Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VII(NEW) • EXAMINATION – WINTER 2016

Subject Code:2172602 **Date:21/11/2016**

Subject Name:Polymer Kinetics

Time:10.30 AM to 1.00 PM **Total Marks: 70**

Instructions:

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

Q.1 (a) Discuss in detail about the factors affecting the rate of reaction. **07**

Q.1 (b) For the gas phase decomposition of azomethane $(CH_3)_2N_2 \rightarrow C_2H_6 + N_2$, the rate expression is $r_{N2} = K_1[AZO]^2/ 1 + K'[AZO]$, where AZO = azomethane. Devise a mechanism to explain this rate. **07**

Q.2 (a) Derive a temperature dependency of rate constant from collision theory. **07**

Q.2 (b) Answer the following

i The activation energy of nimolecular reaction is about 9159 cal./mole. How much faster is this reaction takes place at 500K than 400K? **03**

ii Differentiate the molecularity and order of reaction. **04**

OR

Q.2 (b) Answer the following

i The pyrolysis of ethane proceeds with an activation energy about 75,000 calories. How much faster is the decomposition at 650°C than 500°C? **03**

ii Explain the elementary and non-elementary reactions with suitable examples. **04**

Q.3 (a) A mixed flow reaction is being used to determine the kinetics of reaction whose stoichiometry is A→R. For this purpose various flow rates of an aqueous solution of 100millimoleA/liter are fed to a one liter reactor and for each run the outlet concentration of A is measured. Fine the rate equation to represent the following data. Also assume that reactant alone affect the rate. **07**

ν, Liter/Minute	1	6	24
C_A, Millimoe/Liter	4	20	50

Q.3 (b) Answer the following

i Define the given terms: (i) Space Time (ii) Space Velocity **02**

ii A polymerization reaction occurs at constant temperature in homogeneous phase, 30% of monomer reacts in 40 minutes. For initial monomer concentration of 0.3, 0.5 and 0.9 mole/liter, find the reaction rate. **05**

OR

Q.3 (a) At 650°C phosphine vapour decomposes as follows, $4PH_3 \rightarrow P_{4(g)} + 6_{H2(g)}$, $-r_{pho} = (10hr^{-1})$[phosphine]. What size of plug flow reactor operating at 649°C and 11.4 atmosphere is needed for 75% conversion of 10mole/hour of phosphine in a 2/3, phosphine, 1/3 inert in the feed? **07**

Q.3 (b) Following results are obtained for the decomposition of nitrous oxide in contact with the gold surface at 900°C **07**

Time(Minutes)	15	30	45	65	80
$\%N_2O$ decomposed	17	32	44.5	57	65

Show that order of the reaction is unity.

PTO..

Q.4	**(a)**	Discuss in detail about the kinetics of free radical polymerisation.	**07**
Q.4	**(b)**	Answer the following	
	i	Write a brief note on ceiling temperature.	**03**
	ii	Which principles are adopted to achieve narrow composition distribution in commercial copolymerization?	**04**

OR

Q.4	**(a)**	Discuss in detail about the kinetics of free radical copolymerisation.	**07**
Q.4	**(b)**	Answer the following	
	i	Write a brief note on chain modifier.	**03**
	ii	Which methods are used to determine the reactivity ratio? Explain any one.	**04**
Q.5	**(a)**	Write shot note on the polymerization reactors. How they differ from chemical reactors?	**07**
Q.5	**(b)**	Answer the following	
	i	Write down the formula to calculate the viscosity average molecular weight and Z-average molecular weight.	**03**
	ii	Fraction of butadiene repeat units f_{Bu}=0.30 and fraction of acrylonitrile repeat units f_{Ac}=0.70. Degree of polymerization is 2000. Calculate the number average molecular weight of random nitrile rubber.	**04**

OR

Q.5	**(a)**	Give the name of the method which is used to determine the viscosity average molecular weight. Discuss it in detail.	**07**
Q.5	**(b)**	Answer the following	
	i	Explain the term ‘kinetic chain length’.	**02**
	ii	What do you mean by talogens? With the reaction chemistry, explain the telomerisation.	**05**

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