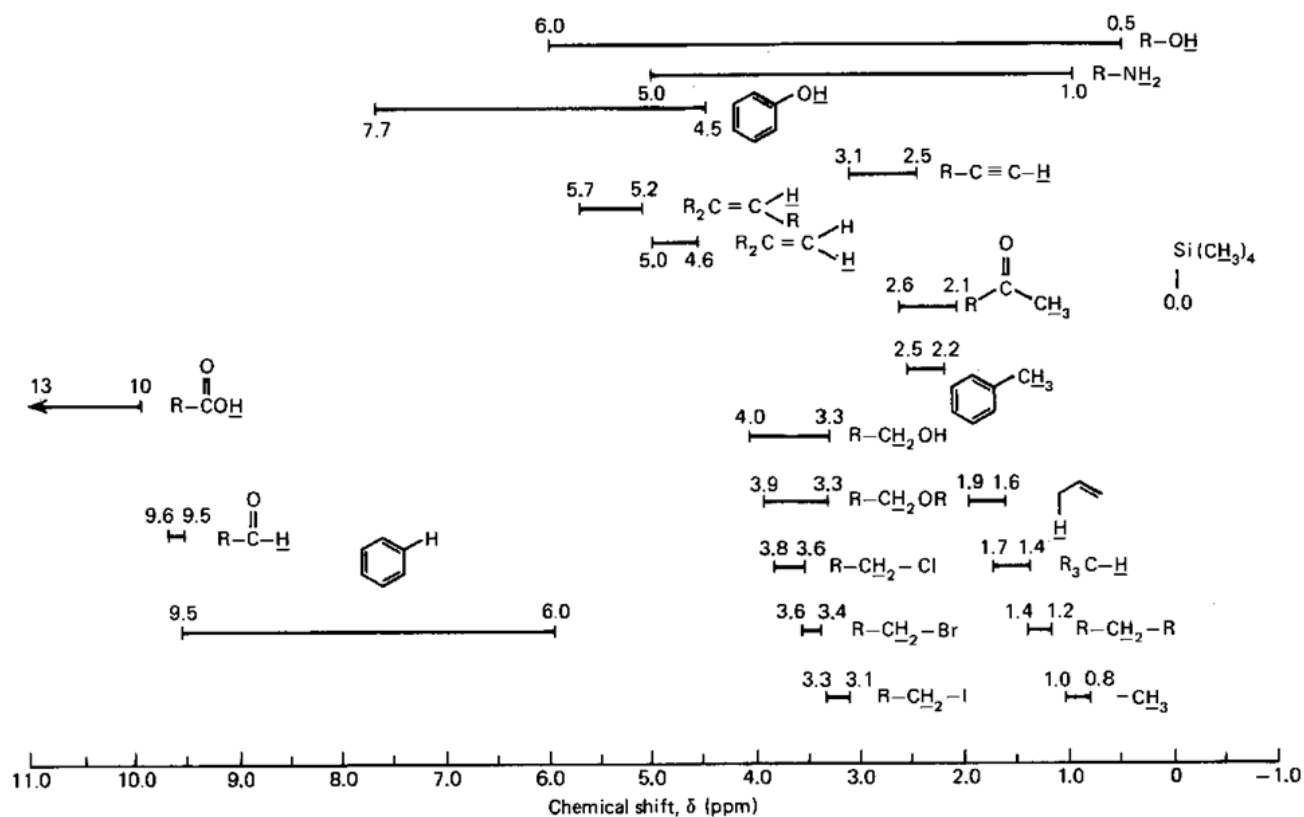


Typical ^1H Chemical Shifts



Carbon environment chemical shifts (ppm)

C=O (in ketones)	205 - 220
C=O (in aldehydes)	190 - 200
C=O (in acids and esters)	170 - 185
C in aromatic rings	125 - 150
C=C (in alkenes)	115 - 140
RCH_2OH	50 - 65
RCH_2Cl	40 - 45
RCH_2NH_2	37 - 45
R_3CH	25 - 35
$\text{CH}_3\text{CO-}$	20 - 30
R_2CH_2	16 - 25
RCH_3	1

A summary of the principle infrared bands and their assignments

R =aliphatic group

Funct. Group	Type		Frequencies cm ⁻¹	Peak Intensity	Examples Figure No.	
C-H	sp ³ hybridized	R ₃ C-H	2850-3000	M(sh)	6, 18, 22	
	sp ² hybridized	=CR-H	3000-3250	M(sh)	7, 13, 42	
	sp hybridized	≡C-H	3300	M-S(sh)	13	
	aldehyde C-H	H-(C=O)R	2750, 2850	M(sh)	14, 15	
N-H	primary amine, amide	RN-H ₂ , RCONH ₂	3300, 3340	S,S(br)	18, 19	
	secondary amine, amide	RNR-H, RCONHR	3300-3500	S(br)	20, 21	
	tertiary amine, amide	RN(R ₃), RCONR ₂	none		22, 23	
O-H	alcohols, phenols	free O-H	3620-3580	W(sh)	17, 24, 25	
		hydrogen bonded	3600-3650	S(br)	24, 25, 28	
	carboxylic acids	R(C=O)O-H	3500-2400	S(br)	26, 27, 29, 30	
C≡N	nitriles	RC≡N	2280-2200	S(sh)	31	
C≡C	acetylenes	R-C≡C-R	2260-2180	W(sh)	32	
		R-C≡C-H	2160-2100	M(sh)	13	
C=O	aldehydes	R(C=O)H	1740-1720	S(sh)	14	
	ketones	R(C=O)R	1730-1710	S(sh)	35	
	esters	R(CO ₂)R	1750-1735	S(sh)	33, 34	
	carboxylic acids	RCO ₂ H	1720-1680	S(sh)	26,27,30	
	amides (Amide I)	RCONH ₂ , RCONHR	1670-1640	S(sh)	19, 21	
		(Amide II)	RCONH ₂	1650-1620	S(sh)	19, 21
		(Amide II)	RCONHR	1550	S(sh)	19, 21
	amide	RCONR ₂	1650-1620	S(sh)	23	
	anhydrides	R(CO ₂ CO)R	1820, 1750	S, S(sh)	36	
carboxylates	R(CO ₂) ⁻ , M ⁺	1600, 1400	S,S(sh)	42		
C=C	olefins	R ₂ C=CR ₂	1680-1640	W(sh)	10, 39, 40	
		R ₂ C=CH ₂	1600-1675	M(sh)	9, 35	
		R ₂ C=C(OR)R	1600-1630	S(sh)	41	
-NO ₂	nitro groups	RNO ₂	1550, 1370	S,S(sh)	28	

Factorss that influence IR frequencies

1. Hydrogen bonding
2. Resonance
3. Ring strain