

Chemistry 333

Final Examination

December 13, 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. (25 points)

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

A. The signal with the highest m/z value in a mass spectrum

1. always is the molecular ion
2. usually is the molecular ion
3. never is the molecular ion

B. (2*R*, 5*S*)-5-bromohexan-2-ol and (2*R*, 5*R*)-5-bromohexan-2-ol are

1. diastereomers
2. enantiomers
3. regioisomers

C. S_N2 reactions proceed with

1. racemization
2. retention of configuration
3. inversion of configuration

D. Protons have different chemical shifts due to

1. spin-spin coupling
2. different local, induced magnetic fields
3. different external magnetic fields

E. The most stable conformation of *cis*-1,4-diethylcyclohexane has

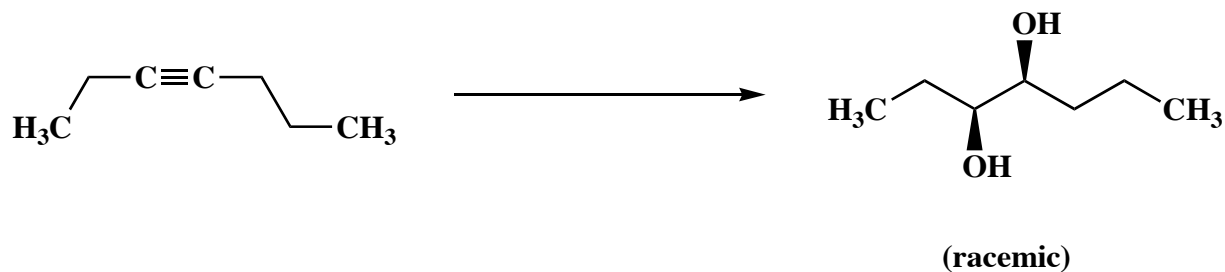
1. both substituents equatorial
2. both substituents axial
3. one substituent equatorial, and one substituent axial

Name: _____

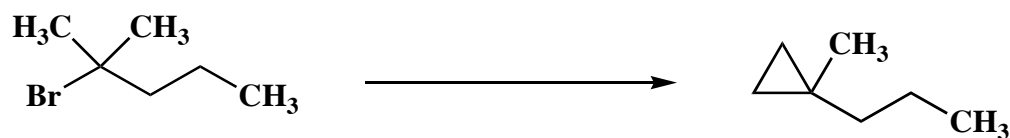
2. (25 points)

Draw the specific reagent(s) necessary to effect the following three (3) transformations. If more than one reaction is involved in an answer, be certain to distinguish the individual steps clearly.

A.



B.



C.



Name: _____

3. (25 points)

Draw specific structures for each of the following twelve (12) categories.

A. a carbene:

B. a carbanion:

C. a carbocation:

D. another carbocation, that is more stable than the carbocation in part C:

E. a radical:

F. another radical, that is less stable than the radical in part E:

G. a nucleophile:

H. an electrophile:

I. an *E*-alkene:

J. a *Z*-alkene:

K. a reaction of an alkyl halide that would exhibit a primary kinetic isotope effect:

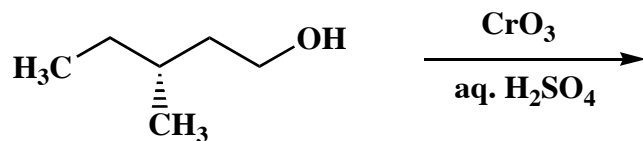
L. a reaction of an alkyl halide that would not exhibit a primary kinetic isotope effect:

Name: _____

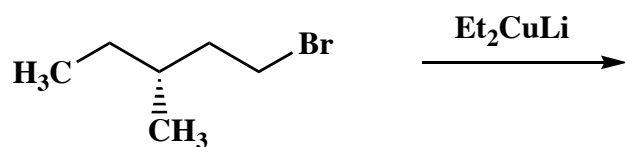
4. (50 points)

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

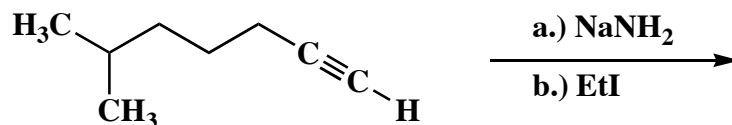
A.



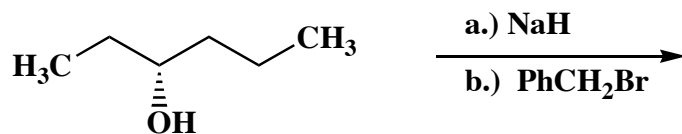
B.



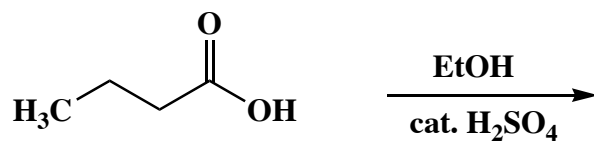
C.



D.



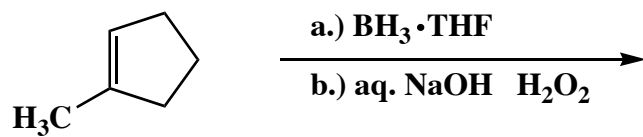
E.



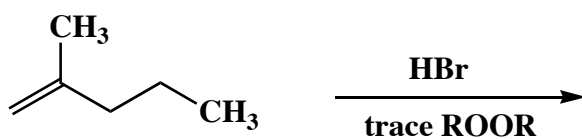
Name: _____

4. (continued)

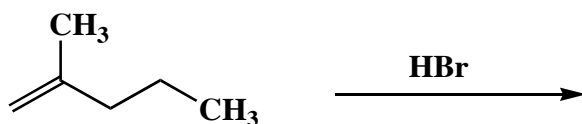
F.



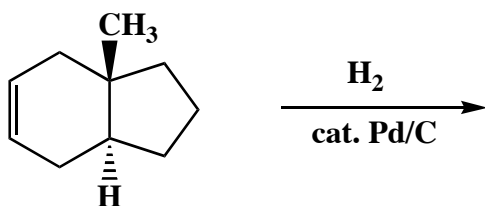
G.



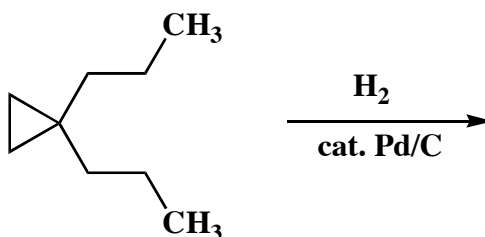
H.



I.



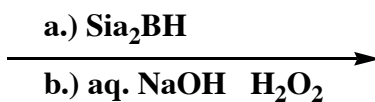
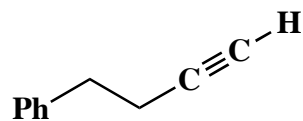
J.



Name: _____

5. (25 points)

The product from the following reaction shows infrared absorptions at 1450 cm^{-1} , 1500 cm^{-1} , 1580 cm^{-1} , 1600 cm^{-1} , 1710 cm^{-1} , 2720 cm^{-1} , 2820 cm^{-1} , 3025 cm^{-1} and a number of weak resonances in the $2870\text{--}2950\text{ cm}^{-1}$ range. 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:

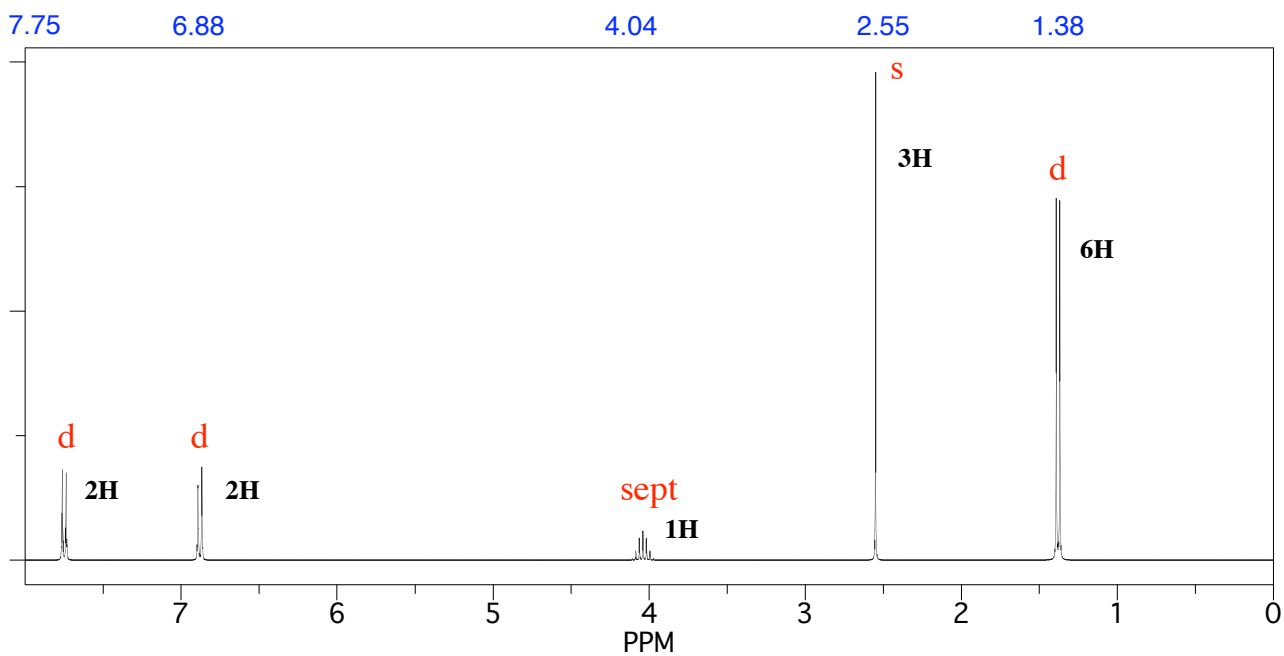
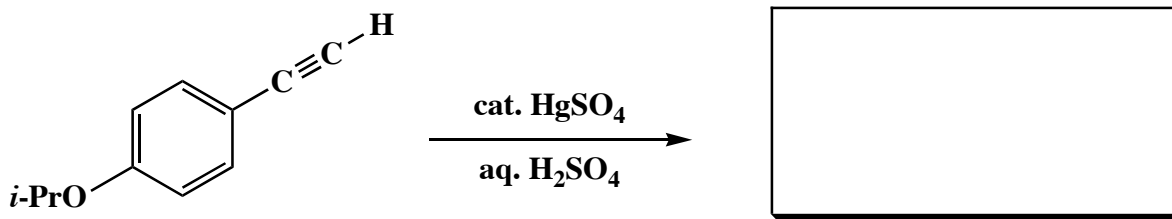
absorption

assignment

Name: _____

6. (25 points)

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



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6. (continued)

^1H NMR assignments:

chemical shift (ppm)

assignment

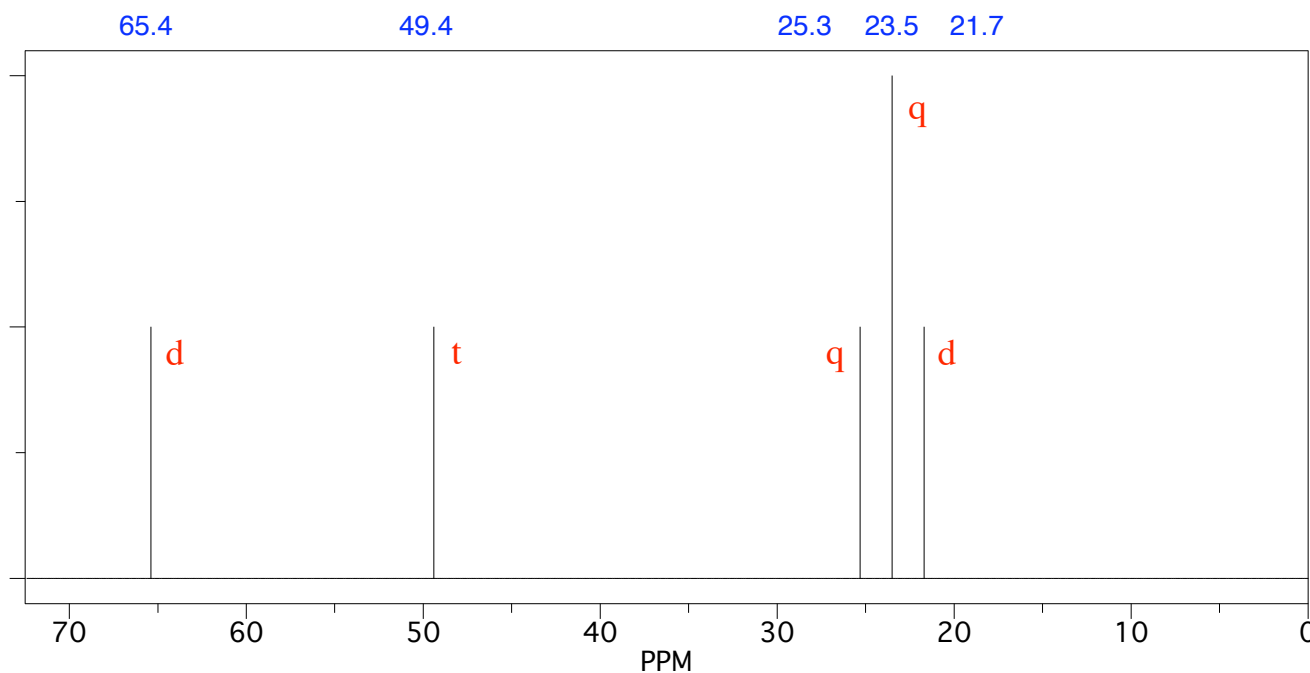
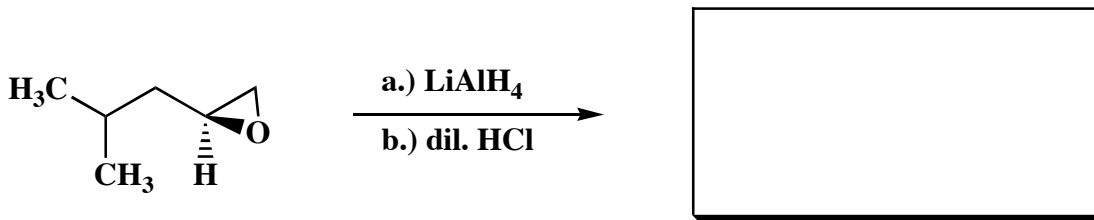
explanation of multiplicity



Name: _____

7. (25 points)

Draw the major organic product that is formed from the following reaction. The broadband proton-decoupled ^{13}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}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}C NMR correlation table is included separately.)



Name: _____

7. (continued)

^{13}C NMR assignments:

chemical shift (ppm)

assignment

explanation of multiplicity



Congratulations!

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

Course grade: _____