PROBLEM SET 1, BCMB 8190

1) Using a table of nuclear properties such as found at:

http://www-usr.rider.edu/~grushow/nmr/NMR_tutor/periodic_table/nmr_pt_frameset.html

examine the elements in the first three rows of the periodic table and find all the spin ½ isotopes.

-What are the receptivities for these nuclei compared to protons?
-How do they compare if natural abundances are not included (comparing equal numbers of nuclei)?
-How do operating frequencies depend on the magnetogyric ratios?
-How do the receptivities depend on the magnetogyric ratios?
-What is the relative receptivity for an equal number of magnetic nuclei at 4° K versus 300° K?

2) 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 11.7 T field? What is the chemical shift difference in ppm?

3) 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 s, -28; t= 0.5 s, -23 s; t=2.5 s, -2; 12.5 s, 27; 60 s, 30.

4) It is frequently important to know the radiofrequency (RF) field imposed by a spin decoupling coil in an NMR experiment. Suppose we use the decoupling coil to provide a proton excitation pulse and determine that we need to apply RF for 200 μs to get a 90° pulse. What is the RF field in Tesla?