

Enrolment No.:

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B. Sc. Chemistry, V Semester
End-term Examination 2024

Paper Name: Halogen, Oxygen and Nitrogen containing Functional Groups
Time: 2.5 hours

Paper Code: BCH DSC 501TH
Maximum Marks: 60

Note: This paper has 3 sections A, B, and C, attempt all three sections; *Section A: Answer all the questions; Section B: Answer any 2 out of 4; Section C: Answer all the questions, each question has an internal choice*

Abbreviations Used

CLO- Course Learning Outcome, PLO- Program learning Outcome, BTL- Bloom Taxonomy Level: BT level 1-Remember; BT level 2-Understand; BT level 3-Apply; BT level 4-Analyse; BT level 5-Evaluate, BT level 6-Create

SECTION- A

Attempt all questions

(10*2= 20 Marks)

[BTL] CLO PLO

- | | |
|---|-------------|
| A 1. What is the reactivity order for the alkyl halides towards S_N2 reaction? | 1/2 1-3 1-3 |
| A 2. When two moles of ethyl chloride react with two moles of sodium in the presence of ether what will be formed? | 3/4 4-5 4-5 |
| A 3. Why is ortho nitrophenol more acidic than ortho methoxyphenol? | 3/4 4-5 4-5 |
| A 4. Write equations for Friedel-Crafts reaction-alkylation of anisole and Nitration of anisole. | 1/2 1-3 1-3 |
| A 5. How can you convert 1-propanol to 1-chloro-2-propanol and Phenol to salicylic acid. | 3/4 4-5 4-5 |
| A 6. Reaction of iodoethane with CN^- yields a small amount of isonitrile, CH_3CH_2NC , along with the nitrile CH_3CH_2CN as the major product. Write electron-dot structures for both products, assign formal charges as necessary, and account for their formation. | 1/2 1-3 1-3 |
| A 7. What products would you obtain from reaction of 1-pentanol with the following reagents: PBr_3 , $SOCl_2$ and Dess–Martin periodinane | 3/4 4-5 4-5 |
| A 8. How would you use a Grignard reaction on an aldehyde or ketone to synthesize 2-Pentanol? | 3/4 4-5 4-5 |
| A 9. Pregabalin, marketed as Lyrica, is an anticonvulsant drug that is also effective in treating chronic pain. The IUPAC name of pregabalin is (S)-3-(aminomethyl)-5-methylhexanoic acid. (An aminomethyl group is $-CH_2NH_2$.) Draw the structure of pregabalin. | 3/4 4-5 4-5 |
| A 10. How could you convert 1-Butanol or 1-Bromobutane into butanoic acid? | 4/5 4/5 4/5 |

SECTION B

Attempt any two out of the following four questions

(2*10=20 Marks)

- B 1** a). Which compound in each of the following pairs will react faster in an S_N2 reaction with OH^- 3/4 4-5 4-5
- i) CH_3Br or CH_3I (ii) CH_3CH_2I in ethanol or in dimethyl sulfoxide (iii) $(CH_3)_3CCl$ or CH_3Cl (iv) $H_2C=CHBr$ or $H_2C=CHCH_2Br$
- b). Which reactant in each of the following pairs is more nucleophilic? Explain.
- (i) $^-NH_2$ or NH_3 (ii) H_2O or $CH_3CO_2^-$ (iii) BF_3 or F^- (iv) $(CH_3)_3P$ or $(CH_3)_3N$ (v) I^- or Cl^-

c). What effect would you expect the following changes to have on the rate of the S_N2 reaction of 1-iodo-2-methylbutane with cyanide ion?

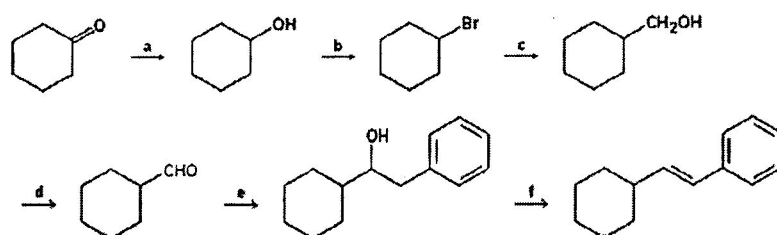
(i) The CN^- concentration is halved, and the 1-iodo-2-methylbutane concentration is doubled.

(ii) Both the CN^- and the 1-iodo-2-methylbutane concentrations are tripled.

B What products would you expect to obtain from reaction of 1-methylcyclohexanol with the following reagents?

(a) HBr (b) NaH (c) H_2SO_4

B Identify the reagents a–f in the following scheme



B Carboxylic acids can be prepared from nitriles. How can we prepare carboxylic acids by using the scheme ($RBr \rightarrow RC\equiv N \rightarrow RCO_2H$). 3/4 4-5 4-5

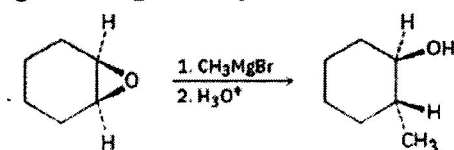
SECTION C

Attempt *all* questions, each question has an *internal choice*

(7x5=35 Marks)

C Epoxides react with Grignard reagents to yield alcohols. Propose a mechanism.

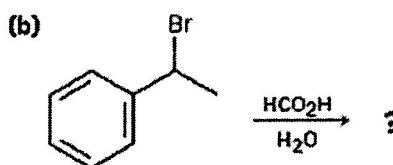
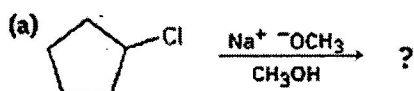
3/4 4-5 4-5



OR

Tell whether each of the following reactions is likely to be S_N1 , S_N2 , E1, E1cB, or E2, and predict the product of each:

5/6 6-7 6-7

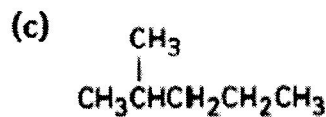
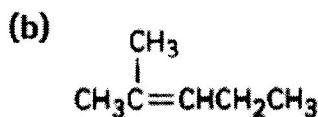
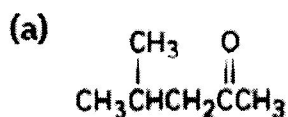


C Show all the steps in the acid-catalyzed formation of a cyclic acetal from ethylene glycol and an aldehyde or ketone. 5/6 6-7 6-7

OR

Show how you could prepare the following compounds from 4-methyl-3-penten-2-one, $(CH_3)_2C=CHCOCH_3$

5/6 6-7 6-7



C Identify the most acidic hydrogens in each of the following compounds

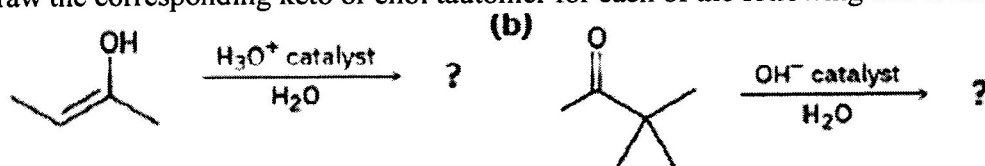
5/2 6-7 6-7

(a) CH_3CH_2CHO (b) $(CH_3)_3C-COCH_3$ (c) CH_3CO_2H (d) Benzamide (e) $CH_3CH_2CH_2CN$ (f) $CH_3CON(CH_3)_2$

OR

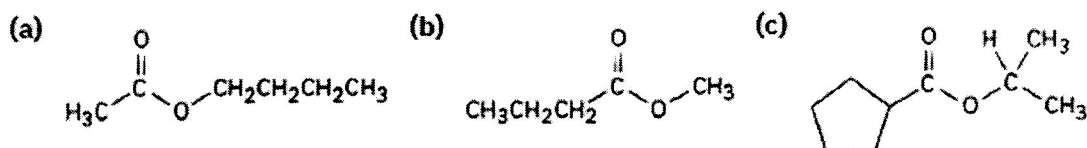
Draw the corresponding keto or enol tautomer for each of the following molecules.

5/6 6-7 6-7



C How might you prepare the following esters from the corresponding acids?

3/4 4-5 4-5



OR

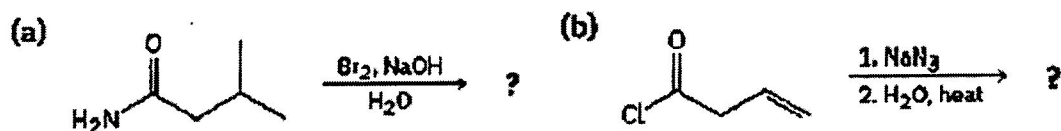
How could you prepare the following amides using an acid chloride and an amine or ammonia?

5/6 6-7 6-7

(a) $\text{CH}_3\text{CH}_2\text{CONHCH}_3$ (b) N, N-Diethylbenzamide

C Predict the product(s) and write the mechanism for each of the following reactions:

6-7 6-7



5/6

OR

The diazotization of aniline first involves the formation of NO^+ (nitrosonium ion) by the dehydration of nitrous acid with sulfuric acid. The aniline nitrogen then acts as a nucleophile and eventually loses water. Propose a mechanism for the formation of the diazonium salt of aniline using curved arrows to show all electron movement.

3/4 4-5 4-5