5-2 Notes "Quantum Theory"

* the dual wave-particle model accounted for many of the previously unexplained behaviors of atoms - but NOT everything

Bohr - scientist that was able to explain a lot of behaviors like discontinuous emission spectra of Hydrogen

- Ground state = atom that has the lowest allowable energy state
- Excited State = when atom's electrons gain energy

- when electrons gain energy - they can "jump" to new energy levels - like climbing a ladder.
- this emits or absorbs energy to/from surroundings

moving ↓ = emitting energy (emission spectra)
moving ↑ = (absorption spectra) absorbing energy

de Broglie - scientist that corrected Bohr's work.

- stated that all moving objects have wave characteristics
- used following equation

$$\lambda = \frac{h}{mv}$$

h = planck's const.
m = mass
v = velocity
λ = wavelength

- stated that atom can't be set up like orbits around the nucleus

Heisenberg Uncertainty Principle

- impossible to determine exact location & velocity of electrons.

- Any method of observation would alter either and make exact location unknown.
  - can only predict general region around nucleus

Schrödinger Wave Equation

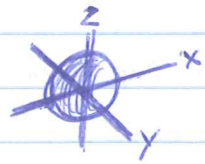
- model originally designed for H atoms that treats electrons as waves called the "Quantum Mechanical Model"
  - no attempt made to predict path of electrons.

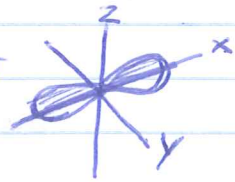
In this model, electrons exist as 3-D "balloon" shaped regions in atom called orbitals
- uses probability & energy states to predict location

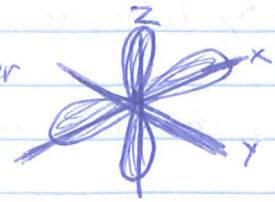
As energy ↑, the ability for E's to exist in orbitals farther from nucleus ↑, known as having higher energy levels.

Within each principal energy level there are sublevels, or increasing sub regions within the energy level
- Each period on P.T. = principal energy level (1, 2, 3 ... 7)
- Sublevels are s, p, d, & f (chunks or blocks of P.T.)

- each type of sublevel has a different 3-D shape

s = 3-D sphere 

p = hourglass 

d = 3-D propeller 

f = complex multi-lobed shape.

- Using ↑ combinations of these orbitals for each energy level, you increase the # of places that electrons can exist.

- It's like having a large stamp collection, you have to have a place to store each one, so the more you have, the more complex the organization must be.

see table 5.2 pg 155

shortened version:

period	sub-level(s)	# of orbitals	Tot. # of orbitals
1	s	1	1
2	s	1	
	p	3	4
3	s	1	
	p	3	
	d	5	9
4	s	1	
	p	3	
	d	5	
	f	7	16

ex) for Hydrogen (element #1) - its location for the 1 electron can exist only in the 1s orbital (only orbital for H) and has a higher likelyhood of being found
- adding energy quanta may change this