

**DEPARTMENT OF MEDICINAL CHEMISTRY  
SCHOOL OF PHARMACY**

Medicinal Chemistry I  
Dr. Umesh R. Desai

**FINAL EXAM**

MEDC 501  
October 18, 2007

**KEY**

**STUDENT NAME**

**HONOR PLEDGE**

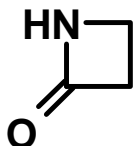
Ring Size	Saturated	Partly Saturated	Unsaturated
3	-irane	-	-irene
4	-etane	(dihydro)	-ete
5	-olane	(dihydro)	-ole
6	-inane	(di or tetrahydro)	-ine
7	-epane	(di, tetra, or hexahydro)	-epine
8	-ocane	(di, tetra, or hexahydro)	-ocine

	IV	V	VI	VII
2	C	N	O	F
3	Si	P	S	Cl
4	Ge	As	Se	Br
5	Sn	Sb	Te	I

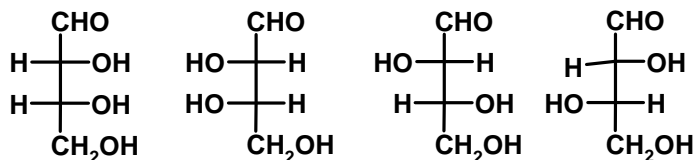
1. Draw structure of an epoxide, a beta-lactam, and a four-carbon reducing sugar in the open-chain form. Place charges, if present, on appropriate atoms. (9 pts)



an epoxide

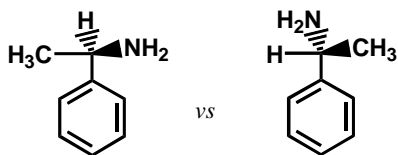


a beta-lactam

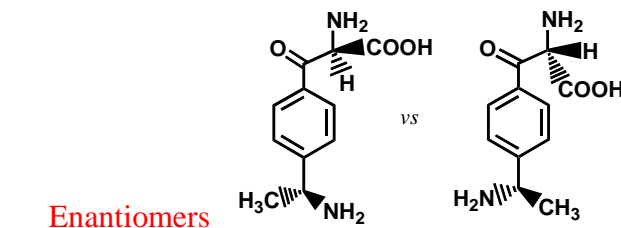


a four-carbon reducing sugar (open-chain form)

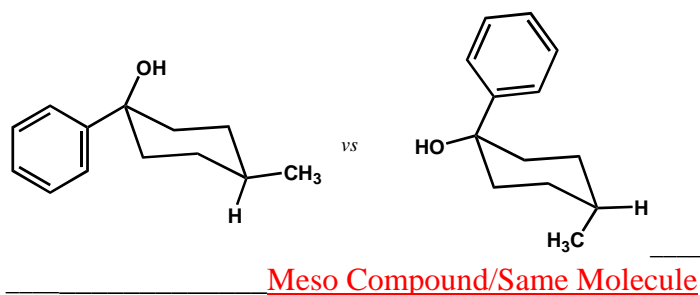
2. Which of the following terms best describes each pair of compounds shown below: (20 pts)
- Conformational isomer
  - Enantiomers
  - Diastereomers
  - Meso compound
  - Same molecule
  - All of the above
  - None of the above



Conformational Isomer

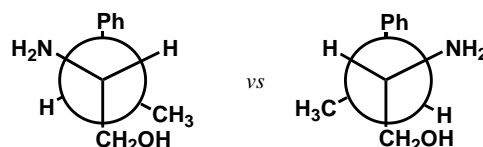


Enantiomers



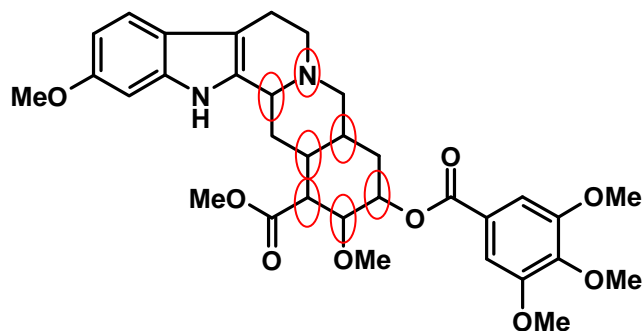
Meso Compound/Same Molecule

Enantiomers

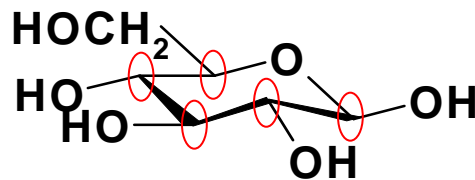


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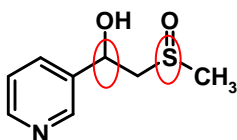
3. Circle chiral centers in the following molecules. If there are no chiral centers in a molecule, write **NONE**. **Note: Each chiral center should contain only one atom. Negative points for identifying centers that are not chiral centers.** (14 pts)



**Reserpine**  
(antihypertensive)

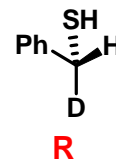
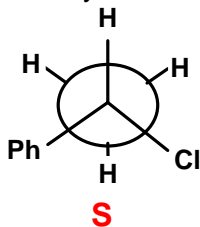


**β-D-Glucose**

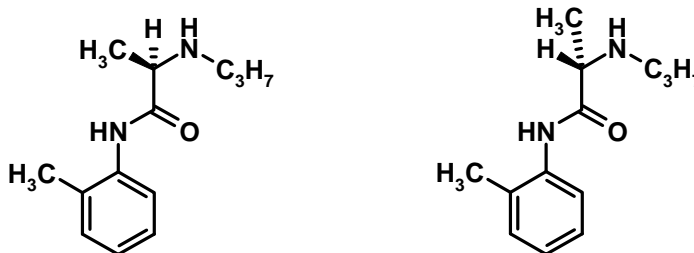


**Oxisuranol**  
(metabolite of oxisuran  
a immunosuppresant)

4. Identify the chirality of all the chiral centers in the following molecules. Use 'R' or 'S' nomenclature. (8 pts)



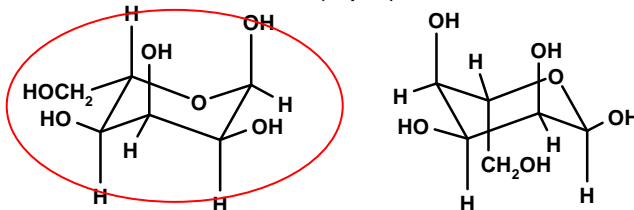
5. The isomer on the left is more extensively hydrolyzed in our body than the isomer on the right. Why? (4 pts)



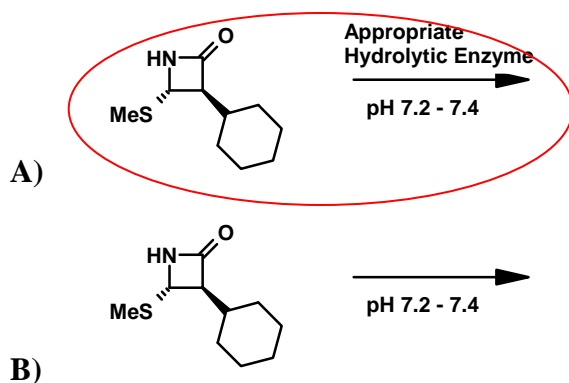
Our body utilizes enzymes to metabolize molecules. These enzymes usually recognize molecules specifically, e.g., a specific stereoisomers is usually recognized. The isomer on the left is therefore likely to be metabolized extensively.

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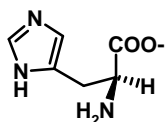
6. Draw a chair conformer of a six-membered reducing monosaccharide with the following distribution of groups: -OH groups at 1 and 3 are axially oriented, while those at 2 and 4 are equatorial. The -CH<sub>2</sub>OH group at 5 position is equatorial (4 pts). Draw its conformational isomer that might exist in equilibrium (4 pts). Circle the isomer that more stable of the two. (1 pts)



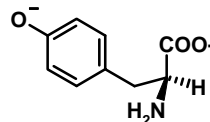
7. Consider reactions A) and B). Circle the reaction that has a shorter half-life? (4 pts)



8. Draw the structure of following natural  $\alpha$ -amino acids at pH 12 in their stereochemically correct form ('S' stereochemistry according to Cahn-Ingold-Prelog convention). Use bold and cross-hatched lines to show 'S' stereochemistry. Indicate appropriate charges (12 pts)

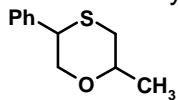


Histidine

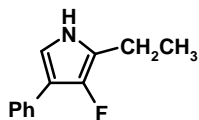


Tyrosine

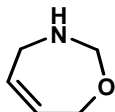
9. Write the systematic name of the following heterocycles. (12 pts)



**2-methyl-5-phenyl-[1,4]-oxathiane**



**2-ethyl-3-fluoro-4-phenyl-1H-azole**

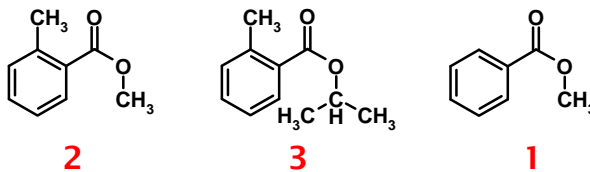


**2H,3H,4H,7H-[1,3]-oxazepine**

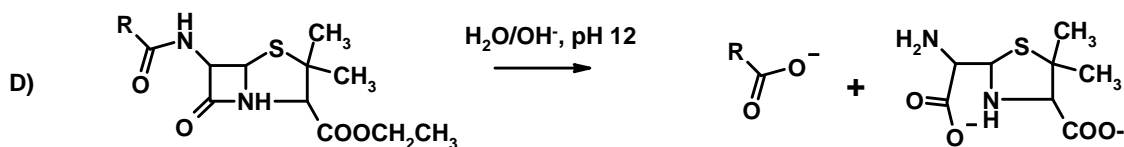
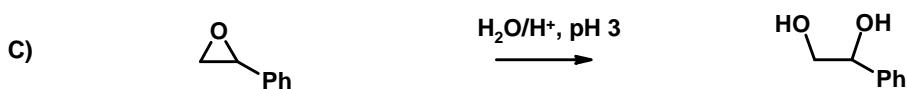
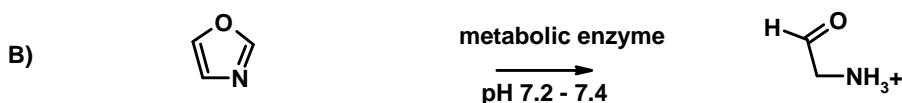
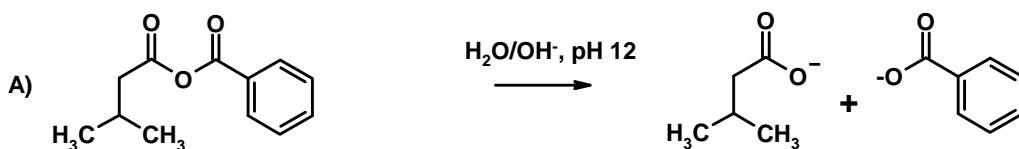
**2,3,4,7-tetrahydro-[1,3]-oxazepine**

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10. Rank the following compounds on their ability to undergo hydrolysis at pH 1 ( $H^+/H_2O$ ). Use 1 for most easily hydrolyzable and 3 for least. **NOTE: Entire sequence has to be correct to get any points.** (6 pts)



11. Draw product(s) of the following hydrolytic reactions assuming that complete hydrolysis is occurring. Write appropriate charges on functional groups formed in the reaction. If there is no product, write NONE. (22pts)



12. Define the following terms: (12 pts)

**1) Meso Compounds** \_ **Stereoisomers containing more than one chiral center that possess a plane of symmetry such that mirror image isomers are superimposable** \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**2) Diastereomers** \_\_\_\_ **Pair of stereoisomers containing more than one chiral center that are not related as mirror image isomers** \_\_\_\_\_

\_\_\_\_\_

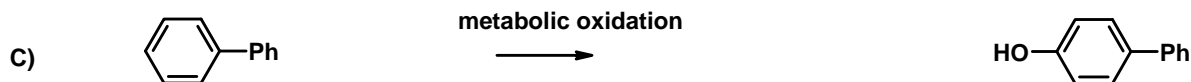
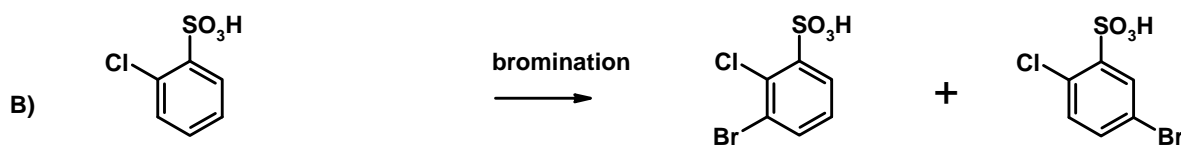
\_\_\_\_\_

\_\_\_\_\_

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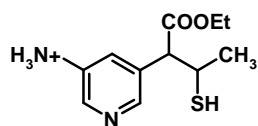
3) Enantiomers  Mirror image stereoisomers that are non-superimposable

13. Predict the product(s) of the following reactions. If there is no product, write NONE. (15 pts)

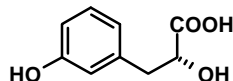


14. Indicate whether the following compounds will exhibit good water solubility at pH 7.2 – 7.4. Circle the correct answer. (12 pts)

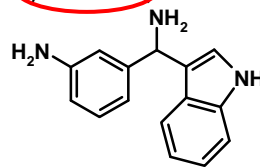
A) Soluble, **Insoluble**



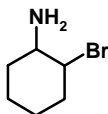
B) **Soluble**, Insoluble



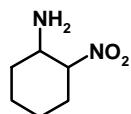
C) **Soluble**, Insoluble



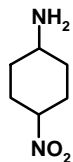
15. Rank the following molecules according to the basicity of  $-NH_2$  group. Use 1 for most basic and 4 for least. (12 pts)



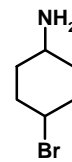
**3**



**4**

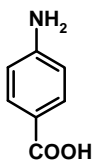


**2**

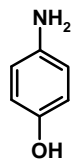


**1**

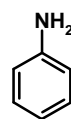
16. Rank the following molecules according to their acidity. Use 1 for most acidic and 3 for least acidic. (9 pts)



**1**



**2**



**3**

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17. Circle ionizable functional group(s) (pH range 0 -14) in the following molecules and indicate their approximate  $pK_A$  value or range. **NOTE: If there are no ionizable groups on the molecule, write NONE. Also, -1 point for identifying an ionizable functional group, which does not ionize in the pH range 0-14.** (20 pts)

