Notes#23/Periodic Relationships#1/AP Chemistry

II. Electron Configurations of CATIONS (_____) and ANIONS (_____)

1. Determining ionic e- configurations of the REPRESENTATIVE ELEMENTS

** Elements gain or lose e- so that they can be more STABLE by _______________________________.

** In cations, the e-'s in the ________________occupied n shell (or ____________ energy shell) are the first to be removed!

	Neutral	Ion conf.	Ion Symbol
Na:	[Ne]$3s^1$		
Mg	[Ne]$3s^2$		
Al	[Ne]$3s^2 3p^1$		
F	[He]$2s^2 2p^5$		
O	[He]$2s^2 2p^4$		
N	[He]$2s^2 2p^3$		

** Just by looking at the P.T. we can predict what ion charge an element will take, right?

** Notice that all of the above elements form ions so as to have _________________________________.

2. **ISOELECTRONIC -** when ions and elements have the SAME e- configuration. F^-, O^{2-} and N^{3-} are isoelectronic because they all have _____ e- and the same e- conf. as __________

EX. Which of the following are isoelectronic with Ar??? Ca^{2+}, Br^-, S^{2-}, Mg^{2+}, K^+, Ga^{3+}, Cl^-

4. Determining e- configurations of the TRANSITION METALS

- What kind of ions do you suppose transition metals always make? ____________________

- In transition metals, **always remove electrons first from the HIGHEST energy orbital in THE HIGHEST n QUANTUM NUMBER!!!** Why? *Think about distance from nucleus!*

EX Mn: [Ar] ________________ Mn^{2+}: ________________

** Not surprisingly, transition metals commonly produce _____ ions.......they just lose e- in their ______________ occupied n shell or highest energy orbital. EX: $CuSO_4$, $ZnCl_2$ etc....

** Transition metals are also known to produce more than one possible ion charge as seen below....

PRACTICE:

1. Iron commonly forms *both* Fe^{2+} and Fe^{3+} ions. Explain why and how the Fe^{3+} ion would exist?

2. Copper commonly forms *both* Cu^{2+} and Cu^{1+} ions? Why do you think a Cu^{1+} ion would form.

III. The FIVE Major Periodic Trends

A. ATOMIC RADII - a measure of the "size" of an atom.

1. Considering atomic orbitals just represent____________________ and not fixed physical boundaries, how could a definite radius of an atom actually be determined???

   - Atomic radii is actually determine indirectly - it's 1/2 the distance between two nuclei in two adjacent atoms either in a molecule or 3-d lattice structure (bonding atomic radius).

2. **THE TREND** - As you go down the PT atomic radii ____________________.
   As you go across the PT, atomic radii ____________________.

3. The explanation:
   ** As you go <u>down</u> the PT atomic radii ________________. This should make sense because as you go down, the ______ quantum number ____________ which is directly proportional to ____________. In other words, as n increases, the size ____________________.

   ** As you go <u>across</u> the PT atomic radii _______________. Why would this be so?? This trend can be explained via a process called SHIELDING (which we talked about briefly last chapter).

SHIELDING:

1. THE BOTTOM LINE: The more the (+) protons in the nucleus can pull on the outer e- the _________ the atomic radii. So, as you go across the PT, the pull of the protons _________________. Why?

2. For atoms, with three or more electrons, the electrons in a given shell are shielded by electrons in inner shells (shells closer to the nucleus). In other words, electrons that are "shielded" can't feel the ______________________ of the nucleus as much because the inner electrons are in the way.

3. Electrons in the *same* shell can also "shield" each other, but only in the same n shell. Remember, 2s < 2p (with respect to energy).

4. Put points 2 and 3 together and you can figure the EFFECTIVE NUCLEAR CHARGE that an electron would actually feel.

$$Z_{eff} = Z_{actual} - 0$$

Nuclear effective charge   # of protons   core electrons

EX, 1. Look at Li. Li has 3p+ and 3e-

2. Look at Be. Be has 4p+ and 4e-

*** Basically, as you go across the P.T., the amount of shielding is ______________ but the # of p+ in the nucleus _________________. The _____________# of p+ pull on the outer e- ___________ causing atomic radii to __________________.