدة: ساعة واحدة	الاسم: الرقم:

This Exam Is Composed of Three Exercises. It Is Inscribed on 2 Pages.
Answer the Three Following Exercises:

First Exercise (6 points)
Obtaining of Polyvinyl Chloride (PVC)

Polyvinyl chloride or polychloroethene, is obtained by polymerization of the monomer vinyl chloride C_2H_3Cl. Polyvinyl chloride (PVC) is the most used plastic material in the world after polyethene.

Given: . The Lewis electron dot symbols of hydrogen, carbon and chlorine atoms are given below:



1. The element chlorine belongs to the period three of the periodic table.
1.1 - Specify to what column (group) of the periodic table chlorine does belong.
1.2 - Determine the atomic number of the element chlorine.

2. The molecular formula of ethene is obtained by replacing the chlorine atom Cl in the molecular formula of vinyl chloride by a hydrogen atom H.
2.1 - Give the condensed structural formula of ethene.
2.2 - Indicate the type of bond between the carbon atoms of the ethene molecule.

3. Write the structural formula of vinyl chloride.

4. The general equation of the polymerization of a monomer M is given as : $\mathbf{n}(M) \longrightarrow -(M)-_{\mathbf{n}}$

- Choose, from the following equations, the equation of the polymerization reaction of vinyl chloride.

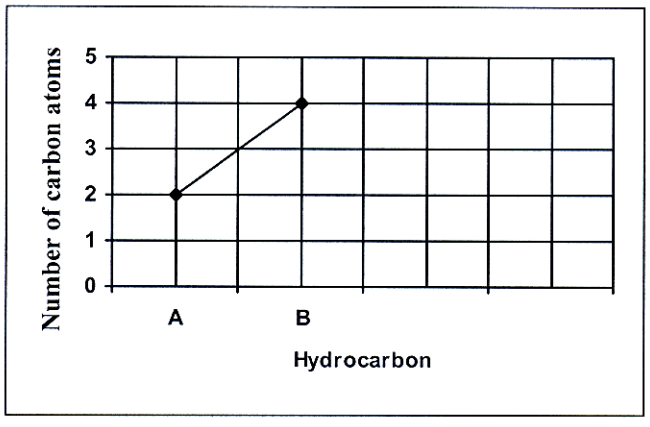
a) $\mathbf{n}\,(CH_2 = CHCl) \longrightarrow -(CH_2 - CHCl)-_{\mathbf{n}}$

b) $(CH_2 = CHCl)\mathbf{n} \longrightarrow -(CH_2 - CHCl)-_{\mathbf{n}}$

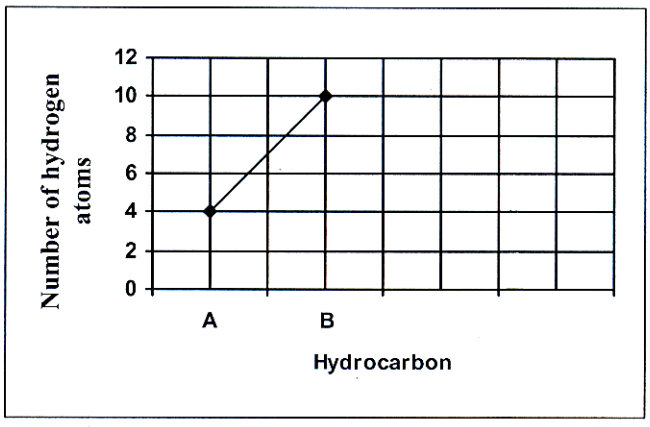
c) $\mathbf{n}\,(CH_2 = CHCl) \longrightarrow -(CH_2 - CHCl)-_{\mathbf{n}}$

Second Exercise (7 points)
Petroleum

Petroleum is a mixture of hydrocarbons. Petroleum should be treated before it is used. During the refining process, hydrocarbons **(A)** and **(B)** are obtained. The following graphs **(1)** and **(2)** show the number of carbon and hydrogen atoms in the molecules of **(A)** and **(B)**.



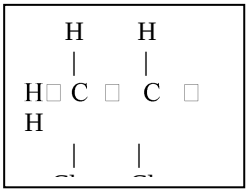
Graph (1)



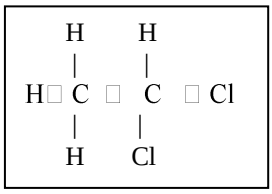
Graph (2)

1. Refer to the graphs **(1)** and **(2).** Verify that the molecular formula of **(A)** is C_2H_4 and that of **(B)** is C_4H_{10}.
2. Identify the family (class) to which each of the above hydrocarbons does belong.
3. Write the equation of the complete combustion of hydrocarbon **(B)**.
4. One molecule of hydrocarbon **(A)** reacts with one molecule of chlorine and a compound **(D)** is obtained.

4.1- Explain which of the following two structural formulas **(I)** or **(II)** can be associated to compound **(D).**



(I)



(II)

4.2- Indicate whether compound **(D)** is a hydrocarbon or is not a hydrocarbon. Justify.

Third Exercise (7 points)
Galvanic Cell: Zn-Cu

Into a beaker containing copper II sulfate solution (blue color) and a thermometer indicating a temperature 21°C, a strip of zinc is introduced. After a certain time, the thermometer indicates 22°C. A chemical reaction took place. The equation of the reaction is given as:

$$Zn + Cu^{2+} \longrightarrow Zn^{2+} + Cu \quad \text{equation (E)}$$

1 . Show, using oxidation numbers, that the reaction represented by the equation (E) is an oxidation-reduction reaction.

2 . Indicate the cations that are present in the solution during the reaction.

3 .

3.1 - Write the reduction half-reaction and the oxidation half-reaction that take place.

3.2 - Identify the oxidizing agent in the above reaction.

3.3- Deduce which of the two metals zinc or copper has more tendency to lose electrons.

4 . It is required to construct a galvanic cell **(G).** The overall reaction of the galvanic cell **(G)** is represented by the equation (E).

Available Materials:

- Beakers 250 mL.
- Strips of: Zinc, silver, copper.
- Solution containing zinc (Zn^{2+}) ions.
- Solution containing silver (Ag^{+}) ions.
- Solution containing copper II (Cu^{2+}) ions.
- Connecting wires.
- U shape iron wire.
- Voltmeter.
- U shape tube containing an electrolyte.

4.1 - List the materials needed to construct the anode half-cell.

4.2 - A salt bridge is used in constructing the galvanic cell Zn – Cu.
Give two reasons why the salt bridge is used to associate the solutions in the two half-cells.

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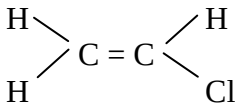
First Exercise (6 points)

Part of the Q	Answer	Mark
1.1	- The number of electrons on the outer energy level stands for the number of the group or the unit digit of the column number. - According to the Lewis electron dot symbol, chlorine has 7 electrons on the outer energy level $\Rightarrow$ Chlorine belongs to column 17 (group 7**).**	**1**
1.2	- The number of the occupied energy levels is the number of the period (row) of an element. - Cl belongs to the third period $\Rightarrow$ the outer energy level is M holding 7 electrons $\Rightarrow$ The electron configuration is: K^2, L^8, M^7. **(0.5 pt)** Total number of electrons = 17. An atom contains equal number of protons and electrons **(0.5 pt)** $\Rightarrow$ Atomic number of Cl is: Z=17 **(0.5pt)**	**1.50**
2.1	The condensed structural formula of ethene is $CH_2 = CH_2$	**0.75**
2.2	In the molecule of ethene, **C = C** is double covalent bond**.**	**0.75**
3	The structural formula of vinyl chloride is: 	**1**
4	**c)** **n** $(CH_2 = CHCl) \longrightarrow -(CH_2 - CHCl)-_{\mathbf{n}}$	**1**

Second Exercise (7 points)

Part of the Q	Answer	Mark
1	For **(A)** : From graph **(1)** Number of C atoms = 2 From graph **(2)** Number of H atoms = 4 Molecular formula of **(A)** is: C_2H_4. **(1pt)** For **(B)** : From graph **(1)** Number of C atoms = 4 From graph **(2)** Number of H atoms = 10 Molecular formula of **(B)** is: C_4H_{10}. **(1pt)**	**2**
2	**(A)** is an alkene, it satisfies the general formula C_nH_{2n} **(0.75pt)** **(B)** is an alkane, it satisfies the general formula C_nH_{2n+2} **(0.75pt)**	**1.50**
3	$2C_4H_{10} + 13O_2 \rightarrow 8CO_2 + 10H_2O$	**1**
4.1	Hydrocarbon **(A)** C_2H_4, is an alkene. It undergoes addition reaction with chlorine .One of the bonds of the double covalent bond breaks and a chlorine atom is added to each of the carbon atoms. **(1pt)** => Structural formula **(I)** can be associated to compound **(D)**. **(0.5pt)**	**1.50**
4.2	Compound **(D)** is not a hydrocarbon**. (0.5pt)** A molecule of **(D)** contains the element chlorine in addition to the elements carbon and hydrogen. **(0.5pt)** ***** Hydrocarbon is composed only of carbon and hydrogen.	**1**

Third Exercise (7 points)

Part of the Q	Answer	Mark
1	$\overset{0}{Zn} + \overset{+2}{Cu^{2+}} \longrightarrow \overset{+2}{Zn^{2+}} + \overset{0}{Cu}$ The oxidation number of Zn increased from 0 to +2. The oxidation number of copper decreased from +2 to 0. The oxidation numbers of the reactants have changed .Therefore, the reaction is an oxidation reduction reaction. **3 x (0.5pt)**	**1.50**
2	The ions present in the solution during the reaction are: Zn^{2+} and Cu^{2+}. **2 x(0.25pt)**	**0.50**
3.1	The reduction half-reaction is: $Cu^{2+} + 2\bar{e} \longrightarrow Cu$ The oxidation half-reaction is: $Zn \longrightarrow 2\bar{e} + Zn^{2+}$ **2× (0.5 pt)**	**1**
3.2	The oxidizing agent (oxidant) is Cu^{2+} ion because it is reduced. (gained electrons)	**1**
3.3	Zn releases electrons to Cu^{2+} ions, zinc metal has more tendency to lose electrons than copper metal.	**1**
4.1	At the anode oxidation takes place**.** The materials needed to construct the anode half-cell are: - Beaker 250 mL - Zn strip. - Solution containing zinc Zn^{2+} ions.	**1**
4.2	The salt bridge is used: - To complete the circuit. - To keep the electroneutrality of the solutions in the two half-cells. **2x (0.5pt)**	**1**