CHM 12500 Concept Problems  
Week 10

1. A hydrogen atom contains one proton and one electron. Explain why the negatively-charged electron in the hydrogen atom does not “collapse”, or “fall”, onto the positively-charged nucleus.

2. a. Sketch the shapes of the following atomic orbitals. For each sketch, indicate the position of the nucleus, and the spatial orientation of the atomic orbital with respect to a Cartesian coordinate-axis system.
   - 1s
   - 2p_x, 2p_y, and 2p_z
   - 3d_xy, 3d_xz, 3d_yz, 3d_y^{2}, and 3d_z^{2}

b. What is an atomic orbital? That is, explain what the sketches in part (a) represent.

3. Getting sunburned is dangerous as well as painful. Too much exposure to high energy electromagnetic (EM) radiation can lead to cellular DNA damage causing an increased risk for cancer. You know that DNA damage occurs if the energy of the incident, EM radiation is above a certain threshold. What would you predict is worse based on your knowledge of quantum theory - a weak beam of ultraviolet light, or an intense beam of infrared light? Explain your reasoning.

4. The atomic emission spectrum for hydrogen contains four different lines (i.e., wavelengths of light) in the visible region of the electromagnetic spectrum. Explain why only four, discrete wavelengths of light are observed instead of a continuous spectrum of wavelengths.