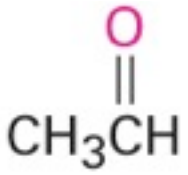
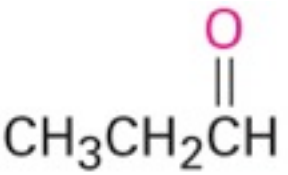
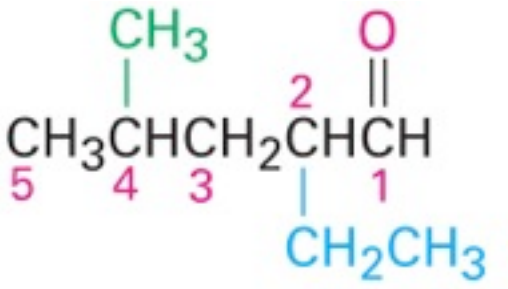


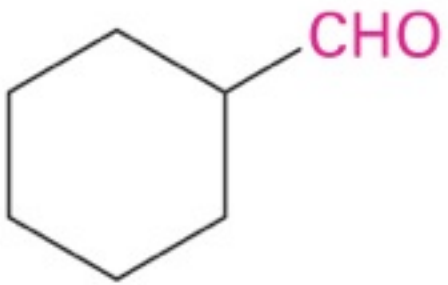
Ethanal
(acetaldehyde)



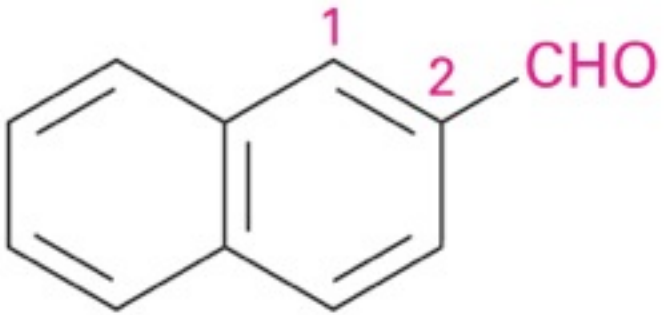
Propanal
(propionaldehyde)



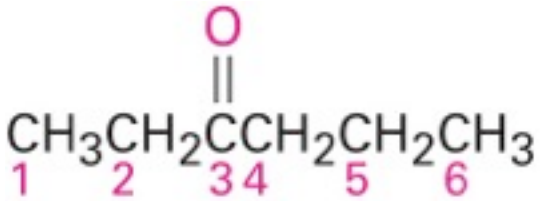
2-Ethyl-4-methylpentanal



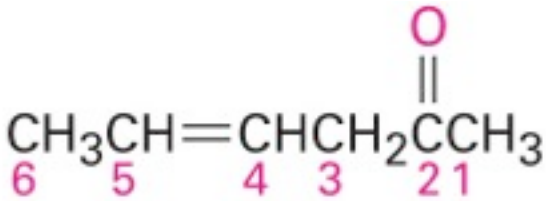
Cyclohexanecarbaldehyde



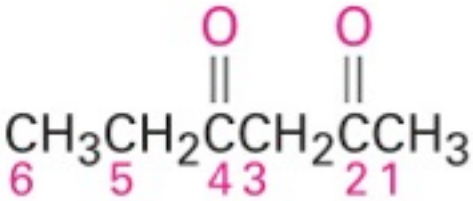
2-Naphthalenecarbaldehyde



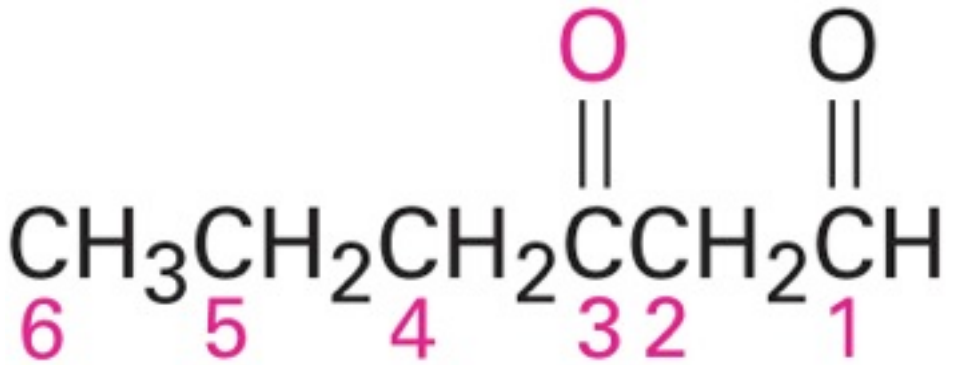
3-Hexanone
(New: Hexan-3-one)



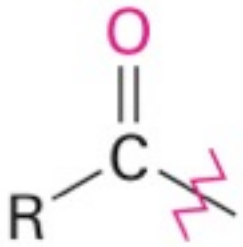
4-Hexen-2-one
(New: Hex-4-en-2-one)



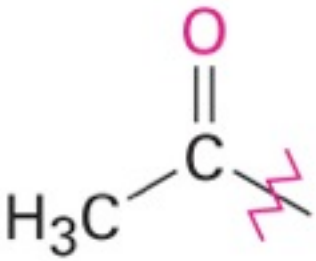
2,4-Hexanedione
(New: Hexane-2,4-dione)



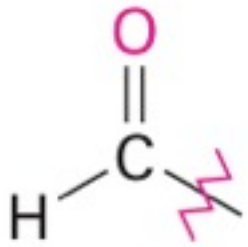
3-Oxohexanal



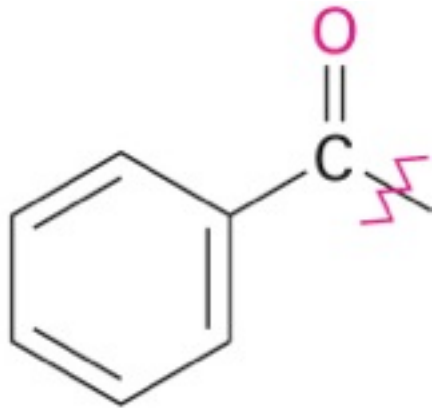
An acyl group



Acetyl

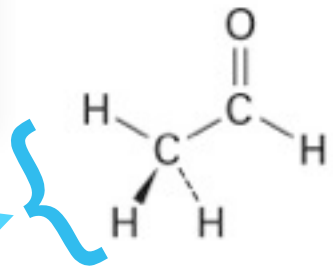


Formyl

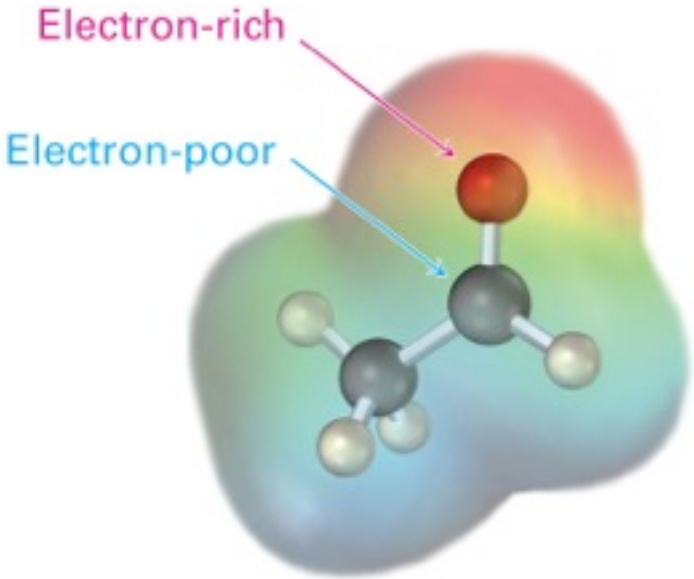


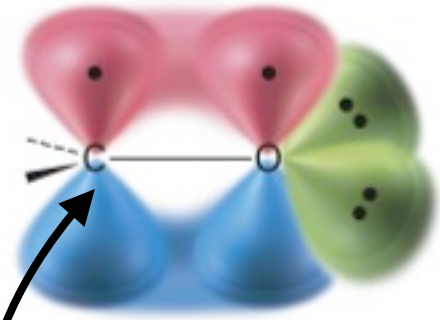
Benzoyl

Preview of Carbonyl Chemistry

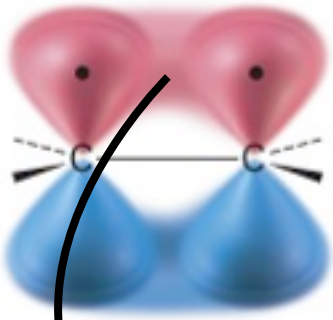


Electron-poor hydrogens

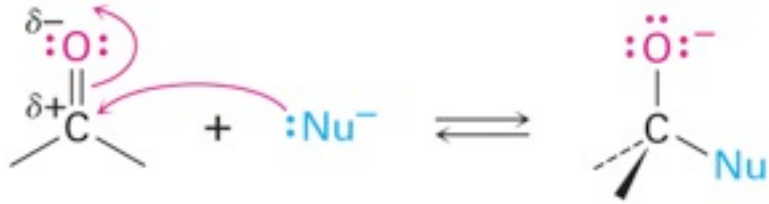




Carbonyl group



Alkene



A carbonyl compound
(sp^2-hybridized carbon)

A tetrahedral intermediate
(sp^3-hybridized carbon)

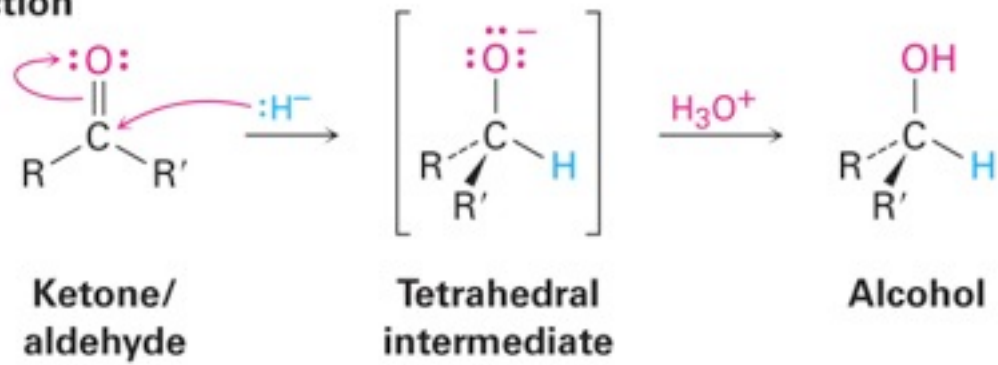
Nu:$^-$

E^+

Nucleophilic
Acyl Addition

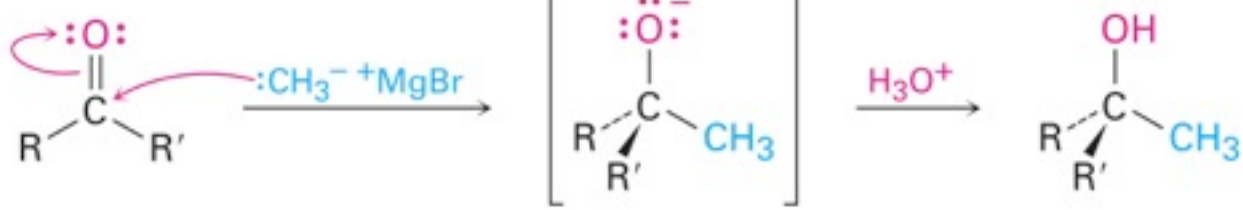
Nucleophilic Acyl Addition

Reduction



Ketone/ aldehyde — Tetrahedral intermediate — Alcohol

Grignard reaction



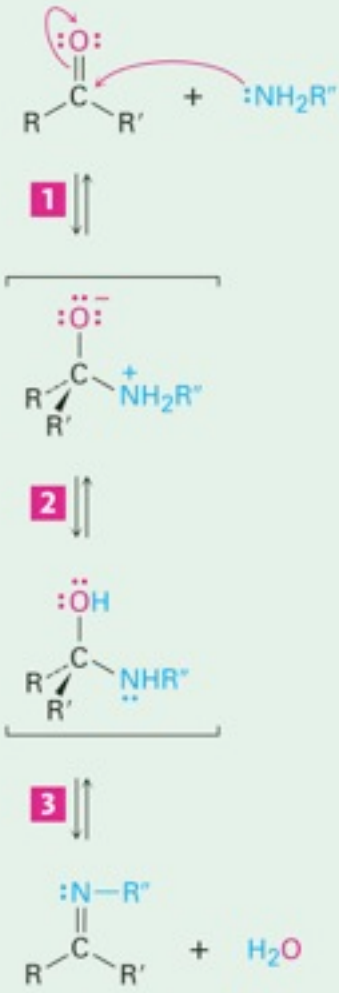
Ketone/ aldehyde — Tetrahedral intermediate — Alcohol

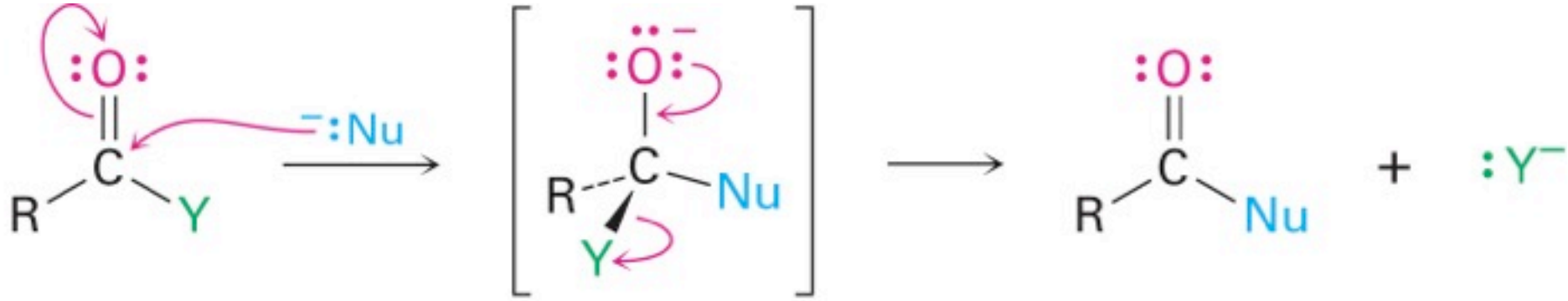
Nucleophilic Acyl Addition by Amines is Unique

1 Addition to the ketone or aldehyde carbonyl group by the neutral amine nucleophile gives a dipolar tetrahedral intermediate.

2 Transfer of a proton from nitrogen to oxygen then yields an amino alcohol intermediate.

3 Dehydration of the amino alcohol intermediate gives neutral imine plus water as final products.





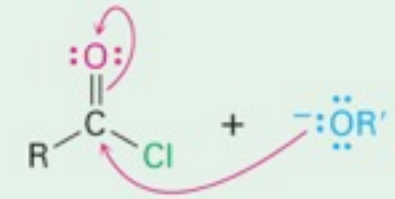
Carboxylic acid derivative

Tetrahedral intermediate

Nucleophilic Acyl Substitution

[Y = –OR (ester), –Cl (acid chloride), or –OCOR (acid anhydride)]

Nucleophilic Acyl Substitution

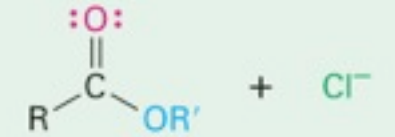


1 Nucleophilic addition of alkoxide ion to an acid chloride yields a tetrahedral intermediate.

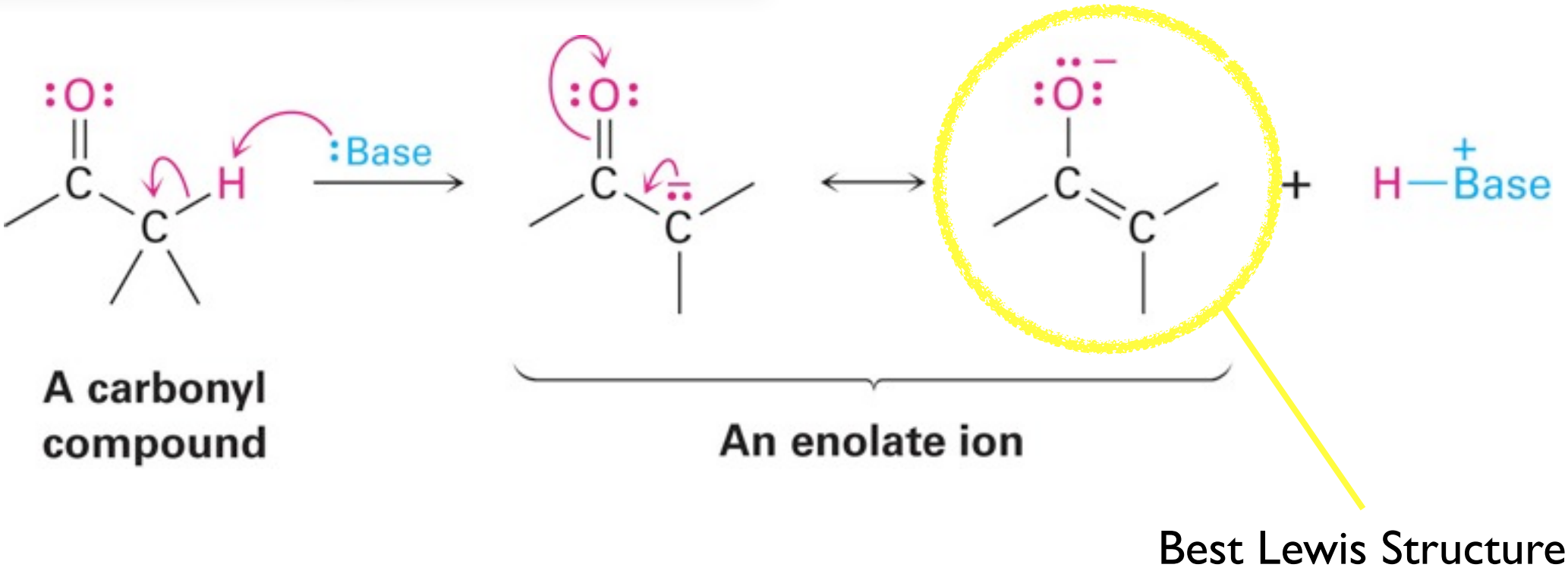
1

2 An electron pair from oxygen expels chloride ion and yields the substitution product, an ester.

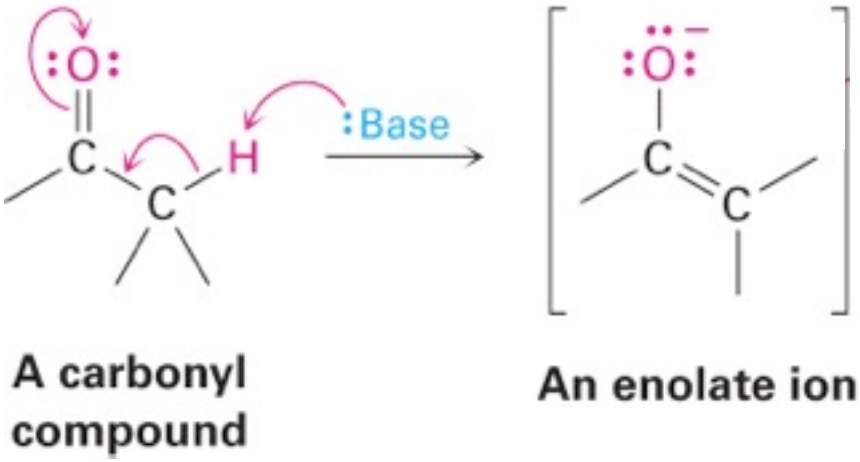
2



Alpha Hydrogens are Acidic



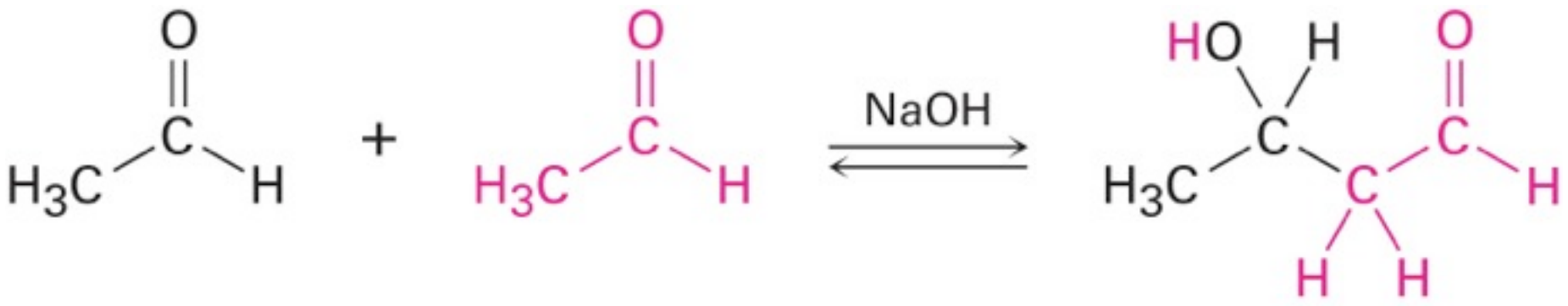
Best Lewis Structure



A carbonyl compound

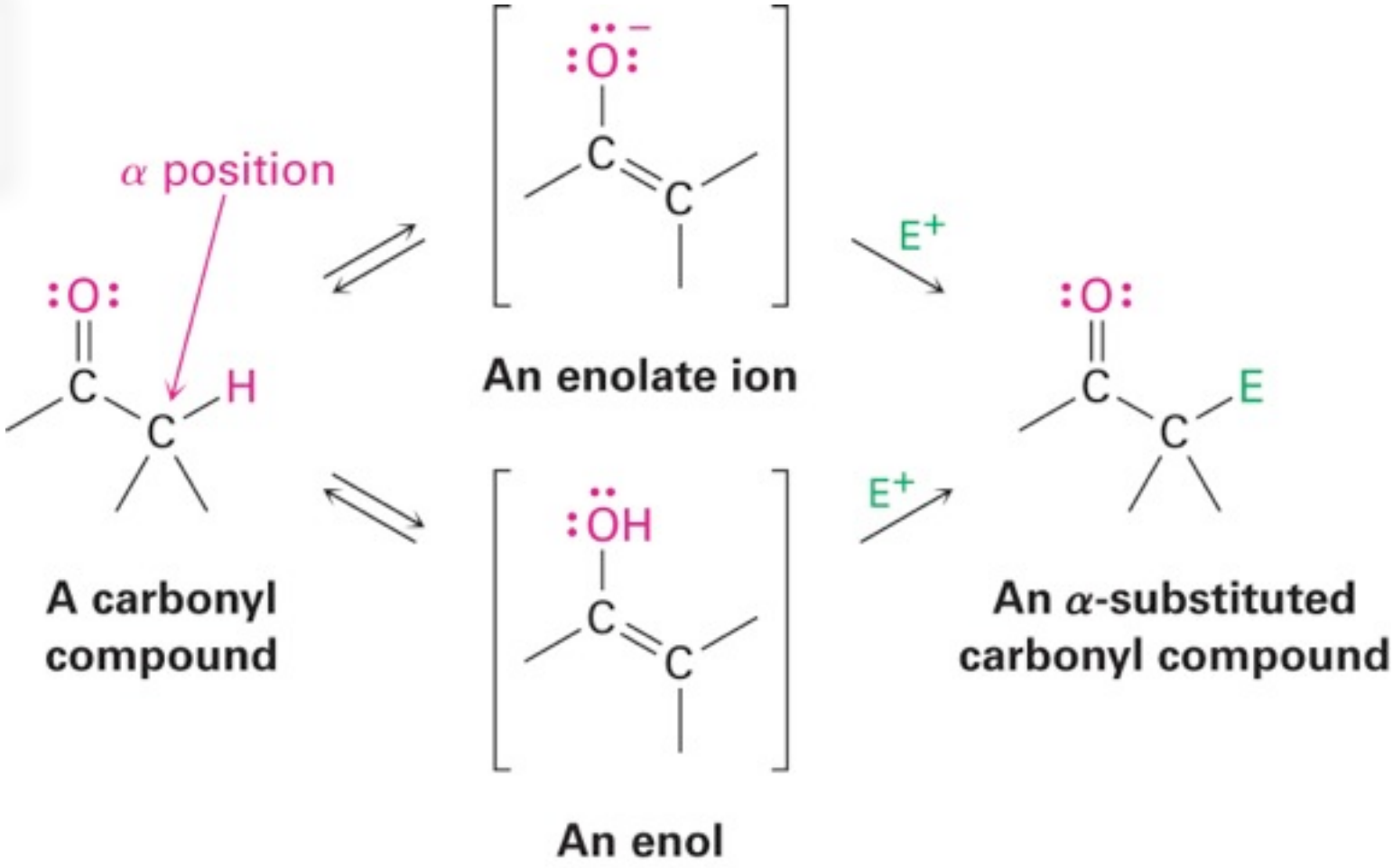
An enolate ion

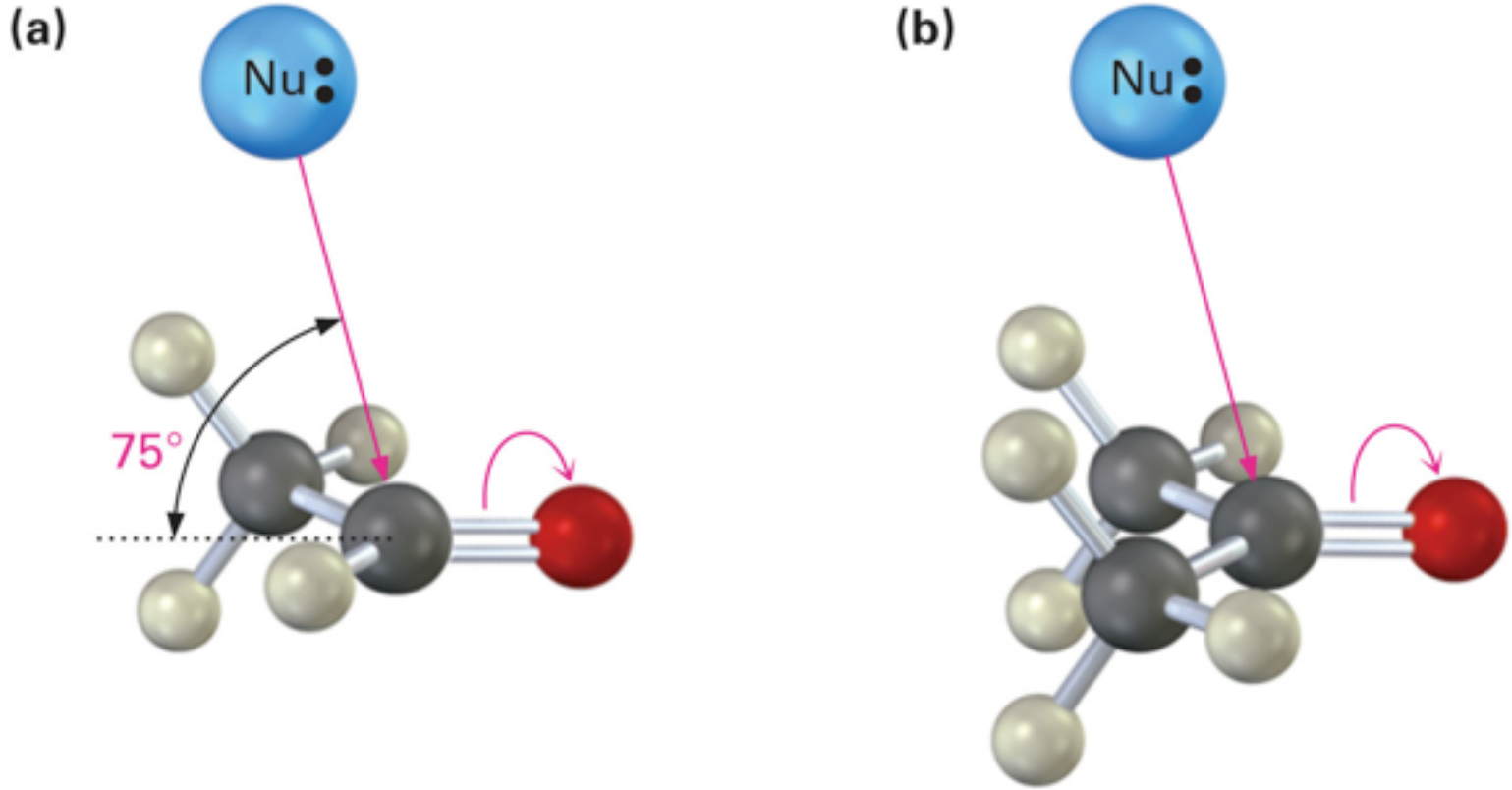
in almost all cases, enolates are carbon nucleophiles



Two acetaldehydes **Aldol**

Alpha Substitution




(a)
Nu
75°
(b)
Nu