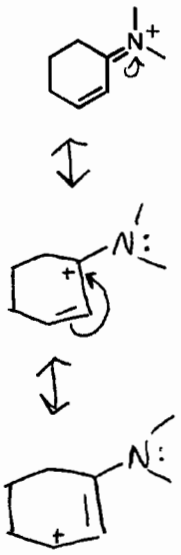
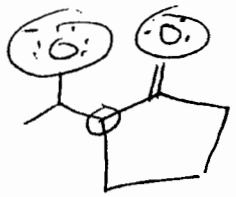
**Problem Set #2**
Due: February 17, 4:00 pm

1. Circle all the electrophilic carbon atoms in the following structure. Explain your answer with resonance contributors.



Electrophilic C atoms

2. Draw in all lone pairs. Circle all the nucleophilic atoms in the following structure. Explain your answer with resonance contributors.



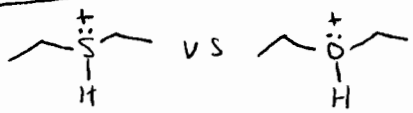
nucleophilic atoms

3. Circle the molecule that is more basic and provide an explanation for your choice.

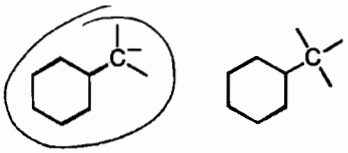
a) 

:Br:⁻ larger than :F:⁻, less charge density, less likely to share e⁻ with H+

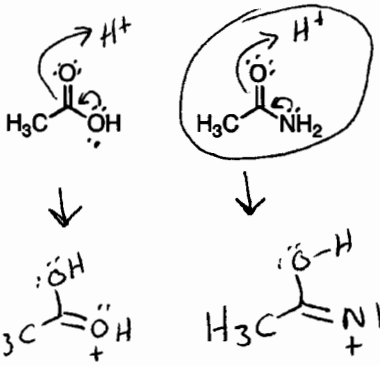
b) 



O smaller than S, more stable as (+)

c) 

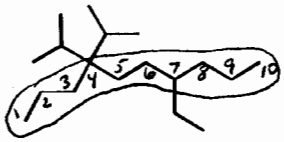
Charged vs. non-charged

d) 

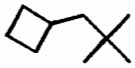
N more electropositive than O

4. Circle each molecule that can function as a Lewis acid. Draw a box around each molecule that can function as a Lewis base.

5. Name the following alkanes.

a) 


7-ethyl-4,4-diisopropyldecane

b) 

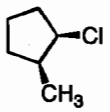
ring: 4 C

straight chain: 3 C

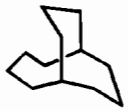
neopentylcyclobutane

or

2,2-dimethylpropylcyclobutane

c) 

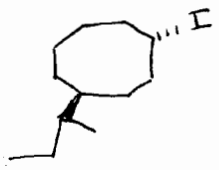

cis-1-chloro-2-methylcyclopentane

d) 

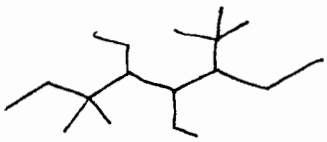
bicyclo[4.3.3]dodecane

6. Provide structures for the following molecules.

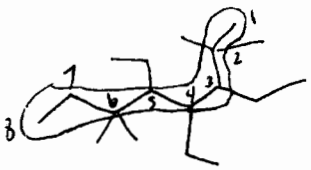
a) *trans*-iodo-4-*sec*-butylcyclooctane




b) 6-*tert*-butyl-4,5-diethyl-3,3-dimethyloctane

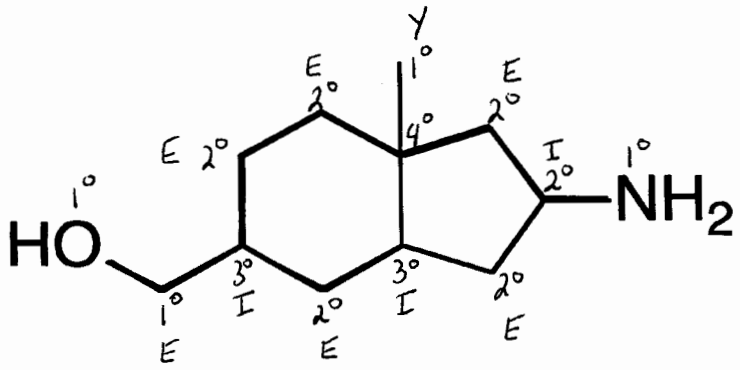


c) The name in b) is actually incorrect. What is proper name of the molecule you drew?

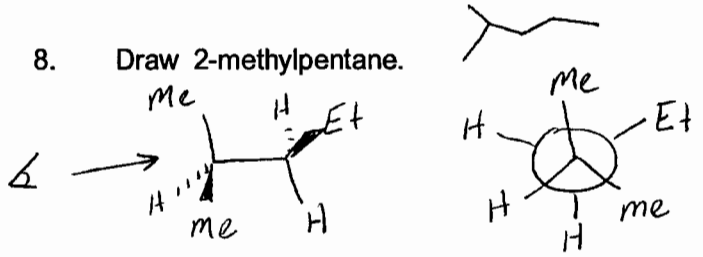


3,4,5-triethyl-2,2,6,6-tetramethyloctane

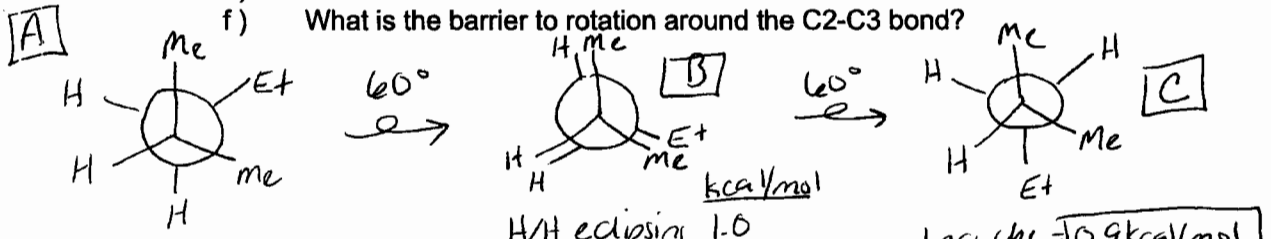
7. Label each carbon atom, nitrogen atom, and hydroxyl group as 1°, 2°, 3°, or 4°. Label each 1°, 2°, 3° carbon atom as methyl (Y), methylene (E), or methine (I).



8. Draw 2-methylpentane.



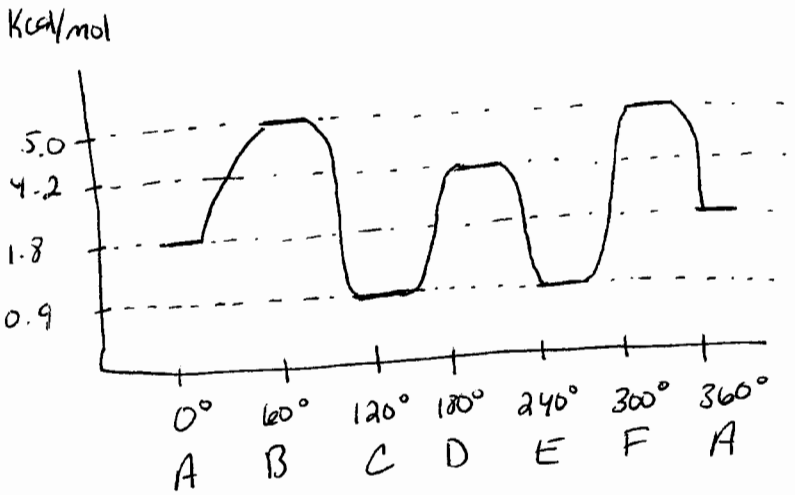

a) Draw Newman projections for the six energy maxima and minima for rotation around the C2-C3 bond.
b) Calculate the energy at each conformation. (Assume the same energies for -Et as you would for -Me.)
c) Use these values to make a graph of potential energy versus dihedral angle.
d) Label the most stable conformation.
e) Label the least stable conformation?
f) What is the barrier to rotation around the C2-C3 bond?

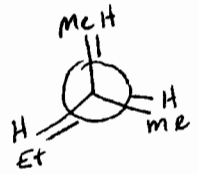



2 gauche
2(0.9 kcal/mol) = 1.8 kcal/mol

kcal/mol
H/H eclipsing 1.0
H/Me eclip. 1.4
Me/Et eclip. 2.6
5.0 kcal/mol

1 gauche = 0.9 kcal/mol

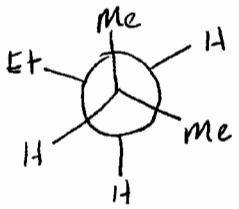



60°

3 Me/H eclipsing
1.4 × 3 = 4.2 kcal/mol

60°




1 gauche
0.9 kcal/mol

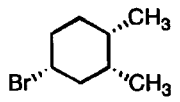

kcal/mol
H/H eclip. 1.6
Me/H eclip. 1.4
Me/Me eclip 2.6
5.0 kcal/mol

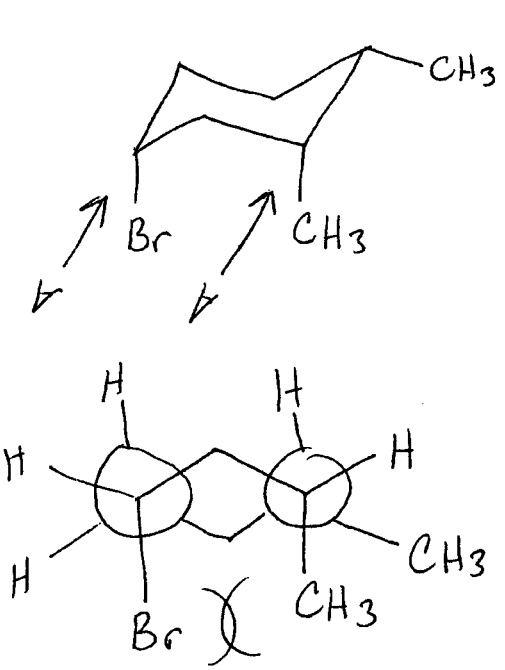
C & E - most stable
B & F - least stable

Barrier to Rotation: 5.0 − 0.9 = 4.1 kcal/mol

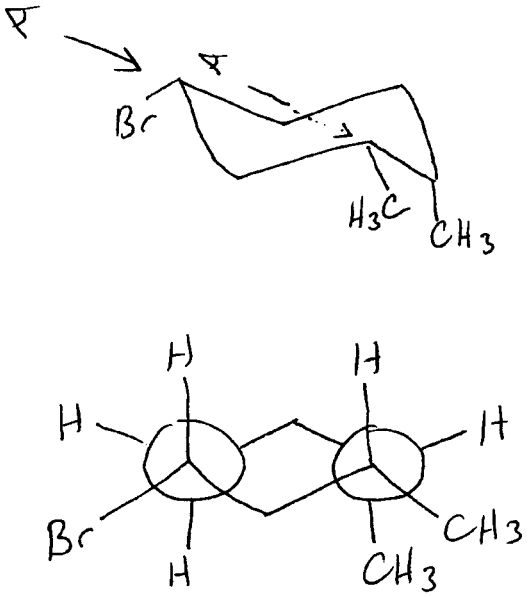
9. Draw the chair conformation and the ring-flipped chair conformation for the following molecule. Draw Newman projections of each conformer, viewing along the ~~$C_1$-$C_6$~~ and ~~$C_3$-$C_4$~~ axes. Which conformation is more stable? Why?

$C_4$-$C_5$ $C_2$-$C_1$



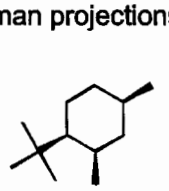



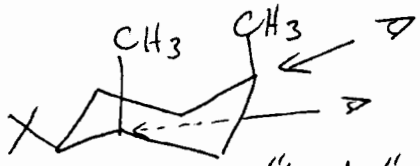

less stable
2 axial substituents



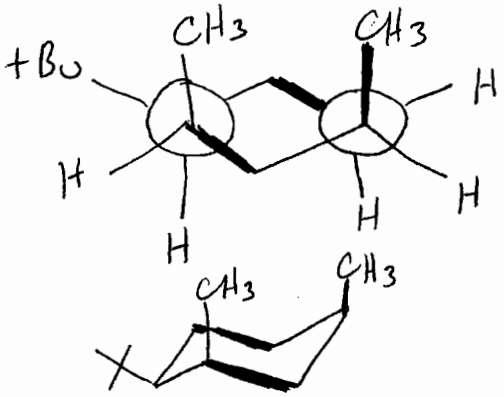

more stable
less 1,3-diaxial interaction
1 methyl substituent is axial

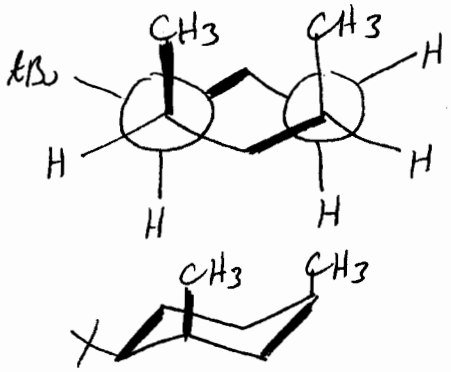
10. Indicate the gauche interactions that each methyl group experiences with the cyclohexane ring by drawing Newman projections.



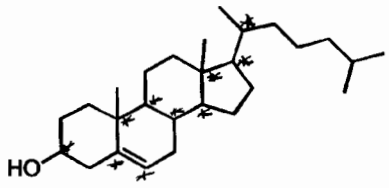



t-butyl group "locks" cyclohexane into this conformer



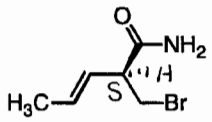

11. Place an asterisk next to each stereogenic center in cholesterol.



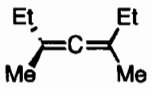

10 stereogenic centers

8 chirality centers

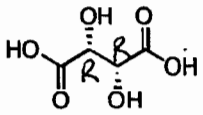
12. Label each molecule as chiral, achiral, or achiral/meso. Label each stereocenter as R or S.



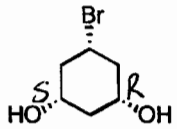
Chiral



Chiral

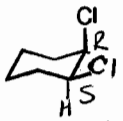


Chiral



achiral/meso

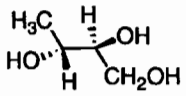
achiral/meso

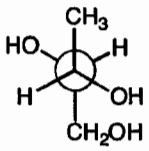


Chiral
but optically inactive
b/c chair flips to enantiomer @ room T°

13. Indicate if the pair of molecules are enantiomers, diastereomers, or the same molecule.

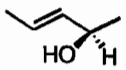
a)

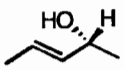




enantiomers

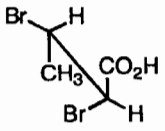
b)

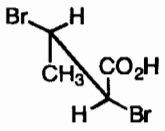




same molecule

c)





diastereomers