Code No: OR320853 **OR**

III B.Tech II Semester Supplementary Examinations, April/May 2005
CHEMICAL REACTION ENGINEERING-I
(Chemical Engineering)

Time: 3 hours **Max Marks: 70**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Define reaction rate constant. Develop an expression that facilitates calculation of units of rate constant for any order.

   (b) Determine equilibrium conversion of A at 373oK for the following aqueous reaction.

   $A \underset{k_2}{\overset{k_1}{\rightleftharpoons}} R$ ΔGo = -3375 K cal/K mole

   ΔH_r^o = -18,000 K cal/K mole

   Assume specific heats of all solutions are equal to that of water.

2. (a) A first order gaseous reaction A $\rightarrow$ 2R + S takes place isothermally in a constant pressure experimental reactor. Starting with a mixture of 75% A and 25% inerts the volume doubles in 8 minutes. What is the conversion achieved?

   (b) Write a note on excess reactant and stoichiometric proportion methods.

3. (a) Explain the psendo steady state hypotnesis

   (b) If the following mechanism is proposed

   $A + B \underset{k_2}{\overset{k_1}{\rightleftharpoons}} X$

   $A + X \xrightarrow{K_3} R$

   For the reaction 2A + B $\rightarrow$ R, show that the rate of formation is one half of the rate of disappearance of A.

4. The homogeneous gas reaction A $\rightarrow$ 3 R follows second order kinetics. For a feed rate of $4m^3/hr$ of pure A at 5 atm and 350^0C, an experimental reactor consisting of 0.025 m I.D. pipe and 2 m long gives 60 % conversion of feed. A commercial plant is to treat 300 m^3/hr of feed at 25 atm and 350^0C to obtain 80% conversion of A. Find out the required volume of the reactor.

5. From steady-state kinetics runs in a mixed flow reactor, we obtain the following data on the reaction A $\rightarrow$ R.

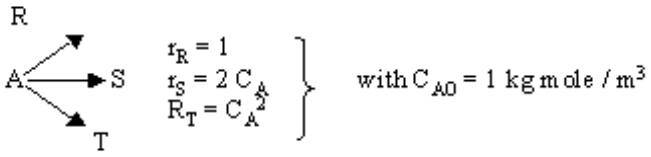
t, sec	C_{AO}, mmol/liter	C_A, mmol/liter
60	50	20
35	100	40
11	100	60
20	200	80
11	200	100

Find the space time needed to treat a feed of $C_{AO} = 100 mmol/litre$ to 80% conversion.

(a) In a plug flow reactor

(b) In a mixed flow reactor.

6. For the parallel decomposition of A, where R is desired



What is the maximum CR we may expect in isothermal operations

(a) in a mixed flow reactor

(b) in a plug flow reactor

7. For the elementary liquid phase reaction, A $\rightleftharpoons$ B determine the adiabatic equilibrium temperature and conversion when pure A is fed to the reactor at $300^0 K$. The heat of reaction at $298^0 K$ is -20000cal/mol. The heat capacities of A and B may be taken as 50 cal/mol.0K and the equilibrium constant at $298^0 K$ as 100000.

8. Write detailed notes on:

(a) Integral and differential methods

(b) Total volume and total pressure methods.

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