

Nomenclature & Formula Writing 6

Writing Formulas & Names for Acids

INFORMATION

The precise definition of **acids** varies greatly depending on the context, the compound, and the reaction in which they are involved. For this activity, only **Arrhenius acids** will be considered; that is, acids which, when dissolved in water, ionize to donate hydride ions (H^+) to the system.

Arrhenius bases, on the other hand, are compounds that donate the hydroxide polyatomic anion, OH^- , to the system when dissolved in water. They are named in a manner consistent with other compounds containing polyatomic anions (NaOH is sodium hydroxide, for example), and therefore are not further investigated in this activity.

***Advanced Knowledge:** Strictly speaking, H^+ ions do not exist – they would be far too reactive to remain an independent species for any length of time. When acids dissolve in water, the would-be hydride ions actually bond with water molecules, forming the ion hydronium, H_3O^+ . Hydronium is a very important intermediate or catalyst (a compound that speeds up a reaction without being consumed by it) in many chemical reactions.*



Svante Arrhenius,
1859-1927

Acids (in this context) are characterized as compounds that *always have hydrogen as the cation* (H^+). While acids are not strictly ionic (they exhibit some molecular properties, as well), their formulas are written in the style of single-valent ionic compounds.

Writing Formulas for Acids

There are two types of acids – **binary** and **ternary**. The formulas for binary acids appear as the formula would for a binary ionic compound – hydrogen as the **cation and a single nonmetal as the anion (such as chlorine or sulfur)**.

The formulas for ternary acids appear as the formula would for polyatomic ionic compounds – hydrogen as the cation, and a polyatomic ion as the anion (such as sulfate or nitrate).

Writing Names for Acids

Binary acids are named by adding a *hydro-* prefix and an *-ic* suffix to the nonmetal root (see *Nomenclature & Formula Writing 3*), followed by the word *acid*.

*H_2S has the nonmetal sulfur as its anion. This acid is called **hydrosulfuric acid**.*

Ternary acids are named based on the ending of the polyatomic ion they contain. Polyatomic ions ending in *-ate* take the suffix *-ic* to the root of the non-oxygen nonmetal in the polyatomic, and add the word *acid* after it.

HNO₃ contains the polyatomic ion nitrate (NO₃⁻¹). This acid is called nitric acid.

Polyatomic ions ending in *-ite* take the suffix *-ous* to the root of the non-oxygen nonmetal in the polyatomic, and add the word *acid* after it.

HNO₂ contains the polyatomic ion nitrite (NO₂⁻¹). This acid is called nitrous acid.



Key Questions

1. What aspects of the names of acids differentiate binary acids from ternary acids?
2. In grammatically correct English, write detailed procedures for a) writing acid formulas and b) naming acids. Assume that the procedures will be used by someone who has no prior knowledge of this material.
3. Write the names of the four acids associated with the polyatomic oxyanion formed by chlorine. What patterns do you notice?

Exercises

4. Write the formulas for the following acids:
 - a. Hydrosulfuric acid
 - b. Sulfurous acid
 - c. Nitric acid
 - d. Chlorous acid
 - e. Hydroiodic acid
 - f. Hypochlorous acid
 - g. Carbonic acid
 - h. Hydrochloric acid
 - i. Acetic acid
 - j. Tartaric acid
5. Write the formulas for the following acids:
 - a. H₃PO₄
 - b. HF
 - c. HIO₃
 - d. HBrO₂
 - e. H₂Cr₂O₇
 - f. H₃P

Student Name: _____ Pd. _____ Date: _____

Supplementary Exercises
Acid Naming and Formula Writing

Write the correct name for the following compounds.

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|----------------------------|--------------------------------------|-----------------------------|
| 1. HClO_4 | 6. HI | 11. H_2CO_3 |
| 2. H_3PO_4 | 7. $\text{HC}_2\text{H}_3\text{O}_2$ | 12. H_2SO_3 |
| 3. HCl | 8. HF | 13. HClO_2 |
| 4. H_2SO_4 | 9. H_3PO_3 | 14. HNO_3 |
| 5. HNO_2 | 10. HClO_3 | 15. HBr |

Write the correct formula for the following compounds.

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|----------------------|-----------------------|----------------------|
| 16. Nitric acid | 21. Chromic acid | 26. Perchloric acid |
| 17. Chloric acid | 22. Hydrochloric acid | 27. Hydroiodic acid |
| 18. Acetic acid | 23. Phosphoric acid | 28. Phosphorous acid |
| 19. Hydrobromic acid | 24. Nitrous acid | 29. Carbonic acid |
| 20. Sulfurous acid | 25. Oxalic acid | 30. Sulfuric acid |