

CHEMISTRY 263 - Section B6

Lecture Outline 4 & Assignment 4

TR 12:30-13:50
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Read:

TWG Solomons and CB Fryhle "Organic Chemistry" 8th Edition (2004):

- Functional Group List on pp 70-71 and (Periodic Table) one page back from Inside Back Cover
- Relative Strength of Acids and Bases on Inside Front Cover - same table page 105
- Chapter 18 – Carboxylic Acids and their Derivatives
- Chapter 19 – More Chemistry of Enolate Ions
 - Sections 19.1 to 19.9 and 19.12
- Chapter 23 – Lipids

Problems:

Do Not turn in, answers available in "Study Guide and Solutions Manual for Organic Chemistry" by Solomons and Fryhle.

Chapter 18:

18.1; 18.3; 18.5 to 18.11; 18.14; 18.19; 18.20; 18.24; 18.25; 18.29; 18.37; 18.39; 18.52

Chapter 19:

19.1; 19.2; 19.4; 19.6; 19.8; 19.15

Chapter 23:

23.9; 23.12

Lecture Outline 4: Carboxylic Acids and Their Derivatives

1. Structure and Nomenclature - The Acyl Group

- A. Acids - RCOOH
- B. Acid Halides - RCOX
- C. Anhydrides - $(\text{RCO})_2\text{O}$
- D. Esters - RCOOR'
- E. Amides - RCONH_2 , RCONHR , RCONR_2

2. Carboxylic Acids

- A. Acidity and Physical Properties
- B. Preparation
 - 1. Oxidation of Alkenes
 - 2. Oxidation of Alcohols and Aldehydes
 - 3. Oxidation of Alkylbenzenes
 - 4. Oxidation of Methyl Ketones (Haloform reaction)
 - 5. Hydrolysis of Nitriles
 - 6. Carbonation of Grignard Reagents ($\text{RMgX} + \text{CO}_2$)
- C. Reactions
 - 1. Salt formation
 - 2. Ester formation
 - 3. Reduction

3. Acid Halides

- A. Physical Properties and Reactivity

- B. Preparation from Carboxylic Acids
- C. Reactions on Carbonyl Carbon - (Nucleophilic Substitution)
 - 1. Hydrolysis to Carboxylic Acids
 - 2. Anhydride Formation with Carboxylates
 - 3. Alcoholysis to Esters
 - 4. Ammonolysis to Amides
 - 5. Reduction to Alcohols or Aldehydes
 - 6. Friedel Crafts Acylations
- D. Reaction on alpha-carbon - Perkin Reaction

4. Anhydrides

- A. Physical Properties
- B. Preparation
 - 1. From Acid Halides and Carboxylates
 - 2. Cyclic Dehydration of Diacids
- C. Reactions on Carbonyl Carbon
 - 1. Hydrolysis to Carboxylic Acids
 - 2. Alcoholysis to Ester and Acid
 - 3. Ammonolysis to Amide and Salt of Acid
 - 4. Reduction to Alcohols
 - 5. Friedel Crafts Acylations
- D. Reaction on alpha-carbon - Perkin Reaction

5. Esters

- A. Physical Properties
- B. Preparation
 - 1. Alcoholysis of Acid Halides
 - 2. Alcoholysis of Anhydrides
 - 3. Esterification of Carboxylic Acids
 - a. Primary and Secondary ROH
 - b. Tertiary ROH
 - c. Lactone formation
- C. Reactions at Carbonyl Carbon
 - 1. Acidic Hydrolysis - Acyl - Oxygen and Alkyl - Oxygen Cleavage
 - 2. Alkaline Hydrolysis - Acyl - Oxygen Cleavage
 - 3. Transesterification with Alcohols
 - 4. Ammonolysis to Amide and Alcohol
 - 5. Reduction to Alcohols
 - 6. Grignard Reaction
- D. Reactions at alpha-carbon
 - 1. Ester-Ester Condensation - Claisen and Dieckmann
 - 2. Ester-Ketone and Ester-Aldehyde Condensation
- E. Fats, Waxes, and Soaps

6. Amides

- A. Physical Properties
- B. Preparation
 - 1. Ammonolysis of Acid Halides, Anhydrides, Esters
 - 2. Partial Hydrolysis of Nitriles
- C. Reactions at Carbonyl Carbon
 - 1. Hydrolysis
 - 2. Reduction to Amines