KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS
2019/2020 ACADEMIC YEAR

THIRD YEAR FIRST SEMESTER
SUPPLEMENTARY EXAMINATIONS

FOR THE DEGREE OF BSC (CHEMISTRY)

COURSE CODE: SCH 331

COURSE TITLE: CHEMISTRY OF AROMATIC COMPOUNDS

DATE: 1/02/21 **TIME:** 11 – 1 Pm

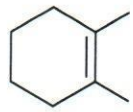
INSTRUCTIONS TO CANDIDATES:

TIME: 2 Hours

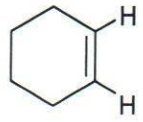
Answer question ONE and any TWO of the remaining

Question 1 (30 marks)

a) Draw the products if any and name the reactions occurring below**(5 marks)**

i  $KMnO_4/ H_2O$ ⟶

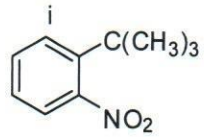
ii  $KMnO_4/ H_2O$ ⟶

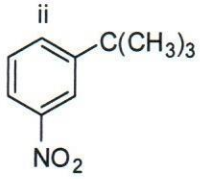
iii  Br , CCl_4 ⟶

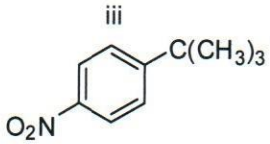
iv  Br , CCl_4 ⟶

v  H_2O / H^+ ⟶

b) Arrange the products according to the % yield obtained from the nitration of *t*-butylbenzene. Justify the order.**(1 marks)**

i 

ii 

iii 

c) Draw the formation of Cl^+ from $AlCl_3$ and Cl_2**(1½ marks)**

d) Draw the mechanism of the reaction between Cl^+ and a benzene.**(2½ marks)**

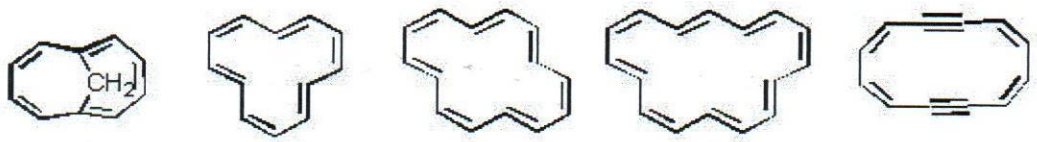
e) State the criteria for aromaticity **(4 marks)**

f) State Huckel's rule. **(1 mark)**

g) Discuss stability of benzene using resonance theory. **(4 marks)**

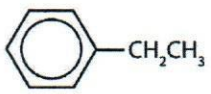
h) How many dibromobenzene's are possible?Name them**(4 marks)**

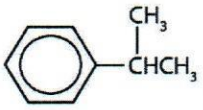
i) Which of the following structures are aromatic according to Hückel's rule?**(2 marks)**

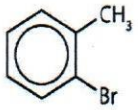


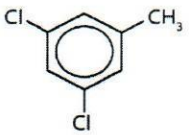
a b c d e

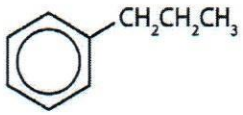
j) Name the following compounds. **(5 marks)**

i 

ii 

iii 

iv 

v 

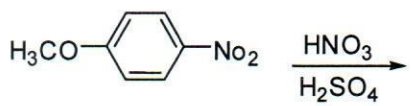
Question 2 (20 marks)

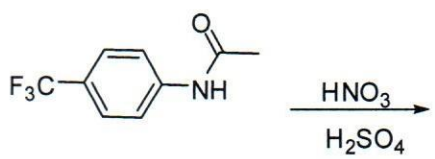
a) Differentiate between a phenyl and a benzyl group. **(2 marks)**

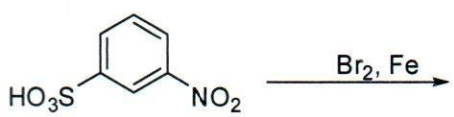
b)Toluene reacts with bromine to form *p*-bromotoluene outline the mechanism of these reaction showing the resonance forms of the cation.**(8 marks)**

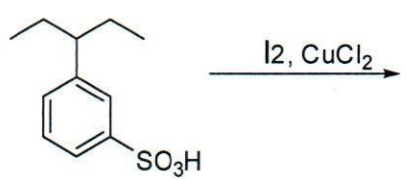
c) Draw the major product in each of the following reactions **(10 marks)**

i 

ii 

iii 

iv 

v 

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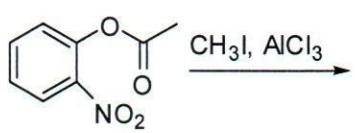
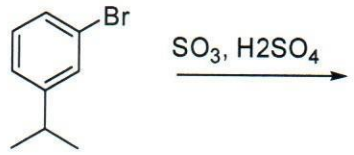
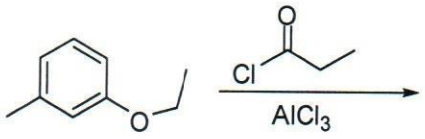
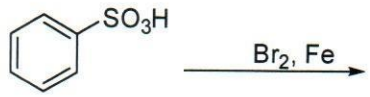
vii 

viii 

xi 

x 

Question 3 (20 marks)

a) What is meant by the prefixes meta, ortho, or para? Give an illustration.**(3 marks)**

b) Anthracene and phenanthracene can both be oxidized or reduced at position 9 or 10 explain. **(2 marks)**

c) Define the following; **(5 marks)**

i) Aromatic compound ii) Annulene iii) Canonical forms iv) Degenerate orbitals

v) Conjugated double bonds

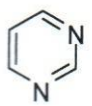
d) Give four criteria for aromaticity. **(4 marks)**

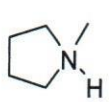
e) Draw and name any three annulenes of your choice.**(6 marks)**

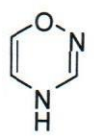
Question 4 (20 marks)

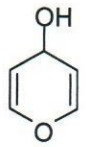
a) Describe the molecules as aromatic, anti-aromatic or non-aromatic assume all are planar. **(10 marks)**

i 

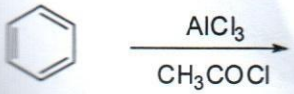
ii 

iii 

iv 

v 

b) Use curly arrows and any required charges to complete the step-by-step mechanisms for each of the following reaction schemes. **(10 marks)**

i 

ii  $\xrightarrow[CH_3CH_2Cl]{AlCl_3}$

Question 5 (20 marks)

a) Stability of benzene can be attributed to molecular orbital theory. With the help of diagrams, discuss how this theory depicts this concept. Indicate the bonding and antibonding MO's and the number of nodes in each case. **(20 marks)**