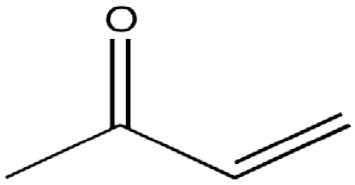
CONJUGATE ADDITION

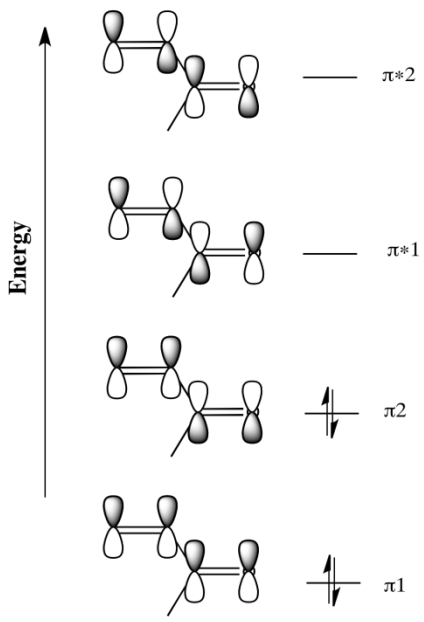
Conjugated systems are structures that contain alternating double and single bonds (or, in some cases, a double bond that is next to an atom with either a lone pair or a vacant orbital). Conjugated systems are usually at lower energy than regular double bonds because the electrons involved in bonding are delocalized; they are spread out over a greater area and thus can have a longer wavelength.



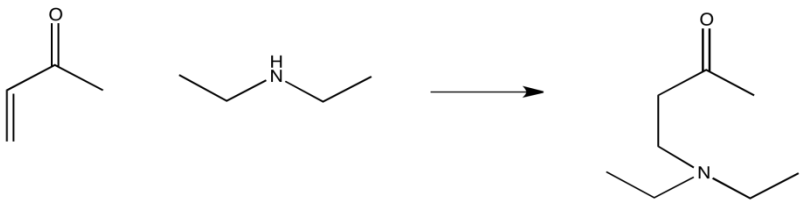
3-butene-2-one

(or methyl vinyl ketone)

For example, the -bonding system for 3-butene-2-one (or methyl vinyl ketone) is described by orbitals involving both the carbonyl group and the alkene group. These two groups become linked together so that there is not longer an independent carbonyl nor an independent alkene, but one "enone" (a term taken from the words alk*ene* and ket*one*).



Because of that extra stability, it might not be surprising that conjugated carbonyls are often a little slower to react than regular carbonyls. The surprise is that conjugated carbonyls can sometimes give additional products in which addition does not take place at the carbonyl.



The product shown above is called a conjugate addition product, or a 1,4-addition product. In conjugate addition, the nucleophile does not donate to the carbonyl, but instead donates to an atom that is involved in conjugation with the carbonyl. This additional electrophilic position is sometimes called a "vinylogous" position (from the word *vinyl*, which refers to that $CH=CH_2$ unit next to the carbonyl).

- Conjugate additions (or 1,4-additions) can occur when a carbonyl is attached to a C=C bond.

Source : http://employees.csbsju.edu/cschaller/Reactivity/carbonyl/COconjadd.htm