Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VII • EXAMINATION – SUMMER • 2015

Subject code: 172602 **Date: 08/05/2015**

Subject Name: Polymer Kinetics

Time: 02.30pm-05.00pm **Total Marks: 70**

Instructions:

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

Q.1	**(a)**	Write about temperature dependent term in reaction rate. Explain Arrhenius theory of temperature dependency on reaction rate.	**07**
Q.1	**(b)**	Answer the following	
	i	List the factors affecting the rate of reaction. Explain any two.	**04**
	ii	Give the classification of multiple reaction with suitable example.	**03**
Q.2	**(a)**	The irreversible reaction $2A+B=A_2B$ has been studied kinetically and rate of formation of product has been found to be well correlated by the following rate equation: $r_{A2B}=0.72C_A*C_B/\ 1+2\ C_A$. What reaction mechanism is suggested by this rate expression, if the chemistry of reaction suggests that intermediate consists of an association of reactant molecules and chain reaction does not occur?	**07**
Q.2	**(b)**	Answer the following	
	i	Explain kinetic view of equilibrium for elementary reaction.	**04**
	ii	Explain the term molecularity with suitable example.	**03**
		OR	
Q.2	**(b)**	Answer the following	
	i	Define the term half life of reaction. Derive equation of half life for n^{th} order reaction.	**04**
	ii	Explain the term order of reaction with suitable example.	**03**
Q.3	**(a)**	The gas reaction $2A\rightarrow R+2S$ is approximately second order with respect to A. When pure A is introduced at 1 atmosphere into constant volume batch reactor, the pressure rises 40% in 3 minutes. For a constant pressure batch reactor find (i) Time required for the same conversion (ii) The fractional increase in volume at the same time.	**07**
Q.3	**(b)**	For variable volume second order irreversible reaction $A+B\rightarrow$ Product with equimolar feed takes place in ideal plug flow reactor (PFR). Derive its performance equation.	**07**
		OR	
Q.3	**(a)**	For second order reaction type $A+B\rightarrow$ Products, develop integral rate expression.	**07**
Q.3	**(b)**	The homogeneous gas decomposition of phosphine $4PH_3(g)\rightarrow P_4(g)+6H_2$ proceeds at 1200°F with first order rate $-r_{PH3}=(10/hr)C_{PH3}$, What size of plug flow reactor operating at 1200°F and 4.6atm can produce 80% conversion of feed consisting of 4 lb-mol of pure phophine per hour?	**07**

Q.4	**(a)**	Discuss the characteristic features of polymerization reactor which are different from conventional reactor reactors? Which reactors are suitable as polymerization reactors?	**07**
Q.4	**(b)**	Answer the following	
	i	Which principles are adopted to achieve narrow composition distribution in case of copolymerization?	**05**
	ii	What do you mean by chain transfer consatant? On which parameters it depends?	**02**
		OR	
Q.4	**(a)**	Derive copolymer equation by following the kinetics of free radical polymerization.	**07**
Q.4	**(b)**	Answer the following	
	i	Give the relationship between degree of polymerization and kinetic chain length. Discuss the variables affecting degree of polymerization and extent of conversion respectively in case of free radical polymerization.	**05**
	ii	What do you mean by chain modifier? Which chain modifier is used for industrial production of Styrene Butadiene Rubber (SBR)?	**02**
Q.5	**(a)**	How polymer molecular weight determination is carried out by light scattering methd?	**07**
Q.5	**(b)**	Discuss the kinetics of cationic polymerization.	**07**
		OR	
Q.5	**(a)**	How polymer molecular weight determination is carried out by viscometry method?	**07**
Q.5	**(b)**	Discuss the kinetics of anionic polymerization.	**07**

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