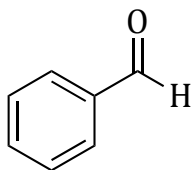
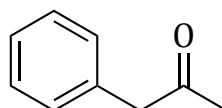
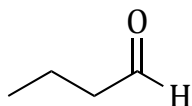
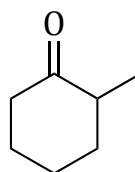
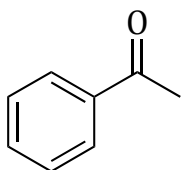


Enols & Enolates: Carbonyl Compounds as Nucleophiles(?!)

What will happen if you treat **acetone** with 1 equivalent of a very strong base?

The resulting species, called an **enolate**, can be a *base* or a *nucleophile*, and is therefore known as an **ambident nucleophile**. Show the *two* products that can result from the protonation of this enolate. Do you recognize these products?

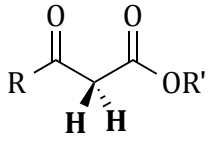
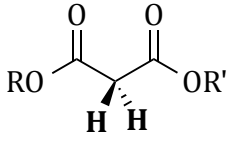
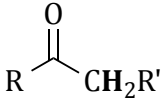
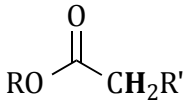
Show the enolate that will result from the deprotonation of the most acidic proton in each of the following species:



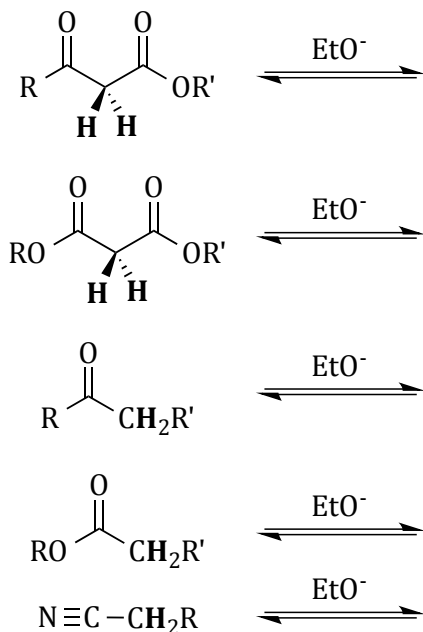
Enols & Enolates:

pK_as of Carbonyl Compounds

Explain the trends in pK_a values for the following carbonyl compounds.

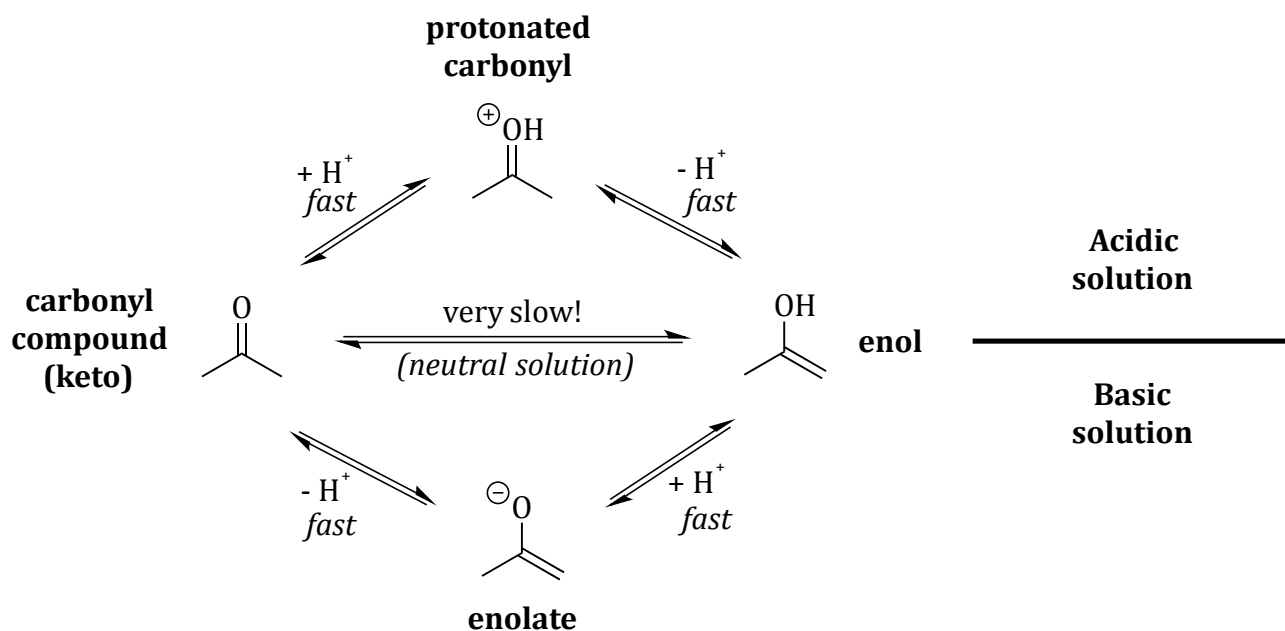
	pK _a	Conjugate base
	11	
	13	
	20	
	25	
N≡C-CH ₂ R	31	

Each of these compounds is treated with the base *sodium ethoxide*. What will the *predominant* species be at equilibrium in each case?



Enols & Enolates: Keto/Enol(ate) Equilibria

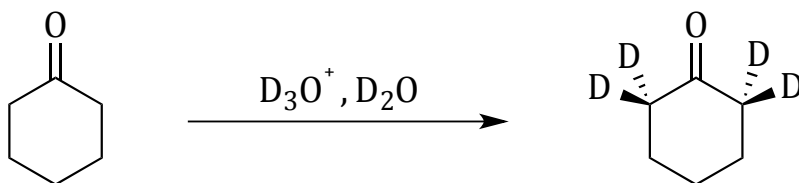
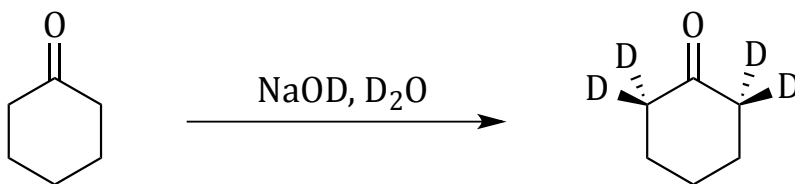
All carbonyl compounds are in equilibrium with their *enol* forms; in addition, depending on the pH, they may be in equilibrium with their protonated or deprotonated forms:



Show the mechanisms for *base-* and *acid-catalyzed* conversion from keto to enol.

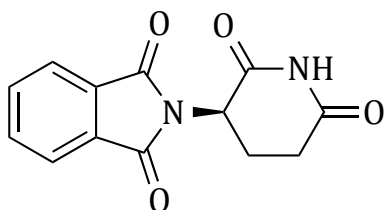
Enols & Enolates: Deuteration

Provide curved-arrow mechanisms for the following reactions:

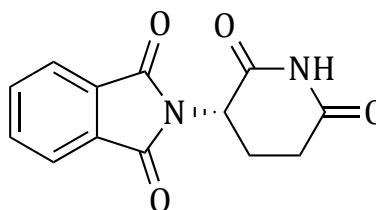


Enols & Enolates: Racemization of α -Carbons

The thalidomide story:



(R)-thalidomide
sedative



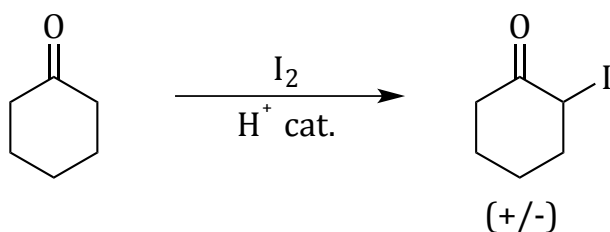
(S)-thalidomide
teratogen

Why can't we safely administer *only* the *R* enantiomer of thalidomide?

Enols & Enolates:

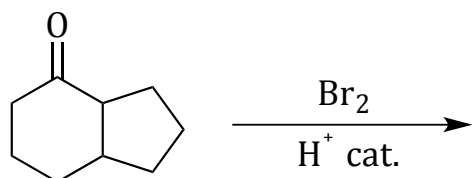
α -Halogenation, Acidic Conditions

Provide a curved-arrow mechanism for the following reaction **and** explain the observed rate law:



$$\text{rate} = k[\text{cyclohexanone}][H^+]$$

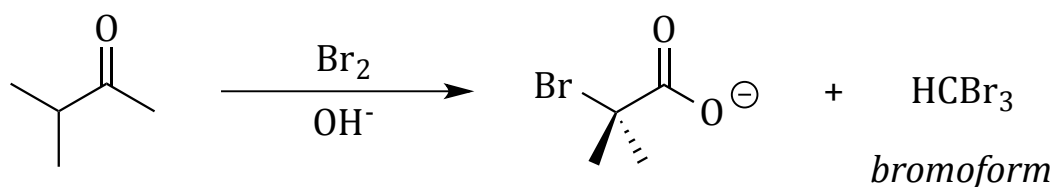
Predict the product of the following reaction:



Why are α -halocarbonyl compounds useful?

The Haloform Reaction: α -Halogenation, Basic Conditions

Provide a curved-arrow mechanism for the following:

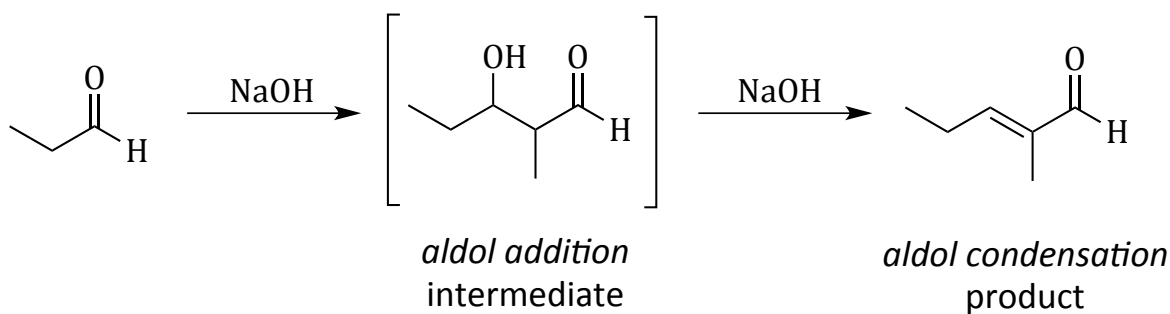


The Most Interesting Reaction in the World: The Aldol Reaction

"Nature, it seems, is an organic chemist having some predilection for the aldol condensation."

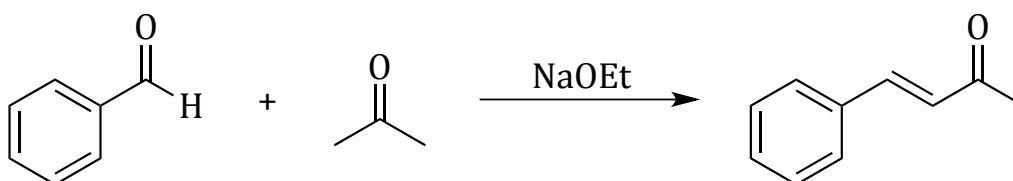
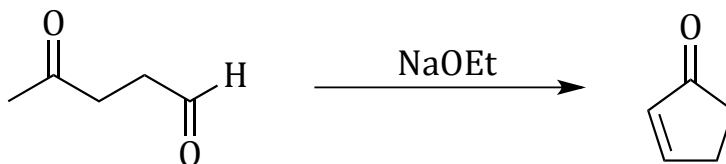
John W. Cornforth
Nobel Prize in Chemistry, 1975

Provide a complete curved-arrow mechanism for the following reaction:



The Aldol Reaction: Intramolecular & “Crossed” Aldols

Provide complete curved-arrow mechanisms for the following reactions:



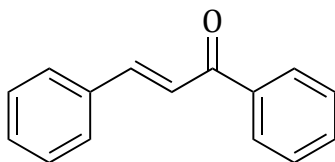
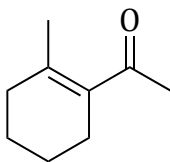
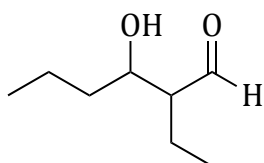
Why can “crossed” aldol condensations be used only in limited cases?

The Aldol Reaction: Acid Catalysis; Retrosynthetic Analysis

Provide a complete curved-arrow mechanism for the following reaction:

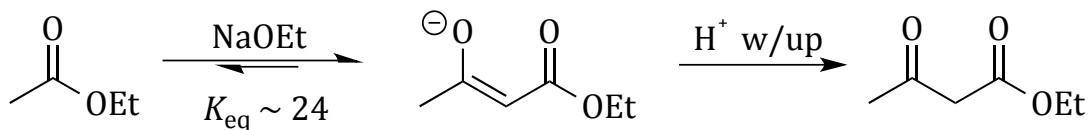


Show the **starting materials** that would produce each of the following products via an aldol reaction:

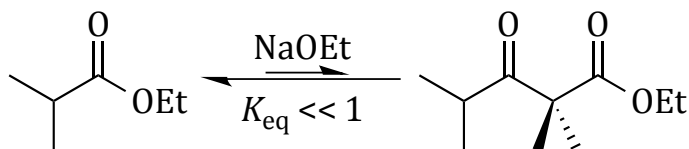


The Claisen Condensation: Another Cool Reaction

Provide a complete curved-arrow mechanism for the following reaction:

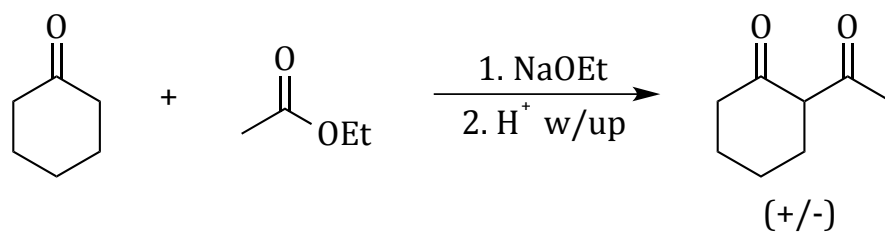
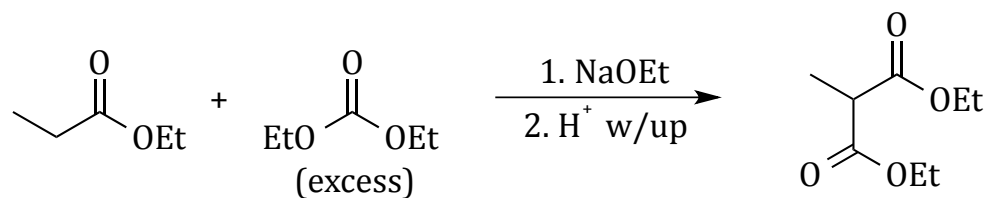
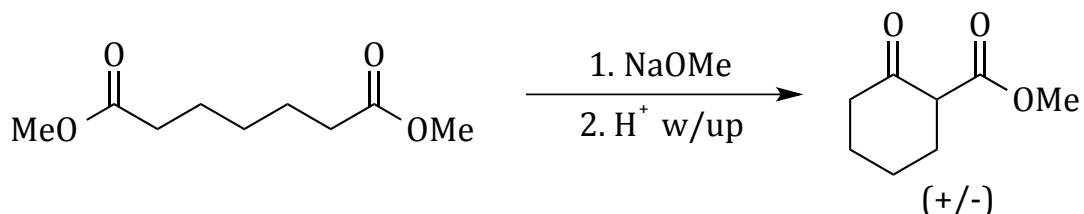


Explain why the following attempted Claisen condensation does *not* work, and provide a curved-arrow mechanism for the *reverse* reaction:



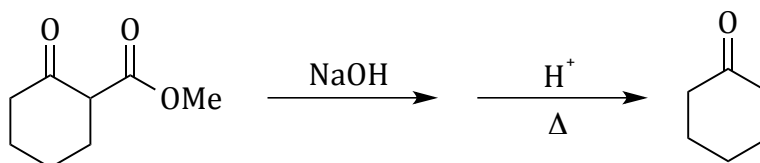
The Claisen Condensation: Intramolecular and "Crossed" Claisens

Provide complete curved-arrow mechanisms for the following reactions:



The Claisen Condensation: Hydrolysis and Decarboxylation of β -Keto Esters

Provide a complete curved-arrow mechanism for the following reaction:

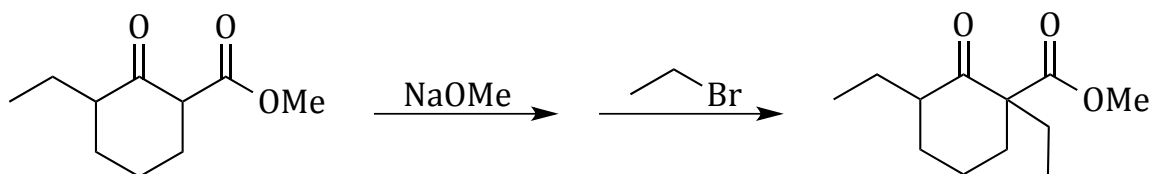
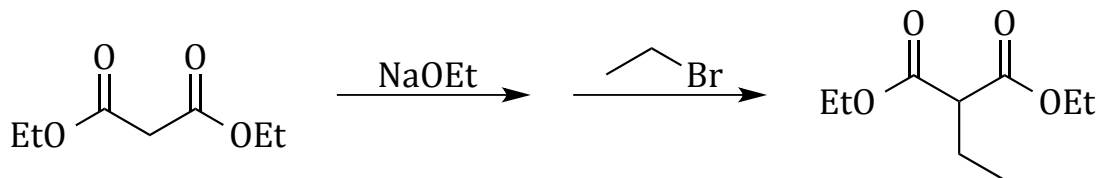


Why is the β -carbonyl *essential* for this reaction?

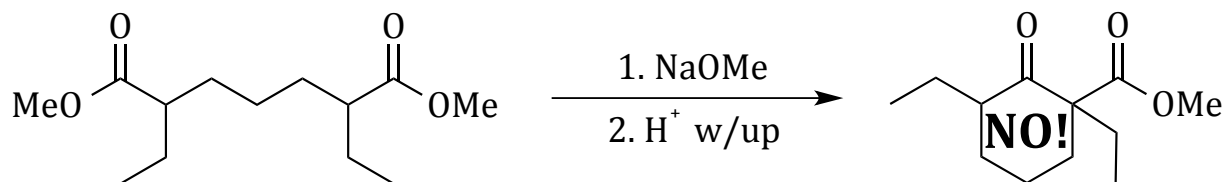
Alkylation of Enolates

Enolate ions can be good S_N2 nucleophiles, but *not* under equilibrium conditions: you need a carbonyl compound to be *completely* deprotonated under the reaction conditions!

Provide complete curved-arrow mechanisms for the following reactions:

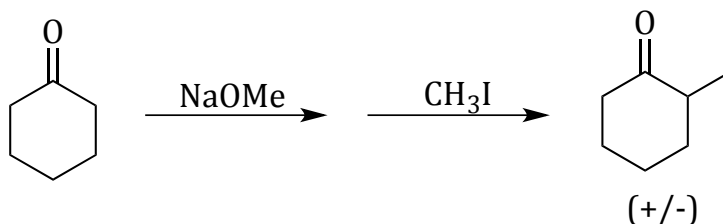


Why can't we use the following Claisen condensation to form the product above?



Alkylation of Enolates: Sequential Alkylation/Decarboxylation

Why can't you carry out the following transformation as written?



Show how the following route allows you to carry out the same (net) transformation.

