Q.1 What is the Arrhenius theory of acids and bases? Give examples.

Explanation:

According to Arrhenius theory:

- **Acid:** A substance that increases the concentration of H^+ (hydrogen) ions in aqueous solution.
  Example: $HCl \rightarrow H^+ + Cl^-$

- **Base:** A substance that increases the concentration of OH^- (hydroxide) ions in aqueous solution.
  Example: $NaOH \rightarrow Na^+ + OH^-$

This theory is limited to aqueous solutions and does not explain acid-base behavior in non-aqueous solvents.

Q.2 What is meant by water of crystallization?

Answer:

Water of crystallization is the **fixed number of water molecules** chemically bound to a salt's crystal lattice. It gives the salt its **shape and color**.

For example:

$CuSO_4 \cdot 5H_2O$ contains **five water molecules**. When heated, it loses this water and becomes white anhydrous $CuSO_4$.

This concept is essential in **quantitative chemistry** to determine the **formula of hydrates**, and in applications like **thermometers, dyes, and construction materials** where specific hydrated salts are used.

Q.3 Classify acids on the basis of basicity. Give examples.

Answer:

Acids are classified based on **basicity**, which is the number of hydrogen ions (H^+) that one molecule of an acid can donate in aqueous solution.

- **Monobasic acids** release one H^+ ion per molecule. Example: HCl, HNO_3

- **Dibasic acids** release two H^+ ions per molecule. Example: H_2SO_4, H_2CO_3

- **Tribasic acids** release three H^+ ions per molecule. Example: H_3PO_4
  This classification is important to understand the capacity of acids to neutralize bases and the volume of base required for complete neutralization in titration experiments.

Q.4 Define and give examples of strong and weak acids.

Answer:

Strong acids are acids that completely ionize in water to release H^+ ions, making them highly reactive and corrosive. Examples include hydrochloric acid (HCl), nitric acid (HNO_3), and sulfuric acid (H_2SO_4). These acids produce a high concentration of H^+ ions and have a low pH (close to 1).

Weak acids, on the other hand, partially ionize in water, producing fewer H^+ ions. They are less corrosive and less reactive. Examples include acetic acid (CH_3COOH), carbonic acid (H_2CO_3), and formic acid (HCOOH). Weak acids have higher pH values (between 4 and 6).

Q.5 What happens when acids react with metals? Write a balanced equation and explain.

Answer:

When acids react with metals, they generally produce **salt** and **hydrogen gas**. This is a **displacement reaction** in which the metal displaces hydrogen from the acid. For example:

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

Here, zinc reacts with hydrochloric acid to form zinc chloride and hydrogen gas. You can observe bubbles of hydrogen gas during the reaction. However, **not all metals** react this way. Highly unreactive metals like copper and silver do not react with dilute acids. This reaction is an important test to identify acids and reactive metals in chemistry.

Q.6 What are salts? How are they formed?

Answer:

Salts are **ionic compounds** formed by the **neutralization reaction** between an acid and a base. They consist of **positive metal ions** and **negative non-metal or acid radicals**.

For example:

$NaOH + HCl \rightarrow NaCl + H_2O$

Here, sodium chloride (NaCl) is a salt formed when NaOH (a base) reacts with HCl (an acid). Salts can be **neutral**, **acidic**, or **basic**, depending on the strength of the acid and base involved. Salts are essential in **food, agriculture, chemicals, and industry**.

Q.7 What is the reaction between bases and non-metal oxides? Give a balanced equation.

Answer:

Non-metal oxides are **acidic in nature**, and they react with bases to form **salt and water**. For example:

$CO_2 + Ca(OH)_2 \rightarrow CaCO_3 + H_2O$

Carbon dioxide, a non-metal oxide, reacts with calcium hydroxide (lime water) to form calcium carbonate (a white precipitate) and water. This reaction is used in the **limewater test for CO_2**. The formation of salt (calcium carbonate) and water shows that non-metal oxides are acidic, just as metal oxides are basic, and both can neutralize their counterparts.

Q.8 Describe the physical properties of acids.

Answer:

Acids have several common physical properties:

- They have a **sour taste**, like lemon juice or vinegar.
- They **turn blue litmus red**, indicating acidity.
- They are **corrosive**, especially strong acids like HCl and H_2SO_4.
- Most acids are **soluble in water** and conduct electricity due to the presence of free H^+ ions.
- Acids have a **pH less than 7**, with strong acids having a pH close to 1.

These properties help in identifying acids in laboratories and everyday products. However, due to corrosiveness, direct tasting or touching is dangerous.

Q.9 Write a brief note on neutralization reaction with a real-life example.

Answer:

A **neutralization reaction** occurs when an acid reacts with a base to form **salt and water**. This is an exothermic reaction. For example:

$HCl + NaOH \rightarrow NaCl + H_2O$

In real life, one common use of neutralization is in treating **acid indigestion**, where an antacid (like magnesium hydroxide) neutralizes excess stomach acid (HCl). Another example is the treatment of soil acidity using slaked lime ($Ca(OH)_2$). Such reactions are also used in water

treatment plants and industry to manage pH levels. These reactions are essential for maintaining environmental and biological balance.

Q.10 **Why is pH important in everyday life? Give at least two examples.**

Answer:

pH plays a crucial role in daily life.

1. **Stomach Health:** The stomach contains hydrochloric acid (pH ~1.5–3.5) for digestion. If acidity increases, antacids like magnesium hydroxide neutralize it by raising the pH.

2. **Oral Care:** Tooth decay occurs if the pH in the mouth drops below 5.5 due to bacterial acid, damaging the enamel. Brushing helps restore a safer pH.
   Thus, maintaining proper pH in biological systems and household products is vital for health and hygiene.