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# KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS  
2017/2018 ACADEMIC YEAR

THIRD YEAR SECOND SEMESTER  
SUPPLEMENTARY/SPECIAL EXAMINATIONS

FOR THE DEGREE OF BACHELOR OF SCIENCE

**COURSE CODE:** SCH 331

**COURSE TITLE:** CHEMISTRY OF AROMATIC COMPOUNDS  
**DURATION:** 2 HOURS

**DATE:** 02/10/2018

**TIME:** 8-10PM

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## INSTRUCTIONS TO CANDIDATES

- Answer **QUESTION ONE** (Compulsory) and any other two (2) Questions.
- Indicate **answered questions** on the front cover.
- Start every question on a new page and make sure question's number is written on each page.

This paper consists of 5 printed pages. Please Turn Over



KIBU observes ZERO tolerance to examination cheating

SECTION A

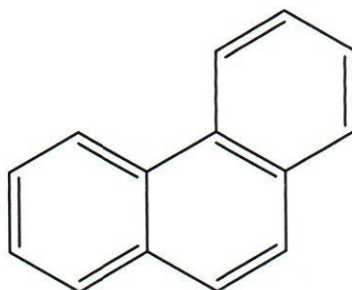
QUESTION ONE COMPULSORY (30 MARKS)

- (a) Draw structures of the following compounds
- 3 - nitrotoluene
  - 2- methyl - 3 - bromophenathrene
  - 2 - phenylethanol
- (3 mks)
- (b) Name and draw structures of any five common benzoid aromatic compounds (5 mks)
- (c) Write chemical equations and name the products for the reaction between pyridine and each of the following reagents/conditions
- $\text{HNO}_3/\text{H}_2\text{SO}_4$
  - $\text{H}_2\text{SO}_4$  (i)
  - Explain why pyridine fails to undergo the Friedel-Crafts reaction
- (4 mks)
- (d) State and explain whether the following compounds are aromatic, anti-aromatic or non-aromatic

i.



ii.



iii.



iv.



v.



(10 Marks)

- (e) How will you distinguish between
- Benzene and cyclohexene (2 mks)
  - Toluene and styrene (2 mks)
  - Benzene and toluene (2 mks)

SECTION B : ANSWER ANY TWO QUESTIONS

## QUESTION TWO (20 MARKS)

- (a) Methylbenzene was prepared by treatment of benzene with methyl bromide in the presence of a Lewis acid.
- Write an equation and suggest a plausible mechanism for the reaction. (6 mks)
  - state five limitations of the above method for the synthesis of alkylated benzenes (5 mks)
- (b) Starting with benzene, outline the synthesis of a butylbenzene (5 mks)
- (c) (i) Explain why (i) toluene is more reactive towards electrophiles compared to benzene (2 mks)
- (ii) Nitrobenzene is less reactive towards electrophile substitutions compared to benzene (2 mks)

## QUESTION THREE (20 MARKS)

- (a) Starting with benzene, outline the synthesis of anthracene (10 mks)
- (b) Write chemical equations for the reactions of anthracene in the presence of the following reagents and conditions
- concentrated sulfuric acid at 40<sup>o</sup>c (2 mks)
  - Acidified potassium dichromate (2 mks)
  - Metallic sodium in ethanol under reflux (2 mks)
- (c) State four uses of anthracene
- Artificial production of the red dye alizarin
  - wood preservations, insecticides and wadding materials
  - Organic semi-conductor (4 mks)

## QUESTION FOUR (20 MARKS)

- (a) Using a circle and polygon diagram, predict the stability, reactivity and geometry of cyclooctatetraene (COT) (10 mks)
- (b) Explain the causes of stability in benzene (2 mks)
- (c) Give three conditions that must be exhibited by an aromatic compound (3 mks)
- (d) (i) Define the term 'annulene' (1 mk)
- (ii) Give any structures of annulenes with their corresponding names (4 mks)

## QUESTION FIVE (20 MARKS)

- (a) Starting with benzene and chloroethanol, outline a reaction for the Friedel-Crafts acylation, followed by a Clemmensen reduction. (8 mks)

- (b) Suggest a plausible stepwise synthesis of 1, 3, 5 - trinitrotoluene (TNT) using benzene and other common laboratory reagents. (6 marks)
- (c) Indicate the missing reagents/products (A-D) in the reaction scheme below (4 marks)

