

Chemical Reactions and Equations

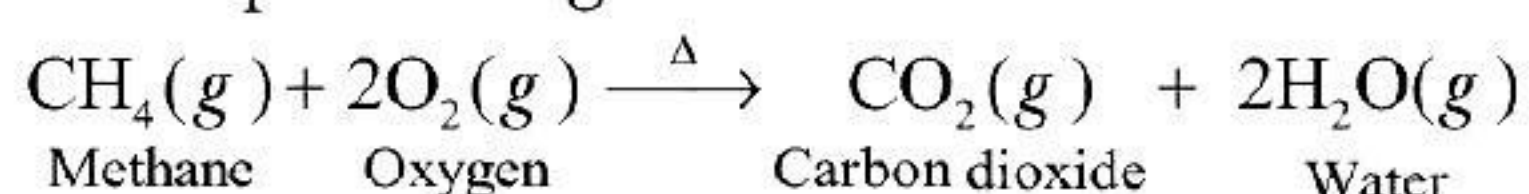
Quick Revision

1. Chemical Reactions

- A chemical reaction is a change in which one or more substance(s) or reactant(s) react to form new substance(s) or product(s) with entirely different properties.
- The reacting species are known as **reactants** (the substances that undergo chemical change in the chemical reaction) and the new species formed as a result of the reaction are called **products**.
- A chemical reaction can be identified either by (i) change in state or colour (ii) evolution of gas (iii) change in temperature (iv) formation of a precipitate.

2. Chemical Equations

A chemical equation is the symbolic representation of a chemical reaction. Symbols and formulae of the reactants and products are used to write chemical equation. e.g.



3. Balanced Chemical Equations

A balanced chemical equation is that in which the total number of atoms of each element are equal on both sides of the equation.

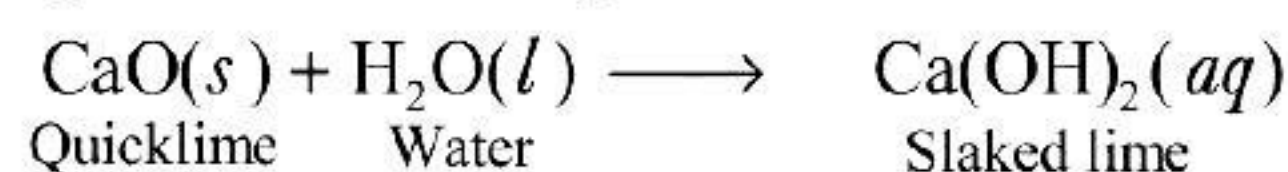
4. Types of Chemical Reactions

The chemical reactions are classified into different types depending upon the chemical changes taking place.

- (i) **Combination Reaction** A reaction in which two or more reactants react together to form a single product, is called a combination reaction.

e.g. When calcium oxide (quick lime) is dissolved in water, it forms calcium hydroxide (slaked lime).

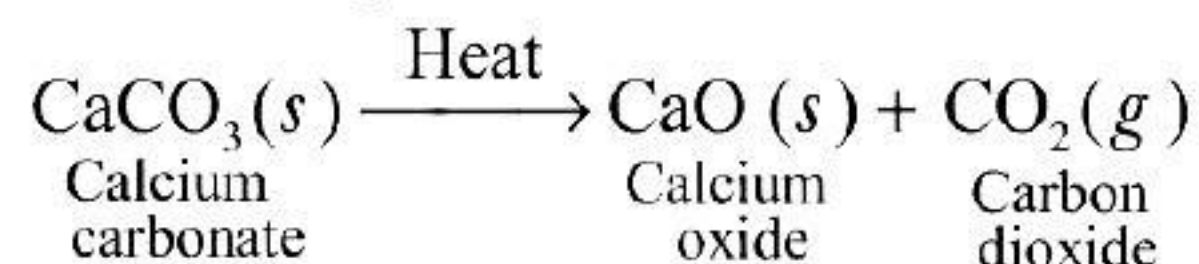
The reaction is highly exothermic, i.e. a lot of heat is produced during the reaction.



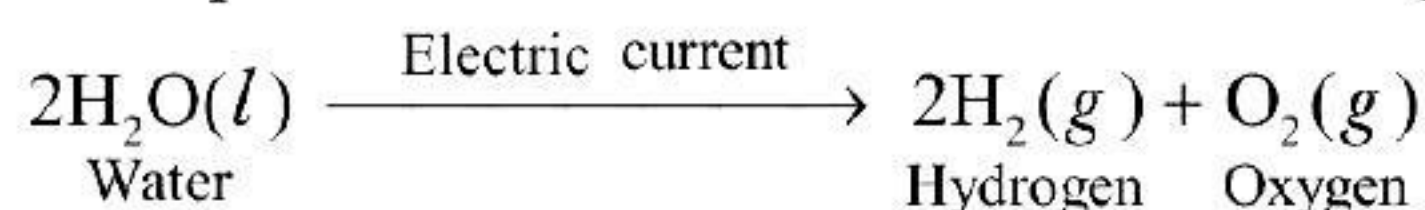
- (ii) **Decomposition Reaction** A reaction in which a single reactant breaks down to form two or more products, is known as decomposition reaction.

On the basis of the form of energy required for the reaction, these reactions are of three types

- Thermal Decomposition** These reactions involve the use of energy in the form of heat for decomposition of the reactant. e.g.

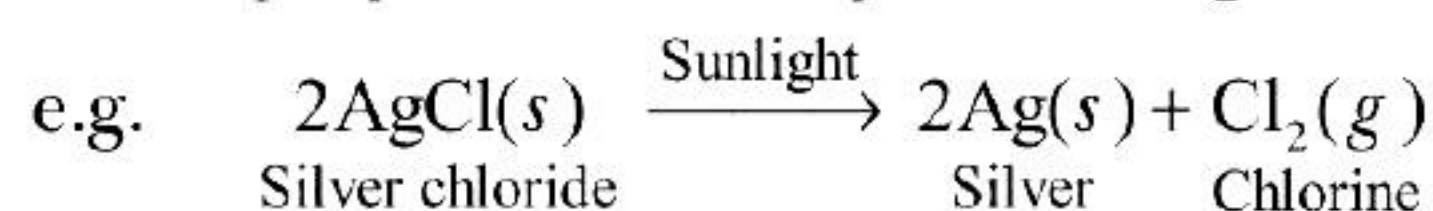


- Electrolysis** These reactions involve the use of electrical energy required for the decomposition of the reactant molecules. e.g.



- **Photolysis or Photochemical Decomposition**

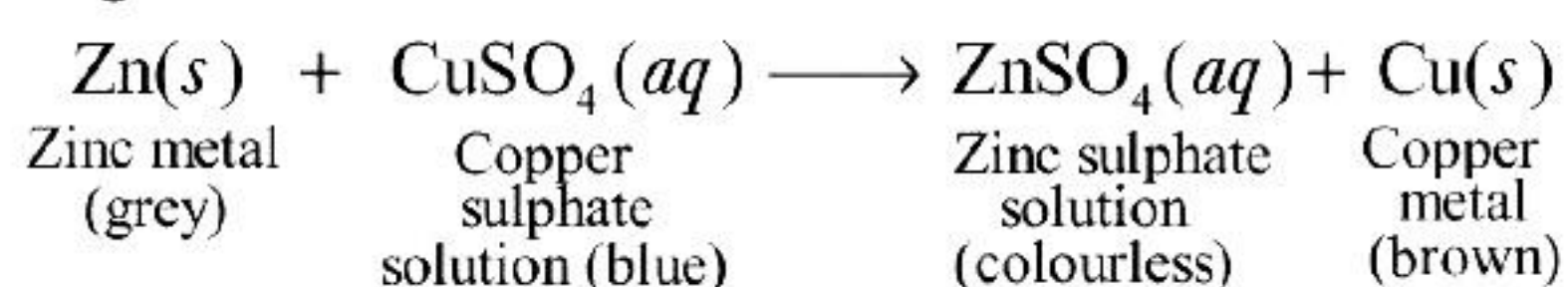
These reactions involve the use of light energy for the purpose of decomposition. e.g.



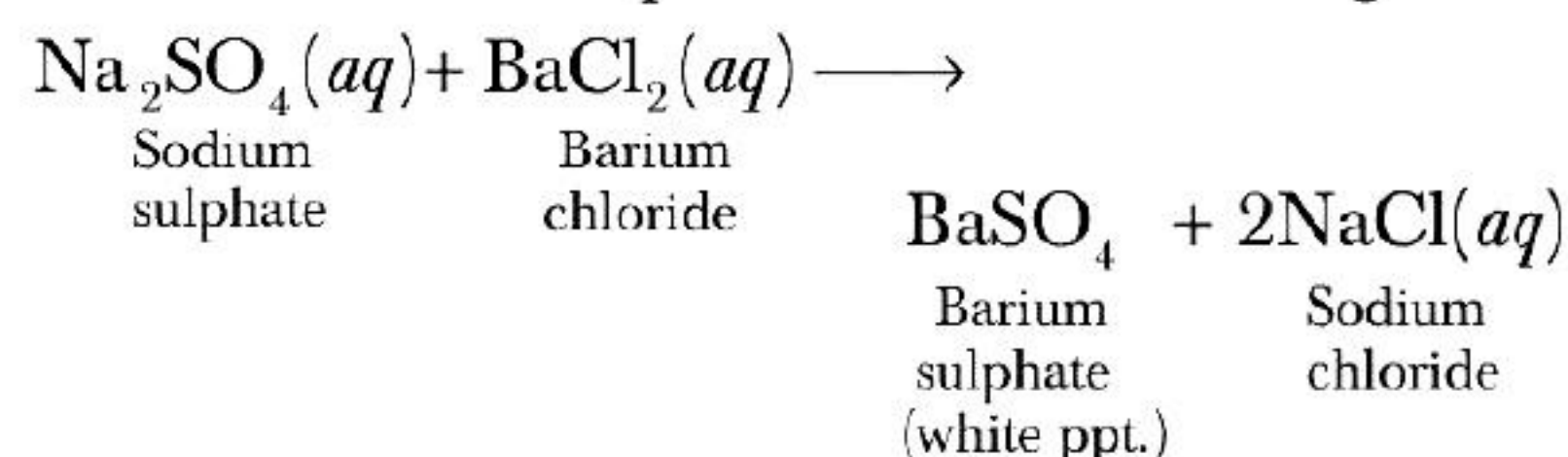
(iii) **Displacement Reaction** This reaction is of two types :

- **Single Displacement Reaction** A reaction in which a more reactive element displaces a less reactive element from the solution of its compound, is called single displacement or displacement reaction.

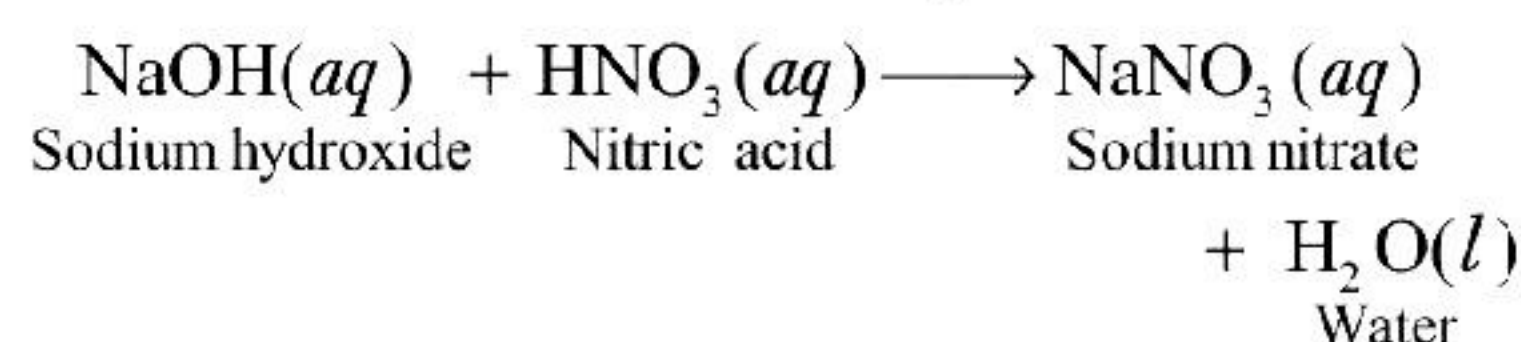
e.g.



- **Double Displacement Reaction** The reaction in which two different ions in the reactant molecules are displaced by each other, is called double displacement reaction. e.g.

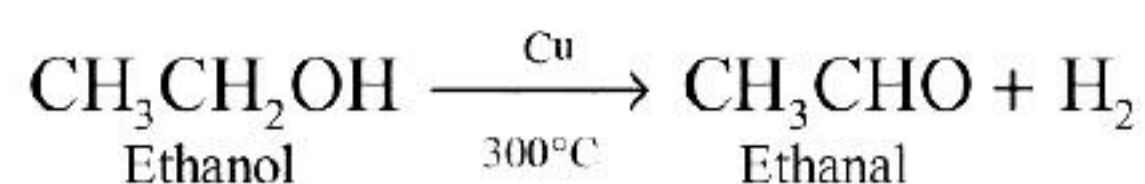
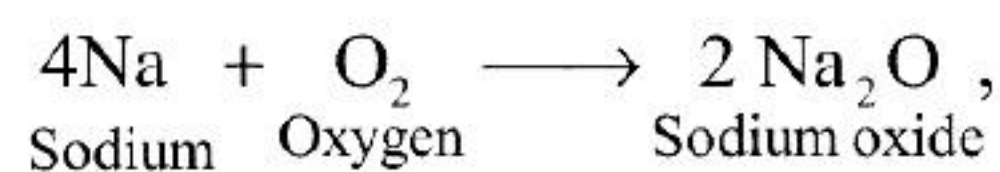


(iv) **Neutralisation Reaction** The reaction in which an acid reacts with a base to give salt and water is called neutralisation reaction. e.g.

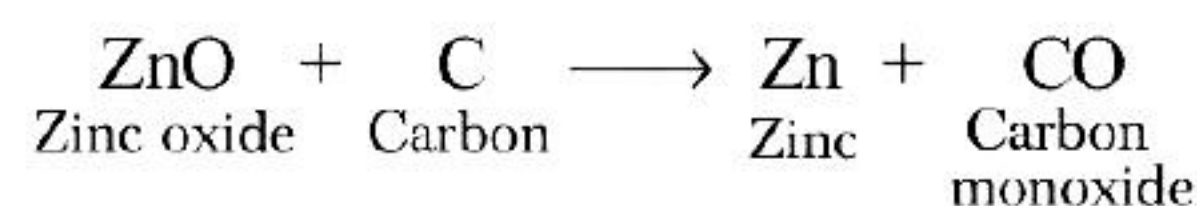
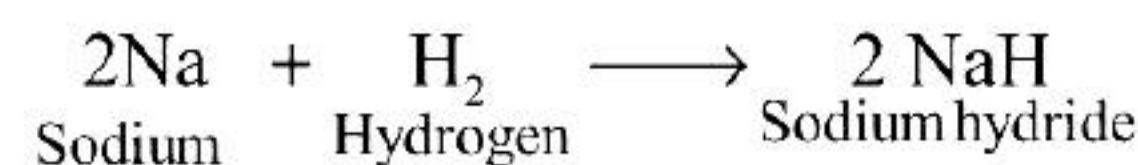


(v) **Oxidation and Reduction Reactions**

- **Oxidation** The process in which oxygen is added to a substance or the process in which hydrogen is removed from a substance is called oxidation.



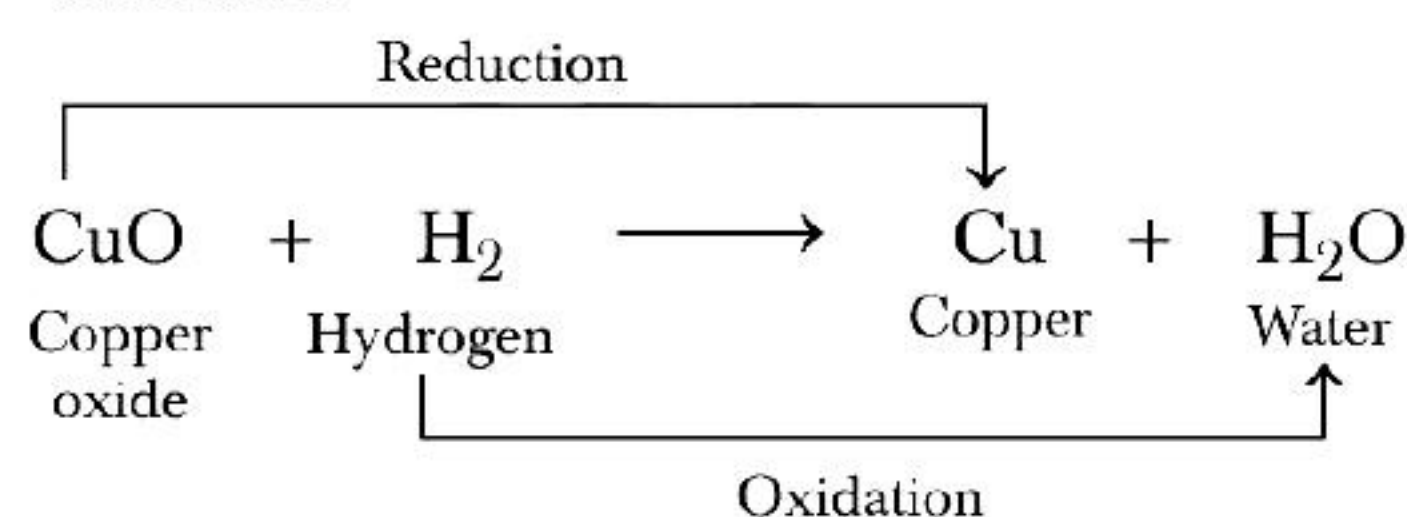
- **Reduction** The process in which hydrogen is added to a substance or the process in which oxygen is removed from a substance is called reduction.



- **Redox Reactions** Those reactions in which oxidation and reduction take place simultaneously are called redox reactions.

In this reaction, the copper (II) oxide is losing oxygen and is being reduced.

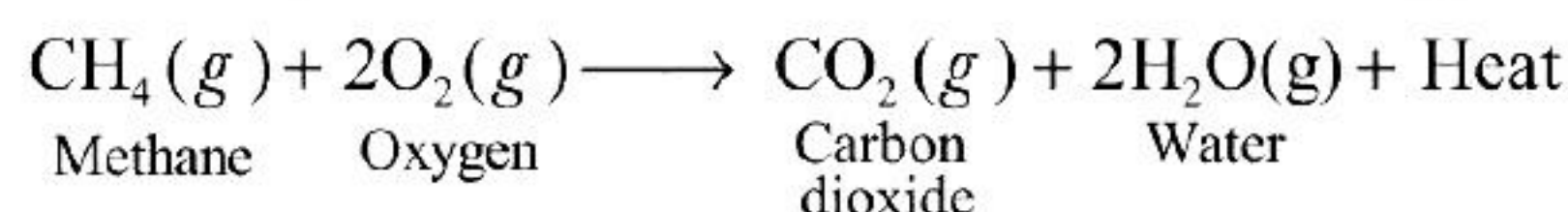
Hydrogen is gaining oxygen and is being oxidised.



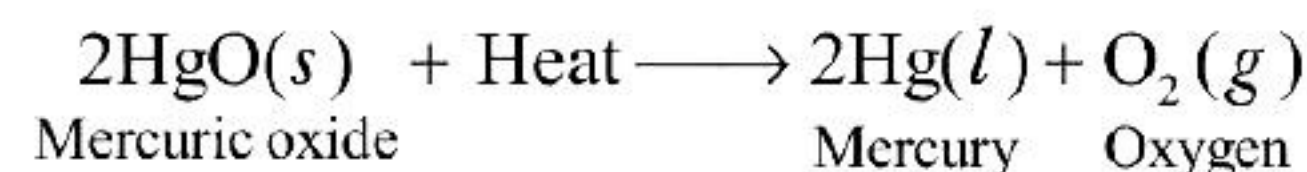
- **Oxidising Agent** A substance which helps in the oxidation of another substance, is called oxidising agent. It is always to be remembered that oxidising agent itself gets reduced.
- **Reducing Agent** A substance that helps in the reduction of another substance, is called reducing agent. It is always to be remembered that reducing agent itself gets oxidised.

(vi) **Exothermic and Endothermic Reactions**

- **Exothermic reactions** The reactions which are accompanied by the evolution of heat, are called exothermic reactions. e.g.



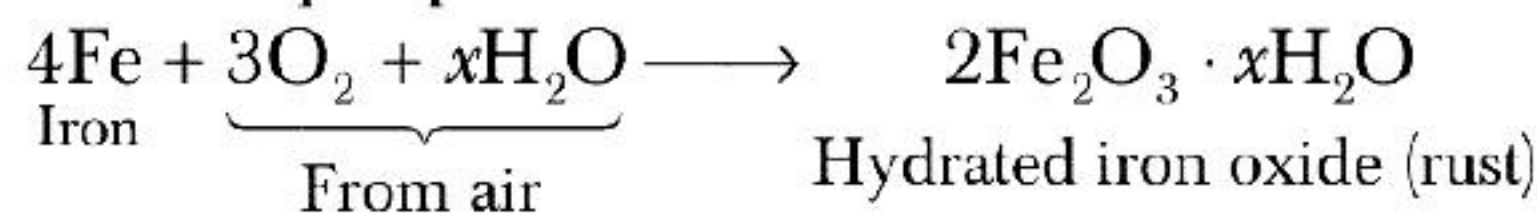
- **Endothermic reactions** The reactions which occur by the absorption of heat/energy are called endothermic reactions. e.g.



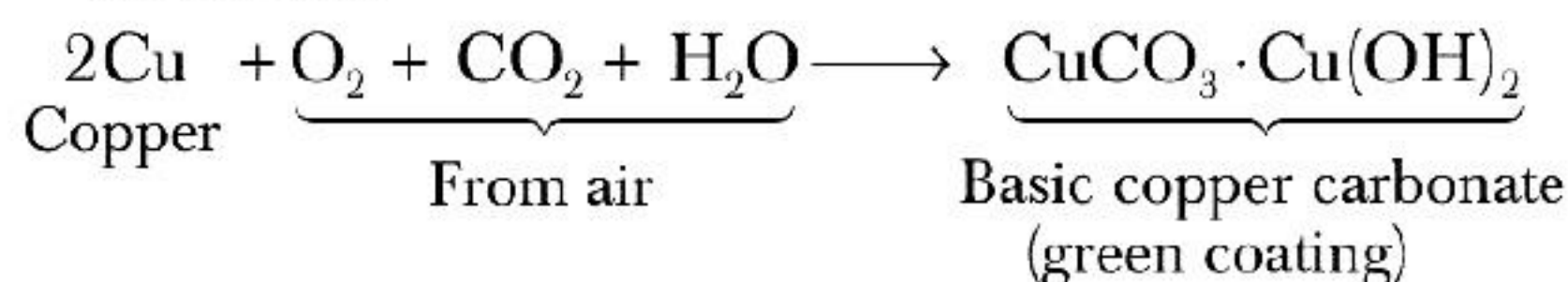
5. Corrosion

The phenomenon due to which metals are slowly eaten away by the reaction of air, water and chemicals present in atmosphere, is called corrosion.

- **Rusting of Iron** Corrosion of iron is called **rusting**. Iron forms hydrated iron oxide (rust) when kept open in moist air.



- **Formation of a Green Layer Over Copper** New copper (brown in colour) vessel forms a green layer of basic copper carbonate after some time due to the reaction of air and moisture.



- Corrosion causes damage to car bodies, bridges, iron railing, ships and all objects made

of metals, specially those which are made of iron.

- Corrosion is a wasteful process in most of cases. Every year, a lot of tones of various metals especially iron get wasted in the country. Hence, it is quite necessary to prevent corrosion.

6. Rancidity

- It is the process of slow oxidation of oils and fats present in the food materials resulting in the production of foul odour and taste in them.
- Anti-oxidants are added to foods containing fats and oils in order to prevent their oxidation.

Objective Questions

Multiple Choice Questions

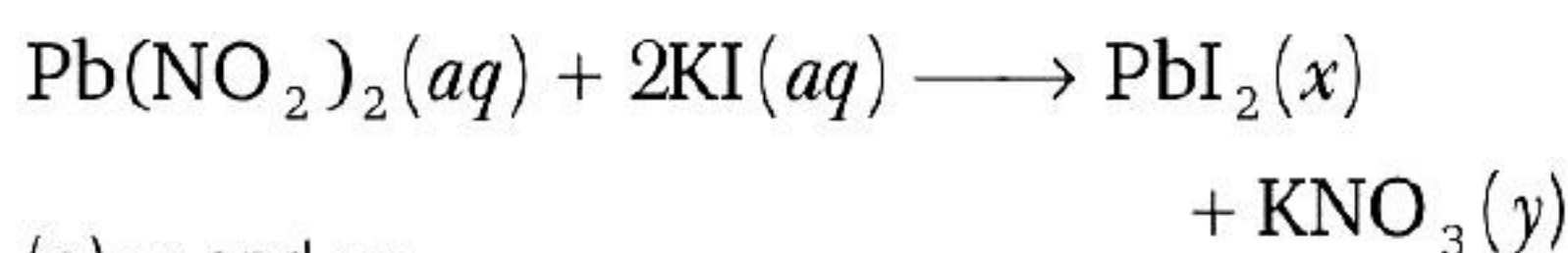
- 01.** Which one of the following process involve chemical reactions?

- Storing of oxygen gas under pressure in a gas cylinder
- Liquefaction of air
- Keeping petrol in a China dish in the open
- Heating copper wire in the presence of air at high temperature

- 02.** The number of atoms of each element is conserved in any chemical reaction.

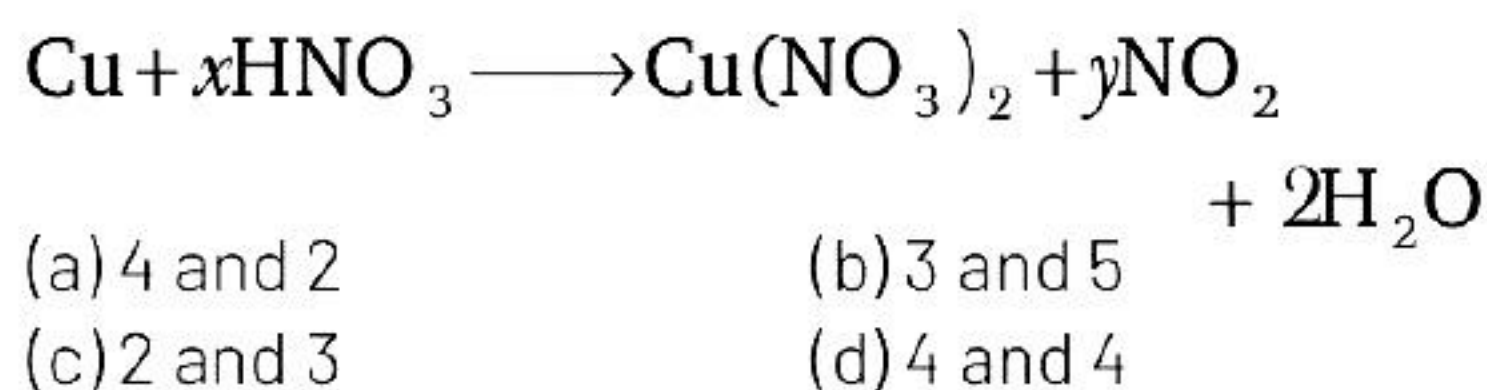
- True
- False
- Can't say
- Partially true/false

- 03.** Complete the missing variables given as 'x' and 'y' in the following reaction:



- aq and aq
- s and s
- aq and s
- s and aq

- 04.** Identify x and y in the following reaction



- 4 and 2
- 3 and 5
- 2 and 3
- 4 and 4

- 05.** The following reaction is an example of
- $$\text{CaO}(s) + \text{H}_2\text{O}(l) \longrightarrow \text{Ca(OH)}_2(aq)$$

- Displacement reaction
- Combination reaction
- Decomposition reaction
- Exothermic reaction

- Only (III)
- (I) and (III)
- (II) and (IV)
- Only (I)

- 06.** Ferrous sulphate crystals lose water when heated. How many molecules of water are lost?

- 5
- 7
- 2
- 4

- 07.** Heating of limestone produces

- slaked lime
- quick lime
- lime water
- caustic soda

- 08.** Carbon dioxide gas burns with a pop sound when a burning candle is brought near it.
(a) True
(b) False
(c) Can't say
(d) Partially true/false
- 09.** The formation of quick lime and carbon dioxide from calcium carbonate is an example of
(a) photochemical decomposition reaction
(b) thermal decomposition reaction
(c) oxidation reaction
(d) displacement reaction
- 10.** Electrolysis of water is a decomposition reaction. The mole ratio of hydrogen and oxygen gases liberated during electrolysis of water is
(a) 1:1
(b) 2:1
(c) 4:1
(d) 1:2
- 11.** Which of the following can be decomposed by the action of sunlight?
(a) KBr
(b) AgBr
(c) MgO
(d) NaCl
- 12.** What will happen, when silver chloride is placed in sunlight for sometime?
(a) White silver chloride changes into grey coloured compound
(b) Decomposition takes place
(c) Both (a) and (b) takes place
(d) Nothing will happen
- 13.** The heating of lead nitrate produces brown fumes of 'X' gas. Identify 'X' from the following.
(a) Lead oxide
(b) Oxygen
(c) Nitrogen dioxide
(d) Dinitrogen oxide
- 14.** The carbonate of metal lead is a white solid. It decomposes when heated to form carbon dioxide and a yellow solid oxide 'X'. What is X?
(a) Zinc oxide
(b) Lead oxide
(c) Silver oxide
(d) Magnesium oxide
- 15.** Which of the following is exothermic reaction?
(a) Dissolution of sodium hydroxide in water
(b) Evaporation of water
(c) Sublimation of silver chloride
(d) Dissolution of salt in water
- 16.** Identify the endothermic process from the following:
(a) $\text{H}_2\text{O}(l) \longrightarrow \text{H}_2\text{O}(g)$
(b) $\text{CaO}(s) + \text{H}_2\text{O}(l) \longrightarrow \text{Ca}(\text{OH})_2(aq)$
(c) Combustion of methane
(d) Addition of conc. HCl to water.
- 17.** When zinc granules are reacted with dilute sulphuric acid, then which of the following gas is evolved?
(a) Oxygen gas
(b) Sulphur dioxide gas
(c) Hydrogen gas
(d) Hydrogen sulphide gas
- 18.** Which of the following gives reddish-brown precipitate on mixing?
(a) $\text{FeCl}_3 + \text{NH}_4\text{OH}$
(b) $\text{NaCl} + \text{H}_2\text{O}$
(c) $\text{AgNO}_3 + \text{NH}_4\text{OH}$
(d) $\text{CuSO}_4 + \text{H}_2\text{S}$
- 19.** The following reaction is an example of
$$\text{Fe}_2\text{O}_3 + 2\text{Al} \xrightarrow{\Delta} 2\text{Fe} + \text{Al}_2\text{O}_3$$

(a) thermal decomposition reaction
(b) displacement reaction
(c) double displacement reaction
(d) neutralisation reaction
- 20.** Which of the following is incorrect statement?
(a) Mg is more reactive than H
(b) Fe is less reactive than Zn
(c) Cu is more reactive than Al
(d) Ag is less reactive than Cu

21. What happens when copper rod is dipped in iron sulphate solution?

- I. Copper displaces iron.
- II. Blue colour of copper sulphate solution is obtained.
- III. Reaction is exothermic.
- IV. No reaction takes place.

- (a) (I) and (II) (b) (I), (II) and (III)
(c) Only (I) (d) Only (IV)

22. What happens, when chlorine water is added to KI solution?

- (a) $I_2(aq)$ is formed
- (b) IO_3^- ions of white coloured are produced
- (c) KOH is formed
- (d) $HCl(g)$ is evolved.

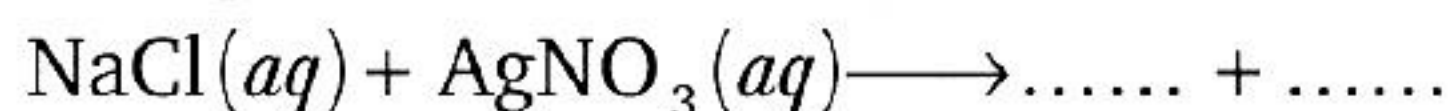
23. Match chemical compound given in the Column I with its colour given in Column II and select the correct answer using the options given below:

Column I (Chemical compounds)	Column II (Colour of their compound)
A. Barium sulphate	1. Colourless
B. Ferrous sulphate	2. Blue
C. Copper sulphate	3. Green (light)
D. Zinc sulphate	4. White

Codes

- | | | | |
|-------|---|---|---|
| A | B | C | D |
| (a) 1 | 3 | 4 | 2 |
| (b) 4 | 2 | 1 | 3 |
| (c) 2 | 4 | 3 | 2 |
| (d) 4 | 3 | 2 | 1 |

24. Complete the following reaction:



- (a) Na, $Ag(NO_3)Cl$ (b) $NaNO_2$, $AgOCl$
(c) $NaNO_3$, $AgCl_2$ (d) $NaNO_3$, $AgCl$

25. The reaction in which two compounds exchange their ions to form two new compounds is

- (a) precipitation reaction

- (b) double displacement reaction
(c) decomposition reaction
(d) neutralisation reaction

26. 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)

- (a) Lead sulphate (insoluble)
- (b) Lead acetate
- (c) Ammonium nitrate
- (d) Potassium sulphate

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

- I. Exchange of atoms takes place.
- II. Exchange of ions takes place.
- III. A precipitate is produced.
- IV. An insoluble salt is produced.

The correct option is (CBSE 2020)

- (a) (II) and (IV) (b) (I) and (III)
(c) Only (II) (d) (III) and (IV)

28. The process of respiration is

- (a) oxidation and exothermic
- (b) reduction and endothermic
- (c) oxidation and endothermic
- (d) reduction and exothermic

29. When magnesium ribbon is burnt, which of the following statements is observed?

- (a) Magnesium burns with white flame and changes into white powder
- (b) Magnesium burns with white flame and changes into black powder
- (c) Magnesium burns with yellow flame and changes into yellow powder
- (d) Magnesium burns with yellow flame and changes into white powder

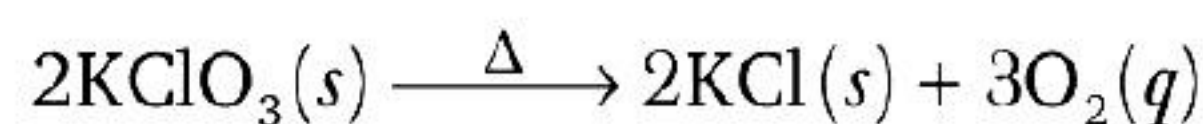
30. Fire flies glow at night due to of luciferin (protein).

- (a) reduction (b) oxidation
(c) combustion (d) displacement

31. The addition of phosphorus and oxygen gives a product. This reaction is an example of reaction.

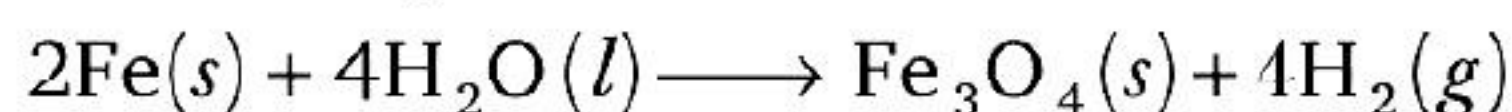
- (a) decomposition (b) precipitation
(c) oxidation (d) reduction

32. The following reaction is an example of which type of reaction:



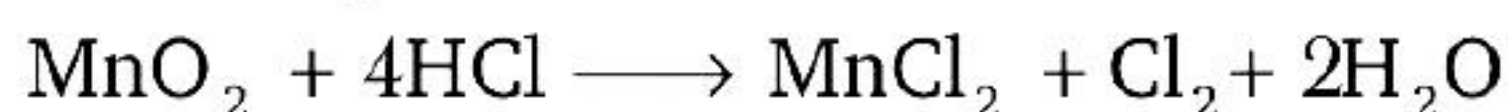
- (a) Reduction reaction
(b) Oxidation reaction
(c) Displacement reaction
(d) Exothermic reaction

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



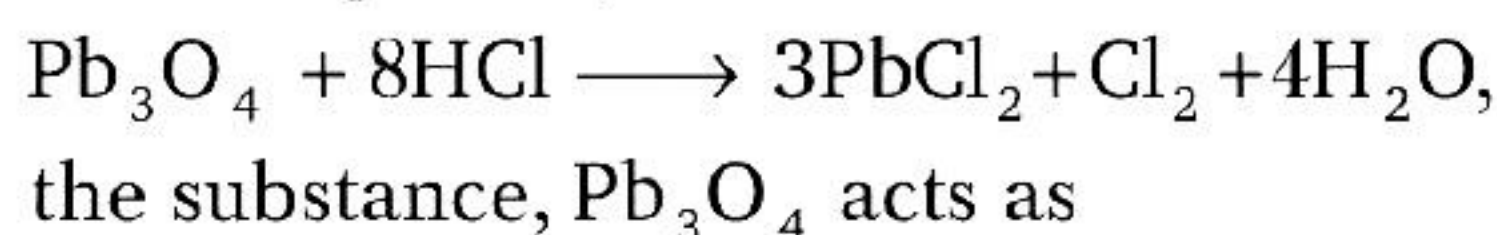
- I. Iron metal is getting oxidised.
II. Water is getting reduced.
III. Water is acting as reducing agent.
IV. Water is acting as oxidising agent.
(a) (I), (II) and (III) (NCERT Exemplar)
(b) (III) and (IV)
(c) (I), (II) and (IV)
(d) (II) and (IV)

34. Identify the oxidising agent in the following:



- (a) MnO_2 (b) MnCl_2
(c) HCl (d) H_2O

35. In the equation,



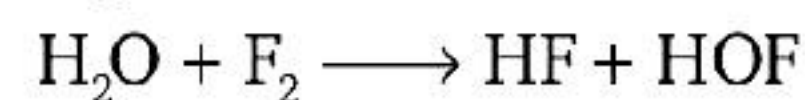
- (a) an oxidising agent
(b) an acid
(c) a reducing agent
(d) a dehydrating agent

36. A dilute ferrous sulphate solution was gradually added to the beaker containing acidified permanganate solution. The light purple colour of the solution fades and finally disappears.

Which of the following is the correct explanation for the observation?

- (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 the presence of FeSO_4 to a colourless compound

37. Identify the reducing agent in the following reaction:



- (a) H_2O (b) F_2
(c) HF (d) HOF

38. The following reaction is a type of reaction.



- (a) oxidation (b) reduction
(c) redox (d) decomposition

39. Match chemical reactions given in the Column I with the type of chemical reactions given in the Column II and select the correct answer using the options given below:

Column I (Chemical reactions)	Column II (Types of chemical reactions)
A. Formation of NH_3 from N_2 and H_2	1. Decomposition
B. Calcination of zinc carbonate	2. Double displacement
C. Rusting of iron	3. Combination
D. Reaction of aqueous BaCl_2 solution with dil. H_2SO_4	4. Redox

Codes

	A	B	C	D
(a)	3	1	4	2
(b)	3	4	2	1
(c)	1	4	3	2
(d)	4	3	2	1

40. Gold is a metal which does not corrode when exposed to the atmosphere.

- (a) True
(b) False
(c) Can't say
(d) Partially true/false

41. The iron rod is covered with reddish-brown layer which damages the surface of rod. Which of the following method can be used to prevent its damage?

- (a) By covered it with layer of base
(b) By covered it with thin layer of zinc
(c) By covered it with layer of dilute acid
(d) By covered its with layer of copper

42. Chemically, rust is

- (a) hydrated ferrous oxide
(b) only ferric oxide
(c) hydrated ferric oxide
(d) None of the above

43. Food items made up of oils and fats are flushed with nitrogen gas

- I. to protect them from being rancid.
II. to protect their taste.
III. to maintain the weight of food.
IV. to enhance their flavour.

The correct statements are

- (a) (I), (II) and (III)
(b) (II) and (IV)
(c) (I) and (II)
(d) All of the above

44. are used to prevent rancidity of food.

- (a) Acids (b) Anti-oxidants
(c) Galvanisation items (d) Anti-reductants

45. Which of the following gases can be used for storage of fresh sample of an oil for a long time?

- (a) Carbon dioxide or oxygen
(b) Nitrogen or oxygen
(c) Carbon dioxide or helium
(d) Helium or nitrogen

46. Match the chemical reactions given in the Column I with the gas evolved given in the Column II and select the correct answer using the options given below:

Column I (Reactions)	Column II (Gas evolved)
A. Zinc granules are treated with dilute H_2SO_4 .	1. O_2
B. Calcium carbonate on reacting with HCl.	2. CO_2
C. Lead nitrate is heated strongly in a hard glass test tube.	3. H_2
D. Decomposition of KClO_3	4. NO_2

Codes

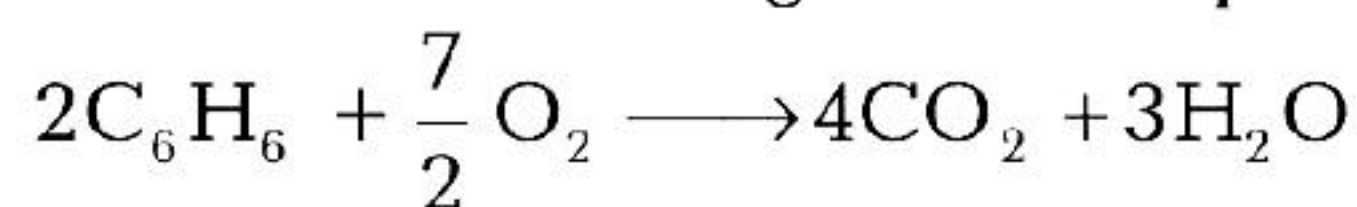
	A	B	C	D
(a)	3	4	2	1
(b)	3	2	4	3
(c)	1	3	4	2
(d)	3	2	4	1

Assertion-Reasoning MCQs

Direction (Q.Nos. 47-54) For question numbers two statements are given—one labeled **Assertion** (A) and the other labelled **Reason** (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below.

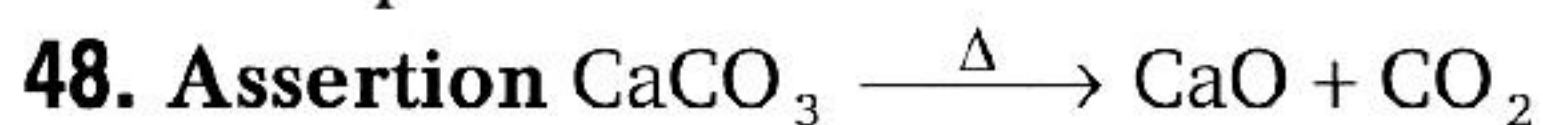
- (a) Both A and R are true and R is correct explanation of the A.
(b) Both A and R are true but R is not the correct explanation of the A.
(c) A is true but R is false.
(d) A is false but R is true.

47. Assertion The following chemical equation,



is a balanced chemical equation.

Reason In a balanced chemical equation, the total number of atoms of each element is equal on both side of the equation.



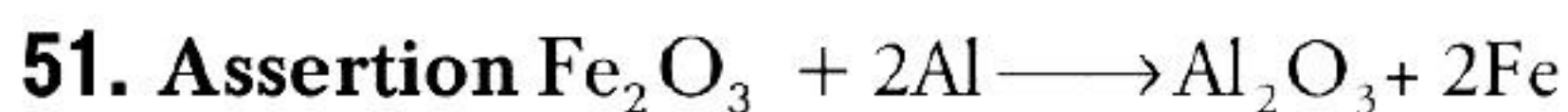
Reason Photochemical decomposition occurs in the presence of sunlight.

49. Assertion Quicklime reacts vigorously with water releasing a large amount of heat.

Reason The above chemical reaction is an exothermic reaction.

50. Assertion Photosynthesis is considered as an endothermic reaction.

Reason Energy gets released in the process of photosynthesis.



The above chemical equation is an example of displacement reaction.

Reason Aluminium being more reactive than iron, displaces Fe from its oxide.

52. Assertion Reaction between silver nitrate and potassium chloride is a precipitation reaction.

Reason Precipitation reaction produces insoluble salt.

53. Assertion In the following chemical equation,



Zinc is getting oxidised and copper oxide is getting reduced.

Reason The process in which oxygen is added to a substance is called oxidation whereas the process in which oxygen is removed from a substance is called reduction.

54. Assertion Corrosion involves the damage or deterioration of metal components.

Reason The reduction reaction occurs between metal and atmospheric gases.

Case Based MCQs

55. Read the following and answer questions from (i) to (v).

Chemical reactions involve the breaking and making of bonds between atoms to produce new substances. During a chemical reaction atoms of one element do not change into those of another element. Nor do, atoms disappear from the mixture or appear from elsewhere.

There are certain types of reactions.

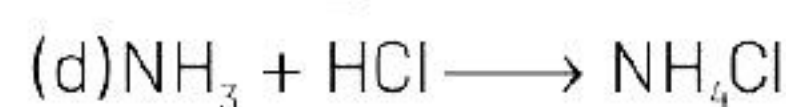
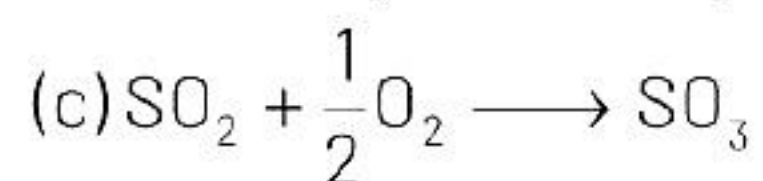
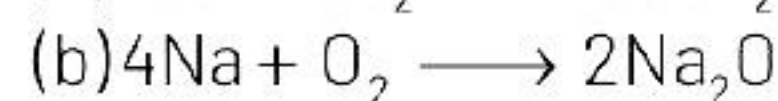
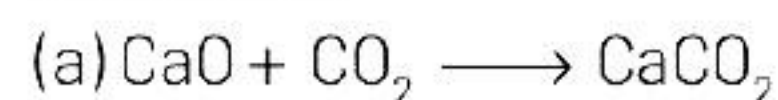
Reactions in which a single product is formed from two or more reactants is known as a combination reactions.

Decomposition reactions are the reaction in which a compound breaks down into simpler compounds.

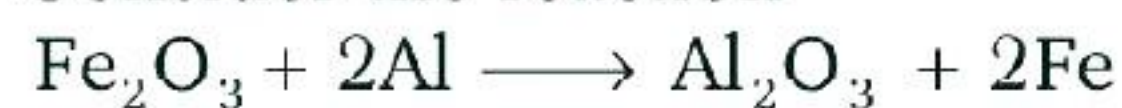
Displacement and double displacement reactions are one in which an atom or group of atom is replaced by another.

A double displacement reaction usually occurs in solution and one of products, being insoluble, precipitate out (separate as a solid). Another of reaction is redox reactions in which simultaneous oxidation and reduction takes place.

(i) Which of the following reactions involved the combination of two element?



(ii) Consider the reaction



The above reaction is an example of

(a) combination reaction

(b) double displacement reaction

(c) decomposition reaction

(d) simple displacement reaction

(iii) The equation,



represents

- I. decomposition reaction
 II. displacement reaction
 III. combination reaction
 IV. double displacement reaction
 V. redox reaction

- (a) I and II (b) III and IV
 (c) II and V (d) IV and V

- (iv) Which of the following is a decomposition reaction?
 (a) $2\text{HgO} \xrightarrow{\text{Heat}} 2\text{Hg} + \text{O}_2$
 (b) $\text{CaCO}_3 \xrightarrow{\text{Heat}} \text{CaO} + \text{CO}_2$
 (c) $2\text{HgO} \xrightarrow{\text{Electrolysis}} \text{H}_2 + \text{O}_2$
 (d) All of the above
- (v) $\text{CuO} + \text{H}_2 \longrightarrow \text{H}_2\text{O} + \text{Cu}$ reaction is an example of
 (a) redox reaction (b) synthesis Reaction
 (c) neutralisation (d) analysis reaction

56. Read the following and answer question from (i) to (v).

A magnesium ribbon 'X' was taken by four students *P*, *Q*, *R* and *S* and they cleaned it by sand paper. 2 cm 'X' and a piece of coat 'Y' were taken in a watch glass by four students. On burning 'X' and 'Y' by using burner following observation were recorded in the form of table as given below:

Observations by	Item	Flame's colour	Residue obtained
<i>P</i>	<i>X</i>	Dazzling white	Greyish ash
	<i>Y</i>	Yellowish	Black ash
<i>Q</i>	<i>X</i>	Dazzling white	White powder
	<i>Y</i>	Sooty	Blackish grey
<i>R</i>	<i>X</i>	White flame	Grey powder
	<i>Y</i>	White flame	Black coke
<i>S</i>	<i>X</i>	Yellowish	Greyish ash
	<i>Y</i>	Sooty	Black ash

- (i) The correct observation was made by the student
 (a) *P* (b) *Q* (c) *R* (d) *S*
- (ii) When magnesium ribbon burnt it produces
 (a) magnesium hydroxide
 (b) magnesium oxide
 (c) magnesium chloride
 (d) magnesium carbonate
- (iii) The magnesium ribbon must be cleaned before burning in air so as to
 (a) remove the layer of MgO
 (b) remove the layer of Mg(OH)_2
 (c) remove the dirt
 (d) remove the layer of rust
- (iv) The type of reaction involved in this experiment is
 (a) decomposition reaction
 (b) displacement reaction
 (c) combination reaction
 (d) combustion reaction
- (v) The yellow flame indicates
 (a) the complete combustion
 (b) the flame is not very hot
 (c) an incomplete combustion
 (d) oxygen supply is high

57. Read the following and answer questions from (i) to (v).

Oxidation has damaging effect on metals as well as on food.

The damaging effect of oxidation is studied as corrosion and that on food is studied as rancidity.

Corrosion causes damage to car bodies, bridges, iron railings, ships and all objects made of metals, specially those of iron, present in the atmosphere. Every year an enormous amount of money is spent to replace and prevent the damaged iron.

Some metals also get tarnished in this manner. The change in colour and the coating of layer indicates the corrosion. When metals are new, they are lustrous and shiny. But their appearance becomes

dull after sometime. These all are the signs of corrosion of metals.

- (i) The corrosion of iron is also called as
 (a) oxidation (b) reduction
 (c) rusting (d) calcination
- (ii) The factors responsible for the corrosion are
 (a) oxygen and moisture
 (b) carbon dioxide and water
 (c) heat and acid
 (d) All of the above
- (iii) The black coating on silver is due to presence of in air.
 (a) nitrogen dioxide
 (b) sulphur oxide
 (c) hydrogen sulphide
 (d) carbon dioxide
- (iv) The rusting process is a type of which reaction?
 (a) Decomposition reaction
 (b) Displacement reaction
 (c) Endothermic reaction
 (d) Redox reaction
- (v) Which of the following method is not used for prevention of corrosion of metals?
 (a) Using anti-oxidants
 (b) Painting
 (c) Galvanising
 (d) Electroplating

58. Read the following and answer questions from (i) to (v).

Rancid fats are formed in human diet in places such as cooking oils and fats, deep fried foods and some ethnic foods that are purposely made rancid. However, any fat, given the right conditions and amount of time, can go rancid. It means that any food containing fat can become rancid.

For instance, India, 1992, a group of 45 childrens were hospitalised with vomiting, abdominal pain and diarrhoea, which prompted an investigation.

The investigation turned up a total of 71 childrens and 9 adults who were affected by eating rancid cream-filled biscuits which the children had found in the street and shared with their families. Most children ate 0.5 to 2 biscuits and were discharged from the hospitals within 24 hours, one girl ate 12 biscuits and remained in the hospital for 7 days. All the hospitalised children were treated successfully and the researchers decided that the cause of illness was the oxidative rancidity of the cream inside the biscuits. Presence of antioxidants is an antidote for rancidity.

- (i) Which of the follownig food items become oxidised if placed for a few hours in open?
 (a) Dark green vegetables (b) Biscuits
 (c) Oil (d) Potato
- (ii) The following steps are taken to protect yourself from the effect of rancid fats.
 I. Store oils and fats correctly.
 II. Avoid food which contains fats or stale smell.
 III. Consume antioxidants containing foods such as dark green vegetables.
 The correct steps, mentioned above are
 (a) I, II (b) II, III
 (c) Only III (d) All of these
- (iii) The fresh food become stale and tasteless when exposed to air due to
 (a) reduction of fats and oils takes place
 (b) oxidation of fats and oil takes place
 (c) corrosion of food
 (d) reaction between carbon dioxide and fats and oils present in food.
- (iv) Which of the following is used to prevent rancidity of food?
 (a) Species (b) Vinegar
 (c) Antioxidants (d) All of these
- (v) The packed food items like potato chips are flushed with which gas?
 (a) CO_2 (b) O_2
 (c) H_2 (d) N_2

ANSWERS

Multiple Choice Questions

- | | | | | | | | | | |
|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| 1. (d) | 2. (a) | 3. (d) | 4. (a) | 5. (c) | 6. (b) | 7. (b) | 8. (b) | 9. (b) | 10. (b) |
| 11. (b) | 12. (c) | 13. (c) | 14. (b) | 15. (a) | 16. (a) | 17. (c) | 18. (a) | 19. (b) | 20. (c) |
| 21. (d) | 22. (a) | 23. (d) | 24. (d) | 25. (b) | 26. (b) | 27. (d) | 28. (a) | 29. (a) | 30. (b) |
| 31. (c) | 32. (a) | 33. (c) | 34. (a) | 35. (a) | 36. (a) | 37. (a) | 38. (c) | 39. (a) | 40. (a) |
| 41. (b) | 42. (c) | 43. (c) | 44. (b) | 45. (d) | 46. (d) | | | | |

Assertion-Reasoning MCQs

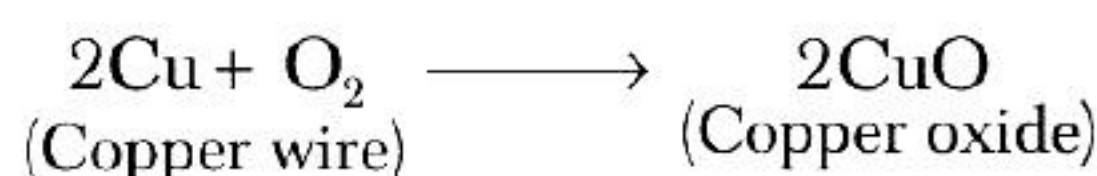
47. (d) 48. (b) 49. (a) 50. (c) 51. (a) 52. (a) 53. (a) 54. (c)

Case Based MCQs

55. (i)-(b), (ii)-(d), (iii)-(c), (iv)-(d), (v)-(a) 56. (i)-(b), (ii)-(b), (iii)-(a), (iv)-(d), (v)-(c)
 57. (i)-(c), (ii)-(d), (iii)-(c), (iv)-(d), (v)-(a) 58. (i)-(b), (ii)-(d), (iii)-(b), (iv)-(c), (v)-(d)

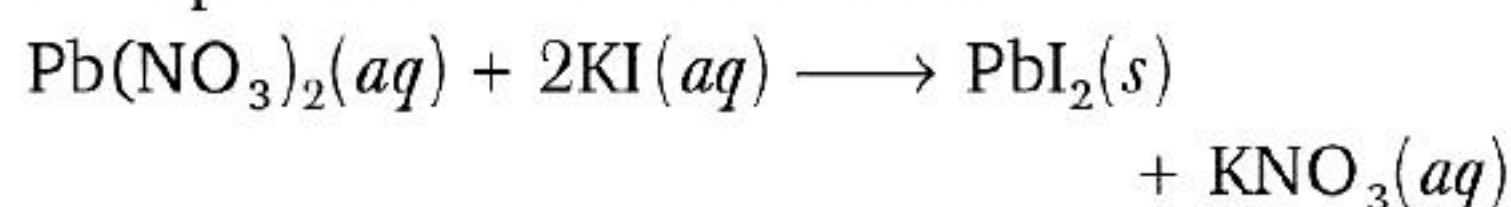
EXPLANATIONS

1. A chemical reaction is a change in which one or more substance(s) or reactant(s) react to form new substance(s) with entirely different properties. Heating of copper wire in presence of air at high temperature gives copper oxide.

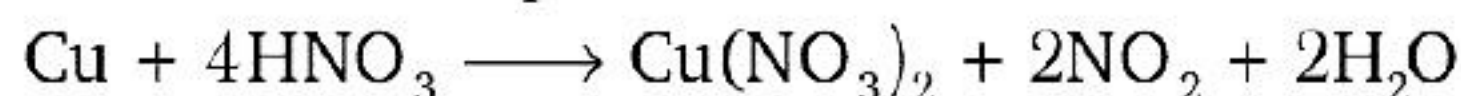


2. According to law of conservation of mass, the mass of reactants must be equal to mass of products. In other words, the number of atoms of each element is same, before and after the chemical reaction.

3. When lead nitrate reacts with potassium iodide solution, then insoluble solid precipitates of lead iodide are formed along with potassium nitrate solution.



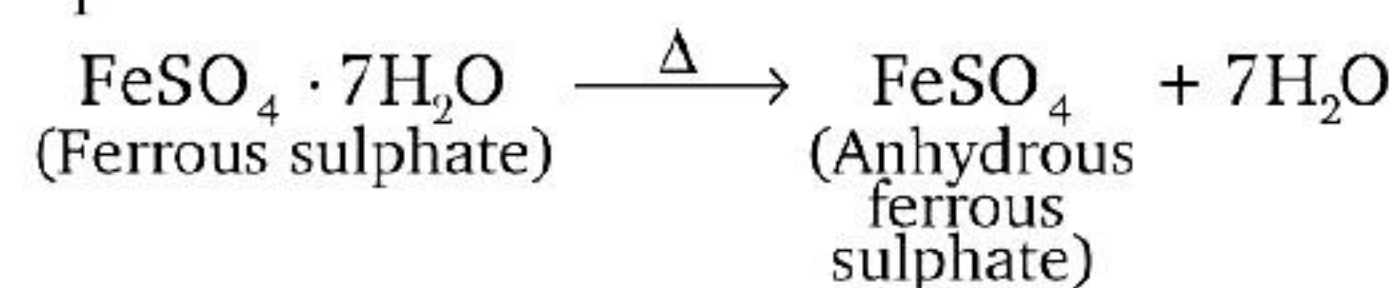
4. By equating the number of atoms both sides, the balanced equation will be



5. The given reaction is an example of both combination and exothermic reaction because calcium oxide and water are combined together to form single product, i.e. calcium hydroxide and produces heat during reaction.

Hence, it is exothermic and combination reaction.

6. When blue crystals of ferrous sulphate ($\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$) are heated, then 7 water molecules are lost and anhydrous ferrous sulphate is formed.

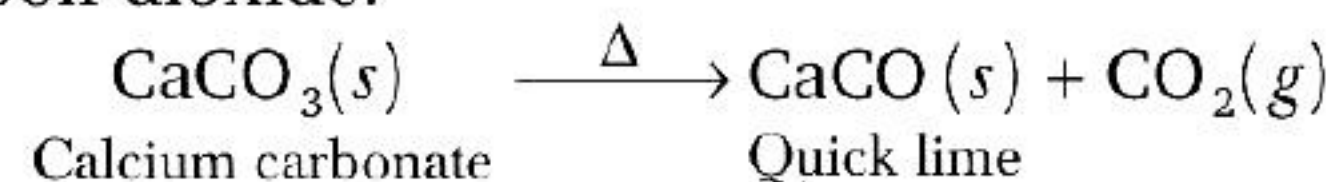


7. When lime stone (also called calcium carbonate) is heated, then it decomposes into calcium oxide and carbon dioxide. Calcium oxide is also known as quick lime.

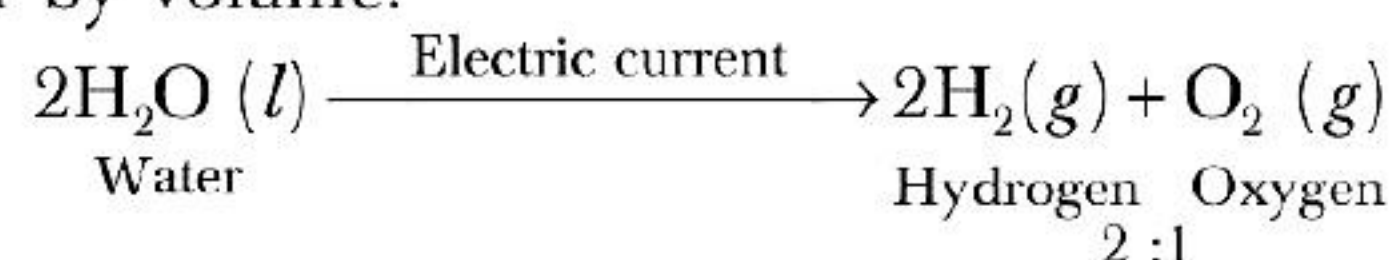


8. The carbon dioxide gas which is evolved in the reaction can be detected by lime water test. The burning candle test is used for the detection of hydrogen gas. So, the given statement is false.

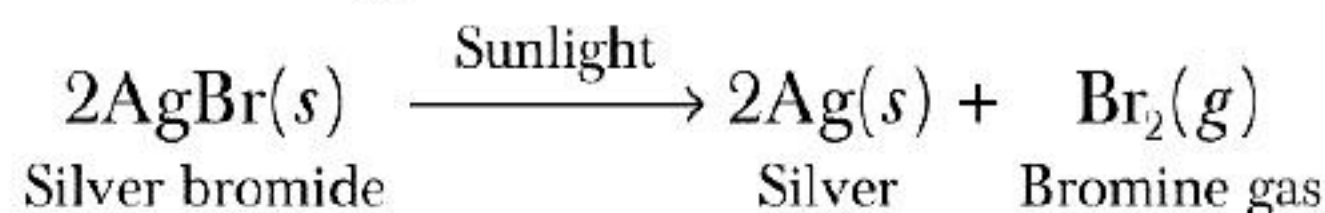
9. The given reaction is a type of thermal decomposition because heat is required for the breakdown of a reactant, i.e. calcium carbonate decomposes into quick lime and carbon dioxide.



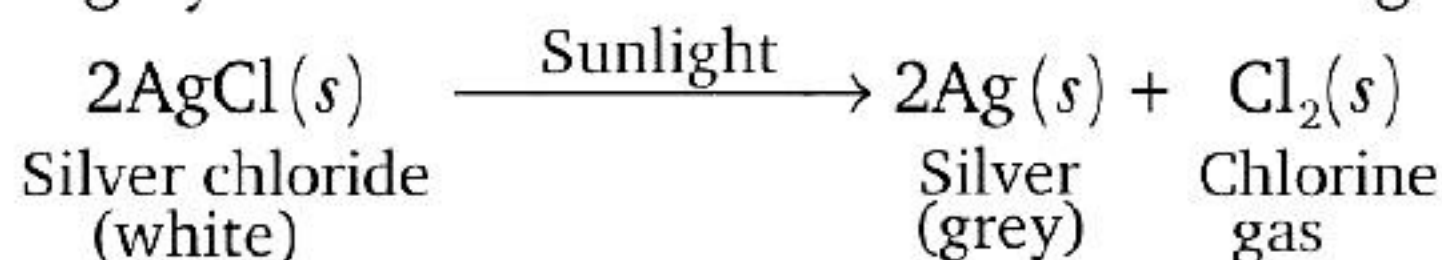
10. The water decomposes during electrolysis to form hydrogen and oxygen gases in the ratio 2:1 by volume.



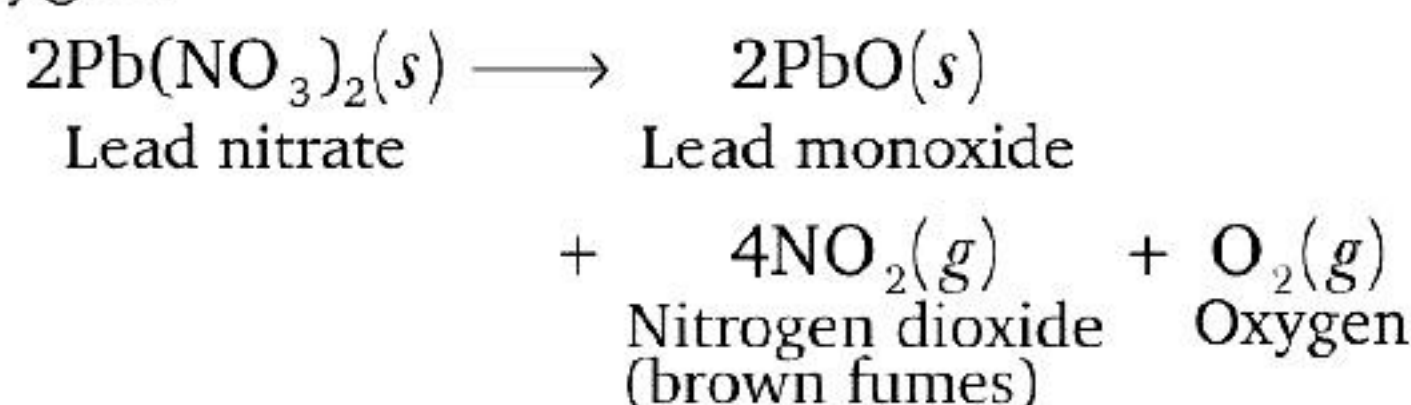
11. AgBr, (silver bromide) gets decomposed when exposed to sunlight and form silver metal and bromine gas is evolved.



12. When silver chloride, AgCl is placed in sunlight for sometime, then silver chloride changes into grey coloured silver metal and chlorine gas.

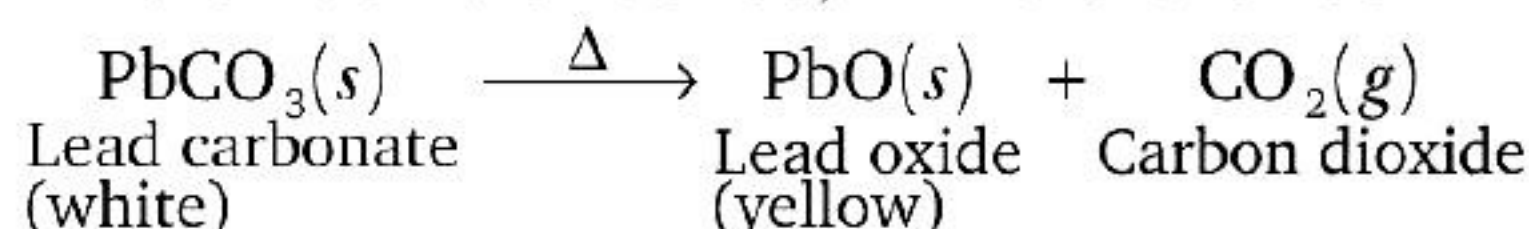


13. When lead nitrate is heated, it decomposes into lead monoxide, nitrogen dioxide and oxygen.



So, brown fumes evolved are of nitrogen dioxide.

14. The white solid, lead carbonate is heated and decomposes into yellow coloured lead oxide and carbon dioxide. So, 'X' is lead oxide.

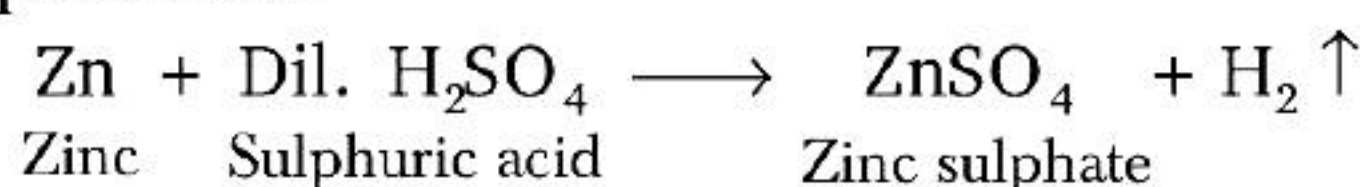


15. Exothermic reactions are those in which energy is released in form of heat. The dissolution of sodium hydroxide in water produces heat and make a beaker warm in which dissolution takes place.
16. Endothermic reactions are those in which the reactant(s) absorb heat energy from the surrounding for the formation of product(s). Water in liquid form can be converted into gaseous form by heating. Therefore, heat energy is required to form vapours of water. Hence, $\text{H}_2\text{O}(l) \longrightarrow \text{H}_2\text{O}(g)$ is endothermic process.

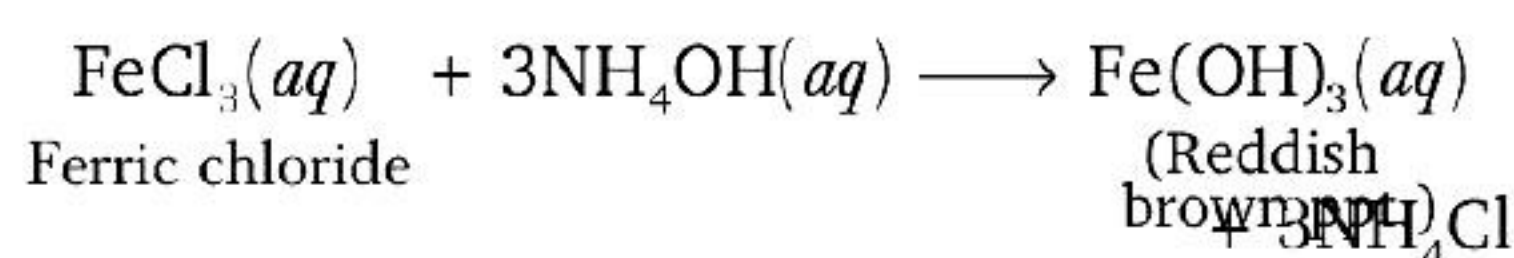
17. When any metal reacts with dilute acid, then hydrogen gas is evolved.



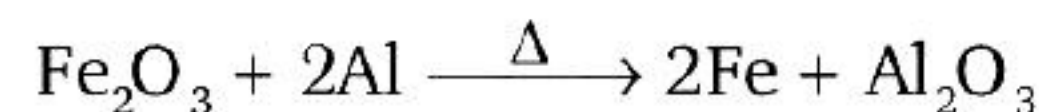
Therefore, when zinc granules reacts with dil. H_2SO_4 , it gives hydrogen gas and zinc sulphate salt.



18. When ferric chloride (FeCl_3) is mixed with NH_4OH , it gives reddish-brown precipitates of $\text{Fe}(\text{OH})_3$, (ferric hydroxide).



19. The following reaction is an example of displacement reaction.



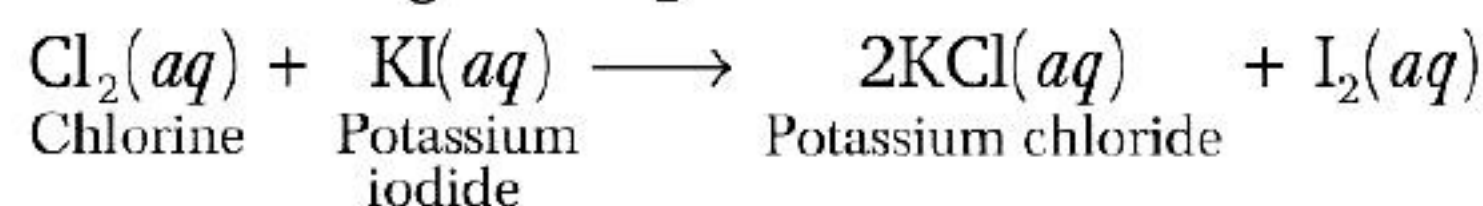
In this reaction, aluminium, being more reactive than iron, displaces iron from its place and form aluminium oxide.

20. The order of reactivity of given elements is $\text{Mg} > \text{Al} > \text{Zn} > \text{Fe} > \text{H} > \text{Cu} > \text{Ag}$. So, according to this reactivity series, Cu is less reactive than Al. Hence, option (c) is incorrect.

21. Iron is more reactive than copper.

Hence, Cu will not displace iron from iron sulphate and no reaction will take place.

22. When chlorine water is added to potassium iodide solution, then potassium chloride is formed along with I_2 , iodine.



This type of reaction is called displacement reaction.

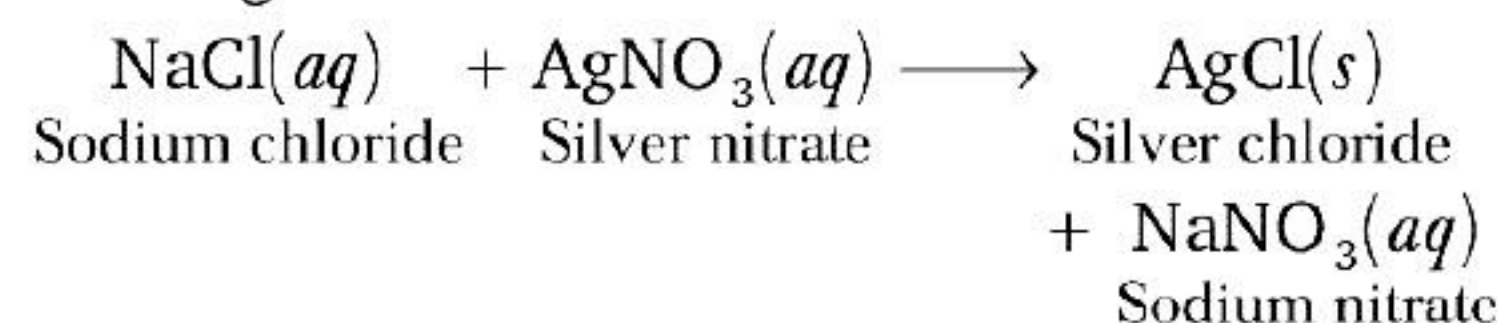
23. Barium sulphate is white in colour.

Ferrous sulphate is light green in colour.

Copper sulphate is blue in colour.

Zinc sulphate is colourless in colour.

24. When sodium chloride reacts with silver nitrate, then silver chloride and sodium nitrate get formed.



25. The reaction is called double displacement reaction because it involves the exchange of ions to form two new compounds.

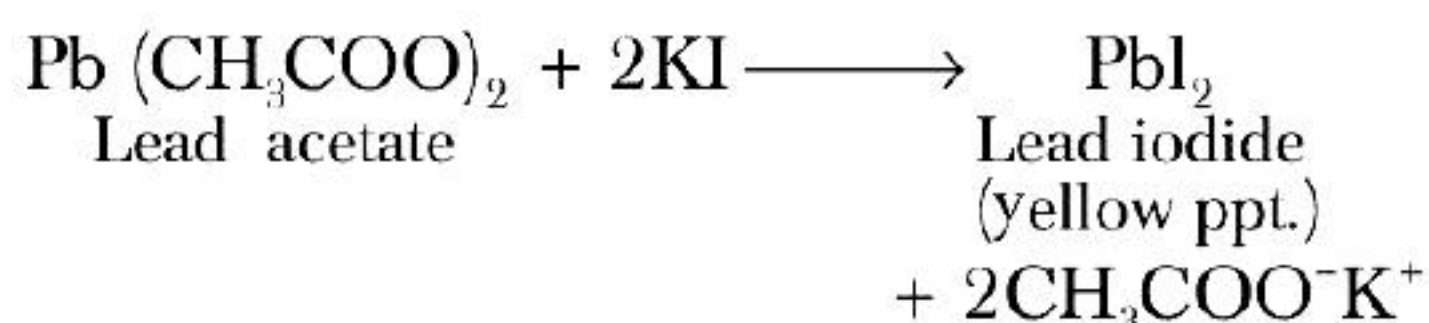


Here, AX and BY form two new compounds BX and AY due to exchange of their ions.

Hence, it is a double displacement reaction.

- 26.** Lead acetate can be used in place of lead nitrate because like lead nitrate, it is also a soluble salt in water.

The reaction is



Lead sulphate is insoluble in water, so it cannot be used.

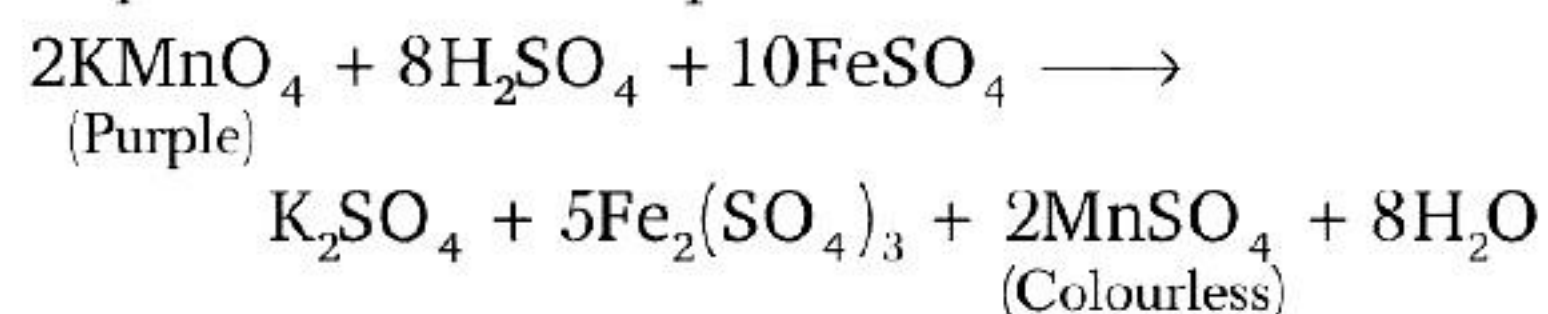
- 27.** In double displacement reaction, two different ions in reactant molecules are displaced or exchanged by each other and precipitate of insoluble salt is produced.
- 28.** The respiration involves the following reaction:

$$\text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2 \longrightarrow 6\text{CO}_2 + 6\text{H}_2\text{O} + \text{Energy}$$
 This reaction is a type of oxidation reaction in which addition of oxygen takes place and energy is released in this reaction, therefore, it is an exothermic reaction too.
- 29.** Magnesium burns with a dazzling white flame and changes into a white powder. This powder is magnesium oxide (MgO) which is formed due to the reaction of magnesium and oxygen present in the air.
- $$\begin{array}{ccc} 2\text{Mg} & + \text{O}_2 & \xrightarrow{\Delta} 2\text{MgO} \\ \text{(Magnesium ribbon)} & & \text{(Magnesium oxide)} \end{array}$$
- This is a type of oxidation reaction.
- 30.** Fire flies have a special kind of substance (protein), i.e. luciferin that undergoes oxidation (by atmospheric oxygen) in the presence of an enzyme. This reaction is accompanied by emission of light.
- 31.** The addition of phosphorus and oxygen can gives two products in different ratio.
- (i) $4\text{P} + 3\text{O}_2 \xrightarrow{\text{Oxidation}} 2\text{P}_2\text{O}_3$
- (ii) $4\text{P} + 5\text{O}_2 \xrightarrow{\text{Oxidation}} 2\text{P}_2\text{O}_5$
- In both reactions, oxidation takes place.
- 32.** In the given reaction, KClO_3 loses its oxygen and becomes KCl. So, there is removal of oxygen in this reaction and hence, it is an example of reduction reaction.
- 33.** Fe is gaining oxygen to give Fe_3O_4 . H_2O is losing oxygen to give H_2 . The substance which oxidises the other substance in a chemical reaction is known as an oxidising agent. So, water is acting as oxidising agent.

- 34.** In the given reaction, the substance that reduced is MnO_2 . It acts as an oxidising agent because it helps hydrogen to get oxidised and itself get reduced.

- 35.** In the given reaction, HCl has been oxidised to Cl_2 (removal of H) and Pb_3O_4 has been reduced to PbCl_2 (removal of O). Hence, Pb_3O_4 acts as an oxidising agent.

- 36.** KMnO_4 in the presence of dil. H_2SO_4 , i.e. in acidic medium, acts as strong reducing agent. In acidic medium, KMnO_4 oxidises ferrous sulphate to ferric sulphate.



- 37.** H_2O is the reducing agent because of the addition of electronegative F, it get oxidised to HOF. It reduces F_2 to HF (by addition of hydrogen).

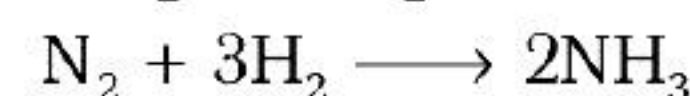
- 38.** In the following reaction,



PbO is losing oxygen and thus, being reduced and the hydrogen is gaining oxygen and thus being oxidised. Oxidation and reduction both occurs simultaneously.

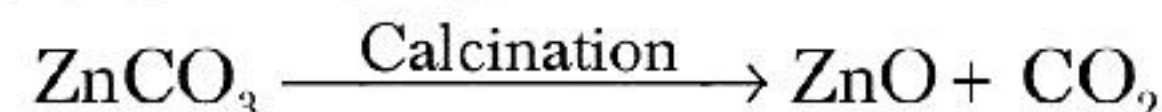
Hence, it is a type of redox reaction.

- 39.** (A) The chemical reaction for the formation of NH_3 from N_2 and H_2 is



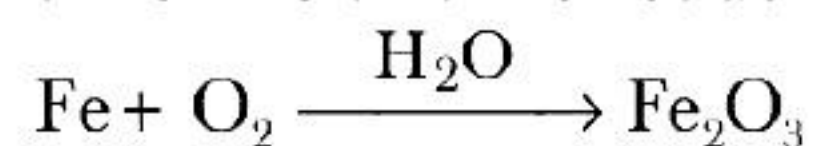
This reaction is combination reaction as N_2 and H_2 are combined together to form NH_3 .

- (B) The calcination of zinc carbonate is a type of decomposition reaction. The chemical reaction involves:

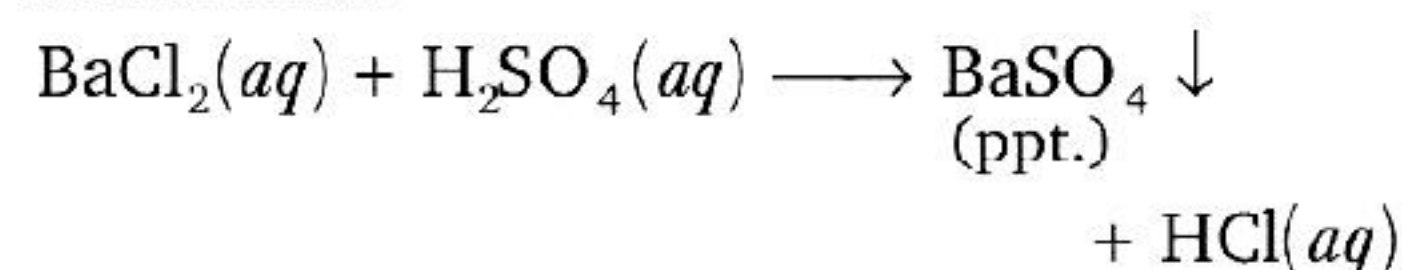


Since, ZnCO_3 decomposes into ZnO and CO_2 , therefore, it is decomposition reaction.

- (C) Rusting of iron is a redox reaction in which oxygen acts as the oxidising agent and iron acts as the reducing agent.



- (D) When dilute sulphuric acid is added to barium chloride solution, then barium sulphate and hydrogen chloride solution are formed.

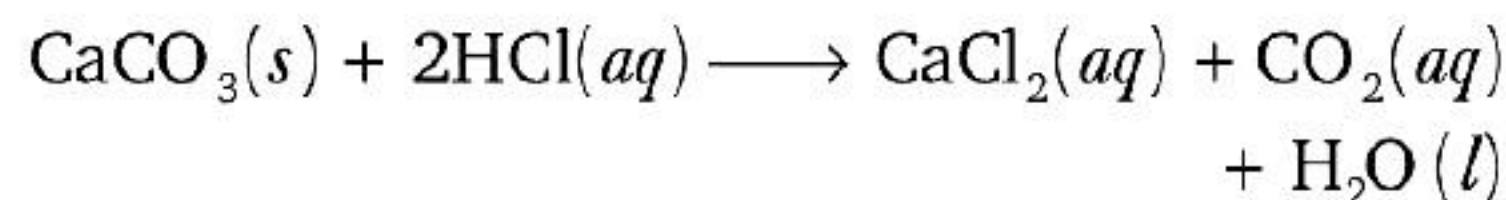


This reaction is a type of double displacement reaction because two compounds exchange their ions form two new products.

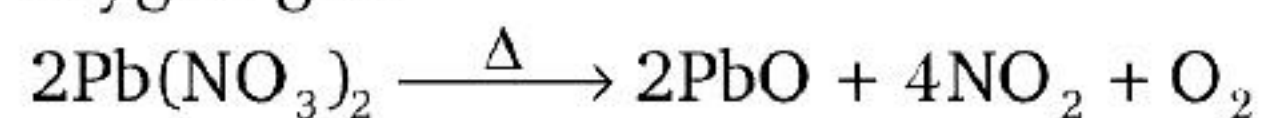
- 40.** In the reactivity series, gold is present at the bottom as it is highly unreactive metal. Hence, it does not react with oxygen present in atmosphere. So, the given statement is true.
- 41.** The iron rod can be protected from corrosion (or rust) by coating a thin layer of zinc metal. The process of coating zinc over iron is called galvanisation.
- 42.** Iron reacts with oxygen from the air in the presence of moisture and rust gets formed. The formula of rust is $\text{Fe}_2\text{O}_3 \cdot x\text{H}_2\text{O}$, where x is a variable. So, rust is the hydrated form of ferric oxide.
- 43.** Rancidity spoils the taste and odour of the food. To prevent rancidity, food items made of oils and fats are flushed with nitrogen gas so that the taste and odour of food do not change.
- 44.** Anti-oxidants are used to prevent the oxidation of oils and fats present in food and rancidity can be prevented.
- 45.** Helium and nitrogen both gases are inert in nature. When the packed food is surrounded by unreactive gas, there is no oxygen to cause its oxidation and make it rancid.
- 46.** (A) When zinc granules are treated with dil. H_2SO_4 , it will give hydrogen gas and zinc sulphate.



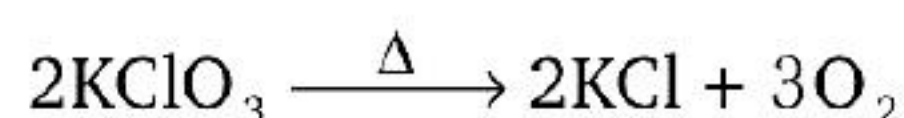
- (B) On reacting with HCl, calcium carbonate gives calcium chloride, water and carbon dioxide.



- (C) When lead nitrate is heated strongly in a hard glass test tube, then lead oxide is formed along with nitrogen dioxide and oxygen gas.



- (D) On decomposition of KClO_3 , two products are formed, that are potassium chloride and oxygen gas.



- 47.** A is false but R is true. In a balanced chemical equation, the total number of atoms of each element are equal on both sides of the equation. Moreover, the correct balanced chemical equation is,



- 48.** Both A and R are true but R is not the correct explanation of A. The given reaction is thermal decomposition reaction not a photochemical decomposition reaction.
- 49.** Both A and R are true and R is the correct explanation of A. In exothermic reactions, heat is released along with the formation of products.
- 50.** A is true but Reason is false. Photosynthesis is considered as an endothermic reaction because energy in the form of sunlight is absorbed by the green plants.
- 51.** Both A and R are true and R is the correct explanation of A.
- $$\text{Fe}_2\text{O}_3 + 2\text{Al} \longrightarrow \text{Al}_2\text{O}_3 + 2\text{Fe}$$
- is a displacement reaction. Here, a highly reactive element (Al) displaces Fe from Fe_2O_3 .
- 52.** Both A and R are true and R is the correct explanation of A.
- $$\text{AgNO}_3(aq) + \text{KCl}(aq) \longrightarrow \text{AgCl}(s) + \text{KNO}_3(aq)$$
- (White ppt.)
- The white precipitate formed is insoluble salt of AgCl.
- 53.** Both A and R are true and R is the correct explanation of A. The reaction involves both oxidation and reduction in which, CuO is reduced to Cu and Zn is oxidised to ZnO.
- 54.** A is true but R is false. The oxidation reaction occurs between the metal and atmospheric gases such as O_2 , CO_2 , SO_2 etc., and results in corrosion.
- 55.** (i) $4\text{Na} + \text{O}_2 \longrightarrow 2\text{Na}_2\text{O}$
- In this reaction, two elements sodium and oxygen participate and form sodium oxide. However in other reactions, the compounds are you combined together and form a single product.

- (ii) The given reaction is an example of simple displacement reaction because Al being more reactive than Fe, replace iron from its oxide and forms aluminium oxide.
- (iii) $\text{Mg}(s) + \text{CuO}(s) \longrightarrow \text{MgO}(s) + \text{Cu}(s)$
In this reaction, Mg displaces Cu from its oxide and form magnesium oxide. Also, Mg is being oxidised (addition of oxygen) and Cu is being reduced (removed of oxygen). Therefore, this reaction is a redox reaction and displacement reaction.
- (iv) All the given reactions are decomposition reaction because in all reactions, single compound decomposes into two products.
- (v) $\text{CuO} + \text{H}_2 \longrightarrow \text{H}_2\text{O} + \text{Cu}$
This reaction is an example of redox reaction in which reduction and oxidation both takes place. CuO is being reduced to Cu and H_2 is being oxidised to H_2O .
- 56.** (i) Magnesium ribbon burns with dazzling white flame and sooty fumes. The correct observation was made by the student Q.
- (ii) When magnesium ribbon burnt, it reacts with oxygen present in the air and form a powdery ash called magnesium oxide (MgO).
- (iii) Magnesium ribbon must be cleaned before burning in the air so as to remove the layer of MgO formed due to reaction between magnesium and air.
- (iv) Combustion reaction is involved in this experiment which is as follows:
 $\text{Mg}(s) + \text{H}_2\text{SO}_4(aq) \longrightarrow \text{MgO}(s) + \text{H}_2(g) \uparrow$
- (v) The yellow flame indicates the incomplete combustion of gas because of insufficient supply of oxygen.
- 57.** (i) The iron articles when coated with reddish brown powder on the exposure to air and moisture, that coating is known as rusting. The process of corrosion of iron is rusting.
- (ii) The atmosphere contains gases like oxygen, carbon dioxide, sulphur dioxide; moisture and heat which are responsible for the corrosion of metal. Moreover, presence of acid in the atmosphere can easily cause corrosion.
- (iii) When silver articles exposed to air, then silver reacts with hydrogen sulphide present in air and becomes black. This process is called tarnishing of silver.
- (iv) The rusting of iron is a redox reaction in which oxygen acts as the oxidising agent and iron acts as the reducing agent.
- (v) Painting, galvanising and electroplating are some methods which are used to prevent corrosion. By using anti-oxidants, rancidity of food is prevented.
- 58.** (i) Biscuits will become oxidised and inedible if it is placed for a few hours in open.
- (ii) All of the given steps are correct and can be helpful to protect yourself from effect of rancid fats.
- (iii) The fats and oils present in food items are oxidised by air and make them rancid. This rancidity responsible for stale and tasteless food.
- (iv) Antioxidants are the additives capable of preventing rancidity of food due to oxidation.
- (v) Being unreactive, N_2 gas is flushed to packing food like potato chips to prevent oxidation or rancidity.