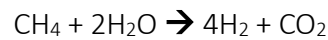
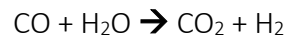
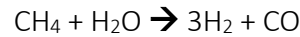




Homogeneous reactor  
Series N° 01

Exercise 1:

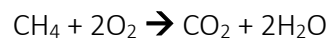
The following reactions represent the reforming of methane with steam (la vapeur d'eau)



- What will be the notation of the stoichiometric coefficient of  $\text{CO}_2$  in reaction number 2?
- What does the stoichiometric coefficient  $\nu_{3,3}$  correspond to? What is its value?
- Calculate the stoichiometric expansion of the 3<sup>rd</sup> reaction.

Exercise 2:

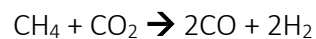
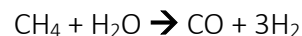
The following reactions are carried out in an open reactor with a steady state. This reactor is powered continuously by: 15 mol/h of methane, 35 mol/h of dioxygene and 5 mol/h of water.



- What is the limiting reagent of this reaction? Explain with and without calculation.
- For a conversion rate of 80% of the limiting reagent, calculate the molar flows that leaving the reactor

Exercise 3:

In an open reactor operating on a steady state, 0.310 mol/s of methane and 0.26 mol/s of air are injected (in presence of 0.98 mol/s of Azote that consider as inert).



- Determine the normalized advancement of the three reactions knowing that the flow leaving the reactor contains : 2,9% of methane, 1,8% of oxygen, 53,4% of nitrogen, 1,6% of carbon dioxide, 9,3% of water, 18,6% of hydrogen and 12,4% of carbon monoxide.

Exercise 4:

Inside a closed reactor; 0,25 mole of ethanol and 1 mole of  $\text{O}_2$  are added. The combustion of ethanol is represented by the following reaction:  $\text{C}_2\text{H}_5\text{OH} + 3\text{O}_2 \rightarrow 2\text{CO}_2 + 3\text{H}_2\text{O}$

- Give the stoichiometric notation of each element.
- Indicate the limiting reagent.
- Knowing that:  $\sum \nu_i A_i = 0$ , give the sentences indicates the proportion between the number of moles and the stoichiometric coefficient.



- What is the number of moles of  $\text{CO}_2$  formed and  $\text{O}_2$  left when burning totally alcohol?
- Calculate the chemical advancement of the reaction and give a conclusion.

### **Exercise 5:**

By the action of hydrochloric acid (HCl), it is possible to remove rust ( $\text{Fe}_2\text{O}_3$ ) forming on the sheets.

The reaction being:  $\text{Fe}_2\text{O}_3 + 6\text{HCl} \rightarrow 2\text{FeCl}_3 + 3\text{H}_2\text{O}$

- How much rust can be removed with a solution containing 3.60 g of HCl?

### **Exercise 6:**

The combustion equation for ethanol is :  $\text{C}_2\text{H}_5\text{OH} + 3\text{O}_2 \rightarrow 2\text{CO}_2 + 3\text{H}_2\text{O}$

3 moles of ethanol and 5 moles of dioxygen are reacted together; one of the reagents disappears completely.

- How many moles of carbon dioxide,  $\text{CO}_2$ , are formed at the end of the reaction?

### **Exercise 7:**

We consider the combustion of acetone:  $\text{C}_3\text{H}_6\text{O} + 4\text{O}_2 \rightarrow 3\text{CO}_2 + 3\text{H}_2\text{O}$

We burn 2 moles of acetone in 4 moles of oxygen. One of the reagents disappears completely.

- Give the composition in moles of the reaction medium at the end of the reaction.

### **Exercise 8:**

We consider the reaction equation for the preparation of chlorine from manganese dioxide and hydrogen chloride:

$\text{MnO}_2 + 4\text{HCl} \rightarrow \text{MnCl}_2 + \text{Cl}_2 + 2\text{H}_2\text{O}$ .

3 moles of manganese dioxide are reacted with 5 moles of hydrogen chloride. One of the reagents disappears.

- Give the composition in moles of the reaction medium at the end of the reaction.

### **Exercise 9:**

The ammonia synthesis reaction equation being:  $\text{N}_2 + 3\text{H}_2 \rightarrow 2\text{NH}_3$

- Give the stoichiometric notation of this reaction.
- What is the number of moles of ammonia obtained and hydrogen disappeared when 0.127 moles of dinitrogen reacted with the strictly necessary quantity of dihydrogen?
- Calculate the chemical progress of the reaction in relation to the three constituents. Conclude.