

Chemistry 333

Final Examination

May 21, 2007

Professor Charonnat

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

Be certain that your examination has ten (10) 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.

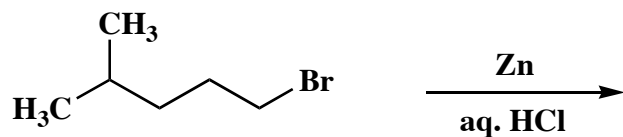
Molecular models are allowed for this examination. All electronic devices, including calculators, are unnecessary and are not allowed.

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

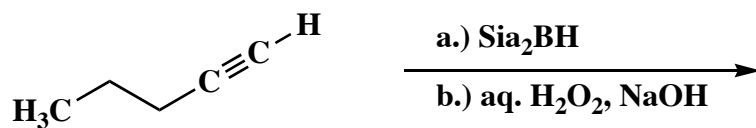
1. (50 points)

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

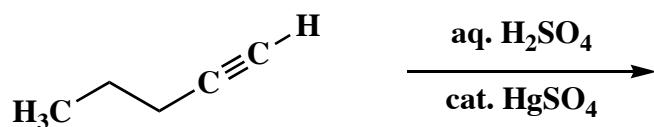
A.



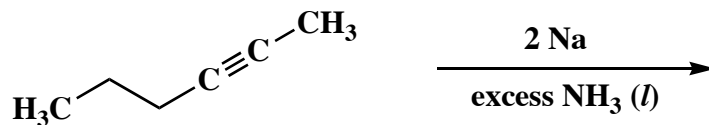
B.



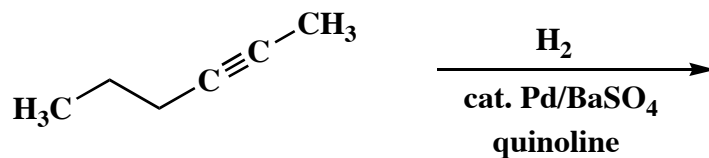
C.



D.



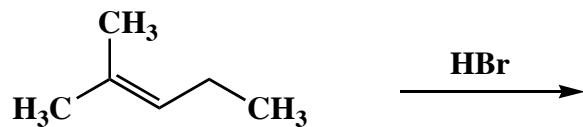
E.



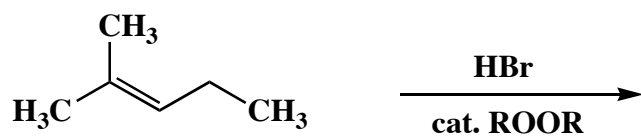
Name: \_\_\_\_\_

1. (continued)

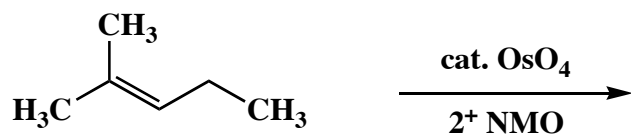
F.



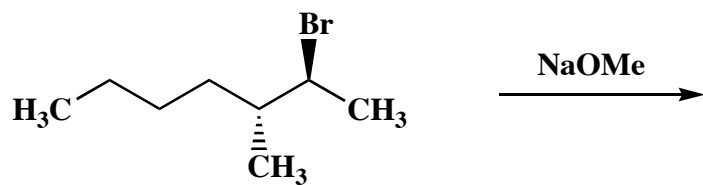
G.



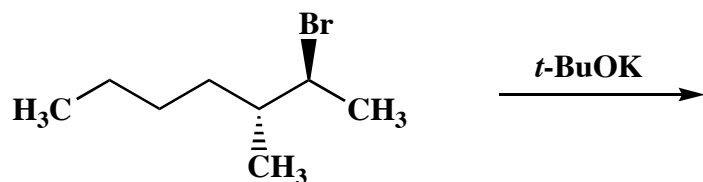
H.



I.



J.

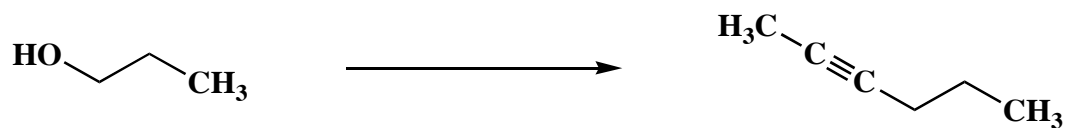


Name: \_\_\_\_\_

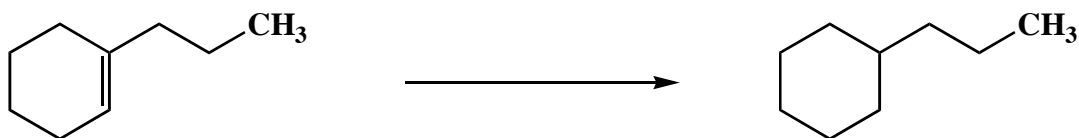
2. (25 points)

Draw the specific reagent(s) necessary to effect the following four (4) transformations. If more than one reaction is involved in an answer, be certain to distinguish the individual steps clearly. Specify the relative stoichiometry of all reagents, also.

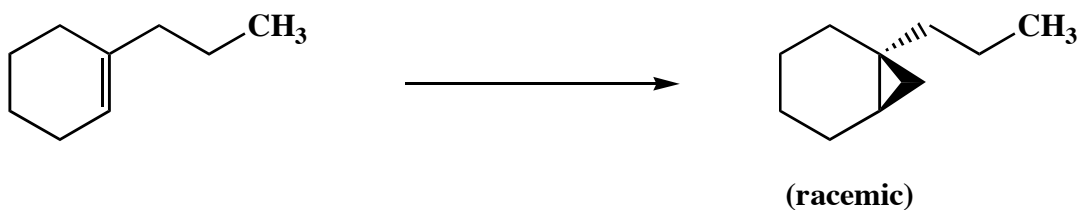
A.



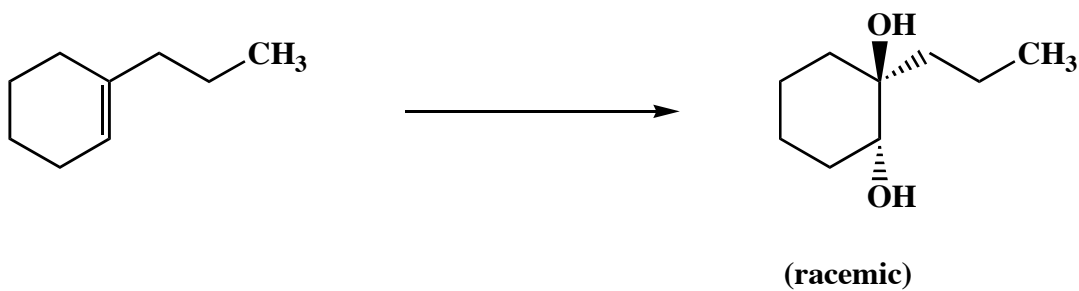
B.



C.



D.



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

3. (25 points)

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

A. Infrared spectroscopy probes molecular

1. vibrations
2. rotations
3. translation

B. Acid-catalyzed dehydration of an alcohol is

1. a substitution reaction
2. an addition reaction
3. an elimination reaction

C. According to the Karplus equation, vicinal  $^1\text{H}$ - $^1\text{H}$  coupling constants are

1. always large
2. sometimes large
3. never large

D. Tertiary alkyl halides can undergo

1.  $\text{S}_{\text{N}}2$  reactions
2.  $\text{S}_{\text{N}}1$  reactions
3. both  $\text{S}_{\text{N}}1$  and  $\text{S}_{\text{N}}2$  reactions

E. Which of the following are mirror images of each other?

1. a pair of regioisomers
2. a pair of diastereomers
3. a pair of enantiomers

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

4. (20 points)

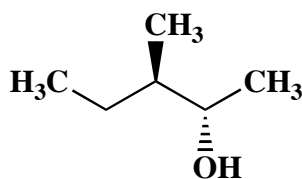
Answer both of the following two (2) questions clearly, concisely and with correct grammar.

A. Why are 1-bond  $^1\text{H}$ - $^{13}\text{C}$  couplings usually not observed in  $^1\text{H}$  NMR spectra?

B. Why is a ketone carbonyl stretch a strong absorption in an infrared spectrum?

5. (10 points)

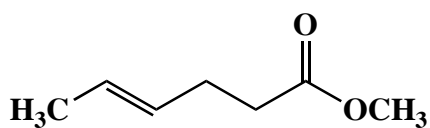
Use IUPAC nomenclature to write the systematic name of the following alcohol.



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

6. (25 points)

When the following reaction was run, a product was isolated that showed infrared absorptions at 3500 (broad), 3040, 2950, 1660, 1350, 1210 and 1140  $\text{cm}^{-1}$ . 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**

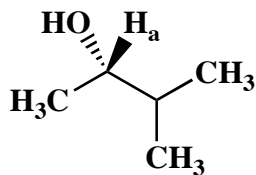
**assignment**

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

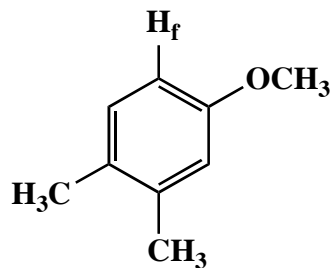
7. (20 points)

Label all the sets of chemically equivalent protons for both of the following two (2) compounds. Then draw annotated tree diagrams for protons  $H_a$  and  $H_f$ . Specify, but do not quantify all appropriate coupling constants in each tree diagram.

A.



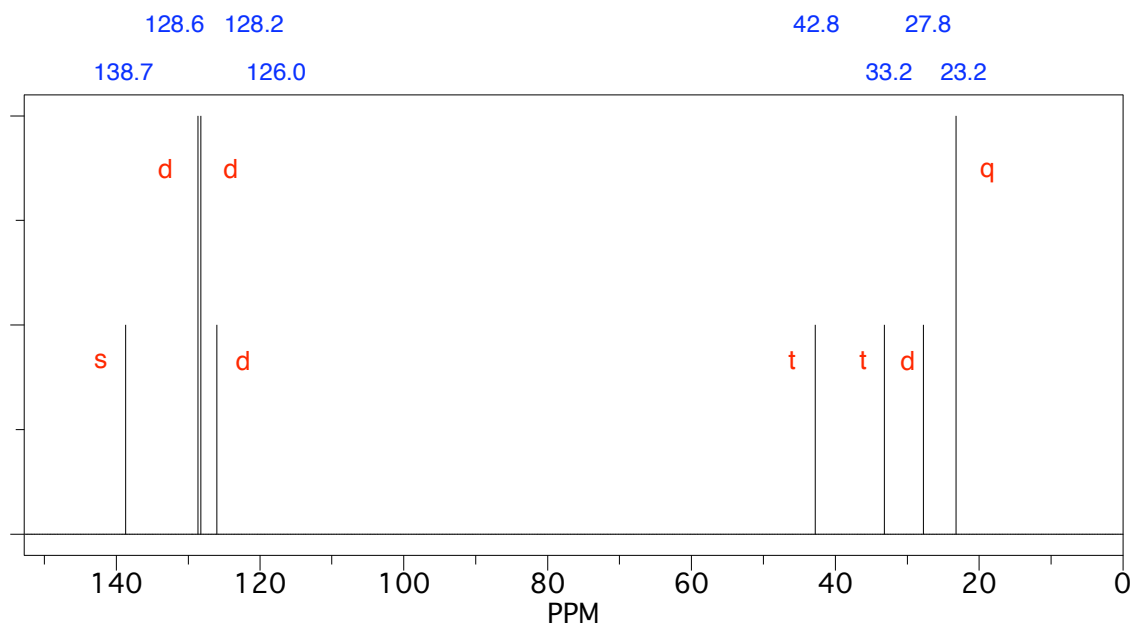
B.



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

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 (s = singlet, d = doublet, t = triplet, q = quartet). Use this spectroscopic evidence to identify the compound. Make clear assignments of all resonances to explain your reasoning. (A  $^{13}\text{C}$  NMR correlation table is included separately.)



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

8. (continued)



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

**chemical shift (ppm)**

**assignment**

**explanation of multiplicity**

**Congratulations!**

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