國立雲林科技大學 114 學年度
碩士班招生考試試題

系所：化材系
科目：化工動力學

1. The reaction $A \rightarrow 2B$ is carried out isothermally in a continuous-flow reactor. The entering volumetric flow rate and molar rate are 20 dm^3 h^{-1} and 10 mol h^{-1}, respectively. Assume the reaction rate is $-r_A = kC_A$ with $k = 0.0001$ s^{-1}.
   (a) Calculate both the CSTR and PFR reactor volumes necessary to consume 90% of A. (16%)
   (b) Calculate the time necessary to consume 99% of species A in a 1000 dm^3 constant volume batch reactor with $C_{A0} = 0.5$ mol dm^{-3}. (8%)

2. The space time necessary to achieve 70% conversion in a CSTR is 4 h. The entering volumetric flow rate and concentration of reactant A are 1.5 dm^3 min^{-1} and 2.0 mol dm^{-3}, respectively.
   (a) Determine the rate of reaction. (5%)
   (b) Determine the reactor volume. (5%)
   (c) Determine the exit concentration of A. (4%)

3. The rate law for the reaction $A + 2B \rightarrow C$ is $-r_A = kC_AC_B^2$ with $k_A = 24$ dm^6 mol^{-2} s^{-1}. What are k_B and k_C? (12%)

4. For a liquid-phase reaction operating in a 40 L CSTR, the concentrations of the A and B feed streams are 3.2 and 2.4 M before mixing, respectively. The volumetric flow rate of each stream is equal. It is known that k_1 and k_2 are 9 and 1.5 L mol^{-1} min^{-1}, respectively. Determine the total flow rate of A and B, if 75% conversion of the entering species B is required. (25%)

$$A + B \underset{k_2}{\overset{k_1}{\rightleftharpoons}} R + S$$

國立雲林科技大學 114 學年度 碩士班招生考試試題

系所：化材系

科目：化工動力學

5. Suppose a liquid-phase reaction (A → B + C) is carried out isothermally and the data are as following:

Conversion, X	0	0.2	0.4	0.45	0.5	0.6	0.8	0.9
$-r_A$ (mol L^{-1} min^{-1})	13	21.7	65	65	65	65	16.3	11.8

The molar flow rate of A is 0.5 kmol min^{-1}.

(a) For a single CSTR, what is the volume necessary to achieve 80% conversion of the entering species A? (7%)

(b) For a single PFR, what is the volume necessary to achieve 80% conversion of the entering species A? (8%)

(c) To achieve 80% conversion of the entering species A, how to arrange the reactors to minimize the total volume of reactors? (10%)