Ionic and Covalent Bonding

1. Define the following terms:

   a) valence electrons

   - the electrons in the highest occupied energy level
   - always electrons in the "s" and "p" orbitals
   - maximum of 8 valence electrons
   - valence electrons are the electrons involved in forming chemical bonds

   b) electron dot symbols

   - the inner electrons and the nucleus are represented by the symbol of the element
   - the valence electrons are shown as dots

   c) octet rule

   - atoms react by sharing or transferring electrons in order to obtain a stable noble gas configuration. Noble gases (except He) have 8 valence electrons.

   d) cations

   - positively charged ions

   e) anions

   - negatively charged ions

   f) ionic bond

   - A bond formed from the transfer of electrons
   - A transfer of electrons produces positive and negative ions, an ionic bond forms as a result of the attraction between oppositely charged ions
   - Generally occurs between a metal and a nonmetal (or a polyatomic ion)

g) covalent bond

- A bond formed as the result of sharing electrons
- Generally occurs between two nonmetals

h) single covalent bond

- A single covalent bond forms when two atoms share one electron each

i) double covalent bond

- A double covalent bond forms when two atoms share two electrons each

j) triple covalent bond

- A triple covalent bond forms when two atoms share three electrons each

k) polar covalent bond

- A polar covalent bond results when the electrons are shared unequally between the two atoms, causing one to become slightly positive (δ+) and the other to become slightly negative (δ-)
- This occurs when there is a difference in electronegativity of 0.5 up to 1.7 between the two atoms involved in the bond

l) nonpolar covalent bond

- A nonpolar covalent bond results when electrons are shared equally between the two atoms
- Electronegativity difference less that 0.5 between the two atoms involved in the bond

m) van der Waals forces

- The weakest attractions between molecules are van der Waals forces. They include Dispersion forces and dipole interactions

n) London Dispersion forces

- Dispersions forces are the result of the attraction of electrons in one molecule for the nuclei in adjacent molecules
- All molecules exhibit dispersion forces
- Dispersion forces increase as the number of electrons in a molecule increase

o) Dipole interactions

- Dipole interactions occur between polar molecules
- The slightly positive end of one polar molecule is attracted to the slightly negative end of an adjacent molecule.
- The more polar the molecule, the greater the dipole interaction

p) hydrogen bonds

- Hydrogen bonding only occurs in molecules where a hydrogen atom is bonded to a highly electronegative atoms such as oxygen, nitrogen, or fluorine
- Because hydrogen only has one electron, when that electron is involved in a polar bond, the results are more pronounced because there are no other electrons. This leaves the nucleus electron-deficient

2. List the properties of ionic compounds.

- crystalline solids at room temperature
- the ions are arranged in a repetitive three dimensional pattern called a lattice structure
- conduct electricity when molten or aqueous, but do not conduct electricity when solid
- many are soluble in water
- high melting and boiling points
- hard but brittle
- if enough force is applied, the crystal will break apart along smooth, flat surfaces

3. List the properties of covalent compounds.

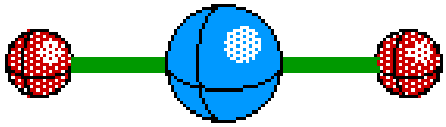
- Covalent compounds exist as gases, liquids, and solids at room temperature.
- Solid covalent compounds are usually soft.
- Compared with ionic compounds, covalent compounds usually evaporate readily and have low melting points and boiling points.
- any covalent compounds are not soluble in polar substances such as water, but they are soluble in nonpolar substances such as gasoline.
- They do not conduct electricity in either the liquid or the solid state.

4. What is VSEPR?

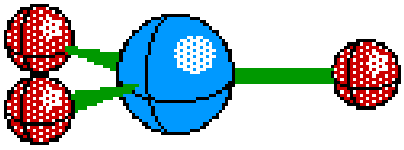
VSEPR stands for Valence Shell Electron Pair Relusion

VSEPR Theory is based on the fact that like charges repel. VSEPR Theory predicts the shapes of molecules. Electron pairs (bonding and nonbonding) arrange themselves to be as far apart as possible in order to minimize repulsions between like charges.

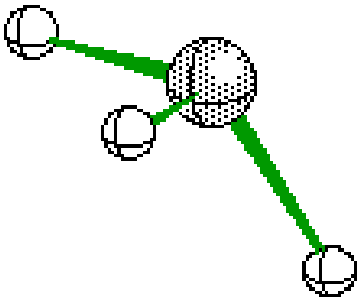
5. Give an example of compounds with the following shapes. Include a sketch of the shape.
   a) linear



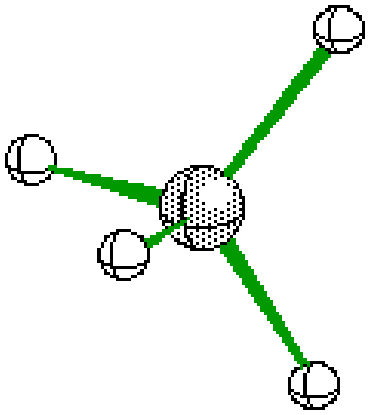
   b) trigonal planar



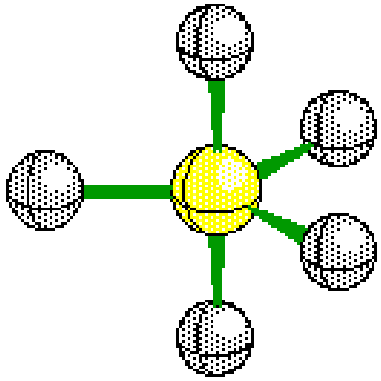
   c) trigonal pyramidal



d) tetrahedral



f) trigonal bipyramidal



e) bent or angular