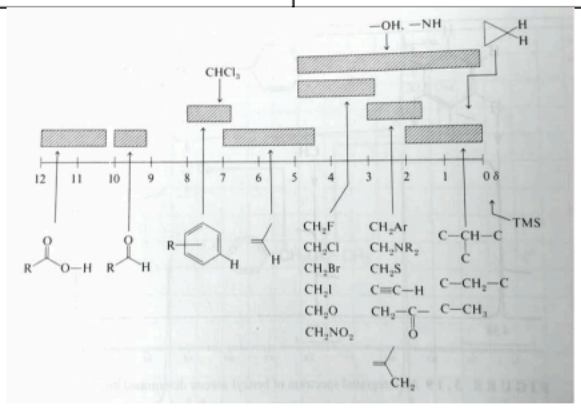
Appendix A

APPROXIMATE CHEMICAL SHIFTS:
Protons in Different Molecular Environments

Methyl Protons	ppm	Methylene Protons	ppm	Methine Protons	ppm	Other Protons	ppm
$-CH_3$	0.9-2.0	$-CH_2-$	1.3-1.9	$-CH<$	1.5-2.2	$-NH_2$	3.5-4.5
$-O-CH_3$	1.4	$-O-C(=O)-CH_2-$	2.2	$-O-C(=O)-CH<$	2.5	$-C_6H_5$	6.5-8.0
$-O-C(=O)-CH_3$	2.0	$-C(=O)-CH_2-$	2.4	$-C(=O)-CH<$	2.7	$-C(=O)-H$	10
$-C(=O)-CH_3$	2.2	$-C_6H_5-CH_2-$	2.7	$-C_6H_5-CH<$	3.0	$-C(=O)-OH$	9-12
$-C_6H_5-CH_3$	2.3	$N\equiv C-CH_2-$	2.8	$-O-CH<$	3.7	$-N-H$	0.5-5
$X-CH_3$	2.7-3.0	$-O-CH_2-$	3.4	$X-CH<$	4.0-4.1	$-O-H$	0.5-5
$-O-CH_3$	3.3	$X-CH_2-$	3.4	$-C(=O)-O-CH<$	4.8	$>C=C<H$	~ 4-8
$-C(=O)-O-CH_3$	3.7-3.9	$-C(=O)-O-CH_2-$	4.1			$-O-H$	>15
$-O-C_6H_5$	3.8	$-O-C_6H_5-CH_2-$	3.9-4.3				



From: Pavia, D. L., Lampman, G. M., Kriz, G. S., & Vyvyan, J. A. (2008). Introduction to Spectroscopy. Cengage Learning. p. 124.