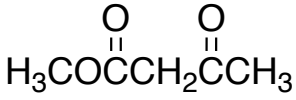
Chem 234 Final Exam Review

Organic I Material

Condensed & Partially Condensed Structures

- ACS Exam uses many condensed and partially condensed structures.

$CH_3CH_2CH_2Br$



$NaOCH_2CH_3$
$HOCH_2CH_3$

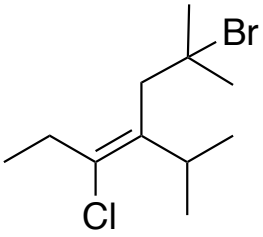
$KOC(CH_3)_3$

$LiN[CH(CH_3)_2]_2$

H_3CCO_2H

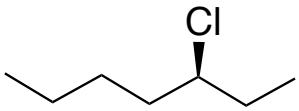
Nomenclature

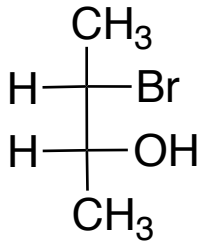
- Don’t expect anything too complex.
- Be able to name alkenes with E/Z system.



Nomenclature

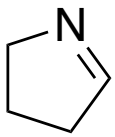
- Be able to name using the R/S System

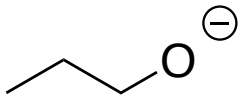




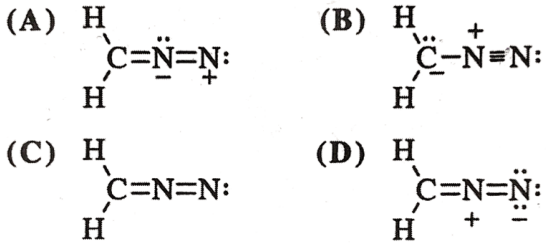
Structure

- Don't forget about lone pairs or the octet rule!!



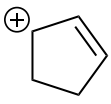


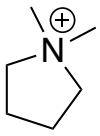
- Sample Q: Which is an acceptable Lewis Structure for diazomethane?

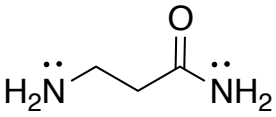


Hybridization

- A bond or lone pair counts as one group.
  - 4 Groups = sp^3
  - 3 Groups = sp^2
  - 2 Groups = sp







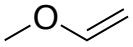
Tips:

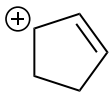
- A "+" charge on carbon is a void (lacks one group).
- A "+" on heteroatom is typically just a formal charge.
- An atom with a lone pair next to a Pi-bond will typically be sp^2 hybridized despite appearing sp^3.

Resonance

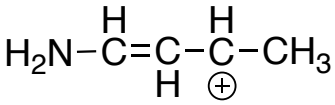
Watch For:

- "+" or "-" or lone pair on atom next to double bond.





- Lone pair on atom next to a carbocation.

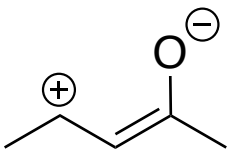


Resonance

Which resonance structure is the major contributor to the resonance hybrid?

i.e. Which resonance structure is most important?

i.e. Which resonance structure contributes most to the overall picture of this molecule?



1. Minimized Charges
2. Structures where all atoms have octet
3. Negative charge on most electronegative atom

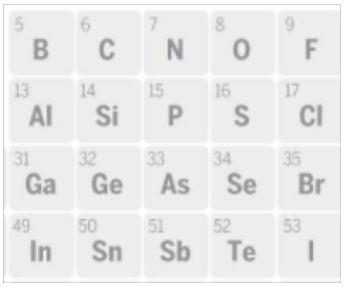
Acidity

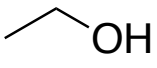
Acidity is assessed by analyzing the conjugate base stability.

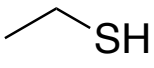
1. Charged acids are more acidic than uncharged acids.

H_2S vs H_3S^+

2. Atom Effect (acidity increases ↓ and →)

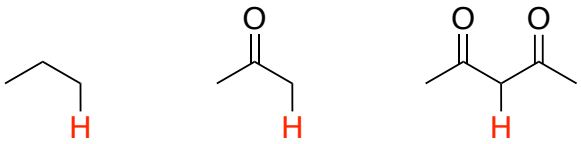






Acidity

3. If the conjugate base is resonance stabilized, the acid is more acidic.

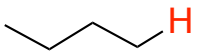


4. Inductive Effect: Nearby e-neg atoms increase acidity.

but… watch out for resonance donors!

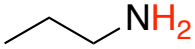
Acidity

5. More s-character = more acidic



An important exception to know!!

vs



Conformational Analysis of Acyclic Alkanes

- Stability Trend:
  - staggered anti > staggered gauche > eclipsed

$CH_3CH_2CH_2CH_3$

Cyclohexane Chair Conformation

What is the relationship between the two molecules?

Which chair conformation is more stable?

Alkene Stability

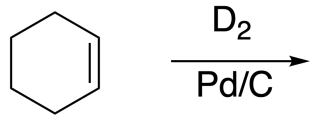
Alkenes become more stable with increasing substitution.

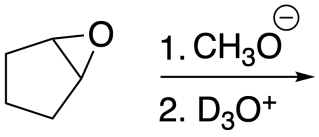
Conjugation increases stability.

Reactions

Important Tip: A deuterium (D) can be used in place of a hydrogen (H) in any reaction.

The deuterium reacts *identically* to the hydrogen.

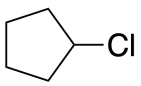




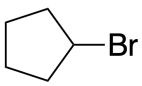
Reactions

The ACS exam may use the term “ionization” to describe what I typically call “loss of a leaving group.”

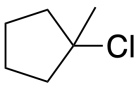
Sample Q: Which one will undergo ionization at the fastest rate?



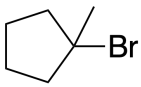
a



b



c



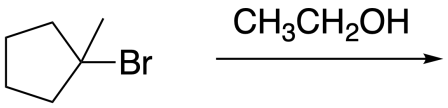
d

Synthesis Involving Acetylide Ion

Show how you can make trans-2-butene starting with acetylene.

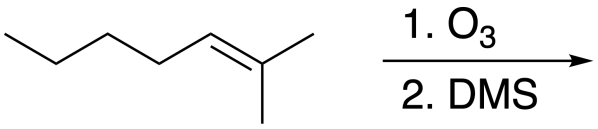
Solvolysis

S_N1 with the solvent acting as the nucleophile.



Ozonolysis

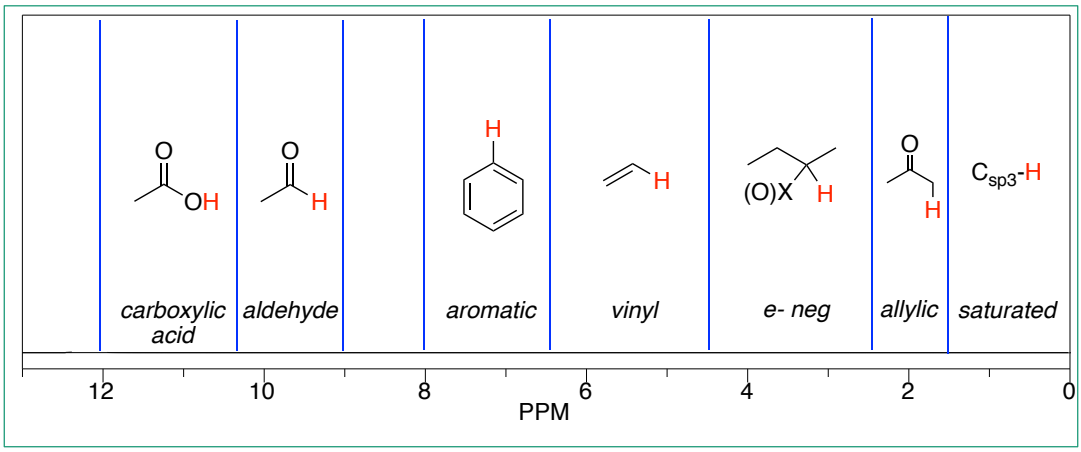
Uses ozone to cleave pi-bonds.



Spectroscopy

You will not be given any data tables, but you also don't need to know many specifics.

Know approximate 1H NMR Regions



Spectroscopy - IR

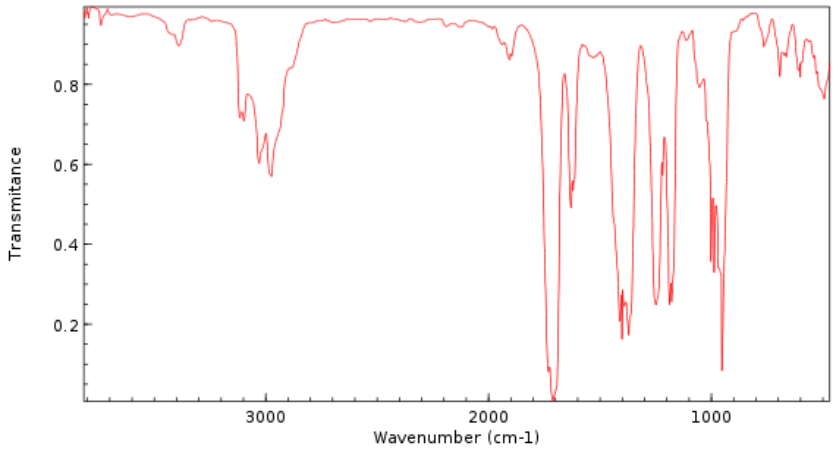
You will not be given any data tables, but you also don't need to know many specifics.

Know a few key IR Stretches

Functional Group	Frequency
OH & NH Stretch	~3300 cm^{-1} (relatively broad)
Terminal Alkyne C-H	3300 cm^{-1} (sharp narrow band)
Csp^2-H Stretch	Just above 3000 cm^{-1}
Csp^3-H Stretch	Just below 3000 cm^{-1}
C≡C Stretch	~2100 cm^{-1}
C=O Stretch	~1700 cm^{-1}
C=C Stretch	~1650 cm^{-1}
-CH_3 bending	Just below 1400 cm^{-1}

Spectroscopy - IR

Sample Q: Which one of the following compounds will give rise to the IR spectrum shown?



a **b** **c** **d**

Spectroscopy – Mass Spectrometry

Detecting the presence of a halogen by the $M^+/[M+2]^+$ ratio