21.0 Introduction

21.1 Naming Carboxylic Acid Derivatives

21.1 Exercises

Questions

Q21.1.1

Name the following compounds using IUPAC conventions

(a)

(b)

(c)
Solutions

S21.1.1

a. 3-methylpentanoyl chloride
b. 2-cyclopentylacetamide
c. propyl 2-methylpropanoate
d. cyclohexylbutanoate
e. tert-butyl cyclopentanecarboxylate
f. 1-methylbutylcyclopentane carboxylate
g. N-methyl-3-butenamide
h. (S)-2-hydroxypropanoyl phosphate
i. propyl 2,3-dimethyl-2-butenethioate

21.2 Nucleophilic Acyl Substitution Reactions

21.3 Nucleophilic Acyl Substitution Reactions of Carboxylic Acids

21.3 Exercises
Questions

Q21.3.1

How would you create the following esters from the corresponding acids?

(a)

(b)

(c)

Q21.3.2

The following molecule is treated with acid and undergoes an intramolecular Fischer Esterification. Draw the product.

Solutions

S21.3.1

a. Acetic acid + ethanol
b. Butanoic acid + isopropanol  
c. Cyclohexanecarboxylic acid + propanol

\[ \text{S21.3.2} \]

\[ \text{\includegraphics[width=0.2\textwidth]{image}} \]

**21.4 Chemistry of Acid Halides**

**21.4 Exercises**

**Questions**

Q21.4.1

Draw the mechanism for the following reaction

\[ \text{\includegraphics[width=0.5\textwidth]{image}} \]

Q21.4.2

Propose a synthesis of the following molecules from an acid chloride and an amide.

(a)

\[ \text{\includegraphics[width=0.1\textwidth]{image}} \]

(b)
Solutions

S21.4.1

S21.4.2

a. Acetyl chloride and dimethylamine
b. Benzoyl chloride and ethylamine
c. Acetyl chloride and ammonia

21.5 Chemistry of Acid Anhydrides

21.5 Exercises
Questions

Q21.5.1

Draw out the mechanism for the following reaction.

\[
\begin{array}{c}
\text{NH}_2 \\
\text{O} \\
\text{+ HOOC} \\
\end{array}
\xrightarrow{\text{reaction}}
\begin{array}{c}
\text{O} \\
\text{O} \\
\text{NH} \text{CO} \\
\end{array}
\]

Q21.5.2

Draw the product of the reaction between these two molecules.

\[
\begin{array}{c}
\text{O} \\
\text{O} \\
\text{O} \\
\end{array}
\text{ + } \begin{array}{c}
\text{CH}_3 \text{OH} \\
\end{array}
\]

Solutions

S21.5.1

\[
\begin{array}{c}
\text{O} \\
\text{O} \\
\text{O} \\
\end{array}
\xrightarrow{\text{reaction steps}}
\begin{array}{c}
\text{O} \\
\text{O} \\
\text{O} \\
\end{array}
\]

S21.5.1
21.6 Chemistry of Esters

21.6 Exercises

Questions

Q21.6.1

Why is the alkaline hydrolysis of an ester not a reversible process? Why doesn't the reaction with a hydroxide ion and a carboxylic acid produce an ester?

Q21.6.2

Draw the product of the reaction between the following molecule and LiAlH₄, and the product of the reaction between the following molecule and DIBAL.

Q21.6.3

How might you Prepare the following molecules from esters and Grignards?

(a)
Solutions

S21.6.1

The reaction between a carboxylic acid and a hydroxide ion is an acid base reaction, which produces water and a carboxylate anion.

S21.6.2

S21.6.3

(a)
21.7 Chemistry of Amides

21.7 Exercises

Questions

Q21.7.1

How would you prepare the following compounds from N-Propyl benzamide?

(a)

(b)

(c)
Q21.7.2

Propose a synthesis for the following.

Solutions

S21.7.1

a. NaOH, H₂O
b. NaOH, H₂O, then LAH
c. LAH

S21.7.2

21.8 Chemistry of Thioesters and Acyl Phosphates: Biological Carboxylic Acid Derivatives

21.9 Polyamides and Polyesters: Step-Growth Polymers

21.10 Spectroscopy of Carboxylic Acid Derivatives