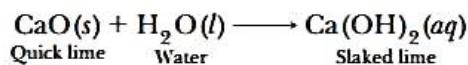


Chemical Reactions and Equations

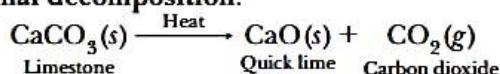
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Basic Concepts

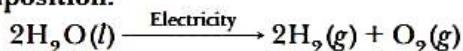
1. **Chemical reaction:** It is a process in which one or more substances react to form some other new substances with different properties.
 2. **Chemical equation:** It is the shorthand notation of actually occurring chemical reaction in terms of the symbols, formulae and the ratio of the number of various reactants and products involved.
 3. **Balanced chemical equation:** A chemical equation is said to be balanced when the number of atoms of each element on the reactant side is equal to the number of atoms of corresponding elements on the product side. Equations must always be balanced according to law of conservation of mass.
A complete balanced chemical equation represents the reactants, products and the conditions under which a reaction occurs.
 4. **Types of chemical reactions:** Chemical reactions can be classified into combination, decomposition, displacement and double displacement reactions.
 5. **Combination reaction:** A reaction in which two or more substances combine to form a new single substance is called a combination reaction.



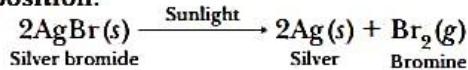
- 6. Decomposition reaction:** In decomposition reaction, a single substance decomposes to give two or more simpler substances. The reaction in which decomposition occurs by applying heat is known as **thermal decomposition**.



The reaction in which decomposition occurs by applying electricity is known as **electric decomposition**.



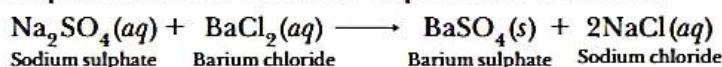
The reaction in which decomposition occurs in the presence of sunlight is called **photo decomposition**.



- 7. Displacement reaction:** The reaction in which a more reactive element displaces a less reactive element from its salt solution is called displacement reaction. In displacement reaction, one atom or a group of atoms of a compound is replaced by another atom or group of atoms.

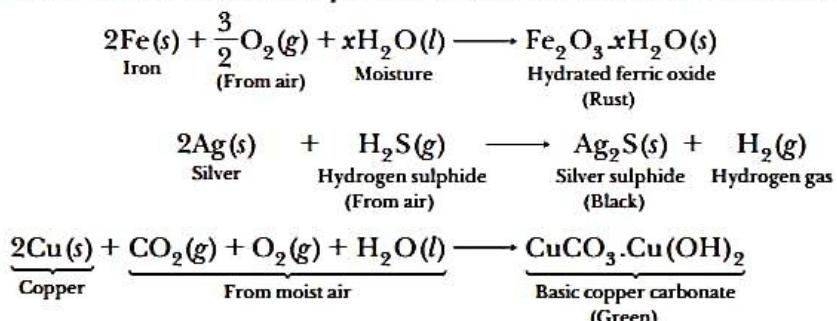


- 8. Double displacement reactions:** The reactions in which two compounds exchange their ions to form two new compounds are called double displacement reactions.



- 9. Exothermic reactions:** Reactions in which heat is given out along with the products are called exothermic reactions.
- 10. Endothermic reactions:** Reactions in which heat is absorbed are known as endothermic reactions.
- 11. Precipitation reactions** produce insoluble salts.
- 12. Redox (Oxidation-Reduction) Reactions:**
- (i) Oxidation is a process which involves gain of oxygen or loss of hydrogen.
 - (ii) Reduction is a process which involves gain of hydrogen or loss of oxygen.
 - (iii) Redox reactions are those reactions in which oxidation and reduction take place simultaneously.
 - (iv) Oxidising agent is a substance which gives oxygen or gains hydrogen.
Alternatively, oxidising agent is the substance which oxidises other substances and reduces itself.
 - (v) Reducing agent is a substance which gives hydrogen or gains oxygen.
Alternatively, reducing agent is the substance which reduces other substances and oxidises itself.

- 13. Corrosion:** The process of slowly eating up of the metals due to attack of atmospheric gases such as oxygen, carbon dioxide, hydrogen sulphide, water vapour, etc. on the surface of the metals so as to convert the metal into oxide, sulphide, carbonate, etc. is known as corrosion.



- 14. Methods to Prevent Corrosion:**

- ▶ Painting
- ▶ Oiling and greasing
- ▶ Plastic coating
- ▶ Chromium plating
- ▶ **Galvanising (zinc plating):** This method allows a coating of a more reactive metal (zinc) over the surface of iron or steel so that they can be protected against rusting.
- ▶ **Alloying:** This method changes the properties of the metal.

- 15. Rancidity:** We have often noticed that a food containing oil or fat, if left for a long time, develops a bad taste and smell. This is because the oils and fats present in such foods get oxidised with the passage of time. The products (compounds) formed as a result of this oxidation are volatile and have bad smell. Due to this reason, the taste of the food also changes.

The oxidation of oils or fats in a food resulting into a bad taste and smell is called rancidity.

- 16. Methods to Prevent Rancidity:**

- (i) **By adding anti-oxidants:** Anti-oxidant is a substance (or chemical) which prevents oxidation. In the food industry, a number of special types of substances are added before packing which slow down the process of oxidation. BHA (Butylated Hydroxy Anisole) is one of the example of antioxidants.
- (ii) **Vacuum packing:** In a number of cases, after packing the food, the container is evacuated before sealing so that no air/oxygen is available to bring about the oxidation of the food.

(iii) **Replacing air by nitrogen:** In some food-stuffs, the air present around them is replaced by nitrogen in the packet containing the food-stuff. Thus, oxidation of the food-stuff is prevented. For example, the plastic bags containing chips are flushed with nitrogen to prevent them from oxidation.

(iv) **Refrigeration of the food-stuff:** When the food is kept in a refrigerator, the oxidation of fats and oils in it is slowed down due to low temperature, so the development of rancidity due to oxidation is retarded.

NCERT Intext Questions

Q. 1. Why should a magnesium ribbon be cleaned before burning in air?

Ans. The magnesium ribbon which we use usually has a coating of a white layer of magnesium oxide on its surface. It is formed by the slow reaction of moist air on it. This hinders the burning of magnesium. So, this layer is removed by rubbing with sandpaper before burning.

Q. 2. Write the balanced equation for the following chemical reactions:

(i) Hydrogen + Chlorine —→ Hydrogen chloride

(ii) Barium chloride + Aluminium sulphate —→ Barium sulphate + Aluminium chloride

(iii) Sodium + Water —→ Sodium hydroxide + Hydrogen

Ans. (i) $\text{H}_2(g) + \text{Cl}_2(g) \longrightarrow 2\text{HCl}(g)$

(ii) $3\text{BaCl}_2(aq) + \text{Al}_2(\text{SO}_4)_3(aq) \longrightarrow 3\text{BaSO}_4(s) + 2\text{AlCl}_3(aq)$

(iii) $2\text{Na}(s) + 2\text{H}_2\text{O}(l) \longrightarrow 2\text{NaOH}(aq) + \text{H}_2(g)$

Q. 3. Write a balanced chemical equation with state symbols for the following reactions:

(i) Solutions of barium chloride and sodium sulphate in water react to give insoluble barium sulphate and the solution of sodium chloride.

(ii) Sodium hydroxide solution (in water) reacts with hydrochloric acid solution (in water) to produce sodium chloride solution and water.

Ans. (i) $\text{BaCl}_2(aq) + \text{Na}_2\text{SO}_4(aq) \longrightarrow \text{BaSO}_4(s) + 2\text{NaCl}(aq)$

(ii) $\text{NaOH}(aq) + \text{HCl}(aq) \longrightarrow \text{NaCl}(aq) + \text{H}_2\text{O}(l)$

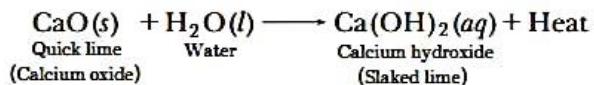
Q. 4. A solution of a substance 'X' is used for whitewashing.

(i) Name the substance 'X' and write its formula.

(ii) Write the reaction of the substance 'X' named in (i) above with water.

Ans. (i) The substance 'X' used for whitewashing is quick lime (calcium oxide). Its formula is CaO .

(ii) When quick lime is mixed with water, the following reaction takes place:



Q. 5. Why is the amount of gas collected in one of the test tubes double of the amount collected in the other in electrolysis of water experiment? Name this gas.

Ans. The gas which is collected in double the amount in the electrolysis of water experiment is hydrogen. This is because water (H_2O) contains two parts of hydrogen element as compared to one part of oxygen element by volume.

Q. 6. Why does the colour of copper sulphate solution change when an iron nail is dipped in it?

Ans. Iron is more reactive than copper. It displaces copper from copper sulphate solution according to the following reaction:

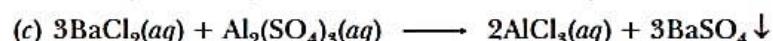


According to the law of conservation of mass, matter can neither be created nor destroyed in a chemical reaction. During a chemical reaction, the total mass of reactants and products remain the same. Hence, in a chemical reaction, the number of atoms of the various elements on both sides should be equal. Therefore, a chemical equation is to be balanced in accordance with the law of conservation of mass.

Q. 5. Translate the following statements into chemical equations and then balance them.

- Hydrogen gas combines with nitrogen to form ammonia.
- Hydrogen sulphide gas burns in air to give water and sulphur dioxide.
- Barium chloride reacts with aluminium sulphate to give aluminium chloride and a precipitate of barium sulphate.
- Potassium metal reacts with water to give potassium hydroxide and hydrogen gas.

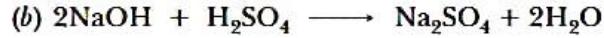
Ans. (a) $\text{N}_2(g) + 3\text{H}_2(g) \longrightarrow 2\text{NH}_3(g)$



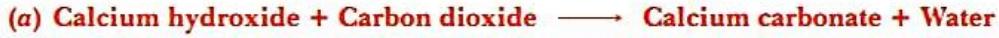
Q. 6. Balance the following chemical equations:



Ans. (a) $2\text{HNO}_3 + \text{Ca}(\text{OH})_2 \longrightarrow \text{Ca}(\text{NO}_3)_2 + 2\text{H}_2\text{O}$



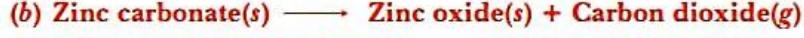
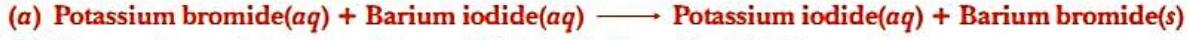
Q. 7. Write the balanced chemical equations for the following reactions.



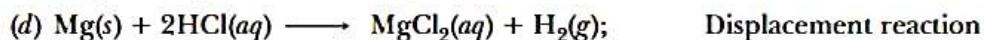
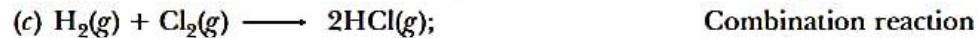
Ans. (a) $\text{Ca}(\text{OH})_2(aq) + \text{CO}_2(g) \longrightarrow \text{CaCO}_3(s) + \text{H}_2\text{O}(l)$



Q. 8. Write the balanced chemical equation for the following and identify the type of reaction in each case.



Ans. (a) $2\text{KBr}(aq) + \text{BaI}_2(aq) \longrightarrow 2\text{KI}(aq) + \text{BaBr}_2(s)$; Double displacement reaction



Q. 9. What does one mean by exothermic and endothermic reactions? Give examples.

Ans. **Exothermic reaction:** In exothermic reaction, heat is evolved during the reaction which is indicated by '+ heat' sign on the right hand side of the equation.

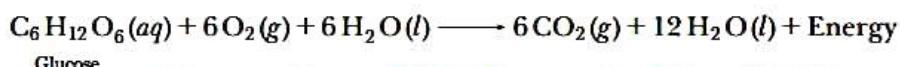
For example: $\text{CaO}(s) + \text{H}_2\text{O}(l) \longrightarrow \text{Ca}(\text{OH})_2(aq) + \text{Heat}$

Endothermic reaction: In this reaction, heat is absorbed which is indicated by putting '+ heat' sign on the left hand side of the equation.

For example: $\text{N}_2(g) + \text{O}_2(g) + \text{Heat} \longrightarrow 2\text{NO}(g)$

Q. 10. Why is respiration considered an exothermic reaction? Explain.

Ans. During respiration, the glucose combines with oxygen in the cells of our body and provides energy. Thus, respiration is an exothermic process because energy is produced during this process.



Q. 11. Why are decomposition reactions called the opposite of combination reactions? Write equations for these reactions.

Ans. In a combination reaction, two or more substances combine to form a single product. Also, a large amount of heat is evolved.

The decomposition reactions require energy either in the form of heat, light or electricity for breaking down one substance into two or more substances.

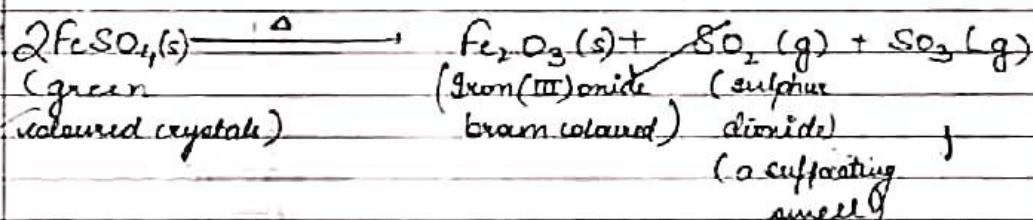


Q. 12. Write one equation each for decomposition reactions where energy is supplied in the form of heat, light or electricity. [CBSE 2018]

Ans.

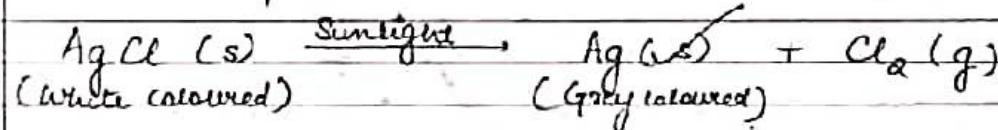
$$\text{Answer: } 6$$

(i) Thermal decomposition reaction

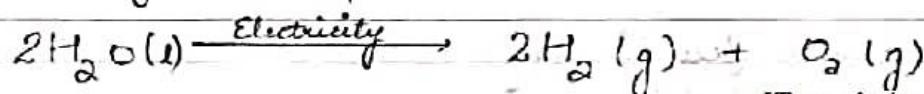


\Rightarrow Green coloured crystals change to brown coloured Fe_2O_3 along with gases like SO_2 & SO_3 .

ii) Photo-decomposition reaction



(iii) Electrolytic decomposition reaction



[Topper's Answer 2018]

Q. 13. What is the difference between displacement and double displacement reactions? Write equations for these reactions.

Ans. In a displacement reaction, a more reactive element displaces or removes another element from its compound.

For example, zinc being more reactive, displaces copper from its compound.



In case of double displacement reactions, two compounds react by exchanging their ions and form two new compounds.

For example, silver nitrate and sodium chloride exchange their ions, NO_3^- and Cl^- respectively and form two new compounds in the following reaction



Q. 14. In the refining of silver, the recovery of silver from silver nitrate solution involved displacement by copper metal. Write down the reaction involved.



Q. 15. What do you mean by precipitation reactions? Explain by giving examples.

Ans. On mixing the clear solutions of two ionic compounds, a substance which is insoluble in water, is formed. This insoluble substance formed is known as precipitate. Any reaction that produces a precipitate is called a precipitation reaction.

When sodium sulphate solution is mixed with barium chloride solution, a white precipitate of BaSO_4 is formed by the reaction of SO_4^{2-} and Ba^{2+} .

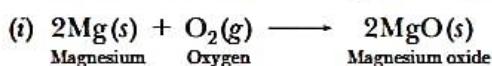


The other product formed is sodium chloride which remains in the solution.

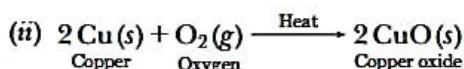
Q. 16. Explain the following in terms of gain or loss of oxygen with two examples each:

(a) Oxidation, (b) Reduction.

Ans. **(a) Oxidation:** It is defined as a process which involves gain of oxygen. For example,

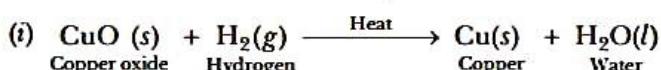


Here, Mg has gained oxygen to form MgO. Hence, Mg has been oxidised to MgO.

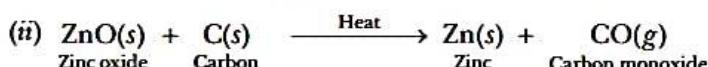


In this reaction, Cu has gained oxygen to form CuO. Thus, Cu is oxidised to copper oxide (CuO).

(b) Reduction: It is defined as the process which involves loss of oxygen. For example,



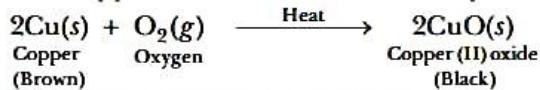
In this reaction, copper oxide is losing oxygen. So, it is being reduced to copper.



In this reaction, zinc oxide is losing oxygen. So it is being reduced to zinc.

Q. 17. A shiny brown coloured element 'X' on heating in air becomes black in colour. Name the element 'X' and the black coloured compound formed.

Ans. Element X is copper. The black coloured compound formed is copper (II) oxide.



Q. 18. Why do we apply paint on iron articles?

Ans. By coating paint over iron articles, the contact of moist air with iron is cut off. So, moist air cannot attack on the surface of iron articles and there is no risk of rusting (corrosion of iron). Thus, iron articles can be protected from damage for many years.

Q. 19. Oil and fat containing food items are flushed with nitrogen. Why?

Ans. In the presence of oxygen in the air, the fats present in the fatty food are oxidised to compounds which have a bad smell, i.e., the food becomes rancid. Flushing with nitrogen cuts off the contact of food with oxygen and protects the food from rancidity.

Q. 20. Explain the following terms with one example each.

Ans. (a) **Corrosion:** It is a process of slow and gradual conversion of a metal into its undesirable compounds (sulphides, carbonates, oxides, etc.) by the attack of air and moisture (water) present in the atmosphere.

For example, reddish brown coating on iron, black coating on silver and green coating on copper are some examples of corrosion of iron, silver and copper respectively. Corrosion of iron is known as rusting.

(b) **Rancidity:** When the food items are kept for a long period, the fats and oils present in them get oxidised and their smell and taste change. They become rancid and so the process is called rancidity.

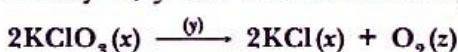
For example, rancid (decaying) flavour or smell in old cooking oil.

Multiple Choice Questions

Each question has 4 choices (a), (b), (c) and (d). Choose and write the correct option.

1. Identify 'x', 'y' and 'z' in the following reaction:

[CBSE 2020 (31/2/1)]



- (a) x = gas; y = reaction condition; z = gas
 (b) x = solid; y = liquid; z = gas
 (c) x = number of moles of KClO_3 ; y = reaction condition; z = no. of molecules of oxygen
 (d) x = physical state of KClO_3 and KCl ; y = reaction condition; z = physical state of O_2

2. In which of the following equations, the mass is not same on both the sides?

- (a) Word equation (b) Skeletal equation (c) Balanced equation (d) Both (a) and (b)

3. A student makes a list of some activities he observes one day.

[CBSE Question Bank]

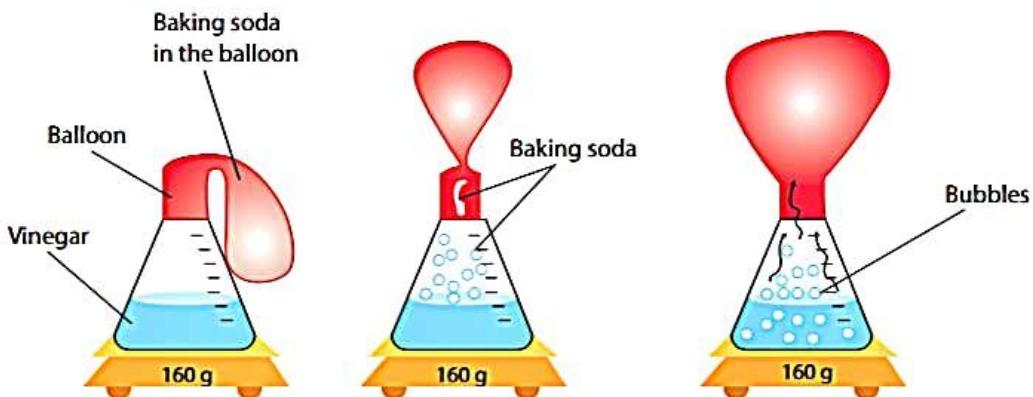
1. Baking a cake in an oven
 2. Cutting an apple pie into slices
 3. Crushing the can after drinking a soda
 4. Carving a wooden log to make a stand

Which activity can the student classify as a chemical change?

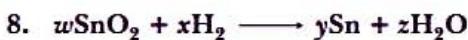
- (a) Activity 1, as the properties of the substances in the mixture change.
(b) Activity 2, as the physical state of the apple pie changes when cut.

- (c) Activity 3, as the shape of the can changes.
(d) Activity 4, as the shape and size of the wooden log changes.

4. A student poured 100 mL of water in a bottle and added 40 mL vinegar to it. A balloon was filled with 20 g baking soda and was fixed at the mouth of the bottle. Slowly the shape of the balloon changed, as shown. [Competency Based Question] [CBSE Question Bank]



The student claims that a chemical change happened when the two substances were mixed. Is the claim made by the student correct?



[CBSE Question Bank]

For which of the following values of w , x , y and z will the equation above be balanced?

- (a) $w = 1, x = 1, y = 1, z = 1$ (b) $w = 1, x = 2, y = 2, z = 1$
(c) $w = 1, x = 2, y = 1, z = 2$ (d) $w = 1, x = 1, y = 1, z = 2$

9. Which of the following is not a physical change?

[NCERT Exemplar]

- (a) Boiling of water to give water vapour
(b) Melting of ice to give water
(c) Dissolution of salt in water
(d) Combustion of Liquefied Petroleum Gas (LPG)

10. Which among the following is (are) double displacement reaction(s)?

[NCERT Exemplar]

- (i) $\text{Pb} + \text{CuCl}_2 \longrightarrow \text{PbCl}_2 + \text{Cu}$
(ii) $\text{Na}_2\text{SO}_4 + \text{BaCl}_2 \longrightarrow \text{BaSO}_4 + 2\text{NaCl}$
(iii) $\text{C} + \text{O}_2 \longrightarrow \text{CO}_2$
(iv) $\text{CH}_4 + 2\text{O}_2 \longrightarrow \text{CO}_2 + 2\text{H}_2\text{O}$
(a) (i) and (iv) (b) (ii) only (c) (i) and (ii) (d) (iii) and (iv)

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



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?

[CBSE 2020 (31/I/I)]

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

12. A student adds lead and silver to two different test tubes containing an equal amount of copper sulphate solution. The student observes that the colour of the solution in the test tube with lead changes. What explains the change in the colour of the solution? [CBSE Question Bank]

- (a) A displacement reaction takes place as lead replaces copper from the solution.
(b) Decomposition reaction takes place as copper dissociates from sulphate in the solution.
(c) A double displacement reaction takes place as copper dissociates from sulphate and lead combines with sulphate in the solution.
(d) A combination reaction takes place as lead combines with sulphate in the solution.

13. A dilute ferrous sulphate solution was gradually added to the beaker containing acidified potassium permanganate solution. The light purple colour of the solution fades and finally disappears. Which of the following is the correct explanation for the observation?

[NCERT Exemplar] [HOTS]

- (a) KMnO_4 is an oxidising agent, it oxidises FeSO_4 .
(b) FeSO_4 acts as an oxidising agent and oxidises KMnO_4 .
(c) The colour disappears due to dilution; no reaction is involved.
(d) KMnO_4 is an unstable compound and decomposes in presence of FeSO_4 to a colourless compound.

14. Which of the following reactions is an endothermic reaction?

[CBSE Sample Paper 2020]

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

15. Which of the following are combination reactions? [NCERT Exemplar]
- (i) $2\text{KClO}_3 \longrightarrow 2\text{KCl} + 3\text{O}_2$ (ii) $\text{MgO} + \text{H}_2\text{O} \longrightarrow \text{Mg(OH)}_2$
 (iii) $4\text{Al} + 3\text{O}_2 \longrightarrow 2\text{Al}_2\text{O}_3$ (iv) $\text{Zn} + \text{FeSO}_4 \longrightarrow \text{ZnSO}_4 + \text{Fe}$
 (a) (i) and (iii) (b) (iii) and (iv) (c) (ii) and (iv) (d) (ii) and (iii)
16. Strong heating of ferrous sulphate leads to the formation of a brown solid and two gases. This reaction can be categorised as [CBSE 2020 (31/5/1)]
 (a) displacement and redox (b) decomposition and redox
 (c) displacement and endothermic (d) decomposition and exothermic
17. In which of the following chemical equations, the abbreviations represent the correct states of the reactants and products involved at reaction temperature? [NCERT Exemplar]
 (a) $2\text{H}_2(l) + \text{O}_2(l) \longrightarrow 2\text{H}_2\text{O}(g)$ (b) $2\text{H}_2(g) + \text{O}_2(l) \longrightarrow 2\text{H}_2\text{O}(l)$
 (c) $2\text{H}_2(g) + \text{O}_2(g) \longrightarrow 2\text{H}_2\text{O}(l)$ (d) $2\text{H}_2(g) + \text{O}_2(g) \longrightarrow 2\text{H}_2\text{O}(g)$
18. Which of the following are exothermic processes? [NCERT Exemplar]
 (i) Reaction of water with quick lime (ii) Dilution of an acid
 (iii) Evaporation of water (iv) Sublimation of camphor (crystals)
 (a) (i) and (ii) (b) (ii) and (iii) (c) (i) and (iv) (d) (iii) and (iv)
19. Which one of the following processes involve chemical reactions? [NCERT Exemplar]
 (a) Storing of oxygen gas under pressure in a gas cylinder
 (b) Liquefaction of air
 (c) Keeping petrol in a china dish in the open
 (d) Heating copper wire in presence of air at high temperature
20. In the double displacement reaction between aqueous potassium iodide and aqueous lead nitrate, a yellow precipitate of lead iodide is formed. While performing the activity if lead nitrate is not available, which of the following can be used in place of lead nitrate? [NCERT Exemplar] [HOTS]
 (a) Lead sulphate (insoluble) (b) Lead acetate
 (c) Ammonium nitrate (d) Potassium sulphate
21. Solid calcium oxide reacts vigorously with water to form calcium hydroxide accompanied by liberation of heat. This process is called slaking of lime. Calcium hydroxide dissolves in water to form its solution called lime water. Which among the following is (are) true about slaking of lime and the solution formed? [NCERT Exemplar]
 (i) It is an endothermic reaction
 (ii) It is an exothermic reaction
 (iii) The pH of the resulting solution will be more than seven
 (iv) The pH of the resulting solution will be less than seven
 (a) (i) and (ii) (b) (ii) and (iii)
 (c) (i) and (iv) (d) (iii) and (iv)
22. A student writes a balanced chemical equation as [CBSE Question Bank]
 $\text{Pb}(s) + \text{CuCl}_2(aq) \longrightarrow \text{PbCl}_2(aq) + \text{Cu}(s)$
- Which option gives the number of atoms on the LHS and RHS of the chemical equation?

	Element	Number of Atoms in Reactants (LHS)	Number of Atoms in Products (RHS)
(a)	Pb	1	1
	Cu	1/2	1/2
	Cl	2	2

(b)	Pb	1	1
	Cu	1	1
	Cl	1/2	1/2
(c)	Pb	1	1
	Cu	1	1
	Cl	1	1
(d)	Pb	1	1
	Cu	1	1
	Cl	2	2

- 23.** The reaction between iron oxide and hydrogen is given below.

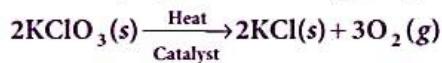


Which option shows the compounds undergoing oxidation and reduction?

[CBSE Question Bank]

	Oxidation	Reduction
(a)	4H_2	Fe_3O_4
(b)	Fe_3O_4	$4\text{H}_2\text{O}$
(c)	$4\text{H}_2\text{O}$	Fe_3O_4
(d)	3Fe	4H_2

24. The following reaction is used for preparation of oxygen gas in the laboratory:



Which of the following statements is correct about the reaction?

[NCERT Exemplar]

- (a) It is a decomposition reaction and endothermic in nature.
 - (b) It is a combination reaction.
 - (c) It is a decomposition reaction and is accompanied by release of heat.
 - (d) It is a photo chemical decomposition reaction and exothermic in nature.

25. 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: [CBSE 2020 (31/1/I)]

26. A student notices that the bread kept out has a green coloured coating over it after a few days. What explains the reason for the student's observation? [CBSE Question Bank]

 - (a) The oils in the bread reduces and cause the change in the colour of the bread.
 - (b) Bread comes in contact with atmospheric moisture and corrodes.
 - (c) The oil in the bread oxidises and causes rancidity.
 - (d) Comes in contact with the atmospheric nitrogen and a layer deposits over it.

Answers

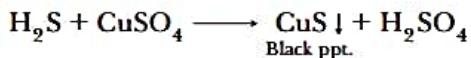
- | | | | | | | |
|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| 1. (d) | 2. (d) | 3. (a) | 4. (a) | 5. (a) | 6. (c) | 7. (a) |
| 8. (c) | 9. (d) | 10. (b) | 11. (d) | 12. (a) | 13. (a) | 14. (d) |
| 15. (d) | 16. (b) | 17. (d) | 18. (a) | 19. (d) | 20. (b) | 21. (b) |
| 22. (d) | 23. (a) | 24. (a) | 25. (d) | 26. (c) | | |

Explanations of selected Multiple Choice Questions

2. (d) The mass is same on both the sides only when the equation is balanced. Skeletal equations are unbalanced equations.
4. (a) When vinegar reacts with baking soda, carbon dioxide gas is produced.
9. (d) Combustion of LPG is a chemical change because the new products, carbon dioxide and water are produced.
14. (d) Decomposition of calcium carbonate occurs by applying heat.
20. (b) The reaction is $\text{Pb}(\text{NO}_3)_2 + 2\text{KI} \longrightarrow \text{PbI}_2 \downarrow + 2\text{KNO}_3$
Yellow ppt.

Lead nitrate can be replaced by any other salt of lead only. As lead sulphate being insoluble does not dissociate into ions, so lead acetate is used.

23. (a) H_2 is gaining oxygen to form H_2O so it is getting oxidised while Fe_3O_4 is losing oxygen to form Fe so it is getting reduced.
25. (d) The reaction is



In this reaction, cupric ions from copper sulphate combine with sulphide ions to form CuS and hydrogen ions combine with sulphate ions to form H_2SO_4 .

Assertion-Reason Questions

The following questions consist of two statements — Assertion (A) and Reason (R). Answer these questions selecting the appropriate option given below:

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

1. Assertion(A) : Decomposition of vegetable matter into compost is an example of exothermic reaction.

Reason (R) : Exothermic reactions are those reactions in which heat is evolved.

2. Assertion(A) : When HCl is added to zinc granules, a chemical reaction occurs. [HOTS]

Reason (R) : Evolution of a gas and change in colour indicate that the chemical reaction is taking place.

3. Assertion(A) : Calcium carbonate when heated gives calcium oxide and water.

Reason (R) : On heating calcium carbonate, decomposition reaction takes place.

4. Assertion(A) : Brown fumes are produced when lead nitrate is heated.

Reason (R) : Nitrogen dioxide gas is produced as a by product due to the decomposition of lead nitrate.

5. Assertion(A) : White silver chloride turns grey in sunlight.

Reason (R) : Decomposition of silver chloride in presence of sunlight takes place to form silver metal and chlorine gas.

6. Assertion(A) : Pungent smelling gas is produced when sulphur burns in air.

Reason (R) : Sulphur trioxide is formed on reaction of sulphur with oxygen.

7. Assertion(A) : In a reaction of copper with oxygen, copper serves as a reducing agent.

Reason (R) : The substance which gains oxygen in a chemical reaction acts as a reducing agent.

- (ii) The reducing agent in the reaction IV and V is 1
 (a) Fe and V_2O_5 (b) Ca and Fe (c) H_2O and Ca (d) V and H_2O
- (iii) If hydrogen gas is passed over CuO, then the colour of the product formed is 1
 (a) brown (b) yellow (c) green (d) blue
- (iv) Out of the examples shown in the table which of the redox reactions is also a combination reaction? 1
 (a) I (b) II (c) III (d) IV
- Ans.** (i) (d); Alkaline $KMnO_4$ and acidified $K_2Cr_2O_7$ both act as oxidizing agents.
 (ii) (b); Since Ca and Fe is gaining oxygen in the reaction IV and V respectively, i.e., they are undergoing oxidation and therefore they act as reducing agent.
 (iii) (a); If hydrogen gas is passed over CuO, the opposite reaction takes place. The black coating turns brown and copper is obtained.
 (iv) (b); Since Mg is combining with O_2 to form MgO so it is a combination reaction.

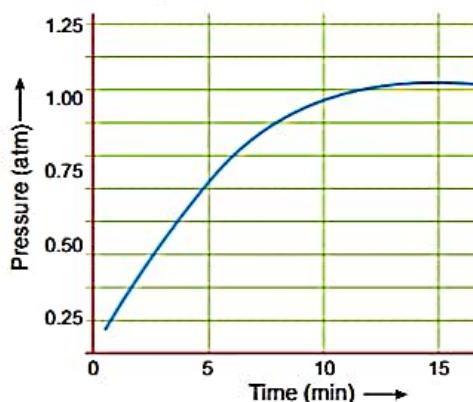
PASSAGE-2

Marble's popularity began in ancient Rome and Greece, where white and off-white marble were used to construct a variety of structures, from hand-held sculptures to massive pillars and buildings.

[Competency Based Question] [CBSE Question Bank]



- (i) The substance not likely to contain $CaCO_3$ is 1
 (a) dolomite (b) a marble statue
 (c) calcined gypsum (d) sea shells
- (ii) A student added 10 g of calcium carbonate in a rigid container, secured it tightly and started to heat it. After some time, an increase in pressure was observed, the pressure reading was then noted at intervals of 5 mins and plotted against time, in a graph as shown below. During which time interval did maximum decomposition took place? 1



- (a) 15-20 min (b) 10-15 min (c) 5-10 min (d) 0-5 min

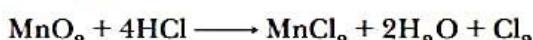
8. Assertion(A) : Following is a balanced chemical equation for the action of steam on iron:



[CBSE 2020 (31/4/I)] [HOTS]

Reason (R) : The law of conservation of mass holds good for a chemical equation.

9. Assertion(A) : The reaction



is an example of a redox reaction.

[CBSE 2020 (31/4/2)]

Reason (R) : In this reaction, HCl is reduced to Cl_2 whereas MnO_2 is oxidised to MnCl_2 .

10. Assertion(A) : After white washing the walls, a shiny white finish on walls is obtained after two to three days.

[CBSE Sample Paper 2021]

Reason (R) : Calcium oxide reacts with carbon dioxide to form calcium hydrogen carbonate which gives shiny white finish.

Answers

- | | | | | | | |
|--------|--------|---------|--------|--------|--------|--------|
| 1. (a) | 2. (b) | 3. (d) | 4. (a) | 5. (a) | 6. (c) | 7. (a) |
| 8. (b) | 9. (c) | 10. (c) | | | | |

Explanations of selected Assertion-Reason Questions

2. (b) The reaction is $\text{Zn} + \text{HCl} \longrightarrow \text{ZnCl}_2 + \text{H}_2$. Only the evolution of gas takes place. There is no change in colour.
3. (d) Calcium carbonate on heating gives calcium oxide and carbon dioxide gas.
6. (c) Sulphur reacts with oxygen to form sulphur dioxide.
8. (b) It is a balanced chemical equation because the number of atoms of Fe, H and O are equal on both the sides.
9. (c) MnO_2 is reduced to MnCl_2 and HCl is oxidised to Cl_2 .
10. (c) Calcium oxide reacts with carbon dioxide to form calcium carbonate which gives white shiny finish to walls.

Passage-based/Case-based/Source-based Questions

Read the following passages and answer the questions that follow.

PASSAGE-1

Oxidation is the process of gaining of oxygen, or losing of hydrogen. Reduction is the process of losing of oxygen or gaining of hydrogen. The substance which undergoes oxidation is the reducing agent while the substance which undergoes reduction is known as the oxidising agent. Oxidation and reduction always take place together and these types of reactions are known as redox reactions. Some of the examples of redox reactions are given below:

- | | |
|------|--|
| I. | $\text{Pb}_3\text{O}_4 + 8\text{HCl} \longrightarrow 3\text{PbCl}_2 + \text{Cl}_2 + 4\text{H}_2\text{O}$ |
| II. | $2\text{Mg} + \text{O}_2 \longrightarrow 2\text{MgO}$ |
| III. | $\text{CuSO}_4 + \text{Zn} \longrightarrow \text{Cu} + \text{ZnSO}_4$ |
| IV. | $\text{V}_2\text{O}_5 + 5\text{Ca} \longrightarrow 2\text{V} + 5\text{CaO}$ |
| V. | $3\text{Fe} + 4\text{H}_2\text{O} \longrightarrow \text{Fe}_3\text{O}_4 + 4\text{H}_2$ |
| VI. | $\text{CuO} + \text{H}_2 \longrightarrow \text{Cu} + \text{H}_2\text{O}$ |

(i) Which of the following is an oxidising agent?

- | | |
|---|------------------------------|
| (a) LiAlH_4 | (b) Alkaline KMnO_4 |
| (c) Acidified $\text{K}_2\text{Cr}_2\text{O}_7$ | (d) Both (b) and (c) |

1

- (ii) The reducing agent in the reaction IV and V is 1
 (a) Fe and V_2O_5 (b) Ca and Fe (c) H_2O and Ca (d) V and H_2O
- (iii) If hydrogen gas is passed over CuO, then the colour of the product formed is 1
 (a) brown (b) yellow (c) green (d) blue
- (iv) Out of the examples shown in the table which of the redox reactions is also a combination reaction? 1
 (a) I (b) II (c) III (d) IV
- Ans.** (i) (d); Alkaline $KMnO_4$ and acidified $K_2Cr_2O_7$ both act as oxidizing agents.
 (ii) (b); Since Ca and Fe is gaining oxygen in the reaction IV and V respectively, i.e., they are undergoing oxidation and therefore they act as reducing agent.
 (iii) (a); If hydrogen gas is passed over CuO, the opposite reaction takes place. The black coating turns brown and copper is obtained.
 (iv) (b); Since Mg is combining with O_2 to form MgO so it is a combination reaction.

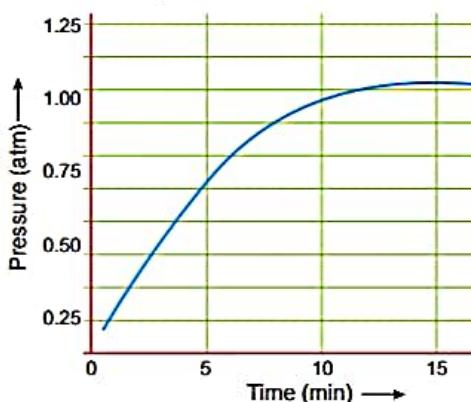
PASSAGE-2

Marble's popularity began in ancient Rome and Greece, where white and off-white marble were used to construct a variety of structures, from hand-held sculptures to massive pillars and buildings.

[Competency Based Question] [CBSE Question Bank]

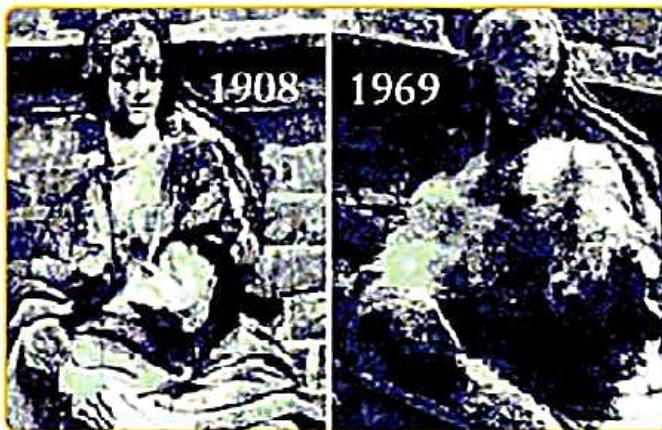


- (i) The substance not likely to contain $CaCO_3$ is 1
 (a) dolomite (b) a marble statue
 (c) calcined gypsum (d) sea shells
- (ii) A student added 10 g of calcium carbonate in a rigid container, secured it tightly and started to heat it. After some time, an increase in pressure was observed, the pressure reading was then noted at intervals of 5 mins and plotted against time, in a graph as shown below. During which time interval did maximum decomposition took place? 1



- (a) 15-20 min (b) 10-15 min (c) 5-10 min (d) 0-5 min

- (iii) Gas A, obtained above is a reactant for a very important biochemical process which occurs in the presence of sunlight. Identify the name of the process. 1
 (a) Respiration (b) Photosynthesis (c) Transpiration (d) Sphotolysis
- (iv) Marble statues are corroded or stained when they repeatedly come into contact with polluted rain water. Identify the main reason. 1



- (a) decomposition of calcium carbonate to calcium oxide
 (b) polluted water is basic in nature hence it reacts with calcium carbonate
 (c) polluted water is acidic in nature hence it reacts with calcium carbonate
 (d) calcium carbonate dissolves in water to give calcium hydroxide.

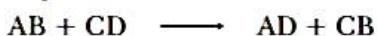
- Ans.** (i) (c); In calcined gypsum, or hemihydrate ($\text{CaSO}_4 \cdot 0.5\text{H}_2\text{O}$), CaCO_3 is not present.
 (ii) (d); during this time interval, maximum increase in pressure was observed. So, maximum decomposition takes place.
 (iii) (b); photosynthesis
 (iv) (c); polluted water is acidic in nature hence it reacts with calcium carbonate

PASSAGE-3

In **single-replacement reactions**, an element, symbolized as A, reacts with a compound, BC, to take the place of one of the component of the compound. This type of reaction can be represented by the following general equation.



In **double-replacement reactions**, two compounds, AB and CD, can be thought of as "exchanging partners" to produce two different compounds, AD and CB.



The positive ion, A, in the first compound combines with the negative ion, D, in the second compound while the positive ion, C, of the second compound combines with the negative ion, B, in the first compound.

Source: Section 10.4—Classifying Reactions, Page No. 293, 'Essentials of Chemistry' by Ralph A-Burns.

- (i) On keeping the iron nails dipped in copper sulphate solution for about 30 minutes, what are the changes that you will observe? 1
 (ii) What is the colour of the precipitate obtained when aqueous silver nitrate and sodium chloride are mixed? 1
 (iii) On adding dilute hydrochloric acid to the reaction mixture of sodium sulphite and barium chloride, white precipitate disappears. Give reason. [NCERT Exemplar] [HOTS] 2

- Ans.** (i) Iron nails become brownish in colour and the blue colour of copper sulphate solution changes to light green. This is because iron displaces copper from copper sulphate solution and forms ferrous sulphate which is light green in colour.



- (ii) When aqueous solutions of silver nitrate and sodium chloride are mixed, double displacement of ions takes place. As a result of which, a white precipitate of silver chloride and a solution of sodium nitrate are formed.



- (iii) When sodium sulphite reacts with barium chloride, BaSO_3 is formed. BaSO_3 is a salt of a weak acid (H_2SO_3), therefore dilute acid such as HCl decomposes barium sulphite to produce sulphur dioxide gas which has the smell of burning sulphur. BaCl_2 is soluble in water and therefore white precipitate disappears.



Very Short Answer Questions

Each of the following questions are of 1 mark and have to be answered in one word or one sentence.

- Q. 1. What does the word aqueous (aq) represent in a chemical reaction?**

Ans. It represents that the compound is present as a solution in water.

- Q. 2. What is wrong with the following equation?**



Identify the mistake and balance the equation.

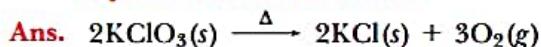
Ans. In this equation, oxygen should be in molecular form (O_2).



- Q. 3. What is meant by skeletal equation?**

Ans. The equation where the number of atoms of each element on both the sides of a chemical equation are not equal is called skeletal equation.

- Q. 4. Potassium chlorate (KClO_3) on heating forms potassium chloride and oxygen. Write a balanced equation for this reaction.**



- Q. 5. Which compound gives shiny white finish to the walls?**

Ans. Calcium carbonate, CaCO_3 .

- Q. 6. List any two observations when Ferrous Sulphate is heated in a dry test tube?**

[CBSE Sample Paper 2021]

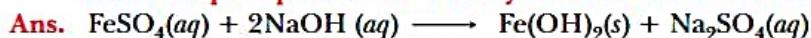
- Ans.**
- Initial light green colour changes to reddish brown colour
 - Colourless gas is evolved
 - Gas with choking smell is evolved

1

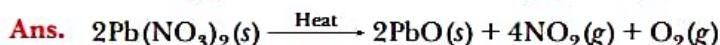
(Any two) [CBSE Marking Scheme 2021]

- Q. 7. Convey the following information in the form of a balanced chemical equation:**

“An aqueous solution of ferrous sulphate reacts with an aqueous solution of sodium hydroxide to form a precipitate of ferrous hydroxide and sodium sulphate remains in solution.”

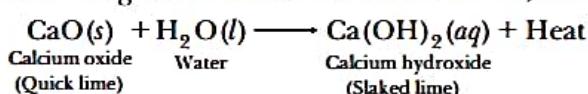


- Q. 8. Balance the following chemical equation:**



- Q. 9. Give one example of a combination reaction which is also exothermic.**

Ans. When quicklime or calcium oxide (CaO) reacts with water, slaked lime [$\text{Ca}(\text{OH})_2$] is formed. During this reaction a large amount of heat is released. So, this reaction is an exothermic reaction.



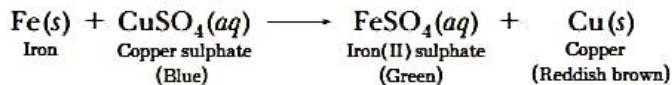
Q. 10. Samuel had a silver coin which turned black. He kept the coin in a bowl lined with aluminium foil. Then he filled the bowl with water and boiled it. After sometime, he found that the coin has become new. Its blackness disappeared. How did it happen? [HOTS]

Ans. The blackness of silver coin is due to the formation of silver sulphide on its surface due to its exposure to air. On boiling, the aluminium foil reacts with the layer of silver sulphide and displaces silver from silver sulphide to form aluminium sulphide and silver. This makes the coin shiny.



Q. 11. Justify with the help of an example that displacement reaction is also a redox reaction. [HOTS]

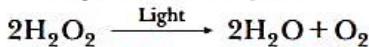
Ans. Consider the following displacement reaction in which Fe displaces Cu from CuSO_4 to form FeSO_4 :



In the above reaction, Fe is gaining oxygen. Hence, Fe is oxidised. CuSO_4 is loosing oxygen. Hence, it is reduced. So, it is a redox reaction.

Q. 12. Why is hydrogen peroxide kept in coloured bottles?

Ans. This is done in order to cut off light because hydrogen peroxide decomposes into water and oxygen in the presence of light.



Q. 13. Give one example of a reaction which is a double displacement reaction as well as a precipitation reaction.



Q. 14. Why is photosynthesis considered an endothermic reaction?

Ans. Photosynthesis is an endothermic reaction because energy, in the form of sunlight is absorbed during the process of photosynthesis by green plants.

Q. 15. What type of reaction is represented by the digestion of food in our body?

Ans. Decomposition reaction.

Q. 16. How will you test for the gas which is liberated when hydrochloric acid reacts with an active metal?

Ans. When an active metal like Zn reacts with HCl, the gas produced burns with a pop sound which indicates that it is a hydrogen gas.



Q. 17. Can a double displacement reaction take place when the products are highly soluble or highly ionised?

Ans. No, double displacement reaction takes place when there is a formation of a slightly soluble salt.

Q. 18. What changes in the colour of iron nails and copper sulphate solution do you observe after keeping the iron nails dipped in copper sulphate solution for about 30 minutes?

Ans. Iron nails become brownish in colour and the blue colour of copper sulphate solution fades. This is because iron displaces copper from copper sulphate solution and forms ferrous sulphate which is light green in colour.

Q. 19. Name the oxidising and reducing agent in the following reaction:



Ans. H_2S is the reducing agent while SO_2 is the oxidising agent.

Q. 20. A dilute ferrous sulphate solution was gradually added to the beaker containing acidified potassium permanganate solution. The light purple colour of the solution fades and finally disappears. Write the correct explanation for this observation.

Ans. Potassium permanganate solution (KMnO_4) is an oxidising agent. It oxidises ferrous sulphate (FeSO_4) to ferric sulphate [$\text{Fe}_2(\text{SO}_4)_3$].

Q. 21. Define rancidity.

Ans. The oxidation of oils or fats in food resulting in a bad taste and smell is called rancidity.

Q. 22. Name one synthetic antioxidant.

Ans. Butylated hydroxyanisole (BHA).

Short Answer Questions-I

Each of the following questions are of 2 marks and have to be answered in about 30–50 words.

Q. 1. Which among the following are physical or chemical changes?

- (a) Evaporation of petrol
 - (b) Burning of Liquefied Petroleum Gas (LPG)
 - (c) Heating of an iron rod to red hot
 - (d) Curdling of milk
 - (e) Sublimation of solid ammonium chloride

[NCERT Exemplar]

Ans. (a) Physical change (b) Chemical change

Q. 2. Which among the following changes are exothermic or endothermic in nature?

- (a) Decomposition of ferrous sulphate
 - (b) Dilution of sulphuric acid
 - (c) Dissolution of sodium hydroxide in water
 - (d) Dissolution of ammonium chloride in water

[NCERT Exemplar]

Ans. (a) is endothermic as heat is absorbed in these changes.

- (b) is exothermic as heat is released in these changes.
 - (c) is exothermic as heat is released in these changes.
 - (d) is endothermic as heat is absorbed in these changes.

Q. 3. Why do fire flies glow at night?

[NCERT Exemplar]

Ans. Fire flies have a protein which in the presence of enzyme undergoes aerial oxidation. This is a chemical reaction which involves emission of visible light. Therefore, fire flies glow at night.

Q. 4. Why do we store silver chloride in dark coloured bottles?

[NCERT Exemplar]

Ans. Silver chloride on exposure to sunlight may decompose as per the following reaction.



Therefore, it is stored in dark coloured bottles.

Q. 5. Complete the missing components/variables given as x and y in the following reactions:

- (i) $\text{Pb}(\text{NO}_3)_2(aq) + 2\text{KI}(aq) \longrightarrow \text{PbI}_2(x) + 2\text{KNO}_3(y)$
(ii) $\text{Cu}(s) + 2\text{AgNO}_3(aq) \longrightarrow \text{Cu}(\text{NO}_3)_2(aq) + x(s)$
(iii) $\text{Zn}(s) + \text{H}_2\text{SO}_4(aq) \longrightarrow \text{ZnSO}_4(x) + \text{H}_2(y)$
(iv) $\text{CaCO}_3(s) \xrightarrow{x} \text{CaO}(s) + \text{CO}_2(g)$

[NCERT Exemplar]

Ans. (i) $x - (s)$; $y - (aq)$

Q. 6. Give reasons:

- (i) Aluminium is a reactive metal but is still used for packing food articles.
 - (ii) Red litmus paper turns blue when touched with aqueous solution of magnesium oxide.

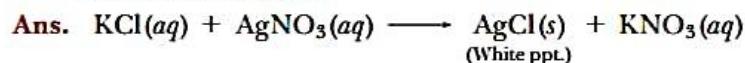
[NCERT Exemplar]

Ans. (i) On exposure to air, aluminium forms a hard protective layer of aluminium oxide (Al_2O_3) which prevent further oxidation.

(ii) Magnesium oxide is an oxide of a metal, so, it is basic in nature. Due to its basic character it turns red litmus paper blue when touched with its aqueous solution.

Q. 7. A solution of potassium chloride when mixed with silver nitrate solution, an insoluble white substance is formed. Write the chemical reaction involved and also mention the type of the chemical reaction. [NCERT Exemplar]

[NCERT Exemplar]



It is a double displacement and precipitation reaction.

Q. 8. Grapes hanging on the plant do not ferment but after being plucked from the plant can be fermented. Under what conditions do these grapes ferment? Is it a chemical or a physical change? [NCERT Exemplar]

[NCERT Exemplar]

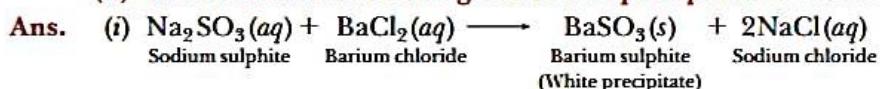
Ans. Grapes when attached to the plants are living and therefore, their own immune system prevents fermentation. The microbes can grow in the plucked grapes and under anaerobic conditions these can be fermented. This is a chemical change.

Q. 9. On adding a drop of barium chloride solution to an aqueous solution of sodium sulphite, white precipitate is obtained.

(i) Write a balanced chemical equation of the reaction involved.

(ii) What other name can be given to this precipitation reaction?

[NCERT Exemplar]



(ii) This reaction is also known as double displacement reaction.

Short Answer Questions-II

Each of the following questions are of 3 marks and have to be answered in about 50-80 words.

Q. 1. Identify the type of each of the following reactions. Also write balanced chemical equation for each reaction. [CBSE 2020 (31/3/3)]

(i) A reaction in which the reaction mixture becomes warm.

(ii) A reaction in which an insoluble substance is formed.

15 i Exothermic reaction

$$\text{CaO} + \text{H}_2\text{O} \xrightarrow{\text{quick lime}} \text{Ca(OH)}_2 \xrightarrow{\text{slaked lime}} \text{heat}$$

ii Precipitation reaction (double displacement reaction)

$$\text{Pb(NO}_3)_2 \text{(aq)} + \text{KI (aq)} \rightarrow \text{PbI}_2 \text{(s) } \text{yellow precipitate} + \text{KNO}_3 \text{(aq)}$$

[Topper's Answer 2020]

Q. 2. (a) Which of the following reactions is/are an endothermic reaction(s) where decomposition also happens?

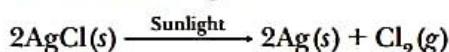
- Respiration
 - Heating of lead nitrate
 - Decomposition of organic matter
 - Electrolysis of acidified water

(b) Silver chloride when kept in the open turns grey. Illustrate this with a balanced chemical equation. [CBSE Sample Paper 2021]

[CBSE Sample Paper 2021]

Ans. (a) Heating of lead nitrate and electrolysis of acidified water.

(b) The white silver chloride turns grey in sunlight. This is because silver chloride decomposes to form silver and chlorine gas.

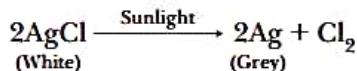


Q. 3. Mention with reason the colour changes observed when:

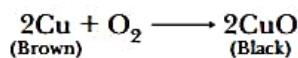
[CBSE 2020 (31/3/1)]

- (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.

Ans. (i) The colour changes from white to grey due to the decomposition reaction of silver chloride when exposed to sunlight.



- (ii) The colour changes from brown to black due to the oxidation of copper into copper oxide.



- (iii) The colour changes from blue to colourless due to the displacement reaction as zinc is more reactive than copper.



Q. 4. A compound 'A' is used in the manufacture of cement. When dissolved in water, it evolves a large amount of heat and forms compound 'B'. [Competency Based Question] [CBSE 2020 (31/2/1)]

- (i) Identify A and B.
(ii) Write chemical equation for the reaction of A with water.
(iii) List two types of reaction in which this reaction may be classified.

Ans. (i) A = CaO/Quick lime/Calcium oxide

B = Ca(OH)_2 /Slaked lime/Calcium hydroxide

(ii) $\text{CaO} + \text{H}_2\text{O} \longrightarrow \text{Ca(OH)}_2$ + heat or energy

(iii) Combination reaction

Exothermic reaction.

[CBSE Marking Scheme 2020 (31/2/1)]

Q. 5. A copper coin was kept dipped in silver nitrate solution for a few hours/days. What will happen to the copper coin? What will happen to the colour of the solution?

Ans. Copper is more reactive than silver. Hence, it displaces silver from the silver nitrate solution according to the given reaction.



The silver thus formed is deposited on the surface of copper, thereby giving it a white shining appearance.

The solution becomes blue due to the formation of copper nitrate.

Q. 6. When hydrogen sulphide gas is passed through a blue solution of copper sulphate, the colour of the solution fades and a black precipitate is obtained.

- (a) Name the type of reaction mentioned above.
(b) Why does the colour of the solution fade away?
(c) Write the chemical name of the black precipitate formed.
(d) Give the balanced chemical equation for the reaction involved.

Ans. (a) Double displacement reaction.

(b) Due to the formation of colourless sulphuric acid in the solution.

(c) Copper Sulphide/CuS

$$(d) \text{CuSO}_4 + \text{H}_2\text{S} \longrightarrow \text{CuS} + \text{H}_2\text{SO}_4$$

[CBSE 2020 (31/4/2)]

Chemical Reactions and Equations

[CBSE Marking Scheme 2020 (31/4/2)]

Q. 7. Identify the reducing agent in the following reactions.

- (i) $4\text{NH}_3 + 5\text{O}_2 \longrightarrow 4\text{NO} + 6\text{H}_2\text{O}$ (ii) $\text{H}_2\text{O} + \text{F}_2 \longrightarrow \text{HF} + \text{HO}\text{F}$
(iii) $\text{Fe}_2\text{O}_3 + 3\text{CO} \longrightarrow 2\text{Fe} + 3\text{CO}_2$ (iv) $2\text{H}_2 + \text{O}_2 \longrightarrow 2\text{H}_2\text{O}$ [NCERT Exemplar]
Ans. (i) Ammonia (NH_3) (ii) Water (H_2O) as F_2 is getting reduced to HF
(iii) Carbon monoxide (CO) (iv) Hydrogen (H_2)

Q. 8. Write the balanced chemical equations for the following reactions:

- (i) Sodium carbonate on reaction with hydrochloric acid in equal molar concentrations gives sodium chloride and sodium hydrogen carbonate.
(ii) Sodium hydrogen carbonate on reaction with hydrochloric acid gives sodium chloride, water and liberates carbon dioxide.
(iii) Copper sulphate on treatment with potassium iodide precipitates cuprous iodide (Cu_2I_2), liberates iodine gas and also forms potassium sulphate. [NCERT Exemplar]

- Ans. (i) $\text{Na}_2\text{CO}_3(s) + \text{HCl}(aq) \longrightarrow \text{NaCl}(aq) + \text{NaHCO}_3(s)$
(ii) $\text{NaHCO}_3(s) + \text{HCl}(aq) \longrightarrow \text{NaCl}(s) + \text{H}_2\text{O}(l) + \text{CO}_2(g)$
(iii) $2\text{CuSO}_4(aq) + 4\text{KI}(s) \longrightarrow \text{Cu}_2\text{I}_2(s) + 2\text{K}_2\text{SO}_4(aq) + \text{I}_2(s)$

Q. 9. Write the balanced chemical equations for the following reactions and identify the type of reaction in each case.

- (i) Nitrogen gas is treated with hydrogen gas in the presence of a catalyst at 773 K to form ammonia gas.
(ii) Sodium hydroxide solution is treated with acetic acid to form sodium acetate and water.
(iii) Ethanol is warmed with ethanoic acid to form ethyl acetate in the presence of concentrated H_2SO_4 .
(iv) Ethene is burnt in the presence of oxygen to form carbon dioxide, water and releases heat and light. [NCERT Exemplar]

- Ans. (i) $\text{N}_2(g) + 3\text{H}_2(g) \xrightarrow[773\text{ K}]{\text{Catalyst}} 2\text{NH}_3(g)$

Combination reaction

- (ii) $\text{NaOH}(aq) + \text{CH}_3\text{COOH}(aq) \longrightarrow \text{CH}_3\text{COONa}(aq) + \text{H}_2\text{O}(l)$

Double displacement reaction/Neutralisation reaction

- (iii) $\text{C}_2\text{H}_5\text{OH}(l) + \text{CH}_3\text{COOH}(l) \xrightarrow{\text{H}^+} \text{CH}_3\text{COOC}_2\text{H}_5(l) + \text{H}_2\text{O}(l)$

Double displacement reaction/Esterification reaction

- (iv) $\text{C}_2\text{H}_4(g) + 3\text{O}_2(g) \longrightarrow 2\text{CO}_2(g) + 2\text{H}_2\text{O}(g) + \text{Heat} + \text{Light}$

Redox reaction/Combustion reaction

Q. 10. Write the balanced chemical equations for the following reactions and identify the type of reaction in each case.

- (i) Thermit reaction, iron (III) oxide reacts with aluminium and gives molten iron and aluminium oxide.
(ii) Magnesium ribbon is burnt in an atmosphere of nitrogen gas to form solid magnesium nitride.
(iii) Chlorine gas is passed in an aqueous potassium iodide solution to form potassium chloride solution and solid iodine.
(iv) Ethanol is burnt in air to form carbon dioxide, water and releases heat. [NCERT Exemplar]

- Ans. (i) $\text{Fe}_2\text{O}_3(s) + 2\text{Al}(s) \longrightarrow \text{Al}_2\text{O}_3(s) + 2\text{Fe}(l) + \text{Heat}$

(Displacement reaction)

- (ii) $3\text{Mg}(s) + \text{N}_2(g) \longrightarrow \text{Mg}_3\text{N}_2(s)$

(Combination reaction)

- (iii) $2\text{KI}(aq) + \text{Cl}_2(g) \longrightarrow 2\text{KCl}(aq) + \text{I}_2(s)$

(Displacement reaction)

- (iv) $\text{C}_2\text{H}_5\text{OH}(l) + 3\text{O}_2(g) \longrightarrow 2\text{CO}_2(g) + 3\text{H}_2\text{O}(l) + \text{Heat}$

(Oxidation reaction/Combustion reaction)

Q. 11. (i) Classify the following reactions into different types:

- $\text{AgNO}_3(aq) + \text{NaCl}(aq) \longrightarrow \text{AgCl}(s) + \text{NaNO}_3(aq)$
- $\text{CaO}(s) + \text{H}_2\text{O}(l) \longrightarrow \text{Ca}(\text{OH})_2(aq)$
- $2\text{KClO}_3(s) \xrightarrow{\Delta} 2\text{KCl}(aq) + 3\text{O}_2(g)$
- $\text{Zn} + \text{CuSO}_4 \longrightarrow \text{ZnSO}_4 + \text{Cu}$

(ii) Translate the following statement into a balanced chemical equation:

“Barium chloride reacts with aluminium sulphate to give aluminium chloride and barium sulphate.” [CBSE 2019 (31/4/1)]

Ans. (i) (a) Double displacement reaction

$\frac{1}{2} \times 4$

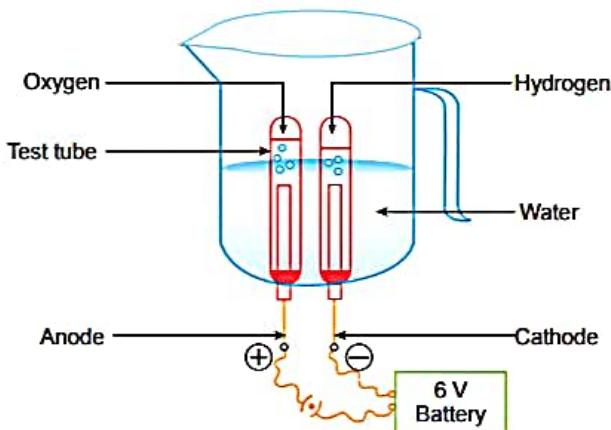
- Combination reaction
- Decomposition reaction
- Displacement reaction



1

[CBSE Marking Scheme 2019 (31/4/1)]

Q. 12. Study the figure given below and answer the following questions:



(a) Name the process depicted in the diagram.

(b) Write the composition of the anode and the cathode.

(c) Write the balanced chemical equation of the reaction taking place in this case.

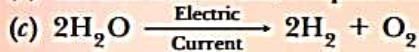
(d) The reaction does not take place if a few drops of dilute sulphuric acid are not added to water. Why? [CBSE 2020 (31/4/2)]

Ans. (a) Electrolysis of water

1

(b) Carbon electrodes/Graphite rod

$\frac{1}{2}$



1

(d) Pure water is a non-conductor of electricity/electric current is carried through the acidic solution by ions.

$\frac{1}{2}$

[CBSE Marking Scheme 2020 (31/4/2)]

Q. 13. Translate the following statements into chemical equations and then balance the equations:

(i) Phosphorus burns in oxygen to give phosphorus pentoxide.

(ii) Aluminium metal replaces iron from ferric oxide, Fe_2O_3 , giving aluminium oxide and iron.

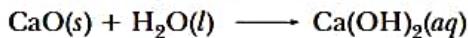
(iii) Carbon disulphide burns in air to give carbon dioxide and sulphur dioxide.

(iv) Barium chloride reacts with zinc sulphate to give zinc chloride and barium sulphate.

Q. 18. A substance X, which is an oxide of a group 2 element, is used intensively in the cement industry. This element is present in bones also. On treatment with water it forms a solution which turns red litmus blue. Identify X and also write the chemical reactions involved.

[Competency Based Question] [NCERT Exemplar]

Ans. X is calcium oxide, also called quick lime. It reacts with water to form calcium hydroxide which is basic in nature. So, it turns red litmus blue.



Q. 19. A shining metal 'M', on burning gives a dazzling white flame and changes to a white powder 'N'.

(i) Identify 'M' and 'N'.

(ii) Represent the above reaction in the form of a balanced chemical equation.

(iii) Does 'M' undergo oxidation or reduction in this reaction? Justify. [CBSE 2020 (31/5/1)]

Ans. (i) 'M' is magnesium/Mg

½

'N' is Magnesium oxide/MgO

½

(ii) $2\text{Mg}(s) + \text{O}_2(g) \longrightarrow 2\text{MgO}$

1

(iii) 'M' undergoes oxidation because oxygen is added to it/ Loss of 2 electrons

½ + ½

[CBSE Marking Scheme 2020 (31/5/1)]

Q. 20. Identify the type of each of the following reactions stating reason for your answers:



[CBSE 2020 (31/5/3)]

Ans. (a) Displacement /Redox/ Exothermic reaction/Thermit reaction.

Displacement- Iron is displaced by aluminium

Redox : Aluminium is oxidised and Iron is reduced

Exothermic- Heat is produced

Thermit reaction: Molten iron is produced.

½ + ½

(Any one type with appropriate reason)

(b) Double displacement reaction

½

Ions are exchanged between the reactants

½

(c) Decomposition reaction /Calcination

½

ZnCO_3 decomposes to $\text{ZnO} + \text{CO}_2$

½

[CBSE Marking Scheme 2020 (31/5/3)]

Q. 21. During the reaction of some metals with dilute hydrochloric acid, following observations were made.

(i) Silver metal does not show any change.

(ii) The temperature of the reaction mixture rises when aluminium (Al) is added.

(iii) The reaction of sodium metal is found to be highly explosive.

(iv) Some bubbles of a gas are seen when lead (Pb) is reacted with the acid.

Explain these observations giving suitable reasons.

[NCERT Exemplar]

Ans. (i) Silver being a less reactive metal than hydrogen does not displace hydrogen from HCl. Hence, it does not react with dilute HCl.

(ii) The temperature of the reaction mixture rises when aluminium is added because it is an exothermic reaction.

(iii) Reaction of sodium metal is found to be highly explosive because it is an exothermic reaction.

(iv) When lead is treated with hydrochloric acid, bubbles of hydrogen gas are evolved.

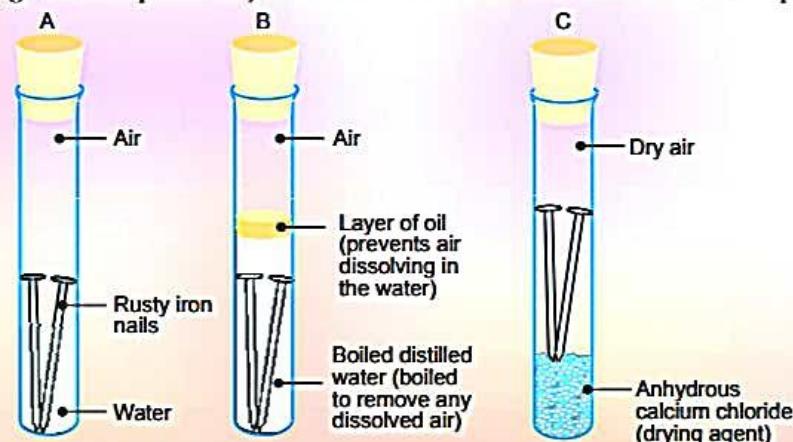


Q. 22. What is 'rusting'? Describe with a labelled diagram an activity to investigate the conditions under which iron rusts. [CBSE 2020 (31/1/2)]

Ans. • Oxidation of iron when exposed to air and moisture and acquiring a coating of brown flaky substance. 1

Activity –

- Take three test tubes marked A, B and C with clean iron nails in each.
- Pour some water in test tube 'A' and cork it.
- Pour some boiled distilled water and a drop of oil in test tube B and cork it.
- Put some anhydrous calcium chloride in test tube 'C' and cork it. It will absorb moisture from air. Leave the test tubes for a few days.
- Rusting will take place only in test tube A, which has air and moisture present.



[CBSE Marking Scheme 2020 (31/1/2)]

Q. 23. On heating blue coloured powder of copper (II) nitrate in a boiling tube, copper oxide (black), oxygen gas and a brown gas X is formed.

(i) Write a balanced chemical equation of the reaction.

(ii) Identify the brown gas X evolved.

(iii) Identify the type of reaction.

(iv) What could be the pH range of aqueous solution of the gas X? [NCERT Exemplar] [CBSE 2019 (31/2/1)] [HOTS]

Ans. (i) $2\text{Cu}(\text{NO}_3)_2(s) \xrightarrow{\text{Heat}} 2\text{CuO}(s) + \text{O}_2(g) + 4\text{NO}_2(g)$

(ii) The brown gas X evolved is nitrogen dioxide (NO_2).

(iii) This is a decomposition reaction.

(iv) Nitrogen dioxide dissolves in water to form acidic solution because it is an oxide of non-metal. Therefore, pH of this solution is less than 7.

Q. 24. 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. [CBSE 2020 (31/1/1)]

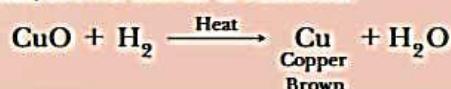
Ans. • A black colour is formed on the surface



½

½+½

• Original/brown colour is restored.



½

½+½

[CBSE Marking Scheme 2020 (31/1/1)]

Q. 25. A silver article generally turns black when kept in the open for a few days. The article when rubbed with toothpaste again starts shining.

(i) Why do silver articles turn black when kept in the open for a few days? Name the phenomenon involved.

(ii) Name the black substance formed and give its chemical formula. [NCERT Exemplar]

Ans. (i) Metals such as silver when attacked by substances around it such as moisture, acids, gases, etc, are said to corrode and this phenomenon is called corrosion.

(ii) The black substance is formed because silver (Ag) reacts with H_2S present in air. It forms thin black coating of silver sulphide (Ag_2S).



Long Answer Questions

Each of the following questions are of 5 marks and have to be answered in about 80-120 words.

Q. 1. (i) What is a double displacement reaction? Explain with an example.

(ii) A small amount of quick lime is added to water in a beaker.

(a) Name and define the type of reaction that has taken place.

(b) Write balanced chemical equation for the above reaction and the chemical name of the product formed.

(c) List two main observations of this reaction.

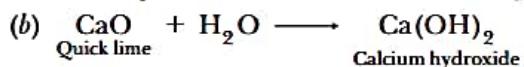
[CBSE 2019 (31/3/3)]

Ans. (i) In double displacement reaction, two compounds react by exchanging their ions and form two new compounds.

For example, silver nitrate and sodium chloride exchange their ions, NO_3^- and Cl^- respectively and form two new compounds in the following reaction.



(ii) (a) **Combination reaction:** A combination reaction is a reaction where two or more elements or compounds combine to form a single compound.



Chemical name of the product formed- (calcium hydroxide/slaked lime)

(c) Observations of the reactions:

- Reaction takes place vigorously.
 - Large amount of heat is released.

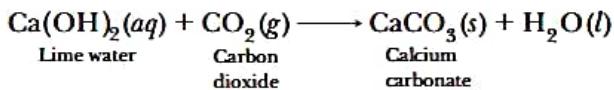
Q. 2. Give the characteristic tests for the following gases:

(i) CO_2 (ii) SO_2 (iii) O_2 (iv) H_2

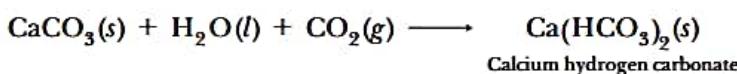
[NCERT Exemplar]

Ans. The characteristic test for the given gases are as follows:

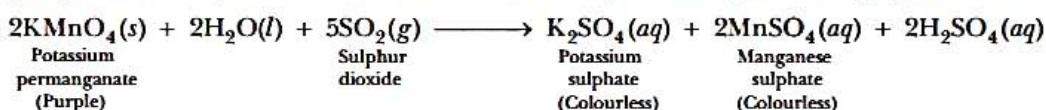
(i) Carbon dioxide (CO_2) gas turns lime water milky when passed through it due to the formation of insoluble calcium carbonate.



When CO_2 gas is passed in excess through lime water, milkiness disappears due to formation of soluble calcium hydrogen carbonate.



(ii) Sulphur dioxide (SO_2) gas when passed through acidic potassium permanganate solution (purple in colour) turns it colourless because SO_2 is a strong reducing agent.



(iii) The evolution of oxygen (O_2) gas during a reaction can be confirmed by bringing a burning candle near the mouth of the test tube containing the reaction mixture. The intensity of the flame increases because oxygen supports burning.

(iv) Hydrogen (H_2) gas burns with a pop sound when a burning candle is brought near it.

Q. 3. With the help of an activity explain that hydrogen and oxygen are released when an electric current is passed through water.

Ans. (i) Take a plastic vessel. Drill two holes at its bottom and set rubber stoppers in these holes.

(ii) Insert carbon electrodes in these rubber stoppers and connect these electrodes to a 6 volt battery and a switch.

(iii) Fill the vessel with water such that the electrodes are immersed. Add a few drops of dilute sulphuric acid to the water in the vessel.

(iv) Take two graduated test tubes filled with water and invert them over the two carbon electrodes.

(v) Switch on the current.

(vi) After sometime, you will observe the formation of bubbles at both the electrodes. These bubbles displace water in the graduated tubes.

(vii) Once the test tubes are filled with the respective gases, remove them carefully.

(viii) Test these gases one by one by bringing a burning splinter of wood close to the mouth of test tubes.

When the glowing splinter of wood is brought close to the mouth of one test tube, it relights and when it is brought close to the mouth of other test tube, the gas burns with a pop sound. Oxygen is the only common gas that relights the splinter and hydrogen gas burns with a pop sound.

Q. 4. (i) Design an activity to demonstrate the decomposition reaction of lead nitrate.

(ii) Draw labelled diagram of the experimental set up. List two main observations.

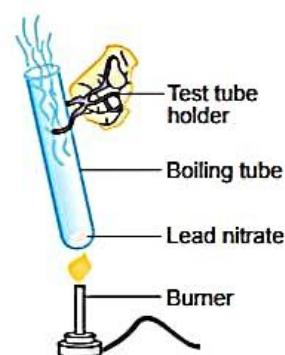
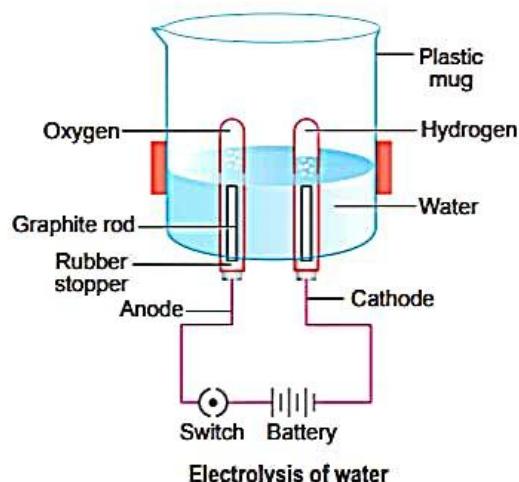
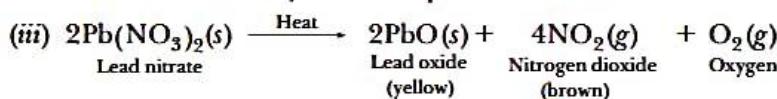
(iii) Write balanced chemical equation for the reaction stating the physical state of the reactant and the products. [CBSE 2019 (31/3/3)]

Ans. (i) **Activity:**

- Take a boiling tube and put about 3 g lead nitrate powder in it.
- Hold the boiling tube carefully with a pair of tongs.
- Now, heat the tube over a flame.

(ii) **Observations:**

- Brown fumes of nitrogen dioxide gas is observed.
- Lead oxide, a yellow compound is formed.



Q. 5. What happens when a piece of

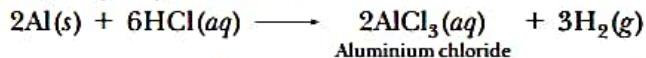
- (i) zinc metal is added to copper sulphate solution?
 - (ii) aluminium metal is added to dilute hydrochloric acid?
 - (iii) silver metal is added to copper sulphate solution?

Also, write the balanced chemical equation if the reaction occurs. [NCERT Exemplar]

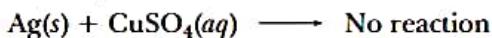
Ans. (i) Zinc being more reactive than copper displaces copper from its solution and a solution of zinc sulphate is obtained.



(ii) Aluminium being more reactive displaces hydrogen from dilute hydrochloric acid solution and hydrogen gas is evolved.



(iii) Silver metal being less reactive than copper cannot displace copper from its salt solution. Therefore, no reaction occurs.



Q. 6. What happens when zinc granules are treated with dilute solution of H_2SO_4 , HCl , HNO_3 , $NaCl$ and $NaOH$? Also write the chemical equations if reaction occurs. [NCERT Exemplar]

Ans. The reaction of Zn granules with

- (i) dilute H_2SO_4

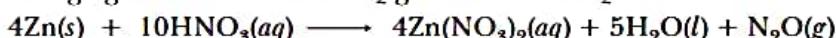
$$\text{Zn}(s) + \text{H}_2\text{SO}_4(aq) \longrightarrow \text{ZnSO}_4(aq) + \text{H}_2(g)$$

(ii) dilute HCl

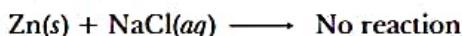
$$\text{Zn}(s) + 2\text{HCl}(aq) \longrightarrow \text{ZnCl}_2(aq) + \text{H}_2(g)$$

(iii) dilute HNO_3

Reaction with dilute HNO_3 is different as compared to other acids because nitric acid is an oxidising agent and it oxidises H_2 gas evolved to H_2O .



(iv) NaCl solution



(v) NaOH solution



Q. 7. (i) Crystals of copper sulphate are heated in a test tube for some time.

- (a) What is the colour of copper sulphate crystals before heating, and after heating?
 (b) What is the source of liquid droplets seen on the inner upper side of the test tube during the heating process?

(ii) A metal 'X' when dipped in aqueous solution of aluminium sulphate, no reaction is observed whereas when it is dipped in an aqueous solution of ferrous sulphate, the pale green solution turns colourless. Identify metal 'X' with reason.

Ans. (i) (a) The colour of copper sulphate crystals before heating is blue and turns white after heating.

- (b) The liquid droplets are actually the water droplets. The source of water droplets is the water of crystallisation of hydrated copper sulphate crystals ($\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$).

(ii) When metal 'X' is dipped in aqueous solution of aluminium sulphate no reaction is observed, it means it is less reactive than aluminium. But when it is dipped in ferrous sulphate solution, the solution turns from pale green to colourless, so 'X' is more reactive than iron and thus displaces it from its solution.

Therefore, 'X' must be zinc. It reacts with ferrous sulphate to form colourless zinc sulphate solution by displacing iron.



Self-Assessment

Time allowed: 1 hour

Max. marks: 40

SECTION-A

Choose and write the correct answer for each of the following.

(4 × 1 = 4)

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

- (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:

[CBSE 2020 (31/I/1)]

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

2. A student notices that her silver jewellery turned dull and had a grey-black film over it after wearing for a few months. What results in the change in colour of the silver metal?

- (a) The polish over the jewellery was removed after wearing for a few months.
(b) The jewellery comes in contact with air, moisture, and acids and corrodes.
(c) Dust deposits over the jewellery which changes its colour.
(d) Silver breaks due to wear and tear and in turn its colour changes due to rusting.

3. In which of the following the identity of initial substance remains unchanged?

[CBSE 2020 (31/3/1)]

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

4. Which of the following statements about the given reaction are correct?



- (i) Iron metal is getting oxidised.
(ii) Water is getting reduced.
(iii) Water is acting as a reducing agent.
(iv) Water is acting as an oxidising agent.
(a) (i), (ii) and (iii) (b) (iii) and (iv)
(c) (i), (ii) and (iv) (d) (ii) and (iv)

The following questions consist of two statements—Assertion(A) and Reason(R). Answer these questions selecting the appropriate option given below:

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

(2 × 1 = 2)

5. Assertion(A) : In electrolysis of water, the volume of hydrogen liberated is twice the volume of oxygen formed.

Reason (R) : Water (H_2O) has hydrogen and oxygen in the ratio of 1 : 2 by volume.

6. Assertion(A) : The balancing of chemical equations is based on law of conservation of mass.

Reason (R) : Total mass of reactants is equal to total mass of products.

Answer the following questions in one word or one sentence.

(3 × 1 = 3)

7. Name the reaction which takes place when ferrous sulphate is heated.
8. Give an example of displacement reaction.
9. Name the substance which is getting oxidised in the reaction, $\text{H}_2\text{S} + \text{Cl}_2 \longrightarrow 2\text{HCl} + \text{S}$.

SECTION-B

Answer the following questions in about 30-50 words each.

(2 × 2 = 4)

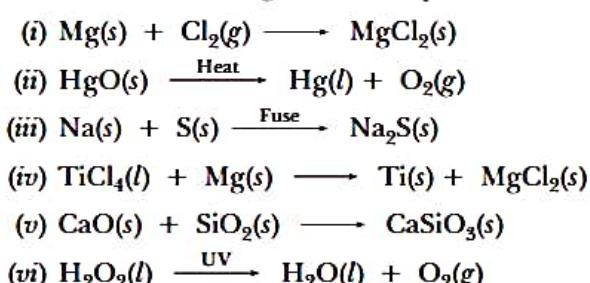
10. Giving an example, list two informations which make a chemical reaction more useful?
11. Write the balanced chemical equation for the following reaction and identify the type of reaction in each case.
Nitrogen gas is treated with hydrogen gas in the presence of a catalyst at 773 K to form ammonia gas.

SECTION-C

Answer the following questions in about 50-80 words each.

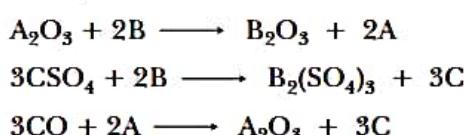
(4 × 3 = 12)

12. Balance the following chemical equations and identify the type of chemical reaction.



[NCERT Exemplar]

13. A, B and C are three elements which undergo chemical reactions according to the following equations.

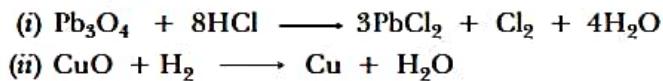


Answer the following questions with reasons.

- (i) Which element is the most reactive?
- (ii) Which element is the least reactive?
- (iii) What is the type of reactions listed above?
14. What happens when food materials containing fats and oils are left for a long time? List two observable changes and suggest three ways by which this phenomenon can be prevented.

[CBSE 2020 (31/4/1)]

15. What is a redox reaction? Identify the substance oxidised and the substance reduced in the following reactions.



SECTION-D

Answer the following questions in about 80-120 words each.

(3 × 5 = 15)

16. You are provided with two containers made up of copper and aluminium. You are also provided with solutions of dilute HCl, dilute HNO_3 , ZnCl_2 and H_2O . In which of the above containers these solutions can be kept?

[NCERT Exemplar]

17. (i) (a) Define corrosion. Under what conditions does corrosion take place?

(b) Give the formula and the chemical name of rust.

(ii) Give two methods to slow down rancidity.

18. Observe the diagram given below and answer the following questions:

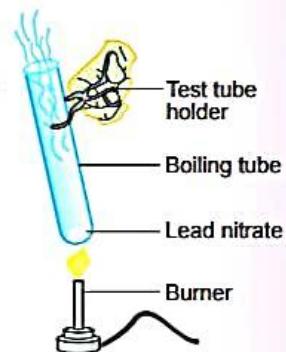
(i) What do you observe when lead nitrate is heated?

(ii) Mention the two gases evolved during heating.

(iii) Write the balanced chemical equation for it.

(iv) What is the type of chemical reaction called?

(v) Give one more example of this type of reaction.



Answers

1. (d) 2. (b) 3. (b) 4. (c) 5. (c)

7. Decomposition reaction



9. H_2S

