



MACHAKOS UNIVERSITY

University Examinations 2022/2023

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF PHYSICAL SCIENCES

THIRD YEAR SECOND SEMESTER EXAMINATION FOR
BACHELOR OF EDUCATION SCIENCE (SPECIAL NEEDS)

BACHELOR OF SCIENCE (ANALYTICAL CHEMISTRY)

BACHELOR OF EDUCATION (SCIENCE)

SCH 302: THE CHEMISTRY OF AROMATIC COMPOUNDS

DATE: 17/4/2023

TIME: 2:00 – 4:00 PM

INSTRUCTIONS:

- The paper consists of **two** sections.
- Section **A** is **compulsory** (30 marks).
- Answer any **two** questions from section **B** (each 20 marks).

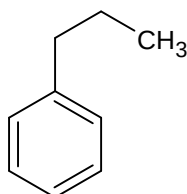
SECTION A

SECTION A: COMPULSARY

QUESTION ONE (30 MARKS)

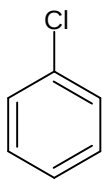
a) Provide the IUPAC name of the following chemical structures;

i.



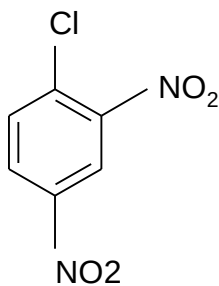
(1 mark)

ii.



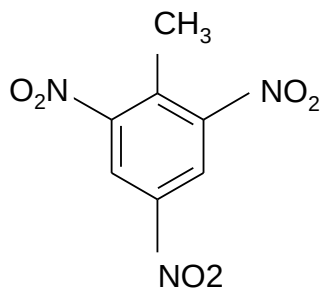
(1 mark)

iii.



(1 mark)

iv.



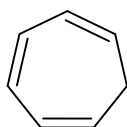
(1 mark)

b) State the criteria for aromaticity

(4 marks)

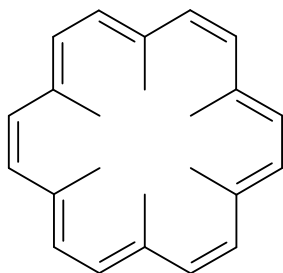
c) Classify the following chemical structures as aromatic, non-aromatic or anti aromatic, giving reasons.

i.



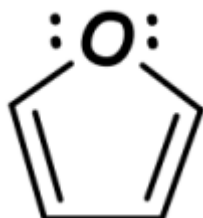
(2 marks)

ii.



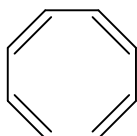
(2 marks)

iii.



(2 marks)

iv.



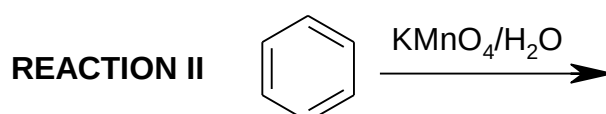
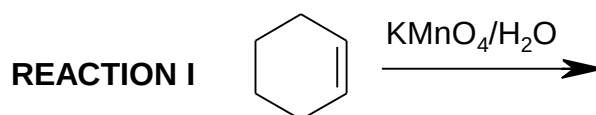
(2 marks)

v.



(2 marks)

d) Study the following chemical reactions then answer the questions that follow;

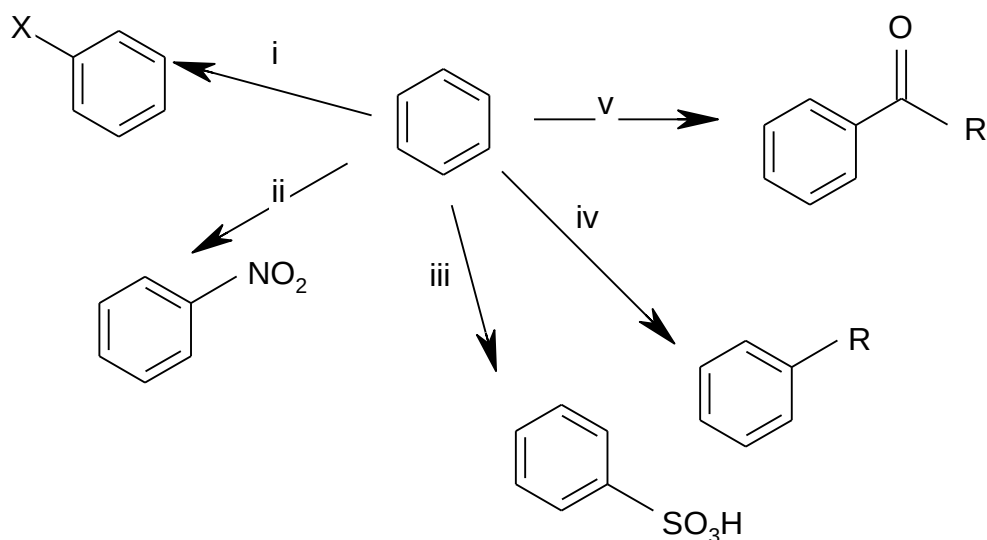


- i. Complete the above reactions (2 marks)
- ii. Explain the observations expected in the above reactions (2 marks)
- e) State four instrumental methods that can be used to analyse polycyclic aromatic compounds (4 marks)
- f) List two examples of each of the following;
 - i. Strong electron withdrawing group (2 marks)
 - ii. Strong electron donating group (2 marks)

SECTION B: ATTEMPT ANY TWO QUESTIONS

QUESTION TWO (20 MARKS)

Study the schematic presentation of benzene reactions below and answer the questions that follow;

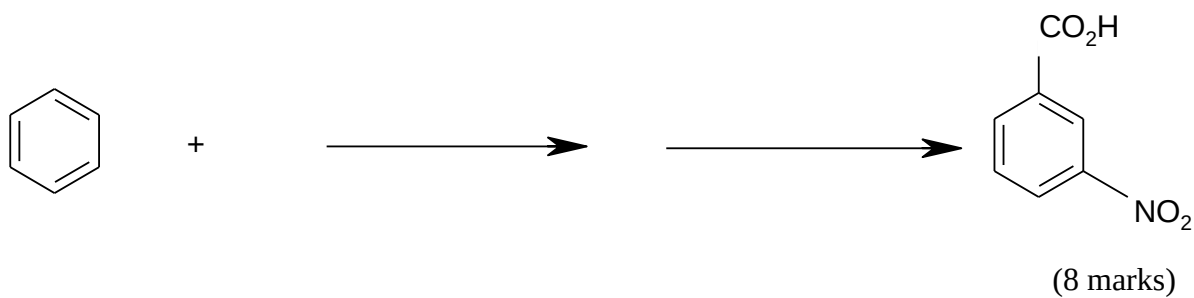


- a) Given that X=F, Br, Cl or I and R=alkyl group. Identify the reaction i-v in the above scheme (5 marks)
- b) Determine the appropriate reagents for each of the above reactions, i-v. (5 marks)
- c) Illustrate the mechanism for reaction (ii) in the above scheme (5 marks)
- d) Illustrate the mechanism for reaction (iii) in the above scheme (5 marks)

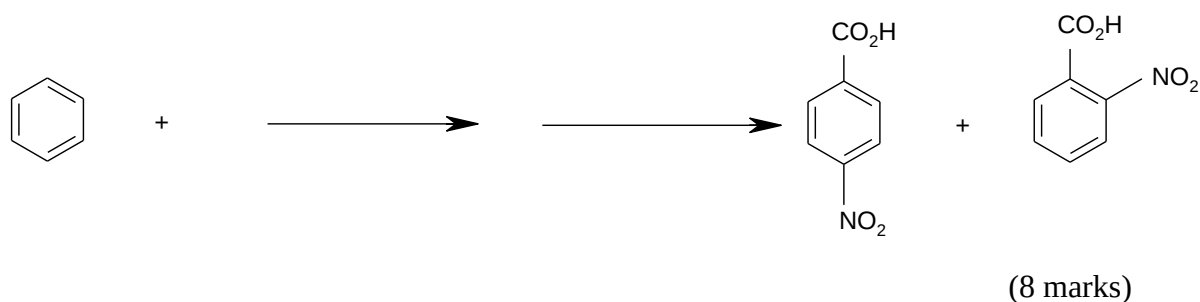
QUESTION THREE (20 MARKS)

a) Describe how the following transformations can be achieved;

i.



ii.



b) Explain the effect of the following to the benzene ring

i. Electron withdrawing groups

(2 marks)

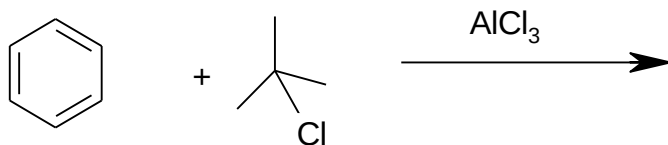
ii. Electron donating groups

(2 marks)

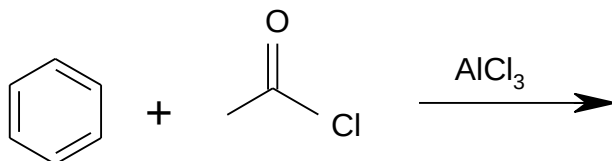
QUESTION FOUR (20 MARKS)

Study the following equations and answer the questions that follow;

Equation I



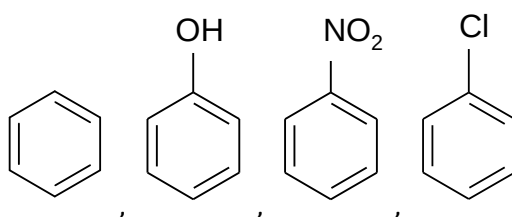
Equation II



- a) Identify the type of reactions above (2 marks)
- b) Complete the above reactions (2 marks)
- c) Illustrate the mechanisms for the above reactions (10 marks)
- d) Explain the limitations of type of reactions in equation I above (4 marks)
- e) State the advantage of the products of equation II in synthetic reactions (2 marks)

QUESTION FIVE (20 MARKS)

- a) Describe briefly a laboratory test for identifying aromatic compounds (3 marks)
- b) Explain five precautions to be taken when working in an organic chemistry laboratory especially on reactions involving aromatic compounds (5 marks)
- c) Explain the Kekule proposal structure for benzene and give its limitations (5 marks)
- d) Study the aromatic compounds listed below and answer the questions that follow;



- i. Arrange the above aromatic compounds from least reactive to most reactive (4 marks)
- ii. Explain your answer in (d) i above (3 marks)