7th Standard- Science

Physical and Chemical Changes

Every day we come across many changes that are taking place all around us. These changes may involve one or more substances. Sometimes, milk becomes sour. Souring of milk is a change. Making a sugar solution is a change. Similarly, setting of curd from milk is a change.

Some changes that we have noticed around us are melting of ice, making of ice cream, melting of wax, stretching a rubber band, evaporation of water, cutting of paper, breaking of glass pane, bending of glass tube by heating, boiling of water, sublimation of camphor, etc.
Broadly, these changes are of two kinds:

- Physical changes
- Chemical changes

Physical Changes

In a physical change, a substance undergoes changes only in its physical properties such as shape, size, colour and state, and no new substance is formed. First, we shall perform some activities to show the physical changes that are taking place all around us are:

Characteristics of Physical Changes

The physical changes are temporary changes which can be easily reversed to form the original substance. In such a change, no new substance is formed.

Thus, we noticed that the important characteristics of physical changes are as follows:

- No new substance is formed in this change.
- It is a temporary change and is generally reversible.
- A temporary change in colour may take place.
- Very little energy (heat, etc) is either absorbed or evolved.

Chemical Changes

Chemical changes are also called chemical reactions. A chemical change occurs when two substances react chemically to form a new substance with different chemical properties. All the new substances which we use in various fields of our life are produced as a result of chemical changes (or chemical reactions).

A change with which we are quite familiar is the rusting of iron. Almost every iron (or steel) object kept in the open gets rusted slowly. It acquires a coating of a brownish substance called rust and the process is called rusting. We can usually see iron gates of parks or farmlands, iron benches kept in lawns and gardens, almost every article of iron, kept in the open gets rusted. The agricultural tools such as spades and shovels, also get rusted when exposed to the atmosphere for some time. In the kitchen, a wet iron pan (tawa) often gets rusted if left in that state for some time. Rust is not iron. It is different from iron on which it gets deposited.

Now, we shall perform some activities to show the chemical changes where new substances are formed.

When baking soda ($NaHCO_3$) reacts with vinegar which contains acetic acid carbon dioxide comes out, which turns lime water milky, therefore it is a chemical change. In all these activities, we saw that in each change, one or more new substances are formed. When the magnesium ribbon was burnt, the ash was the new substance formed.

The reaction of copper sulphate with iron produced two new substances, i.e. iron sulphate and copper. Vinegar and baking soda together produced carbon dioxide which turned lime water milky. So, all those changes in which one or more new substances formed, are called chemical changes. These are permanent changes which can usually not be reversed to form the original substance.

In addition to new products, the following may accompany a chemical change:

- Heat, light or any other radiation (e.g. ultraviolet) may be given off or absorbed.
- The sound may be produced.
- A change in smell may take place or a new smell may be given off.
- A colour change may take place.
- A gas may be formed.

Chemical Changes in Our Daily Life

Chemical changes are very important in our lives. Indeed, every new material is discovered by studying chemical changes, e.g. If metal is to be extracted from an ore such as iron from iron ore, we need to carry out a series of chemical changes.

Medicine is the end product of a chain of chemical reactions. Important and useful new materials such as plastics and detergents are produced by chemical reactions.

Let us consider some more examples of chemical changes. We saw from the activity that burning of magnesium ribbon is a chemical change. Burning of coal, wood or leaves is also a chemical change. In fact, burning of any substance is a chemical change. Burning is always accompanied in the production of heat and light.

- An explosion of a firework (or crackers) is also a chemical change which produces heat, light, sound and unpleasant gases that pollute the atmosphere.
- When food gets spoiled, it produces a foul smell. This shows that new substances have been formed in the spoiled food which has a foul smell. So, the spoilage of food is a chemical change.
- If we cut an apple into slices and kept in the open for some time, we will find that the cut surface of apple acquires a brown colour. This change in colour is due to the formation of the new substance by the action of oxygen (or air). So, this change in colour is a chemical change.
- Similarly, the cut surface of potato or brinjal turns black on keeping in air for some time due to the chemical change.
- When an acid reacts with a base, then a neutralisation reaction takes place in which two new substances, salt and water, are formed. So, neutralisation is a chemical change.

- During photosynthesis, the plants intake carbon dioxide and water in the presence of chlorophyll and sunlight to form two new substances, glucose (food) and oxygen. So, photosynthesis is a chemical change.
- In the process of digestion, the various food materials break down to form new substances which can be absorbed by the body, so the process of digestion is a chemical change.

Rusting of Iron

When an iron object is left exposed to moist air, it chemically reacts with oxygen and water in the air to form a red-brown flaky substance called rust. The process of rusting can be represented by the following equation:

Iron (Fe) + Oxygen (O_2) (From air) + Water (H_2O) → Rust (Iron oxide, Fe_2O_3)

Rusting occurs in the presence of both oxygen and water. The more humid the air, the faster the rusting occurs. The rust slowly eats away or corrodes the iron, leading to considerable loss. Since iron is used in making bridges, ships, * cars, truck bodies and many other articles, the monetary loss due to the rusting is huge.

Preventions of Rusting

Rusting can be prevented by not allowing the iron to come in contact with moisture and air. The simplest method is to coat the iron with oil, grease or paint. These coats should be applied regularly to prevent rusting.

A more efficient method is to coat the iron with another metal such as zinc or chromium. 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.

Rusting of ships is a major problem in the shipping industry as the body of a ship is always in contact with water and the air around it is also very humid. The salt in water speeds up the process of rusting. This leads to huge monetary loss to the shipping industry. Rusting of iron can be prevented by allowing it to make stainless steel. Stainless steel is made by mixing iron with carbon and metals like chromium, nickel and manganese. It does not rust.

Crystallisation

Seawater contains salts dissolved in it which makes it salty. We have learnt in Class VI that salt can be obtained from seawater by the process of evaporation. The salt obtained in this manner is not pure and its crystals are small. The shape of the crystals cannot be seen clearly. Large crystals of pure substances can, however, be obtained from their solutions by the process of crystallisation. It is an example of a physical change. The process of cooling a hot concentrated solution of a substance to obtain crystals is called crystallisation. The process of crystallisation is used to obtain crystals of a pure solid substance from the impure solid substance.

Impure copper sulphate powder can be purified by the process of crystallisation to obtain large crystals of pure copper sulphate.