


المادة: الكيمياء – اللغة الإنكليزية الشهادة: المتوسطة نموذج رقم: 2 / 2019 المدة: ساعة واحدة	الهيئة الأكاديمية المشتركة قسم: العلوم	 المركز العلمي للبحوث والابتاء
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This Exam Is Composed of Three Exercises. It Is Inscribed on Two Pages, Numbered 1 and 2. Answer the Three Following Exercises:

Exercise 1 (7 points) Polymers and Environment

Polymers are long chain molecules that occur naturally in living things and can also be made by chemical processes in industry. Polymers, such as plastics, can be extremely useful.

Ethene (C₂H₄) composed of the elements carbon and hydrogen, is the building block for a vast range of chemicals from plastics (plastic bags) to antifreeze solutions and solvents.

The aim of this exercise is to study how polymers are produced from hydrocarbons and the pollution problems they cause.

1. **Document-1** shows the column and the period of carbon and hydrogen elements in the periodic table.

1.1. Write the electron configuration of each of hydrogen and carbon atoms.

1.2. Give the Lewis dot symbol of each.

2. **Document -2** shows the equation of polymerization of ethene.

2.1. Draw the bonds to complete the structural formula of ethene and polyethene in the equation.

2.2. "Polyethene is obtained by addition polymerization of ethene". Justify this statement.

3. In general, polymers are unreactive. This makes them suitable for storing food and other substances safely. However, this property makes it difficult to dispose them of.

Give one negative consequence of the non-reactivity of polymers.

4. Waste polymers, such as plastic bags, are incinerated (combustion at high temperature).

4.1. Write the equation of the combustion of ethene.

4.2. Match each term in column (A) to the corresponding one(s) in column (B).

Column (A)

a- Advantage

b- Disadvantage

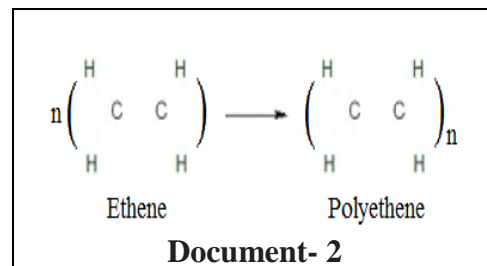
Column (B)

1- Polymers make excellent fuels.

2- The combustion of polymers releases CO₂ into the atmosphere, which causes global warming when produced in large amounts.

3- The incineration of polymers releases large amounts of energy which can be used in many ways.

Element	Period (Raw)	Column (Group)
Carbon	2	14 (group IV)
Hydrogen	1	1 (group I)
Document-1		



Exercise 2 (7 points)

Forms and Reactions of Metals

Metals are found in different forms in the earth crust. Most metals cannot resist natural processes like corrosion because they are reactive. The aim of this exercise is to study one of the occurrences of metals in nature as well as the reactivity of some metals.

1. Metals react with acids. The more active the metal, the higher the temperature of the obtained solution.

Document-1 shows a table of the temperature variation when different metals are placed in acidic solutions.

Metal	Increase of the temperature (in °C) of the obtained solution
Iron	6.1
Magnesium	12.4
Zinc	7.8
Document-1	

Arrange the metals in **document-1**, in order of increasing activity. Justify.

2. Magnesium metal (Mg) reacts with the ions (H^+) of acid to produce a soluble salt and hydrogen gas according to the following balanced equation:



- 2.1. Pick out one sign that a chemical reaction has occurred.
- 2.2. Give the oxidation number of each species in the above equation.
- 2.3. Deduce that the reaction between Mg and H^+ ion is a redox reaction.
- 2.4. Indicate the reducing agent.
- 2.5. Write the oxidation half reaction.

3. Metals are made of atoms.

Document – 2 shows a table of the atomic numbers and mass numbers of three atoms.

Two propositions are given. If the proposition is true, justify it and if it is false, correct it.

- 3.1. The three atoms have different relative charges of the nucleus.
- 3.2. These atoms are isotopes.

Atom	Atomic number	Mass number
1	12	24
2	12	25
3	12	26
Document –2		

Exercise 3 (6 points)

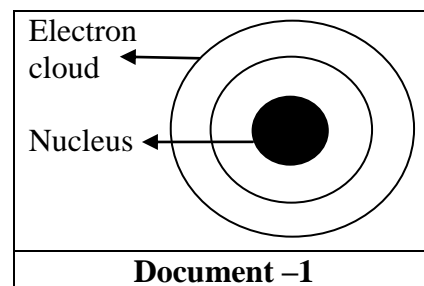
Carbon Compounds

Carbon compounds are chemical substances whose molecules contain a carbon atom bonded to an atom of another element. These compounds are generally organic in nature.

The aim of this exercise is to study the chemical and physical properties of some carbon compounds.

1. **Document-1** shows a diagram of a carbon atom with two energy levels (shells).

Redraw and complete this diagram to show the electronic structure of carbon atom having six electrons. Use x to represent an electron.



2. Complete the following description: The central part (nucleus) of this atom contains six neutrons of null charge and -----protons of -----charge.
3. Crude oil is a mixture of carbon compounds that are mainly hydrocarbons. What does the term hydrocarbon mean?
4. **Document – 2** shows the boiling points of some alkanes and alkenes.


Table – 1: Alkanes			Table – 2: Alkenes		
Name	Molecular formula	Boiling point in °C	Name	Molecular formula	Boiling point in °C
Ethane	C ₂ H ₆	- 89	Ethene	C ₂ H ₄	-104
Propane	C ₃ H ₈	-42	Propene	C ₃ H ₆	-48
Document- 2					

- 4.1. Specify the relation between the number of carbon atoms and the boiling point of alkanes.
- 4.2. Compare the boiling point of an alkane to that of the alkene having the same number of carbon atoms.
5. A student wanted to investigate the difference between alkanes and alkenes in the laboratory using bromine solution.

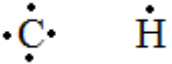
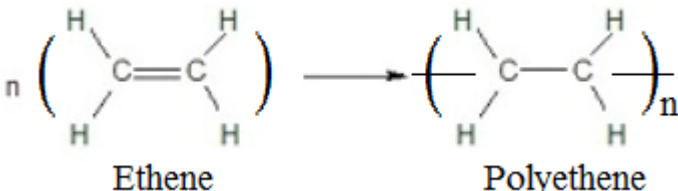
Test 1: Addition of bromine solution (orange color) over a colorless liquid alkane, the orange color persists.

Test 2: Addition of bromine solution (orange color) over a colorless liquid alkene, the orange color disappears.

Explain, referring to the type of the bonds in the hydrocarbons, the experimental results thus obtained.

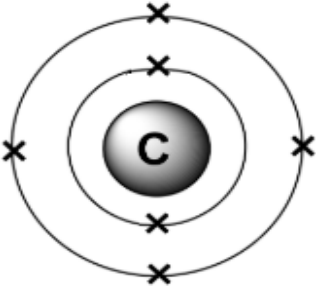
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أسس التصحيح:

Part of question	Exercise 1 (7 points) Polymers and Environment	Mark
	Expected Answer	
1.1.	The unit digit of the column number corresponds to the number of electrons in the valence shell. Carbon is in column 14 (group IV) so it has 4 electrons in the valence shell. Hydrogen is in column 1(group I), so it has 1 electron in its valence shell. The period number is the number of energy levels. So carbon atom has 2 energy levels and hydrogen atom has one energy level. So the electron configuration: C: K ² L ⁴ H: K ¹	¼ ¼ ¼ ¼ ¼ ¼ ¼ ¼
1.2.		¼ ¼
2.1.		¾
2.2.	Addition polymerization reaction is the process through which separate homomonomers containing double bonds join together to form addition polymer containing single bond.	1
3.	Plastic wastes landfill.	½
4.1.	$C_2H_4 + 3O_2 \rightarrow 2CO_2 + 2H_2O$	¾
4.2.	a-1 a-3 b-2	½ ½ ½

Part of question	Exercise 2 (7 points) Forms and Reactions of metals	Mark
	Expected Answer	
1.	Iron, zinc, magnesium. Magnesium is the most active metal among the three as it produced the highest temperature (12.4°C) and iron is the least active since it produced the lowest temperature (6.1°C).	½ 1
2.1.	Release of hydrogen gas.	½
2.2.	For Mg , the o.n. is zero. For H ⁺ , the o.n. is +I. For Mg ²⁺ , the o.n. is +II. For H ₂ , the o.n. of H is zero.	¼ ¼ ¼ ¼
2.3.	It is a redox reaction since the oxidation number of the element Mg increased from zero to +II and that of hydrogen decreased from +I to zero.	1
2.4.	The reducing agent is Mg.	½

2.5.	Oxidation half reaction: $\text{Mg} \longrightarrow \text{Mg}^{2+} + 2\text{e}^{-}$	$\frac{1}{2}$
3.1.	False. Charge of the nucleus is equal to the charge of protons since the charge of neutrons is null. Charge of protons = number of protons x relative charge of a proton (The atomic number Z is the number of protons) The three atoms have the same atomic number (Z), so they have the same charge of the nucleus.	$\frac{1}{4}$ 1
3.2.	True. The three atoms have the same atomic number but different mass number.	$\frac{1}{4}$ $\frac{1}{2}$

Part of question	Exercise 3 (6 points) Carbon Compounds Expected Answer	Mark
1.		1
2.	six protons. positive charge.	$\frac{1}{2}$ $\frac{1}{2}$
3.	Hydrocarbons are organic compounds composed of the elements carbon and hydrogen only.	$\frac{1}{2}$
4.1.	The boiling point of ethane (C_2H_6) is -89°C and that of propane (C_3H_8) is -42°C , so as the number of carbon atoms in alkanes increases, the boiling point increases.	$\frac{1}{2}$ $\frac{1}{2}$
4.2.	The boiling point of ethane (-89°C) is higher than that of the ethene (-104°C). (Same for propane and propene).	1
5.	When bromine solution is added to an alkane no reaction takes place, the orange color of bromine solution does not change (test 1). Whereas, when added to an alkene, a decoloration occurs indicating that a reaction has occurred, due to the presence of the double bond (test 2).	$\frac{3}{4}$ $\frac{3}{4}$