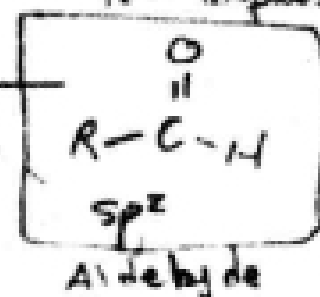


* MC is down Saturday!

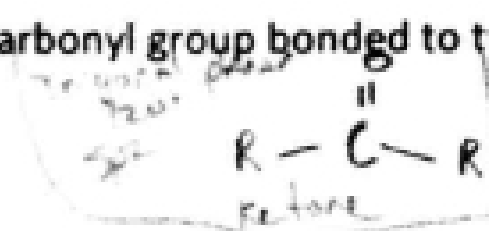
Chapter 16: Aldehydes and Ketones Lecture Notes

Trigonal planar
120° angles.



I. Structure and Bonding

- A. The functional group of an aldehyde is a carbonyl group bonded to a hydrogen atom and a carbon atom.
- B. The functional group of a ketone is a carbonyl group bonded to two carbon atoms.



II. Nomenclature

A. IUPAC Nomenclature

1. Naming aldehydes and ketones work along similar lines as other organic molecules: we count the longest chain of carbon atoms and that's our parent chain

2. Aldehydes

- a. -change the suffix -e to -al.
-Aldehydes must be at the end of molecules.
-Occupy C-1 position so we don't have to call out the location of the carbonyl.



c.

Very common

- d. For cyclic molecules in which the aldehyde group is directly bonded to the ring, the molecule is named by adding the suffix *-carbaldehyde* to the name of the ring. The atom of the ring to which the aldehyde group is bonded is #1.

- e. Molecules that retain their common name in the IUPAC system: benzaldehyde, cinnamaldehyde, formaldehyde, and acetaldehyde.

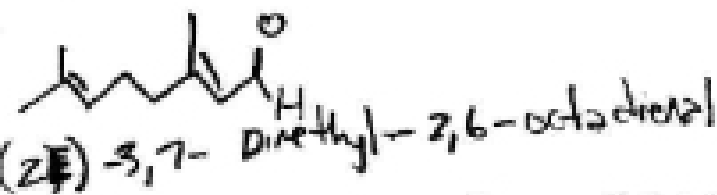
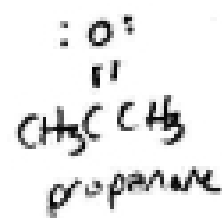
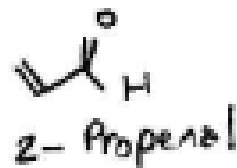
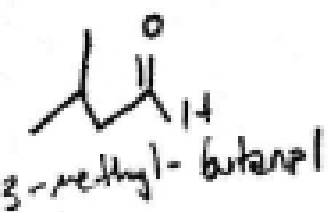
3. Ketones

- a. Change the ending from -e to -one.
-cannot occupy C-1 position.

must be sp2!

practice

Number the chain so that the carbonyl gets the lowest # possible.



c. Molecules that retain their common name in the IUPAC system: acetone, acetophenone, and benzophenone.

B. IUPAC Names for More Complex Aldehydes and Ketones

- IUPAC has established an order of precedence of functions for molecules that have more than one functional group. Table 16.1 (pg. 563) gives the order:

Table 16.1 Increasing Order of Precedence of Six Functional Groups

Functional Group	Suffix if Higher Priority	Prefix if Lower Priority	Example When the Functional Group Has Lower Priority
Carboxyl	-oic acid	—	
Aldehyde	-al	oxo-	3-Oxopropanoic acid <chem>OC(=O)CC=O</chem>
Ketone	-one	oxo-	3-Oxobutanoic acid <chem>OC(=O)C(=O)C</chem>
Alcohol	-ol	hydroxy-	4-Hydroxybutanoic acid <chem>OC(=O)CCC(O)C</chem>
Amino	-amine	amino-	5-Aminohexanoic acid <chem>OC(=O)CCCC(N)C</chem>
Sulphydryl	-thiol	mercapto-	2-Mercaptoethanol <chem>OCCS</chem>

*Don't know
Must know this chart

C. Common Names

- The common name for an aldehyde is derived from the common name of the corresponding carboxylic acid — this occurs by dropping the word "acid" and changing the suffix -ic or -oic to -aldehyde.
- The common name for a ketone is derived by naming the two alkyl or aryl group bonded to the carbonyl group as separate words, followed by the word *ketone*.

*Know how to name cyclic ketones.

III. Physical Properties

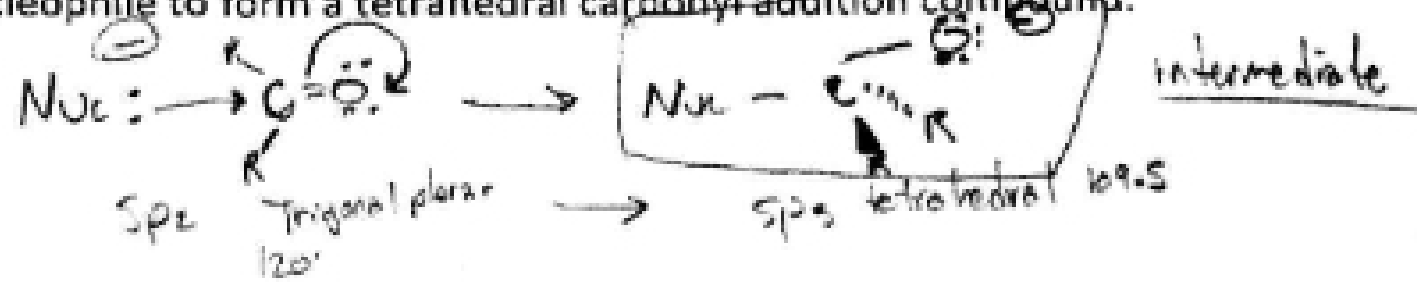
- A. Because of the polarity of the carbonyl group, aldehydes + ketones are polar compounds + interact through dipole-dipole interactions + hydrogen bonding.
- They will have higher MP + BP than non-polar compounds of comparable size + weight.

When you use a catalyst, you have to replace it.

1. Remember - the more interactions (and stronger interactions), the higher the boiling points!

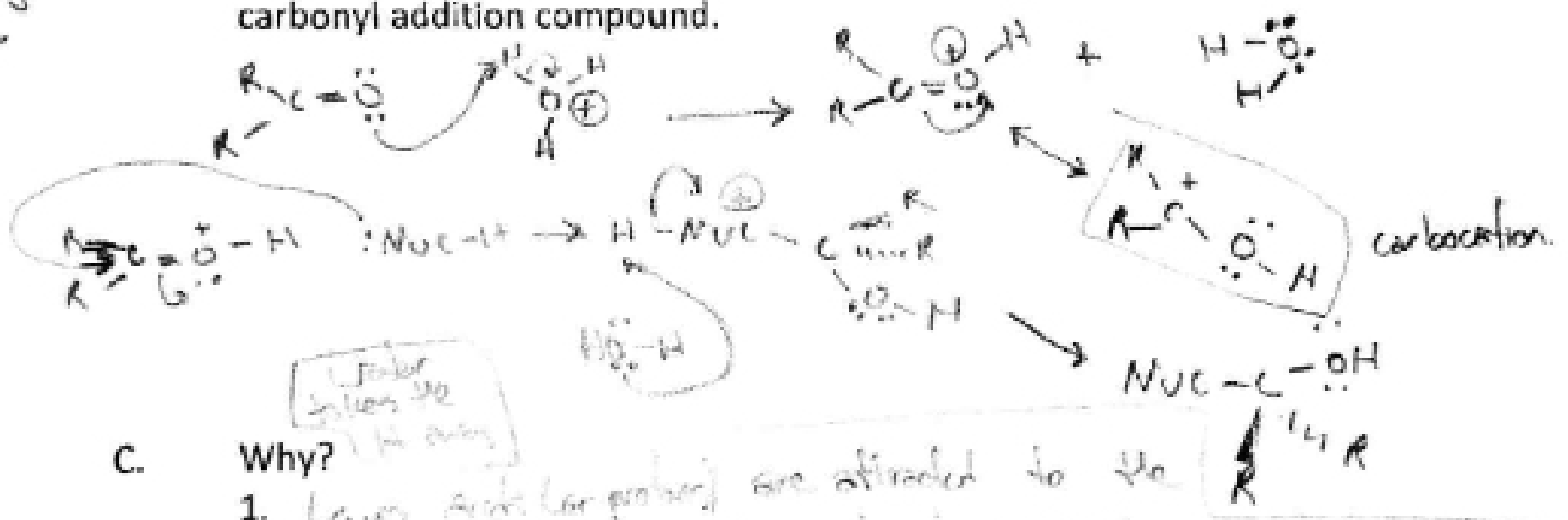
IV. Reactions *All reactions in a chap have a pattern.* *will be base or acid catalyzed reaction.* *Acid catalyzed*
 A. One of the most common reaction themes of a carbonyl group is addition of a nucleophile to form a tetrahedral carbonyl addition compound.

Usually includes strong nucleophile. Base
 ... No resonance. Just going for H.



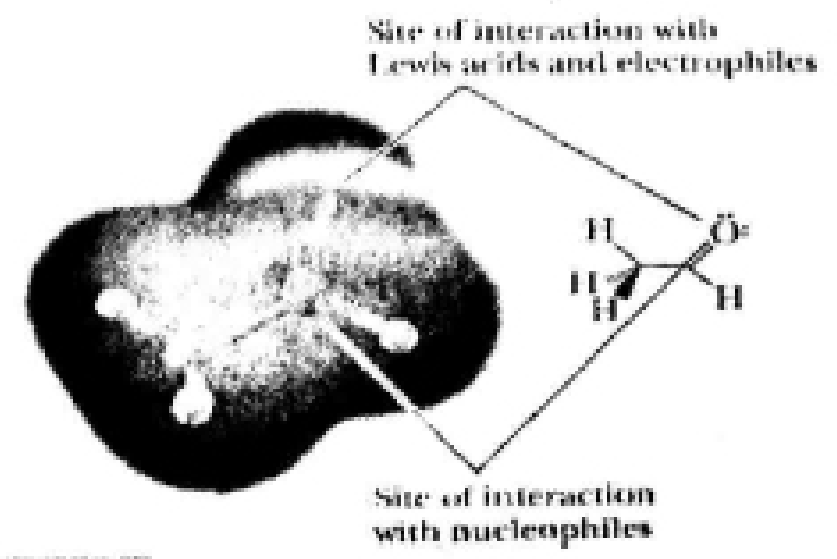
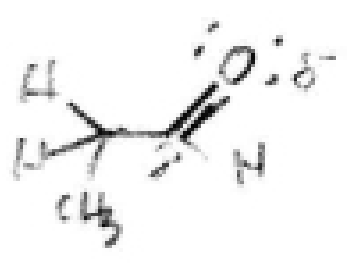
If the nucleophile is NOT a good nucleophile

B. A second theme is reaction with a proton or other Lewis acid to form a resonance-stabilized cation, which then reacts with nucleophiles to give a carbonyl addition compound.



They all combine together!
Acid
 ... Resonance, takes H, etc...

C. Why?
 1. Lewis acids (or protons) are attracted to the partial negative charge of the carbonyl oxygen.
 Nucleophiles (Lewis bases) are attracted to the partial positive charge of the carbonyl carbon.



dark blue is electron-deficient
 red is electron-rich