北京化工大学 2013——2014 学年第一学期

《化学反应工程》（双语）期末考试试卷

课程代码	C	H	E	3	2	4	0	1	T

班级：_____ 姓名：_____ 学号：_____ 任课教师：_____
分数：_____

题号	一	二	三	四	五	六	总分
得分							

1. Determine the volume of a mixed flow reactor required to obtain 65% conversion of A in A→P, given that v_0=0.3m^{3}min^{-1}, the density of the system is constant, C_{A0}=4 kmol·m^{-3}, and k_A=2.5x10^{-3}s^{-1}. (20points)

2 A first order gas decomposition A→3P proceeds in a plug flow reactor isothermally. The inlet stream with 50% A and 50% inert is introduced into the reactor. The volume of outlet stream is 1.5 times as inlet one and the mean residence time is 10 sec. Please find the conversion of reactant A and the rate constant.

(20 oints)

3 A gas phase reaction between methane (A) and sulfur (B) is conducted at 600°C and 101kPa in a PFR, to produce carbon disulfide and hydrogen sulfide.

$$CH_4(A)+2S_2(B) \rightarrow CS_2(R)+2H_2S(S)$$

The reaction is first order with respect to each reactant, with k_B=12 $m^3mol^{-1}hr^{-1}$ (based upon the disappearance of sulfur). The inlet molar flow rates of methane and sulfur are 23.8 and 47.6 mol hr^{-1} respectively. Determine the volume required to achieve 18% conversion of methane, and the space time.

(15points)

4 The following liquid reactions proceed in a mixed flow reactor.

$$A \underset{k_2}{\overset{k_1}{\rightleftharpoons}} R$$

$$A \xrightarrow{k_3} S$$

Please find the concentrations of products S and R with the conversion x_A=80%. (All the three rate constants are 2 min^{-1}, C_{A0}=3kmol·m^{-3}.)

(15points)

5

A first order reversible reaction in an adiabatic MFR, if the feed temperature is 25℃,what is the reactor volume for x_A=60%?

(15points)

The useful data are as follows: $A \underset{k_2}{\overset{k_1}{\rightleftharpoons}} R$

F_{A0}=1kmol·min^{-1}, C_{A0}=4 kmol·m^{-3}, -ΔH=75.3kJ·mol^{-1}A, C_P=1.046kJ/(molA·K), R=8.314J·$mol^{-1}K^{-1}$, k_1=3.4x10^5exp(-48900/RT) min^{-1}, k_2=1.81x10^{18}exp(-124200/RT)min^{-1}

6 The following table represents a continuous response to a pulse input into a reactor. Calculate the mean residence time and the variance of fluid. If there is a first order aqueous irreversible reaction (k=0.2min^{-1}) in the reactor, what is its conversion?

(15points)

Time t/min	0	5	10	15	20	25	30	35
Tracer output C/kg.m^{-3}	0	3	5	5	4	2	1	0