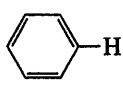

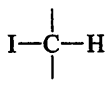

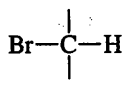

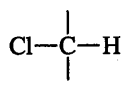
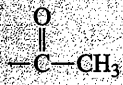
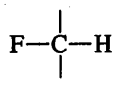
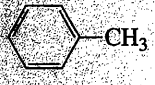

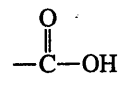
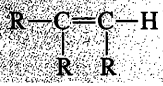



TABLE 13.1 Approximate Values of Chemical Shifts for $^1\text{H NMR}^a$

Type of proton	Approximate chemical shift (ppm)	Type of proton	Approximate chemical shift (ppm)
$(\text{CH}_3)_4\text{Si}$	0		6.5-8
$-\text{CH}_3$	0.9		9.0-10
$-\text{CH}_2-$	1.3		2.5-4
	1.4		2.5-4
	1.7		3-4
	2.1		4-4.5
	2.3	RNH_2	variable, 1.5-
$-\text{C}=\text{C}-\text{H}$	2.4	ROH	variable, 2-5
$\text{R}-\text{O}-\text{CH}_3$	3.3	ArOH	variable, 4-7
	4.7		variable, 10-
	5.3		

^aThe values are approximate because they are affected by neighboring substituents.

TABLE 13.4 Approximate Values of Chemical Shifts for ^{13}C NMR

Type of carbon	Approximate chemical shift (ppm)	Type of carbon	Approximate chemical shift (ppm)
$(\text{CH}_3)_4\text{Si}$	0	$\text{C}-\text{I}$	0-40
$\text{R}-\text{CH}_3$	8-35	$\text{C}-\text{Br}$	25-65
$\text{R}-\text{CH}_2-\text{R}$	15-50	$\text{C}-\text{Cl}$	35-80
$\begin{array}{c} \text{R} \\ \\ \text{R}-\text{CH}-\text{R} \end{array}$	20-60	$\text{C}-\text{N}$	40-60
$\begin{array}{c} \text{R} \\ \\ \text{R}-\text{C}-\text{R} \\ \\ \text{R} \end{array}$	30-40	$\text{C}-\text{O}$	50-80
$\equiv\text{C}$	65-85	$\begin{array}{c} \text{R} \\ \diagdown \\ \text{C}=\text{O} \\ \diagup \\ \text{N} \end{array}$	165-175
$=\text{C}$	100-150	$\begin{array}{c} \text{R} \\ \diagdown \\ \text{C}=\text{O} \\ \diagup \\ \text{RO} \end{array}$	165-175
	110-170	$\begin{array}{c} \text{R} \\ \diagdown \\ \text{C}=\text{O} \\ \diagup \\ \text{HO} \end{array}$	175-185
		$\begin{array}{c} \text{R} \\ \diagdown \\ \text{C}=\text{O} \\ \diagup \\ \text{H} \end{array}$	190-200
		$\begin{array}{c} \text{R} \\ \diagdown \\ \text{C}=\text{O} \\ \diagup \\ \text{R} \end{array}$	205-220