※ 考生請注意．本題 ☑可 □不可 使用計算機

1. Experimental data are collected from decomposition of A. Determine the reaction order and rate constant in proper units. The answer directly from solving simultaneous equations is not acceptable and the attached graph is applicable. (9 points)

Run	Reaction rate (mol/liter·s)	Concentration of A (mol/liter)
1	0.05	0.1
2	0.41	0.5
3	1.60	1.0
4	4.00	2.0
5	12.1	4.0

2. Two metal tubes in series are used to carry out gas-phase reaction $A \rightarrow B + C$ isothermally without pressure drop. The reaction rate constant at 50°C is 10^{-4} min^{-1}, and the activation energy is 85 kJ/mole. Pure A enters the first tube at 10 atm and 127°C and a molar flow rate of 2.5 mol/min. Calculate the volume of the second tube if the conversions from the first and second tubes are 20% and 90%, respectively. (25 points)

3. For the elementary liquid phase reaction $A \xrightarrow{k_1} B \xrightarrow{k_1} C$ in a CSTR with feed contains only A, please derive and plot: (1) concentration profile of B and (2) selectivity of B to C, as functions of space time τ in a CSTR. (3) How do you determine the feed flow rate v_0 in order to maximize the selectivity of B to C? [18 points, part 1, 2, and 3 are worth 6, 8, and 4 points, respectively]

4. The elementary irreversible reaction $A \rightarrow B$ was carried out in a packed bed reactor. The following profiles were obtained when pure A was fed to the reactor.

   (1) Is it possible that this reaction was carried out adiabatically? Please state your reasons in detail. (7 points)
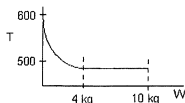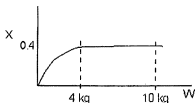
（背面仍有題目,請繼續作答）

系所組別　化學工程學系甲組
考試科目　化學反應工程　　　　　　　　　　　　　　　　　　　　　考試日期，0307　節次：3

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(2) If this reaction was carried out adiabatically, and inerts were added to the reactor system while T_0, P_0, and n_0 were kept constant. Please derive and sketch the exit conversion as a function of the θ_I ($\theta_I = F_{I0}/F_{A0}$). (8 points)

5. (a) 請舉出觸媒二個最重要的物理性質，並說明它們在催化反應中的重要性。（6分）

   (b) 請說明使用擔體 (support) 的優點。以 Pt/Al_2O_3 為例，說明製備金屬擔體觸媒的方法和步驟。（9分）

6. (a) A reaction, $A \rightarrow R$, proceeds with heterogeneous catalysis. The reaction mechanism is

$$A + S \xrightarrow{\ k_1\ } (A \cdot S)^*$$

$$(A \cdot S)^* \xrightarrow{\ k_2\ } A + S$$

$$(A \cdot S)^* \xrightarrow{\ k_3\ } R + S$$
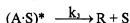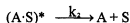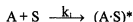
   where S is the surface site and $(A \cdot S)^*$ is the intermediate species on the solid surface. The total number of surface sites is fixed, with a constraint of $[S_0] = [S] + [(A \cdot S)^*]$ = total site concentration = constant. Obviously, desorption of the product R from the surface is fast and this step is not shown in the mechanism. Please derive the rate law for $-r_A$ in terms of [A] and $[S_0]$. (12 分)

   (b) 已知 $A + B \rightarrow D + E$ 是依 Eley-Rideal 反應機構進行，且知 A 會被吸附 (分子吸附)，表面反應為速率決定步驟，D 為分子吸附，試寫出反應機構。（6分）