Original

Index no:.....

**UNIVERSITY OF RUHUNA – FACULTY OF ALLIED HEALTH SCIENCES**

**DEPARTMENT OF PHARMACY**

**FIRST BPHARM PART II EXAMINATION – JUNE/JULY 2023**

**PH 1213 PHARMACEUTICAL CHEMISTRY II (SEQ) – OLD SYLLABUS**

**TIME: THREE HOURS**

---

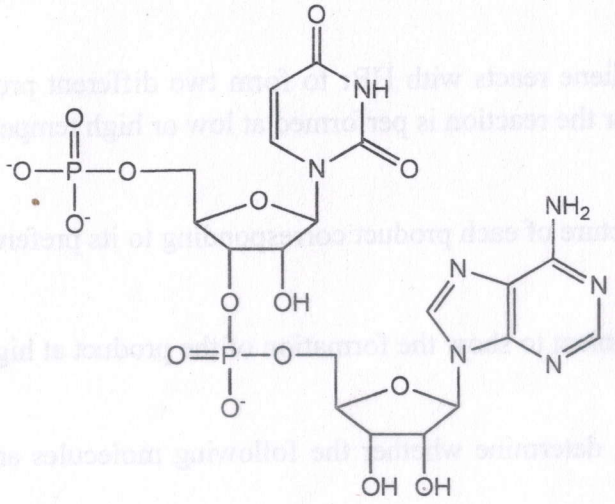
**INSTRUCTIONS**

- 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.**

1.1 Consider the given dinucleotide below:



Indicate each of the following:

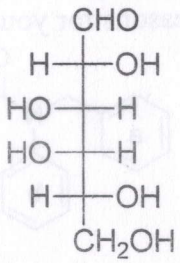
1.1.1 Names of the sugar/s and the nitrogen base/s. (*15 marks*)

1.1.2 Anomeric carbon atom(s). (*05 marks*)

1.1.3 N-glycoside bond(s) specifying whether α or β. (*10 marks*)

1.1.4 Numbering of the sugar units and the nitrogen base. (*10 marks*)

1.2 Fischer projection formula of the D-galactose is shown below:



1.2.1 Draw the Haworth projections of the α and β-pyranose of D-galactose. (*10 marks*)

1.2.2 Convert the above Haworth projections to the chair confirmations. (*10 marks*)

Index no:.....

1.3

1.3.1 Categorize the following amino acids into acidic, basic, and aromatic amino acids and give their one-letter codes. (***20 marks***)

Asp, Glu, His, Lys, Phe, Tyr

1.3.2 Draw the chemical structures of Phe and Tyr. (***10 marks***)

1.4 Oleic acid is the most common fatty acid in the triacylglycerols of olive oil. Molecular formula of oleic acid is as $C_{17}H_{23}COOH$.

1.4.1 Draw the structure of (18:1, **ω-9**) ***cis*** oleic acid. (***05 marks***)

1.4.2 Draw the structure of triglyceride formed between glycerol and ***trans*** oleic acid. (***05 marks***)

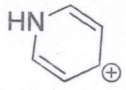
**02.**

2.1 2,3-Dimethylbutadiene reacts with HBr to form two different products. The preferred product depends on whether the reaction is performed at low or high temperature.

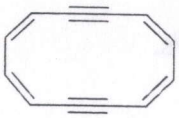
2.1.1 Draw the structure of each product corresponding to its preferential temperature. (***10 marks***)

2.1.2 Draw a mechanism to show the formation of the product at high temperature. (***20 marks***)

2.2 Using Hückel rule, determine whether the following molecules are aromatic, anti-aromatic, or non-aromatic. (***20 marks***)

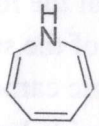



2.2.1.



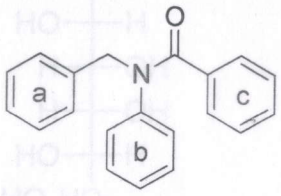
2.2. 2


2.2.3



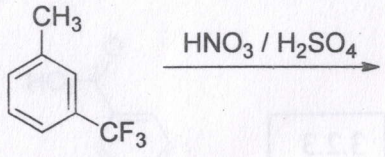

2.2.4

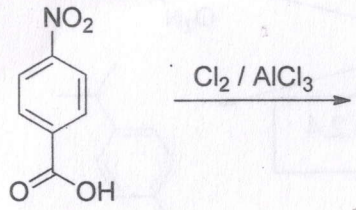
2.3 If the compound given below is subjected to the electrophilic aromatic substitution conditions, which ring reacts the fastest? Give reasons for your answer. (***20 marks***)

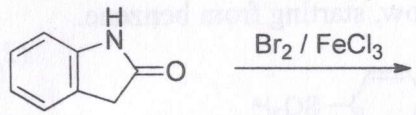


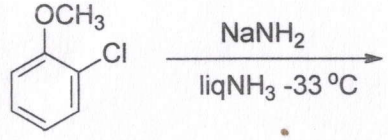
Index no:.....

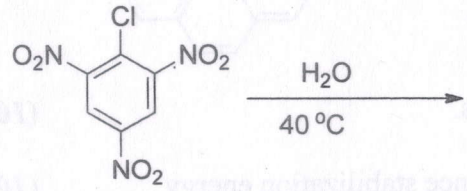
2.4 Draw the structure(s) of major product(s) formed in the substitution reactions shown below:
***(30 marks)***

2.4.1 


2.4.2 

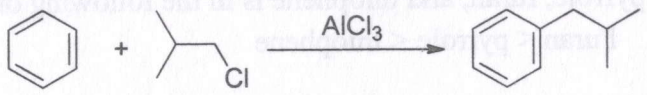

2.4.3 


2.4.4 


2.4.5 

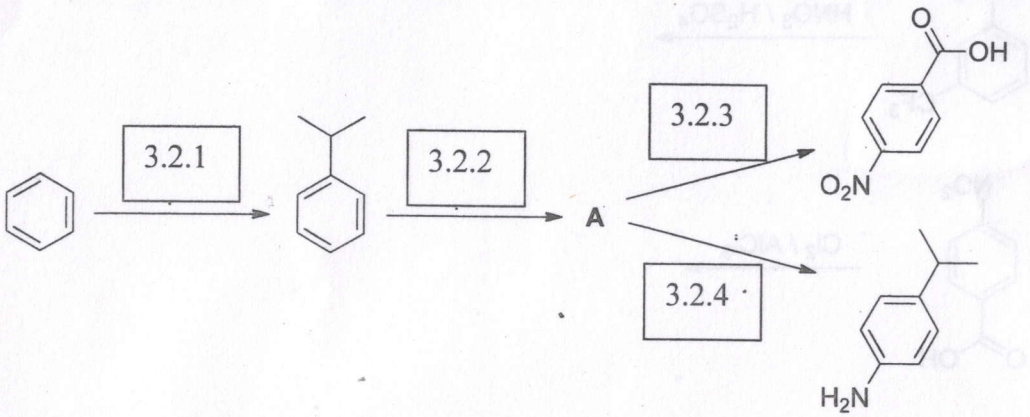

**03.**

3.1 Explain why the following Friedel-Crafts reaction does not produce the product expected as shown in the reaction. Write down the steps that need to be followed to get the desired product.
***(20 marks)***

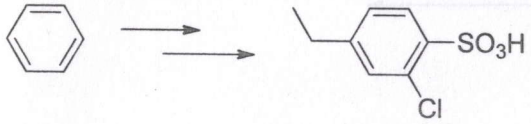


Index no:.....

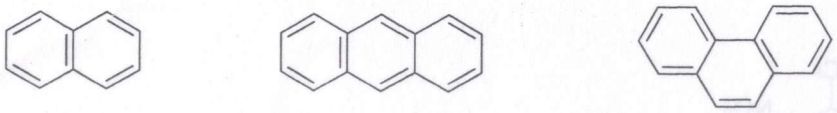
3.2 Write the appropriate chemical reagents and the intermediate products formed for the transformation given below. (***25 marks***)




3.3 Propose a multistep synthesis of the product shown below, starting from benzene. (***25 marks***)




3.4 Consider the following fused aromatic compounds.



3.4.1 Give the trivial names of the above compounds. (***10 marks***)

3.4.2 Arrange them in the order of increasing resonance stabilization energy. (***10 marks***)

3.4.3 Draw the major product(s) formed when each compound is reacted with one equivalent of $Br_2$ under appropriate conditions. (***10 marks***)

**04.**

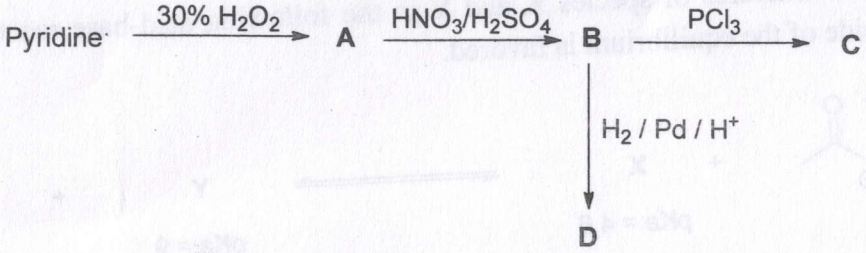
4.1 Explain the following.

4.1.1 The aromaticity of pyrrole, furan, and thiophene is in the following order:

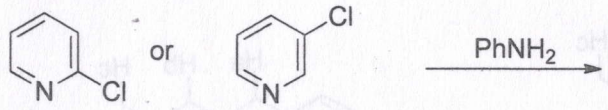
Furan < pyrrole < thiophene (***15 marks***)

4.1.2 Electrophilic substitution in pyrrole, furan, and thiophene occur preferentially at C-2 (the position next to the heteroatom) rather than at C-3. (***15 marks***)

4.2 Consider the following reaction scheme and draw the structures of **A**, **B**, **C** and **D**. (***20 marks***)



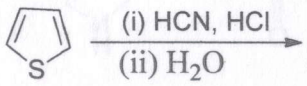

4.3 Depending on their structures, some heterocyclic compounds can undergo nucleophilic aromatic substitution reactions.

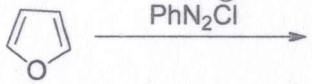


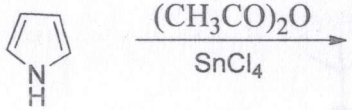

4.3.1 Of the reaction shown above, only **one** of the chloro pyridines reacts with aniline. Which chloro pyridine reacts? Explain. (***10 marks***)

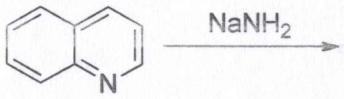
4.3.2 Draw the structure of the product of the above reaction and propose a reasonable mechanism for the formation of the product. (***10 marks***)

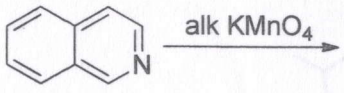
4.4 Predict the product expected from each of the following reactions. (***30 marks***)

4.4.1 


4.4.2 


4.4.3 

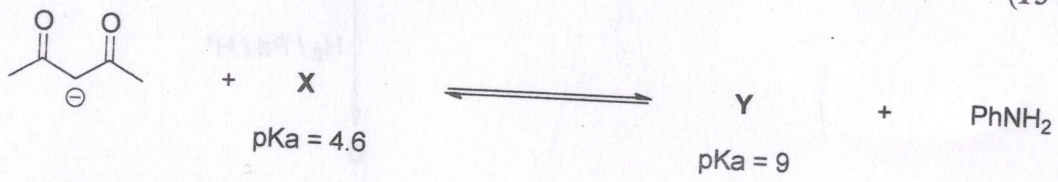

4.4.4 


4.4.5 

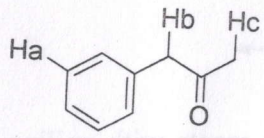
**05.**

5.1

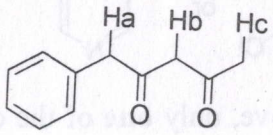
5.1.1 Draw the structures of species **X** and **Y** in the following acid-base reactions and predict which side of the equilibrium is favored. ***(15 marks)***



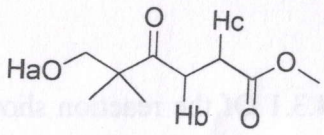

5.1.2 In each compound below, arrange the labelled hydrogens in order of increasing acidity. ***(15 marks)***




**P**

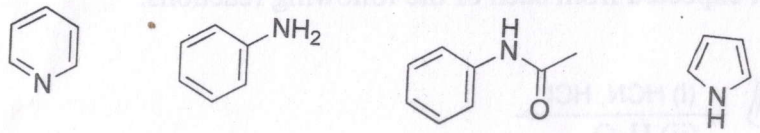



**Q**




**R**

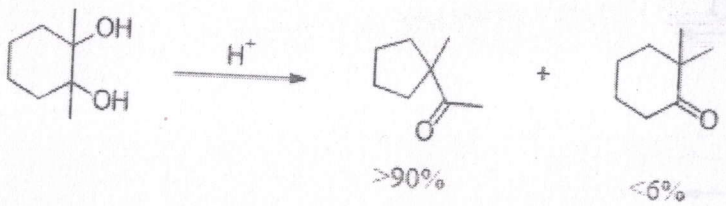
5.1.3 Two of the compounds below are bases and two are not. Identify the two bases and explain why they react with acids and why the other two compounds do not. ***(20 marks)***



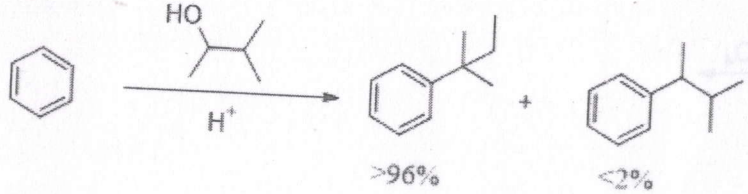

## PART B

5.2 Briefly explain each of the following observations using a plausible mechanism. ***(50 marks)***

5.2.1




5.2.2

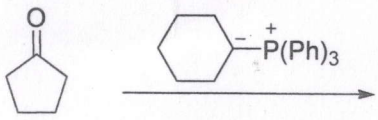


Index no:.....

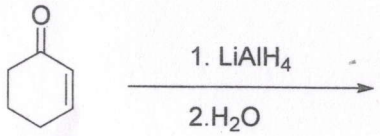
**06.**

6.1 Predict the major products of the following reactions. ***(30 marks)***

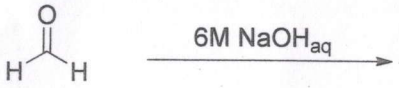
6.1.1



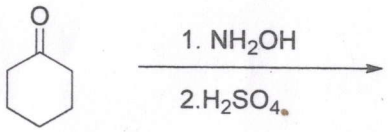

6.1.2



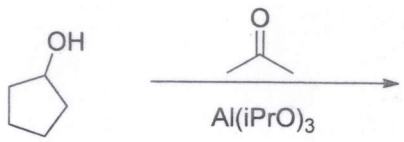

6.1.3




6.1.4



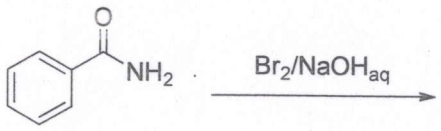

6.1.5




6.2 Draw the mechanism of formation of iodoform from acetone. ***(20 marks)***

6.3 Draw the major products of following reactions. Write the mechanisms for the formation of the major products. ***(50 marks)***

6.3.1




6.3.2


@@@@@@@@@@@@@@@@@@@@@@@@@@@@@