

Table 1. Characteristic IR Absorption Peaks of Functional Groups\*

Vibration	Position (cm <sup>-1</sup> )	Intensity*	Notes
<b>Alkanes</b>			
C-H stretch	2990 – 2850	m to s	
<b>Alkenes</b>			
=C-H stretch	3100 – 3000	m	
C=C stretch	1680 – 1620 (sat.) 1650 – 1600 (conj.)	w to m	
=C-H bend	995 – 685	s	See Table 2 for detail
<b>Alkynes</b>			
≡C-H stretch	3310 – 3200	s	
C≡C stretch	2250 – 2100	m to w	
<b>Aromatic Compounds</b>			
C-H stretch	3100 – 3000	m to w	
C=C stretch	1625 – 1440	m to w	Hidden in fingerprint region
C-H bend	900 – 680	s	See Table 2 for detail
<b>Alcohols**</b>			
O-H stretch	3550 – 3200	br, s	Hydrogen bonded (typical)
<b>Amines</b>			
N-H stretch	3550 – 3250	br, m	Primary (two bands) Secondary (one band)
<b>Nitriles</b>			
C≡N stretch	2280 – 2200	s	
<b>Aldehydes</b>			
C-H stretch	2900 – 2800 & 2800 – 2700	s	H-C=O Fermi doublet
C=O stretch	1740 – 1720 (sat.) 1715 – 1680 (conj.)	s	
<b>Ketones</b>			
C=O stretch	1750 – 1705 (sat.) 1700 – 1665 (conj.)	s	
<b>Esters**</b>			
C=O stretch	1765 – 1735 (sat.) 1730 – 1715 (conj.)	s	
<b>Carboxylic Acids**</b>			
O-H stretch	3200 – 2500	br, m to w	
C=O stretch	1725 – 1700 (sat.) 1715 – 1680 (conj.)	s	
<b>Amides</b>			
N-H stretch	3500 – 3150	m	Primary (two bands) Secondary (one band)
C=O stretch	1700 – 1630	s	

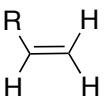
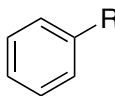
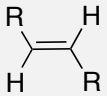
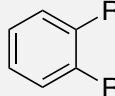
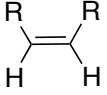
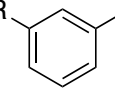
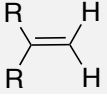
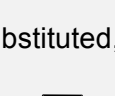
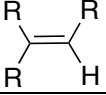
Table 1 cont'd

Vibration	Position (cm <sup>-1</sup> )	Intensity	Notes
<b>Anhydrides**</b>			
C=O stretch	1850 – 1800 & 1790 – 1740	s	
<b>Acid Chlorides</b>			
C=O stretch	1815 – 1770	s	
<b>Nitro Compounds</b>			
NO <sub>2</sub> stretch	1570 – 1490 & 1390 – 1300	s	
<b>Thiols†</b>			
R-S-H stretch	2550 – 2600		
<b>Alkyl &amp; Aryl Halides†</b>			
C-F stretch	1000 – 1400		Hidden in fingerprint region
C-Cl stretch	< 600 – 840		
C-Br stretch	< 700		
C-I stretch	< 600		

\* Abbreviations: s = strong; m = medium; w = weak; br = broad; sat. = saturated; conj. = conjugated

\*\* Alcohols, Esters, Carboxylic Acids, and Anhydrides also absorb in the fingerprint region due to the C-O stretch (1300 – 1000, s).

Table 2. Out-of-Plane C-H Bending Vibrations in Alkenes and Aromatics

Alkene Structure	Position (cm <sup>-1</sup> )	Phenyl Structure	Position (cm <sup>-1</sup> )
Mono-substituted 	997 – 985 & 915 – 905	Mono-substituted 	770 – 730 & 720 – 680
Disubstituted, <i>trans</i> 	980 – 960	Disubstituted, <i>ortho</i> 	770 – 735
Disubstituted, <i>cis</i> 	730 – 665	Disubstituted, <i>meta</i> 	810 – 750 & 725 – 680
Disubstituted, <i>symm.</i> 	895 – 885	Disubstituted, <i>para</i> 	860 – 800
Trisubstituted 	840 – 790		

\* Adapted from...Mohrig, J. R.; Hammond, C. N.; Schatz, P. F. "Infrared Spectroscopy" in *Techniques in Organic Chemistry*. Freeman: New York, 2006.

† Palleros, D. R. "Infrared Spectroscopy" in *Experimental Organic Chemistry*. Wiley: New York, 2000. p. 688.