

CHEMICAL ENGINEERING
(Final)

1. In a combustion process at steady state ,1 mole of carbon and 1 mole of oxygen is fed to the system and 1 mole of carbon dioxide is obtained per unit time. The accumulation in this process is

| | |
|--------|--------|
| (A) 12 | (B) 32 |
| (C) 0 | (D) 44 |

2. In a test ,20kg of propane was burnt with 40kg of air to produce 44kg of CO₂ and 12 kg CO.What was the percent excess air?

| | |
|-----------|---------|
| (A) 2.27 | (B) 28 |
| (C) 13.79 | (D) 2.8 |

3. Calculate the molality of 1 litre solution of 93% sulphuric acid (weight /volume)

| | |
|----------|-----------------------|
| (A) 0.91 | (B) 10.43 |
| (C) 9.30 | (D) None of the above |

4. Weight of 56 litres of ammonia at N.T.P. is _____ gram.

| | |
|----------|----------|
| (A) 2.5 | (B) 8600 |
| (C) 42.5 | (D) 4.56 |

5. A gas at 0°C is cooled at constant pressure until its volume becomes half the original volume. The temperature of the gas at this state will be

| | |
|---------------|---------------|
| (A) - 273°C | (B) - 136.5°K |
| (C) - 136.5°C | (D) 0°K |

6. Number of gram moles of solute dissolved in 1 kg of solvent is called its

| | |
|---------------|---------------|
| (A) normality | (B) molality |
| (C) molarity | (D) formality |

7. The value of gas constant ‘R’ is _____ kcal/kg.mole.°C.

| | |
|----------|-----------------------|
| (A) 2.79 | (B) 1.987 |
| (C) 3.99 | (D) None of the above |

8. The vapor pressures of benzene and toluene are 3 and 4/3 atmospheres respectively. A liquid feed of 0.4 moles of benzene and 0.6 moles of toluene is vapourised. Assuming that the products are in equilibrium, the vapor phase mole fraction of benzene is

| | |
|---------|---------|
| (A) 0.8 | (B) 0.6 |
| (C) 0.2 | (D) 0.4 |

25. For settling in the stoke's range ,the value of Reynold's number is

- | | |
|-------------------------------|------------------------------|
| (A) $2 < \text{Rep} < 200$ | (B) $200 < \text{Rep} < 500$ |
| (C) $500 < \text{Rep} < 2100$ | (D) $0 < \text{Rep} < 2$ |

26. Kynch Theory is applicable for the design of

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|--------------------------|
| (A) Ball Mill |
| (B) Continuous thickener |
| (C) Distillation column |
| (D) Packed Bed |

27. Which of the following is not categorised as a “mechanical operation”?

- | | |
|----------------------|--------------------|
| (A) Size enlargement | (B) Filtration |
| (C) Agitation | (D) Humidification |

28. Two particles are called to be equal settling, if they are having the same.

- | |
|---|
| (A) size |
| (B) terminal velocities in the same fluid & in the same field of force. |
| (C) specific gravity |
| (D) None of the above |

29. Diatomaceous earth is a/an

- | | |
|-------------------|----------------|
| (A) explosive | (B) filter aid |
| (C) filter medium | (D) catalyst |

30. For a non-spherical particle, the sphericity

- | |
|--|
| (A) has the dimension of length. |
| (B) is always less than 1. |
| (C) is the ratio of volume of a sphere having the same surface area as the particle to the actual volume of the particle. |
| (D) is defined as the ratio of surface area of a sphere having the same volume as the particle to the actual surface area of the particle. |

31. Froth floatation is the most suitable for treating

- | | |
|-------------------|-----------------------|
| (A) sulphide ores | (B) quartzite |
| (C) iron ores | (D) None of the above |

32. The main size reduction operation in ultrafine grinders is

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|-----------------|---------------|
| (A) compression | (B) attrition |
| (C) impact | (D) cutting |

33. Trommels separate a mixture of particles depending on their

- | | |
|--|-----------------|
| (A) size | (B) density |
| (C) electrical and magnetic properties | (D) wettability |

42. Poise is the unit of
(A) kinematic viscosity (B) dynamic viscosity
(C) pressure (D) power

43. Which of the following fluid is essentially a non-Newtonian fluid under normal working conditions?
(A) Human blood (B) Thin lubricating oils
(C) Water (D) Air

44. The plot below corresponds to
(A) pseudo plastic fluid (B) real fluid
(C) bingham plastic (D) None of the above.

45. Gauge pressure at a point is equal to
(A) absolute pressure minus absolute zero pressure
(B) absolute pressure minus atmospheric pressure
(C) absolute zero pressure plus absolute pressure
(D) absolute zero pressure plus atmospheric pressure

46. Laminar flow of a Newtonion fluid ceases to exist, when the Reynolds number exceeds
(A) 3000 (B) 4000
(C) 2100 (D) 1500

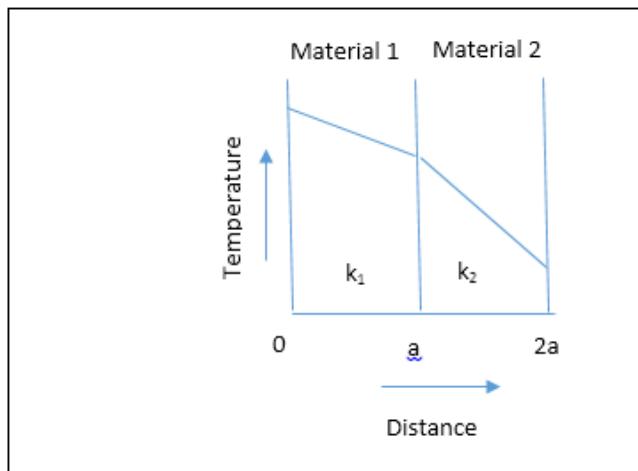
47. The net positive suction head (NPSH) of a centrifugal pump is defined as the sum of the velocity head and the pressure head at the
(A) suction
(B) discharge minus vapor pressure of the liquid at the discharge temperature
(C) discharge
(D) suction minus vapor pressure of the liquid at suction temperature

48. Which of the following denotes the effect of compressibility in fluid flow?
(A) Mach number (B) Weber number
(C) Euler number (D) Reynolds number

49. Power loss in an orificemeter is _____ that in a venturimeter.
(A) same as (B) more than
(C) data insufficient, cannot be predicted (D) less than

50. At high Reynolds number
- (A) viscous forces predominate.
 - (B) inertial forces control and viscous forces are unimportant.
 - (C) inertial forces are unimportant and viscous forces control.
 - (D) None of the above
51. For a particle settling in water at its terminal settling velocity, which of the following is true?
- (A) Weight = buoyancy + drag
 - (B) Buoyancy = weight + drag
 - (C) Drag = buoyancy + weight
 - (D) Drag = weight
52. Very small pressure difference (< 5 mm water column) can be most conveniently measured by a/an _____ manometer.
- (A) inclined tube water
 - (B) U-tube water
 - (C) U-tube mercury
 - (D) inclined tube mercury
53. Priming is needed in a _____ pump.
- (A) diaphragm
 - (B) centrifugal
 - (C) reciprocating
 - (D) gear
54. Where does the maximum stress occur in case of laminar flow of incompressible fluid in a closed conduit of diameter 'd'?
- (A) At $d/8$ from the wall
 - (B) At the wall
 - (C) At $d/4$ from the wall
 - (D) At the centre
55. Boundary layer separation is caused by the
- (A) reduction of pressure to vapour pressure
 - (B) boundary layer thickness reducing to zero
 - (C) adverse pressure gradient
 - (D) reduction of pressure gradient to zero
56. When a small quantity of water evaporates into large quantity of unsaturated air, the steady-state temperature attained is referred to as
- (A) Dew point
 - (B) Bubble point
 - (C) Wet-bulb temperature
 - (D) Dry-bulb temperature

57. The maximum heat loss from a heated pipe occurs when the thickness of thermal insulation is
- (A) less than critical radius (B) equal to critical radius
(C) more than critical radius (D) Both (B) and (C)
58. A cold fluid is heated from 100°C to 150°C by steam at 200°C. The LMTD in counter flow is
- (A) equal to the LMTD in parallel flow
(B) greater than the LMTD in parallel flow
(C) lower than the LMTD in parallel flow
(D) None of the above
59. Typically dropwise condensation occurs on cold surfaces which are
- (A) smooth and clean (B) polished
(C) slightly rough and dirty (D) made of only specific materials
60. Film boiling is not usually desired in commercial equipment because
- (A) it is very difficult to maintain
(B) it is not economical
(C) it is possible only in certain situations
(D) heat transfer rate is low
61. A preferred heat exchanger for gas-gas service is
- (A) multi pass shell and tube (B) double pipe
(C) plate type (D) finned tube
62. For concentrating fruit juice, the recommended evaporator to be used is
- (A) falling film evaporator (B) short tube vertical evaporator
(C) long tube vertical evaporator (D) agitated film evaporator
63. The cooling effect in a cooling tower can be speeded up by
- (A) increasing the area of exposed wet surface
(B) decreasing the air velocity
(C) increasing the barometric pressure
(D) increasing the humidity of air



- (A) $k_2 = 0$ (B) $k_2 > k_2$
 (C) $k_2 = k_2$ (D) $k_2 < k_2$

69. The ratio of kinematic viscosity to thermal diffusivity is known as

 - (A) Stanton Number
 - (B) Mach number
 - (C) Nusselt Number
 - (D) Prandtl number

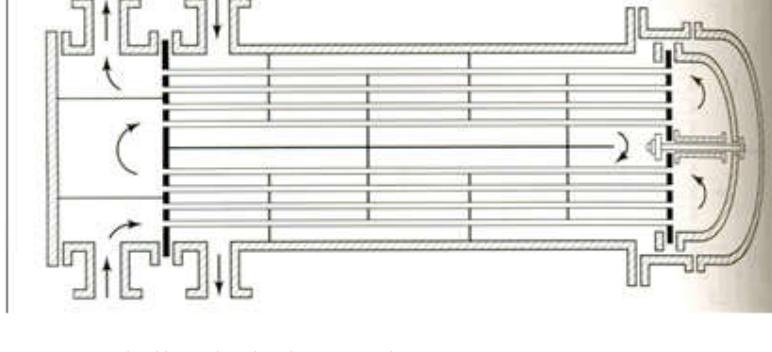
70. When Biot number approached towards zero, then

 - (A) no surface resistance
 - (B) high surface resistance
 - (C) no conductive resistance
 - (D) None of the above

71. According to Stefan Boltzmann's law, the emissive power of a black body is proportional to

 - (A) $T^{3/2}$
 - (B) T
 - (C) T^4
 - (D) T^3

72. The shell and tube heat exchanger shown in the figure below is a


 - (A) 2-4 shell and tube heat exchanger
 - (B) 4-2 shell and tube heat exchanger
 - (C) 2-2 shell and tube heat exchanger
 - (D) 4 -4 shell and tube heat exchanger

73. Which one of the following heat exchanger is used for evaporating viscous or heat sensitive material under high vacuum?

 - (A) Plate and frame exchanger
 - (B) Scraped surface heat exchanger
 - (C) Shell and tube heat exchanger
 - (D) Finned tube heat exchanger

74. For strong solutions , the boiling point elevation is best found by empirical rule known as

 - (A) Lambert rule
 - (B) Duhring rule
 - (C) Kirchoff's rule
 - (D) Fourier's rule

75. The LMTD correction factor (FT) is to be applied for

 - (A) counter flow exchanger
 - (B) co-current flow exchanger
 - (C) cross flow exchanger
 - (D) All of the above

76. In a heat exchanger shell, with tube size and pitch remaining same
- (A) more number of tubes can be accommodated in triangular pitch arrangement.
 - (B) more number of tubes can be accommodated in square pitch arrangement.
 - (C) equal number of tubes can be accommodated in both the cases
 - (D) cannot say
77. In a packed tower, the gas velocity must be about
- (A) 0.9 times the flooding velocity (B) 0.5 times the flooding velocity
 - (C) 0.3 times the flooding velocity (D) 0.2 times the flooding velocity
78. For gas liquid contact the pressure drop is the least in the following equipment
- | | |
|---------------------------|-----------------------|
| (A) bubble cap tower | (B) wetted wall tower |
| (C) perforated tray tower | (D) grid tray tower |
79. Langmuir equation is used in
- | | |
|----------------|------------------|
| (A) absorption | (B) distillation |
| (C) adsorption | (D) extraction |
80. Which of the following methods for the design of distillation column assume constant molal vaporization and overflow?
- | | |
|----------------------------|-----------------------------------|
| (A) Ponchon Savarit method | (B) Mc Cabe Thiele method |
| (C) Ellis method | (D) Enthalpy concentration method |
81. The ratio of flux to concentration gradient is known as
- | | |
|-------------------------------|----------------------------|
| (A) thermal diffusivity | (B) eddy diffusivity |
| (C) mass transfer coefficient | (D) volumetric diffusivity |
82. Channeling is most severe in
- (A) stacked packings
 - (B) dumped packings of crushed solids
 - (C) dumped packings of regular units
 - (D) any one of the above
83. Cox chart is used to find
- | | |
|----------------------|-----------------|
| (A) vapour pressure | (B) viscosity |
| (C) specific gravity | (D) diffusivity |
84. In an azeotropic mixture, the equilibrium liquid composition is
- | | |
|---------------------------------|-------------------------------|
| (A) more than vapor composition | (B) same as vapor composition |
| (C) less than vapor composition | (D) independent of pressure |

93. Rayleigh's equation is applicable for
- (A) continuous fractionation (B) continuous absorption
(C) simple distillation (D) continuous extraction
94. Phenomenon of liquid passing through the perforations in the tray column is called
- (A) flooding (B) loading
(C) coning (D) weeping
95. A spherical storage vessel is quarter-filled with toluene. The diameter of the vent at the top of the vessel is 1/20th of the diameter of the vessel. Under the steady state condition, the diffusive flux of toluene is maximum at
- (A) the surface of the liquid
(B) the mid-plane of the vessel
(C) the vent
(D) a distance 20 times the diameter of the vent away from the vent
96. Diffusivity of solute gas A in a gaseous mixture is
(where T is the temperature)
- (A) Proportional to $T^{1/2}$ (B) Proportional to T
(C) Proportional to $T^{3/2}$ (D) Independent of T
97. For a ternary mixture in extraction, a pure component can be represented by
- (A) sides of equilateral triangular coordinates
(B) apex of an equilateral triangular coordinates
(C) a point inside the binodal curve in the equilateral triangle
(D) a point outside the binodal curve in the equilateral triangle
98. Drying operation under vacuum is used to
- (A) reduce drying temperature
(B) increase drying temperature
(C) maintain drying at the same temperature as in the case of atmospheric pressure
(D) None of the above
99. The riser in bubble cap trays conduct the flow of
- (A) liquid (B) vapour
(C) both liquid and vapour (D) None of the above
100. An ideal plug flow reactor has
- (A) uniform mixing (B) axial dispersion
(C) flat velocity profile (D) None of the above

101. For any given duty and for all positive reaction orders, the size of mixed reactor is
- (A) higher than plug flow reactor (B) smaller than plug flow reactor
 (C) same as plug flow reactor (D) cannot say
102. For an increase in pressure in gas reactions, when the number of moles decreases conversion
- (A) decreases (B) increases
 (C) unaffected (D) cannot say
103. The response curve for a step input signal from a reactor is called
- (A) E-curve (B) C-curve
 (C) F-curve (D) I-curve
104. In a zero order reaction, the rate of chemical reaction
- (A) increases with the increase of concentration of reactants
 (B) decreases with the increase of concentration of reactants
 (C) is independent of the concentration of reactants
 (D) None of the above
105. For a gas phase reaction at 298 K, the rate is reported as $\frac{-dp_A}{dt} = 3.20p_A^3$, atm/h
 The unit of rate constant is
- (A) atm.h⁻¹ (B) atm⁻¹h⁻¹
 (C) atm⁻²h⁻¹ (D) atm⁻³h⁻¹
106. For a chemical reaction,
- $$\begin{array}{c} k \\ \text{3A+B} \xrightarrow{\hspace{1cm}} \text{2C} \end{array}$$
- the rate of formation of product is 0.4 mole/(litre.h). The rate of disappearance of A must be equal to
- (A) 0.4 mole//(litre.h) (B) 0.6 moles /(litre.h)
 (C) 0.2moles /(litre.h) (D) None of the above
107. For a reaction
- $$\begin{array}{c} k \\ \text{A+2B} \xrightarrow{\hspace{1cm}} \text{C} \end{array}$$
- The experimental data suggests that rate=k[A][B]. The molecularity and order of reaction for this reaction is
- (A) 3 and 2 respectively (B) 2 and 3 respectively
 (C) 3 and 3 respectively (D) 2 and 2 respectively

108. In a chemical reaction, the time required to reduce the concentration of reactant from 1 mole/litre to 0.5 mole/litre, is same as that required to reduce it from 50 moles/litre to 25 mole/litre in the same volume. Then the reaction is of

(A) Zero order (B) first order
(C) second order (D) third order

109. Which one of the following reaction will be favoured by low pressure?

(A) $N_2 + 3H_2 \leftrightarrow 2NH_3$ (B) $2SO_2 + O_2 \leftrightarrow 2SO_3$
(C) $2H_2 + O_2 \leftrightarrow 2H_2O$ (D) $N_2O_4 \leftrightarrow 2NO_2$

110. With the increase in temperature the equilibrium conversion of a reversible endothermic reaction $A \leftrightarrow R$

(A) decreases (B) increases
(C) remains unaffected (D) cannot say

111. A catalyst increases the rate of a reaction, because it

(A) increases the activation energy of the reactants
(B) decreases the activation energy of the reactants
(C) brings together the reactant molecules
(D) increases the temperature

112. For mixed flow systems, the Dispersion number

(A) Tends to infinity (B) tends to zero
(C) tends to 1 (D) None of the above

113. A first order reaction requires two equal sized CSTR. The conversion is

(A) more when they are connected in series
(B) less when they are connected in series
(C) same whether they are connected in series or in parallel
(D) more when they are connected in parallel

114. The most unsuitable reactor for carrying out reactions in which high reactant concentration favours high yields is

(A) plug flow reactor (B) series of CSTR
(C) PFR in series (D) backmix reactor

115. For every 10°C rise in temperature, the rate of chemical reaction doubles. When the temperature is increased from 30°C to 70°C , the rate of reaction increases _____ times.

(A) 12 (B) 8
(C) 16 (D) 32

123. Quick opening valves are generally of the type of
- | | |
|---------------------|-----------------|
| (A) needle valve | (B) globe valve |
| (C) diaphragm valve | (D) gate valve |
124. For measuring the temperature of a furnace which is the most suitable instrument
- | | |
|----------------------------|----------------------------|
| (A) thermocouple | (B) optical pyrometer |
| (C) bimetallic thermometer | (D) resistance thermometer |
125. In process control it is desirable to anticipate the effect of large load changes and reduce the maximum error; a possible control action to achieve this is
- | | |
|------------------|----------------|
| (A) proportional | (B) integral |
| (C) derivative | (D) PI control |
126. When $\zeta = 0$, the nature of step response is
- | | |
|-----------------|-----------------------|
| (A) underdamped | (B) critically damped |
| (C) overdamped | (D) undamped |
127. The band width of an on-off controller is
- | | |
|----------|--------------|
| (A) one | (B) 100 |
| (C) zero | (D) infinite |
128. Rheometer is used to measure
- | | |
|---------------------------|---------------|
| (A) density | (B) viscosity |
| (C) molecular diffusivity | (D) velocity |
129. In an underdamped second order response, the value of decay ratio is equal to
- | | |
|-----------------------------|-----------------------------|
| (A) overshoot | (B) overshoot ² |
| (C) overshoot ⁻² | (D) overshoot ⁻¹ |
130. A special case of proportional control is on-off control, when its gain Kc is
- | | |
|----------|-----------------------|
| (A) zero | (B) infinity |
| (C) 1 | (D) None of the above |
131. Servo problem is encountered when there is a change in
- | | |
|--------------------------|-----------------------|
| (A) set point | (B) load variable |
| (C) manipulated variable | (D) None of the above |
132. Consider a system with $G(s) = \frac{1}{s^2 + s + 1}$. The percentage overshoot for this system for a step change is
- | | |
|-----------|-----------|
| (A) 63.5% | (B) 16.6% |
| (C) 32 % | (D) 83% |

142. The closed loop pole of a stable second order system could be

- (A) complex conjugate with positive real parts
- (B) both real and negative
- (C) both real and positive
- (D) one real positive and the other real negative

143. The Laplace transform of $f(s)$ is

- | | |
|---------------------------------|-------------------------------|
| (A) $s^2 f(s) - s f(0) - f'(0)$ | (B) $s f(s) - s f(0) - f'(0)$ |
| (C) $s f(s) - f(0)$ | (D) $s^2 f'(s) - f(0)$ |

144. Which of the following second order systems are equivalent to two first order systems in series?

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|-------------------------------------|---|
| (A) $G(s) = \frac{1}{s^2 + 2s + 2}$ | (B) $G(s) = \frac{1}{s^2 + 1.9s + 0.7}$ |
| (C) $G(s) = \frac{1}{s^2 + 5}$ | (D) $G(s) = \frac{1}{s^2 + s + 2}$ |

145. If the absolute temperature of an ideal gas is doubled and pressure is reduced to one half, the volume of gas will

- | | |
|-----------------------|------------------------|
| (A) increase two fold | (B) increase four fold |
| (C) decrease two fold | (D) remains unchanged |

146. For a reversible adiabatic process ΔS is

- | | |
|-----------|-----------------------|
| (A) < 0 | (B) > 0 |
| (C) $= 0$ | (D) None of the above |

147. The expansion of a gas into vacuum is

- | | |
|------------------------|--------------------------|
| (A) reversible process | (B) irreversible process |
| (C) Both of the above | (D) None of the above |

148. Five moles of an ideal gas are compressed isothermally at 400°K from 1 atm to 5atm. Calculate the free energy change for the process.

- | | |
|----------------------------|------------------------------|
| (A) $- 5116.7 \text{ cal}$ | (B) 5116.7 cal |
| (C) 21409.39 cal | (D) $- 21409.39 \text{ cal}$ |

149. Pore diffusion resistance in a catalyst is considered negligible if Theile modulus is

- | | |
|-------------|-------------|
| (A) > 1 | (B) < 1 |
| (C) < 0.5 | (D) > 0.5 |

150. An adiabatic system can exchange energy with its surroundings

- (A) only in the form of work
- (B) either in the form of heat or work
- (C) in the form of only heat
- (D) both in the form of heat and work
