

CHAPTER – 1

CHEMICAL REACTIONS AND EQUATIONS

CHEMICAL REACTIONS

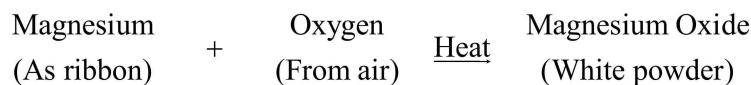
Any change can be classified as physical change and chemical change. Physical changes can be easily reversed but, it is not easy to reverse a chemical change.

In chemical changes, new substances are formed and it is difficult to regenerate the original substances. Chemical changes are more permanent than physical changes.

Chemical reaction involves chemical changes.

Chemical reactions are the processes in which new substances with new properties are formed. During a chemical reaction, atoms of one element do not change into those of another element. Only a rearrangement of atoms takes place in a chemical reaction.

Magnesium ribbon burns with a dazzling white flame and changes into a white powder. This powder is magnesium oxide. It is formed due to the reaction between magnesium and oxygen present in the air.



The burning of magnesium in air to form magnesium oxide is an example of chemical reaction.

REACTANTS AND PRODUCTS

The substances which take part in a chemical reaction are called reactants.

The new substances produced as a result of chemical reaction are called products.

In the above chemical reaction, there are two reactants : Magnesium and Oxygen but only one product : Magnesium oxide.

CHARACTERISTICS OF CHEMICAL REACTIONS

In a chemical reaction, reactants are transformed into products.

The important characteristics of chemical reaction are:

- ❖ Evolution of a gas
- ❖ Formation of a precipitate
- ❖ Change in colour
- ❖ Change in temperature and
- ❖ Change in state.

Any one of these characteristics can tell us whether a chemical reaction has taken place or not.

CHEMICAL EQUATIONS

The method of representing a chemical reaction with the help of symbols and formulas of the substances involved in it is known as chemical equation.

A word-equation shows change of reactants to products through an arrow placed between them. The reactants are written on the left-hand side (LHS) with a plus sign (+) between them. Similarly, products are written on the right-hand side (RHS) with a plus sign (+) between them. The arrowhead points towards the products, and shows the direction of the reaction.

Example: A + B → C + D

In this equation, A and B are called reactants and C and D are called the products. Arrow shows the direction of chemical reaction. Condition, if any, is written generally above the arrow.

When hydrogen reacts with oxygen, it gives water. This reaction can be represented by following chemical equation:



In first equation words are used and in second symbols of substances are used to write the chemical equation. For convenience, symbol of substance is used to represent chemical equations. Chemical Equation is a way to represent the chemical reaction in concise and informative way.

Chemical equation can be divided into two types – Balanced Chemical Equation and Unbalanced Chemical Equation.

Balanced Chemical Equation: A balanced chemical equation has number of atoms of each element equal on both sides.



In this equation, numbers of zinc, hydrogen and sulphate are equal on both sides, so it is a balanced chemical equation.

Unbalanced Chemical Equation: If the number of atoms of each element in reactants is not equal to the number of atoms of each element present in product, then the chemical equation is called unbalanced chemical equation.



In this example number atoms of elements are not equal on two sides of the reaction. For example, on the left hand side only one iron atom is present, while three iron atoms are present on the right hand side. Therefore, it is an unbalanced chemical equation.

BALANCING A CHEMICAL EQUATION:

To balance the given or any chemical equation, follow these steps:



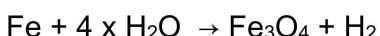
Write the number of atoms of elements present in reactants and in products in a table; as shown here.

Name of atom	No. of atoms in reactant	No. of atoms in product
Iron	1	3
Hydrogen	2	2
Oxygen	1	4

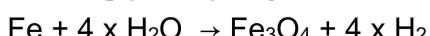
Balance the atom which is the maximum in number; on either side of chemical equation.

In this equation, the number of oxygen atom is the maximum on the RHS.

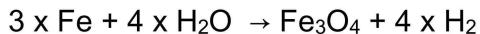
To balance the oxygen one needs to multiply the oxygen on the LHS by 4; so that the number of oxygen atoms becomes equal on both sides.



Now, the number of hydrogen atoms becomes 8 on the LHS; which is more than that on the RHS. To balance it, one needs to multiply the hydrogen on the RHS by 4.



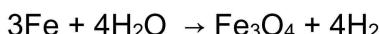
After that number of oxygen and hydrogen atoms becomes equal on both sides. The number of iron is one on the LHS, while it is three on the RHS. To balance it, multiply the iron on the LHS by 3.



Now the number of atoms of each element becomes equal on both sides. Thus, this equation becomes a balanced equation.

Name of atom	No. of atoms in reactant	No. of atoms in product
Iron	3	3
Hydrogen	8	8
Oxygen	4	4

After balancing, the above equation can be written as follows.



Writing the symbols of Physical States of substances in Chemical equation:

By writing the physical states of substances a chemical equation becomes more informative.

- Gaseous state is represented by symbol ‘g’
- Liquid state is represented by symbol ‘l’
- Solid state is written by symbol ‘s’
- Aqueous solution is written by symbol ‘aq’

Writing the condition in which reaction takes place: The condition is generally written above and/or below the arrow of a chemical equation.

Thus, by writing the symbols of physical state of substances and condition under which reaction takes place, a chemical equation can be made more informative.

INTEXT QUESTIONS PAGE NO. 6

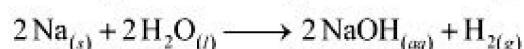
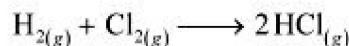
Q1: Why should a magnesium ribbon be cleaned before it is burnt in air?

Answer : Magnesium is an extremely reactive metal. When stored, it reacts with oxygen to form a layer of magnesium oxide on its surface. This layer of magnesium oxide is quite stable and prevents further reaction of magnesium with oxygen. The magnesium ribbon is cleaned by sand paper for removing this layer so that the underlying metal can be exposed to air.

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

- Hydrogen + Chlorine → Hydrogen chloride
- Barium chloride + Aluminium sulphate → Barium sulphate + Aluminium chloride
- Sodium + Water → Sodium hydroxide + Hydrogen

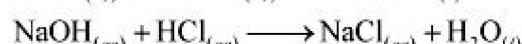
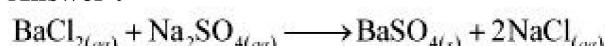
Answer :



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

- Solutions of barium chloride and sodium sulphate in water react to give insoluble barium sulphate and the solution of sodium chloride.
- Sodium hydroxide solution (in water) reacts with hydrochloric acid solution (in water) to produce sodium chloride solution and water.

Answer :



TYPES OF CHEMICAL REACTION

Chemical reactions can be classified in following types:

- Combination Reaction
- Decomposition Reaction
- Displacement Reaction
- Double Displacement Reaction
- Oxidation and Reduction Reaction

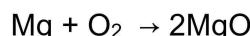
COMBINATION REACTION

Reactions in which two or more reactants combine to form one product are called COMBINATION REACTION.

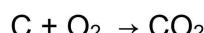
A general combination reaction can be represented by the chemical equation given here.



Example: When magnesium is burnt in air (oxygen), magnesium oxide is formed. In this reaction, magnesium is combined with oxygen.



When carbon is burnt in oxygen (air), carbon dioxide is formed. In this reaction, carbon is combined with oxygen.



When hydrogen reacts with chlorine, hydrogen chloride is formed.



When calcium oxide reacts with water, calcium hydroxide is formed



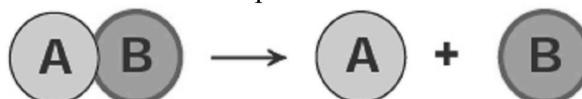
When carbon monoxide reacts with oxygen, carbon dioxide is formed.



DECOMPOSITION REACTION

Reactions in which one compound decomposes in two or more compounds or element are known as DECOMPOSITION REACTION. Decomposition reaction is just opposite of combination reaction.

A general decomposition reaction can be represented as follows:



Example: When calcium carbonate is heated, it decomposes into calcium oxide and carbon dioxide



When ferric hydroxide is heated, it decomposes into ferric oxide and water



$$\text{Ferric hydroxide} \rightarrow \text{Ferric oxide} + \text{Water}$$

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



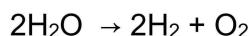
Lead nitrate \Rightarrow Lead oxide + Nitrogen oxide + Oxygen

In above examples, compound is decomposed because of heating, so, these reactions are called THERMAL DECOMPOSITION REACTION.

ELECTROLYTIC DECOMPOSITION

Reactions in which compounds decompose into simpler compounds because of passing of electricity, are known as ELECTROLYTIC DECOMPOSITION. This is also known as ELECTROLYSIS.

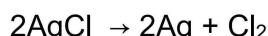
Example: When electricity is passed in water, it decomposes into hydrogen and oxygen.



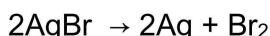
PHOTOLYSIS OR PHOTO DECOMPOSITION REACTION

Reactions in which a compound decomposes because of sunlight are known as PHOTOLYSIS or PHOTO DECOMPOSITION REACTION.

Example: When silver chloride is put in sunlight, it decomposes into silver metal and chlorine gas.



Similarly, when silver bromide is put under sunlight, it decomposes into silver metal and bromine gas.



Photographic paper has coat of silver chloride, which turns into grey when exposed to sunlight. It happens because silver chloride is colourless while silver is a grey metal.

INTEXT QUESTIONS PAGE NO. 10

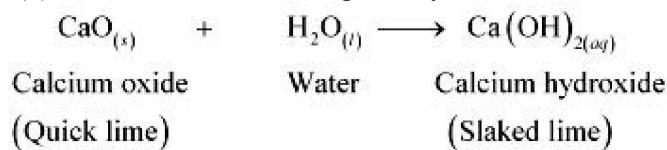
Question 1: A solution of a substance 'X' is used for white washing.

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

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

Answer : (i) The substance 'X' is calcium oxide. Its chemical formula is CaO .

(ii) Calcium oxide reacts vigorously with water to form calcium hydroxide (slaked lime).



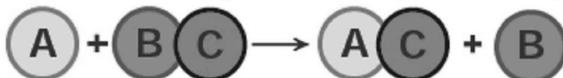
Question 2: Why is the amount of gas collected in one of the test tubes in Activity 1.7 double of the amount collected in the other? Name this gas.

Answer : Water (H_2O) contains two parts hydrogen and one part oxygen. Therefore, the amount of hydrogen and oxygen produced during electrolysis of water is in a 2:1 ratio. During electrolysis, since hydrogen goes to one test tube and oxygen goes to another, the amount of gas collected in one of the test tubes is double of the amount collected in the other.

DISPLACEMENT REACTION

Reactions in which atoms or ions move from one compound to other to form new compound are known as DISPLACEMENT REACTION. Displacement reaction is also known as Substitution Reaction or Single displacement /Replacement Reaction.

A general displacement reaction can be represented using chemical equation as follows:



Displacement reaction takes place only when 'A' is more reactive than B. If 'B' is more reactive than 'A', then 'A' will not displace 'C' from 'BC' and reaction will not be taken place.

Example: When zinc reacts with hydrochloric acid, it gives hydrogen gas and zinc chloride.



When zinc reacts with copper sulphate, it forms zinc sulphate and copper metal.

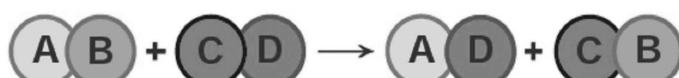


When silver metal is dipped in copper nitrate, no reaction takes place because silver metal is less reactive than copper.



DOUBLE DISPLACEMENT REACTION

Reactions in which ions are exchanged between two reactants forming new compounds are called double displacement reactions.



Example: When solution of barium chloride reacts with the solution of sodium sulphate, white precipitate of barium sulphate is formed along with sodium chloride.



When sodium hydroxide (a base) reacts with hydrochloric acid, sodium chloride and water are formed.



Double displacement reaction, in which precipitate is formed, is also known as precipitation reaction. Neutralisation reactions are also examples of double displacement reaction.

EXOTHERMIC AND ENDOTHERMIC REACTION

The chemical reactions which proceed with the evolution of heat energy are called exothermic reactions.



All combustion reactions are exothermic. Heat energy is liberated as the reaction proceeds.

The chemical reactions which proceed with the absorption of heat energy are called endothermic reactions.



Most of the combination reactions are endothermic. Most of the decomposition reactions are exothermic. Respiration is a decomposition reaction in which energy is released. When quick lime (calcium carbonate) is added to water, it decomposes and releases energy. Cooking involves chemical reactions which are endothermic as cooking is possible because of heating.

OXIDATION AND REDUCTION REACTION:

Oxidation: Addition of oxygen or non-metallic element or removal of hydrogen or metallic element from a compound is known as oxidation.

Elements or compounds in which oxygen or non-metallic element is added or hydrogen or metallic element is removed are called to be oxidized.

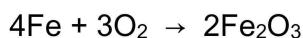
Oxidizing agent: Compounds which can add oxygen or a non-metallic compound or remove hydrogen or metallic element are known as oxidizing agents.

Reduction: Addition of hydrogen or metallic element or removal of oxygen or non-metallic element from a compound is called reduction. The compound or element which goes under reduction is called to be reduced.

Reducing agent: Compounds or elements which can cause reduction are called reducing agents.

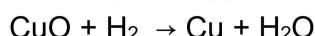
In a chemical reaction oxidation and reduction both take place simultaneously and such reactions are also known as REDOX REACTIONS. In the word REDOX, 'Red' stands for reduction and 'Ox' stands for oxidation.

Example: When iron reacts with air, it forms iron oxide (rust)



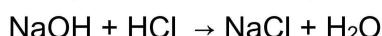
In this reaction, oxygen is added to iron, thus, iron is oxidized. Here oxygen is oxidizing agent.

When cupric oxide reacts with hydrogen, it gives copper and water.



In this reaction, oxygen is removed from copper and oxygen is added to hydrogen. So, cupric oxide is reduced to copper and hydrogen is oxidized to water. Cupric oxide is oxidizing agent and hydrogen is reducing agent.

When sodium hydroxide reacts with hydrochloric acid, it gives sodium chloride and water.



In this reaction, sodium hydroxide is reduced to sodium chloride since hydrogen is removed from sodium hydroxide. Hydrochloric acid is oxidized to water, since oxygen is added to hydrogen chloride and non-metallic element chloride is removed. Sodium hydroxide is oxidising agent and hydrochloric acid is reducing agent.

In this reaction oxidation and reduction both takes place simultaneously, thus it is an example of redox reaction.

SIGNIFICANCE OF OXIDATION REDUCTION IN EVERYDAY LIFE:

- Respiration is oxidation reaction in which food is oxidized to produce energy.
- Iron gets oxidized to form rust; which leads to corrosion of iron in the long run.
- Most of the metals react with atmospheric oxygen and it leads to formation of a layer on the metal article. The metal gets corroded in the long run.
- Rusting of iron can be prevented by painting the iron article. This can also be prevented by applying a layer of zinc over iron article. This process is known as galvanization.
- Fried food gets oxidized when exposed to air. This spoils the taste of the food and the food becomes unfit for consumption. The spoiling of fried food because of oxidation is called rancidity. Fried food is often packed in airtight packets to prevent rancidity.

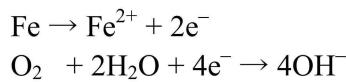
- We are able to utilize various types of fuel because of oxidation. Oxidation of fuel helps in producing energy.

CORROSION

Corrosion is defined as the slow and steady destruction of a metal by the environment. It results in the deterioration of the metal to form metal compounds by means of chemical reactions with the environment.

Corrosion is a simple electro chemical reaction. When the surface of iron is in contact with moisture and other gases in the atmosphere an electrochemical reaction occurs. In this, impure iron surface acts as the cathode and pure iron acts as anode. H_2CO_3 formed from moisture and CO_2 from air acts as electrolyte.

The electrochemical reactions are as follows:



The Fe^{2+} ions are oxidised to Fe^{3+} ions.

The Fe^{3+} ions combine with OH^- ions to form $Fe(OH)_3$. This becomes rust ($Fe_2O_3 \cdot xH_2O$) which is hydrated ferric oxide.

METHODS OF PREVENTING CORROSION

Corrosion of metals is prevented by not allowing them to come in contact with moisture, CO_2 and O_2 . This is achieved by the following methods:

- **By coating with paints:** Paint coated metal surfaces keep out air and moisture.
- **By coating with oil and grease:** Application of oil and grease on the surface of iron tools prevents them from moisture and air.
- **By alloying with other metals:** Alloyed metal is more resistant to corrosion.
- **Example:** stainless steel.
- **By the process of galvanization:** This is a process of coating zinc on iron sheets by using electric current. In this zinc forms a protective layer of zinc carbonate on the surface of iron. This prevents corrosion.
- **Electroplating:** It is a method of coating one metal with another by passing electric current. Example: silver plating, nickel plating. This method not only lends protection but also enhances the metallic appearance.
- **Sacrificial protection:** Magnesium is more reactive than iron. When it is coated on the articles made of steel it sacrifices itself to protect the steel.

RANCIDITY

When fats and oils are oxidised, they become rancid and their smell and taste change. Rancidity is the chemical decomposition of fats, oils and other lipids.

There are three basic types of rancidity.

- ❖ Hydrolytic rancidity occurs when water splits fatty acid chains away from the glycerol backbone in glycerides.
- ❖ Oxidative rancidity occurs when the double bonds of an unsaturated fatty acid react chemically with oxygen.
- ❖ Microbial rancidity refers to a process in which microorganisms such as bacteria use their enzymes, including lipases, to break down chemical structures in the fat.

In each case, these chemical reactions result in undesirable odors and flavors. It is a condition produced by aerial oxidation of unsaturated fat present in foods and other products, marked by unpleasant odour or flavour.

When a fatty substance is exposed to air, its unsaturated components are converted into hydroperoxides, which break down into volatile aldehydes, esters, alcohols, ketones, and hydrocarbons, some of which have disagreeable odours.

Butter becomes rancid by the foregoing process and by hydrolysis, which liberates volatile and malodorous acids, particularly butyric acid. Saturated fats such as beef tallow are resistant to oxidation and seldom become rancid at ordinary temperatures.

Usually substances which prevent oxidation (antioxidants) are added to foods containing fats and oil. Keeping food in air tight containers helps to slow down oxidation.

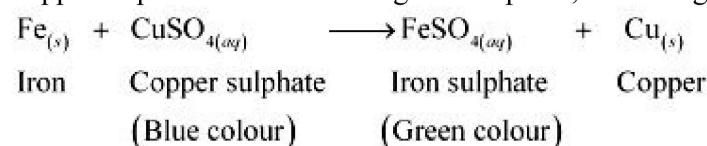
Rancidity can be avoided by:

1. Storing food in air tight containers
2. Storing food in refrigerators
3. Adding antioxidants
4. Storing food in an environment of nitrogen

INTEXT QUESTIONS PAGE NO. 13

Question 1: Why does the colour of copper sulphate solution change when an iron nail is dipped in it?

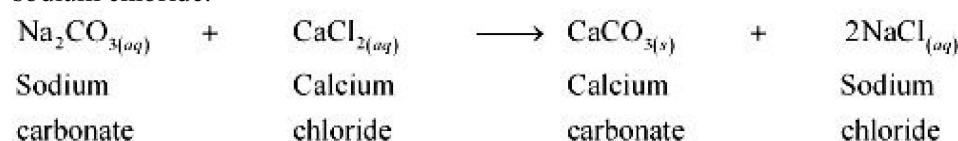
Answer : When an iron nail is placed in a copper sulphate solution, iron displaces copper from copper sulphate solution forming iron sulphate, which is green in colour.



Therefore, the blue colour of copper sulphate solution fades and green colour appears.

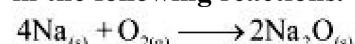
Question 2: Give an example of a double displacement reaction other than the one given in Activity 1.10.

Answer : Sodium carbonate reacts with calcium chloride to form calcium carbonate and sodium chloride.



In this reaction, sodium carbonate and calcium chloride exchange ions to form two new compounds. Hence, it is a double displacement reaction.

Question 3: Identify the substances that are oxidised and the substances that are reduced in the following reactions.

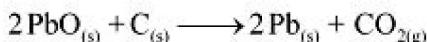


Answer : (i) Sodium (Na) is oxidised as it gains oxygen and oxygen gets reduced.

(ii) Copper oxide (CuO) is reduced to copper (Cu) while hydrogen (H₂) gets oxidised to water (H₂O).

EXERCISE QUESTIONS PAGE NO. 14, 15 and 16

Question 1: Which of the statements about the reaction below are incorrect?



- (a) Lead is getting reduced.
 - (b) Carbon dioxide is getting oxidised.
 - (c) Carbon is getting oxidised.
 - (d) Lead oxide is getting reduced.
- (i) (a) and (b)
 - (ii) (a) and (c)
 - (iii) (a), (b) and (c)
 - (iv) all
- Answer :** (i)(a) and (b)

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Question 2:



The above reaction is an example of a

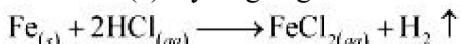
- (a) combination reaction.
- (b) double displacement reaction.
- (c) decomposition reaction.
- (d) displacement reaction.

Answer : (d) The given reaction is an example of a displacement reaction.

Question 3: What happens when dilute hydrochloric acid is added to iron filings? Tick the correct answer.

- (a) Hydrogen gas and iron chloride are produced.
- (b) Chlorine gas and iron hydroxide are produced.
- (c) No reaction takes place.
- (d) Iron salt and water are produced.

Answer : (a) Hydrogen gas and iron chloride are produced. The reaction is as follows:



Question 4: What is a balanced chemical equation? Why should chemical equations be balanced?

Answer : A reaction which has an equal number of atoms of all the elements on both sides of the chemical equation is called a balanced chemical equation.

The law of conservation of mass states that mass can neither be created nor destroyed. Hence, in a chemical reaction, the total mass of reactants should be equal to the total mass of the products. It means that the total number of atoms of each element should be equal on both sides of a chemical equation. Hence, it is for this reason that chemical equations should be balanced.

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

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

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Answer :

- (a) $3\text{H}_{2(g)} + \text{N}_{2(g)} \longrightarrow 2\text{NH}_{3(g)}$
(b) $2\text{H}_2\text{S}_{(g)} + 3\text{O}_{2(g)} \longrightarrow 2\text{H}_2\text{O}_{(l)} + 2\text{SO}_{2(g)}$
(c) $3\text{BaCl}_{2(aq)} + \text{Al}_2(\text{SO}_4)_{3(aq)} \longrightarrow 2\text{AlCl}_{3(aq)} + 3\text{BaSO}_{4(s)}$
(d) $2\text{K}_{(s)} + 2\text{H}_2\text{O}_{(l)} \longrightarrow 2\text{KOH}_{(aq)} + \text{H}_{2(g)}$

Question 6: Balance the following chemical equations.

- (a) $\text{HNO}_3 + \text{Ca}(\text{OH})_2 \longrightarrow \text{Ca}(\text{NO}_3)_2 + \text{H}_2\text{O}$
(b) $\text{NaOH} + \text{H}_2\text{SO}_4 \longrightarrow \text{Na}_2\text{SO}_4 + \text{H}_2\text{O}$
(c) $\text{NaCl} + \text{AgNO}_3 \longrightarrow \text{AgCl} + \text{NaNO}_3$
(d) $\text{BaCl}_2 + \text{H}_2\text{SO}_4 \longrightarrow \text{BaSO}_4 + \text{HCl}$

Answer :

- (a) $2\text{HNO}_3 + \text{Ca}(\text{OH})_2 \longrightarrow \text{Ca}(\text{NO}_3)_2 + 2\text{H}_2\text{O}$
(b) $2\text{NaOH} + \text{H}_2\text{SO}_4 \longrightarrow \text{Na}_2\text{SO}_4 + 2\text{H}_2\text{O}$
(c) $\text{NaCl} + \text{AgNO}_3 \longrightarrow \text{AgCl} + \text{NaNO}_3$
(d) $\text{BaCl}_2 + \text{H}_2\text{SO}_4 \longrightarrow \text{BaSO}_4 + 2\text{HCl}$

Question 7: Write the balanced chemical equations for the following reactions.

- (a) Calcium hydroxide + Carbon dioxide → Calcium carbonate + Water
(b) Zinc + Silver nitrate → Zinc nitrate + Silver
(c) Aluminium + Copper chloride → Aluminium chloride + Copper
(d) Barium chloride + Potassium sulphate → Barium sulphate + Potassium chloride

Answer :

- (a) $\text{Ca}(\text{OH})_2 + \text{CO}_2 \longrightarrow \text{CaCO}_3 + \text{H}_2\text{O}$
(b) $\text{Zn} + 2\text{AgNO}_3 \longrightarrow \text{Zn}(\text{NO}_3)_2 + 2\text{Ag}$
(c) $2\text{Al} + 3\text{CuCl}_2 \longrightarrow 2\text{AlCl}_3 + 3\text{Cu}$
(d) $\text{BaCl}_2 + \text{K}_2\text{SO}_4 \longrightarrow \text{BaSO}_4 + 2\text{KCl}$

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

- (a) Potassium bromide (aq) + Barium iodide (aq) → Potassium iodide (aq) + Barium bromide(s)
(b) Zinc carbonate (s) → Zinc oxide (s) + Carbon dioxide (g)
(c) Hydrogen (g) + Chlorine (g) → Hydrogen chloride (g)
(d) Magnesium (s) + Hydrochloric acid (aq) → Magnesium chloride (aq) + Hydrogen (g)

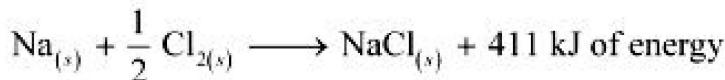
Answer :

- (a) $2\text{KBr}_{(aq)} + \text{BaI}_{2(aq)} \longrightarrow 2\text{KI}_{(aq)} + \text{BaBr}_{2(s)}$; Double displacement reaction
(b) $\text{ZnCO}_{3(s)} \longrightarrow \text{ZnO}_{(s)} + \text{CO}_{2(g)}$; Decomposition reaction
(c) $\text{H}_{2(g)} + \text{Cl}_{2(g)} \longrightarrow 2\text{HCl}_{(g)}$; Combination reaction
(d) $\text{Mg}_{(s)} + 2\text{HCl}_{(aq)} \longrightarrow \text{MgCl}_{2(aq)} + \text{H}_{2(g)}$; Displacement reaction

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

Answer : Chemical reactions that release energy in the form of heat, light, or sound are called exothermic reactions.

Example: Mixture of sodium and chlorine to yield table salt



In other words, combination reactions are exothermic.

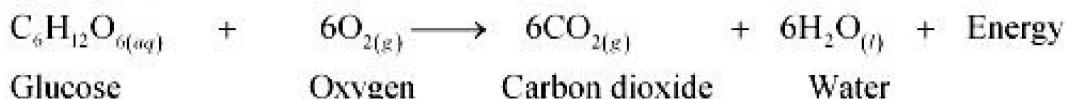
Reactions that absorb energy or require energy in order to proceed are called endothermic reactions.

For example: In the process of photosynthesis, plants use the energy from the sun to convert carbon dioxide and water to glucose and oxygen.



Question 10: Why is respiration considered an exothermic reaction? Explain.

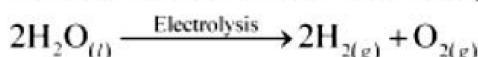
Answer : Energy is required to support life. Energy in our body is obtained from the food we eat. During digestion, large molecules of food are broken down into simpler substances such as glucose. Glucose combines with oxygen in the cells and provides energy. The special name of this combustion reaction is respiration. Since energy is released in the whole process, it is an exothermic process.



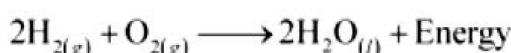
Question 11: Why are decomposition reactions called the opposite of combination reactions? Write equations for these reactions.

Answer : Decomposition reactions are those in which a compound breaks down to form two or more substances. These reactions require a source of energy to proceed. Thus, they are the exact opposite of combination reactions in which two or more substances combine to give a new substance with the release of energy.

Decomposition reaction: $\text{AB} + \text{Energy} \longrightarrow \text{A} + \text{B}$



Combination reaction: $\text{A} + \text{B} \longrightarrow \text{AB} + \text{Energy}$



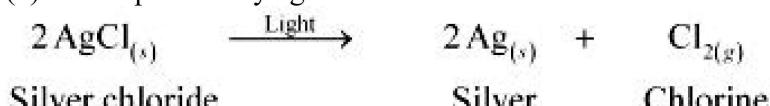
Question 12: Write one equation each for decomposition reactions where energy is supplied in the form of heat, light or electricity.

Answer : (a) Thermal decomposition:

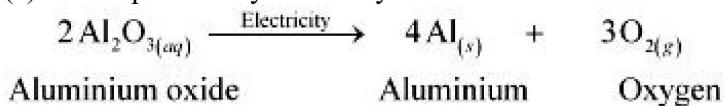


Ferrous sulphate Ferric oxide Sulphur dioxide Sulphur trioxide

(b) Decomposition by light:



(c) Decomposition by electricity:



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

Answer : In a displacement reaction, a more reactive element replaces a less reactive element from a compound.



where A is more reactive than B

In a double displacement reaction, two atoms or a group of atoms switch places to form new compounds.

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For example:

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Displacement reaction:



Double displacement reaction:



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

Answer :



Silver nitrate Copper Copper nitrate Silver

Question 15: What do you mean by a precipitation reaction? Explain by giving examples.

Answer : A reaction in which an insoluble solid (called precipitate) is formed is called a precipitation reaction.

For example:



Sodium carbonate Calcium chloride Calcium carbonate Sodium chloride

In this reaction, calcium carbonate is obtained as a precipitate. Hence, it is a precipitation reaction.

Another example of precipitation reaction is:



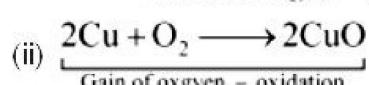
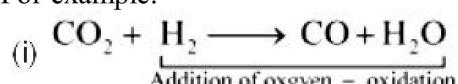
Sodium sulphate Barium chloride Barium sulphate Sodium chloride

In this reaction, barium sulphate is obtained as a precipitate.

Question 16: Explain the following in terms of gain or loss of oxygen with two examples each. (a) Oxidation (b) Reduction

Answer : (a) Oxidation is the gain of oxygen.

For example:



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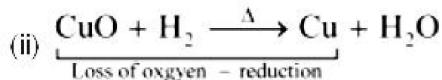
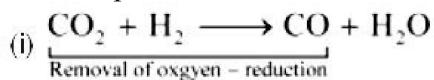
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In equation (i), H₂ is oxidized to H₂O and in equation (ii), Cu is oxidised to CuO.

(b) Reduction is the loss of oxygen.

For example:

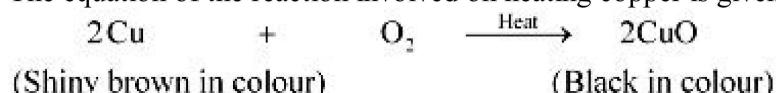


In equation (i), CO₂ is reduced to CO and in equation (ii), CuO is reduced to Cu.

Question 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.

Answer : ‘X’ is copper (Cu) and the black-coloured compound formed is copper oxide (CuO).

The equation of the reaction involved on heating copper is given below.



Question 18: Why do we apply paint on iron articles?

Answer : Iron articles are painted because it prevents them from rusting. When painted, the contact of iron articles from moisture and air is cut off. Hence, rusting is prevented. So presence of air and moisture is essential for rusting to take place.

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

Answer : Nitrogen is an inert gas and does not easily react with these substances. On the other hand, oxygen reacts with food substances and makes them rancid. Thus, bags used in packing food items are flushed with nitrogen gas to remove oxygen inside the pack. When oxygen is not present inside the pack, rancidity of oil and fat containing food items is avoided.

Question 20: Explain the following terms with one example each.

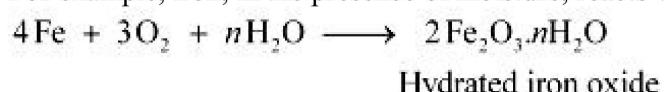
(a) Corrosion (b) Rancidity

Answer :

(a) Corrosion:

Corrosion is defined as a process where materials, usually metals, deteriorate as a result of a chemical reaction with air, moisture, chemicals, etc.

For example, iron, in the presence of moisture, reacts with oxygen to form hydrated iron oxide.



This hydrated iron oxide is rust.

(b) Rancidity:

The process of oxidation of fats and oils that can be easily noticed by the change in taste and smell is known as rancidity.

For example, the taste and smell of butter changes when kept for long.

Rancidity can be avoided by:

1. Storing food in air tight containers
 2. Storing food in refrigerators
 3. Adding antioxidants
 4. Storing food in an environment of nitrogen
-

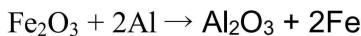
ASSIGNMENT QUESTIONS SET – 1
CHAPTER – 1
CHEMICAL REACTIONS AND EQUATIONS

VERY SHORT ANSWER TYPE QUESTIONS

1. How are chemical reactions expressed in the shortest way?
2. What is the type of reaction in which the reactant gives simpler products?
3. What is the type of reaction in which two or more reactants combine to give a single product?
4. In which type of reaction does an exchange of partners take place?
5. Why are chemical equations balanced?
6. What symbol is used to indicate a solution made in water?
7. What type of reaction occurs during the digestion of food inside our body?
8. What type of reaction is represented by the following equation?

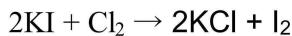


9. What type of reaction occurs when silver bromide is exposed to sunlight?
10. A solution of a substance is used for white-washing. Name the substance with its formula.
11. Name the type of reaction represented by the following equations:



12. Balance the following equation using state symbols: $\text{Fe} + \text{HCl} \rightarrow \text{FeCl}_2 + \text{H}_2$.
13. Express the following statement in the form of a balanced chemical equation: "Sodium reacts with water to form sodium hydroxide and hydrogen".
14. Write the balanced chemical equation for the reaction that occurs between aluminium hydroxide and sulphuric acid forming aluminium sulphate and water.
15. What type of reaction occurs when ammonia is allowed to react with hydrogen chloride?
16. Name the type of reaction involved when a zinc plate is dipped in a solution of copper sulphate?
17. In the reaction, $\text{CuO(s)} + \text{H}_2\text{(g)} \rightarrow \text{Cu(s)} + \text{H}_2\text{O(l)}$. Pick out the following:
 - (i) the substance which is oxidised
 - (ii) the substance which is reduced
 - (iii) the oxidizing agent
 - (iv) the reducing agent

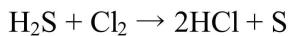
18. What chemical reaction is involved in the corrosion of iron?
19. Aluminum metal when burnt in air forms aluminium oxide. Write the balanced chemical equation for the reaction.
20. Is the reaction represented by the following reaction a displacement reaction?



21. Express the following reaction in the form of a balanced chemical equation: "When a strip of copper is dipped in a solution of silver nitrate, silver metal is precipitated and a solution of copper nitrate is produced."
22. Write the following equation in a balanced form?



23. What is the process called in which a substance is converted into a new substance?
24. Name the gas evolved when a magnesium ribbon is dropped into dilute sulphuric acid?
25. Give an example of a double displacement reaction.
26. Is copper more reactive than iron? Give the equation of the reaction in support of your answer?
27. Can a combustion reaction be a redox reaction?
28. Can a double displacement reaction be a redox reaction?
29. State one characteristics of the chemical reaction when lemon juice is added gradually to potassium permanganate solution?
30. Which gas does evolve when dilute HCl is added to sodium carbonate?
31. Why is photochemical reaction considered an endothermic reaction?
32. Which term is applied for the process in which unpleasant smell and taste develop in foods containing fats and oils?
33. What are the substances called which are added to foods containing fats and oils to protect them from becoming rancid?
34. Why are potato chips packaged in nitrogen?
35. In the refining of silver, silver is obtained from silver nitrate by using copper metal. Write down the reaction involved?
36. A shiny brown coloured element when heated in air becomes black. Name the element and the black coloured substance so formed.
37. Name the substance which is oxidised in the following reaction:



38. Why are all decomposition reactions endothermic?
39. Is the decomposition of vegetable matter into compost an exothermic reaction?

40. Why is photosynthesis an endothermic reaction?
41. Balance the following equation:
- (i) $\text{MNO}_2 + \text{HCl} \rightarrow \text{MNCl}_2 + \text{Cl}_2 + \text{H}_2\text{O}$
 - (ii) $\text{Na} + \text{O}_2 \rightarrow \text{Na}_2\text{O}$
 - (iii) $\text{H}_2\text{O}_2 \rightarrow \text{H}_2\text{O} + \text{O}_2$
 - (iv) $\text{Mg(OH)}_2 + \text{HCl} \rightarrow \text{MgCl}_2 + \text{H}_2\text{O}$
 - (v) $\text{Fe} + \text{O}_2 \rightarrow \text{Fe}_2\text{O}_3$
 - (vi) $\text{Al(OH)}_3 \rightarrow \text{Al}_2\text{O}_3 + \text{H}_2\text{O}$
 - (vii) $\text{NH}_3 + \text{CuO} \rightarrow \text{Cu} + \text{N}_2 + \text{H}_2\text{O}$
 - (viii) $\text{Al}_2(\text{SO}_4)_3 + \text{NaOH} \rightarrow \text{Al(OH)}_3 + \text{Na}_2\text{SO}_4$
 - (ix) $\text{HNO}_3 + \text{Ca(OH)}_2 \rightarrow \text{Ca(NO}_3)_2 + \text{H}_2\text{O}$
 - (x) $\text{NaOH} + \text{H}_2\text{SO}_4 \rightarrow \text{Na}_2\text{SO}_4 + \text{H}_2\text{O}$
 - (xi) $\text{BaCl}_2 + \text{H}_2\text{SO}_4 \rightarrow \text{BaSO}_4 + \text{HCl}$
 - (xii) Calcium hydroxide + Carbon dioxide \rightarrow Calcium carbonate + Water
 - (xiii) Aluminium + Copper chloride \rightarrow Aluminium chloride + Copper
 - (xiv) Calcium + Water \rightarrow Calcium hydroxide + Hydrogen
 - (xv) Sulphur dioxide + Oxygen \rightarrow Sulphur trioxide
 - (xvi) $\text{MnO}_2 + \text{HCl} \rightarrow \text{MnCl}_2 + \text{Cl}_2 + \text{H}_2\text{O}$
 - (xvii) $\text{Zn} + \text{HCl} \rightarrow \text{ZnCl}_2$

SHORT ANSWER TYPE QUESTIONS

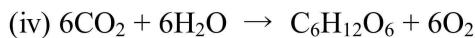
1. What do you mean by a Chemical reaction? Give an example of a chemical reaction.
2. What do you mean by a combination reaction? Give an example.
3. What do you mean by a displacement reaction? Give an example.
4. What do you mean by a decomposition reaction? Give an example.
5. What do you mean by a double displacement reaction? Give an example.
6. Explain the term “Electrolytic decomposition”, giving a suitable example.
7. Mention any two uses of decomposition reaction.
8. Give an example of a reaction in which a less reactive non-metal is displaced by a more reactive non-metal.
9. Why does the blue colour of copper sulphate change when a piece of iron is dropped into it?

10. In the reactions given below, identify the substances that act as oxidizing and reducing agents:
- (i) $4\text{Na}(\text{s}) + \text{O}_2(\text{g}) \rightarrow 2\text{Na}_2\text{O}(\text{s})$
- (ii) $\text{ZnO}(\text{s}) + \text{C}(\text{s}) \rightarrow \text{Zn}(\text{s}) + \text{CO}(\text{g})$
11. Write the balanced chemical equation for the following reactions and identify the type of reaction in each case:
- (i) Potassium chloride (aq) + Barium iodide (aq) \rightarrow Potassium iodide (aq) + barium chloride (s)
- (ii) Zinc carbonate (s) \rightarrow Zinc oxide (s) + Carbon dioxide (g)
- (iii) Hydrogen (g) + Chlorine (g) \rightarrow Hydrogen chloride (g)
- (iv) Magnesium (s) + Hydrochloride acid (aq) \rightarrow Magnesium chloride (aq) + Hydrogen(g)
12. Name the type of reaction involved in the reactions represented by the following equations:
- (i) $\text{CaO} + \text{H}_2\text{O} \rightarrow \text{Ca}(\text{OH})_2$
- (ii) $\text{Zn} + \text{CuSO}_4 \rightarrow \text{ZnSO}_4 + \text{Cu}$
- (iii) $\text{Al}_2(\text{SO}_4)_3 + 6\text{NH}_4\text{OH} \rightarrow 2\text{Al}(\text{OH})_3 + 3(\text{NH}_4)_2\text{SO}_4$
- (iv) $\text{CaCO}_3 \rightarrow \text{CaO} + \text{CO}_2$
- (v) $\text{H}_2 + \text{Cl}_2 \rightarrow 2\text{HCl}$
13. Why is magnesium ribbon cleaned before burning it in air?
14. State the characteristics of a chemical reaction.
15. What is a chemical equation?
16. Write the balanced chemical equations for the following chemical reactions:
- (i) Hydrogen + Chlorine \rightarrow Hydrogen Chloride
- (ii) Barium Chloride + Aluminium sulphate \rightarrow Barium sulphate + Aluminium chloride
- (iii) Sodium + water \rightarrow Sodium Chloride + hydrogen
17. 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 a precipitate of barium sulphate and the solution of sodium chloride.
- (ii) Sodium hydroxide solution (in water) reacts with hydrochloride acid solution (in water) to produce sodium chloride solution and water.
18. How can you explain that respiration is an exothermic reaction?
19. What do you mean by a precipitation reaction? Explain by giving example.

20. What are anti-oxidants? Name two substances which are usually used as anti-oxidants.
21. State any two ways to prevent the rancidity of food containing oils and fats.
22. What observations do you expect to get when granulated zinc taken in a test tube is treated with dilute sulphuric acid?
23. Give an example of a chemical reaction which take place with fall in temperature.
24. State on characteristic of chemical reaction taking place when
 - (i) dilute sulphuric acid is made to react with marble chips.
 - (ii) lemon juice is added to a solution of potassium permanganate.
 - (iii) dilute hydrochloride acid is added to a solution of lead nitrate in the cold.
 - (iv) water is added to quick lime.
25. Which of the following reactions are exothermic and which are endothermic?
 - (i) Burning of natural gas
 - (ii) Photosynthesis
 - (iii) Electrolysis of water
 - (iv) Respiration
26. What would you observe when lead nitrate is heated in a test tube?
27. Why is respiration considered an exothermic reaction?
28. Give an example of a decomposition reaction. Describe an activity to illustrate such a reaction by heating.
29. When hydrogen is passed over copper oxide, copper and steam are formed. Write a balanced equation for this reaction and state which of the chemicals are (i) elements (ii)compounds (iii) reactants (iv) products (v) metals (vi) non-metals
30. (a) What is a balanced chemical equation? Why should chemical equations be balanced?
(b) Aluminium burns in chlorine to form aluminium chloride. Write a balanced chemical equation for this reaction.

LONG ANSWER TYPE QUESTIONS

1. Balance the chemical equations for the following reactions:
 - (i) $\text{Cu} + \text{H}_2\text{SO}_4 \rightarrow \text{CuSO}_4 + \text{SO}_2 + \text{H}_2\text{O}$
 - (ii) $\text{NaOH} + \text{H}_2\text{SO}_4 \rightarrow \text{Na}_2\text{SO}_4 + \text{H}_2\text{O}$
2. Differentiate between balanced and an unbalanced chemical equation.
3. Write the following chemical equation with state symbols:
 - (i) $\text{CaCO}_3 \rightarrow \text{CaO} + \text{CO}_2$
 - (ii) $2\text{Na} + 2\text{H}_2\text{O} \rightarrow 2\text{NaOH} + \text{H}_2$
 - (iii) $\text{AgNO}_3 + \text{NaCl} \rightarrow \text{AgCl} + \text{NaNO}_3$



4. What do you mean by exothermic and endothermic reactions? Give examples.
 5. What is the difference between displacement and double displacement reactions? Write equations for these reactions.
 6. Explain, how do oxidation and reduction processes occur simultaneously.
 7. What is corrosion? Write the chemical reaction that takes place during the corrosion of iron?
 8. What are the various ways to make a chemical equation more informative?
 9. Explain the following terms: (i) corrosion (ii) Rancidity
 10. When metal X is treated with a dilute acid Y, then a gas Z is evolved which burns readily by making a little explosion.
 - (a) Name any two metals which can behave like metal X.
 - (b) Name any two acids which can behave like acid Y.
 - (c) Name the gas Z.
 - (d) Is the gas Z lighter than or heavier than air?
 - (e) Is the reaction between metal X and acid Y exothermic or endothermic?
 - (f) By taking a specific example of metal X and dilute acid Y, write a balanced chemical equation for the reaction which takes place. Also indicate physical state of all the reactants and products.
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