

Name :

Roll No. :

Invigilator's Signature :

CS/B.Pharm/SEM-7/PT-707/2009-10

2009

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) In case of *rectification*, when the feed is a mixture of liquid and vapour, the slope of *q*-line may be equal to

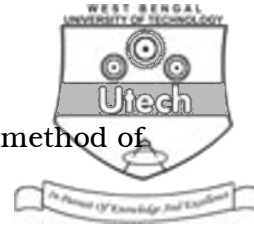
- a) zero (0) b) - 1
c) 1 d) none of these.

ii) Pre-freezing of the sample is a must for

- a) Lyophilization
b) Leaching
c) Rectification
d) None of these.

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- iii) *Stefan's technique* is an experimental method of
- a) estimation of *diffusion coefficient*
 - b) calculation of *critical moisture content*
 - c) calculating number of total theoretical plate for rectification
 - d) determination of *triple point*.
- iv) Which one of the following is not a *continuous type dryer* ?
- a) spray dryer
 - b) drum dryer
 - c) tunnel dryer
 - d) lyophilizer.
- v) 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) $D \propto T^2$.
- vi) Which of the following parameters remains constant during chemical dehumidification ?
- a) dry bulb temperature
 - b) dew point
 - c) wet bulb temperature
 - d) none of these.
- vii) Efficiency of the fractionating column is measured by
- a) HLTP
 - b) HETP
 - c) LTTP
 - d) HETLP.



- viii) Vitamin A is separated from fish liver oil using
- molecular distillation
 - fractional distillation
 - reduced distillation
 - flash distillation.
- ix) At dew point temperature, humidity is
- 0%
 - 50%
 - 100%
 - none of these.
- x) "Rayleigh" equation is used for analysis of
- simple batch distillation
 - fractional distillation
 - molecular distillation
 - azeotropic distillation
- xi) If dry bulb temperature is T_1 & wet bulb temperature is T_2 then
- $T_1 = T_2$
 - $T_2 < T_1$
 - $T_2 > T_1$
 - $T_1 = 1.39T_2$.
- xii) Plate towers, packed towers & agitated towers are related to
- distillation
 - extraction
 - dehumidification
 - none of these.

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GROUP – B
(Short Answer Type Questions)

Answer any *three* of the following.

3 × 5 = 15

2. Write down with example, the role of *diffusion* in *mass transfer*.
 $2 \times 2\frac{1}{2}$
3. What are azeotropes ? Give their boiling point and equilibrium diagrams and explain them.
4. What do you mean by 'weeping and entrainment' ? Give their disadvantages.
5. A rotary dryer is used to dry 39000 kg/hr. of a wet drug containing 10% w/w of water of a water content of 0.8% w/w. Calculate the weight of water removed during drying operation.
6. Define humidity, relative humidity, percentage humidity, humid heat and humid volume.

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GROUP – C

(Long Answer Type Questions)

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

7. a) A continuous fractioning column operating at 1 atm. is to be designed to separate 10000 kg/hr. of a solution of benzene (boiling point = 80°C) and toluene (boiling point = 110.6°C). The feed contains 50% (w/w) toluene. The overhead product contains 90% (w/w) benzene. The bottom product contains 7% (w/w) benzene. The feed is at its boiling point. Calculate the number of theoretical plates required at total reflux condition.

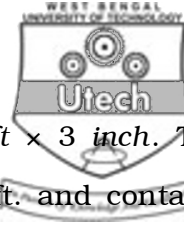
The value of relative volatility is 2.00

Specific heat feed is $0.44 \text{ (cal.) (gm.}^{-1} \text{) (}^{\circ} \text{C} \text{)}^{-1}$

Latent heat of feed is 200 cal./gm. 8

- b) Derive the operating line for countercurrent contact extraction with immiscible solvent. 7
8. a) Explain the construction, working principle of fluidized bed dryer ? What are the advantages and disadvantages of fluidized bed dryer over other dryers.

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- b) In a tray dryer each tray is $4\text{ ft} \times 4\text{ ft} \times 3\text{ inch}$. The density of the wet material is 60 lb/cuft and contains 3 lb of water per lb of dry solid. How many trays are necessary to obtain 200 lb of a product containing 0.2 lb of water per lb of dry solid ? 15

9. a) Write notes on any *three* of the following : 3 × 3

- i) Molecular diffusion
- ii) Liquid-liquid diffusion
- iii) Molecular distillation
- iv) Rotocell extractor
- v) Stefan's technique for the measurement of diffusing of gas mixture.

b) Deduce the mathematical expression

$$q = \frac{H_f - h_F}{H_f - h_f}$$

where q = heat required to vaporize 1 mole of feed at entering conditions/molar latent heat of vaporization of liquid.

h_F = enthalpy of feed per mole

h_f = enthalpy of feed per mole

H_f = enthalpy of vapour per mole. 6

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10. a) Write short notes on the following :

- i) Bound water
- ii) Unbound water
- iii) Critical moisture content
- iv) Effective moisture content
- v) Free moisture content.

b) Describe the construction and working of a fluidized bed drier. (5 × 2) + 5

11. a) Define refrigerants. What should be ideal factors for refrigerants ?

b) Explain basic components of a refrigerator. 2 + 6 + 7

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