

Chemistry BC2001x: General Chemistry I

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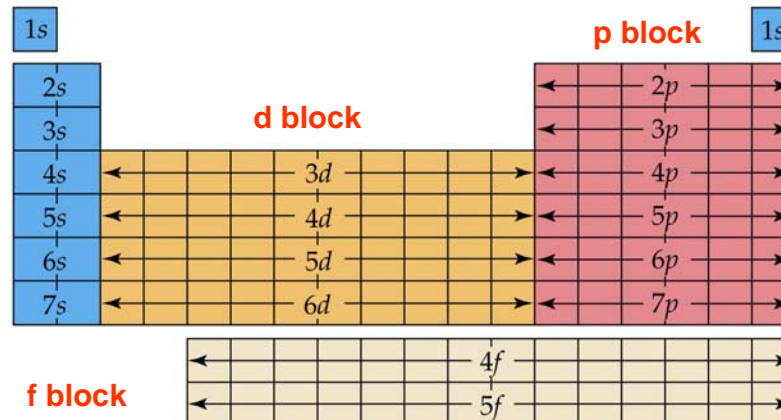


Lecture 5: Tuesday September 22, 2009 Octets, Lewis Structures and Bonding

Pick up the following:

- **Graded problem set 1:** alphabetical by your **last name** arranged in groups (A through E, F - H, etc.) look in the correct stack. solution this week is stapled to your problem; starting with Set 3, on Courseworks only.
- **Simple bonding theory (8 pages)**

s block



Representative s-block elements

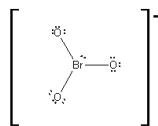
Transition metals

Representative p-block elements

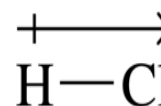
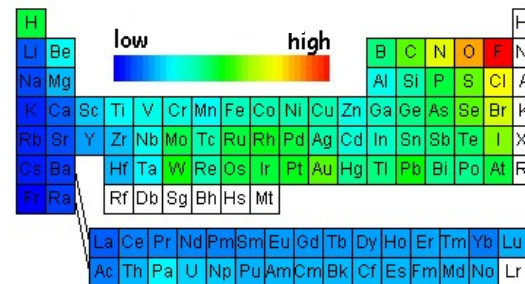
f-Block metals

Drawing Lewis Electron Dot Structures: suggested procedure (others ok as well)

- Start by counting valence electrons (**always do this step, whatever method you use!**)
 - The number of valence electrons for each atom is found from the element's column in the periodic table.
 - In a neutral molecule, the total number of valence electrons is the sum for all atoms
 - In a covalently bonded molecular **ion**, the net **charge** must be considered in the total count. Add one valence electron for each negative charge on the ion; remove one valence electron for each positive charge on the ion.
- Decide what atom is connected to what, which atom is in the center, etc. This is sometimes stated, sometimes implied by the formula. You are not assuming geometry, just topology. Use this to write symbols for each atom.
- Draw a single line, implying a shared electron pair, between all bonded atom pairs. Count how many electrons you have used (two per bond).
- Starting from the outside, and working around the molecule, add lone pairs to each atom to complete the octets. (Each H atom is connected to another atom with a bond, so H's are automatically ok.) If your molecule contains halogens, complete their octets first. Stop when you have used up your valence electrons. If all octets are complete, you are done.
- If you run out of electrons before completing all octets, the molecule has **multiple bonds**. Two shared pairs of electrons constitute a **double bond**; three shared pairs of electrons constitute a **triple bond**. Move a lone pair from an atom with a filled octet (not a halogen) to be shared with an adjacent atom that needs electrons to complete its octet. Continue forming multiple bonds until you have satisfied the octet rule for each atom. Rewrite the completed structure, using lines to indicate bonds. **Check that the final structure has the correct number of valence electrons. (Do this for any method).**
- When there are multiple bonds, it is sometimes possible to draw two or more equivalent Lewis structures, each satisfying all the rules of valence electron octet theory. These structures are called "**resonance**" structures.



Electronegativity: The ability to attract electrons in a covalent bond



calculated electron density in HCl (red = high)