



UNIVERSITI KUALA LUMPUR
ROYAL COLLEGE OF MEDICINE PERAK

FINAL EXAMINATION
MARCH 2026 SEMESTER

COURSE CODE	: RCB20303
COURSE NAME	: PHARMACOLOGY AND TOXICOLOGY I
PROGRAMME NAME	: BACHELOR IN PHARMACEUTICAL TECHNOLOGY (HONOURS)
DATE	: 22 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 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. Which term describes the strength of binding between a drug and its target receptor?
 - A. Potency
 - B. Affinity
 - C. Efficacy
 - D. Selectivity
 - E. Bioavailability
2. Select the **CORRECT** route of drug administration in treating asthma.
 - A. Intramuscular
 - B. Intravenous
 - C. Inhalation
 - D. Transdermal
 - E. Intranasal
3. Which route of drug administration provides 100% bioavailability and rapid onset of action?
 - A. Intramuscular
 - B. Intravenous
 - C. Inhalation
 - D. Transdermal
 - E. Intranasal
4. Select the **CORRECT** order that shows the slowest to fastest drug bioavailability.
 - A. Oral > intravenous > subcutaneous > transdermal
 - B. Oral > subcutaneous > transdermal > intravenous
 - C. Intravenous > subcutaneous > transdermal > oral
 - D. Transdermal > subcutaneous > intravenous > oral
 - E. Transdermal > oral > subcutaneous > intravenous

5. Select the **CORRECT** type of drug transport that requires carrier proteins without energy.
- A. Passive diffusion
 - B. Active transport
 - C. Facilitated diffusion
 - D. Endocytosis
 - E. Non-ionic diffusion
6. Identify the type of barrier that restricts the diffusion of drugs to spermatocytes and spermatids.
- A. Blood-testis barrier
 - B. Simple cell placental barrier
 - C. Blood-brain barrier
 - D. Placental barrier
 - E. Cerebrospinal fluid barrier
7. Which receptor type does insulin bind to?
- A. G-protein coupled receptors
 - B. Nuclear receptors
 - C. Tyrosine kinase receptors
 - D. Ligand-gated ion channels
 - E. Serine/threonine kinase receptors
8. Which of the following describes the phenomenon where the combined effect of two drugs is greater than the sum of their individual effects?
- A. Tolerance
 - B. Dependence
 - C. Synergism
 - D. Summation
 - E. Antagonism

9. Therapeutic index is an assessment of the _____.
A. drug efficacy
B. drug potency
C. onset of action
D. duration of action
E. margin of safety
10. Identify the fastest acting receptor.
A. JAK-STAT receptor
B. Kinase receptor
C. Ligand-gated ion channel
D. Nuclear receptor
E. Metabotropic receptor
11. Identify the maturation age of renal blood flow in pediatrics.
A. 1 - 2 months
B. 3 months
C. 4 months
D. 5 - 12 months
E. 12 - 24 months
12. Why does percutaneous drug absorption pose a special toxicity problem to infants?
A. The renal function is not fully developed.
B. Higher metabolic rate than adults.
C. Higher water content in the body.
D. Lower body surface area compared to adults.
E. Lack of protective barrier to the skin until 2-3 weeks after life.
13. Choose the consequence of slow drug metabolism in pediatrics.
A. Results in shorter drug half-life.
B. Increase drug clearance.
C. Increases drug accumulation in the body.
D. Decreases water content in the body.
E. Decreases the possibility of adverse drug reactions.

14. Choose the **CORRECT** pair of drug and adverse reaction commonly observed in children.
- A. Furosemide - renal failure
 - B. Indomethacin - hepatotoxicity
 - C. Aspirin - Gray baby syndrome
 - D. Chloramphenicol - growth suppression
 - E. Tetracyclines - discolored teeth
15. Select the drug used for the treatment of hyperactivity in children.
- A. Theophylline
 - B. Caffeine
 - C. Indomethacin
 - D. Prostaglandin E1
 - E. Methylphenidate
16. Most elderly people may absorb drug slowly due to the decrease in ____.
- A. splanchnic blood flow
 - B. gastrointestinal motility
 - C. gastric pH
 - D. liver enzyme activity
 - E. renal filtration rate
17. Drug distribution in the elderly may be impaired by ____.
- A. hypoalbuminemia
 - B. increased muscle mass
 - C. reduced body fat
 - D. increased fluid content
 - E. increased renal blood flow
18. Identify the factor that contributes to decreased drug excretion in elderly patients.
- A. Reduction in renal blood flow
 - B. Increase in glomerular filtration rate (GFR)
 - C. Increase in tubular secretory activity
 - D. Increase in number of functional nephrons
 - E. Reduction in muscle mass

19. Identify the term that describes the undesirable but unavoidable pharmacodynamic effects of a drug.
- A. Toxic effects
 - B. Idiosyncrasy
 - C. Side effects
 - D. Intolerance
 - E. Photosensitivity
20. Identify the antidote for toxicity caused by benzodiazepine.
- A. Atropine
 - B. Naloxone
 - C. Methylene blue
 - D. Fomepizole
 - E. Flumazenil

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

1. A drug is highly lipophilic but poorly soluble in water. Predict its absorption and distribution characteristics.
2. Differentiate agonist and antagonist.
3. List **TWO (2)** examples of enteral drug administration.
4. Define stabilizer use in drug formulation.
5. State **TWO (2)** drug dosage forms used for oral administration.
6. State **TWO (2)** types of drug biotransformation process.
7. State **TWO (2)** urinary acidifiers used to enhance the excretion of basic drugs.
8. Describe quantal dose-response relationship.
9. Describe an allosteric inhibitor to the agonist receptor site.
10. State **TWO (2)** common adverse drug reactions among elderly.

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 researcher is evaluating three candidate compounds (A, B, and C) using an *in vitro* receptor-binding and functional bioassay system. The following pharmacodynamic parameters were obtained:

Drug	E _{max} (% maximal response)	EC ₅₀ (μM)	K _d (μM)
A	100	2	2
B	80	0.5	0.5
C	100	5	10

- i. Compare the potency and efficacy of the three drugs. Justify your answer using the data provided. (4 marks)
- ii. Explain the relationship between EC₅₀ and K_d for Drug A and Drug C in terms of the presence of spare receptors. (6 marks)
- iii. Predict how the presence of a competitive antagonist would alter the EC₅₀ and E_{max} of Drug A. Provide a mechanistic explanation. (4 marks)
- (b) Explain the signaling mechanism of nuclear receptor with an example. (6 marks)

Question 2

- (a) i. Explain the process of drug delivery via sublingual administration. (5 marks)
- ii. Illustrate a schematic diagram representing the position of needle for drug administered through intramuscular. (5 marks)
- (b) Explain blood brain barrier and placenta barrier and their respective selectivity towards drug entry. (4 marks)
- (c) Describe **THREE (3)** advantages and disadvantages of enteral route of drug administration. (6 marks)

Question 3

- (a) A pest control worker is involved in indoor spraying of an insecticide without protective equipment. The product contains a chlorinated hydrocarbon compound (e.g., DDT). After prolonged exposure, he develops dizziness, headache, nausea, muscle twitching, fine tremors, and hyperreflexia. He remains alert with stable vital signs and shows no respiratory distress or skin lesions.
- i. Explain the likely mechanism of toxicity of chlorinated hydrocarbon. (4 marks)
- ii. Differentiate this type of toxicity from organophosphate poisoning in terms of:
a. mechanism of action
b. neurotransmitter involvement (4 marks)
- iii. Suggest a general approach to treat this patient. (2 marks)
- (b) Explain zero and first-order kinetics of drug elimination with an appropriate illustration. (4 marks)
- (c) i. Explain drug distribution. (2 marks)
- ii. A patient with renal failure shows an increased drug half-life and risk of toxicity for drug A (200 mg) which was taken one in every 6 hours. Calculate the new dose and interval if the renal function (RF) value of the patient is 0.5. (4 marks)

Question 4

- (a) Mr. Jackson accidentally ingested a small quantity of an herbicidal solution that contained paraquat. Within 2 hours, he was admitted to the emergency department of a nearby hospital.
- i. State **TWO (2)** probable symptoms shown by Mr. Jackson. (2 marks)
- ii. Suggest treatment options for Mr. Jackson. (3 marks)
- (b) Elaborate on the effects and treatment of carbon monoxide poisoning. (5 marks)
- (c) Illustrate the differences of permeation capability between drugs with molecular weight of ≤ 450 Da and ≤ 600 Da through the intestinal epithelium cells. (4 marks)
- (d) i. Explain Phase I drug metabolism. (2 marks)
- ii. Calculate and describe the renal clearance ratio of lipophilic drugs for normal individuals. (4 marks)

END OF EXAMINATION PAPER