

Reactions with Acids

Chemistry 10

Mrs. Page

Learning Objectives

- Predict the products and balance chemical equations for the reactions with acids involving; reactive metals, metal oxides, metal hydroxides, hydrogen carbonates, and carbonates
- Explain the process and write balanced equations of neutralization reactions
- Describe how acid rain is formed and the effects of acid rain on humans and ecosystems

Acids + Reactive Metals

Reactive metals are from Lead up on Reactivity Table

- $\text{Acid}_{(aq)} + \text{Metal}_{(s)} \rightarrow \text{Salt} + \text{H}_{2(g)}$
- Examples:
 - $\text{HCl}_{(aq)} + \text{Mg}_{(s)} \rightarrow \text{MgCl}_2 + \text{H}_{2(g)}$
 - $\text{H}_2\text{SO}_{4(aq)} + \text{Zn}_{(s)} \rightarrow \text{ZnSO}_4 + \text{H}_{2(g)}$
- Write the reaction that occurs with phosphoric acid reacts with aluminum
- $\text{H}_3\text{PO}_{4(aq)} + \text{Al}_{(s)} \rightarrow \text{AlPO}_{4(s)} + \text{H}_{2(g)}$

Acids + Carbonate

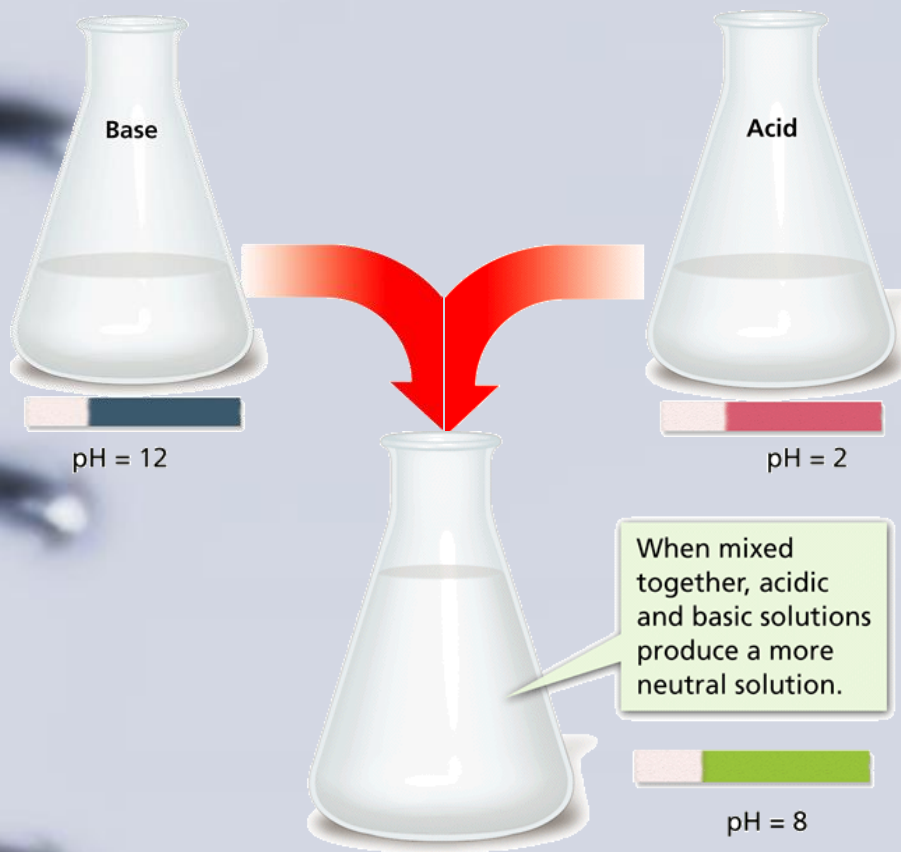
(or Hydrogen Carbonates)

- $\text{Acid}_{(aq)} + \text{Carbonate} \rightarrow \text{Salt} + \text{CO}_{2(g)} + \text{H}_2\text{O}_{(l)}$
- Examples:
 - $\text{HCl}_{(aq)} + \text{CaCO}_{3(s)} \rightarrow \text{CaCl}_2 + \text{CO}_{2(g)} + \text{H}_2\text{O}_{(g)}$
 - $\text{H}_3\text{PO}_{4(aq)} + \text{Na}_2\text{CO}_{3(s)} \rightarrow \text{Na}_3\text{PO}_4 + \text{CO}_{2(g)} + \text{H}_2\text{O}_{(g)}$
- Predict the products and write the balanced equations when nitric acid reacts with potassium carbonate.
- $2\text{HNO}_{3(aq)} + \text{K}_2\text{CO}_{3(aq)} \rightarrow 2\text{KNO}_{3(aq)} + \text{CO}_{2(g)} + \text{H}_2\text{O}_{(l)}$

Acids + Metal Oxides/Hydroxides

- $\text{Acid}_{(aq)} + \text{Metal Oxide}_{(s)} \rightarrow \text{Salt} + \text{H}_2\text{O}_{(l)}$
- $\text{Acid}_{(aq)} + \text{Metal Hydroxide} \rightarrow \text{Salt} + \text{H}_2\text{O}_{(l)}$
- Examples:
 - $\text{HCl}_{(aq)} + \text{Na}_2\text{O}_{(s)} \rightarrow \text{NaCl}_{(aq)} + \text{H}_2\text{O}_{(l)}$
 - $\text{H}_3\text{PO}_4(aq) + 3\text{LiOH}_{(aq)} \rightarrow \text{Li}_3\text{PO}_4(s) + 3\text{H}_2\text{O}_{(l)}$
- Predict the products and write the balanced equations for the reaction between perchloric acid (HClO_4) and aluminum oxide
- $6\text{HClO}_4(aq) + \text{Al}_2\text{O}_3(s) \rightarrow 2\text{Al}(\text{ClO}_4)_3(aq) + 3\text{H}_2\text{O}_{(l)}$

Acid – Base Reactions

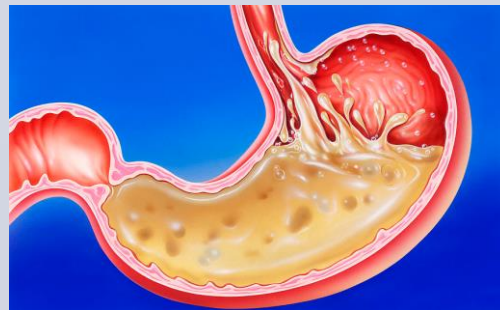


NOTE: The pH of a neutralization reaction will depend on the strength of the acid and base that are reacting. NOT ALWAYS 7!

- A reaction between an acid and a base is called ***neutralization***.
- An acid-base mixture is not as acidic or basic as the individual starting solutions.
- Which of the reactions in your notes are neutralization reactions?

Neutralization in Life

- Your stomach secretes **hydrochloric acid**, the pH of your stomach varies, from 1-2 up to 4-5. When you eat, the stomach releases proteases and hydrochloric acid to aid in digestion.
- After the meal has been digested, your stomach pH returns to a resting level of about 4 or 5.
- Your stomach secretes acid in response to high-protein meals, your stomach pH may drop to as low as 1 to food, so first thing in the morning you can expect a slightly acidic stomach pH, but not an acidic level representative of pure hydrochloric acid.



Antacids



- Antacids are medicines that help correct the pH balance in your stomach.
- pH may be disrupted when you eat acidic or spicy foods, when you don't eat on time and you have an empty stomach.
- What the antacid does is to **neutralize** this affect. They buffer the stomach's gastric acid since they are **basic** in nature.



Reactions with Acids

Predict the products and write the balanced equations for the following reactions. Identify which reactions are neutralization reactions.

- Sodium hydroxide and hydrobromic acid
- Magnesium carbonate and sulfuric acid.
- Nitrous acid and calcium
- Zinc (I) carbonate and phosphoric acid
- Hydrofluoric acid and calcium hydroxide
- Sodium bicarbonate and acetic acid
(CH_3COOH)

Acid – Base reactions

Common Salts	
Salt	Uses
Sodium chloride NaCl	Food flavoring; food preservative
Potassium iodide KI	Additive in "iodized" salt that prevents iodine deficiency
Calcium chloride CaCl ₂	De-icer for roads and walkways
Potassium chloride KCl	Salt substitute in foods
Calcium carbonate CaCO ₃	Found in limestone and seashells
Ammonium nitrate NH ₄ NO ₃	Fertilizer; active ingredient in cold packs

- Each salt listed in this table can be formed by the reaction between an acid and a base.
- Write a reaction that would result in the formation of each of these salts. (Try to use a variety of reactions)

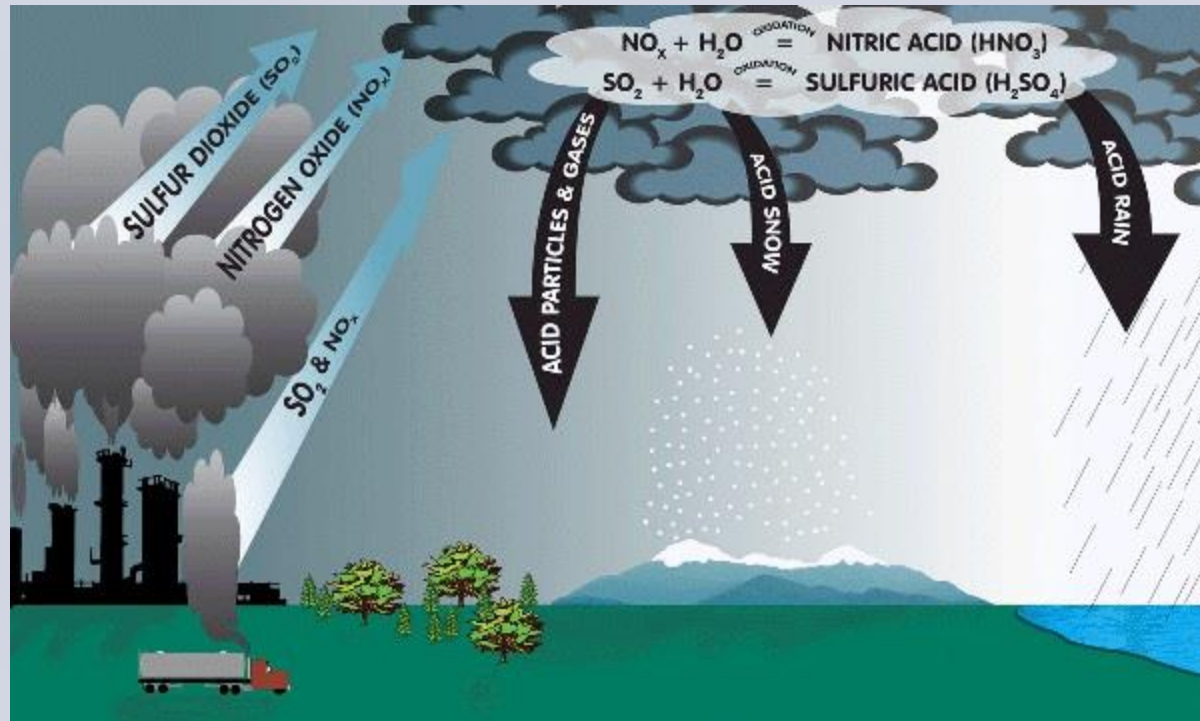
Acid Precipitation

Acid rain is a **rain** or any other form of precipitation that is unusually **acidic**, meaning that it possesses elevated levels of hydrogen ions (low pH). It can have harmful effects on plants, aquatic animals and infrastructure.

http://en.wikipedia.org/wiki/Acid_rain



How does it form?



- **Man Made Contribution:** Power plants release huge amounts of SO₂, burning of fossil fuels by factories and automobiles contribute large amounts of NO_x and SO₂
- **Natural Sources:** NO_x from volcanic activity and from the nitrogen cycle

Why should we care?

- Increasing Acid Could Kill Most Coral by 2050

- <http://www.livescience.com/2135-increasing-acid-kill-coral-2050.html>



Effects of Acid Rain

- Acid precipitation alters the pH levels of waterways (lakes, streams, wetlands, and even oceans). This disrupts the ecosystem causing organisms to die.
- Damages forests – by destroying leaves it makes trees vulnerable to disease, insects, and weather
- Alters pH of soil, killing microorganisms necessary for decomposition and maintaining soil health
- Acid erodes buildings & artwork (marble), metals (cars, pipes, bridges, etc)
- SO_2 and NO_x particulates in the atmosphere are harmful to human health (lung problems)

Acid Rain Equations

- Marble is calcium carbonate. Since marble is often used in construction of buildings, it is extremely susceptible to acid precipitation. Write the two (think of the two acids involved in acid rain) chemical reactions that would occur when marble reacts with acid rain.



The Speed Dating Game



- Can only “date” person with card of different color (acids red)
- Both partners must record reactants – then predict products independently – then check answers
- Trade cards
- Date new partner for new round