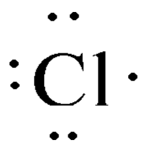
(3a.)
Honors Chemistry

Bonita Vista High School

Topic: Bonding

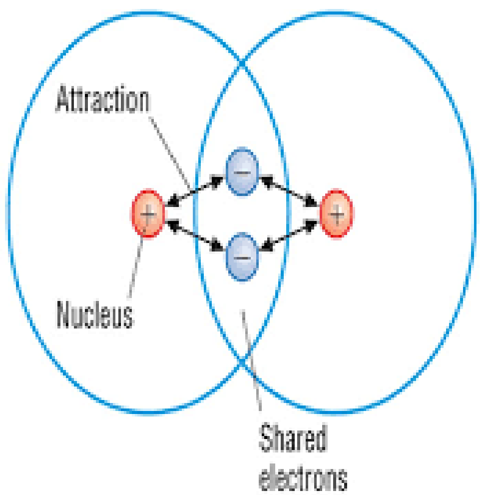
I. Lewis Symbols and Valence electrons.
   a. Review Valence electrons for nonmetals and semimetals
   b. Lewis Electron Dot Symbols.

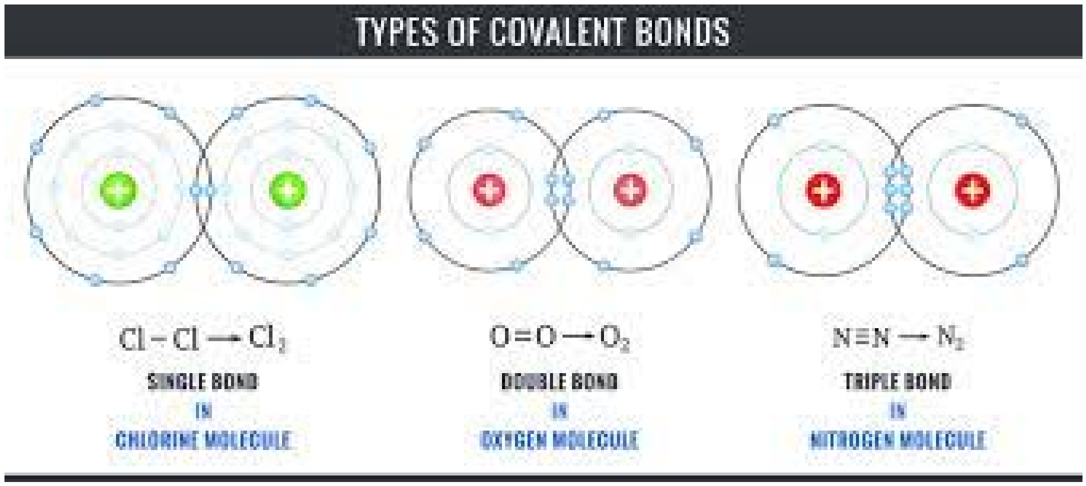


For the Cl atom = $[Ne]3s^2 3p^5$ (seven valence electrons)

   c.

II. Covalent Bonding
   a. Occurs when two nonmetallic atoms share a PAIR of electrons.
   b. The pair of electrons concentrate themselves between the nuclei acting like a glue.

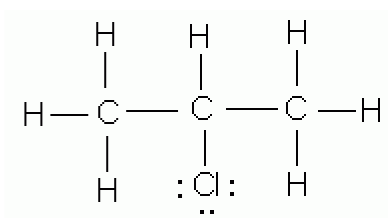


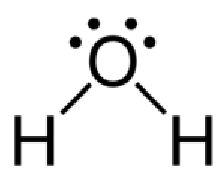


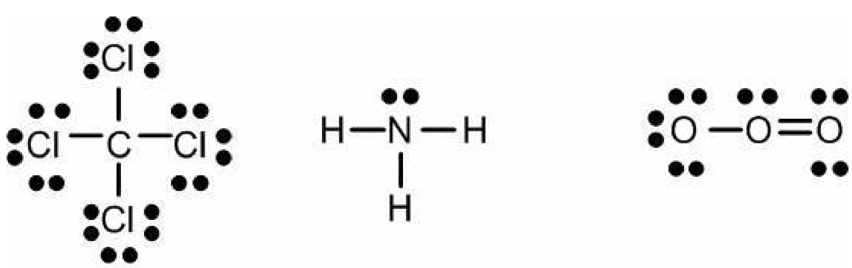
c. The more electronegative atom pulls on the pair of electrons more than the less electronegative atom resulting in "partial charge." *This idea of partial charge will be discussed later during the Polarity/Shapes section of these notes.

d. A Lewis structure is used to represent how the valence electrons that two atoms have are distributed during the bonding process.

e. An electron pair is represented as a line and a nonbonding pair of electrons is represented by two dots.







Correct Lewis structures for carbon tetrachloride, ammonia, and ozone.

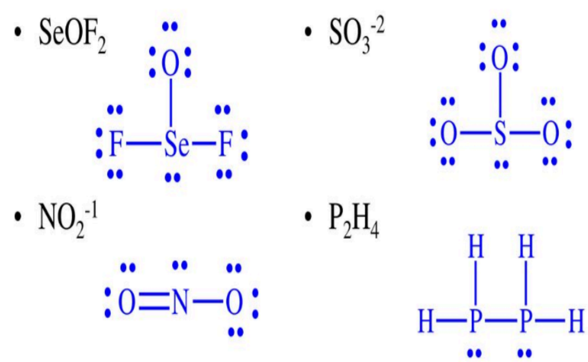
(note taking section for students)

f. How To Draw Lewis Structures

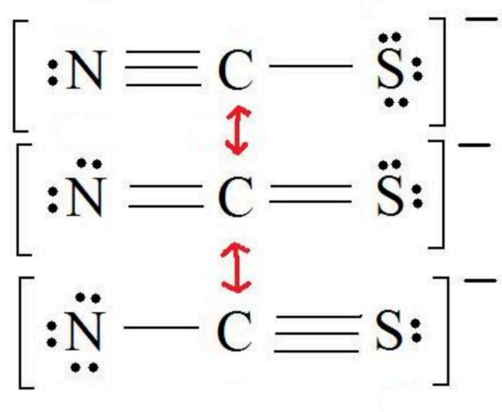
   i. Count the total number of valence electrons. Don't forget to add or subtract if the species is ionic.
   ii. Draw an arrangement of atoms. Usually the atom in the least amount is in the center. Arrange all other atoms as outer atoms.
   iii. Draw a line (representing a pair of electrons) from the central atom to each outer atom.
   iv. Subtract the amount of bonding electrons used so far from the original total.
   v. Use the remaining valence electrons to complete octets by drawing in lone pairs around atoms.
   vi. If you have extra electrons, put them on the central atom.
   vii. If you run out of electrons to complete the octet, you must rearrange and form double or triple bonds.

g. Resonance Structures occur when more than one valid Lewis Structure can be drawn for a molecule (ex: CO_2, SO_4^{2-}) **SUPPORT VIDEO**

h. *Formal Charge of an atom is the charge the atom would have if electrons were shared equally. To calculate formal charge for each atom: **SUPPORT VIDEO**
   i. Count the number of valence electrons
   ii. Subtract the number of bonds to that atom
   iii. Subtract the number of nonbonded electrons to that atom.

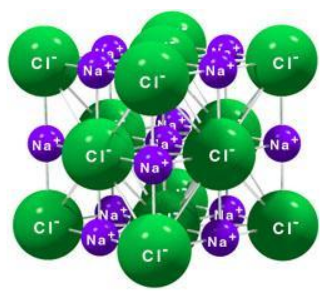


i. Formal charge helps choose the “best” resonance structure.
   i. Generally choose structure which has atoms having formal charges closest to a value of zero
   ii. Generally chose structure in which any negative charges are on the more electronegative atoms



III. **<u>IONIC BONDS</u>** This kind of bond refers to the electrostatic forces (attractions) between ions with opposite charge. [WATCH THIS VIDEO ON IONIC BONDING]

a. Ions are formed when electrons are transferred from one atom to another.
b. Ionic substances usually formed from interactions of metals with nonmetals.
c. Ions arranged in lattice. No discrete "molecule."
d. In general two factors make the lattice stronger:
    1. Larger magnitude of charges
    2. Smaller radius of ions



Examples: Which lattice structure do you expect to be stronger? MgO or Na_2O?

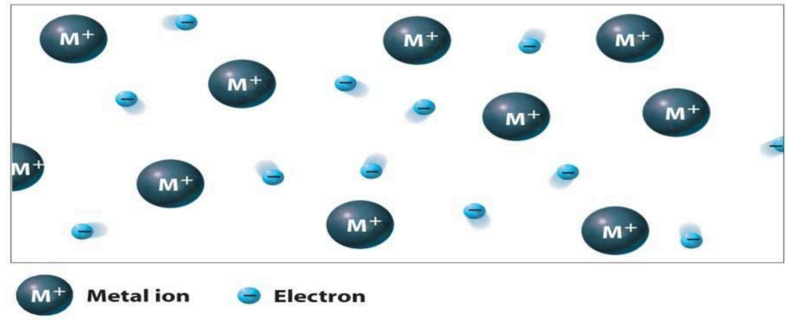
Examples: Which lattice structure do you expect to be stronger? Li_2O or Na_2O?

Examples: Which ionic compound do you expect to have a higher melting point? Al_2O_3 or MgO?

Examples: Which ionic compound do you expect to have a higher melting point? LiCl or LiF?

IV. **<u>METALLIC BONDS</u>**. Found in metals. Each atom in a metal atom is bonded to several neighboring atoms. [WATCH THIS VIDEO ON METALLIC BONDING]

a. Bonding electrons are relatively free (loosely held) to move throughout the structure of the metal.
b. Positive nuclei held together in a "sea of electrons".


M+
Metal ion
Electron