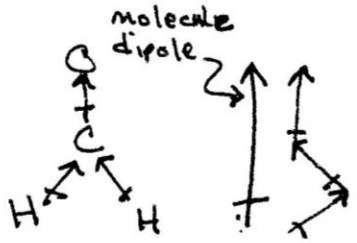
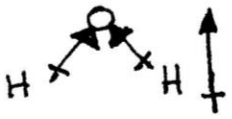
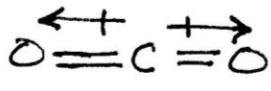
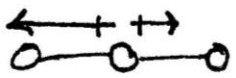
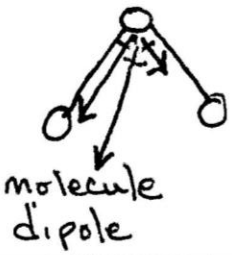
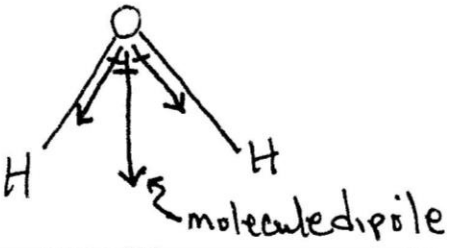
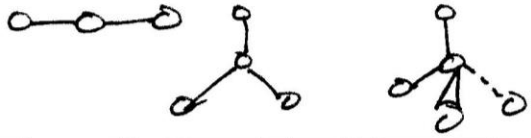
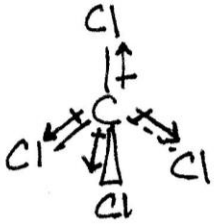
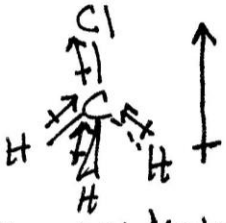
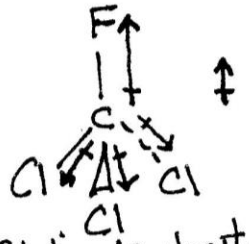
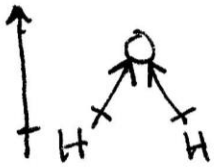
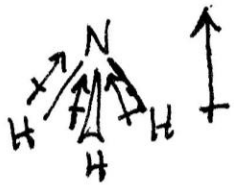
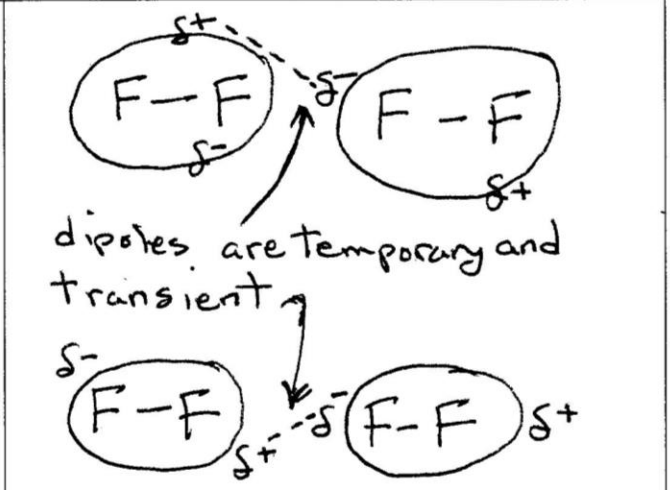
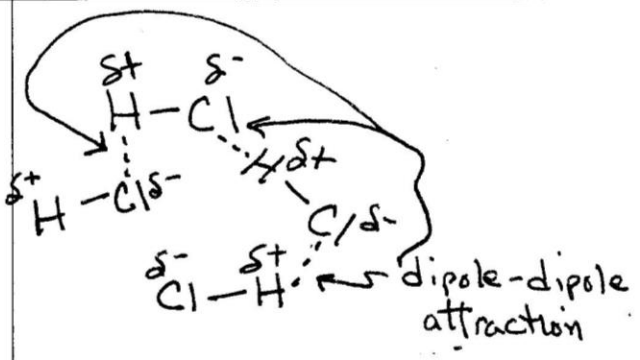
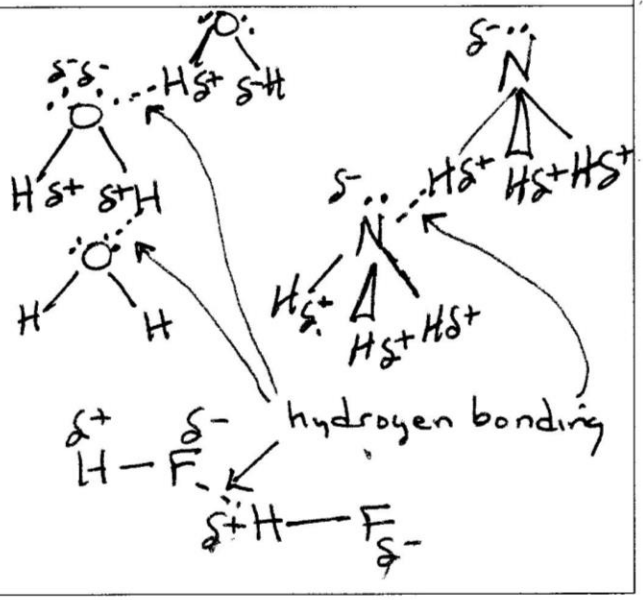
Chemistry: Intermolecular Forces Graphic Organizer ***Teacher's Notes***

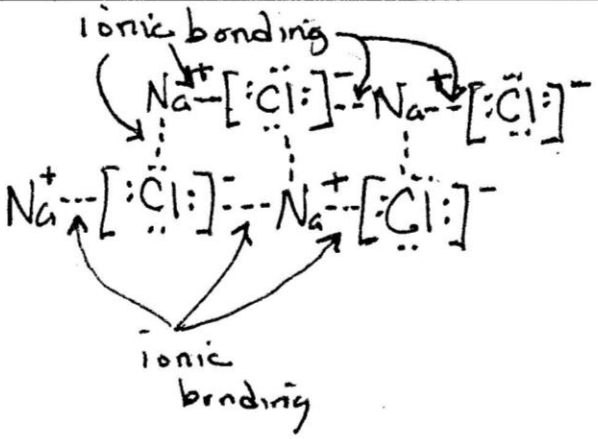
How to Determine Molecular Polarity & Molecular Dipole	
Strength	Examples
The molecular dipole is an "average" or combination of the individual bond dipoles. Tail-to-Tip Method Molecule dipole starts at the tail of the first bond dipole and ends at the tip of the last bond dipole	 stack bond dipoles tail-to-tip in any order.
If the bond dipoles have at least part of their direction in common, then the molecular dipole will be stronger than the individual bond dipoles.	 both O-H bond dipoles are pointing upward, so molecule dipole is larger than individual bond dipole.
If the bond dipoles are in opposite directions, then they will either partially or completely cancel out each other.	 Cancel each other out.  smaller dipole only cancels part of the larger dipole.
Direction	Examples
The molecular dipole will point in the same general direction as, or "lean" toward, the stronger bond dipole.	
If the bond dipoles are the same strength, then the direction of the molecular dipole will be an average of the bond dipoles. Exactly halfway between the 2 bond dipoles	

Symmetry	Examples
Symmetrical Molecular Shapes 	Linear Trigonal planar Tetrahedral
Asymmetrical Molecular Shapes 	Bent Trigonal pyramidal
Symmetrical molecules will be non-polar if all the bond dipoles are the same strength and are either all pointing toward or all pointing away from the central atom. This is the case if the exterior atoms are the same.	 all pointing toward central atom.  all pointing away from central atom
Symmetrical molecules with bond dipoles that have different strengths and/or different directions will have molecular polarity. This is the case if the exterior atoms are not all the same.	 H and Cl dipoles all point "up"  Cl dipole don't completely cancel F dipole
Asymmetrical molecules will have molecular polarity even if the bond dipoles are the same strength and pointing in the same direction.	 

Intermolecular Forces – What Attracts the Molecules to Each Other?	
Electrostatic forces. The positively charged end of one molecule aligns with the negatively charged end of another molecule.	
London Dispersion Forces Temporary dipoles are created in the electron cloud of the molecule because of electron movement. These attractions are constantly broken and reformed. All compounds, including non-polar compounds have this IMF.	
Dipole-Dipole Attraction The attraction between the permanent positive and negative poles that are created by the partial positive and partial negative charges. All polar molecules have this IMF.	
Hydrogen Bonding A special type of dipole-dipole attraction between the hydrogen atom from one molecule and the lone pair(s) of electrons of an oxygen, nitrogen or fluorine atom from another molecule. Molecules must have H plus either N, O or F to have this IMF.	

Ionic Bonding

The attraction created between the full positive charge of the cation and the full negative charge of the anion. Must be an ionic compound to have this IMF.



Some compounds have more than one type of IMF.

- Non-Polar: London Dispersion (LD) forces.
- Polar Molecules: LD and dipole-dipole (DD) attraction
- Polar Molecules with H and either N, O or F: LD, DD and hydrogen bonding.
- Ionic Compounds: Ionic bonding