Name_____ Identification # ___ ___ ___ ___

Section 1: Multiple Choice

Fill in your answers using the blue scantron sheet provided by the Testing Center. Be sure to fill out the top portion of the scantron and to use a No. 2 pencil. *For this section, only the scantron portion will be graded*.

Page	PTS	
Section 1 / 78		
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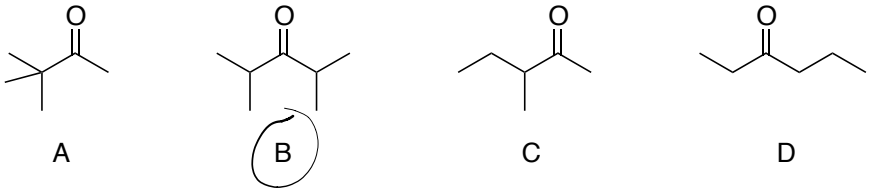
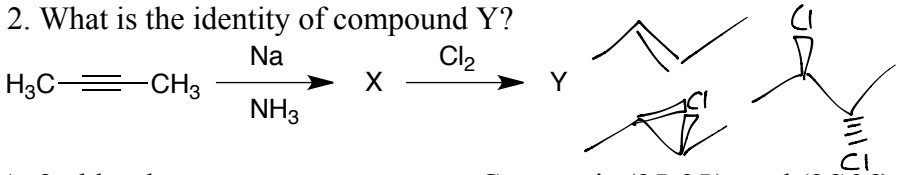
TOTAL		

13 problems, 6 pts each, 78 pts total

1. Which of the following ketones **cannot** be made by treating an alkyne with $HgSO_4$, H_2SO_4 and H_2O?



2. What is the identity of compound Y?

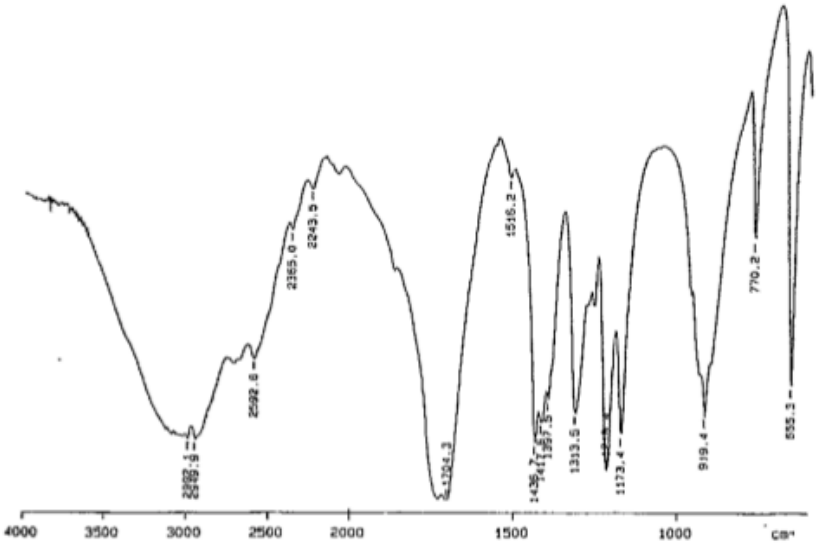


A. 2-chlorobutane
B. *meso*-2,3-dichlorobutane
C. racemic (2*R*,3*R*)- and (2*S*,3*S*)-2,3-dichlorobutane
D. 2,3-dichloro-2-butene

3. The mass spectrum of compound A has a peak at 112 and a peak at 114. The peak at 112 is three times taller than the peak at 114. Compound A must contain

A. two bromine atoms
B. one bromine atom
C. two chlorine atoms
D. one chlorine atom

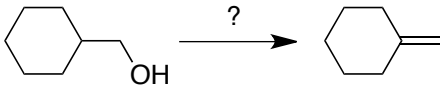
4. The IR spectrum of compound Z is shown below. What class of compounds does compound Z belong to?



A. alcohol
B. aldehyde
C. ketone
D. carboxylic acid

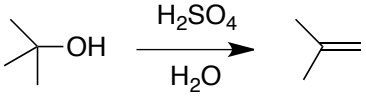
Name_____ Identification # ___ ___ ___ ___

5. Which of the following would be the **best** method for performing the reaction shown below?



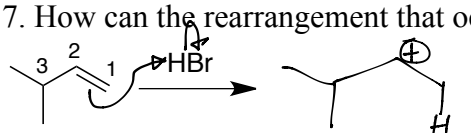
A. HBr
B. $NaOCH_2CH_3$
C. $POCl_3$, pyridine
D. (1) Br_2, (2) NaOH

6. What is the rate-determining step in the acid-catalyzed dehydration of 2-methyl-2-propanol?



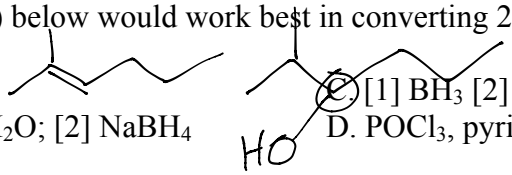
A. Protonation of the alcohol to form a positively-charged oxonium ion.
B. Loss of water from the oxonium ion to form a carbocation.
C. Loss of a β-hydrogen from the carbocation to form the alkene.
D. The simultaneous loss of a β-hydrogen and water from the oxonium ion to form the alkene.

7. How can the rearrangement that occurs in the following reaction be described?



A. A hydride shift from C-2 to C-1.
B. A hydride shift from C-3 to C-2.
C. A proton shift from C-2 to C-1.
D. A methyl shift from C-3 to C-2.

8. Which reagent(s) below would work best in converting 2-methyl-2-hexene into 2-methyl-3-hexanol?



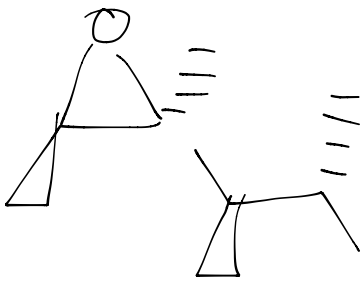
A. H_2SO_4, H_2O
B. [1] $Hg(OAc)_2$, H_2O; [2] $NaBH_4$
C. [1] BH_3 [2] H_2O_2, NaOH, H_2O
D. $POCl_3$, pyridine

9. A compound X with molecular formula C_8H_{12} and no triple bonds reacts with H_2 and Pd/C to give a new compound having molecular formula C_8H_{14}. Which of the following statements about X is true?

A. Compound X has 3 rings
B. Compound X has 1 ring and 2 double bonds
C. Compound X has 2 rings and 1 double bond.
D. Compound X has 3 double bonds.

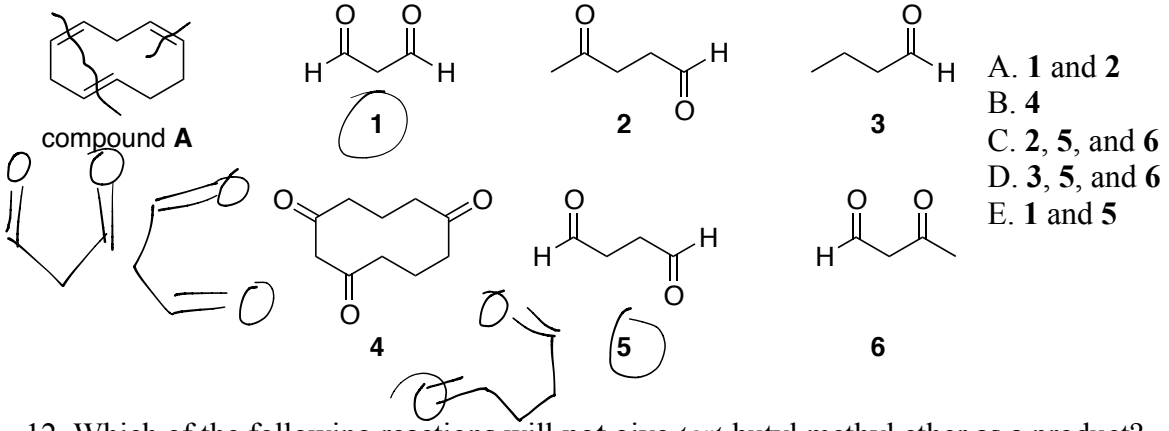
10. Which of the following would be the best method for performing the reaction shown below?

A. OsO_4
B. [1] Br_2, H_2O (excess); [2] NaH
C. [1] mCPBA; [2] H_2O, NaOH
D. $NaCr_2O_7$, H_2SO_4, H_2O



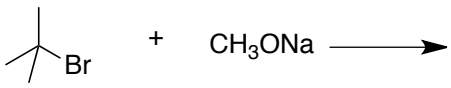
11. Which of the following products is (are) formed by ozonolysis of compound **A**, followed by treatment with dimethyl sulfide?

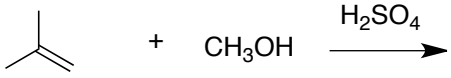
Name_____ Identification # ___ ___ ___ ___

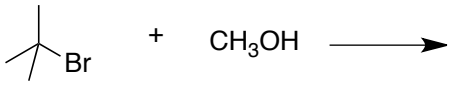


A. **1** and **2**
B. **4**
C. **2**, **5**, and **6**
D. **3**, **5**, and **6**
E. **1** and **5**

12. Which of the following reactions will **not** give *tert*-butyl methyl ether as a product?

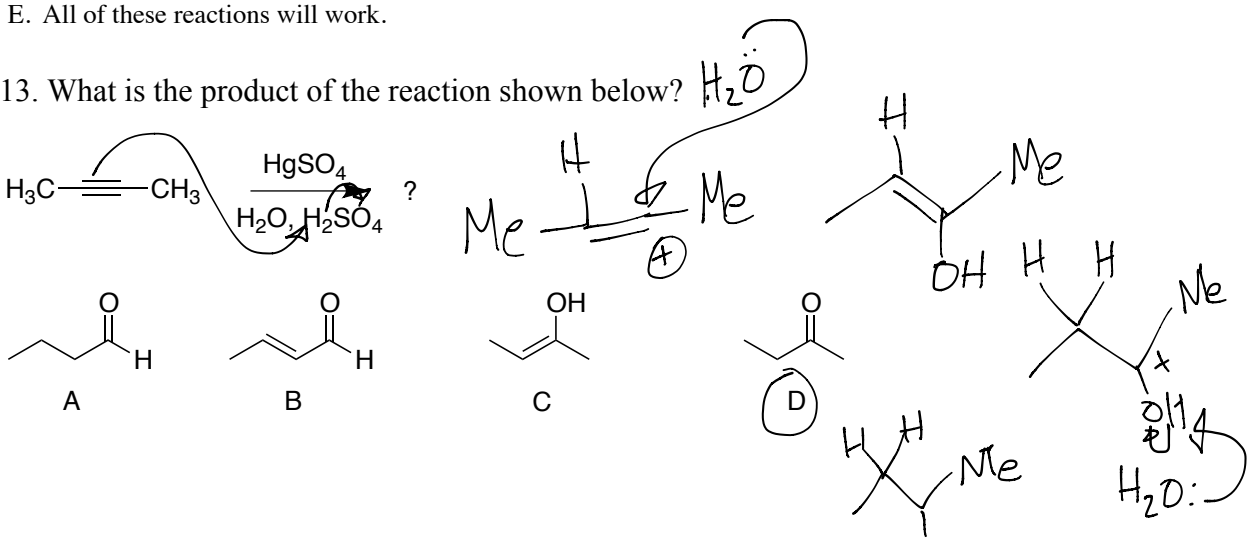
B. 

C. 

D. 

E. All of these reactions will work.

13. What is the product of the reaction shown below?

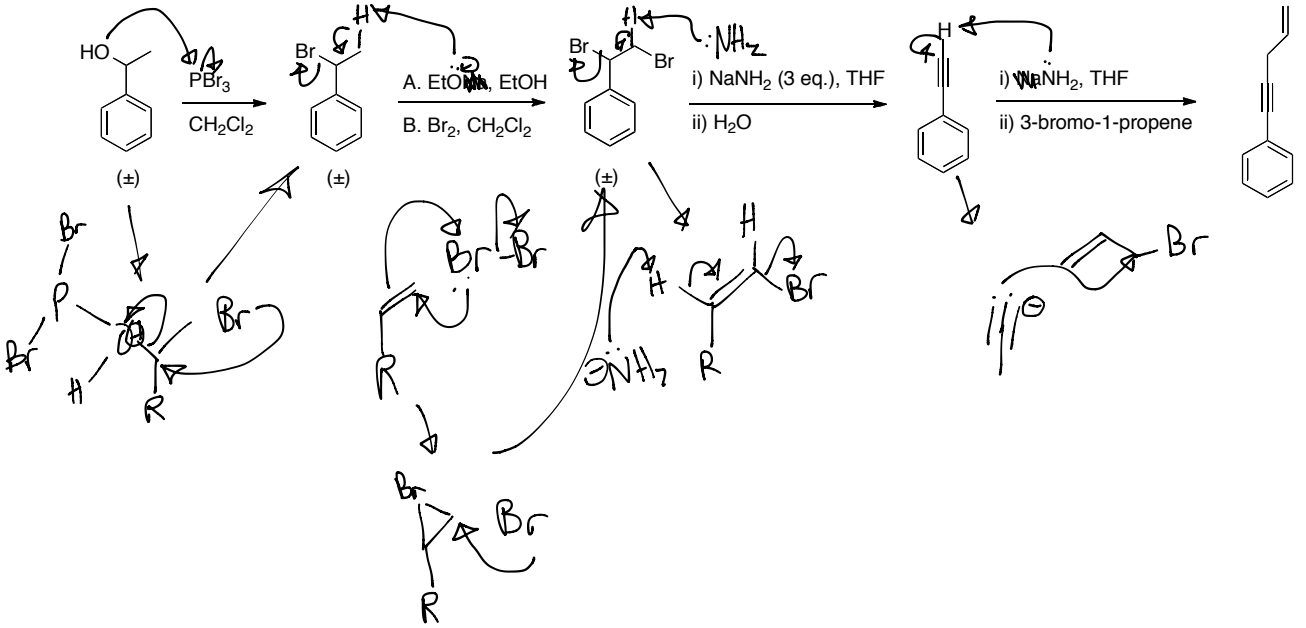


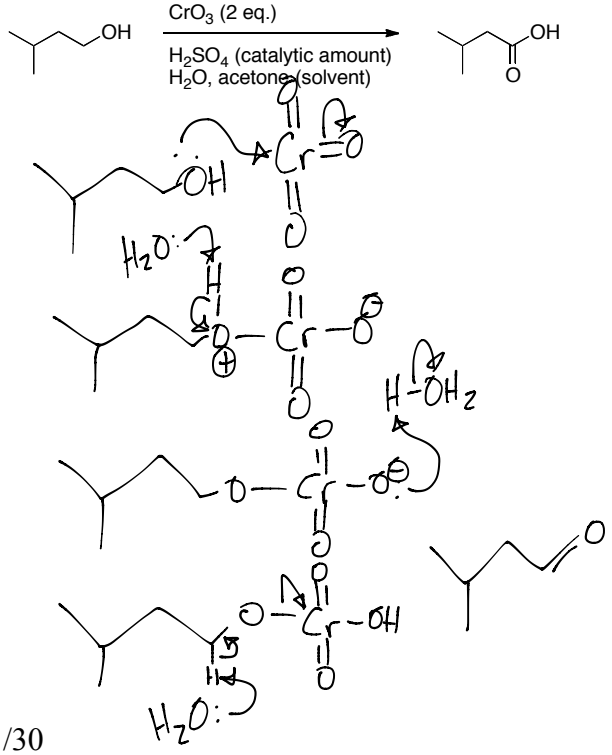
Name_____ Identification # ___ ___ ___ ___

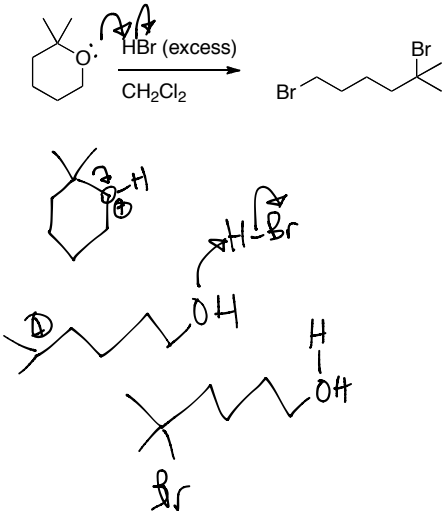
Section 2: Free Response

If any answers are written on the back of a page, you *must* indicate it on the front of the page. Otherwise, the answer will not be graded. Please make your answers as concise and clear as possible. You will be graded not only on your answers, but also on the means by which you communicate them. In drawing structures you must use the rules we discussed in class (i.e., include H's on heteroatoms and if you draw C's, include the H's).

1. (30 pts) Using the appropriate arrows to show electron flow, draw the mechanisms of the following reactions. The (±) below a compound indicates that the compound a racemic mixture of enantiomers.







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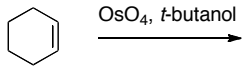
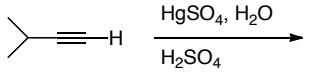
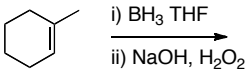
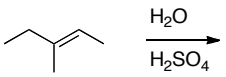
Name_____ Identification # ___ ___ ___ ___

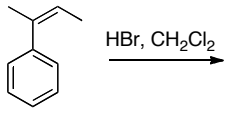
2. (40 pts) Predict the products of the following reactions. If more that one product is expected, indicate which will be the major product(s). Be sure to indicate the stereochemistry of the products. If multiple stereoisomers (including enantiomers) form in a reaction, draw all of them. Do not draw the same compound twice.

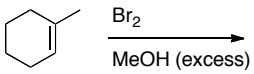


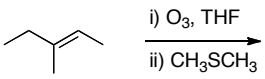


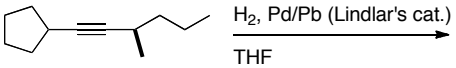


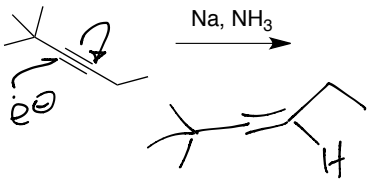


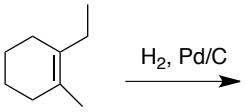


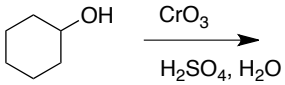


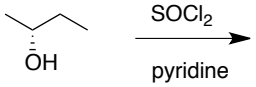












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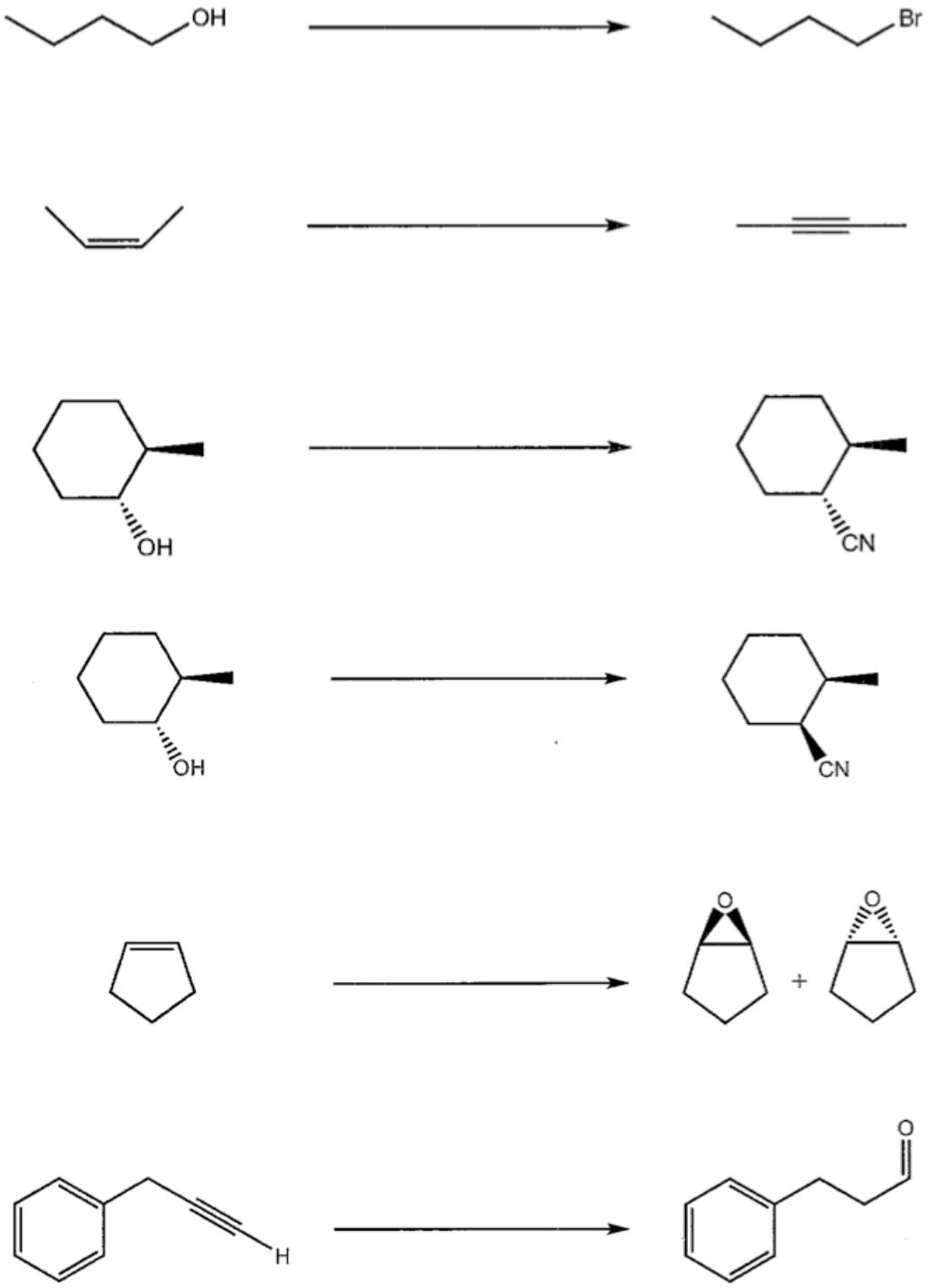
Name_____ Identification # ___ ___ ___ ___

4. (24 pts) Provide reagents over the arrows for each of the following transformations. If more than one equivalent of the reagent is needed, please state this. Note: some transformations may require more than one step!



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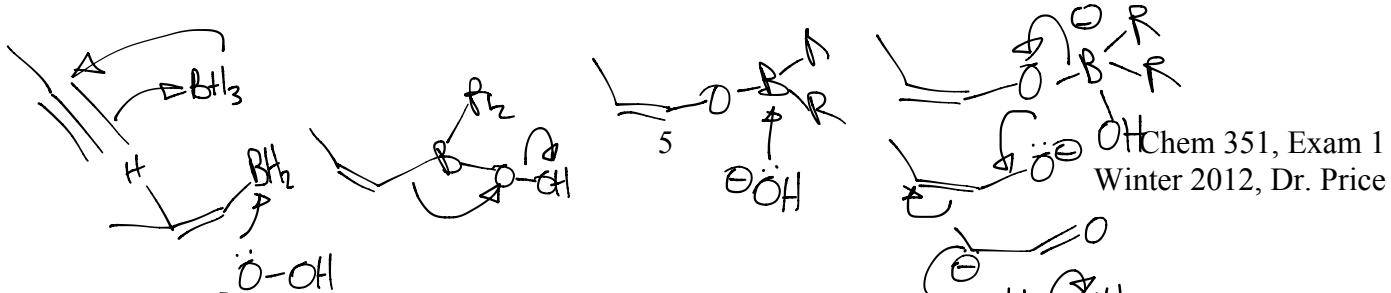
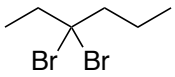
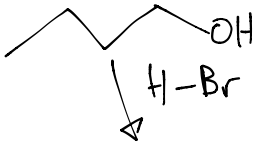


Name_____ Identification # ___ ___ ___ ___

5. (28 pts) You discover that the compound drawn below has life-extending properties. You wish to create your own personal Fountain of Youth (and get rich in the process). Show how you would synthesize this compound using **alcohols of 4 carbons or less**. You have access to all of the standard reagents and solvents used in organic chemistry, but the carbon atoms in your product **must** come from the alcohol starting materials. Your alcohol starting materials of 4 carbons or less may not contain any double bonds, triple bonds or other functional groups besides the alkyl portion and the –OH group. You will probably need to use the principles of retrosynthetic analysis to solve this problem, but only your synthesis in the forward direction will be graded.





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