CHE 101 - Study Guide Ch 11

Terms: Covalent, ionic, dipole, polar covalent, nonpolar covalent, electronegativity, ionization energy, lewis structure, linear structure, tetrahedral structure, trigonal planar structure, trigonal pyramidal, bent (109.5 and 120), octet rule, lone pair electrons.

Concepts:

1. Periodic trends in atomic radius of atoms, cations, and anions.
2. Ionization energy and periodic trends in ionization energy.
3. Electronegativity, and periodic trends in electronegativity.
4. Difference between Ionic and Molecular compounds.
5. Understand formation of ionic compounds in terms of Lewis structures/electron configurations/octet rule
6. Understand formation of molecular compounds in terms of Lewis structures/electron configurations/octet rule.
7. Ionic, covalent and polar covalent bonding, and how to predict which will occur.
8. Calculate the number of valence electrons for common elements.
9. Draw Lewis structures of atoms and small molecules.
10. VSEPR Model.
11. Assign molecular shapes to simple molecules.
12. Molecular Polarity
13. Determine if a molecule is dipolar or nonpolar based on molecular structure.

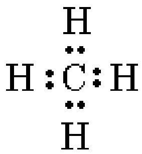
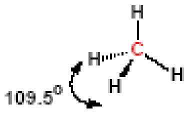
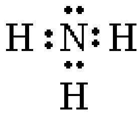
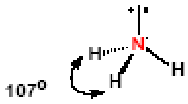
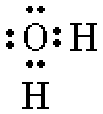
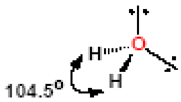
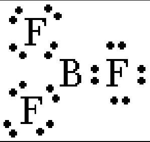
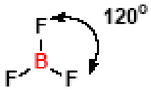
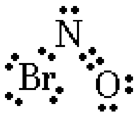
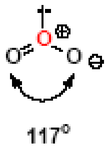
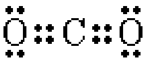
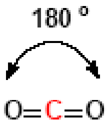
Lewis structures:

1) Write the skeletal structure
    a. The least electronegative element usually occupies the central position.
    b. H always occupies a terminal end. F, Cl, Br, I normally occupy a terminal end.
2) Add up all valence electrons
    a. calculate the number of valence electrons of each element
    b. anions = add the charge
    c. cations = subtract the charge
3) Draw the molecule
    a. Draw one covalent bond between all atoms (H can only form 1 bond)
    b. Complete octets of atoms around the central atom.
    c. Show non-bonded electrons as lone pairs.
    d. Use all of the electrons from step 2 above. Remember a bond = 2 electrons.
4) Evaluate the structure
    a. Calculate the number of electrons round each atom. Hydrogen should have 2, the remaining elements prefer 8 electrons around them.
    b. If the central atom has fewer then 8 electrons around it add double or triple bonds to surrounding atoms using lone pair electrons.
    c. Repeat step 4 until all atoms have 8 electrons around them.
5) Evaluate formal charge

a. Determine the formal charge for each atom. If at all possible they should equal the number of valence electrons for that atom.
b. Assign a negative or positive charge to the atom whose formal charge is negative or positive.

Determining the shape of Covalent molecules:

1) The geometry is determined by the position of electrons **and** atoms. The name given to the shape is **only** determined by the position of the atoms.
2) Polarity
   a. Dipolar Molecules:
      i. Must have polar bonds (ie a difference in EN > 0.6)
      ii. Bond vectors do not cancel
   b. Non-Polar Molecules
      i. All bonds must be non-polar
      ii. Polar bond vectors cancel (linear, trigonal planar, or tetrahedral)

Lewis Structure	Molecular Shape	Example	Bond Angle	Molecular Polarity
	Tetrahedral		109.5°	Non-polar: if outer atoms same Dipolar: if outer atoms different
	Trigonal Pyramidal		109.5°	Dipolar
	Bent		109.5°	Dipolar
	Trigonal Planar		120°	Non-polar: if outer atoms same Dipolar: if outer atoms different
	Bent		120°	Dipolar
	Linear		180°	Non-polar: if outer atoms same Dipolar: if outer atoms different