

## CHAPTER 2

# ACIDS, BASES & SALTS

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# Acids

Acids are chemical agents that release hydrogen ions when added to water.

# Properties of Acids

Acids are:

- Sour to taste.
- They change the colour of blue litmus to red.



# Base

A base is a substance that can accept a hydrogen ion ( $H^+$ ) from another substance.

# Property of Base

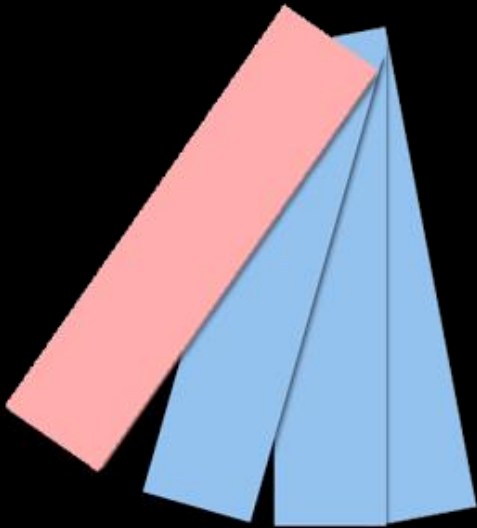
Bases are:

- Bitter to taste.
- They change the colour of red litmus to blue.



# Indicators

Indicators are chemical substances which give different colours in acidic or basic.



Litmus paper



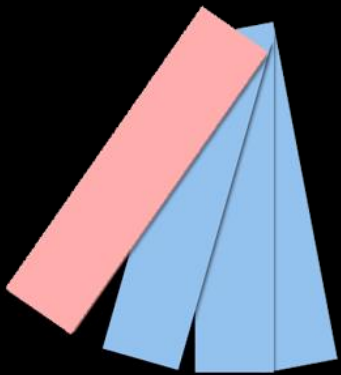
Phenolphthalein



Methyl Orange

# Natural Indicators

Litmus, turmeric, red cabbage leaves, coloured petals of some flowers.



**Litmus paper**



**Turmeric**



**Red Cabbage**



**Colour petals**



**What happens to a stain of curry on a white cloth when soap is scrubbed on it?**

The stain becomes reddish brown because soap is basic in nature.



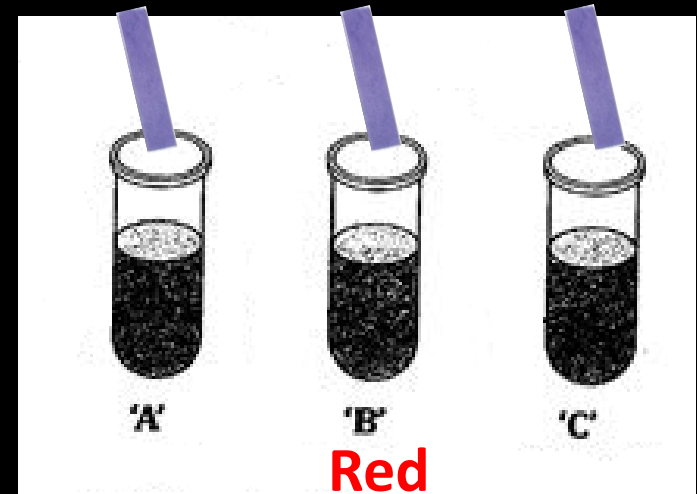
You have been provided with three test tubes A, B and C. One of them contains distilled water and the other two contain an acidic solution and a basic solution, respectively. If you are given only red litmus paper, how will you identify the contents of each test tube?

In each test tube put blue litmus paper. In test tube B it will turn red but no change will occur in test tubes A and C. Put litmus paper in test tubes A and C. It will turn blue in C showing it contains basic solution but no change will occur in A.

A contains distilled water.

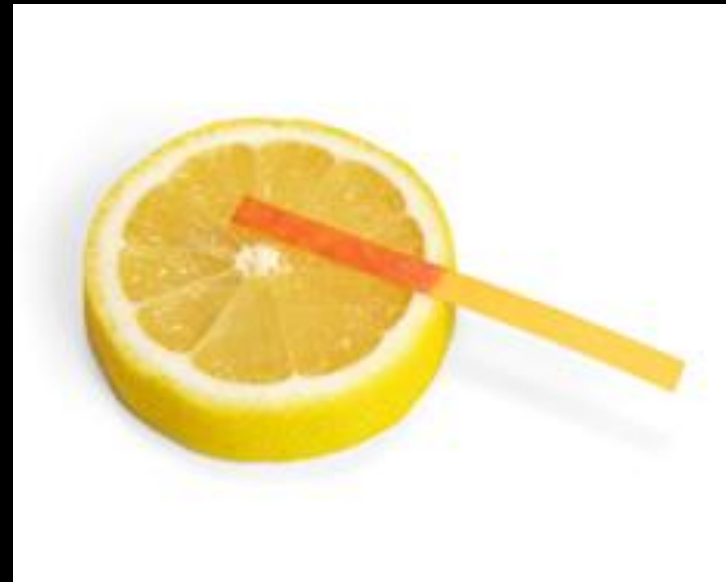
B contains acidic solution.

C contains basic solution.



A knife which is used to cut a fruit was immediately dipped into water containing drops of blue litmus solution. If the colour of the solution is changed to red, what inference can be drawn about the nature of the fruit and why?

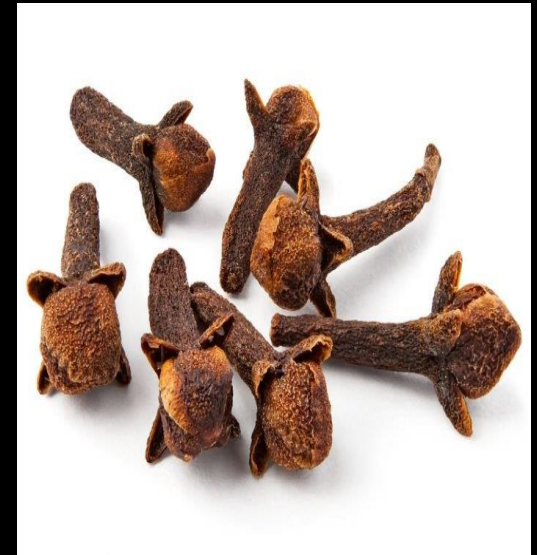
The fruit is acidic because acidic solution changes blue litmus solution red.



# Olfactory Indicators

Substances whose odour changes in acidic or basic media are called **olfactory indicators**.

Ex: Onion, vanilla and cloves.



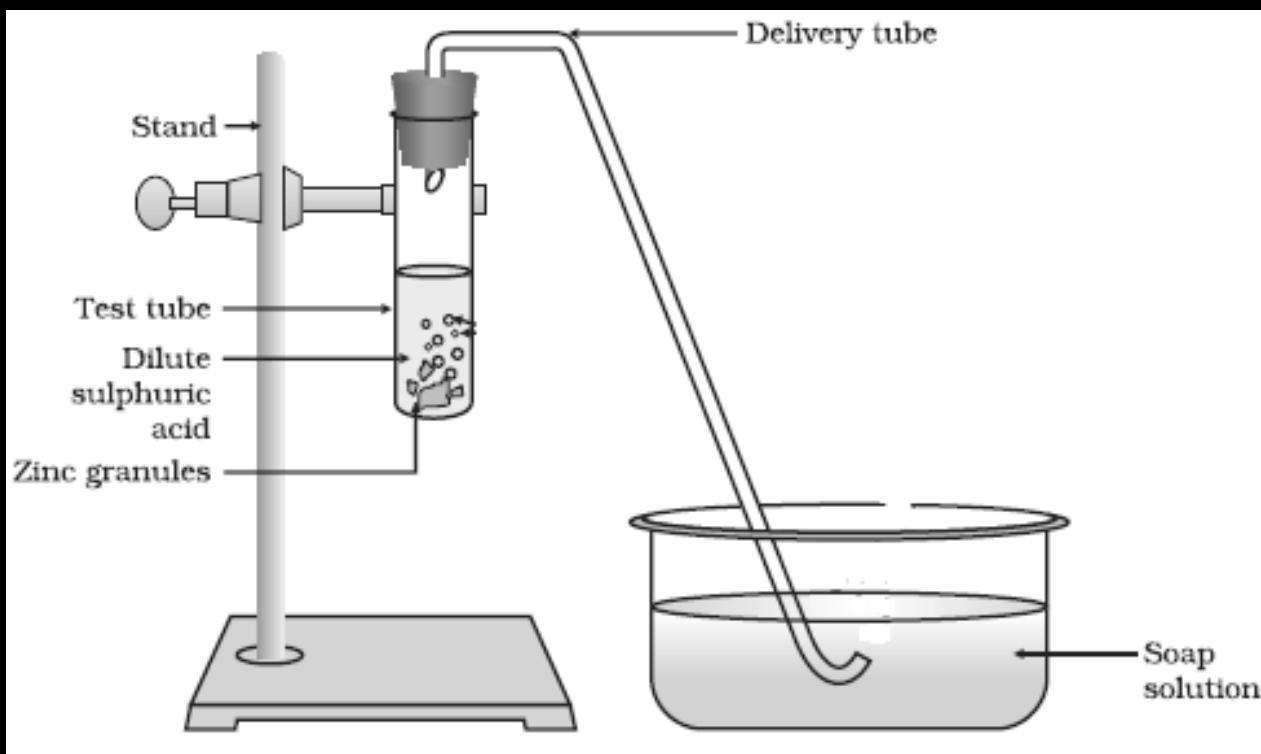
# Principle of Olfactory Indicators

An olfactory indicator works on the principle that when an acid or base is added, then its characteristic smell can be detected.

What observation do you notice when few drops of dilute HCl solution is added a cloth strips with odour of onion and few drops of NaOH solution is added on another cloth strip with odour of onion?

Onion has a characteristic smell. When a base (like NaOH) is added to a cloth strip treated with onion extract-then the smell is destroyed. An acid solution (HCl) does not destroy the smell of onion.

**Take about 5 ml of dilute sulphuric acid in a test tube and add a few pieces of zinc granules to it.**



**e) What do you observe when acids like  $\text{HCl}$ ,  $\text{HNO}_3$  and  $\text{CH}_3\text{COOH}$  is taken instead of sulphuric acid?**

The same observation is seen when sulphuric acid is replaced with  $\text{HCl}$ ,  $\text{HNO}_3$  or  $\text{CH}_3\text{COOH}$ .

## Reaction of metals with acids

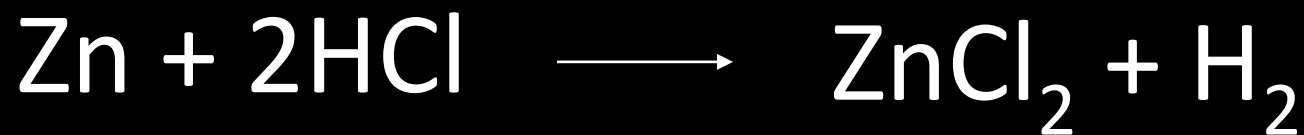
Metals combine with an acid to form salt and hydrogen is displaced from the acid.



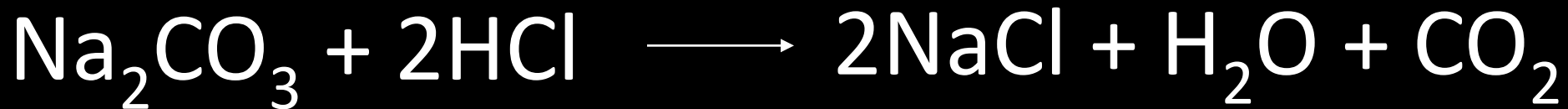


## Reaction of metals with acids

Acids react with metals to produce salt and hydrogen gas.



Acids react with metal carbonates and metal hydrogen carbonates to give salt and carbon dioxide.



## Reaction of metals with acids

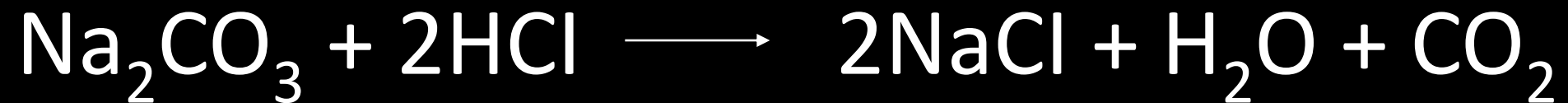
Acids react with bases to produce salt and water.



Take two test tubes A and B. Take about 0.5 g of sodium carbonate ( $\text{Na}_2\text{CO}_3$ ) in test tube A and about 0.5 g of sodium hydrogen carbonate ( $\text{NaHCO}_3$ ) in test tube B. Add about 2 ml of dilute HCl to both the test tubes.

a) What do you observe?

Sodium carbonate on reaction with dilute HCl forms sodium chloride, water and carbon dioxide. As sodium carbonate is a basic salt, while hydrochloric acid is an acid neutralization takes place



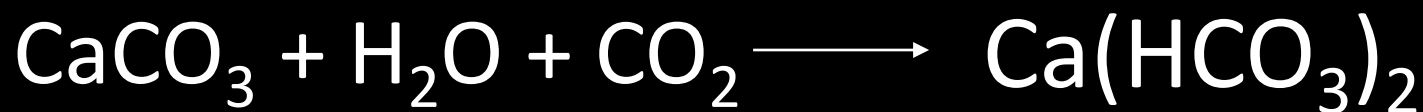
Take two test tubes A and B. Take about 0.5 g of sodium carbonate ( $\text{Na}_2\text{CO}_3$ ) in test tube A and about 0.5 g of sodium hydrogen carbonate ( $\text{NaHCO}_3$ ) in test tube B. Add about 2 ml of dilute HCl to both the test tubes.

b) What happens when the gas produced in each test tube is passed through lime water (calcium hydroxide solution)?

On passing the gas evolved through lime water, it turns milky with formation of white precipitate.

## What happens when excess carbon dioxide is passed through calcium carbonate?

On passing excess  $\text{CO}_2$  the white precipitate disappears as soluble calcium bicarbonate is formed.



# How do metal carbonates react with acids?

All metal carbonates and hydrogen-carbonates react with acids to give corresponding salt, carbon dioxide and water.



Take 2 mL of dilute NaOH solution in a test tube and two drops of phenolphthalein solution is added to it.

a) What is the colour of the solution?

Pink

b) When dilute HCl solution is added to the above solution drop by drop. Is there any colour change for the reaction mixture?

If dilute HCl is added to the solution then the colour of the solution fades. If we keep on adding HCl, the solution becomes colourless.

Take 2 mL of dilute NaOH solution in a test tube and two drops of phenolphthalein solution is added to it.

c) Why did the colour of phenolphthalein change after the addition of an acid?

HCl being a strong acid will neutralize NaOH.

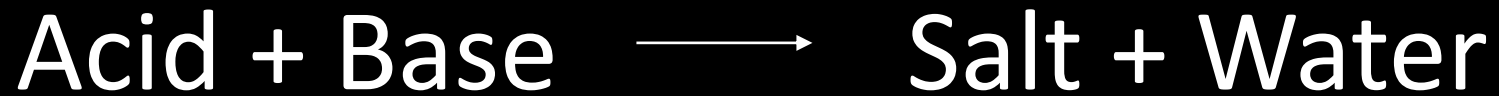
d) Does the pink colour of phenolphthalein reappear?

If few drops of NaOH is added again to the same solution, the solution become basic and the pink colour of the phenolphthalein reappears.



# Neutralisation Reaction

Acids react with bases to produce salt and water.

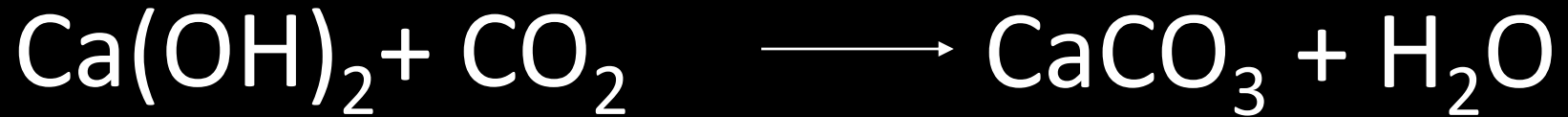


**A student dropped few pieces of marble in dilute HCl contained in a test tube. The evolved gas was passed through lime water.**

**a) What change would be observed in lime water?**

Lime water turns milky.

**b) Write balanced chemical equation for the above change.**



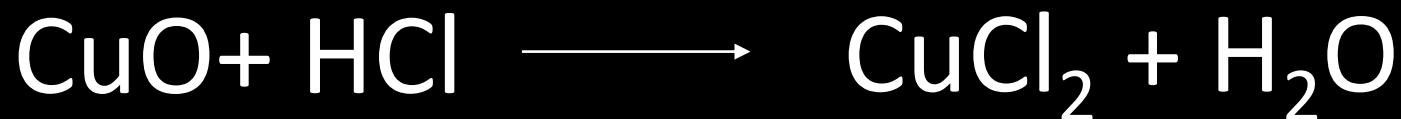
**Take a small amount of copper oxide in a beaker and add dilute hydrochloric acid slowly while stirring. What is the colour of the solution? What happens to the copper oxide?**

The colour of the solution becomes blue-green and the copper oxide dissolves. The blue-green colour of the solution is due to the formation of copper(II) chloride in the reaction.

## Reaction between metal oxide and an acid

Metal oxide + Acid  $\longrightarrow$  Salt + Water

Reaction between Copper oxide and dilute hydrochloric acid



# Why should curd and sour substances not be kept in brass and copper vessels?

Curd and other sour substances contain acids. Therefore, when they are kept in brass and copper vessels, the metal reacts with the acid to liberate hydrogen gas and harmful products, thereby spoiling the food.

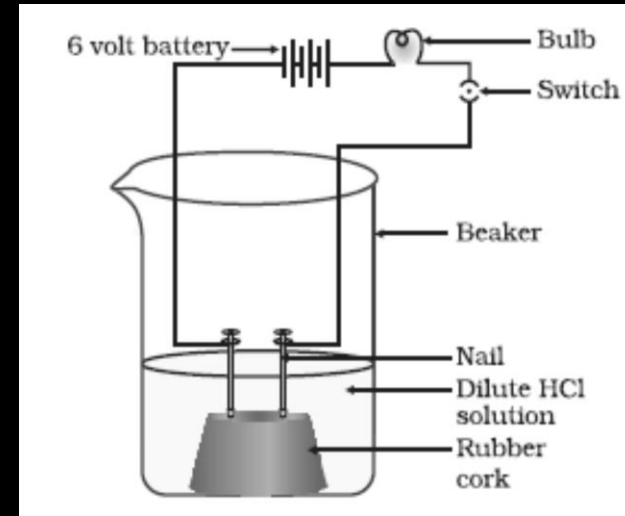
# Why these sour substances are effective in cleaning the vessels?

Lemon or tamarind juice is acidic in nature and reacts with oxidised copper to dissolve it into salt and water. Thus copper vessel is cleaned.



Take solutions of glucose, alcohol, hydrochloric acid, sulphuric acid, etc. Fix two nails on a cork, and place the cork in a 100 mL beaker. Connect the nails to the two terminals of a 6 volt battery through a bulb and a switch, as shown in the figure.

Now pour some dilute HCl in the beaker and switch on the current. What do you observe?



The bulb will start glowing.

Repeat the experiment separately with glucose and alcohol solutions. What do you observe now?

Glucose and alcohol solutions do not conduct electricity.

Does the bulb glow in all cases?

The bulb will start glowing in the case of acids (all acids contain hydrogen but not all compounds containing hydrogen are not acids)

**Compounds such as alcohols and glucose also contain hydrogen but are not categorized as acids.**

Two nails are fitted on a cork and are kept it in a 100 mL beaker. The nails are then connected to the two terminals of a 6-volt battery through a bulb and a switch. Some dilute HCl is poured in the beaker and the current is switched on. The same experiment is then performed with glucose solution and alcohol solution.

**Result:**

HCl dissociates into  $\text{H}^+$  and  $\text{Cl}^-$  ions. These ions conduct electricity in the solution resulting in the glowing of the bulb. On the other hand, the glucose solution does not dissociate into ions. Therefore, it does not conduct electricity.

**Conclusion:**

From this activity, it can be concluded that all acids contain hydrogen but not all compounds containing hydrogen are acids. That is why, though alcohols and glucose contain hydrogen, they are not categorised as acids.



Why do HCl, HNO<sub>3</sub>, etc., show acidic characters in aqueous solutions while solutions of compounds like alcohol and glucose do not show acidic character?

The dissociation of HCl or HNO<sub>3</sub> to form hydrogen ions always occurs in the presence of water. Hydrogen ions (H<sup>+</sup>) combine with H<sub>2</sub>O to form hydronium ions (H<sub>3</sub>O<sup>+</sup>).

The reaction is as follows:

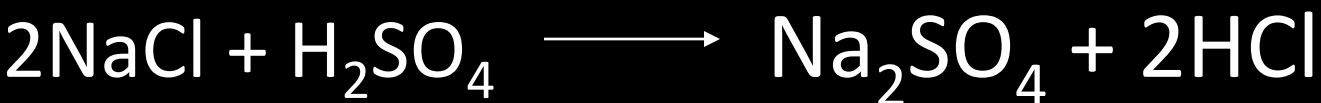
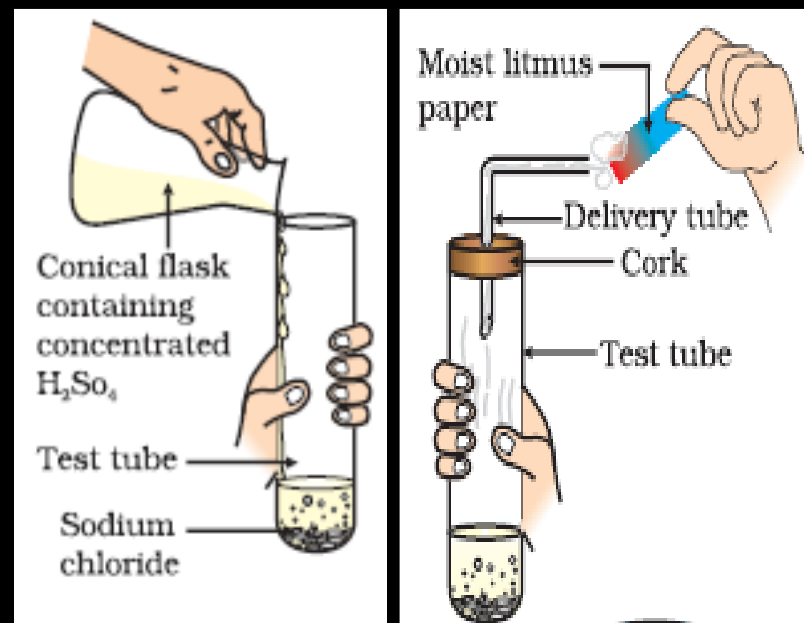
Although aqueous solutions of glucose and alcohol contain hydrogen, these cannot dissociate in water to form hydrogen ions. Hence, they do not show acidic character.

What is responsible for the acidic property?

The  $H^+$  ions in solution are responsible for the acidic property of acid.

Take about 1g solid NaCl in a clean and dry test tube and set up the apparatus as shown in figure. Add some concentrated sulphuric acid to the test tube.

Reaction takes place and hydrochloric acid gas is produced.

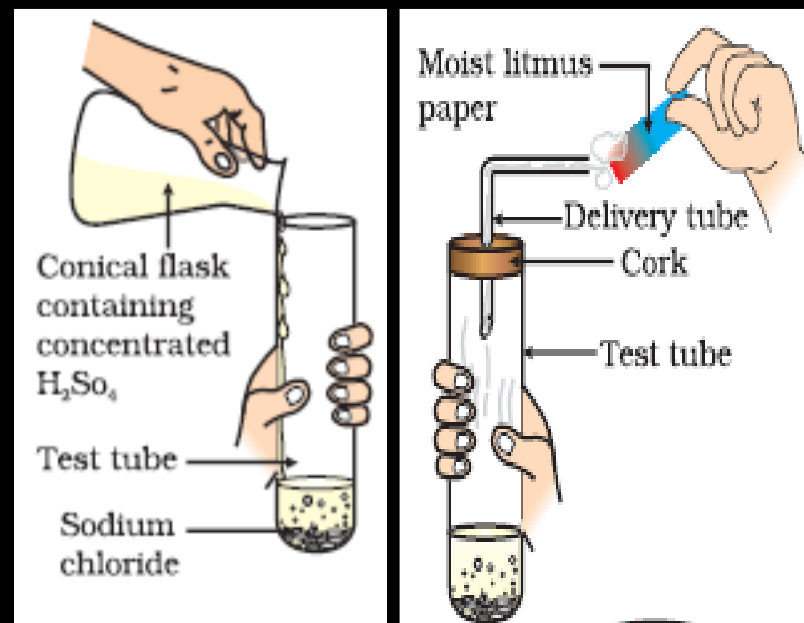


Test the gas evolved successively with dry and blue litmus paper.

Take about 1g solid NaCl in a clean and dry test tube and set up the apparatus as shown in figure. Add some concentrated sulphuric acid to the test tube.

In which case does the litmus paper change colour?

The gas has no effect on dry litmus paper but wet litmus paper turns red.



On the basis of the above Activity, what do you infer about the acidic character of: (i) dry HCl gas (ii) HCl solution?

Experiment suggests that hydrogen ions in HCl are produced in the presence of water. The separation of  $H^+$  ion from HCl molecules cannot occur in the absence of water.

## Why does dry HCl gas not change the colour of the dry litmus paper?

Colour of the litmus paper is changed by the hydrogen ions. Dry HCl gas does not contain  $H^+$  ions. It is only in the aqueous solution that an acid dissociates to give ions. Since in this case, neither HCl is in the aqueous form nor the litmus paper is wet, therefore, the colour of the litmus paper does not change.

# Why does an aqueous solution of acid conduct electricity?

Acids dissociate in aqueous solutions to form ions. These ions are responsible for conduction of electricity.

## **Why does distilled water not conduct electricity, whereas rain water does?**

Distilled water is a pure form of water and does not contain any ions. So it does not conduct electricity. Rain water, being an impure form of water, contains many ionic species such as acids and therefore it conducts electricity.

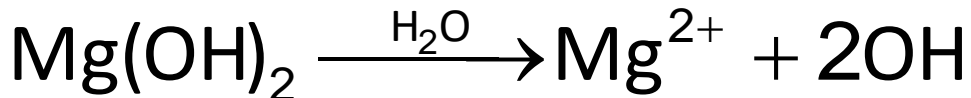
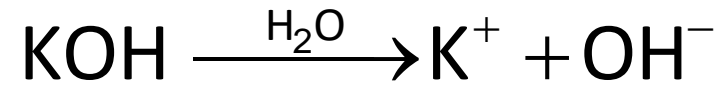
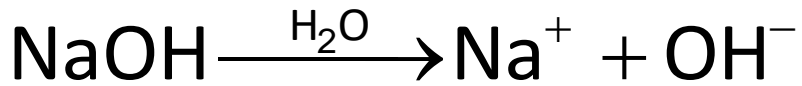
## Why do acids not show acidic behaviour in the absence of water?

Acids do not show acidic behaviour in the absence of water because the dissociation of hydrogen ions from an acid occurs in the presence of water only. It is the hydrogen ions that are responsible for the acidic behaviour.



## Base reaction with water

Bases produce hydroxide ( $\text{OH}^-$ ) ions in water.



# Alkalis

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

## Characteristics of Alkalis

Alkalis are soapy to touch. They are bitter and corrosive.

## General reaction between acids and bases



**Take 10 mL water in a beaker. Add a few drops of concentrated  $\text{H}_2\text{SO}_4$  to it and swirl the beaker slowly.**

**Touch the base of the beaker. Is there a change in temperature?**

The temperature rises.

**Is this an exothermic or endothermic process?**

Dissolution of acid in water is an exothermic process.

**Add sodium hydroxide pellets to 10ml water in a beaker. What do you observe?**

The temperature of beaker increases as sodium hydroxide dissolves in water.

**Acid must be added to water and not vice versa during dilution.**

We should always add acid slowly to water, keeping the solution continuously stirred, while preparing dilute solutions of acid like nitric acid and sulphuric acid. If water is added to acid, so much heat is produced during the dilution process that the container may break. The hot contents may also cause an explosion and spill on our clothes and body.

## Dilution

The process of mixing an acid or base with water to decrease the concentration of ions ( $\text{H}_3\text{O}^+$  /  $\text{OH}^-$ ) is called **dilution**.

**How is the concentration of hydronium ions ( $\text{H}_3\text{O}^+$ ) affected when a solution of an acid is diluted?**

When an acid is diluted, the concentration of hydronium ions ( $\text{H}_3\text{O}^+$ ) per unit volume decreases. This means that the strength of the acid decreases.

**How is the concentration of hydroxide ions ( $\text{OH}^-$ ) affected when excess base is dissolved in a solution of sodium hydroxide?**

The concentration of hydroxide ions ( $\text{OH}^-$ ) would increase when excess base is dissolved in a solution of sodium hydroxide.

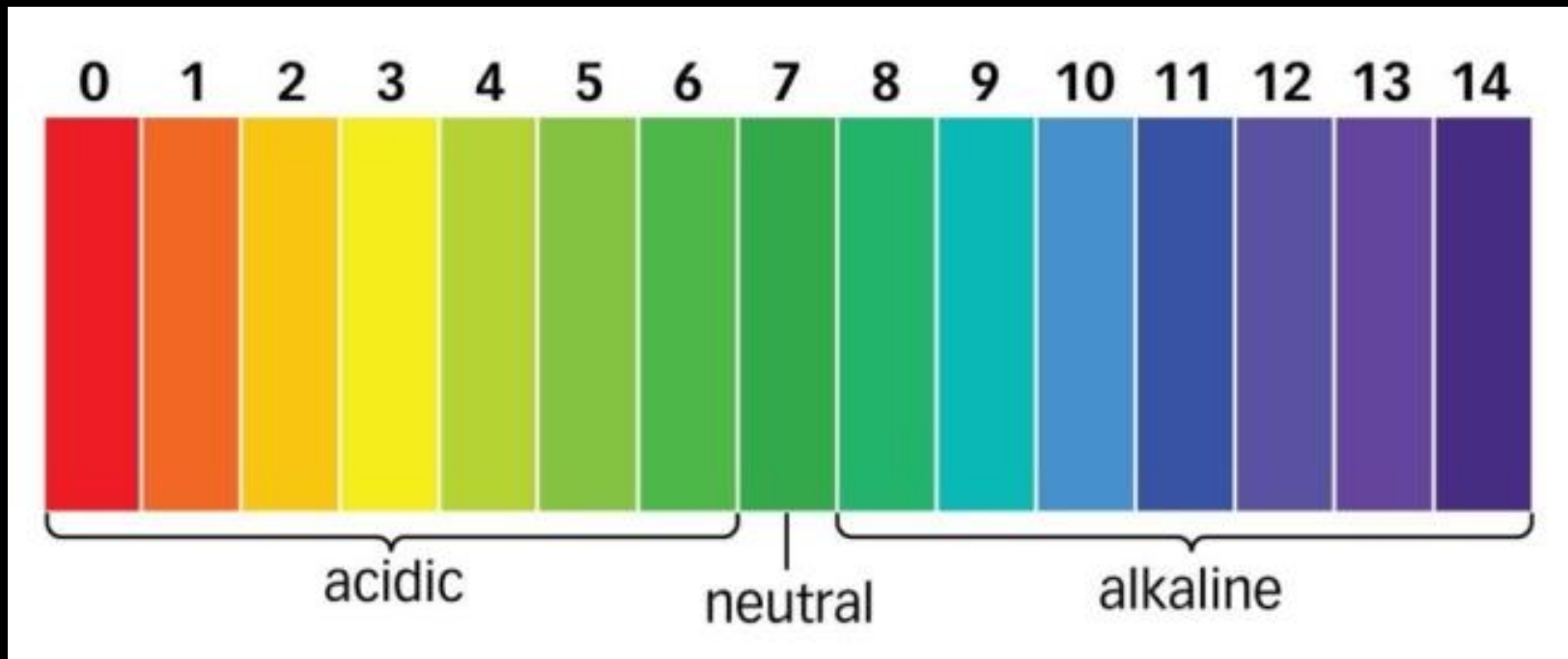
## Universal Indicator

An indicator which shows different colours at different concentrations of hydrogen ions in a solution is called **universal indicator**.



## pH scale

A scale for measuring hydrogen ion concentration in a solution is called **pH scale**.



# pH scale

No.	Solution	Colour of pH paper	pH Value	Nature of substance
1	Saliva (before meal)	Light green	7.4	Basic
2	Saliva (after meal)	Pale yellow	5.8	Acidic
3	Lemon juice	Pink red	2.5	Acidic
4	Colourless aerated drink	Pale yellow	6	Acidic
5	Carrot juice	Light orange	4	Acidic
6	Coffee	Orange yellow	5	Acidic
7	Tomato juice	Dark orange	4.1	Acidic
8	Tap water	Green	7	Neutral
9	1M NaOH	Dark blue, violet	13-14	Basic
10	1M HCl	Red	1	Acidic

## Strong Acid

Acids that give rise to more  $H^+$  ions or acids in which complete dissociation of hydrogen ion takes place are called **strong acid**.

Ex: Hydrochloric acid, sulphuric acid, nitric acid.

## Weak Acid

Acids that give less  $H^+$  ions or acids in which there is partial dissociation of hydrogen ions are called **weak acids**.

Acetic acid ( $CH_3COOH$ ) and oxalic acid ( $H_2C_2O_4$ ) are examples of weak acids.

Equal lengths of magnesium ribbons are taken in test tubes A and B. Hydrochloric acid (HCl) is added to test tube A, while acetic acid ( $\text{CH}_3\text{COOH}$ ) is added to test tube B. Amount and concentration taken for both the acids are same. In which test tube will the fizzing occur more vigorously and why?

The fizzing will occur strongly in test tube A, in which hydrochloric acid (HCl) is added. This is because HCl is a stronger acid than  $\text{CH}_3\text{COOH}$  and therefore produces hydrogen gas at a faster speed due to which fizzing occurs.

# Antacid

An antacid is a base which is used to reduce the pain and irritation caused by excess production of acid in the stomach due to indigestion.

Ex: Magnesium hydroxide (Milk of magnesia)



**A person is suffering from indigestion due to the intake of hot spicy food. What remedy will you prescribe to the patient? Give the name of a chemical that can give relief to him.**

The person should be given an antacid like milk of magnesia [ $\text{Mg}(\text{OH})_2$ ]

# How do antacids reduce the pain and irritation caused due to indigestion?

Antacids neutralise the excess acid produced by the stomach during indigestion.



## Tooth-decay

Tooth decay is the corrosion of the tooth enamel.

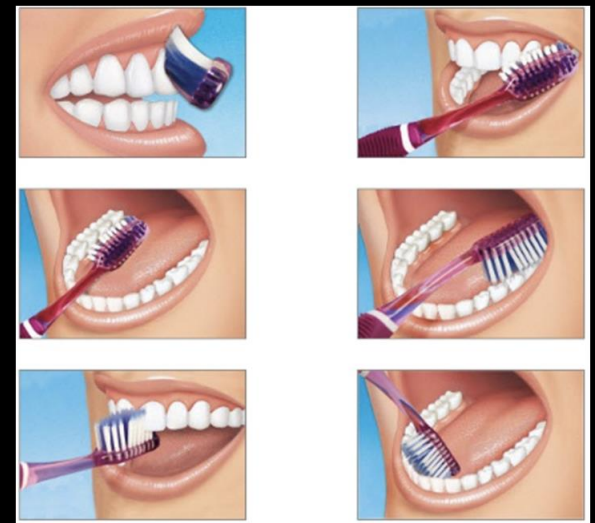
When the pH in the mouth is below 5.5, bacteria present in the mouth produce acids by degradation of sugar and food particles remaining in the mouth after eating. This corrodes the tooth enamel causing tooth decay.

# Tooth-decay



## Reducing Tooth-decay

The best way to prevent tooth decay is to clean the mouth after eating food. Using toothpastes, which are generally basic, for cleaning the teeth can neutralise the excess acid and prevent tooth decay.



## How does the enamel undergo damage due to eating of chocolates and sweets? What should be done to prevent it?

Tooth enamel is chemically calcium phosphate. Sugar present in chocolates and sweets gets broken to acids by bacteria present in the mouth. It starts corroding when pH falls below 5.5, food particles in the mouth degrade to produce acid which lowers the pH of the mouth. Doctors advice the use of paste to prevent tooth decay because these are alkaline and neutralise the acid produced.



# How can the pain and irritation caused by bee sting be reduced?

Bee-sting leaves an acid which causes pain and irritation. Use of a mild base like baking soda on the stung area reduces the pain and irritation.



**Kamala was playing in the garden. She was stung by a wasp. Her mother immediately applied a coating of toothpaste on the affected area and then took her to the doctor.**

**a) What does wasp sting contain?**

Wasp sting contains venom which is acidic.

**b) Why did her mother apply toothpaste on the affected area?**

As toothpaste is basic in nature. So on applying it on the affected area, it neutralises the effect of acidic wasp sting.

**A student accidentally touches a nettle plant while trekking. How can you help to reduce the pain and irritation caused by it?**

The leaves of nettle plant have stinging hair which releases methanoic acid. We can neutralise the pain and irritation of the acid by rubbing the area with the leaf of the dock plant. Dock plant produces base which neutralises the acid.



# Acid present in substances

Substance	Acid	Substance	Acid
Vinegar	Acetic acid	Sour milk (Curd)	Lactic acid
Orange	Citric acid	Lemon	Citric acid
Tamarind	Tartaric acid	Ant sting	Methanoic acid
Tomato	Oxalic acid	Nettle sting	Methanoic acid



**You have two solutions, A and B. The pH of solution A is 6 and pH of solution B is 8. Which solution has more hydrogen ion concentration? Which of this is acidic and which one is basic?**

A pH value of less than 7 indicates an acidic solution, while greater than 7 indicates a basic solution. Therefore, the solution with pH = 6 is acidic and has more hydrogen ion concentration than the solution of pH = 8 which is basic.

Five solutions A, B, C, D and E when tested with universal indicator showed pH as 4, 1, 11, 7 and 9, respectively. Which solution is (a) neutral (b) strongly alkaline (c) strongly acidic (d) weakly acidic (e) weakly alkaline Arrange the pH in increasing order of hydrogen-ion concentration.

- a) Solution D is neutral (pH=7)
- b) Solution C is strongly alkaline (pH=11)
- c) Solution A is strongly acidic (pH=4)
- d) Solution E is weakly acidic (pH=1)
- e) Solution E is weakly alkaline (pH=9)

pH in the increasing order of hydrogen ion concentration is:  
 $\text{pH}=11 < \text{pH}=9 < \text{pH}=7 < \text{pH}=4 < \text{pH}=1$

**The soil in a field is highly acidic. List any two materials which can be added to this soil to reduce its acidity. Give reason.**

Calcium carbonate, calcium oxide, magnesium oxide or magnesium carbonate can be added to neutralise the acidity of the soil.

## Importance of pH in our daily life

- 1) Our body works within the pH range of 7-7.8.
- 2) When pH of rain water is less than 5.6, it is called acid rain.
- 3) Acid produced in stomach which causes pain and irritation.
- 4) To get rid of this pain, people uses antacid (mild base) like milk of magnesia

## Importance of pH in our daily life

- 5) Tooth decay starts when pH of mouth is lower than 5.5.
- 6) Using toothpaste (generally basic) tooth decay can be prevented.
- 7) Bee sting leaves an acid which cause pain and irritation. Use of a mild base like baking soda on stung area gives relief.
- 8) Stinging hair of nettle leaves inject methanoic acid causing burning pain. Rubbing with leaf of dock plant gives relief.

**The tanks in which milk is stored for retail selling are cleaned with sodium hydroxide solution every time fresh milk is filled in them. Give reason for this practice.**

Milk contains lactic acid and its effect remains in the empty tank. The acidic effect in the tank can be neutralised by cleaning it with a solution of a base. It changes the acid into salt which then gets removed from the tank by cleaning with water.

Check the solubility in distilled water of the following salts. Find the pH using a pH paper. Which of the salts are acidic, basic or neutral? Identify the acid or base used to form the salt.

Salt	Solubility in water	Acidic/ Basic/ Neutral	pH Value	Acid used	Base used
Sodium chloride	Soluble	Neutral	7	HCl	NaOH
potassium nitrate	Soluble	Neutral	7	HNO <sub>3</sub>	KOH
Aluminium chloride	Soluble	Acidic	<7	HCl	Al(OH) <sub>3</sub>
Zinc sulphate	Soluble	Acidic	<7	H <sub>2</sub> SO <sub>4</sub>	Zn(OH) <sub>3</sub>
Copper sulphate	Soluble	Acidic	<7	H <sub>2</sub> SO <sub>4</sub>	Cu(OH) <sub>3</sub>
Sodium acetate	Soluble	Basic	>7	CH <sub>3</sub> COOH	NaOH
Sodium carbonate	Soluble	Basic	>7	H <sub>2</sub> CO <sub>3</sub>	NaOH
Sodium hydrogen carbonate	Soluble	Basic	>7	H <sub>2</sub> CO <sub>3</sub>	NaOH

A milkman adds a very small amount of baking soda to fresh milk.

(a) Why does he shift the pH of the fresh milk from 6 to slightly alkaline?

(a) The milkman shifts the pH of the fresh milk from 6 to slightly alkaline because in alkaline condition, milk does not set as curd easily.

(b) Why does this milk take a long time to set as curd?

(b) Since this milk is slightly basic than usual milk, acids produced to set the curd are neutralized by the base. Therefore, it takes a longer time for the curd to set.



# Difference between Acid and Alkali

Acid	Alkali
Compound formed by the reaction of acidic oxide with water.	The hydroxide of metals which dissolve water
Turns litmus solution red	Turn litmus solution blue

# Difference between Base and Alkali

## Base

Base is a substance which contains hydroxyl group

Ex: NaOH, KOH,  
 $\text{Al}(\text{OH})_3$

## Alkali

The hydroxide of metals which dissolve water

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

## Rock Salt

Large crystals of sodium chloride are called rock salts.

**Why is rock salt brown in colour?**

Rock salt is brown in colour due to impurities.

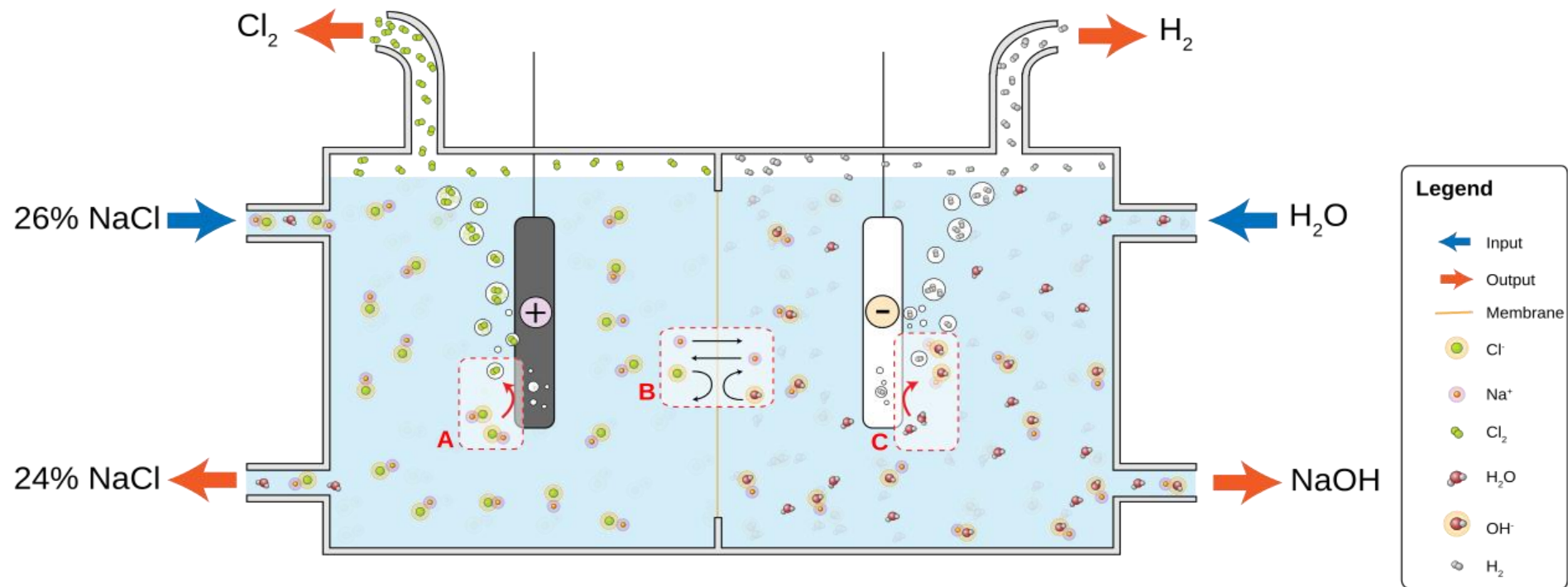


## Preparation of sodium hydroxide or Chlor-alkali process

When electricity is passed through an aqueous solution of sodium chloride, it decomposes to form sodium hydroxide.



# Preparation of sodium hydroxide or Chlor-alkali process



# **In the chlor-alkali process of manufacture of sodium hydroxide,**

**i) Name the gas produced at a) cathode b) anode**

i) Chlorine gas is given off at the anode, and hydrogen gas at the cathode.

**ii) At which electrode is sodium hydroxide formed?**

ii) Sodium hydroxide is formed at the cathode.

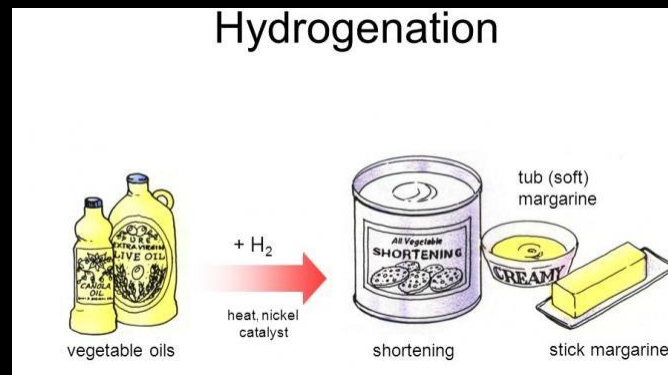
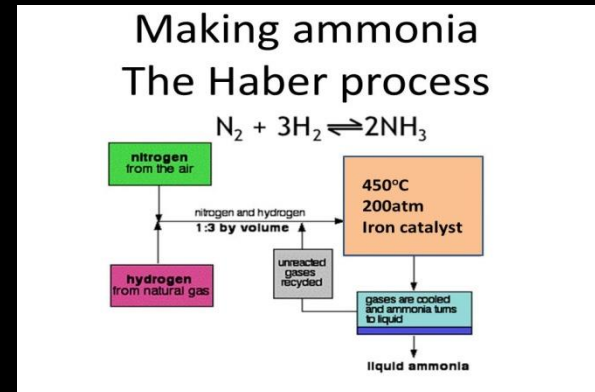
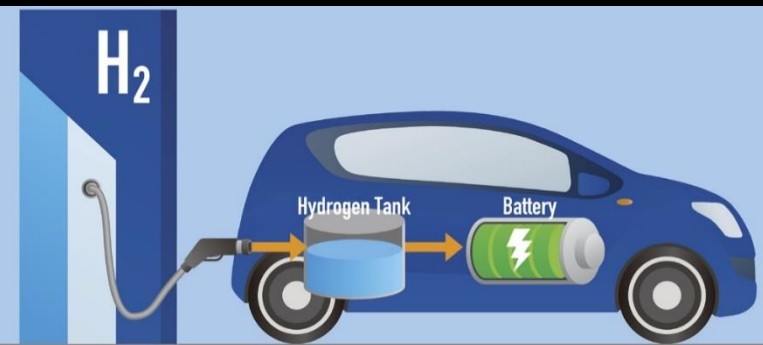
## Uses of chlorine gas

- It is used for water treatment.
- It is used in swimming pools as disinfectant.
- It is used for manufacture of PVC, CFC's, bleaching powder and pesticides.



# Uses of Hydrogen gas

- It is used as fuel.
- It is used in the manufacture of ammonia.
- It is used for manufacture of ghee, margarine etc.





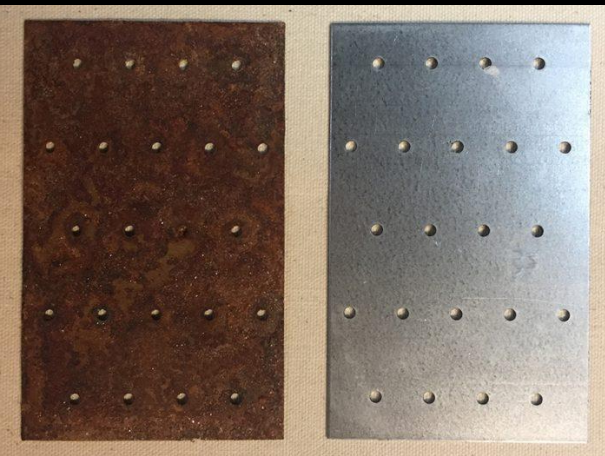
# Uses of sodium hydroxide

- It is used for de-greasing metals.
- It is used in making paper.
- It is used for the manufacture of soaps and detergents.
- It is used in artificial fibre industry.



# Uses of hydrochloric acid

- Hydrochloric acid is used for cleaning steel.
- It is used in the manufacture of ammonium chloride.
- It is used in the manufacture of medicines and cosmetics.



## Preparation of bleaching powder

Bleaching powder is produced by the action of chlorine on dry slaked lime  $[\text{Ca}(\text{OH})_2]$ .



Bleaching powder is chemically calcium oxy-chloride. Its formula is  $\text{CaOCl}_2$ .

# Uses of bleaching powder

- Bleaching powder is used for bleaching cotton and linen in the textile industry, bleaching wood pulp in paper factories, bleaching washed clothes in laundry.
- It is used as an oxidising agent in many chemical industries.
- It is used for disinfecting drinking water to make it free of germs.



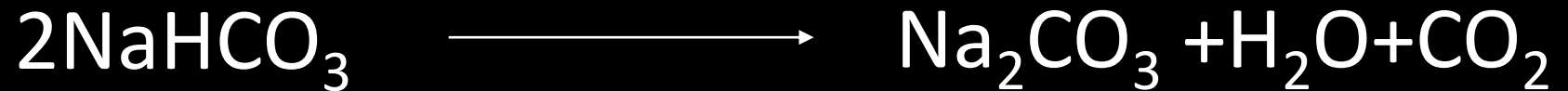
## Baking soda

- Baking soda is chemically sodium hydrogen carbonate. Its chemical formula is  $\text{NaHCO}_3$ .
- Baking soda is produced using sodium chloride as one of the raw materials.



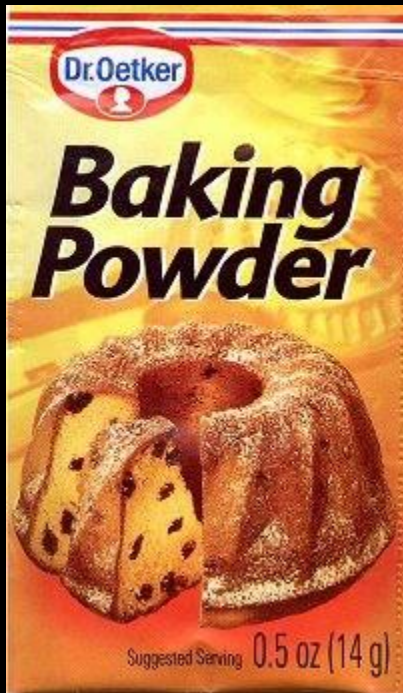
## Effect of heating Baking soda

When baking soda (sodium hydrogen carbonate) is heated during cooking sodium carbonate is formed.



# Uses of Baking soda

- Baking soda is used in the manufacture of baking powder.
- It is used in antacids to neutralize excess acids in the stomach and provide relief.
- It is used in soda-acid fire extinguishers.



## Baking powder

- Baking powder is a mixture of baking soda (sodium hydrogen carbonate) and a mild edible acid such as tartaric acid.



What happens when baking powder is heated or mixed with water?

When baking powder is heated or mixed in water, the following reaction takes place



Why is baking powder used in bakery industry?

When baking powder is used in bakery products like bread or cake, carbon dioxide produced makes the products soft and spongy.

Why does bread or cake become soft and spongy when baking powder is added to the dough?

When the dough is mixed with baking powder and water and heated, carbon dioxide is produced which makes the bread or cake to rise making them soft and spongy.

# Why is baking powder used in bakery industry?



# Washing soda

Washing soda is chemically sodium carbonate. Its formula is  $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$ .

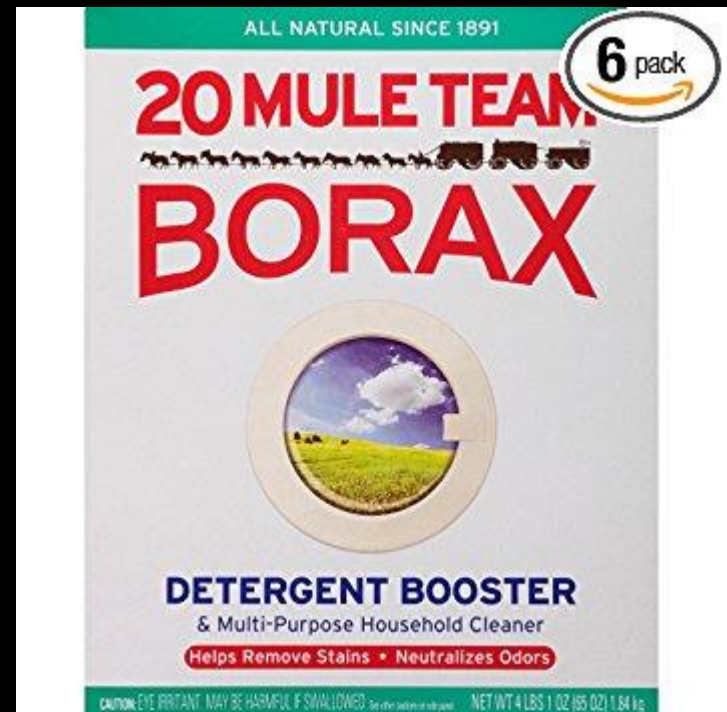
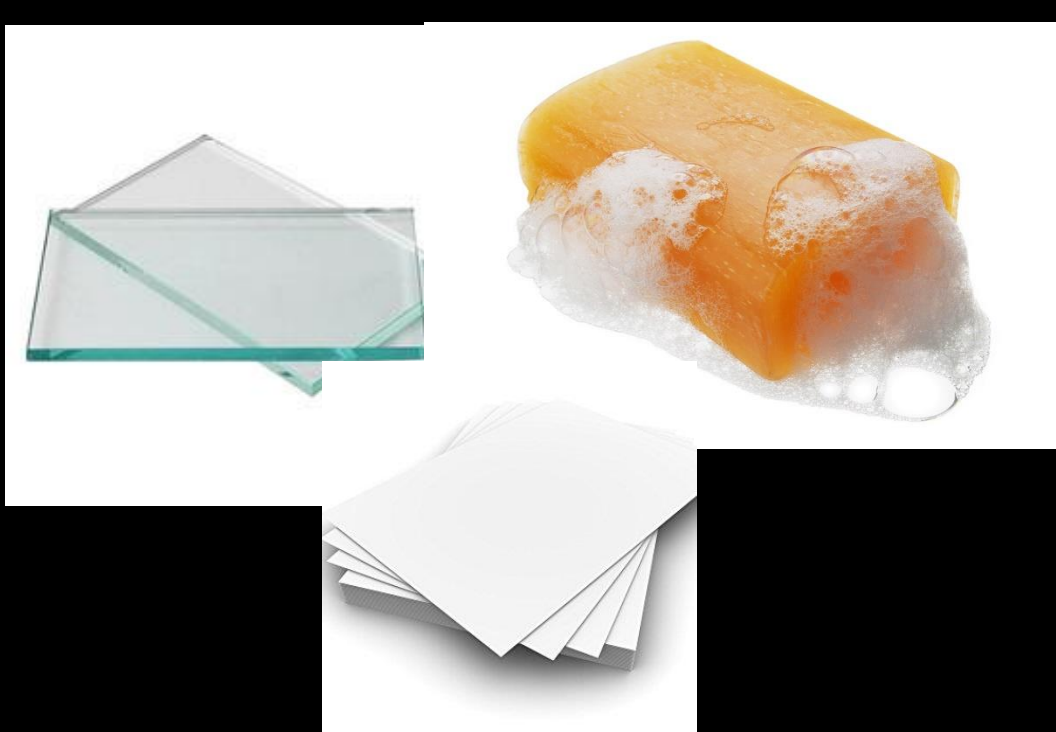
## Washing soda Preparation

When baking soda is heated, sodium carbonate is produced. Re-crystallisation of sodium carbonate gives washing soda.



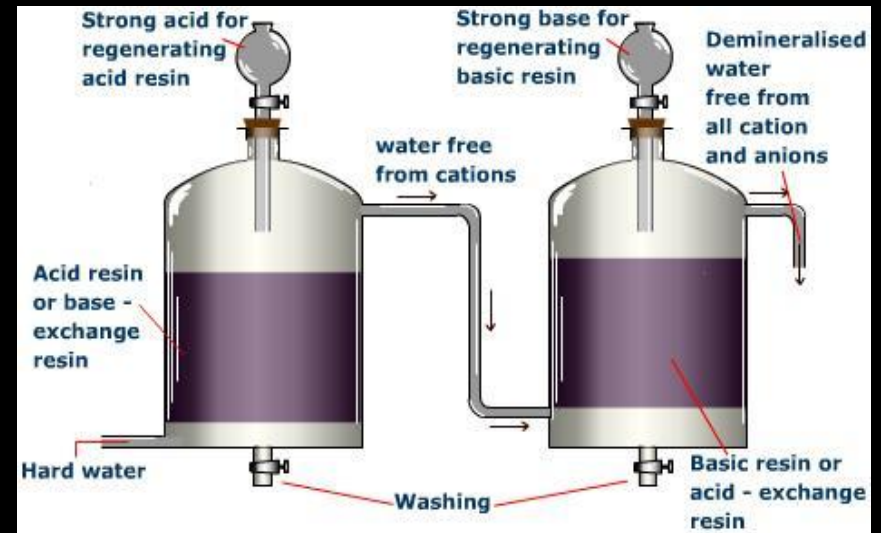
# Uses of Washing soda

- Washing soda is used in the manufacture of glass, soap and paper.
- It is used in the manufacture of sodium compounds such as borax.



# Uses of Washing soda

- It is used as a cleaning agent for domestic purposes.
- It is used for removing permanent hardness of water.



## Water of crystallization

Water of crystallisation is the fixed number of water molecules present in one formula unit of a salt.

Copper sulphate  $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$

Sodium carbonate  $\text{Na}_2\text{CO}_3 \cdot 10 \text{H}_2\text{O}$

Gypsum  $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$

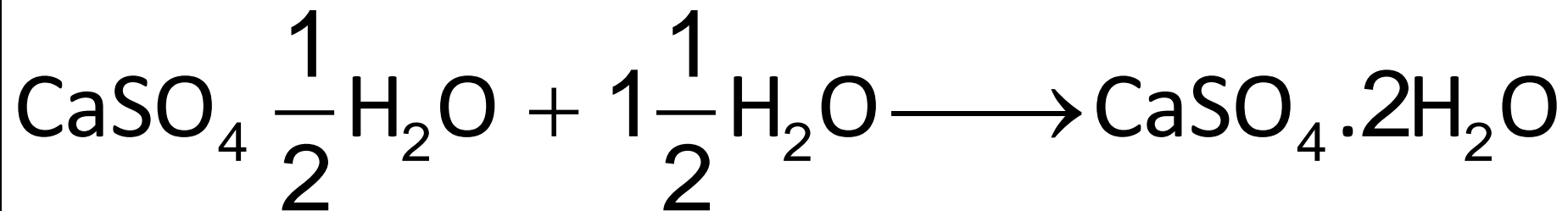
# Plaster of Paris

Plaster of Paris is chemically calcium sulphate hemihydrate.

Its formula is  $CaSO_4 \frac{1}{2} H_2O$



# Reaction between Plaster of Paris and water



**Plaster of Paris should be stored in a moisture-proof container.**

Plaster of Paris (POP) should be stored in a moisture-proof container because Plaster of Paris, a powdery mass, absorbs water (moisture) to form a hard solid known as gypsum.



## Uses of plaster of Paris

- Plaster of Paris is used by doctors for supporting fractured bones in the right position.



# Uses of plaster of Paris

- It is used for making toys.



## Uses of plaster of Paris

- It is used for making materials for decoration.



## Uses of plaster of Paris

- It is used for making surface smooth.



# Exercise (MCQ)

**1. A solution turns red litmus blue, its pH is likely to be**

(a) 1

(b) 4

(c) 5

(d) 10



**2. A solution reacts with crushed eggshells to give a gas that turns lime-water milky. The solution contains:**

(a) NaCl

(b) HCl

(c) LiCl

(d) KCl

**3. 10 mL of a solution of NaOH is found to be completely neutralised by 8 mL of a given solution of HCl. If we take 20 mL of the same solution of NaOH, the amount of HCl solution (the same solution as before) required to neutralise it will be:**

- (a) 4 mL
- (b) 8 mL
- (c) 12 mL
- (d) 16 mL

**4. Which one of the following types of medicines is used for treating indigestion?**

- (a) Antibiotic
- (b) Analgesic
- (c) Antacid
- (d) Antiseptic

**5. What happens when a solution of an acid is mixed with a solution of a base in a test tube?**

- (i) The temperature of the solution increases
  - (ii) The temperature of the solution decreases
  - (iii) The temperature of the solution remains the same
  - (iv) Salt formation takes place
- (a) (i) only
  - (b) (i) and (iii)
  - (c) (ii) and (iii)
  - (d) (i) and (iv)

**6) An aqueous solution turns red litmus solution blue. Excess addition of which of the following solution would reverse the change?**

(a) Baking powder

(b) Lime

(c) Ammonium hydroxide solution

(d) Hydrochloric acid

**7) During the preparation of hydrogen chloride gas on a humid day, the gas is usually passed through the guard tube containing calcium chloride. The role of calcium chloride taken in the guard tube is to:**

- (a) absorb the evolved gas
- (b) moisten the gas
- (c) absorb moisture from the gas
- (d) absorb  $\text{Cl}^-$  ions from the evolved gas

**8) Which of the following salts does not contain water of crystallisation?**

- (a) Blue vitriol
- (b) Baking soda
- (c) Washing soda
- (d) Gypsum

**9) Sodium carbonate is a basic salt because it is a salt of:**

- (a) strong acid and strong base
- (b) weak acid and weak base
- (c) strong acid and weak base
- (d) weak acid and strong base



**10) Calcium phosphate is present in tooth enamel. Its nature is:**

- (a) basic
- (b) Acidic
- (c) Neutral
- (d) amphoteric

**11) A sample of soil is mixed with water and allowed to settle. The clear supernatant solution turns the pH paper yellowish-orange. Which of the following would change the colour of this pH paper to greenish-blue?**

- (a) Lemon juice
- (b) Vinegar
- (c) Common salt
- (d) An antacid

**12) Which of the following gives the correct increasing order of acidic strength?**

- (a) Water < Acetic acid < Hydrochloric acid
- (b) Water < Hydrochloric acid < Acetic acid
- (c) Acetic acid < Water < Hydrochloric acid
- (d) Hydrochloric acid < Water < Acetic acid

**13) If a few drops of a concentrated acid accidentally spills over the hand of a student, what should be done?**

- (a) Wash the hand with saline solution
- (b) Wash the hand immediately with plenty of water and apply a paste of sodium hydrogen carbonate
- (c) After washing with plenty of water apply solution of sodium hydroxide on the hand
- (d) Neutralise the acid with a strong alkali

**14) Sodium hydrogen carbonate when added to acetic acid evolves a gas. Which of the following statements are true about the gas evolved?**

- (i) It turns lime water milky
  - (ii) It extinguishes a burning splinter
  - (iii) It dissolves in a solution of sodium hydroxide
  - (iv) It has a pungent odour
- (a) (i) and (ii)  
(b) (i), (ii) and (iii)  
(c) (ii), (iii) and (iv)    (d) (i) and (iv)

**15) Common salt besides being used in kitchen can also be used as the raw material for making**

(i) washing soda    (ii) bleaching powder  
(iii) baking soda    (iv) slaked lime

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

END