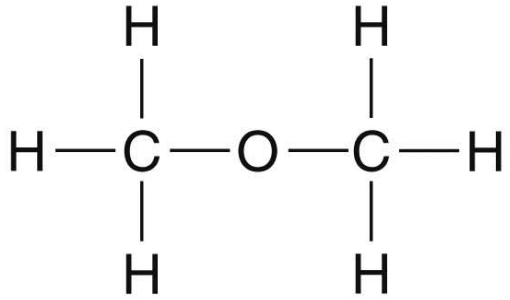
Chapter 1:
Electronic Structure and Bonding
Or
A Brief Review of General Chemistry
(Part 1) (Chapter 1.1-1.7)

1. The Structure of an Atom
2. Ionic and Covalent Bonds

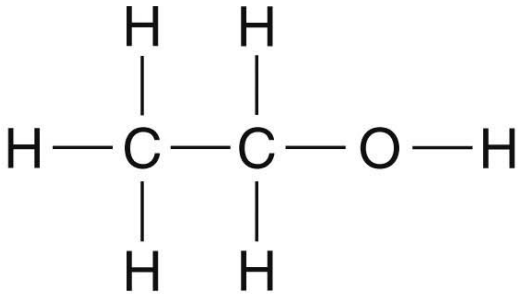
Review ideas from general chemistry:
atoms, bonds, molecular geometry

Electronic Structure and Bonding

In the mid 1800s, it was first suggested that substances are defined by a specific arrangement of atoms.



Dimethyl ether
Boiling point = −23°C



Ethanol
Boiling point = 78.4°C

Electronic Structure and Bonding

- An _____ is the set of orbitals with the same value of N.

- The electrons in the outermost occupied shell are _____.

- _____ (lowest energy arrangement) of an atom lists orbitals occupied by its electrons

- _____: He, Ne, Ar, Kr, Xe, and Ra – The "Noble" Gases - are inert elements as their outer electron shells are filled

- Atoms tend to react in ways that enable them to achieve a more stable outer shell of 8 e-.

Electronic Structure and Bonding

- If an element gives up (or donates) its electron easily – it is_____

K

- If an element accepts an electron easily – it is _____

Cl

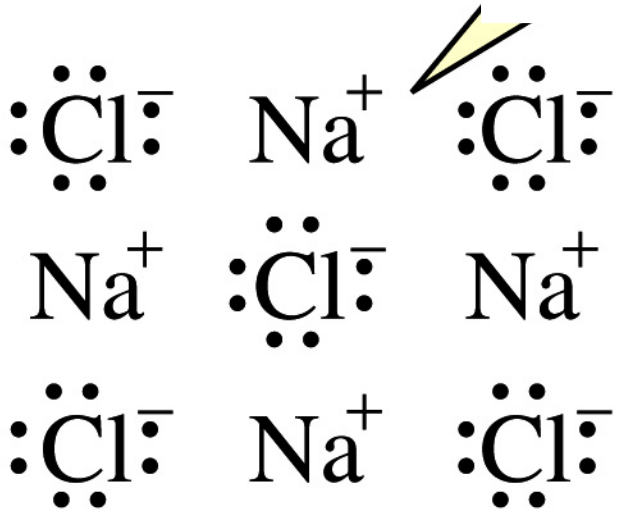
Electronic Structure and Bonding

- How do atoms form an octet?

- Atoms can obtain octets through

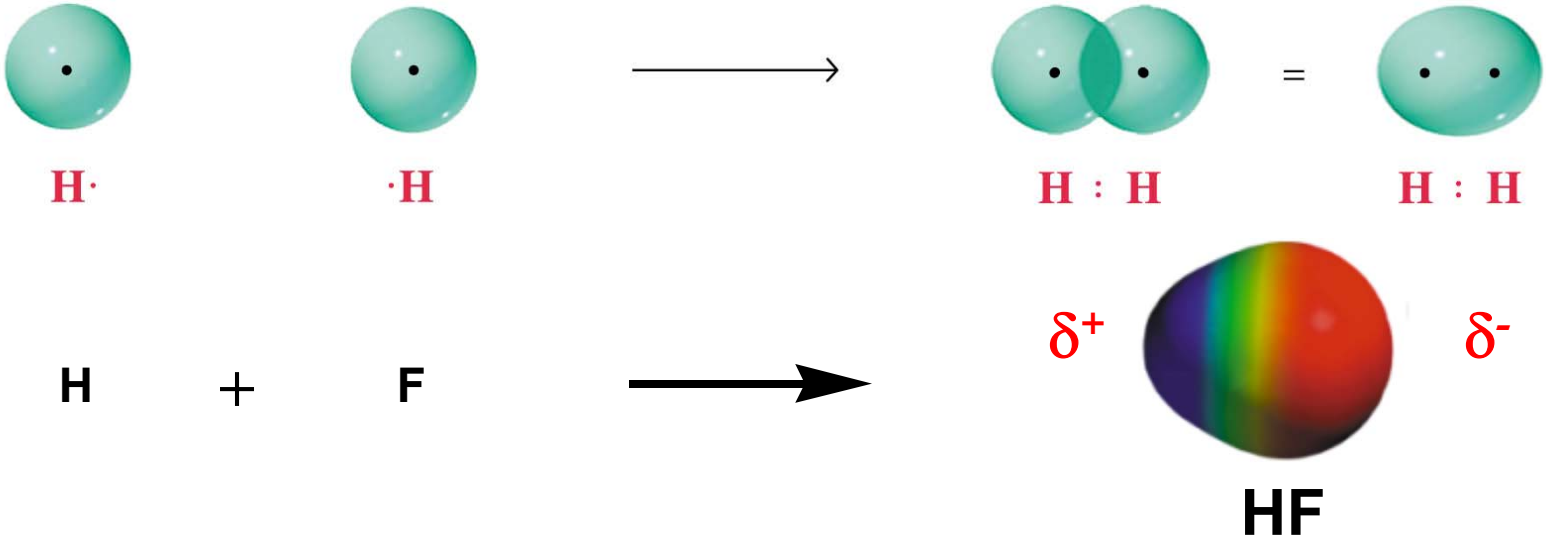
- An atom that _____ an electron becomes a negatively charged _____.
- An atom that_____an electron becomes a positively charged _____.

Electronic Structure and Bonding



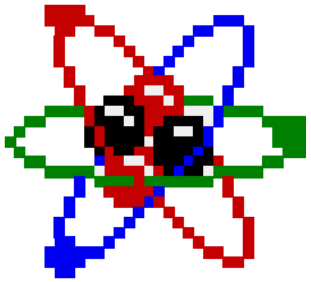
sodium chloride

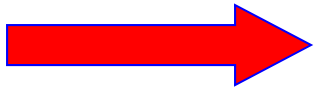
Electronic Structure and Bonding



Quantum Mechanics

- DeBroglie first proposed that matter should exhibit wavelike properties.
- _____uses the mathematical equation of wave motions to characterize the motion of an electron around a nucleus.
- The wave functions (or orbitals) developed by Schrödinger tell the energy of the electron and the volume of space around the nucleus where an electron is most likely to be found.

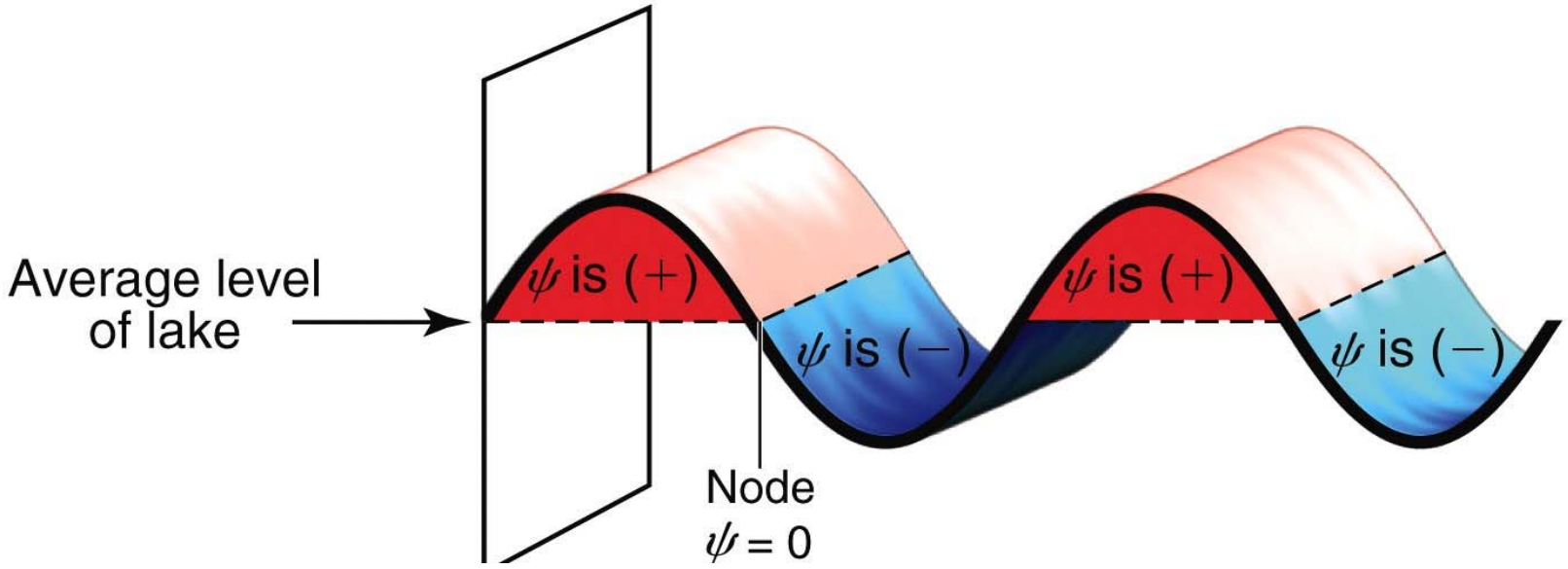




Quantum Mechanics

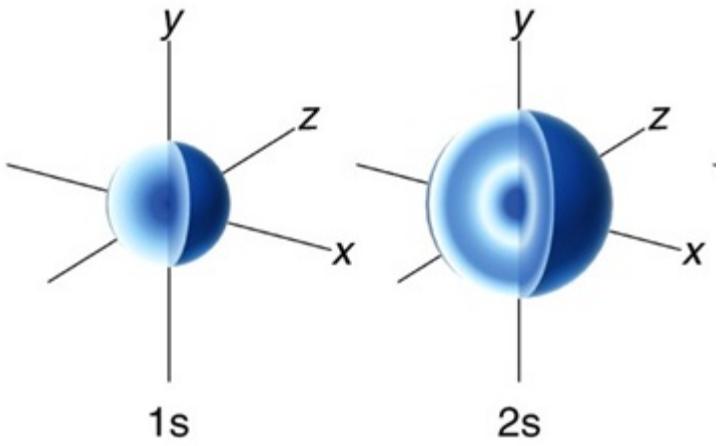
- Electrons behave as.
- An orbital is

- The theory does match experimental data, and it has predictive capability.



Quantum Mechanics

- Electrons are most stable (lowest in energy) if they are in the 1s orbital?
- The 1s orbital is full once there are two electrons in it.
- The 2s orbital is filled next. The 2s orbital has a node.

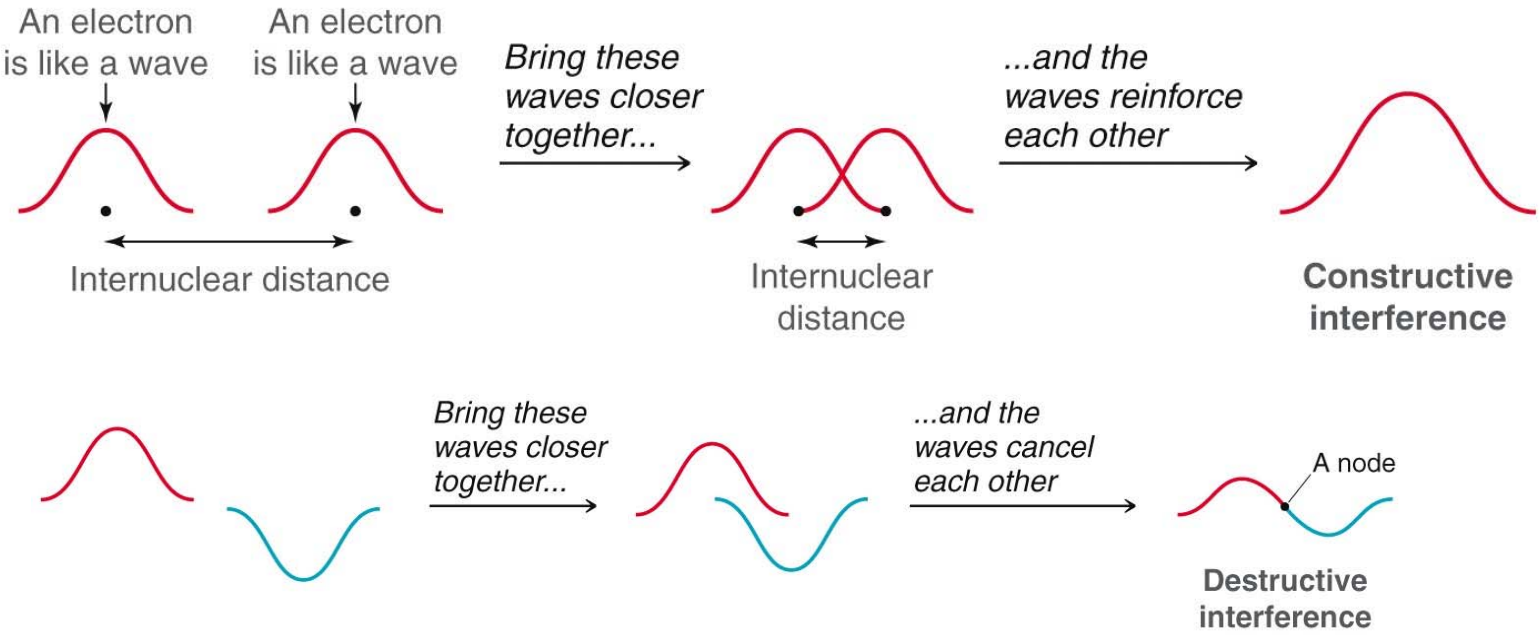


Electronic Structure and Bonding

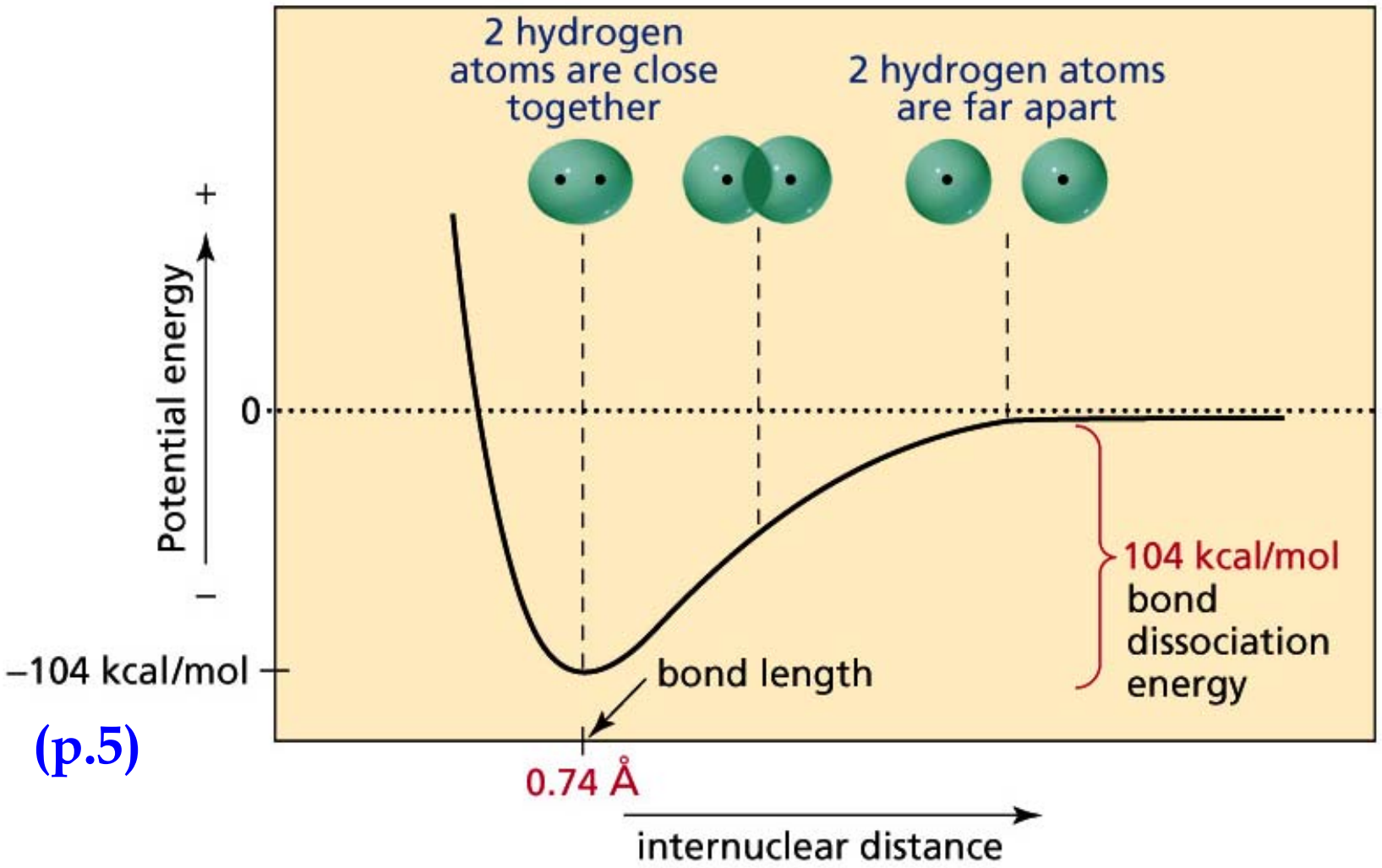
2p - Orbitals

Valence Bond Theory

- A bond occurs when atomic orbitals overlap. Overlapping orbitals are like overlapping waves.



- Only constructive interference results in a bond.



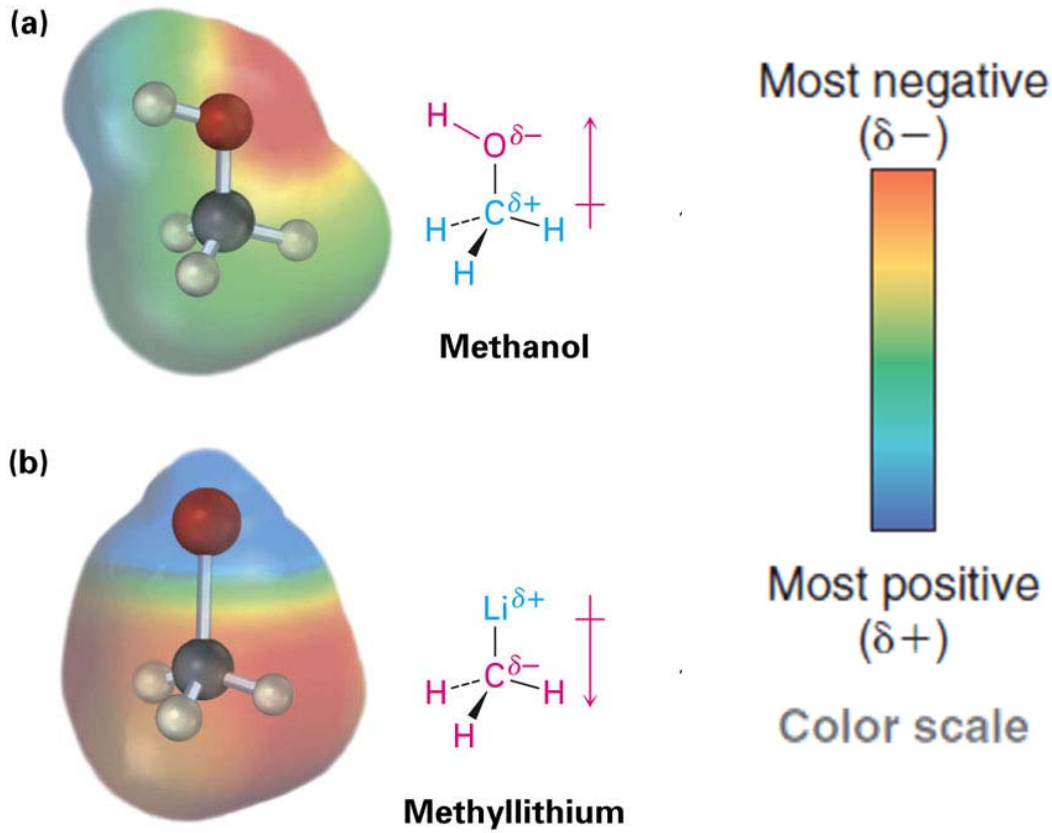
(p.5)

Organic compounds have

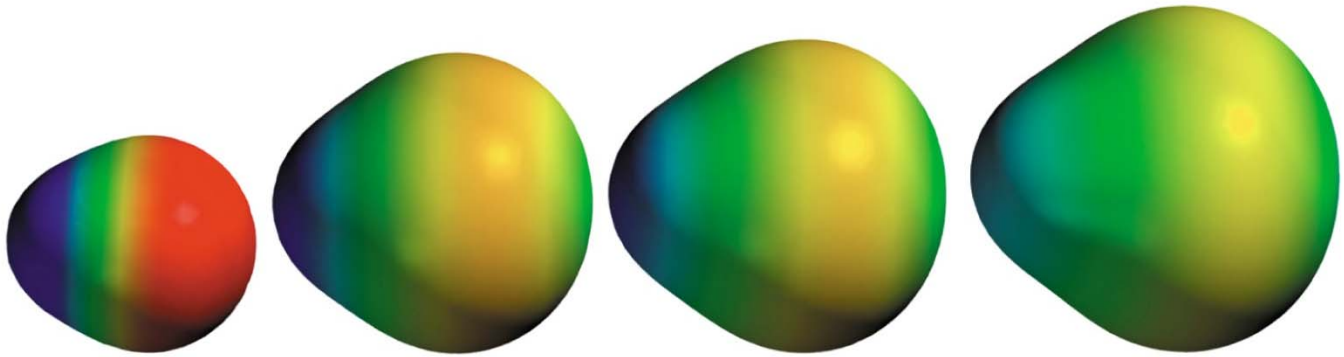
Product has 436 kJ/mol less energy than two atoms: H–H has **bond strength** of 436 kJ/mol or 104 kcal/mol

Electrostatic Potential Maps

- Colors indicate electron rich (red) and electron-poor (blue) regions
- Used to give a visual depiction of polarity.
- Arrows indicate

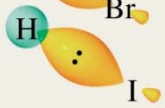


Electronic Structure and Bonding

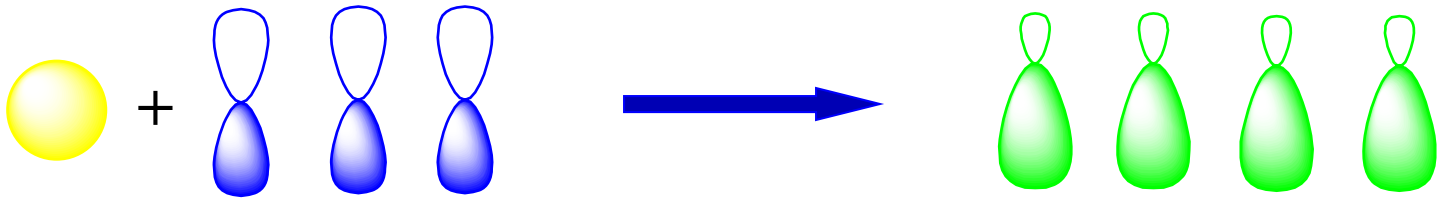


HF **HCl** **HBr** **HI**

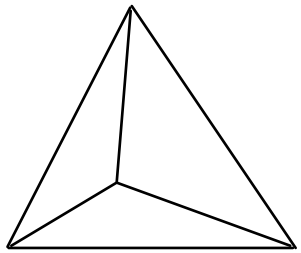
Table 1.6 Hydrogen–Halogen Bond Lengths and Bond Strengths

Hydrogen halide		Bond length (Å)	Bond strength kcal/mol	Bond strength kJ/mol
H—F		0.917	136	571
H—Cl		1.2746	103	432
H—Br		1.4145	87	366
H—I		1.6090	71	298

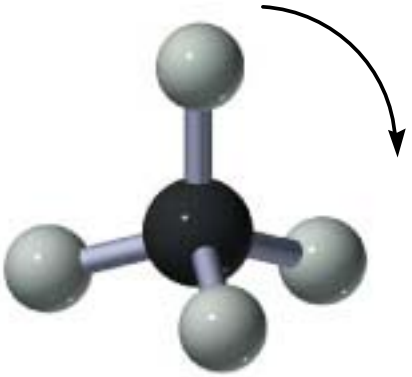
sp^3 Orbitals and the Structure of Methane



2s 2p sp^3



(tetrahedral)



1.08Å

438 kJ/mol

For Next Time….

- Friday Sections 1.8 – 1.11
  - Monday Chapter 2 (2.1-2.7)
  - Wednesday Chapter 2 (2.8-2.11)

- Homework Practice Problems Chapter 1
  #8,12,15,37,39,43,45,48,49,53,56

- If you will be needing Accommodations – please contact me as soon as possible.