
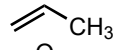
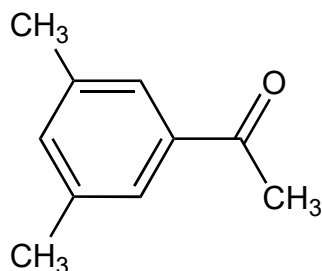


<sup>13</sup> C NMR: Carbons			
Type of carbon	δ (ppm)	Type of carbon	δ (ppm)
R-CH <sub>3</sub>	10-30	$\left. \begin{array}{l} \text{R}-\overset{\text{O}}{\parallel}{\text{C}}-\text{OR} \\ \text{R}-\overset{\text{O}}{\parallel}{\text{C}}-\text{NH}_2 \end{array} \right\}$	165-185
C-O	40-80		
RC≡CR	65-90		
R <sub>2</sub> C=CR <sub>2</sub>	100-150	$\left. \begin{array}{l} \text{R}-\overset{\text{O}}{\parallel}{\text{C}}-\text{R/H} \end{array} \right\}$	185-220
	110-170		

<sup>1</sup> H NMR	
Protons on Carbon	
Type of C-H	δ (ppm)
R-CH <sub>3</sub>	0.9
R-CH <sub>2</sub> -R	1.3
R <sub>3</sub> C-H	1.5-2
 CH <sub>3</sub>	1.8
R- $\overset{\text{O}}{\parallel}{\text{C}}$ -CH <sub>3</sub>	2-2.3
Ar-CH <sub>3</sub>	2.3
RC≡C-H	2.5
R <sub>2</sub> N-CH <sub>3</sub>	2-3
R-CH <sub>2</sub> -X	3-3.5
RO-CH <sub>3</sub>	3.8
R-CH <sub>2</sub> -F	4.5
R <sub>2</sub> C=CH-R	5-5.3
Ar-H	7.3
R- $\overset{\text{O}}{\parallel}{\text{C}}$ -H	9.7
Protons on Oxygen	
Type of H	δ (ppm)
ROH	0.5-5
ArOH	4-7
R- $\overset{\text{O}}{\parallel}{\text{C}}$ -OH	10-13

6A. (6 pts) On the given compound, label each unique type of carbon atom a/b/c/etc., and answer the two questions below.



1. How many signals are expected in the <sup>13</sup>C NMR spectrum?

2. Do you expect any signals in the <sup>13</sup>C NMR spectrum to be above 170 ppm? Explain briefly.

6B. (8 pts) Select the <sup>1</sup>H NMR spectrum that corresponds to the given compound, and then match the labeled peaks in the spectrum with each set of protons on the structure provided. (Label the protons on the structure a/b/c/d/e)

Correct spectrum (1 or 2):

