CHUKA UNIVERSITY

UNIVERSITY EXAMINATIONS

FOURTH YEAR EXAMINATION FOR THE AWARD OF DEGREE OF BACHELOR OF SCIENCE

CHEM 438: HETEROCYCLIC CHEMISTRY

STREAMS: BSC **TIME: 2 HOURS**

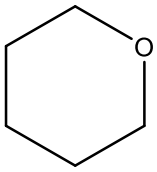
DAY/DATE: WEDNESDAY 15/04/2020 **8.30 A.M. – 10.30 A.M.**

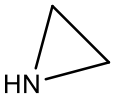
INSTRUCTIONS: ANSWER QUESTION ONE AND ANY OTHER TWO QUESTIONS

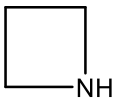
QUESTION ONE (30 MARKS)

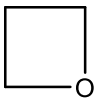
a) Name the following heterocyles (4 marks)

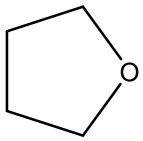
i) 

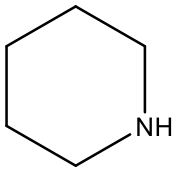
ii) 

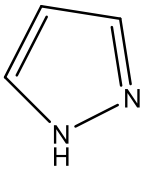
iii) 

iv) 

v) 

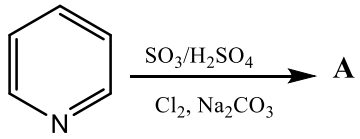
vi) 

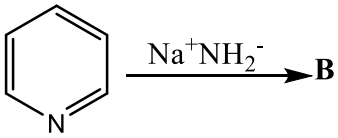
vii) 

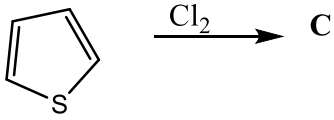
viii) 

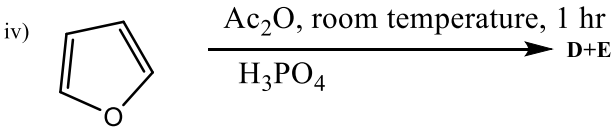
b) Draw the resonance structures of pyridine (3 marks)

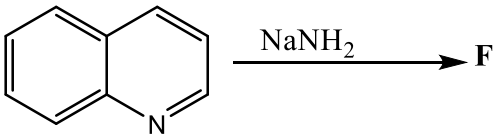
c) Give product(s) of the following reactions (6 marks)

i) 

ii) 

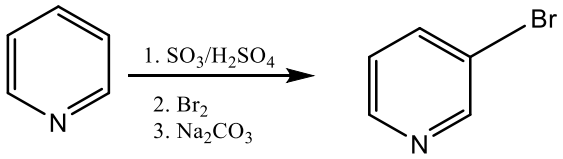
iii) 

iv) 

v) 

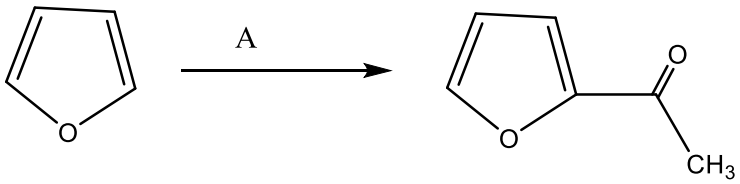
d) Give two reasons why π-excessive ring systems undergo electrophilic reactions faster than benzene (4 marks)

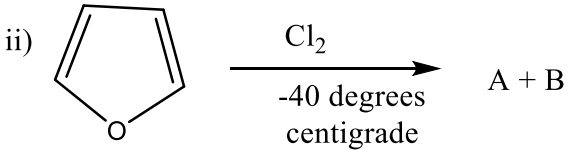
e) Write the mechanism of bromination of pyridine (6 marks)



f) Using a diagram explain why the electrophilic aromatic substitution reaction of five membered aromatic heterocycles favours the α position than the β position (5 marks)

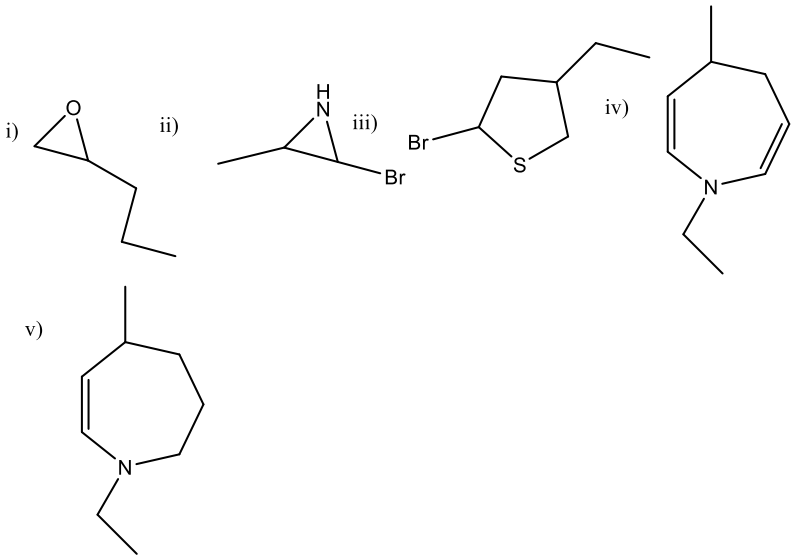
g) Write the reagent(s) and the products in the following reaction (2 marks)

i) 

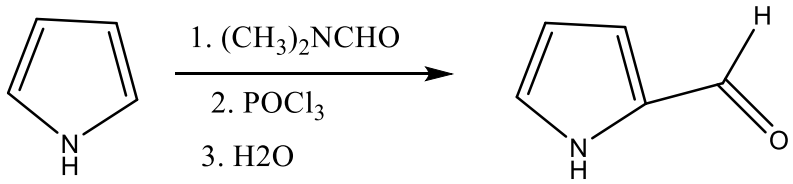
ii) 

QUESTION TWO (2O MARKS)

a) Give the IUPAC names of the following structures (5 marks)

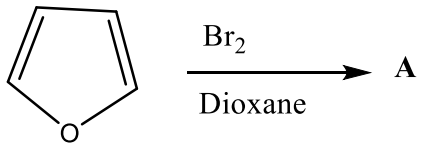


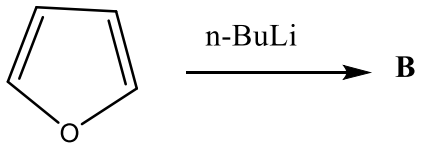
b) Write the mechanism of the following reaction (6 marks)

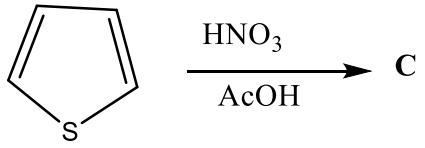


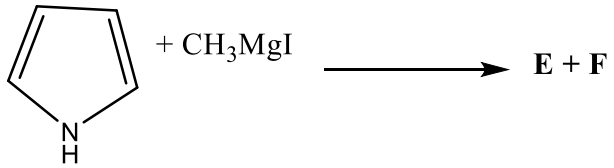
c) Briefly explain why electrophilic substitution at carbon atoms of the pyridine is difficult (4 marks)

d) Write the product(s) of the following reactions (5 marks)

i) 

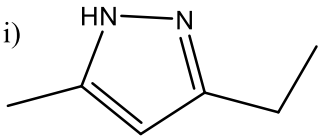
ii) 

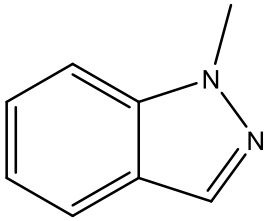
iii) 

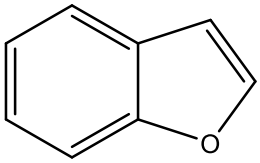
iv) 

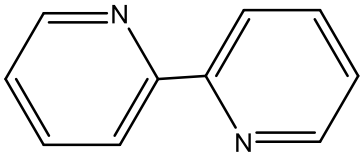
QUESTION THREE (2O MARKS)

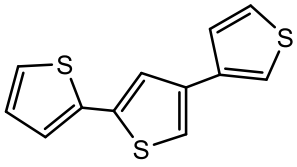
a) Name the following compounds (5 marks)

i) 

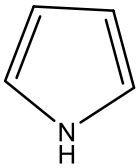
ii) 

iii) 

iv) 

v) 

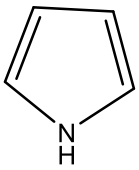
b) Name the product(s) of the following reactions (5 marks)

i) 

$AcNO_2$

Ac_2O/-10 degrees

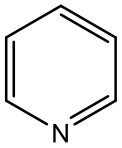
A+ B

ii) 

KI/AcOH

aq.EtOH/H_2O_2

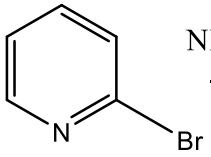
C

iii) 

CH_3I

AcOH

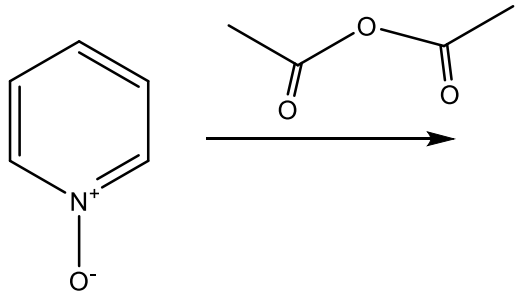
D

iv) 

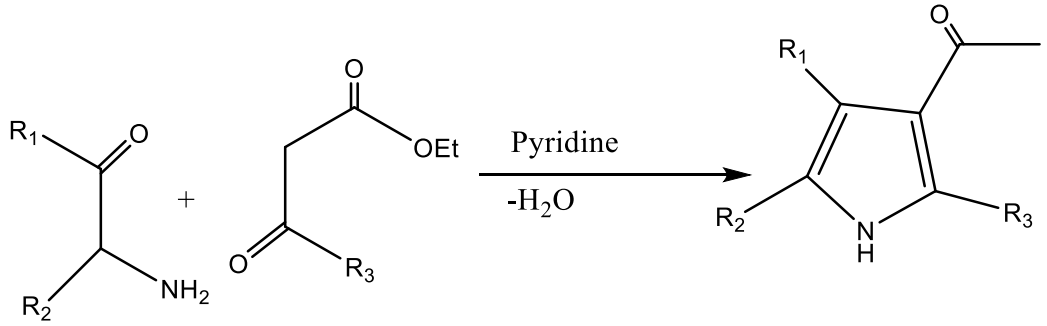
NH_3,200 degrees

E

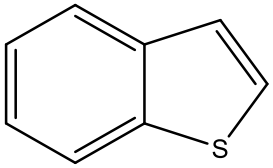
c) Write the mechanism of formation of the following reaction of pyridine-N-oxide with acetic anhydride (3 marks)

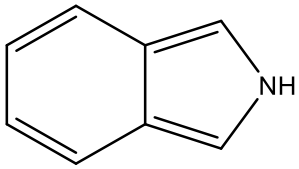


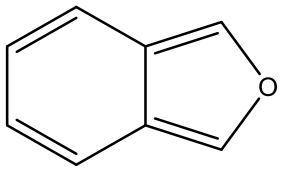
d) Write the mechanism of the condensation of α-amino ketone with a β-diketone (4 marks)



e) Name the following heterocycles (3mks)

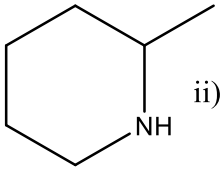
i) 

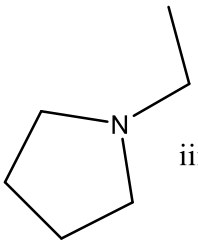
ii) 

iii) 

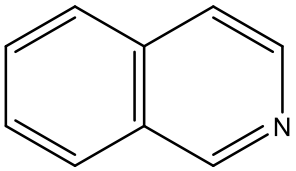
QUESTION FOUR (20 MARKS)

a) Name the following heterocycles (4 marks)

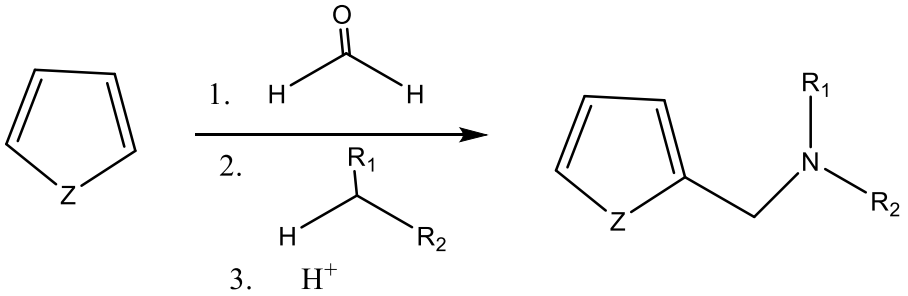
i) 

ii) 

iii) 

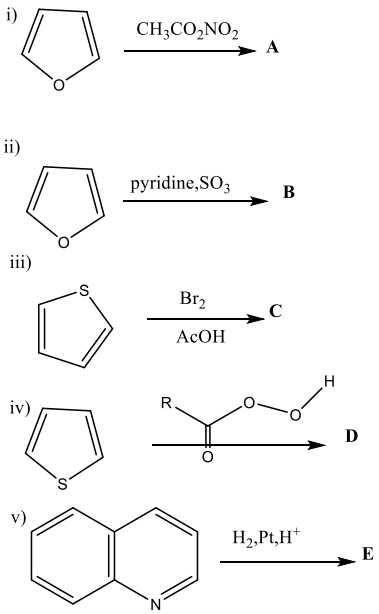
iv) 

b) Write the mechanism of the following reaction (6 marks)



Z= O, S, NH

c) Give the products of the following reactions (5 marks)



c) Write the mechanism of the Guareschi synthesis of unsymmetrical pyridines from the reaction between a β-dicarbonyl compound and a β-enamimocarbonyl compound (5 marks)