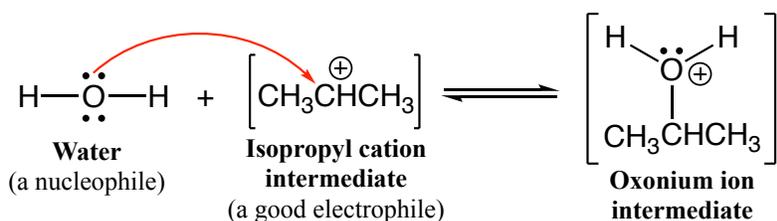
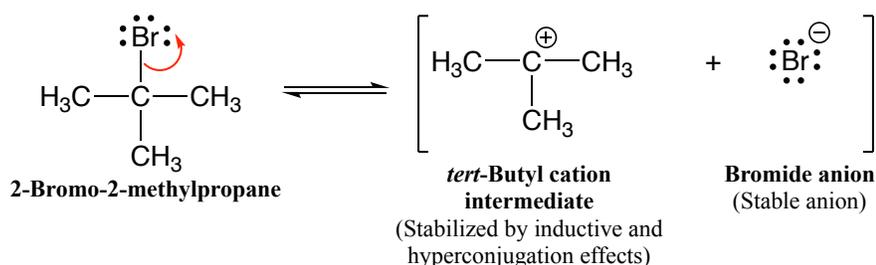


Polar Reaction Mechanisms: Polar reactions are most of what you will see in organic chemistry. There are only four different mechanistic elements that combine to make up the different steps of almost all the mechanisms you saw in CH320M/CH328M. Better yet, in CH320N the following four mechanistic elements are pretty much all you need to think about until we get to electrophilic aromatic substitution.

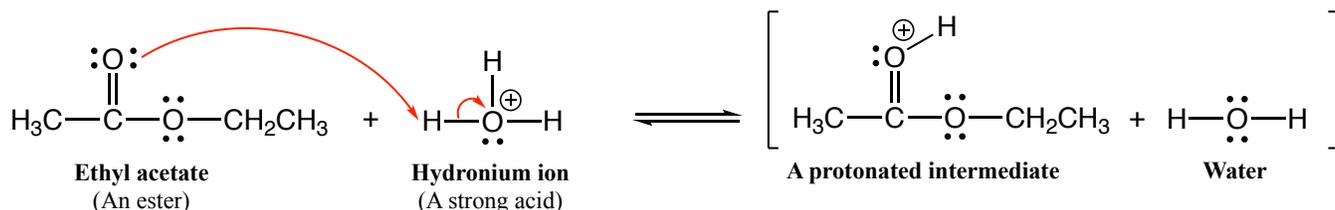
- 1. Make a new bond between a nucleophile (source for an arrow) and an electrophile (sink for an arrow).** Use this element when there is a nucleophile present in the solution as well as an electrophile suitable for reaction to occur.



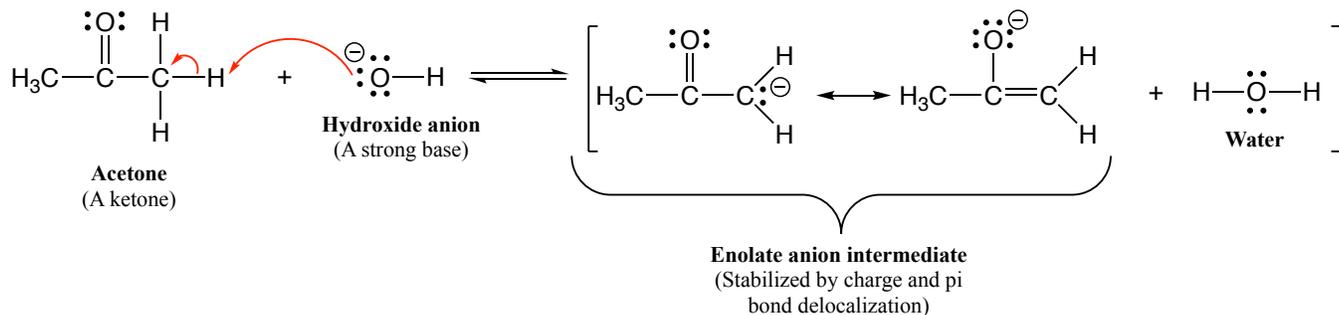
- 2. Break a bond so that relatively stable molecules or ions are created** Use this element when there is no suitable nucleophile-electrophile or proton transfer reaction, but breaking a bond can create neutral molecules or relatively stable ions, or both.



- 3. Add a proton** Use this element when there is no suitable nucleophile-electrophile reaction, but the molecule has a strongly basic functional group or there is a strong acid present.



- 4. Take a proton away** Use this element when there is no suitable nucleophile-electrophile reaction, but the molecule has a strongly acidic proton or there is a strong base present.



The situation is even simpler than you might expect because 1 and 2 are the functional reverse of each other, as are 3 and 4.

Mechanism Summary

The following questions and mechanistic elements are described from the point of view of the carbon-containing reagent, written in the form of a flowchart.

Is there a strong acid present or is the carbon-containing reagent a strong base?

YES
⇒

Add a proton

⇓
NO

Is there a strong base present or is the carbon-containing reagent a strong acid?

YES
⇒

Take a proton away

⇓
NO

Are there a nucleophile and electrophile present?

YES
⇒

Make a bond

⇓
NO

Can a bond be broken to create stable molecules or ions?

YES
⇒

Break a bond

⇓
NO

Think about alternative mechanistic elements (radical reaction, S_N2 , E2, etc.)

Here are the keys to understanding mechanisms in 320N!!

1) There are basically four different mechanism elements that make up the steps of carbonyl reactions.

A) Make a bond between a nucleophile and an electrophile

B) Break a bond to give stable molecules or ions

C) Add a proton

D) Take a proton away

2) These same four mechanism elements describe most of the other mechanisms you have/will learn!!! (Yes, organic chemistry really is this simple if you look at it this way!!)

There are basically four different mechanisms that describe the vast majority of carbonyl reactions and these mechanisms are different combinations/ordering of the four mechanism elements listed above. In this class, I have termed them "Mechanism A", "Mechanism B", "Mechanism C", and "Mechanism D". They all involve a nucleophile attacking the partially positively charged carbon atom of the carbonyl to create a tetrahedral intermediate. Different reaction mechanisms are distinguished by the timing of protonation of the oxygen atom as well as the presence or absence of a leaving group attached to the carbonyl.

Four Mechanisms for the Reaction of Nucleophiles with Carbonyl Compounds

