

# Chp 16: Lect 1: Acids & Bases

Chapter 16, Section 2: Acids, Bases, pH, Indicators *1 pt ec printing*

## Acids

### What is an acid?

- A compound that dissolves in water and produces \_\_\_\_\_
- Comes from the Latin word acidus that means "sharp" or "sour".  
 $\text{Acid} + \text{Water} \rightarrow \text{H}_3\text{O}^+ + \text{ions}$
- Example:  
 $\text{HCl} + \text{H}_2\text{O} \rightarrow \text{Cl}^- + \text{H}_3\text{O}^+$

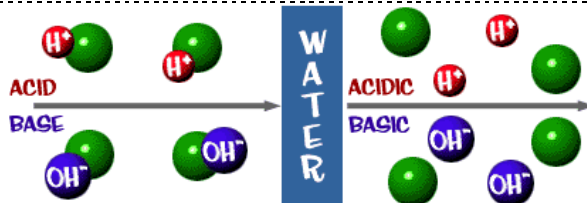
### Strong vs. Weak acids

- As an acid dissolves in water, its molecules break apart & produce  $\text{H}^+$  (or  $\text{H}_3\text{O}^+$ ).
- If \_\_\_\_\_ of the molecules break apart, the acid is considered a \_\_\_\_\_ acid.
- Examples of strong acids are sulfuric acid, nitric acid, hydrochloric acid.
- If only \_\_\_\_\_ of the molecules break apart, the acid is considered a \_\_\_\_\_ acid.
- Examples of weak acids include acetic acid, citric acid, carbonic acid.

### Acidic Properties

- pH \_\_\_\_\_ than 7
- Taste \_\_\_\_\_
- May change the color of certain compounds
- React with metals to produce hydrogen gas ( $\text{H}_2$ )
- Can be very \_\_\_\_\_, meaning they may destroy metals & burn skin

### Examples of Acids



### Examples of Bases

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### Examples of Bases

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### Examples of Bases

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**Acids & Bases:** Look around. Every liquid you see will probably be either an acid or a base. The only exception would be distilled water. Distilled water is just water. That's it. But what about baking soda? Vinegar? Scientists use something called the "pH" scale to measure how acidic or basic a liquid is.

### Acids + Bases = ?

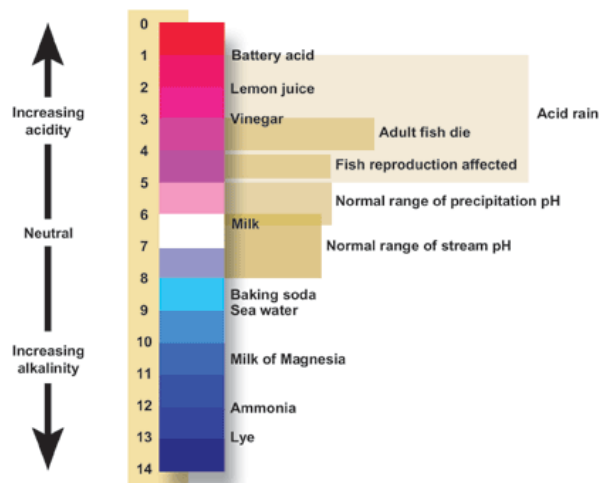
What do you think happens if you add acids & bases together? They \_\_\_\_\_ each other! These reactions occur when the positive ions from the base combine with the negative ions from the acid. This reaction is really important - without it, the acid in your stomach would eat away your entire digestive tract. As the fluids & acids leave your stomach, the pancreas & liver produce bicarbonate (a base) to neutralize the stomach acid.

### Acids & Bases Unite!

In fact, there's a little more to it than that. When acids & bases combine, the positive hydrogen ion ( $\text{H}^+$ ) from the acid combines with the negative hydroxide ion ( $\text{OH}^-$ ) from the base. This forms water ( $\text{H}_2\text{O}$ ) and a salt with the remaining ions.

Example:  $\text{HCl} + \text{NaOH} \rightarrow \text{H}_2\text{O} + \text{NaCl}$





## What is an indicator?

Certain chemicals turn different colors at different pH. These chemicals are called pH indicators and they are used to determine pH. Red cabbage juice is an indicator you can make at home. Red & blue litmus papers are also used to test pH. An indicator is not an acid, base or neutral! It is an indicator of those chemicals.

## pH in the Environment

Living things depend on having a steady pH in their environment. The pH of soil directly affects nutrient availability for plants. Most plants prefer a slightly acidic soil with a pH between 6.5 and 7.0. In highly acid soils too much aluminum, manganese and other elements may leach out of soil minerals and reach concentrations that are toxic to plants. The pH of water directly affects aquatic life too. Most freshwater lakes, streams, and ponds have a natural pH in the range of 6 to 8. Most freshwater fish can tolerate pH between 5 and 9 although some negative effects appear below pH of 6. Trout are among the most pH tolerant fish and can live in water with a pH from 4 to 9.5.

## Acids, Bases, & YOU!

Many reactions, such as the ones that occur in your body, work best at specific pH values. For example, acids and bases are very important in the reactions involved in digesting food. As you may know, the stomach secretes hydrochloric acid (HCl), a strong acid (pH 1.4). The level of acidity in our stomachs is necessary to break down the protein molecules in food so they can be absorbed. A mucus lining in the stomach protects it from the acid produced. Very spicy foods, stress, or poor diet can cause the stomach to produce too much acid, or allow stomach acid to escape from the stomach. An \_\_\_\_\_ may occur when the mucus lining of the stomach is damaged. Stomach acid can then attack the more sensitive tissues of the stomach itself. The uncomfortable condition called heartburn is caused by excessive stomach acid backing up into the esophagus. Eating very large meals can lead to heartburn because an overflowing stomach pushes acid up into the esophagus.

## The pH Scale:

The scale goes from "0" to "14". Distilled water is 7 (right in the middle). When you start looking at the pH of chemicals the numbers go to the extremes. If you ever go into a chemistry lab, you could find solutions with a pH of "1" and others with a pH of "14". Those chemicals are very dangerous. There are pH values higher than 14 and lower than 0, but let's just start with 0-14.

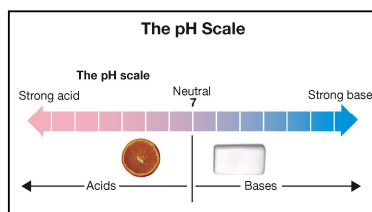
- pH measures the **acidity** of a solution, or how many **hydronium ions** are in the solution.
- The pH scale ranges from **0-14**
- A pH of 7 is **neutral**
- This means the solution is neither acidic nor basic, like distilled water.

\_\_\_\_\_ An acid that only partially ionizes in an aqueous solution. That means not every molecule breaks apart. They usually have a **pH closer to 7 (3.5-6.5)**

\_\_\_\_\_ : A base that only partially ionizes in an aqueous solution.

That means not every molecule breaks apart. They usually have a **pH close to 7 (8.5-10.5)**

\_\_\_\_\_ : A solution which has a pH of 7. It is neither acidic nor basic. (**the neutral range is: 6.5-8.5**)



### Acids

have a pH less than 7  
Strong acids: very low pH, 0-4  
Weak acids: low pH, 3-6

### Bases

have a pH greater than 7  
Weak bases: high pH, 8-10  
Strong bases: very high pH, 10-14

## Definitions to Know:

\_\_\_\_\_ A solution that has an excess of H<sup>+</sup> ions. It comes from the Latin word "acidus" which means "sharp".

\_\_\_\_\_ A solution that has an excess of OH<sup>-</sup> ions. Another word for base is ALKALI.

\_\_\_\_\_ : A solution which is mainly water. Think about the word aquarium. AQUA means water.

\_\_\_\_\_ An acid which has a very low pH (0-3.5)

\_\_\_\_\_ A base which has a very high pH (10.5-14)

## Acid & Base Review

1. Acids release positively charged \_\_\_\_\_ atoms when they are dissolved in water. When those hydrogen atoms combine with \_\_\_\_\_ molecules, hydronium ions form.
2. The pH scale gives you a measure for identifying acids & bases. pH stands for \_\_\_\_\_ and the scale ranges from 0 to 14.
3. A substance with a pH of exactly 7, like distilled water, is called pH \_\_\_\_\_.
4. Bases also contain hydrogen, but they form \_\_\_\_\_ ions when they dissolve in water.