



UNIVERSITI KUALA LUMPUR
ROYAL COLLEGE OF MEDICINE PERAK

FINAL EXAMINATION
MARCH 2026 SEMESTER

COURSE CODE : RCB20103
COURSE NAME : PHARMACEUTICAL ENGINEERING
PROGRAMME NAME : BACHELOR IN PHARMACEUTICAL TECHNOLOGY
(HONOURS)
DATE : 26 JUNE 2026
TIME : 9.00 AM – 11.00 AM
DURATION : 2 HOURS

INSTRUCTIONS TO CANDIDATES

1. Please read CAREFULLY the instructions given in the question paper.
2. This question paper has information printed on both sides of the paper.
3. This question paper consists of TWO (2) sections; Section A and Section B.
4. Answer ALL questions in Section A. For Section B, answer THREE (3) questions WITH AT LEAST ONE (1) question from question 3 or question 4.
5. Please write your answers on the OMR answer script and answer booklet provided.
6. Answer all questions in English language ONLY.

THERE ARE 9 PAGES OF QUESTIONS, EXCLUDING THIS PAGE.

SECTION A (Total: 40 marks)

I) MULTIPLE CHOICE QUESTIONS (20 marks)

INSTRUCTION: Answer ALL questions.

Use the OMR sheet provided.

1. A drug solution is prepared by dissolving 340 mg of the drug in 15 g of water. During scale-up, an additional 5 g of water is added unintentionally. Calculate the w/w drug concentration.
- A. 1.60%
 - B. 1.70%
 - C. 1.85%
 - D. 2.00%
 - E. 2.22%
2. A manometer uses two immiscible liquids to ____.
- A. reduce pressure
 - B. increase flow
 - C. create visible interface
 - D. create density differences
 - E. reduce viscosity
3. Convert viscosity $5 \times 10^{-4} \text{ lb ft}^{-1} \text{ s}^{-1}$ to SI unit. Given that 1 lb = 0.4536 kg and 1 ft = 0.3048 m.
- A. $7.4 \times 10^{-4} \text{ kg m}^{-1} \text{ s}^{-1}$
 - B. $8.0 \times 10^{-4} \text{ kg m}^{-1} \text{ s}^{-1}$
 - C. $1.5 \times 10^{-3} \text{ kg m}^{-1} \text{ s}^{-1}$
 - D. $1.2 \times 10^{-3} \text{ kg m}^{-1} \text{ s}^{-1}$
 - E. $1.0 \times 10^{-3} \text{ kg m}^{-1} \text{ s}^{-1}$

4. A pharmaceutical slurry shows a rapid decline in filtration rate after initial operation. Choose the best strategy to effectively improve performance without changing equipment.
- A. Increasing the thickness of the filter cake.
 - B. Adding a filter aid to increase the porosity of the filter cake.
 - C. Reducing the pressure drop across the filter.
 - D. Decreasing the temperature of the equipment.
 - E. Using finer particles in the slurry will reduce resistance to filtration.
5. Why is rotary drum filtration suitable for high solid concentration?
- A. The system allows continuous removal of the filter cake during operation.
 - B. The system operates at low rotational speed, which enhances separation efficiency.
 - C. The process operates at a low pressure, which improves handling of dense slurries.
 - D. The system uses a small filtration area, which is sufficient for concentrated suspensions.
 - E. The filter cake formed has low porosity, allowing faster liquid flow.
6. A heat-sensitive antibiotic is degraded during milling in a hammer mill. Choose the **CORRECT** modification to ensure the proper size reduction of this antibiotic.
- A. Increase the rotor speed of hammer mill.
 - B. Switch to ball mill.
 - C. Increase the feed rate of hammer mill.
 - D. Reduce the screen size.
 - E. Switch to fluid energy mill.
7. Over-mixing leads to segregation due to _____.
- A. increase in particle cohesion
 - B. particle breakage
 - C. reduced diffusion
 - D. tendency of demixing
 - E. increase in particle density

8. Which of the following best describes evaporation?
- A. Separation of components based on boiling point differences.
 - B. Vaporization of liquid to obtain a concentrated product.
 - C. Conversion of vapour into liquid by cooling.
 - D. Separation of immiscible liquids using steam.
 - E. Separation of mixtures into pure components.
9. Select the **CORRECT** statement that describes phase equilibrium in evaporation.
- A. Evaporation occurs without condensation.
 - B. Condensation rate is higher than evaporation rate.
 - C. Evaporation and condensation occur at equal rates.
 - D. Only vapour phase is present at equilibrium.
 - E. Concentration of reactants continuously changes.
10. Choose the statement that best explains the main limitation in the drying efficiency of spray dryers.
- A. Low airflow
 - B. Heat loss
 - C. Air bypass without contact
 - D. High pressure
 - E. Low atomization
11. Drug X degrades under high turbulence. Choose the drying equipment that must be avoided.
- A. Tray dryer
 - B. Vacuum dryer
 - C. Spray dryer
 - D. Freeze dryer
 - E. Fluidized bed dryer
12. Which drying stage removes residual moisture in freeze drying?
- A. Freezing
 - B. Primary drying
 - C. Secondary drying
 - D. Tertiary drying
 - E. Atomization

13. Which of the following statements correctly describes nucleation in crystallization?
- I. Formation of small stable clusters in solution.
 - II. Occurs in a supersaturated solution.
 - III. Initiates the crystallization process.
 - IV. Occurs after crystal growth.
- A. I and II
B. II and III
C. III and IV
D. I, II, and III
E. I, II, III, and IV
14. Select the **CORRECT** statements regarding crystal growth.
- I. Involves diffusion of solute molecules to nuclei.
 - II. Involves deposition of solute onto crystal surface.
 - III. Occurs before nucleation.
 - IV. Determines the size of crystals.
- A. I and II
B. III and IV
C. I, II, and IV
D. II, III, and IV
E. I, II, III, and IV
15. Select the **CORRECT** statements regarding automation in manufacturing systems.
- I. Automation replaces both physical and mental human activities with machines.
 - II. Automation increases dependence on manual labour to improve efficiency.
 - III. Automation focuses only on mechanical operations without control systems.
 - IV. Automation involves a regulating and controlling system to achieve desired outcomes.
- A. I and IV
B. II and III
C. III and IV
D. I, III, and IV
E. I, II, III, and IV

16. Which of the following pressure measurement devices works based on the height of a liquid column?
- A. Strain gauge
 - B. Thermocouple
 - C. Manometer
 - D. Bimetal thermometer
 - E. Resistance thermometer
17. Select the **CORRECT** statements regarding process variables in automated process control systems.
- I. Process variables are dynamic features that may change rapidly.
 - II. Accurate measurement of process variables is important for maintaining process accuracy.
 - III. Process variables only include temperature and pressure.
 - IV. Level is also a commonly measured process variable.
- A. I and II
 - B. III and IV
 - C. I, II, and III
 - D. I, II, and IV
 - E. I, II, III, and IV
18. Select the **CORRECT** statements regarding the hierarchy of computer control in a manufacturing process.
- I. Unit operation control is the lowest level in the hierarchy.
 - II. Departmental and corporate control levels focus on planning and management.
 - III. Plant control handles individual equipment operations.
 - IV. Lack of computer control at plant level may slow operation.
- A. I and II
 - B. I and IV
 - C. II and III
 - D. II, III, and IV
 - E. I, II, III, and IV

19. Select the **CORRECT** statements regarding humidification and dehumidification.
- I. Humidification involves transfer of liquid water into water vapour.
 - II. Dehumidification increases moisture content in air.
 - III. Humidity relates to mixtures of air and water vapour.
 - IV. Humidification and dehumidification are involved in air conditioning processes.
- A. I and II
B. III and IV
C. I, II, and III
D. I, III, and IV
E. I, II, III, and IV
20. Choose the **CORRECT** statements regarding refrigeration.
- I. Refrigeration lowers the temperature of a substance below that of its surroundings.
 - II. Refrigeration capacity is expressed in humidity ratio.
 - III. Refrigeration is used for preservation of thermolabile substances.
 - IV. The refrigeration cycle is also known as the vapour compression cycle.
- A. I and II
B. II and III
C. III and IV
D. I, II, and III
E. I, III, and IV

II) SHORT ANSWER QUESTIONS (20 marks)**INSTRUCTION: Answer ALL questions in the answer booklet provided.****Each question carries TWO (2) marks.**

1. A solution contains 116.88 g of sodium chloride in 1 L. Calculate the molarity. Given that molecular weight is 58.44 g/mol.
2. Explain how temperature affects filtration.
3. Describe neutral mixing with **ONE (1)** example.
4. Explain the concept of relative volatility in distillation.
5. Define dew point and bubble point in distillation.
6. Describe **TWO (2)** advantages of vacuum oven as a dryer.
7. Define supersaturation and state its importance in crystallization.
8. Explain the working principle of a thermocouple in temperature measurement.
9. State **TWO (2)** functions of the latest monitoring system in automated tablet manufacturing.
10. List **TWO (2)** applications of air conditioning in pharmaceutical industry.

SECTION B: MODIFIED ESSAY QUESTIONS (Total: 60 marks)

INSTRUCTION: This section consists of **FOUR (4)** questions.

You are required to answer **THREE (3)** questions in the answer booklet provided.

Question 1 and 2 are COMPULSORY.

Answer EITHER Question 3 OR 4.

Question 1

- (a) A gas occupies 1 m^3 at 1.2 atm and 300 K . Calculate the number of moles present. Given that $R = 0.08206 \text{ m}^3 \text{ atm mol}^{-1} \text{ K}^{-1}$. (5 marks)
- (b) Sample A has a thermal conductivity of $200 \text{ btu ft}^{-1} \text{ h}^{-1} \text{ }^{\circ}\text{F}^{-1}$. Calculate the conductivity in $\text{J m}^{-1} \text{ s}^{-1} \text{ }^{\circ}\text{C}^{-1}$. Given that $1 \text{ btu} = 1055 \text{ J}$ and $0.3048 \text{ m} = 1 \text{ ft}$. (5 marks)
- (c) Explain interactive mixture of solid powders with illustration. (5 marks)
- (d) Describe the mechanism and principle of rotary cutter mill. (5 marks)

Question 2

- (a) Explain azeotropic distillation, including the definition of an azeotrope and its key characteristics. (10 marks)
- (b) Explain Mier's theory of crystallization with illustration. (10 marks)

Question 3

- (a) Explain the operation and principle of horizontal bed filter with illustration. (10 marks)
- (b) Explain the operation and principle of a vacuum oven. (10 marks)

Question 4

- (a) Explain the principle of isopycnic equilibrium centrifugation. (10 marks)
- (b) Explain the classification of bed dryers based on the movement of solids with example. (10 marks)

END OF EXAMINATION PAPER