Polar Covalent Molecules

Electronegativity - a measure of the relative attraction that an atom has for electrons
- nonmetals have a greater attraction for valence electrons than metals and therefore a higher EN value
- values for each element are in the periodic table.
- values range from 0.7 for francium to 4.0 for fluorine.

Write the electronegativity values for:

Li _____ C _____ N _____ Mg _____ O_____ Cl_____

Nonpolar Covalent Bond

- a bond between 2 atoms which have the **same** electronegativity
- the atoms **equally share** the bonding electron pair

Eg. H - H - each H atom has an electronegativity value of 2.1
- the covalent bond between them is nonpolar

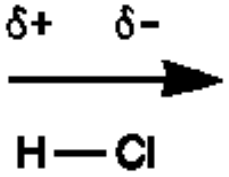
Circle the pairs of atoms below that would form a nonpolar covalent bond?

C & H N & Cl H & O P & H F & S

Polar Covalent Bond

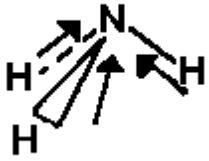
- a bond between 2 nonmetal atoms that have different electronegativities
- there is **unequal sharing** of the bonding electron pair
- the bonding electrons are pulled closer to the more electronegative atom

Eg. H - Cl - the bonding pair is pulled toward the Cl
- the Cl has a partial negative charge
- the H has a partial positive charge.



- the separation of charge or ***bond dipole*** is shown using an arrow pointing toward the more electronegative atom.
- the Greek letter delta (δ) indicates 'partial' charges

- the diagram below shows the bond dipoles and the shape of NH_3



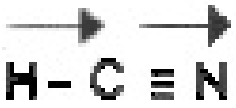
Draw shape diagrams and bond dipoles for each of the following:

CH_4 H_2O CO_2

CH_2O PH_3

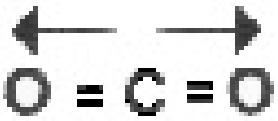
Polar Molecule

- a molecule in which the bond dipoles present ***do not cancel*** each other



NonPolar Molecule

- a molecule in which the bond dipoles present ***cancel*** each other
- a molecule which has only nonpolar bonds



THINK:

Water and carbon tetrachloride are immiscible because one of the compounds is polar and the other is nonpolar.

Which compound, H_2O or CCl_4, is polar?

Complete the following table:

Formula	Lewis Diagram (Electron Dot)	# of bonds	# of lone pairs	Shape Diagram (with bond dipoles)	Polar or Nonpolar
SiH_4					
C_2Cl_4					
Cl_2O					
PH_3					

Formula	Lewis Diagram (Electron Dot)	# of bonds	# of lone pairs	Shape Diagram (with bond dipoles)	Polar or Nonpolar
CH_2Cl_2					
NF_3					
CSO					
C_2FBr_3					

3. Network Covalent Bonding

- occurs in $\mathbf{C_n}$ (diamond), $\mathbf{SiO_2}$ (quartz) and **SiC** (carborundum).
- the strongest type of bonds
- these substances will be the hardest and have very high melting and boiling points
- the strength and hardness comes from the fact that each atom is connected to others in a three dimensional array of atoms

4. Metallic Bonding

- occurs in metals
- the valence electrons are **mobile** because they are very loosely held by the metal atom
- the nucleus of one metal atom attracts the **mobile** valence electrons of adjacent atoms
- the metal is held together by the simultaneous attraction of the metal nuclei for the **sea** of mobile valence electrons

Properties of metals:

1. metals ***conduct electricity*** because they have electrons which are free to move (electric current is the flow of electrons).
2. metals are malleable and ductile because the ions/electrons are not held in fixed positions and can slip by each other.
3. metals are solids because the forces of attraction between opposite charges is relatively strong.