淡江大學98學年度碩士班招生考試試題

系別：化學工程與材料工程學系　　科目：化學反應工程

准帶項目請打「V」	
✓	簡單型計算機

本試題共 1 頁，5 大題

1. A CSTR is used to decompose a dilute solution of A. The decomposition is irreversible and first order, with reaction rate constant of 3.45 h^{-1}. The reactor volume is 10 m^3. What flow rate of feed solution be treated by this reactor if 95% decomposition is required? (15 分)

2. The elementary gas-phase reaction $A \rightarrow B + 2C$ is carried out isothermally in a flow reactor with no pressure drop. The specific reaction rate at 50℃ is 10^{-4} min^{-1} and the activation energy is 85 kJ/mol. Pure A enters the reactor at 10 atm and 127℃ and a molar flow rate of 2.5 mol/min. Calculate the reactor volume and space time to achieve 90% conversion in a PFR. (20 分)

3. The liquid-phase irreversible reaction A → B + C is carried out in a CSTR. To learn the rate law the volumetric flow rate, v_0, is varied and the effluent concentrations of species A recorded as a function of the space time τ. Pure A enters the reactor at a concentration of 2 mol/dm^3. Steady-state conditions exist when the measurements are recorded.

Run	1	2	3	4	5
τ (min)	15	38	100	300	1200
C_A (mol/dm^3)	1.5	1.25	1.0	0.75	0.5

Determine the reaction order and specific reaction rate. (20分)

4. A and B react with each others as following elementary reactions: (20 分)

$$2A \xrightarrow{k_1} R$$
$$A + B \xrightarrow{k_2} S$$
$$2B \xrightarrow{k_3} T$$

Find what ratio of A to B should be in a CSTR so as to maximize the fractional yield of desired product S.

5. The mechanism of a homogeneous gas phase reaction $H_2 + Br_2 \Leftrightarrow 2HBr$ is suggested as follows:

Initiation: $Br_2 \xrightarrow{k_1} 2Br\bullet$

Propagation: $Br\bullet + H_2 \xrightarrow{k_2} H\bullet + HBr$

$H\bullet + Br_2 \xrightarrow{k_3} Br\bullet + HBr$

$H\bullet + HBr \xrightarrow{k_4} H_2 + Br\bullet$

Termination: $2Br\bullet \xrightarrow{k_5} Br_2$

Determine the overall rate expression for the rate of formation of HBr. (25 分)