

Chemistry 211 -- EXAM 4 (Spring 2004 - Dr. Robertson)

***** BEFORE BEGINNING EXAM, PLEASE READ THE FOLLOWING *****

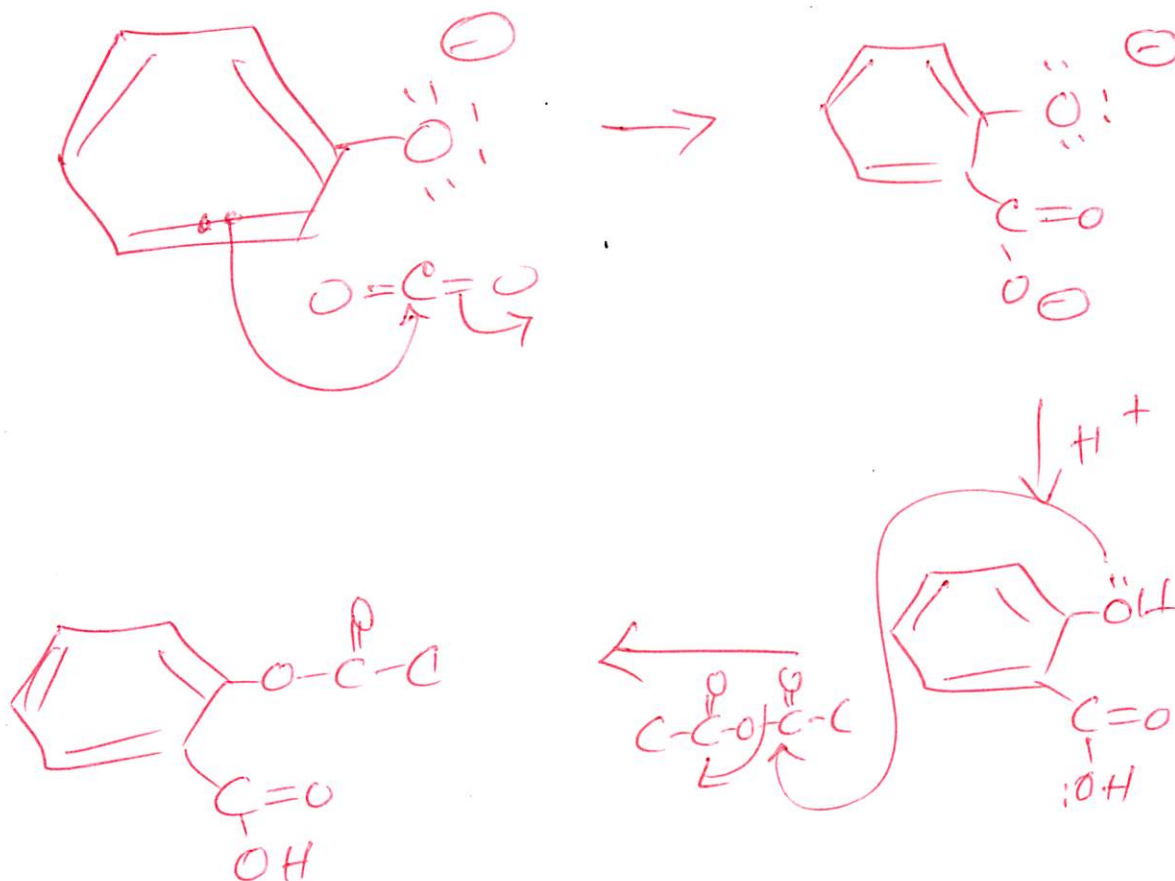
The exam consists of this cover sheet, 9 problems and an extra credit problem, which is optional. The time limit for this exam is **2.0 hours**. Please read problems carefully so that you understand the entire problem. No work = no credit.

I have not had assistance during the taking of this exam.

Signed _____

Key

EXTRA POINT QUESTION (3 points): Salicylic acid can be prepared by reacting phenol, in the presence of base with CO_2 (2 pts). Show the reaction mechanism for the reaction that produces salicylic acid. Then, show the reaction necessary to produce aspirin with this salicylic acid (1 pt).



Aspirin

If there is a compound used in a reaction that you do not know the structure of, you can ask for a 1 point deduction, but you cannot ask for the structure of a compound in problems #1, #2, #11, or the Extra Point question.

30 1. Draw structures for each of the following (for amino acids, show only the side chain):

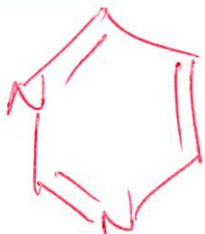
purine



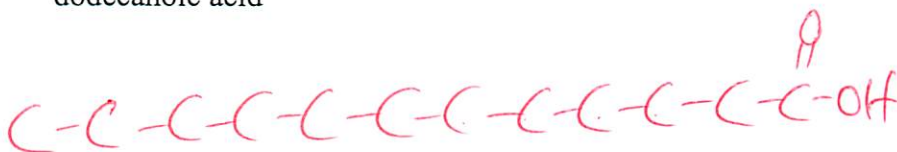
adenine



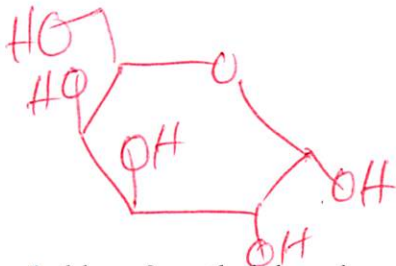
Pyrimidine



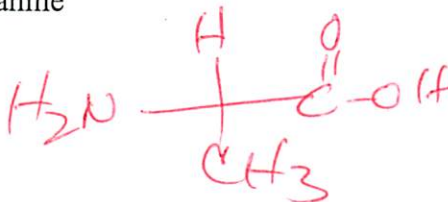
dodecanoic acid



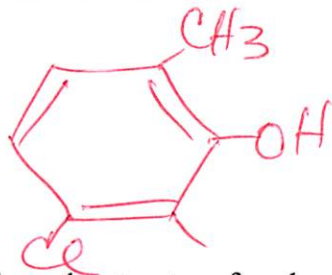
α -D-galactopyranose



alanine



5-chloro-2-methylphenol

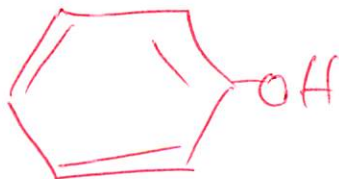


benzyne

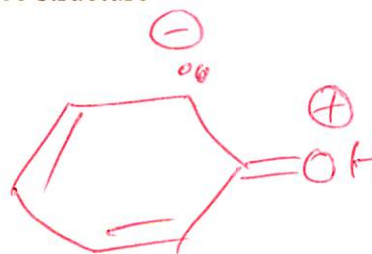


Show the structure for phenol. Then, show one correct resonance structure for phenol

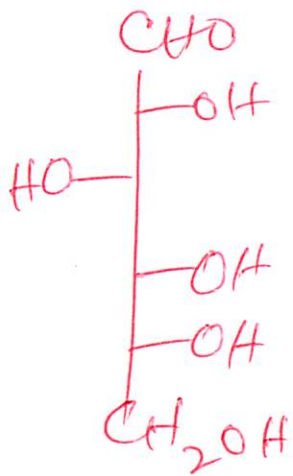
Phenol



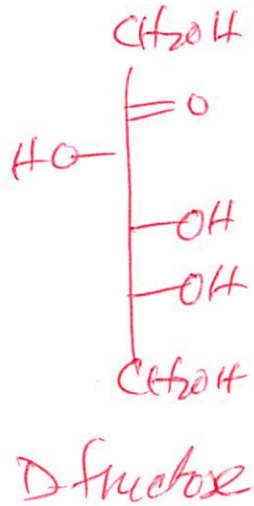
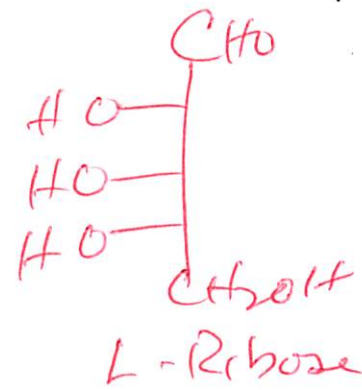
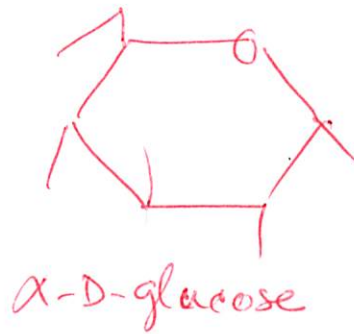
Resonance structure



16 2. Show structures for D-glucose (Fischer projection), α -D-glucopyranose, L-ribose, D-fructose.

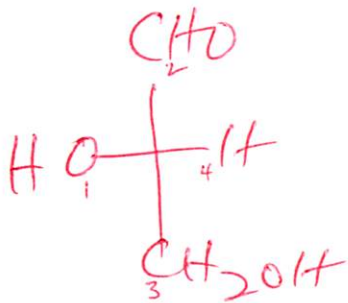


D-glucose

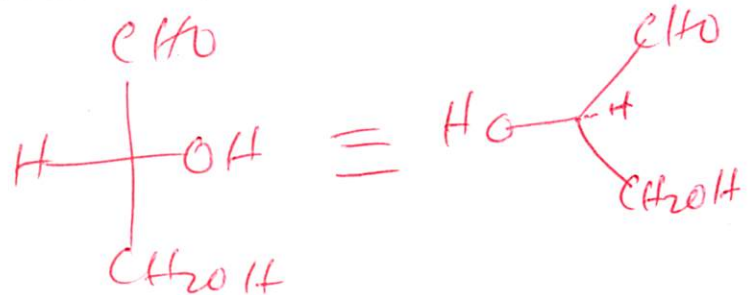


6 3. Glyceraldehyde is an aldotriose. Draw correct Fischer perspective diagrams for:

L-glyceraldehyde

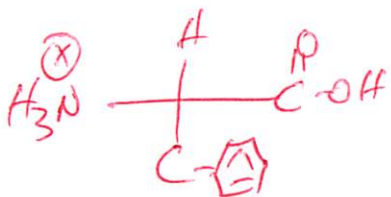


(R)-glyceraldehyde

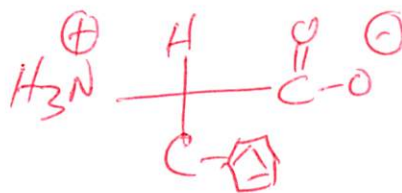


6 4. Using D-phenylalanine, show structures for this amino acid at the pH values shown below. Circle the zwitterion if there is one. Define zwitterion.

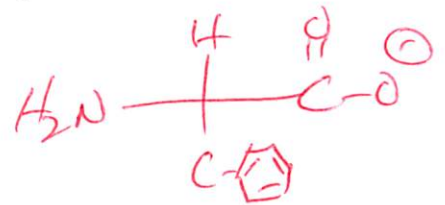
pH 1



pH 7



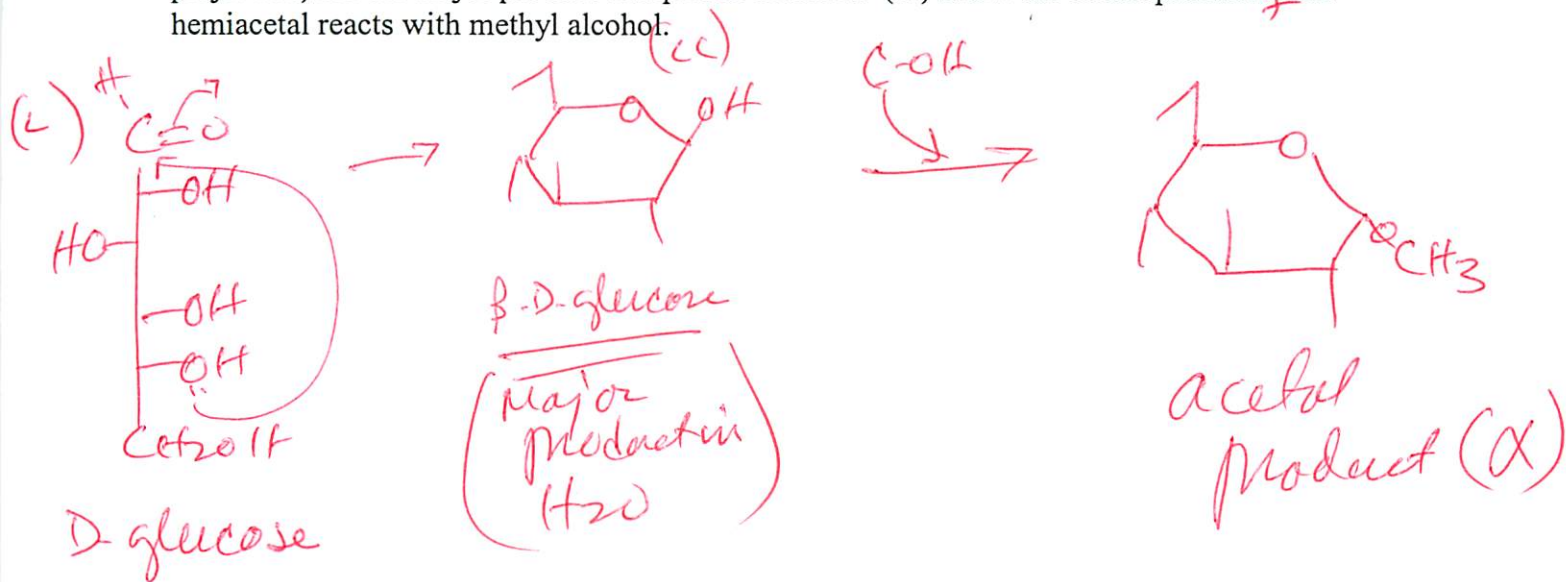
pH 12



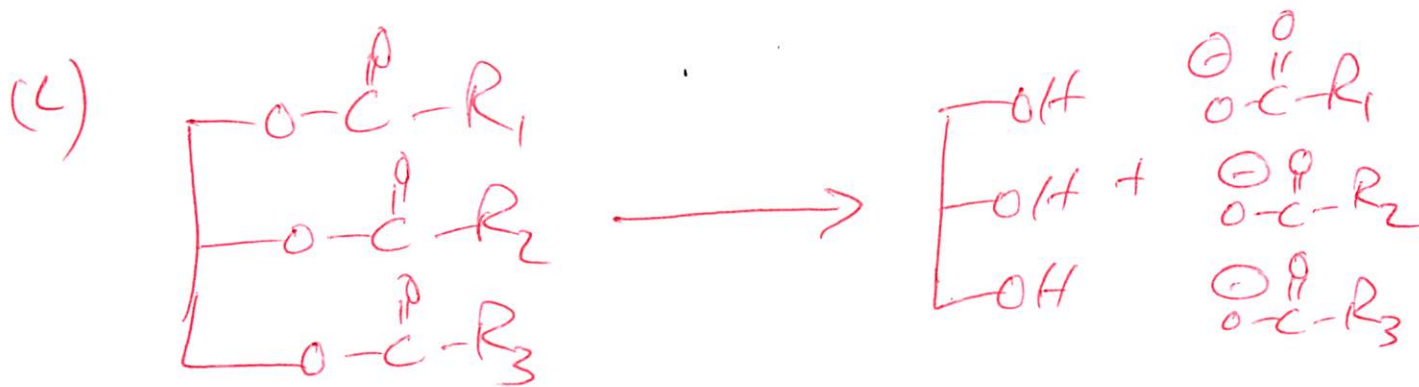
What is a Zwitterion (2 pts):

a discharged amino acid like Phe above @ pH 7

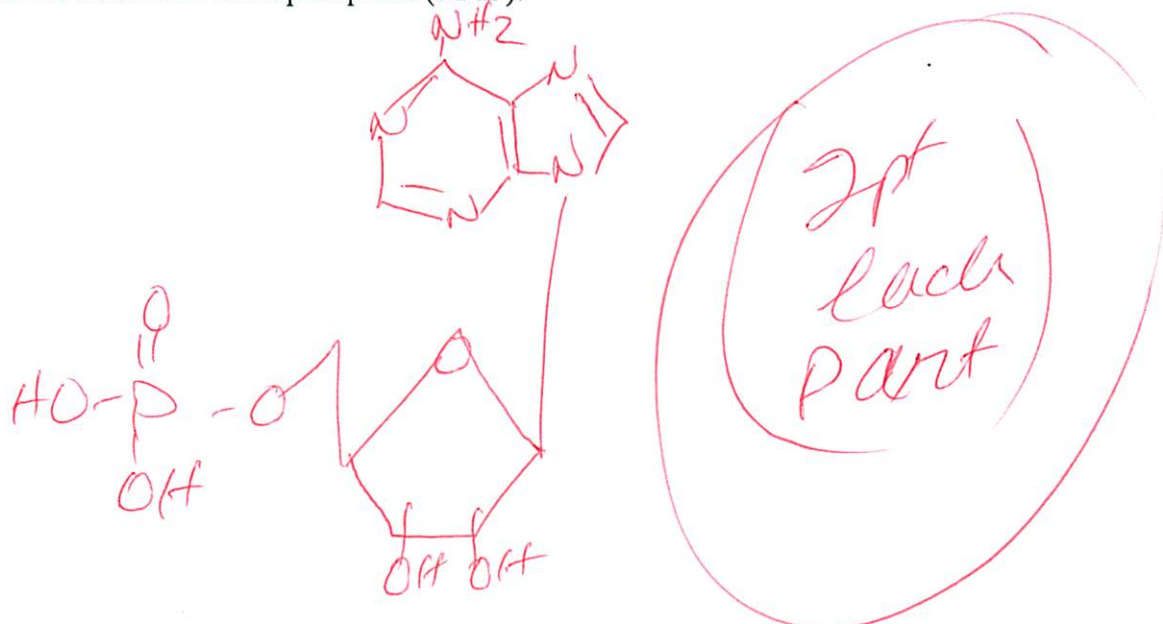
- 12 5. Starting with the Fischer projection of D-glucose, (i) Show the *reaction mechanism* (including arrows) required to form an intramolecular hemiacetal. (ii) Show the structure (Haworth projection) for the major product in aqueous solution. (iii) Show the acetal product if the hemiacetal reacts with methyl alcohol.



- 8 6. (i) Show the structure for a triacylglyceride (TAG). (ii) Show the products for saponification of this TAG, in correct ionization states.

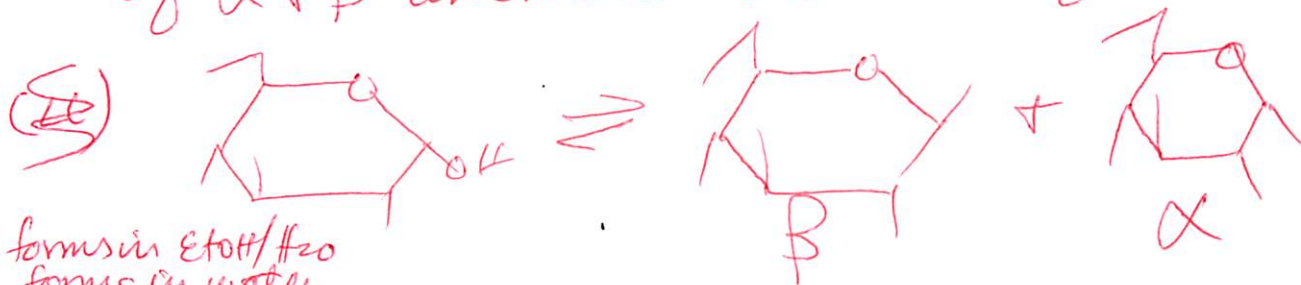


6 7. Show the structure for adenosine monophosphate (AMP).



6 8. (i) Define mutarotation. What happens when α -D-glucopyranose dissolves in water? Show structures. (ii) Show the recrystallization conditions by which either α -D-glucopyranose or β -D-glucopyranose can be prepared in pure crystalline form.

(i) when the α form undergoes mutarotation to a mixture of $\alpha + \beta$ anomers. Likewise for β



(ii) α forms in EtOH/H₂O
 β forms in water

8 8. (i) Show the reaction mechanism and product for reaction between p-fluoronitrobenzene (aryl fluoride) and sodium ethoxide. (ii) Show all possible resonance structures for the reaction intermediate for this nucleophilic aromatic substitution reaction.

