

Naming Inorganic Compounds

common names
systematic names

Molecular
Formula

Common
name

Systematic
name

AgCl

Lunar caustic

Silver chloride

H₂SO₄

Oil of vitriol

Sulfuric acid

MgSO₄

Epsom salts

Magnesium sulfate

Nonenclature

When naming chemical compounds we distinguish between

Organic compounds

- compounds containing carbon.

Exceptions: CO, CO₂, CS₂, CN⁻, CO₃²⁻, HCO₃⁻, H₂CO₃

Inorganic compounds

- all other compounds

we can break the naming of inorganic compounds into four categories:

Ionic compounds

Molecular compounds

Acids and Bases

Hydrates

Binary compounds contain two different elements

Examples: NaCl, FeBr₃, Al₂O₃, N₂O₅, P₄O₁₀

Instead of concerning ourselves with whether the compound is ionic or molecular, let's reintroduce the idea of **electronegativity.**

Electronegativity

measure of an elements ability to attract electrons toward itself when bonded to another element

An electronegative element attracts electrons.

An electropositive element releases electrons.

decreasing
electronegativity

Increasing electronegativity



Group	1	2		3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
	1A	2A		3B	4B	5B	6B	7B		8B		1B	2B	3A	4A	5A	6A	7A	8A
Period																			
1	1 H																		2 He
2	3 Li	4 Be												5 B	6 C	7 N	8 O	9 F	10 Ne
3	11 Na	12 Mg												13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
4	19 K	20 Ca		21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr
5	37 Rb	38 Sr		39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe
6	55 Cs	56 Ba	*	71 Lu	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn
7	87 Fr	88 Ra	**	103 Lr	104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt	110 Uun	111 Uuu	112 Uub	113 Uut	114 Uuq	115 Uup	116 Uuh	117 Uus	118 Uuo
lanthanides			*	57 La	58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb		
actinides			**	89 Ac	90 Th	91 Pa	92 U	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No		

Naming Ionic Compounds

Naming binary compounds

binary compounds contain two elements

and are named as two words

first word is name of more **electropositive element**

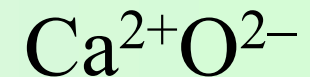
second word is first part of name of more **electronegative element followed by -ide**

Examples of binary compounds of metals

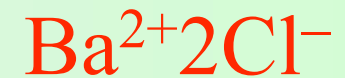
sodium bromide:



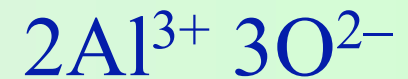
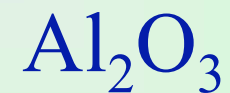
calcium oxide:



barium chloride:



aluminum oxide:



number of positive charges must equal number of negative charges

Common Monatomic Cations

+1: H

+1: Li, Na, K, Cs

+2: Mg, Ca, Ba

+3: Al

Common Monatomic Anions

-1: F, Cl, Br, I

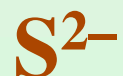
-2: O, S

-3: N, P

Example

Write the formulas for the following compounds:

(a) potassium sulfide



Answer: K_2S

Example

But some metals can form more than one type of cation

Often, but not always, a transition metal

Binary compounds of metals (cont'd)

When metal can form more than one type of cation, indicate charge by Roman numeral in parenthesis

MnO	manganese(II) oxide
Mn₂O₃	manganese(III) oxide
MnO₂	manganese(IV) oxide

use of the suffixes -ous and -ic is discouraged

Commonly encountered cations that can exist as two different charge types

+1, +2: Cu, Hg

+2, +3: Fe, Co

+2, +4: Sn, Pb

Example

Write the formulas for the following compounds:

(a) tin(II) fluoride



Answer: SnF_2

Example

Write the formulas for the following compounds:

(a) mercury(II) oxide



Answer: HgO

Example

Write the formulas for the following compounds:

(a) mercury(I) iodide

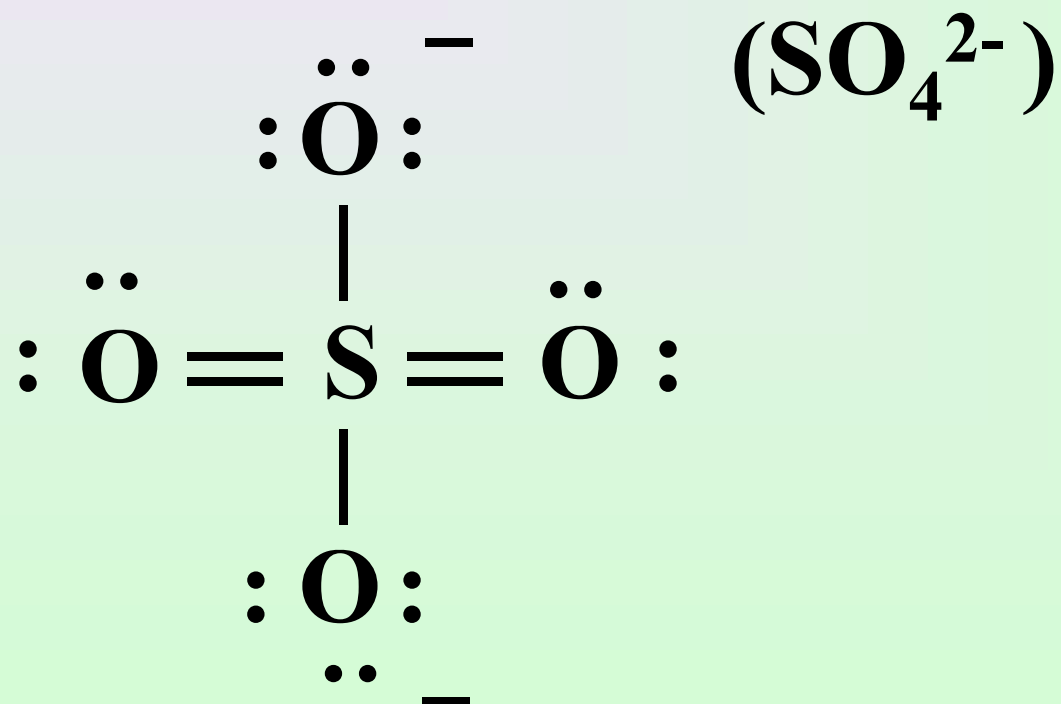
Hg⁺ actually exists as Hg₂²⁺

I⁻

Answer: Hg₂I₂

Polyatomic Ions

molecules with a charge



Polyatomic Ions

(CO₃²⁻)	carbonate
(CrO₄²⁻)	chromate
(OH⁻)	hydroxide
(NO₃⁻)	nitrate
(Cr₂O₇²⁻)	dichromate
(ClO₃⁻)	chlorate

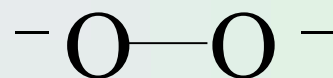
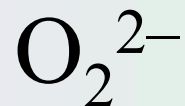
bromate



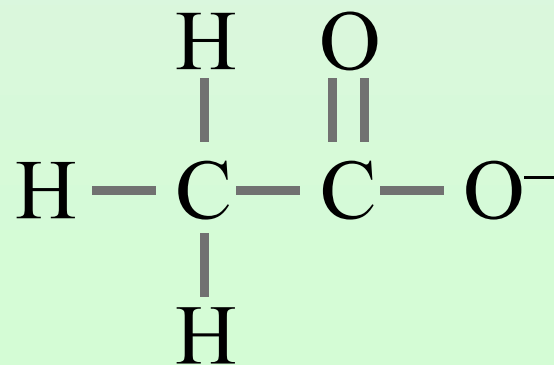
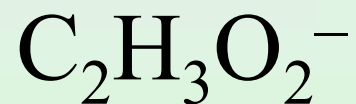
Iodate



peroxide



acetate



Example

Name the following ionic compounds:



Answer: copper(II)nitrate

Naming Molecular Compounds

Molecular Compounds

Electrons are shared by the atoms.

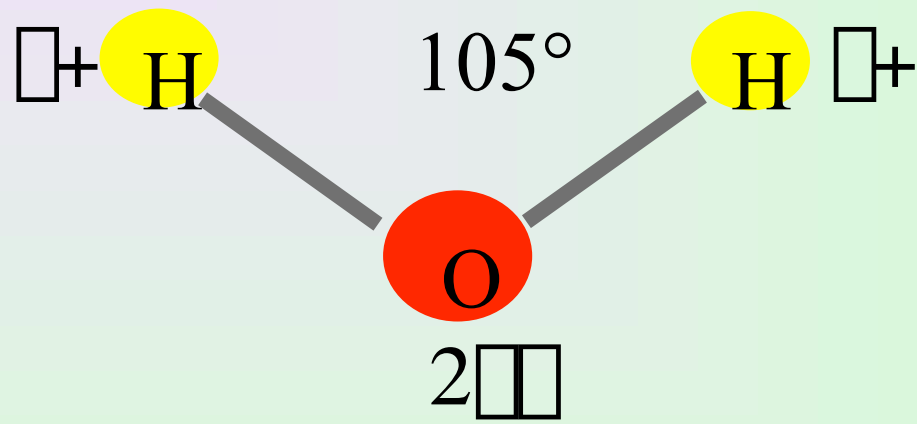
Covalent Bonds

Electrons however are not shared equally.

Molecular Compounds

Elements that are more electronegative assume an **apparent negative charge** (\ominus).

Elements that are more electropositive assume an **apparent positive charge** (\oplus).



naming binary compounds of nonmetals

- 1) more electropositive element named first
(and listed first in chemical formula)
- 2) more electronegative element named in usual
way (with -ide suffix)
- 3) **counting prefixes** are used with each name
but mono is not used with first name

Greek prefixes used in naming molecular compounds

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

Examples

CO	carbon monoxide
CO ₂	carbon dioxide
SO ₂	sulfur dioxide
SO ₃	sulfur trioxide
PCl ₃	phosphorus trichloride
PCl ₅	phosphorus pentachloride
NO ₂	nitrogen dioxide
N ₂ O ₄	dinitrogen tetroxide
Cl ₂ O ₇	dichlorine heptoxide

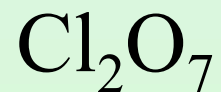
Name the following compounds



chlorine trifluoride



sulfur dichloride



dichlorine heptoxide

Naming Acids and Bases

Acids and Bases

An acid is a substance that yields hydrogen ions (H^+) when dissolved in water.

Acids that contain hydrogen, oxygen, and another element are called oxyacids.

Acids and Bases

Bases are substances that yield hydroxide ions (HO^-) when dissolved in water.

NaOH , KOH , $\text{Ba}(\text{OH})_2$, NH_3

Naming Acids

Naming an acid depends on whether the anion contains oxygen

If the anion does not contain oxygen the acid is named with the prefix *hydro* and the suffix *--ic*

If the anion contains oxygen the acid name is formed from the root name of the anion with the suffix *-ic or -ous*

Names for some binary acids

Anion

Corresponding Acid

F^- (fluoride)

HF (hydrofluoric acid)

Cl^- (chloride)

HCl (hydrochloric acid)

Br^- (bromide)

HBr (hydrobromic acid)

I^- (iodide)

HI (hydroiodic acid)

CN^- (cyanide)

HCN (hydrocyanic acid)

S^{2-} (sulfide)

H_2S (hydrosulfuric acid)

Polyatomic anions

sulfite SO_3^{2-}

sulfate SO_4^{2-}

hypochlorite ClO^-

chlorite ClO_2^-

chlorate ClO_3^-

perchlorate ClO_4^-

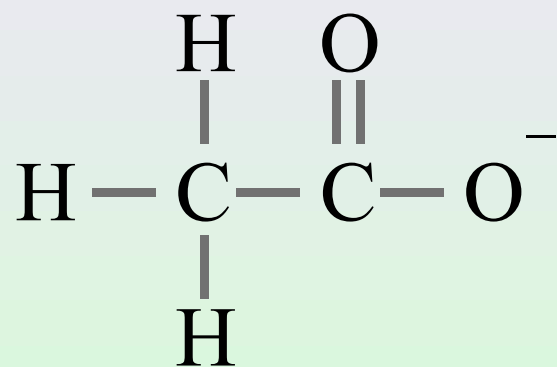
Ternary acids

three element acids

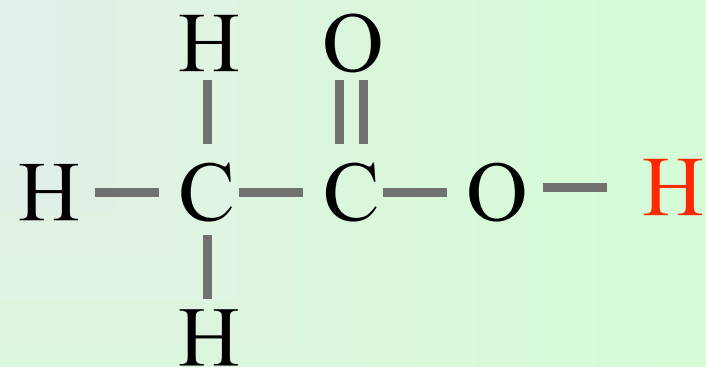
most ternary acids are oxyacids containing hydrogen, oxygen, and one other element

Oxyacids

acetate anion



acetic acid



Oxyacids

sulfite **SO_3^{2-}** **sulfurous acid** **H_2SO_3**

HOSO₂OH

sulfate **SO_4^{2-}** **sulfuric acid** **H_2SO_4**

HOSO₂OH

Oxyacids

perchlorate ClO_4^- **perchloric acid** HClO_4
 HOClO_3

Addition of one O atom

chlorate ClO_3^- **chloric acid** HClO_3
 HOClO_2

removal of one O atom

chlorite ClO_2^- **chlorous acid** HClO_2
 HOClO

removal of two O atoms

hypochlorite ClO^- **hypochlorous acid** HOCl

Hydrates

Compounds that have a specific number of water molecules attached to them

Copper(II) sulfate pentahydrate



Copper(II) sulfate anhydrous



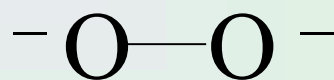
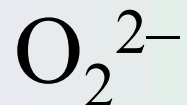
Anhydrous - the water molecules have been driven off by heating

Polyatomic anions

hydroxide



peroxide



acetate

