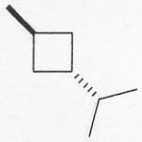
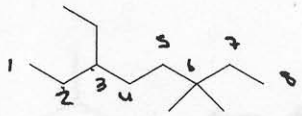
1. (10 pts) Provide a proper IUPAC name for the following molecules:



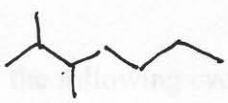
trans-1-isopropyl-3-methyl cyclobutane



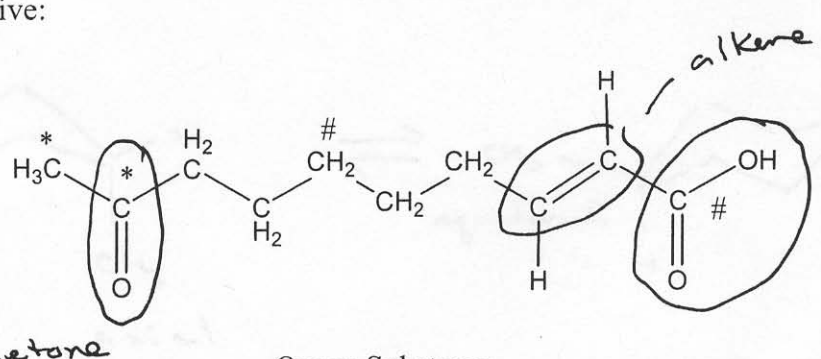
3-ethyl-6,6-dimethyl-octane

Provide structures for each of the following name.

2, 3-dimethyl heptane



2. (10 pts) For queen substance, the molecule that queen honey bees secrete as a signal for many functions around the hive:



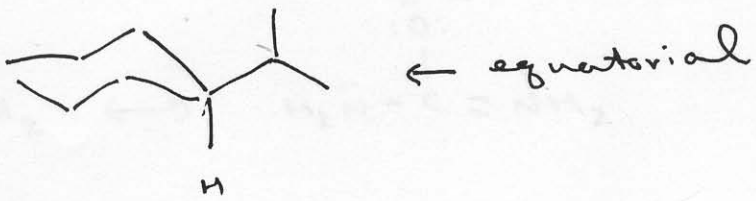
Circle and name all the functional groups. (exclude alkanes and alkyl groups)

Give the number of primary and secondary carbons in the molecule.

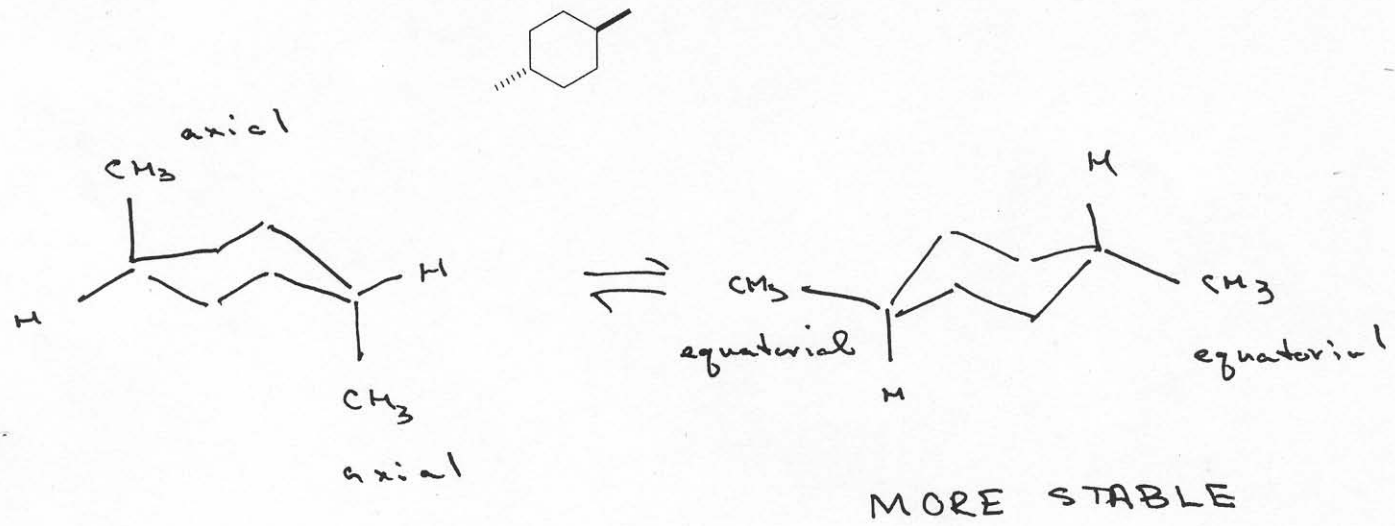
$1^{\circ} = 2$

$2^{\circ} = 8$

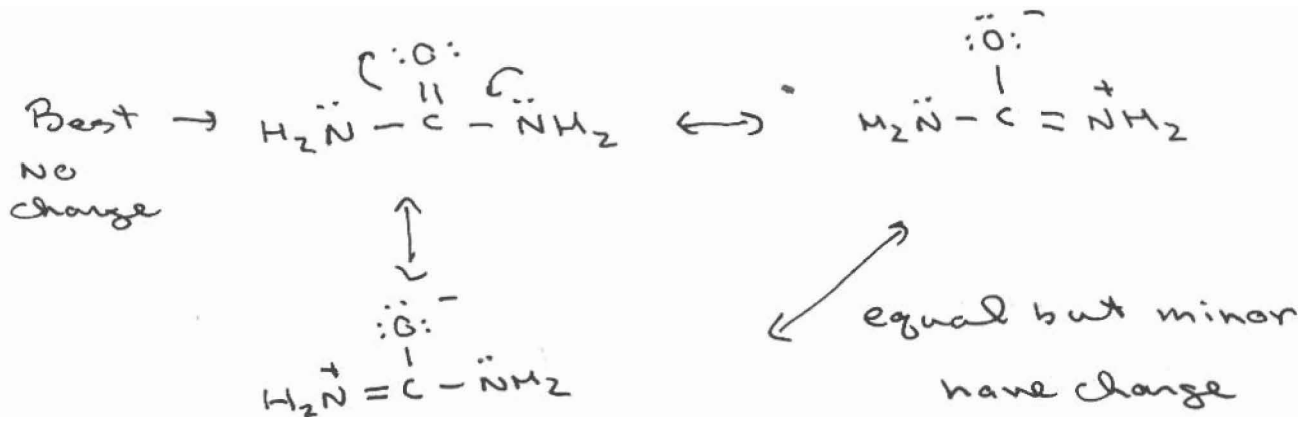
3. (15 pts) Draw the most stable chair conformation of isopropyl cyclohexane.



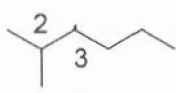
Draw the two chair conformations for the following cyclohexane and label the substituents as axial or equatorial (you do not have to draw in all the hydrogens). Label which conformation is more stable.

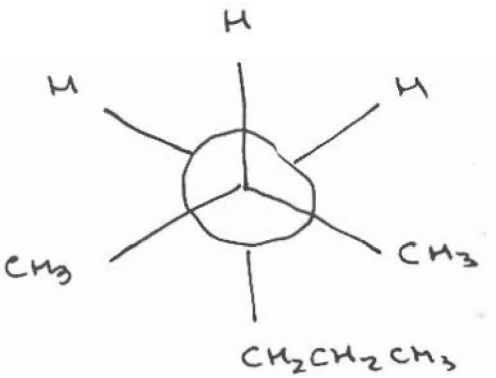


4. (15 pts) Draw a Lewis structure of urea, NH_2CONH_2, in which all the atoms have filled octets. Show all non-bonding electrons and formal charges. Draw any resonance contributors to the structure you first drew in which <u>all the atoms have filled octets</u>. Rank your structures in order of stability

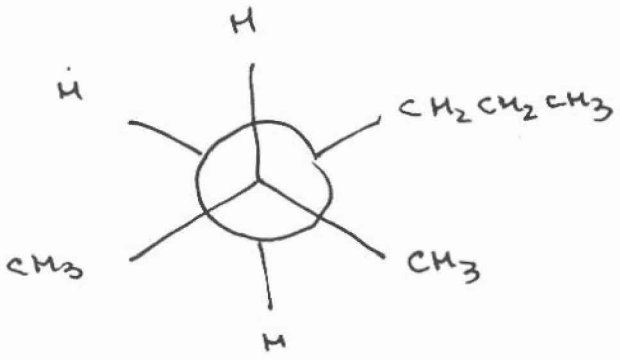


5. (10 pts) Draw Newman projections for the each of the staggered conformations between the C2-C3 bond of 2-methyl hexane. Label the most and least stable conformations.

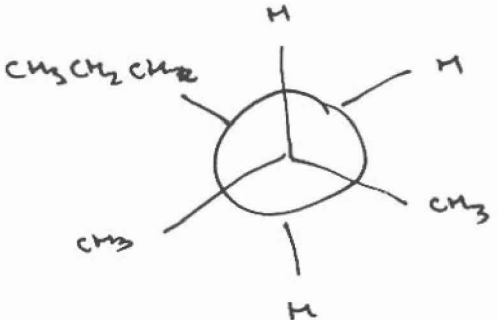




← Least Stable
all 3 groups together
"gauche"



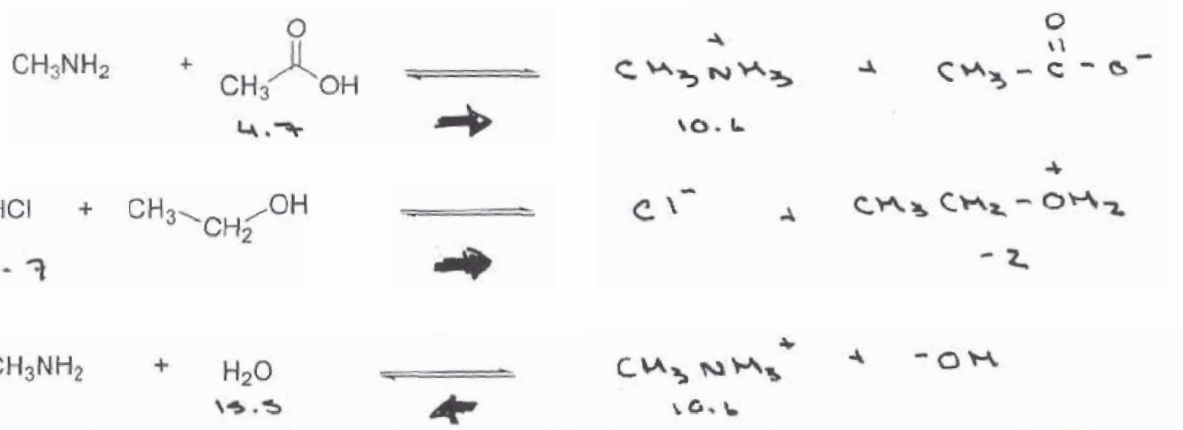
Equal - more stable
- only 2 groups gauche



6. (15 pts) For each of the following reactions

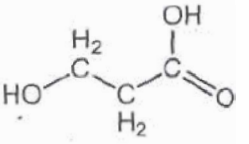
Provide the products of each acid-base reaction below

Using the pKa values given draw an arrow to show which side the equilibrium lies.



pKa's: $CH_3CO_2\underline{H}$ = 4.7, $CH_3N\underline{H}_2$ = 36, $CH_3{}^+N\underline{H}_3$ = 10.6, $CH_3CH_2O\underline{H}$ = 15, H_2O = 15.5, H_2S = 8.5, HCl = -7, $CH_3CH_2O\underline{H}_2{}^+$ = -2, H_2CO_3 = 7, NH_3 = 36, $^+NH_4$ = 9.4, H_3O^+ = -1.5.

Based upon the pKa values above, answer the following questions about the following molecule.



Circle the bases that will remove the proton from both the carboxylic acid and alcohol groups.

$^-NH_2$ H_2O $^-HCO_3$ ^-SH

Circle the bases that will remove only the proton from the carboxylic acid group.

$^-NH_2$ H_2O $^-HCO_3$ ^-SH

Circle the acids that will protonate the alcohol group.

H_2CO_3 H_2O HCl H_2S

7. (15 pts)

Circle the molecule with the highest boiling point.

$CH_3CH_2CH_2CH_2CH_3$ $CH_3CH_2CH_2CH_3$ $CH_3CH_2CH(CH_3)_2$ CH_3CH_2OH

Circle the most acidic compound.

$CF_3CF_2CF_3$ CH_3OH CH_3SeH CH_3SH

A molecule with the formula $C_6H_8O_2$ will contain how many unsaturations?

One Two Three Zero

The most stable form of cyclopentane is the:

Chair Boat Envelope twist form

The anion of an acid can be stabilized by which following factors?

Resonance size electronegativity space

Circle the structure of sec-butyl bromide

8. (10 pts) Draw all of the constitutional isomers of C_3H_9N.