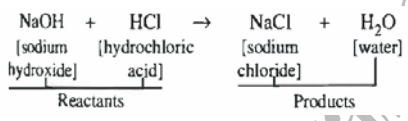
Chemical Reaction

1. **What is Chemical?**
   Ans. Any chemical change in matter which involves transformation into one or more substances with entirely different properties is called a chemical reaction.

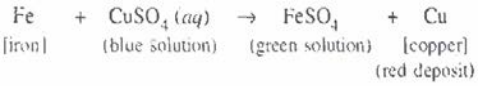
2. **What happen in a Chemical Reaction?**
   Ans. A chemical reaction involves breaking of chemical bonds between the atoms or groups of atoms of reacting substances and rearrangement of atoms making new bonds to form new substances with absorption or release of energy normally in the form of heat and light.

3. **What is Chemical Bond?**
   Ans. A chemical bond is the attractive force that holds the atoms of a molecule together in a compound.

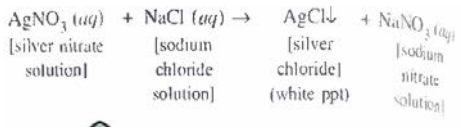
4. **What is Reactant and Product?**
   Ans. The substances taking part in a reaction are called reactants and the new substances formed are called products.



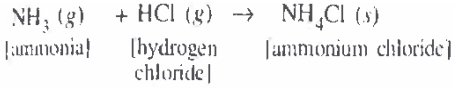
5. **What are the characteristics of Chemical Reaction?**
   Ans. Chemical reactions are characterised by changes that are quite easily observed. Some of these typical changes are:
   i. **Evolution of gas:** In many chemical reactions, one of the products is a gas.
   ii. **Change of color:** Certain chemical reactions are characterised by a change in the color of the reactants.
   Ex: When a few pieces of iron are dropped into a blue-coloured copper sulphate solution, the blue color of the solution fades and eventually turns into light green.



   iii. **Formation of precipitates:** Certain chemical reactions are characterised by the formation of insoluble solid substances called precipitates, which settle down at the bottom of the reaction tube.
   Ex: When a solution of silver nitrate is added to solution of sodium chloride, a white insoluble substance (precipitate), silver chloride is formed.



   iv. **Change of state:** In many chemical reactions, a change of state is observed. For example, the reaction might start with solid or liquid reactants and end up with gaseous products, and vice-versa.
   Ex: The reaction between ammonia and hydrogen chloride gases produces ammonium chloride which is a white solid.



v. **Change in energy:** During a chemical reaction, change in energy takes place. e.g. (a) When burning a fuel, a large amount of energy is released in the form of heat and light. (b) During decomposition of calcium carbonate, heat energy is absorbed.

6. Which conditions are essential for any chemical reaction?

Ans. The following conditions are essential for any chemical reaction

a. Close contact:
b. Attraction in the physical state of the reactants
c. Heat Energy
d. Light Energy
e. Pressure
f. Catalyst

7. How close contact of two compounds make a chemical reaction?

Ans. A chemical reaction takes place when two or more substances are mixed together, i.e. when they directly come into contact with each other.

Ex: When Sodium comes in contact with Cold Water an explosive reaction occurs.

$$2Na + 2H_2O \xrightarrow[\text{(Vigorous Reaction)}]{} 2NaOH + H_2$$

8. How Chemical Reactions take place under Heat Energy?

Ans. Some chemical reactions take place only in the presence of heat.

Ex: When lead Nitrate is heated, it breaks down into Lead Monoxide, Nitrogen DiOxide and Oxygen.

$$2\,Pb(NO_3)_2 \xrightarrow[\text{(Heat)}]{} 2PbO+4NO_2+O_2$$

9. What is Photochemical Reaction?

Ans. Some chemical reactions can take place only in the presence of light. They are called Photochemical Reactions.

Ex. Photosynthesis is a chemical reaction in which food (glucose) is prepared by the green leave of a plant but light is necessary for the reaction to lake place.

$$6CO_2 + 6\,H_2O \xrightarrow{Sunlight\ and\ Chlorophyl} C_6H_{22}O_6 + 6O_2$$

10. What is Electrochemical Reaction?

Ans. Some chemical reactions occur only when electricity is passed through the reactants. Such reactions are called Electrochemical Reactions.

Ex: Water decomposes into hydrogen and oxygen when electric current is passed through it.

$$2H_2O \xrightarrow{Electric\ Current} 2H_2 + O_2$$

11. How chemical reaction takes place under pressure?

Ans. Some chemical reactions take place when the reactants are subjected to high pressure.

Ex: Nitrogen and hydrogen when subjected to high pressure produce ammonia gas.

$$N_2 + H_2 \xrightarrow{200\ atm,\ 450^0C} 2NH_3$$

12. What is Catalyst?

Ans. A catalyst is a substance that either increases or decreases the rate of a chemical reaction without itself undergoing any chemical change during the reaction.

13. Catalysts are how many types?

Ans. There are two types of catalysts

a. Positive Catalysts
b. Negative Catalysts

14. What are Positive Catalysts?

Ans. When a catalyst increases the rate of a chemical reaction, it is known as a positive catalyst.

Ex: Finely divided Iron is used as a positive catalyst in the manufacture of ammonia from hydrogen and nitrogen.

$$N_2 + 3H_2 \xrightarrow[Iron\ (Catalyst) 200-900\ atm\ 450^0C]{} 2NH_3 + Heat$$

15. What are Negative Catalysts?

Ans. When a substance decreases the rate of a chemical reaction, it is known as a Negative Catalyst.

Ex: Phosphoric acid acts as a negative catalyst to decrease the rate of decomposition of hydrogen peroxide. Alcohol too acts as a negative catalyst in certain chemical reactions.

16. What are Precipitates?

Ans. Chemical precipitation is the process of conversion of a solution into solid by converting the substance into insoluble form or by making the solution a super saturated one.

17. Chemical Reactions are how many types?

Ans. There are different types of chemical reactions

a. Combination Reaction
b. Decomposition Reaction
c. Displacement Reaction
d. Double Displacement Reaction

18. What is Combination Reaction?

Ans. A reaction in which two or more substances combine to form a single substance is called a combination reaction.

This type of a reaction is also called a **Synthesis Reaction**.

$$A+B \longrightarrow AB$$

In the combination reaction two elements combine to form a Compound.

Ex: When Iron and Sulphur (both elements) are heated together, they combine to form Iron Sulphide Compound.

$$Fe\ (s) + S\ (s) \longrightarrow FeS\ (s)$$

19. What are the characteristics of Combination Reactions?

Ans. The characteristics of Combination Reactions are

a. Two elements combine to form a compound.
   Ex: Carbon burns in oxygen to form Carbon Di Oxide Gas.

$$C\ (s) + O_2\ (g) \longrightarrow CO_2\ (g)$$

b. An element and a compound can combine to give one product.
   Ex: Carbon monoxide gas burns in the presence of oxygen gas to form a single product carbon di oxide gas.

$$2CO\ (g) + O_2\ (g) \longrightarrow 2CO_2\ (g)$$

c. Two or more compounds can combine to form a single product.
   Ex: Ammonia and Hydrogen both gaseous compound combines to form a compound Ammonium Chloride.

$$NH_3\ (g) + HCl\ (g) \longrightarrow NH_4Cl\ (g)$$

20. What is Decomposition Reaction?

Ans. A reaction in which a compound breaks up on heating into two or more simpler substances is called Decomposition Reaction.

$$AB \xrightarrow[(heat)]{} A + B$$

Since most of the decomposition reactions are carried out by heating, they are called 'Thermal Decomposition Reactions'.

Ex: Mercuric Oxide compound when heated, it decomposes to form two elements mercury and oxygen.

$$2HgO\ (s) \xrightarrow[(heat)]{} 2\ Hg\ (s) + O_2\ (g)$$

21. What are the properties of Decomposition Reactions?

Ans. The properties of Decomposition Reactions are

a. A compound can break up to form two or more elements.
Ex: When Electric Current is passed through acidulated water, the water decomposes into hydrogen and oxygen.

$$2\ H_2O\ (l) \xrightarrow[(Electric\ Current)]{} 2\ H_2\ (g) + O_2\ (g)$$

b. A compound can break up to form two or more new simpler compounds.
Ex: Potassium Nitrate decomposes on heating to produce a compound Potassium Nitrite and Oxygen.

$$2\ KNO_3\ (s) \xrightarrow[(Heat)]{} 2KNO_2\ (s) + O_2\ (g)$$

c. A compound can break up to form both elements and compounds.
Ex: The compound calcium carbonate decomposes on strong heating to form two compounds, Calcium Oxide and Carbon Dioxide.

$$CaCO_3\ (s) \xrightarrow[100^oC]{} CaO\ (s) + CO_2\ (g)$$

22. What is Displacement Reaction?

Ans. A reaction in which a more active element displaces a less active element from compound is called Displacement Reaction.

$$AB + C \longrightarrow CB + A$$

In such reactions, one constituent of the reactant molecule is replaced by another.
Ex: Zinc is more reactive than Copper. So, it displaces copper from Copper Culphate solution.
The Blue Copper Sulphate solution turns colorless due to formation of Zinc Sulphate.

$$Zn + CuSO_4 \longrightarrow ZnSO_4 + Cu$$

23. What are the properties of Displacement Reactions?

Ans. The properties of Displacement Reactions are

a. A more reactive metal displaces a less reactive metal from its salt solution.
Ex: Iron Displace Copper from blue Copper Sulphate Solution to form a green iron sulphate solution. Since Iron is more reactive than copper.

$$Fe + CuSO_4 \longrightarrow FeSO_4 + Cu$$

b. A metal more reactive than hydrogen displaces hydrogen gas from an acid.
Ex: Highly active metal Zinc displace hydrogen from dilute hydrochloric acid solution.

$$Zn + HCl \longrightarrow ZnCl_2 + H_2$$

c. A more reactive non-metal displaces a less reactive non-metal from the solution of its compound.
Ex: Chlorine is more reactive than Bromine. So that it displaces Bromine from Potassium Bromine Solution.

$$2KBr + Cl_2 \longrightarrow 2KCl + Br_2$$

24. What is Dabble Displacement Reaction?

Ans. A chemical reaction in which two compounds in their aqueous state exchange their ions or radicals to form new compounds is called a double decomposition reaction or a double displacement reaction.
Ex: $AB + CD \longrightarrow CB + AD$

25. Dabble Displacement Reactions are how many types?

Ans, Dabbled Displacement Reactions are two types
(a) Precipitation reaction
(b) Neutralization reaction

26. What is Precipitation Reaction?

Ans. A chemical reaction in which two compounds in their aqueous state react to form an insoluble solid (a precipitate) as one of the products is known as a Precipitation Reaction.
Ex: When Barium Chloride Solution reacts, with Sodium sulphate solution. a white precipitate of Barium Sulphate and a soluble salt Sodium Chloride are obtained.

$$BaCl_2 + Na_2SO_4 \longrightarrow BaSO_4\downarrow + 2NaCl$$

27. What are Neutralization Reactions?

Ans. A chemical reaction in which a base or an alkali reacts with an acid to produce a salt and water only is known as a neutralization reaction.

$$\text{Acid} + \text{Base/Alkali} \longrightarrow \text{Salt} + \text{Water}$$

Ex: When Sodium Hydroxide reacts with Hydrochloric Acid, it forms Sodium Chloride salt and Water.

$$NaOH\,(aq) + HCl\,(aq)\ NaCl\,(aq) + H_2O$$

28. Why Neutralization Reaction is important in our daily life?

Ans. Due to following reasons Neutralization Reactions are Important to our Daily Life.

Indigestion: The acidity and indigestion can be overcome by taking antacids like milk of magnesia [$Mg(OH)_2$].

Oral hygiene: Many toothpastes contain bases to neutralize the acids formed the mouth.

Insect sting: When a bee stings, it injects an acidic liquid (formic acid) through the skin which can be neutralized by applying a basic calamine solution or baking soda solution or slaked lime. But wasp stings are alkaline. They can be neutralized by vinegar which is a weak acid. Lemon juice also be used.

Soil treatment: If the soil is acidic, it can be treated with bases like quick lime, slaked lime or chalk to make it neutral. Similarly, basic soils are neutralized by adding sulphate salt.

29. What are Acids and Bases?

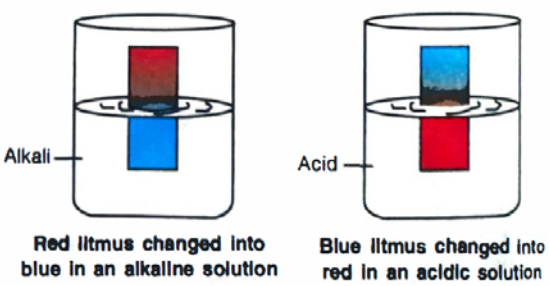
Ans. Acids are the substances which when dissolved in (H+) as the only water produce hydrogen ions

All metallic oxides and metallic hydroxides are called bases, whereas those bases that dissolve in water is known as alkalis.

30. What are Indicators?

Ans. These are the organic compounds which show characteristic color in acidic and basic solutions.

Example: Phenolphthalein, methyl orange, blue and red litmus, etc.

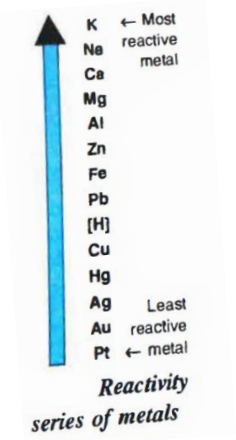


Red litmus changed into blue in an alkaline solution

Blue litmus changed into red in an acidic solution

31. What is Metal Activity Series?

Ans. A list in which the metals are arranged in a decreasing order of their chemical reactivity is called the metal reactivity series.



32. What are the features of the activity series?

Ans. The features are

a. The ease with which a metal in solution loses electron(s) and forms a positive ion decreases down the series, i.e. from potassium to platinum.
b. Hydrogen is included in the activity series because, like metals, it too loses an electron and becomes positively charged (H+) in most of the chemical reactions.
c. The series facilitates the comparative study of metals in terms of the degree of their reactivity.
d. The compounds of the metals (oxides, carbonates, nitrates and hydroxides) too can be easily compared.

33. Why the energy of any reaction changes?

Ans. A chemical reaction involves the breaking up of chemical bonds between atoms resulting in the absorption of energy in the form of heat and simultaneously the formation of bonds takes place with the release of energy. These two types of energy are different from each other i.e. there is either a surplus or a deficit of energy during the reaction. Therefore, in a chemical reaction energy is either absorbed or released.

34. On the basis of Change in Energy Chemical Reactions are how many types?

Ans. Depending upon the energy absorbed or evolved, chemical reactions are of two types :

a. Exothermic Reaction
b. Endothermic Reaction

35. What is Exothermic Reaction?

Ans. A chemical reaction in which heat (form of energy) is given out is called an exothermic reaction.

It causes a rise in temperature.

Respiration, rusting, burning of fuels like coal, petrol, kerosene, etc. are some common exothermic reactions. All neutralization reactions are exothermic in nature.

Ex: When Carbon burns in Oxygen to form Carbon Di Oxide a lot of heat is produced

$$C + O_2 \longrightarrow CO_2 + \Delta$$

36. What is Endothermic Reaction?

Ans. A Chemical Reaction is Endothermic in which heat is absorbed at the time of reaction.

It causes a fall in temperature.

Ex: Reaction of magnesium carbonate when heated gives magnesium oxide and carbon dioxide gas

$$MgCO_3 + Heat \longrightarrow MgO + CO_2$$

37. What is Oxide?

Ans. An oxide is a compound which essentially contains oxygen in its molecule, chemically combined with a metal or a non-metal.

38. Oxides are how many types?

Ans. Oxides are mainly two types

a. Metallic Oxides
b. Non-metallic Oxides

39. What are Metallic Oxides?

Ans. Metallic oxides are formed when a metal reacts with oxygen on heating or without heating.

Metals like sodium, potassium, calcium. magnesium, zinc, aluminium, iron, lead, etc. react with oxygen to produce their oxides.

$$4Na + O_2 \longrightarrow 2Na_2O$$

40. What are the properties of Metallic Oxides?

Ans. The properties of Metallic Oxides are

a. Some metallic oxides are formed on heating metallic carbonates, nitrates etc.
   Ex: Lead Carbonate on strong heating produces lead monoxide.

$$PbCO_3 \longrightarrow PbO + CO_2$$

b. Most of the metallic oxides are basic in nature hence called as basic oxides.
c. Some of these basic oxides dissolve in water to produce soluble bases known as alkalis.

$$Na_2O + H_2O \longrightarrow 2NaOH$$

d. Basic oxides react with acids to produce salt and water.

$$: CaO + 2HCl \longrightarrow CaCl_2 + H_2O$$

e. Metallic oxides like zinc oxide lead monoxide and aluminum oxide are called amphoteric oxides because they react both with acids as well as bases to produce salt and water.

$$ZnO + 2HCl \longrightarrow ZnCl_2 + H_2O$$

41. What are Non-Metallic Oxides?

Ans. Non-metallic oxides are formed when a non-metal is heated with oxygen. Non-metals like carbon, Sulphur, phosphorus, nitrogen, hydrogen combine with oxygen to produce their respective oxides.

Ex: $C + O_2 \longrightarrow CO_2 + \Delta$

42. What are the properties of Non-Metallic Oxides?

Ans. The properties of Non-Metallic Oxides are

a. Most of the non-metallic oxides like carbon di oxide, sulphur dioxide, sulphur tri oxides, phosphorus pentoxides and nitrogen di oxides are all acidic in nature.
They turn moist blue litmus into red.
They dissolve in water to produce their respective acids.

$$CO_2 + H_2O \longrightarrow H_2CO_3 \text{ (Carbonic Acid)}$$

b. Acidic Oxides reacts with bases and alkalis to produce salt and water

$$CO_2 + 2NaOH \longrightarrow Na_2CO_3 + H_2O$$