

Carbonyl Mechanisms

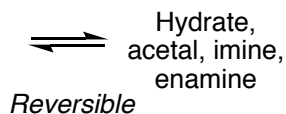
Type I = Aldehyde/Ketone
Type II = COOH or Derivative

a = acidic conditions
b = basic/nucleophilic conditions

Type Ia

Aldehyde/Ketone
+ **Weak Nucleophile**
(H₂O, HOR, NH₃, NH₂R)

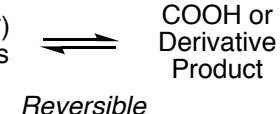
Acidic (H⁺)
Conditions



Type IIa

COOH or Derivative
+ **Weak Nucleophile**
(H₂O, HOR, amine)

Acidic (H⁺)
Conditions



Protonate C=O 1st

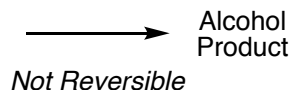
- *Typically don't use acid w/ amine Nu
- *The Nu replaces the LG
- *Product should be more stable than the St. Mat.

See next
page for
details

*Generally will get the same products without acid, but rxn is slower.

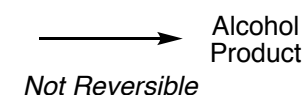
Type Ib

Aldehyde/Ketone
+ **Strong Nucleophile**
R-MgBr, R-Li, NaBH₄, LAH



Type IIb

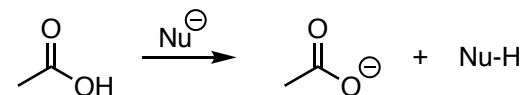
COOH or Derivative
+ **Strong Nucleophile**
R-MgBr, R-Li, NaBH₄, LAH



Nu Attacks C=O 1st

*Due to the LG, strong Nu adds twice!

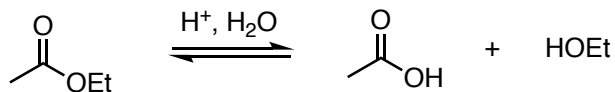
Exception: Other than LAH, a strong Nu will simply deprotonate a carboxylic acid.



Type IIa - Expanded Details

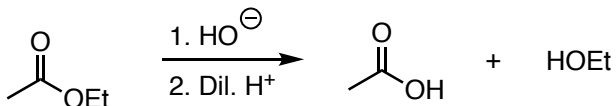
COOH Derivatives can react under acidic, basic, or neutral conditions.

1. Acidic Conditions



Mechanism:

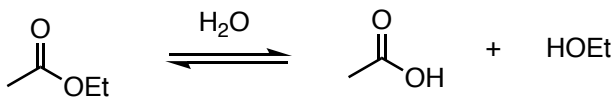
2. Basic Conditions



Mechanism:

These are moderate bases like HO^- , RO^- , and H_2N^- . Unlike the very strong nucleophiles, these only add 1x to displace the leaving group and reform a carbonyl product.

3. Neutral Conditions



Mechanism:

This tends to be slow and you need at least 2 equivalents of nucleophile/weak base