

# Polyatomic Ions

A polyatomic ion

- is a group of atoms.
- has an overall ionic charge.

Examples:



ammonium



hydroxide



sulfate



carbonate



phosphate

# Names and Formulas of Common Polyatomic Ions

TABLE 5.7 Names and Formulas of Some Common Polyatomic Ions

Nonmetal	Formula of Ion*	Name of Ion
Hydrogen	$\text{OH}^-$	Hydroxide
Nitrogen	$\text{NH}_4^+$	Ammonium
	<b><math>\text{NO}_3^-</math></b>	<b>Nitrate</b>
Chlorine	$\text{NO}_2^-$	Nitrite
	$\text{ClO}_4^-$	Perchlorate
	<b><math>\text{ClO}_3^-</math></b>	<b>Chlorate</b>
	$\text{ClO}_2^-$	Chlorite
Carbon	$\text{ClO}^-$	Hypochlorite
	<b><math>\text{CO}_3^{2-}</math></b>	<b>Carbonate</b>
	$\text{HCO}_3^-$	Hydrogen carbonate (or bicarbonate)
Sulfur	$\text{CN}^-$	Cyanide
	$\text{H}_2\text{C}_3\text{O}_2^-$	Acetate
	<b><math>\text{SO}_4^{2-}</math></b>	<b>Sulfate</b>
	$\text{HSO}_4^-$	Hydrogen sulfate (or bisulfate)
	$\text{SO}_3^{2-}$	Sulfite
	$\text{HSO}_3^-$	Hydrogen sulfite (or bisulfite)
	<b><math>\text{PO}_4^{3-}</math></b>	<b>Phosphate</b>
Phosphorus	$\text{HPO}_4^{2-}$	Hydrogen phosphate
	$\text{H}_2\text{PO}_4^-$	Dihydrogen phosphate
	$\text{PO}_3^{3-}$	Phosphite

\*Formulas and names in bold show the most common polyatomic ion for that element.

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# Compounds Containing Polyatomic Ions

Polyatomic ions

- must be associated with an ion of opposite charge.
- form ionic bonds with ions of opposite charge to achieve charge balance.

Example:



calcium nitrate ion

$$\text{charge balance: } (2+) + 2(1-) = 0$$



calcium nitrate

# Name $K_2SO_4$

**Step 1 Identify the cation and polyatomic ion (anion).**

Cation:  $K^+$  Anion:  $SO_4^{2-}$

**Step 2 Name the cation, using a Roman numeral if needed.**

$K^+$  = potassium ion

**Step 3 Name the polyatomic ion.**

$SO_4^{2-}$  = sulfate ion

**Step 4 Write the name or the compound, cation first and the polyatomic ion second.**

$K_2SO_4$  = potassium sulfate

# Learning Check

Name each of the following compounds.



# Solution

**Step 1 Identify the cation and polyatomic ion (anion).**

	<b>cation</b>	<b>polyatomic ion</b>
1. $\text{Cu}(\text{ClO}_3)_2$	$\text{Cu}^{2+}$	$\text{ClO}_3^-$
2. $\text{PbCO}_3$	$\text{Pb}^{2+}$	$\text{CO}_3^{2-}$
3. $\text{Ba}_3(\text{PO}_3)_2$	$\text{Ba}^{2+}$	$\text{PO}_3^{3-}$

**Step 2 Name the cation using a Roman numeral, if necessary.**

	<b>cation name</b>
1. $\text{Cu}(\text{ClO}_3)_2$	copper(II)
2. $\text{PbCO}_3$	lead(II)
3. $\text{Ba}_3(\text{PO}_3)_2$	barium

# Solution

**Step 3 Name the polyatomic ion.**

**polyatomic ion**

1.  $\text{Cu}(\text{ClO}_3)_2$
2.  $\text{PbCO}_3$
3.  $\text{Ba}_3(\text{PO}_4)_2$

chlorate

carbonate

phosphate

**Step 4 Write the name or the compound, cation first and the polyatomic ion second.**

**compound name**

1.  $\text{Cu}(\text{ClO}_3)_2$
2.  $\text{PbCO}_3$
3.  $\text{Ba}_3(\text{PO}_3)_2$

copper(II) chlorate

lead(II) carbonate

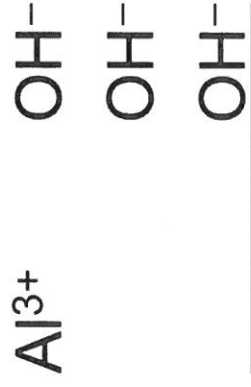
barium phosphite

# Write the Formula for Aluminium Hydroxide

Step 1 Identify the cation and polyatomic ion (anion).



Step 2 Balance the charges.



$$\text{charge balance: } 1(3+) + 3(1-) = 0$$

Step 3 Write the formula, cation first, using the subscripts from charge balance.

