
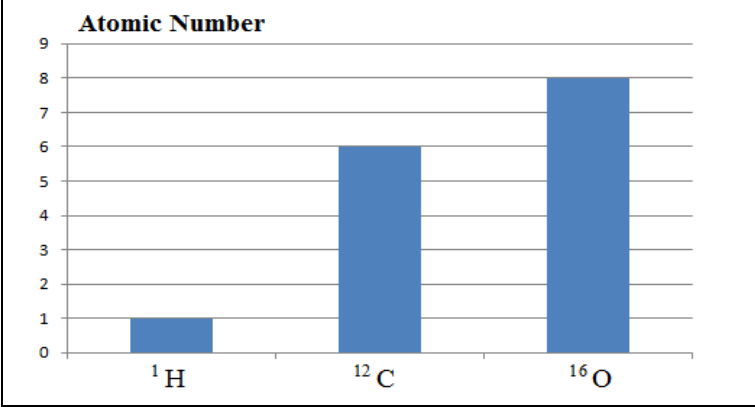
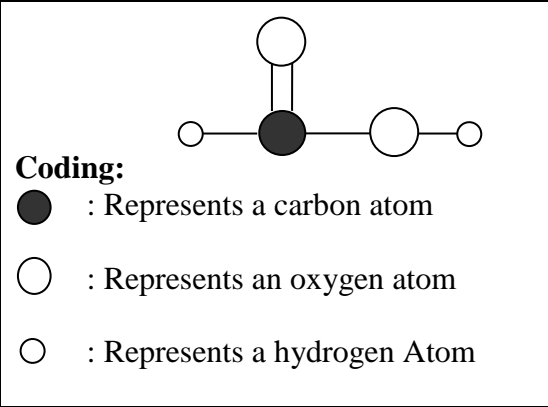


المادة: الكيمياء – اللغة الإنكليزية الشهادة: المتوسطة نموذج رقم: ٢٠١٩ / ١ المدة: ساعة واحدة	الهيئة الأكاديمية المشتركة قسم: العلوم	
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This Exam Is Composed of Three Exercises. It Is Inscribed on Two Pages, Numbered 1 and 2. Answer the Three Following Exercises:

Exercise 1 (7 points) Composition and Structure of Formic Acid

Formic acid, known as methanoic acid of formula $C_xH_yO_2$, is a corrosive liquid used to produce insecticides. The aim of this exercise is to study the atomic composition and the Lewis structure of methanoic acid.

 <p style="text-align: center;">Document -1</p>	 <p>Coding: ● : Represents a carbon atom ○ : Represents an oxygen atom ○ : Represents a hydrogen Atom</p> <p style="text-align: center;">Document -2</p>
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Document-1: Histogram showing the atomic number (Z) of each element found in methanoic acid.

Document-2: Molecular model of methanoic acid.

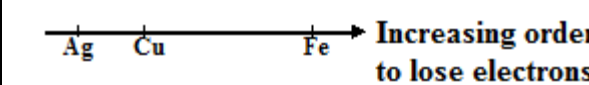
- By referring to **document-1**, answer the following questions:
 - Calculate the number of neutrons of carbon atom.
 - Write the electronic configuration of oxygen atom.
- Methanoic acid decomposes in the presence of platinum as a catalyst to give two gaseous products hydrogen and carbon dioxide according to the following equation:

$$C_xH_yO_2 \rightarrow H_2 + CO_2$$
 - Determine, referring to the above equation, the molecular formula of methanoic acid.
 - Choose, among the following, the pollution effect caused by excessive emission of carbon dioxide:
 - Ozone depletion
 - Green house effect
 - Acid rain
- Referring to **document-2**, answer the following questions:
 - Specify the type of bond between the carbon atom and the hydrogen atom.
 - Indicate the number of valence electrons of carbon and hydrogen atoms. Justify your answer.
 - Give the Lewis dot symbol of carbon and hydrogen atoms.
 - Write the Lewis structure of methanoic acid.

Exercise 2 (7 points) Identifying the Nature of Electrodes of an Electrochemical Cell

In an Electrochemical Cell, spontaneous electron-transfer reactions can be used to produce electricity in a device that converts chemical energy into electrical energy.

The aim of this exercise is to identify the electrode of an electrochemical cell.

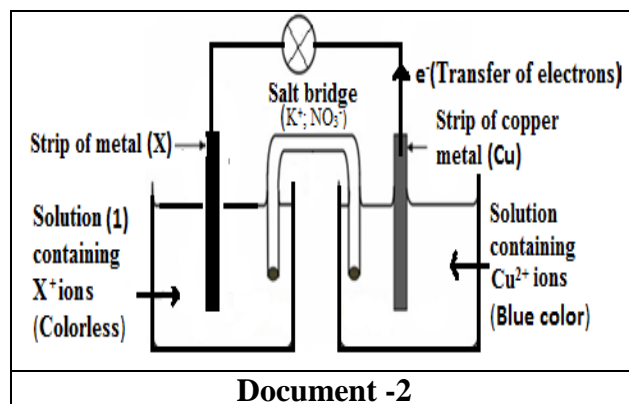

Document -1

Document-1: Classification of metals according to their tendency to lose electrons.

Document-2: Scheme of an electrochemical cell (Cu- X) while operating.

- Referring to **documents 1 and 2**, show that the metal (X) is silver (Ag).
- Referring to **document – 2**, answer the following questions:

- Identify the anode of this cell.
- Write the two half- reactions that take place at the electrodes of the electrochemical cell.
- Deduce the overall equation of the reaction.
- Give the cell representation.
- Specify whether the following statements are true or false.
 - The K^+ ions move from the salt bridge into the beaker containing solution (1).
 - Solution (1) contains silver ions Ag^+ .
 - The intensity of the blue color decreases when the cell operates.



Exercise 3 (6 points)

Alkanes

Crude oil is a complex mixture of hydrocarbons. At an oil refinery, the various hydrocarbons are separated into mixtures of compounds with similar boiling points; boiling points depend on the composition of hydrocarbons.

Document-1: Table showing the boiling point of some straight chain alkanes.

Straight chain alkanes	Ethane	Alkane (A)	Octane
Boiling point	-87°C	0°C	125°C

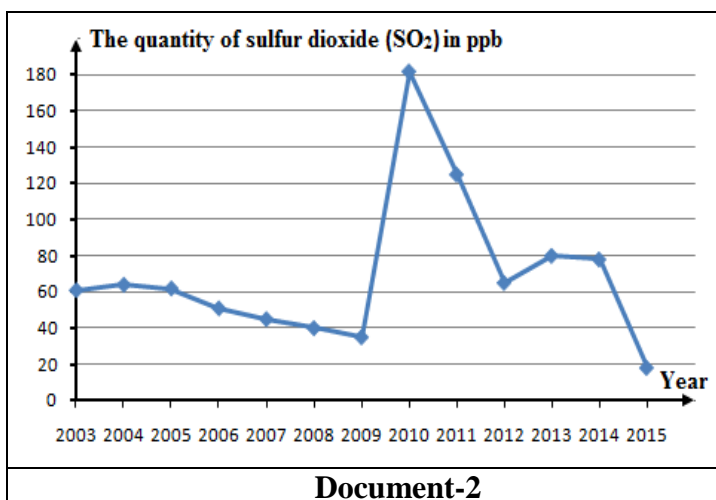
Document-1

- Name the separation technique used to separate the constituents of the crude oil.
- For each of the following, choose the correct answer. Justify.
 - Alkane (A) can be:
 - Decane
 - Methane
 - Butane
 - Alkane (A) has another isomer (A_1) which has a branched chain. The boiling point of (A_1) is:
 - lower than 0°C
 - higher than 0°C
 - equal to 0°C


- During the combustion of a fuel containing octane, the sulfur dioxide gas (SO_2) released reacts with water vapor to produce sulfuric acid which contributes to the formation of acid rain. This phenomenon damages tree roots and attacks statues and buildings.

Document-2: Graph showing the quantity of sulfur dioxide gas (SO_2) in ppb (part per billion) released between 2003 and 2015.

- Compare the amount of SO_2 (in ppb) released in 2010 and 2015.
- Pick out from the text two harmful consequences of acid rain on the environment.



- Ethane is obtained by the hydrogenation reaction of ethene in the presence of nickel (Ni) as catalyst, according to the following equation: $CH_2 = CH_2 + H_2 \rightarrow CH_3 - CH_3$
Specify whether this is an addition or a substitution reaction.

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أسس التصحيح :

Part of questions	Exercise 1 (7 points) Composition and Structural of Formic Acid	Mark
Expected Answers		
1.1	A=Z+N (A= mass number=12, Z=atomic number = 6, N= number of neutrons) So N= 12-6=6 neutrons	1/2 1/2
1.2	In a neutral atom, the number of protons is equal to the number of electrons= 8, so the electronic configuration is K ² L ⁶ .	1/4 1/2
2.1	According to the law of conservation of matter, the number of atoms of each element is conserved. For carbon: x = 1 For hydrogen: y =2 Then the molecular formula of compound C _x H _y O ₂ is CH ₂ O ₂ .	1/2 1/4 1/4 1/4
	ii- Greenhouse effect	1/2
3.1	The bond is single covalent bond since the carbon atom shares one pair of electrons with the hydrogen atom.	1/2
3.2	- The number of valence electrons of carbon atom is 4. - The number of valence electrons of hydrogen atom is 1. The carbon atom shares one pair of electrons with the hydrogen atom and one pair of electrons with one of the two oxygen atoms; it also shares two pairs of electrons with the second oxygen atom. So, carbon has 4 valence electrons. The hydrogen atom shares one pair of electrons with carbon atom; so, it has one valence electron.	1/4 1/4 1/2 1/2
3.3	The Lewis dot symbol of these atoms are: $\cdot\overset{\cdot}{\underset{\cdot}{\text{C}}}\cdot$ $\overset{\cdot}{\text{H}}$	2x(1/4)
3.4	$\begin{array}{c} \text{:}\ddot{\text{O}}\text{--H} \\ \\ \text{H--C}=\ddot{\text{O}}\text{:} \end{array}$	1

Part of questions	Exercise 2 (7 points) Identifying the Nature of Electrodes of an Electrochemical Cell	Mark
Expected Answers		
1	Referring to document-2, the electrons move from the copper electrode to electrode (X), this means that metal (X) has lower tendency to lose electrons than copper, and by referring to document-1, the metal (X) is Ag.	1
2.1	The anode is the copper electrode Cu, since the electrons move from copper metal to silver metal.	1/2 1/2
2.2	Ag ⁺ + 1e ⁻ → Ag Cathode half – reaction Cu → Cu ²⁺ + 2e ⁻ Anode half – reaction	1/2 1/2

2.3	$(\text{Ag}^+ + 1\text{e}^- \rightarrow \text{Ag}) \times 2$ $\text{Cu} \rightarrow \text{Cu}^{2+} + 2\text{e}^-$ Overall reaction: $2\text{Ag}^+ + \text{Cu} \rightarrow 2\text{Ag} + \text{Cu}^{2+}$	1
2.4	$\text{Cu} \mid \text{Cu}^{2+}$ - salt bridge - $\text{Ag}^+ \mid \text{Ag}$	$\frac{3}{4}$
2.5	a- True, to maintain the electroneutrality of solution (1), the K^+ ions of the salt bridge move towards the cathode half-cell. b- True, in the electrochemical cell, the metal is immersed in a solution containing its cation. c- False, when the cell is operating, the anode Cu is oxidized to give copper ions Cu^{2+} having a blue color; so, the intensity of the blue color increases with time.	$\frac{1}{4}$ $\frac{1}{2}$ $\frac{1}{4}$ $\frac{1}{2}$ $\frac{1}{4}$ $\frac{1}{2}$

Part of questions	Exercise 3 (6 points) Alkanes	Mark
	Expected Answers	
1.	Fractional Distillation.	$\frac{1}{2}$
2.1	iii- Butane In a straight chain alkane, the boiling point increases as the number of carbon atoms increases. Since the alkane (A) has higher boiling point (0°C) than that of ethane (-87°C) and lower than that of octane (125°C), the number of carbon atoms of alkane A should be between that of ethane (2) and that of octane (8). So alkane A is butane.	$\frac{1}{2}$ 1
2.2	i- lower than 0°C For the isomers of an alkane, the boiling point of the branched alkane is lower than that of its corresponding straight chain isomer.	$\frac{1}{4}$ $\frac{3}{4}$
3.1	The quantity of SO_2 in 2010 is 180 ppb. The quantity of SO_2 in 2015 is 20 ppb. So the quantity of SO_2 in 2015 is lower than that in 2010.	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$
3.2	- Damages tree roots. - Attacks statues and buildings.	$\frac{1}{4}$ $\frac{1}{4}$
4	Addition reaction. Since two hydrogen atoms are added over the double bond to form one saturated compound (alkane).	$\frac{1}{4}$ $\frac{3}{4}$