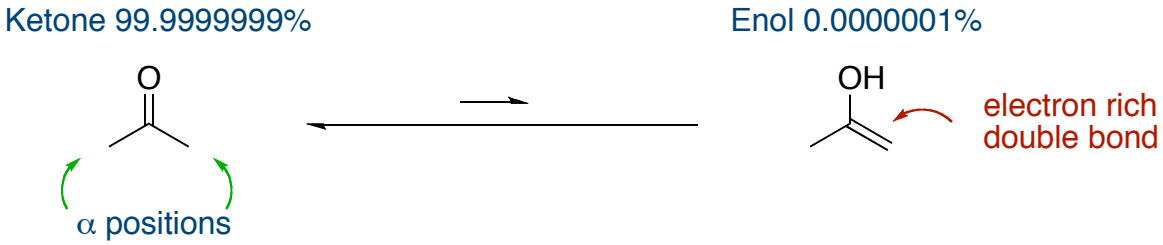
Chem 342 • Organic Chemistry II

Lecture Summary 28 - 22 Apr 2009

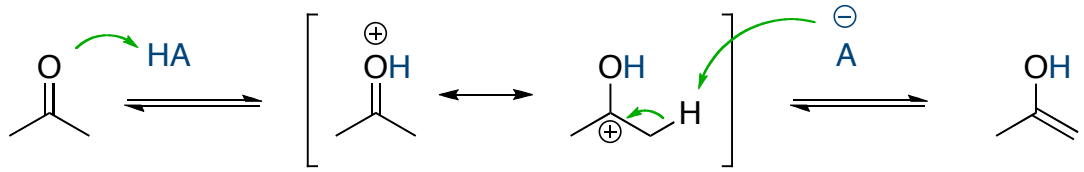
Chapter 22 - Carboxylic Alpha-Substitution Reactions

Enols

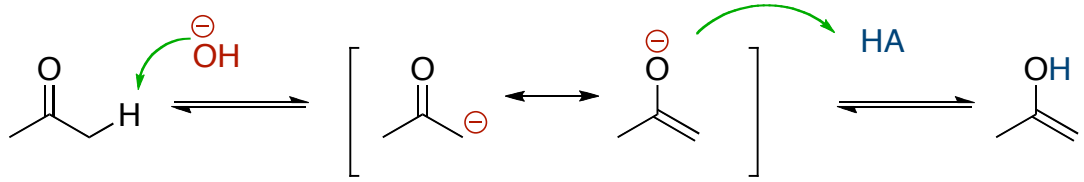
Ketoenol tautomerization lies far to the side of the ketone. The equilibrium is accelerated by the addition of acid or base catalysts.



Acid Catalyzed Enol Equilibrium

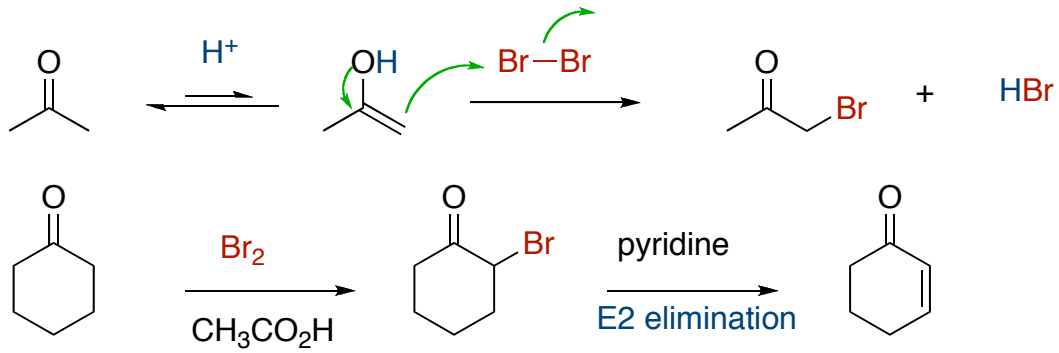


Base Catalyzed Enol Equilibrium

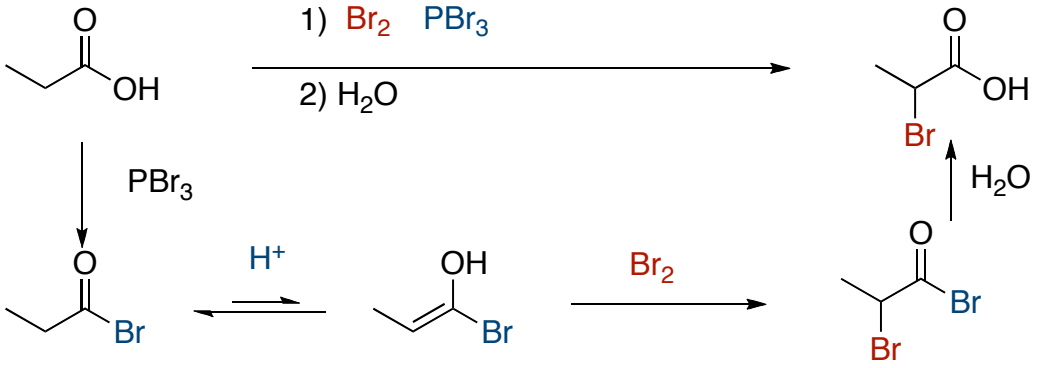


Alpha Halogenation

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

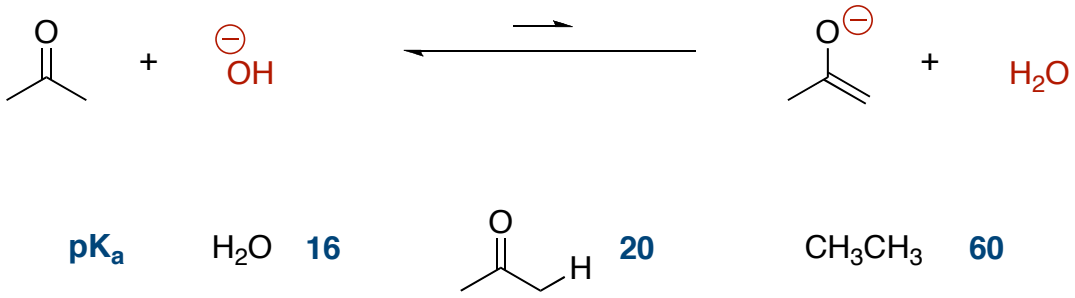


The alpha halogenation works well for aldehydes and ketones, but it does not work with carboxylic acids. That is because it is difficult to enolize a carboxylic acid (the proton on the acid oxygen comes off easier than the proton on the alpha carbon). Using PBr_3 with Br_2, an intermediate acid bromide 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.



Acidity of Alpha Protons - 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.



Daily Quiz

Q:	Which of the following statements is false?	1:	Amides are best hydrolyzed under acid-catalyzed conditions.
		2:	Esters can be made directly from carboxylic acids.
		3:	The most general method for making amides is by heating acids and amines at high temperature and pressure.
		4:	Reduction of an amide with lithium aluminum hydride will produce an amine product.