



JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY
SCHOOL OF BIOLOGICAL AND PHYSICAL SCIENCES
UNIVERSITY EXAMINATION FOR THE DEGREE OF BACHELOR OF EDUCATION
(SCIENCE)
4TH YEAR 1ST SEMESTER 2019/2020
MAIN REGULAR

COURSE CODE: SCH 401

COURSE TITLE: Heterocyclic Chemistry

EXAM VENUE: STREAM: (B.ED SCI)

DATE:

EXAM SESSION:

TIME: 2:00 HRS

Instructions:

- 1. Answer question 1 (Compulsory) in Section A and ANY other 2 questions in Section B.**
- 2. Candidates are advised not to write on the question paper.**
- 3. Candidates must hand in their answer booklets to the invigilator while in the examination room**

Section A - Compulsory

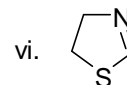
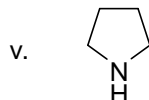
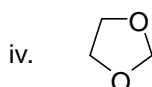
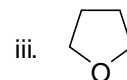
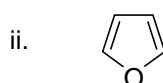
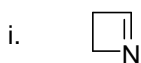
Question one (30 marks)

- a) Draw the structures of the following compounds shown below: [6 marks]
- i. Pyrazole
 - ii. Thiophene-3-carboxylic acid
 - iii. 1,3,4-oxadiazole
 - iv. 3,4-dimethyl-1H-pyrole
 - v. 1,2,4-oxathiazine
 - vi. Pyrrolidine
- b) Account for the aromatic properties of the imidazole ring. [4 marks]
- c) What structural features do the following stems that follow prefixes indicate in the nomenclature of heterocycles: [6 marks]
- i. -ir
 - b. -et
 - c. -oc
 - d. -ol
- d) Name any **FIVE** sulfonamides that are still in use as medicine. [2.5 marks]
- e) Name any **FIVE** pharmaceutical that contain the pyridine ring and what they treat. [2.5 marks]
- f) Draw the structures of the following three natural heterocyclic compounds. [3 marks]
- a) Quinine
 - b) Furanose
 - c) Pyranose
- g) State the names of any **THREE** oxygen containing heterocycles. [2 marks]

SECTION B

Question 2 (20 marks)

- a) Few heterocycles are known in nature where sulfur is the sole heteroatom in the ring. Draw the structure of **TWO** such compounds of thiophene derivatives. [4 marks]
- b) What are the names of the **FIVE** nucleobases that form the monomeric building blocks found in living systems? Draw the structures of their nucleosides. [10 marks]
- c) Give the names of the following heterocyclic compounds [6 marks]

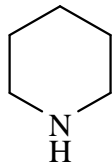


Question 3 (20 marks)

- a) Most vitamins have heterocycles moieties. State any **FOUR** of these. [4 marks]
- b) Draw the structure for the following heterocycles. [4 marks]
- Thiacyclobutane
 - Aziridine
 - Oxetane
 - Oxirane
- c) The only phosphorus-containing ring system found in nature is a cyclic derivative of phosphoric acid.
- State its name [1 mark]
 - Give the name of its phosphoric cyclic ring system [2 marks]
 - Outline its activity in humans [3 marks]
- d) Oxygen containing heterocycles may be cataloged as derivatives of Furan, pyran and benzofuran ring systems. Name an example for each and show their respective structures. [6 marks]

Question 4 (20 marks)

- a) Describe and Illustrate the Hofmann exhaustive methylation process for the identification of cyclic amines using piperidine as an example. [10 marks]



- b) Name any **TWO** common porphyrins and their associated uses in the living system of plants and animals. [4 marks]
- c) Name any **THREE** pharmaceuticals that contain the pyrimidine ring and what they treat [3 marks]
- d) Briefly discuss the order of reactivity of pyrrole, furan and thiophene towards electrophiles. [3 marks]

Question 5 (20 marks)

- a) Define the following terms;
- Fused rings [2 marks]
 - Homocyclic compounds [2 marks]
- b) Using structures differentiate between pyridine and pyrimidine [3 marks]
- c) Pyrrole tends to polymerise in presence of strong acids but pyridine remains unaffected. [3 marks]
- d) Explain, giving reasons, the preferred electrophilic and nucleophilic substitution positions in pyridine. [3 marks]
- e) Name any **TWO** vitamins that contain heterocyclic systems [3 marks]
- f) Following the Hantzsch – Widman Nomenclature name the chemical structures drawn below. [4 marks]

