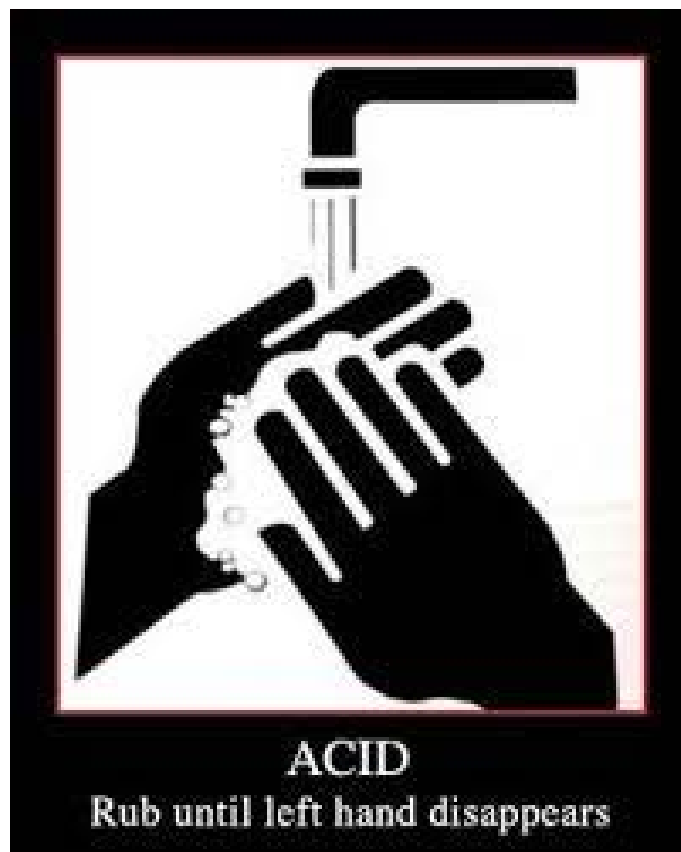


Acids & Bases



Outcome:

S2-2-08 Experiment to classify acids and bases using their characteristic properties. *Include: pH, indicators, reactivity with metals.*

What the heck are acids & bases?

- **ACIDS** and **BASES** are two groups of compounds that have their own **CHARACTERISTIC FORMULAS** and **CHEMICAL PROPERTIES**, especially when they are **DISSOLVED** in **WATER**.
- Acids and bases will normally be **DISSOLVED** in **WATER**, and therefore have the _(aq) subscript after their formula indicating an **AQUEOUS SOLUTION**.
- Substances that are acidic or basic usually contain either **HYDROGEN IONS** (H^+) or **HYDROXIDE IONS** (OH^-)
- How acidic or basic a substance is can be measured using the **pH SCALE** – more on this later...

Definition of Acids and Bases:

All substances will fall into one of three categories:

1. ACID
2. BASE
3. NEUTRAL (neither)

Chemists have come up with many ways of classifying substances into these categories. We will use the simplest definition...

Acids

- Are IONIC compounds that contain HYDROGEN IONS (H⁺), or release HYDROGEN IONS in water.
- The HYDROGEN ions are what give acids their distinct PROPERTIES.

Bases

- Are ionic compounds that contain HYDROXIDE IONS (OH⁻), or release HYDROXIDE IONS in water.
- The HYDROXIDE ions are what give bases their distinct PROPERTIES.

Properties of Acids:

Acids typically have the following properties:

1. CONTAIN HYDROGEN IONS (H⁺)

- When acids are dissolved in water they **RELEASE H⁺ IONS**.
- These ions are what give acids their properties
ex) $HCl \rightarrow H^+ + Cl^-$

2. CONDUCT ELECTRICITY

- Since there are ions (charges), acids can carry electricity



Properties of acids:

3. SOUR TASTE

- Think of CITRUS JUICES (orange or grapefruit), they all contain CITRIC ACID.
- SOUR candies are also coated in CITRIC ACID



4. CORROSIVE

- Will REACT with most METALS
- BURN the SKIN – like battery acid or bee stings



Properties of Bases:

Bases:

Bases typically have the following properties:

1. CONTAIN HYDROXIDE IONS (OH⁻)

- When Bases are dissolved in water they RELEASE OH- IONS.
- These ions are what give bases their properties



2. CONDUCT ELECTRICITY

- Since there are ions (charges), bases can also carry electricity

3. BITTER TASTE

- Think of SOAPS, BAKING SODA



Properties of bases:

4. FEEL SLIPPERY

- Think of SOAPS, which are made by reacting a base with fats.



5. CAUSTIC

- Reacts with LIVING TISSUE to BREAK it down.
- Used in DRAIN cleaners and PAPERMAKING.



Some Common Acids:

Formula	Name	Found In
$\text{H}_2\text{SO}_{4(\text{aq})}$	Sulfuric Acid	Car batteries
$\text{HCl}_{(\text{aq})}$	Hydrochloric Acid	Stomach acid
$\text{H}_2\text{CO}_{3(\text{aq})}$	Carbonic Acid	Soft drinks
$\text{H}_3\text{PO}_{4(\text{aq})}$	Phosphoric Acid	Soft drinks
$\text{HNO}_{3(\text{aq})}$	Nitric Acid	Explosives
$\text{HC}_2\text{H}_3\text{O}_{2(\text{aq})}$	Acetic Acid	Vinegar
$\text{HC}_6\text{H}_7\text{O}_{7(\text{aq})}$	Citric Acid	Oranges, lemons
$\text{HC}_3\text{H}_5\text{O}_{3(\text{aq})}$	Lactic Acid	Sour milk, muscle fatigue
$\text{HC}_9\text{H}_7\text{O}_{4(\text{aq})}$	Acetylsalicylic Acid	Aspirin

Some Common Bases:

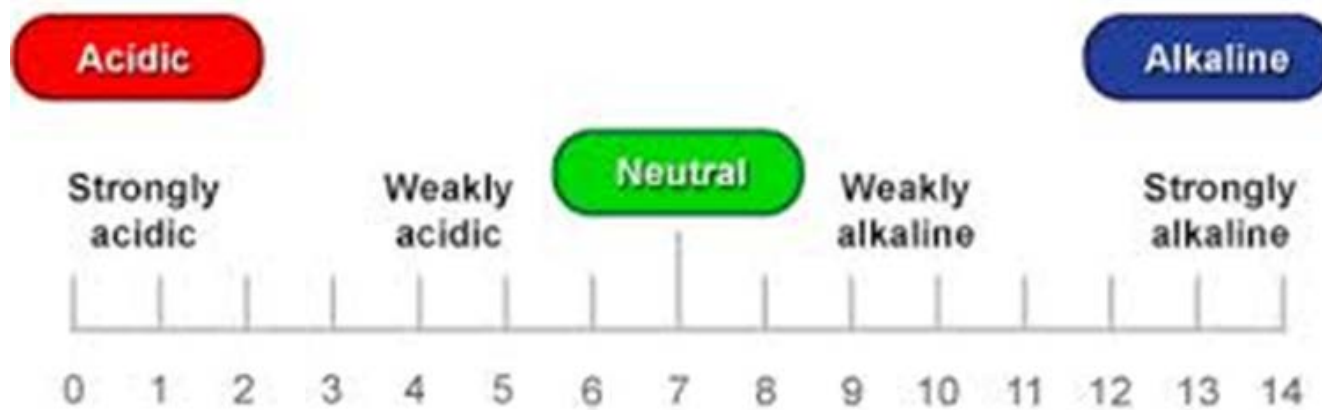
Formula	Name	Found In
NaOH(aq)	Sodium hydroxide	Drain cleaner
KOH(aq)	Potassium hydroxide	Soap, cosmetics
Al(OH) ₃ (aq)	Aluminum hydroxide	Antacids
NH ₄ OH(aq)	Ammonium Hydroxide	Ammonia, windex

Testing acids and bases...

There are different ways to test how acidic or basic (alkaline) a substance is...

pH – “The Power of Hydrogen”

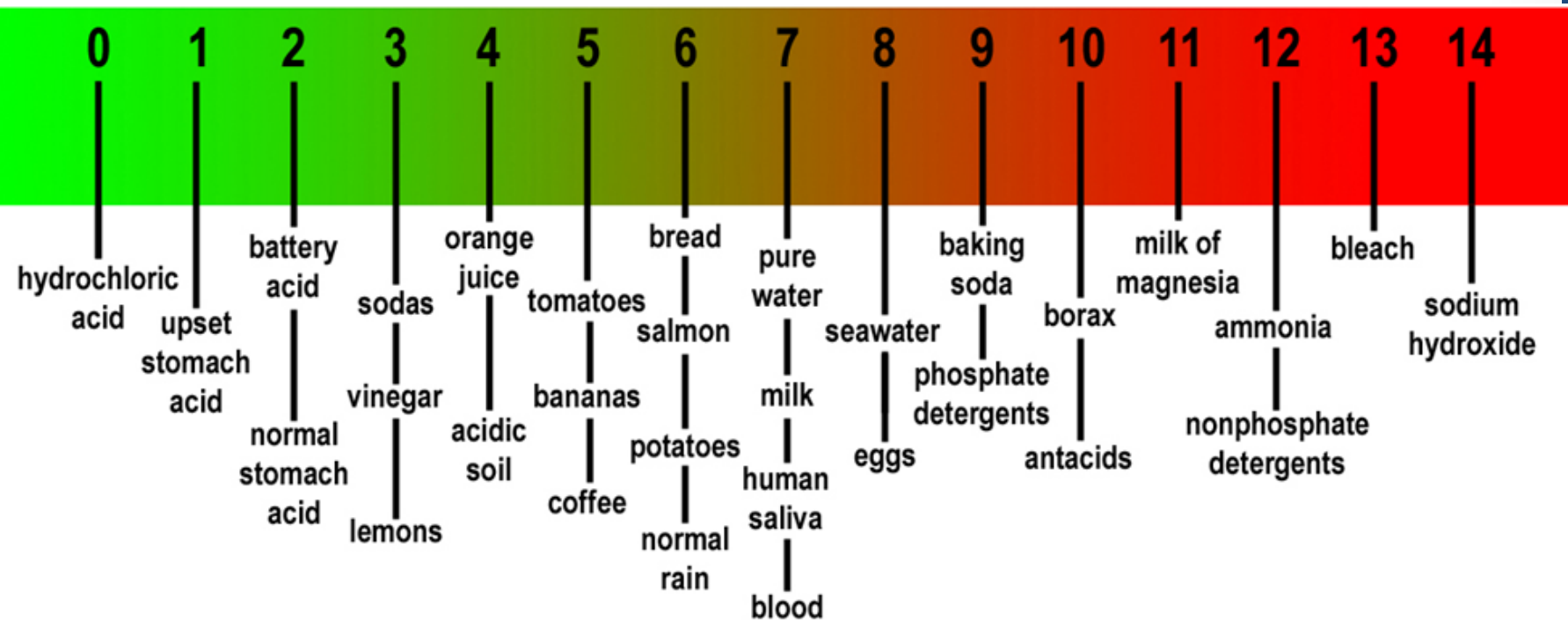
- A scale that goes from 0 – 14 that tells us how ACIDIC or BASIC (ALKALINE) a substance is:



Testing acids and bases...

pH – “The Power of Hydrogen”

- here are some examples of everyday substances and their **APPROXIMATE** pH:



Testing acids and bases...

pH – “The Power of Hydrogen”

- Every UNIT of pH represents a difference of a FACTOR OF 10, for example:
 - VINEGAR (pH \approx 3) is TEN times more ACIDIC than ORANGE JUICE (pH \approx 4)
 - BATTERY ACID (pH \approx 2) is 10X more ACIDIC than VINEGAR (pH \approx 3) and 100X more ACIDIC than ORANGE JUICE (pH \approx 4)
- pH can be measured using a pH METER or certain INDICATORS.

Testing acids and bases...

Indicators

- Indicators are substances that change **COLOUR** when in the presence of an **ACID** or a **BASE**.
- Some common indicators are listed in the table below:

Indicator	Acid Colour	Base Colour
Litmus	Red	Blue
Phenolphthalein (feeno-thay-leen)	Colourless	Pink
Methyl orange	Orange	Yellow
Bromothymol blue	Light yellow	Blue
Red Cabbage Juice	Pink	Blue

- A bunch of indicators can be **MIXED** together to make **UNIVERSAL INDICATOR**, which will change different **COLOURS** at a **RANGE** of different **pH VALUES**.

Testing acids and bases...

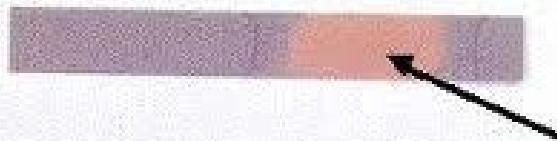
Litmus paper

- Paper that has been **SOAKED** in **LITMUS** indicator.
- Cannot tell you a **pH VALUE**, but will tell you if a solution is **ACIDIC** or **BASIC**.
- Comes in two colours – **BLUE** and **RED**.
 - **BLUE** litmus turns **RED** in **ACID**
 - **RED** litmus turns **BLUE** in **BASE**

Red litmus paper with a drop of base here



Blue litmus paper with a drop of acid here



Testing acids and bases...

pH paper

- Paper that has been **SOAKED** in **UNIVERSAL INDICATOR**.
- You can **DIP** the paper in the **SOLUTION** and compare the resulting **COLOUR** with the **CHART** on the **CONTAINER** to get an **APPROXIMATE pH**

