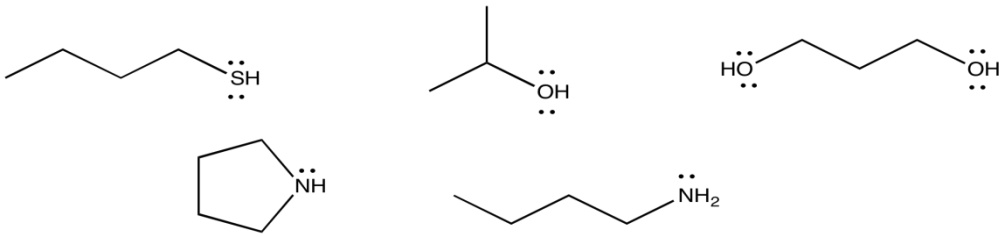
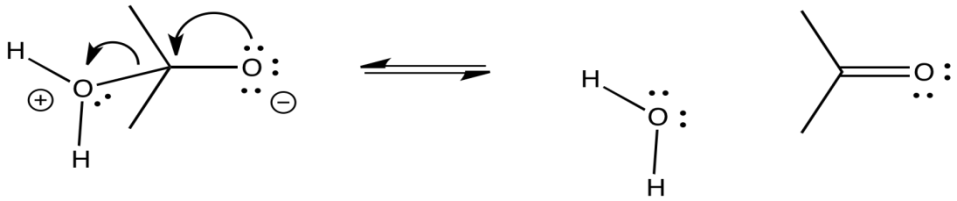
# ADDITION OF NEUTRAL NUCLEOPHILES

Nucleophiles do not have to be ionic, or even "semi-anionic". The basic requirement for a nucleophile is a lone pair. If a nucleophile has a lone pair, it can donate the lone pair to an electrophile such as a carbonyl. By donating a lone pair to a carbonyl, it can form a bond.

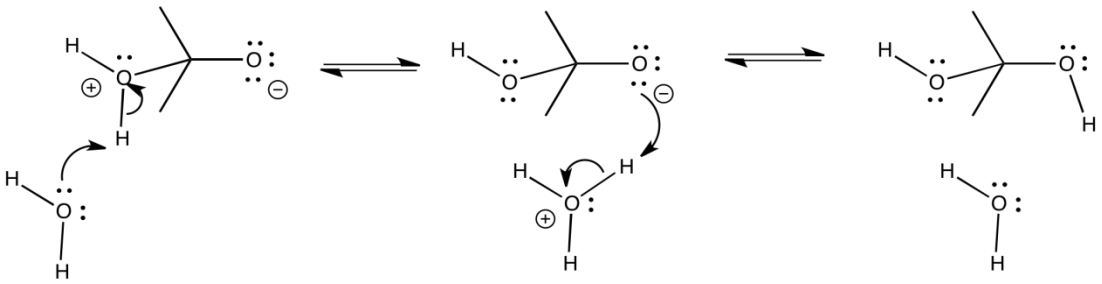



However, donation of a lone pair to a carbonyl is reversible. If there is something about the nucleophile/electrophile adduct that isn't very stable, the reaction may revert to reactants again. In the case of neutral nucleophiles, charge separation may destabilize the first-formed products of the reaction. Let's think about addition of water to propanone. Two neutral molecules, water and propanone, come together. The water donates a lone pair to the carbonyl carbon in propanone. That leaves the oxygen atom from the water with a positive charge, and the oxygen atom from the propanone with a negative charge.


One easy way to get rid of the charge separation is for the water to leave again. That step would just be the reverse of the first one.



On the other hand, another way to solve the charge problem is to move a proton ($H^+$) from the positively charged oxygen to the negatively charged one. That turns out to be pretty easy to do. If that happens, a "hydrate" or a "geminal diol" forms. A geminal diol, or twin diol, has two hydroxy groups on one carbon.



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