وزارة التربية والتعليم العالي المديرية العامة للتربية دائرة الامتحانات الرسمية	امتحانات الشهادة المتوسطة	دورة العام ٢٠١٦ الاستثنائيّة الأربعاء ٣ آب ٢٠١٦
	مسابقة في مادة الكيمياء المدة: ساعة واحدة	الاسم: الرقم:

This Exam Is Composed of Three Exercises. It Is Inscribed on 2 Pages.
The Use of Non-programmable Calculator Is Allowed.
Answer The Three Following Exercises:

First Exercise (7 points)
A Substitute of Table Salt

The table salt (sodium chloride) is an important constituent of the Lebanese diet; however, consumption of the table salt should be limited to less than 1500 milligrams per day, even for healthy individuals. Individuals suffering from high blood pressure (hypertension) must consume a substitute of table salt to lower sodium intake in their diet. One trade name of a substitute of table salt is known as **Losalt** which is a mixture of sodium chloride and potassium chloride.

A study of a chemical element X gave the following information:

- The relative charge of the electron cloud of the atom of the element X is (17-).
- The number of neutrons in the nucleus of the atom of the element X is greater than the number of protons by 1 (N = Z+1).

1- Show that the atomic number of the element X is 17, knowing that the relative charge of an electron is(1-).

2- Determine the mass number of the atom of the element X.

3- Write the electron configuration of the atom of the element X.

4- Choose, among the couples given below, the couple that corresponds to the placement of the element X in the periodic table. Justify your answer.

a- group VII, period 2 (column 17, row 2)
b- group VII, period 4 (column 17, row 4)
c- group VII, period 3 (column 17, row 3)
d- group VI, period 2 (column 16, row 2)

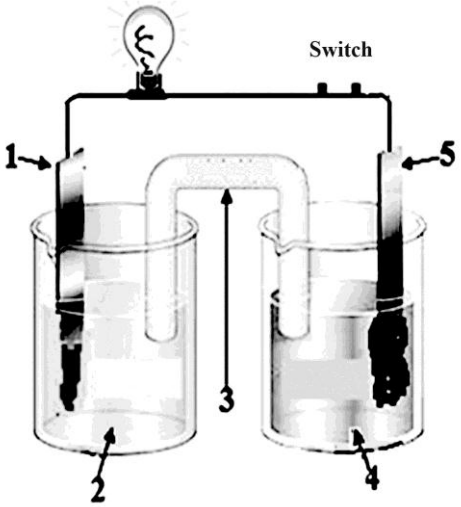
5- The element X is chlorine (Cl). The Lewis electron dot symbol of sodium atom is: $\dot{N}a$

- Explain the bond formation in the compound sodium chloride (NaCl).

6- Justify, based on the text, why the patient suffering from hypertension should use a substitute of table salt.

Second Exercise (7 points)
Zinc-Copper Galvanic Cell

A galvanic cell or voltaic cell is an electrochemical cell that produces electrical energy from a spontaneous oxidation-reduction reaction taking place within the cell. The adjacent figure represents the schema of an operating (Zn-Cu) galvanic cell.



Given: The copper (II) ion is Cu^{2+}
The zinc ion is Zn^{2+}

1- Give the name of each of the numbered parts **2, 3, 4** and **5** in the schema of the operating galvanic cell, knowing that the numbered part **1** is zinc strip.

2- Indicate the anode of the operating (Zn – Cu) galvanic cell.

3- Write the half-reaction that takes place at the cathode.

4- The mass of the cathode increases as time elapses. The increase in mass of the cathode after operating for (t) hours corresponds to 0.01 mol.

4.1- Calculate the increase in mass of the cathode.

4.2- Deduce the mass of the cathode after operating the cell for (t) hours, knowing that the initial mass of the strip that serves as cathode is 18.25g.

Given : M (Cu) = 64 $g.mol^{-1}$

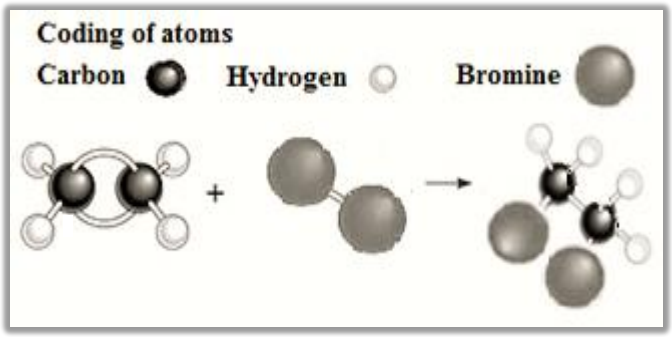
5- Justify why the lamp does not light when the numbered part **3,** connecting the solutions in the two beakers, is removed.

Third Exercise (6 points)
The Importance of Ethene

Have you thought why a ripe banana can speed up the ripening process when placed among some green tomatoes? The answer is that ripe banana releases ethene which is a plant hormone.

1- The molecule of ethene consists of 2 carbon atoms and 4 hydrogen atoms. The molecular formula of bromine is Br_2.

1.1- Translate, the reaction represented by molecular models in the adjacent figure, into an equation form using condensed structural formulas for the organic compounds.



1.2- Give the IUPAC name of the product obtained.

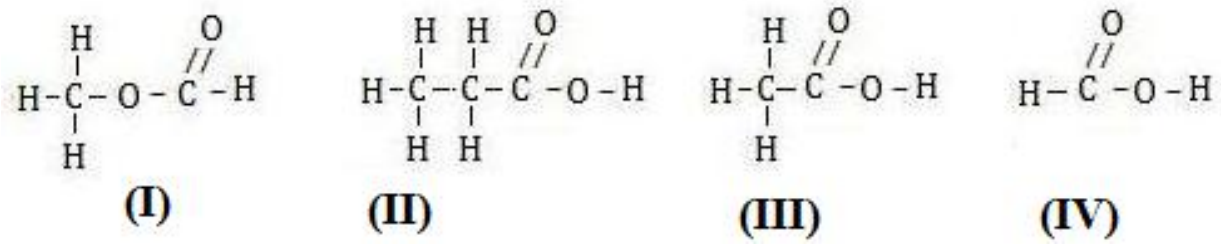
2- Ethene reacts with water, under the effect of heat and in the presence of sulphuric acid as a catalyst, to produce an alcohol (A).The reaction is known as hydration reaction.

- Write, using structural formulas of the organic compounds, the equation of the hydration reaction of ethene.

3- The aroma of banana and many other fruits, plants, flowers… is due to the presence of an ester. A compound (B) reacts with alcohol (A) to give an ester and water. The molecule of compound (B) has the same number of carbon atoms as the molecule of alcohol (A).

3.1- Deduce that compound (B) is a carboxylic acid.

3.2- Choose, among the structural formulas **(I)**, **(II)**, **(III)** and **(IV)** given below, the one that corresponds to the structural formula of compound (B). Justify.



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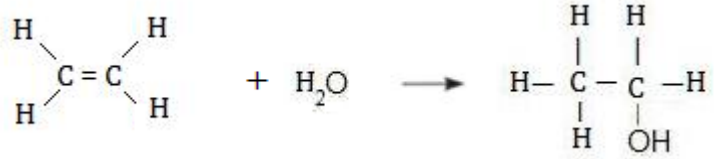
	First Exercise (7 points) Expected Answer	Mark
1	$Q_{(electron\ cloud)}$ = nb of electrons x relative charge of an electron (17-) = nb of electrons x (1-) => nb of electrons = 17 The atom is electrically neutral, so the number of electrons = number of protons = 17 Number of protons = atomic number = Z = 17	**1**
2	N = Z + 1; N = 17+ 1 =18 **(0.25 pt)** Mass number = A = Z + N **(0.5 pt)** ⇨A = 17 + 18 = 35 **(0.25 pt)**	**1**
3	The electron configuration of the atom of the element X is: K^2, L^8, M^7.	**1**
4	The couple **(c)** corresponds to the placement of the element X in the periodic table (**0.5 pt)**. The number of occupied energy levels indicates the number of the period **(0.25 pt)**. The number of electrons on the outer energy level indicates the number of the group (the unit digit of the column) **(0.25 pt).** The atom of element (X) has 3 occupied energy levels and $7e^-$ on the outer energy level **(0.5 pt).**	**1.5**
5	The sodium atom has 1 electron on its valence energy level. The sodium atom loses it valence electron to attain its octet (satisfies the octet rule) and becomes sodium ion Na^+ **(0.5 pt)**. The chlorine atom, Cl has seven electrons on its valence energy level, gains one electron to attain its octet (satisfies the octet rule) and becomes chloride ion Cl^-.**(0.5 pt)** The oppositely charged Na^+ ions and Cl^- ions attract each other mutually by an electrostatic force. The bond formed between them is an ionic bond. **(0.5 pt)**	**1.5**
6	A patient suffering from hypertension must consume a substitute of table salt to lower sodium intake in his diet.	**1**

	Second Exercise (7 points) Expected Answer	Mark
1	**(2):** solution containing Zn^{2+} ions; **(3):** salt bridge; **(4)**: solution containing Cu^{2+} ions; **(5):** copper strip **(4x0.5 pt)**	**2**
2	The anode of the galvanic cell is the zinc strip.	**1**
3	The half-reaction that takes place at the cathode is: $Cu^{2+} + 2e^- \rightarrow Cu$	**1**
4.1	The increase in mass corresponding to 0.01 mol n = (m/M); **(0.25 pt)** m = n x M = 0.01 x 64 **(0.25 pt)** = 0.64g **(0.5 pt)**	**1**
4.2	The mass of the copper strip (cathode) after operating for (t) hours = 18.25 + 0.64 **(0.5 pt)** = 18.89g **(0.5 pt)**	**1**
5	When the salt bridge is removed, the circuit becomes opened; the spontaneous redox reaction ceases, therefore no electrons flow through the external circuit.	**1**

	Third Exercise (6 points) Expected Answer	Mark
1.1	The equation of the reaction is: $CH_2 = CH_2 + Br_2 \rightarrow CH_2Br - CH_2Br$	**1.5**
1.2	The IUPAC name of the product obtained is: 1,2-dibromoethane.	**1**
2	The equation of the hydration reaction of ethene is: 	**1.5**
3.1	An ester is the product of the reaction of an alcohol with a carboxylic acid **(0.25 pt)**. Compound (A) is alcohol, so Compound (B) is carboxylic acid **(0.75 pt)**.	**1**
3.2	The structural formula of compound (B) is **(III). (0.5 pt)** Compound (B) has two carbon atoms in its molecule, and it possesses a carboxyl group -COOH. **(0.5 pt)**	**1**