March 8, 2018

7th Grade Acids and Bases Study Guide

***Vocabulary***

**Solution**: a mixture of two or more substances

**Solute**: the substance that is present in the smallest amount when a solution is prepared

* This substance is typically a solid, but not always
	+ When we did the dilutions in lab #2, the HCl was the solute because we mixed 1 little milliliter of HCl into 9 mL of water

**Solvent**: the substance that is present in the largest amount when a solution is prepared

* This substance is typically a liquid
	+ In the lab #2 dilutions, the solvent was *water*
	+ Ex. in salt water (a solution), salt is the solute and water is the solvent

**Concentration**: the amount of solute compared to the volume of solvent

* + Concentration = solute ÷ solvent
	+ Usually expressed as a certain mass of solute that is dissolved in milliliters of solvent
	+ Ex. concentration of H+ = how many H+ ions are dissolved into water

**Dissociate**: when a chemical compound is dissolved in a solvent and separates into two or more ions

* A compound breaks down into ions
* Ex. HCl → H+ + Cl- HCl *dissociates* into H+ and Cl-

**Ion**: a chemical compound that has a negative or a positive charge

* + A *cation* is positively charged, and an *anion* is negatively charged
	+ Ex. H+ and OH-

**Hydrogen ion**: H+

* A hydrogen atom that has lost 1 electron, so that only the nucleus and a single proton remain
	+ When an acid is mixed with water, the acid breaks down into a negatively charged ion and H+
		- Ex. HCl 🡪 H+ + Cl-
		- The presence of H+ makes acids acidic

**Acid**: a chemical compound that dissociates into an H+ and a negatively charged ion when mixed with water

* + Acids turn litmus paper (pH paper) RED

**Hydroxide ion**: OH-

* A water molecule that has lost a hydrogen ion, H+
	+ When a base is mixed with water, it dissociates into a positively charged ion and an OH–
		- NaOH 🡪 Na+ + OH-
		- The presence of OH- makes bases basic

**Base**: a compound that dissociates into an OH- and a positively charged ion when mixed with water

* + Bases turn litmus paper BLUE

**pH scale**: a scale from 0 to 14 that is a measure of the hydrogen ion concentration

* A higher pH means there is LESS H+
	+ Lower pH = more H+
* A higher pH means there is MORE OH-
	+ Lower pH = less OH-
* pH is measured on a **logarithmic scale** (“log” scale)
* A pH of 7 has 10x more H+ than a pH of 8
	+ A pH of 7 is 10x more acidic than a pH of 8
* A pH of 9 has 100x more OH- than a pH of 7
	+ A pH of 9 is 100x more basic than a pH of 7
* A pH of **7 is neutral**

**Dilution**: when a concentrated solution is prepared by adding more solvent

* In our labs, we diluted HCl by adding more water

**Neutralization**: when an acid and a base react to form a water molecule and a salt

* Acid + Base → H2O and a salt
	+ The OH- binds to the free H+
	+ This reduces the amount of free H+ ions, which decreases acidity and raises pH, making the solution a more neutral pH
* Ex. HCl + NaOH 🡪 H2O + NaCl

**Stomach acid**: HCl

* Human stomachs are lined with cells that produce HCl (acid) to aid digestion
* Our stomachs also have cells that produce mucus to protect our stomachs from the HCl
* Excessive stomach acid can cause acid reflux or ulcers

***Focus Questions***

*What properties make acids and bases chemically reactive?*

* Acids release H+ ions when they are mixed with water
* Bases release OH- and combine with H+ ions when they are mixed with water.

*What is the relationship between the concentration of H+ ions in a solution and the chemical reactivity of strong and weak acids?*

* Strong acids release more H+ ions when mixed with water, resulting in a higher concentration of H+ ions
	+ This yields a lower pH
* Weak acids release fewer H+ ions, resulting in a lower concentration of H+ ions
	+ This yields a higher pH

*What is the relationship between the concentration of H+ ions in a solution and the chemical reactivity of strong and weak bases?*

* Strong bases release more OH- ions that can remove more H+ ions when mixed with water, resulting in a lower concentration of H+ ions
	+ This results in a higher pH
* Weak bases remove fewer H+ ions resulting, in a higher concentration of H+ ions
	+ This results in a lower pH

*What is the relationship between the pH of a solution and the concentration of hydrogen ions (H+)?*

* As the pH of a solution increases, the concentration of H+ ions decreases
	+ An increase of 1 pH unit *decreases the H+ concentration 10 times*
* As the pH of a solution decreases, the concentration of H+ ions increases
	+ A decrease of 1 pH unit *increases the H+ concentration 10 times*

*What is the relationship between the pH of a solution and the concentration of hydrogen ions (OH-)?*

* As the pH of a solution increases, the concentration of OH- ions increases
	+ An increase of 1 pH unit *increases the OH- concentration 10 times*
* As the pH of a solution decreases, the concentration of OH- ions decreases
	+ A decrease of 1 pH unit *decreases the OH- concentration 10 times*

*What happens to the concentration of hydrogen ions (H+) when an acid and a base react?*

* When an acid and a base are mixed, H+ ions and OH- ions react to produce water and a salt
	+ Ex. HBr + KOH 🡪 H2O + KBr
* This decreases the concentration of free H+ and OH- ions, resulting in a more neutral solution
* Water is neutral!! Water has a pH of 7

Acids

* pH < 7
* taste sour
* neutralize bases
* release H+

Bases

* pH > 7
* taste bitter
* feel slippery
* neutralize acids
* release OH-