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UNIVERSITY OF RUHUNA – FACULTY OF ALLIED HEALTH SCIENCES

DEPARTMENT OF PHARMACY

FIRST BPHARM PART II EXAMINATION – NOVEMBER 2021

PH 1213 PHARMACEUTICAL CHEMISTRY II (SEQ) – OLD SYLLABUS

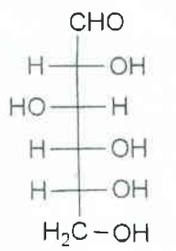
TIME: THREE HOURS

INSTRUCTIONS

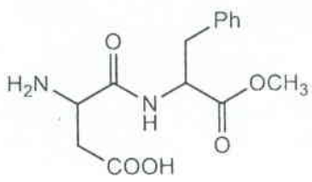
- There are **six** questions in parts **A** and **B** in this paper.
- Answer **all** questions.
- No paper should be removed from the examination hall.
- Do not use any correction fluid.
- Use illustrations where necessary.

PART A

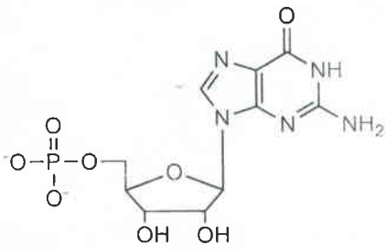
01. Consider the structures shown below to answer the following questions:



A- Glucose



B-Aspartame



C- Nucleotide

1.1 Using the Fisher projection formula of D-Glucose (**A**):

1.1.1 Draw the Haworth projection for the two pyranose forms (anomers) of it indicating the anomeric carbons. (*15 marks*)

1.1.2 Draw suitable chair confirmations for those anomeric forms and name them. (*20 marks*)

1.1.3 By using glucose as an example explain the term epimers. (*05 marks*)

1.2 Aspartame (**B**) which is an artificial sweetener, is a dipeptide.

1.2.1 Draw its zwitterionic structure and the structures of the amino acids obtained from the complete hydrolysis of Aspartame. (*15 marks*)

1.2.2 Of the two amino acids drawn in the part 1.2.1 which is more hydrophobic? Give three letter and one letter codes for the structures drawn in the part 1.2.1. (*15 marks*)

1.3

1.3.1 Name the nucleotide **C** and number both purine ring and the sugar unit. (*10 marks*)

1.3.3 What is the name for the type of bond that connects?
the phosphate and sugar subunits
the nitrogen base and the sugar subunits
two such nucleotides together (*10 marks*)

1.4 Draw structures for *cis*-ω-2 and *trans*-ω-5 fatty acids. (*10 marks*)

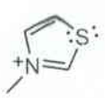
02.

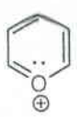
2.1 Draw all the resonance forms for *m*-methoxybenzyl cation. (***15 marks***)

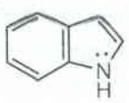
2.2 Show how both the 1,2- and 1,4- addition of HBr to 2-chlorobutadiene (chloroprene) take place, giving the resonance forms for the expected intermediates. (***15 marks***)

2.3 Using the Hückel rule, indicate whether the following molecules are aromatic or not. (***20 marks***)

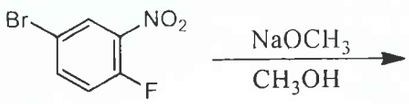
2.3.1. 

2.3.2 

2.3.3 

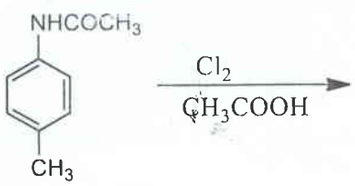
2.3.4 

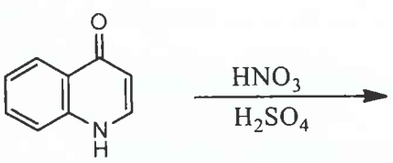
2.4 Draw the structure(s) of the major product(s) of following substitution reactions. Give a brief explanation for your answers. (***50 marks***)

2.3.1 

2.3.2 

2.3.3 

2.3.4 

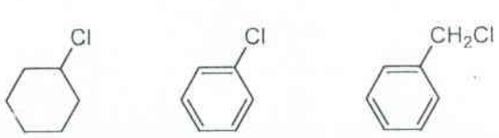
2.3.5 

(consider as a di-substituted benzene)

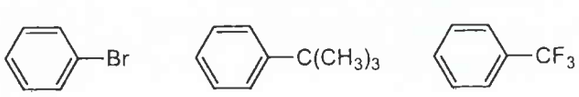
03.

3.1 Arrange the following compounds in order with respect to the property indicated.

3.1.1 Reactivity in nucleophilic substitution (***10 marks***)



3.1.2 Reactivity in nitration (***10 marks***)



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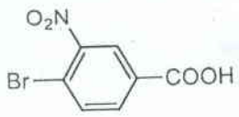
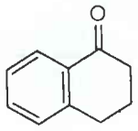
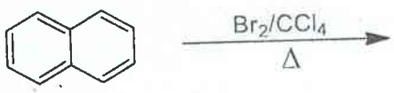
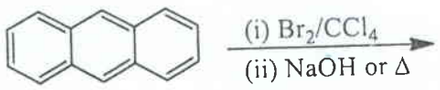
3.2 Show a reaction sequence that could be used to prepare the following two compounds starting from benzene. (*50 marks*)

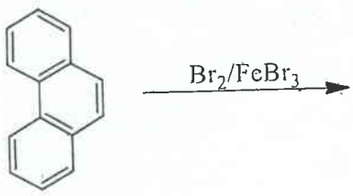
3.2.1 

3.2.2 

3.3 Draw the structure(s) of the major product(s) of following substitution reactions. (*30 marks*)

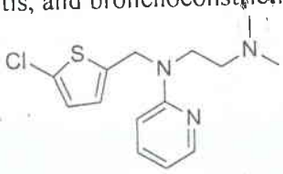
3.3.1 

3.3.2 

3.3.3 

04.

4.1 Chlorothen is an antihistamine usually administered in the form of its citrate (trade name Tagathen). It is a first generation H1 receptor antagonist that have been used for the treatment of asthma, bronchitis, and bronchoconstriction.

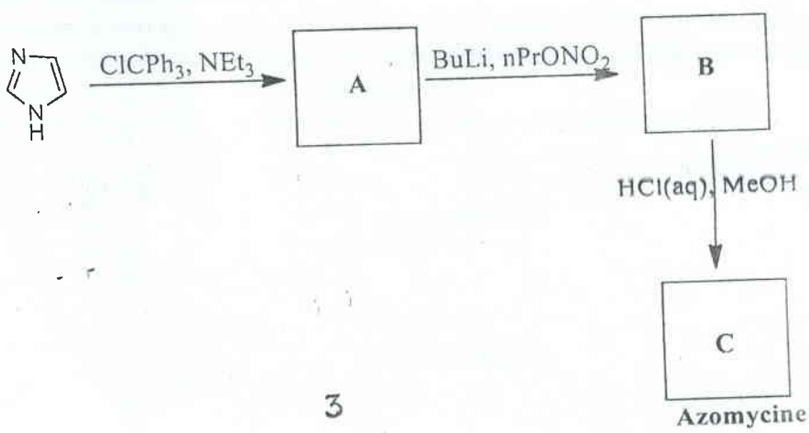


Chlorothen

4.1.1 Write down the trivial names of the two heterocycles present in chlorothene. (*10 marks*)

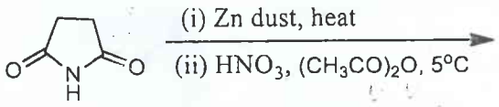
4.1.2 Explain why electrophilic substitution is always preferred at C-2 in one heterocycle (five-membered) and C-3 in the other heterocycle (6-membered). Draw all the resonance forms for the cationic intermediates to predict the regiochemistry of electrophilic substitution for both heterocycles. (*25 marks*)

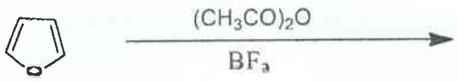
4.2 Fill in the blank boxes and follow the directions to complete the 3-step synthesis of azomycine (2-nitroimidizole) given below. (*15 marks*)

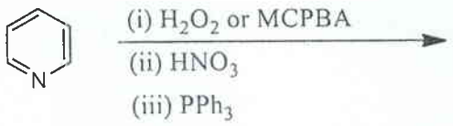


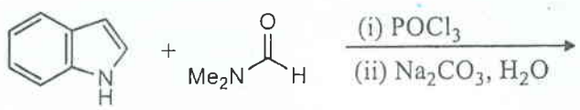
Azomycine

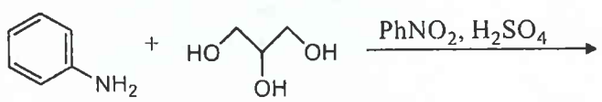
4.3 Predict the product expected from each of the following reactions. (*50 marks*)

4.3.1 

4.3.2 

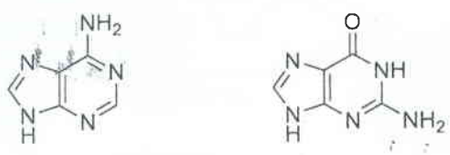
4.3.3 

4.3.4 

4.3.5 

05.

5.1 Two nitrogenous bases found in DNA and RNA are shown below. Indicate the nitrogen atoms that are weak bases (if any) and that have lone pairs contributing to the aromaticity of the molecule. (*15 marks*)

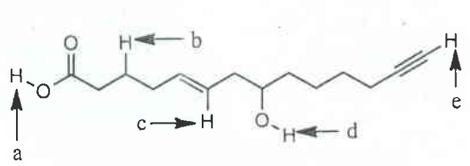


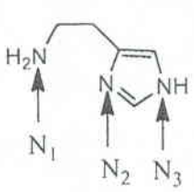
5.2 Show the structures of species **A**, **B**, **X** and **Y** in the following acid-base reactions and indicate the direction of equilibrium. (*15 marks*)

5.2.1 

5.2.2 

5.3 Arrange the indicated hydrogens/nitrogens of the following two compounds in order of increasing acidity/basicity, respectively. (*20 marks*)





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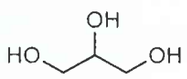
PART B

5.4 Write down the product/s of the following reactions.

5.4.1 $C_6H_5CHO \xrightarrow[MeOH]{NaBH_4}$

5.4.2 $C_2H_5COOH \xrightarrow[H_3O^+]{LiAlH_4}$

5.4.3  $\xrightarrow{HIO_4}$

5.4.4 $C_2H_5CH{=}CH(C_6H_5) \xrightarrow[-78\ ^0C]{O_3/CH_2Cl_2}$

5.4.5 $CH_3(CH_2)_{15}CH_2CH_2Cl \xrightarrow[DMSO,\ 25\ ^0C]{KOC(CH_3)_3}$

(*50 marks*)

06.

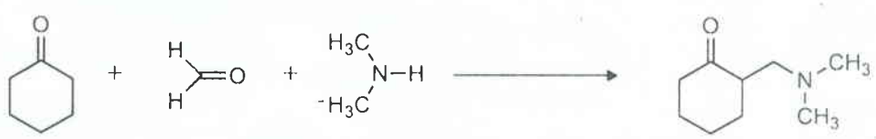
6.1 Acetaldehyde undergoes the aldol condensation with dilute sodium hydroxide at room temperature to produce an aldol.

6.1.1 Show the aldol product forms from acetaldehyde (*15 marks*)

6.1.2 Write a plausible mechanism that accounts for the formation of the product that you have shown in the part 6.1.1. (*20 marks*)

6.1.3 Indicate the nucleophilic donor and the electrophilic acceptor involved in the mechanism in part 6.1.2. (*10 marks*)

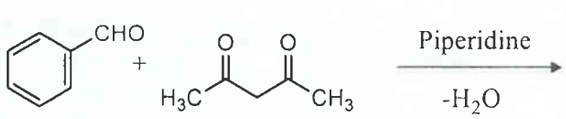
6.2 Outline a reasonable mechanism that accounts for the formation of the product of the following Mannich reaction. (*20 marks*)

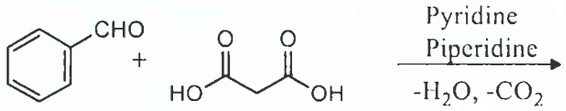


Mannich product

6.3 Write down the chemical reaction with products for the Crossed Claisen condensation of CH_3CH_2COOEt and $C_6H_5CH_2COOEt$. (*15 marks*)

6.4. The Knoevenagal reaction is an aldol-type condensation of a ketone or aldehyde with a di-carbonyl compound containing an active methylene group.
Write down the possible product/s of the following Knoevenagal condensations.
(*20 marks*)

6.4.1 

6.4.2 

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