Class -7th

Chapter 5th

Physical change and Chemical Change

We have many substances around us. All these substances have certain properties such as state (solid, liquid or gas), size, shape, colour, smell, temperature, composition and structure, etc. When one or more properties of a substance become different, we say that a change has taken place in it. Some of the changes observed by us in our everyday life are:

(i) Formation of curd from milk

(ii) Cooking of food

(iii) Drying of clothes

(iv) Ripening of fruits, and

(v) Burning of fuels

(vi) Rusting of iron

TYPES OF CHANGES

Changes can be of two types:

1. Physical changes, and

2. Chemical changes

PHYSICAL CHANGES

Those changes in which no new substances are formed, are called physical changes. The changes in state, size, shape and colour of a substance are physical changes. The physical changes are temporary changes which can be easily reversed to form the original substance.

Very little energy (in the form of heat, etc.) is either absorbed or evolved in physical changes.

Thus, the important characteristics of a physical change are as follows:

(i) No new substance is formed in a physical change.

(ii) A physical change is a temporary change.

(iii) Very little energy is either absorbed or evolved in a physical change.

(iv) A temporary change in colour may take place in a physical change.

CHEMICAL CHANGES

Those changes in which new substances are formed, are called chemical changes. The properties of new substances formed in chemical changes are entirely different from those of the original substances. During chemical change, a substance undergoes a change in its chemical composition (or change in chemical properties). Chemical changes are also called chemical reactions. The chemical changes are permanent changes which can usually not be reversed to form the original substance. A lot of energy is either absorbed or given out in chemical changes.

Thus, the various characteristics of a chemical change are as follows:

(i) One or more new substances are formed in a chemical change

(ii) A chemical change is a permanent change. A chemical change usually cannot be reversed.

(iii) A lot of energy is either absorbed or given out in a chemical change.

Importance of Chemical Changes

Chemical changes are very important in our lives. Some of the examples of the importance of chemical changes are given below:

(i) Metals are extracted from their naturally occurring compounds called 'ores' by a series of chemical changes. For example, iron metal is extracted from the iron ore by chemical changes.

(ii) Medicines are prepared by carrying out a chain of chemical changes.

(iii) The materials such as plastics, soaps, detergents, perfumes, acids, bases, salts, etc., are all made by carrying out various types of chemical changes.

(iv) Every new material is discovered by studying different types of chemical changes.

MAGNESIUM OXIDE

Get a small piece of a thin strip or ribbon of magnesium. Clean its tip with sandpaper. Bring the tip near a candle flame. It burns with a brilliant white light. When it is completely burnt it leaves behind a powdery ash.

The change can be represented by the following equation:

Magnesium (Mg) + Oxygen (O_2) = Magnesium oxide (MgO)

On dissolving the ash in water it forms a new substance. This change can be written in the form of the following equation:

Magnesium oxide (MgO) + Water (H_2O) = Magnesium hydroxide [$Mg(OH)_2$]
So, magnesium oxide is a new substance formed on burning of magnesium.

Magnesium hydroxide is another new substance formed by mixing magnesium oxide with water.

Change in colour of the copper sulphate solution due to reaction with iron

The changes that you notice are due to a reaction between copper sulphate and iron. The change of colour of the solution from blue to green is due to the formation of iron sulphate, a new substance. The brown deposit on the iron nail is copper, another new substance. We can write the reaction as:

Copper sulphate solution (blue) + Iron = Iron sulphate solution (green)

+ Copper (brown deposit)

Reaction between Baking Soda and Vinegar

Take about a teaspoonful of vinegar in a test tube. Add a pinch of baking soda to it. You would hear a hissing sound and see bubbles of a gas coming out.

The change in the test tube is as follows:

Vinegar (Acetic acid) + Baking soda (Sodium hydrogen carbonate) = Carbon dioxide + other substances

The reaction between carbon dioxide and lime water is as follows:

Carbon dioxide (CO2) + Lime water [Ca(OH)2] = Calcium Carbonate

(CaCO3) + Water (H2O)

When carbon dioxide is passed through lime water, calcium carbonate is formed, which makes lime water milky. The turning of lime water into milky is a standard test of carbon dioxide.

One or more new substances are produced in a chemical change. In addition to new products, the following may accompany a chemical change:

1 Heat and light absorbed.

2 Sound may be produced.

3 A change in smell

4 A colour change may take place

RUSTING OF IRON

When an iron object is left in damp air (or water) for a considerable time, it gets covered with a red- brown flaky substance called rust. This is called rusting of iron. During the rusting of iron, iron metal combines with the oxygen (of air) in the presence of water (moisture) to form a compound iron oxide. This iron oxide is rust. The process of rusting can be represented by the following word equation:

Iron (Fe) + Oxygen (O_2, from the air) + water (H_2O) = rust (iron oxide Fe_2O_3)

Almost every iron (or steel) object kept in the open gets rusted slowly. We can usually see the rusted iron gates of parks and iron benches kept in the gardens which always remain in the open.

Conditions Necessary for Rusting

Two conditions are necessary for the rusting of iron to take place:

(i) presence of oxygen (of air), and

(ii) presence of water or water vapour (called moisture).

Rusting Damages Iron Objects

Rust is soft and porous, and it gradually falls off from the surface of a rusted iron object, and then the iron below starts rusting. Thus, rusting of iron is a continuous process which slowly eats up the iron objects and makes them useless.

How Do We Prevent Rusting of Iron

Some of the methods of preventing rusting of iron are given below:

(i) Rusting of iron can be prevented by painting. When a coat of paint is applied the surface of an iron object, then air and moisture cannot come in contact with the iron object and hence no rusting takes place.

(ii) Rusting of iron can be prevented by applying grease or oil. When some grease or oil is applied to the surface of an iron object, then air and moisture cannot come in contact with it and hence rusting is prevented.

(iii) Rusting of iron can be prevented by galvanisation. The process of depositing a thin layer (or coating) of zinc metal on iron objects is called galvanisation.

(iv) Iron is coated with chromium to prevent rusting. This is called chrome-plating. Chromium metal is resistant to the action of air and moisture. So, when a layer of chromium is deposited on an Iron object, then the iron object is protected from rusting.

(v) Rusting of iron can be prevented by alloying it to make stainless steel. Stainless steel does not rust at all. Cooking utensils, knives, scissors and surgical instruments are made of stainless steel and do not rust at all.

GALVANISATION

Another way is to deposit a layer of a metal like chromium or zinc on iron. The process of depositing a layer of zinc on iron is called galvanisation. The iron pipes we use in our homes to carry water are galvanised to prevent rusting.

CRYSTALLISATION

Salt can be obtained by the evaporation of sea water. The salt obtained in this manner is not pure and the shape of its crystals cannot be seen clearly. However, large crystals of pure substances can be formed from their solutions. The process is called crystallisation. The process of separation of salts from their solution is called crystallisation. It is an example of a physical change.