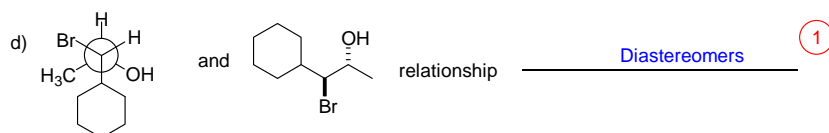
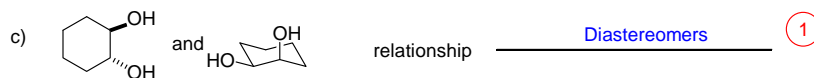
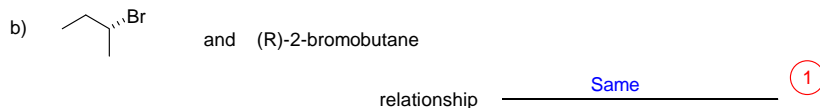
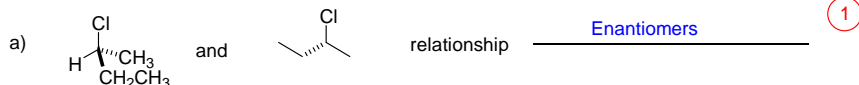


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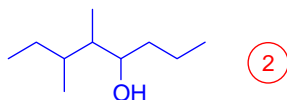
Mid Term 1 (February 4, 2011) Answers

1) Identify the stereochemical relationship between the following molecules (enantiomers, diastereomers, same molecule, meso compound) (4 Points)

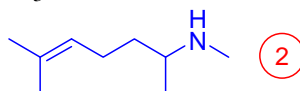


2) Draw the following as line structures: (4 points)

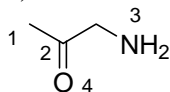
a) 5,6-dimethyloctan-4-ol



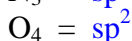
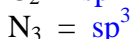
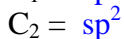
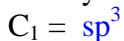
b) $(\text{CH}_3)_2\text{CCHCH}_2\text{CH}_2\text{CHCH}_3\text{NHCH}_3$



3) For the following compound:



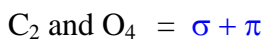
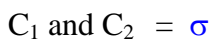
a) What is the hybridization of both carbons, and both oxygens? (4 points)



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

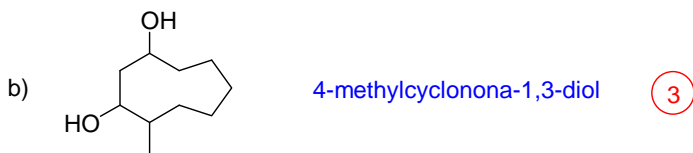


c) What molecular orbitals connect the following pairs of atoms? (4 points)

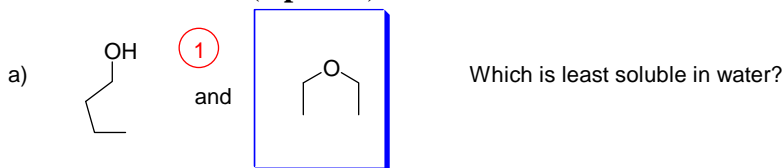


4) Give IUPAC names for the following: (6 points)



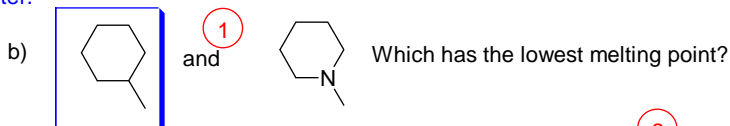


5) For each of the following pairs, circle the compound that best fits the criteria. Briefly justify your choice in each case. (9 points)



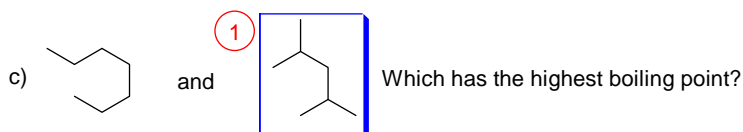
First structure can hydrogen bond with water, and can participate fully (has hydrogen and lone pair)
Second structure capable of hydrogen bonding with water, but only using lone pairs. The hydrogen bonding will be weaker for this compound.

The first compound is capable of stronger hydrogen bonds with water, and so will be more soluble in water. (2)



Both structures are capable of van der Waals interactions (2)

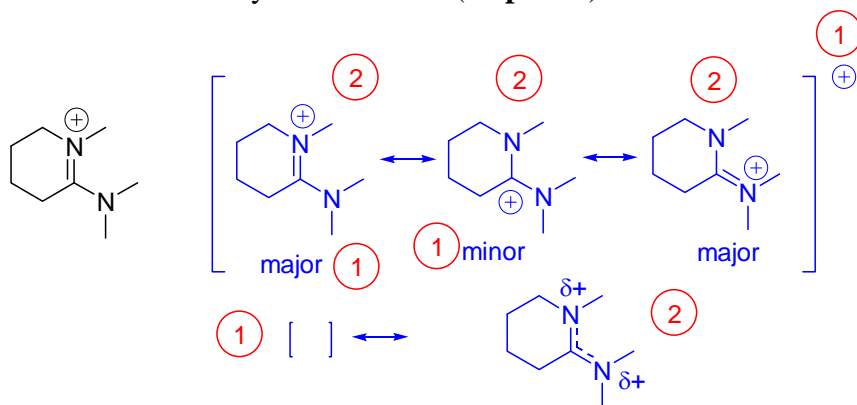
Second structure has a dipole and is capable of dipole-dipole interactions. These are stronger than VdW and so the second structure will have stronger intermolecular forces and a higher boiling point



Both structures are capable of van der Waals interactions only. (2)

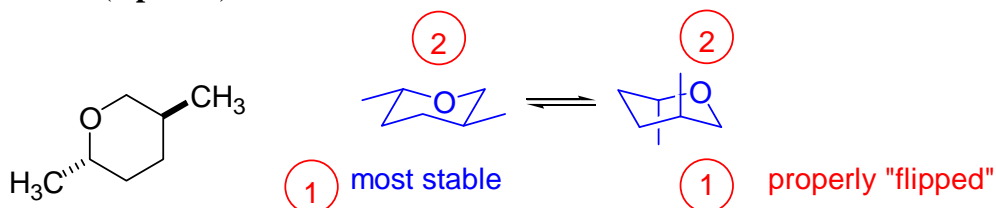
First structure is an open-chain compound, second structure is a ring. Rings pack together better making boiling more difficult.

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

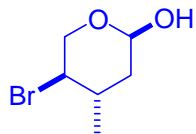
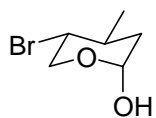


7) For the following:

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



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

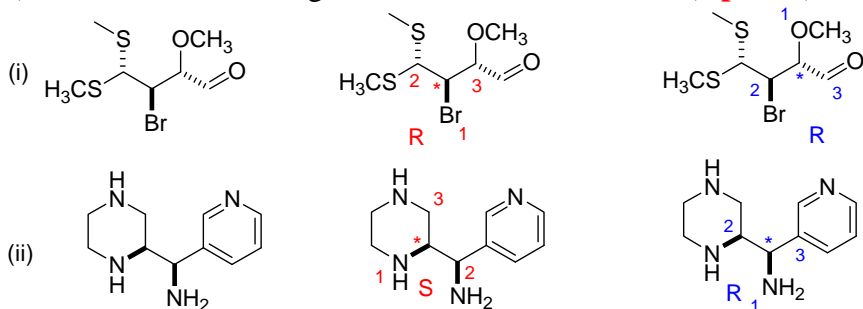


8) For the following compounds

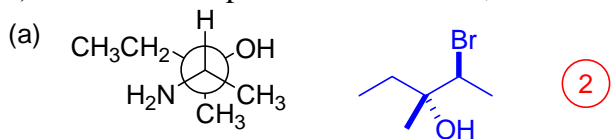
a) show the stereogenic centre(s) by labeling them with a star (*) (4 points)

b) 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)

c) Determine the configuration of each stereogenic centre (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° . 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

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

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

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

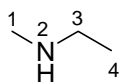
$$S + R = 100$$

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

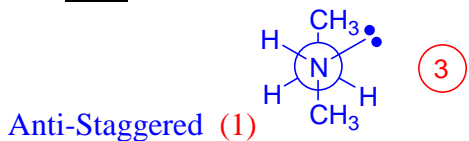
$$S = 37.5$$

Mixture is 37.5 % S isomer and 62.5 % R isomer

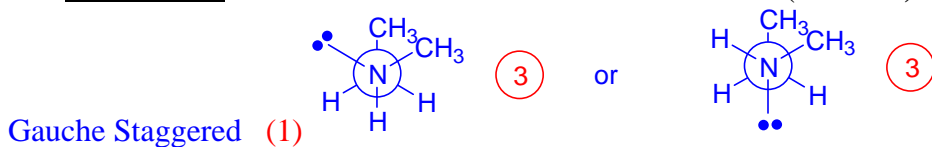
11) For the following compound, draw the appropriate Newman projection along the N₂-C₃ bond of the following:



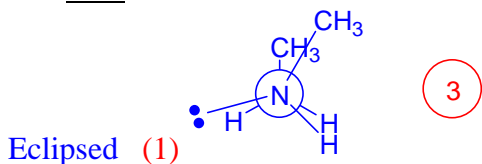
a) The most stable conformer and name the conformer. (4 Points)



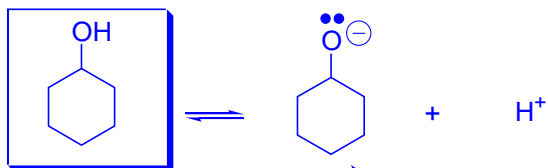
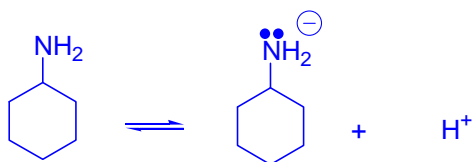
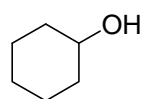
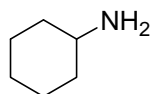
b) The second most stable conformer and name the conformer. (4 Points)



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



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



Oxygen is more electronegative than nitrogen. Therefore a negative charge will be stabilized better on oxygen than on nitrogen. This means that this conjugate base is weaker, and therefore the OH compound is the stronger acid.