AP Chemistry
Ms. Ye

Name _____
Date _____ Block ____

Naming Compounds Overview

- Covalent Compounds
- Ionic Compounds
- Acids
- Organic Compounds

- You need to be comfortable writing the chemical formula and determining the name of each type of substance. You should also be comfortable drawing structures for some of the simpler substances.

Covalent Compounds: 2+ nonmetals

1. The less electronegative element is usually listed first.
2. A **prefix** is used to denote the number of atoms of each element in the compound
   Exception: *mono* is not used on the first element listed
3. The ending of the **first element is not changed**.
The ending of **the second element is changed to -IDE**.
4. The last vowel on the prefix is dropped if the element starts with an "a" or an "o" (i.e. mono + oxide = monoxide)

Prefix	Meaning
Mono-	*1*
Di-	*2*
Tri-	*3*
Tetra-	*4*
Penta-	*5*
Hexa-	*6*
Hepta-	*7*
Octa-	*8*
Nona-	*9*
Deca-	*10*

Covalent Nomenclature Practice:

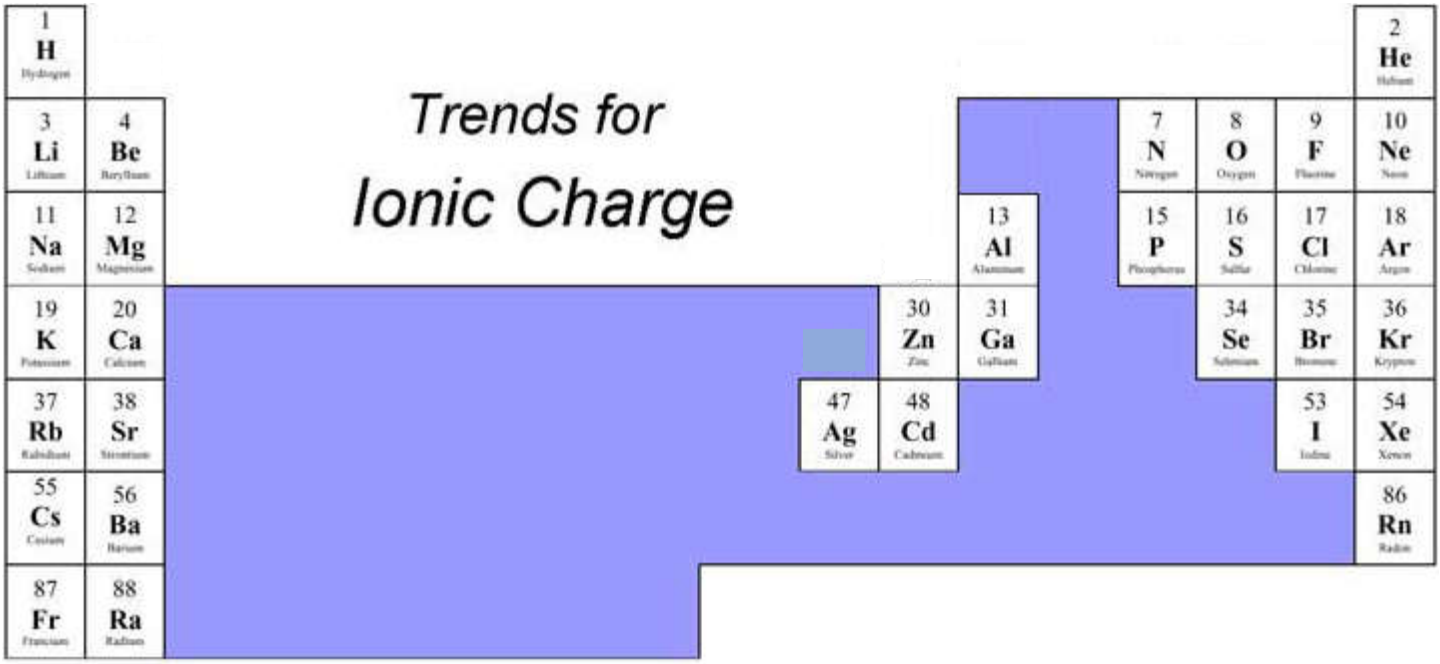
Write the correct name or formula for each of the following.

1. N_2O_3 _____
2. SF_6 _____
3. PCl_3 _____
4. CO _____
5. P_4O_{10} _____
6. SO_2 _____
7. CS_2 _____
8. SiO_2 _____
9. BF_3 _____

10. Chlorine monoxide _____
11. Boron monophosphide _____
12. Dinitrogen monoxide _____
13. Nitrogen trifluoride _____
14. Sulfur tetrachloride _____
15. Carbon dioxide _____
16. Phosphorous trichloride _____
17. Bromine pentafluoride _____
18. Disulfur dichloride _____
19. Boron trifluoride _____
20. Silicon tetrachloride _____

<u>**Ionic Compounds:**</u> Metal + Nonmetal

1. Charges Of Ions: Figure out based on how many electrons need to be gained/lost to obtain a noble gas electron configuration



2. In a chemical formula, **the charges of the cations and anions MUST add up to 0!**

3. Simple Binary Compounds: **(Name of Metal) + (Name of Nonmetal with –IDE ending)**

4. **Transition Metal Cations (and Sn, Pb, Bi):** Must include the charge of the cation using (Roman Numerals)

Exceptions: Zn is always +2, Ag is always +1

5. **Polyatomic Ions:** Made up of 2 or more different types of atoms. Use parentheses to indicate more than 1 of the polyatomic ion. **Must memorize!**

Polyatomic Ions: contain 2 or more different atoms (polyatomic means "many atoms") that collectively carry a charge.

Here are some common examples: **YOU NEED TO MEMORIZE THE BOLDED ONES!**

a. **Ammonium:** NH_4^{1+} (the only positive polyatomic ion you need to know)

b. **"HYPO_____-iTE" ions**: remove one oxygen from the "ITE" ion and keep the same charge

Hypochlorite = ClO^{1-}
Hypobromite = BrO^{1-}
Hypoiodite = IO^{1-}

c. **"ATE" ions:** contain an atom bonded to several oxygen atoms:

Nitrate = NO_3^{1-}
Sulfate = SO_4^{2-}
Carbonate = CO_3^{2-}
Acetate = $CH_3CO_2^{1-}$ (or CH_3COO^{1-})
Phosphate = PO_4^{3-}
Chlorate = ClO_3^{1-}
Bromate = BrO_3^{1}
Iodate = IO_3^{1-}

d. **"ITE" ions:** remove one oxygen from the "ATE" ion and keep the same charge

Nitrite = NO_2^{1-}
Sulfite = SO_3^{2-}
Phosphite = PO_3^{3-}
Chlorite = ClO_2^{1}
Bromite = BrO_2^{1-}
Iodite = IO_2^{1-}

e. **"PER _____ -ATE" ions:** add one more oxygen to the "ate" ions and keep the same charge

Perchlorate = ClO_4^{1-}
Perbromate = BrO_4^{1-}
Periodate = IO_4^{1-}

f. Other common complex ions:
Hydroxide = OH^{1-}
Bicarbonate: HCO_3^{1-}
Permanganate = MnO_4^{1-}
Chromate = CrO_4^{2-}
Dichromate **=** $Cr_2O_7^{2-}$

g. For polyatomic ions, use parentheses and then a subscript to indicate how many of that ion you need

$Mg(NO_3)_2$ = 1 Mg^{2+} ion, 2 NO_3^{1-} ions.

Ionic Nomenclature Practice:

Write the correct name or formula for each of the following.

I. Simple Binary Ionic Compounds:

1. $MgCl_2$
2. NaI
3. Na_2S
4. Cs_2Se
5. Al_2S_3

1. Lithium oxide
2. Barium fluoride
3. Cesium sulfide
4. Beryllium oxide
5. Strontium iodide

II. Binary Ionic Compounds with Multi-Valent Metals:

1. $FeCl_3$
2. SnS_2
3. Ti_2O_3
4. PbF_2
5. $PtSe_2$

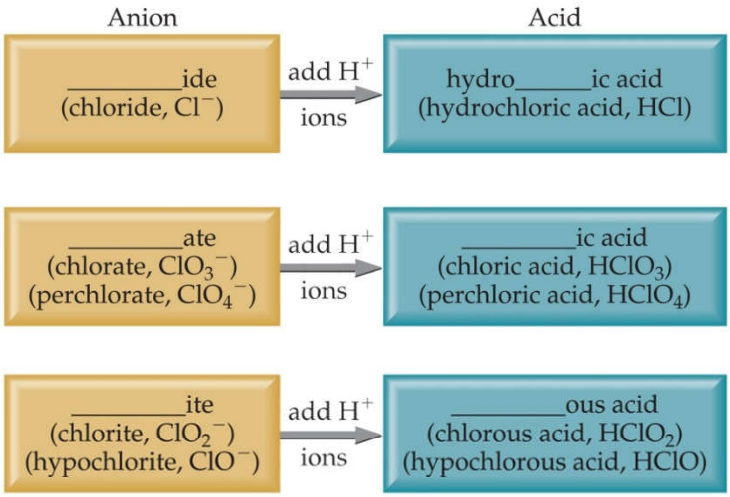
1. Chromium (IV) sulfide
2. Cobalt (II) bromide
3. Nickel (III) phosphide
4. Gold (I) nitride
5. Iron (II) arsenide

III. Ionic Compounds with Polyatomic Ions:

1. $NaCH_3COO$
2. $ZnCO_3$
3. $Al(NO_3)_3$
4. KNO_3
5. $Zn_3(PO_4)_2$

1. Silver nitrite
2. Ammonium hydroxide
3. Magnesium Phosphite
4. Lead (IV) nitrate
5. Iron (III) carbonate

Acids: Hydrogen + Nonmetal(s)



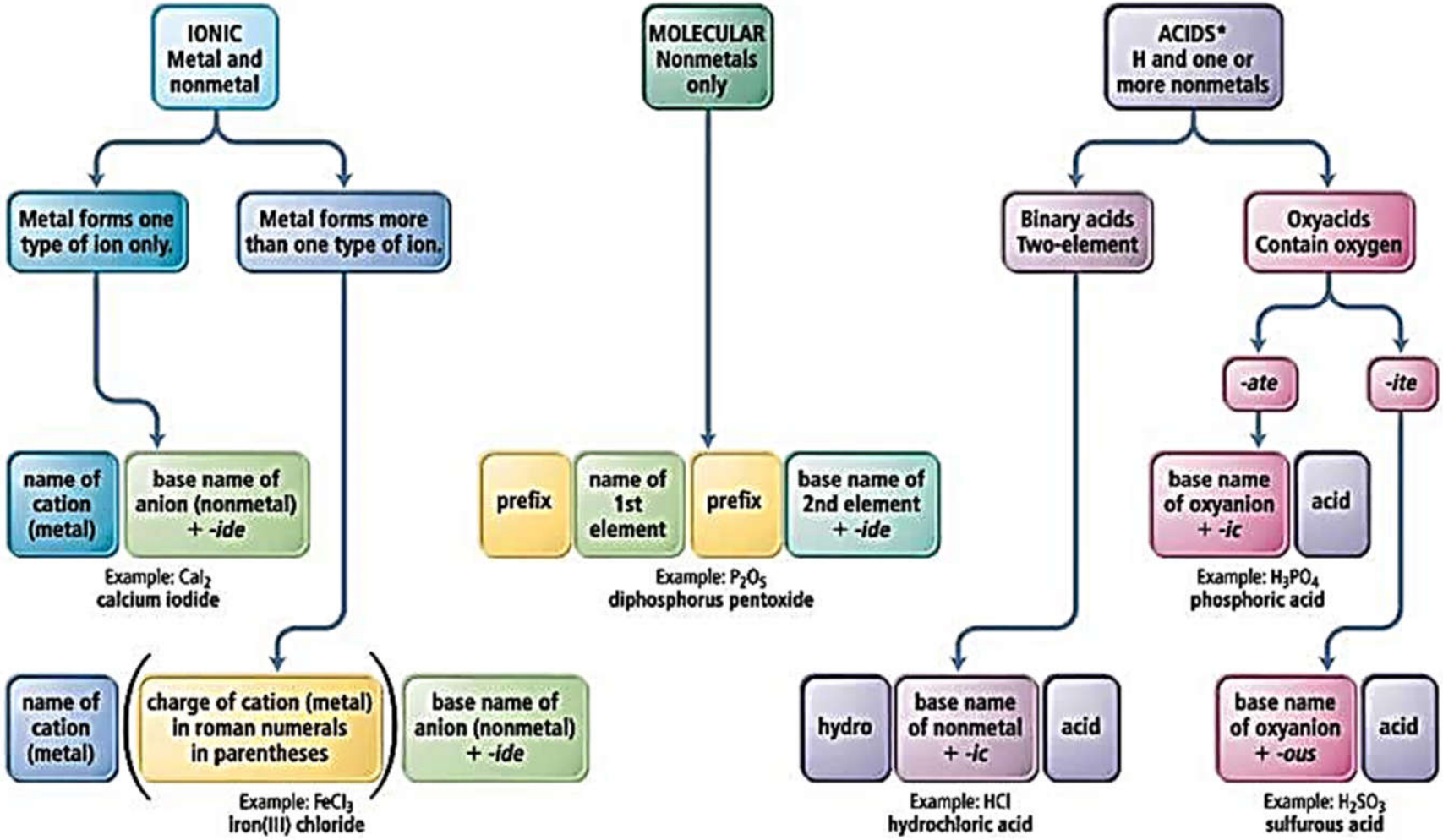
- **Hydrogen + monoatomic anion (ends in –*IDE*):** change the ending to -***ic acid*** and add the prefix ***hydro-***
- **Hydrogen + Polyatomic Ion that ends in –ATE:** change the ending to -***ic acid***
- **Hydrogen + Polyatomic Ion that ends in –ITE:** change the ending to -***ous acid***

Acidic Nomenclature Practice:

Write the correct name or chemical formula for each of the following.

1. $HC_2H_3O_2$ _____
2. HNO_3 _____
3. HI _____
4. H_2S _____
5. HNO_2 _____
6. H_2Se _____
7. H_3PO_4 _____
8. $HClO_3$ _____
9. H_2SO_4 _____
10. Sulfurous acid _____
11. Chlorous acid _____
12. Hydrofluoric acid _____
13. Hydrosulfuric acid _____
14. Chloric acid _____
15. Hydrobromic acid _____
16. phosphorous acid _____

Inorganic Nomenclature Flow Chart



<u>Organic Compounds</u>: must contain carbon. May contain other nonmetals such as hydrogen oxygen, nitrogen, sulfur…

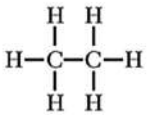
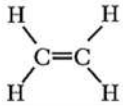
- **Simple Hydrocarbons: contain just carbon and hydrogen**
  - Use **prefix** to indicate **number of carbon atoms**

Organic Prefixes

Prefix	Number of Carbon Atoms
meth-	1
eth-	2
prop-	3
but-	4
pent-	5
hex-	6
hept-	7
oct-	8
non-	9
dec-	10

  - Use **-ane**, **-ene**, or **-yne** ending to indicate types of bonds present.

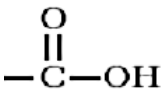
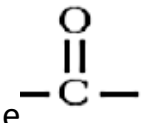
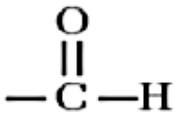
Homologous Series of Hydrocarbons

Name	General Formula	Examples	
		Name	Structural Formula
alkanes	C_nH_{2n+2}	ethane	
alkenes	C_nH_{2n}	ethene	
alkynes	C_nH_{2n-2}	ethyne	$H-C\equiv C-H$

Note: n = number of carbon atoms

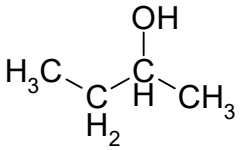
- **Functional Groups:** an atom or group of atoms that replace hydrogen within a hydrocarbon and give the organic compound unique characteristics/properties.
  - When a functional group is present, the ending of the hydrocarbon is changed to indicate its presence.

Common Functional Groups:

Name and Structure of Functoinal Groups	Suffix ending	Example
Alcohol 	-ol	$CH_3CH_2CH_2OH$ 1-propanol
Carboxylic acid 	-oic acid	$CH_3CH_2\overset{O}{\overset{\|\|}{C}}-OH$ propanoic acid
Ketone 	-one	$CH_3\overset{O}{\overset{\|\|}{C}}CH_2CH_2CH_3$ 2-pentanone
aldehyde 	-al	$CH_3CH_2\overset{O}{\overset{\|\|}{C}}-H$ propanal

- With functional groups, there is a systematic method to indicate where something is occurring within an organic structure. Use a numbering system of the "parent" chain.
  From formula to name:
  - Find the longest hydrocarbon chain, this is your parent chain
  - Number the chain so that functional group coming off is off the lowest numbered carbon
  - Write the #, substituent, -, then parent chain
  - The number can also indicate which carbon the double/triple bond is

Organic Nomenclature Practice:

Name	Structure
Butane	
	
2-butene