

**Dissociation, Ionization, and Dissolution**

- Dissociation: **Ionic** substance separates into ions.
 - $\text{NaCl}(s) \rightarrow \text{Na}^+(\text{aq}) + \text{Cl}^-(\text{aq})$
- Ionization: Nonionic substance reacts with **water** to form ions.
 - $\text{NH}_3(\text{g}) \rightarrow \text{H}_2\text{O}(\text{I}) \rightarrow \text{NH}_4^+(\text{aq}) + \text{OH}^-(\text{aq})$
- Dissolution: **Substance** does not form ions.
 - $\text{C}_6\text{H}_{12}\text{O}_6(\text{s}) \rightarrow \text{C}_6\text{H}_{12}\text{O}_6(\text{aq})$

**Lesson Objectives**

By the end of this lesson, you should be able to:

- Describe the observable properties of acids.
- Describe the **observable** properties of bases.
- Describe **applications** of acids and bases.

Science Practice: Determine the meaning of the key terms *acid* and *base* as they are used in chemistry.

**Words to Know**

Fill in this table as you work through the lesson. You may also use the glossary to help you.

base	a compound that ionizes to form hydroxide ions; a chemical substance that decreases H^+ concentration in aqueous solution or that increases OH^- concentration in solution
acid	a compound that ionizes to form hydrogen ions; a chemical substance that increases H^+ concentration in aqueous solution
salt	an ionic compound formed from the reaction of an acid and a base

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Properties of Acids and Bases

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Lesson Question

How does the concentration of specific ions affect the properties of a solution?

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Acids

- **Acid:** a substance that increases the concentration of H^+ (H_3O^+) ions in

solution

- H^+ : hydrogen ion
- H_3O^+ : hydronium ion
- Examples include:
 - Hydrochloric acid (HCl)
 - Sulfuric acid (H_2SO_4)
 - Acetic acid (HCH_3COO)
 - Oxalic acid ($H_2C_2O_4$)
 - Carbonic acid (H_2CO_3)

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Salts and Neutralization Reactions

A **salt** is an ionic compound formed by combining an acid and a base.

When an acid reacts with a base, a salt and water are formed.

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Salts and Neutralization Reactions

Examples include:

- Antacids
- Agricultural lime added to acidic soil

The reaction of the soil acid with **lime** is also an example of an acid **carbonate** reaction.

Physical and Chemical Properties of Acids

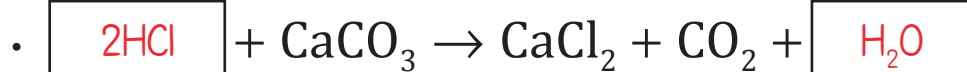
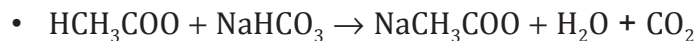
Acids

- have a **sour** taste.
- turn blue **litmus** paper red.
- turn methyl orange solution **red**.
- react with **carbonates** and bicarbonates.
- are **neutralized** by bases.
- react with metals.

Reactions of Acids with Bicarbonate and Carbonate

- Acid reacts with carbonate or bicarbonate compound to form **CO₂**, H₂O, and a salt.

Examples include:



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Metal Reactions

- Acid reacts with metal to form a **salt** and hydrogen **gas**.

The general formula is a metal is added to an acid to form a metal **oxide** and **H₂**, hydrogen gas.

Examples include:

- Metal etching
- Acid rain damage (for example, to vehicles)

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Bases

- **Base:** a chemical substance that decreases H⁺ concentration in aqueous solution or that increases **OH⁻** concentration in solution

Examples include:

- Ammonia **(NH₃)**
- Sodium hydroxide (NaOH)
- Potassium **hydroxide** (KOH)
- **Calcium** carbonate (CaCO₃)

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Physical and Chemical Properties of Bases

Bases

- taste bitter.
- are slippery.
- turn red litmus paper **blue**.

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Physical and Chemical Properties of Bases

- turn colorless phenolphthalein **pink**.
- **neutralize** acids.
- may react with some metal salts.
- may react with carbon **dioxide**.

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Reactions of Bases with Metal Salts

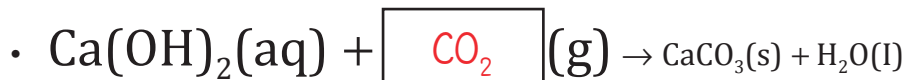
- Base reacts with **soluble** metal salt to form **insoluble** metal hydroxide.

Examples include:

**Reactions of Bases with Carbon Dioxide**

- Base reacts with carbon dioxide to form **carbonate**.

Examples include:



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Properties of Acids and Bases

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Acids in Food

Examples include:

- Benzoic acid: preservative
- Carbonic acid: carbonated drinks
- Acetic acid: vinegar
- Tartaric acid: soft drinks, tartness to food
- Citric acid: tartness, citrus fruits, preservative

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Acids and Bases in Cleaning

Examples include:

- Hydrochloric acid: household cleaners and swimming pool maintenance
- Sodium and potassium hydroxides: manufacture of soaps, detergents, and cleaners; drain cleaner
- Sodium hypochlorite: bleach, disinfectant
- Ammonia: window cleaner, household cleaner

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Acids and Bases in Medicine, Health, and Cosmetics

Examples include:

- Aluminum hydroxide, magnesium hydroxide, calcium carbonate: **antacids**
- **Magnesium** hydroxide: antiperspirant/deodorant
- Hydrochloric acid: stabilizer for many medications
- Carbonic acid: regulator of acidity in **blood**

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Acids and Bases in Manufacturing

Examples include:

- Hydrochloric acid: used in **electroplating** and leather processing
- Nitric acid: used in the production of fertilizers and explosives; used to etch metals and purify **gold**
- Ammonia: used in the production of fertilizers and the manufacture of nitric acid; used to neutralize acid in petroleum and in the production of **latex**

Summary

Properties of Acids and Bases

**Lesson Question**

How does the concentration of specific ions affect the properties of a solution?

**Answer**

(Sample answer) In the presence of an acid, the concentration of hydrogen ions increases in a solution, and in the presence of a base, the concentration of hydrogen ions decreases in a solution.

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Properties of Acids and Bases

- An acid is a substance that increases the concentration of H^+ ions in an aqueous solution.
- A base is a substance that decreases the concentration of H^+ ions in an aqueous solution.
- Acids have a sour taste, turn **blue** litmus red, and react with metals, carbonates, and bases.
- Bases have a bitter taste, feel slippery, turn **red** litmus blue, and react with metal salts, carbon dioxide, and acids.

Applications of Acids and Bases

- Acids are commonly used in **foods** to provide tartness and retard spoilage.
- Acids and bases are used in many cleaning products.
- Many **medications** and other health products include acids or bases.
- Manufacturing relies on acids and bases in a variety of ways.

Summary

Properties of Acids and Bases

Use this space to write any questions or thoughts about this lesson.