

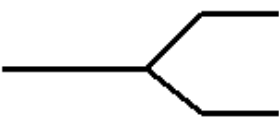
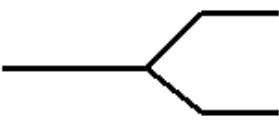
BCMB/CHEM 8190

PROBLEM SET 1

1) From the gyromagnetic ratios or frequencies given in a table of nuclear properties predict the receptivities relative to an equal number of protons for ${}^7\text{Li}$, ${}^{43}\text{Ca}$, and ${}^{15}\text{N}$. How do they compare if natural abundances are included? What is the relative receptivity for an equal number of magnetic nuclei at 4K versus 300K?

2) Use the shell model of the nucleus (energy level diagram below) to predict the spin and the sign of the gyromagnetic ratio for the following nuclei. Compare them with a table of nuclear properties. ${}^7\text{Li}$, ${}^{15}\text{N}$

Energy Level Diagram

$n+1$		j	degeneracy	total
2s	—————	1/2	2	20
1d		3/2	4	6
		5/2	6	
1p		1/2	2	8
		3/2	4	
1s	—————	1/2	2	2

3.) If the shielding constant for a proton of a methyl group is 60.0×10^{-6} and that for a proton on a hydroxyl group is 55.2×10^{-6} , what is the difference in precession frequency of the two protons at an 11.7T field? What is the chemical shift difference in ppm?

4.) The following amplitudes of a water resonance are observed at the indicated delay times in an inversion recovery experiment. What is the T1 for water? $t = 0.1\text{s}$, -28; $t = 0.5\text{s}$, -23; $t = 2.5\text{s}$, -2; $t = 12.5\text{s}$, 27; $t = 60\text{s}$, 30.
