HW 1	Multinuclear NMR	Name:	
Points:	C6800	Date:	
Max. 100 points	Spring 2011	Version A	

1. A nucleus has a T_1 of 5.0 seconds. If the net magnetization is set equal to zero, how long will it take for the net magnetization to recover by spin-lattice relaxation to 95% of its equilibrium value? T_1 [s] longitudinal relaxation time = 5.0 s (Hint: Use Bloch equations.)

2. A nucleus has a T_2 of 100 ms. How long will it take for any transverse magnetization to decay by spin-spin relaxation to 37% of its starting value? T_2 [s] transverse relaxation time = 100 ms (Hint: Use Bloch equations.)

3. What is the energy of the photon that will be absorbed by a ^{1}H nucleus in a 11.5 Tesla magnetic field? Compare this energy to a 2 10^{19} Hz x-ray photon. What is the ionization potential for a typical organic molecule and which of the two photons will ionize the molecule?

4. Show that $\boldsymbol{E_{mag} = -\mu \cdot B_0 = -\mu_z |B|}$

5. Find nuclear spins I of ^{2}H, ^{10}B, ^{51}V, and ^{183}W. For each nucleus list all possible values of m_I in the order of increasing stability of energy state. Calculate the energy difference between the levels inside a 300 MHz magnet. Calculate the excess of nuclei on the lowest energy level of ^{10}B at 300 and 173 K.