



THE CATHOLIC UNIVERSITY OF EASTERN AFRICA

A. M. E. C. E. A

MAIN EXAMINATION

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JANUARY – APRIL 2014 TRIMESTER

FACULTY OF SCIENCE

DEPARTMENT OF NATURAL SCIENCE

SCHOOL FOCUSED PROGRAMME

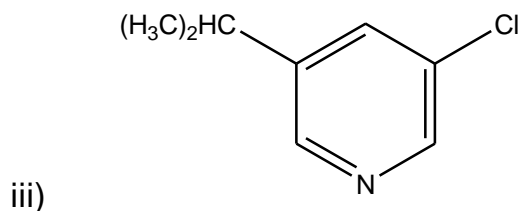
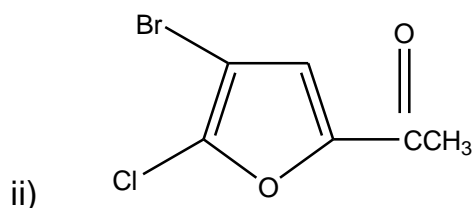
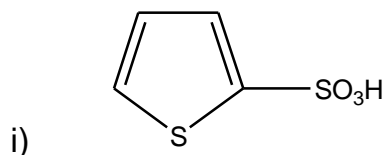
CHEM 410: CHEMISTRY OF HETEROCYCLIC COMPOUNDS

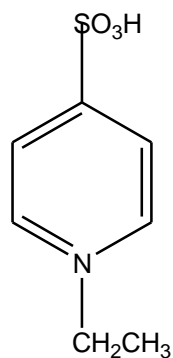
Date: APRIL 2014

Duration: 2 Hours

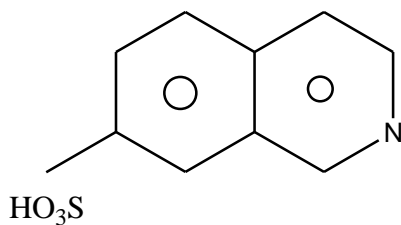
INSTRUCTIONS: Answer Question ONE and ANY OTHER TWO Questions

Q1. a) Give IUPAC names of each of the following compounds:





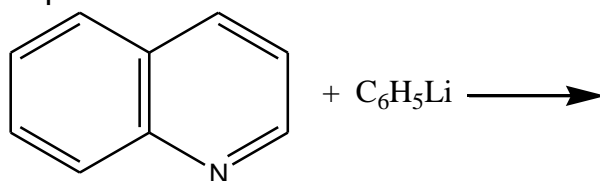
iv)



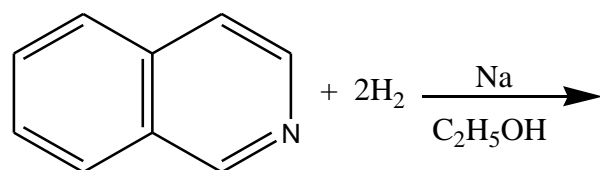
v)

(5 marks)

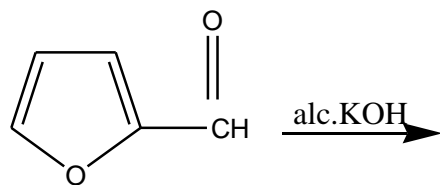
b) Give the products formed in each of the following equations:



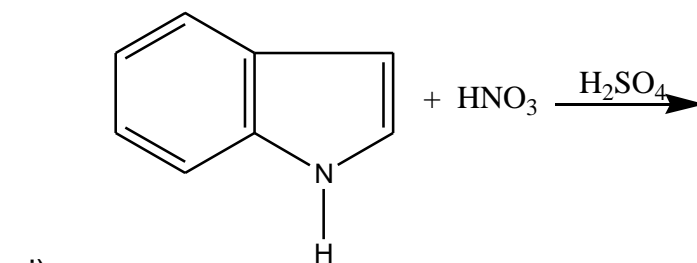
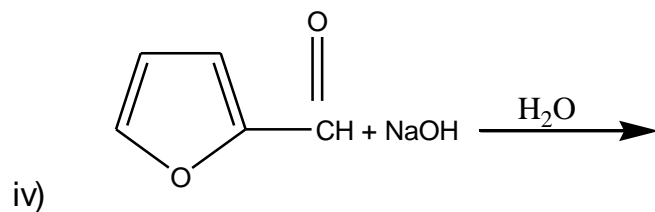
i)



ii)



iii)



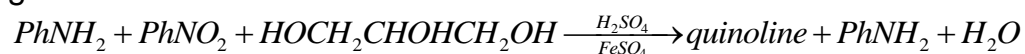
(5 marks)

c) Show with the help of equations how pyridine is isolated from coal tar. **(6 marks)**

d) Discuss the difference in (i) dipole moments and (ii) water solubility of pyridine and pyrrole. **(4 marks)**

e) Explain why pyridine does not undergo Friedel-Craft's reactions. **(4 marks)**

f) Show the reaction steps involved in the Skraup quinoline synthesis given the overall reaction as



(6 marks)

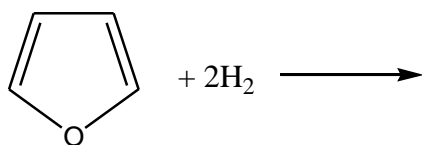
Q2. a) Why is pyridine less basic than trimethylamine? **(4 marks)**

b) Show with the help of equations as to why pyridine undergoes nucleophilic substitution at position 2 and not at position 3. **(6 marks)**

c) Furfural is an aldehyde. How does it react with each of the following reagents?

- i) HCN
- ii) CH_3MgI
- iii) NH_2OH
- iv) Tollen's reagent

- v) $C_6H_5NHNH_2$ (7½ marks)
- d) What happens when acetaldehyde is treated with dilute NaOH followed by heating? (2½ marks)
- Q3. a) Describe/explain each of the following terms: (6 marks)
- i) Disproportionation
 - ii) Cannizzaro reaction
 - iii) Oxidizing agent
- b) i) Why is aniline less basic than pyridine? (4 marks)
- ii) Name the products obtained from the reaction of:
- I) Furan with:
 - a) Acetyl nitrate
 - b) Acetic anhydride
 - II) Pyrrole with:
 - a) SO_3 | Pyridine
 - b) $PhN_2^+ Cl^-$
 - III) Thiophene with:
 - a) Br_2 | PhH
 - b) H_2SO_4
- (6 marks)
- c) Give the product resulting from heating pyridine with $NaNH_2$ followed by addition of water. What name is given to this reaction? (4 marks)
- Q4. a) Give the products formed from the reaction of OH^- and (4 marks)
- i) Pyridine
 - ii) N-methylpyridinium cation.
- b) Give the expected product of the monobromination of quinoline and explain the orientation. (4 marks)
- c) Give the structures and names of the products from the reactions of furfural with:
- i) Concentrated aq. NaOH
 - ii) $CH_2CH=O$ | NaOEt



iii)

(4 marks)

d) Give the product of the reaction of pyridine with:

i) HCl

ii) BMe₂

iv) MeI

v) t-BuCl

(8 marks)

Q5. a) Show with the help of resonance structures as to why electrophilic substitution in pyridine preferentially occurs in position 3 and not at position 2. **(8 marks)**

b) Discuss the molecular orbital structure of pyrrole. **(7 marks)**

c) Explain why pyridine and pyrrole are aromatic. **(5 marks)**

END