

CHEM 3331, Professor Zhang, Spring 2016
First hour exam, Feb 9, 2016

Printed Name: Key Student ID: _____

Recitation TA Name: _____ Recitation day and time: _____

Scores:

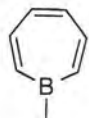
- 1)
 - 2)
 - 3)
 - 4)
 - 5)
-

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).



Aromatic.



antiaromatic



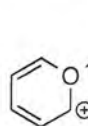
non aromatic



hybridization?

sp^3

non-aromatic

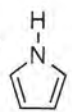


hybridization?

sp^2

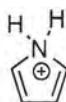
aromatic.

- c) Pyrrole (1) and pyrrolidine (2) differ greatly in their basicity. In the following Bronsted acid-base reactions of 1 and 2, the compounds are acting as bases (H_3O^+ is the acid). Circle the compound that has the larger K_{equ} going left to right (i.e. the stronger base). (3 pts)



+

H_3O^+



+

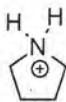
H_2O

1



+

H_3O^+



+

H_2O

2

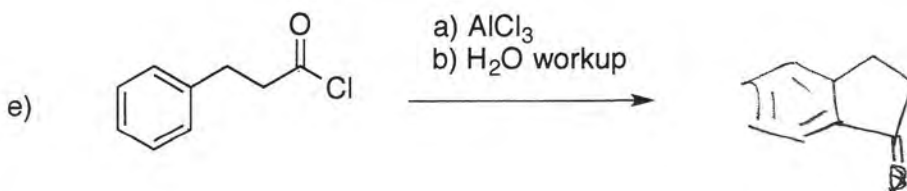
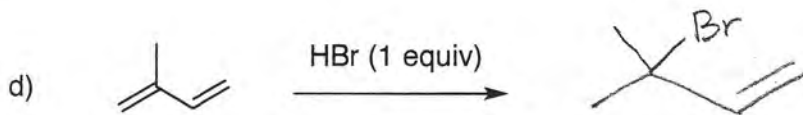
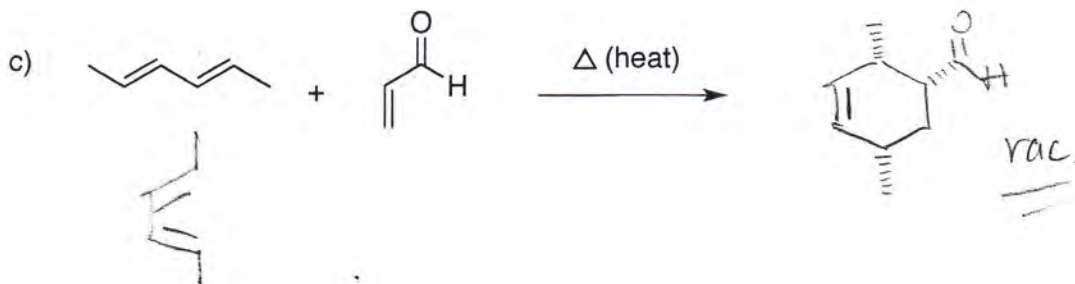
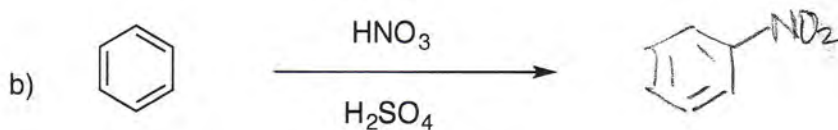
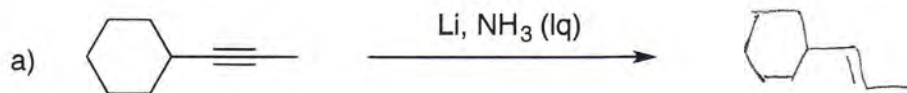
- d) Briefly explain your answer to part c) above (3 pts).

In Compound 1, N atom is sp^2 hybridized, and its lone pair participates in conjugation, more stable, thus weaker base.

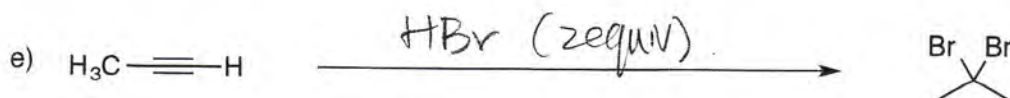
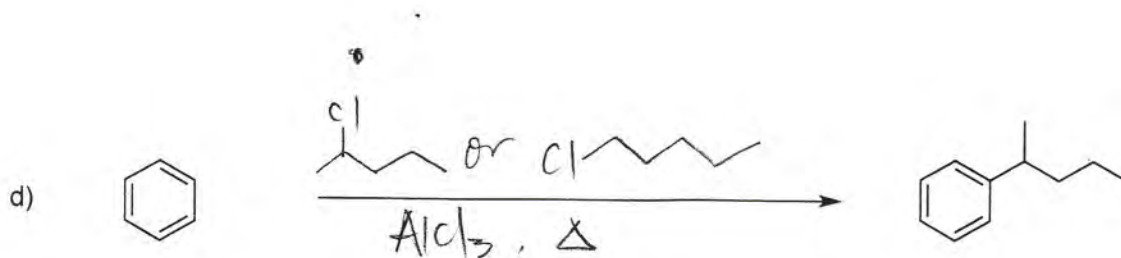
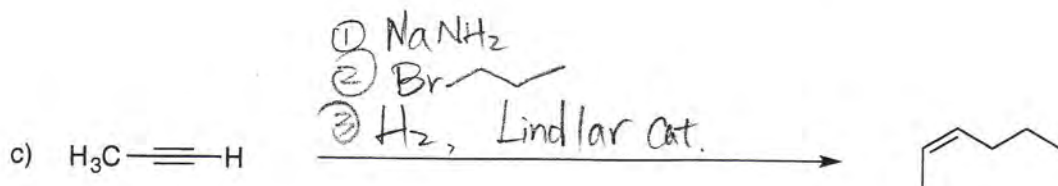
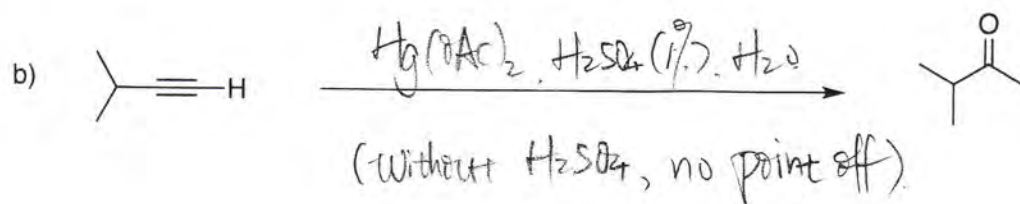
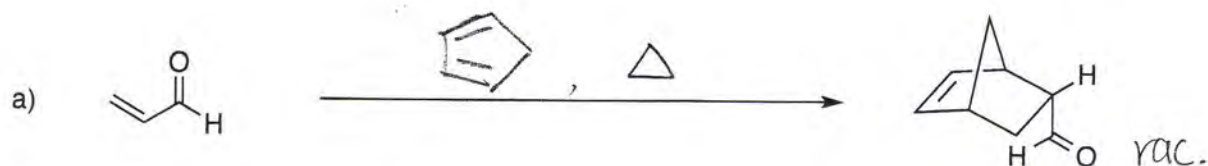
In Compound 2, N atom is sp^3 , lone pair more available, stronger base.



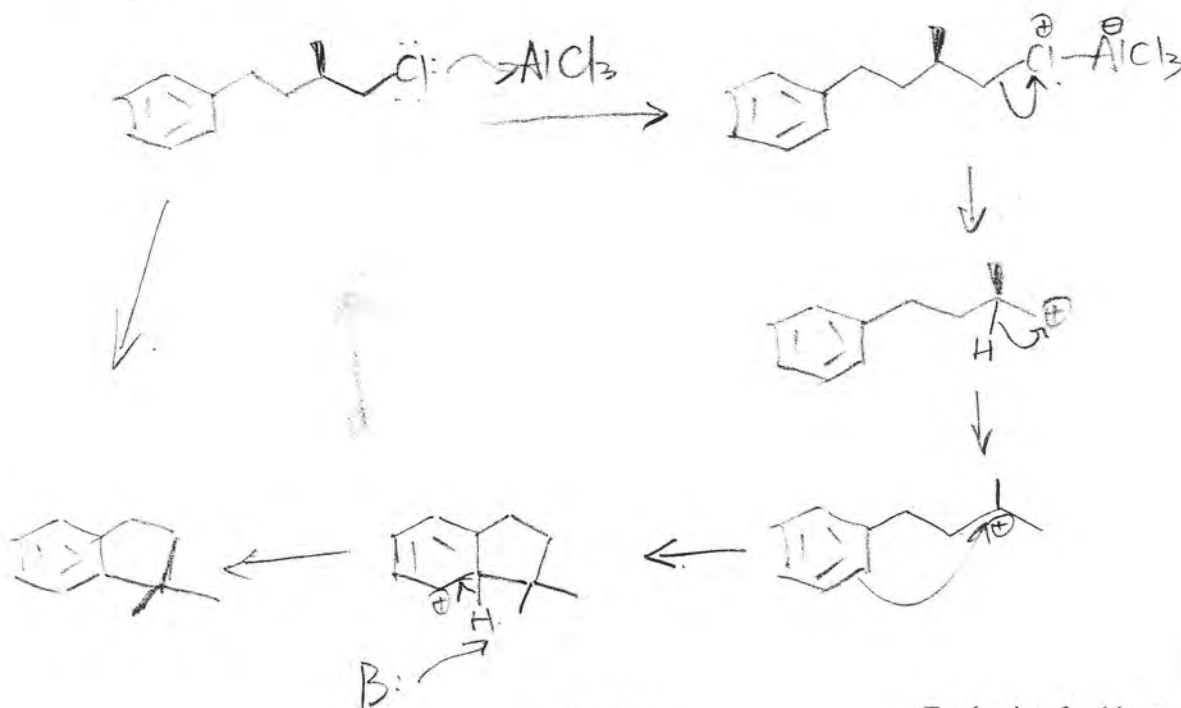
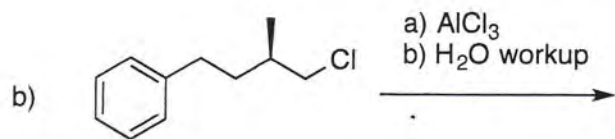
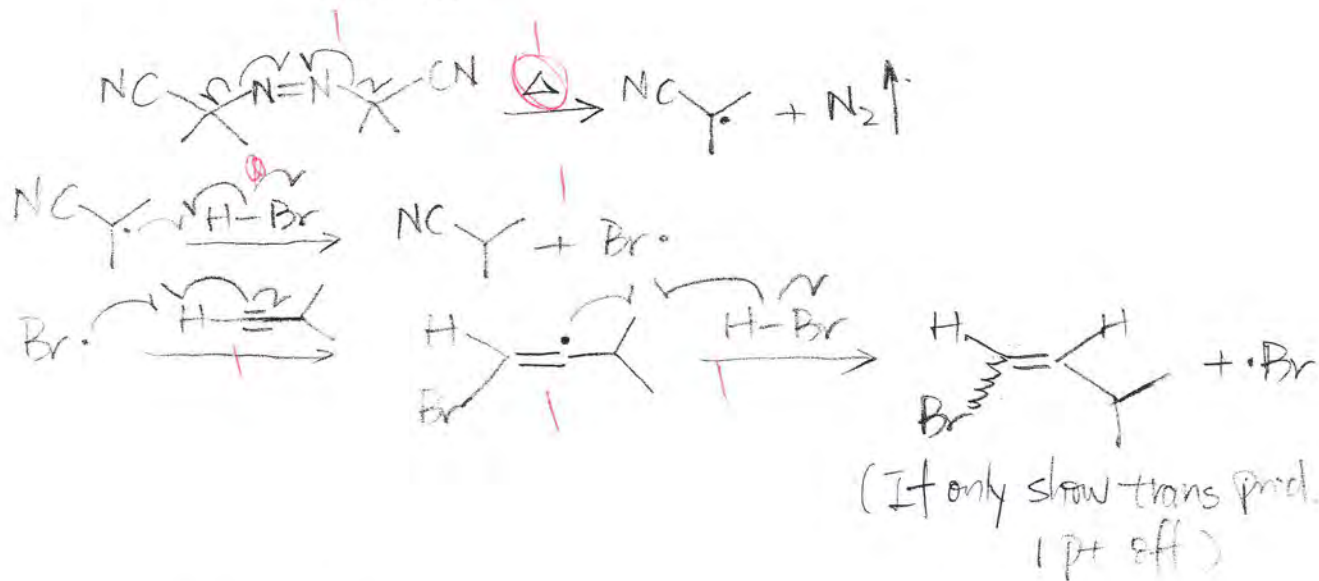
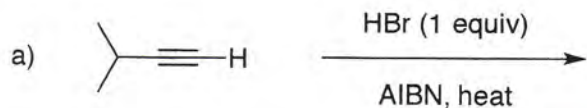
2) (20 pts) Give the single major product of each of the following reactions, carefully showing stereochemistry if appropriate. If a racemate is formed, show only one enantiomer, and label it "rac". (4 pts each)



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.

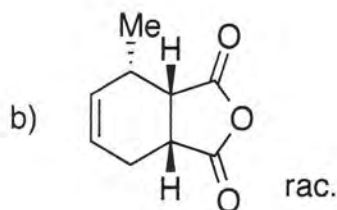
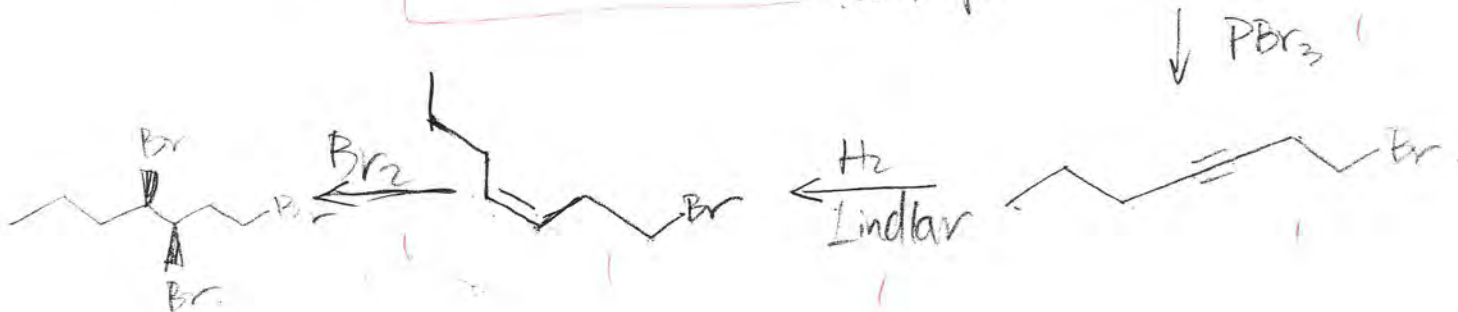
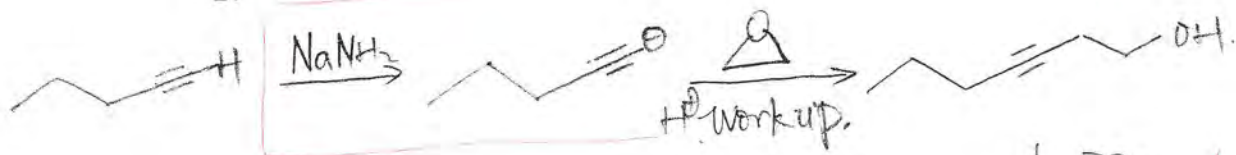
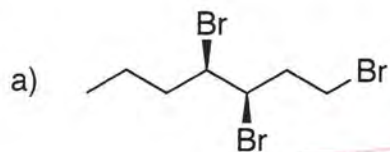


4) (18 pts) Provide the products and mechanisms for the following **two (2)** reactions. Show every intermediate with the proper changes and all the arrows required for each step of the reaction. (3 pts for product, 6 pts for mechanism).

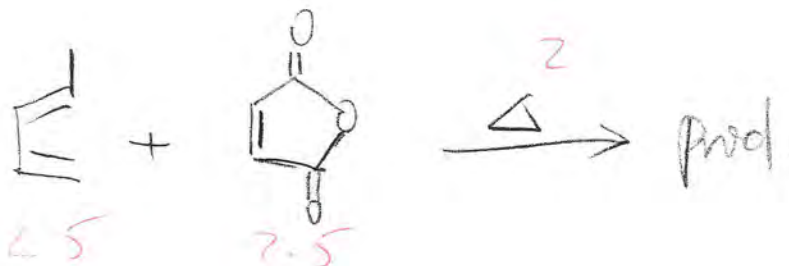


5) (22 pts) Propose a synthesis of each of the following **three (3)** targets, starting with benzene and/or any other organic molecules containing **five (5)** carbons or less. You may use any necessary inorganic reagents. Try to make your synthesis efficient (i.e. the desired product should be the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

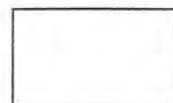
0



7



ye



c)

