

Nomenclature for polyatomic ions

Worksheet-Answer Key

Polyatomic ions

Polyatomic ions are charged groups of atoms. An example is ammonium ion, NH_4^+ . It has five atoms (one nitrogen and four hydrogens) that share a charge of +1. The polyatomic ions remain intact, and parentheses may be required when using subscripts. For example, ammonium chloride is NH_4Cl and ammonium sulfide is $(\text{NH}_4)_2\text{S}$. Ammonium is the only polyatomic cation. Common anions are shown in Table 1.

Table 1. Polyatomic ions

Ion Name	Ion Formula
ammonium	NH_4^+
cyanide	CN^-
hydroxide	OH^-
perchlorate	ClO_4^-
chlorate	ClO_3^-
chlorite	ClO_2^-
hypochlorite	ClO^-
bromate	BrO_3^-
iodate	IO_3^-
nitrate	NO_3^-
sulfate	SO_4^{2-}
carbonate	CO_3^{2-}
hydrogen carbonate (bicarbonate)	HCO_3^-
phosphate	PO_4^{3-}
hydrogen phosphate	HPO_4^{2-}
dihydrogen phosphate	H_2PO_4^-
chromate	CrO_4^{2-}
acetate	CH_3COO^-

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There are many polyatomic anions. Many occur in **families of names**. **Start by learning the polyatomic ions ending with “-ate”** such as chlorate (ClO_3^-), nitrate (NO_3^{2-}), sulfate (SO_4^{2-}), carbonate (CO_3^{2-}), and phosphate (PO_4^{3-}).

The corresponding “-ite” ion name has one less oxygen and the same charge. For example, chlorite ion is ClO_2^- . Less commonly used names are the “per__-ate” and “hypo__-ite” forms to indicate different numbers of oxygen.

Key in on the chlorate family in Table 1 to construct names for other ions. For example, sulfite (not in the table) would be SO_3^{2-} , because it has the same charge and one less oxygen than sulfate (SO_4^{2-} in the table).

Sometimes “bi-“ indicates H^+ has attached. For example, bicarbonate (HCO_3^-) and carbonate (CO_3^{2-}).

Hydroxide, cyanide, permanganate, acetate, and chromate/dichromate are common polyatomics that do not occur in families.

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Exercise 1. Complete the table of neutral ionic compounds with the formulas and names for each cation-anion pair.

	SO_4^{2-}	NO_3^-	PO_4^{3-}	CO_3^{2-}	ClO_3^-	OH^-
Na^+	Na_2SO_4 sodium sulfate	NaNO_3 sodium nitrate	Na_3PO_4 sodium phosphate	Na_2CO_3 sodium carbonate	NaClO_3 sodium chlorate	NaOH sodium hydroxide
Al^{3+}	$\text{Al}_2(\text{SO}_4)_3$ aluminum sulfate	$\text{Al}(\text{NO}_3)_3$ aluminum nitrate	AlPO_4 aluminum phosphate	$\text{Al}_2(\text{CO}_3)_3$ aluminum carbonate	$\text{Al}(\text{ClO}_3)_3$ aluminum chlorate	$\text{Al}(\text{OH})_3$ aluminum hydroxide
Ba^{2+}	BaSO_4 barium sulfate	$\text{Ba}(\text{NO}_3)_2$ barium nitrate	$\text{Ba}_3(\text{PO}_4)_2$ barium phosphate	BaCO_3 barium carbonate	$\text{Ba}(\text{ClO}_3)_2$ barium chlorate	$\text{Ba}(\text{OH})_2$ barium hydroxide
NH_4^+	$(\text{NH}_4)_2\text{SO}_4$ ammonium sulfate	NH_4NO_3 ammonium nitrate	$(\text{NH}_4)_3\text{PO}_4$ ammonium phosphate	$(\text{NH}_4)_2\text{CO}_3$ ammonium carbonate	NH_4ClO_3 ammonium chlorate	NH_4OH ammonium hydroxide
Cu^+	Cu_2SO_4 copper (I) sulfate	CuNO_3 copper (I) nitrate	Cu_3PO_4 copper (I) phosphate	Cu_2CO_3 copper (I) carbonate	CuClO_3 copper (I) chlorate	CuOH copper (I) hydroxide

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Exercise 2. Provide the formula for each compound.

sodium sulfate



sodium bisulfate



sodium sulfite



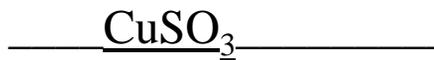
sodium sulfide



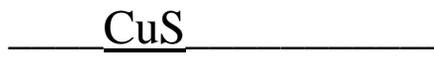
copper (I) sulfate



copper (II) sulfite



copper (II) sulfide

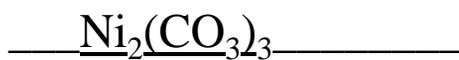


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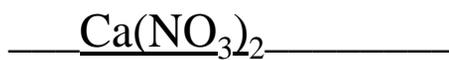
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Exercise 3. Provide the formula for each compound.

nickel (III) carbonate



calcium nitrate



copper (II) acetate



potassium phosphate



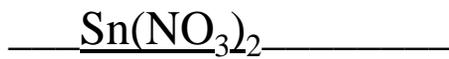
silver acetate



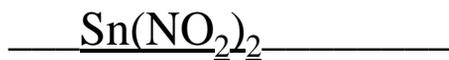
zinc chromate



tin (II) nitrate



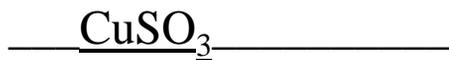
tin (II) nitrite



ammonium bicarbonate



copper (II) sulfite



sodium hydroxide



potassium cyanide



potassium phosphide



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Exercise 4. Provide the name for each compound.

CuCN copper (I) cyanide

FeO iron (II) oxide

ZnO zinc oxide

Al_2O_3 aluminum oxide

AgCl silver chloride

NH_4NO_3 ammonium nitrate

NaNO_3 sodium nitrate

NaNO_2 sodium nitrite

$\text{Ca}(\text{NO}_2)_2$ calcium nitrite

FeCrO_4 iron (II) chromate