



25

# KIBABII UNIVERSITY

**UNIVERSITY EXAMINATIONS  
2017/2018 ACADEMIC YEAR**

**THIRD YEAR FIRST SEMESTER  
MAIN EXAMINATIONS**

**FOR THE DEGREE OF B.ED (SCIENCE)**

**COURSE CODE: SCH 331**

**COURSE TITLE: CHEMISTRY OF AROMATIC COMPOUNDS**

**DURATION: 2 HOURS**

**DATE: 9<sup>TH</sup> JANUARY 2018 TIME: 2 – 5PM**

---

### 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



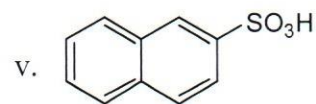
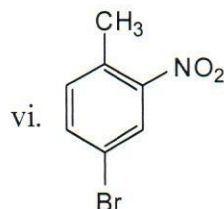
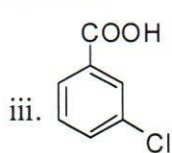
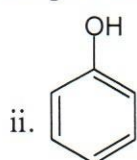
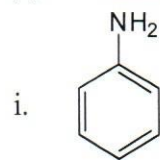
KIBU observes ZERO tolerance to examination cheating

## SECTION A

### QUESTION ONE COMPULSORY (30 MARKS)

#### QUESTION ONE

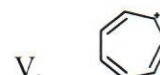
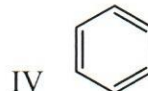
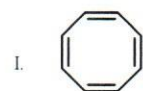
(a) name the compounds shown below



(5 Marks)

(b) (i) State three conditions necessary for a compound to be aromatic (3 Marks)

(ii) With reasons classify the following compounds as aromatic, anti-aromatic or non-aromatic



(2 Marks each)

(c) Starting with benzene, outline the synthesis of each of the following compounds

(i) 2-phenylethanol

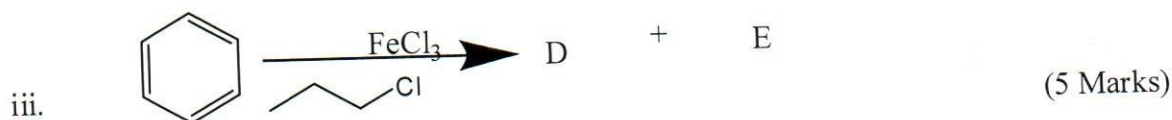
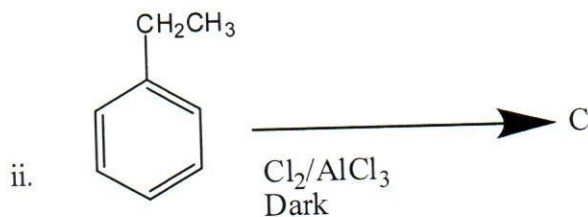
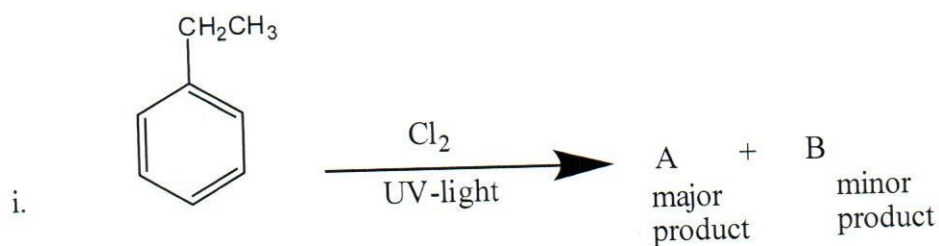
(ii) 1-methyl-2,4,6-trinitrobenzene

(iii) p-bromobenzoic acid

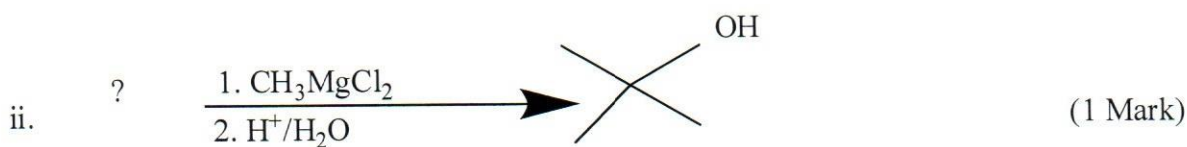
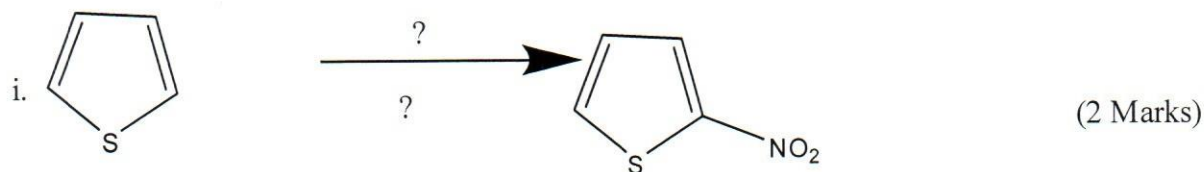
(6 Marks)

**SECTION B (40 MARKS)**  
**ANSWER ANY TWO QUESTIONS FROM THIS SECTION**

- (a) Explain the following observations for electrophilic aromatic substitutions on benzene.
- (i) A methoxy group (-OCH<sub>3</sub>) is a ring activator while a nitro group (-NO<sub>2</sub>) is deactivating (4 Marks)
- (ii) an ethyl group (-CH<sub>2</sub>CH<sub>3</sub>) is an ortho - para director (3 Marks)
- (b) Identify the products A to E in the reactions below



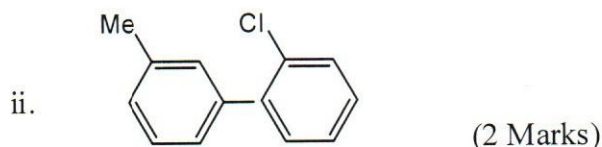
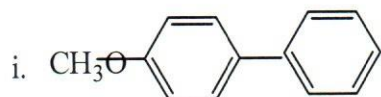
- (c) Indicate the missing reagents/reactants in the reactions below



(d) State five drawbacks of the Friedel-Crafts alkylation (5 Marks)

### QUESTION THREE (20 MARKS)

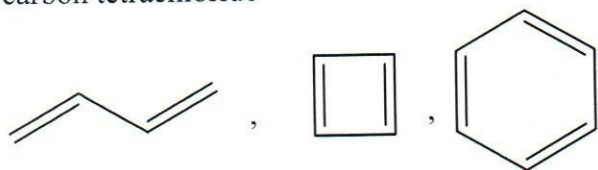
- (a) How will you distinguish between
- Toluene and styrene (2 Marks)
  - benzene and cyclohexane (2 Marks)
  - cyclobut-1,3-diene and but-1,3-diene (2 Marks)
- (b) Write equations for the coupling reactions of phenol to *p*-Hydroxybenzoic acid (6 Marks)
- (c) Show the three steps in the Kolbe reaction for the conversion of phenol to *o*-hydroxybenzoic acid. (6 marks)
- (d) Name the following compounds:-



### QUESTION FOUR (20 MARKS)

- (a) Write equations for the reaction of naphthalene with each of the following reagents, and the products formed in each case
- Nitric acid with a few drops of concentrated sulfuric acid (2 Marks)
  - Bromine with iron (iii) bromide (2 Marks)
  - Concentrated sulfuric acid (2 Marks)
  - Sodium metal in ethanol (2 Marks)

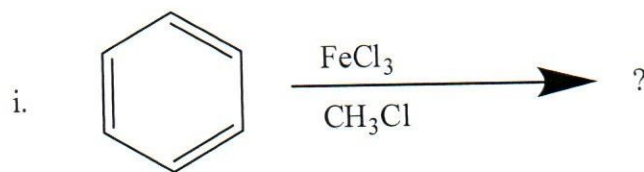
(b) (i) Arrange the following compounds in order of increasing reactivity towards bromine in carbon tetrachloride



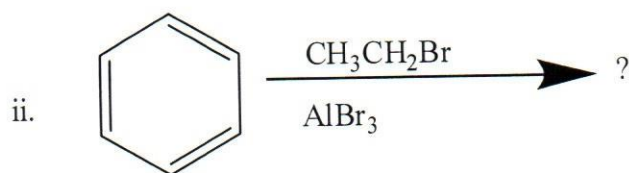
(1 Mark)

(ii) Explain your order in b(i) above

(c) Write a mechanism for the reactions below



(4 Marks)



(4 Marks)

### QUESTION FIVE (20 MARKS)

- (a) Benzene is considered to be a hybrid of five resonance forms. Write down the five resonance structures of benzene (5 Marks)
- (b) Draw the  $\pi$ -molecular orbital structure of benzene (2 Marks)
- (c) Pyridine is more basic than pyrrole, but less basic than aliphatic amines. Explain this statement. (5 Marks)
- (d) Write equations for the reactions of naphthalene with
- (i) Acidified potassium permanganate
- (ii) Iron (iii) bromide/bromine (2 Marks)