

5/12/2024 CHEMICAL SEM-VI C SCHEME CRE-II QP CODE: 10066606

(3 Hours)

[Total : 80]

N.B. : (1) Question No. 1 is compulsory.**(2) Solve any three questions from the remaining questions.****(3) Assume suitable data wherever necessary.**

Q 1. Answer the following questions: (20)

- (a) In an experiment to determine the pore volume and catalyst particle porosity the following data were obtained on a sample of activated silica (granular, 4 to 12 mesh size): Mass of catalyst sample placed in chamber = 101.5 gm Volume of helium displaced by sample = 45.1 gm Volume of mercury displaced by sample = 82.7 cm³ Calculate the pore volume, density of solid material in the catalyst & the porosity of the silica gel particles.
- (b) Discuss different controlling mechanisms in Non catalytic heterogeneous reactions.
- (c) Explain various steps involved in a solid catalyzed reaction..
- (d) Write a short note on the packed bed reactor.

Q.2.(a) Explain Brunner Emmett Teller method for determination of surface area. (10)

- (b) Spherical solid particles containing 'B' are roasted at constant temperature in an oven by gas constant composition. Solids are converted to give a firm non flaking product according to the Shrinking core model (SCM). From the following conversion data determine the rate controlling mechanism for the transformation of solid. (10)

Data:

dp,mm	XB	t,s
2	0.875	1
1	1	1

Q.3. (a) Develop conversion time relationship for Shrinking spherical particles when resistance through the ash layer is controlling. (10)

- (b) Explain in detail the contacting patterns in fluid- fluid reactions.

Q.4. a) The effluent concentration readings given below represent a continuous response to a pulse input into a closed vessel. (10)

t, min	0	1	2	3	4	5	6	7	8	9	10	12	14
C Pulse g/m ³	0	1	5	8	10	8	6	4	3	2.2	1.5	0.6	0

This vessel is to be used as a reactor for decomposition of liquid A.



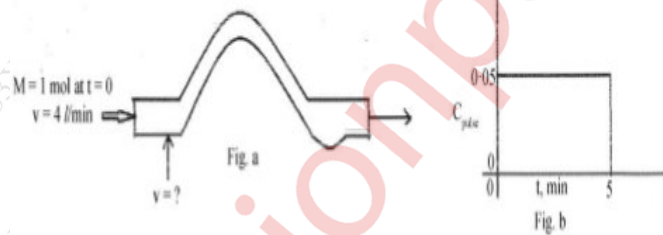
$$-r_A = k CA, \quad k = 0.10 \text{ min}^{-1}$$

Calculate the mean conversion of reactant A in the real reactor.

(b) A feed comprising of 20% of 1mm particles, 30 % of 2 mm particles & 50% of 4 mm passes through a rotating tubular reactor where it reacts with gas to yield a hard solid product according to the SCM with reaction step is rate controlling. The time required for complete conversion of 4 mm particles is 4 h. Determine the residence needed in the tubular reactor for; a) 95 % conversion of solids b) 75 % conversion of solids. (10)

Q.5. (a) The result of pulse input to a vessel are shown in following fig a & b

- i) Check the material balance with the experimental tracer curve to see whether the results are consistent or not.
- ii) If so evaluate mean residence time & V. (10)



(b) Write short notes on Slurry Bed and Trickle Bed Reactor. (10)

Q.6. Answer the following questions. (Any four): (20)

- a) Write short note on Tanks in Series model
- b) Draw kinetic regime for i) slow reactions, no mass transfer resistance. ii) Instantaneous reaction with low CB
- c) Differentiate between Physical adsorption & Chemical adsorption
- d) Write a short note on Shrinking core model and Progressive conversion model
- e) Explain Pulse input experiment for RTD measurement.
