<u>Tutorial for Chapter 5</u> Std 1

1. Vocabulary and people – define each of the following terms and/or tell what each of the following people contributed to our knowledge of the atom:
   - wave
   - frequency
   - wavelength
   - amplitude

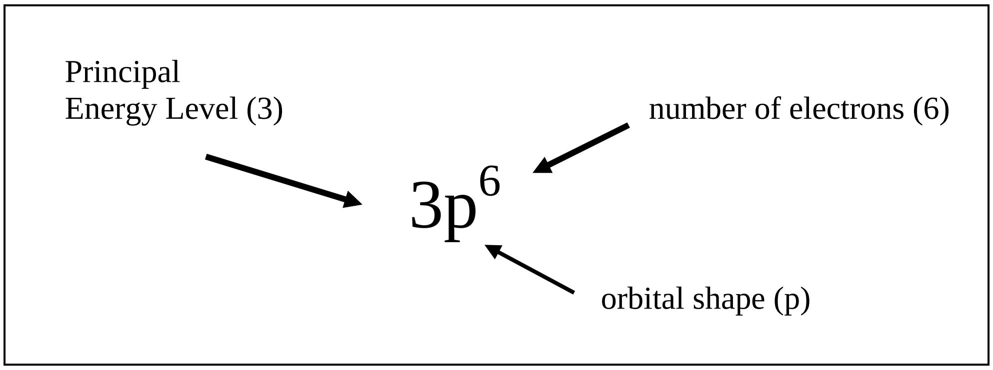
   light – considered to be all wavelengths of the electromagnetic spectrum (EMR)
   photon
   radiation
   Bohr – orbits, only explains Hydrogen and fails to explain all other elements
   deBroglie / Schrodenger - orbitals
   orbits – circular shape
   orbitals – probability maps
   ground state
   quantum / quantized
   principal energy levels – what they are and how they correspond to rows on the periodic chart.
   sublevels (energy levels) – how many in each principal energy level

2. spectra –
   a. Tell what are they.
   b. Arrange the following from largest to smallest wavelength:
      radio waves, micro waves, red – violet, uv, x-rays, gamma rays (see p. 297)
   c. Arrange the following from largest to smallest frequency:
      radio waves, micro waves, red – violet, uv, x-rays, gamma rays (see p. 297)
   d. Arrange the following from largest to smallest amount of energy per photon:
      radio waves, micro waves, red – violet, uv, x-rays, gamma rays (see p. 297)
3. ozone O_3 – protects earth and people from uv radiation
4. orbital shapes and how many at each principal energy level
   a. s-orbitals – round shape, 2 electrons each, only 1 s-orbital principal energy level 1 and up
   b. p-orbitals – dumbbell-shape, 2 electrons each, 3 p-orbitals in principal energy level 2 and up
   c. d-orbitals – double-dumbbell-shape, 2 electrons each, 5 d-orbitals in principal energy levels 3 and up.

5. Electron Configuration and Orbital Configuration are the same thing.
   The electron configuration is written for each element to fill in how many electrons it has.
   Example: Phosphorous Z = 15 (the atomic number)

   Electron configuration is $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^3$

   In this kind of configuration here's what it all means:



6. We can abbreviate electron configurations. When you get to energy levels 4 –7, the electron configuration is very long. For instance:
The electron configuration for Cs (z = 55) can be written 2 ways:

$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3s^2\ 3p^6\ 4s^2\ 3d^{10}\ 4p^6\ 5s^2\ 4d^{10}\ 5p^6\ 6s^1$
or simply write [Xe] $6s^1$

Xe accounts for the first 54 electrons and their configuration:
$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3s^2\ 3p^6\ 4s^2\ 3d^{10}\ 4p^6\ 5s^2\ 4d^{10}\ 5p^6$
By writing Xe we get all this for free! What we did was take the Nobel gas in the row above Cs as the starting point for the configuration and just added what comes after the $5p^6$ electron part of the configuration.

7. Atoms like full sublevels. They fill in the order given on your orbital filling chart.
8. **<u>Valence Electrons</u>** – only the electrons in the highest energy level. These will always be s and p electrons in the **<u>highest pel (Principal Energy Level) only</u>**.

Example:
Question: How many valence electrons for Sn (z = 50)?
Solution
Sn is on row 5 of the chart in column 14. The valence electrons are the 5s and 5p electrons. There are 2 5s electrons and 2 5p electrons for a total of **<u>4 valence electrons</u>**.

9. **<u>Core Electrons</u>** – all of the atom's electrons except the valence shell electrons.
Core electrons = total electrons - valence electrons

Example:
Question: How many core electrons for Sn (z = 50)?
Solution: We just figured the valence electrons for Sn in the last example. Using the formula above: Core electrons = total electrons – valence electrons
50 - 4 = **<u>46 core electrons</u>**

10. **<u>Ionization energy</u>** – energy required to remove an electron from an atom. We always measure this energy when the element is in the gas phase.
Example - For potassium (K)
$K_{(g)}$ ---> K^{+1} + e^- (the energy to do this, *<u>take away the electron</u>*)

Wave Mechanical Model – Summary

1. maximum number of electrons in any orbital = 2 **AND** they must have opposite spins (Pauli exclusion principle)
2. The same types of orbitals recur as you go from n = 1 to n = 7
   (n is the **principal energy level**). All elements in a vertical column are filling electrons in the same sublevels.
3. **Valence electrons** are the number of electrons in the outermost energy level that has electrons in it. All elements that have the same number of valence electrons in their outer shell will be in the same column (also call a **group** or **family**). All elements in the same column will react similarly chemically. See Figure 10.30 (p. 318). Notice that the numbers of s and p electrons (the only sublevels that will ever have valence electrons in them) are always the same in a column. The only difference is the **n** number.