

Class 10 Chemistry Chapter 1 Notes

Chemical Reactions and Equations

Comprehensive Study Material and Revision Notes

1 Introduction to Chemical Reactions

A **chemical reaction** is a process in which one or more substances (reactants) are converted to one or more different substances (products). During a chemical reaction, the original bonds break and new bonds form to create entirely new substances with different properties.

1.1 Characteristics of Chemical Reactions

You can determine if a chemical reaction has taken place by observing any of the following changes:

- **Change in State:** e.g., solid wax and oxygen gas yielding liquid water and carbon dioxide gas.
- **Change in Colour:** e.g., iron rusting (turns reddish-brown).
- **Evolution of a Gas:** e.g., zinc reacting with dilute sulphuric acid to release hydrogen gas.
- **Change in Temperature:** e.g., quicklime reacting with water (exothermic reaction).
- **Formation of a Precipitate:** e.g., mixing lead nitrate and potassium iodide yields a yellow precipitate of lead iodide.

2 Chemical Equations

A **chemical equation** is the symbolic representation of a chemical reaction using symbols and chemical formulas of the reactants and products.

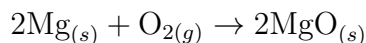
2.1 Word and Skeletal Equations

- **Word Equation:** Magnesium + Oxygen $\rightarrow$ Magnesium oxide
- **Skeletal Equation:** $\text{Mg} + \text{O}_2 \rightarrow \text{MgO}$ (An unbalanced equation is called a skeletal chemical equation).

2.2 Balanced Chemical Equations

According to the **Law of Conservation of Mass**, mass can neither be created nor destroyed in a chemical reaction. Therefore, the total mass of the elements present in the products must be equal to the total mass of the elements present in the reactants.

Balanced Equation Example:



Note: The physical states of reactants and products are often indicated as (s) for solid, (l) for liquid, (g) for gas, and (aq) for aqueous solution.

3 Types of Chemical Reactions

3.1 1. Combination Reaction

A reaction in which two or more reactants combine to form a single product.

- **General Form:** $A + B \rightarrow AB$
- **Example:** Burning of coal: $\text{C}_{(s)} + \text{O}_{2(g)} \rightarrow \text{CO}_{2(g)}$
- **Example:** Formation of slaked lime: $\text{CaO}_{(s)} + \text{H}_2\text{O}_{(l)} \rightarrow \text{Ca}(\text{OH})_{2(aq)} + \text{Heat}$

*Reactions in which heat is released along with the formation of products are called **exothermic chemical reactions**. (e.g., Respiration, combustion of natural gas).*

3.2 2. Decomposition Reaction

A reaction in which a single reactant breaks down to give simpler products. This requires energy in the form of heat, light, or electricity.

- **General Form:** $AB \rightarrow A + B$
- **Thermal Decomposition (using heat):**
 $\text{CaCO}_{3(s)} \xrightarrow{\text{Heat}} \text{CaO}_{(s)} + \text{CO}_{2(g)}$
- **Electrolytic Decomposition (using electricity):**
 $2\text{H}_2\text{O}_{(l)} \xrightarrow{\text{Electricity}} 2\text{H}_{2(g)} + \text{O}_{2(g)}$
- **Photolytic Decomposition (using light):**
 $2\text{AgCl}_{(s)} \xrightarrow{\text{Sunlight}} 2\text{Ag}_{(s)} + \text{Cl}_{2(g)}$
(This reaction is used in black and white photography).

*Reactions in which energy is absorbed are known as **endothermic reactions**.*

3.3 3. Displacement Reaction

A reaction in which a more reactive element displaces a less reactive element from its compound.

- **General Form:** $A + BC \rightarrow AC + B$
- **Example:** $\text{Fe}_{(s)} + \text{CuSO}_{4(aq)} \rightarrow \text{FeSO}_{4(aq)} + \text{Cu}_{(s)}$
(Iron displaces copper from copper sulphate solution because iron is more reactive than copper. The blue colour of copper sulphate fades to light green).

3.4 4. Double Displacement Reaction

A reaction in which there is an exchange of ions between the reactants.

- **General Form:** $AB + CD \rightarrow AD + CB$
- **Example:** $\text{Na}_2\text{SO}_{4(aq)} + \text{BaCl}_{2(aq)} \rightarrow \text{BaSO}_{4(s)} + 2\text{NaCl}_{(aq)}$

*Any reaction that produces a precipitate (an insoluble solid) can be called a **precipitation reaction**.*

3.5 5. Oxidation and Reduction (Redox Reactions)

- **Oxidation:** The addition of oxygen to a substance or the removal of hydrogen from a substance.
- **Reduction:** The addition of hydrogen to a substance or the removal of oxygen from a substance.
- **Redox Reaction:** A reaction in which one reactant gets oxidized while the other gets reduced.

Example:



Here, CuO is reduced to Cu, and H₂ is oxidized to H₂O.

4 Effects of Oxidation Reactions in Everyday Life

4.1 Corrosion

When a metal is attacked by substances around it such as moisture, acids, etc., it is said to corrode, and this process is called corrosion.

- **Examples:** The black coating on silver, the green coating on copper, and the rusting of iron.
- **Prevention:** Painting, oiling, greasing, galvanizing (coating with zinc), chrome plating, anodizing, or making alloys.

4.2 Rancidity

When fats and oils are oxidized, they become rancid, and their smell and taste change.

- **Prevention:**

1. Adding antioxidants to foods containing fats and oils.
2. Storing food in air-tight containers to slow down oxidation.
3. Flushing bags of chips with an unreactive gas like nitrogen to prevent the oil from getting oxidized.

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