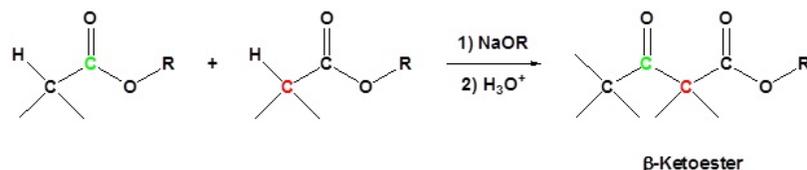


## 23.9: THE CLAISEN CONDENSATION REACTIONS OF ESTERS

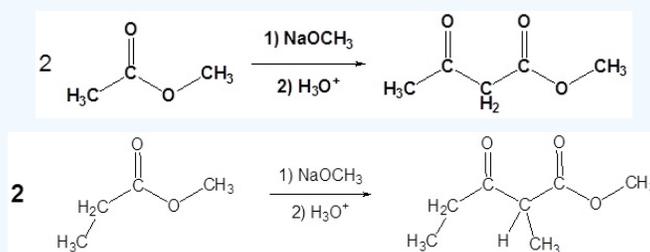
Because esters can contain alpha hydrogens, they can undergo a condensation reaction similar to the aldol reaction called a **Claisen Condensation**. In a fashion similar to the aldol, one ester acts as a nucleophile while a second ester acts as the electrophile. During the reaction a new carbon-carbon bond is formed. The product is a  $\beta$ -keto ester. A major difference with the aldol reaction is the fact that hydroxide cannot be used as a base because it could possibly react with the ester. Instead, an alkoxide version of the alcohol used to synthesize the ester is used to prevent transesterification side products.

### CLAISEN CONDENSATION



The Claisen condensation reactions of methyl acetate and methyl propanoate are shown as examples.

#### Example: Claisen Condensation

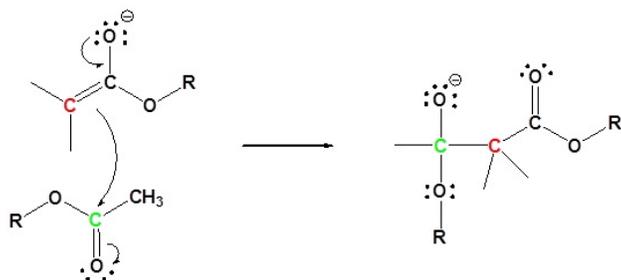


### CLAISEN CONDENSATION MECHANISM

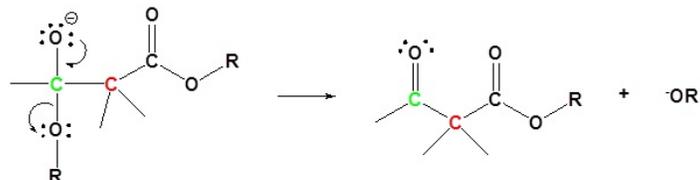
1) Enolate formation



2) Nucleophilic reaction

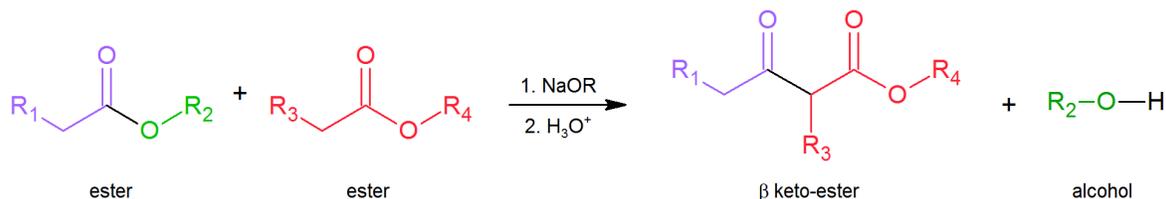


3) Removal of leaving group

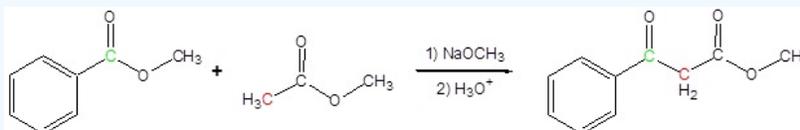


## CROSSED CLAISEN CONDENSATION

Claisen condensations between different ester reactants are called **Crossed Claisen** reactions. Crossed Claisen reactions in which both reactants can serve as donors and acceptors generally give complex mixtures. Because of this most Crossed Claisen reactions are usually not performed unless one reactant has no  $\alpha$  hydrogens.



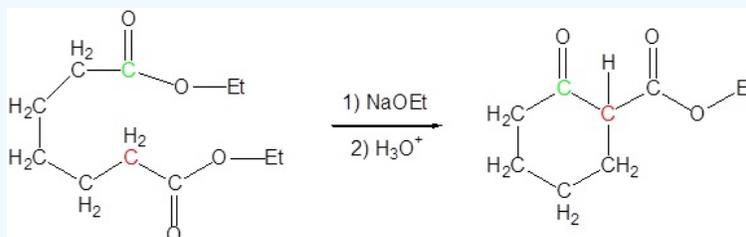
### Example: Crossed Claisen Condensation



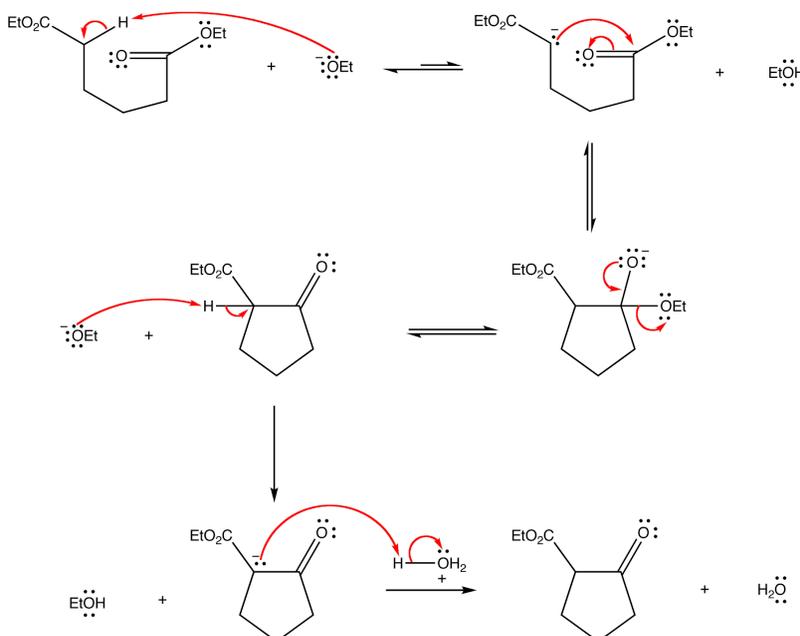
## DIECKMANN CONDENSATION

A diester can undergo an intramolecular reaction called a Dieckmann condensation.

### Example: Dieckman Condensation



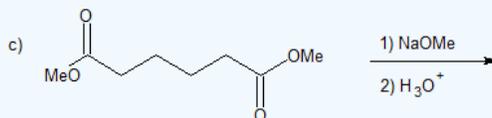
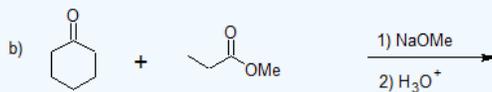
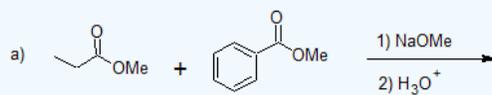
## MECHANISM



1. Dieckmann, W. *Ber. Dtsch. Chem. Ges.* **1894**, 27, 102–103.

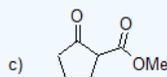
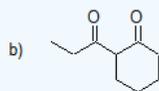
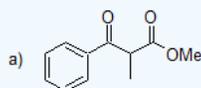
**Exercise**

13. Draw the bond-line structures for the products of the following reactions.



**Answer**

13.



### CONTRIBUTORS AND ATTRIBUTIONS

- [Dr. Dietmar Kennepohl](#) FCIC (Professor of Chemistry, [Athabasca University](#))
- [Prof. Steven Farmer](#) ([Sonoma State University](#))
- [Gamini Gunawardena](#) from the [OChemPal](#) site ([Utah Valley University](#))

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