本試題是否可以使用計算機：□可使用 ，☑不可使用 （請命題老師勾選）

1. A sequential isomerization reaction, $A \xrightarrow{k_1} B \xrightarrow{k_2} C$, is being studied in a series combination of two CSTRs. Each of these reactors has a volume of 2 liters. Liquid is being fed to the first reactor at a rate of 1.5 liter/min. This liquid contains only pure A and the solvent. The inlet concentration of A is 2 g moles/liter. Under the conditions of operation, $k_1 = 0.5\,\text{min}^{-1}$ and $k_2 = 0.3\,\text{min}^{-1}$. Both reactors operation at the same temperature. What is the composition of the effluent from (a) the first reactor and (b) the second reactor? (12%)

2. A reversible isomerization reaction, $A \leftrightarrow B$, takes place over a supported metal catalyst. The reaction is elementary. A and B are liquid, miscible and of nearly identical density; the equilibrium constant for the reaction (in concentration unit) is 7.0. In a plug flow reactor, a feed of pure A undergoes a net conversion to B of 30 %. If a second, identical flow reactor at the same temperature is placed downstream from the first, what is the overall conversion of A if:
   (a) The reactors are directly connected in series? (9%)
   (b) The products from the first reactor are separated by appropriated processing and only the unconverted A is fed to the second reactor? (12%)

3. In a competitive inhibitive bioreaction, and inhibitor (I) adsorbs on the same type of site as the substrate (S). The resulting inhibitor-enzyme (E·I) complex is inactive. (25%)
   (a) Derive the rate law in a simplified forms (i.e. you may group two or more constants into a constant).
   (b) Sketch a diagram to show the relationship between the reaction rate and the concentration of substrate.
   (c) Describe an experimental method to find the typical constants in the rate law.

$$E + S \underset{k_2}{\overset{k_1}{\rightleftharpoons}} E\bullet S$$

$$E + I \underset{K_4}{\overset{K_3}{\rightleftharpoons}} E\bullet I$$

$$E\bullet S \xrightarrow{K_5} E + P$$

4. A reversible exothermic reaction needs to be carried out in continuous-stirred tank reactors. The heat of reaction should be managed. (9%)
   (1) Explain the importance in temperature controlling.
   (2) Raise three practical methods to do this job, and explain how it works.

（背面仍有題目，請繼續作答）

5. Please propose a method for the deposition of **uniform** thin films on the surface of deep grooves with an aspect ratio larger than 10 on semiconductor devices. The aspect ratio is defined as the ratio of the depth of the groove to the opening of the groove.
   Without using the method as you just proposed, what problems will happen to the coating of thin films inside the groove surface? Usually, to fabricate the high quality semiconductor devices, we need to coat a continuous thin film all over the groove surface (including surface and the bottom of the groove). Please consider the effects of the diffusion inside the groove and the reaction of gas reactants reacted on the groove surface to deposit a thin film. In other words, you have to consider the effect of concentration gradient. (12%)

6. For a solid bed catalytic reactor, compare the effects of internal and external mass transfer and heat transfer between the gas and the liquid reactants. (6 %)

7. (a) What are the three components usually used in the supported catalysts? (5%)
   (b) How to measure the pore size distribution of the solid? Please give one example. (5%)
   (c) What is the coking of the catalyst? How does it occur? (5%)