What do All acids and Bases have in Common.

→ All acids have H^+ ions in common.

→ Acids produce H^+ ions in solution which are responsible for their acidic properties

→ All bases have OH^- (hydroxyl ions) in common.

Acid contains H^+ ion as cation and Cl^- ion as anion in HCl.

Acid or Base in Water Solution

→ Acids produce H^+ ions in presence of water.

→ The hydrogen ions in HCl are produced in the presence of water. The separation of H^+ ion from HCl molecules cannot occur in the absence of water

→ H^+ ions cannot exist alone, they exist as $H^+(aq)$ or hydronium ion (H_3O^+)

Bases when dissolved in water gives OH^- ions

$NaOH \xrightarrow{H_2O} Na^+_{(aq)} + OH^-(aq)$

$Mg(OH)_2 \xrightarrow{H_2O} Mg^{2+} + 2OH^-$

→ Bases soluble in water are called Alkalis

Strength of Acid and Base

Strength of Acid Base can be estimated using universal indicator

Universal Indicator:- is a mixture of indicators. It shows different colours at different concentration of H^+ ions in the solution.

pH Scale :- A scale for measuring H^+ ion concentration in a solⁿ.

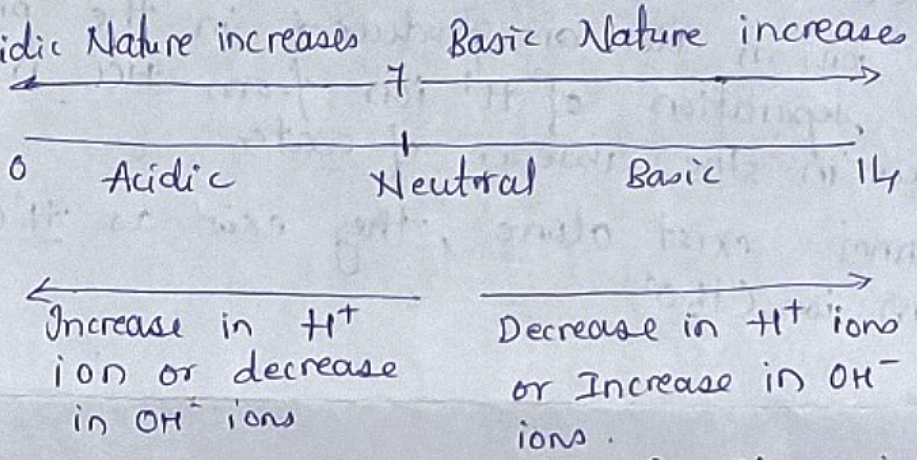
p in pH stands for 'potenz' a German word means power

pH → potential of hydrogen

pH = 7 ⟶ Neutral solⁿ

pH less than 7 → Acidic solⁿ

pH more than 7 → Basic solⁿ



Importance of pH in everyday life given in Notes given in class.

pH of salts :-

i) Strong Acid + Strong Base → Neutral salt : pH = 7

ii) Salt of strong Acid + weak bases → Acidic salt : pH < 7

iii) Salt of strong base + weak Acid → Basic salt : pH > 7

Chemicals from Common Salts (NaCl)

NaOH (Sodium hydroxide)	Bleaching powder ($CaOCl_2$)	Baking soda ($NaHCO_3$)	Washing Soda ($Na_2CO_3 \cdot 10H_2O$)	Plaster of Paris ($CaSO_4 \cdot \frac{1}{2}H_2O$)

1. **Sodium Hydroxide (NaOH) :** When electricity is passed through an aqueous solution of NaCl (brine), it decompose to form NaOH. (Chlor-alkali process)

$$2NaCl + 2H_2O \rightarrow 2NaOH + Cl_2 + H_2$$

At anode : Cl_2 gas

At cathode : H_2 gas

Near cathode : NaOH solution is formed.

Uses :

H_2 : Fuels, margarine

Cl_2 : Water treatment, PVC, CFC's

HCl : Cleaning steels, medicines

NaOH : Degreasing metals, soaps and paper making

Cl_2 + NaOH → Bleach : Household bleaches, bleaching fabrics

2. **Bleaching Powder ($CaOCl_2$):** It is produced by the action of chlorine on dry slaked lime.

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

Uses :

(a) Bleaching cotton and linen in textile industry.

(b) Bleaching wood pulp in paper factories.

(c) Oxidizing agent in chemical industries.

(d) Disinfecting drinking water.

3. **Baking Soda (Sodium Hydrogen Carbonate) ($NaHCO_3$) :**

$$NaCl + H_2O + CO_2 + NH_3 \rightarrow NH_4Cl + NaHCO_3$$

Baking soda

- It is mild non-corrosive base.
- When it is heated during cooking :

$$2NaHCO_3 \xrightarrow{\Delta} Na_2CO_3 + H_2O + CO_2$$

Uses :

(a) For making baking powder (mixture of baking soda and tartaric acid). When baking powder is heated or mixed with water, CO_2 is produced which causes bread and cake to rise making them soft and spongy.

(b) An ingredient in antacid.

(c) Used in soda acids, fire extinguishers.

4. **Washing Soda ($Na_2CO_3.10H_2O$) :** Recrystallization of sodium carbonate gives washing soda. It is a basic salt.

$$Na_2CO_3 + 10H_2O \rightarrow Na_2CO_3.10H_2O$$

Uses :

(a) In glass, soap and paper industry.

(b) Manufacture of borax.

(c) Cleaning agent for domestic purposes.

(d) For removing permanent hardness of water.

5. Plaster of Paris (Calcium sulphate hemihydrates) ($CaSO_4.½H_2O$) :

On heating gypsum ($CaSO_4.2H_2O$) at 373K, it loses water molecules and becomes Plaster of Paris (POP).

It is a white powder and on mixing with water it changes to gypsum.

$$CaSO_4.½H_2O + 1½H_2O \rightarrow CaSO_4.2H_2O$$

Uses :

(a) Doctors use POP for supporting fractured bones.

(b) For making toys, material for decoration.

(c) For making surfaces smooth.

Water of Crystallization : It is a fixed number of water molecules present in one formula unit of a salt.

E.g., $CuSO_4.5H_2O$ has 5 water molecules.

$Na_2CO_3.10H_2O$ has 10 water molecules.

$CaSO_4.2H_2O$ has 2 water molecules.