



AMBITION INSTITUTE

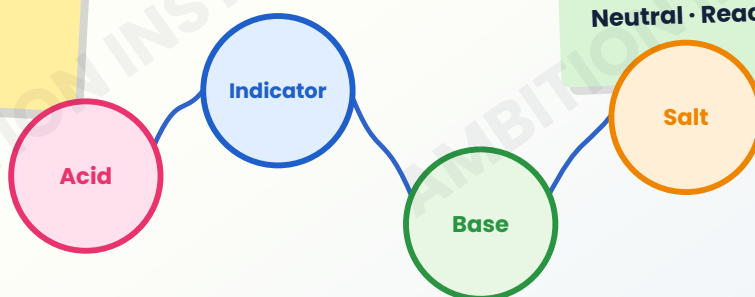
CLASS 10TH

CHAPTER 2

ACIDS, BASES AND SALTS

Let's Test, Neutralise and React – The Chemistry of Everyday Life!

Every colour has a story... Let's find the acid, the base and the salt!



**Sour · Bitter · Salty ·
Neutral · Reactive!**

Acid + Base → Salt + Water

Neutralisation – the heart of this chapter

Observe · Test · Neutralise · Understand



ACIDS, BASES & INDICATORS



IN SHORT

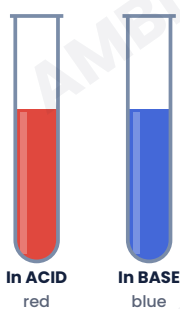
- **Acids** taste sour, turn blue litmus red and give H^+ ions in water.
- **Bases** taste bitter, feel soapy, turn red litmus blue and give OH^- ions in water.
- **Indicators** show different colours in acid and base.
- Acid + Base $\rightarrow$ Salt + Water = **neutralisation**.

Note

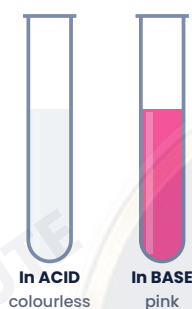
- A base that dissolves in water is an **alkali**. All alkalis are bases, but **not all bases are alkalis**.
- Never taste or touch unknown chemicals – strong acids and bases are **corrosive**.
- Science Class – 10 😊

INDICATORS – COLOUR CHANGE

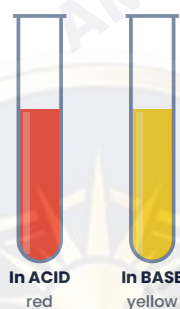
Litmus



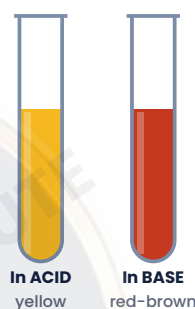
Phenolphthalein



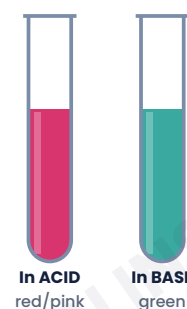
Methyl orange



Turmeric



Red cabbage



ACIDS VS BASES

Property	Acids	Bases
Taste	Sour	Bitter
Touch	Corrosive when strong	Soapy, slippery
Blue / red litmus	Blue turns red	Red turns blue
Phenolphthalein	Colourless	Pink
Methyl orange	Red	Yellow
Ions in water	H^+ (hydrogen ions)	OH^- (hydroxide ions)
Examples	HCl, H_2SO_4 , HNO_3 , CH_3COOH	NaOH, KOH, $Ca(OH)_2$, NH_4OH , $Mg(OH)_2$

Natural source

Acid present

Vinegar	Acetic (ethanoic) acid
Lemon, orange	Citric acid
Tamarind	Tartaric acid
Tomato	Oxalic acid
Sour milk (curd)	Lactic acid
Ant / nettle sting	Methanoic (formic) acid

OLFACTORY INDICATORS

- Smell changes with the medium: **onion, vanilla, clove**.
- Their smell is **lost** when mixed with a **base** (e.g. NaOH).

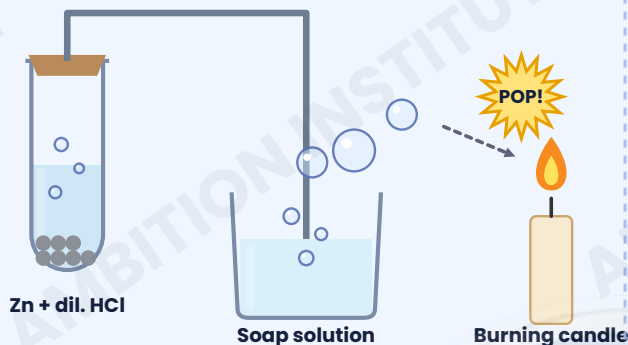
Remember!

B-R-A: Blue litmus turns Red in Acid.

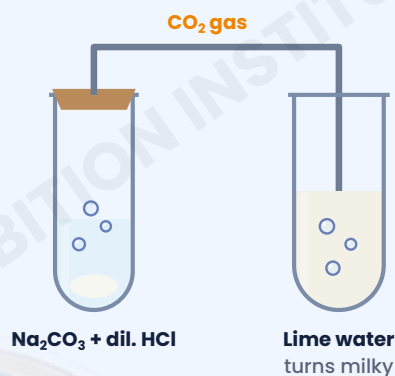


LAB ACTIVITIES – GAS TESTS

ACID + METAL > HYDROGEN



ACID + CARBONATE > CARBON DIOXIDE



SUMMARY OF REACTIONS

Reaction	General equation	Example
Acid + Metal	Acid + Metal → Salt + H ₂	Zn + 2HCl → ZnCl ₂ + H ₂
Base + Metal	Base + Metal → Salt + H ₂	2NaOH + Zn → Na ₂ ZnO ₂ + H ₂
Acid + Metal carbonate	Acid + Carbonate / hydrogencarbonate → Salt + CO ₂ + H ₂ O	Na ₂ CO ₃ + 2HCl → 2NaCl + H ₂ O + CO ₂
Acid + Base (neutralisation)	Acid + Base → Salt + Water	NaOH + HCl → NaCl + H ₂ O
Acid + Metal oxide	Acid + Metal oxide → Salt + Water	CuO + 2HCl → CuCl ₂ + H ₂ O
Base + Non-metal oxide	Base + Non-metal oxide → Salt + Water	Ca(OH) ₂ + CO ₂ → CaCO ₃ + H ₂ O

TEST FOR HYDROGEN

- Bring a **burning candle** near the gas.
- H₂ burns with a **pop sound**.
- Soap bubbles filled with H₂ rise and pop.

TEST FOR CARBON DIOXIDE

- Pass the gas through **lime water**: it turns **milky** (CaCO₃).
- Excess CO₂ forms soluble Ca(HCO₃)₂ – milkiness **disappears**.

ACIDIC & BASIC OXIDES

- Metal oxides** are **basic** (react with acids).
- Non-metal oxides** are **acidic** (react with bases).
- Both give salt + water.

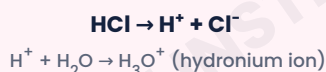


ACIDS & BASES IN WATER



WHAT DO ACIDS AND BASES HAVE IN COMMON?

ACID > H⁺ IONS

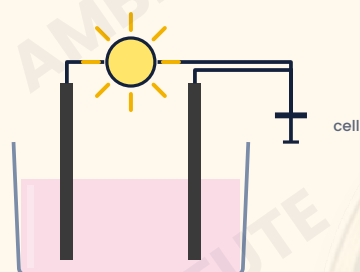


BASE > OH⁻ IONS

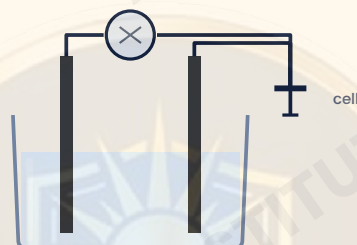


Bases soluble in water are called **alkalis**.

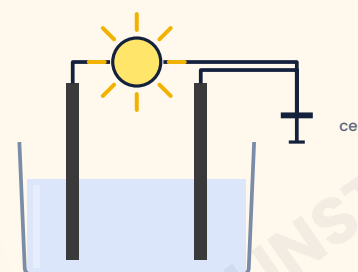
DO THEY CONDUCT ELECTRICITY?



HCl / H₂SO₄ (acid)



Glucose / alcohol



NaOH / KOH (alkali)

Bulb glows **only** when ions are present: acids and alkalis conduct because they form **ions** in solution; glucose and alcohol do not.

DILUTION – DO IT SAFELY

Dissolving an acid or base in water is highly **EXOTHERMIC**



Acid added to water
slowly, with stirring



Water added to acid
splashes dangerously

STRONG VS WEAK

Type	Ionisation	Examples
Strong acid	Nearly complete	HCl, H ₂ SO ₄ , HNO ₃
Weak acid	Partial	CH ₃ COOH, citric acid
Strong base	Nearly complete	NaOH, KOH
Weak base	Partial	NH ₄ OH, Mg(OH) ₂

Dilution **decreases** the concentration of H⁺ (or OH⁻) **per unit volume**.

Remember!

Add acid to water, never water to acid – the heat released can crack glass or splash!

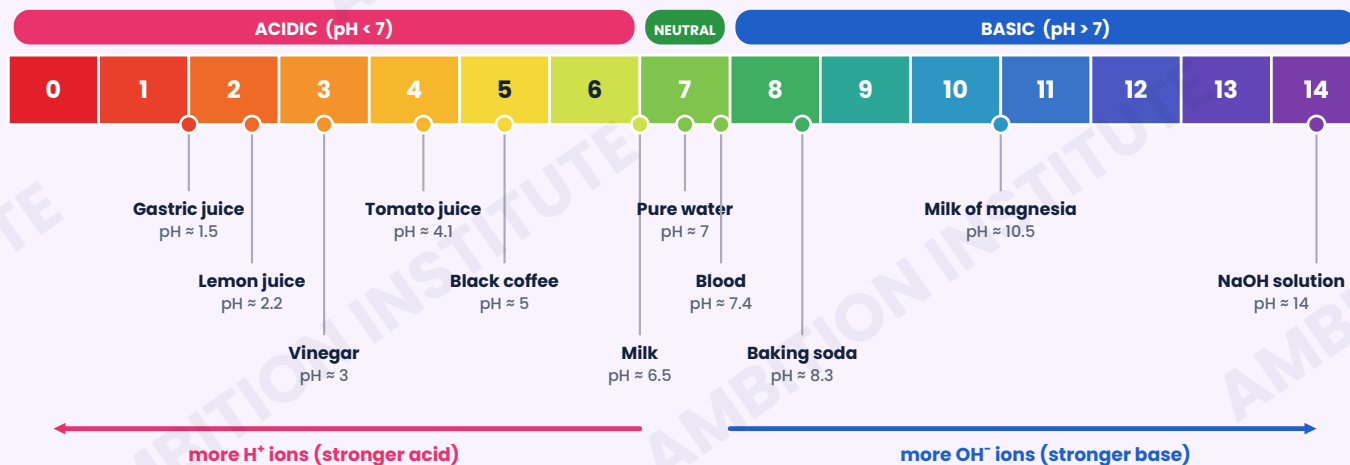




THE pH SCALE



pH SCALE (0 – 14)



Each step on the scale = a **tenfold** change in H⁺ ion concentration. **Universal indicator** / pH paper show these colours; a pH meter gives the exact value.

WHAT IS pH?

- **pH** = "power of hydrogen" – a number showing H⁺ ion concentration (Sørensen).
- pH < 7 acidic · pH = 7 neutral · pH > 7 basic.
- Stronger acid → **lower** pH; stronger base → **higher** pH.

GOOD TO KNOW

- Pure water: **pH 7** (neutral).
- Our blood: **7.35 – 7.45**.
- Dilution moves pH **towards 7**.

pH IN EVERYDAY LIFE

DIGESTION

Stomach makes **HCl** (pH ≈ 1.5) to digest food. Excess acid → indigestion; **antacids** like milk of magnesia (Mg(OH)₂) neutralise it.

TOOTH DECAY

Bacteria make acid from sugar. When mouth pH falls **below 5.5**, enamel (calcium phosphate) corrodes. Basic **toothpaste** neutralises acid.

SOIL

Plants grow best in a **particular pH**. Farmers add **lime** or chalk to acidic soil and organic manure to basic soil.

ACID RAIN & STINGS

Rain with pH **below 5.6** is acid rain – harms rivers and aquatic life. Bee / nettle sting = methanoic acid; rub **baking soda**.

HOW TO TEST pH

- Dip a strip of **pH paper** in the solution.
- Compare its colour with the **colour chart**.
- Read off the pH value.

Tip!

Lower pH = **stronger acid**. Higher pH = **stronger base**. Pure water = 7.



SALTS & COMMON SALT



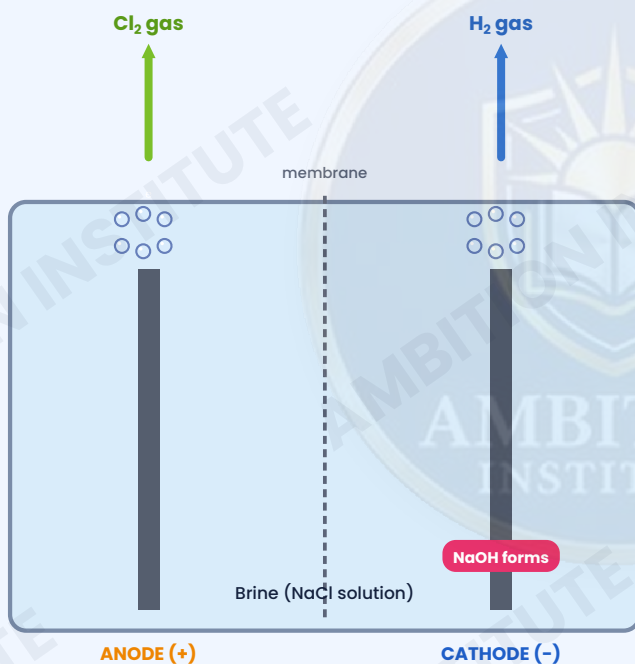
WHAT IS A SALT?

- A **salt** is formed when an acid reacts with a base (neutralisation).
- Salts with the **same positive or negative ion** form a **family**: NaCl , Na_2SO_4 (sodium salts); NaCl , KCl (chlorides).
- Common salt (NaCl) is made from **HCl + NaOH** .

pH OF SALTS

Made from	pH	Example
Strong acid + strong base	7 (neutral)	NaCl , Na_2SO_4
Strong acid + weak base	< 7 (acidic)	NH_4Cl
Strong base + weak acid	> 7 (basic)	Na_2CO_3

CHLOR-ALKALI PROCESS – ELECTROLYSIS OF BRINE



CHLORINE Cl_2

Water treatment, swimming pools, PVC, disinfectants, CFCs, pesticides

HYDROGEN H_2

Fuel, margarine, ammonia for fertilisers

SODIUM HYDROXIDE NaOH

Degreasing metals, soaps and detergents, paper, artificial fibres



COMMON SALT (NaCl)

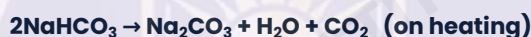
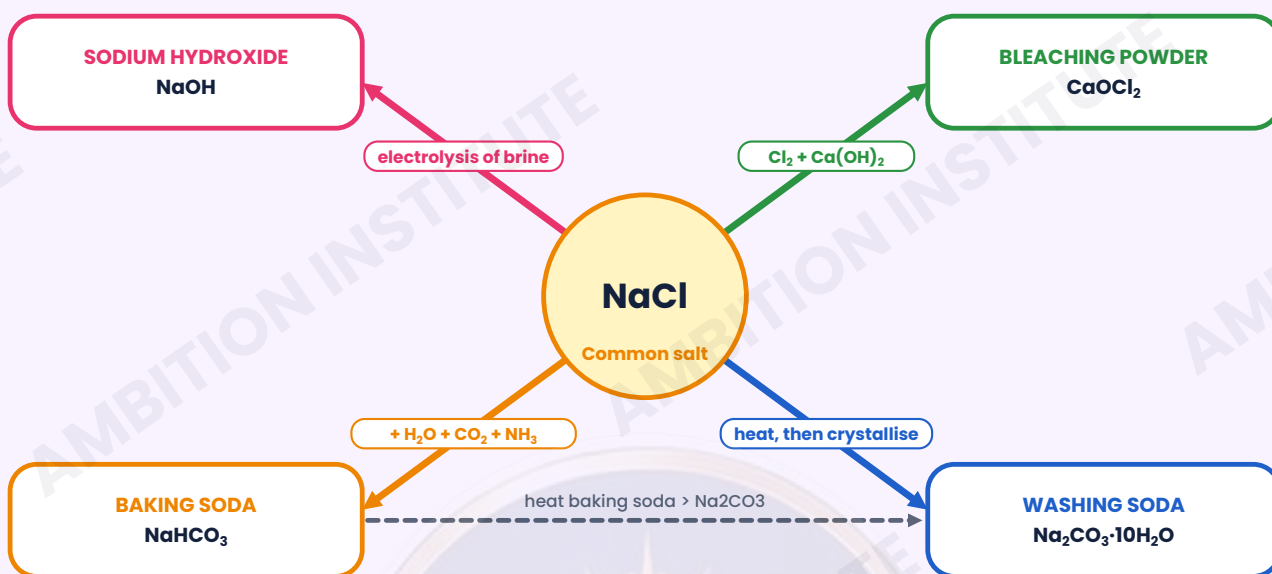
- Obtained from **sea water** by evaporation.
- Rock salt** is mined like coal; large **brown** crystals (impure).
- Raw material for **NaOH , Cl_2 , H_2 , bleaching powder, baking soda, washing soda.**

Remember!

Chlorine at the **anode (+)**, hydrogen at the **cathode (-)**, NaOH forms near the cathode.



ONE RAW MATERIAL – MANY USEFUL COMPOUNDS



PREPARATION & USES

Compound	How it is made	Key uses
Bleaching powder CaOCl_2	$\text{Ca(OH)}_2 + \text{Cl}_2 \rightarrow \text{CaOCl}_2 + \text{H}_2\text{O}$	Bleaching cotton, linen, wood pulp; disinfecting drinking water; oxidising agent
Baking soda NaHCO_3	$\text{NaCl} + \text{H}_2\text{O} + \text{CO}_2 + \text{NH}_3 \rightarrow \text{NH}_4\text{Cl} + \text{NaHCO}_3$	Baking powder (with tartaric acid), antacid, soda-acid fire extinguisher
Washing soda $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$	Heat baking soda $\rightarrow \text{Na}_2\text{CO}_3$; recrystallise with 10 H_2O	Glass, soap, paper, borax; cleaning; removes permanent hardness of water
Baking powder soda + tartaric acid	$\text{NaHCO}_3 + \text{H}^+ \rightarrow \text{CO}_2 + \text{H}_2\text{O} + \text{sodium salt}$	CO_2 makes cakes and bread soft and spongy

BAKING SODA – MILD BASE

- A **mild, non-corrosive** base – safe as an antacid.
- Heating gives **CO_2** , which is why it is used in baking.

Tip!

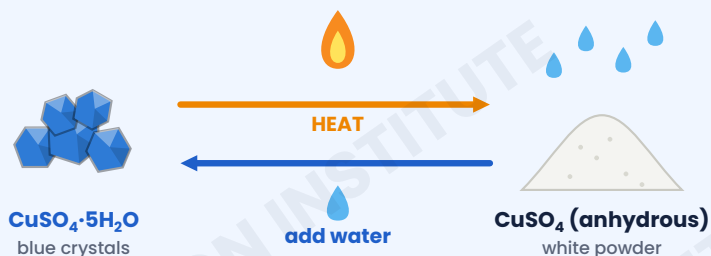
Baking **soda** = NaHCO_3 . Washing **soda** = $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$. Do not mix them up!



CRYSTALS & PLASTER OF PARIS



WATER OF CRYSTALLISATION



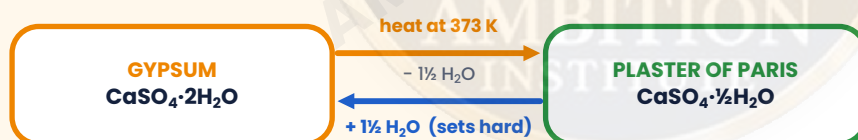
Water of crystallisation gives crystals their shape and colour.

DEFINITION

- **Water of crystallisation** = fixed number of water molecules in one formula unit of a salt.
- Heating removes it – crystals lose colour and shape.
- Adding water restores it.

Hydrated salt	Water molecules	Colour
$\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ (copper sulphate)	5	Blue
$\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$ (washing soda)	10	Colourless / white
$\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ (gypsum)	2	White
$\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$ (green vitriol)	7	Light green

PLASTER OF PARIS (PoP)



Plaster cast



USES OF PoP

- Plaster for **fractured bones**
- Toys, decorative items, statues
- Smooth surface before painting

PRECAUTIONS

- Store in **moisture-proof** containers.
- Heat gypsum only to **373 K**; more heat gives anhydrous CaSO_4 that will not set.

Tip!

PoP + water → **gypsum** again; that is why it sets into a hard mass.



QUICK REVISION



KEY POINTS IN ONE GLANCE

- Acids give H^+ ; bases give OH^- . Litmus: blue $\rightarrow$ red in acid; red $\rightarrow$ blue in base.
- Acid + metal $\rightarrow$ salt + H_2 · Acid + carbonate $\rightarrow$ salt + CO_2 + H_2O · Acid + base $\rightarrow$ salt + water.
- pH 0–14: **< 7 acid, 7 neutral, > 7 base**. Always add **acid to water**.
- Salts: neutral (strong acid + strong base), acidic or basic otherwise.
- Brine electrolysis: **Cl_2** at anode, **H_2** at cathode, **NaOH** formed.
- Common salt $\rightarrow$ NaOH , bleaching powder (CaOCl_2), baking soda (NaHCO_3), washing soda ($\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$).
- $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$: blue $\rightarrow$ white on heating. Plaster of Paris = $\text{CaSO}_4 \cdot \frac{1}{2}\text{H}_2\text{O}$.

COMMON MISTAKES TO AVOID

- Adding **water to acid** – always acid to water.
- Writing pH of pure water as 0 – it is **7**.
- Not balancing equations (e.g. $2\text{NaOH} + \text{Zn}$).

- Mixing up baking soda (NaHCO_3) and washing soda ($\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$).
- Putting Cl_2 at the cathode – it is at the **anode**.
- Heating gypsum above 373 K.

PRACTICE QUESTIONS

1 MARK (MCQ / VSA)

1. What is the pH of pure water?
2. Name the gas evolved when zinc reacts with dilute HCl .
3. Which indicator turns pink in a base?
4. Write the chemical formula of baking soda.
5. Name the gas formed at the cathode in the chlor-alkali process.
6. Write the formula of Plaster of Paris.

2–3 MARKS

1. What is neutralisation? Give an equation.
2. Why must acid be added to water and not water to acid?
3. How does tooth decay start? How can it be prevented?
4. Describe the chlor-alkali process with products and one use each.
5. How is washing soda obtained from baking soda? Give two uses.
6. What is water of crystallisation? Explain with $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$.

ANSWERS (1 MARK)

1. 7

2. Hydrogen

3. Phenolphthalein

4. NaHCO_3

5. Hydrogen

6. $\text{CaSO}_4 \cdot \frac{1}{2}\text{H}_2\text{O}$

SELF-CHECK

- Can I name 3 indicators and their colour changes?
- Can I write equations for acid reactions?
- Can I place substances on the pH scale?
- Can I list four compounds made from common salt?

Exam tip!

Balanced equations and labelled diagrams carry marks: chlor-alkali cell, lime-water test and conductivity circuit are frequent.

