

Name: \_\_\_\_\_

Whittier College

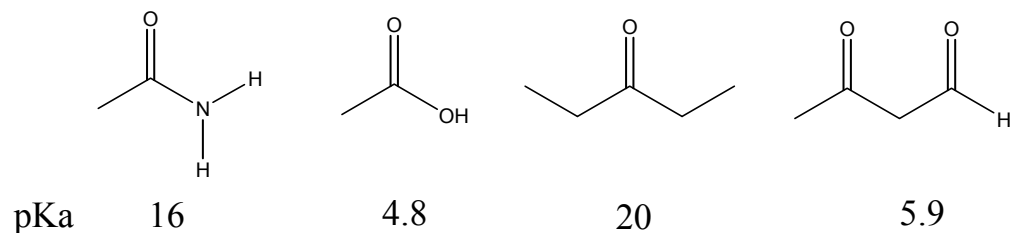
## Organic Chemistry: CHEM 231A

### Test # 2

120 Points Total

October 14, 2002

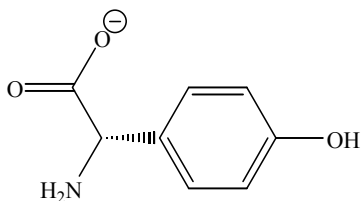
1. Consider the following molecules with the following pKa values: (28 points)



- 1a. What is an acid? What factors are involved in making an acid a strong acid? (8 pts)
- 1b. Identify and/or circle the MOST Acidic atom(s) for each molecule. (4 pts)
- 1c. Number the molecules in the order from most acidic (1) to least acidic (4). (2 pt)
- 1d. Explain the meaning of pKa. (2 pts)
- 1e. What characteristics of each molecule help us understand the relationship between the structure of the molecule and the pKa for EACH molecule. (12 points = 3 pts for each molecule)

2. Consider and explain thoroughly the following questions: (35 points)
- 2a. What is a base? What factors are involved in determining the strength of a base? (8 points)

- 2b. Consider anionic tyrosine (below). Circle the atom(s) that could be basic? (4 points)



- 2c. Which atom is the most basic? Explain why this is the case by comparing it to the other basic atoms. (8 points)

- 2d. Consider the following reaction:



- 2d1. What is a probable product for this reaction? (4 points)
- 2d2. What is the mechanism for this reaction? Make sure that you show the movement of electrons using arrows to explain the formation of the product. (5 points)

2d3. If the  $pK_b$  of tyrosine anion is 9.2 and the  $pK_a$  of acetic acid is 4.8. What is the overall equilibrium constant for the reaction? Are products or reactants favored? Explain. (6 Points)

3. Consider and explain thoroughly the following questions: (27 points)

3a. What is a nucleophile? Give an example, explain why it is a nucleophile and explain whether it is a good or bad nucleophile. (9 points)

3b. What is an electrophile? Give an example, explain why it is an electrophile and explain whether it is a good or bad electrophile. (9 points)

3c. Draw a specific example of a reaction between a nucleophile with an electrophile (does not need to involve your answer to question 3a or 3b). Do not use an acid / base reaction as an example. Draw a mechanism for this reaction. Explain how dipoles, developing charges and curved arrows are used to explain the reaction. (9 points)

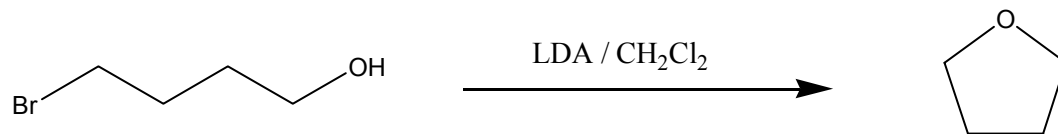
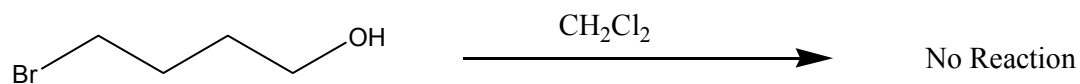
4. Consider the following molecules: (15 points)

4a. What is a conformer and why do we care? (4 points)

4b. Draw the Newman projection of three most stable conformations of the C3-C4 bond for 2,2,4-trimethylhexane. (6 points)

4c. Which is the most stable? Explain. (5 points)

5. Consider the following S<sub>N</sub>2 Reactions. (15 points)



5a. What is an S<sub>N</sub>2 reaction? (3 points)

5b. What is LDA and what role does it play in this reaction? (4 points)

5c. What is the mechanism for the reaction with LDA in it? (5 points)

5d. Draw an energy diagram for the reaction. (3 points)