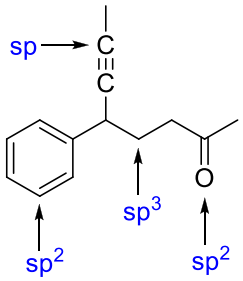
CHM 1321 C
Midterm 1 – V2 ANSWERS
February 6, 2009

Note: The points are given as a guide and are subject to minor changes.

Last name: _____ First name: _____

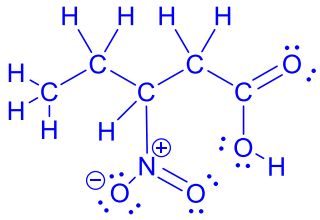
Student Number: _____

1. Identify the hybridization of the indicated atoms: **(4 points)**

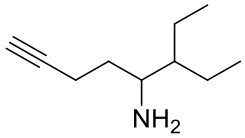


2. Draw the complete Lewis structure for the following molecule: **(2 points)**

$CH_3CH_2CH(NO_2)CH_2COOH$ -1 per error



3. Name the following molecule using IUPAC nomenclature. **(3 points)**
-1 per error



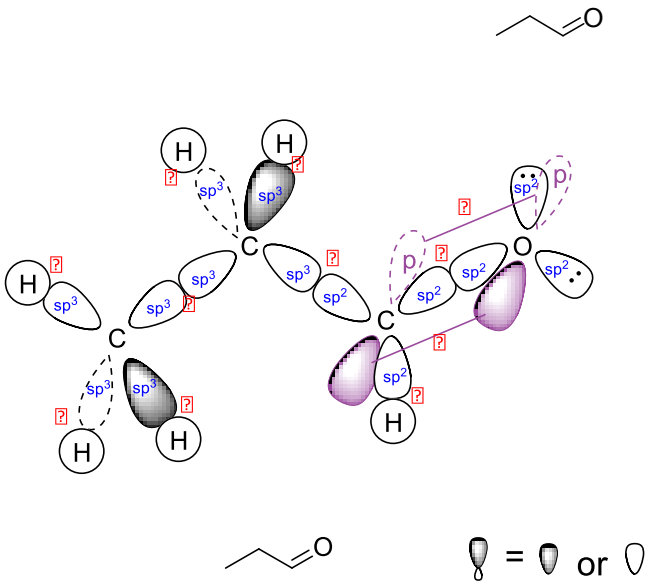
3-ethyloct-7-yn-4-amine

4.

a. Draw the molecule below using the LCAO method (**4 points**).
2 points: correct molecule
2 points: molecular geometry

b. Label all the orbitals in part a (p, sp, sp^2, sp^3) (**3 points**).
3/3 – perfect; 2/3 1 or 2 small errors; 1/3 many errors or concept not well understood

c. Label all the bonds in part a (σ, π) (**3 points**).
σ network: 2/2 – perfect; 1/2 - good attempt; 0/2 – many errors
π bond: 1 point

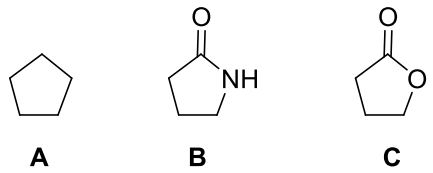


5. Why is cyclopropane considered to be a strained ring? **(3 points)**

1 point for each of the key ideas

a. The bond angles in cyclopropane of **60° deviate** largely from the **ideal tetrahedral geometry of 109°**.
b. All the CH bonds in cyclopropane are **eclipsed**

6. Rank the following in order of *decreasing* solubility in water. **(2 points)**



A **B** **C**

___B____ > ___ C_____ > ____A____

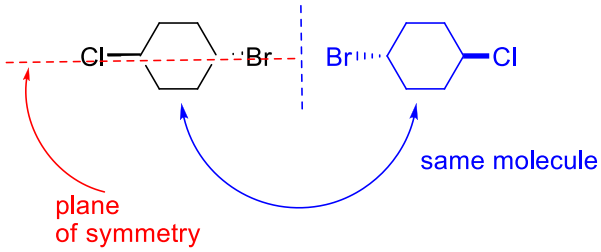
-1 per error

7. Give the definition of "diastereomers" and show an example. **(3 points)**

Stereoisomers (2 different molecules with the same formula that are connected in the same way but have a different orientation of their atoms in space) **that are not enantiomers.** (2 points)

(1 point)

8. Is the following molecule chiral? Explain clearly how you came to this conclusion. **(3 points)**

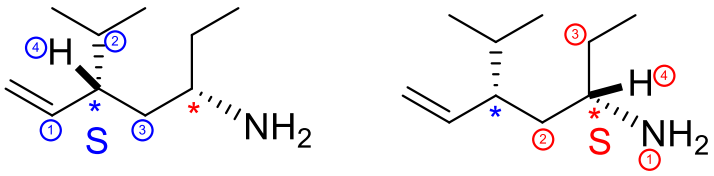


No (1 point)

The molecule is superimposable on its mirror image (or "there is a plane of symmetry in the molecule). (1 point)

Plane of symmetry drawn or mirror image drawn (1 point)

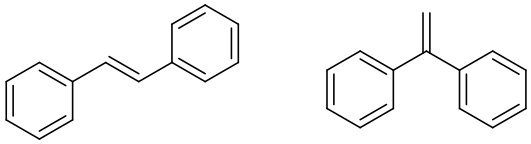
9. For the following molecule **(8 points)**
   a. Identify the stereocentre(s) with a star (*).1 point each
   b. Determine the priorities of the substituents around each stereocentre (redrawing the structure helps). 2 points each (all 4 priorities must be listed)
   c. Assign the configuration of the stereocentre(s). 1 point each (based on the student's assignment of priorities, not the absolute answer)



10. Give the relationship (enantiomer, etc...) between each of the following pairs. Be as specific as possible. **(~~2~~ 4 points)** **2 points each**

Relationship:

a.



constitutional isomers (2/2)

isomers (1/2)

b.

conformers or conformational isomers (2/2)

("same molecule" is not specific enough) - 1/2

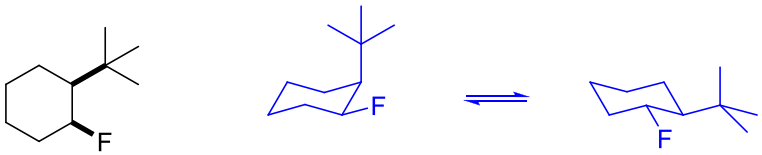
11. Compare the differences between the physical properties of enantiomers and diastereomers. **(4 points)**

1 point for each underlined idea

Diastereomers have different physical properties (boiling point, melting point, etc) while enantiomers have identical physical properties with 2 exceptions. Enantiomers rotate plane polarized light in equal but opposite directions and enantiomers react differently with other chiral molecules.

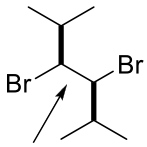
12.

a. Draw the two chair conformations of the molecule below. Note: you do not have to draw the H's. **(5 points)**
b. For each structure, label the substituents as being axial or equatorial. **(2 points) −1 per error**
c. Identify the most stable and least stable conformation. **(1 point)**

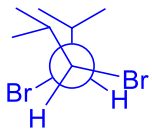


/5:
1 point: chairs well-drawn
1 point: right molecule (many people drew the enantiomer)
1 point: both conformations drawn
2 points: orientation of the substituents

13. Consider the Newman projection of the following molecule about the indicated bond.



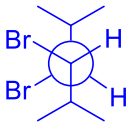
a. Draw and name the Newman projection of the least stable conformation **(3 points)**



eclipsed

1 required conformation
1 correct molecule
1 name of conformation

b. Draw and name the Newman projection of the most stable conformation **(3 points)**

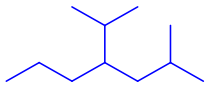


anti staggered

1 required conformation
1 correct molecule
1 name of conformation

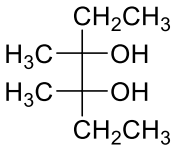
14. Draw the following molecules as line structures. **(4 points)**

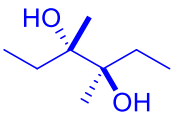
a. 4-isopropyl-2-methylheptane



−1 point per error

b.





−1 point per error

BONUS!

Draw the molecule below using the LCAO method. **(2 points)**

$(H_3C)HC=C=CHCl$