KISII UNIVERSITY
UNIVERSITY EXAMINATIONS

FOURTH YEAR EXAMINATION FOR THE AWARD OF THE DEGREE OF BACHELOR OF SCIENCE IN INDUSTRIAL CHEMISTRY

SECOND SEMESTER 2021/2022
(FEBRUARY-JUNE, 2022)

CHEM 462: ADVANCED HETROCYCLIC CHEMISTRY

STREAM: : Y4S2 **TIME: 2 HOURS**

DAY: MONDAY, 8.00 AM – 11.00 AM **DATE: 00/05/2022**

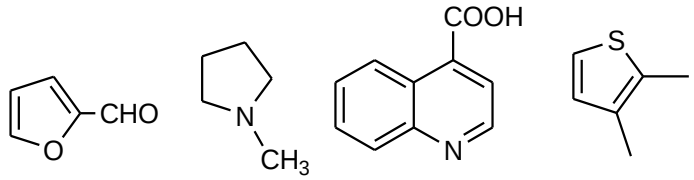
INSTRUCTIONS:

1. ***Do not write anything on this question paper.***
2. **Answer ALL Questions in Section A and any other two in Section B.**

SECTION A (40MKS)

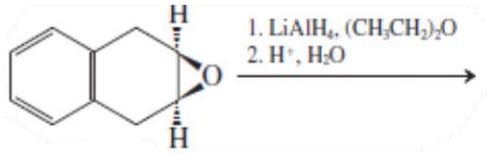
1. a. Draw the following compounds. (8 marks)
   i. *cis*-2,3-Diphenyloxacyclopropane
   ii. 3-azacyclobutanone
   iii. 1,3-oxathiacyclopentane;
   iv. 2-butanoyl-1,3-dithiacyclohexane;

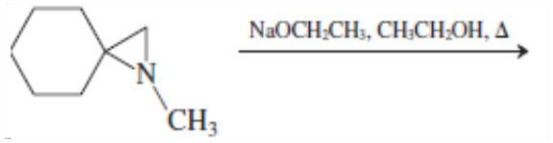
   b. Name the following compounds. (8 marks)

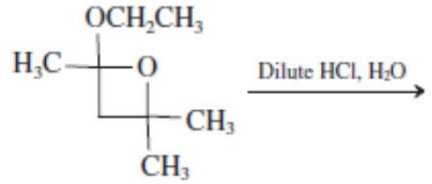


i ii iii iv

   c. Give the expected product of each of the following reaction sequences. (6 marks)

i. 

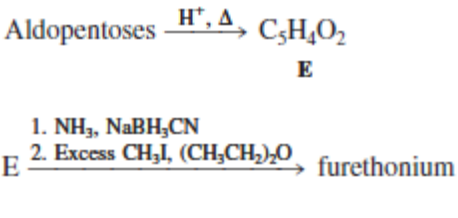
ii 

iii. 

d. Rank the following compounds in increasing order of basicity: water, hydroxide, pyridine, pyrrole and ammonia. (5 marks)

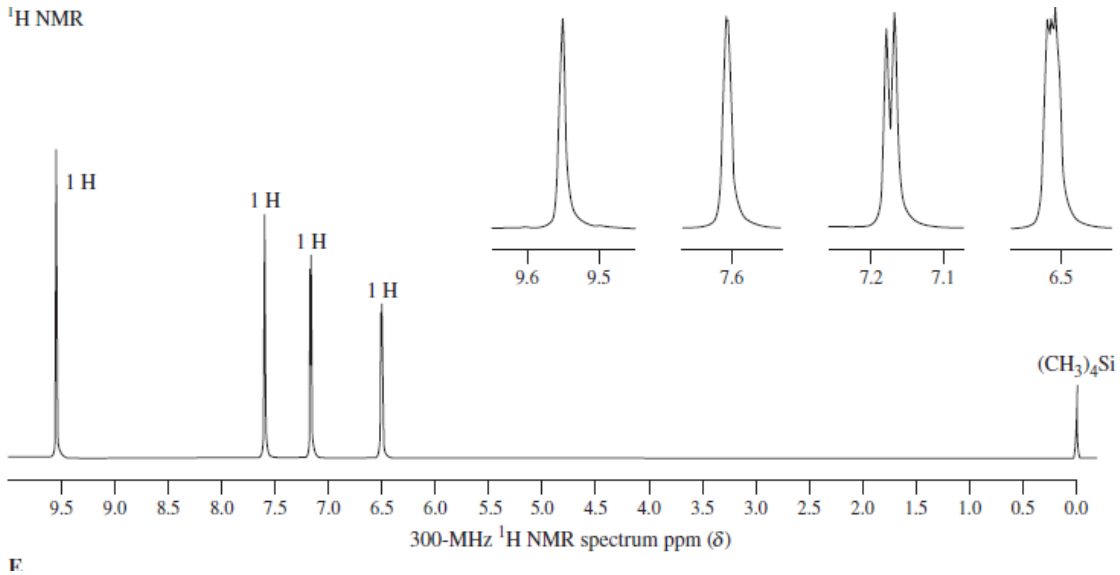
e. Give the reasons as to why isPyrrole is a much weaker base than azacyclopentane (pyrrolidine). (4 marks)

f. in the following reaction scheme compound E is a valuable synthetic starting material. The following sequence convertsit into furethonium, which is useful in the treatment of glaucoma. What is the structure of furethonium? (7 marks)

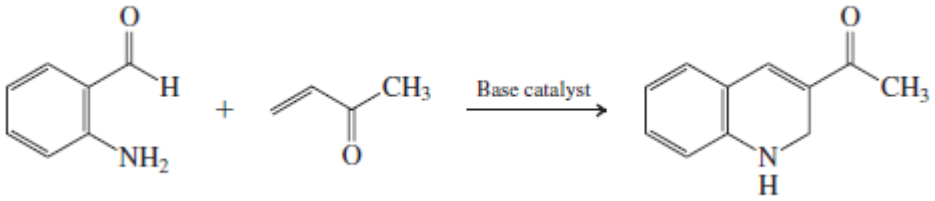


SECTION B (30MKS)

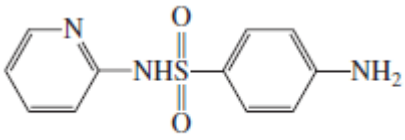
2. The commercial synthesis of a useful heterocyclic derivative requires treatment of a mixture of aldopentoses (derived from corncobs, straw, etc.) with hot acid under dehydrating conditions. The product, E, has 1H NMR spectrum E, shows a strong IR band at 1670 cm21, and is formed in nearly quantitative yield. Identify compound E and formulate a mechanism for its formation. (15mks)



3. Quinolines are heterocycles that are widely used in medicinal chemistry because of the diversity of biological activity — including anticancer utility — that their derivatives display. A short synthesis of 3-cyldihydroquinolines (which may be converted into 3-acylquinolines by mild oxidation) is shown below. Propose a mechanism for this process. (15 marks)



4. Starting with benzenamine (aniline) and pyridine, propose a synthesis for the antimicrobial sulfa drug sulfapyridine.



Sulfapyridine