Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VII • EXAMINATION – WINTER 2013

Subject Code: 172602 **Date: 05-12-2013**

Subject Name: Polymer Kinetics

Time: 10.30 am - 01.00 pm **Total Marks: 70**

Instructions:

1. **Attempt all questions. 2. Write the answers to the points.**
3. **Make suitable assumptions wherever necessary.**
4. **Figures to the right indicate full marks.**

Q. 1 (a) Give the psedosteady state hypothesis. The irreversible reaction A+B=AB has been studied kinetically and rate of formation of product has been found to be well correlated by the following rate equation: $r_{AB} = kC_B^2$…. Independent of C_A, What reaction mechanism is suggested by this rate expression if the chemistry of the reaction suggests that the intermediate consists of an association of reactant molecules and that a chain reaction does not occur? **07**

Q. 1 (b) Answer the following

i Compare the collision theory with transition state theory. **05**

ii Define the following terms: (i) Rate Constant (ii) Transition Complex **02**

Q. 2 (a) Develop the general expression which relates the changing total pressure P to the changing concentration or partial pressure of any reaction components, for given initial conditions and any reaction stoichiometry. **07**

Q. 2 (b) Answer the following

i Write down the step wise procedure for analyzing the complete rate equation by differential method. **05**

ii Which points are taken in account before the kinetic study of heterogeneous reaction system? **02**

OR

Q. 2 (b) Answer the following

i Write down the general procedure of analyzing the kinetic data by integral method. **05**

ii Draw any two ideal contacting patterns for two flowing fluids for heterogeneous reaction system. **02**

Q. 3 (a) Pure gaseous A at about 3 atmosphere and 30°C (120 millimole/liter) is fed into a liter mixed flow reactor at various flow rate. There it decomposes and exit concentration of A is measured for each flow rate. From the following data find the rate equation to represent the kinetics of the decomposition of A. Assume that reactant A alone affects the rate. Reaction is A→3R **07**

ν_0 (liter/Min)	0.06	0.48	1.5	8.1
C_A (millimole/liter)	30	60	80	105

Q. 3 (b) Answer the following

i A reaction A→B occurs in plug flow tubular reactor with 90% conversion. If $k=0.5 min^{-1}$, C_{A0} = 2moles/liter and ν_0= 4 liters/min, what residence time and reactor volume will be required? **05**

ii The rate constant of zero order reaction is 0.2 mole/liter*hour. What will be the initial concentration of the reactant if, after an hour, its concentration is 0.05 mole/liter? **02**

OR

Q. 3 (a) Derive the first order rate equation of ideal plug flow reactor for constant volume and variable volume system respectively. **07**

Q. 3 (b) Answer the following

i A zero order homogeneous gas reaction A→ rR proceeds in constant volume bomb, 20% inert and pressure rises from 1to1.3 atmosphere in 2 minutes. If the same reaction takes place in a constant pressure batch reactor, what is the fractional volume change in 4 minutes, if the feed is at 3 atmospheres and consists of 40% inert? **05**

ii For the gas phase reaction at 350K, the rate is reported as: $-dP_A/dt = 3.55P_A^2$ Atmosphere/hour. What is the value and the unit of rate constant? **02**

Q. 4 (a) Discuss in detail about the polymerization reactors with their characteristics which are different from other reactors. Also list the reactors which are preferred for polymerization. **07**

Q. 4 (b) Answer the following

i Write a note on ceiling temperature. **04**

ii Explain the term kinetic chain length with its equations. **03**

OR

Q. 4 (a) Discuss the kinetics of free radical polymerization reactions. **07**

Q. 4 (b) Answer the following

i What do you mean by mayo equation? Also explain its applications. **04**

ii Explain the telomerization with suitable example. **03**

Q. 5 (a) Discuss in detail about the sedimentation velocity method to determine the molecular weight. **07**

Q. 5 (b) Answer the following

i If the polymer sample has population as: **04**

No. of molecules	10	20	20	25
Mass of each molecule	5,000	7,500	10,000	15,000

Calculate the number average and weight average molecular weight respectively.

ii Which assumptions are made to find out the degree of polymerization in case of kinetics of anionic polymerization? **03**

OR

Q. 5 (a) Give the name of the method which is used to determine the viscosity average molecular weight and discuss that method in detail. **07**

Q. 5 (b) Answer the following

i Calculate the number average molecular weight and weight average molecular weight respectively for a polymer mixture of following amount of fractions (with respective molecular weights given in parenthesis). 1gm (20,000), 2grams (50,000) and 0.5 grams (1,00,000) . **04**

ii Which principles are adopted to achieve the narrow composition distribution in commercial copolymerization? **03**

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