MAHESH PUBLIC SCHOOL, JODHPUR

REVISION NOTES - 2

CLASS X **Subject : SCIENCE**

Chapter : Acids Bases and Salts

Their definitions in term of furnishing of H+ and OH- ions, General properties, examples and uses, Concept of pH scale (Definition relating to logarithm not required), Importance of pH in everyday life; Preparation and uses of Sodium hydroxide, Bleaching powder, Washing soda and Plaster of Paris.
Facts that Matter
Acids : Acids are sour in taste, turn blue litmus to red, dissolve in water to release H+ ions.
E.g., vinegar, hydrochloric acid and sulphuric acid.

- Reaction with Metal

Acid + Metal → Salt + Hydrogen gas
e.g., $2HCl + Zn \rightarrow ZnCl_2 + H_2$

- Reaction with Metal carbonate

Acid + Metal carbonate → Salt + CO_2 + H_2O
e.g., $2HCl + Na_2CO_3 \rightarrow 2NaCl + CO_2 + H_2O$

- Reaction with Metal hydrogen carbonate

Acid + Metal hydrogen carbonate Salt + CO_2 + H_2O
e.g. $HCl + NaHCO_3 \rightarrow NaCl + H_2O + CO_2$

- Reaction with Metallic oxide

Acid + Metal oxide → Salt + Water
e.g. $2HCl + CuO \rightarrow CuCl_2 + H_2O$

- Acids in water:

Acids produce H+ ions when dissolved in water. H+ ions cannot exist alone. They combine with water molecule (H_2O) to form H_3O^+ (hydronium ions). It conducts electricity.

- Decrease in H30+ ions concentration per unit volume results in formation of dilute acids.
- It is a highly exothermic reaction.

Acids when dissolved in water release large amount of heat. If water is added to concentrated acid then the heat generated may cause the mixture to splash out and cause bums. Hence to avoid burns acid must be added drop wise into water with constant stirring. So that the heat generated spreads over in water.
strong acids → release more H+ ions → HCl

weak acids → releases less number of H+ ions → acetic acid
strong base → give more OH– ions → NaOH
weak base → gives less OH– ions → CH3COOH
Bases: Bases are bitter in taste, turns red litmus to blue and when dissolved in water releases OH– ions;
e.g., NaOH and KOH.

- Reaction with metal

Base + Metal → Salt + H2 gas
e.g., 2NaOH + Zn → Na2ZnO2 + H2
This reaction is possible only with reactive metals like sodium and potassium.

- Reaction with non-metallic oxide

Base + Non-metallic oxide → Salt + H2O
Bases in water → Bases produce OH– ions when dissolved in water. Bases soluble in water are called alkalis. It conducts electricity.

- Decrease in OH– ions single concentration per unit volume results in formation of dilute bases.
- It is a exothermic reaction.

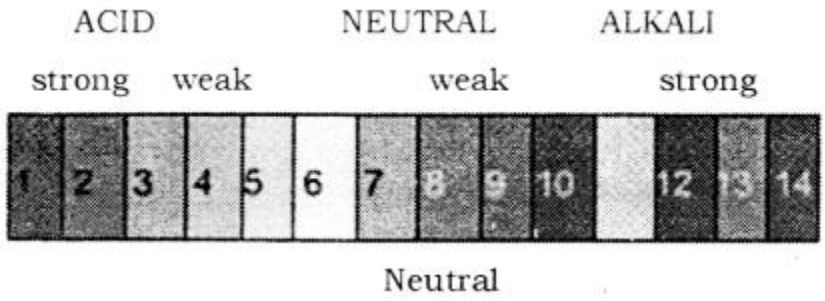
To make basic solution, base must be added drop wise into water with constant stirring, so that the heat generated spreads over in water.
Indicators: Indicators are those substances which tell us whether a substance is acidic or basic by change in colour. For e.g., litmus solution.

- Olfactory indicators: Those substances whose odour changes in acidic or basic media are called lfactory indicators. For e.g., clove, vanilla, onion.
- Natural indicators: Turmeric, litmus (obtained from lichen)
- Synthetic indicators: Methyl orange, phenolphthalein.

Indicator	Acids	Bases
1. Red litmus	remains red	turns blue
2. Blue litmus	turns red	remains blue
3. Phenolphthalein	colourless	pink
4. Methyl orange	red	yellow

Universal Indicator: Using a litmus paper, phenolphthalein, methyl orange, etc. only the acidic or basic character of a solution can be determined, but the use of these indicators does not give the idea about the strength of acid or base. So, to get the strength as well as acidic and basic nature of a given solution universal indicator is used.

Universal indicator shows different colour over the range of pH value from 1 to 14 for a given solution. Universal indicator is available both in the form of strips and solution. Universal indicator is the combination of many indicators, such as water, propanol, phenolphthalein, sodium salt, sodium hydroxide, methyl red, bromothymol blue monosodium salt, and thymol blue monosodium salt. The colour matching chart is supplied with a universal indicator which shows the different colours for different values of pH.



Some Important Compounds and their Uses:

Common Name	Chemical name	Chemical formula	Uses
Washing soda	Sodium carbonate decahydrate	$Na_2CO_3 . 10H_2O$	Manufacture of borax, caustic soda, softening of hard water.
Baking soda	Sodium hydrogen carbonate	$NaHCO_3$	Used as antacid, ingredient of baking powder.
Bleaching powder	Calcium oxychloride	$CaOCl_2$	Bleaching clothes, used as oxidizing agent, disinfecting water, manufacture of chloroform.
Plaster of Paris	Calcium sulphate hemihydrate	$CaSO_4 . {}^1/_2H_2O$	Plastering fractured bones, making toys, decorative materials, statues.

pH value shown by different colours role of pH everyday life:

(i) pH in our digestive system: Dilute HCl (Hydrochloric acid) helps in digestion of food (proteins) in our stomach. Excess acid in stomach causes acidity (indigestion). Antacids like magnesium hydroxide [$Mg(OH)_2$] also known as milk of magnesia and sodium hydrogen carbonate (baking soda) are used to neutralize excess acid.

(ii) Tooth decay caused by acids: The bacteria present in our mouth converts the sugar into acids. When the pH of acid formed in the mouth falls below 5.5, tooth-decaying starts. The excess acid has to be removed by

cleaning the teeth with a good quality toothpaste because these kinds of toothpaste are alkaline in nature.

(iii) Soil of pH and plant growth: Most of the plants have a healthy growth when the soil has a specific pH (close to 7) range which should be neither alkaline nor highly acidic. Therefore,

- Compound ‘X’ is Sodium hydroxide (NaOH).

Salts: Salts are the ionic compounds which are produced after the neutralization reaction between acid and base. Salts are electrically neutral. There are number of salts but sodium chloride is the most common among them. Sodium chloride is also known as table salt or common salt. Sodium chloride is used to enhance the taste of food.

Cause of formation of acidic, basic and neutral salts:

- When a strong acid reacts with a weak base, the base is unable to fully neutralize the acid. Due to this, an acidic salt is formed.
- When a strong base reacts with a weak acid, the acid is unable to fully neutralize the base. Due to this, a basic salt is formed.
- When equally strong acid and a base react, they fully neutralize each other. Due to this, a neutral salt is formed.

pH value of salt:

- Neutral salt: The pH value of a neutral salt is almost equal to 7.
- Acidic salt: The pH value of an acidic salt is less than 7.
- Basic salt: The pH value of a basic salt is more than 7.

Some Important Chemical Compounds
1. Common Salt (Sodium Chloride): Sodium chloride (NaCl) is also known as Common or Table Salt. It is formed after the reaction between sodium hydroxide and hydrochloric acid. It is a neutral salt. The pH value of sodium chloride is about 7. Sodium chloride is used to enhance the taste of food. Sodium chloride is used in the manufacturing of many chemicals.

Important chemical from sodium chloride
Sodium Hydroxide (NaOH): Sodium hydroxide is a strong base. It is also known as caustic soda. It is obtained by the electrolytic decomposition of

solution of sodium chloride (brine). In the process of electrolytic decomposition of brine (aqueous solution of sodium chloride), brine decomposes to form sodium hydroxide. In this process, chlorine is obtained at anode and hydrogen gas is obtained at cathode as by products. This whole process is known as Chlor – Alkali process.
Use of products after the electrolysis of brine:

Hydrogen gas is used as fuel, margarine, in making of ammonia for fertilizer, etc.
Chlorine gas is used in water treatment, manufacturing of PVC, disinfectants, CFC, pesticides. It is also used in the manufacturing of bleaching powder and hydrochloric acid.
Sodium hydroxide is used for degreasing of metals, manufacturing of paper, soap, detergents, artificial fibres, bleach, etc.
2. Bleaching Powder ($CaOCl_2$): Bleaching powder is also known as chloride of lime. It is a solid and yellowish white in colour. Bleaching powder can be easily identified by the strong smell of chlorine.
When calcium hydroxide (slaked lime) reacts with chlorine, it gives calcium oxychloride (bleaching powder) and water is formed.

Aqueous solution of bleaching powder is basic in nature. The term bleach means removal of colour. Bleaching powder is often used as bleaching agent. It works because of oxidation. Chlorine in the bleaching powder is responsible for bleaching effect.

Use of Bleaching Powder:

Bleaching powder is used as disinfectant to clean water, moss remover, weed killers, etc.
Bleaching powder is used for bleaching of cotton in textile industry, bleaching of wood pulp in paper industry.
Bleaching powder is used as oxidizing agent in many industries, such as textiles industry, paper industry, etc.
3. Baking Soda ($NaHCO_3$): Baking soda is another important product which can be obtained using byproducts of chlor – alkali process. The chemical name of baking soda is sodium hydrogen carbonate ($NaHCO_3$) or sodium bicarbonate. Bread soda, cooking soda, bicarbonate of soda, sodium bicarb, bicarb of soda or simply bicarb, etc. are some other names of baking soda.

Preparation Method: Baking soda is obtained by the reaction of brine with carbon dioxide and ammonia. This is known as Solvay process.

In this process, calcium carbonate is used as the source of CO_2 and the resultant calcium oxide is used to recover ammonia from ammonium chloride.

Properties of Sodium Bicarbonate:

Sodium bicarbonate is white crystalline solid, but it appears as fine powder.
Sodium hydrogen carbonate is amphoteric in nature.
Sodium hydrogen carbonate is sparingly soluble in water.
Thermal decomposition of sodium hydrogen carbonate (baking soda).
When baking soda is heated, it decomposes into sodium carbonate, carbon dioxide and water.
$2NaHCO_3 + heat \rightarrow Na_2CO_3 + CO_2 + H_2O$
Sodium carbonate formed after thermal decomposition of sodium hydrogen carbonate decomposes into sodium oxide and carbon dioxide on further heating.
$Na_2CO_3 \rightarrow Na_2O + CO_2$
This reaction is known as Dehydration reaction.
Use of Baking Soda:

Baking soda is used in making of baking powder, which is used in cooking as it produces carbon dioxide which makes the batter soft and spongy.
Baking soda is used as an antacid.
Baking soda is used in toothpaste which makes the teeth white and plaque free.
Baking soda is used in cleansing of ornaments made of silver.
Since sodium hydrogen carbonate gives carbon dioxide and sodium oxide on strong heating, thus, it, is used as a fire extinguisher.
Baking Powder: Baking powder produces carbon dioxide on heating, so it is used in cooking to make the batter spongy. Although, baking soda also produces carbon dioxide on heating, but it is not used in cooking because on heating, baking soda produces sodium carbonate along with carbon dioxide. The sodium carbonate, thus, produced, makes the taste bitter.

Baking powder is the mixture of baking soda and a mild edible acid. Generally, tartaric acid is mixed with baking soda to make baking powder.

When baking powder is heated, sodium hydrogen carbonate ($NaHCO_3$) decomposes to give CO_2 and sodium carbonate (Na_2CO_3). CO_2 causes bread and cake fluffy. Tartaric acid helps to remove bitter taste due to formation of Na_2CO_3.

4. Washing Soda (Sodium Carbonate)
Preparation Method: Sodium carbonate is manufactured by the thermal decomposition of sodium hydrogen carbonate obtained by Solvay process.

The sodium carbonate obtained in this process is dry. It is called Soda ash or Anhydrous sodium carbonate. Washing soda is obtained by rehydration of anhydrous sodium carbonate.

Since there are 10 water molecules in washing soda, hence, it is known as Sodium Bicarbonate Decahydrate.
Sodium carbonate is a crystalline solid and it is soluble in water when most of the carbonates are insoluble in water.

Use of sodium carbonate:

It is used in the cleaning of cloths, especially in rural areas.
In the making of detergent cake and powder.
In removing the permanent hardness of water.
It is used in glass and paper industries.
The water of Crystallization: Many salts contain water molecule and are known as Hydrated Salts. The water molecule present in salt is known as Water of crystallization.
Examples:
Copper sulphate pentahydrate ($CuSO4.5H2O$): Blue colour of copper sulphate is due to presence of 5 molecules of water. When copper sulphate is heated, it loses water molecules and turns: into grey – white colour, which is known as anhydrous copper sulphate. After adding water, anhydrous copper sulphate becomes blue again.