

**DEPARTMENT OF MEDICAL CHEMISTRY  
SCHOOL OF PHARMACY**

Medicinal Chemistry I  
Dr. Umesh R. Desai

**FINAL EXAM**

MEDC 501  
October 20, 2006

**STUDENT NAME**

KEY

**HONOR PLEDGE**

Ring Size	Saturated	Partly Saturated	Unsaturated
<i>Rings with N</i>			
3	-iridine		-irine
4	-etidine		-ete
5	-olidine	-oline	-ole
6	(hexahydro)	(di or tetrahydro)	-ine
7	(hexahydro)	(di or tetrahydro)	-epine
8	(octahydro)	(di, tetra, or hexahydro)	-ocine
<i>Rings without N</i>			
3	-irane		-irene
4	-etane		-ete
5	-olane	-olene	-ole
6	-ane	(di or tetrahydro)	-ine
7	-epane	(di or tetrahydro)	-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 isoquinoline, thiophene and tetrahydrofuran. Place charges, if present, on appropriate atoms. (9 pts)



isoquinoline

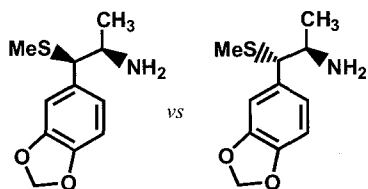


thiophene

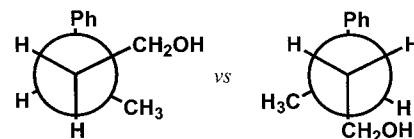


tetrahydrofuran

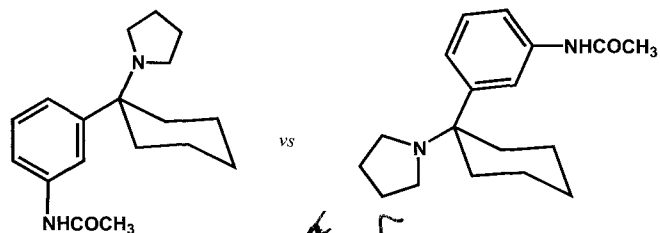
2. Which of the following terms best describes each pair of compounds shown below: (20 pts)
- Conformational isomer
  - Enantiomers
  - Diastereomers
  - Meso compound
  - Racemic compound
  - None of the above



c



b



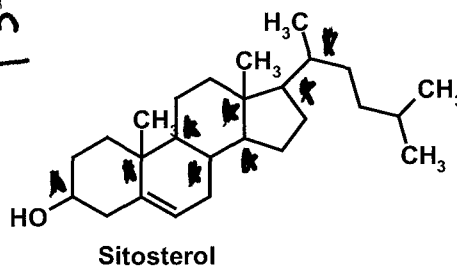
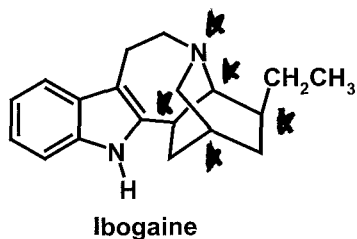
f



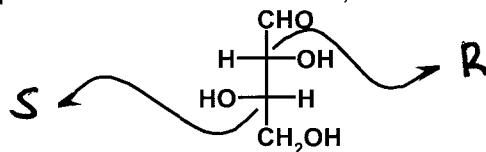
a

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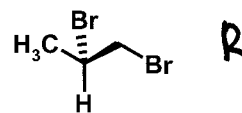
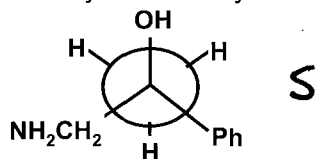
3. Identify chiral centers (mark with an asterisk "\*\*") in the following molecules. If there are no chiral centers in a molecule, write **NONE**. (6 pts)



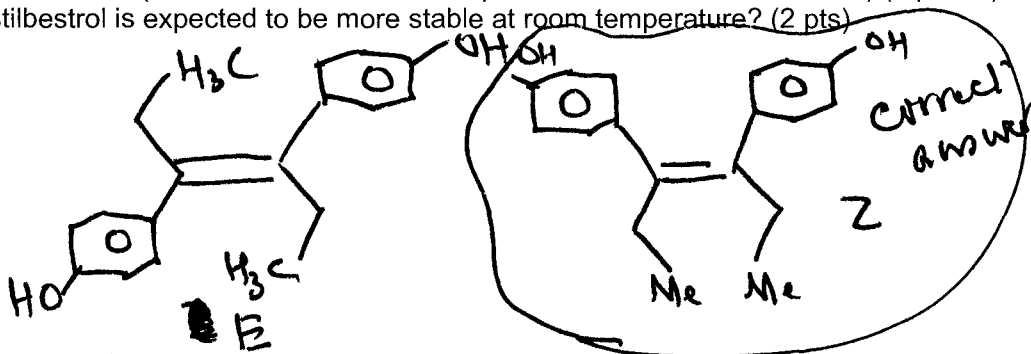
4. Following is a Fischer projection for a precursor to glucose. Identify the configuration (R and/or S) of the stereo-centers present in this precursor. For convenience, arrows are provided. (4 pts)



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

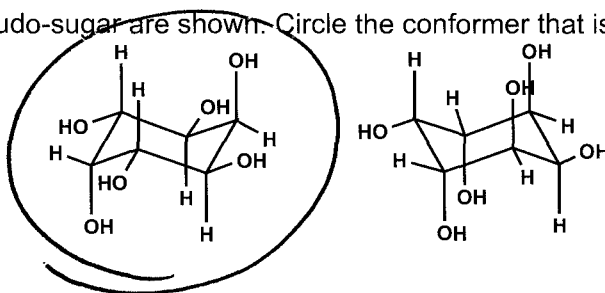


6. Draw 'Z' isomer of diethylstilbestrol ( $R_1R_2C=CR_1R_2$ , where  $R_1 = p\text{-HO-C}_6\text{H}_4\text{-}$  and  $R_2 = \text{-CH}_2\text{CH}_3$ ) (4 points). Which isomer of diethylstilbestrol is expected to be more stable at room temperature? (2 pts)



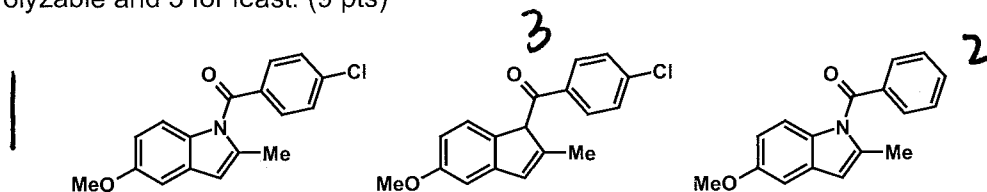
The isomer of diethylstilbestrol that is expected to be more stable at room temperature is **E**.

7. Two conformers of a pseudo-sugar are shown. Circle the conformer that is more stable of the two. (4 pts)



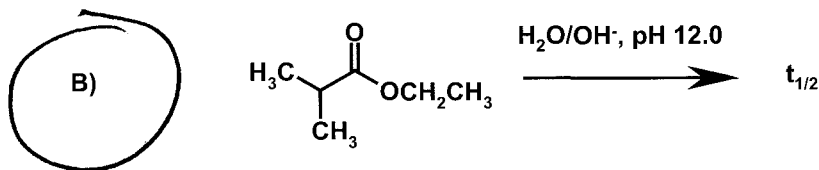
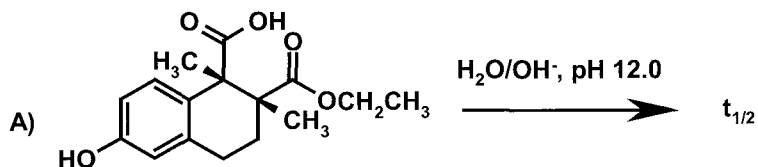
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8. Rank the following compounds on their ability to undergo hydrolysis at pH 12 ( $H_2O/OH^-$ ). Use 1 for most easily hydrolyzable and 3 for least. (9 pts)

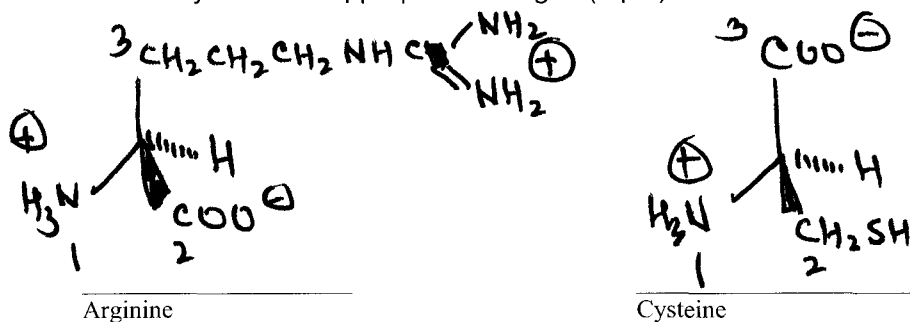


3 pts Ea  
correct  
structure

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

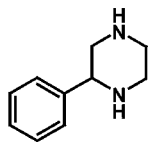


10. Draw the structure of following natural  $\alpha$ -amino acids at pH 7.2 in their stereochemically correct form ('S' stereochemistry according to Cahn-Ingold-Prelog convention). Use bold and cross-hatched lines to show 'S' stereochemistry. Indicate appropriate charges (8 pts)



chirality = 2 pt  
Side chain = 1 pt  
charges = 1/2 pt Ea

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

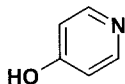


2-Phenyl-  $\xrightarrow{1 \text{ pt}}$  hexahydro-  $\xrightarrow{1 \text{ pt}}$  1H,4H-diazine  $\xrightarrow{2 \text{ pt}}$

"H" may or  
may not  
be  
there)



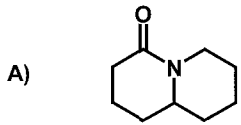
3-Fluoro-  $\xrightarrow{1 \text{ pt}}$  oxolane  $\xrightarrow{3 \text{ pt}}$



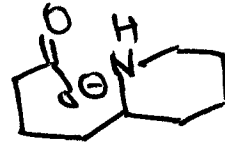
4-hydroxy-  $\xrightarrow{1 \text{ pt}}$  pyridine  $\xrightarrow{3 \text{ pt}}$

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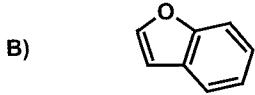
12. Draw product(s) of the following reactions. Write appropriate charges on functional groups formed in the reaction. If there is no product, write NONE. (22 pts)



$\text{H}_2\text{O}/\text{OH}^-$ , pH 12



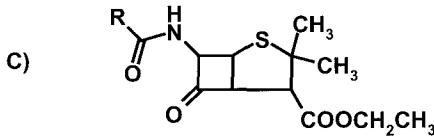
4 pts



$\text{H}_2\text{O}/\text{H}^+$ , pH 3

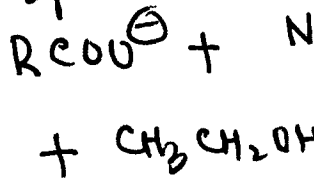
NONE

4 pts.

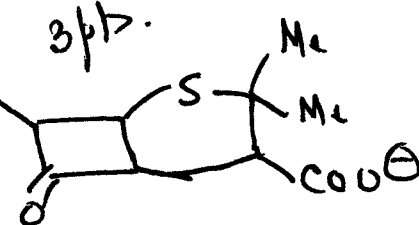


$\text{H}_2\text{O}/\text{OH}^-$ , pH 12

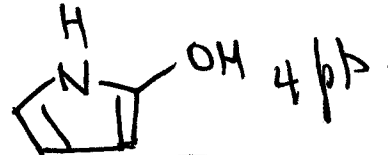
3 pts



3 pts.



metabolic enzyme

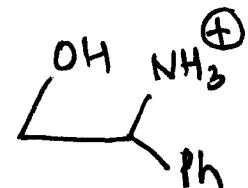
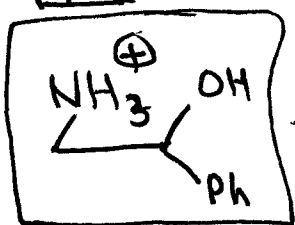


4 pts.

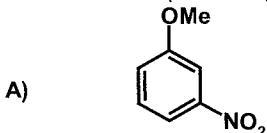


$\text{H}_2\text{O}/\text{H}^+$ , pH 3

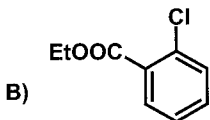
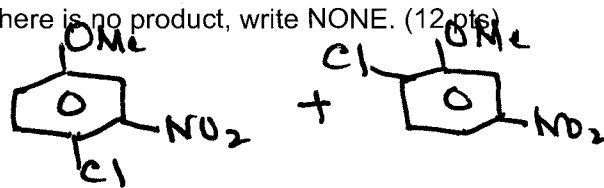
4 pts.



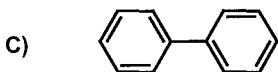
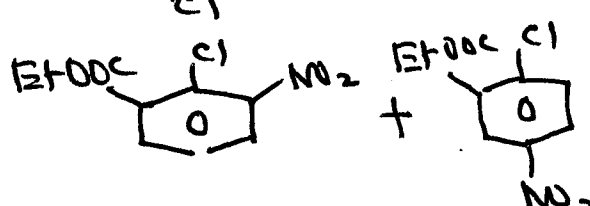
13. Predict the product(s) of the following reactions. If there is no product, write NONE. (12 pts)



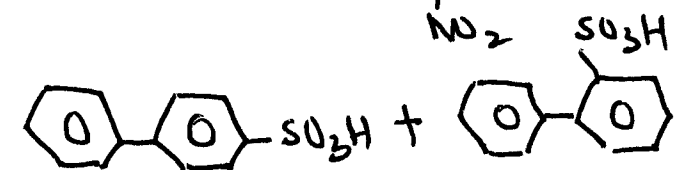
chlorination



nitration



sulfation



14. Complete the following sentences: (8 pts)

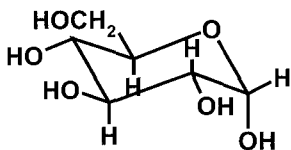
1) Glycated hemoglobin is formed by the reaction of \_\_\_\_\_ residue of hemoglobin.

Open-chain form of sugar with lysine  
or Aldehyde

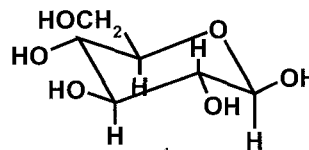
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2) ATP is a high energy molecule because 4 negatively charges on three phosphatic groups create instability due to charge-charge repulsion, thereby releasing energy on hydrolysis.

15. Underneath each structure below, write whether it is  $\alpha$  (alpha) or  $\beta$  (beta) sugar. (6 pts)



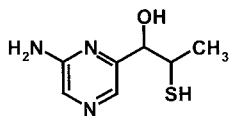
$\alpha$



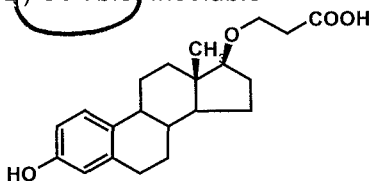
$\beta$

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

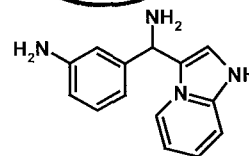
A) Soluble, Insoluble



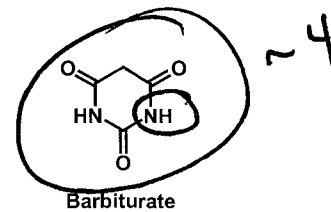
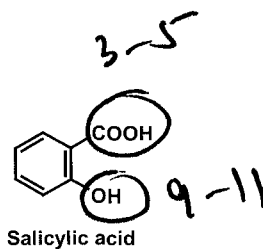
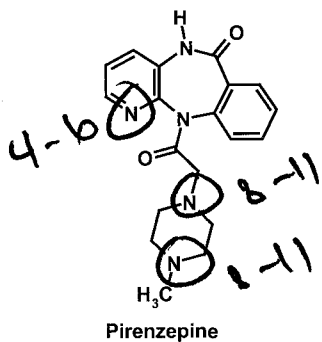
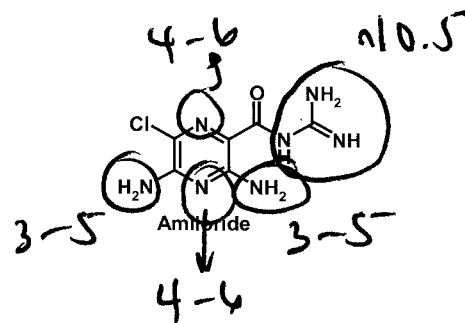
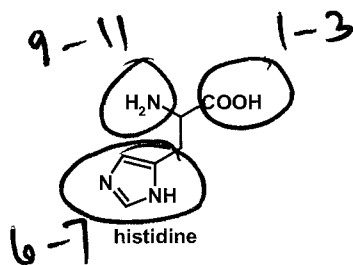
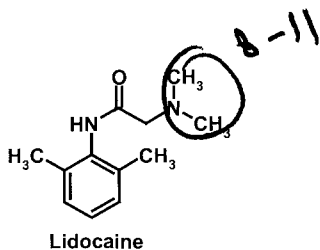
B) Soluble Insoluble



C) Soluble, Insoluble

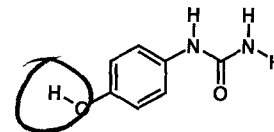
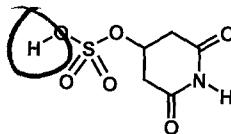
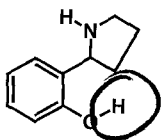
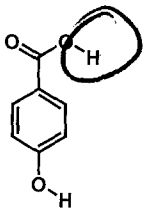


17. Circle ionizable functional group(s) (pH range 0 -14) in the following molecules and indicate their approximate  $pK_A$  value or range. If there are no ionizable groups, write NONE. **NOTE: -1 point for identifying an ionizable functional group, which does not ionize in the pH range 0-14.** (14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

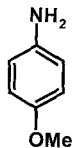


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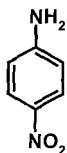
18. Circle the most acidic proton in the each of the following structures. (12 pts)



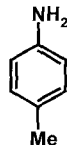
19. Rank the following molecules according to the basicity of  $-NH_2$  group. Use 1 for most basic and 4 for least. (12 pts)



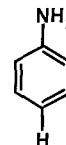
1



4

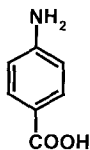


2

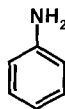


3

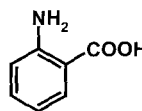
20. Rank the following molecules according to their mp/bp. Use 1 for highest mp/bp and 3 for lowest. (12 pts)



1



3



2