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Lect 1:Acids & Bases

Chapter 16, Section 2: Acids, Bases, pH, Indicators

Acids

What is an acid?

- A compound that dissolves in water and produces _____
- Comes from the Latin word acidus that means "sharp" or "sour".

Acid + Water → H_3O^+ + ions

- Example: $HCl + H_2O \rightarrow Cl^- + H_3O^+$

Strong vs. Weak acids

- As an acid dissolves in water, its molecules break apart & produce H^+ (or H_3O^+).
- 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 (H_2)
- Can be very _____, meaning they may destroy metals & burn skin

Examples of Acids

-
-
-

Bases

What is a base?

- A compound that dissolves in water to produce _____
- Another word for base is _____.

Base + Water → OH^- + ions

- Example: $NaOH + H_2O \rightarrow Na^+ + OH^-$

Strong vs. Weak Bases

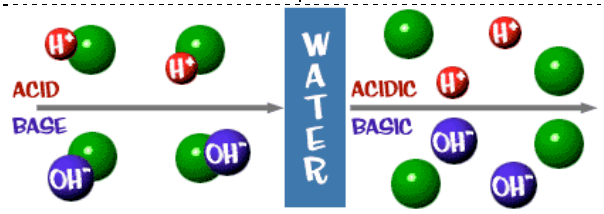
- As with acids, when ALL of the molecules of a break apart in water to produce OH^-, the base is called a _____ base.
- Examples of strong bases are sodium hydroxide, calcium hydroxide, potassium hydroxide.
- If only a few of the molecules break apart, the base is called a _____ base.
- Examples of weak bases include ammonia, magnesium hydroxide, aluminum hydroxide.

Basic Properties

- pH _____ than 7
- Taste _____
- Feel _____, like soap
- May change the color of certain compounds
- Can be very _____

Examples of Bases

-
-
-



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 = ?

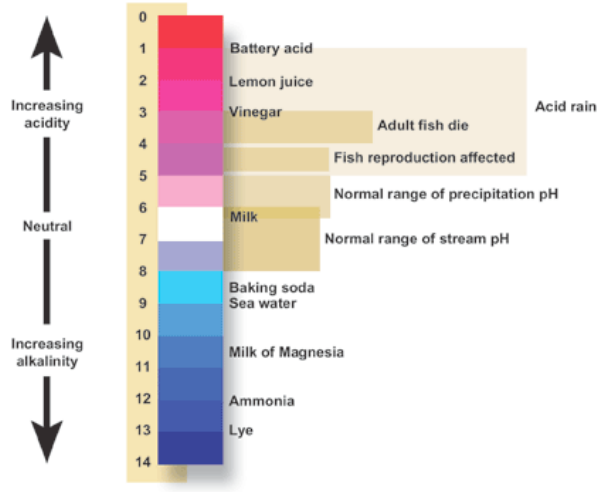
What do you think happens if you add acids & bases together? They _____ each other! These reactions occur when the positive ions from the base combine with the negative ions from the acid. This reaction is really important - without it, the acid in your stomach would eat away your entire digestive tract. 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 (H^+) from the acid combines with the negative hydroxide ion (OH^-) from the base. This forms water (H_2O) and a salt with the remaining ions.

Example: $HCl + NaOH \rightarrow H_2O + NaCl$

Acid + Base → Water + Salt



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.

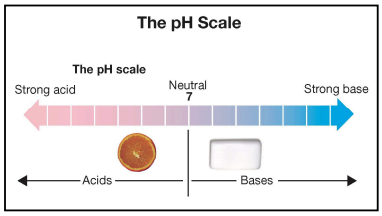
- pH measures the **acidity** of a solution, or how many **hydronium ions** are in the solution.
- The pH scale ranges from **0-14**
- A pH of 7 is **neutral**
- This means the solution is neither acidic nor basic, like distilled water.

_____ 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+ ions. It comes from the Latin word "acidus" which means "sharp".

_____ A solution that has an excess of OH- 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.