2.4: Chemical Shifts for Other Nuclei

Generally speaking, the chemical shifts for most magnetic nuclei are much larger than for hydrogen. Representative δ values for ^{17}O and ^{14}N are given in Table 2-3; these have a greater spread than the proton δ values by a factor of about 100. The decisive factor with these nuclei is probably the greater polarizability of the electrons in the L shell as compared to those in the K shell. Chemical shifts associated with ^{13}C have also been measured for a variety of simple organic compounds by Lauterbur and Holm,[6] using ^{13}C of natural abundance. A fairly special technique is necessary, and rather large samples are required. Nonetheless, the shifts are large, as with ^{14}N and ^{17}O, and many chemical applications of the ^{13}C resonances can be foreseen.

Table 2–3. Typical ^{17}O and ^{14}N δ Values ($\times 10^6$)*

H_2O	0	$NH_4\oplus$	+602
RONO	−170	N_2H_4	+566
RCO_2H	−220	NH_3	+544
$HCONH_2$	−320	CH_3CONH_2	+498
RONO	−380	RCN	+385
SO_2	−540	C_5H_5N	+276
$(CH_3)_2CO$	−600	$C_6H_5NO_2$	+252
RNO_2	−640	$NO_2\ominus$	0

* Data from B. E. Holder and M. P. Klein, *J. Chem. Phys.*, **23**, 1956 (1955), and H. E. Weaver, B. M. Tolbert, and R. C. La Force, *J. Chem. Phys.*, **23**, 1956 (1955).

6 P. C. Lauterbur, J. Chem. Phys., 26, 217 (1957) and Ann. N.Y. Acad. Sci., 70, 841 (1958); C. H. Holm, J. Chem. Phys., 26, 707 (1957).