

ACIDS, BASES AND SALTS

Acid :- A substance that gives $H^+(aq)$ as the only positive ion in aqueous solution.

- Sour (khatta) in taste.
- Turns blue litmus red.

E.g:

HCl	Hydrochloric Acid
H_2SO_4	Sulphuric Acid
HNO_3	Nitric Acid
CH_3COOH	Acetic acid (Vinegar)

Base :- A substance which increases OH^- ions in aqueous solution.

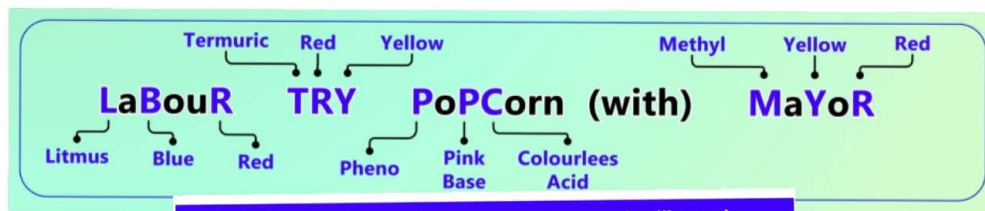
- Bitter (kaddu) in taste.
- Soapy in touch.
- Turns red litmus blue.

E.g:

1. NaOH	Sodium hydroxide
2. KOH	Potassium hydroxide
3. NH_4OH	Ammonium hydroxide
4. $Mg(OH)_2$	Magnesium hydroxide
5. $Ca(OH)_2$	Calcium hydroxide
6. CaO, MgO	

Indicators : Tells whether a substance is acid or base.

INDICATORS	BASE	ACID
Litmus	Blue	Red
Turmeric (Yellow)	Red	Yellow
Phenolphthalein (Colourless)	Pink	Colourless
Methyl Orange (Orange)	Yellow	Red



1. Out of the following, which compound / compounds will turn the phenolphthalein solution pink ? (CBSE 2023)

- A CH_3COOH X
 B $Ca(OH)_2$ ✓
 C HCl X
 D NaOH ✓
- Handwritten notes: PoPCorn → Ph → Pink Base A, Colourless A

2. A solution Phenolphthalein Pink B Solution Pink Color disappears Drops of A
 Pink Basic Basic Acidic
 The respective changes in the nature of the solution are from (CBSE 2024, CBSE 2023, CBSE 2022, CBSE 2021)

- A acidic → basic → basic
 B basic → acidic → acidic
 C acidic → basic → acidic
 D basic → acidic → basic ✓
- Handwritten notes: PoPCorn → Ph → Pink B, Colourless A

Olfactory indicators :- substances whose smell (odour) changes in acidic or basic medium.

- Retains smell in acid
- loses smell in Base



A Clove oil & vanilla essence **B** Onion & turmeric (CBSE 2023)

C Clove oil & litmus paper **D** Vanilla & methyl orange

A Blue litmus ✗

B Clove oil ✓

C Red cabbage extract ✗

D Hibiscus extract ✗

(CBSE 2020)



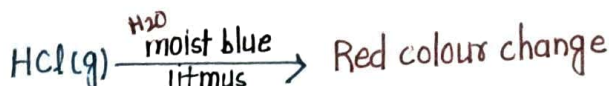
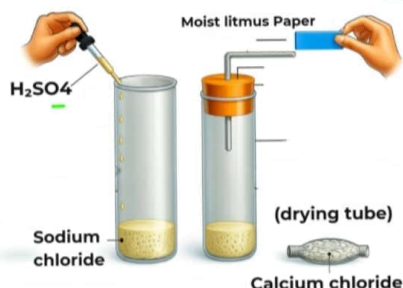
- $\text{HCl} \longrightarrow \text{No } \text{H}^+ \text{ ions}$
(dry) X
gas

- $$H^+ + H_2O \longrightarrow H_3O^+$$

Note :-

- Note:-**
- So, we say acid gives H_3O^+ (Hydronium ion) or H^+ (aq) ion.
 - This H^+ (aq) ion or H_3O^+ (Hydronium ion) give common properties to all acids.

Preparation of HCl gas



(CBSE 2023)

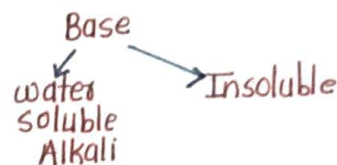
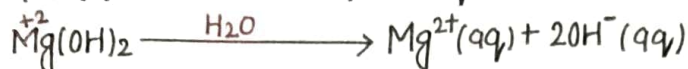
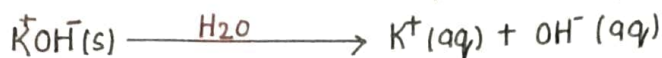
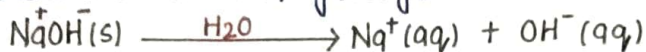
- C** Hydrogen chloride gas & water
 $\text{HCl} + \text{H}_2\text{O} \rightarrow \text{H}_3\text{O}^+ + \text{Cl}^-$
- D** Ethanol & water

(CBSE 2025)

- D** Calcium carbonate

Base in water

- Bases increase OH^- (Hydroxyl) ions in water.



Alkalies :- some bases are water soluble, these are called Alkalies.

NaOH , KOH , NH_4OH
Very soluble

$\text{Mg}(\text{OH})_2$, $\text{Ca}(\text{OH})_2$, $\text{Ba}(\text{OH})_2$
Partially soluble

★ Base but not alkali $\text{Zn}(\text{OH})_2$, $\text{Fe}(\text{OH})_2$, $\text{Cu}(\text{OH})_2$

7. (a) Write the formula of the ions which (i) acids, and (ii) bases generate in water solutions.

(b) Dry HCl gas does not change the colour of dry litmus paper. Why?

(CBSE 2025)

Ans

(a) i - $\text{H}^+(aq)$ or H_3O^+ ii - $\text{OH}^-(aq)$

(b) because dry HCl gas, without water cannot give $\text{H}^+(aq)$ ion or H_3O^+ (Hydronium ion) which is responsible for its acidic property.

Diluting an Acid → Mixing Concentrated Acid and water

- Acid + water is highly exothermic.
- if water is added to a concentrated acid, the heat generated may cause the mixture to splash out and cause burns. The glass container can also break due to heat given out.

Never add water to Acid
Always add acid slowly to water with constant stirring.

AaThyW
Acid To water



8. Concentrated H_2SO_4 is diluted by adding drop by drop

A water to acid with constant stirring

(CBSE Term 1 | 2021-22)

B acid to water with constant stirring

ATW

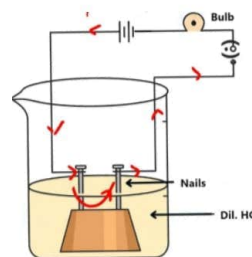
C water to acid followed by a base

D base to acid followed by cold water

Acids And Alkalis - Electric Current?

Electric current through the solution is carried by ions.

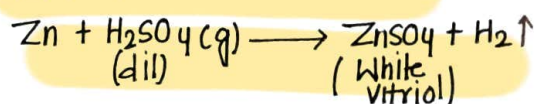
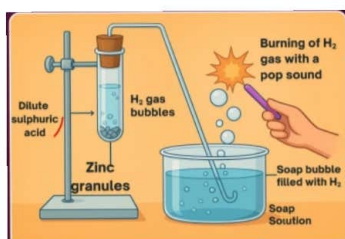
- solutions of acids: HCl , H_2SO_4 , HNO_3 and CH_3COOH generate ions and hence they conduct electricity.
- Alkalis also generate ions - NaOH , KOH , NH_4OH and hence conduct electricity.
- Glucose ($\text{C}_6\text{H}_{12}\text{O}_6$), Alcohol ($\text{C}_2\text{H}_5\text{OH}$) do not generate ions and hence do not conduct electricity.



Design an experimental set-up to demonstrate that "Alcohol and glucose contain hydrogen but are not categorised as acids". Also give the reason to justify this fact.

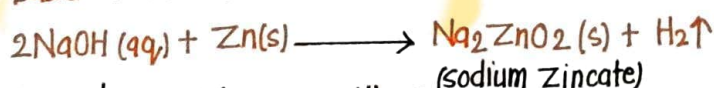
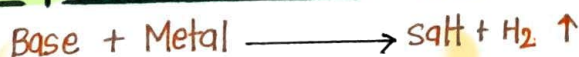
(CBSE 2025)

Reaction with Metal :- Metals above Hydrogen in activity series displace Hydrogen from acids.

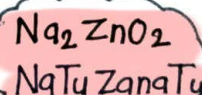


- Bubbles appear - gas is released
- H_2 gas burns with pop sound and extinguishes a candle or glowing splinter.

Reaction of base with Metal :-

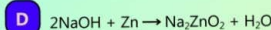
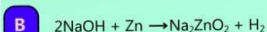
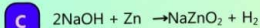
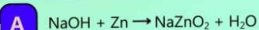


- Reaction does not happen with all metals.



9. When 2 mL of sodium hydroxide solution is added to few pieces of granulated zinc in a test tube & then warmed, the reaction that occurs can be written in the form of a balanced chemical equation as :

(CBSE 2024)



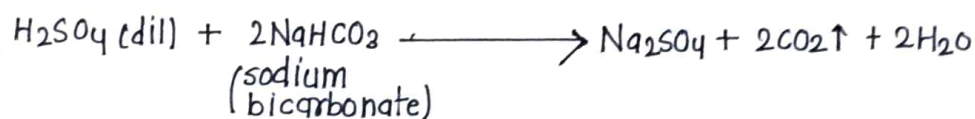
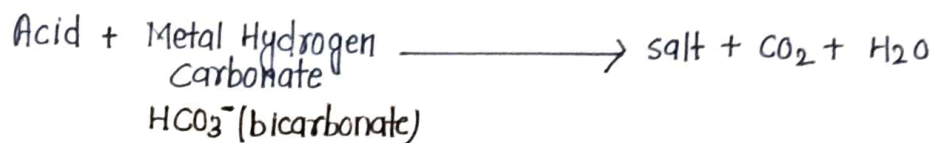
10. A student adds zinc granules to dilute sulphuric acid in one test tube and to sodium hydroxide in another. A gas is evolved in both cases. Name the gas and how you would test it.

(CBSE 2025, CBSE 2024, CBSE 2018, CBSE 2015)



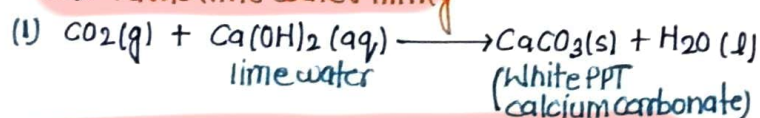
Hydrogen gas is evolved. Test for Hydrogen gas -
When a burning matchstick or glowing splinter is brought near the gas -
 H_2 gas burns with pop sound & extinguishes a glowing flame

Reaction of Metal Carbonate with Acid

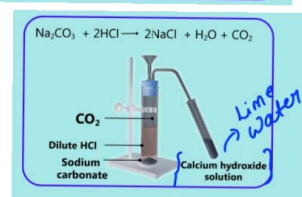
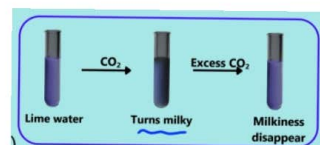
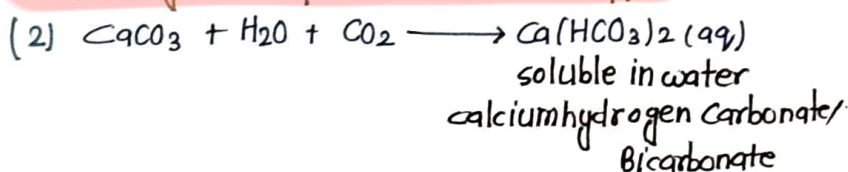


Test for CO_2 :-

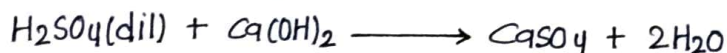
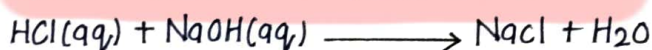
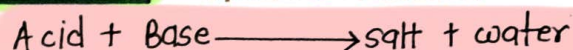
CO_2 turns lime water milky



on passing excess of CO_2 , milkiness disappear

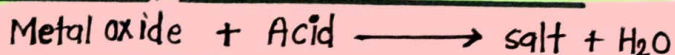


Neutralisation $\rightarrow$ Acid Base Reaction

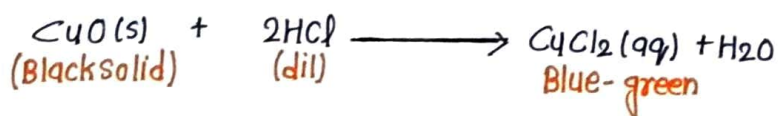


Acid and Base reacts to give SALT and WATER

Reaction of Metal Oxide with Acid

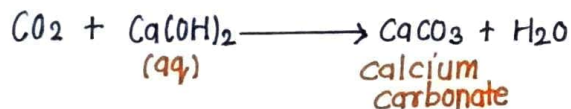
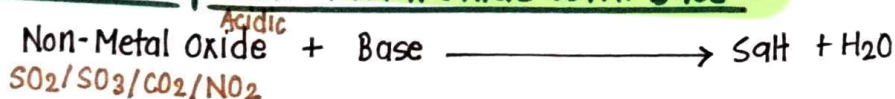


Basic $\text{CuO}/\text{MgO}/\text{CaO}$



- Generally metal oxides are basic in nature because they react with acid to give salt & water.

Reaction of Non-Metal Oxide with Base :-



Generally non-metal oxides are acidic in nature because they react with base to give salt & water.

11. A student took a small amount of copper oxide in a conical flask and added dilute hydrochloric acid to it with constant stirring. He observed a change in the color of the solution.

- (i) Write the name of the compound formed and its colour.
(ii) Write a balanced chemical equation for the reaction involved.

(CBSE 2025, CBSE 2024, CBSE 2023, CBSE 2022, CBSE 2021)

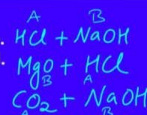
i - Cupric Chloride, Blue green colour



12. Consider the following reactions :

- (i) Dilute hydrochloric acid reacts with sodium hydroxide.
(ii) Magnesium oxide reacts with dilute hydrochloric acid.
(iii) Carbon dioxide reacts with sodium hydroxide.

It is found that in each case :



(CBSE 2025, CBSE 2020, CBSE 2018, CBSE 2015)

- A Salt and water is formed.
B Neutral salts are formed.
C Hydrogen gas is formed.
D Acidic salts are formed

C, S, N, P
Non Metal Oxide
 $\text{CO}_2, \text{SO}_2, \text{SO}_3, \text{NO}_2$
Acidic Gases

Basic Gas $\rightarrow \text{NH}_3$ Ammonia

Strength of Acid and Base :-

strong Acid :- $\text{H}_2\text{SO}_4, \text{HCl}, \text{HNO}_3$

- Gives more concentration of H^+ (aq) ions.

Weak Acid :-

CH_3COOH (acetic acid), citric acid, lactic acid, H_2CO_3 (carbonic acid)
(generally organic acids- natural sources)

- Give less concentration of H^+ (aq) ions.

strong Base :- $\text{NaOH}, \text{KOH}, \text{Ca(OH)}_2$

- Gives more Concentration of OH^- ions

Weak Base :- $\text{NH}_4\text{OH}, \text{Cu(OH)}_2, \text{Fe(OH)}_2, \text{Zn(OH)}_2$

- Gives less Concentration of OH^- ions

pH :-

Measures H^+ (aq) ions concentration in a solution

pH scale 0 $\rightarrow$ 14 pH $\downarrow$ H^+ $\uparrow$ Acidic



More H^+ (aq) conc $\rightarrow$ lower pH $\rightarrow$ More Acidic

H^+ $\uparrow\uparrow$

pH $\downarrow\downarrow$

13. Phenolphthalein turns pink in a solution. What can you infer about the pH of the solution?

Popcorn
Pink
Colours
A

Basic $\rightarrow$ pH $>$ 7

(CBSE 2025, CBSE 2024, CBSE 2023, CBSE 2022, CBSE 2021)

14. A solution has a pH of 7. Name a compound you would use to:
(i) increase its pH, and
(ii) decrease its pH.

Acidic Basic
0 1 2 3 4 5 6 7 8 9 10

(CBSE 2025)

(i) Base (ii) Acid

15. The following table shows the pH values of four solutions A, B, C and D on a pH scale:



The solutions A, B, C and D respectively are of a:

(CBSE 2025)

- A Strong acid, weak acid, neutral, strong base
- B Weak acid, neutral, weak base, strong base
- C Weak acid, neutral, strong base, strong acid
- D Weak acid, strong acid, neutral, strong base,

16. Consider the pH value of the following acidic samples.
The decreasing order of their H^+ ion concentration is

pH ultra H^+

- A $3 > 4 > 1 > 2$
- B $2 > 1 > 3 > 4$
- C $2 > 1 > 4 > 3$
- D $3 > 4 > 2 > 1$

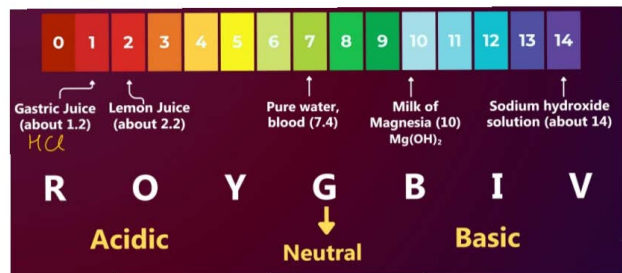
S.No.	Sample	pH Value
1.	Lemon Juice	2.2
2.	Gastric Juice	1.2
3.	Vinegar	3.76
4.	Dil. Acetic acid	3.0

(CBSE Term 1 | 2021-22)

pH $\rightarrow 3 > 4 > 1 > 2$
 $H^+ \rightarrow 3 < 4 < 1 < 2$

Universal Indicators :-

Substance which detects nature of chemical as acid or base and also measures strength of it.



17. Which one of the options in the table is correct?

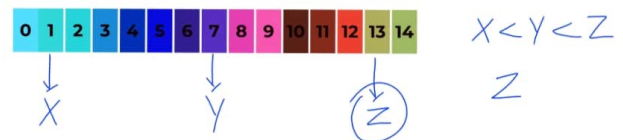
(CBSE 2023)

Option	Sample	Colour of pH paper	Approximate pH Value	Nature of solution
(a)	Lemon Juice	Orange	3	Basic
(b)	Milk of magnesia	Blue	10	Basic
(c)	Gastric Juice	Red	6	Acidic
(d)	Pure water	Yellow	7	Neutral

- A a
- B b
- C c
- D d

18. A universal indicator was added to three test tubes containing solutions X, Y and Z. The colours observed were red, green and purple. Arrange the solutions in increasing order of their pH. Which solution will turn phenolphthalein pink?

(CBSE 2019, CBSE 2019, CBSE 2025)



$X < Y < Z$
Z

Importance of pH in everyday life :-

(1) pH range for human body - 7.0 to 7.8 pH of rain water $< 5.6 \Rightarrow$ Acid rain
Acid rain $\rightarrow$ river $\rightarrow$ aquatic life survival difficult.

(2) stomach produces $HCl(aq)$ Gastric acid $\rightarrow$ helps in digestion of food. During indigestion, stomach produces too much acid.
 $\rightarrow$ Causes pain and irritation.
people use antacid (milk of magnesia) $Mg(OH)_2$ mild Base (Baking soda)
 $\rightarrow$ Antacid neutralise excess of acid.

- (3) pH of mouth $< 5.5 \Rightarrow$ Tooth decay (due to sugar and food degradation)
 Toothpaste (basic in nature) neutralises excess acid.
- (4) Honey bee sting $\rightarrow$ acid (formic acid / methanoic acid)
 Treatment $\rightarrow$ mild base like baking soda (NaHCO_3)
- (5) Nettle stinging hair $\rightarrow$ methanoic acid $\rightarrow$ painful when touched
 Remedy $\rightarrow$ rubbing area with dock plant (Dock plant often grows beside nettle $\rightarrow$ Nature provides neutralisation)

20. Tooth enamel is made up of calcium hydroxyapatite (a crystalline form of calcium phosphate). This chemical starts corroding in the mouth when the pH is:

(CBSE 2025)

- A 7
 B 5
 C 10
 D 14

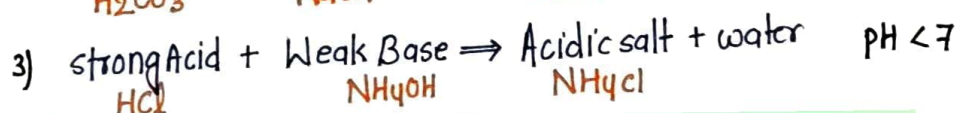
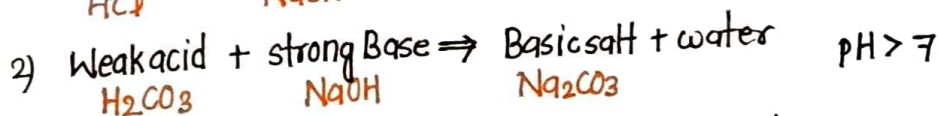
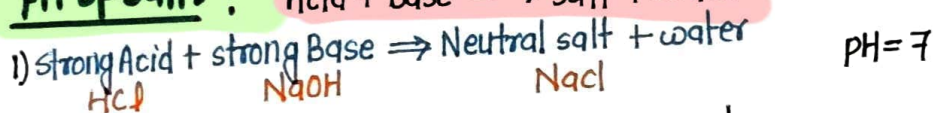
21. The body of human beings works within the pH range of:

(CBSE 2025)

- A 6.1 to 6.8
 B 6.5 to 7.3
 C 7.0 to 7.8
 D 7.5 to 8.1

pH of Salts ?

Acid + Base $\rightarrow$ salt + water



Strong Acid : H_2SO_4 , HCl , HNO_3

Weak Acid : CH_3COOH (acetic acid),
 Citric Acid, Lactic acid, H_2CO_3

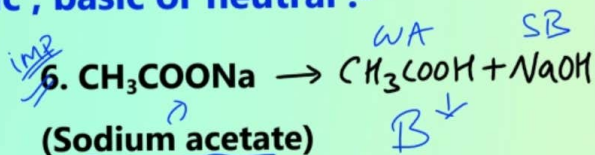
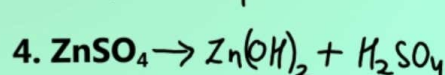
Strong Base : NaOH , KOH , Ca(OH)_2

Mg(OH)_2 , Ba(OH)_2

Weak Base : NH_4OH , Cu(OH)_2 , Fe(OH)_2

Zn(OH)_2

Identify the Salts as acidic, basic or neutral :-



Strong Acid : H_2SO_4 , HCl , HNO_3

Weak Acid : CH_3COOH (acetic acid),
 Citric Acid, Lactic acid, H_2CO_3

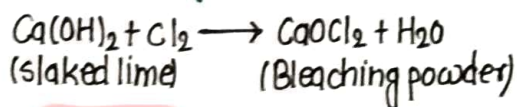
Strong Base : NaOH , KOH , Ca(OH)_2

Mg(OH)_2 , Ba(OH)_2

Weak Base : NH_4OH , Cu(OH)_2 , Fe(OH)_2

Zn(OH)_2

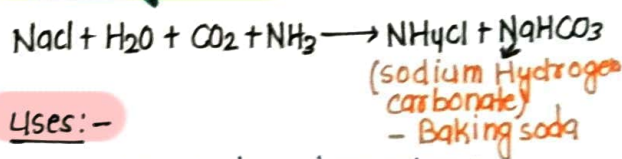
Bleaching Powder



Uses:-

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

Baking soda



Uses:-

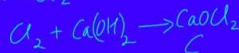
- For making tasty crispy pakora
- Neutralize acidity (mild base Antacid)
- Soda-acid fire extinguisher.
- Delay curdling of milk
- for faster cooking

26. During electrolysis of brine, a gas 'G' is liberated at anode. When this gas 'G' is passed through slaked lime, a compound 'C' is formed, which is used for disinfecting drinking water.

i) Write formula of 'G' and 'C'.



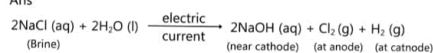
ii) State the chemical equations involved.



iii) What is the common name of compound 'C'?

(CBSE 2023)

Ans



27. A compound 'X' is used in the kitchen for making crispy pakoras. Its pH is around 9. Identify the compound 'X'. Write its chemical name and formula. Write a chemical equation involved. Mention one use of it.

Ans

(CBSE 2025, 2024, 2023, 2020, 2019, 2018)

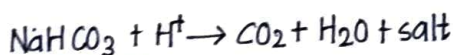
Chemical Name - Sodium Hydrogen Carbonate
Common Name - Baking soda
Formula - NaHCO_3



Use- Neutralize acidity (mild base) Antacid ; Soda-acid fire extinguisher

Baking Powder

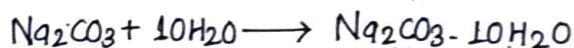
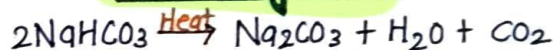
Baking Powder = Baking soda + Tartaric acid



Uses:-

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

Washing soda $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$



sodium carbonate
Decahydrate

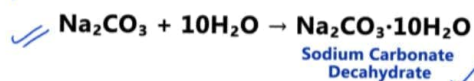
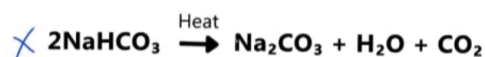
Uses:-

- Removing permanent hardness of water.
- Glass, soap and paper industry.

28. How is washing soda obtained from sodium carbonate? Write the chemical equation. What is the type of this salt? Which type of hardness of water is removed by it?

Ans

(CBSE 2025, CBSE 2023, CBSE 2020, CBSE 2017)



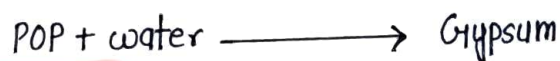
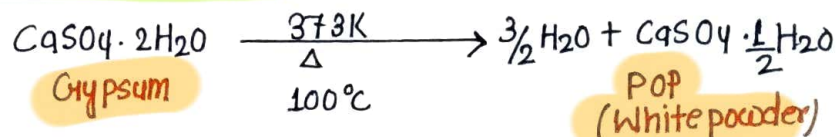
Water of Crystallization :-

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

$\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ Copper sulphate crystals (Blue Colour)	$\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$ Sodium Carbonate decahydrate (Washing Soda)
$\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ Gypsum	$\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$ Ferrous sulphate crystals (Green Colour)



Plaster of Paris (POP) :-



Usage:-

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

29. Write the name, chemical formula and one use of the compound obtained when gypsum is heated at 373 K.

Ans

Plaster Of Paris $\text{CaSO}_4 \cdot \frac{1}{2}\text{H}_2\text{O}$

(CBSE 2025, CBSE 2024, CBSE 2020, CBSE 2017, CBSE 2016)

Usage :

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

30. What is meant by water of crystallisation? Write the chemical formula of two salts having water of crystallisation. State one use of each.

Ans

(CBSE 2025, 2023, 2020, 2015)

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

$\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ - Gypsum . Use - To manufacture Plaster Of Paris

$\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$ - Washing Soda . Use - Removing permanent hardness of water