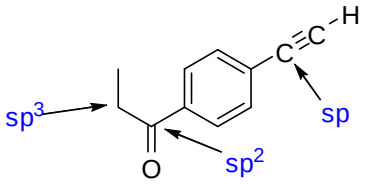
CHM 1321 C
Midterm 1 - ANSWERS
February 8, 2008

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

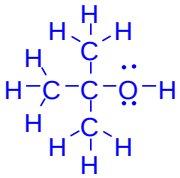
Surname: _____ First name: _____

Student Number: _____

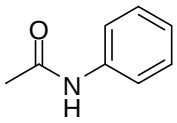
1. Identify the hybridization of the indicated atoms: **(3 points)**
   1 point each

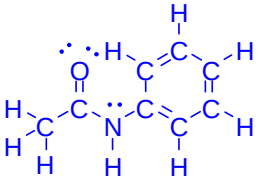


4. Draw the complete Lewis structure for the following molecules: **(4 points)**
   - 1 per error
   a. $(CH_3)_3COH$



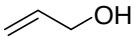
   b.





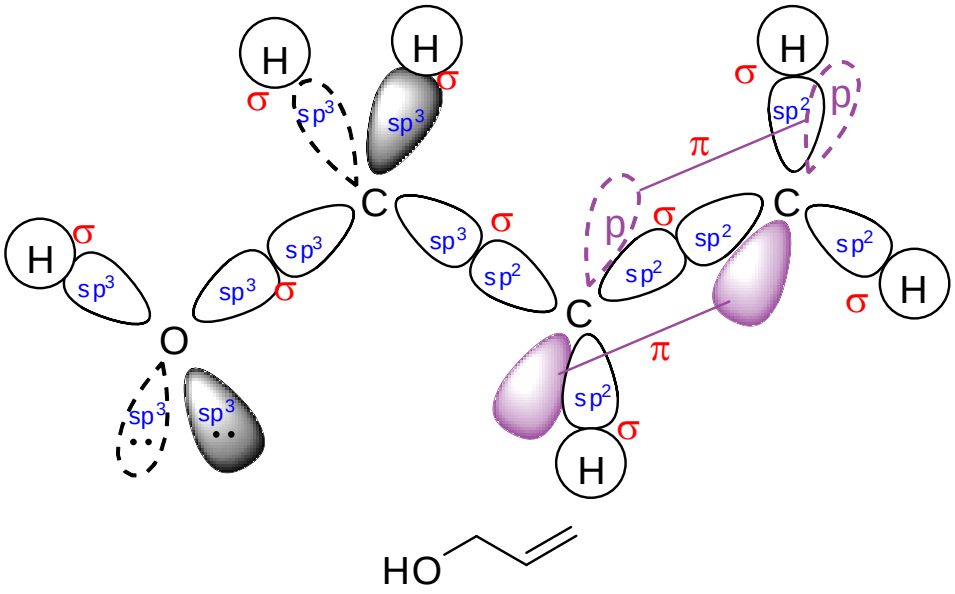
5. a) Draw the molecule below in using the LCAO method (**~~4~~ 5 points**).

1 point: labels for sp^2 and sp^3 orbitals
1 point: p orbitals labeled
1 point: 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

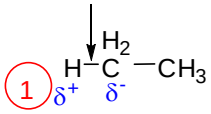
c) Label all the bonds in part a (σ, π) (**~~3~~ 2 points**). 2/2 – perfect; 1/2 - good attempt; 0/2 – many errors



6.

a. Identify the direction of the dipole in the indicated bonds. **(2 points)**
b. Are the indicated bonds ionic or covalent? **(2 points)**
c. Show how you came to the conclusion made in part b. **(1 points)**

i.

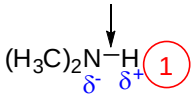


1

1 Covalent bond

Difference in electronegativity
= 2.5 - 2.2 = 0.3 (< 2) 1

ii.

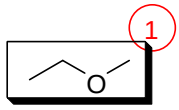


1

Liaison covalente 1

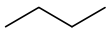
Différence d'électronégativité
= 3.1 - 2.2 = 1.1 (< 2)

7. Circle the compound that will have the higher boiling point and explain your prediction. **(3 points)**



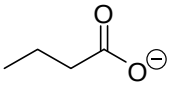
1

or



1 Intermolecular interactions in the first molecule are primarily dipole-dipole, while in the second molecule, only weaker Van Der Waals intermolecular forces exist. 1

8. Would the following molecule be soluble in water? Explain your prediction. **(3 points)**



1 1 1

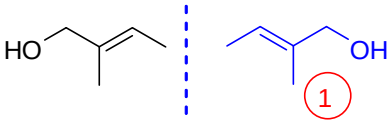
YES. "Like dissolves like". Charged molecules can form strong hydrogen bonds and ion-dipole interactions with water.

9. Give a brief explanation for "stereoisomers" and show an example. **(3 points)**

Two different molecules with the same formula which have the same connectivity (1) but whose substituents are have different orientations in space (1)

example: 1

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



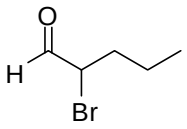
1

same molecule

NO (1 point). There is a plane of symmetry that cuts through all the atoms in the skeleton of the molecule OR the molecule and the mirror image of the molecule are superimposable (1 point).

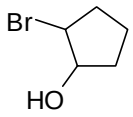
11. Name the following molecules using IUPAC nomenclature or accepted common names: **(4 points)** **– 1 per error**

a.



2-bromopentanal

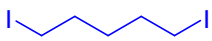
b.



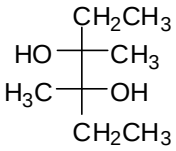
2-bromocyclopentanol

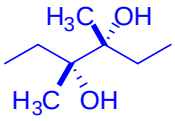
12. Draw the following molecules as line structures. **(4 points)**
- 1 per error

a. 1,5-diiodopentane



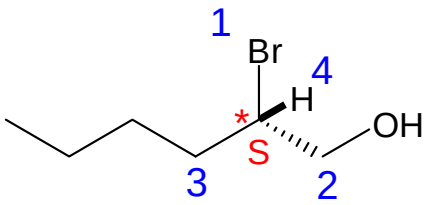
b.





13. For the following molecule **(4 points)**

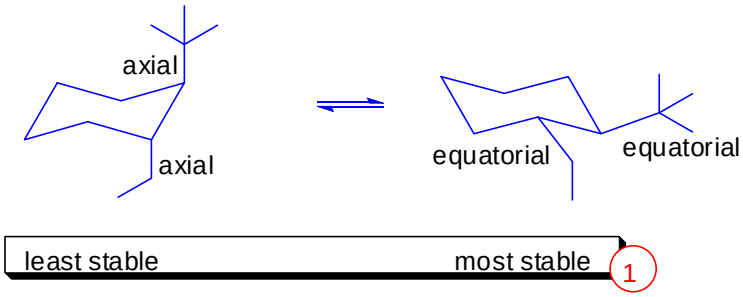
a. Identify the stereocentre(s) with a star (*). 1 point
b. Determine the priorities on each stereocentre. 2 points
c. Assign the configuration of the stereocentre(s). 1 point



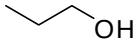
14.

a. Draw the two chair conformations of *trans*-1-*tert*-butyl-2-ethylcyclohexane. **(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)**

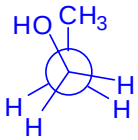
/5:
1 point: chairs well-drawn
1 point: right molecule
1 point: both conformations drawn (many people drew the enantiomer)
2 points: orientation of the substituents



15. Consider the Newman projection of propan-1-ol down the C1-C2 bond.



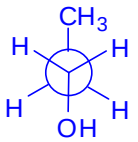
a. Draw and name the Newman projection of the least stable conformation **(3 points)**



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)**

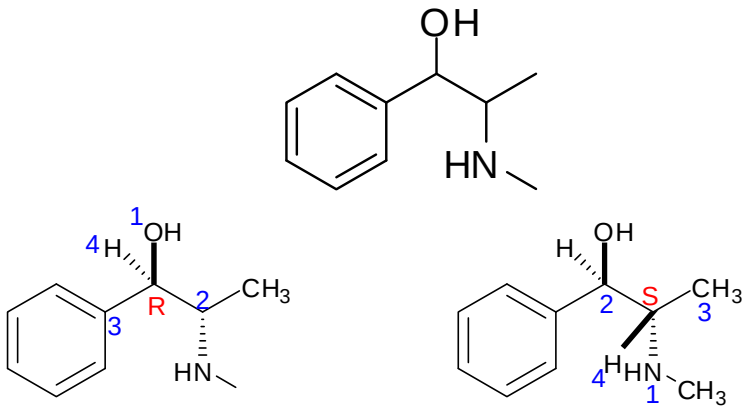


anti

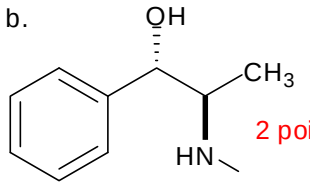
1 required conformation
1 correct molecule
1 name of conformation

16. Ephedrine has the structure shown below but with the (1*R*, 2*S*) configuration.
    a. Draw its structure with the correct configurations at the stereocentres. The priorities given to each group to determine the correct structure must be indicated (redrawing the structure for each chiral centre helps). **(4 points)**
    b. Draw the enantiomer of ephedrine. **(2 points)**

a. 1 point per chiral centre drawn with correct stereochemistry
2 points for the priorities being correctly assigned



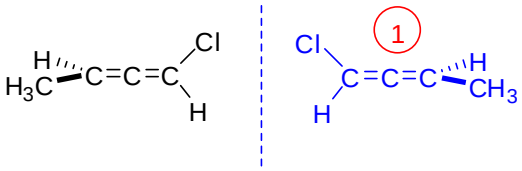
b.



2 points (- 1 per error)

BONUS!

Is the following molecule chiral? Explain or show clearly how you came to that conclusion **(2 points)**



YES, because the molecule is not superimposable on its mirror image. (1)

OR

YES, because the molecule does not contain a plane of symmetry (with justification)