

## 1

## CHAPTER

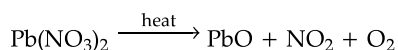
Chemical Reactions  
and Equations

## Level - 1

## MULTIPLE CHOICE QUESTIONS (MCQs)

(1 Mark)

1. Option (A) is correct.

**Explanation:** To balance the reaction:**Lead (Pb):** It is balanced, as there is 1 lead atom in  $\text{Pb}(\text{NO}_3)_2$  and 1 in  $\text{PbO}$ **Nitrogen (N):** Each molecule of  $\text{Pb}(\text{NO}_3)_2$  contains 2 nitrogen atoms from its 2 nitrate groups. To balance this on the product side, we need 2 nitrogen atoms, which means we require 2 molecules of  $\text{NO}_2$ .**Oxygen (O):** Each molecule of  $\text{Pb}(\text{NO}_3)_2$  has 6 oxygen atoms. On the product side,  $\text{PbO}$  has 1 oxygen, 2 molecules of  $\text{NO}_2$  contribute 4 oxygen atoms, and  $\text{O}_2$  contributes 2 oxygen atoms. To balance the oxygen atoms, we need to multiply the entire reaction by 2.

This gives the balanced equation:

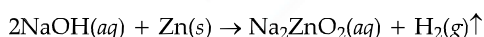
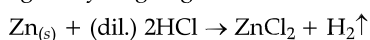
So,  $p = 2$ ,  $q = 2$ , and  $r = 4$ .

2. Option (B) is correct.

**Explanation:** In cooking, heat is absorbed by the food to bring about chemical changes, making cooking an endothermic process.

In contrast, the burning of a candle, the reaction of sodium with air, and the decomposition of vegetable matter are exothermic reactions, as they release heat during the process.

3. Option (B) is correct.

**Explanation:** When sodium hydroxide is heated with zinc granules, sodium zincate and hydrogen gas is evolved.When burning splinter is brought near the mouth of the test tube, it burns with a pop sound. If zinc granules react with strong acids ( $\text{HCl}$  or  $\text{H}_2\text{SO}_4$ ) then again hydrogen gas will be evolved.

4. Option (C) is correct.

**Explanation:** Photochemical decomposition is a breakdown that uses light as its energy source. Among the options given, the reaction involving silver bromide ( $2\text{AgBr} \rightarrow 2\text{Ag} + \text{Br}_2$ ) is a photochemical decomposition reaction.

5. Option (D) is correct.

**Explanation:** A redox reaction is where oxidation and reduction occur simultaneously in a reaction. Here  $\text{MnO}_2$  is reduced to  $\text{MnCl}_2$  and  $\text{HCl}$  is oxidized to  $\text{H}_2\text{O}$  and  $\text{Cl}_2$ .

6. Option (D) is correct.

**Explanation:**  $\text{CaSO}_4 + \text{Al}$  (case 1) and  $\text{FeSO}_4 + \text{Cu}$  (case 3) do not displace  $\text{Ca}$  and  $\text{Fe}$  from their sulphates due to their lower reactivity. In  $\text{CuSO}_4 + \text{Ca}$  and  $\text{ZnSO}_4 + \text{Mg}$  reactions,  $\text{Ca}$  and  $\text{Mg}$  are more reactive and displace  $\text{Cu}$  and  $\text{Zn}$  from the sulphates, resulting in the formation of  $\text{CaSO}_4$  and  $\text{MgSO}_4$ .

7. Option (C) is correct.

**Explanation:** In this reaction  $\text{SO}_2$  act as an oxidizing agent that's why  $\text{SO}_2$  is undergoing reduction to form sulphur. During the reaction, sulphur in  $\text{H}_2\text{S}$  is oxidised to sulphur with an oxidation state of 0.

8. Option (A) is correct.

**Explanation:** Calcium carbonate on heating decomposes to form calcium oxide (quick lime) and carbon dioxide. The equation for this thermal decomposition reaction can be written as:  $\text{CaCO}_3 \rightarrow \text{CaO} + \text{CO}_2$ . Therefore, X in the above reaction is calcium oxide (quick lime).

9. Option (A) is correct.

**Explanation:** The balanced chemical equation is:  $\text{Al}_2\text{O}_3 + 6\text{HCl} \rightarrow 2\text{AlCl}_3 + 3\text{H}_2\text{O}$ . Therefore, the values of  $a$ ,  $b$ ,  $c$ , and  $d$  are 1, 6, 2, 3, respectively.

10. Option (B) is correct.

**Explanation:**  $(A) \text{NaCl} + \text{AgNO}_3 \rightarrow \text{AgCl} + \text{NaNO}_3$ : This is a double displacement or metathesis reaction, where two compounds exchange bonds or ions to form different compounds.

- (B)  $\text{CaO} + \text{H}_2\text{O} \rightarrow \text{Ca(OH)}_2$ : This is a combination or synthesis reaction, where two or more reactants combine to form a single product.
- (C)  $\text{KNO}_3 + \text{H}_2\text{SO}_4 \rightarrow \text{KHSO}_4 + \text{HNO}_3$ : This is also a double displacement or metathesis reaction, similar to option (A).
- (D)  $\text{ZnCl}_2 + \text{H}_2\text{S} \rightarrow \text{ZnS} + 2\text{HCl}$ : This is a displacement or substitution reaction, where one element displaces another element from a compound.

Therefore, the correct answer is option (B), because it is the only one that is a combination reaction, while the others are double displacement or displacement reactions.

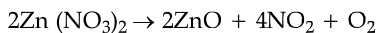
11. Option (B) is correct.

**Explanation:** The reaction involves zinc (Zn) reacting with acetic acid ( $\text{CH}_3\text{COOH}$ ) to form zinc acetate ( $(\text{CH}_3\text{COO})_2\text{Zn}$ ) and hydrogen gas ( $\text{H}_2$ ). This is a single replacement or displacement reaction. In this reaction, zinc displaces hydrogen from acetic acid, forming zinc acetate and hydrogen gas.

12. Option (C) is correct.

**Explanation:** Zinc Nitrate  $\rightarrow$  Zinc Oxide + Dioxygen + Nitrogen Dioxide

The balanced equation is:



13. Option (D) is correct.

**Explanation:**  $\text{Fe}_2\text{O}_3 + 3\text{CO} \rightarrow 2\text{Fe} + 3\text{CO}_2$  is a redox reaction, but not a combination reaction. Redox reactions are oxidation and reduction reactions. It is a chemical reaction in which the oxidation states of the reactants are changed. Combination reaction is a type of reaction in which two reactants combine to form a product. The above reaction is not a combination reaction but it is a redox reaction as oxidation and reduction is taking place simultaneously. In this reaction, carbon monoxide (CO) acts as a reducing agent and  $\text{Fe}_2\text{O}_3$  as an oxidising agent.

14. Option (A) is correct.

**Explanation: I.  $\text{CuO} + \text{H}_2$ :** This reaction involves the reduction of copper oxide by hydrogen, forming copper and water. It is not a combination reaction.

**II.  $\text{ZnO} + \text{C}$ :** This reaction involves the reduction of zinc oxide by carbon, forming zinc and carbon monoxide. It is not a combination reaction.

**III.  $\text{Na} + \text{O}_2$ :** This reaction involves the combination of sodium and oxygen to form sodium oxide. It is a combination reaction.

**IV.  $\text{CH}_4 + \text{O}_2$ :** This reaction involves the combustion of methane with oxygen to form carbon dioxide and water. It is not a combination reaction.

15. Option (D) is correct.

**Explanation:** Double-replacement reactions involve the formation of an insoluble ionic compound. Barium sulphate, in the reaction provided, is the insoluble salt formed, indicating a double displacement reaction.

16. Option (C) is correct.

**Explanation:** The balanced chemical equation is:  
 $\text{NaCl} + \text{NH}_3 + \text{H}_2\text{O} + \text{CO}_2 \rightarrow \text{NaHCO}_3 + \text{NH}_4\text{Cl}$   
 i.e., Sodium chloride + Ammonia + Water + Carbon dioxide  $\rightarrow$  Sodium hydrogen carbonate + Ammonium chloride

17. Option (B) is correct.

**Explanation:** Here  $\text{H}_2$  is getting oxidised since its oxidation number is increasing and CuO is getting reduced since its oxidation number is decreasing. The one who gets oxidised act as reducing agent and the one who get reduced act as an oxidising agent. So, here  $\text{H}_2$  is a reducing agent and CuO is an oxidising agent.

18. Option (B) is correct.

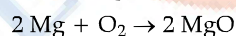
**Explanation:** Lead (II) Iodide ( $\text{PbI}_2$ ) is insoluble in water, so it forms a solid precipitate. Potassium nitrate ( $\text{KNO}_3$ ) remains in the aqueous solution.

19. Option (B) is correct.

**Explanation:**

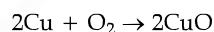


In this reaction, magnesium and oxygen combine to create magnesium oxide.



20. Option (D) is correct.

**Explanation:** When red coloured copper metal is heated in presence of oxygen it forms copper (II) oxide which is a black solid.



21. Option (A) is correct.

**Explanation:** When lead nitrate ( $\text{Pb}(\text{NO}_3)_2$ ) is heated, it undergoes thermal decomposition to form lead oxide (PbO), nitrogen dioxide ( $\text{NO}_2$ ), and oxygen ( $\text{O}_2$ ).

The reaction is:



22. Option (C) is correct.

**Explanation:** The balanced equations is:

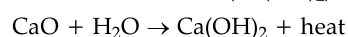


Therefore, the values of x, y and z are 4, 2 and 1, respectively.

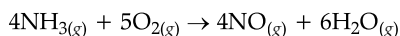
23. Option (C) is correct.

**Explanation:** An endothermic process absorbs heat from its surroundings.

(A) Formation of slaked lime – ( $\text{Ca(OH)}_2$ ):



- This is an exothermic reaction, as it releases heat.
- (B) Decomposition of vegetable matter into compost:  
This process involves the breakdown of organic matter by microbes, releasing energy in the form of heat. It is exothermic.
- (C) Dissolution of ammonium chloride in water: When ammonium chloride ( $\text{NH}_4\text{Cl}$ ) dissolves in water, it absorbs heat from the surroundings, making the solution colder. This is an endothermic process.
- (D) Digestion of food in our body: Digestion involves the breakdown of food molecules, which releases energy (e.g., in the form of ATP). This is an exothermic process.
24. Option (B) is correct.  
**Explanation:** Salt and hydrogen gas are produced when metals and acids react. As a result, when zinc combines with sulphuric acid, zinc sulphate is formed along with the release of hydrogen gas.  
$$\text{Zn}_{(s)} + \text{H}_2\text{SO}_{4(aq)} \rightarrow \text{ZnSO}_{4(aq)} + \text{H}_{2(g)}$$
25. Option (B) is correct.  
**Explanation:** The balanced chemical equation shown above is:  $3\text{Fe}_{(s)} + 4\text{H}_2\text{O}_{(l)} \rightarrow \text{Fe}_3\text{O}_{4(s)} + 4\text{H}_{2(g)}$ . The ratio  $x : y = 3 : 4$ .
26. Option (C) is correct.  
**Explanation:** The reaction in the given set up involves zinc granules reacting with dilute sulphuric acid:  
$$\text{Zn} + \text{H}_2\text{SO}_4 \rightarrow \text{ZnSO}_4 + \text{H}_2$$
  
This reaction produces hydrogen gas ( $\text{H}_2$ ), which is denoted as gas 'X'.  
When a burning matchstick is brought near the gas, it burns with a pop sound, which confirms the presence of hydrogen.
27. Option (C) is correct.  
**Explanation:** In a single displacement reaction of the form  $\text{PQ} + \text{R} \rightarrow \text{PR} + \text{Q}$ , the following is typically true: The ion R in the product PR will be anion as in the reactant R. The stability of PR as compared to PQ will be high.
28. Option (D) is correct.  
**Explanation:** The two chemical reactions that are of the SAME type are:  
(P)  $\text{AgNO}_3 + \text{NaCl} \rightarrow \text{AgCl} + \text{NaNO}_3$   
(S)  $2\text{KOH} + \text{H}_2\text{SO}_4 \rightarrow \text{K}_2\text{SO}_4 + \text{H}_2\text{O}$   
Both of these reactions are double displacement reactions, where the ions in the reactants exchange places to form new compounds. In reaction P, the silver ions ( $\text{Ag}^+$ ) from  $\text{AgNO}_3$  exchange with the sodium ions ( $\text{Na}^+$ ) from  $\text{NaCl}$  to form  $\text{AgCl}$  and  $\text{NaNO}_3$ . In reaction S, the potassium ions ( $\text{K}^+$ ) from  $2\text{KOH}$  exchange with the hydrogen ions ( $\text{H}^+$ ) from  $\text{H}_2\text{SO}_4$  to form  $\text{K}_2\text{SO}_4$  and  $\text{H}_2\text{O}$ .
29. Option (C) is correct.  
**Explanation:** Simple displacement (or single displacement) reaction occurs when one element replaces another in a compound.  
$$\text{A} + \text{BC} \rightarrow \text{AC} + \text{B}$$
  
Here, A is usually a more reactive metal or non-metal that displaces B from the compound BC.  
When a metal reacts with an acid. For example,  
$$\text{Zn} + 2\text{HCl} \rightarrow \text{ZnCl}_2 + \text{H}_2$$
  
Zinc displaces hydrogen from hydrochloric acid to form zinc chloride and hydrogen gas.
30. Option (D) is correct.  
**Explanations:** The necessary condition for all chemical reactions is that there should be physical contact between the reactants.
31. Option (A) is correct.  
**Explanation:** The coefficients of  $\text{PbO}$  and  $\text{NO}_2$  in the given balanced chemical equation represent the ratio of the number of moles produced of the two substances. Therefore, the correct answer is the ratio of the number of moles produced of the two substances.
32. Option (D) is correct.  
**Explanation:** The balanced chemical equation shown above is:  
$$3\text{Fe} + 4\text{H}_2\text{O} \longrightarrow \text{Fe}_3\text{O}_4 + 4\text{H}_2$$
  
In this equation, three atoms of iron combine with water to form one molecule of iron oxide.
33. Option (C) is correct.  
**Explanation:** Decomposition reaction is a type of chemical reaction in which a compound breaks down into two or more simpler substances. In the case of rotting of fruits and vegetables, the complex organic compounds are broken down into simpler substances such as water, carbon dioxide, and other organic compounds by the action of enzymes and bacteria.
34. Option (B) is correct.  
**Explanation:** The combustion of methane can be represented by the following chemical equation:  
$$\text{CH}_4 + 2\text{O}_2 \rightarrow \text{CO}_2 + 2\text{H}_2\text{O} + \text{heat energy}$$
  
This equation shows that one molecule of methane reacts with two molecules of oxygen gas to produce one molecule of carbon dioxide, two molecules of water, and heat energy. The heat energy released during this reaction can be used as a source of fuel for various purposes.
35. Option (B) is correct.  
**Explanation:**
- It is a type of reaction in which one element is replaced by another in a compound.
  - The general description of displacement reaction can be given as:  
$$\text{AB} + \text{C} \rightarrow \text{AC} + \text{B}$$
  - The given reaction is an example of a displacement reaction is:



(Ammonia) (Oxygen) (Nitric oxide) (Water)

- This is a displacement reaction, as the ions get exchanged within other compounds.

36. Option (A) is correct.

**Explanation:**

- Oxidation in terms of Oxygen (O) can be defined as the addition of Oxygen. So that Iron (Fe) is oxidized due to the addition of Oxygen forming Iron(II, III) oxide ( $\text{Fe}_3\text{O}_4$ ).

- An oxidizing agent is the species that oxidize the other substance and reduces itself. Water ( $\text{H}_2\text{O}$ ) oxidizes Fe and itself reduces to form Hydrogen gas.

37. Option (A) is correct.

**Explanation:** Photosynthesis is a photochemical combination reaction. It is a subtype of combination reaction in which light energy is a catalyst, where light energy is directly absorbed from sunlight.

## ASSERTION-REASON QUESTIONS

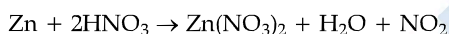
(1 Mark)

1. Option (C) is correct.

**Explanation:** When dilute HCl is added to a metal (substance 'X'), a colourless gas (hydrogen) is produced, which burns with a pop sound when a burning matchstick is brought near, confirming the presence of flammable hydrogen gas. However, the reason is incorrect because, in this reaction, hydrogen does not displace the metal. Instead, the metal reacts with the acid, displacing hydrogen from HCl and releasing hydrogen gas. Therefore, the assertion is true, but the reason is false.

2. Option (A) is correct.

**Explanation:** When zinc reacts with nitric acid, it does not release hydrogen gas, unlike many other reactions where metals react with acids (like zinc with hydrochloric acid). The general reaction when zinc reacts with nitric acid is:



In this reaction, Zinc reacts with nitric acid. Instead of hydrogen gas ( $\text{H}_2$ ) being released, nitrogen dioxide ( $\text{NO}_2$ ) is released as a product, which is a brown gas, and water ( $\text{H}_2\text{O}$ ) is formed.

**Reason:** Hydrogen gas is not evolved because nitric acid is a strong oxidizing agent. It oxidizes any hydrogen gas produced to form water ( $\text{H}_2\text{O}$ ).

Hence, both Assertion (A) and Reason (R) are correct, and Reason (R) correctly explains Assertion (A).

3. Option (A) is correct.

**Explanation:** When quicklime reacts with water, it undergoes an exothermic reaction, releasing a large amount of heat. Therefore, both the assertion and the reason are correct, and the reason correctly explains why the reaction is exothermic.

4. Option (D) is correct.

**Explanation:** Assertion is false because  $\text{BaSO}_4$  is insoluble in water and forms white precipitate. The reason is true because all aqueous solution do not form precipitate with aqueous solution but in some case it is possible.

5. Option (D) is correct.

**Explanation:** The assertion is incorrect because burning of natural gas is an exothermic process, not endothermic. The reason is correct as it accurately describes the chemical reaction involving methane and oxygen.

## Level - 2

## CASE-BASED QUESTIONS

(4 Marks)

1. (i) At 1 minute

(ii) (a) The rate of the reaction increases when the reaction is repeated with magnesium powder in place of magnesium ribbon under the same conditions.  $25 \text{ cm}^2$  of hydrogen gas is formed at 2 minutes.

OR

(b) Adding more amount of acid to the flask - 'Yes'

Heating the acid in the flask - 'Yes'

Using a higher concentration of acid - 'Yes'

(iii)  $\text{Mg}_{(\text{s})} + 2\text{HCl}_{(\text{aq})} \rightarrow \text{MgCl}_{2(\text{aq})} + \text{H}_{2(\text{g})}$

2. (i) Silver sulphide, a black coloured compound gets formed on the surface of silver by the action of corrosion.

(ii) Gold and Platinum are the metals which do not corrode easily.

(iii) (a) Corrosion is said to be an oxidation reaction because it involves the loss of electrons by a metal. In the process of corrosion, metal atoms are oxidised by oxygen in the presence of moisture or other corrosive substances. This results in the formation of metal oxides or other compounds, leading to the deterioration of the metal. The transfer of electrons from the metal to the oxygen is characteristic of oxidation reactions, which is why corrosion is described as an oxidation process. Iron articles are shiny when new, but get coated with reddish brown colour

when left for some time.

OR

(b) The marble statues often slowly get corroded when kept in air for a long time. This is

because the marble does react with the acidic compounds which are present in the air, like carbonic acid, sulphuric acid and nitric acid, etc.

### Level - 3

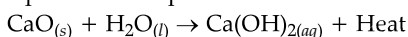
### VERY SHORT ANSWER TYPE QUESTIONS

(2 Marks)

1. (i) Exothermic/Displacement reaction/Redox reaction.  
Heat is evolved or a more reactive element displaces a less reactive element or aluminium reduces iron (III) oxide to iron

(ii) Double displacement/Precipitation reaction.  
As there is an exchange of ions between reactants and products/(Yellow) precipitate (of Lead iodide) is formed.

2. When calcium oxide (CaO) reacts with water, it undergoes a chemical reaction known as combination reaction. In this reaction, two substances combine to form a single product. The balanced chemical equation can represent this reaction:



In this reaction, water is added to calcium oxide (quick-lime), resulting in the formation of calcium hydroxide (slaked lime).

3. A precipitation reaction involves the formation of an insoluble product (precipitate) when two aqueous ionic compounds react and exchange ions. The statement "No precipitation reaction can occur without exchange of ions" is justified because the formation of a precipitate depends on the combination of specific ions that form an insoluble compound. Without ion exchange, there would be no interaction between ions that could result in the formation of an insoluble product.

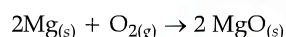
**Example:** Reaction:



The formation of precipitate, such as BaSO<sub>4</sub> is possible only because of the exchange of ions between the reactants. This justifies the statement that 'No precipitation reaction can occur without the exchange of ions between the two reactants.'

4. Displacement Reaction	Double Displacement Reaction
A displacement reaction occurs when a more reactive element removes a less reactive element from the solution.	A double displacement reaction occurs when the ions of both reactants exchange places to generate new molecules.
Example: $\text{CuSO}_{4(aq)} + \text{Fe}_{(s)} \rightarrow \text{FeSO}_{4(aq)} + \text{Cu}_{(s)}$	Example: $\text{AgNO}_{3(aq)} + \text{NaCl}_{(aq)} \rightarrow \text{AgCl}_{(s)} + \text{NaNO}_{3(aq)}$

5. When magnesium ribbon (Mg) is burnt in air, it reacts with oxygen (O<sub>2</sub>) to form magnesium oxide (MgO). The chemical equation for this reaction is:



The ash produced in this reaction is magnesium oxide (MgO), which is a white solid.

This reaction is an example of a synthesis or combination reaction. In a synthesis reaction, two or more substances combine to form a single product. In this case, magnesium (Mg) and oxygen (O<sub>2</sub>) combine to form magnesium oxide (MgO).

6. The product formed is copper oxide which is black in colour.

The chemical equation for the reaction is:



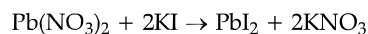
7. 
$$\text{BaCl}_{2(aq)} + \text{Na}_2\text{SO}_{4(aq)} \rightarrow \text{BaSO}_{4(s)} + 2\text{NaCl}_{(aq)}$$
  
Ba<sup>2+</sup>, SO<sub>4</sub><sup>2-</sup>

8. Yes, the given reaction is a redox reaction.

In this reaction, HCl is oxidised to Cl<sub>2</sub> and MnO<sub>2</sub> is reduced to MnCl<sub>2</sub>.

9. When aqueous solutions of potassium iodide and lead nitrate are mixed together, yellow precipitate of lead iodide is formed.

The reaction is double displacement reaction or Precipitation reaction.



10. HNO<sub>3</sub> – Nitric acid

Ca(OH)<sub>2</sub> – Calcium hydroxide

Ca(NO<sub>3</sub>)<sub>2</sub> – Calcium nitrate

H<sub>2</sub>O—Water

11. (i) 
$$\text{CaO} + \text{H}_2\text{O} \rightarrow \text{Ca(OH)}_2$$

(ii) It is the example of combination reaction and exothermic reaction because CaO combining with H<sub>2</sub>O and forming Ca(OH)<sub>2</sub>, during the reaction heat is releasing that's why it is exothermic reaction.

12. (i) 
$$2\text{K}_{(s)} + 2\text{H}_2\text{O}_{(l)} \rightarrow 2\text{KOH}_{(aq)} + \text{H}_{2(g)}$$

(ii) The type of chemical reaction that is prevented by storing potassium metal under kerosene is a single displacement reaction.

**SHORT ANSWER TYPE QUESTIONS****(3 Marks)**

1. (i) **Change in colour:** The solution will become green in colour.  
$$\text{Fe(s)} + \text{CuSO}_4(\text{aq}) \rightarrow \text{FeSO}_4 + \text{Cu(s)}$$

Blue                      Green

(ii) **Change in temperature:** The temperature will increase.  
$$\text{NaOH}(\text{aq}) + \text{HCl}(\text{aq}) \rightarrow \text{NaCl}(\text{aq}) + \text{H}_2\text{O}(\text{l})$$

+ Heat

(iii) **Formation of precipitate:** Yellow precipitate of  $\text{PbI}_2$  is formed.  
$$\text{Pb}(\text{NO}_3)_2(\text{aq}) + 2\text{KI}(\text{aq}) \rightarrow \text{PbI}_2(\text{s}) + 2\text{KNO}_3(\text{aq})$$

Yellow  
precipitate

2. Bubbles of hydrogen gas are formed which stick to the surface of calcium and make it lighter than water.  
$$\text{Ca(s)} + 2\text{H}_2\text{O}(\text{l}) \rightarrow \text{Ca}(\text{OH})_2(\text{aq}) + \text{H}_2(\text{g})$$

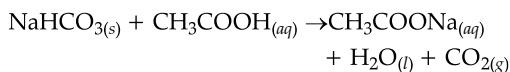
When the aqueous solution of the product formed, i.e., calcium hydroxide ( $\text{Ca}(\text{OH})_2$ ) reacts with Carbon dioxide gas, the solution formed turns milky.  
$$\text{Ca}(\text{OH})_2(\text{aq}) + \text{CO}_2(\text{g}) \rightarrow \text{CaCO}_3(\text{s}) + \text{H}_2\text{O}(\text{l})$$

3. (i) (1) Reducing Agent:  $\text{NH}_3$  (Ammonia)  
 $\text{NH}_3$  loses hydrogen (is oxidised) and reduces oxygen to water.  
(2) Reducing Agent:  $\text{H}_2\text{O}$  (water).  
 $\text{H}_2\text{O}$  donates electrons to  $\text{F}_2$ , causing the reduction of  $\text{F}_2$  to HF.
- (3) Reducing Agent: CO (carbon monoxide).
- 
- CO is oxidised to
- $\text{CO}_2$
- , reducing
- $\text{Fe}_2\text{O}_3$
- to Fe.
- 
- (4) Reducing Agent:
- $\text{H}_2$
- (hydrogen gas).
- 
- $\text{H}_2$
- is oxidised to
- $\text{H}_2\text{O}$
- , reducing
- $\text{O}_2$
- to water.(ii) A redox reaction is a chemical reaction which involves gain or loss of oxygen simultaneously.4. (i) The black substance formed is copper (II) oxide. It is formed because upon heating, the copper metal melts gradually and turns black on the surface. This is because the copper powder present in the china dish reacts with the atmospheric oxygen and forms copper (II) oxide.
- 
- (ii) This substance can be reversed to its original form by reacting copper oxide with hydrogen or carbon.5. (i) Bubbles of gas/evolution of gas
- 
- (ii) Change in colour. Zinc changes from silver grey to black.
- 
- (iii) Change in temperature.6. (i) Test tube B
- 
- (ii) Copper is lower to iron in the reactivity series so displacement reaction will be maximum.
- 
- (iii)
- $$\text{Fe}(\text{s}) + \text{CuSO}_4(\text{aq}) \rightarrow \text{FeSO}_4(\text{aq}) + \text{Cu}(\text{s})$$

**LONG ANSWER TYPE QUESTIONS****(5 Marks)**

1. A chemical reaction is a process in which substances, known as reactants, are transformed into different substances, known as products. During a chemical reaction, the bonds between atoms in the reactants are broken, and new bonds are formed to create the products. This process often involves the exchange or sharing of electrons and leads to changes in the properties and composition of the substances involved.
- (i) **Activity to Show Change of Colour:** Reaction Between copper sulphate and iron  
**Procedure:**
- Take a beaker and fill it with 100 ml of copper sulphate solution.
  - Drop an iron nail or iron filings into the solution.
  - Allow the setup to sit undisturbed for 15–20 minutes.
  - **Observation:** Initially, the copper sulphate solution is blue due to the presence of  $\text{Cu}^{2+}$  ions. After some time, the iron nail or filings become coated with a reddish-brown substance, and the blue colour of the solution fades to a lighter green or may disappear altogether.
- Chemical Reaction:**  
$$\text{Fe}(\text{s}) + \text{CuSO}_4(\text{aq}) \rightarrow \text{FeSO}_4(\text{aq}) + \text{Cu}(\text{s})$$

The change in colour from blue to greenish or colourless indicates a chemical change has occurred, where copper sulphate has been converted to iron sulphate and copper metal.
- (ii) **Activity to Show Change in Temperature:** Exothermic reaction of baking soda and Vinegar  
**Procedure:**
- Take a beaker and add 50 ml of vinegar to it.
  - Record the initial temperature of the vinegar using a thermometer.
  - Add a tablespoon of baking soda to the vinegar and immediately observe the reaction.
  - **Observation:** As soon as baking soda is added to the vinegar, a vigorous fizzing reaction occurs, producing bubbles and foam. Measure the temperature of the solution during the reaction.

**Chemical Reaction:**

The increase in temperature during the reaction demonstrates that a chemical change has taken place, with the reactants being transformed into new products and heat being released in the process.

2. (i) A reactant breaks down to give two or more products. A reaction which requires energy to split a compound or reactant in two or more simple substances.

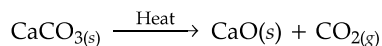
(I) Water splits into hydrogen gas and oxygen gas.

**Electrical energy**

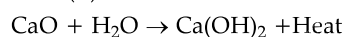
(II) Silver bromide decomposes into silver and bromine

**Light energy**

- (ii) (I) **Formation of calcium oxide:**



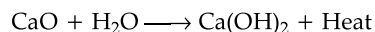
It is an endothermic reaction/decomposition reaction. (II) Formation of calcium hydroxide:



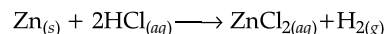
It is exothermic/combination reaction

3. (i) **Change in Temperature:** The reaction between calcium oxide (CaO) and water (H<sub>2</sub>O) to form calcium hydroxide [Ca(OH)<sub>2</sub>] is determined by change in temperature.

This is because the reaction between calcium oxide and water is highly exothermic and releases a lot of heat.



- (ii) **Evolution of Gas:** The reaction between zinc and hydrochloric acid to form zinc chloride and hydrogen gas is determined by evolution of gas. This is because hydrogen gas is evolved during the reaction.



- (iii) **Change in Colour:** The reaction between lead nitrate [Pb(NO<sub>3</sub>)<sub>2</sub>] and potassium iodide (KI) is determined by the change in colour. This is because during the reaction exchange of ions between the reactants takes place leading to the formation of potassium nitrate (KNO<sub>3</sub>) and a yellow precipitate of lead iodide (PbI<sub>2</sub>).



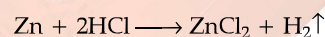
Lead nitrate	Potassium iodide	Lead iodide (Yellow ppt.)	Potassium nitrate
--------------	---------------------	------------------------------	----------------------

4. Displacement reaction is a type of reaction in which a more reactive element displaces another less reactive element. The reactivity series of metals can be used to find out the displacement reaction.

Chemical equation for a displacement reaction in which iron is a reactant:



Zinc is another element whose behaviour is similar to that of iron in such reaction.



This behaviour is not shown by gold as it is the least reactive element.

