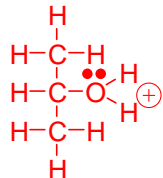


CHM 1321A

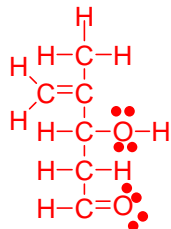
Mid Term 1 version a answers

1) Draw the following as Lewis structures: (6 points)

a) $(\text{CH}_3)_2\text{CHOH}_2^+$

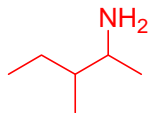


b) $\text{CH}_2\text{C}(\text{CH}_3)\text{CH}(\text{OH})\text{CH}_2\text{CHO}$

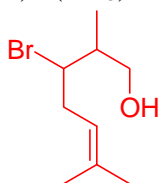


2) Draw the following as line structures: (6 points)

a) $\text{CH}_3\text{CH}_2\text{CH}(\text{CH}_3)\text{CH}(\text{NH}_2)\text{CH}_3$



b) $(\text{CH}_3)_2\text{CCHCH}_2\text{CHBrCH}(\text{CH}_3)\text{CH}_2\text{OH}$



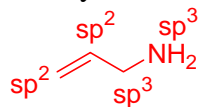
3) For the following compound:

$\text{CH}_2\text{CHCH}_2(\text{NH}_2)$

a) Draw the molecule as a line structure (2 Points)

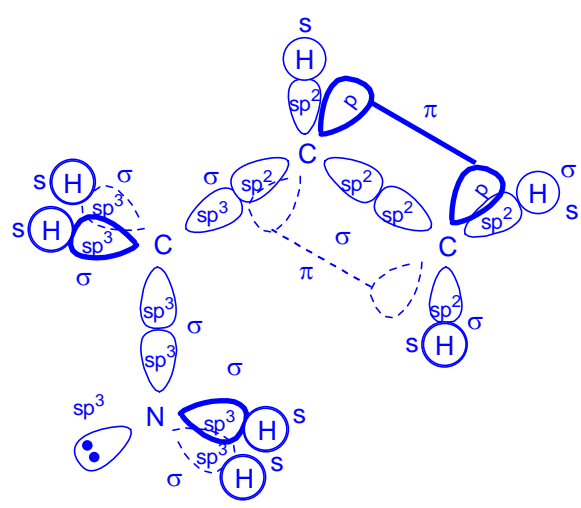


b) What is the hybridization of both carbons and of the nitrogen? (4 points)

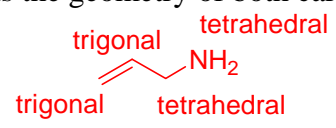


c) Show the structure of the molecule using the LCAO method. (8 points)

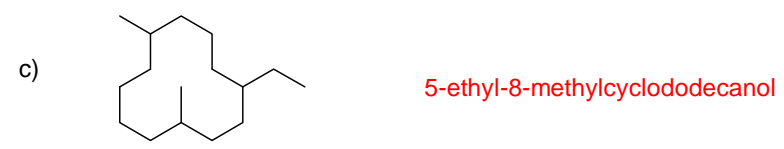
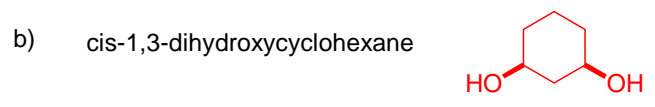
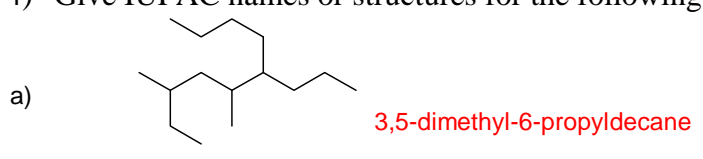
- ② sp^3 geometries
- ② sp^2 geometries
- ② connectivity
- ② atoms and lone pairs



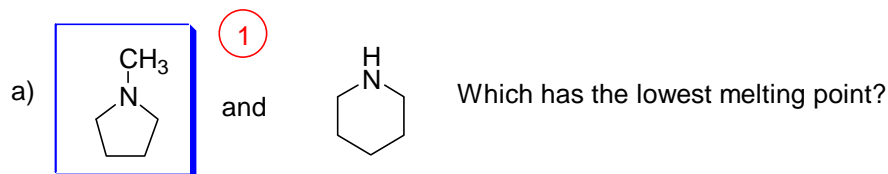
- d) Label all the atomic orbitals used in part c. (7 points)
- e) Label the bonds in part c (5 Points)
- f) What is the geometry of both carbons and the nitrogen? (3 points)



- 4) Give IUPAC names or structures for the following: (6 points)



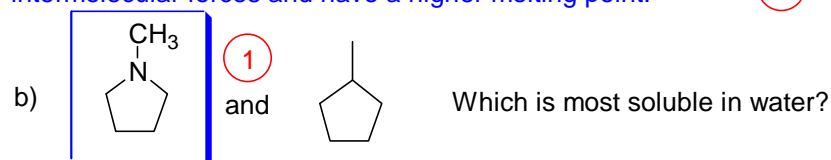
- 5) For each of the following pairs, circle the compound indicated. Briefly justify your choice in each case. (9 points)



Second structure can hydrogen bond with itself in addition to having van der Waals and dipole interactions.

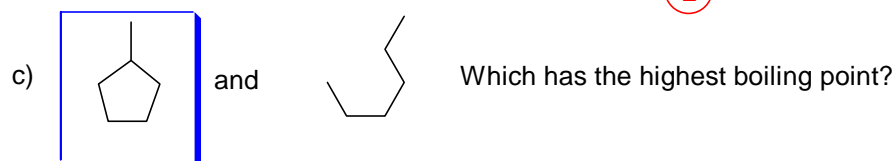
First structure capable of dipole-dipole and van der Waals only.

Hydrogen bonds are stronger than dipole interactions so the second structure will experience stronger intermolecular forces and have a higher melting point. (2)



Second structure capable of van der Waals interactions only.

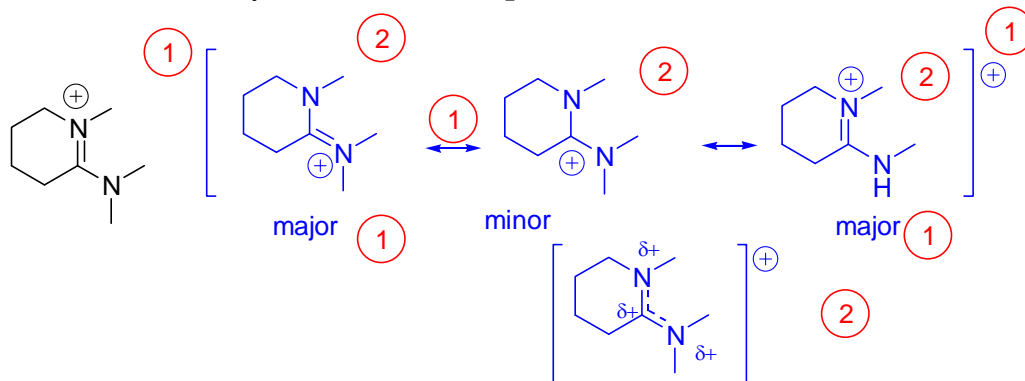
First structure capable of hydrogen bonding to water, in addition to having dipole-dipole and van der Waals interactions. (2)



Both structures are capable of van der Waals interactions only.

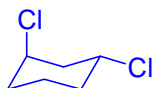
First structure is a ring. Rings pack together better than open-chain compounds, and so these molecules will "stick" together better thus raising the boiling point.

- 6) Draw the important resonance forms for the following. Identify the major and minor forms and show the resonance hybrid structure. (12 points)

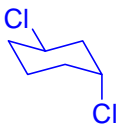


- 7) For *trans*-1,3-dichlorocyclohexane

- a) Draw one chair form of the compound. (4 points)



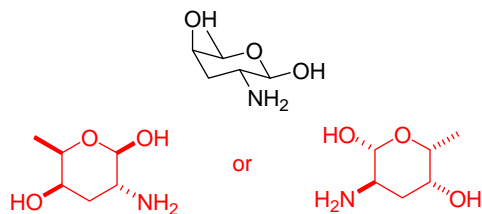
- b) Draw the **other** chair form of the compound. (3 points)



- c) Indicate which chair form is the most stable (part a or b) and justify your choice. (3 points)

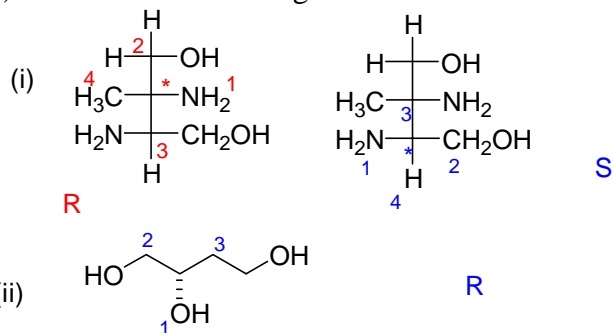
Both have same energy. Each has one Cl axial and one equatorial

- 8) Convert the following chair representation to a simple line structure (hexagon) showing stereochemistry. (4 points)

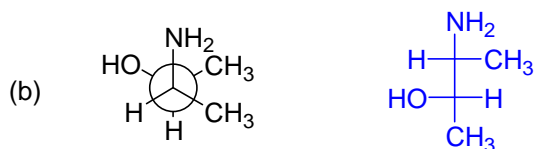
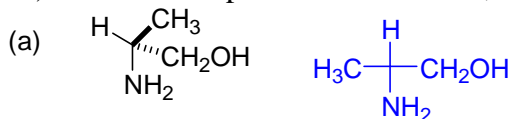


9) For the following compounds

- show the stereogenic centre(s) by labeling them with a star (*) **(3 points)**
- determine the priorities of the substituents on each stereogenic centre. For compounds with more than one centre, make sure you clearly indicate which priorities refer to which centre. (re-drawing the structure helps) **(6 points)**
- Determine the configuration of each stereocentre **(3 points)**



10) For each compound shown below, convert the structure to a Fischer projection. **(4 points)**



11) The specific rotation of (R)-cocaine is $+40.0^\circ$ in CH_2Cl_2 . The police confiscate a sample of cocaine that gives a rotation of -10.0° ($c = 1.0$, CH_2Cl_2). What is the composition of enantiomers (R and S) in the sample, and which isomer is in excess? **(6 Points)**

Rotation of sample is negative, so the S isomer is in excess

$$\text{optical purity} = \frac{10}{40} \times 100\% = 25\%$$

$$\text{optical purity} = ee = \frac{S - R}{S + R} \times 100\% = 25\%$$

$$S + R = 100$$

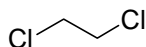
$$R = 100 - S$$

$$ee = 25\% = \frac{2S - 100}{100} \times 100\%$$

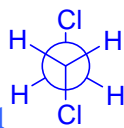
$$S = 62.5$$

$$R = 37.5$$

12) For the following compound, draw the Newman projection along the carbon-carbon bonds of the following:

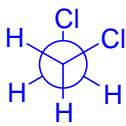


- The most stable conformer and name the conformer. **(4 Points)**



Anti-Staggered most stable (1); Newman (2) name (1)

b) The second most stable conformer and name the conformer. (4 Points)



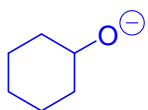
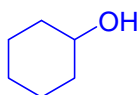
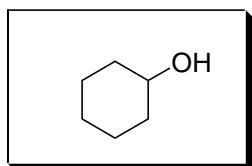
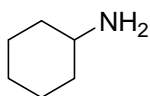
Gauche Staggered second most stable (1); Newman (2) name (1)

c) The least stable conformer and name the conformer. (4 Points)



Eclipsed least stable (1); Newman (2) name (1)

Bonus: Which of the following alcohols is the strongest acid? You must justify your answer to get the marks. (2 Points)



H+

oxygen right of nitrogen in periodic tabel
oxygen is more electronegative
better able to stabilize negative charge
weaker conjugate base
stronger acid