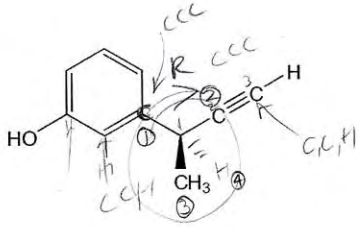
A. Nomenclature: Total = 12 points

Please provide a proper IUPAC name for each of the following compounds. Include stereochemistry where appropriate.

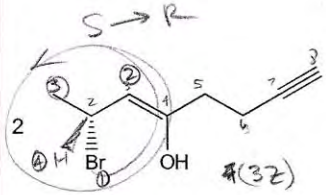
1



3-((1R)-1-methyl-2-propynyl)phenol

~~phenol propynyl~~ 3-(2-propynyl) 3-(1-methyl-2-propynyl) 3-((1R)-1-methyl-2-propynyl)phenol

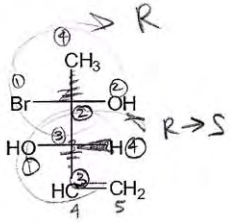
2



(2R,3Z)-2-bromooct-3-en-7-yn-4-ol

octanol octan-4-ol oct-3-en-4-ol oct-3-en-7-yn-4-ol (2R) (3Z) 2-bromo

3

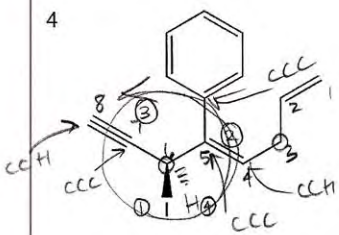


(2R,3S)-2-bromopent-4-ene-2,3-diol

pentenediol pent-4-ene-2,3-diol (2R)(3S) 2-bromo

★ NOTE use "ene" with diols ONLY!! usually it is seen as ex: pent-4-en-3-ol

4

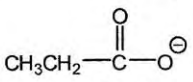


(4E,6S)-6-iodo-5-phenylocta-1,4-dien-7-yne

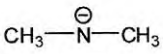
octa-1,4-dien-7-yne (4E)(6S) 6-iodo 5-phenyl

B. Facts: Total Points = 22

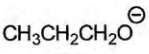
3. Rank the following carbanions in order of increasing stability. (1=least stable, 4=most stable) (3 pts.)



[4]



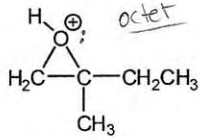
[2]



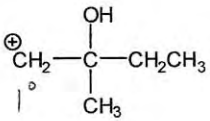
[3]

[1]

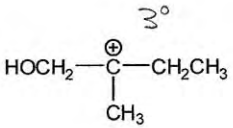
2. Rank the following carbocations in order of increasing stability. (1=least stable, 3=most stable) (3 pts.)



[3]

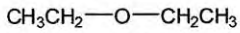


[1]

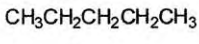


[2]

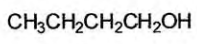
3. Rank the following molecules in order of decreasing boiling point. (3 = lowest, 1 = highest) (3 pts.)



[2]



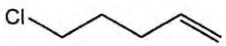
[3]



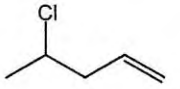
[1]

4. Rank the following molecules in order of increasing rate of reaction with the E1 process. (1 = lowest, 3 = highest) (3 pts.)

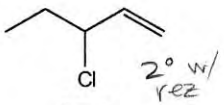
E1: 3°>2°>1°



[1]

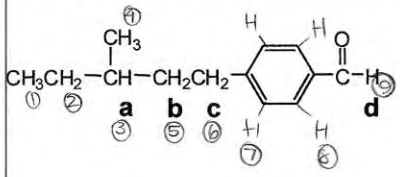


[2]



[3]

5. Place the answers to the following questions in the appropriately labeled boxes. a) How many distinct types of protons does the compound below have? b) What are the theoretically predicted multiplicities (splitting patterns) of the signals for the protons labeled **a,b,c,d**? (10 pts.)



a) types of protons [9]

b) multiplicity of H_a [36]

multiplicity of H_b $(2+1)(1+1)=(3)(2)$ [6]

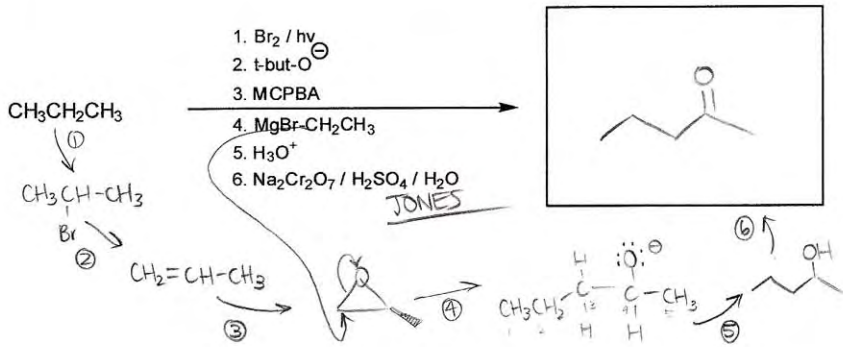
multiplicity of H_c $(2+1)$ [3]

multiplicity of H_d [1]

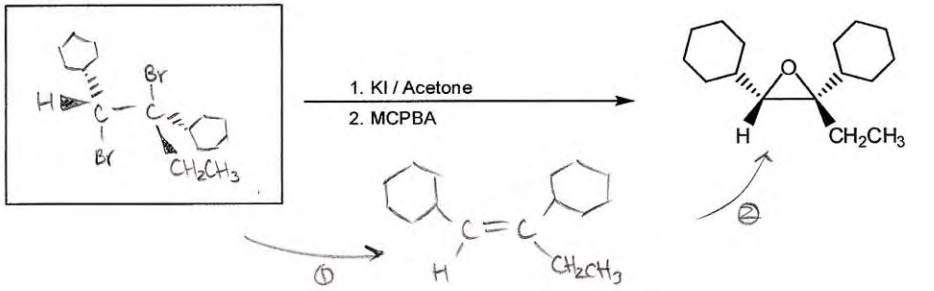
$(2+1)(3+1)(2+1)=(3)(4)(3)=36$

C. Reactions: Total = 36 points, 6 points each
Please provide the major product in the answer box. Be sure your drawing indicates stereochemistry if applicable. Partial credit is awarded only when intermediate products are shown below the reaction.

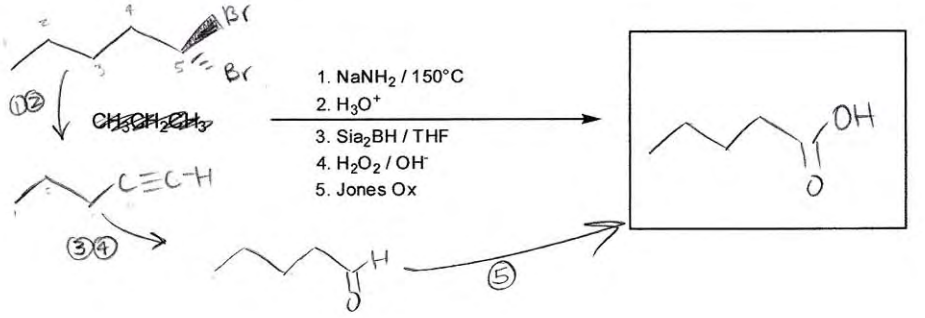
1.



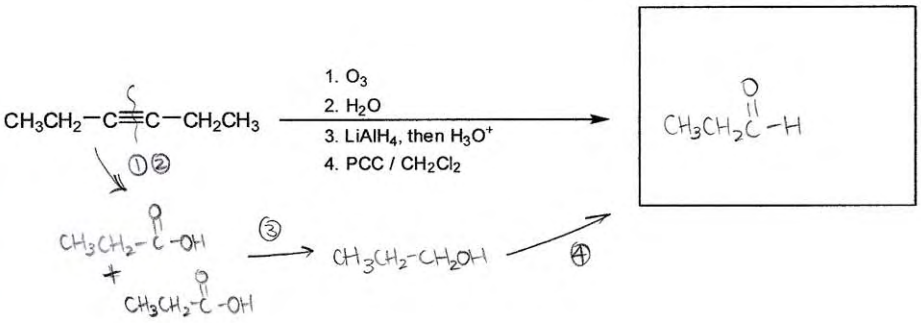
2.



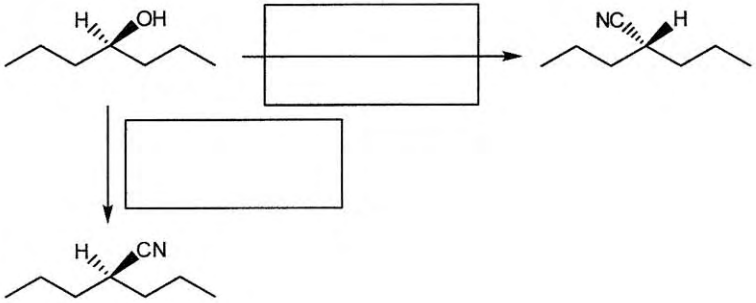
3.



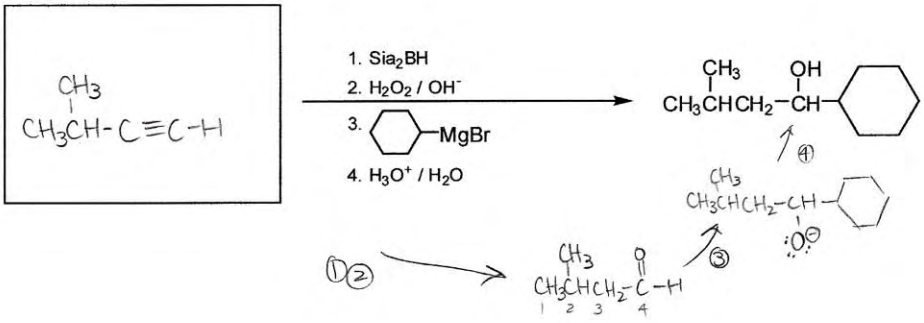
4.


1. O_3
2. H_2O
3. $LiAlH_4$, then H_3O^+
4. PCC / CH_2Cl_2
$CH_3CH_2-C\equiv C-CH_2CH_3$
① ②
$CH_3CH_2-C(=O)-OH$
+
$CH_3CH_2-C(=O)-OH$
③
$CH_3CH_2-CH_2OH$
④
$CH_3CH_2C(=O)-H$

5.

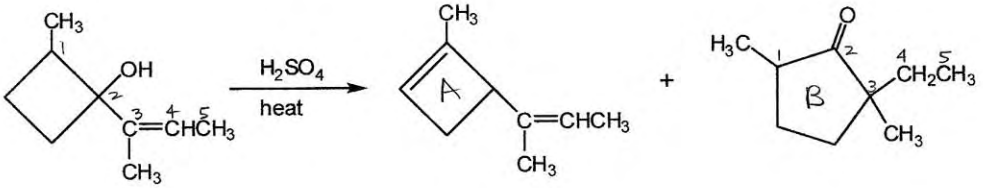

H
OH
NC
H
H
CN

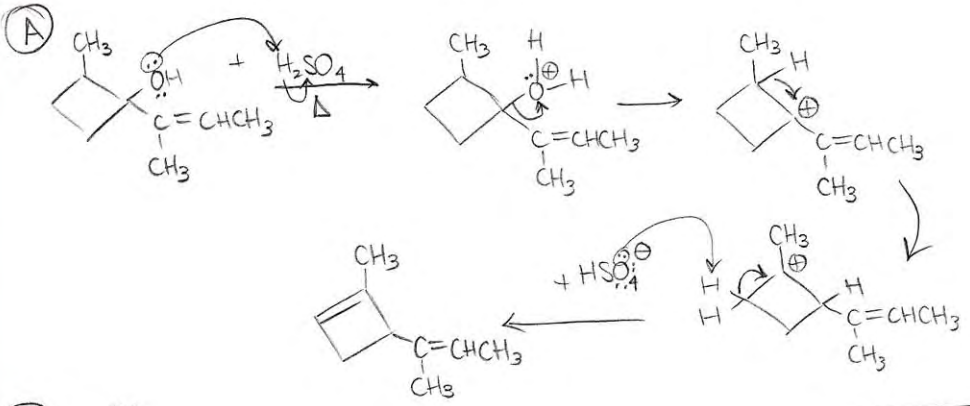
6.

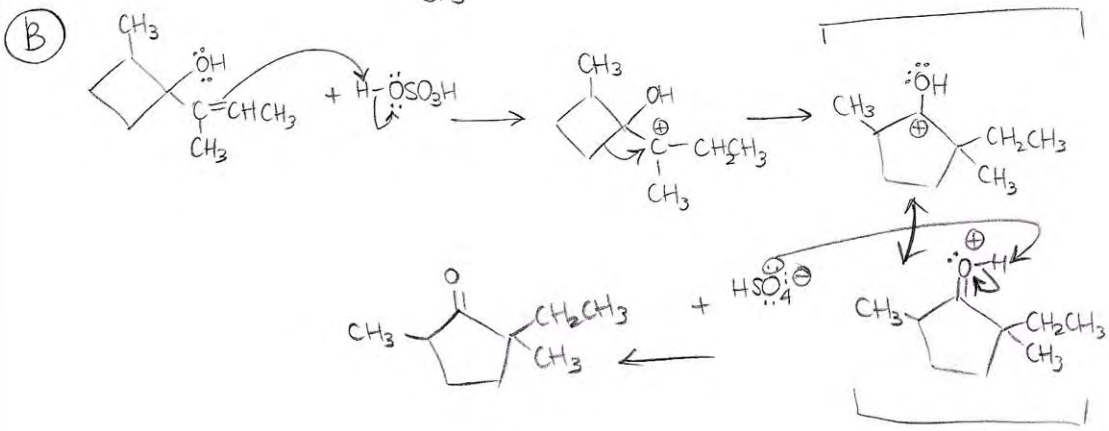

$CH_3CH(CH_3)-C\equiv C-H$
1. Sia_2BH
2. H_2O_2 / OH^-
3. MgBr
4. H_3O^+ / H_2O
$CH_3CH(CH_3)CH_2-CH(OH)-C_6H_5$
④
$CH_3CH(CH_3)CH_2-CH(O^{\ominus})-C_6H_5$
⑤
$CH_3CH(CH_3)CH_2-C(=O)-H$
1 2 3 4
① ②

D. Mechanisms: (10 points)

The reaction presented below produces several products. Provide clear mechanisms to explain the formation of the two products shown. Use curved arrows to indicate "electron flow". Remember to show only one step at a time. **Show all intermediates and all formal charges. Do not show transition states!**

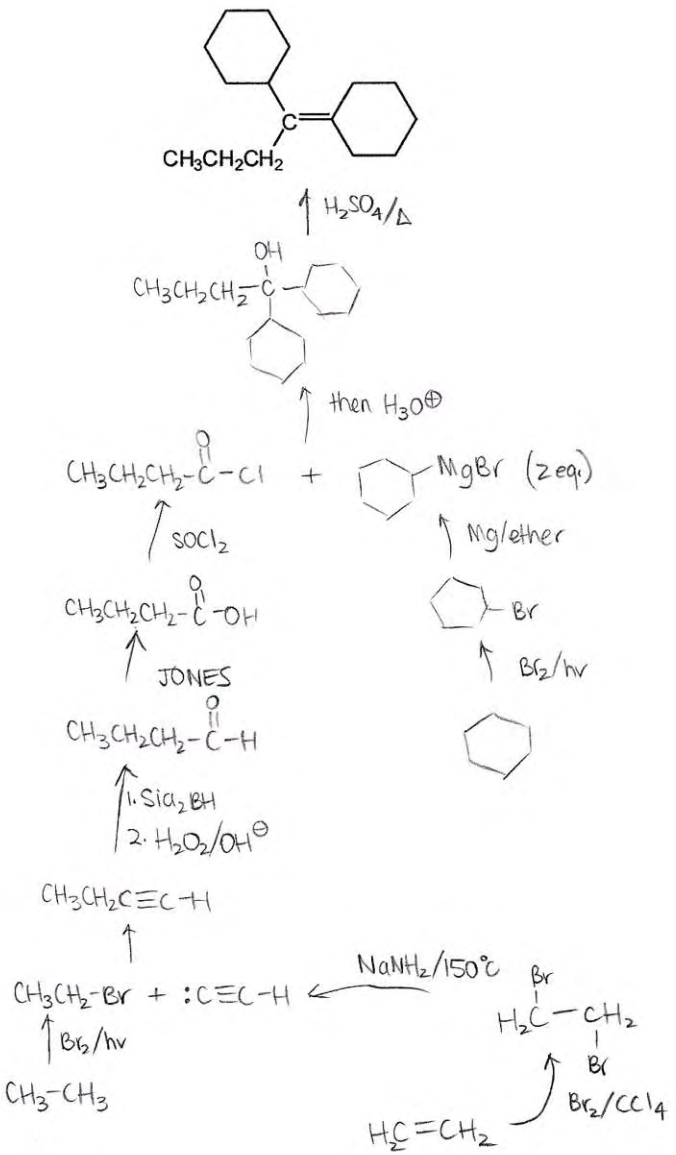






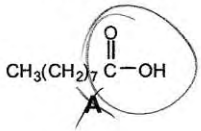
E. Synthesis: (10 points)

Synthesize the molecule below using any of the following reagents: cyclohexane, alkanes, or alkenes of no more than **two carbons**, any inorganic reagents, any peroxy acids, and any oxidizing or reducing agents.

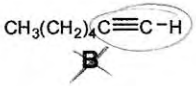


F(a). Spectroscopy (10 points)

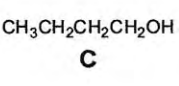
Carefully examine the five infrared spectra and the compounds below. Place the letter of the compound in the box beside its spectrum.



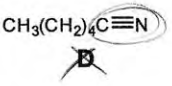
A



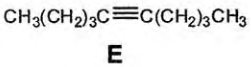
B



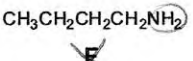
C



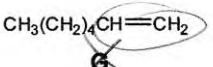
D



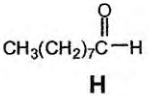
E



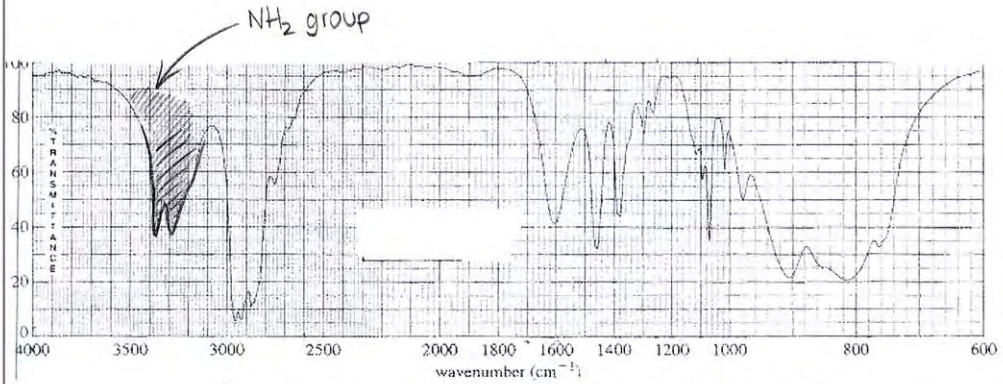
F



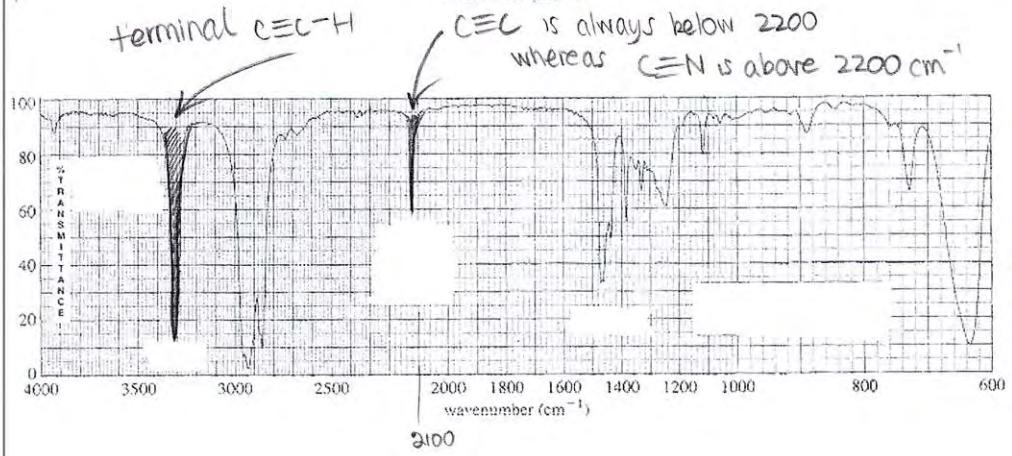
G



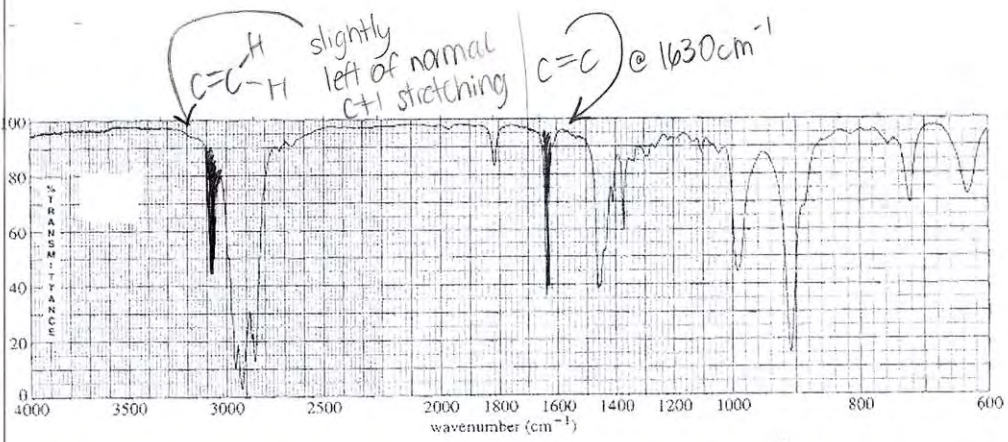
H



1. F

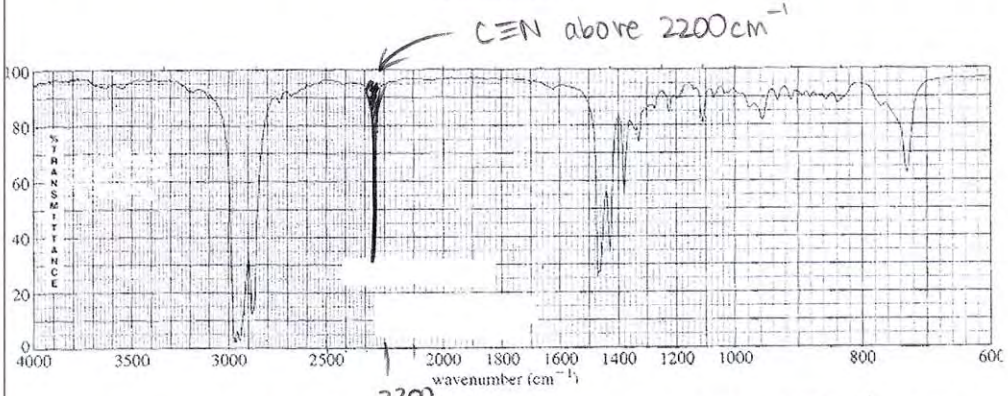


2. B



3

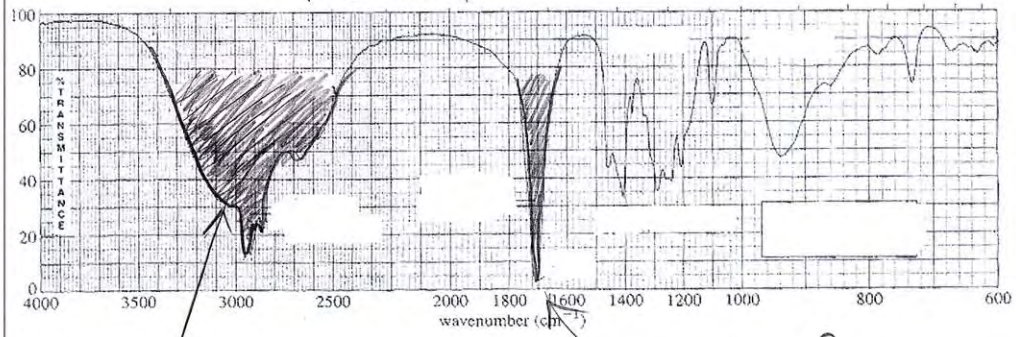
G



4

D

★ when OH stretch shifts to be centered @ 3000 cm^{-1}, you are pretty sure you have a carboxylic acid. It is usually @ 3300cm^{-1}



5

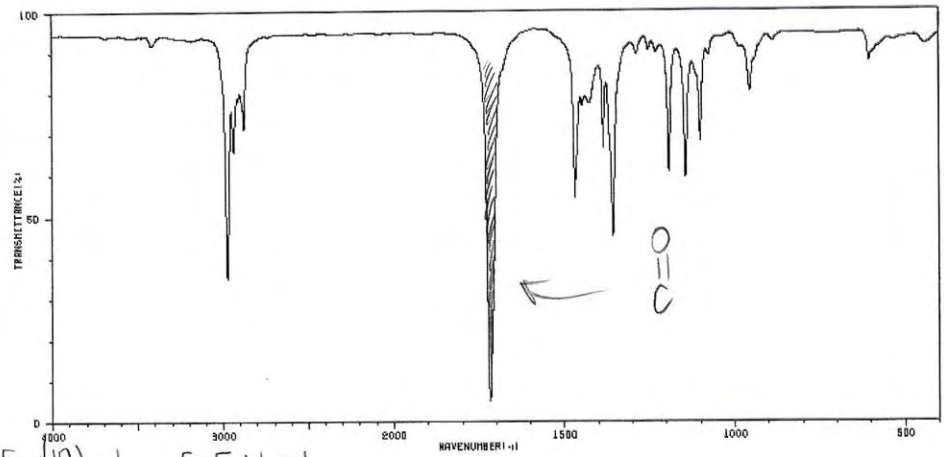
A

OH stretch shifted to 3000cm^{-1}

1710cm^{-1} is C=O

F(b). Spectroscopy BONUS: 10 Points

A compound with the formula $C_5H_{10}O$ exhibits the IR and ^1H NMR shown below. Please identify this compound and draw the structure in the box provided below.



UN= $5-\left(\frac{10}{2}\right)+1 = 5-5+1=1$