UNIVERSITI KUALA LUMPUR
ROYAL COLLEGE OF MEDICINE PERAK

FINAL EXAMINATION
MARCH 2026 SEMESTER

COURSE CODE	:	RCB20403
COURSE NAME	:	PHARMACEUTICAL MEDICINAL CHEMISTRY I
PROGRAMME NAME	:	BACHELOR IN PHARMACEUTICAL TECHNOLOGY (HONOURS)
DATE	:	29 JUNE 2026
TIME	:	2.30 PM – 4.30 PM
DURATION	:	2 HOURS

INSTRUCTIONS TO CANDIDATES

1. Please CAREFULLY read 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.

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SECTION A (Total: 40 marks)

I) MULTIPLE CHOICE QUESTIONS (20 marks)

INSTRUCTION: Answer ALL questions.

Use the OMR sheet provided.

1. Intermolecular forces that occur between a cation/anion and a dipole are known as _____.

   A. dipole-dipole bonding
   B. Van der Waals attraction
   C. ion-dipole bonding
   D. ionic bonding
   E. covalent bonding

2. Compounds with log P_{calc} values greater than _____ are considered _____.

   A. +0.1 ; lipophilic
   B. +0.3 ; lipophilic
   C. +0.5 ; lipophilic
   D. +0.8 ; hydrophilic
   E. +1.0 ; hydrophilic

3. Select the **CORRECT** statements regarding geometric isomerism.

   I. It is an approach to resolve biological problems effectively.
   II. It is a procedure to synthesize a lead compound's structural analogues by substituting an atom or a group of atoms.
   III. It results from the restricted rotation of a chemical bond.
   IV. It is not a mirror image and has different physicochemical properties and pharmacological activity.

   A. I and II
   B. II and III
   C. III and IV
   D. I, II, and IV
   E. I, II, III, and IV

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4. Drugs after phase II metabolism usually have _____ pharmacological activity and _____ water solubility.

A. equal ; higher
B. more ; higher
C. less ; higher
D. more ; lower
E. less ; lower

5. Select the **CORRECT** reaction showing the conversion of a drug into a toxic metabolite.

A. Diazepam → Oxydiazepam
B. Enalapril → Enalaprilat
C. Paracetamol → N-acetyl-*p*-benzoquinone imine
D. Procaine → *p*-aminobenzoic acid
E. Halothane → Trifluoroacetic acid

6. Choose the **CORRECT** type of microsomal oxidation that involves a primary or secondary amine group.

A. Aliphatic hydroxylation
B. Aromatic hydroxylation
C. Amine oxidation
D. Phospoxidation
E. Sulphoxidation

7. Identify the enzyme used in the sulfation reaction of phase II metabolism.

A. UDP-glucuronyl transferase
B. Glutathione-S-transferase
C. Acetyltransferase
D. Sulfotransferase
E. O-methyltransferase

8. Identify the **CORRECT** pair of drug and prodrug.

A. Prodrug for ampicillin is augmentin.
B. Prodrug for paracetamol is sultamicillin.
C. Prodrug for sulindac sulphone is sulindac.
D. Prodrug for dopamine is heroin.
E. Prodrug for prednisolone is prednisolone sodium phosphate.

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9. Identify the characteristic of a tripartite prodrug.
   A. It consists of a single carrier group attached to the drug.
   B. It consists of two pharmacologically active drugs.
   C. It consists of one carrier group and a linking structure attached to the drug.
   D. It is designed from a molecular modification of the active drug itself.
   E. It consists of one carrier group and two pharmacologically active drugs.

10. Select the **CORRECT** location of Type IIA Prodrug biotransformation.
   A. Gastrointestinal fluid
   B. Systemic circulation
   C. Inside the metabolic tissues
   D. Extracellular fluid compartments
   E. Inside the therapeutic target tissues

11. Identify the long-acting barbiturate.
   A. Thiopental
   B. Hexabutal
   C. Secobarbital
   D. Pentobarbital
   E. Phenobarbital

12. Choose the **CORRECT** statement regarding general anaesthetics.
   A. It is commonly used to treat psychosis.
   B. It can reduce excitement and calm a person.
   C. It causes a temporary loss of consciousness with loss of pain and reflexes.
   D. It can only be administered intravenously.
   E. It is commonly used for treating insomnia.

13. Select the number of methyl group(s) in the quaternary ammonium group needed for optimum cholinergic agonist agent activity.
   A. 1
   B. 2
   C. 3
   D. 4
   E. 5

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14. 'A rule of five' theory states that there should be no more than _____ atom(s) between the nitrogen and terminal hydrogen.

A. 1
B. 2
C. 3
D. 4
E. 5

15. Select the basic components in the structure of local anaesthetic agents.

I. Lipophilic aromatic ring
II. Intermediate chain
III. Hydrophilic amine group
IV. Azole ring

A. I and III
B. II and III
C. I, II, and III
D. I, II, and IV
E. I, II, III, and IV

16. Identify the component responsible for lipid solubility of local anaesthetics.

A. Amino group
B. Aromatic ring
C. Ester linkage
D. Amide linkage
E. Carbonyl group

17. Potassium-sparing diuretic is used _____.

A. to reduce intraocular pressure
B. as a diagnostic agent for kidney function
C. to increase the urine volume of patients with acute renal failure
D. to treat hypertension
E. to reduce cerebrospinal fluid pressure and volume

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18. Identify carbonic anhydrase inhibitor diuretic agent.

A. Acetazolamide
B. Bumetanide
C. Chlorothiazide
D. Isosorbide
E. Mannitol

19. Identify the **CORRECT** classification of antihistamines.

A. Ethyl piperidyl derivatives
B. Salicylic acid derivatives
C. Pyrazolidinedione derivatives
D. Aryl alkanoid acid derivatives
E. Ethylenediamine derivatives

20. Select the pharmacological uses of antihistamines.

I. It is effective for mild and localized allergic reactions to insect bites.
II. It reduces rigidity and tremors in Parkinson's disease.
III. It is effective in active and prophylactic management of motion sickness.
IV. It relieves anxiety, stress, worry, and fear.

A. I and III
B. II and III
C. I, II, and III
D. I, II, and IV
E. I, II, III, and IV

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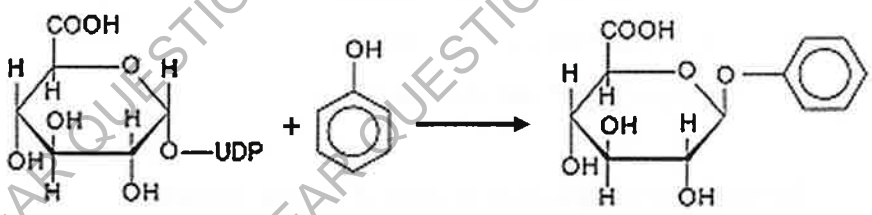
II) SHORT ANSWER QUESTIONS (20 marks)

INSTRUCTION: Answer ALL questions in the answer booklet provided.

Each question carries TWO (2) marks.

1. State **TWO (2)** major families of receptors.

2. Describe **TWO (2)** factors that cause receptor desensitization.

3. 

State the type of phase II metabolism reaction and enzyme involved.

4. List **TWO (2)** by-products of glutathione conjugation in phase II metabolism.

5. Directed Enzyme Prodrug Therapy (DEPT).

6. List **TWO (2)** examples of thiazide diuretic.

7. List **TWO (2)** therapeutic uses of osmotic diuretic.

8. State **TWO (2)** structural requirements for antihistamines.

9. State **TWO (2)** examples of non-sedative antihistamines.

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10. Describe antipyretics.

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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.

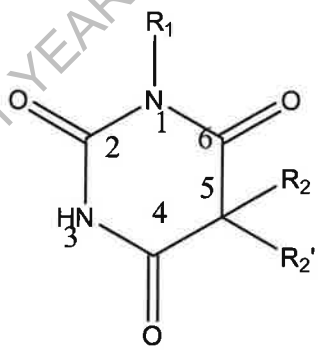
Answer EITHER Question 3 OR 4.

Question 1

(a) Describe the therapeutic uses of anxiolytics.

(3 marks)

(b) Explain the structure-activity relationships (SARs) of barbiturate.



(7 marks)

(c) Describe analgesics and provide **TWO (2)** classifications.

(4 marks)

(d) Explain the SARs of acetaminophen with an appropriate illustration.

(6 marks)

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Question 2

(a) Explain local anaesthetics with **FOUR (4)** ideal properties.

(6 marks)

(b) Explain the SARs of anilide derivatives with an appropriate illustration.

(4 marks)

(c) i. Draw and describe the chemical structure of good and poor acetylcholine agonists based on the difference in the quaternary ammonium group.

(4 marks)

ii. Differentiate **THREE (3)** SARs of acetylcholine agonist and antagonist.

(6 marks)

Question 3

(a) Explain bioisosterism and provide its **THREE (3)** importance in medicinal chemistry.

(10 marks)

(b) Explain **FIVE (5)** examples of DEPT in treating cancer.

(10 marks)

Question 4

(a) Explain the properties that allow a molecule to become a 'drug-like molecule' according to Lipinski's Rule of Five.

(10 marks)

(b) Justify how prodrugs can improve drug pharmacokinetics.

(10 marks)

END OF EXAMINATION PAPER

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