



Pre-Health Post-Baccalaureate Program  
CHM2211 Study Guide & Practice Problems

Date:

10/5 - 10/9

Topics Covered:

Reactivity staircase

Acyl Substitution

Fischer Esterification

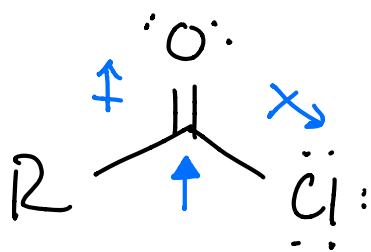
Saponification

Created by Isaac Loy

# Reactivity Staircase

- From your notes - know this handout like the back of your hand!
- Up the staircase: more electrophilic carbonyl carbon means more reactive / less stable

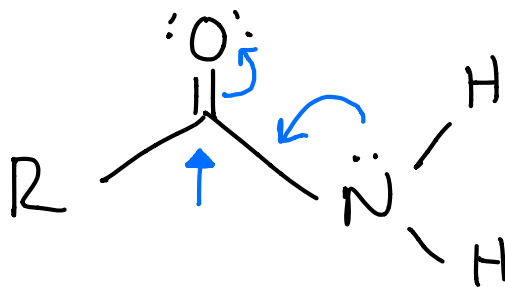
**Ex** "The King"



The carbonyl carbon is lacking in electron density because the electronegative -Cl is "hogging" the electrons in that bond, making it very susceptible to a nucleophilic attack

- Down the staircase: less electrophilic carbonyl carbon means less reactive / more stable

**Ex** Amide

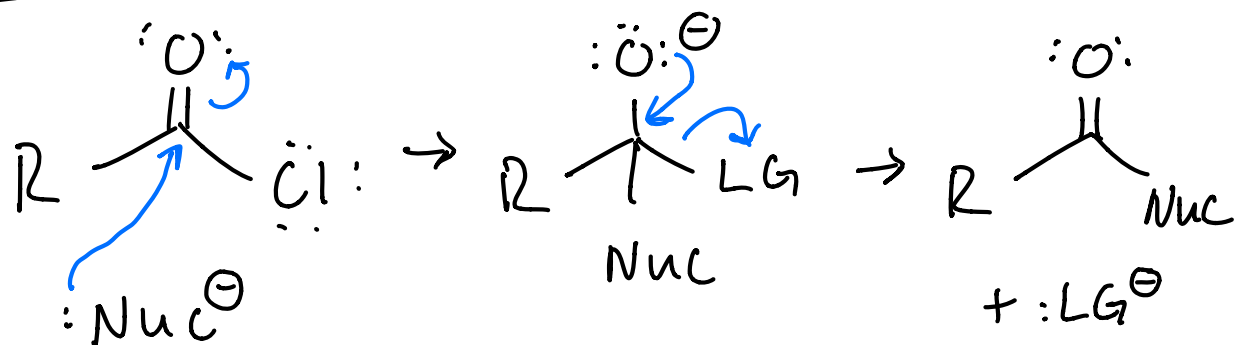


The LP from the -NH<sub>2</sub> can be shared across the neighboring atoms (including the carbonyl carbon), making it less "hungry" for electrons and less susceptible to nucleophilic attack

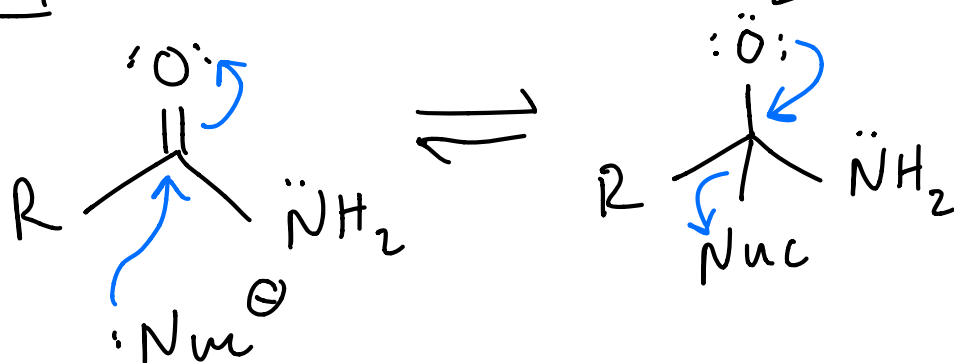
# "The" Acyl Substitution Mechanism

- The model for pretty much every reaction you'll learn for the rest of the semester
- Product formation depends on the "strength" of the leaving group (LG): good LG leads to replacement of LG with Nuc, whereas bad LG returns back to starting material (SM)

**[Ex]** Good LG:  $-Cl$

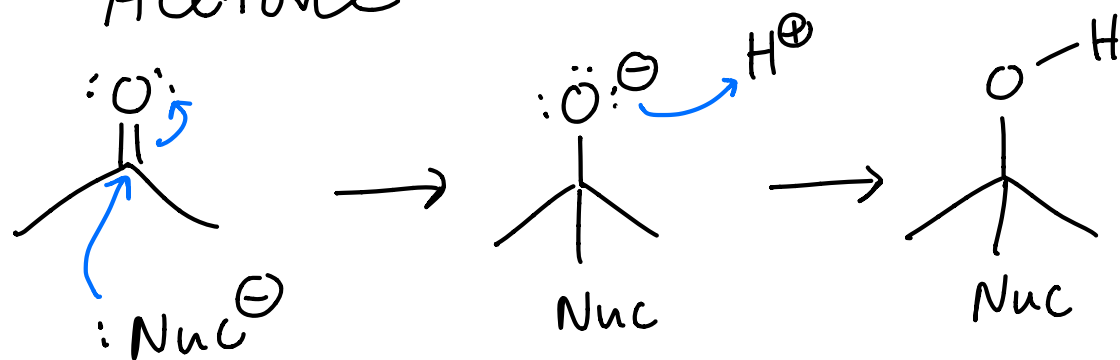


**[Ex]** Bad LG:  $-NH_2$

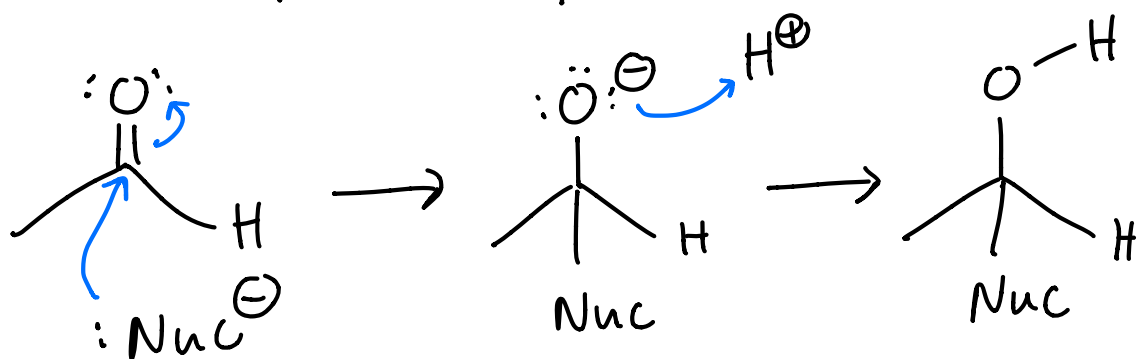


— The above mechanism works with staircase carbonyls.  
For aldehydes/ketones — the "other" type of carbonyls — we form tetrahedral carbons with a alcohol after a workup step

[Ex] Acetone



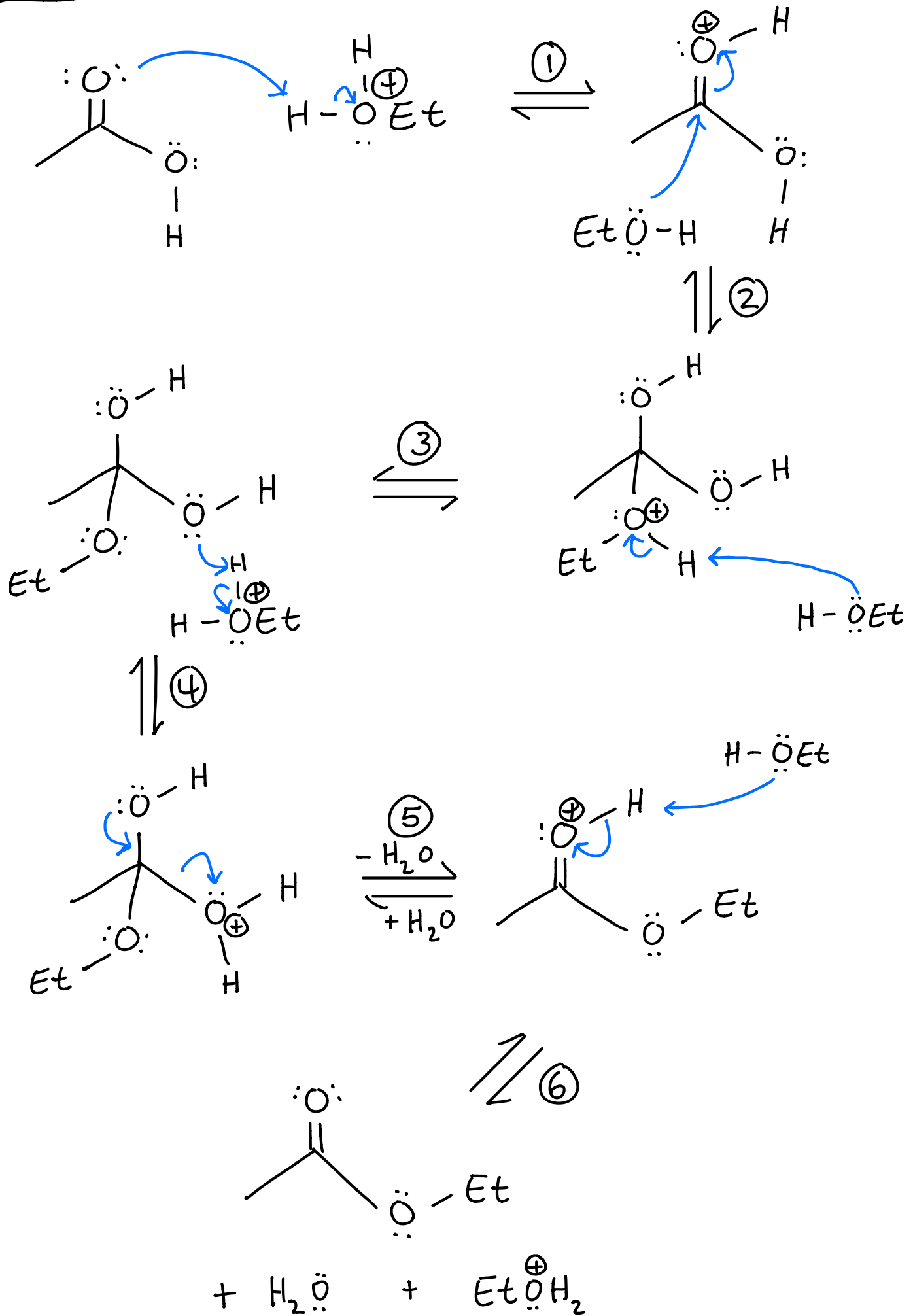
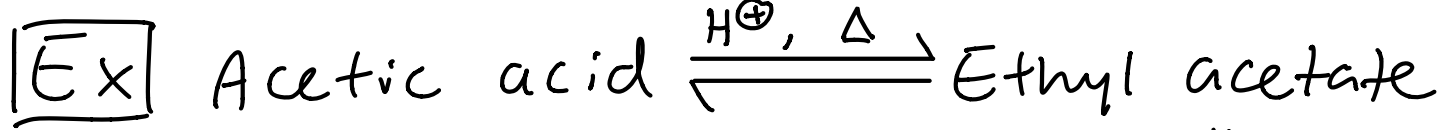
[Ex] Acetaldehyde



# "The" Fischer Esterification

## Mechanism

- You've had MOWs. This is the MOS - the mechanism of the semester! know it backwards and forwards, and what is happening in each step
- An acyl substitution mechanism which allows for the conversion between a carboxylic acid and an ester (hence esterification)
- Follows the pattern PADPED:
  - ① Protonate
  - ② Attack
  - ③ Deprotonate
  - ④ Protonate
  - ⑤ Extract
  - ⑥ Deprotonate



# Saponification mechanism

- Creation of soaps (polar head with nonpolar tail) through base-driven hydrolysis (another acyl substitution mechanism)

