

Chapter 9

Chemical Names and Formulas

- 9.1 Naming Ions
- 9.2 Naming and Writing Formulas for Ionic Compounds
- 9.3 Naming and Writing Formulas for Molecular Compounds
- 9.4 Naming and Writing Formulas for Acids and Bases**
- 9.5 The Laws Governing How Compounds Form

9.4 Naming and Writing Formulas for Acids and Bases

CHEMISTRY & YOU

What's the name of the acid responsible for the crisp taste in this drink?

There's a certain acid that gives many soft drinks their crisp, enjoyable taste.

H_3PO_4 - phosphoric acid.



9.4 Naming and Writing Formulas for Acids and Bases



Names and Formulas of Acids

Names and Formulas of Acids



How do you determine the name and formula of an acid?

9.4 Naming and Writing Formulas for Acids and Bases

Names and Formulas of Acids

- Acids are a group of ionic compounds with unique properties.
- Acids can be defined in several ways, but for now:
 - An **acid** is a compound that contains one or more hydrogen atoms,
 - AND produces hydrogen ions when dissolved in water.

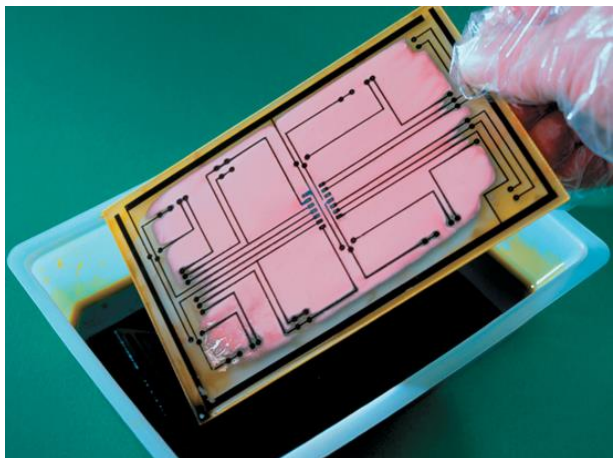


9.4 Naming and Writing Formulas for Acids and Bases

Names and Formulas of Acids

- Acids have many uses . . . and many are natural.

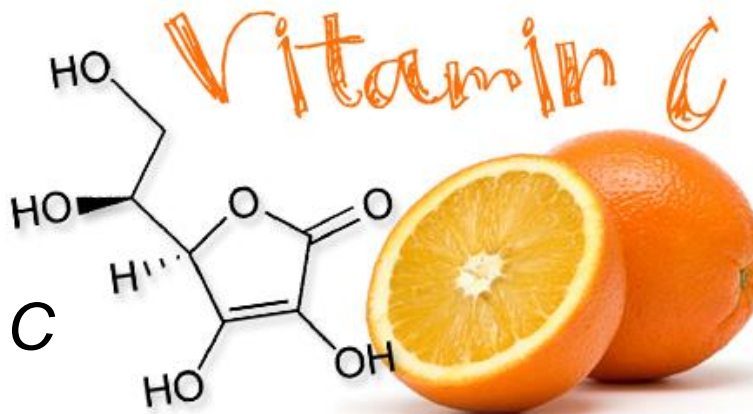
Sulfuric acid is often used to etch circuit boards.



Citric acid is found in fruit.



Ascorbic acid is vitamin C



9.4 Naming and Writing Formulas for Acids and Bases

Names and Formulas of Acids

- An acid consists of an anion combined with as many hydrogen cations as needed to make the molecule electrically neutral.
- The chemical formulas of acids are generally written as:
 - H_nX ,
 - **H** is the hydrogen atom
 - **X** is a monatomic or polyatomic anion
 - ***n*** is the number of hydrogen cations.

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Names and Formulas of Acids

- Three rules to name an acid with the general formula H_nX dissolved in water.

Rule 1

- When the name of the anion ends in **-ide**, the acid name begins with the prefix **hydro-**
 - The anion has the suffix **-ic**
 - and is followed by the word **acid**.
-
- HCl (X = chloride) – hydrochloric acid.
 - HF (X = fluoride) – hydrofluoric acid

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Names and Formulas of Acids

Rule 2

- When the anion name ends in **-ite**, the acid name is the anion with the suffix **-ous**,
 - followed by the word **acid**.
- H_2SO_3 (X = sulfite) – sulfur**ous** acid.
 - HNO_2 (X = nitrite) – nit**rous** acid

Recall that “**-ite**” is an oxyanion (contains oxygen).

9.4 Naming and Writing Formulas for Acids and Bases

Names and Formulas of Acids

Rule 3

- When the anion name ends in **-ate**, the acid name is the anion with the suffix **-ic**,
 - followed by the word **acid**.
- HNO_3 (X = nitrate) – nitric acid.
 - H_3PO_4 (X = phosphate) – phosphoric acid

Recall that “**-ate**” is an oxyanion (contains oxygen).

9.4 Naming and Writing Formulas for Acids and Bases

Names and Formulas of Acids

Writing Formulas of Acids

- To write the empirical (or chemical) formula for an acid, use the rules in reverse.
- Then, balance the ionic charges just as you would for any ionic compound.

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Names and Formulas of Acids

Writing Formulas of Acids

Practice 1 . . .

What is the empirical formula for hydrobromic acid?

1. “**Hydro**” tells us to use rule 1
2. Use the suffix “**ide**” on the anion, therefore “**bromide**” will be the anion.
3. It is an acid, so a hydrogen cation (H^+) is present.
4. H forms a 1+ cation (H^+)
5. Br forms a 1- anion (Br^-)
6. Therefore, formula for hydrobromic acid is **HBr**

9.4 Naming and Writing Formulas for Acids and Bases

Names and Formulas of Acids

Writing Formulas of Acids

Practice 2 . . .

What is the empirical formula for phosphorous acid?

1. “**ous**” tells us to use rule 2
2. Use the suffix “**ite**” on the anion, therefore “**phosphite**” will be the anion. “**ite**” also tells us it is an oxyanion.
3. It is an acid, so a hydrogen cation (H^+) is present.
4. H forms a 1+ cation (H^+)
5. The phosphite oxyanion forms a 3- anion (PO_3^{3-})
6. Therefore, formula for phosphorous acid is **H_3PO_3**

9.4 Naming and Writing Formulas for Acids and Bases

Names and Formulas of Acids

Writing Formulas of Acids

Practice 3 . . .

What is the empirical formula for sulfuric acid?

1. “**ic**” tells us to use rule 3
2. Use the suffix “**ate**” on the anion, therefore “**sulfate**” will be the anion. “**ate**” also tells us it is an oxyanion.
3. It is an acid, so a hydrogen cation (H^+) is present.
4. H forms a 1+ cation (H^+)
5. The sulfate oxyanion forms a 2- anion (SO_4^{2-})
6. Therefore, formula for phosphorous acid is **H_2SO_4**

9.4 Naming and Writing Formulas for Acids and Bases



Names and Formulas of Bases

Names and Formulas of Bases



How do you determine the name and formula of a base?

9.4 Naming and Writing Formulas for Acids and Bases

Names and Formulas of Bases

- A **base** is an ionic compound that produces hydroxide anions (OH^{1-}) when dissolved in water.
- The common base sodium hydroxide (NaOH) is used in making cleaners, soap, and paper.
- It is composed of sodium cations (Na^+) and hydroxide anions (OH^-).



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> Names and Formulas of Bases

To write the formula for a base . . .

1. Write the symbol for the metal cation
2. followed by the formula for the hydroxide ion.
3. Balance the ionic charges.

9.4 Naming and Writing Formulas for Acids and Bases

Names and Formulas of Bases

Example 1:

- What is the empirical formula for Aluminum hydroxide?
 - Aluminum hydroxide has the aluminum cation (Al^{3+}) and the hydroxide anion (OH^-).
 - Crisscross $\text{Al}^{3+}\text{OH}^-$.
 - aluminum hydroxide is $\text{Al}(\text{OH})_3$.

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Names and Formulas of Bases

Example 2:

- What is $\text{Fe}(\text{OH})_2$?
 - Reverse crisscross to get the charges $\text{Fe}(\text{OH})_2$
 - This results in a cation: Fe^{2+} , and anion: OH^-
 - Fe^{2+} is iron(II); OH^- is hydroxide
 - Therefore, $\text{Fe}^{2+}\text{OH}^-$ is iron(II) hydroxide

9.4 Naming and Writing Formulas for Acids and Bases >



Is the naming of a base more similar to the naming of an acid or to the naming of other ionic compounds?

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Is the naming of a base more similar to the naming of an acid or to the naming of other ionic compounds?

Unlike acids, bases are named in the same way as other ionic compounds.

9.4 Naming and Writing Formulas for Acids and Bases > Vocab and probs

Chapter 9

Problems: sect9.1 – 4, 5, 6, 7; sect9.2 – 23, 24, 25; sect9.3 – 30, 31; sect9.4 – 43, 44, 45

Vocabulary: must have the 1) word/phrase, 2) definition, and 3) an drawing of your interpretation

Section 1

1. Monatomic ion

Section 2

2. Binary compound

Section 4

3. Acid
4. Base

Section 5

5. Law of definite proportions
6. Law of multiple proportions

9.4 Naming and Writing Formulas for Acids and Bases >

END OF 9.4