

Name :

Roll No. :

Invigilator's Signature :

CS/B.Pharm (NEW)/SEM-5/PT-507/2010-11

2010-11

PHARMACEUTICAL ENGINEERING

Time Allotted : 3 Hours

Full Marks : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

GROUP - A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following :

10 × 1 = 10

i) Example of minimum boiling azeotrope mixture is

- a) Ethanol of water b) HCl-H₂O
c) HNO₃ - H₂O d) None of these.

ii) The dimensional formula for diffusivity (D_v) is

- a) L² θ⁻¹ b) Lθ⁻¹
c) L⁻¹ θ⁻¹ d) None of these.

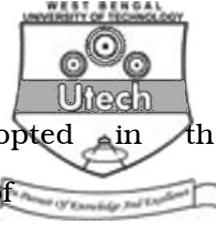
iii) Freon 12 used as refrigerant. Chemically it is

- a) CCl₂F₂ b) CClF₃
c) CCl₃F d) C₂Cl₄F₂.

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- iv) Fluidized bed dryer is well adopted in the pharmaceutical industry for the drying of
- a) Powders before filling capsule
 - b) Fibrous materials before passing through cutter mill
 - c) Powders before mixing and granulation
 - d) Granules before compression into tablets.
- v) "Triangular diagram" is used for
- a) Solid-Liquid extraction
 - b) Distillation
 - c) Liquid-Liquid extraction
 - d) Liquid-Solid extraction.
- vi) Penicillin is recovered from the fermentation broth by
- a) Distillation
 - b) Evaporation
 - c) Leaching
 - d) Liquid extraction.
- vii) Plate towers, packed towers and spray towers are related to
- a) distillation
 - b) extraction
 - c) dehumidification
 - d) none of these.

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- viii) Spray dryer is suitable for
- Milk products only
 - Milk product and fruit juice
 - Granular substance
 - Thermolabile substance.
- ix) Ethylene is a
- Primary refrigerant
 - Secondary refrigerant
 - Tertiary refrigerant
 - None of these.
- x) From fish liver oil, Vitamin A and Vitamin D are separated by
- Fractional distillation
 - Molecular distillation
 - Steam distillation
 - Vacuum distillation.
- xi) If dry bulb temperature is T_1 and wet bulb temperature is T_2 , then
- $T_1 > T_2$
 - $T_2 > T_1$
 - $T_1 = T_2$
 - $T_1 \geq T_2$.
- xii) If α is the relative volatility, x and y are liquid and vapour composition of any component of a binary mixture then
- $y = \alpha x / \{1 + (\alpha - 1)x\}$
 - $y = \alpha x / \{1 + (1 - \alpha)x\}$
 - $y = \alpha x / \{1 - (\alpha - 1)x\}$
 - $y = \alpha x / \{1 + (x - 1)\alpha\}$.

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GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following.

3 × 5 = 15

2. What is relative volatility ? Deduce the relation of relative volatility with liquid and vapour composition of any component.
3. What is humidity chart ? How does you determine the humidity and related parameter from humidity chart using dew-point temp. and room temp. ?
4. What are the factors that influence the rate of solid-liquid extraction ? Explain the effect of agitation on mass transfer in extraction.
5. A mixture of air and water vapour weighs 80 kg. Determine the humidity of air if there is 15% of water vapour in the mixture.
6. Write a short note in low-pressure distillation.

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GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

7. a) Describe the working principle of dehumidifier. What is refrigerant ? What factors should be considered in selection of refrigerant ?
- b) What do you mean by refrigeration ? What are the basic parts of a refrigeration unit ? $8 + 7$
8. a) Explain Raoult's Law with suitable diagram. What are the deviations of Raoult's Law ?
- b) What is azeotropic mixture ? What are the types of azeotropes ? Represent the boiling point diagram with respective equilibrium diagram for azeotropes.
- c) What information you get from a boiling point diagram ? $5 + 7 + 3$

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9. a) In a batch distillation of binary mixture, write the procedure to calculate number of plates in rectification column by McCabe Thiele diagram.

b) A continuous fractionating column is to be designed to separate 30,000 kg/hr of a mixture of 40% w/w benzene and 60% w/w toluene into an overhead product containing 97% w/w benzene and 97% w/w benzene and a bottom product containing 98% toluene. The reflux ratio is 3.5 and the feed will be liquid at its boiling point.

- i) Calculate the moles of overhead product and bottom product
- ii) Determine the number of theoretical plates and position of feed plate.

Equilibrium composition of benzene (mvc) in liquid (x)

and vapour (y) are given in the following table :

x	0	0.015	0.07	0.14	0.21	0.29	0.37	0.46	0.56	0.66	0.78	1.0
y	0	0.030	0.16	0.28	0.39	0.50	0.59	0.69	0.76	0.83	0.90	1.0

6 + 9

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10. a) What is molecular diffusion ?
- b) Describe a method to determine diffusivity of gas based on Stefan's Law.
- c) Estimate the diffusivity of ethyl acetate in nitrogen at 68° F and 600 mm Hg absolute

[Data given : $V_{\text{Ethyl acetate}} = 107 \cdot 2 \text{ c.c/gm - mol}$,

$$V_{\text{N}_2} = 31 \cdot 20 \text{ c.c/gm - mole}$$

2 + 7 + 6

11. a) Mention the importance of "drying" as unit operation in pharmacy.
- b) Classify drying equipments.
- c) What are the advantages and disadvantages of fluidized bed drying over other drying methods ? What are its pharmaceutical applications ?
- 3 + 3 + 5 + 4

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