NOTES #27 BONDING - PART B AP CHEMISTRY

V. Exceptions to the octet rule (continued)

B. Some atoms can handle _____ than 8 valence electrons. These atoms form _____ octets.
** Only elements in the THIRD row of the periodic table or below can do this. Why?

** Expanded octets are very common for the elements, _____ and _____.
They often have 10 or 12 electrons around them.

PRACTICE: Draw the Lewis structures for the following compounds:

PCl_5 SCl_4 $XeOF_4$

A Helpful Trick: The rule of 32.

C. Odd-Electron Molecules. Some molecules contain an *odd* number of electrons. It's impossible to pair up an odd number. The octet rule CANNOT be satisfied for all atoms. The atom that brings the odd number of e^- has to wear them!

Ex. NO NO_2

VI. RESONANCE:

A. Looking back at the carbonate ion, there are actually three different ways it can be represented. Which one is CORRECT?

- Actually, not ONE of these structures are correct but rather the *actual* structure of the carbonate ion is a mixture of the three.
How do we know? Consider the bond lengths of the C--O bonds. ALL of the C---O bonds are _____.
And each C---O bond is _____ than a single bond yet _____ than a double bond.
In many ways, it's like the C---O bonds aren't single bonds, aren't double bonds but a rather _____.
Such a structure is impossible to represent in one Lewis structure drawing so we draw all of the RESONANCE STRUCTURES and assume that the actual structure is somewhere in between.

B. RESONANCE - the use of two or more Lewis structures to more accurately represent one molecule.

C. You need to be able to draw the different resonance structures for different compounds.

** *Just remember, when drawing resonance structures, the _____ of the atoms CANNOT be changed, only the positions of the electrons.*

ex. Draw a resonance structure for Benzene, C_6H_6
BOND LENGTHS?

ex. Draw all of the resonance structures for NO_3^-.

ex. Draw ALL the resonance structures for the molecule, N_2O, which is arranged in the order, N-N-O.

VII. BOND POLARITY

A. ALL covalent bonds don't share their electrons equally. For example, in an H---F bond, which atom has more attraction for electrons? _____ . So, F is going to pull on the e^- more. This introduces the *last* periodic table trend.....

B. ELECTRONEGATIVITY - the ability of an atom to attract towards itself the e^-s in a chemical bond.

- Electronegativity is very similar to Electron Affinity. The _____ the Electron Affinity, the _____ the Electronegativity. The only differences are:

1. Electronegativity is NOT a measure of energy but rather is a relative measurement among the atoms where the values have arbitrarily set between 0 and 4. 4 being the *most* electronegative.

2. Electronegativity deals with attraction of e^-s in a bond whereas electron affinity is dealing with a _____accepting an e-.

TREND: As you go <u>across</u> the periodic table electronegativity _____.
As you go <u>down</u> the periodic table electronegativity _____.

C. Bond type is determined by differences in electronegativity of the atoms involved.

1. **NON-POLAR COVALENT** (0.0 - 0.4)- electrons are shared equally in a bond. There is NO (or only a slight) electronegativity difference between the atoms.
ex.

2. **POLAR COVALENT** (0.5 - 1.9) - electrons are *not* shared equally in a bond. One atom is significantly more electronegative than the other. The more electronegative atom pulls the e^-s closer to itself and acquires a partial (-) charge. A polar covalent bond has POLES....a (-) end and a (+) end.
ex.

3. **IONIC BOND** (2.0 or greater) - The electronegativity between two atoms is so great that a complete TRANSFER of electrons takes place. No sharing! Greedy little atoms....
ex.

PRACTICE: Classify the following bonds as Non-polar, Polar, or Ionic. Label partial charges and draw a "polarity arrow."

C----Cl C-----O Si-----H Ca-----F P------Cl