**5.1 Acids and Bases Notes**

Many compounds can be classified as either an acid or a base.

When put in water Acids and Bases break down (\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_) differently.

These ions can mix together to form \_\_\_\_\_\_\_\_\_\_\_\_\_\_! Acidic and basic solutions mixed together can **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** each other.

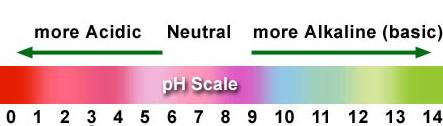
H+ + OH- 🡪 H20

Acids and Bases are all around us:

* in our \_\_\_\_\_\_\_\_\_\_\_\_\_\_,
* in house hold products like \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* in the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

**Acids and Bases can be identified by their:**

1. pH
2. Formula
3. Characteristics
4. Name
5. Reaction to other substances
6. **Identifying Acids and Bases by pH**



pH is a scale of 1-14 that measures how \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ a substance is.

* Any solution with a pH of 7 is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
* pH of **less than** 7 is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
* pH of **more than** 7is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_)
* pH indicates the **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** of the acid or base
* **Strong** acids have very **\_\_\_\_\_\_\_\_\_\_** pH,
* **Strong bases** have very **\_\_\_\_\_\_\_\_\_\_\_** pH,
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is **neutral with a pH of 7**.
* pH measures of the **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**of H ions in a solution.

**[H+*(aq)*] [OH–*(aq)*]**

* + - High [H+*(aq)*] = **low pH, very acidic**
    - High [OH–*(aq)*] = **high pH, very basic**
* A small change in pH points is very significant:
  + 1 pH unit indicates **a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** (10x) change in acidity or basicity.

Example: pH 4 is **\_\_\_\_\_\_\_\_\_\_** more acidic than pH 5

Example: pH 4 is **\_\_\_\_\_\_\_\_\_\_** more acidic than pH 6

* A small change in pH can have large consequences especially for living organisms.

**pH of a solution can be determined by:**

1. **Indicators:** pH indicators **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** depending on the solution they are in.

Litmus Paper

* + \_\_\_\_\_\_\_\_\_\_\_\_\_\_ solution turns paper \_\_\_\_\_\_\_\_\_\_
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_ solution turns paper \_\_\_\_\_\_\_\_\_.
  + Inexpensive, **single use only**.
  + Cannot give **numerical** pH value.

Universal indicator

* + Different indicators **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**, so different indicators are used to identify different pH values
  + accurate within **\_\_\_ pH values**

1. **Natural Sources**
2. **pH Meter**
   * Measures **electrical \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of a solution**.
   * **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, accurate**
   * **Expensive**
   * **Multi use**

A solution **cannot** have BOTH high [H+] and [OH–], at the same time because they cancel each other out and form **water**.

This process is called **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**. **H+*(aq)* + OH–*(aq)* → H2O(l )**

**Characteristics of Acids and Bases**

Acids Bases

Taste: \_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_

Touch: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

pH: \_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_

Litmus: \_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_

* Acids and bases can conduct electricity because they release\_\_\_\_\_\_\_\_ in solution.
  + Acids release **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, H+*(aq)***
  + Bases release **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ ions OH–*(aq)***

**NAMING ACIDS AND BASES**

Most acids \_\_\_\_\_\_\_\_\_\_\_ with an H:

HCl HClO3 H3BO3  HNO3 H2SO4 HN  
 Exceptions: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and acids containing \_\_\_\_\_\_\_\_: CH3COOH

* Acids behave like acids only **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.**
* It is only in solution where they **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** and give up their protons (H+).
* Therefore, acids are often written with subscript **(aq) = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.**

eg HCl (aq)

**Naming Binary Acids:**

* A binary acid is when hydrogen is bonded to a second **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**:
* Eg. HCl, HF, HBr, HI, H2S
* Acids must be in **\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
* The formula HF does not indicate state of matter:

solid compound: hydrogen fluoride

in solution: hydrofluoric acid.

* If in **aqueous** form, use:

Hydro……….ic acid

eg. HCl 🡺\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* If no state is given, use:

Hydrogen…..….-ide

eg. HCl 🡺\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Example: Name compound HI (Hydrogen Iodide) as and acid solution:

1. Start with \_\_\_\_\_\_\_\_\_\_-
2. Take anion root -\_\_\_\_\_\_\_\_\_
3. add -\_\_\_\_\_\_\_\_\_
4. Add to end \_\_\_\_\_\_\_\_\_\_
5. Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Example: Name H2S (hydrogen sulfide) as an acid in solution:

1. Start with Hydro-
2. Add anion root Sulfur-
3. Add -ic
4. Add Acid
5. Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Naming Acids with Oxygen (polyatomic ions):**

* Do not add hydrogen to these names!
* Naming depends the **anion** (-ate, -ite, per-)

1. If ion ends in **"-\_\_\_\_\_\_\_**“, 🡪 add “\_\_\_\_\_\_\_\_”

Example: NO3  is a nitr**ate ion**,

So HNO3  (hydrogen nitrate) will be **nitric acid**

Example: hydrogen perchlorate ……HClO4 (aq) will be perchloric acid

Example: SO4 2- \_\_\_\_\_\_\_\_\_\_\_\_

H2SO4 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ as a solid compound

H2SO4 (aq) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ when in solution

1. If ion ends in “**–\_\_\_\_\_\_\_**”, The **acid** will end in **"-\_\_\_\_\_\_\_\_**."

Example: ClO2- anion is chlorite,

HClO2 is called chlorous acid

Example: HClO4 (aq) is called **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.**

**Naming Acids Summary**

Binary Acids: hydro……ic acid

Containing Polyatomic ion with Oxygen:

Anion Acid

Ends with –ate ……………ic acid

Ends with –ite ………..…ous acid

Starts with per- per…………ic acid

Starts with hypo- hypo……..ous acid

**BASES**

The chemical formula of a base usually **ends** with a **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (-OH).**

* Bases usually start with a **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** or **\_\_\_\_\_\_\_\_\_\_\_\_\_\_.**
* Bases, like acids, behave like bases **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.**
* Therefore, bases are often written with subscript **(aq) = aqueous = in solution**
* Most strong bases contain **hydroxide (OH), a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ ion.**
* Therefore, the naming strong bases follows same rules for naming **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**:

*anion + cation*

* Example: NaOH is **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**,
* Example: Ca(OH)2 is **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**.
* Example: NH4OH is **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.**

**5.2 Salts**

* Salts are ionic compounds formed when acids and bases react.

**HCl + NaOH 🡪 NaCl + H2O**

**acid + base 🡪 salt + water**

* Salts are also produced when acids react with:

oxides (compounds containing oxygen), carbonates or metals.

**Importance of Salt**

Table salt, NaCl, is found in sea water, salt lakes or rock deposits.

* + Salt was once very valuable as a commodity.
  + Iodine is now added to salt to minimize \_\_\_\_\_\_\_\_\_\_\_\_ (a disease of the thyroid).
  + Salt is used to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ or in \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
  + Salt is sprinkled on roads and sidewalks to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

**Where are salts found?**

* NaCl is only one kind of salt. A salt is made up of a **positive ion from a base** and a **negative ion from an acid.**
* Other salts are found in many things:
  + - In \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, explosives and fertilizers
    - In \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
    - In many living \_\_\_\_\_\_\_\_

**Acid-Base Neutralization**

**Neutralization** reactions occur when an **acid and a base** react to produce a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_:

* + HCl(aq) + NaOH(aq) → NaCl(s) + H2O(l)

*acid base salt water*

**Metal Oxides and Non-Metal Oxides:**

* **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** react with water to form **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.**
  + Na2O(s) + H2O(l) → 2NaOH(aq)
* **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** react with water to form **\_\_\_\_\_\_\_\_\_\_\_\_.**
  + SO2(g) + H2O(l) → H2SO3(aq)
  + Non-metal oxides are formed from the burning of fossil fuels.
    - Acid added to water in the atmosphere = acid precipitation.

**Acids and Metals**

* + The most \_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_, at the bottom of groups 1 and 2 on the periodic table, react **vigorously** with \_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_.
  + All other metals are **less** reactive than those in groups 1 and 2.
  + When metals do react with acids, \_\_\_\_\_\_\_\_\_\_\_\_\_\_ is usually released.
  + 2HCl(aq) + Mg(s) → MgCl2(s) + H2(g)

**Acids and Carbonates**

* + Carbonates \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ acids, protecting locations with natural carbonate supplies from acid \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
  + H2SO4(aq) + CaCO3(s) → CaSO4(s) + H2O(l) + CO2(g)

*sulphuric calcium calcium water carbon*

*acid carbonate sulphate dioxide*