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CHAPTER NOTES

Acids, Bases and Salts — Class 10 Science Notes | CBSE Chapter 2

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Acids, Bases and Salts — Class 10 Science Notes | CBSE Chapter 2

Acids, Bases and Salts is Chapter 2 of CBSE Class 10 Science. In this chapter, you will learn what acids and bases are, how they react with each other and with metals, how to measure acidity using pH, and how everyday salts like baking soda and washing soda are made and used.

This chapter carries 5–8 marks in board exams every year. The pH scale, neutralisation reactions, and the properties of important salts are the most frequently tested topics.

Key Concepts

1. Indicators — How We Detect Acids and Bases

An **indicator** is a substance that changes colour in the presence of an acid or base.

Indicator	Colour in Acid	Colour in Base
Litmus (red)	Stays red	Turns blue
Litmus (blue)	Turns red	Stays blue
Phenolphthalein	Colourless	Pink
Methyl orange	Red/pink	Yellow

Olfactory indicators — substances whose smell changes in acids/bases. Example: onion (smell disappears in base), clove oil (smell disappears in base).

2. Chemical Properties of Acids

a) Acids react with metals → Salt + Hydrogen gas



The hydrogen gas burns with a 'pop' sound — this is the test for H_2 .

b) Acids react with metal carbonates → Salt + Water + CO_2





CO_2 turns lime water milky — this is the test for CO_2 .

c) Acids react with metal hydrogen carbonates $\rightarrow$ Salt + Water + CO_2



d) Acids react with metal oxides (bases) $\rightarrow$ Salt + Water



This is a **neutralisation reaction**.

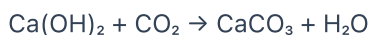
3. Chemical Properties of Bases

a) Bases react with metals $\rightarrow$ Salt + Hydrogen gas

(Not all metals — only some like Zn, Al react with bases)



b) Bases react with non-metal oxides $\rightarrow$ Salt + Water



(This is why lime water turns milky with CO_2)

c) Neutralisation — Acid + Base $\rightarrow$ Salt + Water



This reaction always produces a **salt** and **water**. It releases heat (exothermic).

4. What Makes Acids and Bases What They Are?

Acids in Water

Acids produce **H^+ ions (hydrogen ions)** in water. The H^+ ion cannot exist alone — it attaches to water to form H_3O^+ (hydronium ion).



Key fact: Dry HCl gas does not turn litmus red. HCl dissolved in water does. This proves water is necessary for an acid to show acidic properties.

Bases in Water

Bases produce **OH⁻ ions (hydroxide ions)** in water.



Strong vs. Weak Acids/Bases

- **Strong acids:** fully ionise in water — HCl, HNO₃, H₂SO₄
- **Weak acids:** partially ionise — CH₃COOH (acetic acid), H₂CO₃
- **Strong bases:** NaOH, KOH
- **Weak bases:** NH₄OH, Mg(OH)₂

5. The pH Scale

pH measures how acidic or basic a solution is. The scale runs from **0 to 14**.

- pH < 7 → Acidic (lower pH = stronger acid)
- pH = 7 → Neutral (pure water)
- pH > 7 → Basic (higher pH = stronger base)

pH in Everyday Life

Substance	Approximate pH
Gastric juice (stomach acid)	1–2
Lemon juice	2–3
Vinegar	3
Pure water	7
Blood	7.4
Baking soda solution	8–9
Milk of magnesia	10
NaOH solution	13–14

Why pH Matters

- **Tooth decay:** Bacteria in the mouth produce acids that lower pH below 5.5, causing enamel to dissolve. Toothpaste is basic to neutralise this.
- **Soil pH:** Farmers add lime (CaO or Ca(OH)₂) to acidic soil to neutralise it.
- **Bee sting:** acidic — use baking soda (base) to relieve pain

- **Wasp sting:** basic — use vinegar (acid) to relieve pain
- **Stomach acidity:** antacids ($\text{Mg}(\text{OH})_2$, NaHCO_3) neutralise excess acid

6. Salts — Formation and Properties

A salt is formed when an acid reacts with a base. The nature of the salt depends on the strength of the acid and base.

- Strong acid + strong base $\rightarrow$ neutral salt ($\text{pH} = 7$), e.g., NaCl
- Strong acid + weak base $\rightarrow$ acidic salt ($\text{pH} < 7$), e.g., NH_4Cl
- Weak acid + strong base $\rightarrow$ basic salt ($\text{pH} > 7$), e.g., Na_2CO_3

7. Important Salts You Must Know

a) Common Salt — NaCl (Sodium Chloride)

- Source: sea water, rock salt
- Used to make NaOH , Na_2CO_3 , NaHCO_3 , Cl_2

b) Sodium Hydroxide — NaOH (Caustic Soda)

Made by **chlor-alkali process**: electrolysis of brine (NaCl solution)



- Products: NaOH (at cathode), Cl_2 (at anode), H_2 (at cathode)
- Cl_2 is used to make bleaching powder and PVC
- H_2 is used as fuel and making margarine
- NaOH is used in paper, soap, detergent, textile industries

c) Baking Soda — NaHCO_3 (Sodium Hydrogen Carbonate)

Made from: $\text{NaCl} + \text{H}_2\text{O} + \text{CO}_2 + \text{NH}_3 \rightarrow \text{NaHCO}_3 + \text{NH}_4\text{Cl}$

- When heated: $2\text{NaHCO}_3 \rightarrow \text{Na}_2\text{CO}_3 + \text{H}_2\text{O} + \text{CO}_2\uparrow$ (this releases CO_2 that makes bread/cake rise)
- Uses: baking, as antacid, in fire extinguishers, soda-acid type

d) Washing Soda — $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$ (Sodium Carbonate)

Made by heating baking soda: $2\text{NaHCO}_3 \rightarrow \text{Na}_2\text{CO}_3 + \text{H}_2\text{O} + \text{CO}_2$ (then rehydrated)

- Uses: washing and cleaning, glass and soap industry, water softening (removes hardness by precipitating Ca^{2+} and Mg^{2+})
- Basic in nature

e) Bleaching Powder — $\text{Ca}(\text{OCl})\text{Cl}$ or CaOCl_2

Made by: $\text{Ca}(\text{OH})_2 + \text{Cl}_2 \rightarrow \text{CaOCl}_2 + \text{H}_2\text{O}$

- Used to bleach cotton and linen, disinfect drinking water, as oxidising agent

f) Plaster of Paris — $\text{CaSO}_4 \cdot \frac{1}{2}\text{H}_2\text{O}$

Made by heating gypsum: $\text{CaSO}_4 \cdot 2\text{H}_2\text{O} \rightarrow \text{CaSO}_4 \cdot \frac{1}{2}\text{H}_2\text{O} + 1\frac{1}{2}\text{H}_2\text{O}$

- When mixed with water, it sets (hardens) back to gypsum in 5–15 min
- $\text{CaSO}_4 \cdot \frac{1}{2}\text{H}_2\text{O} + 1\frac{1}{2}\text{H}_2\text{O} \rightarrow \text{CaSO}_4 \cdot 2\text{H}_2\text{O}$
- Uses: making casts for broken bones, statues, chalk, fire-proofing
- Important:** Plaster of Paris should be stored in a moisture-proof container to prevent it from hardening

8. Water of Crystallisation

Many salts contain a fixed number of water molecules as part of their crystal structure. This is called **water of crystallisation**.

Salt	Formula	Common Name	Water molecules
Copper sulphate	$\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$	Blue vitriol	5
Ferrous sulphate	$\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$	Green vitriol	7
Sodium carbonate	$\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$	Washing soda	10
Calcium sulphate	$\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$	Gypsum	2
Plaster of Paris	$\text{CaSO}_4 \cdot \frac{1}{2}\text{H}_2\text{O}$	—	$\frac{1}{2}$

When blue $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ is heated, it loses water and turns white (anhydrous CuSO_4). Adding water turns it blue again.

Important Definitions

Term	Definition
Acid	Substance that produces H^+ (H_3O^+) ions in water
Base	Substance that produces OH^- ions in water
Alkali	A base that is soluble in water (e.g., NaOH , KOH)
Neutralisation	Reaction between an acid and a base to form salt and water
Salt	Ionic compound formed by replacing H^+ of an acid with a metal ion
pH	Scale (0–14) measuring the concentration of H^+ ions in solution
Indicator	Substance that shows different colours in acids and bases
Dilution	Adding water to a concentrated acid or base to reduce concentration
Brine	Concentrated aqueous solution of sodium chloride (NaCl)
Water of crystallisation	Fixed number of water molecules chemically bound in a salt crystal
Anhydrous	A salt that has lost its water of crystallisation
Chlor-alkali process	Electrolysis of brine to produce NaOH , Cl_2 and H_2

Solved Examples (NCERT-Based)

Example 1

A student adds a few drops of phenolphthalein to a solution. The solution turns pink. What does this tell you?

Answer: The solution is basic (alkaline). Phenolphthalein is colourless in acid and neutral solutions but turns pink in bases.

Example 2

Why does dry HCl gas not change the colour of litmus paper, but HCl solution does?

Answer: Dry HCl has no free H^+ ions. When dissolved in water, HCl ionises to produce H^+ ions (as H_3O^+), which are responsible for acidic properties. Water is essential for an acid to show its acidic nature.

Example 3

What happens when baking soda is added to a solution of hydrochloric acid?

Answer: $\text{NaHCO}_3 + \text{HCl} \rightarrow \text{NaCl} + \text{H}_2\text{O} + \text{CO}_2\uparrow$

Carbon dioxide gas is released, which can be confirmed by passing it through lime water — it turns milky.

Example 4

A farmer finds his soil is too acidic. What should he add and why?

Answer: He should add slaked lime $\text{Ca}(\text{OH})_2$ or quicklime CaO . These are bases that neutralise the excess acid in soil, bringing the pH closer to 7 — the neutral range most crops need.

Important Questions for Board Exams

1-Mark Questions

1. Name the gas produced when zinc reacts with dilute sulphuric acid.
2. What colour does phenolphthalein turn in a basic solution?
3. What is the pH of a neutral solution?
4. Name the process used to prepare sodium hydroxide commercially.
5. What is water of crystallisation?

2-Mark Questions

1. Distinguish between a strong acid and a weak acid. Give one example of each.
2. What happens when CO_2 is passed through lime water? Write the chemical equation.
3. Why should you add acid to water, not water to acid?
4. A solution has $\text{pH} = 2$. Is it acidic or basic? What happens to its pH when water is added?
5. State two uses each of: (a) baking soda (b) washing soda.

3-Mark Questions

1. What is the chlor-alkali process? Write the equation and state two uses each of the products obtained.
2. Explain with equations what happens when (a) Na_2CO_3 reacts with HCl (b) NaOH reacts with CO_2 (c) $\text{Ca}(\text{OH})_2$ reacts with HCl .
3. How is plaster of Paris prepared from gypsum? What happens when it is mixed with water?
4. Explain any three situations where pH plays an important role in daily life.
5. A solution turns red litmus blue and has $\text{pH} = 11$. Identify the type of solution and explain the observations.

5-Mark Questions

1. Describe the chemical properties of acids with equations — reactions with metals, metal oxides, metal carbonates, and bases.
 2. What are salts? Describe the preparation, properties and uses of (a) sodium hydroxide (b) baking soda (c) washing soda.
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Quick Revision Points

- Acids $\rightarrow$ H^+ ions in water; Bases $\rightarrow$ OH^- ions in water
 - Acid + Metal $\rightarrow$ Salt + H_2 ; Acid + Metal carbonate $\rightarrow$ Salt + H_2O + CO_2
 - Acid + Base (neutralisation) $\rightarrow$ Salt + Water (always)
 - $\text{pH} < 7$ = acid; $\text{pH} = 7$ = neutral; $\text{pH} > 7$ = base
 - Dry HCl $\neq$ acidic — water is needed for H^+ ions to form
 - Sting: bee = acid (use baking soda); wasp = base (use vinegar)
 - Chlor-alkali: electrolysis of brine $\rightarrow$ NaOH + Cl_2 + H_2
 - Baking soda = NaHCO_3 ; Washing soda = $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$; Plaster of Paris = $\text{CaSO}_4 \cdot \frac{1}{2}\text{H}_2\text{O}$
 - Gypsum heated $\rightarrow$ Plaster of Paris; Plaster of Paris + water $\rightarrow$ Gypsum (sets hard)
 - $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ = blue; anhydrous CuSO_4 = white; add water $\rightarrow$ turns blue again
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Previous Chapter: Chapter 1 — Chemical Reactions and Equations

Next Chapter: Chapter 3 — Metals and Non-metals



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