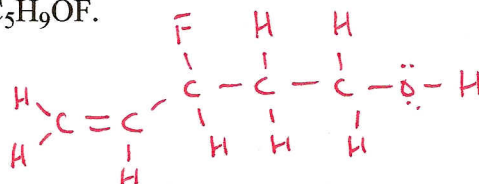


I. Draw a stable Kekule structure for the formula C_5H_9OF .

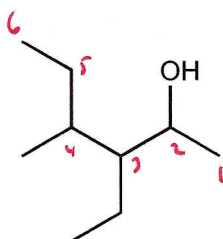
Show all atoms, bonds, and lone pairs (5 pts).

many answers possible; one is

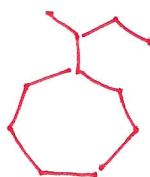


II. Write the IUPAC name for each structure or write the structure for the given name as appropriate. (5 pts each, 15 pts total)

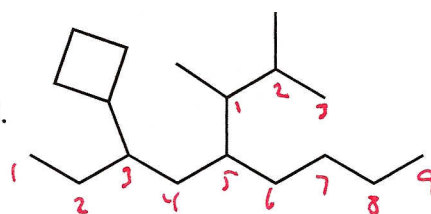
1.



2. sec-butylcycloheptane

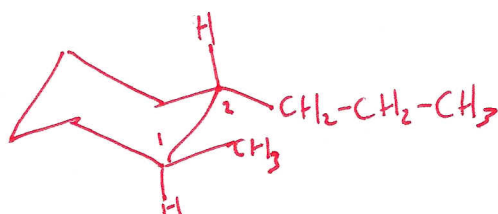


3.



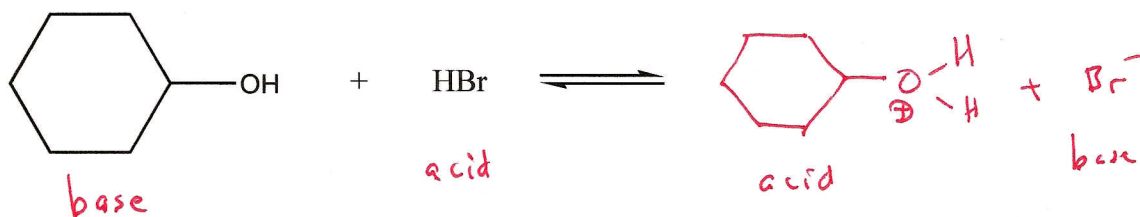
3-cyclobutyl-5-(1,2-dimethylpropyl)
nonane

III. Draw the most stable chair conformation of trans-1-methyl-2-propylcyclohexane (5 pts)

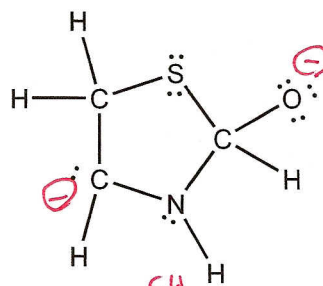


both groups are equatorial when trans on 1 + 2

IV. Complete the acid-base equation shown and label each structure as an acid or a base according to how it participates in this reaction. (6 pts)

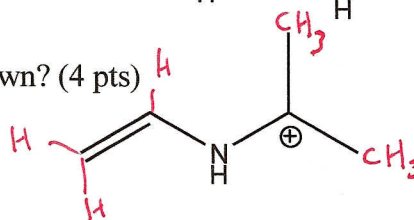


V. Write the proper formal charge on each atom whose charge is not zero. All atoms, bonds, and lone pairs are shown (7 lone pairs total). (5 pts)

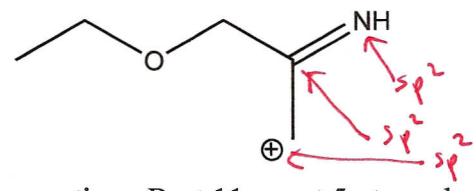


VI. How many total hydrogens are present in the compound shown? (4 pts)

10

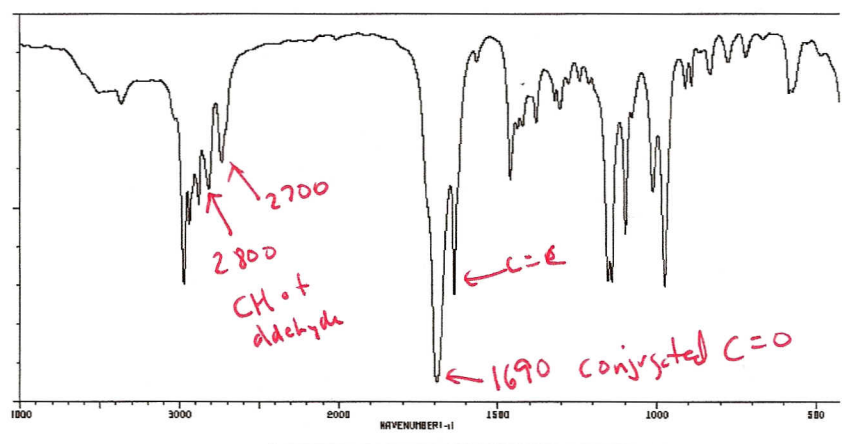
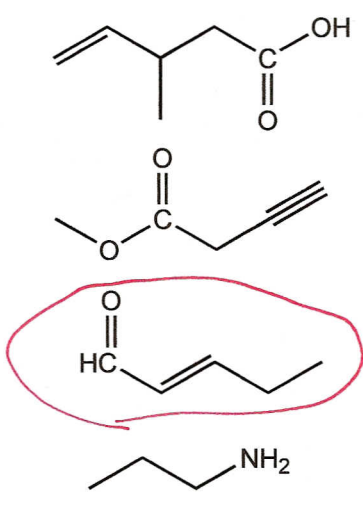


VII. Identify every atom whose hybridization is NOT sp^3 and write what the hybridization is. (5 pts)

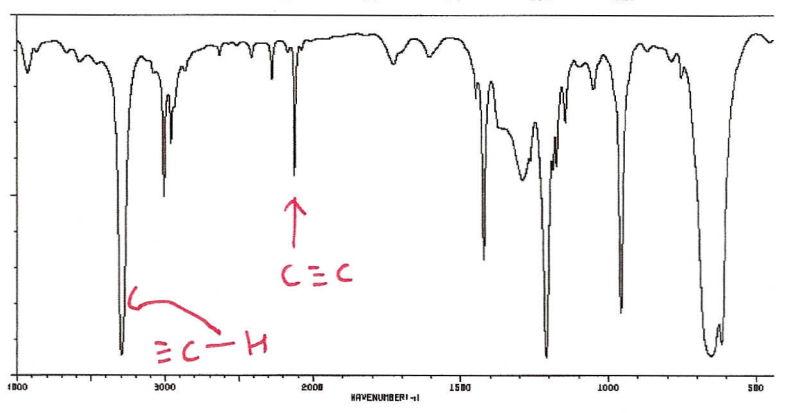
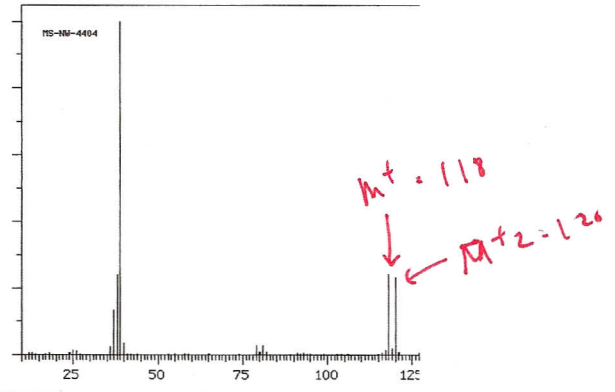
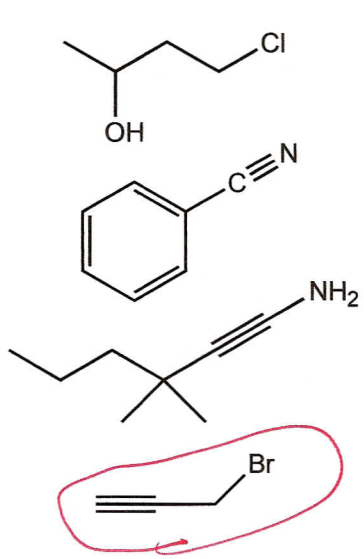


VIII. Multiple choice. Circle the one best answer to each question. Best 11 count 5 pts each, 55 pts total, try all for bonus.

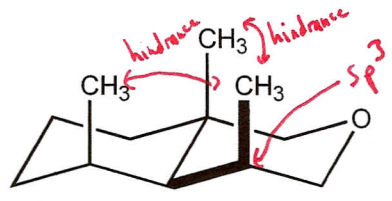
1. Which compound will give the IR spectrum shown?



2. Which compound will give both the IR and the MS shown?



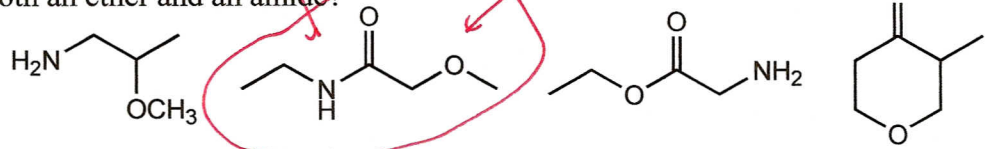
3. Consider the interactions in the system shown and predict the likely bond angle between the bold bonds..



- 60 deg 104 deg 109.5 deg **118 deg** 120 deg 127 deg 180 deg

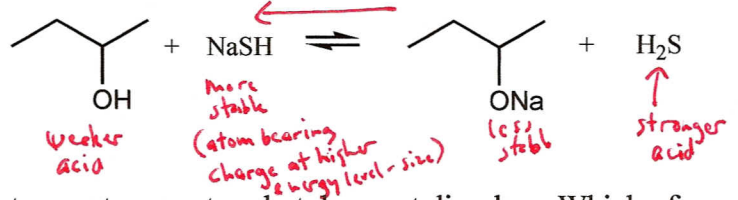
ideal is 109.5
steric hindrance from other axial methyls "pushes away" to increase bond angle

4. Which compound has both an ether and an amide?



5. In the reaction shown, the equilibrium favors:

products reactants neither not enough info

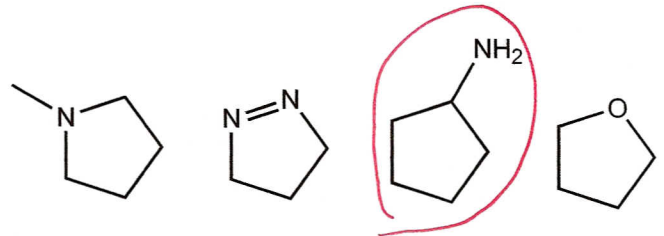


6. A sample to be recrystallized is added to hexane at room temperature but does not dissolve. Which of the following is true based on this information?

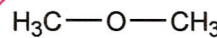
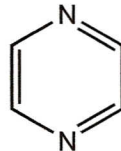
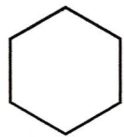
- a. it can now be concluded that hexane is a good solvent choice for this recrystallization
- b. hexane is not an appropriate solvent for the recrystallization and a different one must be chosen
- c. as long as the sample remains undissolved when heated, hexane will be a good solvent choice for the recrystallization
- d. if the sample dissolves when heated, then hexane will be a good solvent choice for the recrystallization

7. Which compound has the highest boiling point?

otherwise similar in London forces, the amine can hydrogen bond



8. Which compound is polar?



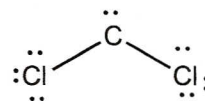
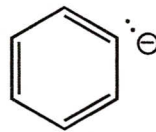
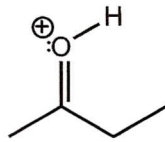
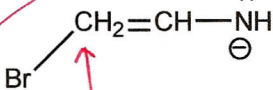
none of these

no dipoles of significance (no electroneg. atoms)

symmetrical dipoles cancel

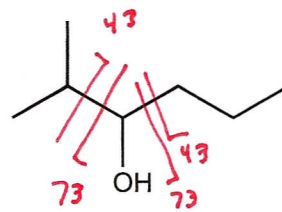
tetrahedral atom
CH₃
CH₃

9. Which compound can NOT exist as drawn? All atoms, lone pairs, and charges are shown.



10e⁻ violates octet rule

10. The compound shown has a molecular weight of 116. The mass spectrum is most likely to have prominent peaks at both of the following masses (m/z values):



116 and 87

43 and 73

101 and 86

~~134 and 43~~

M⁺ unlikely with alcohols

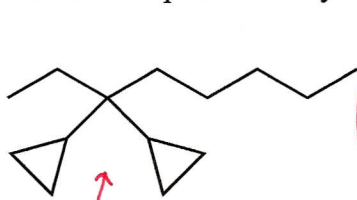
Much better option than M-15

> MW

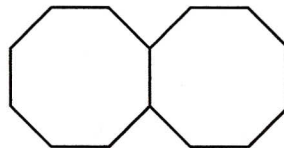
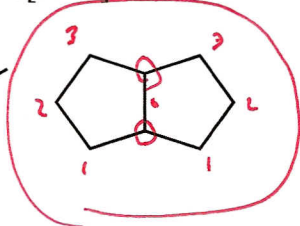
11. A recrystallization is performed by properly following directions for gravity filtration, solvent volume reduction, slow cooling, and vacuum filtration. The sample is still impure. Upon repeating, purity improves. What is the most likely explanation?

- a. the solvent choice was not appropriate *← purification succeeded 2nd time*
- b. the directions need editing to have faster cooling to prevent impurities from having time to get in the crystals *← slow cooling is best*
- c. more solvent needs to be present during the cooling step *← not enough solvent means soluble impurities will not stay dissolved*
- d. a more efficient filter with finer porosity is needed *← doubtful problem, esp. w/ success 2nd time*

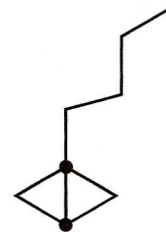
12. Which compound is bicyclo[3.3.0]octane?



1,3-dicyclopropyl octane



bicyclo[6.6.0]tetradecane



13. The Hf energies in kcal/mol for several conformations of 2-bromobutane are listed. What is the predicted energy when the dihedral angle is fixed at 10 degrees between C1 and C4?

- 32
- 30
- 29
- 26
- 25
- 24

- anti -30.51
- gauche -29.65
- eclipsed -27.18
- totally eclipsed -25.79

dihedral angle of 10° is nearly totally eclipsed.

∴ energy will reflect slightly more stable than totally eclipsed