**ACP Unit 5 Learning Objectives**

Chapter 11: Modern Atomic Theory

10.1 *(Atoms and Energy)*

You will know what the EM spectrum is, and the progression of broad ranges in the EM spectrum (radio, microwave, IR, visible, UV, etc.).

You will know the order of colors in visible light (ROYGBIV).

You will know that the speed of light (in a vacuum) is constant from all frames of reference.

The symbol for the speed of light is “c”. In the *SI* system, c = 2.9979 × 108 m/s.

You will understand the relationship between *wavelength* and *frequency* of light.

The *wavelength* of light measures the distance light travels through one complete oscillation of the EM field. The symbol for the wavelength is the Greek letter lambda, “λ”.

The *frequency* of light is the number of oscillations of the EM field in one second. The symbol for the frequency of light is the Greek letter nu, “ν᠎”.

You will be able to calculate frequency given wavelength and wavelength given frequency. Like any wave, the velocity is the product of the wavelength and the frequency: c = ν᠎ λ

You will understand the relationship between the frequency of light and the minimum amount of energy (quantum or photon) that light can add to, or receive from, matter.

You will understand the relationship between the frequency of light and the minimum amount of energy (called a quantum of energy or a photon) that light can add to, or receive from, matter.

You will be able to calculate the energy per quantum or energy per photon given frequency or wavelength, or calculate the frequency or wavelength given the energy per quantum. (ΔE = ℎ ν)

Higher frequency EM radiation transfers more energy per quantum than lower frequency EM radiation. (Blue light is higher energy light than red light.

10.2 *(The Hydrogen Atom)*

Students should have a basic understanding of the Bohr model – the introductory version of the modern model – that (incorrectly) viewed the electron as a point particle in orbit around the nucleus.

You will understand that atoms have discrete energy levels. The energy of the atom is usually thought of as the energy of the electron(s) that are at a particular energy level.

Understand that when the absorption or emission of light occurs, the atom (electron) transits between energy states.

You will understand the difference between a line spectrum (atomic spectrum) and a continuous spectrum (temperature spectrum).

10.3 *(Atomic Orbitals)*

You will use the hydrogen atom as a simple model (one electron) as an analogy to understand the fundamentals, such as the shapes of orbitals.

You will know that for each energy level of an atom, there is a corresponding electron wave (orbital) associated with the energy. The orbitals have specific shapes that show the wave-pattern of the electron around the nucleus.

Know the shapes of *s*, *p*, and *d* orbitals.

You will have a basic understanding of modern model of the atom (the Quantum Mechanical model, or wave model of the atom) describes the electron as a cloud of charge in a wave-like pattern around the nucleus that is represented by the “orbital”.

10.4 *(Electron Configuration and Atomic Properties)*

The atomic energy levels divide into “shells” that loosely correspond to the periods on the table. Each energy “shell” divides into “subshells” that correspond do the orbital shapes of *s*, *p*, *d*, etc.

You will understand how to use the Pauli Exclusion Principle to place the correct number of electrons

Understand and use the Aufbau Principle to order electrons for a given atom (up to element 30)

You will be able to write the electron configuration for an atom (or ion). The *electron configuration* is a notation to identify the electrons of an atom (or ion) by the energy level and sublevel for each.

You will be able to identify an atom (or ion) through element 30 from the electron configuration (and charge).

Equations to understand:

 c = ν᠎ λ

 ΔE = ℎ ν