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**Certain icons are used in this  
textbook for convenience**



*For further reading  
(Evaluation not required)*



*ICT possibilities for making  
concepts clear*



*Significant learning outcomes*



*Let us assess*



*Extended activities*



Unit

1

# Life's Mysteries in Little Chambers

*The bell rang.. It is the Biology period now.*

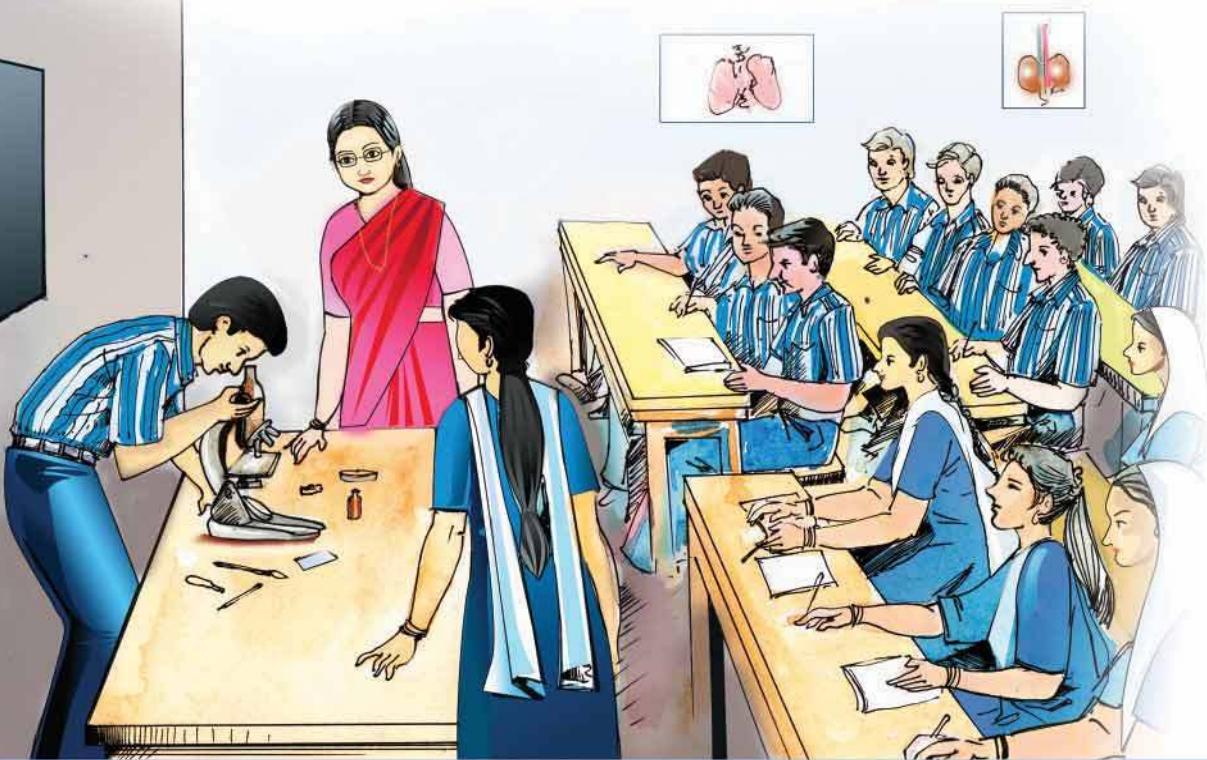
*Manu, the class leader, peeped out to the verandah and said,  
"Teacher is coming. She has something in her hand too".*

*It is her usual way. She always carries some materials in her hand. What  
is she bringing today? Everyone became anxious.*

*When the teacher entered the class, Rahna said in a loud voice,  
"I know it. Isn't it a microscope?  
And what is in your other hand, Madam?"  
"I'll tell you....."*

*The teacher placed the microscope on the table and gave the other  
materials to Meenu.*

*"Madam, isn't it the root of a plantain?"*



*"Well, don't you know that the body of all organisms are made up of cells? Let's observe the cells in the root of plantain through this microscope. Don't you remember having observed onion cells? Similarly arrangements should be made to observe the cells in the root of plantain. All required materials are there in this box. Who will do this?"*

*"I'll do Madam", Manu came forward enthusiastically.*

*He took the section of the root using a blade, placed it on a slide and observed it through the microscope...*

*Nothing could be seen! Then he turned the knob of the microscope. Feeling disappointed he said,*

*"No Teacher. Nothing is visible".*

Why were Manu's attempts a failure? Can you help him? For this, you must know how to operate a microscope and prepare materials for observation.

Let's familiarise ourselves with the microscope. Observe the microscope with the help of your teacher and identify the following parts and their use.

- Eyepiece              • Knob              • Objective lens
- Stage and clip      • Condenser      • Mirror

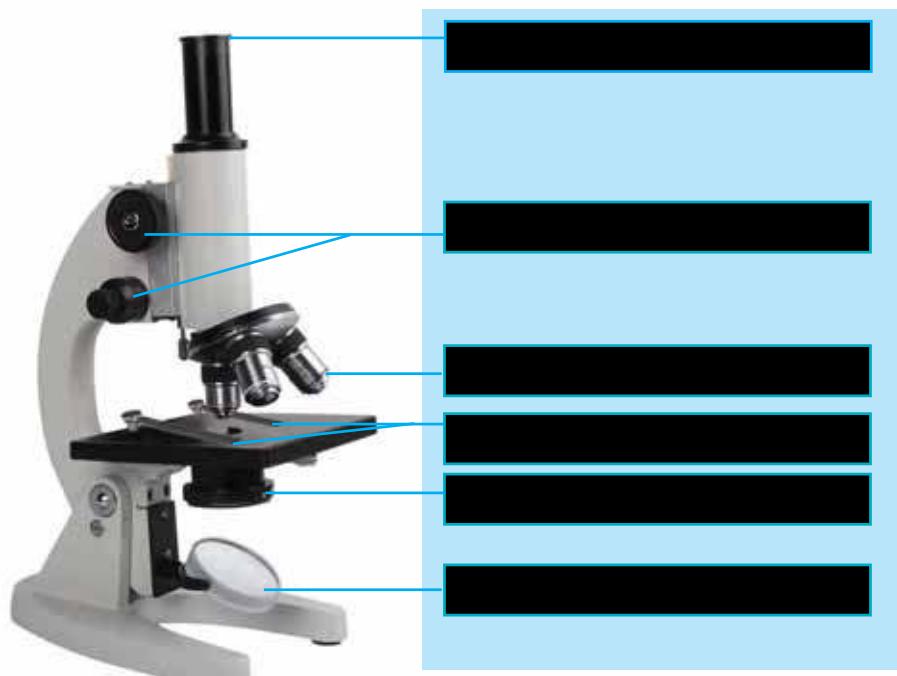


Fig. 1.1  
Compound microscope

The function of a microscope is to magnify objects, isn't it? Lenses are fixed in the microscope for this purpose. Name the parts where lenses are fixed.

- 
- 

Microscopes in which more than one lens is used are called compound microscopes (Fig 1.1).

Analyse the given description on the basis of indicators and note down your inferences in the science diary.

### Arrangement of light in a microscope

In the microscope, the part fixed below the stage is to reflect light on the material to be observed. This arrangement which is fixed in a metal ring has two planes, a plane mirror to reflect sunlight and a concave mirror to reflect artificial light. The lens in the condenser that is fixed on the lower side of the stage focuses light on the material to be observed. Diaphragm, a part of the condenser, helps to regulate the intensity of light.

### Indicators

- Why is a mirror fixed in a microscope?
- Why do we use a slide made of glass to place the material to be observed?

Have you understood the basic concepts of a microscope? Accuracy in using a microscope can be attained only through practice. Learn to operate a microscope using the permanent slides available in your science lab.

### Let's prepare the observation material

Preparation of observation material requires much accuracy and patience. Observe the illustration that shows the stages for the preparation of the slide to observe plant cells. Then prepare a slide by taking the cross section of the root of plantain.

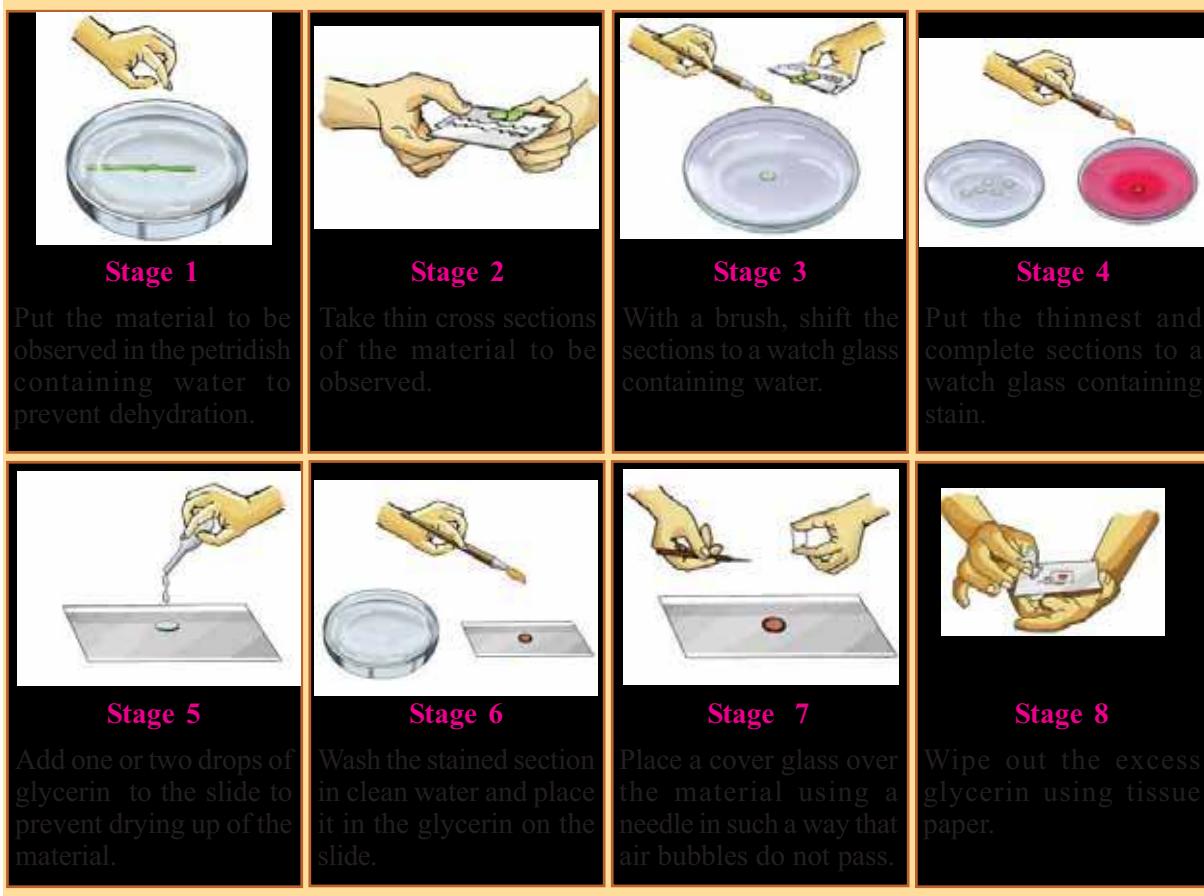


### Magnification power



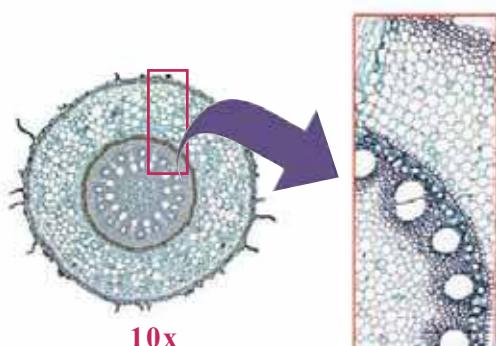
The magnification power of objective lenses are marked as 10x and 45x. Such markings can be seen in eyepiece too. The magnification power of a microscope is the result of multiplying the numbers seen in the objective lens and the eyepiece.

### Preparation of observation material



**Illustration 1.1**

Observe the slide you have prepared through a microscope. Try to understand the difference in the magnification when lenses 10x and 45x are used.



**Fig. 1.2**

**45x**

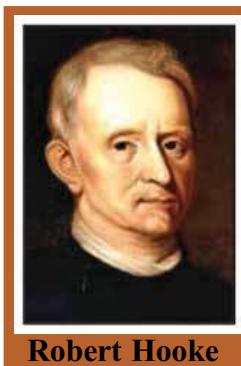
Recording the findings is as important as conducting practicals in science. Record each stage of the experiment following the sample given, in your science diary.

#### Sample of practical recording

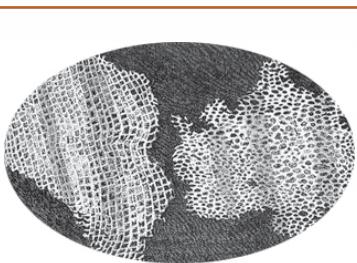
Aim	:
Materials required	:
Procedure	:
Observation	:
Inference	:

## Discovering the cell

Robert Hooke was the first scientist who observed cells with the help of a simple microscope. He observed the section of cork through a microscope and called the tiny chambers seen in the section 'cell.'



Robert Hooke



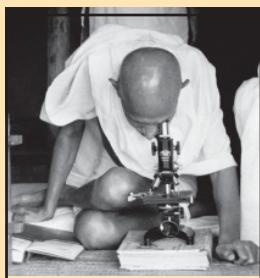
Cell observed by  
Robert Hooke

Fig. 1.3

Study of the cell is an extensive branch of science which is rapidly developing nowadays. It is known as Cell Biology. Remarkable findings that paved way for the development of cell biology were made in the middle of nineteenth century.



## Science for Survival



Gandhiji observing pathogens  
through a microscope  
(Sevagram Ashram – 1940)

It was the invention of microscopes that enabled us to observe and study microscopic pathogens. This brought about drastic changes in the field of medicine. Such instruments enabled us to overcome the limitations of vision and bring the diseases that the world dreaded, under control.

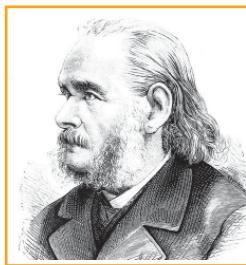
## Milestones in the history of Cell Biology



Robert Brown

Discovered the centre of the cell, and named it the nucleus.

1831



M.J. Schleiden

Found out that the body of a plant is made up of cells.

1838



Theodor Schwann

Found out that the body of an animal is made up of cells.

1839



Rudolf Virchow

Observed dividing cells and inferred that new cells arise only from existing cells.

1858

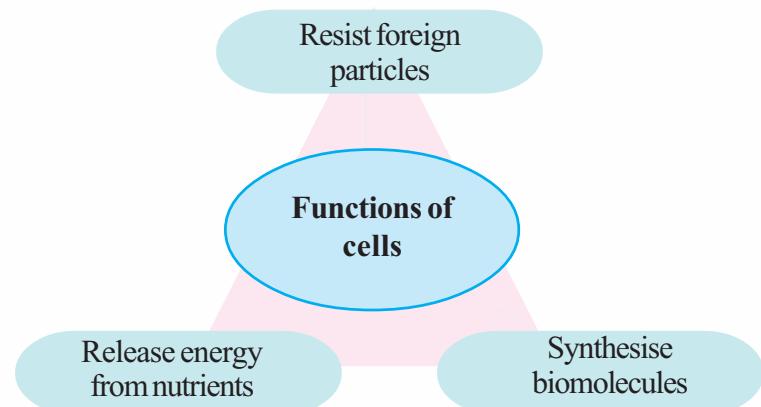
## Cell Theory

The cell theory was formulated by M.J.Schleiden and Theodor Schwann summarizing the findings of various scientists. It puts forward two main concepts -

1. The body of all organisms is made up of cells.
2. Cells are the structural and functional units of organisms.

What are the functions performed by cells?

Observe the illustration.



The structure of a cell is complex enough to perform all these functions. There are specific parts to perform each physiological function inside the cell.

Observe different parts of a plant cell.

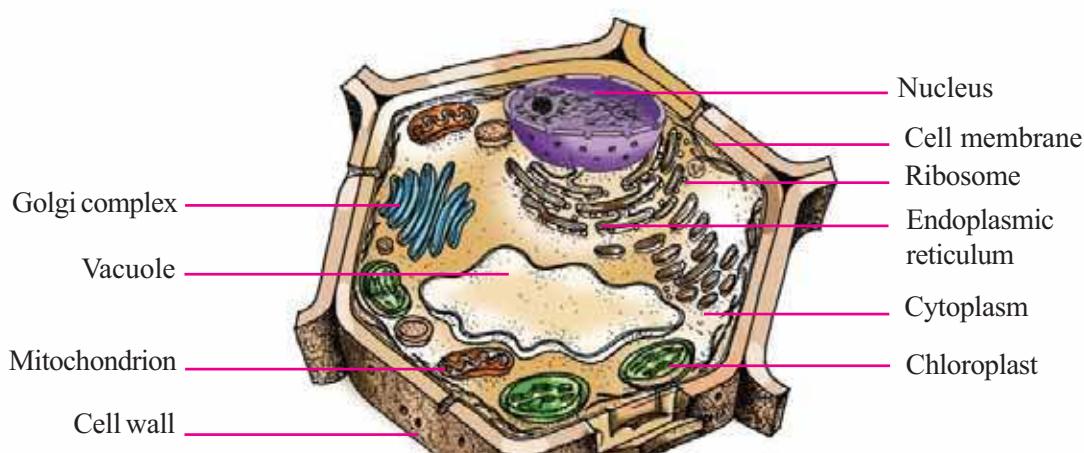


Fig. 1.4  
Plant cell

You are already familiar with the cell wall, the cell membrane (plasma membrane), the cytoplasm, the nucleus etc. What are the other parts you observed in the figure? List them.

- 
- 
- 
- 
- 



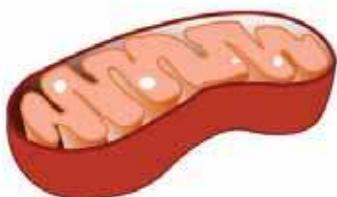
To get more information, pictures etc.,  
regarding cell – [http://en.wikipedia.org/  
wiki/cell\\_biology](http://en.wikipedia.org/wiki/cell_biology)

Read the following information to know more about each cell organelle.

### Protoplasm and cytoplasm

All substances inside the cell membrane constitute the protoplasm. Cytoplasm is the part of the protoplasm excluding the nucleus. All factors required for life activities are present in the cytoplasm. Cell organelles are the specific parts seen in the cytoplasm to perform physiological functions.

### Mitochondrion



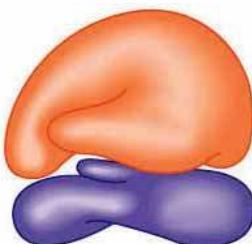
- Power house of the cell. Helps in the production and storage of energy.
- Abundantly seen in the cells of liver, brain and muscles where energy requirement is high.

### Endoplasmic reticulum



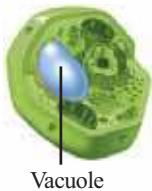
- The passage in the cell. Conduction of materials inside the cell takes place through this organelle.
- Also known as cytoskeleton as it provides firmness and shape to the cell.

### Ribosome



- Centre of protein synthesis in the cell.
- Seen either attached to the endoplasmic reticulum or free in the cytoplasm.

## Vacuole



- Covered by a characteristic membrane called tonoplast.
- Stores water, salts, excretory materials etc.

## Golgi complex



- Collects cell secretions like enzymes, hormones, mucous etc., in small vesicles.
- Seen in plenty in glandular cells.

Complete the illustration given below related to different kinds of organelles.

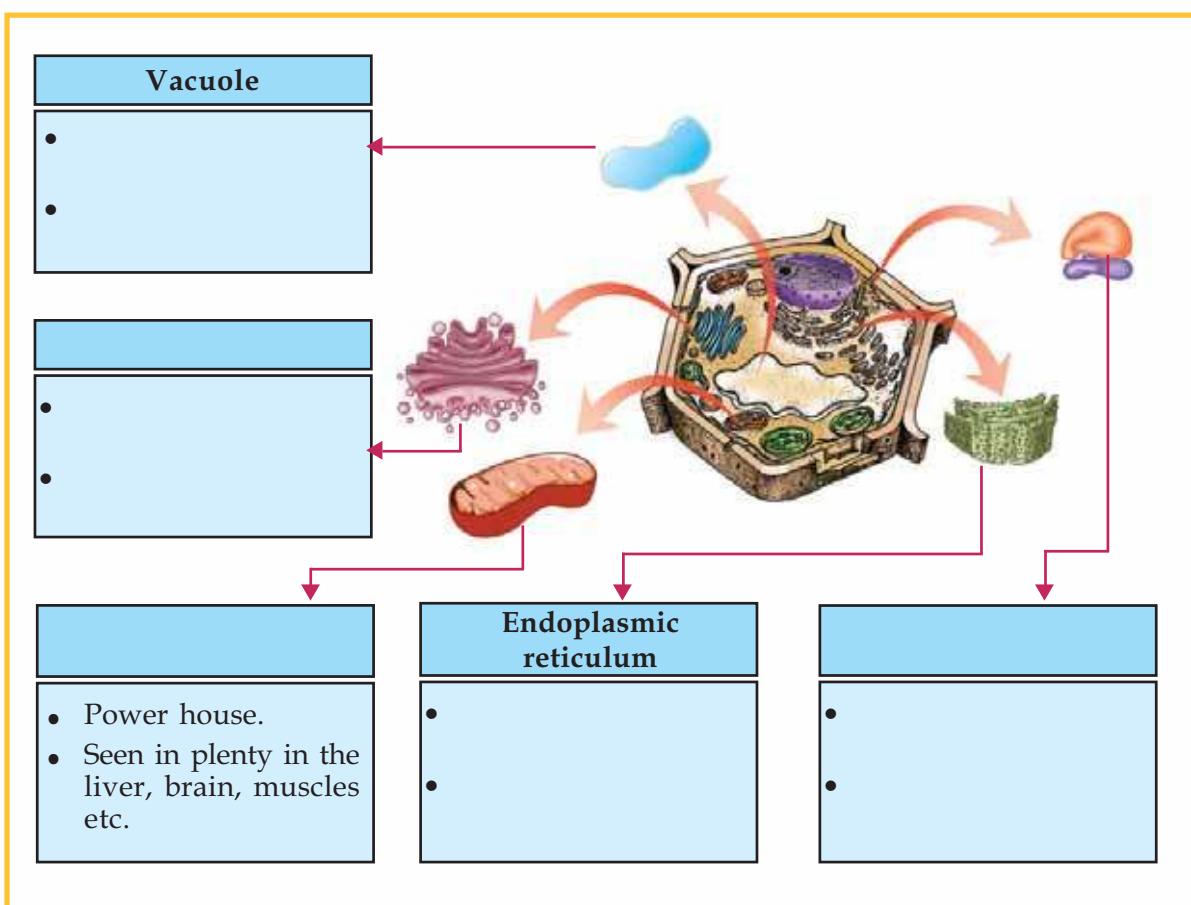


Illustration 1.2

## Stages of development

The development of cell biology is the result of the growth in the field of research of microscopes. A compound microscope magnifies an object only 2000 times (maximum) its size. Electron microscopes utilize electrons instead of a light source (Fig 1.6). With the emergence of the electron microscope, which magnifies objects million times clearly we got a thorough understanding of microscopic cell organelles.



Fig. 1.6  
Electron microscope

## Nucleus – the regulatory centre of the cell

Isn't it necessary to control and coordinate innumerable life activities in the cells? The various proteins produced in the cell play a major role in regulating various activities in the cell. The synthesis of proteins is under the control of genes in the chromatin reticulum in the nucleus. Hence the nucleus is considered as the regulatory centre of the cell.

Observe the illustration 1.3.



Fig. 1.5  
A microscope of the earlier times

The history of the microscope is the best evidence showing how science enables the development of technology and how technology enables the development of science. It would be very interesting to collect information and pictures of various microscopes from the simple microscope that helped Robert Hooke to observe tiny chambers of life to the advanced microscope that enabled us to understand the secrets of life within those tiny chambers. Organise an exhibition including all the collections.

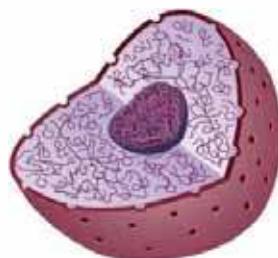


Fig. 1.7  
Nucleus

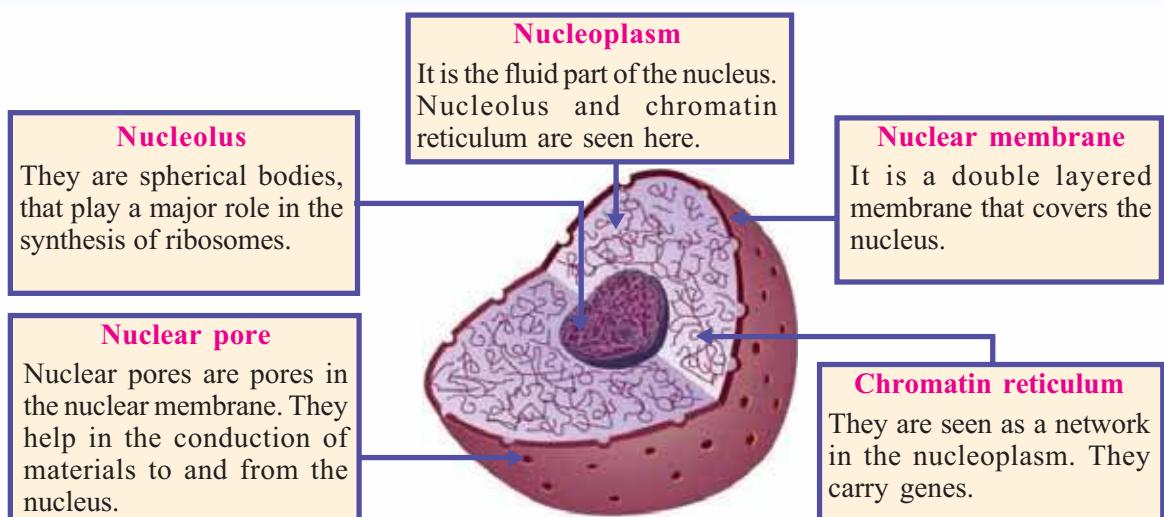


Illustration 1.3

Have you understood the different parts of the nucleus and their functions? Now complete the table given below.

Part				
Peculiarity				

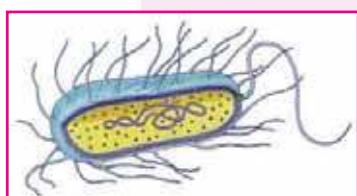
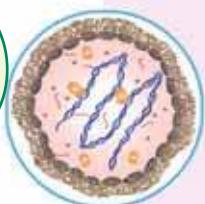
Table 1.1

### Prokaryotes and eukaryotes

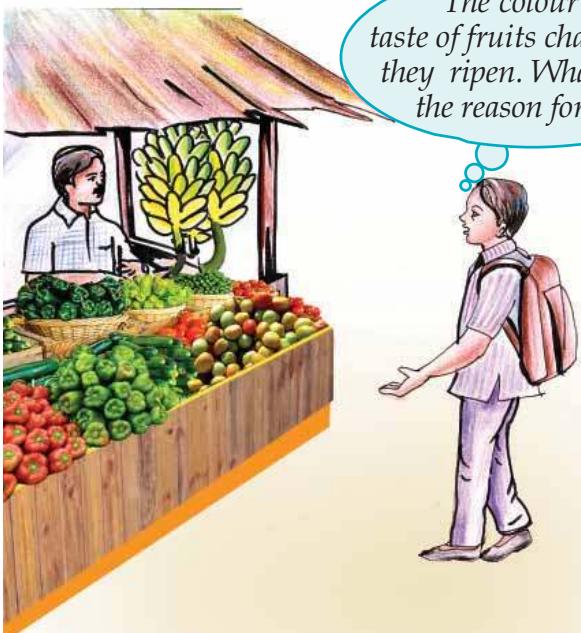
In the cells of bacteria, cyano bacteria and mycoplasma, no nucleus is seen. These organisms are called prokaryotes.

But in the cells of amoeba, animals and plants, a well defined nucleus covered by membrane is seen. These organisms are called eukaryotes.

*Isn't it surprising that cells exist even without a nucleus?*



## Those who change colour and taste



### Biomembranes

Didn't we see that the cell has a membranous covering. This covering separates the cell from its adjacent cells. Not only the cell, but the nucleus and many of the cell organelles also have membranous covering. These biomembranes regulate the exchange of materials between cells and between cell organelles and cytoplasm. These membranes are called selectively permeable membranes as they allow only the essential materials to pass.

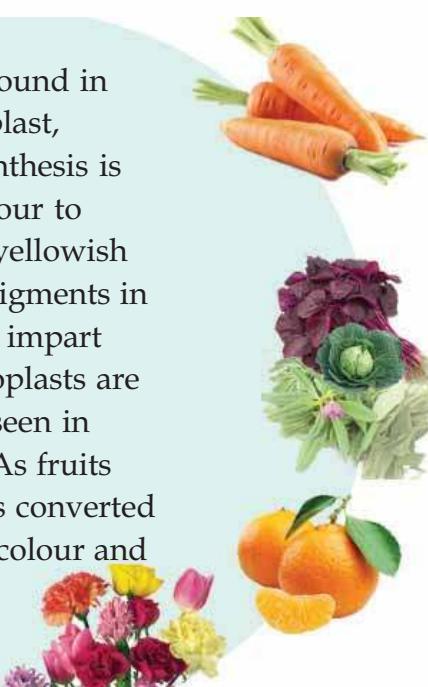
Haven't you had such doubts? Can you guess the reason?

Read the description below and check the validity of your guess. Discuss on the basis of indicators and record your inferences in the science diary.

### Indicators

- Plastids in the plant cells.
- Pigments in the chromoplasts.
- Chromoplasts and sunlight.
- Change of colour and taste in fruits.

Plastids are the cell organelles that are exclusively found in plant cells. They are of three kinds namely chromoplast, chloroplast and leucoplast. You know that photosynthesis is performed by chloroplast. Chromoplasts impart colour to flowers and fruits. Xanthophyll (yellow), carotene (yellowish orange), anthocyanin (red, purple) etc., are certain pigments in the chromoplasts. Various ranges of these pigments impart different colours to various parts of the plant. Leucoplasts are plastids having no specific colour. Leucoplasts are seen in plenty in the cells where food materials are stored. As fruits ripen, chloroplasts change to chromoplasts. Starch is converted to sugar. This is the secret behind the change in the colour and taste of fruits.



Haven't you now learnt about cell organelles that perform different physiological functions in a plant cell? Observe the illustration showing various cell organelles in the animal cell.

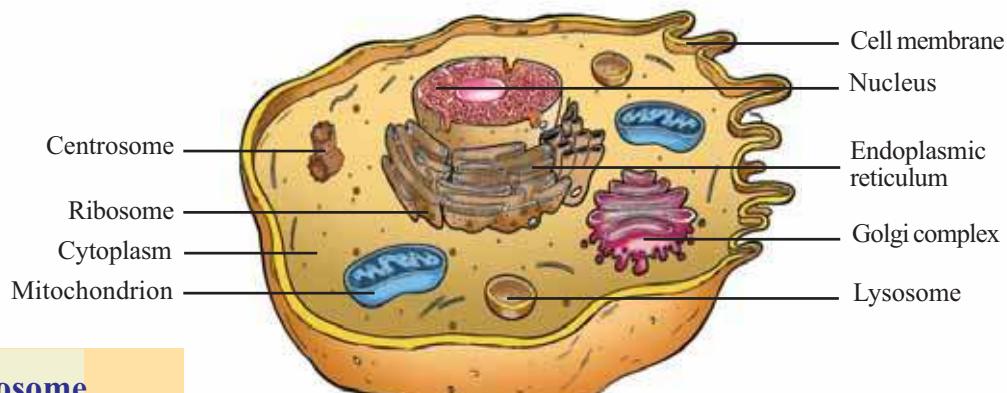


Fig. 1.8  
Animal cell

### Centrosome

Centrosome is the cell organelle that is found only in animal cells. The centrioles that play a major role in cell division are seen in the centrosome.

### Lysosome

Lysosome contains the digestive enzymes that are required for the destruction of foreign substances entering the cell. It is seen in animal cells.

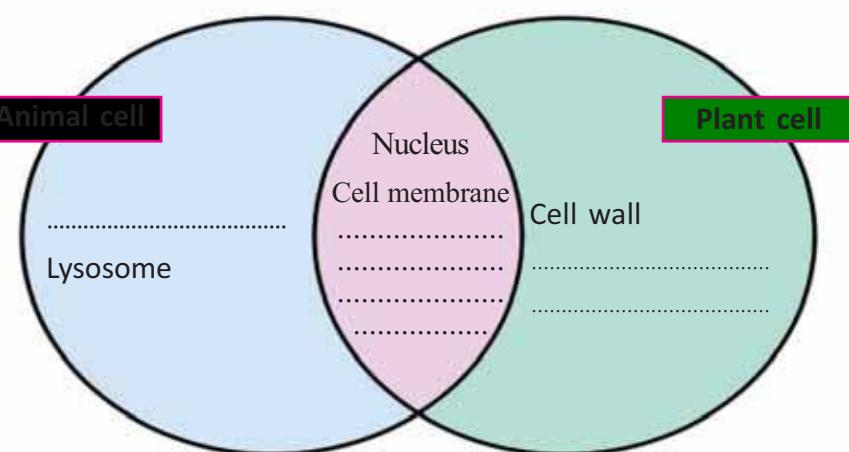


Illustration 1.4

Prepare an illustration like this showing the differences between prokaryotes and eukaryotes. Though organisms show diversity in their external characters, their cells show resemblances in their structure and function. This unity at the micro level is a clear evidence of the interrelationship of organisms.



## Significant learning outcomes

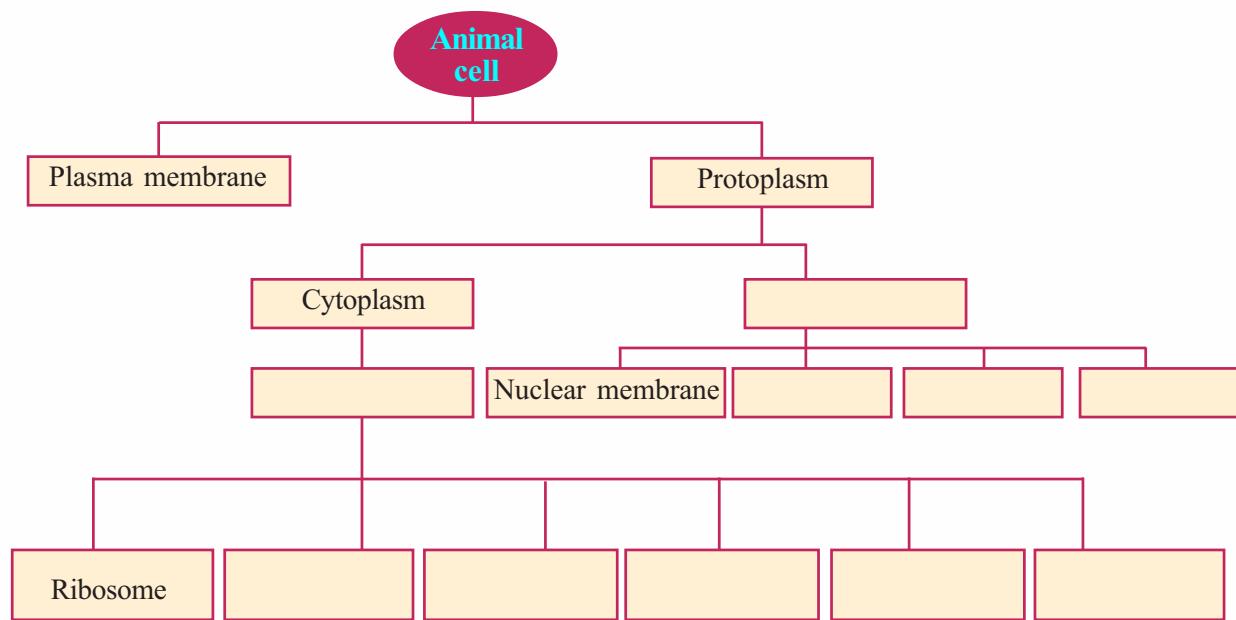
The learner can

- identify and explain cell as the fundamental unit of life.
- explain the milestones in the history of cell biology.
- compare different cell organelles and their functions and explain their similarities and differences.
- compare plant cell and animal cell and find out their similarities and differences.
- take sections of plant parts and prepare slides.
- handle microscopes accurately and precisely.

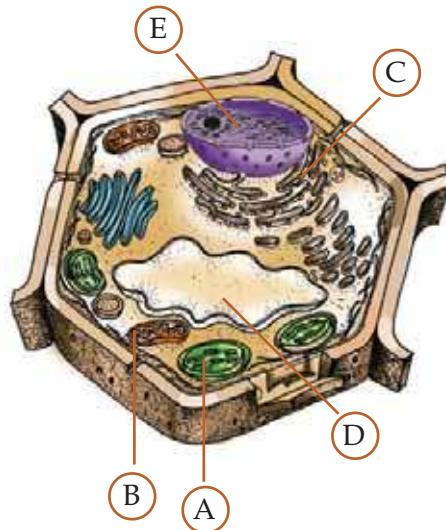


## Let us assess

1. Complete the concept map related to the structure of animal cells.



2. (i) Identify the parts A,B, C,D,E marked in the plant cell.



(ii) Write the function of the parts denoted by the letters given below.

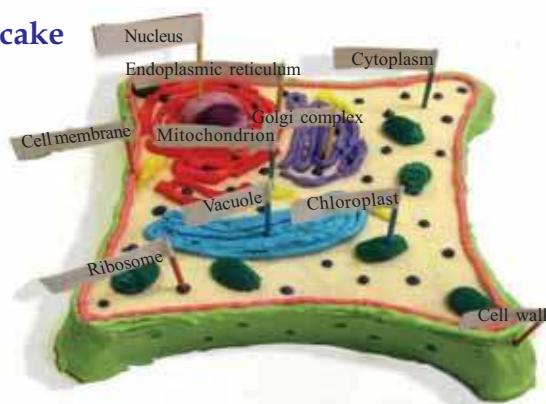
A	
B	
C	

(iii) In which part of the cell are genes found?



## Extended activities

### 1. Cell cake



This is the cell cake. Shall we prepare a wonderful cake like this?

What are the materials used? Discuss.

Cereals, vegetables, woollen threads, beads.....

Construct the model of a cell with your friends and exhibit it in the classroom.

## 2. Anu's poem



*Many are my shapes, and  
Many are my sizes.  
Many are those made of me,  
the grass and worm, and your  
body too!  
Many are the tasks I undertake,  
Into many I multiply and grow.  
Not visible to the naked eye  
though  
I am, I am the basis of life!  
In all and there am I.  
Now tell me, who am I?*

Could you answer Anu's question?

If yes, recite the poem with your friends rhythmically.

Can't you write a story, a poem or a cartoon based on the topic 'Cell'?

Prepare a magazine including the creative works of your friends.



Unit  
2

## Cell Clusters



Did you notice Unnikuttan's doubt?

What is your opinion?

.....

Are the same type of cells seen in all parts of the body? Analyse the illustration and description given below and write down the inferences in your science diary.

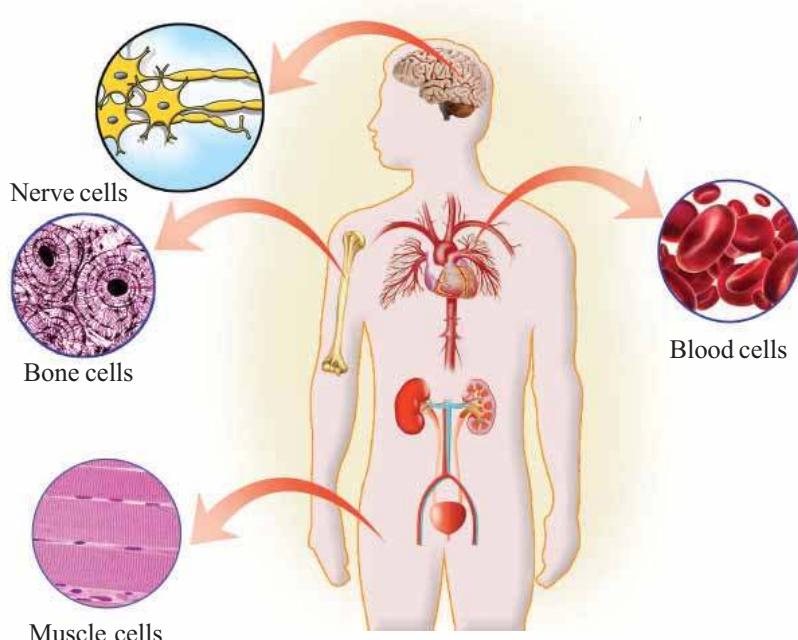
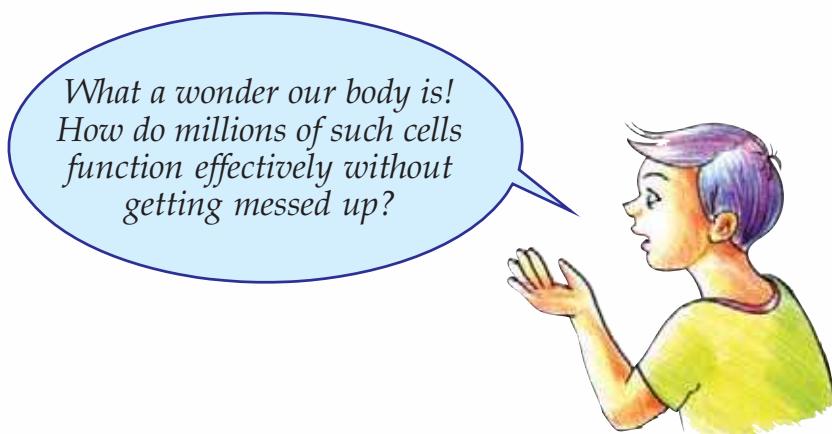


Illustration 2.1

## Diversity among cells

Each part of the human body is made up of millions of different kinds of cells. There are about 200 different kinds of cells like nerve cells, muscle cells, blood cells, bone cells etc., in the human body.



Yes, the human body is indeed a wonder. The well-being of the human body depends on the systematic and regulated action of the cells. Similar cells function together in groups, not separately. Such clusters of cells are called tissues.

### Tissues

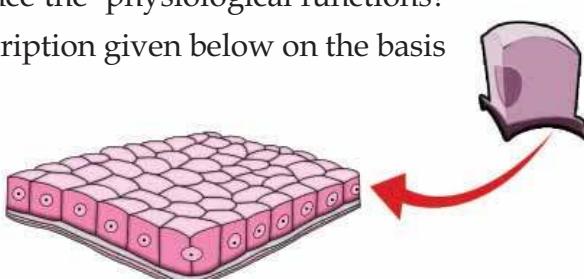
Tissues are groups of similar cells that have a common origin and perform specific functions. There are different kinds of tissues in multicellular organisms like plants and animals. The co-ordinated action of these tissues helps in performing different physiological functions effectively.

Have you observed the muscle cell and nerve cell in Illustration 2.1? Though both are cells, they differ so much in appearance.

What may be the reason for the differences?

How do these differences influence the physiological functions?

Conduct a discussion on the description given below on the basis of the indicators.



## **From a single cell !**

*Our body is developed from a single cell called zygote. The zygote undergoes continuous divisions and forms the foetus consisting cells of different shape, size and content. Foetal cells gradually attain change in structure and function. This process is known as cell differentiation.*

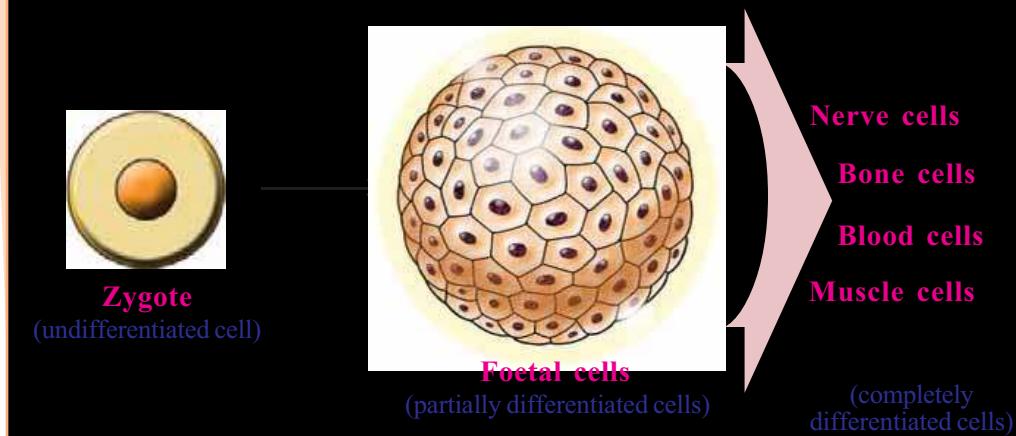
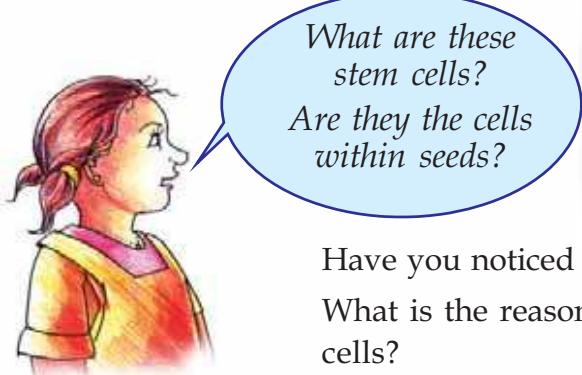


Illustration 2.2

### **Indicators**

- Formation of foetus.
- Significance of cell differentiation.

Write down the consolidation of the discussion in the science diary.



### **A giant leap in stem cell research**

Science has succeeded in artificially developing tissues from stem cells. A lot of research has gone into this achievement, which would become a milestone in the field of medicine.

Have you noticed Sneha's doubt about the newsclipping?

What is the reason for the immense popularity gained by stem cells?

Have a discussion on the description given below on the basis of the indicators.

## **Stem cells**

*Stem cells are specialized cells that can transform into any kind of cells. Stem cells undergo constant differentiation and get transformed into other kinds of cells.*

*Stem cells can either get transformed into other cells through division or exist as such. When the cells in the tissues get destroyed, new cells develop from the stem cells. Stem cells are found in the bone marrow, skin, digestive tract etc.*

*Nowadays, science can develop the desired type of cells from stem cells, in research centres, under specific laboratory conditions.*

*It is expected that the research of stem cells can bring about miraculous changes in the treatment of Blood cancer, Diabetes, Parkinson disease etc., and also in the manufacture of artificial organs.*



**Blood vessels developed from the stem cells in blood.**

## **Indicators**

- What are the peculiarities of stem cells when compared to other cells?
- How is the destruction of cells in tissues compensated?
- Why is stem cell research gaining importance?

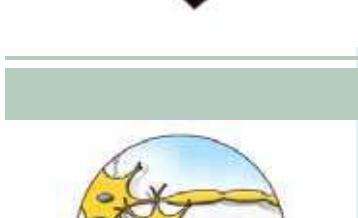
Record the consolidation of your discussion in the science dairy. Now let us read about the different types of animal tissues.

## **Animal tissues**



### **Epithelial tissue**

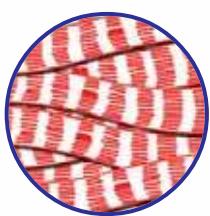
- covers and protects the body.
- lines the inner wall of the digestive tract.
- performs functions such as protection, absorption and production of secretions.



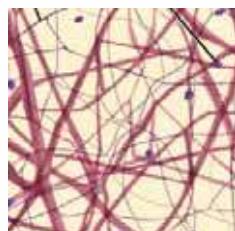
### **Nervous tissue**

- controls and coordinates physiological functions.
- enables to respond identifying the changes inside and outside the body.

## Muscular tissue



- consists of cells that can contract and regain the original state.
- enables the movement of the body.



## Connective tissue

- either connects different tissues or acts as a support to them. Bone, cartilage, fibrous tissue, blood etc., are various connective tissues.
- Bone and cartilage provide support, protection and a definite shape to the body.
- Fibrous tissue connects other tissues.
- Blood carries out the conduction of materials and makes the body resistant to diseases.



### Connective Tissues

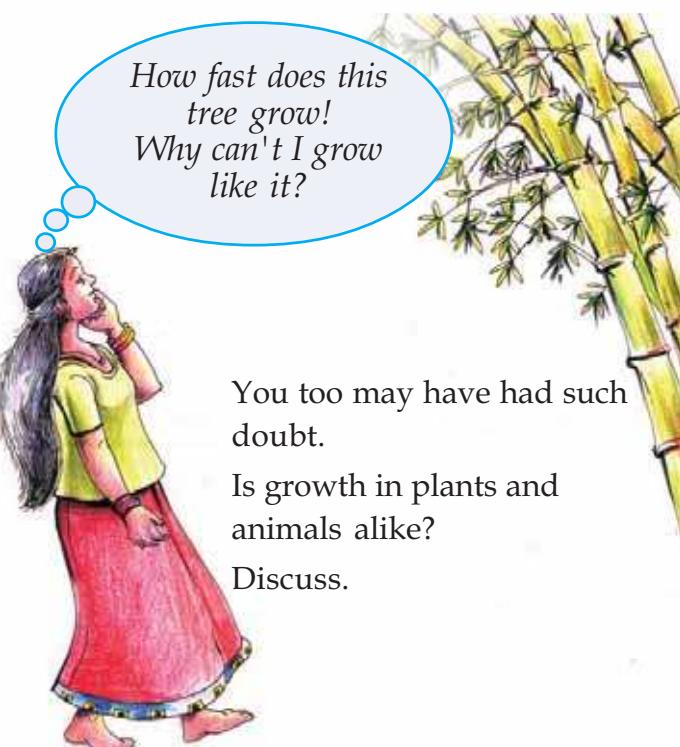
As the name suggests, connective tissues bind other tissues together. Tendons that connect muscles to the bones, ligaments that connect bones together and fibrous tissues that hold the eyes and kidneys in the proper place are examples for connective tissues.

Bone and cartilage, that are connective tissues help in movement and provide shape, support and strength to the body. Besides, they cover and protect internal organs.

Blood, the fluid tissue, also belongs to the group of connective tissues. Blood carries out various functions like transporting respiratory gases and nutrients, providing immunity etc.

Connective tissues are the most diverse and the largest in number in our body.

Observe the slides of animal tissues through a microscope with the help of your teacher. Prepare an illustration showing different types of tissues and their functions.



Growth in plants is mainly centered at the tip of stems and roots. But, in animals, growth is not confined to any specific area.

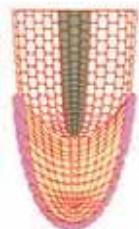
Why does growth in plants occur at specific areas?

Find the answer by analysing the following description.



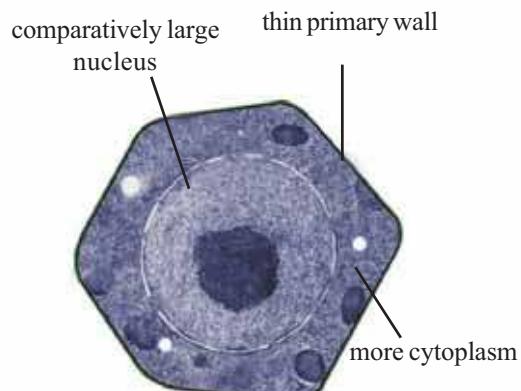
### Meristematic tissues

*Meristematic cells are specific cells seen at the tip of the stem and the root in plants. They undergo rapid division and this results in the growth of plants.*

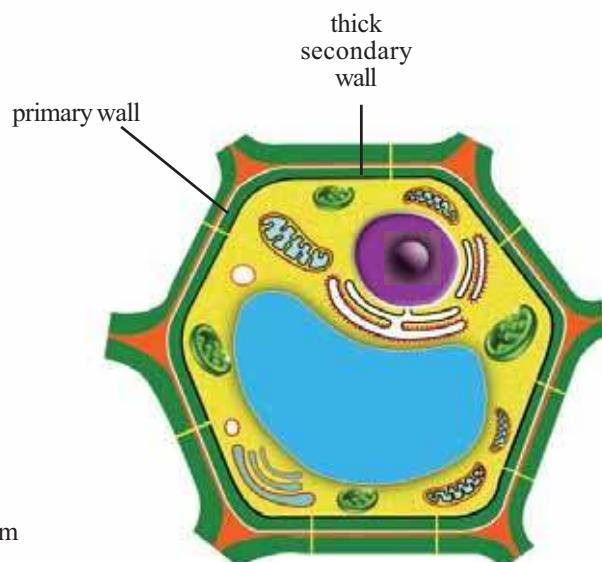


Compare the figures of a meristematic cell and a mature cell.

Find out the differences and complete the table.



Meristematic cell



Mature cell

Fig 2.1

Characteristics	Meristematic cells	Mature plant cells
• Relative size of the nucleus		
• Thickness of the cell wall		
• Quantity of cytoplasm		

Table 2.1

Different types of plant tissues are formed from meristematic cells. Parenchyma, collenchyma, sclerenchyma, xylem, phloem etc., are

different types of plant tissues. Let's observe these tissues through a microscope.

Observe the structure of a plant stem and prepare a note based on your observations. Identify the tissues observed with the help of Figure 2.2.

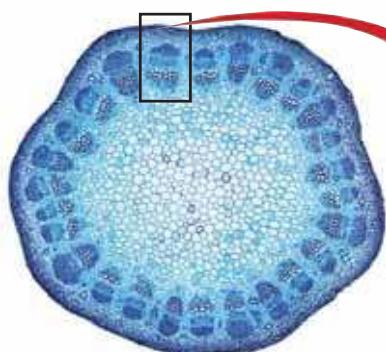
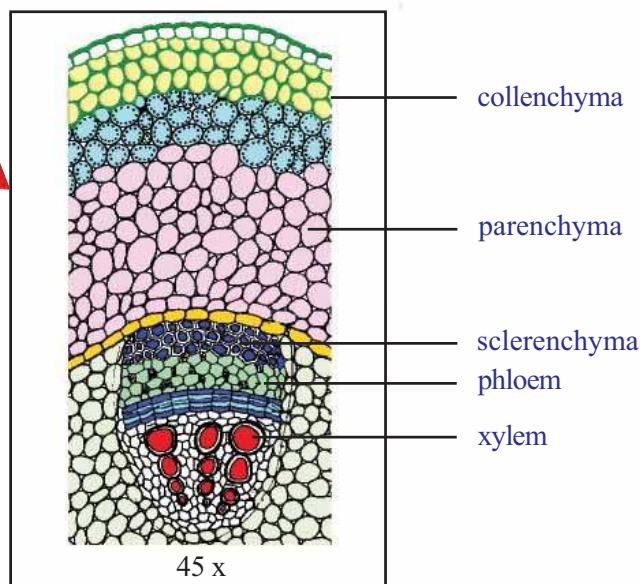
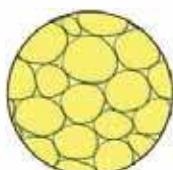


Fig. 2.2  
Structure of a plant stem



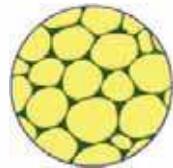
## Plant tissues

### Parenchyma



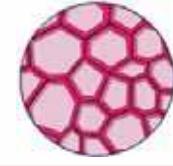
- composed of cells with the simplest structure.
- seen in the soft parts of the plant.
- helps in photosynthesis and the storage of food.

### Collenchyma



- composed of cells that are thick only at the corners of the cell wall.
- provides flexibility and support to plant parts.

### Sclerenchyma



- composed of cells that are uniformly thick all over the cell wall.
- provides strength and support to plant parts.

## Vascular tissues

The water and minerals absorbed by roots need to be transported to leaves and the food prepared in leaves need to be transported to different parts. The specialized tissues formed from peculiar cells to do this are called vascular tissues. They are called complex tissues because they are formed from different kinds of cells. The two types of complex tissues found in plants are xylem and phloem.

### Xylem

- tubes formed from elongated cells.
- transports water and minerals absorbed by the roots to the leaves.
- has thick cell walls and therefore provide support and strength to the plant.

### Phloem

- composed of tubular inter-connected cells.
- transports food synthesized in the leaves to various parts of the plant body.

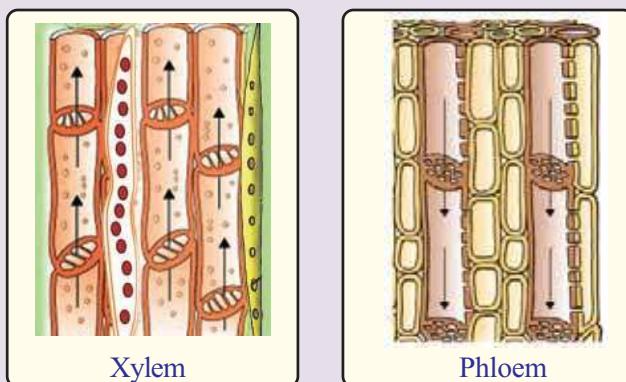
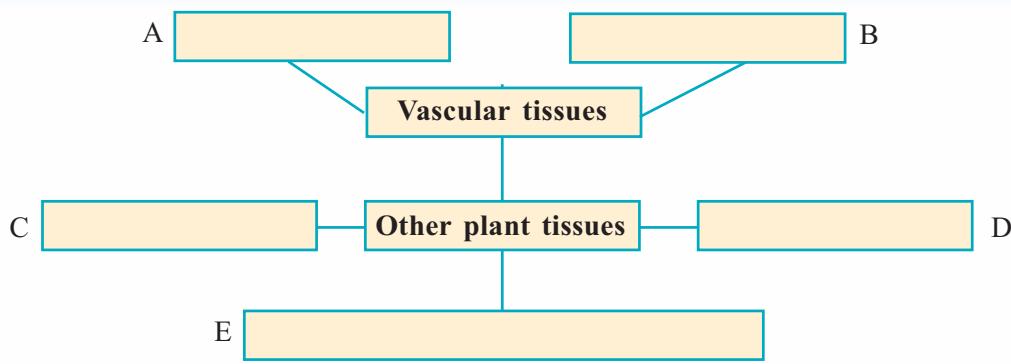


Fig 2.3

Now you have understood the different types of plant tissues and their characteristics. Complete the following worksheet based on the hints given below.

- A. transports food prepared in the leaves to various parts of the plant.
- B. transports water and minerals absorbed by the roots to the leaves.
- C. seen in the tender parts of the plant.
- D. only the corners of the cell walls are thick.
- E. cells that are uniformly thick all over the cell wall are seen.



*Cells combine to form tissues.  
What if tissues combine...?*

Write your response to this.

Do tissues work together just as the cells do?

Based on the indicators, analyse the illustration given below.  
Write your inferences in the science diary.

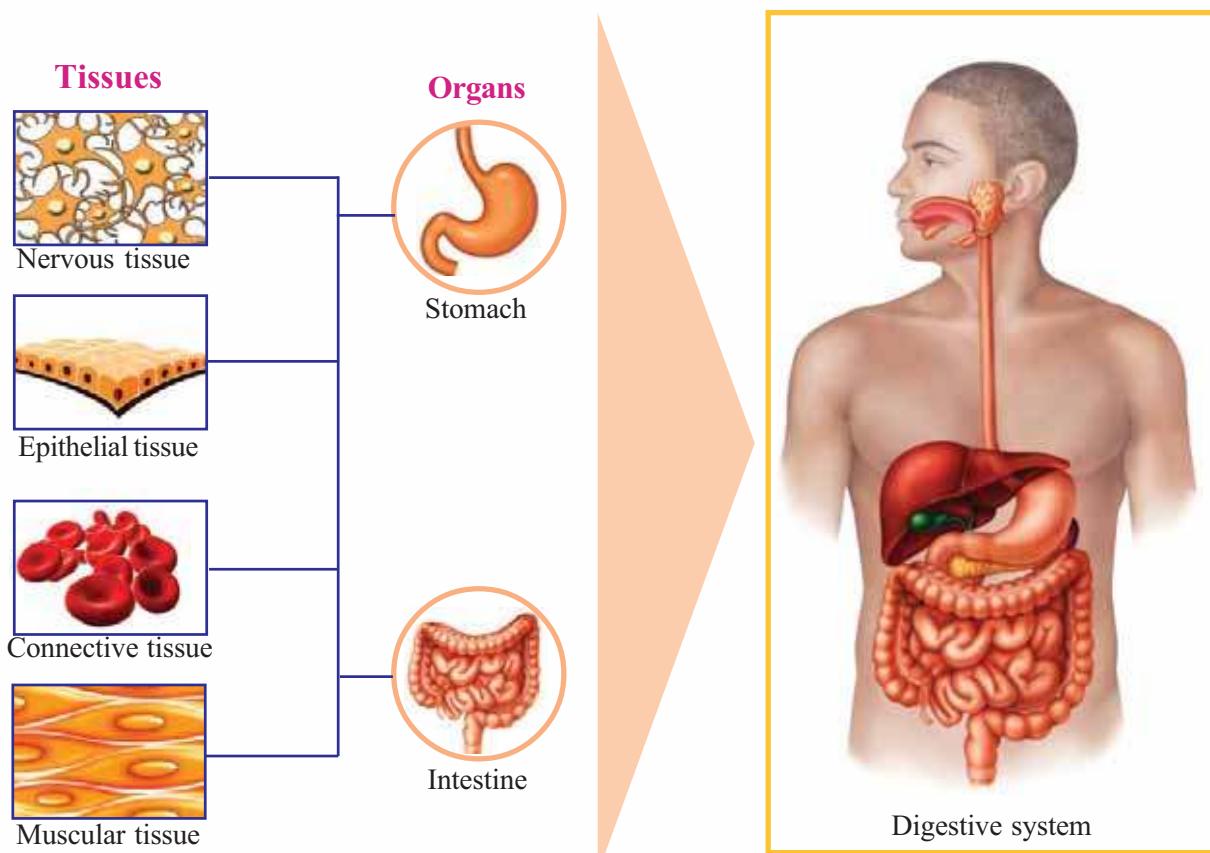


Illustration 2.3

## Indicators

- What are the functions performed by each tissue in the illustration?
- What are the important tissues that the stomach and the intestine are made up of?
- What is the function of the stomach?
- What is the function of the intestine?
- Is the function performed by an organ the same as the function of its constituent tissues?
- What is the advantage of organs with the same function working together as a system?

Tissues combine to form organs. What would happen when organs combine? Discuss.

- Physiological functions are smoothly carried out by the combined action of many organs. Digestion is the process of the combined action of organs of the digestive system such as stomach, liver and intestine. Whether the functioning of the digestive system alone is sufficient to transport the nutrients produced by digestion, to different parts of the body? Discuss.
- Complete the following table by finding out the systems to which the organs listed in the table belong to:



For more details and pictures of tissues  
[http://en.wikipedia.org/  
wiki/Tissue\\_\(biology\)](http://en.wikipedia.org/wiki/Tissue_(biology))

Organs	Organ system
Heart, blood vessels	
Nose, trachea, lungs	
Kidney, ureter, urinary bladder	
Brain, nerves	

Table 2.2

No organ system can function independently. A given physiological activity can be completed only by the combined action of different organ systems.

You have understood that cells combine to form tissues, tissues combine to form organs and organs combine to form organ systems.

Discuss what happens when organ systems combine together.

Aren't you now convinced that an organism is a combination of different organ systems?

An organism can survive only when these organ systems work in a coordinated way.

As organ systems become complex, the structure of the body also becomes complex. The structure of higher order animals including human beings is complex, as it is formed by a combination of various organ systems.

Do all organisms have an organ system?

However unicellular organisms also exist on the earth?

Discuss.

Cell is the basic unit of life.

Parts of the cell are formed of various substances.

You might have learnt that all substances are basically formed of atoms.

Observe the illustration which shows the levels of organisation from atom to community. Prepare a note and record it in your science diary.

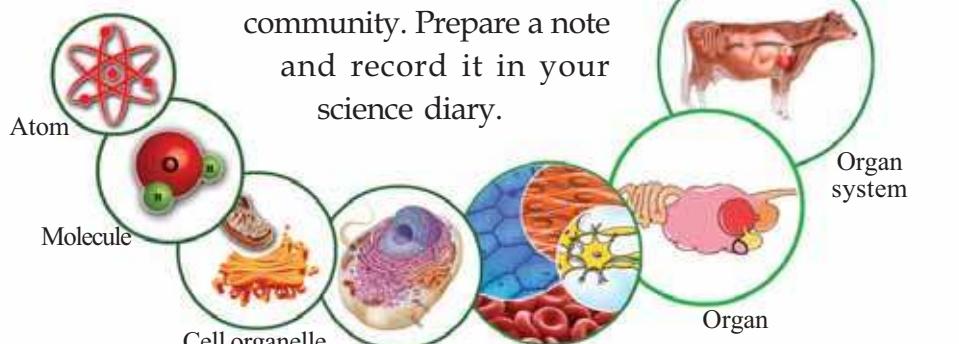


Illustration 2.4

A complex living body is formed by the continuous division and differentiation of cells. In organisms that belong to higher levels of organization, different types of tissues act complementarily to perform several complex physiological activities. Efficiency of the organisms increases with the variety of its tissues. Hope you have understood the importance of functioning together. Isn't it relevant in our social life too?



## Significant learning outcomes

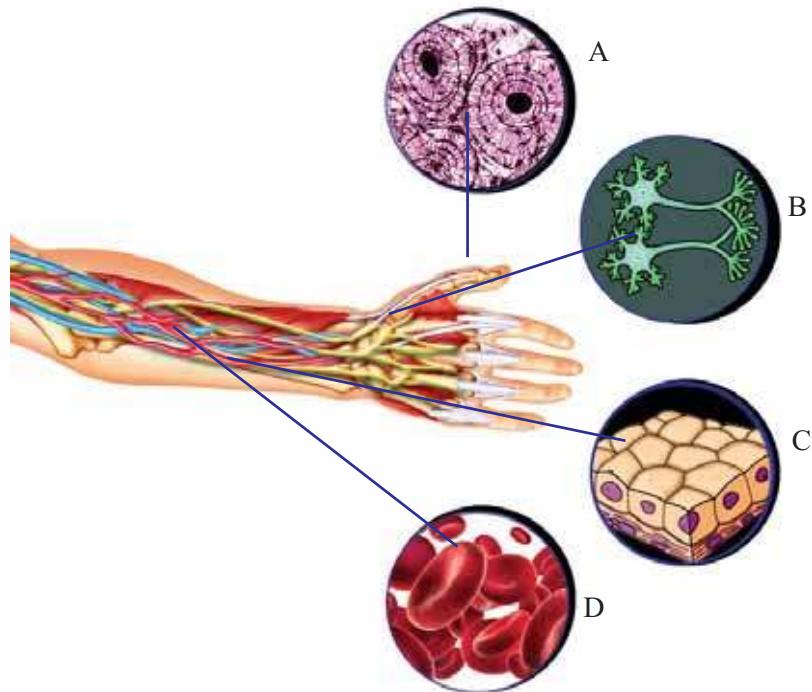
The learner can

- identify and explain the formation of tissues from cells.
- identify and explain the characteristics and functions of animal tissues.
- list the characteristic features of meristematic cells.
- identify and explain the formation of different types of cells from the zygote.
- identify the structure of various plant tissues and list their functions.
- identify and illustrate different levels of organization in organisms.



## Let us assess

1. Given below in the illustration are various tissues related to the structure of hand.



Observe the illustration and write the alphabet suitable to each statement.

- provides support, protection and shape: .....
- covers the body parts : .....

- transports substances : .....
  - helps to respond by recognizing changes: .....
2. Which among the following statements is not related to tissues?
    - a. different types of cells are seen.
    - b. similar kinds of cells are seen.
    - c. performs specific function.
    - d. formed from different cells.
  3. Which indicator helps to identify collenchyma when it is observed through a microscope.
    - a. thin cell wall.
    - b. uniformly thick cell wall.
    - c. no nucleus in the cell.
    - d. only the corners of the cells are thick.



### Extended activities

1. Arrange an exhibition showing pictures and descriptions of different types of cells.
2. Prepare a magazine specifying the importance, relevance and scope of stem cells.



# Unit 3

## Let's Regain our Fields

### Food scarcity



### Food security

Illustration 3.1

Didn't you notice the illustration and the newspaper report ?

What is the concept indicated by the illustration?

Discuss it with your friends using the given indicators. Write your inferences in the science diary.

- reasons for the scarcity of food.
- role of science in solving the problem.
- relevance of food security.

### Loksabha passes Food Security bill

New Delhi :The Loksabha has passed the Food Security bill. The bill ensures the distribution of food grains at a lower rate. The bill has been legalized to distribute rice at a price of 3 rupees and wheat at 2 rupees per kilogram.



## For a prosperous future

Food security is the situation that ensures sufficient food for everyone to lead a healthy life . It is necessary to ensure food security for a better and healthy society where there is no poverty or health issues due to lack of nutrition.

Isn't rice our staple food? Examine the table given below related to the production of rice in Kerala. Analyse the information based on indicators and write the inference in the science diary.

Year	Rice production		Population (in crores)
	Area of land for Cultivation (in lakh hectares)	Production (in lakh tonnes)	
1971	8.75	13.65	2.13
1991	5.5	10.6	2.91
2011	2.08	5.69	3.34

Courtesy : Janapatham

Table 3.1

### Indicators

- What were the changes that occurred in the area of agricultural fields from the year 1971 to 2011?
- What tendency could be observed in rice production and population growth during the period?
- Is this tendency desirable? Why?

We have so far examined only the production of rice. The case is not different with other food items too.

How is it that we have to depend on other states for fruits, vegetables, egg and meat?

It is a challenge to ensure food security in a situation when cultivable land is decreasing. It is essential to recreate a culture of love for the soil and agriculture. Regaining lost cultivable land is also important. Only through a comprehensive approach can we reduce our excessive dependence on others for food.

## Crises in the agricultural sector

What are the obstacles faced by farmers today?

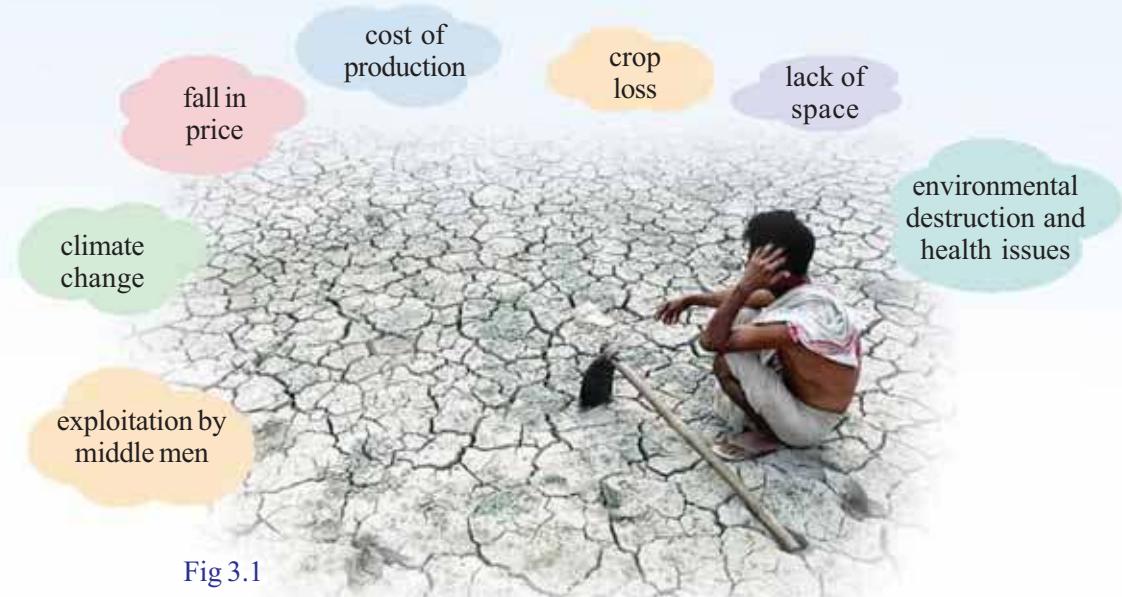


Fig 3.1

Prepare a note using the indicators in the picture and by adding more information.

Don't you think that many problems can be overcome if the approach to agriculture is made scientific? Let us examine the possibilities to overcome each issue.

Discuss the description given below based on the indicators. Write your inferences in the science diary.

### Fertile soil, the basis of food security

About 20 different elements are required for the proper growth of plants. They are known as essential elements. Carbon, hydrogen, oxygen, nitrogen, phosphorus, potassium, sulphur etc., are examples of essential elements.

These elements are made naturally available in the soil through decomposition by microorganisms.

Haven't you learnt the advantages of growing leguminous plants in fields? Besides this, the fertility of the soil can be improved through the application of fertilizers too. The pH of the soil is also an important factor that influences the growth of the plants. The presence of elements in the soil and the pH value can be identified by soil testing. Organisms like bacteria, fungi, algae, termite, earthworm etc., help to increase soil fertility.

## Indicators

- What is the role of microorganisms in ensuring the natural availability of elements in the soil?
- What is the need of testing the soil?
- Why does the application of fertilizers become essential for better crop yield?

Farmers use different kinds of fertilizers in order to increase the fertility of the soil. You are familiar with different kinds of fertilizers such as chemical fertilizers, bio-fertilizers, green leaf manure etc. Now observe the picture below.



Read the pamphlet Geethu got from the Agricultural Officer when she sought to clarify certain doubts.

### Microbes that provide fertilizers

Microbial fertilizers are substances that contain microorganisms which help to increase the fertility of soil. The presence of microbes enables increase in the soil factors which are essential for plant growth. Bacteria like *Rhizobium*, *Azotobacter*, *Azospirillum* and aquatic plants like *Azolla* can be used to increase nitrogen content in the soil.

#### Things to be taken care of

- ensure the availability of biofertilizers in the soil.
- proper irrigation should be provided.
- chemical fertilizers or chemical pesticides should not be used.

Microorganisms can exist in soil only if these precautions are taken.

What are the consequences of unscientific application of chemical fertilizers? Discuss on the basis of the following indicators.

- composition of soil
- microorganisms in soil
- health issues
- financial factors

Organise an exhibition for creating awareness among farmers.

### To control pests

Isn't pest infestation yet another important problem faced by our farmers? People generally apply chemical pesticides to overcome this.

Chemical pesticides destroy pests totally. But when the pests acquire resistance, the quantity of pesticides has to be increased.

Excessive application of chemical pesticides causes many environmental and health issues.

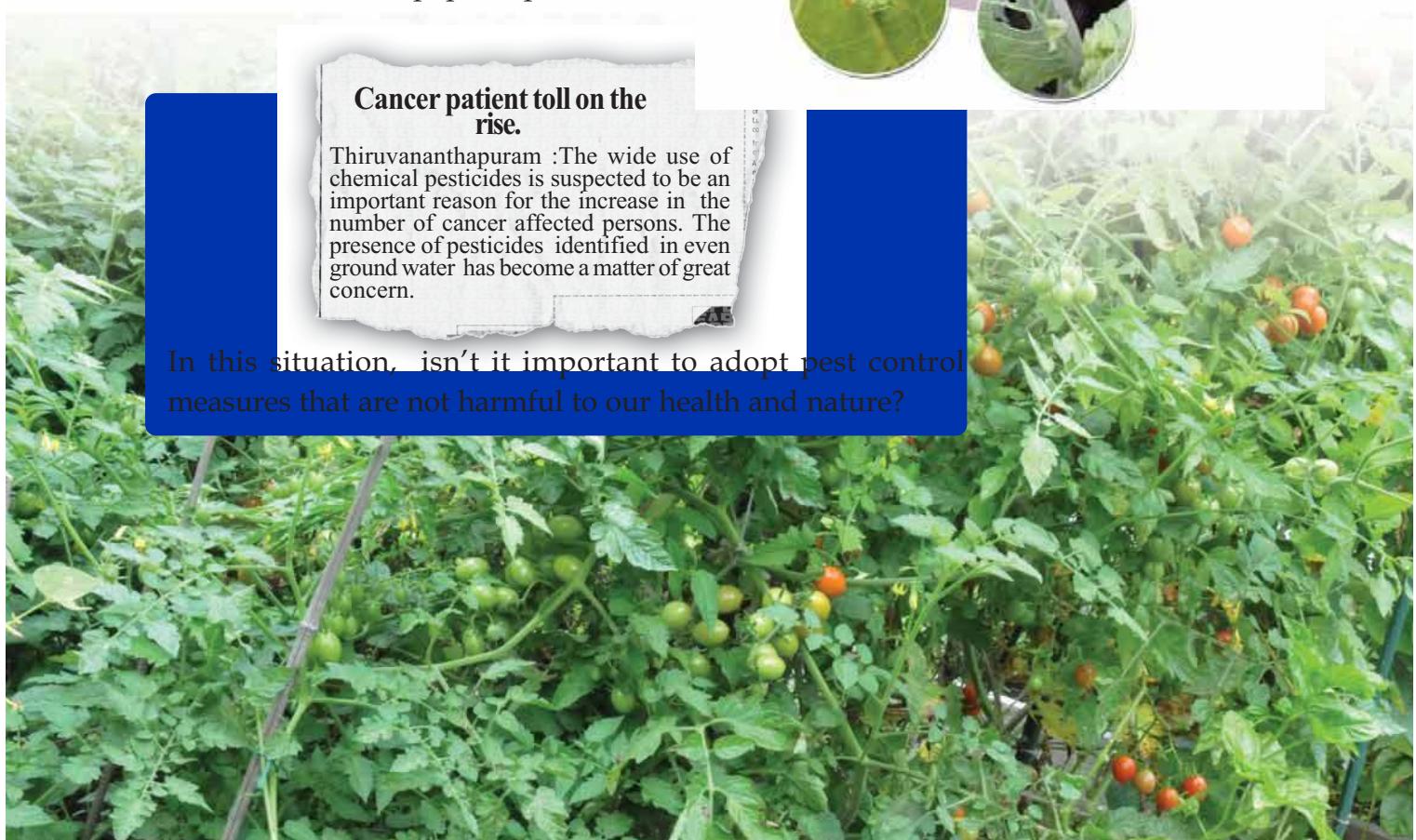
Now read this newspaper report.



#### Cancer patient toll on the rise.

Thiruvananthapuram :The wide use of chemical pesticides is suspected to be an important reason for the increase in the number of cancer affected persons. The presence of pesticides identified in even ground water has become a matter of great concern.

In this situation, isn't it important to adopt pest control measures that are not harmful to our health and nature?





## Modern technology and pests

With the large scale production of chemical fertilizers research in other areas of pest control has not been encouraged adequately. Although it is proved that pests can be controlled by using ultrasonic sound waves, such technologies are not accessible to farmers.

Another possibility of controlling the multiplication of pests is destroying the reproductive capacity of male pests using radiations.

Devices like pheromone trap are becoming more widespread. The method employed here is to attract and destroy insects using artificial substances that have a chemical nature similar to that of pheromone emitted by insects. Its demerit is that it is easily evaporated by heat and wind and dissolved by water. However, now, with the help of modern technology, it is possible to develop artificial pheromone traps which are not exposed to any chemical and physical change.

Read the science excerpt given below.

### Pests and their natural enemies

Have you ever thought of the tremendous increase of certain pests? The main reason for this is the fall in the number of organisms that prey on them. Predators, parasites and pathogens of pests can be called natural enemies of pests. The service of these organisms may be effectively utilized in agriculture.



### Integrated Pest Management-IPM

The basic principle of Integrated Pest Management is not the destruction of pests totally. Instead it tries to prevent the multiplication of pests and to limit their number without loss of crop.

This ecofriendly method ensures pest control without disturbing the environment. This is done by reducing the use of chemical pesticides and encouraging the application of biopesticides, natural enemies of pests, mechanical pest control etc.

Measures of pest control that do not cause any harm to the environment are desirable. Let us list the advantages of Integrated Pest Management.

- 
- 
- 



*See 'Keedaniyanthranamargangal'.  
in School Resources in IT @  
School, Edubuntu.*

The high investment required for agriculture makes it uneconomic. The high cost of seeds, fertilizers and pesticides, makes the farmer a debtor.

The decline in the fertility of soil and the increase of pests compel peasants to use fertilizers and pesticides in greater quantities.

But though the excessive use of fertilizers and chemical pesticides provide profit for a short period, gradually the land may become barren.

It is in these circumstances that the concept of sustainable agriculture becomes relevant. Here the method adopted is to reduce the use of fertilizers and pesticides and to make one's decaying matter a manure for another. Diverse crops are seen in the fields adopting this method. No waste remains. By giving importance to the cultivation of food crops, market dependency and price hike can be reduced. Conservation of biodiversity also becomes possible by cultivating native varieties of crops.

### **Waste management and sustainable agriculture**

One of the main problems faced by modern society is the disposal of organic waste. Will sustainable agriculture be an answer for this? Discuss with the help of the given indicators and write your conclusions in the science diary.

- composting
- biogas production
- fodder production
- poultry fodder production
- production of fish feed



Fig 3.2 Biogas plant



### **The changing perspective**

High yield seed varieties were widely popularised as part of the efforts to increase agricultural production, to meet the demands of the increasing population. This was accompanied by wide use of fertilizers and pesticides. In this practice, since the seeds and fertilizers are brought from outside to the agricultural field, this method may be called HEIA (High External Input Agriculture). However, this method was criticized for its heavy expense and its adverse effect on health and environment. Gradually, LEISA (Low External Input Sustainable Agriculture) began to receive wide recognition. LEISA emphasises the perspective that only agriculture with minimum use of external materials can be sustainable. This method allows the use of fertilizers and pesticides in limited quantity, under emergency situations. As a stage ahead, this method envisages NEISA (No External Input Sustainable Agriculture) as a possibility, wherein one's waste becomes the manure for another and therefore sustainable and not dependent on anything from outside.

## Reaping diversity

There are different agricultural sectors which help to earn better income through a scientific approach. Let us try to familiarize ourselves with a few farming methods that can be chosen on the basis of their nature and scope.

### Livestock management

Rearing cattle for milk, meat and agricultural purposes.

#### Important varieties of cattle

Cow : Jersey, Holstein Friesian, Vechoor

Buffalo : Murrah, Niliravi, Bhadawari

Goat : Thalassery, Jamnapari,  
Boer



### Poultry farming



Rearing birds for egg and meat.

Chicken varieties : Athulya, Gramalekshmi, White Leghorn

Duck varieties : Muscovy, Chara, Chemballi

Quill varieties : Japanese, Bob white.



### Sericulture



Rearing silkworms for the production of natural silk is called sericulture. Silk is formed from the special glands of the larvae of the silk moth. Mulberry silkworm, Tussar silkworm, Muga silkworm etc., are the major varieties.

### Pisciculture

The scientific way of rearing fish in natural water bodies, paddy fields or artificial tanks, is pisciculture. Varieties such as Pearl spot, Rohu, Catla etc., are reared for food and Gold fish, Guppy etc., are reared for ornamental purposes. Important prawn varieties reared are Naran, Kara etc.



## **Floriculture**



Cultivation of flowering plants on a commercial basis. Jasmine, Marigold, Chrysanthemum, Rose, Orchid, Anthurium etc., are flowers of commercial demand.

## **Apiculture**

Scientific rearing of honey bees. Honey is a product of medicinal and nutritional value. Varieties of honey bees like Kolan, Mellifera, Njodiyan etc., are reared commonly.



## **Cuniculture**



Scientific way of rearing of rabbits. Varieties like Grey giant, White giant etc., are reared for meat. Ankora is reared for fur.

## **Mushroom culture**



Scientific way of growing mushroom. Mushroom is a nutritious and tasty food item. Button mushroom (*Palkoon*), Oyster mushroom (*Chippikoon*) etc., are commonly cultivated mushroom varieties.

## **Horticulture**

Scientific cultivation of fruits and vegetables. Besides indigenous varieties, exotic varieties like Litchi, Rambutan, Durian etc., are cultivated in our land.



## Medicinal plant cultivation

The Indian system of medicine ‘Ayurveda’ exists completely depending on medicinal plants. The popularity of Ayurveda and the destruction of natural ecosystems have raised the importance of medicinal plant cultivation. Basil, Aloe, Neem, Adathoda, Sida (*Kurunthotti*), Vettivera (*Ramacham*), Aegle marmelos (*Koovalam*), Plumbago (*Koduveli*) etc., can be grown in crop fields.



Complete the following table related to various agricultural sectors.

Sector	Products	Varieties
	.....	Pearl spot, Rohu
	Honey, wax	.....
	Mushroom culture	.....
	Livestock management	.....
	.....	Ankora, Grey giant
	.....	.....
	Poultry farming	.....

Table 3.2

## *Come on farmers ... be hitech*

Farmers in the district have been encouraged to enter hitech farming...

Haven't you noticed the newspaper report?

What are the advantages of adopting modern agricultural practices?

- can increase production
- can control weeds and pests
- 

Climate change is another important crisis in the agricultural sector. The unpredictable climate adversely affects traditional farming methods. The techniques that are used to overcome these challenges are gaining currency nowadays. Familiarize yourselves with some such new techniques.

Discuss the given information based on indicators and write the inferences in your science diary.

### **Polyhouse Farming**

Polyhouse is a special kind of arrangement in which a crop field is completely or partially covered by transparent polyethene sheets. Since the temperature and moisture in the polyhouse is constantly regulated, growth of plants becomes rapid. Nutrients are dissolved in water and are supplied on plants through drip irrigation. Pest infestation will also be less because the sides of the polyhouse are covered with net. Although the expense is high in the beginning, crop yield is many times greater than that of the regular field.



Fig 3.3  
Polyhouse farming

### **Precision Farming**

In this method of farming, the nature of soil, quantity of elements in the soil, pH value of soil, presence of water etc., in the crop field are tested using modern technology, and appropriate crops are selected for cultivation. By covering the soil using polythene sheet, we can effectively control weeds and also limit irrigation.



Fig 3.4  
Precision farming

## Cultivation without soil !

Can we grow plants without soil? If so, is it possible to overcome the crises in agriculture like climate change, change in soil texture, lack of irrigation facility etc? Science has proved that cultivation is possible in the absence of soil even though there are limitations to popularize it as a method of cultivation. Aeroponics and hydroponics are examples for this.

In hydroponics, plants are grown in nutrient solution. In aeroponics, plants are grown in such a way that their roots grow into air and nutrients are sprayed directly, on roots.



Fig 3.5  
Hydroponics



Fig 3.6  
Aeroponics

### Indicators

- How are modern agricultural practices helpful in reducing crop loss due to climate change?
- What are the advantages of precision farming?
- How does cultivation become possible without depending on soil?

In modern agricultural practices, hybrids are used to ensure productivity. There are also arguments in support of a return of traditional agricultural practices because it is beneficial to nature and humans. It also argues that modern methods have many limitations. In traditional agricultural practices, indigenous varieties are used.

Is it essential to retain indigenous varieties when many hybrid varieties are available? Note down your opinion.

Read the description and check the validity of your opinion. Collect more information on this topic and organize a debate in your class.

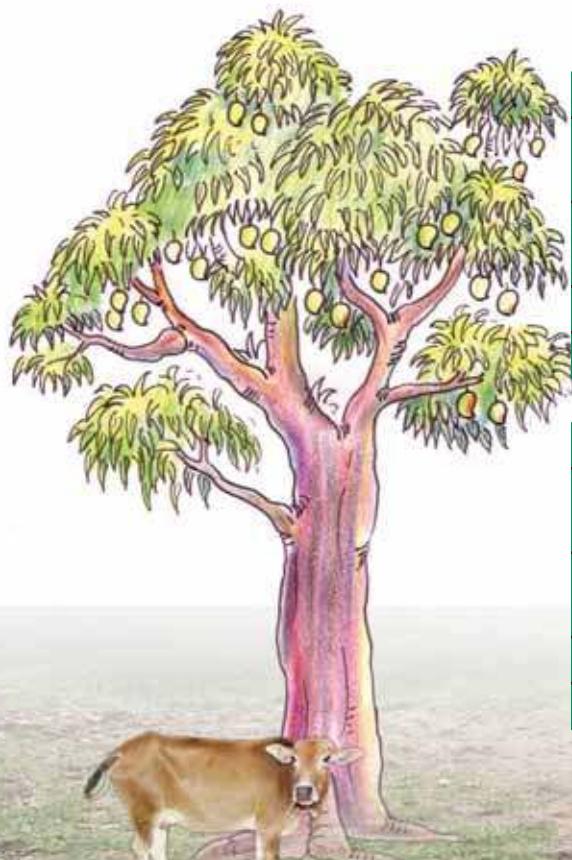
## Native Varieties for tomorrow...

*Indigenous varieties of a locality are varieties that acquire natural immunity by adapting to the climate, the availability of food, soil texture of that place etc. We had many cattle varieties of high disease resistance and low cost of management, though they were less productive. We also had crops of diverse taste and nutrients. Many indigenous tuber crops are disappearing today. Dioscorea (Kachil), taro, arrow root (Koova) etc., have been eliminated from our diet. We must realize that through the extinction of these food crops, that are rich in nutrients and easy to cultivate, we are losing invaluable treasure.*

*Extinction of indigenous varieties causes depletion of our biological wealth. We can develop new high quality varieties only from indigenous varieties that can survive the challenges of adverse climatic conditions. We mustn't ignore the reality that these valuable resources cannot be regained if lost once.*

Given below are a few indigenous varieties.

Expand the table collecting more information.



Crop	Varieties
Mango	Muvandan Kilichundan
Plantatin	Njalipoovan, Palayamkodan

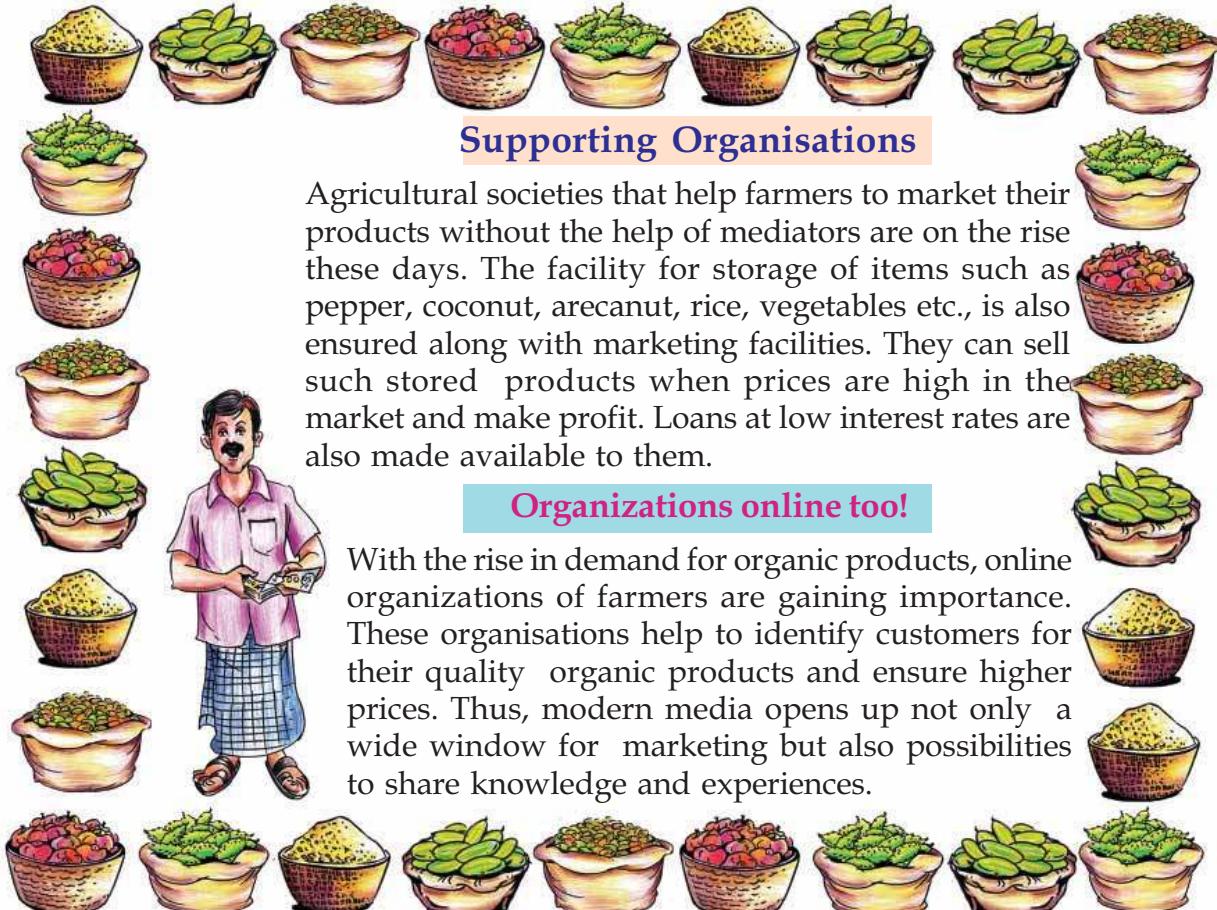
Table 3.3



Animal	Varieties
Cow	Vechoor, Kasaragod Kullan
Goat	Malabari, Attappadi black

Table 3.4

Agriculture should be a means, for farmers, to lead a life without hurdles. One of the crises faced by farmers is the fall in price of products and exploitation by middle men. How can this be overcome? Discuss and formulate an opinion.



### Supporting Organisations

Agricultural societies that help farmers to market their products without the help of mediators are on the rise these days. The facility for storage of items such as pepper, coconut, arecanut, rice, vegetables etc., is also ensured along with marketing facilities. They can sell such stored products when prices are high in the market and make profit. Loans at low interest rates are also made available to them.

### Organizations online too!

With the rise in demand for organic products, online organizations of farmers are gaining importance. These organisations help to identify customers for their quality organic products and ensure higher prices. Thus, modern media opens up not only a wide window for marketing but also possibilities to share knowledge and experiences.

It is not sufficient to make agriculture productive and sustainable. One should realize that agriculture is not the sole responsibility of farmers. People working in other fields must also try to engage in agriculture in a limited way atleast. The concept of 'agriculture for all in society' is relevant here.

Is this concept practical? Do we have enough time to spend on cultivation in the midst of the busy life? Isn't it easy to buy things from the market? Such doubts may naturally occur in our minds.

Read the diary of a farmer.



# 2014

Sun	Mon	Tue	Wed	Thu	Fri	Sat
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

December 15

Many things fall into sight during my morning walk through the fields. Following the advice of the Agricultural Officer, the soil was tested and lime was added became useful. Fruit borers have started attacking the vegetables here and there. It is time for the application of tobacco decoctions. The best pods from pea plants should be collected for seed. A lot of night soil (*kuruppa*) can be seen. Earthworms must have multiplied. The arecanut saplings have worn out being exposed to sunlight. It is necessary to provide them shade or whitewash their trunks. On the advice of a friend, I also tried land paddy cultivation. There was no need to use chemical fertilizers or chemical pesticides. Since it was an indigenous variety of rice. How nice it is to see the plants raising heads high in the lush green! Such a diet that includes rice and vegetables is not only profitable but also one provides taste, health and satisfaction. How can this be rated? The result of hard work! Something to be experienced. How nice that I could spare some time for farming!

Did you read the diary note? Is the concept 'agriculture for all in society' possible? Note down your opinion.

.....

Do you think that the agricultural practices of the farmer is scientific? What is the scientific method? Read the following note.

The scientific method includes identifying the problem, collecting information through observation, experimentation etc., analysis of collected information, formulation of proper inference and improvement of the inference through continuous enquiry. Scientists follow this method. Science is a means to solve problems by applying acquired knowledge as well as to create a better future.

Does the diary note of the farmer contain the elements of the scientific method like identifying the problem, observation, experimentation, collection of information etc.? Examine.



The farmer is one who applies the scientific method. Isn't it clear now that a real farmer is, in fact, a scientist?

These scientists are the ones who sustain a society. People who deserve recognition more than any others! While eating, do we recollect that it is the result of the hard work of a farmer?

The number of people engaged in agriculture, either individually or in groups, is increasing. The reason behind it is the awareness of the need of fresh, pure food. Are there group activities such as 'Sunday farming', 'Family farming' etc., in your locality? What are the advantages of this?

- utilization of barren land
- pesticide free food
- exercise for the body
- recreation
- 

There are many people today who wish to set up their own vegetable garden, after realizing the seriousness of health problems caused by food items that contain pesticides. What are the main obstacles in their way?

- lack of space
- availability of seed
- ignorance of nurturing
- 

Examine the pictures and the news paper report collage. Analyse the possibilities to overcome the above said limitations.



Fig. 3.7  
Terrace cultivation



Fig. 3.8  
Grow bag cultivation



Fig. 3.9  
Vertical farming

There are many institutions which make available facilities for agriculture. The government plans and implements many projects to promote agriculture. Awards are instituted in order to encourage youngsters into agriculture and to recognize outstanding skills. Collect more information on this.

This chapter deals with the possibilities to overcome some crises in the agriculture sector.

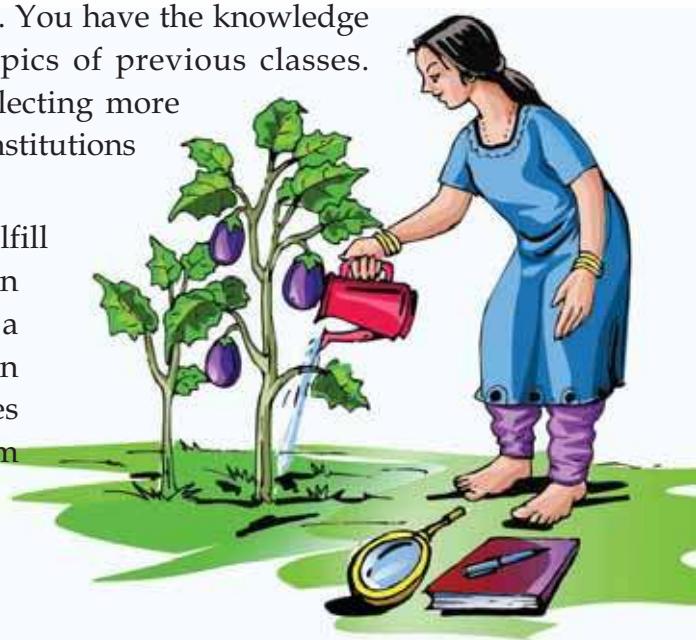
Complete the following table, adding important ideas.

Crises	Possibilities to overcome
Climate change	<ul style="list-style-type: none"> <li>• Polyhouse farming</li> <li>• Hydroponics</li> </ul>
Environment destruction and health problems	<ul style="list-style-type: none"> <li>• Scientific application of fertilizers</li> <li>• Integrated pest management</li> <li>• Organic waste disposal</li> </ul>
Cost of production	<ul style="list-style-type: none"> <li>•</li> <li>•</li> </ul>
Crop loss	<ul style="list-style-type: none"> <li>•</li> <li>•</li> </ul>
Lack of space	<ul style="list-style-type: none"> <li>•</li> <li>•</li> </ul>
Fall in price	<ul style="list-style-type: none"> <li>•</li> <li>•</li> </ul>

Table 3.5

Many issues are yet to be discussed. You have the knowledge and experiences related to the topics of previous classes. Organise a seminar in the class collecting more information from farmers, research institutions and the media.

Let us also do all that we can to fulfill the concept 'agriculture for all in society'. Do not forget to prepare a diary note while you engage in agriculture. Exchange the diary notes amongst yourselves and publish them as a volume.





## Significant learning outcomes

The learner can

- explain the idea of food security.
- explain methods of integrated pest management and identify their advantages.
- identify the greatness of agriculture and learn to respect farmers.
- identify and explain possibilities of modern agricultural practices.
- identify the significance of indigenous varieties and engage in activities to protect them.
- implement and propagate agricultural practices that are harmless to the environment and health.



## Let us assess

1. Cuniculture is related to
  - a. Keeping of honey bees
  - b. Rearing of rabbits
  - c. Cultivation of fruits and vegetables
  - d. Rearing of fish
2. *High quality hybrid varieties provide high yield. Then, what is the need of native varieties?* Record your response to this statement.
3. Which is the most appropriate way to reduce crop loss due to pests?
  - a. Using high concentration pesticides
  - b. Protecting friendly pests.
  - c. Practicing integrated pest management
  - d. Applying organic pesticides only.
4. ‘Lower price during higher yield’. Suggest a practical solution to overcome this crisis faced by farmers.



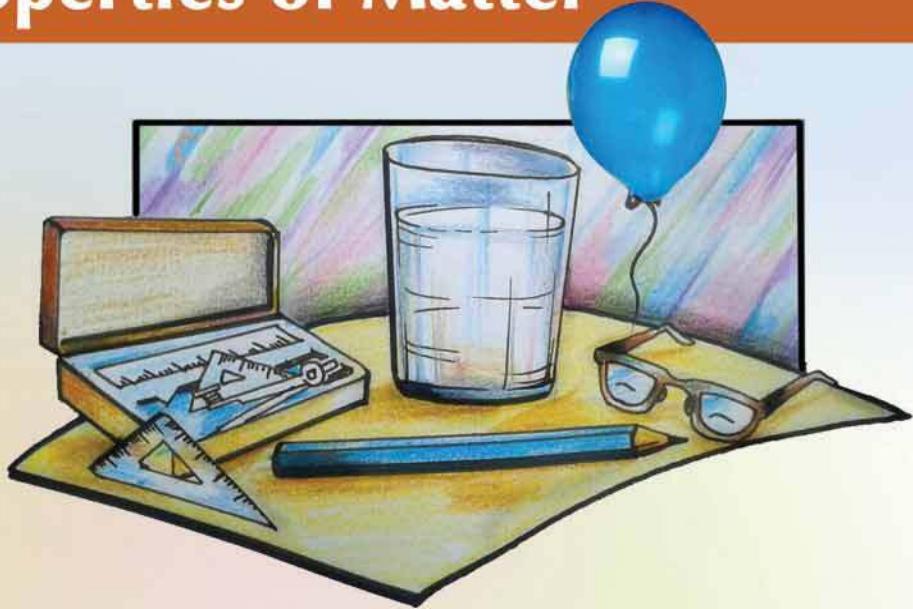
## Extended activities

1. Plan and implement land paddy cultivation, vegetable cultivation, etc., in the school premises with the help of agricultural authorities and experienced farmers.
2. Prepare a magazine collecting information on the indigenous varieties of different crops.



## 4

## Properties of Matter



What are the objects seen in the picture?

---

---

What are the materials present in each object?

- Balloon : \_\_\_\_\_
- Pencil : \_\_\_\_\_

There are many objects of diverse nature around us. All these are made up of different materials. We are familiar with the physical states of materials. Which are the different physical states of materials seen around us?

- 
- 
-

Classify and tabulate the materials given in the picture on the basis of their physical states.

Solid	Liquid	Gas

Table 4.1

- What are the important properties of materials?

Let's find out through some activities.

Observe the figure. What are the things required to do the experiment shown in the figure?

- How do we do this experiment?

Try to write down the procedure after observing Figure 4.1

- What happens to the water level when the stone is dipped in water? What is the reason?

Fill three-fourth of a trough with water. Keep a dry glass tumbler perpendicularly immersed in water in the trough (Figure 4.2).

- What happens to the water level in the trough?

- Does water enter the tumbler?

- What material does the tumbler already contain?

- Is there a relationship between the volume of this material and the difference in the water level?

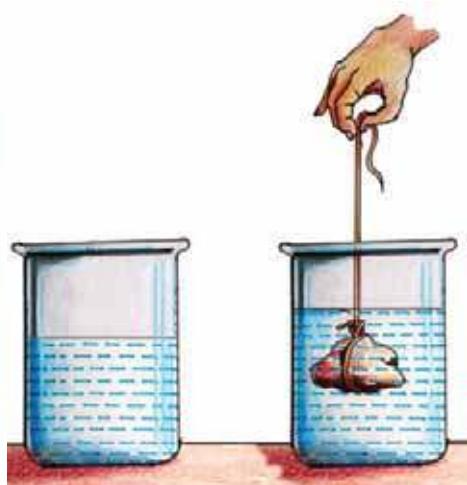


Fig. 4.1

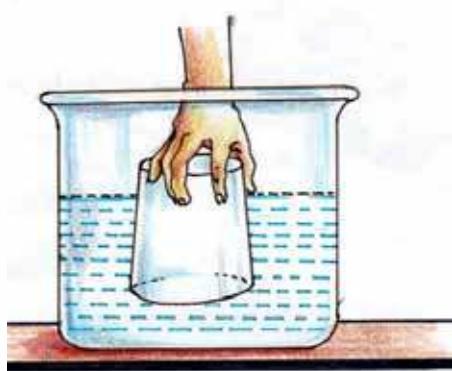


Fig. 4.2

Isn't it clear that air requires space to occupy.

Hang two balloons filled with air at the two ends of a 30 cm long metal scale. Affix a piece of cello tape on one of the balloons. With the help of a thread, suspend the scale in a balanced position (Figure 4.3). Then, pierce the balloon with a needle on the cello tape.

- Record your observation.
- What do you infer from this?

From these experiments what inferences can be drawn about the properties of matter.

- 
- 

*Matter is anything that occupies space and has mass.*

We are familiar with materials in the solid, liquid and gaseous states.

- Which properties of the solids are you familiar with?
- What are the properties of liquids?
- Which of these properties are applicable to gases?

The properties related to the three states of matter are given below. Complete Table 4.2.

(Tick the appropriate ones).



Fig. 4.3



### Plasma and other states

Matter is also found in states other than solid, liquid and gas. The fourth state of matter is Plasma. Matter is found in plasma state in the central part of the sun and other stars. Plasma is the state of matter in which the particles exist in ionized state at very high temperature.

The fifth and sixth states of matter are named Bose - Einstein Condensate and Fermionic Condensate respectively. Another state of matter is Super Fluid State. All these states can be generated in the laboratory only under special conditions.

Property	Solid	Liquid	Gas
Has mass			
Has definite volume			
Has permanent shape			

Table 4.2

## Tiny particles in matter

Fill three fourth of a beaker with water. Put two or three crystals of potassium permanganate into it and stir well.

- What happened to potassium permanganate crystals?  
-----
- Can you see the crystals?  
-----
- Why the particles cannot be seen even though potassium permanganate is present in the solution?  
-----

It may therefore be inferred that each crystal of potassium permanganate is made up of crores of tiny particles.

Let's do another experiment.

Put some sugar in water and stir.

Are the sugar crystals visible? You can guess why?

Does this solution have the sweetness of sugar?

Aren't the dissolved tiny sugar particles that impart its property to the solution?

*Each substance is made of tiny particles which cannot be seen with naked eyes. These particles bear all the properties of the substance.*

## Arrangement of particles in different states of matter

Note how some other characteristics of particles of substances in different physical states have been listed.

- particles have a distance between them.
- particles move continuously.
- particles attract one another.

The magnitude of these properties differ in various states.

Let's see how.

Observe the Figure 4.4.

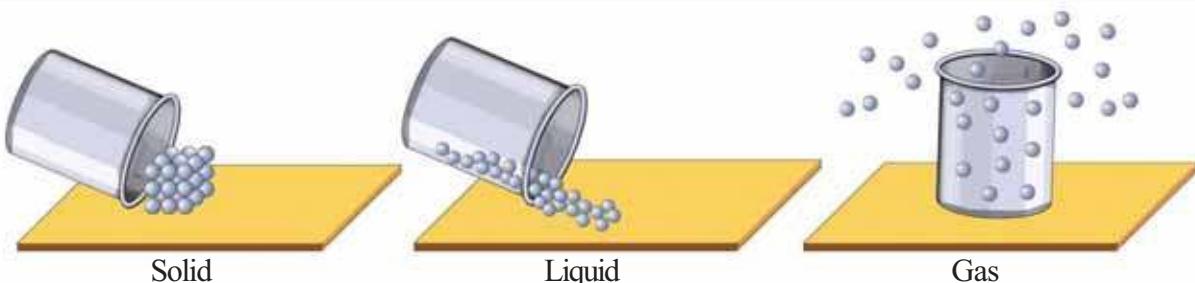


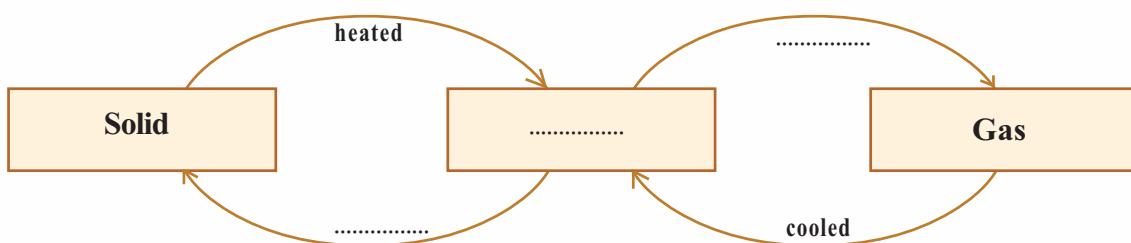
Fig. 4.4

- Is the arrangement of particles in the solid, liquid and gaseous states the same?
- In which of these states do particles remain very close to each other?
- In which of these states are the particles most distant apart?

### Change of State

You must have studied that, when ice is heated, it changes into water and when water is further heated it boils and changes into steam. Similarly, change of state occurs to matter in all states.

Complete the flow chart given below.



Which form of energy is responsible for the change of state here?

Observe the figure that depicts the movement of particles in solid, liquid and gas (Figure 4.5).

What are the changes that happen to the following properties when heat is absorbed?



Fig. 4.5

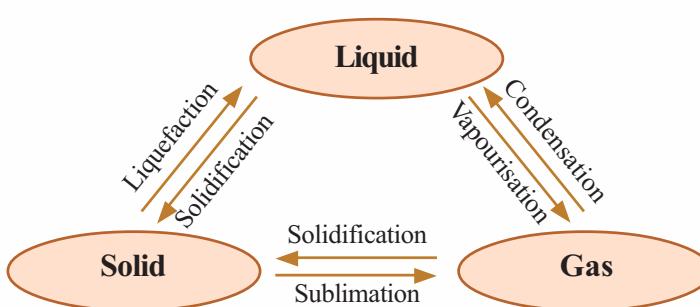
- energy of particles :
- distance between particles :
- attraction between particles :
- movement of particles :

We convert solid into liquid and subsequently liquid into gas by supplying heat. If so, won't the particles of gas have higher energy than in the other two states?

- The particles of solid are very close to each other. Their freedom of movement is limited.
- In the liquid state, particles are relatively farther apart and have more freedom of movement than in the solid state.
- In the gaseous state, particles remain far away from one another. Their freedom of movement is very high.
- The difference in temperature causes the change of state.

In all states, when heat is provided, the energy and movement of particles increase, while attraction among particles decreases.

Some substances, when heated, change directly into gas without forming liquid. This phenomenon is **sublimation**.



When the vapours of these substances are cooled, they change directly into the solid form. Naphthalene and iodine are examples for such substances.

Examine the given picture.

Analyse Table 4.3 given below and write down the changes during the transformation of states.

	When solid changes into liquid	When liquid changes into gas	When gas changes into liquid	When solid changes into gas
Movement of particles				
Distance between particles				
Attraction between particles				
Energy of particles				

Table 4.3

### Diffusion of substances in different states

Let's look at another property of matter.

Iodine is a substance that is easily converted into gas on heating. Heat a few crystals of iodine in a watch glass. Collect the vapour

in a gas jar. Keep another gas jar on top of it in inverted position (Figure 4.6).

- Observe the colour of vapour.
- What change occurs in the colour of iodine vapours in the lower gas jar?
- What about the upper gas jar?
- What is the reason for this?



Fig. 4.6

An incense stick has fragrance. But the fragrance fills the room only when the stick is lit. Why do the fragrance spreads quickly in the room when the incense stick is lit?

Is there any relation between temperature and diffusion? Why does the smell of hot food spread quickly to a long distance?

Is the rates of diffusion of substances in gas and liquid the same?

Take water in a beaker, and add carefully a drop of red ink into it.

What do you see? Does the ink spread in the water?

Compare the diffusion of iodine vapour and ink and find the difference.

What is the relation between diffusion and movements of particles in different states?

In solids, is there a similar possibility for diffusion?

Place a drop of ink on a glass plate and observe.

*Diffusion is the spontaneous mixing of different particles having freedom of movement*

Find more examples for diffusion from daily life.

- Spreading of the smell of fruits.
- 
- 

### Pure Substances and Mixtures

You are now familiar with the states of matter and the properties

of particles in these states. Each of the substances that we use are made up of tiny particles. Depending on their nature, substances can be classified into two.

### 1. Pure Substances      2. Mixtures

Molecules of water, common salt and gold have their own unique properties. Materials made of particles of identical nature are called **pure substances**. In saline water, both particles with properties of salt and water are present. The substances made of particles of different nature are called **mixtures**.

Classify the given materials into pure substances and mixtures.

Gold, soda water, soil, water, ice, water vapour, sugar, common salt, carbon dioxide, sugar solution and salt solution.

Pure Substance	Mixture
• Gold	• Soda water
•	•
•	•
•	•
•	•

Table 4.4

Expand the table by including more substances you know.



*See 'Padarthangalude Vargeekaranam' in School Resources in IT @ School Edubuntu.*

### Separating the Components of a Mixture

Most of the substances found in nature are mixtures. Eg:- soil, sea water, rock powder, sand, river water and air. Think about their components.

In daily life, we have occasions when components of mixtures are to be separated.

Look at a few instances where components of mixtures are to be separated: List out more of such instances.

- separating husk (chaff) from paddy.
- separating tea dreg from tea.
- separating common salt from sea water.
-

Complete the table given below:

Occasion / separation of	Method of separation	Property used for separation
• Tea dreg from tea	Filtration	Difference in the size of particles
• Common salt from sea water		
• Chaff from paddy		
• Iron powder from a mixture of iron powder and aluminium powder		

Table 4.5

*The choice of the method of separation of components depends on the properties of the components of a mixture.*

You know that common salt is separated from sea water by evaporation. Is this method sufficient if water is also to be obtained through separation? Here distillation can be used.

### Distillation

Figure 4.7 depicts the method of distillation. Common salt solution is taken in the round bottomed flask. On heating the solution,

- Which component evaporates?
- Which substance will remain in the flask? What is the reason?
- What happens to the water vapour when it passes through the condenser?

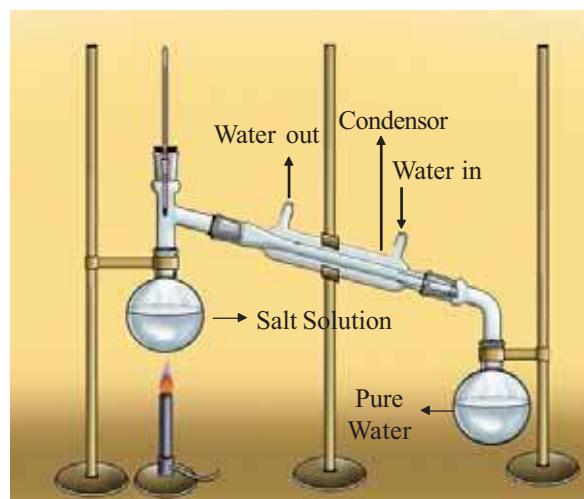


Fig. 4.7 Distillation

*When one component of the mixture is volatile and the others do not vapourise under the same condition, they can be separated by distillation.*

If the components of a mixture possess a large difference in their boiling points, they can be separated by distillation.

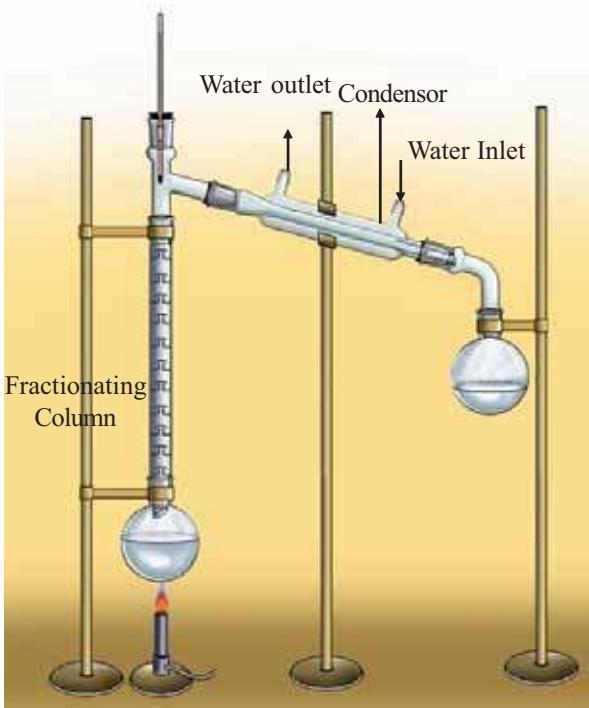
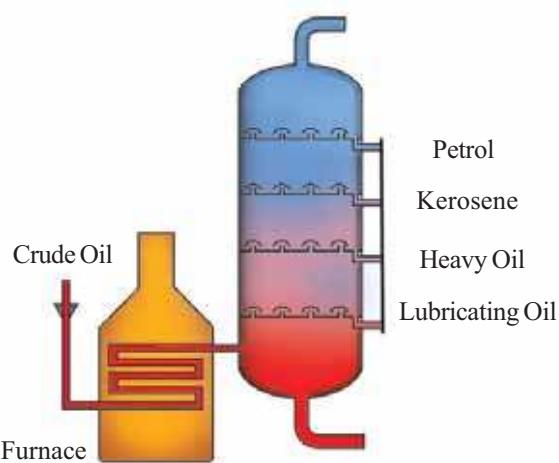


Fig. 4.8 Fractional Distillation



### Fractional Distillation of Crude Oil

Crude oil which is drilled out from the depths of the earth is a mixture of hydrocarbons which do not have much difference in their boiling points. From this, petrol, diesel, kerosene, naphtha etc., are separated by fractional distillation.



Eg: Distillation can be used to separate a mixture of water (boiling point  $100^{\circ}\text{C}$ ) and acetone (boiling point  $56^{\circ}\text{C}$ ).

Ordinary water contains many minerals dissolved in it. The distilled water used for injection and in storage battery is produced by separating these minerals through distillation.

### Fractional Distillation

If the boiling points of components have very small differences, fractional distillation is to be used to separate them. See Figure 4.8.

Ethanol (boiling point  $78^{\circ}\text{C}$ ) and methanol (boiling point  $65^{\circ}\text{C}$ ) are two miscible liquids. There is only a small difference in their boiling points. These two liquids are separated from their mixture by fractional distillation.

When vapours of the mixture pass through the fractionating column, repeated liquefaction and vapourisation take place. Subsequently, the vapours of low boiling methanol enter the condenser from the fractionating column, condense to liquid and get collected in the round bottomed flask first. Similarly, ethanol with higher boiling point can be collected later in another round bottomed flask.

### Separation using Separating Funnel

Fill one-fourth of a bottle with kerosene. Pour equal amount of water into it, close the bottle and shake well. Keep it aside for a few minutes and observe.

What do you observe?

What is the reason?

Which liquid is seen at the bottom? Why?

Can you suggest a method to separate kerosene and water from this mixture?

*Separating funnel is an apparatus used for separating immiscible liquids from their mixture.*

Look at the picture showing the separation of liquid mixture with the help of a separating funnel. (Fig. 4.9)

### Sublimation

Hope you remember collecting iodine vapour by heating iodine crystals. Iodine is a substance that changes directly into gas on heating without changing into liquid.

Which other substances show the same property?

Take naphthalene, camphor and ammonium chloride in separate test tubes. Heat them and observe. Do they melt into liquid? The process in which a solid, when heated, changes directly into gas without melting into liquid is called **sublimation**. This method can be used to separate the components which have the property of sublimation from the mixture.

Look at the given picture (Figure 4.10) showing the arrangement for separating the components of a mixture of ammonium chloride and sand. Observe the picture and write down the procedure. How did you obtain pure ammonium chloride?

### Centrifugation

This is a method for separating components from a mixture, based on the difference in the mass of particles. This method is used in clinical laboratories to separate blood cells from blood samples and also for the quick separation of the precipitate obtained during chemical experiments. The liquid containing the sample is taken in a test tube and is rotated about a central point in the instrument. The particles with higher mass then get separated, away from the centre and those with lower mass remain closer to the centre.

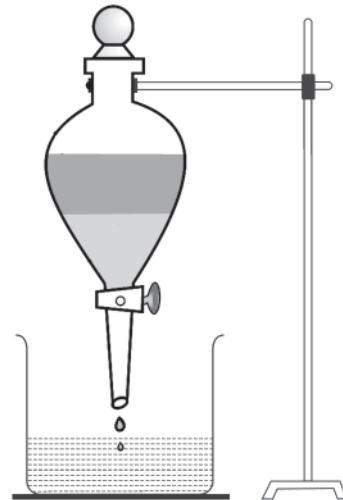


Fig. 4.9  
Separating Funnel

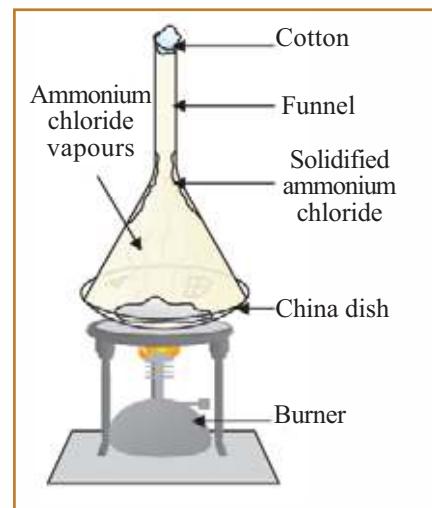
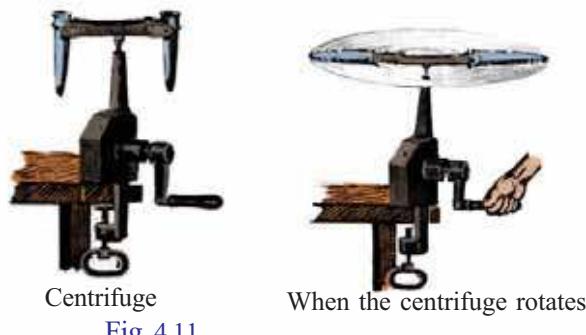


Fig. 4.10 Sublimation of ammonium chloride



In order to separate insoluble particles in a liquid mixture on the basis of their mass difference, Centrifuge (Figure 4.11) is used. The process is known as centrifugation.

This method is used for separating butter from curd.

### Chromatography

Put a black spot using a sketch pen on one end of a filter paper cut like a ribbon. Keep this dipped in the water in a beaker as shown in Figure 4.12 (a).

- What can be observed when the water level in the filter paper ascends?
- What can be inferred from the different colours found in the filter paper?

This method of separating components of a mixture is known as Chromatography.

*Chromatography is the method used to separate more than one solute dissolved in the same solvent. This method was first employed for separating coloured substances and hence this process came to be known as Chromatography.*

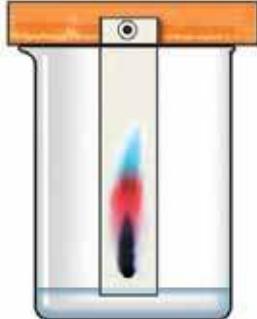


Fig. 4.12 (a)

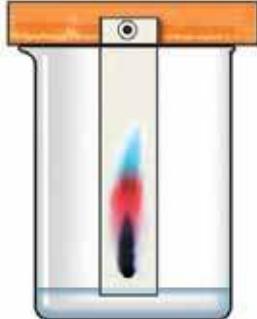


Fig. 4.12 (b)

### Adsorption-The basis of Chromatography

Capillarity is the phenomenon by which liquids rise through micropores against gravitation. The solute particles move along with the solvent which rises through the micropores in the filter paper. Due to the attraction between the filter paper and solute particles they get attached to the surface of the filter paper. This is called adsorption. Particles are separated on the surface of filter paper on the basis of the difference in the rate of adsorption.

Look at some of the occasions where chromatography is employed.

- to separate components from dyes.
- to separate poisonous substances mixed with blood.

Hope you are now familiar with some of the methods of separating components from a mixture. The components of a mixture will have to be separated by employing the above methods as well as by some other modern techniques. You will learn them in higher classes.



## Significant learning outcomes

The learner can

- explain the peculiarities of materials.
- classify materials by identifying the different states of matter and their characteristic properties.
- identify and picturise the arrangement of particles in different states of matter.
- explain the property of diffusion in liquid and gaseous states, and make use of it in daily life.
- distinguish pure substances and mixtures and tabulate them.
- separate components of a mixture on the basis of their characteristic properties.
- explain the various methods used for separating components from mixtures and make use of them in daily life.



## Let us assess

1. A few mixtures are given below. Tabulate the methods to separate their components and give the reasons for selecting the method.

Mixture	Method	Reason
Common salt and ammonium chloride		
Sugar solution		
Petrol and Kerosene		
Camphor and glass powder		
Iron powder and sand		

2. Given below are certain changes taking place to the particles during change of state. From this, find out and tabulate the changes in the particles when water boils to form steam and also when steam condenses to form water.
  - distance increases
  - attractive force decreases
  - energy increases

- rate of movement increases
  - distance decreases
  - energy decreases
  - attractive force increases
  - rate of movement decreases
3. Spirit kept open in a watch glass disappears after some time. Which among the following phenomena are responsible for this?
- a) sublimation    b) distillation
  - c) evaporation    c) diffusion
4. Which are the methods that can be used to separate the components of a mixture made of common salt, ammonium chloride and sand?
- Write the methods in the order in which they are applied.
5. Many minerals are present in ordinary water.
- Which is the method that can be used to remove the minerals and obtain pure water?
  - In which type of mixtures is this method employed?
  - Water purified by this method is distilled water Write two instances of its use.
6. From the following statements, tick (✓) those which apply to solid substances alone.
- Particles have little freedom of movement.  
 Distance between particles is very high  
 Particles remain very close to each other  
 Energy of particles is very high



## Extended activities

- Take a small wooden rectangular block and find its volume. (volume = length x breadth x height).  
 Take a big measuring jar and fill three-fourth of it with water and mark the water level. Then dip the block in water in the jar. (To prevent floating, nails can be inserted in the block). Mark the difference in the water level.
  - Is there any relation between the difference in the water level and the volume of the block?

- b) Which property of matter is revealed by this experiment?
2. Electronic balances are very popular now. On an electronic balance, find the weight of an empty balloon. Again, find its weight after filling air. Now, can you find the weight of the air in the balloon?  
Repeat the experiment using balloons of different size by filling them with varying quantity of air.
3. Take water mixed with chalk powder in a bottle. Tie a string to the bottle and swirl it at high speed along a circular path. Observe after sometime.  
Repeat the activity using other mixtures which are suspensions. To which method of separation of components of a mixture can this be connected? Are there instances where this principle is made use of. Prepare a note.
4. Take a long white chalk piece and put a mark with black ink slightly above the bottom. Keep the chalk piece dipped perpendicularly in water in a watch glass. After some time observe the changes. Repeat the experiment using different chalk pieces marked with sketch pens of different colours. To which of the methods of separation you have studied is this related?



## 5

# Basic Constituents of Matter



The earth in which we live is rich in diverse substances. Most of these substances which occur in different physical states, are mixtures and a few others are pure substances. Classify the substances familiar to you into mixtures and pure substances. Do you see such substances in the above picture? How are these substances produced?

Break a piece of sugar candy. Break the pieces thus obtained, again into smaller pieces. Have you ever thought how small the particles can be made into by breaking it?

Sugar candy, potassium permanganate, gold, silver, etc., are pure substances. You know that the particles in sugar candy and potassium permanganate solutions cannot be seen as they are extremely small.

Now, let's carry out an experiment.

Take one or two pieces of camphor in a china dish. Heat the china dish slowly. What do we observe?

- What kind of change occurs to camphor?
- Do you get the smell?

Doesn't the smell linger even after the camphor has disappeared completely? Here also, the particles of camphor are not visible. Now can't you infer that camphor has spread in air as extremely small particles.

Isn't it the same that happens when water taken in a watch glass evaporates?

It may therefore be learnt that all the substances like sugar candy, potassium permanganate, water and camphor are made of minute particles.

Similarly, pure substances like gold, silver etc., are also made of extremely small particles.

Can pure substances be further decomposed?

Fill one quarter of a boiling tube with sugar and close it with cotton. Then heat the boiling tube strongly (Figure 5.1). What can be observed? What is seen on the sides of the boiling tube?

- 
- 

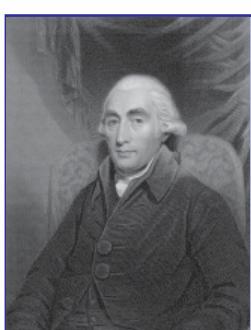
What are the substances obtained by heating sugar?



Fig. 5.1  
Heating of sugar



Sir Humphry Davy  
(1778 - 1829)



Henry Cavendish  
(1731 - 1810)

Now you know that carbon and water are the components of sugar. Carbon obtained by heating sugar cannot be further divided. But, in 1806 Sir Humphry Davy discovered that when electricity is passed through water it splits into hydrogen and oxygen. In fact, Davy's finding was made possible by the discovery of Henry Cavendish that hydrogen burns in oxygen to give water. Sugar, a pure substance can be further divided into carbon, hydrogen and oxygen. Similarly, another pure substance, water can be divided into hydrogen and oxygen. At the same time, pure substances like carbon, hydrogen, oxygen, gold and silver cannot be further divided into its components by chemical reactions.

### Elements and Compounds

Don't you now realise that pure substances are of two kinds? Of these, **the pure substances which cannot be further decomposed through chemical processes are called elements**. Find more examples of elements and list them.

- Hydrogen
-

**Compounds** are pure substances formed from two or more elements through chemical combination. Compounds can be converted into its constituent elements through suitable chemical processes. Find more examples for compounds and note them in the science diary.

- Water
- Sugar
- 



## Berzelius

In early days, pictures were used as the symbols of elements. The modern method of assigning symbols was developed by the Swedish scientist Berzelius.

Berzelius also discovered the elements Selenium, Thorium, Cerium and Silicon.



Berzelius  
(1779 - 1848)

*Elements are pure substances which cannot be split into simpler components through chemical processes. Compounds are substances formed by the combination of two or more elements through chemical reactions.*

## Origin of the names of elements

Have you ever thought how each element got its name?

In the past, the elements were named after places, countries, continents, characteristic properties, scientists, planets, satellites etc.

Note some of the examples given below.

Element	The basis of naming		
Polonium	Poland	-	Country
Curium	Marie Curie	-	Scientist
Chromium	Chrome	-	Colour
Indium	Indigo	-	Colour
Chlorine	Chloro	-	Colour
Neptunium	Neptune	-	Planet
Europium	Europe	-	Continent

Table 5.1

Find the basis for giving names to the elements in the Table given below, and complete the table.

Element	The basis of naming
Americium	.....
Francium	.....
Rubidium	.....
Plutonium	.....
Titanium	.....
Mendelevium	.....
Rutherfordium	.....

Table 5.2



See kalziumold in  
IT @ School Edubuntu,  
for finding out how  
elements got their  
names.

## Symbols

Symbols are used for representing elements. Symbols are assigned to elements in different ways.

Look at the examples given.

Elements	Symbol
Carbon	C
Oxygen	O
Nitrogen	N
Hydrogen	H
Sulphur	S

Table 5.3

The first letter of the English name is used as the symbol for the elements in the table. The capital letters are used as the symbols.

But, for some elements, along with the first letter, the second or another prominent letter is also used in the symbol as a small letter.

Elements	Symbol
Calcium	Ca
Chlorine	Cl
Chromium	Cr
Bromine	Br
Beryllium	Be

Table 5.4

The symbols of some elements have been derived from their Latin names. Look at the examples.

Elements	Latin name	Symbol
Sodium	Natrium	Na
Potassium	Kalium	K
Copper	Cuprum	Cu
Iron	Ferrum	Fe

Table 5.5



See the part  
'Moolakangal' in  
School Resources in  
IT@ School Edubuntu.

The periodic table of elements is given in the picture (Figure 5.2) (See page 159 for the Periodic Table).

Periodic Table																																					
Key		Atomic Number Symbol Malayalam Name English Name Latin/Greek name																																			
		Gases		Liquids		Synthetic Elements																															
1 H	Hydrogen	2 Li	Lithium	3 Be	Boron	4 B	Boron	5 C	Carbon	6 N	Nitrogen	7 O	Oxygen	8 F	Fluorine	9 Ne	Neon																				
11 Na	Sodium	12 Mg	Magnesium	13 Al	Aluminum	14 Si	Silicon	15 P	Phosphorus	16 S	Sulfur	17 Cl	Chlorine	18 Ar	Argon	He	Helium																				
19 K	Potassium	20 Ca	Calcium	21 Sc	Scandium	22 Ti	Titanium	23 V	Vanadium	24 Cr	Chromium	25 Mn	Manganese	26 Fe	Iron (Ferrous)	27 Co	Cobalt	28 Ni	Nickel	29 Cu	Copper (Cuprum)	30 Zn	Zinc	31 Ga	Gallium	32 Ge	Germanium	33 As	Antimony	34 Se	Selenium	35 Br	Bromine	Kr	Krypton		
37 Rb	Rubidium	38 Sr	Sodium	39 Y	Yttrium	40 Zr	Zirconium	41 Nb	Niobium	42 Mo	Molybdenum	43 Tc	Technetium	44 Ru	Ruthenium	45 Rh	Rhodium	46 Pd	Palladium	47 Ag	Silver (Argentum)	48 Cd	Cadmium	49 In	Inert	50 Sn	Tin (Stannum)	51 Sb	Antimony	52 Te	Te	53 I	Iodine	Xe	Xenon		
55 Cs	Cesium	56 Ba	Barium	57 La	Lanthanum	58 Hf	Hafnium	59 Ta	Tantalum	60 W	Tungsten (Tantalum)	61 Re	Rhenium	62 Os	Osmium	63 Ir	Iridium	64 Pt	Platinum	65 Au	Gold (Aurum)	66 Hg	Mercury (Hydrogen)	67 Tl	Thallium	68 Pb	Lead (Plumbum)	69 Bi	Bismuth	70 Po	Astatine	71 At	Astatine	72 Rn	Radon	Uuo	Ununoctium
87 Fr	Francium	88 Ra	Radium	89 Ac	Actinium	90 Rf	Rutherfordium	91 Db	Dubnium	92 Sg	Seaborgium	93 Bh	Bohrium	94 Hs	Hassium	95 Mt	Moscovium	96 Ds	Darmstadtium	97 Rg	Roentgenium	98 Cn	Copernicium	99 Uut	Ununtrium	100 Fl	Flame	101 Uup	Ununpentium	102 Lv	Livermorium	103 Uus	Ununseptium	104 Lr	Lawrencium	105 Uuo	Ununoctium
98 Ce	Cerium	99 Pr	Praseodymium	100 Nd	Neodymium	101 Pm	Promethium	102 Sm	Samarium	103 Eu	Europeum	104 Gd	Gadolinium	105 Tb	Terbium	106 Dy	Dysprosium	107 Ho	Holmium	108 Er	Erbium	109 Tm	Thulium	110 Yb	Ytterbium	111 Lu	Lu										
99 Th	Thorium	101 Pa	Protactinium	102 U	Uranium	103 Np	Neptunium	104 Pu	Plutonium	105 Am	Americium	106 Cm	Curium	107 Bk	Berkelium	108 Cf	Californium	109 Es	Einsteinium	110 Fm	Fermium	111 Md	Mendelevium	112 No	Noberium	113 Lr	Lanthanum										

Fig. 5.2

Analyzing the periodic table, find out the following.

- The elements familiar to you.
- The elements which you have actually seen.
- The elements which are more useful in our daily life.
- List separately some elements which exist in solid, liquid and gaseous states.

### Atom and Molecule

Let us see which is the smallest particle of an element. The element carbon is made up of extremely small particles. Think of breaking a piece of carbon into smaller and smaller particles. When it is broken up in this manner, we get the smallest particle which retains all the characteristic properties of carbon at the end. This smallest particle is called an atom of carbon. The other elements are also made up of their atoms.

*Atom is the smallest particle which shows all the characteristic properties of an element.*

Atoms of some gaseous elements like helium, neon etc., can exist as free single atoms. But atoms of some other gaseous elements like hydrogen, oxygen etc., can exist only as a combination of two atoms. Atoms of some elements are seen to exist as a

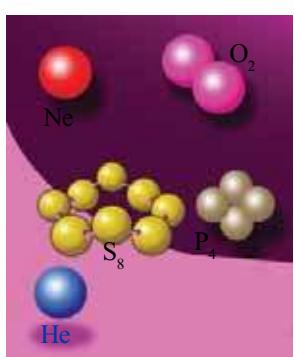


Fig. 5.3  
Molecules of element

combination of more than two atoms (Figure 5.3). The smallest particles which can exist independently are called molecules. Like elements, compounds also have molecules. Molecules of compounds consist of atoms of two or more different elements.

*Molecules are the smallest particles which can exist independently.*

### Method of representing Atoms and Molecules

You have studied the method of assigning symbols for the elements. Now, let us see how the atoms and molecules are represented.

The symbol of helium is 'He'. When we write 'He', it represents one atom of the element helium. What does  $2\text{He}$  represent?

Elements like helium, neon, argon etc., are seen in nature as single atoms. They are monoatomic molecules. Their molecules can also be represented as He, Ne, Ar etc. But elements like hydrogen exist as diatomic molecules. Hydrogen atom is represented as H, and how about its molecule?

$\text{H}_2$  represents a hydrogen molecule.

Some elements exist as molecules of more than two atoms. Phosphorus ( $\text{P}_4$ ), sulphur ( $\text{S}_8$ ) etc., are examples of such elements.

*Molecules with only one atom are called monoatomic molecules. Those with two atoms each are called diatomic and molecules with more than two atoms are called polyatomic molecules.*

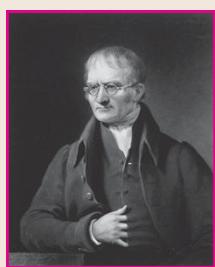
In monoatomic molecules, the number given on the left side of the symbol indicates the number of molecules and atoms. In polyatomic molecules, the subscript on the right side of the symbol indicates the number of atoms within one molecule. The total number of molecules is indicated on the left side.

Classify the following molecules into monoatomic, diatomic and polyatomic.



### The size of Atom

Can you imagine the size of an atom? The word, 'atom' has been derived from the Latin word, Atomos. It means something indivisible. The diameter of a gold atom is 0.0000000254 cm, which means around 3.5 crores gold atoms arranged in a row would be as long as just 1cm. Ancient Indian thinker Kanadan and Greek thinker Democritus have talked about the smallest particles of substances centuries ago. It was John Dalton, an English Scientist who formulated the modern theory of atom.



John Dalton (1766-1844)

Monoatomic	Diatomeric	Polyatomic

Table 5.6

In the table given below, write the number of molecules and the total number of atoms.

Substance	Number of molecules	Total number of atoms
O <sub>2</sub>		
2N <sub>2</sub>		
6Cl <sub>2</sub>		
2He		
5Na		
O <sub>3</sub>		
P <sub>4</sub>		

Table 5.7

## Compounds

We have seen how molecules are formed from the same type of atoms. Millions of English words are formed from the letters of the English alphabet. Similarly, the compounds contain molecules formed from atoms of different elements (Figure 5.4).

Compound Molecules and Atoms	
Molecules	Atoms present
Carbon dioxide	Carbon, Oxygen
Hydrogen chloride	Hydrogen, Chlorine
Water	.....
Sugar	.....
Mercuric oxide	Mercury, Oxygen

Table 5.8

Carbon dioxide is a compound. Carbon dioxide is formed when carbon burns in oxygen. Carbon dioxide is also formed by the decomposition of calcium carbonate.

Whatever be the source of a compound, a fixed ratio is maintained between the atoms of the different elements present in it. In carbon

dioxide molecule, the ratio of carbon atoms to oxygen atoms is always 1 : 2. Thus carbon dioxide molecule can be represented as  $\text{CO}_2$ . This type of representation is known as **the chemical formula** of the compound.

The table shows some molecules and the atoms present in them. Try to find more examples.

Molecule	Atoms present	Chemical formula
Carbon dioxide	Carbon - 1 Oxygen - 2	$\text{CO}_2$
Water	Hydrogen - 2 Oxygen - 1	$\text{H}_2\text{O}$

Table 5.9

- The chemical formula of sulphuric acid is  $\text{H}_2\text{SO}_4$ . How many hydrogen atoms are present in one molecule of sulphuric acid?
- How many sulphur atoms are present? How about oxygen atoms?
- Altogether, how many atoms are present?  
What if it is  $2\text{H}_2\text{SO}_4$ ?

Determine the total number of atoms present in the molecules given below.

- $\text{CO}_2$
- $5\text{H}_2\text{O}$
- $7\text{NH}_3$
- $2\text{C}_{12}\text{H}_{22}\text{O}_{11}$
- $3\text{NaCl}$
- $\text{ZnCl}_2$

## Chemical Equations

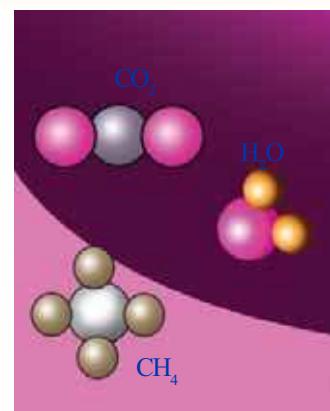
Write the symbol of the element, zinc.

What is the chemical formula of hydrochloric acid?

You have seen earlier the reaction between hydrochloric acid and zinc. What are formed as a result of this reaction?

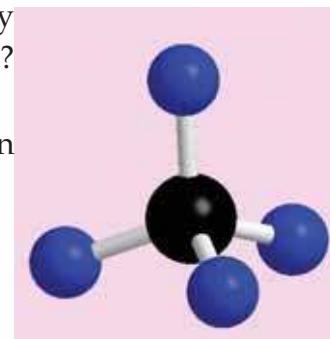
*The substances taking part in a chemical reaction are called the reactants. Substances formed as a result of the reaction are called the products.*

Note down the reactants and the products in the reaction given above.



Models of carbon dioxide, water and methane molecules.

Fig. 5.4 (a)



Ball and stick model of methane ( $\text{CH}_4$ )

Fig. 5.4 (b)



*Different molecular models can be produced using ghemical in IT @ schoolEdubuntu.*

Reactants : -----

Products : -----

The chemical reactions can be represented as equations containing the symbols and chemical formulae of the reactants and the products. If so, can the above reaction be represented as



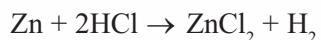
Now, see how the number of atoms on both sides of the arrow has been tabulated.

Atom	The number of atoms	
	Reactants	Products
Zn	1	1
H	1	2
Cl	1	2

Table 5.10

Is the number of atoms on both sides of the arrow equal?

The number of identical atoms should be equal on both sides of the arrow. So let us re-write the equation as follows:



Examine the number of atoms in this equation.

Atom	The number of atoms	
	Reactants	Products
Zn	1	1
H	2	2
Cl	2	2

Table 5.11

Now, isn't the number of atoms of the same kind on both sides of the arrow equal?

*When a chemical equation is written, the number of atoms of the same kind, on the side of reactants and that of products should be equal. This type of chemical equations are called **balanced chemical equations**.*

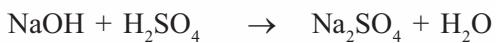
Now, look at the balanced chemical equations given below. Write down the reactants and products in the table.



No.	Reactants	Products
1		
2		
3		

Table 5.12

The equations given below are not balanced. Can you balance them?



Write down the equations for the chemical reactions familiar to you and try to balance them. You will learn more chemical reactions and chemical equations in higher classes.



## Significant learning outcomes

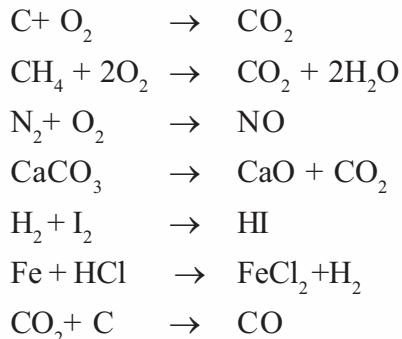
*The learner can*

- distinguish between elements and compounds.
- identify the symbols of different elements.
- list the atoms present in the molecules of elements and compounds.
- formulate the symbols for different elements.
- write the chemical formulae of different compounds.
- write and balance the equations for chemical changes.



## Let us assess

1. Classify the following into elements and compounds.  
Ammonia, sugar, nitrogen, mercury, sodium chloride, water, copper sulphate, sodium, carbon.
2. Analyse the chemical equation given for the reaction between nitrogen and hydrogen to give ammonia.  
$$\text{N}_2 + 3\text{H}_2 \rightarrow 2\text{NH}_3$$
  - (a) What are the reactants and products in this reaction?
  - (b) Find the total number of molecules and atoms of the reactants.
  - (c) Find the total number of molecules and atoms of the products.
  - (d) What is the relation between the number of atoms of the reactants and products?
3. N is the symbol of nitrogen.
  - (a) What do  $\text{N}_2$ ,  $2\text{N}$  and  $2\text{N}_2$  indicate?
  - (b) How many molecules and atoms are present in  $5\text{N}_2$ ?
4. Some chemical equations are given.



- (a) Which of these are balanced chemical equations?
  - (b) Balance those equations which are not balanced.
5. Find whether the following statements are right or wrong.
  - (a) All atoms of the same element show the same properties.
  - (b) The atoms present in a compound are different.
  - (c) Elements are pure substances.
  - (d) Hydrogen is a monoatomic molecule.



## Extended Activities

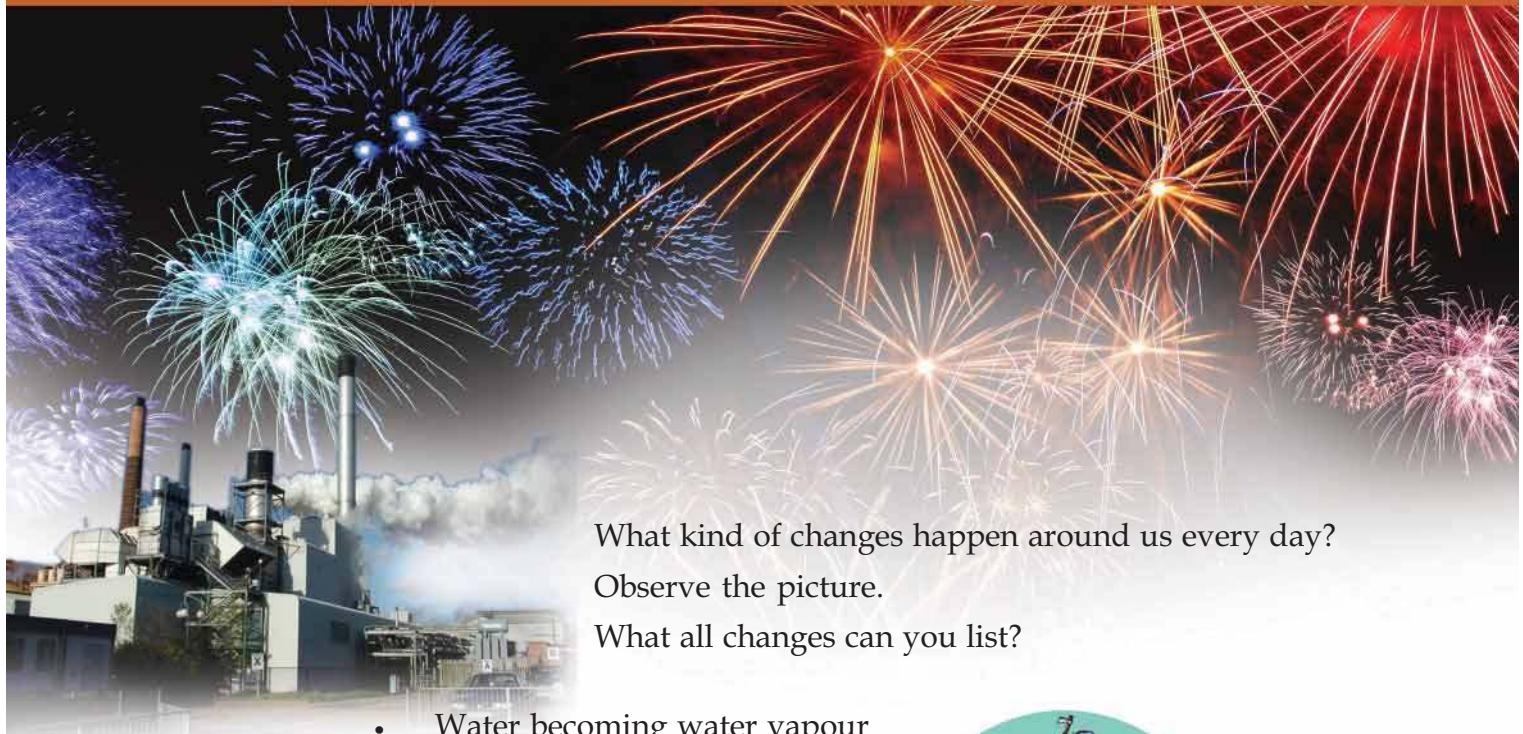
1. Take iron powder and sulphur powder in their mass ratio of 7:4 in a china dish. Heat it strongly for some time.
  - (a) Try to separate the iron powder using a magnet. What can be observed? What is the reason?
  - (b) Add a little dilute hydrochloric acid to the above product; observe the changes taking place, and write them down.
  - (c) Write down the inferences you have arrived at from these observations.
2. Make and exhibit the models of the following molecules using ball and sticks, different fruits and splints.
  - (a) Water ( $H_2O$ )
  - (b) Ammonia ( $NH_3$ )
  - (c) Carbon dioxide ( $CO_2$ )
  - (d) Methane ( $CH_4$ )
- (3) Haven't you understood how symbols are assigned to elements? Given below are some elements that received symbols from their Latin names. Complete the table with the help of the Periodic Table.

Element	Latin name	Symbol
Silver	.....	.....
.....	Hydrargium	.....
Tin	.....	.....
.....	.....	Pb
Antimony	.....	.....
.....	Aurum	.....



Unit  
6

## Chemical Changes



What kind of changes happen around us every day?

Observe the picture.

What all changes can you list?

- Water becoming water vapour
- Burning of wood
- Rusting of iron
- Melting of wax
- Explosion of crackers
- Cutting of wood
- 
- 

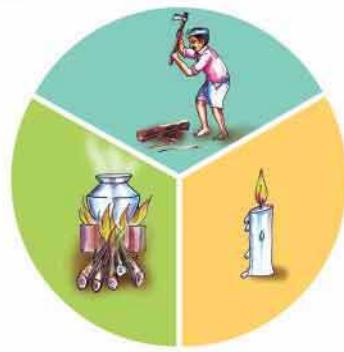


Fig. 6.1

Classify the above into physical changes and chemical changes.

Physical change	Chemical change

Table 6.1