

**Organic Chemistry 2**  
**Second Examination**  
**March 25, 2005**  
**Prof. Malachowski**

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

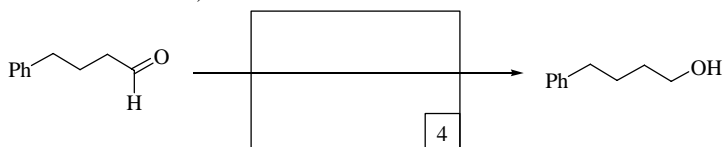
The examination has five questions on four pages. The point values for each question are found with the question. Partial credit where appropriate will be given.

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.

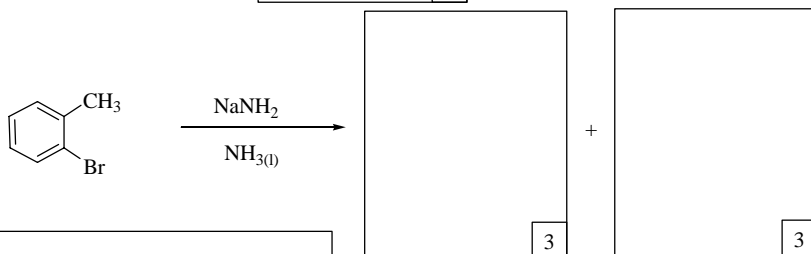
In organic chemistry, hand-drawn pictures convey specific information. Be sure the drawing you have made conveys the essential information required to answer the question. Make certain that three-dimensional pictures display the correct atom arrangements. Don't forget to include lone pairs of electrons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

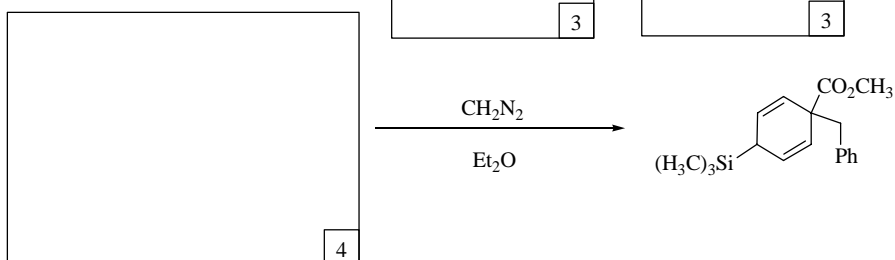
a)



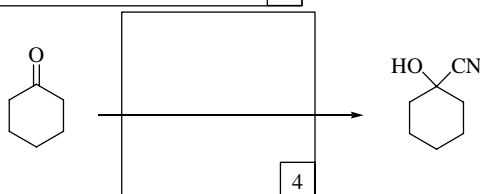
b)



c)

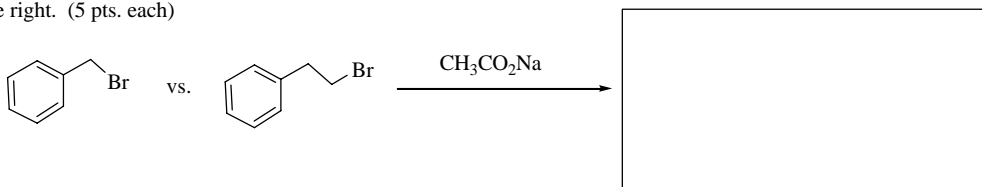


d)

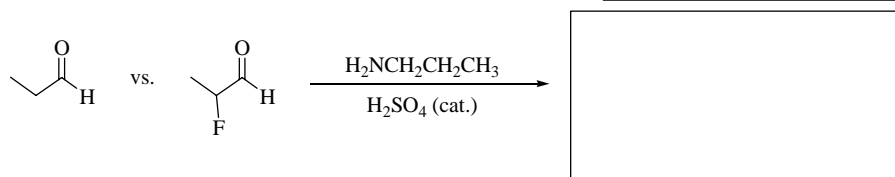


2. Circle the starting material that would react faster with the reagents shown and provide the product of this reaction in the box to the right. (5 pts. each)

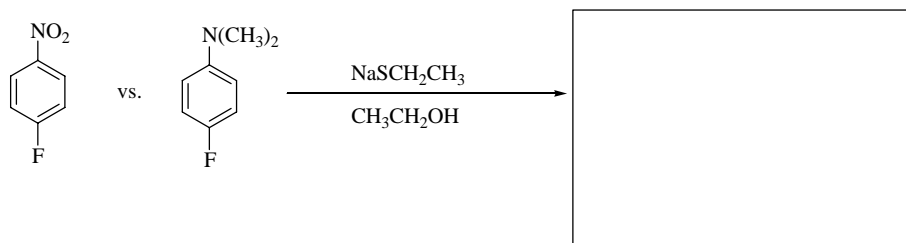
a)

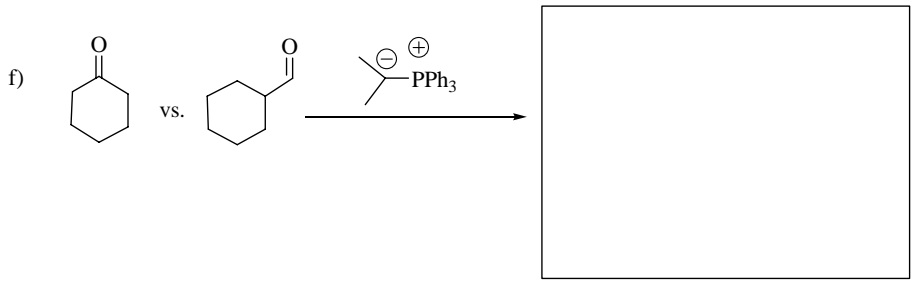
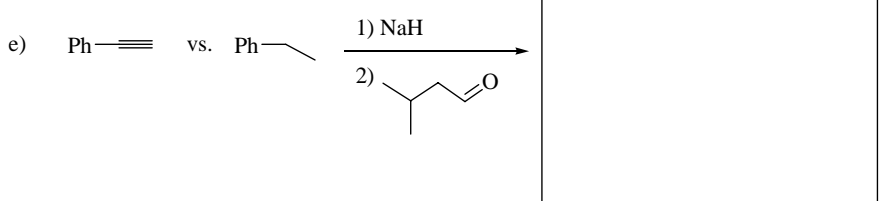
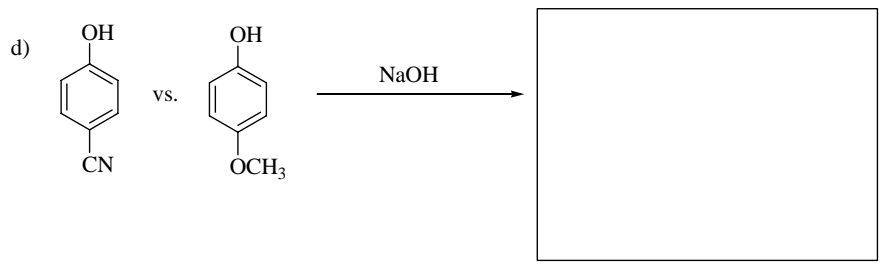


b)

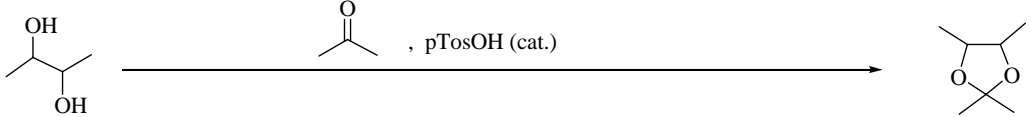


c)



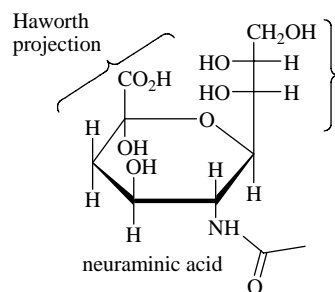


3. a) Draw the curved-arrow electron flow mechanism of the following reaction. (12 pts.)



b) What type of reaction mechanism is depicted in your answer to part a? (3 pts.)

4. Neuraminic acid is a nine carbon sugar that is cleaved from a polysaccharide by an enzyme in the influenza virus. The cleavage allows the virus to be released from infected cells, thus spreading the virus in the respiratory tract. The structure of neuraminic acid shown below is taken from a drug reference book. The ring structure is drawn as a Haworth projection and the side chain is drawn as a Fischer projection. Answer the following questions about neuraminic acid based on our discussions of carbohydrates.



a) What is the configuration of the chiral carbons at positions 7 and 8 of neuraminic acid? (2 pts. each)

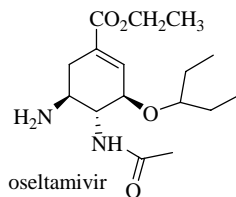
configuration at C-7: \_\_\_\_\_

configuration at C-8: \_\_\_\_\_

b) Draw the most stable chair structure of neuraminic acid. You should draw the side chain in the thermodynamically most stable conformation, but you don't need to worry about correctly depicting the stereochemistry of the chiral centers in the side chain. (10 pts.)

c) Is neuraminic acid a **ketose** or an **aldose** ? Circle one. (3 pts.)

d) In 1999, the drug called oseltamivir was approved for the treatment of influenza virus. Oseltamivir mimics neuraminic acid and inhibits the influenza enzyme that causes the virus to spread. There are several parts of oseltamivir which look similar to neuraminic acid and enable the drug to fool the enzyme. For instance, oseltamivir contains a six member ring like neuraminic acid; however oseltamivir's six member ring is more stable than the six member ring of neuraminic acid. This greater stability is important for drug activity and stability. Why is the ring of neuraminic acid less stable than the ring of oseltamivir? (6 pts.)



5. Devise a synthesis for the product on the right from the starting material on the left. You may use any inorganic or organic reagents. (7 pts. each)

