Chapter 4

Chemical Reactions

Points to study

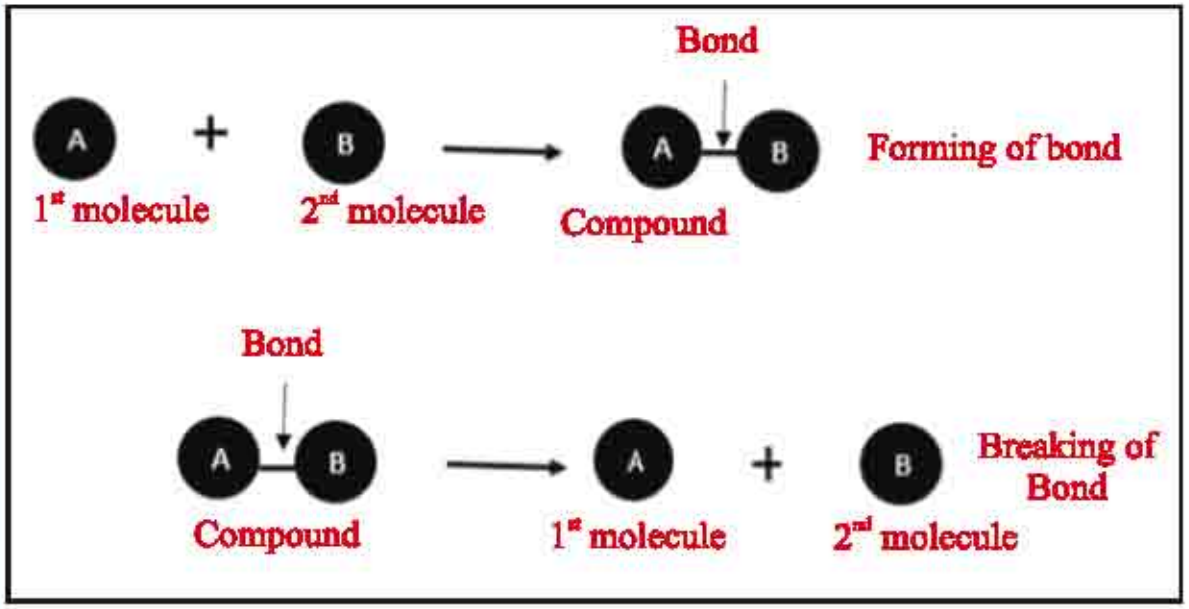
4.1 Chemical Reactions
4.2 Properties of chemical reactions
4.3 Types of chemical reactions

4.1 Chemical reactions

We see many changes around us in daily life like synthesis of food by plants, digestion of food in our body, bubbling of soda water on squeezing lemon juice, darkening of apple, rusting of iron bubbling in lime water, colour of heena etc. Why this happens?

All this happens due to activity of chemical reactions. What is chemical reaction? Let us learn

The process in which substances changes their chemical composition and properties are known as chemical reaction. The substances which are reacting together are called reactants while which are formed through their reaction is called products.



During chemical reactions the chemical bonding between substances is either form or break.

Activity 1

Take sulphur powder in a china dish. Heat it with small amount of iron dust. What you will observe? You will observe that sulphur and iron react with each other and form a new compound called iron sulphide.

$$\text{Iron} + \text{Sulfer} \xrightarrow{\text{heat}} \text{Iron Sulphide}$$

Fig 4.1 Chemical reaction

While writing a chemical reaction we write reactants on the left of arrow (→) and products on the right side.chemical reactions are of various types.

4.2 Properties of Chemical Reactions :

What will happen when we leave iron roti tawa in open and humid environment? Iron of tawa reacts with oxygen present in air in the presence of water and form iron oxide (rust).This is also a type of chemical reaction.

Chemical reactions have some specific properties. On the basis of their properties we can identify the changes .What are these properties?

Let us learn.

Note -: Do all activities in the presence of your teacher.

1. Production of Gas :

Fuels like petrol, diesel, kerosene etc. when burn react with air and form carbon dioxide gas. Likewise when we burn coal carbon dioxide is produce.

$$C + O_2 \longrightarrow CO_2 (Gas)$$

Activity 2

Take zinc granules in a test tube. Now add dilute sulphuric acid gently in the test tube. A gas is liberated which burn with explosion when we bring burning match stick near the mouth of test tube. This gas is hydrogen.

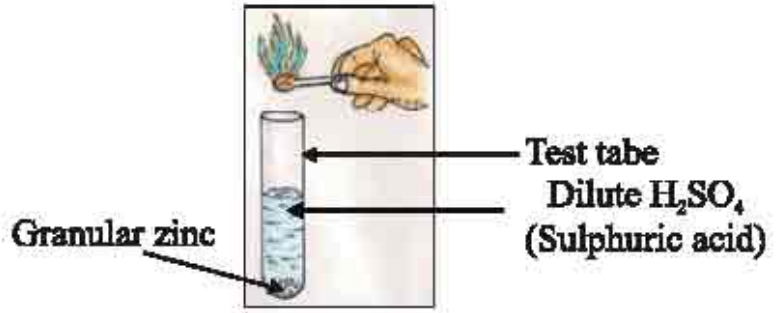


Fig. 4.2 Burning of hydrogen gas with blue flame

2. Change in colour :

when we kept a half cutter apple in air it colour changes to brown as the iron present in apple react with oxygen present in environment and form iron oxide.

3. Heat changes:

when we add ammonium chloride in water .it cools down.

4. Precipitation:

soap precipitate in salty water in spite of forming froth like in fresh water. On the basis of above given properties, we can say that chemical reactions are of various types.

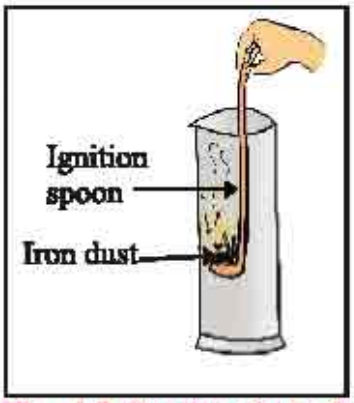


Fig. 4.3 Combustion of iron powder

4.3 Types of chemical reactions:

1. Addition reactions:

Activity 3

Take iron dust in an ignition spoon. Heat it till red hot. Now take this spoon in a gas jar filled with oxygen.

Iron dust burn with sparkling flames and form ferric oxide.

$$Fe \text{ (iron dust)} + O_2 \text{ (oxygen)} \rightarrow Fe_3O_4 \text{ (ferric oxide)}$$

When two or more elements or compounds reacts to form new compounds (products), this reaction is called Addition Reaction.

2. Dissociation or Decomposition reaction:

Activity 4

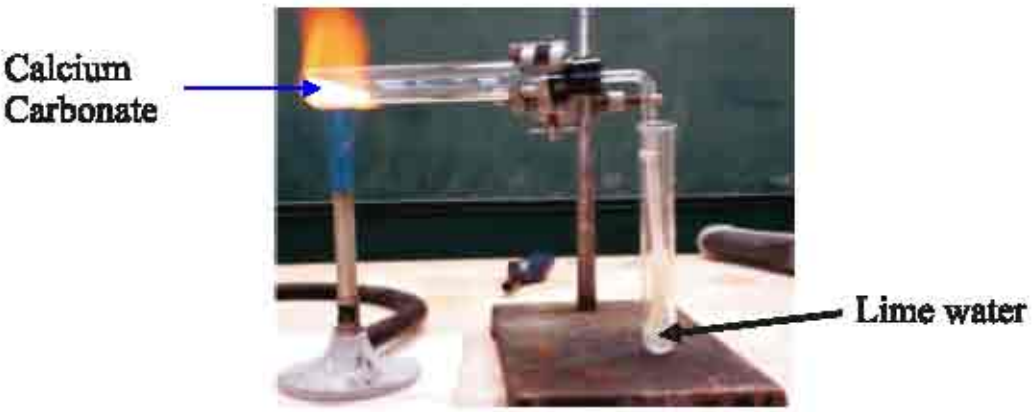


Fig. 4.4 Dissociation of calcium carbonate

$$\text{Calcium Carbonate } (CaCO_3) \xrightarrow{\text{Heat}} \text{Calcium Oxide } (CaO) + \text{Carbon di oxide } (CO_2) \uparrow$$

Heat calcium carbonate. When it gets heated a gas starts liberating from it. Now take this to lime water, which get milky white when exposed to this gas. This gas is carbon dioxide. When we heat calcium carbonate, calcium oxide and carbon dioxide are formed.

The reaction in which reactant breaks in two or more products are called decomposition or dissociation reactions.

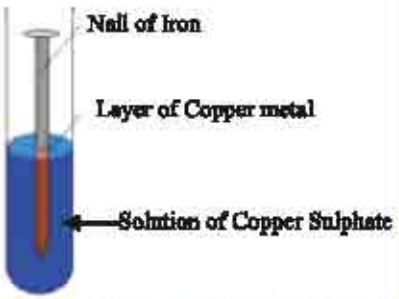


Fig. 4.5 Displacement of Copper on Iron

3. Displacement reaction:

Activity 5

make a solution of copper sulphate in a test tube. Now add non rusted iron nail in this test tube. Leave them for some time.

After some time iron nail has deposition of light brown colour. This layer is of copper metal. The colour of solution also changes to green from blue. The copper of copper sulphate get deposited on iron nail. Here more reactive metal displace less reactive metal. Iron is more reactive than copper (cu) and hence displace copper (cu) and form iron sulphate.

$$\underset{\text{(Iron)}}{Fe} + \underset{\text{(Copper sulphate)}}{CuSO_4} \longrightarrow \underset{\text{(Ferrous sulphate)}}{FeSO_4} + Cu$$

> The reaction in which more reactive compound displace less reactive is called displacement reaction.

4. Oxidation Reaction :

Activity 6

Take copper powder in a test tube and heat. After some time you will observe a blackish layer on the surface of copper sulphate powder. This layer is of copper oxide, which is formed by the reaction of copper and oxygen.

$$\underset{\text{(Copper)}}{Cu} + \underset{\text{(Oxygen)}}{O_2} \longrightarrow \underset{\text{(Copper Oxide)}}{CuO}$$

Fig. 4.6 Oxidation Reaction

In this reaction copper is oxidised to copper oxide

$$\underset{\text{(Methane)}}{CH_4} \xrightarrow[600°C]{\text{Heat}} \underset{\text{(Carbon)}}{C} + \underset{\text{(Hydrogen)}}{2H_2}$$

The reaction in which oxygen is consumed and hydrogen is liberated are called oxidation reaction

Reduction reaction :-

$$\underset{\text{Copper oxcide}}{CuO} + \underset{\text{Hydrogen}}{H_2} \longrightarrow \underset{\text{Copper}}{Cu} + \underset{\text{Water}}{H_2O}$$

(Oxygen is liberated)

When hydrogen gas is react with hot copper oxide copper and water are formed.

H_2(Hydrogen gas) + Cl_2(Clorine gas) ⟶ HCl(Hydrocloric acid)

The reactions in which any substance oxygen is liberated and hydrogen is consumed are called reduction reaction.

Oxidation and reduction reactions are opposites of each other and never take place independently. They take place always together. When in a reaction one substance get oxidised the other get reduced.

The reactions in which oxidation and reduction take place together are called redox reaction or oxy - reduction reaction.

5. Neutralization Reaction :

$$\underset{\substack{\text{(Hydro cholric Acid)}\\\text{(Acid)}}}{HCl} + \underset{\substack{\text{(Sodium hydroxide)}\\\text{(Base)}}}{NaOH} \longrightarrow \underset{\substack{\text{(Sodium cholride)}\\\text{(Salt)}}}{NaCl} + \underset{\text{(Water)}}{H_2O} + \text{energy}$$

Acid and base reacts together to form salt and water.

The reaction in which acid (HCl) and base (NaOH) react together ,they form salt (NaCl) and water are called Neutralization reaction.

6. Endothermic and Exothermic reaction:-

Activity 7

Take a glass beaker and add little waterinto it. Note the temperature with the help of thermometer. Now add powder of potassium nitrate to it. Stir and again note the temperature. You notice a change in temperature.

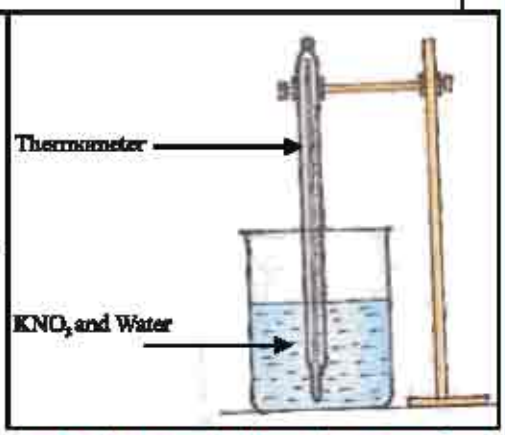


Fig. 4.7 Endothermic Reaction

The reason for decrease in temperature is

absorption of heat during reaction. The reaction in which heat is absorbed are called endothermic reaction.

Repeat the above experiment with sodium hydroxide

We notice a rise in temperature this time. The reason is energy get liberated during reaction. The reactions in which energy is evolved are called exothermic reaction.

What have you learnt

- The change in any substance due to chemical activity is called Chemical Reaction.
- State change, evolution of gas, change in color, change in heat, Precipitation etc. are the properties of chemical reactions.
- When two or more elements or compounds react together and form a product, the reaction is called addition reaction.
- The reaction in which reactant breaks and form two or more products it is called decomposition reaction.
- The reaction in which less reactive element is replaced by more reaction element is replaced by more reaction is called displacement reaction.
- Oxidation and Reduction reaction take place simultaneously.
- Acid and base in fixed quantities react to make salt, water and energy. These reactions are neutralization reaction.
- The reaction in which energy is absorbed is endothermic reaction.
- The reaction in which energy is liberated is called exothermic reactions.

Exercise

Choose the correct options:

1. The following is an example of which type of reaction.
   $NH_3(g) + HCl(g) \rightarrow NH_4Cl(s)$
   (a) Addition (b) Displacement
   (c) Decomposition (d) Neutralisation ( )
2. In oxidation reaction.
   (a) Oxygen is Added (b) Hydrogen is added
   (c) Oxygen is removed (d) Hydrogen is removed ( )
3. Acid change blue litmus to.
   (a) White (b) Red
   (c) Black (d) Purple ( )
4. Copper (Cu) + Oxygen (O_2) →
   (a) H_2O (b) O_2
   (c) Cu O (d) $CuSO_4$ ( )

Fill in the blanks:

1. Dissociation reaction is opposite of _____ reaction.
2. On adding fixed volume of acid and bases _____ and _____ are obtained.
3. Addition of oxygen is known as _____
4. The reaction in which energy is liberated is called _____

Match the following columns:

	Columns: 1	Column : 2
1.	Salt and water are formed from acid and base	Oxidation
2.	Liberation of oxygen	Neutralization
3.	Liberation of energy	Reduction
4.	Removal of hydrogen	Exothermic

Short answer type questions:-

1. Write an example of displacement reaction.
2. Why lime water milky when carbon dioxide gas pass through it?
3. Explain addition reaction with example.
4. Explain displacement reaction with example.
5. Write properties of chemical Reaction.

Long answer type questions:

1. How many types of chemical reactions are there? Explain any four with example.
2. Example with experiment any two properties of chemical reaction.
3. Explain with example.
   (a) Neutralization reaction.
   (b) Dissociation reaction.
   (c) Exothermic reaction.
   (d) Endothermic reaction.

Activity work

Take a plastic bottle and make two holes at the bottom of it. Put two carbon rods in these holes and seal them with wax. Fill the bottle with water. Cover the rods with test tubes. New connect both rods with a cell and observe carefully. This is a typical water voltameter. When current flows oxygen on positive electrode and hydrogen on negative electrode get deposited. We see it by observing bubbles on these rods. Like this we can separate H_2 and O_2 of water CH_2O

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