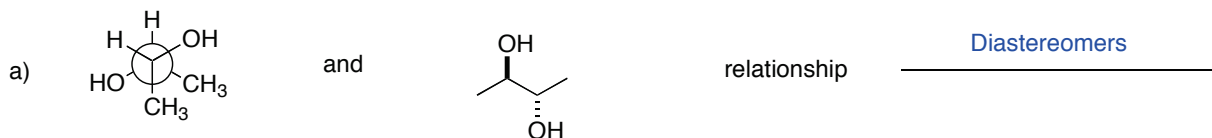


CHM 1321 A
Mid Term 1 Answers Version B

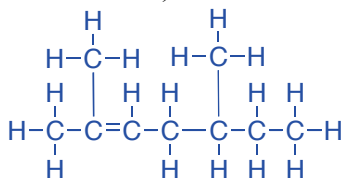
1) Identify the stereochemical relationship between the following pairs of molecules (enantiomers, diastereomers, same molecule, meso compound) (3 Points)



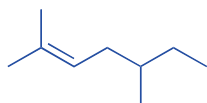
2) Draw 2,5-dimethylhept-2-ene as: (6 points)

a) A condensed formula
 $(\text{CH}_3)_2\text{CCHCH}_2\text{CHCH}_3\text{CH}_2\text{CH}_3$

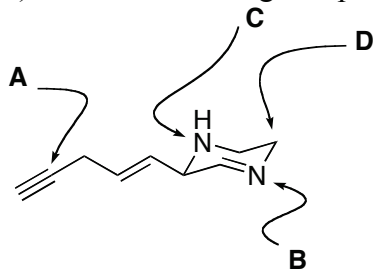
b) A Lewis structure



c) A line structure



3) For the following compound:



a) What is the hybridization of the indicated atoms? (4 points)

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

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

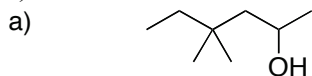
Atom A = $\sigma + \pi$

Atom B = $\sigma + \pi$

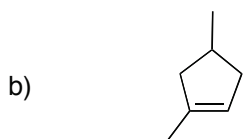
Atom C = σ

Atom D = σ

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



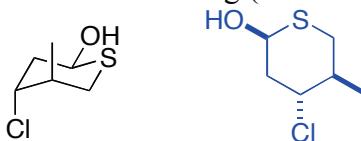
4,4-dimethylhexan-2-ol



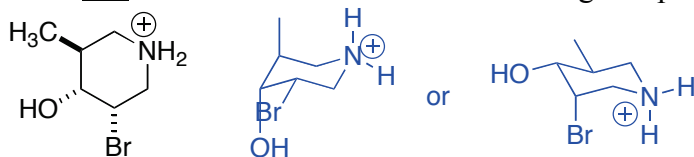
1,4-dimethylcyclopentene

5) For the following:

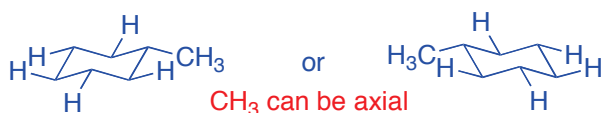
a) Draw the “hexagon” line structure of the following (be sure to indicate stereochemistry). (3 points)



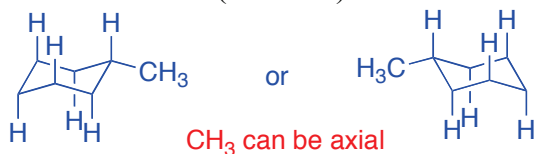
b) Draw one chair conformation of the following compound. (4 Points)



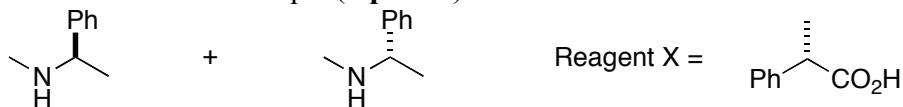
c) Draw one chair conformation of 1-methylcyclohexane showing ALL OF THE EQUATORIAL HYDROGENS. (3 Points)

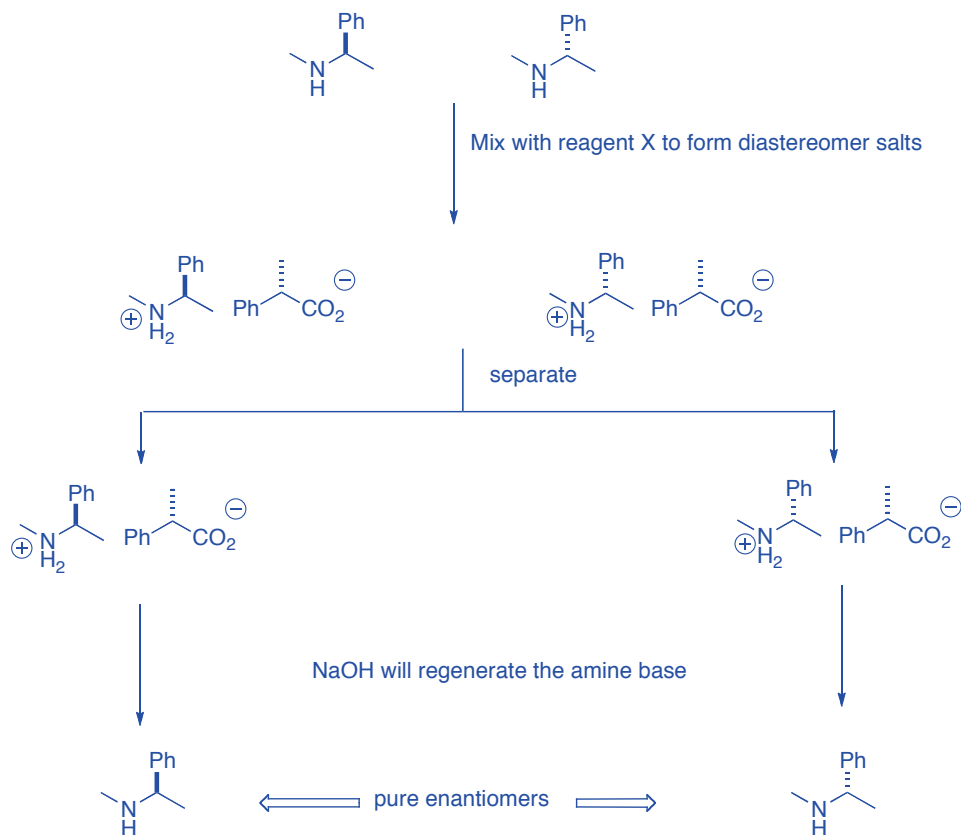


d) Draw the same chair conformation of 1-methylcyclohexane showing ALL OF THE AXIAL HYDROGENS. (3 Points)



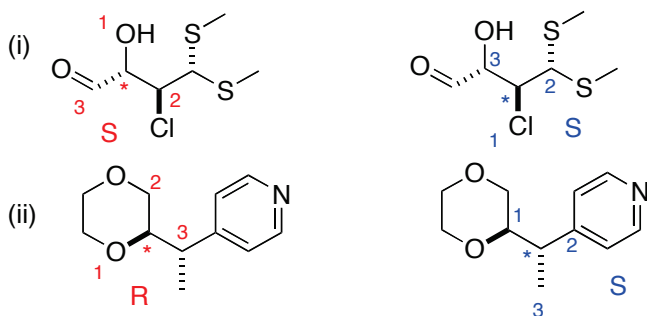
6) Use a flow chart to illustrate how you could separate a mixture of the following compounds using an extraction. Be sure to include all steps. (7 points)



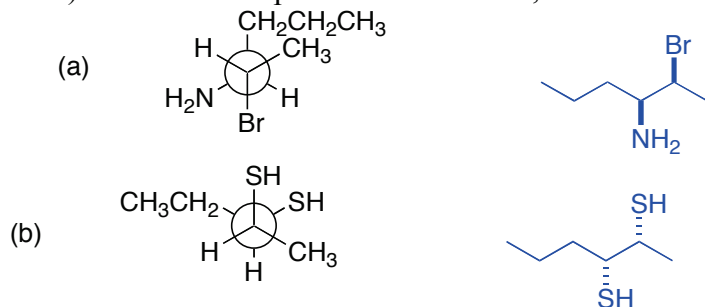


7) For the following compounds

- 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 pure (S) form of methamphetamine is -30.0° . Heisenberg is selling some methamphetamine to Gus. To save money, Jessie makes a mixture of the active (R) form and the

inactive (S) form. Gus asks Gale to measure the optical rotation of the test batch, and he gets a value of the specific rotation of -10° .

- a) What is the enantiomeric excess of the sample? (3 points)

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

$$33\% = \frac{10}{30} \times 100\%$$

- b) Which isomer is in excess and why? (2 points)

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

- c) What is the composition of the mixture (how much R form and how much S form)? (3 points)

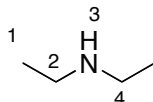
$$ee = \text{optical purity} = \frac{|S - R|}{S + R} \times 100\% \quad S + R = 100$$

$$33\% = \frac{2S - 100}{100} \times 100\%$$

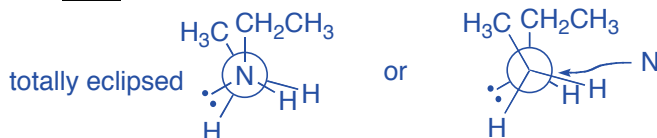
$$S = 66.5$$

Mixture is 66.7 % S isomer and 33.3 % R isomer

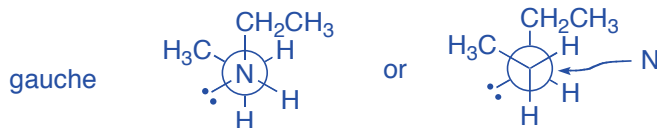
- 10) For the following compound, draw the appropriate Newman projection along the N3-C4 bond of the following:



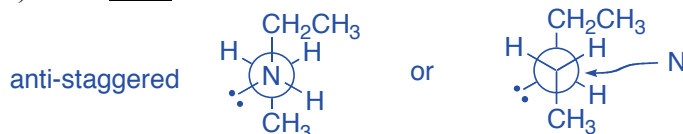
- a) The least stable conformer and name the conformer. (4 Points)



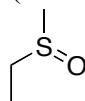
- b) The second most stable conformer and name the conformer. (4 Points)



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



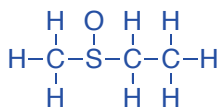
BONUS! The following molecule is chiral. Provide a brief explanation of why this is possible (it may be helpful to draw a Lewis structure of the molecule). (2 Points)



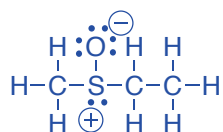
3 X carbon = 4 X 3 = 12
 1 X oxygen = 6 X 1 = 6
 1 X sulfur = 6 X 1 = 6
 8 X hydrogen = 8 X 1 = 8

32 valence electrons

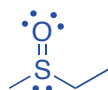
connect with single bonds



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