

Q.3(a) Derive integrated rate equation for irreversible unimolecular – type First order reaction in terms of concentration and conversion. Also derive half-life of the reaction. (6)

(b) The decomposition of NH_3 on tungsten wire at 856°C yielded the following results. (6)

Total pressure (torr)	228	250	273	318
Time, sec.	200	400	600	1000

Determine the order of reaction and calculate the rate constant.

OR

(b) Derive an integrated rate expression for the Autocatalytic reaction in term of concentration. (6)

Q.4(a) Consider a gas phase reaction $2A = R + 2S$ with unknown kinetics. A space velocity of $1/\text{min}$ is required to achieve 90% conversion of A in a PFR. Find the space time and mean residence time in reactor. (6)

(b) Derive an integrated rate expression for the functioning of Adiabatic Batch reactor. (6)

OR

(b) Derive an integrated rate expression for PFR. (6)

Q.5(a) How are chemical reactors classified? (6)

(b) Assuming a stoichiometry $A \rightarrow R$ for a first order gas phase reaction, the size (volume) of plug flow reactor required to achieve 99% conversion of a pure A is 32 lit. In fact, however the stoichiometry of the reaction is $A \rightarrow 3R$. For this corrected stoichiometry, find the required size of the same type reactor. (6)

OR

(b) Derive an integrated rate equation for an isothermally operated CFSTR. (6)

Q.6(a) What are the seven steps involved in kinetics of heterogeneous reactions? Derive the Global rate of reaction. (6)

(b) Give a brief account of catalyst promoter, catalyst inhibitor and poisons. (6)

OR

(b) What are the absorption isotherms? Explain in brief Langmuir Adsorption Isotherm. (6)
