系組：化材系甲丙組

准考證號碼：□□□□□□

（請考生自行填寫）

科目： 反應工程學

注意事項	一、 請先檢查<u>准考證號碼</u>、<u>報考系(組)別</u>、<u>考試科目名稱</u>，確定無誤後再作答。 二、 所有答案應寫於答案紙上，否則不予計分。 三、 作答時應依試題題號，依序由上而下書寫，作答及未作答之題號均應抄寫。

1. The first-order reaction A $\rightarrow$ B is carried out in a PFR with a constant flow rate v.

    (a) Write down the equation relating the reactor volume V to the entering and exiting concentration of A (C_{A0} and C_A), the rate constant k, and v. (10%)

    (b) Determine the reactor volume required to achieve a conversion of C_{A0} ($v = 10$ L/min, $k = 0.23$ min^{-1}). (10%)

2. The elementary liquid-phase reaction:

    $$A+2B \rightleftharpoons R$$

    with rate equation $\quad -r_A = -2r_B = (12.5 \text{ litter}^2/\text{mol}^2 \cdot \text{min})C_A C_B^2 - (1.5\text{min}^{-1})C_R \quad [\text{mol/liter} \cdot \text{min}]$

    is to take place in a 6-liter steady-state mixed flow reactor. Two feed streams, one containing 2.8 mol A/liter and the other containing 1.6 mol B/liter, are to be introduced at equal volumetric flow rate into the reactor, and 80% conversion of limiting component is desired. What should be the flow rate of each stream? Assume a constant density throughout. (20%)

    C'$_{AO}$ = 2.8 mol A/liter

    C'$_{BO}$ = 1.6 mol B/liter

    $v_A = v_B = v$

    V = 6 liter
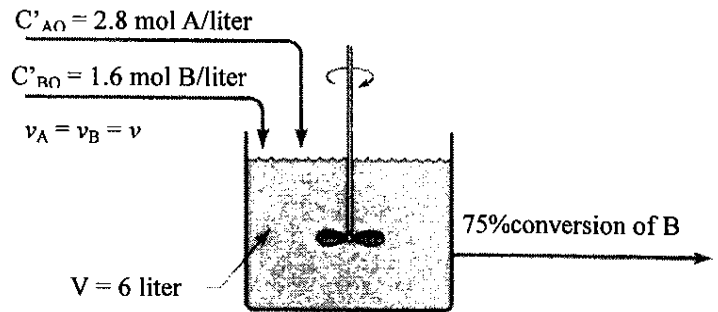
    75%conversion of B

3. A homogeneous gas reaction A $\longrightarrow$ 3R has a reported rate at 215℃

    $$-r_A = 10^{-2}C_A^{1/2} \quad [\text{mol/liter} \cdot \text{sec}]$$

    Use the graphical integration method to find the space time needed for 80% conversion of a 50%A-50%inert feed to a plug flow reactor operating at 215℃ and 5 atm (C_{A0}=0.00625 mol/litter). (20%)

    A$_{(g)}$ → 3R$_{(g)}$

    50%A – 50% I

    215 ℃

    5 atm

    X$_A$ = 0.8

    t =?
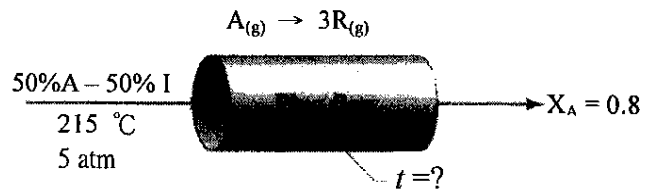
（!請注意，背面還有題目!）

4. (a) 請寫下速率常數之阿忍尼斯方程式(Arrhenius equation)，並解釋各項意義。(7%)
   (b) 某生以化學氣相沉積法製備奈米碳管，得到下列數據，請做出 Arrhenius 圖，並解釋數據是否符合阿忍尼斯方程式。 (7%)

Temperature (°C)	Growth rate (m/min)
600	0.4
650	1.2
700	3.0
750	5.0

5. (a) 請比較連續攪拌反應器(CSTR)、栓流反應器(PFR)、及批次(Batch)反應器三者之異同。(7%)
   (b) 填充床觸媒反應器(Packed-bed catalytic reactor)可採用上述哪種理想反應器來近似? (7%)

6. PH_3 的均勻分解反應為

$$4PH_{3(g)} \longrightarrow P_{4(g)} + 6H_{2(g)}$$

在 1200 °F 下進行，其為一階反應，即

$$-r_{PH3} = (10/hr)C_{PH3}$$

一在 1200°F 和 4.6 atm 下操作的塞流反應器，進料為 4 lb-mole PH_3/hr，反應後轉化率達 80%，則其所需反應器大小為何? (註：氣體常數為 0.729 ft^3 · atm/lb-mole · °R) (12%)