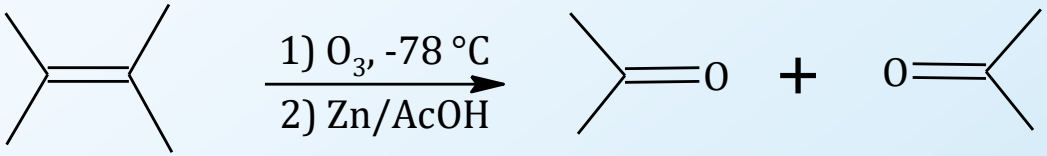
Aldehydes and Ketones
2 - Synthesis

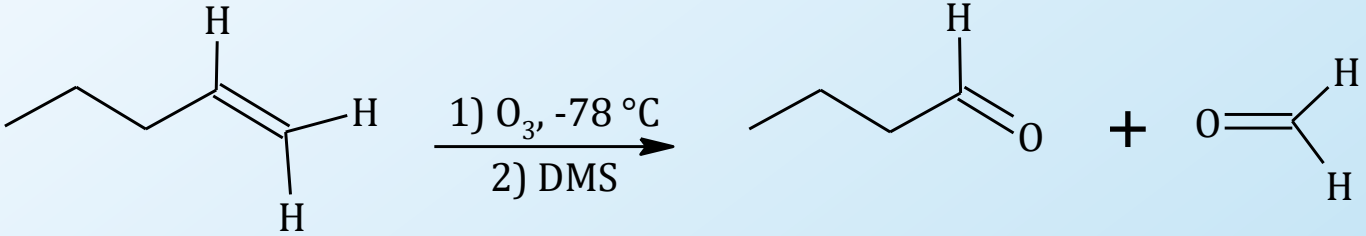
Dr. Sapna Gupta

1) From Alkenes

Aldehydes and ketones can be made by oxidative cleavage using ozonolysis. Substituted alkenes give ketones while alkenes with H will give aldehydes.



Substituted alkenes will give only ketones

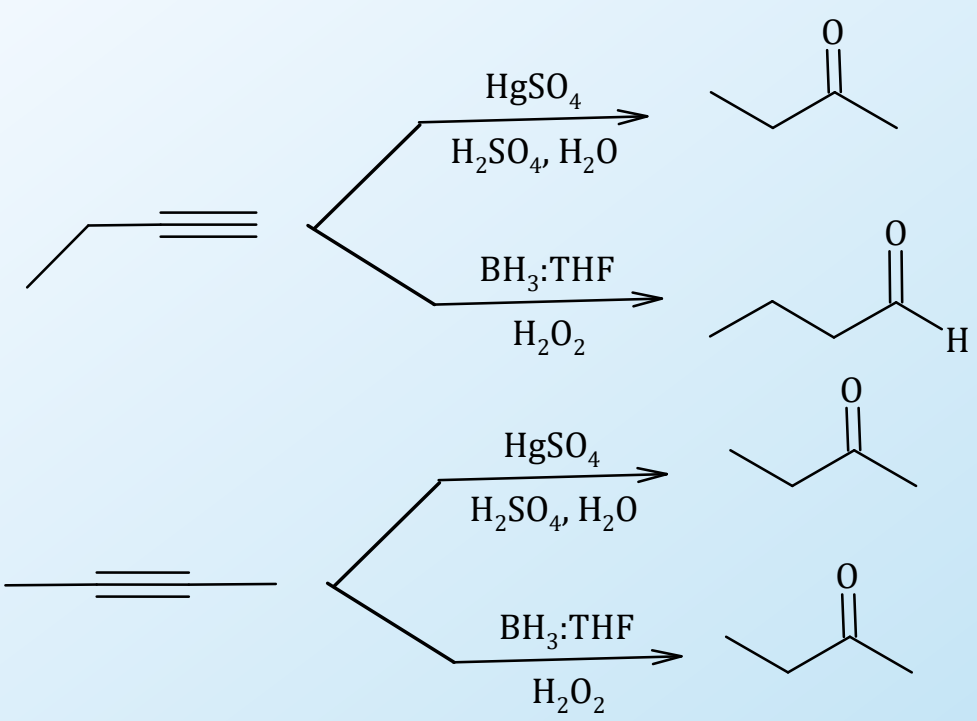


Alkenes with H give aldehydes

2) From Alkynes

Hydration of alkynes can give Markovnikov (ketone) or anti Markovnikov (aldehyde) product.

- Use $HgSO_4$, H_2SO_4, H_2O to make ketones.
- Use Sia_2BH or BH_3 followed by H_2O_2 in NaOH to make aldehydes. For aldehydes, the alkyne must be terminal.
- Internal alkynes will give only ketones with any reagent.

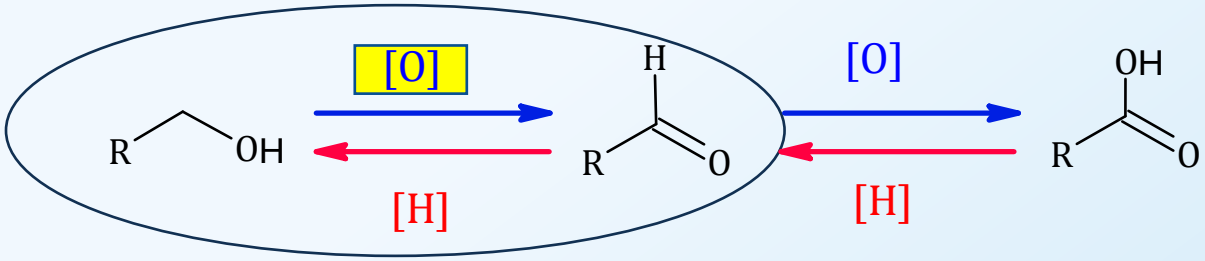


Markovnikov's Product – ketone

Anti Markovnikov's Product – aldehyde

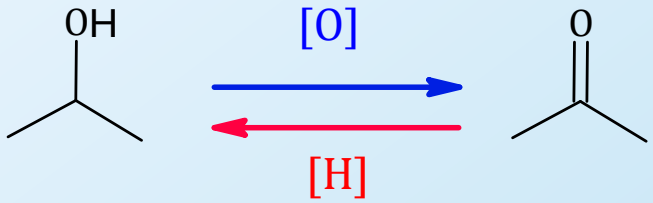
Internal alkynes will give only ketones

3) From Alcohols – Oxidation



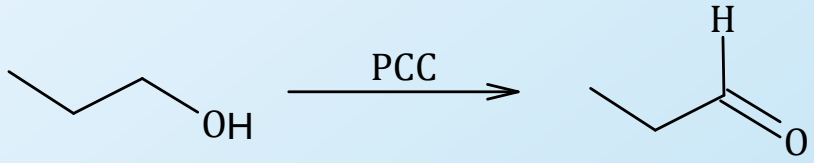
Primary and Secondary Alcohols can be oxidized to aldehydes and ketones, respectively.

- 1° alcohol + PCC → aldehyde
- 2° alcohol + $Na_2Cr_2O_7$ → ketone

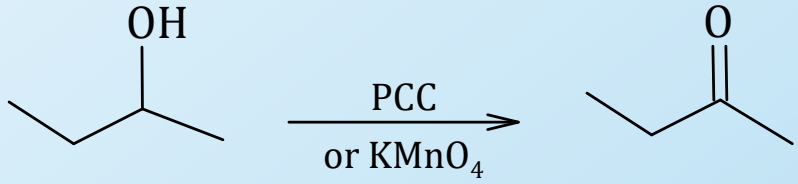


A strong oxidizing agent can be used for 2° alcohol since ketones cannot be oxidized further, but use only mild oxidizing agent for 1° alcohols (strong oxidizing agent will give carboxylic acids)

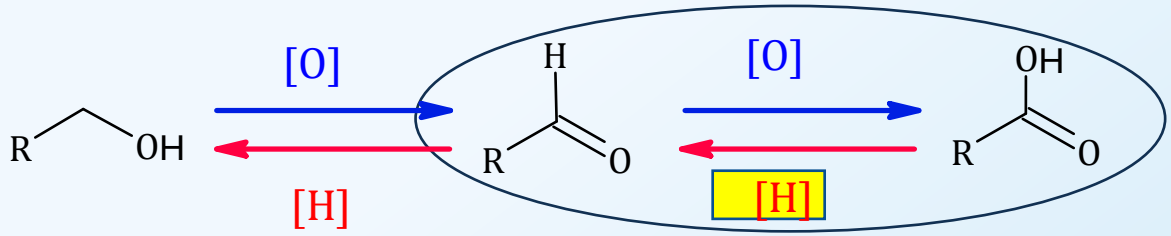
Primary alcohol



Secondary alcohol

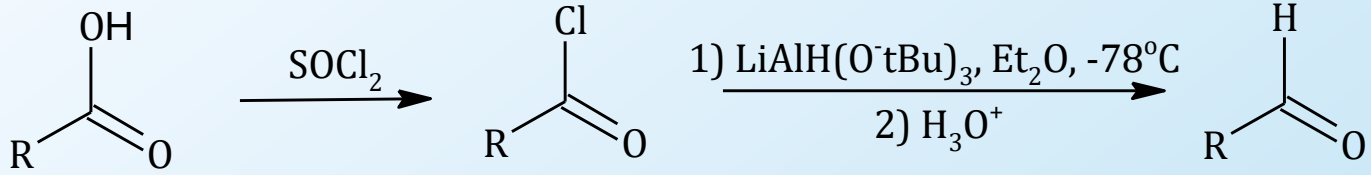


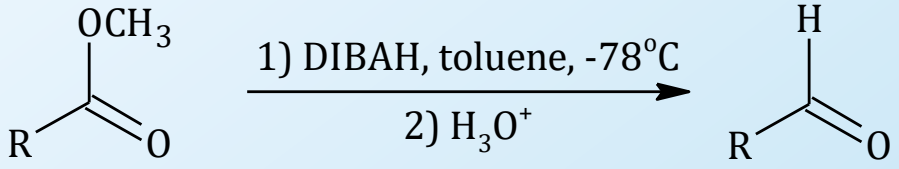
4) From Acids - Reduction



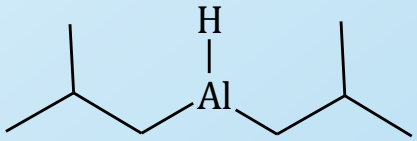
Acyl chlorides and esters an be reduced to form aldehydes. Ketones cannot be made from this process since acyl chlorides and esters in reductions are terminal groups and so is aldehyde.

A weak reducing agent is used so the reagent does not reduce the acid derivative to give a 1° alcohol. (*Note: $NaBH_4$ cannot be used here*).



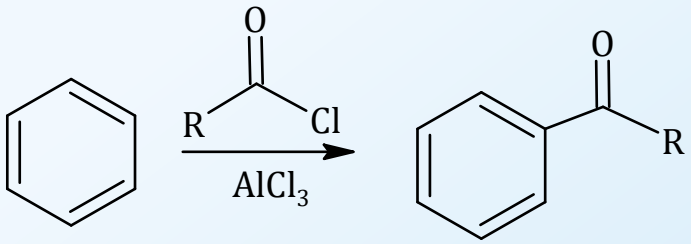


DIBAH – Diisobutylaluminum hydride

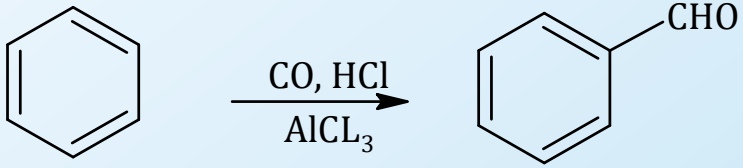


5) From Benzene

Friedel-Crafts Acylation can be used to make ketones.



Gatterman-Koch synthesis can be used to synthesize benzaldehyde.



Key Concepts

- Synthesis using
  - Alkenes
  - Alkynes
  - Oxidation of alcohol
  - Reduction of acyl chloride and esters
  - Benzene (Friedel Craft acylation)