

Chemistry 333

Final Examination

May 23, 2005

Professor Charonnat

Name: \_\_\_\_\_

Be certain that your examination has eleven (11) pages including this one.

Put your name on **each** page of this examination booklet.

By putting your name on this examination booklet you agree to abide by California State University, Northridge policies of academic honesty and integrity.

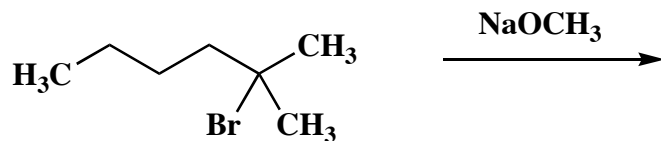
Molecular models are allowed for this examination. All electronic devices, including calculators, are unnecessary and are not allowed.

Name: \_\_\_\_\_

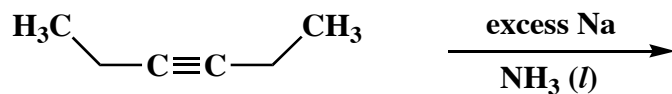
1. (50 points)

Draw the structure of the expected major organic product for each of the following ten (10) questions. Clearly specify stereochemistry, if relevant.

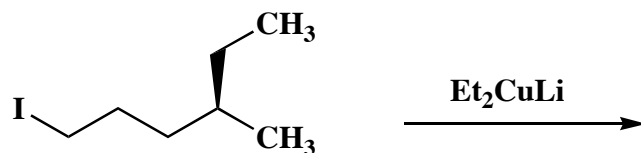
A.



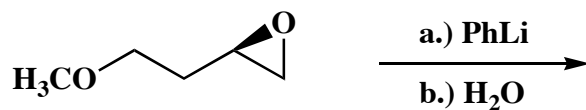
B.



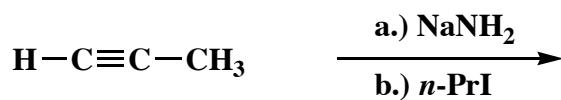
C.



D.



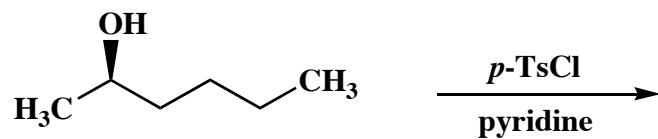
E.



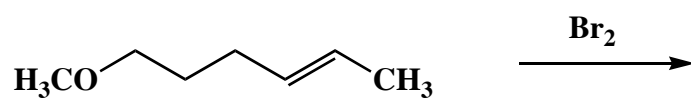
Name: \_\_\_\_\_

1. (cont.)

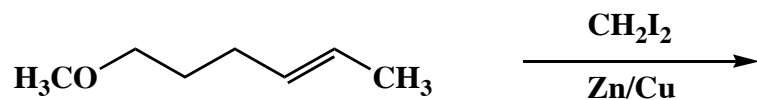
F.



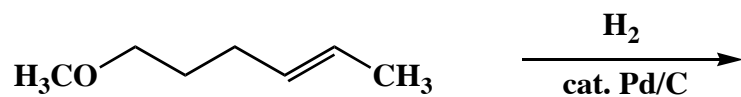
G.



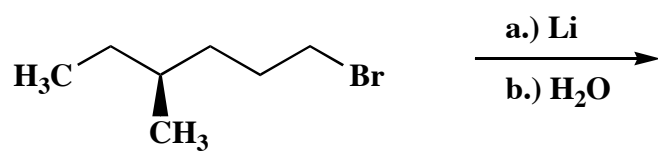
H.



I.



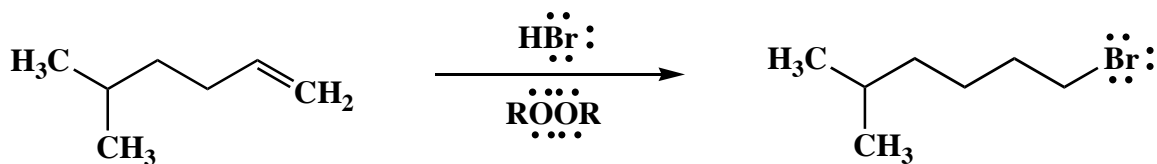
J.



Name: \_\_\_\_\_

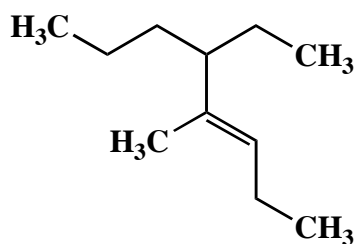
2. (20 points)

Draw the mechanism of the following reaction, using the curved-arrow notation to indicate the reorganization of electron density. Show all intermediates and denote all unshared electrons, formal charges and countercharges where appropriate.



3. (10 points)

Use IUPAC nomenclature to write the systematic name of the following compound.



Name: \_\_\_\_\_

4. (25 points)

Circle the number that corresponds to the correct answer for each of the following five (5) questions.

A. The vibrational frequency of a C-D bond is

1. smaller than the vibrational frequency of the corresponding C-H bond
2. the same as the vibrational frequency of the corresponding C-H bond
3. larger than the vibrational frequency of the corresponding C-H bond

B. A compound's molecular ion appears at  $m/z = 109$  in its electron-impact mass spectrum. The compound contains

1. carbon, hydrogen and nitrogen
2. carbon, hydrogen and chlorine
3. carbon, hydrogen and bromine

C. The methine proton of (*S*)-2-chloroheptane is coupled to

1. one set of chemically equivalent nuclei
2. two sets of chemically equivalent nuclei
3. three sets of chemically equivalent nuclei

D. Which of the following conformations of cyclohexane is the least stable?

1. the twist-boat conformation
2. the boat conformation
3. the half-chair conformation

E. The transition state of a highly exothermic  $S_N2$  reaction is

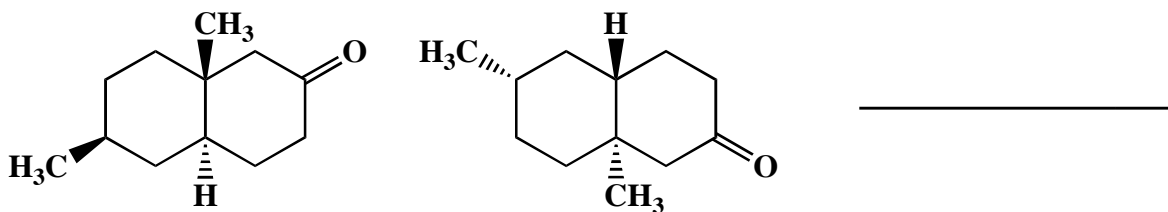
1. early
2. late
3. neither early nor late

Name: \_\_\_\_\_

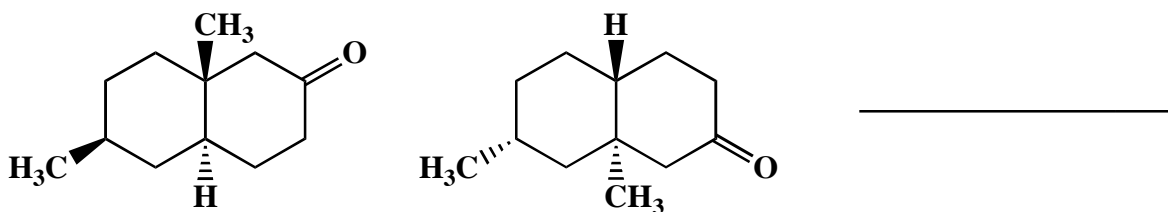
5. (25 points)

State the relationship between each of the following five (5) pairs of structures (identical, enantiomers, diastereomers, regioisomers, conformational isomers, different compounds that are not isomeric).

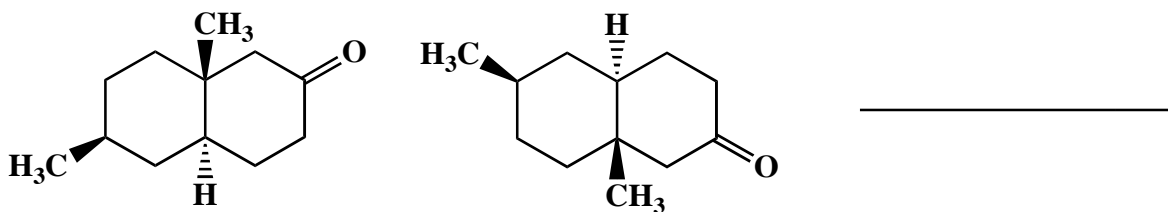
A.



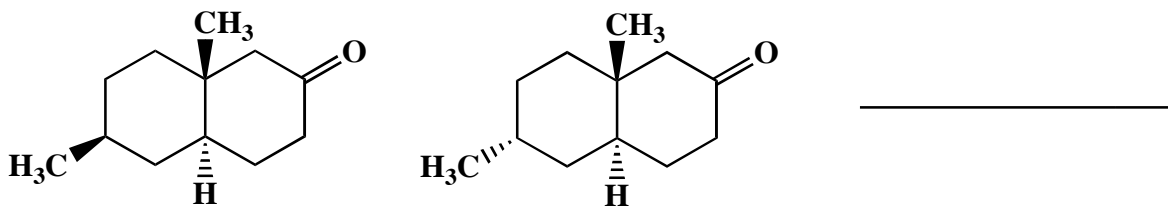
B.



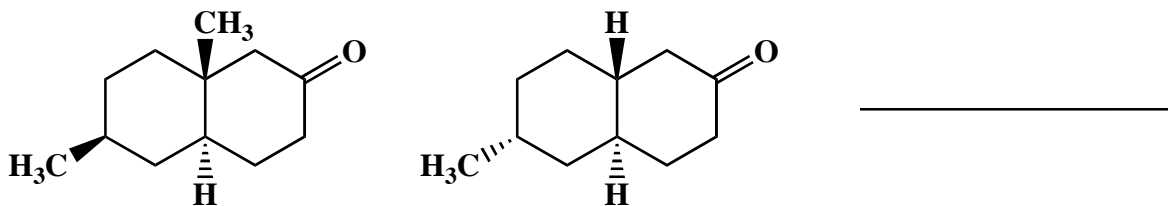
C.



D.



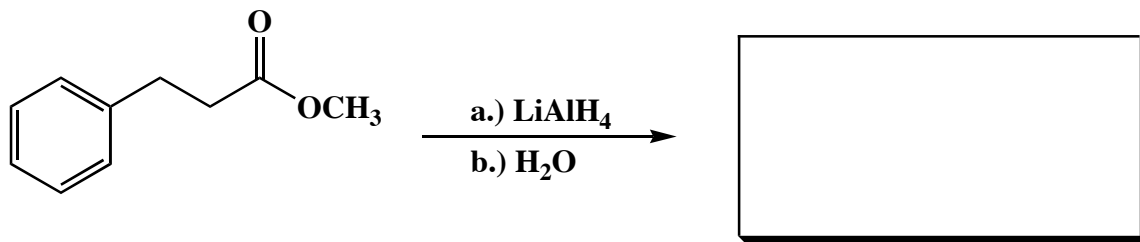
E.



Name: \_\_\_\_\_

6. (20 points)

When the following reaction was run, a product was isolated that showed infrared absorptions at 3500, 3025, 2975, 1600, 1495, 1305 and 1130  $\text{cm}^{-1}$ . Draw the structure of the product. Use the infrared spectroscopic evidence to support your answer. Make clear assignments of all absorptions to explain your reasoning. (An IR correlation table is included separately.)



**infrared assignments:**

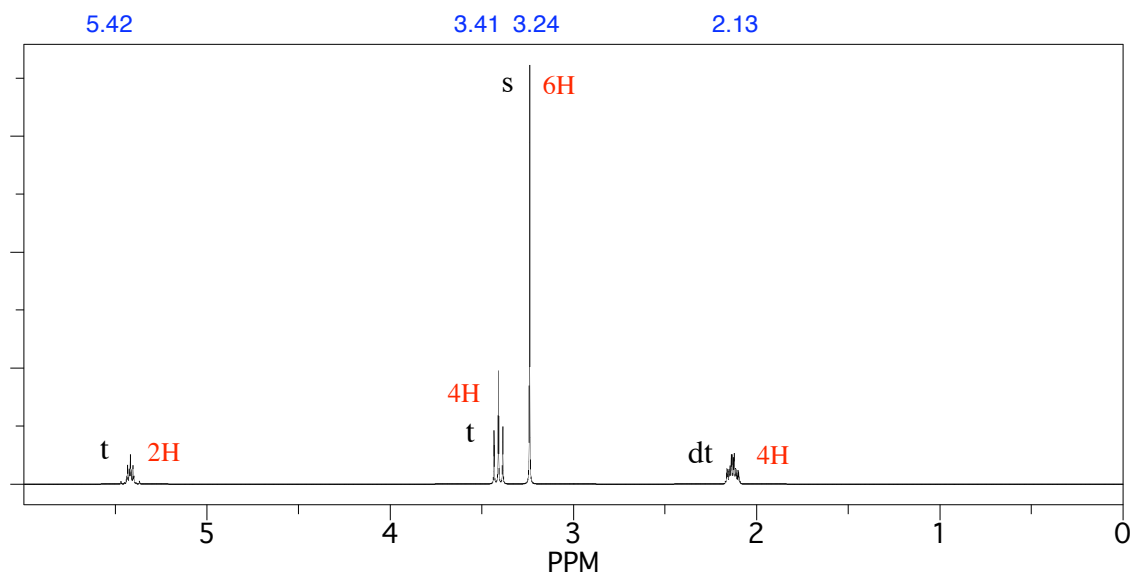
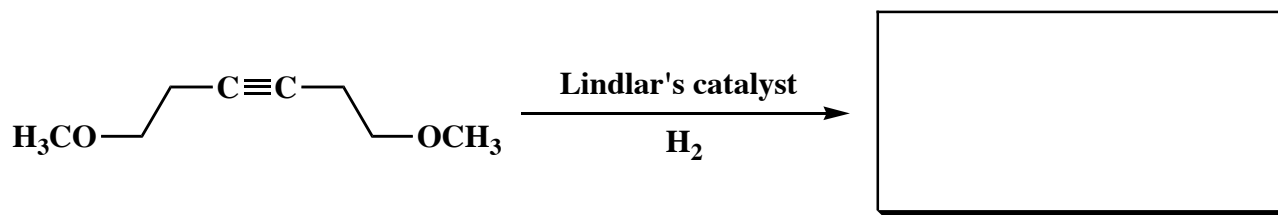
**absorption**

**assignment**

Name: \_\_\_\_\_

7. (25 points)

Draw the major organic product that is formed from the following reaction. The  $^1\text{H}$  NMR spectrum of the product is shown below. The labels next to each of the resonances signify the multiplicities observed in the spectrum (s = singlet, t = triplet, dt = doublet of triplets). Use this spectroscopic evidence to determine the identity of the compound. Make clear assignments of all resonances to explain your reasoning. (A  $^1\text{H}$  NMR correlation table is included separately.)



Name: \_\_\_\_\_

7. (continued)

**$^1\text{H}$  NMR assignments:**

**chemical shift (ppm)**

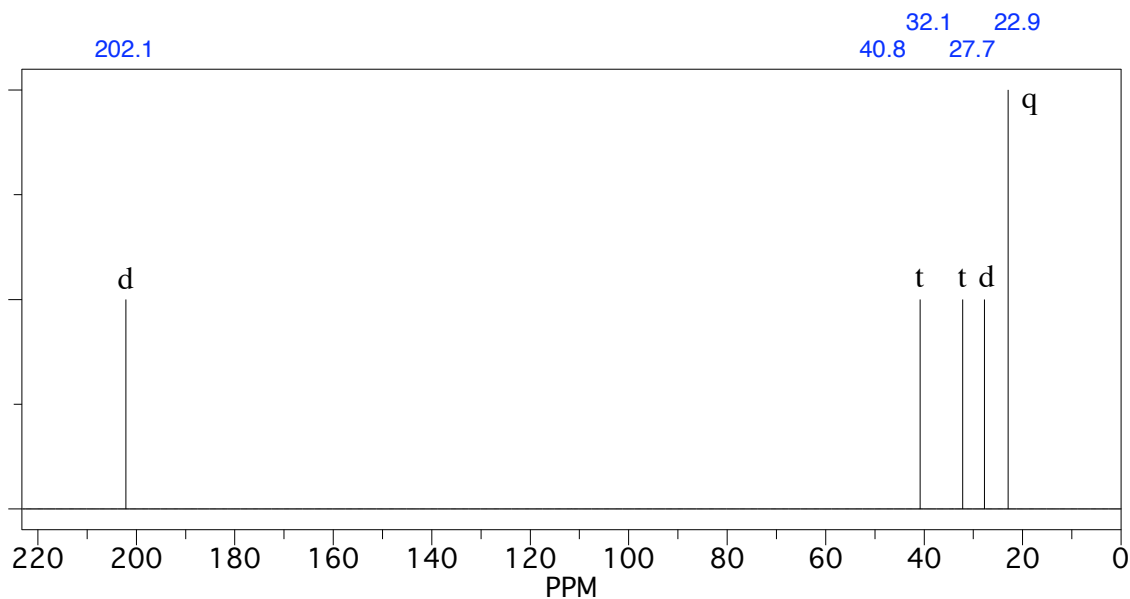
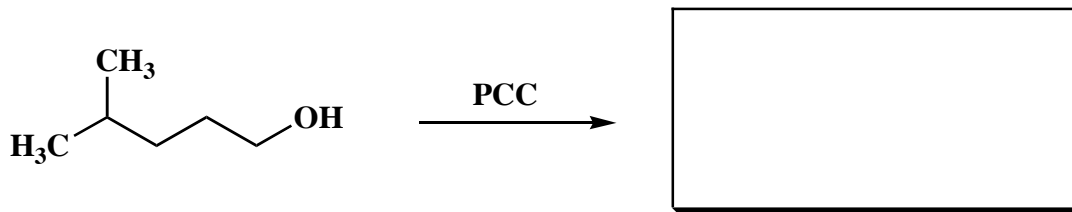
**assignment**

**explanation of multiplicity**

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8. (25 points)

Draw the major organic product that is formed from the following reaction. The broadband proton-decoupled  $^{13}\text{C}$  NMR spectrum of the product is shown below. The labels next to each of the resonances signify the multiplicities observed in the corresponding off-resonance proton-decoupled  $^{13}\text{C}$  NMR spectrum (d = doublet, t = triplet, q = quartet). Use this spectroscopic evidence to determine the identity of the compound. Make clear assignments of all resonances to explain your reasoning. (A  $^{13}\text{C}$  NMR correlation table is included separately.)



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8. (continued)

**$^{13}\text{C}$  NMR assignments:**

**chemical shift (ppm)**

**assignment**

**explanation of multiplicity**

**Congratulations!**

1	/50
2	/20
3	/10
4	/25
5	/25
6	/20
7	/25
8	/25
<hr/>	
Total:	/200

**course grade:** \_\_\_\_\_