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SARDAR PATEL UNIVERSITY M.Sc. 3rd Semester (Surface Coating Technology) Examination (CBCS)

Monday, April 11, 2016 Time: 2:30 pm to 5:30 pm

Course No. : PS03ESCT01
Subject: Chemical Reaction Engineering

Total Marks: 70

| N.B. | (1) Marks allotted to the question are on its RHS (2) Illustrate your answers wherever necessary with the help of neat sketches & chemical equations | | | | | | | |
|----------|--|---|---|--|---|--------------------------------------|-----|--|
| Q.1 | Choo | se the correct op | tion | | | | | |
| (1) | In the given rate expression $-r_A = k C_A^{1/3} C_B^{5/3}$. What is the order of reaction? | | | | | | | |
| | a. 0 | | b. 1 | | c. 2 | d. 3 | | |
| (2) | | | | the initial concentration of the reactant. b. inversely proportional to d. none of these | | | (1) | |
| (3) | a. an | experimentally d | reaction is etermined quantity total stoichiometric | nun | nber of reactants | b. never fractional d. none of these | (1) | |
| , , | For a a. zer c. sec | o | tion the unit of rate | b. | stant and rate of re first third | eaction are the same? | (1) | |
| (5) | a. B | | the FOUR terms of | | ss balance equation b. Semibatch d. PFR | on appear? | (1) | |
| (6) | There must be some product to catalyze the reaction in reaction. a. complex b. series c. autocatalytic d. homogenous catalyzed | | | | | | (1) | |
| (7) | '-r _A ' a. Ba | | gn of integration in b. Semi batch | | | | (1) | |
| (8) | | emical reaction of | ccurs, when the ene | | | elecule is the activation | (1) | |
| | a. le | ss than | | b. | more than | | | |
| | c. eq | qual to or more tha | nn | d. | None of these | | | |
| Q.2 1 | Answer Any seven of the following Define activation energy. | | | | | | | |
| 2 | Differentiate between order of reaction and molecularity. | | | | | | | |
| 3 | Enlist the methods used to analyses the kinetic data/rate data to determine order of reaction. | | | | | | | |
| 4 | What is half life time period of reaction? | | | | | | | |
| 5 | Explain Zeorth order and Autocatalytic reaction with example. | | | | | | | |
| 6 | | ne Yield and Sele | | | | | | |
| 7 | | | ristics of catalyst. | | | | | |
| 8 | | Define catalyst promoter and inhibitor. | | | | | | |
| 9 | Defin | ne Physisorption | and Chemisorption. | | | | | |

| 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. | | | | | | | |
|--------|---|-----|--|--|--|--|--|--|
| (b) | The decomposition of NH_3 on tungsten wire at $856^{\circ}C$ yielded the following results. Total pressure (torr) 228 250 273 318 Time, sec. 200 400 600 1000 Determine the order of reaction and calculate the rate constant. | (6) | | | | | | |
| OR | | | | | | | | |
| (b) | Derive an integrated rate expression for the Autocatalytic reaction in term of concentration. | | | | | | | |
| Q.4(a) | Consider a gas phase reaction $2A = R + 2S$ with unknown kinetics. A space velocity of 1/min is required to achieve 90% conversion of A in a PFR. Find the space time and mean residence time in reactor. | | | | | | | |
| (b) | (b) Derive an integrated rate expression for the functioning of Adiabatic Batch reactor. | | | | | | | |
| | OR | | | | | | | |
| (b) | Derive an integrated rate expression for PFR. | | | | | | | |
| Q.5(a) | How are chemical reactors classified? | | | | | | | |
| (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. | | | | | | | |
| | OR | | | | | | | |
| (b) | Derive an integrated rate equation for an isothermally operated CFSTR. | | | | | | | |
| Q.6(a) | What are the seven steps involved in kinetics of heterogeneous reactions? Derive the Global rate of reaction. | | | | | | | |
| (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) | | | | | | |
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