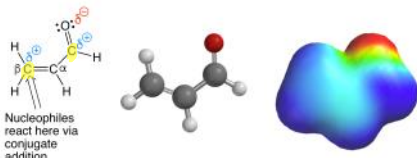


Week 10 Handouts

### Conjugate Addition



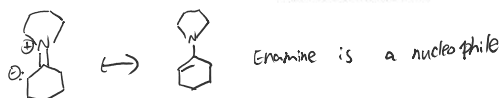
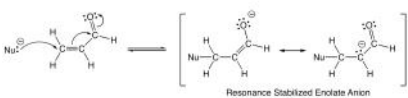
A) Alkenes adjacent to a carbonyl are conjugated and are therefore electrophilic.

B) These species are called  $\alpha,\beta$  unsaturated carbonyl compounds.

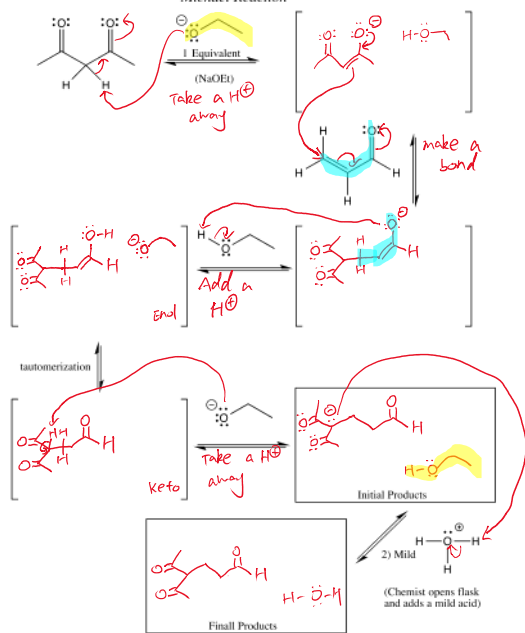
C)  $\alpha,\beta$  unsaturated carbonyl compounds are conjugated, in that the  $\pi$  electrons of the C=C and C=O bonds can delocalize over all four atoms. This lends some degree of extra stabilization to these species, because  $\pi$  electrons prefer to delocalize.

D) Nucleophiles can, however, react at the  $\beta$  carbon atom in a process called conjugate addition.

E) Conjugate addition is favorable because the intermediate formed is a resonance stabilized enolate, thus relatively low energy.

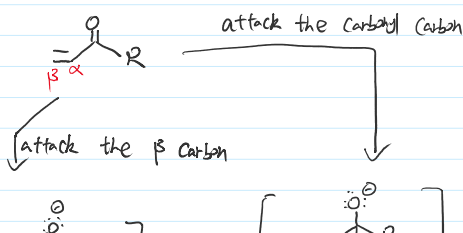


### Michael Reaction



Back in Micheal reaction:

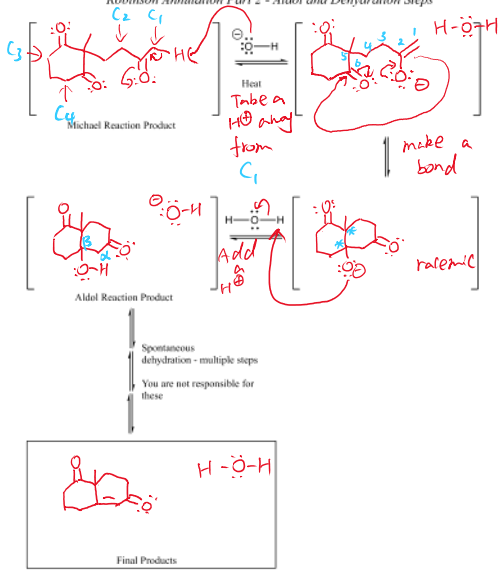
why do we attack the  $\beta$  Carbon, not the carbonyl carbon?



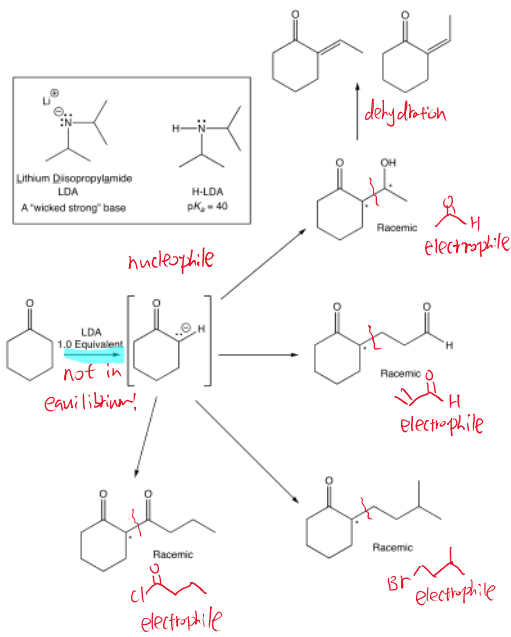
Types for Effective Michael Reactions	$\beta$ -Diketone	$\beta$ -Ketoester	$\beta$ -Ketone nitrile	$\beta$ -Diester	Enamine Amine
These Types of Compounds Provide Effective Nucleophiles for Michael Reactions	$CH_3C(=O)CH_2C(=O)CH_3$	$CH_3C(=O)CH_2COEt$	$CH_3C(=O)CH_2CN$	$EtOOCCH_2COEt$	$CH_3C(=O)CH_2NH_2$ $R_2NH$ , $R_3NH$



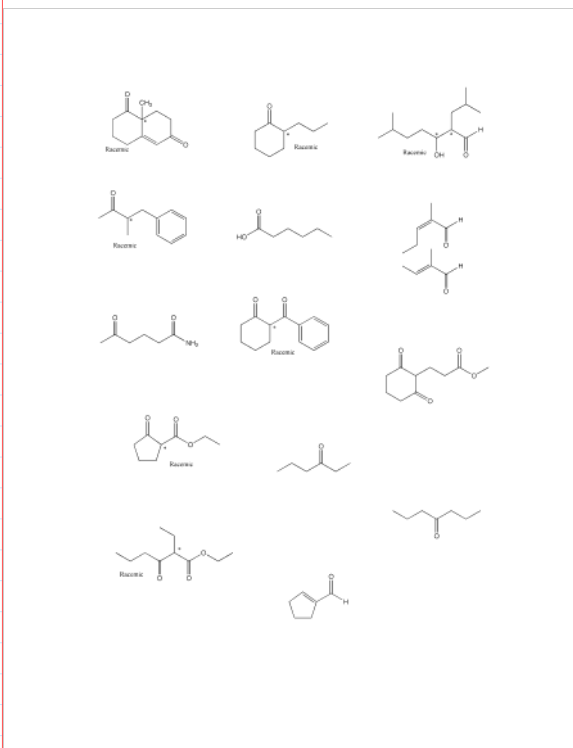
Robinson Annulation Part 2 - Aldol and Dehydration Steps



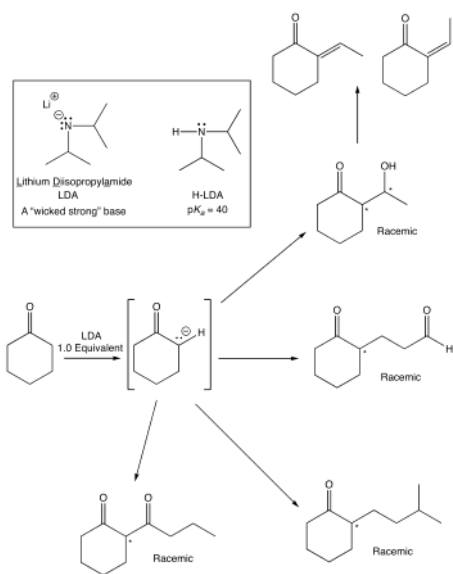
shortened KRE



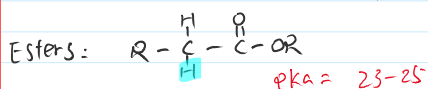
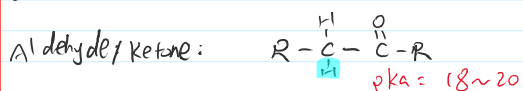
$\alpha,\beta$ -Unsaturated aldehydes, ketones, or esters	$\beta$ -Keto esters
$\alpha,\beta$ -Unsaturated aldehydes	Acid Chlorides
$\beta$ -Hydroxy aldehydes	Ketones
Aldehydes	Carboxylic acids
$\beta$ -Substituted aldehydes, nitriles, ketones, or esters	$\beta$ -Ketoaldehyde
$\alpha,\beta$ -Unsaturated aldehydes, ketones, or esters	$\beta$ -Diketone
$\beta$ -Ketoaldehyde	Substituted ketone
Substituted aldehyde	$\beta$ -Diester



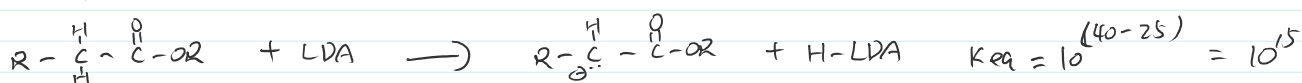
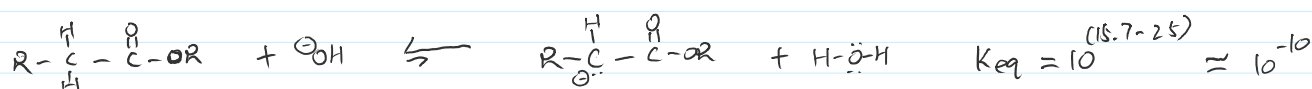
Blank lined area for writing answers.



Equivalence:



Bases:	$\ominus OH$	$\ominus OR$	LDA
conjugate acid	H-OH	H-OR	H-LDA
	$pK_a = 15.7$	$pK_a = 16-17$	$pK_a = 40$



Try to run a Claisen:

- need equal amount of original ester and the ester enolate
- if we used 1 eq. of LDA  $\rightarrow$  we have  $\emptyset$  original ester to behave as electrophile  $\rightarrow$  NO Claisen!
- So, for Claisen, can only add 0.5 eq of LDA.

