

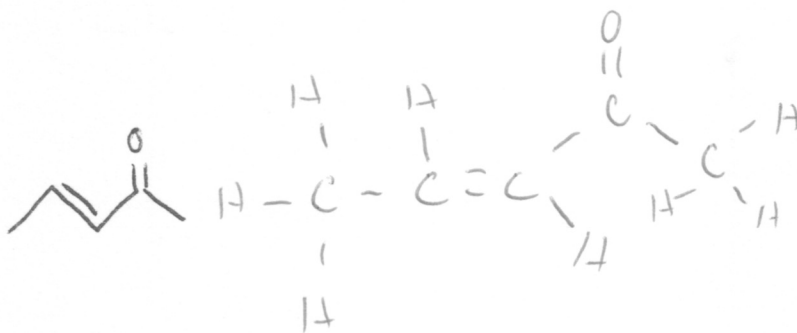
Name: \_\_\_\_\_

## CHM 227 Exam 1a Summer 2017

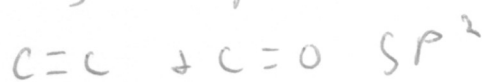
### Short Answer

1. The skeleton of a compound is shown.

Complete the Lewis structure



Indicate the hybridization of each central atom.

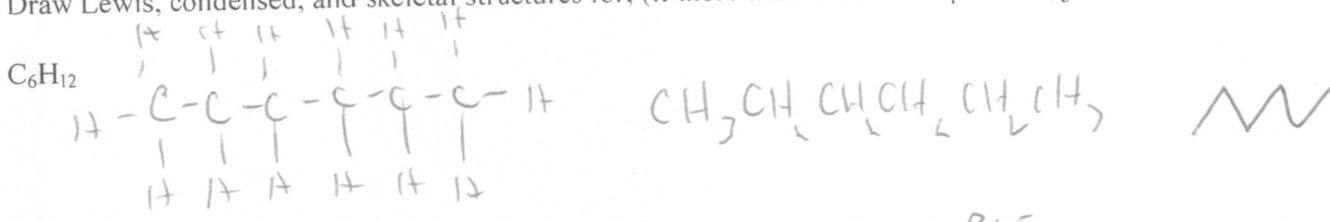


Indicate the geometry of each central atom.

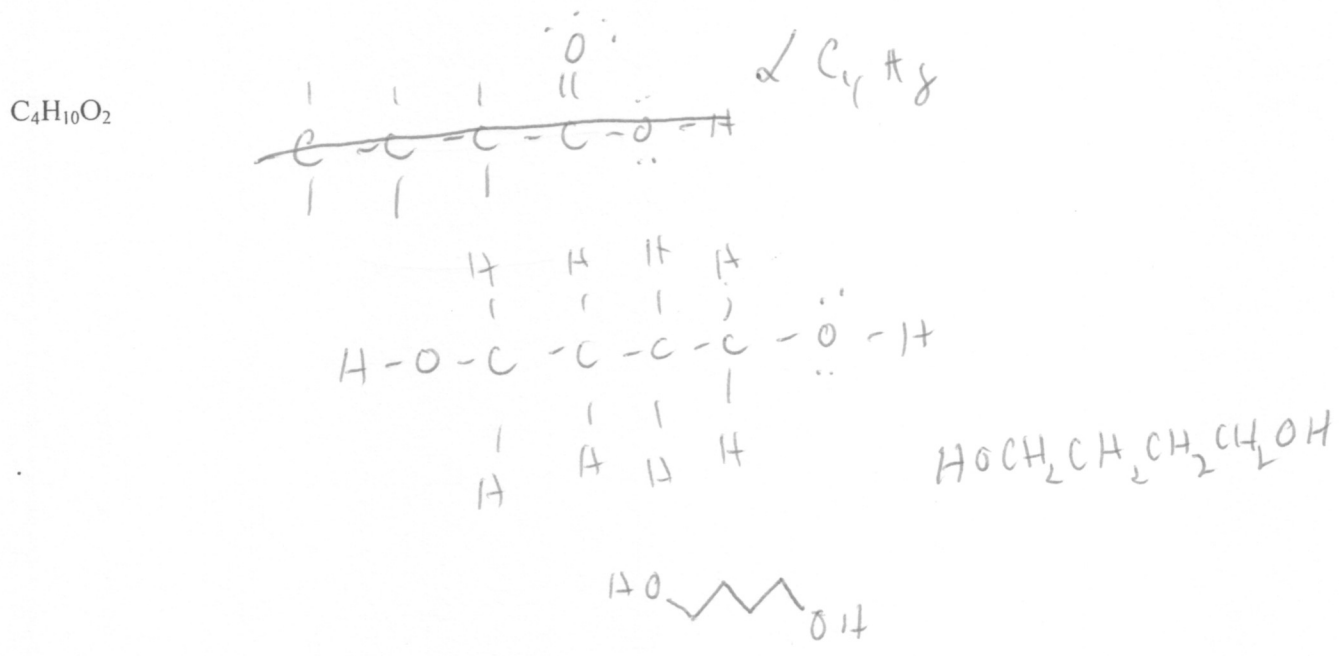
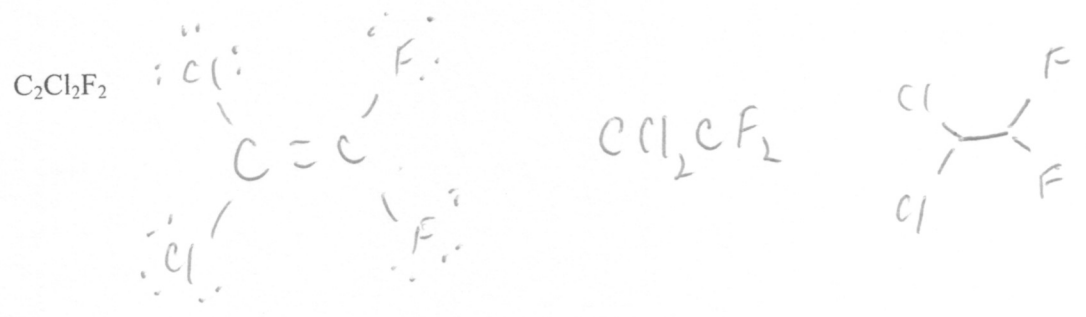
~~For~~



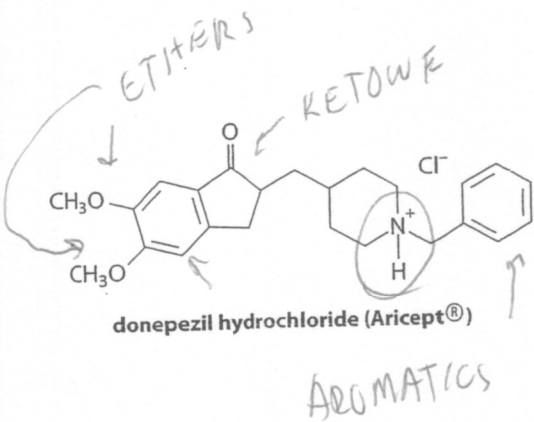
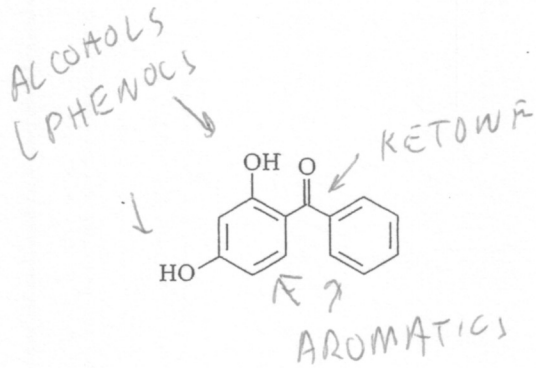
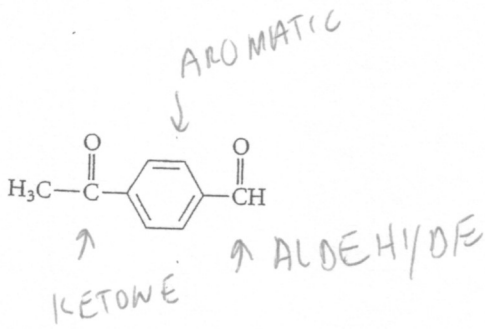
5. Draw Lewis, condensed, and skeletal structures for; (if more than 1 isomer is possible, just draw one)



MANY ISOMERS POSSIBLE



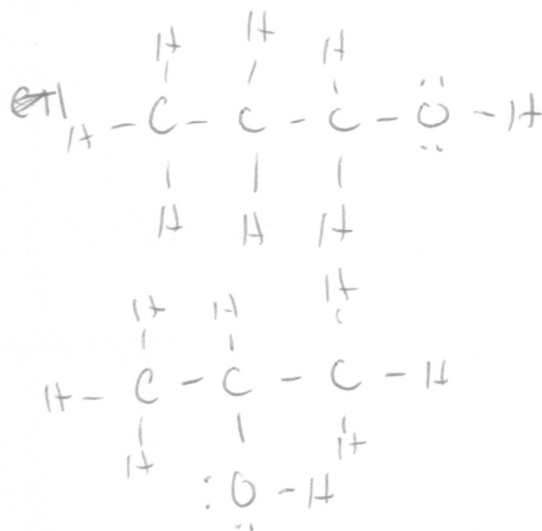
6. Circle each functional group and identify it. There are some that we have not covered yet, just circle those.



$\text{N}^+$  IS AN AMMONIUM

THIS IS THE ONLY  
DRUG KNOWN THAT  
SLOWS THE PROGRESS  
OF ALZHEIMERS

4. Draw 2 isomers. (Lewis structures) Label the functional groups.



2 POSSIBLE ALCOHOLS

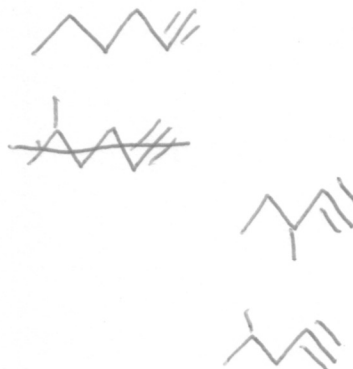
1 ETHER

~~1 ALDEHYDE~~

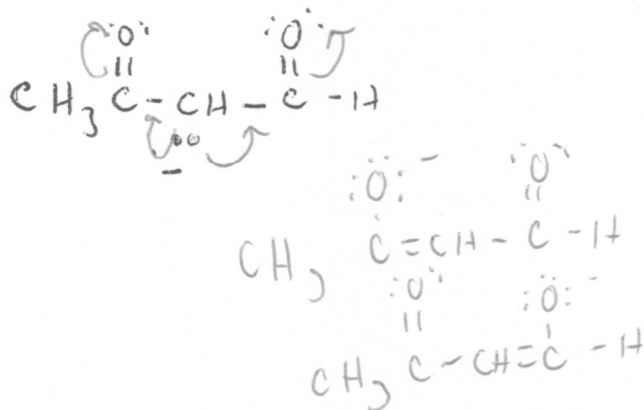
~~1 KETON~~

2. Draw structures of any four isomers of an alkyne with the formula  $C_6H_{10}$ .

SKETAAL IS EASIEST



3. Draw 2 resonance structures.



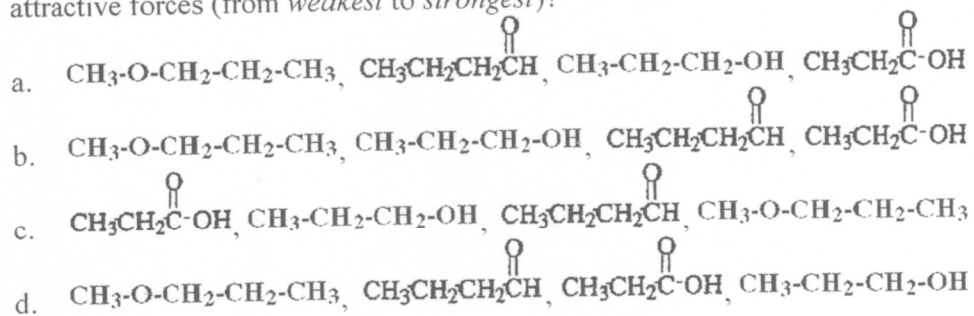
Name: \_\_\_\_\_

## CHM 227 Exam 1b Summer 2017

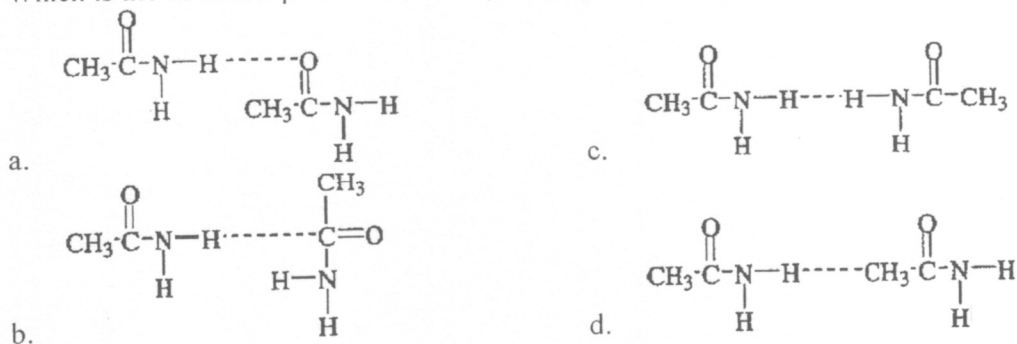
### Multiple Choice

Identify the choice that best completes the statement or answers the question.

- A 1. Which of the following correctly lists the molecules in order of increasing strength of intermolecular attractive forces (from weakest to strongest)?



- A 2. Which is the correct representation of hydrogen bonding between these molecules?



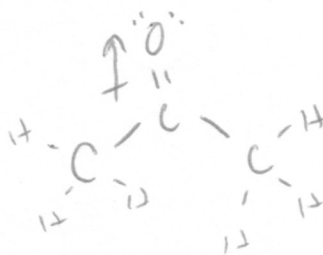
- E 3. Which of these compounds would have the lowest boiling point?



## Short Answer

4. Acetone, the three carbon ketone, is about 3 times more massive than water and has a 50% higher dipole moment. Using Lewis structures, explain, in terms of intermolecular attractive forces;

a) why is acetone more polar?



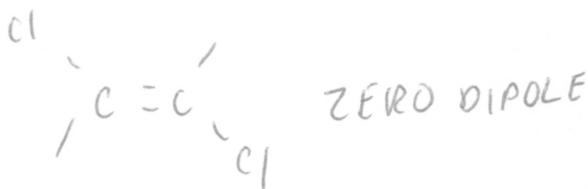
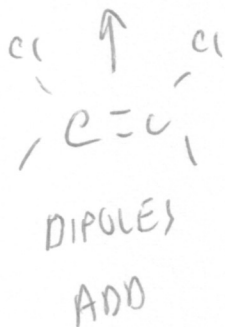
$\pi$   $e^-$  LOOSELY HELD

b) why does water have a much higher boiling point? (100 °C vs 57 °C)

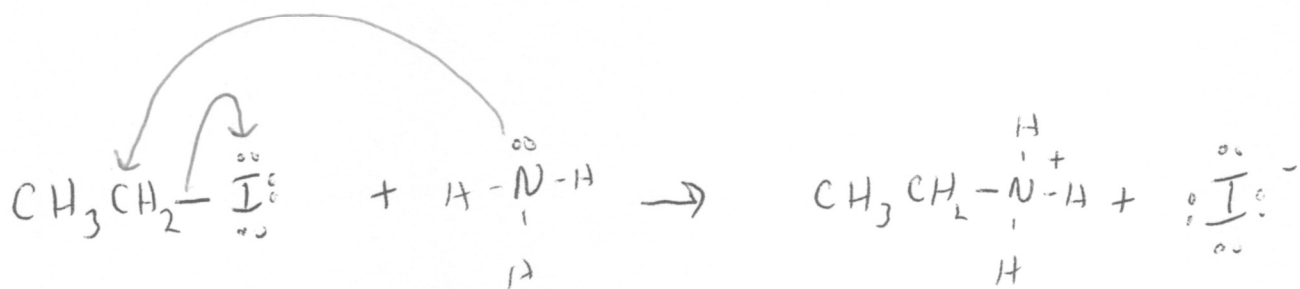
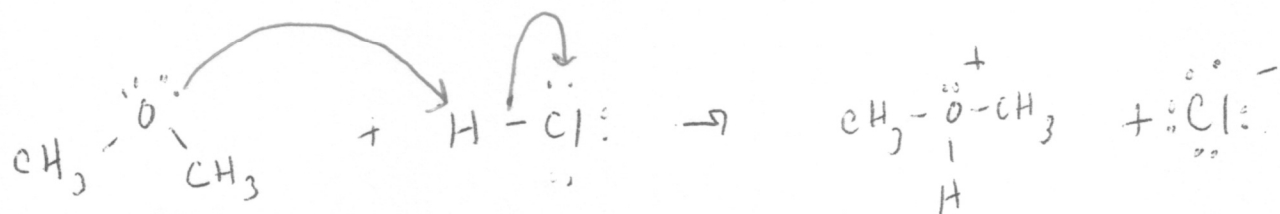
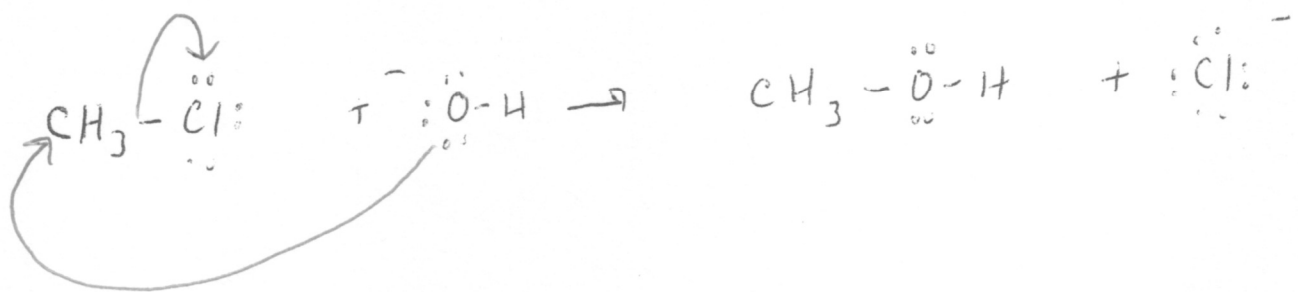
HYDROGEN BONDING



5. There are 2 isomers of 1,2-dichloroethene,  $\text{CHCl}=\text{CHCl}$ . One has a large dipole and the other has a dipole of zero. Draw the two isomers and explain the difference in dipole moment.

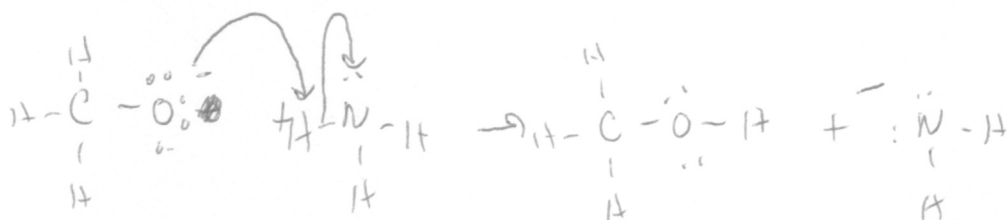
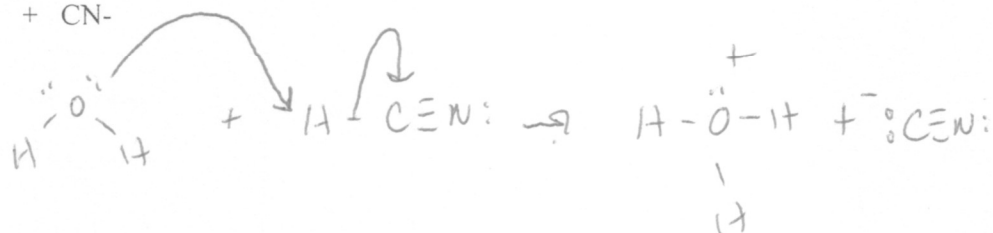


6. Provide curved arrows for the following transformations;





7. Draw Lewis structures for each compound. Label the acids and bases in these equations. Draw curved arrows to indicate electron flow in the forward (left to right) direction.



8. The pKa of acetic acid ( $\text{CH}_3\text{COOH}$ ) is 4.75. What must the pKa of  $\text{CH}_3\text{SH}$  be if this reaction is to proceed from left to right?

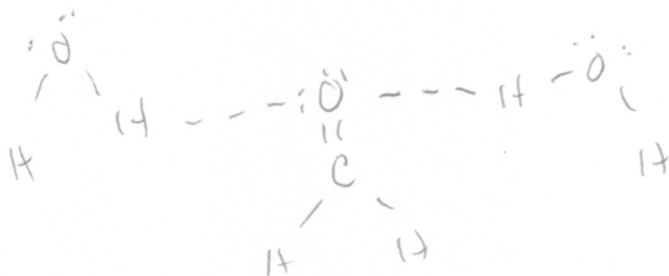


$\text{CH}_3\text{COOH}$  MUST BE THE

STRONGEST ACID

pKa FOR  $\text{CH}_3\text{SH}$  MUST BE  $> 4.75$

9. Draw a Lewis structure for  $\text{CH}_2\text{O}$  with the proper geometry. Draw Lewis structures of two water molecules, with the proper geometry. Indicate the polarities of each compound and show explicitly how the water molecules interact with the  $\text{CH}_2\text{O}$  molecule.



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

## CHM 227 Exam 2 Summer 2017

### Multiple Choice

Identify the choice that best completes the statement or answers the question.

- D 1. Which of the following statements is (are) true for the compound (3R,4R)--3,4-dimethylhexane?
- a. this compound is chiral
  - b. the enantiomer of this compound is (3S,4S)--3,4-dimethylhexane
  - c. this compound is a diastereomer of (3R,4S)--3,4-dimethylhexane
  - d. all of the above
  - e. none of the above
- 2 2. Which of the statements below correctly describes the chair conformations of trans-1,4-dimethylcyclohexane?
- a. The two chair conformations are of equal energy
  - b. the higher energy chair conformation has one methyl axial and one methyl equatorial
  - c. the lower energy chair conformation has two axial methyl groups
  - d. the lower energy chair conformation has one methyl axial and one methyl equatorial
  - e. the higher energy chair conformation has two axial methyl groups

### Short Answer

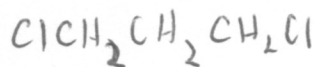
3. Draw a Newman projection of 2,3-dichlorobutane in the most stable conformation.



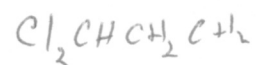
4. Draw all the isomers of  $C_3H_6Cl_2$ . Use any type of structure necessary.

CONDENSED

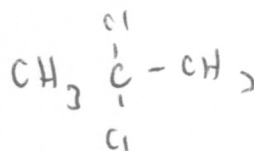
1, 3



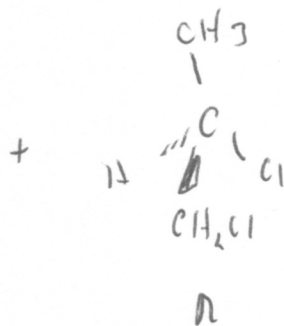
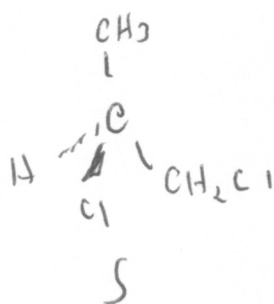
1, 1



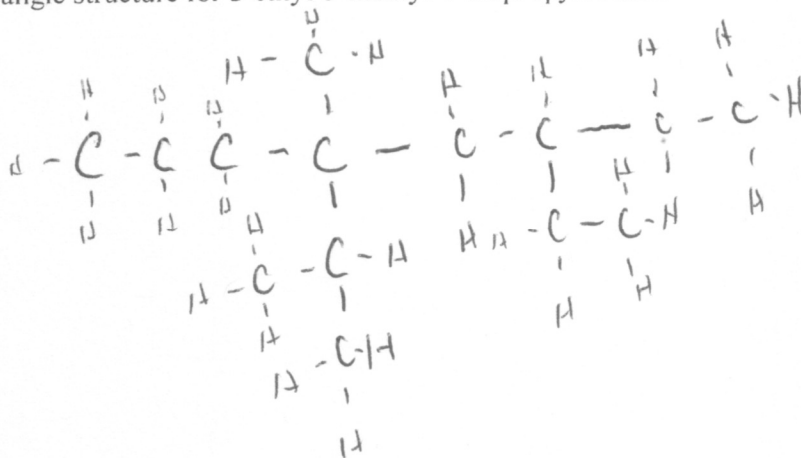
2, 2



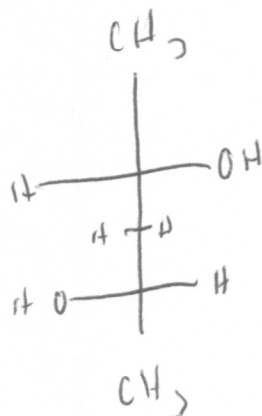
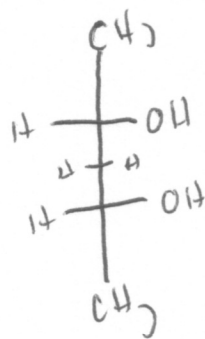
1, 2 IS CHIRAL



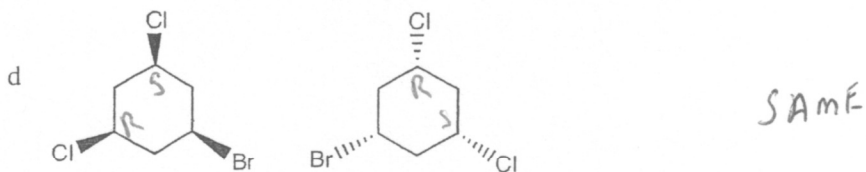
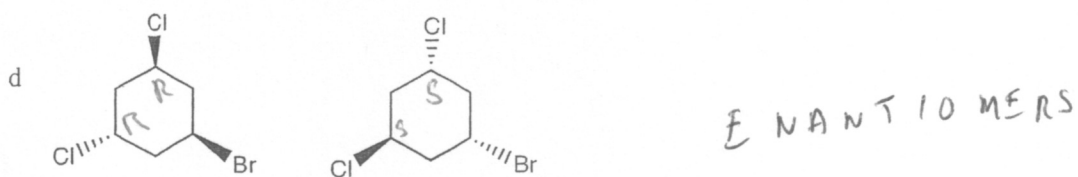
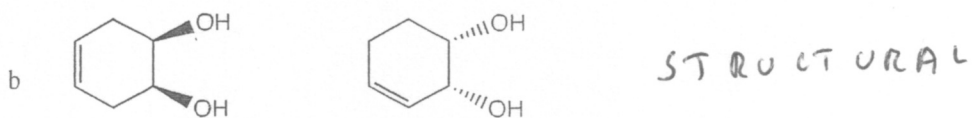
5. Draw a Lewis structure and a line/angle structure for 3-ethyl-5-methyl-5-isopropyloctane.



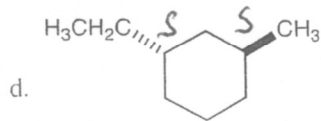
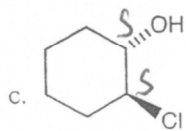
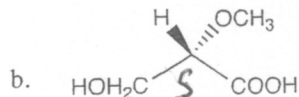
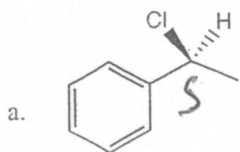
6. Draw a Fischer projection of (2R,4S)-pentanediol (has OH groups on the numbered carbons). Draw a Fischer projection of a diastereomer of this compound.



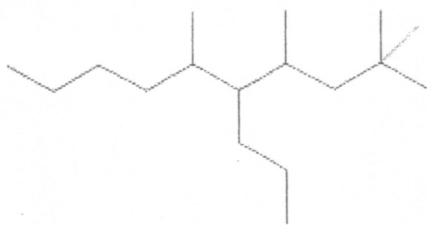
State the relationship between each of the following pairs of structures (identical, enantiomers, diastereomers, constitutional (structural) isomers, or different compounds that are not isomeric)



Assign R, S configurations to each chiral center in these molecules:



What is the name of the alkane shown?



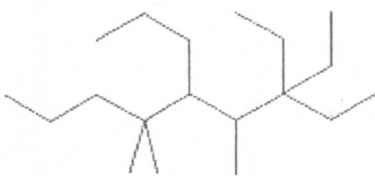
2,2,4,6-tetramethyl-5-propyldecane ✓

6-propyl-5,7,9,9-tetramethyldecane

5,7,9,9-tetramethyl-6-propyldecane

2-ethyl-4,6-dimethyl-5-propyldecane

What is the name of the alkane shown?



3,3-diethyl-4,6,6-trimethyl-5-propylnonane ✓

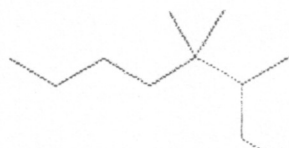
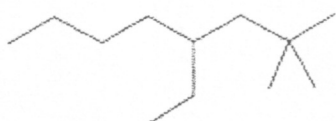
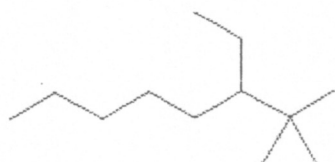
2,2-diethyl-3,5,5-trimethyl-4-propyloctane

7,7-diethyl-4,4,6-trimethyl-5-propylnonane

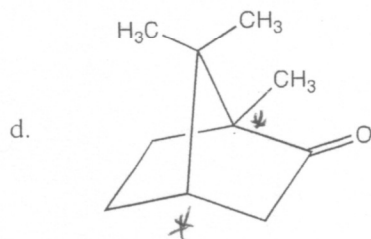
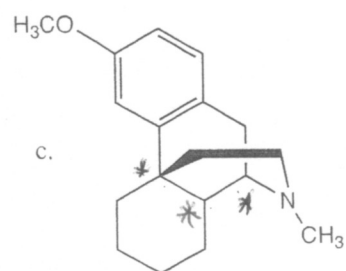
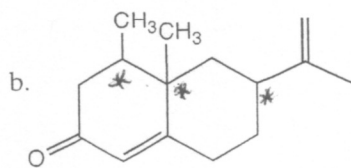
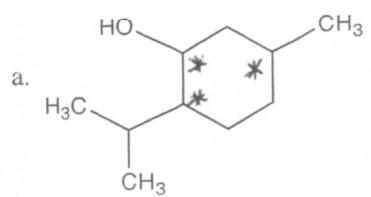
6,6-diethyl-3,3,5-trimethyl-4-propyloctane

6,6-diethyl-3,3,5-trimethyl-4-propylnonane

What is the correct structure of the alkane 4-ethyl-2,2-dimethyloctane?



Identify all the chiral centers in the following molecules:

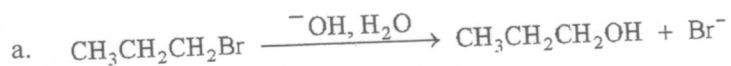


Name: \_\_\_\_\_

### CHM 227 Summer 2017 Exam 3

#### Problem

**Instructions:** Consider the pair of reactions below to answer the following question(s).



or



1. Consider the reactions above.

a) Which reaction would be predicted to be faster? **B**

b) Classify the reactions as  $\text{S}_{\text{N}}1$  or  $\text{S}_{\text{N}}2$ .

**$\text{S}_{\text{N}}2 \rightarrow 1^\circ$  SUBSTRATE  
STRONG NUC**

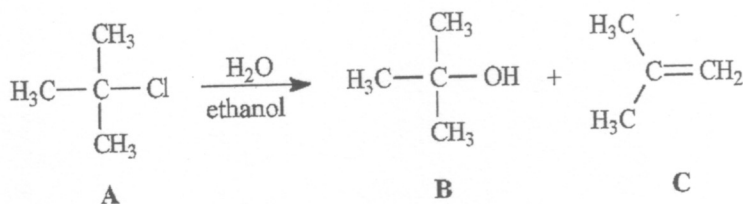
c) Explain your answers to the questions above.

**$^-\text{SH}$  BETTER NUC  
LARGER  $e^-$  CLOUD**

#### Multiple Choice

Identify the choice that best completes the statement or answers the question.

**Instructions:** Consider the reaction below to answer the following question(s).

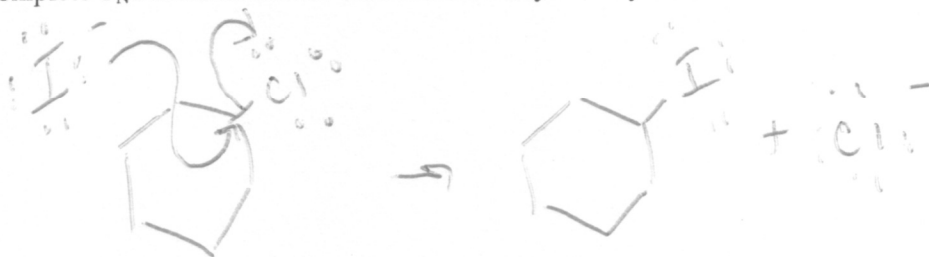


B 2. Refer to instructions. Compound B is the:

- $\text{S}_{\text{N}}2$  product
- $\text{S}_{\text{N}}1$  product
- E2 product
- E1 product



6. Draw a complete  $S_N2$  mechanism for the reaction of cyclohexylchloride with Iodide ion..

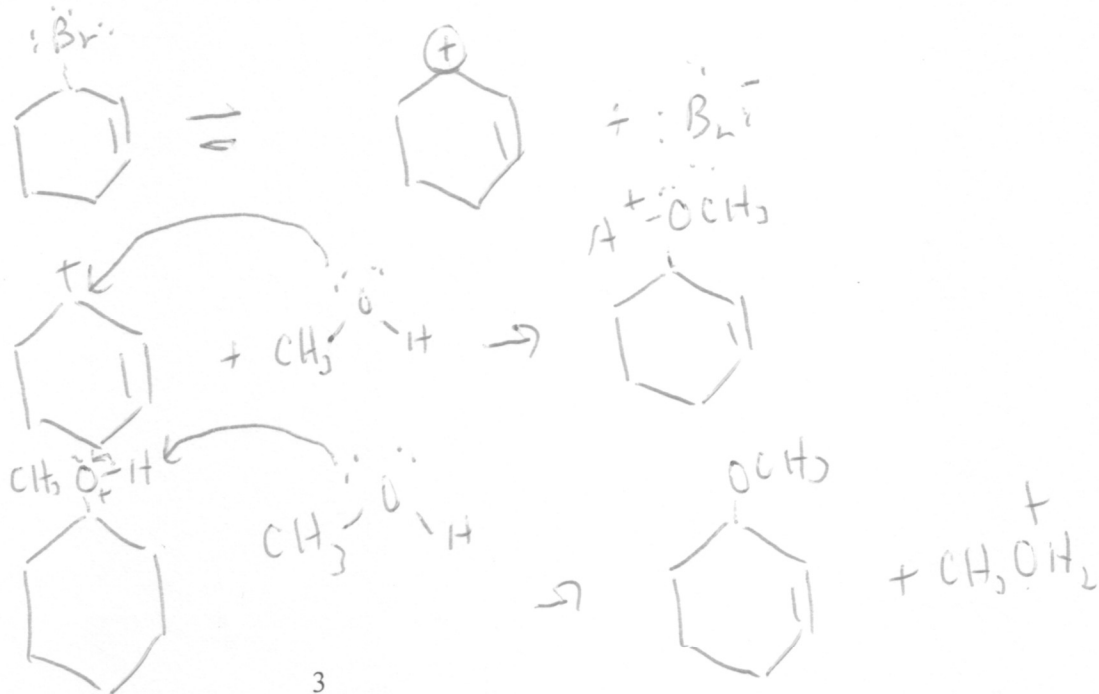


7. Which compound reacts faster in a  $S_N1$  reaction. Briefly explain your choice.

2-bromo-2-methylbutane or 2-bromo-3-methylbutane.



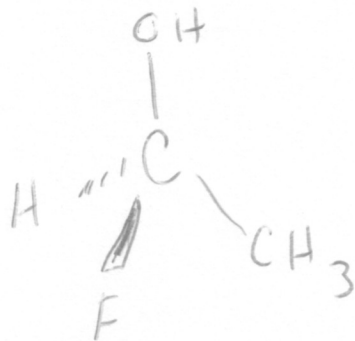
8. 3-bromocyclohexene undergoes  $S_N1$  reaction rapidly in methanol. Draw a complete mechanism.



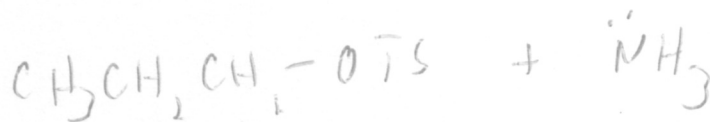
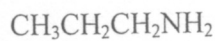
9. Make a **stereochemical** drawing of the product.

(S)-1-bromo-1-fluoroethane reacts with NaOH.

NEED R



10. Show how you might prepare the following compounds using a nucleophilic substitution at some step. You may use any reagent with 3 carbons or less.



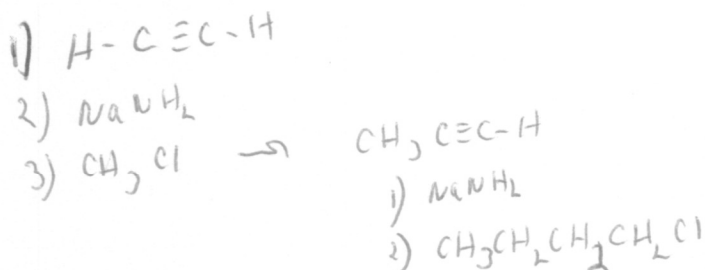
Name: \_\_\_\_\_

### CHM 227 Exam 4 Summer 2017

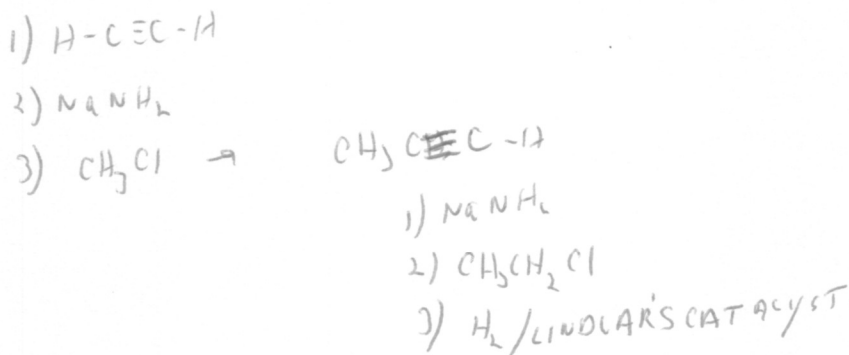
#### Short Answer

1. Devise a synthesis of these compounds using acetylene, any alkyl halide, and any needed reagents.

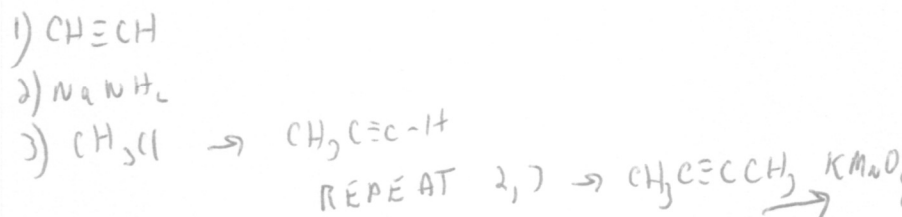
oct-2-yne (2-octyne)



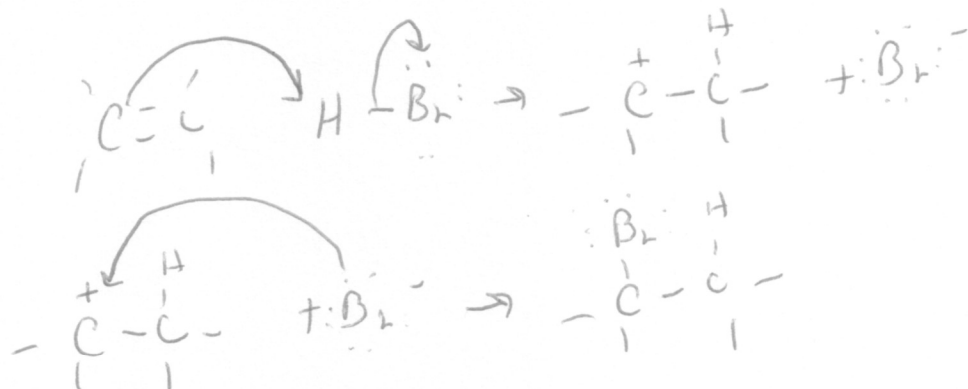
cis-pent-2-ene (2-pentene)



ethanoic acid ( $\text{CH}_3\text{COOH}$ )

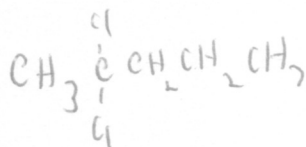


2. Write a mechanism for the addition of HBr to an alkene. Show each step separately.

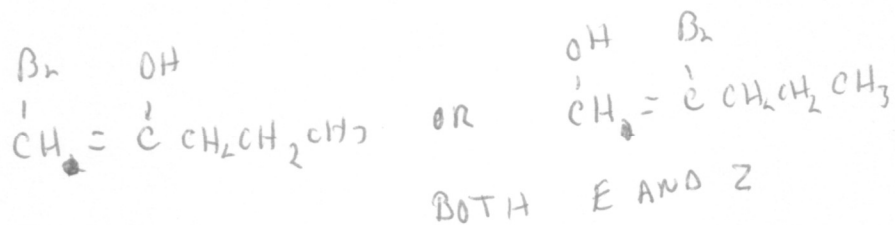


3. Draw the structure of the product of the reaction between pent-1-yne (1-pentyne) and;

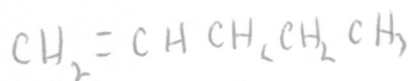
2 equivalents of HCl



1 equivalent of  $\text{Br}_2/\text{H}_2\text{O}$

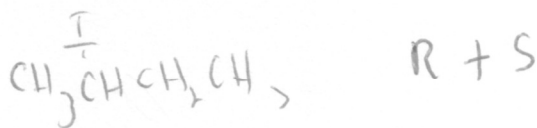


sodium metal in liquid ammonia

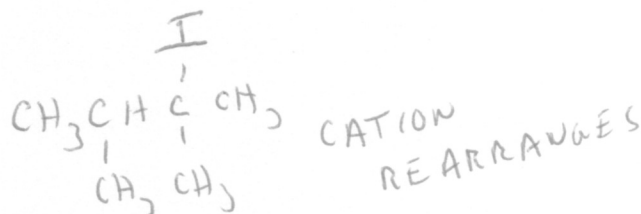


6. Draw the structure of the product(s) when HI reacts with;

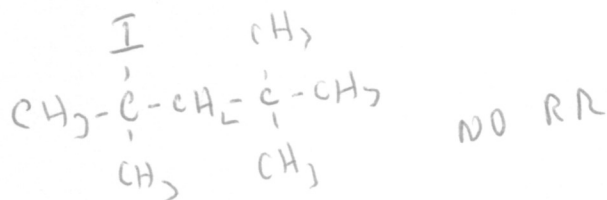
2-butene



3,3-dimethyl-1-butene



2,4,4-trimethyl-2-pentene



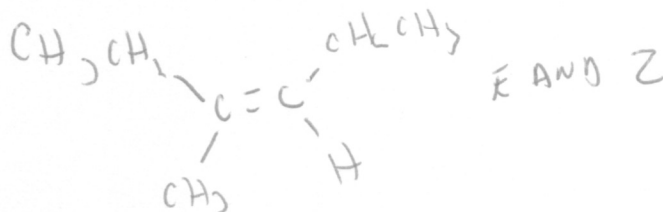
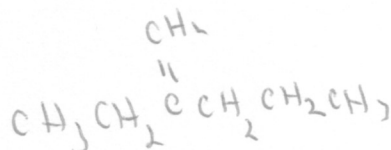
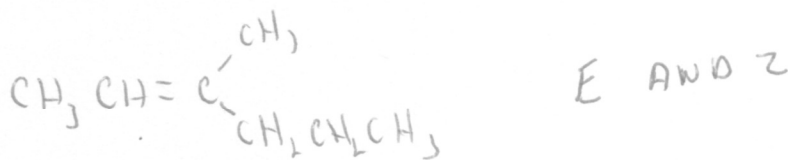
7. Write the structure(s) of all the alkenes that form 3-methylhexane upon reaction with  $\text{H}_2$  and catalyst.

PLUS

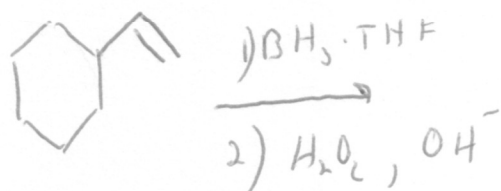
1-ENE

4-ENE

5 ENE



4. Show how you can synthesize, from any alkene and any needed reagents, 2-cyclohexylethanol.



5. Acetylide ions are useful for forming carbon - carbon bonds. A student proposes to form such a bond using the compound:

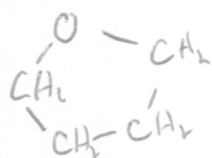


Expecting a 6 carbon product, the student is disappointed to find only a four carbon product and a 2 carbon product.

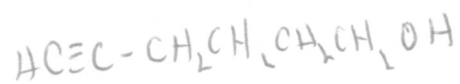
Draw three structures; of the expected 6 carbon product, the four carbon product (C4H8O) and the 2 carbon product.



4 C



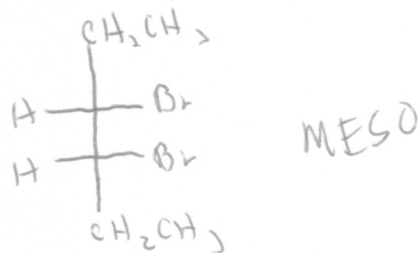
DESIRED 6 C



BUT -OH

IS TOO ACIDIC  
FOR  
ACETYLIDE  
FORMATION

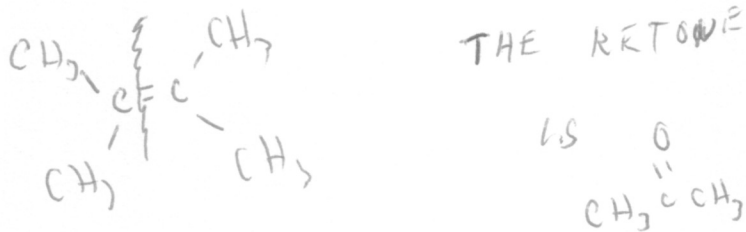
8.  $\text{Br}_2$  adds to (E)-3-hexene. Draw the structure of the product(s).



9. A compound A with molecular formula  $\text{C}_6\text{H}_{12}$  has one chiral carbon. After catalytic hydrogenation A is converted to B ( $\text{C}_6\text{H}_{14}$ ). B has no chiral carbons. Propose structures for A and B.

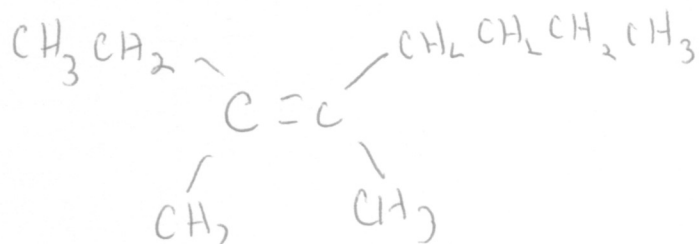


10. A hydrocarbon, A, adds one mole of hydrogen in the presence of a platinum catalyst to form 2,3-dimethylbutane. When A is oxidized with  $\text{KMnO}_4$  a single ketone containing three carbons is produced. What is the structure of A?





11. Draw the structure of Z-3,4-dimethyl-3-octene



12. Cyclohexylchloride reacts with hydroxide ion in an E2 mechanism.  
Draw the mechanism, using a cyclohexane chair.

