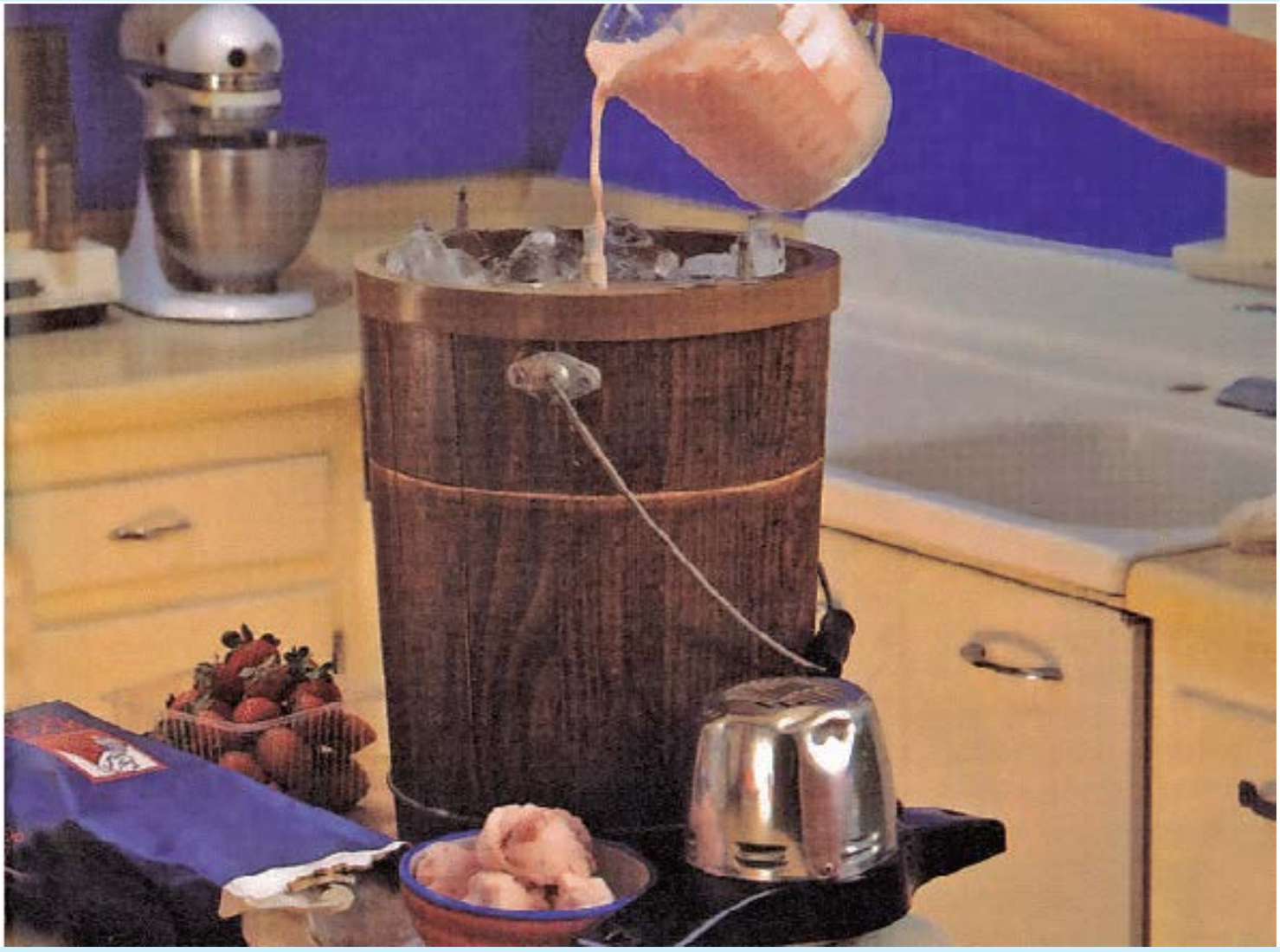
Students' Learning Outcomes

After completing this chapter, the students will be able to:

- Differentiate between physical and chemical changes.
- Identify the physical and chemical changes taking place in environment.
- Explain the use of hydrocarbons as fuels.
- Explain the use of physical and chemical properties of fertilizers, which make them useful in agriculture.
- Discuss harmful effects of improper use of fertilizers.
- Describe the chemical process in which vegetable oil changes into fat.
- Describe the simple process for the manufacture of plastics.
- Distinguish between reversible and non-reversible changes in materials.
- Identify a variety of reversible and non-reversible changes in materials and in their surroundings.



We observe many changes in our everyday life.

Changes in materials are going on around us all the time. Leaves change their colour; trees shed their leaves, milk changes to curd, and iron nails rust in moisture. Some changes around us are slow and some are fast. In this chapter we will study about changes in matter.

7.1: Types of changes

Most of the changes in materials are of two main types, i.e. physical changes and chemical changes.

Physical Changes

A physical change is one in which only the physical properties of a substance change and its chemical composition remains the same. Size, shape, colour, etc. are the physical properties of a substance.

Physical changes are temporary and can easily be reversed. Freezing of water, cutting fruit into pieces, switching on the bulb, dissolving of something into another, etc. are some examples of physical changes (Fig.7.1).

Ice melts or water freezes, it does not change the composition of water (H_2O). Melting of ice or freezing of water are physical changes.

Extend Your Thinking

Explain the presence of puddle of water on the sidewalk one day and its absence on the next day.

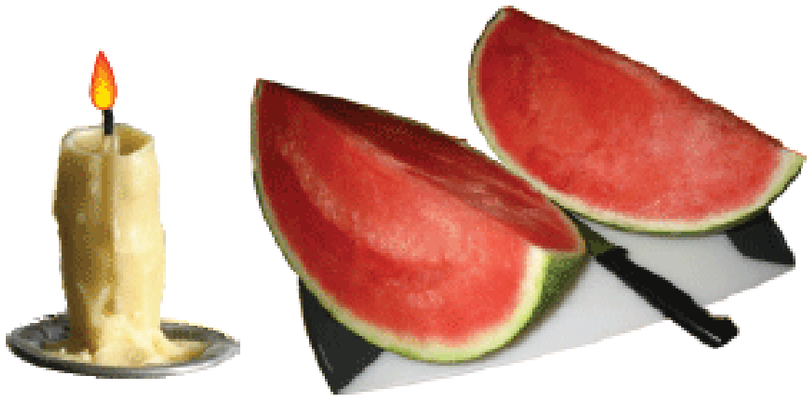


Fig. 7.1: Cutting fruit and melting of wax are examples of physical changes.

Activity 7.1 Dissolving of Table Salt into Water

You will need:

- table salt
- beaker
- water
- spoon
- tripod stand
- spirit lamp
- match stick

Procedure

1. Take some water in the beaker.
2. Dissolve some amount of table salt in the water.
3. Is the sugar visible in the water?
4. Put the beaker on the tripod stand.
5. Boil off the water in the beaker. What does remain in the beaker?

Things to think

How dissolving of table salt into water is a physical change?

Chemical Changes

A chemical change is one in which a new substance is formed.

Chemical changes are permanent and are not easy to reverse. Burning of paper, rusting of iron, turning of milk into yogurt, cooking of food, etc. are some examples of chemical changes (Fig.7.2).

Fig. 7.2: Turning of milk into yogurt, burning of coal and rusting of iron are some examples of chemical changes.

Coal is carbon. When we burn coal, it changes into smoke, energy and ash. So, burning of coal is a chemical change because new substances are formed during this process.

Some Clues to Chemical Changes

- Formation of gas bubbles
- Change of colour
- Releasing and absorbing of energy

If any one of the above clues takes place, it shows the chemical change.

Extend Your Thinking

When we chew food, what type of change are we causing to the food, a physical change or a chemical change?

Activity 7.2 Rusting of Iron

Put a few iron nails in half-filled glass of water. After a few days observe the nails. Iron has reacted with oxygen in water. It is called rusting of iron. What type of change is this?

$$\text{Iron + Oxygen} \xrightarrow{\text{Water}} \text{Iron oxide (rust)}$$

Activity 7.3 Reaction of Marble with Bleach

Pour some amount of bleach on a piece of marble.
Observe what happens.
The marble reacts with the bleach and produces bubbles.
Is it a physical change or a chemical change?

Activity 7.4 Observing a Chemical Change

You will need:

- balloon
- spoon
- baking soda
- vinegar
- narrow-necked bottle

Procedure

1. Pour some amount of baking soda into the balloon.
2. Add several spoonfuls of vinegar to a narrow-necked bottle.
3. Stretch the opening of the balloon over the mouth of the bottle, as shown in the picture.
4. Lift the balloon and hold it above the bottle so that the baking soda falls into the bottle.

Observe the changes that take place when the baking soda mixes with the vinegar.

Things to thinK

i What happened to the balloon?

ii Are baking soda and vinegar still present, or have they changed into new substances?

iii What clue did you observe that a chemical change takes place inside the bottle after the mixing of baking soda with the vinegar?

7.2: Applications of Chemical Changes

As a result of chemical changes new products are formed. We are living in the world of chemical changes. Chemical changes are taking place in our bodies, in our vehicles and in our environment. Sometimes chemical changes form harmful substances (Fig.7.3).

Fig. 7.3: Factories release toxic gases which react chemically with rain water. The rain water becomes acidic. Acid rain destroys forests. Acid rain is the result of chemical changes

7.2.1: Use of Hydrocarbons as Fuels

Extend Your Thinking

Why do you think chopping of wood is a physical change but burning of wood is a chemical change?

Burning of fuels is another example of a chemical change. Fuel that we use to run our vehicles or factories consists of substances known as hydrocarbons. A **hydrocarbon** is a compound consisting of only hydrogen and carbon atoms. These hydrocarbons are mostly obtained from crude oil (petroleum). When hydrocarbons burn in the presence of oxygen their chemical compositions change. As a result of burning of hydrocarbons, a lot of heat is produced. People use the heat for various purposes such as cooking, heating, movement, etc.

Fig.7.4: The fuel used in motor vehicles is a hydrocarbon.

7.2.2: Use of Fertilizers in Agriculture

Repeated cultivation of crops decreases the fertility of soil. Farmers use certain substances to increase the fertility of the soil. A substance which adds minerals to the soil is called a **fertilizer**. It may be a natural fertilizer or a chemical fertilizer. Chemical fertilizers are prepared in factories. Many chemical changes take place during their preparation. Most fertilizers supply nitrogen (N), phosphorus (P) and potassium (K) elements to the soil (known as NKP).

Physical properties of fertilizers such as particle size and their hardness are very important. Small-sized particles of a fertilizer dissolve easily in water. Hard particles are better than soft ones because they release nutrients gradually.

A **liquid fertilizer** is a clear solution. It contains the nutrients essential for plants. Liquid fertilizers are dustless and they reach to every plant easily

Harmful Effects of Improper Use of Fertilizers

In case of excess spreading, some fertilizers are not absorbed by the plants. These fertilizers may reach into canals and rivers causing water pollution and encourage the growth of algae. During the manufacture of chemical fertilizers a lot of fossil fuel such as coal and natural gas is used, due to which our fossil fuel reserves are reducing quickly.

Fig. 7.5: Chemical fertilizers increase the production of crops.

Waste materials of plants and animals are called manure. **Manure** is rich in nutrients needed by the soil. Chemical changes in manure increase the production of crops.

7.2.3: How does Vegetable Oil Change into Fat?

A chemical process called hydrogenation changes vegetable oil into solid fat (Banaspati ghee). When hydrogen is passed through vegetable oil in the presence of nickel, it converts into solid fat. This process is called hydrogenation. Vegetable oil is liquid while fat (ghee) is solid at room temperature. A large amount of heat is used to bring about this chemical change.

Fig.7.6: Vegetable oil combines with hydrogen and converts into solid fat or ghee.

$$\text{Vegetable oil} + \text{Hydrogen} \xrightarrow{\text{nickel}} \text{Banaspati ghee (fat)}$$

Margarine is the result of chemical changes. It is a mixture of hydrogenated vegetable oil and skimmed milk. In hydrogenation, hydrogen is passed through the vegetable oil. Some people use margarine in place of butter.

7.2.4: Plastics

Plastics are also the result of chemical changes. A **plastic** is any material that can be moulded into any form. Plastics are very large molecules made from many smaller molecules called monomers. That is why plastics are also called polymers (long molecules made from smaller molecules). Monomers are obtained from crude oil. Polyethylene, polyvinyl chloride (PVC), etc. are some examples of plastics.

By heating, plastics can be moulded into a number of shapes, in form of toys, cups, bottles, utensils, etc. Plastics do not decay and therefore are a cause of pollution. Recycling is the best way to deal with pollution caused by plastics.

Activity 7.5 Making Plastic

You will need:

- cup
- spoon
- white glue
- water
- borax
- blue ink

Procedure

1. Take some amount of glue in the cup. Add a few drops of blue ink to the glue and mix.
2. Add water to the glue and stir the mixture thoroughly with the spoon.
3. Add borax to the mixture as you stir it. Observe the changes in the appearance of the mixture. Continue adding the borax until no more liquid is visible.
4. Pick up the material and give it different shapes.

   Can you compare the new compound with plastic?

7.3: Reversible and Irreversible Changes

A change that can go forwards or backwards is called a **reversible change**. It is a temporary change. We can get the same thing again. Melting of ice into liquid water, switching on a tube light, increase of heartbeat during running, mixing of salt in water, wetting a dry cloth, etc. are reversible changes. A change that cannot go back is called a **irreversible change**. It is a permanent change. We cannot again get the thing in its original form. Turning of milk into yogurt, mixing of plaster of Paris with water, burning of paper and wood, rotting of egg or fruit, etc. are examples of irreversible changes. How can we relate reversible and irreversible changes to physical and chemical changes?

Fig. 7.7: Identify reversible and irreversible changes in given examples.

Extend Your Thinking

When sugar is heated for a long time, it forms a solid black substances. Identify it as a reversible or irreversible change.

Activity 7.6 **Reversible and Irreversible Changes**

Make lists of reversible and irreversible changes around you. Also discuss these changes with your friends and teacher.

Science, Technology and Society

Many people use plastic bags for grocery, but some people prefer paper bags. Both of these bags come from natural resources which are rapidly reducing.

Decide which bag should be used for grocery.

- Paper bags can hold more items than plastic bag. Paper bags come from trees.
- Plastic bags are light weight and waterproof. Plastic bags are usually non-biodegradable. They cause land pollution. Plastic bags can be recycled.

The Right Choice

Both paper and plastic bags have some advantages and some disadvantages. But the best choice may be neither paper nor plastic. One reusable cloth bag could replace hundreds of paper and plastic bags.

Key Points

- In a physical change, only shape, size or physical state of a material changes. In a chemical change, a material changes into a new material.
- Boiling and freezing of water, cutting fruit into pieces, switching on the bulb, etc. are some physical changes. Rusting of iron, burning of paper, cooking of food, etc. are some chemical changes.
- Hydrocarbons burn in the presence of oxygen and change into heat, water and carbon dioxide. This heat is used for different purposes.
- Chemical fertilizers, banaspati ghee and plastics are the result of chemical changes.
- The size and hardness of grains of chemical fertilizers help to release nutrients gradually in the soil.
- Improper use of chemical fertilizers can cause water pollution.
- A chemical process hydrogenations changes vegetable oil into solid fat.
- Plastics are very large molecules which are made from many smaller molecules called monomers.
- In reversible change the product formed can again go back to its original form. In an irreversible change, the product formed cannot again go back to its original form.
- Boiling or freezing of water, melting of wax, etc. are examples of reversible changes. Rotting of egg or fruit turning of milk into yogurt, etc. are examples of irreversible changes.

Questions

1. Complete each of the following sentences by writing the correct term.

(i) A change in size, shape or state of matter _____

(ii) Results in new substances with different properties _____

(iii) Farmers use to increase crop production _____

(iv) A compound containing only carbon and hydrogen atoms _____

(v) A polymer that can be easily moulded _____

3. Give short answers.

i. What is meant by a physical change?

ii. Define a chemical change.

iii. Give an example to show that people change the environment.

iv. What is hydrogenation?

v. What is a plastic?

4. Explain with examples that a chemical change brings change in the properties of a substance.

5. Write brief notes on:

i. Plastics ii. Change of vegetable oil into fat

6. How are fertilizers useful and harmful for us?

7. Explain reversible and irreversible changes with examples.

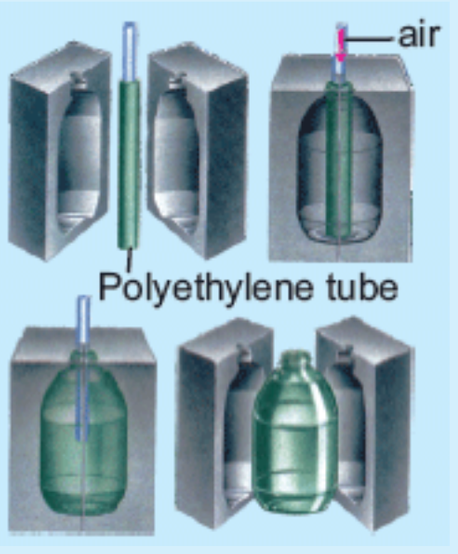
Making of Plastic Soft Drink Bottles

Amazingly, the making of plastic soft-drink bottles is same as to blow up a balloon.

A tube of warm polyethylene is placed inside a bottle shaped mould.

After closing the mould, compressed air is blown into the polyethylene tube. The tube expands and takes the shape of the mould.

The mould is then opened. Your soft-drink bottle is ready for filling.



Computer Links

For more information visit:

- http://www.learnnext.com/lesson/CBSE-VII-Science-Physical-and-Chemical-Changes.htm
- http://en.wikipedia.org/wiki/Chemical_process