JASPERSE CHEM 350 TEST 1 VERSION 4 Organic Chemistry I - Jasperse
Intro and Review
Structure and Properties of Organic Molecules
Structure, Nomenclature, and Conformation/Stereochemistry of Alkanes

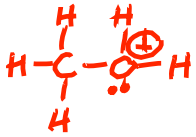
H
eneg →
C N O F
Cl
Br
I

1. Order the following according to increasing electronegativity, 1 being highest, 4 lowest. (2pts)

N 3 F 1 O 2 C 4

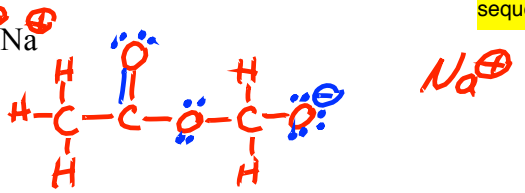
2. Write Lewis structures and assign any non-zero formal charges. (3pts each)

a. $[CH_3OH_2]^+$

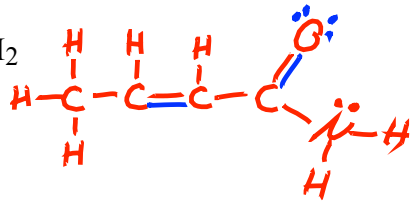


1. Want normal bonding for all: in absence of metal ions or overall charge
2. C=O (or C=C in other cases) may help
3. If you have any formal charges, they must sum to net charge of molecule (zero, in this case)
4. Organization must match condensed formula sequence

b. $CH_3CO_2CH_2ONa$



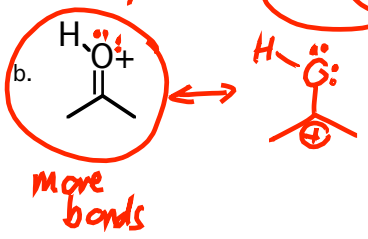
c. $CH_3CHCHCONH_2$



3. For each of the following, a) draw its resonance structure, and for each pair b) circle the structure that would make the greater contribution to the resonance hybrid. (2 pts each)

a.

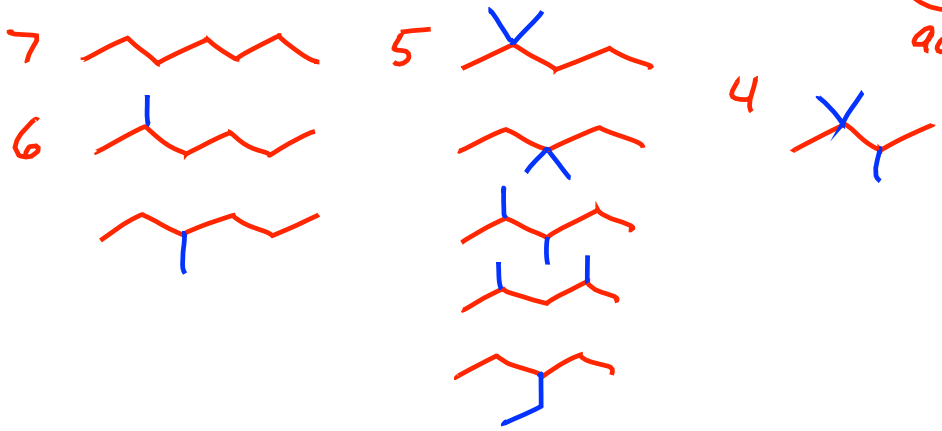
b.



2 Factors:
1. More bonds (priority)
2. Electronegativity (if bonds are equal)

4. Draw line-angle structures for 7 of the 9 structural isomers of C_7H_{16}. (5 pts)

acyclic alkane

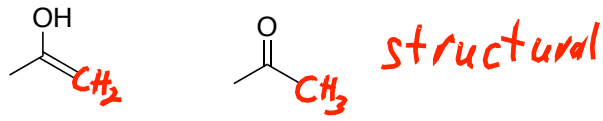


Alkane Acyclic: C_nH_{2n+2}
Alkane Cyclic: C_nH_{2n}

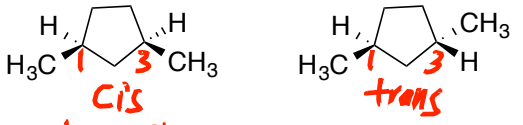
Beware of drawing same thing twice!

5. For the following pairs of structures, identify them as either: Resonance Structures, Structural Isomers, Stereoisomers, or Same. (2 pts each)

1. Resonance: No atoms can move!
2. Stereo: same condensed formula
3. Structural: different condensed formula

a. 

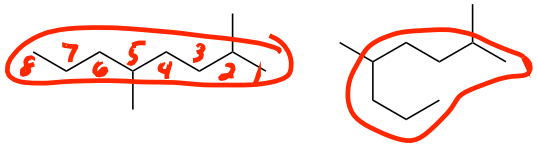
structural

b. 

Cis trans
stereo

c. 

resonance
no atoms moved

d. 

same

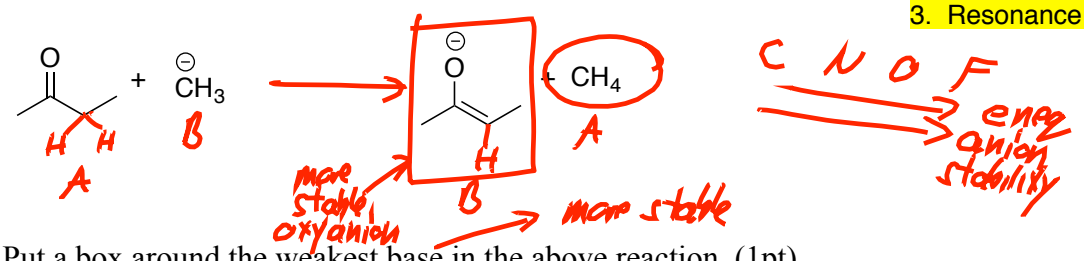
e. $CH_3CH_2CH_2CH_2CH_3$ $(CH_3)_2CHCH_2CH_3$ structural

6. Rank the acidity of the following molecules, 1 being most acidic, 4 being least acidic. (3 pts)

CH_3NH_2 3 CH_3OH 2 HCO_2H 1 CH_3CH_3 4

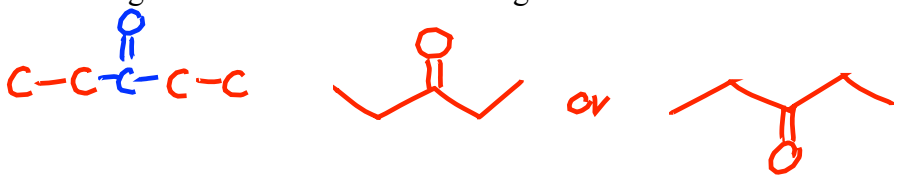
think anion

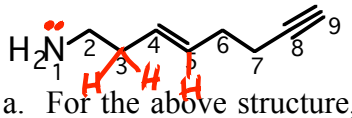
3 Acidity Factors:
1. charge (not relevant here)
2. Eneg
3. Resonance

7. 

a) Put a box around the weakest base in the above reaction. (1pt)
b) Put a circle around the weakest acid in the above reaction. (1pt)
c) Draw an arrow to show whether at equilibrium the reaction will go left-to-right or right-to-left. (2pt)

8. Draw the line-angle structure for the following condensed structural formula: $(CH_3CH_2)_2CO$ (3pt)



9. 

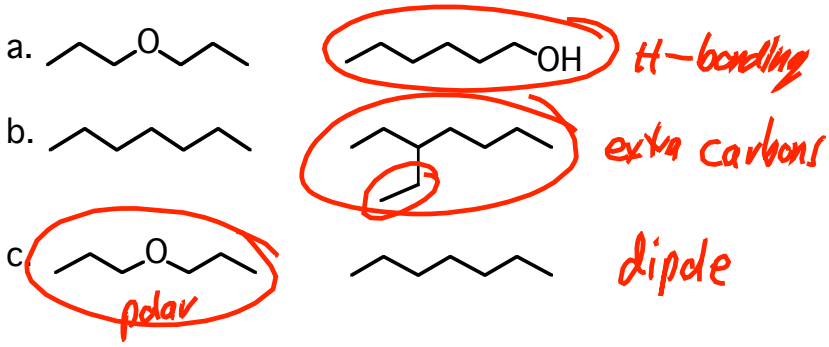
a. For the above structure, what is the hybridization, electron-pair geometry, and approximate bond angles (109, 120, or 180) about: (6pt)

4	N-1	sp^3	tetrahedral	~109
4	C-3	sp^3	tetrahedral	~109
3	C-5	sp^2	trigonal planar	~120
2	C-8	sp	linear	~180

b. Rank the length of the following bonds, 1 being shortest, 3 being longest. (2pt)

C2-C3	C4-C5	C8-C9
③	②	①
single	double	triple

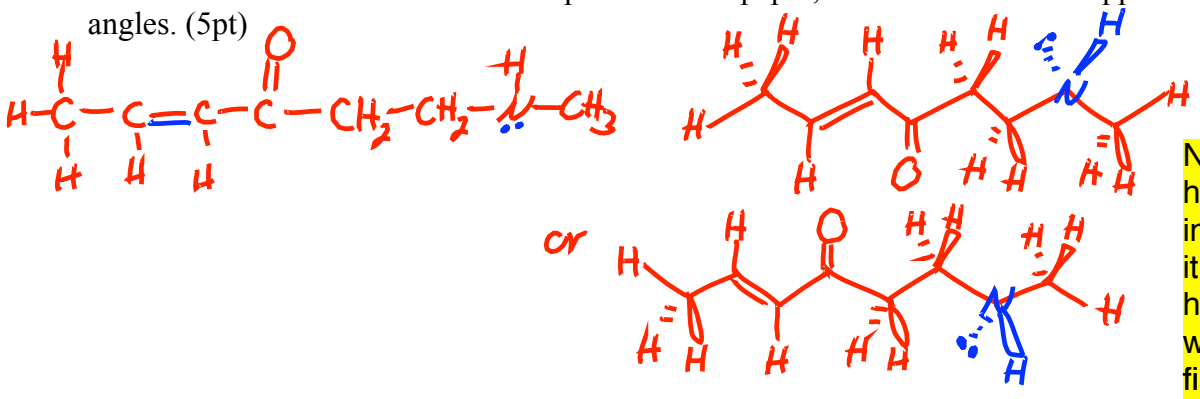
10. For each of the pairs listed, circle the one with the higher boiling point (4pt)



2 factors:
1. H-bonding (raises bp + solubility)
2. London force (# of carbons)
-more C's raises bp but reduces water solubility

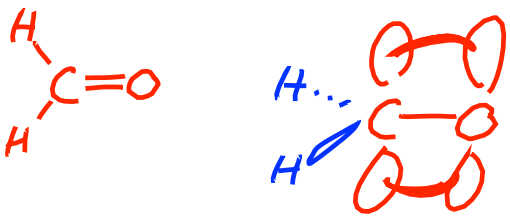
3. Polarity

11. Draw a 3-dimensional picture for all of the atoms (hydrogens included) in the molecule CH3CHCHCOCH2CH2NHCH3. Your picture should use the hash-wedge convention to illustrate atoms that are not in the plane of the paper, and should reflect approximate bond angles. (5pt)



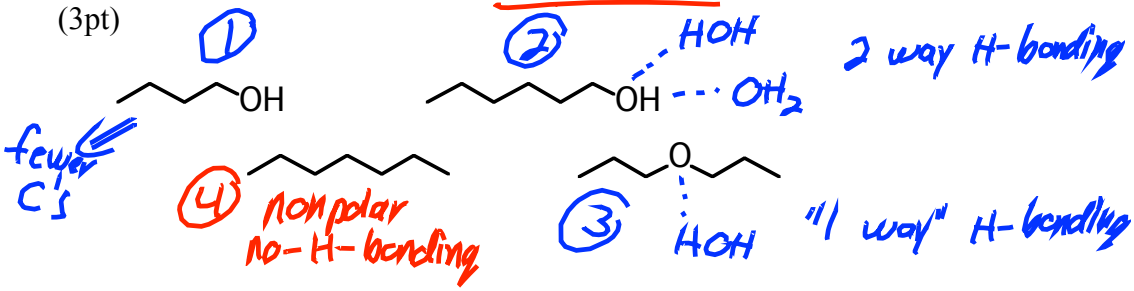
Note: N-H hydrogen is NOT in the plane. But it could be drawn hashed or wedged, either is fine.

12. Draw a 3-D picture of CH2O showing the π bond as well as the four atoms. (3pt)



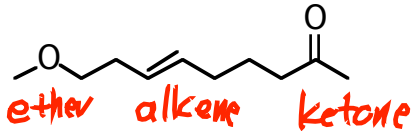
p-orbitals used to make the pi-bond are perpendicular to the plane of the atoms. So if we draw the pi-bond in the plane, the attached H's must be out of plane.

13. For the following set, rank the solubility in water, from 1 (most soluble) to 4 (least soluble). (3pt)

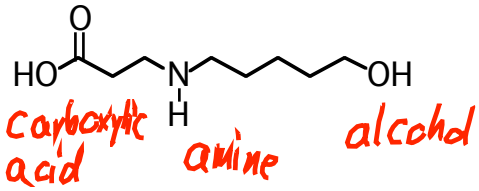


14. Identify the functional groups in the following molecules. (8pt)

a.



b.



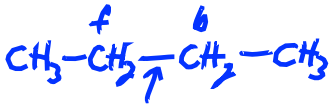
15. Give the IUPAC name for the following compounds. (6pt)

a.

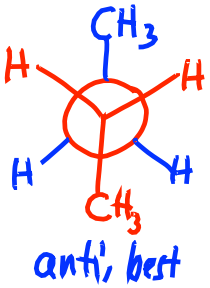
1. Longest chain
2. Alphabetize substituents
3. Number from end near substituent

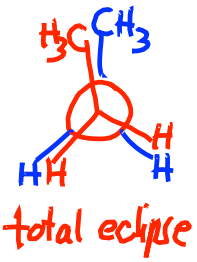
b.

1. cis/trans for di-subbed rings
2. Alphabetize substituents
3. Numbering
4. Know isopropyl and t-butyl



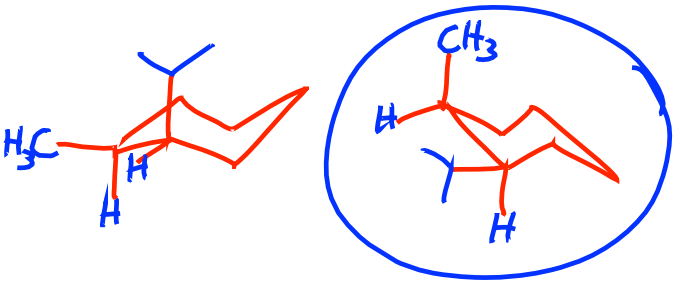
16. Draw the Newman projections for the best and worst conformations of butane, and give the names for these conformations. Briefly explain what "strain factors" make the worst conformation worse than the best conformation. (6pt)





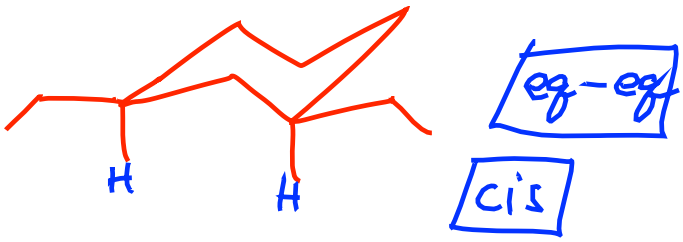
Torsional strain; any eclipsed conformation has torsional strain, repulsion beween bond-pair electrons.
Steric strain: atom are unnecessarily close, and repel each other

17. a.) Draw both chair conformations of cis-1-methyl-2-isopropylcyclohexane. Draw the substituents and H-atoms attached to carbons 1 and 2. (You don't need to show the H's on the other carbons). (4pt)
b.) **Circle the more stable conformation.** (1pt)

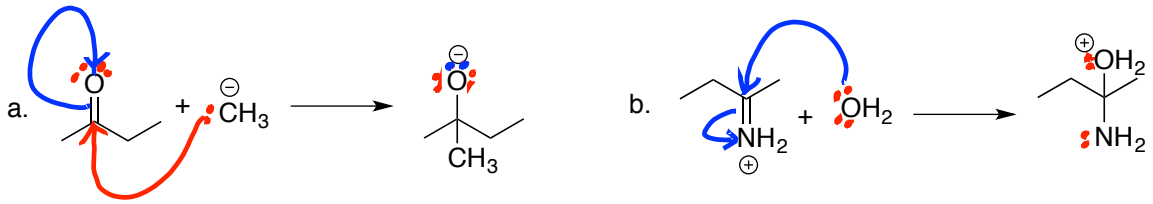


1. Make sure you've really drawn "flipped" chairs
2. What's "ax" in one chair flip is "eq" in the other.
3. Process cis-trans
4. Draw in H's on substituted carbons (easier to see ax/eq).

18. Draw the best chair conformation for 1,3-diethylcyclohexane, and identify whether it is "cis" or "trans". (3pt)



19. Use the arrow-pushing convention to show the electron-movement mechanisms for the follow two reactions. (5pt)



Good mechanism must explain changs in:
1. Bonds
2. Formal Charges
3. Lone pairs