Hey guys! Let's delve into more of Aldehydes and Ketones and start to tackle Carboxylic Acid derivatives this week! As always, if you have any questions or need study tips, please do not hesitate to reach out to me at Megan_Hudson2@baylor.edu!

In-person group tutoring sessions will take place every Thursday from 5:15 - 6:15 pm in Sid Rich Rm. 75! In these sessions I will provide practice problems and be available for specific questions. To reserve a spot, go to https://baylor.edu/tutoring. I hope to see you there!

**Key Words:** Nucleophilic Addition, Sulfur, Hydrolysis, Carboxylic Acid Derivatives

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**TOPIC OF THE WEEK:** NUCLEOPHILIC ADDITION REACTIONS CONT'D

**Hydrolysis of Acetals, Imines, and Enamines**

- Acetal Hydrolysis *usually requires acidic conditions (acid catalysis)*

![Acetal Hydrolysis Reaction](image)

**Wolff-Kishner Reduction**

![Wolff-Kishner Reduction](image)

**Sulfur Nucleophiles**

![Sulfur Nucleophiles](image)
-Note: Desulfurization

Hydrogen Nucleophiles

- Alkoxide intermediate
- Reduction of carbonyl group with LAH or NaBH₄ is not reversible

Carbon Nucleophiles

- Grignard Reagents

-Cyanohydrin Formation

Baeyer-Villiger Oxidation of Aldehydes and Ketones

- Lactone Formation
- When ketone is unsymmetrical, formation of the ester is regioselective. The more substituted group moves onto the Oxygen. Migratory aptitude is present: H > Tertiary > Secondary, Phenol > Primary > Methyl
Wittig Reaction

- To make Wittig reagents, treat triphenylphosphine with an alkyl halide and a strong base.

**HIGHLIGHT #1: CARBOXYLIC ACID DERIVATIVES**

<table>
<thead>
<tr>
<th>Carboxylic Acid</th>
<th>Starting molecule and product for many reactions listed below</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acid Halide (X=Cl, Br, etc.)</td>
<td>Most reactive; Can be formed from a carboxylic acid; can form an anhydride, an ester, an amide, an aldehyde or a carboxylic acid</td>
</tr>
<tr>
<td>Anhydride</td>
<td>Can be formed from carboxylic acid or acid chloride; can form an ester or carboxylic acid</td>
</tr>
</tbody>
</table>
### THINGS YOU MAY STRUGGLE WITH:

1. **REVIEW THESE MECHANISMS!** I highly recommend doing problems 20.63, 20.66, 21.50, and 21.55. Be able to draw the entire mechanism FROM MEMORY to ensure you know what types of reagents to use and the products formed.


<table>
<thead>
<tr>
<th>Compound</th>
<th>Formation and Reactions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ester</td>
<td>Can be formed from carboxylic acid, an acid chloride, or an anhydride; can form an amide or a carboxylic acid</td>
</tr>
<tr>
<td>Amide</td>
<td>Least reactive; can be formed from a carboxylic acid, an acid chloride, an anhydride, or an ester; can form a nitrile, an amine, or a carboxylic acid</td>
</tr>
</tbody>
</table>
PRACTICE PROBLEMS:

1. Predict product and identify intermediate

\[
\begin{align*}
\text{O} & \quad \xrightarrow{[\text{H}^+], \text{H}_2\text{N-NH}_2, -\text{H}_2\text{O}} \\
\text{C}_6\text{H}_5\text{CH}_2\text{Y} & \quad \xrightarrow{2) \text{KOH/H}_2\text{O}, \Delta} \\
\end{align*}
\]

2. Identify reagents necessary to accomplish this transformation

\[
\begin{align*}
\text{HO} & \quad \xrightarrow{\text{DIBAH}} \quad \text{EtOH} \\
\text{H} & \quad \xrightarrow{\text{[H}^+]\text{}} \quad \text{EtOH} \\
\text{D} & \quad \xrightarrow{\text{DIBAH}} \quad \text{A} \\
\text{E} & \quad \xrightarrow{\text{1) LiAlH}_2\text{OR}_2\text{H}} \quad \text{B} \\
\text{B} & \quad \xrightarrow{\text{2) H}_2\text{O}} \quad \text{C} \\
\end{align*}
\]

3. Determine the missing structures

\[
\begin{align*}
\text{D} & \quad \xrightarrow{\text{[H}^+]\text{}} \quad \text{EtOH} \\
\text{A} & \quad \xrightarrow{\text{H}_2\text{SO}_4, \text{H}_2\text{O}} \quad \text{B} \\
\text{B} & \quad \xrightarrow{\text{SOCl}_2} \quad \text{C} \\
\end{align*}
\]

ANSWERS TO PRACTICE PROBLEMS:

1. Predict product and identify intermediate

\[
\begin{align*}
\text{O} & \quad \xrightarrow{[\text{H}^+], \text{H}_2\text{N-NH}_2, -\text{H}_2\text{O}} \\
\text{C}_6\text{H}_5\text{CH}_2\text{Y} & \quad \xrightarrow{2) \text{KOH/H}_2\text{O}, \Delta} \\
\end{align*}
\]

Intermediate is a hydrazone

\[
\begin{align*}
\text{O} & \quad \xrightarrow{[\text{H}^+], \text{H}_2\text{N-NH}_2, -\text{H}_2\text{O}} \\
\text{C}_6\text{H}_5\text{CH}_2\text{Y} & \quad \xrightarrow{2) \text{KOH/H}_2\text{O}, \Delta} \\
\end{align*}
\]

\[
\begin{align*}
\text{O} & \quad \xrightarrow{[\text{H}^+], \text{H}_2\text{N-NH}_2, -\text{H}_2\text{O}} \\
\text{C}_6\text{H}_5\text{CH}_2\text{Y} & \quad \xrightarrow{2) \text{KOH/H}_2\text{O}, \Delta} \\
\end{align*}
\]
All diagrams, tables, and external information is property of Organic Chemistry by David Klein, unless otherwise specified.