Chapter 5: Acid, bases and salts

Question. 1. Fill in the blanks

(1) The chemical formula of red oxide is **Fe_2O_3**.

(2) The electrode connected to the negative terminal of a battery by means of a conducting wire is called a **cathode**

(3) The electrode connected to the positive terminal of a battery is called an **anode**.

(4) Aluminium oxide reacts with sodium hydroxide to form **sodium aluminate ($NaAlO_2$)** and water.

(5) Magnesium metal reacts with dilute hydrochloric acid and an inflammable gas, **hydrogen**, is formed.

(6) pH 7 indicates a **neutral** solution

(7) pH : power of **hydrogen**

(8) The proportion of a solute in a solution is called the **concentration** of the solute in the solution.

Question. 2. Odd man out

(1) Chloride, nitrate, hydride, ammonium. **Hydride**

(2) Hydrogen chloride, sodium hydroxide, calcium oxide, ammonia. **Ammonia**

(c) Acetic acid, carbonic acid, hydrochloric acid, nitric acid. **Acetic acid**

(d) Ammonium chloride, sodium chloride, potassium nitrate, sodium sulphate. **Ammonium chloride**

(e) Sodium nitrate, sodium carbonate, sodium sulphate, sodium chloride. **Sodium chloride**

(f) Calcium oxide, magnesium oxide, zinc oxide, sodium oxide. **Zinc oxide**

(g) Crystalline blue vitriol, crystalline common salt, crystalline ferrous sulphate, crystalline sodium carbonate. **Crystalline common salt (Sodium chloride)**

(h) Sodium chloride, potassium hydroxide, acetic acid, sodium acetate. **Acetic acid**

Question. 3. Answer in one sentence

(1) What is strong acid?

Answer: On dissolving in water, a strong acid dissociates almost completely and the resulting aqueous solution contains mainly H+ ions and the concerned acidic radical.

(2) What is strong base?

Answer: On dissolving in water, a strong base dissociates almost completely and the resulting aqueous solution contains mainly OHions and the concerned basic radicals.

(3) What is alkali?

Answer: The bases which are highly soluble in water are called alkali.

(4) What is weak acid?

Answer: On dissolving in water a weak acid does not dissociate completely. The resulting aqueous solution contains H+ ion and the concerned acidic radical in small proportion along with large proportion of the undissociated molecules of the acid.

(5) What is weak base?

Answer: On dissolving in water a weak base does not dissociate completely. The resulting aqueous solution contains a small proportion of OH- ions and the concerned basic radical along with a large proportion of undissociated molecules of the base.

(6) What is Basicity of acids?

Answer: The number of H+ ions obtainable by the dissociation of one molecule of an acid is called its basicity.

(7) What is Acidity of bases?

Answer: The number of OH- ions obtainable by the dissociation of one molecule of a base is called its acidity.

Question. 4. Answer the following question.

(1) What is concentration of acid and bases?

Answer: The concentration of acids and bases refers to the amount of acid or base dissolved in a given volume of solution. It is commonly expressed in terms of molarity (moles of solute per liter of solution), where a higher molarity means a stronger, more concentrated solution.

(2) What is universal indicator?

Answer: A universal indicator is a pH indicator composed of a mixture of dyes that change color gradually over a wide pH range (0-14), providing a visual indication of the acidity or alkalinity of a solution. It changes from red in strongly acidic solutions to violet in strongly basic solutions.

(3) Explain water of crystallisaton?

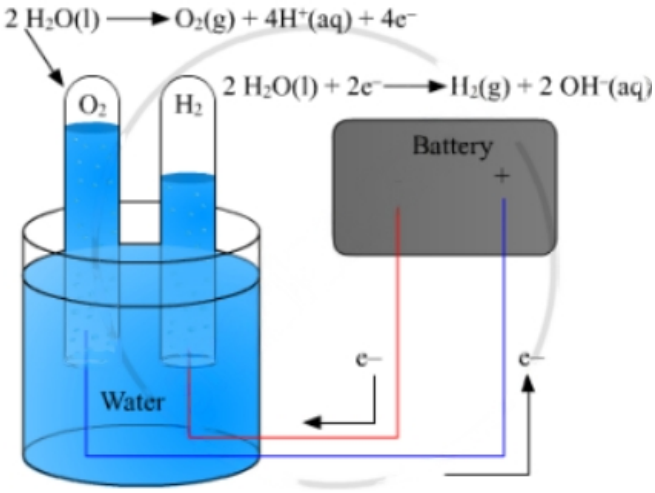
Answer: Water of crystallization refers to the fixed number of water molecules chemically bound within the crystalline structure of a compound. These water molecules are necessary for the compound to maintain its crystalline shape. For example, copper sulfate pentahydrate ($CuSO_4 \cdot 5H_2O$) has five water molecules of crystallization.

(4) Explain with diagram Electrolysis of water?

Answer:

Setup:

1. Electrolysis Cell: A container filled with water, usually mixed with a small amount of acid or base (such as sulfuric acid or sodium hydroxide) to increase the conductivity of water.
2. Electrodes: Two electrodes (an anode and a cathode) are placed in the water and connected to a power source (like a battery or DC power supply).
    - Anode (positive electrode): Oxygen gas is released here.
    - Cathode (negative electrode): Hydrogen gas is released here.
3. Power Supply: Provides the electrical current needed for electrolysis.
4. Water: Pure water has low conductivity, so an electrolyte (acid/base) is added.



Reaction:

The electrolysis of water decomposes it into hydrogen (H_2) and oxygen (O_2) gases when an electric current is passed through the water.

The reactions at the electrodes are:

At the Cathode (Reduction):

Hydrogen ions (H^+) gain electrons (reduction) to form hydrogen gas (H_2).

$2H_2O + 2e^- \rightarrow H_2(g) + 2OH^-$

At the Anode (Oxidation):

Water molecules lose electrons (oxidation) to form oxygen gas (O_2) and hydrogen ions (H^+).

$2H_2O \rightarrow O_2(g) + 4H^+ + 4e^-$

Overall Reaction:

$2H_2O \rightarrow 2H_2(g) + O_2(g)$

Hydrogen gas (H_2) is collected at the cathode.

Oxygen gas (O_2) is collected at the anode

(5) Explain the Reaction of acids with metals.

Answer: When acids react with metals, they produce a salt and hydrogen gas. The general reaction is:

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

For example, hydrochloric acid reacts with zinc to form zinc chloride and hydrogen gas:

$$2HCl + Zn \rightarrow ZnCl_2 + H_2$$

(6) Explain the Reaction of acids with oxides of metals.

Answer: Acids react with metal oxides to form salt and water. Metal oxides are basic in nature, so they neutralize acids in the following reaction:

$$\text{Acid} + \text{Metal Oxide} \rightarrow \text{Salt} + \text{Water}$$

For example, hydrochloric acid reacts with copper oxide to form copper chloride and water:

$$2HCl + CuO \rightarrow CuCl_2 + H_2O$$

(7) Explain the Reaction of bases with oxides of non-metals.

Answer: Bases react with non-metal oxides to form salts and water. Non-metal oxides are acidic in nature, and when they react with a base, they neutralize each other:

$$\text{Base} + \text{Non-metal Oxide} \rightarrow \text{Salt} + \text{Water}$$

For example, sodium hydroxide reacts with carbon dioxide to form sodium carbonate and water:

$$2NaOH + CO_2 \rightarrow Na_2CO_3 + H_2O$$