

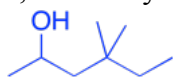
**CHM 1321 A**  
**Sample Mid Term 1**  
 (Answers Provided in Color)

- 1) Identify the stereochemical relationship between the following molecules (enantiomers, diastereomers, same molecule, meso compound) (3 Points)

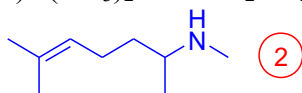


- 2) Draw the following as line structures: (4 points)

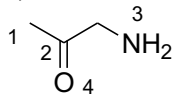
- a) 4,4-dimethylhexan-2-ol



- b)  $(\text{CH}_3)_2\text{CCHCH}_2\text{CH}_2\text{CHCH}_3\text{NHCH}_3$



- 3) For the following compound:



- a) What is the hybridization of both carbons, the nitrogen and the oxygen? (4 points)

$$\text{C}_1 = sp^3$$

$$\text{C}_2 = sp^2$$

$$\text{N}_3 = sp^3$$

$$\text{O}_4 = sp^2$$

- b) What is the geometry of both carbons, the nitrogen and the oxygen? (4 points)

$$\text{C}_1 = \text{tetrahedral}$$

$$\text{C}_2 = \text{trigonal}$$

$$\text{N}_3 = \text{tetrahedral}$$

$$\text{O}_4 = \text{trigonal}$$

- c) What type of molecular orbitals connect the following pairs of atoms? (4 points)

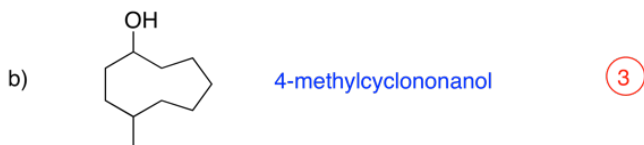
$$\text{C}_1 \text{ and } \text{C}_2 = \sigma$$

$$\text{C}_2 \text{ and } \text{O}_4 = \sigma + \pi$$

$$\text{N}_3 \text{ and } \text{H} = \sigma$$

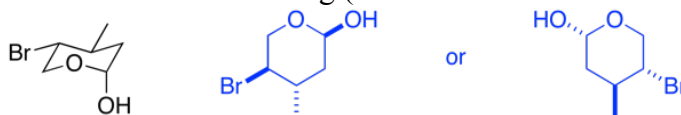
- 4) Give IUPAC names for the following: (6 points)



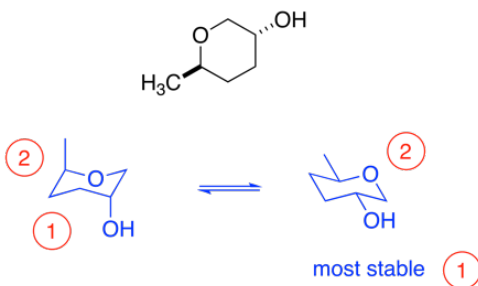


5) For the following:

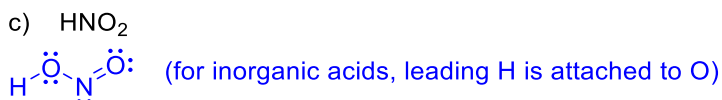
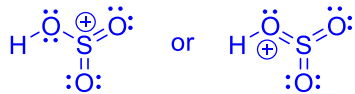
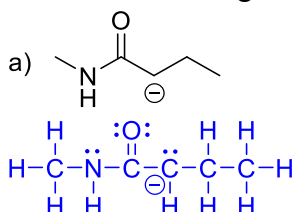
a) Draw the “flat” line structure of the following (be sure to indicate stereochemistry). (3 points)



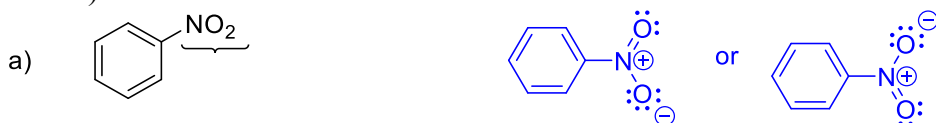
b) Draw both chair conformations of the following compound. Indicate which form is the most stable (6 points)



6) Draw the following molecules as Lewis structures. (6 points)

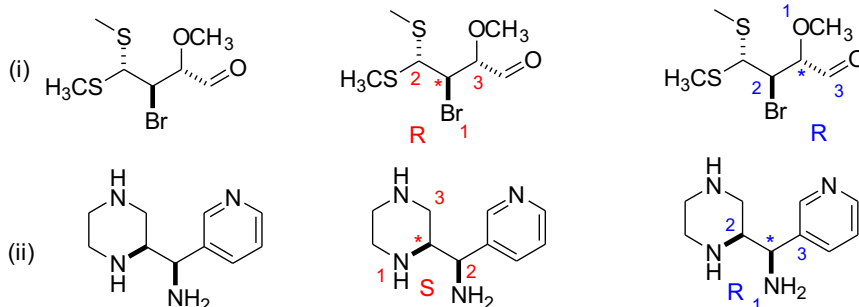


7) Re-draw the following molecules showing the full Lewis structure at the indicated location. (6 Points)

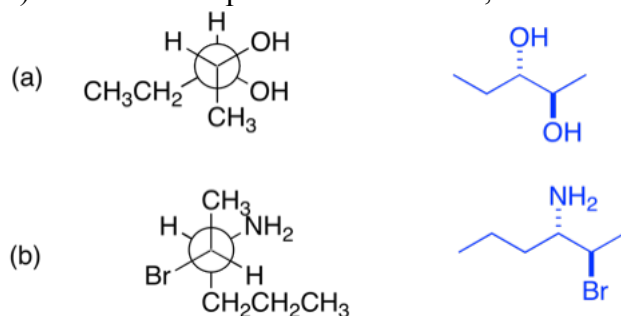


8) For the following compounds

- show the stereogenic centre(s) by labeling them with a star (\*) (4 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) (8 points)
- Determine the configuration of each stereocentre (4 points)



9) For each compound shown below, convert the structure to zig-zag (line) notation. (4 points)



10) The specific rotation of the (S) form of Viagra is  $-20.0^\circ$ . A third world drug maker is selling Viagra on the internet. To save money, the company makes a mixture of the active (R) form and the inactive (and toxic) (S) form. The FDA confiscates the shipment of this “counterfeit” Viagra and measures the optical rotation. If the value of the specific rotation is  $+5^\circ$ , what is the composition of the mixture (how much R form and how much S form)? (7 points)

the rotation of the sample is positive so the R isomer is in excess

$$\textcircled{1} \text{ optical purity} = \frac{[\alpha]_{\text{sample}}}{[\alpha]_{\text{pure}}} \times 100 \%$$

$$\textcircled{1} 25 \% = \frac{5^\circ}{20^\circ} \times 100 \% \quad \textcircled{1}$$

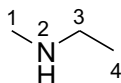
$$\text{ee} = \text{optical purity} = \frac{|R - S|}{S + R} \times 100 \% \quad \textcircled{1} \quad S + R = 100 \quad \textcircled{1}$$

$$\textcircled{1} 25 \% = \frac{100 - 2S}{100} \times 100 \%$$

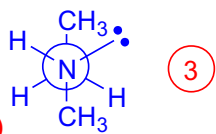
$$S = 37.5$$

Mixture is 37.5 % S isomer and 62.5 % R isomer  $\textcircled{1}$

11) For the following compound, draw the appropriate Newman projection along the N2-C3 bond of the following:

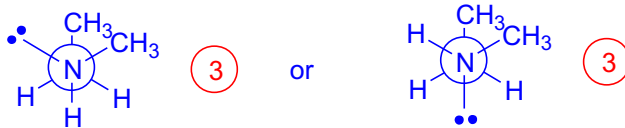


a) The most stable conformer and name the conformer. (4 Points)



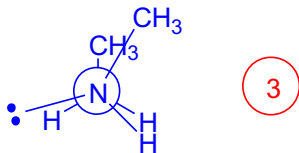
Anti-Staggered (1)

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



Gauche Staggered (1)

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



Eclipsed (1)