

Chemistry 333

Final Examination

December 6, 2004

Professor Charonnat

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

Be certain that your examination contains fourteen (14) pages including this cover page.

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.

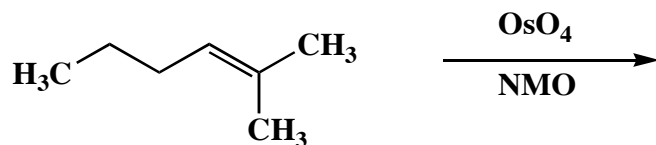
Molecular models are allowed for this examination. All electronic devices, including calculators, are unnecessary and are not allowed.

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

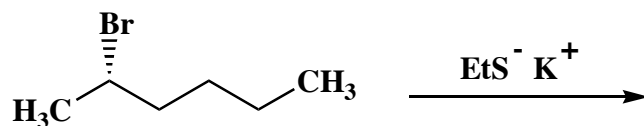
1. (25 points)

Draw the structure of the expected major organic product for each of the following five (5) questions. Clearly specify stereochemistry, if relevant.

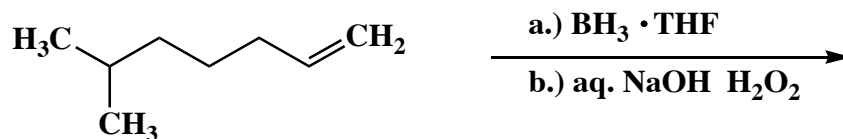
A.



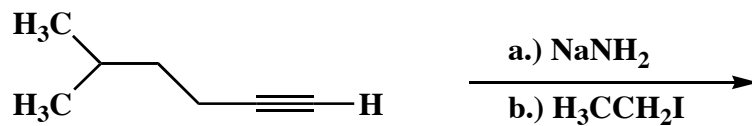
B.



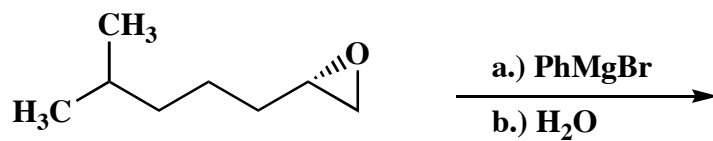
C.



D.



E.

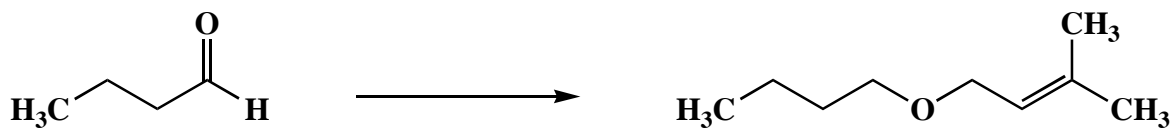


Name: \_\_\_\_\_

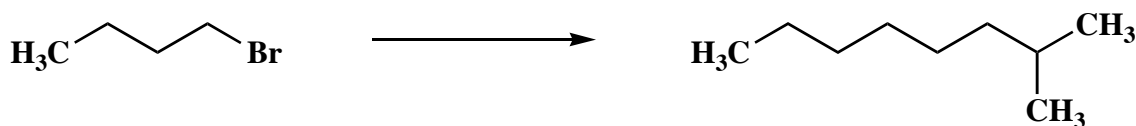
2. (25 points)

Draw the specific reagent(s) necessary to effect the transformation shown for each of the following three (3) questions. If more than one step is required, be certain to specify each step separately.

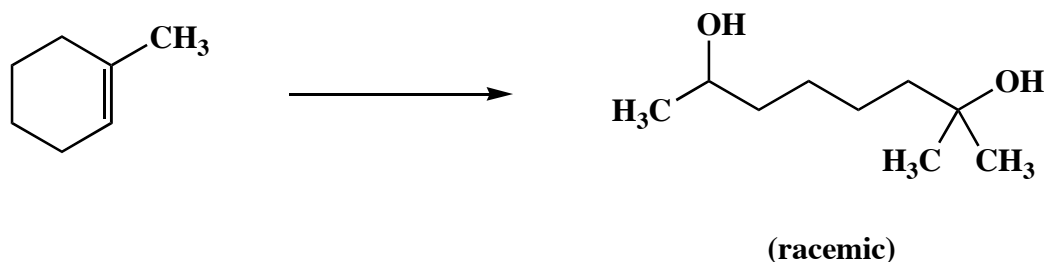
A.



B.

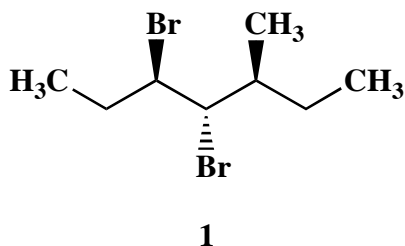


C.



3. (10 points)

Draw a structure for each of the following three (3) isomers of the dibromoalkane 1.



a diastereomer



the enantiomer



a regioisomer

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

4. (25 points)

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

A. In an electron-impact mass spectrometer, the energy of the electron beam is

1. much more than the energy of a typical covalent bond
2. approximately the energy of a typical covalent bond
3. much less than the energy of a typical covalent bond

B. Organic compounds containing nitrogen

1. always have an even molecular weight
2. always have an odd molecular weight
3. can have either an even or odd molecular weight

C. Any fragmentation product observed in a mass spectrum has

1. a larger  $m/z$  value than the molecular ion
2. a smaller  $m/z$  value than the molecular ion
3. the same  $m/z$  value as the molecular ion

D. Which spectrometric technique can be used to determine molecular connectivity?

1. IR
2. NMR
3. UV-VIS

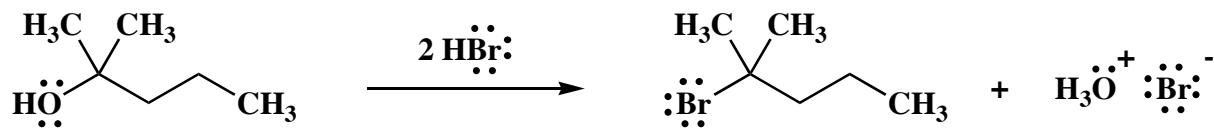
E. As one increases either the  $m_1$  or  $m_2$  mass of a harmonic oscillator, the reduced mass,  $\mu$ , of the system

1. decreases
2. remains constant
3. increases

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

5. (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** lone pairs, nonzero formal charges and countercharges.

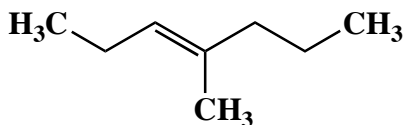


Name: \_\_\_\_\_

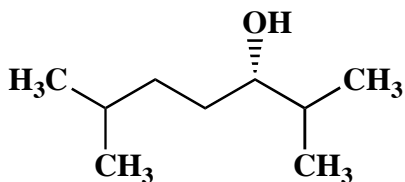
6. (20 points)

Use IUPAC nomenclature to write the systematic name for both of the following two (2) compounds.

A.

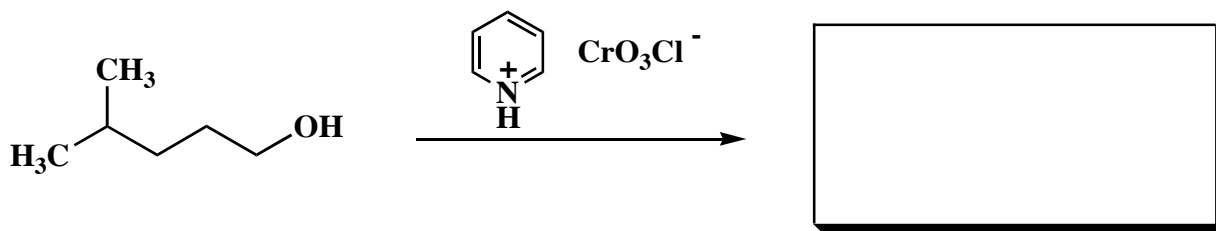


B.



7. (20 points)

When the following reaction was run, a product was isolated that showed infrared absorptions at 2985–2870, 2810, 2710 and 1710  $\text{cm}^{-1}$ . 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 on page 11.)



**infrared assignments:**

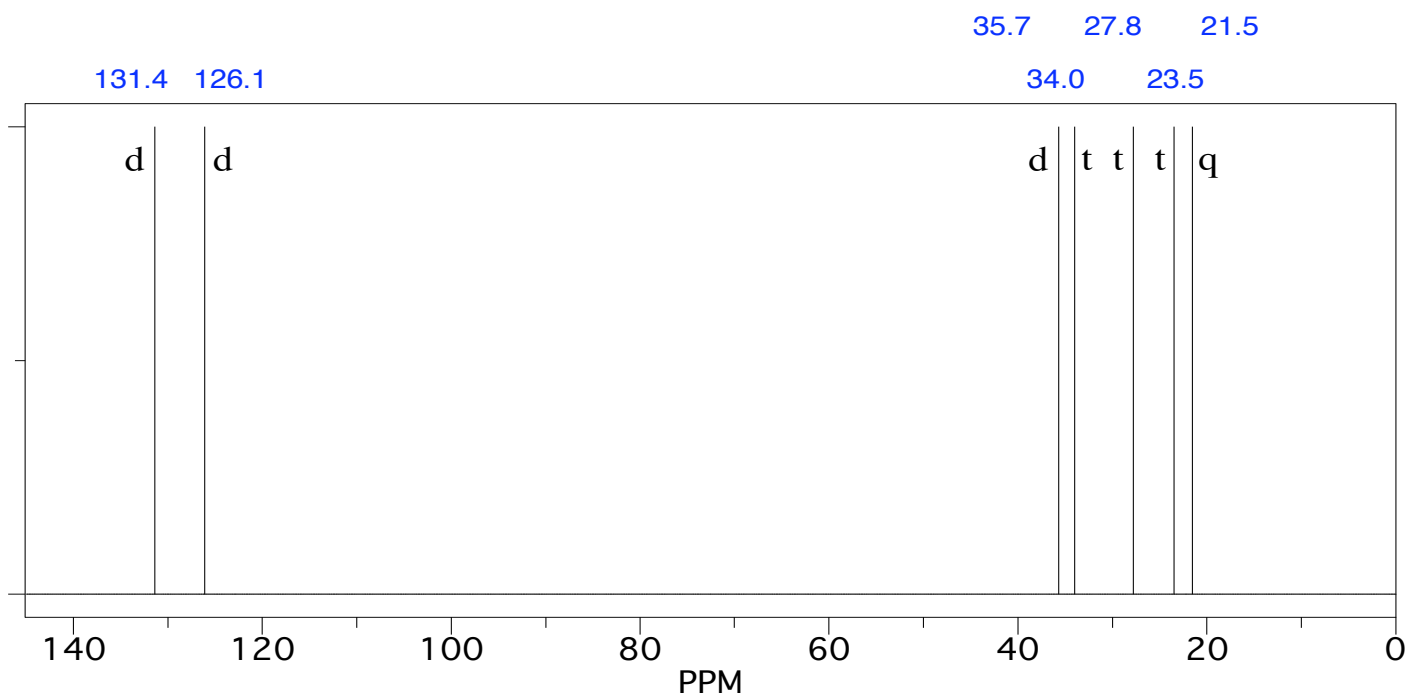
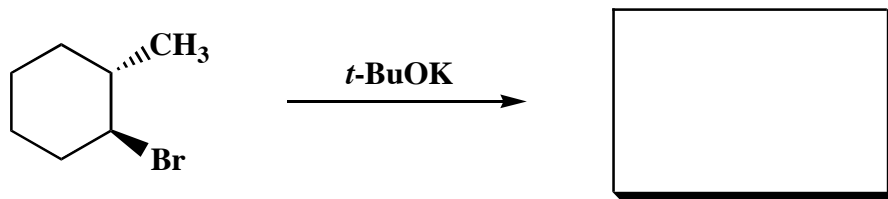
**absorption**

**assignment**

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

8. (30 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 (s = singlet, 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. Draw a three-dimensional structure at the bottom of the next page to depict the mechanism of this reaction. Use this diagram to explain why no other regioisomeric alkene is formed. (A  $^{13}\text{C}$  NMR correlation table is included on page 12.)



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

8. (continued)

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

**chemical shift (ppm)**

**assignment**

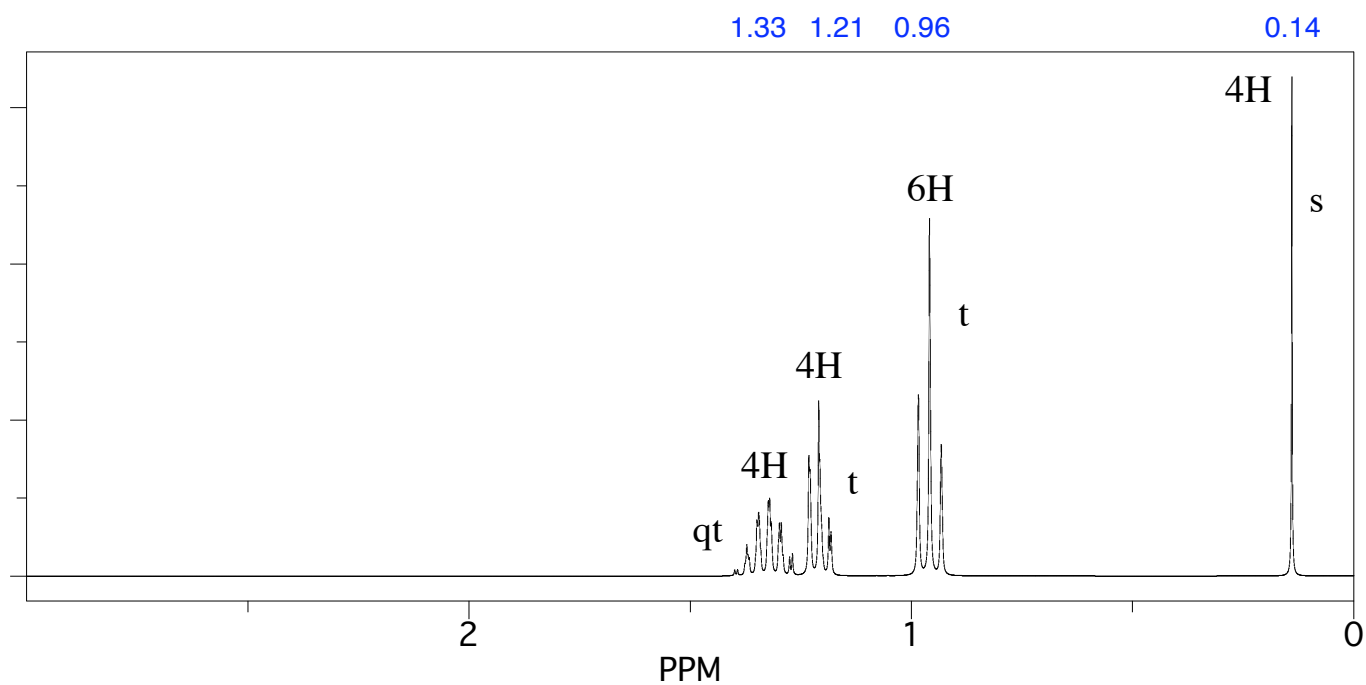
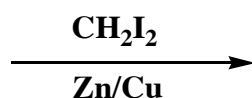
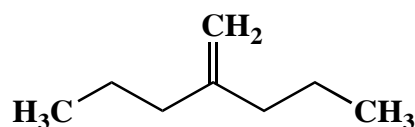
**explanation of multiplicity**

**mechanism:**

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

9. (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, 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. Comment briefly why only four multiplets are observed in the spectrum. (A  $^1\text{H}$  NMR correlation table is included on pages 13-14.)



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

9. (continued)

**<sup>1</sup>H NMR assignments:**

**chemical shift (ppm)**

**assignment**

**explanation of multiplicity**

**Congratulations!**

1	/25
2	/25
3	/10
4	/25
5	/20
6	/20
7	/20
8	/30
9	/25
Total:	/200

**Course grade:** \_\_\_\_\_