

CH 253, Fall 2004  
Exam #4 - M. Schwartz  
December 10, 2004

Name \_\_\_\_\_  
(Print Clearly)

Question	Points Possible	Points Received
1	20	
2	10	
3	15	
4	12	
5	10	
6	33	
Subtotal	100	
Extra Credit	2	
Total	102	

1. (20 points) Multiple choice. Circle the one best answer for each problem below.

A. Calculate SODAR for  $C_7H_{11}Cl$

- i. 0                  ii. 1                  iii. 2                  iv. 3                  v. 4

B. A compound with the formula  $C_{10}H_{14}$  reacts with excess hydrogen and a catalyst to give a new compound with the formula  $C_{10}H_{18}$ . The compound could have:

- i. one ring and three double bonds      ii. two rings and two double bonds  
iii. two rings and a triple bond      iv. no rings and two double bonds  
v. more than one of the above

C. Cyclohexene is treated with cold, dilute, basic  $KMnO_4$ . The spatial arrangement of the two hydroxyl groups in the product will be:

- i. Equatorial-axial                  ii. Axial-axial  
iii. Equatorial-equatorial      iv. Coplanar                  v. trans

D. Which can exist as E/Z isomers?

- i. 1-pentene                  ii. 3-hexene                  iii. cyclopentene  
iv. 2-methyl-2-butene      v. 3-ethyl-2-pentene

E. Markovnikov addition of HCl to propene involves:

- i. initial attack by a chloride ion      ii. initial attack by a chlorine atom  
iii. isomerization of 1-chloropropane      iv. formation of a propyl cation  
v. formation of an isopropyl cation

F. The ozonolysis of an unsymmetrical, unbranched alkene forms:

- i. A single aldehyde                  ii. An aldehyde and a ketone  
iii. Two different ketones      iv. Two different aldehydes  
iv. A single ketone

G. Your task is to convert 2-bromobutane to 1-butene in the highest yield. Which reagents would you use?

- i.  $\text{KOH}/\text{H}_2\text{O}$       ii.  $\text{KOH}/\text{CH}_3\text{OH}$       iii.  $\text{CH}_3\text{ONa}/\text{CH}_3\text{OH}$   
iv.  $\text{CH}_3\text{CH}_2\text{ONa}/\text{CH}_3\text{CH}_2\text{OH}$       v.  $(\text{CH}_3)_3\text{COK}/(\text{CH}_3)_3\text{COH}$

H. Predict the splitting pattern you would observe for the proton at C3 of 2,3-dimethyl-2-phenylbutane

- i. doublet    ii. singlet    iii. quartet    iv. septet    v. octet

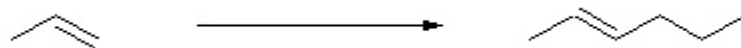
I. How many  $^1\text{H}$  NMR signals would you expect to find in the spectrum of  $\text{CH}_3\text{OCH}_2\text{CH}_2\text{OCH}_3$ ?

- i. 1      ii. 2      iii. 3      iv. 4      v. 5

J. The intensities of a four-line splitting pattern (quartet) are approximately:

- i. 1:1:1:1    ii. 1:2:2:1    iii. 1:3:3:1    iv. 1:4:4:1    v. unpredictable

2. (10 points) Synthesis! Show how to accomplish the conversion given below. Show all isolable intermediates and be as specific as possible in reagents and reaction conditions. No mechanisms, please.

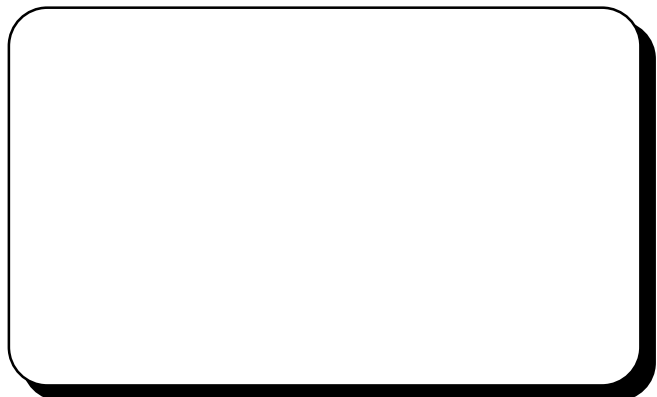


3. (15 points) You are given three compounds, F, G, and H. All three have the molecular formula  $C_6H_{10}$ , and all three rapidly decolorize  $Br_2$  in  $CCl_4$ . F has an IR absorption near  $3300\text{ cm}^{-1}$ ; G and H do not. F and G react with excess  $H_2/Pd$  to give hexane. H absorbs one equivalent of  $H_2$  under the same conditions to give a compound with the formula  $C_6H_{12}$ . When F is treated with hot, basic  $KMnO_4$  followed by an acidic workup, the only organic compound that can be isolated is  $CH_3CH_2CH_2CH_2CO_2H$ . Under the same conditions, G gives only  $CH_3CH_2CO_2H$ , and H gives  $HO_2CCH_2CH_2CH_2CH_2CO_2H$ . What are F, G, and H?

Answer:



F

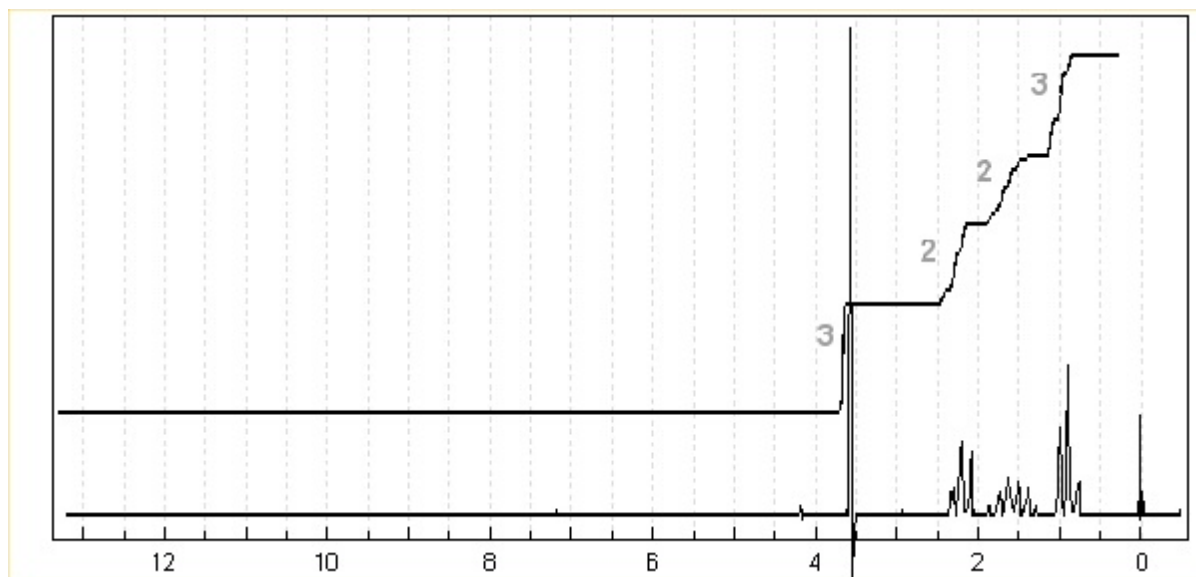
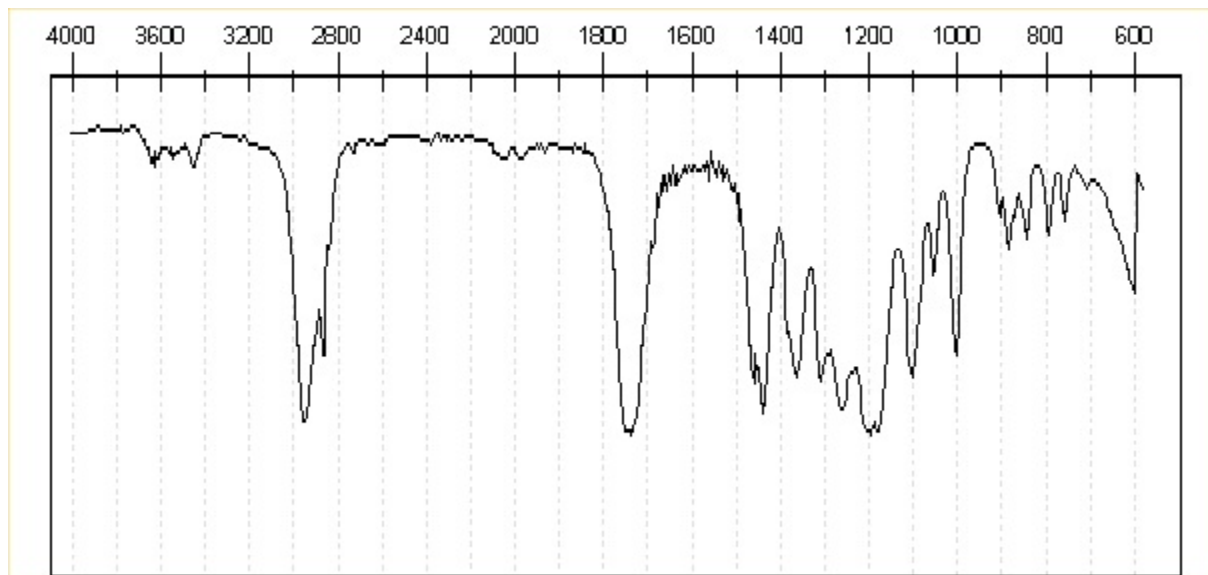


G



H

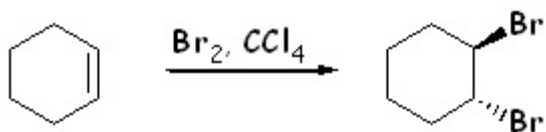
4. (12 points) Shown below are IR and  $^1\text{H}$  NMR spectra for an unknown compound, formula  $\text{C}_5\text{H}_{10}\text{O}_2$ . Deduce the structure of the compound, indicating as much of your reasoning as possible. Don't forget SODAR.



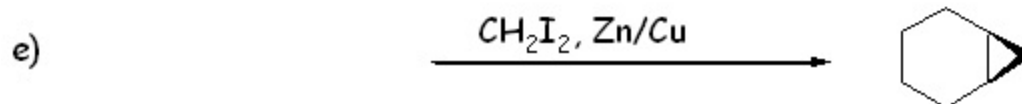
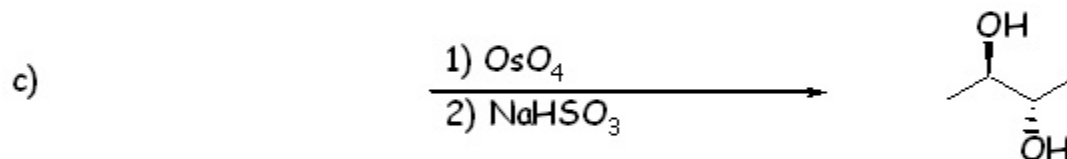
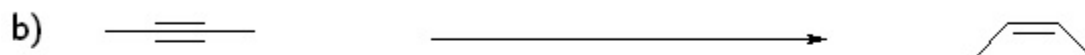
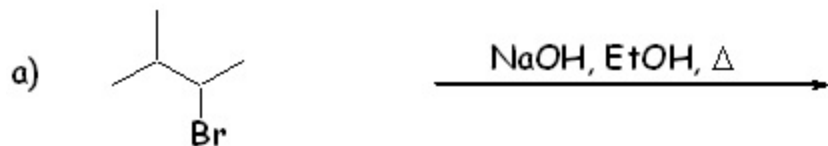
<- Answer



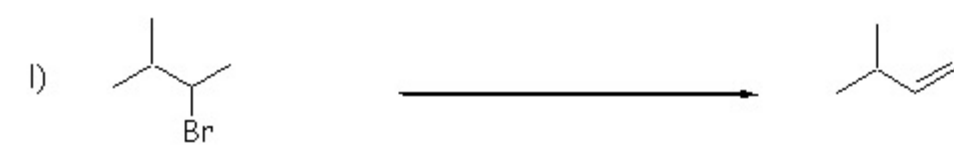
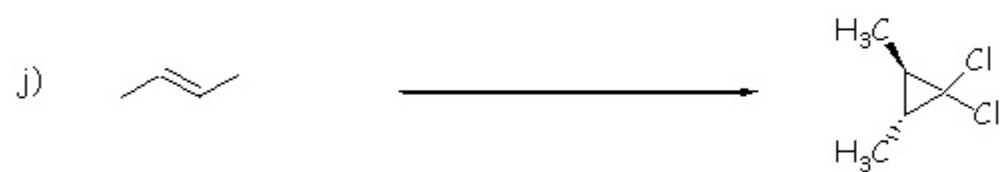
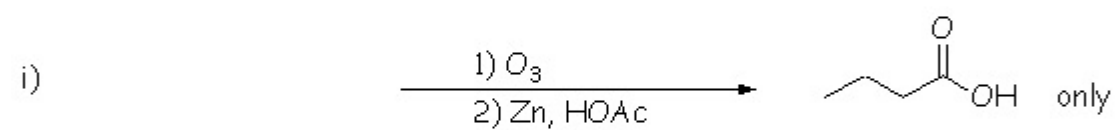
5. (10 points) Provide a mechanism for the following transformation, using proper electron-pushing formalisms.



6. (33 points) Each of the following transformations is missing either reactant(s), reagent(s), or product(s). Fill in the missing information so as to successfully complete the reaction. Remember that "NRX" is always a possible PRODUCT. Your best 11 of the 12 reactions given will be counted. Indicate stereochemistry where appropriate.







Extra Credit:

a) Who narrated "Rudolph, the Red-Nosed Reindeer"?

B) What is the "name reaction" used in problem 7e?