Nomenclature for polyatomic ions
Worksheet

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 $(NH_4)_2S$. 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^+						
Al^{3+}						
Ba^{2+}						
NH_4^+						
Cu^+						

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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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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.

$CuCN$ _____

FeO _____

ZnO _____

Al_2O_3 _____

$AgCl$ _____

NH_4NO_3 _____

$NaNO_3$ _____

$NaNO_2$ _____

$Ca(NO_2)_2$ _____

$FeCrO_4$ _____