Unit 2 Review

Chemistry 0

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Chemical Reactions

- A physical change, such as a state change or dissolving, does not create a new substance, but a chemical change does.
- In a chemical reaction, the atoms and molecules that interact with each other are called **reactants**.
- In a chemical reaction, the atoms and molecules produced by the reaction are called **products**.

Naming Compounds

- Binary compounds
  - A binary compound is a compound that consists of two elements.
  - The second element almost always ends with -*ide*.
  - The second element of a binary element is always a non-mental, regardless of whether the bond is ionic or covalent.

Counting Atoms

- Learning how to count the atoms of a given element will help to understand how to balance a chemical reaction.
- A chemical formula can tell you how many which type of atom are bonded together. It can also tell you the nature of the bond, whether or not the bond is ionic or covalent.

Balancing Equations

- A chemical equation indicates which compounds are involved in the reaction.
- The left side of the equation has the **reactants** added together, while the right side of the equation has the **products** added together.
- The equation has a yield ($\longrightarrow$) symbol rather than an equal (=) sign. The reaction "yields" the products.
- A balanced equation tells you how much of each reactant is needed to form the products.

Balancing Equation Rules

- Begin by balancing one element at a time.
- First balance elements that appear only once on each side of the equation.
- Balancing multi-element compounds before balancing single-element compound.
- Balance H and O atoms last.
- Use trial and error. Be patient.
- Add up all of the kinds of atoms on both sides of the equation to make sure it is completely balanced.

Types of Chemical Reactions

Basic types of chemical reactions:

1. Synthesis Reaction
2. Decomposition Reaction
3. Single-Replacement Reaction
4. Double-Replacement Reaction

Conservation of Mass in Chemical Reactions

- In a chemical reaction, atoms in the reactant molecules unbond from one another and then rearrange and rebond in different ways to form the products.

- The equal number of atoms on each side of the equation shows that mass is conserved during a chemical reaction.

Effect of temperature on the rate of chemical reaction

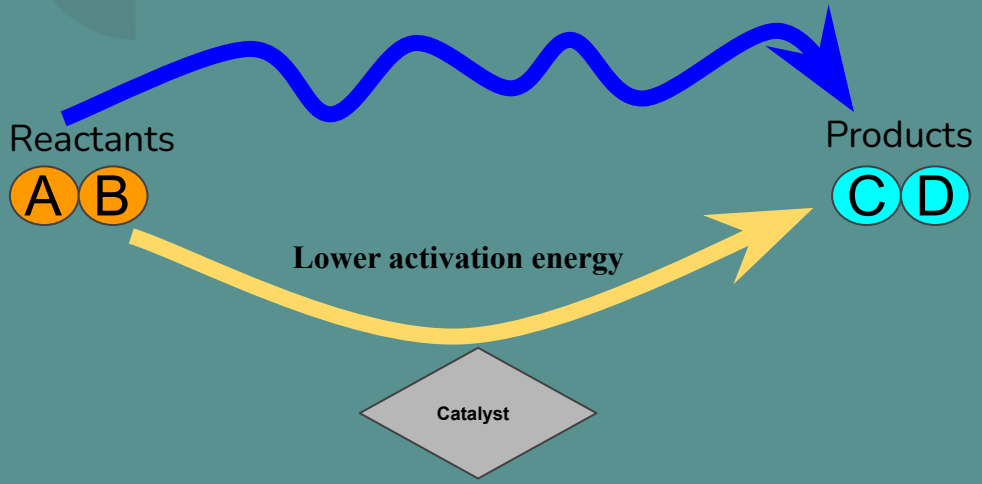
- Reactants must be moving fast enough and hit each other hard enough for a chemical reaction to take place.
- Increasing the temperature increases the average speed of the reactant molecules.
- As more molecules move faster, the number of molecules moving fast enough to react increases, which results in faster formation of products.

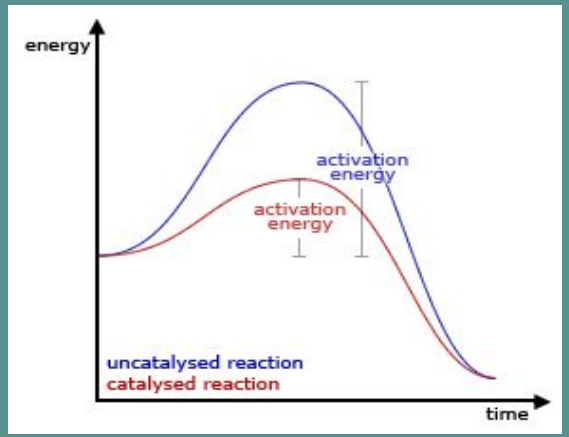
Catalyst and Rate of the Reaction

- A catalyst is a substance that can help the reactants in a chemical reaction react with each other faster.

- A catalyst does not actually become part of the products of the reaction.

How does catalyst work?





A catalyst works by providing an alternative activation pathway for the reaction to occur. This pathway has a lower activation energy than the pathway without the catalyst.

Energy Changes in Chemical Reactions

- A chemical reaction involves the breaking of bonds in the reactants and the making of bonds in the products. It takes energy to break bonds and that energy is released when bonds are formed.

- Endothermic reactions absorb energy from the surroundings, whereas exothermic reactions release energy into the surroundings.

Acids and Bases

- General properties

Acids	Bases
Sour in taste	Bitter in taste
Not slippery to the touch	Slippery to the touch
Dissolve metals	React with metals to form precipitates
Vinegar, tomatoes, black coffee	Detergents and many cleaners

Acid-Base Theory

- Swedish Chemist **Svante <u>Arrhenius</u>** Theory

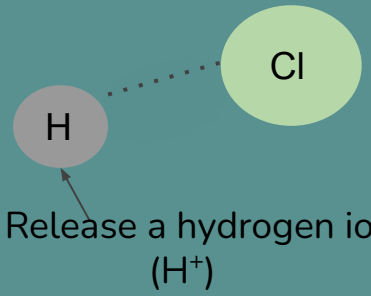
Arrhenius Acid

$HA \rightarrow A^- + H^+$

(acid)

Example

Hydrogen Chloride (HCl)



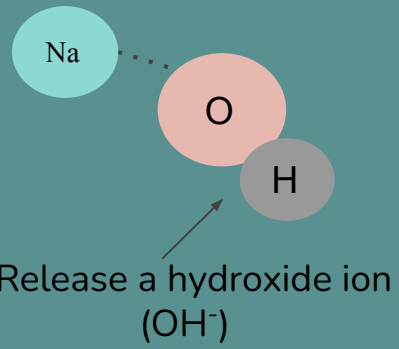
Arrhenius Base

$BOH \rightarrow B^+ + OH^-$

(base)

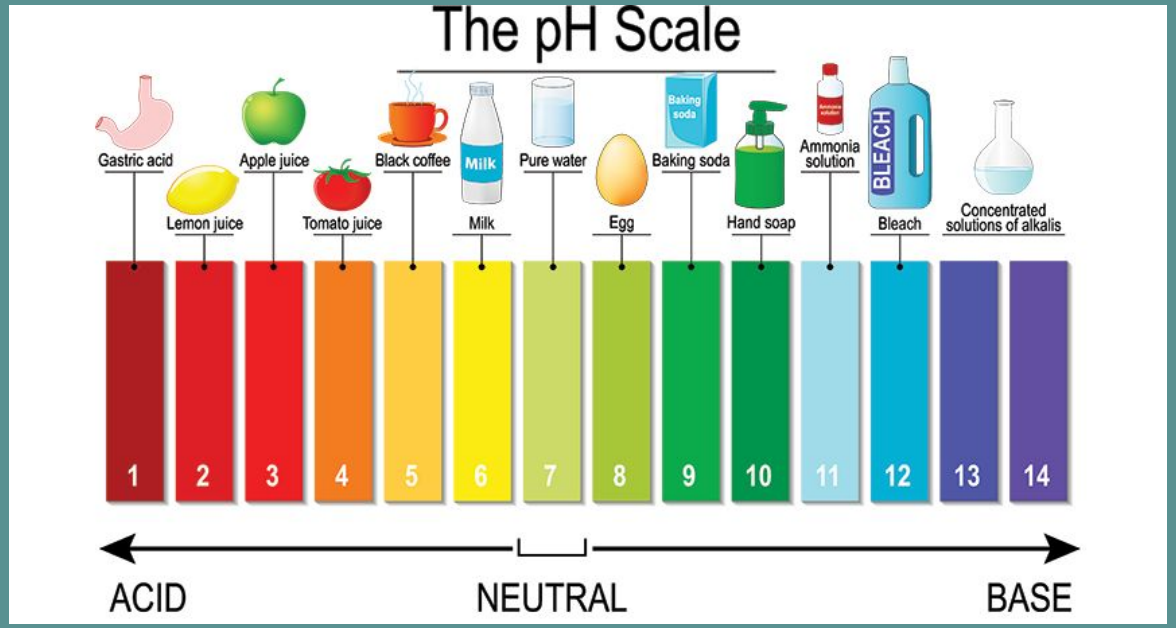
Example

Sodium Hydroxide (NaOH)



Distinguishing Acids from Bases

- The pH Scale



https://www.sciencenewsforstudents.org/article/scientists-say-ph

pH Measurement

Universal Indicators

www.fishersci.com

pH Meter

www.hannainst.com/

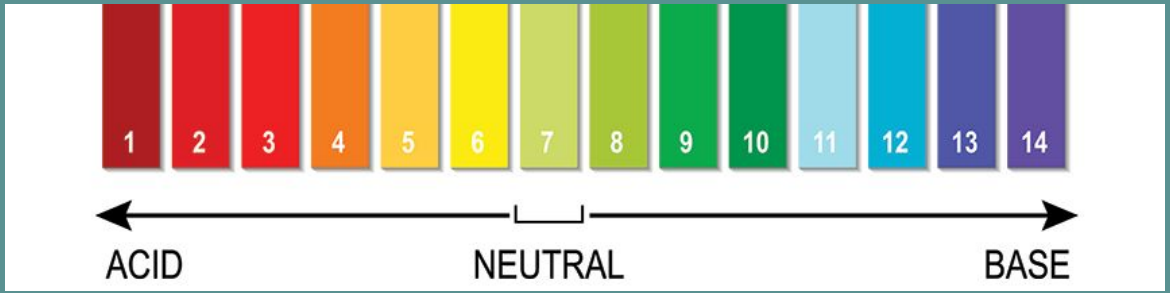
pH Paper

https://www.istockphoto.com/photo/ph-paper-test-gm512132335-47438806

Acid-Base Neutralization

- pH is a measure of the concentration of hydrogen ions in a solution.
- Adding an acid increases the concentration of hydrogen ions in the solution.
- Adding a base decreases the concentration of hydrogen ions in the solution.
- An acid and a base are like chemical opposites.

Acid-Base Neutralization



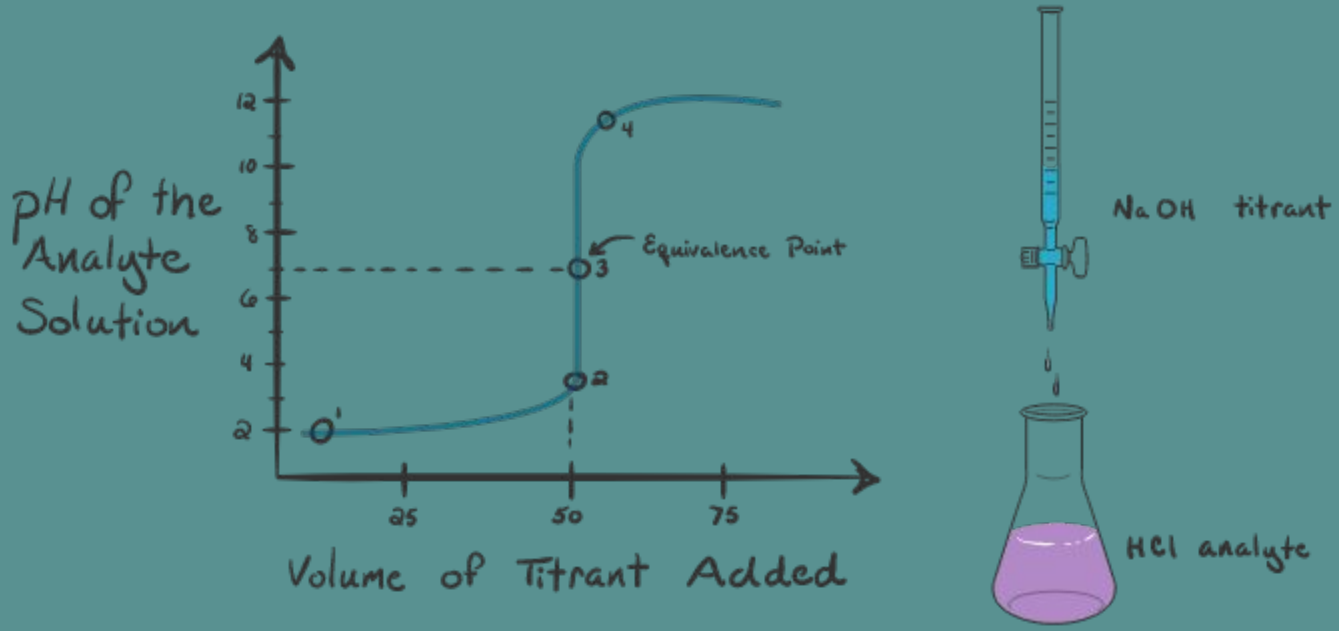
- If a base is added to an acidic solution, the solution becomes less acidic and moves toward the middle of the pH scale. This is called neutralizing the acid.

- If an acid is added to a basic solution, the solution becomes less basic and moves toward the middle of the pH scale. This is called neutralizing the base.

Acid- Base Titration

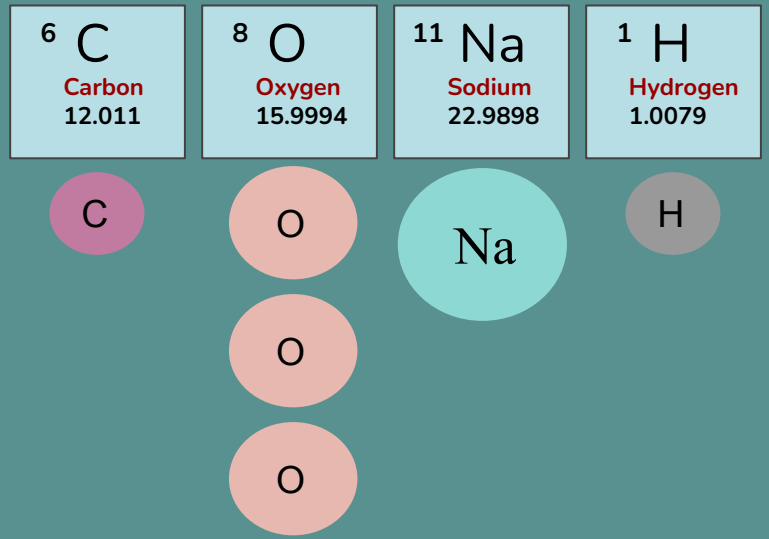
- Titration is a technique to determine the concentration of an unknown solution.
- Titration is the slow addition of one solution of a known concentration to a known volume of another solution of unknown concentration until the reaction reaches neutralization.
- Acid-Base titrations are usually used to determine the concentration of the unknown acid or base through acid base reactions.
- An acid base indicator a pH meter is used to observe the acid base reaction during the titration.

Plot of an Acid- Base Titration



https://www.khanacademy.org/

Moles and weights



- One mole of carbon atoms = 12 grams
- One mole of hydrogen atoms = 1 gram
- One mole of sodium atoms = 23 grams
- One mole of oxygen atoms = 16 grams

Molecular weight of baking soda ($NaHCO_3$)
= (1x12 amu) + (3x16 amu) + (1x23 amu)+ (1x1 amu) = 84 amu

One mole of baking soda molecules = 84 grams

Concentration of solutions

- The most common unit of concentration is molarity (M).
- The molarity (M) is defined as the number of moles of solute present in exactly 1 L of solution:

$$\text{Concentration (Molarity)} = \frac{\text{Amount of Solute (mol)}}{\text{Volume of the solution (L)}}$$

Example:

If we know that the volume of the 1 mole of acetic acid is 1 L, how much is the concentration of the acetic acid solution?

Concentration = 1 mol/ 1 L = 1 mol/L = 1 M