# PROBLEM SET 1, Phcg 631

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 two rows of the periodic table, find all the spin ½ isotopes and answer the following.
1a) What are the receptivities for these nuclei compared to protons?
1b) How do they compare if natural abundances are not included (comparing equal numbers of nuclei)?
1c) How do the frequencies depend on the magnetogyric ratios?
2) What is the ***Larmor*** frequency and how is it mathematically expressed?
3) What is the magnetogyric ratio ($\gamma$)?
4) What does the term ***bulk magnetization*** mean?
5) What are the Bloch Equations?
6) What are the two NMR spin-relaxation types that the Bloch Equations presented?
7) Which axis/plane each relaxation type is working?
8) How many energy levels does a spin = 1/2 nucleus have?
9) Correlate the differences between energy levels and transitions for NMR observation?
10) Why is NMR spectroscopy so insensitive?
11) What are the factors that limit the signal resolution in NMR?
12) What does the term ***bulk magnetization*** mean?
13) What do we mean when we observe the magnetization vector in the ***laboratory frame***?
14) What do we mean when we observe the magnetization vector in the ***rotating frame***?
15) What can be used to perturb the ***bulk magnetization*** from its equilibrium state?
16) Why do we want to make this perturbation?
17) Why does RF pulse have to be at or near the Larmor frequency?
18) What are shimming coils and what do they do for the NMR system?
19) What does the field-frequency lock system do for the NMR system?
20) What is necessary to induce a spin to relax?