Chem 342 Organic Chem II

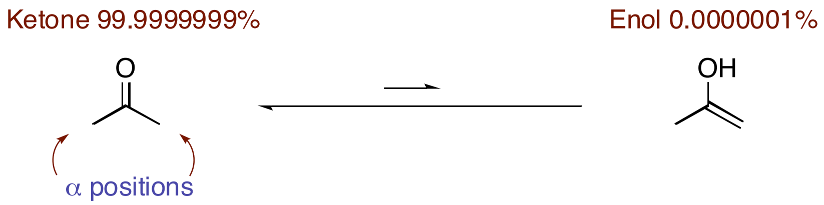
Lecture Summary 36
24 Apr 2002

These notes can be obtained at: http://www.ndsu.nodak.edu/instruct/grcook/chem342/notes.shtml

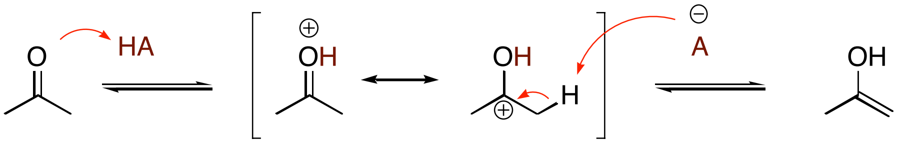
Chapter 22: Carbonyl Alpha-Subsitution Reactions

Enols

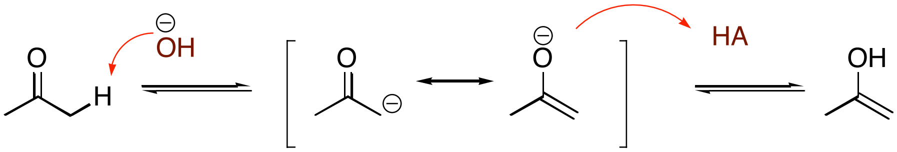
Ketoenol tautomerization lies far to the side of the ketone. The equilibrium is accelerated by the addition of acid or base catalysts.



Acid Catalyzed Enol Equilibrium

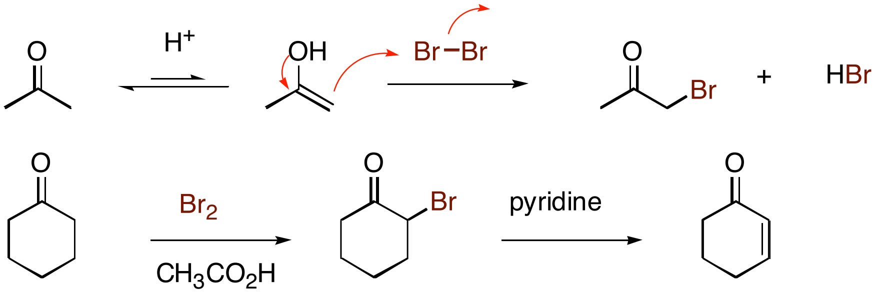


Base Catalyzed Enol Equilibrium

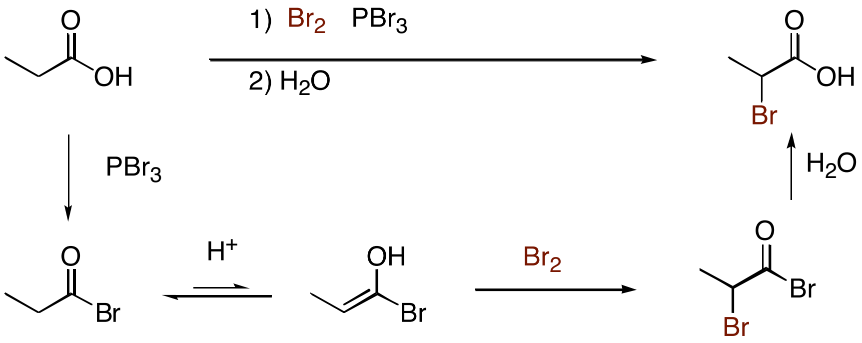


Alpha Halogenation

Enols are electron rich – more so than the typical alkene – and they will react with reactive electrophiles like Br_2. Alpha bromo ketones can be eliminated easily with pyridine.

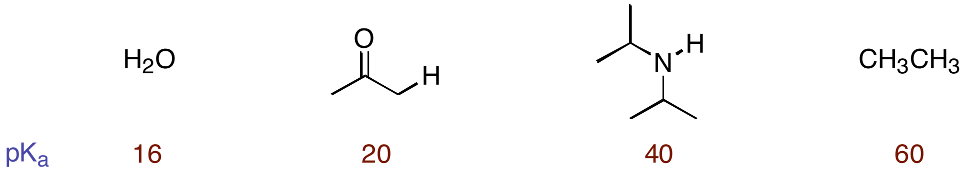


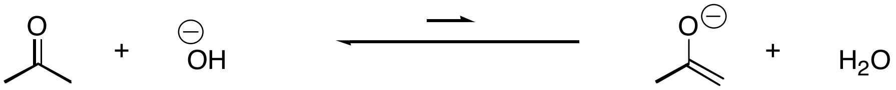
The alpha halogenation works well for aldehydes and ketones, but it does not work with carboxylic acids. That is because it is difficult to enolize a carboxylic acid (the proton on the acid oxygen comes off easier than the proton on the alpha carbon). Using PBr_3 with Br_2, an intermediate acid bromide is formed which undergoes enolization and bromination. The acid bromide is subsequently hydrolyzed to give the acid back. This is the Hell-Volhard-Zelinskii reaction.

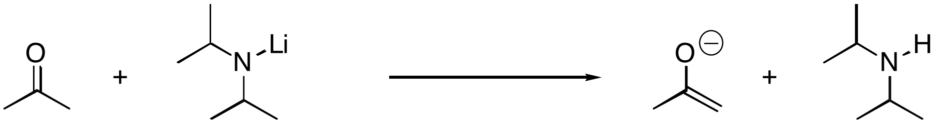


Ketone Enolates

Enols will only react with very reactive electrophiles like bromine. In order to do alpha substitution with less reactive electrophiles, like alkyl halides, you need to deprotonate with a strong base to make an enolate. The hydrogen alpha to a ketone is less acidic than water, so hydroxide is not a strong enough base to completely form the enolate, though it will exist in a small amount in equilibrium with the ketone. To fully form an enolate, LDA is used as the base. It is a very strong base as well as a very bulky base, so there is no problem with the LDA adding to the carbonyl carbon.







LDA
lithium
diisopropyl
amide

100%