CHM 110: Chapter 7 Study Guide / Learning Objectives

Chapter 7 in the textbook deals primarily with introducing the basics of quantum mechanics - the way we as modern scientists describe the arrangement of electrons in an atom. We also discussed light and the properties of light that allowed us to unlock the secrets of the atom. We went over theories describing the inner workings of the atom, from Dalton's atomic theory up to quantum mechanics.

The chapter contains almost no mathematics, but does require that you understand several theories of the atom and their limitations.

At the end of this chapter, you should be able to:

{Definitions]
- Define terms related to light: waves, frequency, wavelength, speed of light, diffraction, photons, photoelectric effect
- Define terms related to older theories of atomic structure: atom, nuclear model, electrons, atomic line spectrum, energy levels, transitions, emission, absorption
- Define terms related to quantum mechanics: quantum mechanics, classical mechanics, wave functions, atomic orbitals, quantum numbers, shell, subshell

[Light]
- List the units for properties of light (frequency, wavelength)
- Convert from frequency to wavelength and vice versa using the wavelength
- Find the energy (in joules) of a photon given speed or wavelength.
- Explain the photoelectric effect in terms of the energy content of photons.

[Dalton, Rutherford, and the atom]
- Describe the concept of atoms used by Dalton.
- Describe the nuclear model of the atom.
- Explain what advantages the nuclear model of the atom had over earlier models of the atom. (What did it explain that older models didn't?)

[The Bohr model]
- List Bohr's postulates.
- Explain what Bohr's model tells us about the atom that the nuclear model doesn't.
- Explain how Bohr's model predicts atomic line spectra.
- Describe how absorption and emission of light by atoms works in terms of the Bohr model.
- Explain the limitations of the Bohr model - what was it unable to predict?

[Quantum mechanics]

- Define the four quantum numbers - their symbols, and what each represents.
- Determine whether a set of four quantum numbers is allowed by applying the rules for assigning quantum numbers.
- Describe the shape of atomic orbitals (e.g. "s" orbitals, "p" orbitals, "d" orbitals)

[*Review problems from the text]*

- 7.33, 7.63, 7.65, 7.67, 7.69,