

Lecture 8 February 1, 2019

Oxidation States;

Formal Charges

Lewis Structures;

Covalent bond types

- Polar molecules
 - Electrons are not *equally* shared
 - One part of molecule is more negative than the another part of the molecule
 - Molecule thus has negative and positive 'poles' like a battery
 - Hydrophilic ('water loving')
- Nonpolar molecules
 - Electrons are *equally* shared
 - No one part of molecule is distinctly negative or positive; no 'poles'
 - Hydrophobic 'water fearing'

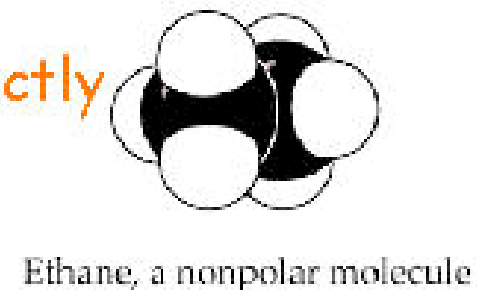


Figure 1
Potential Energy Changes that Accompany
Changes in the Internuclear Separation of Two
Hydrogen Atoms

Two Electrons Shared between Two Atoms
Make a Bond! G.N. Lewis

(G. = Gilbert
N. = Newton
Lewis as in Lewis Structures!)

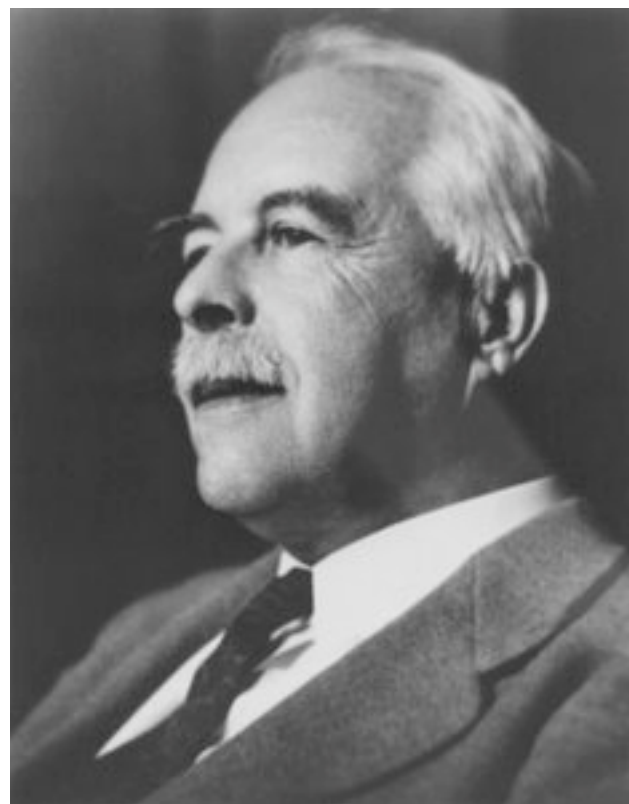
Lewis Structures and VSEPR:

Workshop Study

Simple Review videos

<https://www.youtube.com/watch?v=1ZlnzyHahvo>

https://www.youtube.com/watch?v=xNYiB_2u8J4



Rules for Oxidation State Assignment

Rule 1: The oxidation number of an element in its free (uncombined) state is zero — for example, Al(s) or Zn(s). This is also true for elements found in nature as *diatomic* (two-atom) elements and for sulfur, found as:

Rule 2: The oxidation number of a *monatomic* (one-atom) ion is the same as the charge on the ion

Rule 3: The sum of all oxidation numbers in a neutral compound is zero. The sum of all oxidation numbers in a *polyatomic* (many-atom) ion is equal to the charge on the ion that may have multiple oxidation states, if the other atoms in the ion have known oxidation numbers.

Rule 4: The oxidation number of an alkali metal (IA family) in a compound is +1; the oxidation number of an alkaline earth metal (IIA family) in a compound is +2.

Rule 5: The oxidation number of oxygen in a compound is usually -2 . If, however, the oxygen is in a class of compounds called *peroxides* (for example, hydrogen peroxide), then the oxygen has an oxidation number of -1 .

Rule 6: The oxidation state of hydrogen in a compound is usually +1. If the hydrogen is part of a *binary metal hydride* (compound of hydrogen and some metal), then the oxidation state of hydrogen is -1 .

Rule 7: The oxidation number of fluorine is always -1 . Chlorine, bromine, and iodine usually have an oxidation number of -1 , unless they're in combination with an oxygen or fluorine.

The Pauling Electroneutrality Principle:

Pauling's principle of electroneutrality states that each atom in a stable substance has a charge close to zero. It was formulated by Linus **Pauling** in 1948 and later revised.

Formal Charges: Keeping track of electrons leading to charge separation in a molecule:

Formal Charge

$$\text{FC} = \frac{\# \text{ Valence } e^- \text{ in Free Atom}}{\text{Total \# Nonbonding } e^-} - \frac{\text{Total \# Bonding } e^-}{2}$$

Lewis Structures: Do a Zillion.