

# KEY

CHEM 3331, Professor Zhang, Spring 2012  
First hour exam, Feb 14, 2012

Printed Name: \_\_\_\_\_ Student ID: \_\_\_\_\_

Recitation TA Name: \_\_\_\_\_ Recitation day and time: \_\_\_\_\_

Scores:

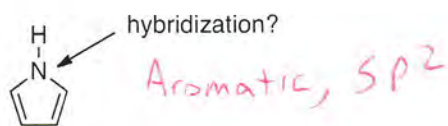
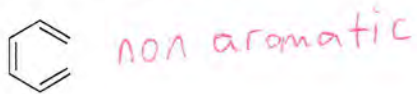
- 1)
  - 2)
  - 3)
  - 4)
  - 5)
- 

CU Honor Code Pledge: On my honor, as a University of Colorado at Boulder Student, I have neither given nor received unauthorized assistance.

This is a closed-book exam. The use of notes, models, calculators, scratch paper will not be allowed during the exam. Please put all your answers on the test. Use the backs of the pages for scratch.

1A							8A
1 H							2 He
	2A	3A	4A	5A	6A	7A	
3 Li	4 Be	5 B	6 C	7 N	8 O	9 F	10 Ne
11 Na	12 Mg	13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
							35 Br
							53 I

- 1) (20 pts) a) Indicate whether the following **five (5)** molecules are aromatic, non-aromatic, or anti-aromatic. Assume all the molecules are planar. (2 pts each).  
 b) For the **last two (2)** molecules, also provide the hybridization of the atoms indicated with an arrow (2 pts each).



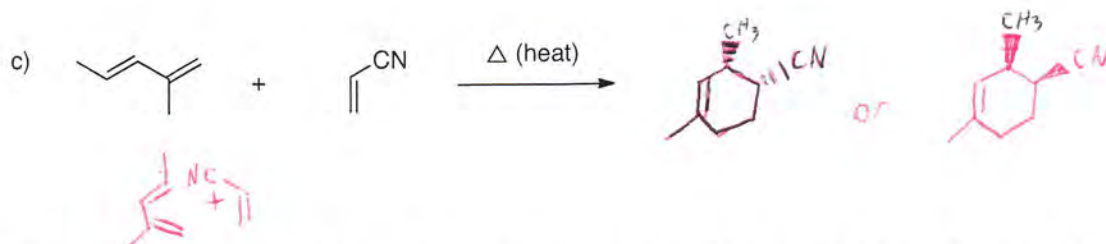
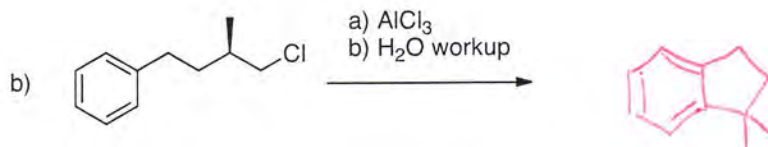
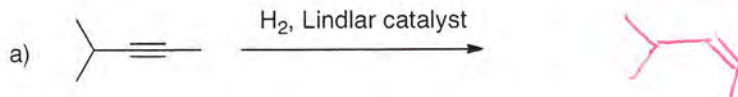
- b) Cyclopropene (**1**) and cyclopentadiene (**2**) differ greatly in their acidity. In the following Bronsted acid-base reactions of **1** and **2**, the compounds are acting as acids (*n*-BuLi as base). Circle the compound that has the larger  $K_{\text{equ}}$  going left to right (i.e. the stronger acid). (3 pts)



- d) **Briefly** explain your answer to part c) above (3 pts).

*Upon loss of  $H^+$ , cyclopentadiene's anion is delocalized in a very stable aromatic molecule. This makes cyclopentadiene's proton much more labile.*

2) (20 pts) Give the single major product of each of the following reactions, carefully showing stereochemistry if appropriate. If a racemate is formed, show only one enantiomer, and label it "rac". (4 pts each)



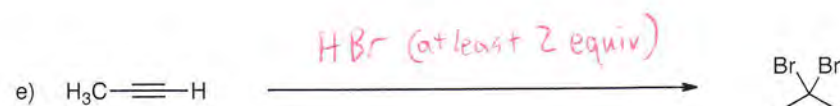
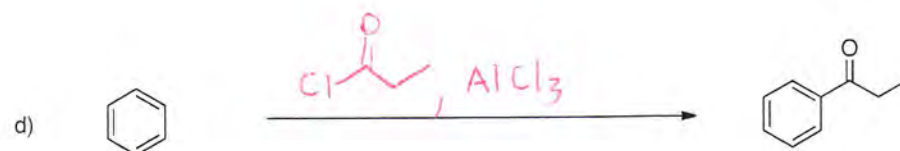
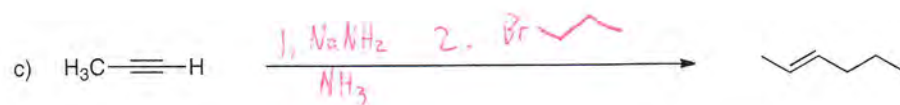
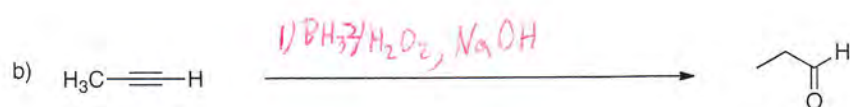
d) i) Provide the major and minor products expected from the reaction shown below and indicate which is major and which is minor. (6 pts)

ii) Is this reaction under kinetic or thermodynamic control? (2 pts)

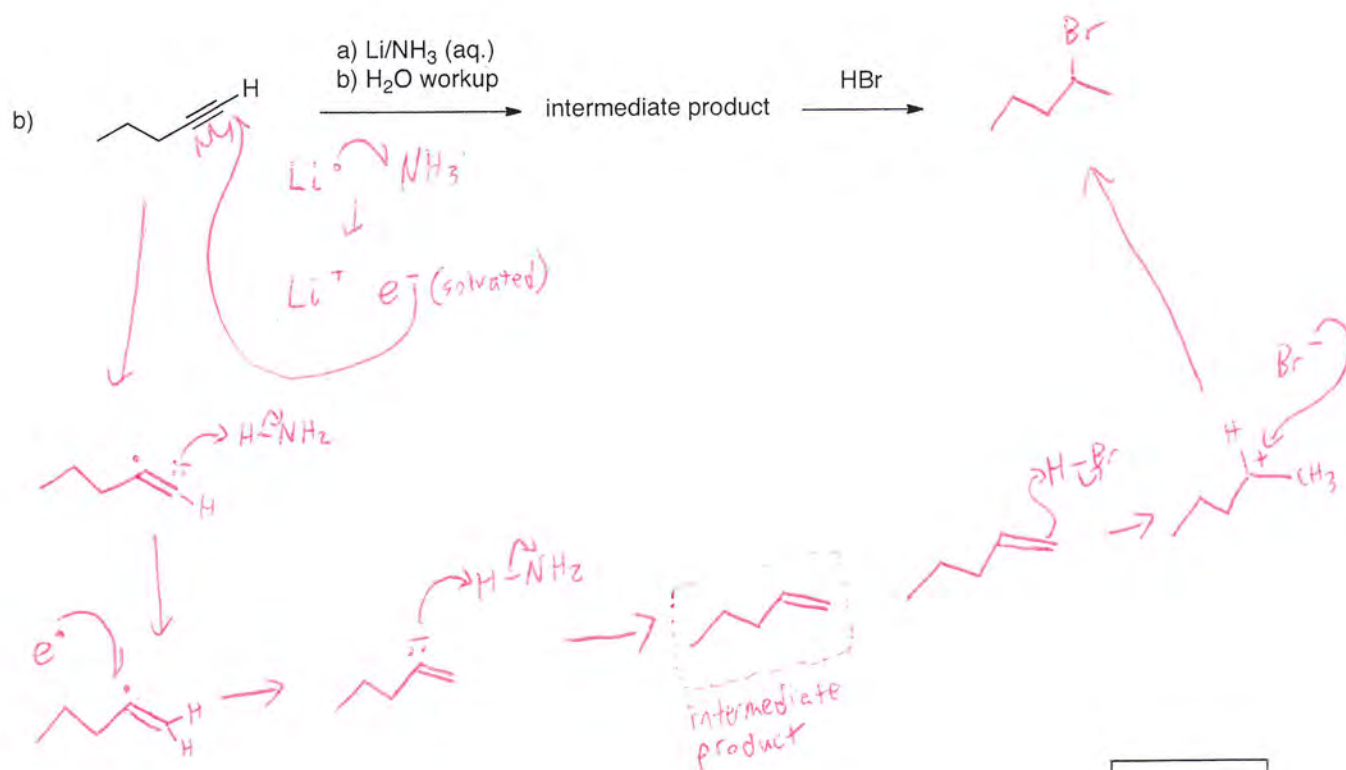
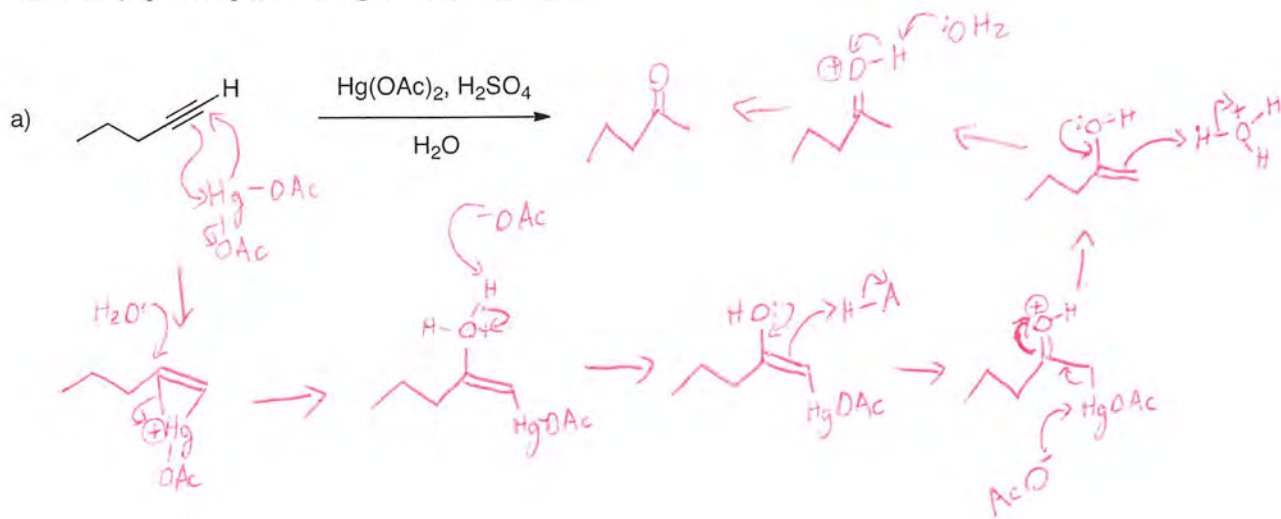


This reaction is under Kinetic control

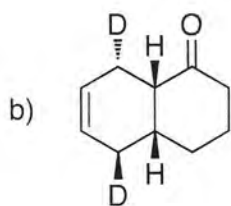
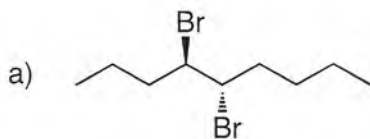
3) (20 pts) Propose reagents for accomplishing the following transformations. NOTE: more than one step may be required! Try to make your synthesis efficient (i.e. the desired product should be the major product, and generally a shorter synthesis is better than a longer one). You must use the starting material given; you may use any other reagents you need.



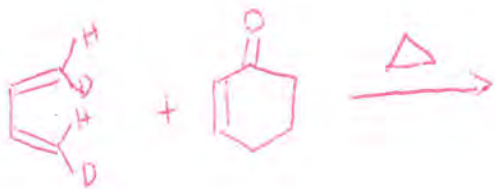
4) (18 pts) Provide the products and mechanisms for the following **two (2)** reactions. Show every intermediate with the proper charges and all the arrows required for each step of the reaction. (3 pts for product, 6 pts for mechanism).

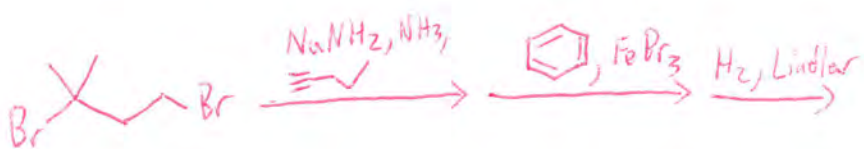
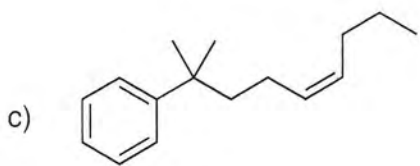


5) (22 pts) Propose a synthesis of each of the following **three (3)** targets, starting with benzene and/or any other organic molecules containing **six (6)** carbons or less. You may use any necessary inorganic reagents. Try to make your synthesis efficient (i.e. the desired product should be the major product, and generally a shorter synthesis is better than a longer one). More than one step may be required.



( D, also known as  $^2\text{H}$ , is the isotope of  $^1\text{H}$ )





or

