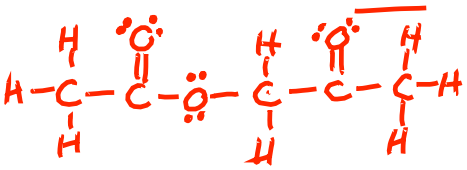
JASPERSE CHEM 350 TEST 1 VERSION 2 Organic Chemistry I - Jasperse
Intro and Review
Structure and Properties of Organic Molecules
Structure, Nomenclature, and Conformation/Stereochemistry of Alkanes

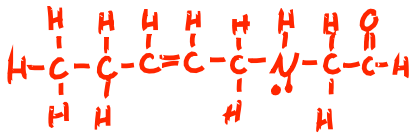
1. Draw the correct Lewis structure of $CH_3CO_2CH_2COCH_3$. (Needn't show 3-D geometry) (3pt)

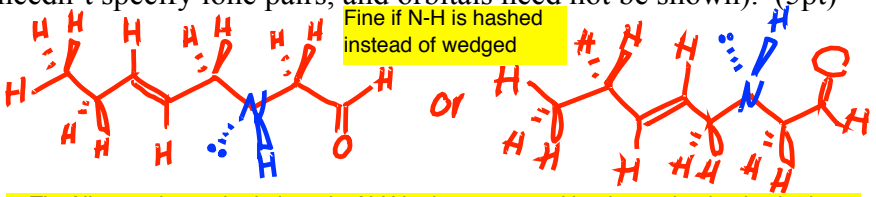
normal bonding



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

2. Draw a 3-dimensional picture for the atoms in CH3CH2CHCHCH2NHCH2CHO, using the hash-wedge convention. (You needn't specify lone pairs, and orbitals need not be shown). (5pt)



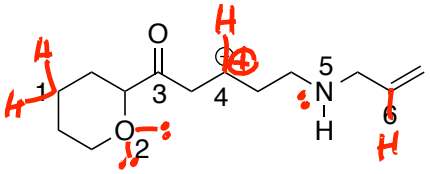


Fine if N-H is hashed instead of wedged

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!

3. For the structure shown, what is the hybridization, electron-pair geometry, and approximate bond angle (90, 109, 120, or 180) relative to: (7pt, 2 points off for each error)

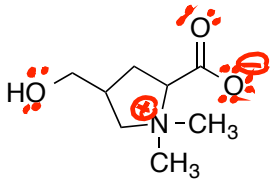
tet trig



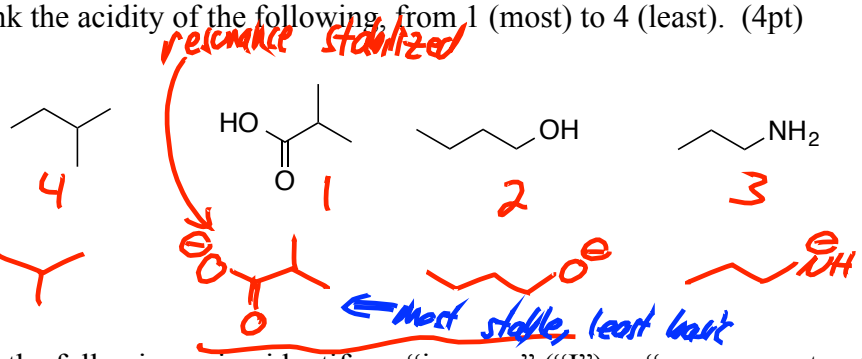
	hybridization	electron-pair geometry	bond angle		hybridization	electron-pair geometry	bond angle
C-1	sp^3	tetrahedral	~109°	C-4	sp^2	trig planar	120
O-2	sp^3	tetrahedral	109°	N-5	sp^3	tet	109
C-3	sp^2	trigonal planar	120°	C-6	sp^2	trig	120

4. Assign any formal charges to any appropriate atoms for the structure shown below. (4pt)

ox 2
N 3
C 4

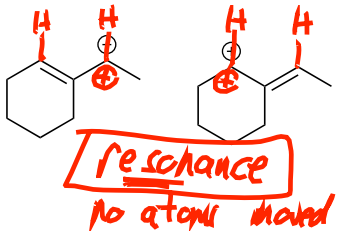


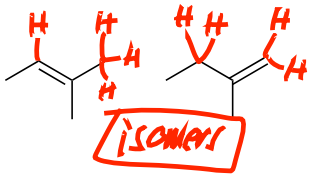
5. Rank the acidity of the following, from 1 (most) to 4 (least). (4pt)



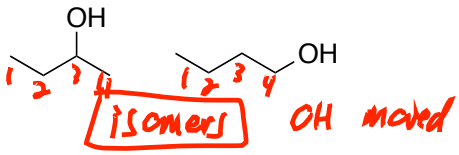
3 Acidity Factors:
1. charge (not relevant here)
2. Eneg
3. Resonance

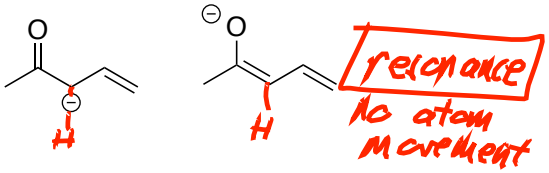
6. For the following pairs, identify as "isomers" ("I") or "resonance structures" ("R"). (6pt)





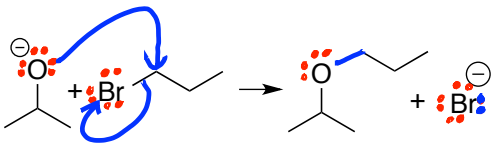
No atoms can move!



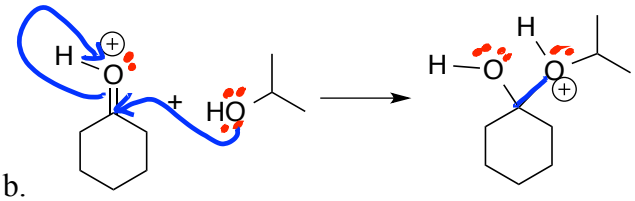


7. Draw arrows to show electron-movement in the following reactions. (These are reactions, not resonance.) (5pt)

a.



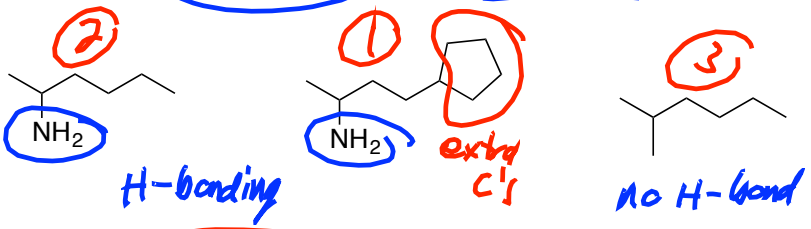
b.



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

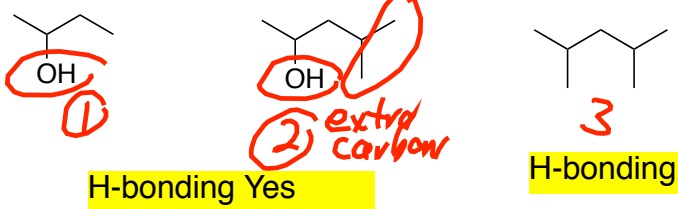
8. Rank the series on the basis of boiling point, 1 having highest boiling point, 3 having lowest. (3pt)

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



9. 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



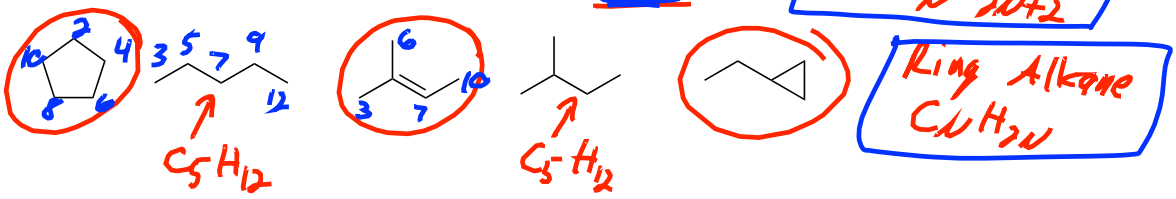
H-bonding Yes

Extra C's reduce solubility

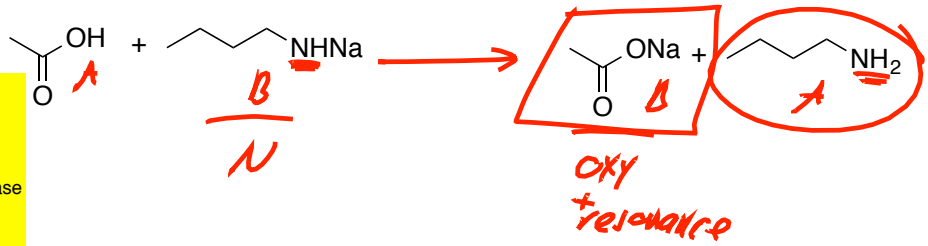
H-bonding No

Alkane Acyclic: C_nH_{2n+2}
Alkane Cyclic: C_nH_{2n}
Alkene: C_nH_{2n} (not expected to remember, but evident if you count)
Counting H's can always double-check on this!

10. Circle whichever of the following could fit the formula C_5H_{10}? (3pt)



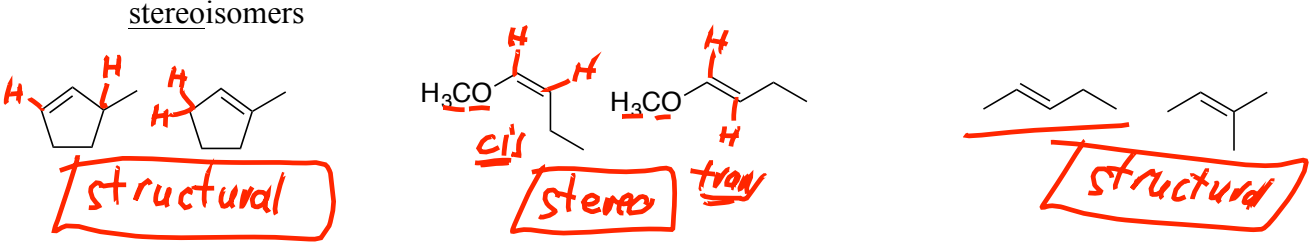
11. For the following acid-base reaction,
   a. put a box around the weakest base in the reaction
   b. put a circle around the weakest acid
   c. draw an arrow to show whether the equilibrium goes to the right or left. (4pt)

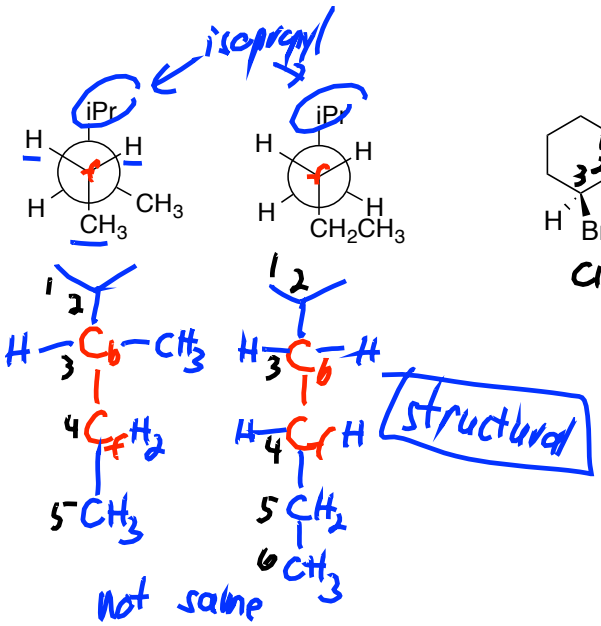


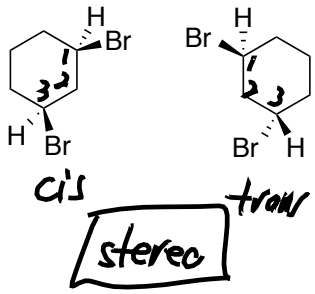
Base Stability factors:
1. charge
2. eneg
3. resonance

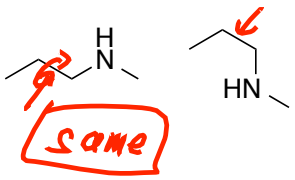
1. Equilibrium favors the more stable base
2. More stable base is "weaker" base
3. "Weaker" acid + base on same side

12. Classify the relationship between each pair of molecules as either: (10 pt)
same compound structural isomers resonance structures
stereoisomers

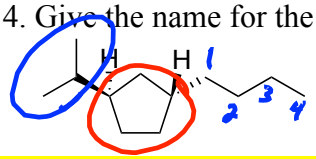






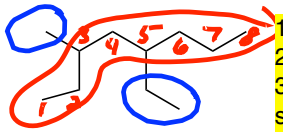


14. Give the name for the following. (7pt)



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

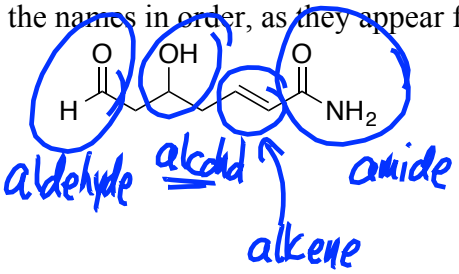
trans-1-butyl-3-isopropylcyclopentane

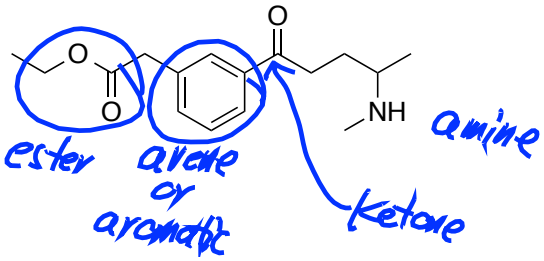


1. Longest chain
2. Alphabetize substituents
3. Number from end near substituent

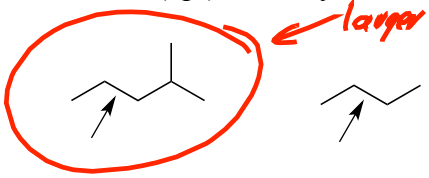
5-ethyl-3-methyloctane

16. Identify and write down the names for each of the functional groups in each of the following molecules. (Do not include "alkane", since that isn't "functional".) For each molecule, try to write the names in order, as they appear from left-to-right in the molecules. (8pt)





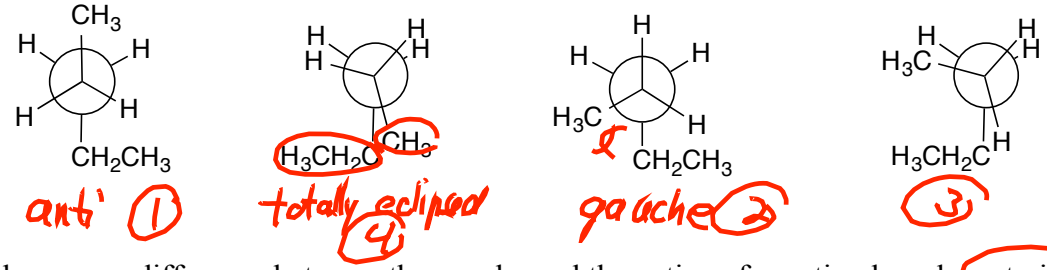
17. Circle which of the following pair will have the larger rotation barrier, relative to the bonds indicated? (2pt) Identify which reason explains why: steric strain, torsional strain, or angle strain?



steric strain

Greater steric strain when totally eclipsed.
(Both will have equal torsional strain when totally eclipsed.)

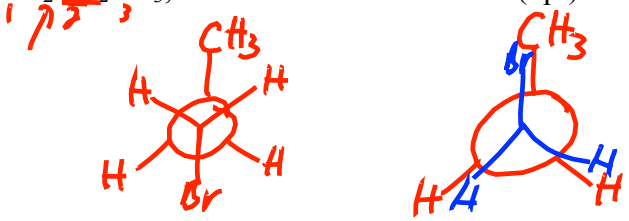
18. For the following Newman projections: (6pt total)
    a. rank them in stability from 1 to 4, 1 being most stable
    b. identify the "anti", "gauche", and the "totally eclipsed" conformations.



    c. Is the energy difference between the gauche and the anti conformation based on steric strain, torsional strain, or angle strain?

    d. In the case of ethane (not shown), staggered conformations are better than eclipsed conformations. Is the difference based on steric strain, torsional strain, or angle strain?

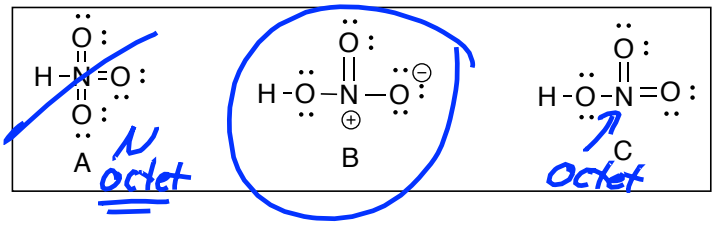
19. Draw both the most stable and the least stable Newman projections for 1-bromopropane, $BrCH_2CH_2CH_3$, relative to C1-C2 bond. - (3pt)



Best: staggered and "anti"

Worst: Totally eclipsed

20. Which of the following are correct Lewis structures, including formal charges, for nitric acid, HNO_3. (3 pts)



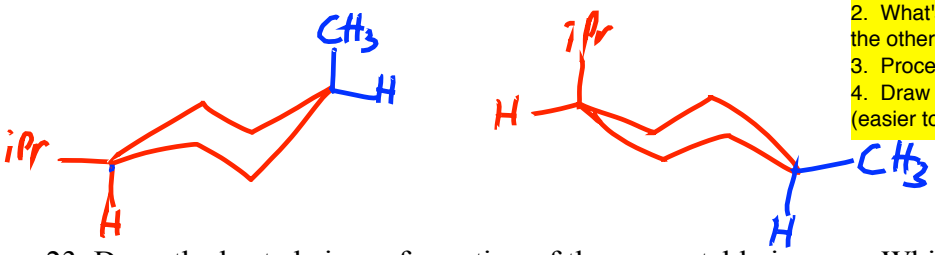
21.

a. A only
b. B only
c. C only
d. Both A and C
e. All of the above

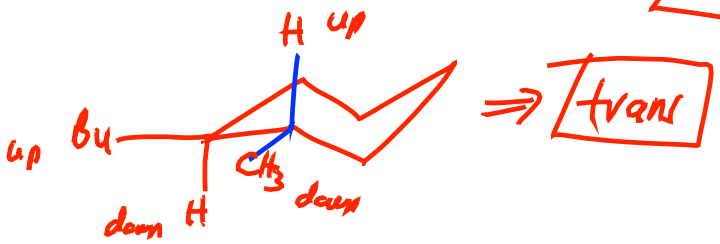
1. Do not exceed octet
2. If formal charges, must sum to net charge
3. As much "normal bonding" as possible, given the above constraints.

22. Draw the **two chair conformations** of cis-1-isopropyl-4-methylcyclohexane. (You don't have to draw all the hydrogens). (5pt) (Use "iPr" as abbreviation).

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).

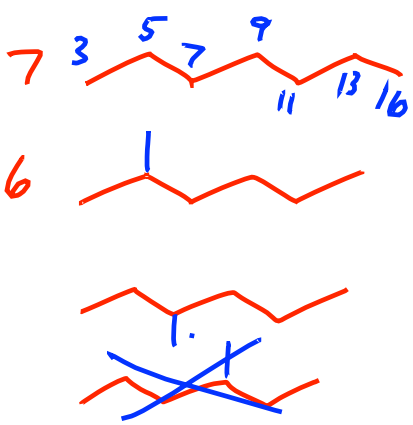


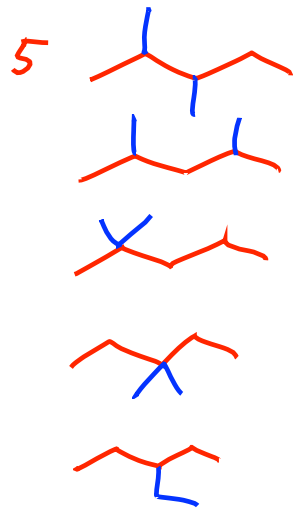
23. Draw the best chair conformation of the more stable isomer. Which is more stable, cis- or trans-1-butyl-2-methylcyclohexane? (4pt)

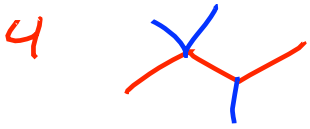


1. More stable chair has both substituents equatorial
2. Process cis-trans

24. Draw any 6 of the 9 possible structural isomers for **alkanes** with formula C_7H_{16}. When deciding whether to draw cyclic or acyclic alkanes, make sure that you fit the formula! Be careful not to draw the same isomer twice! I will take off points for duplicating! (You can try to show off by getting more than 6, but if you do still be sure you don't duplicate!) (6pt)







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

Beware of drawing same thing twice!