



Class 10<sup>th</sup>

## CHEMISTRY

### CHEMICAL REACTIONS AND EQUATIONS

A matter can undergo two types of changes:

#### 1. Physical Change

Physical changes only involve the change in physical characteristics of the substance like physical state (solid, liquid, gas), shape, colour etc. There is no formation of new substances.

Example: Melting of ice, boiling of water

#### 2. Chemical Change

Chemical changes involve a chemical reaction in which the formation of new substances takes place.

Example: Burning of coal, burning of magnesium ribbon in air

**Chemical equation:** A chemical reaction is represented by a chemical equation.

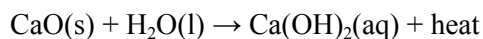
Example:  $2\text{Mg(s)} + \text{O}_2\text{(g)} \rightarrow \text{MgO(s)}$

**Balanced chemical equation:** In a balanced chemical equation number of each atom should be equal in both product and reactant sides.

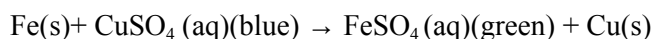
Example:  $3\text{Fe(s)} + 4\text{H}_2\text{O(g)} \rightarrow \text{Fe}_3\text{O}_4\text{(s)} + 4\text{H}_2\text{(g)}$

**Characteristics of a chemical reaction:**

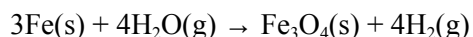
- **Change in state**



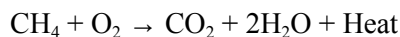
- **Change in colour**



- **Evolution of a gas**



- **Change in temperature**



**Types of chemical reactions:**

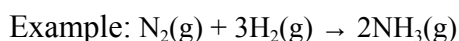
#### 1. Combination reaction:

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

Example:  $\text{CaO(s)} + \text{H}_2\text{O(l)} \rightarrow \text{Ca(OH)}_2\text{(aq)} + \text{heat}$

**Types of combination reactions:**

A. **Element-Element combination reaction:** A reaction in which an element combines with another element to form a compound.



B. **Element-Compound combination reaction:** A reaction in which an element combines with a compound to form a new substance.



Example:  $\text{SO}_2(\text{g}) + \text{O}_2(\text{g}) \rightarrow \text{SO}_3(\text{g})$

**C. Compound-Compound Combination reaction:** A reaction in which a compound combines with another compound to form a new substance.

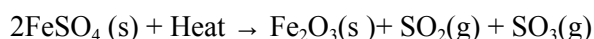
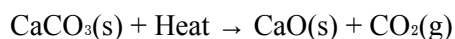
Example:  $\text{CaO}(\text{s}) + \text{H}_2\text{O}(\text{l}) \rightarrow \text{Ca}(\text{OH})_2(\text{aq}) + \text{Heat}$

## 2. Decomposition reaction:

A reaction in which a single reactant decomposes into different products due to the effect of heat, light and electricity.

**A. Thermal decomposition:** Thermal decomposition takes place in the presence of heat.

Example:  $2\text{Pb}(\text{NO}_3)_2 + \text{Heat} \rightarrow 2\text{PbO} + 4\text{NO}_2 + \text{O}_2$



**B. Photolytic decomposition:** Photolytic decomposition takes place in the presence of sunlight.

Example:  $2\text{AgCl} + \text{sunlight} \rightarrow 2\text{Ag} + \text{Cl}_2$



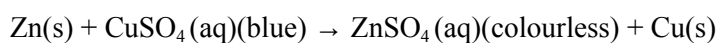
These reactions are used in black and white photography.

**C. Electrolytic decomposition:** Electrolytic decomposition takes place in the presence of electricity.

Example:  $2\text{H}_2\text{O} + \text{electricity} \rightarrow 2\text{H}_2 + \text{O}_2$

**3. Displacement reaction:** A reaction in which a more reactive element displaces a less reactive element from its compound.

Example:  $\text{Fe}(\text{s}) + \text{CuSO}_4(\text{aq})(\text{blue}) \rightarrow \text{FeSO}_4(\text{aq})(\text{green}) + \text{Cu}(\text{s})$



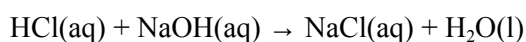
**4. Double displacement reaction:** The reactions in which the exchange of ions takes place between reactants are called double displacement reactions.

Example:  $\text{Na}_2\text{SO}_4(\text{aq}) + \text{BaCl}_2(\text{aq}) \rightarrow \text{BaSO}_4(\text{white ppt}) + 2\text{NaCl}(\text{aq})$



**Types of double displacement reactions:**

**A. Neutralization reaction:** A reaction in which acids and bases are neutralised by each other.



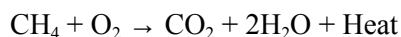
**B. Precipitation reaction:** A reaction in which an insoluble precipitate is formed.



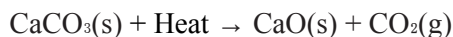
**Other important reactions:**



1. **Exothermic reaction:** A reaction in which heat is released or produced during the reaction.



2. **Endothermic reaction:** Reaction in which heat is absorbed.



3. **Redox reactions:** A reaction in which both reduction and oxidation take place simultaneously is called a redox reaction.

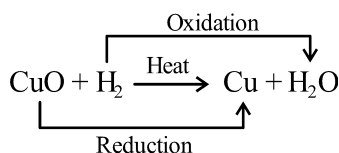
**Oxidation:**

- a. Addition of oxygen
- b. Removal of hydrogen
- c. Addition of electronegative element
- d. Increase in oxidation number

**Reduction:**

- a. Addition of hydrogen
- b. Removal of oxygen
- c. Addition of electropositive element
- d. Decrease in oxidation number

Example of redox reaction:

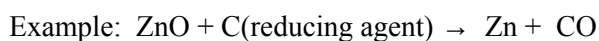


**Oxidizing and Reducing agents:**

Oxidising agent: A substance which oxidises other substances and reduces itself.



Reducing agent: A substance which reduces other substances and oxidises itself.



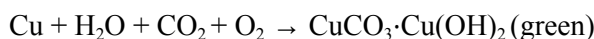
**Corrosion:**

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.

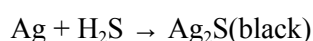
Iron gets corroded in the presence of air and moisture by forming hydrated ferric oxide which is a reddish brown colour substance.  $4\text{Fe} + 3\text{O}_2 + x.\text{H}_2\text{O} \rightarrow 2\text{Fe}_2\text{O}_3.x\text{H}_2\text{O}$

Other examples:

1. Copper acquires a green coating of basic copper carbonate when it is exposed to air and moisture.



2. Silver also gets corroded in the air to form a black coating of silver sulphide.



**Rancidity:**



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When fats and oils are oxidised, they become rancid and their smell and taste change. Antioxidants are added to foods containing fats and oils. Keeping food in airtight containers helps to slow down oxidation. Chips manufacturers usually flush bags of chips with gas such as nitrogen to prevent the chips from getting oxidised.