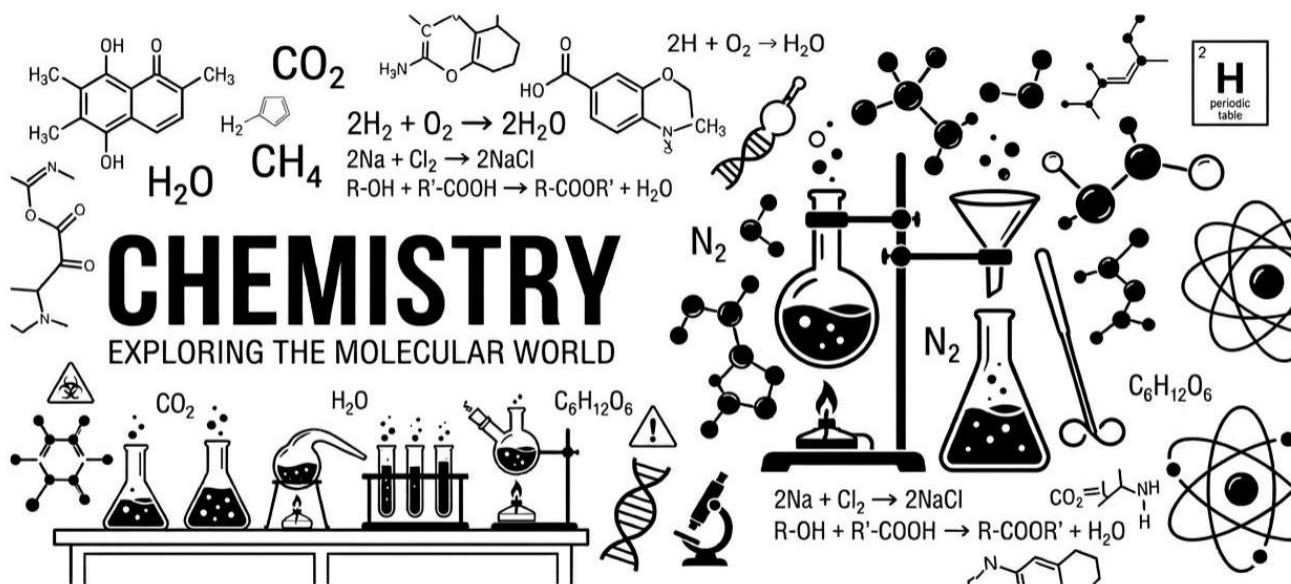


By Navigator Academy

(Science)

Chapter 2: Acids, Bases and Salts



Acids and Bases

In our daily life, we observe that: Lemon tastes sour and Soap feels bitter and slippery. These are simple indications of acids and bases. But chemistry doesn't stop at taste it goes deeper.

Acids are substances that show sour taste and change blue litmus to red, while bases are bitter and turn red litmus blue.

But honestly, remembering just taste is not enough. The real idea is:

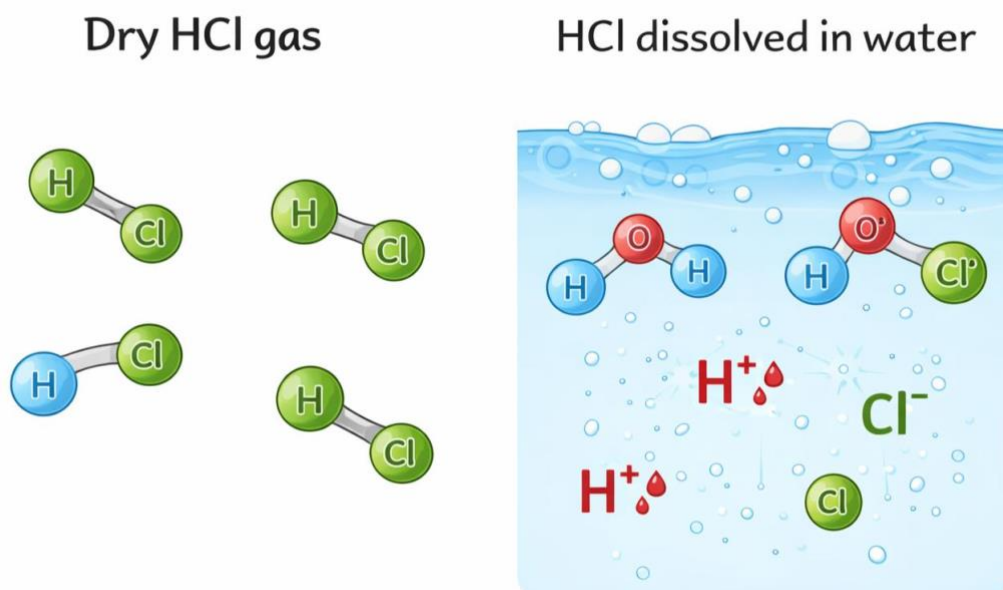
- **Acids** are substances which produce H^+ ions in aqueous solution
- **Bases** are substances which produce OH^- ions in aqueous solution

That's where the real chemistry starts.

Why Water is So Important?

Acids and bases show their properties only in the presence of water.

Example:



- Dry HCl gas \rightarrow does NOT show acidic nature.
- HCl dissolved in water \rightarrow becomes acidic

Why? Because acids produce H^+ ions only in aqueous solution

No water \rightarrow no ions \rightarrow no acidity

When a base is dissolved in water, it increases the concentration of hydroxide ions (OH^-) by dissociating (strong base) or accepting protons from water (weak bases), resulting in a solution with a pH greater than 7.

- $NaOH \rightarrow Na^+ + OH^-$ [This OH^- ion makes the solution basic (alkaline)]
- $KOH \rightarrow K^+ + OH^-$ [Produces OH^- ions, Strong base]

How Do We Identify Acids and Bases?

You obviously can't taste chemicals in a lab (and you shouldn't). So how do scientists identify them? They use indicators.

Common Indicators:

- Turmeric
- Litmus (natural)
- Phenolphthalein, Methyl orange (synthetic).

| Indicator | Acid | Base |
|-----------------|-----------|------------|
| Blue Litmus | Turns Red | No change |
| Red Litmus | No change | Turns Blue |
| Phenolphthalein | Colorless | Pink |
| Methyl Orange | Red | Yellow |

Even onion and clove oil can act as **Olfactory Indicators** (their smell changes in acidic/basic medium)

That's actually interesting chemistry is not always about color, sometimes even smell matters.

Chemical Properties of Acids

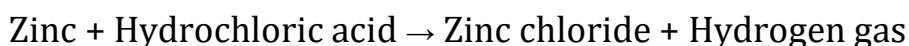
(i) Reaction with Metals

Do Acids React with Metals? Yes, and this is where things get exciting. When an acid reacts with a metal, something very noticeable happens: Hydrogen gas is released

General reaction:

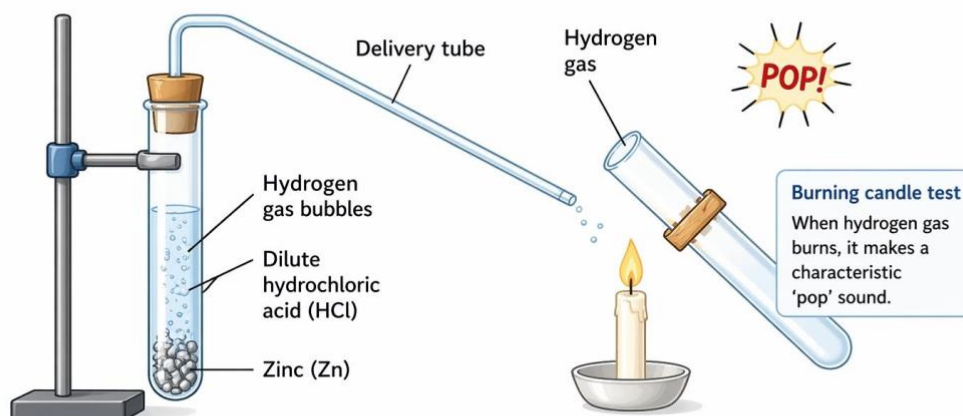


Example:



You might have seen bubbles forming in experiments, those bubbles are hydrogen gas. If you burn hydrogen gas, it makes a characteristic 'POP' sound. Understand the lab experiment from the image provided below.

Zinc Reacts with Hydrochloric Acid to Produce Hydrogen Gas



Key idea:
Zinc reacts with hydrochloric acid to produce hydrogen gas.

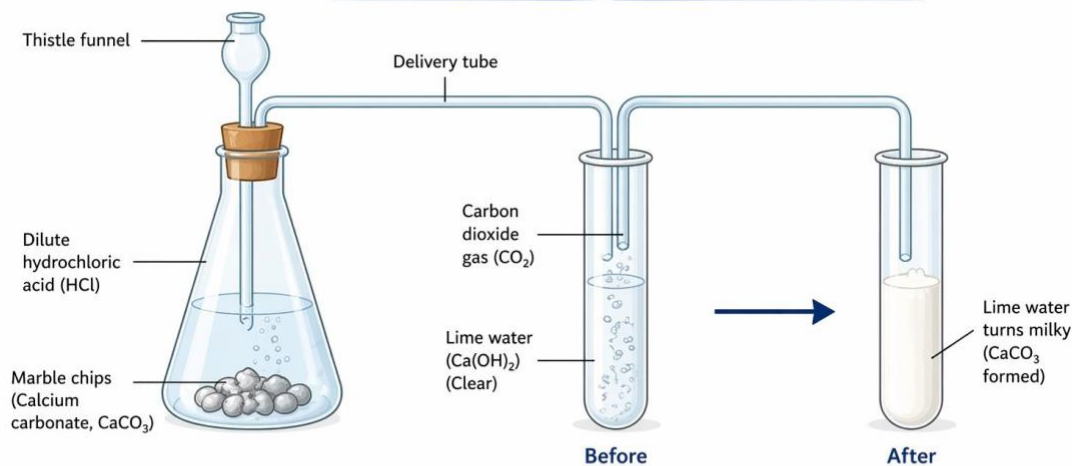
(ii) Reaction with Metal Carbonates

Whenever acids react with carbonates or bicarbonates:

You always get:

- Salt
- Water
- Carbon dioxide

CARBON DIOXIDE GAS TURNS LIMEWATER MILKY



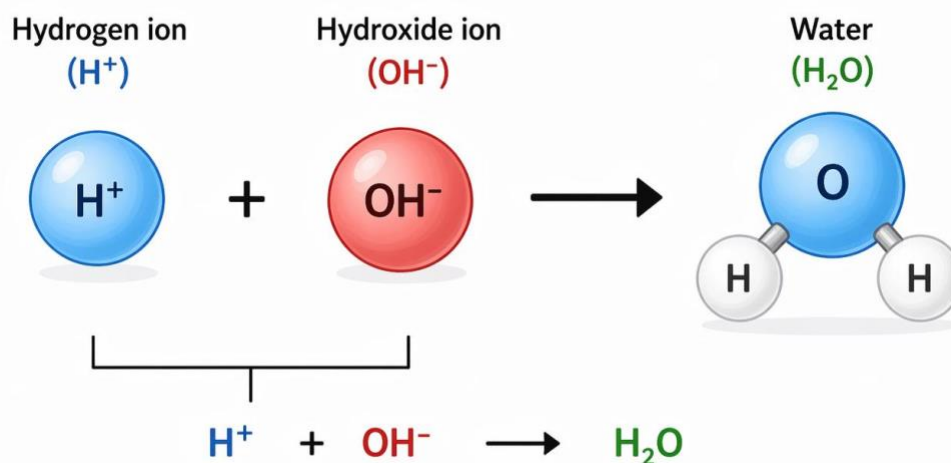
When carbon dioxide gas is passed through lime water (calcium hydroxide), it turns milky due to the formation of insoluble calcium carbonate.

$$\text{Ca(OH)}_2 + \text{CO}_2 \rightarrow \text{CaCO}_3\downarrow + \text{H}_2\text{O}$$

This CO₂ gas turns lime water milky a classic test you'll see again and again in exams.

Neutralization: When Acid Meets Base

H⁺ Ions Combine with OH⁻ Ions to Form Water

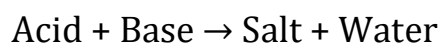


Now imagine this situation: Too much acid in your stomach discomfort

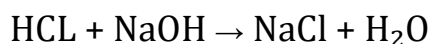
What do we take?

We take Antacid (which is a base) but Why?

Because:



Example:



This is called a **Neutralization Reaction**.

It's not just theory it's literally happening inside your body.

Why Acid Solutions Conduct Electricity?

You might remember an experiment where a bulb glows when connected to an acid solution. That's because:

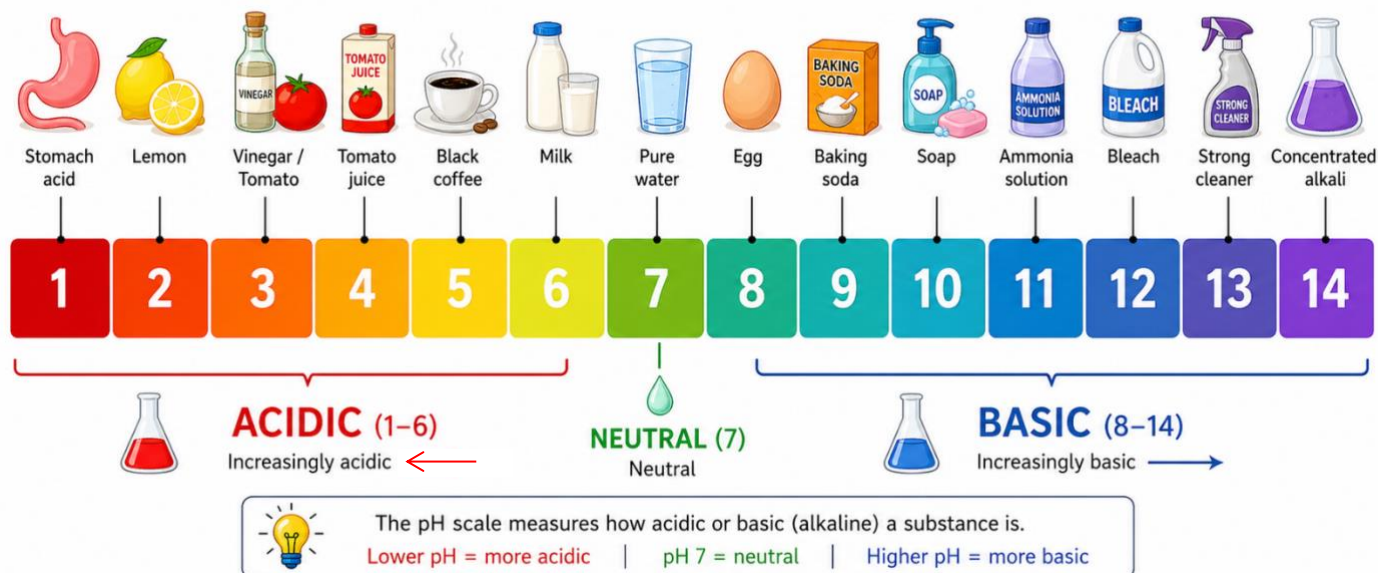
- **Acids and bases produce ions**
- **Ions carry electric current**

That's why glucose solution doesn't conduct electricity no ions

Strength of Acids and Bases (pH Concept)

Not all acids are equally strong. Some release more H ions, some release less. To measure this, we use the pH scale (0-14):

The pH Scale



Lower PH Stronger Acid

Higher PH Stronger Base

Strength ≠ Concentration

- **Strong Acid** → Produces more H⁺ ions (Example: HCl)
- **Weak Acid** → Produces fewer H⁺ ions (Example: CH₃COOH)

Use of Universal Indicator

A universal indicator is a mixture of several indicators that shows different colours at different pH values.

It is used to find the **exact strength of acids and bases**.

Why do we use it?

Litmus only indicates: Acid or Base

But universal indicator indicates: **How strong is the Acid or Base?**

How does it work?

| pH Value | Nature | Colour |
|----------|-------------|---------------|
| 0 - 3 | Strong Acid | Red |
| 4 - 6 | Weak Acid | Orange/Yellow |
| 7 | Neutral | Green |
| 8 - 10 | Weak Base | Blue |
| 11 - 14 | Strong Base | Purple |

Universal indicator helps us measure **strength (pH)**, not just identify acid or base.

Importance of pH in Everyday Life

This part makes your notes **real-life connected + interesting**, pH plays a very important role in our daily life. Let's see how:

(i) Human Body

- Normal pH: 7.0 – 7.8
 - Small change → Dangerous
- Life survives in narrow pH range

(ii) Digestive System

- Our stomach produces hydrochloric acid
 - Excess acid → causes indigestion and pain
- Treatment: Antacids (bases) neutralise the acid

(iii) Tooth Decay

- Bacteria produce acids in mouth
 - When pH falls below 5.5, enamel starts dissolving
- Toothpaste (basic) neutralizes acid

(iv) Acid Rain

- Acid rain pH less than 5.6 of water bodies
 - Harms aquatic life
- pH control is important for environment

(v) Soil pH

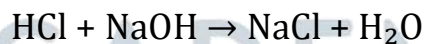
- Plants grow best in a specific pH range
 - Too acidic/basic soil → poor growth,
- So Farmers use lime or manure to maintain pH of Soil.

pH of Salts

What are salts?

Salts are formed from the reaction of an acid and a base (Neutralization Reaction)

Example:



Important Concept:

The pH of salt depends on the strength of the acid and base

| Type | Salt Nature | Example | pH |
|---------------------------|-------------|---------------------------------|--------|
| Strong Acid + Strong Base | Neutral | NaCl | pH ≈ 7 |
| Strong Acid + Weak Base | Acidic | NH ₄ Cl | pH < 7 |
| Weak Acid + Strong Base | Basic | Na ₂ CO ₃ | pH > 7 |

The nature of the salt (acidic/basic/neutral) depends on its parent acid and base

Some Naturally Occurring Acids

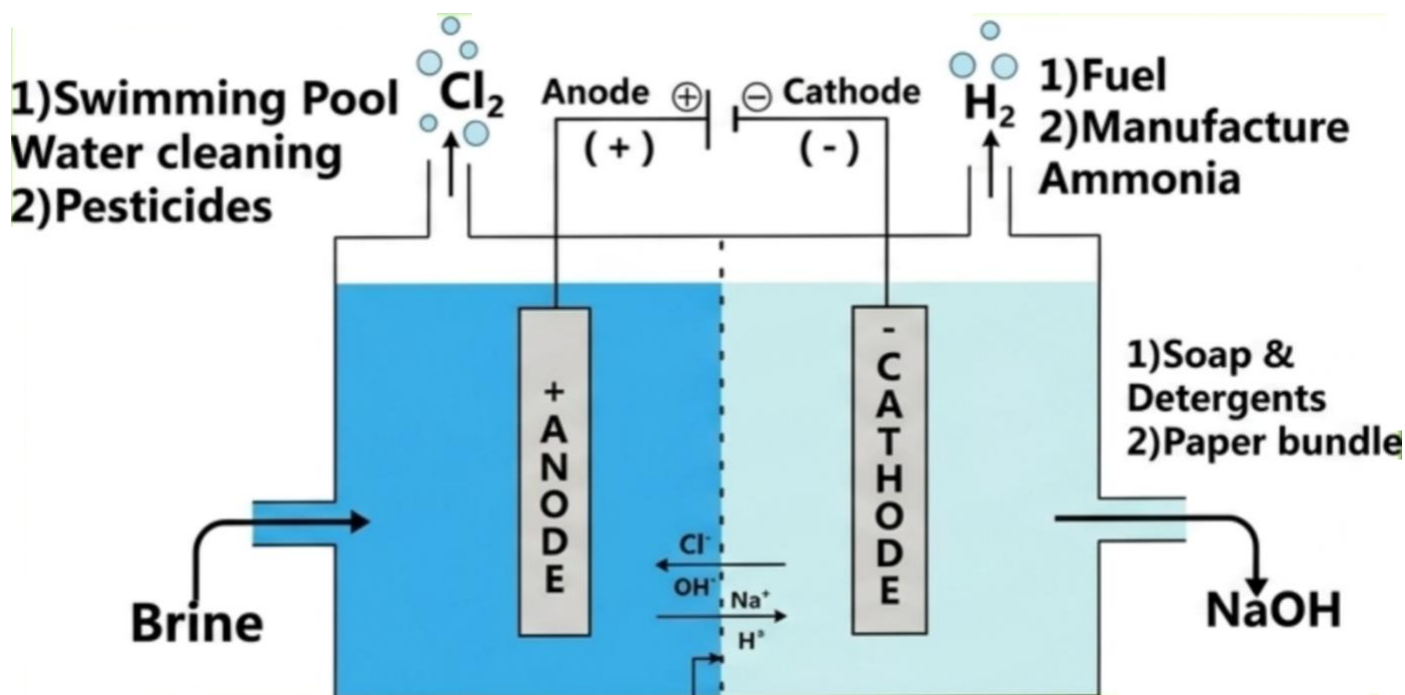
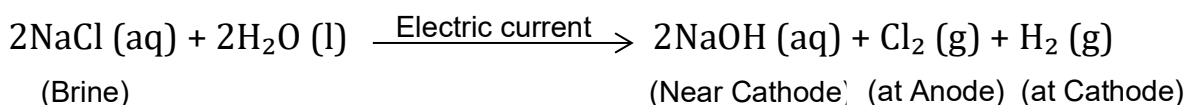
Acids found in natural sources, Here's some Important Examples:

| Natural Source | Acid |
|----------------|---------------------------|
| Lemon | Citric acid |
| Vinegar | Acetic acid |
| Curd | Lactic acid |
| Tamarind | Tartaric acid |
| Tomato | Oxalic acid |
| Orange | Ascorbic acid (Vitamin C) |
| Ant sting | Methanoic acid |
| Nettle sting | Methanoic acid |

Chlor-Alkali Process

Electrolysis of brine (NaCl solution) to produce useful chemicals.

Chlor - Alkali Process \longrightarrow **Sodium hydroxide OR Caustic Soda (NaOH)**



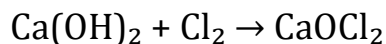
Products & Uses:

- NaOH \rightarrow Soap, paper
- Cl₂ \rightarrow Disinfection
- H₂ \rightarrow Fuel

Chemicals from Common Salt (VERY IMPORTANT)

(i) Bleaching Powder (CaOCl₂)

Preparation:



Uses:

- bleaching cotton and linen; Bleaching washed clothes
- Make drinking water free from germs
- Oxidising agent

(ii) Baking Soda (NaHCO₃)

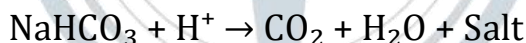


Uses:

- For making tasty crispy pakora
- Neutralize Acidity (mild base) Antacid
- Soda-acid fire extinguisher
- Delay curding of milk
- For faster cooking

Baking Powder

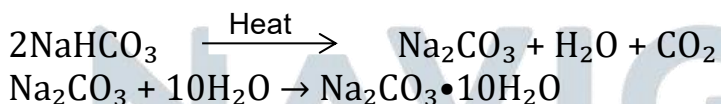
Baking Powder = Baking Soda + Tartaric Acid



Uses:

- Causes bread or cake to rise making them soft or spongy

(iii) Washing Soda (Na₂CO₃·10H₂O)



Uses:

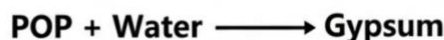
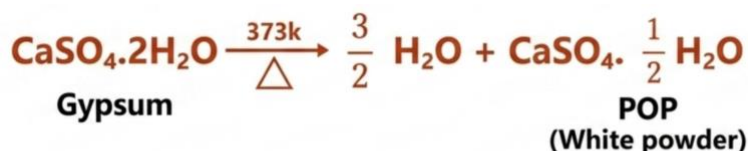
- Removing permanent hardness of water
- Glass, Soap & paper industry

(iv) Water of Crystallization

Fixed number of water molecules present in one formula unit of salt.

| | |
|---|---|
| <p>CuSO₄·5H₂O Copper sulphate crystals (Blue Colour)</p> | <p>Na₂CO₃·10H₂O Sodium Carbonate decahydrate (Washing Soda)</p> |
| <p>CaSO₄·2H₂O Gypsum</p> | <p>FeSO₄·7H₂O Ferrous sulphate crystals (Green Colour)</p> |

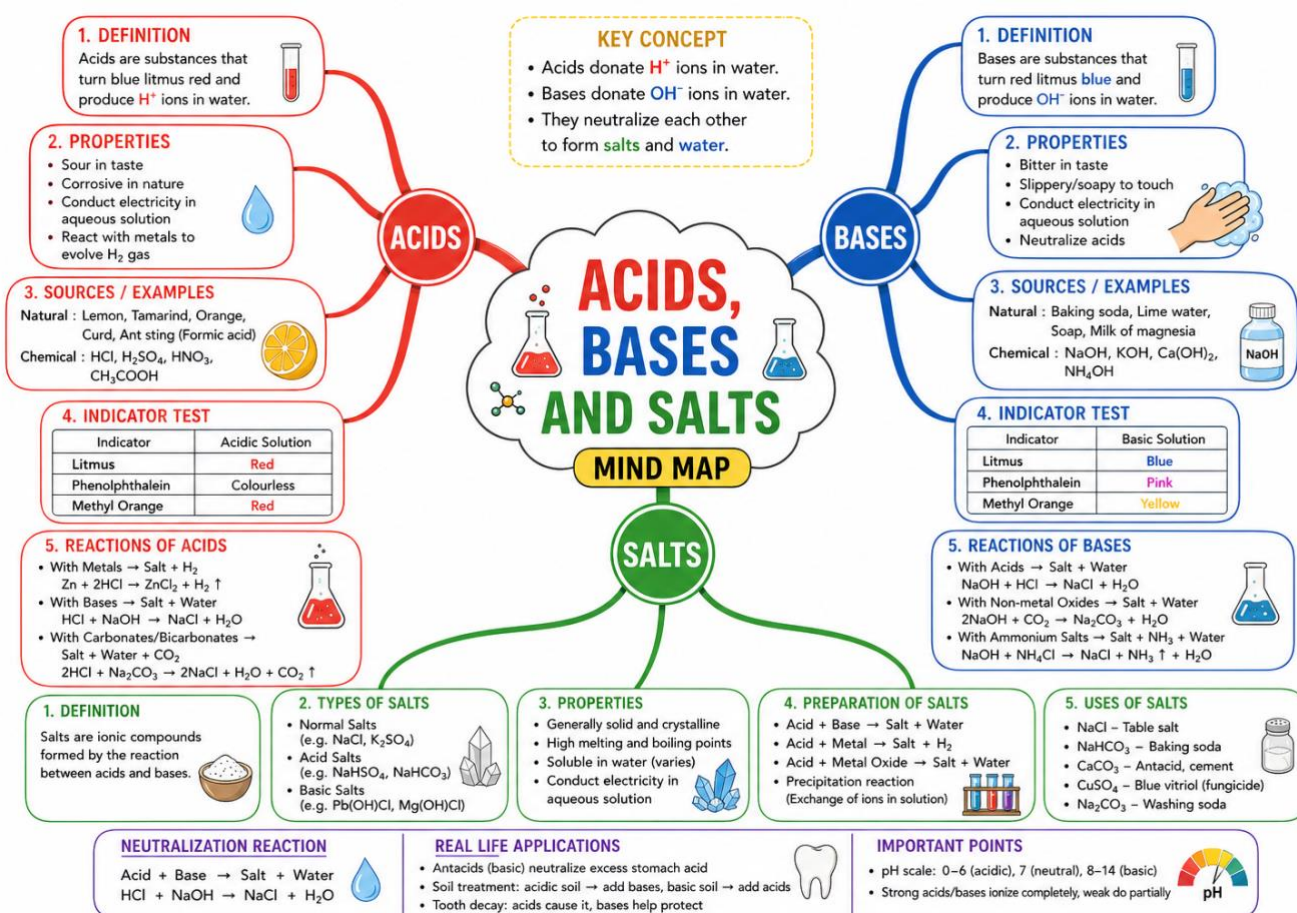
(v) Plaster of Paris (POP)



Uses:

POP is used for making toys, making surfaces smooth & materials for decoration.

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