
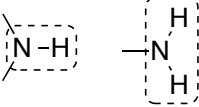
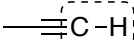



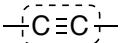





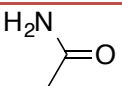

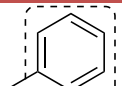

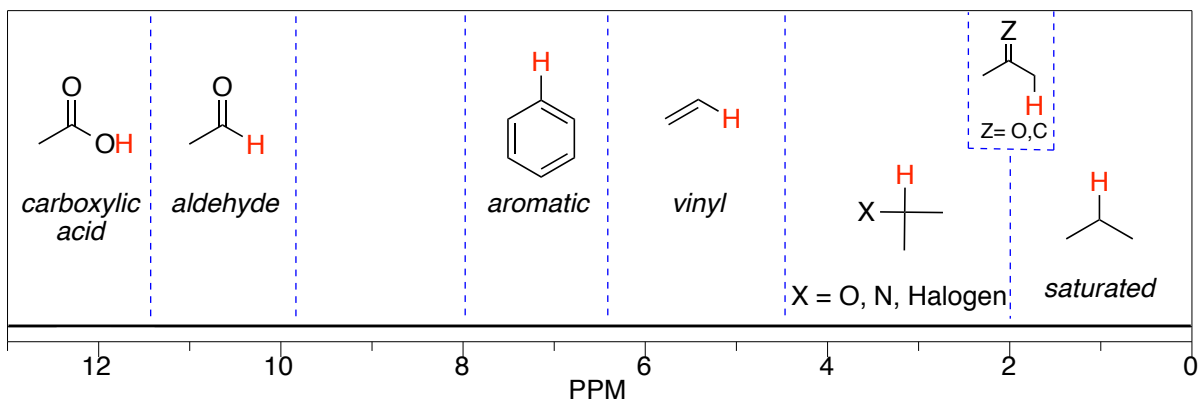


Characteristic Infrared Absorption Frequencies

Structural Unit	Wavenumber, cm^{-1}	Special Features
	3200-3600 (s, br)	
	3300-3500 (m)	R ₂ N-H = one IR stretch RNH ₂ = two IR stretches
	~3300 (s)	
	2850-2960 (m)	Look for C _{sp3} -H stretches just below 3000 cm^{-1} H-C-H bending just above 1400 cm^{-1} -CH ₃ bending just below ~1400 cm^{-1}
	3000-3100 (m)	Look for C _{sp2} -H stretches just above 3000 cm^{-1}
	2200-2300 (s)	
	~2150 (v)	
Carbonyl Groups 	1650-1850 (s)	Variable depending on the carbonyl functionality (see below)
	1750-1850	
	1700-1750	Also look for strong C _{sp2} -O stretch between 1200 and 1300 cm^{-1}
	1720-1740	Also look for aldehyde C-H stretches at ~2720 and ~2820 cm^{-1}
	1680-1750	Generally around 1720 cm^{-1} ; Decreased when in conjugation
	1650-1700	
	1600-1700 (v)	
	1450-1600 (v)	Look for 2 or 3 peaks in this region generally at ~1600, ~1500, and <1500 cm^{-1}
	C_{sp3}-O: 1000-1100 (m) C_{sp2}-O: 1200-1300 (s)	

Absorption strength abbreviations: s = strong, m = medium, w = weak, v = variable

Proton NMR Chemical Shift Regions



Representative Values for the Saturated Region

Methyl	Methylene	Methine
$\begin{array}{c} \text{H} \\ \\ -\text{C}-\text{H} \\ \\ \text{H} \end{array}$	$\begin{array}{c} \text{H} \\ \\ -\text{C}- \\ \\ \text{H} \end{array}$	$\begin{array}{c} \\ -\text{C}-\text{H} \\ \end{array}$
~0.9 ppm	~1.2 ppm	~1.7 ppm

Representative Values - Neighboring Electronegative Atom

$\begin{array}{c} \text{H} \\ \\ -\text{O}-\text{C}-\text{H} \\ \\ \text{H} \end{array}$	$\begin{array}{c} \text{H} \\ \\ \text{Cl}-\text{C}-\text{H} \\ \\ \text{H} \end{array}$	$\begin{array}{c} \text{H} \\ \\ \text{Br}-\text{C}-\text{H} \\ \\ \text{H} \end{array}$	$\begin{array}{c} \text{H} \\ \\ \text{I}-\text{C}-\text{H} \\ \\ \text{H} \end{array}$	$\begin{array}{c} \text{H} \\ \\ \text{H}_2\text{N}-\text{C}-\text{H} \\ \\ \text{H} \end{array}$
~3.4 ppm	3.1 ppm	2.7 ppm	2.2 ppm	2.4 ppm

Carbon-13 NMR Chemical Shift Regions

