University of Mumbai
Online Examination 2020

Program: BE Chemical Engineering

Curriculum Scheme: Revised 2016

Examination: Third Year Semester VI

Course Code: CHC604

Course Name: Chemical Reaction Engineering II

Time: 1-hour Max. Marks: 50

Note to the students: - All Questions are compulsory and carry equal marks

1 The vessel dispersion number (D/uL) for plug flow is

A] 0

B] 500

C] 750

D] ∞

2 The response curve for a step input signal from a reactor is called C-curve. The variance of C-curve in a 'tanks in series model' comprising of 'm' tanks is equal to

A] m

B] 1/m

C] √m

D] m2

3 Pick out the wrong statement.

A] Exit age description function (E) and internal age distribution function (I) are related as, $E = -(dI/d\theta)$

B] Chemisorption studies are useful in the determination of catalyst surface area and pore size distribution

C] A higher temperature favours the reaction of higher activation energy

D] A catalyst increases the potential energy barrier over which the reactants must pass to form products

4 Tanks in series model is ----------parameter model

A] Zero

B] One

C] Two

D] Three

5 Segregation Model is _____-parameter model

A] Zero

B] One

C] Two

D] Three

6 Dispersion Model is _____parameter model

A] Zero

B] One

C] Two

D] Three

7 Which of the following statement is false?

A] RTD describes the deviation from ideal behavior.

B] RTD is not a unique signature of a reactor.

C] RTD of perfect PFR and perfect CSTR are same.

D] RTD can be measured using concentration of tracer

8 Pick out the wrong statement.

A] The vessel dispersion number (D/UL) for plug flow and mixed flow approaches zero and infinity respectively.

B] Space time in a flow reactor is a measure of its capacity and is equal to the residence time when the density of reaction mixture is constant.

C] Mixed reactor is always smaller than the plug flow reactor for all positive reaction orders for a particular duty.

D] In an ideal tubular flow reactor, mixing takes place in radial direction and there is no mixing in logitudinal direction.

9 Calculate the time required for complete burning of particles of graphite at 9000C and 1 atm of size R0 = 5 mm ρB = 2.2 g/cm3, PAg = 0.08 atm, R = 82.06 cm3 atm/mol K k^'' = 20 cm/sec

A] 4505.5 sec

B] 3505.5 sec

C] 5505.4 sec

D] 6000 sec

10 _____ resistance is not involved in the combustion of a carbon particle

A] Ash

B] Gas film

C] None of these

D] Chemical reaction

11 A fluidised bed is charged with particles of single size at a rate of 2 kg/min.The bed contains 60 kg of solids. Find the mean residence time of solid for no carry over of particles

A] 30 min

B] 60 min

C] 40 min

D] 20 min

12 If τ is the time necessary to consume the entire solid particle. which one of these is the correct relation for the case of reaction controlled condition? Note: All the symbols used have the usual meaning.

A] $\tau = \frac{\rho_B \phi_B R_0^2}{6 D_e C_{A0}}$

B] $\tau = \frac{\rho_B R_0}{k'' C_{A0}}$

C] $\tau = \frac{\rho_B R_0}{3 k'' C_{A0}}$

D] $\tau = \frac{\rho_B R_0}{k'' C_{A0}}$

13 An ore of uniform size particles is to be roasted in a fluidised bed reactor. The time required for complete conversion of solid particles is 20 min and the mean residence time of particles in the bed is 48 min. The solids remain unchanged in size during reaction. Calculate the fraction of the original ore remaining unconverted assuming chemical reaction step as rate controlling

A] 10.6 %

B] 9.6%

C] 2.3 %

D] 5.4 %

14 An ore of uniform size particles is to be roasted in a fluidised bed reactor. The time required for complete conversion of solid particles is 20 min and the mean residence time of particles in the bed is 48 min. The solids remain unchanged in size during reaction. Calculate the fraction of the original ore remaining unconverted assuming Ash diffusion step as rate controlling

A] 8.6 %

B] 4.5 %

C] 7.6 %

D] 10.6 %

15 _____ explains the mechanism of catalysis

A] Activated complex theory

B] Collision theory

C] Thermodynamics

D] None of these

16 BET method of finding out surface area of catalyst, uses the extension of _____ isotherm

A] Langmuir

B] Freundlich

C] Temkin

D] All of the above

17 A catalyst is said to be a negative catalyst if it

A] Retards the rate of reaction

B] Reduces the value of equilibrium constant

C] Does not initiate the reaction

D] All of the above

18 Effectiveness factor of a catalyst pellet is measure of the _____ resistance.

A] Pore diffusion

B] Gas film

C] Chemical reaction

D] None of these

19 Fluidised bed reactors are characterised by the

A] Uniformity of temperature

B] Comparatively smaller equipment

C] Very small pressure drop

D] Absence of continuous catalyst regeneration facility

20 For nearly isothermal operation involving large reaction time in a liquid-phase reaction, the most suitable reactor is a _____ reactor.

A] stirred tank

B] tubular flow

C] batch

D] fixed bed

21 Which of the following is a controlling factor in very fast heterogeneous reaction?

A] Heat and mass transfer effects

B] Pressure

C] Temperature

D] Composition of reactant

22 _____ is the controlling step in a highly temperature sensitive fluid-solid non-catalytic reaction.

A] Gas film diffusion

B] Ash diffusion

C] Chemical reaction

D] none of these

23 A trickle bed reactor is the one, which

A] has altogether three streams either entering or leaving.

B] processes three reactants at different flow rates.

C] processes three reactants with same flow rate.

D] employs all the three phases (i.e.. .solid, liquid and gas).

24 The 'E' curve for a non-ideal reactor defines the fraction of fluid having age

between t and t + dt

A] At the inlet

B] At the outlet

C] In the reactor

D] Averaged over the inlet and outlet

25 For a first order isothermal chemical reaction in a porous catalyst, the effectiveness factor is 0.3. The effectiveness factor will increase if the

A] Catalyst size is reduced or the catalyst diffusivity is reduced

B] Catalyst size is increased or the catalyst diffusivity is increased

C] Catalyst size is increased or the catalyst diffusivity is reduced

D] Catalyst size is reduced or the catalyst diffusivity is increased

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