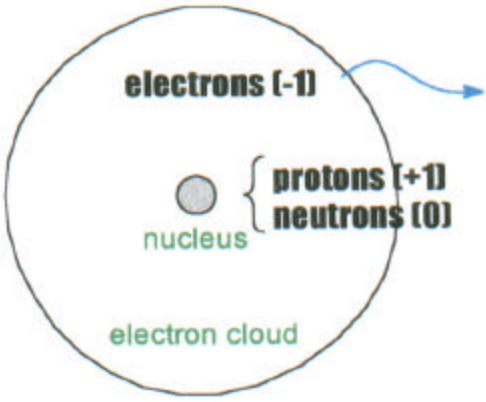
STRUCTURE OF MATTER

FUNDAMENTAL PARTICLES



In s, p, d or f orbitals, 2 e-'s per orbital.
Orbitals arranged in shells:
1st Shell: s = 2e-
2nd Shell: s, p_x, p_y, p_z = 8e-
3rd Shell: s, p_x, p_y, p_z,
d_{z2}, d_{x2-y2}, d_{xy}, d_{xz}, d_{yz} = 18e-

ATOMS

lose or gain VALENCE electrons

share VALENCE electrons
Covalent Bonds

GOAL: Get more stable electron configuration. Fill valence e-shell.

Cations Anions

IONS

lose or gain VALENCE electrons

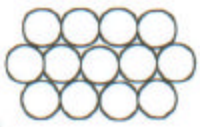
MOLECULES, METALS

Ionic Bonds ← Electrostatic in nature → **Intermolecular Interactions**

ion-dipole, dipole-dipole, dispersion forces

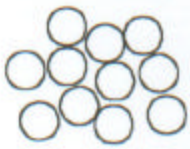
MACROSCOPIC MATERIALS

SOLIDS



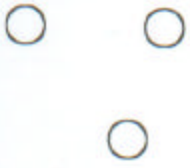
Strong Intermolecular Interactions

LIQUIDS



Weak Intermolecular Interactions

GASSES



No Intermolecular Interactions

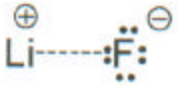
CHEMICAL BONDING

IONIC BONDS

electrostatic interactions between cations and anions

LiF

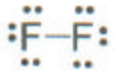
completey ionic



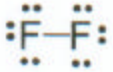
COVALENT BONDS

shared electron pair between 2 atoms

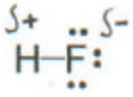
F_2



non-polar covalent



polar covalent

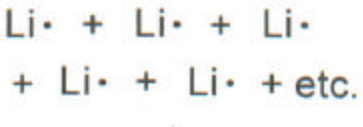


F is more electronegative than H

METALLIC COVALENT BONDS

electrons shared over many atoms

Li(s)



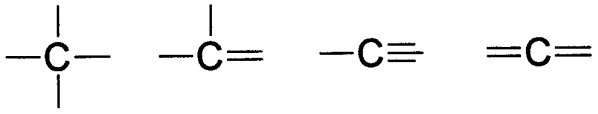
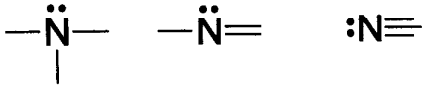
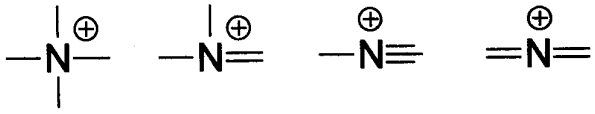
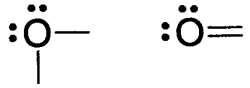
Important difference between ionic and covalent bonds: Ionic bonds are broken when solid dissolves, covalent bonds are not.

STRUCTURE OF MOLECULES AND POLYATOMIC IONS INVOLVING MAIN GROUP ELEMENTS

Octet Rule: Predicts Bonding
VSEPR: Predicts Shape

Octet Rule: Main group elements form bonds so as to give each atom an octet (4 pairs) of valence electrons.

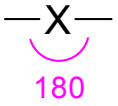
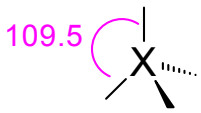
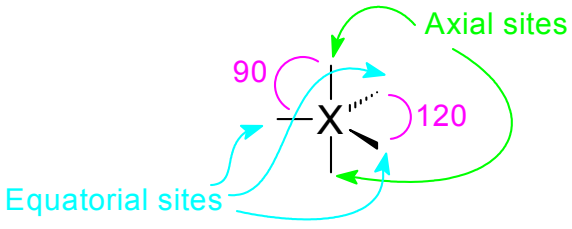
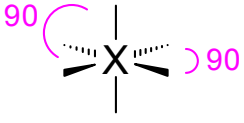
Exception: H is on the first row of the periodic table so it only needs 2 electrons. This means H can only form one covalent bond, so it will always be on the periphery.

	# bonds + #lone pairs = 4		Possible Bonding
	4	0	
	3	1	
	4	0	
	2	2	
	1	3	
	1	3	

VSEPR: Valence Shell Electron Pair Repulsion

VSEPR: In order to minimize the repulsion between like charges, groups of electrons orientate to get as far apart as possible.

"Group of electrons" means electrons in bonds or lone pairs. In VSEPR all bonds (single, double or triple) just count as ONE electron group.

# e- groups	VSEPR geometry (bond angle)	
2		Linear
3		Trigonal Planar
4		Tetrahedral
5		Trigonal Bipyramidal Only geometry with non-equivalent sites. Lone pairs prefer equatorial sites.
6		Octahedral

GUIDELINES FOR WRITING LEWIS STRUCTURES FOR MAIN GROUP INORGANICS

1. Place the atoms relative to each other. If not given any other info, assume symmetry. H has to be on periphery; O usually is.

2. Determine the total number of valence e- available. (Don't forget to consider any charge.)

3. Draw a single bond from each surrounding atom to the central atom. Subtract 2 e- per bond to give number of valence electrons remaining.

4. Distribute remaining e- in pairs so that each atom has an octet (except for H). Start with terminal atoms (on periphery). If still have valence e-'s left after satisfying the octet rule, put them on the central atom. This gives the central atom an expanded octet. This is OK if the central atom is on the 3rd row or greater of the periodic table.

5. If the central atom doesn't have an octet move a lone pair from a terminal atom to form a pi bond. Repeat until octet rule is satisfied.