編號： 152 國立成功大學 108 學年度碩士班招生考試試題

系　　所：生物醫學工程學系

考試科目：化學反應工程　　考試日期：0224，節次：1

※ 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, $A + B \longrightarrow C$ and $A + 2C \longrightarrow D + 2E$, 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:

   (a) $A \longrightarrow 2B$

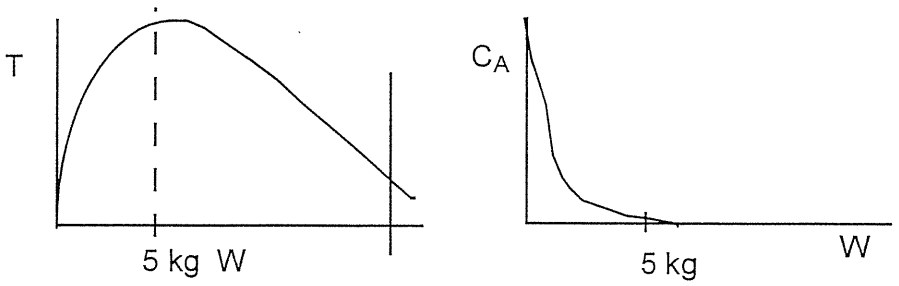
   (b) $A \longrightarrow B$

   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. **(9%)** The series reaction

   $A \longrightarrow B \longrightarrow C$

   is carried out in a packed bed reactor. The following profiles were obtained.



Circle the correct true (T) or False (F) answer for this system (請於答案卷上作答)

T　F　a) The above profiles could represent a system where the reactions are carried out adiabatically.

T　F　b) The above profiles could represent a system where there is a heat exchanger attached to the system.

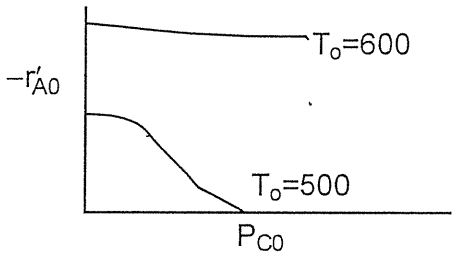
T　F　c) The above profiles could represent an adiabatic system where both of the reactions could be endothermic.

T　F　d) The above profiles could represent an adiabatic system where only one of the reactions is exothermic

T　F　e) The above profiles could represent a system where the addition of inerts could decrease the exit molar flow rate of the desired product, B.

T　F　f) The above profiles could represent an adiabatic system where increasing the feed temperature will increase the concentration of B in the exit stream.

4. **(6%)** The irreversible gas phase reaction of A and B to form C and D was carried out in a packed bed reactor in which there is no catalyst decay.
The following figure shows the rate of reaction at the reactor entrance as a function the partial pressure of C for various entering temperatures, To



Circle the correct answer True (T), False (F), or Cannot Tell (CT) from the information given for the above system (請於答案卷上作答)

T F CT a) The reaction is exothermic.
T F CT b) The reaction is endothermic.
T F CT c) Species C is adsorbed on the catalyst surface at 400°K.
T F CT d) Species C is adsorbed on the catalyst at 700°K.

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) **(7%)** Concentration profile of B.
(b) **(8%)** Selectivity of B to C, as functions of space time τ in a CSTR.
(c) **(5%)** How do you determine the feed rate v_0 in order to maximize the selectivity of B to C?

6. The gas phase irreversible reaction

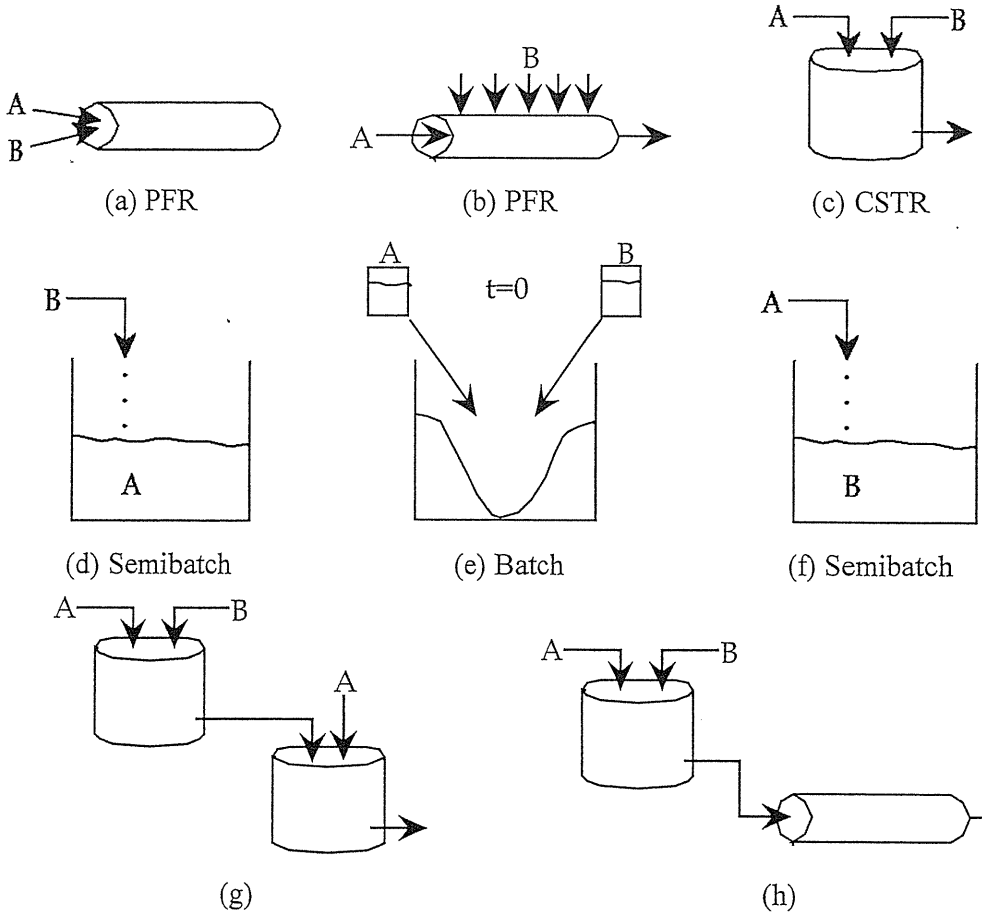
$$A + B \rightarrow C$$

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/dm^3. k= 2 dm^3/mol·min and T_0= 500 K.
(a) **(10%)** What is the CSTR reactor volume necessary to achieve 90% conversion?
(b) **(20%)** What PFR volume is necessary to achieve 90% conversion?

7. (1) **(5%)** The following elementary liquid phase reactions are to be carried out

$$A + B \longrightarrow R$$
$$R + B \longrightarrow S$$

Species R is the desired product. Which of the following schemes should be used?



(2) **(10%)** In the reactors

$$A \longrightarrow B \qquad r_B = k_B C_A^2$$

$$A + B \longrightarrow 2C \qquad r_C = k_C C_A C_B$$

What is the instantaneous selectivity of C to B? Which reactor or combination of reactors and at what temperatures would you use for the following reaction system?

C is the desired product.

Data for Part (2)

$C_{A0} = 4$ mol/dm^3, $k_B = 1$ dm^3/mol·min at 300 K with E= 4000 cal/mol

and $k_C = 1$ dm^3/mol·min at 300 K with E= 12000 cal/mol