LRNR Classes
Class - 10th
Acid, Bases & Salts
Chapter - 2

- Acids are sour in taste and change blue litmus to red.
- Bases are bitter in taste and change red litmus to blue.
- Indicator - It is a substance which gives us information about acid and base. Ex:- litmus, turmeric, methyl orange, phenolphthalein, red cabbage.
- In acidic medium phenolphthalein show no change in colour but in basic medium it changes into pink.
- In acidic medium methyl orange changes into pink red & basic medium it changes into yellow.
- When zinc granules react with sulphuric acid it forms zinc sulphate and liberates hydrogen gas.
  Eq:- Zn + $H_2SO_4 \rightarrow$ ZnSO_4 + H_2
- When zinc granules react with hydrochloric acid it forms zinc chloride and liberates hydrogen gas.
  Eq:- Zn + 2$HCl \rightarrow$ ZnCl_2 + H_2
- When zinc granules react with nitric acid it forms zinc nitrate and liberates hydrogen gas.
  Eq:- Zn + $HNO_3 \rightarrow$ Zn$(NO_3)_2$ + H_2
- When zinc granules react with acetic acid it forms zinc acetate and liberates hydrogen gas.
  Eq:- Zn + $CH_3COOH \rightarrow$ Zn$(CH_3COOH)_2$ + H_2
- When acid reacts with metal, metal displaces hydrogen atom from acid and it forms salt & liberate hydrogen gas.
  Eq:- Acid + Metal → Salt + Hydrogen gas
  Ex:- 2NaOH(aq) + Zn(s) → Na_2ZnO_2(s) + H_2(g)
  (Sodium zincate)
- When metal carbonates & metal bicarbonates react with acid it forms salt, water and carbon dioxide.

Ex:- Na_2CO_3(s) + 2HCl(aq) → 2NaCl(aq) + H_2O(l) + CO_2(g)

$NaHCO_3$(s) + HCl(aq) → NaCl(aq) + H_2O(l) + CO_2(g)

- On passing the carbon dioxide gas evolved through lime water,
  Ca$(OH)_2$(aq) + CO_2(g) → $CaCO_3$(s) + H_2O(l)
  (Lime water) (White precipitate)
- On passing excess amount of carbon dioxide we get calcium hydrogen carbonate.
  $CaCO_3$(s) + H_2O(l) + CO_2(g) → Ca$(HCO_3)_2$ (aq)
  (Soluble in water)

- Metal carbonate/Metal hydrogen carbonate + Acid → Salt + Carbon dioxide + Water
- The reaction in which both acid and base reacts to form salt and water. This reaction is known as a neutralisation reaction.
  Base + Acid → Salt + Water
  Eq:- NaOH(aq) + HCl(aq) → NaCl(aq) + H_2O(l)
- When metal oxide (Copper oxide) reacts with acid (Hydrochloric acid) it forms salt (Copper chloride) and water.
  Metal oxide + Acid → Salt + Water
  Eq:- CuO + HCl →$CuCl_2$ + H_2O
- When non- metallic oxide (Calcium hydroxide) reacts with base (Carbon dioxide) it forms salt (Copper chloride) and water.
  Metal oxide + Acid → Salt + Water
  Eq:- Ca$(OH)_2$ + CO_2 → CaCO3 + H_2O
- Acids and bases are good conductors of electricity.
- In aqueous solution acid releases H^+ ion and base releases OH^- ion.
  Ex:- When an acid i.e. HCl dissolves in water, releases H^+ ion and combine with water molecules to form hydronium ions.
  HCl + H_2O→ H_3O^++ Cl^-

$H^+ + H_2O \rightarrow H_3O^+$

- When a base dissolve in water it generates OH^- ion.

NaOH(s) $\xrightarrow{H2O}$ Na^+(aq) + OH^- (aq)

KOH(s) $\xrightarrow{H2O}$ K^+(aq) + OH^- (aq)

$Mg(OH)_2$(s) $\xrightarrow{H2O}$ Mg^+(aq) + 2 OH^- (aq)

Bases which are soluble in water are called alkalis.

- When an acid or base dissolves in water it generates heat energy. So this reaction is known as an hyexothermic reaction.
- Care must be taken while we add conc. acid i.e. HCl, H_2SO_4, HNO_3 to water. Always conc. acid is added to water to dilute, if water is added to conc. Acid to dilute more amount of heat is generated which may cause splash out and the container may also break due to excessive heat generated.
- Mixing of an acid or base to water results in decrease in the conc. of ion (H_3O^+/ OH^-) per unit volume. This process is known as dilution & the acid and base is said to be diluted.
- Strong acid is that acid which gives us more amount of H^+ ion. Similarly strong base is that base which gives us more amount of OH^- ion.
- If one solution's pH value is lying between 0 to 7 then that solution is acidic or pH value is lying between 7 to 14 then that solution is basic in nature. Acidic character increases towards pH 7 to 0 and basic character increases towards pH 7 to 14. If pH value is placed at 7 then that is our neutral solution.
- Strong bases are:-
  Sodium hydroxide: NaOH
  Potassium hydroxide: KOH
  Lithium hydroxide: LiOH
  Barium hydroxide: $Ba(OH)_2$
  Calcium hydroxide: $Ca(OH)_2$

- Strong acids are:-
  Sulphuric Acid (H_2SO_4)
  Nitric Acid (HNO_3)
  Perchloric Acid ($HClO_4$)
  Hydrochloric Acid (HCl)
  Chloric Acid ($HClO_3$)
- Weak bases are:-
  Ammonia: (NH_3)
  Lead hydroxide: Pb$(OH)_2$
  Aluminium hydroxide: Al$(OH)_3$
  Copper hydroxide: Cu$(OH)_2$
  Ferric hydroxide: Fe$(OH)_3$
- Weak acids are:-
  Formic acid: (HCOOH)
  Acetic acid: (CH_3COOH)
  Nitrous acid: (HNO_2)
  Sulfurous acid: (H_2SO_3)
  Oxalic acid ($C_2H_2O_4$)
- Our body works within the pH 7.0 - 7.8. If rain water pH is less than 5.6 then, it is called acid rain. Plants also depend on specific pH values to grow.
- Our stomach contains hydrochloric acid but too much HCl causes indigestion. To relieve pain we take antacid such as milk of magnesia i.e. magnesium hydroxide {$Mg(OH)_2$}.
- When an ant bite, it injects formic acid into the skin. To relieve the pain we use moist baking soda (sodium hydrogen carbonate) and calamine solution (zinc carbonate).
- When we use fertilizer in the soil the soil becomes acidic or basic. If the soil becomes acidic or basic, plants do not grow well. To maintain or neutralise the basic character of soil we use quick lime (calcium

oxide) or in acidic character of soil we use slaked lime (calcium hydroxide).

- Factory waste contains acid. If we allow the wastes flow into water bodies, it affects our aquatic animals and plants also. So we will allow wastes after neutralise using basic substances.
- Tooth decay starts when the pH of the mouth is less than 5.5. Tooth enamel is made up of calcium phosphate which is our hardest substance of our body.
- **Sodium Hydroxide - (NaOH)**

  Aqueous solution of sodium chloride is brine. When it decomposes, it forms sodium hydroxide. This process is known as chlor-alkali process where chlor is represented to chlorine and alkali is represented to sodium hydroxide.

  $2NaCl(aq) + 2H_2O(l) \rightarrow 2NaOH(aq) + Cl_2(g) + H_2(g)$

  (sodium chloride) (sodium hydroxide)
- **Bleaching Powder - ($CaOCl_2$)**

  When slaked lime (Calcium hydroxide) reacts with chlorine gas, bleaching powder results.

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

  Uses:- It is used in textile industry. Also used for bleaching washed clothes in laundry and for bleaching wood pulp in paper factory.
  It is used as an oxidising agent in the chemical industry.
  It is used to drink water to make germ free.
- **Baking Soda - ($NaHCO_3$)**

  We get baking soda (Sodium hydrogen carbonate) when sodium chloride reacts with ammonia in presence of water and carbon dioxide.

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

  (Ammonium chloride) (Sodium hydrogen carbonate)
- When Sodium hydrogen carbonate is heated then sodium carbonate results.

$$2NaHCO_3 \xrightarrow{\text{Heat}} Na_2CO_3 + H_2O + CO_2$$

(Sodium hydrogen carbonate) (Sodium carbonate)

Uses:- It is used in the kitchen for making tasty crispy pakoras.

It is used in soda-acid fire extinguishers.

It is used as an antacid.

- **Washing Soda - ($Na_2CO_3.10\,H_2O$)**

Recrystallisation of sodium carbonate gives us washing soda. It is also a basic salt which we can obtain from sodium chloride.

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

Uses:- It is used in glass, soap and paper industry

It is used in the manufacture of borax $Na_2[B_4O_5(OH)_4].8\,H_2O$.

It is used for removing permanent hardness of water.

It is used as a cleansing agent for domestic purpose.

- **Plaster Of Paris - ($CaSO_4.\frac{1}{2}H_2O$)**

On heating gypsum ($CaSO_4.2\,H_2O$) at 373K, It loses water and converts into plaster of paris/ calcium sulphate hemihydrate ($CaSO_4.\frac{1}{2}H_2O$).

- Plaster of paris changes to gypsum($CaSO_4.2\,H_2O$) on mixing with water.

$$CaSO_4.\frac{1}{2}H_2O + 1\frac{1}{2}H_2O \rightarrow CaSO_4.2\,H_2O$$

(Plaster of paris) (Gypsum)

Uses:- It is used as plaster for supporting fractured bones in the right position.

It is used for making toys, material for decoration, for idol making etc.

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