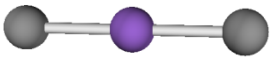
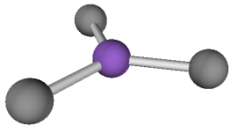
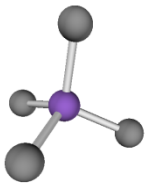
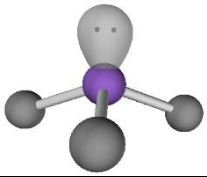
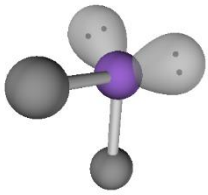
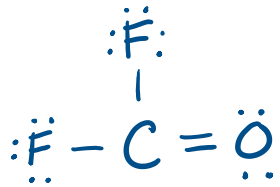
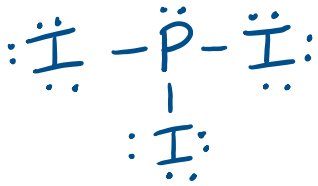
Molecular Shapes

Valence **S**hell **E**lectron **P**air **R**epulsion **T**heory (**VSPER**)

Picture	Molecule Geometry Name (Molecule Shape)	# of Bonding Regions	# of Lone Pairs	Total e^- regions around center atom (add # of Bonding Regions + # of Lone Pairs)
	LINEAR	2	0	2
	TRIGONAL PLANAR	3	0	3
	TETRAHEDRAL	4	0	4
	TRIGONAL PYRAMIDAL	3	1	4
	BENT	2	2	4

Practice Determining Molecule Shape – use the given Lewis structure to predict the molecule shape.

Lewis Structure	# of Bonding Regions	# of Lone Pairs (around center atom)	Total # of e^- Regions	Molecule Shape Name
				
				

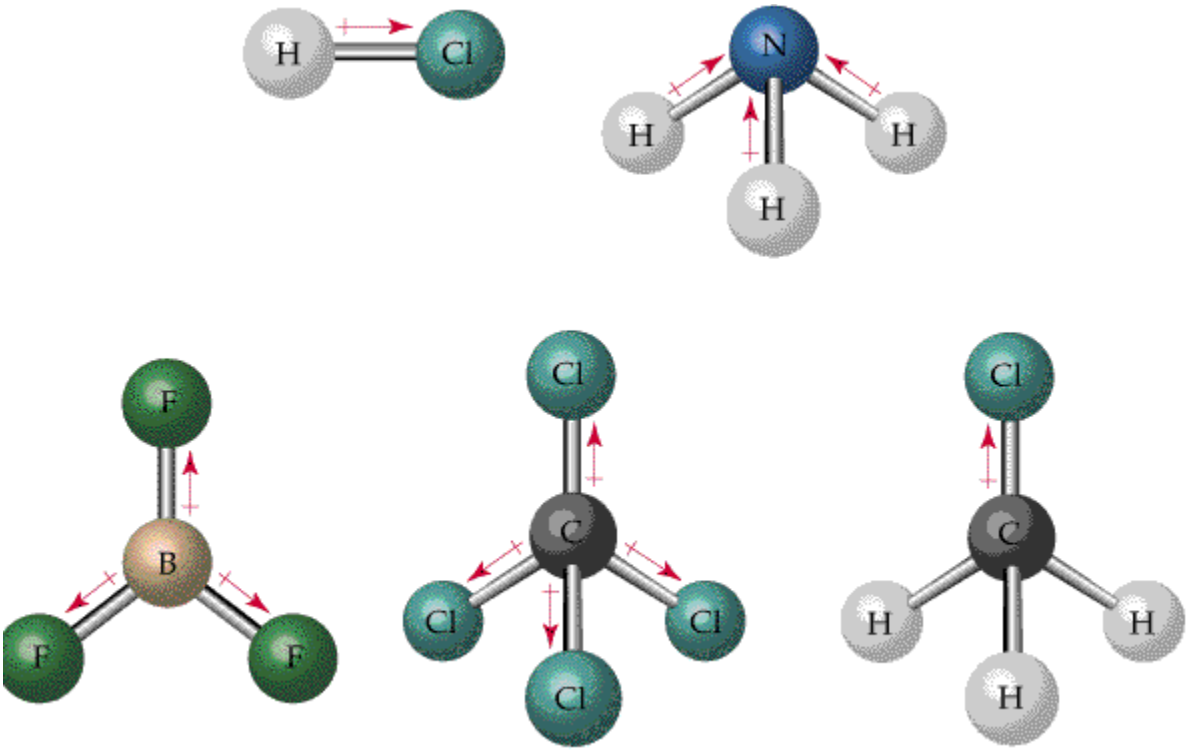
Molecular Polarity

Nonpolar Molecule: equal distribution of electrical charge throughout the molecule. The charge distribution is symmetric around the central atom.

Polar Molecule: unequal distribution of electrical charge throughout the molecule. The charge distribution is asymmetric around the central atom.

Practice Determining Molecular Polarity – Determine if each molecule is polar or nonpolar.

*The arrow points toward the more electronegative atom in a chemical bond.



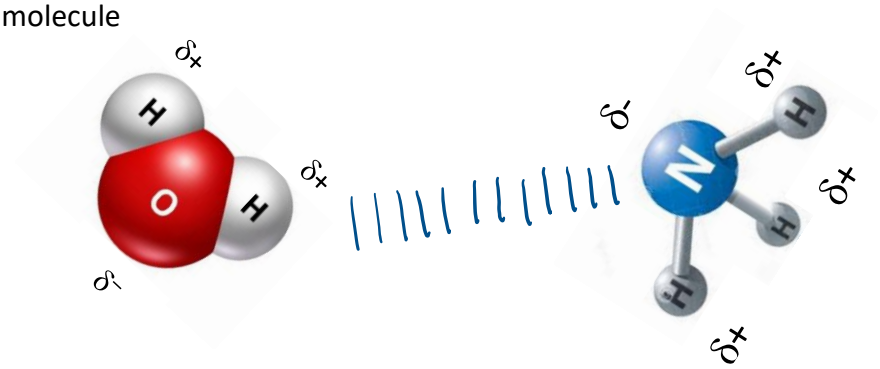
Intermolecular Forces

Intermolecular Forces (IMF's): attractions **between** molecules (NOT the covalent bonds in the molecule!)

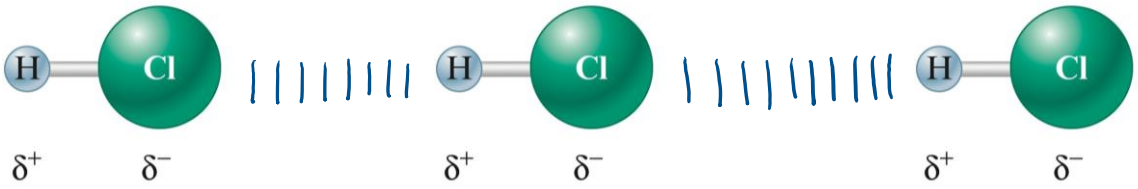
Stronger the attraction between molecules = _____ to separate molecules from one another = _____ energy to separate molecules = _____ melting and boiling point

<u>3 Types of IMF's</u> (represented as ||||||| in the images below)

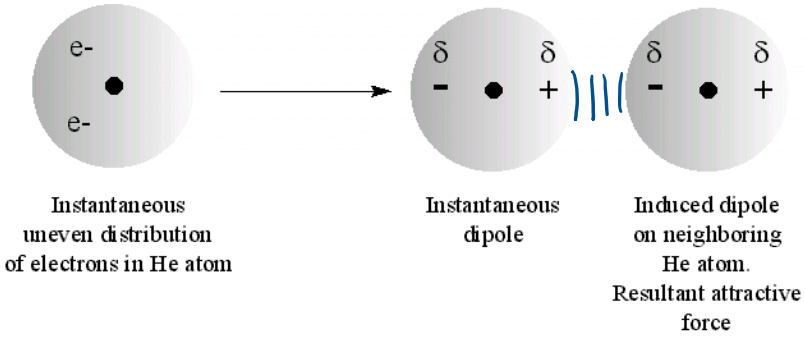
1. <u>Hydrogen bonding</u>: strongest IMF; attraction between H in one molecule and N,O, or F in a different molecule



2. <u>Dipole-dipole</u>: attraction between polar molecules; negative dipole of one molecule is attracted to the positive dipole of another molecule



3. <u>London Dispersion Forces (LDF's)</u>: caused by movement of electrons; for a moment in time one side of the molecule has more electrons than the other causing a temporary dipole to form; since these dipoles are temporary, London forces are the weakest type of IMF; since all molecules have electrons, **London forces are present between ALL types of molecules**



Practice Putting It All Together

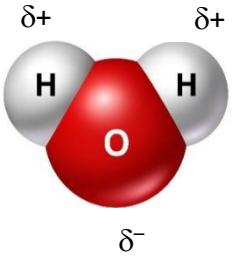
Formula	Lewis Structure	Draw and Name Molecule Shape (geometry)	Bond Polarity	Molecular Polarity	IMF
CF_4			F: C:		
NF_3			F: N:		
BCl_3			Cl: B:		
CH_3F			F: C: C: H:		

Solubility – in order for a solute to dissolve in a solvent, the solute must be attracted to the solvent (in other words, solute and solvent must have similar types of intermolecular forces)

*Polar solvents dissolve polar and ionic solutes.

*Nonpolar solvents dissolve nonpolar solutes.

1. Determine the polarity of water.



2. Which of molecules from the table above will dissolve in water?