CH 221 Chapter Three Study Guide

- Be able to define wavelength, frequency, wave amplitude and node.

- Understand the relationship between frequency, wavelength and the speed of light; know how to use this relationship in calculations.

- Know the difference between standing waves and moving waves.

- *Memorize* the value for the speed of light, **c** = $2.998*10^{8}$ m/s.

- Know the *relative positions* of these sections of the electromagnetic spectrum: visible, ultraviolet, infrared, radio, gamma, X-ray and microwaves.

- Understand the relationships amongst the energy of a photon, the frequency of the photon and Planck's constant. Be able to convert the frequency to wavelength if required; also be able to convert between one photon and a mole of photons.

- *Memorize* the value for Planck's constant, **h** = $6.626*10^{-34}$ J·s.

- Be able to describe in general terms the Bohr model for the hydrogen atom. Be able to explain how it accounts for the emission line spectra of excited atoms.

- Be able to calculate the energy levels of the hydrogen atom using the Bohr equation. You will *not* have to memorize neither this equation nor the Rydberg constant.

- Understand the de Broglie equation and know how it is used and for what systems.

- Recognize the significance of wave or quantum mechanics in describing the modern view of atomic structure.

- Understand that an orbital for an electron in an atom corresponds to an allowed energy of that electron.

- Know that the position of the electron is not known with certainty due to the Heisenberg uncertainty principle; only the probability of the electron being within a given region of space can be calculated.

- Be able to describe the allowed energy states of an electron in an atom using the quantum numbers **n**, ***l*** and $\mathbf{m}_l$. Be able to describe the shapes of the orbitals.

- Be able to classify substances as diamagnetic or paramagnetic.

- Know that the spin quantum number, m_s, has values of + $^1/_2$ and - $^1/_2$. Know what these values refer to in the presence of a magnetic field.

- Recognize that each electron in an atom has a different set of the four quantum numbers - the Pauli Exclusion Principle.

- Recognize that the Pauli Exclusion Principle leads to the conclusion that no atomic orbital can be assigned more than two electrons *and* that the two electrons must have opposite spins (i.e. opposite values of m_s.)

- Using the periodic table as a guide, be able to depict electron configuration of the elements and monatomic ions by the orbital box notation or the spectroscopic notation. Understand the significance and relevance of the noble gas notation.

- Understand that electrons are generally assigned to the subshells of an atom in order of increasing subshell energy.

- Recognize that subshell energies in the hydrogen atom depend on both the n and *l* quantum numbers.

- When assigning electrons to atomic orbitals, be able to apply the Pauli Exclusion Principle and Hund's rule.

- Predict how properties of atoms - size, ionization energy and electron affinity - change on moving down a group or across a period of the periodic table.
- Be able to identify the main group metals, transition (variable charge) metals and nonmetals on a periodic table. Know the metalloid line.

- Understand the difference between molecular compounds and ionic compounds. Understand how ionic compounds consist of ions. Know the polyatomic ions (in the Nomenclature lab) and how to use them.

- Understand when a metal has a fixed charge and when a metal has a variable charge. Know the Roman numbers (1 - 9 at least). Know the difference between a metal and a nonmetal.

- Know when to use the Greek prefixes for covalent compounds. Know the Greek prefixes and what it means to chemists when they are used.

- Understand how acids and bases can be identified in chemistry. Know how to identify a hydrated compound.

- Be able to solve and understand the assigned problems in problem set #3.