



UNIVERSITI KUALA LUMPUR
ROYAL COLLEGE OF MEDICINE PERAK

FINAL EXAMINATION
MARCH 2026 SEMESTER

COURSE CODE : RCB10903
COURSE NAME : PHYSICAL PHARMACEUTICS
PROGRAMME NAME : BACHELOR IN PHARMACEUTICAL TECHNOLOGY
(HONOURS)
DATE : 25 JUNE 2026
TIME : 2.30 PM – 4.30 PM
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 10 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. The drug and pharmaceutical materials _____.
 - A. cannot produce a safe drug product
 - B. may affect each other's stability without concern
 - C. can produce a stable product that may still be toxic
 - D. must be compatible with one another
 - E. produce a safe product but are complicated to administer

2. Drug products should be _____.
 - I. manufactured with appropriate quality control measures
 - II. packaged in containers that maintain product stability
 - III. packaged in light-permeable containers for light-sensitive drugs
 - IV. always packaged in amber glass containers
 - A. I and II
 - B. I and III
 - C. II and III
 - D. I and IV
 - E. II and IV

3. Select the **CORRECT** statement regarding types of stability.
 - A. Chemical stability ensures the product maintains its color and appearance.
 - B. Physical stability ensures the drug retains its antimicrobial effectiveness.
 - C. Therapeutic stability ensures no increase in toxicity occurs.
 - D. Toxicological stability ensures the drug maintains its dissolution properties.
 - E. Microbiological stability ensures sterility or resistance to microbial growth.

4. Select the types of powders that are involved in micromeritics.
- I. Granules
 - II. Fine powder
 - III. Nanoparticles
 - IV. Coarse powder
 - A. I and II
 - B. I and III
 - C. I, II, and III
 - D. II, III, and IV
 - E. I, II, III, and IV
5. Select the **CORRECT** statement regarding micromeritics.
- A. Particle size has no impact on suspensions.
 - B. Larger particles produce more stable suspensions.
 - C. Smaller surface area gives a higher dissolution rate.
 - D. Smaller particle size produces more stable suspensions.
 - E. Wide particle size distribution produces more stable emulsions.
6. Select the **CORRECT** statement regarding particle size distribution.
- A. The frequency distribution curve is obtained by plotting particle size against time.
 - B. The most frequently occurring particle size in a sample is known as the median.
 - C. In a normal distribution, the curve is asymmetrical around the mean.
 - D. The mode represents the particle size that occurs most frequently in the sample.
 - E. In a normal distribution, most particles are far from the average size.
7. Which of the following dosage forms involve a liquid-solid interface?
- A. Syrups
 - B. Solutions
 - C. Capsules
 - D. Ointments
 - E. Suspensions

8. Which of the following systems form a surface rather than an interface?
- A. Gas-liquid
 - B. Solid-solid
 - C. Liquid-solid
 - D. Liquid-liquid
 - E. Liquid-liquid-solid
9. Diffusion happens when molecules move _____.
I. from a higher concentration to a lower concentration
II. without the use of cellular energy (ATP)
III. only through a semipermeable membrane
IV. from a lower concentration to a higher concentration
- A. I and II
 - B. I and III
 - C. II and IV
 - D. I, II, and III
 - E. II, III, and IV
10. Identify the **CORRECT** statements about diffusion.
- I. Diffusion occurs in liquids and gases.
 - II. Diffusion requires a specific type of membrane to occur.
 - III. Diffusion rate increases with a larger concentration gradient.
 - IV. Diffusion requires proteins to assist the movement of molecules.
- A. I and II
 - B. I and III
 - C. II and IV
 - D. I, II, and III
 - E. I, II, III, and IV

11. Choose the **CORRECT** description of rheology.
- A. The subject of rheology is concerned with the study of deformation and flow matter.
 - B. Rheology is not important in the formulation of tablet.
 - C. When subjected to external forces, solid will flow.
 - D. When subjected to external forces, liquid will deform.
 - E. Rheology is only concerned with the deformation of matter without influence of stress.
12. Which of the following substances exhibit plastic behaviors?
- A. Diclofenac ointment
 - B. Aqueous cream
 - C. Magnesium magma
 - D. Paracetamol syrup
 - E. Glycerin
13. Choose the **CORRECT** viscometer for measuring the viscosity of 70% ethanol.
- A. Cone and plate viscometer
 - B. Cup and bob viscometer
 - C. Haake viscometer
 - D. Stormer viscometer
 - E. Falling sphere viscometer
14. Select the **CORRECT** statement regarding coarse dispersion of particles.
- A. Particles are visible under ordinary microscope.
 - B. Pass through filter paper but not through semipermeable membrane.
 - C. Undergo rapid diffusion.
 - D. Particles do not settle down on standing.
 - E. Particles cannot be detected by electron microscope.

15. Choose the **CORRECT** statement for the theory of sedimentation.
- A. In dilute suspension, particles interfere with one another during sedimentation and free settling occurs.
 - B. Greater the difference in density between the particles and the vehicle, the lower will be the rate of sedimentation.
 - C. For dispersed phase containing 5% and above, the particles exhibit hindered settling.
 - D. Increasing the viscosity of the dispersion medium will increase the rate of sedimentation.
 - E. Sedimentation does not affect the viscosity of suspension.
16. Choose the **CORRECT** rheological properties of emulsions.
- A. The liquid/liquid interface layers are only able to introduce a response to deformation.
 - B. The dispersed phase viscosity relative to that of the medium does not have an effect on the rheology of the emulsion.
 - C. The deformable nature of droplets in the continuous phase, particularly for large droplets, has an effect on the emulsion rheology.
 - D. As the viscosity of the emulsion increases, flocculation of globules will be increased.
 - E. Concentrated emulsions exhibit "Newtonian flow".
17. Choose the **CORRECT** example of inclusion complexes.
- A. Polymer complex
 - B. Drug-cafeine complex
 - C. Aromatic complex
 - D. Monomolecular complex
 - E. Chelates complex
18. Select the **CORRECT** classification of drug-cafeine complex.
- A. Channel type
 - B. Monomolecular inclusion type
 - C. Layer type
 - D. Clathrates type
 - E. Organic molecular type

19. Select the buffer with pH range between 4 – 6.
- A. Histidine
 - B. Acetate
 - C. Tris
 - D. Phosphate
 - E. Citrate
20. What is the concentration of hydronium ions (H^+) in hydrochloric acid (HCl) with a pH of 6?
- A. 1/100
 - B. 1/1000
 - C. 1/10000
 - D. 1/1000000
 - E. 1/100000000

II) SHORT ANSWER QUESTIONS (20 marks)

INSTRUCTION: Answer ALL questions in the answer booklet provided.

Each question carries TWO (2) marks.

1. Classify the flow properties of powder samples with angles of repose of $25-30^\circ$ and $46-55^\circ$.
2. Classify **TWO (2)** types of particle density.
3. Describe how particle size and surface area influence the angle of repose of a powder.
4. State **TWO (2)** importance of rheology in pharmaceutical manufacturing operations.
5. Define shear stress from rheological perspective.
6. State **TWO (2)** examples of substances that exhibit Newtonian system.
7. Calculate the concentration of H^+ and the pH of 0.8 M solution of HCl.
8. The K_a of hexanoic acid is 1.32×10^{-5} . Calculate the pH of 0.65 M of hexanoic acid.
9. Ammonia is one of the examples of weak base. Calculate the pH of 0.3 M ammonia. Given the pK_b of ammonia is 4.767.
10. State **TWO (2)** criterias of a good buffer.

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) Explain the concept of true density, describe the **TWO (2)** types of samples for which true density can be measured, and describe a suitable method that can be used to determine the true density for both types of samples.

(10 marks)

- (b) A liquid formulation shows a decrease in surface tension when temperature increases, and its surface tension changes upon addition of sodium chloride and phenol. Explain **TWO (2)** factors affecting surface tension based on this observation.

(5 marks)

- (c) Explain how diffusion is applied in pharmaceutical processes including drug release, absorption, distribution, excretion, and pharmaceutical separation techniques.

(5 marks)

Question 2

- (a) A topical ointment contains 200 mg/mL of active ingredient and degrades by zero-order kinetics with a reaction rate constant of 0.8 mg/mL/hour. After 50 hours, calculate the remaining concentration of intact drug and determine the zero-order half-life ($t_{1/2}$).

(5 marks)

- (b) An oral syrup of a drug at 10 mg/mL undergoes first-order degradation with a rate constant of 0.001 mg/mL/day. Calculate the remaining drug concentration after 60 days and determine the half-life ($t_{1/2}$).

(5 marks)

- (c) Complexation has different purposes and importance in the pharmaceutical field. Describe **THREE (3)** importance of complexation with relevant examples.

(6 marks)

- (d) Explain the rheological behaviors of liquid tragacanth.

(4 marks)

Question 3

- (a) Explain the types of stability studies and describe their conditions, duration, and sampling points. Justify the purpose of conducting stability studies.

(10 marks)

- (b) Explain the dilatant flow behaviors of cornstarch in water at rest and after sheared conditions.

(10 marks)

Question 4

- (a) Explain how the Arrhenius equation is used to determine activation energy (E_a) and predict the shelf-life of a drug. In your answer, include the linear relationship obtained and how it is interpreted.

The Arrhenius equation is given as:

$$K = Ae^{-E_a/RT}$$

Which can be expressed in logarithmic form as:

$$\log K = \log A - \frac{E_a}{2.303Ra} \cdot \frac{1}{T}$$

(10 marks)

- (b) A pharmaceutical company is planning to formulate an antihistamine (specifically cetirizine) syrup. An important criterion of a syrup formulation is to have proper rheological behaviors to deliver the medication effectively. Explain and illustrate the mechanisms of a suitable viscometer to measure the rheological properties of cetirizine syrup.

(10 marks)

END OF EXAMINATION PAPER