

Chemistry 333

Final Examination

May 14, 2008

Professor Charonnat

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

Be certain that your examination has nine (9) 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.

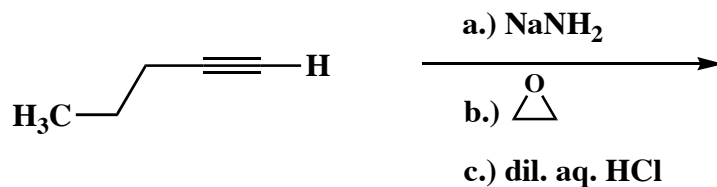
Molecular models are allowed for this examination. All electronic devices, including calculators, are unnecessary and are not allowed.

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

1. (50 points)

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

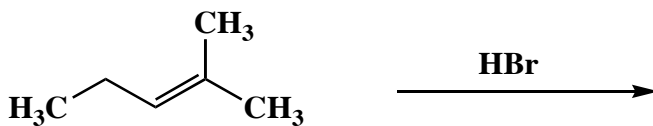
A.



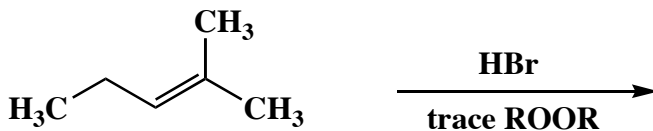
B.



C.



D.



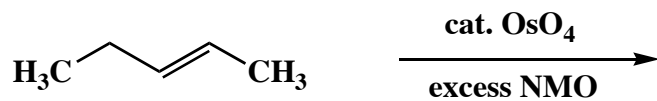
E.



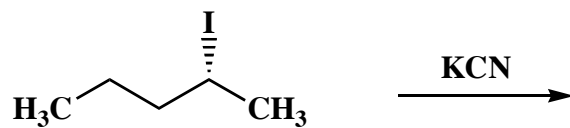
Name: \_\_\_\_\_

1. (cont.)

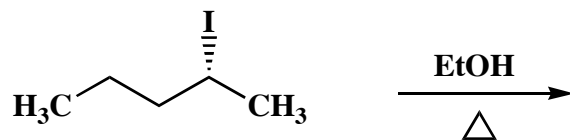
F.



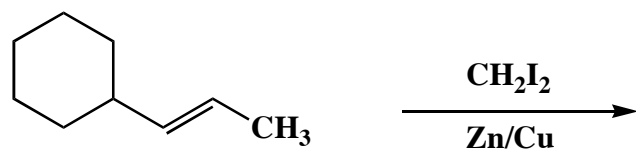
G.



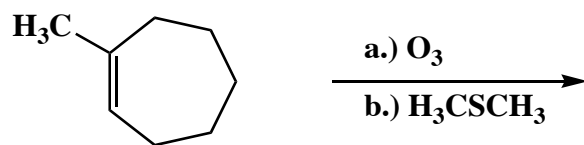
H.



I.



J.

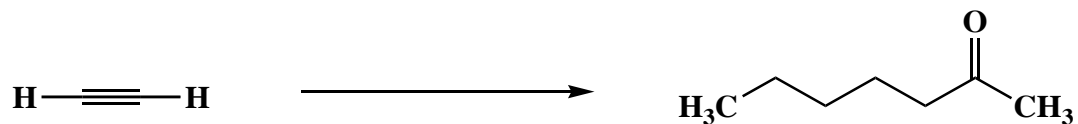


Name: \_\_\_\_\_

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.

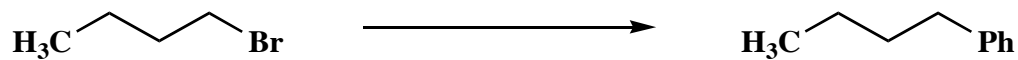
A.



B.



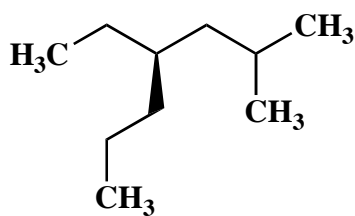
C.



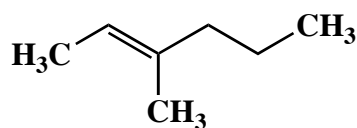
3. (20 points)

Use IUPAC nomenclature to write the systematic names of the following two (2) compounds.

A.



B.



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

4. (30 points)

Circle the number that corresponds to the correct answer for each of the following six (6) questions.

A. A compound's molecular formula is  $C_9H_{13}ClO_2$ . The compound possesses

1. one degree of unsaturation
2. two degrees of unsaturation
3. three degrees of unsaturation

B.  $^1H$  has

1. one spin state
2. two spin states
3. three spin states

C. If the intensity of an M+2 peak is 4.4% of the molecular ion's intensity, what element is present?

1. sulfur
2. chlorine
3. bromine

D. Isopentylbenzene  $[(H_3C)_2CH(CH_2)_2Ph]$  possesses

1. four sets of chemically equivalent hydrogens
2. five sets of chemically equivalent hydrogens
3. seven sets of chemically equivalent hydrogens

E. A compound shows a weak molecular ion at  $m/z = 142$  and an intense fragment peak at  $m/z = 124$ . What functional group most likely is present?

1. an ester
2. a ketone
3. an alcohol

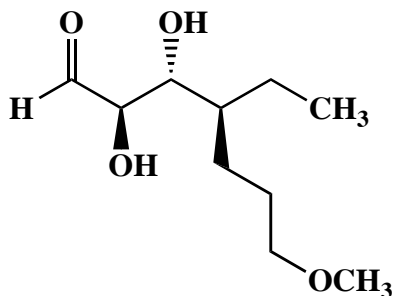
F. Mass spectrometers are run at very low pressure to

1. ensure that intermolecular collisions do not occur
2. ionize the sample
3. pull the ions through the instrument

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

5. (20 points)

Consider the following carbonyl compound. Draw structures that correspond to each of the following: the enantiomer, a diastereomer, a conformational isomer, and a regioisomer of this carbonyl compound.



\_\_\_\_\_

**the enantiomer**

\_\_\_\_\_

**a diastereomer**

\_\_\_\_\_

**a conformational isomer**

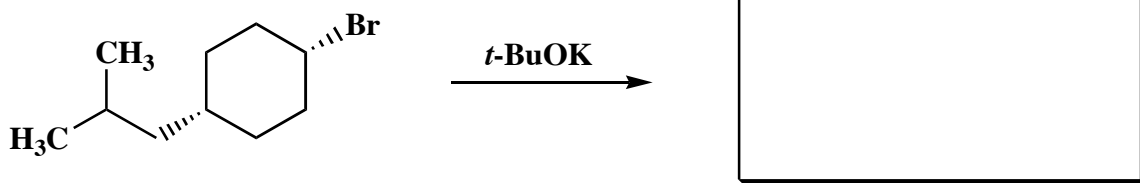
\_\_\_\_\_

**a regioisomer**

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

6. (15 points)

When the following reaction was run, a product was isolated that showed infrared absorptions at 3040, 2975, 1658 and 1190  $\text{cm}^{-1}$ . 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.)



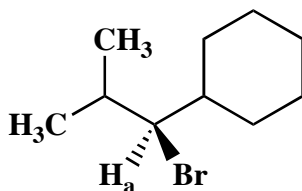
**infrared assignments:**

**absorption**

**assignment**

7. (15 points)

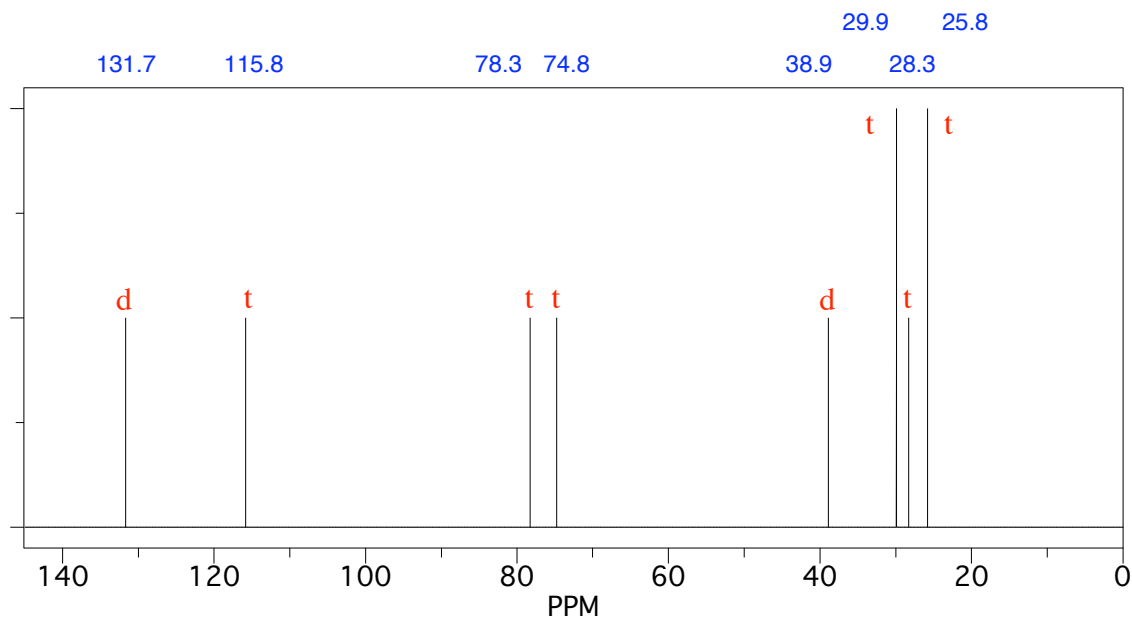
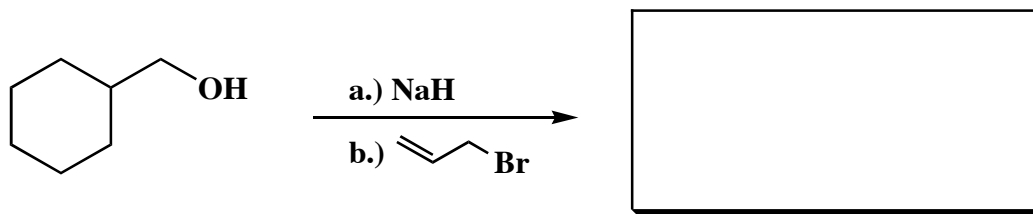
Use letters to label all the sets of chemically equivalent protons that are coupled to  $\text{H}_a$  in the following alkyl bromide. Then draw an annotated tree diagram to show the multiplicity of the  $\text{H}_a$  resonance. Specify, but do not quantify all appropriate coupling constants in the tree diagram.



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

8. (25 points)

Draw the major organic product that is formed from the following reaction. Use letters to label all the sets of chemically equivalent carbons in the product. The broadband proton-decoupled  $^{13}\text{C}$  NMR spectrum of the product is shown below. The labels next to each of the individual resonances signify the multiplicities that are observed in the corresponding off-resonance proton-decoupled  $^{13}\text{C}$  NMR spectrum (d = doublet, t = triplet). Use this spectroscopic evidence to determine the identity of the compound. Assign all the  $^{13}\text{C}$  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	/20
4	/30
5	/20
6	/15
7	/15
8	/25
<hr/>	
Total:	/200