



NATIONAL OPEN UNIVERSITY OF NIGERIA  
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JABI - ABUJA.

FACULTY OF SCIENCES  
DEPARTMENT OF CHEMISTRY  
2024 1 EXAMINATION

COURSE CODE: CHM 305  
COURSE TITLE: ORGANIC CHEMISTRY III  
COURSE UNIT: 3  
TIME: 3 HOURS  
INSTRUCTION: Answer question one and any other three questions.

#### QUESTION ONE

(1a) Provide the chemical structure and IUPAC name of the product obtained when butanol reacted with acidified potassium dichromate. What is the practical significance of this reaction? (5 marks)

(1b) Arrange the following in order of decreasing acidity: 2-bromobutanoic acid, butanoic acid, 3-bromobutanoic acid, 2-methylbutanoic acid, and 3-methylbutanoic acid (Use the chemical structures of the compounds). (10 marks)

(1c) Review the solubility of carboxylic acids in water. (5 marks)

(1d) Show the detailed steps in the reaction of Grignard reagent and carbon(IV) oxide. (5 marks)

#### QUESTION TWO

(2a) Write out the general formula for ethers and give examples of three ethers you know. (4 marks)

(2b) Using an alkene, discuss the concept of oxymercuration-demercuration in the synthesis of ether (Detailed chemical structure only). (6 marks)

(ii) Mention three methods of preparing epoxides (Chemical structures compulsory). (5 marks)

#### QUESTION THREE

(3a) With the aid of chemical structures, illustrate five methods of synthesizing alcohol. (10 marks)

(3b) Why is water more acidic than alcohol? (5 marks)

#### QUESTION FOUR

(4a) List three ways of ensuring that primary alcohols are oxidized to aldehydes only when using acidified potassium heptaoxodichromate. (4<sup>1/2</sup> marks)

(4b) What is the product of the reaction of hexan-1-ol with metallic copper at 300 °C? (3 marks)

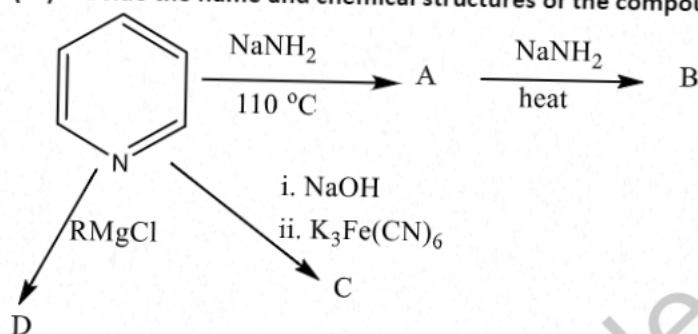
(4c) Demonstrate how aldehyde or ketone can be transformed to  $\alpha$ -hydroxycarboxylic acid using KCN, dilute  $H_2SO_4$ , and conc. HCl. (7<sup>1/2</sup> marks)

#### QUESTION FIVE

(5a) What is a heterocyclic compound? List five examples of heterocyclic compounds. (4 marks)

(5b) The Reimer-Teimann reaction of pyrrole produces an important synthetic intermediate. Provide the name and structure of the compound. (3 marks)

(5c) Provide the name and chemical structures of the compounds labelled A-D.



(8 marks)

#### QUESTION SIX

(6a) Draw the structures of butan-1,4-dioic acid, pentan-1,5-dioic acid, and 3-methylhexan-1,6-dioic acid. (3 marks)

(6b) Using chemical structures, describe any five reactions of dicarboxylic acid. (5 marks)

(6c) Demonstrate how you can synthesize 2-ethyl-3-oxobutanoic acid from acetoacetic ester. (7 marks)