

----- your Roll No.

SEMESTER-IV EXAMINATIONS-2022

M.Sc. CHEMISTRY

PAPER CODE: MCHCCO-403

PAPER TITLE: HETEROCYCLIC CHEMISTRY

(Write your Roll No. at the top immediately on receipt of this question paper)

Time: Three Hours

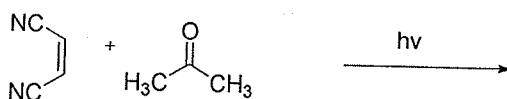
Maximum Marks: 75

Attempt all questions. All parts of a question must be attempted in continuation. Start answer of a fresh question on a new page. Cite examples and draw labeled diagrams wherever necessary.

Q1. Answer any five questions

5x3=15

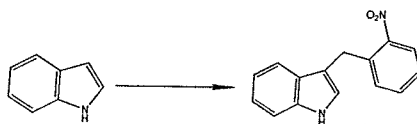
- How would you separate chemically a mixture of benzene and thiophene? Explain with a mechanism.
- Predict the product with a mechanistic explanation for the following reaction.



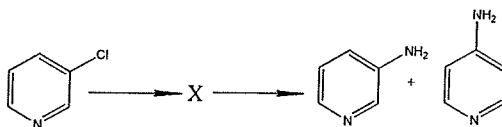
- Pyrrole undergoes electrophilic substitution reaction about 10⁵ faster than furan under similar conditions, though the resonance energy of pyrrole is greater than that of furan-explain.
- The side-chain reactivity of which ion facilitates a targeted synthesis of cyanine dyes.
- Predict the expected product and explain the following reaction mechanistically



- Carry out the following conversion via a dithiane intermediate. You may need more than one step.



- Write the expected product formed in the following synthetic sequences



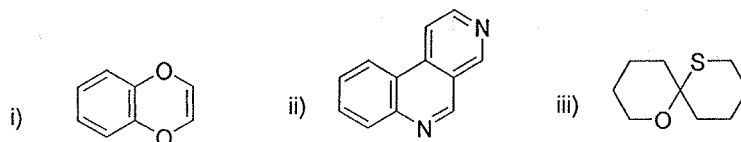
Q2. Answer any three questions

3x5=15

A. (i) Draw the structures of the following heterocyclic compounds.2

i) Pyrimidine-2(1H)-one ii) Imidazo (2, 1-b)oxazole

(ii) Give a name to the following compounds according to the replacement nomenclature of heterocyclic compounds. 3



B. (i) Mark the chemically different sets of proton(s) according to the proton NMR of Pyridine and arranges the sets according to their chemical shift with an explanation.

(i) Draw the possible tautomeric structures of 2-pyridone and explain the major differences that are expected to be observed in $^1\text{H-NMR}$ of the tautomers.

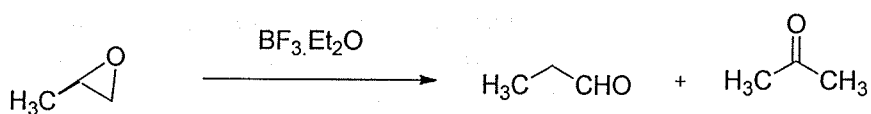
C. (i) Which one between pyridine and piperidine has a higher dipole moment? Suggest an explanation in favour of your answer.

(ii) Discuss the electrophilic substitution at indole and predict the preferred site of attack of the electrophile.

D. Draw the tautomeric structure of the following compounds and predict the predominant form in the solution.

i) pyrazine ii) 1,2,4-tetrazole, (iii) 2, 4, 6-trihydroxy pyrimidine

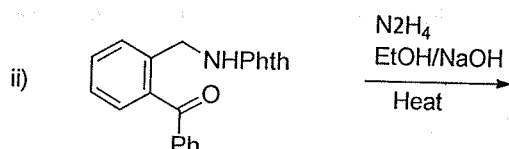
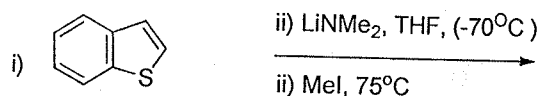
E. Propose a mechanism for the following conversions.



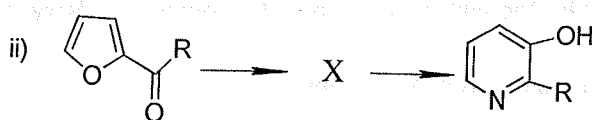
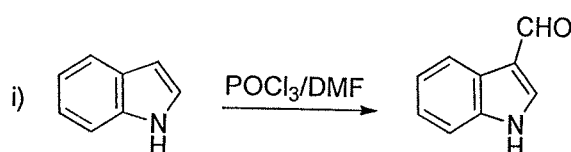
Q3. Answer any three questions

3x5=15

A. Predict the expected major product with a mechanism for the following conversions.



B. Suggest a mechanistic explanation for the following reactions.



C. Illustrate Hegedus Indole Synthesis

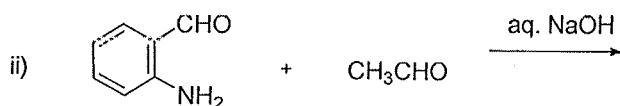
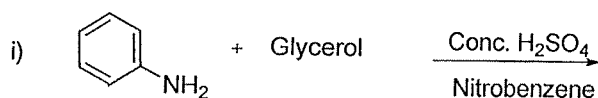
D. Give an account of the synthesis of oxiranes

E. Explain the following facts

- Furan undergoes electrophilic substitution about 10^{11} times faster than benzene under similar conditions.
- The aromaticity of thiophene is greater than that of furan.

Q4. Answer any three questions

- Briefly discuss the mechanistic pathway involves in the Hantzsch Synthesis of pyridine derivatives with a suitable example.
- Explain why the C3 position of pyridine is a preferred position for electrophilic substitution. Compare the relative reactivity with respect to benzene. Which one between pyrrole and pyridine is more basic and why?
- Discuss Pechman's synthesis of Coumarins.
- Write the expected product with a mechanism and role of each reagent/chemical in the following reaction.



- c1ccccc1O

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$$5 \times 3 = 15$$

- A. Draw all the possible tautomeric forms of azepine and comment on the aromaticity property of 1H-azepine. Suggest a synthetic route for the synthesis of ethyl 1H-azepine-1-carboxylate starting from benzene.
- B. Propose a synthetic route for Dihydroazepines from azatrienes.
- C. Give synthesis of Pentaphenylarsole
- D. Discuss the different chemical behavior of phosphorene toward the CH_3Li .
- E. Justify the statement.
 - (i) Phosphole is a non-aromatic compound.
 - (ii) Phosphobenzene is aromatic