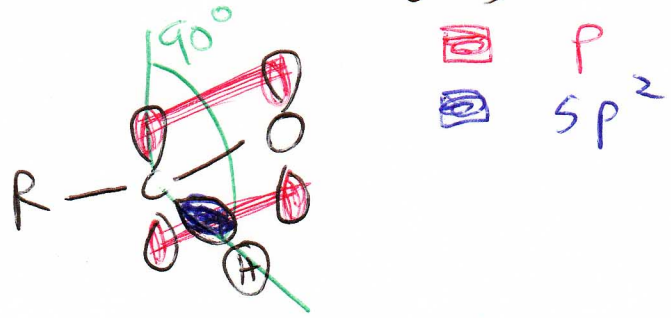
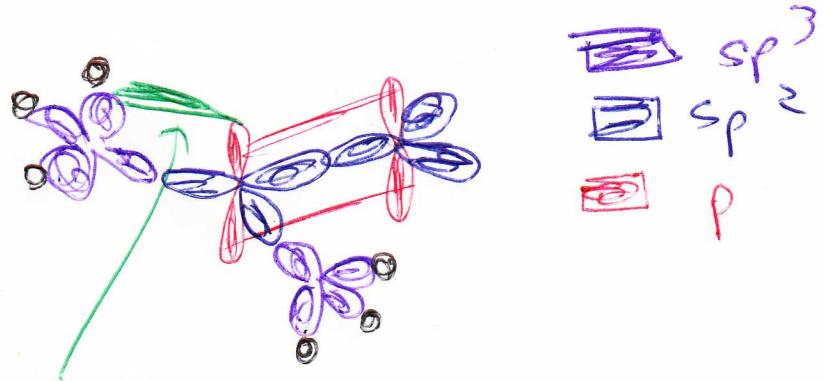
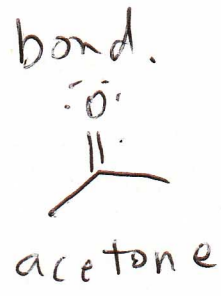


Structural Molecular Orbital Graph (SMOG)



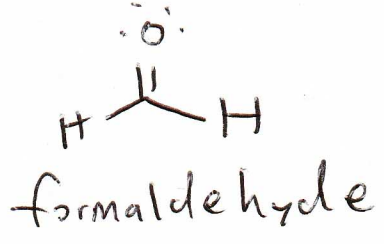
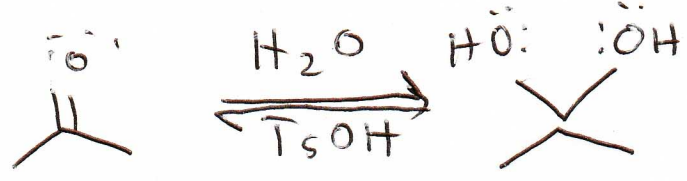
In an aldehyde, the hydrogen attached to the carbonyl is unable to hyperconjugate with the C=O itself since the hydrogen is \perp to the π bond to

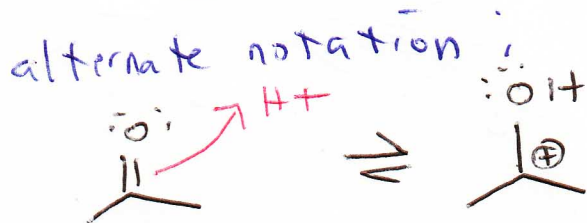
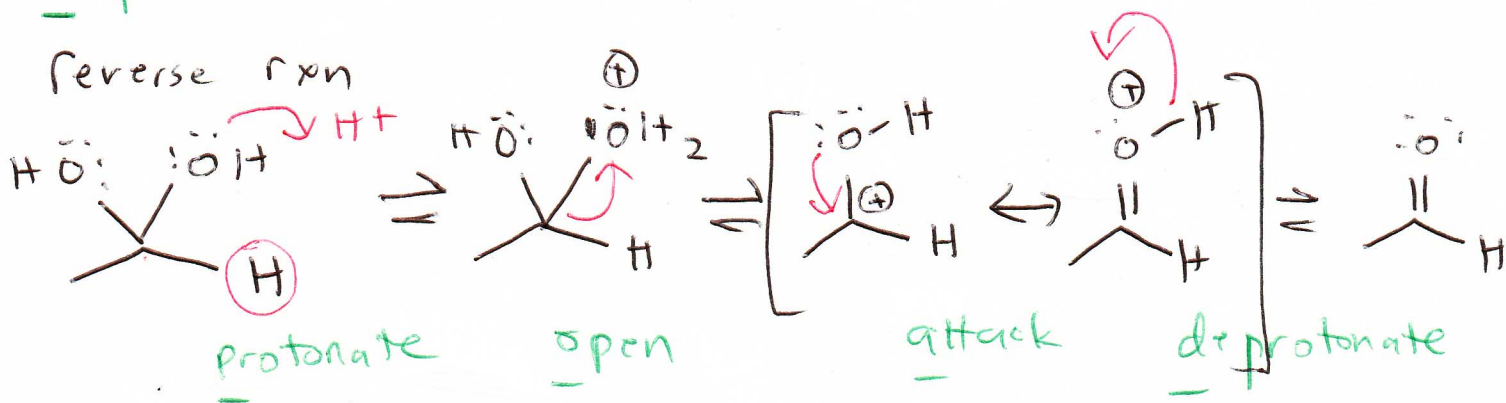
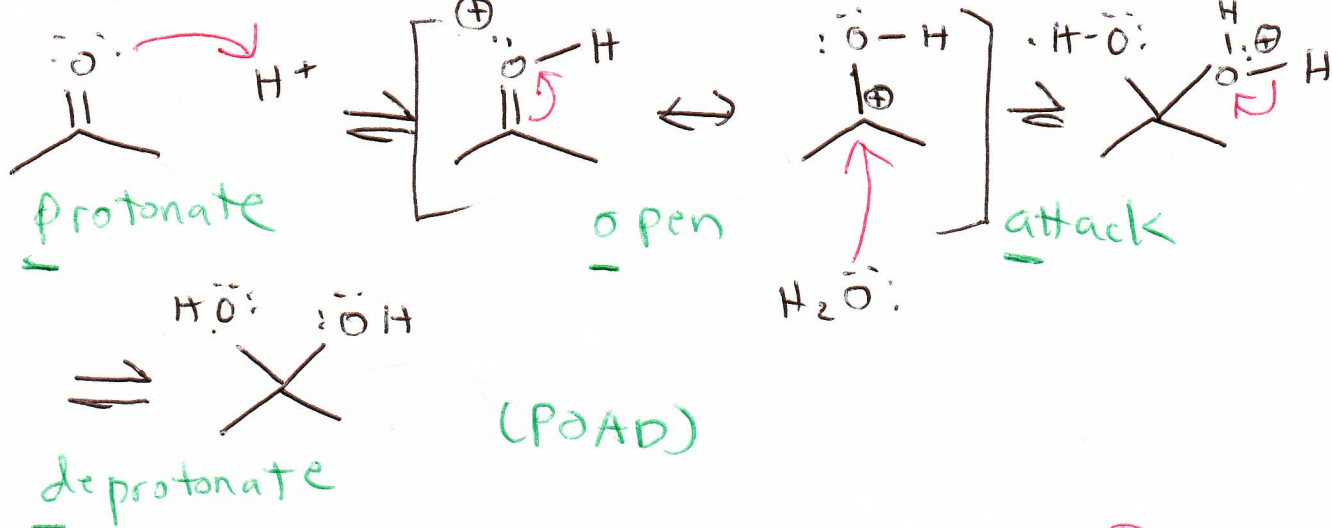


Hyperconjugation

In a ketone, both groups attached to the carbonyl are able to undergo ^{hyper}conjugation with the carbonyl. Hyperconjugation effectively reduces the δ^+ on the carbonyl carbon, which therefore makes the C=O less polar and less reactive.

hydrate (geminal diol)



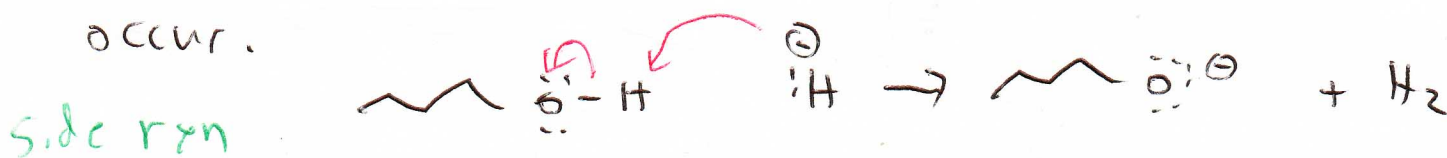


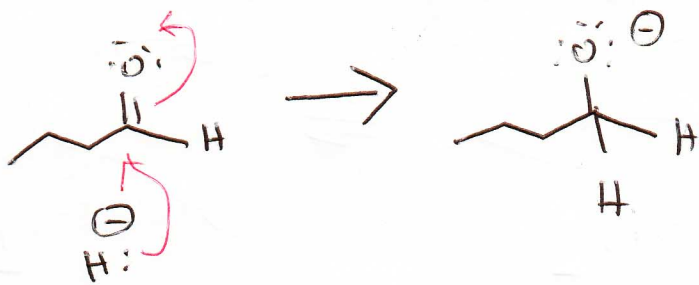
cationic reactions - especially involving acid catalysts - are normally reversible.

reduction

- NaBH₄ sodium borohydride
- LiAlH₄ lithium aluminum hydride

The electronegativity difference between aluminum and hydrogen is greater than between boron and hydrogen. LiAlH₄ is therefore a far more powerful reducing agent. NaBH₄ can be safely used in the presence of protic solvents; decomposition will occur, but slowly enough reduction can still occur.





Reduction is essentially an irreversible reaction because the reducing agent is far more basic than the product formed.

H_2 larger pK_a
weaker acid
stronger conj. base

ROH smaller pK_a
stronger acid
weaker conj. base

Anionic reactions are often irreversible, especially when there is a large difference in the basicity of the reactants vs. products.

