Chapter 16 - Chemistry of Benzene: Electrophilic Aromatic Substitution

Synthesis Strategies

In order to think about multi-step synthesis, it is useful to carry out a Retrosynthetic Analysis of the route.

- Work backwards from the target molecule to the starting material
- Determine if each step is reasonable.

For synthesis dealing with Aromatic Rings, it is useful to keep in mind several things.
- Which groups can be directly added to the ring
- Which groups must be made by modification of other substituents
- Activators, deactivators - o,p- or m- directors
- For alkyl groups it is often best to do FC-Acylation followed by reduction

Aromatic Functionalization Chart

<table>
<thead>
<tr>
<th>Substituents we can add directly</th>
<th>Substituent Modifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>SO(_3)H</td>
<td>OH</td>
</tr>
<tr>
<td>X</td>
<td>NH(_2)</td>
</tr>
<tr>
<td>NO(_2)</td>
<td></td>
</tr>
<tr>
<td>O</td>
<td>R - CO(_2)H</td>
</tr>
<tr>
<td>R</td>
<td></td>
</tr>
</tbody>
</table>

Retrosynthetic Analysis for how to synthesize p-nitrobenzoic acid

Not Possible - no way to add carboxylic acid directly. Also, NO\(_2\) is a meta-director, so anything you add would be in the wrong place.

Not Possible - you can add NO\(_2\) with HNO\(_3\)/H\(_2\)SO\(_4\), but the CO\(_2\)H group would be a meta director.
Steps needed to incorporate functional groups:

- Br₂, FeBr₃
- H₂SO₄, SO₃
- CH₃CH₂COCl, AlCl₃
- H₂/Pd/C (to reduce ketone to alkane)

Retrosynthesis that would work for every step:

- Due to carbocation rearrangements, need to use F-C Acylation first, then reduce the ketone to alkane.
- Can be directly added with electrophilic substitution.
Chapter 17 - Alcohols and Phenols

Naming

Alcohols are generally named by dropping the e, and adding ol. If required, the position of the OH group is given by numbering either before the name, or in the middle of the name. There are several common names that are used for alcohols.

- Methanol (methyl alcohol)
- Ethanol (ethyl alcohol)
- 2-Propanol (isopropanol)
- 1-Butanol (n-butanol)
- 2-Butanol (sec-butanol)
- Tert-butanol

Alcohols are classified according to their degree of alkyl substitution.

- 1° - primary
- 2° - secondary
- 3° - tertiary