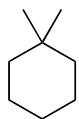
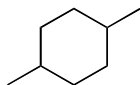


1. Rank the following compounds in the trend requested. (15 points each)

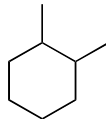
a. The following compounds all have 8 carbons. Rank by the number of signals in a spin decoupled ^{13}C NMR. The compound with the fewest number of peaks is 1, while the compound with the greatest number of peaks is 5.



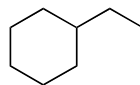
4



2



3



5



1

b. The following compounds all have one singlet peak in a ^1H NMR. Rank by the downfield shift of that peak in the ^1H NMR. The compound with the furthest downfield shift is 1, while the compound with the smallest downfield shift is 5.



1



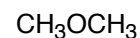
3



5

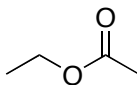


4



2

c. Rank by the multiplicity of peaks in a ^1H NMR. Consider only the signal with the greatest multiplicity for each compound. The compound which has a signal with the greatest multiplicity in this series is 1, while the compound with the least is 5.



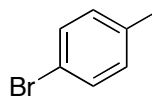
3



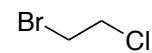
2



1

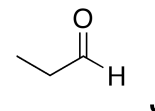
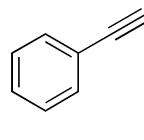
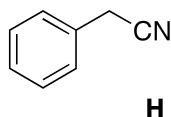
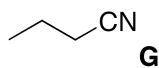
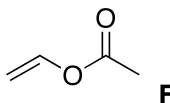
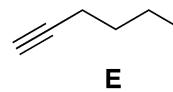
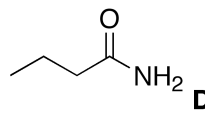
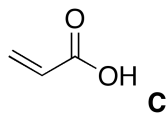
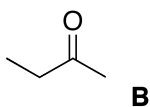
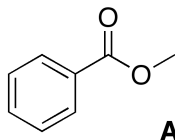


5

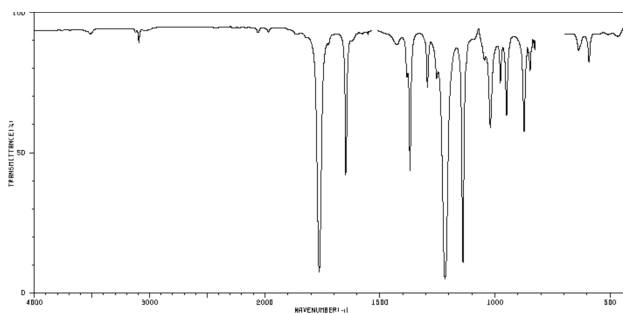


4

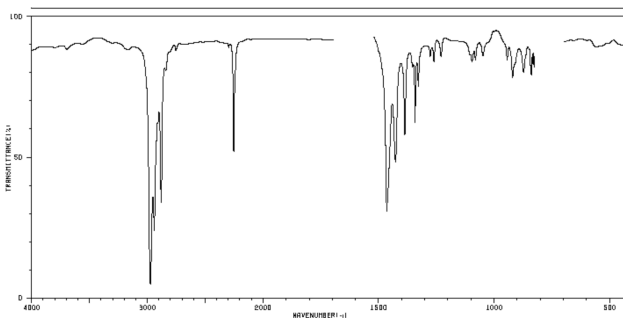
2. Place the appropriate letter, corresponding to the compound it represents, adjacent to each IR spectrum shown below. The major scale bars on each IR are 500, 1000, 1500, 2000, 3000 and 4000 cm^{-1} . (10 points each)



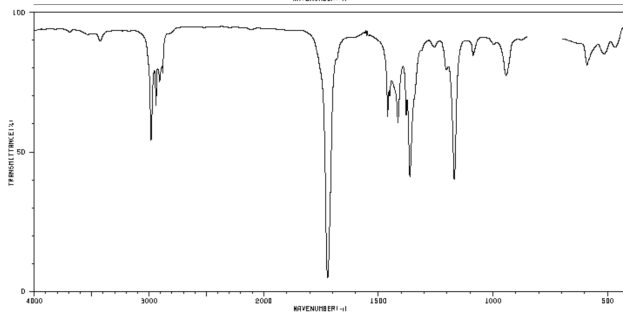
F



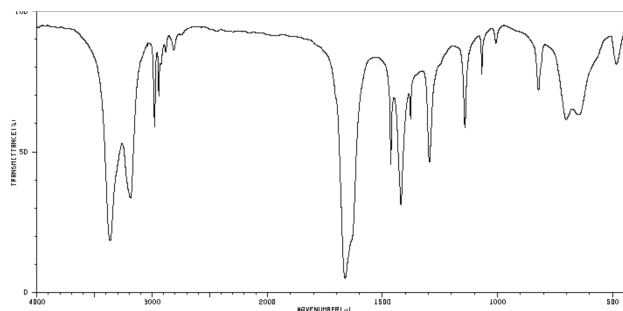
G



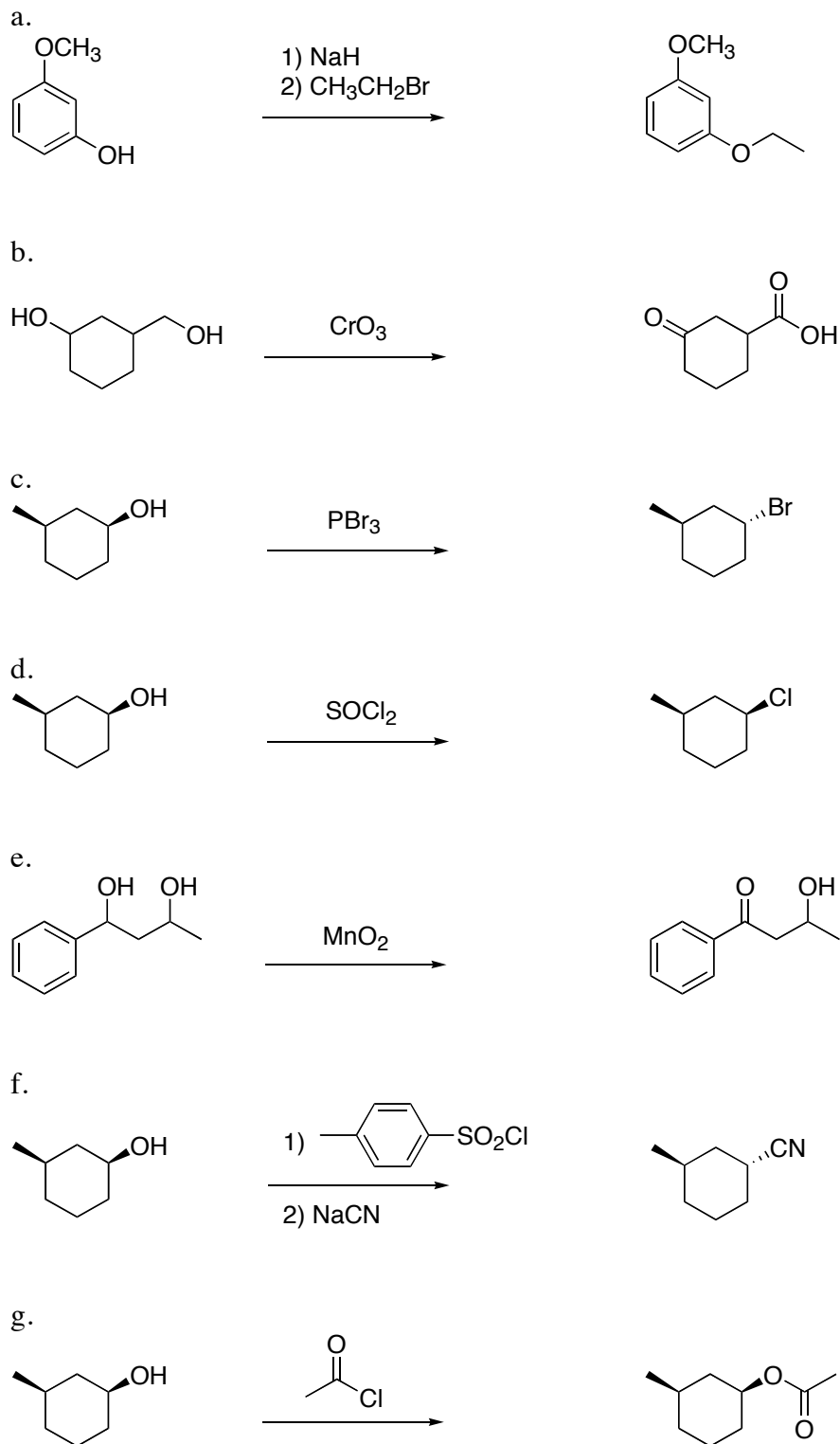
B



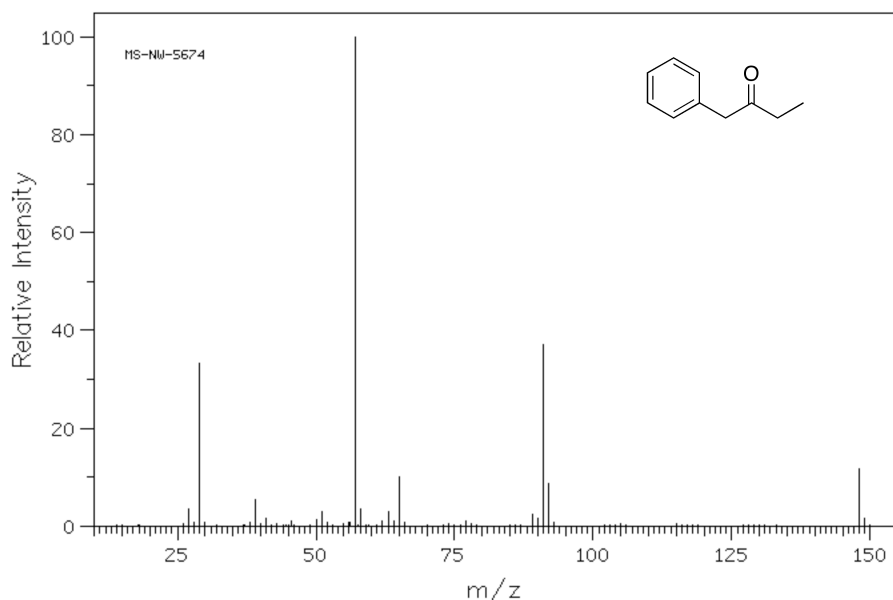
D



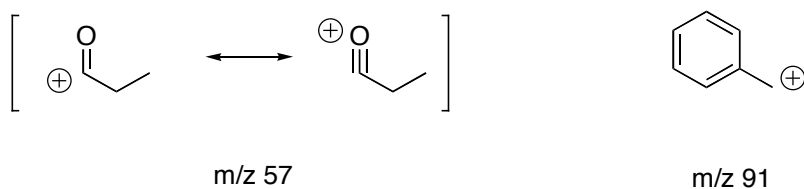
3. Indicate the preferred product obtained in the following reactions. Only write one product for each reaction. Multiple answers will be counted wrong. (7 points each)



4. The following MS is for the compound 1-phenyl-2-butanone (m/z 148).



a.(12) Indicate what structures correspond to the peaks at m/z 91, 57.

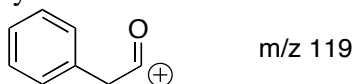


b.(8) Why is the peak at 57 larger than the one at 91?

It is due to the overall stability of both fragments responsible for each signal. The peak at m/z 57 is due to the acylium cation shown above and also a benzylic radical. The peak at m/z 91 is due to the benzylic cation shown above and an acylium radical. The overall stability is higher to place the radical on a benzylic site rather than an acylium site. Both cations are strongly stabilized.

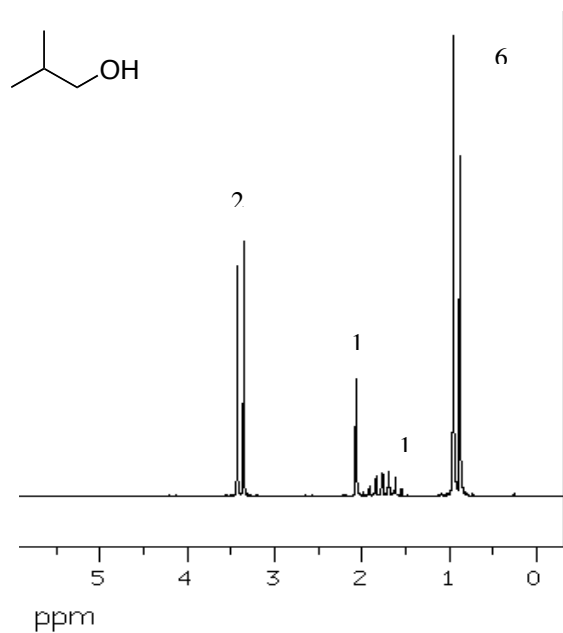
c.(8) What other peak might be expected in a fragmentation of this ketone, corresponding to a common fragmentation for any ketone, and why is this fragmentation pathway limited?

The other fragment to be expected is an α -cleavage on the other side of the ketone. This cleavage would also result in an ethyl radical which is far less stable than a benzylic radical.

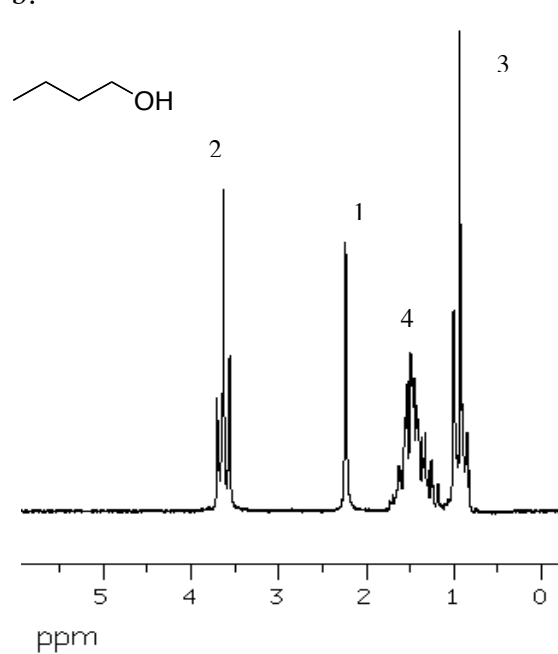


5. Below are shown the ^1H NMR of four isomers of $\text{C}_4\text{H}_{10}\text{O}_1$. Each isomer is an alcohol. Draw the structure which corresponds to each isomer next to the appropriate ^1H NMR. The integration for each signal is indicated. (8 points each)

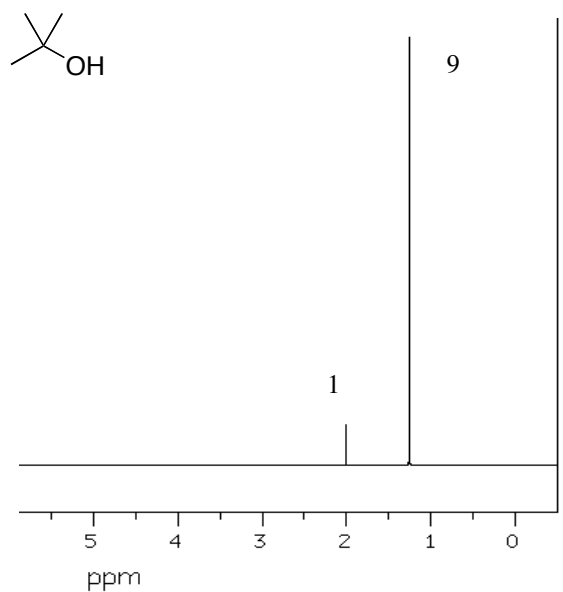
a.



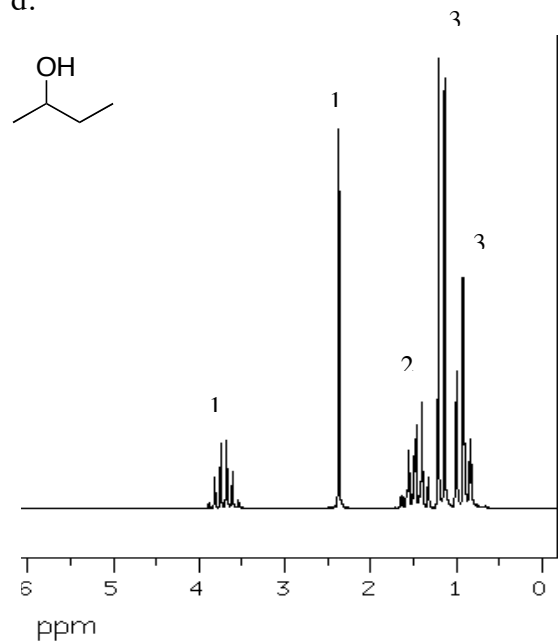
b.



c.

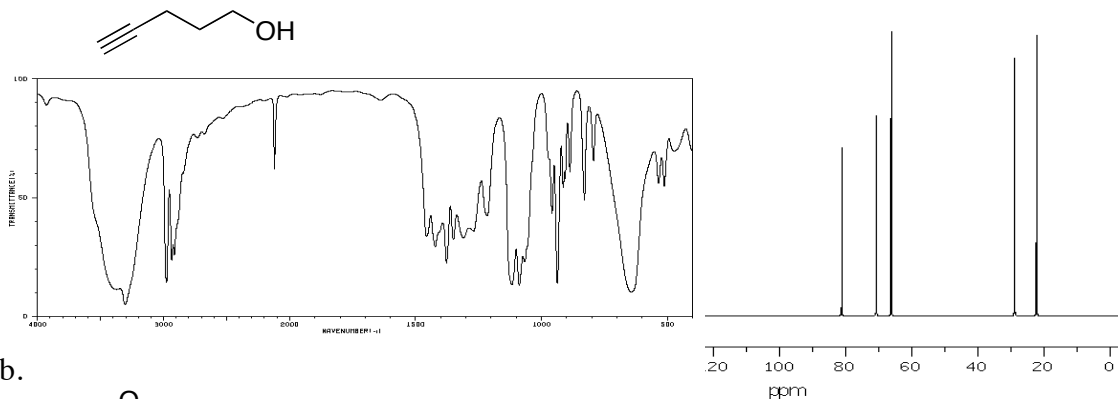


d.

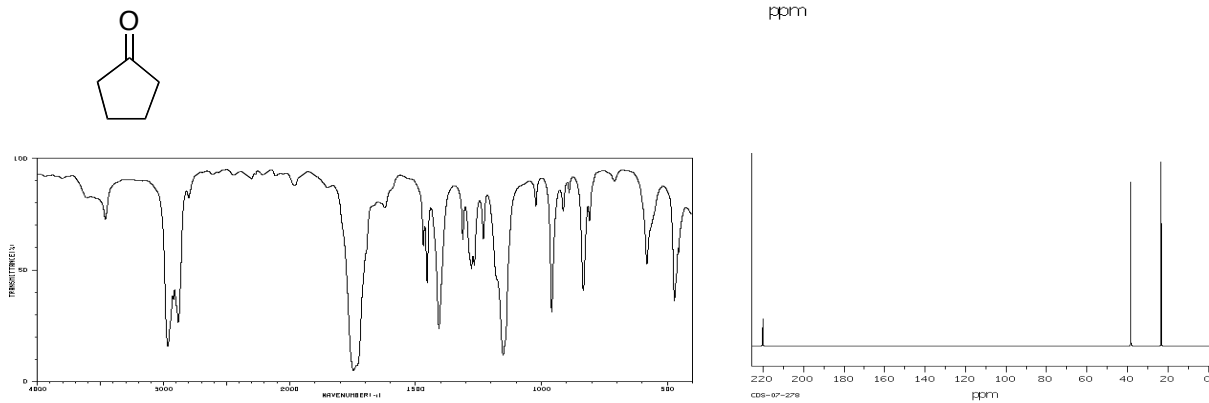


6. The ^{13}C NMR and IR for three isomers of $\text{C}_5\text{H}_8\text{O}_1$ are supplied below. Indicate the structure which corresponds to each set of spectra. (8 points each)

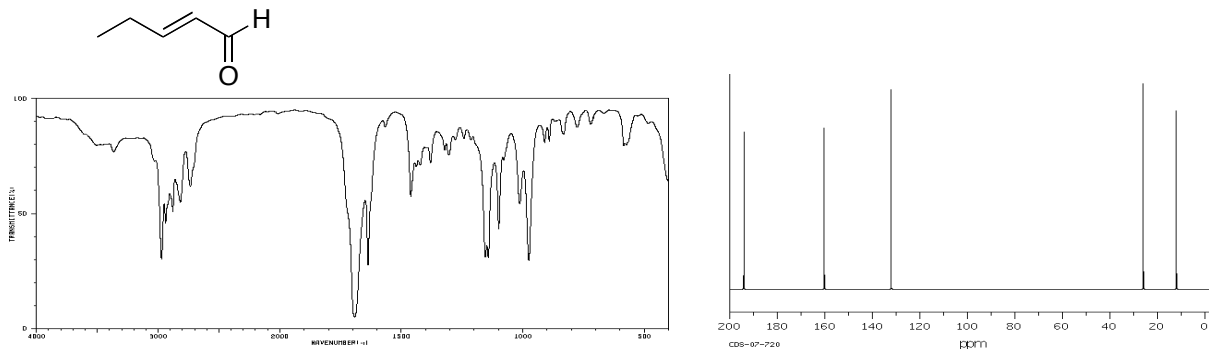
a.



b.

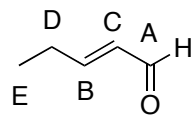


c.



d. In the answer for part C above, assign which carbon atoms correspond to each peak in the ^{13}C NMR. Draw the compound again and place the letter listed for each signal next to the carbon atom responsible for that signal.

^{13}C signal	<u>194</u>	<u>160</u>	<u>132</u>	<u>26</u>	<u>12</u>
	A	B	C	D	E



7. A reaction sequence is shown below. The ^1H NMR and IR for the final product **C** are included along with the MS for the starting material **A**. With this information indicate what the structures for **A**, **B** and **C** by drawing the structure in the appropriate box. (8 points each)

