

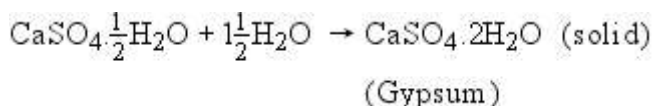
## 5. Acids, Bases and Salts

- Acid is a substance which dissolves in water to furnish ions as only positively charged ions.
  - Basicity of the acid refers to the number of hydrogen ions furnished by one or more molecule of an acid, on dissolving in water.
  - Organic acids are obtained from plants or the animals. Examples are acetic acid, ascorbic acid.
  - Inorganic acids are obtained from minerals present in earth. Examples are sulphuric acid, carbonic acid.
  - Strong acids are the acids in which more than 30% of the molecules ionize in water to furnish ions.
  - Weak acids are the acids in which less than 30% of the molecules ionize in water to furnish ions.
  - The acids are prepared by
    - Dissolving oxides of non-metal in water
    - Reaction of sulphuric acid with salts
    - Direct combination of hydrogen and halogens
    - Oxidation of non-metals
  - They are sour tasting liquids, with pH less than 7 and good conductors of electricity.
  - Acids turn blue litmus red, methyl orange solution pink.
  - Metals like zinc, magnesium react with acids to form metal salt and hydrogen.
  - All dilute mineral acids react with metallic hydroxides, sulphites, sulphides, chlorides, nitrates and carbonates to form their respective metallic salts.
  - Acids react with metal oxides to produce metal salt and water.
  - They react with bases in neutralisation reaction and form salt and water.
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- Bases are the substances which react with acids to form salt and water.
  - All bases which are soluble in water are called alkalis.
  - The oxides and hydroxide of sodium and potassium are strong bases while the oxides and hydroxide of all other metals are weak bases.
  - Bases are prepared by
    - Direct combination of metals like sodium, magnesium with oxygen
    - Reaction of metallic oxides with water
    - Double decomposition of salts with alkalis
    - Reaction of oxygen with metal sulphides
    - Decomposition of metal carbonates and nitrates
  - The alkalis are prepared by dissolving basic oxides of calcium, magnesium etc in water.
  - All bases/ alkalis have bitter taste and soapy touch.
  - All bases/ alkalis produce blisters on coming in contact with skin.
  - All bases/ alkalis turn red litmus blue, methyl orange solution from pink to yellow.
  - They react with acids to form salt and water in neutralisation reaction.
  - They absorb carbon dioxide from the air to form carbonates.
  - They react with heavy metals to form insoluble metal hydroxides.
  - Bases react with non-metal oxides to produce salt and water.
  - Alkalis release ammonia gas on reaction with ammonium salts.
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- Higher  $H^+$  concentration  $\rightarrow$  Strong acid
  - Lower  $H^+$  concentration  $\rightarrow$  Weak acid
  - Higher the  $OH^-$  concentration  $\rightarrow$  Stronger the base

- **pH Measure**
- pH  $\rightarrow$  Measure of acidity  $\rightarrow$  Measure  $H^+$  concentration on the scale (0 – 14)
- pH 7  $\rightarrow$  Neutral solution
- pH < 7  $\rightarrow$  Acidic solution
- pH > 7  $\rightarrow$  Basic solution
- **Salts' pH = 7**
- When an acid is mixed with a base, they neutralize the effect of each other. This reaction is known as **neutralization reaction**. Water and salt are produced as products during the neutralization reaction. Heat is also produced during the neutralization reaction.



- The salt produced during neutralization reactions can be acidic, basic, or neutral in nature.
- Acidic salts = weak base + strong acid
- Basic salts = weak acid + strong base
- Neutral salts = strong base + strong acid
- **Water of crystallisation** : It refers to a fixed number of water molecules present in one formula unit of salt.
- **Example** - In gypsum, the water of crystallisation is 2.



- **Hydrated substances**: Substances containing water of crystallisation for example, hydrated copper sulphate ( $CuSO_4 \cdot 5H_2O$ ).
- **Anhydrous substances**: Substances either not containing water of crystallisation or from which water of crystallisation is removed, for example, sodium chloride (NaCl) and anhydrous copper sulphate ( $CuSO_4$ ).
- **Drying agents**: Substances that absorb moisture without undergoing a chemical reaction, for example, anhydrous calcium chloride ( $CaCl_2$ ).
- **Dehydrating agents**: Substances that remove chemically bonded water from a compound, for example, concentrated sulphuric acid ( $H_2SO_4$ ).
- Flow of electrons through a conductor is called electric current. The substances which do not allow the electric current to pass through them are called **insulators**.
- **An ionic compound or electrovalent compound** is formed when electropositive atoms donate electrons and electronegative atoms accept them.
- **Electrolysis** is the process due to which a chemical compound in fused state or in aqueous solution undergoes a chemical change on passing the current through it.
- The graphite or metal rods through which electric current enters or leaves from an electrolyte are called **electrodes**.
- Cathode is the electrode, which is connected to negative terminal of the battery. It has an excess of electrons.
- Anode is the electrode, which is connected to positive terminal of the battery. It has a deficiency of electrons.

- **Electrolytes** refer to the compound which in fused state or in aqueous state conducts electric current.
- **Non-electrolyte** is the chemical compound which does not conduct electric current in a fused state or in an aqueous solution.
- When a chemical compound in a fused state or in an aqueous solution breaks up into electrically charged atoms or group of atoms, the charged particles are called **ions**.
- A positively charged ion is a cation. They migrate towards the cathode.
- A negatively charged ion is an anion. They migrate towards anode.

### **Characteristics of electrolysis**

- On passing the electric current, cations migrate towards cathode while the anions migrate towards anode.
- The number of electrons accepted by an anode is equal to the number of electrons donated by cathode.
- The products of electrolysis are formed on the surface of the cathode where an exchange of electrons occurs.
- The preferential discharge of ions depends upon their position in electrochemical series and the concentration of ions.
- Neutral atoms of metals and hydrogen are liberated at cathode. Therefore, they are called electropositive elements. Neutral atoms of non-metals are liberated at anode. Therefore, they are called electronegative elements.
- According to Faraday's law of electrolysis, the mass of a substance discharged at an electrode is directly proportional to the quantity of electricity passing through the electrolyte.
- Direct current is suitable to carry out electrolysis.
- Electrolysis is a redox reaction, where reduction occurs at cathode and oxidation occurs at anode.