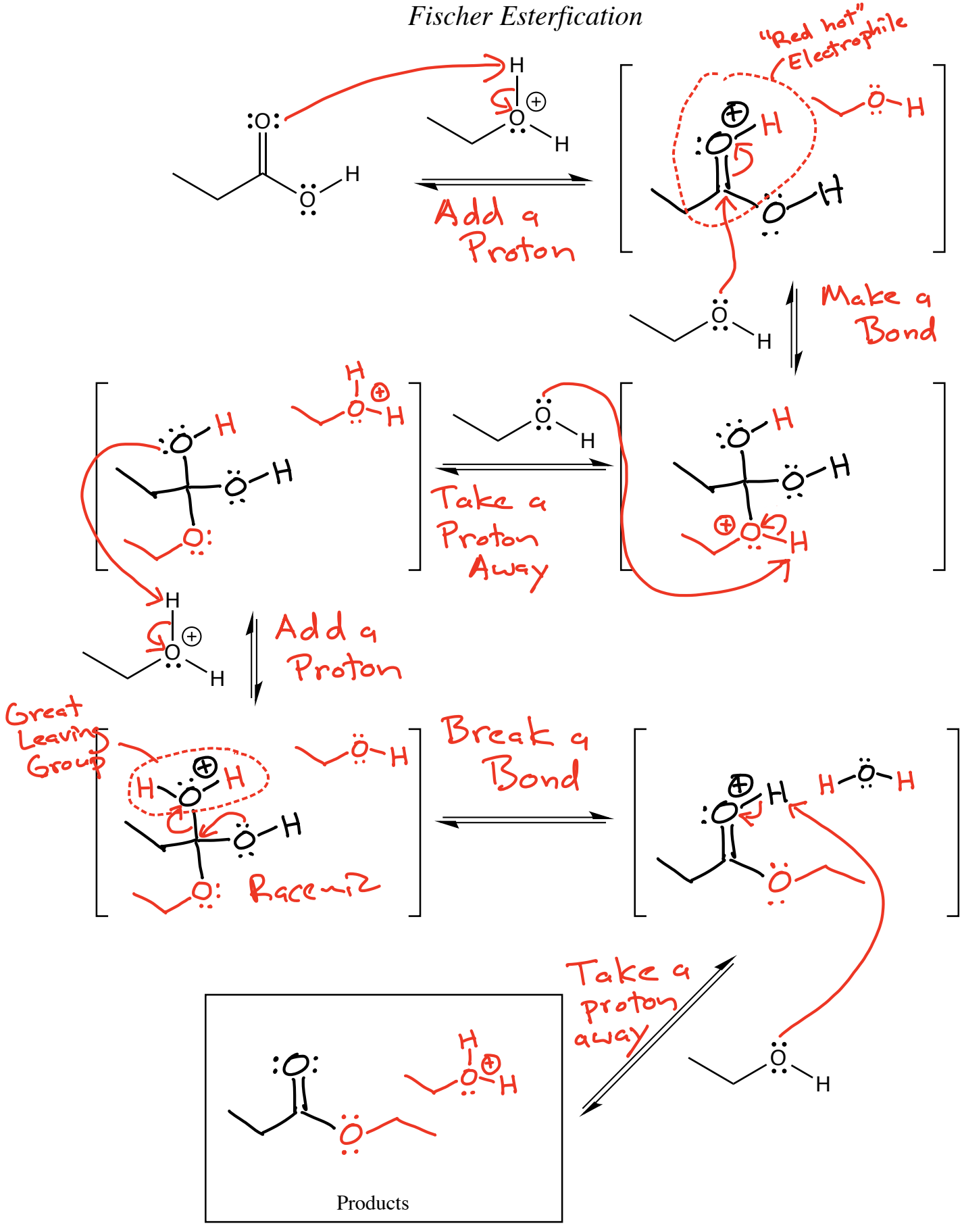
Fischer Esterfication



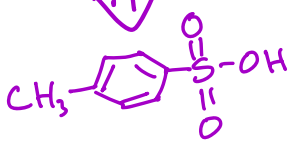
Is - or -2 4

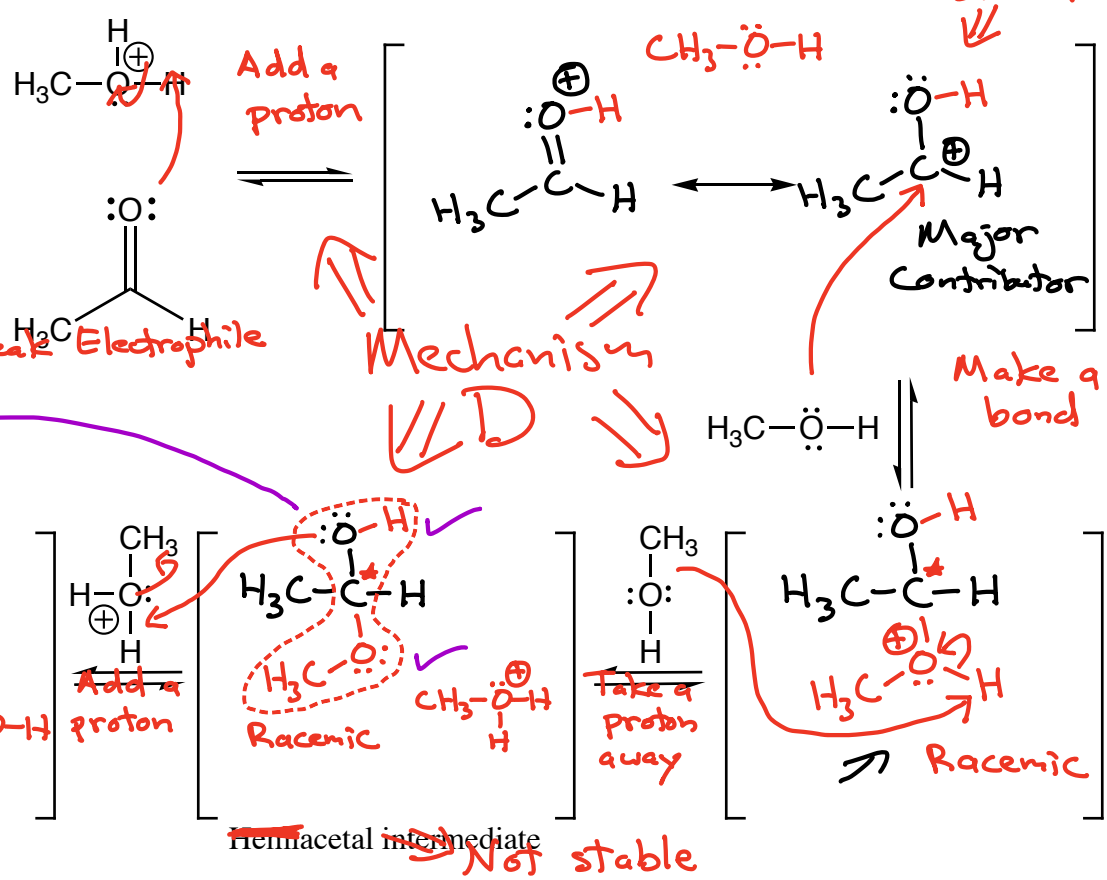
Tosylic Acid

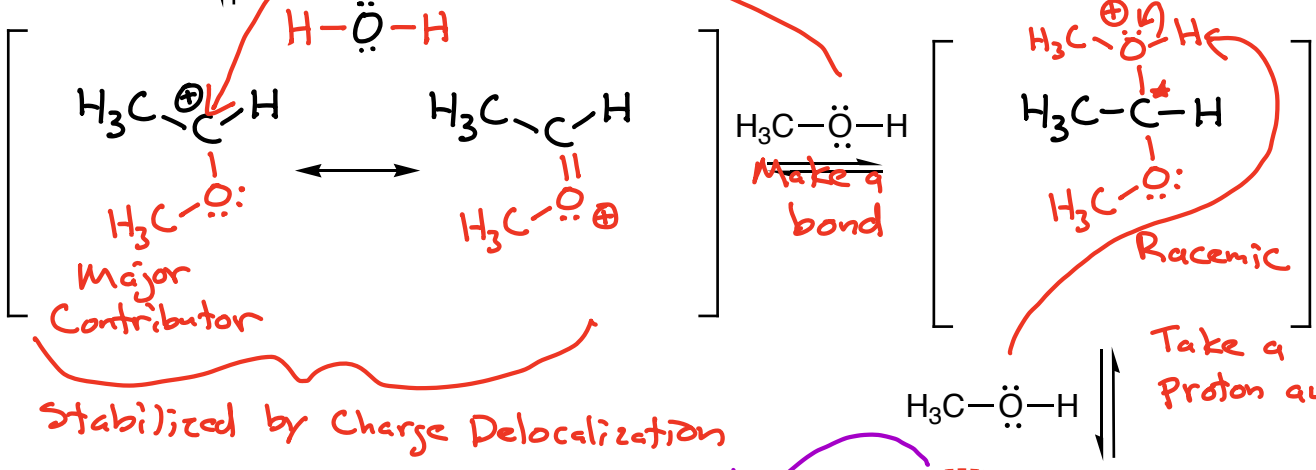
-ey, oes - e - ing ave a

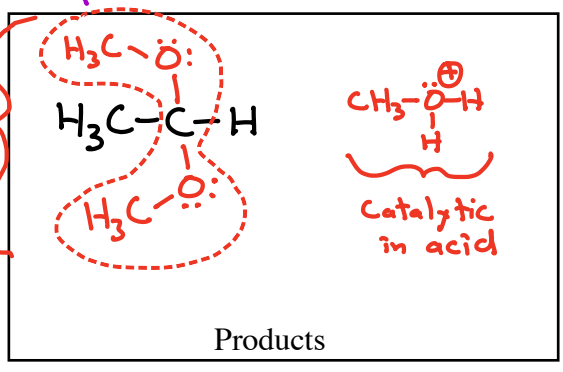
hemi init?" "SWEET!" !"

Acid Catalyzed Hemiacetal and Acetal Formation From an Aldehyde or Ketone







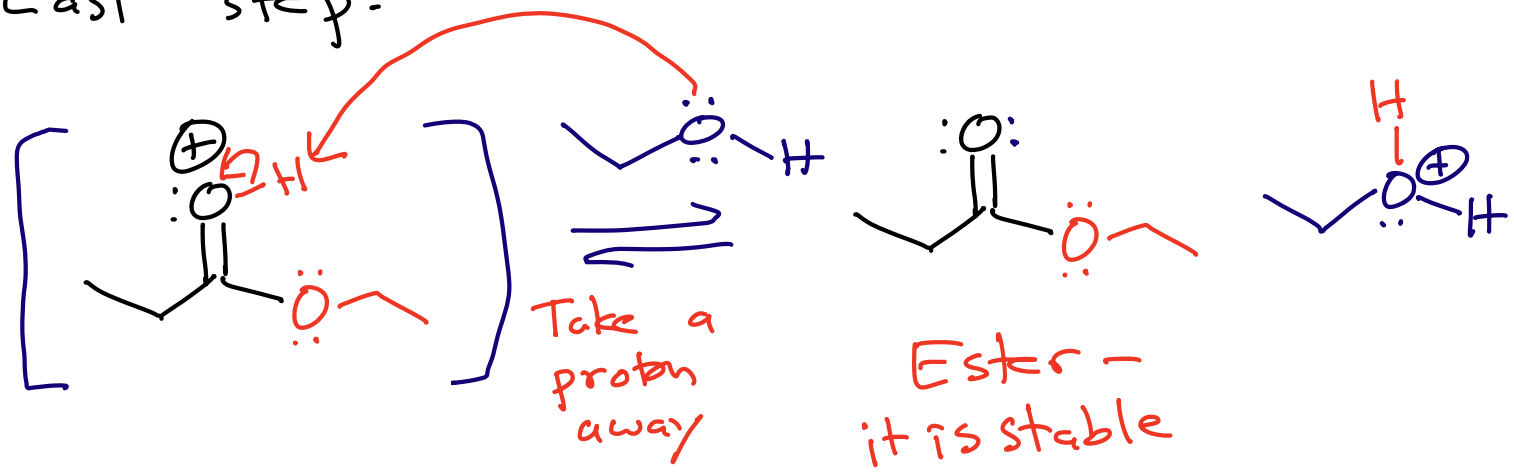


Key Recognition Element (KRE):

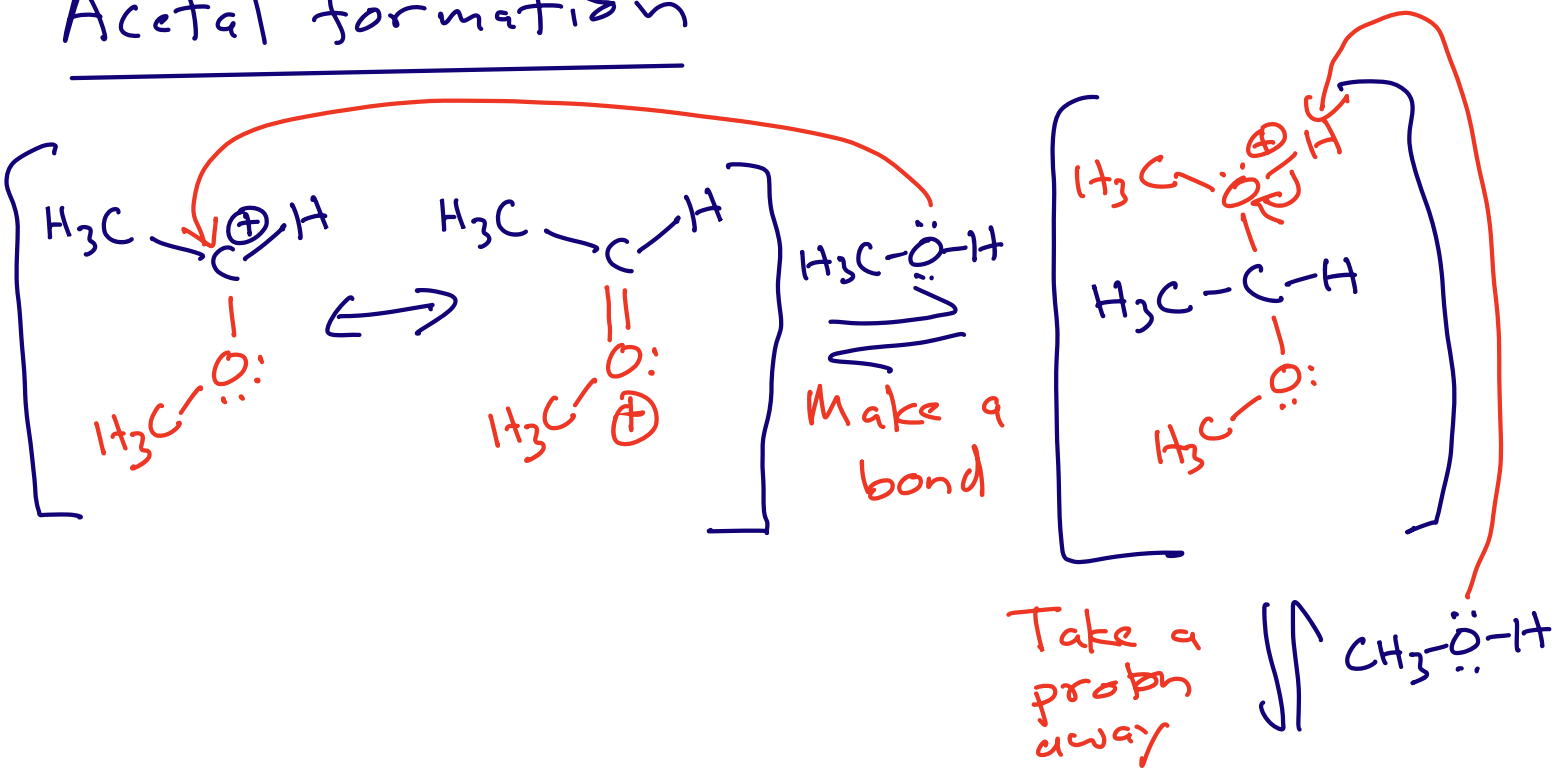
Two bonds to ether O atoms to an sp^3 C atom

Fischer Esterification

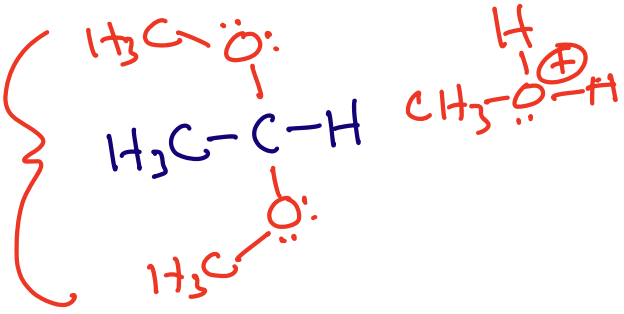
Last step:



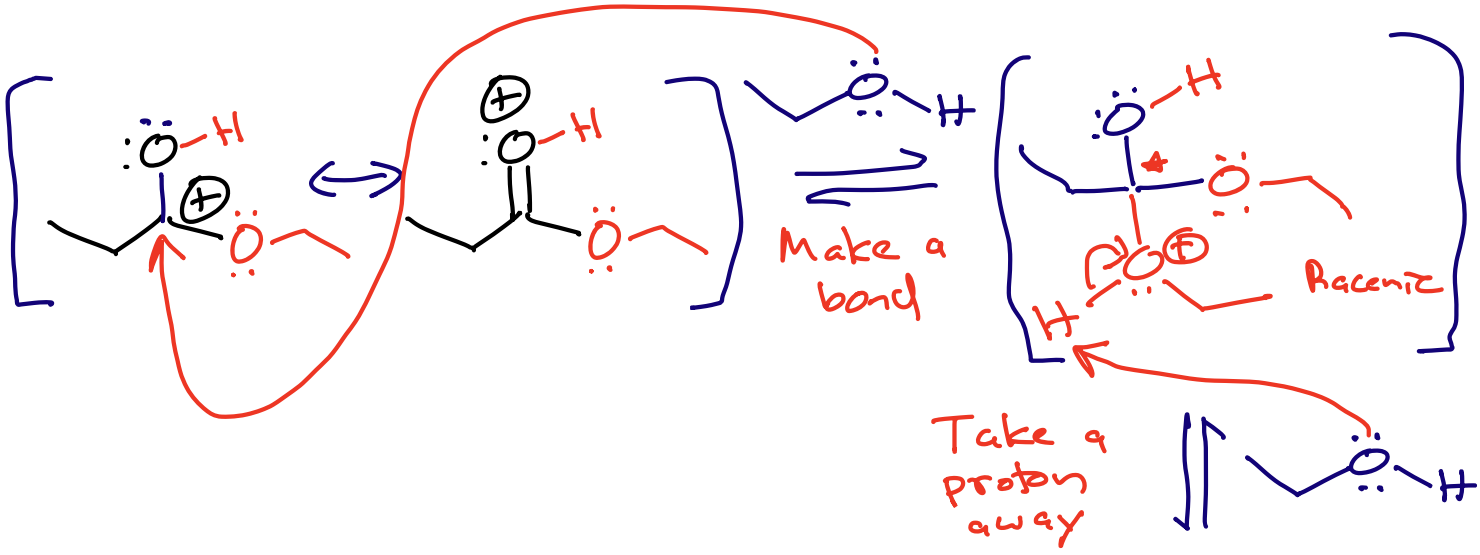
Acetal formation

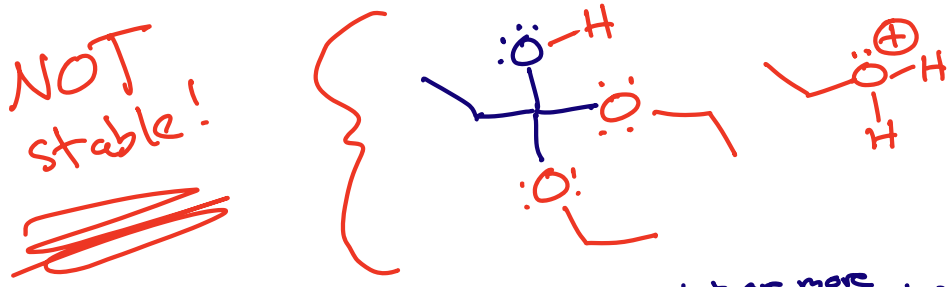


Acetal - it is stable



What about: Making the last steps of the Fischer esterification look like the last steps of acetal formation?





Products that are more stable than the starting material(s)

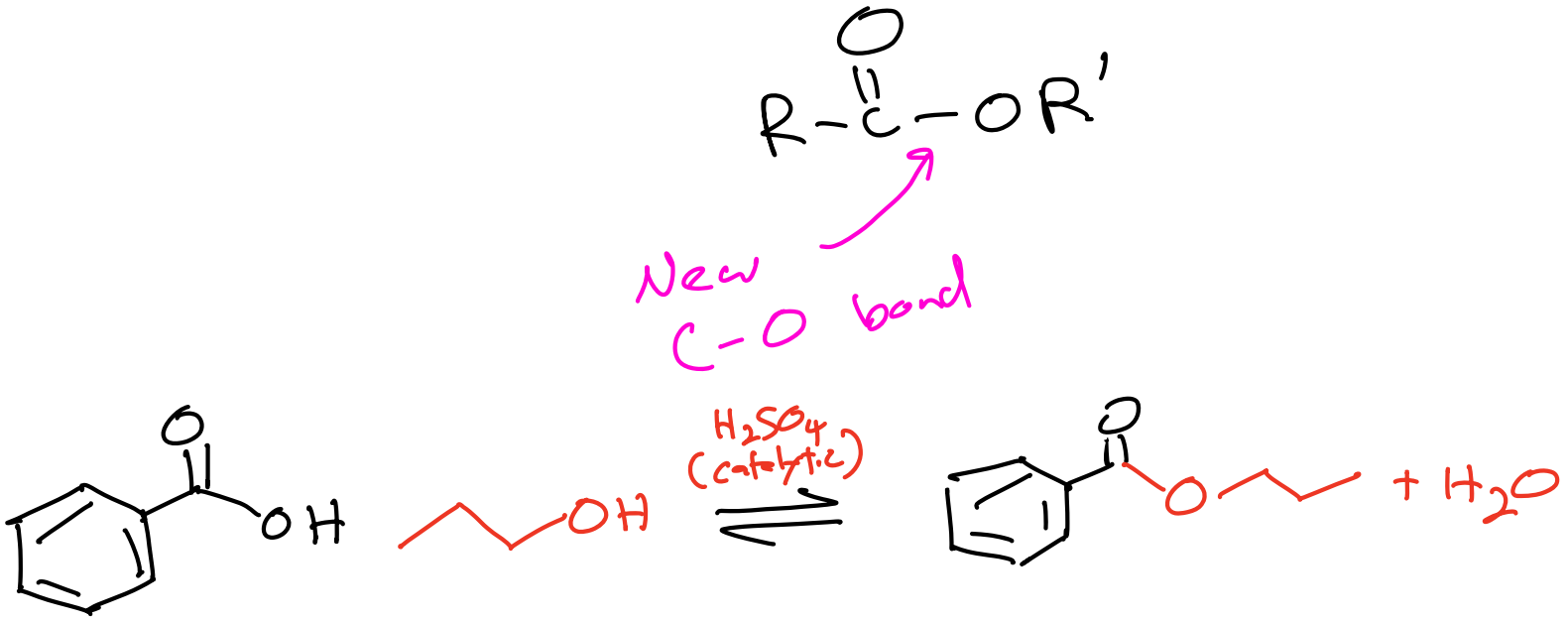
A reaction needs both motive and opportunity. This last step has reasonable "opportunity" as the alcohol as a nucleophile makes a bond with an electrophilic carbon. That is reasonable from a mechanism standpoint.

Reasonable mechanism

However we can ignore this because it leads to a product that is NOT stable. (3 O atoms on same C atom → too many lone pairs close to each other).

No motive! Does not happen!

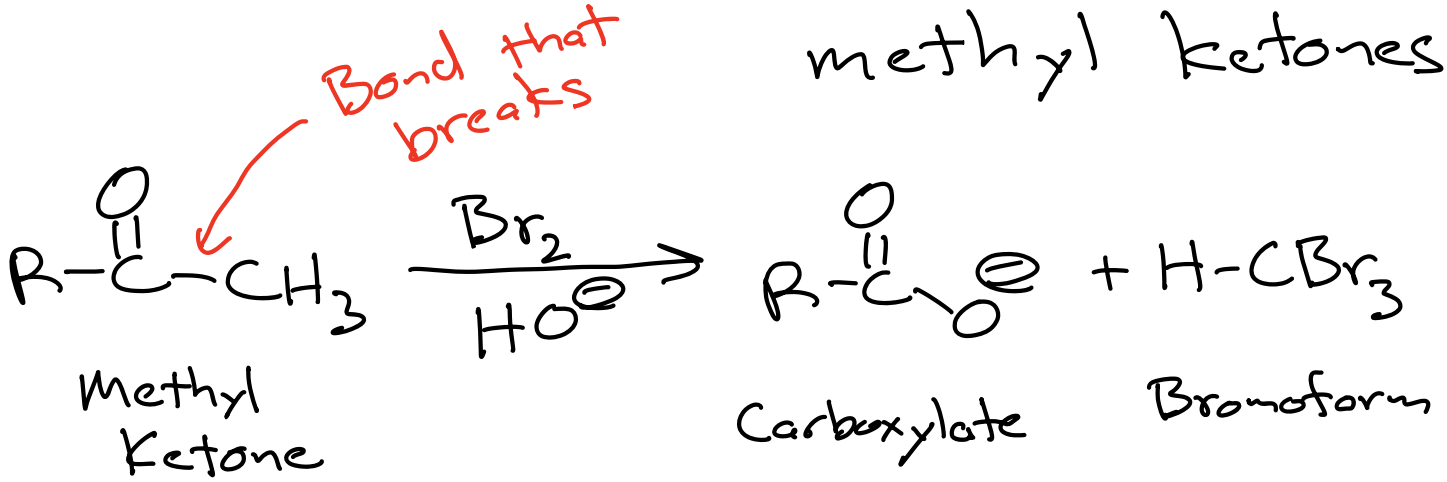
KRE → An ester is formed



Time Capsule →
This is reversible
→ The position of equilibrium depends on the ratio of alcohol to water

Le Chatlier's Principle ⟹

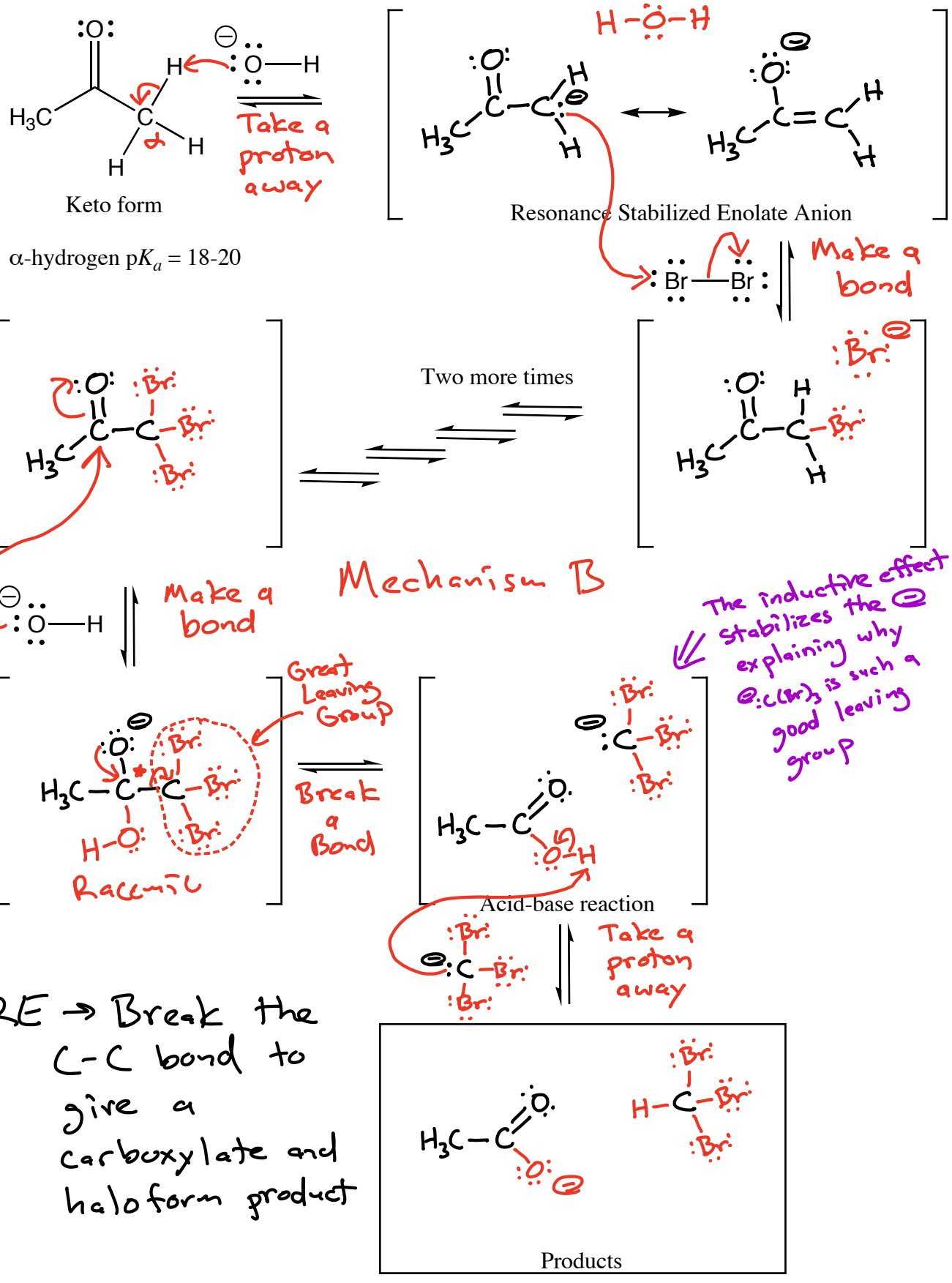
The haloform reaction → uses methyl ketones



Not that useful for synthesis, however the mechanism contains three elements that are important to second semester organic chemistry

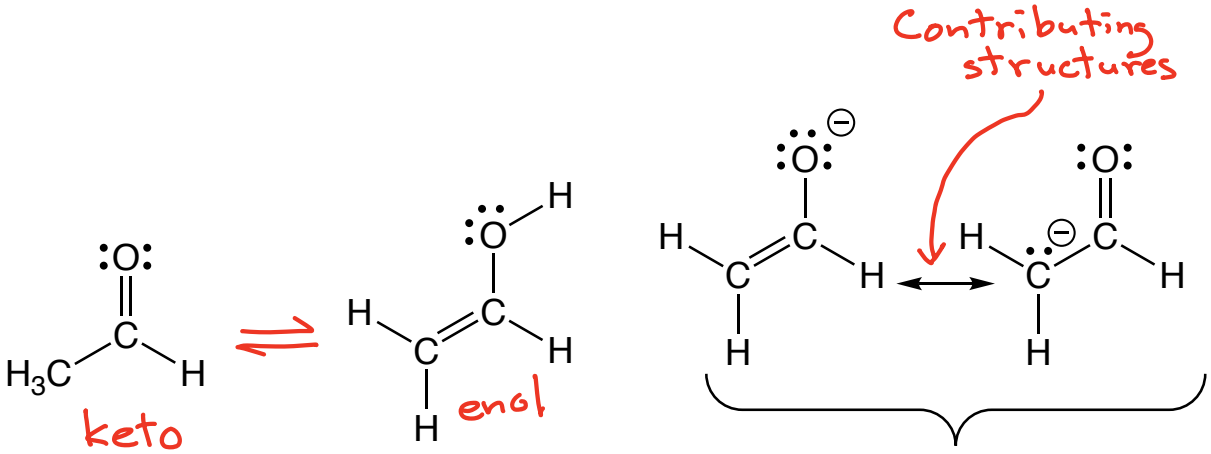
1) acidity of α-hydrogen
2) enolate nucleophile
3) Mechanism B

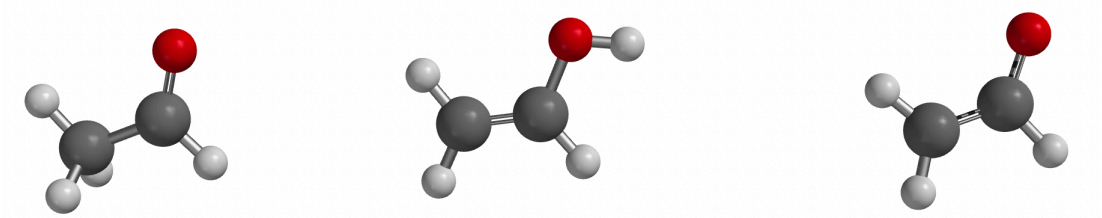
The Haloform Reaction

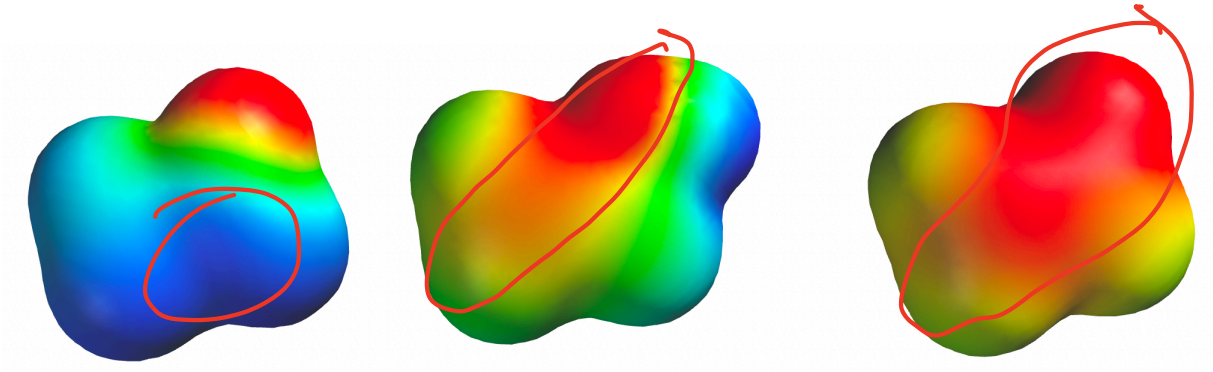


KRE → Break the C-C bond to give a carboxylate and haloform product

Be Careful: Do not confuse keto-enol equilibrium with enolate contributing structures!







Electrophile

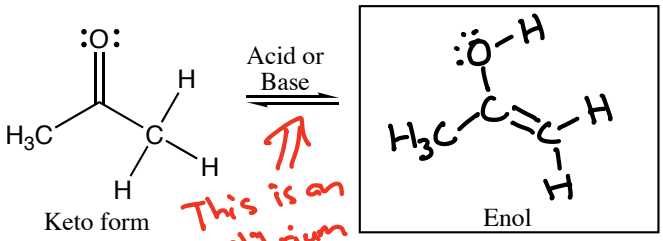
Nucleophile

Strong Nucleophile

Enol has an "N" like Nucleophile
Keto keeps its electrons!

Keto-Enol Tautomerization vs. Enolate Resonance

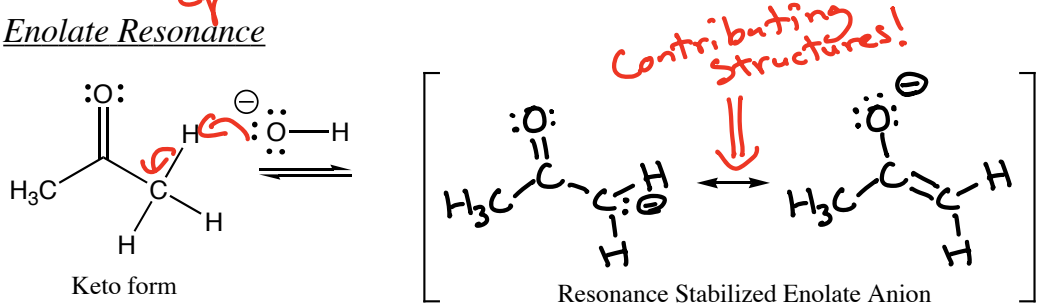
Keto-Enol Tautomerization



This is an equilibrium

Both the keto and enol molecules are Neutral!

Enolate Resonance



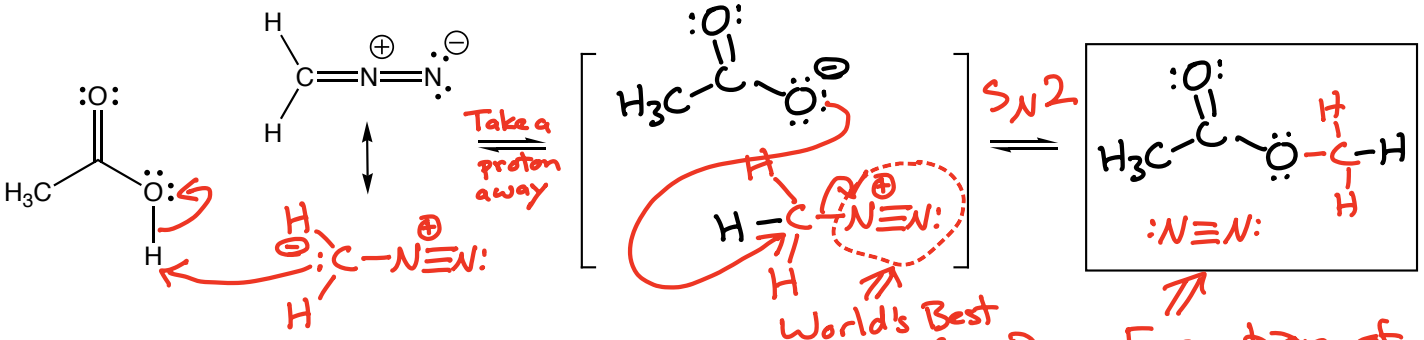
Contributing structures!

Full ⊖ so strong nucleophile!

α-hydrogen pK_a = 18-20

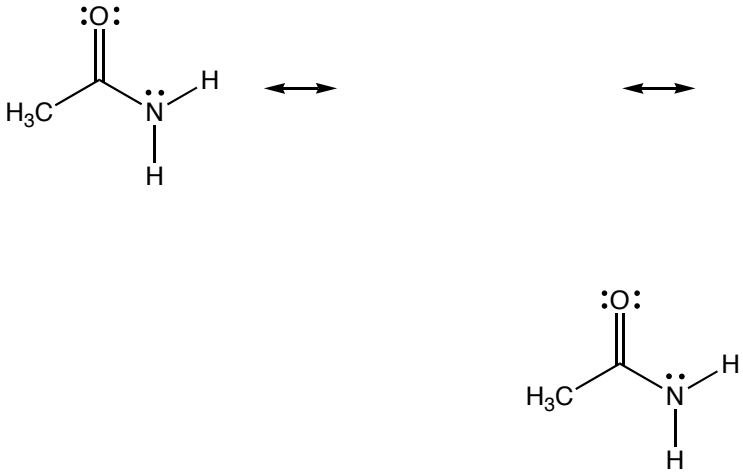
In an enolate something "ate" the H atom!

Diazomethane reaction

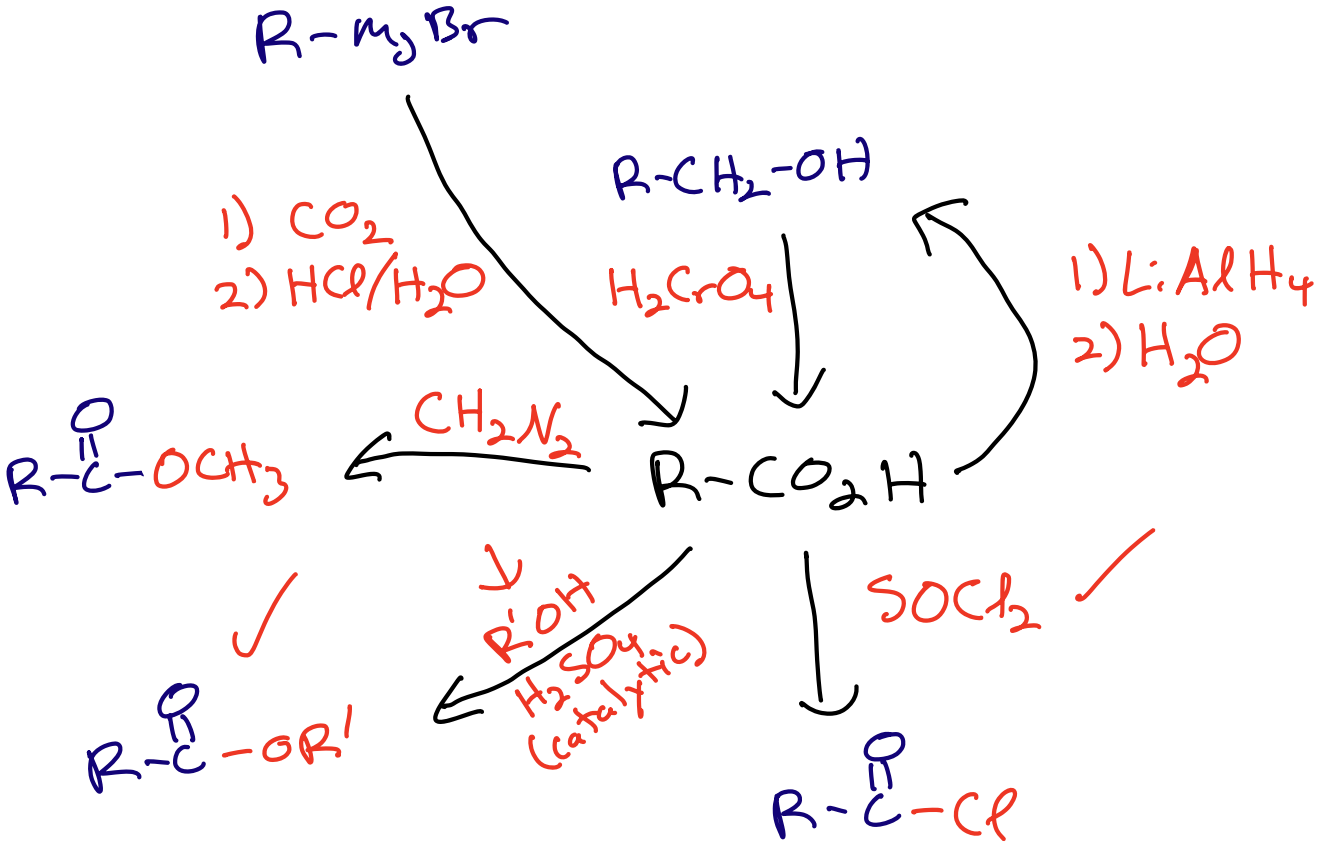


Formation of N_2 drives reaction!

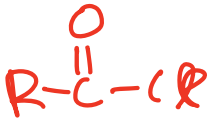
Amide Resonance VERY IMPORTANT!!!!!!



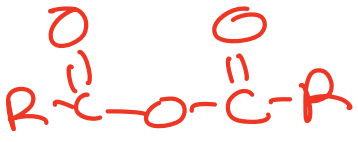
Summary of Carboxylic Acid Reactions →



Carboxylic Acid Derivatives

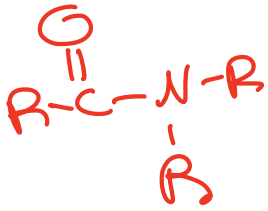


Acid Chloride



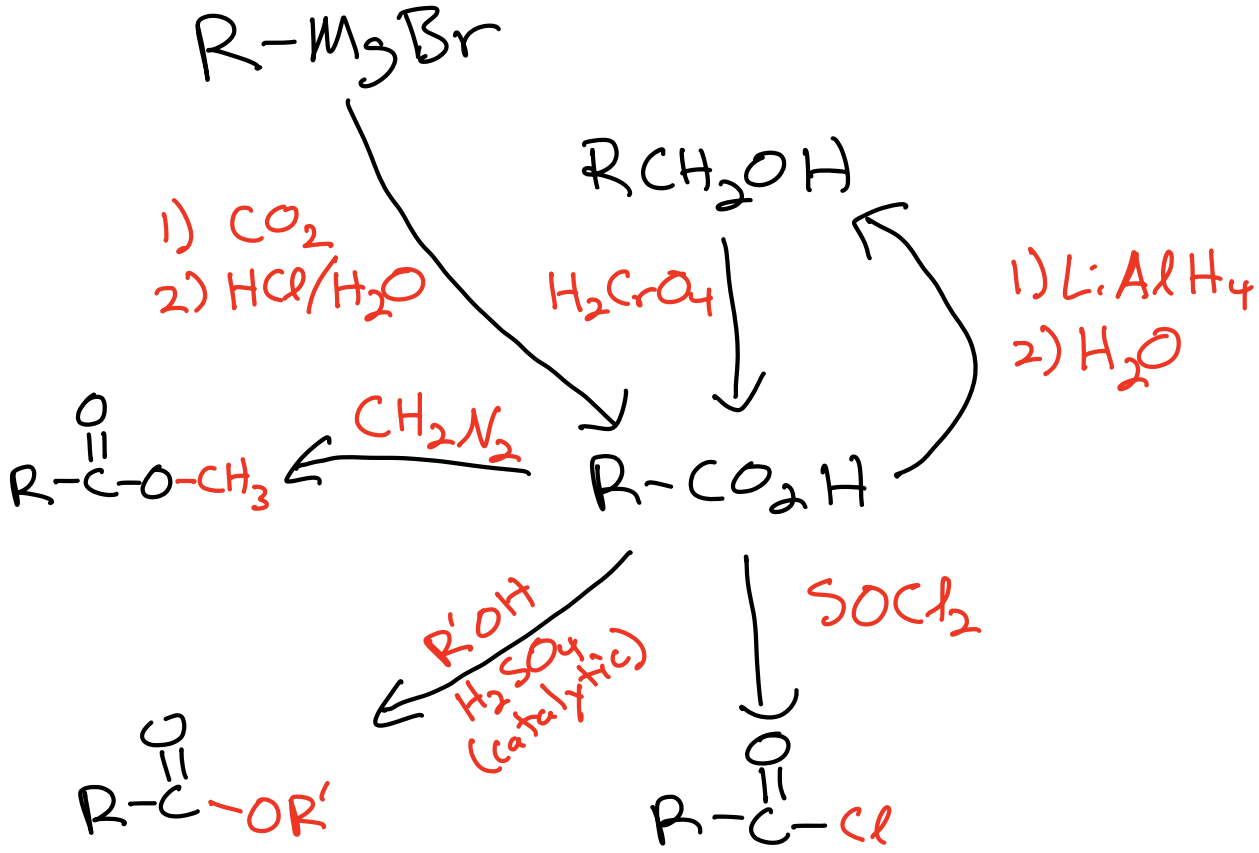
Anhydride

Ester

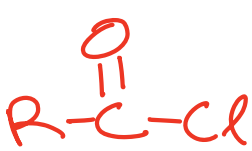


Amide

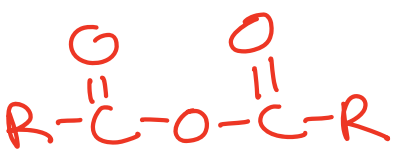
Summary of Carboxylic Acid Reactions → So Far...



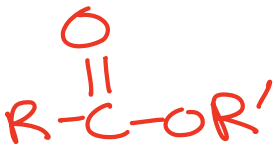
Carboxylic Acid Derivatives



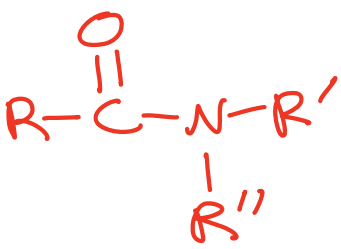
Acid Chloride



Anhydride



Ester



Amide

Interconversion of Carboxylic Acid Derivatives