CHEMISTRY

REFERENCE STUDY MATERIAL

for

CLASS – X

CHAPTER WISE CONCEPTS, FORMULAS AND QUESTIONS INLCUDING HOTS QUESTIONS

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.

Magnesium		Oxygen	Heat	Magnesium Oxide
(As ribbon)	+	(From air)		(White powder)

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: $A + B \rightarrow C + D$

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:

Hydrogen + Oxygen ⌴ Water

$$H_2 + O_2 \rightarrow H_2O$$

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.

Example: $Zn + H_2SO_4 \rightarrow ZnSO_4 + H_2$

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.

Example: $Fe + H_2O \rightarrow Fe_3O_4 + H_2$

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:

$$Fe + H_2O \rightarrow Fe_3O_4 + H_2$$

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.

$$Fe + 4 \times H_2O \rightarrow Fe_3O_4 + H_2$$

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.

$$Fe + 4 \times H_2O \rightarrow Fe_3O_4 + 4 \times H_2$$

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.

$$3 \times Fe + 4 \times H_2O \rightarrow Fe_3O_4 + 4 \times H_2$$

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.

$$3Fe + 4H_2O \rightarrow Fe_3O_4 + 4H_2$$

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.

(i) Hydrogen + Chlorine → Hydrogen chloride

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

(iii) Sodium + Water → Sodium hydroxide + Hydrogen

Answer :

$$H_{2(g)} + Cl_{2(g)} \longrightarrow 2HCl_{(g)}$$

$$3BaCl_{2(s)} + Al_2(SO_4)_{3(s)} \longrightarrow 3BaSO_{4(s)} + 2AlCl_{3(s)}$$

$$2Na_{(s)} + 2H_2O_{(l)} \longrightarrow 2NaOH_{(aq)} + H_{2(g)}$$

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

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

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

Answer :

$$BaCl_{2(aq)} + Na_2SO_{4(aq)} \longrightarrow BaSO_{4(s)} + 2NaCl_{(aq)}$$

$$NaOH_{(aq)} + HCl_{(aq)} \longrightarrow NaCl_{(aq)} + H_2O_{(l)}$$

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.

$$Mg + O_2 \rightarrow 2MgO$$

Magnesium + Oxygen ⌟ Magnesium oxide

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

$$C + O_2 \rightarrow CO_2$$

Carbon + Oxygen ⌟ Carbon dioxide

When hydrogen reacts with chlorine, hydrogen chloride is formed.

$$H_2 + Cl_2 \rightarrow 2HCl$$

Hydrogen + Chlorine ⌟ Hydrogen chloride

When calcium oxide reacts with water, calcium hydroxide is formed

$$CaO + H_2O \rightarrow Ca(OH)_2$$

Calcium oxide + Water → Calcium hydroxide

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

$$2CO + O_2 \rightarrow 2CO_2$$

Carbon monoxide + Oxygen → Carbon dioxide

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

$$CaCO_3 \rightarrow CaO + CO_2$$

Calcium carbonate → Calcium oxide + Carbon dioxide

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

$$2Fe(OH)_3 \rightarrow Fe_2O_3 + 3H_2O$$

Ferric hydroxide → Ferric oxide + Water

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

$$2Pb(NO_3)_2 \rightarrow 2PbO + 4NO_2 + O_2$$

Lead nitrate ⌟ 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.

$$2H_2O \rightarrow 2H_2 + O_2$$

PHOTOLYSIS OR PHOTO DECOMPOSITIONREACTION

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.

$$2AgCl \rightarrow 2Ag + Cl_2$$

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

$$2AgBr \rightarrow 2Ag + Br_2$$

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).

$$CaO_{(s)} + H_2O_{(l)} \longrightarrow Ca(OH)_{2(aq)}$$

Calcium oxide	Water	Calcium hydroxide
(Quick lime)		(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.

$$Zn + 2HCl \rightarrow ZnCl_2 + H_2$$

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

$$Zn + CuSO_4 \rightarrow ZnSO_4 + Cu$$

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

$$Ag + Cu(NO_3)_2 \rightarrow \text{No reaction takes place}$$

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.

$$BaCl_2 + Na_2SO_4 \rightarrow BaSO_4 + 2NaCl$$

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

$$NaOH + HCl \rightarrow NaCl + H_2O$$

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.

$$\mathbf{N_2 + 3H_2 \rightarrow 2NH_3 + Heat}$$

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.

$$\mathbf{2NH_3 + Heat \rightarrow N_2 + 3H_2}$$

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)

$$4Fe + 3O_2 \rightarrow 2Fe_2O_3$$

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.

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

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.

$$NaOH + HCl \rightarrow NaCl + H_2O$$

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:

$$Fe \rightarrow Fe^{2+} + 2e^-$$

$$O_2 + 2H_2O + 4e^- \rightarrow 4OH^-$$

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 ($Fe_2O_3.xH_2O$) which is hydrated ferric oxide.

METHODS OF PREVENTING CORROSION

Corrosion of metals is prevented by not allowing them to come in contact with moisture,CO2 and O2.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 electriccurrent. 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.

$$Fe_{(s)} + CuSO_{4(aq)} \longrightarrow FeSO_{4(aq)} + Cu_{(s)}$$

Iron	Copper sulphate (Blue colour)	Iron sulphate (Green colour)	Copper

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.

$$Na_2CO_{3(aq)} + CaCl_{2(aq)} \longrightarrow CaCO_{3(s)} + 2NaCl_{(aq)}$$

Sodium carbonate	Calcium chloride	Calcium carbonate	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.

$$4Na_{(s)} + O_{2(g)} \longrightarrow 2Na_2O_{(s)}$$

$$CuO_{(s)} + H_{2(g)} \longrightarrow Cu_{(s)} + H_2O_{(l)}$$

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 (H_2) gets oxidised to water (H_2O).

EXERCISE QUESTIONS PAGE NO. 14, 15 and 16

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

$$2PbO_{(s)} + C_{(s)} \longrightarrow 2Pb_{(s)} + CO_{2(g)}$$

(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)

Question 2:

$$Fe_2O_3 + 2Al \longrightarrow Al_2O_3 + 2Fe$$

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:

$$Fe_{(s)} + 2HCl_{(aq)} \longrightarrow FeCl_{2(aq)} + H_2 \uparrow$$

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.

Answer :

(a) $3H_{2(g)} + N_{2(g)} \longrightarrow 2NH_{3(g)}$

(b) $2H_2S_{(g)} + 3O_{2(g)} \longrightarrow 2H_2O_{(l)} + 2SO_{2(g)}$

(c) $3BaCl_{2(aq)} + Al_2(SO_4)_{3(aq)} \longrightarrow 2AlCl_{3(aq)} + 3BaSO_{4(s)}$

(d) $2K_{(s)} + 2H_2O_{(l)} \longrightarrow 2KOH_{(aq)} + H_{2(g)}$

Question 6: Balance the following chemical equations.

(a) $HNO_3 + Ca(OH)_2 \longrightarrow Ca(NO_3)_2 + H_2O$

(b) $NaOH + H_2SO_4 \longrightarrow Na_2SO_4 + H_2O$

(c) $NaCl + AgNO_3 \longrightarrow AgCl + NaNO_3$

(d) $BaCl_2 + H_2SO_4 \longrightarrow BaSO_4 + HCl$

Answer :

(a) $2HNO_3 + Ca(OH)_2 \longrightarrow Ca(NO_3)_2 + 2H_2O$

(b) $2NaOH + H_2SO_4 \longrightarrow Na_2SO_4 + 2H_2O$

(c) $NaCl + AgNO_3 \longrightarrow AgCl + NaNO_3$

(d) $BaCl_2 + H_2SO_4 \longrightarrow BaSO_4 + 2HCl$

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) $Ca(OH)_2 + CO_2 \longrightarrow CaCO_3 + H_2O$

(b) $Zn + 2AgNO_3 \longrightarrow Zn(NO_3)_2 + 2Ag$

(c) $2Al + 3CuCl_2 \longrightarrow 2AlCl_3 + 3Cu$

(d) $BaCl_2 + K_2SO_4 \longrightarrow BaSO_4 + 2KCl$

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) $2KBr_{(aq)} + BaI_{2(aq)} \longrightarrow 2KI_{(aq)} + BaBr_{2(s)}$; Double displacement reaction

(b) $ZnCO_{3(s)} \longrightarrow ZnO_{(s)} + CO_{2(g)}$; Decomposition reaction

(c) $H_{2(g)} + Cl_{2(g)} \longrightarrow 2HCl_{(g)}$; Combination reaction

(d) $Mg_{(s)} + 2HCl_{(aq)} \longrightarrow MgCl_{2(aq)} + H_{2(g)}$; 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

$$Na_{(s)} + \frac{1}{2} Cl_{2(s)} \longrightarrow NaCl_{(s)} + 411 \text{ kJ of energy}$$

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.

$$6CO_{2(g)} + 6H_2O_{(l)} \xrightarrow{\text{Sunlight}} C_6H_{12}O_{6(aq)} + 6O_{2(g)}$$

Glucose

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.

$$C_6H_{12}O_{6(aq)} + 6O_{2(g)} \longrightarrow 6CO_{2(g)} + 6H_2O_{(l)} + \text{Energy}$$

Glucose Oxygen Carbon dioxide Water

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

$$2H_2O_{(l)} \xrightarrow{\text{Electrolysis}} 2H_{2(g)} + O_{2(g)}$$

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

$$2H_{2(g)} + O_{2(g)} \longrightarrow 2H_2O_{(l)} + \text{Energy}$$

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:

$$2FeSO_{4(s)} \xrightarrow{\Delta} Fe_2O_{3(s)} + SO_{2(g)} + SO_{3(g)}$$

Ferrous sulphate Ferric oxide Sulphur dioxide Sulphur trioxide

(b) Decomposition by light:

$$2AgCl_{(s)} \xrightarrow{\text{Light}} 2Ag_{(s)} + Cl_{2(g)}$$

Silver chloride Silver Chlorine

(c) Decomposition by electricity:

$$2Al_2O_{3(aq)} \xrightarrow{\text{Electricity}} 4Al_{(s)} + 3O_{2(g)}$$

Aluminium oxide Aluminium Oxygen

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.

$$A + BX \longrightarrow AX + B;$$

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.

$$AB + CD \longrightarrow AD + CB$$

For example:

Displacement reaction:

$$CuSO_{4(aq)} + Zn_{(s)} \longrightarrow ZnSO_{4(aq)} + Cu_{(s)}$$

Double displacement reaction:

$$Na_2SO_{4(aq)} + BaCl_{2(aq)} \longrightarrow BaSO_{4(s)} + 2NaCl_{(aq)}$$

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 :

$$2AgNO_{3(aq)} + Cu_{(s)} \longrightarrow Cu(NO_3)_{2(aq)} + 2Ag_{(s)}$$

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:

$$Na_2CO_{3(aq)} + CaCl_{2(aq)} \longrightarrow CaCO_{3(s)} + 2NaCl_{(aq)}$$

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:

$$Na_2SO_{4(aq)} + BaCl_{2(aq)} \longrightarrow BaSO_{4(s)} + 2NaCl_{(aq)}$$

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:

(i) $\underbrace{CO_2 + H_2 \longrightarrow CO + H_2O}_{\text{Addition of oxgyen - oxidation}}$

(ii) $\underbrace{2Cu + O_2 \longrightarrow 2CuO}_{\text{Gain of oxgyen - oxidation}}$

In equation (i), H_2 is oxidized to H_2O and in equation (ii), Cu is oxidised to CuO.
(b) Reduction is the loss of oxygen.
For example:

(i) $\underbrace{CO_2 + H_2 \longrightarrow CO + H_2O}_{\text{Removal of oxgyen – reduction}}$

(ii) $\underbrace{CuO + H_2 \xrightarrow{\Delta} Cu + H_2O}_{\text{Loss of oxgyen – reduction}}$

In equation (i), CO_2 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.

$$\underset{\text{(Shiny brown in colour)}}{2Cu} + O_2 \xrightarrow{\text{Heat}} \underset{\text{(Black in colour)}}{2CuO}$$

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.

$$4Fe + 3O_2 + nH_2O \longrightarrow \underset{\text{Hydrated iron oxide}}{2Fe_2O_3.nH_2O}$$

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 a 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 does occur during the digestion of food inside our body?
8. What type of reaction is represented by the following equation?

   $CaCO_3 \rightarrow CaO + CO_2$

9. What type of reaction does occur 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 which is represented by the following equations:

    $Fe_2O_3 + 2Al \rightarrow Al_2O_3 + 2Fe$

12. Balance the following equation using state symbols: $Fe + HCl \rightarrow FeCl_2 + H_2$.
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 does occur 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, $CuO(s) + H_2(g) \rightarrow Cu(s) + H_2O(l)$. 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?

$$2KI + Cl_2 \rightarrow 2KCl + I_2$$

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?

$$NH_3 + O_2 \rightarrow N_2 + 2H_2O$$

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:

$$H_2S + Cl_2 \rightarrow 2HCl + S$$

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) $MNO_2 + HCl \rightarrow MNCl_2 + Cl_2 + H_2O$

(ii) $Na + O_2 \rightarrow Na_2O$

(iii) $H_2O_2 \rightarrow H_2O + O_2$

(iv) $Mg(OH)_2 + HCl \rightarrow MgCl_2 + H_2O$

(v) $Fe + O_2 \rightarrow Fe_2O_3$

(vi) $Al(OH)_3 \rightarrow Al_2O_3 + H_2O$

(vii) $NH_3 + CuO \rightarrow Cu + N_2 + H_2O$

(viii) $Al_2(SO_4)_3 + NaOH \rightarrow Al(OH)_3 + Na_2SO_4$

(ix) $HNO_3 + Ca(OH)_2 \rightarrow Ca(NO_3)_2 + H_2O$

(x) $NaOH + H_2SO_4 \rightarrow Na_2SO_4 + H_2O$

(xi) $BaCl_2 + H_2SO_4 \rightarrow BaSO_4 + HCl$

(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) $MnO_2 + HCl \rightarrow MnCl_2 + Cl_2 + H_2O$

(xvii) $Zn + HCl \rightarrow ZnCl_2$

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) $4Na\ (s) + O_2\ (g) \rightarrow 2Na_2O\ (s)$

(ii) $ZnO\ (s) + C(s) \rightarrow Zn(s) + CO\ (g)$

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) → Potassium iodide (aq) + barium chloride (s)

(ii) Zinc carbonate (s) → Zinc oxide (s) + Carbon dioxide (g)

(iii) Hydrogen (g) + Chlorine (g) → Hydrogen chloride (g)

(iv) Magnesium (s) + Hydrochloride acid (aq) → Magnesium chloride (aq) + Hydrogen(g)

12. Name the type of reaction involved in the reactions represented by the following equations:

(i) $CaO + H_2O \rightarrow Ca(OH)_2$

(ii) $Zn + CuSO_4 \rightarrow ZnSO_4 + Cu$

(iii) $Al_2(SO_4)_3 + 6NH_4OH \rightarrow 2Al(OH)_3 + 3(NH_4)_2SO_4$

(iv) $CaCO_3 \rightarrow CaO + CO_2$

(v) $H_2 + Cl_2 \rightarrow 2HCl$

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 → Hydrogen Chloride

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

(iii) Sodium + water → 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) $Cu + H_2SO_4 \rightarrow CuSO_4 + SO_2 + H_2O$
    (ii) $NaOH + H_2SO_4 \rightarrow Na_2SO_4 + H_2O$
2. Differentiate between balanced and an unbalanced chemical equation.
3. Write the following chemical equation with state symbols:
    (i) $CaCO_3 \rightarrow CaO + CO_2$
    (ii) $2Na + 2H_2O \rightarrow 2NaOH + H_2$
    (iii) $AgNO_3 + NaCl \rightarrow AgCl + NaNO_3$

(iv) $6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$

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.

ASSIGNMENT QUESTIONS SET – 2
CHAPTER – 1
CHEMICAL REACTIONS AND EQUATIONS

1. What is a balanced chemical equation? Why should chemical equations be balanced?

2. Balance the following chemical equations.
a) $NaOH + H_2SO_4 \rightarrow Na_2SO_4 + H_2O$
b) $Hg(NO_3)_2 + KI \rightarrow Hg I_2 + KNO_3$
c) $H_2 + O_2 \rightarrow H_2O$
d) $KClO_3 \rightarrow KCl + O_2$
e) $C_3H_8 + O_2 \rightarrow CO_2 + H_2O$

3. Write the balanced chemical equations for the following reactions.
a) Zinc + Silver nitrate → Zinc nitrate + Silver.
b) Aluminum + copper chloride → Aluminum chloride + Copper.
c) Hydrogen + Chlorine. → Hydrogen chloride.
d) Ammonium nitrate → Nitrogen + Carbon dioxide + water.

4. Write the balanced chemical equation for the following and indentify the type of reaction in each case.
a) Calcium hydroxide $_{(aq)}$ + Nitric acid $_{(aq)}$ → Water $_{(l)}$ + Calcium nitrate $_{(aq)}$
b) Magnesium $_{(s)}$ + Iodine $_{(g)}$ → Magnesium Iodide. $_{(s)}$
c) Magnesium$_{(s)}$ + Hydrochloric acid$_{(aq)}$ → Magnesium chloride$_{(aq)}$ + Hydrogen$_{(g)}$
d) Zinc$_{(s)}$ + Calcium chloride $_{(aq)}$ → Zinc Chloride $_{(aq)}$ + Ca$_{(s)}$

5. $Fe_2O_3 + 2Al \rightarrow Al_2O_3 + 2\ Fe$.
The above reaction is an example of:
a) Combination reaction b) Decomposition reaction
c) Displacement reaction d) Double decomposition reaction

6. What happens when dil.hydrochloric acid is added to iron filings? Chose 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.

7. Write an equation for decomposition reaction where energy is supplied in the form of heat/ light/ electricity.

8. What do you mean by precipitation reaction?

9. Why is respiration considered as an exothermic reaction? Explain.

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

11. What is the use of keeping food in air tight containers?

12. What do you mean by corrosion? How can you prevent it?

13. $MnO_2 + 4HCl \rightarrow MnCl_2 + 2H_2O + Cl_2$
In the above equation, name the compound which is oxidized and which is reduced?

14. Match the following:

1) $2AgNO_3 + Na_2CrO_4 \rightarrow Ag_2CrO_4 + 2NaNO_3$	( ) a) combination reactions
2) $2\ NH_3 \rightarrow N_2 + 3H_2$	( ) b) decomposition reactions
3) $C_2H_4 + H_2O \rightarrow C_2H_6O$	( ) c) displacement reactions
4) $Fe_2O_3 + 3CO \rightarrow 2\ F_2 + 3CO_2$	( ) d) double displacement Reactions

15. Give two examples for oxidation-reduction reaction.

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

17. Explain rancidity.

18. Name the reactions taking place in the presence of sunlight?

19. $2\ PbO_{(s)} + C_{(s)} \rightarrow 2Pb_{(s)} + CO_{2\,(g)}$
Which of the following statements are correct for the above?
a) Lead is reduced. b) Carbon dioxide is oxidized.
c) Carbon is oxidized. d) Lead oxide is reduced.
i) (a)and (b) ii) (a) and (c) iii) (a), (b), and (c) d) all.

20. Balance the following chemical equations including the physical states.
a) $C_6H_{12}O_6 \rightarrow C_2H_5OH + CO_2$
b) $Fe + O_2 \rightarrow Fe_2O_3$
c) $NH_3 + Cl_2 \rightarrow N_2H_4 + NH_4cl$
d) $Na + H_2O \rightarrow NaOH + H_2$

21. Balance the chemical equation by including the physical states of the substances for the following reactions.
a) Barium chloride and sodium sulphate aqueous solutions react to give insolubleBarium sulphate and aqueous solution of sodium chloride.
b) Sodium hydroxide reacts with hydrochloric acid to produce sodium chloride and water.
c) Zinc pieces react with dilute hydrochloric acid to liberate hydrogen gas and forms zinc chloride

22. Which of the following is not a physical change?
(a) Boiling of water to give water vapour
(b) Melting of ice to give water
(c) Dissolution of salt in water
(d) Combustion of Liquefied Petroleum Gas (LPG)

23. The following reaction is an example of a
$4NH_3(g) + 5O_2(g) \rightarrow 4NO(g) + 6H_2O(g)$
(i) displacement reaction
(ii) combination reaction
(iii) redox reaction

(iv) neutralisation reaction

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

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

$3Fe(s) + 4H_2O(g) \rightarrow Fe_3O_4(s) + 4H_2(g)$

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

25. Which of the following are exothermic processes?
(i) Reaction of water with quick lime
(ii) Dilution of an acid
(iii) Evaporation of water
(iv) Sublimation of camphor (crystals)

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

26. Three beakers labelled as A, B and C each containing 25 mL of water were taken. A small amount of NaOH, anhydrous $CuSO_4$ and NaCl were added to the beakers A, B and C respectively. It was observed that there was an increase in the temperature of the solutions contained in beakers A and B, whereas in case of beaker C, the temperature of the solution falls. Which one of the following statement(s) is(are) correct?
(i) In beakers A and B, exothermic process has occurred.
(ii) In beakers A and B, endothermic process has occurred.
(iii) In beaker C exothermic process has occurred.
(iv) In beaker C endothermic process has occurred.

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

27. 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 presence of $FeSO_4$ to a colourless compound.

28. Which among the following is(are) double displacement reaction(s)?
(i) $Pb + CuCl_2 \rightarrow PbCl_2 + Cu$
(ii) $Na_2SO_4 + BaCl_2 \rightarrow BaSO_4 + 2NaCl$
(iii) $C + O_2 \rightarrow CO_2$
(iv) $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$

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

29. Which among the following statement(s) is(are) true? Exposure of silver chloride to sunlight for a long duration turns grey due to
(i) the formation of silver by decomposition of silver chloride
(ii) sublimation of silver chloride
(iii) decomposition of chlorine gas from silver chloride
(iv) oxidation of silver chloride

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

30. Solid calcium oxide reacts vigorously with water to form calcium hydroxide accompanied by liberation of heat. This process is called slaking of lime. Calcium hydroxide dissolves in water to form its solution called lime water. Which among the following is (are) true about slaking of lime and the solution formed?
(i) It is an endothermic reaction
(ii) It is an exothermic reaction
(iii) The pH of the resulting solution will be more than seven
(iv) The pH of the resulting solution will be less than seven

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

31. Barium chloride on reacting with ammonium sulphate forms barium sulphate and ammonium chloride. Which of the following correctly represents the type of the reaction involved?
(i) Displacement reaction
(ii) Precipitation reaction
(iii) Combination reaction
(iv) Double displacement reaction

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

32. 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

33. Which of the following is(are) an endothermic process(es)?
(i) Dilution of sulphuric acid
(ii) Sublimation of dry ice
(iii) Condensation of water vapours
(iv) Evaporation of water

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

34. 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?
(a) Lead sulphate (insoluble)
(b) Lead acetate
(c) Ammonium nitrate
(d) Potassium sulphate

35. 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

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

$$2KClO_3\,(s) \xrightarrow[\text{Catalyst}]{\text{Heat}} 2KCl\,(s) + 3O_2\,(g)$$

Which of the following statement(s) is(are) correct about the reaction?
(a) It is a decomposition reaction and endothermic in nature
(b) It is a combination reaction
(c) It is a decomposition reaction and accompanied by release of heat
(d) It is a photochemical decomposition reaction and exothermic in nature

37. Which one of the following processes involve chemical reactions?
(a) Storing of oxygen gas under pressure in a gas cylinder
(b) Liquefaction of air
(c) Keeping petrol in a china dish in the open
(d) Heating copper wire in presence of air at high temperature

38. In which of the following chemical equations, the abbreviations represent the correct states of the reactants and products involved at reaction temperature?
(a) $2H_2(l) + O_2(l) \rightarrow 2H_2O(g)$
(b) $2H_2(g) + O_2(l) \rightarrow 2H_2O(l)$
(c) $2H_2(g) + O_2(g) \rightarrow 2H_2O(l)$
(d) $2H_2(g) + O_2(g) \rightarrow 2H_2O(g)$

39. Which of the following are combination reactions?

(i) $2KClO_3 \xrightarrow{Heat} 2KCl + 3O_2$

(ii) $MgO + H_2O \longrightarrow Mg(OH)_2$

(iii) $4Al + 3O_2 \longrightarrow 2Al_2O_3$

(iv) $Zn + FeSO_4 \longrightarrow ZnSO_4 + Fe$

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

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

(a) Nitrogen gas is treated with hydrogen gas in the presence of a catalyst at 773K to form ammonia gas.
(b) Sodium hydroxide solution is treated with acetic acid to form sodium acetate and water.
(c) Ethanol is warmed with ethanoic acid to form ethyl acetate in the presence of concentrated H_2SO_4 .
(d) Ethene is burnt in the presence of oxygen to form carbon dioxide, water and releases heat and light.

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

(a) Thermit reaction, iron (III) oxide reacts with aluminium and gives molten iron and aluminium oxide.
(b) Magnesium ribbon is burnt in an atmosphere of nitrogen gas to form solid magnesium nitride.
(c) Chlorine gas is passed in an aqueous potassium iodide solution to form potassium chloride solution and solid iodine.
(d) Ethanol is burnt in air to form carbon dioxide, water and releases heat.

42. Complete the missing components/variables given as *x* and *y* in the following reactions

(a) $Pb(NO_3)_2\ (aq) + 2KI(aq) \longrightarrow PbI_2\ (x) + 2KNO_3(y)$

(b) $Cu(s) + 2Ag\ NO_3(aq) \longrightarrow Cu(NO_3)_2(aq) + x(s)$

(c) $Zn(s) + H_2SO_4(aq) \longrightarrow ZnSO_4(x) + H_2(y)$

(d) $CaCO_3(s) \xrightarrow{X} CaO(s) + CO_2(g)$

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

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

44. Write the balanced chemical equations for the following reactions

(a) Sodium carbonate on reaction with hydrochloric acid in equal molar concentrations gives sodium chloride and sodium hydrogencarbonate.
(b) Sodium hydrogencarbonate on reaction with hydrochloric acid gives sodium chloride, water and liberates carbon dioxide.

(c) Copper sulphate on treatment with potassium iodide precipitates cuprous iodide (Cu_2I_2), liberates iodine gas and also forms potassium sulphate.

45. Identify the reducing agent in the following reactions

(a) $4NH_3 + 5O_2 \longrightarrow 4NO + 6H_2O$

(b) $H_2O + F_2 \longrightarrow HF + HOF$

(c) $Fe_2O_3 + 3CO \longrightarrow 2Fe + 3CO_2$

(d) $2H_2 + O_2 \longrightarrow 2H_2O$

46. Identify the oxidising agent (oxidant) in the following reactions

(a) $Pb_3O_4 + 8HCl \longrightarrow 3PbCl_2 + Cl_2 + 4H_2O$

(b) $2Mg + O_2 \longrightarrow 2MgO$

(c) $CuSO_4 + Zn \longrightarrow Cu + ZnSO_4$

(d) $V_2O_5 + 5Ca \longrightarrow 2V + 5CaO$

(e) $3Fe + 4H_2O \longrightarrow Fe_3O_4 + 4H_2$

(f) $CuO + H_2 \longrightarrow Cu + H_2O$

47. A solution of potassium chloride when mixed with silver nitrate solution, an insoluble white substance is formed. Write the chemical reaction involved and also mention the type of the chemical reaction?

48. Ferrous sulphate decomposes with the evolution of a gas having a characteristic odour of burning sulphur. Write the chemical reaction involved and identify the type of reaction.

49. Why do fire flies glow at night?

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

51. Which among the following are physical or chemical changes?

(a) Evaporation of petrol

(b) Burning of Liquefied Petroleum Gas (LPG)

(c) Heating of an iron rod to red hot.

(d) Curdling of milk

(e) Sublimation of solid ammonium chloride

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

(a) Silver metal does not show any change

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

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

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

Explain these observations giving suitable reasons.

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

54. Write a balanced chemical equation for each of the following reactions and also classify them.
(a) Lead acetate solution is treated with dilute hydrochloric acid to form lead chloride and acetic acid solution.
(b) A piece of sodium metal is added to absolute ethanol to form sodium ethoxide and hydrogen gas.
(c) Iron (III) oxide on heating with carbon monoxide gas reacts to form solid iron and liberates carbon dioxide gas.
(d) Hydrogen sulphide gas reacts with oxygen gas to form solid sulphur and liquid water.

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

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

57. A magnesium ribbon is burnt in oxygen to give a white compound X accompanied by emission of light. If the burning ribbon is now placed in an atmosphere of nitrogen, it continues to burn and forms a compound Y.
(a) Write the chemical formulae of X and Y.
(b) Write a balanced chemical equation, when X is dissolved in water.

58. Zinc liberates hydrogen gas when reacted with dilute hydrochloric acid, whereas copper does not. Explain why?

59. A silver article generally turns black when kept in the open for a few days. The article when rubbed with toothpaste again starts shining.
(a) Why do silver articles turn black when kept in the open for a few days? Name the phenomenon involved.
(b) Name the black substance formed and give its chemical formula.

60. On heating blue coloured powder of copper (II) nitrate in a boiling tube, copper oxide (black), oxygen gas and a brown gas X is formed
(a) Write a balanced chemical equation of the reaction.
(b) Identity the brown gas X evolved.
(c) Identity the type of reaction.
(d) What could be the pH range of aqueous solution of the gas X?

61. Give the characteristic tests for the following gases
(a) CO_2
(b) SO_2
(c) O_2
(d) H_2

62. What happens when a piece of
(a) zinc metal is added to copper sulphate solution?
(b) aluminium metal is added to dilute hydrochloric acid?
(c) silver metal is added to copper sulphate solution?
Also, write the balanced chemical equation if the reaction occurs

63. What happens when zinc granules are treated with dilute solution of H_2SO_4, HCl, HNO_3, NaCl and NaOH, also write the chemical equations if reaction occurs.

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

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

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

(c) On adding dilute hydrochloric acid to the reaction mixture, white precipitate disappears. Why?

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