Intro Comments

- Exams were generally excellent and will be returned at the end. Comments
  - almost no "silly" mistakes this time
  - nomenclature is still not perfect and now there's Stock Notation
  - expect to to be asked for the 3 equations(exam problem 13) on the final
  - Key will be distributed next week
  - Final is Tues 12/9 at 3:30. If you **must** take it at a different time, see me no later than 12/2
- Expect quizzes the last two days of class
- A course grade projection is available on the web.

Basic Thoughts on the Chemical Bond

- The energies involved in nuclear processes are far greater than those involved in chemical change. Thus, the key to chemical change, which is simply the formation of chemical compounds, must be the electrons.
- In the simplest terms-chemical change occurs when the result produces a more stable "electron environment." We have already seen that in the formation of ionic compounds.
- When ion formation is not "an option", such as a simple homonuclear diatomic (H_2), the stability arises from the sharing of electrons(covalence).
- Electrons shared between nuclei are more stable due to their ability to interact with two centers of positive charge.
- There will be a minimum distance where the net energy of the electron-nuclei attractions is balanced against the nuclear-nuclear repulsions.(Fig 7.2 p.244). In many cases more than one electron pair is shared between two atoms, producing what are called multiple bonds.
- The energies resulting from such sharing are called bond energies and exhibit a very broad range(Table 7.1 p. 246). Since bond energies are defined as the energy accompanying the "breaking of the bond" :

$$H:H(g) \Rightarrow 2H\cdot(g)$$

they are positive.

Lewis Octet Theory

- In the process of sharing electrons, an element is still limited to its elemental electron capacity. For the early elements, which are the “most prolific” in terms of compound formation, that is either two (for H) or 8 (Be to F). This “octet” is also the electronic configuration of the noble gases, so it is viewed as particularly desirable or stable. Thus, elements combine covalently in a manner that results in all elements having an octet.
- Since the electrons must still follow the Pauli principle, bonds form from “shared **pairs**”.
- The usual of bonds (normal valence) that are formed is equal to the number of unpaired electrons in the outermost (valence) shell. Up to group IV it’s equal to the group #. From group V on, it’s equal to the 8-group#
- A Lewis symbol is simply the elemental symbol surrounded on all four sides (for the four orbitals) by the electrons it has either as bonding or unshared.
- If multiple bonds are formed, this is symbolized by placing multiple pairs between the involved atoms
- There are many weaknesses in the Lewis Theory. However, properly applied, the methodology will produce a correct bonding description of a polyatomic species which combined with VSEPR will also give a

Building Lewis Structures

1. Determine the total electron count (note charges)
2. Store all Hs (without e^-s)
3. Identify the central atom
   a. It's obvious (for example H and F are never central, while C usually is)
   b. Least electronegative
   c. Highest normal valence
4. Attach all nonH atoms to the central atom with single bonds (subtract e^-s used)
5. Complete octets on all outlying atoms (subtract e^-s used)
6. If any e^-s remain, place them on the central atom as pairs
7. If the central atom lacks an octet, convert nonbonding pairs on the outlying atoms to bonding pairs(forming multiple bonds) until the central atom has an octet
8. Distribute any Hs (step 2) among the atoms to satisfy their normal valences
9. The structure at this point will be an acceptable Lewis form. It may be further "tuned", particularly for atoms after Ne, by further creation of double bonds to adjust formal charges.
10. Careful electron counting is critical to the success of this method
11. Examples:$CHCl_3$, H_2CO, H_2CO_2, H_2CO_3, C_2H_6O,C_2H_4O,BF_3,PF_5,

Formal Charge

- Formal charge is just a comparison of the electron count for an atom in a compound with the atom as an element
  - FC=Valence e^-s-(LP e^-s + 0.5* Bond e-s)

  Ideally the formal charge=0

  When comparing two different, but acceptable Lewis structures, preference is given to the one with the lower formal charges.

Electronegativity and bond polarity

- Electronegativity is a measure of the ability of an atom to attract bonding electrons
- Not surprisingly, it follows the same trends as the other electron attracting properties (ionization energy and electron affinity).
- Increases toward the upper right of the periodic table
- A heteronuclear bond will be polarized with the negative end toward the more electronegative element
- Bond polarity introduces an ionic component to heteronuclear bonds, resulting in their being shorter and stronger than a simple model would predict.