TABLE 15.5 Some ^{13}C Chemical Shifts

Type of Carbon	Chemical Shift (δ)[a]	Type of Carbon	Chemical Shift (δ)[a]
Alkanes		Alcohols, ethers	
Methyl	0–30	C–O	50–90
Methylene	15–55	Amines	
Methine	25–55	C–N	40–60
Quaternary	30–40	Halogens	
Alkenes		C–F	70–90
C=C	80–145	C–Cl	25–50
Alkynes		C–Br	10–40
C≡C	70–90	C–I	−20–10
Aromatics	110–170	Carbonyls, C=O	
Benzene	128.7	$R_2C=O$	190–220
		RXC=O (X = O or N)	150–180

[a]The chemical shift δ is in parts per million (ppm) from TMS.

TABLE 15.4 Chemical Shifts of Various Hydrogens[a,b]

Hydrogen	δ (ppm)
CH_3	0.8–1.0
CH_2	1.2–1.5
CH	1.4–1.7
C=C–CH (allylic hydrogens)	1.8–2.3
O=C–CH	2.0–2.5
Ph–CH (benzylic hydrogens)	2.3–2.8
≡C–H	2.5
R_2N–CH	2.0–3.0
I–CH	2.8–3.3
Br–CH	2.8–3.5
Cl–CH	3.1–3.8
F–CH	4.1–4.7
O–CH	3.1–3.8
$=CH_2$ (terminal alkene)	5.0
C=CH (internal alkene)	4.5–5.5
Ph–H (aromatic hydrogens)	7.0–7.5
O=CH (aldehyde hydrogens)	9.0–10.0
RCOOH	10–13

[a]These values are approximate. There will surely be examples that lie outside the ranges indicated. Use them as guidelines, not "etched in stone" inviolable numbers.

[b]Watch out for loose talk. For example, "aromatic hydrogen" means a hydrogen attached to a benzene ring.

Some Useful IR Stretching Frequencies

Bond	Frequency (cm^{-1})	Intensity
O-H (alcohol)	3650-3200	Strong, broad
O-H (carboxylic acid)	3300-2500	Strong, **very** broad
N-H	3500-3300	Medium, broad
C-H	3300-2700	Medium
C≡N	2260-2220	Medium
C≡C	2260-2100	Medium to weak
C=O	1780-1650	Strong
C-O	1250-1050	strong