Acids, Bases and Salts: Online NCERT Summary Class - X (Science) for UPSC/IAS Preparation

LESSON 3 OF 19

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COURSE: SUMMARY OF NCERT CLASS X SCIENCE
LESSON: ACIDS, BASES AND SALTS

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About me

- B Tech /M tech from IIT Roorkee
- Cleared UPSC CSE Prelims 4 times
- 6 years of Corporate Experience
- Hobbies: Playing Chess, Listening Songs
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Acid

- Acids are **sour in taste** and change the colour of blue litmus to red
- Some Common Acids: HCL, H_2SO_4, HNO_3
- Acidic nature of a substance is due to the formation of H^+ (aq) ions in water solution.

$$HCl + H_2O \rightarrow H^+(aq) + Cl^-(aq)$$

- The separation of H^+ ion from HCl molecules cannot occur in the absence of water.

Base

- Bases are **bitter** and change the colour of the **red litmus to blue**.
- Some Common Bases: $NaOH$, $Ca(OH)_2$
- When a base is dissolved it generate hydroxide (OH^-) ions in water

$$NaOH \rightarrow Na^+(aq) + OH^-(aq)$$

- The separation of OH- ion from NaOH molecules cannot occur in the absence of water

Litmus

- Litmus is a natural indicator.
- Litmus solution is a purple dye, which is extracted from **lichen**, a plant belonging to the division Thallophyta.
- When the litmus solution is neither acidic nor basic, its colour is **purple**.

Other indicators

- Natural indicators such as **cabbage leaves, turmeric**.
- Synthetic indicators such as **methyl orange** and **phenolphthalein**

Reactions

- Reaction of Acid with Metals

$$\text{Acid} + \text{Metal} \rightarrow \text{Salt} + \text{Hydrogen gas}$$

$$2NaoH + Zn \rightarrow Na_2ZnO_2 + H_2$$

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

- Reaction of Acid with Metal Carbonates/Metal Hydrogen Carbonates

$$\text{Acid} + \text{Metal Carbonates/Metal Hydrogen Carbonates} \rightarrow \text{Salt} + CO_2 + \text{Water}$$

Reactions

- Reaction of Acids and Bases with each other (Neutralization Reaction)

Base + Acid → Salt + Water

$NaOH(aq) + HCl(aq) \rightarrow NaCl(aq) + H_2O(l)$

- Reaction of Metallic Oxides with Acids

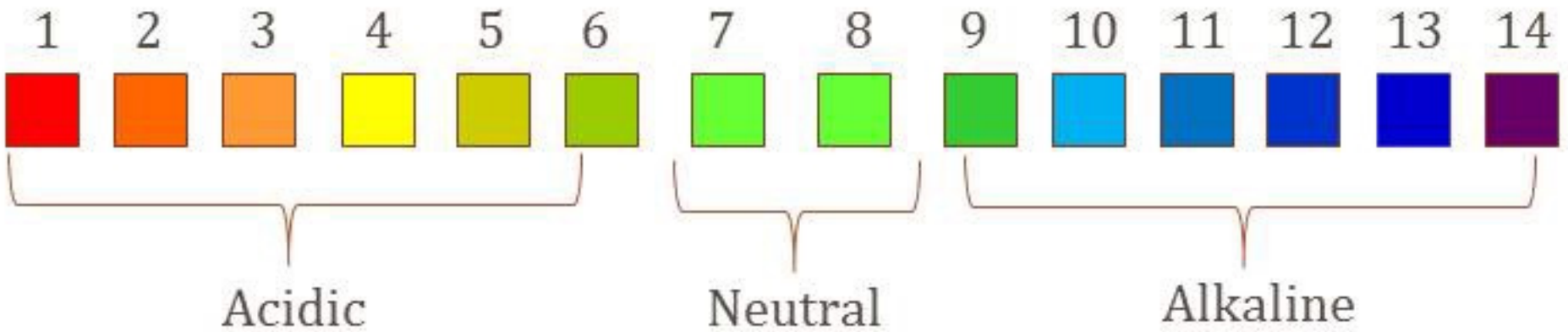
Metal oxide + Acid → Salt + Water

- Reaction of Non-metallic Oxide with Base

Non Metal oxide + Base → Salt + Water

pH scale

- A scale for measuring **hydrogen ion (H+)** concentration in a solution
- The p in pH stands for '**potenz**' in German, meaning power
- On the pH scale we can measure pH from 0 (very acidic) to 14 (very alkaline).
- The pH of a neutral solution is 7



Significance of pH in everyday life

1. Existence of Life

- Living organisms can survive only in a narrow range of pH change
- When pH of rain water is less than 5.6, it is called **acid rain**
- This acid rain lowers the pH of the river water, making survival of aquatic life difficult

2. pH in our digestive system

- Our stomach produces **hydrochloric acid (HCl).** It helps in the digestion of food without harming the stomach
- During indigestion the stomach produces too much acid and this causes pain and irritation
- To get rid of this pain, people use bases called **antacids**. e.g. **Magnesium hydroxide** (Milk of magnesia)

Significance of pH in everyday life

3. pH change as the cause of tooth decay

- Tooth enamel, made up of **calcium phosphate** **($Ca_3(PO_4)_2$)** is the **hardest** substance in the body
- It gets corroded when the pH in the mouth is below 5.5
- **Bacteria present** in the mouth produce acids by **degradation of sugar** and food particles that remain in the mouth after eating
- Cleaning the mouth after eating food is the best way to prevent this. Toothpastes, which are generally **basic**, can neutralise the excess acid and prevent tooth decay

4. Self defence by animals and plants through chemical warfare

- **Bee-sting** leaves an acid which causes pain and irritation
- Stinging hair of **nettle** leaves inject **methanoic acid** causing burning pain

Salts

Rock Salt

- Seawater contains many salts dissolved in it
- These large crystals are often **brown** due to impurities. This is called rock salt
- Beds of rock salt were formed when seas of bygone ages dried up
- Rock salt is mined like coal

Salts

Common salt (NaCl) — A raw material for chemicals

- **Baking soda** ($NaHCO_3$) - faster cooking, tasty crispy pakoras, ingredient in antacids,, making baking powder, soda-acid fire extinguishers
- **Washing soda** ($Na_2CO_3.10H_2O$)- glass, soap and paper industries, **borax** manufacturing, cleaning agent for domestic purposes, removing permanent hardness of water
- **Bleaching powder** ($CaOCl_2$)- oxidising agent , disinfectant for drinking water , bleaching washed clothes in laundry

Salts

Water of Crystallization

- Crystals of Salt are not completely dry
- Water of crystallisation is the fixed number of water molecules present in one formula unit of a salt
- **Gypsum** has two water molecules as water of crystallisation. It has the formula $CaSO_4.2H_2O$

Plaster of Paris

- Heating of gypsum causes loss of water molecules and it becomes calcium sulphate hemihydrate ($CaSO_4.1/2H_2O$)
- This is called **Plaster of Paris**, which is used by doctors, as plaster for supporting fractured bones in the right position
- It is also used for making toys, materials for decoration and for making surfaces smooth