Naming Inorganic Acids

Acids are important hydrogen-containing molecular compounds, whose names follow special rules. For the moment, we can define an acid as a compound that in water can produce electrically equivalent numbers of hydrogen ions and anions; e.g.,

$$HCl \rightarrow H^+ + Cl^-$$
$$H_2SO_4 \rightarrow 2H^+ + SO_4^{2-}$$

In general, the formulas of inorganic acids have H written first, whereas hydrogen-containing inorganic compounds that are not acids do not have H written first.

Acids: HCl, HCN, HNO_3, H_2SO_4, H_3PO_4
Not acids: LiH, BeH_2, NH_3, PH_3

An **oxoacid** is an acid containing hydrogen, oxygen, and another element. The anion produced when an oxoacid dissolves in water is an **oxoanion**. The names of oxoacids follow the following rules:

1. If a central atom can form two different oxoanions, the one with more oxygen atoms is named with the *-ate* suffix, and the one with fewer oxygen atoms is named with the *-ite* suffix.

Anion	Name	Anion	Name
NO_3^-	nitr*ate* ion	NO_2^-	nitr*ite* ion
SO_4^{2-}	sulf*ate* ion	SO_3^{2-}	sulf*ite* ion

2. If the anion name ends in *-ate*, the corresponding acid name ends in *-ic*.

Anion	Name	Acid	Name
NO_3^-	nitr*ate* ion	HNO_3	nitr*ic* acid
SO_4^{2-}	sulf*ate* ion	H_2SO_4	sulfur*ic* acid

3. If the anion name ends in *-ite*, the corresponding acid name ends in *-ous*.

Anion	Name	Acid	Name
NO_2^-	nitr*ite* ion	HNO_2	nitr*ous* acid
SO_3^{2-}	sulf*ite* ion	H_2SO_3	sulfur*ous* acid

4. When a central atom can form three or four oxoacids, both the anions and the oxoacids are distinguished with the prefix *hypo-* and *per-* for the species with the fewest and most oxygen atoms, respectively.

Anion	Name	Acid	Name
ClO^-	*hypo*chlor*ite* ion	HClO	*hypo*chlor*ous* acid
ClO_2^-	chlor*ite* ion	$HClO_2$	chlor*ous* acid
ClO_3^-	chlor*ate* ion	$HClO_3$	chlor*ic* acid
ClO_4^-	*per*chlor*ate*	$HClO_4$	*per*chlor*ic* acid

Acid anions have H atoms that they can lose as H^+ in water. The names of these ions add *hydrogen* in front of the name of the corresponding ion that does not have H in it. If the acid anion has two or more hydrogen atoms capable to forming H^+, the appropriate Greek prefix is used to indicate the number. *Mono-* is omitted if only one acid anion is possible.

Acid Ion	Name
HCO_3^-	hydrogen carbonate ion
HSO_4^-	hydrogen sulfate ion
HPO_4^{2-}	monohydrogen phosphate ion
$H_2PO_4^-$	dihydrogen phosphate ion

Binary hydrogen compounds with nonmetals may form H^+ and an anion when dissolved in water. The acidic solutions are named as if they were molecular acids, using the usual name for the compound itself, replacing *hydrogen* with *hydro-* and the suffix *-ide* with *-ic* . The word *acid* is then added. The formula for such a compound in water is often distinguished from the compound itself by (*aq*), indicating water (aqueous) solution.

Compound	Name	Acid Solution	Name
HCl	hydrogen chloride	HCl(*aq*)	hydrochloric acid
HCN	hydrogen cyanide	HCN(*aq*)	hydrocyanic acid
H_2S	hydrogen sulfide	H_2S(*aq*)	hydrosulfuric acid

HCN, although not a binary compound, is analogous to the binary hydrogen halides (HCl, HBr, HI), and so as an acid is named in a similar manner. The name of H_2S(*aq*) as an acid is slightly irregular in using the full stem name of the element.