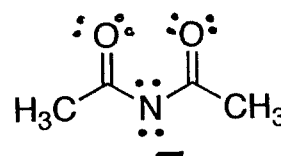
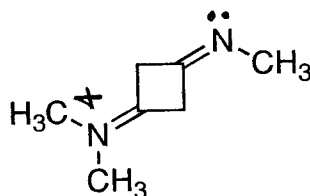
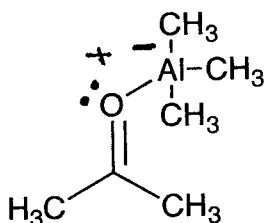


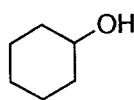
Test 1 (104 points)

1. Fill in any missing lone pair electrons and assign charges to the heteroatoms in the following molecules? (6 points)

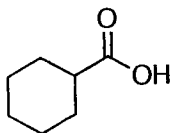


2. Rank the following compounds: (12 points)

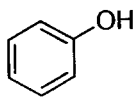
- (a) In order of protic acidity:



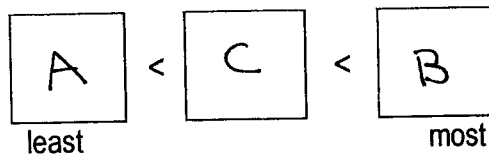
A



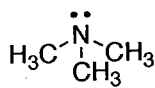
B



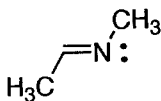
C



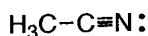
- (b) In order of Lewis basicity:



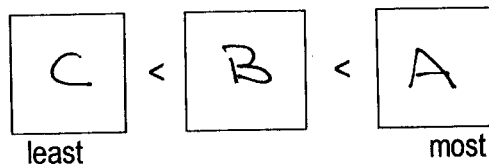
A



B



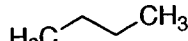
C



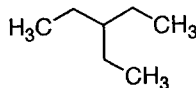
- (c) In order of boiling point:



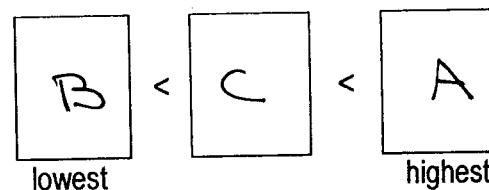
A



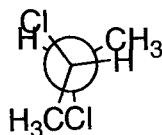
B



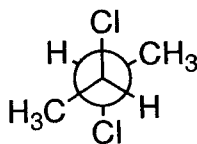
C



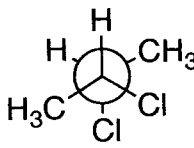
- (d) In order of energy:



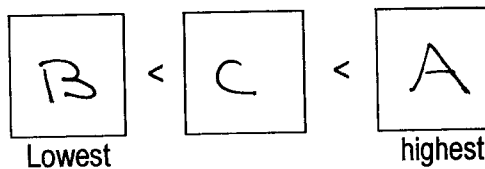
A



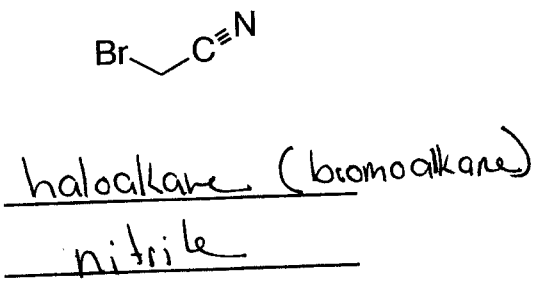
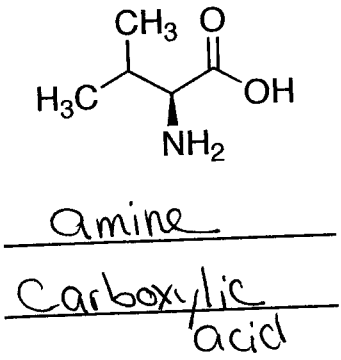
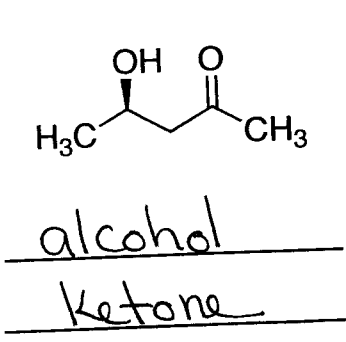
B



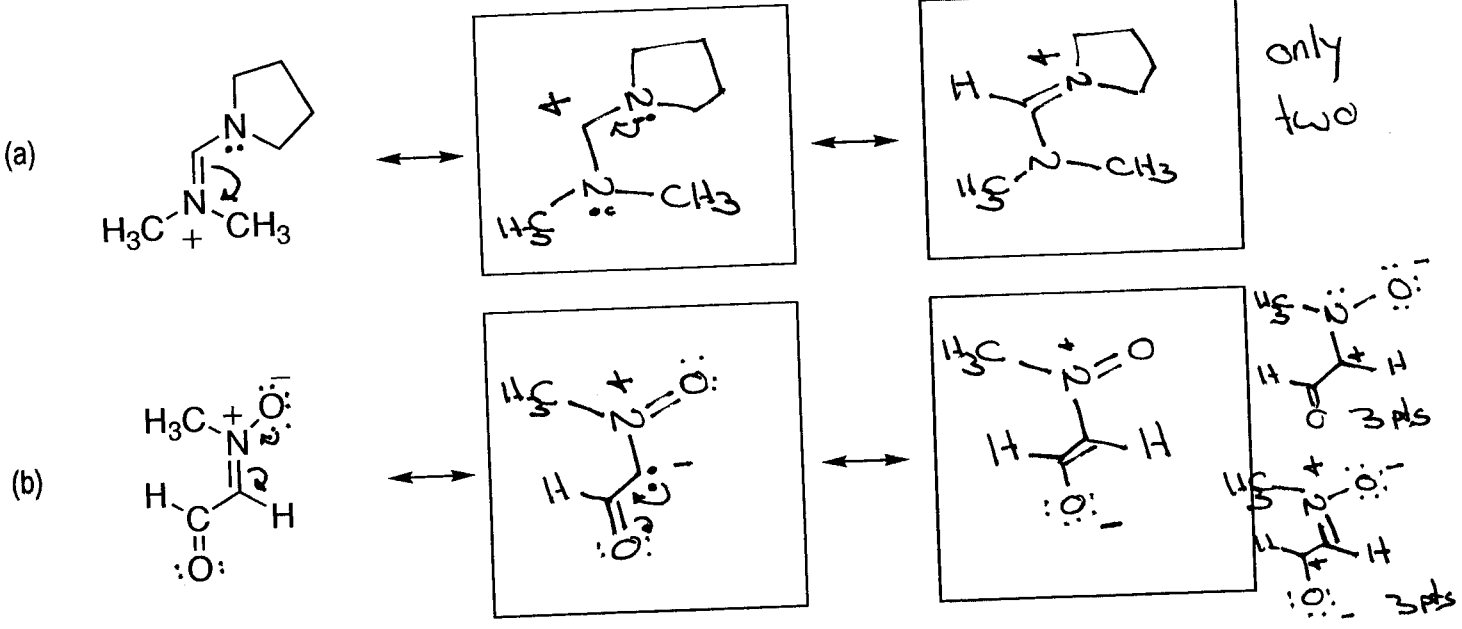
C



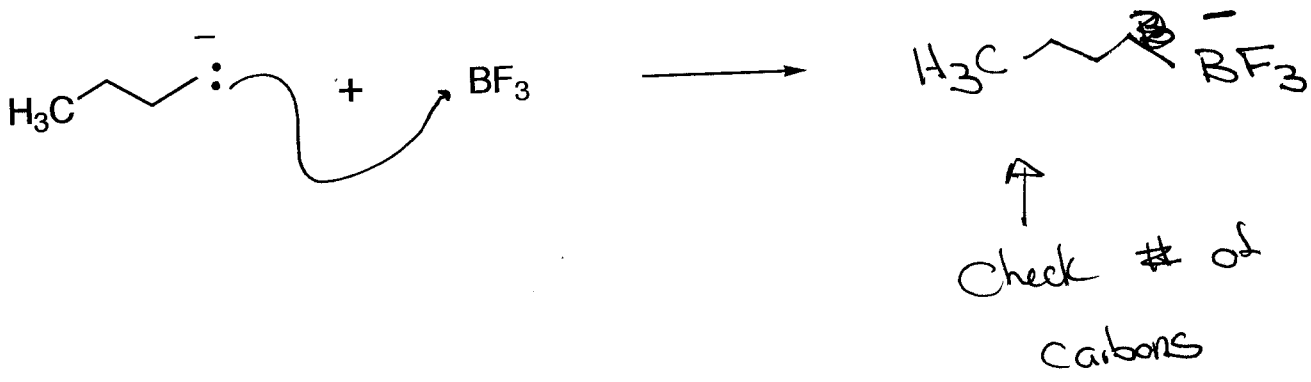
3. Name the functional groups found in each of the following molecules. (6 points)



4. Draw resonance structures for the following compounds. Be sure to clearly indicate electron pairs, formal charges, and arrows. (16 points)



5. Draw the product of the Lewis Acid-Lewis Base reaction of the following compounds. Use an arrow to show the movement of the electrons and assign any necessary formal charges in the product. (6 points)

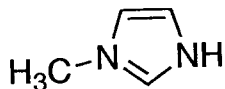
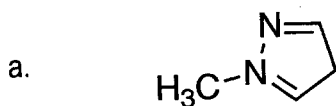


6. Label the relationship between each of the pairs of compounds as one of the following: (8 points)

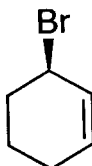
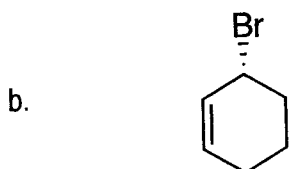
E: enantiomers

CI: constitutional isomers

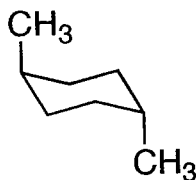
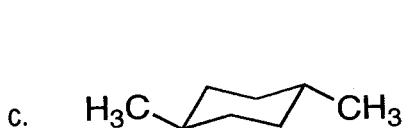
S: same compound



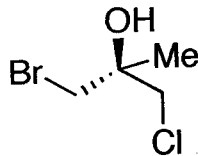
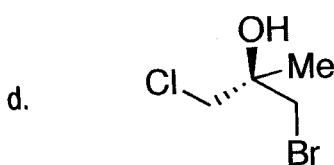
CI



E



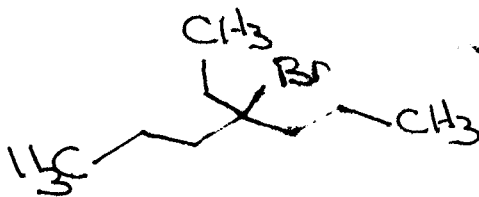
S



E

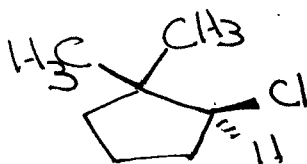
7. Draw structures for the following compounds: (6 points)

a. 4-ethyl-4-bromoheptane



2 pts

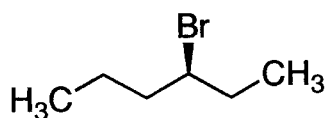
b. (S)-1-chloro-2,2-dimethylcyclopentane



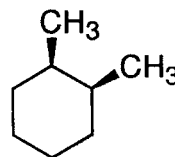
4 pts

-1 wrong stereochem.  
 -2 no stereochem.  
 -1 not cyclo but otherwise ok

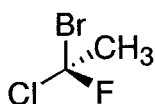
8. Give IUPAC names for the following compounds, including stereochemistry, if any. (8 points)



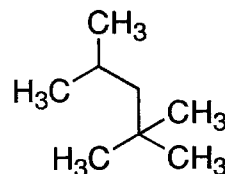
(a) (S)-3-bromohexane



(b) cis-1,2-dimethylcyclohexane



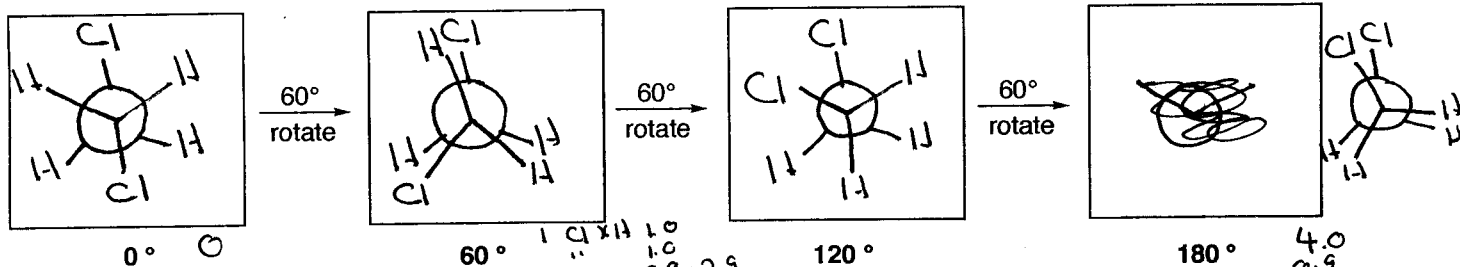
(c) (S)-1-bromo-1-chloro-1-fluoroethane



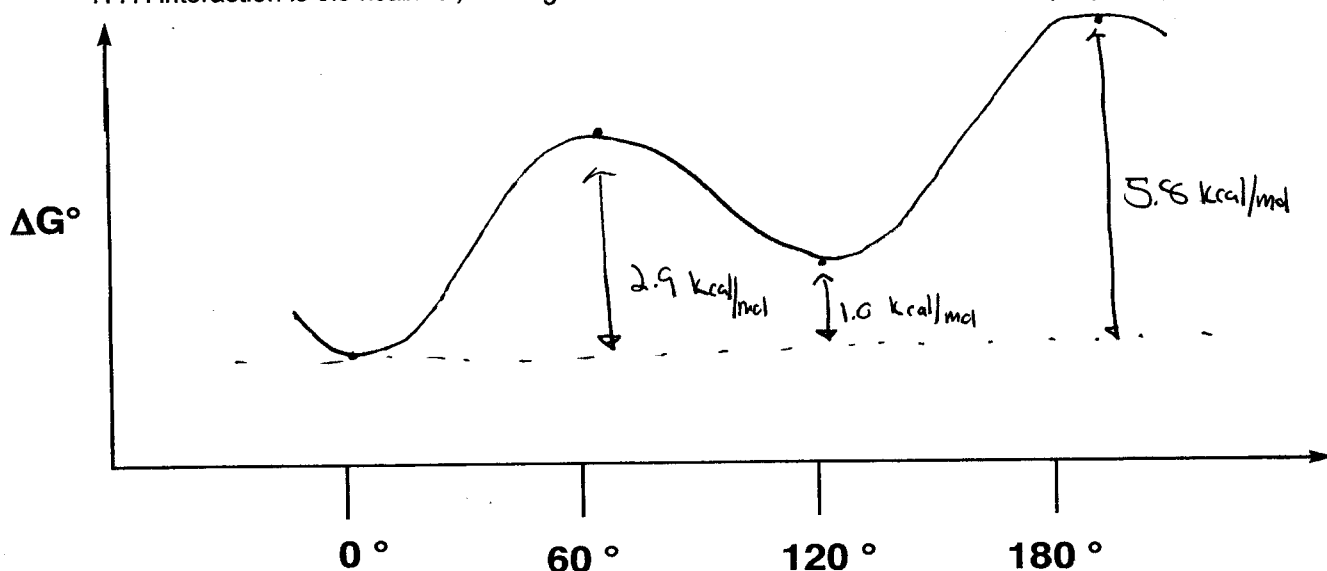
(d) 2,2,4-trimethylpentane

9.

a. Draw Newman projections of 1,2-dichloroethane showing the conformations observed upon rotating around the carbon-carbon bond. It does not matter which conformation you start at or which direction you rotate. (8 points)

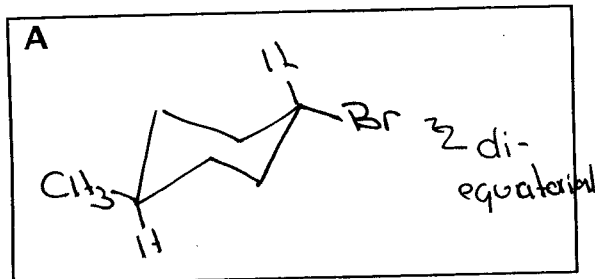


b. Draw an energy diagram showing the relative energies for the conformers that you have drawn above. An eclipsing Cl : H interaction is 1.0 kcal/mol; an eclipsing Cl : Cl interaction is 4.0 kcal/mol; an eclipsing H : H interaction is 0.9 kcal/mol; and a gauche Cl : Cl interaction is 1.0 kcal/mol. (10 points)

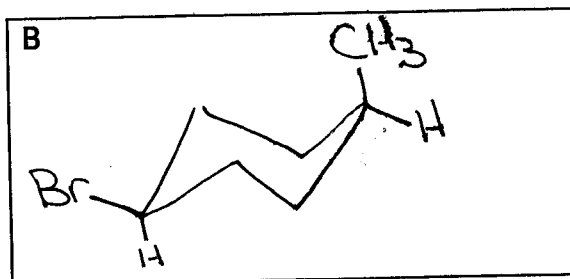


10. Draw the following representations of 1-bromo-4-methylcyclohexane (remember, there are two diastereomers; assume that bromo and methyl are the same size): (12 points)

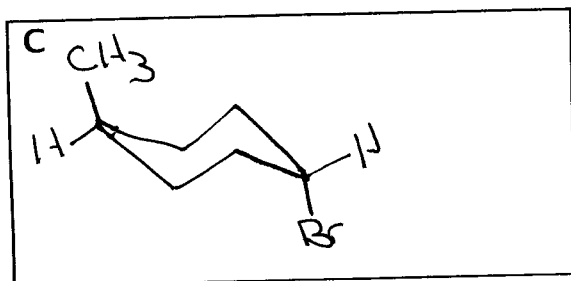
a. The most stable chair conformer of the *trans*-diastereomer.



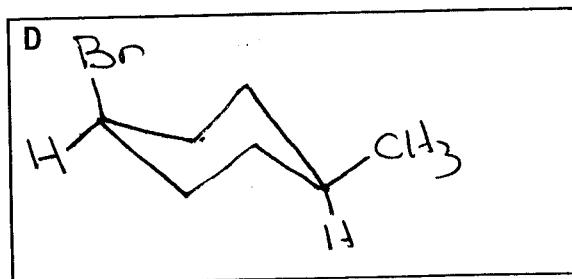
b. The most stable chair conformer of the *cis*-diastereomer.



c. The ring flipped chair conformer of the *trans* diastereomer drawn above.



d. The ring flipped chair conformer of the *cis* diastereomer drawn above.



Other way around is also ok, as long as it is eq.

e. Estimate the relative population of conformer A to conformer C at equilibrium.

A:  % C:  %

f. Estimate the relative population of conformer B to conformer D at equilibrium.

B:  % D:  %

11. Identify the hybridization (i.e.  $sp^3$ ,  $sp^2$ , etc.) of each of the indicated atoms in the following molecule. (6 points)

