Pre-AP Chemistry – Unit 3 – Atomic Structure and the Nature of Electrons

Objective 1: Students will explain the development of atomic theory from Dalton to the quantum model. [AT.1.C.1, AT.1.C.2]

1. Explain the problems with Dalton's Modern Atomic Theory.
2. Explain how Thomson and Rutherford used their experimental results to arrive at their models.
3. What important piece of information was obtained in the Millikan oil drop experiment?
4. What significant piece of information was discovered by Chadwick?
5. What has to occur, according to Bohr, for an electron to transition from one energy level to another?
6. Name the atomic model associated with Schrödinger. Briefly explain how it is different than Bohr's model and why this was a necessary adjustment.

Objective 2: Students will describe the location of subatomic particles and the forces that bind them. [AT.2.C.1, AT.2.C.2]

1. Which subatomic particle defines identity and which defines reactivity?
2. What force(s) hold a nucleus together? What force(s) attract electrons to it? Which is stronger? What easily observable, naturally occurring phenomenon supports the strength argument?
3. Draw a simple diagram of an atom and indicate the location and charge of each type of subatomic particle discussed in class. Use the appropriate symbols to identify the particles.
4. Briefly explain why the particles are constrained to the locations indicated in your diagram from question three.

Objective 3: Students will differentiate and fully describe isotopes of elements, including average atomic mass, isotopic mass, and isotopic symbol. [AT.2.C.3, AT.2.C.4, AT.2.C.5]

1. Define the following terms: atomic number, mass number, average atomic mass, atomic mass unit.
2. Give the number of each of the subatomic particles in gallium-71.
3. Explain, in detail, how you can tell the following two atoms are isotopes: ${}^{14}_{7}X$ and ${}^{12}_{7}X$.
4. Explain how to calculate the average mass of a naturally occurring element.
5. Calculate the average atomic mass of an element, X, that has the following isotopes: X-102 (65.2%, 102.01amu), X-98 (31.2%, 97.99amu), and X-105 (3.6%, 105.00amu).
6. Calculate the percent abundance of Zirconium-93 and Zirconium 90. The average mass of Zirconium is 91.22 amu.

Objective 4: *Students will write electron configurations for atoms and ions as well as calculate the energies and wavelengths associated with electron transitions. [AT.3.C.1, AT.3.C.2, AT3.C.3, AT.3.C.4]*

1. Define the following: Aufbau principle, Hund's rule, Pauli exclusion principle, electron configuration, orbital configuration, pseudo noble gas configuration, photon.
2. A red laser has a wavelength of 696 nm. What is the energy of the laser beam? What is the frequency?
3. If an electron drops from an energy level with $E_1 = 3.23 \times 10^{-19}$J to a level where $E_2 = 9.1 \times 10^{-20}$ J what would be the wavelength of the emitted radiation?
4. Using a diagram, show two different Bohr electron transitions and state which transition releases light of greater energy.
5. Write electron configurations for the following: sodium, iodine, nitrogen, aluminum cation, fluoride ion, iron(II) ion.
6. Write orbital electron configurations for the following: oxygen and manganese.