

ORGO 1: PRE-COURSE REVIEW

THE ELECTRON CONFIGURATION

- **Ground State Electron Configuration:** Distributions of electrons ($1s$, $2s$, $2p$..) within orbitals using the *Auf Bau Principle*.
 - **Auf Bau Principle:** Starting from $1s$, electrons fill _____ energy orbitals before moving to _____ energy orbitals.
- **Condensed Electron Configuration:** we start at the last **noble gas** before the desired element.

	1A (1)																	8A (18)
1	1s $1s^1$	2A (2)																
2	2s $1s^2 2s^1$																	
3			3B	4B	5B	6B	7B	8B	1B	2B	3A (13)	4A (14)	5A (15)	6A (16)	7A (17)			
4																		
5																		
6																		
7																		

Legend:
____ - block (light blue)
____ - block (light orange)
____ - block (light purple)
____ - block (light red)

Red arrows indicate the filling order: from $1s$ to $2s$, and then from $2s$ to $2p$.

EXAMPLE: Write the ground state and condensed electron configurations for the following element: Phosphorus ($Z = 15$)

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ELECTRONEGATIVITY

● **Electronegativity (EN):** Measurement of an element's ability to attract electrons to itself.

□ **Periodic Trend:** Electronegativity _____ moving from left to right across a period and going up a group.

Electronegativity																	
1A (1)	2A (2)							3A (3)	4A (4)	5A (5)	6A (6)	7A (7)	8A (8)				
1 H 2.1	Li 1.0	Be 1.5															
2 Na 0.9	Mg 1.2																
3 K 0.8																	
4																	
5																	
6																	
7																	

EXAMPLE: Which of the following represents the most electronegative Group 7A element?

a) Br

b) S

c) I

d) Cl

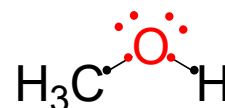
e) O

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OCTET RULE

- The tendency of most Main Group Elements in achieving _____ octet electrons by way of chemical bonding.
 - **Valence Electrons:** Electrons an element possesses based on _____.
 - **Shared Electrons:** Electrons an element _____ through a chemical bond.
 - _____ Electrons = _____ Electrons + _____ Electrons

EXAMPLE: Which of the following statements is true in terms of the following compound:



- a) Oxygen possesses 6 octet electrons: 6 valence and 2 shared electrons.
- b) Oxygen possesses 8 octet electrons: 6 valence and 2 shared electrons.
- c) Oxygen possesses 8 octet electrons: 8 valence and 0 shared electrons.
- d) Oxygen possesses 32 octet electrons: 6 valence and 2 shared electrons.

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FORMAL CHARGE

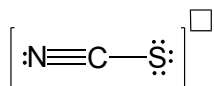
- Used to check to see if you drew your Lewis Dot Structure correctly.
 - The only allowable formal charges for an element can be either -1, 0, +1.
 - If you add up all the formula charges in your compound that will equal the overall charge of the compound.

Formal Charge Formula

$$\text{Formal Charge} = \text{_____ Electrons} - (\text{_____} + \text{_____ Electrons})$$

□ **Valence Electrons** = _____ of element □ **Nonbonding Electrons** = Counted _____

EXAMPLE: Determine the formal charges of each element with the thiocyanate ion. of the nitrogen atom found within the ammonia molecule, NH_3 .



$$\text{N (Group 5A)} = \text{_____} - (\text{_____} + \text{_____}) = \text{_____}$$

$$\text{C (Group 4A)} = \text{_____} - (\text{_____} + \text{_____}) = \text{_____}$$

$$\text{S (Group 6A)} = \text{_____} - (\text{_____} + \text{_____}) = \text{_____}$$

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DRAWING LEWIS DOT STRUCTURES

- Many possible Lewis Dot Structures exist, but there are rules to draw the best structure.

EXAMPLE: Draw the Lewis Dot Structure for the following molecule: COCl_2 .

STEP 1: Determine the total number of valence electrons of the structure.

- ☐ Recall, Valence Electrons = _____ of the element.

STEP 2: Place the _____ electronegative element in the center and connect all elements with single bonds.

- ☐ **Exception:** _____ never goes in the center.
- ☐ **Halogens:** Only make _____ bonds as a surrounding element.

STEP 3: Add electrons to all the _____ elements until they have 8 electrons (Octet Rule).

- ☐ **Exception:** Hydrogen only wants _____ electrons around it.

STEP 4: Place any remaining electrons on the central atom.

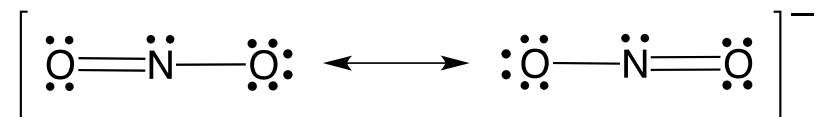
STEP 5: If any elements don't have 8 octet electrons, add _____ and _____ bonds between them.

STEP 6: The Formal Charge can be used to determine if a Lewis Dot Structure is drawn correctly.

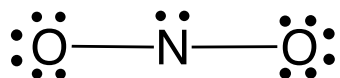
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RESONANCE STRUCTURES

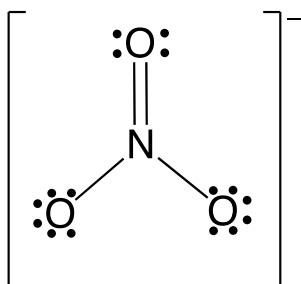
- A set of two or more valid Lewis Dot Structures for polyatomic species possessing at least _____ pi bond(s).
 - In a *Resonance Structure* we have the movement of only _____ from either a pi bond or lone pair.



- **Double Sided Arrows:** used to show that resonance structures are _____ with each other.
- The real structure is represented by the _____ of the resonance structures called the *resonance hybrid*.
- **Resonance Hybrid:** A composite of all major resonance structures.
 - To draw the resonance hybrid we place a _____ anywhere a pi bond has been.



EXAMPLE: Determine the remaining resonance structures possible for the nitrate ion, NO_3^- .






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HYBRIDIZATION

- The hybridization of a central element can be connected to its number of electron groups.

□ **Electron Groups** = _____ pairs + _____ groups (surrounding elements).

Hybridization					
Electron Groups	Electron Geometry	Hybridization	Add It Up	Hybridized Orbitals	Unhybridized Orbitals
2	Linear		___ + ___ = ___		
3	Trigonal Planar		___ + ___ = ___		
4	Tetrahedral		___ + ___ = ___		

EXAMPLE: Draw and determine the hybridization and number of unhybridized orbitals for the following covalent compound.

HCN



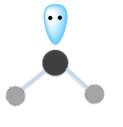
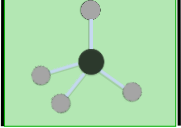
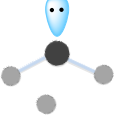

Hybridization:

Unhybridized Orbitals:

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MOLECULAR POLARITY

- **Molecular Polarity:** Polarity that arises for a(n) _____ molecule.
 - **Nonpolar Molecule:** Any hydrocarbon and any non-hydrocarbon with a *perfect shape*.
 - **Perfect Shape I:** central element has _____ surrounding elements and has _____ lone pairs.
 - **Polar Molecule:** Any Lewis Dot Structure that doesn't have a perfect shape.

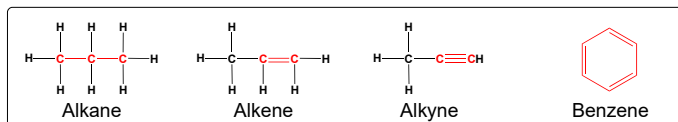
Molecular Polarity				
Electron Groups	0 Lone Pair	1 Lone Pair	2 Lone Pairs	3 Lone Pairs
2				
3				
4				

EXAMPLE: Determine if nitrogen trifluoride, NF_3 , is polar or nonpolar.

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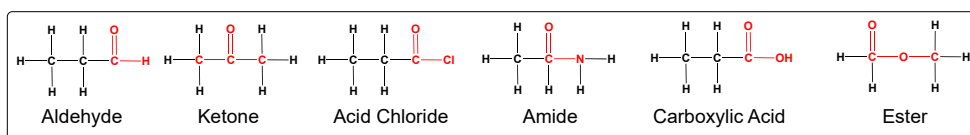
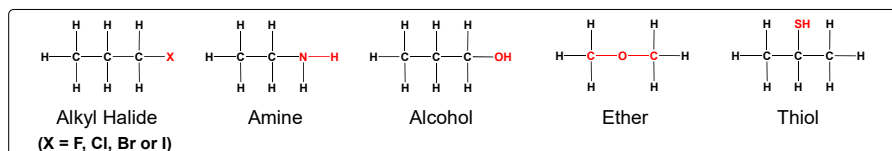
FUNCTIONAL GROUPS

- **Functional Group:** the part of a molecule that is recognizable and responsible for a compound's _____.



Hydrocarbons

w/o Carbonyls



w/ Carbonyls