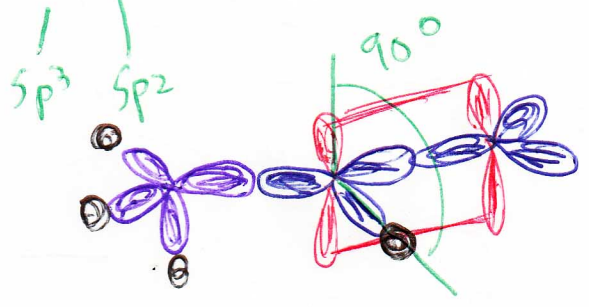
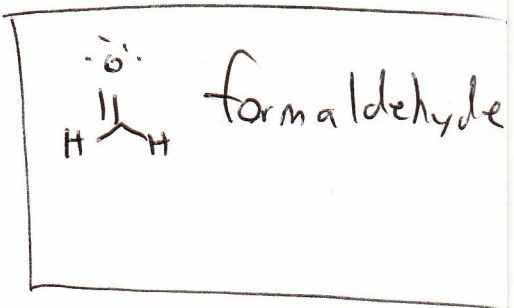


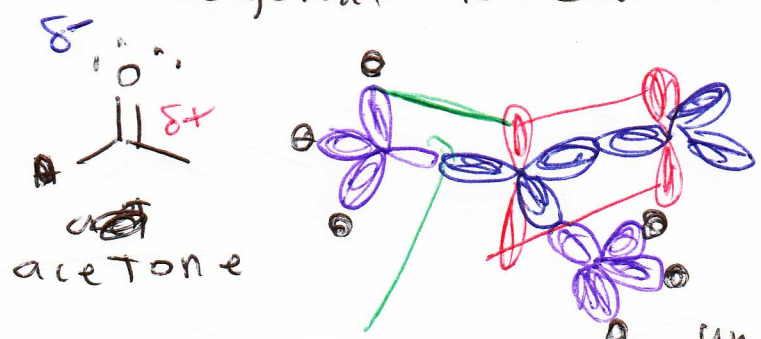
Structural molecular orbital graph



- (SMOG)
- sp<sup>3</sup>
  - sp<sup>2</sup>
  - p
  - s



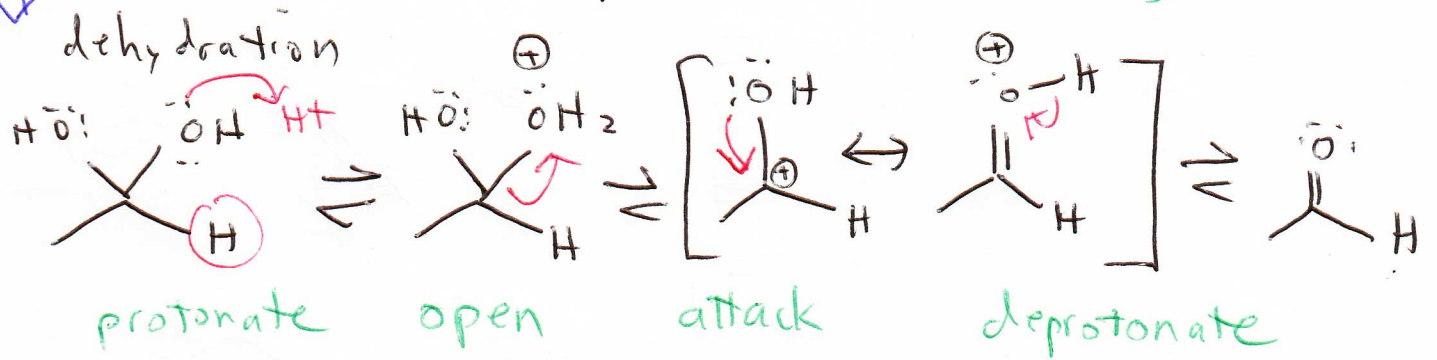
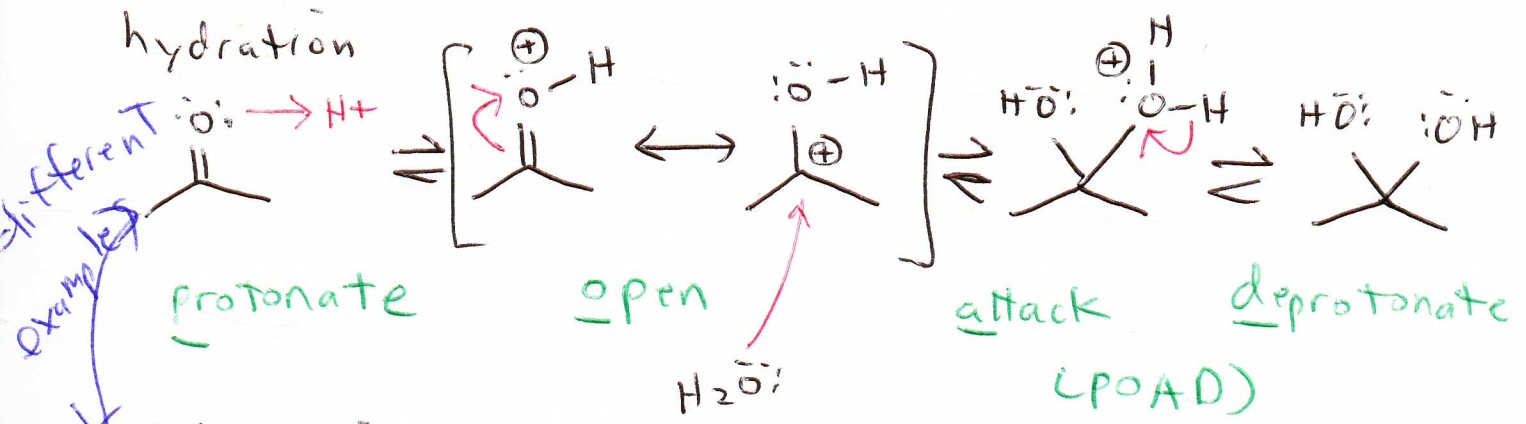
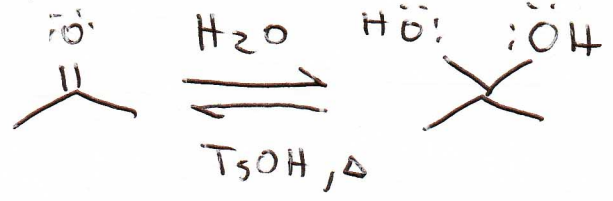
In aldehydes, there is no overlap between the bond connecting the hydrogen to the carbonyl and the  $\pi$  bond from the carbonyl, since they are orthogonal to each others,



In a ketone, both groups attached to the carbonyl are able to undergo hyperconjugation

with the  $\text{C}=\text{O}$ . Hyperconjugation reduces the polarity of the carbonyl bond (by providing electron density to the  $\delta^+$  carbon) which therefore reduces the reactivity of the  $\text{C}=\text{O}$ .

hydrate (geminal diol)



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

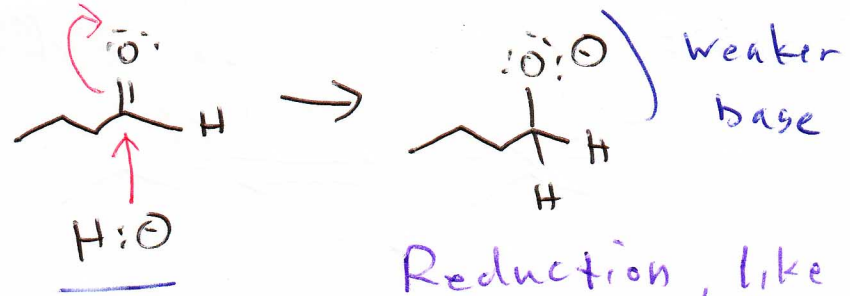
reduction (of aldehydes + ketones)

NaBH<sub>4</sub> - sodium borohydride

LiAlH<sub>4</sub> - lithium aluminium hydride

The electronegativity difference between aluminium + hydrogen is much greater than the difference between boron and hydrogen. Lithium aluminium hydride is therefore a much more powerful reducing agent than sodium borohydride. NaBH<sub>4</sub> can be safely used in many protic solvents; decomposition will occur, but slowly enough reduction can still occur.





Reduction, like many anionic reactions, is normally irreversible because of the large difference in basicities of the reactants and products.

