

Chapter 17: Carbonyl Compounds I

Learning Objectives:

1. Recognize the general structures of carboxylic acids, acyl halides, acid anhydrides, esters, amides, and nitriles, and be able to assign names to simple members of these compound families.
2. Identify and be able to write the general mechanism for nucleophilic acyl substitution, and be able to judge the relative reactivities of carbonyl compounds in this reaction.
3. Identify and be able to write the mechanisms for nucleophilic substitutions of acyl halides, and esters.
4. Identify and be able to write the mechanism for the acid-catalyzed hydrolysis of an ester and of a nitrile.
5. Identify and be able to write the mechanism for the hydroxide-promoted hydrolysis of an ester.
6. Identify and be able to write the mechanisms for the acid-catalyzed and the hydroxide-promoted hydrolysis of amides.
7. Identify and be able to write the mechanism for the Fischer esterification of a carboxylic acid
8. Be able to describe the structures of fats, oils, and soaps, and be able to explain how detergents and surfactants work.
9. Be able to describe how to use chemical reagents for the desired transformation among acid derivatives.

Sections to be covered (in the order of delivery):

- 17.2 Structures of Carboxylic Acids and Carboxylic Acid Derivatives
- 17.3 Physical Properties of Carbonyl Compounds
- 17.5 How Class I Carbonyl Compounds React*
- 17.6 Relative Reactivities of Carboxylic Acids and Carboxylic Acid Derivatives*
- 17.7 General Mechanism for Nucleophilic Acyl Substitution Reactions*
- 17.8 Reactions of Acyl Halides
- 17.9 Reactions of Acid Anhydrides
- 17.10 Reactions of Esters
- 17.11 Acid-Catalyzed Ester Hydrolysis*
- 17.12 Hydroxide –Ion Promoted Ester Hydrolysis*
- 17.13 Soaps, Detergents, and Micelles
- 17.14 Reactions of Carboxylic Acids
- 17.15 Reactions of Amides
- 17.16 Acid-Catalyzed Hydrolysis of Amides*
- 17.17 Hydrolysis of an Imide: The Gabriel Synthesis
- 17.18 Hydrolysis of Nitrile*
- 17.19 Designing a Synthesis IV: The Synthesis of Cyclic Compounds
- 17.20 Synthesis of Carboxylic Acid Derivatives*
- 17.21 Dicarboxylic Acids and Their Derivatives

* Sections that will be focused

Recommended additional problems

17.38 – 17.46, 17.49 – 17.51, 17.53-17.55, 17.64 – 17.75