

03. According to the Fenske equation, what will be the minimum number of plates required in a distillation column to separate an equimolar binary mixture of components A and B into an overhead fraction containing 99 mol% A and a bottom fraction containing 98 mol% B ? Assume that relative volatility ($\alpha_{AB} = 2$) does not change appreciably in the column.

- (A) 5
- (B) 9
- (C) 12
- (D) 28

Answer: Option C

04. With increase in the mass velocity of the gas, the rate of drying during the constant rate period _____, if the conduction and radiation through the solid are negligible.

- (A) Increases
- (B) Decreases
- (C) Remain same
- (D) Increases linearly

Answer: Option A

05. During the constant rate period of drying of a solid,

- (A) Increased air humidity decreases the rate of drying
- (B) Increasing the air temperature decreases the drying rate
- (C) Surface evaporation of unbound moisture occurs
- (D) None of these

Answer: Option C

06. Large scale drying of wheat is done in a _____ dryer.

- (A) Fluidised bed
- (B) Spouted bed
- (C) Tray
- (D) Vacuum rotary

Answer: Option B

07. Humidification involves mass transfer between a pure liquid phase and a fixed gas, which is

- (A) Insoluble in the liquid
- (B) Soluble in the liquid
- (C) Non-ideal in nature
- (D) At a fixed temperature

Answer: Option A

08. With increase in temperature, the leaching rate increases due to

- (A) Decreased liquid viscosity
- (B) Increased diffusivity
- (C) Both (A) and (B)
- (D) Neither (A) nor (B)

Answer: Option C

09. As the reflux ratio, in a continuous counter-current extraction is increased, the number of stages

- (A) Increase
- (B) Decrease
- (C) Remain unchanged
- (D) Can either increase or decrease, depends on the system

Answer: Option B

10. 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

- (A) $q > 1$
- (B) $q < 1$
- (C) $q = 1$
- (D) $q = 0$

Answer: Option C

11. Large scale drying of sugar is done in a _____ dryer.

- (A) Spouted bed
- (B) Tray

- (C) Rotary
 - (D) Truck
- Answer: Option C

12. Though, theoretically the adsorption & desorption isotherms is expected to coincide but sometimes at least a part of the isotherms does not coincide and this phenomenon is known as adsorption hysteresis. In such cases, the desorption equilibrium pressure is _____ that obtained for adsorption.

- (A) Lower than
- (B) Higher than
- (C) Same as
- (D) Either same or higher than

Answer: Option A

13. H₂S is being absorbed in a gas absorber unit. The height of the transfer unit based on the overall mass transfer coefficient on the gas side is 0.4 m. The equilibrium data is given by, $y = 1.5x$. The bulk concentration of H₂S has to be reduced from 0.05 to 0.001 mole fraction in the gas side. The height of the tower (in metres) corresponding to an operating line given by, $y = 5x + 0.001$ is

- (A) 2.0
- (B) 1.56
- (C) 1.0
- (D) 0.56

Answer: Option A

14. Reboiler is considered as one theoretical plate, because

- (A) Of the assumption that vapour and liquid leaving the reboiler are in equilibrium
- (B) Vapour is recycled to the column
- (C) Reboiler itself contains one plate
- (D) None of these

Answer: Option A

15. In an absorption column, the flooding velocity for random packing is _____ that for stacked/regular packing.

- (A) Greater than
- (B) Smaller than
- (C) Equal to
- (D) Either (A), or (B); depends on the type of packing

Answer: Option B

16. Experiments were conducted to determine the flux of a species A in a stagnant medium across a gas-liquid interface. The overall mass transfer co-efficient based on the liquid side for dilute systems for the above was estimated to be 4×10^{-3} kg mole/m².s. The equilibrium data for the system is given as $y = 2x$. The flux across the interface (in kg mole/m².s) for bulk concentrations of A in gas phase and liquid phase as $y = 0.4$ and $x = 0.01$ respectively is:

- (A) 5.6×10^{-4}
- (B) 8.5×10^{-4}
- (C) 5.6×10^{-3}
- (D) 8.5×10^{-3}

Answer: Option B

17. In case of cooling towers, the ratio of the rates of heat and mass transfer is indicated by the _____ number.

- (A) Lewis
- (B) Grashoff
- (C) Sherwood
- (D) None of these

Answer: Option A

19. When the gas to be dissolved in liquid is a/an _____ then normally co-current adsorber are used.

- (A) Mixture of two gases
- (B) Pure gas
- (C) Ideal gas
- (D) Sparingly soluble gas

Answer: Option B

18. Unsaturated air (with dry and wet bulb temperatures being 35 and 25°C respectively) is passed through water spray chamber maintained at 35°C. The air will be

- (A) Cooled
- (B) Humidified
- (C) Both (A) & (B)
- (D) Dehumidified

Answer: Option B

20. _____ equation applies to diffusivities in liquids.

- (A) Gilliland
- (B) Hirschfelder
- (C) Wilke and Chang
- (D) None of these

Answer: Option A

21. Mass transfer co-efficient is defined as

- (A) Flux = Co-efficient/concentration difference
- (B) Co-efficient = Flux/concentration difference
- (C) Flux=concentration difference/coefficient
- (D) None of these

Answer: Option B

22. The relative volatility of a binary mixture at constant temperature _____ the total pressure.

- (A) Decreases with increase in
- (B) Increases with increase in
- (C) Is independent of
- (D) None of these

Answer: Option A

23. Large quantity of silica gel is normally dried in a _____ dryer.

- (A) Freeze
- (B) Through circulation
- (C) Rotary vacuum
- (D) Tray

Answer: Option B

24. The mass transfer co-efficient for a solid sphere of radius 'a' dissolving in a large volume of quiescent liquid, in which 'D' is the diffusivity of solute, is

- (A) D/a
- (B) $D/2a$
- (C) Proportional to \sqrt{D}
- (D) Dependent on the Reynolds number

Answer: Option D

25. The value of ' L/mG ' ratio for economical absorption operation ranges from

- (A) 0.5 to 0.8
- (B) 0.8 to 1.2
- (C) 1.25 to 2.0
- (D) 2.5 to 3.5

Answer: Option C

26. Cox chart, which is useful in the design of distillation column particularly for petroleum hydrocarbons, is a plot of (where, P = vapor pressure, T = temperature).

- (A) $\log P$ vs. T
- (B) $\log P$ vs. $\log T$
- (C) T vs. P
- (D) P vs. $\log T$

Answer: Option A

27. In a single stage extraction process, 10 kg of pure solvent S (containing no solute A) is mixed with 30 kg of feed F containing A at a mass fraction $x_f = 0.2$. The mixture splits into an extract

phase E and a raffinate phase R containing A at $x_B = 0.5$ and $x_R = 0.05$ respectively. The total mass of the extract phase is (in Kg)

- (A) 6.89
- (B) 8.89
- (C) 10
- (D) 8.25

Answer: Option B

28. The commonly used solvent in supercritical extraction is

- (A) Methyl ethyl ketone
- (B) Water
- (C) Carbon tetrachloride
- (D) Carbon dioxide

Answer: Option D

29. Dried finished product sampled from various parts of a _____ dryer exhibits non-uniformity in the moisture content.

- (A) Rotary
- (B) Tray
- (C) Freeze
- (D) None of these

Answer: Option B

30. For the same system, if the same liquid used in an absorber is decreased, the tower height will

- (A) Increase
- (B) Decrease
- (C) Remain unaffected
- (D) Decrease or increase; depends on the type of liquid

Answer: Option A

31. In steam distillation, the

- (A) Temperature is 100°C
- (B) Temperature is more than 100°C
- (C) Product must be immiscible with water
- (D) Temperature is higher than the boiling point of either component

Answer: Option C

32. The equation, $N_A = (D_{AB} \cdot P_t / RTZ \cdot P_{BM}) (P_{A1} - P_{A2})$ is for

- (A) Fick's second law of diffusion
- (B) Steady state diffusion for stagnant case
- (C) Liquid M.T.C. by Higbie penetration theory
- (D) None of these

Answer: Option B

33. A slurry is to be dried to produce flaky solid. Which dryer would you recommend?

- (A) Spray dryer
- (B) Drum dryer
- (C) Rotary dryer
- (D) Dielectric dryer

Answer: Option A

34. Perforated plate towers are unique for solvent extraction because, they provide

- (A) Higher contact area
- (B) Better contact of the phase
- (C) Repeated coalescence & redispersion of the drop phase
- (D) None of these

Answer: Option C

35. Which of the following parameters remains constant during chemical dehumidification?

- (A) Dry bulb temperature
- (B) Partial pressure of vapour
- (C) Wet bulb temperature
- (D) None of these

Answer: Option A

36. For the gas absorption, the height of a transfer unit, based on the gas phase is given by (G : superficial molar gas velocity, L : superficial molar liquid velocity, F_G : mass transfer co-efficient, moles/m², a : interfacial area per unit volume of tower)

- (A) $G/(F_G \cdot a)$
- (B) $F_G/(G \cdot a)$
- (C) $(G \cdot a)/F_G$
- (D) $L/(F_G \cdot G)$

Answer: Option A

37. Coffee is prepared from coffee beans by leaching with

- (A) Cold water
- (B) Hot water
- (C) Dilute hot caustic solution
- (D) Naphtha

Answer: Option B

38. Pore size of the molecular sieve 5A is _____ mm.

- (A) 5
- (B) 0.5
- (C) 0.05
- (D) 50

Answer: Option B

39. The equation, $N_A = (D_{AB} \cdot P_t / RTZ) (y_1 - y_2)$ is for

- (A) Steady state equimolar counter diffusion
- (B) Fick's first law of diffusion
- (C) Steady state diffusion for stagnant case
- (D) Liquid M.T.C. by penetration theory

Answer: Option A

40. To remove all the moisture from a wet solid it requires exposure to _____ air.

- (A) Perfectly dry
- (B) Highly humid
- (C) High temperature
- (D) None of these

Answer: Option A

41. Penetration theory states that the mass transfer co-efficient is equal to (where, D_e is diffusivity and ' t ' is time)

- (A) $(D_e \cdot t)^{1/2}$
- (B) $(D_e/t)^{1/2}$
- (C) $(4D_e/\pi t)^{1/2}$
- (D) $(4D_e/t)$

Answer: Option C

42. The cooling effect in a cooling tower can be speeded up by

- (A) Increasing the air velocity and area of exposed wet surface
- (B) Reducing the barometric pressure
- (C) Reducing the humidity of the air
- (D) All (A), (B) and (C)

Answer: Option D

43. The relative volatility of a binary mixture at the Azeotropic composition is

- (A) 1
- (B) > 1
- (C) 0
- (D) ∞

Answer: Option A

44. Which of the following processes is not an example of adsorption applied to gaseous separations?

- (A) Recovery of valuable solvent vapors from dilute mixture with air and other gases
- (B) Dehumidification of air and gas
- (C) Removal of objectionable odour and impurities from industrial gases

(D) Decolouration of yellow glycerine

Answer: Option D

45. For absorbing a sparingly soluble gas in a liquid, the

(A) Gas side co-efficient should be increased

(B) Liquid side coefficient should be increased

(C) Gas side co-efficient should be decreased

(D) Liquid side co-efficient should be decreased

Answer: Option B

46. The Knudsen diffusivity is proportional to (where, T = absolute temperature)

(A) \sqrt{T}

(B) T^2

(C) T

(D) T^4

Answer: Option A

47. Moisture content of a substance when at equilibrium with a given partial pressure of the vapour is called the _____ moisture.

(A) Free

(B) Unbound

(C) Equilibrium

(D) Bound

Answer: Option C

48. For the flow of gases through a capillary, with increase in temperature, the permeability _____ as per Knudsen law.

(A) Increases

(B) Decreases

(C) Remain same

(D) Either (A) or (B); depends on the gas

Answer: Option A

49. A natural draft cooling tower is filled with wooden grids, which covers about _____ percent of the tower height.

(A) 10-15

(B) 30-40

(C) 70-80

(D) 90-100

Answer: Option A

50. With increase in the liquid flow rate at a fixed gas velocity in a randomly packed counter current gas-liquid absorption column, the gas pressure drop

(A) Decreases

(B) Remains unchanged

(C) Increases

(D) Decreases exponentially

Answer: Option C

51. Which of the following is not fixed by the process requirements, in the design of absorbers?

(A) Flow rate of the entering gas

(B) Composition of the entering liquid

(C) Terminal concentrations of gas stream

(D) None of these

Answer: Option D

52. Pick out the wrong statement:

(A) Absorption factor is constant, when the equilibrium and operating lines are straight

(B) In case of a stripper, the equilibrium curve is always below the operating line

(C) In case of an absorber, the operating line is always above the equilibrium curve

(D) In the absorption of low solubility gases, the liquid film is the controlling resistance

Answer: Option B

53. Which of the following processes is followed by unsaturated air (with dry bulb temperature 12°C and relative humidity 47%) passing through water spray washer (temperature of water being constant at 40°C)?

- (A) Humidification only
- (B) Heating only
- (C) Both heating and humidification
- (D) Evaporative cooling

Answer: Option C

54. The velocity, concentration and temperature boundary, for the boundary layer development on a flat plate during convective mass transfer will be same, if

- (A) $N_{Sc} = 1$
- (B) $N_{Sc} = N_{Pr} = N_{Le}$
- (C) $N_{Pr} = N_{Le}$
- (D) $N_{Sc} = N_{Le}$

Answer: Option B

55. Pick out the wrong statement. Generally for physical adsorption, a gas of

- (A) Higher molecular weight is adsorbed in preference to a gas of low molecular weight
- (B) High critical temperature is adsorbed in preference to a gas of low critical temperature
- (C) Low volatility is adsorbed in preference to a gas of high volatility
- (D) None of these

Answer: Option D

56. Co-current absorbers are usually used when the gas to be dissolved in the liquid is

- (A) Sparingly soluble
- (B) Highly soluble
- (C) A pure substance
- (D) A mixture

Answer: Option C

57. Molecular sieves are regenerated by heating to _____ °C.

- (A) < 150
- (B) 200-330
- (C) > 500
- (D) > 1000

Answer: Option B

58. In triangular co-ordinates, the ternary composition point falls _____ of the triangle.

- (A) In the corners
- (B) Inside
- (C) On the sides
- (D) None of these

Answer: Option B

59. When acetone is added in a two layer mixture of methyl isobutyl ketone and water at 30°C, the acetone distributes between the two layers and the composition of the layer follows two solubility curves. For this system,

- (A) As the acetone concentration increases, the solubility curves approach each other
- (B) Both the phases become identical at a particular common point on both the solubility curves called the plait point
- (C) The distribution curve which is a plot between x (acetone concentration in one phase) and y (acetone concentration in other phase) is analogous to x-y curve used in distillation and absorption terminates on the x = y diagonal at the concentration of the plait point
- (D) All (A), (B) and (C)

Answer: Option D

60. During sensible cooling process

- (A) Relative humidity decreases
- (B) Relative humidity increases
- (C) Wet bulb temperature decreases
- (D) Both (B) and (C)

Answer: Option D

61. For stripping of a gas in a counter current stripper, the operating line

- (A) Lies above the equilibrium curve
- (B) Lies below the equilibrium curve
- (C) Can lie above or below the equilibrium curve
- (D) Is always parallel to the equilibrium curve

Answer: Option C

62. The Reynolds number of the liquid was increased 100 fold for a laminar falling film used for gas-liquid contacting. Assuming penetrating theory is applicable, the fold increase in the mass transfer co-efficient (K_c) for the same system is.

- (A) 100
- (B) 10
- (C) 5
- (D) 1

Answer: Option B

63. The boiling points of pure components of a binary system _____ with increase in total pressure of the system.

- (A) Decreases
- (B) Increases
- (C) Remains unchanged
- (D) May increase or decrease, depends on the system

Answer: Option B

64. In gas-liquid contact operation, the number of ideal stages, $N = (x_a - x_b)/(x_b - x^{*b})$. This is true when the stripping factor 'S' is

- (A) $S > 1$
- (B) $S < 1$
- (C) $S = 1$
- (D) $S = \infty$

Answer: Option A

65. Large scale usage of flash distillation is practised in

- (A) Soap manufacturing
- (B) Ammonia synthesis plant
- (C) Polymerisation industry
- (D) Petroleum refining

Answer: Option D

66. Drying of a solid involves _____ transfer.

- (A) Only heat
- (B) Only mass
- (C) Both heat and mass
- (D) None of these

Answer: Option C

67. Desulphurisation of petrol is done in a

- (A) Bollman extractor
- (B) Rotating disc extractor
- (C) Packed extraction column
- (D) Plate type extraction column

Answer: Option B

68. Pick out the wrong statement

- (A) Co-current absorbers are usually used, when the gas to be dissolved in the liquid is a pure substance
- (B) In case of gas absorption, HETP is equal to HTU, when both the operating line & the equilibrium lines are parallel
- (C) Hatta number is important in case of gas absorption with chemical reaction
- (D) In actual practice, absorption is an endothermic process, while stripping is an exothermic process

Answer: Option D

69. Which of the following increases during evaporative cooling process with recirculated water supply?

- (A) Wet bulb temperature

- (B) Relative humidity
 - (C) Partial pressure of vapour
 - (D) Both (B) and (C)
- Answer: Option D

70. Operating velocity in a packed tower is usually _____ the flooding velocity.

- (A) Half
- (B) Twice
- (C) Equal to
- (D) More than

Answer: Option A

71. For gas absorption, low viscosity solvents are preferred, because of their

- (A) Better flow characteristics
- (B) Low pumping pressure drop
- (C) Rapid absorption rates
- (D) All (A), (B) and (C)

Answer: Option D

72. Which of the following is used for the concentration of rubber latex?

- (A) Agitated film evaporator
- (B) Long tube vertical evaporator
- (C) Short tube evaporator
- (D) Calandria

Answer: Option A

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

- (A) Less
- (B) More
- (C) Equal
- (D) Either (A) or (B); depends on the packing height

Answer: Option B

74. In case of absorption & stripping, the interface of the liquid & gas phases are present in equilibrium, when the diffusional resistance of _____ is zero.

- (A) Interface
- (B) Gas phase
- (C) Liquid phase
- (D) All 'a', 'b' & 'c'

Answer: Option A

75. Henry's law states that the

- (A) Partial pressure of a component over a solution is proportional to its mole fraction in the liquid
- (B) Partial pressure of a component over a solution is proportional to the mole fraction in the vapour
- (C) Vapour pressure is equal to the product of the mole fraction and total pressure
- (D) Partial pressure is equal to the product of the mole fraction and total pressure

Answer: Option A

76. The change in enthalpy, when a unit quantity of gas is absorbed by relatively large quantity of adsorbent (on which a definite concentration of the adsorbed gas already exists) is termed as the

- (A) Differential heat of adsorption
- (B) Heat of wetting
- (C) Integral heat of adsorption
- (D) None of these

Answer: Option A

77. A 25 cm × 25 cm × 1 cm flat sheet weighing 1.2 kg initially was dried from both sides under constant drying rate conditions. It took 1500 seconds for the weight of the sheet to reduce to 1.05 kg. Another 1m × 1m × 1cm flat sheet of the same material is to be dried from one side only. Under the same constant drying rate conditions, the time required for drying (in seconds) from its initial weight of 19.2 kg to 17.6 kg is

- (A) 1000
- (B) 1500
- (C) 2000
- (D) 2500

Answer: Option A

78. Moisture in a solid exerting an equilibrium vapour pressure equal to that of the pure liquid at the same temperature is called the _____ moisture.

- (A) Unbound
- (B) Critical
- (C) Free
- (D) Bound

Answer: Option A

79. Swenson-Walker crystalliser is a _____ unit.

- (A) Continuous
- (B) Batch
- (C) Semi-batch
- (D) Cooling (adiabatic)-cum-evaporation

Answer: Option A

80. For a binary mixture distillation process, the degree of freedom is 2. However, if the pressure is fixed in this process, the number of independent variables in this process will be

- (A) 1
- (B) 0
- (C) 2
- (D) 3

Answer: Option A

81. Calculation of mass transfer co-efficient is mostly/normally done using _____ theory.

- (A) Surface renewal
- (B) Film
- (C) Penetration
- (D) None of these

Answer: Option B

82. With increase in temperature, the leaching rate increases because of the

- (A) Increased diffusivity
- (B) Decreased viscosity of liquid
- (C) Both (A) and (B)
- (D) Neither (A) nor (B)

Answer: Option C

83. Relative volatility varies with the concentration of component for an ideal solution. The relative volatility of a binary mixture may be defined as the ratio of vapor pressure of component 'A' to that of component 'B', when

- (A) Only vapor phase follows Raoult's law
- (B) Only liquid phase obeys Dalton's law
- (C) Liquid phase obeys Dalton's law and vapor phase obeys Raoult's law
- (D) Vapor phase obeys Dalton's law and liquid phase obeys Raoult's law

Answer: Option D

84. Which one of the following devices is not used for both the absorption as well as the liquid-liquid extraction processes?

- (A) Packed towers
- (B) Plate towers
- (C) Spray towers
- (D) Wetted wall columns

Answer: Option D

85. Penetration theory relates the average mass transfer co-efficient (K) with diffusivity (D) as

- (A) $K \propto D$
- (B) $K \propto \sqrt{D}$
- (C) $K \propto D^{1.5}$

(D) $K \propto D^2$

Answer: Option B

86. Pick out the wrong statement.

(A) Mechanical agitation is required, if the system has low interfacial tension

(B) Sieve tray towers are generally used for systems having low interfacial tension

(C) When Henry's law constant is very small, then the mass transfer rate is controlled by the gas film resistance

(D) Taylor-Prandtl analogy for heat and mass transfer considers the transfer through both laminar and turbulent layers

Answer: Option A

87. For water-ethanol system, the minimum reflux ratio

(A) Is computed from the slope of the upper operating line that is tangent to the equilibrium curve

(B) Is computed from the intercept of the operating line

(C) Cannot be computed

(D) Is the optimum reflux ratio

Answer: Option A

88. Polar organic compounds are normally used as separating agents for the azeotropic and extractive distillation. Which of the following is the most important factor to be considered for the choice of the separating agent for extractive distillation?

(A) Cost

(B) Availability

(C) Toxicity

(D) Selectivity

Answer: Option D

89. At 750°K and 1 atm, the approximate value of Schmidt number for air is

(A) 0.01

(B) 0.1

(C) 1

(D) 10

Answer: Option B

90. What is the degree of freedom of an absorption process in which only one component is transferred between phases?

(A) 1

(B) 2

(C) 3

(D) 4

Answer: Option C

91. Rayleigh equation applies to _____ distillation.

(A) Differential

(B) Flash

(C) Equilibrium

(D) Molecular

Answer: Option A

92. In a vapor-liquid contacting equipment, the overall gas phase mass transfer co-efficient (M.T.C), K_G is related to individual co-efficients (K_G and K_L) as

(A) $K_G = 1/K_G + m/K_L$

(B) $1/K_G = 1/K_G + m/K_L$

(C) $1/K_G = 1/K_L + m/K_G$

(D) $K_G = 1/K_L + m/K_G$

Answer: Option B

93. Leaching of coarse solid lumps is also termed as

(A) Decoction

(B) Dissolution

(C) Percolation

(D) Agitation and settling

Answer: Option C

94. Which of the following can be calculated theoretically using steam table and Dalton's law of partial pressure; if the relative humidity and dry bulb temperature of moist air is known?

- (A) Dew point
- (B) Humidity ratio
- (C) Wet bulb temperature
- (D) None of these

Answer: Option C

95. Danckwerts developed the _____ theory.

- (A) Penetration
- (B) Surface renewal
- (C) Film
- (D) None of these

Answer: Option B

96. Steam distillation is used to

- (A) Reduce the number of plates
- (B) Avoid thermal decomposition of a component
- (C) Increase the efficiency of separation
- (D) Increase the total pressure of distillation

Answer: Option B

97. When an unsaturated air-water mixture is heated at constant pressure, then

- (A) The partial pressure of water vapour increases
- (B) The specific humidity decreases
- (C) The relative humidity increases
- (D) The relative humidity decreases

Answer: Option D

98. Flash distillation is

- (A) Same as differential distillation
- (B) Used for multi-component systems like crude refining
- (C) Same as simple distillation
- (D) Most useful for handling binary systems

Answer: Option B

99. Mechanism of moisture removal in case of freeze drying of food stuff is by

- (A) Evaporation
- (B) Sublimation
- (C) Dehydration
- (D) Adsorption

Answer: Option B

100. Molality is defined as the number of gm moles of solute per _____ of solvent.

- (A) Litre
- (B) gm
- (C) Kg
- (D) m³

Answer: Option C

101. When the mixture to be distilled has a very high boiling point and the product material is heat sensitive, the separation technique to be used is _____ distillation.

- (A) Continuous
- (B) Steam
- (C) Azeotropic
- (D) None of these

Answer: Option B

102. Alcohol is dehydrated using _____ distillation.

- (A) Extractive
- (B) Azeotropic
- (C) Steam
- (D) Molecular

Answer: Option B

103. The wet and 'dry bulb temperature for a vapour-gas mixture are 25°C and 30°C respectively. If the mixture is heated to 45°C at constant pressure, the wet bulb temperature will be _____ $^{\circ}\text{C}$.

- (A) 25
- (B) > 25
- (C) < 25
- (D) - 25

Answer: Option B

104. Water entrained by circulating air in cooling towers is termed as

- (A) Drift
- (B) Blow down
- (C) Vapor load
- (D) None of these

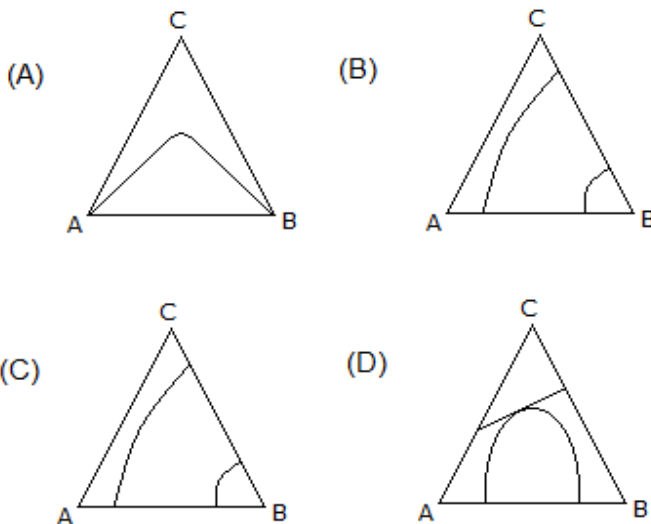
Answer: Option A

105. Pick out the wrong statement. Raoult's law does not apply, when the

- (A) Size of component molecules are not equal
- (B) Attractive forces between like and unlike molecules in the solution are approximately equal
- (C) Component molecules are non-polar
- (D) Chemical combination or molecular association between unlike molecules takes place in the formation of solution

Answer: Option C

106. Which of the following is the correct ternary diagram for liquid-liquid extraction system comprising of one pair partly soluble (e.g. water-benzene-acetic acid in which A - diluent, B - solvent and C - solute)?



Answer: Option A

107. Pick out the wrong statement pertaining to the analogy between equations of heat and mass transfer operations.

- (A) Sherwood number in mass transfer is analogous to Nusselt number in heat transfer
- (B) Prandtl number in heat transfer is analogous to Schmidt number in mass transfer
- (C) Reynolds number in mass transfer is analogous to Grashoff number in heat transfer
- (D) Reynolds number remains the same in both heat and mass transfer

Answer: Option C

108. Plate efficiency in a distillation column is reduced due to the _____ of liquid.

- (A) Entrainment
- (B) Foaming
- (C) Weeping & dumping
- (D) All (A), (B) & (C)

Answer: Option D

109. Pick out the wrong statement.

- (A) Mass transfer co-efficient does not account for gas-liquid diffusion
- (B) Diffusion co-efficient and mass transfer co-efficient are not same in any mass transfer operation
- (C) Contacting cold vapor-gas mixture with hot liquid exemplifies humidification process

(D) Contacting cold liquid with warm vapor-gas mixture exemplifies dehumidification process
Answer: Option A

110. Blowdown in a cooling tower

- (A) Means discarding a small fraction of circulating water to prevent and limit the concentration of salt and impurities
 - (B) Increases the scale forming tendencies of water
 - (C) Is undesirable
 - (D) All (A), (B) & (C)
- Answer: Option A

111. Pick out the wrong statement.

- (A) In solvent extraction, the distribution co-efficient should be as large as possible for solvent economy
 - (B) With increase in pressure, the solubility of gases in solvent increases at a fixed temperature
 - (C) Decrease in Murphree plate efficiency is an indication of entrainment in distillation column
 - (D) The capacity of a distillation column is maximum at total reflux
- Answer: Option D

112. Rayleigh's equation applies to _____ distillation.

- (A) Continuous
 - (B) Steam
 - (C) Differential
 - (D) Flash
- Answer: Option C

113. In extraction, as the temperature increases, the area of heterogeneity (area covered by binodal curve)

- (A) Decreases
 - (B) Increases
 - (C) Remains unchanged
 - (D) None of these
- Answer: Option A

114. In most of the mechanically agitated liquid-liquid extractors, baffles or horizontal compartmental plates are provided, which helps in

- (A) Reducing the axial mixing
 - (B) Increasing the rate of extraction
 - (C) Maintaining the concentration difference between the two phases
 - (D) All 'a', 'b' & 'c'
- Answer: Option D

115. The interfacial area per unit volume of dispersion, in a gas-liquid contactor, for fractional hold up of gas = 0.1 and gas bubble diameter = 0.5 mm is given by (in m^2/m^3)

- (A) 500
 - (B) 1200
 - (C) 900
 - (D) 800
- Answer: Option A

116. The slope of 9-line is determined by the

- (A) Reflux ratio
 - (B) Plate efficiency to be achieved
 - (C) Thermal condition of the feed
 - (D) Relative volatility
- Answer: Option C

117. For a binary mixture with low relative volatility,

- (A) Use steam distillation
 - (B) Use molecular distillation
 - (C) Use high pressure distillation
 - (D) An azeotrope may be formed during distillation
- Answer: Option D

118. Freundlich equation applies to the adsorption of solute from

- (A) Dilute solutions, over a small concentration range
- (B) Gaseous solutions at high pressure
- (C) Concentrated solutions
- (D) None of these

Answer: Option A

119. Pick out the wrong statement pertaining to the cooling towers.

- (A) In case of induced draft cooling tower, the fan is placed at the top of the tower
- (B) Effectiveness of forced draft cooling tower is reduced by the recirculation of the humid and hot discharged air
- (C) A natural draft cooling tower is recommended to be used, when the air humidity is low and air temperature is also low
- (D) Effectiveness of a mechanical draft cooling tower is reduced with increase in air wet-bulb temperature

Answer: Option D

120. The Hatta number is important in

- (A) Multi-component distillation
- (B) Binary distillation
- (C) Gas absorption without chemical reaction
- (D) Gas absorption with chemical reaction

Answer: Option D

121. The dew point of an unsaturated gas-vapor mixture does not depend upon the _____ of the mixture.

- (A) Composition
- (B) Temperature
- (C) Total pressure
- (D) All (A), (B) and (C)

Answer: Option B

122. A solid is being dried in the linear drying rate regime from moisture content X_o to X_F . The drying rate is zero at $X = 0$ and the critical moisture content is the same as the initial moisture X_o . The drying time for $M = (L_s/AR_c)$ is (where, L = total mass of dry solid, A = total surface area for drying R_c = Constant maximum drying rate per unit area X = moisture content (in mass of water/mass of dry solids))

- (A) $M(X_o - X_F)$
- (B) $M(X_o/X_F)$
- (C) $M \ln(X_o/X_F)$
- (D) $MX_o \ln(X_o/X_F)$

Answer: Option D

123. The drying time between fixed moisture content within diffusion controlled 'falling rate period' is proportional to (assuming that drying occurs from all surfaces of the solid) (where, T = thickness of the solid).

- (A) \sqrt{T}
- (B) T
- (C) T^2
- (D) T^3

Answer: Option C

124. In case of physical adsorption, the difference between heat of adsorption and heat of normal condensation is

- (A) Equal to the heat of formation of surface compound
- (B) Equal to the heat of wetting
- (C) Zero
- (D) Called integral heat of adsorption

Answer: Option B

125. The critical moisture content in case of drying indicates the _____ rate period.

- (A) Beginning of falling
- (B) Beginning of constant
- (C) End of falling
- (D) None of these

Answer: Option A

126. Pick out the wrong statement.

- (A) The binary diffusivity in liquids is of the order of 10^{-5} cm²/sec
- (B) Molecular diffusion in solid is much faster than that in liquids
- (C) Particles movement from higher concentration to lower concentration takes place in diffusion process
- (D) According to Poiseuille's law, the permeability decreases with increase in temperature for flow of a gas through a given capillary

Answer: Option B

127. Humidity chart is useful for the solution of problems concerning condensation, vaporisation and air conditioning. At a given dry bulb temperature, value of humidity obtained from the humidity chart directly, is in terms of _____ humidity.

- (A) Molal
- (B) Relative
- (C) Percentage
- (D) None of these

Answer: Option A

128. Separation of two volatile liquids by distillation makes use of their

- (A) Selectivity
- (B) Relative volatility
- (C) Solubility
- (D) Density difference

Answer: Option B

129. Powdery materials can be guarded against caking tendency on storage by

- (A) Providing irregular grain size
- (B) Providing minimum percentage of voids
- (C) Having maximum possible points of contact
- (D) None of these

Answer: Option D

130. The minimum liquid rate to be used in an absorber corresponds to an operating line

- (A) Of slope = 1
- (B) Of slope = 0.1
- (C) Tangential to the equilibrium curve
- (D) None of these

Answer: Option C

131. Leaching of uranium ore and gold ore is done in

- (A) Centrifugal extractor
- (B) Pachuca tanks
- (C) Bollman extractor
- (D) None of these

Answer: Option B

132. The slope of the operating line for a single component co-current absorber when plotted in terms of mole ratio units is

- (A) 0
- (B) ∞
- (C) -ve
- (D) +ve

Answer: Option C

133. For a ternary mixture, in which equilateral triangular co-ordinate is used in leaching and extraction, a _____ of the equilateral triangular co-ordinates.

- (A) Binary mixture is represented by the apex
- (B) Binary mixture is represented by any point inside
- (C) Ternary mixture is represented by the sides
- (D) Pure component is represented by the apex

Answer: Option D

134. In a gas-liquid absorption column, for obtaining the maximum absorption efficiency

- (A) Liquid stream should be distributed uniformly

- (B) Gas stream should be distributed uniformly
 - (C) Both gas as well as liquid streams should be distributed uniformly
 - (D) By passing should be completely avoided
- Answer: Option C

135. To get high tray efficiency

- (A) Interfacial surface between liquid and gas phase should be large
- (B) Time of contact between the two phases should be less
- (C) Gas velocity should be very low
- (D) Liquid entrainment should be severe

Answer: Option A

136. Lewis number (Le) is

- (A) $Sc \times Pr$
- (B) $Pr \times St$
- (C) $Sh \times Pr$
- (D) $St \times Sh$

Answer: Option A

137. Which is not concerned directly with mass transfer?

- (A) Schmidt number
- (B) Sherwood number
- (C) Lewis relationship
- (D) Froude number

Answer: Option D

138. Most important factor to be considered in the selection of packings for absorbers is the _____ of packing.

- (A) Size
- (B) Durability
- (C) Porosity
- (D) Cost

Answer: Option C

139. For ethanol-water system, the lowering of distillate quality from 95% to 92% will cause _____ plate requirement.

- (A) No change in theoretical
- (B) Marginal decrease in the number of
- (C) Major decrease in the number of
- (D) None of these

Answer: Option B

140. Experimental determination of _____ is done by wetted wall column method.

- (A) Diffusion co-efficient
- (B) Mass transfer co-efficient
- (C) NTU
- (D) None of these

Answer: Option B

141. Ammonia present in the coke oven gas is removed by washing with

- (A) Caustic solution
- (B) Dilute ammoniacal liquor
- (C) Dilute HCl
- (D) Ethanolamine

Answer: Option B

142. Which of the following provides maximum contact surface for a liquid-vapour system?

- (A) Packed tower
- (B) Bubble-cap plate column
- (C) Sieve-plate column
- (D) Wetted wall column

Answer: Option A

143. At the boiling point of the liquid at the prevailing pressure, the saturated absolute humidity becomes

- (A) 1
 - (B) 0
 - (C) ∞
 - (D) None of these
- Answer: Option C

144. Measurement of the interfacial area of mass transfer is achieved easily & accurately in case of a _____ column.

- (A) Spray
 - (B) Packed
 - (C) Bubble cap plate
 - (D) Wetted wall
- Answer: Option D

145. Which of the following is directly concerned with Psychrometry?

- (A) Lewis relationship
 - (B) Galileo number
 - (C) Weber number
 - (D) Dean number
- Answer: Option A

146. In the layout plan for a vacuum distillation unit, operating at 60 mm Hg, supported by a barometric condenser, the appropriate place for the location of vacuum drum for collecting the distillate will be

- (A) At ground level
 - (B) 2 metres above the ground
 - (C) 5 metres above ground
 - (D) 10 metres above ground
- Answer: Option A

147. Which of the following is an undesirable property in a tower packing?

- (A) Large surface per unit volume
 - (B) Large free cross-section
 - (C) Low weight per unit volume
 - (D) Large weight of liquid retained
- Answer: Option D

148. High pressure at the bottom of a distillation tower handling heat sensitive materials results in

- (A) Thermal decomposition of bottoms
 - (B) Increased relative volatility
 - (C) Erosion of the tower
 - (D) Very efficient operation
- Answer: Option A

149. Steady state equimolar counter diffusion is encountered in

- (A) Separation of a binary mixture by distillation
 - (B) Absorption of NH_3 from air by water
 - (C) All liquid-liquid diffusion systems
 - (D) All liquid-solid diffusion systems
- Answer: Option A

150. Minimum reflux ratio in a distillation column results in

- (A) Optimum number of trays
 - (B) Minimum reboiler size
 - (C) Maximum condenser size
 - (D) Minimum number of trays
- Answer: Option C

151. In a binary distillation column, if the feed contains 40 mole % vapour, the q line will have a slope of

- (A) 1.5
- (B) -0.6
- (C) -1.5
- (D) 0.6

Answer: Option C

152. The individual mass transfer co-efficients (moles/m²s) for absorption of a solute from a gas mixture into a liquid solvent are, $K_L = 4.5$ and $K_G = 1.5$. The slope of the equilibrium line is 3. Which of the following resistance (s) is (are) controlling?

- (A) Liquid side
- (B) Gas side
- (C) Interfacial
- (D) Both liquid and gas side

Answer: Option B

153. Steady state temperature reached by a small amount of liquid evaporating into a large amount of unsaturated vapour-gas mixture is called the _____ temperature.

- (A) Dry-bulb
- (B) Wet-bulb
- (C) Dew point
- (D) Adiabatic saturation

Answer: Option B

154. In case of unsaturated air

- (A) Dew point < wet bulb temperature
- (B) Wet bulb temperature < dry bulb temperature
- (C) Both (A) and (B)
- (D) Neither (A) nor (B)

Answer: Option C

155. The apex of an equilateral-triangular coordinate (in ternary liquid system) represents a/an

- (A) Pure component
- (B) Binary mixture
- (C) Ternary mixture
- (D) Insoluble binary system

Answer: Option A

156. _____ extractor is used for the concentration of radioactive nuclear waste.

- (A) Pulsed column
- (B) Sieve plate
- (C) Mixer-settler
- (D) Bollman

Answer: Option A

157. Removal of _____ exemplifies an adsorption unit operation.

- (A) Uranium from its ore
- (B) Water from petrol
- (C) Ammonia from coke oven gas
- (D) Mustard oil from mustard seed

Answer: Option B

158. Use of packed towers for distillation is generally limited to the

- (A) Small sizes
- (B) Multi-component distillation
- (C) High pressure operation
- (D) Vacuum distillation

Answer: Option A

159. Dimension of mass diffusivity is the same as that of

- (A) Kinematic viscosity
- (B) Dynamic viscosity
- (C) Surface tension
- (D) Pressure

Answer: Option A

160. Paper industry employs _____ driers.

- (A) Cylinder
- (B) Rotary
- (C) Spray

(D) Fluidised bed
Answer: Option A

161. Pick out the wrong statement

- (A) A horizontal line on the humidity chart indicates the temperature changes at constant molal humidity
- (B) When water is cooled from 80 to 70°C by exposure to the air with a wet bulb temperature of 60°C, then both the approach & the range would be 10°C
- (C) For unsaturated air-water vapor mixture at atmospheric conditions, the wet bulb temperature & adiabatic cooling lines are the same
- (D) Relative saturation of unsaturated mixture of water vapor & air cannot be increased by either reducing the mixture temperature or by increasing the total pressure

Answer: Option D

162. Laboratory determination of the diffusivity of vapor is done by _____ method.

- (A) Wetted wall column
- (B) Gilliland's
- (C) Winkelmann's
- (D) Wike's

Answer: Option C

163. The relation among various mass transfer co-efficients (M.T.C) for ideal gases is given by (where, K_c & K_m are M.T.C. for equimolar counter diffusion with concentration & mole fraction respectively as the driving force. and, K_p = M.T.C. for diffusion of a gas through a stagnant inert gas with pressure as driving force.)

- (A) $K_c = K_p = K_m$
- (B) $K_c = K_p/RT = K_m \cdot RT/P$
- (C) $K_c = K_p \cdot RT = K_m \cdot RT/p$
- (D) None of these

Answer: Option C

164. Pick out the wrong statement:

- (A) Change in barometric pressure does not affect the relative humidity
- (B) In case of a packed tower, the operating velocity is about half of the flooding velocity, generally
- (C) 'Elution' means the desorption of the adsorbed solute by a solvent
- (D) The equilibrium moisture content of the solid can be reduced by increasing the absolute humidity

Answer: Option D

165. The temperature of water cooled in cooling tower is always _____ temperature of entering air.

- (A) More than the wet bulb
- (B) Less than the wet bulb
- (C) Equal to the wet bulb
- (D) Equal to the dry bulb

Answer: Option A

166. Reverse osmosis is also called

- (A) Dialysis
- (B) Electrodialysis
- (C) Diffusion
- (D) Ultra-filtration

Answer: Option D

167. Design calculation for multiple component distillation is done by

- (A) Ponchon-Savarit method
- (B) McCabe-Thiele method
- (C) Enthalpy concentration method
- (D) Tray to tray calculations

Answer: Option D

168. Absorption (liquid-gas system) with evolution of heat as compared to isothermal absorption results in

- (A) Decreased solute solubility

- (B) Large minimum liquid to gas (L/G) ratio
 - (C) Large number of trays
 - (D) All (A), (B) and (C)
- Answer: Option D

169. The unit of volumetric diffusivity is

- (A) cm^2/sec
- (B) cm/sec
- (C) cm^3/sec
- (D) cm^2/sec^2

Answer: Option A

170. Drying of a wet solid under constant drying conditions means the exposure of the wet solid to the air of constant

- (A) Humidity
- (B) Velocity
- (C) Temperature
- (D) All (A), (B) & (C)

Answer: Option D

171. The diffusivity (D) in a binary gas mixture is related to the pressure (P) as

- (A) $D \propto P^{0.5}$
- (B) $D \propto 1/P^{0.5}$
- (C) $D \propto 1/P$
- (D) $D \propto 1/P^{1.5}$

Answer: Option C

172. In liquid extraction, if the selectivity is unity, then

- (A) Separation of the constituents is the most effective
- (B) No separation will occur
- (C) Amount of solvent required will be minimum
- (D) Solvent flow rate should be very low

Answer: Option B

173. Can the efficiency of a plate in the distillation tower be greater than 100%?

- (A) Yes
- (B) Normally not; but is possible if infinite number of plates are put
- (C) Never
- (D) Yes; if the reflux ratio is maximum

Answer: Option C

174. H_2S present in naphtha reformed gas is removed by absorbing with

- (A) Ethanolamine
- (B) K_2CO_3
- (C) HCl
- (D) Vacuum gas oil

Answer: Option A

175. Dorr thickener is an equipment used for

- (A) Classification
- (B) Sedimentation
- (C) Clarification
- (D) Leaching

Answer: Option B

176. With the lowering of equilibrium pressure, at a given temperature, the amount of adsorbate on the adsorbent

- (A) Increases
- (B) Decreases
- (C) Remain same
- (D) Either (A) or (B), depends on the system

Answer: Option B

177. Mass transfer co-efficient is directly proportional to D_{AB} according to the _____ theory.

- (A) Film
- (B) Penetration
- (C) Surface-renewal
- (D) None of these

Answer: Option A

178. A pure drug is administered as a sphere and as a cube. The amount of drug is the same in the two tablets. Assuming that the shape and size do not influence the mass transfer, the ratio of rate of dissolution in water at $t = 0$ for the cubic to spherical tablet is:

- (A) 0.54
- (B) 1.04
- (C) 1.24
- (D) 1.94

Answer: Option C

179. _____ extractor uses centrifugal force for separating the two phases.

- (A) Treybal
- (B) Scheibel
- (C) Podbielniak
- (D) None of these

Answer: Option C

180. With increase in temperature, the mutual solubility of two liquids

- (A) Increases
- (B) Decreases
- (C) Remains unchanged
- (D) Decreases exponentially

Answer: Option A

181. The operating cost of a distillation column at minimum reflux ratio is

- (A) Minimum
- (B) Maximum
- (C) Infinite
- (D) Zero

Answer: Option A

182. For a single component absorber, the operating line is straight only when plotted in term of _____ units.

- (A) Partial pressure
- (B) Mole ratio
- (C) Mole fraction
- (D) None of these

Answer: Option B

183. The cooling effect in a cooling tower cannot be increased by

- (A) Increasing the air velocity over the wet surfaces
- (B) Reducing the humidity of entering air
- (C) Lowering the barometric pressure
- (D) None of these

Answer: Option D

184. Separation of _____ employs gaseous diffusion process.

- (A) N_2 and O_2 from air
- (B) Isotopes of uranium
- (C) Isotopes of helium
- (D) SO_2 and air

Answer: Option B

185. Sodium bicarbonate is produced during soda ash manufacture using a _____ tower.

- (A) Plate
- (B) Baffle
- (C) Packed
- (D) None of these

Answer: Option B

186. Leaching rate is independent of the

- (A) Agitation
- (B) Temperature
- (C) Particle size
- (D) None of these

Answer: Option D

187. With increase in temperature, the rate of leaching increases, because the

- (A) Diffusivity of solute increases
- (B) Viscosity of solvent decreases
- (C) Thermal conductivity of solute increases
- (D) None of these

Answer: Option A

188. Bound moisture is that liquid which exerts an equilibrium vapor pressure _____ that of the pure liquid at the given temperature.

- (A) Less than
- (B) More than
- (C) Equal to
- (D) Either (A) or (B); depends on the solid

Answer: Option A

189. The reflux to a distillation column is 100 moles/hr, when the overhead product rate is 50 moles/hr. The reflux ratio is

- (A) 2
- (B) 0.5
- (C) 50
- (D) 150

Answer: Option A

190. Which of the following is not a batch drier?

- (A) Truck drier
- (B) Agitated pan drier
- (C) Fluidised bed drier
- (D) Vacuum shelf drier

Answer: Option C

191. Acetic acid will be most economically separated from a dilute solution of acetic acid in water by

- (A) Solvent extraction
- (B) Continuous distillation
- (C) Evaporation
- (D) Absorption

Answer: Option A

192. The main reason for dividing a tall packed tower into series of small towers is to

- (A) Minimise the overall pressure drop
- (B) Avoid flooding
- (C) Reduce liquid hold up
- (D) Avoid channelling

Answer: Option D

193. The most efficient cooling tower out of the following is

- (A) Induced draft
- (B) Forced draft
- (C) Natural draft
- (D) Atmospheric

Answer: Option A

194. Molecular distillation is

- (A) High temperature distillation
- (B) For heat-sensitive materials
- (C) Very low pressure distillation
- (D) Both (B) and (C)

Answer: Option D

195. The value of $N_A/(N_A + N_B)$ for steady state molecular diffusion of gas 'A' through non-diffusing gas 'B' is

- (A) 1
- (B) ∞
- (C) 0.5
- (D) 2

Answer: Option A

196. All moisture in a non-hygroscopic material is the _____ moisture.

- (A) Free
- (B) Equilibrium
- (C) Unbound
- (D) Bound

Answer: Option C

197. Molecular diffusivity of a liquid

- (A) Increases with temperature
- (B) Decreases with temperature
- (C) May increase or decrease with temperature
- (D) Is independent of temperature

Answer: Option A

198. Raschig ring made of porcelain cannot be used for treating concentrated

- (A) Hydrochloric acid
- (B) Nitric acid
- (C) Alkalis
- (D) Sulphuric acid

Answer: Option C

199. Use of natural draft cooling tower is practised, when the air has low

- (A) Humidity
- (B) Temperature
- (C) Both 'a' & 'b'
- (D) Neither 'a' nor 'b'

Answer: Option C

200. At a fixed pressure, the humidity depends upon the partial pressure of vapor in the mixture. Humidity of a vapour free gas is _____ percent.

- (A) 100
- (B) 0
- (C) 50
- (D) Between 0 and 100

Answer: Option B

201. Tower diameter may be decreased by

- (A) Using higher reflux ratio
- (B) Use of increased tray spacing
- (C) Increasing the liquid flow rate
- (D) Increasing the vapour flow rate

Answer: Option B

202. Pick out the wrong statement.

- (A) The mass diffusivity, the thermal diffusivity and the eddy momentum diffusivity are the same for $N_{Sc} = N_{Pr} = 1$
- (B) 1 Nm^3 of dry air is lighter than 1 Nm^3 of humid air
- (C) The Lewis number of a mixture is unity, when the thermal diffusivity is equal to the mass diffusivity
- (D) An Azeotropic mixture of two liquids has boiling point higher than either of them, when it shows negative deviation from Raoult's Law

Answer: Option B

203. The humid volume may be increased by increasing the

- (A) Temperature at constant humidity
- (B) Humidity at constant temperature

- (C) Both (A) and (B)
 - (D) Neither (A) nor (B)
- Answer: Option C

204. Pick out the correct relationship. (Where, R_i = internal reflux ratio R_o = external reflux ratio.)

- (A) $(1 + R_o) = R_o/R_i$
 - (B) $(1 - R_o) = R_o/R_i$
 - (C) $(1 + R_i) = R_o/R_i$
 - (D) $(1 - R_i) = R_o/R_i$
- Answer: Option A

205. According to Poiseuille's law, the permeability for gas flow through a capillary is proportional to (where, μ = gas viscosity)

- (A) μ
- (B) $1/\mu$
- (C) $\sqrt{\mu}$
- (D) μ^2

Answer: Option B

206. Even though bubble cap towers are very effective for humidification operation, they are not used commonly in industries, because of the

- (A) High evaporation losses of water
- (B) High pressure drop of the gas
- (C) Difficulty in its fabrication
- (D) None of these

Answer: Option B

207. In case of constant underflow extraction operation, the _____ at all solute concentration.

- (A) Solids are drained to the same extent
- (B) Ratio of the insoluble to solution is constant
- (C) Both (A) & (B)
- (D) Neither (A) nor (B)

Answer: Option C

208. Which of the following has the same dimension as mass diffusivity?

- (A) Momentum flux
- (B) Kinematic viscosity
- (C) Thermal diffusivity
- (D) Both (B) and (C)

Answer: Option D

209. Packed column distillation is limited to the column _____ metres.

- (A) Height < 6
- (B) Diameter < 0.6
- (C) Both (A) & (B)
- (D) Neither (A) nor (B)

Answer: Option C

210. Which of the following decreases during evaporative cooling process with recirculated water supply?

- (A) Wet bulb temperature
- (B) Relative humidity
- (C) Partial pressure of vapour
- (D) None of these

Answer: Option D

211. During constant rate period, the rate of drying decreases with the

- (A) Decrease in air temperature
- (B) Increase in air humidity
- (C) Both (A) and (B)
- (D) Neither (A) nor (B)

Answer: Option C

212. At what percentage (by volume) of alcohol composition, it forms an azeotrope with water?

- (A) 90
- (B) 91.5
- (C) 95
- (D) 99

Answer: Option C

213. Which of the following is considered equivalent to one theoretical stage in Mc-Cabe Thiele's method?

- (A) Partial condenser
- (B) Total condenser
- (C) Reboiler
- (D) Both (B) and (C)

Answer: Option D

214. Steam distillation is not recommended to be used, if the

- (A) Azeotropic mixture is to be separated and the final product is miscible with water
- (B) Liquids decompose, if distilled directly at atmospheric pressure
- (C) Material cannot be distilled by indirect heating even under low pressure, because of the high boiling temperature
- (D) Material to be distilled is thermally unstable or has the tendency to react with other components associated with it, at the boiling temperature

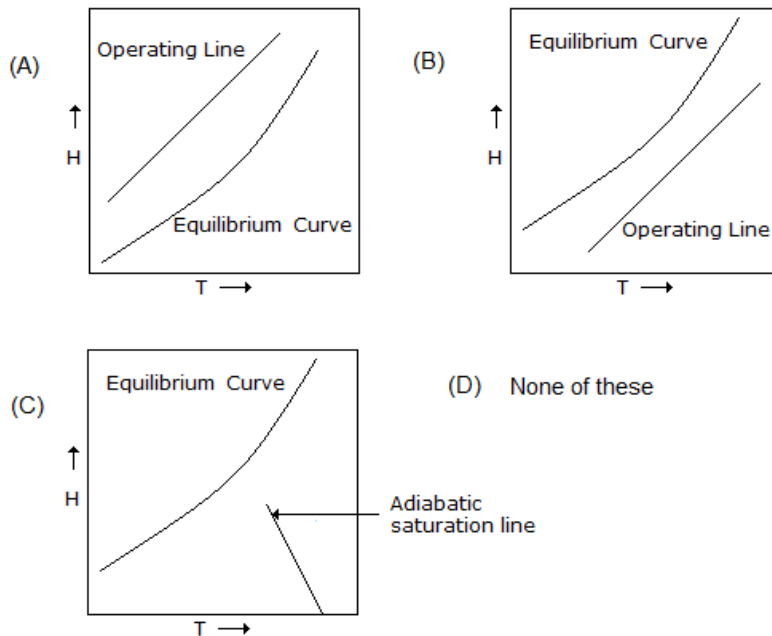
Answer: Option A

215. It takes 6 hours to dry a wet solid from 50% moisture content to the critical moisture content of 15%. How much longer it will take to dry the solid to 10% moisture content, under the same drying conditions? (The equilibrium moisture content of the solid is 5%).

- (A) 15 min
- (B) 51 min
- (C) 71 min
- (D) 94 min

Answer: Option C

216. Which of the following liquid temperature (T) vs. vapor-gas mixture enthalpy (H) diagram is valid for humidification operation?



Answer: Option B

217. In Azeotropic mixture, the equilibrium vapour composition is

- (A) More than liquid composition
- (B) Less than liquid composition
- (C) Same as liquid composition
- (D) Independent of pressure

Answer: Option C

218. In rectifying section of a continuous distillation column, the

- (A) Vapour is enriched with low boilers

- (B) Vapour is enriched with high boilers
 - (C) Liquid is stripped of high boilers
 - (D) None of these
- Answer: Option B

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

- (A) Low pressure drop and high hold up
 - (B) High pressure drop and low hold up
 - (C) Low pressure drop and low hold up
 - (D) High pressure drop and high hold up
- Answer: Option C

220. Diameter of raschig rings used in packed tower in industry is normally around _____ inches.

- (A) 2
- (B) 8
- (C) 12
- (D) 18

Answer: Option A

221. The ratio of Murphree plate efficiency to point efficiency is 1 in a _____ flow model.

- (A) Plug
- (B) Perfectly mixed
- (C) Both (A) & (B)
- (D) Neither (A) nor (B)

Answer: Option B

222. Plate efficiency

- (A) Is a function of the mass transfer between liquid and vapour
- (B) Increases due to foaming
- (C) Increases due to liquid entrainment
- (D) Increases due to weeping and dumping of liquid

Answer: Option A

223. Weeping in a distillation column

- (A) Increases tray efficiency
- (B) Provides large interfacial surface for mass transfer
- (C) Results due to very high gas velocity
- (D) Results due to very low gas velocity

Answer: Option D

224. The expression, $y(1 - x)/x(1 - y)$ is for

- (A) Absorption factor
- (B) Relative volatility
- (C) Selectivity
- (D) Murphree efficiency

Answer: Option B

225. The process employing desorption of the absorbed solute by a solvent is called

- (A) Elution
- (B) Osmosis
- (C) Reverse osmosis
- (D) Sublimation

Answer: Option A

226. In McCabe-Thiele method, at infinite reflux ratio

- (A) Number of plates is maximum
- (B) Overhead product is maximum
- (C) Both the operating lines coincide with the diagram
- (D) None of these

Answer: Option C

227. Plate towers are preferred to packed towers, when large temperature changes are involved, because of the reason that the

- (A) Packing may be crushed due to thermal expansion/contraction of the equipments
 - (B) Pressure drop in the equipment will be very high
 - (C) Viscosity variation of the fluids may cause channelling/flooding
 - (D) None of these
- Answer: Option A

228. Pick out the correct statement.

- (A) Higher hold up of the solid in the rotary dryer results in better exposure of the solids to the gas
- (B) The 'Hatta number' is important in problems involving gas absorption without chemical reaction
- (C) For a non-reacting binary mixture of ideal gases, the partial pressure distribution of both components is linear in the case of steady state equimolar counter-diffusion
- (D) Total reflux in case of distillation operation requires infinite number of plates for a binary system separation

Answer: Option C

229. A binary mixture of benzene and cyclohexane is separated by

- (A) Flash vaporisation
- (B) Extractive distillation
- (C) Solvent extraction
- (D) Ordinary distillation

Answer: Option B

230. Mass transfer co-efficient 'K' according to penetration theory varies with mass diffusivity as

- (A) $D^{0.5}$
- (B) D
- (C) $1/D$
- (D) $D^{1.5}$

Answer: Option A

231. Free flowing granular materials can be best dried in a _____ drier.

- (A) Rotary
- (B) Cylinder
- (C) Drum
- (D) Freeze

Answer: Option A

232. In a packed bed absorption column, the channelling will be noted by the

- (A) Increase in flow rate
- (B) Sharp drop in pressure drop
- (C) Sharp rise in pressure drop
- (D) None of these

Answer: Option B

233. The ratio of Murphree plate efficiency to point efficiency is always > 1 in a _____ flow model.

- (A) Plug
- (B) Perfectly mixed
- (C) Both (A) & (B)
- (D) Neither (A) nor (B)

Answer: Option A

234. Fractional solvent extraction

- (A) Employs only one solvent
- (B) Employs two solvents
- (C) Results in low interfacial tension
- (D) None of these

Answer: Option B

235. At the same gas flow rate, the pressure drop in a packed tower being irrigated with liquid _____ that in dry packed tower.

- (A) Is greater than
- (B) Is lower than

- (C) Is same as
 (D) Cannot be predicted as data are insufficient
 Answer: Option A

236. During dehumidification of unsaturated air wet bulb temperature & partial pressure of vapor are not constant. However, during evaporative cooling process with recirculated water supply, the _____ remains constant.

- (A) Wet bulb temperature
 (B) Partial pressure of water vapor
 (C) Relative humidity
 (D) None of these
 Answer: Option A

237. Wet bulb and dry bulb temperatures becomes identical at _____ percent saturation curve.

- (A) 100
 (B) 50
 (C) 78
 (D) None of these
 Answer: Option A

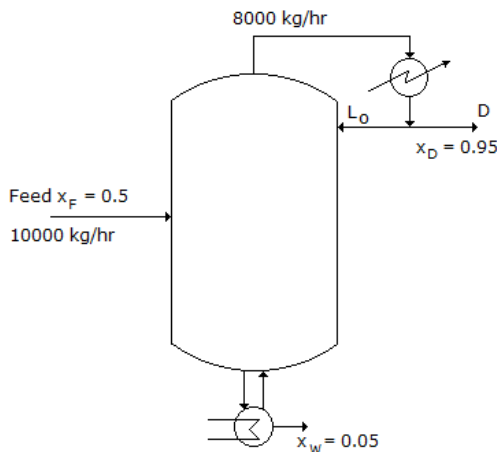
238. _____ is the separation technique used for desalination of sea water.

- (A) Thermal diffusion
 (B) Reverse osmosis
 (C) Adsorption
 (D) Absorption
 Answer: Option B

239. The partial pressure distribution of an ideal gas diffusing through another stagnant ideal gas at steady state follows a/an _____ law.

- (A) Exponential
 (B) Parabolic
 (C) Linear
 (D) Cubic
 Answer: Option A

240. A distillation column separates 10000 kg/hr of a benzene-toluene mixture as shown in the figure below:



In the figure x_F , x_D and x_W represent the weight fraction of benzene in the feed, distillate and residue respectively. The reflux ratio is

- (A) 0.5
 (B) 0.6
 (C) 1.0
 (D) 2.0
 Answer: Option B

241. Out of two equilibrium curves, first one lies above the diagonal and the second lies below the diagonal in the x-y plot. It means that separation by distillation is

- (A) Not possible in the second case unless vacuum is applied
 (B) Not possible in the second case unless high pressure is applied
 (C) More readily done in the second case compared to first one

(D) None of these
Answer: Option C

242. According to Chilton-Colburn analogy for mass transfer, $N_{St} \cdot N_{Sc}^{2/3}$ is equal to

- (A) f
- (B) $f/2$
- (C) $2f$
- (D) $1/f$

Answer: Option B

243. Very tall packed towers are divided into series of beds to

- (A) Reduce the overall pressure drop
- (B) Avoid channelling
- (C) Reduce liquid hold-up
- (D) Avoid flooding

Answer: Option B

244. If ' f ' is defined as above, then which of the following applies to a feed at dew point?

- (A) $f = 1$
- (B) $f < 1$
- (C) $f > 1$
- (D) $0 < f < 1$

Answer: Option A

245. Separation of the isotopes of helium for scientific investigations is done by

- (A) Reverse osmosis
- (B) Thermal diffusion
- (C) Leaching
- (D) Solvent extraction

Answer: Option B

246. Flash distillation is suitable for the separation of components

- (A) Having very close boiling points
- (B) Which form maximum boiling azeotrope
- (C) Having very wide boiling points
- (D) Which form minimum boiling azeotrope

Answer: Option C

247. The McCabe ΔL law states that the

- (A) Molar heats of vaporisation of components are nearly equal
- (B) Linear crystal growth rate depends on the degree of super-saturation
- (C) Linear crystal growth rate does not depend on the crystal size
- (D) Linear crystal growth rate depends on the crystal size

Answer: Option C

248. When both the fluids flow concurrently in an absorber, the slope of the operating line is

- (A) -ve
- (B) +ve
- (C) 1
- (D) -1

Answer: Option A

249. Steam distillation is used for separation of high boiling

- (A) Substances from non-volatile impurities
- (B) Volatile impurity from still higher boiling substances
- (C) Both (A) and (B)
- (D) Neither (A) nor (B)

Answer: Option C

250. The relative saturation of a partially saturated mixture of vapour and gas can be increased by _____ of the mixture.

- (A) Reducing the total pressure
- (B) Increasing the total pressure
- (C) Reducing the temperature
- (D) Both (B) and (C)

Answer: Option D

251. Pick out the correct statement.

- (A) Ponchan-Savarit method is more accurate than McCabe-Thiele method to determine the number of theoretical stages required for the separation of non-ideal binary system by distillation
- (B) A sharp decrease in pressure drop is an indication of flooding in a distillation column
- (C) Solvent used in extractive distillation should be of high volatility
- (D) Flash distillation is suitable for separating components which have very close boiling temperature

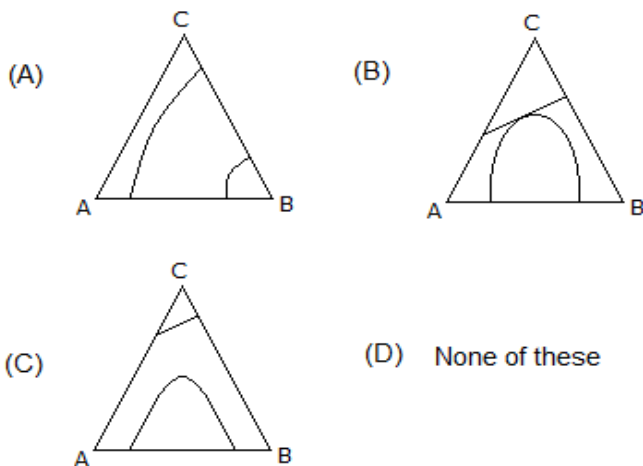
Answer: Option A

252. Pick out the wrong statement.

- (A) Constant pressure distillation cannot separate an Azeotropic mixture
- (B) Relative volatility of a binary mixture changes appreciably with the minor change in temperature
- (C) The relative volatility of a binary mixture at Azeotropic composition is unity
- (D) Flash distillation is practised on wide spread scale in petroleum refinery

Answer: Option B

253. Which of the following is the correct ternary diagram for liquid-liquid extraction system comprising of two pairs partly soluble (e.g., chlorobenzene-water-methyl ethyl ketone system)?



Answer: Option A

254. For a fixed number of ideal stages in a distillation column, as the reflux ratio is increased, the difference in composition between the top and bottom product streams

- (A) Increases
- (B) Decreases
- (C) Remain unaffected
- (D) Passes through a maximum

Answer: Option A

255. _____ diffusion is used for separating the isotopes of methane.

- (A) Thermal
- (B) Pressure
- (C) Concentration
- (D) Force

Answer: Option A

256. Pick out the wrong statement.

- (A) The Reynolds analogy for mass transfer is given by Lewis relation and is applicable, when Schmidt number is one
- (B) Sherwood number for flow in pipes can be expressed as the ratio of the concentration gradient at wall to the overall concentration difference
- (C) According to film theory for equimolar counter diffusion, the mass transfer coefficient is given by $D_{AB}(B)P - 3, Q - 2$
- (D) The z-component of the total mass flux of a component A in binary mixture of A and B is given by $-D_{AB} \cdot dC_A/dz$

Answer: Option C

257. According to the film theory of mass transfer, the mass transfer co-efficient is proportional to (where, D = molecular diffusivity).

- (A) D
- (B) D^2
- (C) $D^{0.5}$
- (D) $1/D$

Answer: Option A

258. For a distillation column operating at minimum reflux, the

- (A) Concentration of liquid and vapour leaving a plate will be same
- (B) Reflux ratio will be maximum
- (C) Number of plates required will be maximum
- (D) None of these

Answer: Option C

259. Compound A is extracted from a solution of A + B into a pure solvent S. A Co-current unit is used for the liquid-liquid extraction. The inlet rate of the solution containing A is 200 moles of B/hr.m² and the solvent flow, rate is 400 moles of S/m². hr. The equilibrium data is represented by $Y = 3X^2$, where Y is in moles of A/moles of B and X is in moles A/moles of S. The maximum percentage extraction achieved in the unit is

- (A) 25%
- (B) 50%
- (C) 70%
- (D) 90%

Answer: Option B

260. Mass transfer co-efficient is directly proportional to $D_{AB}^{0.5}$, according to _____ theory.

- (A) Penetration
- (B) Surface renewal
- (C) Film
- (D) None of these

Answer: Option A

261. Which of the following gas-liquid contacting devices incurs the least pressure drop for a particular duty?

- (A) Grid tray tower
- (B) Perforated tray tower
- (C) Wetted wall tower
- (D) Bubble cap tower

Answer: Option D

262. For experimental determination of mass transfer co-efficient by wetted wall tower, the mass transfer area is

- (A) Calculated
- (B) Unknown
- (C) Known
- (D) Not required

Answer: Option C

263. With decrease in the throughput (compared with the design capacity) for a bubble cap distillation column, its efficiency

- (A) Increases
- (B) Decreases
- (C) Remain same
- (D) May increase or decrease; depends on individual design

Answer: Option A

264. Diameter to height ratio for a raschig ring is

- (A) 1
- (B) 0.5
- (C) 2
- (D) 8

Answer: Option A

265. Which of the following operations does not involve leaching?

- (A) Dissolving gold from ores
- (B) Dissolving pharmaceutical products from bark or roots
- (C) Dissolving sugar from the cells of the beet
- (D) Removing nicotine from its water solution by kerosene

Answer: Option D

266. Flooding in a distillation column is detected by a sharp

- (A) Increase in Murphree plate efficiency
- (B) Decrease in pressure drop
- (C) Decrease in liquid hold up in the column
- (D) Increase in pressure drop

Answer: Option D

267. In case of an ideal solution, the total vapor pressure varies _____ with the composition expressed as mole fraction,

- (A) Inversely
- (B) Linearly
- (C) Exponentially
- (D) None of these

Answer: Option B

268. With increase in temperature, the rate of extraction in leaching (solid-liquid extraction system).

- (A) Increases
- (B) Decreases
- (C) Remain unaffected
- (D) Increases Linearly

Answer: Option A

269. Component A is diffusing in a medium B. The flux N_A relative to a stationary point is equal to the flux due to molecular diffusion, if

- (A) Mass transfer is accompanied by reaction
- (B) Diffusion of A is in stagnant medium B
- (C) Molecular mean free path is high
- (D) There is equimolar counter diffusion

Answer: Option D

270. Absorption accompanied by heat evolution results in

- (A) Increased capacity of the absorber
- (B) Increase in equilibrium solubility
- (C) Decrease in equilibrium solubility
- (D) None of these

Answer: Option C

271. The solvent used in liquid extraction should not have high latent heat of vaporisation, because

- (A) The pressure drop and hence the pumping cost will be very high
- (B) It cannot be recovered by distillation
- (C) Its recovery cost by distillation may be prohibitively high
- (D) It will decompose while recovering by distillation

Answer: Option C

272. Mass transfer co-efficient varies as $D_{AB}^{0.5}$, according to the _____ theory.

- (A) Film
- (B) Surface renewal
- (C) Penetration
- (D) None of these

Answer: Option B

273. The suitable evaporator for concentration of foaming liquids is a _____ evaporator.

- (A) Long tube
- (B) Short tube
- (C) Vacuum
- (D) Falling film

Answer: Option A

274. In stripping section of continuous distillation column, the

- (A) Liquid is stripped of high boiler
- (B) Liquid is enriched with high boiler
- (C) Vapour is stripped of low boiler
- (D) None of these

Answer: Option B

275. An aqueous solution of methanol is to be distilled in a tray column. High pressure steam is available as a source of heat. For a given reflux ratio and overhead composition, two options are being explored; (i) a reboiler is used and (ii) no reboiler is used but steam is fed directly to the bottom of the column. As compared to option (i), in option (ii)

- (A) Less number of trays are required
- (B) Composition of the residue remains unchanged
- (C) More number of trays are required but the residue composition remains unchanged
- (D) More number of trays are required and the residue composition is more dilute in methanol

Answer: Option A

276. The Schmidt number which is defined as, $\mu/\rho D$, is the ratio of the

- (A) Momentum diffusivity to the mass diffusivity
- (B) Thermal diffusivity to the mass diffusivity
- (C) Momentum diffusivity to the thermal diffusivity
- (D) None of these

Answer: Option A

277. N_{Sc}/N_{Pr} is called the

- (A) Psychrometric ratio
- (B) Lewis number
- (C) Sherwood number
- (D) Stanton number

Answer: Option B

278. At constant pressure, with increase of temperature, the dew point will

- (A) Increase
- (B) Decrease
- (C) Remain unchanged
- (D) Increase/decrease; depends on the temperature

Answer: Option A

279. Pick out the correct statement.

- (A) Dialysis process is used for the production of fresh water from brine
- (B) Electrodialysis is used in the manufacture of NaOH
- (C) Electrodialysis is used for the refining/purification of petrol
- (D) Both (B) and (C)

Answer: Option B

280. The percentage humidity is less than the relative humidity only at _____ percent humidity.

- (A) Zero
- (B) Hundred
- (C) Both zero and hundred
- (D) None of these

Answer: Option C

281. 'ADDUCTS' and 'CLATHRATES' are used in case of

- (A) Extractive distillation
- (B) Crystallisation
- (C) Absorption
- (D) None of these

Answer: Option B

282. _____ is concerned with the adsorption equilibria.

- (A) Fick's law
- (B) Gibb's equation

- (C) Freundlich equation
 (D) None of these
 Answer: Option C

283. In most of the vacuum crystalliser, vacuum is generally produced by means of a

- (A) Suction pump
 (B) Compressed air jet
 (C) Steam jet ejector with a barometric condenser
 (D) None of these
 Answer: Option C

284. In a distillation column, with increase in the reflux ratio, the heat removed in the cooler

- (A) Increases
 (B) Decreases
 (C) Remains unaffected
 (D) And the heat required in reboiler decreases
 Answer: Option A

285. The feed to fractionating column is changed from saturated vapour to saturated liquid. If the separation and reflux ratio remains unchanged, the number of ideal stages will

- (A) Increase
 (B) Decrease
 (C) Remain same
 (D) Depend on saturated boiling point; may increase or decrease
 Answer: Option A

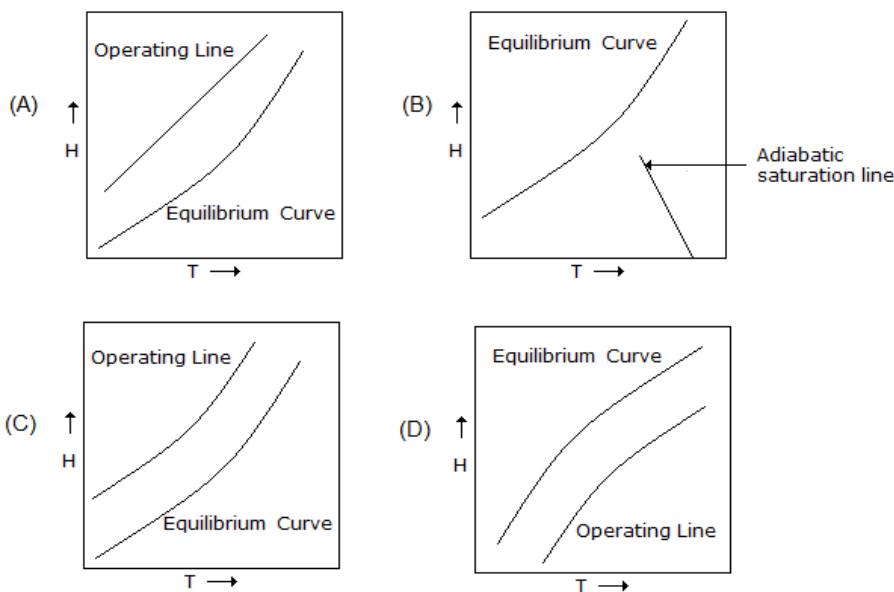
286. During constant rate drying period, vaporisation rate per unit drying surface area

- (A) Decreases with time
 (B) Increases with time
 (C) Does not change with time
 (D) Does not affect the moisture content of the wet solid
 Answer: Option C

287. A coalescer in a mixer-settler liquid-liquid extraction column

- (A) Comprises of thin bed of substances of extended surface having high porosity
 (B) Helps in increasing the bubble size entering the settler
 (C) Helps in increasing the settling rate of the bubbles
 (D) All 'a', 'b', & 'c'
 Answer: Option D

288. Which of the following T-H diagram is valid for dehumidification operation?



Answer: Option A

289. In which of the following unit operations, the selectivity is an important parameter?

- (A) Distillation
 (B) Solvent extraction
 (C) Absorption

(D) None of these
Answer: Option B

290. Flash distillation is suitable for separating the constituents of a binary system, which

- (A) Form minimum boiling azeotrope
- (B) Have very wide boiling points
- (C) Have very close boiling points
- (D) Form constant boiling azeotrope

Answer: Option B

291. In case of an unsaturated mixture of gas and vapor, the percentage saturation is _____ its relative saturation.

- (A) Lower than
- (B) Higher than
- (C) Equal to
- (D) Either (A) or (B), depends on the mixture composition

Answer: Option A

292. At _____ reflux, theoretical number of plates in a distillation column is calculated using Fenske-Underwood equation.

- (A) Operating
- (B) Total
- (C) Minimum
- (D) Maximum permissible

Answer: Option B

293. Pick out the correct statement.

- (A) The slope of the stripping line is always less than unity
- (B) For a given separation in a binary distillation column, with increase in reflux ratio (above the minimum reflux ratio), the fixed cost of the distillation column first increases and then decreases
- (C) In Ponchon-Savarit method of no. of theoretical plate determination, the stripping and rectifying operating lines are vertical at total reflux
- (D) Kremser-Brown-Souder's equation is used to calculate the efficiency of a plate tower

Answer: Option C

294. In physical terms, Schmidt number means

- (A) Thermal diffusivity/mass diffusivity
- (B) Thermal diffusivity/momentum diffusivity
- (C) Momentum diffusivity/mass diffusivity
- (D) Mass diffusivity/thermal diffusivity

Answer: Option C

295. Unit operation involved in the prilling of urea is

- (A) Evaporation
- (B) Drying
- (C) Crystallisation
- (D) Both (B) and (C)

Answer: Option D

296. Degree of freedom for leaching and solvent extraction process is

- (A) 0
- (B) 1
- (C) 2
- (D) 3

Answer: Option D

297. With increase in temperature, the solubility of gases in liquids, at fixed pressure

- (A) Increases
- (B) Decreases
- (C) Remain same
- (D) Either (A) or (B), depends on the system

Answer: Option B

298. The equipment used in the extraction of highly corrosive radioactive liquids is

- (A) Pulse column
 - (B) Spray column
 - (C) Mixer settler
 - (D) Baffle tower
- Answer: Option A

299. Tea percolation employs

- (A) Liquid-liquid extraction
 - (B) Leaching
 - (C) Absorption
 - (D) None of these
- Answer: Option B

300. When the solvent dissolves very little of solute, then

- (A) Solvent of low latent heat of vaporisation should be used
 - (B) Solvent of low freezing point should be used
 - (C) Large quantity of solvent is required to extract the solute
 - (D) Very small quantity of solvent is required
- Answer: Option C

301. Bollman extractor

- (A) Is a static bed leaching equipment
 - (B) Is used for extraction of oil from oilseed
 - (C) Is a centrifugal extractor
 - (D) Employs only counter-current extraction
- Answer: Option B

302. In case of absorption, both the operating and equilibrium lines will be straight for

- (A) Isothermal operation
 - (B) Dilute solutions
 - (C) Dilute solutions and isothermal operation
 - (D) None of these
- Answer: Option C

303. The most economical range of absorption factor is

- (A) 0 to 0.5
 - (B) 0 to 3
 - (C) 1.25 to 2
 - (D) 5 to 15
- Answer: Option C

304. In a distillation operation, what is the effect of the temperature of the reflux stream (given below) on the condenser and reboiler loads?

Reflux conditions:

(i) Reflux stream is completely liquid and is at its bubble point.

(ii) Reflux stream is below its bubble point.

- (A) Condenser and reboiler loads are the same in both the cases
- (B) Reboiler load is the same in both the cases but condenser load is higher in case (ii)
- (C) Condenser load is the same in both the cases but reboiler load is higher in case (ii)
- (D) Both condenser and reboiler loads are higher in case (ii) as compared to case (i)

Answer: Option D

305. In the constant rate period of the rate of drying curve for batch drying,

- (A) Cracks develop on the surface of the solid
 - (B) Rate of drying decreases abruptly
 - (C) Surface evaporation of unbound moisture occurs
 - (D) None of these
- Answer: Option C

306. Back-trapping in a distillation column

- (A) Increases tray efficiency
 - (B) Decreases tray efficiency
 - (C) Reduces pressure drop
 - (D) Is desirable, as it provides improved vapour-liquid contact
- Answer: Option B

307. Rose oil is extracted from rose leaves using _____ distillation.

- (A) High pressure
- (B) Low pressure
- (C) Extractive
- (D) Steam

Answer: Option D

308. The value of $N_A/(N_A + N_B)$, for steady state equimolar counter diffusion of two gases 'A' and 'B' is

- (A) 1
- (B) ∞
- (C) 0.5
- (D) 2

Answer: Option B

309. Pick out the wrong statement pertaining to the rotary dryer.

- (A) Flights (located in the inside shell of rotary dryer) lift the material being dried and shower it down through the current of hot air/gases. It extends from the wall to a distance which is about 8-12% of the inside diameter of shell
- (B) Hold up of a rotary drier is defined as the fraction of the dryer volume occupied by the solid at any instant. The best performance for rotary drier is obtained, when the hold up is in the range of 0.05 to 0.15
- (C) Rotary dryer is suitable for drying sticky material
- (D) Recommended peripheral speed of a rotary drier is in the range of 10 to 30 metres/minute

Answer: Option C

310. Which of the following is not a unit of mass transfer co-efficient?

- (A) Moles transferred/ [(time) (area) (mole fraction)]
- (B) Moles transferred/ [(time) (area) (mass A/mass B)]
- (C) Moles transferred/ [(time) (area) (pressure)]
- (D) None of these

Answer: Option D

311. Dry bulb temperature of the gas is _____ the wet bulb temperature.

- (A) Less than
- (B) More than
- (C) Equal to
- (D) None of these

Answer: Option B

312. _____ column is used in gas absorption process.

- (A) Wetted wall
- (B) Sieve/perforated tray
- (C) Bubble cap
- (D) Packed

Answer: Option D

313. The equilibrium liquid composition compared to the vapor composition in case of Azeotropic mixture is

- (A) More
- (B) Less
- (C) Same
- (D) Either more or less; depends on the system

Answer: Option C

314. The diffusion co-efficient in m^2/s . of acetic acid in benzene (liquid in liquid) is

- (A) 2.09×10^{-4}
- (B) 2.09×10^{-5}
- (C) 2.09×10^{-9}
- (D) 2.09×10^{-12}

Answer: Option A

315. Unsaturated air (with dry bulb temperature and dew point being 35°C and 18°C respectively) is passed through a water spray chamber maintained at 15°C. The air will be cooled

- (A) And humidified
- (B) And dehumidified with increase in wet bulb temperature
- (C) At the same relative humidity
- (D) And dehumidified with decrease in wet bulb temperature

Answer: Option D

316. The 'shanks system' of leaching (i.e., counter-current multiple contact leaching) is used for

- (A) Recovery of tannis from the tree barks and woods
- (B) Leaching sodium nitrate from Chilean nitrate bearing rock
- (C) Both (A) and (B)
- (D) Neither (A) nor (B)

Answer: Option C

317. The value of Lewis number ($Le = Sc/Pr$) for air-water vapour system is around

- (A) 1
- (B) 0.24
- (C) 3.97
- (D) 600

Answer: Option A

318. Which of the following employs an accessory known as 'drift eliminator'?

- (A) Multiple effect evaporator
- (B) Mechanical draft cooling tower
- (C) Rotary dryer
- (D) Rotating disc contactor

Answer: Option B

319. Dew point of an air-water vapor mixture

- (A) Decreases with decrease in pressure
- (B) At constant humidity & total pressure is fixed
- (C) Corresponding to any point on the humidity chart is obtained by projecting a line through this point parallel to the temperature axis and to the saturation curve
- (D) All 'a', 'b' & 'c'

Answer: Option D

320. The term "approach" in a cooling tower refers to the difference in the temperature of the

- (A) Cold water leaving the tower and the wet bulb temperature of the surrounding air
- (B) Hot water entering the tower and the wet bulb temperature of the surrounding air
- (C) Hot water entering and the cooled water leaving the cooling tower
- (D) None of these

Answer: Option A

321. The relation, $Sc = Pr = 1$, is valid, when the mechanism of _____ transfer is same.

- (A) Heat and mass
- (B) Mass and momentum
- (C) Heat and momentum
- (D) Heat, momentum and mass

Answer: Option A

322. The surface renewal frequency in Danckwerts' model of mass transfer is given by (K_L : mass transfer co-efficient)

- (A) $\sqrt{(K_L^2 \cdot D_A)}$
- (B) $K_L^2 \cdot D_A$
- (C) K_L^2 / D_A
- (D) K_L / D_A^2

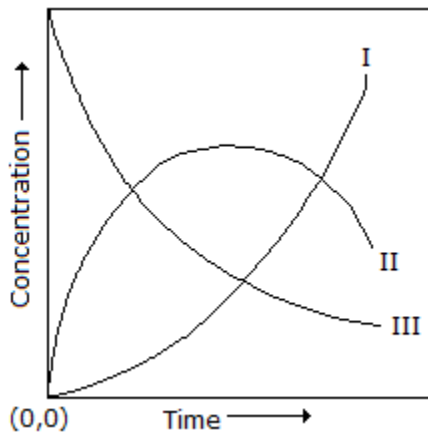
Answer: Option A

323. McCabe-Thiele method

- (A) Uses molal units for material and energy balance
- (B) Uses weight fractions to express liquid and vapour composition
- (C) Can use any type of units
- (D) Is more accurate than Ponchon-Savarit method

Answer: Option A

324. Below is given an equilibrium moisture curve of a substance. State which regions represent free moisture and unbound moisture respectively.



- (A) II, III
- (B) II, IV
- (C) IV, III
- (D) IV, II

Answer: Option A

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

- (A) 100
- (B) > 100
- (C) < 100
- (D) None of these

Answer: Option B

326. Humid volume, at a given temperature is a/an _____ function of humidity.

- (A) Inverse
- (B) Exponential
- (C) Linear
- (D) Logarithmic

Answer: Option C

327. If the specific heats of a gas and a vapor are $0.2 \text{ KJ/Kg.}^\circ\text{K}$ and $1.5 \text{ KJ/Kg.}^\circ\text{K}$ respectively, and the humidity is 0.01; the humid heat in $\text{KJ/}^\circ\text{Kg.}$ is

- (A) 0.31
- (B) 0.107
- (C) 0.017
- (D) 0.215

Answer: Option D

328. Flooding in a vapor-liquid contacting equipment occurs in a tray, when the pressure drop through a tray is _____ the liquid head available in the downcomer.

- (A) Less than
- (B) More than
- (C) Same as
- (D) Very much less

Answer: Option B

329. In case of _____ distillation, a solvent is added to alter the relative volatility of the mixture to be separated.

- (A) Molecular
- (B) Azeotropic
- (C) Extractive
- (D) Flash

Answer: Option C

330. Pick out the wrong statement.

- (A) Packed towers are preferred for vacuum operation, because the pressure drop through the packing is less and they (packings) also lessen the possibility of tower wall collapse

- (B) Packed towers are preferred over plate towers for handling corrosive and foamy liquids
- (C) Diameter of randomly packed tower is normally more than 1.2 metres
- (D) Due to uneven supply and improper distribution of liquid, problem of channelling, loading & flooding is generally encountered in packed towers

Answer: Option C

331. Moisture contained by a substance in excess of the equilibrium moisture is called the _____ moisture.

- (A) Unbound
- (B) Free
- (C) Critical
- (D) Bound

Answer: Option B

332. Which of the following is an undesirable characteristic for the solvent used in gas absorption?

- (A) Low vapor pressure
- (B) Low viscosity
- (C) High gas solubility
- (D) None of these

Answer: Option D

333. Hypersorption refers to a _____ process.

- (A) Fixed bed absorption
- (B) Moving bed absorption
- (C) Fixed bed adsorption
- (D) Moving bed adsorption

Answer: Option D

334. Drying of refractory is normally carried out in a _____ dryer.

- (A) Open pan
- (B) Tray
- (C) Rotary vacuum
- (D) Truck/tunnel

Answer: Option D

335. For the same feed, feed quality and separation (in a distillation column), with the increase of total pressure, the number of ideal plates will

- (A) Increase
- (B) Decrease
- (C) Remain same
- (D) Data insufficient, can't be predicted

Answer: Option A

336. In case of liquids, the binary diffusivity is proportional to (where, T = temperature)

- (A) T
- (B) \sqrt{T}
- (C) T^2
- (D) $1/T$

Answer: Option A

337. A liquid mixture contains 30% o-xylene, 60% p-xylene and 10% m-xylene (all percentages in w/w). Which of the following statements would be true in respect of this mixture?

- (A) The mixture exhibits an azeotrope at 101.3 kPa
- (B) The composition of the mixture, in percent by volume is: o-xylene 30, p-xylene 60. and m-xylene 10
- (C) The composition of the mixture in mole percent is: o-xylene 30, p-xylene 60 and m-xylene 10
- (D) The mixture contain optical isomers

Answer: Option A

338. The relative saturation of an unsaturated mixture of gas and vapor is independent of the

- (A) Nature of the vapor
- (B) Temperature of the mixture
- (C) Composition of the mixture
- (D) None of these

Answer: Option D

339. In case of binary distillation, increasing the reflux ratio above optimum does not result in the increase of

- (A) Area between operating line and 45° diagonal x-y diagram
- (B) Condenser and reboiler surfaces
- (C) Tower cross-section
- (D) None of these

Answer: Option A

340. Advantage of continuous drying over batch drying is that the

- (A) Drying cost per unit weight of dried product is less
- (B) Product with more uniform moisture content is produced
- (C) Equipment size required is smaller
- (D) All 'a', 'b' & 'c'

Answer: Option D

341. Which of the following assumes constant molal vaporisation and overflow?

- (A) McCabe-Thiele method
- (B) Ponchan-Savarit method
- (C) Enthalpy concentration method
- (D) Plate absorption column

Answer: Option A

342. An air-water vapour mixture has a dry bulb temperature of 60°C and a dew point temperature of 40°C . The total pressure is 101.3 kPa and the vapour pressure of water at 40°C and 60°C are 7.30 kPa and 19.91 kPa respectively. The humidity of air sample expressed as kg of water vapour/kg of dry air is:

- (A) 0.048
- (B) 0.079
- (C) 0.122
- (D) 0.152

Answer: Option D

343. Which of the following binary systems is an example of a maximum boiling azeotrope?

- (A) Water-hydrochloric acid
- (B) Acetone-carbon disulphide
- (C) Water-ethyl alcohol
- (D) n-heptane-n-octane

Answer: Option A

344. For an absorber, both equilibrium and operating line will be straight for

- (A) Concentrated solution and non-isothermal operation
- (B) Dilute solution and non-isothermal operation
- (C) Dilute solution and isothermal operation
- (D) Concentrated solution and isothermal operation

Answer: Option C

345. Channelling is most severe

- (A) In towers packed with stacked packing
- (B) In towers packed randomly with crushed solids
- (C) In dumped packing of regular units
- (D) At very high liquid flow rate

Answer: Option A

346. Penetration model (theory) for mass transfer was enunciated by

- (A) Danckwerts
- (B) Toor and Marcello
- (C) Higbie
- (D) Kissinevskii

Answer: Option C

347. Pick out the correct statement.

- (A) Bound moisture is removed during constant rate drying period
- (B) Free moisture is removed during falling rate drying period

- (C) The sum of free moisture and equilibrium moisture in a solid is called the critical moisture
(D) The driving force for mass transfer in a wet solid is its free moisture content
Answer: Option D

348. Milk is dried usually in a _____ dryer.

- (A) Freeze
(B) Spray
(C) Tray
(D) Rotary

Answer: Option B

349. Extraction of coffee from its seed is done by

- (A) Liquid-liquid extraction
(B) Leaching
(C) Extractive distillation
(D) Steam distillation

Answer: Option B

350. Unit of molal diffusivity is

- (A) $\text{cm}^2/\text{sec gm} \cdot \text{mole}$
(B) $\text{gm moles}/\text{cm}^2 \cdot \text{sec}$
(C) $\text{gm moles}/\text{cm} \cdot \text{sec}$
(D) $\text{gm moles}/\text{cm}^2 \cdot \text{sec}$

Answer: Option C

351. When the liquid phase and vapour phase of a binary system obeys Raoult's and Dalton's law respectively, the relative volatility is the ratio of

- (A) Vapour pressure of component A to that of component B
(B) Vapour pressure of component A to the total pressure
(C) Vapour pressure of component A to the partial pressure of A
(D) Partial pressure of component A to the total pressure

Answer: Option A

352. In case of non-ideal gases and liquids, the molal diffusivity

- (A) Varies inversely as the pressure
(B) Varies directly as the pressure
(C) Is independent of pressure
(D) Is equal to the volumetric diffusivity

Answer: Option C

353. Flooding in a column results due to

- (A) High pressure drop
(B) Low pressure drop
(C) Low velocity of the liquid
(D) High temperature

Answer: Option A

354. Which of the following is a suitable absorbent for removal of H_2S from natural gas?

- (A) Vetrocoke solution
(B) Monoethanolamine (MEA)
(C) Dilute
(D) Hot water

Answer: Option B

355. Raoult's law is applicable to the

- (A) Ideal solutions
(B) Real solutions
(C) Mixture of water and alcohol
(D) Non-ideal gases

Answer: Option A

356. Humid volume is the total volume in m^3 of 1 kg of

- (A) Vapour laden gas at 1 atm. and room temperature
(B) Gas plus its accompanying vapour at 1 atm. and room temperature
(C) Gas plus its accompanying vapour at 1 atm. and gas temperature

(D) Vapour laden gas at 1 atm. and gas temperature

Answer: Option C

357. Calcium ammonium nitrate (a fertiliser) is dried in a _____ dryer.

- (A) Rotary
- (B) Vacuum
- (C) Tunnel
- (D) Tray

Answer: Option A

358. Components, having widely different boiling point in a binary mixture, can be separated using _____ distillation.

- (A) Molecular
- (B) Extractive
- (C) Steam
- (D) Simple

Answer: Option D

359. Pick out the system with minimum boiling azeotrope at 1 atm.

- (A) Benzene-toluene
- (B) Ethyl alcohol-water
- (C) Hydrochloric acid-water
- (D) All (A), (B) and (C)

Answer: Option B

360. Unsaturated air (with dry bulb and wet bulb temperatures being 45°C and 25°C respectively) is passed through a water spray chamber maintained at 23°C. The air will be cooled and

- (A) Humidified with wet bulb temperature decreasing
- (B) Humidified at constant wet bulb temperature
- (C) Dehumidified
- (D) None of these

Answer: Option A

361. The film penetration model of mass transfer was enunciated by

- (A) Gilliland
- (B) Toor and Marcello
- (C) Stefan
- (D) Fick

Answer: Option B

362. Equilibrium moisture of a solid is equal to the total moisture minus free moisture. Which of the following substances will have maximum equilibrium moisture?

- (A) Anthracite coal
- (B) Rag paper
- (C) Bamboo
- (D) Inorganic solids

Answer: Option C

363. ($N_{Re} \cdot N_{Sc}$) is termed in mass transfer operation as the _____ number.

- (A) Stanton
- (B) Sherwood
- (C) Peclet
- (D) None of these

Answer: Option C

364. At a given equilibrium pressure, with increase in temperature, the concentration of adsorbed gas on solid adsorbent

- (A) Increases
- (B) Decreases
- (C) Remains unchanged
- (D) Increases exponentially

Answer: Option B

365. With lapse of time, the overhead composition of light component in case of batch distillation with constant reflux

- (A) Increases
- (B) Decreases
- (C) Remain same
- (D) May increase or decrease; depends on system

Answer: Option B

366. HETP is numerically equal to HTU, only when the operating line

- (A) Lies below the equilibrium line
- (B) Lies above the equilibrium line
- (C) And equilibrium lines are parallel
- (D) Is far from the equilibrium line

Answer: Option C

367. The operation involved when the soluble material is largely on the surface of an insoluble solid and is merely washed off by the solvent is called

- (A) Decoction
- (B) Percolation
- (C) Elutriation or elution
- (D) None of these

Answer: Option C

368. _____ number indicates the ratio of the rates of the heat and mass transfer incase of a cooling tower.

- (A) Sherwood
- (B) Stanton
- (C) Lewis
- (D) Peclet

Answer: Option C

369. The recovery of penicillin from the acidified fermentation broth is done by

- (A) Distillation
- (B) Evaporation
- (C) Absorption
- (D) Liquid extraction

Answer: Option D

370. Drift in a cooling tower is

- (A) The water entrained by the circulating air
- (B) Dependent on the water lost by evaporation
- (C) Desirable
- (D) All (A), (B) & (C)

Answer: Option A

371. In McCabe-Thiele method, at infinite reflux ratio

- (A) The overhead product is minimum
- (B) Both the operating lines coincide with diagonal
- (C) Both (A) and (B)
- (D) Neither (A) nor (B)

Answer: Option A

372. Gaseous diffusivity at atmospheric pressure is of the order of _____ cm²/second.

- (A) 1
- (B) 1 to 5
- (C) 5 to 10
- (D) > 10

Answer: Option A

373. Absorption factor, for a fixed degree of absorption from a fixed amount of gas should be

- (A) 1
- (B) > 1
- (C) < 1
- (D) ≤ 1

Answer: Option B

374. Pick out the wrong statement.

- (A) With decrease in feed temperature, the number of plates required for binary distillation decreases for a given ' L/V ' ratio
- (B) The extraction per unit of total height for a short packed column is more effective than for a tall column, in case of liquid-liquid extraction
- (C) Natural draft cooling towers are made of ferroconcrete and its cross-section is wider at the bottom
- (D) Vander wall adsorption is also called chemisorption

Answer: Option D

375. Molarity is defined as the number of gm moles of solute per _____ of solvent.

- (A) Litre
- (B) kg
- (C) gm
- (D) c.c

Answer: Option A

376. If R_m is the minimum reflux ratio, the optimum reflux ratio may be around _____ R_m .

- (A) 1.2 to 1.5
- (B) 2.5 to 3
- (C) 3 to 4
- (D) 5

Answer: Option A

377. Adsorption is a unit operation which generally involves _____ systems.

- (A) Liquid-solid
- (B) Gas-solid
- (C) Fluid-solid
- (D) Solid-solid

Answer: Option C

378. Surface renewal model of mass transfer was enunciated by

- (A) Toor and Marcello
- (B) Fick
- (C) Danckwerts
- (D) Stefan

Answer: Option C

379. Agitator is provided in a crystalliser for

- (A) Avoiding deposition on cooler surfaces
- (B) Formation of nuclei
- (C) Crystal growth
- (D) All (A), (B) and (C)

Answer: Option D

380. Which of the following adsorbent is used to decolourise yellow glycerine?

- (A) Silica gel
- (B) Alumina
- (C) Fuller's earth
- (D) Activated carbon

Answer: Option D

381. Lewis number, which is important in problems involving simultaneous heat and mass transfer, is the ratio of

- (A) Mass diffusivity to momentum diffusivity
- (B) Thermal diffusivity to mass diffusivity
- (C) Momentum diffusivity to thermal diffusivity
- (D) None of these

Answer: Option B

382. Binary distillation involves the mass transfer by _____ at the gas-liquid interface.

- (A) Unidirectional diffusion from liquid to gas phase
- (B) Unidirectional diffusion from gas to liquid phase
- (C) Either 'a' or 'b'

(D) A counter diffusion at an almost equal molar rate

Answer: Option D

383. Corresponding to Nusselt number in heat transfer, the dimensionless group in mass transfer is the _____ number.

(A) Sherwood

(B) Schmidt

(C) Peclet

(D) Stanton

Answer: Option A

384. Sand is dried in foundries in a _____ drier.

(A) Rotary

(B) Fluidised bed

(C) Vacuum

(D) Spray

Answer: Option B

385. Cox chart is useful in the design of

(A) Distillation column

(B) Evaporator

(C) Dryer

(D) Crystalliser

Answer: Option A

386. Acetone is to be removed from air in an isothermal dilute absorber using pure water as solvent. The incoming air contains 5 mole% of acetone ($y_{in} = 0.05$). The design equation to be used for obtaining the number of trays (N) of the absorber is, $N+2 = 6 \log (y_{in}/y_{out})$. For 98% recovery of acetone, the number of trays required is/are:

(A) 4

(B) 8

(C) 9

(D) 10

Answer: Option C

387. The binary diffusivity in gases and liquids vary respectively as

(A) $T^{3/2}$ and T

(B) T and $T^{3/2}$

(C) \sqrt{T} and $T^{3/2}$

(D) $T^{3/2}$ and \sqrt{T}

Answer: Option A

388. In a liquid-liquid extraction, 10 kg of a solution containing 2 kg of solute C and 8 kg of solvent A is brought into contact with 10 kg of solvent B. Solvent A and B are completely immiscible in each other whereas solute C is soluble in both the solvents. The extraction process attains equilibrium. The equilibrium relationship between the two phases is $Y^* = 0.9X$, where Y^* is the kg of C/kg of B and X is kg of C/kg of A. Choose the correct answer.

(A) The entire amount of C is transferred to solvent B

(B) Less than 2 kg but more than 1 kg of C is transferred to solvent B

(C) Less than 1 kg of C is transferred to B

(D) No amount of C is transferred to B

Answer: Option A

389. Pick out the wrong statement pertaining to leaching.

(A) Fine solids cannot be leached in a Pachuca tank

(B) Door classifier can be used for leaching of coarse solids

(C) Vegetable seeds can be leached in either of Bollman extractor, Rotocel or Kennedy extractor

(D) Very high temperature is not needed for the leaching of sugar beet

Answer: Option A

390. Azeotropism for ethyl alcohol-water system disappears by

(A) Increasing temperature

(B) Decreasing pressure

(C) Increasing pressure

(D) No means

Answer: Option B

391. Ordinary diffusion process is also called _____ diffusion.

- (A) Pressure
- (B) Thermal
- (C) Concentration
- (D) Forced

Answer: Option C

392. The falling rate period in the drying of a solid is characterised by

- (A) Increase in rate of drying
- (B) Increasing temperatures both on the surface and within the solid
- (C) Decreasing temperatures
- (D) None of these

Answer: Option B

393. Decoction refers to the use of solvent

- (A) At ambient temperature
- (B) At its boiling point
- (C) In its vapor form
- (D) None of these

Answer: Option B

394. Schmidt number and Lewis number for pure air at atmospheric conditions are respectively

- (A) < 1 and ≈ 1
- (B) 1 and 0
- (C) > 1 and ≈ 1
- (D) 0 and ≈ 1

Answer: Option A

395. Out of the following gas-liquid contacting devices, for a given set of operating conditions, gas pressure drop is the least in _____ tower.

- (A) Wetted wall
- (B) Bubble cap
- (C) Perforated tray
- (D) Packed

Answer: Option A

396. Pick out the correct statement.

- (A) For identical gas flow rates, less pressure drop occurs through a plate tower than through a packed tower
- (B) Plate column can handle greater liquid loads without flooding than packed column, but the liquid hold up is more in the case of plate column
- (C) For the same duty, plate columns weigh less than packed columns
- (D) All (A), (B) and (C)

Answer: Option D

397. The solvent used in liquid-liquid extraction should have _____ less than one.

- (A) Selectivity
- (B) Distribution co-efficient
- (C) Both (A) and (B)
- (D) Neither (A) nor (B)

Answer: Option D

398. Diffusion co-efficient generally depends upon the temperature, pressure & the nature of the components of the system. Its dimension is not the same as that of the

- (A) Mass transfer co-efficient
- (B) Thermal diffusivity
- (C) Kinematic viscosity
- (D) Volumetric diffusivity

Answer: Option A

399. Pick out the wrong statement.

- (A) Different solids have different equilibrium moisture curves

- (B) Total condenser or reboiler is considered equivalent to one theoretical plate in McCabe-Thiele method of theoretical plate calculation for distillation column
- (C) Heat removal load on cooler remains constant, even with increase of the reflux ratio in a distillation column
- (D) Even a forced draft cooling tower cannot cool water below the wet bulb temperature
- Answer: Option C

400. Which of the following equipments is not used for liquid dispersion?

- (A) Wetted wall towers
- (B) Packed towers
- (C) Venturi scrubbers
- (D) Agitated vessels

Answer: Option D

401. The rough value of diffusion co-efficient of water vapor into air at 25°C may be about _____ cm²/sec.

- (A) 0.25
- (B) 2.5
- (C) 1.25
- (D) 0.0025

Answer: Option A

402. Molecular diffusion is caused by the

- (A) Transfer of molecules from low concentration to high concentration region
- (B) Thermal energy of the molecules
- (C) Activation energy of the molecules
- (D) Potential energy of the molecules

Answer: Option B

403. Liquid diffusivity is of the order of _____ cm²/second.

- (A) 0.01
- (B) 0.1
- (C) 10⁻⁵ to 10⁻⁶
- (D) > 1

Answer: Option C

404. The diffusivity, D_{AB} (for component A diffusing in B) is equal to the diffusivity D_{BA} (for component B diffusing in A) for a binary mixture of

- (A) Newtonian liquids
- (B) Non-Newtonian liquids
- (C) Ideal gases
- (D) Real gases

Answer: Option C

405. Can a cooling tower cool water below the wet bulb temperature of inlet air?

- (A) Yes
- (B) No
- (C) Yes; but height of cooling tower will be prohibitively high
- (D) Yes; but the air flow rate should be excessively high

Answer: Option B

406. The expression, $\ln(F/W) = \int_{x_W}^{x_F} [dx/y^* - x]$ is

- (A) Differential distillation equation
- (B) For N_{toG} in absorption for dilute mixture
- (C) Slope of q -line in McCabe-Thiele method
- (D) For relative volatility

Answer: Option A

407. Wetted wall tower experiment determines the

- (A) Molal diffusivity
- (B) Volumetric co-efficient
- (C) Mass transfer co-efficient
- (D) None of these

Answer: Option C

408. Condensation of a vapour-gas mixture just begins, when (where, p = partial pressure of the vapour P = vapour pressure of the liquid).

- (A) $p = P$
- (B) $p \gg P$
- (C) $p < P$
- (D) $p \ll P$

Answer: Option A

409. If the overall efficiency and Murphree plate efficiency are equal, then both the equilibrium and operating lines are:

- (A) Straight
- (B) Parallel
- (C) Both (A) & (B)
- (D) Neither (A) nor (B)

Answer: Option C

410. J_D factor for mass transfer is a function of Reynolds number. Mass transfer by molecular diffusion from a single drop to surrounding still air is given by

- (A) $N_{sh} = 2$
- (B) $N_{st} = 2$
- (C) $N_{sc} = 2$
- (D) None of these

Answer: Option A

411. In liquid-liquid extraction, the number of phases at plait point is

- (A) 1
- (B) 2
- (C) 3
- (D) 4

Answer: Option A

412. Molecular sieves are porous

- (A) Alumina
- (B) Silica
- (C) Synthetic zeolites crystals/metal alumino-silicates
- (D) None of these

Answer: Option C

413. Nitrobenzene (boiling point = 210.6°C) is steam distilled at 1 atm pressure. Nitrobenzene will distil off _____ °C.

- (A) At < 100
- (B) At > 210.6
- (C) Between 100 and 210
- (D) None of these

Answer: Option A

414. Selectivity of the solvent used in solvent extraction should be

- (A) 1
- (B) > 1
- (C) < 1
- (D) 0

Answer: Option B

415. The relative humidity of air decreases in spite of an increase in the absolute humidity, when the

- (A) Temperature rises
- (B) Pressure rises
- (C) Temperature falls
- (D) Pressure falls

Answer: Option A

416. The dew point of a saturated gas phase equals the _____ temperature.

- (A) Gas
- (B) Room
- (C) Wet bulb

(D) None of these
Answer: Option A

417. The amount of steam required per unit quantity of distillate in case of steam distillation will be reduced by

- (A) Raising the temperature
 - (B) Lowering the total pressure
 - (C) Both (A) and (B)
 - (D) Neither (A) nor (B)
- Answer: Option C

418. Priming in a distillation column

- (A) Results from very low gas velocity
 - (B) Is desirable from point efficiency consideration
 - (C) Is characterised by the presence of foam throughout the space between trays
 - (D) Reduces the overall pressure drop
- Answer: Option C

419. Separation of a mixture of two gases by absorption in the liquid solvent depends upon the difference in their

- (A) Viscosity
 - (B) Density
 - (C) Solubility
 - (D) Relative volatility
- Answer: Option C

420. The efficiency of a plate column will be maximum, when the flow is ideal _____ the plate.

- (A) Across
 - (B) Above
 - (C) Both (A) & (B)
 - (D) Neither (A) nor (B)
- Answer: Option C

421. _____ columns are used for liquid dispersion in a continuous gas phase.

- (A) Packed
 - (B) Pulse
 - (C) Bubble cap
 - (D) Sieve plate
- Answer: Option A

422. Pick out the wrong statement.

- (A) When the concentration difference for the mass transfer becomes zero at the bottom of the gas absorption tower, then the upper end of the operating line touches the equilibrium curve
 - (B) The average distance between the operating line and equilibrium line is large, when the liquid-gas ratio is also large in case of a counter current gas absorption tower
 - (C) The operating line lies above the equilibrium curve in case of a gas desorber
 - (D) With decrease in the liquid flow rate for a fixed gas flow rate, the slope of the operating line decreases, in case of gas absorption process
- Answer: Option C

423. An alkaline solution is used to reduce the concentration of carbon dioxide in a stream from 10% to 0.1% by absorption with irreversible chemical reaction. The overall number of transfer units based on gas phase is:

- (A) 9.21
 - (B) 4.605
 - (C) 100
 - (D) 0.001
- Answer: Option B

424. The overall mass transfer co-efficient for the absorption of SO₂ in air with dilute NaOH solution can be increased substantially by

- (A) Increasing the gas film co-efficient
- (B) Increasing the liquid film co-efficient
- (C) Increasing the total pressure

(D) Decreasing the total pressure

Answer: Option A

425. Air initially at 101.3 kPa and 40°C and with a relative humidity of 50%, is cooled at constant pressure to 30°C. The cooled air has a

- (A) Higher dew point
- (B) Higher absolute (specific) humidity
- (C) Higher relative humidity
- (D) Higher wet bulb temperature

Answer: Option C

426. When the psychrometric ratio is _____ then the adiabatic saturation temperature and wet bulb temperature becomes equal.

- (A) 1
- (B) < 1
- (C) > 1
- (D) ∞

Answer: Option A

427. With increase in the concentration of the adsorbate, the integral heat of adsorption

- (A) Increases
- (B) Decreases
- (C) Remains unchanged
- (D) May increase or decrease; depends on the type of adsorbate

Answer: Option B

428. Use of raschig rings in place of crushed stones as packing in packed beds (other things being same)

- (A) Increases pressure drop, increases surface area
- (B) Increases pressure drop, decreases surface area
- (C) Decreases pressure drop, increases surface area
- (D) Decreases pressure drop, decreases surface area

Answer: Option C

429. A solid material shows case hardening properties while drying. Which of the following should be controlled to control the drying process?

- (A) Flow rate of inlet air
- (B) Relative humidity of outlet air
- (C) Humidity of inlet air
- (D) Temperature of the solid

Answer: Option D

430. Fenske equation for determining the minimum number of theoretical stages in distillation column holds good, when the

- (A) Relative volatility is reasonably constant
- (B) Mixture (to be separated) shows negative deviation from ideality
- (C) Mixture (to be separated) shows positive deviation from ideality
- (D) Multi-component distillation is involved

Answer: Option A

431. When the _____ the relative humidity of air decreases, despite an increase in the absolute humidity.

- (A) Temperature rises
- (B) Pressure rises
- (C) Temperature falls
- (D) Pressure falls

Answer: Option A

432. Pick out the wrong statement.

- (A) Critical moisture content is not a property of the material itself
- (B) A sharp increase in pressure drop gives an indication of the flooding in a distillation column
- (C) Separation of components is not possible in liquid extraction, if selectivity is unity
- (D) Dehydration of ethyl alcohol is most economically done by molecular distillation at very high vacuum

Answer: Option D

433. Detergent solution is dried to a powder in a

- (A) Spray dryer
- (B) Spouted bed dryer
- (C) Tunnel dryer
- (D) Pan open to atmosphere

Answer: Option A

434. Stefan's law describes the mass transfer by

- (A) Diffusion
- (B) Bulk flow
- (C) Both 'a' & 'b'
- (D) Neither 'a' nor 'b'

Answer: Option C

435. Which of the following equipments is not used in liquid-liquid extraction?

- (A) Pachuka tank
- (B) Agitated vessels
- (C) Centrifugal extractors
- (D) Packed towers

Answer: Option A

436. Flights in a rotary dryer are provided to

- (A) Lift and shower the solids thus exposing it thoroughly to the drying action of the gas
- (B) Reduce the residence time of solid
- (C) Increase the residence time of the solid
- (D) None of these

Answer: Option A

437. In a forced draft cooling tower, water is cooled from 95 to 80°F by exposure to air with a wet bulb temperature of 70°F. In this case, the

- (A) Range is 15°F
- (B) Approach is 10°F
- (C) Both (A) & (B)
- (D) Neither (A) nor (B)

Answer: Option C

Explanation:

Temperature range $(T_1 - T_2) = 15^\circ\text{F}$

Temperature approach $(T_2 - t_w) = 10^\circ\text{F}$

Wet-bulb temperature $t_w = 70^\circ\text{F}$

438. To increase the absorption factor, (where, G = gas flow rate, S = solvent flow rate)

- (A) Increase both ' G ' and ' S '
- (B) Decrease both ' G ' and ' S '
- (C) Increase ' S ' and decrease ' G '
- (D) Increase ' G ' and decrease ' S '

Answer: Option C

439. The adiabatic saturation curve for a vapour-gas mixture is

- (A) Straight line
- (B) Slightly concave upward
- (C) Slightly concave downward
- (D) None of these

Answer: Option B

440. For the case of flow of air past a wet bulb thermometer (air water vapour system), the approximate value of $h_2/k_y.C_z$ is around

- (A) 0.60
- (B) 0.24
- (C) 1
- (D) 0.72

Answer: Option C

441. The temperature to which a vapour gas mixture must be cooled (at varying humidity) to become saturated is called the _____ temperature.

- (A) Dew point
 - (B) Wet bulb
 - (C) Dry bulb
 - (D) None of these
- Answer: Option D

442. Absorption factor is defined as (where, S_1 = slope of the operating line S_2 = slope of the equilibrium curve)

- (A) S_2/S_1
- (B) S_1/S_2
- (C) $S_1 - S_2$
- (D) $S_1 \times S_2$

Answer: Option B

443. At what value of reflux ratio, number of theoretical plates in a distillation column is minimum?

- (A) 0
- (B) 1
- (C) ∞
- (D) < 1

Answer: Option C

444. Under conditions of flooding in packed tower, the gas pressure drop

- (A) Decreases rapidly
- (B) Increases rapidly
- (C) Remain constant
- (D) Is maximum

Answer: Option D

445. With increase in solvent rate, the number of transfer units, N_{toG} , for a fixed degree of absorption from a fixed amount of gas

- (A) Increases
- (B) Decreases
- (C) Decreases linearly
- (D) Remain unaffected

Answer: Option B

446. Absorption accompanied with chemical reaction is exemplified by the absorption of

- (A) Ammonia in water
- (B) Benzol present in coke oven gas by wash oil
- (C) SO_2 in alkaline solution
- (D) All (A), (B) and (C)

Answer: Option C

447. For turbulent mass transfer in pipes, the Sherwood number depends on the Reynolds number as

- (A) $Re^{0.33}$
- (B) $Re^{0.53}$
- (C) $Re^{0.83}$
- (D) Re

Answer: Option C

448. In a counter-current liquid extractor

- (A) Both liquids flow at fixed rate
- (B) Both liquids can have any desired flow rate
- (C) Only one of the liquids may be pumped at any desired rate
- (D) Liquid's flow rate depends upon the temperature and pressure

Answer: Option C

449. The vapour pressure exerted by the moisture contained in a wet solid depends upon the

- (A) Nature of the moisture
- (B) Temperature
- (C) Nature of the solid
- (D) All (A), (B) and (C)

Answer: Option D

450. In distillation, overhead product contains

- (A) Only one component
- (B) Two components
- (C) Any number of components
- (D) Only saturated liquid

Answer: Option C

451. Equilibrium-moisture curves of different solids

- (A) Are different
- (B) Are same
- (C) Depend on the humidity of the gas
- (D) None of these

Answer: Option A

452. The caking of crystals can be prevented by

- (A) Maintaining high critical humidity
- (B) Maintaining low critical humidity
- (C) Coating the product with inert material
- (D) Both (A) and (C)

Answer: Option D

453. In McCabe-Thiele method of theoretical plate calculation for a distillation column, the operating lines of stripping and rectifying sections coincide with the diagonal at _____ reflux.

- (A) Total
- (B) Minimum
- (C) Operating
- (D) Maximum permissible

Answer: Option A

454. Mass transfer co-efficient (K) and diffusivity (D) are related according to film theory as

- (A) $K \propto D$
- (B) $K \propto \sqrt{D}$
- (C) $K \propto D^{1.5}$
- (D) $K \propto D^2$

Answer: Option A

455. Steady state equimolar counter diffusion occurs in case of

- (A) Leaching
- (B) Absorption
- (C) Binary phase distillation
- (D) Liquid-liquid extraction

Answer: Option C

456. On moving the feed line (q -line) from saturated liquid feed (vertical position) to saturated vapor feed (horizontal feed), if the slope of both the operating lines are to be increased, then it will result in

- (A) Greater degree of separation with a fixed number of trays
- (B) Increased reboiler load
- (C) Increased reflux ratio
- (D) None of these

Answer: Option C

457. _____ is used as an 'entrainer' for the separation of acetic acid-water mixture by distillation.

- (A) Furfural
- (B) Benzol
- (C) Butyl acetate
- (D) Hexane

Answer: Option C

458. Mass transfer rate between two fluid phases does not necessarily depend on the _____ of the two phases.

- (A) Chemical properties

- (B) Physical properties
 - (C) Degree of turbulence
 - (D) Interfacial area
- Answer: Option A

459. If mass diffusivity in a mixture is equal to the thermal diffusivity, then the Lewis number is

- (A) 0
- (B) 1
- (C) < 1
- (D) > 1

Answer: Option B

460. Which of the following solutions will follow Raoult's law most closely?

- (A) A solution of benzene, toluene and o-xylene
- (B) 35% solution of camphor in water
- (C) 35% solution of NH_3 in water
- (D) A solution of polar organic compounds (not of homologue of a series)

Answer: Option A

461. For continuous drying of granular or crystalline material, the dryer used is the _____ dryer.

- (A) Tunnel
- (B) Tray
- (C) Rotary
- (D) None of these

Answer: Option C

462. Pick out the correct statement.

- (A) In case of liquid-liquid extraction, no separation is possible, if the selectivity of the solvent used is unity
- (B) With increase in temperature, the selectivity of the solvent used in solvent extraction decreases
- (C) The selectivity of solvent used in solvent extraction is unity at the plait point
- (D) All (A), (B) and (C)

Answer: Option D

463. _____ column is preferred to be used, when a high liquid hold up is required in a reactor for gas-liquid reaction.

- (A) Packed
- (B) Bubble
- (C) Spray
- (D) Tray

Answer: Option B

464. As complete saturation of an adsorbent is approached, the differential heat of adsorption approaches

- (A) That of normal condensation
- (B) Integral heat of adsorption
- (C) Zero
- (D) None of these

Answer: Option A

465. During bottling of cold drinks (e.g. Pepsi), the main resistance to mass transfer for the absorption of carbon dioxide in water lies in the

- (A) Gas film
- (B) Liquid film
- (C) Liquid-gas interface
- (D) None of these

Answer: Option B

466. Relative humidity is the ratio of the

- (A) Partial pressure of the vapour to the vapour pressure of the liquid at room temperature
- (B) Partial pressure of the vapour to the vapour pressure of the liquid at gas temperature
- (C) Actual humidity to saturation humidity
- (D) None of these

Answer: Option B

467. In the absorption of ammonia in water, the main resistance to absorption is by the _____ phase.

- (A) Liquid
- (B) Gas
- (C) Both (A) & (B)
- (D) Neither (A) nor (B)

Answer: Option B

468. In paper industry, paper is dried in a _____ dryer.

- (A) Tunnel
- (B) Heated cylinder
- (C) Conveyor
- (D) Festoon

Answer: Option B

469. Tray spacing in a distillation column of dia 10-12 ft. used in petroleum refinery may be around _____ inches.

- (A) 5
- (B) 30
- (C) 60
- (D) 100

Answer: Option B

470. Which of the following plays an important role in problems of simultaneous heat and mass transfer?

- (A) Lewis number
- (B) Schmidt number
- (C) Prandtl number
- (D) Sherwood number

Answer: Option A

471. In a moderately sized packed absorption tower, channelling (which is most severe with stacked packings) can be minimised by taking the ratio of tower diameter to packing diameter

- (A) $> 4 : 1$
- (B) $< 8 : 1$
- (C) $> 8 : 1$
- (D) $< 6 : 1$

Answer: Option C

472. If f = moles of vapour present per mole of feed, then the slope of feed line is (McCabe-Thiele method)

- (A) $(1 - f)/f$
- (B) $-(f - 1)/f$
- (C) $-1/f$
- (D) $-f/(1 - f)$

Answer: Option C

473. Pick out the wrong statement.

- (A) The operating line always lies above the equilibrium solubility curve in case of a single component absorber
- (B) The operating line always lies below the equilibrium solubility curve in case of a single component stripper
- (C) The operating pressure in solvent extraction system should be below vapor pressures of all components
- (D) The solubility of a particular gas in ideal solution in any solvent is always the same

Answer: Option C

474. Mass transfer co-efficient of liquid is

- (A) Affected more by temperature than that for gases
- (B) Affected much less by temperature than that for gases
- (C) Not affected by the temperature
- (D) None of these

Answer: Option A

475. Heat sensitive materials with very high latent heat of vaporisation may be economically separated using

- (A) Liquid extraction
- (B) Distillation
- (C) Evaporation
- (D) Absorption

Answer: Option A

476. The reciprocal of stripping factor is termed as

- (A) Selectivity index
- (B) Relative volatility
- (C) Absorption factor
- (D) Murphree efficiency

Answer: Option C

477. A distillation column with N plates is being operated under normal conditions. At some point of time, the operation is shifted to total reflux condition (i.e., no product and residue are being withdrawn and feed to the column is stopped). At the new steady state,

- (A) Composition of vapors and that of liquid do not vary throughout the column
- (B) Reboiler load and condenser load are minimum
- (C) The top and bottom compositions are unchanged with and without total reflux
- (D) The top and bottom compositions correspond to the maximum enrichment available

Answer: Option D

478. In distillation columns, the number of bubble caps per tray primarily depends upon the

- (A) Allowable liquid velocity
- (B) Allowable gas velocity
- (C) Allowable gas and liquid velocities
- (D) Feed composition

Answer: Option C

479. Batch tray dryers suffers from the disadvantage of

- (A) High maintenance cost
- (B) Non-uniform & low production rate
- (C) High labour cost & low heat economy
- (D) All 'a', 'b' & 'c'

Answer: Option C

480. For absorbing a sparingly soluble gas in a liquid

- (A) Gas side mass transfer co-efficient should be increased
- (B) Liquid side mass transfer co-efficient should be increased
- (C) Liquid side mass transfer co-efficient should be decreased
- (D) Mass transfer co-efficient must be kept constant

Answer: Option B

481. Smoke is an example of

- (A) Solid dispersed in liquid
- (B) Solid dispersed in gas
- (C) Liquid dispersed in gas
- (D) Gas dispersed in liquid

Answer: Option B

482. Low viscosity absorbent is preferred for reasons of

- (A) Rapid absorption rates and good heat transfer characteristics
- (B) Improved flooding characteristics
- (C) Low pressure drop on pumping
- (D) All (A), (B) and (C)

Answer: Option D

483. Pick out the wrong statement.

- (A) Cellulose acetate membranes are used in dialysis process
- (B) Elutriation process refers to when the soluble material is largely concentrated on the surface of an insoluble solid and is simply washed off by the solvent

(C) 'Cascade' means a group of stages interconnected so that various streams flow from one to another

(D) Zirconia probe is used for the humidity measurement

Answer: Option D

484. The wetted wall tower is used to determine

(A) Individual mass transfer co-efficient (M.T.C.) in gaseous system

(B) M.T.C. of individual components in a liquid-liquid system

(C) M.T.C. of liquid in liquid-gas system

(D) The overall M.T.C. of the system

Answer: Option A

485. Rotary dryers cannot handle _____ materials.

(A) Free flowing

(B) Dry

(C) Sticky

(D) Granular

Answer: Option C

486. In a solution containing 0.30 Kg mole of solute and 600 kg of solvent, the molality is

(A) 0.50

(B) 0.60

(C) 1

(D) 2

Answer: Option A

487. Small dia distillation column can be a

(A) Packed column

(B) Sieve tray

(C) Bubble cap

(D) Any of these

Answer: Option A

488. Prandtl number for water at 20°C is about

(A) 7

(B) 70

(C) 0.7

(D) 150

Answer: Option A

489. Relative volatility does not change appreciably with the change in

(A) Temperature

(B) Vapour pressure of either component

(C) Total pressure

(D) None of these

Answer: Option A

490. The difference of wet bulb temperature and adiabatic saturation temperature of unsaturated mixture of any system is

(A) +ve

(B) -ve

(C) Zero

(D) None of these

Answer: Option A

491. A minimum boiling azeotrope is exemplified by

(A) Toluene-benzene

(B) Acetone-carbon disulphide

(C) Water-isobutyl alcohol

(D) None of these

Answer: Option B

492. Moisture in a substance exerting an equilibrium vapour pressure less than that of pure liquid at the same temperature is called the _____ moisture.

(A) Bound

- (B) Unbound
 - (C) Critical
 - (D) None of these
- Answer: Option A

493. Which is the controlling factor for a drum drier?

- (A) Diffusion
 - (B) Heat transfer
 - (C) Both (A) and (B)
 - (D) Neither (A) nor (B)
- Answer: Option B

494. 1 kg of a saturated aqueous solution of a highly soluble component A at 60°C is cooled to 25°C. The solubility limits of A are (0.6 kgA/kg water) at 60°C and (0.2 kgA/kg water) at 25°C. The amount in kg of the crystals formed is:

- (A) 0.4
 - (B) 0.25
 - (C) 0.2
 - (D) 0.175
- Answer: Option C

495. Which of the following is not a continuous drier?

- (A) Drum drier
 - (B) Spray drier
 - (C) Tunnel drier
 - (D) Tray drier
- Answer: Option D

496. Pick out the wrong statement:

- (A) Reboiler is not used in open steam distillation
 - (B) The separation of solutes of different molecular sizes in a liquid solution by use of a suitable membrane is called dialysis
 - (C) Freeze drying is used for the drying of fish
 - (D) Fenske-Underwood equation is used for calculating theoretical number of plates in a distillation column at normal operating reflux condition
- Answer: Option D

497. In an operating distillation column, the

- (A) Vapors and liquids are at their dew point and bubble point respectively
 - (B) Driving force for the liquid flow is its specific weight
 - (C) Driving force for the vapor flow is the pressure drop, as the pressure decreases gradually from the bottom to the top of the column
 - (D) Highest temperature is encountered at the top of the column
- Answer: Option C

498. Psychrometry deals with the properties of gas-vapor mixture. Humidity can be determined by the measurement of the _____ of a fibre.

- (A) Electrical resistance
 - (B) Thermal conductivity
 - (C) Strength
 - (D) None of these
- Answer: Option A

499. As per Gilliland's equation, the diffusivity is

- (A) Directly proportional to $T^{1.5}$
 - (B) Inversely proportional to 'P'
 - (C) Dependent on the molecular volume & molecular weight of components
 - (D) All 'a', 'b' & 'c'
- Answer: Option D

500. Pick out the wrong statement.

- (A) In the McCabe-Thiele diagram for binary distillation, vertical feed line represents saturated liquid feed and horizontal feed line represents saturated vapour feed
- (B) In small columns, local efficiency is larger than Murphree efficiency; in large columns local efficiency is smaller than Murphree efficiency

- (C) For Laminar flow over a plate of length L , the local mass transfer co-efficient at a distance L from the leading edge is 1.5×10^{-2} m/s. Then the average mass transfer co-efficient for the plate is 2×10^{-2} m/s
- (D) The concentration and hydrodynamic boundary layers over a flat plate are of equal thickness, if Schmidt number is equal to unity

Answer: Option C

501. If the solubilities of different components (in a liquid-liquid extraction system) increase with rise in temperature, then the temperature above which they dissolve completely is known as the critical solution temperature (CST or consolute temperature). If solubilities increase with decrease in temperature, then CST is the temperature below which they dissolve completely. If a binary system has no critical solution temperature, it implies that

- (A) The system comprises of partially miscible liquids
(B) The system comprises of miscible liquids
(C) The system comprises of an azeotrope
(D) On heating, a vapor phase will appear; while on cooling, a solid phase will appear

Answer: Option D

502. Leaching of coffee from coffee beans is done by

- (A) Hot water
(B) Hexane
(C) Lime water
(D) Dilute H_2SO_4 (hot)

Answer: Option A

503. In case of an absorber, the operating

- (A) Line always lies above the equilibrium curve
(B) Line always lies below the equilibrium curve
(C) Line can be either above or below the equilibrium curve
(D) Velocity is more than the loading velocity

Answer: Option A

504. Desirable value of absorption factor in an absorber is

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

Answer: Option C

505. Radioactive nuclear waste is treated in

- (A) Mixer-settler extractor
(B) Rotating-disc contactor
(C) Pulsed column extractor
(D) Bollman extractor

Answer: Option C

506. In case of a desorber (stripper), the

- (A) Operating line always lies above the equilibrium curve
(B) Operating line always lies below the equilibrium curve
(C) Temperature remains unaffected
(D) Temperature always increases

Answer: Option B

507. In a packed tower, the value of HETP equals HTU_{OG} , when the equilibrium and the operating lines are (where, HETP = height equivalent to a theoretical plate HTU_{OG} = overall gas phase height of a transfer unit).

- (A) Straight
(B) Parallel
(C) Both (A) & (B)
(D) Neither (A) nor (B)

Answer: Option C

508. Make up water is required in a cooling tower to replace the water lost by

- (A) Evaporation
(B) Drift

- (C) Blowdown and leakage
 - (D) All (A), (B) and (C)
- Answer: Option D

509. Langmuir equation is associated with

- (A) Leaching
 - (B) Adsorption
 - (C) Steam distillation
 - (D) Multi-component absorption
- Answer: Option B

510. A packed tower compared to a plate tower for a particular mass transfer operation

- (A) Incurs smaller pressure drop
 - (B) Allows installation of cooling coils
 - (C) Is less costly when built in large sizes/diameters
 - (D) Is more suitable, if suspended solids are present in fluid streams
- Answer: Option A

511. Which of the following is an undesirable property for an absorbing solvent?

- (A) Low vapour pressure
 - (B) Low velocity
 - (C) Low freezing point
 - (D) None of these
- Answer: Option D

512. Stacked packing compared to dumped packing

- (A) Provides poorer contact between the fluids
 - (B) Gives lower pressure drop
 - (C) Both (A) and (B)
 - (D) Gives higher pressure drop
- Answer: Option C

513. Raoult's law applies to the

- (A) All liquid solutions
 - (B) Non-ideal solution only
 - (C) Non-volatile solute
 - (D) Solvents
- Answer: Option D

514. _____ developed the film theory.

- (A) Higbie
 - (B) Fick
 - (C) Ergun
 - (D) Levenspiel
- Answer: Option A

515. Hydrogenation of oil is carried out in a/an _____ in Vanaspati manufacturing plant.

- (A) Agitated vessel
 - (B) Sieve tray column
 - (C) Bubble cap column
 - (D) Packed tower
- Answer: Option A

516. Schmidt number is given by

- (A) $\mu/\rho D_{AB}$
 - (B) $Re \times Pe$
 - (C) $Sh \times Pe$
 - (D) Re/Pe
- Answer: Option A

517. Pick out the correct statement.

- (A) Diffusivity decreases with increase in temperature
- (B) Diffusivity increases with increase in molecular weight
- (C) Diffusivity increases with the size of the individual molecule
- (D) None of these

Answer: Option D

518. Fenske equation determines the

- (A) Maximum number of ideal plates
- (B) Height of the distillation column
- (C) Minimum number of theoretical plates
- (D) Optimum reflux ratio

Answer: Option C

519. If x_D = overhead product molal composition and R_D = reflux ratio, then slope and intercept of the operating line for rectifying section are respectively

- (A) $[x_D/(R_D + 1)]$, $[R_D/(R_D + 1)]$
- (B) $[R_D/(R_D + 1)]$, $[x_D/(x_D + 1)]$
- (C) $[x_D/(R_D + 1)]$, $[(R_D + 1)/R_D]$
- (D) None of these

Answer: Option B

520. Which of the following equipments is not used for gas dispersion?

- (A) Agitated vessels
- (B) Bubble cap tray towers
- (C) Perforated sieve tray towers
- (D) Spray towers

Answer: Option D

521. _____ column is the most suitable for achieving the best performance for mass transfer operations involving liquid with dispersed solids.

- (A) Wetted wall
- (B) Packed
- (C) Plate
- (D) Spray

Answer: Option C

522. When adsorption hysteresis is observed, the desorption equilibrium pressure is _____ that obtained by adsorption.

- (A) Always lower than
- (B) Always higher than
- (C) Same as
- (D) Dependent on the system; can be either lower or higher than

Answer: Option A

523. On addition of solute in the solvent, the _____ of the solution decreases.

- (A) Boiling point
- (B) Freezing point
- (C) Vapour pressure
- (D) Both (B) and (C)

Answer: Option D

424. Extraction of penicillin employs a _____ extraction column.

- (A) Centrifugal
- (B) Packed
- (C) Plate
- (D) None of these

Answer: Option A

525. Which of these columns incurs the lowest pressure drop?

- (A) Packed column (with stacked packing)
- (B) Packed column (with dumped packing)
- (C) Bubble plate column
- (D) Pulse column

Answer: Option A

526. 'Absorption with chemical reaction' is involved in the removal of

- (A) Carbon dioxide from gaseous stream using alkaline solution
- (B) Benzol from coke oven gas using solar oil/wash oil
- (C) Ammonia from coke oven gas using refrigerated water

(D) Tar from coke oven gas in primary gas coolers using chilled water

Answer: Option A

527. Which of the following mixtures does not form an azeotrope at atmospheric pressure?

- (A) Water-alcohol
- (B) Methyl alcohol-acetone
- (C) Butyl acetate-water
- (D) None of these

Answer: Option D

528. In batch distillation with constant reflux, overhead product composition _____ with time.

- (A) Increases
- (B) Decreases
- (C) Does not vary
- (D) May increase or decrease, depends on the system

Answer: Option B

529. McCabe-Thiele method of binary distillation does not assume that the

- (A) Sensible heat changes are negligible compared with latent heat changes
- (B) Molar latent heats of all components are equal
- (C) Heat of mixing is negligible
- (D) None of these

Answer: Option D

530. Which of the following same diameter columns gives lowest pressure drop per unit height?

- (A) Bubble-cap column
- (B) Sieve-plate column
- (C) Packed column (stacked)
- (D) Randomly packed column

Answer: Option C

531. Absorption factor method is used to calculate the number of ideal stages, when

- (A) Operating line lies above the equilibrium line
- (B) Operating line lies below the equilibrium line
- (C) Both operating and equilibrium lines are parallel
- (D) Pressure drop in the column is very high

Answer: Option C

532. Entrainer used in Azeotropic distillation should

- (A) Form a low boiling azeotrope with one of the constituents of the mixture
- (B) Form a new azeotrope of low relative volatility with one of the constituents of the mixture
- (C) Have high latent heat of vaporisation
- (D) Have high viscosity to provide high tray efficiency

Answer: Option A

533. A plait point is the point on the solubility curve, where the tie line reduces to a point. What is the number of plait point for a ternary system containing two pairs of partially miscible liquids?

- (A) 0
- (B) 1
- (C) 2
- (D) 3

Answer: Option A

534. For the same process conditions, the reflux ratio of an unlagged distillation column

- (A) Decreases in winter
- (B) Increases in winter
- (C) Increases in summer
- (D) None of these

Answer: Option B

535. Minimum possible diameter of a packed column is decided mainly by the

- (A) Flooding
- (B) Gas viscosity

- (C) Liquid density
 - (D) Liquid hold up
- Answer: Option A

536. Ponchon-Savarit method analyses the fractional equipment based on

- (A) Enthalpy balance only
- (B) Material balance only
- (C) Both enthalpy and material balances
- (D) The assumption of constant molal-overflow

Answer: Option C

537. Dryer widely used in a textile industry is _____ dryer.

- (A) Festoon
- (B) Cylinder
- (C) Conveyor
- (D) Tunnel

Answer: Option C

538. Which of the following liquid-vapor contacting devices provides maximum contact surface area for a particular duty?

- (A) Sieve plate column
- (B) Bubble cap column
- (C) Randomly packed column
- (D) Wetted wall column

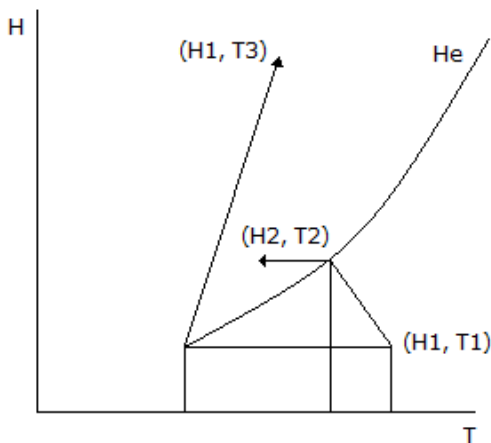
Answer: Option D

539. In a binary system, separation is very efficient, when the relative volatility is

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

Answer: Option B

540. The following plot gives the saturated humidity (H_e) versus temperature (T). Line joining (H_1, T_1) and (H_2, T_2) is the constant enthalpy line. Choose the correct one from among the alternatives A, B, C and D.



- (A) T1-Dew point temp; T2-Dry bulb temp; T3-Wet bulb temp
- (B) T1-Dew point temp; T2-Wet bulb temp; T3-Dry bulb temp
- (C) T1-Wet bulb temp; T2-Dry bulb temp; T3-Dew point temp
- (D) T1-Dry bulb temp; T2-Wet bulb temp; T3-Dew point temp

Answer: Option D

541. Channelling in a packed tower results from the

- (A) High pressure drop
- (B) Maldistribution of liquid
- (C) Non-uniformity of packing
- (D) Both (B) and (C)

Answer: Option D

542. Which of the following adsorbent is used in the refining of sugar?

- (A) Bone charcoal

- (B) Wood charcoal
 - (C) Silica gel
 - (D) Activated clay
- Answer: Option A

543. With increase in pressure, the relative volatility for a binary system

- (A) Increases
 - (B) Decreases
 - (C) Remains same
 - (D) Either (A) or (B), depends on the system
- Answer: Option B

544. When the liquid over a plate is of uniform concentration, then

- (A) Murphree efficiency > point efficiency
 - (B) Murphree efficiency < point efficiency
 - (C) Murphree efficiency = point efficiency
 - (D) Murphree efficiency \neq point efficiency
- Answer: Option C

545. Solvent extraction is the terminology applied to the liquid-liquid extraction, which is preferred for the separation of the components of liquids, when

- (A) Extracting solvent is cheaply & abundantly available
 - (B) One of the liquid components is heat sensitive
 - (C) Viscosity of liquid components is very high
 - (D) One of the liquid components has very high affinity towards the solvent
- Answer: Option D

546. A good solvent used for absorption should not have very high

- (A) Viscosity
 - (B) Vapor pressure
 - (C) Freezing point
 - (D) All (A), (B) & (C)
- Answer: Option D

547. An example of elution is

- (A) Separation of uranium oxide from its ore by H_2SO_4 in a Pachuca tank
 - (B) Separation of sugar from sugar beet by hot water
 - (C) Dissolution of tannin out of tree barks by water
 - (D) Recovery of vegetable oils from seeds
- Answer: Option A

548. The term "cooling range" in a cooling tower refers to the difference in the temperature of

- (A) Cold water leaving the tower and the wet bulb temperature of the surrounding air
 - (B) Hot water entering the tower and the wet bulb temperature of the surrounding air
 - (C) Hot water entering the tower and the cooled water leaving the tower
 - (D) None of these
- Answer: Option C

549. If the amount of the steam used in steam distillation is increased, the temperature of distillation

- (A) Increases
 - (B) Decreases
 - (C) Remains unchanged
 - (D) Depends on relative volatility
- Answer: Option B

550. Rate of leaching increases with increasing

- (A) Temperature
 - (B) Viscosity of solvent
 - (C) Pressure
 - (D) Size of the solid
- Answer: Option A

551. With increase in gas rate, the number of transfer units, N_{OG} , for a fixed degree of absorption by a fixed amount of solvent

- (A) Increases
- (B) Decreases
- (C) Decreases linearly
- (D) Remains unaffected

Answer: Option A

552. Heat load in a cooling tower

- (A) Means the amount of heat thrown away (KCal/hr.) by the cooling tower
- (B) Is equal to the number of kg, of water circulated times the cooling range
- (C) Both (A) & (B)
- (D) Neither (A) nor (B)

Answer: Option C

553. Separation of two or more components of a liquid solution cannot be achieved by

- (A) Fractional crystallisation
- (B) Liquid extraction
- (C) Absorption
- (D) Evaporation

Answer: Option C

554. For _____ drying, the effects of velocity, temperature and humidity of the gas and the thickness of the solid are the same.

- (A) Unsaturated surface
- (B) Constant rate
- (C) Both (A) and (B)
- (D) Neither (A) nor (B)

Answer: Option C

555. In continuous distillation, the internal reflux ratio (R_i) and the external reflux ratio (R_e) are related as

- (A) $R_i = R_e/(1 - R_e)$
- (B) $R_i = (1 - R_e)/R_e$
- (C) $R_i = R_e$
- (D) $R_i = R_e/(1 + R_e)$

Answer: Option D

556. Deaeration (removal of O₂) of water is done by

- (A) Rectification
- (B) Absorption
- (C) Ion-exchange
- (D) Adsorption

Answer: Option C

557. For the air water system under ambient conditions, the adiabatic saturation temperature and the wet bulb temperature are nearly equal, because

- (A) Water has a high latent heat of evaporation
- (B) Lewis number is close to unity
- (C) They are always equal under all circumstances
- (D) Solubility of the components of air in water is very small

Answer: Option A

558. Dew point of a gas-vapour mixture

- (A) Increases with temperature rise
- (B) Decreases with temperature rise
- (C) Decreases with decrease in pressure
- (D) Increases with increase in pressure

Answer: Option C

559. If moisture content of solid on dry basis is X, then the same on wet basis is

- (A) $X/(X + 1)$
- (B) $X/(1 - X)$
- (C) $(1 + X)/X$
- (D) $(1 - X)/X$

Answer: Option A

560. _____ temperature is the steady state temperature attained by a small amount of liquid evaporating into a large quantity of unsaturated gas-vapor mixture.

- (A) Dry bulb
- (B) Wet bulb
- (C) Dew point
- (D) None of these

Answer: Option B

561. The relative volatility for separation of a non-ideal binary mixture by distillation should be

- (A) 0
- (B) 1
- (C) > 1
- (D) < 1

Answer: Option C

562. In case of steam distillation, the steam leaving the liquid is not completely saturated with distillate vapour, because

- (A) Temperature is less
- (B) Total pressure is less
- (C) Mixing of steam with the material being vaporised is not so intimate as to result in equilibrium condition
- (D) Saturated steam is used for steam distillation

Answer: Option C

563. Which of the following unit operations makes use of Thiele-Geddes equation?

- (A) Liquid-liquid extraction
- (B) Solid-liquid extraction
- (C) Multi-component absorption with chemical reaction
- (D) Multi-component distillation

Answer: Option D

564. Gaseous diffusion co-efficient increases with increase in the

- (A) Pressure
- (B) Temperature
- (C) Both (A) & (B)
- (D) Neither (A) nor (B)

Answer: Option B

565. Sides of equilateral-triangular co-ordinates (on which ternary liquid system is plotted) represent

- (A) A pure component
- (B) A binary mixture
- (C) A ternary mixture
- (D) Partially miscible ternary system

Answer: Option B

566. The rate of mass transfer is not dependent upon the

- (A) Degree of dispersion of one fluid in the other
- (B) Interfacial surface exposed between the phases
- (C) Both (A) & (B)
- (D) None of these

Answer: Option D

567. Air at a particular humidity is heated in a furnace. The new dew point

- (A) Decreases
- (B) Increases
- (C) Depends on the extent of heating
- (D) Remain unchanged

Answer: Option B

568. The rate of solid-liquid extraction is limited by the

- (A) Phase change of the solute as it dissolves in the solvent
- (B) Diffusion of the solute through the solvent in the pores to the outside of the particle
- (C) Diffusion of the solute from the solution in contact with the particle to the main bulk of the solution

(D) All 'a', 'b' & 'c'
Answer: Option D

569. In case of gases, the binary diffusivity is proportional to (where, P = pressure).

- (A) P
- (B) $1/P$
- (C) $1/\sqrt{P}$
- (D) \sqrt{P}

Answer: Option B

570. One mole feed of a binary mixture of a given composition is flash vaporised at a fixed P and T . If Raoult's law is obeyed, then changing the feed composition would effect

- (A) The product composition but not the fraction vaporised
- (B) The product composition as well as the fraction vaporised
- (C) The fraction vaporised but not the product composition
- (D) Neither the product composition nor the fraction vaporised

Answer: Option C

571. What is the reflux ratio at total reflux?

- (A) Zero
- (B) Infinity
- (C) Unity
- (D) Data insufficient

Answer: Option B

572. The operating line for an absorber is curved, when plotted in terms of

- (A) Mole fractions
- (B) Mole ratios
- (C) Partial pressure
- (D) Mass fractions

Answer: Option C

573. Which of the following is the most suitable for extraction in a system having very low density difference?

- (A) Mixer-settler extractor
- (B) Centrifugal extractor
- (C) Pulsed extractor
- (D) Packed extraction tower

Answer: Option B

574. ($N_{Sh}/N_{Re} \cdot N_{Sc}$) is termed in mass transfer operation as the

- (A) Stanton number
- (B) Peclet number
- (C) Thermal diffusivity
- (D) Momentum diffusivity

Answer: Option A

575. In the desorption of highly soluble gas from the liquid, the main resistance will be in the _____ phase.

- (A) Gas
- (B) Liquid
- (C) Both (A) & (B)
- (D) Neither (A) nor (B)

Answer: Option B

576. Positive deviation from Raoult's law means a mixture whose total pressure is

- (A) Greater than that computed for ideality
- (B) Less than that computed for ideality
- (C) Less than the sum of the vapour pressure of the components
- (D) None of these

Answer: Option A

577. Flooding results in

- (A) High tray efficiency
- (B) Low tray efficiency

- (C) High gas velocity
 - (D) Good contact between the fluids
- Answer: Option B

578. At minimum reflux ratio for a given separation

- (A) Number of plates is zero
- (B) Number of plates is infinity
- (C) Minimum number of the theoretical plates is required
- (D) Separation is most efficient

Answer: Option B

579. An ideal tower packing should not

- (A) Have low weight per unit volume
- (B) Have large surface area per unit volume
- (C) Have large free cross-section
- (D) Hold up large amount of liquid in the packing

Answer: Option D

580. Diffusion in concentrated solutions differs from that in dilute solutions, because of the change in the _____ with the concentration of the solution.

- (A) Degree of ideality
- (B) Viscosity
- (C) Both 'a' & 'b'
- (D) Neither 'a' nor 'b'

Answer: Option C

581. Make up water is supplied during cooling tower operation to compensate for water losses due to

- (A) Evaporation
- (B) Blowdown
- (C) Entrainment
- (D) All (A), (B) & (C)

Answer: Option D

582. The dimension of diffusivity is same as that of the

- (A) Density
- (B) Molal concentration
- (C) Kinematic viscosity
- (D) Velocity head

Answer: Option C

583. As the reflux ratio in a distillation column is increased from the minimum, the

- (A) Slope of the operating line in stripping section decreases
- (B) Number of plates decreases very slowly first and then more and more rapidly
- (C) Total cost first decreases and then increases
- (D) Liquid flow increases while the vapor flow decreases for a system

Answer: Option C

584. Fenske-Underwood equation used for calculating the minimum number of theoretical plates in distillation column is valid for

- (A) Constant molal overflow
- (B) Total reflux
- (C) Constant relative volatility
- (D) All (A), (B) and (C)

Answer: Option D

585. Solvent used in extractive distillation

- (A) Is of low volatility
- (B) Forms a low boiling azeotrope
- (C) Forms a high boiling azeotrope
- (D) Does not alter the relative volatility of the original components

Answer: Option B

586. When the feed to a distillation column is a saturated liquid, slope of the feed line is

- (A) Zero

- (B) Unity
 - (C) Infinity
 - (D) None of these
- Answer: Option C

587. The absorption factor is defined as (where, L = liquid flow rate, G = gas flow rate and, m = slope of the equilibrium line).

- (A) L/mG
- (B) G/mL
- (C) mL/G
- (D) LG/m

Answer: Option A

588. Chemisorption (chemical adsorption) is

- (A) Same as "Van der Waals" adsorption
- (B) Characterised by adsorption of heat
- (C) An irreversible phenomenon
- (D) A reversible phenomenon

Answer: Option C

589. A mixture of 10% C_6H_6 vapour in air at $25^\circ C$ and 750 mm Hg has a dew point of $20^\circ C$. Its dew point at $30^\circ C$ and 700 mm Hg will be around _____ $^\circ C$.

- (A) 21.7
- (B) 20
- (C) 27.3
- (D) 18.7

Answer: Option D

590. Inside the distillation column, the

- (A) Driving force for the vapour flow is the pressure drop
- (B) Liquids are not always at their bubble points
- (C) Pressure increases gradually from bottom to the top of the column
- (D) None of these

Answer: Option A

591. Dry bulb temperature of unsaturated air is more than its _____ temperature.

- (A) Dew point
- (B) Wet bulb
- (C) Both 'a' & 'b'
- (D) Neither 'a' nor 'b'

Answer: Option C

592. Boiling point diagram is not affected by the ambient

- (A) Pressure
- (B) Humidity
- (C) Temperature
- (D) Both (B) and (C)

Answer: Option D

593. Total reflux in a distillation operation requires minimum

- (A) Reboiler load
- (B) Number of plates
- (C) Condenser load
- (D) All (A), (B) and (C)

Answer: Option B

594. Inside the distillation columns, the

- (A) Highest temperatures is near the feed plate
- (B) Driving force for the liquid flow is its weight
- (C) Vapors are not always at their dew points
- (D) All (A), (B) and (C)

Answer: Option B

595. An Azeotropic mixture is a _____ mixture.

- (A) Binary

- (B) Ternary
 - (C) Constant boiling point
 - (D) None of these
- Answer: Option C

596. The change in enthalpy per unit weight of adsorbed gas when adsorbed on gas free or "outgassed" adsorbent to from a definite concentration of adsorbate is called its

- (A) Integral heat of adsorption
- (B) Heat of wetting
- (C) Differential heat of adsorption
- (D) Heat of normal condensation

Answer: Option A

597. The diffusivity (D) in a binary gas mixture is related to the temperature (T) as

- (A) $D \propto T$
- (B) $D \propto T^{0.5}$
- (C) $D \propto T^{1.5}$
- (D) $D \propto T^2$

Answer: Option C

598. The mass diffusivity, the thermal diffusivity and the eddy momentum diffusivity are same for, $N_{Pr} = N_{Sc} =$ _____

- (A) 1
- (B) 0.5
- (C) 10
- (D) 0

Answer: Option A

599. At a fixed total pressure, humidity depends only on the

- (A) Partial pressure of vapour in the mixture
- (B) Heat capacity of the vapour
- (C) Density of the vapour
- (D) None of these

Answer: Option A

600. In extractive distillation, solvent is

- (A) Added to alter the relative volatility of the mixture
- (B) Of high volatility
- (C) Present in overhead stream
- (D) Of high viscosity to give high tray efficiency

Answer: Option A

601. Pick out the wrong statement.

- (A) The mole fraction of solute is directly proportional to the molality of a 'dilute' solution
- (B) For a non-reacting binary mixture of ideal gases, the partial pressure distribution of both components is nonlinear in the case of steady state unimolal unidirectional diffusion
- (C) Azeotropes obey Raoult's law at all temperature
- (D) The relative volatility of a binary mixture at the Azeotropic composition is 1

Answer: Option C

602. During drying operation, it is easier to remove the _____ moisture.

- (A) Equilibrium
- (B) Critical
- (C) Unbound
- (D) Bound

Answer: Option C

603. Which of the following quantities need not be fixed before starting the design of a co-current absorber?

- (A) Heat gain or loss
- (B) Flow rate of entering liquid
- (C) Flow rate of gas
- (D) None of these

Answer: Option B

604. Which of the following parameters remains almost constant during adiabatic saturation of unsaturated air?

- (A) Dry bulb temperature
- (B) Dew point
- (C) Wet bulb temperature
- (D) None of these

Answer: Option C

605. In an absorber, HETP does not vary with the

- (A) Flow rate of liquid
- (B) Flow rate of gas
- (C) Type and size of packing
- (D) None of these

Answer: Option D

606. Leaching of sugar from sugar beets is done by

- (A) Hot water
- (B) Hexane
- (C) Dilute H_2SO_4
- (D) Lime water

Answer: Option A

607. In case of liquid-liquid binary diffusion, diffusivity of one constituent into another is not dependent on the

- (A) Temperature and pressure
- (B) Concentration
- (C) Nature of the constituents
- (D) None of these

Answer: Option D

608. When the temperature and humidity of air is low, we usually use _____ draft cooling tower.

- (A) Natural
- (B) Forced
- (C) Induced
- (D) None of these

Answer: Option A

609. Water-ethyl alcohol solution can be concentrated (in respect of alcohol concentration) by _____ distillation.

- (A) Atmospheric
- (B) Vacuum
- (C) High pressure
- (D) None of these

Answer: Option B

610. In an interphase mass transfer process, the lesser the solubility of a given solute in a liquid, the higher are the chances that the transfer process will be

- (A) Liquid phase resistance-controlled
- (B) Gas phase resistance controlled
- (C) Impossible
- (D) Driven by a non-linear driving force

Answer: Option B

611. Percentage saturation is _____ the relative saturation.

- (A) Always smaller than
- (B) Always greater than
- (C) Not related to
- (D) None of these

Answer: Option A

612. If a_1 and a_2 are the relative volatilities when the pressure in the distillation column is 1 and 2 atm respectively. Pick out the correct statement.

- (A) $a_1 = a_2$
- (B) $a_1 = 2a_2$

- (C) $a_1 = 0.5 a_2$
(D) None of these
Answer: Option D

613. In a packed absorption tower, if the equilibrium and operating lines are both straight lines, then the ratio, $HETP/HTU_{OG}$ _____ the absorption factor.

- (A) Increases with increase in
(B) Is one at unity value of
(C) Both (A) and (B)
(D) Neither (A) nor (B)
Answer: Option C

614. If a two phase system is in physical equilibrium; then it means that, the

- (A) Escaping tendency of each component from the liquid phase to the vapor phase is exactly equal to that from vapor phase to liquid phase
(B) Temperature of the liquid phase is equal to that of the vapor phase
(C) Total pressure throughout the liquid phase is equal to that throughout the vapor phase
(D) All (A), (B) and (C)
Answer: Option D

615. Which of the following remains constant during evaporative cooling process with recirculated water supply?

- (A) Relative humidity
(B) Partial pressure of vapour
(C) Wet bulb temperature
(D) None of these
Answer: Option C

616. Weight of 1 m^3 of humid air as compared to 1 m^3 of dry air, under the same conditions, is

- (A) Less
(B) More
(C) Same
(D) Unpredictable
Answer: Option A

617. Solvent used in extractive distillation

- (A) Changes the relative volatility of the original components
(B) Should be of high volatility
(C) Should form azeotropes with the original components
(D) All (A), (B) and (C)
Answer: Option A

618. The equipment frequently used for adiabatic humidification-cooling operation with recirculating liquid is

- (A) Natural draft cooling tower
(B) Induced draft cooling tower
(C) Spray chamber
(D) None of these
Answer: Option C

619. CO_2 can be absorbed by

- (A) Hot cupric oxide
(B) Heated charcoal
(C) Cold $\text{Ca}(\text{OH})_2$
(D) Alumina
Answer: Option B

620. The Knudsen diffusivity is dependent on the

- (A) Molecular velocity only
(B) Pore radius of the catalyst only
(C) Molecular mean free path only
(D) Molecular velocity and pore radius of the catalyst
Answer: Option D

621. Critical humidity of a solid salt means the humidity

- (A) Above which it will always become damp
 - (B) Below which it will always stay dry
 - (C) Both (A) and (B)
 - (D) Above Which it will always become dry and below which it will always stay damp
- Answer: Option C

622. For a binary mixture with low relative volatility, continuous rectification to get pure products will require

- (A) Low reflux ratio
- (B) Less number of trays
- (C) Small cross-section column
- (D) High reflux ratio

Answer: Option D

623. Overall efficiency of the distillation column is

- (A) The ratio of number of ideal plates to actual plates
- (B) The ratio of number of actual plates to ideal plates
- (C) Same as the Murphree efficiency
- (D) Always more than the point efficiency

Answer: Option A

624. The binary diffusivity in gases does not depend upon the

- (A) Pressure
- (B) Temperature
- (C) Nature of the components
- (D) None of these

Answer: Option D

625. Diffusivity in concentrated solutions differs from that in dilute solutions, because of the changes in

- (A) Viscosity with concentration
- (B) Degree of ideality of the solution
- (C) Both (A) and (B)
- (D) Neither (A) nor (B)

Answer: Option C

626. The assumption made in Elis method in distillation is that enthalpy concentration lines of vapor and liquid are

- (A) Parallel
- (B) Straight
- (C) Both parallel and straight
- (D) Neither parallel nor straight

Answer: Option C

627. For contacting a highly soluble gas with a liquid

- (A) Bubble the gas through liquid
- (B) Spray the liquid on gas stream
- (C) Either (A) or (B) would suffice
- (D) None of these

Answer: Option A

628. Which of the following remains constant during sensible cooling process?

- (A) Specific humidity
- (B) Partial pressure of vapour
- (C) Both (A) and (B)
- (D) Neither (A) nor (B)

Answer: Option C

629. In saturated gas, the

- (A) Vapour is in equilibrium with the liquid at the gas temperature
- (B) Vapour is in equilibrium with the liquid at the room temperature
- (C) Partial pressure of vapour equals the vapour pressure of the liquid at room temperature
- (D) None of these

Answer: Option A

630. In a counter-current extractor, as the axial mixing increases, the extraction efficiency

- (A) Increases
- (B) Decreases
- (C) Remains unchanged
- (D) Depends on the pressure of the system

Answer: Option B

631. At equilibrium the concentration of water in vapour phase (C^*) in kg/m^3 of air space and the amount of water (m) adsorbed per kg of dry silica gel are related by, $C^* = 0.0667m$. To maintain dry conditions in a room of air space 100m^3 containing 2.2 kg of water vapour initially, 10 kg of dry silica gel is kept in the room. The fraction of initial water remaining in the air space after a long time (during which the temperature is maintained constant) is

- (A) 0.0
- (B) 0.2
- (C) 0.4
- (D) 1.0

Answer: Option C

632. In case of absorption with exothermic reaction, for fluids having

- (A) $Pr = Sc$; percentage change in heat and mass transfer flux will be the same for a given change in the degree of turbulence
- (B) $Pr = Sc = 1$; total mass, momentum and thermal diffusivity will be the same
- (C) Both (A) and (B)
- (D) $Pr = Sc$; there won't be any change in heat and mass transfer flux with changes in degree of turbulence

Answer: Option C

633. Drying operation under vacuum is carried out to

- (A) Dry those materials which have very high unbound moisture content
- (B) Reduce drying temperature
- (C) Increase drying temperature
- (D) Dry materials having high bound moisture content

Answer: Option B

634. Sticky material can be dried in a _____ dryer.

- (A) Tray
- (B) Rotary
- (C) Fluidised bed
- (D) None of these

Answer: Option A

635. The drying time between fixed moisture contents within the 'constant rate period' is proportional to (assuming that drying occurs from all surfaces of the solid) (where, T = thickness of the solid).

- (A) \sqrt{T}
- (B) T
- (C) $T^{1.5}$
- (D) T^3

Answer: Option B

636. The minimum number of theoretical plates is required for achieving a given separation in distillation column with

- (A) No reflux
- (B) Total reflux
- (C) Zero reflux ratio
- (D) Minimum reflux ratio

Answer: Option B

637. For which of the following unit operations, Lewis number is of significance?

- (A) Adsorption
- (B) Binary distillation
- (C) Gas absorption
- (D) Humidification

Answer: Option D

638. Heat in BTU necessary to increase the temperature of 1 lb of gas and its accompanying vapour by 1°F is called the

- (A) Latent heat
- (B) Humid heat
- (C) Specific heat
- (D) Sensible heat

Answer: Option C

639. With increase in absolute humidity, the dew point of an unsaturated mixture of air and water vapor (at constant pressure and temperature).

- (A) Increases
- (B) Remains unchanged
- (C) Decreases
- (D) Decreases linearly

Answer: Option A

640. As the reflux ratio decreases, the

- (A) Separation becomes more efficient
- (B) Number of plates increases
- (C) Column diameter increases
- (D) None of these

Answer: Option B

641. Only small amount of evaporation of water produces large cooling effects because of its

- (A) Large latent heat
- (B) Low viscosity
- (C) Small latent heat
- (D) None of these

Answer: Option A

642. Ion exchange process is similar to

- (A) Absorption
- (B) Adsorption
- (C) Extraction
- (D) Leaching

Answer: Option B

643. Physical absorption is

- (A) An irreversible phenomenon
- (B) A reversible phenomenon
- (C) Accompanied by evolution of heat
- (D) Both (B) and (C)

Answer: Option D

644. Corresponding to Prandtl number in heat transfer, the dimensionless group in mass transfer is the _____ number.

- (A) Schmidt
- (B) Sherwood
- (C) Peclet
- (D) Stanton

Answer: Option A

645. If G = insoluble gas in gas stream and L = non-volatile solvent in liquid stream, then the slope of the operating line for the absorber is

- (A) L/G
- (B) G/L
- (C) Always < 1
- (D) None of these

Answer: Option A

646. For achieving rapid drying rate in a spray dryer, the diameter of the particles in the feed should be in the range of _____ microns (1 mm = 1000 microns).

- (A) 1-5
- (B) 10-60
- (C) 200-300

(D) > 500
Answer: Option B

647. Berl saddle made of carbon cannot be used for

- (A) Alkalis
 - (B) SO₂
 - (C) H₂SO₄
 - (D) Oxidising atmosphere
- Answer: Option D

648. Capacity of a rotary dryer depends on its

- (A) rpm
 - (B) Inclination with ground surface
 - (C) Both (A) and (B)
 - (D) Neither (A) nor (B)
- Answer: Option C

649. The most common packing used in industrial operations is _____ rings.

- (A) Raschig
 - (B) Lessing
 - (C) Cross-partition
 - (D) Single spiral
- Answer: Option A

650. Refractory bricks are usually dried in a _____ dryer.

- (A) Tray
 - (B) Tunnel
 - (C) Conveyor
 - (D) Festoon
- Answer: Option B

651. Occurrence of 'case hardening' during drying of a high moisture solid cake _____ the drying rate.

- (A) Increases
 - (B) Decreases
 - (C) Does not affect
 - (D) Exponentially increases
- Answer: Option B

652. The binary diffusivity in gases at atmospheric conditions is about

- (A) 10⁻⁹ cm/sec
 - (B) 10⁻¹ cm²/sec
 - (C) 10⁻³ sec/cm
 - (D) 10⁻⁴ cm²/sec²
- Answer: Option B

653. For absorbers, high pressure drop results in

- (A) Increased efficiency
 - (B) Decreased efficiency
 - (C) High operating cost
 - (D) Better gas liquid contact
- Answer: Option C

654. _____ is the temperature at which a gas-vapor mixture becomes saturated, when cooled at constant total pressure out of contact with a liquid.

- (A) Dew point
 - (B) Bubble point
 - (C) Dry bulb temperature
 - (D) Wet bulb temperature
- Answer: Option A

655. ' L/mG ' is the expression for

- (A) Absorption factor
- (B) Brinkman number
- (C) Slope of operating line in absorber