

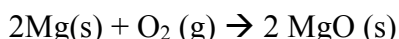
CH-1 CHEMICAL REACTIONS AND EQUATIONS

GIST OF THE LESSON

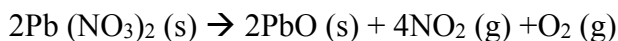
- 1) **Chemical reaction**— Chemical changes or chemical reactions are the changes in which one or more new substances are formed.
- 2) **Chemical Equations** – Representation of a chemical reaction in terms of symbols and formulae of the reactants and products is known as chemical equation.
- 3) **Balanced Chemical equations** – The chemical equation in which the no. of atoms of different elements is same on both sides of the arrow is called balanced chemical equation.

4) The chemical reactions can be classified into different types such as—

- a) **Combination reaction** – The reactions in which two or more substances combine to form a new substance are called combination reaction. For example,



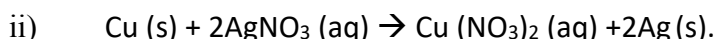
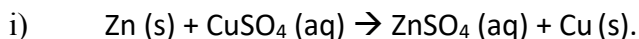
- b) **Decomposition reaction** - The reaction in which a single compound breaks up into two or more simpler substances are called decomposition reactions. For example,



The decomposition of a substance by passing electric current through it is known as electrolysis.

The decomposition of a substance on heating is known as thermal decomposition. The decomposition of a substance by absorbing light energy is called photochemical decomposition.

- c) **Displacement reactions** -The chemical reactions in which a more reactive element displaces a less reactive element from a compound are known as displacement reactions. For example,

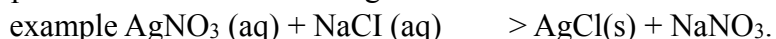


- d) **Double Displacement Reactions** - The chemical reactions in which compounds react to form two different compounds by mutual exchange of ions are called double displacement reactions.

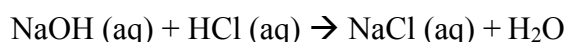
These reactions take place in solution two common types of this reaction are precipitation reactions and neutralization reactions

- i) **Precipitation reaction** : In this reactions, aqueous solution of two salts are mixed whereby

Some salts precipitate due to mutual exchange of ions between the two salts. For



- ii) **Neutralization reaction**: In this type of reaction an acid reacts with a base to form salt and water by exchange of ions.

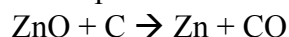


- e) **Redox reaction**: Chemical reaction which shows both oxidation and reduction reaction.

Oxidation: Reaction that involves the gain of oxygen or loss of hydrogen.

Reduction: Reaction that shows the loss of oxygen or gain of hydrogen.

Both oxidation and reduction take place simultaneously and hence called redox reaction.



ZnO reduce to Zn -----reduction

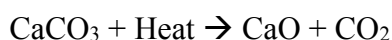
C oxidize to CO -----oxidation

f) **Exothermic reaction and endothermic reaction:** On the basis of energy changes during chemical reaction, they can be classified as

i) **Exothermic reaction:** A chemical reaction in which heat energy is produced.



ii) **Endothermic reaction:** A chemical reaction in which heat energy is absorbed.



5. Corrosion – The process of slow conversion of metals into their undesirable compounds due to their reaction with oxygen, water, acids, gases etc. present in the atmosphere is called corrosion.

Rusting – Iron when reacts with oxygen and moisture forms red substance called rust.

6. Rancidity – The taste and odour of food materials containing fat and oil changes when they are left exposed to air for long time. This is called rancidity. It is caused due to oxidation of fat and oil present in food material.

It can be prevented by using various methods such as by adding antioxidants to the food materials, Storing food in air tight container and by flushing out air with nitrogen.

IMPORTANT QUESTIONS (SOLVED)

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

Solution:

Magnesium ribbon should be cleaned before burning in air because Magnesium metal reacts with the atmospheric oxygen and forms Magnesium Oxide (MgO) layer which is a very stable compound. In order to prevent further reactions with Oxygen, it is therefore necessary to clean the ribbon by to remove the layer of MgO.

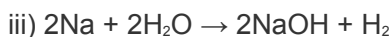
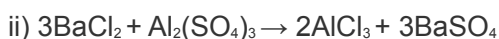
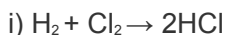
2. Write a balanced equations for the following chemical reactions.

i) **Hydrogen + Chloride $\rightarrow$ Hydrogen chloride**

ii) **Barium chloride + Aluminium sulphate $\rightarrow$ Barium sulphate + Aluminium chloride**

iii) **Sodium + Water $\rightarrow$ Sodium hydroxide + Hydrogen**

Solution:

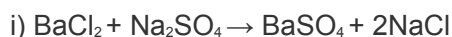


3. Write a balanced chemical equation with state symbols for the following reactions

i) **Solutions of Barium chloride and Sodium sulphate in water react to give insoluble Barium sulphate and solution of Sodium chloride.**

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

Solution:



4. A solution of a substance 'X' is used for whitewashing.

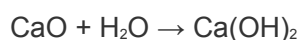
(i) Name the substance 'X' and write its formula.

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

Solution:

i) The substance 'X' which is used in whitewashing is quick lime or **Calcium Oxide** and its formula is **CaO**.

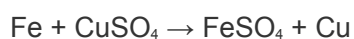
ii)



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

Solution:

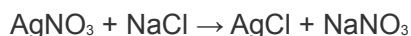
When an iron nail is dipped in the copper sulphate solution, iron displaces copper from the copper sulphate because iron is more reactive than copper. Therefore the colour of the copper sulphate solution changes. The reaction is:



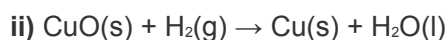
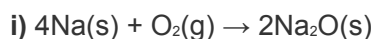
6. Give an example of a double displacement reaction other than the one given in Activity 1.10.

Solution:

Reaction Between silver nitrate (AgNO_3) and Sodium chloride (NaCl) is an example of double displacement reaction. Here Silver donates its ion to Sodium chloride ion and pick up nitrate ion to form silver chloride and sodium Nitrate



7. Identify the substances that are oxidized and that are reduced in the following equation.



Solution:

The Sodium (Na) in the first equation is getting oxidized with the addition of Oxygen (O_2) and the Copper (Cu) in the second equation is reduced due to the addition of Hydrogen (H_2)

8. Which of the statements about the reaction below are incorrect?



(a) Lead is getting reduced

(b) Carbon Dioxide is getting oxidised

(c) Carbon is getting oxidised

(d) Lead oxide is getting reduced

(i) (a) and (b)

(ii) (a) and (c)

(iii) (a), (b) and (c)

(iv) all

Solution:

(i) (a) and (b)

Explanation: (a) because Oxygen is being removed and (b) because the removed oxygen from Lead is added to the elemental Carbon.



The above reaction is an example of a

1. **Combination reaction.**
2. **Double displacement reaction.**
3. **Decomposition reaction.**
4. **Displacement reaction.**

Solution:

Answer is 4. Displacement reaction.

Explanation: The Oxygen from the Ferrous oxide is getting displaced to the Aluminium metal to form Aluminium Oxide. In this reaction Aluminum is more reactive metal than Fe. Therefore Al will displace Fe from its oxide. This type of chemical reactions in which one of the elements displace another is called displacement reaction. Here less reactive metal is displaced by more reactive metal. Since one-time displacement is occurring, therefore, it is called a single displacement reaction.

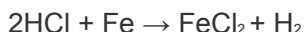
10. What happens when dilute hydrochloric acid is added to iron fillings? Tick the correct answer.

1. **Hydrogen gas and Iron chloride are produced.**
2. **Chlorine gas and Iron hydroxide are produced.**
3. **No reaction takes place.**
4. **Iron salt and water are produced.**

Solution:

1. Hydrogen gas and Iron chloride are produced.

Explanation: The Chlorine from Hydrogen chloride is displaced by the Iron fillings to undergo the following reaction.



11. What is a balanced chemical equation? Why should a chemical equation be balanced?

Solution:

A balanced equation is the one in which number of different atoms on both the reactant and product sides are equal. Balancing chemical equation is necessary for the reaction should obey The Law of Conservation of energy. Balancing the chemical equation has no defined method and is purely a trial and error attempt.

12. Translate the following statements into chemical equations and balance them.

(a) Hydrogen gas combines with nitrogen to form ammonia.

(b) Hydrogen sulphide gas burns in air to give water and sulphur dioxide.

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

(d) Potassium metal reacts with water to give potassium hydroxide and Hydrogen gas.

Solution:

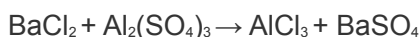
(a) Unbalanced: $\text{H}_2 + \text{N}_2 \rightarrow \text{NH}_3$

Balanced: $3\text{H}_2 + \text{N}_2 \rightarrow 2\text{NH}_3$

(b) Unbalanced: $\text{H}_2\text{S} + \text{O}_2 \rightarrow \text{H}_2\text{O} + \text{SO}_2$

Balanced: $2\text{H}_2\text{S} + 3\text{O}_2 \rightarrow 2\text{H}_2\text{O} + 2\text{SO}_2$

(c) Unbalanced:



(d) Unbalanced: $\text{K} + \text{H}_2\text{O} \rightarrow \text{KOH} + \text{H}_2$



13. What is meant by exothermic and endothermic reactions? Give examples.

Solution:

An endothermic reaction occurs when energy is absorbed from the surroundings in the form of heat. (Example: Photosynthesis, melting of ice, evaporation). Conversely, an exothermic reaction is one in which energy is released from the system into the surroundings. (Example: Explosions, concrete setting, nuclear fission and fusion).

14. Why is respiration considered to be an exothermic reaction?

Solution:

For the survival of life, we require energy. We obtain this energy from the food we eat. The food molecules, through the process of digestion, is broken down into a simpler molecule like glucose. These substances come in contact with the Oxygen present in our body cells to form Carbon dioxide and water along with a certain amount of energy (Respiration process). Since the energy is in the form of heat (that maintains our body temperature) the respiration is considered to be an exothermic reaction. The reaction taking place is:



15. Why do we apply paint on iron articles?

Solution:

Iron articles are painted to prevent them from rusting. When left unpainted, the metal surface comes in contact with the atmospheric oxygen and in the presence of moisture it forms Iron(III) oxide. But if painted the surface does not come in contact with moisture and air thus preventing Rusting.

16. Oil and Fat containing food items are flushed with Nitrogen. Why?

Solution:

The main purpose of flushing Nitrogen into food packets that contain oil and fat items is to prevent Rancidity which occurs when the oil or fat reacts with the oxygen letting out an unpleasant smell and taste. Therefore by flushing Nitrogen, an unreactive surrounding is created thus preventing rancidity.

17. Explain the following terms with one example each.

(a) Corrosion

(b) Rancidity

Solution:

(a) Corrosion is a process where a refined metal is oxidised by atmospheric oxygen to form a more stable compound such as oxides. The metal gradually degrades during the corrosion process. Rusting of iron is a good example of corrosion where the iron is converted to Iron oxide. Millions of dollars are spent annually in preventing rusting from bridges and other monuments.

(b) The condition produced by the aerial oxidation of the oil and fat present in the food material that produces an unpleasant taste and smell. The rancidity is retarded when the food is kept inside the refrigerator since the low temperature does not promote the oxidation reaction.