Chpt. 18 – Ketones & Aldehydes

Characterized by

\[
\begin{align*}
\text{Structure:} & \quad \text{Interactions:} \\
\text{CH}_3 & \quad \text{Cl} \\
\end{align*}
\]

*In comparison with C=C

**Aldehyde nomenclature:**
- **Parent =**
- **Carbonyl always**
- **As substituent =**

- **Unsaturated aldehydes:**
- Cylic with -CHO attached to ring:

- Common names:

**Ketone nomenclature**
- Parent alkane =
- Parent name =
- As substituent =

\[
\begin{align*}
\text{CH}_3\text{CCH}_3 & \quad \text{CH}_3\text{CCH}_3 \\
\text{C}_6\text{H}_5 & \quad \text{C}_6\text{H}_5
\end{align*}
\]
- Common names

![Chemical structures](image)

Functional group priority:

<table>
<thead>
<tr>
<th>Functional group</th>
<th>Suffix if higher</th>
<th>Prefix if lower</th>
</tr>
</thead>
<tbody>
<tr>
<td>--CO₂H</td>
<td></td>
<td></td>
</tr>
<tr>
<td>--CHO</td>
<td></td>
<td></td>
</tr>
<tr>
<td>--O</td>
<td></td>
<td></td>
</tr>
<tr>
<td>--OH</td>
<td></td>
<td></td>
</tr>
<tr>
<td>--NH₂</td>
<td></td>
<td></td>
</tr>
<tr>
<td>--SH</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Examples:

![Chemical structures](image)
Physical properties:
- Based on
- Extremely
- Boiling points: *
- *
- Solubility *
- *
- Densities of

Uses:

Reactions: Synthesis of Carbonyls

1) Oxidation of 2° Alcohols

2) Oxidation of 1° Alcohols

3° alcohols cannot be oxidized to a carbonyl!!!
3) Hydration of alkynes (review) – Markovnikov addition

4) Hydration of alkynes (review) – Anti-markovnikov addition

Reactions – Review: Reduction of Carbonyls

1) By Catalytic hydrogenation

2) With NaBH₄ or LAH
New Reactions - Nucleophilic Addition

\[ \text{Nu}^{-} + \begin{array}{c} \text{R} \\ \text{R} \end{array} \text{C} = \text{O} \quad \text{H} \quad \text{H} \quad \text{Nu}^{-} \quad \text{H} \quad \text{Nu}^{-} \]

Most valuable reaction:
Why?

Grignard reagent: Also:
Properties:

\[ R-X + Mg \rightarrow R-X + 2Li \]

Reactions with Grignard/ Organolithium Nu:

Example:

\[ \text{CH}_3\text{CH}_2\text{MgI} + \text{CH} = \text{O} \rightarrow \text{H}_2\text{O}^+ \]

Grignard + acid →
  + aldehyde →
  + ketone →
  + carbon dioxide →
  + ethylene oxide →
Reactions with oxygen Nu:

1) Hemiacetal

- Formed by:

\[
\text{CH}_3\text{CCH}_3 + \text{CH}_3\text{CH}_2\text{OH} \rightarrow \]  

- Generally
- Except

2) Acetal

- Formed by:

\[
\text{CH}_3\text{CCH}_3 + \text{CH}_3\text{CH}_2\text{OH} \rightarrow \]  

- Shift equilibrium to right by:
Reactions with Nitrogen Nu:

1) Imine a.k.a.

- Formed by:

\[
\begin{align*}
\text{CH}_3\text{CH} & \quad + \quad \text{NH}_2\text{O} \\
\end{align*}
\]

\[
\xrightleftharpoons{H^+}
\]

Tollen’s Test:

\[
\begin{align*}
\text{R-C-H} & \quad + \quad 2\text{Ag(NH}_3\text{)_2}^+ \\
\end{align*}
\]

\[
\xrightleftharpoons{3\text{OH}^- \rightarrow \text{H}_2\text{O}}
\]

Suggested Problems:

Chapter 11: 2 (a,b,c,e), 5 (a,b,c), 6 (a,b,f)

Chapter 18: 39, 51 (c,f,g,h), 52 (b,c,e,f), 56 (b,f,h,i), 57, 61 (a,d), 62 (a,b,d), 63 (a,c,e,f)