Ch 8: Covalent Bonding

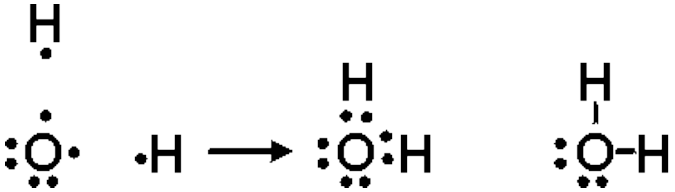
SC3e: Compare and contrast types of chemical bonds (i.e. ionic, covalent)

8.1 Molecular Compounds

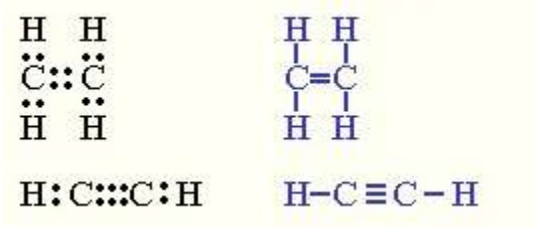
- Covalent Bond are atoms held together by sharing electrons.
- Molecule is a neutral group of atoms joined together by covalent bonds.
- Diatomic molecule is a molecule consisting of two atoms
- Molecular compound is a compound composed of molecules.
- **Molecular compounds tent to have relatively lower melting and boiling points that ionic compounds**
- Most are gases or liquids at room temperature, and most molecular compounds are composed of two or more nonmetals.
- Molecular formula is the chemical formula of a molecular compound
- **A molecular formula shows how many atoms of each element a molecule contains**

8.2 The nature of Covalent Bonding

- **In covalent bonds, electrons sharing usually occur so that atoms attain the electron configuration of noble gases.**
- In covalent bonds elements usually acquire a total of eight electrons (an octet) by sharing electrons.
- Single covalent bond is when atoms are held together by sharing a pair of electrons
- **An electron dot structure such as H:H represents the shared pair of electrons of the covalent bond by two dots.**
- Structural formula represents covalent bonds by dashes and shows the arrangement of covalently bonded atoms.
- Unshared pair is a pair of valence electrons that is not shared between the atoms



- The oxygen atom has two unshared pair of electrons and two single covalent bonds.
- **Atoms form double or triple covalent bonds if they can attain a noble gas structure by sharing two pairs or three pairs of electrons.**
- Double covalent bond is a bond that involves two shared pairs of electrons
- Triple covalent bond is a bond that involves three shared pairs of electrons



Steps for Drawing Lewis Structures

1. Decide on a central atom. Generally the LEAST electronegative atom is central atom. Hydrogen can NEVER be central atom because it can only form one bond.
2. Add up the number of valance electrons for ALL elements in compound
3. Form a single bond between the central atom and each of the other atoms
4. Add lone pair to elements to complete the octet (remember Hydrogen only want 2 electrnos)

5. Check each element to make sure they have access to 8 electrons (H=2). Ask are they happy?
6. Add up the number of electrons in drawing [count dots + 2(# of lines)] and see if this number match the number of valance electrons in step 2
   - If you have too many form double or triple bonds as needed
   - If you have too few than you made a mistake in your drawing.

Diatomic Molecules

- There are 7 elements that do not exist in nature as a single atom; they always appear as pairs
- When atoms turn into ions, this NO LONGER HAPPENS! They can form bonds as single atoms.
  - Hydrogen H_2
  - Nitrogen N_2
  - Oxygen O_2
  - Fluorine F_2
  - Chlorine Cl_2
  - Bromine Br_2
  - Iodine I_2
- **Remember: BrINClHOF**
- **Or remember the 7 elements in the shape of a 7 on the periodic table**

8.4 Polar Bonds and Molecules

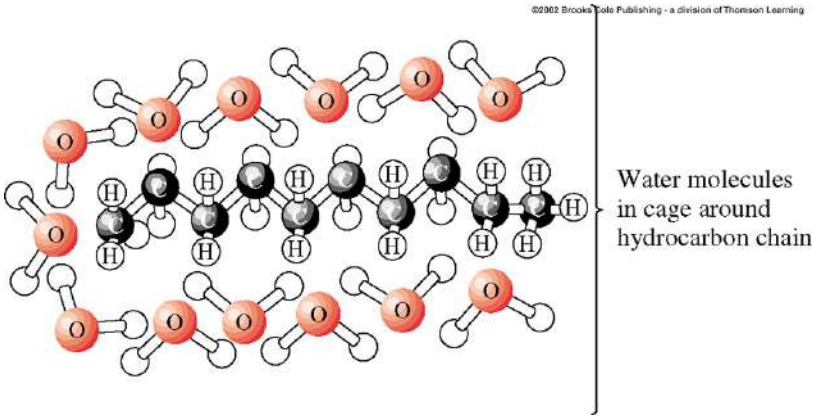
- Nonpolar covalent bond (polar bond) is when the bonding electrons are shared equally.
- ALL diatomic halogen molecules are nonpolar
- Polar covalent bond (polar bond) is when the bonding electrons are NOT shared equally
- **The more electronegative atom attracts electrons more strongly and gains a slightly negative charge. The less electronegative atom has a slightly positive charge.**
- **When polar molecules are placed between oppositely charges plates they tend to become oriented with respected to the positive and negative plates.**
- To determine if a bond is polar or nonpolar look at the difference in electronegativity values
  1. Nonpolar covalent is electronegativity difference range of 0.0 to 0.3
  2. Slightly (moderately) polar covalent is electronegativity difference range of 0.4 to 1.0
  3. Very polar covalent is electronegativity difference range of 1.0 to 1.6
  4. Ionic bonds is electronegativity difference range above 1.7 to 4.0

Table of Electronegativity Values

	IA												IIIA	IVA	VA	VIA	VIIA	VIIIA
1	1 H 2.1	IIA																2 He
2	3 Li 1.0	4 Be 1.5											5 B 2.0	6 C 2.5	7 N 3.0	8 O 3.5	9 F 4.0	10 Ne
3	11 Na 0.9	12 Mg 1.2	IIIB	IVB	VB	VIB	VIIB	VIII			IB	IIB	13 Al 1.5	14 Si 1.8	15 P 2.1	16 S 2.5	17 Cl 3.0	18 Ar
4	19 K 0.8	20 Ca 1.0	21 Sc 1.3	22 Ti 1.5	23 V 1.6	24 Cr 1.6	25 Mn 1.5	26 Fe 1.8	27 Co 1.8	28 Ni 1.8	29 Cu 1.9	30 Zn 1.6	31 Ga 1.6	32 Ge 1.8	33 As 2.0	34 Se 2.4	35 Br 2.8	36 Kr
5	37 Rb 0.8	38 Sr 1.0	39 Y 1.2	40 Zr 1.4	41 Nb 1.6	42 Mo 1.8	43 Tc 1.9	44 Ru 2.2	45 Rh 2.2	46 Pd 2.2	47 Ag 1.9	48 Cd 1.8	49 In 1.8	50 Sn 1.8	51 Sb 1.9	52 Te 2.1	53 I 2.5	54 Xe
6	55 Cs 0.7	56 Ba 0.9	57 La	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl 1.8	82 Pb 1.9	83 Bi 1.9	84 Po 2.0	85 At 2.2	86 Rn
7	87 Fr 0.7	88 Ra 0.9	89 Ac	104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt	110	111	112		114		116		

Lanthanides	58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb	71 Lu
Actinides	90 Th	91 Pa	92 U	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lr

- Differences in polarity can prevent different molecules from mixing
  1. Water is a polar molecule
  2. Oils are nonpolar molecules
  3. Oil and water don't mix because they are so different in polarity



4.
5. **Remember: "Like Dissolves Like."** Polar dissolves Polar and Nonpolar dissolves Nonpolar

Compare and contrast Ionic and Covalent bonds

Characteristic	Ionic Bonds	Covalent Bonds
Reason for forming	Because atoms want to have full outer energy levels	
How they form	Transferring electrons	Sharing electrons
Strength of bond	Very strong bond	Weak bond
Melting/Boiling Points	Very HIGH	LOW
Phase at room temperature	Most are solids	Most are liquids or gases