

# 國立中正大學九十二學年度碩士班招生考試試題

系所別：化學工程學系

科目：化工熱力學與化工動力學

第 1 頁，共 2 頁

1. A irreversible gas phase reaction,  $A \Rightarrow 2R$ , is carried out in a tubular plug flow reactor at  $T$  (temperature) =  $60^\circ\text{C}$  and  $P$  (total pressure) =  $4.75\text{ atm}$ . The feed consists of 50 mol% A and 50 mol% inert at a rate of  $4000\text{ kg/h}$ . The molecular weights of A and inert are 40 and 20, respectively, and the rate coefficient is  $k=2000\text{ hr}^{-1}$ . Determine the reactor size for 35% conversion of A. (20 分)

2. 解釋名詞：

- Arrhenius Equation
- Semibatch Reactor
- Differential Flow Reactor
- Heterogeneous Catalysis
- Reaction Order

(15 分)

3. 選出最佳之答案並解釋您選此答案之理由

- 下列那一種反應器可能有較大的外在質傳阻力 (1) CSTR (2) Fixed Bed Reactor (3) Batch Reactor (4) Fluidized Bed Reactor .
- 一自催化反應其反應速率與產物關係為 (1) 產物愈多則速率愈快 (2) 產物愈少速率愈快 (3) 無關 (4) 隨著產物增加至最高點後逐漸減少 .
- 化學吸附為 (1) 形成共價鍵 (2) 單層吸附 (3) 具電子轉移行為 (4) 以上皆是 .
- 抽煙屬於氧化反應的行為，此反應為 (1) 質傳控制 (2) 化學反應控制 (3) 伴隨著質傳與化學反應控制 (4) 無法判斷 .
- 反應之階數 (reaction order) 愈高則反應速率 (1) 愈快 (2) 愈慢 (3) 在相同濃度下則愈快 (4) 無法判斷 .

(15 分)

4. An ideal gas,  $C_p = (5/2)R$  and  $C_v = (3/2)R$ , is changed from  $P_1 = 1$  bar and  $V_1 = 10\text{m}^3$  to  $P_2 = 10$  bar and  $V_2 = 1\text{m}^3$  by the following mechanically reversible processes:

- Isothermal compression.
- Adiabatic compression followed by cooling at constant pressure.
- Adiabatic compression followed by cooling at constant volume.
- Heating at constant volume followed by cooling at constant pressure.
- Cooling at constant pressure followed by heating at constant volume.

Calculate  $Q$ ,  $W$ ,  $\Delta U$  and  $\Delta H$  for each of these processes (25%).

5. A Carnot heat engine receives  $250\text{ kJ s}^{-1}$  of heat from a heat source reservoir at  $525^\circ\text{C}$  and rejects heat to heat-sink reservoir at  $50^\circ\text{C}$ .

- What are the work developed during the process and the efficiency of the cycle (5%).
- Calculate the change of entropy in the high temperature and low temperature reservoirs (10%).

6. On the basis that  $\Delta G^\circ$  ( $298^\circ\text{K}$ ) for the reaction  $1/2\text{N}_2 + 3/2\text{H}_2 \rightarrow \text{NH}_3$  is  $-16\text{kJ/mol}$ .

- Find the equilibrium constant for the above reaction (5%).
- Find the equilibrium constant for  $\text{NH}_3 \rightarrow 1/2\text{N}_2 + 3/2\text{H}_2$  (5%).