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Chapter #02 Acids, Bases & Salts

Properties of Acid.
- Tastes sour.
- Turns red on blue litmus paper.
- no effect on red litmus.
- Corrosive for skin

Properties of Base
- Tastes Bitter
- no effect on blue litmus.
- turns blue on red litmus.
- Corrosive on skin

Lewis Concept:- (1923)
Acid:- Substance that accepts a pair of e^- to form covalent coordinate bond.
Base:- Substance that donates a pair of e^- to form coordinate covalent bond.
∴ A coordinate covalent bond is formed b/w the acid & base
Example:- $HCl + H_2O \rightleftharpoons H_3O + Cl^-$
base acid

PH:- Negative logarithm of the molar concentration of H^+ ions in aqueous solutions.
$pH = -\log[H^+]$
$[H^+]\uparrow [pH^-]\downarrow$
$[H^+] = 1\times10^{-7}$ M.
$pH = -\log(1\times10^{-7})$
$pH = 7$. (pH of water)

POH:- Negative logarithm of molar concentration of OH^- ions in aqueous solutions.
$pOH = -\log[OH^-]$

HCl (Hydrochloric Acid)
HNO_3 (Nitric Acid)
H_2SO_4 (Sulphuric Acid)
H_3PO_4 (Phosphoric Acid)
$NaOH$ (Sodium Hydroxide)
KOH (Potassium Hydroxide)
$Ca(OH)_2$ (Calcium Hydroxide)
$Mg(OH)_2$ (Magnesium Hydroxide)
(H_2CO_3) (Carbonic Acid)
Cl^{-1}, NO_3^{-1}, SO_4^{-2}, PO_4^{-3},
CO_3^{-2}, OH^-, HCO_3^{-1}

Methods for making Salts:-
1. Acid + Base → Salt + water
$HCl + NaOH \rightarrow NaCl + H_2O$
2. Acid + metal oxide → Salt + Water
$H_2SO_4 + CuO \rightarrow CuSO_4 + H_2O$
3. Acid + Metal → Salt + Hydrogen
$2HCl + Mg \rightarrow MgCl_2 + H_2$

Arrhenius Concept:- (1887)
Acid:- Ionizes in water to produce H^+ ions.
Base:- Ionizes in water to produce OH^- ions.
Examples:- $HCl \xrightleftharpoons{H_2O} H^+ + Cl^-$ (HCl: acid)
$NaOH \xrightleftharpoons{H_2O} Na^+ + OH^-$ (NaOH: Base)
Intro:- 1887

Self-Ionization of Water
Definition:- Reaction in which two water molecules produce ions.
→ occurs at a small extent
$2H_2O \rightarrow H_3O^+ + OH^-$
$\rightarrow H_2O \rightarrow H^+ + OH^-$
At 25°C concentration of H^+ & OH^- is 1×10^{-7} M.
$K_c = \frac{[H^+][OH^-]}{[H_2O]}$
$K_c[H_2O] = [H^+][OH^-]$
$K_w = (1\times10^{-7})(1\times10^{-7})$
$K_w = 1\times10^{-14}$

$[H^+] = [OH^-] = 1\times10^{-7}$ (neutral)
$[H^+] > 1\times10^{-7}$ (acidic)
$[H^+] < 1\times10^{-7}$ (basic)

Application of PH:-
1. create soil conditions for plant growth.
2. medical diagnosis.
3. maintaining acid-base blance in swimming pools.
4. electroplating.
5. manufacture of medicines.

4. Acid + carbonate (metal carbonate) → Salt + water + carbon dioxide
$2HCl + CaCO_3 \rightarrow CaCl_2 + CO_2 + H_2O$
5. Salt + Salt → Salt + Salt
$AgNO_3 + NaCl \rightarrow AgCl\downarrow + NaNO_3$

Uses of salts:- Salts such as benzoates sulphites are used in preservation of food for thousand years.
Side effects of preservatives:- 1. can cause breathing difficulties, weaken heart tissues & transform into carcinogins.

Bronsted-Lowery Concept
Acid:- Proton donor
Base:- Proton acceptor
Example:-
$HCl + H_2O \rightarrow H_3O + Cl^-$
acid base
$H_2O + NH_3 \rightarrow NH_4 + OH$
acid base
Intro: 1923

pH Scale:- A number scale from 0-14 to describe concentration of H^+ ions in a solution.
pH = 7 (neutral)
pH less than 7 (acid)
pH more than (7) (base)

Etch Art:- It is a type of art in which a glass or metal is covered with a thin layer of wax. Then patterns are carved onto the wax and the glass or metal with pattern is dipped into any acid. Acid eats away at the exposed portion, leaving behind a textured mark. plate is taken out of acid and cleaned. Inks can be used to make the designs colourful.

Amphoteric Substances
$HCl + H_2O \rightarrow H_3O + Cl^-$
acid base
$NH_3 + H_2O \rightarrow NH_4 + OH$
base acid
In one example water donates H^+ while in other it accepts H^+
This means water acts as an acid as well as base. It is amphoteric in nature.
Substances that react with both acids and bases are called Amphoteric substances.

Measurement of PH:-
1. universal indicator paper.
2. litmus paper.
3. Indicators (methyl red, Bromothymol blue, phenol-phthalene)
4. pH meter.

Salts:- An acid contains replaceable hydrogen atoms. When these are completely or partially replaced by metal cations salt is formed.
$HCl \rightarrow NaCl$

Neutral Salt:- Salt formed by complete neutralization of an acid is normal salt.
Example:- Na_2CO_3
$H_2CO_3 + 2NaOH \rightarrow + H_2O$

Basic Salt:- Salt containing replaceable OH group.
Example:- $Zn(OH)Cl$
$Zn(OH)_2 + HCl \rightarrow H_2O$

Acid Salt:- salt containing replaceable H group
Example:- $NaHCO_3$
$H_2CO_3 + NaOH \rightarrow + H_2O$

SLO CORNER:-
Q:- Clarify water as proton donor and proton acceptor?
Q1:- What is lewis-acid base concept? Give examples.
Q2:- What is bronsted-lowery concept? explain with examples?
Q3:- What is the effect of acid on a blue litmus paper?
Q4:- What are some properties of acid
Q5:- Differentiate between acids and bases.
Q6 Write the methods for making salts with reactions.