

Name \_\_\_\_\_

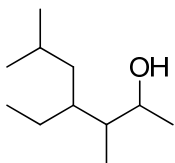
**Exam 1**  
**Chemistry 52**  
**July 8, 2013**  
**65 minutes**

Do not open or begin this exam until instructed. This exam consists of 5 pages plus the cover page and one blank piece of paper for scratch work. Before starting the exam, check to make sure that you have all of the pages. The exam has a total of 100 points and includes 10 questions. Only legible answers written on the exam will be considered for grading. Work on scratch paper will not be considered. All pertinent information needed for the exam is given. Notes, textbooks, and electronic communication devices are not permitted. This exam is administered under the Dartmouth College Honor Principle.

**Use your time wisely.**

<b>Page Number</b>	<b>Value</b>	<b>Points Awarded</b>
1	17	
2	24	
3	21	
4	18	
5	20	
Total	100	

1. a. (3 points) Provide an IUPAC accepted name for the following compound.



b. (6 points, 2 each) Provide the structure of each of the following compounds.

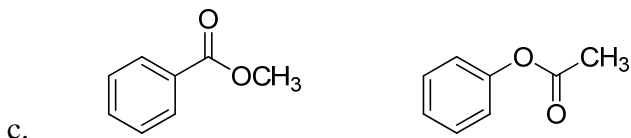
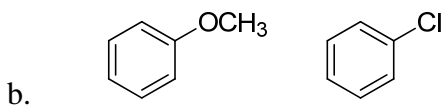
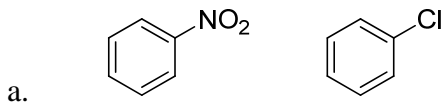
aniline

ethylene oxide

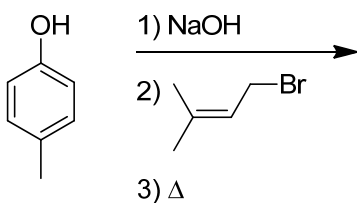
a mercaptan

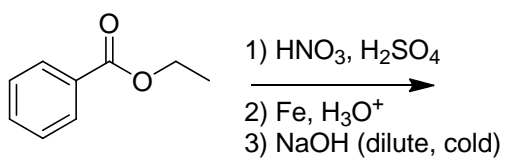
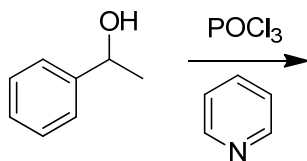
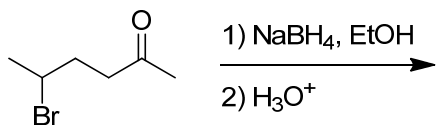
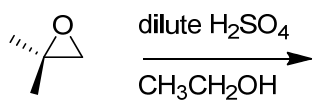
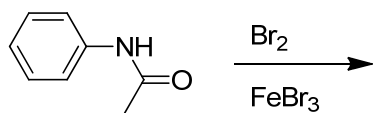
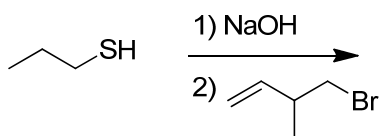
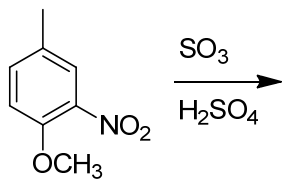
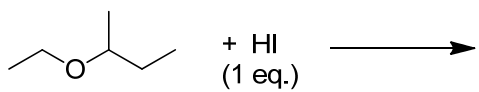
2. (2 points) A reaction which can be described as one in which all bonds change in a single step, the reaction proceeds through a cyclic transition state and is characterized by a  $\sigma$ -bond migrating from one end of a conjugated  $\pi$ -system to the other is a \_\_\_\_\_ reaction.

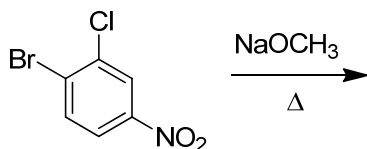
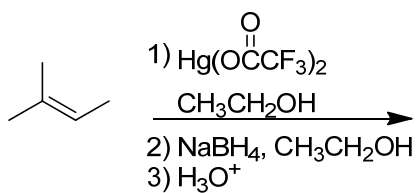
3. (3 points, 1 each) For each pair of reagents, circle the one that will react faster in an electrophilic aromatic substitution reaction.



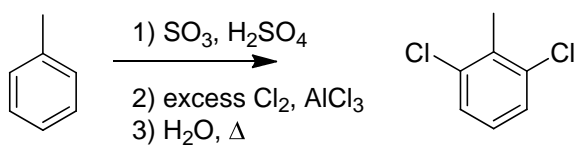
4. (33 points, 3 each) Provide the major organic product for each of the following reactions.



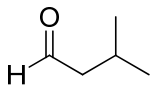




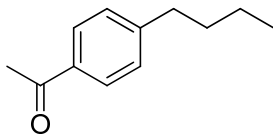
5. (5 points) What is the purpose of the first step in the following reaction sequence?



6. (10 points) Provide a synthesis for the following target. Organic reagents of 3 carbons or less in addition to any inorganic reagents and solvents are acceptable starting materials. As always, if you wish to use organometallic reagents, you must synthesize them. While it is acceptable to use retrosynthetic analysis, write your final reaction sequence in the forward direction.



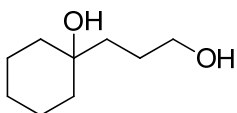
7. (8 points) Provide a synthesis of the target compound from benzene. You may use any additional reagents you need. Clearly separate the reagents used for each step of these multi-step syntheses. You may use a retrosynthetic analysis if you wish, but be sure to write your final answer in the forward direction.



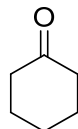
8. When a mixture containing one mole each of the three dimethylbenzenes (*o*-, *m*-, and *p*-xylene) is treated with one mole of chlorine in the presence of a Lewis acid catalyst, one of the three hydrocarbons is monochlorinated in 100% yield, whereas the other two remain completely unreacted.
- (1 point) Which isomer reacts?
  - (2 points) Briefly explain why only that isomer reacts.
  - (7 points) Provide a mechanism for the main product of the reaction assuming that  $\text{AlCl}_3$  is the Lewis acid catalyst.

9. (10 points) Provide a synthesis for the following diol. Cyclohexanone and any organic reagents containing three carbons or less in addition to any inorganic reagents and solvents are acceptable starting materials.

Target:



Cyclohexanone:



10. (10 points) Provide the products and a complete electron-pushing mechanism for the following reaction. Be sure to include any by-products as they are formed and show arrows for every covalent bond change. Watch your formal charges, too. Do not combine steps!!

