

IUPAC nomenclature of inorganic chemistry

The IUPAC nomenclature of inorganic chemistry is a [systematic](#) way of naming [inorganic chemical compounds](#) as recommended by the [International Union of Pure and Applied Chemistry](#) (IUPAC). Ideally, every [inorganic compound](#) should have a name from which an unambiguous [formula](#) can be determined. There is also a [IUPAC nomenclature of organic chemistry](#).

The names "[caffeine](#)" and "3,7-dihydro-1,3,7-trimethyl-1H-purine-2,6-dione" both describe the same chemical. The systematic name encodes the structure and composition of the caffeine molecule in some detail, and provides an unambiguous reference to this compound, whereas the name "caffeine" just names it. These advantages make the systematic name far superior to the common name when absolute clarity and precision is required. However, even professional chemists will use the non-systematic name almost all of the time, because caffeine is a well-known common chemical with a unique structure. Similarly, the chemical [water](#) is always known as such, never as "dihydrogen monoxide."

1. Single atom anions are named with an *-ide* suffix: for example, H^- is hydride.
2. Compounds with a positive [ion \(cation\)](#), the name of the compound is simply the cation's name (usually the same as the element's), followed by the anion. For example, NaCl is *sodium chloride*, and CaF_2 is *calcium fluoride*.
3. Cations able to take on more than one positive charge are labeled with [Roman numerals](#) in parentheses. For example, Cu^+ is copper(I), Cu^{2+} is copper(II). An older, deprecated notation is to append *-ous* or *-ic* to the root of the Latin name to name ions with a lesser or greater charge. Under this naming convention, Cu^+ is cuprous and Cu^{2+} is cupric. For naming metal complexes see the page on [complex \(chemistry\)](#).
4. [Oxyanions](#) (polyatomic anions containing oxygen) are named with *-ite* or *-ate*, for a lesser or greater quantity of oxygen. For example, NO_2^- is nitrite, while NO_3^- is nitrate. If four oxyanions are possible, the prefixes *hypo-* and *per-* are used: Hypochlorite is ClO^- , Perchlorate is ClO_4^- .
5. The prefix *bi-* is a deprecated way of indicating the presence of a single [hydrogen](#) ion, as in "sodium bicarbonate" (NaHCO_3). The modern method specifically names the hydrogen atom. Thus, NaHCO_3 would be pronounced "sodium hydrogen carbonate".

Positively charged ions are called [cations](#) and negatively charged ions are called [anions](#). The cation is **always** named first. Ions can be metals or polyatomic ions. Therefore the name of the metal or positive polyatomic ion is followed by the name of the non-metal or negative polyatomic ion. The positive ion retains its element name whereas for a single non-metal anion the ending is changed to *-ide*.

Example: sodium chloride, potassium oxide, or calcium carbonate.

When the metal has more than one possible ionic charge or [oxidation number](#) the name becomes ambiguous. In these cases the oxidation number of the metal ion is represented by a Roman numeral in parentheses immediately following the metal ion name. For example in uranium(VI) fluoride the [oxidation number](#) of [uranium](#) is 6. Another example is the iron oxides. FeO is iron(II) oxide and Fe₂O₃ is iron(III) oxide.

An older system used prefixes and suffixes to indicate the oxidation number, according to the following scheme:

Oxidation state	Cations and acids	Anions
Lowest	hypo- -ous	hypo- -ite
	-ous	-ite
	-ic	-ate
Highest	per- -ic	per- -ate

Thus the four oxyacids of [chlorine](#) are called hypochlorous acid (HOCl), chlorous acid (HOClO), chloric acid (HOClO₂) and perchloric acid (HOClO₃), and their respective [conjugate bases](#) are the hypochlorite, chlorite, chlorate and perchlorate ions. This system has partially fallen out of use, but survives in the [common names](#) of many [chemical compounds](#): the modern literature contains few references to "ferric chloride" (instead calling it "iron(III) chloride"), but names like "potassium permanganate" (instead of "potassium manganate(VII)") and "sulfuric acid" abound.

Naming simple ionic compounds

An ionic compound is named by its cation followed by its anion. See [polyatomic ions](#) for a list of possible ions.

For cations that take on multiple charges, the charge is written using [Roman numerals](#) in parentheses immediately following the element name) For example, Cu(NO₃)₂ is [copper\(II\) nitrate](#), because the charge of two [nitrate](#) ions is 2 x -1 = -2, and since the net charge of the [ionic compound](#) must be zero, the Cu ion has a 2+ charge. This compound is therefore copper(II) nitrate.

The [Roman numerals](#) in fact show the [oxidation number](#), but in simple ionic compounds (i.e., not [metal complexes](#)) this will always equal the ionic charge on the metal. For a simple overview see [\[1\]](#), for more details see [selected pages from IUPAC rules for naming inorganic compounds](#).

[\[edit\]](#)

List of common ion names

Monatomic anions:

Cl^- chloride
 S^{2-} sulfide
 P^{3-} phosphide

Polyatomic ions:

NH_4^+ ammonium
 H_3O^+ hydronium
 NO_3^- nitrate
 NO_2^- nitrite
 ClO^- hypochlorite
 ClO_2^- chlorite
 ClO_3^- chlorate
 ClO_4^- perchlorate
 SO_3^{2-} sulfite
 SO_4^{2-} sulfate
 HSO_3^- hydrogen sulfite (or bisulfate)
 HCO_3^- hydrogen carbonate (or bicarbonate)
 CO_3^{2-} carbonate
 PO_4^{3-} phosphate
 HPO_4^{2-} hydrogen phosphate
 H_2PO_4^- dihydrogen phosphate
 CrO_4^{2-} chromate
 $\text{Cr}_2\text{O}_7^{2-}$ dichromate
 BO_3^{3-} orthoborate
 AsO_4^{3-} arsenate
 $\text{C}_2\text{O}_4^{2-}$ oxalate
 CN^- cyanide
 MnO_4^- permanganate

Naming hydrates

Hydrates are ionic compounds that have absorbed water. They are named as the ionic compound followed by a numerical prefix and *-hydrate*. The numerical prefixes used are listed below:

1. mono-
2. di-
3. tri-
4. tetra-
5. penta-
6. hexa-

7. [hepta-](#)
8. [octa-](#)
9. [nona-](#)
10. [deca-](#)

For example, $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ is "copper(II) sulfate pentahydrate".

Naming molecular compounds

Inorganic molecular compounds are named with a prefix (see list above) before each element. The more [electronegative](#) element is written last and with an *-ide* suffix. For example, CO_2 is *carbon dioxide*, and CCl_4 is *carbon tetrachloride*. There are some exceptions to the rule, however. The prefix **mono-** is not used with the first element; for example, CO_2 is *carbon dioxide*, not "monocarbon dioxide". Sometimes prefixes are shortened when the ending vowel of the prefix "conflicts" with a starting vowel in the compound. This makes the compound easier to speak; for example, CO is "carbon monoxide" (as opposed to "monoxide").

Naming acids

Acids are named by the anion they form when dissolved in water. If an acid forms an anion named *___ide*, it is named *hydro___ic acid*. For example, *hydrochloric acid* forms a *chloride* anion. Secondly, anions with an *-ate* suffix are formed from acids with an *-ic* suffix are dissolved -- *chloric acid* dissociates to *chlorate* anions in water. Thirdly, anions with an *-ite* suffix are formed when acids with an *-ous* suffix are dissolved in water; for example *chlorous acid* dissociates into *chlorite* anions.

Compositional nomenclature

Substitutive nomenclature

BH_3	borane	CH_4	methane	NH_3	azane	H_2O	oxidane	HF	fluorane
AlH_3	alumane	SiH_4	silane	PH_3	phosphane	H_2S	sulfane	HCl	chlorane
GaH_3	gallane	GeH_4	germane	AsH_3	arsane	H_2Se	selane	HBr	bromane
InH_3	indigane	SnH_4	stannane	SbH_3	stibane	H_2Te	tellane	HI	iodane

TlH ₃	thallane	PbH ₄	plumbane	BiH ₃	bismuthane	H ₂ Po	polane	HAs	astatane
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A

- [Aluminium oxide](#) – Al₂O₃
- [Aluminium chloride](#) – AlCl₃
- [Aluminium hydroxide](#) – Al(OH)₃
- [Aluminium monostearate](#)
- [Aluminium sulfate](#) – Al₂(SO₄)₃
- [Ammonia](#) – NH₃
- [Ammonium bicarbonate](#) – NH₄HCO₃
- [Ammonium cerium\(IV\) nitrate](#) – (NH₄)₂Ce(NO₃)₆
- [Ammonium chloride](#) – NH₄Cl
- [Ammonium nitrate](#) – NH₄NO₃
- [Ammonium sulfate](#) – (NH₄)₂SO₄
- [Antimony\(III\) acetate](#)
- [Antimony hydride](#) – SbH₃
- [Antimony pentachloride](#)
- [Antimony pentafluoride](#)
- [Antimony trioxide](#) – Sb₂O₃
- [Arsine](#) – AsH₃
- [Arsenic trioxide](#) (Arsenic(III) oxide) – As₂O₃

B

- [Barium carbonate](#) – BaCO₃
- [Barium chloride](#) – BaCl₂
- [Barium hydroxide](#) – Ba(OH)₂
- [Barium iodide](#) – BaI₂
- [Barium nitrate](#) – Ba(NO₃)₂
- [Barium sulfate](#) – BaSO₄
- [Beryllium hydroxide](#)
- [Beryllium oxide](#) — BeO
- [Bismarck Brown Y](#)
- [Bismuth\(III\) oxide](#) Bi₂O₃
- [Bismuth subsalicylate](#)
- [Borane](#)
- [Borax](#) – Na₂B₄O₇·10H₂O
- [Boric acid](#) – H₃BO₃
- [Boron carbide](#)
- [Boron nitride](#) – BN
- [Boron oxide](#)

- [Boron trifluoride](#) – BF₃
- [Bromine pentafluoride](#)
- [Bromine trifluoride](#)
- [n-Butyllithium](#)
- [sec-Butyllithium](#)
- [tert-Butyllithium](#)

C

- [Cacodylic acid](#)
- [Cadmium chloride](#)
- [Cadmium sulfate hydrate](#)
- [Caesium bicarbonate](#)
- [Caesium carbonate](#)
- [Caesium chloride](#)
- [Caesium fluoride](#)
- [Calcium carbide](#)
- [Calcium carbonate](#)
- [Calcium chloride](#) – CaCl₂
- [Calcium fluoride](#) – CaF₂
- [Calcium hydride](#)
- [Calcium hydroxide](#) – CaOH₂
- [Calcium sulfate](#) (redirect to [Gypsum](#))
- [Carbon dioxide](#) – CO₂
- [Carbonic acid](#)
- [Carbonyl fluoride](#)
- [Carboplatin](#)
- [Cerium\(III\) chloride](#)
- [Cerium\(IV\) sulfate](#)
- [Chromic acid](#)
- [Chromium\(III\) chloride](#)
- [Chromium\(II\) chloride](#)
- [Chromium\(III\) oxide](#)
- [Chromium\(IV\) oxide](#)
- [Chromium\(VI\) oxide](#) (redirect to [Chromic acid](#))
- [Cobalamin \(Vitamin B12\)](#)
- [Cobalt\(II\) chloride](#) – CoCl₂
- [Cobalt\(II\) carbonate](#) – CoCO₃
- [Copper\(II\) carbonate](#) – CuCO₃
- [Copper\(I\) chloride](#) – CuCl
- [Copper\(II\) chloride](#) – CuCl₂
- [Copper\(I\) oxide](#) – Cu₂O
- [Copper\(II\) oxide](#) – CuO
- [Copper\(II\) sulfate](#) – CuSO₄
- [Copper\(I\) sulfide](#) – Cu₂S
- [Copper\(II\) sulfide](#) – CuS

- [Cyanogen](#)
- [Cyanogen chloride](#)
- [Cyanuric chloride](#)

D

- [Decaborane](#) (redirect to [Diborane](#))
- [Diborane](#)
- [Dichlorosilane](#)
- [Dimethylmercury](#)
- [Disilane](#)
- [Dysprosium\(III\) chloride](#)

E

- [Europium\(III\) chloride](#)

G

- [Gadolinium\(III\) chloride](#)
- [Gallium arsenide](#) – [GaAs](#)
- [Gallium\(III\) chloride](#)
- [Germanium tetrahydride](#)
- [Gold\(III\) chloride](#)

H

- [Hexafluorotitanic acid](#)
- [Hydrazine](#) – N_2H_4
- [Hydrazoic acid](#)
- [Hydrobromic acid](#) – HBr
- [Hydrochloric acid](#) – HCl
- [Hydroiodic acid](#) – HI
- [Hydrogen bromide](#) – HBr
- [Hydrogen chloride](#) – HCl
- [Hydrogen fluoride](#) – HF
- [Hydrogen peroxide](#) – H_2O_2
- [Hypochlorous acid](#)
- [Hypophosphorous acid](#)

I

- [Indium\(I\) chloride](#)
- [Indium phosphide](#)

- [Iodic acid](#)
- [Iodine monochloride](#)
- [Iridium\(IV\) chloride](#)
- [Iron\(III\) chloride](#) – FeCl_3
- [Iron\(II\) oxide](#) – FeO
- [Iron\(II,III\) oxide](#) – Fe_3O_4
- [Iron\(III\) oxide](#) – Fe_2O_3
- [Iron-sulfur cluster](#)
- [Iron\(III\) thiocyanate](#)

J

K

- [Potassium hydroxide](#) – KOH

L

- [Lanthanum carbonate](#)
- [Lead\(IV\) acetate](#)
- [Lead\(II\) chloride](#)
- [Lead\(II\) iodide](#)
- [Lead\(II\) nitrate](#)
- [Lead\(II\) oxide](#)
- [Lead\(IV\) oxide](#)
- [Lithium aluminium hydride](#)
- [Lithium bromide](#)
- [Lithium carbonate](#) (redirect to [Lithium salt](#))
- [Lithium chloride](#)
- [Lithium citrate](#) (redirect to [Lithium salt](#))
- [Lithium diisopropylamide](#)
- [Lithium hydride](#)
- [Lithium hydroxide](#)
- [Lithium nitrate](#)
- [Lithium sulfate](#)
- M
- [Magnesium carbonate](#)
- [Magnesium chloride](#)
- [Magnesium oxide](#)
- [Magnesium phosphate](#) – $\text{Mg}_3(\text{PO}_4)_2$
- [Magnesium sulfate](#)
- [Manganese\(IV\) oxide](#) – MnO_2 , manganese dioxide
- [Manganese\(II\) acetate](#)
- [Manganese\(II\) chloride](#)

- [Manganese\(IV\) fluoride](#)
- [Manganese\(II\) phosphate](#)
- [Mercury\(I\) chloride](#)
- [Mercury\(II\) chloride](#)
- [Mercury fulminate](#)
- [Mercury\(II\) sulfide](#)
- [Metaphosphoric acid](#)
- [Methylmercury](#)
- [Methylmercury hydroxide](#)
- [Molybdate orange](#)
- [Molybdenum trioxide](#)
- [Molybdenum disulfide](#) – MoS_2
- [Molybdenum hexacarbonyl](#)
- [Molybdic acid](#)
- N
- [n-butyllithium](#) (redirect to [Organolithium reagent](#))
- [Neodymium\(III\) chloride](#)
- [Nessler's reagent](#)
- [Nickel\(II\) hydroxide](#)
- [Nickelocene](#)
- [Nickel\(II\) nitrate](#)
- [Niobium pentachloride](#)
- [Nitric acid](#)
- [Nitric oxide](#)
- [Nitrogen dioxide](#)
- [Nitrosylsulphuric acid](#)
- [Nitrous oxide](#)]

O

- [Orthophosphoric acid](#)
- [Osmium tetroxide](#) – OsO_4 , osmium(VIII) oxide
- [Oxybis\(tributyltin\)](#)
- [Oxygen difluoride](#)
- [Ozone](#) – O_3

P

- [Palladium\(II\) nitrate](#)
- [Pentaborane](#)
- [Pentasulfide antimony](#)
- [Perchloric acid](#) – HClO_4
- [Perchloryl fluoride](#)
- [Phenylarsine oxide](#)

- [Phenyllithium](#)
- [Phenylmercuric acetate](#)
- [Phenylphosphine](#)
- [Phosgene](#)
- [Phosphine](#) – PH_3
- [Phosphomolybdic acid](#)
- [Phosphoric acid](#)
- [Phosphorus pentabromide](#)
- [Phosphorus pentafluoride](#)
- [Phosphorus tribromide](#)
- [Phosphorus trichloride](#)
- [Phosphorus trifluoride](#)
- [Phosphorus triiodide](#)
- [Phosphotungstic acid](#)
- [Platinum\(IV\) chloride](#)
- [Platinum\(II\) chloride](#)
- [Plutonium\(IV\) oxide](#)
- [Potash Alum](#)– $\text{K}_2\text{SO}_4 \cdot \text{Al}_2(\text{SO}_4)_3 \cdot 24\text{H}_2\text{O}$
- [Potassium bromide](#)
- [Potassium hydrogencarbonate](#)
- [Potassium carbonate](#)
- [Potassium chloride](#)
- [Potassium citrate](#)
- [Potassium hydroxide](#)
- [Potassium iodide](#)
- [Potassium monopersulfate](#) – $\text{K}_2\text{SO}_4 \cdot \text{KHSO}_4 \cdot 2\text{KHSO}_5$
- [Potassium nitrate](#), [KNO₃](#)
- [Potassium permanganate](#) – KMnO_4
- [Potassium sulfate](#)
- [Praseodymium\(III\) chloride](#)
- [Prussian blue](#) (Iron(III) hexacyanoferrate(II)) – [Fe₄\[Fe\(CN\)₆\]₃](#)

Q

R

- [Radium chloride](#)
- [Radon difluoride](#) – RnF_2
- [Rhodium\(III\) chloride](#)
- [Rubidium hydroxide](#)
- [Ruthenium\(VIII\) oxide](#)

S

- [Samarium\(II\) iodide](#)

- [Samarium\(III\) chloride](#)
- [Sec-butyllithium](#)
- [Selenium dioxide](#)
- [Silane](#) – SiH_4
- [Silica gel](#)
- [Silicic acid](#)
- [Silicochloroform](#)
- [Silicofluoric acid](#)
- [Silicon dioxide](#)
- [Silver chloride](#)
- [Silver\(I\) fluoride](#) – AgF
- [Silver iodide](#)
- [Silver nitrate](#) – AgNO_3
- [Soda lime](#)
- [Sodium acetate](#)
- [Sodium bromide](#)
- [Sodium carbonate](#)
- [Sodium chloride](#) – NaCl
- [Sodium chlorate](#)
- [Sodium cyanide](#)
- [Sodium hydride](#)
- [Sodium hydrogen carbonate](#) (Sodium bicarbonate)
- [Sodium hydroxide](#)
- [Sodium iodide](#)
- [Sodium nitrate](#)
- [Sodium nitrite](#)
- [Sodium percarbonate](#) – $2\text{Na}_2\text{CO}_3 \cdot 3\text{H}_2\text{O}_2$
- *Sodium phosphate*; see [Trisodium phosphate](#) – Na_3PO_4
- [Sodium silicate](#)
- [Sodium sulfate](#)
- [Sodium sulfide](#)
- [Sodium sulfite](#)
- [Stannous chloride](#) (tin(II) chloride)
- [Stibine](#)
- [Strontium chloride](#)
- [Strontium nitrate](#)
- [Sulfamic acid](#)
- [Sulfane](#)
- [Sulfur dioxide](#) – SO_2
- [Sulfurated potash](#)
- [Sulfuric acid](#) – H_2SO_4
- [Sulfurous acid](#)
- [Sulfuryl chloride](#)

T

- [Tantalum carbide](#)
- [Tantalum\(V\) oxide](#)
- [Tellurium tetrachloride](#)
- [Terbium\(III\) chloride](#)
- [Tert-butyllithium](#)
- [Tetraborane\(10\)](#)
- [Tetrabutyltin](#)
- [Tetrachloroauric acid](#)
- [Tetraethyl lead](#)
- [Tetraethyl tin](#)
- [Tetrafluorohydrazine](#)
- [Tetramminecopper\(II\) sulfate](#)
- [Tetraphenyltin](#)
- [Thallium\(III\) sulfate](#)
- [Thallium\(I\) fluoride](#)
- [Thallium\(III\) oxide](#)
- [Thallium\(I\) carbonate](#)
- [Thionyl chloride](#)
- [Thiophosgene](#)
- [Thiophosphoryl chloride](#)
- [Thorium dioxide](#)
- [Thulium\(III\) chloride](#)
- [Tin\(II\) chloride](#)
- [Tin\(II\) fluoride](#)
- [Tin\(IV\) chloride](#)
- [Titanic acid](#) – $\text{Ti}(\text{OH})_4$
- [Titanium dioxide](#) – TiO_2 , titanium(IV) oxide
- [Titanium\(IV\) chloride](#)
- [Titanocene dichloride](#)
- [Triethylaluminium](#)
- [Trimethyltin chloride](#)
- [Triphenylantimony](#) (triphenylstibine)
- [Tripotassium phosphate](#)
- [Trisodium phosphate](#) – Na_3PO_4
- [Tungsten carbide](#) – WC
- [Tungstic acid](#)

U

- [Uranium hexafluoride](#) – UF_6
- [Uranyl zinc acetate](#)
- [Uranium Oxide\(Pitch Blende\)](#) – U_3O_8

V

- [Vanadium oxytrichloride](#)
- [Vanadyl sulfate](#)
- [Vanadium\(V\) oxide](#)

W

- [Water](#) – H₂O

X

- [Xenon difluoride](#)
- [Xenon hexafluoroplatinate](#)
- [Xenon tetrafluoride](#)
- [Xenon tetroxide](#)

Y

- [Ytterbium chloride](#)
- [Yttrium fluoride](#)

Z

- [Zinc chloride](#)
- [Zinc chromate hydroxide](#)
- [Zinc oxide](#)
- [Zirconium\(IV\) chloride](#)
- [Zirconium\(IV\) oxide](#)
- [Zirconocene dichloride](#)