Final Exam

Chemistry 3331

December 8, 2015

Name:_____

Signature:_____

ID#_____

PLEASE CIRCLE CLASS TIME!

10:00 AM

1:00 PM

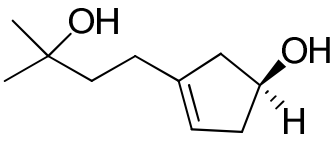
Page #	Score	
1. 12 pt		
2. 13 pt		
3. 13 pt		
4. 12 pt		
5. 12 pt		
6. 12 pt		
7. 10 pt		
8. 10 pt		
9. 6 pt		

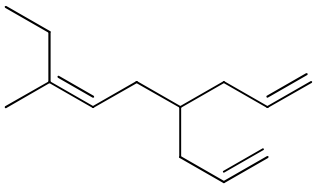
Total:_____

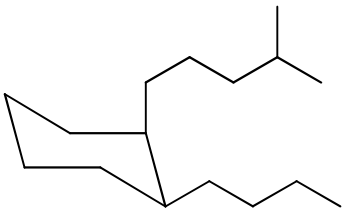
NOTE: Present your ID when you return the exam booklet.

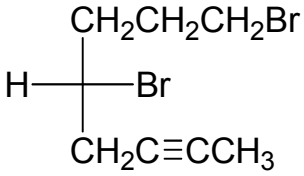
Yi-Kai Lin

A. Nomenclature: (12 points)
Given an acceptable IUPAC name for each compounds. Be sure to indicate the **stereochemistry** where appropriate.

1. 

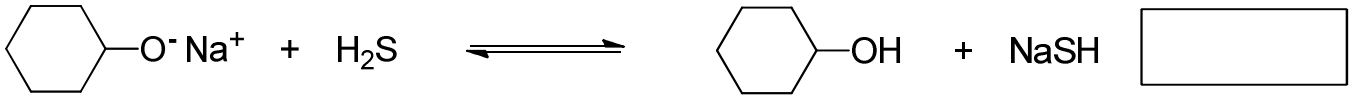
2. 

3. 

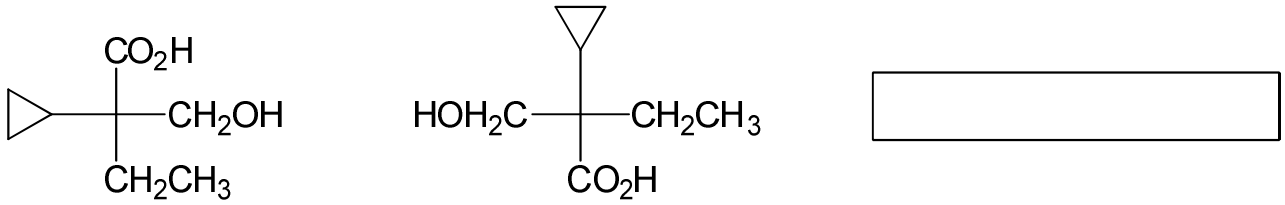
4. 

B. Facts: 26 points

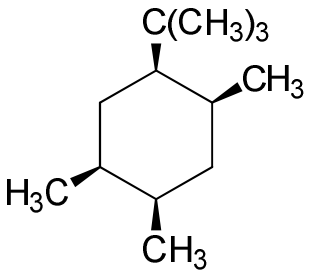
1. Does the following equilibrium lie to the Left or the Right? (2 pts.)



2. Label the following pair as identical, structural isomers, enantiomers or diastereomers. (2 pts.)

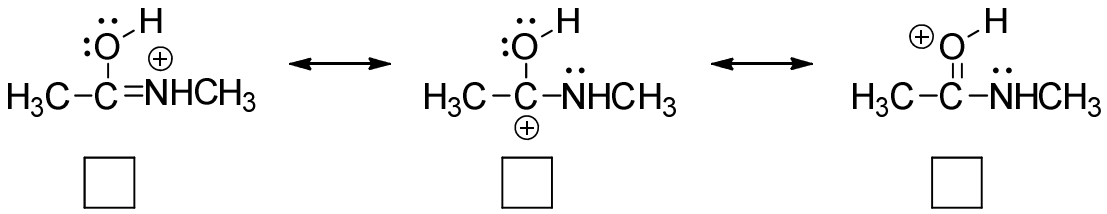


3. Consider the substituted cyclohexane below. In the more stable chair conformation, how many methyl groups are in **axial** positions? (2 pts.)



Answer: ☐

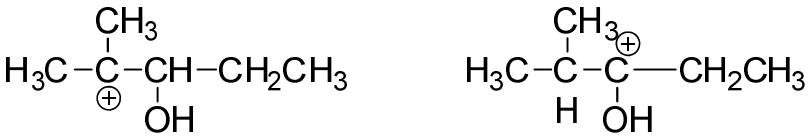
4. Consider the resonance contributors below.



☐ ☐ ☐

   a. Place the contributors in order of increasing importance to the hybrid. (1=contributes least, 3=contributes most) (3pts.)
   b. Place the hybridization of the oxygen atom in the box. (1 pt.) ☐

5. Which is the more stable carbocation, **A** or **B**? (3 pts.)



A **B**

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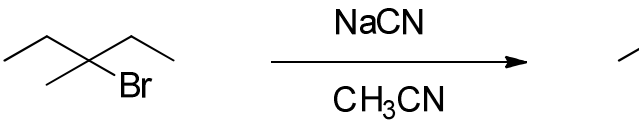
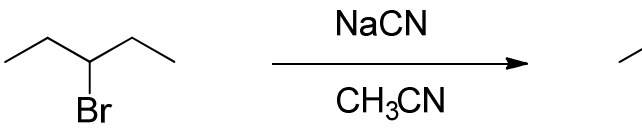
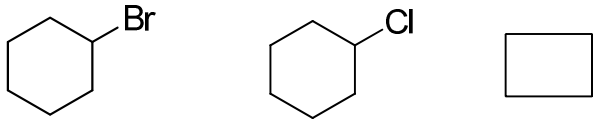
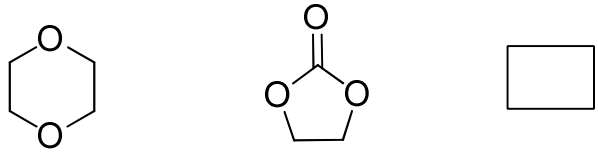
6. Compare the reaction rates of reaction **a)** and reaction **b)**, and place the letter of the faster reaction in the box. (2 pts.)

a) 

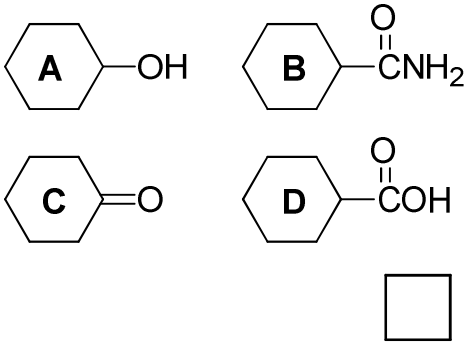
b) 

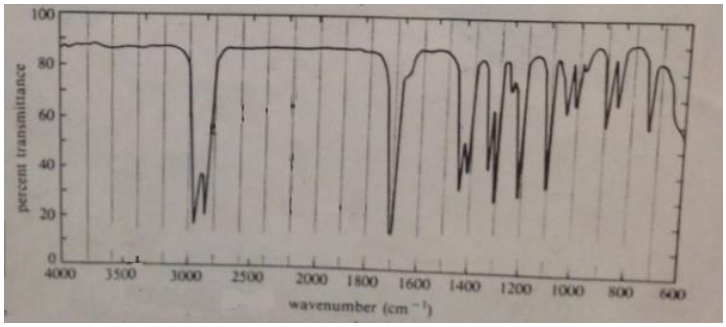
7. In the box, indicate which technique, NMR, IR, or MS, would most readily allow differentiation between the compounds in each pair. (4 pts.)

a) 

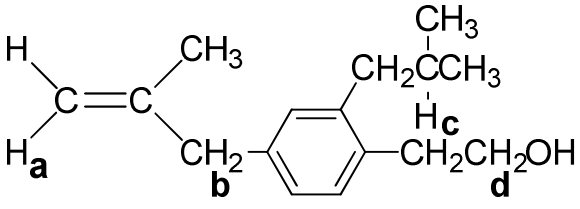
b) 

8. Carefully examine the spectrum and the compounds below. Place the letter of the correct compound in the box beside the spectrum. (2 pts.)





9. Answer the following questions for the molecule shown below and place the answers in the appropriate boxes. (i) Under normal conditions of purity, what are the theoretically predicted multiplicities (splitting patterns) of the signals for the protons labeled **a**, **b**, **c**, and **d**? (ii) Under ultrapure conditions, what is the theoretically predicted multiplicity of the signal for the protons labeled **d**? (5 pts.)



(i) multiplicity of H_a ☐

multiplicity of H_b ☐

multiplicity of H_c ☐

multiplicity of H_d ☐

(ii) multiplicity of H_d ☐

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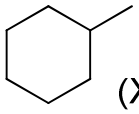
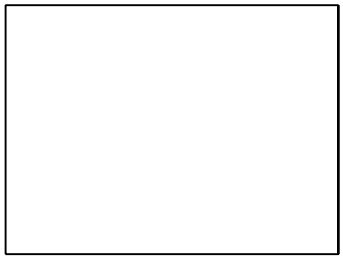
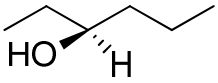
C. Reactions: Total = 36 points, 4 points each

Please provide the major product unless otherwise indicated in the answer box. Be sure your drawing indicates stereochemistry if applicable. Partial credit is awarded only when intermediate products in a multi-step reaction are shown below the reaction.

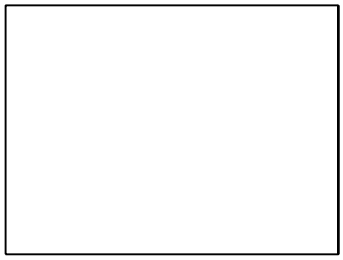
1.  (XS)

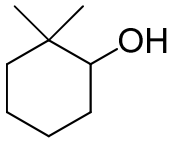
$\xrightarrow[\text{2. } NaOCH_2CH_3/EtOH \\ \text{3. } O_3 \\ \text{4. } (CH_3)_2S \\ \text{5. } CH_3C{\equiv}C{:}^{-}\ Na^{+}\ (XS),\ \text{then } H_3O^{+}]{\text{1. } Br_2/Light}$



2. 

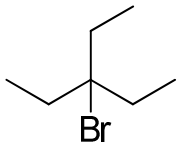
$\xrightarrow[\text{2. NaSH / DMSO}]{\text{1. } PBr_3}$



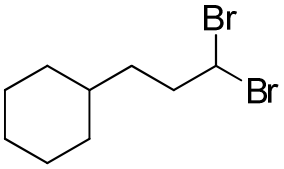
3. 

$\xrightarrow[\text{2. NBS/Light}]{\text{1. } H_2SO_4/Heat}$

 + 

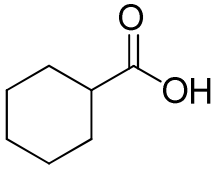
4. 

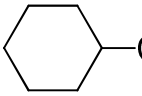
CH_3OH / heat → [ ] + [ ]

5. 

1. KOH/200°C
2. H_2 / Pd ($BaSO_4$) / quinoline
3. $CHBr_3$/KOH

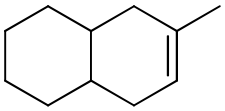
→ [ ]

6. 

1. $CH_3CH_2CH_2OH/H^+$
2. 

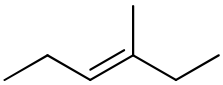
(xs) then H_3O^+

→ [ ]

7. 

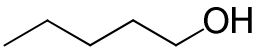
1. $OsO_4/H_2O_2/OH^-$

2. HIO_4
3. $LiAlH_4$ (xs), then H_3O^+

8. 

1. $BH_3{\cdot}THF$

2. H_2O_2/OH^-
3. $Na_2Cr_2O_7/H_2SO_4/H_2O$

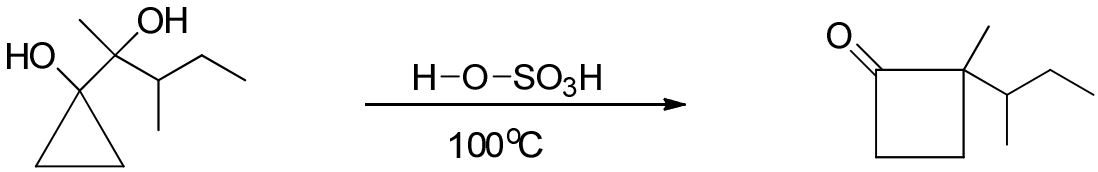
9. 

1. Na

2. $CH_3CH_2CH_2Br$

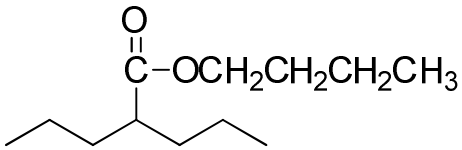
D. Mechanism: (10 points)

Provide a clear mechanism to explain the formation of the product shown. Use curved arrows to indicate "electron flow". Remember to show only one step at a time. Show all intermediates and all formal charges. **If more than one resonance contributor is possible, be sure to show the more stable contributor.**



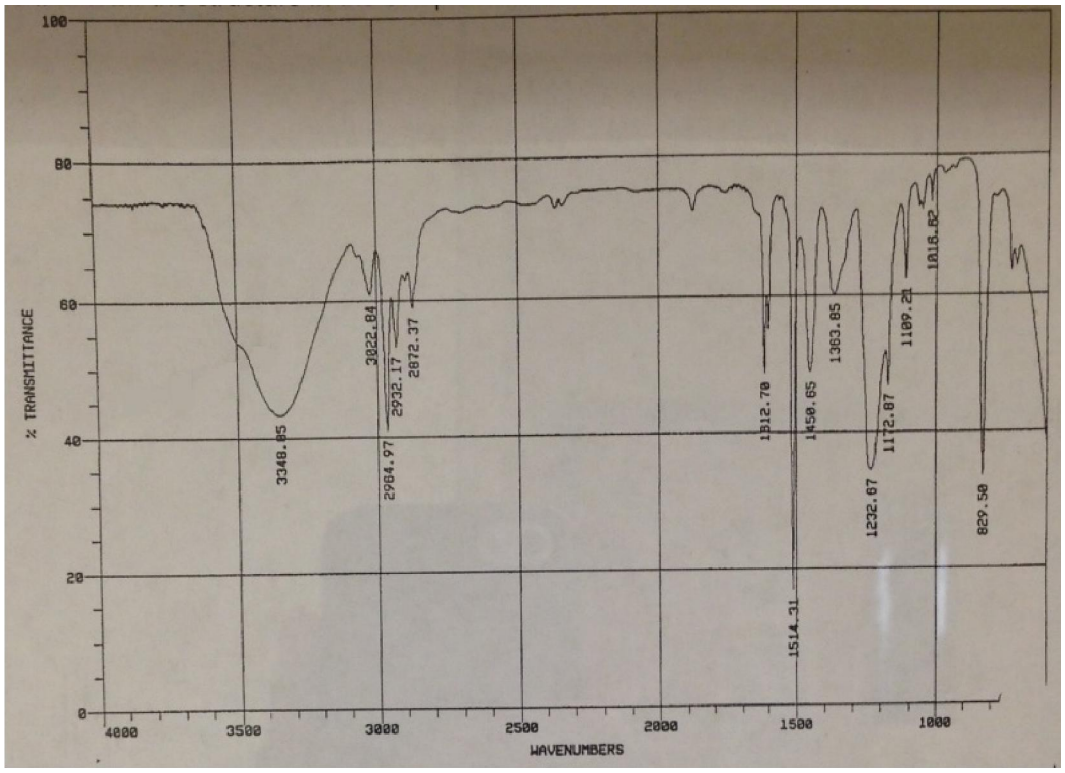
E. Synthesis: (10 points)

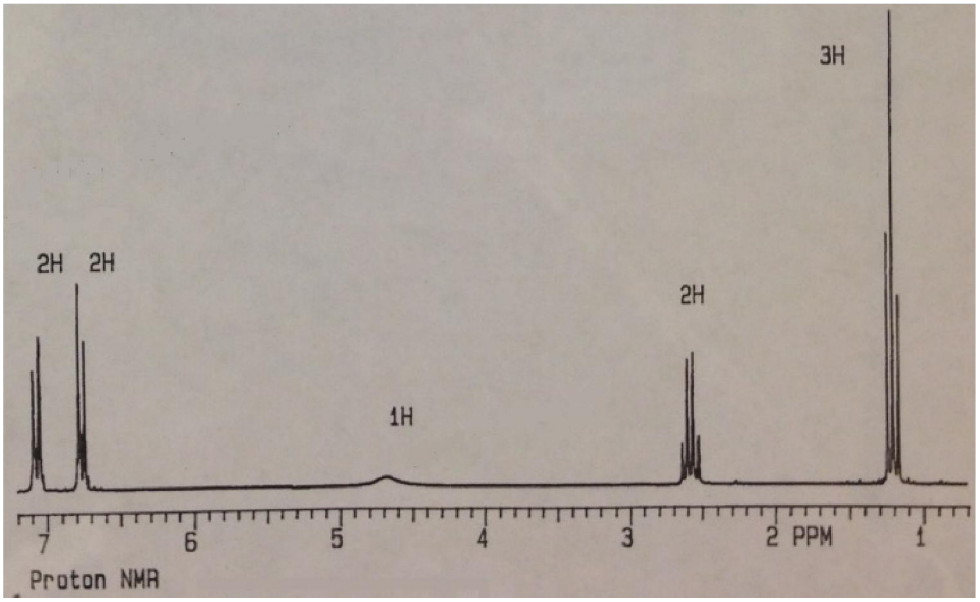
Synthesize the molecule below using any of the following reagents: **alcohols or alkenes** of **four carbons or less**, any other inorganic reagents, and any oxidizing or reducing agents.



F. Spectroscopy: 6 Points

A compound with the formula $C_8H_{10}O$ exhibits the IR and ^1H NMR shown below. Please identify this compound and draw the structure in the box provided below.





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