Class -7th

Chapter 4th

Acids, Bases & Salts

INDICATORS FOR TESTING ACIDS AND BASES

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. Thus, an indicator tells us whether the substance we are testing is an acid or a base by change in its colour.

Acid-base indicators are of two types:

Natural indicators and Synthetic indicators.

(i) Litmus, China rose and Turmeric are naturally occurring indicators.
(ii) Phenolphthalein is a synthetic indicator.

Litmus

Litmus is a natural indicator.

Litmus solution is a purple coloured dye which is extracted from a type of plant called lichen'.

When litmus solution is neither acidic nor basic (it is neutral), then its colour is purple.

When litmus is added to an acidic solution, it tums red. And when litmus is added to a basic solution, it turns blue.

China rose

Indicator China rose is also a natural indicator.

China rose indicator is a light pink coloured solution which is (from extracted from the red flowers of China rose plant with water.

Acids turn China rose indicator to magenta (deep pink).

Bases turn China rose indicator to green.

Turmeric

Turmeric paper is used as indicator.

Turmeric paper is yellow in colour.

Turmeric paper is yellow in acid solution.

Bases turn the yellow turmeric paper to red.

Phenolphthalein

Phenolphthalein is a synthetic (man-made) acid-base indicator.
Phenolphthalein indicator is colour less in acid solution.
Phenolphthalein indicator gives pink colour in basic solution.
Phenolphthalein indicator use when we carry out the neutralisation reaction of an acid and a base.

ACIDS

The acids present in plant materials and animals are natural acids called organic acids.

A substance which reacts with a base to form a salt (and water) is called an acid.

Acids have sour taste.

Acids turn blue litmus to red.

Some examples of acids are: Acetic acid, Citric acid, Hydrochloric acid Sulphuric acid and Nitric acid.

Acids are of two types:

Organic acids

Mineral acids.

Organic Acids

Organic acids are the naturally occurring acids.

They are found in various types of plants and animals.

Some of the important organic acids are:

1. Acetic acid

2. Formic acid

3. Citric acid

4. Lactic acid

5. Tartaric acid

6. Ascorbic acid

7. Oxalic acid

(i) Acetic acid is found in vinegar. Vinegar is used as a preservative in foods.

(ii) Formic acid is present in ant's sting. The sharp pain caused by the sting of an ant is due to the formic acid pushed into our skin during the sting.

(iii) Citric acid is present in citrus fruits such as lemons and oranges.
(iv) Lactic acid is present in curd and in sour milk.

(v) Tartaric acid is present in tamarind, unripe grapes and unripe mangoes.

(vi) Ascorbic acid is present in amla and citrus fruits. Ascorbic acid is commonly known as vitamin C.

(vii) Oxalic acid is present in spinach.

Organic acids are weak acids.

It is not harmful to eat or drink substances containing naturally occurring acids in them.

Mineral Acids

The acids prepared from the minerals of the earth are called mineral acids.

Mineral acids are also known as laboratory acids because they are used in the science laboratory to perform experiments.

The three most common mineral acids are:

1. Hydrochloric acid,

2. Sulphuric acid,

3. Nitric acid.

Hydrochloric acid is used in cleaning kitchen sinks and bathroom sanitary ware (like wash basin and toilet seat).

Sulphuric acid is used in making storage batteries for cars, buses, trucks and inverters.

Nitric acid is used by goldsmiths for cleaning gold and silver ornaments.

Strong Acids and Weak Acids

All the acids can be divided into two groups:

Strong acids and weak acids.

Hydrochloric acid, sulphuric acid and nitric acid are strong acids.

On the other hand, acetic acid, formic acid, citric acid, tartaric acid and carbonic acid are some of the weak acids.

Mineral acids are strong acids.

Only one mineral acid, carbonic acid, is a weak acid.

Strong acids are very dangerous to drink. Even the dilute solutions of strong acids are extremely harmful to drink. The organic acids are weak acids the dilute solutions of weak acids safe to, drink.

Organic acids like acetic acid, citric acid and tartaric acid are used as food ingredients.

Many foods like pickle and tomato ketchup contain acetic acid in the form of vinegar. Vinegar preserves fruits and vegetables.

Baking powder used in making cakes and biscuits contains tartaric acid. Though carbonic acid is not an organic acid, but it is a weak acid. Carbonic acid is used in fizzy soft drinks and soda water. It gives them a pleasant taste.

Acid Rain

The rain which contains a higher level of acid than normal is called acid rain.

Acid rain is caused by the acidic gases like sulphur dioxide, nitrogen dioxide and carbon dioxide which are released into the air as pollutants during the burning of various types of fuels.

Sulphur dioxide gas dissolves in falling rain drops to form sulphuric acid;

Nitrogen dioxide gas dissolves in rain drops to form nitric acid whereas carbon dioxide gas dissolves in rain drops to form carbonic acid.

The presence of sulphuric acid, nitric acid and carbonic acid in rain water makes the rain water acidic. And when this acidic rain water falls on the earth, we call it acid rain.

Acid rain causes damage to aquatic animals (like fish), trees, crop plants, metal structures and stone buildings and monuments.

BASES

A substance which can neutralise an acid to form a salt (and water) is called a base.

Bases have bitter taste.

Bases turn red litmus to blue.

Some of the examples of bases are:

1. Sodium hydroxide

2. Potassium hydroxide

3. Calcium hydroxide

4. Magnesium hydroxide

5. Ammonium hydroxide

6. Sodium carbonate

7. Sodium hydrogen carbonate

A base which is soluble in water is called an alkali.

(i) Sodium hydroxide and potassium hydroxide are found in sopes

(ii) Calcium hydroxide is found in lime water.

(iii) Magnesium hydroxide is found in milk of magnesia.

(iv) Ammonium hydroxide (also called ammonia solution) is found in window cleaners.

(v) Sodium carbonate is found in washing soda.

(vi) Sodium hydrogen carbonate is found in baking soda.

Strong Bases and Weak Bases

Like acids, bases can also be strong or weak.

Some of the strong bases and weak bases are given below:

Strong Bases Sodium hydroxide, Potassium hydroxide

Weak Bases Calcium hydroxide, Ammonium hydroxide, Sodium carbonate, Magnesium hydroxide and Sodium hydrogen carbonate.

Sodium hydroxide is commonly known as 'caustic soda' and potassium hydroxide is commonly known as 'caustic potash' ("caustic means 'corrosive or 'burning').

Sodium hydroxide and potassium hydroxide are dangerous bases which can burn our skin. They must be handled very carefully.

Calcium hydroxide, ammonium hydroxide and sodium carbonate are weak bases but their solutions are unsafe to drink.

Magnesium hydroxide is, however, a very weak base which is safe to drink. It is used in milk of magnesia and other indigestion mixtures.

Sodium hydrogen carbonate is a very weak base which is used as an antacid to cure indigestion.

Neutral Substances

Those substances which are neither acidic nor basic in nature are called neutral substances.

Neutral substances do not change the colour of any indicator.

If the solution of a substance in water does not change the colour of either blue litmus or red litmus, then it will be a neutral substance.

Some of the neutral substances are: Pure water (or Distilled water), Glucose, Cane sugar and Common salt.

NEUTRALISATION

The reaction in which an acid reacts with a base to form salt and water is called neutralization.

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. So, when sodium hydroxide is treated with hydrochloric acid, then a neutralisation reaction takes place to form sodium chloride (salt) and water.

Sodium hydroxide + Hydrochloric acid ⟶ Sodium chloride + Water

(NaOH) (HCl) (NaCl) (H_2O)

The salt formed in this neutralisation reaction of sodium hydroxide and hydrochloric acid is sodium chloride (NaCl). It is known as common salt.

Neutralisation in Everyday Life

Indigestion

Stomach produces hydrochloric acid. This hydrochloric acid helps in digesting our food without harming the stomach. Sometimes, excess of hydrochloric acid is produced in the stomach due to various reasons. The excess of acid in the stomach causes indigestion

To cure indigestion and get rid of pain, we can take bases called 'antacids'. Antacids are a group of mild bases which have no toxic effects on the body. Being basic in nature, antacids react with excess acid in the stomach and neutralise it.

A common antacid used for curing indigestion due to acidity is milk of magnesia. Milk of magnesia contains a base called magnesium hydroxide. Another antacid is baking soda. Baking soda contains a base called sodium hydrogen carbonate.

Ant's Sting

The sting of an ant contains an acid called formic acid. If an ant stings a person, then rubbing a mild base like baking soda solution (or calamine solution) on the stung area of the skin gives relief. This is because, being a base, baking soda solution (or calamine solution) neutralises the acidic liquid injected by the ant and cancels its effect

Soil Treatment

The excessive use of chemical fertilisers in the fields also makes the soil too acidic. When the soil is too acidic, it is treated with bases such as quicklime (calcium oxide) or slaked lime (calcium hydroxide). The bases such as quicklime (or slaked lime) neutralise the excess acid present in the soil and reduce its acidic nature.

Factory Wastes

The waste substances discharged by many factories contain acids. If these untreated factory wastes are discharged into water bodies (like lakes, ponds, and rivers, etc.), then the acids present in them will kill the fish and other aquatic organisms which live in the water bodies. The acidic factory wastes should be treated with basic substances to

neutralise them before discharging them into water bodies (such as lakes, ponds and rivers, etc.).

SALTS

A salt is a substance formed by the reaction of an acid with a base.

The name of a salt consists of two parts: the first part of the salt's name is derived from the name of the base and the second part of the salt's name is derived from the name of the acid.

For example, the name of the salt called 'sodium chloride' comes from the 'sodium hydroxide' base and hydrochloric acid'.

(i) The salts of hydrochloric acid are called chlorides.

(ii) The salts of sulphuric acid are called sulphates.

(iii) The salts of nitric acid are called nitrates.

(iv) The salts of carbonic acid are called carbonates.

(v) The salts of acetic acid are called acetates.

Salts can be of three types:

(i) Neutral salts

(ii) Acidic salts, and

(iii) Basic salts.

Those salts which form a neutral solution on dissolving in water are called neutral salts. The salts formed by the neutralisation of a strong acid by a strong base are neutral salts.

Examples of neutral salts are sodium chloride (NaCl) and sodium sulphate (Na_2SO_4). The solution of a neutral salt has no effect on any litmus.

Those salts which form an acidic solution on dissolving in water are called acidic salts. The salts formed by the neutralisation of a strong acid with a weak base are acidic salts.

Examples of acidic salts are ammonium chloride (NH_4Cl) and ammonium sulphate [$(NH_4)2SO_2$. The solution of an acidic salt in water turns blue litmus to red.

Those salts which form basic solutions on dissolving in water are called basic salts. The salts formed by the neutralisation of weak acids with strong bases are basic salt.

Examples of basic salts are sodium carbonate (Na_2CO_3) and sodium hydrogen carbonate ($NaHCO_3$). The solutions of basic salts in water turn red litmus to blue.