Electrolytes, Acids, and Bases

Electrolyte

Strong

Weak

Non—electrolyte

Light Bulb Demo:

Acids and Bases are Electrolytes!

Strong

Weak

What do we know from our 8th grade science and biology classes?

Acids   Bases

Note: Do not taste the chemicals. You will be dead by the time you get to the second stockroom shelf.
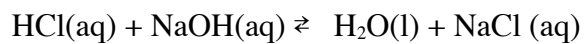
Let's look at some different definitions of acids and bases:

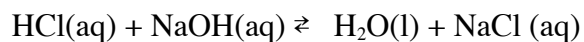Arrhenius Model (late 1800s)

Acid

Base

How do our most common examples of acids and bases illustrate this?

$$HCl(aq) + NaOH(aq) \rightleftarrows H_2O(l) + NaCl(aq)$$

Bronsted—Lowry Theory (Early 1900s)

Acid

Base

$$HCl(aq) + NaOH(aq) \rightleftarrows H_2O(l) + NaCl(aq)$$

Lewis Acid/Base Theory (Early 1930s)

Acid

Base

$$BCl_3 + NH_3 \rightleftarrows Cl_3BNH_3$$
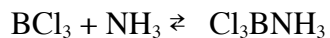
What are the six strong acids?

What about strong bases?

Conjugate Acid and Base Pairs

Acid

Example:

Base

Example:

Write the dissociation equations when the following electrolytes react with water:

Acids:

1) HNO_3

2) $HC_2H_3O_2$

3) HCN

4) $HOCl$

Bases:

5) CH_3NH_2

6) NH_3

Some important ideas about acids and bases

Polyprotic Acids

Reactions:

Amphoteric/Amphiprotic

Indicator

Red Cabbage demo

A mathematical treatment of acids and bases

How do hydrogen and hydroxide relate to each other in a solution?

Acids

Bases

Some Background from math class

Logarithms

pH is a measure of substances acidity!

Are pH and pOH related to each other?

Where does this come from? Remember the auto ionization of water:

A square roadmap

pH	pOH	$[H^+]$	$[OH^-]$	Acid or Base
7				
	11			
		1.00×10^{-1}		
			1.00×10^{-2}	
		2.00×10^{-8}		
	7.500			
4.320				
	0.90			
		1.00×10^{-14}		
			9.87×10^{-5}	

Weak Acids

What are the six strong acids?

What are the weak acids?

What are the strong bases?

What are the weak bases?

How do Acids and Bases dissociate in water?

Strong Acids:

1) HCl

2) HI

Weak Acids:

3) HNO_2

4) $HC_2H_3O_2$
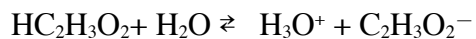
Strong Bases:

5) $NaOH$

Weak Bases:

6) NH_3

7) CH_3NH_2

Let's focus on the idea of Ka and Kb

Now what is the product of these:

1) What is the $[H_3O^+]$ and pH of some 0.10M HCl?

Imagine the dissociation of acetic acid:

$$HC_2H_3O_2 + H_2O \rightleftarrows H_3O^+ + C_2H_3O_2^-$$

2) What is the $[H_3O^+]$ and pH of a 0.10M solution of acetic acid in water? The Ka for acetic acid is 1.75×10^{-5}

Acid Base Neutralization

What happens when we mix an acid and a base?

Does this mean if I mix some HCl with some NaOH, it will be safe to drink?

How much of each reactant would we need to mix so that the resulting solution was neutral with pH 7?

The Equation!

1) How much 2.00-M HCl would be needed to neutralize 42.0 mL of 1.50-M NaOH?

2) How many mL's of 0.50M HCl are needed to completely react with 25.0 mL's of 0.50 M NaOH?

3) What is the concentration of KOH if it takes 36.0 mL of 0.250-M H_2SO_4 to neutralize 25.0 mL of it?

What is titration?

How does it work? Buret, Flask, Indicator. Let's Draw!

What are the Equivalence Point and the End Point?

Why use a Buret?

Titration Math (Honors Chemistry Only)

What is vinegar?

Consider this classic example of titration. We are using standardized NaOH to determine the concentration of acetic acid in vinegar.

Mass of empty flask	95.00 grams
Mass of flask and vinegar	99.00 grams
Initial buret reading	0.22 mL
Final buret reading	14.61 mL
mL's of NaOH added	
Molarity of NaOH	0.2315 moles per liter
Liters of NaOH added	
Moles of NaOH added	
Moles of acetic acid in vinegar	
Mass of acetic acid in vinegar	
Mass of vinegar	
% acetic acid in vinegar	

This titration deals with a new household cleaner that contains ammonia (molar mass 17.04 g/mole) to determine the percent composition of the new sample.

Mass of empty flask	147.30
Mass of flask and household cleaner	152.30
Initial buret reading	0.25
Final buret reading	65.46
mL's of HCl added	
Molarity of HCl	0.4500 moles per liter
Liters of HCl added	
Moles of HCl added	
Moles of ammonia in cleaner	
Mass of ammonia in cleaner	
Mass of household cleaner	
% Ammonia in cleaner	