(University of Choice)

MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY (MMUST)

SPECIAL/ SUPPLEMENTARY EXAMINATIONS 2021/2022 ACADEMIC YEAR

SECOND YEAR SECOND SEMESTER EXAMINATIONS

FOR THE DEGREE OF BACHELOR OF SCIENCE (CHEMISTRY & INDUSTRIAL CHEMISTRY)

COURSE CODE: SCH 233/SCI 263

COURSE TITLE: AROMATICITY AND CHEMISTRY OF ARENES

DATE: 03.08.2022 **TIME:** 8.00AM -10.00AM

INSTRUCTIONS TO CANDIDATES

- Answer **ALL** questions

MMUST observes ZERO tolerance to examination cheating

This Paper Consists of 4 Printed Pages. Please Turn Over.

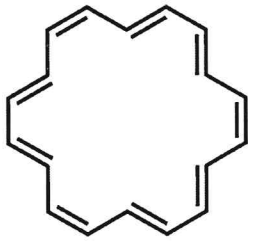
QUESTION ONE (18 Marks)

a) Huckel rule helps distinguish aromatic compounds from non aromatic compounds

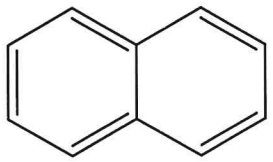
i) State Hückel's rule as used in aromaticity **(2 marks)**

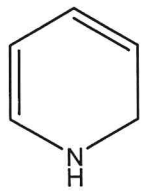
ii) What is the value of n in Hückel's rule when a compound has nine pairs of electrons? **(2 marks)**

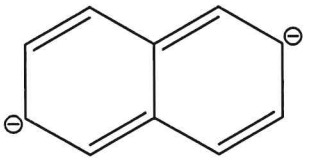
iii) Is such a compound aromatic? Explain using the structure below **(2 marks)**

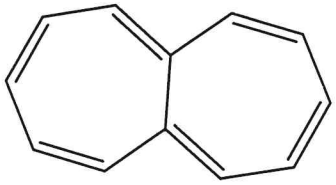


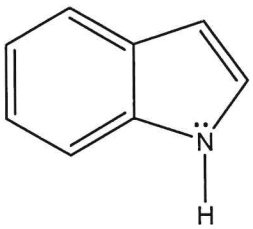
b) Classify the following molecules as aromatic, antiaromatic or nonaromatic. Give an explanation for your answer. **(6 marks)**

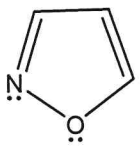
i) 

ii) 

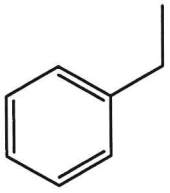
iii) 

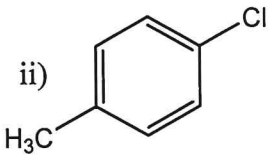
iv) 

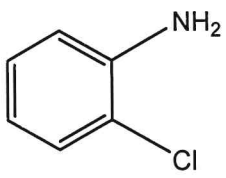
v) 

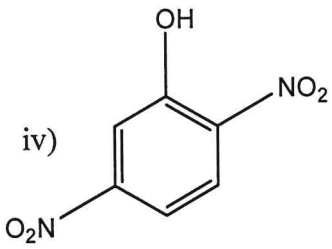
vi) 

c) Give the IUPAC names of the following compounds **(4 marks)**

i) 

ii) 

iii) 

iv) 

d) Alkenes undergo addition reactions whereas benzene normally undergoes substitution reactions. Explain why benzene doesn't normally undergo addition reactions. **(2 marks)**

QUESTION TWO (18 Marks)

a) Give the main difference between naphthalene and anthracene as used in Aromatic Chemistry **(4 marks)**

b) Explain the following reactions as used in aromatic chemistry **(6 marks)**

i) Halogenation

ii) Nitration

iii) Sulfonation

b) Give the reagents that will result to formation of the following two compounds. **(8 marks)**

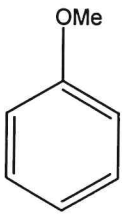
i) Bromobenzene

ii) Benzenesulfonic acid

QUESTION THREE (16 Marks)

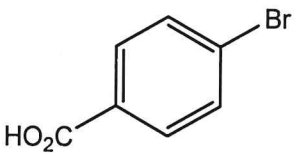
a) What is meant by the term 'çonjugation'? **(2 marks)**

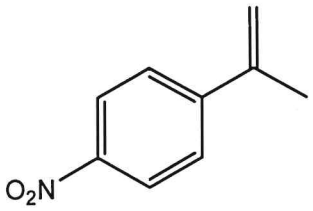
b) Indicate the resonance behavior of the aromatic compound below. The resonance to include the donation of electrons into the benzene ring. **(6 marks)**



c) Propose a multistep synthesis of the following compounds from benzene **(8 marks)**

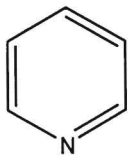
i)



ii) 

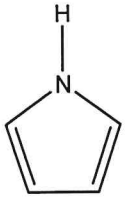
QUESTION FOUR (18 Marks)

a) In each of the following pairs, explain which molecule is more easily protonated **(6 marks)**

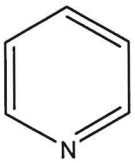
i) 

pyridine

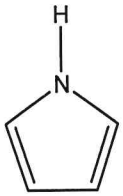

benzene

ii) 

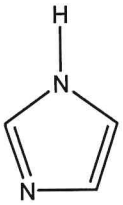
pyrrole



pyridine

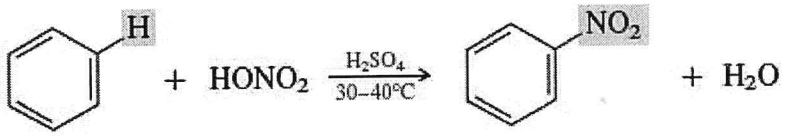
iii) 

pyrrole



imidazole

b) Given the reaction below;



i) Establish the importance of nitration in Benzene chemistry **(2 marks)**

ii) Write down the full mechanism of this reaction below **(10 marks)**