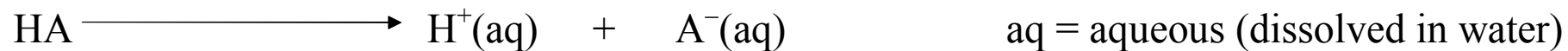


ACIDS

Molecular Compounds that yield hydrogen ions (H^+) and an anion, when dissolved in water
 H_2O



CLASSIFICATION OF ACIDS

	I. BINARY ACIDS	II. OXOACIDS	
	(H + NONMETAL)	(H + NONMETAL + O)	
		1. More O atoms	2. Fewer O atoms
Names	Hydro + Nonmetal + ic + acid	nonmetal + ic + acid	nonmetal + ous + acid
Examples	$HCl(aq)$ hydro chloric acid	$HClO_3(aq)$ chlor ic acid	$HClO_2(aq)$ chlor ous acid
	$H_2S(aq)$ hydro sulfuric acid	$H_2SO_4(aq)$ sulfur ic acid	$H_2SO_3(aq)$ sulfur ous acid
	-----	$HNO_3(aq)$ nitri c acid	$HNO_2(aq)$ nitro us acid
	-----	$H_3PO_4(aq)$ phosphori c acid	$H_3PO_3(aq)$ phosphoro us acid
	-----	$H_2CO_3(aq)$ carboni c acid	-----
	-----	$HC_2H_3O_2(aq)$ aceti c acid	-----

Other important facts to remember about some common acids.

1. Common Binary Acids (H + Nonmetal) contain Group VIIA and VIA nonmetals:

Nonmetals		Binary Acids	
VIA	VIIA	VIA	VIIA
	F		HF(aq) hydrofluoric acid
S	Cl	H ₂ S(aq) hydrosulfuric acid	HCl(aq) hydrochloric acid
	Br		HBr(aq) hydrobromic acid
	I		HI(aq) hydroiodic acid

2. Some nonmetals form more than two oxoacids with varying number of O atoms



?????

chlorous acid

chloric acid

?????

less O
than chlorous acid

more O
than chloric acid

hypochlorous acid

hyperchloric acid

Summing up:



hypochlorous acid

chlorous acid

chloric acid

perchloric acid

fewer O atoms

more O atoms

TERNARY IONIC COMPOUNDS

- contain at least **3 elements**
- contain at least one **Polyatomic Ion**
 - an ion consisting of 2 or more atoms bonded together and carrying a common charge. Example: SO_4^{2-} (sulfate ion)
- ending depends on the name of the anion.

TERNARY IONIC COMPOUNDS

CATION(s)		ANION(s)		
Monoatomic	Polyatomic	Monoatomic	Polyatomic	
Na^+ , Mg^{2+} , Al^{3+} , etc.	NH_4^+ ammonium ion	Cl^- , O^{2-} , N^{3-} , etc	OH^- hydroxide ion	Oxoanions (derived from oxoacids)

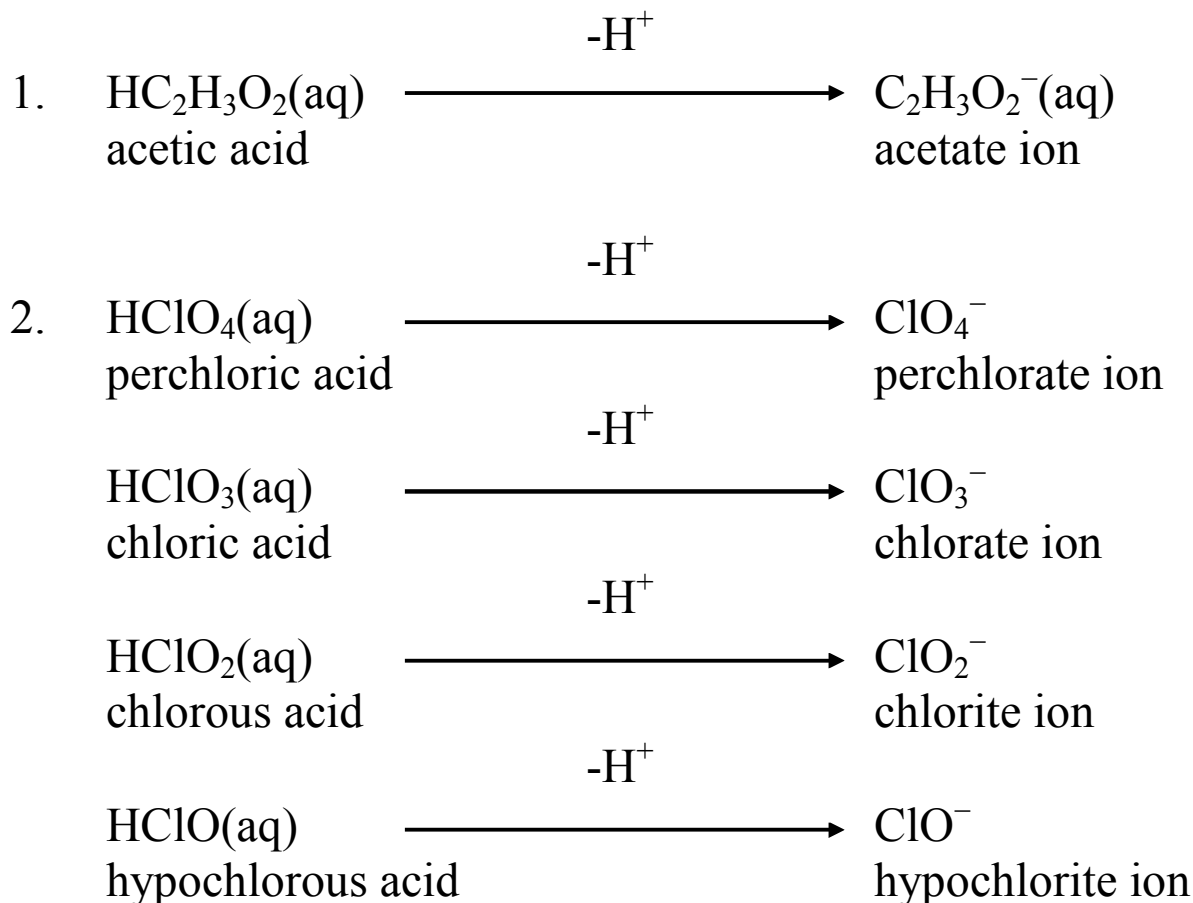
OXOANIONS

- are derived from oxoacids by partial or complete removal of hydrogen ions (H^+)
- Negative Charge of Oxoanion = Number of H^+ ions removed from oxoacids

OXOANIONS

MORE O atoms		FEWER O atoms	
- H ⁺ (s)		- H ⁺ (s)	
Oxoacids (“ ic ”)	Oxoanions (“ ate ”)	Oxoacids (“ ous ”)	Oxoanions (“ ite ”)
HClO ₃ (aq) chloric acid	ClO ₃ ⁻ chlor ate ion	HClO ₂ (aq) chlorous acid	ClO ₂ ⁻ chlor ite ion
H ₂ SO ₄ (aq) sulfuric acid	HSO ₄ ⁻ hydrogen sulf ate ion SO ₄ ²⁻ sulf ate ion	H ₂ SO ₃ (aq) sulfurous acid	HSO ₃ ⁻ hydrogen sulf ite ion SO ₃ ²⁻ sulf ite ion
HNO ₃ (aq) nitric acid	NO ₃ ⁻ nitr ate ion	HNO ₂ (aq) nitrous acid	NO ₂ ⁻ nitr ite ion
H ₃ PO ₄ (aq) phosphoric acid	H ₂ PO ₄ ⁻ dihydrogen phosph ate HPO ₄ ²⁻ monohydrogen phosph ate ion PO ₄ ³⁻ phosph ate ion	H ₃ PO ₃ (aq) phosphorous acid	H ₂ PO ₃ ⁻ dihydrogen phosph ite ion HPO ₃ ²⁻ monohydrogen phosph ite ion PO ₃ ³⁻ phosph ite ion
H ₂ CO ₃ (aq) carbonic acid	HCO ₃ ⁻ hydrogen carbon ate ion CO ₃ ²⁻ carbon ate ion	-----	-----

NOTE:



FORMULAS AND NAMES OF TERNARY IONIC COMPOUNDS

In writing the correct formulas, keep in mind that:

1. the formulas and the charges of the ions must be known,
2. the ionic charges must cancel (the compound as a whole is neutral)

Examples:

1. Write the formula of sodium sulfate: Na^+ SO_4^{2-}
 $\text{Na}^+ \text{SO}_4^{2-} \longrightarrow \text{Na}_2\text{SO}_4$
??????
2. Write the formula of calcium nitrate: Ca^{2+} NO_3^-
 $\text{Ca}^{2+} \text{NO}_3^- \longrightarrow \text{Ca}(\text{NO}_3)_2$
??????
3. Write the formula of ammonium (NH_4^+) hydroxide (OH^-)
 NH_4OH

4. What is the name of CuCO_3 ?

Copper carbonate

???

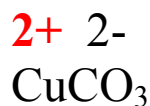
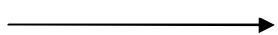
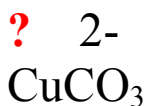
Which copper carbonate ?

- copper (I) carbonate (cuprous carbonate)

OR

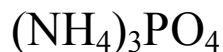
- copper (II) carbonate (cupric carbonate)

The ionic charge of the Copper ion in the compound must be known!



copper (II) carbonate
cupric carbonate

5. Write the formula of ammonium (NH_4^+) phosphate (PO_4^{3-})



6. Write the formula of ammonium (NH_4^+) hydroxide (OH^-)



7. Write the formula of calcium (Ca^{2+}) hydrogen carbonate (HCO_3^-)



8. Write formulas of the following compounds:

sodium (Na^+) carbonate (CO_3^{2-}) : Na_2CO_3

sodium (Na^+) hydrogen carbonate (HCO_3^-) : NaHCO_3

ammonium (NH_4^+) acetate ($\text{C}_2\text{H}_3\text{O}_2^-$) : $\text{NH}_4\text{C}_2\text{H}_3\text{O}_2$

barium (Ba^{2+}) hydroxide (OH^-) : $\text{Ba}(\text{OH})_2$

barium (Ba^{2+}) sulfate (SO_4^{2-}) : BaSO_4

9. Give the correct name for the following compounds:

$\text{Fe}_2(\text{SO}_4)_3$? 2- 3+ 2-
 $\text{Fe}_2(\text{SO}_4)_3$ $\text{Fe}_2(\text{SO}_4)_3$ $\text{Fe}_2(\text{SO}_4)_3$ iron(III) sulfate, or
ferric sulfate

CuSO_4 ? 2- 2+ 2-
 CuSO_4 CuSO_4 CuSO_4 copper(II)sulfate, or
cupric sulfate

CaCO_3 calcium carbonate
(Ca ion can have one charge only: Ca^{2+})

Na_2HPO_4 sodium hydrogen phosphate

NH_4Cl ammonium chloride

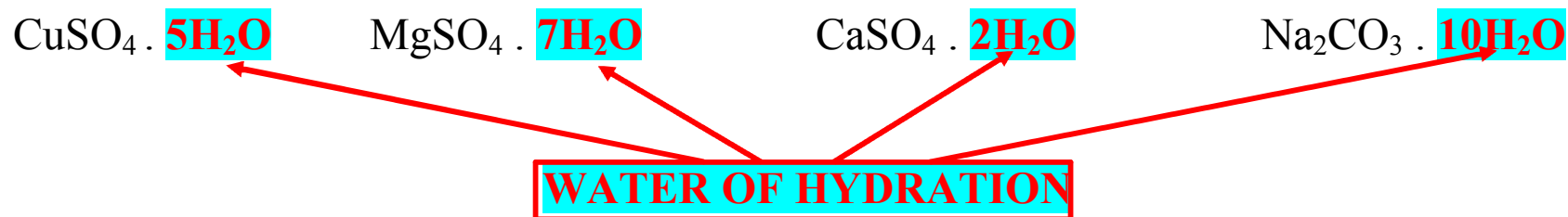
NH_4NO_2 ammonium nitrite

$\text{Ni}(\text{NO}_3)_2$? 1- 2+ 1-
 $\text{Ni}(\text{NO}_3)_2$ $\text{Ni}(\text{NO}_3)_2$ $\text{Ni}(\text{NO}_3)_2$ nickel (II) nitrate

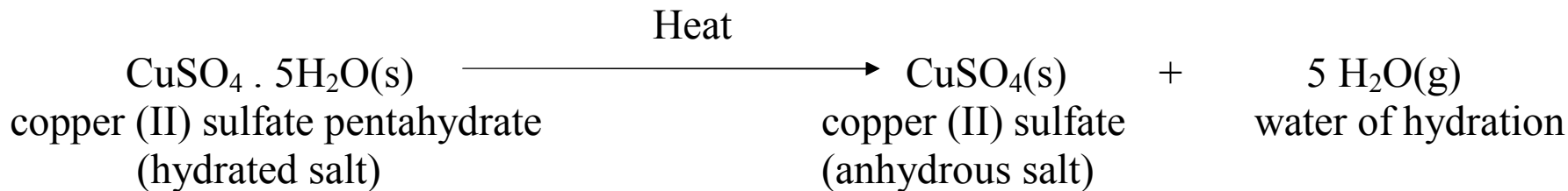
HYDRATES

are Ionic Compounds that contain water molecules chemically bound with the crystals of the Ionic Compound

<u>Examples:</u>	<u>Common Name</u>	<u>IUPAC Name</u>
$\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$	Root killer	copper(II) sulfate pentahydrate
$\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$	Epsom Salt	magnesium sulfate heptahydrate
$\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$	Gypsum	calcium sulfate dihydrate
$\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$	Washing Soda	sodium carbonate decahydrate



The water of hydration can be easily removed by heating:



blue crystals



white powder

NOTE:

The hydrated salts are crystalline, whereas the corresponding anhydrous salts are powders.

