Chapter 7—The Electronic Structure of Atoms 1/22/07 12:30 PM

After this chapter, you should be able to…

- Explain what is meant by a wave
  - Explain what is meant by the terms: speed, frequency, and wavelength
- Define an Electromagnetic wave
  - Calculate the frequency of an EM wave given its wavelength, or vice-versa
- Explain what is meant by a photon
  - Calculate the energy of one, or of some specified number of photons
  - Predict the general trend of energy versus position in the EM spectrum
- Explain what is meant by the line-spectrum of hydrogen
  - Sketch the experiment
  - Explain why it is different than an incandescent light-bulb's spectrum
- Calculate the energy of an electron in the n'th shell of a hydrogen atom
  - Explain what is meant by the ground or excited state
  - Calculate the energy/wavelength/frequency of light emitted/absorbed during a specified transition of an electron in a hydrogen atom
- Calculate the de Broglie wavelength of a moving particle
- Explain that the behavior of an electron is completely described by a wavefunction (or orbital) that is a solution to the Schrödinger equation.
  - Recall that the value of the wavefunction (psi or Ψ) squared at each point in space is directly proportional to the probability of finding the electron there
  - Recall that the mathematical solution to the Schrödinger equation results in a wavefunction of orbital that depends on three quantum numbers: n, l, and m_l
    - Explain how the value of n, determines possible values of l
    - Explain how the value of l, determines possible values of m_l

        - Name orbitals with a specific value of n and l using the 1s, 2s, 2p, … notatation
    - Recognize that in addition to the quantum numbers n, l, and m_l, an electron also possesses the property of *spin*, which requires a fourth quantum number: m_s.
        - Recall that m_s can be either + ½ or – ½ , which is typically indicated by drawing an upward of downward pointing arrow.
- Sketch the general shape of s, p_x, p_y, p_z, d_{z^2}, $d_{x^2-y^2}$, d_{xy}, d_{xz}, and d_{xz} orbitals
- Recall the order of atomic orbitals for hydrogen atoms, and multi-electron atoms (>1 e-)
- Write an electron configuration for any atom on the periodic table, using both the full (ex: $1s^2 2s^2 2p^6 3s^2$) notation and the shorthand notation (ex: [Ne]$3s^2$)
    - Remember that Cr and Cu are exceptions to the building-up (Auf bau) principle
- Write the ground-state (lowest energy) orbital diagram for an atom, applying the Pauli-Exclusion Principle and Hund's rule
    - Explain what is meant by the Pauli Exclusion Principle
    - Explain what is meant by Hund's rule
    - Identify whether an atom or ion will be diamagnetic or paramagnetic based on its ground-state electron-configuration/orbital diagram

Make sure you can solve all the end-of-chapter homework problems!