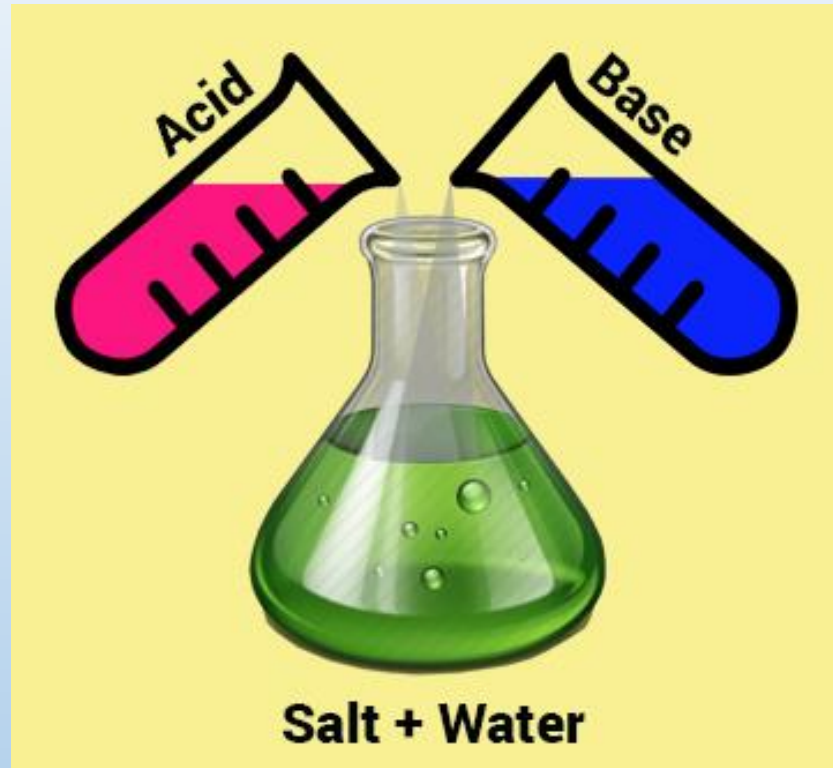


# Neutralization Reactions



Note: Slides contain audio. Click icon in bottom right corner to play.



# Neutralization Reactions: Acids & Bases

A neutralization reaction is a unique type of double displacement reaction that occurs between an acid and a base.

## Acids:

- substances that produce hydrogen ions ( $\text{H}^+$ ) in water.
- example: HCl when mixed with water:

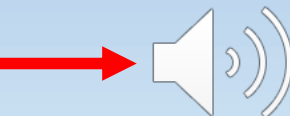


## Bases:

- Substances that produce hydroxide ions ( $\text{OH}^-$ ) in water.
- Example: NaOH when mixed with water:

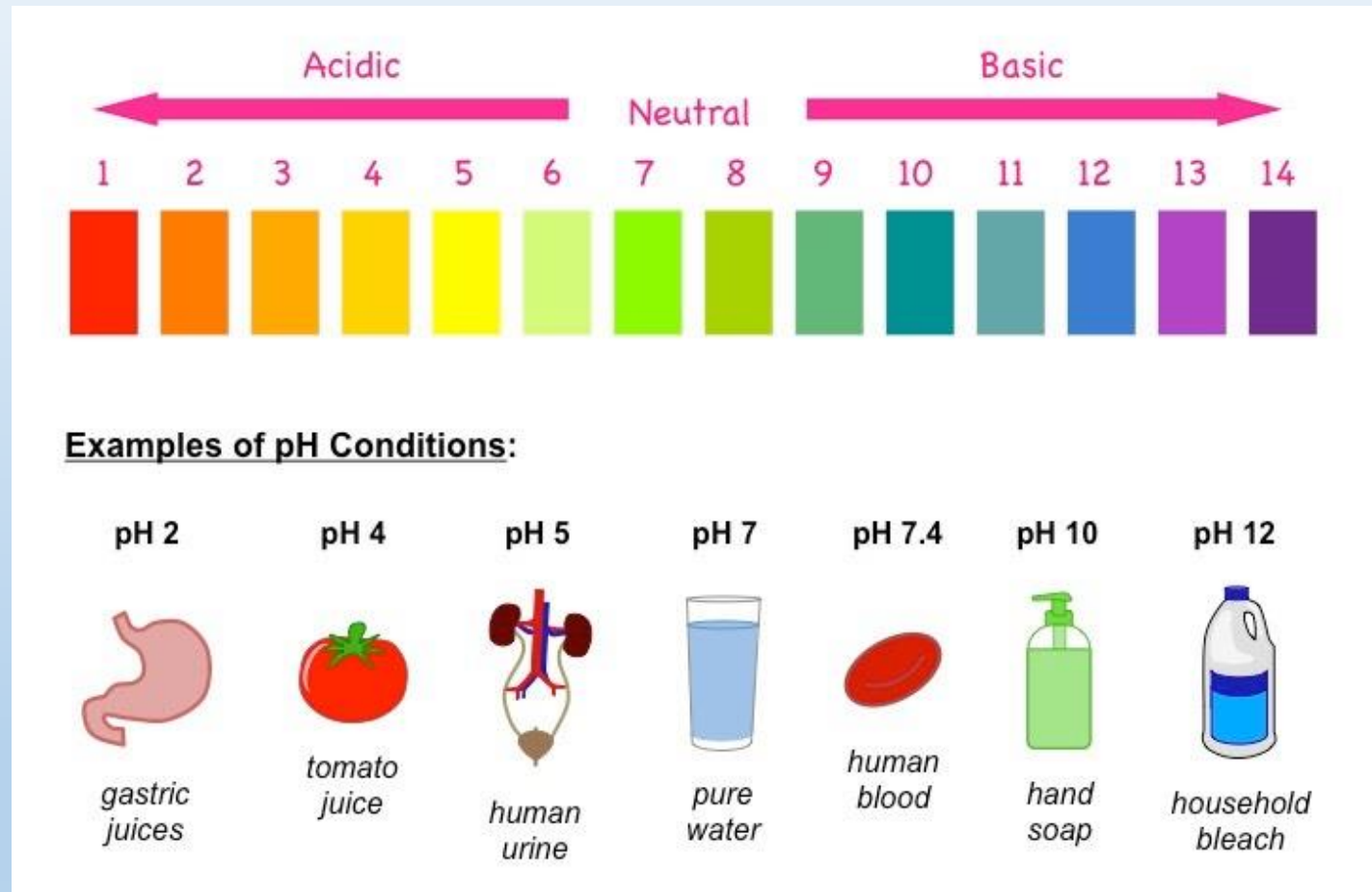


Click this icon  
to play audio



# Neutralization Reactions – pH scale

The pH scale is used to measure the relative acidity or alkalinity (how basic) of a solution. Solutions that are acidic have pH values less than 7 while basic solutions have pH values greater than 7. Solutions that are **neutral** have a pH value of 7.



# Neutralization Reactions – Acids & Bases

A neutralization reaction is a unique type of **double displacement** reaction that occurs **between an acid and a base** producing an ionic compound as well as **water**.



The end result of a neutralization reaction is a solution that has a pH closer to a pH of 7 than either of the original reactants. These are called neutralization reactions because the result is a pH that is close to neutral. Given this information, try to predict the products of a reaction between the acid nitric acid ( $\text{HNO}_{3(aq)}$ ) and the base sodium hydroxide ( $\text{NaOH}_{(aq)}$ ) and write the balanced chemical reaction equation.

Click for the Balanced  
Reaction Equation



# Neutralization Reactions

A neutralization reaction is a unique type of **double displacement** reaction that occurs **between an acid and a base**. The products of a neutralization reaction are an ionic compound (salt) and water. Given this information, try to predict the products of a neutralization reaction between the nitric acid ( $\text{HNO}_3_{(\text{aq})}$ ) and the base sodium hydroxide ( $\text{NaOH}_{(\text{aq})}$ ) and write the balanced chemical reaction equation.

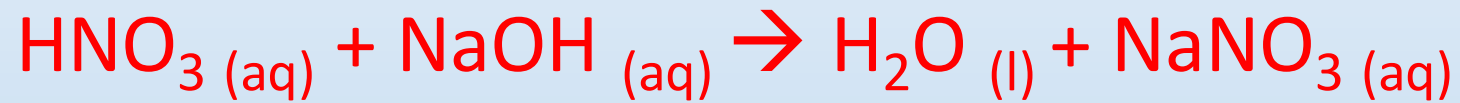


Click for the Reaction  
Mechanism

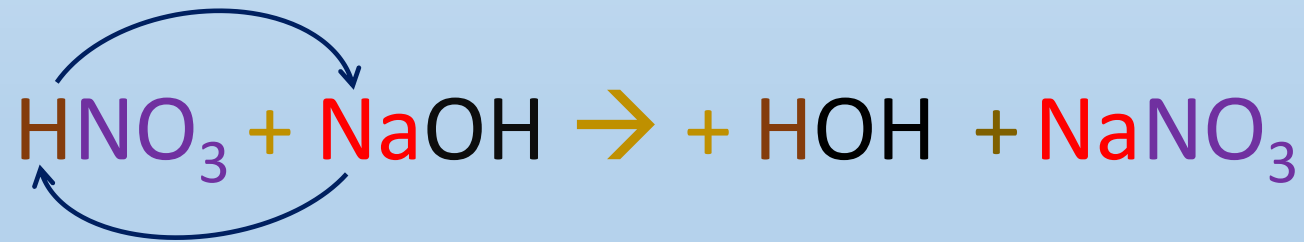


# Neutralization Reactions

Given the following neutralization reaction:



Note the double displacement nature of the reaction in which the H from the acid and the Na from the base displace each other if you think of the water molecule as made up of two parts H-OH:



# Neutralization Reactions – Carbonate Compounds

Acids can also be neutralized by carbonate compounds which are compounds that contain a carbonate group ( $\text{CO}_3$ ) such as calcium carbonate ( $\text{CaCO}_3$ ). In general, when a carbonate compound reacts with an acid, the products are water, carbon dioxide gas and an ionic compound.

**Acid + Carbonate  $\rightarrow$  Water + Carbon Dioxide + Ionic Compound**

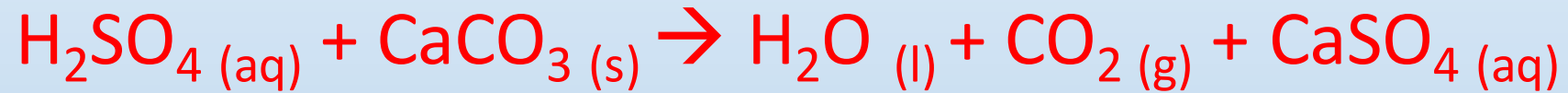
Predict the products and write the balanced chemical equation for the neutralization of sulfuric acid ( $\text{H}_2\text{SO}_{4(aq)}$ ) with calcium carbonate ( $\text{CaCO}_{3(s)}$ )

[Click for the Balanced  
Reaction Equation](#)



# Neutralization Reactions – Carbonate Compounds

The balanced chemical equation for the neutralization of sulfuric acid ( $\text{H}_2\text{SO}_4$  (aq)) with calcium carbonate ( $\text{CaCO}_3$  (s)) is as follows:



Applications of Neutralization





# Applications of Neutralization Reactions

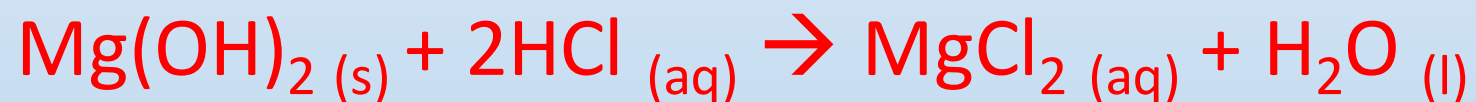
Neutralization reactions are involved in medications known as antacids which are used to relieve heartburn by neutralizing excess stomach acid. Antacids contain bases and/or carbonate compounds to aid in the neutralization. For example, the base, magnesium hydroxide ( $\text{Mg}(\text{OH})_2(\text{s})$ ), is a common ingredient in antacids, and it reacts to neutralize  $\text{HCl}_{(\text{aq})}$  in the stomach. Predict and write the balanced equation for this neutralization reaction.

Click for the Balanced  
Reaction Equation



# Antacid Neutralization Reactions

Neutralization reactions are involved in medications known as antacids which are used to relieve heartburn by neutralizing excess stomach acid. The base magnesium hydroxide ( $\text{Mg}(\text{OH})_2$ ) is a common ingredient in antacids, and it reacts to neutralize  $\text{HCl}_{(\text{aq})}$  in the stomach. The balanced reaction equation for this neutralization is:



Testing for Neutralization  
Reactions



As you may have noticed in the first two examples, neutralization reactions generally do not produce precipitates, therefore, other methods have to be used to detect if a neutralization reaction has occurred besides observing the formation of a precipitate. Based on what you know about acids & bases, pH and neutralization reactions, can you think of one way to detect if a neutralization reaction has occurred?

[Click for the Answer](#)



# Detecting a Neutralization Reaction

An easy way to test if a neutralization reaction has occurred is to test the pH of the resulting solution and compare it to the pH of the reactant solutions. Which of the following pH values for the product solution would indicate a neutralization reaction has taken place? (Click the correct answer)

pH = 5

pH = 0

pH = 7

pH = 10



# Test Your Understanding Answer



The correct answer is a pH of 7 in the product solution indicates that a neutralization reaction has taken place.

pH = 5

pH = 0

pH = 7

pH = 10



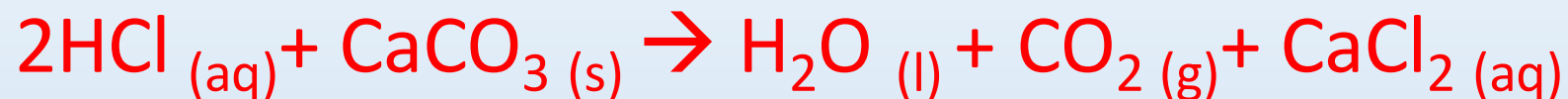
# Test Your Understanding

Which of the following reactions is a neutralization reaction?  
(Click the box with the correct answer)



# Answer

The correct answer is:

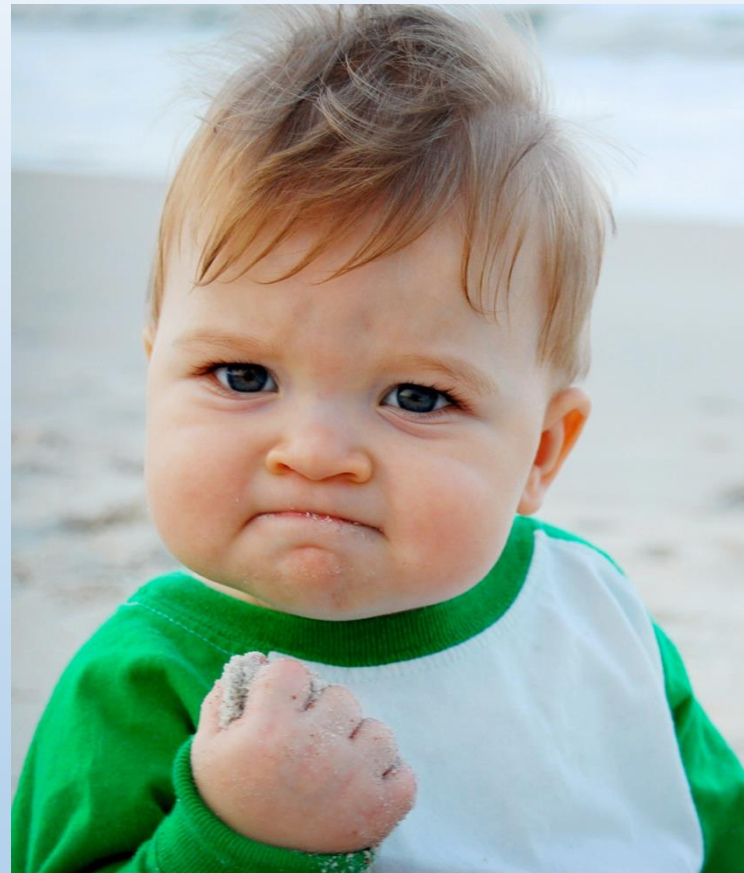


which is a neutralization reaction involving an acid and a carbonate.



# Success!

You have reached the end of this activity. You will know that you have achieved the goals for this activity when you can describe and identify neutralization reactions, can give examples of these reactions and can predict the products of these reactions.



[Back to Start](#)

