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 : $10 \times 1 = 10$

   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) $D \alpha T$ b) $D \alpha T^{0.5}$

c) $D \alpha T^{1.5}$ d) $D \alpha T^{2}$.

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.

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viii) Vitamin *A* is separated from fish liver oil using

a) molecular distillation

b) fractional distillation

c) reduced distillation

d) flash distillation.

ix) At dew point temperature, humidity is

a) 0% b) 50%

c) 100% d) none of these.

x) "Rayleigh" equation is used for analysis of

a) simple batch distillation

b) fractional distillation

c) molecular distillation

d) azeotropic distillation

xi) If dry bulb temperature is T_1 & wet bulb temperature is T_2 then

a) $T_1 = T_2$ b) $T_2 < T_1$

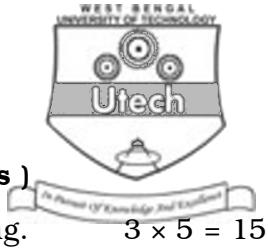
c) $T_2 > T_1$ d) $T_1 = 1{\cdot}39\,T_2$.

xii) Plate towers, packed towers & agitated towers are related to

a) distillation b) extraction

c) dehumidification d) none of these.

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GROUP – B
(Short Answer Type Questions)

Answer any *three* of the following. $3 \times 5 = 15$

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 × 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 (cal.) ($gm.^{-1}$) ($^{\circ} C)^{-1}$

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 *ft* × 4 *ft* × 3 *inch*. The density o 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 and 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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