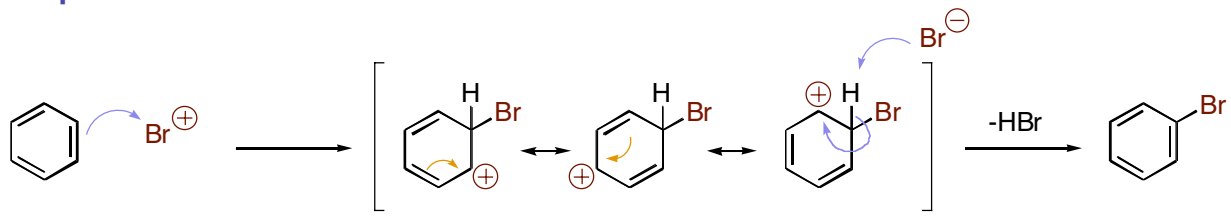
Electrophilic Aromatic Substitution



Electron Donating Groups

alkyl —OR —NR_2 —SR

ortho-para directors

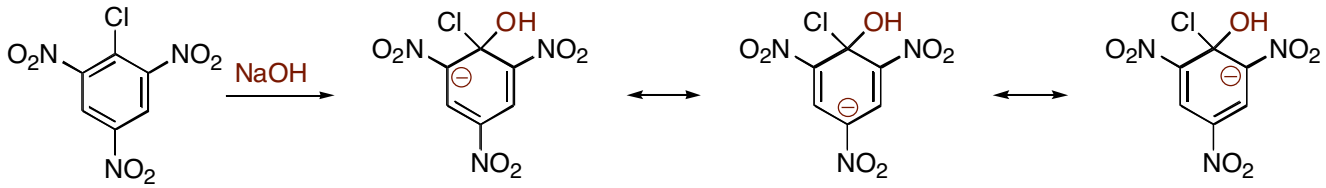
Electron Withdrawing Groups

acyl —CN —NO_2 —SO_3H

meta directors

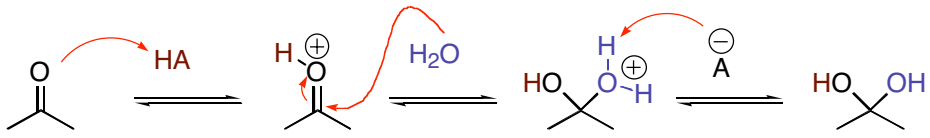
—X ortho-para director

Nucleophilic Aromatic Substitution

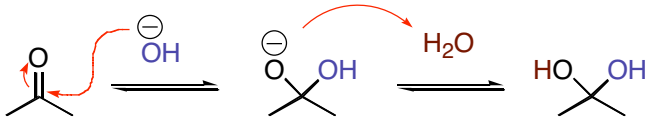


Carbonyl Addition Reactions

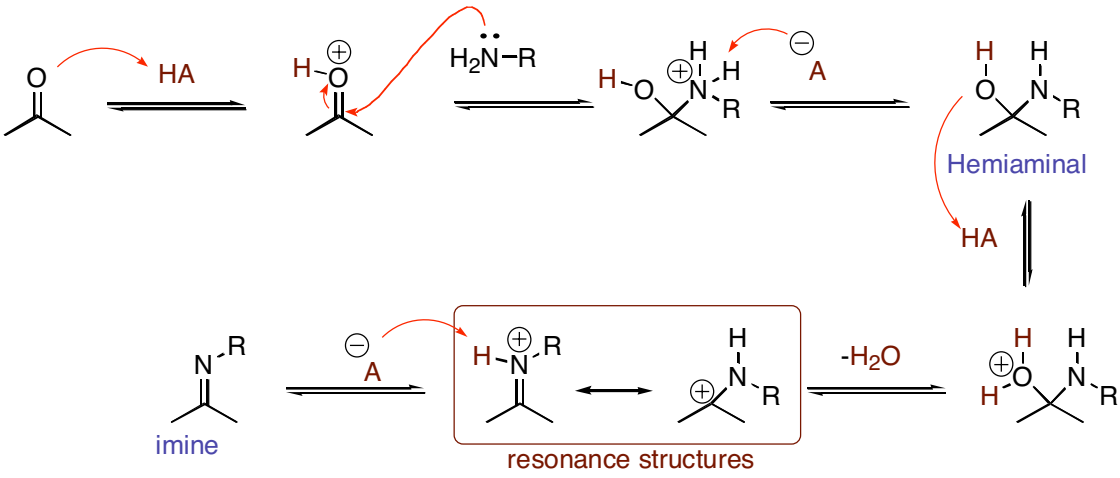
Acid Catalyzed Hydration acid activates the carbonyl making it more reactive (more electrophilic) so water can add



Base Catalyzed Hydration hydroxide is a more reactive nucleophile than water and can add more readily to the carbonyl

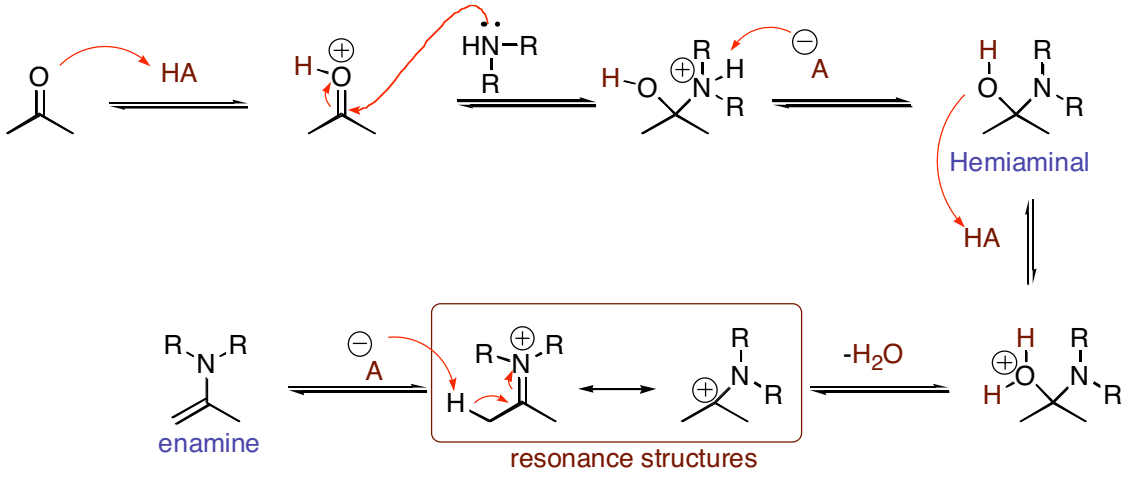


Mechanism for Imine Formation



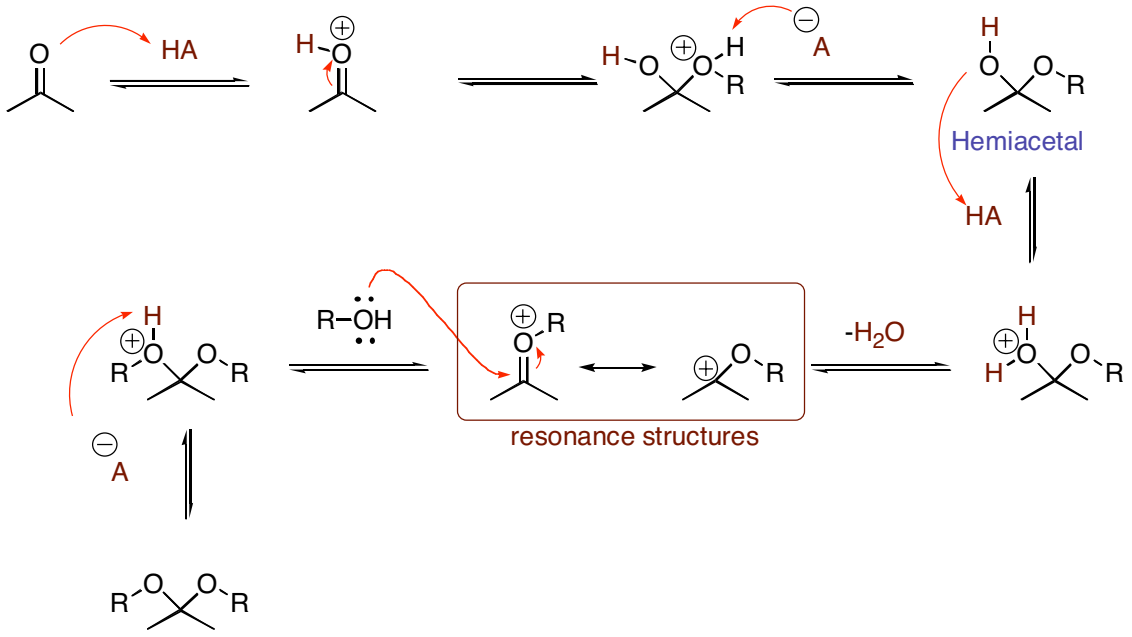
Up to here this is identical to a hydration with amine as nucleophile instead of water

Mechanism for Enamine Formation



The only difference is this last step. There is no proton on the nitrogen to come off, so a proton is taken off of the alpha carbon

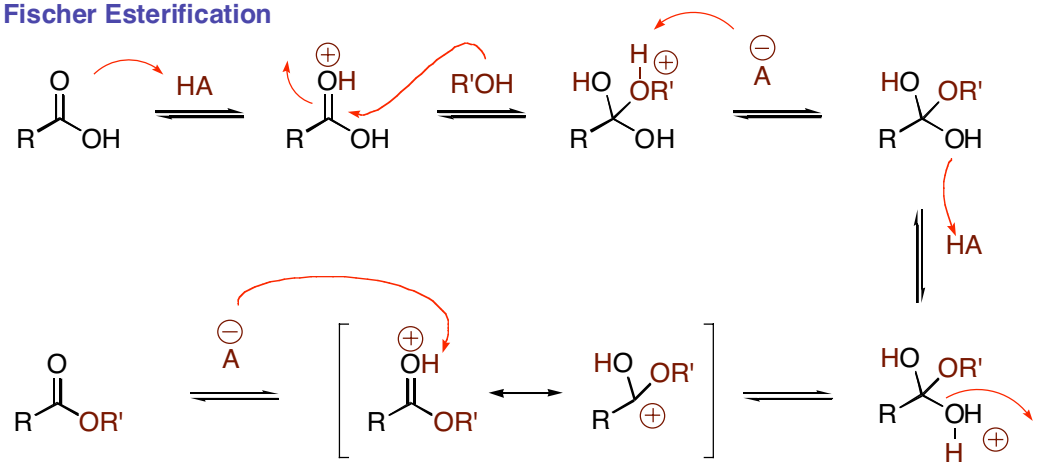
Mechanism for Acetal Formation



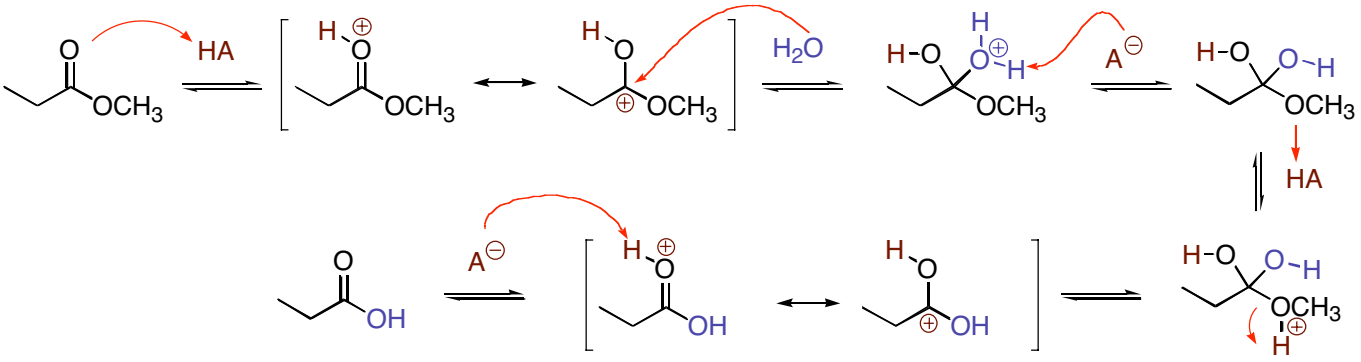
Up to here this is identical to a hydration with alcohol as nucleophile instead of water

Acyl Substitution Reactions

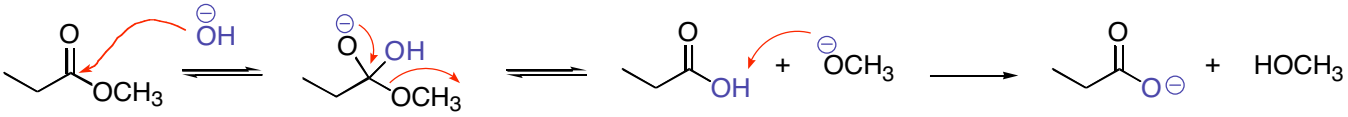
Fischer Esterification



Acid Catalyzed Hydrolysis



Base Catalyzed Hydrolysis (Saponification)



Acid Catalyzed Hydrolysis of Amides