

Inorganic Chemical Nomenclature

Inorganic compounds constitute a large and important class of chemical substances used extensively in laboratories, industries, agriculture, medicine, and environmental applications. Unlike organic compounds, which primarily contain carbon and hydrogen, inorganic compounds include acids, bases, salts, oxides, metals, minerals, and coordination compounds. Since thousands of inorganic compounds are known, a systematic method of naming them is necessary to avoid confusion and ensure uniformity in scientific communication.

The **International Union of Pure and Applied Chemistry (IUPAC)** has established internationally accepted rules for naming inorganic compounds. These rules provide each compound with a unique name based on its chemical composition, oxidation state, and type of bonding. The systematic naming of inorganic compounds enables chemists to identify a substance accurately without ambiguity.

General Rules for Naming Inorganic Compounds

Although different classes of inorganic compounds follow specific naming rules, the following general principles are commonly applied:

- The name of the positive ion (cation) is written first, followed by the negative ion (anion).
- Simple metallic ions retain the name of the element.
- Monatomic negative ions usually end with the suffix **-ide**.
- Polyatomic ions retain their accepted names, such as sulfate, nitrate, carbonate, and phosphate.
- If a metal exhibits more than one oxidation state, its oxidation number is written in Roman numerals within parentheses.

1. Nomenclature of Binary Compounds

Binary compounds consist of only two different elements. They are generally classified as ionic or covalent compounds depending on the nature of bonding.

(a) Binary Ionic Compounds

Binary ionic compounds are formed by the combination of a metal and a non-metal. The metal forms a positive ion, while the non-metal forms a negative ion. The name of the cation is written first, followed by the name of the anion ending with the suffix **-ide**.

Formula	IUPAC Name
NaCl	Sodium chloride
MgO	Magnesium oxide
CaS	Calcium sulfide

Formula	IUPAC Name
AlN	Aluminium nitride

(b) Binary Covalent Compounds

Binary covalent compounds are formed between two non-metals. Numerical prefixes are used to indicate the number of atoms present in the compound.

Prefix	Number of Atoms
Mono-	1
Di-	2
Tri-	3
Tetra-	4
Penta-	5
Hexa-	6

Examples

Formula	IUPAC Name
CO	Carbon monoxide
CO ₂	Carbon dioxide
N ₂ O ₅	Dinitrogen pentoxide
SF ₆	Sulfur hexafluoride

2. Nomenclature of Acids

Acids are compounds that produce hydrogen ions (H⁺) when dissolved in water. The naming of acids depends on whether they contain oxygen.

Hydroacids (Without Oxygen)

Formula	Name
HCl	Hydrochloric acid
HBr	Hydrobromic acid
HI	Hydroiodic acid

Oxyacids (Containing Oxygen)

Formula	Name
H ₂ SO ₄	Sulfuric acid
HNO ₃	Nitric acid
H ₃ PO ₄	Phosphoric acid
H ₂ CO ₃	Carbonic acid

3. Nomenclature of Bases

Bases usually consist of a metal ion combined with one or more hydroxide (OH⁻) ions. They are named by writing the name of the metal followed by the word **hydroxide**.

Formula	Name
NaOH	Sodium hydroxide
KOH	Potassium hydroxide
Ca(OH) ₂	Calcium hydroxide
Al(OH) ₃	Aluminium hydroxide

4. Nomenclature of Salts

Salts are ionic compounds produced by the reaction between an acid and a base. The cation is named first, followed by the name of the anion.

Formula	Name
Na ₂ SO ₄	Sodium sulfate
KNO ₃	Potassium nitrate
CaCO ₃	Calcium carbonate
NH ₄ Cl	Ammonium chloride

5. Compounds Containing Metals with Variable Oxidation States

Certain metals, particularly transition metals, can exhibit more than one oxidation state. In such cases, the oxidation number is written in Roman numerals after the metal name.

Formula	IUPAC Name
FeCl ₂	Iron(II) chloride
FeCl ₃	Iron(III) chloride
Cu ₂ O	Copper(I) oxide
CuO	Copper(II) oxide

Note:

The Roman numeral indicates the oxidation state of the metal ion only. It is not used for metals that possess a single common oxidation state, such as sodium, calcium, magnesium, or aluminium.

Importance of Inorganic Nomenclature

- Provides a unique and internationally accepted name for every inorganic compound.
- Avoids confusion arising from common or local names.
- Indicates the composition and oxidation state of compounds.
- Facilitates communication among scientists, industries, and regulatory agencies.
- Ensures proper labeling, storage, transportation, and safe handling of chemicals.
- Supports industrial production, quality control, and scientific research.

The IUPAC system is widely accepted in scientific literature and industrial documentation. However, in everyday life and commercial practice, many chemicals are still known by common, generic, or trade names. Therefore, the next section explains the differences between **common names**, **generic names**, and **trade names**, along with their significance in chemical industries.