

Total No. of printed pages = 6

**END SEMESTER EXAMINATION – 2022**

Semester : 4th (New)

Branch : Chemical

Subject Code : Ch-405

**PRINCIPLE OF UNIT OPERATION – II**

Full Marks – 70

Time – Three hours

The figures in the margin indicate full marks for the questions.

**Instruction :**

- All questions of PART – A and PART – B are compulsory.

**PART – A**

Marks – 25

1. Fill in the blanks : 1×10=10

(a) In distillation, the constituents of liquid mixture are separated using \_\_\_\_\_ energy.

(b) When diffusion results from the random movement / motion of the molecules, it is called as \_\_\_\_\_.

[Turn over

- (c) A mixture-settler is a \_\_\_\_\_ stage extraction equipment.
- (d) The temperature at which condensation will first occur is known as \_\_\_\_\_.
- (e) The section above the feed plate / tray of fractionating column is called \_\_\_\_\_ section.
- (f) \_\_\_\_\_ is the part of drying process during which the rate of drying remains constant.
- (g) Solvent lean phases are known as \_\_\_\_\_.
- (h) The formula for degree of freedom in vapour liquid equilibrium is  $F =$  \_\_\_\_\_.
- (i) When a particular component is removed out with the help of a solvent is called \_\_\_\_\_.
- (j) The reverse of absorption is called \_\_\_\_\_.

2. Write True or False : 1×10=10

- (a) 'Weeping' problem in sieve-plate distillation column is due to high-gas rates through perforations.
- (b) In gas absorption process, the mass is transferred from the liquid phase to the gas phase.

- (c) The difference in vapour pressure / volatilities of different constituents at the same temperature is responsible for separation of constituents.
- (d) In packed-tower absorption column the packings are generally classified as random packings and regular packings.
- (e) Rotocell extractor is a leaching equipment.
- (f) In Bollman / Basket extractor there is a series of perforated baskets attached to a chain conveyor.
- (g) Liquid-liquid extraction utilizes the differences in volatility of components to effect a separation.
- (h) In drying process, unsaturated gas phase is known as drying medium.
- (i) For reducing the transportation cost, drying operation is carried out.
- (j) Area of drying surface does not affect the rate of drying.

3. Choose the correct answer :

1×5=5

(a) If relative volatility  $\alpha_{AB} = 1$ , then the separation by distillation is

- (i) Possible (ii) Not possible  
(iii) 50% possible (iv) None of these

(b) \_\_\_\_\_ gives the relationship between the concentration of gas dissolved in a liquid and the equilibrium partial-pressure of the gas above the liquid surface.

- (i) Raoult's law (ii) Dalton's law  
(iii) Henry's law (iv) Gibb's law

(c) Impellers are used in

- (i) Distillation column  
(ii) Agitated vessel  
(iii) Fractionation column  
(iv) Packed vessel

(d) When the constituents of a liquid mixture are separated by using an insoluble liquid solvent, it is known as

- (i) Solid-liquid extraction  
(ii) Liquid-liquid extraction  
(iii) Solid-gas extraction  
(iv) Gas-liquid extraction

(c) \_\_\_\_\_ is used for drying of free-flowing granular materials on a large scale.

- (i) Tunnel dryer                      (ii) Tray dryer  
(iii) Rotary dryer                      (iv) All of these.

PART - B

Marks - 45

4. (a) Write a brief note on 'Selecting criterion for solvent in gas absorption'. 2

(b) Describe the process of fractional distillation. Use a simple schematic diagram. 5

(c) Give a description with diagram about bubble-cap tray of distillation column. 5

Or

Explain rotary drier with neat diagram. 5

5. (a) Define Raoult's law. 2

(b) Explain the working principles of tray drier with the proper schematic diagram. 5

Or

Explain the working of spray tower/column of liquid-liquid extraction with simple diagram. 5

(c) Write short notes on :

3+3=6

(i) Rotocell extractor

(ii) Rotating disc contractor.

6. (a) What are the factors that affect the rate of leaching ? 2

(b) State the difference between leaching and extraction process. 3

(c) Explain packed column/tower for gas absorption, with a neat schematic diagram. Mention two advantages of packed column. 5+1=6

7. (a) Define the following terms : 1×4=4

(i) Dry bulb temperature

(ii) Wet bulb temperature

(iii) Bound moisture content

(iv) Free moisture content.

(b) Explain gas absorption by mechanically agitated vessel with a suitable diagram. 5

Or

Describe packed column for distillation process with diagram. 5