(Answer ALL questions)

56. When pressure is applied on the system, icewater, then
1. equilibrium cannot be established.
2. more ice will be formed.
3. more water will be formed.
4. evaporation of water will take place

57. Partial molar free energy of an element A in solution is same as it's
1. chemical potential
2. activity
3. fugacity
4. activity co-efficient

58. Free energy change at equilibrium is
1. zero
2. positive
3. negative
4. indeterminate

59. Heat pump
1. accomplishes only space heating in winter
2. accomplishes only space cooling in summer
3. accomplishes both (1) and (2)
4. works on Carnot cycle

60. The temperature at which both liquid and gas phases are identical, is called the ———— point.
1. critical
2. triple
3. freezing
4. boiling

61. Entropy change of mixing two liquid substances depends upon the
1. molar concentration
2. quantity (i.e. number of moles)
3. both (1) and (2)
4. neither (1) nor (2)

62. The four properties of a system viz. P, V, T, S are related by ———— equation.
1. Gibbs-Duhem
2. Gibbs-Helmholtz
3. Maxwell
4. None of the above

63. If the pressure on 100 c.c. of air is halved, then its volume (at the same temperature) would be ———— c.c.
1. 100
2. 50
3. 205
4. 200

64. Pick out the wrong statement.
1. Cp of monatomic gases such as metallic vapor is about 5 kcal/kg.atom
2. The heat capacity of solid inorganic substance is exactly equal to the heat capacity of the substance in the molten state
3. There is an increase in entropy, when a spontaneous change occurs in an isolated system
4. At absolute zero temperature, the heat capacity for many pure crystalline substances is zero

65. The principle applied in liquefaction of gases is
1. Adiabatic expansion
2. Joule-Thomson effect
3. Both (1) and (2)
4. Neither (1) nor (2)

66. Pebble mills are tumbling mills widely used for grinding in the manufacture of paints and pigments and cosmetic industries, where iron contamination in the product is highly objectionable. Pebbles used in pebble mill are made of
1. bronze
2. stainless steel
3. flint or porcelain
4. concrete

67. Filter aids like asbestos, kieselguhr, diatomaceous earth etc. are used to increase the porosity of the final filter cake and reducing the cake resistance during filtration. Filter aid is
1. added to the feed slurry
2. precoated on the filter medium prior to filtration
3. separated from the cake by dissolving solids or by burning it off
4. all of the above

68. Which of the following relationships between co-efficient of friction (μ) between rock and roll and a (half of the angle of nip) of the particle to be crushed is correct?

1. $\mu > \tan\alpha$
2. $\mu \geq \tan\alpha$
3. $\mu > \tan 2\alpha$
4. $\mu \leq \tan\alpha$

69. Pick out the wrong statement pertaining to the roll crushers.

1. Maximum feed size determines the required roll diameter
2. For hard material's crushing, the reduction ratio should not exceed 4
3. Both the rolls run necessarily at the same speed
4. Reduction ratio and differential roll speed affect production rate and energy consumed per unit of surface produced

70. Which of the following is not an ultrafine grinder (colloid mill)?

1. Micronizers
2. Agitated mills and fluid energy mills
3. Toothed roll crusher
4. Hammer mills with internal classification

71. The reason for preferring packed towers over plate towers in distillation practice is that the packed tower operation gives

1. low pressure drop and high hold up
2. high pressure drop and low hold up
3. low pressure drop and low hold up
4. high pressure drop and high hold up

72. If the path of liquid across the plate is very long as in case of large diameter tower, Murphree efficiency can be _____ percent.

1. 100
2. >100
3. <100
4. none of the above

73. Compound A is extracted from a solution A + B into a pure solvent S. A Co-current u is used for the liquid-liquid extraction. T inlet rate of the solution containing A 200 moles of B/hr.m2 and the solvent fl rate is 400 moles of S/m2. hr. The equilibri data is represented by Y = 3X2 , where Y i moles of a A/moles of B and X is in m A/moles of S. The maximum percent extraction achieved in the unit is

1. 25%
2. 50%
3. 70%
4. 90%

74. Raoult's law is applicable to the

1. ideal solutions
2. real solutions
3. mixture of water and alcohol
4. non-ideal gases

75. Weeping in a distillation column

1. increases tray efficiency
2. provides large interfacial surface mass transfer
3. results due to very high gas velocity
4. results due to very low gas velocity

76. Pressure drop through plate tower compared to that through packed tower, the same duty will be

1. less
2. more
3. equal
4. either (1) or (2); depends on the pac height

77. Dimension of mass diffusivity is the sam that of

1. kinematic viscosity
2. dynamic viscosity
3. surface tension
4. pressure

78. Dorr thickener is equipment used for

1. classification
2. sedimentation
3. clarification
4. leaching

79. Steam distillation is used to separate

1. azeotropes
2. high boiling substances nonvolatile impurities
3. heat sensitive materials
4. mixtures of low relative volatility

80. In distillation where q is defined as the moles of liquid flow in the stripping section per mole of feed introduced, for saturated liquid feed
1. $q > 1$
2. $q < 1$
3. $q = 1$
4. $q = 0$

81. Pick out the wrong statement :
1. Absorption factor is constant, when the equilibrium and operating lines are straight
2. In case of a stripper, the equilibrium curve is always below the operating line
3. In case of an absorber, the operating line is always above the equilibrium curve
4. In the absorption of low solubility gases, the liquid film is the controlling resistance

82. In liquid extraction, if the selectivity is unity, then
1. separation of the constituents is the most effective
2. no separation will occur
3. amount of solvent required will be minimum
4. solvent flow rate should be very low

83. Paper industry employs ———— driers.
1. cylinder
2. rotary
3. spray
4. fluidised bed

84. Which of the following has the same dimension as mass diffusivity?
1. Momentum flux
2. Kinematic viscosity
3. Thermal diffusivity
4. Both (1) and (3)

85. Pick out the wrong statement pertaining to the cooling towers
1. In case of induced draft cooling tower, the fan is placed at the top of the tower
2. Effectiveness of forced draft cooling tower is reduced by the recirculation of the humid and hot discharged air
3. A natural draft cooling tower is recommended to be used, when the air humidity is low and air temperature is also low
4. Effectiveness of a mechanical draft cooling tower is reduced with increase in air wet-bulb temperature

86. S.T.P. corresponds to
1. 1 atm. absolute pressure & 15.5°C
2. 760 mm Hg gauge pressure & 15.5°C
3. 760 torr and 0°C
4. 101.325 kPa gauge pressure & 15.5°C

87. With rise in pressure, the solubility of gases in solvent, at a fixed temperature
1. increases
2. decreases
3. remains unchanged
4. decreases linearly

88. Pick out the wrong statement.
1. 'Reduced temperature' of a substance is the ratio of its existing temperature to its critical temperature, both expressed on celsius scale
2. 'Reduced pressure' is the ratio of the existing pressure of a substance to its critical pressure
3. 'Reduced volume' is the ratio of the existing molal volume of a substance to its critical molal volume
4. None of these

89. Vapor pressure of water at 100°C is about ———— bar.
1. 0.1013
2. 1.013
3. 10.13
4. 101.3

90. At room temperature, the product [H+] [OH-] in a solution is 10-14 moles/litre. If, [OH-] = 10-6 moles/litre, then the pH of the solution will be
1. 6
2. 8
3. 10
4. 12

91. In the reversible reaction of the type, A + B AB, in general
1. both forward and backward reactions will be exothermic
2. neither of the reactions will be endothermic
3. the combination reaction will be exothermic, while the dissociation reaction will be endothermic
4. the combination reaction will be endothermic, while the dissociation reaction will be exothermic

92. A batch reactor is
1. suitable for gas-phase reactions on commercial scale
2. suitable for liquid phase reactions involving small production rate
3. least expensive to operate for a given rate
4. most suitable for very large production rate

93. For a first order reaction carried out in a plug flow reactor, the space time is
1. $\frac{1}{K}\ln\frac{C_0}{C}$
2. $\frac{1}{K}\ln\frac{C}{C_0}$
3. $K\ln\frac{C_0}{C}$
4. $K\ln\frac{C}{C_0}$

94. For an isothermal second order aqueous phase reaction, A B, the ratio of the time required for 90% conversion to the time required for 45% conversion is
1. 2
2. 4
3. 11
4. 22

95. A chemical reaction is of zero order, when the reaction rate is (where, CA = concentration of reactant)
1. ∞ CA
2. ∞ 1/CA
3. independent of temperature
4. none of the above

96. Which of the following fixes the volume of a batch reactor for a particular conversion and production rate?
1. Operating conditions (e.g. pressure and temperature)
2. Rate constant
3. Density of mixture
4. None of the above

97. Volume change for unimolecular type first order reaction, increases ———— with time.
1. linearly
2. exponentially
3. parabolically
4. logarithmically

98. Half life period of decomposition of a liquid 'A' by irreversible first order reaction is 12 minutes. The time required for 75% conversion of 'A' is ———— minutes.
1. 18
2. 24
3. 6
4. 12

99. Decomposition rate of a liquid 'X' which decomposes as per the following reaction given by
$X \xrightarrow{K_1} A,\ X \xrightarrow{K_2} B,\ X \xrightarrow{K_3} C$
1. $K1 \cdot CX$
2. $(K1 + K2 + K3)\ CX$
3. $(K1 + K2)\ CX$
4. $(K2 + K3)\ CX$

100. With increase in the space time of an irreversible isothermal reaction being carried out in a P.F. reactor, the conversion will
1. increase
2. decreases
3. remains same
4. data in insufficient; can't be predicted

101. The head loss in turbulent flow in pipe is proportional to (where, V = velocity of fluid through the pipe)
1. V2
2. 1/V2
3. 1/V
4. V

102. Unsteady non-uniform flow is represented by flow through a/an
1. long pipe at constant rate
2. long pipe at decreasing rate
3. expanding tube at increasing rate
4. expanding tube at constant rate

103. Prandtl number is a measure of the
1. heat conduction to viscosity of a fluid
2. Cp/Cv of a fluid
3. elastic force to pressure force in the fluid flow
4. inertial force to elastic force in the flow

104. A centrifugal pump has the following specifications :
Power = 4 H.P.; Speed = 800 rpm
Head = 8 meters
Flow = 1000 liters/minutes.
If its speed is halved, then the new head will be ———— meters.
1. 2
2. 4
3. 8
4. 5.5

105. In hindered settling, the particles are
1. placed farther from the wall
2. not affected by other particles and the wall
3. near each other
4. none of these

106. Short distance transportation of grain, gravel, sand, ash, asphalt etc. is done by using a ———— conveyor.
1. flight
2. slat or drag
3. ribbon
4. screw

107. Equivalent diameter of a particle is the diameter of the sphere having the same
1. ratio of surface to volume as the actual volume
2. ratio of volume to surface as the particle
3. volume as the particle
4. none of these

108. If dp is the equivalent diameter of a non-spherical particle, Vp its volume and sp its surface area, then its sphericity is Φs is defined by
1. $\Phi s = 6\ Vp/dp\ sp$
2. $\Phi s = Vp/dp\ sp$
3. $\Phi s = 6\ dp\ Sp/Vp$
4. $\Phi s = dp\ Sp/Vp$

109. Power required to drive a ball mill with a particular ball load is proportional to (where, D = diameter of ball mill)
1. D
2. 1/D
3. D2.5
4. 1/D2.5

110. Pick out the wrong statement.
1. Recycled coarse material to the grinder by a classifier is termed as circulating load
2. Wear and tear in wet crushing is more than that in dry crushing of materials
3. Size enlargement (opposite of size reduction) is not a mechanical operation.
4. A 'dust catcher' is simply an enlargement in a pipeline which permits the solids to settle down due to reduction in velocity of the dust laden gas

111. Which of the following variables affects the furnace capacity?
1. Temperature of flue gas
2. Thermal conductivity of stock
3. Thickness of heating stock
4. all of the above

112. In a furnace, the heat taken by the charge/stock and the heat lost to the furnace structure and flue gases depends on the
1. rate of firing and emissivity of flame
2. Thermal conductivity of the charge and structural materials of furnace
3. nature of process; whether batch, continuous or intermittent.
4. all (1), (2) and (3)

113. In which of the following furnaces, the gases are sucked through the stock bed from below?
1. Soaking pit
2. Sintering machine
3. Beehive oven
4. None of the above

114. Waste heat from the outgoing flue gases in a thermal power plant is recovered by a/an
1. economiser
2. steam superheater
3. air preheater
4. all of the above

115. Recuperator is
1 not used for fuel gas preheating
2. an intermittent waste heat recovery equipment
3. a continuous waste heat recovery equipment
4. heavier than regenerator meant for the same duty