# Oxidation & Nomenclature Notes

## Oxidation #

* HINT: ions +/- go behind #
oxidation +/- goes infront of #

Rules:

1. A pure, unreacted element or diatomic molecule = Zero
2. An ion w/ a given charge = the oxidation #
   example: $Ca^{2+} \rightarrow Ca = +2$

   Polyatomic ions - the sum of the oxidation # = the charge for the whole polyatomic ion.
   example: $OH^{1-}$ $(O=-2)+(H=+1) = \boxed{-1}$
3. The sum of the oxidation # for a compound = Zero
   example: $H_2O$ $2(H=+1)+(O=-2) = \boxed{0}$
4. There can only be one negative oxidation # in a compound or polyatomic ion.
   example: $KNO_3$ $(K=+1)+(N=+5)+3(O=-2)$
5. Exceptions
   Oxygen is generally -2, except when peroxide $O_2^{2-} \rightarrow O=-1$
   Hydrogen can be +1 or -1 depending on what H is bonded to.
   H = +1 if bonded to a nonmetal
   H = -1 if bonded to a metal (hydride)

## Practice

1. Ag  Ag=___
2. $I_2$  I=___
3. CaS  Ca=___ S=___
4. $SnCl_2$  Sn=___ Cl=___
5. $SnCl_4$  Sn=___ Cl=___
6. $NO_2^{1-}$  N=___ O=___
7. $ClO_3^{1-}$  Cl=___ O=___
8. $N_2O$  N=___ O=___
9. $Hg_2Cl_2$  Hg=___ Cl=___
10. $H(NO_3)$  H=___ N=___ O=___
11. Na(OH)  Na=___ O=___ H=___
12. $H_2O_2$  H=___ O=___
13. LiH  Li=___ H=___
14. $H_2(SO_4)$  H=___ S=___ O=___
15. $Fe(NO_3)_3$  Fe=___ N=___ O=___
16. $K(ClO_3)$  K=___ Cl=___ O=___

# Nomenclature - the process of naming a compound

## More about POLYATOMIC IONS

| | | | | | |
|---|---|---|---|---|---|
| Acetate | $C_2H_3O_2^{1-}$ | Sulfate | $SO_4^{2-}$ | Phosphate | $PO_4^{3-}$ |
| Chlorate | $ClO_3^{1-}$ | Carbonate | $CO_3^{2-}$ | | |
| Nitrate | $NO_3^{1-}$ | Peroxide | $O_2^{2-}$ | | |
| Cyanide | $CN^{1-}$ | | | Ammonium | $NH_4^{1+}$ |
| hydroxide | $OH^{1-}$ | | | | |

### Polyatomic Family Rules:

The prefix PER denotes adding another oxgen to -ate
The suffix - ATE denotes the main poly all are based on
The suffix - ITE denotes removing an oxygen from -ate
The prefix HYPO denotes removing another oxygen

example:
- $ClO_4^{1-}$ perchlorate
- * $ClO_3^{1-}$ chlorate ← memorize
- $ClO_2^{1-}$ chlorite
- $ClO^{1-}$ hypochlorite

Keep the same charge for all.

Practice: Complete for the nitrate family

$NO_4^{1-}$ _____
$NO_3^{1-}$ _____
$NO_2^{1-}$ _____
$NO^{1-}$ _____

## IONIC COMPOUNDS

The name consists of the name of the metal followed by the "-ide" form of the nonmetal or the name of the polyatomic ion.

Ex: MgO → magnesium oxide $Ca(C_2H_3O_2)_2$ → Calcium acetate

Practice:

CaO _____ $BaCl_2$ _____

$Al_2(CO_3)_2$ _____ $(NH_4)_2(SO_4)$ _____

## * Compounds w/ Metals that have multiple Oxidation State

1st The oxidation state of the transition or inner transition metal must be found.

Ex. $FeCl_2$ we know Cl has a 1- charge i.e. $2 \times 1- = 2-$ so that $Fe + (2-) = zero$

$Fe = 2+$

2nd Record the name of the metal w/ the charge written in Roman Numerals, so from the example: Iron(II) Chloride

Practice:

Name the following compounds

1.) $Fe(OH)_3$ _____

2.) $Cu_2(SO_4)$ _____

3.) $PbS$ _____

4.) $Sn(NO_3)_2$ _____

Write the formula for the following compounds.

1.) Mercury(I) chloride _____

2.) Iron(II) phosphate _____

3.) Copper(I) selenide _____

4.) Cobalt(III) nitride _____

## Binary Compounds Containing Two NonMetals

The nonmetal with the lower electronegativity is named 1st followed by the "-ide" form of the nonmetal w/ the higher electronegativity.

Example: dinitrogen monoxide = $N_2O$

* prefixes = subscript

Practice:

1.) $PBr_3$ _____

2.) $CS_2$ _____

3.) $Cl_2O_7$ _____

4.) $SiO_2$ _____

5.) $N_2O_5$ _____

6.) Dibromine tetroxide _____

7.) Phosphorous triiodide _____

8.) Tetrasulfur tetranitride _____

9.) Sulfur hexafluoride _____

10.) dibromide monoxide _____

# Acids - Binary & Ternary Inorganic Acids

* All acids contain hydrogen!! * All must be aqueous *

## Acid Flow Chart

? Polyatomic Ion Present

**No - Binary Acid**

Name: hydro_ic acid

Formula = H + nonmetal
(Quantities are based on oxidation #)

EX:
$HCl(aq)$ → hydrochloric acid
$H_2S(aq)$ → hydrosulfuric acid

**Yes - Ternary Acid**

? ate, ide, or ite?

-ATE
name: change poly ending to -ic acid

-ITE
name: change poly ending to -ous acid

-IDE
name: hydro_ic acid

Formula = H + polyatomic ion
(Quantities are based on ox #)

EX:
$HClO_3(aq)$ → Chloric acid
$HNO_2(aq)$ → nitrous acid
$HCN(aq)$ → hydrocyanic acid

**Practice:**

1.) $H(C_2H_3O_2)(aq)$ _____
2.) $HF(aq)$ _____
3.) $HBr(aq)$ _____
4.) $H_2(SO_4)(aq)$ _____
5.) phosphoric acid _____
6.) hydroiodic acid _____
7.) chlorous acid _____
8.) carbonic acid _____

**Hydrates** -- compounds that have water weakely bonded to their crystals

* when these compounds lose the water molecule they are called anhydrous.

Naming Hydrates - name the ionic compound followed by a prefix + hydrate. (the prefix tells the # of water molecules)

EX. $CuSO_4 \cdot 5H_2O$ → Copper (II) sulfate pentahydrate

Practice:

1.) $Na_2CO_3 \cdot 10\ H_2O$ _____

2.) $BaCl_2 \cdot 2\ H_2O$ _____

3.) magnesium sulfate heptahydrate _____

4.) iron (III) nitrate trihydrate _____