17562

15162

3 Hours / 100 Marks Seat No. | | | | | | | | |

Instructions : *(1)* ***All*** *questions are* ***compulsory****.*
(2) Answer ***each*** *next main question on a* ***new*** *page.*
(3) Illustrate your answers with neat sketches ***wherever*** *necessary.*
(4) Figures to the ***right*** *indicate* ***full*** *marks.*
(5) Assume suitable data, if ***necessary****.*

Marks

1. A) Attempt **any three**: **12**

a) Define chain and non chain reaction.

b) Derive the relationship between conversion and equilibrium constant for second order reversible reaction.

c) The rate of reaction at concentrations 0.15 mol/l and 0.05 mol/l are 2.7×10^{-3} and 0.3×10^{-3} mol/1 min. What is the order of reaction with respect to the reactant ?

d) Give the relation between C_A and X_A for :

i) constant density system

ii) changing density system.

B) Attempt **any one**: **6**

a) Derive the integrate form of rate expression for zero order reaction in terms of concentration and conversion. Give the graphical representation.

b) List theories of reaction rate constant and compare between them on the basis of

i) Experiment

ii) Mathematical equation

iii) Activated complex.

2. Attempt **any two**: **16**

a) Explain temperature dependency of rate constant from collusion theory.

b) In an isothermal batch reactor, the conversion of a liquid reactant A achieved in 13 min is 70%. Find the space time and space velocity necessary to effect this conversion in a plug flow reactor and in a mixed flow reactor consider first order kinetics.

c) Draw the neat labeled Sketch of fixed bed and fluidised bed reactor and explain in brief.

P.T.O.

Marks

3. Attempt **any four** : **16**

a) In an experiment at 1000 K the equilibrium concentration of ammonia, hydrogen and nitrogen are 0.105, 1.5, and 1.10 mol/l respectively. Calculate Kc and Kp for the reaction.

$N_2 + 3H_2 \rightleftharpoons 2NH_3$.

b) Define half life period and write the relation between half life and rate constant for first order reaction. State its one characteristics.

c) Define the following terms :

i) Fugacity

ii) Chemical potential

iii) Chemical Equilibrium constant

iv) Gibbs free energy.

d) Explain the types of intermediate involved in non-chain reactions.

e) State the steps involved in solid catalysed gas phase reactions.

4. A) Attempt **any three** : **12**

a) Derive an integrated rate expression for irreversible second order reaction.

$2A \rightarrow$ products in terms of conversion.

b) Name three catalyst deactivation categories. Describe any one in brief.

c) The half life for the conversion of ammonium cynate into urea at 303 K at initial concentration of ammonium cynate of 0.1 mol/1 and 0.2 mol/l are 1152 min and 568 min respectively. What is the order of reaction ?

d) Derive $Kp = Kc\ (RT)^{\Delta n}$.

B) Attempt **any one**: **6**

a) Concentration Vs time data for the reaction is given below

$A \rightarrow R$

$B \rightarrow S$

Time (hr)	**Concentration of A mol/lit**	**Concentration of R mol/lit**
0	0.100	0.00
2	0.050	0.050

Marks

Time (hr)	Concentration of B mol/lit.	Concentration of S mol/lit.
0	0.100	0.00
2	0.075	0.025

Calculate :

i) Which reaction proceed at greatest rate ?

ii) What are the rates of formation of R and S ?

b) Derive the expression for entropy change of an ideal gas for

i) constant pressure process.

ii) constant temperature process.

5. Attempt **any two** : **16**

a) Derive the integrated form of rate expression for constant volume first order reversible reaction A B in terms of concentration and conversion. Give the graphical representation also.

b) Derive the performance equation for constant volume PFR. Give the graphical representation also.

c) Compare MFR and PFR (4 points).

6. Attempt **any four** : **16**

a) Define space time and space velocity. Give its unit.

b) Why temperature increase is not desirable for exothermic reaction ? (On the basis of Van't Hoff equation).

c) Give the significance of activation energy.

d) Explain the differential method of analysis of data.

e) How feeding should be done when PFR's are connected in parallel ?