Chapter: 3

Q.1 Textbook activity question **11**

1 Why is potassium permanganate used during cleaning water tanks?

Ans Potassium permanganate is an oxidising agent. It oxidies dissolved iron, manganese and hydrogen sulphide into solid particles that are filtered out of the water tank . It is used to control iron bacteria growth tank.

2 Does a new substance form when a solute dissolves in a solvent ?

Ans When a solute dissolves in a solvent, new substance is not fomed.

3 What is meant by valency of elements?

Ans The valence or valency of an element is a measure of its combining power with other atoms when it forms chemical compounds or molecules.

4 Take into account the time required for following processes. Classify them into two groups and give titles to the groups.
1. Cooking gas starts burning on ignition.
2. Iron article ungergoes rusting.
3. Errosion of rocks takes place to form soil.
4. Alcohol is formed on mixing yeast in glucose solution under proper condition.
5. Effervescence is formed on adding baking soda into a test tube containing dilute acid.
6. A white precipitate is formed on adding dilute sulphuric acid to barium chloride solution.

Ans The above processes are classified into two groups (a) slow speed reactions (b) fast speed reations.
(a) Slow speed reations : (2),(3) and (4).
(b) Fast speed reactions : (1) ,(5) and (6).

5 Which is the oxidant used for purification of drinking water?

Ans Ozone (03) is the most powerful oxidant used in water purifications.

6 What is the number of reactants in each of the above reactions?

Ans The number of reactants in each of the above reaction is two

7 How many products are formed in each of the above reactions?

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

8 Is it possible to produce hydrogen by decomposition of water by means of heat, electricity or light?

Ans It is not possible to produce hydrogen by decomposition of pure water by heat or light energy.

9 What is the difference in the process of dissolution and a chemical reaction?

Ans Dissolution refers to the process of dissolving a solute into a solvent to make a solution. On the other hand a chemical reaction is a process that involves rearrangement of the molecular as ionic structure of a substance, as distinct from a change in physical form or a nuclear reaction.

10 Complete the following reactions and give names of the products.
1. $CuSO_4$ (aq) + Fe (s) → ..... + ...
2. $CuSO_4$ (aq) + Pb(s) → ..... + ...

Ans 1. $CuSO_4$ (aq) + Fe (s) → $FeSO_4$ (aq) + Cu(s)
(Ferrous sulphate and copper are the products)

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2. $CuSO_4$ (aq) + Pb(s) → $PbSO_4$ (aq) + Cu(s)
(Lead sulphate and copper are the products)

These reactions are examples of displacement reactions.

11 (a) Identify the reactants and products of equation (6).
(b) Write down the steps in balancing the equation.

$N_2(g) + H_2(g) \rightleftharpoons NH_3(g)$

Ans (a) The substance(s) to the left of the arrow in a chemical equation are called reactants. A reactant is a substance that is present at the start of a chemical reaction. The substance(s) to the right of the arrow are called products.

(b) $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$

LHS	RHS
N = 2	N = 1 × 2 = 2
H = 2 × 3 = 6	H = 3 × 2 = 6

Q.2 **Give scientific reasons** **6**

1 It is recommended to use air tight containers for storing oil for long time.

Ans If oil or any fried food item is left aside for a long time it undergoes air oxidation and becomes rancid. The process of oxidation reaction of food stuff can be slowed down by storing it in air tight container. This happens because of oxidation of the oil.

2 When the gas formed on heating limestone is passed through freshly prepared lime water, the lime water turns milky.

Ans i. When limestone is heated, calcium oxide and carbon dioxide gas are formed.

$CaCO_{3(s)}$ + Heat → $CaO_{(s)}$ + $CO_2\uparrow$
Calcium carbonate — Calcium oxide — Carbon dioxide

ii. When carbon dioxide gas is passed through freshly prepared lime water, the solution turns milky due to the formation of calcium carbonate, which is insoluble in water.

3 It takes time for pieces of Shahabad tile to disappear in HCl, but its powder disappears rapidly.

Ans It takes time for pieces of Shahabad tile to disappear in HCl, but its powder disappears rapidly because the rate of reaction depends upon the size of the particles of the reactant taking part in the reaction. Smaller the size of the reactant particles, higher is the rate of reaction.

Q.3 **Chemical reactions with equations.** **8**

1 Balance the following equation
$NaOH(aq)+H_2SO_4$ (aq) → $Na_2SO_4(aq)+H_2O(l)$

Ans $2NaOH + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O$

2 Balance the following equation.
(i) $H_2S_2O_7(l) + H_2O(l) \rightarrow H_2SO_4(l)$
(ii) $SO_2(g)+H_2S(aq) \rightarrow S(s)+H_2O(l)$

Ans (i) $H_2S_2O_7 + H_2O(l) \rightarrow \underline{2}H_2SO_4(l)$
(ii) $SO_2(g)+\underline{2}H_2S(aq) \rightarrow \underline{3}S(s)+\underline{2}H_2O(l)$

3 Identify from the following reactions that undergo oxidation or Reduction.
i. $Fe+S \rightarrow FeS$
ii. $2Ag_2O \rightarrow 4Ag+O_2\uparrow$
iii. $2Mg+O_2 \rightarrow 2MgO$
iv. $NiO+H_2 \rightarrow Ni+H_2O$

Ans i. Oxidation
ii. Reduction
iii. Oxidation

iv. Reduction

4 Identify the endothermic and exothermic reaction.

i. $HCl + NaOH \rightarrow NaCl + H_2O$ + heat

ii. $2KClO_3(s) \xrightarrow{\Delta} 2KCl + 3O_2\uparrow$

iii. $CaO + H_2O \rightarrow Ca(OH)_2$ + Heat

iv. $CaCO_3(s) \xrightarrow{\Delta} CaO(s) + CO_2\uparrow$

Ans i. exothermic reaction
ii. endothermic reaction
iii. exothermic reaction
iv. endothermic reaction

Q.4 **Laws/define/principles** **6**

1 Explain displacement reaction with example.

Ans The reaction in which the place of 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.
$2NaCl + H_2SO_4 \rightarrow Na_2SO_4 + 2HCl$.

2 Explain Endothermic Reaction with example.

Ans Chemical reaction during which the heat is either absorbed from the surroundings or has to be supplied continuously form outside is called Endothermic reaction.
$CaCO_3(s) + Heat \rightarrow CaO(s) + CO_2(g)$

3 Defined Balanced equation with example.

Ans If the number of atoms of the elements in the reactant in a equation is same as the number of atoms of the elements in products, then the equation is Balanced equation.

Eg:- $N_2 + 3H_2 \rightleftarrows 2NH_3$

Q.5 **Write Distinguish between** **2**

1 Adding NaOH to water and Adding CaO to water.

Ans

	Adding NaOH to water	**Adding CaO to water**
Similarity	Heat is given away during this process. So, it is an exothermic process.	Heat is given away during this reaction. So, it is an exothermic reaction.
Difference	No new substances are formed as the process involves only dissolution.	New substance (calcium hydroxide) is formed.

Q.6 **Explain with the help of examples** **18**

1 Explain with the help of examples.
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. **Example:** When magnesium (Mg) strip is burnt in air, a white powder of magnesium oxide (MgO) is formed.

$2Mg_{(s)} + O_{2(g)} \rightarrow 2MgO_{(s)}$
Magnesium Oxygen Magnesium Oxide
In this reaction, magnesium oxide is formed as the single product by the combination of two reactants: magnesium and oxygen. Thus, it is a combination reaction.

2 Explain the term reactant and product giving examples.

Ans i. The substances taking part in chemical reaction are called reactants.
ii. The substances formed as a result of a chemical reaction by formation of new bonds are called products.
iii. Examples:
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.

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b. Decomposition of calcium carbonate by heating to form calcium oxide and carbon dioxide is a chemical reaction. In the reaction, calcium carbonate is the reactatn while calcium oxide and carbon dioxide are the products.

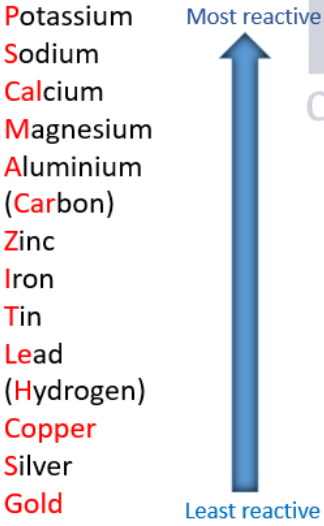
3 Explain the following terms with examples.
Endothermic reaction

Ans **Endothermic reaction:**
An endothermic reaction is any chemical reaction that absorbs heat from its environment. The absorbed energy provides the activation energy for the reaction to occur. A hallmark of this type of reaction is that it feels cold.
A good example of an endothermic reaction includes dissolving a salt. It doesn't have to be table salt, nor does the solvent need to be water.

(i) The reaction of barium hydroxide octahydrate crystals with dry ammonium chloride.
(ii) Dissolving ammonium chloride in water.
(iii) The reaction of thionyl chloride ($SOCl_2$) with cobalt(II) sulfate heptahydrate.
(iv) Mixing water and ammonium nitrate.
(v) Mixing water with potassium chloride.
(vi) Reacting ethanoic acid with sodium carbonate.
(vii) Photosynthesis (chlorophyll is used to react carbon dioxide plus water plus energy to make glucose and oxygen)

4 Explain the following terms with examples.
Displacement reaction.

Ans Displacement reaction is a chemical reaction in which a more reactive element displaces a less reactive element from its compound. Both metals and non-metals take part in displacement reactions. Chemical reactivity of metals is linked with their relative positions in the activity series. A metal placed higher in the activity series can displace the metal that occupies a lower position from the aqueous solution of its salt.



For example:
$Zn_{(s)} + CuSO_{4(aq)} \rightarrow ZnSO_{4(aq)} + Cu_{(s)}$
$ZAl_{(s)} + 3CuSO_{4(aq)} \rightarrow 3Cu_{(s)} + Al_2(SO_4)_{3(aq)}$
$Fe_{(s)} + CuSO_{4(aq)} \rightarrow Cu_{(s)} + FeSO_{4(aq)}$
$Pb_{(s)} + CuCl_{2(aq)} \rightarrow PbCl_{2(aq)} + Cu_{(s)}$

5 Explain the following terms with examples.
Combination reaction.

Ans Those reactions in which two or more substances combine to form single substance is called combination reaction.
For example: Magnesium and oxygen combine, when heated, to form magnesium oxide.
$2Mg + O_2 \rightarrow 2MgO$

6 Explain the types of reaction with reference to oxygen and hydrogen. Illustrate with examples.

Ans i. The types of reaction with reference to oxygen and hydrogen are oxidation and reduction reactions respectively.

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

iii. **Example:**

a. $2Mg + O_2 \rightarrow 2MgO$
Mg combines with oxygen to form MgO. Here, Mg undergoes oxidation.

b. $MgH_2 \rightarrow Mg + H_2$
MgH_2 loses hydrogen to form Mg. Here, MgH_2 undergoes oxidation.

iv. The chemical reaction in which a reactant gains hydrogen or loses oxygen to form the product is called reduction reaction.

v. **Example:**

a. $C + 2H_2 \rightarrow CH_4$
C gains hydrogen to form CH_4. Here, C undergoes reduction.

b. $2Ag_2O \rightarrow 4Ag + O_2$
Ag_2O loses oxygen to form Ag. Here, Ag_2O undergoes reduction.

Q.7 Answer the following **18**

1 Balance the equation stepwise.

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

Ans Step I - Write the chemical equation.

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

Step II -

Element	Reactants	Products
H	4	2
S	2	1
O	8	4

Step III - To balance the atoms in product.

Element	Reactants	Product
H	4	2×2
S	2	1×2
O	8	4×2

Step IV - Find balanced equation.

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

2 What is the reaction called when oxidation and reduction take place simultaneously ? Explain with one example.

Ans Oxidation is a losing of electrons and Reduction is a gaining of electrons. The reaction in which oxidation reduction taking place simultaneously are called as Redox reaction.
For example,
$Cuo + H_2 \rightarrow Cu + H_2O$
In this examples copper oxide is reduced and acts as oxidizing agent and H_2 is oxidized and acts as reducing agent.these are the reaction in which oxidation and reduction are occurs in a same compound.

3 How can the rate of a chemical reaction, namely decomposition of hydrogen peroxide be increased?

Ans $2H_2O_2 \rightarrow 2H_2O + O_2 \uparrow$At room temeprature, the decomposition of hydrogen peroxide into water and oxygen takes place slowly. However the same reaction occurs at a faster rate on adding manganese dioxide powder in it. The hydrogen peroxide naturally undergoes slow decomposition into water and oxygen.

4 Explain the similarity and difference in two events, namely adding NaOH to water and adding CaO to water.

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Ans Chemical equations involved.

(i) $NaOH(s) + H_2O(l) \rightarrow Na^+(aq) + OH^-(aq) + \Delta$ (Heat)

(ii) $CaO(s) + H_2O(l) \rightarrow Ca(OH)_2(aq) + \Delta$ (Heat)

Similarities:

(i) Both of the equations are exothermic. It means a lot of heat is evolved during the reaction.

(ii) Both reactions from strong basic solutions.

Differences:

(i) Sodium Hydroxide is a strong base dissociates to form Na* and OH⁻ion. While Calcium oxide added water to form Calcium Hydroxide which further dissociates.

(ii) NaOH is a monoacidic base. and CaO is a Di-Acidic base.

(iii) NaOH, CaO should be added to water gradually with constant stirring. CaO on reacting with water produces a basic solution called Calcium hydroxide which is used for whitewashing and this reaction is more dangerous as compared to NaOH.

5 Balance the equation stepwise.

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

Ans Step I - Write the chemical equation.

Step II -

Element	Reactants	Product
S	2	1
O	2	1
H	2	2

Step III - First balance atoms of sulphur.

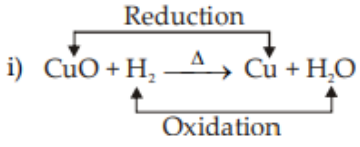
atoms of sulphur (s)	In reactant	In product
initially	2	1
To balance	2	1×2

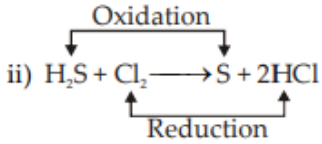
Step IV - Final balanced equation.

$SO_{2(g)} + H_2S_{(ag)} \rightarrow 2S_{(g)} + H_2O_{(l)}$

6 What is the reaction called when oxidation and reduction take place simultaneously ? Explain with one example.

Ans What is the reaction called when oxidation and reduction take place simultaneously ? Explain with one example





Q.8 **Answer the following in detail** **10**

1 Observe and complete the following picture and write down the chemical reaction with explanation.

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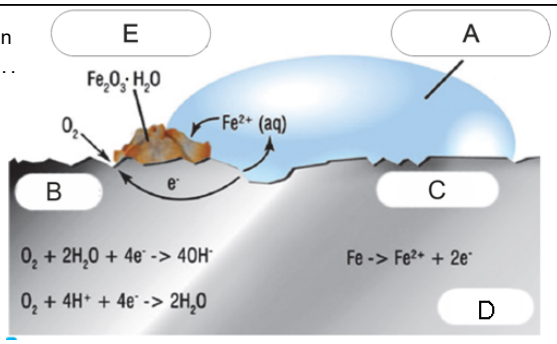
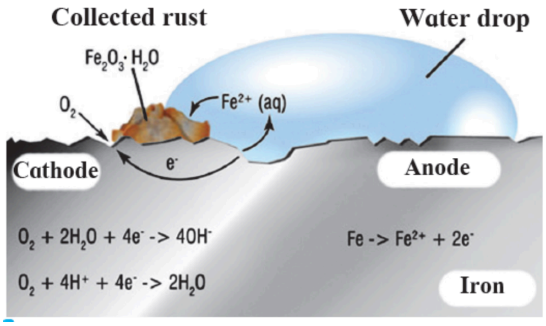


Ans



A. Water drop
B. Cathode
C. Anode
D. Iron
E. Rust

i. Iron is oxidised to form Fe^{2+} in the anode region -

$Fe(s) \rightarrow Fe^{2+}(aq) + 2\bar{e}$

ii. O_2 is reduced to form water in the Cathode region -

$O_2 + 4H^+ (aq) + 4\ \bar{e} \rightarrow 2H_2O(l)$

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

iv. A reddish coloured hydrated oxide is formed from Fe^{3+} ions. It is called rust.

$2Fe^{3+}(aq) + 4H_2O(l) \rightarrow 2Fe_2O_3 \cdot H_2O + 6H^+ (aq)$

2 Match the column in the following table.

Reactants	Products	Type of chemical reaction
i. $BaCl_2(aq) + ZnSO_4(aq)$	H_2CO_3 (aq)	Displacement
ii. 2AgCl(s)	$FeSO_4$ (aq) + Cu (s)	Combination
iii. $CuSO_4$ (aq) + Fe(s)	$BaSO_4 \downarrow + ZnCl_2$ (aq)	Decomposition
iv. $H_2O(l) + CO_2$ (g)	2Ag(s) + Cl_2(g)	Double displacement

Ans

i.	$Bacl_2(aq) + ZnSO_4(aq) \rightarrow BaSO_4 + ZnCl_2$ -	Double displacement
ii.	$2AgCl \rightarrow 2Ag(s) + Cl_2(g)$ -	Decomposition
iii.	$CuSO_4(aq) + Fe(s) \rightarrow FeSO_4(aq) + Cu(s)$ -	Displacement
iv.	$H_2O(l) + CO_2(g) \rightarrow H_2CO_3(aq)$ -	Combination