

國立臺北科技大學九十九學年度碩士班招生考試

系所組別：3510 化學工程研究所甲組

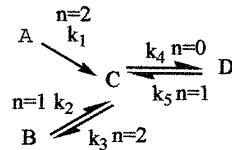
第二節 化工熱力學與反應工程 試題

第一頁 共二頁

注意事項：

1. 本試題共八題，配分共 100 分。
2. 請標明大題、子題編號作答，不必抄題。
3. 全部答案均須在答案卷之答案欄內作答，否則不予計分。

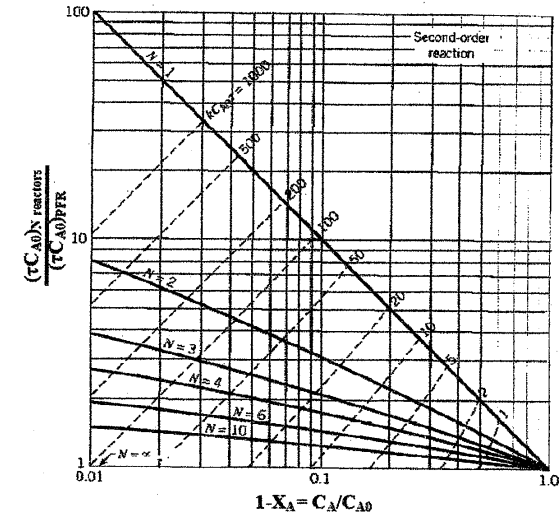
一、Write the rate equation of C and D for the following reactions, where k is reaction rate constant and n is the reaction order. (10%)



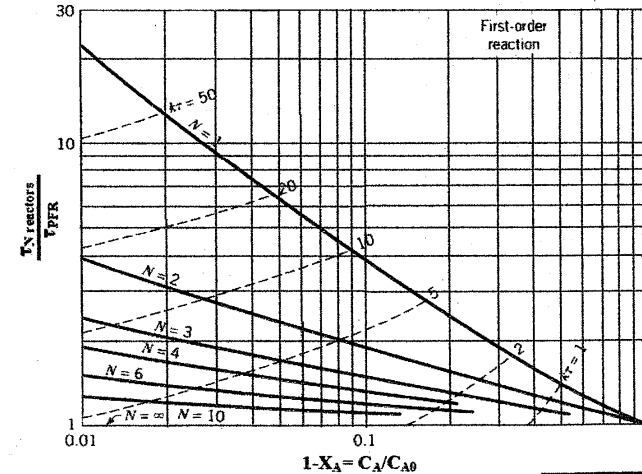
二、Given a gaseous feed, $T_0=400$ K, $\pi_0=4$ atm, $C_{A0}=100$ mmol/L, $C_{B0}=200$ mmol/L, $A+B \rightarrow 2R$, $T=300$ K, $\pi=3$ atm, $C_A=20$ mmol/L. Find X_A , X_B , C_B . (15%)

三、At present 80% of reactant A is converted into product by a second-order reaction in a single mixed flow reactor. We plan to place another two reactors similar to the one being used in series with it.

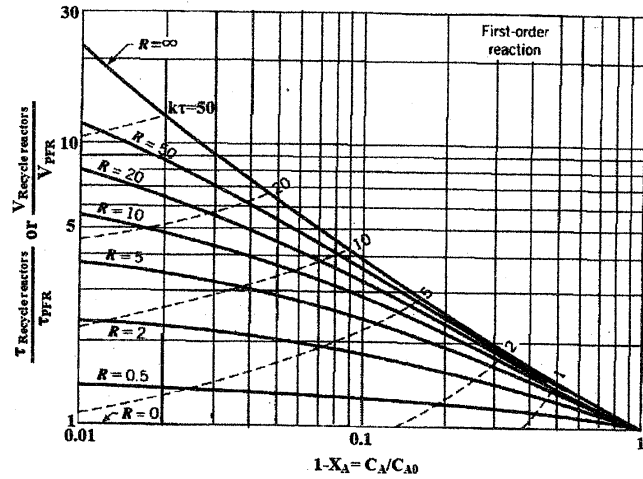
- (1) For the same treatment rates as that used at present, how will this addition affect the conversion of reactant? (5%)
 - (2) For the same 80% conversion, by how much can the treatment rate be increased? (5%)
- Note: Please provide the detail explanation on how to derive the answer from the provided figure. Without any explanation, no points will be given.



- 四、For a first order reaction, (1) what is the volume ratio of mixed flow reactor to plug flow reactor as $k\tau=10$? (5%)
- (2) What is the conversion for a plug flow reactor with recycle ratio $R=2$ as $k\tau=10$? (5%)
- (3) The recycle reactor is a convenient way for approaching mixed flow reactor. If two same mixed flow reactors in series can get a product with 90% conversion. How to use a plug flow reactor with recycle to get the equal performance? (5%)
- Note: Please provide the detail explanation on how to derive the answer from the provided figures. Without any explanation, no points will be given.



注意：背面尚有試題



五、A valve on an evacuated insulated tank is opened. Air (an ideal gas) rushes in and the pressure equalizes. The valve is then quickly closed. What is the temperature of the gas in the tank if room temperature is 27 °C and pressure is 1 bar? Assume the process occurs adiabatically and $c_p=29.1 \text{ J/mol.K}$ at all temperature. (10%)

六、Find ΔS (entropy change) when 10 kg of liquid water at 0 °C is frozen at 0 °C.
Note: the latent heat (heat of fusion) of ice is 333kJ/kg. (10%)

七、A 2 liter plastic pop bottle contains air at 300 K and 11.5 bar gauge pressure. (1) How much work could be done by this gas (ideal) if you could expand it down to 1 bar isothermally and reversibly? (7%)(2) However, in doing so the gas had to push back the 1 bar atmosphere. Let us now account for this work, subtract it from the work done, and thereby evaluate the useful work (shaft work) that could be extracted by this with isothermal expansion.(8%)

八、100 kg of water at 100 °C furnishes heat to a Carnot engine that discards heat to a large sink at 0 °C. The process continues, the 100 °C water cools and finally ends up at 0 °C. Calculate the maximum amount of work obtainable. (15%)