大同大學 101 學年度研究所碩士班入學考試試題

考試科目:熱力與動力　　所別:化學工程研究所　　

註:本次考試 不可以參考自己的書籍及筆記； 不可以使用字典； 可以使用計算器。

Thermodynamics

1. [10%] Which of the followings are correct for a single component system at vapor-liquid equilibrium? (A)$T^V=T^L$ (B)$P^V=P^L$ (C)$\underline{V}^V=\underline{V}^L$ (D)$f^V=f^L$ (E)$\underline{S}^V=\underline{S}^L$

2. [10%] Translate the following terms into Chinese and explain their thermodynamic meanings briefly. 1.1 State Function; 1.2 Isenthalpic Process

3. [10%] Which equation or model will you use to calculate the vapor and liquid phase fugacity of methanol in a mixture of methanol and water at 50°C and 1 atm?

4. [20%] Five moles of an ideal gas undergo an isothermal expansion from state 1 (P_1 = 3 bar, $\underline{V}_1$ = 0.020 m^3/mol) to state 2 (P_2 = 1 bar). Calculate T_2, $\underline{V}_2$, W,ΔH andΔS for the state change, assuming that the ideal gas has a constant C_p of 30 J/(mol-K).

Chemical Reaction Engineering

5. The irreversible liquid phase second order reaction

$$2A \xrightarrow{k_1} B \quad k_1 = 0.03 dm^3/mol \cdot s$$

is carried out in a CSTR. The entering concentration of A, C_{A0}, is 2 molar and the exit concentration of A, C_A is 0.15 molar. The entering and exiting volumetric flow rate, v_o, is constant at 5 dm^3/s. What is the corresponding reactor volume? (10%)

6. The adiabatic exothermic irreversible gas phase reaction

$$\frac{1}{2}A + B \longrightarrow 2C$$

is to be carried out in a flow reactor for a stoichiometric feed of A and B.

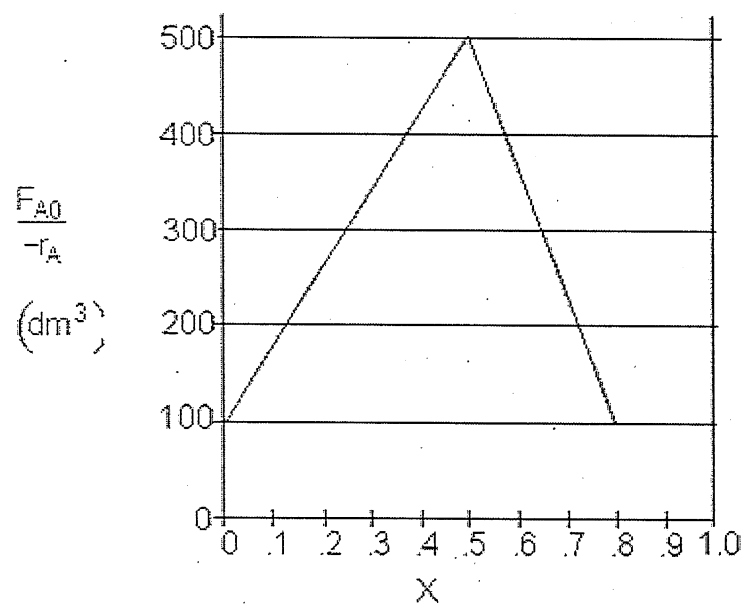

Fig. 6-1

(a) What CSTR volume (V_1 in Fig. 6-2) is necessary to achieve 50% conversion?

(b) What PFR volume (V_2 in Fig. 6-2)must be added to raise the conversion to 80% at the exit of the PFR? (15%)

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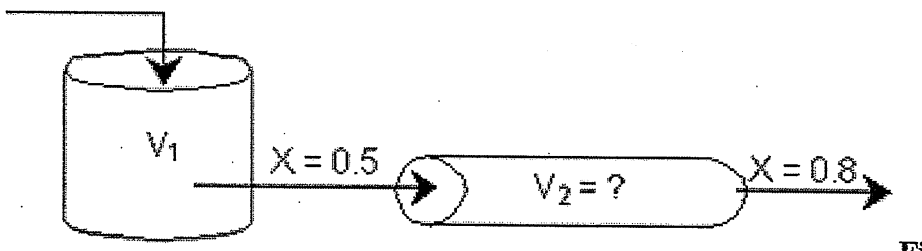

Fig. 6-2

7. Please set up the mole balances for the multiple liquid phase reaction carried out in a plug flow reactor (the entering volumetric flow rate is v_0) (15%)

$A + 2B \rightarrow C$ (1) $\quad -r_{1A} = k_{1A} C_A C_B^2$

$2C + A \rightarrow D$ (2) $\quad -r_{2C} = k_{2C} C_C^2 C_A$

8. Derive the working equation for a plug flow reactor by (1) the macroscopic volume (the general molar balance equation) (2) the differential volume approach. (10%)