

Oxidation & Nomenclature Notes

Oxidation

* HINT: IONS $\frac{+}{-}$ go behind #
oxidation $\frac{+}{-}$ goes in front of #

Rules:

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

Polyatomic ions - the sum of the oxidation # = the charge for the whole polyatomic ion.

example: $\text{OH}^{-1} \quad (\text{O} = -2) + (\text{H} = +1) = \boxed{-1}$

3. The sum of the oxidation # for a compound = Zero

example: $\text{H}_2\text{O} \quad 2(\text{H} = +1) + (\text{O} = -2) = \boxed{0}$

4. There can only be one negative oxidation # in a compound or polyatomic ion.

example: $\text{KNO}_3 \quad (\text{K} = +1) + (\text{N} = +5) + 3(\text{O} = -2)$

5. Exceptions

Oxygen is generally -2, except when peroxide



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 = | _____ | 9. Hg_2Cl_2 | Hg = | _____ | Cl = | _____ | | | | |
| 2. I_2 | I = | _____ | 10. $\text{H}(\text{NO}_3)$ | H = | _____ | N = | _____ | O = | _____ | | |
| 3. CaS | Ca = | _____ | S = | _____ | 11. $\text{Na}(\text{OH})$ | Na = | _____ | O = | _____ | H = | _____ |
| 4. SnCl_2 | Sn = | _____ | Cl = | _____ | 12. H_2D_2 | H = | _____ | O = | _____ | | |
| 5. SnCl_4 | Sn = | _____ | Cl = | _____ | 13. LiH | Li = | _____ | H = | _____ | | |
| 6. NO_3^{1-} | N = | _____ | O = | _____ | 14. $\text{H}_2(\text{SO}_4)$ | H = | _____ | S = | _____ | O = | _____ |
| 7. ClO_3^{1-} | Cl = | _____ | O = | _____ | 15. $\text{Fe}(\text{NO}_3)_3$ | Fe = | _____ | N = | _____ | O = | _____ |
| 8. N_2O | N = | _____ | O = | _____ | 16. $\text{K}(\text{ClO}_3)$ | 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 oxygen 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: $MgO \rightarrow$ magnesium oxide $Ca(C_2H_3O_2)_2 \rightarrow$ calcium acetate

Practice:

CaO	_____	$BaCl_2$	_____
$Al_2(CO_3)_3$	_____	$(NH_4)_2(SO_4)$	_____

* 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. $2 \times 1- = 2-$ so that $Fe + (2-) = \text{zero}$
 $Fe = 2+$

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.) $Cu_2(OH)_4$ _____
- 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 _____ | 6.) Dibromine tetroxide _____ |
| 2.) CS_2 _____ | 7.) Phosphorous triiodide _____ |
| 3.) Cl_2O_7 _____ | 8.) Tetrasulfur tetranitride _____ |
| 4.) SiO_2 _____ | 9.) Sulfur hexafluoride _____ |
| 5.) N_2O_5 _____ | 10.) dibromide monoxide _____ |

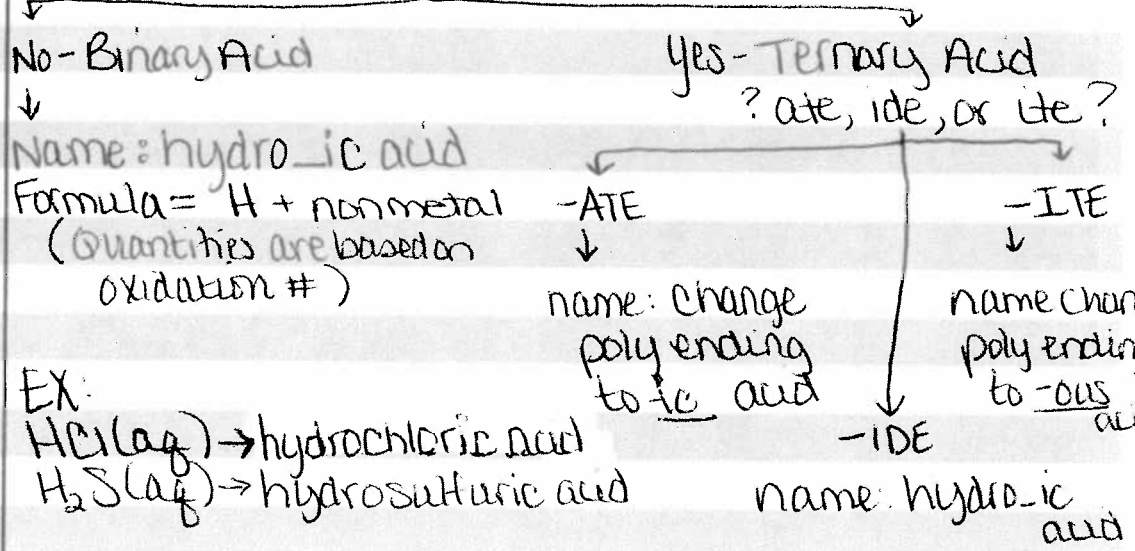
ACIDS

Binary & Ternary Inorganic Acids

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

Acid Flow Chart

? Polyatomic Ion Present



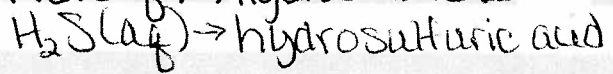
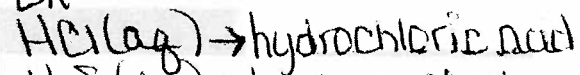
No - Binary Acid

↓

Name: hydro-ic acid

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

EX:



Yes - Ternary Acid

? ate, ide, or ite?

-ATE

↓

name: change poly ending to ic acid

-ITE

↓

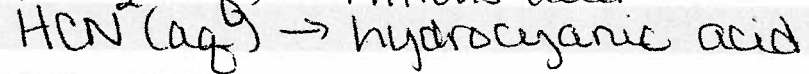
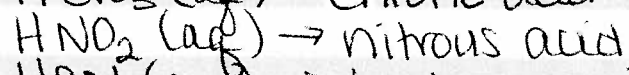
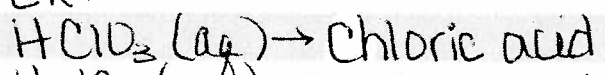
name: change poly ending to -ous acid

-IDE

name: hydro-ic acid

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

EX:



Practice:

1.) $H(C_2H_3O_2)(aq)$ _____

2.) $HF(aq)$ _____

3.) $HBr(aq)$ _____

4.) $H_2SO_4(aq)$ _____

5.) phosphoric acid _____

6.) hydroiodic acid _____

7.) chlorous acid _____

8.) carbonic acid _____

Hydrates - compounds that have water weakly 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. $Cu(SO_4) \cdot 5 H_2O \rightarrow$ 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 _____