

CHUKA



UNIVERSITY

## UNIVERSITY EXAMINATIONS

## EXAMINATION FOR THE AWARD OF DEGREE OF BACHELOR OF SCIENCE IN CHEMISTRY

CHEM 438: HETEROCYCLIC CHEMISTRY

STREAMS: BSC CHEMISTRY

TIME: 2 HOURS

DAY/DATE: THURSDAY 23/09/2021

2.30 P.M – 4.30 P.M.

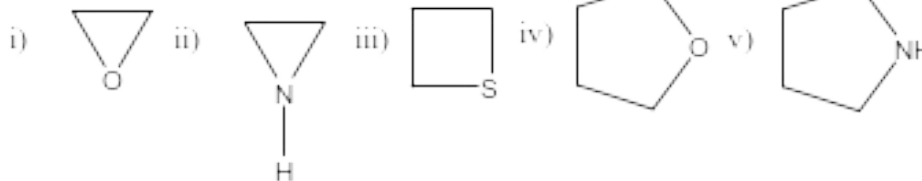
INSTRUCTIONS:

- ANSWER QUESTION ONE AND ANY OTHER TWO QUESTIONS

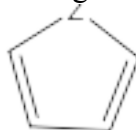
## QUESTION ONE (30 MARKS)

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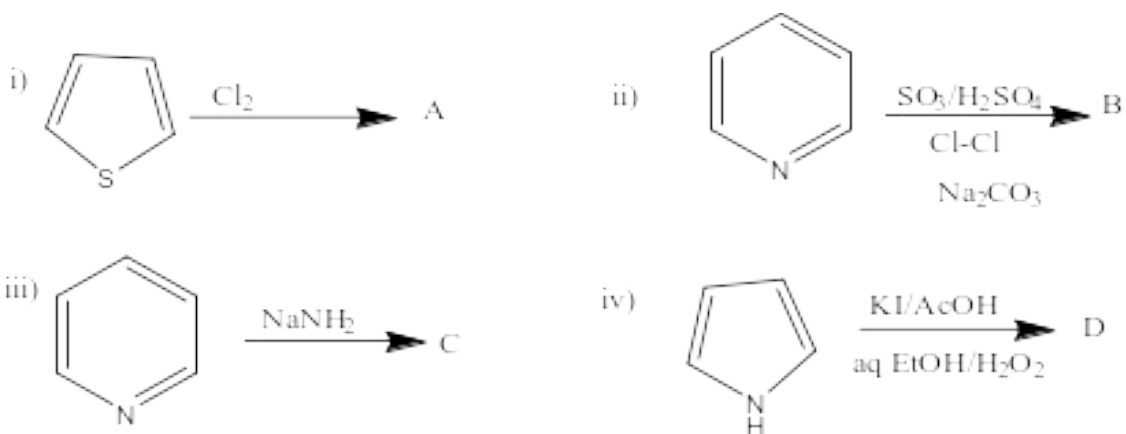
- a) Give the IUPAC name of the following heterocycles (5 marks)



- b) Write the resonance structure of the following five membered heterocycle (4 marks)

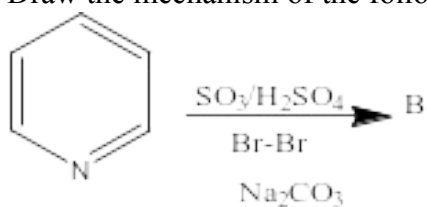


- c) Give two reasons why electrophilic aromatic substitutions for  $\pi$ -excessive heterocyclic aromatic compounds are faster than Benzene (2 marks)
- d) Give the product(s) of the following reactions (5 marks)

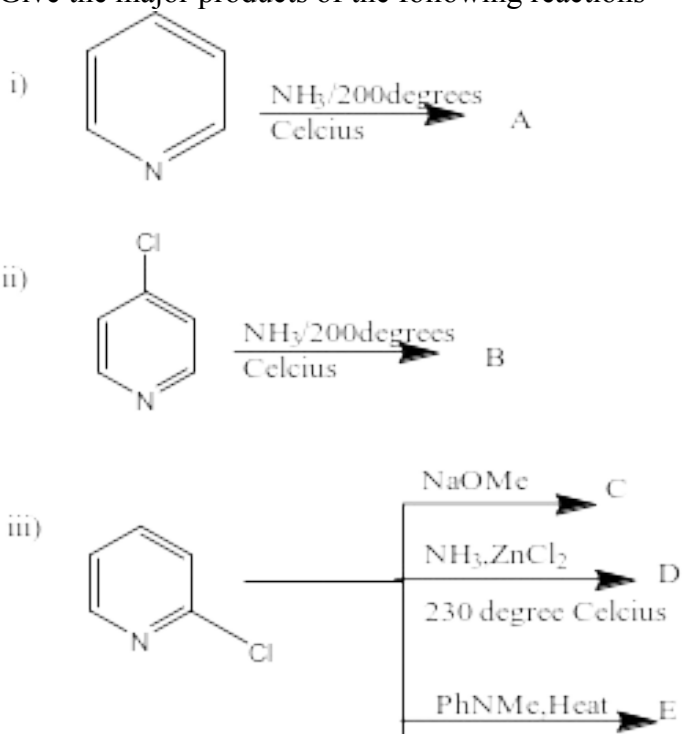


e) Explain two key differences between the structure of pyridine and benzene. (4 marks)

f) Draw the mechanism of the following reaction. (5 marks)



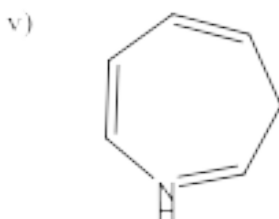
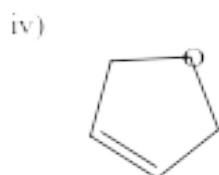
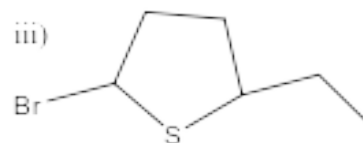
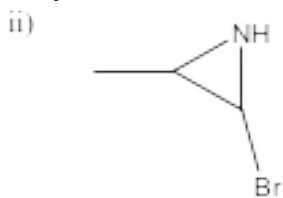
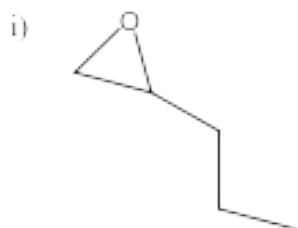
g) Give the major products of the following reactions (5 marks)



**QUESTION 2 (20 MARKS)**

a) Name the following heterocycles

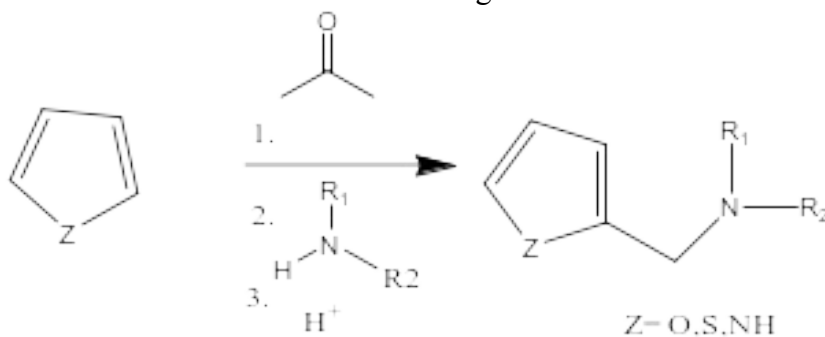
(5 marks)



b) Explain the electrophilic aromatic substitution reaction of five membered aromatic heterocycles is regioselective to the  $\alpha$ -position (5 marks)

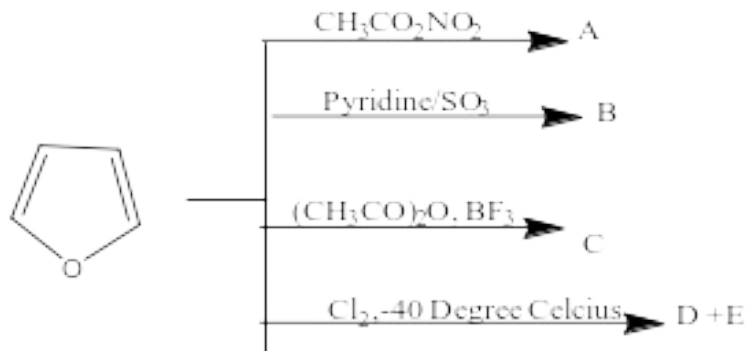
c) Write the mechanism of the following Mannich reaction (5 marks)

(5 marks)



d) Complete the following reactions

(5 marks)

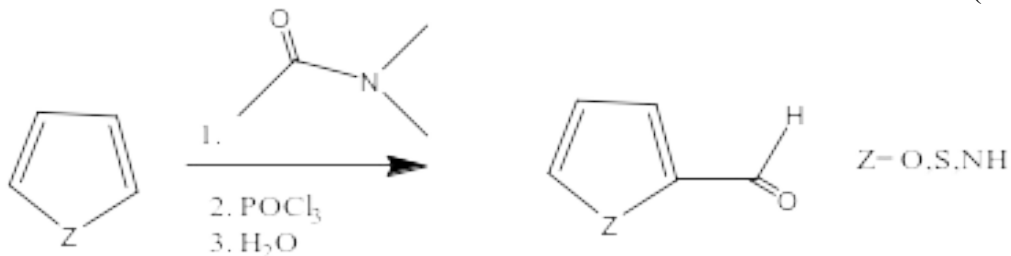


**QUESTION 3(20 MARKS)**

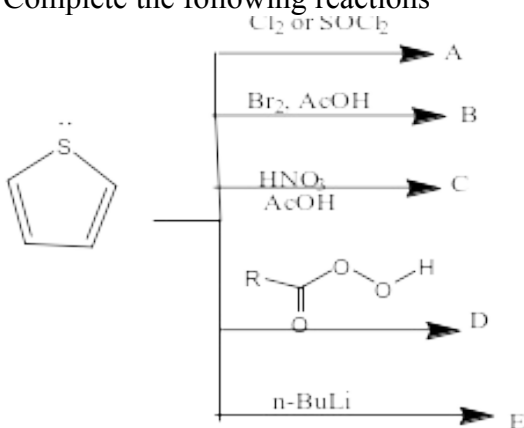
a) Draw the structures of the following compounds (5 marks)

- i. 2,3-Dihydroazepine
- ii. 1-ethyl-4-methyl-4,5-dihydroazepine
- iii. 1,3,5-Triazine
- iv. 1,2,4-Triazole
- v. 1,4-oxazine

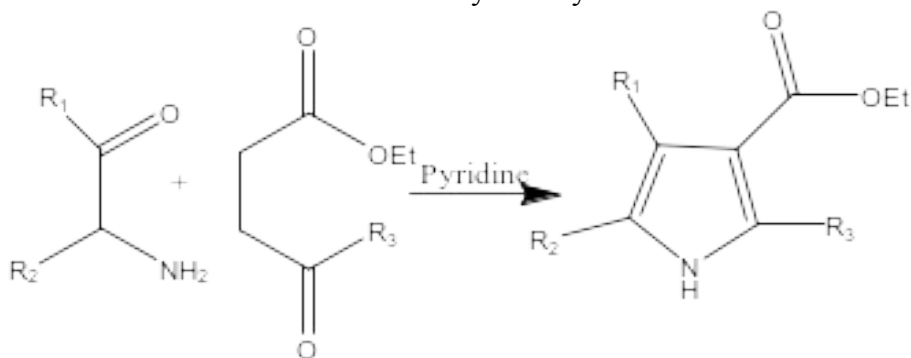
b) Write the mechanism of the Vilsmeier-Haack reaction (5 marks)



c) Complete the following reactions (5 marks)



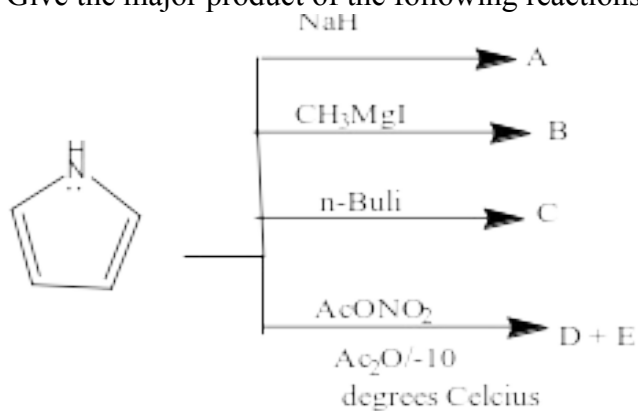
d) Write the mechanism of the Knorr-Pyrrrole Synthesis (5 marks)

**QUESTION 4 (20 MARKS)**

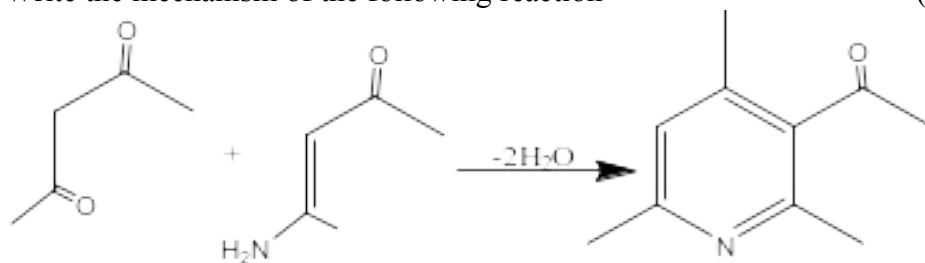
a) Draw the structures of the following compounds (5 marks)

- i. Indole
- ii. Quinoline
- iii. Isoquinoline
- iv. Coumarin
- v. 1,4-Dihydropyridine

b) Give the major product of the following reactions (5 marks)



c) Write the mechanism of the following reaction (5 marks)



d) Give the IUPAC names of the following heterocycles (5 marks)

