

**UCH 6503 – SYNTHETIC ORGANIC CHEMISTRY AND HETEROCYCLIC COMPOUNDS**

Date: 23-11-2024

Dept. No.

Max. : 100 Marks

Time: 09:00 am-12:00 pm

SECTION A - K1 (CO1)**Answer ALL the Questions****(10 x 1 = 10)****1. Answer the following**

- a) Mention any two important characteristics of Pericyclic reactions.
- b) What are group transfer reactions? Give an example.
- c) List any two differences between consecutive and convergent synthesis.
- d) Predict the product for the reaction of furan with maleic anhydride.
- e) How will you prepare benzothiophene?

2. Define the following

- a) Retrosynthesis.
- b) Catalytic hydrogenation of cyclohexene.
- c) Intramolecular addition reactions.
- d) Aromaticity of thiophene.
- e) Nitration of furan.

SECTION A - K2 (CO1)**Answer ALL the Questions****(10 x 1 = 10)****3. Choose the correct answer**

- a) What is the main purpose of using a protecting group in organic synthesis?
a) To increase the yield b) To prevent a functional group from reacting under certain conditions
c) To catalyse a reaction d) To reduce the reaction time
- b) Which of the following reagents is used in the Wolff-Kishner reduction?
a) Zinc and hydrochloric acid b) Hydrazine (N_2H_4) and a strong base
c) Lithium aluminum hydride ($LiAlH_4$) d) Sodium borohydride ($NaBH_4$)
- c) Thermal electrocyclic reactions involving $[4n + 2]-\pi$ -electrons are
a) disrotatory b) conrotatory c) antarafacial d) suprafacial
- d) Which compound is least basic?
a) Pyridine b) Pyrrole c) Furan d) Thiophene
- e) What is the chemical formula of isoquinoline?
a) C_9H_7N b) $C_{10}H_8O$ c) $C_6H_5NH_2$ d) $C_8H_6N_2$

4. True or False

- a) Disconnections in retrosynthesis refer to breaking bonds in the target molecule to identify simpler building blocks.
- b) Sodium borohydride cannot be employed to reduce the ester.
- c) Pericyclic reactions are concerted and proceed through an acyclic transition state.
- d) Pyrrole is more reactive than furan.

e)	In isoquinoline, the nucleophilic substitution occurs at 3-position.
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



SECTION B - K3 (CO2)

	Answer any TWO of the following (2 x 10 = 20)
5.	(a) Describe the significance of Umpolung synthesis with an example. (5) (b) What are some common group disconnections for carbon-carbon bond formation? (5)
6.	(a) Explain the synthetic uses of Pb(OAc) ₄ , and OsO ₄ agents with examples. (5) (b) Discuss the steps involved in the catalytic hydrogenation of alkene using nickel catalyst. (5)
7.	Describe the synthesis of following using retrosynthetic approach. (10) (i) 2, 4-Dichlorophenoxyacetic acid (ii) Daminozide (iii) Cetaben ethyl ester.
8.	(a) Explain why thiophene is more reactive at position 2 than at position 3. (5) (b) Discuss the nucleophilic substitution reactions of quinoline. (5)

SECTION C – K4 (CO3)

	Answer any TWO of the following (2 x 10 = 20)
9.	(a) Discuss the retrosynthesis of acetyl acetone. (3) (b) Describe FMO approach to explain the thermal and photochemical [4+2]-cycloaddition reaction. (7)
10.	(a) Discuss the reduction reaction mechanism of carbonyl compounds using LiAlH ₄ . (5) (b) Explain the oxidation and reduction reaction of quinoline. (5)
11.	(a) Explain Woodward rule to explain the thermal feasibility of 4n electrocyclic reaction. (5) (b) Define sigmatropic rearrangement reaction. Explain its types. (5)
12.	(a) How is indole prepared by Fischer Indole synthesis? (5) (b) Discuss the electrophilic substitution reactions of isoquinoline. (5)

SECTION D – K5 (CO4)

	Answer any ONE of the following (1 x 20 = 20)
13.	(a) What is consecutive (linear) synthesis, and how is it different from convergent synthesis? (5) (b) Discuss the mechanism of hydroboration-oxidation and Wolf-Kishner reduction reactions. (10) (c) Explain the factors influencing the Claisen rearrangement. (5)
14.	(a) Differentiate between thermal and photochemical Frontier Molecular Orbital approach for electrocyclic reactions with suitable examples. (10) (b) Identify the products for the following reactions. (5) <div style="display: flex; align-items: center;"> <div style="margin-right: 20px;">  $\xrightarrow{\text{HCN/HCl}}$ </div> <div style="margin-right: 20px;">  $\xrightarrow{\text{AlCl}_3/\text{H}_2\text{O}}$ </div> <div style="margin-right: 20px;">  $\xrightarrow{n\text{-C}_4\text{H}_9\text{Li}}$ </div> <div style="margin-right: 20px;">  $\xrightarrow{\quad}$ </div> </div>

	(c) Discuss the preparation and properties of benzofuran. (5)
SECTION E – K6 (CO5)	
	Answer any ONE of the following (1 x 20 = 20)
15.	(a) Explain any six synthetic strategies followed in retro synthesis. (5) (b) Predict the oxidizing agents involved in the following conversions. (10) (i) Cyclohexene to cyclohexane diol (ii) Toluene to benzoic acid (iii) Acetone to propane (iv) Cyclohexanol to adipic acid (c) Outline the preparation and properties isoindole. (5)
16.	(a) Electrophilic substitution of pyridine occurs at C3 but nucleophilic substitution at C2. Explain with example. (5) (b) Explain the Oxy-Cope rearrangement. (5) (c) Outline the reactions of indole. (5) (d) Explain the synthesis of quinoline by ring closure method. (5)
