



# Inorganic Chemical Formulation

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# Oxides: Combination of an element with an oxide $O^{2-}$ anion

- ✓ To formulate: write the symbol of the element +  $O^{2-}$  and interchange o.n. as subscripts.
- ✓ To name: just the name of the element (indicating in Roman numeral o.n if more than one) followed by oxide

Eg: Aluminium oxide       $Al_2O_3$   
(systematic: dialuminium trioxide)

# Oxides

1. Barium oxide
  - BaO
2. Sodium oxide
  - Na<sub>2</sub>O
3. Gold(I) oxide
  - Au<sub>2</sub>O
4. Silver oxide
  - Ag<sub>2</sub>O
5. Aluminium oxide
  - Al<sub>2</sub>O<sub>3</sub>
6. Ni<sub>2</sub>O<sub>3</sub>
  - Nickel(III) oxide
7. Cl<sub>2</sub>O<sub>7</sub>
  - Chlorine(VII) oxide
8. N<sub>2</sub>O<sub>5</sub>
  - Nitrogen(V) oxide
9. Fe<sub>2</sub>O<sub>3</sub>
  - Iron(III) oxide
10. SrO
  - Strontium oxide

# Hydroxides:

Combination of a metal with a hydroxide ion  $\text{OH}^-$

- ✓ To formulate: write the symbol of the metal +  $\text{OH}^-$  and interchange o.n. as subscripts.
- ✓ To name: just the name of the element (indicating in Roman numeral o.n if more than one) followed by hydroxide.

Eg: Iron(III) hydroxide       $\text{Fe}(\text{OH})_3$   
(systematic: Iron trihydroxide)

# Hydroxides

1. Calcium hydroxide

2. Iron(III) hydroxide

3. Tin(IV) hydroxide

4. Lead(II) hydroxide

5. Cadmium hydroxide

6.  $\text{Ni(OH)}_2$

7.  $\text{Pb(OH)}_4$

8.  $\text{Mg(OH)}_2$

9.  $\text{Co(OH)}_3$

10.  $\text{CuOH}$

1.  $\text{Ca(OH)}_2$

2.  $\text{Fe(OH)}_3$

3.  $\text{Sn(OH)}_4$

4.  $\text{Pb(OH)}_2$

5.  $\text{Cd(OH)}_2$

6. Nickel(II) hydroxide

7. Lead(IV) hydroxide

8. Magnesium hydroxide

9. Cobalt(III) hydroxide

10. Copper(I) hydroxide

# Acids

- These compounds **have a hydrogen (H) first in the formula.**
- Two types:
  - Hydracids (binary acids)
  - Oxyacids (ternary acids)

# Hydracids

- Binary compounds → only two elements
- (exception to the rule: Hydrocyanic acid HCN)
- **Combination of  $H^+$  with “-ide” anions.**
  - $F^-$  : Fluoride                       $CN^-$  : Cyanide
  - $Cl^-$  : Chloride                       $S^{2-}$  : Sulfide
  - $Br^-$  : Bromide
  - $I^-$  : Iodide
- Turn into hydro- - ic acids.

# Hydracids

When combined with  $H^+$

- $F^-$  : Fluoride  $\longrightarrow$  HF: Hydrofluoric acid
- $Cl^-$  : Chloride  $\longrightarrow$  HCl: Hydrochloric acid
- $Br^-$  : Bromide  $\longrightarrow$  HBr: Hydrobromic acid
- $I^-$  : Iodide  $\longrightarrow$  HI: Hydriodic acid
- $CN^-$  : Cyanide  $\longrightarrow$  HCN : Hydrocyanic acid
- $S^{2-}$  : Sulfide  $\longrightarrow$   $H_2S$ : Hydrosulfuric acid



# Oxyacids

- Ternary compounds → three elements
- Contain Oxygen
- Combination of  $H^+$  with “-ite” or “-ate” anions such as,
  - $NO_2^-$  : Nitrite                       $PO_4^{3-}$  : Phosphate
  - $NO_3^-$  : Nitrate                       $CO_3^{2-}$  : Carbonate
- “-ite” → “-ous” acids.
- “-ate” → “-ic” acids.

# Oxyacids

To name them:

**Only use the common nomenclature.**

**Never use the systematic.**

# Oxyacids

When combined with  $H^+$

$NO_2^-$ : Nitrite  $\longrightarrow$   $HNO_2$ : Nitrous acid

$NO_3^-$ : Nitrate  $\longrightarrow$   $HNO_3$ : Nitric acid

$PO_4^{3-}$ : Phosphate  $\longrightarrow$   $H_3PO_4$ : Phosphoric acid

$ClO^-$ : hypochlorite  $\longrightarrow$   $HClO$ : hypochlorous acid

$ClO_2^-$ : Chlorite  $\longrightarrow$   $HClO_2$ : Chlorous acid

$ClO_3^-$ : Chlorate  $\longrightarrow$   $HClO_3$ : Chloric acid

$ClO_4^-$ : Perchlorate  $\longrightarrow$   $HClO_4$ : Perchloric acid

1. Nitric acid
2. Carbonic acid
3. (Ortho)phosphoric acid
4. Hydrochloric acid
5. Perchloric acid
6. HI
7.  $\text{H}_2\text{SO}_3$
8.  $\text{H}_2\text{SO}_4$
9.  $\text{H}_2\text{CrO}_4$
10. HF

1.  $\text{HNO}_3$
2.  $\text{H}_2\text{CO}_3$
3.  $\text{H}_3\text{PO}_4$
4. HCl
5.  $\text{HClO}_4$
6. Hydriodic acid
7. Sulfurous acid
8. Sulfuric acid
9. Chromic acid
10. Hydrofluoric acid

# Salts

- Two types:
  - binary salts: Combination of a metal cation and a simple nonmetal anion. (Eg. NaCl)
  - ternary salts: Combination of a metal cation and an oxygen containing anion. (Eg. CaCO<sub>3</sub>)

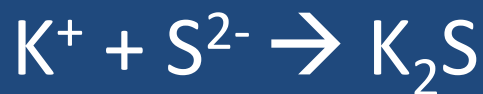
# Binary Salts

✓ To formulate:

write the symbol of the metal + the symbol of the anion and interchange o.n. as subscripts.

• Eg.

Potassium sulfide:



# Binary salts

- ✓ To name: just the name of the metal (indicating in Roman numeral o.n if more than one), followed by the name of the anion.

## Common

NaCl: sodium chloride

FeS: iron(II) sulfide

## Systematic

(sodium chloride)

(iron monosulfide)

# Ternary Salts

✓ To formulate:

write the symbol of the metal + the symbol of the anion and interchange o.n. as subscripts.

• Eg.

Calcium carbonate:





# Ternary Salts

Only use the common nomenclature.

Never use the systematic.

- ✓ Name of the metal cation (indicating in Roman numeral o.n if more than one), followed by the name of the anion.
- $\text{FeSO}_4$  : Iron(II) sulfate
- $\text{Zn}(\text{ClO})_2$  : Zinc hypochlorite

1. Sodium perchlorate
2. Aluminium sulfate
3. Potassium hypoiodite
4. Calcium (ortho)phosphate
5. Iron(II) sulfite
6.  $\text{Sn}(\text{ClO}_3)_4$
7.  $\text{Pb}(\text{SO}_3)_2$
8.  $\text{LiNO}_2$
9.  $\text{Na}_2\text{CO}_3$
10.  $\text{Zn}(\text{NO}_3)_2$

1.  $\text{NaClO}_4$
2.  $\text{Al}_2(\text{SO}_4)_3$
3.  $\text{KIO}$
4.  $\text{Ca}_3(\text{PO}_4)_2$
5.  $\text{FeSO}_3$
6. Tin(IV) chlorate
7. Lead(IV) sulfite
8. Lithium nitrite
9. Sodium carbonate
10. Zinc nitrate

1. Copper(I) iodide

2. Methane

3. Iron(III) sulfide

4. Sodium chloride

5. Potassium bromide

6.  $\text{NH}_3$

7.  $\text{SnS}_2$

8.  $\text{CoF}_2$

9.  $\text{FeBr}_3$

10.  $\text{CdCl}_2$

1.  $\text{CuI}$

2.  $\text{CH}_4$

3.  $\text{Fe}_2\text{S}_3$

4.  $\text{NaCl}$

5.  $\text{KBr}$

6. Ammonia

7. Tin(II) sulfide

8. Cobalt(II) fluoride

9. Iron(III) bromide

10. Cadmium chloride

# Hydrides

- Two types:

➤ Metal hydrides: metal cation + hydride ( $\text{H}^-$ )

To formulate them:

Symbol of metal cation +  $\text{H}^-$  and interchange o.n. as subscripts

e.g. Lithium hydride



# Metal Hydrides

- To name: just the name of the metal (indicating in Roman numeral o.n if more than one) followed by hydride.

LiH: Lithium hydride

(systematic: lithium hydride)

PdH<sub>2</sub>: Palladium hydride

(systematic: Palladium dihydride)

# Nonmetal Hydrides

- You **only have to know 4** of them and they are named with their trivial name.
  - $B_2H_6$ : diborane
  - $CH_4$ : methane
  - $NH_3$ : ammonia
  - $H_2O$ : water