

Name :

Roll No. :

Invigilator's Signature :

CS/B.Pharm/SEM-5/PT-507/2009-10

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) Volatile oil can be separated from crude drugs by
 - a) vacuum distillation b) steam distillation
 - c) simple distillation d) none of these.

- ii) Segregation occurs due to the one of the following reason :
 - a) absorption of moisture from dry powder
 - b) poor flow properties of the powder bed inside a blender
 - c) inadequate mixing of ingredients of powder
 - d) none of these.

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- iii) Rate of evaporation is increased by
- a) increasing the temperature
 - b) decreasing the temperature
 - c) increasing the vapour pressure
 - d) increasing the amount of material.
- iv) Constant boiling solutions are completely separated by
- a) Fractional distillation
 - b) Azeotropic distillation
 - c) Distillation under reduced pressure
 - d) Simple distillation.
- v) Elastic materials are milled by
- a) fluid energy mill b) ball mill
 - c) roller mill d) rotary cutter mill.
- vi) For a black body,
- a) emissivity \neq absorptivity
 - b) emissivity = absorptivity
 - c) emissivity < absorptivity
 - d) emissivity > absorptivity.
- vii) Shear mixing will help in mixing by
- a) reducing the force of attraction
 - b) carrying the material
 - c) helping in micro-mixing
 - d) forming aggregate.

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- viii) Sodium chloride is an example of
- a) cubic crystal
 - b) rhombohedral crystal
 - c) hexagonal crystal
 - d) tetragonal crystal.
- ix) Rod mill is used to grind
- a) coarse material
 - b) sticky material
 - c) soft material
 - d) none of these.
- x) Heat transfer by conduction is governed by
- a) Fourier's law
 - b) Kick's law
 - c) Stefan's law
 - d) Kirchhoff's law.
- xi) In vacuum crystallizer, supersaturation is obtained by
- a) isothermal cooling
 - b) condensation cooling
 - c) adiabatic cooling
 - d) adiabatic evaporative cooling.
- xii) Sequence of crystal growth is
- a) cluster, embryo, nucleus, crystal
 - b) cluster, nucleus, embryo, crystal
 - c) nucleus, embryo, crystal, cluster
 - d) nucleus, crystal, embryo, cluster.

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GROUP – B
(Short Answer Type Questions)

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

2. What is evaporation ? Classify the different types of evaporators. 2 + 3
3. Write a short note about black body. 5
4. Write a short note on stainless steel as material of plant construction. 5
5. Define polymorph and isomorph with examples. $2 \frac{1}{2} + 2 \frac{1}{2}$
6. Write a short note on sigma blender. 5

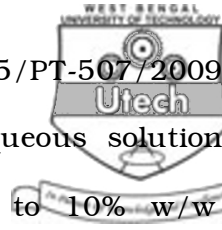
GROUP – C
(Long Answer Type Questions)

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

7. a) Differentiate between evaporation and drying.
- b) How vapour pressure, temperature and surface area affect the rate of evaporation.

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- c) In a single effect evaporator an aqueous solution is being concentrated from 5% w/w to 10% w/w at atmospheric pressure (212° F). Boiling point elevation of 10% solution is 5°C. Saturated steam at 130°C used as heating medium. Overall heat transfer coefficient is 600 Btu/hr. sq. ft. °F. If feed enters the evaporator at a rate of 6000 lb/hr as a 5% solution, estimate the heat transfer area of the evaporator.

Latent heat of evaporation at 212°F is 970.3 Btu/hr.

2 + 5 + 8

8. a) Define size reduction.
- b) What are the advantages of size reduction ?
- c) Explain the theories related to size reduction.
- d) Explain with the help of a diagram, the construction and working of a ball mill. 1 + 3 + 5 + 6
9. a) Find out the expression for the rate of heat transfer through a thick walled cylinder of inner diameter R_1 and outer diameter R_2 and the temperature of inside and outside surface is T_1 and T_2 respectively.

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- b) Water is heated from 25° C to 45° C in a steel pipe
(ID = 7.65 cm, OD = 8.75 cm, $K = 40 \text{ kcal/hr.sq.m.}^\circ\text{C}$)
by saturated steam at 110° C condensing outside the
steel pipe. Water film and steel film coefficients are 2500
and 10000 kcal/hr.sq.m.°C respectively. What length is
necessary if water flows at the rate of 15000 kg/hr ? 15

10. a) Explain the different types of flow pattern induced
during liquid-liquid mixing.

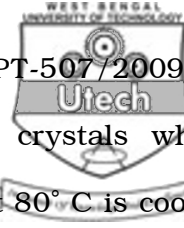
- b) Why is vortex formed ?
c) How can it be prevented ? 5 + 5 + 5

11. a) What do you mean by crystallization ? How does it differ
from precipitation ?

- b) Giving neat diagram, describe the principle,
construction, working and advantages of Swenson-
Walker crystallizer.

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- c) Calculate the yield of $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$ crystals when 1000 kg saturated solution of MgSO_4 at 80°C is cooled to 30°C , assuming 10% of the water is lost by evaporation during cooling.

$$\text{Data : Solubility of } \text{MgSO}_4 \text{ at } 80^\circ\text{C} = \frac{64.2 \text{ kg}}{100 \text{ kg water}}$$

$$\text{Solubility of } \text{MgSO}_4 \text{ at } 30^\circ\text{C} = \frac{40.8 \text{ kg}}{100 \text{ kg water}}$$

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12. a) What is screen analysis ? Classify screening equipment. Give one example of each type.
- b) Explain the factors to be considered in the selection of screening equipment.
- c) With the help of a diagram, describe the construction, principle of working and applications of cyclone separator.

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