

اسم: _____
الرقم: _____

مسابقة في مادة الكيمياء
المدة: ساعة واحدة

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

First Exercise (7 Points)

Organic and Inorganic Compounds

Organic compounds and inorganic compounds are employed in our everyday life. The **list** given below shows the formulas of some compounds.

List : (A) CH₄, (B) C₂H₅OH, (C) NH₃, (D) CH₃COOH, (E) C₄H₁₀, (F) C₂H₄, (G) CaCO₃

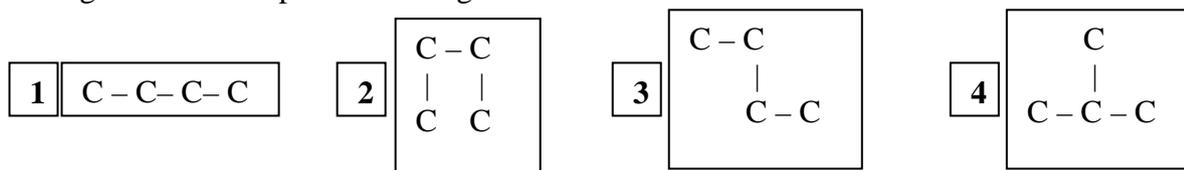
1- Copy the table given below and use it to classify the above given compounds into organic compounds (hydrocarbons, or not hydrocarbons) and inorganic compounds.

Organic compounds		Inorganic compounds
Hydrocarbons	Not hydrocarbons	

2-Ethanoic acid is the component of vinegar which is responsible for its sour taste. Butane is known as stove gas, it is used as heat source for cooking. Calcium carbonate (CaCO₃) is the main component of marble which is used in making sinks and to cover the floors of rooms.

- Write the structural formula for the molecule of each of the compounds (B) and (D).
- Give the name of the functional group responsible for the characteristic properties of each of the compounds (B) and (D).
- Ethanoic acid reacts with calcium carbonate and damages it. Justify why we should not spill vinegar on a marble sink.

3- Compound (E) is an alkane. The carbon atoms in a molecule of (E) may be connected to each other according to the four representations given below:



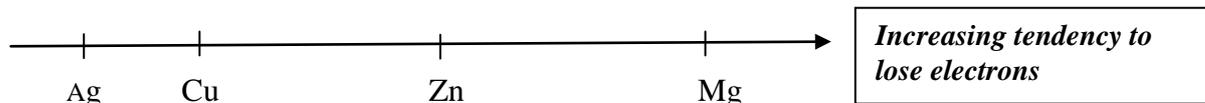
Indicate whether each of the four given representations stands for a straight chain alkane or stands for a branched chain alkane. Justify.

Second Exercise (7 points)

Galvanic Cells

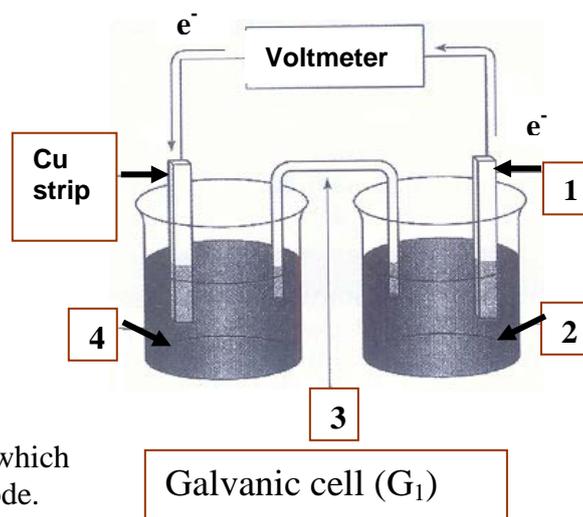
The electrodes of a galvanic cell (G) are two metals **M₁** and **M₂**. Metal **M₁**, has more tendency to lose electrons than metal **M₂**. A strip of metal **M₁** serves as the anode of the galvanic cell (G). The cell representation of the galvanic cell (G) is given as: **M₁|M₁ⁿ⁺ - Salt bridge - M₂^{m+}|M₂**

Given: Four metals Ag, Cu, Zn and Mg are arranged on an axis according to their increasing tendency to lose electrons.



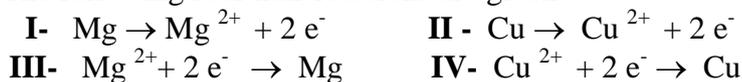
1- During a laboratory session, the teacher distributes to the students, the schema of galvanic cell (G_1) [Zn-Cu] given at the right.

- Write on the answer sheet the name matching to each of the numbered parts of the schema of galvanic cell (G_1).
- Write the cell representation of galvanic cell (G_1).



2- A galvanic cell (G_2) [Mg-Cu] is constructed.

The following four half-reactions are given:

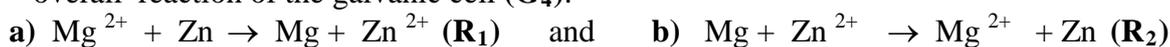


Choose from the above given half-reactions, the half-reaction which takes place at the cathode and that which takes place at the anode.

Deduce the overall reaction for the galvanic cell (G_2).

3- A galvanic cell (G_3) [Cu-Ag] is constructed. Indicate which metal can serve as the anode for the galvanic cell (G_3). Justify.

4- A galvanic cell (G_4) [Mg-Zn] is constructed. The teacher proposes the following equations for the overall reaction of the galvanic cell (G_4).



Explain which equation (R_1) or (R_2) can be associated to galvanic cell (G_4).

Third Exercise (6 points) A Peculiar Organic Compound (A)

Compound (A) is an important raw material in the industry of polymers such as polyurethanes, which are used to manufacture furniture, mattresses and car seats. Polymers are widely used because they have better properties than natural alternatives and are cheaper. The Lewis dot structure of the molecule of a peculiar organic compound (A) is shown in **Figure -1**.

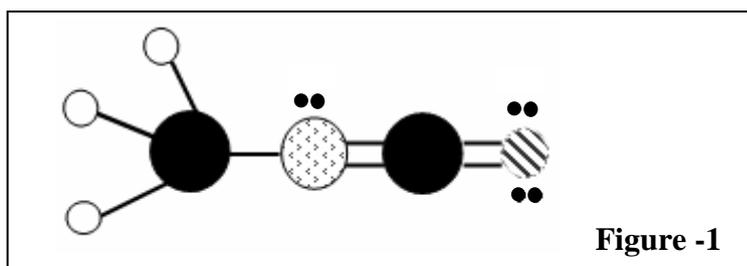
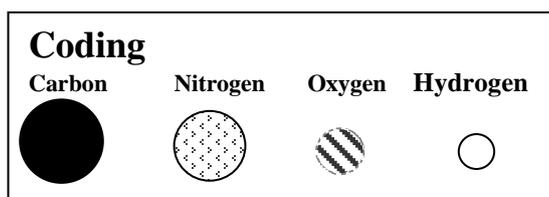


Figure -1

Use the information given in figure -1 to answer the questions 1,2,3 and 4.

- Write the molecular formula of compound (A).
- Indicate the type of bonds between the nitrogen atom and each of the carbon atoms in a molecule of compound (A).
- The nitrogen atom is bonded to two carbon atoms and has 2 electrons on its valence energy level which are not involved in bond formation (non-bonding electron pair). Determine the number of valence electrons for the nitrogen atom.
- Write a Lewis dot structure of a molecule of compound (B), which has the same molecular formula as that of compound (A).
- Justify why this peculiar organic compound (A) is an important raw material.

Expected Answer	Marks	Comments
<p>4- In galvanic cell (G₄) magnesium is the anode, it has more tendency to lose electrons than zinc metal. At the anode oxidation takes place. Magnesium should be oxidized in galvanic cell (G₄). In reaction R₂ magnesium is oxidized. So it can be associated to galvanic cell (G₄).</p>	<p>1/2 +1/2 1</p>	<p>- Using half reactions is acceptable. - Using oxidation number is acceptable.</p>
Third Exercise (6pts.)		
<p>1- The molecular formula of (A) is C₂H₃NO</p>	1/2	
<p>2- The Nitrogen - Carbon bond is a single covalent bond. (N ≡ C) The Nitrogen - Carbon bond is a double covalent bond. (N=C)</p>	<p>3/4 3/4</p>	<p>- Single bond (1/2) - Double bond (1/2)</p>
<p>3- The number of valence electrons for an atom is the number of electrons on the outer energy level. - In the single covalent (N-C) bond, nitrogen atom contributes one electron. In the double covalent bond (N=C), nitrogen atom contributes two electrons. Also, valence energy level holds two electrons not involved in bonding. => Total number of valence electrons 1+2+2 = 5 electrons</p>	<p>1/2 1/2 1/2 1/2</p>	<p>The number of valence electrons = number of non bonding electrons + number of bonding electrons .Acceptable - Logical reasoning is acceptable . - 1+2+2 =3+2=5 e⁻(1) - 5 e⁻ (zero).</p>
<p>4-</p> $ \begin{array}{ccccccc} & \cdot\cdot & \cdot\cdot & & \cdot\cdot & \cdot\cdot & \\ \text{H} & & & \text{H} & = & \text{C} & = & \text{N} & - & \text{N} & = & \text{O} & \cdot\cdot \\ & & \cdot\cdot & & & & & & & & & & \cdot\cdot \\ & \text{H} & & \text{H} & & \text{H} & & & & & & & \end{array} $	1	<p>- Any correct Lewis dot structure is acceptable.</p>
<p>5- It is used as a raw material to produce polymers, which have better properties than natural alternatives and are cheaper</p>	<p>1/2 1/4+1/4</p>	