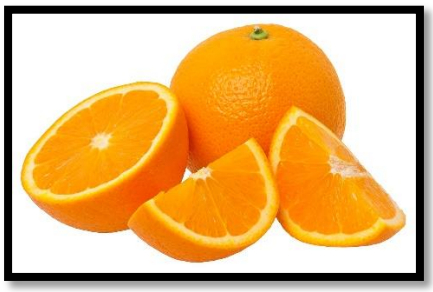
St. Andrews Scots Sr. Sec. School

9th Avenue, I.P. Extension, Patparganj, Delhi – 110092.
Session : 2022-2023
Subject : Science
Class : VII **L-5: Acids, Bases and Salts** **Topic: Notes**

ACIDS

If we cut a lemon with a knife and taste it, the lemon appears to have a sour taste. The sour taste of lemon is due to the presence of an acid in it. The acid present in lemon which gives it a sour taste is citric acid. Thus, **Acids are those chemical substances which have a sour taste**. Some of the common fruits such as raw mango, raw grapes, lemon, orange, and tamarind are sour in taste due to the presence of acids in them.



The acids present in plant materials and animals are called **organic acids**. Example: Acetic acid is found in vinegar, Citric acid is found is present in citrus fruits, Lactic acid is present in sour milk or curd, Oxalic acid is present in tomatoes, etc.

The acids prepared from the minerals of the earth are called **mineral acids**. Mineral acids are man-made acids. Example: Hydrochloric acid, Sulphuric acid and Nitric acid, etc.

DIFFERENT TYPES OF ACIDS

As per their strength, acids are of two types: **Strong acids and Weak acids**.

(i) Hydrochloric acid (HCl), Sulphuric acid (H_2SO_4) and Nitric acid (HNO_3) are **Strong acids**. Therefore, **all the mineral acids are strong acids.** Strong acids are very dangerous to drink.

(ii) Acetic acid (CH_3COOH), Formic acid (HCOOH), Citric acid ($C_6H_8O_7$), Tartaric acid ($C_4H_6O_6$), etc are **Weak acids**. Therefore, **organic acids are weak acids**.

As per concentration, acids are of two types: **Concentrated acids and Dilute acids**.

(i) A **concentrated acid** is one which contains the minimum possible amount of water in it.

(ii) A **dilute acid** is one which contains much more water in it. A dilute acid is obtained by mixing the concentrated acid with water. The process of mixing concentrated acid with water is highly exothermic (heat producing). The dilution of a concentrated acid should always be

done by adding concentrated acid to water gradually with stirring and not by adding water to concentrated acid. This is because:

- When a concentrated acid is added to water for preparing a dilute acid, then the heat is evolved gradually and easily absorbed by the large amount of water.
- If, however, water is added to concentrated acid to dilute it, then a large amount of heat is evolved at once. This heat changes some of the water to steam explosively which can splash the acid on our face or clothes and causes acid burns.

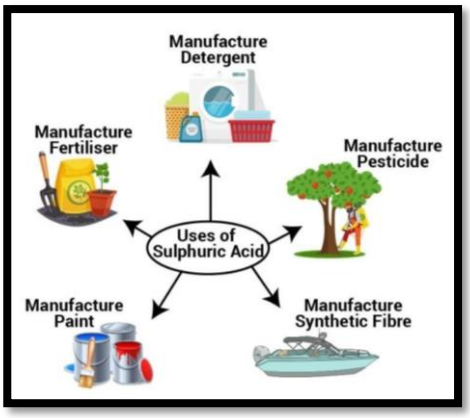
PROPERTIES OF ACIDS

- Acids are sour in taste
- The chemical nature of such substances is acidic
- Acid turns blue litmus red
- It gives hydrogen ion when dissolves in water
- Do not give any colour with phenolphthalein indicator
- Do not absorb carbon dioxide gas
- Acids do not react with ammonium salt
- Acids are generally found in Vinegar, Curd, Spinach, lemons, Citrus fruits, Amla, Tamarind, grapes, unripe mangoes, Citrus fruits such as oranges, etc.

USES OF ACIDS

a) **Sulphuric Acid (H_2SO_4)**

- It is used in making fertilizers
- It is used in the production of steel and iron
- It is used in chemical manufacturing industries
- It is used in petroleum refining
- It is used to produce phosphoric acid
- It used as a cleaning agent in industries to remove the rust from steel and iron
- It is used in lead-acid batteries as an electrolyte
- It is used in making ammonium sulfate
- It is used in storage batteries



b) **Nitric Acid (HNO_3)**

- It is used to produce ammonium nitrates to manufacture plastic, dye, and fertilizers
- It is used in making explosives such as TNT
- It is used in liquid-fueled rockets as an oxidizer
- In its pure form, it is used in the removal of the wart

c) **Hydrochloric Acid (HCl)**

- Production of glucose and corn sugar from starch
- Refining of cane sugar
- Making glue and gelatin
- Manufacturing synthetic rubber and plastics
- Purification of common salt
- Manufacture of aqua regia to dissolve noble metals such as gold and platinum.

BASES

The solutions of substances like caustic soda, lime and washing soda are bitter in taste and soapy to touch (slippery to touch). They are called bases. Thus, **Bases are those chemical substances which have a bitter taste.** For Example: Sodium oxide(Na_2O), Sodium hydroxide(NaOH), Ammonium hydroxide(NH_4OH), etc

DIFFERENT TYPES OF BASES

As per their strength, bases are of two types: **Strong Bases and Weak Bases.**

(i) Sodium hydroxide (NaOH) and Potassium hydroxide (KOH) are strong bases. Another name of Sodium hydroxide is Caustic Soda and Potassium hydroxide is Caustic Potash. They are corrosive to skin. 'Caustic means corrosive'.

(ii) Magnesium hydroxide[$Mg(OH)_2$] and Ammonium hydroxide(NH_4OH) are weak bases.

As per their solubility, bases are:

(i) The bases which are soluble in water are called **alkalis**. For example - Sodium hydroxide(NaOH), Potassium hydroxide(KOH), Barium hydroxide[$Ba(OH)_2$], etc.

(ii) The bases which are either partially soluble or insoluble in water are **not alkalis**. For Example – Magnesium hydroxide[$Mg(OH)_2$], Ammonium hydroxide(NH_4OH) are only **bases**.

Therefore, we can say that all alkalis are bases, but all bases are not alkalis.

PROPERTIES OF BASES

- Bases have bitter taste.
- Bases feel soapy to touch.
- Bases turn red litmus blue.
- Bases conduct electricity.
- Bases are corrosive to skin.
- Bases react with acids to form salt and water.

$$2NaOH + H_2SO_4 \longrightarrow Na_2SO_4 + 2H_2O$$

(Sodium hydroxide) (Sulphuric acid) (Sodium sulphate) (Water)

(Base) (Acid) (Salt)

USES OF BASES

a) **Sodium Hydroxide (NaOH)**

- It is used as a cleansing agent and in the manufacturing of washing soda.
- Sometimes, sodium hydroxide is also used as a reagent in the laboratories.
- It is used in the preparation of soda lime.
- It is used in the extraction of aluminium by purifying bauxite.

b) **Ammonium Hydroxide (NH_4OH)**

- Ammonium hydroxide solution is an important tool in the manufacturing process of chemical fertilizers. It is used as a solution or as salt in these fertilizers.
- Ammonium hydroxide is also used in the production of organic and inorganic chemicals containing nitrogen. It is the base chemical in the manufacture of nitric acid.
- Ammonia can be used in the production of chloramine which is a good disinfectant. It remains active in still water for longer durations than chlorine.
- Any wood that contains tannic acid can be sealed in a container with ammonium hydroxide solution to give a dark stained look to the wood. Thus, the ammonium hydroxide solution is used in furniture darkening.

c) **Calcium Hydroxide [$Ca(OH)_2$]**

- In the process of sewage treatment, calcium hydroxide is used as a clarifying agent or as a flocculant.
- $Ca(OH)_2$ is used in the paper industry during the Kraft process of converting wood into wood pulp.
- It is a very important compound in the preparation of ammonia.
- This compound is also used as a pH modifier due to its basicity.
- The pickling of cucumbers is generally done with the help of $Ca(OH)_2$
- The production of many plastics involves the use of calcium hydroxide as an ingredient.
- It is also used in pesticides, hair care products, and the manufacture of ebonite.
- In root canal procedures, this compound is used to fill the cavities in the human teeth.
- Sugar beets and sugarcane are processed via carbonation, which involves the use of $Ca(OH)_2$.
- Calcium hydroxide is used in the leather industry to separate the fur/hair from the animal hide.

d) **Magnesium Hydroxide [$Mg(OH)_2$]**

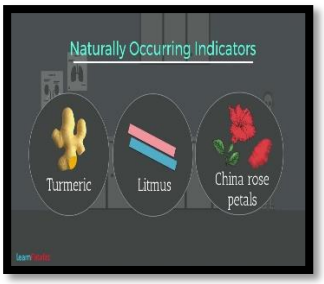
- Magnesium hydroxide is an excellent thermal conductor and poor electrical conductor.
- It is used in suspensions as a laxative or antacid.
- Used as a food additive.
- It is widely used in waste-water treatment.
- Used as a fire retardant.
- It is used in gold mining.
- Used in warehouses.

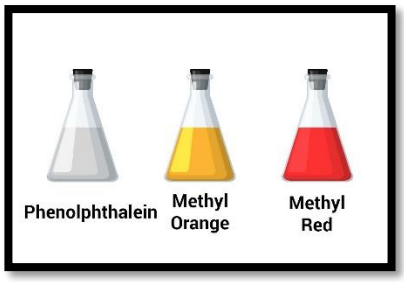
INDICATORS

An **indicator** is a ‘dye’ that changes colour when it is put into an acid or a base. An indicator gives different colours in acid and base.

A substance which contains an acid is said to be **acidic** whereas the substance which contains a base is said to be **basic**. An indicator tells us whether the substance we are testing is acidic or basic by change in its colour.

There are two types of indicators: **Natural Indicators and Synthetic Indicators**.



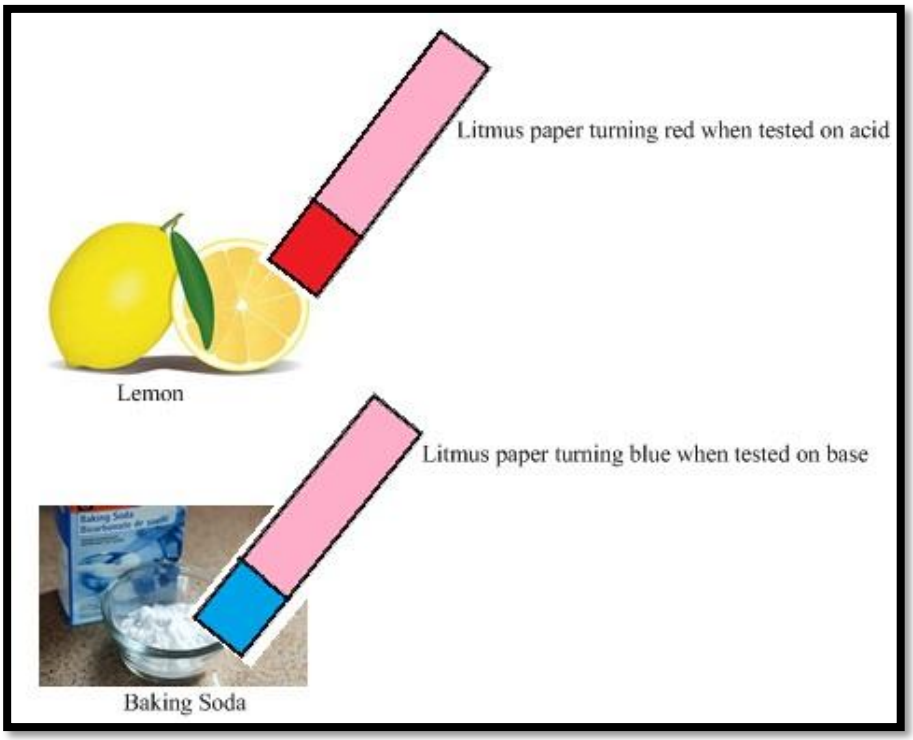


NATURAL INDICATORS

Natural indicator is a substance which is found naturally and can determine whether the substance is acidic or basic. Some examples of natural indicators are turmeric, grape juice, red cabbage, cherries, onion, beetroot etc.

a) **Litmus**

Litmus is the most commonly used natural indicator available as strips of paper called litmus paper or solution. It is extracted from lichens. It turns to red on addition of an acidic solution and turns blue on addition of a basic solution. There are two types of litmus paper: Red litmus paper and Blue litmus paper.



b) **Turmeric**

Turmeric powder dissolved in water is also used as a common natural indicator. It changes colour from orange to red in basic solution. That is why a turmeric stain on white cloth turns red when it is washed with soap. It is because the soap solution is basic in nature and changes the colour of the turmeric stain. Turmeric compound remains yellow when acid or neutral solutions are added to it.

c) **China rose indicator**

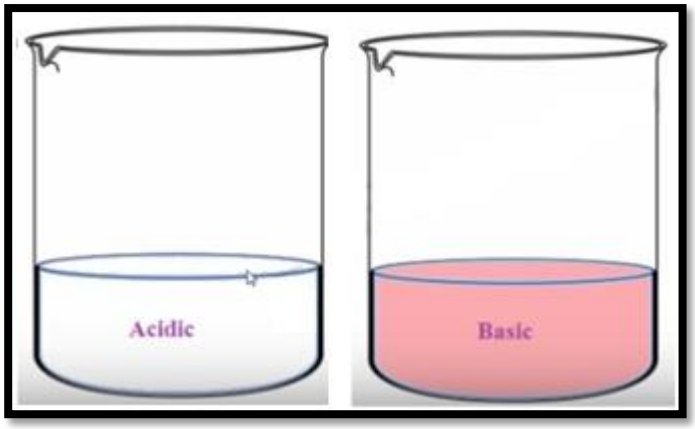
China rose petals when kept soaked in warm water for a while make water coloured. This coloured water may be used as an indicator. This indicator turns acidic solutions to dark pink (magenta) and basic solutions to green.

SYNTHETIC INDICATORS

Synthetic indicators are indicators which are synthesized in the laboratory. Examples of synthetic indicators include phenolphthalein, methyl orange etc. litmus paper is also an example of synthetic indicator.

a) **Phenolphthalein**

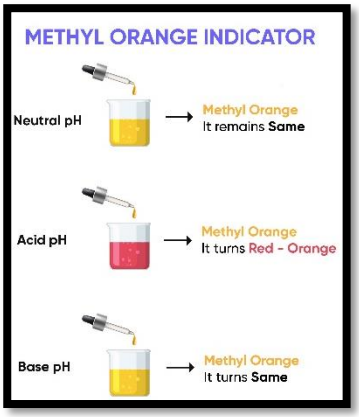
Phenolphthalein is colourless indicator. It gives a pink colour in case of basic solution and remains colourless in case of acidic solution.



(Phenolphthalein in case of acidic solution and basic solution)

b) Methyl Orange

Methyl orange is an orange-pink coloured indicator which is orange in acidic medium and yellow in basic medium.



DIFFERENCE BETWEEN ACIDS AND BASES

	ACIDS	BASES
(i)	These are sour to taste.	These are bitter to taste.
(ii)	Acids turn blue litmus red.	Bases do not change the colour of blue litmus.
(iii)	Acids do not change the colour of red litmus.	Bases turn red litmus blue.
(iv)	With china rose indicator, these give dark pink colour.	Bases give green colour with china rose indicator.
(v)	Acids do not change the colour of turmeric indicator.	Bases turn the colour of turmeric indicator to red

NEUTRALISATION

The products formed on mixing an acid and a base are salt and water. The reaction in which an acid reacts with a base to form salt and water is called **neutralisation**.

A neutralisation reaction can be represented as:

Acid + Base————> Salt + Water

Some heat is always evolved (or produced) in a neutralisation reaction. This heat raises the temperature of reaction mixture due to which the reaction mixture becomes hot.

In a neutralisation reaction, two new substances, salt and water, are formed. The salt formed during a neutralisation reaction depends on which acid and which base are reacted with each other.

Sodium hydroxide is a base and hydrochloric acid is an acid. When sodium hydroxide is treated with hydrochloric acid, then a neutralisation reaction takes place to form sodium chloride (salt) and water.

$$NaOH + HCl \longrightarrow NaCl + H_2O$$

(Sodium Hydroxide) (Hydrochloric Acid) (Sodium Chloride) (Water)

The salt formed in this neutralisation reaction of sodium hydroxide (NaOH) and hydrochloric acid (HCl) is sodium chloride (NaCl), It is known as common salt. Some heat is also evolved during this neutralisation reaction.

SALT

Salt is a compound formed from an acid by the replacement of the hydrogen in the acid by a metal. For Example: Sodium Chloride (NaCl) (Common Salt),etc. **Salts** are formed when acids react with bases. Salt can be acidic, basic or neutral in nature. $HCl+NaOH \rightarrow NaCl+H2O$

(COPPER SULPHATE CRYSTALS) **(SODIUM CHLORIDE)**

PREPARATION OF SALT

Salts can be prepared by the following reactions:

1. By the reaction between an acid and a base. For Example – Common salt is prepared by the reaction between sodium hydroxide and hydrochloric acid.

2. By the reaction between an acid and a metal. In this reaction, the metal displaces hydrogen from the acid to form a salt. Thus, salts may be defined as a compound formed by replacing the hydrogen of an acid by a metal.

PROPERTIES OF SALT

Salts are coloured or colourless solids. They, generally, have high melting and boiling points. Usually, they are soluble in water. In molten state as well as in aqueous state, salts conduct electricity.