GUJARAT TECHNOLOGICAL UNIVERSITY BE - SEMESTER-VII • EXAMINATION – SUMMER 2013

Subject Code: 172602

Date: 24-05-2013

Subject Name: Polymer Kinetics

Total Marks: 70

Instructions: 1. Attempt all questions.

Time: 02.30 pm - 05.00 pm

- Attempt an questions.
 Make suitable assumptions wherever necessary.
- 3. Figures to the right indicate full marks.
- Q.1 (a) Which is temperature dependent term in the reaction rate? Write in brief 07 about the collision theory of temperature dependency on rate of reaction.
- Q.1 (b) Answer the following
 - i Explain the elementary reaction and non-elementary reaction respectively 04 with suitable examples.
 - ii Explain the classification of reactors according to variations in the process 03 variables with time.
- Q.2 (a) Discuss the factors affecting the rate of reaction. 07
- Q.2 (b) At 400°K, the rate of bimolecular reaction is ten times the rate at 300°K. 07 Find the activation energy of this reaction: (a) From Arrhenius law (b) From collision theory (c) What is the percentage difference in the rate of reaction at 500°K predicted by these two methods?

OR

- Q.2 (b) What do you mean by pseudo steady state hypothesis? Experiment shows 07 that homogeneous decomposition of ozone proceeds with rate $-r_{O3} = k^*[O_3]^{2*}[O2]^{-1}$. What is the overall order of reaction? Suggest two step mechanism to explain this rate and state how you could further test this mechanism.
- Q.3 (a) Derive the integral rate expression for bimolecular type second order 07 reaction $A + B \rightarrow$ products for constant volume batch reactor.
- **Q.3** (b) Answer the following
 - i One liter/min of liquid containing A and B(C_{A0} =0.10mole/liter, 05 C_{B0} =0.01mole/liter) flow into mixed reactor of volume V=1liter. The materials react in such a manner for which stoichiometry is unknown. The outlet stream from the reactor contains A, B and C (C_{Af} =0.02mole/liter, C_{Bf} =0.03mole/liter, C_{Cf} =0.04mole/liter). Find the rate of reaction of A, B and C for the conditions within the reactor.
 - ii Define the following terms: (i) space time (ii) space velocity 02

OR

- Q.3 (a) Derive the performance equation for ideal plug flow reactor. 07
- Q.3 (b) The homogeneous gas decomposition of phophine $4PH_{3(g)} \rightarrow P_{4(g)} + 6H_2$ 07 (g) proceeds at 1400°F with first order rate $-r_{PH3} = (10/hr) C_{PH3}$. What size of plug flow reactor operating at 1400°F and 5 atm can proceed 80% conversion of feed consisting of 4 lb-mole of pure phophine per hour?

РТО..

- 0.4 Answer the following **(b)**
 - Which conclusions can be drawn regarding to kinetics of free radical 04 i polymerization?
 - Normally solvents are used as good chain transfer agent-justify this ii 03 statement with suitable example.

OR

- Derive the mathematical expression for kinetics of non-catalyzed Q.4 06 **(a)** polycondensation reaction. Also show its relationship with number average degree of polymerization.
- Q.4 **(b)** Answer the following
 - Which principles are adopted to achieve the narrow composition 05 i distribution in case of copolymerization? 03
 - Write a brief note on chain modifier. ii
- Q.5 Which method is used to determine the viscosity average molecular 07 **(a)** weight? Discuss that method.
- Q.5 Answer the following **(b)**
 - Equal number of molecules with $M_1=10,000$ and $M_2=1,00,000$ are mixed. 04 i Calculate number average, weight average and z-average molecular weight.
 - Write a brief note on the ceiling temperature. ii 03

OR

- Q.5 Discuss the ultracentrifugation method to determine the molecular weight. 07 **(a)**
- Q.5 **(b)** Answer the following
 - Equal mass of polymer molecules with M₁=10,000 and M₂=1,00,000 are 04 i mixed. Calculate the number average and weight average molecular weight respectively.
 - ii What do you mean by kinetic chain length? Give its relationship with 03 degree of polymerization.
