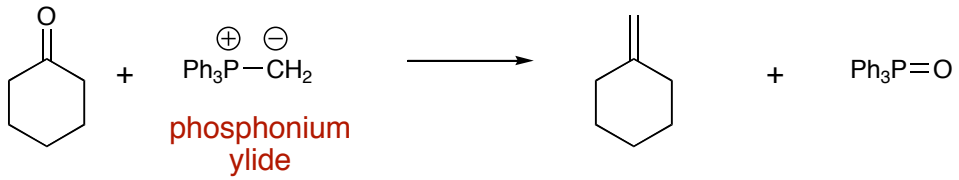
Chapter 19 - Aldehydes and Ketones: Nucleophilic Addition Reactions

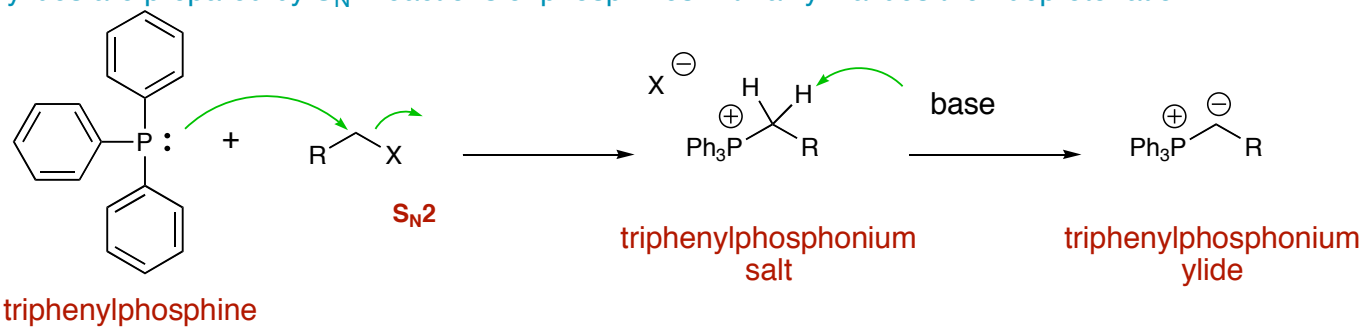
The Wittig Reaction

Essentially the reverse of an ozonolysis, the Wittig reaction takes a ketone or aldehyde and makes alkenes from then by adding carbons. A phosphonium ylide is the reagent necessary for this transformation. Phosphonium ylides are prepared by the S_N2 reaction of phosphines with alkyl halides. The resulting salt can be deprotonated with a base such as butyl lithium. The mechanism involves the attack of the nucleophilic ylide onto the carbonyl followed by loss of a phosphine oxide.

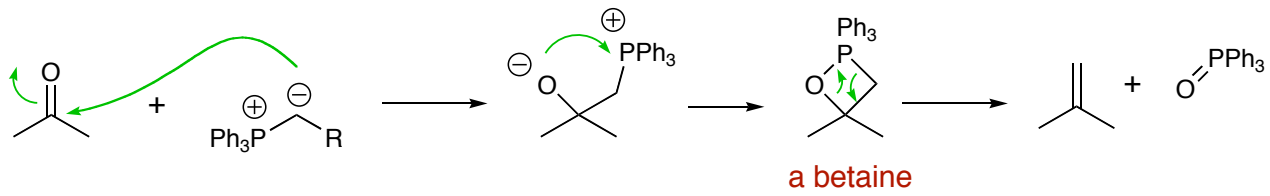
Wittig Reaction



ylides are prepared by S_N2 reactions of phosphines with alkyl halides then deprotonation

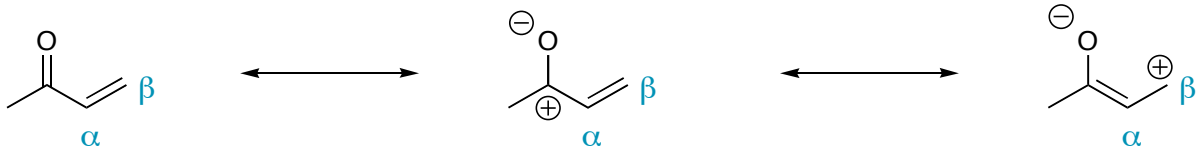


ylides are nucleophilic and will react with carbonyls

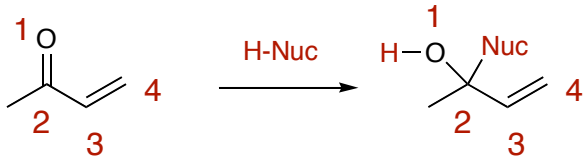


α,β-Unsaturated Carbonyl Compounds

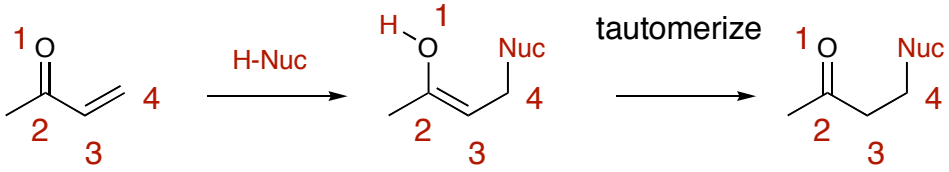
Carbonyl compounds which are conjugated with a double bond are called α,β-unsaturated carbonyls. Note from the resonance structures that there is electrophilic character (positive charge) on the carbonyl carbon AND the beta carbon.



Using a generic nucleophile as an example, you can see that addition of the H^+ and $^-$Nuc can occur in a 1,2-fashion or a 1,4-fashion.



1,2-addition



1,4-addition (conjugate addition)