CBSE Class 10 Science: Chapter 2 – **Acids, Bases, and Salts**

Introduction

This chapter focuses on the properties of acids, bases, and salts, their reactions, and the process of salt formation. It also covers various concepts like pH, indicators, and real-life applications of acids, bases, and salts.

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1. Acids and Bases

1.1 Acids:

- **Definition:** Substances that release hydrogen ions (H^+) when dissolved in water.
- **Taste:** Sour
- **Examples:** Hydrochloric acid (HCl), Sulfuric acid (H_2SO_4), Citric acid (found in lemon), Acetic acid (found in vinegar).
- **Chemical Properties:**
  - Acids turn blue litmus red.
  - React with metals to form salt and hydrogen gas.
    - **Example:** $2HCl + Zn \rightarrow ZnCl_2 + H_2$

- React with metal carbonates and bicarbonates to form salt, water, and carbon dioxide.
  - **Example:** $HCl + NaHCO_3 \rightarrow NaCl + H_2O + CO_2$
- React with bases to form salt and water (neutralization reaction).
  - **Example:** $HCl + NaOH \rightarrow NaCl + H_2O$

1.2 Bases:

- **Definition:** Substances that release hydroxide ions (OH^-) when dissolved in water.
- **Taste:** Bitter and feel slippery to touch.
- **Examples:** Sodium hydroxide (NaOH), Potassium hydroxide (KOH), Ammonium hydroxide (NH_4OH).
- **Chemical Properties:**
  - Bases turn red litmus blue.
  - React with acids to form salt and water (neutralization reaction).
    - **Example:** $NaOH + HCl \rightarrow NaCl + H_2O$
  - Some bases are soluble in water and are known as alkalis (e.g., NaOH, KOH).

2. Indicators

- **Indicators** are substances used to test whether a solution is acidic or basic by changing color.
  - **Litmus:** Turns red in acid and blue in base.
  - **Phenolphthalein:** Colorless in acidic medium, pink in basic medium.
  - **Methyl orange:** Red in acidic medium, yellow in basic medium.

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3. The pH Scale

- **pH** measures the acidity or basicity of a solution. It ranges from 0 to 14.
  - **pH < 7:** Acidic
  - **pH = 7:** Neutral
  - **pH > 7:** Basic
- **Importance of pH in everyday life:**
  - **Plants and soil:** Most plants grow well in neutral to slightly acidic soils (pH 6-7).
  - **Human body:** Stomach acid (HCl) has a low pH (around 1.5-3.5) to aid digestion.
  - **Tooth decay:** Caused by acids formed by bacteria acting on sugary foods, lowering the pH in the mouth.

4. Salts

- **Definition:** Salts are ionic compounds formed from the neutralization reaction of an acid and a base.
- **Example:** Sodium chloride (NaCl), Potassium nitrate (KNO_3), Calcium sulfate ($CaSO_4$).

4.1 Types of Salts:

- **Normal salts:** Formed by the complete neutralization of an acid by a base. (e.g., NaCl)
- **Acidic salts:** Formed when a strong acid reacts with a weak base. (e.g., $NaHSO_4$)
- **Basic salts:** Formed when a weak acid reacts with a strong base. (e.g., Na_2CO_3)

4.2 Important Salts in Daily Life:

- **Sodium chloride (NaCl):** Common table salt used in food.
- **Baking soda ($NaHCO_3$):** Used in baking, as an antacid, and in fire extinguishers.
- **Washing soda ($Na_2CO_3.10H_2O$):** Used in laundry detergents and for softening hard water.
- **Plaster of Paris ($CaSO_4.½H_2O$):** Used in making casts, and for setting fractured bones.

5. Important Chemical Reactions

5.1 Neutralization Reaction:

- **Definition:** A reaction in which an acid reacts with a base to form salt and water.
  - **Example:** $HCl + NaOH \rightarrow NaCl + H_2O$

5.2 Reaction of Acids with Metals:

- **Reaction:** Acids react with active metals to form salt and hydrogen gas.
  - **Example:** $2HCl + Zn \rightarrow ZnCl_2 + H_2$

5.3 Reaction of Bases with Non-metal Oxides:

- **Reaction:** Bases react with non-metal oxides to form salt and water.
  - **Example:** $2NaOH + CO_2 \rightarrow Na_2CO_3 + H_2O$

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6. Water of Crystallization

- **Definition:** Water molecules that form part of the crystal structure of a salt.
- **Example:** Copper sulfate ($CuSO_4.5H_2O$) contains 5 molecules of water of crystallization, giving it a blue color. When heated, it loses water and turns white.

7. Importance of Acids, Bases, and Salts in Everyday Life

- **Acids:** Used in food (vinegar, lemon juice), in the stomach (HCl), and in industries (sulfuric acid for batteries).
- **Bases:** Used in soaps, detergents, and for neutralizing acidic soils.
- **Salts:** Used in food (NaCl), as preservatives, in medicines (antacids), and in various industrial processes.

Key Formulas:

- Neutralization reaction: $Acid + Base \rightarrow Salt + Water$
- Acid with metal: $Acid + Metal \rightarrow Salt + H_2$
- Base with non-metal oxide: $Base + Non-metal oxide \rightarrow Salt + Water$

Practice Questions:

1. What happens when an acid reacts with a metal? Write an equation for the reaction between zinc and hydrochloric acid.
2. How does the pH of soil affect plant growth?
3. Explain the importance of water of crystallization with an example.
4. Write the neutralization reaction between sulfuric acid and sodium hydroxide.
5. Describe the role of baking soda in baking and extinguishing fires.

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