Chemistry 333

Examination #3

July 9, 2019 Professor Charonnat

Name: _____

Be certain that your examination has six (6) 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.

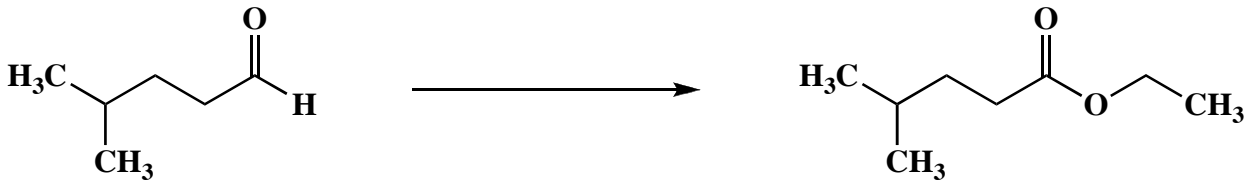
Molecular models are allowed for this examination. All electronic devices, including calculators and cell phones, are unnecessary and are not allowed.

Name: _____

1. (30 points)

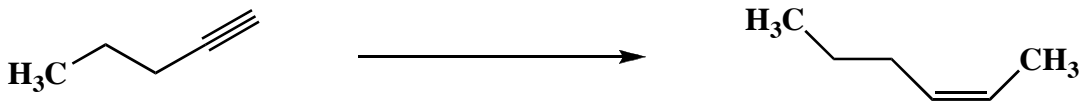
Write the specific reagent(s) necessary to effect the transformation shown for each of the following three (3) questions. If more than one reaction is involved in an answer, be certain to distinguish the individual steps clearly. Include stoichiometric coefficients of reagents, as well.

A.



B.

C.



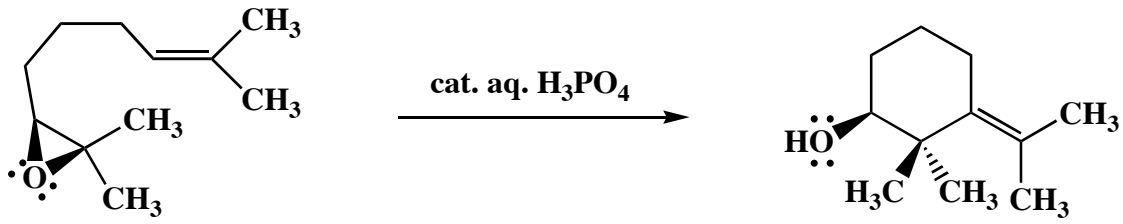
2. (10 points)

An organic compound has a molecular ion at m/z = 130, an M+1 isotope peak at m/z = 131, and an M+2 isotope peak at m/z = 132. The M+1 and M+2 signals are 8% and 33% of the molecular ion's intensity, respectively. Use all of the above mass spectral data to determine the molecular formula of the compound. Given this molecular formula, how many degrees of unsaturation are present? Show your reasoning. Finally, draw two structural isomers that are consistent with this molecular formula.

Name: _____

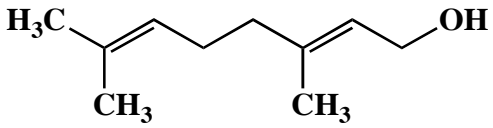
3. (20 points)

Draw the mechanism of the following reaction, using the curved-arrow notation to indicate the reorganization of electron density. Show all intermediates, lone pairs, nonzero formal charges, countercharges, and reversibility or irreversibility. Explain in detail why only a catalytic amount of phosphoric acid is required. Finally, explain why the six-membered ring closure occurs instead of the starting material epoxide reacting with another copy (or copies) of itself to form an acyclic product.



4. (10 points)

Use IUPAC nomenclature to write the systematic name of the terpene, geraniol.



Name: _____

5. (25 points)

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

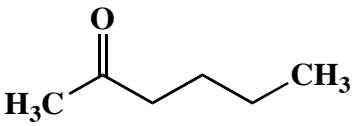
A. The infrared spectrum of a compound allows one to determine

1. the compound's molecular formula
2. the presence of certain functional groups in the compound
3. the compound's covalent bond pattern

B. Simmons-Smith cyclopropanation of oct-1-ene occurs

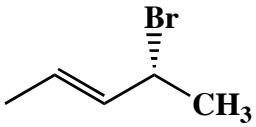
1. in a stepwise mechanism via an ionic intermediate
2. in a stepwise mechanism via a radical intermediate
3. in a one-step, concerted mechanism without an intermediate

C. Reduction of the following ketone with sodium borohydride, followed by aqueous HCl workup, affords



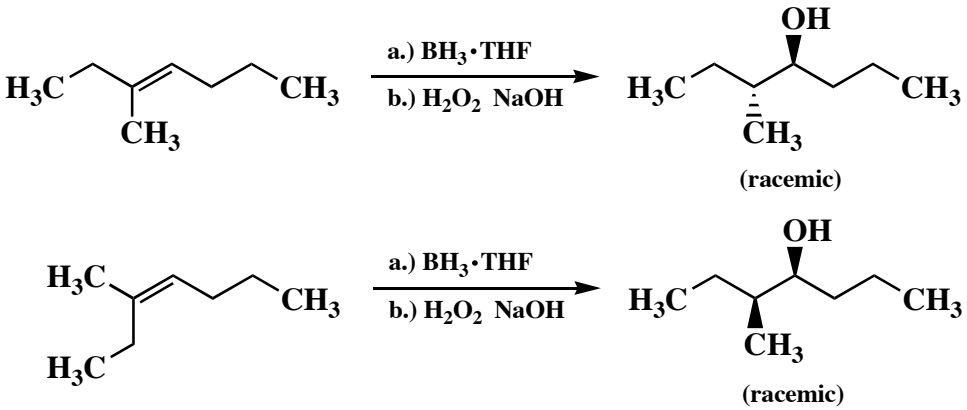
1. an optically-inactive, chiral alcohol
2. an optically-active, chiral alcohol
3. an optically-inactive, achiral alcohol

D. How many strong resonances are expected in the DEPT 90 spectrum of the following allylic bromide?



1. 1
2. 2
3. 3

E. The following set of reactions is

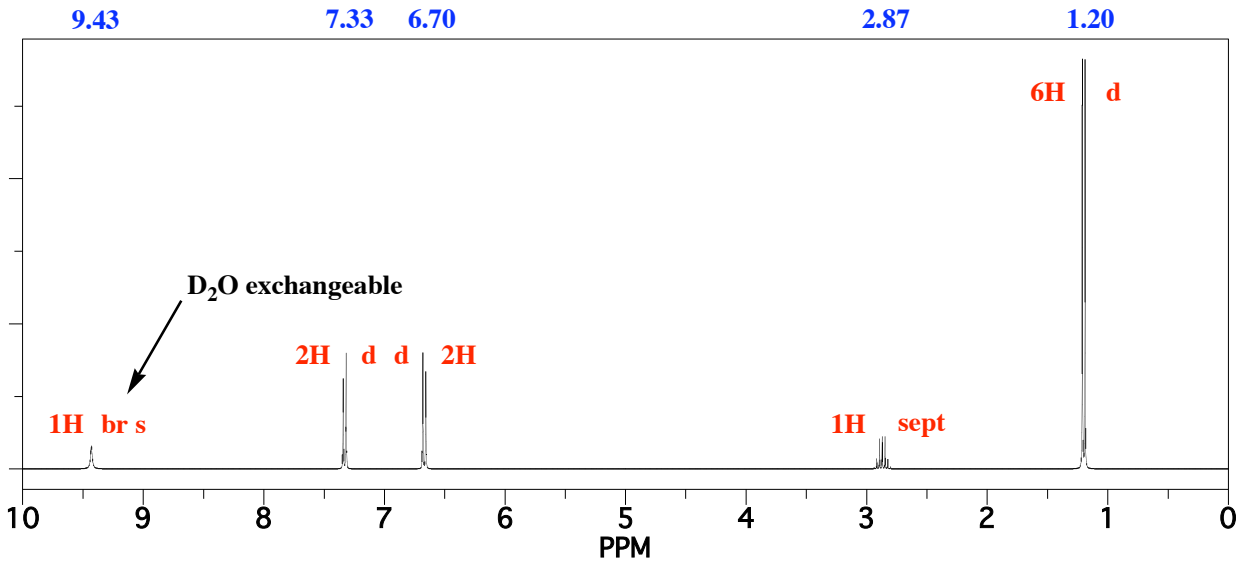


1. enantiospecific
2. diastereospecific
3. neither enantiospecific nor diastereospecific

Name: _____

6. (25 points)

The ^{1}H NMR spectrum of an unknown organic compound ($C_9H_{12}O$) is shown below. The labels next to each of the resonances signify the integrals and multiplicities observed in the spectrum (br s = broad singlet, d = doublet, sept = septet). Use this spectroscopic data to determine the identity of the compound. Draw the structure of this compound in the box at the bottom of the next page and use letters to label each set of chemically equivalent protons. Make clear assignments of all the resonances and explain their multiplicities in detail. (A ^{1}H NMR correlation table is included separately.)



Name: _____

6. (continued)

^{1}H NMR assignments:

chemical shift (ppm)	assignment	explanation of multiplicity
9.43		
7.33		
6.70		
2.87		
1.20		

structure:

Congratulations!

1	/30
2	/10
3	/20
4	/10
5	/25
6	/25
Total:	/120