Acids , Bases And Salts

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ACID	BASES
Usually sour in taste.	Bitter in taste and soapy to touch.
Turns blue litmus paper red.	Turns red litmus paper blue.
Gives hydrogen ions in solution pH < 7 e.g. Hydrochloric Acid (HCl), Acetic Acid (CH_3COOH)	Gives hydroxyl ions in solution pH > 7 eg. Sodium Hydroxide (NaOH)

Important

Natural Source	Acid	Natural Source	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

INDICATORS: A chemical compound that changes its colour in presence of an acid or a base.

OLFACTORY: substances whose odour changes in acidic or basic medium are called Olfactory indicators. eg- Vanilla, Onion. clove oil.
base (no smell), acid (smell remains)

Natural: (found in nature)

Indicator	Neutral solution	Reac. with Acid	Reac. with Base
Litmus	Pale purple (Mauve)	Red	Blue
Hydrangea flowers	Blue	Blue	pink
Turmeric	yellow	yellow	Red

Synthetic: (from chemical proesses)

Indicator	Reac. with Acid	Reac. with Base
Phenolphthalein	Colourless	pink
Methyl Orange	Red	yellow

- **Strong acids release more H^+ ions, while weak acids release fewer H^+ ions. The same applies to bases.**

Dilution occurs when an acid or base is mixed with water, reducing the concentration of H_3O^+ or OH^- ions per unit volume, making the acid or base less concentrated.

diluted acid - small amount of acid (solute) dissolved in a large amount of water (solvent)

Concentrated acid - large amount of acid dissolved in a small amount of water.

Importance of pH in daily life:

- Digestion: The stomach uses hydrochloric acid with a pH of 1 to 3 to break down food.
- Soil: Plants thrive in soil with a pH of 6.3 to 7.3. If soil is too acidic, adding lime helps; if too basic, gypsum is added.
- Tooth Decay: Bacteria in the mouth make it acidic, leading to tooth decay. Toothpaste, being basic, balances the mouth's pH.
- Blood: Blood functions best with a pH between 7.0 to 7.8.
- Plants and Animals: They prefer specific pH levels, with most plants growing best in soil around pH 7.
- Bee Stings: Baking soda neutralizes the acidity caused by bee stings.
- Acid Rain: Pollution can cause rain to become acidic, harming fish and other animals.

Salts

alts are ionic compounds composed of positively charged ions (cations) and negatively charged ions (anions), These ions are held together by ionic bond

Litmus solution is a purple dye from lichen, used as an indicator

Chemical Properties of Acid:

Base with Metal Metal + Base → Salt + Hydrogen Gas
eg; $Zn + 2NaOH \rightarrow Na_2ZnO_2 + H_2$ {Hydrogen gas evolved; indicates a reaction with the base}

Base with Non-Metal Oxide Non-Metallic Oxide + Base → Salt + Water
eg; $CO_2 + Ca(OH)_2 \rightarrow CaCO_3 + H_2O$ {Neutralization reaction; forms salt and water, indicating acidic nature of non-metal oxide}.

Base + Acid → Salt + Water NaOH + HCl → NaCl + H_2O

Chemical Properties of Acids:

Acid with Metal eg: $Zn + 2HCl \rightarrow ZnCl_2 + H_2$
{Hydrogen gas evolved; bubbles in soap solution ignite with a popping sound when a burning candle is brought near.}

Metal Carbonate eg: $Na_2CO_3 + 2HCl \rightarrow 2NaCl + CO_2 + H_2O$
{Carbon dioxide turns lime water milky, indicating its presence}

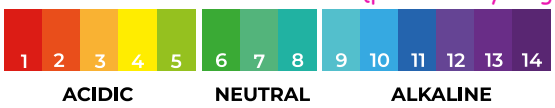
Metal Hydrogencarbonate eg: $NaHCO_3 + HCl \rightarrow NaCl + CO_2 + H_2O$
{Carbon dioxide turns lime water milky, indicating its presence.}

Metallic Oxide eg: $CuO + 2HCl \rightarrow CuCl_2 + H_2O$
{The solution turns blue-green, indicating the formation of copper(II) chloride.}

Strength of Acids and bases:

- Strength of Acid and Base can be estimated using universal indicator.
- It shows different colours at different concentrations of H+ ions in the solution.

P(potenz)H: pH is a measure of the concentration of hydrogen ions in solution. {power of hydrogen}



pH<7 { Acidic }
ph = 7 { neutral }
pH>7 { Basic }

H: strong acid + strong base are neutral (pH 7).
strong acid + weak base are acidic (pH < 7),
strong base + weak acid are basic (pH > 7).

Sodium Chloride (NaCl) HCl + NaOH → NaCl + H_2O (Neutral)

- Found in seawater and rock salt deposits
- Used in food seasoning, raw material for chemicals like NaOH,.

Sodium Hydroxide (NaOH) (Basic) $2NaCl + 2H_2O \rightarrow 2NaOH + Cl_2 + H_2$ (Chlor-alkali process)

- Produced by electrolysis of brine
- At anode: Cl_2 (uses Water treatment, PVC, disinfectants)
- At cathode: H_2 gas (uses Fuels, margarine.)
- Near cathode: NaOH solution is formed (Soap, paper, textiles.)

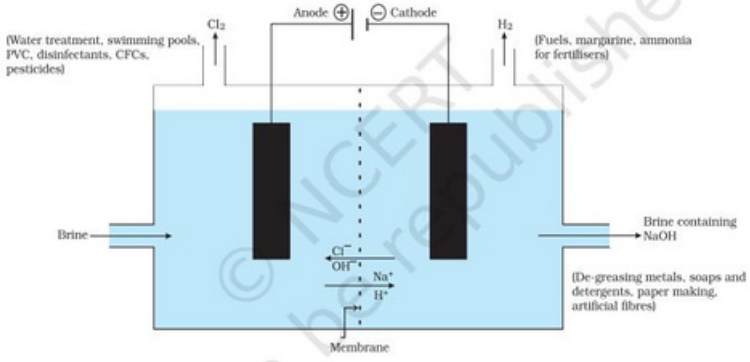


Figure 2.8 Important products from the chlor-alkali process

Sodium Hydrogen Carbonate ($NaHCO_3$) $NaCl + H_2O + CO_2 + NH_3 \rightarrow NH_4Cl + NaHCO_3$ (Basic)

- Produced using sodium chloride, water, and carbon dioxide
- Used in bakng powder, antacids, soda-acid fire extinguisher.

Sodium Carbonate (Na_2CO_3)

$2NaHCO_3 \rightarrow Na_2CO_3 + CO_2 + H_2O$ **Baking Soda** (Basic)

- Obtained by heating sodium hydrogen carbonate and recrystallization
- Used in glass, soap, and paper industries, and to remove water hardness.

Calcium Oxychloride ($CaOCl_2$)

$Ca(OH)_2 + Cl_2 \rightarrow CaOCl_2 + H_2O$

Bleaching powder

- Produced by reacting chlorine with slaked lime
- Used for bleaching in textile and paper industries,

Calcium Sulphate Hemihydrate ($CaSO_4 \cdot \frac{1}{2}H_2O$)

$CaSO_4 \cdot 2H_2O$ (gypsum) $\rightarrow CaSO_4 \cdot \frac{1}{2}H_2O$ (Plaster of Paris) $+ 1\frac{1}{2}H_2O$ (Neutral)

- Found as gypsum in natural deposits
- Used for removing permanent hardness of water.

Sodium Carbonate Decahydrate (Basic) ($Na_2CO_3 \cdot 10H_2O$)

$Na_2CO_3 + 10H_2O \rightarrow Na_2CO_3 \cdot 10H_2O$

Washing Soda

- Produced by recrystallization of sodium carbonate
- Used as washing soda, in glass, soap, and paper industries, and for removing permanent hardness of water.

Copper(II) Sulphate ($CuSO_4 \cdot 5H_2O$)

$CuSO_4 \cdot 5H_2O$ (blue) $\rightarrow CuSO_4$ (white) $+ 5H_2O$ (Acidic)

Are the Crystals of Salts really Dry?

- Copper sulphate, contain water molecules in their crystal structure, known as water of crystallisation.
- When copper sulphate crystals are heated, they lose their water of crystallisation and turn from blue to white.
- Rehydration: Adding water back to the white, anhydrous copper sulphate restores its blue color.
- Chemical Formula: The hydrated form of copper sulphate is represented as $CuSO_4 \cdot 5H_2O$, indicating it has five water molecules per formula unit..

Chapter ka KAZAANA:

- ***Indicators + pH scale***
- ***Chlor - Alkali Process***
- ***POP, Washing, Baking Soda (Specially Baking Soda)***