國立聯合大學 102 學年度碩士班考試招生

化學工程學系 入學考試試題

科　目：化工動力學第1頁共1頁

1. The mechanism of the reaction

$$H_2 + Br_2 \rightleftarrows 2HBr$$

was proposed as the following steps

Initiation	$Br_2 \xrightarrow{k_1} 2Br\bullet$	$\Delta H_r = 46.1$ kcal/mole	(1)
Propagation	$Br\bullet + H_2 \xrightarrow{k_2} H\bullet + HBr$	$\Delta H_r = -6.1$kcal / mole	(2)
	$H\bullet + Br_2 \xrightarrow{k_3} Br\bullet + HBr$		(3)
	$H\bullet + HBr \xrightarrow{k_4} Br\bullet + H_2$		(4)
Termination	$2Br\bullet \xrightarrow{k_5} Br_2$		(5)

Prove that the reaction rate can be fitted as

$$\frac{d[HBr]}{dt} = \frac{k[H_2][Br_2]^{1/2}}{1 + k'[HBr]/[Br_2]}$$ (15%)

2. For the decomposition A→R, C_{A0} = 1 mol/liter, in a batch reactor conversion is 75% after 1 hour, and is just complete after 2 hours. The rate equation can be expressed as $-r_A = kC_A^n$, find k and n. (15%)

3. Consider an isothermal single-phase flow reactor operating at steady-state and constant pressure. Given a gaseous feed, C_{A0}=200, C_{B0}=100, A + B→R, C_B=50. Find the conversion X_A, X_B and the concentration C_A. (15%)

4. Reaction A→R, second-order kinetics and C_{A0} = 1 mol/liter, we get 50% conversion after 1 hour in a plug flow reactor. What will be the conversion and concentration of A after 1 hour if C_{A0} = 10 mol/liter? (15%)

5. In an aqueous feed stream (25 liter/min) with reactant A (C_{A0} = 2 mol/liter) the kinetics of the fermentation at a given enzyme concentration is given by

$$A \xrightarrow{enzyme} R, \quad -r_A = \frac{0.1C_A}{1 + 0.5C_A} \text{ (mol/liter-min)}$$

Find the conversion of A in the exit stream of a 500 liter mixed flow reactor. (15%)

6. Reactant A (A→R, C_{A0} = 10 mol/liter, $-r_A = 0.5\ C_A$ mol/liter-min) passes through 2 equal-sized mixed flow reactors in series. When steady state is achieved C_A is found to be 1 mol/l, what must be the space time τ for each mixed flow reactor? (15%)

7. For a reaction A→R with $-r_A = k\ C_A$ is proceeded in N equal-sized mixed flow reactors, when N→∞ prove that $N\tau_i = \frac{1}{k}\ln\frac{c_0}{c}$, where τ_i is the space time for each single mixed flow reactor, C_o is the initial concentration of A and C is the final concentration of A. (10%)