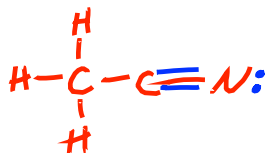


JASPERSE CHEM 350 TEST 1 VERSION 1 Organic Chemistry I - Jasperse
Intro and Review
Structure and Properties of Organic Molecules
Structure, Nomenclature, and Conformation/Stereochemistry of Alkanes

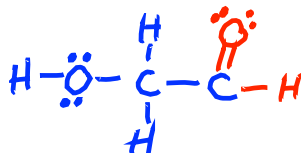
1. Draw the correct Lewis structure of CH₃CN. (Needn't show 3-D geometry) (3pt)



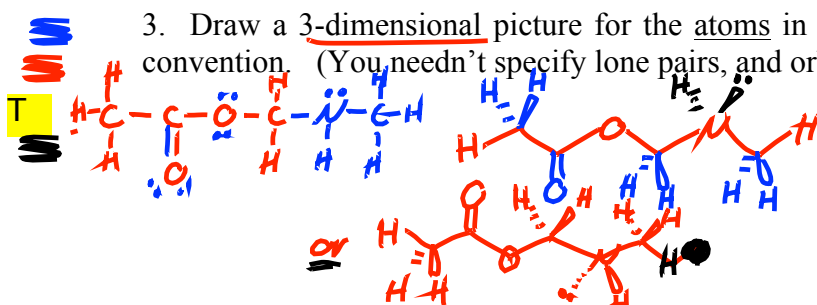
1. Want normal bonding for all
2. C=O (or C=C in other cases) may help
3. If you have any formal charges (not here), they must sum to net charge of molecule (zero, in this case)
4. Organization must match condensed formula sequence

Metal ⇒ formal charge

2. Draw the correct Lewis structure for HOCH₂CHO. (Needn't show 3-D geometry). (3pt)



3. Draw a 3-dimensional picture for the atoms in CH₃CO₂CH₂NHCH₃, using the hash-wedge convention. (You needn't specify lone pairs, and orbitals need not be shown). (5pt)



1. The Nitrogen is tetrahedral, so the N-H hydrogen must either be wedged or hashed. (The lone pair doesn't need to be drawn in, but it impacts the shape of the nitrogen)
2. Drawing the correct Lewis structure is essential! Do first!

Fine if N-H is hashed instead of wedged

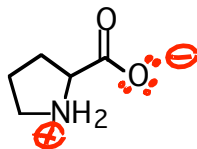
4. For the structure shown, what is the hybridization, electron-pair geometry, and approximate bond angle (90, 109, 120, or 180) relative to: (6pt)

	hybridization	electron-pair geometry	bond angle	hybridization	electron-pair geometry	bond angle
O-1	sp ³	tetrahedral	~109°	C-5	sp ²	trig planar 120
C-2	sp ³	tet	109	N-7	sp ³	tet 109
C-3	sp ²	trigonal planar	120	O-9	sp ²	trig planar 120

5. Assign any formal charges to any appropriate atoms for proline, given the structure shown (one of the body's 20 monomers from which protein and enzyme biopolymers are constructed). (3pt)

Normal

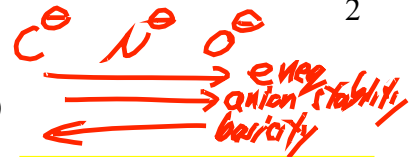
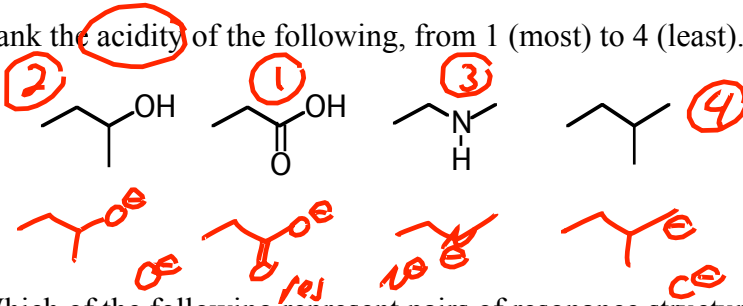
C 4
N 3
O 2



Ox 3 bonds ⇒ +
1 ⇒ ⊖
N 4

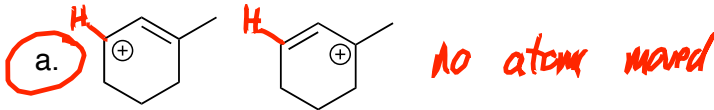
6. Rank the acidity of the following, from 1 (most) to 4 (least). (4pt)

Think Anion/ base

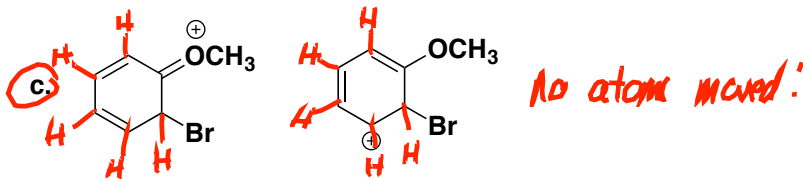
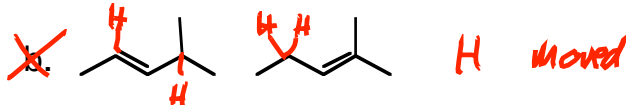


3 Acidity Factors:
 1. charge (not relevant here)
 2. Energ
 3. Resonance

7. Which of the following represent pairs of resonance structures? (4pt)



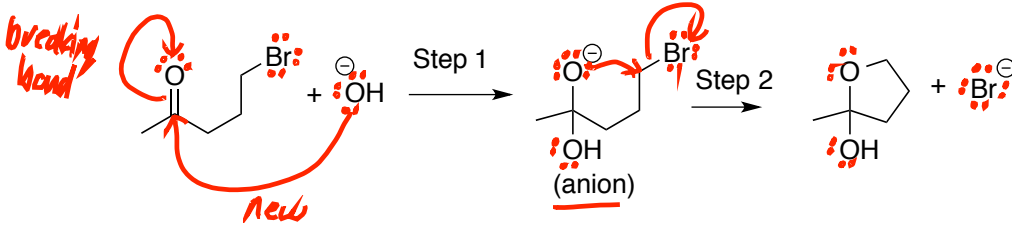
No atoms can move!



d. Both a and c

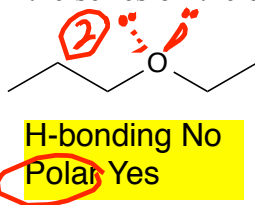
e. a, b, and c are all resonance structures.

8. Draw arrows to show electron-movement in the following two steps (draw arrows for each step). Draw a circle around the atom that functions as nucleophile in step 1, and a square around the atom that functions as nucleophile in step 2. (5pt)



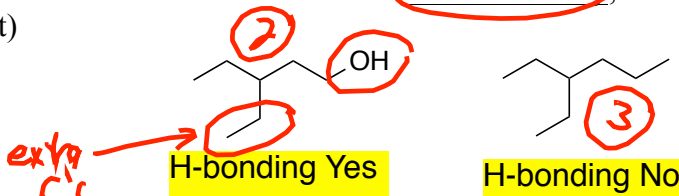
Explain change in:
 1. Bonds
 2. Charge
 3. Lone Pairs

9. Rank the series on the basis of boiling point, 1 having highest boiling point, 3 having lowest. (3pt)



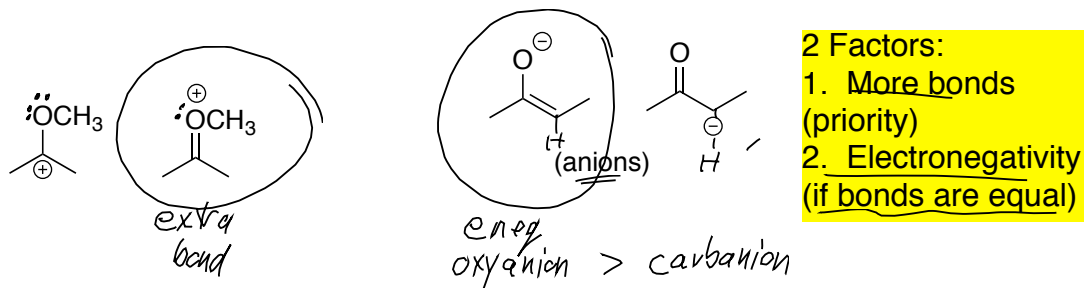
3 factors:
 1. H-bonding
 2. London force (# of carbons) - both RAISE BP
 3. Polar vs nonpolar

10. Rank the series on the basis of water solubility, 1 having highest solubility, 3 having lowest. (3pt)



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

11. For each of the following pairs of resonance structures, circle the one that would make a greater contribution to the actual resonance hybrid. (4pt)



12. Cyclopropane is much more "strained" than cyclopentane. Why? (Short!) (3pt)

Angle strain. Bonds are forced to be 60° , far from the ideal $\sim 109^\circ$ angle.

Note: angle strain only appears in certain rings;

For acyclics, steric and torsional are the only strains available.

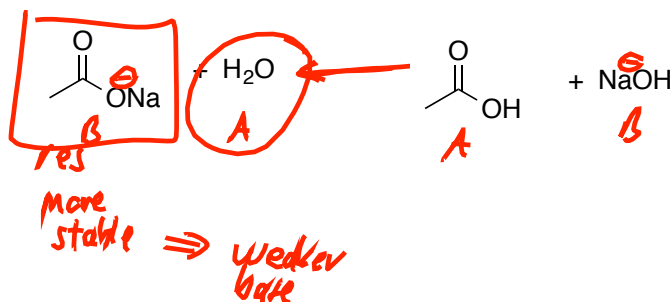


13. For the following acid-base reaction,

a. put a box around the weakest base in the reaction

b. put a circle around the weakest acid

c. draw an arrow to show whether the equilibrium goes to the right or left. (4pt)



Base Stability factors:

1. charge
2. eneg
3. resonance

1. Equilibrium favors the more stable base
2. More stable base is "weaker" base
3. "Weaker" acid + base on same side

14. Classify the relationship between the pairs of molecules as either: (8pt)

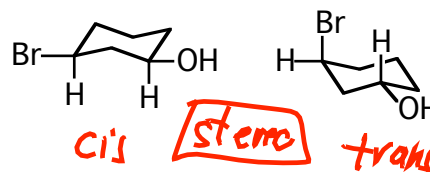
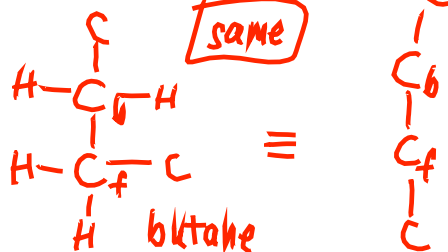
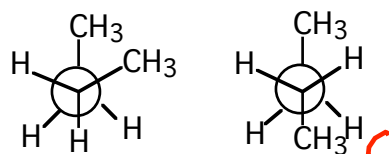
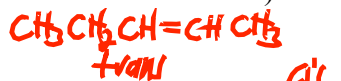
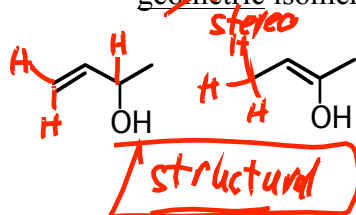
same compound

structural isomers

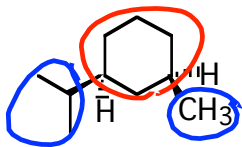
resonance structures

geometric isomers

not isomers (different molecular formulas)

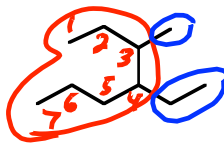


15. Give the name for the following. (7pt)



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

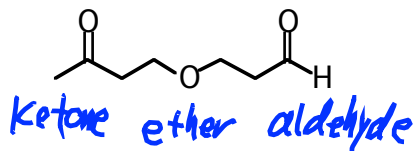
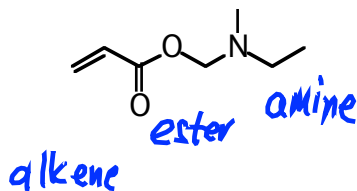
cis-1-isopropyl-3-methylcyclohexane



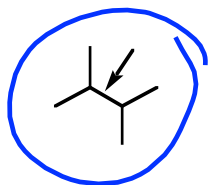
1. Longest chain
2. Alphabetize substituents
3. Number from end near substituent

4-ethyl-3-methylheptane

16. Identify all the functional groups in the following molecules. (Do not include "alkane", since that isn't "functional".) (6pt)

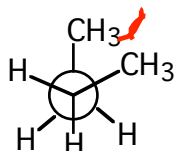


17. Which of the following pair will have the larger rotation barrier, relative to the bonds indicated? (3pt)

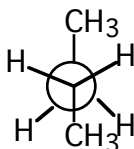


steric reasons
in totally eclipsed

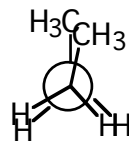
18. For the following Newman projections, rank them in stability from 1 to 4, 1 being most stable. Identify the "anti" conformation, the "gauche" conformation, and the "totally eclipsed" conformation. (6pt)



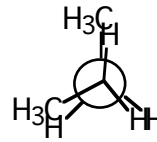
gauche
②



anti
①

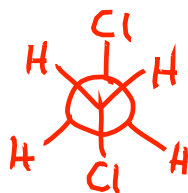


totally eclipsed
④



③

19. Draw the Newman projection for the most stable conformation of 1,2-dichloroethane. (3pt)

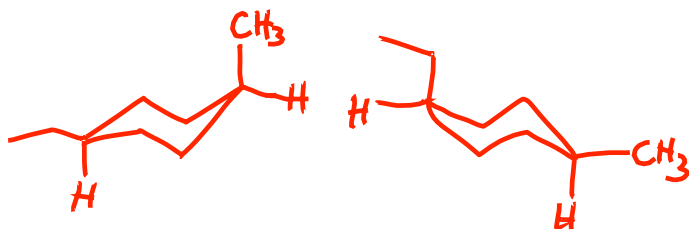


Best: staggered
and "anti"



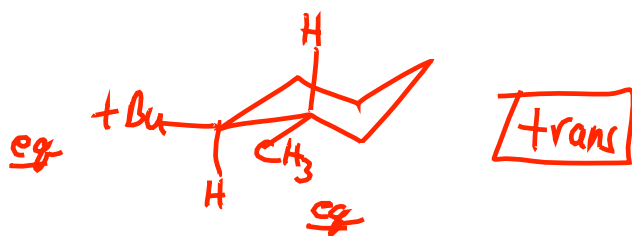
Worst: Totally
eclipsed

20. Draw the two chair conformations of cis-1-ethyl-4-methylcyclohexane. (You don't have to draw all the hydrogens). (5pt)



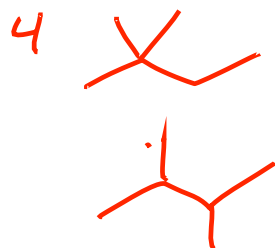
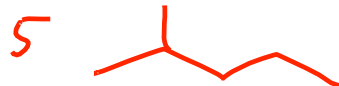
1. Make sure you've really drawn "flipped" chairs
2. What's "ax" in one chair flip is "eq" in the other.
3. Process cis-trans
4. Draw in H's on substituted carbons (easier to see ax/eq).

21. Which is more stable, cis- or trans-1-t-butyl-2-methylcyclohexane? Draw the best conformation of the more stable isomer. (4pt)



1. More stable chair has both substituents equatorial
2. Process cis-trans

22. Draw as many structural isomers as you can for C₆H₁₄. Be careful not to draw the same isomer twice! I will take off points for duplicating! (6pt)



alkanes

↓
acyclic
alkane

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

Beware of drawing same thing twice!