

SECTION 2 Acids and Bases



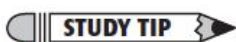
California Science Standards

8.5.e

BEFORE YOU READ

After you read this section, you should be able to answer these questions:

- What are the properties of acids?
- What are the properties of bases?

**STUDY TIP**

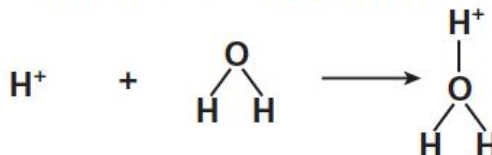
Graphic organizer In your science notebook, create two Idea Wheels, one about acids and one about bases.

TAKE A LOOK

1. **Explain** How is a hydronium ion formed?

What Are Acids?

Many of the foods we eat contain acid. For example, lemons, vinegar, grapes, and soft drinks are *acidic*, or acid-containing foods. But acids are not just in foods. You can find acid in car batteries, in paper, and even in your stomach. An **acid** is any compound that increases the number of hydronium ions (H_3O^+) when dissolved in water. The figure below shows how the hydronium ion forms.

Formation of a Hydronium Ion

Hydrogen ion plus water make a hydronium ion.

What Are the Properties of Acids?

The hydrogen ions in acids are what give acids their special properties. There are several properties that give us a clue that a substance is an acid.

SOUR TASTE

Have you ever bitten into a lemon? It probably tasted sour and made your mouth pucker up. Foods that have a sour taste usually contain acid. In fact, the word *acid* means “sour” in Latin. The taste of lemons, limes, and other citrus fruits comes from citric acid. But, remember that you should never taste, touch, or smell an unknown chemical. ✓

Many acids are dangerous because they are *corrosive*. That means that they destroy body tissue, clothing, and many other things. Most acids are also poisonous.

**READING CHECK**

2. **Identify** What kind of taste do acids have?

SECTION 2 Acids and Bases *continued*

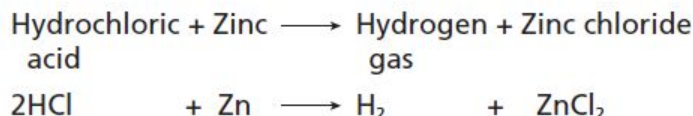
COLOR CHANGE OF INDICATORS

We can use colored chemicals to tell us if a solution is an acid or a base. A substance that changes color in the presence of an acid or base is an **indicator**. For example, if you squeeze lemon juice into a cup of tea, it changes color. The tea shows that the lemon juice has increased the acidity.

A solution called *bromthymol blue* is an indicator used by scientists. If you add acid to bromthymol blue, it changes from pale blue to yellow. It *indicates*, or shows, the presence of acid. Scientists also use a special kind of paper called *litmus paper* as an indicator. The paper contains the substance litmus. The paper comes in blue or red. When you add acid to blue litmus paper, it turns red.

REACTION WITH METALS

Acids react with some metals to make hydrogen gas. For example, when hydrochloric acid reacts with the metal zinc, the product is hydrogen gas. This is the chemical equation for that reaction:




In this reaction, zinc takes the place of hydrogen in hydrochloric acid. This reaction happens because zinc is a reactive metal. But other metals, such as silver or gold, do not react easily. For example, if silver were used in the reaction above, no hydrogen gas would be produced.

ELECTRICAL CONDUCTIVITY

When acids dissolve in water, they break apart and form ions in the solution. The ions make it possible for the solution to conduct an electric current. ✓

A car battery is an example of how an acid can be used to produce an electric current. The acid that is in a car battery conducts an electric current to help start the car's engine.

 CALIFORNIA STANDARDS CHECK
<p>8.5.e Students know how to determine whether a solution is acidic, basic, or neutral.</p> <p>3. Describe What is an indicator?</p> <p>4. Name What are two kinds of indicators used by scientists?</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p>

TAKE A LOOK

5. Identify What forms when zinc reacts with hydrochloric acid?

 **READING CHECK**

6. Identify What makes it possible for a solution to conduct an electric current?

SECTION 2 Acids and Bases *continued***How Do We Use Acids?**

Acids are important chemicals because they have so many uses. Sulfuric acid is the most widely used chemical in the world. It is used to make many products including paper, paint, and detergents. The sulfuric acid in car batteries conducts the current to help start the car's engine. You can find nitric acid in fertilizers, rubber, and plastic. ✓

READING CHECK

7. Identify Which of the following uses nitric acid: making paper, making paint, or making fertilizers?

Another acid, hydrochloric acid, is used to separate metals from the other materials in their ores. We also put it in swimming pools to keep them free of algae. In addition, hydrochloric acid helps your stomach digest the food you eat.

Food has many kinds of acid in it. For example, orange juice contains citric acid and ascorbic acid (vitamin C). The main ingredient in vinegar is acetic acid. Carbonic acid and phosphoric acid help give soft drinks a sharp taste. ✓

READING CHECK

8. Name What are two foods that contain acid?

What Are Bases?

Bases are found in baking powder, chalk, soap, and even the saliva in your mouth. Bases are the opposite of acids. When a base meets an acid, it *neutralizes* it. That means it cancels out acidity. A **base** is any compound that makes many hydroxide ions (OH^-) when it is dissolved in water. For example, sodium hydroxide breaks apart to form sodium ions and hydroxide ions when dissolved in water.

Sodium hydroxide \longrightarrow Sodium ion + Hydroxide ion

$\text{NaOH} \longrightarrow \text{Na}^+ + \text{OH}^-$

Bases, such as a solution of sodium hydroxide, will have many more hydroxide ions than hydronium ions.

Critical Thinking

9. Predict What does an antacid tablet do to excess acid in your stomach?

What Are the Properties of Bases?

Hydroxide ions give bases their properties. These properties make bases very useful substances. Imagine how dirty we would be without soap and other cleaners made from base compounds. ✓

READING CHECK

10. Describe What gives bases their properties?

SECTION 2 Acids and Bases *continued***BITTER TASTE AND SLIPPERY FEEL**

The properties of a base solution include a bitter taste and a slippery feel. Have you ever tasted soap? It has a bitter taste. Soap also has the slippery feel of a base.

Never use taste, touch, or smell to identify an unknown chemical. Like acids, many bases are corrosive. If you use a base in an experiment, be very careful. If your fingers feel slippery, you may have gotten the base on your hands. You should quickly rinse your hand with large amounts of water and tell your teacher.

COLOR CHANGE OF INDICATORS

Like acids, bases change the color of an indicator. Bases turn most indicators a different color than acids do. For example, bases change the color of red litmus paper to blue. Bromthymol blue turns a darker blue when you add a base to it.

ELECTRICAL CONDUCTIVITY

Like acids, solutions of bases conduct an electric current. Bases are good conductors because they contain many hydroxide ions (OH^-).



Soaps are made by using sodium hydroxide, which is a base. Soaps remove dirt and oils from skin and feel slippery when you touch them.



Baking soda is a mild base. It is used in toothpastes to neutralize acids, which can produce unpleasant odors.

How Are Bases Used?

Like acids, bases have many uses. Companies use the base sodium hydroxide to make soap and paper. It is also used in oven cleaners and in products that unclog drains. Ammonia is found in many household cleaners and is used to make fertilizers. The antacids people use to treat heartburn contain magnesium hydroxide and aluminum hydroxide.

Critical Thinking

11. Apply Concepts Why do you think it's a bad idea to use taste, touch, or smell to identify an unknown chemical?

TAKE A LOOK

12. Identify What color will baking soda turn litmus paper?

READING CHECK

13. Identify What are two products that contain ammonia?
