LAXMINARAYAN INSTITUTE OF TECHNOLOGY

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY

4th SEMESTER B.TECH CHEMICAL ENGINEERING

SUBJECT: MASS TRANSFER I

QUESTION BANK

1) Diffusion is a process of
   A. Movement of particles from higher concentration to lower concentration
   B. Movement of particle through semipermeable membrane
   C. Rarefraction of particles
   D. Accumulation of particles on solid surface

2) The unit of volumetric diffusivity is
   A. cm^2/sec
   B. cm/sec
   C. cm^3/sec
   D. cm^2/sec^2

3) Molecular diffusion is caused by
   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

4) Pick out the correct statement
   A. Diffusivity increases with increase in molecular weight
   B. Diffusivity decreases with increase in temperature
   C. Diffusivity increases with the size of the individual molecule
   D. None of these

5) Mass transfer coefficient is defined as
   A. Flux = Coefficient /concentration difference
   B. Coefficient = Flux / concentration difference
   C. Flux = concentration difference / coefficient

D. None of these

6) Corresponding to Prandtl number in heat transfer, the dimensionless group in mass transfer is
   A. Schmidt number
   B. Sherwood number
   C. Peclet number
   D. Stanton number

7) 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

8) Corresponding to Nussult number in heat transfer, the dimensionless group in mass transfer, is
   A. Sherwood number
   B. Schmidt number
   C. Peclet Number
   D. Stanton number

9) Mass transfer coefficient in 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 temperature
   D. None of these

10) Wetted wall tower experiment determines
   A. Molal diffusvity
   B. Volumetric coefficient
   C. Mass transfer coefficient
   D. None of these

11) Methane being cracked on a catalyst $CH_4 \rightarrow C + 2H_2$ under circumstances such that methane diffuses to the cracking surface and hydrogen diffuses back. At steady state the ratio of $N_A/(N_A + N_B)$ is

A. 1/3
B. -1
C. 2/3
D. -2

12) The binary diffusivity in gases varies almost as

A. T
B. $T^{1/2}$
C. $T^{3/2}$
D. T^2

13) The binary diffusivity in liquids varies almost as

A. T
B. $T^{3/2}$
C. T^2
D. T^3

14) The units of mass transfer coefficients could be

A. Moles transferred / Time(area)pressure
B. Moles transferred / Time (area) mole fraction
C. Mole transferred / Time (area) concentration
D. Any of these answers

15) According to the film theory the mass-transfer coefficient is directly proportional to

A. D_{AB}
B. $D_{AB}^{0.5}$
C. D_{AB}^{2}
D. $D_{AB}^{1.5}$

16) According to the penetration theory the mass-transfer coefficient is directly proportional to

A. D_{AB}
B. $D_{AB}^{0.5}$
C. D_{AB}^{2}
D. $D_{AB}^{1.5}$

17) A two phase is said to be in physical equilibrium if
A. The temperature of the vapor phase is equal to the temperature of the liquid phase
B. The total pressure throughout the vapor phase is equal to the total pressure throughout the liquid phase
C. The tendency of each phase is exactly equal to its tendency to escape from the vapor phase from the vapor phase to the liquid phase
D. All of the above

18) ethanol-water solution containing 50 mole percent ethanol can be separated to get 97 mole percent ethanol by
A. atmospheric distillation
B. distillation at higher pressure
C. vacuum distillation
D. all of the above

19) The ratio of the actual equilibrium partial pressure of a component to the ideal value is called
A. activity coefficient
B. turndown ratio
C. relative volatility
D. fugacity

20) For ideal liquid phase and vapor phase the relative volatility of component A relative to component B is equal to
A. P_A/P_t
B. P_B/P_t
C. P_A/P_B
D. P_B/P_A

21) An azeotropic mixture of two liquids has boiling points lower than either of them when it
   A. Shows no deviation from Raoult's law
   B. Shows positive deviation from Raoult's law
   C. Shows negative deviation from Raoult's law
   D. Is saturated

22) Which of the following systems is an example of minimum boiling azeotrope at 1 atm
   A. Ethanol-water
   B. Hydrochloric acid-water
   C. Acetone-chloroform
   D. Benzene-toulene

23) Flash process is carried out by
   A. Reducing the pressure on the feed stream
   B. Cooling the feed at constant pressure
   C. Increasing the pressure on the feed stream
   D. None of the above

24) Flash distillation is suitable for separating components which
   A. Boil at very close temperature
   B. Boil at widely different temperature
   C. Form minimum boiling azeotrope
   D. Form maximum boiling azeotrope

25) If there is condensation of carrier steam in the steam distillation of high boiling organic material, the steam consumption is minimum at
   A. The highest permissible temperature and pressure
   B. The lowest practicable temperature and pressure
   C. The highest permissible temperature and lowest practicable pressure

D. The lowest temperature and highest practicable pressure

26) An ideal plate is defined as one where
   A. The vapor and liquid leaving streams are in equilibrium
   B. The vapor and liquid entering streams are in equilibrium
   C. The vapor leaving stream is in equilibrium with liquid entering stream
   D. The vapor entering stream is in equilibrium with the liquid leaving stream

27) The relative volatility of A and B is $\alpha_{AB} = 1.5$. What is the mole fraction of B in the first droplet of liquid condensed from an equimolar saturated vapor mixture of A and B?
   A. 0.5
   B. 0.6
   C. 0.4
   D. 0.7

28) A student was asked to do Flash calculation of an ideal mixture of four components having an overall composition (in mole fraction) of w_1=0.2, w_2=0.15, w_3=0.4. At the condition of flash drum, the equilibrium vaporization ratios were: K_1=2.1, K_2=1.02, K_3=0.2. The student reported that 38 mole % of the feed vaporized on flashing. What was the value of relative volatility?
   A. 0.33
   B. 3.1
   C. 0.4
   D. 1.1

29) A column receives a ‘cold reflux’ and the ‘external reflux ratio’ is 2.0. For each mole of cold reflux, 0.05 mole of the vapor condensers at the top tray. What is the true slope of the rectifying section operating line?
   A. 0.667
   B. 0.5
   C. 1.0
   D. 0.377

30) Which of the following appears to be a representative value of the specified interfacial area of contact in an industrial scale packed tower?
   A. 0.5 cm^{-1}
   B. 0.5 ft^{-1}
   C. 0.5 m^{-1}
   D. 0.5 m^2

31) How does the number of ideal trays required for stripping of a solute from a solution vary with the absorption factor A=L/mG ? With increasing A, the number of ideal trays required to achieve a specified degree of separation will
   A. Increase
   B. Decrease
   C. Remains unchanged
   D. None of the above

32) Which of the following appears to be a representative value of the specified interfacial area of contact in an industrial scale packed tower?
   A. 0.5 cm^{-1}
   B. 0.5 ft^{-1}
   C. 0.5 m^{-1}
   D. 0.5 m^2

33) What is the physical significance of NTU?
   A. It indicates the ease of separation of the mixture
   B. It indicates the difficulty of separation of a mixture
   C. It indicates the efficiency of a particular packing for mass transfer
   D. None of the above

34) A gas is being absorbed in a pure liquid and in this particular case, the liquid-side interfacial concentration is negligibly small. What fraction of the inlet gas is expected to be absorbed in one transfer unit?
   A. 50 %
   B. 23.6%
   C. 63.2 %

D. 10.2 %

35) Under which of the following conditions the gas-phase driving force will be constant along the column?
A. L / G=1
B. L > G and m=1
C. L / G = m
D. L = G

36) What is the physical significance of the absorption factor?
A. It is the ratio of the slopes of the equilibrium line and the operating line
B. It is the ratio of the individual gas-phase and liquid phase mass transfer coefficient
C. It is fractional absorption of the feed gas
D. None of the above

37) The optimum ratio of the actual liquid rate to the minimum liquid rate for gas absorption generally lies between
A. 0 and 1
B. 0.5 to 1.5
C. 1.2 to 2.0
D. 2.1 to 5

38) In a packed column the height of an overall gas-phase transfer unit is 1.2 ft. The absorption factor is 1.6. What is the value of HETP?
A. 1.2 ft
B. 1.5 ft
C. 2.8 ft
D. 3.5 ft

39) Which of the following is a probable value of dynamic liquid holdup (volume fraction) in a packed bed?
A. 0.5
B. 0.35
C. 0.035

D. 0.0035

40) An ideal plate is defined as one where

A. The vapor and liquid leaving streams are in equilibrium
B. The vapor and liquid entering streams are in equilibrium
C. The vapor leaving stream is in equilibrium with liquid entering stream
D. The vapor entering stream is in equilibrium with the liquid leaving stream