



UNIVERSITY OF RUHUNA - FACULTY OF ALLIED HEALTH SCIENCES

DEPARTMENT OF PHARMACY

FIRST BPHARM PART I EXAMINATION – JULY/AUGUST 2026

PH 1112 PHARMACEUTICAL CHEMISTRY– SEQ

TIME: TWO HOURS

INSTRUCTIONS

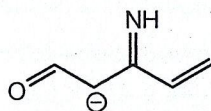
- There are four questions under Parts A and B of this paper.
- Answer all questions using a separate answer booklet for each part.
- No paper should be removed from the examination hall.
- Do not use any correction fluid.
- Use illustrations where necessary.

PART A

1.

1.1 Draw complete molecular orbital energy level diagrams for H_2 , H_2^* , H_2^+ , H_2^- , and predict bond order of each species. (* indicates excited state). (20 marks)

1.2 Consider the molecular anion shown below and answer the following questions.



1.2.1 Indicate necessary lone pairs of the molecule. (05 marks)

1.2.2 Draw two additional resonance structures. (05 marks)

1.2.3 Which one is the major contributor to the resonance hybrid? (05 marks)

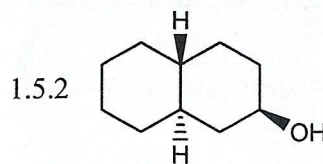
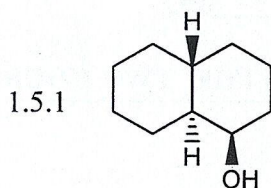
1.2.4 How many atoms are in conjugation? Draw a picture showing the location of every *p* orbital participating in conjugation. (05 marks)

1.3 Difference between Inductive Effect and Resonance Effect is essential for mastering reaction mechanisms in organic chemistry. Both effects influence molecular structure, stability, and reactivity, but operate via distinct electronic principles. Explain this briefly.

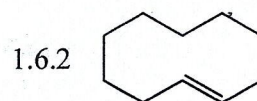
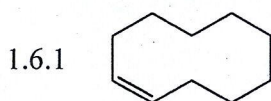
(10 marks)

1.4 How does hyperconjugation explain the stability difference of methyl carbocation (CH_3^+) and the primary ethyl carbocation ($CH_3CH_2^+$) (10 marks)

1.5 Draw the most stable chair conformation of each of the following decalin molecules. For each structure, determine whether the -OH group is in an axial or an equatorial position, and identify whether the ring fusion is *cis* or *trans*. (15 marks)



1.6 For cycloalkenes containing eight or more carbons, a non-ambiguous name should be given to identify them. Name the two isomers of cyclodecacene appropriately to help distinguish the two isomers. (10 marks)



1.7 Draw all possible isomers for the compound with the molecular formula $C_2BrClFI$ and assign the appropriate E/Z configuration to each isomer. (15 marks)

2.

2.1 The α -amino acids are the building blocks of proteins and peptides.

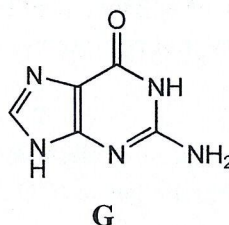
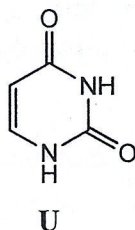
2.1.1 Give the name, chemical structure, three-letter code and one-letter code for two standard α -amino acids containing a sulfur (S) atom in their side chain. (10 marks)

2.1.2 Comment on the polarity of each of the above amino acids. (05 marks)

2.1.3 Draw structures of the two possible dipeptides, which can be formed by joining (S)-alanine to glycine. (10 marks)

2.2

2.2.1 How can tautomerism explain why nucleic acid bases, such as uracil (U) and guanine (G), exhibit aromaticity even though their aromatic nature is not apparent from the structures shown below?



(10 marks)

2.2.2 Draw a structural formula for a nucleoside composed of α -D-Ribose and adenine. Clearly indicate the anomeric carbon and N-glycosidic bond. (15 marks)

2.3 Draw the following structural representations for D-erythrose (a trihydroxybutanal).

2.3.1 Fischer projection

2.3.2 Wedge-and-Dash representation

2.3.3 Sawhorse projection

2.3.4 Newman projection

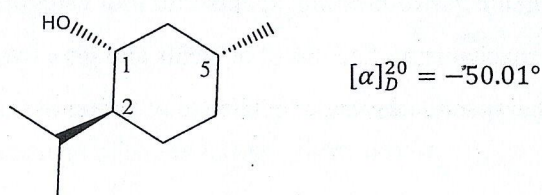
(20 marks)

2.3.5 Haworth projection of the α -furanose form of D-erythrose labeling the furanose ring and the anomeric carbon (*Note: The cyclic hemiacetal is formed by the reaction of the primary hydroxyl (-OH) group with the aldehyde (-CHO) group.*). (10 marks)

2.4 Draw the structure of the 1-monoglyceride formed by esterification of glycerol with an 18:2(ω -6) fatty acid. Indicate the total number of stereoisomers possible for 1-monoglyceride. (20 marks)

3.

3.1. The structure of the (-)-menthol found naturally in the mint plant is shown below:



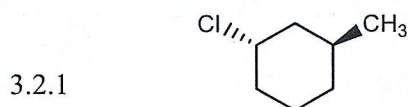
3.1.1. Determine R/S configuration of the stereocenters of (-)-menthol and mark on the structure. (12 marks)

3.1.2. Draw the enantiomer of the above stereoisomer and assign R/S configuration. (10 marks)

3.1.3. Comment on the optical rotation of the enantiomer. (03 marks)

3.1.4. Draw the two chair conformations of the (-)-menthol and identify the most stable conformation. (15 marks)

3.2 Complete the IUPAC names of the following two molecules, including R, S designations for stereo centers. (10 marks)



(.....,)-1-chloro-3-methylcyclohexane



(.....,)-2-(2-methylpropyl)cyclopentan-1-ol

PART B

3.3

3.3.1 Define body fluids and explain the three major body fluid compartments. (05 marks)

3.3.2 Compare the electrolyte composition of intracellular fluid and extracellular fluid highlighting the major ions present in each compartments. (05 marks)

3.3.3 State five physiological functions of electrolytes in the human body. (05 marks)

3.4

3.4.1 Distinguish between bulk metals and trace metals, giving suitable examples.

(05 marks)

3.4.2 Explain the biological importance of iron in the human body and describe its role in haemoglobin.

(05 marks)

3.4.3 Describe the physiological roles of zinc and discuss the consequences of zinc deficiency.

(05 marks)

3.5

3.5.1 Classify inorganic gastrointestinal agents into four categories.

(04 marks)

3.5.2 Describe the mechanism of action of antacids and give two examples.

(03 marks)

3.5.3 Explain the therapeutic uses and mechanism of action of saline cathartics.

(03 marks)

3.6

3.6.1 Classify topical inorganic preparations into three categories.

(03 marks)

3.6.2 Explain the desirable properties of topical protectives and discuss the pharmaceutical uses of talc and zinc oxide.

(04 marks)

3.6.3 Describe the uses, advantages, and limitations of hydrogen peroxide solution as a topical antimicrobial agent.

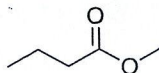
(03 marks)

4.

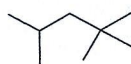
4.1 Give the IUPAC names of the following compounds.

(20 marks)

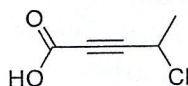
4.1.1



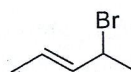
4.1.2



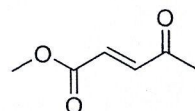
4.1.3



4.1.4



4.1.5



4.2 Draw the structures pertaining to the following IUPAC names.

(20 marks)

4.2.1 N-methylbutan-1-amine

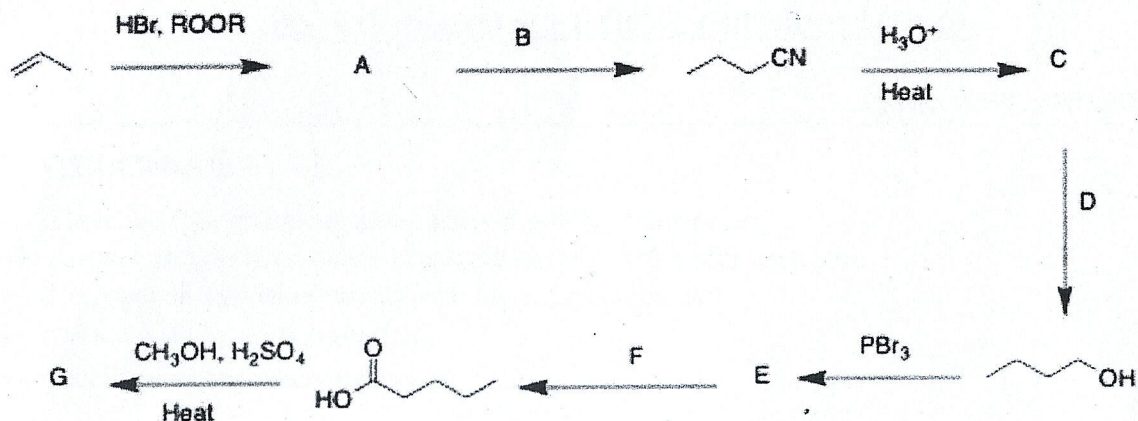
4.2.2 2-methylbutanoic acid

4.2.3 ethyl 4-aminobenzoate

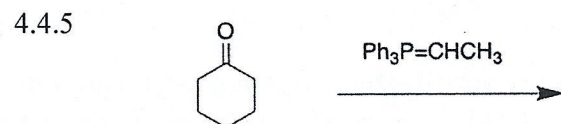
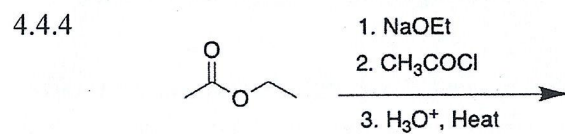
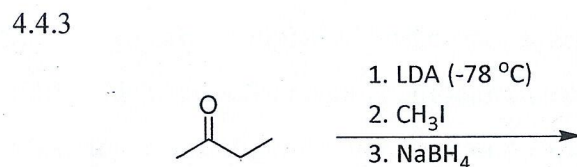
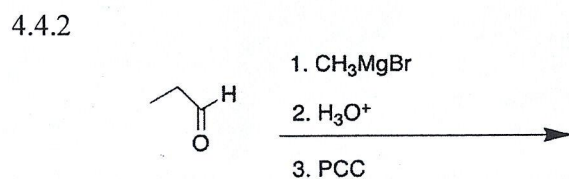
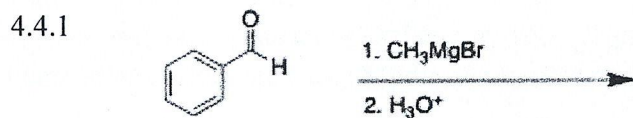
4.2.4 N-ethyl-3-hydroxybutanamide

4.2.5 2-ethoxy-4-nitrophenol

4.3 Write down suitable reagents and reaction conditions required in A-G of the chemical transformation given below. (30 marks)



4.4 Write down the major products of the reactions given below. (30 marks)



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