3 Chemical Reactions and Equations

Q.1. (A) 1. Fill in the blanks and rewrite the complete statements:

(1) The reaction $CaCO_3 \rightarrow CaO + CO_2$ is a ..... reaction.

(2) The reaction in which oxygen is added to the substance is called ..... reaction.

(3) Corrosion can be prevented by using ..... .

(4) The chemical reaction in which heat is absorbed is called ..... reaction.

(5) The substance undergoing oxidation acts as a ..... agent.

(6) Formation of Nitric oxide from nitrogen and oxygen is a ..... reaction.

(7) When Oxidation and Reduction takes place simultaneously in a given chemical reaction, it is known as ..... .

(8) The substances taking part in a chemical reaction are called ..... , whereas the substances formed as a result of a chemical reaction are called ..... .

(9) A chemical reaction is represented by writing a ..... .

(10) The reaction of a vegetable oil with hydrogen gas takes place in the presence of ..... as a catalyst to form vanaspati ghee.

(11) The reaction in which heat is given out along with products is known as ..... reaction.

(12) $AgNO_3 + NaCl \rightarrow AgCl +$ ..... .

(13) A redox reaction takes place during ..... respiration.

(14) Rancidity in the food stuff cooked in oil or ghee is prevented by using ..... .

(15) The chemical reaction during which $H_{2(g)}$ is lost is termed as ..... .

(16) When acids and alkalis react together, ... and ..... is formed.

(17) $Fe + CuSO_4 \rightarrow FeSO_4 +$ ..... .

(18) The symbol 'aq' in a chemical equation represents ..... .

(19) All chemical reactions obey law of conservation of mass, hence, chemical equations should be ..... .

(20) Double displacement reaction in which an insoluble salt is formed is also called ..... reaction.

Ans. *(1) decomposition (2) oxidation (3) anti-rust solution (4) endothermic (5) reducing (6) combination (7) redox reaction (8) reactants, products (9) chemical equation (10) Nickel (Ni) (11) Exothermic (12) $NaNO_3$ (13) cellular (14) anti-oxidants (15) oxidation (16) salt, water (17) $Cu_{(s)}$ (18) aqueous solution (19) balanced (20) precipitation*

Q.1. (A) 2. Match the columns:

(I)

Reactants	Products	Types of Reaction
(1) Fe + S	(a) $NaCl + H_2O$	(i) Oxidation
(2) $CuSO_4$ + Zn	(b) 2CuO	(ii) Neutralization
(3) $2Cu + O_2$	(c) $ZnSO_4 + Cu$	(iii) Displacement
(4) HCl + NaOH	(d) FeS	(iv) Combination

Ans. *(1-d-iv), (2-c-iii), (3-b-i), (4-a-ii)*

***(II)**

Reactants	Products	Types of Reaction
(1) $BaCl_{2(aq)} + ZnSO_{4(aq)}$	(a) $H_2CO_{3(aq)}$	(i) Displacement
(2) $2\ AgCl_{(s)}$	(b) $FeSO_{4(aq)} + Cu_{(s)}$	(ii) Combination
(3) $CuSO_{4(aq)} + Fe_{(s)}$	(c) $BaSO_4 \downarrow + ZnCl_{2(aq)}$	(iii) Decomposition
(4) $H_2O_{(l)} + CO_{2(g)}$	(d) $2Ag(s) + Cl_{2(g)}$	(iv) Double displacement

Ans. *(1-c-iv), (2-d-iii), (3-b-i), (4-a-ii)*

(III)

Column A	Column B
(1) Heating of Potassium Chlorate	(a) Turns lime water milky
(2) Depositing a layer of zinc on iron	(b) Physical change
(3) Souring of milk	(c) Rust
(4) Carbon dioxide	(d) MnO_2 is used as catalyst
(5) Iron oxide	(e) Chemical change
(6) Dissolving common salt in water	(f) Galvanisation

Ans. *(1-d), (2-f), (3-e), (4-a), (5-c), (6-b)*

Q.1. (A) 3. State whether the following statements are True or False. Write the correct statements:

(1) Digestion of food is a chemical change.

(2) A catalyst slows down the rate of reaction to make a better product.

(3) Reaction that releases energy is called Endothermic.

(4) Ammonium chloride is a sublimable salt.

(5) Rusting of iron is an oxidation reaction.

(6) Size of the particles of reactants does not affect the rate of chemical reaction.

(7) Combustion is the rapid reaction between carbon dioxide and fuel.

(8) A precipitate is an insoluble solid formed from solution during a chemical reaction.

(9) A chemical equation shows a chemical reaction using symbols and chemical formulae instead of words.

(10) Decomposition of compost is an endothermic reaction.

(11) Unlike physical changes, chemical changes cannot be easily reversed.

(12) A burning of match stick is an example of chemical change.

(13) The reaction $Zn(s) + CuSO_4(aq) \rightarrow ZnSO_4(aq) + Cu(s)$ is an example of double displacement reaction.

(14) Chemical change is a temporary change.

(15) (g) indicates the physical state of a substance as solid.

(16) Conversion of quick lime into slaked lime is an example of displacement reaction.

(17) Calcium oxide is also called lime or quicklime.

(18) In a chemical equation, the symbol $\downarrow$ is used to denote precipitation formation.

Ans. *(1) True (2) False. Catalyst speed up the rate of reaction. (3) False. Reaction that releases energy is called Exothermic. (4) True (5) True (6) False. Size of the particles of reactants affect the rate of chemical reaction. (7) False. Combustion is the rapid reaction between oxygen and fuel. (8) True (9) True (10) False. Decomposition of compost is an exothermic reaction. (11) True (12) True (13) False. It is a displacement (single) reaction (14) False. It is a permanent change. (15) False. (g) indicates the physical state of a substance as gas. (16) False. It is an example of combination reaction. (17) True (18) True.*

Q.1. (A) 4. Name the following:

(1) A change that takes place due to change in the parameters such as temperature, pressure.

Ans. Physical change

(2) A process in which some substances undergo bond breaking and are transformed into new substances by formation of new bonds.

Ans. Chemical reaction

(3) Representation of a chemical reaction in a condensed form using chemical formulae.

Ans. Chemical equation

(4) If the number of atoms of each element is not same on the two sides of an equation.

Ans. Unbalanced equation

(5) Fuel formed when organic waste is decomposed by micro-organism.

Ans. Biogas

(6) The substance in whose presence the rate of a chemical reaction changes without causing any chemical change to it.

Ans. Catalyst

(7) The life on earth is protected from ultraviolet radiation of the sun.

Ans. Ozone layer

(8) A state prior to the formation of the O_2 molecule.

Ans. Nascent oxygen.

Q.1. (A) 5. Complete the following reactions and name the products:

(1) $\mathbf{CuSO_{4(aq)} + Fe_{(s)}} \rightarrow \underset{\text{Ferrous Sulphate}}{FeSO_{4(aq)}} + \underset{\text{Copper}}{Cu_{(s)}}$

(2) $\mathbf{CuSO_{4(aq)} + Pb_{(s)}} \rightarrow \underset{\text{Lead Sulphate}}{PbSO_{4(aq)}} + \underset{\text{Copper}}{Cu_{(s)}}$

Q.1. (B) Choose and write the correct option:

(1) A chemical reaction involves ..... .

(a) Only breaking of bonds.
(b) Only formation of bonds.
(c) Both breaking and formation of bonds.
(d) None of these.

(2) A balanced chemical equation always obeys ..... .

(a) Law of conservation of Mass
(b) Law of thermal equilibrium
(c) Law of conservation of energy
(d) All of the above

(3) Oily food kept out for few days gives a bad taste and a bad smell because of ..... .

(a) Corrosion (b) Displacement
(c) Heating (d) Rancidity

(4) The sign ↓ indicates.

(a) Release of gas
(b) Dissolution of gas
(c) Formation of precipitate
(d) Lowering of temperature

(5) What is rust?

(a) Sodium oxide (b) Iron oxide
(c) Copper oxide (d) Silver oxide

(6) Because of the formation of which of the following, lime water turns milky when carbon dioxide is passed through it?

(a) Calcium Carbonate
(b) Calcium bicarbonate
(c) Calcium hydroxide
(d) Sodium Carbonate

(7) Which of the following is formed when Sodium hydroxide reacts with hydrochloric acid?

(a) Calcium Chloride
(b) Hydrogen Chloride
(c) Sodium hydroxide
(d) Sodium Chloride

(8) ..... is a physical change.

(a) Ice changes into water
(b) Milk is set into curd
(c) Ripening of fruit
(d) Respiration process

(9) When sulphuric acid is poured over zinc, which of the following gas is formed?

(a) Sulphur dioxide (b) Hydrogen
(c) Oxygen (d) Zinc dioxide

(10) Heating of sugar is called a ..... reaction.

(a) Combination reaction
(b) Displacement reaction
(c) Double displacement reaction
(d) Decomposition reaction

(11) Antioxidants are used to prevent ..... of food containing fats and oils.

(a) Reduction
(b) Oxidation
(c) Oxidation and reduction
(d) Decomposition

(12) In the reaction given $CuO_{(s)} + H_{2(g)} \rightarrow Cu_{(s)} + H_2O_{(l)}$. Copper oxide is ..... and hydrogen is ..... .

(a) Oxidized, reduced (b) Reduced, oxidized
(c) Unaffected, reduced (d) Unaffected, oxidized

(13) Which among the following is double displacement reaction?

(a) $Pb + CuCl_2 \rightarrow PbCl_2 + Cu$

(b) $Na_2SO_4 + BaCl_2 \rightarrow BaSO_4\downarrow + 2NaCl$

(c) $C + O_2 \rightarrow CO_2$

(d) $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$

Ans. *(1) (c) Both breaking and formation of bonds. (2) (a) Law of conservation of Mass (3) (d) Rancidity (4) (c) formation of precipitate (5) (b) Iron oxide (6) (a) Calcium carbonate (7) (d) Sodium chloride (8) (a) Ice changes into water (9) (b) Hydrogen (10) (d) Decomposition Reaction (11) (b) oxidation (12) (b) reduced, oxidized (13) (b)* $Na_2SO_4 + BaCl_2 \rightarrow BaSO_4\downarrow + 2NaCl$

Q.2.1.Answer the following:

(1) What is a balanced chemical equation?

Ans. The chemical equation in which the number of atoms of different elements are equal in reactant side (L.H.S.) and product side (R.H.S.) is called a balanced chemical equation.

(2) "We need to balance an unbalanced skeletal chemical equation". Justify the statement.

Ans.

(i) Skeletal chemical equations are either self balanced or unbalanced.

(ii) We need to balance the unbalanced chemical equation because of law of conservation of mass which states that "In any reaction, the total mass of each of the elements in the reactants is the same as that of the total mass of each of the respective elements in the products".

(iii) Therefore, chemical equation must be balanced in each and every chemical reaction.

(3) Giving an example list two information which make a chemical equation more useful. (informative).

Ans. (i) Physical state of reactants must be mentioned, e.g. $2H_{2(g)} + O_{2(g)} \rightarrow 2H_2O_{(l)}$.

(ii) Condition in which a reaction takes place is written on the arrow head,

e.g. $2H_{2(g)} + O_{2(g)} \xrightarrow{\text{burning}} 2H_2O_{(l)}$.

(4) What type of reaction takes place when vegetable matter is converted to compost?

Ans. During composting complex substances are broken down into simpler substances with the evolution of heat. Hence, it is an exothermic decomposition reaction.

(5) What is rust? Write the chemical formula.

Ans.

(i) Due to moisture and various components of atmosphere, oxidation of iron takes place.

(ii) A certain type of reddish coloured solid layer collects on the iron surface. This layer is called rust.

(iii) The chemical formula is $Fe_2O_3.\ xH_2O$.

(6) Why respiration is considered an exothermic reaction?

Ans. In the process of respiration glucose is broken into Carbon dioxide and energy is released. That is why, it is considered as an exothermic reaction.

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

(7) Name the factors on which the speed of a chemical reaction depends.

Ans. The speed of a chemical reaction depends on factors like size of the particles of reactants, concentration of the reactants, nature of the reactants, temperature of the reaction and presence or absence of catalyst.

(8) What is meant by reactants?

Ans. The chemicals that undergo chemical change in a chemical reaction are called reactants.

(9) What is meant by the term products of a chemical reactions?

Ans. The substances that are formed after a chemical reaction takes place, are called products of a chemical reaction.

(10) When carbon dioxide is passed through lime water it turns milky. Why?

Ans. Lime water (Calcium hydroxide) combines with carbon dioxide to form a suspension of calcium carbonate which turns lime water milky.

$Ca(OH)_{2(aq)} + CO_{2(g)} \rightarrow CaCO_{3(s)} + H_2O_{(l)}$

(11) What type of reaction is this: $Na_2SO_4 + BaCl_2 \rightarrow BaSO_4 + 2NaCl$.

Ans. It is a double displacement reaction.

(12) What do you understand by precipitation reaction? Explain with examples.

Ans.

(i) When two ionic compounds react and two ionic compounds (product) are formed of which one product is insoluble and settles as a solid, it is called a precipitate.

(ii) Such reactions in which precipitate is formed are called precipitation reactions.

(iii) Example: When aqueous solution of Sodium Sulphate is mixed with the aqueous solution of Barium Chloride, it forms Barium Sulphate in the form of white precipitate.

$Na_2SO_{4(aq)} + BaCl_{2(aq)} \rightarrow \underset{\textit{(White)}}{BaSO_4\downarrow} + 2NaCl_{(aq)}$

(13) Which soloution is used in voters ink?

Ans. Solution of Silver nitrate ($AgNO_3$) is used in the voters ink.

(14) What happens when a piece of zinc metal is added to copper sulphate solution?

Ans.

(i) When a piece of zinc metal is added to copper sulphate solution, more reactive zinc metal displaces the less reactive copper from copper sulphate solution and a solution of zinc sulphate is obtained while copper gets deposited on zinc making it reddish brown in colour.

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

***(15) Which is the oxidant used for purification of drinking water?** *(Use your brain power! Textbook page number 42)*

Ans.

(i) Chlorine is a strong oxidant commonly used in water treatment for oxidation and disinfection.

(ii) Even Potassium permanganate can be used as oxidant for purification of water.

***(16) Why is potassium permanganate used for cleaning of water tanks?** *(Use your brain power! Textbook page number 42)*

Ans.

(i) Potassium permanganate oxidises dissolved iron, manganese and hydrogen sulphide into solid particles.

(ii) $KMnO_4$ is used to remove organic matter from the water tank by oxidation which also removes unwanted taste and odour.

(iii) It also kills harmful bacteria and fungi.

***(17) Some examples of redox reaction are given. Identify the reductants and oxidants from them.** *(Use your brain power! Textbook page number 43)*

$2H_2S + SO_2 \rightarrow 3S\downarrow + 2H_2O$

Ans.

(i) In a redox reaction, the reductant transfers electrons to the oxidant.

(ii) Then in the reaction, the reductant or reducing agent loses electrons and is oxidised and the oxidant or oxidizing agent gains electrons and is reduced.

(iii) $\therefore$ Hence, in the above equation, reductant is SO_2 and oxidant is H_2S

$MnO_2 + 4HCl \rightarrow MnCl_2 + 2H_2O + Cl_2\uparrow$

(i) Reductant: MnO_2 - as it loses oxygen.

(ii) Oxidant: HCl - as it gains oxygen.

***(18) If oxidation means losing electrons, what is meant by reduction?** *(Use your brain power! Textbook page number 43)*

Ans. If oxidation means losing electrons, then reduction means gaining electrons.

***(19) Write the reaction of formation of Fe^{2+} by the reduction Fe^{3+} by making use of the symbol (e^-)?** *(Use your brain power! Textbook page number 43)*

Ans. $Fe^{3+}_{(aq)} + e^- \xrightarrow[\text{reduce}]{} Fe^{2+}_{(aq)}$.

(20) Write two conditions necessary for rusting of iron.

Ans. Rusting of iron takes place in (i) the presence of air and (ii) presence of moisture.

(21) Name the term used for the solution of a substance in water.

Ans. Aqueous (aq) is the term used for the solution of a substance in water.

(22) What are the changes that take place when fats and oils are oxidized?

Ans. When fats and oils are oxidized, they become rancid and their taste changes.

***(23) Identify the reactants and products of equation:**

$\text{Vegetable Oil}_{(l)} + H_{2(g)} \xrightarrow[\text{Ni Catalyst}]{60°C} \text{Vanaspati ghee}_{(s)}$

(Use your brain power! Textbook page number 35)

Ans. Reactants: Vegetable oil and hydrogen gas
Product: Vanaspati ghee

***(24) Use your brain power!** *(Textbook page number 36)*

(i) What is the number of reactants in the following reactions.

$NH_{3(g)} + HCl_{(g)} \rightarrow NH_4Cl_{(s)}$ - (1)

$2Mg + O_2 \rightarrow 2MgO$ - (2)

$CaO + H_2O \rightarrow Ca(OH)_2 + Heat$ - (3)

Ans. In all the above equations, there are two reactants.

(ii) What is the number of molecules of reactants taking part in the above reactions?

Ans.

NH_3	+	HCl	$\rightarrow$	NH_4Cl
1 molecule		1 molecule		
2Mg	+	O_2	$\rightarrow$	2MgO
2 molecules		1 molecule		
CaO	+	H_2O	$\rightarrow$	$Ca(OH)_2$ + Heat
1 molecule		1 molecule		

(iii) How many products are formed in each of the above reaction?

Ans. In all the above reactions, only one product is formed.

Q.2.2. Define the following/write notes:

(1) Physical Change

Ans. It is a change in which only the physical properties of substances are changed and no new substance is formed. This change is a temporary and reversible change.

(2) Chemical Change

Ans. It is a change in which substances are converted into new substance or product possessing properties altogether different from the original. This is a permanent and irreversible change.

(3) Chemical Reaction

Ans. A chemical reaction is a process in which some substances undergo bond breaking and are transformed into new substances by formation of new bonds.

(4) Chemical Equation

Ans. The representation of a chemical reaction in a condensed form using chemical formulae is called as the chemical equation.

***(5) Combination Reaction**

Ans.

(i) When two or more reactants combine in a reaction to form a single product, it is called a combination reaction.

(ii) e.g.: When a Magnesium strip is burnt in air, it combines with oxygen, to form white ash of magnesium oxide.

(iii) $2Mg_{(s)} + O_{2(g)} \rightarrow 2MgO_{(s)}$ (white ash)

Magnesium Oxygen Magnesium oxide

(6) Decomposition Reaction

Ans.

(i) The chemical reaction in which two or more products are formed from a single reactant is called Decomposition Reaction.

(ii) e.g.: When Calcium carbonate is strongly heated it decomposes to form Calcium oxide and Carbon dioxide gas.

(iii) e.g. $CaCO_{3(s)} \xrightarrow{\Delta} CaO_{(s)} + CO_2\uparrow$

Calcium Carbonate — Calcium Oxide — Carbon dioxide

***(7) Displacement Reaction**

Ans.

(i) The reaction in which the place of the ion of a less reactive element in a compound is taken by another more reactive element by formation of its own ions, is called displacement reaction.

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

Zinc — Copper sulphate — Zinc sulphate — Copper

(iii) In the above equation when zinc dust is added to blue coloured copper sulphate solution, a colourless solution of zinc sulphate is formed and copper is deposited on zinc.

(iv) The Zn^{2+} ions formed from Zn atom take the place of Cu^{2+} ions in copper sulphate, and Cu atoms formed from Cu^{2+} ion come out. It means that Zn displaces Cu from $CuSO_4$.

(8) Double displacement Reaction

Ans.

(i) The reaction in which the ions in the reactants are exchanged to form a precipitate are called double displacement reactions.

(ii) $BaSO_{4(aq)} + K_2CrO_{4(aq)} \rightarrow BaCrO_{4(s)} + K_2SO_{4(aq)}$

Barium sulphate — Potassium chromate — Barium chromate — Potassium sulphate

(iii) Potassium chromate solution reacts with Barium sulphate solution to form Potassium sulphate solution and a yellow precipitate of Barium chromate ($BaCrO_4$).

***(9) Endothermic Reaction**

Ans.

(i) A reaction in which heat is either absorbed from the surrounding or has to be supplied continuously from outside is called as endothermic reaction.

(ii) e.g. melting of ice, dissolution of potassium nitrate in water. During the process of dissolution of potassium nitrate (KNO_3) in water, heat from the surroundings is absorbed and therefore, the temperature of the resulting solution is less.

(iii) The process in which heat is absorbed from outside is called endothermic process.

(iv) $KNO_{3(s)} + H_2O_{(l)} + \text{Heat} \rightarrow KNO_{3(aq)}$

Potassium nitrate — Water — Potassium nitrate solution

(10) Exothermic Reaction

Ans.

(i) A reaction in which heat is given away when reactants are transformed into the products is called as exothermic reaction.

(ii) e.g. formation of ice from water, dissolution of sodium hydroxide in water.

(iii) When solid NaOH is dissolved in water, heat is given out and therefore, the temperature increases.

(iv) $NaOH_{(s)} + H_2O_{(l)} \rightarrow NaOH_{(aq)} + \text{Heat}$

Sodium hydroxide — Water — Sodium hydroxide solution

***(11) Oxidation Reaction**

Ans. The chemical reaction in which a reactant combines with oxygen or loses hydrogen to form a product is called oxidation reaction.

e.g. (1) $2Mg_{(s)} + O_{2(g)} \rightarrow 2MgO_{(s)}$

Magnesium — Oxygen — Magnesium oxide

(2) $2Cu_{(s)} + O_{2(g)} \rightarrow 2CuO_{(s)}$
Copper Oxygen Copper oxide

(3) $MgH_2 \rightarrow Mg_{(s)} + H_{2(g)}$
Magnesium hydride Magnesium Hydrogen

(12) Reduction Reaction

Ans. The chemical reaction in which reactants gain hydrogen or loses oxygen to form the product is called reduction reactions.

e.g. (1) $HgO_{(s)} \rightarrow Hg_{(l)} + O_{2(g)}$
Mercuric oxide Mercury Oxygen

(2) $H_{2(g)} + Cl_{2(g)} \rightarrow 2HCl_{(g)}$
Hydrogen Chlorine Hydrogen Chloride

(13) Redox Reaction

Ans. A chemical reaction in which oxidation and reduction takes place simultaneously is called redox reaction.

Oxidation

e.g. $CuO_{(s)} + H_{2(g)} \rightarrow Cu_{(s)} + H_2O_{(l)}$
Copper Oxide Hydrogen Copper Water

Reduction

(14) Catalyst

Ans.

(i) The substance in whose presence the rate of a chemical reaction changes, without causing any chemical change to it is called a catalyst.

(ii) e.g. Potassium chlorate ($KClO_3$) decomposes rapidly in presence of manganese dioxide (MnO_2) to liberate O_2 gas, where manganese dioxide acts as a catalyst.

(ii) $2KClO_3 \xrightarrow[MnO_2]{\Delta} 2KCl + 3O_2$

(15) Neutralisation Reaction

Ans.

(i) The reaction in which an acid and a base react together to form salt and water is called Neutralisation reaction.

(ii) e.g. $HCl_{(aq)} + NaOH_{(aq)} \rightarrow NaCl_{(aq)} + H_2O_{(l)}$
Hydrochloric acid (acid) Sodium hydroxide (base) Sodium chloride (Salt) Water (Water)

(16) Rancidity

Ans. Rancidity is the oxidation of oils and fats resulting in change in taste and giving out foul smell. Rancidity in the food stuff is prevented by antioxidants.

***(17) Balanced Equation**

Ans.

(i) The number of atoms of the elements in the reactants is same as the number of atoms of those elements in the products. Such an equation is called a 'balanced equation'.

(ii) In any reaction, the total mass of each of the respective elements in the reactants is same as the total mass of each of the respective elements in the products.

(iii) This is in accordance with the law of conservation of mass.

(iv) e.g. $SO_2 + 2H_2S \rightarrow 3S + 2H_2O$

On reactant side	On product side
No. of atoms of Sulphur (S) = 3	No. of atoms of Sulphur (S) = 3
No. of atoms of Oxygen (O) = 2	No. of atoms of Oxygen (O) = 2
No. of atoms of hydrogen (H) = 4	No. of atoms of hydrogen (H) = 4

$\therefore$ The given equation is balanced.

Q.2.3. Complete the following chemical equations, balance and state the type of reactions:

(1) $H_2S_2O_7 + H_2O \rightarrow$ ☐

Ans. $H_2S_2O_7 + H_2O \rightarrow \boxed{2}\,\mathbf{H_2SO_4}$
It is a Combination reaction.

(2) ☐ $KClO_3 \xrightarrow{\Delta}$ ☐ + ☐ O_2

Ans. $2KClO_3 \xrightarrow{\Delta} \boxed{2}\,\mathbf{KCl} + \boxed{3}\,O_2$
It is a Decomposition reaction.

(3) ☐ $\xrightarrow{\text{Sunlight}}$ ☐ $Ag + Cl_2$

Ans. $\boxed{2}\,\mathbf{AgCl} \xrightarrow{\text{Sunlight}} \boxed{2}\,Ag + Cl_2$
It is a Decomposition reaction.

(4) ☐ $Al +$ ☐ $HCl \rightarrow$ ☐ + ☐ H_2

Ans. $\boxed{2}\,Al + \boxed{6}\,HCl \rightarrow \boxed{2}\,\mathbf{AlCl_3} + \boxed{3}\,H_2$
It is a Displacement reaction.

(5) ☐ $NaOH + H_2SO_4 \rightarrow$ ☐ + ☐ H_2O

Ans. $\boxed{2}\,NaOH + H_2SO_4 \rightarrow \mathbf{Na_2SO_4} + \boxed{2}\,H_2O$
It is a Double displacement reaction.

(6) $N_2 +$ ☐ $\rightarrow$ ☐ NH_3

Ans. $N_2 + \boxed{3}\,H_2 \rightarrow \boxed{2}\,NH_3$
It is a Combination reaction.

Q.2.4.Distinguish between:

(1) Physical Change and Chemical Change.

Ans.

Physical Change	Chemical Change
(i) In this change, the composition of substance does not change and no new substance is formed.	(i) In this change, the composition of substance changes and a new substance is formed.
(ii) There is a change only in physical properties.	(ii) There is a change in both physical and chemical properties.
(iii) This change is temporary.	(iii) This change is permanent.
(iv) The original substance can be recovered by simple means.	(iv) The original substance cannot be recovered by simple means.
(v) e.g.: Steam is condensed.	(v) e.g.: Ripening of fruit, Milk is converted to curd.

(2) Displacement and Double displacement Reaction

Ans.

Displacement Reaction	Double displacement Reaction
(i) The reaction in which the place of the ion of a less reactive element in a compound is taken by another more reactive element by formation of its own ions, is called displacement reaction.	(i) The reaction in which the ions in the reactants are exchanged to form a precipitate are called double displacement reactions.
(ii) These reactions are usually slow and take longer time for their completion.	(ii) These reactions are usually fast and take place instantaneously.
(iii) During these reactions, change of colour takes place. $Fe_{(s)} + CuSO_{4(aq)} \rightarrow FeSO_{4(aq)} + Cu_{(s)}$ *Iron* *Copper sulphate* *Iron sulphate* *copper*	(iii) During these reactions, precipitates are formed. $AgNO_{3(aq)} + NaCl_{(aq)} \rightarrow AgCl_{(s)}\downarrow + NaNO_{3(aq)}$ *Silver nitrate* *Sodium chloride* *Silver chloride* *Sodium nitrate*

(3) Combination reaction and Decomposition reaction

Ans.

Combination reaction	Decomposition reaction
(i) When two or more reactants combine in a reaction to form a single product, it is called a combination reaction.	(i) The chemical reaction in which two or more products are formed from a single reactant is called decomposition reaction.
(ii) It is a synthesis reaction.	(ii) It is a degradation reaction.
(iii) New substances are synthesized in industry using this reaction.	(iii) In nature, complex substances are broken down into simpler compounds.
(iv) $CaO_{(s)} + H_2O_{(l)} \rightarrow Ca(OH)_{2(aq)}$ *Calcium oxide* *Water* *Calcium hydroxide*	(iv) $CaCO_{3(s)} \xrightarrow{\Delta} CaO_{(s)} + CO_{2(g)}\uparrow$ *Calcium carbonate* *Calcium oxide* *Carbon dioxide*

(4) Exothermic reaction and Endothermic reaction

Ans.

Exothermic reaction	Endothermic reaction
(i) The reaction where heat energy is evolved or liberated is called as exothermic reaction.	(i) The reaction where heat energy is absorbed is called as endothermic reaction.
(ii) Temperature of the reaction mixture rises.	(ii) Temperature of the reaction mixture lowers.

(iii) Generally, the reactions are fast.	(iii) Generally, the reactions are slow.
(iv) e.g.: When NaOH dissolves in water heat is evolved.	(iv) e.g.: When Calcium carbonate is strongly heated, calcium oxide is formed.

(5) Oxidation reaction and Reduction reaction

Ans.

Oxidation reaction	Reduction reaction
(i) It is a chemical process in which a substance gains oxygen or loses hydrogen.	(i) It is a chemical process in which a substance gains hydrogen or loses oxygen.
(ii) During oxidation reaction, an atom or an ion loses electron.	(ii) During reduction reaction, an atom or ion gains electron.
(iii) Oxidizing agents are used to carry out this reaction.	(iii) Reducing agents are used to carry out this reaction.
(iv) Example: $C + O_2 \rightarrow CO_2\uparrow$	(iv) Example: $C + 2H_2 \rightarrow CH_4$

Q.2.4.Give scientific reasons:

***(1) When the gas formed on heating limestone is passed through freshly prepared lime water, the lime water turns milky.**

Ans.

(i) On heating, limestone undergoes thermal decomposition to form calcium oxide (quick lime) and carbon dioxide.

$$CaCO_{3(s)} \xrightarrow{\Delta} CaO_{(s)} + CO_2\uparrow$$

quick lime

(ii) Calcium oxide when dissolved in water forms Calcium hydroxide (lime water).

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

Calcium hydroxide

(iii) When carbon dioxide is passed through lime water it turns milky due to formation of white precipitate of Calcium carbonate.

$$Ca(OH)_{2(aq)} + CO_{2(g)} \rightarrow CaCO_{3(s)} + H_2O_{(l)}$$

Calcium carbonate

***(2) It takes time for pieces of Shahabad tiles to disappear in HCl, but its powder disappears rapidly.**

Ans.

(i) When HCl is added to Shahabad stone effervescence of CO_2 is formed.

(ii) The CO_2 effervescence is formed slowly with the pieces of Shahabad tiles while at the faster speed with the powder.

(iii) This is because the rate of a reaction depends upon the size of the particles of the reactants taking part in the reaction.

(iv) Smaller the size of the reactant particles more is the surface area available for the reaction and higher is the rate of reaction.

(v) Hence, it takes time for pieces of Shahabad tiles to disappear in HCl, but its powder disappears rapidly.

***(3) While preparing dilute sulphuric acid from concentrated sulphuric acid in the laboratory, the concentrated sulphuric acid is added slowly to water with constant stirring.**

Ans.

(i) Concentrated sulphuric acid (H_2SO_4) is a hazardous, highly corrosive chemical. It has a higher density than water and is hygroscopic, which means that it absorbs water from the air.

(ii) In the process of dilution of concentrated sulphuric acid with water, very large amount of heat is liberated.

(iii) As a result, water gets evaporated instantaneously along with splashing of acid which may cause an accident.

(iv) To avoid this, required amount of water is taken in a glass container and small quantity of concentrated sulphuric acid at a time is added with stirring.

(v) Therefore, only a small amount of heat is liberated at a time.

***(4) It is recommended to use air tight container for storing oil for long time.**

Ans.

(i) Air, heat and light affect the quality of edible oil, which deteriorates through oxidation (rancidity).

(ii) The oxidation process is greatly enhanced when edible oils are stored in containers that are not air tight and in areas where oil is exposed to air, heat and light.

(iii) Hence, it is recommended to use air tight containers for storing oil for long time, to prevent it from getting oxidised.

(5) Grills of doors and windows are always painted before they are used.

Ans.

(i) The grills of doors and windows are generally made of the metal iron.

(ii) When they are exposed to air, due to the effect of moisture in air, iron undergoes slow oxidation reaction and forms a layer of reddish brown rust which gets deposited on the surface of grills.

(iii) Thus, due to the reaction of slow process of decay or destruction of metal iron, the grills of doors and windows made of metal iron get corroded.

(iv) Hence, in order to prevent the rust and corrosion, grills of doors and windows are always painted before they are used.

(v) By doing this, air and moisture cannot come in contact with the iron and hence rusting doesn't take place.

(6) Digestion of food is an example of decomposition reaction.

Ans. During digestion, the starch in the various food items gets decomposed into simple sugar while proteins get decomposed into amino acids. Hence digestion of food is an example of decomposition reaction.

(7) Respiration is considered to be an exothermic reaction.

Ans.

(i) When heat is given out during a chemical reaction, it is an exothermic reaction.

(ii) Glucose formed in our body during the process of digestion, combines with oxygen in our body and provides energy.

(iii) Therefore, respiration is considered to be an exothermic reaction.

(8) We store silver chloride in dark coloured bottles.

Ans.

(i) A chemical reaction that proceeds by absorption of light is called a photo chemical reaction.

(ii) We store silver chloride in dark coloured bottles in order to protect it from the effect of sunlight.

(iii) Sunlight decomposes silver chloride and forms silver and chlorine.

$$\underset{\text{Silver chloride (white)}}{2AgCl_{(s)}} \xrightarrow{\text{Sunlight}} \underset{\text{Silver (Grey)}}{2Ag_{(s)}} + \underset{\text{Chlorine}}{Cl_2\uparrow}$$

(iv) As dark coloured bottles obstruct light, silver chloride will get prevented from decomposition.

***Q.3.1. Choose the correct option from the bracket and explain the statement giving reason:**

(oxidation, displacement, electrolysis, reduction, zinc, copper, double displacement, decomposition)

(1) To prevent rusting, a layer of *zinc* **metal is applied on iron sheets.**

Ans. Explanation: Due to moisture and various components of atmosphere, oxidation of iron takes place. A certain type of reddish coloured solid layer collects on the iron surface. This layer is called rust. Its chemical formula is $Fe_2O_3 . x H_2O$. To avoid rusting, a layer of zinc metal is applied on iron sheets which prevents iron sheets from directly coming in contact with the atmosphere and hence, prevents rusting. This process of giving a thin coating of zinc on iron to protect it from rusting is called galvanisation.

(2) The conversion of ferrous sulphate to ferric sulphate is *oxidation* **reaction.**

Ans. Explanation: The conversion of ferrous sulphate ($FeSO_4$) into ferric sulphate $Fe_2(SO_4)_3$ is an oxidation reaction.

$2FeSO_4 \rightarrow Fe_2(SO_4)_3$

Net ionic reaction: $\underset{\text{(Ferrous)}}{Fe^{2+}} \rightarrow \underset{\text{(Ferric)}}{Fe^{3+}}$

(a) In the above ionic reaction, when ferric ion is formed from ferrous ion, the positive charge is increased by one unit. While this happens, the ferrous ion loses one electron and losing of electrons is an oxidation reaction.

(3) When electric current is passed through acidulated water *electrolysis* **of water takes place.**

Ans. Explanation:

(i) Water decomposes into hydrogen and oxygen gases on passing electric current through acidulated water.

(ii) This decomposition takes place by means of electrical energy.

(iii) Therefore, it is called as electrolysis.

(4) Addition of an aqueous solution of $ZnSO_4$ to an aqueous solution of $BaCl_2$ is an example of *double displacement* **reaction.**

Ans. Explanation:

(i) When aqueous solution of $ZnSO_4$ is added to aqueous solution of $BaCl_2$, a reaction takes place forming an aqueous solution of $ZnCl_2$ and a white precipitate of $BaSO_4$.

(ii) In this reaction, ions in the reactants are

exchanged to form a precipitate. Such reactions are called double displacement reactions.

Q.3.2.Answer the following:

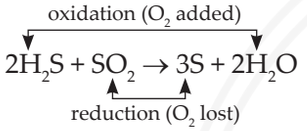
***(1) What is the reaction called when oxidation and reduction take place simultaneously? Explain with one example.**

Ans.

(i) When oxidation and reduction take place simultaneously in a given reaction it is termed as Redox reaction.

(ii) During oxidation a reactant combines with oxygen or loses hydrogen and during reduction it gains hydrogen or loses oxygen.

(iii) Example of Redox reaction:



(iv) In the above reaction, SO_2 is reduced and H_2S is oxidised.

***(2) How can the rate of the chemical reaction namely decomposition of hydrogen peroxide be increased?**

Ans.

(i) The chemical reaction in which two or more products are formed from a single reactant is called decomposition reaction. Hydrogen peroxide decomposes into water and oxygen.

$$\underset{\text{Hydrogen peroxide}}{2H_2O_{2(l)}} \rightarrow \underset{\text{Water}}{2H_2O_{(l)}} + \underset{\text{Oxygen}}{O_2}\uparrow$$

(ii) The decomposition of hydrogen peroxide into water and oxygen takes place slowly at room temperature. However, the rate of this chemical reaction can be increased on adding manganese dioxide (MnO_2) powder in it, here manganese dioxide acts as a catalyst.

***(3) Explain the term reactant and product giving examples.**

Ans.

(i) A chemical reaction is a process in which some substances undergo bond breaking and are transformed into new substances by formation of new bonds.

(ii) The substances taking part in chemical reaction are called reactants, whereas the substances formed as a result of a chemical reaction by formation of new bonds are called products.

(iii) For example :

(a) Formation of carbon dioxide gas by combustion of coal in air is a chemical reaction. In this reaction Coal (carbon) and Oxygen (from air) are the reactants while carbon dioxide is the product.

$$\underbrace{C + O_2}_{\text{Reactants}} \rightarrow \underbrace{CO_2}_{\text{product}}$$

(b) $$\underset{\text{Copper sulphate}}{CuSO_4} + \underset{\text{Zinc}}{Zn} \rightarrow \underset{\text{Zinc sulphate}}{ZnSO_4} + \underset{\text{Copper}}{Cu}$$

In the above equation, copper sulphate and zinc are the reactants and zinc sulphate and copper are the products.

***(4) Explain the types of reaction with reference to oxygen and hydrogen. Illustrate with examples.**

Ans. Types of reaction with reference to oxygen and hydrogen are oxidation reaction and reduction reaction.

Oxidation reaction: The chemical reaction in which a reactant combines with oxygen or loses hydrogen to form the product is called Oxidation reaction.

e.g. $2Mg + O_2 \rightarrow 2MgO$

Here O_2 combines with magnesium (Mg) to form magnesium oxide (MgO)

$MgH_2 \rightarrow Mg + H_2$

Here MgH_2 loses hydrogen.

Reduction reaction: The chemical reaction in which a reactant combines with hydrogen or loses oxygen to form product is called reduction reaction.

e.g. $C + 2H_2 \rightarrow CH_4$

Here carbon combines with hydrogen and forms compound CH_4 (Methane).

$HgO \xrightarrow{\Delta} Hg + O_2$

Here Mercuric oxide loses oxygen to form mercury.

***(5) Explain the similarity and difference in two events, namely adding NaOH to water and adding CaO to water.**

Ans. Similarity:

(i) Both NaOH and CaO dissolve in water. NaOH dissolves in water forming aqueous NaOH while CaO reacts with water to form Calcium Hydroxide [$Ca(OH)_2$]

(ii) Both are bitter in taste, and turn red litmus to blue. i.e. both are basic in nature.

$NaOH_{(s)} + H_2O_{(l)} \rightarrow NaOH_{(aq)} + Heat$

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

Both are exothermic reactions.

(iii) After adding water, the properties of aqueous solution of sodium hydroxide (NaOH) and aqueous solution of calcium oxide (CaO) are different.

Difference:

(i) Sodium Hydroxide (NaOH) is highly soluble in water, whereas calcium oxide (CaO) is less soluble in water.

(ii) Aqueous solution of NaOH is monovalent, whereas aqueous solution of $Ca(OH)_2$ is divalent.

(iii) As NaOH is highly soluble in water, makes strong base whereas $Ca(OH)_2$ is a weak base.

(6) Explain two ways by which food industries prevent rancidity.

Ans.

(i) Rancidity can be prevented by adding antioxidants to food containing fat and oil.

(ii) It can be prevented by packaging fat and oil containing food in airtight containers or by filling the extra space by nitrogen gas.

(7) Will it be possible for you to decompose water by heat or light energy? If you pass current from a 6 volt battery, is decomposition of water possible?

Ans. Pure water cannot be decomposed by heat, light or by passing current from a 6 volt battery. However, if few drops of acid is added to water it can be decomposed by passing current from a 6 volt battery.

***(8) A. Identify from the following reactions the reactants that undergo oxidation and reduction.**

Ans.

(a) $Fe + S \rightarrow FeS$·Fe undergoes oxidation and S undergoes reduction.

(b) $2Ag_2O \rightarrow 4Ag + O_2\uparrow$ – Silver oxide undergoes reduction.

(c) $2Mg + O_2 \rightarrow 2MgO$ – Mg undergoes oxidation.

(d) $NiO + H_2 \rightarrow Ni + H_2O$ Redox reaction.

In the above equation, reactant NiO (Nickel oxide) loses oxygen, thus undergoes reduction whereas H_2 (Hydrogen gas) gains oxygen forming water and undergoes oxidation.

$$\overset{\text{oxidation}}{\overset{\downarrow\quad\downarrow}{NiO + H_2 \rightarrow Ni + H_2O}}\quad \underset{\text{Reduction}}{\underset{\uparrow\quad\uparrow}{}}$$

(8) B. Classify the following reactions into different types.

(a) $\mathbf{AgNO_{3(aq)} + NaCl_{(aq)} \rightarrow AgCl_{(s)} + NaNO_{3(aq)}}$

Ans. (Double displacement reaction) Precipitation reaction

(b) $\mathbf{CaO_{(s)} + H_2O_{(l)} \rightarrow Ca(OH)_{2(aq)} + Heat}$

Ans. Combination reaction [Exothermic reaction.]

(c) $\mathbf{2KClO_{3(s)} \xrightarrow{\Delta} 2KCl_{(aq)} + 3O_{2(g)}}$

Ans. Decomposition reaction/Thermal decomposition reaction.

(d) $\mathbf{CuO + H_2 \xrightarrow{heat} Cu + H_2O}$

Ans. Displacement reaction [Redox reaction.]

(e) $\mathbf{CuSO_{4(aq)} + Pb_{(s)} \rightarrow PbSO_{4(aq)} + Cu_{(s)}}$

Ans. Displacement reaction

(f) $\mathbf{2H_2O_2 \xrightarrow[light]{UV} 2H_2O + O_{2(l)}}$

Ans. Photolytic decomposition is a chemical reaction in which molecules are broken down into smaller units through the absorption of light.

(g) $\mathbf{BaS_{(aq)} + ZnSO_{4(aq)} \rightarrow BaSO_{4(s)} + ZnS_{(aq)}}$

Ans. Double displacement reaction.

***(9) Balance the following equation stepwise.**

(a) $\mathbf{H_2S_2O_{7(l)} + H_2O_{(l)} \rightarrow H_2SO_{4(l)}}$

Ans. **Step 1:** Write the equation and then count the number of atoms of each element on the R.H.S. and L.H.S. of the arrow.

$H_2S_2O_7 + H_2O \rightarrow H_2SO_4$ .....(1)

Elements	No. of atoms in reactants (L.H.S.)	No. of atoms in products (R.H.S.)
H	4	2
S	2	1
O	8	4

Step 2: Check whether no. of atoms on both sides is equal. It is seen from the above table number of atoms of all the elements on the two sides are not the same.

Step 3: To balance the number of atoms on both sides, we write coefficient 2 for H_2SO_4.

Now the equation becomes.

$H_2S_2O_{7\,(l)} + H_2O_{\,(l)} \rightarrow 2H_2SO_{4\,(l)}$ .....(2)

Now see that the number of atoms of each element are equal on both sides.

Elements	No. of atoms in reactants	No. of atoms in products
H	4	4
S	2	2
O	8	8

Hence, the equation (2) is a balanced equation.

(b) $\mathbf{SO_{2(g)} + H_2S_{(g)} \rightarrow S_{(s)} + H_2O_{(l)}}$

Ans. **Step 1:** Write the equation given.

$SO_2 + H_2S \rightarrow S + H_2O$ .....(1)

Count the number of atoms of each element in products and reactants.

Elements	No. of atoms in reactants	No. of atoms in products
S	2	1
O	2	1
H	2	2

Step 2: It is seen from the above table, number of atoms on both sides are not the same. It means that equation (1) needs to be balanced.

Step 3: We will start with oxygen. On product side we need 2 atoms of oxygen, hence coefficient 2 for H_2O. Now the equation will be

$\therefore SO_2 + H_2S \rightarrow S + 2H_2O$ .....(2)

Again count the number of atoms of elements on both the sides.

Elements	No. of atoms in reactants	No. of atoms in products
S	2	1
O	2	2
H	2	4

Still the equation is unbalanced. To balance sulphur and hydrogen atoms on reactant side, write coefficient 2 for H_2S

$\therefore SO_2 + 2H_2S \rightarrow S + 2H_2O$ .....(3)

Again count the number of atoms on both the sides.

Elements	No. of atoms in reactants	No. of atoms in products
S	3	1
O	2	2
H	4	4

Now if we count number of atoms of hydrogen and oxygen, they are equal. But number of atoms of sulphur is not balanced. Now there are 3 atoms of sulphur on reactant side, whereas on product sides it is only one atom. Hence, we write coefficient 3 for sulphur on R.H.S. Now the equation becomes.

$SO_2 + 2H_2S \rightarrow 3S + 2H_2O$ .....(4)

Again count number, of atoms in equation (4)

Elements	No. of atoms in reactants	No. of atoms in products
S	3	3
O	2	2
H	4	4

It means equation (4) is a balanced equation.

(c) $\mathbf{Ag_{(s)} + HCl_{(aq)} \rightarrow AgCl \downarrow + H_2 \uparrow}$

Ans. **Step 1:** Write the chemical equation and count the numbers of atoms in reactants and products.

$Ag + HCl \rightarrow AgCl + H_2$ .....(1)

Elements	No. of atoms in reactants	No. of atoms in products
Ag	1	1
H	1	2
Cl	1	1

Step 2: From the above table, we see the number of atoms of hydrogen on reactant side is not balanced. So, to balance hydrogen atom, we write coefficient 2 for HCl.

$Ag + 2HCl \rightarrow AgCl + H_2$ .....(2)

Again count the number of atoms of elements on both sides.

Elements	No. of atoms in reactants	No. of atoms in products
Ag	1	1
H	2	2
Cl	2	1

Step 3: Now to balance chlorine, we write coefficient 2 for AgCl

$Ag + 2HCl \rightarrow 2AgCl + H_2$ .....(3)

Again count the number of atoms of elements on both sides.

Elements	No. of atoms in reactants	No. of atoms in products
Ag	1	2
H	2	2
Cl	2	2

Step 4: Atoms of elements, hydrogen and chlorine are now balanced. Number of atoms of Ag on product side is 2, and on reactant side is 1 to balance number of atoms of Ag on reactant

side, we write coefficient 2 for Ag.

$\therefore 2Ag + 2HCl \rightarrow 2AgCl + H_2$ .....(4)

Now count number of atoms in equation (4) again

Elements	No. of atoms in reactants	No. of atoms in products
Ag	2	2
H	2	2
Cl	2	2

It means equation (4) is a balanced equation.

(d) $\mathbf{NaOH_{(aq)} + H_2SO_{4(aq)} \rightarrow Na_2SO_{4\,(aq)} + H_2O_{(l)}}$.

Ans. **Step 1:** Write the equation given.

$NaOH + H_2SO_4 \rightarrow Na_2SO_4 + H_2O$ ...(1)

Count the number of atoms of each element in products and reactants.

Elements	No. of atoms in reactants	No. of atoms in products
Na	1	2
O	5	5
H	3	2
S	1	1

The number of oxygen and sulphur atoms are equal on both sides. Hence, we will balance Na atoms on both sides.

Step 2: To balance Na atom we write coefficient 2 for NaOH.

$2NaOH + H_2SO_4 \rightarrow Na_2SO_4 + H_2O$ ...(2)

Step 3: Count the number of Na atoms, H atoms, O atoms and S atoms on both sides.

Elements	No. of atoms in reactants	No. of atoms in products
Na	2	2
O	6	5
H	4	2
S	1	1

Step 4: To balance H, we write coefficient 2 for H_2O on the product side. Hence the equation becomes.

$2NaOH + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O$ ...(3)

Again count the number of atoms of elements on both sides.

Elements	No. of atoms in reactants	No. of atoms in products
Na	2	2
O	6	6
H	4	4
S	1	1

Now the number of atoms of elements are equal on both sides. Hence, equation (3) is a balanced equation.

***(e) Write down the steps in balancing the equation.**
(Use your Brain Power! Textbook page no.35)

$\mathbf{N_{2(g)} + H_{2(g)} \rightarrow NH_{3(g)}}$.

Ans. **Step 1:** Write the equation given.

$N_2 + H_2 \rightarrow NH_3$ ...(1)

Now count the number of atoms of each elements on reactants and product side.

Elements	No. of atoms of reactants	No. of atoms of product
N	2	1
H	2	3

Step 2: Number of atoms of elements on both side is not the same. So we need to balance it. First we will balance Nitrogen by writing coefficient 2 for the product NH_3.

$N_2 + H_2 \rightarrow 2NH_3$ ...(2)

Step 3: Again count the number of atoms of elements on both sides.

Elements	No. of atoms in reactants	No. of atoms in products
N	2	2
H	2	6

Step 4: Number of atoms of Nitrogen is now balanced on both sides, but number of atoms of hydrogen is not balanced. Therefore, we write coefficient 3 for Hydrogen on reactant side. The equation becomes:

$N_2 + 3H_2 \rightarrow 2NH_3$ ...(3)

Now, count the number of atoms on both side.

Elements	No. of atoms in reactants	No. of atoms in products
N	2	2
H	6	6

It means the equation (3) is a balanced equation.

***(f) Write down a balanced chemical equation for the following reaction.** *(Use your Brain Power! Textbook page no.35)*

Calcium chloride + Sulphuric acid → Calcium sulphate + Hydrogen chloride

Ans. $CaCl_{2(s)} + H_2SO_{4\,(aq)} \rightarrow CaSO_{4(s)} + 2HCl_{(aq)}$

Calcium chloride — *Sulphuric acid* — *Calcium sulphate* — *hydrogen chloride*

***(g) Write down the physical states of reactants and products in following reactions.** *(Use your Brain Power! Textbook page no.35)*

(i) $\mathbf{SO_2 + 2H_2S \rightarrow 3S + 2H_2O}$

Ans. $SO_{2(g)} + 2H_2S_{(g)} \rightarrow 3S_{(s)} + 2H_2O_{(l)}$

(ii) $\mathbf{2Ag + 2HCl \rightarrow 2AgCl + H_2}$

Ans. $2Ag_{(s)} + 2HCl_{(l)} \rightarrow 2AgCl_{(s)} + H_{2(g)}$

***(h) Is it possible to produce hydrogen by decomposition of water by means of heat, electricity or light ?** *(Can you recall; Textbook page no.37)*

Ans. Yes. It is possible to produce hydrogen by decomposition of water. Water decomposes into hydrogen and oxygen gases on passing electric current through acidulated water. This decomposition takes place by means of electrical energy.

$$2H_2O(l) \xrightarrow{\text{electric current}} 2H_2\uparrow + O_2\uparrow$$

It is called electrolysis.

***(i) What is the difference in the process of dissolution and a chemical reaction ?** *(Use your Brain Power; Textbook page no.39)*

Ans. In dissolution, solute dissolves in the solvent without reacting chemically with it. In chemical reaction, reactants will react chemically with each other and new products are formed. The bonds in the reactants are broken and new bonds are formed.

(j) Does a new substance form when a solute dissolves in a solvent ? *(Use your Brain Power; Textbook page no.39)*

Ans. No new substance is formed when a solute dissolves in a solvent.

***(k) Take into account the time required for following processes. Classify them into two groups and give titles to the groups.** *(Can you tell; Textbook page no.39)*

(i) Cooking gas starts burning on ignition .

(ii) Iron article undergoes rusting.

(iii) Erosion of rocks takes place to form soil.

(iv) Alcohol is formed on mixing yeast in glucose solution under proper conditions.

(v) Effervescence is formed on adding baking soda into a test tube containing dilute acid.

(vi) A white precipitate is formed on adding dilute sulphuric acid to barium chloride solution.

Ans.

Fast reaction	Slow reaction
(i) Cooking gas starts burning on ignition .	(i) Iron article undergoes rusting.
(ii) Effervescence is formed on adding baking soda into a test tube containing dilute acid.	(ii) Erosion of rocks takes place to form soil.
(iii) A white precipitate is formed on adding dilute sulphuric acid to barium chloride solution.	(iii) Alcohol is formed on mixing yeast in glucose solution under proper condition.

***(l) Complete the following reactions and give names of the products.** *(Use your Brain Power; Textbook page no.38)*

(i) $\mathbf{CuSO_{4(aq)} + Fe_{(s)} \rightarrow \ldots\ldots\ldots\ldots + \ldots\ldots\ldots\ldots}$

Ans. $CuSO_{4(aq)} + Fe_{(s)} \rightarrow FeSO_{4(aq)} + Cu_{(s)}$

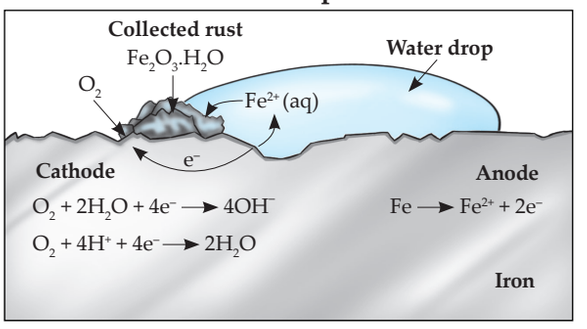
Iron sulphate — *copper*

(ii) $\mathbf{CuSO_{4(aq)} + Pb_{(s)} \rightarrow \ldots\ldots\ldots\ldots + \ldots\ldots\ldots\ldots}$

Ans. $CuSO_{4(aq)} + Pb_{(s)} \rightarrow PbSO_{4(aq)} + Cu_{(s)}$

Lead sulphate — *copper*

***(10) Observe the following picture write down the chemical reaction with explanation.**



(i) In the above diagram, process of rusting takes place.

(ii) A certain type of reddish coloured solid layer collects on the metallic surface.

(iii) This layer is called rust.

(iv) Its chemical formula is $Fe_2O_3.xH_2O$. The rust is formed by an electrochemical reaction.

(v) Different regions on the surface of iron become anode and cathode.

(vi) Fe is oxidised to Fe^{2+} in the anode region.

$Fe_{(s)} \rightarrow Fe^{2+}_{(aq)} + 2e^-$

(vii) O_2 reduces to form water in the cathode region.

$O_{2(g)} + 4H^+_{(aq)} + 4e^- \rightarrow 2H_2O_{(l)}$

When Fe^{2+} ions migrate from the anode region, they react with water and further get oxidised to form Fe^{3+} ions.

(viii) A reddish coloured hydrated oxide is formed from Fe^{3+} ions, it is called rust. It collects on the surface.

(ix) $2Fe^{3+}_{(aq)} + 4H_2O_{(l)} \rightarrow Fe_2O_3.H_2O_{(s)} + 6H^+_{(aq)}$.

(x) Due to various components of atmosphere, oxidation of metals takes place, consequently resulting in their damage.

(xi) This is called Corrosion Iron rusts and a reddish coloured layer is collected on it. This is corrosion of iron.

(11) Explain what happens when following reactions take place and give the balanced chemical equations.

(i) Iron sulphide reacts with sulphuric acid.

Ans. Iron sulphide reacts with sulphuric acid to form ferrous sulphate and hydrogen sulphide.

$$\underset{\text{Iron sulphate}}{FeS_{(s)}} + \underset{\text{Sulphuric acid}}{H_2SO_{4(aq)}} \rightarrow \underset{\text{Ferrous sulphate}}{FeSO_{4\,(aq)}} + \underset{\text{Hydrogen sulphide}}{H_2S_{(g)}}\uparrow$$

(ii) Zinc dust is added to copper sulphate solution.

Ans. Zinc dust reacts with copper sulphate solution, forming zinc sulphate and copper. Zinc displaces copper from copper sulphate and an aqueous solution of zinc sulphate is formed.

$$\underset{\text{Zinc}}{Zn_{(s)}} + \underset{\text{Copper sulphate}}{CuSO_{4(aq)}} \rightarrow \underset{\text{Zinc sulphate}}{ZnSO_{4(aq)}} + \underset{\text{Copper}}{Cu_{(s)}}\downarrow$$

(iii) Potassium chromate solution is added to solution of Barium sulphate.

Ans. When potassium chromate solution is added to solution of Barium sulphate, yellow precipitate of barium chromate is formed. It is a double displacement reaction.

$$\underset{\text{Potassium chromate}}{K_2CrO_{4(aq)}} + \underset{\text{Barium Sulphate}}{BaSO_{4(aq)}} \rightarrow \underset{\text{Potassium sulphate}}{K_2SO_{4(aq)}} + \underset{\text{Barium chromate}}{BaCrO_{4(s)}}\downarrow$$

(iv) Sodium carbonate solution is added to calcium chloride solution.

Ans. When sodium carbonate solution is added to calcium chloride solution, solid calcium carbonate and aqueous solution of sodium chloride is formed. It is a double displacement reaction.

$$\underset{\text{Sodium carbonate}}{Na_2CO_{3(aq)}} + \underset{\text{Calcium chloride}}{CaCl_{2(aq)}} \rightarrow \underset{\text{Calcium carbonate}}{CaCO_{3(s)}} + \underset{\text{Sodium chloride}}{2NaCl_{(aq)}}$$

(v) Copper reacts with concentrated Nitric acid.

Ans. When copper reacts with concentrated nitric acid, reddish coloured poisonous nitrogen dioxide gas is formed.

$$\underset{\text{Copper}}{Cu_{(s)}} + \underset{\text{conc. Nitric acid}}{4HNO_{3(aq)}} \rightarrow \underset{\text{Copper nitrate}}{Cu(NO_3)_{2(aq)}} + \underset{\text{Nitrogen dioxide}}{2NO_{2(g)}} + \underset{\text{Water}}{2H_2O_{(l)}}$$

(vi) Silver nitrate solution added to solution of sodium chloride.

Ans. Silver nitrate reacts with sodium chloride to form a white coloured precipitate of silver chloride and solution of sodium nitrate.

$$\underset{\text{Silver nitrate}}{AgNO_{3(aq)}} + \underset{\text{Sodium chloride}}{NaCl_{(aq)}} \rightarrow \underset{\text{Silver chloride}}{AgCl}\downarrow + \underset{\text{Sodium nitrate}}{NaNO_{3(aq)}}$$

(vii) Sulphur dioxide and hydrogen sulphide reacts.

Ans. Sulphur dioxide and hydrogen sulphide react to form sulphur and water.

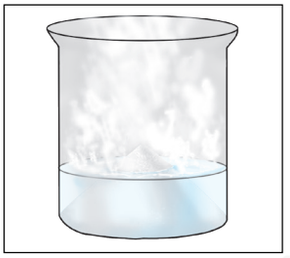
$$\underset{\text{Sulphur dioxide}}{SO_{2(g)}} + \underset{\text{Hydrogen sulphide}}{2H_2S_{(g)}} \rightarrow \underset{\text{Sulphur}}{3S}\downarrow + \underset{\text{Water}}{2H_2O_{(l)}}$$

(viii) Glucose reacts with oxygen.

Ans. When glucose combines with oxygen, carbon dioxide and water are formed with the release of energy.

$$\underset{\text{Glucose}}{C_6H_{12}O_6} + \underset{\text{Oxygen}}{6O_{2(g)}} \rightarrow \underset{\text{Carbon dioxide}}{6CO_{2(g)}} + \underset{\text{Water}}{6H_2O_{(l)}} + \text{energy}$$

Q.4.1. Describe an activity to observe what happens when quick lime is added to water taken in a beaker. State two important observations and name the type of reaction taking place.



Ans. **Aim:** To observe what happens when quicklime is added to water taken in a beaker.

Material Required: Quicklime (Calcium oxide), water, beaker

Procedure:

(i) Take 5g of calcium oxide in a beaker.

(ii) Add water to it slowly.

(iii) Touch the beaker.

(iv) Note down the observations.

Observation: The beaker becomes hot Calcium oxide reacts with water vigorously to form calcium hydroxide with the evolution of heat.

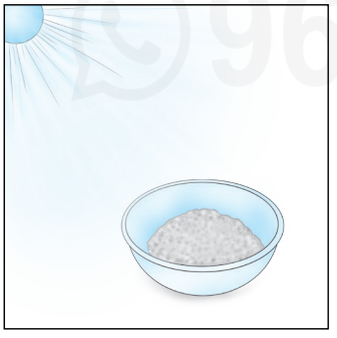
$CaO_{(s)}$ + $H_2O_{(l)}$ $\rightarrow$ $Ca(OH)_{2(aq)}$ + Heat

Quick lime Water Slaked lime

Conclusion: The reaction between CaO and H_2O is a combination reaction. It is an exothermic reaction because heat is evolved.

Q.4.2. Activity based questions:

(1) The following diagram displays a chemical reaction. Observe carefully and answer the following questions.



(a) Identify the type of chemical reaction that will take place and define it. How will the colour of the salt change?

(b) Write the chemical equation of the reaction that takes place.

(c) Mention one commercial use of this salt.

Ans.

(a) Photochemical decomposition reaction: Those reaction in which a compound breaks down into simple substances in the presence of light are called Photochemical decomposition reactions. The colour of salt will change from white to grey.

(b) $2AgCl_{(s)} \xrightarrow{sunlight} 2Ag_{(s)} + Cl_{2(g)}$

(c) Silver chloride is used in photography.

(2) Check the given materials and chemicals required for a chemical reaction and answer the following questions.

Material - Copper wire, iron nail, beaker or big test tube.

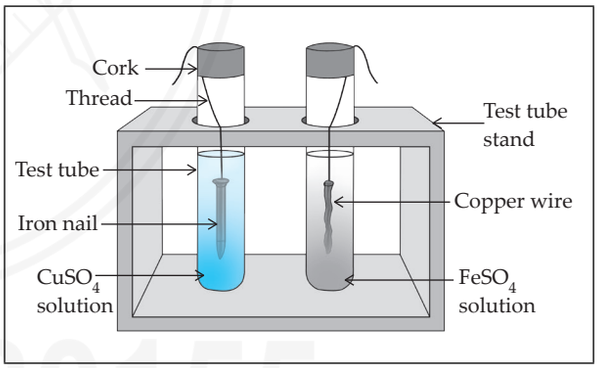
Chemicals - Ferrous sulphate solution and copper sulphate solutions.

(a) Which reaction will you study with the help of above material and solutions? Draw the diagram of the experiment arrangement.

(b) How would identify that the reaction is carried out?

(c) Write a balanced chemical equation for the reaction.

Ans.



(a) Reaction of metal with solution of salts of other metals (Displacement reaction)

(b) The reaction is carried out in the test tube where iron nail is kept in copper sulphate solution. This is because iron being more reactive than copper, iron displaces copper from copper sulphate solution. The colour of copper sulphate changes from blue to light green due to formation of ferrous sulphate and copper gets deposited on iron nail making it reddish brown in colour.

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

Iron Copper sulphate Ferrous sulphate Copper

Q.4.3.Answer the following questions in detail:

(1) What is the importance of a chemical equation? OR Give the significance of a chemical equation.

Ans. The significance of a chemical equation is as follows:

(i) Chemical equation describes briefly the names of the reactants, the products and the state of matter.

(ii) It explains the specific conditions of temperature, pressure, catalyst, etc. under which the reaction takes place.

(iii) It also states whether energy is evolved or needs to be supplied.

(iv) Chemical equation also represents the relative number of molecules and moles of reactants and products.

(v) The relative masses of the reactants and products can also be calculated using a chemical equation. Thus, a chemical equation describes a chemical reaction qualitatively as well as quantitatively.

(2) What is rancidity? Mention only two ways by which rancidity can be prevented.

Ans. The process in which taste and smell of food gets spoiled is called rancidity. It happens due to oxidation.

Prevention of rancidity.

(i) Antioxidants are added to fatty acids to prevent oxidation.

(ii) Food should be kept in airtight containers in refrigerator. Chips are packed in presence of nitrogen gas which prevents spoilage by oxidation.

(3) Give four uses of decomposition reaction.

Ans.

(i) Decomposition reaction helps all the living matter to return back to nature, after death.

(ii) Management of garbage.

(iii) Photosynthesis $\rightarrow$ decomposition of water.

(iv) Photography$\rightarrow$ decomposition of silver bromide.

(v) Used in chemical industry to obtain elements from complex compounds.

(vi) Decomposition of agricultural waste leads to formation of compost.

(4) What is corrosion? Do gold ornaments corrode? Justify.

Ans.

(i) The slow process of decay or destruction of metal due to the effect of air, moisture and acids on it is known as corrosion.

(ii) Gold ornaments do not get corroded.

(iii) Gold is a noble metal and is least reactive.

(iv) It does not react with water or any of the gases present in the atmosphere. Common acids do not have any effect on gold.

(v) Thus, gold ornaments do not corrode.

(5) What are the factors which affect the rate of a chemical reaction.

Ans. The rate of reaction depends upon the following factors.

(i) Nature of the reactants:

(a) $2NO_{(g)} + O_{2(g)} \rightarrow 2NO_{2(g)}$ ⋯⋯► Fast

$2CO_{(g)} + O_{2(g)} \rightarrow 2CO_{2(g)}$ ⋯⋯► Slow

These reactions appear to be similar but the first is fast while second is slow. This is due to the difference in the amounts of energies which are required for breaking up of different bonds and different amounts of energies are released in the formation of different bonds.

(b) $2Al + 6HCl \rightarrow 2AlCl_3 + 3H_2 \uparrow$

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

Al and Zn react with dilute hydrochloric acid, H_2 gas is liberated and water soluble salts of the metals are formed. However, the reaction of aluminium metal takes place faster as compared to zinc metal. The nature of metal is responsible for this difference. Al is more reactive than Zn. Therefore, the rate of reaction of Al with hydrochloric acid is higher than that of zinc. Nature of reactivity of reactants influences the rate of a chemical reaction.

(ii) Concentration of the reactants:

Greater the concentration of the reactants, faster is the reaction conversely, as the concentrations of the reactants decrease the rate of reaction also decreases. Dilute HCl reacts slowly with $CaCO_3$ and thereby, $CaCO_3$ disappears slowly and CO_2 also liberates slowly on the other hand the reaction with concentrated HCl takes place rapidly and $CaCO_3$ disappears fast. Concentrated acid reacts faster than dilute acid, which means that rate of reaction is proportional to the concentration of reactants.

(iii) Temperature:

The rate of reaction increases with increase of temperature. In most of the cases, the rate of reaction becomes nearly double for 10K rise of temperature. In some cases, reactions do not take place at room temperature but take place at higher temperature.

(iv) Presence of catalyst:

A catalyst generally increases the speed of a reaction without itself being consumed in the reaction. In case of reverse reaction, a catalyst helps to attain the equilibrium quickly without disturbing the state of equilibrium.

(v) Size of the particles of reactants:

For a reaction involving a solid reactant or catalyst, smaller the particle size, greater is the surface area, and faster is the reaction.

(vi) Presence of light:

Some reactions do not take place in the dark but can take place in the presence of light like photosynthesis or photochemical reactions.

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