

School of Chemical and Life Sciences
B.Sc-M.Sc Integrated Programme
Semester III Examination 2020
Paper Title: Heterocyclic and Natural Product Chemistry, Organic
Chemistry III
Paper Code: BCHCC09TH

Time allowed: 03 Hours

Max. Marks: 75

Attempt all Questions

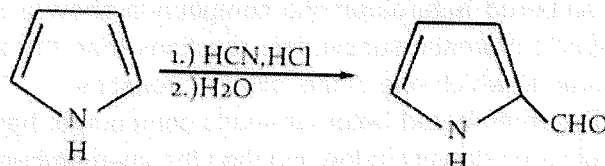
Q1A. Select the most appropriate answer in the following questions.

1x10

(i) Five membered rings come under which category of heterocycle classification on the basis of chemical behaviour?

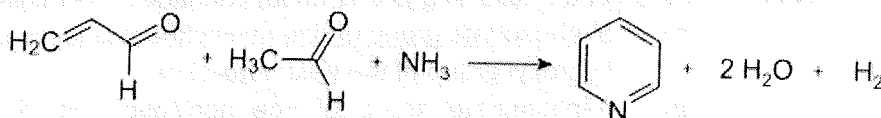
- (a) Excessive heterocycle
- (b) Deficient heterocycle
- (c) Equivalent heterocycle
- (d) Can't say about the five membered rings

(ii) What is the name of the following reaction?



- (a) Gattermann reaction
- (b) Riemer tiemann reaction
- (c) Friedal craft reaction
- (d) Blanc's chloromethylation

(iii) What is the name of the reaction given below when condensation of acrolein and acetaldehyde take place?

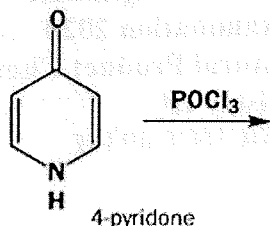


- (a) Chichibabin synthesis
- (b) Dealkylation of alkylpyridine
- (c) Hantzsch pyridine synthesis
- (d) Bonnemann cyclisation

(iv) What is the correct order of reactivity (most reactive first) of pyrrole, furan and thiophene towards electrophiles?

- (a) Furan > thiophene > pyrrole
- (b) Pyrrole > furan > thiophenes

- (d) furan > pyrrole > thiophenes
- (v) What will be the product of the following reaction?



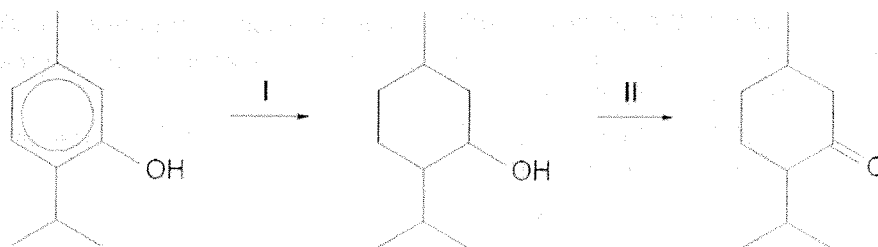
- (a) 3-chloropyridine
- (b) 2-dichloropyridine
- (c) 3,5-dichloropyridine
- (d) 2,5-dichloropyridine
- (vi) Nucleophilic substitution reaction of pyridine is most effective in which of the conditions?
- (a) In slightly acidic conditions
- (b) In slightly basic conditions
- (c) In slightly neutral conditions
- (d) No specific condition requirements
- (vii) Five-membered heteroaromatic compounds show a much higher rate of electrophilic aromatic substitution reactions than the six-membered ones. This is due to which one of the following reasons?
- (a) Five-membered heteroaromatic compounds have higher circulating electron density in the ring than the six-membered ones
- (b) Five-membered heteroaromatic compounds have lower circulating electron density in the ring than the six-membered ones
- (c) Five-membered rings are smaller in size than the six membered ones which affects their reaction rates.
- (d) Six membered heteroaromatic rings are flat while the five-membered ones are puckered
- (viii) Which of the following is true about phosphodiester linkage?
- (a) 5'-phosphate group of one nucleotide unit is joined to the 3'-hydroxyl group of the next nucleotide.
- (b) 3'-phosphate group of one nucleotide unit is joined to the 5'-hydroxyl group of the next nucleotide.
- (c) 5'-phosphate group of one nucleotide unit is joined to the 5'-hydroxyl group of the next nucleotide.
- (d) 3'-phosphate group of one nucleotide unit is joined to the 3'-hydroxyl group of the next nucleotide.

- (ix) Which of the following statements regarding the double-helix of DNA is true?
- All hydroxyl groups of pentoses are involved in linkages
 - Each strand is parallel with 5' to 3' direction
 - The nitrogenous bases are perpendicular to the axis
 - Both strands are identical to one another
- (x) What is the role of hydrogen bonds in the structure of DNA?
- To code for proteins
 - To synthesize proteins
 - To separate the strands
 - To connect the base pairs

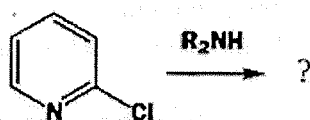
Q1B Answer briefly:

1x5

- (i) Menthol and menthone, the main constituents of oil of peppermint, can be made synthetically from thymol by the following route. State the type of reaction in respect of the reaction I and reaction II as shown under:

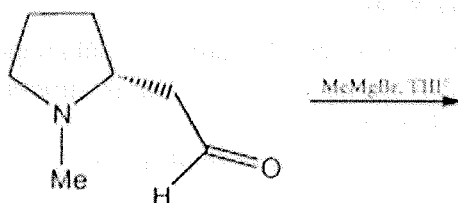


- (ii) Draw the product in the following reactions 1

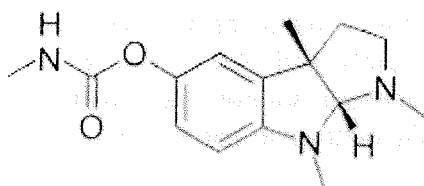


- (iii) Name an alkaloid in which nitrogen is not in the heterocyclic ring

- (iv) Draw the product in the following reaction



- (v) Identify the heterocyclic ring present in the following alkaloid.



- Q2. Explain any two of the following 7½x2

- Sketch the mechanism of the Paal–Knorr furan synthesis.
- Explain why the substitution occurs preferably at C-2 position in pyrrole
- What is Fischer indole synthesis? Sketch its mechanism.
- Discuss the Electrophilic Substitution reactions of indole.

- Q3. Attempt any two of the following 7½x2

- Define and classify alkaloids on the basis of their chemical structures with examples
- Discuss the general properties, colour reactions and uses of alkaloids.
- Discuss how Hoffmann's exhaustive methylation is used in the structure elucidation of alkaloids.
- Sketch the laboratory synthesis of nicotine. Label the reactants and the products formed at different steps.

- Q4. Attempt any two of the following 7½x2

- Discuss how the C-skeleton of Citral is established. Sketch the synthesis of methylheptenone from 3-methyl-2-butanol.
- Explain isoprene rule with suitable examples? What is its deviation? Discuss briefly.
- Give the source of nicotine and show how the carbon atoms are numbered. Discuss how the structure of nicotine was established?
- Sketch the synthesis of Hygrine. Label the reactants and the products formed at different steps. Briefly describe the medicinal importance of Nicotine and Hygrine.

- Q5. Explain any two of the following 7½x2

- Structure of uric acid. based on Medicus and Fittig hypothesis.
- Synthesis of uracil from barbituric acid and structural relationship of barbituric acid and allantoin
- structure and functions of different type of RNAs
- Synthesis and reactions of guanine.

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