

B.E. Chemical Part I (Semester VII)
Subject:- Chemical Reaction Engineering II

- Q1)** Tracer has the property that it
- A) disturb the flow pattern in the vessel
 - B) does not disturb the flow pattern in vessel and it can be detected
 - C) react with the fluid
 - D) none of the above
- Q2)** F curve is
- A) C/C_0
 - B) C_0/C
 - C) $C-C_0$
 - D) C_0-C
- Q3)** Compute K_γ at 10 atm if K_p at this pressure is 0.00381 for ammonia synthesis reaction from hydrogen and nitrogen at 5000C. Assume ideal gas holds good.
- A) 0.381
 - B) 0.813
 - C) 0.138
 - D) 0.111
- Q4)** The exit age distribution of fluid leaving a vessel is used
- A) to study the reaction mechanism
 - B) to study the extent of non-ideal flow in the vessel
 - C) to know the reaction rate constants
 - D) to know the activation energies of a reaction.
- Q5)** Stimulus-response techniques are commonly used to characterize the extent of non-ideal flow in vessels. Tracer input signal is used as stimulus. Any material can be used
- A) as tracer if it can disturb the flow pattern in the vessel
 - B) as tracer if it does not disturb the flow pattern in the vessel and it can be detected.
 - C) as tracer if it follows ideal flow patterns
 - D) as tracer.

- Q6)** In a gas phase reaction $A \rightarrow B + C$, 50% of A is converted at 10000K and 10atm. 50% of A is also converted at 5000K and 0.1atm. Calculate % conversion at 2500K and 0.01atm
 $CPA = 12 \text{ cal/mol.K}$ $CPB = 7 \text{ cal/mol.K}$ $CPC = 5 \text{ cal/mol.K}$
- A) 0.0156
 B) 0.0561
 C) 0.0165
 D) 0.0516
- Q7)** For a heterogeneous catalytic reaction, $A+B$ gives C, with equimole feed of A and B, the initial rate $-r_{Ao}$ is invariant with total pressure. The rate controlling step is
- A) Surface $K_c/(1 + TS)$ reaction between adsorbed A and B in the gas phase
 B) Surface reaction between adsorbed A and adsorbed B
 C) Surface reaction between A in the gas phase and adsorbed B
 D) Desorption of C
- Q8)** The fourth step in the heterogeneous processes is
- A) Chemical Reaction of adsorbed reactants with catalyst particles
 B) Transport of reactant from bulk to fluid solid interface
 C) Desorption of adsorbed products
 D) None of the above
- Q9)** In Nitrogen Adsorption method, Most important condition is
- A) $P = P^o$
 B) $P^o = 1$
 C) $P^o = 0$
 D) $P = - P^o$
- Q10)** Which statement about a catalyst is incorrect?
- A) The presence of a catalyst speeds up a reaction
 B) The presence of a catalyst changes the rate of a reaction
 C) In some reactions, one of the products acts as a catalyst for the forward reaction
 D) During use, a catalyst may be poisoned

- Q11)** Overall rate \ Global Rate of reaction include
- A) Mass transfer rate only
 - B) Energy transfer rate only
 - C) Mass & Energy transfer rates
 - D) None of the above
- Q12)** In the B.E.T. equation, what does p_0 denotes?
- A) Pressure of the gas molecules
 - B) Unsaturated vapor pressure of the gas molecules
 - C) Saturated vapor pressure of the gas molecules
 - D) All mentioned
- Q13)** According to B.E.T. equation, the plot of $P/V(P_0-P)$ versus P/P_0 will yield a_____
- A) Straight line
 - B) Parabola
 - C) Hyperbola
 - D) Eclipse
- Q14)** The B.E.T. theory is used in calculating the _____
- A) Surface area of adsorbate
 - B) Surface area of adsorbent only
 - C) Surface area of adsorbents and catalyst
 - D) None of the mentioned
- Q15)** The surface area occupied by a single gas molecule is inversely proportional to the_____
- A) Molar mass of the gas adsorbed
 - B) Density of the liquefied gas
 - C) Volume of the gas
 - D) All of the mentioned
- Q16)** A Promotor is a substance
- A) Which either increases the rate of a chemical reaction without itself undergoing any chemical change during the reaction.
 - B) that decreases the rate of chemical reaction
 - C) not alter the reaction rate
 - D) All mentioned options

- Q17)** Which among the following statement is false
- A) The adsorption may be monolayered or multilayered
 - B) Particle size of adsorbent will not affect the amount of adsorption
 - C) Increase of pressure increases amount of adsorption
 - D) Increase of temperature may decrease the amount of adsorption
- Q18)** In Freundlich adsorption, isotherm adsorption is proportional to pressure P as
- A) P^0
 - B) P
 - C) P^n
 - D) $P^{1/n}$
- Q19)** Which of the following is not a characteristic of chemisorption
- A) ΔH is of the order of 400 kJ
 - B) Adsorption is irreversible
 - C) Adsorption may be multimolecular layerdone
 - D) Adsorption is specific
- Q20)** Which of the following isotherm is applicable to physical adsorption?
- A) Langmuir
 - B) BET
 - C) Freundlich
 - D) Kisluk
- Q21)** In Freundlich Adsorption isotherm, the value of $1/n$ is
- A) 1 in case of physical adsorption
 - B) 1 in case of chemisorption
 - C) Between 0 and 1 in all cases
 - D) Between 2 and 4 in all cases
- Q22)** The Thiele Modulus for a gas phase first order isothermal reaction for a spherical catalyst particle is found to be 2. The catalyst effectiveness factor is
- A) 0.33
 - B) 0.49
 - C) 0.80
 - D) 0.91

- Q23)** A Porous solid catalyst has the following characteristics
 Particle Density = 0.98g/cm^3 , Particle Diameter = 0.6 mm , Total Surface area = $50\text{ m}^2/\text{g}$
 The External Surface area of the catalyst is
- A) $50\text{ m}^2/\text{g}$
 - B) $102.04\text{ m}^2/\text{g}$
 - C) $102.04\text{ cm}^2/\text{g}$
 - D) $1020.44\text{ cm}^2/\text{g}$
- Q24)** _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
- Q25)** For a heterogeneous catalytic reaction:
- A) Free energy of activation is lowered in the presence of catalyst, which remains unchanged at the end of reaction
 - B) A relatively small amount of catalyst can cause the conversion of large amount of reactants which does not mean that catalyst concentration is important
 - C) The surface of the catalyst does not play an important role during reaction
 - D) The catalyst does not form an intermediate complex with the reactant
- Q26)** A Trickle Bed reactor is 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)
- Q27)** A spherical porous catalyst particle of radius R is subjected to reactant A which reacts to form B by a zero order surface reaction $A \text{ gives } B$. Film mass transfer resistance is negligible and pore diffusion of A is rate controlling The effectiveness factor of the catalyst is reported as $7/8$. Which of the following statements is true?
- A) Inner Catalyst core of radius $R/8$ does not participate in reaction
 - B) Inner Catalyst core of radius $R/2$ does not participate in reaction
 - C) Inner Catalyst core of radius $7R/8$ does not participate in reaction
 - D) Effectiveness factor for a zero order reaction cannot be $7/8$ as it must always be 1

- Q28)** A step input tracer test (switching from tap water to salt water, measuring the conductivity of fluid leaving the vessel) is used to explore the flow pattern of fluid through the vessel ($V = 1\text{ m}^3$, volumetric flow rate = $1\text{ m}^3/\text{min}$). The flow model developed from the above mentioned output response suggests the reactor configuration of two parallel PFR, say X and Y. What will be the flow rate through and volume of each PFR?
- A) X = $0.8\text{ m}^3/\text{min}$ and 0.6 m^3 and Y = $0.2\text{ m}^3/\text{min}$ and 0.4 m^3
 - B) X = $0.8\text{ m}^3/\text{min}$ and 0.4 m^3 and Y = $0.2\text{ m}^3/\text{min}$ and 0.6 m^3
 - C) X = $0.75\text{ m}^3/\text{min}$ and 0.56 m^3 and Y = $0.25\text{ m}^3/\text{min}$ and 0.44 m^3
 - D) Insufficient data for calculation
- Q29)** If helium is introduced in a reactor containing O_2 , SO_2 and SO_3 at equilibrium, so that total pressure increases while volume and temperature remains constant. In this case the dissociation of SO_3 (as per Le Chatlier principle)
- A) Increases
 - B) Remains unaltered
 - C) Decreases
 - D) Changes unpredictably
- Q30)** Backmixing is most predominant in
- A) A well stirred batch reactor
 - B) A plug-flow reactor
 - C) CSTR's connected in series
 - D) A single CSTR
- Q31)** Which of the following factors control the design of a fluid-solid reactor?
- A) Reaction kinetics for single particle
 - B) All of these
 - C) Flow patterns of solids and fluid in the reactor
 - D) Size distribution of solids being treated
- Q32)** Brunaur, Emmet and Teller (BET) equation is used to determine the specific surface area of a porous particle but not the pore volume & the porosity of the catalyst bed
Which of the following postulates is not used to derive BET equation?
- A) Langmuir's assumption applies to every adsorbed layer
 - B) There is no dynamic equilibrium between successive layer
 - C) The adsorbed layer may be polymolecular in thickness and the heat of adsorption in each

layer (except the first one) is involved in each of the evaporation process

- D)** None of these
- Q33)** For the non-catalytic reaction of particles with surrounding fluid, the same needed to achieve the same fractional conversion for particles of different unchanging sizes is proportional to the particle diameter, when the _____ is the controlling resistance
- A)** Film diffusion
B) One of these
C) Chemical reaction
D) Diffusion through ash layer
- Q34)** What is the dispersion number for a plug flow reactor ?
- A)** 1
B) - 1
C) 0
D) Infinity
- Q35)** Overall rate of reaction in a heterogenous catalytic reaction depends upon the mass and energy transfer from the fluid to solid surface and its rate of reaction is usually _____ the concentration of catalyst, if it does not entail a chain mechanism
- A)** Inversely proportional to
B) Proportional to the square of
C) Independent of
D) Proportional to
- Q36)** Non-catalytic fluid-solid reactions are represented by _____ model
- A)** None of these
B) Unreacted core
C) Continuous reaction
D) Dispersion
- Q37)** A back mix reactor is
- A)** Same as ideal stirred tank reactor
B) Same as plug flow reactor (PFR)
C) Ideal at very low conversion
D) Suitable for gas phase reactions

- Q38)** The single parameter model proposed for describing non-ideal flow is the _____ model
- A) None of these
 - B) Tank in series
 - C) Dispersion
 - D) Tank in parallel
- Q39)** When the reaction occurs in the different controlled region, the apparent activation energy which is measured is only ___ of the true value
- A) Twice
 - B) equal to
 - C) Half
 - D) none of the above
- Q40)** Void volume is determine by following method
- A) Helium Mercury Method
 - B) The Mercury Penetration method
 - C) Nitrogen Adsorption method
 - D) Nitrogen desorption Method