Problem Set #7   *Atom stuff*

1. For an electron in hydrogen what angles do the allowed orbital angular momentum vectors make with respect to a *z*-axis if the orbital angular momentum quantum number $l = 2$? Ignore the electron's spin.

2. The total angular momentum of an electron in hydrogen is the sum of its orbital and spin angular momenta: $\vec{J} = \vec{L} + \vec{S}$. Suppose $l = 2$. Enumerate all of the possible $J_z = L_z + s_z$ values. If this number is $2j + 1$ (in analogy with the quantum numbers l and s) what is j and what is the magnitude of J?

3. An electron in hydrogen is initially in a 4d state with $m_l = 2$. Enumerate all of the possible states (n, l, m_l) that it can make a transition to by emitting a photon via an electric dipole process.

4. What is the ground state electronic configuration for P (*Z* = 15)? What is the electronic configuration of the first excited state?

5. Repeat Problem 3 for Rb (*Z* = 37).

6. The ground state of Ag (*Z* = 47) is $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 4d^{10} 5s^1$. The ionization energy of Ag is 7.58 eV. What is the effective nuclear charge "seen" by the 5s electron?