

# Science

## Textbook for Class VI



**Rajasthan State Institute of Educational Research and Training, Udaipur**



**Publisher**  
**Rajasthan State Textbook Board, Jaipur**

**Edition : 2016**

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**Price :**

**Printing Paper : RSTB watermark  
80 GSM Paper**

**Publisher : Rajasthan State Text Book Board  
2-2A, Jhalana Doongri, Jaipur**

**Quantity :**

**Printer :**

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## Foreword

The Changes in scenario of the Society and the nation entail the changes in the system of education which determine and accelerate the process of development in them. Education, beside other factors, is an important factor, responsible for the development of the society and the nation. To make School education, effective, useful and interesting, the changes in the curriculum from time to time is an essential step. The national curriculum framework, 2005 and the Free and Compulsory Child Education Right Act, 2009 in the present time make it evident that a child occupies a pivotal place in all the teaching-learning activities, conducted in any educational institution. Keeping this view in mind, our process of causing learning amongst the students should be such that they construct knowledge on their own on the basis of the knowledge acquired through their experiences. A child should be allowed maximum freedom in the process of learning and for that – teacher should act as a guide and helper rather than a preacher. To make the curriculum easily accessible to children/students, a text book is an important means. That is why the government of Rajasthan has got the new text book written by making necessary changes in them in the light of the changes made the curriculum.

While writing a text book it has been kept in view that the text book should be easy and comprehensible, with the help of simple language and interesting and attractive with the inclusion of pictures and varied activities through which the learners may not only imbibe the knowledge and information, contained in them but also associate themselves with the social, neighborhood and local environment along with the development of and adherence to the knowledge about historical, cultural glory and constitutional values of the country so as to establish themselves as sincere, good and worthy citizens of our country, India.

I very humbly request the teachers that they should not only confine themselves to the completion of the teaching of the text book but also to present it in such a manner that a child gets ample opportunities of learning and accomplishing the objectives of teaching-learning on the basis of the curriculum and his/her experiences.

The state Institute of Educational Research and Training (SIERT), Udaipur acknowledges its thankfulness to all those government and private institutions viz. National Council of Educational Research and Training, New Delhi, State and National Census Departments, Ahad Museum, Udaipur. Directorate of Public Relations, Jaipur, Rajasthan, Rajasthan Text Book Board, Jaipur, Vidya Bharati, All India Educational Institute, Jaipur,





Vidya Bhawan Reference Library, Udaipur, different writers, newspapers and magazines, publishers and websites that have cooperated with us in choosing and making the required material available for writing and developing the text book.

In spite of best efforts, if the name of any writer, publisher, institution, organization and website has not been included here, we apologize for that and extend our thankfulness to them. In this connection, their names will be incorporated in the next editions of this book in future. It (SIERT) also extends thanks to Mr. Damodar Lal Kabra, Retd. Principal, Chittorgarh for cooperation with us in the translation work of this book.

To enhance the quality of the text books, we have received timely guidance and precious suggestions from Shri Kunji Lal Meena Secretary, Elementary Education, Govt. of Rajasthan, Shri Naresh Pal Gangwar Secretary, Secondary Education Govt. of Rajasthan, and Commissioner National Secondary Education Council, Shri Suwa Lal Meena, Director Secondary Education, Govt. of Rajasthan, Shri Babulal Meena, Director Elementary Education, Govt. of Rajasthan and Shri B.L. Jatawat, Commissioner Elementary Education, Govt. of Rajasthan Jaipur, and as such the institute (SIERT) expresses its heartiest gratefulness to all of them.

This book has been prepared with the financial and the technical support of UNICEF. In this connection we are grateful to Mr. Samuel M, Chief, UNICEF Jaipur, Sulgana Roy, Education Specialist and all the related officers of UNICEF for their timely support and cooperation. Besides them the institute appreciates the efforts of all those officers and other members of the staff who have directly or indirectly cooperated with us in accomplishing the task of book writing and publishing it.

I am highly delighted to submit this book to you all with this belief in mind that it will not only prove beneficial to the teachers and the students but also serve as an effective link in the teaching-learning process and the personality development of the students.

To value thoughts and suggestions is a specific feature of a democracy; therefore the SIERT, Udaipur will always welcome your precious thoughts and suggestions for improving the quality of this book and thus make it better in every respect.

Director  
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## For the Teachers

National Curriculum Frame Work, 2005 has thrown new light on the construction of knowledge according to which analysing of one's own experiences, developing of one's own understanding about something/somebody and explaining the meaning of something is called knowledge. Reaching knowledge means to establish one's own dialogue with other explanations and standard knowledge and information.

The great educationist and thinker Gijubhai has said, "Learning is an art and methods / techniques of learning are its tools. Those teachers who have good and proper knowledge of using these tools become expert in the art of teaching-learning, though their speed in this process may be a bit slow. But those teachers who have not had any preparation for using this art remain far away from the art of teaching-learning.

Just as a text book helps explain things to students and establish coordination between other explanations. Similarly a teacher's job is not confined only to serve as a resource of doling out knowledge but to understand the process of knowledge construction in the children, boost it and give it a concrete shape. The N.C.F. 2005 and the principles of guidelines to the Right to Education Act, 2009 have been the main-stay of the process involved in writing this text book (of science). While writing this text book, the important points, facts and subject matter contained in N.C.F., 2005, new Delhi and the curriculum and the text books of other states have been included in it with reference to Rajasthan after careful study of them (the books, curriculum of other states).

The main and important topics and their subject contents have been written in the form of dialogues, based on the experiments (practical work) and activity method. The subject matter of science has been written and presented through varied activities viz observing, inquiring, classifying, analysing, synthesizing, discriminating, concluding and propounding, etc. which have been incorporated through different steps at proper places in the lessons so that the students may construct knowledge by accomplishing these tasks on their own. The teachers are therefore requested to provide the learners ample chances to complete those tasks during the teaching learning process. And for that they (teachers) should encourage them (learners). The teachers



should play the role of guides and help the learners form concepts about the subject. Efforts have been made to incorporate the facts and figures and points related to Rajasthan, India and the world in the subject matter of the lessons in the text book so that the learners may get acquainted with their local, neighbourhood environment, culture and values along with those of their country and the world

By means of this book efforts have been to foster among the learners the feelings of tolerance, equality, consciousness towards the protection of environment, care for good health and healthy nutrition and the inculcation of scientific altitude along with the development of sensitivity towards cleanliness, sanitation and healthy habits. It is expected of the teachers that they will instil and develop the above stated feelings and emotions and values in the learners so that they may become the cultured, capable, suitable and disciplined citizens who may take part actively in the development of the society , the state and the nation. All this entails on the teachers to have not only full subject knowledge but also to have the sense of responsibility and dedication towards their profession. It is only then the will be able to prove himself as a model teacher for the students.

Again it is expected of the teachers that they will teach the subject matter, in the newly written books, in the light of the above stated objectives with zeal, fervor and dedication, using the above mentioned techniques so that the learners may be grounded in quality and value oriented education and thereby they may grow as responsible, dutiful and hardworking students of the country.



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## Points to study

- 1.1 Need of food
- 1.2 Classification of animals on the basis of food
- 1.3 Sources of food
  - (a) Plants as source of food
  - (b) Animals as source of food
- 1.4 Regional food
- 1.5 Special food

Our body needs energy to play, jump, run, study and to perform various types of other tasks. The stored energy of the body is spent to perform these tasks due to which we start feeling tired and hungry. We eat food when we are hungry.

What do we eat in the form of the food?

In this chapter, we will study about the different sources of food that are utilized by us and other living beings.

### 1.1 Need of Food

List all the food items eaten by you during a day in table 1.1.

**Table 1.1: Food items eaten by us during a day**

S.No.	Name of the student	Name of the food items used
1		
2		
3		
4		
5		



Why does our body need food? Let us discuss-

Food performs the following main functions in our body:

- (a) Food provides energy for various activities of the body.
- (b) Food keeps body healthy and also helps in growth and development of the body.
- (c) Food maintains the ability to fight diseases (disease resistance) in the body.

### 1.2 Classification of animals on the basis of food:

Do all organisms and animals have the same physical requirement?

Do all animals eat the same type of food material?

Let us classify the animals listed in table 1.2 according to their food habits.

**Table 1.2: Classification of animals on the basis of food**

S.No.	Name of the animal	Material eaten as food	
		Obtained from plants (cereals /fruits/fodder/vegetables etc)	Obtained from animals (meat/ fish/ insects)
1	Goat		
2	Lizard		
3	Lion		
4	Snake		
5	Cat		
6	Humans		

According to table 1.2, state whether:-

Are plants the source of food for all animals?

Are animals the source of food for all animals?

Do some animals obtain their food from both, plants as well as animals?

So from table 1.2, we can say that some animals eat food stuffs obtained from plants while some animals eat food stuffs obtained from other animals as food. But there are some animals that eat both, products obtained from plants as well as animals. On the basis of food habits, animals are mainly classified into





**Figure 1.1 Herbivorous Animals**

three categories:-

1. Herbivorous animals
2. Carnivorous animals
3. Omnivorous animals

### (1) Herbivorous Animals

Those animals which eat plants and their parts as food, are known as **Herbivorous animals**. For example - cow, sheep, goat, camel, deer etc.

### (2) Carnivorous Animals

Those animals which eat products obtained from animals like meat, fish etc as their food are called **Carnivorous animals**. For example - lion, leopard, wolf, crocodile, snake etc.



### (3) Omnivorous Animals

Those animals which eat both, plant as well as animal products are called **Omnivorous animals**. For example- crow, dog, humans etc.



**Figure 1.2 - Carinivorus animals**

Apart from these examples, write three- three names of animals found in your locality which belong to the categories mentioned in table 1.3-



**Figure 1.3 Omnivorous Animals**



**Table 1.3 : Names of animals on the basis of their food**

S. No.	Herbivore	Carnivore	Omnivore
1			
2			
3			

**1.3 Sources of food**

We know that when animals feel hungry, then they obtain food in the form of one or the other food stuff. Generally, we get food from two main sources-

(a) Plants

(b) Animals

**(a) Plants as a source of food**

Generally, we consume food in the form of products obtained from different parts of the plants, which are mentioned below-

(i) Cereals

(v) Sugar

(ii) Pulses

(vi) Oils

(iii) Vegetables

(vii) Spices

(iv) Fruits

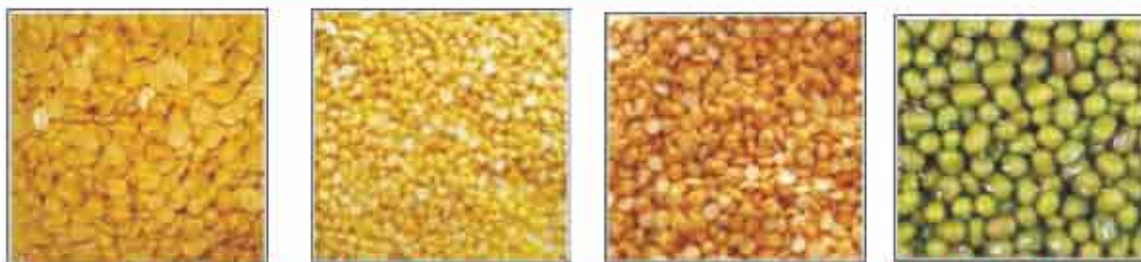
(viii) Energy drinks

**(i) Cereals-** Cereals are important plant products for all animals. They are used as a food ingredients. They are the main source of carbohydrates and provide energy. Example- Wheat, corn, rice, millet, barley etc.

**Figure 1.4 - Different types of cereals- wheat, corn, rice, millet**

**(ii) Pulses-** Pulses are obtained from the seeds of the leguminous plants and are used as food. They are the main source of protein for us. Example- various types of pulses like gram, soyabean, pea, kidney bean, lentil, pigeon pea etc.





**Figure 1.5 - Different types of pulses – pigeon pea, green moong dal, gram and kidney bean**

**(iii) Vegetables-** Various parts of plants like root, stem, leaves, fruits, flowers etc are used as vegetables.



**Figure 1.6 - Various types of vegetables – Cauliflower, lady finger, spinach**

**Table 1.4 Various parts of the plants as the source of vegetables**

S.no	Part of the plant	Name of the vegetable
1.	Flower	Cauliflower
2.	Fruit	Lady finger
3.	Leaf	Spinach
4.	Stem	Potato
5.	Root	Radish

**(iv) Fruit** - Fruit is also an edible product obtained from plants. Fruits like banana, mango, apple, grapes, pomegranate, sweet lemon, guava, plum, papaya etc are helpful for our body because they are rich in sugar and nutrients. Fruits which are obtained from plants and consumed even after drying are called dry fruits. For example- almond, pistachios, cashewnuts, walnut etc.



**Figure 1.7 (a) Different Types of Fruits**







**Figure 1.7 (B) Different types of dry fruits**

**(v) Sugar-** From where do we get jaggery and sugar? These are the products obtained from sugarcane. We either suck the stem of sugarcane or drink the sweet juice extracted from it. Jaggery, sugar etc which are important part of our daily meals are prepared by using this sweet juice. Apart from sugarcane, sugar is also made from beetroot.



**Figure 1.8 Sugarcane and beetroot.**

**(vi) Spices-** The spices used in our daily life are also obtained from plants. They are used in small amounts. They enhance the taste and nutrient richness of the food. Dry ginger, turmeric, clove, fennel, black pepper, bay leaf, cardamom, cumin etc are examples of spices used regularly.



**Figure 1.9 Different types of spices- clove, cardamom, black pepper and bay leaf**

**(vii) Oils** -Oil is an important ingredient of our food which is obtained from various parts of the plant. They are also the source of energy. Oil is obtained mainly from seeds and fruits of various plants like -soyabean, coconut, mustard, groundnut, sesame, sunflower etc.



**Figure 1.10 - Sources Of Oils - Soyabean, Coconut, Mustard, Groundnut**

(vii) **Energy drink** - Tea is prepared by drying the leaves of tea plant and we use them as an energy drink. Similarly, the seeds of coffee plant are used to make coffee powder. Tea and coffee are known as energy drinks.



**Figure 1.11 - Energy drinks- coffee and tea**

### (A) Animals as a source of food

Various types of food are obtained directly or indirectly from animals, like milk, eggs, honey, meat etc. We can say that plants are also a source of food. Edible products obtained from animals are mentioned below-

- |                            |            |
|----------------------------|------------|
| (i) milk and milk products | (ii) honey |
| (iii) eggs                 | (iv) meat  |

### (i) Milk and milk products

Which are the milk products that you use? Make a list-



**Figure 1.12 - Milk and milk products- milk, cheese, ghee and curd**

We get milk from cow, buffalo, goat, sheep etc. Milk is helpful in the physical growth of the body. Milk is the major source of calcium. Curd, buttermilk, maava, ghee, cheese etc are prepared from milk and are used by us as food.





**(ii) Honey**

You must have seen honey.

Where do we get honey from and how does it taste?

We get honey from honeybees. It is sweet in taste. It has many medicinal values. It is an important insect product for our body.



**Figure 1.13**  
honeycomb and honey

**(iii) Eggs** - Eggs are obtained from hen. They contain calcium and protein.

**(iv) Meat** - Meat is obtained from goat, hen, fish etc. It is a source of protein.



**Figure 1.14** Eggs and hen

## 1.4 REGIONAL FOOD

India is a vast nation with cultural prosperity and geographic variation. The climatic and cultural diversity in the states and regions of our nation affects its food and costumes. Some regional food are depicted in the following pictures.



**Dal bati churma**  
Rajasthan



**Missi roti sarso ka saag**  
Punjab



**Idli dosa**  
South India

**Figure 1.15** Regional Food

With the help of your teacher, make a list of some regional foods apart from those depicted in the pictures above.

## 1.5 Special food

In various regions of Rajasthan, different food items are made during different festivals. In table 1.5, classify the dishes prepared in different areas along with the names of the related festivals.



**Table 1.5 Dishes prepared during various festivals in different regions of Rajasthan**

S.No.	Name of the region	Name of the festival	Dish prepared
1			
2			
3			
4			
5			

**What have you learnt**

1. All living things eat food when they feel hungry.
2. The two major sources of food are plants and animals.
3. There are three types of animals on the basis of food – herbivorous, carnivorous and omnivorous.
4. Various food ingredients such as- cereals, pulses, vegetables, oils, spices etc are obtained from different parts of plants such as- roots, stem, leaves, seed and fruits.
5. We get food ingredients like milk, honey, egg, meat, fish etc from animals.

□□□

**Exercises****Choose the correct option**

1. Which of the following is a herbivorous animal?  
 (a) Cheetah (b) Deer ( )  
 (c) Lion (d) Dog
2. Which part of the plant is Pulse?  
 (a) Flower (b) Fruit ( )  
 (c) Seed (d) Stem

**Short Answer Type Question**

1. What is an omnivorous animal? Write giving examples?
2. What benefits do living beings get from food?



3. Write the names of five fruit-bearing plants that are grown in your locality.
4. Name the plants from which the food ingredients are obtained from the roots, stem and leaves?
5. Name the food items obtained from milk?

### Long Answer Type Question

1. Describe the food ingredients obtained from different parts of plants?
2. Describe the food ingredients obtained from animals?
3. Mention some good habits related to food.

### Practical work

1. Collect different types of edible seeds and display them in your classroom.
2. Complete the table by listing the food provided as lunch in the school.

S. no	Day	Food provided
1	Monday	
2	Tuesday	
3	Wednesday	
4	Thursday	
5	Friday	
6	Saturday	





## Points to study

- 2.1 Nutrition in plants
- 2.2 Nutrients
- 2.3 Classification of plants on the basis of nutrition
  - Autotrophic plants
  - Parasitic plants
  - Insectivorous plants
  - Saprotrophic plants
  - Symbiotic plants

### 2.1 Nutrition in plants

You know that all organisms need food. Plants can make their food themselves but animals cannot. They depend on plants or animals for food.

Why do organisms need food?

Food is essential for the growth and development of the living beings and for the repair and maintenance of their damaged parts. Food provides energy for various activities occurring in the body of living beings.

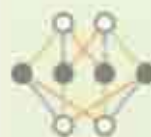
**The process of intake of essential nutrients in the form of food for maintaining health, physical growth and development of an organism is called nutrition.**

### 2.2 Nutrients

Plants are the source of nutrients for all living beings. After germination, plantlets grow by absorbing various types of nutrients from the soil. Plants get nourishment from the nutrients present in the soil. Healthy growth of the plants is not only important for the plant kingdom but also for the animal kingdom.

The nutrients essential for the normal growth of plants which are absorbed from the soil can be mainly classified into two groups, on the basis of their amount required by the plants-

- (i) Macro nutrients
  - (ii) Micro nutrients
- (i) **Macro nutrients** – Macro nutrients are those nutrients which are required by plants in large amount. In plant tissues, their quantity is from 0.2% to





4%. Like carbon, hydrogen, oxygen, nitrogen, potassium, calcium, magnesium, sulphur etc.

Macro nutrients can be further divided into two types –

(a) Primary macro nutrients: nitrogen, phosphorus and potassium

(b) Secondary macro nutrients: calcium, magnesium and sulphur

Plants get carbon, hydrogen and oxygen in the form of carbon dioxide present in water and air in the environment.

- (ii) **Micro nutrients**– Some mineral salts found in the soil are required in very low quantity for the healthy growth of plants. Such nutrients are called micro nutrients.

In plant tissues, their quantity is even less than 0.02% but still their presence is important for the plants. This means that even their small amount affects the normal growth of plants. The deficiency of any of these nutrients causes diseases in plants.

Zinc, copper, manganese, iron, boron, molybdenum, chlorine, nickel are placed in the category micro nutrients.

### 2.3 Classification of plants on the basis of nutrition

Different types of plants are found in different environments of the earth. They depend on other components of their nutrition. Can you tell how many types of plants are there on the basis of nutrition?

#### Let's know

On the basis of nutrition, plants are of following types-

- Autotrophs
- Parasite
- Insectivorous
- Saprotrophs
- Symbiotic

(a) **Autotrophs** - Those plants who prepare their own food with the help of sunlight are called Autotrophs and this mode of nutrition is called **Autotrophic nutrition**.

How does the synthesis of food take place in autotrophic plants? Let us take a glance inside the leaf.

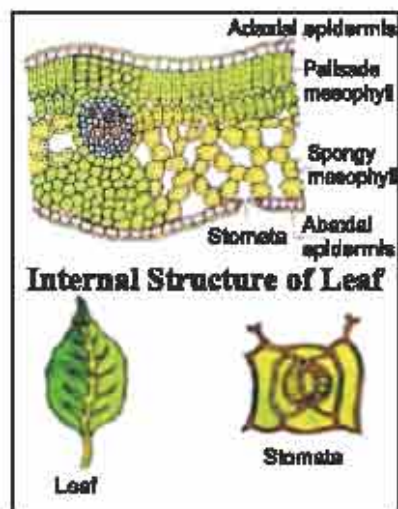


Figure 2.1 - Leaf & internal structure of leaf

The synthesis of food in plants occurs in the leaves. Many tiny pores are present on the surface of the leaves. These pores are called **Stomata**. The stomatal pores are surrounded by guard cells. Carbon dioxide present in air is taken in through the stomata. Leaves require sunlight, water, carbon dioxide and mineral salts to prepare food. The roots of the plant absorb water and minerals from the soil.

How did water and minerals absorb by the roots reach the leaves?

The stem contains tube like vessels through which water and minerals are transported to the leaves. The leaves have a green pigment called **Chlorophyll**.

It helps leaves to capture the energy of the sunlight. This energy is used to synthesize food.

The chlorophyll containing cells of green plants, in the presence of sunlight use water and carbon dioxide and make their own food. This process is called **photosynthesis**.

This process can be represented as an equation



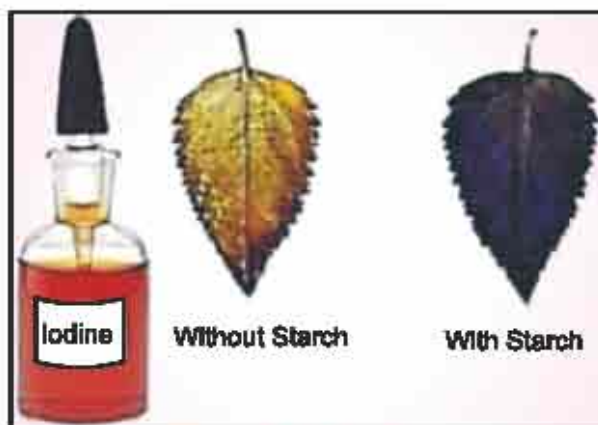
In this process, food is prepared in the form of carbohydrates and oxygen is released. This carbohydrate ultimately gets converted into starch and is stored in the plant.

Does the process of photosynthesis and production of starch occur even in the absence of sunlight?

Let us do an experiment to know this-

### Activity 1

Take two potted plants of the same genus. Keep one in the dark for 72 hours and the other in the sunlight. Take one leaf from both the pots. Now place both the leaves in a test tube and dip them in spirit. Now keep the test tube in a beaker half filled with water and boil it till the leaves lose all chlorophyll molecules. Wash the leaves with water and perform iodine test on them.



**Figure 2.2 Iodine test**





Do you find any colour change in both the leaves?

We will see that the colour change occurs in the leaf of the plant which is kept in sunlight, but no colour change occurs in the leaf of the plant kept in dark.

Why is there no change in colour of the leaf kept in dark?

Let us try to find out.

Photosynthesis occurs in the presence of the sunlight. Due to which, starch is made in the leaves of the plant kept in sunlight and so, the leaf turns blue-black in colour when iodine solution is dropped on it. But photosynthesis does not occur in the plant which is kept in dark, thus starch is absent in its leaves. So, there is no colour change in its leaf. Starch reacts with iodine and imparts blue-black colour. This process is called starch test.

**(b) Parasite:** There are some plants which do not have chlorophyll. They cannot synthesize their own food. Whom do they depend on for their food?

**Let us find out**

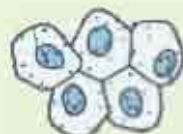


**Figure 2.3 Cuscuta**

Look carefully at the tree depicted in figure 2.3. You can see yellow filaments twining around the stem and the branches of the tree. These yellow filaments are of a plant known as cuscuta. It does not have chlorophyll. It takes readymade food from the plant on which it is climbing. Plants like cuscuta, who obtain their food from other trees or plants are called **Parasite** whereas the tree or the plant from which the parasite obtains food is called the **host**.

You might have seen or heard that insects, ants, butterflies and other organisms derive their food from plants. Have you ever heard about plants that in order to survive, obtain their food from insects?

In nature, there are some plants which can eat insects to survive. What type of plants are these, name them. Let us try to find out:-





(c) **Insectivorous plants**- Those plants which in order to survive, trap insects and digest them are called **Insectivorous plants**. For example- *drosera*, *dionaea*, *utricularia*, pitcher plant etc.



**Figure 2.4 Leaf of a pitcher plant modified into a pitcher (pot)**

Carefully look at figure 2.4. It is a pitcher plant. The pitcher-like structure is the modification of which part? What do you see above the pitcher? In this plant, the leaves are modified into pitcher. The apex of the leaf forms a lid. Inside the pitcher, there are hairs which are directed downward. The mouth of the pitcher is sticky. When an insect lands in the pitcher, it slips and gets entangled into the hair present into the neck of the pitcher. Since, the hair are directed downwards, the insects are unable to escape out. The insect is digested by the digestive juices secreted in the pitcher.



**Figure 2.5 Drosera**

Have you ever imagined why these plants need insects as their food? Let us try to understand -

These plants are found in swampy areas where the amount of nitrogen is insufficient. They eat insects to fulfill their nitrogen requirement.





(d) **Saprotrophs** - During rainy season, you might have seen umbrella-like or white thread like structures on the dung, pickles, vegetables, wood and other decaying matter. What do you call them in your language? In scientific language, they are called fungus. They lack chlorophyll. They cannot prepare their own food. If they do not prepare their own food, then where do they get their food from? Let us try to find out. Look at the fig. 2.6 (a).



**Figure 2.6(a) Fungus on dung**



**Figure 2.6(b) Monotropa**

### Let us know

These plants secrete digestive juices on the surface of dead and decaying matter. The digestive juices convert it into a solution which is absorbed by fungus to get nutrients. The plants which take nutrients from the dead and decaying matter are called **Saprotrophs**. Most of the fungus like *mucor* and *agaricus* are saprotrophic plants. *Monotropa* depicted in figure 2.6(b) is a flowering plant which obtain its food from dead and decaying matter.

You might have seen people involved in various professions and helping each other. Like doctor, engineer, lawyer, teacher, farmer, stockman, milk seller etc. Can anyone of these, imagine to live without the help of people related to other professions? No, we can live a normal life only by mutual cooperation.

Do such cooperation and coordination exists in plants also? Let us try to find out-

(e) **Symbiotic plants** - Some organisms live together and share food, water, nutrients and shelter. This mode of living is called **Symbiosis** and the plants living together are called symbiotic plants. Lichen is an example of symbiosis.

In lichens, two types of plants, fungi and an algae live together. Algae contains chlorophyll but fungi lacks chlorophyll. The algae provides food carbohydrate to the fungi, which the algae prepares by photosynthesis and in return, the fungus provides shelter, water and other nutrients to the algae.



### What have you learnt

- Those plants who prepare their own food in the presence of sunlight are called autotrophs.
- The chlorophyll containing cells of plants, in the presence of sunlight use water, minerals and carbon dioxide to synthesize their own food. This process is called photosynthesis.
- Cuscuta is a parasitic plant.
- Saprotrophic plants obtain their food from dead and decaying matter.
- In lichen, an algae and a fungus live together. It is an example of symbiosis.
- In the pitcher plant, the leaf gets modified into a pitcher-like structure.

### Exercises

#### Choose the correct option

1. It is a saprotrophic plant-  
 (a) neem (b) drosera ( )  
 (c) mucor (d) cuscuta
2. Those plants who depend on other plants for their food are called-  
 (a) parasite (b) autotroph ( )  
 (c) saprotroph (d) insectivorous plant
3. Which of the following is not an insectivorous plant-?  
 (a) drosera (b) dionaea ( )  
 (c) cuscuta (d) utricularia

#### Fill in the blanks

1. In lichen, \_\_\_\_\_ and \_\_\_\_\_ live together.
2. In pitcher plant, pitcher is the modified form of \_\_\_\_\_.
3. The mode of taking essential nutrients in the form of food by an organism for its health and physical growth is called \_\_\_\_\_.



**Short answer type question:**

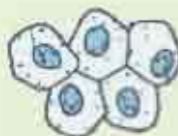
1. What is photosynthesis?
2. What is symbiosis?
3. What is the difference between the host and the parasite?

**Long answer type question.**

1. Describe insectivorous plants with suitable example.
2. Write short notes on the following –
  - (a) symbiotic plants
  - (b) saprotrophic plants
  - (c) parasitic plant
  - (d) photosynthesis

**Practical work**

1. Collect leaves of plants found in your locality and prepare a scrap book.
2. Visit a greenhouse present in your locality. Look, how plants are grown there. Find out how light, water and carbon dioxide are regulated there for healthy growth of the plants.





### Points to study

- 3.1. Grouping of things
- 3.2. Classification of things – On the basis of sources
- 3.3. Properties of things
  - Lustre
  - Hardness
  - Magnetic and non-magnetic
  - Solubility and Insolubility
  - Transparency
  - Density

### 3.1 Grouping of things :

We observe many different things in our class, room, home, market and ground which we use in our daily life. Like Books, wool, utensils, jewellery, clothes, toys, rubber, chair, water, bullock cart, bicycle, ball, pen, wire etc. Among them some are found in nature and some are human made. Is the shape, size, colour and properties of these things same? No, these things are different from each other. Some are very shiny some have no shine, some are hard and some are soft, some are soluble in water and some are not. Those things which are similar in properties grouped in one. Why we have to make group of things? We will find our answer in this chapter. We group things according to our utility and comfort that they do not mix with each other.



Figure 3.1 : Objects around us



**Activity 1:**

Collect few things from your class and few from outside. Things collected can be toys, pencil, notebook, rubber, chair, table, Newspaper, wool, mango, cotton, switches etc. Differentiate the things made of paper, wood, iron, rubber, and plastic Table.

**Table 3.1: Grouping of things according to substances**

S. N.	Substances	Things
1.	Paper	Notebook, book, Newspaper
2.	Plastic	
3.	Wood	
4.	Iron (metal)	

Above table clarify that few things are made up of one substance, some are made up of more than one thing. The sources of these things are different from each other.

**3.2 Classification of things - On the basis of sources:**

Those things which we get from nature (plant & animals) are called **Natural things** and which are man made are called **Artificial or man made things**.

**Activity 2**

In picture 3.2 few things are natural and few are manmade. Find and tabulate it in Table 3.2.

**Figure 3.2 : Natural and man made things**



**Table 3.2 : Classification of things on the basis of source –**

S. N.	Name of thing	Man made or natural
1.	Mango	Natural
2.	Chair	Man made
3.	Cotton	
4.	Plough	
5.	Pomegranate	
6.	Toys	
7.	Wool	

**3.3 Properties of Things :**

We use utensils made of soil, metal and plastic for storage of water at our home. Have you ever thought that why we do not use glasses made of cloth for storage of water? Or why things made of paper is not use to fill water.

This is clear that things are according to their properties. Which are these important properties of things? Let us discuss.

**(i) Shine/Lustre****Activity 3**

Observe a steel plate and a wooden block in sunshine. Which one is shiny in both? Likewise list of some couple of thing is given in table 3.3 Classify them on the basis of their Shine.

**Figure 3.3 : Shiny and ductile things**

Table 3.3 Classification on the basis of shine:-

S.No.	Pair of Things	Shiny	Ductile
1.	Jewellery / Cloth		
2.	Coal/ steel utensils		
3.	Cardboard / Aluminium sheet		
4.	Steel tumbler/ comb		

From the above table and picture we conclude that things made of metals have shine. Like jewellery, utensils, aluminium sheet etc.

**(i) Hardness :****Activity 4 :**

We observe few things are compressed when pressed and few things do not. List few things by classifying them as hard and soft in table 3.4



Figure 3.4 : Hard and soft things

Table 3.4 : Classification of things on the basis of Compression

S.NO.	Name of thing	Hard or soft
1.	Wooden table	Hard
2.	Iron window	Hard
3.	Cotton	Soft
4.	Sponge	
5.	Piece of stone	
6.	Candle	
7.	Paneer / cottage cheese	
8.	Steel utensil	

Those things which are not compressed easily are hard while those things which can be easily compressed are soft.



**(i) Magnetic and non-magnetic:**

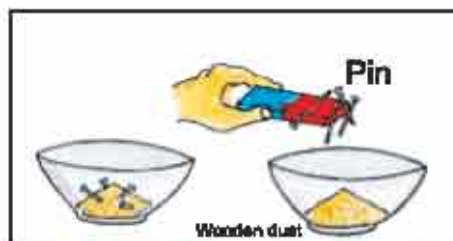
You would have seen pin and keys made up of iron get attracted towards magnet. While if we bring pieces of stones, pencil, plastic pens etc near to magnet do not attract towards it. Why this happens?

According to magnetic properties things are of 2 types:

Things which get attracted towards magnets are Magnetic, like the things made from iron while which do not attract towards it are non magnetic – like plastic or wooden made things.

**Activity 5:**

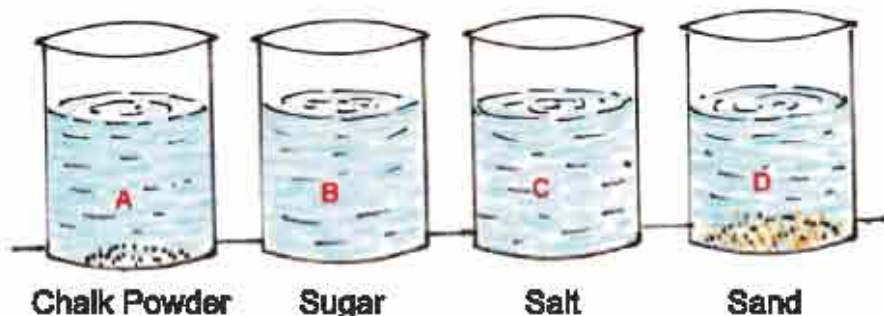
Take pins and wooden dust in a glass bowl. Now bring magnet near the bowl. What you have observe. You observe that pins get attracted towards magnet while wooden dust does not. Therefore we can say that pins are magnetic and wooden dust is non-magnetic.



**Figure 3.5 : Magnetic attraction**

**(ii) Solubility and Insolubility:****Activity 6:**

Take four beaker of glass. Mark A,B,C,D on them put one spoon chalk powder, sugar, soil and sand in beaker A,B,C,D respectively what you will observe ? You will observe that in Beaker B and C sugar and salt completely dissolve in water and a clear solution is seen while in beaker A and D sand and chalk powder can be seen at the bottom of beaker.



**Figure 3.6 : Solubility of things in water**

Hence, this is clear that something are soluble in water are called **Soluble** like salt, sugar etc. while things which are not soluble in water are called **Insoluble things**. Example: chalk powder, sand etc.



Some liquids, like lemon juice is completely miscible in water while some like kerosene, mustard oil etc do not completely mix in water. Likewise, oxygen gas is partially soluble in water while few gases fully mix in it.

Carbon-dioxide gas is completely soluble in water and hence used in soft drink.

### (iii) Transparency:

You all have seen your face in mirror. Is object is visible through mirror?

Through which objects we can clearly see. You have observed that some food items like chocolates, biscuits etc are kept in glass or plastic containers so that they can be seen clearly. Therefore, those things through which we can see are called **Transparent objects**. Example – glass & pour water are transparent.

Opposite to this those things through which we cannot see clearly are **Opaque objects**. Like – wood, notebook, objects made of metals are all opaque objects.



**Figure 3.7 : Transparent Object      Figure 3.8 : Opaque Object**

### Activity 7:

Take a plastic bucket and a torch. Switch on the torch keeping the top of it inside the bucket. Now look at the bucket from outside. Is light of torch visible from outside?



**Figure 3.9 : Translucent Object**



You see that light is not clearly visible from outside. Therefore few things are like this through which we can see but not clearly means partial vision these are called translucent things.

#### (iv) Density:

##### Activity 8:

Do you know that few things float on water and few others sink. You all played with paper boats in floating on water. Wood straw of plants, leaves etc are light weight and float on water, but iron nail, spoon and other sink in water.

Observe things by dropping in water which one float and which one sinks. List them differently.

Generally those things which have density lower than water float on it whereas those things with higher density than water sink in it. This is because of density of things.

**What is density? Let us find-**

##### Activity 9:

Take two containers of equal sizes and fill one with cotton and other with sand completely. Let's lift these containers which one is heavier? Containers of equal volume filled with cotton and sand, sand container heavier one. Therefore we say that density of sand is more than cotton. **Density of a substance is its mass per unit volume.**

The thing which has more mass in a fixed volume is highly dense.

In this way we group different objects in different groups. Grouping of materials is convenient in many ways. Storage by grouping things makes easier to find them. Like in grocery store the shopkeeper groups materials on the basis of priority in use, which makes it easy to explore.

#### What have you learnt

- Objects around us are made up of large variety of material.
- Different materials have different properties.
- We form group on the basis of similarities in materials.
- Something has shiny lustre and some do not.
- On the basis of sources we classify materials into natural and manmade.
- Some materials are hard and some are soft.
- Magnetic materials attract towards magnet.
- Some materials are soluble in water whereas some others are insoluble.
- Some materials are transparent and some are opaque and translucent.
- The materials which have high mass in fixed volume have high density.

□□□



## Exercises

**Choose the correct option of the following:-**

1. Which material has lustre?  
 (a) Wood (b) Chalk powder  
 (c) Kerosene (d) Gold ( )
2. Which one from the following is soluble in water?  
 (a) Wooden dust (b) Chalk powder  
 (c) Glucose powder (d) Iron dust ( )
3. Which one has magnetic properties from the following?  
 (a) Wood (b) Iron  
 (c) Glass (d) Plastic ( )
4. Which one floats on water?  
 (a) Wooden blog (b) Pebbles  
 (c) Iron nail (d) Gold ring ( )

**Fill in the blanks:-**

1. Those things which get attracted towards magnets are called \_\_\_\_\_.
2. Cotton has \_\_\_\_\_ density than iron.
3. Through \_\_\_\_\_ object we can clearly see.
4. Those things which cannot be compressed easily are called \_\_\_\_\_.

**Short answer type questions:**

1. Classify following things on the basis of their compressibility into hard or soft. Sponge, hammer, marble, cotton, rubber, chair, gulabjamun.
2. Write names of three natural things?
3. What do you mean by a magnetic objects?
4. Which property of carbon dioxide made it useful to be used in soft drinks.

**Long answer type questions:-**

1. Define transparent, Translucent, and opaque objects. Explain with examples.
2. Bronze mug loses it shine when kept in open environment. Why?
3. Explain the magnetic proprieties of a substance with example.
4. Iron nail sink in water while paper boat floats on water. Why? Explain.





## Points to be study

- 4.1 Classification of fibres
- 4.2 Plant fibres
  - Cotton
  - Jute
  - Moonj
- 4.3 Spinning, weaving of cotton, fibres and colouring, printing of clothes
- 4.4 Animal fibres
  - Wool
  - Silk
- 4.5 Our clothing

The clothes, bed sheets, curtains etc at our homes made up of different clothes. Will you identify some clothes from these? Let's understand –

### 4.1 Classification of Fibres :

#### Activity 1

Visit a tailor shop nearby your house. Collect some piece of clothes from there. Touch and feel each and every piece of cloth. Label the clothes with cotton, silk, wool and mix on the pieces of clothes. You take the help of tailor.



Figure 4.1 : Cuttings of different types of clothes at a glance



Pull a single thread from any piece of cloth. What this fibre or thread are made up of? Let collect some knowledge:

Those fibres which are obtained from plants and animals both are called Natural fibres. Example: - wool, cotton, jute, moonj, silk etc.



Cotton



Wool



Silk

**Figure 4.2 : Sources of Natural Fibres**

Those fibres which are made by human with chemicals are called **Artificial fibre** or manmade or synthetic fibres. Examples – Rayon, Dacron, Nylon etc.

#### 4.2 Plant Fibres :-

##### Cotton:

We get cotton from cotton plant. Its fruits are of the size of a lemon. After they mature, the ball of cotton fall off from the plant and cotton fibres are seen. If you observe cotton field at the time of fruiting it appear like covered with snow.

**Cotton from cotton balls:** Cotton is usually picked by hand. Fibres are then separated from the seeds by combing. This process is called ginning of cotton. We get cotton from cotton balls. These days, machines are also used for ginning.

##### Jute:

Jute fibre is obtained from the stem of jute plant. For obtaining jute fibre its plant is harvested when it starts flowering. The stems of the harvested plants are immersed in water for a few days. The stems got rotten and fibres are separated by hands. To make fabrics all these fibres are first converted into yarns. We make doormats, chatai and bags from jute.

##### Moonj :

Moonj is obtained from the moonj grass. The botanical name of this plant is *Saccharum moonja*. This is a monocot plant. It is generally found in Nagaur, Bikaner Sikar, Jhunjhunu, Ajmer districts. The stems of this plant is used to make



**Figure 4.3 : Jute****Figure 4.4 : Jute Bag**

huts, traditional furniture ( Table, Mudde), and eco friendly toys. Its fibres are also used to made different types of ropes which villagers used in bed, chairs, and decorative items.

In Ajmer district of Rajasthan moonj dependent small scale industry many different types of commercial products are made which provide financial support to the workers.

### 4.3 Spinning, weaving of cotton, fibres and colouring, printing of clothes

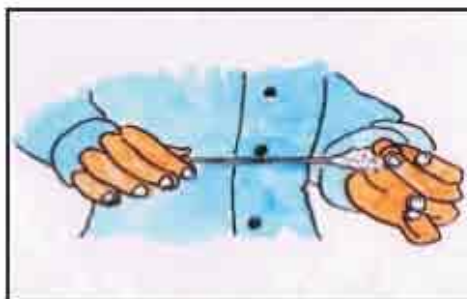
**Figure 4.5 : Moonj****Figure 4.6 : Furniture made of Moonj**

Fibres are used to make clothes. How fibres get converted into yarn? Let's understand.

#### Activity 2

Hold some cotton in one hand. Pinch some cotton between forefingers of the other hand. Now gently start pulling out the cotton while continuously twisting the fibre like you do for making thread for lamp. You observe that a long threaded yarn is formed.





**Figure 4.7 : Making yarn from cotton**

### Spinning :

The process of making yarn from fibre is called **Spinning**. In the process of spinning cotton is pulled and gently twisted simultaneously. This makes fibre close to each other and yarn is formed.

A simple device used for spinning is a hand spindle, also called **Takli**. Another hand operated device used for spinning is **Charkha**.



**Figure 4.8 : Hand spindle**



**Figure 4.9 : Charkha**

### Weaving :

The process of arranging two sets of yarns together to make a fabric is called **Weaving**. Weaving of fabric is done on looms. In knitting a single yarn is used to make a piece of fabric. Knitting is done by hand and also on machines.

### Colouring of Clothes:

Have you ever observed near pond or river the clothes of different colours. How these clothes are differently coloured?



Is all the clothes are coloured similarly?

What is mix to enhance colour on cotton clothes?

What the colouring man do to colour a single cloth with different colour?

In which art the printing on clothes is done?

To colour cotton clothes many types of colours are used. The colour which is to be used for colouring is mixing desired colour in cold water first. Now this colour is poured in hot water, and salt is added and stirred with a long stick. Now dip the clothes in this. The clothes kept dipped in colour till the water get cooler. After this the clothes are squeeze well and dried in shade. After drying iron the clothes.



Figure 4.10 : Colouring of Clothes

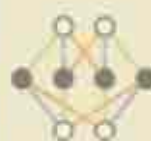
### Let us know

#### Tie and dye:

The clothes of tie and dye are popular in states of Rajasthan & Gujarat with tie and dye a beautiful pattern is made on clothes. It is a scale industry as it require low budget but more profit can be earn. Handkerchief, scarf, saree, blouse, salwar-suits, dupatta, bedsheets, curtains, cushions can be made through this. After this dyeing is done the place where the cloth is tightly threaded colour do not spread and rest whole cloth get dye. If we have to use more than one colour we proceed from light shade to darker one like from white, yellow to red. After colouring with the last colour it is kept to dry completely. After dry the threads are opened with utmost care. The clothes are then ironed with a warm iron. Now the cloth of tie and dye is ready.



Figure 4.11 : Tie and dye work





**Activity 3**

Take a handkerchief of cotton cloth, tie kidney bean seeds with the help of thread. Now dip it in any colour and dry it. Open the thread and see bandej.

**Printing on Clothes :** Sanganer (Jaipur) in Rajasthan has its name in art of printing. Other centres of printing in Rajasthan are Jodhpur, Udaipur, Barmer, Bhilwara, Pali, Bagru, Aakola (Chittorgarh) etc. Here printing is done by wooden blocks. For colouring and printing, Vail and cotton clothes like muslin cloth, and silk clothes are only used. The instruments used for printing is impression block, it is also called bhant. They are made up of wood or metal alloys. After making impressions they are kept in sesame oil for a night.



**Figure 4.12 : Printing of clothes**

Firstly colours are formed in a container for printing. Now this colour is poured on a sponge. Now printing block is kept on sponge so that it takes the colour. Printing is done in fixed pattern from these blocks. This printing is done on borders or on whole cloth. Now a day, machines are also used for printing.

Cotton clothes are formed from cotton plants which include muslin, rubies, vial, poplin etc.

The main significance of cotton clothes.

- 1) They are cool.
- 2) They absorb moisture
- 3) They are easy to dye.

**4.4 Animal Fibres:**

Fibres obtained from animals are called **Animal fibres**. From which animals we get fibres and how we obtained and make useful for us, let us study.

**Wool :**

Wool is obtained from the hairs of camel, sheep, goat, yak, rabbit etc. These animals have a thick layer of hairs on them, which keep their body warm.

Fibres like soft hairs are used to make wool.

**Manufacturing process of wool:**

How the hairs of animals used to obtain wool. Let us study -

**Changing the fibres in wool:** The following processes are involved in the making of wool.



1. The hairs are shaved from animals. It is known as **Shearing**. This process is done in summer season so that the animal doesn't suffer. These hairs are spun to form yarn.
2. Then these fibres are made oil, dust free etc. The process is called **Scouring** for this the hairs are dipped in big tanks and then washed with water.
3. Different types of hairs are then **Sorted**. Small, soft and puffed fibres called **Burr**, are sorted separately. Then they are dried and again scouring. The fibres obtained from this method are spun in thread.
4. Then wool is coloured in different colour.
5. The process of making threads straight and making its roll is called **Reeling**. Long fibres are used in sweater while short fibres are used in making woollen clothes.

In some parts of India, like Jammu and Kashmir wool is obtained from Kashmiri goat or Angora species of goat. This wool is softer and the shawls made from its fibre are called Pashmina shawls. In many states in India like Himachal Pradesh, Uttarakhand, Arunachal Pradesh, Rajasthan, Punjab, and Gujarat sheep are rear for wool also.

Clothes and dresses are also made from silk yarn. Let us know -

**Silk :** Silk is Natural fibre obtained from silkworm.

**Sericulture :** Rearing of silk moth for obtaining silk is known as **Sericulture**. Silk moth resides on mulberry plant and eats its leaves.

**Life cycle of silkworm:** Female silkworm lays eggs on leaves of mulberry tree. These eggs hatch into caterpillar larvae. They develop by eating leaves of this plant. They have a special gland called silk gland. This gland secretes a substance. These caterpillars form a thread like structure which wrap around themselves.

Later this threaded structure took round shape which is called **Cocoon**. In cocoon caterpillar changes to pupa stage. Then this pupa changes into adult silkworm and completes its life cycle. In the life cycle of silkworm, cocoon stage lies useful for sericulture. Before the cocoon changes to adult it is kept in sun or hot water or steam to obtain silk. The formation of silk thread from fibres is called **Reeling**. Then they are spun in yarn and weaver weaves them into clothes. 90% of India's silk production is done in Karnataka, Andhra Pradesh, and Tamil Nadu. China is the largest producer of silk in the world.

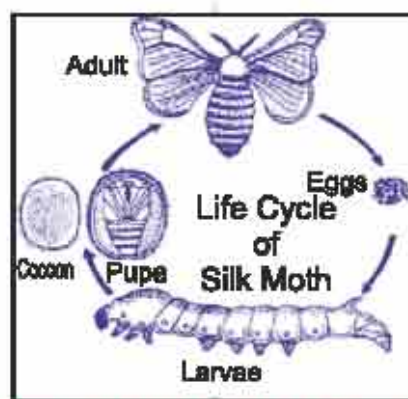


Figure 4.13 : Life cycle of silk moth





**Importance of silk clothes:-**

1. Silk cloth does not wrinkle.
2. They are shiny and attractive.
3. They are light weighted.

**4.5 Our clothing :**

Cotton, silk and woollen clothes are used in Rajasthani poshaks. The dresses which are wear on festivals, marriages and other occasion attract everyone. Chunri Dhoti, kurta, saga and Rajasthani poshak are main dresses wear by man and woman in Rajasthan.



**Figure 4.14 : Different Clothing**

**What have you learnt**

- Clothes are made from threads
- Thread are formed from fibres
- On the basis of sources of fibre we classify them into two
  1. Natural fibres
  2. Artificial fibres
- Natural fibres are further classify into two :-
  1. Plant fibres
  2. Animal fibres (man made).
- Cotton, jute, moonj etc are plant fibre.
- Wool and silk are obtained from animals.
- The process of making yarn from fibre is called Spining.
- Weaving is the process of making clothes form thread.
- Wool is made from sheep while silk from silkworm.



## Exercises

### Choose the correct options :

- The process of separating cotton fibres from its balls is.
 

(a) Spinning	(b) Weaving	
(c) Hand picking	(d) Scoring	( )
- The example of Natural fibre is.
 

(a) Rayon	(b) Nylon	
(c) Cotton	(d) Dacron	( )
- The example animal fibre is.
 

(a) Cotton	(b) Nylon	
(c) Wool	(d) Jute	( )
- From whom the fibre of silk is obtained.
 

(a) Sheep	(b) Goat	
(c) Wool	(d) Silk worm	( )

### Fill in the blanks:

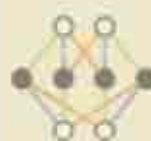
- The process of making thread from fibre is called \_\_\_\_\_.
- The rearing of silk moth is known as \_\_\_\_\_.
- The \_\_\_\_\_ get wrap of silk fibre and form cocoon.
- Nylon, Rayon and Dacron are examples of \_\_\_\_\_ fibres.

### Short answer type questions:

- Explain the difference between natural fibres and synthetic fibres.
- Write any two significance of cotton fibre.
- In which state of our country is silk manufacture?
- Explain the process of making thread from fibre.

### Long answer type questions:

- List the name of clothes used in our daily life and write by which type of fibre they are formed of?
- How is silk obtained from silk worm? Explain.
- Explain the process of obtaining wool from sheep?



**Group activity:**

Do this group activity by making 4-6 groups according to the strength of your class and present in your class.

Group 1 - explanation of animals for obtaining wool.

Group 2 - production of wool.

Group 3 - cloth from cotton plants.

Group 4 - obtaining silk cloth from silk worm.

Group 5 - list of natural and artificial fibre.

Group 6 - list of things formed from moonj.

**Practical work**

1. Draw a print on an unuseful cloth by making blocks of Lady finger, potato and Lotus in the presence of your teacher.
2. Visit to a weaving industry and observe the weaving process.
3. Find out which crop is grown for obtaining fibre and uses of this at your nearby place.
4. Collect knowledge about BT cotton from an agricultural scientist or visit [envior. nic. in/divisions/csnv/btcotton/bgnote.pdf](http://envior.nic.in/divisions/csnv/btcotton/bgnote.pdf).





### Points to be Study

- 5.1 Classification of substances and states of Matter.
- 5.2 Atom and Molecule
- 5.3 Elements, compounds and Mixture

### 5.1 Classifications of substances and States of matter:

We see many things in our daily routine like stone water, paper, sugar, table, plastic, soil etc. All these things are made up of one or other substance. What is substance? Let us know:-

#### Activity 1 :

Collect few things from your nearby places and write their proportion in Table 5.1.

**Table 5.1 : Things and their properties**

S.No.	Things	Weight	Area occupied
1.	Stone	Have weight	Occupy space
2.	Water		
3.	Sugar		
4.	Plastic bucket		
5.	Naphthalene		

From the above table we can say that we have many things around us which have weight and occupy space and are called **Substances**.

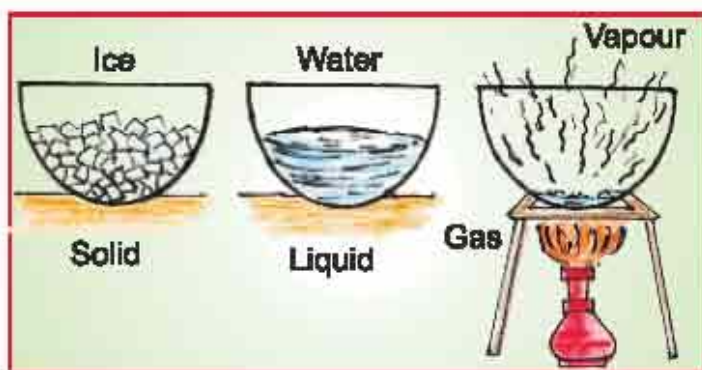
Are all substances similar ?

How many types of substances are there, how they are classified? Let do experiment.

#### Activity 2

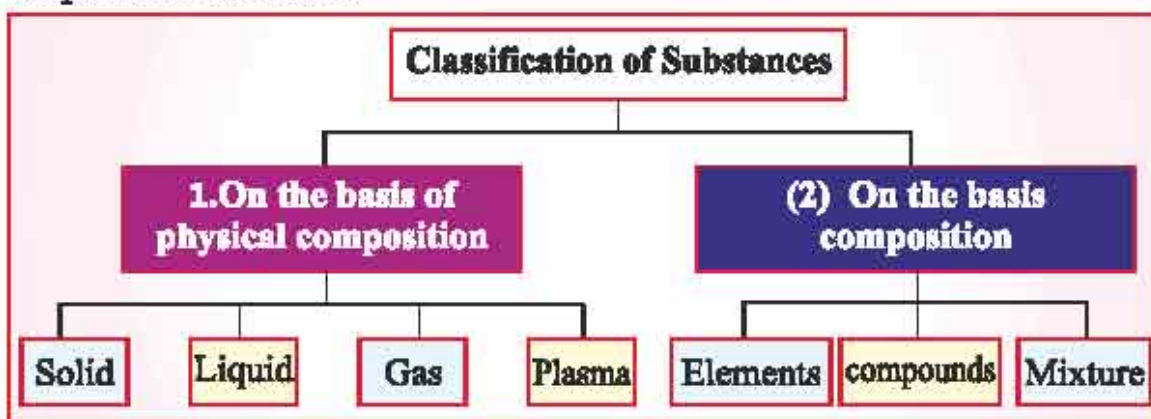
Take some ice cubes in a bowl. Keep for few minutes. You will observe that ice cubes melts into water. Now heat this water. The water gets converted into steam. From this experiment we can say that Substance have three states of matter solid (ice) liquid (water) and gas (steam).





**Figure 5.1 : States of matter**

The physical states of matter are solid, liquid, and gas and plasma. On the basis of chemical composition substances are classified into elements, compounds and mixture.



### The different forms of substances and their states

#### States of matter :

On the basis of volume and shape of particles of substances are classified into following types:

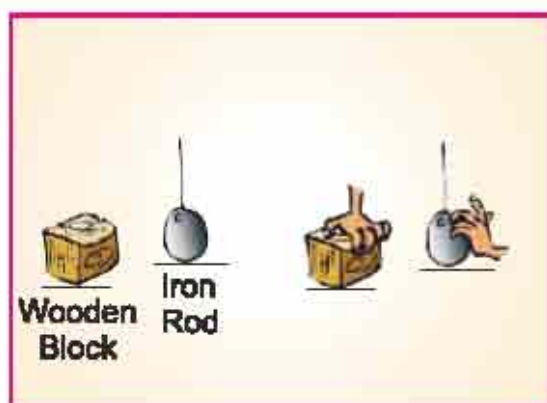
#### Solid :

You all have seen stone, wood, things made from plastic and iron like chair, wooden block etc around your school and homes. What are the shape and volume of these substances? What happens on compressing them? Lets us do experiments.

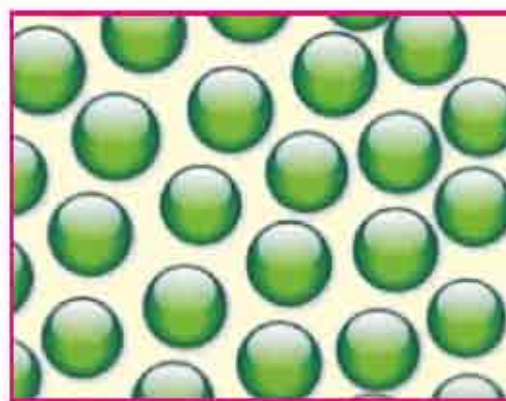
#### Activity 3

Press a wooden block and an iron rod and put them on a table. You find that nothing happened to them. Solids have a definite shape and a definite volume. The particles in solid are very close each other.





**Figure 5.2 (a) : Solids are hard**



**Figure 5.2 (b) : The particles in solid are very close each other**

Those substances that have definite shape and volume are called solid substances.

### Liquid :

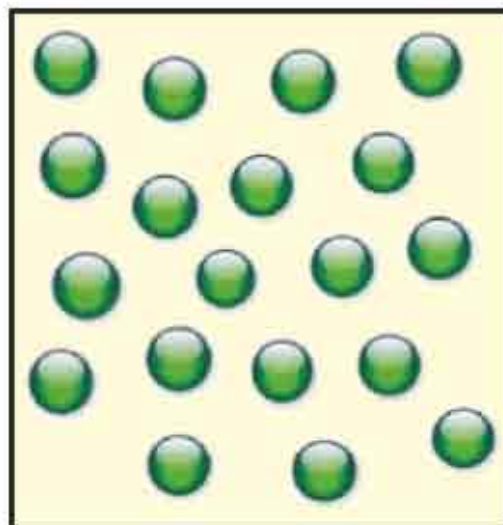
#### Activity 4 :

You have drunk milk, sharbat, water. When we pour water from bottle to a glass, the water takes the shape of that glass. Water takes the shape of the container like- bowl, mud pot, glass etc in which it is poured. Liquids have definite volume but the shape of liquid is dependent on the container in which it is poured. The particles of liquid are little far from each other.

Liquid can flow and can be poured from one container to another.



**Figure 5.3 (a) : The liquid take shape according to container**



**Figure 5.3 (b) : Particles of liquid far from each other**



**Those substances that have definite volume but not definite shape are called liquids.**

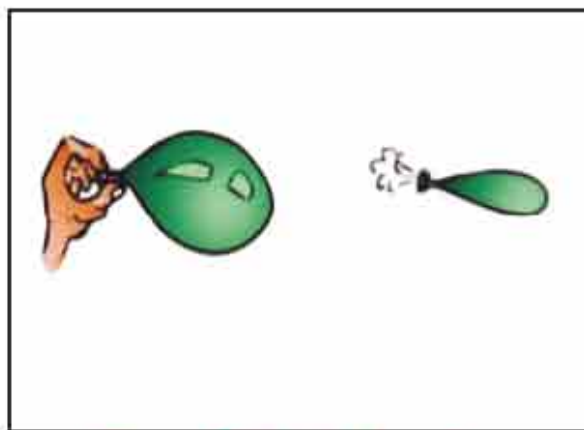
### Activity 5 :

Butter and jelly are solid or liquid. What happens when we spread butter on bread? It does not flow when we keep it on room temperature it does not changes to liquid but when we heat it, it changes to liquid. Jelly is in liquid state, when we refrigerate it, it changes to solid. These types of substances have properties of both solid and liquid.

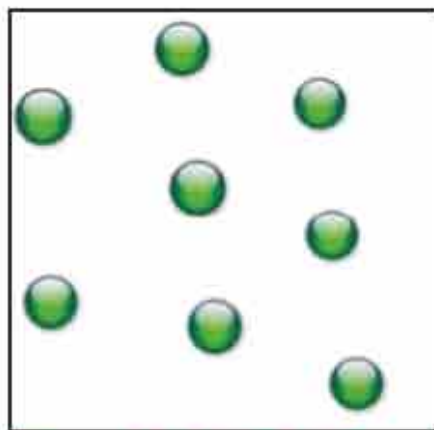
### Gas :

### Activity 6

Inflate balloon and tie it with a thread. What you observe? You see that air takes the shape of balloon. Now open the thread slowly on opening the air comes out and disappear in atmosphere.



**Figure 5.4 (a) : Gas takes the shape of object**



**Figure 5.4 (b) : Particles of gas diffuse at a large distances**

We have air, mixture of gases in our environment we cannot see air. We can feel when it is blowing. The smell of incense stick diffuses everywhere when it lighted. We can feel the smell of smoke from vehicles, fuel smell of waste etc. Gases do not have definite shape and volume and their particles diffuse at a large distances.

**Those substances, whose shape and volume are not definite, are called gases.**



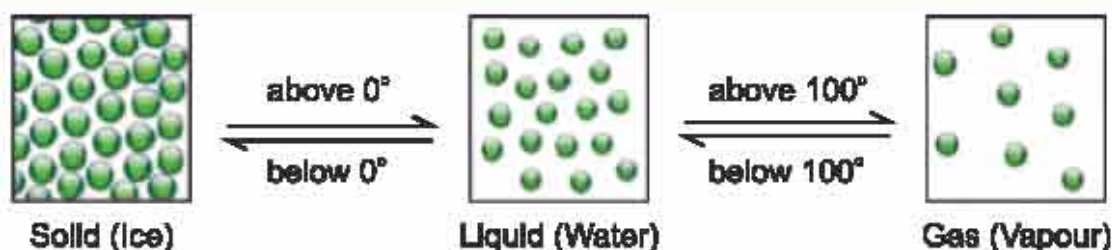


Figure 5.5 : Changes of states

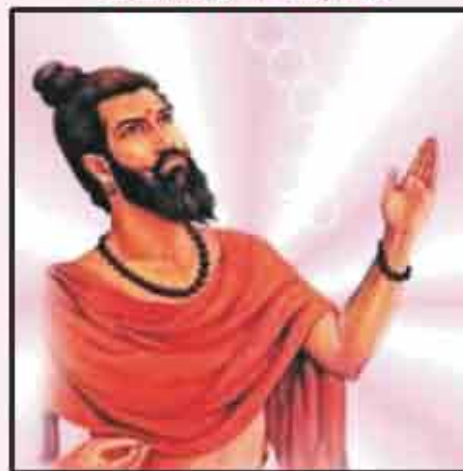
**Plasma :**

This state of matter is actually saturated gases state. This found as hot ionize state. This state is found in sun, stars, tube lights, T.V. and picture tubes. The research is going on this state. You will study this in higher classes.

**5.2 Molecules and Atom****Atom :**

we have studied about states of matter. What these substances are made of? All substances are made up of small particles. Have you ever thought what this small particle is? What is this known as? What is it's the structure? Let us learn –

Many years ago the undivided particle of substance is called as Atom. We cannot see these atoms through naked eyes. Scientists keep on researching in 20<sup>th</sup> century.

**Maharishi Kanad**

In vedic period the great philosopher Kanad authored Veseshik Sutra which is a basic nuclear physics for scientists of West. He propounded the atomic theory in Veseshik philosophy. He gave the concept that atom combines together to build molecules. He ate Tandul particles (also known as Samorice in Hindi) during meditation and created the philosophy that made his name "Kanad". He was the originator of the particles molecule theory hence called as Kanad. This concept of Maharishi Kanad was approximately 25,000 years old than John Dalton, who told about the nuclear principle.



Every substance is formed of atom and atom is the fundamental unit of substance.

Greek philosopher Demokrits named this undivided particle as Atom.

A = cannot + tom = cut

Atom is made up of main three particles:-

Proton (p)

Electron (e)

Neutron (n)

Atom has 2 structural parts

(1) Nucleic (inner part)

(2) Electronic (outer part)

The inner part of atom is called Nucleus.

It has two particles.

(1) Proton (P) - It is positively charged.

(2) Neutron (n) - It is electrically neutral.

The outer parts of atom consist of negatively charged particles called electron (e). They circulate around nucleus in definite orbits.

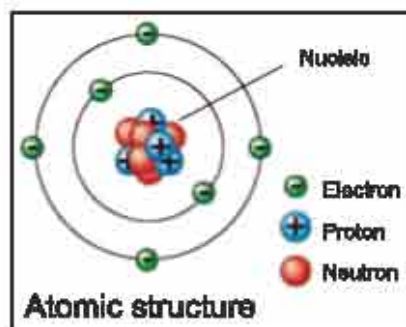


Figure 5.6 : Atomic structure

Atom is the smallest particle of any substance which cannot survive independently and always have properties of its substance.

**Molecules:** - Molecules are formed from two or more than two atoms.

Two atoms of Hydrogen form a molecule of hydrogen.



Figure 5.7 : Molecule of Hydrogen

**Examples:** - Molecule of oxygen and hydrogen are formed from two hydrogen

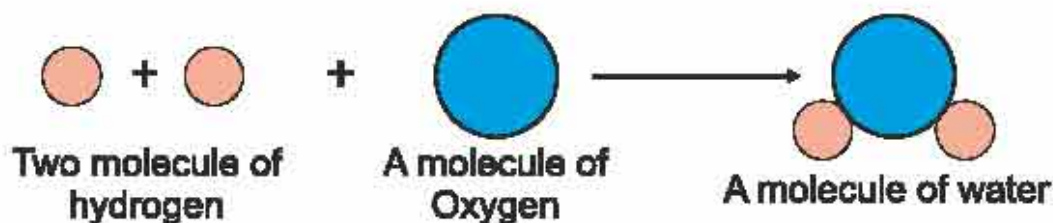


Figure 5.8 : Molecule of water



atom and two oxygen atom respectively but a molecule of water ( $H_2O$ ) is formed from two atom of hydrogen and one atom of oxygen.

**Atom or group of Atoms which can remain independently are called molecule.**

### 5.3 Elements, Compound and Mixture :

From the material around us like – iron, copper, aluminium, gold, salt, water, air, hydrogen, oxygen, carbon dioxide, brass etc some are elements, some are compounds and some are mixtures.

What are element, compound & mixtures? Let us understand

#### Elements :

Pure brass, iron, aluminium, gold, oxygen etc are formed of one type of atom. These are called **Elements**. The atoms of any elements are similar in their properties. Other examples of elements are carbon sulphur and silver etc.

**An element has one type of atom**

#### Chemical symbols :

We use symbols for addition, subtraction, multiplication and division in Mathematics. These symbols represent calculation in abbreviated form. In chemical science we also use symbols like mathematics. In chemical science elements are represented by their symbols. We have discovered 118 elements and millions of compounds are formed from them till date. That's why use of symbol in chemical science is necessary and important in element is represented by one, two or three alphabets of English. Let's learn symbols of some elements:

**Table 5.1 symbols of elements**

Name of Element	Symbol	Name of Element	Symbol
Hydrogen	H	Bromine	Br
Carbon	C	Calcium	Ca
Fluorine	F	Chlorine	Cl
Nitrogen	N	Magnesium	Mg
Phosphorous	P	Sodium	Na
Sulphur	S	Copper	Cu
Oxygen	O	Iron	Fe
Potassium	K	Silver	Ag
Gold	Au	Mercury	Hg
Aluminium	Al	Cobalt	Co



**Compound :**

When two or more atoms combine through chemical reaction in a fixed ratio a compound is form. Eg – sugar, glass, calcium carbonate, salt, sodium bicarbonate, soap, surf etc.

Let us learn some simple compounds and their symbols.

**Table 5.3 compounds and their symbols.**

S.no.	Name of compound	Symbol
1.	Water	$H_2O$
2.	Sodium chloride	$NaCl$
3.	Carbon dioxide	$Co_2$
4.	Magnesium chloride	$Mgcl_2$
5.	Hydrochloric acid	$HCl$

While forming a compound, atom react with other in fixed ratio. The combining capacity of any atom is called **Valency**.

**Mixture :**

All have seen utensils of brass and steel, air, glass,  $H_2O$ , stone etc. Are these all made up of one type of substances? No, all these are formed when two or more compound or elements are mix in any ratio. These substances are called **Mixtures**. Sorbet (sharbat), air, sand are all examples of mixture.

**Satyendra Nath Bose**

He was born on 1 January 1894 AD. He was known as father of statistical engineering. Research of Satyendra Nath Bose and scientist Anarico Fermi made possible to differentiated particles of physics into two parts. For this discovery the particles are given their names as Boson and Fermions. National science council awarded Satyendra Nath Bose with Meghnad Saha Smarak gold medal. 1954 he was awarded with Padma Vibhushan. The principle propounded by Bose is published by famous scientist Einstein. This principle named is Bose Einstein Statistic. With the help of Einstein Satyendra Nath Bose discovered a fifth state of matter as Bose Einstein Condensation which is scientifically proved. That's why he is known as Indian Einstein.



### What have you learnt

- Substances occupy space and have weight.
- On the basis of physical structure substances are of four type solid, liquid, gas and plasma.
- On the basis of chemical composition substances are classified into element, compound and mixture.
- Solid have a definite shape and volume.
- Liquid have a definite volume but its shape is not fixed.
- Gases do not have definite shape and volume.
- Atom is the fundamental unit of substance.
- Atom has inner and outer two parts. Inner part contains proton and neutron. Outer part contain electron.
- An element has one type of atom.
- Group of atom which can remain independently are called molecule.
- When two or more elements combines in fixed ratio through chemical reaction called compound.
- When two or a more element, compound is mixed in any ratio, they called mixture.

### Exercises

#### Choose the correct options.

- The gases state has
 

(a) fixed shape	(b) unfixed shape and volume	
(c) fixed volume	(d) fixed mass	( )
- The main particle of outer part of an atom is.
 

(a) Proton	(b) Neutron	
(c) Proton & neutron	(d) electron	( )
- The substance made up of only one type of particle is.
 

(a) compound	(b) element	
(c) mixture	(d) mixed metal	( )



4. Sugar, salt, glass, plastics are called.  
 (a) element (b) compound  
 (c) mixtures (d) above all ( )

**Fill in the blanks:**

- \_\_\_\_\_ and \_\_\_\_\_ are present in the nucleus of atom.
- The particles of solid are \_\_\_\_\_ to each other while particles of gases are \_\_\_\_\_.
- Sugar is a compound while its syrup is \_\_\_\_\_.

**Match the following correctly.**

Column 1	Column 2
1. Iron	A. Atom
2. Salt	B. Mixture
3. Sarbet	C. Element
4. Electron, Proton and Neutron	D. Compound

**Short answer type questions.**

- Write names of 5 compounds used in our daily life.
- Draw a labelled diagram of structure of atom.
- Identity elements, compounds and mixture from the following - oxygen gas, iron, sugar, salt, hydrogen gas, sand, brass, soap, surf, sugar, syrup, sorbet, air.

**Long answer type questions:**

- Explain with experiments the state of matter.
- Define elements, compound and mixtures with examples.
- Differentiate atom and molecule with example.
- Explain the making of water molecule with diagram.

**Practical work:**

- Make model of structure of atom on a cardboard with the help of balls or marbles.
- Draw chart of symbols of elements and hang in your class.





## Chapter 6

# Living and Non-living

### Points to study

- 6.1 Living and non-living – introduction
- 6.2 Difference between living and non-living
- 6.3 Characteristics of living beings

### 6.1 Living and non-living - Introduction :

Think about your nearby surroundings and name the objects and the animals found in the environment. Make a list of these objects and animals and classify them according to the following table-

**Table 6.1 Classification of objects and animals according to their activities:**

S.No.	Name of the object and animal	Moves by itself	Eats food	Breathes	Grows with time
1	Bag	No	No	No	No
2	Cow				
3	Goat				
4	Stone				
5	Chair				

On the basis of above table, we can say that some animals like humans, cow, goat, parrot, fish etc move by themselves, they breathe and grow. Growth is clearly visible in plants also but these activities are not present in other objects.

So, those organisms in which processes like respiration, movement, growth, reproduction, nutrition etc occur are living. For example- cow, goat, camel, tiger, banyan tree, plants etc. The things in which above mentioned processes are absent are non-living. For example- bag, pen, pencil, rubber, table, chair etc.



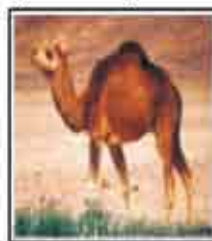
Cow



Tiger



Plant



Camel



Banyan

**Figure 6.1 - Living beings**



Animals and plants show characteristics like growth, movement, respiration, nutrition, reproduction, excretion etc and thus they are called living beings.

In this way, all the objects and plants found in our surroundings are divided into two groups.

- (i) Living- All plants, animals and microorganisms
- (ii) Non-living- All objects except plants, animals and microorganisms.

### 6.2 Differences between living and non-living

Complete the following table to differentiate between living and non-living:

Table 6.2

S. no	Characteristic	Living	Non-living
1.	Life span	Fixed life span	Not fixed
2.	Food		
3.	Respiration		
4.	Reproduction		
5.	Growth		
6.	Excretion		

### 6.3 Characteristics of living beings

By interpreting the above table 6.2, we can say that living beings have some specific characteristics. These characteristics are as follows:

- (i) Living beings eat food.
- (ii) Living beings grow.
- (iii) Living beings respire.
- (iv) Living beings can move by themselves.
- (v) Living beings have sensation and they respond towards stimulus.
- (vi) Living beings perform excretion.
- (vii) Living beings reproduce.
- (viii) Living beings have a fixed life span.

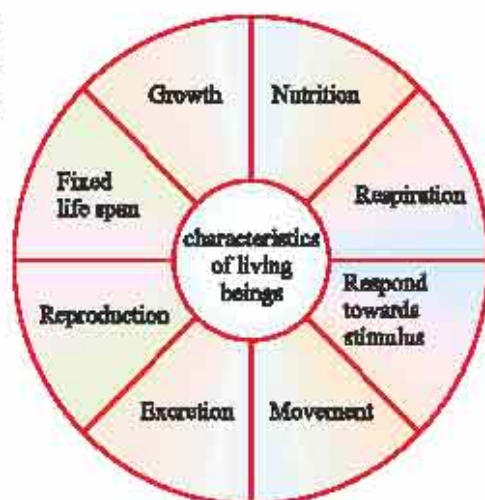


Figure 6.2 Characteristics of living beings



**(i) Living beings eat food**

How do plants take food?

What do animals eat?

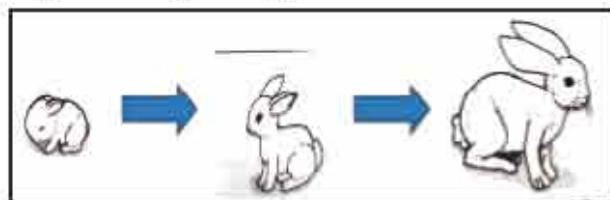
You know that plants prepare their own food by photosynthesis and animals depend mainly on plants for their food. Food provides energy to living beings so that they can perform various daily activities.

**(ii) Living beings grow**

On the basis of our daily observations, we can say that living animals and plants grow. It is the basic characteristic of all the living beings. In animals, growth stops after a certain time but in perennial plants, growth continues.



**Figure 6.3 (a) Growth in plants**



**Figure 6.3 (b) Growth in animals**

**(iii) Living beings respire**

Do all living beings breathe?

Which gas is taken in by living beings during respiration and which gas is given out?

Living beings take in oxygen and give out carbon dioxide gas during respiration.

The breakdown of glucose by oxygen and release of energy in our body is called respiration. Carbon dioxide gas is released in this process.

Does respiration occur in plants also? Yes, respiration occurs in plants also.

Respiration is essential for all living beings (animals and plants). Living beings cannot survive without respiration.

**(iv) Living beings can move on their own**

You have seen human beings and animals walking, fishes swimming in the water, birds flying and snakes crawling.

Do plants also move from one place to another?

Do plants also show movement?

Which characteristics of movement are found in plants?



Let us find out. Animals can move from one place to another but in plants, only indications of movement are observed. The bending of sunflower plant towards the sunlight is an example of movement in plants.

Some non-living things like bus, cycle, car etc can also move. They show movement but they do not move on their own. Here, movement is caused by external factors. They lack other characteristics of living beings.

**(v) Living beings are sensitive and respond towards stimuli**

- ◆ Why do you pull back your leg when pricked by a thorn or a needle?
- ◆ Why does your mouth start watering when you see delicious food?

By discussing the above mentioned questions, we can conclude that living beings react towards changes in our environment, in one way or the other, and it is called the response towards stimuli.

- ◆ Do plants also respond towards stimuli?
- ◆ Plants also respond towards stimulus. For example- leaves of mimosa plant (touch-me-not) shrivel when touched.



**Figure 6.4 : Response of leaves of mimosa plant**

**(vi) Excretion occurs in living beings**

You know that all animals eat food. Digestion of food occurs in the body of animals. Not whole of the ingested food is used by the body. The undigested part of food is expelled out of the body as waste ( faeces- urine). Body sweat is also a form of waste material.

- ◆ Do plants also release waste material?

Some harmful materials are also present as waste in plants. They are removed in the form of secretions. In some plants, these waste materials are collected in some special parts, like- gum.

The process of removal of waste material out of the body by living beings is called excretion.



**(vii) Reproduction occurs in living beings**

Animals produce offsprings similar to them by the process called **Reproduction**. Some animals reproduce by laying eggs. Make a list of animals found around you that can reproduce by laying eggs.

Similarly, you might have seen new plants getting produced by the germination of seeds. On this basis, we can say that all living beings produce offsprings of their own kind and this process is called **Reproduction**.

- ◆ Reproduction is an important characteristic of living beings.
- ◆ Reproduction ensures the existence of living species.
- ◆ Living beings produce offspring similar to them.



**Figure 6.5 (a) Reproduction in animals      Figure 6.5(b) Germination and growth in plants**

**(viii) Living beings have a fixed life span**

- ◆ Do all living beings have a fixed life span?
- ◆ Do all living beings grow?
- ◆ Do all living beings die?

It is true that all living beings take birth, they grow and then they die. All living beings have almost fixed life span.

Life and death are the true characteristics of living beings. So, live life happily.

**Virus**

Virus is the connecting link between living and non-living. They remain as non-living during their independent phase. As soon as they enter living beings, they start normal growth (multiplication) and show other such characteristics of living beings. They cause various diseases in plants and animals.



**Figure 6.6 : Virus**



**Jagdish Chandra Bose**

Acharya Jagdish Chandra Bose was born on 30 November, 1858 and he spent his childhood in Raroli village ( now in Bangladesh). Acharya Bose graduated from Calcutta University and completed M.A. from Camilton University, Cambridge. In 1896, he achieved a doctorate degree in science from London University. He was selected as a fellow of Royal Society in 1920. He conducted important researches in the field of physics and biology. Acharya Bose invented an extremely sensitive instrument called Cescograph, to measure the slow growth in plants. He experimentally proved the sensitivity of plants. At the end of the 19th century, the works of J.C. Bose, brought fame to India, worldwide. In 1898, it was proved that Marconi's wireless receiver was invented by Jagdish Chandra Bose. Acharya Bose invented an instrument which could produce microwaves, which ranged from 25 millimeter to 5 millimeter in length.

**What have you learnt**

- ◆ Two types of things are found in our surroundings- living and non-living.
- ◆ Some characteristic features of living beings are nutrition, growth, respiration, movement, response towards stimuli, excretion, reproduction and fixed life span.
- ◆ Reproduction ensures the existence of the species of living beings.
- ◆ Virus are the connecting link between living and non-living.
- ◆ Virus are non-living during independent phase but as soon as they enter living beings, they acquire characteristics similar to living beings.

**Exercises****Choose the correct option**

1. It is a connecting link between living and non-living?

- (a) virus  
(c) cow

- (b) table  
(d) none of these

( )



2. This is essential for the existence of species of the living beings?  
(a) respiration (b) reproduction ( )  
(c) movement (d) growth

**Fill in the blanks**

1. Living beings \_\_\_\_\_ towards stimuli.
2. Plants prepare their own food by the process of \_\_\_\_\_.
3. During respiration, animals use \_\_\_\_\_ and give out \_\_\_\_\_.
4. Bending of sunflower plant towards the sunlight is a characteristic of \_\_\_\_\_.

**Short answer type question**

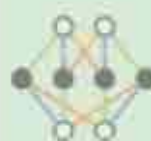
1. Make a list of the characteristics found in living beings?
2. What is respiration? Explain.
3. Give an example to demonstrate movement in plants.
4. Mention two examples which show that plants respond towards stimulus.

**Long answer type question**

1. Explain movement in animals and plants giving example of each.
2. Differentiate between living and non-living, by giving examples.
3. Describe the response towards stimuli in animals and plants.

**Practical work**

1. Observe the daily life of any one animal and write the observations in a notebook.
2. Prepare a chart on the characteristics of living beings and display it in your classroom.



## Points to study

- 7.1 Cell and the discovery of cell
- 7.2 Organisms on the basis of cellular organization
- 7.3 Size of cells
- 7.4 Shape of cells
- 7.5 Parts of the cell
- 7.6 Prokaryotes and eukaryotes

### 7.1 Cell and discovery of the cell

You might have seen a house being built. Lots of bricks are needed to build a house. A house is built by assembling these bricks. Similarly, the body of organisms is made by assembling of many cells.

Can you guess the total number of cells in our body?

Robert Hooke was the first to discover cell in 1665. He observed a thin slice of cork under his self made microscope. He noticed honey comb-like boxes or compartments in the thin cork slice. Robert Hooke coined the term 'cell' for these compartments (fig.7.1).



**Figure 7.1 Compartments in thin slice of cork**

### 7.2 Organisms on the basis of cellular organization

The body of humans and other large organisms is made up of billions of cells. Organisms made up of more than one cell are called **Multicellular organisms**. Some organisms such as amoeba, paramecium etc. are made up of a single cell. They are called **Unicellular organisms**. Just like multicellular organisms, the unicellular organisms also perform all activities like respiration, digestion, growth, reproduction etc.

Every cell consists of a nucleus. On the basis of presence or absence of membrane around the nucleus, organisms are divided into prokaryotes and eukaryotes.

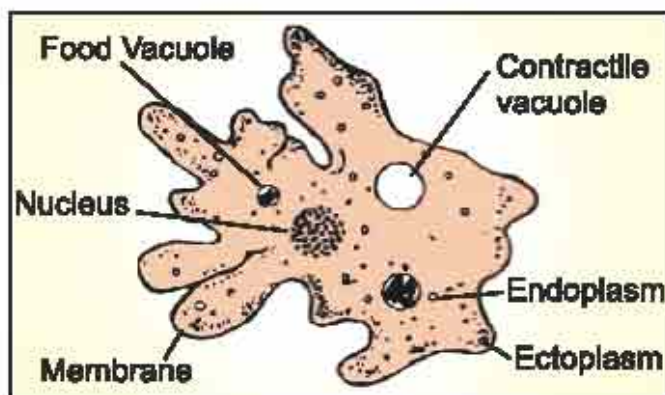


### 7.3 Size of cells

The size of cells may be as small as a millionth of a meter (micrometer) or as large as few centimeters. However, most of the cells are microscopic in size. They are not visible to the unaided eye. Cell can be seen with the help of a microscope. The smallest cell is 0.1 to 0.5 micrometer, which is a bacterial cell. The largest cell is the egg of an ostrich, measuring 170 X 130 mm.

### 7.4 Shape of cells

Shape of some cells is irregular. They keep on changing their shape. For example- Amoeba, Mycoplasma etc.

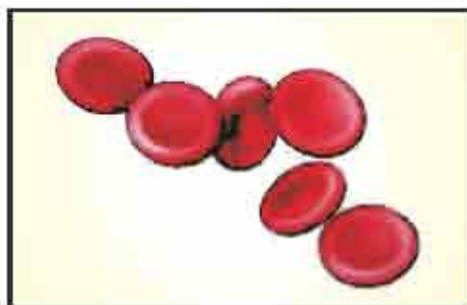


**Figure 7.2 Cell of amoeba**

Various types of cells are found in our body. What is their shape?

**Let us find out-**

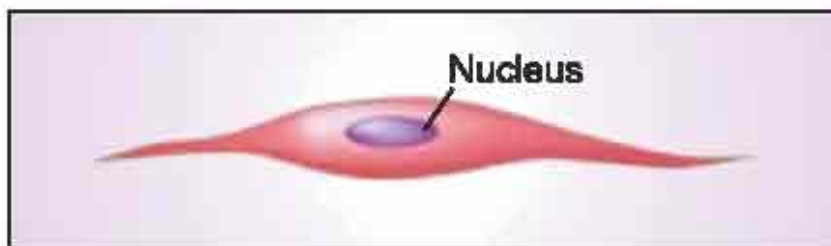
Some cells are round and flat. For example- Blood cells.



**Figure 7.3 Round blood cells**

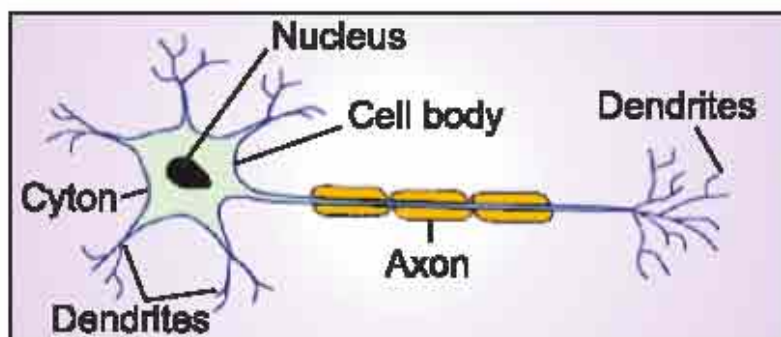
Some cells are long and spindle shaped. They are pointed at both ends. For example- Muscle cells.





**Figure 7.4 Spindle-shaped muscle cell**

Some cells are quite long and branched. For example- nerve cells or neurons.



**Figure 7.5: Long and branched nerve cell**

Generally, cells are round, flat and elongated. Do bigger organisms have larger cells? It is not necessary that the size of cells in large organisms will be large and the cells in smaller organism will be smaller. The size of the cell is related to its function. Example - the nerve cells carry signals from one place to another. Inspite of the difference in the size of humans and rats, nerve cells in both are long and branched.

#### **Tissue-Organ-System:**

- Cell is the structural unit of every living organism.
- A group of cells performing similar function is called a tissue.
- A group of tissues performing similar function is called an organ.
- Different organs form an organ system.
- Different organ systems form the body.

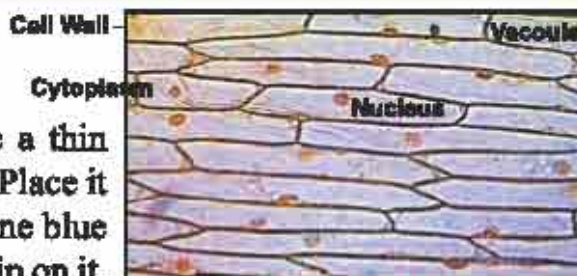
Cell → tissue → organ → system → body



**Let us try and see:**

### Activity 1

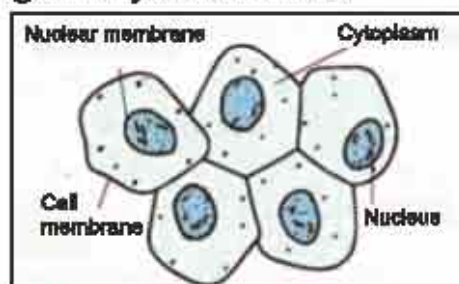
Take a piece of onion. Separate a thin layer of onion with the help of forceps. Place it on a glass slide. Add a drop of methylene blue solution to the layer and place a coverslip on it. While placing the coverslip ensure that there are no air bubbles under the coverslip. Carefully observe the slide under the microscope. With the help of a pencil, draw its diagram in your notebook.



**Figure 7.6 : Cells in a thin layer of onion**

### Activity 2

Take a clean plastic spoon. Scrape inside of your cheek with the rear end of the spoon. Place it in a drop of water on a glass slide. Add 1-2 drops of methylene blue solution. Observe the slide under the microscope. Identify the cell membrane and nucleus. Draw its diagram and label it.



**Figure 7.7 : Cells of inner surface of cheek**

## 7.5 Different Parts of the Cell

There are three basic parts of a cell: cell membrane, cytoplasm and nucleus.

**1. Cell membrane:** It is the outer covering of the cell. It is also called **plasma membrane**. It is porous and is made up of fats and proteins. Cell membrane allows selective substances to enter the cell and helps in removal of waste substances. This membrane is similar in animals and plants. In plants, a thick covering of cellulose is present outside the cell membrane which is called **cell wall**. The cell wall gives definite shape to the plant cells.

**2. Cytoplasm :** The fluid present between the cell membrane and the nucleus is called **cytoplasm**. It is a jelly-like substance. Structures like-mitochondria, vacuoles, golgi body, endoplasmic reticulum, chloroplast etc. are present in the cytoplasm. These structures present in the cytoplasm are called **cell organelles**.

**3. Nucleus :** It is generally spherical. In animal cell, it is located in the centre but in plant cell, it is not located in the centre and shifts towards one side due to large vacuoles. It is enveloped by a double-layered membrane. This membrane is porous and allows the movement of materials. Nucleus contains a small dense structure called the **nucleolus**. Nucleus contains thread-like structures called **chromosomes**. Chromosomes carry genes which carry





hereditary information from the parents to the offspring. Nucleus controls all the activities of the cell.

### 7.6 Prokaryotes and Eukaryotes

The nucleus of a bacterial cell does not have a nuclear membrane around it. Cells in which the nucleus is not enveloped by a nuclear membrane are called **prokaryotic cells** and the organisms having such cells are called **prokaryotes**. Cells which have a nuclear membrane around the nucleus are called **eukaryotic cells**. The organisms having such cells are called **eukaryotes**.

**Cell organelle:** The main cell organelles found in the cytoplasm are described below:

**Lysosome:** It contains very strong digestive enzymes. When the cell gets injured or is dead, then the lysosomes rupture and the digestive enzymes digest their own cell. That is why they are also called suicidal bags.

**Golgi body:** They are flattened membranous structures arranged one above the other. It was first of all described by a scientist named, Camillio Golgi. The substances produced in the endoplasmic reticulum are trapped in golgi apparatus and are sent to various locations inside and outside the cell.

**Mitochondria:** It is a structure covered by a double layer membrane. Its inner membrane is extensively folded. These folds are called cristae. Biological energy ATP is produced in the mitochondria. That is why it is also called the power house of the cell.

**Endoplasmic reticulum:** This structure appears as a network of thin tubules present in cytoplasm. It is of two types:

1. Rough endoplasmic reticulum
  2. Smooth endoplasmic reticulum
- Ribosomes are attached to the rough endoplasmic reticulum and perform the function of protein synthesis.

**Plastid:** They are present in

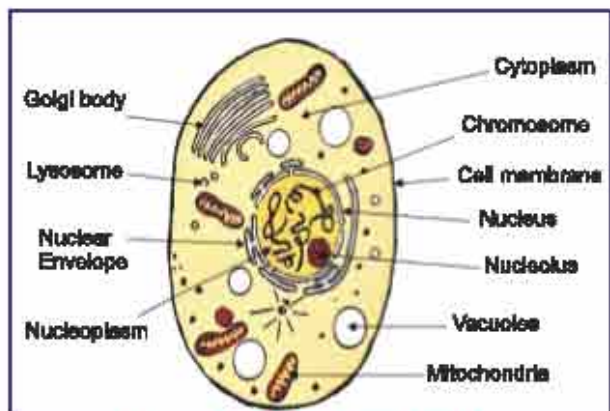


Figure 7.8 Animal cell

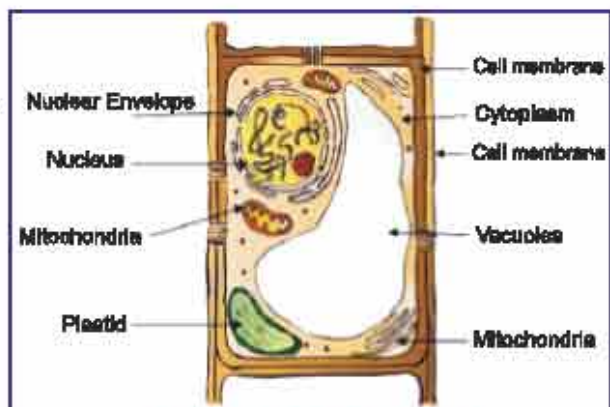


Figure 7.9 Plant cell



the cytoplasm of plant cells. Most plastids contain a green pigment called **chlorophyll** and the green coloured plastids are called chloroplast. These give green colour to the leaves. Plants perform photosynthesis and make their food with the help of chlorophyll. Chlorophyll is very essential for photosynthesis.

**Vacuoles:** Large vacuoles are found in plant cells while animal cells contain small vacuoles.

Look at the figure, mark a (✓) on the correct option in the table given below:-

S. no	Part of cell	Animal cell	Plant cell
1.	Cell membrane	Present / absent	Present / absent
2.	Position of nucleus	In centre/ on one side	In centre/on one side
3.	Size of vacuole	Small/ big	Small/ big
4.	Plastid	Present / absent	Present / absent

#### Dr. Har Govind Khurana



He was born in a town named Raipur of Multan district, Punjab in the unpartitioned India. He passed B.Sc. (honours) in 1943 and M.Sc (honours) in 1945 from Punjab University and went to England after receiving scholarship from The Government of India. He achieved a doctorate degree from Liverpool University by researching under the guidance of A. Robertson. Dr. Khurana was the first to show the role of nucleotides in protein synthesis. In 1968, he was awarded the Nobel prize for outstanding work in the field of genetics. Government of India awarded him the Padma Vibhushan award.

#### Dr. Satish C. Maheshwari



Satish C. Maheshwari achieved B.Sc (honours), M.Sc and Ph.D degrees from Delhi University. He researched on the embryology of duckweed (smallest flowering plant of Lemnaceae family) under the guidance of Prof. B.M. Johari. Dr. Maheshwari and group, used stamen culture technique for the advancement of crops, animal rearing and ornamental plants. 200 research papers of Dr. Maheshwari were published and he also wrote a book "Signal Transduction Mechanism in Plants". He was awarded Bhatnagar Award, J.C. Bose gold medal, Birbal Sahni gold medal and Goyal Foundation award for his outstanding work.



### What have you learnt

- Cell was discovered by a scientist named Robert Hooke in 1665.
- The largest cell is the egg of an ostrich.
- Cell wall is present in plant cell but it is absent in animal cell.
- The fluid present between the cell membrane and the nucleus is called cytoplasm.
- Cells which lack nuclear membrane are called prokaryotic cells.
- Chlorophyll is found in the chloroplast.
- Thread - like structures found in the nucleus are called chromosomes.

### Exercises

#### Choose the correct option

- Who discovered cell?
 

(a) Robert Brown	(b) Robert Hooke	( )
(c) Schleiden	(d) Schwann	
- Which of these is absent in the animal cell?
 

(a) mitochondria	(b) nucleus	( )
(c) cytoplasm	(d) plastid	
- A group of similar cells performing a specific function is called-
 

(a) organ	(b) cell	( )
(c) system	(d) tissue	

#### Fill in the blanks

- Thread like structures found in the nucleus are called \_\_\_\_\_.
- Amoeba is a \_\_\_\_\_ organism.
- An organism made up of more than one cell is called \_\_\_\_\_ organism.
- Nerve cells are \_\_\_\_\_ and \_\_\_\_\_.

#### Short answer type question

- What is the difference between prokaryotic and eukaryotic cell?
- Define a tissue.



3. Why mitochondria is called the power house of the cell?
4. Why lysosome is known as suicidal bag?

### Long answer type questions -

1. Explain the following parts of the cell alongwith diagrams -  
(i) nucleus (ii) cell membrane (iii) cytoplasm
2. What are the differences between animal cell and plant cell?
3. Draw a labelled diagram of the animal cell?

### Practical work

1. Make a chart of cell structure.
2. Collect more information about cell from the website [www.enchantedlearning.com/subjects/plants/cell/sj](http://www.enchantedlearning.com/subjects/plants/cell/sj) and prepare an article.
3. Using gaming method, display the cell organelles and their functions in classroom. Various students will play the role of mitochondria, endoplasmic reticulum, plastid, vacuole etc and explain about these. One student will play the role of an anchor.
4. With the help of your teacher, observe a permanent slide of amoeba under the microscope. Apart from this, collect water from pond and put a drop of pond water on an empty slide and observe the organisms present in it.



## Points to study

- 8.1 Micro-organisms
- 8.2 Types of micro-organisms
- 8.3 Beneficial micro-organisms
- 8.4 Harmful micro-organisms
- 8.5 Proper maintenance of items from protection against micro-organisms

Various organisms are present around us. Some are very large, such as blue whale, elephant, banyan tree etc and some are so small that we normally cannot see them with our eyes, like amoeba, bacteria, virus etc. Organisms that can be seen only with the help of a microscope are called **micro-organisms**.

**Microscope:** An instrument that is used to view micro-organisms is called a microscope.

## 8.1 Micro-organisms

### Activity 1

Keep bread or chapati in a moist place and observe the changes that occur in it daily and list them.

In how many days its surface got covered with white filament-like structures and black spots? Observe these spots with the help of a magnifying glass-

Which type of structures do you see?

Can you see these structures without a magnifying glass?

What are these structures?

Where did these structures come from? These structures are the filaments and spores of fungi. Spores of many micro-organisms remain suspended in air. In presence of favourable environment and nutrition, they grow and form filament-like structures.

### Activity 2

Take a few drops of water from a pond, spread it on a glass slide and observe through a microscope.

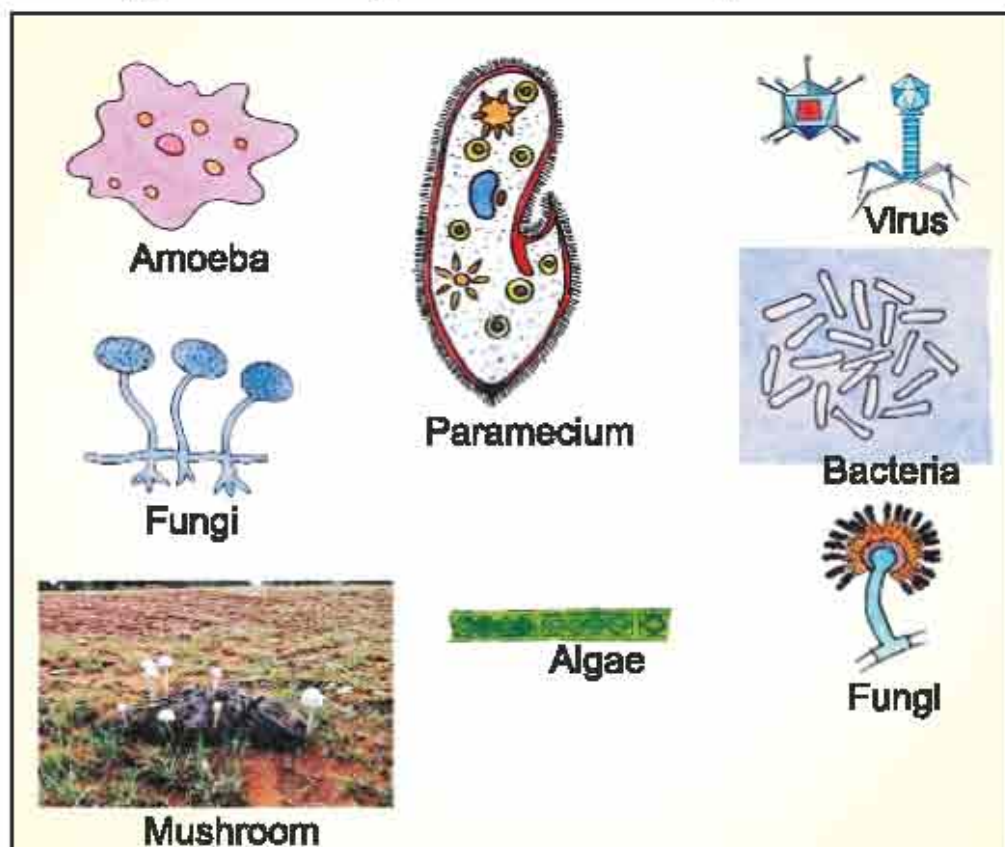
- Which type of structures do you see?
- What are these structures?



Figure 8.1 Magnifying glass



Many types of micro-organisms are found in a single drop of water that can be seen only with the help of a microscope. So, micro-organisms are usually found in air, water, soil, hot water springs, snowy areas, marshy land. This means that they are present everywhere. They are present in the body of other organisms also. Approximately 2.5 billion bacteria are present in per gram of soil. Various types of micro-organisms are shown in Fig. 8.2.



**Figure 8.2 : Different types of micro-organisms**

### 8.2 Types of micro-organisms

Micro-organisms are of 6 types:

1. Virus 2. Mycoplasma 3. Bacteria 4. Fungi 5. Protozoa 6. Algae

**1. Virus :** They are the minutest structures. They are also called the connecting link between living and non-living because they possess both living as well as non-living characteristics. In nature, they remain as non-living but once they enter living being, they start growth and multiplication. They cause many diseases in plants and animals. Example - Tobacco Mosaic Virus (TMV), Human Immuno Deficiency Virus (HIV) etc.



**2. Mycoplasma :** Mycoplasma is the smallest cell which can sieve even through a virus filter. It causes diseases in plants such as little leaf of brinjal and sesame phyllody. They are called the jokers of the plant kingdom.

**3. Bacteria :** They are unicellular prokaryotes. Bacteria are found in all places around us. Example - *E.coli*, *Lactobacillus* etc.

**4. Fungi :** They are also called fungus or moulds. They are micro-organisms with simple structure and can be unicellular or multicellular. They lack chlorophyll in their cells. So, they cannot prepare their own food. Some fungi obtain food as saprophytes by absorbing nutrients from decaying organic substances. Example - mushroom. Some fungi live as parasite on plants and animals. For example - *Puccinia graminis tritici* (black rust disease) in wheat and *Sclerospora graminicola* (downy mildew disease) in millet. Some fungi live in symbiotic relation with algae.

**5. Protozoa :** They are unicellular organisms. Example - amoeba, *Paramecium* etc.

**6. Algae :** They are micro-organisms having simple structure and may be unicellular or multicellular. Water in ponds, puddles and drains appear green due to the presence of algae. Example - *Chlamydomonas*, *Chlorella* (eukaryote, unicellular), *Spirogyra*, *Ulothrix* (eukaryote, multicellular) and blue-green algae (prokaryote, multicellular).

### 8.3 Beneficial micro-organisms

Many micro-organisms are also beneficial to us. Let us study about such micro-organisms.

#### Activity 3

##### Formation of curd

**Requirements :** Milk, curd, utensil, lid etc.

**Procedure :** Boil milk and then cool it till it is lukewarm. Add the required amount of curd in lukewarm milk and stir it well. Cover the utensil with lid.

Now, keep the utensil in a warm place. During winter, it must be kept in flour container.

##### On observing in the morning

**Observation :** Milk is converted into curd.

**Conclusion :** *Lactobacillus* bacteria present in the curd changes milk into curd. From the above activity, we can find out that micro-organisms are also beneficial to us.



### Benefits from micro-organisms

**1. Production of food stuffs :** Micro-organisms are used for the production of curd, cheese, vinegar etc. Yeast is used for making bread and in fermenting the solution used in the preparation of jalebi. Chlorella is used to make soup and other food ingredients. Food ingredients produced by chlorella are used for making ice creams.

**2. Preparation of medicines :** Vitamin B<sub>12</sub> is prepared from a bacteria named, *Clostridium botulinum* and another bacteria named Anthracoid bacilli is used for preparing immunological substances. Penicillin, a life saving drug which is used as a vaccine and antibiotic, is prepared from a fungi named penicillium. Penicillin was discovered by Alexander Fleming.

**3. Biological nitrogen fixation :** Certain species of bacteria and some other micro-organisms convert the atmospheric nitrogen into such compounds that can be absorbed by plants. This process is called **nitrogen fixation**. Example - Rhizobium bacteria is present in the root nodules of leguminous plants such as kidney bean, gram, pea etc. These root nodules are present only in leguminous plants.

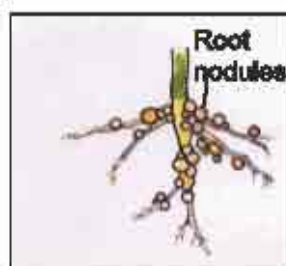


Figure 8.3 : Root nodules in roots of leguminous plants

#### Activity 4

Uproot a pea or kidney bean plant. Wash the soil from roots with water.

- What do you see in roots?
- What are these node like structures called and how are they formed?
- What is their function?

Are they found in the roots of all types of plants?

These node-like structures are called root node or nodules. Rhizobium bacteria are present in it. They are helpful in converting atmospheric nitrogen into nitrates. Nitrates make soil more fertile. Nitrates are the main source of nitrogen for plants. Nitrogen is an integral constituent of protein. Due to this reason, farmers grow leguminous crops like kidney bean, moth, cluster bean (guar) etc in one year and cereal crops like millet, sorghum etc in the next year.

#### Nitrogen Cycle

When decomposition of dead animals and plants occur, then nitrogen present in them is released into the atmosphere. This nitrogen is again obtained by plants. In this way, this cycle continues in nature. As a result, the amount of nitrogen in the soil remains constant. The process of conversion of free atmospheric nitrogen into usable compounds and reaching in living beings and then again release of nitrogen in the atmosphere is called nitrogen cycle.





**4. Humus formation :** Bacteria decompose leaves, dung and other waste material and convert them into humus. This makes soil fertile.

**5. In making toothpaste :** A microorganism named *Xanthomonas compestris* is used to make toothpaste.

### 8.4 Harmful micro-organisms

Some micro-organisms are beneficial where as some are harmful to us. Let us study about these harmful micro-organisms.

Some important harmful micro-organisms are as follows:

**1. Disease causing micro-organisms :** Disease causing micro-organisms are called pathogens. T.B, whooping cough, diphtheria, tetanus, cholera, malaria, skin diseases etc in humans are caused by these micro-organisms. Anthrax is a disease caused by micro-organisms in humans and animals. Foot and mouth disease in cows is caused by a virus. Citrus canker (bacterial), rust of wheat (fungal), yellow mosaic in ladyfinger (viral) are caused by micro-organisms.

**2. Spoiling of food stuff:** Cereals, pulses, ripe fruits, pickles etc get spoiled due to micro-organisms. So, they must be protected from being infected by micro-organisms.



**Figure 8.5 Orange infected by fungi**

**3. Food poisoning:** *Clostridium botulinum*, a bacteria that causes food poisoning and the person who eats this food, suffers from vomiting and diarrhea and in some cases it may lead to death.

**4. Damages valuable items:** Micro-organisms damage valuable items made of clothes, paper, wood, leather etc. which lowers their quality.



**Figure 8.4 Citrus canker disease in lemon**

### 8.4 Proper maintenance of items for protection against micro-organisms:

#### Remedy for protection against harmful micro-organisms:

- Cereals, pulses, clothes etc must be kept in sunlight from time to time.
- Cooked dal, milk etc must be kept in cool place.
- Oils in pickles and sugar in jams can be used.
- Food stuffs can be prevented by using vinegar.
- Neem leaves and balls of mercury (parad goli) must be used in grains of paddy and pulses.



**Food preservation**

- How to preserve the left food at home?
- What changes occur in bread kept in open and moist place?
- What happens when food is contaminated by micro-organisms?
- Is the contamination of food a chemical reaction?

**Activity 5**

Take some of the mangoes kept in your house and keep them outside. Observe them after 6-7 days and see what has happened? They are rotten.

Have you ever imagined that the mangoes were rotten but the mango pickle made by your grandmother or mother does not spoil for a long time. Why this happens? This is possible due to the preservation of food stuffs.

**Food preservation:** The process of maintaining the nutrient richness and quality of food and other edible substances is called food preservation.

**Common methods of food preservation**

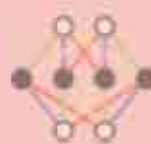
**1. Refrigeration :** In process of refrigeration, the temperature is low. Biological activities of micro-organisms become slow at low temperature. So, food stuff does not get spoiled easily when kept in refrigerator.

The process of keeping food items at low temperature is called **refrigeration**. Now a days, farmers and businessmen, use cold storage to keep fruits, vegetables and other food items fresh and preserved.

**2. Sterilization :** Before one decade, glass syringe and needle were kept in boiling water before using them.

- Why were they heated?  
They became bacteria-free after heating.
- Which type of syringes are used in hospitals now a days?  
Now a days, sterilized needles and syringes are used and they can be used only once.

The process of keeping syringe and needle of an injection in boiling water to make them germ-free, is called sterilization.



To make the equipments and objects used in an operation germ-free, an instrument named autoclave is used. It works like a pressure cooker. Ultraviolet rays can also be used to make objects germ-free.

**3. Pasteurization :** Now a days, the use of canned food items is increasing. Before packaging milk or other food items in cans or bottles, milk or the food items are heated at  $60^{\circ}\text{C}$  for 30 minutes and then cooled down. This process is repeated 2 - 3 times and it kills the harmful micro-organisms present in them. This technique of killing germs is called pasteurization. Air is removed from the cans after pasteurized food items are packaged in cans because the micro-organisms cannot grow in the absence of air.

The date mentioned on the cans before which the food item must be consumed is known as expiry date. We must always see the expiry date of canned food items before buying them. Such food items must be consumed before their expiry date.

**4. Dehydration:** In this, water is removed from food items. Example - keeping wheat and pulses in sunlight to remove moisture.

**5. Boiling:** Liquid food items are boiled to kill micro-organisms present in them. Example - milk, water etc.

**6. By using chemicals:** Those substances which help in preserving food items are called preservatives. Example - sodium benzoate and potassium metabisulphate are used for the preservation of syrups, squash, ketchup etc.

**7. Using salt, sugar, oil and vinegar:** Salt, sugar, oil and vinegar are used in the preservation of meat, pickles, jam, jelly and vegetables.

**8. By using disinfectants:** Soaps are used to wash dirty hands. Phenyl is used to clean dirty toilets and bathrooms and make them bacteria-free.

**9. To make bacteria free water :** Chlorine, bleaching powder, potassium permanganate etc are used. In addition to these, carbonic acid is also used as a germicide (substance which kills germs).





### What have you learnt

- Micro-organisms can be seen only with a microscope.
- Micro-organisms are of 6 types- 1. Virus 2. Bacteria 3. Fungi 4. Protozoa 5. Algae 6. Mycoplasma
- Bacteria are used in the preparation of curd, vinegar, cheese etc.
- Fungi named yeast is used in making bread.
- A unicellular organism named chlorella is used to produce food stuffs.
- Penicillin is obtained from a fungi named penicillium.
- A bacteria named rhizobium is present in the roots of pea plant and it converts atmospheric nitrogen into nitrates.
- Micro-organisms cause diseases in plants and animals.
- Food items can be protected from micro-organisms by refrigeration.
- Canned food items are kept free from micro-organisms by the process called pasteurization.

□□□

### Exercises

#### Choose the correct option

- Which of the following is a microorganism?
 

(a) virus	(b) fungi	( )
(c) bacteria	(d) all of these	
- Which microorganism possess characters of both- living and non-living?
 

(a) bacteria	(b) fungi	( )
(c) virus	(d) protozoa	
- Which of these is an antibiotic?
 

(a) penicillin	(b) insulin	( )
(c) aldrin	(d) auxin	



4. Which of these is an unicellular organism?

- (a) amoeba (b) cow  
(c) star fish (d) humans

( )

### Fill in the blanks:-

- \_\_\_\_\_ can be seen with the help of a microscope.
- Food ingredients are prepared by an unicellular organism named \_\_\_\_\_.
- \_\_\_\_\_ bacteria convert the atmospheric nitrogen into nitrates.
- The process of removal of water from food items is called \_\_\_\_\_.

### Match the following correctly :-

- |                  |                   |
|------------------|-------------------|
| 1. Virus         | nitrogen fixation |
| 2. Rhizobium     | AIDS              |
| 3. Yeast         | curd              |
| 4. Lactobacillus | fermentation      |

### Short answer type questions

- Write name of the different types of micro-organisms?
- Explain about micro-organisms which are useful in our life?
- What is pasteurization?
- What is food poisoning? Why does it happen?
- Write the harms caused by micro-organisms?

### Long answer type questions

- What are micro-organisms? Explain different types of micro-organisms with example?
- What is food preservation? Write the remedies for preventing contamination of food items?
- Draw diagrams of the following :
  - Amoeba
  - Paramecium
  - Algae
  - Fungi
  - Virus
  - Root nodules of plants belonging to leguminous family

### Practical work

- Examine the benefits and harms caused by micro-organisms in our daily life and make a list.
- Collect information from a nearby hospital or medical store about antibiotics and make list of them.
- Make a model of any one microorganism.





## Points to study

- 9.1 Types of plants (on the basis of size)
  - Herb
  - Shrub
  - Tree
- 9.2 Classification of plants (on the basis of life span)
- 9.3 Types of plants on the basis of ascent
- 9.4 Plant habitats
- 9.5 Functions of various parts of plants

You might have visited a garden near your house or school. Which type of plants have you seen there? Were all the plants very big? Were all the plants very small? Were there some plants equal to your height?

### 9.1 Types of plants (on the basis of size)

Various types of plants are grown in a garden, out of which some are very small, some are medium sized and some are big trees.

So let us examine the plants present in the garden and try to complete the following table with the help of your teacher-

**Table 9.1 Different types of plants present in the garden**

S.No.	Types of plants	Name of the plant
1.	Very small plants like grass	
2.	Medium sized plants	
3.	Bush sized plants	
4.	Thorny plants	
5.	Flowering plants	
6.	Fruit bearing plants	
7.	Aquatic plants	
8.	Plants with long leaves	



9.	Vegetable bearing plants	
10.	Shady plants	
11.	Plants that climb up by twinning around support	
12.	Wall climbing plants	
13.	Small plants grown on the walls	

Do you know which is the smallest flowering plant in the world and which is the world's largest tree?

The smallest flowering plant is **Wolffia**. The largest tree in thickness is **General Sherman** and its scientific name is **Sequoia dendron giganteum**. The tallest tree is **Eucalyptus** which is also known as 'safeda' in hindi.

You have learnt that there are different types of plants in the world, some are very small, some are very large, some bear white flowers while some bear red, yellow or other coloured flowers, some are thorny while some are without thorns. The plant kingdom is full of such diversity.



**Figure 9.1 Sequoia dendron giganteum**

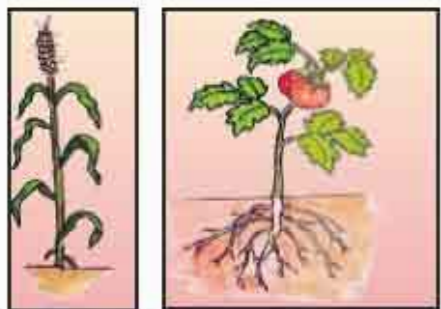
Let us study plant classification into different groups on the basis of size and what are they called in scientific language?

On the basis of size, plants are mainly divided into three groups-

1. Herb
2. Shrub
3. Tree

**1. Herb :** Herbs are plants of short height. Basil (tulsi) plant found in our houses and turmeric, used as medicine for many diseases are herbs. These plants have very short height (less than 1 meter). Their stems are also green in colour. These short sized plants are extremely soft and can be easily bent. For example- wheat, rice, basil, turmeric, chilli, tomato etc.

**2. Shrub :** Shrubs are small and medium sized woody plants and their height is nearly less than 6 meter. Their stem is usually brown in colour. Their main stem branches out near the base. Their stem is often hard. For example- henna, rose, plum etc.



**Figure 9.2 Herbs- wheat, tomato, chilli**





**Figure 9.3 Shrub (a) Rose (b) Capparis decidua (kair)**

**3. Tree :** Some plants are very tall and have hard stem with bark. The stems have branches in the upper part, much above the ground, like- mango, Azadiracta indica (neem), banyan and sacred fig (peepal) etc.



**Figure 9.4 Tree (a) Banyan**

**(b) Neem**

### Let's Know

Sometimes, in farms or garden, unwanted plants grow alongwith the main plant or crop, which are harmful for the growth of the main plant. They harm the main plant by competing for nutrition, respiration, sunlight etc. Such unwanted plants are called **weeds**.

Do all plants have the same life span? Are some plants short lived while others are long lived? Let us try to understand this.

Visit a farm near your house or school, and discuss the following points with the farmer working there :

1. At present, which crop is grown in the farm?
2. When is this crop sown?
3. When are fruits or other edible products obtained from this crop?
4. What is the time duration between sowing and harvesting the crop?
5. Which crops ripe in one year?
6. Which plants have life span of two years?
7. Which plants or trees have a life span of many years?



## 9.2 Classification of Plants (on the basis of life span)

From the above activity, you know that different plants have different life span. The life span of plants can be from few months to one year, some plants have life span of two years and some plants live for many years.

So, on the basis of the life span, plants are broadly divided into three groups -

**1. Annual plants:** Plants that have life span of one year or one season are called annual plants. For example- maize, sorghum, millet, mustard etc.

**2. Biennial plants:** Plants which generally have a life span of two years are called biennial plants. For example- onion, cabbage, carrot etc.

**3. Perennial plants:** They are the plants which live for more than one year and they produce wood. These plants usually flower in summer or spring season. Perennial plants are usually large and shady trees. For example- neem, pine, banyan etc.

## 9.3 Types of plants on the basis of ascent

Have you ever seen a plant with soft stem near your house or in a garden? Are the stems of such plants, strong enough to stand upright on their own? Do these plants need any support?

In nature, there are some plants with weak stem, so they need a support to stand or grow vertically. These plants ascend with the help of a support.

On the basis of ascent, plants are of two types -

**1. Climber -** Climbers are those plants that need a support to climb up. Some plants have thread- like structures which are called tendrils. Tendrils are the modified form of petiole, leaf or stem. Pea, cucumber, bitter gourd, ridge gourd etc. are climbers.



Figure 9.5 : Climber - money plant



**2. Creepers-** These plants have very weak stem. They cannot stand upright. They spread on the ground and grow horizontally and acquire large space. Unlike climbers, they do not have tendrils. For example - water melon, pumpkin, musk melon etc.



**Figure 9.6 Creeper - water melon**

Climbers	Bitter gourd	Money plant	Cucumber
Creepers	Musk melon	Water melon	Pumpkin

#### 9.4 Plant habitats

You have read different types of plants on the basis of their size, life span and their ascent. Do you have any curiosity to know about their habitat? Various types of animals are found in the world, some of them live on land, some in water, some in depths of the oceans, some at the top of mountains, some are also found on snow capped mountains while some live in hot deserts. Just like animals, plants are also distributed in different regions.

On the basis of the habitat, plants are of following two types :

- **Aquatic plants :** Those plants which are found in water bodies like rivers, ponds, lakes, sea etc. are called **aquatic plants**. For example- lotus, vallisneria, water chestnut, hydrilla, water hyacinth (jalkumbhi) etc. These plants are called **hydrophytes**. Roots of aquatic plants are less developed. Air chambers in the stem provide buoyancy and help the plants in floating. The leaves of these plants are ribbon-like and finely dissected. On the basis of position in water, aquatic plants are divided into three groups :
  1. Floating plants like - water hyacinth (jalkumbhi)
  2. Submerged plants like hydrilla
  3. Amphibious plants like vallisneria
- **Terrestrial plants:** Plants found on land are known as terrestrial plants. Terrestrial plants can be classified into the following groups on the basis of their varied habitats.
  1. Mesophytes like- neem and bamboo.



2. Plants of cold habitat like- soldanella, lichen etc.
3. Dry habitat (xerophytes) like- Prosopis cineraria (khejdi), Euphorbia royleana (thor), Opuntia etc.

**Let us find out -**

With the help of your teacher, make a list of plants grown in garden or pots which are flowering or non-flowering and are grown for decorative purposes in lawns.

**Table 9.2 : Various types of flowering and non- flowering plants present in garden**

S. No.	Name of flowering plants	Name of non-flowering plants
1.		
2.		
3.		
4.		
5.		
6.		
7.		

Plants which bear flowers are called flowering plants, like rose, china rose, Delonix regia (gulmohar), Cassia fistula (amaltas) etc.

Those plants which do not have flowers are called non- flowering plants. For example- fern, mosses etc.



**Figure 9.7 Flowering Plants - Delonix regia (Gulmohar)**





**Figure 9.8 : Non flowering plants, moss**

### 9.5 Functions of various parts of the plant

The main parts of a plant are root, stem, leaves and flower. All these perform specialized functions. What are the functions of these plant parts? Let us try to understand-

1. What do we call that part of plant which is below the ground?
2. Which parts of a plant are found above the ground?
3. Name that part of a plant where exchange of gases takes place?

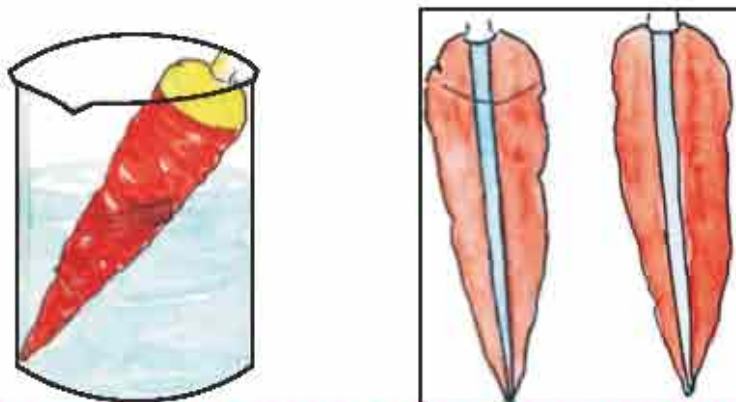
#### Roots

Roots absorb water and minerals from the soil. Roots absorb water present between the soil particles and send it to the stem, branches and leaves.

#### Activity 1

- Take a glass beaker, fill it with water and mix it with blue coloured fluid.
- Keep a fresh carrot or radish in the beaker.
- After two days, cut it as shown in the figure.

Blue colour is visible in Carrot which shows that the absorbed solution moves upwards.



**Figure 9.9 Demonstration of the process of water absorption by roots in Carrot**



Roots provide stability to the plant.

Roots tightly hold the soil and perform an important task of preventing soil erosion.

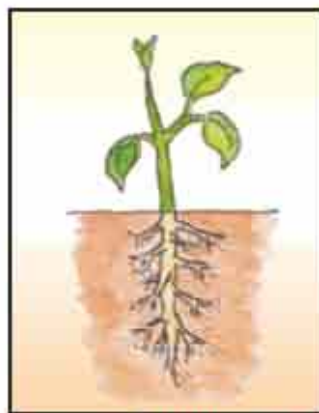
Do all plants have similar roots? Is it possible to uproot a big tree? Are the structure of roots of xerophytic plants and mesophytic plants similar?

Let us find answers to these questions.

Mainly, two types of roots are found in plants-

- Tap root
- Fibrous root

**Tap root** - Tap root are roots that have a main root and other roots arise laterally from the main root. For example- mango, neem etc.



**Figure 9.10 Tap root**

**Fibrous root**- In fibrous roots, no main root is present and all roots appear similar and form a cluster. For example- maize, wheat, onion, sugarcane etc.



**Figure 9.11 Fibrous root**



Can you name a root which can be consumed as a dish or can be eaten raw? Carrot and radish are such plants, whose roots can be consumed after preparing a dish or can be eaten raw. It has stored food.

Do you know about more such roots that are used for eating? The roots of many plants store food in them. The roots of many plants get modified in order to perform specialized functions.

They are of the following types-

1.	For storing food	Carrot, radish, sweet potato
2.	For climbing	Money plant
3.	For reproduction	Dahlia
4.	For providing support	Sugarcane, banyan

### Stem

#### Activity 2

- Take a glass beaker and fill it one third with water. Put a few drops of red ink in water.
- Take a herb plant, and cut it at the base and let it stand in the glass beaker with the help of a support.
- Examine the leaves and branches of the plant after 24 hours.
- Take out the branch and cut few transverse sections of it with the help of a blade.
- Place the transverse section on a slide and put a drop of glycerin and place a cover slip over it. Now, examine under a microscope.

You will notice some red colour in branches and leaves. After observing the transverse section under the microscope, red lines become clearly visible.

On this basis, we can say that the main function of stem is to carry the water and minerals absorbed by the roots and sending them to the aerial parts of the plant.

Apart from this, some other important functions of the stem are as follows-

- Stem bears leaves, flowers, fruits etc.
- To store food material prepared in the leaves.
- To make food by chlorophyll present in green stems like- asparagus.
- Adapting the xerophytic plants by storing water like- cactus.



- Vegetative propagation, for example- rose, jasmine.
  - Provides support (tendrils) like- *Cocculus pendulus* (Peelwan)
- Like roots, do the storage of food occur in the stem also? Does stem play an important role in the development of the plant?

Potato, ginger, turmeric etc are modifications of underground stem that store food. Ginger and turmeric are used in the preparation of various types of medicines.

Apart from food storage, stem performs other functions also, in absence of which it is impossible for the plant to survive.

### Leaf

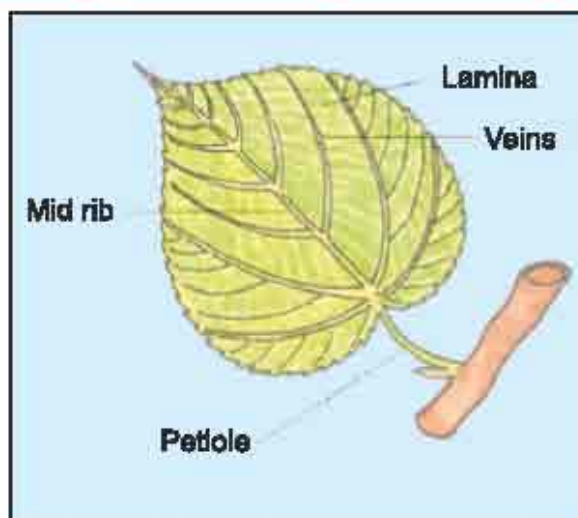
You have read the functions of root and stem. Now, let us read about leaf which is another important part of the plant. Leaves are present on the stem and branches of the plant and the arrangement of leaves on the stem is also of varied types.

Do the leaves of all the plants look alike? Are they similar in their size and shape?

### Activity 3

Make a collection of leaves of plants found in your neighbourhood and paste them in your notebook. With the help of your teacher, fill the table given below-

S. no	Name of the plant	Shape of the leaf	Size of the leaf	Colour	Other descriptions
1.					
2.					
3.					
4.					



**Figure 9.12 : Different parts of a leaf**



The part of leaf which is attached to the stem is called petiole. The broad and flat part of the leaf is called lamina. An emerging line in the middle of the lamina is called midrib and numerous veins arise from it.

#### Activity 4

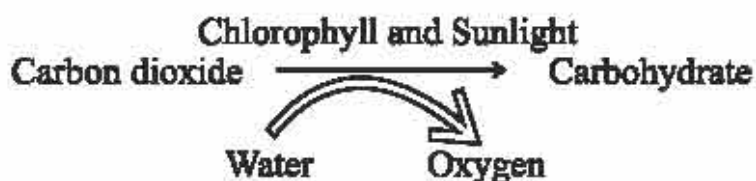
- Put a leaf under a white sheet of paper or a sheet in your notebook.
- Hold your pencil tip sideways and rub it on the portion of the paper having the leaf below it. You will get a clear impression of the leaf on the paper.
- You can see some lines in the impression of the leaf. These lines are called veins.

The thick vein in the middle of the leaf is called the midrib. The veins arising from the midrib form a net-like design on both the side of the midrib, and this type of venation is called reticulate venation. Example- mango, neem, sacred fig (peepal).

- In leaves of some plants, the veins are parallel to one another. This type of venation is called parallel venation.

**Functions of leaf-** The process by which leaves of green plants prepare food material in the presence of sunlight, carbon dioxide, water and chlorophyll is called **photosynthesis**.

The process of photosynthesis can be represented by the following equation-



Plants store food in the form of starch. This starch gets stored in leaves, fruits and stem.

- Plants synthesize glucose in the presence of light and chlorophyll. This process involves the use of water and carbon dioxide. In this process, oxygen is produced as a bi-product from water. Food synthesized by leaves ultimately gets stored as starch in different parts of the plant.
- Stomata are present on the surface of the leaves. Leaves respire through these stomata. The gaseous exchange depends on the opening and closing of the stomata.

Do plants perform functions other than photosynthesis and respiration?

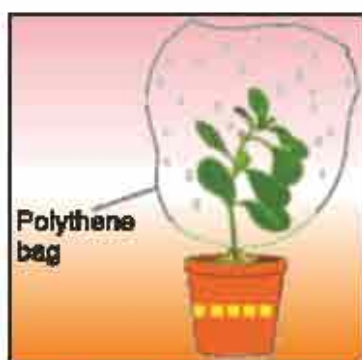


Let us find out-

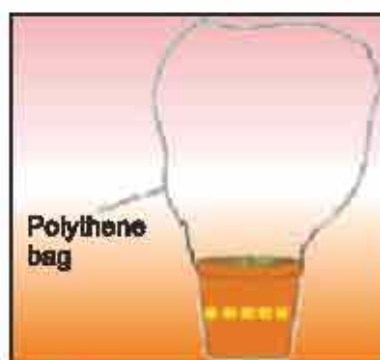
### Activity 5

- Use a flower pot with a healthy plant in it. Enclose the plant in a polythene bag and tie its mouth up with a thread as shown in the figure.
- Enclose another empty flower pot containing dry soil, with a polythene bag.
- Now keep both the pots in the sun for a few hours.
- After few hours, observe the polythene on both the pots.

We will see droplets of water on the inner surface of the polythene bag tied around the plant.



(a) Pot with plant in it



(b) pot without plant

**Figure 9.13 Transpiration Process**

These drops of water have come out of leaves due to the process known as **transpiration**.

The process of transpiration also balances the water cycle in the environment. It also help plants in regulation of their temperature.

### Professor Shipra Guha Mukherjee

She was born on 13 July, 1938 in Calcutta. She achieved graduate and post graduate degrees from Delhi University. She achieved a Ph.D degree under the guidance of Prof. B.M. Johari on the subject "Tissue Culture of Flowers of *Alium cepa*". Under the guidance of S.C. Maheshwari, she invented a technique for production of haploid plant by culturing stamen from the flowers of *Datura innoxia*. This technique is utilized in the field of agriculture to develop new varieties of crop plants. She died of brain tumour on 15 September, 2007.





### What have you learnt

- Plants are classified as herb, shrubs and tree on the basis of their height, stem and branches.
- On the basis of life span, plants are annual, biannual and perennial.
- On the basis of ascent, plants are divided into climbers and creepers.
- On the basis of habitat, plants are mainly aquatic or terrestrial.
- On the basis of flowers, plants are divided into two groups as flowering and non-flowering plants.
- Stem bears leaves, flowers and fruits.
- Leaf mainly consists of leaf lamina, petiole and veins.
- Photosynthesis, transpiration and respiration occur in the leaves.
- Green leaves prepare food in the presence of sunlight by using carbon dioxide and water by the process known as photosynthesis.
- The food material prepared in the leaves is stored in different parts of the plant through stem.
- Basically, there are two types of roots- tap root and fibrous root.

### Exercises

#### Choose the correct option

1. Which One of the following is a biannual plant-  
 (a) wheat (b) gram ( )  
 (c) onion (d) pine ( )
2. How many types of plants are there on the basis of size?  
 (a) three (b) four ( )  
 (c) two (d) six ( )
3. Which of the following is an aquatic plant?  
 (a) Prosopis cineraria (khejri) (b) water hyacinth ( )  
 (c) plum (d) Capparis decidua (kair)

#### Fill in the blanks

1. On the basis of size, plants can be divided into \_\_\_\_\_, \_\_\_\_\_ and \_\_\_\_\_.



2. Plants respire through the \_\_\_\_\_.
3. Climbing plants climb up with the help of \_\_\_\_\_.
4. Roots are of two types (a) \_\_\_\_\_ (b) \_\_\_\_\_.

**Short answer type questions**

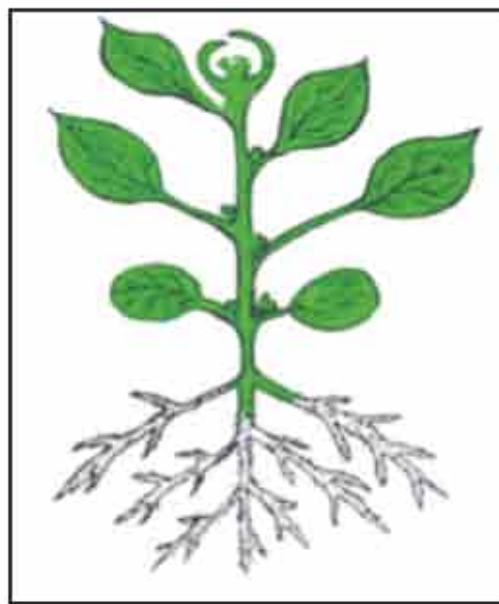
1. What is photosynthesis?
2. In how many categories can plants be classified on the basis of life span? Name them.
3. What is the difference between the stems of herbs and shrubs?

**Long answer type questions**

1. What are the different categories into which plants can be classified on the basis of size?
2. Describe the features of plants living in aquatic habitat?
3. Draw a labelled diagram of leaf?

**Practical work**

1. You have studied the classification of plants found in nature on different-different basis. So, on the basis of these classifications, make a scrap book of various plants.
2. Label the different parts of the plant given below-



◆◆◆



## Points to study

- 10.1 Motion
- 10.2 Types of motion
- 10.3 Measurement of distance
- 10.4 Unit of length

You have seen children walking to school, monkeys climbing on trees, running horses, crawling snakes, fishes swimming in aquariums, ponds.

Living beings move from one place to another by running, walking jumping and swimming etc. Similarly, you may too have seen spinning tops, oscillating pendulum of a wall clock, cars running on roads and the hands of clocks taking rounds. All these objects are also in motion.

### 10.1 MOTION

By observation you can decide whether an object is in motion or in state of rest. You may have noticed that the flying bird, crawling ant, moving bus, running children, and in all the above examples position of objects change with time.

**The change in position of an object with time is called motion.**

### 10.2 Different Types of Motion

You may have enjoyed sliding on slides, swinging on swings, and also rotating in giant wheels in fairs. Don't you think that your different experiences involved different types of motion? Infact there are different types of motions. Straight line motion, circular motion, periodic motion, rotational motion, vibratory motion, etc. are different types of motion.

#### (A) Straight Line Motion (Linear Motion)

##### Activity - 1

Take a stone and drop it from some height. Observe carefully that the stone falls downwards in a straight line.

The figures 10.1(a), 10.1(b) and 10.1(c) represents the motions of vehicle on a road, a boy sliding on a slide and a train running on a straight track, respectively. In all these situations, the objects are in straight line motion. Similarly, the march past parade of soldiers and athletes running in an athletic meet are also the examples of straight line motion.

Can you tell some more examples of straight line motion?



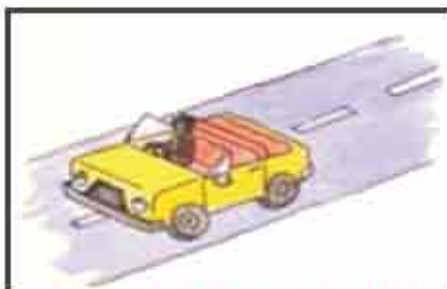


Figure 10.1 (a) Motion of a vehicle on a straight road



Figure 10.1 (b) Children sliding on a slide

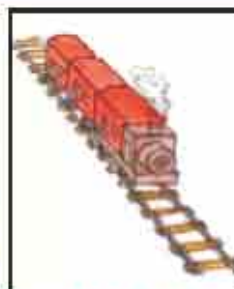


Figure 10.1 (c) Motion of a train on a straight track

The motion in a straight line is called as linear motion.

## (B) Circular Motion

### Activity - 2

Take a piece of thread. Tie a small stone at one end. Hold the other end of the thread in your hand and whirl it round. You will observe that the stone moves in a circular path.



Figure 10.2 Circular motion

You may have seen bull of a bull crusher {kolhu ka bail} taking rounds in a circular track. You may also have seen a moving giant wheel. Can you tell what kind of motion is shown by the bull of a bull crusher and a giant wheel?

The motion of an object on a circular track is called circular motion.

## (C) Periodic Motion

You must have observed the pendulum of a clock and children playing on a swing. In these cases, the motion of the pendulum and that of the swing repeats itself after a certain amount of time. This type of motion is called as periodic motion.

The type of motion which repeats itself after a certain amount of time is called as periodic motion.





Figure 10.3 (a) Motion of the pendulum of a clock Figure 10.3 (b) Motion of a child on a swing

### (D) Vibratory Motion

#### Activity - 3

Take a long thread. Hold one end of the thread and ask your friend to hold the other end. Hold the thread tightly. Stretch it downwards and release it. Observe the motion of the thread carefully. You will observe that the thread is vibrating.

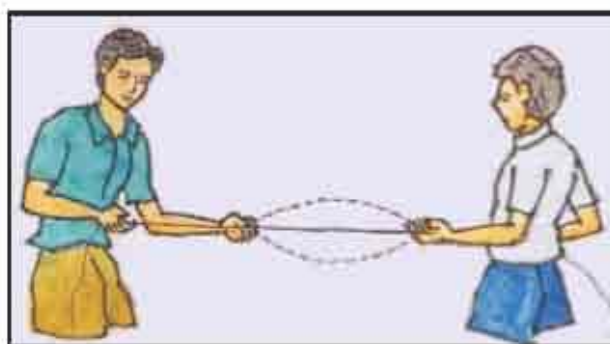


Figure 10.4 vibratory motion

The motion in which the object vibrates is called as vibratory motion.

In vibratory motion the object repeats its motion in a certain amount of time. Thus, vibratory motion is an example of periodic motion.

### (E) Rotational Motion

#### Activity - 4

Stand your bicycle on its stand. Now start paddling the bicycle. Observe carefully the rear wheel of the bicycle. The rear wheel of the bicycle is rotating on its axel (axis). This type of motion which is shown by the rear wheel of the bicycle is called as rotational motion. The motion of a spinning top and that of a potter's wheel are some more examples of rotational motion.

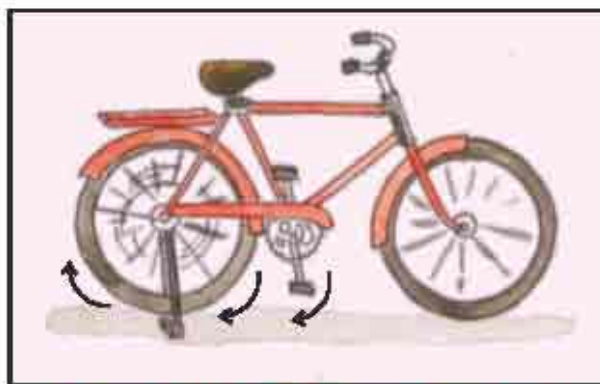


Figure 10.5 Rotational motion





**Figure 10.6 (a) Motion of a spinning top      Figure 10.6 (b) Motion of a potter's wheel**

**The motion around a certain fixed axis is called as rotational motion.**

Now give an example of a situation in which both straight line motion and rotational motion are involved.

When you ride a bicycle on a straight road then the motion showed by the wheels of the bicycle is rotational motion and the motion of the bicycle on the road is straight line motion.

### 10.3 Measurement of Distance

In ancient times, the distance between two places was measured by footsteps. Short distances were measured by fingers {ungal} and hand spans. Are these methods of measurement correct? Let us find out.

#### Activity-5

Take out your science textbook. Measure it in fingers. Draw table 10.1 on the blackboard and write down the measurements of the science textbook.

**Table 10.1**

S.No.	Name of the student	Length of the textbook	
		In fingers	In centimeters

Observe the table carefully. Have all the students written down the same length of the book?



Now measure the length of the textbook by your ruler in centimeters and write down in the table. Does the length of the textbook measured by the students in centimeters is same?

### Activity - 6

You would have played the game of kabaddi in your school. Measure the length and breadth of its ground in foot-spans and in meters. Write it down in the Table 10.2

**Table 10.2**

S. No.	Name of the student	Length		Breadth	
		Foot-spans	Meters	Foot-spans	Meters
1.					
2.					
3.					
4.					
5.					
6.					

Observe the table carefully. You will find that the length and breadth measured by the students in foot spans is different while the length and breadth measured in meters by the students is same.

Meter ruler is a standard measure. The chances of wrong measurements by it are low. From the above activities it is clear that the different sizes of foot-spans and fingers etc. of different persons result in inaccurate measurements.

### 10.4 Unit of Length

All countries over the world use a unit system that is known as the "International System of Units" (S.I. units). The S.I. unit of length is meter. Each meter (m) is divided into hundred equal divisions, each division is called as the centimeter (cm). Each centimeter is further divided into ten smaller divisions and each smaller division is known as the millimeter (mm).

1 meter = 100 centimeters

1 centimeter = 10 millimeters

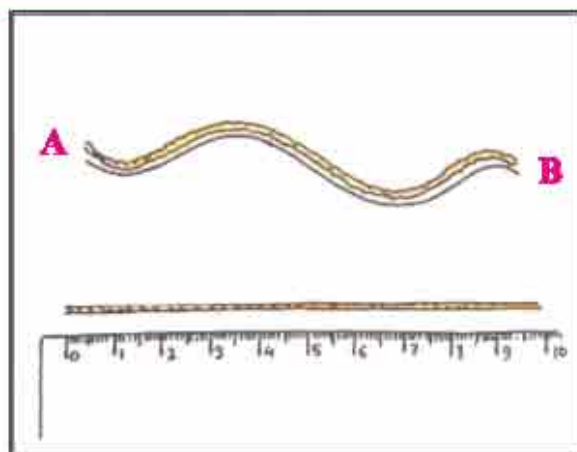
1 meter = 1000 millimeters

For measuring large distances, we use a bigger unit called the kilometer (km).

1 kilometer = 1000 meters

We know that we can measure a straight line by using a ruler. But what if the line is curved?





**Figure 10.7 Measurement of the length of a curved line**

### Activity - 7

To measure the length of the curved line 'AB' (Fig. 10.7), take a long thread. Take one end of the thread and put it on the point 'A' of the curved line. Now move the thread along the curved line. Hold the other end of the thread when it reaches the point 'B'. Now stretch the thread along a meter ruler and measure it. This will be the length of the curved line.

### What have you learnt

1. The change in the position of an object with time is called as motion.
2. Motion is of different types. Straight line motion, circular motion, rotational motion, vibratory motion, etc. are some examples of different types of motion.
3. The motion in a straight line is called as straight line motion.
4. When an object takes round in a circular path, then its motion is said to be as circular motion.
5. The motion which repeats itself after a certain amount of time is called as periodic motion.
6. The motion in which the object vibrates is known as vibratory motion.
7. If an object is in motion around a certain fixed point (axis), then its motion is said to be as rotational motion.
8. All the countries of the world have accepted a standard system of units which is known as the 'International System of Units' (S.I. Units).
9. The S.I. unit of length is meter. The  $1/100$ th part of a meter is called as centimeter and the  $1/10$ th part of the centimeter is called as millimeter.



## Exercises

**Tick the correct answers from the following -**

- 1) An example of circular motion: -
  - a) Motion of a train
  - b) Motion of the bull of a bull-crusher
  - c) Motion of the strings of a violin
  - d) Motion of a butterfly ( )
- 2) Which of the following motions does not repeat itself after certain time interval?
  - a. A fruit falling from a tree
  - b. The beating of the heart
  - c. Rotation of the Earth on its axis
  - d. The motion of the pendulum of a wall clock ( )
- 3) The S.I. unit of length is -
  - a) Kilometer
  - b) Meter
  - c) Second
  - d) Gram ( )
- 4) An example of vibratory motion is -
  - a) Motion of a swing
  - b) Motion of a wheel
  - c) Motion of a bus
  - d) Motion of strings of violin ( )

**Fill in the blanks -**

- 1) The motion of the pendulum of a wall clock is.....
- 2) The motion of the wheel of a car is an example of ..... motion.
- 3) The motion of a truck moving on a straight road is ..... motion.
- 4) 1 kilometer is equal to.....meters.

**Match the following columns -**

### Column 1

1. Periodic motion
2. Circular motion
3. Straight line motion
4. Vibratory motion

### Column 2

- a) Motion of a potter's wheel
- b) Motion of the strings of a violin
- c) Motion of a swing
- d) Motion of a ball dropped from a height

**Short answer type questions -**

- 1) Give two examples of straight line motion.
- 2) What is motion? Write its different types.
- 3) What is the difference between the motion of a spinning top and the motion of the bull of a bull-crusher?
- 4) What type of motion is exhibited by a swing when you are swinging on it?



**Long answer type questions -**

- 1) How can you measure the length of a curved line? Explain step by step.
- 2) Explain periodic motion with the help of examples.
- 3) In present day parks, there are many instruments of playing games. What type of motion do they show?

**Creative work**

- I. Observe the events happening in your surroundings carefully and make a list of objects in motion. Now classify them according to the type of motion they show in the table below -

S. no.	Type of motion	Name of the objects
1.	Straight line motion	
2.	Vibratory motion	
3.	Circular motion	
4.	Periodic motion	
5.	Rotational motion	

- II. You can make your own ruler. Follow the given steps -

- Cut a long strip of cardboard.
- Paste a strip of graph paper on the cardboard strip.

Now measure the lengths and breadths of different objects around you by your cardboard ruler!





## Points to study

11.1 Simple and Complex Machines

11.2 Types of Simple Machines

- Inclined plane
- Wheel and Axle
- Lever
- Pulley
- Wedge
- Screw

In our daily life, we perform many activities or see other people doing them such as farming, house construction, sewing, mending of iron utensils, food processing, etc. Some instruments and equipments are used to carry out these activities.

Write the name of some instruments or equipments in the following table 11.1 that are used in order to make these tasks easier.

**Table 11.1**

S.No.	Activities	Name of the instrument which makes it easier
1.	To shift a heavy stone to another place	Crowbar (sabbal),
2.	To go school from home	Bicycle,
3.	To sew clothes	
4.	To hold a hot object	
5.	To park a motorcycle in a raised house	
6.	To transport construction material in multi-storey buildings	

It is now clear from the above table that to do any work easily, we need certain instruments or equipments. What are these instruments or equipments called?

**The instruments or equipments which are used to do any work easily, quickly and properly are known as machines.**



### 11.1 Simple and Complex Machines

Machines can be divided into two types - simple machines and complex machines on the basis of their work capacity, structure and configuration.

**Simple Machines:** - All the instruments or equipments which use only muscular force to run are called simple machines.

The following are some simple machines: -

- I Inclined plane
- II Wheel and axel
- II Lever
- IV Pulley
- V Wedge
- VI Screw

To run these simple machines no other energy source is required.

**Complex Machines:** - The machines which use electric motors, chains, gears, etc. besides simple instruments or equipments, are called as **complex machines**. Examples are - cycles, motorcycles, sewing machines, huge factories, etc.

We will only study about simple machines in this chapter. You will study more about complex machines in higher classes.

### 11.2 Types of Simple Machines

**Inclined Plane** - Often we observe that an inclined plane is used to load heavy drums in the trucks and to park motorcycles in houses at higher level from the road. A plane that is used to make a difficult task easy is called an inclined plane.

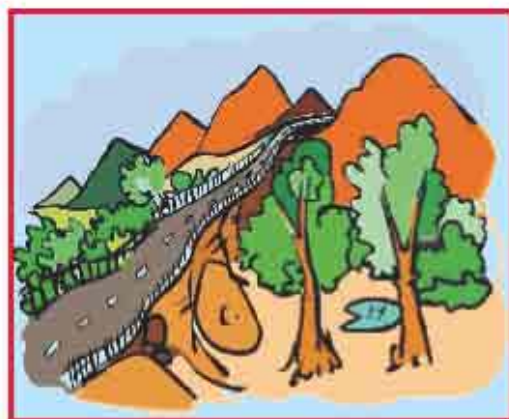


Figure 11.1 (a): To load a drum by an inclined plane      Figure 11.1 (b): winding road up a hill



Apart from this the ladders often found in use at homes and the inclined paths to climb on hills all are examples of inclined planes. Look around yourself and make a list of different inclined planes in use for different purposes.

**Wheel and Axel :** In daily life for travelling from one place to another we often use motorcycle, bus, car, train, etc. The use of all these vehicles is incomplete without the wheel. Wheel is a simple machine. Wheel is one of the first inventions by humans. The wheel is often observed as an important part of complex machines. How does the wheel simplify our work?

### Let's Find Out

#### Activity - 1

Take a heavy attaché case without wheels. Slide it on the ground [Fig.11.2 (a)]. Take another heavy attaché case with wheels. Slide it on the ground [Fig. 11.2 (b)]. What difference do you feel in both the activities? Why do you need to apply more force in moving the heavy attaché case without wheel?



**Figure 11.2 (a):**

**Sliding a wheel-less attaché case**



**Figure 11.2 (b):**

**Sliding an attaché case with wheels**

When we slide an attaché case without wheels on the ground, the ground exerts a greater amount of frictional force on the attaché case. So we can say that a wheel reduces friction.

In the same manner the wheel of a cycle rotates on a rod like structure which is fixed at the centre of the wheel. This rod like structure is called axel. Wheel and axel are also simple machines.

**Lever -** From ancient times, lever is one of the simplest machines ever used. In Fig. 11.3 (a), a man is lifting a load with the help of a crowbar (a long, heavy and pointed rod). This crowbar is an example of lever. The man applies force on one end 'E' of the crowbar to lift the heavy stone. This applied force is called effort force and the end 'E' is called effort point. There is a small stone in the middle of the crowbar for support. This support is known as fulcrum (F). The heavy stone on





the other end of the crowbar lifts up due to the force applied by the man on 'E'. The gravitational force is acting on the heavy stone in the downward direction. This force is called as weight (W). The distance 'EF' from fulcrum (F) to effort (E) is known as effort arm (D). The distance 'FW' from fulcrum (F) to weight (W) is known as weight arm (d).



Figure 11.3 (a): Lifting weight with a crowbar

Lifting weight through a lever is easy.



Fig. 11.3 (b): Effort arm and weight arm

On which principle does the lever work?

Let's find out

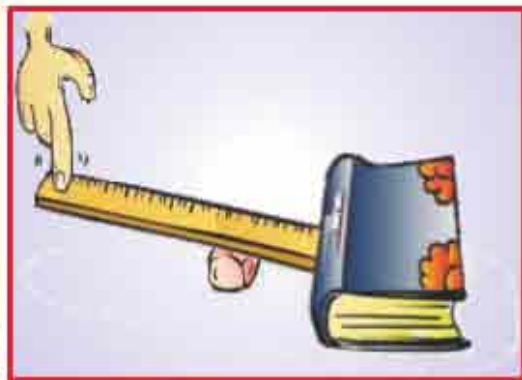


Figure 11.4 (a): Lifting a book with a plastic scale



Figure 11.4 (b): Lifting a load with a bamboo staff

### Activity - 2

Keep one or two of your books on the table. Keep an eraser near them. Now put a plastic scale on the eraser as shown in Fig. 11.4 (a) and try to lift the books. Now put the eraser at some distance from the books and repeat the activity. Repeat this activity several times by increasing the distance between books and eraser. What do you experience? You will find that the higher the distance of the eraser from the books, the higher force you have to apply to lift the books.

### Activity - 3

Put some load in a carton or box and keep one or two bricks near it. Now place a long and strong bamboo - staff under the carton or box as shown in



Fig. 11.4 (b) and try to lift the carton or box. In this situation the distance between the carton or box and the bricks (weight arm) is less whereas the distance between your hands and the bricks (effort arm) is high and you are able to lift the load easily. Now move the bricks a little away from the carton or box and repeat this activity again. What is your experience this time? You will find that if the bricks are near your hands you have to apply more force to lift the load. Therefore, if the length of the effort arm (distance between your hands and the bricks) is more then you have to apply less effort (force) to lift the load. In other words, when the length of the weight arm (the distance between the bricks and the load) is less then you have to apply less effort (force) to lift the load whereas if the length of the weight arm (the distance between bricks and the load) is more then you have to apply more force to lift the load.

Actually in every balanced condition, the product of weight and the weight arm is always equal to the product of effort and effort arm.

The same can be represented by the following formula which is called the principle of the lever or simply lever's principle -

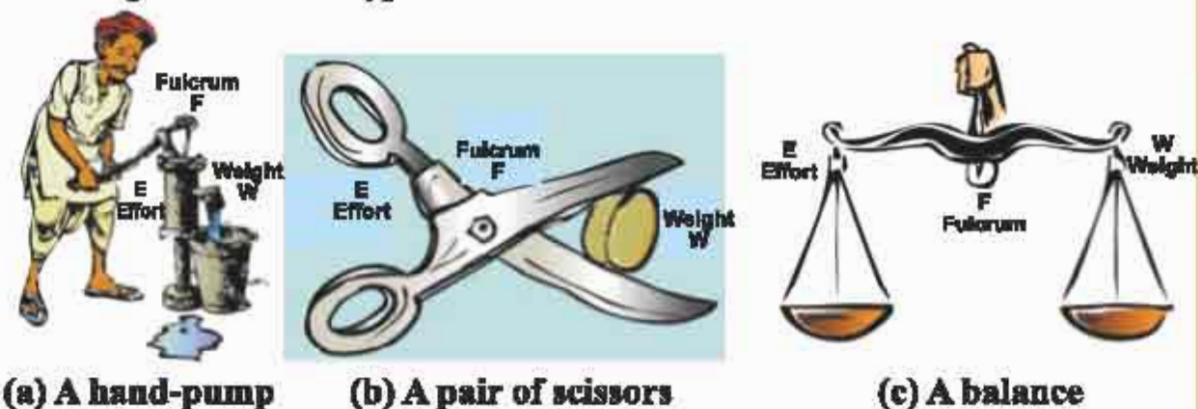
$$\text{Weight} \times \text{weight arm} = \text{effort} \times \text{effort arm}$$

$$W \times d = E \times D$$

Again look at Fig. 11.3 (a) crowbar (sabbal) is a long metal rod. That's why, the length of the effort arm is large which requires lesser effort for lifting a known weight. Because of this reason it becomes easier to lift or slide heavy objects with the help of a crowbar. Therefore, we can say that with the help of a lever a greater force can be exerted at a point by applying a smaller force at some other point.

A pair of scissors, nut-cracker, knife fitted chopping board (karikatta), pair of tongs, handle of a hand-pump, single wheel barrow, holding weight in hand, physical balance, etc. are examples of levers. Are all these of same type? Let's find out -

On the basis of the positions of effort (E), weight (W) and fulcrum (F) the levers are categorised in three types.



**Figure 11.5 Examples of first order levers**





**(1) First Order Levers** - Observe a crowbar, a pair of scissors, a pliers, an old common-balance, a hand-pump, etc. Where is fulcrum (F) is situated in all these? Such levers in which the fulcrum (F) is situated somewhere in between the weight (W) and the effort (E) are called first order levers.

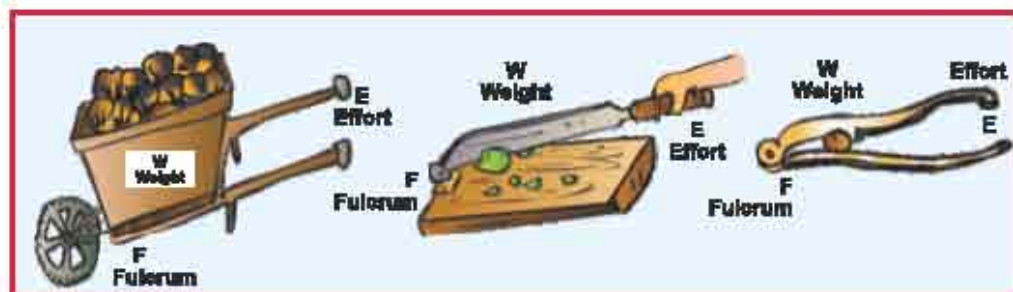
**Do this also -**

As per the figure 11.6 tie up a scale in the centre taking a piece of a spoke of a bicycle wheel. Tie up two plastic spoons at both the ends of the scale. Now take two old small plastic jars and fill them half with sand to make them sufficiently heavy. Keep these jars at a small distance from each other and fit the two ends of the spoke on these jars (as shown in the Fig. 11.6) in such a way that they may rotate freely. In this way you have made your toy see-saw. Keep weights on the two spoons of this lever and exhibit its function. Is it a first order lever? Change the position of fulcrum and lengths of the weight arm and describe the changes you noticed.



**Figure 11.6 Toy see-saw**

**(2) Second Order Levers** - Observe a nut-cracker, knife fitted chopping board (karikatta), fruit cutter and single wheel-barrow (fig. 11.7) Such levers in which weight (W) is situated between fulcrum (F) and effort (E) are called second order lever.



**(a) Single wheel barrow (b) Knife fitted chopping board (c) Nut cracker**

**Figure 11.7 Examples of second order lever**

**(3) Third Order levers** - The levers in which effort (E) is situated in between weight (W) and fulcrum (F) are called third order levers. A pair of tongs, holding weight in a hand, etc. are examples of third order levers.





Figure 11.8 Examples of third order levers

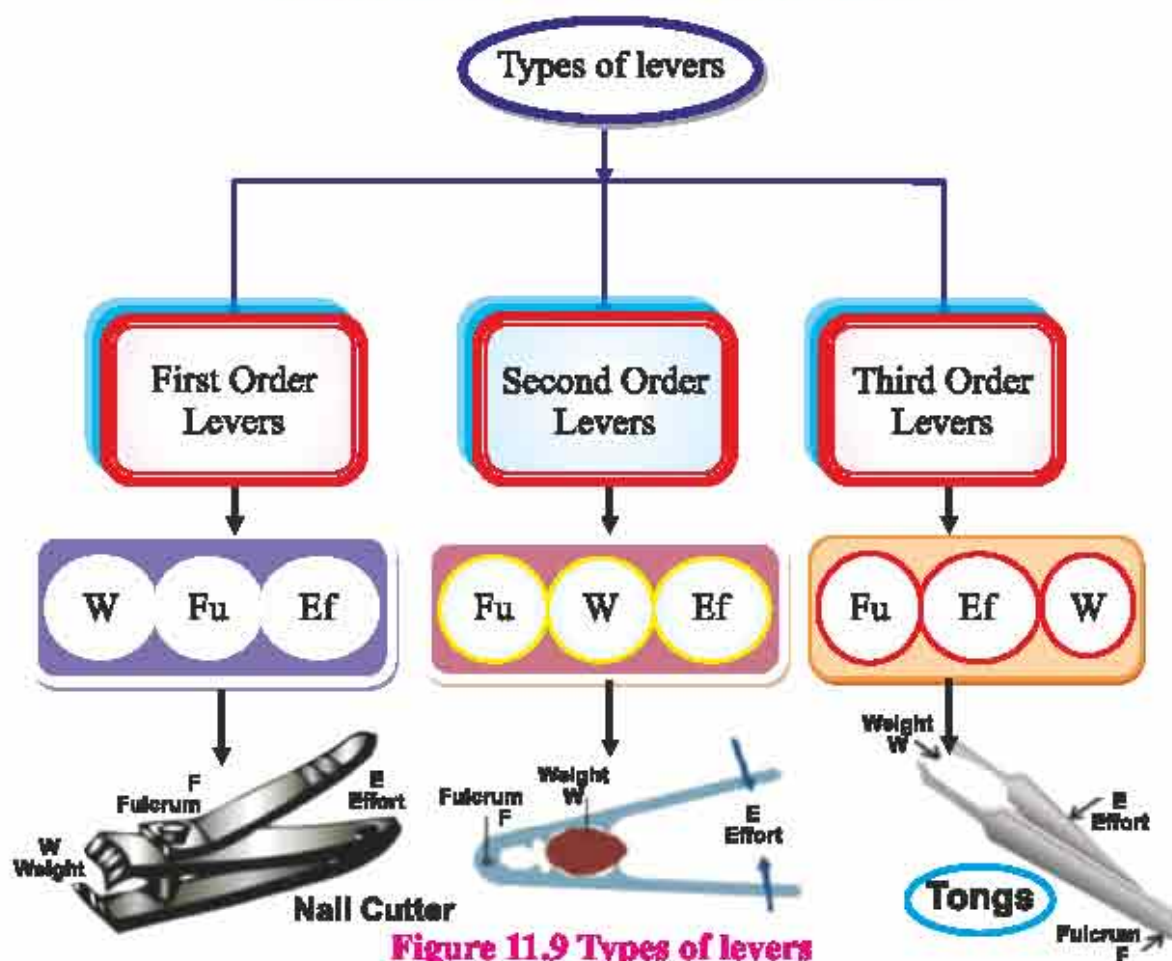


Figure 11.9 Types of levers

**Pulley** : A pulley is a small wheel with a grooved rim. A pulley is often made up of cast iron of which the central part is joined with arms through the hole of pulley. These arms are 4 or 6 six in number. This wheel (pulley) rotates around an axel which passes through the centre of gravity of the pulley and also this axel is perpendicular to the plane of the pulley.



(a) Pulley



(b) Pulling a bucket without the help of pulley



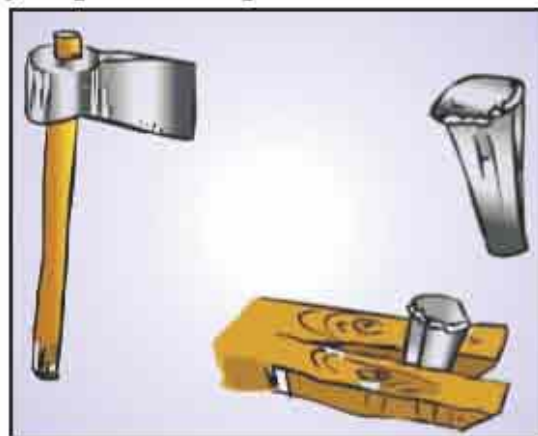
(c) Pulling a bucket with the help of pulley

**Figure 11.10 Use of a pulley**

You must have observed that it is difficult to pull a bucket full of water from a well and it brings tiredness quickly. It is so because the direction of the force applied by the person pulling the bucket is opposite to the gravitational force. With the help of a pulley a bucket full of water can be pulled out of the well easily. Why it is easier to pull objects with the help of pulleys? In order to pull straight up the objects, we need to apply a force in a direction opposite to the gravitational force whereas by the use of pulley the direction of the force get changed because of which the act of pulling the rope down is easier then pulling it straight up.

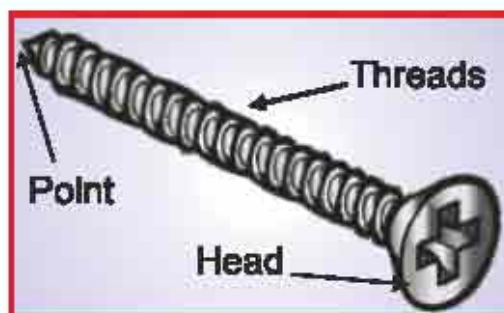
Pulleys are used in factories, cranes, to lift heavy items in houses, to run the curtains on the stage, etc. and for similar works.

**Wedge :** Visit a farmer's or a wood-cutter's workplace and inspect axe and chheni and find out what figure they possess? There are two mutually inclined planes giving a sharp and common edge at front end and a broader and plane shape at back end. This type of figure is called as wedge figure. Chheni and axe cut through wood easily because of their wedge like structure. Wedges are simple machines because they help us in doing our work in an easier way.

**Figure 11.11 Wedges of different figures**



**Screw :** It is a simple tool which is used to join (fasten) two parts. It is called a screw. Take a screw and observe it carefully. It is made of a cylindrical rod of metal by cutting spring like threads over it. It has a head which can be rotated to fasten it. Generally, in order to fasten a screw one needs to rotate it in clockwise direction whereas to unfasten a screw we need to rotate it in anticlockwise direction.



**Figure 11.12 Screw**

### Do and observe -

Till this point, you have learnt that how, we carry out our works easily with the use of machines. If such machines are not carefully and regularly maintained and serviced, they lose their ability and do not carry out their work properly. Visit your nearby factory or manufacturing unit and check how the maintenance and servicing are done there. Make a list of such methods and solutions.

### What have you learnt

1. Machine is a source or tool which carries out work easily and quickly.
2. There are two types of machines - (1) Simple machines, (2) complex machines
3. Crowbar (sabbal) works as a lever, it is a long strong rod which can be rotated all around.
4. The external force applied at one end of a lever to lift or slide heavy objects is called effort.
5. The support around which a lever is rotated is called fulcrum.
6. The weight of the object which is to be lifted or placed or moved acts at any point of the lever.
7. Levers are classified into three categories on the basis of the different positions of fulcrum, effort and weight.
8. Pulley, inclined plane, wheel and axle, wedge, etc. all are examples of simple machines.



## Exercises

### I. Tick the correct answer from the following -

- 1) The positions of effort, fulcrum and weight in a pair of tongs are -  
 a) Effort, fulcrum, weight                      b) Fulcrum, weight, effort  
 c) Weight, effort, fulcrum                      d) Weight, fulcrum, effort                      ( )
- 2) While working with the help of machines -  
 a) More energy is required                      b) More force is required  
 c) Work is done easily and efficiently      d) Work is done with difficulty                      ( )
- 3) Which of the following is a complex machine?  
 a) Screw    b) Wedge  
 c) Sewing machine                                  d) Wheel    ( )
- 4) Wheels are used to move heavy objects because -  
 a) They lessen gravitational force      b) They lessen frictional force  
 c) They lessen magnetic force              d) They increase frictional force                      ( )

### II. Fill in the blanks -

- 1) To ..... a screw, it should be rotated clockwise.
- 2) The use of wheel and axel decreases ..... force.
- 3) Machines should be properly ..... to increase their life and efficiency.
- 4) By the use of pulley, the ..... of force gets changed.

### III. Short answer questions -

- 1) Draw a well labelled diagram of pulley and describe its structure.
- 2) Write the equation of the lever principle.
- 3) What is a machine? How many types of machines are there?
- 4) Screw and wedge are also simple machines. Explain how?
- 5) Classify these objects into the levers of first, second and third order - a pair of tongs, crowbar, hand-pump, nut-cracker, a pair of scissors, a common balance, to hold a weight in hand, single-wheeled barrow and pincer.

### IV. Long answer questions -

- 1) Explain through two equipments or instruments that with the help of machines we can do work easily and efficiently.
- 2) What are levers? State the differences between its different types with the help of examples.





## Points to study

- 12.1 The Concept of Force
  - Effects of Force
  - Unit of Force
- 12.2 Different Types of Force

What do you do to open and close the door? To take a box, cupboard or any other heavy article from one place to another at your home, school or any other place, what do you do? Either you pull them or push them. In our daily life we often bring an object from rest to motion. To bring an object in the state of motion from the state of rest you have to pull it or push it. To take out a bucket full of water from the well you have to tie it to a rope and then pull it out. Also, to lift objects you have to pull them. While playing hockey the player push or pull the ball from his/her stick. A push or a pull is known as force, but this definition of force is incomplete. What is force in the language of science? Let's find out -

### 12.1 The Concept of Force

We summarize the concept of force on the basis of the effects of force. On the basis of some activities, we will try to understand concept of force. How many objects must interact for the force to act? Let's find out -

#### Activity - 1

Complete the table 12.1 by carrying out the activities given in it.

**Table 12.1**

S.No.	Event	Object through which force is applied	Object on which force is applied
1	Opening a book		
2	Closing the door of the cupboard		
3	Combing your hairs		
4	Opening the drawers of a table		
5	Closing a book		



In Fig. 12.1(a) one girl is pulling the other and in Fig. 12.1(b) the boy is pulling the horse.



**Figure 12.1(a) Two girls pulling each other    Figure 12.1(b) A boy pulling a horse**

From looking at Table 12.1 and at the above figures find out how many objects must interact for the force to act. You'll reach to this conclusion -

**Two objects must interact with each other for the force to act.**

### Effects of Force

Applying force has different effects on different objects in different ways. Let us find out the changes that take place on applying force.

#### Activity - 2

Take a ball. Put it on a table and push it slightly. Is there any change in the position of the ball? Put a sheet of paper on the table and blow it. Again, is there any change in its position? In the same way we observe the leaves and the branches of a tree move because of the force applied by the air. A kick brings a football in motion. You can find out from similar examples that -

**The applied force may change the state of an object or it may bring an object from rest to motion.**

What would happen if the force is applied in the direction of motion of a moving object? Let's find out -





**Figure. 12.2 Applying force in the same direction**

### Activity - 3

- (I) Roll a ball on the floor. Apply a little force on the ball with your hand in the direction of its motion. What is the effect on the speed of the ball?
- (II) Observe Fig. 12.2.

In Fig. 12.2, a person is pulling a cart and another person is pushing it from back. What is the effect on the speed of the cart?

It is clear from the above examples that on applying force in the direction of their motion, the speed of the ball and cart increases. So we can say that -

**On applying force in the direction of motion of a moving object, its speed increases.**

What will happen if we apply force in the opposite direction of the direction of motion of a moving object?

### Let's find out -

### Activity - 4

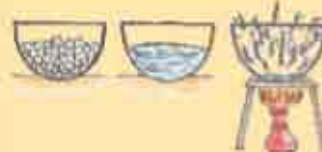
- (I) Push a table so that it starts moving. Ask your friend to push it from the opposite side. What is the change in the motion of the table? (Fig.12.3)

(II) You must have observed that the cart of a street hawker suddenly starts catching speed on a slope.

To slow down the speed of the cart the hawker has to pull the cart from behind.



**Figure 12.3 Applying force in opposite directions**



It is clear from both these situations that on applying force in the opposite direction of motion of an object, its speed decreases.

In which direction an object will move if we apply two forces in the opposite directions simultaneously?

If two forces are simultaneously applied in the opposite directions then the object will move in the direction of greater force.

We can conclude from activity 3 and 4 that the forces can increase the speed of an object as well as decrease it. So we can say that -

**On applying force on an object in motion, its speed might be changed.**

Do you know what a player do in the game of football, hockey or cricket to change the direction of the ball? Some type of force is applied by the players in these games to change the direction of the ball. From this we can say that -

**Force applied on a moving object can change its direction of motion.**

Can you give some more examples in which the direction of motion of moving objects gets changed on applying force?

### Activity - 5

Take a balloon, a sponge, a spring and a rubber-band. Blow the balloon and press it slightly. In the same way apply force on all these objects by pressing or stretching them.

Write down your observations in Table 12.2



**Figure 12.4 Change in shape of objects on applying force**



Table 12.2

S. no.	Activity	Change in shape (yes/no)
1	Pressing a balloon filled with air	Yes
2	Pressing a sponge	
3	Stretching a spring	
4	Stretching a rubber-band	

You will observe that -

**On applying force, the shape of an object changes.**

We can conclude from the above discussions that the force may change the state, speed, direction of motion and shape of an object.

So we can say that -

Force is a factor which -

1. May change the state of an object.
2. May change the speed of an object.
3. May change the direction of motion of an object.
4. May change the shape of an object.

This is the concept of force.

### Unit of Force

The S.I. unit of force is 'Newton' (N). The great scientist Sir Isaac Newton studied force. He gave the laws for gravitational force and motion. The unit of force is named after him in his honour. Newton was also a great mathematician. Born in a poor farming family of England, Newton is generally regarded as the most original and influential theorist in the history of science.



Figure 12.5 Sir Isaac Newton

## 12.2 Different Types of Force

### Gravitational Force

Where does fruit falls from a tree ? Where does an object falls after throwing upward ? Why all objects falls on the earth ? The Earth attracts each and every object towards it.

The force by which the Earth attracts all the objects towards it is known as the gravitational force of the Earth.



## Muscular Force

Can you tell by your experiences that what you have to do to lift a heavy box? It is clear that you have to apply force. This force is exerted by your muscles; therefore it is called muscular force.

Humans and animals both exert muscular force. Discuss how many activities you can carry out with the help of muscular force.

## Electrostatic Force

### Activity - 6

Take a plastic scale. Rub it on your dry hairs or on a woollen cloth. Take it near tiny pieces of paper. What do you observe? Repeat this activity by taking a comb in place of the plastic scale. What do you observe now?

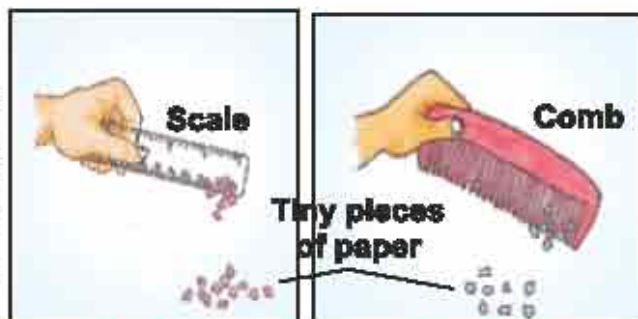


Figure 12.6 Demonstration of electrostatic force

From the above activity you can say that tiny pieces of paper get attracted towards the plastic scale or comb. Why does this happen?

When the plastic scale or comb is rubbed with dry hairs, it accumulates electrostatic charge; this electrostatically charged scale or comb exerts an electrostatic force on the tiny pieces of paper and thus attracts them.

The force acting between electrostatic charges is known as an electrostatic force.

## Frictional Force

We know that to stop a moving object, we have to apply force in the opposite direction. But a ball rolling on ground gradually slows down and comes to rest. Why does this happen?

In the same way when you stop paddling your bicycle, it automatically stops after some time. Why does this happen?

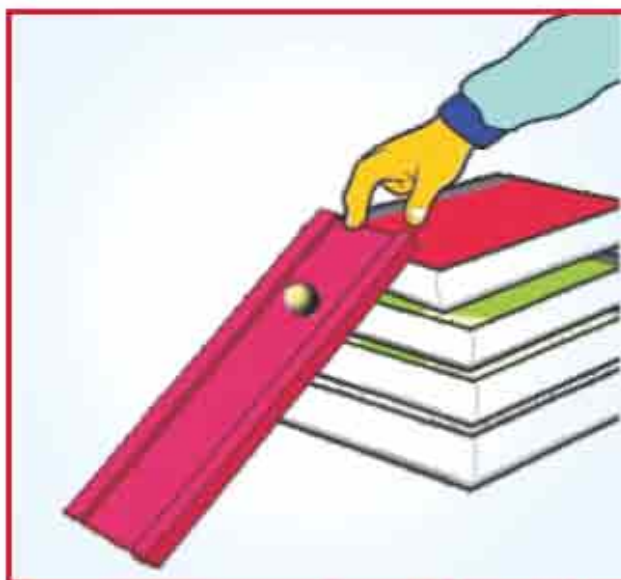
When an object moves on a surface, then a force is applied to it by the surface in the opposite direction of the motion of the object. This force is known as the frictional force or just friction.

Friction opposes the motion. That's why an object moving on the ground gradually slows down and comes to rest. Does friction depend on something? Why do we fall down when we step on a banana peel? Why is it not easy to walk on ice? Why we can walk easily on rough surfaces?



**Let's find out -****Activity - 7**

Take a glass marble. Create an apparatus as shown in Fig. 12.7. Roll it down the apparatus on a smooth surface. How far does it move before coming to rest? Now roll down the glass marble on the same apparatus but on a rough surface. How far does it move this time before coming to rest? You will find that the glass marble comes to rest earlier on the rough surface.



It is clear that friction depends on the surface in contact. If the surface is smooth, then the force of friction will be less whereas if the surface is rough, then the force of friction will be more.

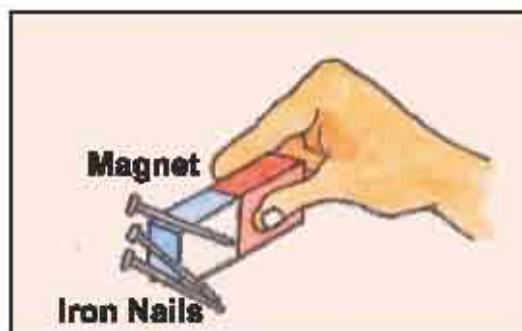
To walk easily force of friction is important. The surface of banana peel and ice is smooth. That's why we can't walk on it easily and fall down.

**Magnetic Force****Activity - 8**

Take a bar magnet. Bring it near some iron nails. What do you observe? The iron nails get attracted towards the magnet.

**The force applied by a magnet on magnetic materials is called as magnetic force.**

Besides gravitational force, friction force, muscular force, electrostatic force and magnetic force; there are other types of forces also. You will study about them in higher classes.



**Figure 12.8 Demonstration of magnetic force**



### What have you learnt

1. Force is a push or a pull. But in the language of science, force is that quantity which can change the state, speed, direction of motion and shape of an object.
2. The S.I. unit of force is Newton (N).
3. The force by which the earth attracts objects towards it is known as the gravitational force of the Earth.
4. The force exerted by muscles is known as muscular force.
5. The force acting between electrostatic charges is known as electrostatic force.
6. The force applied on an object in the opposite direction of its motion by the surface is known as frictional force.
7. The force exerted by a magnet on magnetic materials is known as magnetic force.

### Exercises

#### I. Tick the correct answers from the following -

- 1) Which force is used by a horse in pulling a chariot?
 

a) Magnetic force	b) Electrostatic force
c) Friction	d) Muscular force ( )
- 2) In winter season, you can hear a crackling sound and see sparks while pulling off woollen clothes because of -
 

a) Electrostatic force	b) Magnetic force
c) Gravitational force	d) Muscular force ( )
- 3) The S.I. unit of force is -
 

a) Joule	b) Kilogram
c) Newton	d) Second ( )
- 4) Which among the following cannot be changed by applying force?
 

a) Direction of motion	b) Speed
c) Shape of an object	d) Mass of an object ( )

#### II. Fill in the blanks -

- 1) The force acting between electrostatic charges is called .....
- 2) A push or a pull is known as .....
- 3) Falling of a fruit from a tree is an example of .....



**III. Match the following -**

Column 1

Column 2

- |                        |  |
|------------------------|--|
| 1. Gravitational force | e) The force exerted in the opposite direction of motion by the surface in contact |
| 2. Muscular force      | f) The force exerted by the Earth  |
| 3. Friction            | g) The force acting between electrostatic charges                                  |
| 4. Electrostatic force | h) The force exerted by muscles  |

**IV. Short answer questions -**

- Why does an object finally fall down when we throw it up?
- On which thing does friction depend?
- Differentiate between gravitational force and magnetic force.
- Write the S.I. unit of force.
- A 5 Newton and a 3 Newton force is applied on an object in the opposite directions simultaneously. In which direction will the object move?

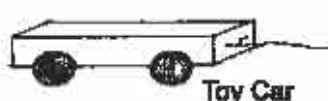
**V. Long answer questions -**

- Explain the effects of force with the help of examples.
- Friction opposes the motion of an object. Explain this with the help of an activity.
- Explain through an experiment that the shape of an object can be changed on applying force.

**Creative work**

- Prepare a toy car according to the Fig. shown below by using a match box, broomsticks and rubber caps. Now perform the activities given in the table below and conclude that by applying force, the speed of an object can be increased and decreased.

S. no.	Activity	Observation
1	To apply force in forward direction by pulling the string of stationary toy car on a plane surface.	The toy car changes its state from rest to motion.
2	To apply force on the moving toy car in the direction of its motion.	The speed of the toy car increases.
3	To apply force on the moving toy car in the opposite direction of its direction of motion.	The speed of the toy car decreases.



### Points to study

- 13.1 Magnetic and Non-Magnetic Materials
- 13.2 Poles of Magnet
- 13.3 Direction Finding Instrument (Compass)
- 13.4 Properties of Magnet
- 13.5 Make Your Own Magnet
- 13.6 Uses of Magnet

It is said that, there was a shepherd named Magnus, who lived in ancient Greece. He used to take his herd of sheep and goats to the nearby mountains for grazing. He would take a stick with him to control his herd. The stick had a small piece of iron attached at one end. One day his stick fell on a rock. He was surprised to find that he had to pull hard to free his stick from the rock. It seemed as if the stick was being attracted by the rock. That rock was a natural magnet and it attracted the iron tip of the shepherd's stick. It is said that this is how natural magnets were discovered. Such rocks were given the name 'magnetite', perhaps after the name of that shepherd. It is also believed that magnetite was first discovered at a place called 'Magnesia'. Magnets which are found in nature are called as natural magnets and the man-made magnets are called as artificial magnets.

### 13.1 Magnetic and Non-Magnetic Materials

#### Activity- 1

Take a magnet near these objects and find out whether they are attracted by the magnet or not?

Table 13.1

S.no.	Object	Material from which it is made of	Attracted by the magnet (yes/no)
1.	Scale	Plastic	
2.	Nail	Iron	
3.	Glass	Glass	
4.	Chair	Wood	
5.	Safety-pin	Iron	
6.	Shoes	Leather	

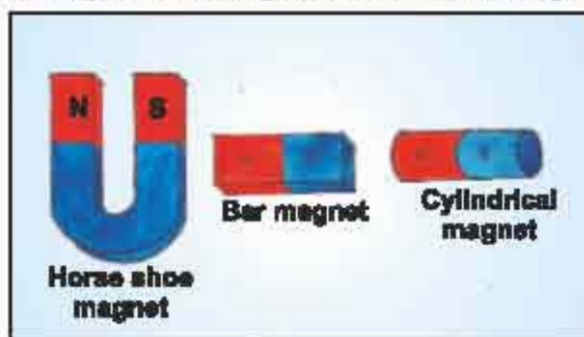
Do you find any material common in the objects which are attracted by the magnet?



The materials which get attracted towards a magnet are called magnetic materials. For example - iron, cobalt, nickel, etc.

The materials which are not get attracted towards a magnet are called non-magnetic materials. For example - glass, wood, leather, etc.

Nowadays, artificial magnets are prepared in different shapes. For example - horse-shoe magnet, bar magnet, cylindrical magnet, etc.



**Figure 13.1** Different types of magnets

### 13.2 Poles of Magnet

#### Activity - 2

Collect some iron filings by rubbing a magnet in sand. Spread the iron filings on a sheet of paper and place a bar magnet on it.

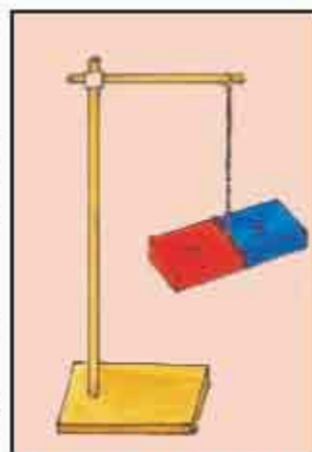
Are the iron filings evenly attracted by the magnet? You will find that the iron filings are attracted to the region close to the two ends of the magnet. These two ends are called as the two poles of the magnet.

How will you decide which pole of the magnet is the North pole and which pole is the South pole?

#### Activity - 3

Tie a thread in the middle of a magnet and suspend it from a stand as shown in Fig. 13.2. Let the magnet come to rest. The pole of the magnet that points towards North is called its North seeking pole or North pole. The other pole which points towards South is called its South seeking pole or South pole.

A freely suspended magnet always comes to rest in a particular direction, which is the North-South direction.



**Figure 13.2** A freely suspended bar-magnet

### 13.3 Direction Finding Instrument (Compass)

Take a compass and observe it carefully. A compass is usually a small box with a glass cover on it. A magnetised needle is pivoted inside the box, which can rotate freely. One end of this needle is North pole and another end is South pole.



It also has dial with directions marked on it. The compass is kept at the place where we wish to know the directions. Its needle indicates the North-South direction when it comes to rest. The compass is then rotated until the North and South marked on the dial are at the two ends of the needle.



Fig. 13.3 Direction finding instrument - compass

### 13.4 Properties of Magnet

From the above activities, we acknowledged the following properties of a magnet: -

1. A freely suspended magnet always comes to rest in the North-South direction.
2. Magnets only attract magnetic materials (i.e., materials made from iron, cobalt, nickel, etc.).

#### Let's do it -

Besides these, what are the other properties of magnets?

#### Activity - 4

Tie a bar magnet in the middle with a thread and suspend it from a stand as shown in Fig. 13.4. Let the magnet come to rest. Now take the South pole of another magnet near the South pole of the suspended magnet. What do you observe? The suspended bar magnet moves backward. This is called as repulsion. Now take the South pole of the magnet near the North pole of the suspended magnet. What do you observe this time? The suspended bar magnet comes closer and even sticks to the other bar magnet. This is called as attraction. What properties of a magnet do you find from this activity?

There is attraction between unlike poles of magnets and repulsion between like poles of magnets.

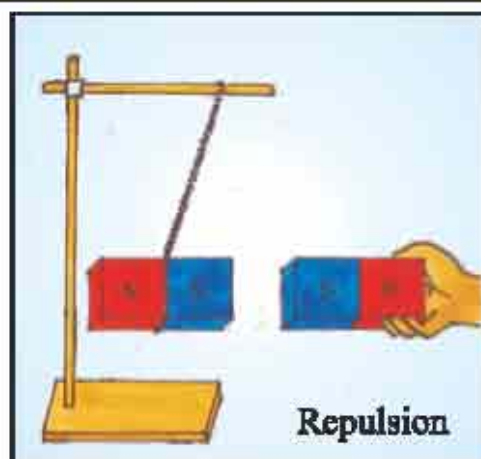
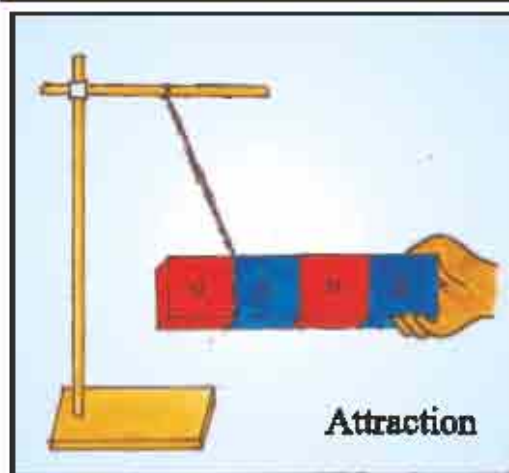


Fig. 13.4 Attraction and repulsion between the poles of two magnets



### 13.5 Make a magnet from Iron.

You can make magnets by two methods. They are given below: -

#### Activity - 5

Take an iron nail. Now take a bar magnet and place one of its poles near one edge of the nail. Without lifting the bar magnet, move it along the length of the iron nail till you reach the other end. Now lift the magnet and bring the pole (the same pole you started with) to the same point of the iron nail from which you began. Move the magnet again along the iron nail in the same direction as you did before. Repeat this process about 30-40 times. Bring some iron filings or some safety pins near the iron nail to check whether it has become a magnet.

You will see that the iron nail has acquired the properties of a magnet.

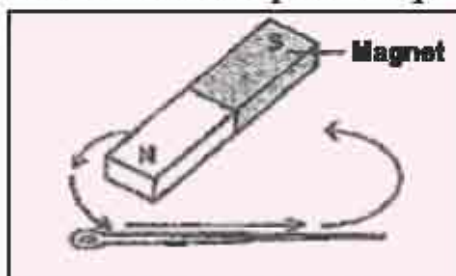


Figure 13.5 Making a magnet

You can make magnet with battery. Copper wire and nail. Let us do.

#### Activity - 6

Take an iron nail again. Wrap an insulated copper wire on it. Connect both the ends of the wire to a battery. Take some iron filings or safety pins near the iron nail. Are the iron filings or safety pins attracted towards the iron nail? Now disconnect the wire from the battery and take the iron filings or safety pins again near the iron nail. Are the iron filings or safety pins attracted towards the iron nail this time?

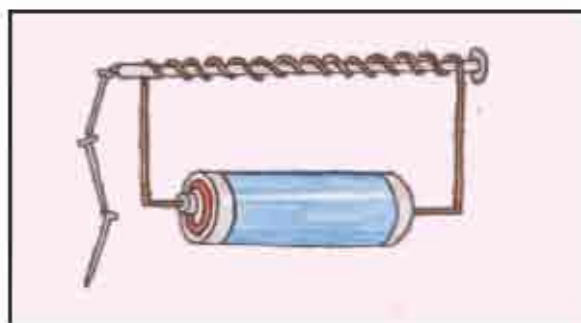


Fig. 13.6 Making an electro-magnet

When an iron nail is connected to a battery through a copper wire, it attracts the iron filings or safety pins. When we disconnect the iron nail from the battery, then it is not able to attract the iron filings or safety pins. A magnet made by this method is called as an electromagnet.



**13.6 Uses of Magnet**

Magnets are very important in our daily life. Some uses of magnets are: -

1. Compass
2. Magnets are used in speakers.
3. Magnets are used in lifting heavy objects made from magnetic materials by an electronic crane.
4. They are also used in removing small pieces of magnetic materials which fell accidentally in eyes.
5. Magnets are used in electronic bells and electric motors.

Proper storage of magnets is also very important because they become weak with time if they are not stored properly. Follow these guidelines to keep your magnets safe: -

1. Bar magnets should be kept in pairs with their unlike poles on the same side.
2. Bar magnets must be separated by a piece of wood while two pieces of soft iron should be placed across their ends.
3. A piece of iron should be kept across the poles of a horse-shoe magnet.
4. Magnets should not be heated, hammered or dropped from some height as they will lose their properties by these activities.

**What have you learnt**

1. Magnet attracts Ferromagnetic materials.
2. Each magnet has two magnetic poles - North pole and South pole.
3. Magnets are mainly of two types - (1) natural magnets, and (2) artificial magnets.
4. Opposite poles of two magnets attract each other whereas similar poles repel each other.
5. Magnets have many uses, like in - electric crane, speaker, electronic bell, etc.

**Exercises****I. Choose the correct answer from the following -**

- 1) Magnetic material from the following is -
 

a) Cobalt	b) Copper	
c) Glass	d) Wood	( )
- 2) A magnet has ..... poles.
 

a) One	b) Two	
c) Three	d) Four	( )



- 3) Where is the maximum force of attraction in a magnet?
  - a) In the centre
  - b) At the two ends
  - c) Can be anywhere
  - d) It is the same everywhere ( )
- 4) Where is an electric crane used?
  - a) To dig a pit
  - b) To lift big stones
  - c) To lift heavy objects made of iron
  - d) None of the above ( )

## II. Fill in the blanks -

- 1) A magnet has a ..... pole and a ..... pole.
- 2) Man-made magnets are called ..... magnets.
- 3) Pieces of ..... are attracted towards a magnet.
- 4) ..... takes place between similar poles of two magnets.

## III. Short answer questions -

- 1) What is a magnet?
- 2) In which direction a freely suspended magnet comes to rest?
- 3) Write two uses of magnets.
- 4) What will happen if a magnet is heated?
- 5) Draw a well labelled diagram of a compass.

## IV. Long answer questions -

- 1) With the help of diagram explain how to make an electromagnet?
- 2) Suggest an activity to explain that - similar poles of a magnet repel each other whereas opposite poles of a magnet attract each other. Draw necessary diagrams also.
- 3) Explain how you will separate wooden dust from the mixture of wooden dust and iron filings.

## Practical work

- I. Take a plastic or paper cup. Fix it to a stand with the help of a clamp (as shown in the adjoining figure). Keep a magnet inside the cup and cover it with a paper so that it could not be visible. Tie an iron clip with a piece of thread. Tie the other end of the thread to the base of the stand. Take the clip near the base of the plastic or paper cup. You will see that the clip is hanging in air like a kite.



## Points to study

- 14.1 Electric Cell
- 14.2 Electric Bulb
- 14.3 Simple Electric Circuit
- 14.4 Function of a Switch
- 14.5 Electric Conductors and Insulators

Electricity is very important in our daily life. We use electricity for many purposes to make our tasks easier. We use a lot of electric appliances such as, refrigerator, television, fans, bulbs, desert coolers, etc. Also, we use electric pumps to pump water from wells. Electricity made it possible to light our homes, work places, roads, markets, etc. We get electricity in our homes from power houses. However, sometimes the supply of electricity from these power houses may fail and it becomes dark. In these situations, we use electric torches, generators, inverters, etc. for backup.



Figure 14.1 Electric cell

### 14.1 Electric Cell

Make a list of the places where you use an electric cell. Observe the electric cell used in a torch.

The electric cell has a metal cap on one end and a metal disc on the other end. The metal cap is the positive terminal of the cell and the metal disc is the negative terminal of the cell. Inside the cell, some chemicals are present in which chemical reactions takes place. The electricity is produced by these chemical reactions. If we use a cell for a long time it stop working. The electric cell then has to be replaced by a new one.

### 14.2 Electric Bulb

#### Activity - 1

Take an electric bulb that is used in a torch. Observe it carefully. You will find that a thin wire is fixed to two thicker wires for support inside the glass bulb. The thin wire is called the filament. See fig. 14.2

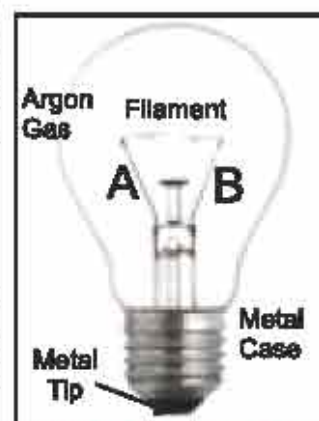


Figure 14.2 Electric bulb



One of these thick wires is connected to the metal case at the base of the bulb and the other wire is connected to the metal tip at the centre of the base. These are the two terminals of the bulb.

Compare the bulb used in homes with the bulb used in torch. What are the similarities between the two?

### 14.3 Simple Electric Circuit

#### Activity - 2

Take a cell and an electric bulb. Take two electric wires of different colours of 10 cm each. Remove the plastic coverings from the ends of the wires and join the wires with the help of insulating tape as shown in fig. 14.3.

In Fig. 14.3 (a) the bulb is glowing but in Fig. 14.3 (b) the bulb is not glowing. Discuss its reason with your friends. In this activity you have connected the terminals of electric cell with the terminals of the bulb with the help of wires. This is an example of a simple electric circuit. The electric circuit shows the flow of electric current between the two terminals of the electric cell. The bulb only glows when electric current flows through the electric circuit. When electricity flows through the filament, it heats up to a very high temperature and glows.



(a)



(b)

Figure 14.3 Simple electric circuit

We call a flowing river as a river current. Similarly, we call flowing electricity as electric current.

**The electric current flows through the positive terminal of the cell to the negative terminal of the cell.**

Sometimes, we see that even in a complete electric circuit, the bulb does not glow. What is the cause of it? It only happens when the connection of the circuit is not complete or the wires are not properly connected or the bulb is damaged. The damaged bulb is also known as a fused bulb. Take a working bulb and a fused bulb and differentiate between them.

### 14.4 Electric Switch

We use switches to turn 'on' and 'off' electric bulbs, fans, coolers, etc. in our homes. Generally, we call an electric switch simply a 'button'.

How a switch works? Let us find out.

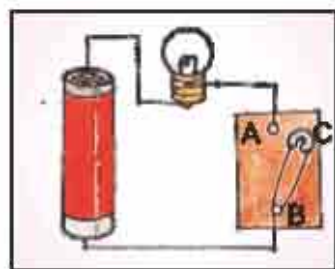




## Function of an Electric Switch

### Activity - 3

Take a drawing board and a safety-pin. Insert a drawing pin into the ring at one end of the safety pin and fix it on the drawing board at point 'B'. Fix the other drawing pin 'A' on the drawing sheet in such a way that the free end of the safety pin can touch it.



**Figure 14.4 (a) Open circuit      Figure 14.4 (b) Closed circuit**

Now with the help of wires, connect drawing pin 'A' to the electric bulb, connect the other terminal of the bulb with an electric cell and connect the other terminal of the cell to the drawing pin 'B' [Fig. 14.4 (a)].

Rotate the free end 'C' of the safety pin so that it touches the drawing pin 'A'. By this, the circuit will be complete and the bulb will glow. In Fig. 14.4 (b) the circuit is complete. A complete circuit is also called as a closed circuit. but when we move the free end 'C' of the safety pin away from drawing pin 'A' the bulb stops glowing. In this case, a gap remains between the drawing pin 'A' and the free end 'C' of the safety pin and the circuit remains incomplete. An incomplete circuit is also called as an open circuit. In this condition, the electric current does not flow through the circuit [Fig. 14.4 (a)].

In homes, when electric bulb glows then circuit is closed and when bulb does not glow then circuit is open.

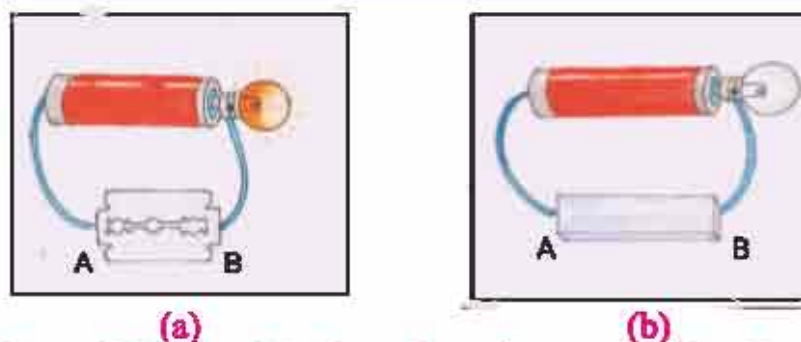
Can electricity flow through all type of substances? Let us find out.

## 14.5 Electric Conductors and Insulators

### Activity - 4

Insert two drawing pins 'A' and 'B' with some gap between them (2cm approx.) in a drawing board. With the help of wires, connect 'A' and 'B' with a cell and a bulb as shown in Fig. 14.5. Now one by one place all these objects between 'A' and 'B' Eraser, Coin, Glass, Wood, Iron nail, Metal key, Plastic scale, Blade, Graphite lead of a pencil, Needle, Paper, Candle, etc.





**Figure 14.5 Identification of conductors and insulators**

Now record your observations in the following Table 14.1 -

**Table 14.1**

S.No.	Object placed between 'A' and 'B'	Raw material from which it is made	Bulb glowed (yes/no)
1	Iron nail	Iron	Yes
2	Scale	Plastic	No
3	Eraser	Rubber	--
4	Paper	Paper	--
5	Piece of glass	Glass	--
6	Needle	Iron	--
7	Key	Metal	--
8	Pencil	Graphite	--
9	Coin	Iron	--

By placing some of these substances between 'A' and 'B', the bulb glows and electric current flows through them. The substances through which electricity can flow easily are known as conductors of electricity.

On the other hand, by placing some of these substances between 'A' and 'B', the bulb does not glow and electric current does not flow through them. The substances through which electricity cannot flow easily are known as poor conductors of electricity or insulators of electricity. Since metals are generally good conductors of electricity, they are used to make electric wires.

If you touch a bare electric wire, you will probably get an electric shock. Conductors are important for the flow of electric current but without insulators we will not be able to use them. That's why electric wires are covered with insulating substances (i.e., plastic, rubber, etc.) to prevent electric shocks. Similarly, electric switches, plugs, sockets, etc. are made of insulators (like ebonite) so that we can touch them easily.



**Warning ( Danger sign ) :**

This type of danger signs are present on electric poles, transformers, towers, etc. (Fig. 14.6). A danger sign means that there is a danger of electricity around that area, So we should never go close to them. We should also never touch bare electric wires, sockets, etc. with bare or wet hands else we will get an electric shock.



**Figure 14.6**  
danger sign

### What have you learnt

- Electricity is produced by the chemical reactions which take place inside the electric cell.
- Electric cell is used as a source of electrical energy.
- The metal cap is the positive terminal and the metal disc is the negative terminal of an electric cell.
- An electric bulb glows when electric current flows through its filament.
- Substances through which electricity can flow easily are known as conductors of electricity.
- Substances through which electricity cannot flow easily are known as insulators of electricity.

### Exercises

#### I. Choose the correct answer from the following -

- 1) The number of terminal(s) in an electric cell are -
 

a) One	b) Two	
c) Three	d) None of these	( )
- 2) Through which of the following, electricity does not flow -
 

a) Copper	b) Iron	
c) Wood	d) Aluminium	( )



- 3) Which of the following is used to make electric wires?  
a) Wood                      b) Copper  
c) Plastic                  d) Thread                    ( )
- 4) Which of the following does not run on electricity?  
a) Fan                         b) Cooler  
c) Television                d) Bicycle                    ( )

## II. Fill in the blanks -

- 1) The substances through which electricity can flow easily are called .....
- 2) The thin wire inside the bulb which is fixed to two other thicker wires in the bulb is called .....

### III. Short answer questions -

- 1) Why the person (electrician) wears rubber gloves while climbing on an electric pole?
- 2) Why are the handles of plyers and screwdrivers are covered with plastic and rubber?
- 3) What is an open electric circuit? Explain by a diagram.
- 4) State the differences between an open circuit and a closed circuit.
- 5) What are conductors and insulators? Give three examples of each.

#### IV. Long answer questions -

- 1) What is flow of electric current? Explain with a diagram.
- 2) Take a used cell and break it to open apart. Now examine and describe each and every content of the cell in detail.
- 3) Describe the structure of an electric bulb used in torches. Also draw its well labelled diagram.

## Practical work

- I. Find out about the life of the inventor of electric bulb - Thomas Alva Edison, and write in your notebook.
- II. Take a damaged torch and observe it from inside. Draw its diagram in your notebook.
- III. Alessandro Volta is the scientist who made the first cell, that cell is called the voltaic cell, after his name. Take a pot of glass, fill it with water and add common salt in it to make a common salt solution. Now insert a copper and a zinc rod (electrodes) into it (make sure that they do not touch each other). Now connect a 1.5-volt electric bulb or a L.E.D through the two rods and pass the current. Does the bulb or L.E.D light up? Now repeat the same activity by taking a plastic container and filling that with cow dung or mud from the field and inserting the same rods again.








### Points to study

- 15.1 What is Science
- 15.2 Why the Study of Science is Important for Us?
- 15.3 How Do Scientists Work?
- 15.4 Applications of Science in Our Daily Life



#### 15.1 What is Science


From ancient times, Science is related to the study and query of natural events, mysteries and principles by men. By their studies, observations and experiences, Indian sages also made countless efforts to make human life easier. Rishi Charak was a famous ancient scholar in the field of Ayurvedic Medicine. He published many books like the 'Charak Code' based on his experiments. The 'Charak Code' is considered to be the oldest book on the subject of Ayurved Medicine. This book presents the birth and growth of a child scientifically. In this book the structure of different organs of the body and their diseases, symptoms and cure, the names of Ayurvedic herbs and their benefits and which medicine is useful for different diseases are present.



Sages like - Ashvini Kumar, Dhanwantari, Bhardwaj, Kapil, Patanjali, Sushrut, etc. can be called the scientists of ancient times. They have written many books based on their researches and experiments. Indian lifestyle has been for a long time very scientific. Scientists have observed the information acquire from experiments and experiences and on the basis of analysis, they have developed the human lifestyle.

In the same line, modern scientists have also defined science as hereunder:

**The systematic knowledge collected through observation of nature is called science.**



In order to systematise the ever increasing pool of knowledge of science, science is classified into following branches of science:

Physical-science (Physics), Chemical-science (Chemistry), Biological-science (Biology), Mathematics, Agriculture-science, Medical-science, computer-science, Astrological-science (Astronomy), Geological-science (Geology), etc.



## 15.2 Why the Study of Science is Important for Us?

### From the study of science:

- A person remains far from conservative ideas.
- Independent thinking is developed in a person.
- People tend to learn more and more about the events, problems and activities going on around them.
- In life the ability to solve problems methodically is developed.
- Persons patiently find out reason of failure and try again.
- True and superstition free ideas are developed in a person.
- Development of scientific point of view takes place.

## 15.3 How Do Scientists Work?

Scientists draw conclusions after collecting and analysing observations of an experiment. Scientists conduct experiments. They collect data thereafter. Finally, they present conclusions after analysing the so collected, organised and analysed data. Doctors also give treatment in scientific manner to the patient.

A disease of patient is a scientific problem for a doctor. To solve this problem doctor starts the process as per the following steps:

- Doctor asks the symptoms of the disease.
- Doctor measures the temperature of the patient by a thermometer.
- Doctor examines the eye, tongue, breathe, etc. of the patient.
- Doctor notes down the facts on the prescription slip he observed from such examinations.
- Doctor presents the hypothesis for the possible disease, to confirm or reject his hypothesis doctor refers the patient for more examinations like stool examination, urine examination, blood examination, sonography, CT-scan, X-ray, etc.
- Finally, doctor prescribes medicines after clear understanding of the disease.

Such a process of solving a problem is referred to as scientific method by a scientist. The steps of the scientific method are as follows: -

- Identification of the problem.
- Collecting and classifying the related facts.
- Forming a hypothesis.



- Examining the validity of the hypothesis through experiments.
- Fram theories and laws on the basis of conclusions.

Science is amazingly progressing day by day. This could happen due to continuously progressing scientific approach of human. We are using a number of scientific equipments in our daily life, for example: - gas stove, fan, motorcycle, refrigerator, washing machine, electric iron, etc. all such items are related to science.

Just because of science our living styles, food habits and processes of medical treatments have become simplified and only healthy humans can create a strong nation.

#### 15.4 Applications of Science in Our Daily Life

Science is the biggest strength of humans. Activities of humans are based fundamentally on science. The scientific discoveries and inventions have established their primacy in each and every field of life.

##### 1. Science in The Field of Communication



(a) Telephone



(b) Fax



(c) Satellite launching

**Figure 15.1 Means of communication**

class rooms, studying through Eduset, writing books through e-mail and internet, to study, to write a letter, to solve the problems of maths, to study through distance education mode, e-learning etc.

##### 5. Science in the Field of Agriculture

Use of tractor for sowing, different machines for harvesting of crops to separate grains and husk by the process of winnowing, the use of thresher, the use of High Yield Variety (HYV) seeds, the use of fertilizers, insecticides on crops, artificial and scientific means of irrigation, for e.g. drip irrigation system, sprinkler irrigation system etc., and their uses, all could be possible because of science.

##### 6. Science in the Field of Entertainment

Cinema, television, radio, tape recorder, CD, preparing of new CDs by the medium of DVD player and computer, listening to music, producing films,



The success to reach on moon, the spaceship sent to planet Mars and the establishments of space-stations with regular space travels by scientists all are examples of the human progress in the field of advanced transportation. The super-fast trains (to the level of bullet train project recently started in our country by the Honourable Prime Minister Sri Narendra Modi Ji) have reduced very long distances to shorter ones. The application of computer in the field of transportation has played a great role, for example -

- The reservation of journeys through busses, trains and aeroplanes have become friendly, easier and quick.
- To command and control the aeroplane flights by the Air Traffic Control (ATC).
- Operation and control of metro trains.
- Operation and control of ships.

### 3. Science in the Field of Medical

Life is precious. God gifted the human body and provided a self defence system to our body. Even though our body may get infected may become unwell and diseased due to various reasons. The scientists regularly and continuously perform experiments to develop different kinds of medication procedures and systems and produce medicines to keep our body well and healthy.

To identify different types of diseases like cancer, TB, heart diseases, chicken pox etc. and find their proper medication and surgery, there are a number of equipments in the field of medical science, for eg.- X ray, CT scan, ECG etc. computers are used for operation and control of such equipments of medical science. With the help of computers medical help can be provided to a remote patient through telemedicine. Surgeries are also performed by laser method again with the help of computers.



**X-Ray Machine**



**C.T. Scan**



**E.C.G.**

**Figure 15.2 : Science in the Field of Medical**

### 4. Science in the Field of Education

Science have played a great role in the field of education, for eg. smart class rooms, studying through Eduset, writing books through e-mail and internet, to study, to write a letter, to solve the problems of maths, to study through distance education mode, e-learning etc.





### 5. Science in the Field of Agriculture

Use of tractor for sowing, different machines for harvesting of crops to separate grains and husk by the process of winnowing, the use of thresher, the use of High Yield Variety (HYV) seeds, the use of fertilizers, insecticides on crops, artificial and scientific means of irrigation, for e.g. drip irrigation system, sprinkler irrigation system etc., and their uses, all could be possible because of science.



**Figure 15.3 Harvester**

### 6. Science in the Field of Entertainment

Cinema, television, radio, tape recorder, CD, preparing of new CDs by the medium of DVD player and computer, listening to music, producing films, production and transmission of TV serial programmes in episodes, watching movies, creating animated movies, playing computer games etc., all are possible because of scientific inventions.



**Figure 15.4 Means of Entertainment**

### 7. Science in the Field of Industries

Most of the use of science is in the industrial field. The reason could be that all the machines used in the industries are in existence because scientific inventions. Moreover, operation of these industries could be done only by computers. The use of these big machines at such large level is not possible without the application of computers. For eg. in a cloth making factory, the thread has to go through a lot of processes like colouring, knitting and other different activities in which machines are involved.



**Figure 15.5 Industrial factory**

### 8. Science in the Field of Defence and Nuclear Power

You must have heard the name of Agnibaarn, Varshabaarn, Shaktibaarn while watching the serial Ramayana and Mahabharata on National Television



Network. The scientists of the world conducted experiments and carried out research on the basis of our ancient scriptures and other research works. There are several contributions of science and signs of scientific activities like Rawat Bhata's atomic reactor, Rajasthan, or the nuclear experiments and underground explosions of Pokhran which included India in the list of the nuclear power nations of the world. Dr. Homi Jahangir Bhabha is the great jewel of India who initiated the atomic research in India and carried out many experiments and researches, that's why he is remembered as the father of nuclear science in India.

### 9. Science in the Field of Construction and Architecture

The design and different construction methods of the ancient and medieval period forts, temples and modern times multi-storeyed buildings, could have been possible due to scientific inventions. By the use of cement and concrete which are given to us by science we have developed CC roads, RCC roofs, multi-storey buildings and other large and high buildings on the basis of architecture.

### 10. Science in the Field of Banking

Even when the world market is down the Indian economy rarely gets affected because of small saving habits found in Indian families. But in modern era, just because of science, we can get money as when we wish through ATM, credit card, transfer of money from one account to another through internet, e-commerce etc. Several works related to banking are the gifts of science.

#### What have you learnt

1. The systematic knowledge collected through observation of nature is called science.
2. By the study of science superstitions and conservative thoughts end and a person becomes truth oriented, curious and patient.
3. Scientists perform their works in a scientific method.
4. Science has brought revolutionary changes in every field of life.
5. The steps of the scientific method involve identification of the problem, collecting and classifying the data forming a hypothesis, examining the validity of the hypothesis through experiments, to draw conclusions and frame theories and laws on the basis of that.
6. Life has become comfortable by the use of science.



## Exercises

### I. Tick the correct answer from the following -

1. By which equipment does science bring revolution in the field of education?
 

a) Television	b) Radio	
c) Computer	d) Tape recorder	(    )
2. What does science give in the field of education?
 

a) Fax	b) Television	
c) Telephone	d) All of the above	(    )
3. Which among the following is not a means of entertainment?
 

a) Video game	b) Fax	
c) Computer	d) TV	(    )

### II. Fill in the blanks -

1. The systematic knowledge collected through observation of nature is called .....
2. Because of the development of science, many nations today are able to generate electricity from ..... energy.
3. Sending mails through internet is known as .....

### III. Match the following -

Column A	Column B
1. Telephone	In the field of electricity
2. Thresher	In the field of medication
3. Nuclear power station	In the field of education
4. Eduset	In the field of communication
5. X ray	In the field of agriculture.

### IV. Short answer questions -

1. What is science?
2. Write the names of four electrical equipments which are used in daily life.
3. Where does in Rajasthan the nuclear energy is converted into electrical energy and then used?
4. What is telemedicine? Explain.

### V. Long answer questions -

1. Explain the contribution of science in the fields of education and medication.
2. What is scientific method? Write down its different steps.
3. How can Science be helpful in the development of villages ? Explain in brief.





## Points to study

- 16.1 Sources of Light
- 16.2 Light Travels in a Straight Line
- 16.3 Transparent, Opaque and Translucent Objects
- 16.4 How Shadows Are Formed?
- 16.5 Antumbra and Penumbra
- 16.6 Eclipse

During daytime, we can easily see objects around us, but at night when it is completely dark, we are not able to see the things around us. When at night time we go to a dark room we are not able to see anything. At that time, to see clearly, we turn on the lights of the room or we light a torch or carry a lighted candle with us. In dark, there is an absence of light. Without light, we are not able to see objects. Hence, light helps us to see objects.

When light falls on an object, it reflects back to our eyes, and only then we are able to see the object. Light is a type of energy by which we are able to see objects.

### 16.1 Sources of Light

Sun is the greatest source of light but light of sun is only available to us in the daytime. To obtain light at night time, we use deepaks, lanterns, electric bulbs, CFLs, tube lights, etc. Like the Sun, these objects also give out or emit their own light. Objects like the Sun that emit their own light are called luminous objects. We also often get the light of moon at night. This light of the moon is actually the light of the Sun. When the light of the Sun falls on the moon, it gets reflected from the moon towards the Earth at night and we see the reflected sunlight as the light of the moon. Because it does not emit its own light and only reflects the light of the Sun, moon is not luminous. The sources of light available to human beings are either natural sources or man-made (artificial) sources.



Let us now classify the following light sources as natural or artificial sources -

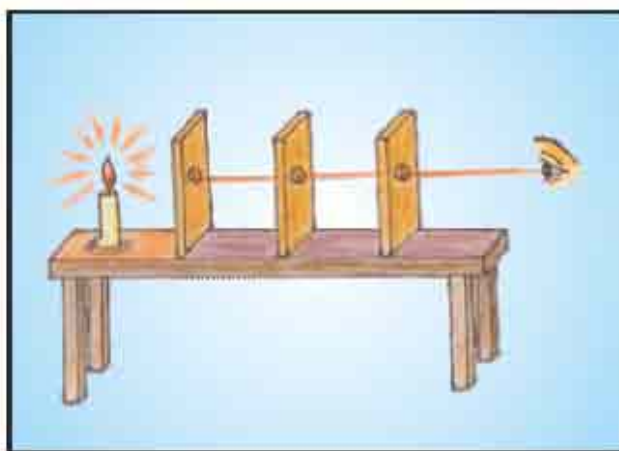
**Table 16.1 - Classification of natural and artificial sources of light**

Source of light	Natural source	Artificial source
1. Torch	---	--- ✓
2. Bulb		
3. Sun		
4. Candle		
5. Moon		
6. Stars		

## 16.2 Light Travels in a Straight Line

### Activity - 1

Take three rectangular cardboard pieces of the same size. Punch a hole exactly in the middle of each of these three cardboard pieces. Now place the cardboard pieces on a table in such a way that their holes will remain in a straight line [Fig. 16.1 (a)]. Place a lighted candle or a glowing bulb in front of the first cardboard piece. Try to see the light of the candle or the bulb from the hole of the third cardboard piece. Is the light of the candle or bulb visible to you?



**Figure 16.1 (a) Light travels in a straight line**

Now displace the second cardboard piece (move it a little leftwards or rightwards). Is the light of the candle or bulb visible to you this time? Why it is so? The above activity suggests that light travels in a straight path. When all the three holes are in a straight line, then light reaches your eyes by traveling through them. But when the second cardboard piece is displaced by you, then light is not able to pass through it and hence does not reach your eyes.



**Activity - 2**

Take a piece of straight plastic pipe. Light a candle and fix it on table and from some distance try to see the candle through plastic pipe. Now standing at the other end of the room look at the candle through the pipe. You will be able to see it. Bend the pipe a little and look at the candle again. Are you still able to see the candle? Now you can easily conclude from this activity that light travels in a straight path.



**Figure 16.1 (b) Light travels in a straight line**

**16.3 Transparent, Opaque and Translucent Objects****Activity - 3**

Collect the objects used in everyday life like glass, textbook, cardboard, plate, spectacles, etc. Try to look at a glowing electric bulb through all of these objects one by one. Are you able to see the glowing bulb through all these objects? You will find that there are some objects through which you can see and some objects through which you cannot see at all. Besides these, there are also some objects through which you can see, but not very clearly. Objects can be classified on the basis of their ability to pass light through them. According to this classification, there are three types of objects: -

**1. Transparent Objects**

Objects through which light can travel without any obstruction and through which we can see objects easily are called as transparent objects. Glass, air, clean water, some types of plastics etc. are some examples of transparent objects.

**2. Opaque Objects**

The objects through which light cannot travel at all and through which we are not able to see objects are called as opaque objects. Metals, wood, cardboard, stones, etc. are some examples of opaque objects.

**3. Translucent Objects****Activity - 4**

Take a sheet of paper and see a glowing electric bulb through it. Are you able to see the bulb clearly? Drop some drops of cooking oil or melted butter at the centre of the sheet of the paper and spread it. Try to see the glowing light bulb through the centre of the paper sheet. What do you see now? Are you able to see the bulb more clearly now? But are you able to see other objects clearly from this oil dripped sheet of paper? Absolutely not!



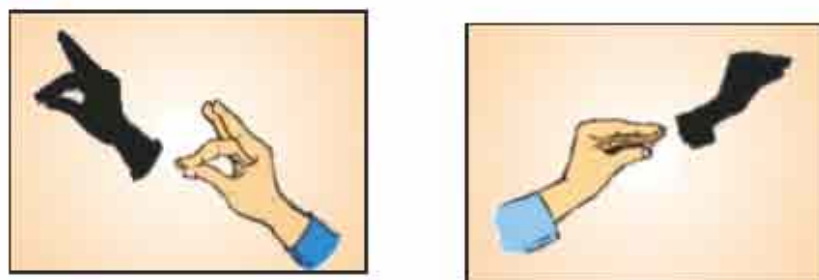


Objects which allow light to travel partially through them and through which we are not able to see them clearly are called as translucent objects. Oil dripped paper, butter paper, tracing paper, rough glass, etc. are some examples of translucent objects.

### 16.4 How Shadows Are Formed

We often see shadows of trees, plants, animals, poles, humans, etc. forming on floors, grounds, walls, etc. what exactly are shadows? What are the requirements for their formation?

**Let's find out -**



**Figure 16.2 Formation of shadows**

### Activity - 5

You can do this activity at night with your friends. Light a candle and place it in a dark room. Make a shadow of your hand on a wall of the room. Now remove hand back and hold a transparent glass sheet in front of the candle. Can you see the shadow of the glass sheet? Blow the candle and try to see the shadow of your hand again. You will not be able to see the shadow of your hand this time. It is clear now that to make a shadow, a source of light and an opaque object are required. Besides these, do we need any other thing?

Take a torch and a big cardboard sheet and go to an open field at night. Ask your friend to raise his hand at a place where there are no buildings, trees, etc. behind him. Now throw light from your torch at your friend's hand. (fig 16.3) Now you have both - a source of light and an opaque object in the path of the light, but are you able to see the shadow of your friend's hand?



**Figure 16.3 Formation of shadows**



It doesn't mean that there is no shadow at all behind your friend's hand. Ask your another friend to hold the cardboard sheet behind the hands of your friend. Are you able to see the shadow of your friend's hand this time? Now we can conclude from this activity that a shadow is only obtained on a screen. Floor, wall, ground, buildings and other similar things act as a screen for the shadows to form on.

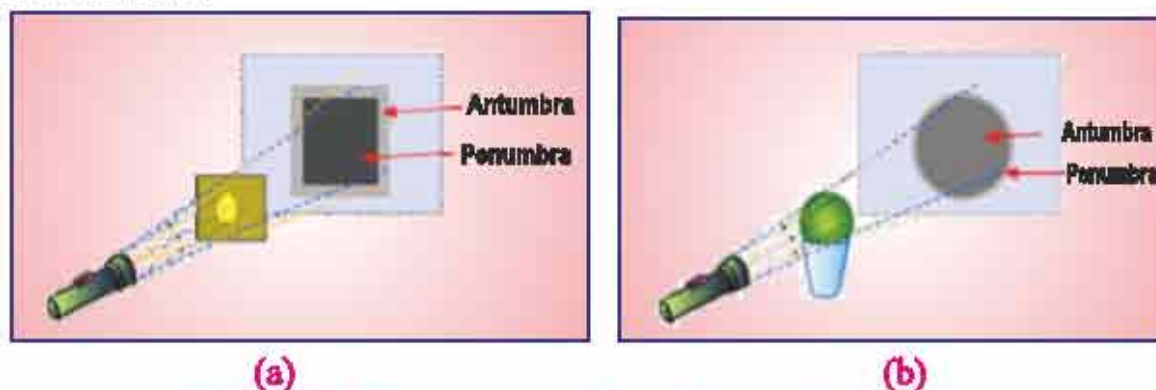
It is clear now that for the formation of a shadow, a source of light, an opaque object in the path of light and a screen to obtain the shadow are the requirements.

When light falls on an opaque object, the image formed on the screen behind the opaque object is called as its shadow. A shadow always forms in the opposite direction of the source of light.

### 16.5 Antumbra and Penumbra

#### Activity - 6

Place a table near a wall in a dark room. Stand a rectangular cardboard piece on the table. Throw light on the cardboard piece by a torch. Carefully observe the shadow formed on the wall. You will observe that a dark shadow is formed on the wall. This dark shadow is called the antumbra. Around this dark shadow, you will observe a lighter shadow. This lighter shadow is called penumbra. In the same way observe the antumbra and penumbra of a cricket ball and a football.

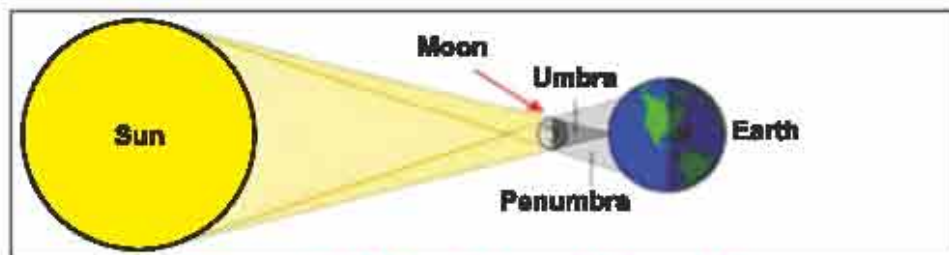


**Figure 16.4 Formation of antumbra and penumbra**

### 16.6 Eclipse

The Earth revolves around the Sun and the moon revolves around the Earth. During their revolutions, if the Sun, Earth and moon comes along a straight line then this event is called as an eclipse. Eclipses are of two types - solar eclipse, and lunar eclipse.





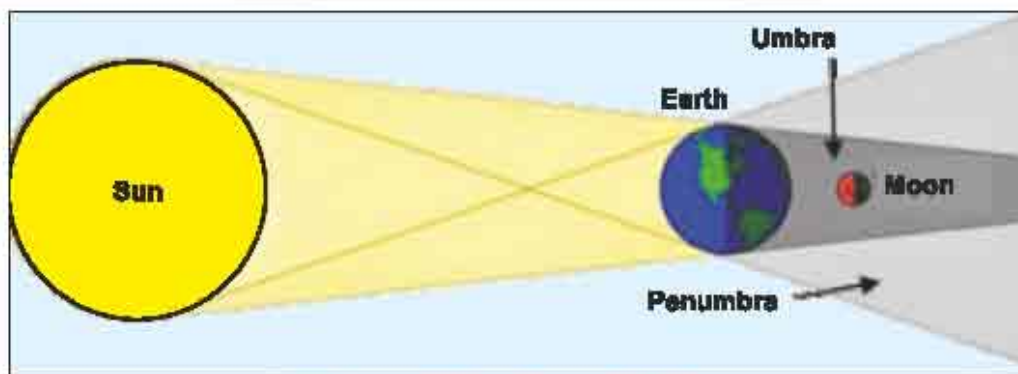
**Figure 16.5 Condition of solar eclipse**

### (1) Solar Eclipse

When moon comes between Sun and Earth, a solar eclipse occurs. When moon comes in between Sun and Earth while revolving around the Earth then the shadow of moon falls on the Earth and for that time we are not able to see the Sun. This event is known as a solar eclipse.

Some part of the Earth gets covered by the antumbra and some by the penumbra of moon. The part covered by the antumbra of moon observes complete solar eclipse while the part covered by penumbra observes fractional solar eclipse. At the time of complete solar eclipse, the outer edge of the Sun is visible around the moon as a ring and is called the disc of Sun.

**Warning:** Solar eclipse should never be observed with naked eyes because the disc of the Sun from which harmful rays of the sun are emitted which can damage the observer's eyes.



**Figure 16.6 : Lunar Eclipse**

### (2) Lunar Eclipse

When the moon while revolving around the Earth falls under the shadow of the Earth then this event is called as lunar eclipse. In other words, when Earth comes in between the Moon and Sun, a lunar eclipse occurs.

Lunar eclipse occurs on a full moon night while a solar eclipse occurs on a new moon night.



### What have you learnt

- We see objects when light falls on them and gets reflected towards our eyes. Light is a kind of energy by which we are able to see different things.
- Sun is the greatest source of light. Objects like the Sun which emit their own light are called luminous objects.
- Light travels in a straight line.
- Objects are classified into three types on the basis of their ability to pass light through them - (1) transparent, (2) opaque, and (3) translucent objects.
- When light falls on an opaque object, the image formed on the screen behind it is called its shadow.
- When moon comes in between Sun and Earth, a solar eclipse occurs whereas when Earth comes in between Sun and moon, a lunar eclipse occurs.

□□□

### Exercises

#### I. Tick the correct answer from the following -

- Which of the following is an opaque object?
 

a) Glass	b) Water	
c) Kerosene	d) Wood	( )
- An artificial source of light is -
 

a) Sun	b) Moon	
c) Candle	d) Star	( )
- Lunar eclipse occurs on -
 

a) New moon night	b) Full moon night	
c) First day of the month	d) Second day of the month	( )
- Which of the following is required for the formation of shadows?
 

a) Light source	b) Opaque object	
c) Screen	d) All of the above	( )



**II. Fill in the blanks -**

- 1) Light travels in a ..... line.
- 2) We can only see in the ..... of light.
- 3) Lantern is a ..... source of light.
- 4) Objects through which we cannot see are called ..... objects.

**III. Short answer type questions -**

- 1) State the differences between transparent, opaque and translucent objects.
- 2) On which days a lunar and a solar eclipse occurs?
- 3) Draw a well labelled diagram of the event of a lunar eclipse.
- 4) Write the reason for the formation of shadows.

**IV. Long answer type questions -**

- 1) Explain through an activity that light travels on a straight line.
- 2) Explain the event of a solar eclipse. Draw necessary diagrams.
- 3) State the differences between antumbra and penumbra.

**Practical work**

- I. Classify different objects according to their transparency.

**Things required:** Mirror, glass (smooth/rough), textbook, bulb, glass tumbler, earthen pot, plastic scale, spectacles, ball, polythene bag, thin sheet of paper, oil dripped sheet of paper, etc.

**Activity:** Keep these objects in front of your eyes one by one and try to see a glowing bulb through them. Classify these objects in the following table-

Nature of the objects	Properties	Name of the objects
1. Transparent	The objects through which light can travel easily and through which the glowing bulb is visible.	
2. Translucent	The objects through which light can travel partially and through which the glowing bulb was not clearly visible.	
3. Opaque	The objects through which light cannot travel and through which the glowing bulb was not visible.	





## Points to study

- 17.1 Air and its components
- 17.2 Uses of air
- 17.3 Water
- 17.4 Water cycle
- 17.5 Water harvesting
- 17.6 Soil
- 17.7 Types of soil

### 17.1 Air and its components

You might have seen leaves and branches of trees and plants moving, pieces of paper, dry straw and clothes kept for drying in houses, flying here and there.

- Who moves the leaves and the branches?
- Who blows straw and paper?

All these actions occur due to air. What is air? Come, let us know-

Air is a mixture of gases. Air is colourless, odourless and tasteless. Our earth is surrounded by a thin layer of air which is called the atmosphere.

#### Components of air

Air consists of substances which are called components of air. What are the components of air? Let us find out-

1. **Water vapour** - When air in the atmosphere comes in contact with a cool surface, then the water vapour present in it, condenses and get converted into water droplets on cold surface. Thus, we can say that air contains water vapour.

2. **Oxygen** -

#### Activity 1

Take a container and fill it one-fourth with water. Light the candle and fix it in the middle of the container and then cover it with an inverted glass as shown in figure. Immediately, mark the level of water in the glass.





**Figure 17.1 Presence of oxygen in air**

After sometime, observe the candle and the level of water in the glass. The candle blows out and the level of water in the glass increases.

Why did this happen?

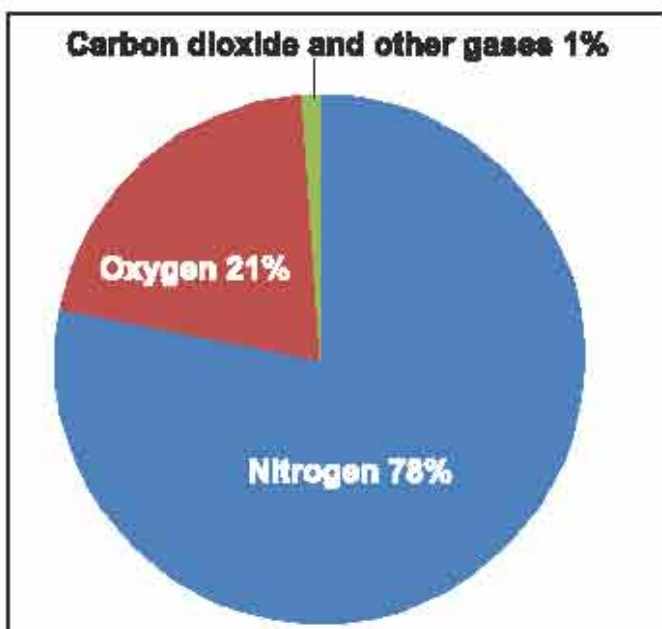
We know that oxygen is a supporter of combustion. Oxygen present inside the glass is used for burning of candle. When the oxygen present in the glass is used up by the burning candle, it can no longer burn and blows out and the water occupies the empty space. So, water rises up in the glass once the candle blows out. So, oxygen is a component of air which is approximately 21 percent of the total air.

**3. Nitrogen** - in the above experiment, the blowing out of the candle indicates the presence of a larger component of air which does not support burning. This component is nitrogen, which is approximately 78 percent of the total air.

**4. Carbon dioxide** - plants and animals release carbon dioxide gas in the environment. In the same way, many substances on burning release carbon dioxide gas in the environment. This carbon dioxide gas is a component of air. Carbon dioxide is 0.03 percent of the total air.

**5. Dust and smoke** - smoke is produced by the burning of fuel and other substances. Smoke consists of gas and micro particles. When you walk in dust storm, tiny dust particles hit your face. So, dust particles are present in air.

Apart from oxygen, nitrogen and carbon dioxide gas, air also contains carbon monoxide, sulphur dioxide etc. These gases are present in a fixed proportion.



**Figure 17.2 Components of air present in atmosphere**



**Components of air present in the atmosphere**

Nitrogen	78%
Oxygen	21%
Carbon dioxide	0.03%
Other gases	0.97%

In the atmosphere, oxygen, carbon dioxide, nitrogen and other gases are present in fixed proportions and they are called components of air.

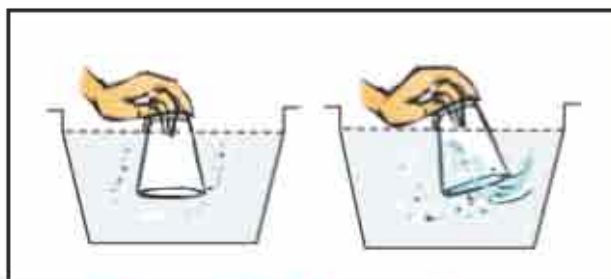
It is clear from figure 17.2, that air is a mixture of gases.

Air is colourless, odourless and tasteless. Air occupies space, has mass and exerts pressure.

**Air occupies space****Activity 2**

Take an empty glass. Is it really empty or does it have something inside it? Let us find out -

Invert the glass in a container filled with water. Observe the glass carefully. Does water enter the glass? Now tilt the glass slightly. Does the water now enter the bottle? Do you see bubbles coming out of the glass? Can you guess what was in the glass?



**Figure 17.3 Air occupies space**

Air was present in the glass due to which bubbles seemed to come out of the glass and water filled up the empty space that air had occupied. So, air occupies space.

How oxygen gas is replaced in the atmosphere?

1. Animals and plants take oxygen from the atmosphere and give out carbon dioxide gas in the atmosphere.
2. During photosynthesis, plants take in carbon dioxide and release oxygen gas.
3. The above mentioned processes occur simultaneously and so, the proportion of oxygen and carbon dioxide gas in the atmosphere remains constant. So, plants and animals are interdependent.



## 17.2 Uses of air

- Air is helpful in burning of substances.
- Air is necessary for respiration in animals and plants.
- Air helps in sailing of boats and in flying of parachutes, gliders and aircrafts. Birds and bats are able to fly because of air.
- Air helps in pollination. It also helps in the dispersal of seeds.
- Air is necessary for the making of clouds and their movement.
- Windmills rotate due to the wind and generate electricity.

### 1. Windmill

Windmill is like a huge electric fan which is placed at a height on a strong base. The kinetic energy generated due to moving air/ wind is called wind energy and it is helpful in rotating the blades of the windmill. The rotating motion of the blades of windmill is used to draw water from wells and to generate electricity. A single windmill generates less electricity. So, many windmills are placed in a larger area. It is called wind energy farm. Windmills are used in Jaisalmer, Barmer, Pratapgarh districts of Rajasthan.



**Figure 17.4 Windmill**

## 17.3 Water

About three-fourth part of our earth is covered with water but, the water obtained from all the water sources is fit for drinking? Can we drink the saline water of the seas? This question must have arisen in your mind, that what will we do if water becomes unavailable on the earth? Come, let us know more about water.

### How much water do we use?

#### Activity 3

List all the activities for which you use water in a day. Discuss with your family members about the amount of water used in cooking, cleaning, in irrigating plants, drinking and other activities. Now, find out how much water your family uses in a day? Now, divide this amount by the number of members in your family, to calculate amount of water used daily by one member. How many people live in your village or city and how much amount of water will be needed for whole village or city in one year? Find out.



### Sources of water

In nature, water is present in abundant quantity. Observe the nearby water sources. There can be different ways of obtaining water at home. But the source of all these are rivers, lakes, hand pump, wells, step-well or tank. Is this water fit for drinking or not? Let us find out.

The water in the seas and oceans is saline due to the presence of salts and it is unfit for drinking. Water from other sources like step-well, lakes, waterfalls, tube wells etc is fit for drinking but its quantity on earth is very less. So, we must use water judiciously.

### Components of water

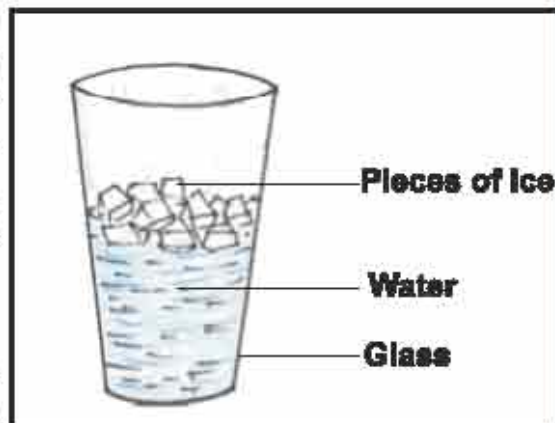
The formula of water is  $H_2O$ . It is made up of two atoms of hydrogen and one atom of oxygen.

### Physical and chemical properties of water

Pure water is colourless, odourless, tasteless and transparent liquid. Boiling point of water is 100 degree Celsius and freezing point of water is 0 degree Celsius. When water forms ice (solid) on freezing, then the density of ice decreases. Let us perform and experiment.

#### Activity 4

Take a glass and add some ice pieces to it. Fill half of the glass with water. What do you see? You will see that pieces of ice float on water due to decreased density of ice.



**Figure 17.5 Ice floating on the surface of water**



**Figure 17.6: Water is a universal solvent**

**As a solvent** - when guests visit your house during summer, your mother makes lemonade for them. How is lemonade prepared? Let us find out-

#### Activity 5

Fill water in a glass and add one teaspoonful of sugar and lime juice in it and then stir it. After sometime, we see that all the particles of sugar mix with water. So, sugar is completely soluble in water. Similarly, oxygen is also soluble in water, due to which aquatic animals perform respiration. So, we can say that water is a universal solvent.





### Uses of water

- Water is used for daily purposes like cooking, bathing, cleaning and drinking.
- Water is used as a universal solvent.
- Water maintains the temperature of our body.
- Water helps in digestion in our body.
- Water is used in factories and industries.
- Water is used to grow plants, vegetables and crops.

### 17.4 Water cycle

Water from water bodies rises up in the form of water vapours formed by evaporation. Clouds are formed due to condensation of water vapours and then water returns back to the water bodies as rain. This circulation of water is called water cycle.



**Figure 17.7 : Water cycle**

### Natural disasters

#### Activity 6

You might have received news from newspaper or television stating that some places have flooded due to excess of rainfall or some places are experiencing drought due to lack of rainfall. These are called natural disasters. How will you help if a flood or drought-like situation occurs in your area? Discuss with teachers or students and make a list of items used in rescue work. The state government also runs many rescue programs. We must be aware about information regarding these programs. It is necessary to harvest water in order to cope with natural disasters. What is water harvesting? Let us know.

### 17.5 Water harvesting

Some part of water available on earth is used by plants, animals and human beings. Most of the water is in the form of sea water which cannot be used directly. Due to less rainfall the level of ground water has decreased drastically. Factors like increase in population, imbalance in rainfall, excessive use of water in industries, wastage of water etc, the amount of drinkable water is decreasing regularly. There are many reasons for the shortage of water. So, it is essential to collect and store rainwater to fulfill our water requirement.

**The process of collecting and storing rainwater is called water harvesting.**

### Technique of water harvesting

The rainwater is collected from the rooftop into pits in the ground, through pipes. This water then seeps into the soil to refill the ground water.



The water collected in the roadside drains must be allowed to go directly into the ground. Such arrangement is depicted in figure 17.8.

### How to use water judiciously?

- Do not allow wastage of water from the tap.
- Immediately repair any water leakage.
- Use less powerful washing machine.
- Keep the drains clean.
- Use slow flush in toilets or use bio- toilets.
- Turn off the tap while shaving or brushing teeth.
- Do not use shower while bathing, instead use bucket.



Figure 17.8 : Storage of water

You have learnt about the need and use of air and water. Apart from water and air, soil is also important factor in our life. Let us know-

### 17.6 Soil

Soil is an important natural resource. Soil tightly holds the roots of the plants and supplies water and nutrients to the plants and helps in their growth.

Soil is the uppermost part of the earth, which is formed by the mixture of various substances produced by the weathering of rocks and minerals and decomposition of organic matter, due to action of wind, water and climate.

Soil consists of different types of layers. Let us study-

#### Activity 7

Take some soil from nearby farm or garden. Put it in a glass filled with water. Stir the water with a stick. Now, allow it to remain undisturbed for sometime. Carefully observe the water in glass. Different layers can be seen in the glass. The uppermost layer which consists of decaying matter is called humus. Second layer is of water, third layer is of clay, fourth layer is of sand and last layer is of gravel. Different types of particles are found in soil.

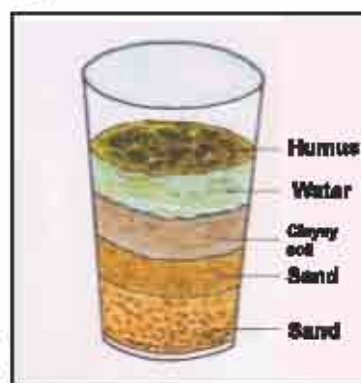


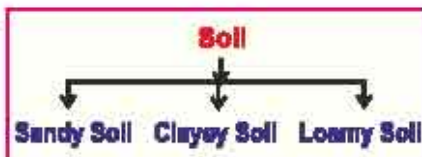
Figure 17.9 Different layers of soil

### 17.7 Types of soil

Soil is classified on the basis of the size of particles. Sandy soil: particles of this soil are very light, airy and dry.



**Clayey soil:** particles of this soil are very small and attached to one another. Water is efficiently absorbed between particles but air less absorbed.



**Loamy soil:** in this type of soil, large and small particles are in approximately same amount.

The removal of topmost fertile layer of the soil by wind and water is known as soil erosion. Soil conservation is essential to protect soil from erosion. Following measures must be implemented to stop soil erosion :

1. Afforestation must be done on large scale to protect the fertile soil from erosion.
2. Natural forests must be conserved.
3. While crop harvesting, roots must be left in the soil.
4. Bio-fencing must be done around the field.

### What have you learnt

- Components of air: nitrogen, oxygen, carbon dioxide and other gases.
- Air is colourless, odourless and tasteless. Air occupies space, air has mass and it exerts pressure.
- Oxygen is essential for respiration in animals and plants and in combustion of substances.
- The thin layer of air around the earth is called atmosphere.
- Plants and animals depend on each other for the regulation of oxygen and carbon dioxide gas present in air.
- Major sources of water are sea, rainfall, wells, ponds, rivers, step-well, lakes, waterfall, hand pumps etc.
- Amount of water is limited in nature.
- The process of collecting and storing rainwater is called water harvesting.
- Three types of soil are sandy, clayey and loamy.
- Electricity is generated by windmills in Jaisalmer, Barmer and Pratapgarh districts of Rajasthan.
- To prevent soil erosion, cutting of trees and deforestation must be stopped and more and more plants must be grown.



## Exercises

### Choose the correct option

1. How much portion of the earth is covered with water?  
 (a)  $3/4$  (b)  $1/2$   
 (c)  $1/4$  (d)  $1/3$  ( )
2. During respiration, which gas living beings take in?  
 (a) oxygen (b) carbon dioxide  
 (c) nitrogen (d) chlorine ( )
3. Which is the most abundant gas in the atmosphere?  
 (a) oxygen (b) nitrogen  
 (c) carbon dioxide (d) other gases ( )

### Fill in the blanks

1. During photosynthesis, plants take in \_\_\_\_\_ gas.
2. The process of collecting and storing rainwater is called \_\_\_\_\_.
3. Electricity is generated in \_\_\_\_\_ by wind.
4. Afforestation helps in soil \_\_\_\_\_.

### Short answer type questions

1. What are the different types of soil?
2. Explain the various techniques of water conservation?
3. Explain water cycle with a suitable diagram?
4. Water occupies space. Explain.
5. Explain the importance of oxygen in atmosphere?

### Long answer type questions

1. Explain diagrammatically, the components of air in the atmosphere.
2. What is soil erosion? What measures should be taken to prevent it?
3. Write various uses of water.

### Creative work

1. Make a rainwater harvesting model with the help of cardboard box and pipes.
2. Make a poster on the topic 'methods to save water' and include some slogans and display it on your school notice board.
3. Develop a project to improve the water management in your area.
4. Make a wind direction measuring device and find out the direction of wind.
5. Make a model of the windmill.



# Road Safety

We use various vehicles such as cycle, motorcycle, bus etc to move from one place to another or from one city to another. Tractor, truck, trailer etc are used to transport goods from one place to another. Even when you come to school, you use a cycle or your parents drop you from home to school in some vehicle.

What do we call a route where many vehicles keep moving? The route connecting one place to another is called road. Roads are mainly divided into three types.

**1. National highway** - Roads which connect different cities of a country are called national highways.

**2. State highway** - Roads which connect various cities of a state are called state highways.

**3. Rural roads (local roads)** - Roads which connect various villages to the state highway are called rural roads or the roads which connect villages to cities or villages to villages are called rural roads.

## Rules for walking on the road -

Are there some rules for walking on these roads?

Do you follow them?

Let us study about these rules. These rules provide us convenience and safety. It is a rule in our country that pedestrians and vehicles must move on the left side of the road. Pedestrians must cross the road only at the zebra crossing ( road with white strips). Thus, it is important to follow these rules for safety.

## Traffic light -

You might have seen different coloured lights glowing in a rectangular box at various crossroads in cities. What are the colours of these lights and what do these colours mean? Have you ever imagined?

The lights of various colours glowing in the rectangular box are called traffic lights. In this, lights of three colours are arranged in a sequence. These three colours are- red, yellow and green. The traffic at crossroads of cities is controlled with the help of traffic lights.

The below mentioned rules must be followed, depending on which light glows or else you may be fined:

1. Red light means we have to stop.
2. Yellow light means that we must be alert whether to move or to stop.
3. Green light means that we can move.



Traffic light