

This Exam Is Composed of Three Exercises. It is inscribed on seven pages, numbered from 1 to 7. Answer the following three exercises.

## مسابقة في مادة الكيمياء

المدة: ساعة واحدة

(إنكليزي)

الاسم: .....

الرقم: .....

## Exercise 1 (7 points)

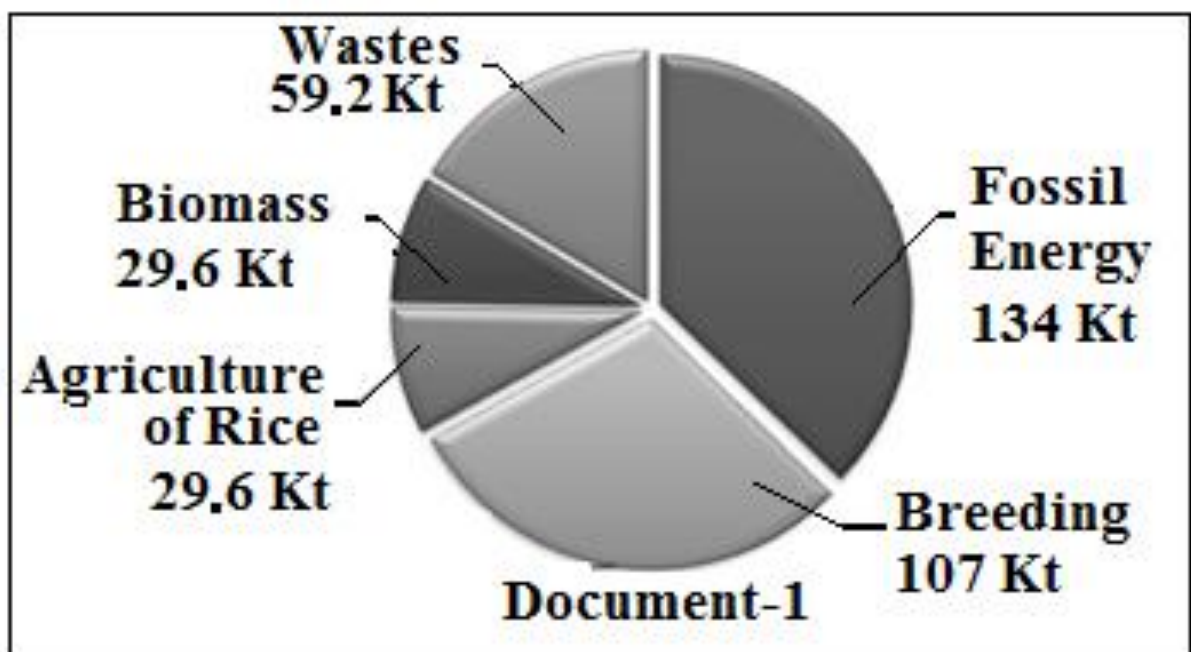
## Alert from Methane!

When talking about global warming, people think immediately about the release of carbon dioxide gas (CO<sub>2</sub>), but methane is responsible of one third of global warming since 1750.

While the emissions of carbon dioxide (CO<sub>2</sub>) start to become stable in certain countries that of methane increase since few years in a worrying rhythm.

*Translated from [www.les4verites2brane.com/climat-alerte-au-methane](http://www.les4verites2brane.com/climat-alerte-au-methane)*

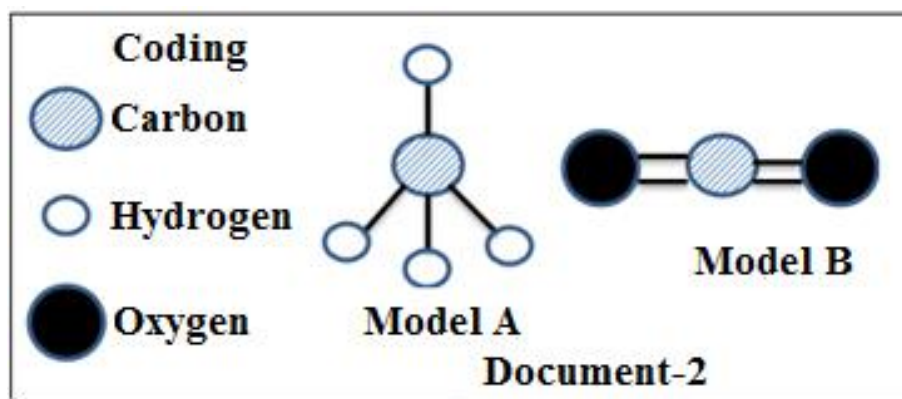
1. **Document-1** represents a circle graph (pie-chart) showing the sectors responsible of the emissions in 2012, of **methane** gas in kilotons (Kt).



1.1 Refer to the text, **name** two gases responsible of global warming.

1.2 Refer to the **Document-1**, which sector emits the highest quantity of methane gas in 2012?

2. **Document-2** represents the molecular models of carbon dioxide and methane.



- Refer to **Document-2**, answer the following questions:

**2.1 Verify** that model **A** corresponds to methane molecule.

**2.2 Answer** by true or false the following propositions below. **Correct** the false proposition.

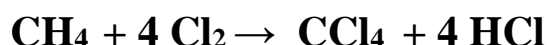
- In model **A**, the bond between the carbon atom and each hydrogen atom is single covalent bond.
- In model **B**, the bond between the carbon atom and each oxygen atom is triple covalent bond.

3. The electron configuration of oxygen atom is:  **$K^2L^6$** .

- **Choose** the correct answer(s). **Justify** your choice.

- Electrons of oxygen atom occupy three energy levels in the ground state.
- The valence of oxygen atom is **2**.
- Oxygen atom possesses **8** positively charged particles.

4. When exposed to light, methane can react with chlorine gas according to a reaction (**R**) represented by the following equation:



**Given:**

- The oxidation number of the element carbon in the compound  **$\text{CCl}_4$**  is equal to **+IV**.
- The oxidation number of the element hydrogen in the compound  **$\text{CH}_4$**  is equal to **+I**.

**4.1 Calculate** the oxidation number of carbon element in the compound  **$\text{CH}_4$** .

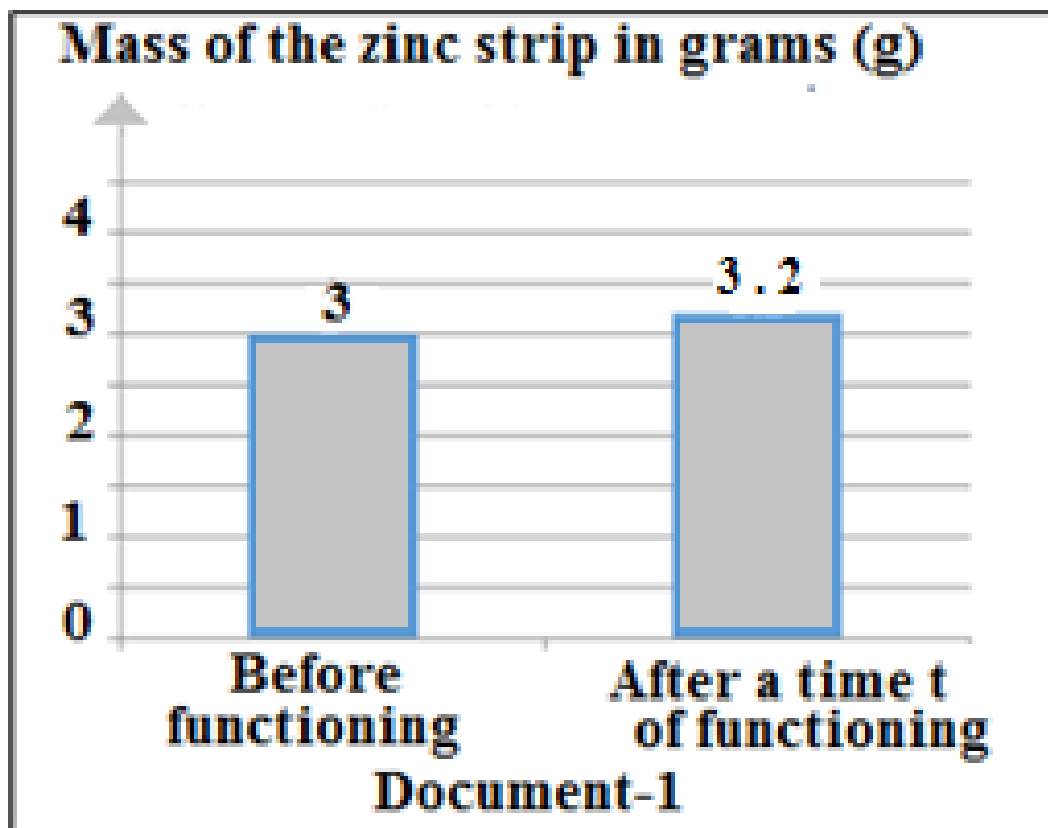
**4.2 Deduce** that methane is the reductant in reaction (**R**).

## Exercise 2 (6 points)

## Aluminum – Zinc Cell

In the laboratory, a group of students construct an aluminum- zinc electrochemical cell (G), in order to study the variation in mass of the zinc strip during the functioning of this cell.

**Document -1** is a bar graph that represents the obtained result.

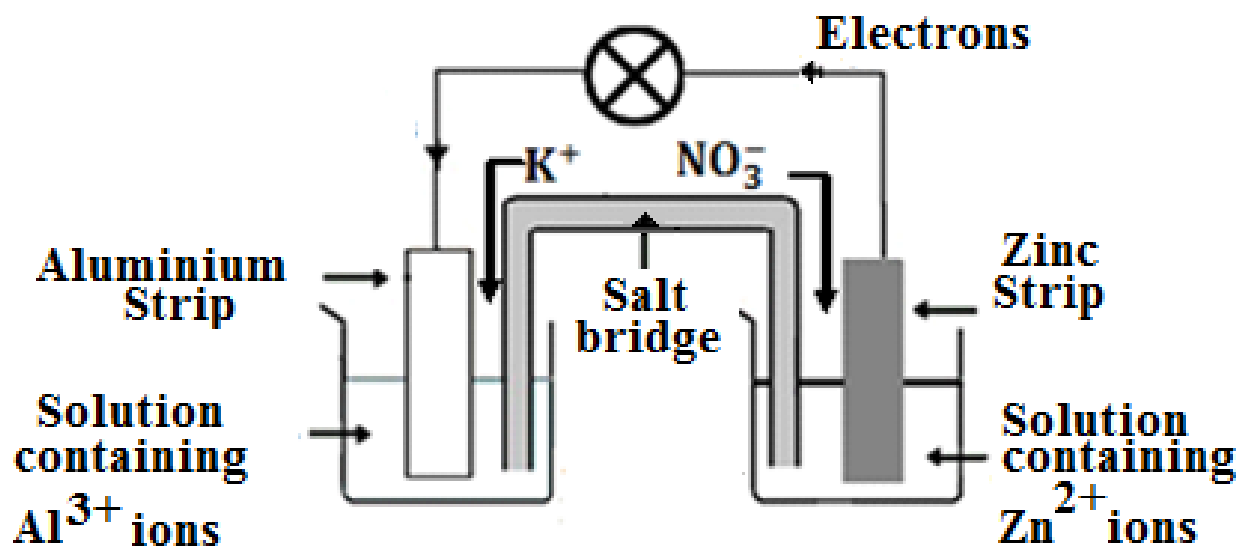


1. Refer to **Document-1**, answer the following questions:

1.1 Show that the zinc strip is the cathode of the cell (G).

1.2 Indicate among the metals zinc and aluminum, the one that has the greater tendency to lose electrons. **Justify**.

2. A grade 9 student schematizes below the cell (G) constructed by his classmates.



- Pick out from this schema the errors committed by this student. Justify.

3. Write:

- the oxidation half- reaction of the cell (G).
- the reduction half- reaction of the cell (G).

4. Give the overall equation of the reaction of this cell.

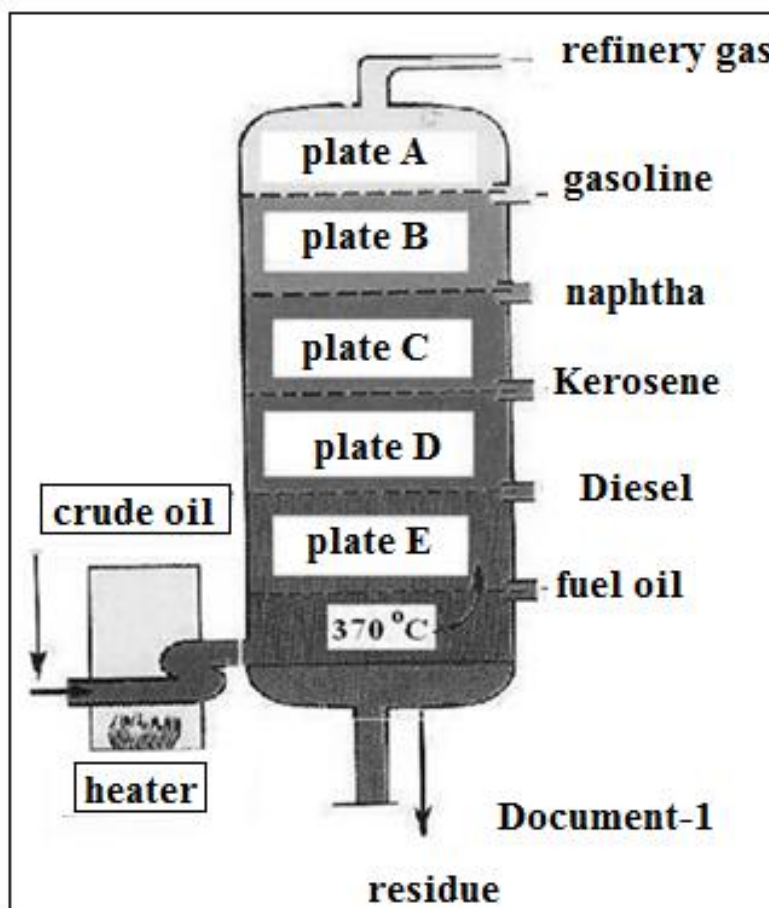
### Exercise 3 (7 points)

### Petroleum

Petroleum is a viscous liquid composed of different hydrocarbons, the majority of which are open chain alkanes and cycloalkanes.

This mixture should be treated before it is used.

**Document-1** shows the schema of a fractionating tower and its different plates.



1. Refer to **Document-1** and to your knowledge, **answer** the following questions:

1.1 **Indicate** the lightest petroleum fraction.

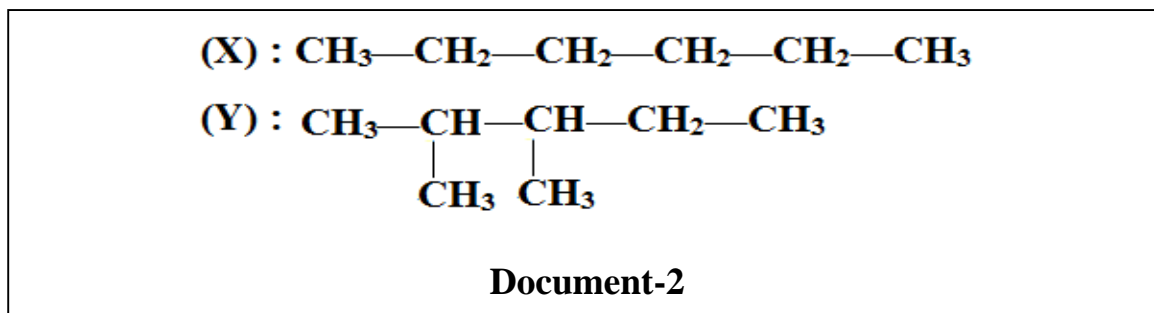
1.2 The temperature at the plate **B** is  $T_1 = 110\text{ }^\circ\text{C}$  and the temperature at the plate **C** is  $T_2\text{ (}^\circ\text{C)}$ .

- **Choose** the correct answer.

- a)  $T_2 = T_1$       b)  $T_2 > T_1$       c)  $T_2 < T_1$

2. Gasoline contains hydrocarbons having 5 to 10 carbon atoms.

**Document-2** represents the condensed structural formulas of the two compounds (X) and (Y) present in gasoline.

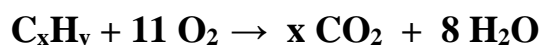


2.1 Give the name of (X) and the name of (Y) according to IUPAC.

2.2 Indicate which of these two compounds is a branched chain hydrocarbon. Justify.

3. A hydrocarbon C<sub>x</sub>H<sub>y</sub>, obtained in one of the fractions, burns completely with oxygen gas in air.

The balanced equation of the complete combustion reaction of C<sub>x</sub>H<sub>y</sub> is:



3.1 Show that  $y = 16$ .

3.2 Deduce the molecular formula of this hydrocarbon (C<sub>x</sub>H<sub>y</sub>) knowing that it is an alkane.

**Given:** The general formula of alkane is C<sub>n</sub>H<sub>2n+2</sub>.

4. Decane C<sub>10</sub>H<sub>22</sub> undergoes cracking to produce heptane and a hydrocarbon of molecular formula C<sub>3</sub>H<sub>6</sub>.

4.1 Indicate which of the two techniques (a) or (b) is a chemical transformation. Justify your choice.

(a)- cracking

(b)- fractional distillation.

4.2 The molecular formula C<sub>3</sub>H<sub>6</sub> corresponds to two possible isomers 1 and 2.

Copy and complete the table below:

	Condensed structural formula	Name according to (IUPAC)	Saturated or unsaturated hydrocarbon	Name of the family
Isomer 1	.....	.....	Saturated hydrocarbon	.....
Isomer 2	.....	Propene	.....	.....