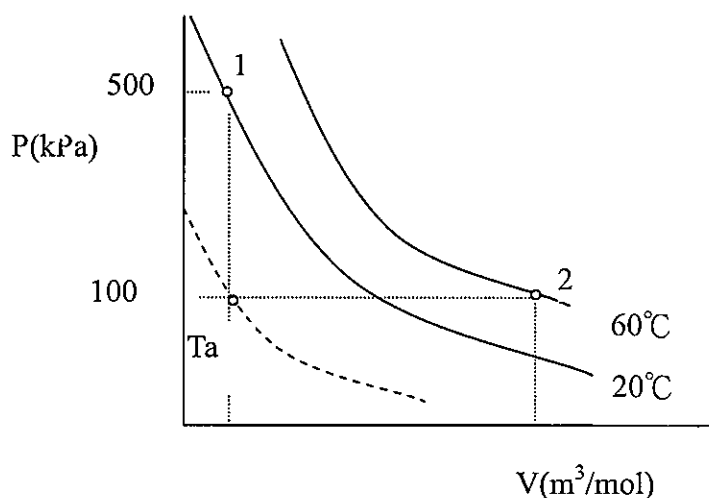


所別： 化工所 組別： 不分組 科目： 化工熱力學與動力學

注意： ☐ 不准 ☐ 一般計算器 ☒ 工程用計算器，考試時間：100 分鐘。試題共 2 頁，第 1 頁

一、化工熱力學

- (20%) Explain the following terms:
 - Reversible and irreversible processes
 - Intensive and extensive variables
 - Excess property
 - Cubic equations of state
- (10%) Pressure 300 bar are measured with a dead-weight gauge. The piston diameter is 3 mm. What is *the approximate mass* in kg of the weights required?
- (10%) The conditions of a gas change in a closed system from 20°C, 500 kPa to 60°C, 100 kPa. Calculate *the heat, work requirements, ΔU and ΔH* of 1 mole of ideal gas for following two steps: cooling at constant volume followed by heating at constant pressure. $C_V = (5/2)R$



- (10%) A rigid vessel of 24.9 liters volume contains an ideal gas, $C_V = (5/2)R$, at 300 K and 1 bar. If heat in the amount of 15000 J is transferred to the gas, determine its *entropy change*.

～背面尚有試題～

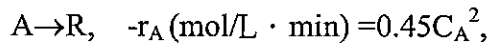
二、動力學

(一)、解釋名詞 (10%):

(1)Space time (τ) , (2)The rate equation , (3)The reaction order (n) , (4)Damkohler number (Da) , (5)Recycle reactor , (6)M-M mechanism , (7)Heterogeneous reaction , (8)Autocatalytic reaction , (9)Expansion factor (ϵ) , (10)Non-elementary reaction

(二)、計算題 (40%):

1. (10%) A homogeneous liquid reaction

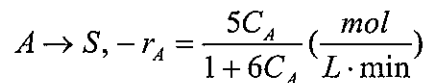


takes place with 80% conversion in a mixed reactor(CSTR), $C_{A0} = 2.0 \text{ mol/L}$.

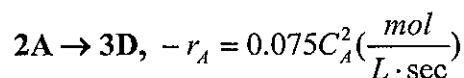
(a). What will be the conversion if this reactor is replaced by another CSTR 5 times as large and everything else unchanged?

(b). What will be the conversion if this reactor is replaced by a plug flow reactor of the same size and everything else unchanged?

2. (10%) At a given enzyme concentration in the aqueous feed stream (25 L/min), find the volume of plug flow reactor (PFR) needed for 75% conversion of reactant A ($C_{A0} = 2 \text{ M}$). The kinetics of the reaction are given by



3. (10%) A gaseous feed of pure A (1 mol/L) enters a mixed flow reactor (2 L) and reacts as follows:



Find what feed rate (L/min) will give an outlet concentration $C_A = 0.5 \text{ mol/L}$.

4. (10%) The reaction $A \rightarrow B$, $r = kC_A^{0.8}$ occurs in a reactor with 85% conversion. If $k = 0.59 \text{ min}^{-0.2}$, $C_{A0} = 2.5 \text{ M}$, $V_0 = 100 \text{ L/h}$, what residence time and reactor volume will be required? (a) in CSTR, (b) in PFR.