

T.E. -V Sem- Chemical
Chemical Reaction Engineering

01/12/15

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TE/V/CBGS/CHEM/CRE-I
Q.P. Code : 5665

(3 Hours)

[Total Marks : 80]

- a Question no 1 is compulsory
b Attempt any three questions from remaining five questions
c Assume suitable data if needed & justify

- Q1 a. What is Optimum Temperature progression? Explain with respect to different types of reactors. 10
- Q1 b. Differentiate Elementary vs Nonelementary Reaction? 03
- Q1 c. Write down the performance equation for recycle reactor? 02
- Q1 d. The activation energy of a biomolecular reaction is about 9150 cal/mol. How much faster is this reaction at 500K than at 400K. 05
- Q2 a. The reaction between CO and NO₂ at low temperatures proceeds with a rate

$$-r_{O_2} = k \cdot [NO_2]^2$$
 Suggest mechanism. 12
- Q2 b. In case of a first order reaction, show that the time required for 75% conversion is double the time required for 50% conversion in a batch reactor. 08
- Q3 a. Calculate the first order rate constant for the disappearance of A as per the gas phase reaction $A \rightarrow 1.6A$ if the volume of reaction mixture, starting with pure A, increases by 50% in 4 minutes. The total pressure of the system remains constant at 1.2 atm and the temperature is 25 deg C. 08

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- Q3 b. The initial rate of the reaction $2A + 2B \rightarrow C + D$ is determined for different initial conditions, with the results listed in the following table: 12

Run	[A] ₀ , M	[B] ₀ , M	Initial rate, M/s
1	0.185	0.133	3.35×10^{-4}
2	0.185	0.266	1.35×10^{-3}
3	0.370	0.133	6.75×10^{-4}
4	0.370	0.266	2.70×10^{-3}

Find the rate law and rate constant for this reaction.

- Q4 From steady state kinetic runs in a mixed flow reactor, we obtain the following data on the reaction A R. 20

? sec	C_{A0} mol/m ³	C_A mol/m ³
60	50	20
35	100	40
11	100	50
20	200	80
11	200	100

Find the space time needed to treat a feed of $C_{A0} = 100$ mol/m³ to 80% conversion 1) in a plug flow reactor 2) in a mixed flow reactor.