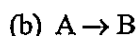


※ 考生請注意：本試題可使用計算機。請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

1. (10%) For the reactions, $A + B \rightarrow C$ and $A + 2C \rightarrow D + 2E$, only A and B are present initially. Find the minimum number of differential equations that will give the composition of the mixture as a function of time.

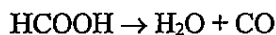
2. (10%) Two identical plug flow reactors are used to carry out two gas-phase reactors separately:



These two reactions have the same rate constant, and the feed conditions are the same in these two reactors.

Without deriving any design equation, how do you judge which reactor will achieve the higher conversion.

3. (10%) The gas phase decomposition of formic acid,



is studied in a plug flow reactor. In one run, the space velocity 1.29 (liters feed at STP) / (min)(liter of reactor volume) results in a conversion of 60% when starting with pure formic acid. The reactor operates at 150°C and 1 atm. The reaction rate is first order with $k = 2.46/\text{min}$. What is the actual residence time?

4. (a) What conditions should an ideal plug flow reactor (PFR) follow? How to achieve it in the reactor design and operation (5%)

(b) What conditions should an ideal continuous-stirred reactor (CSTR) follow? How to achieve it in the reactor design and operation? (5%)

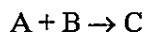
5. For the elementary liquid phase reaction $A \xrightarrow{k_1} B \xrightarrow{k_2} C$ in a CSTR with feed contains only A, please derive and plot:

(a) Concentration profile of B. (7%)

(b) Selectivity of B to C, as functions of space time τ in a CSTR. (8%)

(c) How do you determine the feed rate v_0 in order to maximize the selectivity of B to C? (5%)

6. The gas phase irreversible reaction



is elementary. The entering flow rate of A is 10 mol/min and is equal molar in A and B. The entering concentration of A is 0.4 mol/dm³. $k=2 \text{ dm}^3/\text{mol}\cdot\text{min}$ and $T_0=500 \text{ K}$.

(a) What is the CSTR reactor volume necessary to achieve 90% conversion? (10%)

(b) What PFR volume is necessary to achieve 90% conversion? (20%)

7. (10%) A reversible exothermic reaction needs to be carried out in continuous-stirred tank reactors. The heat of reaction should be managed.

(a) Explain the importance of temperature controlling.

(b) Raise three practical methods to do the job, and explain how it works.