

## Sixth Semester Diploma in Chemical Engineering

Subject- Chemical Reaction Engg.

### Question Bank (**Old Pattern**)

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1. What happens during a combination reaction?
  - A) A molecule breaks down into smaller molecules
  - B) no reaction takes place
  - C) Two or molecules combine
  - D) Species' molecular configuration changes only
2. In case of chemical reaction, where benzene and propylene are formed from cumene molecule is broken down into smaller molecules. It is
  - A) a combination reaction
  - B) a decomposition reaction
  - C) a isomerization reaction
  - D) not a chemical reaction
3. When  $\Delta H$  is negative,  $\Delta S$  is negative and  $\Delta F$  is positive or negative then, feasibility of reaction is proceeding spontaneously,
  - A) At low temperature
  - B) At high temperature
  - C) Impossible at any temp
  - D) can not be predicted
4. Feasibility of a chemical reaction proceeding spontaneously is determined from free energy change equation i.e.  $\Delta F = \Delta H - T * \Delta S$ . When  $\Delta H$  is negative,  $\Delta S$  is positive and  $\Delta F$  is negative, then reaction is
  - (A) possible at high temperature
  - (B) possible at any temperature
  - (C) Reaction is possible at low temperature
  - (D) Impossible at any temperature

5. Feasibility of reaction is determined by Gibb's Free energy change ( $\Delta F$ ). If  $\Delta F$  of a reaction is negative, then the reaction is
- (A) Feasible
  - (B) Not feasible
  - (C) In equilibrium
  - (D) May or may not be feasible
6. Feasibility of a chemical reaction proceeding spontaneously is determined from free energy change equation i.e.  $\Delta F = \Delta H - T * \Delta S$ . When  $\Delta H$  is positive,  $\Delta S$  is negative and  $\Delta F$  is positive, then reaction is
- (A) possible at high temperature
  - (B) possible at any temperature
  - (C) Reaction is possible at low temperature
  - (D) Impossible at any temperature
7. Feasibility of reaction is determined by Gibb's Free energy change ( $\Delta F$ ). If  $\Delta F$  of a reaction is zero, then the reaction is
- (A) Feasible
  - (B) Not feasible
  - (C) In equilibrium
  - (D) May or may not be feasible
8. In the equation  $\Delta F = -RT \ln K$ , if  $\Delta F$  is highly negative, equilibrium conversion is
- (A) Low
  - (B) High
  - (C) Zero
  - (D) cannot be predicted
9. Rate of reaction is independent of concentration in case of
- (A) first order reaction
  - (B) zero order reaction
  - (C) second order reaction
  - (D) half order reaction

10. In the equation  $\Delta F = -RT \ln K$ , if  $\Delta F$  is highly positive, value of equilibrium constant,  $K$  is
- (A) small
  - (B) High
  - (C) zero
  - (D) cannot be predicted
11. For a given chemical reaction at a specified conditions, With the use of catalyst,
- (A) Equilibrium conversion increases
  - (B) Equilibrium conversion do not change
  - (C) Equilibrium conversion decreases
  - (D) It takes longer duration to reach equilibrium conversion compared to reaction without catalyst
12. The entropy change in melting of one gram of ice at  $273\text{ }^{\circ}\text{K}$  is (given latent heat of fusion of ice at  $0\text{ }^{\circ}\text{C}$  is  $80\text{ cal /gram}$ )
- (A)  $3.4125\text{ cal/gm. }^{\circ}\text{K}$
  - (B)  $0.293\text{ cal/gmole. }^{\circ}\text{K}$
  - (C)  $5.274\text{ cal/gmole. }^{\circ}\text{K}$
  - (D)  $0.8\text{ cal/gm. }^{\circ}\text{K}$
13. In a chemical reaction, when there is change in configuration of reactant and product then reaction is called
- (A) Decomposition reaction
  - (B) combination reaction
  - (C) isomerization reaction
  - (D) it is not a chemical reaction
14. When heat content of product is less than the heat content of reactant, then it is a
- (A) Endothermic reaction
  - (B) Exothermic reaction
  - (C) chemical equilibrium
  - (D) Thermal equilibrium

15. When heat content of product is more than the heat content of reactant, then it is a  
(A) Endothermic reaction  
(B) Exothermic reaction  
(C) chemical equilibrium  
(D) Thermal equilibrium
16. A chemical reaction accompanied by release of heat is called  
(A) Exothermic reaction  
(B) Endothermic reaction  
(C) Adiabatic reaction  
(D) None of the above
17. A chemical reaction accompanied by absorption of heat is called  
(A) Exothermic reaction  
(B) Endothermic reaction  
(C) Adiabatic reaction  
(D) None of the above
18. For a exothermic chemical reactions, an increase in temperature  
(A) Increases the yield of product  
(B) Decreases the yield of product  
(C) Does not affect the yield of product  
(D) None of the above
19. Change in moles of a reactant or product per unit time per unit volume of a reaction mixture is  
A) Rate of a reaction  
B) rate constant  
C) order of reaction  
D) molecularity of reaction
20. When rate of reaction,  $r_A$  is positive then A is  
(A) Reactant  
(B) product  
(C) catalyst  
(D) may be reactant or product

21. In case of homogeneous reaction,  
 ( A ) reactant and product are in same phase  
 ( B ) reactant , product and catalyst are in same phase  
 ( C ) Reactant and product are in one phase and catalyst can be in other phase  
 ( D ) None of the above
22. What is the rate of appearance of B in the reaction  $A \rightarrow B$ ?  
 A) Very slow  
 B)  $R_B = R_A$   
 C)  $R_B = -R_A$   
 D)  $R_B = (R_B - R_A)$
- 23 In a rate equation  $-r_A = k C_A$  , k is  
 ( A ) equilibrium constant  
 ( B ) rate constant  
 ( C ) thermodynamic constant  
 ( D ) avagaadro's number
24. What is the reaction rate law in terms of B, for the elementary reaction,  
 $A + (1/2) B \rightarrow C$   
 A)  $-r_B = k_A C_A C_B$   
 B)  $r_B = k_A C_A C_B^2$  ,  
 C)  $r_B = -(k_A/2) C_A C_B^{1/2}$   
 D) None of the above
25. For multiple reactions  $2A \rightarrow R, 2R \rightarrow S$ , the number of moles of S present when the number of moles of A and R are 0.4 and 0.5 respectively (initially 2 moles of A are present only) are  
 A) 0.125  
 B) 0.150  
 C) 0.200  
 D) 0.400

26. Reaction  $A + 2 B \rightarrow 3 C$  is carried out in a batch reactor, if at a particular point the rate of disappearance of A is  $10 \text{ moles/m}^3 \text{ sec}$ , then the rate of formation of C in  $\text{moles/m}^3 \text{ sec}$  is
- (A) 30
  - (B) 20
  - (C) 5
  - (D) 3.33
27. What are the dimensions of k in the equation  $-R_A = k C_A$  ?
- A)  $\text{moles}^2/\text{volume}^2/\text{time}$
  - B)  $\text{time}/\text{mole}/\text{volume}$
  - C) time
  - D)  $\text{time}^{-1}$
28. The use of catalyst changes the equilibrium conversion.    T    F
29. Change in temperature alters the rate of catalytic reaction    T    F
30.  $A \rightarrow B$ . At a particular time t, the rate of formation of B in the reaction,  $r_B$ , is  $10 \text{ mole/cm}^3 \cdot \text{min}$ . Which of the following are true?
- A) The rate of disappearance of B is  $-10 \text{ moles/cm}^3 \cdot \text{min}$ .
  - B) The rate of formation of A is  $-10 \text{ mole/cm}^3 \cdot \text{min}$ .
  - C) The rate of disappearance of A is  $10 \text{ moles/cm}^3 \cdot \text{min}$ .
  - D) All of the above
31. Which of the following reaction orders is most affected by pressure drop?
- A) zero order
  - B) first order
  - C) third order
  - D) out of order
32. What is the reaction rate law in terms of B, for the reaction the elementary Reaction  $A + (1/3) B \rightarrow C$
- (A)  $-r_B = k_A C_A C_B$
  - (B)  $r_B = k_A C_A C_B^2$
  - (C)  $r_B = - (k_A/3) C_A C_B^{1/2}$
  - (D) None of the above

34. With the use of catalyst in a chemical reaction,  
(A) Equilibrium conversion reaches in finite time  
(B) Equilibrium conversion reaches in infinite time  
(C) No change in time to reach equilibrium conversion  
(D) None of the above
35. In case of oxidation of  $\text{SO}_2$  to  $\text{SO}_3$   
(A) Rate of oxidation increases when temperature increases beyond  $300^\circ\text{C}$ , up to  $520^\circ\text{C}$  and conversion reaches maximum conversion i.e higher than 90 %  
(B) increase of temperature beyond  $520^\circ\text{C}$  decreases conversion  
(C) Increase of temperature beyond  $520^\circ\text{C}$  increases conversion  
(D) Both (A) and (B)
36. In case of elementary reaction  
A) When reaction progresses only one energy barrier has to be overcome  
B) Here the mechanism corresponds to stoichiometric equation  
C) Here most of the reaction takes place via number of intermediate steps  
D) Both (A) and (B)
37. In case of non-elementary reaction,  
A) When reaction progresses only one energy barrier has to be overcome  
(B) Here the mechanism corresponds to stoichiometric equation  
(C) Here most of the reaction takes place via number of intermediate steps  
(D) Both (A) and (B)
38. Molecularity of a reaction  
A) Is the number of molecules actually involved in the reaction  
B) Is always a integer value  
C) It can be integer or fractional value  
D) Both (A) and (B)
39. Order of the reaction  
(A) Can be integer or fractional value  
(B) It is always integer value  
(C) Indicates the number of molecules actually taking part in rate determining step  
(D) Refers to only elementary reaction

40. An elementary chemical reaction  $B + 2D \rightarrow 3T$ , proceeds with a rate constant  $k$ ,  
 If  $-r_B = k C_B (C_D)^2$  Then,  $r_T = ?$   
 (A)  $r_T = (k/3)C_B (C_D)^2$   
 (B)  $r_T = 3. k C_B (C_D)^2$   
 (C)  $r_T = - k C_B (C_D)^2$   
 (D)  $r_T = (k/2) C_B (C_D)^2$
41. An elementary chemical reaction  $B+2D \rightarrow 3T$ , proceeds with a rate constant  $k$ ,  
 If  $-r_B = k C_B (C_D)^2$  Then,  $-r_D = ?$   
 a)  $-r_D = (k/2)C_B (C_D)^2$   
 b)  $-r_D = - k C_B (C_D)^2$   
 c)  $-r_D = 2. k C_B (C_D)^2$   
 d)  $-r_D = (k/2) C_B (C_D)^2$
42. For elementary reactions  
 a) Order and molecularity are same  
 b) Order is less than molecularity  
 c) order is always greater than molecularity  
 d) None of the above
43. For non-elementary reaction  
 a) Order and molecularity are same  
 b) Order and molecularity may or may not be same  
 c) order is always greater than molecularity  
 d) None of the above
44. Molecularity of a reaction is  
 (A) number of molecules involved in the rate determining step of chemical reaction  
 (B) number of molecules as per stoichiometric equation  
 (C) either fractional or integer value  
 (D) none of the above

45. In case of elementary bimolecular reaction  
( A ) order and molecularity is two  
( B ) order and molecularity is one  
( C ) order is two while molecularity is one  
( D ) None of the above
46. Given the unit of rate constant as mole/min.lit, the order of the reaction is  
( A ) Zero order  
( B ) First order  
( C ) Second order  
( D ) Third order
47. Given the unit of rate constant as lit/hr. kgmole, the order of the reaction is  
( A ) Zero order  
( B ) First order  
( C ) Second order  
( D ) Third order
48. Given the unit of rate constant as 1/min. the order of the reaction is  
( A ) Zero order  
( B ) First order  
( C ) Second order  
( D ) Third order
49. Half life time of reaction is  
( A ) when reactant concentration reaches to half of the initial concentration  
( B ) When reactant concentration is fifty percent converted  
( C ) Both ( A ) and ( B )  
( D ) half of the time of total reaction time
50. A chemical reaction  $A + 2B \rightarrow 3C$  is carried out in a batch reactor, if at a particular point the rate of formation of C is  $30 \text{ mole/m}^3 \cdot \text{Sec.}$ , the rate of disappearance of A in  $\text{mole/m}^3 \cdot \text{Sec}$  is  
( A ) 10  
( B ) 20  
( C ) 5  
( D ) 30

51. In case of Arrhenius theory, a power of temperature is  
( A) one  
( B) zero  
( C) one half  
( D) Two
52. In case of Arrhenius law,  
( A) A given reaction is much more temperature sensitive at high temperature than At low Temperature  
( B) A given reaction is much more temperature sensitive at low temperature than at high Temperature  
( C) Effect of temperature is same at low as well as at high temperature  
( D) Temperature sensitivity depends on frequency factor
53. In case of transition state theory  
(A) Rate controlling step is the decomposition of activated complex  
(B) Rate controlling step is the formation of activated complex  
(C) Rate is independent of activated complex  
(D) Rate is independent of temperature
54. During a reaction, activated complex formed decomposes spontaneously and give product. This assumption is made in,  
( A) Arrhenius theory  
(B) Transition state theory  
(C) Collision theory  
(D) None of the above
55. As per Arrhenius theory, plot of  $\ln(k)$  versus  $1/T$  gives straight line with slope of  
a)  $-E/R$   
b)  $E/R$   
c)  $R/E$   
d)  $-R/E$

56. As per Arrhenius theory, plot of  $\ln(k)$  versus  $1/T$  gives straight line with Y-intercept of
- $\ln k_0$
  - $-\ln k_0$
  - $-E/R$
  - $1/k_0$
57. According to collision theory
- Formation of intermediate is slow step while its decomposition is fast step
  - Formation of intermediate is fast step while its decomposition is slow step
  - Formation of intermediate and its decomposition both are fast steps
  - Formation of intermediate and its decomposition both are slow steps
58. According to collision theory
- rate constant is directly proportional to absolute temperature
  - rate constant is directly proportional square root of absolute temperature
  - rate constant is directly proportional to square of absolute temperature
  - rate constant is independent of temperature
59. According to transition state theory
- rate constant is directly proportional to absolute temperature
  - rate constant is directly proportional square root of absolute temperature
  - rate constant is directly proportional to square of absolute temperature
  - rate constant is independent of temperature
60. The minimum excess energy above average internal energy of a molecule, required for a chemical change to take place is called
- Entropy
  - Activation energy
  - Fugacity
  - activity coefficient

61. Every ten minutes two reactor volume of feed is being treated at a specified condition in a continuous reactor, the space velocity is  
( A ) 0.2/min  
( B ) 5/min  
( C ) 20/min  
( D ) 10 min
62. In a batch reactor an irreversible first order reaction  $A \rightarrow R$  takes place. The reaction rate constant is  $0.2 \text{ sec}^{-1}$  and the initial concentration of A is  $0.1 \text{ mole/m}^3$ . The conversion of reactant achieved after 5 sec is  
(A)  $X_A = 0.632$   
(B)  $X_A = 0.33$   
(C)  $X_A = 0.367$   
(D)  $X_A = 0.67$
63. The time to reduce the number of moles by a factor of 10 in a batch reactor for the reaction with  $-r_A = kC_A$ , when  $k = 0.046 \text{ min}^{-1}$  is  
A) 60 minutes  
B) 50 minutes  
C) 40minutes  
D) 70 minutes
64. For a second order reaction, when concentration is expressed in moles/lit and time is expressed in hr, unit of rate constant is  
a)  $\text{hr}^{-1} (\text{lit/mol})$   
b)  $\text{hr}^{-1} (\text{mole/lit})$   
c)  $\text{mole/lit.hr}^2$   
d)  $\text{hr}^2 (\text{mole/lit.})^2$
65. For a zero order reaction, when concentration is expressed in moles/lit and time is expressed in hr, unit of rate constant is  
a)  $\text{hr}^{-1} (\text{lit/mol})$   
b)  $\text{hr}^{-1} (\text{mole/lit})$   
c)  $\text{mole/lit.hr}^2$   
d)  $\text{hr}^2 (\text{mole/lit.})^2$

66. For a first order reaction, when concentration is expressed in kgmoles/lit and time is expressed in hr, unit of rate constant is
- a)  $\text{hr}^{-1}$  (lit/kgmol)
  - b)  $\text{hr}^{-1}$  (kgmole/lit)
  - c) kgmole/lit.hr<sup>2</sup>
  - d)  $\text{hr}^{-1}$
67. Given the unit of rate constant as, lit/mole. min, , the order of the reaction is
- a) first order
  - b) second order
  - c) zero order
  - d) half order
68. Differential method of analysis of data is used when
- A) Rate of reaction is function of more than one reactant concentration
  - B) Rate is essentially a function of concentration of only one reactant
  - C) reaction order is known and only k is desired unknown
  - D) multiple reactions are taking place in a reactor
69. In a continuous reactor, it was observed that 30 minutes are required to process five reactor volume of feed measured at specified condition. The space time of the reactor is
- (A) 6 minutes
  - ( B) 10 seconds
  - (C) 150 minutes
  - ( D ) 10 minutes
70. Liquid A decomposes by a first order kinetics and in a batch reactor half-life period of reaction is 300 sec. How much longer would it take to reach fifty percent conversion?
- ( A) 5 minutes
  - (B) 10 minutes
  - ( C) 200 sec
  - ( D) 400 sec

71. Liquid A decomposes by a second order kinetics and in a batch reactor half-life period of reaction is 300 sec. How much longer would it take to reach fifty percent conversion?
- ( A) 200 sec
  - (B) 10 minutes
  - ( C) 400 sec
  - ( D) 5 minutes
72. A gaseous reaction takes place isothermally in a constant pressure reactor, when conversion was fifty percent, the ratio of final to initial volume was found to be 1.6. what is fractional volumetric change
- ( A) 1
  - ( B) 1.2
  - ( C) 1.5
  - ( D) 2
73. A gaseous reaction takes place isothermally in a constant pressure reactor, when fractional volumetric change is 1.2, the ratio of final to initial volume was found to be 1.6. what is conversion?
- ( A) 40 %
  - ( B) 50 %
  - ( C) 60%
  - ( D) 80 %
74. Integral method of analysis of data is used when
- A) Rate of reaction is function of more than one reactant concentration
  - B) Rate is essentially a function of concentration of only one reactant
  - C) reaction order is known and only k is desired unknown
  - D) multiple reactions are taking place in a reactor
75. In a chemical reaction, fractional conversion is
- ( A) Independent of reactant concentration
  - ( B) Ratio of moles of reactant reacted to moles of reactant fed
  - ( C) Ratio of moles of reactant converted to desired product to moles of reactant fed
  - ( D) Fraction of reactant remained unconverted

76. Constant volume reactor means
- (A) volume of reaction mixture do not changes after reaction
  - (B) Reactor size s constant
  - (C) Voume of reaction mixture changes but reactor volume is constant
  - (D) it is variable density mixture in the reactor
77. Variable volume reactor means
- (A) volume of reaction mixture do not changes after reaction
  - (B) Volume of reaction mixture changes
  - (C) it is variable density mixture in the reactor
  - (D) both (B) and (C)
78. In case of irreversible uni-molecular first order reaction analysis of data following equation is obtained
- (A)  $\ln (C_A/C_{A0}) = k t$
  - (B)  $\ln (C_{A0}/C_A) = k t$
  - (C)  $\ln (1-X_A) = kt$
  - (D)  $\ln C_A = C_{A0} k t$
79. In case of zero order reaction, while analyzing batch data
- (A) plot of  $C_A$  against time gives slope  $-k$  and Y- intercept  $C_{A0}$
  - (B) Plot of  $C_A$  against time gives slope  $k$  and Y- intercept  $-C_{A0}$
  - (C) Plot of  $C_A/C_{A0}$  against time gives slope  $k$
  - (D) Plot of  $C_A/CAo$  against time gives slope  $-k$
80. In case of irreversible second order reaction, while analysis of batch data
- (A) Plot of  $1/C_A$  against time gives a straight line with slop  $k$  and Y-intercept of  $C_{A0}$
  - (B) Plot of  $C_A$  against time gives a straight line with slop  $k$  and Y-intercept of  $1/C_{A0}$
  - (C) Plot of  $1/C_A$  against time gives a straight line with slop  $-k$  and Y-intercept of  $1/C_{A0}$
  - (D) Plot of  $1/C_A$  against time gives a straight line with slop  $k$  and Y-intercept of  $1/C_{A0}$

81. When order of reaction “n” is less than one then,
- Reaction never go to completion
  - Reaction go to completion in a finite time  $t = \frac{CA_0^{1-n}}{(1-n)k}$
  - Reaction go to completion in a finite time  $t = \frac{CA_0^{1-n}}{(n-1)k}$
  - Both (b) and (c)
82. Half-life period of a reaction is,
- The half of the time required for the 100% conversion of reactant
  - The time required for the concentration of the reactant to drop to one half the original value
  - Time required to achieve 50% conversion
  - Both (B) and (C)
83. In case of isothermal variable volume gas phase reaction  $A \rightarrow 4 R$ , value of fractional volumetric change is
- 2
  - 3
  - 4
  - 1
84. In case of isothermal variable volume gas phase reaction  $A \rightarrow 4 R$ , containing 50% inert, value of fractional volumetric change is
- 2
  - 3
  - 4
  - 1.5
85. Liquid A decomposes by first order kinetics and in a batch reactor, 75% of A is converted 500 second. How much longer it took to reach 50% conversion.
- 250 sec
  - 300 sec
  - 400 sec
  - 350 sec.

86. A liquid A decomposes by second order kinetics and in a batch reactor 75% of A is converted in 12 minutes run. Find half-life period of the reaction.( i.e. when conversion is 50%)
- 5 min
  - 4min
  - 6 min
  - 8 min
87. In case of variable volume reactor, ratio of final to initial volume was found to be 1.6 and value of  $\epsilon_A = 0.9$ , the conversion achieved in this reaction is
- 60 %
  - 66%
  - 75 %
  - 80 %
88. In case of variable volume reactor, assumption is
- linear variation of volume with conversion
  - linear variation of volume with time
  - Nonlinear variation of volume with conversion
  - Linear variation of volume with temperature.
89. For an isothermal variable volume batch reactor, following relationship is applicable for a first order irreversible reaction
- $X_A = k \cdot t$
  - $\epsilon_A \cdot \ln(1 - X_A) = k \cdot t$
  - $-\ln(1 - X_A) = k \cdot t$
  - $\ln(1 - X_A) = k \cdot t$
90. Steady state reactors means
- concentration, temperature, reaction rate and other parameter remains unchanged with time
  - concentration changes with time
  - concentration, temperature may or may not changes with time
  - only reaction rate remains unchanged with time

91. CSTR stands for  
(A) Continuously flow stirred tank Reactor  
(B) Constant and steady flow tank batch reactor  
(C) Continuously flow Stirred Tubular reactor  
(D) Constant and steady flow tubular reactor
92. CSTR is also called as  
(A) batch reactor  
(B) Backmix reactor  
(C) Steady state mixed flow reactor  
(D) Both ( B) and ( C)
93. Plug flow reactor is  
(A) ideal steady state tubular flow reactor  
( B) unsteady state tubular reactor  
( C ) Continuously flow Stirred Tubular reactor  
( D) None of the above
94. Space time used in flow reactor is  
( A) based on outlet flow rate of reactor  
( B) inlet flow rate of reactor  
( C) not based on flow rate  
( D) both ( A) and ( B)
95. Holding time used in flow reactor is  
( A) based on outlet flow rate of reactor  
( B) inlet flow rate of reactor  
( C) not based on flow rate  
( D) both ( A) and ( B)
96. Space time and holding time are same for  
( A) gas phase reaction with variable volume  
( B) liquid phase reaction with negligible variation in volume  
( C) both gas and liquid phase reaction  
( D) none of the above

97. PFR is a
- (A) Batch reactor
  - (B) Continuous flow tubular reactor
  - (C) Semibatch Reactor
  - (D) Tank reactor
98. CSTR is a
- (A) Batch reactor
  - (B) Continuous flow reactor
  - (C) Semibatch Reactor
  - (D) None of the above
99. If reactor volume is 2 lit while inlet flow rate is 4 lit/min in CSTR then space time is
- (A) 2 min
  - (B) 0.5 min
  - (C) 4 min
  - (D) 6 min
100. If reactor volume is 2 lit while inlet flow rate is 4 lit/min and outlet flow rate is 5 lit/min in CSTR then space time is
- (A) 2 min
  - (B) 0.4 min
  - (C) 0.8 min
  - (D) 0.5 min
101. If reactor volume is 2 lit while inlet flow rate is 4 lit/min and outlet flow rate is 5 lit/min in CSTR then holding time is
- (A) 2 min
  - (B) 0.4 min
  - (C) 0.8 min
  - (D) 0.5 min

102. A term holding time is used for  
(A) Constant volume reactor  
(B) Variable volume reactor  
(C) Both for constant and variable volume reactor  
(D) None of the above.
103. When space velocity is 4 per hour, space time is  
(A) 15 minutes  
(B) 25 minutes  
(C) 20 minutes  
(D) 30 minutes
104. Space velocity is  
(A) velocity of fluid in a reactor  
(B) number of reactor volume processed in unit time  
(C) it is a reciprocal of space time  
(D) both (B) and (C)
105. Performance of flow reactor is defined by a term "Space time" and Space velocity. A reactor processes 10 reactor volume in 20 minutes. What is space time and space velocity?  
a) space time is 10 minutes and space velocity  $20 \text{ min}^{-1}$   
b) space time is 2 minutes and space velocity  $0.2 \text{ min}^{-1}$   
c) space time is 20 minutes and space velocity  $0.05 \text{ min}^{-1}$   
d) space time is 2 minutes and space velocity  $0.5 \text{ min}^{-1}$
106. What assumptions are made when modeling an ideal tubular reactor?  
a) Steady state and complete mixing radially and no mixing in the longitudinal direction  
b) same residence time for all the molecules  
c) concentration varies along the length coordinate but not in radial coordinate  
d) all the above

107. A reaction  $A \rightarrow B$  is carried out in a CSTR and also in a PFR. If entering flow rate and a feed concentration are same, space time required in both the reactor is also same. What is the order of the reaction?
- First order
  - Second order
  - Zero order
  - Half order
108. For a given reaction, for the same reaction conditions and for the same degree of conversion,
- Space time is greater for CSTR than PFR
  - Space time is same for CSTR and PFR
  - Space time is greater for PFR than CSTR
  - None of the above
109. Select correct option from the following
- space time is based on inlet feed flow rate while holding time is based on outlet product flow rate
  - Holding time and space time are same for liquid phase reaction
  - both ( a) and (b)
  - none of the above
110. For a given reaction, for the same reaction conditions and for the same degree of conversion,
- Space time is same for CSTR and PFR
  - b Space time is greater for CSTR than PFR
  - Space time is greater for PFR than CSTR
  - None of the above
111. For a zero order reaction, for the same reaction conditions and for the same degree of conversion,
- Space time is same for CSTR and PFR
  - b Space time is greater for CSTR than PFR
  - Space time is greater for PFR than CSTR
  - None of the above

112. For a given reaction, for the same reaction conditions and for the same degree of conversion,
- a) Ratio of volume of CSTR reactor to volume of plug flow reactor decreases with order of reaction
  - b) Ratio of volume of CSTR reactor to volume of plug flow reactor increases with order of reaction
  - c) Ratio of volume of CSTR reactor to volume of plug flow reactor same for any order of reaction
  - d) None of the above
113. When reaction is carried out in CSTR, the exit conversion of reactant A, for zero order reaction is 90% and space time is 3 minutes. If same reaction is carried out in PFR, what is the space time required to achieve the same conversion?
- a) Less than three minutes
  - b) 3 minutes
  - c) More than three minutes
  - d) Cannot be predicted
114. When reaction is carried out in PFR, the exit conversion of reactant A, for first order reaction is 80% and space time is 3 minutes. If same reaction is carried out in CSTR, what is the space time required to achieve the same conversion?
- a) Less than three minutes
  - b) 3 minutes
  - c) More than three minutes
  - d) Cannot be predicted
115. Space velocity is defined as
- a) time required to process one reactor volume of feed
  - b) Number of reactor volume of feed treated in a unit time
  - c) time required to process ten reactor volume of feed
  - d) Volume of reactor / Feed flow rate.

116. Which one of the following is not a characteristic of a CSTR?
- a) High conversion per unit reactor volume
  - b) Can be connected in series
  - c) Well mixed
  - d) Good temperature control.
117. Space time and holding time is same for ,
- A) Liquid phase reaction
  - B) Gas phase reaction
  - C) Both for liquid and gas phase reaction
  - D) None of the above
118. What assumption is made when studying an Ideal CSTR?
- A) Turbulent mixing
  - B) Adiabatic operation
  - C) Perfect mixing
  - D) Constant volume
119. Which of the following reactors usually have the easiest temperature control?
- A) fluidized bed reactors
  - B) CSTRs
  - C) Tubular reactors
  - D) Batch reactors
120. What is the exit conversion of reactant A for a zero order reaction taking place in a CSTR with the following data rate constant is 1 mole/lit. min, initial concentration is 1 mole/lit, volumetric flow rate is 0.5 lit/min , reactor volume is one litre
- (A) 200 %
  - ( B) 100 %
  - ( C) 50 %
  - (D) 80 %
121. What is the exit conversion of reactant A for a zero order reaction taking place in a PFR with the following data.

Rate constant is 1 mole/lit. min, initial concentration is 1 mole/lit , volumetric flow rate is 0.5 lit/min , reactor volume is one litre.

- (A) 200 %
- ( B) 50 %
- ( C) 100 %
- (D) 80 %

122. What assumptions are made when modeling an ideal tubular reactor?
- A). Steady state and no radial variations
  - B) Plug flow and liquid systems
  - C) only Gas flow and steady state
  - D) That the reactor will photograph well
123. Space time is defined as
- A) time required to process one reactor volume of feed
  - B) number of reactor volume of feed treated in a unit time
  - C) time required to process ten reactor volume of feed
  - D) feed flow rate/ volume of reactor
124. When reaction. is carried out in CSTR, the exit conversion of reactant A for zero order reaction is 80% and space time is 2 minutes. If same reaction is carried out in PFR, what is the space time required to achieve the same conversion?
- A) 1 minute
  - B) 2 minutes
  - c) 3 minutes
  - D) 4 minutes
125. If 1 lit/min of gaseous reactant A is introduced into a mixed flow reactor of volume one lit. If the outlet flow rate is 2 lit/min (as it is variable volume reaction) and conversion is 50%. What is the space time and holding time
- a) space time is 1 minutes and holding time is 2 min
  - b) space time is 2 minutes and holding time is 1 min
  - c) space time is 1 minutes and also holding time is 1 min
  - d) space time is 1 minutes and holding time is 0.5 min

126. For any particular duty and for all positive orders
- (A) Mixed reactor is always smaller than the plug flow reactor
  - (B) Mixed reactor is always larger than the plug flow reactor
  - (C) Size comparison varies based on the order of the reactor
  - (D) for smaller order, CSTR size is smaller and for higher order Plug flow is larger
127. For zero order reaction
- (A) CSTR is larger than plug flow
  - (B) CSTR is smaller than plug flow
  - (C) Both reactors are of same size
  - (D) CSTR and PFR size is decided by feed flow rate only and not order of reaction
128. Generally, low volume and valuable products are treated in
- (A) Batch reactor
  - (B) CSTR
  - (C) Plug flow reactor
  - (D) Fluidized bed reactor
129. In case of CSTR,
- (A) as flow rate varies, concentration also changes in a reactor, but temperature is uniform
  - (B) no complete mixing in vessel hence, concentration, temperature of reaction mixture are varying in all parts of vessel
  - (C) mixing is complete so that concentration, temperature of reaction mixture are uniform in all parts of the vessel.
  - (D) None of the above
130. In case of plug flow reactor
- (A) There is complete mixing in radial direction and no mixing in the direction of flow
  - (B) There is mixing in direction of flow as well as in radial direction
  - (C) There is no mixing in radial direction but mixing in the direction of flow
  - (D) No mixing takes place in plug flow as agitator is not used

131. A homogeneous liquid phase reaction  $A \rightarrow R$  takes place with eighty percent conversion in a plug flow reactor, if the reactor is replaced by CSTR with equal volume, conversion will be
- (A) eighty percent
  - (B) less than eighty percent
  - (C) more than eighty percent
  - (D) cannot be evaluated
132. A homogeneous liquid phase reaction  $A \rightarrow R$  takes place with eighty percent conversion in a CSTR reactor, if the reactor is replaced by Plug flow reactor with equal volume, conversion will be
- (A) eighty percent
  - (B) less than eighty percent
  - (C) more than eighty percent
  - (D) cannot be evaluated
133. In case of CSTR, with zero order reaction, reactor volume is
- a)  $F_{A0} X_A / K$
  - b)  $k / F_{A0} X_A$
  - c)  $k \cdot X_A / F_{A0}$
  - d)  $F_{A0} X_A$
134. In case of Plug flow reactor, with zero order reaction, reactor volume is
- a)  $F_{A0} X_A / K$
  - b)  $k / F_{A0} X_A$
  - c)  $k \cdot X_A / F_{A0}$
  - d)  $F_{A0} X_A$
135. Difference between residence time and space time is
- a. residence time is term used in batch reactor while space time is term used in flow reactor
  - b. residence time and space time are same
  - c. residence time is used in case of flow reactor while space time is used in case of batch reactor
  - d. Residence time is used for CSTR while space time is used in PFR reactor
136. In case of first order constant volume reaction in CSTR, space time is

- A)  $1-X_A/X_A k$   
 B)  $X_A/(1-X_A)k$   
 C)  $1/(1-X_A).k$   
 D)  $kX_A/(1-X_A)$
137. In case of first order constant volume reaction in PFR, space time is  
 A)  $-\ln(1-X_A)/k$   
 B)  $k \ln(1-X_A)$   
 C)  $X_A/k(1-X_A)$   
 D)  $-k(1-X_A)/X_A$
138. What is the space time in CSTR for first order reaction  $A \rightarrow \text{Product}$ , when conversion is 50% and rate expression is  $-r_A = 2.5 C_A$  moles/lit.hr  
 A. 4 hr  
 B 0.4 hr  
 C. 2.5hr  
 D. 2 hrs
139. What is the space time in PFR for first order reaction  $A \rightarrow \text{Product}$ , when conversion is 50% and rate expression is  $-r_A = 2.5 C_A$  moles/lit.hr  
 A. 4 hr  
 B 0.4 hr  
 C. 0.28 hr  
 D. 2.8 hrs
140. What is the space time in an ideal tubular plug flow reactor for second order reaction  $2A \rightarrow \text{Product}$   
 A  $\tau = X_A/k C_{A0}(1-X_A)$   
 B  $\tau = X_A/k C_{A0}(1-X_A)^2$

- C.  $\tau = k.XA/ CA_o( 1-XA)$
- D.  $\tau = k CA_o ( 1-XA) / XA$
141. What is the space time in CSTR for second order reaction  $2 A \rightarrow \text{Product}$
- A.  $\tau = XA/ k CA_o( 1-XA)$
- B.  $\tau = XA/ k CA_o( 1-XA)^2$
- C.  $\tau = k.XA/ CA_o( 1-XA)$
- D.  $\tau = k CA_o ( 1-XA) / XA$
- 142.** In case of homogeneous liquid phase reaction
- A) All reactant , product and catalyst all are in liquid phase
- B) Reactant and product are in liquid phase while catalyst can be in solid phase
- C) Reactant and catalyst are in liquid phase while product can be vapour phase
- D) Only catalyst is in liquid phase
143. A packed bed reactor is also known as a fluidized bed reactor.
- A) Only when using an alias
- B) Depends on the catalyst used
- C) True
- D) Always false
144. A term Plug flow is also called as
- A. Laminar flow
- B. Transitional flow
- C. Slug or piston flow
- D. Turbulent flow

145. A Mixed flow reactor
- A. Plug flow reactor
  - B. CSTR
  - C. Fluidized bed reactor
  - D. Pipe Reactor
146. A packed bed reactor is also known as a fluidized bed reactor.
- A) Only when using an alias
  - B) Depends on the catalyst used
  - C) True
  - D) Always false
147. Hot spot occurs in
- ( A) fluidized bed reactor
  - ( B) fixed bed reactor
  - ( B) tank reactor
  - ( D) all of the above
148. For high rate of heat transfer and high conversion use
- (A) fixed bed reactor
  - ( B) fluidized bed reactor
  - ( C) Tank reactor
  - ( D) all of the above
149. For autocatalytic reactor
- ( A) generally tubular reactor is preferred
  - ( B) generally CSTR is preferred
  - ( C) both are preferred
  - ( D) None of the above

150. Damkohler number
- (A) give quick estimate of size of reactor
  - (B) gives quick estimate of degree of conversion in a continuous flow reactor
  - (C) gives quick estimate of feed flow rate
  - (D) gives quick estimate of type of reactor used
151. When equal sized mixed flow reactors are connected in series
- (A) behavior is similar to single plug flow reactor
  - (B) behavior is similar to single CSTR
  - (C) behavior is initially plug flow reactor and after words like CSTR
  - (D) both (A) and (B)
152. Tungsten is not a good catalyst as compared to nickel, because
- a) Its surface adsorption is very poor
  - b) its desorption is very good
  - c) Adsorption is very strong and Desorption is poor.
  - d) It is very rare metal
153. Ratio of amount of desired product formed to the amount of reactant converted is called as
- a) Regenerability
  - b) Yield
  - c) Selectivity
  - d) Activity
154. Substance when added in a small amount during catalyst manufacturing, which lessens activity, stability or selectivity is called
- a) Promoter
  - b) Inhibitors
  - c) Poison
  - d) Catalyst

155. Catalyst is
- (A) a substance taking part in reaction and increases the rate of reaction and gets consumed
  - (B) a substance which increases the rate of reaction without appearing in the end product.
  - (C) a complex substance taking part in reaction and getting consumed
  - (D) substance used to increase the rate of undesired reaction.
156. Catalyst increases
- (A) the rate of desired reaction
  - (B) the rate of desired and also undesired reaction
  - (C) the rate of only undesired reaction
  - (D) it is used to stop the unwanted reaction
157. Ability of catalyst to retain its initial activity and selectivity over the catalyst life time is
- (A) Regenerability
  - (B) Stability
  - (C) Selectivity
  - (D) Activity
158. Efficiency in catalyzing a desired transformation by a catalyst is
- (A) regenerability
  - (B) stability
  - (C) Selectivity
  - (D) Activity
159. A substance added in small quantity during catalyst preparation which improves catalyst activity, selectivity and stability is called as
- (A) Promoters
  - (B) inhibitors
  - (C) deactivation
  - (D) precipitation

160. A substance added in small quantity during catalyst preparation which lessens the catalyst activity, selectivity and stability is called as
- ( A) Promoters
  - ( B) Inhibitors
  - ( C) Deactivation
  - ( D) Precipitation
161. Leaded petrol with catalytic converter is not used because
- ( A) it gives low conversion
  - ( B) lead acts as poison to catalyst
  - ( C) it is costly
  - ( D) none of the above

