

Chapter – 1

Chemical Reactions and equations

In Text Questions-Pg-6

Q. 1 Why should a magnesium ribbon be cleaned before burning in air?

Answer: Magnesium reacts with oxygen to form magnesium oxide which does not burn in air. Therefore, to remove the oxide layer from the surface of the magnesium ribbon, we should clean the magnesium ribbon using sandpaper before burning in air.

Q. 2 Write the balanced equations for the following chemical reactions:

(i) Hydrogen + Chlorine \rightarrow Hydrochloric Acid

(ii) Barium chloride + Aluminium sulphate \rightarrow Barium sulphate + Aluminium chloride

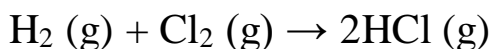
(iii) Sodium + Water \rightarrow Sodium hydroxide + Hydrogen

Answer: (i) Hydrogen + Chlorine \rightarrow Hydrochloric Acid

The above reaction can be written as $\text{H}_2(\text{g}) + \text{Cl}_2(\text{g}) \rightarrow 2\text{HCl}(\text{g})$

Element	Number of atoms in the reactant side	Number of atoms in the product side
H	2	2
Cl	2	2

So, we balance the equation by making the number of each element equal on both side and get,

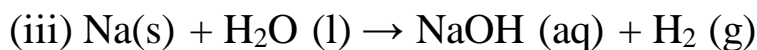


(ii) Barium chloride + Aluminium sulphate \rightarrow Barium sulphate + Aluminium chloride
The above equation can be written as $\text{BaCl}_2 + \text{Al}_2(\text{SO}_4)_3 \rightarrow \text{Ba}_3(\text{SO}_4)_2 + \text{AlCl}_3$



Element	Number of atoms in the reactant side	Number of atoms in the product side
Ba	1	1
Cl	1	3
Al	2	1
S	3	1
O	12	4

So, after balancing we get, $3\text{BaCl}_2 (\text{s}) + \text{Al}_2(\text{SO}_4)_3 (\text{s}) \rightarrow 3\text{BaSO}_4 (\text{s}) + 2\text{AlCl}_3 (\text{s})$

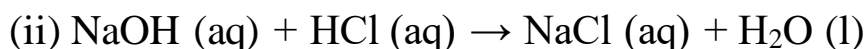
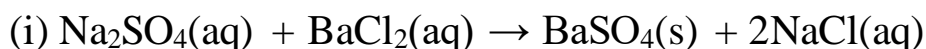


Balancing the equation and making the elements equal on both the side, we get: $2\text{Na} + 2\text{H}_2\text{O} \rightarrow 2\text{NaOH} + \text{H}_2$

Q. 3 Write balanced chemical equations with state symbols for the following reactions:

(i) Solutions of barium chloride and sodium sulphate in water react to give insoluble 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.



In Text Questions-Pg-10

Q. 1 A solution of substance X is used for white washing.

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

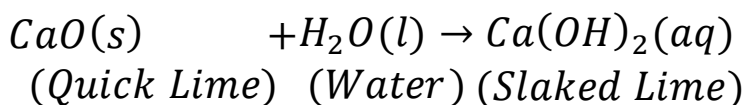
(ii) Write the reaction of the substance X named in (i) above with water.

Answer:

(i) Substance X is Calcium Oxide whose solution we use in water which is used for white washing.

The formula of substance X is CaO.

(ii) Calcium oxide reacts vigorously with water to produce slaked lime (calcium hydroxide) releasing a large amount of heat.



Q. 2 Why the amount of a gas collected in one of the test-tubes double in volume as compared to other test tube during the electrolysis of water? Name this gas.

Answer: Electrolysis of Water produces 2 volumes of Hydrogen Gas and 1 Volume of Oxygen gas through which we can conclude that ratio of Hydrogen to Oxygen is **2:1** by Volume in Water. Hence one of test tube has double the amount of gas as compared to other test tube.

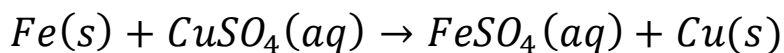
In Text Questions-Pg-13

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

Answer: When an iron nail is dipped in copper sulphate solution, then the colour of copper sulphate solution changes because iron displaces copper from copper sulphate solution to form light green solution of iron sulphate. This reaction is known as displacement reaction.

This displacement occurs because iron is more reactive than copper.

The reaction involved here is:



(copper sulphate) (Iron sulphate)

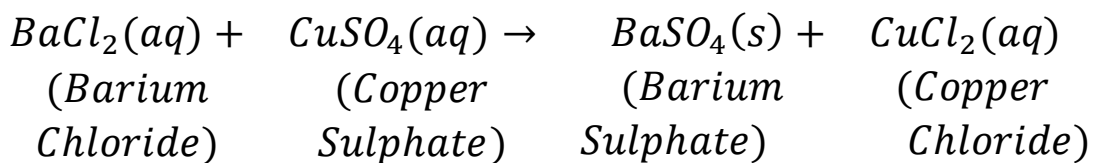
Q. 2 Give an example of a double displacement reaction.

Answer: **Note: In a double displacement reaction, the positive and the negative ions exchange places and form new products, as shown in the figure given below:



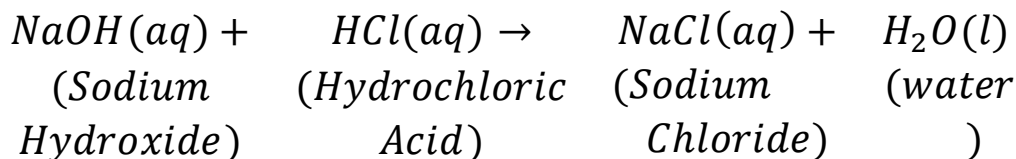
A and C are Cations (Positive Ions)
B and D are Anions (Negative Ions)

Examples: 1) When Barium Chloride is added to Copper Sulphate Solution, a double displacement reaction takes place resulting in the formation of white precipitate of Barium Sulphate along with

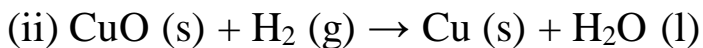
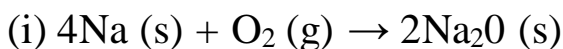


Copper Chloride Solution

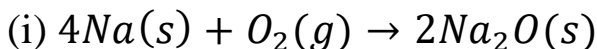
2) Another Example Double Displacement Reaction is as follow:-



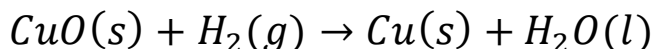
Q. 3 Identify the substances that are oxidised and the substances that are reduced in the following reactions:



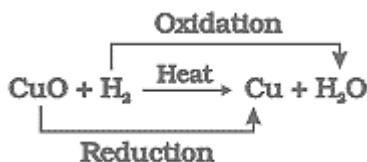
Answer:



If a substance gain oxygen during a reaction, it is said to be oxidized. During this reaction, the sodium is gaining oxygen and is being oxidized. Oxygen is getting reduced.

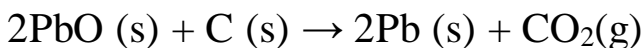


(ii) During this reaction, copper oxide is losing oxygen and is being reduced. The hydrogen is gaining oxygen and is being oxidized.



Exercise-Pg-14

Q. 1 Which of the statements about the reaction below are incorrect?



- (a) Lead is getting reduced
- (b) Carbon dioxide is getting oxidised
- (c) Carbon is getting oxidised
- (d) Lead oxide is getting reduced

- A. (a) and (b)
- B. (a) and (c)
- C. (a), (b) and (c)
- D. all

Answer: Loss of Oxygen is by an element is known Reduction whereas gain of Oxygen by an element is known as Oxidation

Here, lead oxide loses oxygen and is hence reduced. Carbon gains oxygen and hence gets oxidized.



The above reaction is an example of a:

- A. combination reaction
- B. double displacement reaction
- C. decomposition reaction
- D. displacement reaction

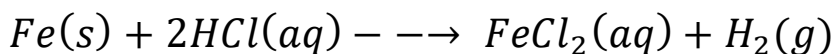
Answer: When an element displaces another element from its compound, a displacement reaction occurs.

In this reaction, aluminium displaces the iron from its compound. Thus, this is an example of displacement reaction.

Q. 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

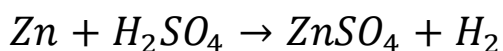
Answer: When dilute hydrochloric acid is added to iron fillings, hydrogen gas and iron chloride are produced.



Q. 4 What is a balanced chemical equation? Why should chemical equations be balanced?

Answer: A chemical reaction which has an equal number of atoms of the elements in the reactants and product sides is called a balanced chemical equation.

For example;



In the above reaction; zinc reacts with sulphuric acid to form zinc sulphate and hydrogen.

Since the number of atoms of each element is the same on both parts of the equation. Hence, it is a balanced chemical equation.

The chemical equation is said to be balanced if it satisfies the law of conservation of mass which states that the 'matter (or atoms) can neither be created nor destroyed in a chemical reaction'.

Thus, the total mass of the elements present in the products of a chemical reaction should be equal to the total mass of the elements present in the reactants. In other words, the number of atoms of each element remains the same, before and after a chemical reaction.

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

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

Answer:

- Hydrogen gas combines with nitrogen to form ammonia.

The equation of the above reaction is $\text{H}_2 (\text{g}) + \text{N}_2 (\text{g}) \rightarrow \text{NH}_3 (\text{g})$

Step 1 - To balance chemical equations, first list the number of atoms of a different type that are present in the chemical equation on both sides –

Element	Number of atoms in LHS	Number of atoms in RHS
H	2	3
N	2	1

Step 2 - To start balancing, we take all compound in the reaction and start balancing the reaction

Element	In Reactant	In product
N	2	1 × 2
H	2 × 3	3 × 2

Hence the Balanced Chemical Equation is $3\text{H}_2 + \text{N}_2 \rightarrow 2\text{NH}_3$

The following questions are solved similarly.(b)Hydrogen sulphide gas burns in air to give water and sulphur dioxide. The equation of the above chemical change is $\text{H}_2\text{S} + \text{O}_2 \rightarrow \text{H}_2\text{O} + \text{SO}_2$

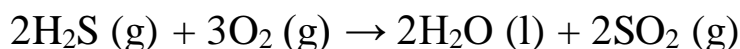
Step 1 - To balance chemical equations, first list the number of atoms of a different type that are present in the chemical equation on both sides –

Element	Number of atoms in LHS	Number of atoms in RHS
H	2	2
S	1	1
O	2	3

Step 2 - To start balancing, we take all compound in the reaction and start balancing the reaction

Element	Reactant	Product
S	1 × 2	1 × 2
H	2 × 2	2 × 2
O	2 × 3 = 6	3 × 2 = 6

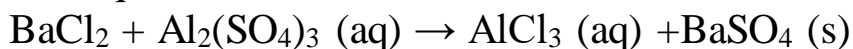
Hence, the Balanced Chemical Equation is



The following questions are solved similarly

(c) Barium chloride reacts with aluminium sulphate to give aluminium chloride solution and a precipitate of barium sulphate.

The equation of the above reaction is



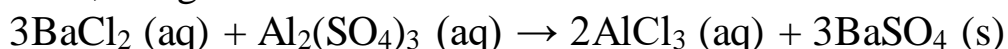
Step 1 - To balance chemical equations, first list the number of atoms of a different type that are present in the chemical equation on both sides –

Element	Number of atoms in LHS	Number of atoms in RHS
Ba	1	1
Al	2	1
S	3	1
O	12	4
Cl	2	3

Step 2 - To start balancing, we take all compound in the reaction and start balancing the reaction.

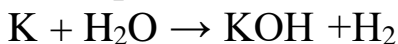
Element	Number of atoms in LHS	Number of atoms in RHS
Ba	1×3	1×3
Al	2	1×3
S	3	1×3
O	12	4×3
Cl	2×3	3×2

Thus, we get



(d) Potassium metal reacts with water to give potassium hydroxide and hydrogen

The equation of the above reaction is



Step 1 - To balance chemical equations, first list the number of atoms of a different type that are present in the chemical equation on both sides –

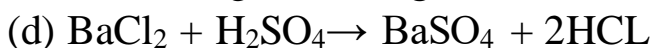
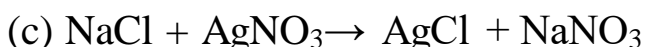
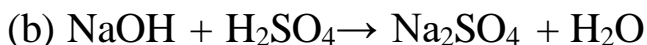
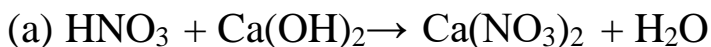
Element	Number of atoms in LHS	Number of atoms in RHS
K	1	1
H	2	3
O	1	1

Step 2 - To start balancing, we take all compound in the reaction and start balancing the reaction

Element	Number of atoms in LHS	Number of atoms in RHS
K	1×2	1×2
H	2×2	3
O	1×2	1×2

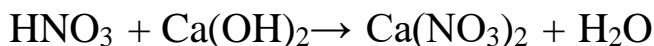
Thus, using the above table the balanced chemical equation is
 $2\text{K} (\text{s}) + 2\text{H}_2\text{O} (\text{l}) \rightarrow 2\text{KOH} (\text{aq}) + \text{H}_2 (\text{g})$

Q. 6 Balance the following chemical equations:



Answer:

(a) Step 1 - To balance chemical equations, first list the number of atoms of different type that are present in the chemical equation on both sides -

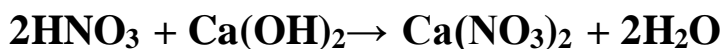


Element	Number of atoms in LHS	Number of atoms in RHS
N	1	2
Ca	1	1
H	$1 + 2 = 3$	2
O	$3 + 2 = 5$	$6 + 1 = 7$

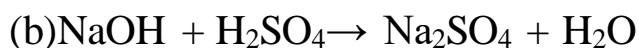
Step 2 - To start balancing, we find the compound that has the highest number of atoms. We can see that $\text{Ca(NO}_3)_2$ on the product side has the highest number of atoms. In this compound Oxygen has the highest number of atoms. Lets start with that.

Atoms of O	In reactant	In Product
Initial	$3 + 2 = 5$	$6 + 1 = 7$
Balanced	$2 \times 3 + 2 = 8$	$6 + 2 \times 1 = 7$

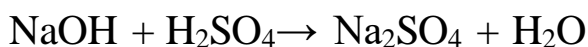
This makes the partially balanced equation -



Step 3 - Now checking for all other elements we note that the number of atoms on both side are same. We can say that the equation is balanced.



Step 1 - To balance chemical equations, first list the number of atoms of different type that are present in the chemical equation on both sides -

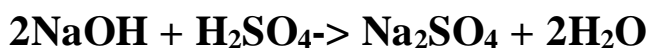


Element	Number of atoms in LHS	Number of atoms in RHS
Na	1	2
O	$1 + 4 = 5$	5
S	1	1
H	3	2

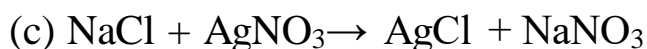
Step 2 - To start balancing, we take any one compound. We will take NaOH on the reactant side in consideration. Let's start with that.

Atoms of	In Reactant	In Product
Na		
Initial	1	2
Balanced	$1 \times 2 = 2$	2

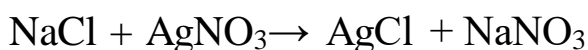
This makes the partially Balanced Equation as:-



Step 3 - Now checking for all other elements we note that the numbers of atoms on both sides are same. We can say that the equation is balanced.



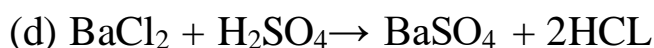
Step 1 - To balance chemical equations, first list the number of atoms of different type that are present in the chemical equation on both sides –



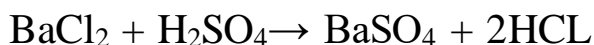
Element	Number of atoms	Number of atoms in
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	in LHS	RHS
Na	1	1
Cl	1	1
Ag	1	1
N	1	1
O	3	3

We can see that the Number of Atoms in LHS and RHS are equal, Hence the equation is already balanced



Step 1 - To balance chemical equations, first list the number of atoms of different type that are present in the chemical equation on both sides –



Element	Number of atoms in LHS	Number of atoms in RHS
Ba	1	1
Cl	2	2
H	2	2
S	1	1
O	4	4

We can see that the Number of Atoms in LHS and RHS is equal, Hence the equation is already balanced•

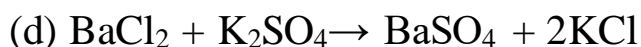
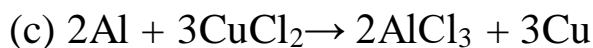
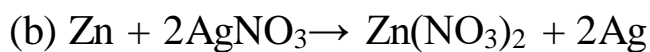
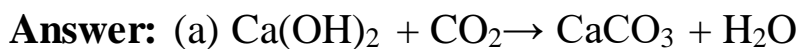
Q. 7 Write the balanced chemical equations for the following reactions:

(a) Calcium hydroxide + Carbon dioxide \rightarrow Calcium carbonate + Water

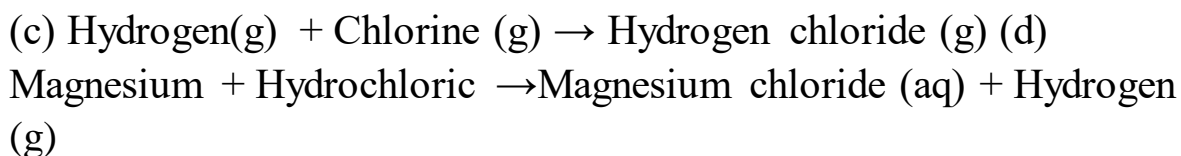
(b) Zinc + Silver nitrate \rightarrow Zinc nitrate + Silver

(c) Aluminium + Copper chloride \rightarrow Aluminium chloride + Copper

(d) Barium chloride + Potassium sulphate \rightarrow Barium sulphate + Potassium chloride

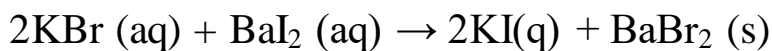


Q. 8 Write the balanced chemical equation for the following and identify the type of reaction in each case.

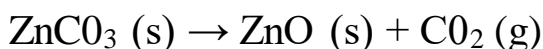


Answer:

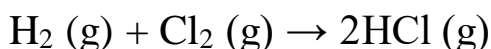
(a) **Double displacement reaction** (also known as precipitation reaction):-



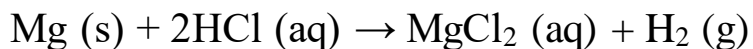
(b) **Decomposition reaction:**



(c) **Combination reaction:**

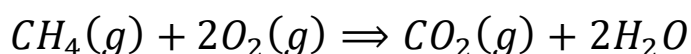


(d) **Displacement reaction:**



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

Answer: Exothermic reaction: Reactions in which heat is released along with the formation of products are called exothermic reaction.

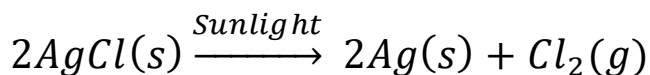


For example: Burning of fuel is an example of exothermic reaction. When methane is burnt in the air, heat is produced along with carbon dioxide and water.

Endothermic reaction: Reactions in which energy is absorbed are known as endothermic reactions.

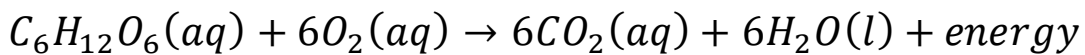
Decomposition reactions are example of endothermic reactions because they require energy in the form of heat, light or electricity for breaking down the reactants.

Example: Silver chloride turns grey in sunlight to form silver metal.



Q. 10 Why respiration is considered an exothermic reaction? Explain.

Answer: In the process of respiration, the glucose combines with oxygen in the cells of our body to form carbon dioxide and energy is released. That's why it is considered an exothermic reaction.

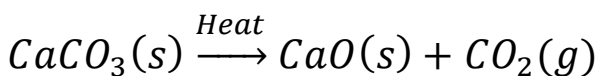


(Glucose)

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

Answer: In a decomposition reaction, a single substance splits to form two or more simpler substances whereas in combination reaction, two or more substances combine to form a single substance. Hence, decomposition reactions are called the opposite of combination reactions.

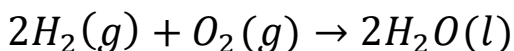
(i) Decomposition reaction:



(Limestone) (Quick lime)

In this reaction, calcium carbonate decomposes into calcium oxide and carbon dioxide on heating. This is an important decomposition reaction used in various industries.

(ii) Combination reaction: Formation of water

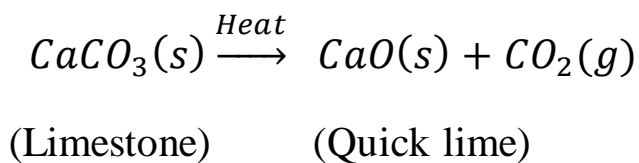


In this reaction, two substances hydrogen and oxygen combine to form single substance water, so this is a combination reaction.

We can see from the above examples that a decomposition reaction is opposite of a combination reaction.

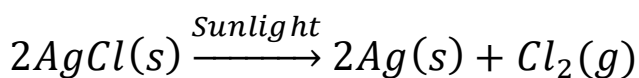
Q. 12 Write one equation each for decomposition reactions where energy is supplied in the form of heat, light or electricity.

Answer: (a) In this reaction, calcium carbonate decomposes into calcium oxide and carbon dioxide on heating. This reaction is carried out by heating.



In this reaction, energy is supplied in the form of heat.

(b) Silver chloride turns grey in sunlight to form silver metal.



In this reaction, energy is supplied in the form of light, i.e. sunlight.

(c) When acidified water is electrolysed, it decomposes to form hydrogen and oxygen:

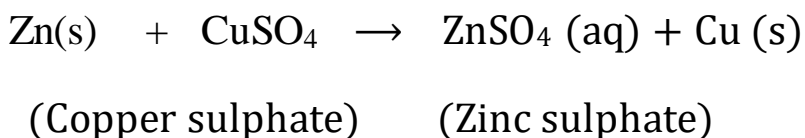


In this case, energy is supplied in the form of electricity.

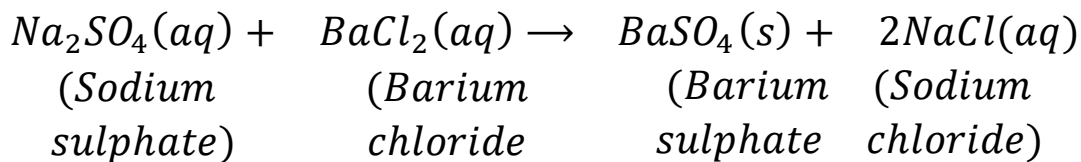
Q. 13 What is the difference between displacement and double displacement reactions? Write equations for these reactions.

Answer: In a displacement reaction, a more reactive element displaces a less reactive element from its solution while in a double displacement reaction, exchange of ions between the reactants takes place to form new products.

(i) Displacement reaction: In this reaction, zinc displaced copper from copper sulphate solution.



(ii) Double displacement reaction:



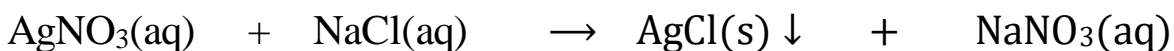
Q. 14 In the refining of silver, the recovery of silver from silver nitrate solution involved "displacement by copper metal. Write down the reaction involved.

Answer: Displacement reaction is used in the recovery of silver from silver nitrate solution during refining of silver.

Q. 15 What do you mean by a precipitation reaction? Explain by giving example.

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

For example: When a solution of silver nitrate is mixed with a solution of sodium chloride, a white precipitate of silver chloride is formed. Hence, it is precipitation reaction.



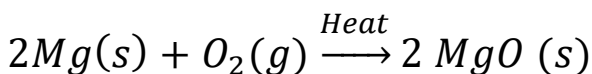
Silver nitrate Sodium chloride White ppt.(silver chloride)

Q. 16 Explain the following in terms of gain or loss of oxygen with two examples each:

(a) Oxidation (b) Reduction

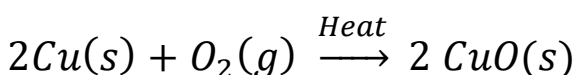
Answer: (a) Oxidation: A chemical reaction in which gain of oxygen or loss of hydrogen takes place.

Example: (i)



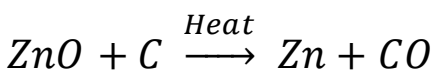
Here, magnesium is oxidised to form magnesium oxide.

(ii) Here, copper is oxidised to form copper oxide.



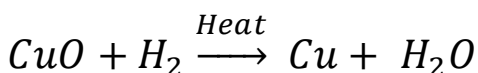
(b) Reduction: A chemical reaction in which loss of oxygen or gain of hydrogen takes place.

Example: (i) When zinc oxide is heated with carbon, then zinc metal and carbon monoxide are formed:



In this reaction, Zinc oxide (ZnO) is reduced to zinc by the loss of oxygen.

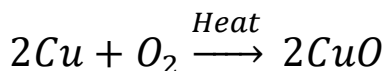
(ii) When copper oxide is heated with hydrogen, then copper metal and water are formed:



In this reaction, copper oxide is losing oxygen to form copper metal. Therefore, copper oxide is reduced to copper.

Q. 17 A shiny brown coloured element X on heating in the air becomes black in colour. Name the element X and the black coloured compound formed.

Answer: The unknown element X is copper (Cu). When copper is heated in air, it forms a black coloured compound called copper oxide (CuO). The reaction for above chemical change is given below:



Q. 18 Why do we apply paint on iron articles?

Answer: Iron articles are painted to prevent them from rusting. When paint is applied on the surface of iron articles, the contact of air and moisture with iron metals is cut off. Therefore, no rusting takes place.

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

Answer: The oil and fat present in food items get oxidized in the presence of air forming products having unpleasant smell and taste which turn the food rancid.

Rancidity makes the food unfit for eating.

This is why antioxidants are added to foods containing oil and fat to prevent oxidation of food.

Nitrogen acts as an antioxidant.

That's why oil and fat containing food items are flushed with nitrogen to prevent oxidation.

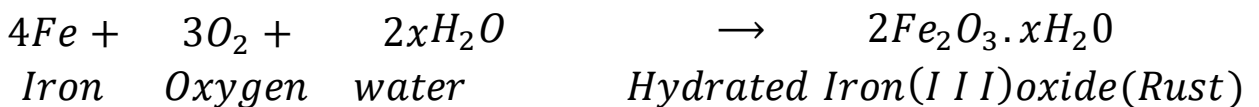
Thus, the food does not turn rancid and remain good to eat for a longer time.

Q. 20 Explain the following terms with one example each: (a) Corrosion (b) Rancidity

Answer: (a) Corrosion: Gradual Deterioration of metals by the action of :-

1. Air
2. Moisture
3. Chemical(such as an acid) on their surface.

Main Cause of corrosion is the oxidation of metals by the oxygen of air. **Example:-** Rusting of Iron - When a piece of Iron is left out in damp time for a period of time it gets covered with a red-brown substance called rust. The following reaction takes place resulting in then formation of rust:-



(b) Rancidity:- Oxidation of Fats and Oils present in food materials by the oxygen present in air resulting in unpleasant smell and taste is called Rancidity. This makes the food not fit for eating.

Example:- Potato Chips that are cooked in oil turn Rancid and give out unpleasant smell and taste if kept exposed for a long time