CHM 110: Chapter 6 Study Guide / Learning Objectives

Chapter 6 in OpenStax discusses the structure of the atom. Instead of focusing on the nucleus, this chapter discusses the electron cloud – where chemistry actually happens. To get there, we will discuss light and how the interaction of light with atoms led to the Bohr model of the electron cloud and then on to quantum mechanics – a branch of physics that allows us to describe the arrangement of electrons in an atom. The chapter also shows how information on the electron cloud is presented (electron configuration) and discusses several properties of elements that depend on electron configuration and position in the periodic table.

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, line spectrum**
- 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, wavefunctions, atomic orbitals, quantum numbers, shell, subshell**
- Define terms related to the electron configuration of atoms: **Pauli Exclusion Principle, orbital diagram, valence electron, noble gas core.**
- Define terms related to periodic trends: **atomic radius, ionization energy, electron affinity.**

[Light]
- List the units for properties of light (frequency, wavelength)
- Explain the photoelectric effect in terms of the energy content of photons.

[The Bohr model]
- Describe Bohr's model in a few sentences.
- 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.
- Determine the number of electrons that may occupy a given shell, subshell, or orbital.
- Describe the shape of atomic orbitals (e.g. "s" orbitals, "p" orbitals, "d" orbitals)

[Electron configuration]

- Write an electron configuration for an element or monatomic ion given a periodic table.
- Write an electron configuration for an element or monatomic ion using the noble gas core notation.
- List the valence electrons of an atom or monatomic ion.
- Draw an orbital diagram for an element or monatomic ion.

[Periodic trends]

- Given two elements, be able to discuss their relative atomic radius, ionization energy, or electron affinity.
- Describe the periodic trends using a periodic table.
- Explain, using what you know about the arrangement of electrons around an atom, why ionization energy decreases as you go down a group and increases as you go across a period.
- Explain, using what you know about the arrangement of electrons around an atom, why atomic radius increases as you go down a group and decreases as you go across a period.

[*Review problems from the text]*

- 1, 17, 29, 31, 33, 35, 37, 45, 49, 51, 55, 61, 67, 69, 71, 73, 75