



Homogeneous reactor  
Series N° 02 (Chapter III)

Exercise 1:

Supposed we have the reaction:  $A \rightarrow B + C$

This reaction is of order 2 compared to reagent A. It is carried out in a closed isothermal reactor.

At time  $t=0$  we place a charge in the reactor:  $n_{a0}$  mole of A and  $n_i$  mole of inert.

1/ If  $v=cst$ ; determine the expression for the residence time ( $t_r$ ) to achieve a conversion rate  $X_{af}$  relative to reagent A.

2/ if we apply constant pressure ( $P=0$ ); determine the expression of ( $t_r$ ).

Exercise 2:

We consider the reaction  $A+B \rightarrow C+D$

To study the kinetics of this reaction, we have a closed, perfectly stirred reactor with a volume of 01 liter. A preliminary study showed that the orders of the reaction with respect to A and B were identical.

To carry out the experiment, we put 5 moles of A and 5 moles of B in the reactor. the results obtained at  $T=30^\circ\text{C}$  are gathered in the following table

Time (Hours)	0.5	1	2	5	10
$C_A$ (mol/l)	4,35	3,85	3,13	2	1,25
$V$ (mol/l.min)	$18,9 \cdot 10^{-3}$	$14,8 \cdot 10^{-3}$	$9,8 \cdot 10^{-3}$	$4 \cdot 10^{-3}$	$1,56 \cdot 10^{-3}$

1/ determine the rate constant (ثابت السرعة) and the kinetic equation of the reaction.

This reaction is carried out in a closed, perfectly stirred reactor of  $2\text{m}^3$ . 240 kg of reagent A are introduced into this reactor and reagent B is added equimolarly.

2/ calculate the operating time to have a conversion of 90% of reagent A

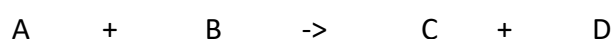
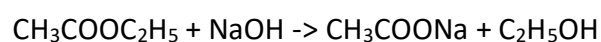
3/ give the composition of the reaction mixture at the end of the reaction

we give:  $M_A=40\text{g/mol}$ ;  $M_B=60\text{g/mol}$

Exercise 3:

laboratory experiments have shown that the alkaline hydrolysis of ethyl acetate in aqueous solution and at  $50^\circ\text{C}$  is an irreversible reaction of global order 2 (order 1 with respect to each reagent) ( $K=28.6 \text{ L/mol.min}$ )

the reaction is as follows:





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1/ We use a perfectly stirred continuous reactor in steady state with a volume  $V_A = 14$  liters with a feed rate  $Q = 120$  liters/hour with  $C_{A0} = C_{B0} = 0.1$  mol/l. What is the value of the output concentration  $C_{Aext}$  (concentration at the exit of reactor) and the corresponding conversion rate  $X_A$ ?

2/ What would be the value of a piston reactor of the same performance powered under the same conditions?

3/ What would be the value of  $X_A$  at the exit of a piston reactor of the same volume as the perfectly stirred continuous reactor of 14 liters.