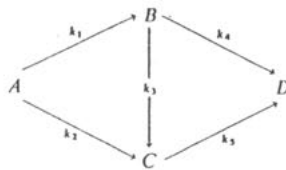


- A liquid feed, with reactant concentration 1.0 mole/l, is fed at volumetric flow rate 2.0 l/min. The rate expression is  $-r_A = kC_A^2$ , where the rate constant  $k = 10$  l/mole·min. Calculate (20%)

  - the conversion from two identical CSTRs in series with volume of 4 liters for each.
  - the volume of a plug flow reactor to obtain the same conversion as (a).
- When you are told that a reactor is accompanied by a vacuum system, what comes to your mind about the type of the reaction in the reactor? Give your reason. (6%)
- For a catalytic reaction  $A \rightarrow 3B$ , give two possible reasons that make the reaction rate proportional to the concentration of reactant A. How do you find which reason is correct? (7%)
- Consider the following complex reaction network:



Relative activation energies ( $E_A$ ) have been estimated by comparison with similar reactions:

Reaction	$E_A$
1	Low
2	High
3	Low
4	High
5	High

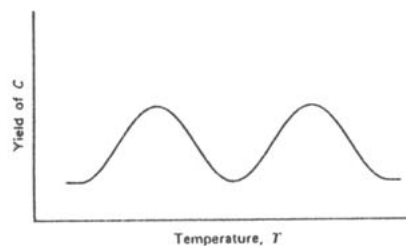
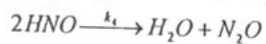
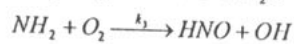
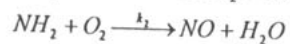
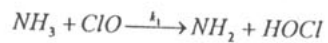


Fig. 1

- It is desired to produce compound C. Assuming all irreversible reactions are first-order, explain the fact that two optimum temperatures are found for operating a CSTR, as shown in Fig. 1. (10%)
- If B is desired, is it better to operate at low or high temperature? Why? (6%)

(背面仍有題目,請繼續作答)

5. The following mechanism has been proposed for the oxidation of ammonia in the presence of ClO.



- (a) Derive an expression for the rate of formation of  $N_2O$ . (8%)  
 (b) What are the limiting cases of this expression if: (i)  $k_2 \gg k_3$ ? (ii)  $k_3 \gg k_2$ ? (4%)  
 (c) Discuss the relative rates of formation of  $H_2O$  and  $N_2O$  in the two limiting cases mentioned in (b). (6%)
6. 簡答下列問題：
- (a) 何謂 Effectiveness factor? 它有何用處? (4%)  
 (b) 何以處理工廠或汽機車廢氣常用網狀或蜂巢狀觸媒而不用填充床? (4%)  
 (c) 何謂担體觸媒? 請舉一例。又担體有何功能? (6%)  
 (d) 在實驗室中研究以固體觸媒催化之反應，有何簡便的方法可以鑑別反應受到外擴散（或稱薄膜擴散）與內擴散（或稱孔洞擴散）阻力之影響? (6%)
7. (a) 請就下列兩種情況比較兩個等體積填充床反應器(packed-bed reactors)串聯或並聯之效能：  
 (i) 外擴散控制時； (ii) 反應控制時。 (6%)  
 (b) 以 Nonporous（不具孔洞）觸媒進行  $2A \rightarrow B + C$  之反應。已知在觸媒表面上之反應速率式為  $(-r_A)_s = k_s C_{As}^2$ ，A 在 bulk fluid 之濃度為  $C_{Ab}$ ，請推導 (i) 總反應速率表示式； (ii) 外擴散控制時之反應速率表示式。 (7%)