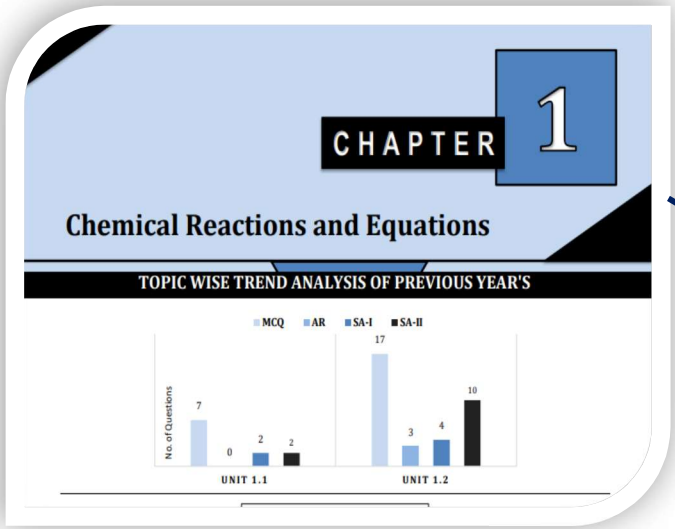
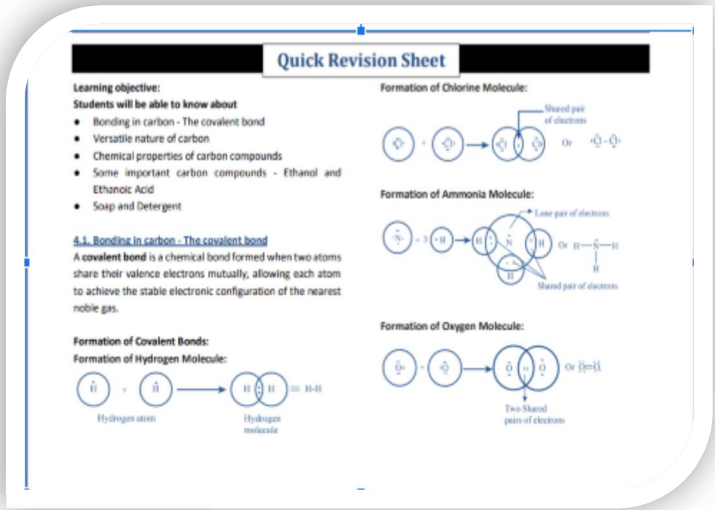
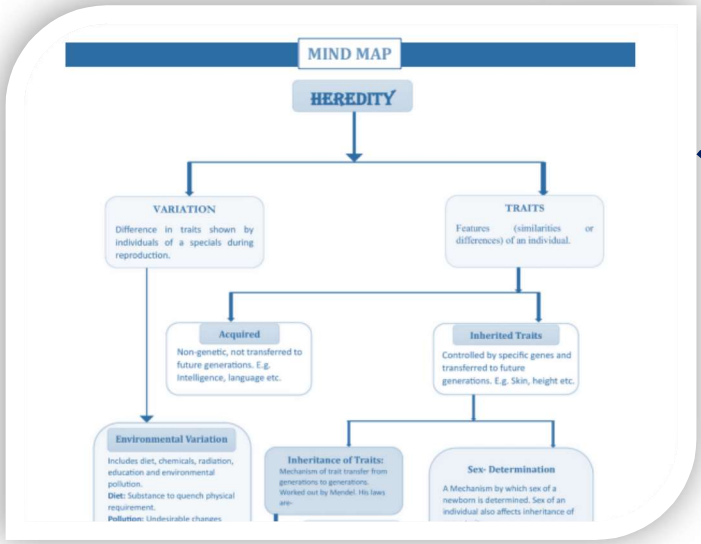
Highlights of the CBSE Science Book



CBSE Question Trend Analysis by Topic: Understand the Patterns in Frequently Asked Questions.

Quick Revision Notes: Essential Chapter Points and Summaries for Quick Recall.





Mind Map: A Visual Tool to Connect and Recall Key Concepts Efficiently.

PREVIOUS YEAR EXAM QUESTIONS

Unit 9.1: Reflection of Light, Images Formed by Spherical Mirrors

Multiple Choice Questions (MCQ) (1 Mark)

(2016 Outside Delhi Term-II)

1. **To determine the approximate value of the focal length of a given concave mirror, you focus the image of a distance object formed by the mirror on a screen. The image obtained on the screen, as compared to the object is always: *(An)***
   (a) Laterally inverted and diminished
   (b) Inverted and diminished
   (c) Erect and diminished
   (d) Erect and highly diminished

(2016 Outside Delhi Term-II)

2. **In your laboratory you trace the path of light rays through a glass slab for different values of angle of incidence ($\angle i$) and in each case measure the values of the corresponding angle of refraction ($\angle r$) and angle of emergence ($\angle e$).On the basis of your observations your correct conclusion is: *(An)***
   (a) $\angle i$ is more than $\angle r$, but nearly equal to $\angle e$
   (b) $\angle i$ is less than $\angle r$, but nearly equal to $\angle e$
   (c) $\angle i$ is more than $\angle e$, but nearly equal to $\angle r$
   (d) $\angle i$ is less than $\angle e$, but nearly equal to $\angle r$

(2020 Delhi)

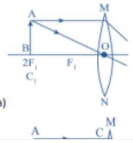
4. **When an object is kept within the focus of a concave mirror, an enlarged image is formed behind the mirror. This image is:**
   (a) Real (b) Inverted
   (c) Virtual and inverted (d) Virtual and erect

(2022 Outside Delhi)

5. **In which of the following is a concave mirror used? *(Re)***
   (a) A solar cooker
   (b) A rear view mirror in vehicles
   (c) A safety mirror in shopping malls
   (d) In viewing full size image of distant tall buildings.

(2022 Delhi)

6. **A student wants to obtain magnified image of an object *AB* as on a screen. Which one of the following arrangements shows the correct position of AB for him/her to be successful? *(An)***



(a)

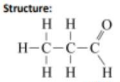
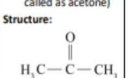
CBSE Previous Year Questions: Detailed Chapterwise and Topicwise Breakdown with Cognitive Level Tagging for the Last 10 Years.

unit, usually $-CH_2$, which increases the molecular size step by step. All members have similar chemical properties. Examples include alkanes, alkenes, and alkynes. **(1 Mark)**

(ii) The melting and boiling points of butene (C_4H_8) are higher than those of propene (C_3H_6) and ethene (C_2H_4) because butene has a greater molecular mass and a longer carbon chain. This leads to stronger intermolecular forces, which require more energy to overcome. **(1 Mark)**

(iii) In a homologous series, all members have the same functional group, which gives them similar chemical properties. This functional group has a stronger influence on chemical behaviour than the slight changes in molecular size, so there is no noticeable change in chemical properties across the series. **(1 Mark)**

(iv)

(i) Aldehyde:	(ii) Ketone:
Name: Propanol **Structure:** 	**Name:** Propanone (also called as acetone) **Structure:** 
(1 Mark)	**(1 Mark)**

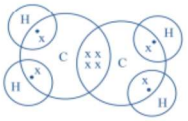
(1 Mark)

Concentrated sulphuric acid acts as a dehydrating agent, removing water from ethanol.

(½ Mark)

[NCERT, Ch-4, Pg. no. 72]

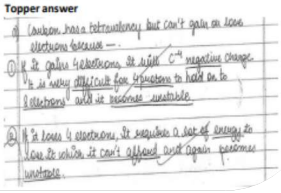
(iii) The hydrocarbon formed is called ethene. Its electron dot structure is:



(1 ½ Mark)

[NCERT, Ch-4, Pg. no. 64]

4. **Answer: (a) (i)**
   Topper answer



Toppers' Answer: Real Exam Responses for Effective Learning and Insight.

Answer:

Human beings have two types of germ cells: the male gamete (sperm) and the female gamete (ovum). **(1 Mark)**

Feature	Male Gamete (Sperm)	Female Gamete (Ovum)
Size	Smaller in size	Larger in size
Movement	Motile (can move)	Non-motile (cannot move)
Nutrient Stores	Contains little to no nutrient stores	Contains nutrient stores for embryo development

(1 Mark)

[NCERT, Ch-7, Pg. no. 121-123]

Commonly made mistake

Students often confuse **germ cells** with **somatic cells**, or fail to specify the type of germ cell, leading to incomplete answers.

Expert tip

Clearly define the types of germ cells, e.g., **sperm** and **egg**, and list their distinct structural differences such as size and the presence of specific organelles in a **tabular form**. Use **bullet points** for clarity.

embryo. **(1 Mark)**

(b) Changes in the uterus when the female gamete (egg) is not fertilized: If the egg is not fertilized, the hormone levels in the body decrease, causing the thickened uterine lining (endometrium) to break down and shed through the vagina. This process is called menstruation, and it marks the beginning of a new menstrual cycle. **(2 Mark)**

[NCERT, Ch - 7, Pg. no. 124]

3. **Answer:**
   Reproduction is very important in living beings because:
   - Continuation of species – It helps living organisms produce new individuals so that their species does not disappear. **(1 Mark)**
   - Genetic variation – It brings small changes in the characters of organisms, especially through sexual reproduction, which helps in diversity. **(1 Mark)**
   - Evolution – These variations, over time, lead to the development of new species and support evolution. **(1 Mark)**

   [NCERT, Ch- 7, Pg. no. 113,114]

4. **Answer:**
   Three techniques developed to prevent pregnancy are:
   - **Condoms** – A barrier method that stops sperm from reaching the egg.
   - **Sterilisation** – A surgical method that makes a person unable to reproduce.
   - **Intrauterine Devices (IUDs)** – Small T-shaped dev...

Common Mistakes and Expert Tips: Avoid Pitfalls and Enhance Your Performance.

CONTENTS

SCIENCE

Chapter 1 Chemical Reaction and Equation 1

Unit 1.1: Chemical Equation 8

Unit 1.2: Type of Chemical Reaction 10

Chapter 2 Acid, Bases and Salts 18

Unit 2.1: Acid and Bases 23

Unit 2.2: Salt, Their property and uses 31

Chapter 3 Metals and Non-Metals 36

Unit 3.1: Properties of Metals and Non-Metal 42

Unit 3.2: Ionic Compounds, Metallurgy and Corrosion 50

Chapter 4 Carbon and Its Compounds 53

Unit 4.1: Carbon and Its Properties,Homologous Series 61

Unit 4.2: Ethanol, Ethanoic Acid, Soaps and Detergents 72

Chapter 5 Life Processes 78

Unit 5.1: Nutrition 86

Unit 5.2: Respiration 90

Unit 5.3: Circulation and Transportation 96

Unit 5.4: Excretion 98

Chapter 6 Control and Co-ordination in Animal and Plant 102

Unit 6.1: Control and Co-Ordination in Plant 109

Unit 6.2: Control and Co-Ordination in Animal 111

Chapter 7 Reproduction 117

Unit 7.1: Asexual Reproduction and Vegetative Propagation 126

Unit 7.2: Sexual Reproduction in Plants 131
Unit 7.3: Reproduction in Human Being 135

Chapter 8 Heredity and Evolution ***142***
Unit 8.1: Accumulation of Variation during Reproduction 149
Unit 8.2: Heredity 150

Chapter 9 Light- Reflection and Refraction ***159***
Unit 9.1: Reflection of Light, Images Formed by Spherial Mirrors 166
Unit 9.2: Refraction, Lenses and Power of Lens 181

Chapter 10 Human Eye and Colourful Word ***191***
Unit 10.1: Human Eye, Defects of Vision and Corrections 197
Unit 10.2: Refraction of Light Through prism, Dispersion of Light and scattering of Light 203

Chapter 11 Electricity ***209***
Unit 11.1: Electric Current, Potential Difference, Resistance, Ohm's law 215
Unit 11.2: Resistance Combination, Heating Effect of Electric Current, Electric Power 223

Chapter 12 Magnetic Effects of Electric Current ***231***
Unit 12.1: Magnetic Effects of Electric current 235
Unit 12.2: AC, DC and Domestic Electric Circuits 240

Chapter 13 Our Environment ***247***
Unit 13.1: Ecosystem and Food Chain 251
Unit 13.2: Biodegradable and NonBiodegradable Substances and Global Warming 255

Chapter 14 Out of Syllabus ***259***

TREND ANALYSIS (2016-2025)

No. of Questions Asked in Previous Exams

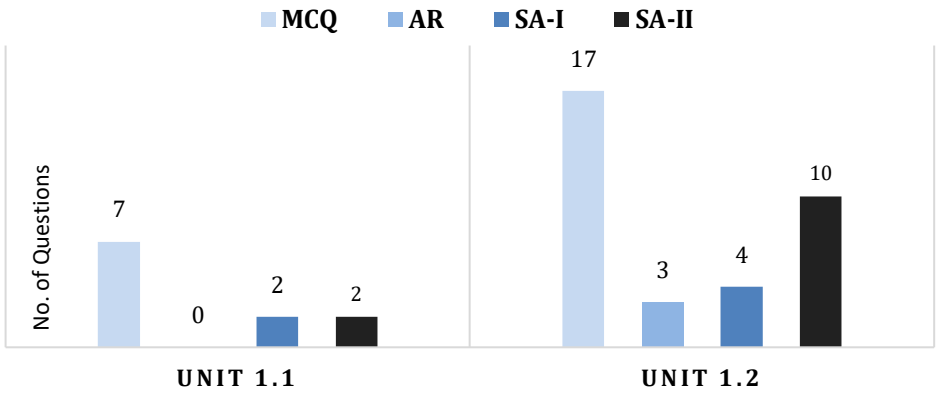
SCIENCE		2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Chapter 1 Chemical Reaction and Equation											
Unit 1.1:	Chemical Equation	-	-	1	-	-	-	3	2	-	5
Unit 1.2:	Type of Chemical Reaction	3	-	1	3	1	-	10	7	8	1
Chapter 2 Acid, Bases and Salts											
Unit 2.1:	Acid and Bases	5	-	-	3	1	-	9	9	3	3
Unit 2.2:	Salt, Their property and uses	-	-	1	1	1	-	4	3	3	2
Chapter 3 Metals and Non-Metals											
Unit 3.1:	Properties of Metals and Non-Metal	4	-	2	5	-	-	5	2	7	5
Unit 3.2:	Ionic Compounds, Metallurgy and Corrosion	-	-	-	-	1	-	1	1	2	1
Chapter 4 Carbon and Its Compounds											
Unit 4.1:	Carbon and Its Properties,Homologous Series	3	11	1	5	2	-	3	3	4	4
Unit 4.2:	Ethanol, Ethanoic Acid, Soaps and Detergents	6	5	1	1	1	-	1	2	-	1
Chapter 5 Life Processes											
Unit 5.1:	Nutrition	4	-	1	1	-	-	4	5	2	2
Unit 5.2:	Respiration	1	-	-	5	-	-	9	3	4	1
Unit 5.3:	Circulation and Transportation	1	-	1	-	-	-	2	1	1	2
Unit 5.4:	Excretion	-	-	1	-	1	-	2	3	1	3
Chapter 6 Control and Co-ordination in Animal and Plant											
Unit 6.1:	Control and Co-Ordination in Plant	2	-	-	2	-	-	-	3	-	1
Unit 6.2:	Control and Co-Ordination in Animal	2		2	1			1	2	5	5
Chapter 7 Reproduction											
Unit 7.1:	Asexual Reproduction and Vegetative Propagation	2	5	2	2	-	-	1	-	4	2
Unit 7.2:	Sexual Reproduction in Plants	2	2	-	3	-	-	3	1	1	4
Unit 7.3:	Reproduction in Human Being	2	7	1	1	1	-	2	2	1	2

Chapter 8 Heredity and Evolution											
Unit 8.1:	Accumulation of Variation during Reproduction	-	-	-	-	-	-	1	1	-	1
Unit 8.2:	Heredity	1	2	1	2	-	-	3	5	5	4
Chapter 9 Light- Reflection and Refraction											
Unit 9.1:	Reflection of Light, Images Formed by Spherial Mirrors	7	5	1	3	2	-	13	3	4	4
Unit 9.2:	Refraction, Lenses and Power of Lens	4	7	2	3	-	-	5	2	2	2
Chapter 10 Human Eye and Colourful Word											
Unit 10.1:	Human Eye, Defects of Vision and Corrections	-	4	1	3	1	-	-	2	4	3
Unit 10.2:	Refraction of Light Through prism, Dispersion of Light and scattering of Light	2	4	1	2	-	-	5	3	1	4
Chapter 11 Electricity											
Unit 11.1:	Electric Current, Potential Difference, Resistance, Ohm's law	4	-	1	7	1	-	4	6	1	4
Unit 11.2:	Resistance Combination, Heating Effect of Electric Current, Electric Power	4	-	3	1	-	-	5	1	5	3
Chapter 12 Magnetic Effects of Electric Current											
Unit 12.1:	Magnetic Effects of Electric current	1	-	1	2	-	-	2	5	4	4
Unit 12.2:	AC, DC and Domestic Electric Circuits	2	-	-	1	-	-	3	3	3	1
Chapter 13 Our Environment											
Unit 13.1:	Ecosystem and Food Chain	-	2	-	-	-	-	2	2	4	3
Unit 13.2:	Biodegradable and NonBiodegradable Substances and Global Warming	2	1	-	2	1	-	1	2	2	3
Chapter 14 Out of Syllabus											
	Out of Syllabus	10	16	6	8	-	-	13	-	-	-

CHAPTER 1

Chemical Reactions and Equations

TOPIC WISE TREND ANALYSIS OF PREVIOUS YEAR'S



Quick Revision Sheet

1. Chemical Reactions & equations

Learning objectives:

What students will be able to learn about -

- **Chemical Reactions**: Understand physical vs. chemical changes and identify signs like color change, gas evolution, or precipitate formation.
- **Balancing Equations**: Learn to write balanced chemical equations, ensuring the Law of Conservation of Mass.
- **Reaction Types**: Study combination, decomposition, displacement, double displacement, and redox reactions.
- **Applications**: Explore examples like respiration, corrosion, combustion, neutralization, and electrolysis.
- **Redox Reactions**: Grasp oxidation and reduction processes in metal extraction and corrosion.
- **Daily Life Effects**: Understand corrosion and rancidity prevention, and the role of exothermic and endothermic reactions in industry and biology.

Physical change: Alters physical properties only; no new substance forms. Usually reversible. *Examples:* melting wax, boiling water.

Chemical change: Produces new substances with different properties. Generally irreversible. *Examples:* fermentation, cooking, respiration, digestion.

A chemical reaction is a molecular-level process where reactants turn into products with new properties by breaking old bonds and forming new ones. The types and numbers of atoms are conserved, consistent with the law of conservation of mass.

Example - When magnesium ribbon burns, it reacts with oxygen in the air, producing a white powder called magnesium oxide.

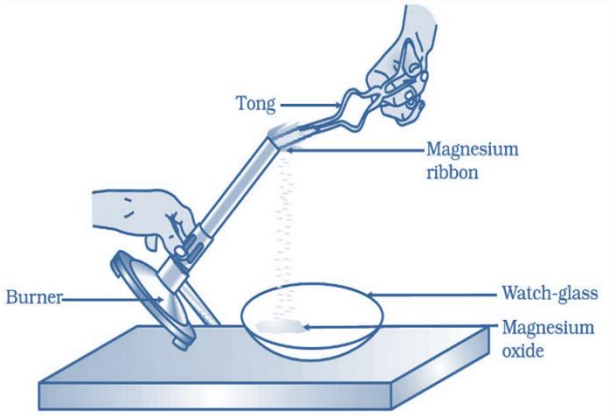


Figure
Burning of a magnesium ribbon in air and collection of magnesium oxide in a watch-glass

2Mg	**+**	**O_2**	**→**	**2MgO**
Magnesium	+ Oxygen (air)		→ Magnesium Oxide (white powder)	

In this reaction, magnesium and oxygen are the reactants, and magnesium oxide is the product. This reaction involves breaking bonds in reactants and forming new bonds in products, e.g., burning magnesium in air.

Chemical reactions can be identified by observable changes, such as:

1. **Change in Colour** - Indicates the formation of a new substance, e.g., rusting of iron forms reddish-brown iron oxide.
2. **Change in Temperature** - Heat may be absorbed (endothermic) or released (exothermic) during a reaction.
3. **Evolution of Gas -** Formation of gas, often seen as bubbles, e.g., mixing baking soda with vinegar produces carbon dioxide.
4. **Formation of Precipitate** - A solid forms in a solution, e.g., mixing silver nitrate and sodium chloride forms white silver chloride.

Mnemonics

Mnemonic: CTGP
Interpretation:
C - Colour
T - Temperature
G - Gas
P – Precipitation

1.1 Introduction to Chemical Equations

A chemical equation uses symbols and formulas to show a reaction: reactants (LHS) transform into products (RHS), with an arrow indicating the direction.

Example:

Carbon + Oxygen → Carbon dioxide - **Word equation**

C + O_2 → CO_2 - **Chemical equation**

Reactant Product

1.1.1. Writing a Chemical Equation:

A chemical equation concisely shows a reaction with symbols/formulas: reactants on the LHS, products on the RHS, an arrow (→) indicating direction, and plus signs (+) separating multiple species; physical states may be included.

To write one:

1. Put reactants on the LHS and products on the RHS.
2. Place → between them; use + to separate multiple reactants/products.
3. Optionally add physical states.

A **skeletal equation s**hows only reactant and product formulas; balancing adds coefficients so atom counts match on both sides (conservation of mass).

Example –

$Fe + O_2 \rightarrow Fe_2O_3$

This equation shows iron reacting with oxygen to create iron(III) oxide. However, it's incorrect because the number of iron and oxygen atoms isn't the same on both sides of the equation.

1.1.2. Balanced Chemical Equations:

A balanced chemical equation has equal numbers of each element's atoms on both sides, satisfying conservation of mass.

$2H_2 + O_2 \rightarrow 2H_2O$ Here are 4 hydrogen atoms and 2 oxygen atoms on both sides of the equation, so it is balanced.

Step 1: Box the formulas: Write reactants → products, then draw boxes around each formula so you only change coefficients (not the formulas) while balancing.

Example:

Unbalanced equation: $Fe + H_2O \rightarrow Fe_3O_4 + H_2$

After boxing:

Step 2: List the Number of Atoms:- From the skeletal equation, list each element and count its atoms on both sides (reactants vs. products) to identify imbalances.

Example (Unbalanced Equation): $Fe + H_2O \rightarrow Fe_3O_4 + H_2$

Count of Atoms:

Element	Number of atoms in Reactants (LHS)	Number of atoms in Products (RHS)
Fe	1	3
H	2	2
O	1	4

Step 3: Identify the element with the highest atom count and balance its quantity - To balance an equation, start with the compound containing the most atoms. Focus on the element with the highest count. For example, in Fe + H_2O → Fe_3O_4 + H_2, balance oxygen first:

(i) Count oxygen atoms:
On LHS: Oxygen is in H_2O (1 atom).
On RHS: Oxygen is in Fe_3O_4 (4 atoms).
Multiply H_2O by 4 to balance oxygen:

(ii) Adjusted coefficients to balance oxygen: Fe + $4H_2O$ → Fe_3O_4 + H_2

(iii) Ensure formulas stay unchanged, modify only coefficients.
This creates a partially balanced equation, with oxygen balanced. Tackle one element at a time, prioritizing complex compounds.

Step 4: Balance second element (Hydrogen Atoms):

- In the partially balanced equation from Step III, the hydrogen atoms are examined.
  Fe + $4H_2O$ → Fe_3O_4 + H_2
- To balance the hydrogen atoms, adjust the coefficient of the hydrogen molecule (H_2) on the right-hand side (RHS).
  Count hydrogen atoms:
  LHS: 8 (from $4H_2O$).
  RHS: 2 (from H_2).
  Multiply the coefficient of H_2 on the RHS by 4 to balance:
  Fe + $4H_2O$ → Fe_3O_4 + $4H_2$
  Hydrogen is now balanced with 8 atoms on each side.

Step 5: Balance the Remaining Element:

- Identify the remaining element that is not balanced.
  Fe + $4H_2O$ → Fe_3O_4 + $4H_2$
- Adjust its coefficient to ensure the same number of atoms on both sides.
  Count Fe atoms:
- LHS: 1
- RHS: 3 (from Fe_3O_4)
- Multiply Fe on the LHS by 3 to balance:
  3Fe + $4H_2O$ → Fe_3O_4 + $4H_2$
  After this step, the equation becomes fully balanced

Step 6: Ensure the equation is balanced -

- **Check for Balance**: Verify that the number of atoms for each element is the same on both sides of the equation.
- **Recount Atoms**: Confirm each element's count matches.
  3Fe + $4H_2O$ → Fe_3O_4 + $4H_2$
  Iron (Fe): 3 = 3
  Oxygen (O): 4 = 4
  Hydrogen (H): 8 = 8
- **Finalize**: Once verified, the equation is balanced.
  Ensures accuracy and compliance with the Law of Conservation of Mass. This is achieved through the hit-and-trial method.

Step 7: Adding Physical States to the Equation:

- In the final step, the physical states of reactants and products are mentioned in the equation to make it more informative.
- The physical states are represented using the following notations:
  (s): Solid
  (l): Liquid
  (g): Gas
  (aq): Aqueous (dissolved in water)
  3Fe(s) + $4H_2O$ (g) → Fe_3O_4(s) + $4H_2$(g)
- Here, H_2O(g) indicates water is in the gaseous state (steam).
  Specify Conditions: Indicate temperature, pressure, or catalysts above/below the reaction arrow.
  Example - CO(g) +$2H_2$(g) $\xrightarrow{340\ atm,\ catalyst}$ CH_3OH(l)
  Adding states and conditions clarifies the reaction's nature and environment, making the equation complete and scientifically precise

1.2 Types of chemical reaction

1.2.1. Combination Reaction:

A chemical reaction where two or more substances combine to form a single product. General representation - dA + B → AB

- Multiple reactants form one product. Often exothermic, releasing heat.
  Examples:

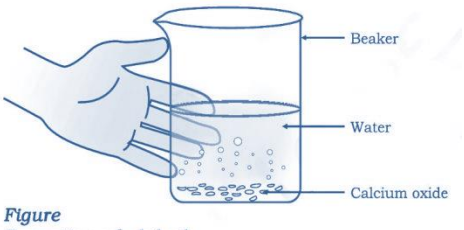


Figure
Formation of slaked lime by the reaction of calcium oxide with water

- Reaction between calcium oxide and water forming slaked lime: $CaO(s) + H_2O(l) \rightarrow Ca(OH)_2(aq) + Heat$
- Formation of carbon dioxide by burning coal: $C(s) + O_2(g) \rightarrow CO_2(g)$
- Formation of water: $2H_2(g) + O_2(g) \rightarrow 2H_2O(l)$

Applications:

- **Slaked lime production -** Used for whitewashing walls.
- **Burning of fuels -** Combustion of carbon-based fuels is a combination reaction.

1.2.2. Decomposition reaction:

Single reactant breaks down into two or more simpler products. General representation: AB ⟶ A + B (often needs energy)

Usually endothermic (energy in to break bonds) and is the opposite of combination reactions.

Types of Decomposition Reactions:

(i) Thermal Decomposition: Breakdown of a compound using heat. Example:

Calcium carbonate decomposes into quicklime and carbon dioxide - $CaCO_3(s) \rightarrow$Heat $CaO(s)+CO_2(g)$

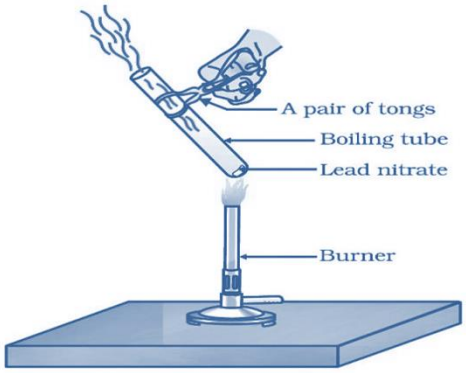


Figure
Heating of lead nitrate and emission of nitrogen dioxide

(ii) Electrolytic Decomposition: Breakdown of a compound using electricity. Example: Electrolysis of water produces hydrogen and oxygen gases - $2H_2O(l) \rightarrow$Electricity $2H_2(g)+O_2(g)$

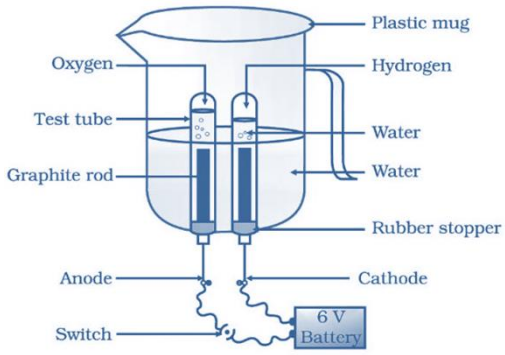


Figure
Electrolysis of water

(iii) Photo Decomposition: Breakdown of a compound using light. Example: Silver chloride decomposes to form silver and chlorine - $2AgCl(s) \rightarrow$Sunlight $2Ag(s) + Cl_2(g)$

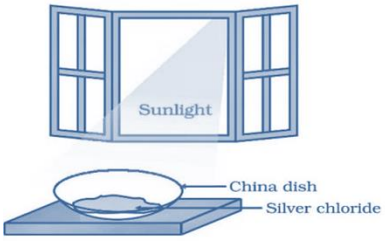


Figure
Silver chloride turns grey in sunlight to form silver metal

Applications:

- **Thermal decomposition** is used in the production of quicklime for cement industries.
- **Electrolysis** is used in water splitting and extraction of metals.
- **Photo decomposition** is essential in photographic processes.

1.2.3 Displacement reaction:

A more reactive element replaces a less reactive one in a compound. General representation - $A + BC \rightarrow AC + B$ (element A displaces B from compound BC to form AC.)

- Single displacement occurs when one element replaces another in a compound. The reactivity series determines which element can replace another. More reactive elements displace less reactive ones. For example, zinc can displace copper but not calcium. These reactions often involve metals with salts or acids.

Examples:

- Reaction between iron and copper sulfate: $Fe(s) + CuSO_4(aq) \rightarrow FeSO_4(aq) + Cu(s)$
  (Iron displaces copper because it is more reactive.)
- Reaction between zinc and hydrochloric acid: $Zn(s) + 2HCl(aq) \rightarrow ZnCl_2(aq) + H_2(g)$
  (Zinc displaces hydrogen, producing hydrogen gas.)

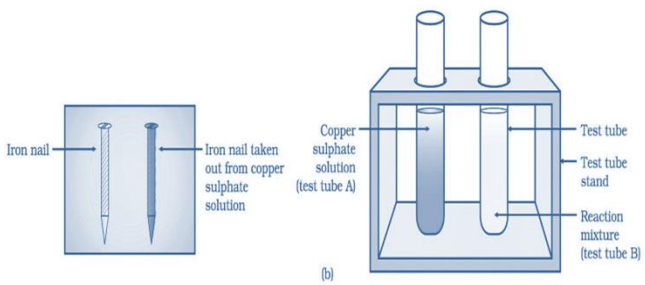


Figure *Iron nails and copper sulphate solutions compared before and after the experiment*

Applications:

- Extraction of metals: Displacement reactions are used in metallurgy to extract metals from their compounds.
- Chemical tests: Used to identify reactivity and properties of elements.

  Observation in Experiments: A color change or metal deposition is often seen in displacement reactions. Example: Iron nails in blue copper sulfate turn the solution green (iron sulfate forms), and copper deposits on the nails.

1.2.4 Double displacement reaction:

Two compounds swap ions. It's driven by forming a precipitate, a gas, or water (neutralization). General representation – AB + CD → AD + CB (The ions swap partners to create two new compounds)

- Ion exchange between reactants can form an insoluble precipitate or release a gas. This is often marked by a state change (solid or gas) or a color change due to new compounds forming.

Examples:

- **Formation of a precipitate**:
  $Na_2SO_4(aq) + BaCl_2(aq) \rightarrow BaSO_4(s) + 2NaCl(aq)$
  (Sodium sulfate reacts with barium chloride to form a white precipitate of barium sulfate and sodium chloride in solution.)
- **Neutralization reaction**:
  $HCl(aq) + NaOH(aq) \rightarrow NaCl(aq) + H_2O(l)$
  (Hydrochloric acid reacts with sodium hydroxide to form sodium chloride and water.)

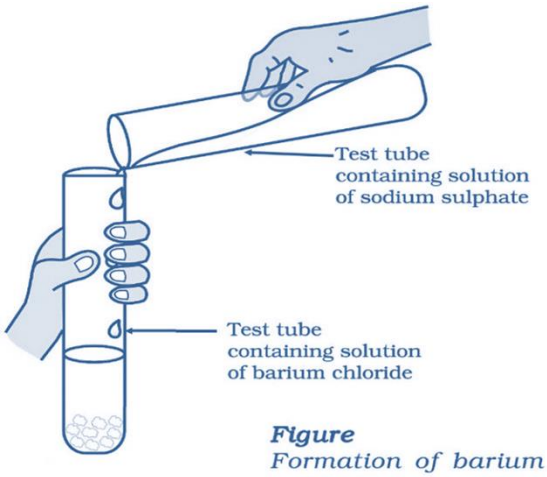


Figure
Formation of barium sulphate and sodium chloride

Applications:

- Precipitation reactions are used in qualitative analysis to identify ions.
- Neutralization reactions are used in everyday tasks like treating acidity.

Observation in Experiments: Mixing solutions that form a precipitate indicates a double displacement reaction, like Calcium chloride ($CaCl_2$) reacts with sodium carbonate (Na_2CO_3) to form calcium carbonate ($CaCO_3$)

1.2.5. Oxidation & Reduction reaction:

- **Oxidation -** A chemical process where a substance gains oxygen or loses hydrogen during a reaction.
- **Reduction -** A chemical process where a substance loses oxygen or gains hydrogen during a reaction.
- **Redox reaction -** Involve simultaneous oxidation and reduction reactions, where one reactant is oxidized, and the other is reduced.

Examples:

- **Oxidation of Copper**: $2Cu(s) + O2(g) \xrightarrow{Heat} 2CuO(s)$ (Copper gains oxygen to form copper oxide.)
- **Reduction of Copper Oxide**: $CuO(s) + H2(g) \xrightarrow{Heat} Cu(s) + H2O(l)$ (Copper oxide loses oxygen to form copper, and hydrogen gains oxygen to form water.)
- **Zinc Oxide and Carbon (Redox)**: $ZnO(s) + C(s) \rightarrow Zn(s) + CO(g)$ (Zinc oxide is reduced to zinc, and carbon is oxidized to carbon monoxide.)

Applications:

- Oxidation - Combustion (burning of fuels), rusting of iron.
- Reduction - Extraction of metals from ores, photosynthesis.
- Redox - Batteries, corrosion, respiration.

Mnemonic: CDDD
Interpretation:
C – Combination reaction
D – Decomposition reaction
D – Displacement reaction
D – Double displacement reaction

1.3 Have you observed the effects of oxidation reactions in everyday life?

1.3.1 Corrosion:

Corrosion is the process by which metals are gradually destroyed by reacting with substances in their environment, such as moisture and acids.

Examples:

- **Rusting of Iron** - Iron reacts with oxygen and moisture, forming a reddish-brown layer of iron oxide (rust).
- **Tarnishing of Silver** - Silver reacts with sulfur in the air to form a black coating of silver sulfide.
- **Green Coating on Copper -** Copper reacts with carbon dioxide and moisture, forming a green layer of basic copper carbonate.

1.3.2 Rancidity:

Rancidity occurs when fats and oils in food are oxidized, causing a change in taste and smell.

Examples:

- Spoiled oil in food items emits a foul smell.
- Chips and fried snacks taste stale when exposed to air for long durations.

Prevention:

Antioxidants substances like vitamin E are added to food to slow down oxidation. Storage like Airtight containers and refrigeration prevent oxidation. Nitrogen Flushing in Chips packets are flushed with nitrogen gas to prevent oxidation and maintain freshness.

MIND MAP

Types of Chemical Reactions

Combination reaction:

Two or more substances combine to form a single product. Also called as synthesis reaction

Formation of water - $2H_2 + O_2 \rightarrow 2H_2O$

Decomposition reaction: Single compound breaks down into two or more simpler substances



Decomposition of calcium carbonate - $CaCO_3 \rightarrow CaO + CO_2$

Displacement reaction: One element replaces another in a compound. Also called single displacement reaction.



$Fe + CuSO_4 \rightarrow FeSO_4 + Cu$

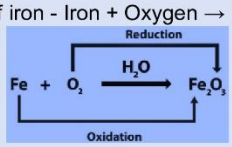
Double displacement reaction: Ions of two compounds exchange places.

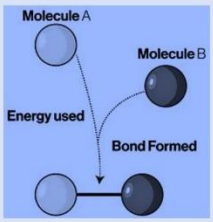


Formation of salt & water - $HCl + NaOH \rightarrow NaCl + H_2O$

Oxidation: Loss of electrons.
Reduction: Gain of electrons.

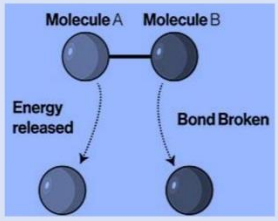
Rusting of iron - Iron + Oxygen → Iron Oxide





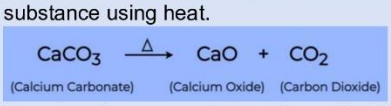
Endergonic:

Reactions that absorb energy. Ex. - Photosynthesis: Conversion of light energy into chemical energy (glucose)



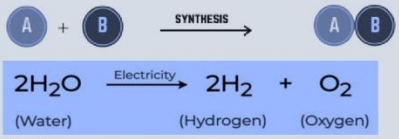
Exergonic:
Reactions that release energy. Ex. - Burning of wood: Releases heat and light energy

Thermal Decomposition: Breakdown of a substance using heat.



Limestone decomposes into calcium oxide (lime) when heated

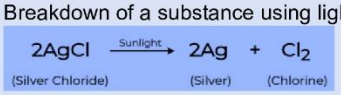
Electrolytic Decomposition: Breakdown of a substance using electricity.



Water decomposes into hydrogen and oxygen gas

Photo Decomposition:

Breakdown of a substance using light.



Silver chloride decomposes into silver metal and chlorine gas

Chemical Equations

Use symbols to represent chemical reactions, showing the reactants, products, and their proportions.

Balanced chemical equation

It has the same number of atoms of each element on both the reactant and product sides.

Steps involved in balancing chemical

1. Drawing Boxes around Formulas
2. List the Number of Atoms
3. Identify the element with the highest atom count and balance its quantity
4. Balance second element (Hydrogen Atoms)
5. Balance the Remaining Element
6. Balance the Remaining Element
7. Adding Physical States to the Equation

PREVIOUS YEAR EXAM QUESTIONS

Unit 1.1: Chemical Equation

Multiple Choice Questions (1 Mark)

(2022 Outside Delhi)

1. In a double displacement reaction such as the reaction between sodium sulphate solution and barium chloride solution: *(Un)*

(A) exchange of atoms takes place
(B) exchange of ions takes place
(C) a precipitate is produced
(D) an insoluble salt is produced

The correct option is:

(a) (B) and (D)
(b) (A) and (C)
(c) only (B)
(d) (B), (C) and (D)

(2022 Outside Delhi Term I)

2. It is important to balance the chemical equations to satisfy the law of conservation of mass. Which of the following statements of the law is incorrect? *(Un)*

(a) The total mass of the elements present in the reactants is equal to the total mass of the elements present in the products.
(b) The number of atoms of each element remains the same, before and after a chemical reaction.
(c) The chemical composition of the reactants is the same before and after the reaction.
(d) Mass can neither be created nor can it be destroyed in a chemical reaction.

(2022 Outside Delhi Term I)

3. Sodium reacts with water to form sodium hydroxide and hydrogen gas. *(Un)*

The balanced equation which represents the above reaction is:

(a) Na (s) $+2H_2O$ (l) $\rightarrow 2NaOH$ (aq) $+2H_2$ (g)
(b) $2Na(s) + 2H_2O(l) \rightarrow 2NaOH(aq) + H_2(g)$
(c) 2 Na (s) $+2H_2O$ (l) $\rightarrow NaOH$ (aq) $+2H_2$ (g)
(d) 2 Na (s) $+H_2O$ (l) $\rightarrow 2NaOH$ (aq) $+2H_2$ (g)

(2023 Outside Delhi)

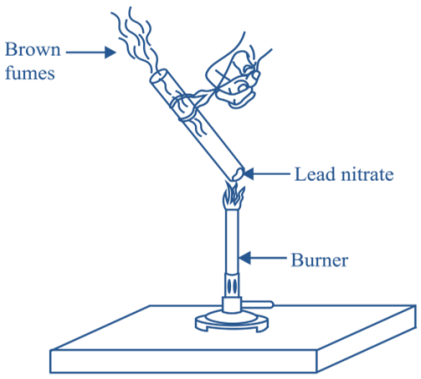
4. $MnO_2 + xHCl \rightarrow MnCl_2 + yH_2O + zCl_2$

In order to balance the above chemical equation, the values of x, y and z respectively are: *(An)*

(a) 6,2,2 (b) 4,1,2
(c) 4,2,1 (d) 2,2,1

(2023 Outside Delhi)

5. The emission of brown fumes in the given experimental set-up is due to *(Ap)*



(a) thermal decomposition of lead nitrate which produces brown fumes of nitrogen dioxide.
(b) thermal decomposition of lead nitrate which produces brown fumes of lead oxide.
(c) oxidation of lead nitrate forming lead oxide and nitrogen dioxide.
(d) oxidation of lead nitrate forming lead oxide and oxygen.

(2025 Delhi) MRQ

6. In which one of the following situations a chemical reaction does not occur? *(Un)*

(a) Milk is left open at room temperature during summer
(b) Grapes get fermented
(c) An iron nail is left exposed to humid atmosphere
(d) Melting of glaciers

(2025 Outside Delhi)

7. Consider the following chemical equation: *(Ev)*

$$p\,Al + q\,H_2O \rightarrow rAl_2O_3 + s\,H_2$$

To balance this chemical equation, the values of ' p ', ' q ', r' and 's' must be respectively:

(a) 3,2,2,1 (b) 2,3,3,1
(c) 2,3,1,3 (d) 3,1,2,**2**

Short Answer Questions Type I (2 Marks)

(2025 Delhi)

1. Define oxidation. Identify and name the substance oxidised in the following reaction: *(Un)*

$$CuO + H_2 \rightarrow Cu + H_2O$$

(2025 Outside Delhi) MRQ

2. (A) List the possible sources of energy required in decomposition reactions. Illustrate any one with a suitable example. *(Re)*

OR

(2025 Outside Delhi)

(B) What is observed when hydrated ferrous sulphate crystals are heated in a dry boiling tube? Give balanced chemical equation (s) of the reactions(s) that occur (s). *(Un)*

Short Answer Questions Type II (3 Marks)

(2018 Delhi/Outside Delhi)

1. **Decomposition reactions require energy either in the form of heat or light or electricity for breaking down the reactants. Write one equation each for decomposition reactions where energy is supplied in the form of heat, light and electricity. *(Re)***

(2025 Delhi)

2. **(A) Why do we balance a chemical equation? Name and state the law that suggests the balancing of a chemical equation? Balance the following chemical equation: *(Un)***

$$Zn + H_3PO_4 \rightarrow Zn_3(PO_4)_2 + H_2$$

OR

(B) Define a precipitation reaction. Give its example and also express the reaction that occurs in the form of a balanced chemical equation. *(Re)*

EXPLANATION

Multiple Choice Questions

1. **Correct Answer is (d):-** In this reaction, sodium and barium ions exchange places, so it is an ion exchange process. A white insoluble precipitate of barium sulphate is formed. **(1 Mark)**

[NCERT, Ch-1, Pg. no. 11]

2. **Correct Answer is (c):-** Statement (c) is incorrect because the chemical composition of the reactants and products is different. This is because new compounds are formed as products. **(1 Mark)**

[NCERT, Ch-1, Pg. no. 3]

3. **Correct Answer is (b):-** Balanced reactions is the number of atoms of each element remains same, before and after a chemical reaction. Here the correct balance equation is,

$$2Na(s) + 2H_2O(l) \rightarrow 2NaOH(aq) + H_2(g)$$

Here, the number of atoms of each element is the same on both sides of the arrow. **(1 Mark)**

[NCERT, Ch-1, Pg. no. 3]

4. **Correct Answer is (c):-** Oxidation - reduction reaction.

Balancing gives: $MnO_2 + 4HCl \rightarrow MnCl_2 + 2H_2O + Cl_2$.

So, x = 4, y = 2, z = 1. **(1 Mark)**

[NCERT, Ch-1, Pg. no. 12]

5. **Correct Answer is (a):-** On heating, lead nitrate decomposes into lead oxide (PbO), nitrogen dioxide (NO_2), and oxygen (O_2). The brown fumes observed are due to NO_2 gas. **(1 Mark)**

[NCERT, Ch-1, Pg. no. 8]

6. **Correct Answer is (d):-** Melting is a physical change (solid→liquid), no new substance forms. Others are chemical changes: milk sours (acid formation), grape ferment (alcohol), iron rusts (oxide forms). **(1 Mark)**

[NCERT, Ch-1, Pg. no.1, 2]

7. **Correct Answer is (c):-** The complete balance equation is:

$$2Al + 3H_2O \rightarrow Al_2O_3 + 3H_2$$

- p=2 (2 moles of aluminum)
- q=3 (3 moles of water)
- r=1 (1 mole of aluminum oxide)
- s=3 (3 moles of hydrogen gas) **(1 Mark)**

[NCERT, Ch-1, Pg. no.3]

Short Answer Questions Type I

1. **Answer:** Oxidation is the gain of oxygen or loss of electrons by a substance. **(1 Mark)**

In the reaction: $CuO + H_2 \rightarrow Cu + H_2O$

Substance oxidised: **Hydrogen (H_2), because it gains oxygen to form water (H_2O).** **(½ Mark)**

Copper oxide (CuO) loses oxygen, so it is reduced.

(½ Mark)

[NCERT, Ch-1, Pg. no. 12]

2. **Answer:**

(A) Decomposition reactions require an external energy source to break down compounds into simpler substances. Common energy sources include heat (thermal decomposition), light (photodecomposition), and electricity (electrolytic decomposition). **(1 Mark)**

For example, silver chloride decomposes into silver and chlorine gas when exposed to light:

$2AgCl(s) \xrightarrow{Sunlight} 2Ag(s) + Cl_2(g)$ **(1 Mark)**

[NCERT, Ch-1, Pg. no. 8-10]

OR

(B) In this decomposition reaction, a single reactant breaks down to form simpler products. When ferrous sulfate crystals ($FeSO_4 \cdot 7H_2O$) are heated, they lose water, and the color of the crystals changes. The ferrous sulfate then decomposes to form ferric oxide (Fe_2O_3), sulfur dioxide (SO_2), and sulfur trioxide (SO_3). Ferric oxide is a solid, while SO_2 and SO_3 are gases. **(1 Mark)**

$$2\,FeSO4(s) \xrightarrow{Heat} Fe2O3(s) + SO2(g) + SO(g)$$

(Ferrous sulphate) **(Ferric oxide)**

(1 Mark)

[NCERT, Ch-1, Pg. no. 8]

Commonly made mistake
Students often failed to write the balance chemical equation

Expert Tips
While writing chemical reactions, students should ensure that each element is balanced.
Students should practice regularly to write balanced equations correctly.

Short Answer Questions Type II

1. Answer:-

Decomposition reactions:

(i) **By electricity:**

$2H_2O$ + electricity → $2H_2 + O_2$ **(1 Mark)**

(ii) **By heat:**

$CaCO_3$ + heat → $CaO + CO_2$ **(1 Mark)**

(iii) **By light:**

$2AgBr$ + light → $2Ag + Br_2$ **(1 Mark)**

[NCERT, Ch-1, Pg. no. 8-10]

2. Answer:-

(A) We balance a chemical equation to obey the Law of Conservation of Mass, which states that mass cannot be created or destroyed in a reaction. This means the number of atoms of each element must be equal on both sides of the equation. **(1 Mark)**

For the given reaction: **$Zn + H_3PO_4 \rightarrow Zn_3(PO_4)_2 + H_2$**

Element	Number of atoms in reactants (LHS)	Number of atoms in products (RHS)
Zinc (Zn)	1	3
Phosphorus (P)	1	2
Oxygen (O)	4	8
Hydrogen (H)	3	2

(1 Mark)

Step 1: Balance P & O → $2H_3PO_4$ (left). Now P=2, O=8 both sides

Step 2: Balance Zn → 3Zn (left). Zn=3 both sides

Step 3: Balance H → $3H_2$ (right). H=6 both sides

Final: **$3Zn + 2H_3PO_4 \rightarrow Zn_3(PO_4)_2 + 3H_2$**

(1 Mark)

[NCERT, Ch-1, Pg. no. 3-5]

OR

(B) A **precipitation reaction** is a type of **double displacement** reaction where two soluble compounds react to form an insoluble solid (precipitate) and a soluble compound. **(1 Mark)**

Example: When sodium sulphate (Na_2SO_4) and barium chloride ($BaCl_2$) solutions are mixed, a white precipitate of barium sulphate ($BaSO_4$) forms, while sodium chloride (NaCl) remains dissolved. **(1 Mark)**

Balanced Chemical Equation: Na2SO4(aq) + BaCl2(aq) → BaSO4(s) + 2NaCl(aq)

In this reaction, **$BaSO_4$** is the precipitate. **(1 Mark)**

[NCERT, Ch-1, Pg. no. 11, 12]

Unit 1.2: Type of Chemical Reaction

Multiple Choice Questions (1 Mark)

(2016 Delhi Term I)

1. Aqueous solution of which of the following is colourless? *(Un)*

(a) $FeSO_4$ (b) $ZnSO_4$

(c) $Al_2(SO_4)_3$ (d) Both (b) and (C)

(2016 Delhi Term I)

2. Which of the following solutions is coloured? *(Un)*

(a) $ZnSO_4$ (b) $FeSO_4$

(c) $Al_2(SO_4)_3$ (d) Na_2SO_4

(2022 Outside Delhi)

3. Calcium oxide reacts vigorously with water to produce slaked lime.

$$CaO(s) + H_2O(l) \rightarrow Ca(OH)_2(aq)$$

This reaction can be classified as:

(A) Combination reaction

(B) Exothermic reaction

(C) Endothermic reaction

(D) Oxidation reaction

Which of the following is a correct option? *(Un)*

(a) (A) and (C) (b) (C) and (D)

(c) (A), (C) and (D) (d) (A) and (B)

(2022 Outside Delhi)

4. When hydrogen sulphide gas is passed through a blue solution of copper sulphate, a black precipitate of copper sulphide is obtained and the sulphuric acid so formed remains in the solution. The reaction is an example of a:

(a) Combination reaction

(b) Displacement reaction

(c) Decomposition rection

(d) Double Displacement reaction

(2022 Outside Delhi)

5. In which of the following, the identity of initial substance remains unchanged? *(Un)*

(a) Curdling of milk
(b) Formation of crystals by process of crystallisation
(c) Fermentation of grapes
(d) Digestion of food

(2022 Outside Delhi Term I)

6. A student took Sodium Sulphate solution in a test tube and added Barium Chloride solution to it. He observed that an insoluble substance has formed. The colour and molecular formula of the insoluble substance is: *(Un)*

(a) Grey, Ba_2SO_4 (b) Yellow, $Ba(SO_4)_2$
(c) White, $BaSO_4$ (d) Pink, $BaSO_4$

(2022 Outside Delhi Term I)

7. $C_6H_{12}O_6(aq) + 6O_2(aq) \rightarrow 6CO_2(aq) + 6H_2O(l)$
The above reaction is a/an *(Un)*

(a) displacement reaction
(b) endothermic reaction
(c) exothermic reaction
(d) neutralisation reaction

(2022 Outside Delhi Term I)

8. Which of the following statements about the reaction given below are correct? *(Un)*

$$MnO_2 + 4HCl \rightarrow MnCl_2 + 2H_2O + Cl_2$$

(i) HCl is oxidized to Cl_2
(ii) MnO_2 is reduced to $MnCl_2$
(iii) $MnCl_2$, acts as an oxidizing agent
(iv) HCl acts as an oxidizing agent

Code:

(a) (ii), (iii) and (iv) (b) (i), (ii) and (iii)
(c) (i) and (ii) only (d) (iii) and (iv) only

(2022 Outside Delhi)

9. Which one of the following reactions is categorised as thermal decomposition reaction? *(Un)*

(a) $2H_2O(l) \rightarrow 2H_2(g) + O_2(g)$
(b) $2AgBr(s) \rightarrow 2Ag(s) + Br_2(g)$
(c) $2AgCl(s) \rightarrow 2Ag(s) + Cl_2(g)$
(d) $CaCO_3(s) \rightarrow CaO(s) + CO_2(g)$

(2022 Outside Delhi)

10. The pair(s) which will show displacement reaction is/are *(Un)*

(i) NaCl solution and copper metal
(ii) $AgNO_3$ solution and copper metal
(iii) $Al_2(SO_4)_3$ solution and magnesium metal
(iv) $ZnSO_4$ solution and iron metal

Code:

(a) Only (ii) (b) (ii) and (iii)
(c) (iii) and (iv) (d) (i) and (ii)

(2023 Delhi)

11. When aqueous solutions of potassium iodide and lead nitrate are mixed, an insoluble substance separates out. The chemical equation for the reaction involved is: *(Un)*

(a) $KI + PbNO_3 \longrightarrow PbI + KNO_3$
(b) $2KI + Pb(NO_3)_2 \longrightarrow PbI_2 + 2KNO_3$
(c) $KI + Pb(NO_3)_2 \longrightarrow PbI + KNO_3$
(d) $KI + PbNO_3 \longrightarrow PbI_2 + KNO_3$

(2023 Delhi)

12. A metal ribbon 'X' burns in oxygen with a dazzling white flame forming a white ash 'Y'. The correct description of X, Y and the type of reaction is: *(Ap)*

(a) $X = Ca; Y = CaO$; Type of reaction = Decomposition
(b) $X = Mg; Y = MgO$; Type of reaction = Combination
(c) $X = Al; Y = Al_2O_3$; Type of reaction = Thermal decomposition
(d) $X = Zn; Y = ZnO$; Type of reaction = Endothermic

(2023 Outside Delhi) MRQ

13. Select endothermic reaction from the following: *(Un)*

(a) Decomposition of vegetable matter into compost.
(b) Decomposition of calcium carbonate to form quid lime and carbon dioxide.
(c) Burning of a candle.
(d) Process of respiration.

(2024 Delhi)

14. Select from the following a decomposition reaction in which source of energy for decomposition is light: *(Un)*

(a) $2FeSO_4 \rightarrow Fe_2O_3 + SO_2 + SO_3$
(b) $2H_2O \rightarrow 2H_2 + O_2$
(c) $2AgBr \rightarrow 2Ag + Br_2$
(d) $CaCO_3 \rightarrow CaO + CO_2$

(2024 Delhi)

15. $MnO_2 + 4HCl \rightarrow MnCl_2 + 2H_2O + Cl_2$
The reaction given above is a redox reaction because in this case: *(An)*

(a) MnO_2 is oxidised and HCl is reduced.
(b) HCl is oxidised.
(c) MnO_2 is reduced.
(d) MnO_2 is reduced and HCl is oxidised.

(2024 Outside Delhi)

16. Select from the following a process in which a combination reaction is involved: *(An)*

(a) Black and White photography
(b) Burning of coal
(c) Burning of methane
(d) Digestion of food

(2024 Outside Delhi)

17. **Solid Calcium oxide reacts vigorously with water to form Calcium hydroxide accompanied by the liberation of heat. From the information given above it may be concluded that this reaction *(Ap)***
    (a) is endothermic and pH of the solution formed is more than 7.
    (b) is exothermic and pH of the solution formed is 7 .
    (c) is endothermic and pH of the solution formed is 7.
    (d) is exothermic and pH of the solution formed is more than 7 .

Assertion & Reasons (1 Mark)

Two statements are given one labeled Assertion (A) and the other labeled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below:

(a) Both A and R are true and R is correct explanation of the assertion.
(b) Both A and R are true but R is not the correct explanation of the assertion.
(c) A is true but R is false.
(d) A is false but R is true.

(2022 Outside Delhi)

1. **Assertion (A):** Burning of Natural gas is an endothermic process.
   Reason (R): Methane gas combines with Oxygen to produce carbon dioxide and water. *(Un)*

(2023 Delhi)

2. **Assertion (A):** Reaction of Quicklime with water is an exothermic reaction.
   Reason (R): Quicklime reacts vigorously with water releasing a large amount of heat. *(Un)*

(2023 Outside Delhi)

3. **Assertion (A):** The colour of aqueous solution of copper sulphate turns colourless when a piece of lead is added to it.
   Reason (R): Lead is more reactive than copper, and hence displaces copper from its salt solution. ***(Un)***

Short Answer Type Question: Type I (2 Marks)

(2016 Delhi Term I)

1. **While studying the double displacement reaction, the solutions of barium chloride and sodium sulphate are mixed together. *(An)***
   (i) What do you observe as soon as the two solutions are mixed together?
   (ii) What will happen in the above observation made by you after ten minutes?

(2018 Delhi/Outside Delhi)

2. **What is observed when a solution of sodium sulphate is added to a solution of barium chloride taken in a test tube? Write equation for the chemical reaction involved and name the type of reaction in this case. *(Un)***

(2024 Delhi)

3. **Name the type of chemical reaction in which calcium oxide reacts with water. Justify your answer by giving balanced chemical equation for the chemical reaction. *(Un)***

(2024 Outside Delhi)

4. **(a) Define a decomposition reaction. Write an equation to show thermal decomposition of ferrous sulphate crystals. *(Re)***

OR

(b) What is meant by a balanced chemical equation? Why is it necessary for the equation to be balanced? *(Re)*

Short Answer Type Questions: Type II (3 Marks)

(2019 Delhi term)

1. **2 g of silver chloride is taken in a china dish and the china dish is placed in sunlight for sometime. What will be your observation in this case? Write the chemical reaction involved in the form of a balanced chemical equation. Identify the type of chemical reaction. *(An)***

(2019 Delhi)

2. **Identify the type of reactions taking place in each of the following cases and write the balanced chemical equation for the reactions. *(Un)***
   (a) Zinc reacts with silver nitrate to produce zinc nitrate and silver.
   (b) Potassium iodide reacts with lead nitrate to produce potassium nitrate and lead iodide.

(2019 Outside Delhi term)

3. **On heating blue coloured powder of copper (II) nitrate in boiling tube, black copper oxide, O_2 and a brown gas X formed. *(Un)***
   (a) Identify the type of reaction and the gas X.
   (b) Write balanced chemical equation of the reaction.
   (c) Write the pH range of aqueous solution of the gas X

(2020 Delhi)

4. **1 g of copper powder was taken in a China dish and heated. What change takes place on heating? When hydrogen gas is passed over this heated substance, a visible change is seen in it. Give the chemical equations of reactions, the name and the color of the products formed in each case. *(An)***

(2022 Outside Delhi)

5. **Mention with reason the colour changes observed when: *(Un)***
   (i) silver chloride is exposed to sunlight.
   (ii) copper powder is strongly heated in the presence of oxygen.
   (iii) a piece of zinc is dropped in copper sulphate solution.

(2023 Outside Delhi)

6. **(a) Identify the reducing agent in the following reactions**
   (i) $4NH_3 + 5O_2 \rightarrow 4NO + 6H_2O$
   (ii) $H_2O + F_2 \rightarrow HF + HOF$
   (iii) $Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$
   (iv) $2H_2 + O_2 \rightarrow 2H_2O$
   (b) Define a redox reaction in terms of gain or loss of oxygen. *(Un)*

(2023 Delhi)

7.
(i) **While electrolysing water before passing the current some drops of an acid are added. Why? Name the gases liberated at cathode and anode. Write the relationship between the volume of gas collected at anode and the volume of gas collected at cathode.**
(ii) **What is observed when silver chloride is exposed to sunlight? Give the type of reaction involved. *(Un)***

(2024 Delhi)

8. **Write one chemical equation each for the chemical reaction in which the following have taken place: *(An)***
   (i) Change in colour
   (ii) Change in temperature
   (iii) Formation of precipitate
   Mention colour change/temperature change (rise/fall)/ compound precipitated along with equation.

(2024 Outside Delhi)

9. **(a) State any two observations when an electric current is passed through acidulated water, in a container having each electrode covered by test tubes filled with water.**
   (b) Write the ratio of the mass of the gas collected at the cathode to the mass of the gas collected at the anode. *(Un)*

(2025 Outside Delhi)

10. **How is a double displacement reaction different from a displacement reaction? Explain giving example in the form of balanced chemical equations. *(Re)***

EXPLANATION

Multiple Choice Questions

1. **Correct Answer is (d):-** Both (b) and (c) are colourless, while the salt in (a) is green in colour. **(1 Mark)**
[NCERT, Ch-1, Pg. no. 8]

2. **Correct Answer is (b):-** Among the given options, $FeSO_4$ solution is coloured (green). **(1 Mark)**
[NCERT, Ch-1, Pg. no. 8]

3. **Correct Answer is (d):-** Calcium oxide reacts with water to form calcium hydroxide, so it is a **combination reaction**. Since the reaction releases a lot of heat, it is also an **exothermic reaction**. **(1 Mark)**
[NCERT, Ch-1, Pg. no. 6]

4. **Correct Answer is (d):-** $CuSO_4 + H_2S \rightarrow CuS\downarrow + H_2SO_4$ Here, copper sulphate reacts with hydrogen sulphide to form copper sulphide (black precipitate) and sulphuric acid. Since two compounds exchange their ions, this is a double displacement reaction. **(1 Mark)**
[NCERT, Ch-1, Pg. no. 11]

Commonly made mistake
Students get confused regarding the necessary conditions and liberation of gases in the reaction.

Expert tips
During practical's, carefully observe the necessary conditions for each reaction.
Make a list of different types of decomposition reactions, their required conditions, and the gases released.
Practice these reactions to understand them better.

5. **Correct Answer is (b):-**
In crystallisation, only pure crystals of the same substance are formed, and the chemical identity does not change. **(1 Mark)**
[NCERT, Ch-1, Pg. no. 1, 2]

6. **Correct Answer is (c):-**
When sodium sulphate (Na_2SO_4) reacts with barium chloride ($BaCl_2$), a double displacement reaction occurs and form barium sulphate an insoluble substance.
(1 Mark)

$Na_2SO_4(aq) + BaCl_2(aq) \rightarrow BaSO_4(s) + 2NaCl(aq)$

(Sodium sulphate)	(Barium chloride)	(Barium sulphate)	(Sodium chloride)

[NCERT, Ch-1, Pg. no. 11]

7. **Correct Answer is (c):-**
The given reaction involved in the process of respiration, breakdown of glucose ($C_6H_{12}O_6$) in the presence of

oxygen to produce carbon dioxide and water, along with the release of energy. Since this reaction releases energy, it is an exothermic reaction. **(1 Mark)**

[NCERT, Ch-1, Pg. no. 7]

8. **Correct Answer is (c):-**

In the given reaction, MnO_2 loses oxygen to form $MnCl_2$, which means MnO_2 is reduced to $MnCl_2$. On the other hand, HCl loses hydrogen and forms Cl_2, so HCl is oxidized to Cl_2. **(1 Mark)**

[NCERT, Ch-1, Pg. no. 12]

9. **Correct Answer is (d):-**

This is a thermal decomposition reaction because it involves the breakdown of a compound (calcium carbonate) into simpler substances (calcium oxide and carbon dioxide) upon heating. Thermal decomposition reactions occur when heat causes a compound to decompose. **(1 Mark)**

[NCERT, Ch-1, Pg. no. 8]

10. **Correct Answer is (b):-**

The metal that is more reactive can displace the less reactive metal. Among the given options, only (ii) and (iii) will undergo displacement reactions. In (ii), copper, being more reactive than silver, will displace silver from silver nitrate solution. In (iii), magnesium, being more reactive than aluminum, will displace aluminum from aluminum sulfate solution. **(1 Mark)**

[NCERT, Ch-1, Pg. no.10-11]

11. **Correct Answer is (b):-**

When potassium iodide solution is mixed with lead nitrate solution, a yellow insoluble substance called lead iodide is formed, along with potassium nitrate which remains dissolved in water.

$$Pb(NO_3)_2(aq) + 2KI(aq) \rightarrow PbI_2(s)(\downarrow) + 2KNO_3(aq)$$

(1 Mark)

[NCERT, Ch-1, Pg. no. 8-9]

12. **Correct Answer is (b):-**

2Mg (X) + O_2 → 2MgO (Y)

X is magnesium (Mg), Y is magnesium oxide (MgO), and the reaction is a combination reaction. **(1 Mark)**

[NCERT, Ch-1, Pg. no. 6]

13. **Correct Answer is (b):-**

The decomposition of calcium carbonate absorbs heat and produces quick lime and CO_2, therefore it is an endothermic reaction. **(1 Mark)**

[NCERT, Ch-1, Pg. no. 8]

14. **Correct Answer is (c):-**

A decomposition reaction that uses light as the source of energy is called a photochemical decomposition reaction. $2AgBr \rightarrow 2Ag + Br_2$ The reaction with silver bromide is an example of this type of reaction. **(1 Mark)**

[NCERT, Ch-1, Pg. no. 10]

15. **Correct Answer is (d):-** In this reaction, HCl is oxidized to Cl_2 and MnO_2 is reduced to $MnCl_2$. A reaction where a substance gains oxygen or loses hydrogen is called an oxidation reaction. A reaction where a substance gains hydrogen or loses oxygen is called a reduction reaction. **(1 Mark)**

[NCERT, Ch-1, Pg. no. 12, 13]

16. **Correct Answer is (b):-**

A combination reaction occurs when two or more substances combine to form one product.

(b) Burning of coal (C + O_2 → CO_2) – Carbon and oxygen combine.

(c) Burning of methane (CH_4 + $2O_2$ → CO_2 + $2H_2O$) – Also a combination (but **mainly combustion**). **(1 Mark)**

[NCERT, Ch-1, Pg. no.7]

17. **Correct Answer is (d):-** Heat is released → Exothermic reaction. Calcium hydroxide ($Ca(OH)_2$) formed is basic → pH > 7. **(1 Mark)**

[NCERT, Ch-1, Pg. no.6]

Assertion & Reasons

1. **Correct Answer is (d):-**

The burning of natural gas (methane) is an exothermic process, not endothermic. It releases energy in the form of heat and light. The reaction of methane with oxygen to form carbon dioxide and water is correct, but it is exothermic, releasing energy.

$$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O + Energy$$

(1 Mark)

[NCERT, Ch-1, Pg. no.7]

2. **Correct Answer is (a):-** When a reaction gives out heat while making products, it is called an exothermic reaction. Quicklime (CaO) reacts strongly with water and produces calcium hydroxide. In this process, a lot of heat is released.

CaO(s) + H_2O(l) → $Ca(OH)_2$(aq) + Heat **(1 Mark)**

[NCERT, Ch-1, Pg. no. 6]

3. **Correct Answer is (a):-** When lead is put in copper sulphate solution, it replaces copper, so the blue colour disappears. This happens because lead is more reactive than copper. **(1 Mark)**

[NCERT, Ch-1, Pg. no. 11]

Short Answer Type Question: Type I

1. Answer:

(i) On mixing the two solutions, a white precipitate of barium sulfate ($BaSO_4$) is formed.

$BaCl_2(aq) + Na_2SO_4(aq) \rightarrow BaSO_4(s) + 2NaCl(aq)$ **(1 Mark)**

(ii) After about 10 minutes, the white precipitate settles at the bottom of the test tube, leaving the solution above it clear and colorless. **(1 Mark)**

[NCERT, Ch-1, Pg. no. 11]

2. Answer:-

When a solution of **sodium sulphate** is added to **barium chloride solution**, a **white insoluble precipitate** of **barium sulphate** is formed. **(½ Mark)**

The reaction is:

$BaCl_2 + Na_2SO_4 \rightarrow 2NaCl + BaSO_4$ **(1 Mark)**

This is an example of a **double displacement reaction**, where the ions of the two reactants **swap places** to form two different compounds. **(½ Mark)**

[NCERT, Ch-1, Pg. no. 11]

3. Answer: A combination reaction is when two or more substances react to form a single product. In this case, **calcium oxide (CaO)**, also known as quick lime, reacts with **water (H_2O)** to form **calcium hydroxide ($Ca(OH)_2$)**, also called slaked lime. This reaction releases a large amount of heat. **(1 Mark)**

Balanced chemical equation:

$CaO(s) + H_2O(l) \rightarrow Ca(OH)_2(aq) + Heat$ **(1 Mark)**

[NCERT, Ch-1, Pg. no. 6]

4. Answer:

(a) A reaction is called a decomposition reaction when a single reactant breaks down into simpler products. It can be represented by the general equation:

$$AB \rightarrow A + B$$

(1 Mark)

The equation for the thermal decomposition of ferrous sulfate is:

$2FeSO_4(s) \xrightarrow{Heat} Fe_2O_3(s) + SO_2(g) + SO_3(g)$

(Ferrous sulphate) (Ferric oxide)

(1 Mark)

[NCERT, Ch-1, Pg. no. 8]

OR

(b) A balanced chemical equation has an equal number of atoms for each element on both sides of the equation. **(1 Mark)**

It is important for the equation to be balanced because it follows the law of conservation of mass, meaning the total mass remains the same before and after a chemical reaction. **(1 Mark)**

[NCERT, Ch-1, Pg. no. 3]

Short Answer Type Questions: Type II

1. Answer: When 2 g of AgCl is exposed to sunlight, it decomposes into silver (Ag) and chlorine (Cl_2). As a result, the white colour of silver chloride slowly turns grey due to the formation of silver. This change can be represented by the reaction: **(2 Mark)**

$$2AgCl \xrightarrow{Sunlight} 2Ag + Cl_2$$

(1 Mark)

This is an example of a **photodecomposition reaction**, as the decomposition of AgCl occurs in the presence of sunlight.

[NCERT, Ch-1, Pg. no. 9]

2. Answer:

(a) This is a displacement reaction and can be represented as:

$Zn(s) + 2AgNO_3(aq) \rightarrow Zn(NO_3)_2(aq) + 2Ag(s)$

Here, zinc displaces silver from silver nitrate to form zinc nitrate and silver. **(1 ½ Mark)**

(b) This is a double displacement reaction and can be represented as:

$2KI(aq) + Pb(NO_3)_2(aq) \rightarrow PbI_2(s)\downarrow + 2KNO_3(aq)$

Here, potassium iodide reacts with lead nitrate to form **lead iodide (yellow precipitate)** and **potassium nitrate**.

(1 ½ Mark)

[NCERT, Ch-1, Pg. no. 11]

3. Answer:

(a) On heating copper(II) nitrate, it breaks down into black copper oxide (CuO), oxygen (O_2), and a brown gas (nitrogen dioxide, NO_2).

Type of reaction: Thermal decomposition

Gas X: Nitrogen dioxide (NO_2) **(1 Mark)**

[NCERT, Ch-1, Pg. no. 8]

(b) Balanced chemical equation:

$2Cu(NO_3)_2 \xrightarrow{\Delta} 2CuO + 4NO_2 + O_2$ **(1 Mark)**

[NCERT, Ch-1, Pg. no. 8]

(c) NO_2 dissolves in water to form an acidic solution: So, pH < 7 (acidic range). **(1 Mark)**

[NCERT, Ch-2, Pg. no. 25]

4. Answer:

When copper is heated in air, it reacts with oxygen and forms a black substance called copper (II) oxide (CuO). **(½ Marks)**

Chemical reaction: $2Cu(s) + O_2(g) \rightarrow 2CuO(s)$. **(1 Mark)**

If hydrogen gas is passed over hot CuO, the black layer changes back to brown copper metal, and water is formed. **(½ Marks)**

Chemical reaction: $CuO(s) + H_2(g) \rightarrow Cu(s) + H_2O(l)$.

(1 Mark)

[NCERT, Ch-1, Pg. no. 12]

5. Answer:

(i) White silver chloride turns grey in sunlight because it decomposes into silver and chlorine.

$$2AgCl(s) \xrightarrow{Sunlight} 2Ag(s)+Cl_2(g)$$

(1 Mark)

[NCERT, Ch-1, Pg. no. 9]

(ii) Copper, on strong heating in oxygen, forms black copper(II) oxide.

$$2Cu(s) + O_2(g) \xrightarrow{Heat} 2CuO(s)$$

(1 Mark)

[NCERT, Ch-1, Pg. no. 12]

(iii) Zinc displaces copper from copper sulphate solution. The solution changes from blue to colorless and a reddish-brown deposit of copper appears.

$$Zn(s)+CuSO_4(aq) \rightarrow ZnSO_4(aq)+Cu(s)$$

(1 Mark)

[NCERT, Ch-1, Pg. no. 11]

6. Answer:

(i) Pure water is a non-electrolyte and does not conduct electricity well. Adding an acid produces ions in the water, which act as charge carriers and allow current to flow. During electrolysis, hydrogen gas is released at the cathode and oxygen gas at the anode. The gases are formed in a volume ratio of 2:1 (hydrogen : oxygen). This ratio reflects the composition of water. **(1 Mark)**

(ii) When silver chloride (AgCl) is exposed to light, it breaks down into silver metal (Ag) and chlorine gas (Cl_2). This reaction is called photolytic decomposition.

$$2AgCl(s) \xrightarrow{Heat} 2Ag(s) + Cl_2(g)$$ **(2 Marks)**

[NCERT, Ch-1, Pg. no. 9]

7. Answer:

(a) Reducing agents:

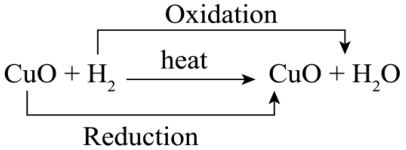
A reducing agent is a substance that loses electrons or gets oxidized in a redox reaction.

1. NH_3 → Reducing agent, as it is oxidized to NO.
2. H_2O → Reducing agent, as it is oxidized to HOF.
3. CO → Reducing agent, as it is oxidized to CO_2.
4. H_2 → Reducing agent, as it is oxidized to H_2O.

(1 Mark)

(b) A redox reaction is a chemical reaction in which oxidation and reduction occur at the same time.

- Oxidation: Gain of oxygen
- Reduction: Loss of oxygen



(2 Mark)

[NCERT, Ch-1, Pg. no. 12]

8. Answer:

(i) When iron reacts with copper sulphate, the blue colour of the copper sulphate changes to pale green.

$$Fe(s) + CuSO_4(aq) \rightarrow FeSO_4(aq) + Cu(s)$$

Iron — Copper Sulphate (blue) — Ferrous Sulphate (pale green) — Copper

(1 Mark)

[NCERT, Ch-1, Pg. no. 3]

(ii) When dilute sulphuric acid reacts with zinc, heat is released, causing the temperature to rise.

$$Zn(s) + H_2SO_4(aq) \rightarrow ZnSO_4(s) + H_2(g)$$

(1 Mark)

[NCERT, Ch-1, Pg. no. 2]

(iii) When lead nitrate $Pb(NO_3)^2$ reacts with potassium iodide (KI), it produces lead iodide (PbI_2) and potassium nitrate (KNO_3). Lead iodide appears as a yellow solid (precipitate), showing both a colour change and the formation of a solid. **(1 Mark)**

[NCERT, Ch-1, Pg. no. 11]

9. Answer: (a)

- At the cathode, hydrogen gas is released, which forms bubbles rising in the test tube covering the cathode.

(1 Mark)

- At the anode, oxygen gas is released, but fewer bubbles form compared to the cathode because oxygen is produced in smaller amounts. **(1 Mark)**

(b) The ratio of the mass of hydrogen gas (collected at the cathode) to the mass of oxygen gas (collected at the anode) can be calculated from the electrolysis process and the chemical equation:

$2H_2O \rightarrow 2H_2+O_2$

(½ Mark)

This shows that twice the volume of hydrogen gas is produced compared to oxygen gas.

(½ Mark)

[NCERT, Ch-1, Pg. no. 9]

10. Answer:

Difference between Displacement Reaction and Double Displacement Reaction:

	Displacement Reaction	Double Displacement Reaction
Definition	One element displaces another from a compound.	Ions of two compounds exchange places to form new compounds.