

Chemical Reaction Engineering I

Self Test 3

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QUESTION 1

An elementary liquid phase reaction is follows;



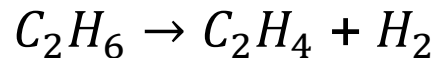
Determine the rate of reaction solely in terms of conversion, X . The inlet flowrate to the batch reactor is equal molar and the initial concentration of A is 2 mol/dm^3 . Use $0.01 (\text{dm}^3/\text{mol})^4 \text{ s}^{-1}$ as the equilibrium constant, k_A

- Construct the stoichiometric table
- Repeat (a) if the phase of the reaction now is in gas form
- What is the rate law?



QUESTION 2

The gas phase pyrolysis reaction of ethane producing ethylene (C_2H_4) and hydrogen (H_2) is as follows:



The reaction was to be carried out in a continuous stirred tank reactor (CSTR) and a plug flow reactor (PFR). As an engineer, you are required to analyze the use of both reactors. As a novice, you strategized yourself to perform the following tasks:

- Construct the stoichiometric table and express the concentration of each species in the reaction solely as a function of conversion when 33mol/min pure ethane enters the reactor at 6 atm and 1100 K with k is 4.32min^{-1} at 1100K. (Assume the reaction is isothermal and isobaric).
- Develop the reaction rate solely as a function of conversion, i.e., (Assume the reaction follows an elementary rate law)
- Construct the table for Levenspiel Plot.
- Design the single CSTR and PFR to achieve 80 % conversion of ethane.



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