

Writing Names and Formulas for Bases and Acids

Bases

Bases are compounds that produce the polyatomic ion hydroxide, OH^- , when they dissolve in water. Rules for naming and writing formulas for bases are the same as the rules for all other ionic compounds. The term alkali is used to refer to a base that is soluble in water.

Acids

Acids are compounds that ionize in water releasing a hydrogen ion, H^+ . There are two types of acids: acids without oxygen and acids with oxygen.

Acids without Oxygen: Binary Acids

Most acids that do not contain oxygen are binary acids. They only contain hydrogen and one other element. An exception is hydrocyanic acid, $\text{HCN}_{(\text{aq})}$, which contains the polyatomic ion CN^- .

The general formula for binary acids is HX , where the H represents hydrogen, and the X represent any non-metal.

To name binary acids, drop the name hydrogen, add the prefix *hydro-* to the name of the second element and the suffix *-ic acid* to the end of the root name.

Example: hydrogen chloride, $\text{HCl}_{(\text{s})}$ becomes *hydrochloric acid*, $\text{HCl}_{(\text{aq})}$.

Acids with Oxygen: Oxyacids

Oxyacids, also known as oxoacids are acids that are composed of oxygen, hydrogen, and atoms of at least one other element that is usually a non-metal. Oxygen and the other element form a negative polyatomic ion. There are three rules for naming oxyacids.

1. For anions that end in *-ate*, the suffix of the acid is changed to *-ic*

Example: ClO_3^{-1} chlorate anion becomes $\text{HClO}_{3(\text{aq})}$ chloric acid

2. For anions that end in *-ite*, the suffix of the acid is *-ous*

Example: ClO_2^{-1} chlorite anion becomes $\text{HClO}_{2(\text{aq})}$ chlorous acid

3. The prefixed *hypo-* and *per-* remain as part of the acid name, just change the suffix appropriately.

Examples: ClO_4^{-1} perchlorate anion becomes $\text{HClO}_{4(\text{aq})}$ perchloric acid

ClO^{-1} hypochlorite anion becomes $\text{HClO}_{(\text{aq})}$ hypochlorous acid

Name of Ion	Name of Acid (dissolved in water)	Examples	
		Name of Ion	Name of Acid (dissolved in water)
<i>hypo(root)ite</i>	<i>hypo(root)ous acid</i>	Hypochlorite, ClO^-	Hypochlorous acid, $\text{HClO}_{(\text{aq})}$
<i>(root)ite</i>	<i>(root)ous acid</i>	Chlorite, ClO_2^-	Chlorous acid, $\text{HClO}_{2(\text{aq})}$
<i>(root)ate</i>	<i>(root)ic acid</i>	Chlorate, ClO_3^-	Chloric acid, $\text{HClO}_{3(\text{aq})}$
<i>per(root)ate</i>	<i>per(root)ic acid</i>	Perchlorate, ClO_4^-	Perchloric acid, $\text{HClO}_{4(\text{aq})}$

Naming Acids Exercise

Name each of the following compounds, as they would be called by themselves **AND** in the presence of water (as an acid).

Formula	Pure Substance Name	Acid Name
HF	Hydrogen fluoride	Hydrofluoric acid
HBr		
H ₂ S		
HI		
HNO ₃		
HNO ₂		
H ₂ SO ₄		
H ₂ SO ₃		
H ₂ SO ₂		
H ₂ CO ₃		
H ₃ PO ₄		
H ₃ PO ₃		
HClO ₃		
HClO ₂		
HClO ₄		
HIO ₄		
H ₂ CO ₂		
HC ₂ H ₃ O ₂		
HIO ₂		

Naming Bases Exercise: Complete the following table.

NaOH	
Ba(OH) ₂	
KOH	
Mg(OH) ₂	
NH ₄ OH	
	Lithium hydroxide
	Beryllium hydroxide
	Aluminum hydroxide
	Strontium hydroxide
	Calcium hydroxide

Writing Acid Formulas Exercise: Write the chemical formula of the following acids.

Hydrobromic acid	
Perchloric acid	
Iodic acid	
Carbonous acid	
Hydrocyanic acid	
Hydrosulfuric acid	
Sulphurous acid	
hydroiodic acid	
nitric acid	
sulfuric acid	
nitrous acid	
bromic acid	
phosphoric acid	
persulfuric acid	
hypophosphorous acid	
acetic acid	
phosphorous acid	
hypochlorous acid	
hydrochloric acid	

Nomenclature #4: Acids and Review

1. Name the following compounds. If they begin with hydrogen, name them as acids.

$\text{Sb}(\text{NO}_2)_3$	$\text{HIO}(\text{aq})$
$(\text{NH}_4)_2\text{CO}_3$	LiClO_4
$\text{HClO}_2(\text{aq})$	HCH_3COO
Au_3PO_3	Cu_3BO_3
$\text{HNO}_2(\text{aq})$	$\text{H}_3\text{PO}_3(\text{aq})$
MnO_2	$\text{Fe}(\text{OH})_3$
$\text{H}_2\text{SO}_3(\text{aq})$	HgO
$\text{HIO}_2(\text{aq})$	$\text{H}_2\text{CO}_3(\text{aq})$
$\text{H}_2\text{S}(\text{aq})$	$\text{HClO}_4(\text{aq})$
$\text{H}_3\text{PO}_4(\text{aq})$	ZnSO_2
$\text{H}_3\text{P}(\text{aq})$	$\text{Co}_2(\text{Cr}_2\text{O}_7)_3$
$\text{HCl}(\text{aq})$	$\text{HBrO}_2(\text{aq})$
Mg_3N_2	$\text{Sn}(\text{S}_2\text{O}_3)_2$
$\text{HIO}_4(\text{aq})$	$\text{P}(\text{SCN})_3$
$\text{H}_3\text{BO}_3(\text{aq})$	$\text{HF}(\text{aq})$

2. Write the chemical formulas for the following compounds. Remember, "hydro" means a binary acid.

nitric acid	hydrochloric acid
gold (III) thiocyanate	chromic acid
bromic acid	potassium selenide
phosphorous acid	cadmium borate
ammonium hydroxide	perbromic acid
chromium (III) chlorate	bismuth (V) phosphide
nickel (II) iodite	hydrobromic acid
hydrosulfuric acid	chlorous acid
carbonic acid	calcium hydroxide
iron (II) fluoride	lead (IV) cyanide
hypoiodous acid	acetic acid
arsenic (V) acetate	zinc carbonate
lead (II) oxalate	oxalic acid
periodic acid	antimony (III) silicate
cesium carbide	ammonium perbromate