

SEAT No. _____

ENROLMENT No. _____

CVM UNIVERSITY
M.Sc. INDUSTRIAL CHEMISTRY
Semester-I Examination
Wednesday, 24th February - 2021
10:00 AM to 12:00 noon
101310104: MASS TRANSFER OPERATIONS

Total Marks: 60

- Note: (1) Attempt all questions.
(2) Figures to the right indicate marks.

Q-1. (a) Answer the following multiple choice question. [08]

1. Higher value of distribution co-efficient in liquid extraction helps to _____.
a. To reduce amount of feed b. To reduce amount of solvent
c. To reduce operating pressure d. To reduce operating temperature
2. Corners of the equilateral triangle in the solubility curve represent _____.
a. A pure component b. A ternary mixture
c. A binary mixture d. A partially miscible ternary mixture
3. What is could be the dry basis moisture content for sample containing 36% moisture?
a. 36.00 b. 0.5625 c. 0.2647 d. 0.3600
4. Atomizer is used in which of the following dryer?
a. Tunnel b. Spray c. Rotary d. Tray
5. Heat supply due to condenser duty is denoted by _____.
a. h_F b. V_m c. Q_C d. Q_R
6. Which of the following is the value of Avogadro's number?
a. 6.2321×10^{22} b. 6.2321×10^{-22}
c. 6.0221×10^{23} d. 6.0221×10^{-23}
7. The reverse of the gas absorption is known as _____.
a. Adsorption b. Weeping c. Gas stripping d. Absorption
8. In gas absorption, solvent should be _____.
a. Non-volatile b. Toxic c. Volatile d. Flammable

(b) Answer the following (Fill in the blanks and True or False) [08]

1. The point on the solubility curve where the tie line merges into a point is called _____.
2. Multistage counter current extraction is used for separation of the same feed and solvent rates. True/ False?
3. Drying equipment exposing the solids to hot gases with which the solid is in contact are known as _____.
4. Filtration is the removal of solid particles from a fluid by passing the fluid through a septum on which solids are deposited. True/ False?
5. In McCabe-Thiele method, number of theoretical stages is represented between operating line and _____.

6. Separation of heat sensitive mixture is distilled by vacuum distillation. True/ False?
7. The ratio of tower diameter to packing diameter is less than 8 to 1 then liquid tends to flow out of the packing and down the walls of column. True/ False?
8. The liquid is enriched in solute gas as it flows down the tower is known as _____.

Q-2 Answer any six of following.

[12]

1. What is Fick's law of diffusion?
2. What is the importance of solubility curve in liquid-liquid extraction?
3. Distinguish the unit operation between evaporation and drying.
4. Enlist the types of drying curves based on morphology.
5. State the following:
 - a. Dalton's law
 - b. Relative volatility
6. Why refluxing is done in column distillation?
7. What does mean of flooding velocity in gas absorption column?
8. Enlist the factors require in selection of solvent for gas absorption.

Q-3 Calculate the number of extraction stages required using cross current liquid-liquid extraction technique to separate solute from its mixture with inert as the details shown below, **[08]**

F= 1000 kg, $x_f = 40\%$, S= 3000 kg, $x_n = 1\%$						
Extract				Raffinate		
%A	%B	%C		%A	%B	%C
1.0	85.0	14.0		88.0	2.0	10.0
3.0	73.0	24.0		77.0	3.0	20.0
7.0	59.0	34.0		65.0	5.0	30.0
11.0	50.0	39.0		58.0	7.0	35.0
15.0	42.0	43.0		51.0	9.0	40.0
25.0	29.0	46.0		45.0	12.0	43.0

OR

Q-3 Draw neat representation of cross current extraction. Discuss it's method to determine the number of stages. **[08]**

Q-4 What is equilibrium moisture content? Discuss the effect of drying operation with time, rate of drying and moisture content. Derive the equation for constant rate of drying period. **[08]**

OR

Q-4 A batch of the solid is dried from the initial weight of the wet solid is 100kg and the drying surface is $1\text{m}^2/24\text{kg}$ dry weight. Calculate the drying hours require for drying wet solid. ($X_1=0.040$, $X^*=0.001$) **[08]**

X	N(kg/m ² .sec)		X	N(kg/m ² .sec)
0.040	8.81×10^{-4}		0.011	8.28×10^{-4}
0.031	8.81×10^{-4}		0.006	7.60×10^{-4}
0.026	8.81×10^{-4}		0.002	5.49×10^{-4}
0.020	8.70×10^{-4}		0.001	4.10×10^{-4}
0.015	8.60×10^{-4}			

Q-5 Discuss and derive enthalpy data for enriching sections and stripping section of column distillation using Ponchon-Savarit method. [08]

OR

Q-5 A-B solution contains 40% solvent-A is to be distilled with 97.0% solvent-A and residue with 2.0% solvent-A. ($h_D = 28.70$ kcal/kg, $H_1 = 232$ kcal/kg, $h_w = 84.0$ kcal/kg, $h_F = 7.35$ kcal/kg, Reflux ratio = 3.50) [08]
Calculate the following distillation value:

1. Amount of residue
2. Condenser duty
3. Q' value
4. Reboiler duty

Q-6 What is gas absorption? Discuss the packed column used for gas absorption and explain channelling effect. [08]

OR

Q-6 What is pressure drop in absorption tower? Discuss the absorption factor of L/G ratio used in gas absorption. [08]

____ Good Luck ____