Honors Chemistry **Name _____**
Chapter 5 – Electrons in Atoms Notes **Date _____**

ATOMIC MODEL

- *See Atomic Model Timeline worksheet for specifics.*

ELECTRONS

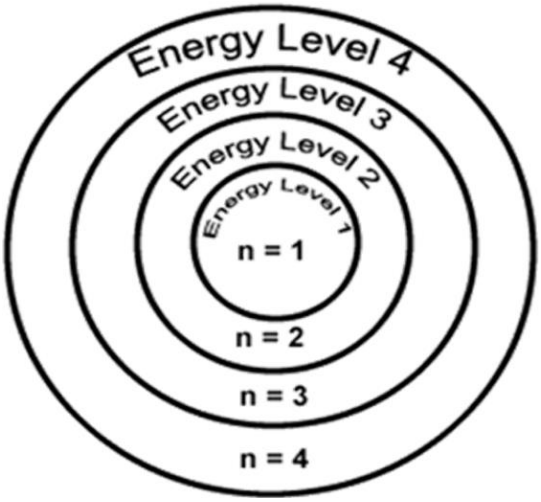
- **Quantum Mechanical (QM) Model**- This is the currently accepted model of the atom.
  - Erwin Schrödinger wrote an equation which describes _____ _____.
    - These locations are not definite because of the Heisenberg Uncertainty Principle.

- Each of the following terms gives a *more specific* description of where an electron *probably* is.

  In Chemistry… **In CB South, for example…**

  - Energy level, *n*
  - Sublevel, *l*
  - Orbital, m_l
  - Spin, *s*

- **Energy Levels, *n*-**
  - An electron may NOT be found _____ _____.
  - Higher *n* = higher energy (typically)
  - To determine how many electrons fit into a given energy level, use this **formula**: _____
  - The maximum number of electrons is **32**.
  - Electrons will occupy the _____ first.



- **Sublevels (subshells), *l*-**
  - Energy levels contain _____ consisting of _____ (shapes) where there is a _____ probability of finding an _____.
  - Orbitals can hold up to _____ electrons.
  - Sublevels hold the orbitals and can hold 1, 3, 5, or 7 orbitals.

	***s* Sublevel**	***p* Sublevel**	***d* Sublevel**	***f* Sublevel**
Shape				
Appears				
# of Orbitals				
Capacity				

ELECTRON CONFIGURATIONS

- **Writing Electron Configuration NOTES**

Electron Configuration	Shorthand Configuration	Orbital Notation
H		
He		
Li		
Be		
B		
C		
Cl		
Ti		
Kr		

Electron Configuration	Shorthand Configuration	Orbital Notation
O		
Ne		
Al		
Na		
Br		
Zr		
Ba		
Rn		

SHORTHAND NOTATION

- Steps to write in *shorthand* electron configuration notation:
  - 1st – Find the **_____** that is in the row above the element you want
  - 2nd – Write that noble gas's _____ in [brackets]
  - 3rd – Then continue with the e^- configuration starting with the next element
    - Ex- Scandium: **Long:** $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^1$

      Shorthand:

    - Ex- Chlorine: **Long:** $1s^2 2s^2 2p^6 3s^2 3p^5$

      Shorthand:

ELECTRON EXCEPTIONS

- Write the configuration for the following:
  - **Cr:**
  - **Cu:**
- ***What they actually are:***
  - **Cr:**
  - **Cu:**
- **Reason –** _____ sublevels are the most _____. _____ sublevels are not as stable as filled, but more stable than others.

ORBITAL NOTATIONS & THE RULES

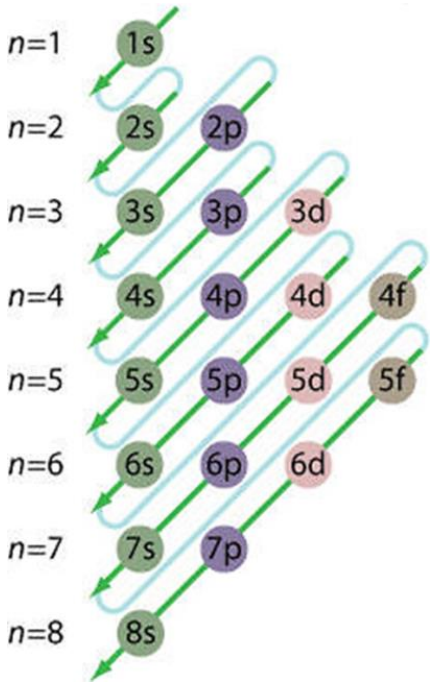
- **Orbital Notations**
  - Use a _____ to represent each _____.
    - s orbitals have _____ line
    - p orbitals have _____ lines
    - d orbitals have _____ lines
    - f orbitals have _____ lines
  - Use up/down arrows to represent _____.
  - Each line can hold a maximum of _____ electrons.
  - **Example**

    Titanium: ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___

    1*s* 2*s* 2*p* 3*s* 3*p* 4*s* 3*d*

FILLING RULES

- **<u>Aufbau Principle</u>**-



  - This is the order we get from "reading" the Periodic Table.

- **<u>Pauli Exclusion Principle</u>**-

  - This is the electron "spin." Either +½ or –½

- **<u>Hund's Rule</u>** –

  - They'd rather spread out.

ELECTRON CONFIGURATION PRACTICE

- Sulfur (S)
- Cobalt (Co)
- Strontium (Sr)
- Molybdenum (Mo)
- Antimony (Sb)
- Chlorine (Cl)
- Calcium (Ca)
- Chromium (Cr)
- Zinc (Zn)
- Selenium (Se)
- Mercury (Hg)
- $1s^2 2s^2 2p^6 3s^2 3p^4$
- $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10}$
- $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^1$

ELECTRON IN ATOMS

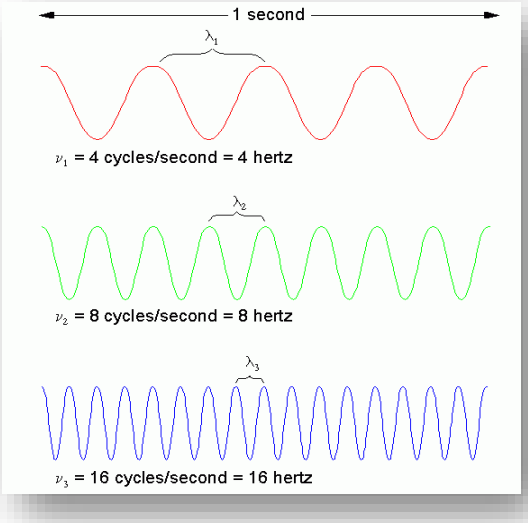
- **Electron Demonstration –** *try to identify key concepts for electrons moving within an atom…*

- **Flame Tests**
  - Elements give off characteristic _____ which can be used to identify them.
  - Electrons _____ energy from the flame (or other heat source).
  - When a certain amount of energy is reached, which is called a _____, electrons jump to a higher energy level called the _____.
  - When the electrons _____ energy in the form of _____, this is also called a **photon** or unit of light, they fall back to the lowest, most _____ energy level called the _____.

VISIBLE LIGHT & THE EM SPECTRUM

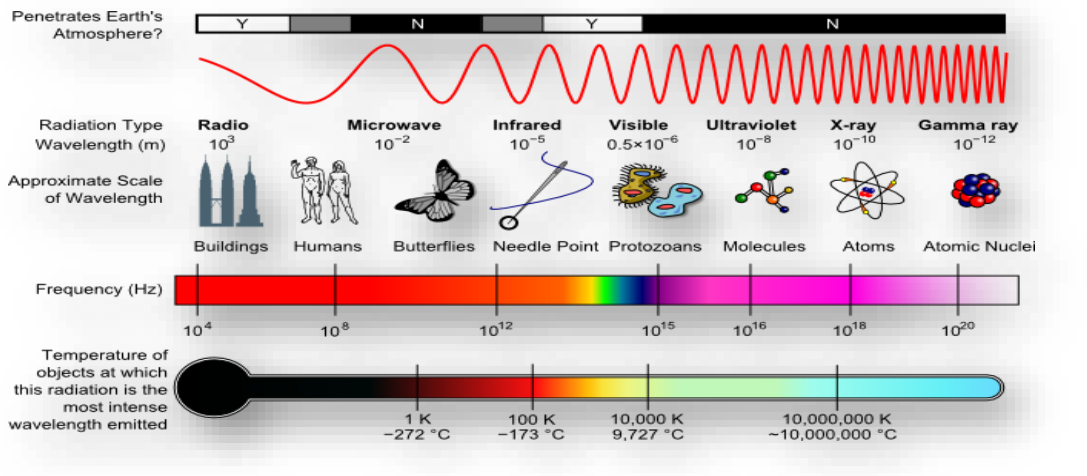
- Visible light exists as a narrow band of _____ that our eyes can detect.
  - The colors of the rainbow _____.
  - **Red light** has a wavelength of about _____ nanometers and represents _____ frequencies.
  - **Violet light** has a wavelength of about _____ nanometers and represents _____ frequencies.

- **Wave Statistics**
  - **Amplitude –** the _____ of the wave from zero to crest.
  - **Wavelength –** the distance between _____ points in phase.
    - Unit:
    - Symbol:
  - **Frequency –** the number of cycles (wave peaks) that occur in a unit of time.
    - Unit:
    - Symbol:
  - Wavelength & frequency are _____ related, meaning that _____ wavelengths go with _____ frequencies and _____ wavelengths go with _____ frequencies.



- **Wave Equation**
  - Formula:
  - Speed of light is always:
  - **Example 1 -** If the frequency of radiation for yellow light is 5.10 x 10^{14} Hz, what is the wavelength?
  - **Example 2 -** What is the frequency of radiation with a wavelength of 5.00 x 10^{-8} m?

- **Electromagnetic Spectrum –** a grouping of all waves that travel at the speed of light.

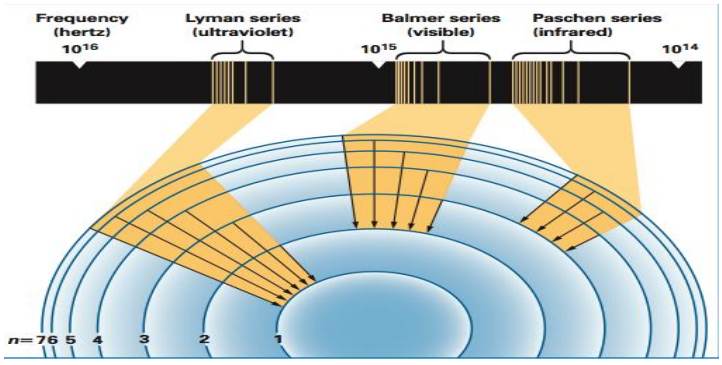


ATOMIC EMISSION SPECTRA

- Electrons returning from an _____ energy level emit _____ of specific _____ (specific bands of color).

- Each element has a _____ emission spectra and therefore is a good way to _____ an element!

- Additional transitions exist, but we can't see them because our eyes only detect visible light. These series of transitions are called Lyman, Balmer and Paschen.



- **Energy –** as an _____ falls from excited states they release a **_____** of energy that can be calculated using Plank's constant and the frequency of the transition.
    - Formula:

    - **Example 1 -** The energy given off when an electron transfers from energy level 6 to 5 is 2.66×10^{-20} J.
        - What is the frequency?

        - What is the wavelength?

    - **Example 2 -** If the frequency associated with a transition from energy level 2 to 1 is 2.48×10^{15}, how much energy is released?