

## IN THIS CHAPTER

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Everything in this universe undergoes a change. In our daily life, we observe many changes around us. Change is the law of nature and can be observed by us at all times and at all places.

Some of the changes occurring are natural, such as change of seasons, formation of clouds, weathering of rocks, formation of glaciers, flowering of plants, ripening of fruits, formation of day and night and beating of the heart.

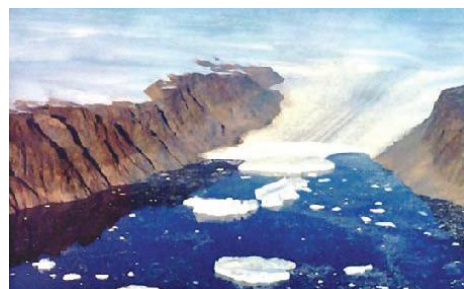
Some changes are man-made, such as cooking of food, burning of oil, weaving of cloth, production of food-grains and dissolving of sugar in water.



Formation of clouds



Weathering of rocks  
Some natural changes



Formation of glaciers

There are some changes that are useful to us and we want them to take place. For example, the burning of LPG (or wood or coal) is a desirable change because the heat produced by its burning is used to cook food and for other heating purposes.

*Some more desirable changes are :*

- formation of curd from milk.
- cleaning of dirty utensils.
- ripening of fruits.



Cooking of food is a desirable change

So, the changes that are useful to us and that we want to take place are called **desirable changes**.

But there are some other changes that are harmful to us. The spoiling of food materials by bacteria or fungi is an undesirable change. This spoilt food becomes unfit for eating. It becomes waste. The occurrence of earthquake is also an undesirable change as it leads to the loss of life and property.



(a) Spoiling of food is an undesirable change



(b) Occurrence of earthquake is an undesirable change

Some undesirable changes

Some more undesirable changes are :

- flooding of rivers
- eruption of volcanoes
- occurrence of landslides
- forest fires

So, the changes that are harmful to us and that we do not want to take place are called **undesirable changes**.

So, some changes are desirable and some are undesirable. It is for this reason that the study of changes around us becomes significant to us. They affect our day-to-day life. We will study them under the following headings :

## 1. Slow and Fast changes

All changes take some time to occur. Different types of changes take different durations of time to occur. The changes that take a long time to occur are called **slow changes**. For example, the growth of seedlings into a tree takes many years. So, the growth of a tree is a slow change.



The growth of a tree is a slow change  
Slow changes

- Some more examples of slow changes are : rusting of iron, growth of a man, formation of curd from milk, weathering of rocks, formation of coal in the Earth, change of seasons and formation of clouds.

The changes that take a short time to occur are called **fast changes**. For example, when we strike a matchstick, it burns up quickly. So, the burning of a matchstick is a fast change.

- Some more examples of fast changes are burning of paper, beating of the heart, bursting of crackers, burning of fuels and occurrence of landslides, volcanoes and earthquakes.



Fast change

## Activity Time

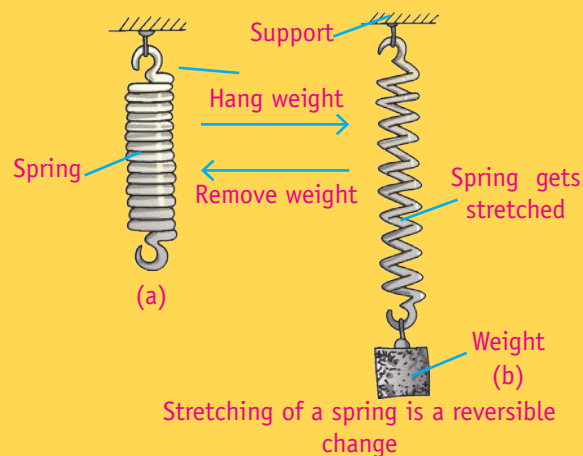
To study (i) the effect of hanging a weight on a spring  
(ii) the effect when it is removed.

**Things needed :** Spring, hook (for support), weight.

**Method :**

1. Take a spring and suspend it from a support.
2. Hang a weight to the lower end of this spring; it gets stretched and its length increases.
3. Remove the weight, the spring comes back to its original length.

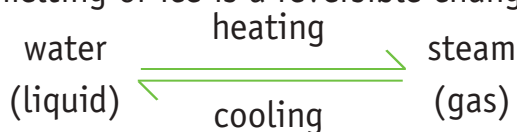
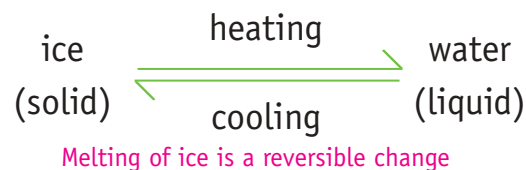
**Conclusion :** On applying force on the spring by hanging a weight, we see an increase in the length of the spring (change takes place). On removing the force by removing the weight, the spring regains its original length.



## 2. Reversible and Irreversible Changes

The stretching of a spring as we have seen in the above activity is an example of a reversible change. The change that can be reversed easily to obtain a substance in its original form is called a **reversible change**.

When we heat ice, it melts to form liquid water. Now if we cool this water, it again changes into ice. So, the changing of ice into water has been reversed by cooling. Thus, melting of ice is a reversible change.



Boiling of water is a reversible change

When we boil water, it changes into steam. Now, if we cool the steam, it again changes into water. So, the changing of water into steam has been reversed by cooling. Thus the boiling of water is a reversible change.

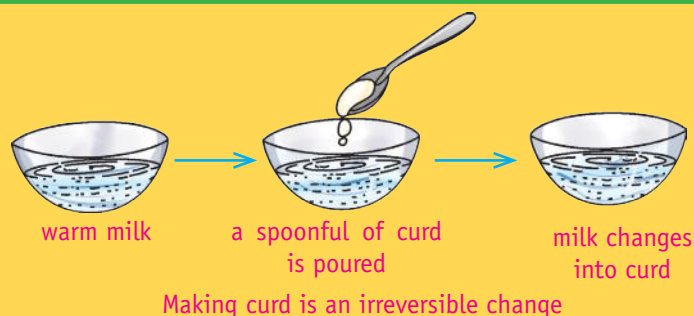
## Activity Time

To study the formation of curd from warm milk.

**Things needed :** Container, warm milk, a spoonful of curd.

**Method :** Take warm milk in a container. Add a spoonful of curd in the warm milk and stir it thoroughly. Cover the container with a glass plate and keep aside for 4-5 hrs.

**Observation :** We notice that after 4-5 hrs, the milk in the container changes into curd. It is semi-solid. It has a sour smell and tastes different from milk.





We can convert milk into curd. But, can we convert curd into milk? No, We cannot curd back to milk.

**Conclusion :** The formation of curd from milk is an irreversible change.

- The change that cannot be reversed to obtain a substance back in its original form is called an irreversible change.
- Some more examples of irreversible changes are : burning of paper, ageing of man, weathering of rocks, grinding of wheat grains into flour, cooking of food and burning of crackers.

### 3. Endothermic and Exothermic Changes



#### Activity Time

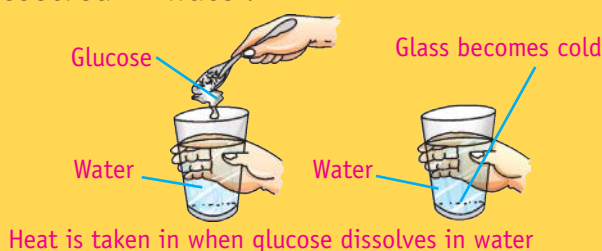
To study the involvement of heat when glucose is dissolved in water.

**Things needed :** glass container, spoon, glucose, water.

**Method :** Hold a glass. Pour some water into it. Also, put two spoonfuls of glucose in it. Stir the contents well.

**Observation :** On dissolving the glucose in the glass containing water, we find that the glass becomes slightly colder.

**Conclusion :** The dissolving of glucose in water is a change in which heat energy is absorbed (taken in) from the water, hence the water becomes cold.



A change during which heat is taken in (that is absorbed) is called an **endothermic change**.

If we put some glucose on our tongue, the glucose dissolves in the saliva and our tongue feels cool. This is because glucose absorbs the heat energy from the tongue. The tongue loses some heat energy and feels cool. So, the dissolving of glucose is an endothermic change in which energy is absorbed.

Take a look at some more examples of endothermic changes are :

- melting of ice on our palm.
- vaporization of perfume when put on our palm.
- dissolving ammonium chloride in water



#### Activity Time

To study the involvement of heat when quicklime is added in water.

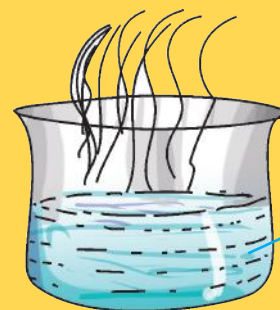
**Things needed :** Quicklime, water, metallic container, hand gloves.

**Method :** Take some quicklime in a metallic container and add water to it. We hear a hissing sound and the water starts boiling. We can feel the heat by touching the container. Be careful to touch only after covering your hand or after wearing gloves.

**Conclusion :** The mixing of quicklime with water is a change in which heat energy is given out from the mixture. Hence, the container becomes hot.

A change during which heat is given out (that is, evolved) is called an **exothermic change**. Some more examples of exothermic changes are :

- burning of fuels (like coal, wood, LPG, petrol, and diesel).
- burning of a matchstick



Water starts boiling when quicklime is mixed

Heat is given out when quicklime is mixed with water

## 4. Physical and Chemical Changes

One of the most important methods of classifying changes depends on whether new substances are formed during the change or not.

A change in which no new substance is formed is called a **physical change**. The changes in the state, size and shape of a substance are physical in nature, so, they are called physical changes. Let us consider some examples of physical change :

(i) When we heat ice, it melts to form water (liquid). Though ice (solid) and water (liquid) are different states of matter, they are both made of water molecules. Thus, no new chemical substance is formed during the melting of ice. So, the melting of ice to form water is physical change.

(ii) When a newspaper is torn into many pieces, each torn piece of paper is still paper. So, during the tearing of newspaper, only the size and shape of paper has changed. No new substance has been formed. So, **the tearing of a newspaper is a physical change**.



A newspaper



Torn pieces of newspaper

Tearing of a newspaper is a physical change

Most of the physical changes are temporary. They can easily be reversed.

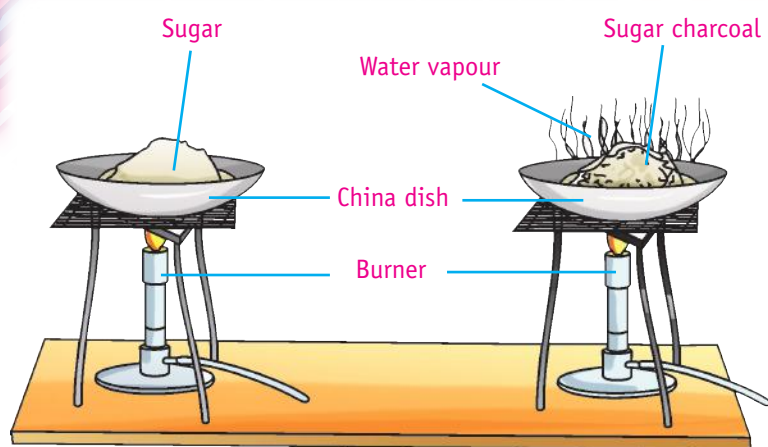
A change in which a new substance is formed is called a **chemical change**. The properties of new substances formed in chemical changes are entirely different from those of the original substances. Let us understand the same from the following examples.

(i) If we burn a piece of paper entirely, new substances like carbon dioxide, water vapour, smoke and ash are produced. So, burning of paper is a chemical change.

(ii) If we heat some sugar on high heat, it chars and forms a black substance called **sugar charcoal**.



Burning of paper is a chemical change



Charring of sugar is a chemical change

Water is eliminated in the form of water vapour. This sugar charcoal and water are entirely new substance. These new chemical substances are formed by the charring of sugar. So, charring of sugar is a chemical change.

Chemical changes are permanent changes. Most of the chemical changes are irreversible.

Some more examples of chemical changes are :

- rusting of iron
- germination of seeds
- burning of fuels (like coal and wood)
- digestion of food
- ripening of fruits and
- burning of fire crackers.



Rusting of iron



Germination of seed



Burning of coal

Some chemical changes





## DIFFERENCE BETWEEN PHYSICAL AND CHEMICAL CHANGES

The main difference between physical and chemical changes are given below :

S. No.	Parameter	Physical change	Chemical change
1.	Formation of new substance	No new substances are formed.	New substances with different properties are formed.
2.	Molecules of the substance	The molecules of the substance remain the same before and after the change.	The molecules of the substances change to form new molecules to make new substances.
3.	Nature of the change	Most of the physical changes are temporary and can easily be reversed.	Most of the chemical changes are permanent and cannot easily be reversed.

## Classification of change in more than one way

Many a time, we classify the same change in more than one way. For example

1. Rusting of iron is a	: slow change undesirable change irreversible change chemical change	
2. Burning of paper is a	: fast change irreversible change chemical change	
3. Growth of a tree is a	: slow change desirable change irreversible change chemical change	
4. Lighting of an electric bulb is a	: fast change desirable change reversible change physical change	

### How To Make Changes Take Place?

We have studied many examples of changes. Let us know how these changes can be brought about. Some ways by which we can bring about changes are : heating and cooling, applying pressure and mixing. Let us study them in detail.

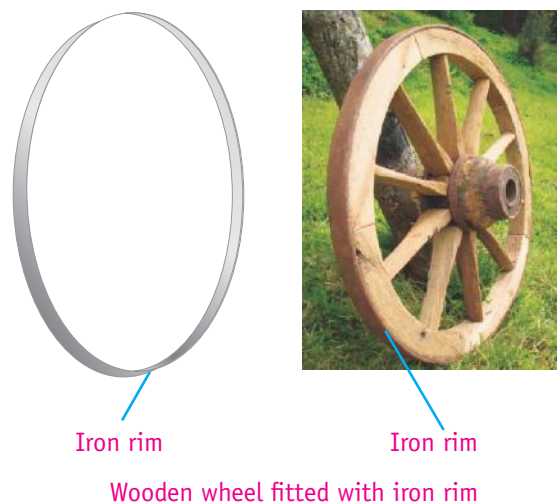
#### 1. Changes Caused By Heating or Cooling

Heating or cooling can cause many kinds of changes. Some important ones are discussed below.

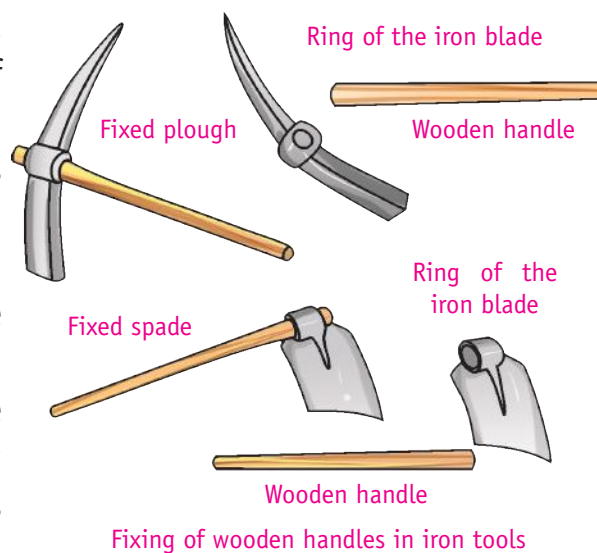
- (a) **Change in temperature** : When we heat water using a gas stove, then the temperature of water rises and it becomes hot. **Objects become hot on heating**. Similarly, if we keep the water in a refrigerator for sometime, then the temperature of water falls and it becomes cold. **Objects become cold on cooling**. The heating and cooling process goes on in nature due to the heat from the sun. The days are warm. The nights are cool. Summer is hot. Winter is cold. Land breeze and sea breeze are also caused by the heating and cooling of land and sea water.
- (b) **Expansion and contraction** : There are many materials that expand (that is, increase in size) on heating and contract (that is, decrease in size) on cooling. For example, metals like iron and aluminium expand on heating and contract on cooling. Let us understand how it works.



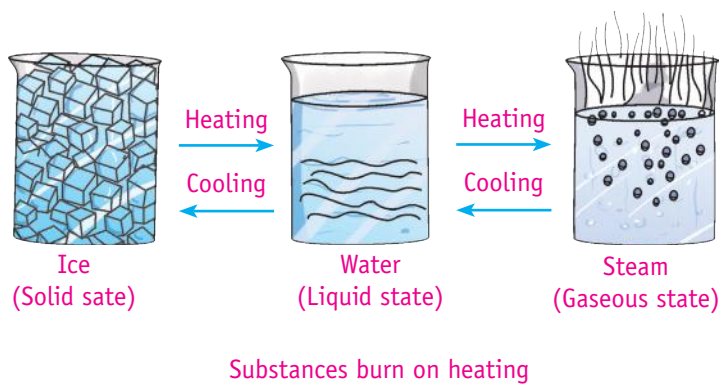
1. **Fixing of iron rim of bullock-cart wheel :** Bullock carts have wooden wheels. These wooden wheels are fitted with iron rims to make them last longer. The iron rim is made slightly smaller in size than the wooden wheel. The ironsmith heats this iron rim uniformly over a dry dung-cake fire. On heating the iron rim expands and becomes somewhat bigger in size. This hot iron rim is now easily put around the wooden wheel. Water is then poured over the hot iron rim to cool it. On cooling, the hot iron rim contracts (shrinks) and fits tightly around the wooden wheel.



2. **Inserting of iron blade :** Tools such as spades and ploughs are used for digging soil. The iron blade of these tools has a ring (oval-shaped hole) in which the wooden handle is fixed. Normally, the ring is made slightly smaller in size than the wooden handle. The ironsmith heats this ring of the iron blade over dry dung-cake fire. On heating, the ring expands and becomes somewhat bigger in size. Now, the wooden handle easily fits into the hot ring. Water is now poured over the hot ring to cool it. When the ring cools down, it contracts and fits tightly on the wooden handle.



3. **Change in state of matter :** We have already learnt that heating and cooling help us bring about a change in the state of matter. For example, on heating, ice (solid state) changes to water (liquid state) and water (liquid state) changes to steam (gaseous state). Similarly on cooling, steam (gaseous state) changes to water (liquid state) and water (liquid state) changes to ice (solid state).



4. **Burns on heating :** Whenever a combustible substance (for example, paper, coal and kerosene) is heated, it starts burning. Light a candle and observe it. After some time, we see that the size of the candle changes. The change is irreversible. Similarly, when paper is heated, it burns and turns into ashes. This is also an irreversible change.



## 2. Changes Caused By Pressure

Pressure can cause many kinds of changes. Some important ones are discussed below.

(a) **Change in shape and size** : Blow up a balloon. Force air into the balloon by applying pressure from your mouth. Observe that the shape and size of the balloon changes. Now, let the air escape from the balloon. The balloon deflates, and the shape and size again changes. Similarly, if we press fluffy solids (like a cushion, a loaf or a ball of wool), their shape change. When the pressure is released, they get back to their original shape. Metals can be given desired shapes by applying pressure. A tyre tube changes its shape and size when inflated. A gas balloon changes its shape and size when filled with gas.



Blowing balloon



A fluffy solid gets temporarily misshapen by pressure

Changes caused by pressure

(b) **Breaking objects** : When pressure is applied on brittle substances (for example, glass, biscuits and coal), they break into pieces. It is an irreversible change.



A brittle solid breaks under pressure

## 3. Changes Caused by Mixing Substances

We can bring about many changes—reversible and irreversible or physical and chemical— by mixing substances. For example, when we dissolve salt in water to obtain salt solution, it is a physical change. In the previous chapter, we learnt how to separate salt from its solution in water. So, we can say that it is a reversible change. When quicklime is mixed with water, it is converted into slaked lime. It is a chemical change. Also, it is an irreversible change.



### Activity Time

To find whether a fixed amount of water dissolves equal amounts of different soluble substances.

**Things needed** : A spoon, two beakers, water, sugar and salt.

**Method** :

Take two beakers A and B. Pour half a cup of water in each of them. Add a teaspoonful of sugar to one glass and stir till the sugar dissolves. Go on adding sugar, one teaspoonful at a time, till the solution gets saturated. Count the number of spoonfuls of sugar that get dissolved in the water and write it in the table below.

Substance	Number of spoonfuls dissolved in water
Sugar	_____
Salt	_____

Now repeat the same procedure with salt in beaker B.

**Observation :** We will find that more spoonfuls of sugar get dissolved than salt. In other words, the solubility of sugar in water is higher than that of salt.

**Conclusion :** Different amounts of soluble substances dissolve in a fixed amount of water so as to form a saturated solution.



### Know the Keywords :

Desirable Change : The change that are useful for us.

Undesirable Change : The change that are harmful for us.

Reversible Change : The change that can be reversed easily to obtain a substance in its original form.

Endothermic Change : A change a during which heat is taken in.



### Point to Remember

- The changes that are useful to us and that we want to take place are called desirable changes.
- The changes that are harmful to us are that we do not want to take place are called undesirable changes.
- The changes that take a long time to occur are called fast changes.
- The change that can be reversed easily to obtain a substance in its original form is called a reversible change.
- The changes that cannot be reversed to obtain a substance back in its original form is called an irreversible change.
- A change during which heat is taken in is called an endothermic change.
- A change during which heat is given out is called an exothermic change.
- A change in which no new substance is formed is called a physical change.
- A change in which a new substance is formed is called a chemical change.

## EXERCISE TIME

### A. Answer the following questions :

1. Describe an activity to show that milk can be changed irreversibly into a new substance.
2. Classify the following into physical and chemical changes :

(i) burning of coal (ii) freezing of water (iii) digestion of food (iv) tearing of paper (v) dissolving sugar in water (vi) baking of chapati (vii) rotting of food (viii) inflating a balloon (ix) rusting of iron

3. Classify the following as reversible or irreversible changes :

(i) cooking food (ii) melting of wax (iii) ripening of fruits (iv) inflating a balloon (v) ironing of a shirt (vi) growth of nails (vii) knitting of a sweater (viii) folding of paper (ix) rusting of iron

4. Classify the following changes in more than one way :

(i) inflating a balloon (ii) baking a cake (iii) digestion of food (iv) tearing of paper (v) melting of wax (vi) drying of wet cement (vii) drawing a picture on a sheet of paper (viii) flowering of a bud (ix) producing biogas from cow dung.

**B. Encircle the odd one. Give reasons for your answer :**

- |                         |                       |                     |                   |
|-------------------------|-----------------------|---------------------|-------------------|
| 1. Forest fire          | eruption of volcanoes | floods              | formation of curd |
| 2. Bursting of crackers | weathering of rocks   | formation of coal   | change of season  |
| 3. Burning of paper     | ageing of man         | cooking of food     | boiling water     |
| 4. Change of seasons    | freezing of water     | hammering of metals | beating of heart  |

**C. Fill in the blanks :**

1. Everything in this \_\_\_\_\_ undergoes a change.
2. All changes take some \_\_\_\_\_ to occur.
3. The \_\_\_\_\_ of water is a reversible change.
4. \_\_\_\_\_ of a newspaper is a physical change.
5. Heating or cooling can cause many kinds of \_\_\_\_\_.
6. \_\_\_\_\_ can cause many kinds of changes.

**D. Write 'T' for true and 'F' for false statements :**

1. The burning of LPG is a desirable change.
2. All changes take some time to occur.
3. The formation of curd from milk is a reversible change.
4. The tearing of a newspaper is a chemical change.
5. Pressure can cause many kinds of changes.

**E. Tick (✓) the correct option :**

1. Burning of coal is a :  
(i) slow change  (ii) natural change  (iii) reversible change
2. Which of the following is an undesirable change ?  
(i) raining  (ii) digestion of food  (iii) earthquake

3. Which of the following is a reversible change ?

(i) ripening of fruits  (ii) baking of a cake  (iii) contraction of metals

4. Which of the following is a chemical change ?

(i) grinding rice  (ii) breaking of a window pane

(iii) cooking food

5. Which of the following is not a chemical change ?

(i) burning of fuels  (ii) melting of ice  (iii) germination of seeds



## Creative Work

- Visit a blacksmith with your teacher to see how he makes different tools. Write in your note book the changes you observe.
- A list of some changes occurring in our daily life is given below. Name the type of change each one is. Also, write whether these changes are reversible or irreversible :

Change	Type of Change
1. Cutting of vegetables	_____
2. Formation of ice	_____
3. Digestion of food	_____
4. Lighting of bulb	_____
5. Making of tea	_____
6. Knitting of a sweater	_____