Covalent compounds

Day6

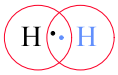
Covalent compounds

- bonds between two non-metals.
- involves sharing electrons.
- electrons will exist in pairs.
- Atoms will share electrons to get 8 electrons in their outer shell.
- Bonding electrons: shared pairs of electrons.
- Lone pairs: unshared pairs of electrons.

Hydrogen

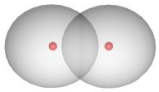
- Each begins with one electron.
- Needs two to get the NG config of He (2 e⁻)

H—H



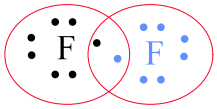
Visualizations of H_2

- ***The two atoms are bound together mainly due to the attraction of the positively charged nuclei for the negatively charged electron cloud located between them***



Fluorine

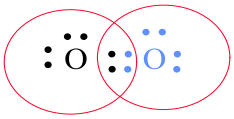
- Each F begins with 7 valence electrons.
- Needs to share one more with the other F.



Oxygen, O_2

- Each oxygen begins with 6 electrons.
- Needs to share two more electrons.
- An example of a double bond.

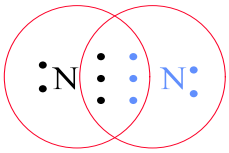
O=O



Nitrogen, N_2

- Each nitrogen begins with 5 electrons.
- Must share three more electrons.
- An example of a triple bond

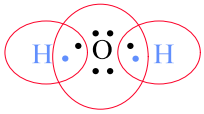
$:N \equiv N:$



Water, H_2O

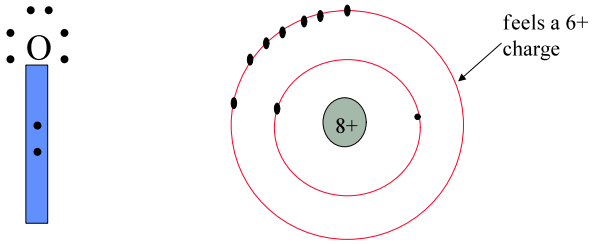
- Each H has I e^- and needs to hare 1 more.
- O has 6 and needs to share 2 more

H–O–H



Carbonate, the Will-Nilly method

Lets examine one the -O



The outer shell feels a 6+ charge and has 7 electrons

Formal Charge

- FC=Group# - # of bonds – e^- in lone pairs
- For that oxygen FC=6-1-6 = –1
- Include the formal charge for every atom in a Lewis structure
- The sum of the individual formal charges equals the overall charge.

The computer method

- Find total valence electrons.
- create a framework using single bonds.
- Add lone pairs from the outside in to give atoms octets.
- Make multiple bonds if necessary (Minimizing formal charge)
- Add formal charge.

The central atom

- The first non-hydrogen atom is usually the central atom.
- Hydrogen is always terminal and so never can be the central atom.
- Carbon is always a central atom.
- There is often more than one central atom.
- If hydrogen is the first atom in the formula, it is usually acidic and attached to oxygen.

carbonate, the computer method

HCN, the computer method

Acetate, $CH_3CO_2^-$

Shapes of molecules, VSEPR

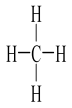
- electrons repel
- areas of electron density repel equally
  - Areas of electron density
    - single bond
    - double bond
    - triple bond
    - lone pair

In this class we are only concerned with the geometry around the central atom.

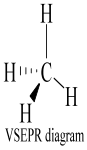
Types of shapes table

see table 3.5 in book	shape	bond angles
2	linear	180º
3	trigonal planar	120º
4	tetrahedral	109.5º

Tetrahedral



Lewis structure

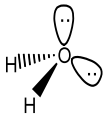


VSEPR diagram

Better VSEPR diagram

Water is also tetrahedral

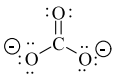
Lewis



VSEPR

Better VSEPR

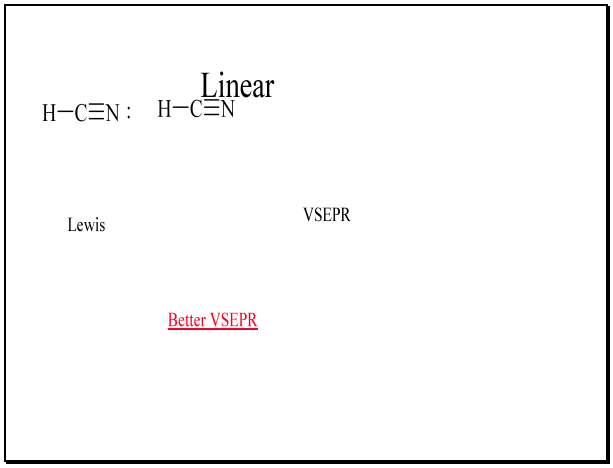
trigonal planar



Lewis structure

VSEPR

Better VSEPR



Electronegativity Values of Selected Elements

Metallic Elements			Nonmetallic Elements			
Li (1.0)	**Be** (1.5)	**H** (2.1)	**C** (2.5)	**N** (3.0)	**O** (3.5)	**F** (4.0)
Na (1.0)	**Mg** (1.2)	**Al** (1.5)		**P** (2.1)	**S** (2.5)	**Cl** (3.0)
K (0.9)	**Ca** (1.0)	**Sc** (1.3)			**Se** (2.4)	**Br** (2.8)

Electronegativity Difference	Bond type
0-0.4 (non-metals)	Non polar covalent
0.5 or more (non metals)	Polar Covalent
Metal + non-metal	Ionic

Naming simple covalent compounds

1. Name the first non-metal by it's elemental name.
2. Name the second nonmetal by its elemental name and an -ide ending.
3. Use the prefixes mono, di, tri, tetra, penta and hexa to denote number of atoms of that element in the molecule.
4. If mono is the first prefix it is understood and not written.

- CO
- CO_2
- P_2O_5
- NO
- N_2O
- NO_2