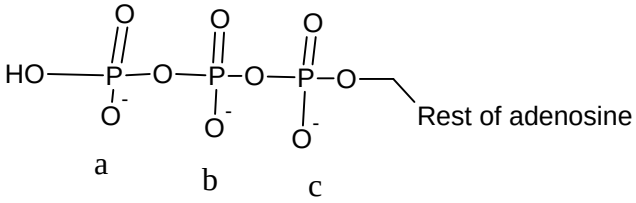
CHEMISTRY 133
Quiz 5 – Solutions

In a 4.70 Tesla field, the magnetogyric ratios (γ) for ^{31}P is 1.08 x 10^8 T^{-1} s^{-1}.
Equations and constants you might need: ν (frequency) = (γ/2π)H (H = magnetic field strength)
a) At what frequency (in MHz) does ^{31}P absorb light?
$\nu = (\gamma/2\pi)H = (1.08 \times 10^8\ T^{-1}\ s^{-1}/2\pi)(4.70\ T) =$ ***80.8 MHz***
+3 pts

b) If the peaks from two closest (spectrally) phosphorous atoms in ATP (see structure below) are located 4.5 ppm apart, what is their difference in Hz?



4.5 ppm = $\Delta\nu * 10^6/\nu$ or $\Delta\nu = (80.8 \times 10^6\ Hz)(4.5)/10^6 =$ ***363 Hz***
+4 pts

c) Given that ^{31}P (the only natural P isotope) has a I = ½, what type of splitting would be seen for each P atom in ATP if splitting can only be observed if across two or fewer bonds. Assume that any OH protons exchange too rapidly to allow splitting.
a and c P nuclei show ***doublets*** *(both split by b P). b P nuclei will be* ***complex*** *(doublet of doublet due to splitting by both a and c P nuclei.*
+3 pts