# BINDURA UNIVERSITY OF SCIENCE EDUCATION
## FACULTY OF SCIENCE
## CHEMISTRY DEPARTMENT

## BACHELOR OF SCIENCE EDUCATION HONOURS

## CH303: ORGANIC CHEMISTRY III



## 2 HOURS

**ANSWER QUESTION ONE AND FOUR OTHERS, TWO FROM EACH OF THE SECTIONS A AND B. EACH QUESTION CARRIES 20 MARKS.**

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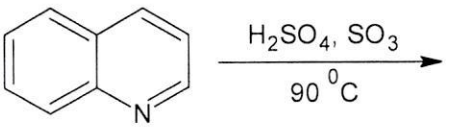
1. (a) What are the products of the following reactions:

(i)

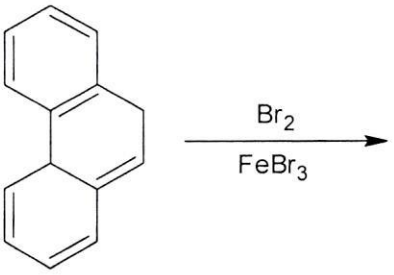



[2 marks]

(ii)


[2 marks]

(iii)




[2 marks]

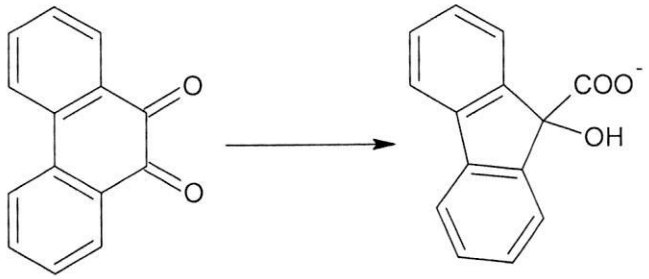
(b) Explain the basicity of pyrrole and pyridine [4+4 marks]

(c) Outline the mechanism of the reaction of a monosaccharide with periodic acid. [6 marks]

**SECTION A: ANSWER ANY TWO QUESTIONS FROM THIS SECTION**

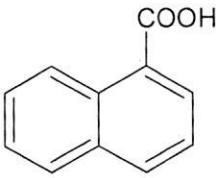
2. (a) (i) Suggest the reason why furan readily undergoes the diels-alder reaction while pyrrole and thiophene do not. [2 marks]

(ii) Suggest how pyrrole can be made reactive towards dienophiles [2 marks]



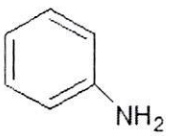

i) Name the mechanism [2 marks]
ii) Outline the mechanism [6 marks]

(b) Illustrate the different methods that can be used to prepare 1-naphthoic acid:

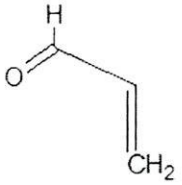



1-Naphthoic acid [8 marks]

3. (a) Propose a mechanism for the Skraup synthesis of quinoline starting from aniline and acrolein



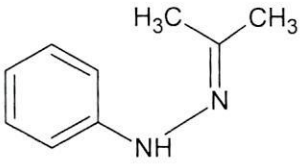

Aniline




Acrolein [10 marks]

(b) Compare electrophilic substitution on benzene with electrophilic substitution at the ring carbons of pyridine, highlighting factors that diminish the reactivity of pyridine. [10 marks]

4. (a) Propose a mechanism for the Fischer indole synthesis starting from the following structure:




[10 marks]

(b) Explain why the preference for electrophilic substitution is C2 for pyrrole whilst it is C3 for indole. [5 marks]

(c) Discuss the greater reactivity of indole compared to benzene. [5 marks]

**SECTION B: ANSWER ANY TWO QUESTIONS FROM THIS SECTION**

5. (a) (i) Illustrate how glucose react with dilute $HNO_3$? [3 marks]
(ii) Discuss importance of oxidation of glucose at C6 in drug metabolism? [3 marks]

(b) Explain with the aid of equations why it is difficult to distinguish between aldoses and ketoses using Tollen's reagent. [6 marks]

(c) Outline the mechanism of the reaction of D-fructose with $NaBH_4$. [8 marks]

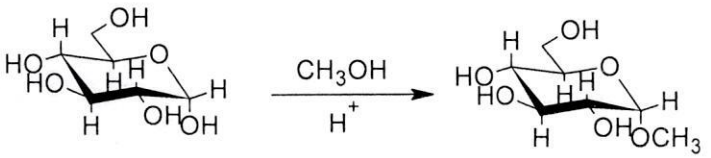
6. (a) (i) What is mutarotation? [2 marks]
(ii) Describe and explain changes in specific rotation that accompanies mutarotation. [5 marks]

(b) Draw the structure of a hypothetical methyl β-D-fructopyranoside, and predict the products from periodic acid oxidation. [13 marks]

7. (a) Propose the mechanism for the base-catalyzed epimerization of D-glucose to a mixture of D-glucose and D-mannose. [5 marks]

(b) Explain why β-D-glucopyranose react with $H_2$/Ni to give D-glucitol, but α-D-fructofuranose reacts with $NaBH_4$ to give a mixture of glucitol and mannitol? [5 marks]

(c) (i) Outline the mechanism for the following conversion of α-D-glucopyranose to methyl-α-D- glucopyranose.




[7 marks]

(ii) Draw the structure of the other product of this reaction [3 marks]

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