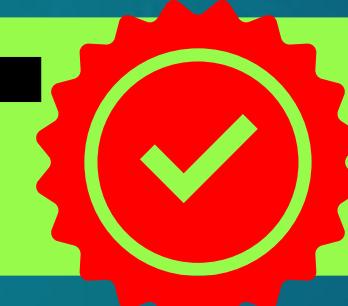


# **ACIDS, BASES & SALTS**

**ONE SHOT**



**GUN SHOT**



**100% Paper yahi se bnega**

**Ek bhi Q bahar se nahi hogा**

# **ACIDS, BASES & SALTS**

**Complete NCERT**

**30+ PYQ CBSE**

**TRICKS To Learn**

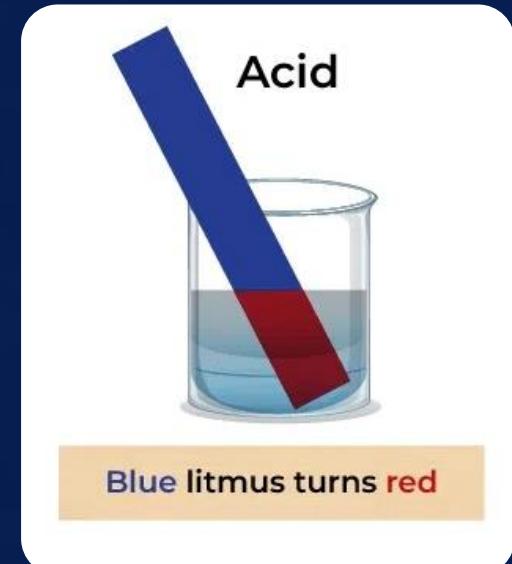
**Acid:** A substance that gives  $\text{H}^+(\text{aq})$  as only +ve ion in aqueous solution.  $\times$

Eg.  $\text{HCl}$ ,  $\text{H}_2\text{SO}_4$ ,  $\text{HNO}_3$



i) Acids are sour (Khatte) in taste.

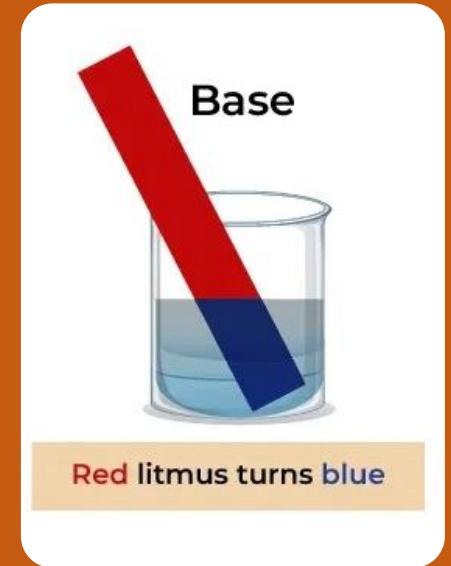
ii) Acid turns blue litmus red.



Blue litmus turns red

# Base: A substance which is

- i. Bitter (Kadwa) in taste
- ii. Soapy in touch
- iii. Turns red blue litmus
- iv. increases Hydroxyl ions OH (aq) in aqueous solution



Eg.



# **Indicators: Tells whether a substance is acid or base**

<b>Indicators</b>	<b>Base</b>	<b>Acid</b>
1. Litmus	Blue	Red
2. Turmeric (Yellow)	Red	Yellow
3. Phenolphthalein Colourless	Pink	Colourless
4. Methyl Orange Range	Yellow	Red

# LaBouR TRY PoPCorn with MaYoR

Indicators	Base	Acid	
Litmus	Blue	Red	↑
Turmeric (Yellow)	Red	Yellow	↑
Phenolphthalein Colourless	Pink	Colourless	↑
Methyl Orange Range	Yellow	Red	

**Q. Out of the following, which compound/compounds will turn the phenolphthalein solution pink?**

- 1)  ~~$\text{CH}_3\text{COOH}$~~       (2)  ~~$\text{Ca}(\text{OH})_2$~~   
3)  ~~$\text{HCl}$~~       (4)  ~~$\text{NaOH}$~~

**(CBSE 2023)**



**Q. An aqueous solution turns blue litmus red. <sup>And</sup> Which of the following solutions when added in excess would reverse the change?**

- (1) ~~Lemon juice~~      (2) ~~Magnesium hydroxide~~  
(3) ~~Vinegar~~      (4) ~~Calcium sulphate~~

LBR

**(CBSE 2023)**

**Q. An aqueous solution 'A' turns phenolphthalein solution pink. When another aqueous solution 'B' is added to the pink solution, the pink colour disappears. Now when a few drops of solution 'A' are added to this reaction, the mixture appears pink again. The respective changes in the nature of the solution are from**

**(CBSE 2024)**

- (a) acidic → basic → basic
- (b) basic → acidic → acidic
- (c) acidic → basic → acidic
- (d) basic → acidic → basic

H.W.

### **Imp points**

1. Litmus solution is originally purple in Colour When no acid or base is added.  
Pure  $\text{H}_2\text{O}$   $\text{h}$  as no effect on colour of litmus.
2. It is Natural Indicator extracted from Plant

# Olfactory Indicators: Substances whose smell (odour) changes in acidic or basic medium.

Onion



vanilla essence



Clove Oil



Acid

Retains  
Smell

Base

Loses  
Smell



**Q. Select a pair of olfactory indicators from the following: (CBSE 2023)**

- (a) Clove oil and vanilla essence ✓
- (b) Onion and turmeric ✗
- (c) Clove oil and litmus paper ✗
- (d) Vanilla and methyl orange ✗

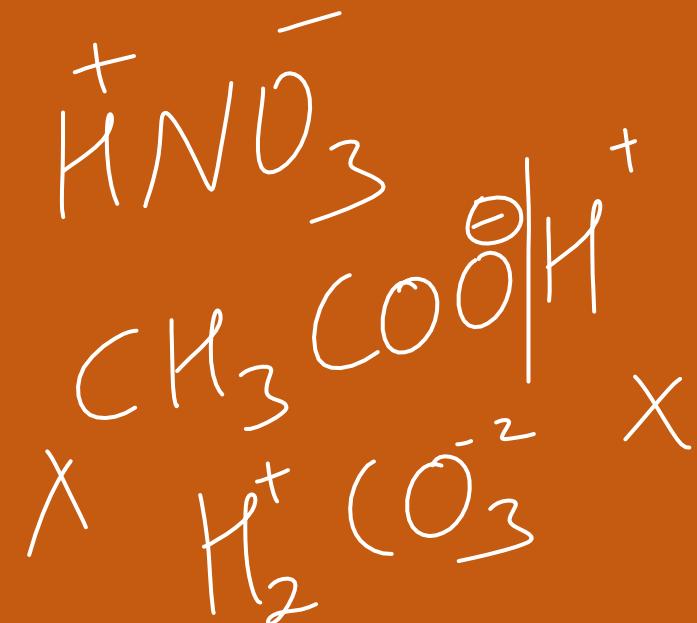
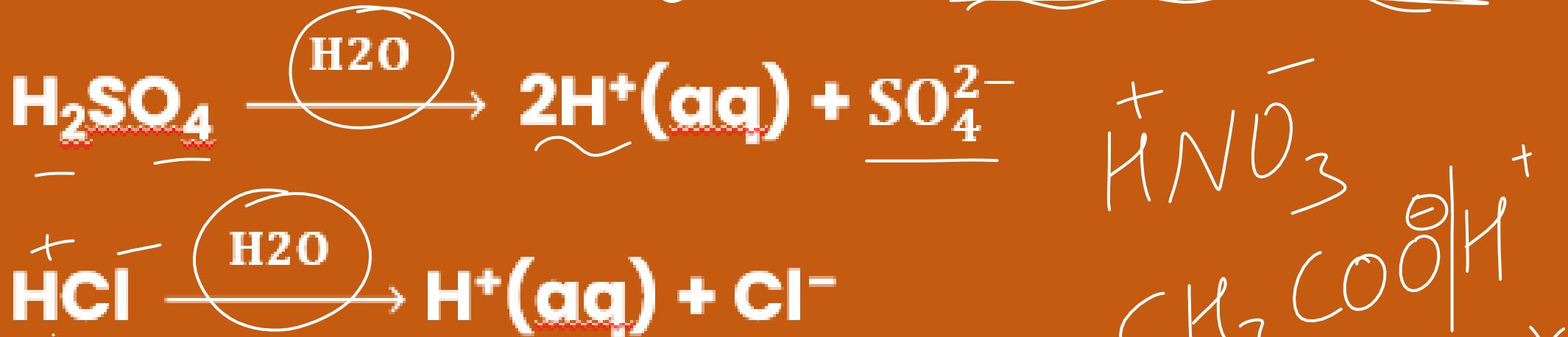
**Q. A visually challenged student, has to perform a lab test to detect the presence of acid in a given solution. The acid-base indicator preferred by him will be**

**(CBSE 2020)**

- (a) Blue litmus ✗
- (b) Clove oil ✓
- (c) Red cabbage extract ✓

## Acid & Base in water

(1) Acids produce H<sup>+</sup> ions in aqueous solution.

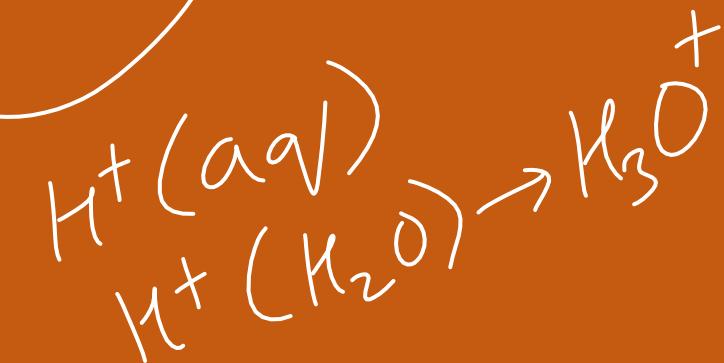


Separation of H<sup>+</sup> and Cl<sup>-</sup>/SO<sub>4</sub><sup>2-</sup> etc. cannot happen without water

$\text{H}^+$  of acid combines with water ( $\text{H}_2\text{O}$ ) to form  $\text{H}_3\text{O}^+$  (Hydronium ion)



$\text{H}^+$  of acid do not stay alone

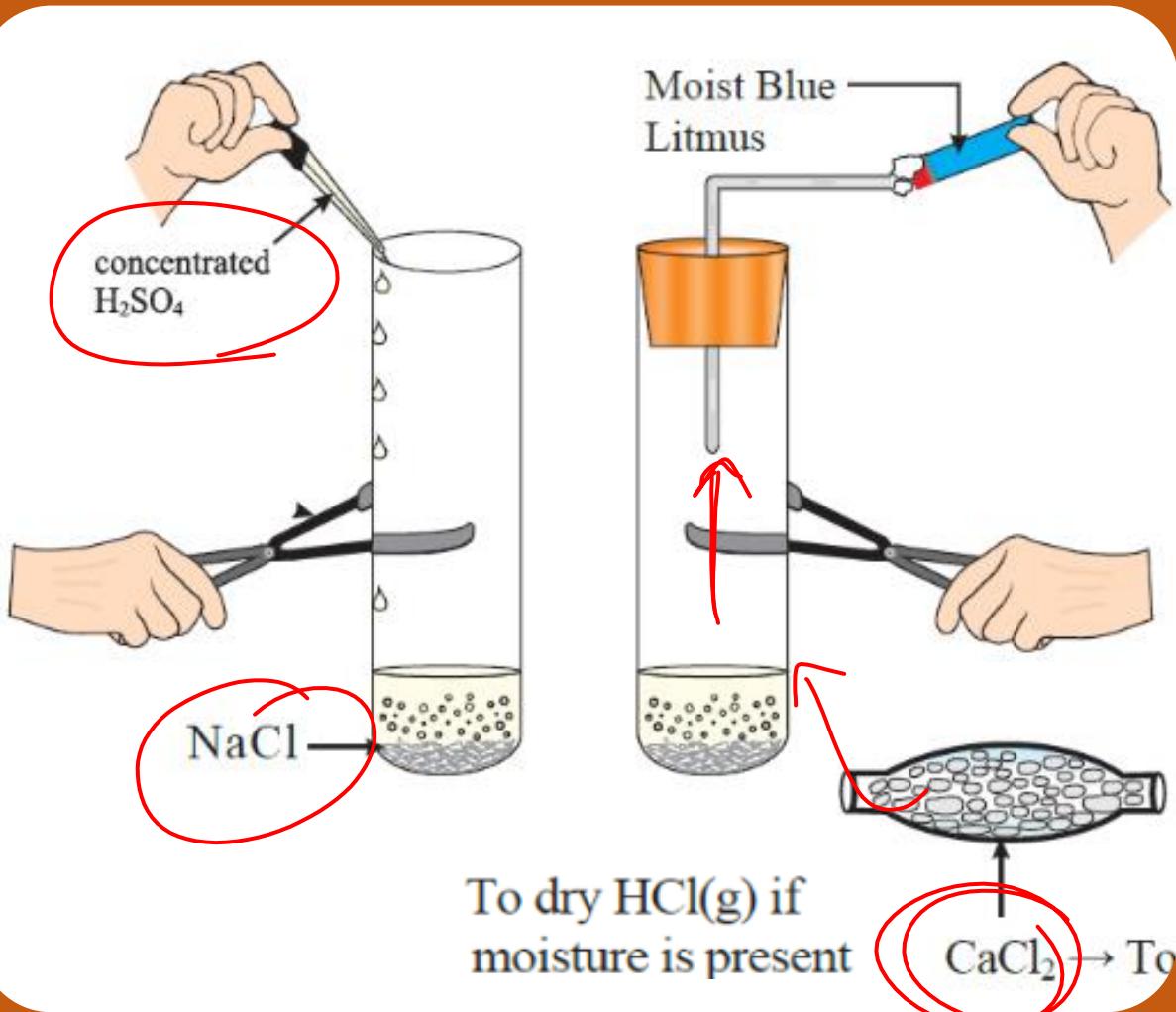


$\text{H}^+$  of acid combines with  $\text{H}_2\text{O}$  to form hydronium ion

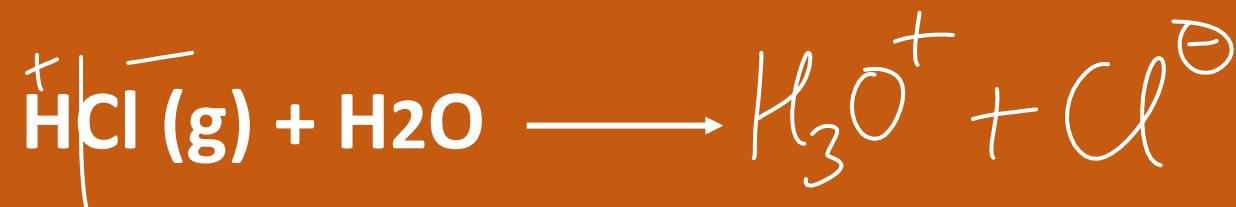
So , We say acid gives  $\text{H}_3\text{O}^+$  (Hydronium ion) or  $\text{H}^+(\text{aq})$  ion

This  $\text{H}^+(\text{aq})$  ion or  $\text{H}_3\text{O}^+$  (Hydronium ion) gives common properties to all acids

# Preparation Of HCl gas



D.P



**Q. Hydronium ions are formed by the reaction between**

**(CBSE 2023)**

- (a) sodium hydroxide and water
- (b) calcium chloride and water
- (c) hydrogen chloride gas and water
- (d) ethanol and water.



**(i) Draw a labelled diagram to show the preparation of hydrogen chloride gas in laboratory.**



**(i) Test the gas evolved first with dry and then with wet litmus paper. In which of the two cases, does the litmus paper show change in colour?**

**(iii) State the reason of exhibiting acidic character by dry HCl gas/HCl solution.**

**(CBSE 2020)**

## (2) Bases increase OH<sup>-</sup> (Hydroxyl) ions in water



All bases are  
not water soluble

**Alkalies:** Some bases are water soluble, these are called alkalies

e.g., NaOH    KOH    NH<sub>4</sub>(OH)

Very Soluble

Mg(OH)<sub>2</sub>    Ca(OH)<sub>2</sub>    Ba(OH)<sub>2</sub>

Partially Soluble

Base but not alkali

Zn(OH)<sub>2</sub>

Fe(OH)<sub>2</sub>

Cu(OH)<sub>2</sub>

**Q. Sodium hydroxide is termed as alkali while ferric hydroxide is not because**

- (a) sodium hydroxide is a strong base, while ferric hydroxide is a weak base
- (b) ~~sodium hydroxide is a base which is soluble in water while ferric hydroxide is also a base but it is not soluble in water~~
- (c) sodium hydroxide is a strong base while ferric hydroxide is a strong acid
- (d) sodium hydroxide and ferric hydroxide both are strong base but the solubility of sodium hydroxide in water is comparatively higher than that of ferric hydroxide.

**Acid + Water is a highly exothermic**

**Always Add Acid slowly to Water  
with constant stirring.**

*drop wise*

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.

**AaThuW**



**Always Add Acid**

**to Water**



**Acid to Water**



**Water to Acid**

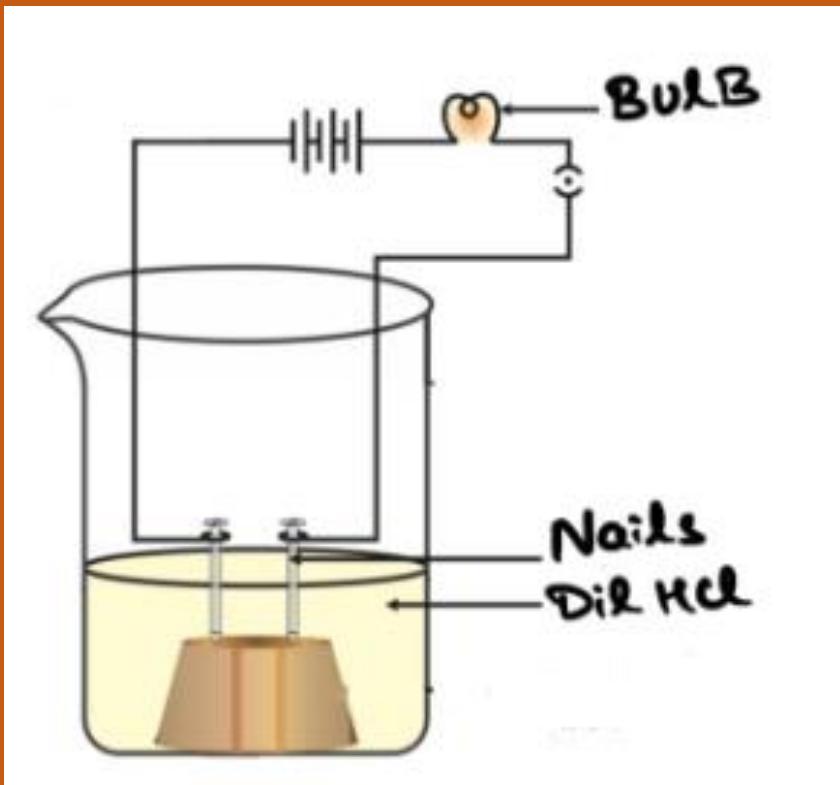


**Q. Concentrated  $\text{H}_2\text{SO}_4$  is diluted by adding drop by drop**

- (a) water to acid with constant stirring
- ~~(b) acid to water with constant stirring~~
- (c) water to acid followed by a base
- (d) base to acid followed by cold water.

**(CBSE 2021-2022 term 1)**

# Acids & Alkalies ~ Electric current?

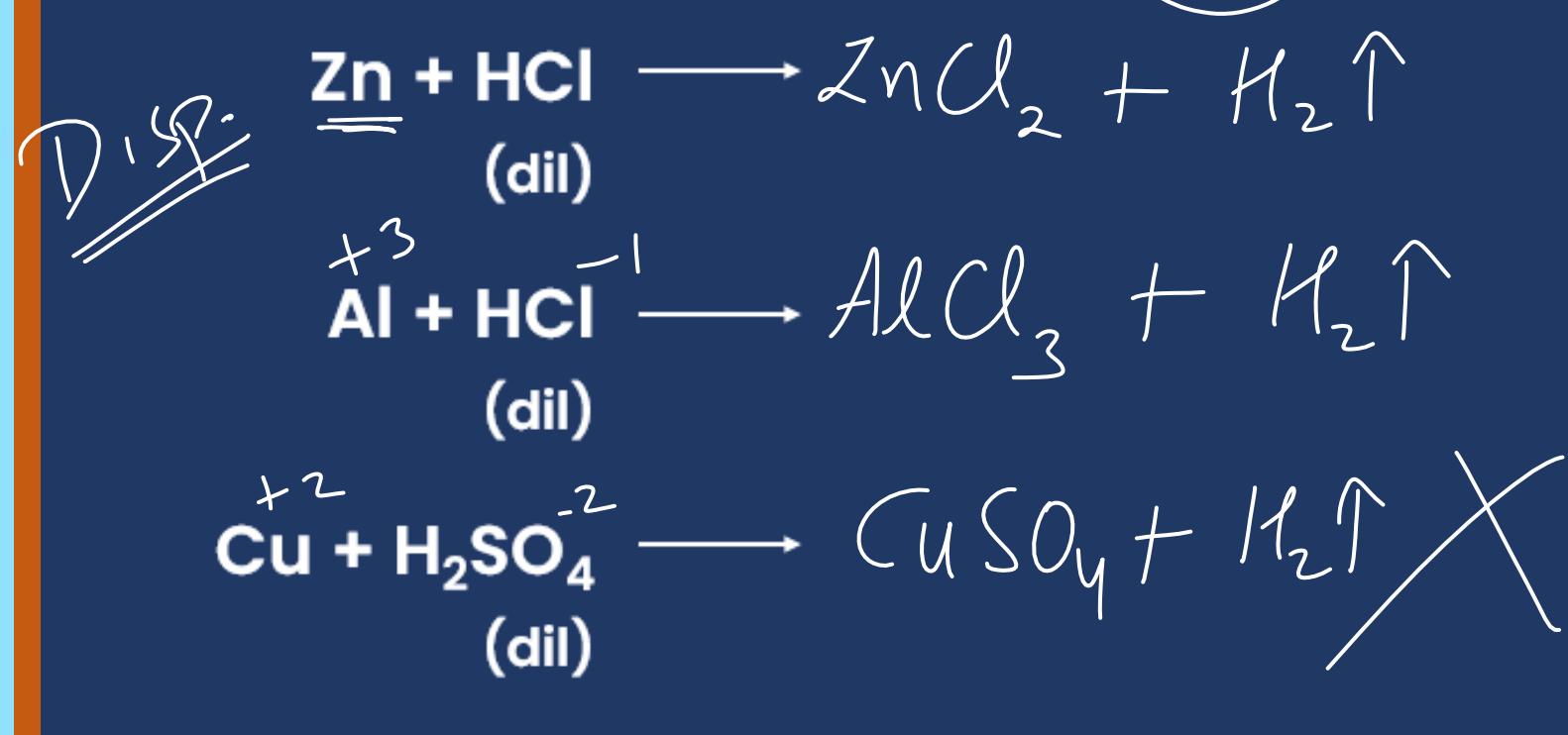


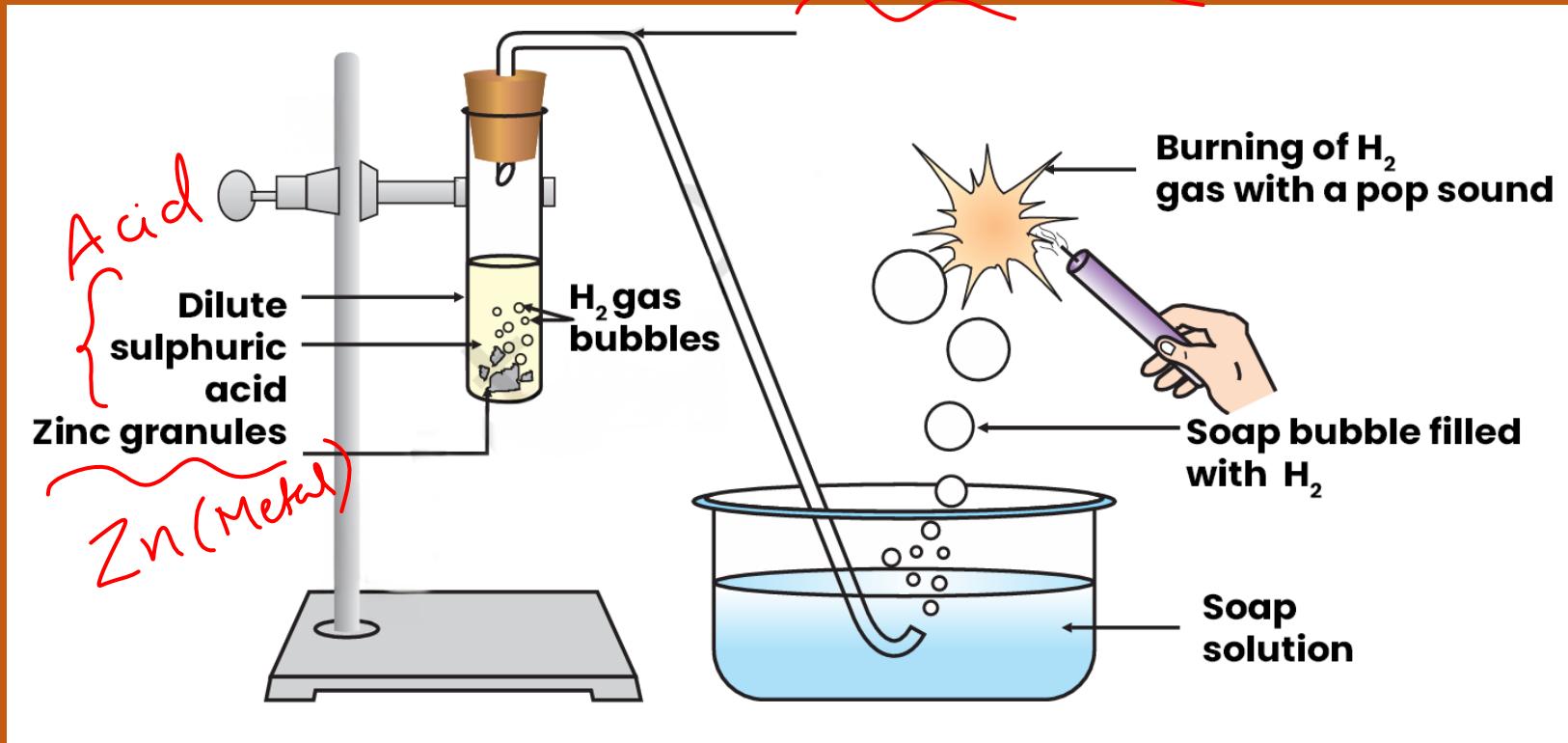
**Electric current through the solution is carried by ions.**

- Solutions of acids: HCl,  $H_2SO_4$ ,  $HNO_3$  and  $CH_3COOH$  generates ions & hence they conduct electricity
- Alkalies also generate ions – NaOH, KOH,  $Mg(OH)_2$ ,  $NH_4OH$  & hence conduct electricity.
- Glucose, Alcohol do not generate ions & hence do not conduct electricity.

# Reaction with Metal

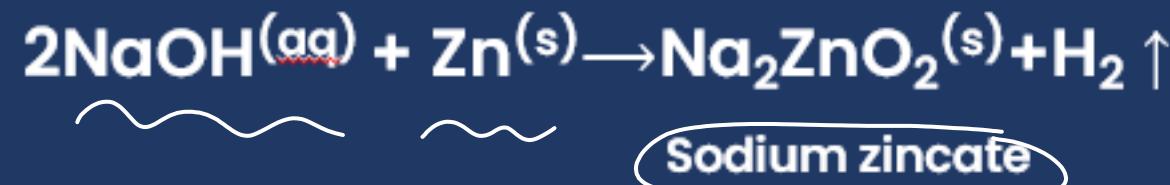
K	Katrina	Potassium
Na	Ne	Sodium
Ca	Car	Calcium
Mg	Mangi	Magnesium
Al	Alto	Aluminium
Zn	Zen	Zinc
Fe	Ferrari	Iron
Pb	Firbhi	Lead
H	Hath	<b>Hydrogen</b>
Cu	Kyu	Copper
Hg	Mili	Mercury
Ag	Silver	Silver
Au	Audi	Gold





1. Zn granules gives more surface area for reaction
2. ZnSO<sub>4</sub> is white coloured salt called White vitriol
3. H<sub>2</sub> gas burns with pop Sound & extinguishes a candle  
Combustible but not supporter of Combustion

Base + metal → salt + H<sub>2</sub>



NaTuZanaTu

Na<sub>2</sub>ZnO<sub>2</sub>

Does not happen with all metals

**Q. Some metals react with acids to produce salt and hydrogen gas.**

**Illustrate it with an example. How will you test the presence of this gas?**



**(CBSE 2024)**

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

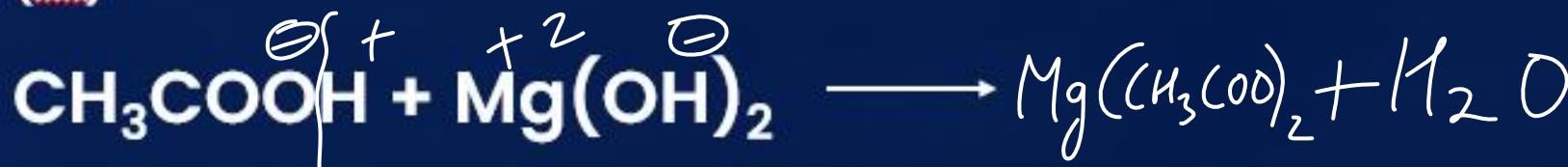
- (a) NaOH + Zn → NaZnO<sub>2</sub> + H<sub>2</sub>O
- (b) ~~2NaOH + Zn → Na2ZnO<sub>2</sub> + H<sub>2</sub>~~
- (c) 2NaOH + Zn → NaZnO<sub>2</sub> + H<sub>2</sub>
- (d) 2NaOH + Zn → Na2ZnO<sub>2</sub> + H<sub>2</sub>O

**(CBSE 2024)**

# Neutralisation

Acid + Base

→ Salt + water



✓ Acid + Base → Salt + Water

✓  $\text{H}^+(\text{aq}) + \text{OH}^-(\text{aq}) \rightarrow \text{H}_2\text{O(l)}$

**Metal Oxide** + Acid → Salt + water  
**ZnO/CuO/MgO/CaO** (*Basic*)



Black Cop on OX doing Colgate Green Blue colour



Generally Metal Oxide are Basic in nature because they react with Acid to give Salt & water

**Non-Metal Oxide + Base → Salt + Water**

**so<sub>2</sub>/so<sub>3</sub>/co<sub>2</sub>/NO<sub>2</sub>**

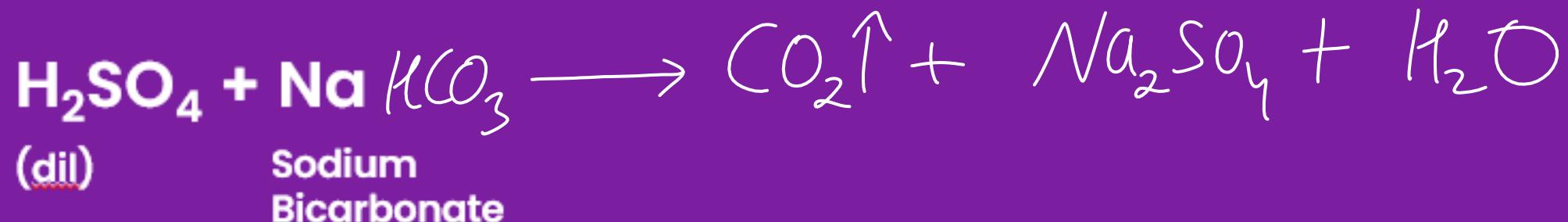
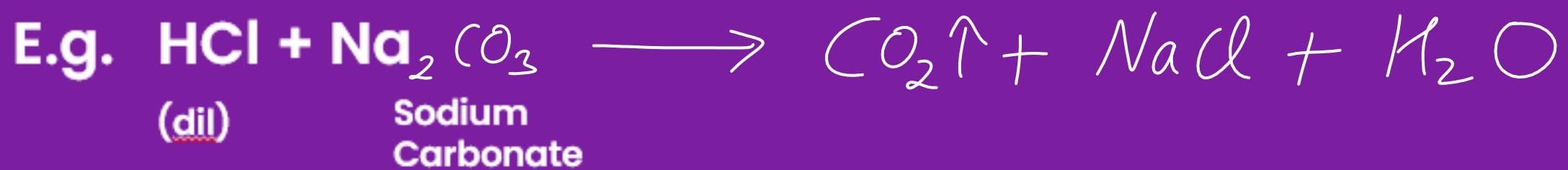
(Acidic)



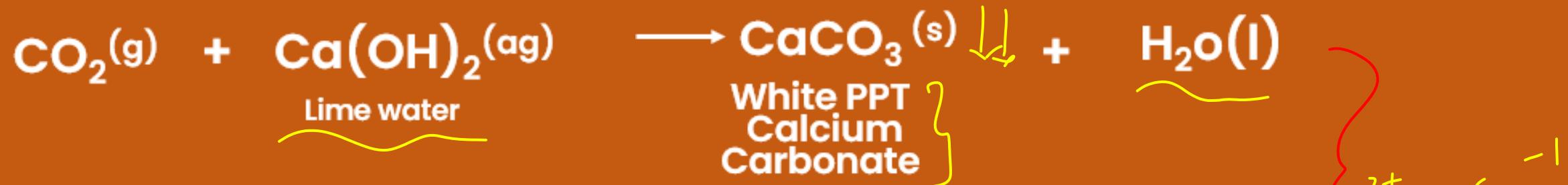
Generally Non - Metal Oxide are Acidic in nature because they react with Base to give Salt & water



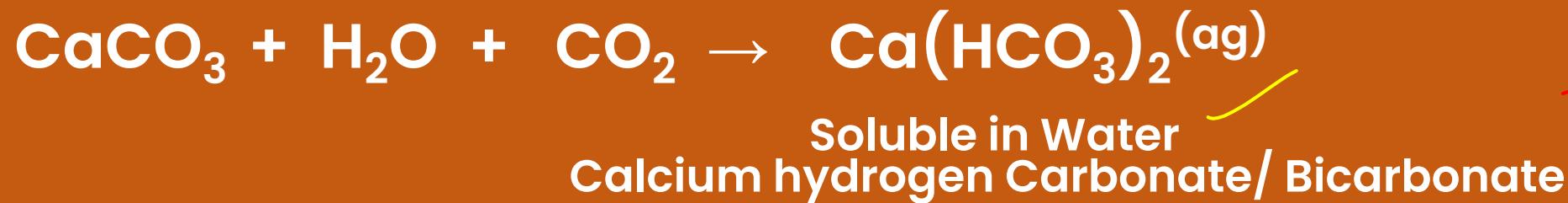
**Metal Hydrogen Carbonate**

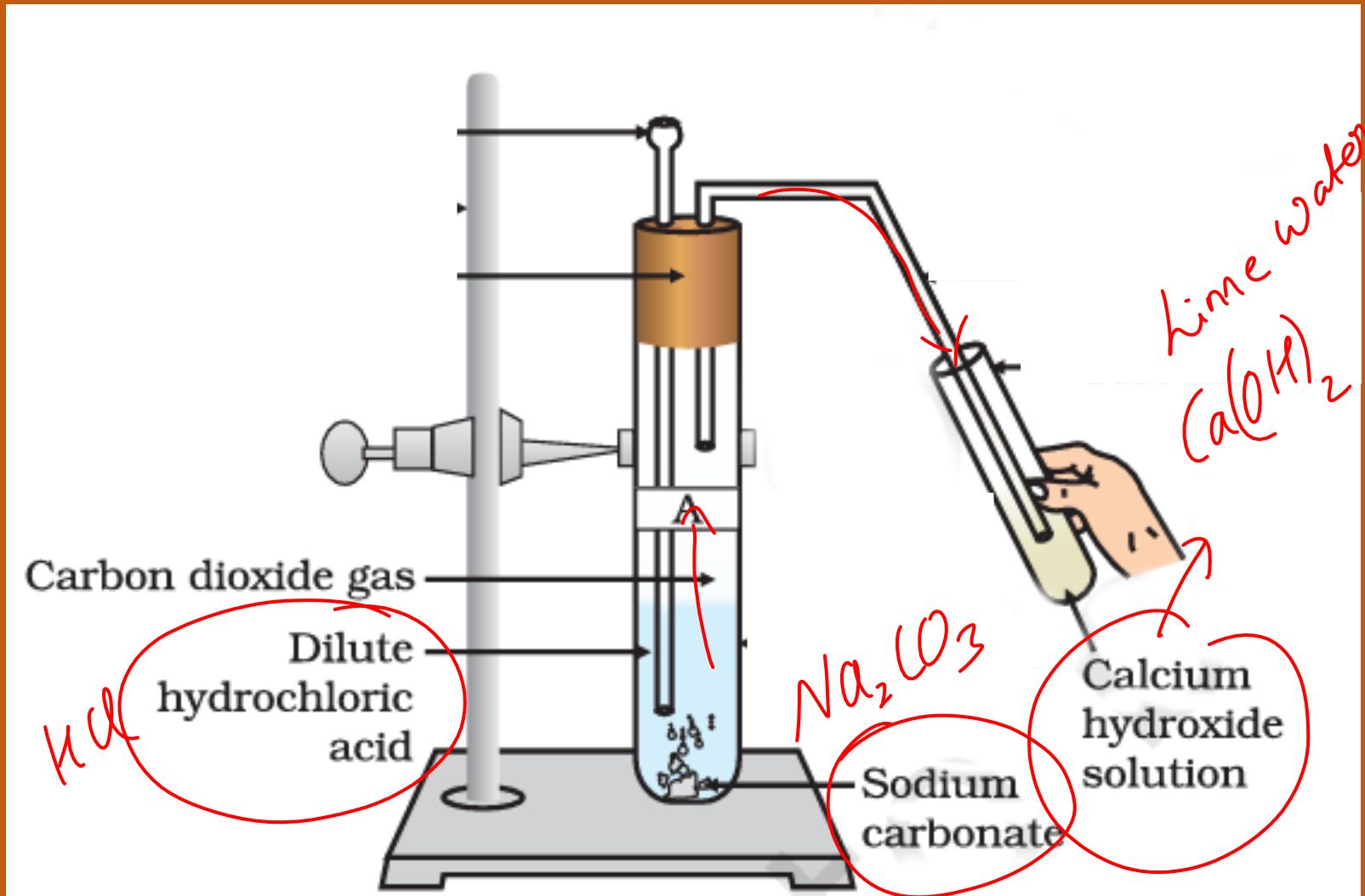


$\text{CO}_2$  turns lime water milky



on passing excess of  $\text{CO}_2$ , milkiness disappear





**Q. When sodium bicarbonate reacts with dilute hydrochloric acid, the gas evolved is**



**(CBSE 2023)**

(a) Hydrogen; it gives pop sound with burning matchstick.

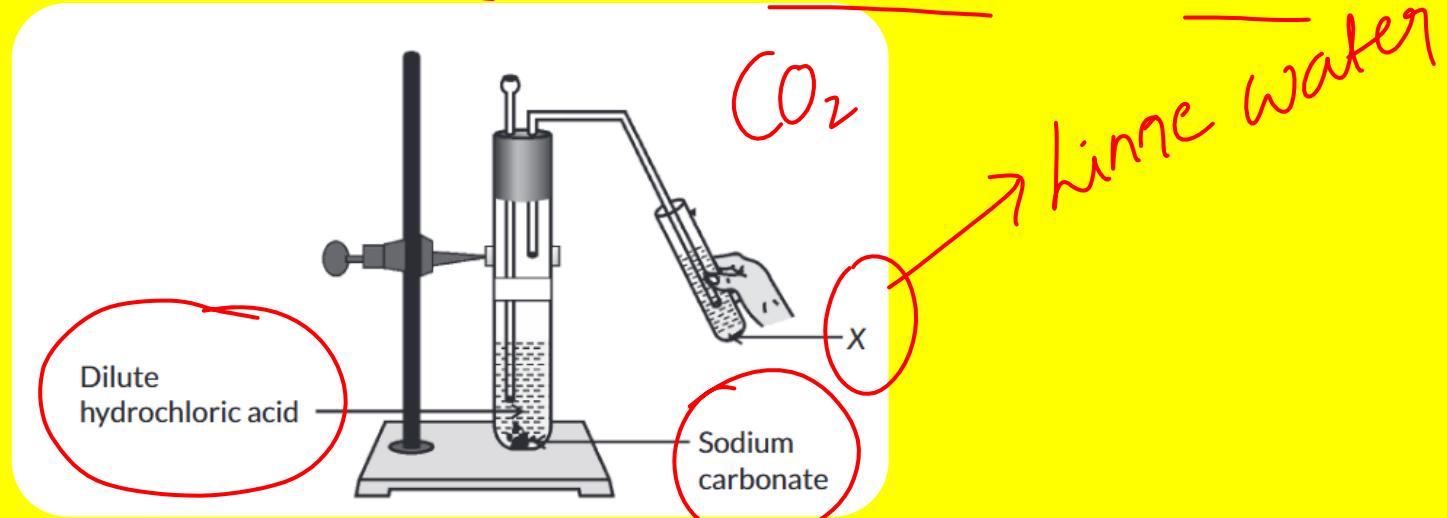
(b) Hydrogen; it turns lime water milky.

(c) Carbon dioxide; it turns lime water milky.

(d) Carbon dioxide; it blows off a burning match stick with a pop sound.

**Q. In the experimental setup given below, it is observed that on passing the gas produced in the reaction in the solution 'X', the solution 'X' first turns milky and then colourless. Explain**

**(CBSE 2023)**



# Strength of Acid & Base

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

Gives more Concentration of  
 $\text{H}^+(\text{aq})$  ions

weak Acid:  $\text{CH}_3\text{COOH}$  (acetic acid)

Citric Acid, Lactic acid,  $\text{H}_2\text{CO}_3$  (Carbonic acid)  
(generally organic acids-Natural sources)

gives Less conc. of  $\text{H}^+(\text{aq})$  ions

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

Gives more Concentration of  $\text{OH}^-$  ions  $\text{Mg}(\text{OH})_2$

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

Gives less Concentration of  $\text{OH}^-$  ions

**Q. Out of the two hydrochloric acid and acetic acid, which one is considered as strong acid and why?**

**Write the name/molecular formula of one more strong acid.**

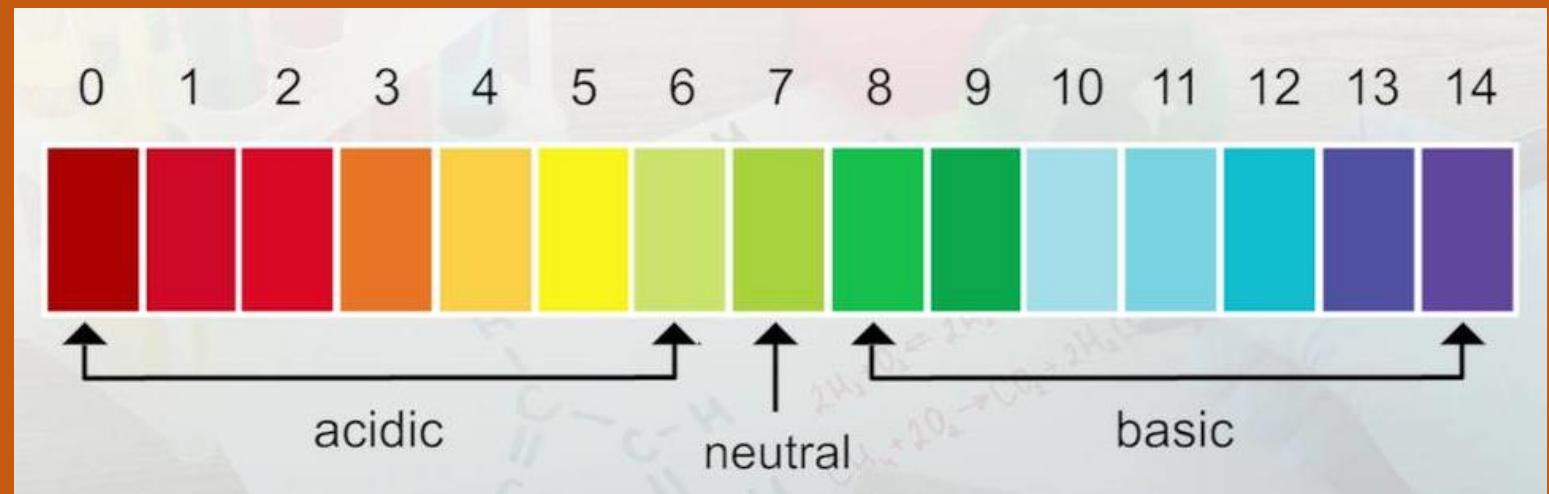
**(CBSE 2021)**

# pH: P(Potenz → Power) H → Hydrogen

- (i) Measures  $\text{H}^+(\text{aq})$  ions concentration in a solution
- (ii) pH ranges from 0 (very acidic) to 14 (very basic)
- (iii)  $\text{pH} \downarrow \rightarrow \text{H}^+(\text{aq}) \uparrow \Rightarrow \text{Acidic} \uparrow$

$\text{H}^+ \uparrow$   
 $\text{pH} \downarrow$

$\text{pH} < 7$  Acidic  
 $\text{pH} = 7$  Neutral  
 $\text{pH} > 7$  Base



**Q. Select from the following the statement which is true for bases.**

- (a) ~~Bases are bitter and turn blue litmus red.~~ X
- (b) ~~Bases have a pH less than 7.~~ X
- (c) ~~Bases are sour and change red litmus to blue.~~
- (d) ~~Bases turn pink when a drop of phenolph-thalein is added to them.~~

**(CBSE 2021-2022 term 1)**



**Q. Consider the pH value of the following acidic samples.**

The decreasing order of their  $H^+$  ion concentration is

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 2021-2022 term 1)**

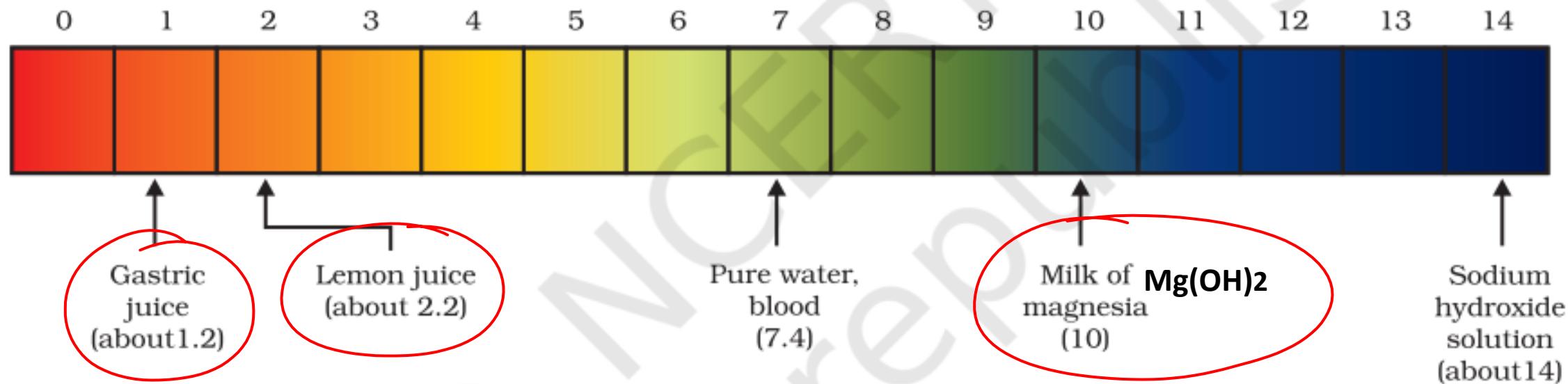
pH

3 > 4 > 1 > 2

$H^+ 3 < 4 < 1 < 2$

- (a) 3>4>1>2      (b) 2>1>3>4  
~~(c) 2>1>4>3~~      (d) 3>4>2>1

**Universal indicators** – Substance which detect **nature** of chemical as acid or base & also measures **strength** of it.  
eg -**pH paper**



R O Y G B I V  
Acidic Neutral Basic

**Q. The table below has information regarding pH and the nature (acidic/basic) of four different solutions. Which one of the options in the table is correct? (CBSE 2023)**

option	Solution	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

*Acid*  
**Two solutions M and N give red and blue colour respectively with a universal indicator.**

**(CBSE 2023)**

- (i) In which solution will the hydrogen ion concentration be more? Justify your answer.
- (ii) If both M and N solutions are mixed and the resultant mixture is tested with a universal indicator, it turns green. What is the nature of the salt formed? Justify your answer.

# Importance of pH in everyday life

1) pH range for human body - 7.0 to 7.8

pH of rain water < 5.6 ⇒ Acid rain

Blood

Acid rain → river → pH of river ↓

→ aquatic life survival difficult

2) Stomach produces HCl(aq) → helps in digestion of food.

During Indigestion, stomach produces too much acid  
→ causes pain & irritation.

People use antacid (milk of magnesia  $Mg(OH)_2$  mild base)

→ Antacid neutralise excess of acid.

3) pH of mouth < 5.5 ⇒ Tooth decay

(due to sugar & food degradation)

Toothpaste (basic in nature) neutralises excess acid

4) Honey bee sting → acid (formic acid)

Treatment → mild base like baking soda



5) Nettle stinging hair → methanol acid → painful when touched

Remedy → rubbing area with dock plant

Dock plant often grows besides nettle ⇒

Nature provides neutralisation

## pH of Salts ?

Acid + Base → Salt + water

Strong acid + Strong base → Neutral salt + water

pH = 7

Weak Acid + Strong Base → Basic salt + water

pH > 7

Strong acid + Weak base → Acidic salt + water

pH < 7



# Strength of Acid & Base

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



weak Acid:  $\text{CH}_3\text{COOH}$  (acetic acid)



Citric Acid, Lactic acid,  $\text{H}_2\text{CO}_3$

(generally organic acids-Natural sources)

Strong Base:  $\text{NaOH}$ ,  $\text{KOH}$ ,  $\text{Ca}(\text{OH})_2$   
 $\text{Mg}(\text{OH})_2$   $\text{Ba}(\text{OH})_2$

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

**Q. An aqueous solution of a salt shows an orange red colour when a drop of universal indicator is added to it. This salt is made up of**

- (a) A strong acid and a strong base  
(b) A weak acid and a weak base  
(c) ~~A strong acid and a weak base~~  
(d) A weak acid and a strong base. (Term, 2021-22)

→ Ans

**(CBSE 2021 - 2022 Term 1)**

**Q. An aqueous solution of a salt turns blue litmus to red. The salt could be the one obtained by the reaction of**

- (a)  $\text{HNO}_3$  and  $\text{NaOH}$  X
- (b)  $\text{H}_2\text{SO}_4$  and  $\text{KOH}$  X
- (c)  $\text{CH}_3\text{COOH}$  and  $\text{NaOH}$  X
- (d) ~~HCl and  $\text{NH}_4\text{OH}$~~   
SA WB

↓  
Acid  
SA WB

**(CBSE 2024)**

**Q. Study the following table and choose the correct option.**

	Salt	Parent Acid	Parent Base	Nature of Salt
(a)	Sodium chloride	HCl	NaOH	Basic
(b)	Sodium carbonate	$\text{H}_2\text{CO}_3$	NaOH	Neutral
(c)	Sodium sulphate	$\text{H}_2\text{SO}_4$	NaOH	Acidic
(d)	Sodium acetate	$\text{CH}_3\text{COOH}$	NaOH	Basic

H.W. (CBSE 2021 – 2022 Term 1)

# Naturally Occurring Acids

Natural source	Acid	
Vinegar	Acetic acid	Sirka Pikar Acting karne lage
Orange	Citric acid	Orange cheela andar City nikli
Tamarind	Tartaric acid	Imlee ko tar se bandha
Tomato	Oxalic acid	Tamatar OX ne khaya

Natural source	Acid	
Sour milk (Curd)	Lactic acid	Dahi ko Lake me feka
Lemon	Citric acid	Lemon cheela andar City nikli
Ant sting	Methanoic acid	Ant ne khaya Methi Paratha
Nettle sting	Methanoic acid	Net me fasa Methi Paratha

**Q. Acid present in Tomato is (CBSE 2023)**

- (a) Methanoic acid
- (b) (acetic acid)
- (c) Lactic acid
- (d) ~~Oxalic acid~~

✓✓

Which of the options in the given table are correct?

Option	Natural Source	Acid Present
(i)	Orange	X Oxalic acid
(ii)	Sour milk	✓ Lactic acid
(iii)	Ant sting	✓ Methanoic acid
(iv)	Tamarind	X Acetic acid

**(CBSE 2021 - 2022 Term 1)**

H.W.

- (a) (i) and (ii)
- (b) (i) and (iv)
- (c) (ii) and (iii)
- (d) (iii) and (iv)

# **Common salt (NaCl) [Rock salt]**

Found in deposits in rock bed

Common salt (NaCl ) is raw material for various chemicals

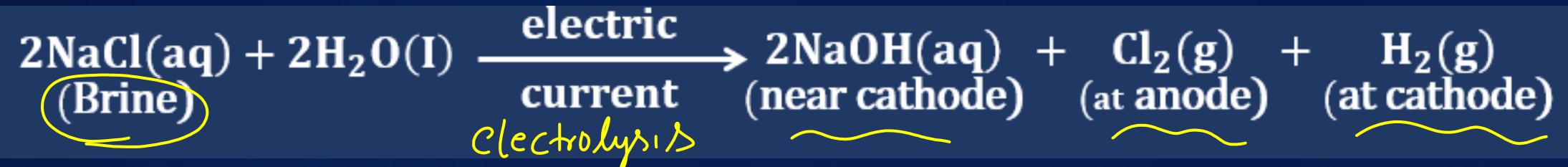
$\text{NaOH}$                       Sodium hydroxide

$\text{CaOCl}_2$                       Bleaching powder

$\text{NaHCO}_3$                       Baking soda

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

# Sodium hydroxide / Caustic Soda NaOH : Chlor - Alkali process



Chor



Namak Pani



PArCl



CHiNa

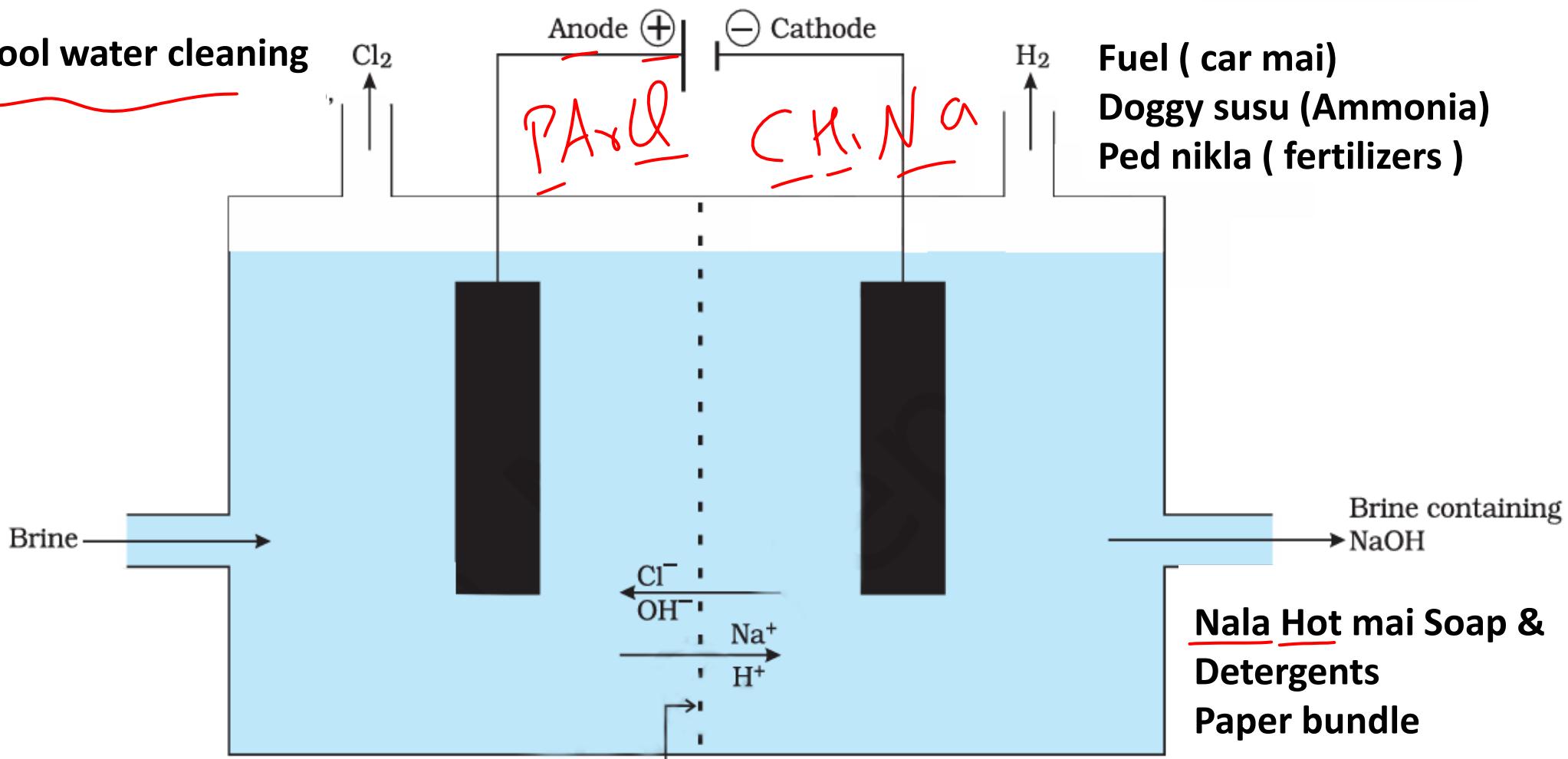


Khali



**Swimming Pool water cleaning**

Pesticides



**Q. List the important products of the Chlor-alkali process. Write one important use of each.**

**(CBSE 2020)**

**Bleaching powder**

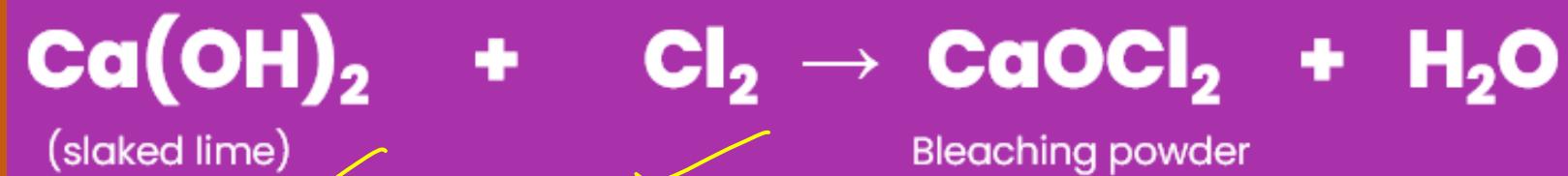


**CaOCl<sub>2</sub>**



**2 Clown on OX pulling a Car**





Snake  
lime



1. Bleaching cotton & linen, wood pulp in paper factories, Bleaching washed clothes

2. Oxidising agent

3. Make drinking water free from germs

Q. The industrial process used for the manufacture of caustic soda  $\rightarrow \text{NaOH}$   
involves electrolysis of an aqueous solution of compound 'X'. In this  
process, two gases 'Y' and 'Z' are liberated. 'Y' is liberated at cathode and  
'Z', which is liberated at anode, on treatment with dry slaked lime forms a  
compound 'B'. Name X, Y, Z and B.



Q. 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.

(CBSE 2020)

- (i) Write formula of 'G' and 'C.'
- (ii) State the chemical equations involved.
- (iii) What is common name of compound 'C'?

# Baking Soda

: NaHCO<sub>3</sub>

Bakri Soda



Bhai on Car Bonut



Sodium hydrogen  
carbonate baking soda

## **Uses.**

**1. For making tasty crispy pakora**

**2. For faster cooking**

**3. Neutralise acidity (mild base) Antacid**

**4. Soda-acid fire extinguisher**

**5. Delay curding of milk**



# For Making Baking Powder

Baking Soda + Tartaric acid



Baking Soda + Tar

Cause bread or cake to rise making them soft or spongy



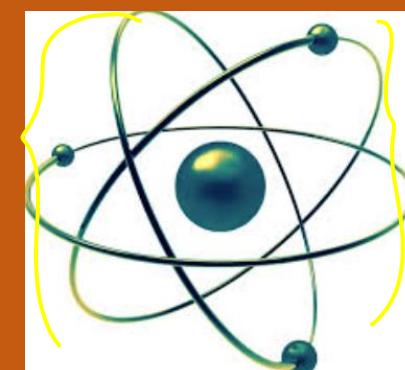
- (ii) State the difference in chemical composition between baking soda and baking powder.

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



- Glass, soap & paper industry
- Removing permanent hardness



**Q. The name of the salt used to remove permanent hardness of water is**

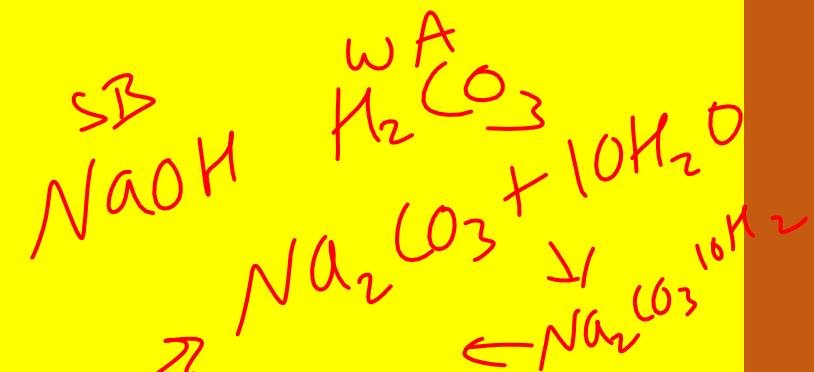
(a) Sodium hydrogen carbonate ( $\text{NaHCO}_3$ )

(b) Sodium chloride ( $\text{NaCl}$ )

(c) ~~Sodium carbonate decahydrate~~  
( $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$ )

(d) Calcium sulphate hemihydrate ( $\text{CaSO}_4 \cdot \frac{1}{2}\text{H}_2\text{O}$ )

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**Q. How is washing soda prepared from sodium carbonate? Give its chemical equation. State the type of this salt. Name the type of hardness of water which can be removed by it.**

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# Water Of Crystallization

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



Copper sulphate crystals



Ferrous sulphate crystals



Washing soda

Sodium Carbonate decahydrate



Gypsum

5ibh



Cat  $\downarrow$  Plate  $2\text{H}_2\text{O}$

Q. Consider the following compounds :



The compound having maximum number of water of crystallisation in its crystalline form in one molecule is

(a)  $\text{FeSO}_4$     (b)  $\text{CuSO}_4$

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(c)  $\text{CaSO}_4$     (d)  $\text{Na}_2\text{CO}_3$



Hari Ferrari Jal kar Lal Hui



Copper sulphate crystals

*Blue*

*White*

**Q. A few crystals of ferrous sulphate were taken in a dry boiling tube and heated. Tiny water droplets were observed in the tube after some time.**

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**(i) From where did these water droplets appear? Explain.**

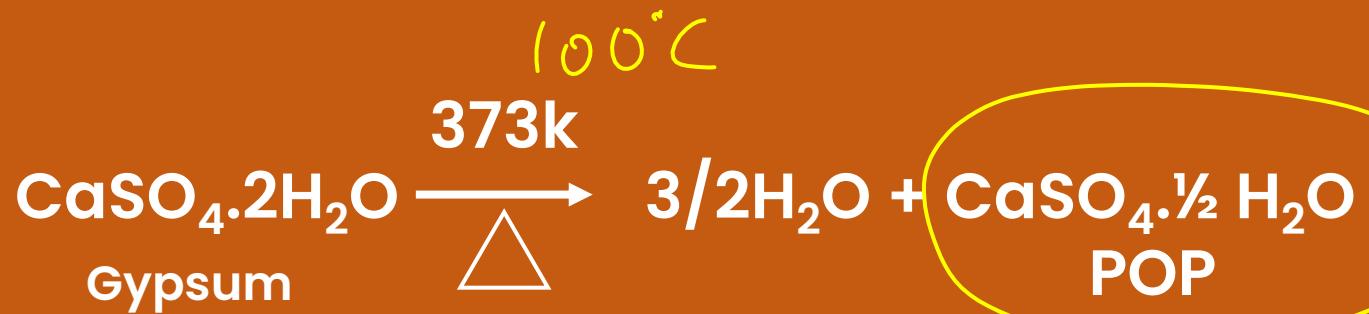
**(ii) What colour change will be observed during heating ?**

**(iii) How many molecules of water are attached per molecule of FeSO<sub>4</sub> crystal? Write the molecular formula of crystalline forms of (i) Copper sulphate, and (ii) Sodium carbonate.**

*H.W.*

# Plaster Of Paris (POP)

(POP) [CaSO<sub>4</sub>.1/2H<sub>2</sub>O] White Powder



POP + Water → Gypsum

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



**Q. The chemical formula for plaster of Paris is**



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*POF*  $\equiv$

**Q. A compound 'X which is prepared from gypsum has the property of hardening when mixed with proper quantity of water. Identify 'X' and write its chemical formula.**

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