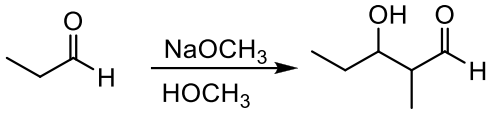
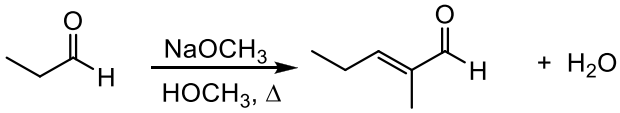
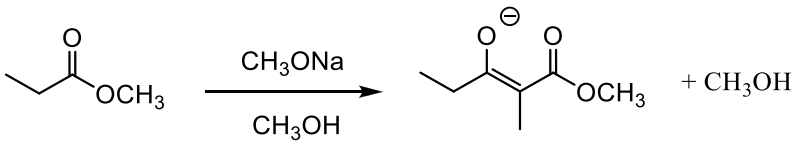
An **addition** reaction is characterized by two molecules joining together. The "**Aldol Addition**" is an example of this type of reaction. Draw the mechanism for the addition reaction below.



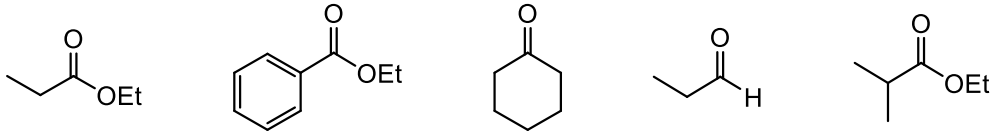
A **condensation** reaction is characterized by two molecules joining together and losing a small molecule (like water) in the process. The "**Aldol Condensation**" is an example of this type of reaction. Draw the mechanism for the condensation reaction below.



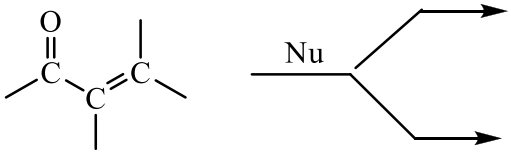
The addition reaction is very sensitive to sterics, therefore generally only works on unhindered aldehydes. The condensation reaction, on the other hand, works well with either aldehydes or ketones. A variation of these reaction which includes at least one ester is known as a "**Claisen Condensation**". Draw the mechanism for the condensation reaction below.



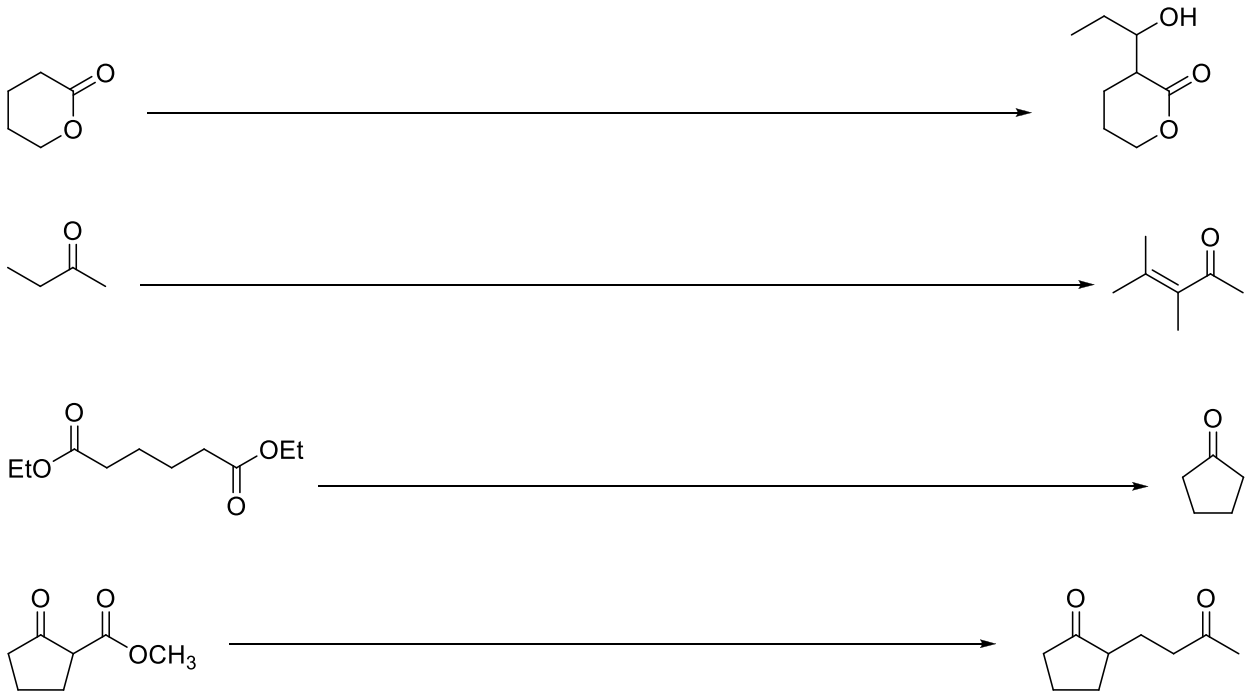
It is important to recognize that these reactions can take place using two different carbonyl species, however if you do one of these "mixed" or "crossed" reactions, it is important that only one of the two molecules have alpha hydrogens in order to prevent multiple products being formed. Which of the molecules below could do a crossed condensation reaction with ethyl acetate (CH_3CO_2Et) in a sodium ethoxide (NaOEt) solution to create only one product?



When nucleophiles attack a,b-unsaturated carbonyl species, there are two possible outcomes. Draw each of them, and then discuss which factors favor each of these products.



Give the reagents needed to accomplish the indicated transformations.



Give the major product(s) of the following reactions: