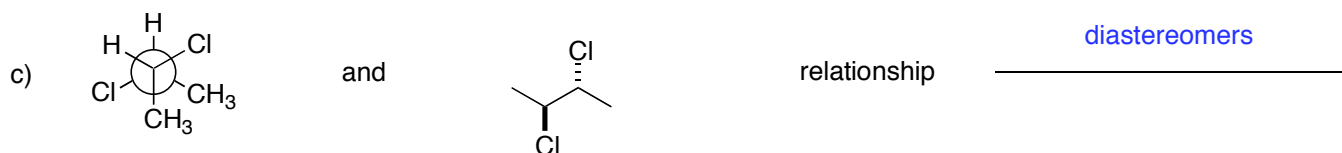
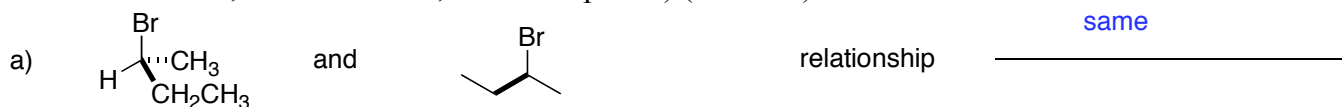


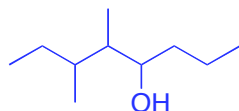
CHM 1321 A
Mid Term 1 Version A
Answers

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

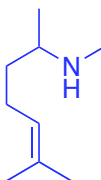


2) Draw the following as line structures: (4 points)

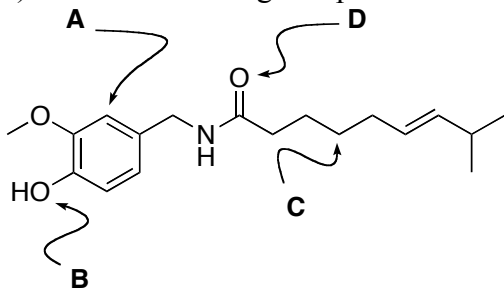
a) 5,6-dimethyloctan-4-ol



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 the indicated atoms? (4 points)

Atom A = sp²
 Atom B = sp³
 Atom C = sp³
 Atom D = sp²

b) What type of molecular orbitals connect the following atoms to other atoms? (6 points)

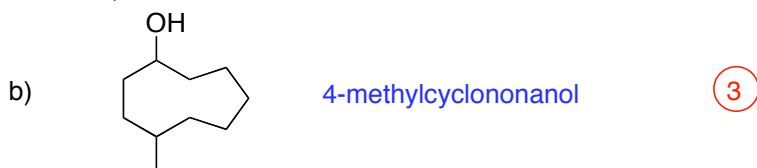
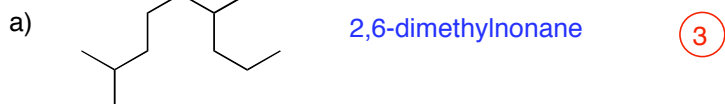
Atom A = σ and π

Atom B = σ

Atom C = σ

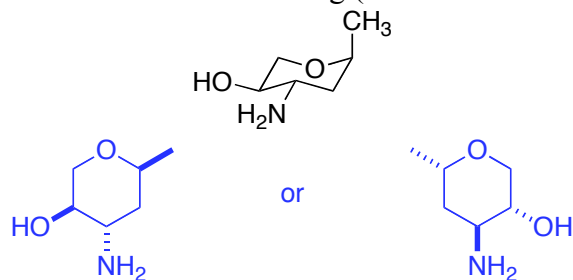
Atom D = σ and π

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

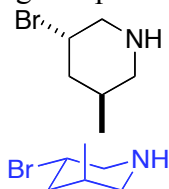


5) For the following:

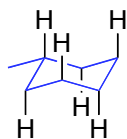
a) Draw the “hexagon” line structure of the following (be sure to indicate stereochemistry). (3 points)



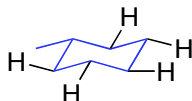
b) Draw one chair conformation of the following compound. (4 Points)



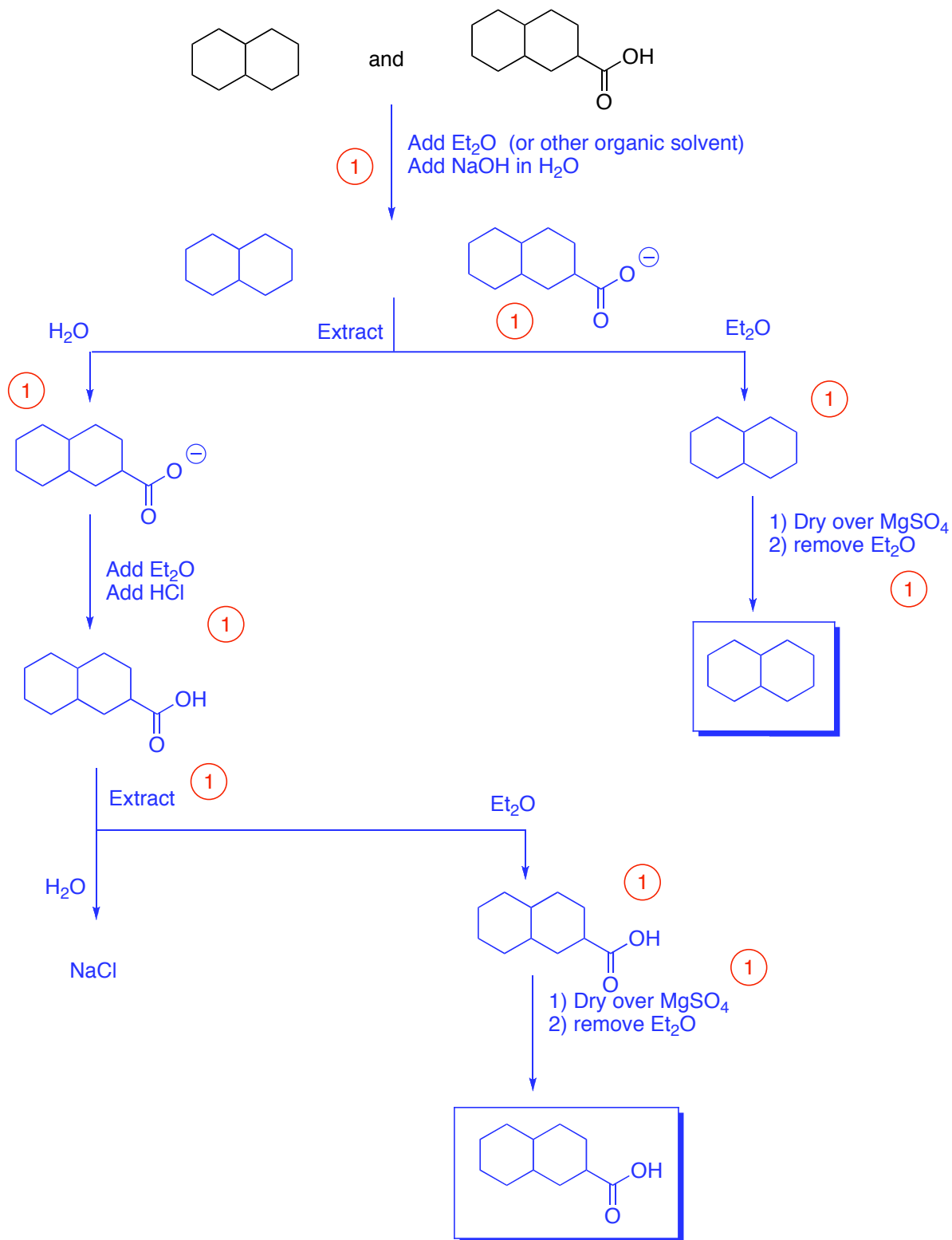
c) Draw one chair conformation of 1-methylcyclohexane showing all of the AXIAL hydrogens. (3 Points)



d) Draw the same chair conformation of 1-methylcyclohexane showing all of the EQUATORIAL hydrogens. (3 Points)

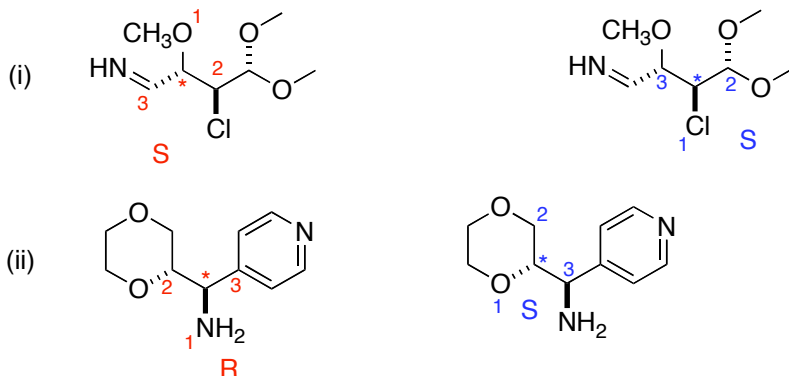


6) Use a flow chart to illustrate how you could separate a mixture of the following compounds using an extraction. Be sure to include all steps. (9 points)

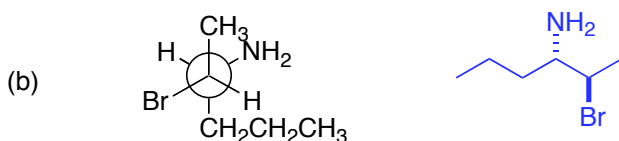
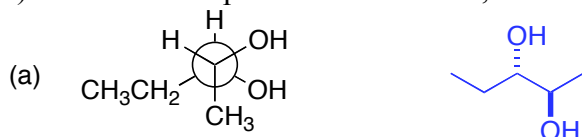


7) For the following compounds

- 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)**



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



9) The specific rotation of the (S) form of Ibuprofen is -30.0° . A third world drug maker is selling Ibuprofen 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” Ibuprofen and measures the optical rotation. If the value of the specific rotation is -15° , what is the composition of the mixture (how much R form and how much S form)? (7 points)

the rotation of the sample is negative so the S isomer is in excess

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

$$50\% = \frac{15}{30} \times 100\%$$

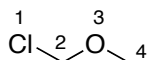
$$\text{ee} = \text{optical purity} = \frac{|S - R|}{R + S} \times 100\% \quad R + S = 100$$

$$50\% = \frac{2S - 100}{100} \times 100\%$$

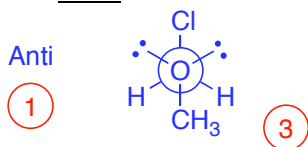
$$S = 75$$

Mixture is 75% S isomer and 25% R isomer

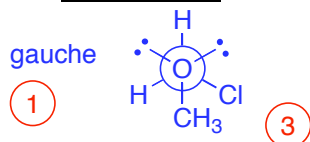
10) For the following compound, draw the appropriate Newman projection along the C2-O3 bond of the following:



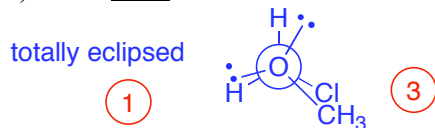
a) The most stable conformer and name the conformer. (4 Points)



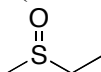
b) The second most stable conformer and name the conformer. (4 Points)



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



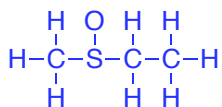
BONUS! The following molecule is chiral. Provide a brief explanation of why this is possible (it may be helpful to draw a Lewis structure of the molecule). (2 Points)



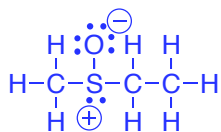
$$\begin{aligned}
 3 \times \text{carbon} &= 4 \times 3 = 12 \\
 1 \times \text{oxygen} &= 6 \times 1 = 6 \\
 1 \times \text{sulfur} &= 6 \times 1 = 6 \\
 8 \times \text{hydrogen} &= 8 \times 1 = 8
 \end{aligned}$$

32 valence electrons

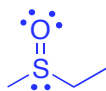
connect with single bonds



12 bonds accounts for 24 electrons



remaining electrons are distributed and formal charges calculated



Final structure has a sulfur with 4 different substituents
it is a chirality center and therefore the molecule is chiral