

**Organic Chemistry 2**  
**First Examination**  
**February 29, 2008**  
**Prof. Malachowski**

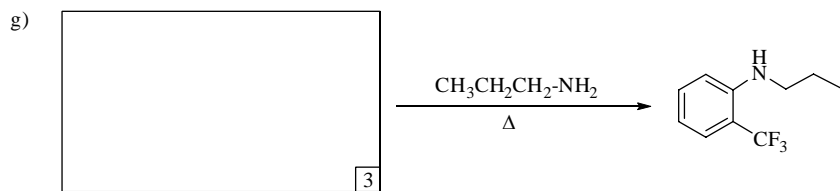
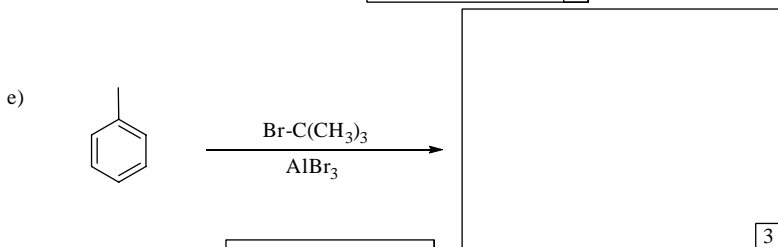
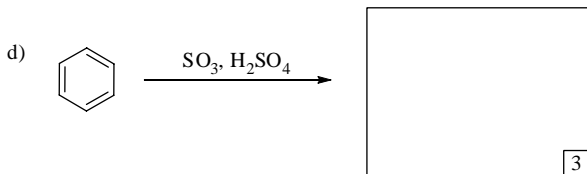
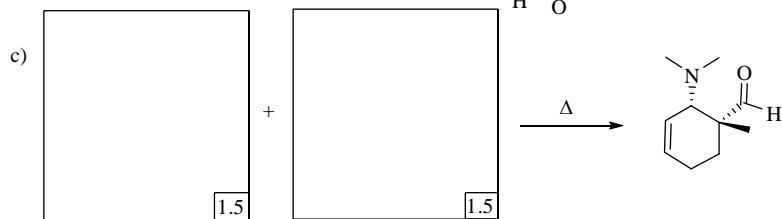
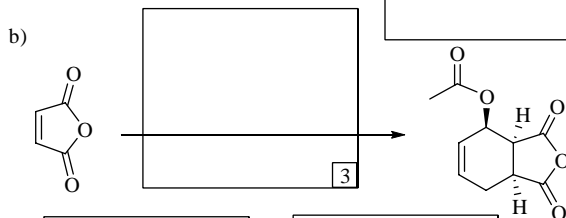
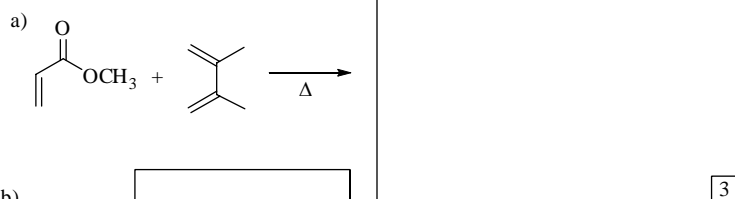
Name: \_\_\_\_\_

The examination has seven questions on four pages. The point values for each question are found with the question. Partial credit will be given where appropriate.

Read each question carefully before answering. Be certain you understand everything the question is requesting. Do the easy questions first. If questions appear confusing or exceedingly complex, then you may need to rethink the question. Keep in mind the intended examination topics.

In organic chemistry, hand-drawn pictures convey specific information. Be sure the drawing you have made conveys the essential information required to answer the question. Make certain that three-dimensional pictures display the correct atom arrangements. Don't forget to include lone pairs of electrons and formal charges when appropriate.

1. Complete the following reactions by providing the necessary information: starting material, reagent or major product. (points listed in corner of box)



h) Write an 'R' to the right of reactions that demonstrate regioselectivity and write an 'S' next to reactions that illustrate stereoselectivity. (3 pts.)

2. a) Draw the lowest energy molecular orbital for cyclopentadienyl anion's  $\pi$  system. (4 pts.)

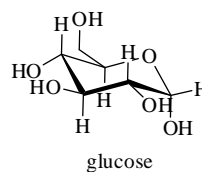
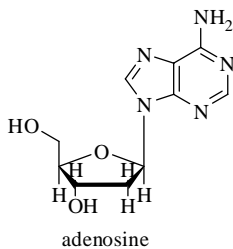
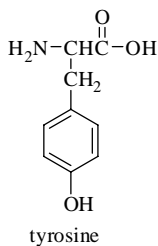
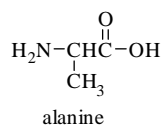


cyclopentadienyl anion

b) How many nodes in this molecular orbital? (2 pts.) \_\_\_\_\_

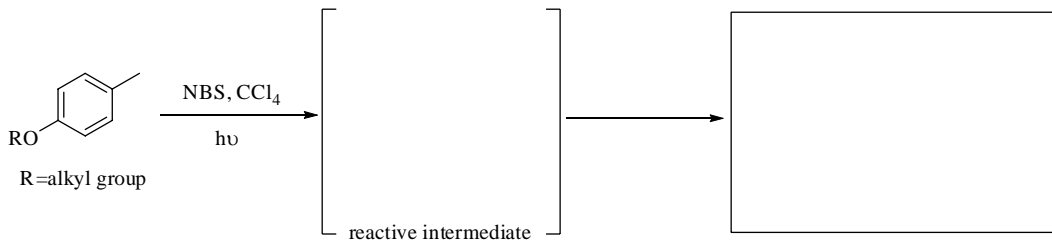
c) Is cyclopentadienyl anion aromatic, non-aromatic or anti-aromatic? (Circle one, 1 pt.)

3. a) Circle the name of the biomolecules shown below that you would expect to absorb UV/visible radiation. (6 pts. total)



4. A graduate student in Prof. Mallory's research group has recently performed the following reaction in the course of her research.

a) Draw the reactive intermediate and the expected product from the reaction. (5 pts.)



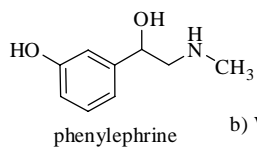
b) She actually also obtained a side product that was the result of electrophilic aromatic bromination. As described in class for substituted benzenes, the electrophilic aromatic substitution with bromine can be regioselective. Draw the two regioisomeric products that could result in the boxes below. (4 pts.)



regioisomeric products

c) Based on our discussions of these reactions with substituted benzenes, we would expect one to be the major product. Write 'major' in the box of the product that you believe would be the major product. (3 pts.)

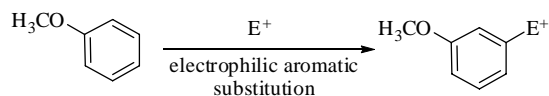
5. In an effort to address the methamphetamine drug crisis, Pfizer pharmaceutical company has promoted a replacement for pseudoephedrine called phenylephrine.



a) You will recall that "kitchen" chemists were able to easily make methamphetamine by removing the benzylic hydroxyl or alcohol group of pseudoephedrine. Does phenylephrine have a benzylic hydroxyl or alcohol group? If so, circle this group on the phenylephrine structure. (3 pts.)

b) Why was it so easy to remove the benzylic hydroxyl or alcohol group from pseudoephedrine? (4 pts.)

You have just graduated from Bryn Mawr College's chemistry program and, of course, you are a 2008 first round draft pick from the chemistry graduate's lottery. Pfizer has drafted you to develop a new synthesis of phenylephrine to meet the growing consumer demand. A co-worker of yours at Pfizer graduated from the on-line University of Phoenix and proposes the following reaction to start the synthesis.



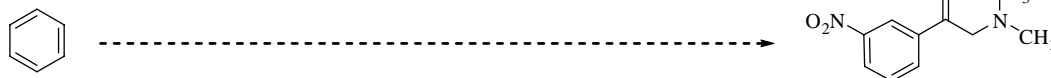
c) What's wrong with this reaction? (3 pts.)

d) Fortunately, you have a chance to warn your co-worker about this ill-concieved reaction before he's fired. He has come to you to ask what the name of his aromatic starting material is because he can't remember. What is the common name of the benzene derivative that he wants to use? (2 pts.)

e) You alert him to the folly of his ways and he is still confused. You elaborate by drawing two resonance structures that show him the most nucleophilic carbons on his aromatic starting material. Remember to include curved electron flow arrows to make it very clear! (8 pts.)



f) You propose an alternative starting with benzene and making the product shown on the right. Draw the reactions, including reagents and products, that will get you there. You may use any inorganic or organic reagents. (8 pts.)



6. Devise a synthesis for the product on the right from the starting material on the left. You may use any inorganic or organic reagents. (8 pts.)

a)



7. Draw the curved-arrow electron flow mechanism of the following reaction. Be sure to include ALL important resonance contributors for reaction intermediates. (15 pts.)

