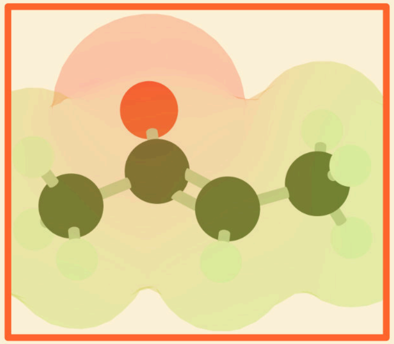
HIGHLIGHTS

- Formation of an enolate from a ß-keto ester.
- Formation of either the thermodynamic or kinetic enolate from a ketone by altering the base and temperature.
- General reaction of enolates.
- Additional reactions including the haloform reaction and decarboxylation of ß-keto esters.
- This is just an introduction to enolate chemistry there is more to come ...



Enolates are the anionic or deprotonated version of an enol. They are formed by treatment of carbonyl-containing compounds with strong bases. The negative charge makes them more nucleophilic than enols and they undergo a wider range of reactions. They will react with halogens but if an excess of halogen & base is used, a C–C bond is cleaved & a carboxylate anion formed in the haloform reaction. They undergo alkylation with haloalkanes. The regioselectivity of enolate formation can be controlled. The less substituted or kinetic enolate, can be formed by reaction with an excess of a strong, bulky base at low temperatures. The more stable, more substituted thermodynamic enolate can be formed by establishing an equilibrium. Equilibrium requires a proton source so either use a weak base or less than one equivalent of base so that unreacted carbonyl can act as a proton source. Performing the reaction at room temperature helps.

CHEMISTRY
CLASSICS

ENOLS AND ENOLATES

PART II: FORMATION & REACTIONS OF ENOLATES

Formation & Reactions of Enolates

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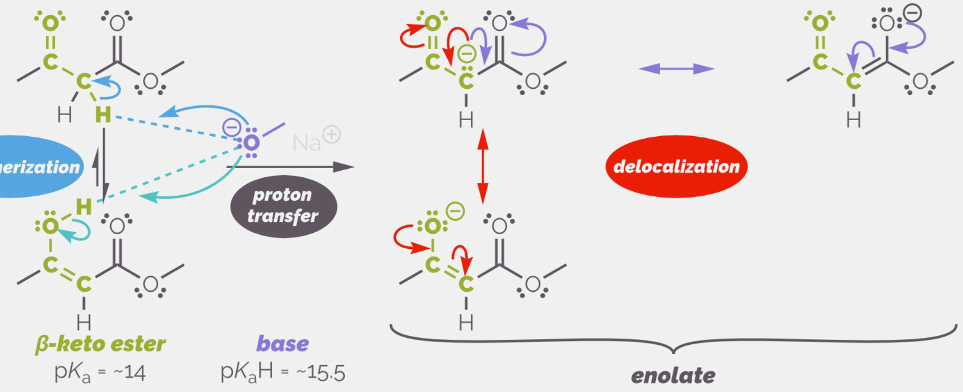
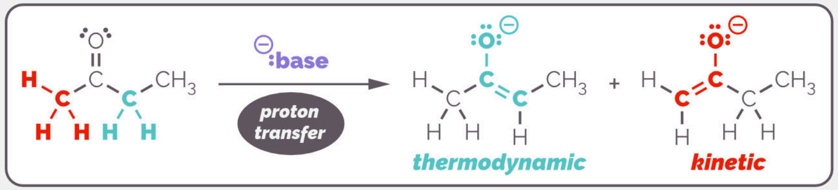
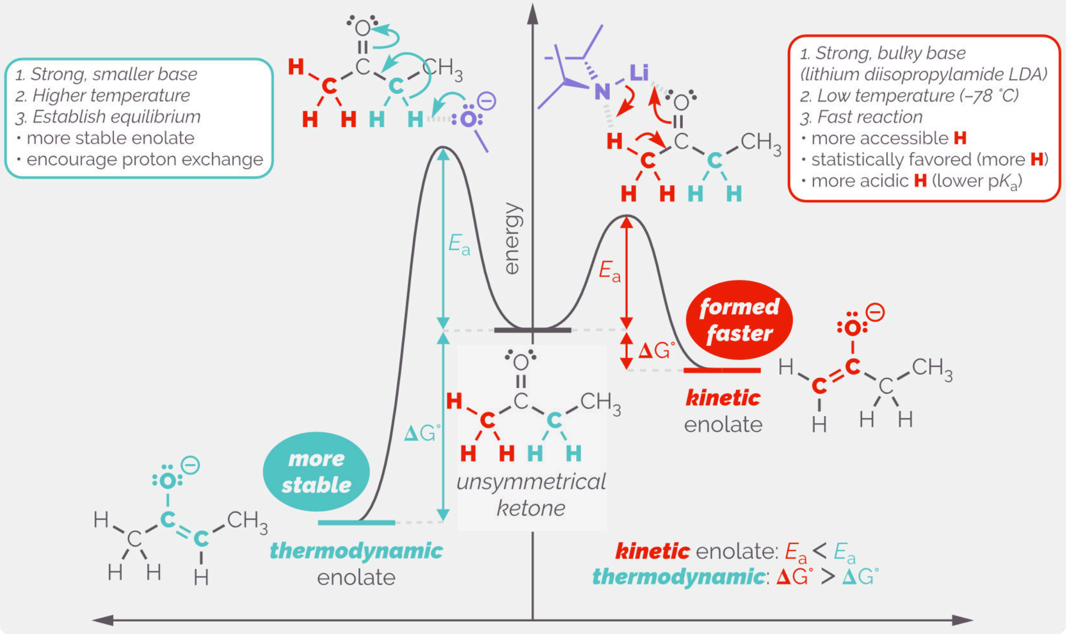
1. Formation of enolates



- Choice of base important to prevent transesterification
- Common to use bulky amide base to make enolate from ketones, esters & amides





1. Strong, smaller base
2. Higher temperature
3. Establish equilibrium
   - more stable enolate
   - encourage proton exchange

1. Strong, bulky base (lithium diisopropylamide LDA)
2. Low temperature (–78 °C)
3. Fast reaction
   - more accessible **H**
   - statistically favored (more **H**)
   - more acidic **H** (lower pK_a)

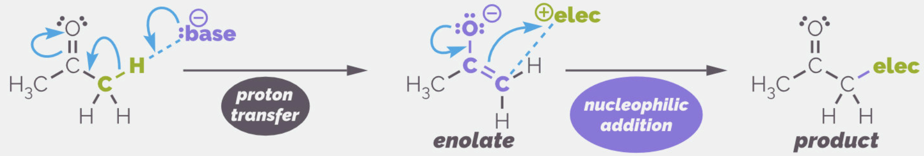
thermodynamic enolate

kinetic enolate

kinetic enolate: $E_a < E_a$
thermodynamic: $\Delta G^\circ > \Delta G^\circ$

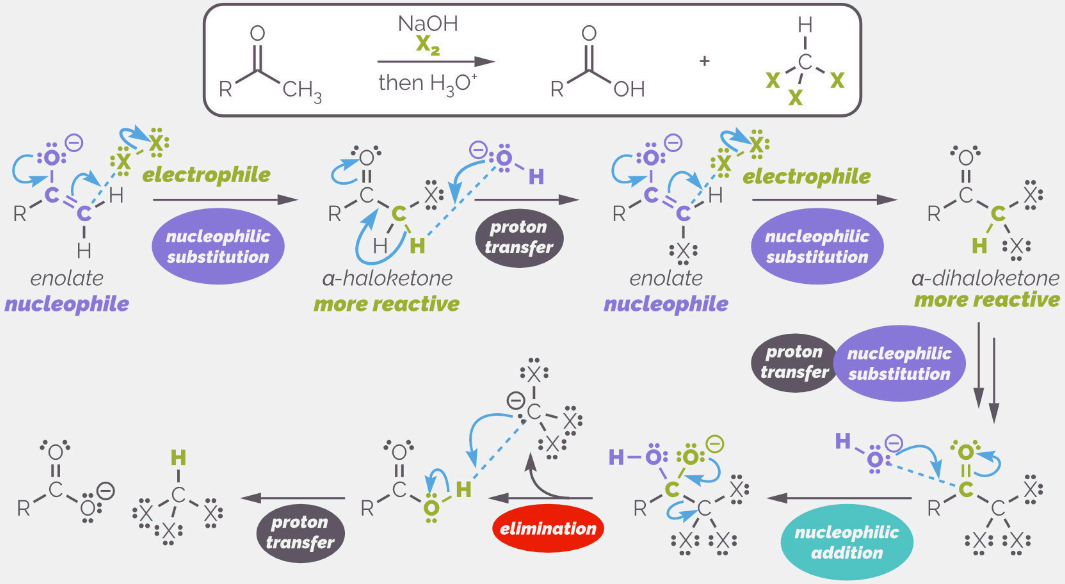
2. General reaction

general reaction - simplified as not showing delocalization - **elec*** = R–X, RCHO, X_2 *etc.*



3. Additional reactions

haloform reaction - doesn't follow standard pattern due to increased acidity of α-proton



regioselective alkylation & decarboxylation - β-keto esters allow control & can be removed