Thursday, September 11, 2025 AP Chemistry

Chemical Nomenclature Essentials

Elements

Substances made of only one kind of atom.

For most elements the symbol is simply the atomic symbol

C carbon

Pb lead

Na sodium

Some elements are molecular

H_2 N_2 O_2 F_2 Cl_2 Br_2 I_2 [P_4 S_8]

Know these

Molecular Compounds

We'll only learn to name binary compounds $X_n Y_m$ of non-metals

Stop Th 2025-09-11 Group 1

Naming pattern:

[Numerical prefix][element name] [Numerical prefix][element name][-ide]

↑ Mono- is not used for the first element

1 mono
2 di
3 tri
4 tetra
5 penta
6 hexa
7 hepta
8 octa
9 nona
10 deca

final "a" or "o" is dropped for oxygen and oxide for ex tetroxide

SPELLING ANOMALIES

N NITRIDE
O OXIDE
P PHOSPHIDE
S SULFIDE

ONLY NON-METALS FORM BINARY MOLECULAR COMPOUNDS

H

C N O F
P S Cl
As Se Br Kr
Sb Te I Xe

COMPOUNDS WITH COMMON NAMES TO KNOW

H_2O — DIHYDROGEN MONOXIDE

NH_3 — AMMONIA ~~PNEUMONIA~~

CH_4 — METHANE

IONIC COMPOUNDS

WE'LL NAME COMPOUNDS OF TWO IONS

(POSITIVE ION) + (NEGATIVE ION)

GENERALLY METAL + NON-METAL

COMBINATIONS MUST BE NEUTRAL BASED ON CHARGES.

CATION (+)	ANION (−)
- USUALLY A METAL	- NON-METAL, MONATOMIC OR
- USUALLY MONATOMIC	- POLYATOMIC

NAMING PATTERN:

[NAME OF CATION] [NAME OF ANION]

NO PREFIXES

YOU NEED TO KNOW YOUR IONS.

W2025-09-17
AP CHEM

NAMING IONS

I. CATIONS

A. MONATOMIC CATIONS

1. METALS WITH ONLY ONE ION CHARGE
2. METALS WITH TWO OR MORE ION CHARGES

B. POLYATOMIC CATIONS

1. ONLY ONE CHARGE

THESE ARE ORGANIZED BY GROUP

GROUP	1	2	3	11	12	13
CHARGE	+1	+2	+3	+1	+2	+3

NAME OF ION = NAME OF ELEMENT

WITH SOME EXCEPTIONS

ANY ELEMENT WITH ONLY ONE ION CHARGE DOES NOT USE ROMAN NUMERALS IN ITS NAME.

2. MORE THAN ONE POSSIBLE CHARGE

GROUPS 4-12 AND ALSO $_{50}Sn$ TIN

$_{81}Tl$ THALLIUM $_{82}Pb$ LEAD $_{83}Bi$ BISMUTH

THESE IONS' NAMES INCLUDE THEIR CHARGE

$Fe \nearrow Fe^{2+}$ IRON (II) ION (FERROUS)	Cu^{+1} COPPER (I) (CUPROUS)
$Fe \rightarrow Fe^{3+}$ IRON (III) ION (FERRIC)	Cu^{+2} COPPER (II) (CUPRIC)

WE DON'T USE ROMAN NUMERALS IN NAMES OF METALS IONS WITH ONLY ONE POSSIBLE CHARGE

Zn^{2+} ZINC ION AND GROUPS 1, 2, 3, & 13

Ag^{+} SILVER ION

Al^{3+} ALUMINUM

IDENTIFYING IONS:

NAMES MUST INCLUDE CHARGE IF THE ELEMENT CAN HAVE MORE THAN ONE

IRON (II) OXIDE $Fe^{2+}\ O^{-2}$ FeO

IRON (III) OXIDE $Fe^{3+}\ O^{-2}$ Fe_2O_3

FORMULAS IMPLY CHARGES BASED ON HOW IONS BALANCE CHARGES SO YOU CAN WORK BACKWARDS FROM THE CHARGE OF THE ANION.

CrO SO... $Cr^{+2}\ O^{-2}$ CHROMIUM (II) OXIDE

Cr_2O_3 Cr^{3+} ($2x = +6$) O^{2-} ($\times 3 = -6$) CHROMIUM (III) OXIDE

YOU TRY $SnCl_2$ $Sn^{+2}\ 2Cl^{-}$ TIN (II) CHLORIDE

$SnCl_4$ $Sn^{4+}\ 4Cl^{-}$ TIN (IV) CHLORIDE

ALWAYS Cl^{-1}

B. POLYATOMIC CATIONS

TWO TO KNOW: ✱ NH_4^{+} AMMONIUM ION, NOT AMMONIA NH_3

Hg_2^{2+} MERCURY (I) ION

NOT Hg^{2+} MERCURY (II)

$Hg^{+}—Hg^{+}$ COVALENT BOND

W 2025-09-17 APCHEM

II. Anions

A. Monatomic anions of non-metals
B. Polyatomic anions

A. Monatomic Anions

The complete list

Groups: 15	16	17
N^{3-}	O^{2-}	F^-
Nitride	Oxide	Fluoride
P^{3-}	S^{2-}	Cl^-
Phosphide	Sulfide	Chloride
As^{3-}	Se^{2-}	Br^-
Arsenide	Selenide	Bromide
	Te^{2-}	I^-
	Telluride	Iodide

Also H^-
Hydride
(forms compounds with metal ions)

[H^+, or hydrogen ion, is what makes acids acidic]

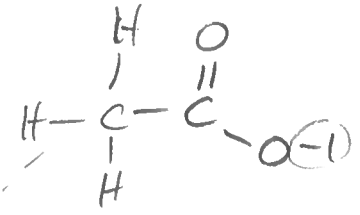
B. Polyatomic Anions

1. Unsystematic names
2. Semi-systematic names

1. Unsystematic names

Memorize individually

CN^- Cyanide
OH^- Hydroxide
SCN^- Thiocyanate
CH_3COO^- Acetate ($C_2H_3O_2^-$, $CH_3CO_2^-$)



$C_2O_4^{2-}$
Oxalate

2. Semi-systematic Names

Oxyanions: molecular ions with a central atom bonded to one or more oxygen atoms.
We'll learn oxyanions of non-metals.

Fig. 2.23 pg 65

-ate ions

	Group 13	14	15	16	17
Period 2	BO_3^{3-} Borate	CO_3^{2-} Carbonate	NO_3^- Nitrate	X	X
Period 3	—	SiO_4^{4-} Silicate	PO_4^{3-} Phosphate	SO_4^{2-} Sulfate	ClO_4^- Perchlorate

Period 2: -ate has 3 oxygens (-3, -2, -1)
Period 3: -ate has 4 oxygens (-4, -3, -2, -1)

Some related oxyanions have one less oxygen atom and an **-ite** suffix (same charge)

NO_3^- nitrate NO_2^- nitrite
PO_4^{3-} phosphate PO_3^{3-} phosphite
SO_4^{2-} sulfate SO_3^{2-} sulfite

Not
nitride N^{-3}
phosphide P^{-3}
sulfide S^{-2}

Oxyanions of the halogens
Cl Br I
(not F)

X = Cl, Br, or I (chlor, brom, iod)

XO^-	hypo-___-ite	ClO^- hypochlorite
XO_2^-	___-ite	ClO_2^- chlorite
XO_3^-	___-ate	ClO_3^- chlorate
XO_4^-	per-___-ate	ClO_4^- perchlorate

W 2025-09-17 AP CHEM

III Acids

A. Binary Acids
B. Oxyacids

An acid is a compound of hydrogen ion (H^+) and an anion. These molecular compounds dissolve in water and separate into these ions in solution, as if they were ionic.

pH measures the "power of hydrogen"

If pH = 1 it means conc. of H^+ is $\frac{0.1\ mol}{1\ L}$

$0.1 = 1 \times 10^{-1}$ ↑ power

TMI (sorry)

A. Binary Acids

H^+ plus a monatomic anion

Names: Hydro-_____-ic acid

HF Hydrofluoric acid
* HCl Hydrochloric acid ($\neq HClO_3$ chloric acid)
HBr Hydrobromic acid
HI Hydroiodic acid

[H_2S Hydrogen sulfide "hydrosulfuric acid" is confusing b/c H_2SO_4 is sulfuric acid]

* most common lab acid

B. OXYACIDS

H^+ PLUS AN OXYANION

NAMES: -ATE BECOMES -IC ACID
-ITE BECOMES -OUS ACID

FOR EX.

	OXYANION	DERIVED ACIDS	
-ATE	NO_3^- NITRATE	HNO_3	NITRIC ACID ★ (COMMON LAB ACIDS)
	SO_4^{2-} SULFATE	H_2SO_4	SULFURIC ACID ★
	ClO_3^- CHLORATE	$HClO_3$	CHLORIC ACID (NOT HCl)
-ITE	NO_2^- NITRITE	HNO_2	NITROUS ACID
	ClO^- HYPOCHLORITE	$HClO$	HYPOCHLOROUS ACID

ACETATE ION CH_3COO^-

ACETIC ACID HCH_3COO OR CH_3COOH
(THE ACTIVE INGREDIENT IN VINEGAR)

SOME POLYATOMIC IONS ARE DERIVED FROM ACIDS AND LOOK LIKE ACIDS

H_2SO_4 → HSO_4^- → SO_4^{2-}
SULFURIC ACID — HYDROGEN SULFATE — SULFATE

H_3PO_4 → $H_2PO_4^-$ → HPO_4^{2-} → PO_4^{3-}
PHOSPHORIC ACID — DIHYDROGEN PHOSPHATE — HYDROGEN PHOSPHATE — PHOSPHATE

SEE ALSO HCO_3^- AND HSO_3^-