Science & Technology

Class 6

2019-20

State Council of Educational Research and Training Chhattisgarh, Raipur

For Free Distribution

Year of Publication - 2019

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Cover Page

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Published By

Chhattisgarh Textbook Corporation, Raipur (C.G.)

Printed By

PREFACE

With the spread of knowledge it has been considered important to incorporate new subjects and thoughts in education. Hence, the process of giving a new format to the textbooks according to the present conditions has got underway.

The book 'Science and Technology' for class VI has been written in this context. The purpose of this book is not to load the students with scientific information, but to teach with main fundamental principles of science as a subject.

Science is defined by activities. Hence, it is necessary to pay attention to activities in order to learn and teach science. In this book, we have paid a lot of attention to prove the principles of science through activities and experiments.

This has also been our motive that students should clearly understand the changes occurring around them and that they develop a vision which would inspire them towards discoveries and experiments. Students should develop habits and skills to solve problems and dare to raise questions. This would motivate them to remove confusion, superstition and pessimism.

Right to Education Act 2009 gives emphasis on imparting quality education to children. NCERT, New Delhi has developed class wise, subject wise learning outcomes and pedagogical processes for classes I to VIII which will help to achieve the objectives of all-round development of children. So, textbook for the session 2018-19 have been made contextual and significant which will provide more opportunities to achieve desired outcomes. We hope that textbooks will be helpful for students and teachers to achieve these goals.

We have got help and advice from teachers of different governments and non government schools, professors of colleges and Pandit Ravishankar Shukla University, Raipur, NGOs and learned citizens. We express our heartiest gratitude to all of them.

We request the intelligensia section of the state to kindly send their advice and amendments to the council to bring about the necessary changes in the book.

Director
State Council of Educational Research and Training
Chhattisgarh, Raipur

INDIA'S GREAT CONTRIBUTION IN THE FIELD OF SCIENCE AND MATHEMATICS

India, since ancient time, has been prosperous in science and from the scientific point of view History clearly depicts that India has contributed a lot to the world. Science, mathematics and technical expertise have been at the base of Indian civilization.

Indian knowledge reached Europe when ancient Indian literature was deciphered in Arabic language. This is even accepted by the European scholars. Let us learn about some Indian scientists who are known for their great contributions to all the world of science and mathematics.

1. BODHYAN AND AAPSTAMB

These mathematicians gave numbers from 1 –9 in arithmetic, conceptualized about zeros and established the Decimal system likewise, what we call Pythagoras theorem in geometry had been there thousands of years ago.

2. CHARAKA

He was the first doctor who established the theories of digestion and body immune system.

3. SHUSHRUT

He was a great doctor. He is known as "Father of Plastic Surgery" in the world. He was not only a physician but a surgeon too.

4. KANNAD

He emphasized the indivisibility of the particles of matter (i.e. atoms) that was later on considered as fundamental of science. Famous vedic scholar Sayanacharya first of all calculated the velocity of light.

5. ARYABHATTA

He was the first man to postulate that earth is round and it rotates on its own axis as well as revolves around the sun, which gives us the day – night and the seasons. He established the scientific facts based upon which time calculations were done and causes of eclipses were made known. He was the first in the world to calculate the value of π.

6. NAGARJUNA

He was a great scholar of chemistry and gave a lot of important information regarding metallurgy and manufacture of medicines in his book 'Rasratnakar'.

7. BHASKARACHARYA

He wrote a famous book on mathematics called "Leelawati". He was the first mathematician to say with full confidence that any digit divided by zero becomes infinite. He established gravitational force, spherical shape of earth, distances between planets, astronomical theories and mathematical processes like differentiation, integration and trigonometry.

8. SRINIVAS RAMANUJAM

Born in Tamil Nadu, this mathematician at the age of 15, found new proofs for many old mathematical theorems and formulated many new theorems.

9. CHANDRASHEKHAR VENKAT RAMAN

He got Nobel Prize for the discovery of light related 'Raman Effect'. He postulated that the nature and behaviour of light changes when it passes through a transparent medium.

10. MEGHNATH SAHA

He explained the order of the occurrence of coloured lines in the area of astrophysics on the basis of ionisation. Which helped astronomers in the study of temperature, pressure and internal structure of Sun as well as other stars.

11. HOMI – JAHANGEER BHABHA

He is known for his contribution in the field of cosmic rays, fundamental particles and quantum mechanics.

12. VIKRAM SARABHAI

His studies on cosmic rays helped to understand the universal (cosmic) magnetism, atmosphere, nature of sun and exosphere (outer universe)

13. JAGDISH CHANDRA BOSE

He discovered sensitivity in plants and invented several sophisticated instruments. Cresco graph is one of them. Rate of plant growth is calculated using this instrument. He also invented the 'wireless'.

14. HARGOVIND KHURANA

He was the first to develop a functional artificial gene in the laboratory, which was in no way less than a natural gene. For this work he shared a Nobel Prize in the field of medical science.

15. SHANTI SWAROOP BHATNAGAR

He made fundamental contribution to the field of magnetic chemistry apart from emulsions, colloids and to the field of industrial chemistry.

In ancient India, science of electricity (D.C. Current), aeronautics, textiles, metallurgy, architecture, mechanical engineering and urban development studies also developed. In this way we see that Indian Scientists by their distinguished contribution have brought pride to India at the International level in the fields of mathematics, physics, chemistry, geography, medical science, technology etc.

CONTENTS

1. OUR EARTH

All living beings found in this world like plants, animals, human beings etc live on earth. There are land, desert, mountains, rivers, lakes and oceans on this earth. These fulfill all the needs of the living beings.

1.1 Structure of the Earth

What is the shape of the Earth, round or flat?

We can see a very small part of the earth at a time, what we see appears to be flat. To see the whole earth we have to travel beyond the atmosphere of the Earth and go into space. You must have heard that many countries send people into space via rockets. They are called astronauts. Astronauts take pictures of the Earth from space and that shows that the shape of the earth is round (figure1.1).

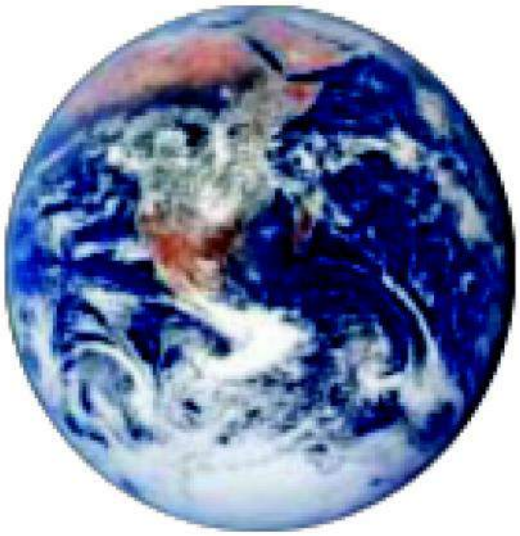


Figure1.1 View of The Earth from space.

Whether the earth is hollow or solid?

You know the Earth is round like a ball? Scientists have found out that earth is not hollow but it is solid. But its surface is not smooth and even. It has high mountains at some places and deep valleys at others. Imagine if the earth is cut, in to two halves how will its structure look like? See that in figure1.2

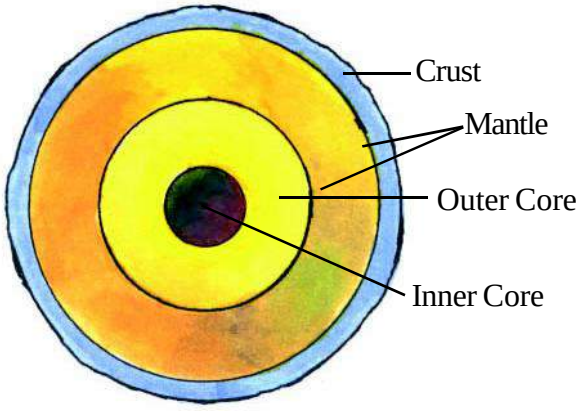


Figure 1.2 Inner structure of the Earth.

The Inner structure of the earth has been divided into three main parts (Figure 1.2)

(1) Crust

(2) Mantle

(3) Core

(1) Crust- The outer most layer of the Earth where oceans and islands are located is called the crust. All the essential things, which are needed for living beings to live like air, water, food, soil and minerals are found in this crust.

Remains of dead and decaying plants and animals are also found in this layer, these make it fertile. Various minerals like iron, aluminum, copper, coal, limestone, petroleum, natural gases etc which fulfill our needs are all found in this layer.

(2) Mantle- Below the crust there is a thick layer of hot molten rock, which is called mantle. This is the middle layer of the Earth. It has molten rocks along with many gases.

(3) Core- The innermost region of the earth is called its core. It is the hottest part of the earth. It consists of mainly iron and nickel. The core is believed to exist in a solid form. The outer region of the core contains mostly iron in a molten form.

ANSWER THESE

(1) Name the three layers of the earth.

(2) Name the various minerals found in the earth's crust.

(3) What is mantle?

(4) Name the metals found in the core of the earth.

1.2 Regions of Earth

See the globe and map of the Earth. In the major part of Earth you will see blue colour. See the upper portion (North pole) and lower portion (South pole) of the globe.

They appear to be white in colour. White colour shows that it is the part of the earth, which is always covered with ice. Do you know that ice is frozen water? On the earth, water is found in liquid form in seas, lakes and rivers and at the poles it is found in solid form. This area which is made up of liquid and solid water is called the Hydrosphere of the earth.

Now see the map or globe again.

Besides the blue and white region, the rest of the earth surface is shown in yellow, brown and green colours. This is the region that we call land. On this land surface there are mountains, at some places and in other places valleys and flat lands. This area of earth is called Lithosphere.

Out of the total area on earth three fourth area is Hydrosphere and one fourth is Lithosphere.

Now can you tell what is more on earth - water or land?

You must have read that all around earth there is air. We cannot see air but we can feel it when it flows. The air surrounding the earth is called atmosphere.

The thickness of atmosphere as compared to the size of earth is quite less.

What is Air Made up of ?

99% of air is found within 40km of height. The air contains 78% Nitrogen, 21% Oxygen and the rest 1% is of Carbon dioxide, water vapour, other gases and dust particles.

ACTIVITY 1

Materials required- Glass, Ice cubes.

Put ice cubes in a glass tumbler. Observe the outer surface of glass after some time? Where did the water droplets come from?

Water vapour is present in air when the air, comes in contact with the cold surface of the glass, the air condenses. With the result that the water vapour converts into small drops of water and are seen on the outer surface of glass.

ACTIVITY 2

Materials Required- A Plastic or glass bottle, bottle cork with two holes, thin glass tube or a straw and lime water.

Fill one fourth of the bottle with limewater and put the cork with two holes on it.

According to figure 1·3 a put the glass tubes A and B into the two holes. Seal the two holes with the wax of lighted candle, so that there is no gap left in the holes around the glass tubes.

The inner end of glass tube A should be totally dipped in the lime water and the inner end of tube B should be above the water surface. From the outer end of tube B suck the air out (fig.1.3b). By doing this, the air enters into the bottle from tube A because we see bubbles of air in the limewater.

After sometime the limewater turns milky because of carbon dioxide. This experiment thus shows that air contains carbon dioxide.

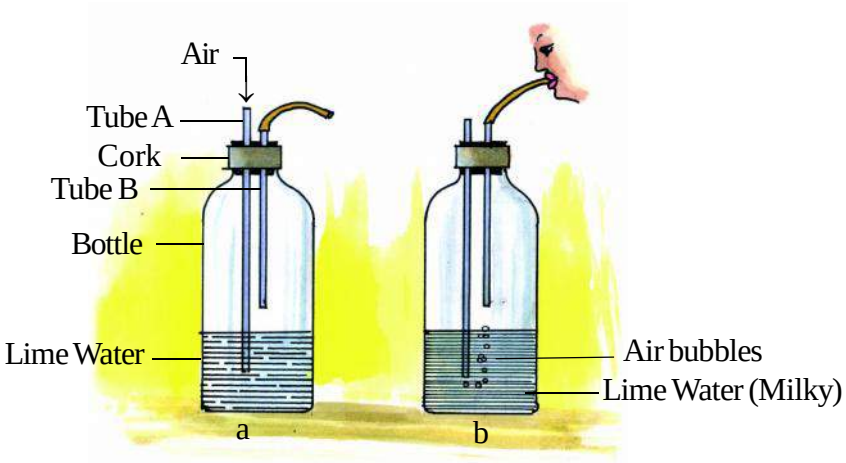


Figure 1.3 Presence of carbon dioxide in air.

ACTIVITY 4

Find a sunny room in your home or school. Close all doors and windows with curtains pulled down to make the room dark. Now, open the door or a window facing the sun, just a little

in such a way that it allows sunlight to enter the room only through a slit. Look carefully at the incoming beam of sunlight. Do you see some tiny shining particles moving in the beam of sunlight? What are these particles? They are dust particles present in air which varies from time to time and place to place.

Activity 1, 2 and 3 conclude that air contains some gases mainly nitrogen, oxygen, small amount of carbon dioxide, other gases, water vapours and dust particles. However, there may be some variations in the composition of air from place to place.

Atmosphere acts as a protective blanket for the earth. It saves the living beings on earth from harmful rays and extreme temperature of the sun.

ANSWER THESE

Fill in the blanks.

1. The earth has been divided into three regions ———, ———and———.
2. At the Poles water is in ——— form.
3. ——— part of the total area of the earth is Hydrosphere and ——— part is Lithosphere.
4. Atmosphere has mainly——, ———and———gases.
5. ————gas turns lime water milky.

1.3 Earth and the Solar System

Sun is a star from which light and heat are being continuously emitted.

Some heavenly bodies revolve around the sun on a fixed path. They are called planets.

Sun had eight planets.

1)	Mercury	2)	Venus	3)	Earth
4)	Mars	5)	Jupiter	6)	Saturn
7)	Uranus	8)	Neptune		

Now Pluto is not a Planet

To decide the definition of planets, in Czech Republic 2500 scientists of from countries took part in the International Conference of Astronomy. After deciding the definition of planets, scientists have found that Pluto is not a planet according to the definition.

They are arranged according to their distance from the sun. The nearest planet is mercury.

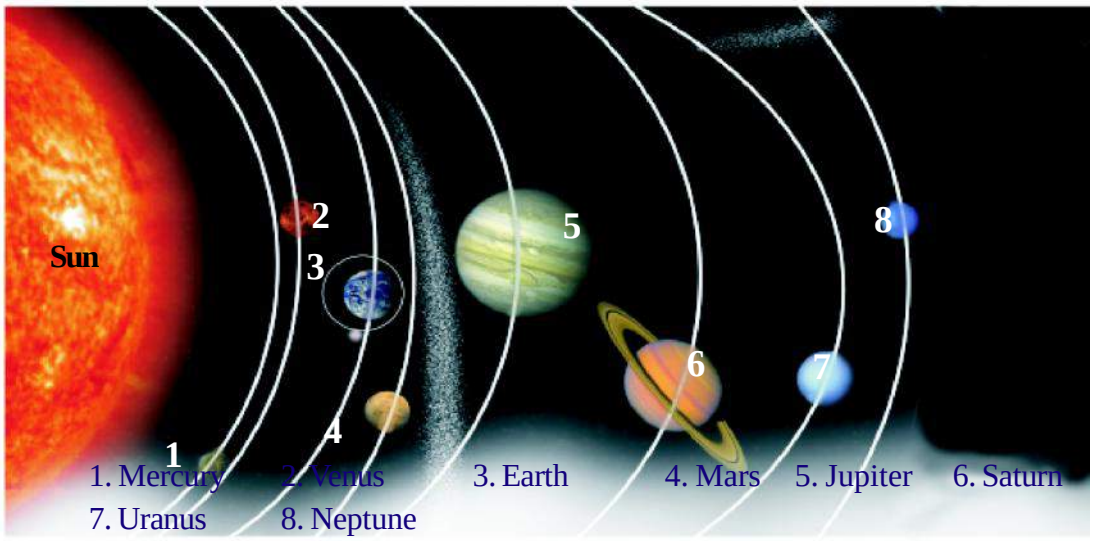


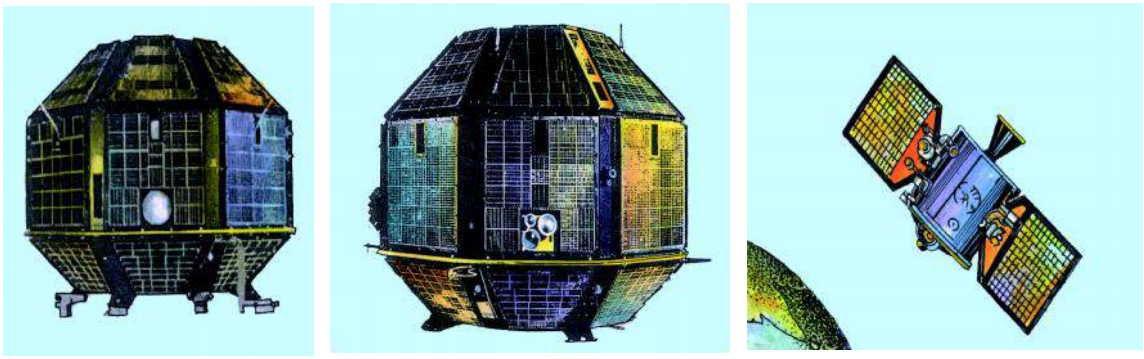
Figure 1.4 Solar System

There are some heavenly bodies that revolve around the planets, These are called satellites. The planets and satellites are lit by sunlight. Sun, planets and satellites together make the Solar System or the solar family.

Satellites are of two types.

1) Natural satellites.

2) Artificial satellites.



A. Aryabhatta B. Bhaskar C. Apple

Figure 1.5 Artificial satellites of the earth

The heavenly bodies, which revolve around any planet, are called natural satellites. Apart from Mercury and Venus all other planets have their own natural satellite. The moon is the only natural satellite of the earth.

Any man-made celestial body that revolves around the plannet and are sent into space with the help of rockets are called are artificial satellites of the earth (figure 1.5).

These artificial satellites serve various purposes such as tele-communications, weather forecasting and gathering of information regarding the geography of earth.

ANSWER THESE

1. Which is the planet nearest to the sun?
2. Which is the planet farthest from the sun?
3. With respect to the distance from the sun, what is the position of the earth?
4. Which is the planet nearest to the earth?
5. Name the natural satellite of the earth.

1.4 Basic Needs of life on the earth

1. Food: All living beings do work. Everyone requires energy to do work. The living beings obtain energy from the food they eat. Why do you feel hungry on returning home after playing? The energy of our body tends to decrease after playing. In order to retrieve back the lost energy food is necessary. Human beings and animals obtain their food from the plants, plant material and also from other animals, but green plants manufacture their own food with the help of CO_2 and H_2O in presence of sunlight.

2. Water: Water is necessary for existence. Green plants and all animals, in addition to food also require water for their survival. A large proportion of the total weight of living being constitutes of water (i.e. 70% of body weight). Water is very important for all the major activities and various processes taking place in the systems of the living beings.

3. Air: Apart from food and water being the necessities, living beings also require air for their survival. You must have noticed from your experience that while being in water, one cannot stay in water for a long time. Similarly, one can experience breathlessness when completely covered with a blanket. Living beings take in O_2 from the surrounding air.

ACTIVITY 4

Materials Required: Test tube, test tube holder, water, candle, burner, match - sticks etc.

Procedure:

- Fill half of the test – tube with water.
- Hold the test tube with a test tube holder and heat the test tube.

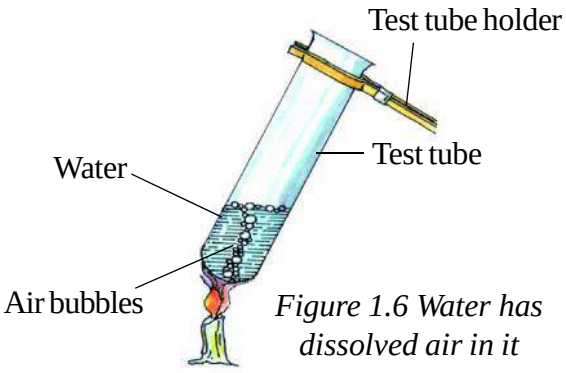


Figure 1.6 Water has dissolved air in it

- After some time you will notice small bubbles emerging from the boiling water.

This experiment shows that water has dissolved air in it.

4. Soil and Light: Other than food, water and air, living beings also need soil and light to sustain life.

The soil supports the green plants to remain in their position and in addition it provides nutrition to the living plants. Soil also supports the life of many small organisms such as insects, earth worms etc. Light is also an important factor for their existence. Plants can manufacture food only in the presence of light. Sun is the major source of heat and light.It is utilized by all.

ANSWER THESE

1. Why do we eat food?
2. Why is water necessary for living beings?
3. Where do aquatic organisms obtain O_2 from?
4. How does soil help green plants?

1.5 The Earth: A Unique Planet of the Solar System

Of all the eight known planets in the solar system, earth is the only planet where life exists. The following features suggest why the earth is considered as the unique planet of the solar system:

1. The hydrosphere of the earth is ideal for the life of human beings and other living organisms.
2. Its atmosphere shows the presence of O_2 gas, which is necessary to maintain sustainability of life on earth.
3. The atmosphere serves as a protective covering that protects us from extremes of temperatures.
4. Water, which is a necessity of life exists here in huge proportions in various forms (ice, water and water vapour).

The earth, therefore, is the only planet that provides all the basic necessities of life (food, water, air) to all living beings.

WE HAVE LEARNT

The earth is round in shape.

- Crust: The uppermost layer of the earth, where soil, minerals, water and dead organisms and plants exists.
- Mantle: The middle layer of the earth, which shows the presence of melted rocks along with the associated gases.
- Core: The inner layer of the earth having very high temperatures.
- Hydrosphere: The total water content on earth.
- Lithosphere: The total landmass and the soil content present on the earth's surface.
- Atmosphere: The total covering of air present around the earth.
- Solar system: The sun along with the revolving planets and their satellites.
- Planet: A heavenly body revolving around the sun.
- Among all the planets in the solar system, Jupiter is the largest.
- The planet nearest to sun is Mercury.
- Satellite: A heavenly body that revolves around the planet.
- The Earth is the only planet of the solar system where all the necessary conditions for life are available.
- Apart from food, water and air, soil and sunlight are also required for life.

EXERCISE

ENF **Choose the correct answer among the given options.**

1. Minerals are found in abundance in
   a. Atmosphere
   b. Mantle
   c. Crust
   d. Core
2. Gas necessary for respiration is
   a. Nitrogen
   b. Air
   c. Oxygen
   d. Carbon Dioxide

3. Which of the following is not a planet
   a. Venus
   b. Mercury
   c. Saturn
   d. Moon
4. In the solar system, the earth is located between which of the two planets?
   a. Mars and Mercury
   b. Venus and Mercury
   c. Mars and Venus
   d. Mars and Jupiter

EOF **Fill in the blanks -**

1. The Innermost portion of earth is known as……
2. …… is the only planet of the solar system where life exists.
3. …… gas present in air is used by the living organisms for breathing.
4. Green plants use……gas for the manufacture of their food.
5. INSAT is an ……satellite of the earth.

EPF **State whether the following statements are true or false. Make the false statement correct.**

1) The Sun is a star ( )
2) Moon is the natural satellite of the earth. ( )
3) Air is soluble in water. ( )
4) The Sun revolves around the earth. ( )
5) In the core solid iron and nickel metals are found. ( )

EQF **Match the following -**

1)	Satellite	Mercury
2)	Middle layer of earth.	Oxygen
3)	Air taken during breathing	Mantle
4)	Nearest planet to sun	Moon
5)	Nearest planet to earth	Mars

(5) Short answer questions.

a. What is the importance of the three layers of earth?

b. Make a labelled diagram of the inner structure of earth.

c. What is the importance of oxygen for living beings?

d. Experimentally explain the presence of CO_2 in air.

e. Write the names of the members of the solar system according to their distance from the Sun.

f. Give the importance of artificial satellites.

g. What are the basic requirements for sustaining life on earth?

h. Why is the Earth called a unique planet?

THINGS TO DO:

1. Make a model of the solar family with your friends.
2. With the help of your teacher gather the following information for your scrap book.

(i) Artificial satellite- name of countries that launch their satellites, year of launching satellites, name of space stations, photographs (if available)

(ii) Name of space scientists, photographs, their contribution and achievements of space scientists.

(iii) Collect informations of space travellers and the achievements of astronauts.

2. OUR ENVIRONMENT

2.1 - Components of Environment

You know that there are many types of things like air, water, soil, plants and animals etc. which are found around us. All these together form our environment and each one of these is a component of our environment. Basically, there are two types of components in an environment – living and non living. Plants and animals comprise of the living components, whereas air, water, soil, light etc. are the non living components.

Make a list of things found around you. Make table 2.1 in your notebook and complete it by using your list.

TABLE 2.1

S.No	Non living component	Living component	
		Plants	Animals
1.			
2.			
3.			
4.			
5.			

You already know that living beings are of two types: plants and animals. You must have noticed that most of the leaves are green in colour, and even stems of some plant are also green. This green colour is because of a green pigment called chlorophyll. Because of the presence of chlorophyll all green plants make their own food in the presence of sunlight and carbon dioxide. Hence, they are known as autotrophs. Animals lack chlorophyll. Then, how do you think they obtain their food? Many animals eat the green plants and are dependent on them for their survival. Such animals are the herbivores, for example: cow, rabbit, and deer. There is another category of animals, which dependent on other animals for their food. They eat other animals. Such animals are called the carnivores, for example wolf, lion, tiger etc. Third types of animals are those, which depend on plants as well as animals for their food, for example man, crow, dog etc. These are the omnivores. Herbivores, carnivores and omnivores cannot manufacture their own food and are hence known as heterotrophs. Since, green plants can prepare their own food with the help of chlorophyll, they are called producers and the animals, which are dependent on plants for food, are called consumers.

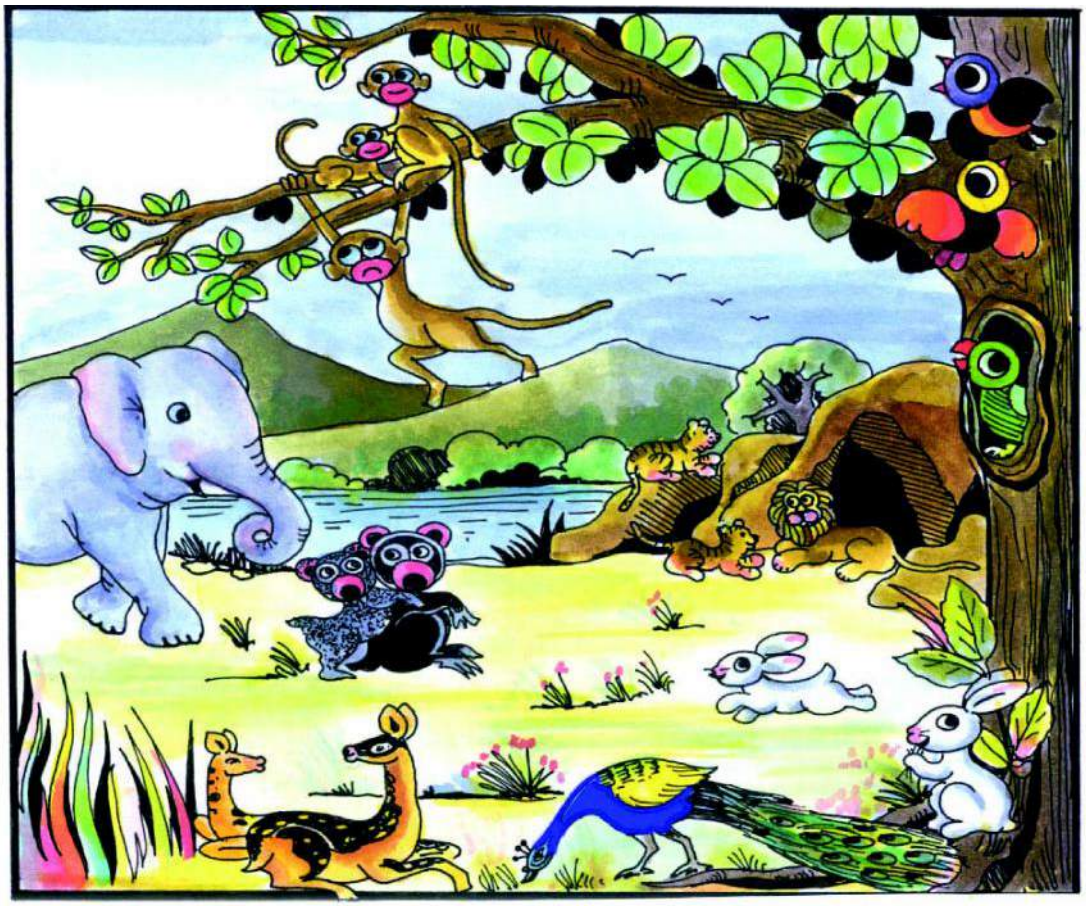


Figure 2.1 Living Component of the Environment

Identify the producers and consumers from figure 2.1.

Now let's play a game to understand how each constituent of environment is dependent on each other.

2.2 - Game of Environment-Web of life

Preparation for game

Your teacher should make 25 cards of 10cm length and 5cm breadth each. These cards can be made from old post cards, wedding invitation cards or even from drawing sheets. On one card your teacher will put the name of any thing from the list given below. Like this, 25 names would be written on 25 cards.

Sun, soil, water, grass, frog, grass hopper, air, light, river, pea plant, mango tree, algae, wheat plant, snake, vulture, monkey, lion, deer, fish, crocodile, temperature, peacock, rabbit, man, mineral salts.

It is not necessary to write only these 25 names. If you wish you can remove any of the names from the list and put names of your choice instead. It is also not mandatory to play this

game with 25 students only. The number of students can be less than 25 or even more. Also make a ball with thin rope used to stitch the sacs. The length of the rope should be around 250 ft.

Teacher will give one card to each student who is playing the game, that child will put it on his chest so that everybody else can see it. This way each child will get a name. Now all the players will stand in a group, when the teacher instructs, living being will move to the left and non- living things to the right hand side. Now, all the living things will form a group on the left side of the teacher and all the non- living things will form another group on the right side of the teacher. Now plants and animals will also separate. Now all the players will sit in the circle in any order. The rest of the students will stand behind them and watch the game. Each student/player sitting in the circle will say 5 sentences about himself/herself. The one who has the Sun's card will talk about the Sun, the one who has *rivers* will talk about river, the one who has *snake* will talk about snakes etc.

The player who has got *Sun's* card will start the game. He will take the ball of rope in his hand and tie it on the middle finger of any of his hands and then throw the ball to any child to whom he feels sun could be related to. Like, if he feels that sun could have a relationship with a *mango tree*, he can throw the ball to the mango tree. The child who is acting as a mango tree can throw the ball further to someone; he feels he could be related to *monkey, water or soil*. Each child should tie the rope tightly before throwing it further. Rope should be held tightly between two children. One player may get the ball more than once or many times. This way the game will continue till all the rope is utilized.

You will observe that because of relationship between the different components of the environment, a web like thing is formed between them. All the living and the non-living components are dependent on each other. Let us see how our environment is effected by the absence of any one of these components.

Now, all the players should loosen the rope from their fingers one by one and then again tie it tightly. What do you observe when even one player loosens the rope from his finger? Does the web become loose? This loosening of net indicates the absence of any one component of the environment.

Is there any component whose absence will not make any difference?

Who eats whom? Game of Food Chain

Now all the students should remove the rope from their fingers and again make a ball of the rope. Let the name cards be still attached to you. The student with *algae* card should now stand in front of everybody. Who eats *algae*? Let us presume it is the *fish*. Now the student with the fish card should stand next to the student with the algae card and hold his hand. Who eats fish? There can be many answers to this question. Let us presume that the human beings are

eating the fish. Now the student with the human being card should hold the hand of the student with the fish card.

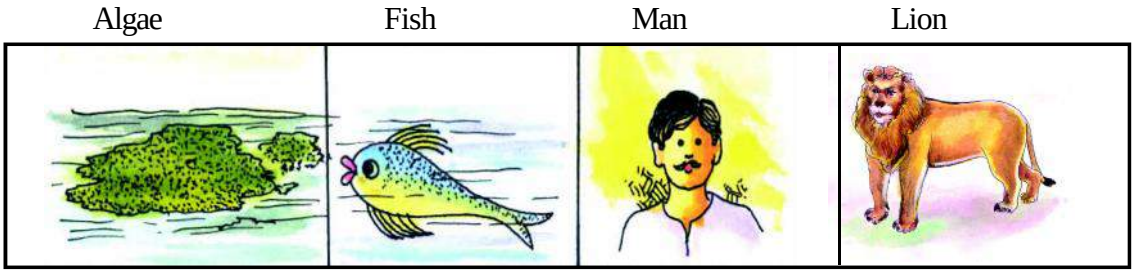


Figure 2.2 Food Chain

Who eats human beings? If the answer is the *lion*, then the student with the lion card should stand on the left side of the child with the human being card and also hold his hand.

Now, you will observe that a chain is formed between animals that eat other animals and are also being eaten. This is called a 'Food Chain.'

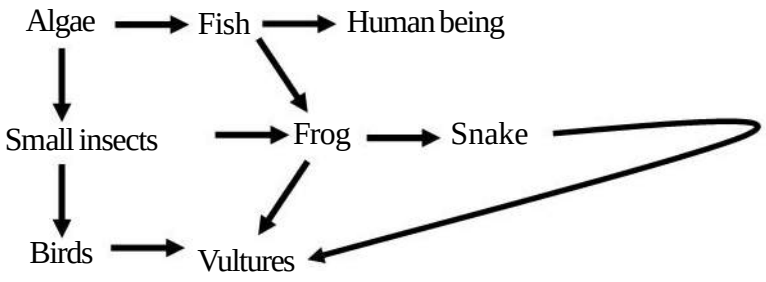
Algae → Fish → Human beings → Lion

Here, an algae is a producer and fish, human beings and the lion are the consumers.

Now, think about similar food chains and show them in the class.

All the students should note these food chains in their note- books and should also try to make different food chains whose components are not given in the list.

You are aware that one organism is eating more than one organisms. So the same organism can be a part of more than one food chain. This way many food chains can be associated to form a web or a net like structure. Such a structure is called a food web.



Let us see how living components are dependent on each other.

We use many things in our daily life. Out of these we get some from plants and some we get from the animals.

Prepare Table 2.2 in your notebook by listing the things, which we obtain from the plants and animals.

TABLE 2.2

Things obtained from plants	Things obtained from animals
----------	----------
----------	----------
----------	----------
----------	----------

Apart from food, living beings are also dependent on plants for many other things. Like birds make their nests on trees. Many small insects also inhabit the trees. Small insects or even birds perform pollination in many flowers. Some seeds and fruits get stuck on to the bodies of birds and animals and are transported to different areas. This is called dispersal of seeds. In this way all other plants and animals are dependent on each other.

2.3 - Environmental Pollution

In the game WEB OF LIFE you have seen that absence of any one component of the environment or even the loosening of rope by any one component effect the environment. Now, let us see how all this happens. Air, soil, water etc are such components, which are associated with other components also.

2.3.1 - Air Pollution

If you loosen the rope of the air component, then what would it mean? You would have seen that the smoke emitted by vehicles, leads to irritation in our eyes and a feeling of general discomfort. If at home also, smoke accumulates, we do not feel comfortable. It is because this smoke contains many poisonous gases, which pollute the air. Smoke from the factories also pollutes the air. Like wise if there is too much dust in the atmosphere, then also air becomes polluted and is harmful for living beings.

Have you noticed garbage heaps of dried leaves on the roadside? Most of the time these are burnt. Farmers too often burn the husk, dried leaves and part of crop plants in their fields after harvesting. Burning of these produces harmful gases and smoke which pollute air. Hence, it is necessary not to burn waste material and not let anyone burn it.

Think of ways by which you can reduce the air pollution and put your thoughts in your notebooks.

2.3.2 -Water Pollution

Water is essential for all living beings. Can any living being live without water? Just think, what kind of water would be good for a living being- clean or polluted?

Water from drains, sewage etc. and also poisonous water from industries joins the river or ponds to make them dirty and polluted. Because of this many living beings die and many human beings and animals become sick.

Think and write ways of checking pollution.

Rain Water Harvesting

One way of increasing the availability of water is to collect rainwater and store it for later use. Collecting the rain water in this way is called rain water harvesting. The basic idea behind rain water harvesting is "Catch water where it falls".

Techniques of rainwater harvesting:-

1. The rainwater is collected from the rooftop to a storage tank, through pipes. This water may contain soil from the roof and need filtering before it is used. Instead of collecting rainwater in the tank, the pipes can go directly into a pit in the ground. This then seeps into the soil to recharge or refill the ground water (fig 2.3).

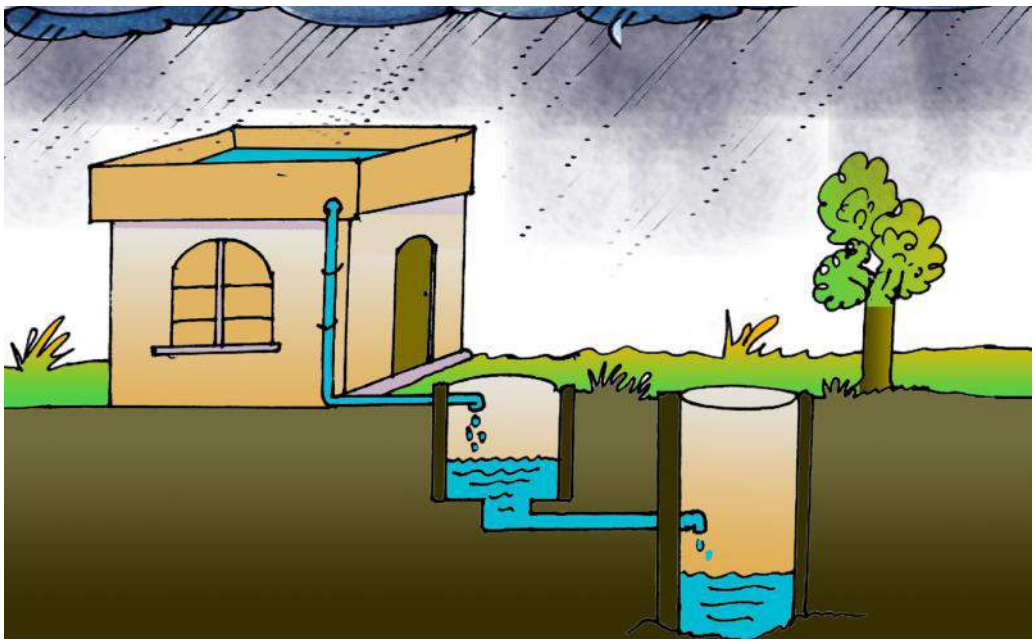


Fig 2.3 Rooftop rain water harvesting

2. Another option is to allow water to go into the ground directly from the roadside drains where rainwater gets collected.

2.3.3 -Soil Pollution

With increasing population, there is an ever-increasing demand for food everyday. Because of this demand, different types of fertilizers, insecticides etc are being used to increase the produce. Of these there are certain minerals, which when present in excess, pollute the soil and reduce its fertility. Hence, it is being advised to use natural manures like cow dung to increase the fertility of the land.

Visit the gardens and fields around you and prepare a list of natural and synthetic manures being used in them.

2.3.4 -Sound Pollution

Now we shall talk about a different type of pollution. Those of you who live in cities would have seen that vehicles start plying on the roads early in the morning. The engines and the horns of these vehicles produce a lot of sound.

Make a list of sources of sound that make a high-pitched sound.

If we are continuously exposed to high pitch sounds, then our ability to hear is reduced or even we can become deaf. Sound pollution also affects our health. We become more irritable which can lead to headaches and other types of sickness.

Think of ways of reducing sound pollution and note them in your notebooks.

2.4 - Forest Conservation, Tree Plantation And Protection of Wildlife

Human beings are constantly trying to raise the standard of living. To lead a comfortable life, we are destroying the environment and directly or indirectly harming the forests and wildlife.

Life of living organisms in the forests has become unsafe because of the large number of trees which are being cut. You have earlier learnt about the food chain and absence of any one organism from the food chain breaks it. This leads to an imbalance in nature. To maintain a balance in nature, trees should not be cut and new tree plantations should be taken up. To protect the forests and the forest animals, Sanctuaries and National Park have been made. Find out how many national parks and sanctuaries are present in Chhattisgarh?

In our Chattisgarh, major vegetation comprises of *Sal, Teak, Beeja, Delbergia, Bamboo, Tendu, Mahuaa, Sarai, and Cotton.* Rabbit, Cheetal, Sambhar, Kotari, Nilgai, Bison, Elephant, Bear, Lion, Leopard, Panther, Wolf, Fox are the predominant species of wild animals. Birds include Maina, Cuckoo, Doodhraj, Peacock, Crane etc. Different species of snake like Cobra, Karat, Python, Dhaman etc. are also found here. Tribes inhabit the forests of the state. Their lives are totally dependent on these forests. Our state is a good example of animal biodiversity.

2.5 What if it Rains Heavily?

The time, duration and the amount of rainfall varies from place to place. In some parts of the world it rains throughout the year while there are places where it rains only for a few days. However, excess of rainfall may lead to many problems. Heavy rains may lead to rise in the level of water in rivers, lakes and ponds. The water may then cause floods. Flood causes extensive damage to crops, domestic animals, property and human life. During floods, the animals living in the water also get carried away with the waters. They often get trapped in mud and die when floodwater recedes. Many pathogens are also grow at that time which cause diseases.

What happens if it does not rain for long period?

Can you imagine what would happen if it does not rain in a region for a year or more? The level of water in ponds and wells of the region would go down and some of them may even dry up. This may lead to drought. The soil continues to lose water by evaporation, therefore it becomes dry.

In drought conditions, it is difficult to get food and fodder. You might have heard about drought occurring at some places, through television and news paper. Are you aware of the difficulties faced by the people living in these areas? What happens to the animals and the vegetation in these conditions? Collect information and find out about this by talking to your teachers, friends and parents. Discuss about your role in both the situations with your friends.

We know that only a small fraction of water available on the earth is fit for use. The number of people using water is increasing with rising population. Hence, it is very important that water is used carefully; we should take care not to waste water.

WE HAVE LEARNT

- Living and non living components together form the environment.
- Living and non living components in the environment are interdependent.
- Light, temperature, water, air and soil are the non-living constituents of the environment.
- Plants and animals are the living constituents of the environment.
- Living and non-living are components dependent on each other for food, shelter and protection.
- Producers and the consumers form the food chain.
- Polluted air, polluted water, polluted land and sharp sound, pollute the environment.
- By checking the environmental pollution, Tree plantations and Conservation of animals, a balance is maintained in nature.
- Excessive rains may cause floods while lack of it for long period may cause drought.

EXERCISE

1. Using the living organism mentioned make at least three food chains:

Grass, lion, cow, small fish, wolf, fox, peacock, vulture, kite, crow, frog, beetles, zooplanktons, big fish, crane, snake, mongoose, algae, green plants.

2. Complete the food chain:

i. Green grass → ……. → Peacock

ii. Plants → Rabbit → ……

iii. Algae → …. ……. → Crane

3. Answer the following questions:

i What is an environment?

ii What is the difference between producers and consumers?

iii Living and non-living components of environments are dependent on each other. Explain.

iv What do you understand by a food chain?

v. What happens if there is scanty of rainfall?

4. Explain briefly:

a. Air pollution b. Water pollution c. Sound pollution

d. Tree-plantation e. Conservation of forests and their wild life.

f. Damage due to heavy rainfall

5. Give the names of two herbivores and carnivores which are easily found in your area.

6. Write the names of birds and snakes found in Chhattisgarh.

7. Write about the measures taken for the protection of wild animals.

8. According to Budhram drivers of vehicals emitting smoke should be charged a penalty. Do you agree with this statement, give reasons for your answer.

THINGS TO DO

1. Visit with your teacher and friends, a field/garden/river/pond or playground located near your school. Collect information and construct various possible food chains in these regions.
2. Display environment related informations, news, puzzles, slogans, stories, pictures, posters, cartoons etc. on the bulletin board of your school. You can make these cartoons or pictures yourself or collect these from magazines.
3. Organise environment day in your school and discuss the importance of environment with your friends.
4. List five activities by which you can save water. Describe the method of each activity.
5. Prepare a poster on ways of saving water and display it on notice board of your school.
6. Under the guidance of your teacher make a plan what would you and your peer group do if nearby area faces draught or flood.

3. NATURE OF MATTER

We see a number of things around us. Like fruits, clothes, air, furniture etc. Out of these certain things are obtained from nature directly like fruits, air etc. While other things are man-made like cloth, furniture etc.

3.1

Do you know that a chair can be made either from plastic, wood or steel? Here chair is a "thing" and plastic, wood or steel is the material from which it can be made. In this example you have observed that one thing can be made from a number of different materials. On the other hand one thing may require a lot of things to make it. For example to construct a house we require cement, sand, bricks, iron etc.

Complete the table given below by adding the names of things and materials used to make it-

TABLE 3.1

S.NO	THING	MATERIALS USED TO MAKE IT
1.	Soda water	Salt, sugar, water and carbon dioxide
2.	Pen	Plastic, metal, ink
3.	Bag	_____
4.	Book	_____
5.	Balloon filled with air	_____
6.	_____	_____

Now separate the materials given in table 3.1 according to their states.

TABLE 3.2

S.NO	SOLID	LIQUID	GAS
—	————————	————————	————————
—	————————	————————	————————
—	————————	————————	————————
—	————————	————————	————————

It is clear from the above table that the materials found in nature can exist in three different states, namely solid, liquid and gas.

3.2 In what way all the materials of the categories similar?

3.2.1 Can we see, touch and feel solids, liquids and gases?

Make the table given below in your notebook and write the characteristics of matter according to the criteria given: -

TABLE 3.3

S.NO.	Characteristics	SOLID	LIQUID	GAS
1.	Can you see it?	_____	_____	____
2.	Can you touch it?	_____	_____	_____
3.	Can you feel it?	_____	_____	_____

Now we have seen that solids, liquids and gases are different from each other. Solids and liquids can be seen, felt and touched. Gases cannot be seen or touched, but can only be felt. Presence of air can felt as it blows.

3.2.2 Do solids, liquids and gases have definite shape

ACTIVITY 1

Materials required-Utensils of different shapes (like glass, beaker, conical flask), water and stone.

Keep a piece of solid for example stone on a table. It stays at its place. There is no change in its shape . Thus, solids have definite shape.

Now take water in a glass and put it in utensils of various shapes. Is the shape of water same in all the utensils. (figure 3.1)

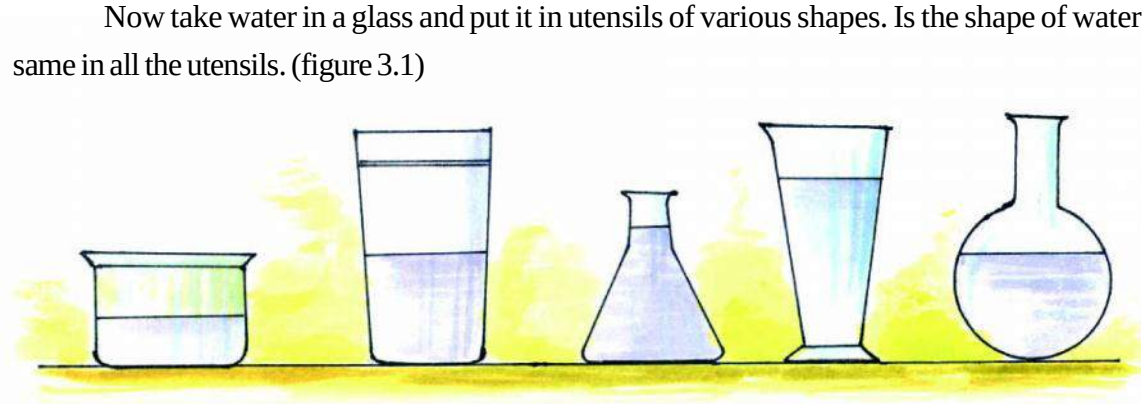


Figure 3.1 Utensils of different shapes

Now spill the water from one of the utensils on the table. We observe that shape of water changes with the shape of the utensil and it flows when spilled. Thus, all liquids can change their shape and can flow when spilled. Similarly, gases also change their shape according to the container and they also flow.

3.2.3 Do solids, liquids and gases occupy space?

Books contained in your bag occupy the empty space available in the bag. Water kept in a bucket occupies the space available inside. Thus, we can say that solids and liquids occupy space.

Let us try to understand if gases occupy space?

ACTIVITY 2

Materials required- a deep bucket, a plastic or glass bottle, rubber tube and water.

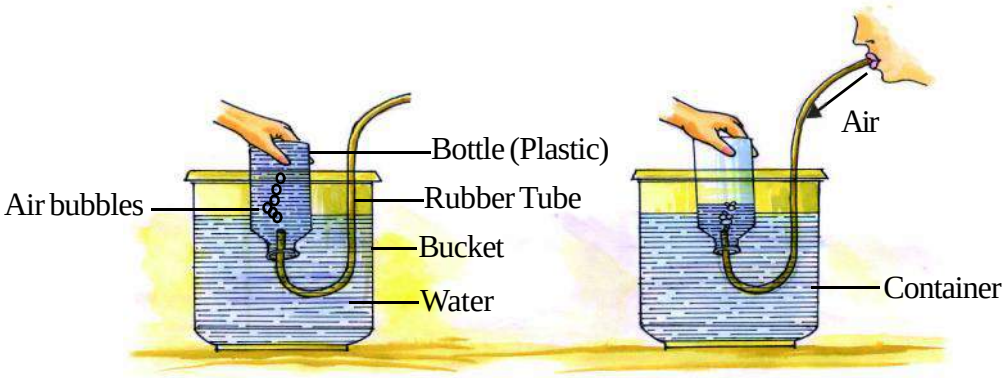


Figure 3.2 Gases occupy space

Take a deep container and fill it completely with water. Now immerse an empty glass or plastic bottle in the filled container. When the bottle is fully filled with water, slowly invert it in such a way that its mouth remains inside the water. Take care that the bottle should be completely filled with water. Now take a rubber tube. Attach one side of the tube to the bottle. Take the other end of the rubber tube close to your mouth and pump out air slowly. We see the air going into the bottle in the form of bubbles. The level of water in the bottle falls down. This shows that air occupies space.

Thus gases also occupy space like solids and liquids.

3.2.4 Do solids, liquids and gases have weight?

You must have noticed that a big stone is heavier than a small stone, or, a bucket half filled with water is lighter than a bucket fully filled with water.

ACTIVITY 3

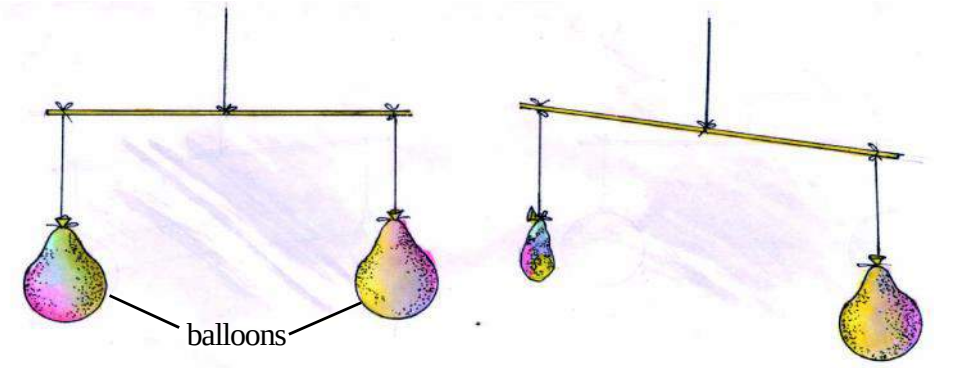
Materials required-Two beakers of equal size, sand.

Take two beakers. Fill one beaker with sand fully and the other only half. Pick up both the beakers together. What do you feel? Beaker which is fully filled with sand is heavier than the half filled beaker. Thus, solids have weight and their weight increases as we increase the quantity of the material. Now let us try to understand if air has weight?

ACTIVITY 4

Materials required-A Strong wooden strip, two balloons, threads

Fill two balloons with air and tie them with thread separately. Now take a thin wooden strip and tie a thread in the middle and make a crude balance as shown in figure 3.3.



Balance state (initial) State of balance after air removal

Figure 3.3 Gases have weight

Now attach the two balloons on each side of the strip in such a way that it is balanced. Now remove air slowly from one of the balloons. As the air goes out from one side, the balance will bend towards the other side. This shows that balloon has become lighter due to removal of air. Thus we can say that air has weight.

Now, let us make a table and see the characteristics of solids, liquids and gases.

TABLE 3.4

S.NO.	CHARACTERISICS	SOLIDS	LIQUIDS	GASES
1.	Flow	Do not flow	Flow	Flow
2.	Shape	Definite	Changeable	Changeable
3.	Occupy space	Occupy space	Occupy space	Occupy space
4.	Weight	Have weight	Have weight	Have weight

Now pick up those characters from the table, which are present in all the three states of matter.

1. _____
2. _____

- Matter has weight and it occupies space.
- Matter that occupies space and has a definite shape is a solid. Solids do not flow.
- Matter, which has weight, and occupies space but does not have a definite shape is a liquid. Liquids flow.
- Matter, which does not occupy a definite space, has no shape but has weight is a gas. Gases flow.

3.3 Can matter change its state?

Normally matter occurs in any one state, for example iron is solid, water is liquid and air is gas. But it is not true that matter can exist in one state only. We can change the state of matter for example by changing the temperature, for example at room temperature water exists in a liquid state, but at extreme cold temperature it changes into ice, which is the solid state. This is called freezing of water. By heating, liquid water changes into its gaseous state, i.e. steam. Water starts to boil at a specific temperature and changes into steam. This is called Boiling point.

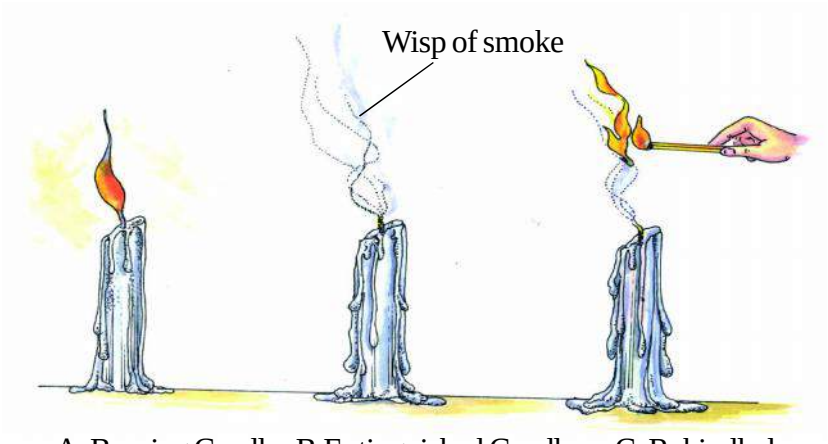
ICE ⇌ W ATER ⇌ STEAM

Now, let us observe the changes in the state of matter.

ACTIVITY 5

Materials required-Candles, matchbox

Take a thick candle and light it. Blow it off after sometime. You can observe white fumes going up as the candle is blown out. If you take a lighted matchstick near the fumes, candle can again be lighted.



A. Burning Candle B.Extinguished Candle C. Rekindled

Figure 3.4 Change of states in a candle

This shows that white fumes, which go up as the candle is put off, is the changed state of wax. Thus, as soon as we take a lighted matchstick near the candle, it lights the candle. Hence, wax can exist in solid, liquid and gaseous state.

ANSWER THESE

1. Name three things made from the same matter.
2. Classify the following into solid, liquid and gas categories- Milk, Chalk, Sugar, Oxygen, Syrup, Smoke and Glass
3. Name five liquids, which are used at homes .
4. What are the changes that take place in ice when it is changed to water.
5. Adjust a paper inside a glass in such a way that the paper does not fall even if the glass is inverted. Now invert this glass and push it straight down to the bottom of a bucket full of water. Take care that the glass does not tilt. Take out the glass and observe if the paper is wet or dry. Give reasons for your answer.

3.4 Characteristics of Matter

Matter is used according to the characteristics it possess.

Let us observe some of the characteristics of matter

1. **SOLUBILITY IN WATER-** In nature, water is found in large quantity. We use it for drinking, washing, cooking etc.

ACTIVITY 6

Materials required-Four glasses, spoon, sugar, sand, salt and chalk dust

Fill three-fourth of water in each of the four glasses. Put one spoonful of sugar, sand, salt and chalk dust in each of the glasses respectively and mix thoroughly with a spoon. Leave them undisturbed for five minutes. Observe carefully. Repeat this activity for other materials and complete the following table.

TABLE 3.5

S.NO.	NAME OF THE MATERIAL	SOLUBLE / INSOLUBLE
1.	Sugar	----------
2.	Sand	----------
3.	Salt	----------
4.	Chalk dust	----------
5.	----------	----------
6.	----------	----------

In the above activity, sugar and salt are soluble in water. They cannot be seen as they are distributed uniformly in water. These materials, which dissolve in water, are called *soluble* materials. Sand, chalk and dust do not dissolve in water, they are called insoluble materials.

- Any material which is dissolved in a liquid is called a solute
- Liquid in which the solute is dissolved is called the solvent
- A solute mixed in a solvent forms a solution.

Now, we would see the solubility of liquids in water.

ACTIVITY 7

Materials required -Four glasses, spoon, milk, kerosene oil, lemon-juice and coconut oil.

Take four glasses. Fill these glasses with water up to three-fourth level. Add two spoons of milk, kerosene oil, coconut oil and lemon-juice respectively in each of these glasses. Stir each liquid using a spoon. Now leave them undisturbed. Observe after five minutes. Repeat this activity for other liquids and complete the following table.

TABLE 3.6

S.NO	MATERIAL	SOLUBLE / INSOLUBLE
1.	Milk	_____
2.	Kerosene oil	_____
3.	Lemon juice	_____
4.	Coconut oil	_____
5.	_____	_____
6.	_____	_____

In the above activity we observe that milk and lime juice are dissolved in water. They are called soluble liquids. While kerosene oil and coconut oil do not dissolve and form a separate layer on water. They are called insoluble liquids.

Similarly, some gases can be dissolved in water like ammonia etc. Some gases cannot be dissolved in water like Hydrogen, Nitrogen etc. Very small quantities of Carbon dioxide and Oxygen gas dissolve in water. Oxygen dissolved in water is responsible for the life of fishes, which live in water.

2. MAGNETIC PROPERTY

ACTIVITY 8

Materials required- Magnet, iron nails, wooden sticks, plastic buttons, all-pins etc.

Spread iron nails, wooden sticks, plastic buttons and all pins on a piece of paper. Bring a magnet close to these materials. Repeat this activity with some other materials and complete the table given below.

TABLE 3.7

S.NO.	MATERIAL	MADE FROM	ATTRACTED/NOT ATTRACTED TOWARDS MAGNET
1.	Iron nails	iron	_____
2.	Wooden sticks	wood	_____
3.	Plastic buttons	plastic	_____
4.	All-pins	iron	_____
5.	_____	_____	_____
6.	_____	_____	_____

We see that things made out of iron are attracted towards the magnet. Thus, we call iron a magnetic material. Nickel and cobalt metals are also magnetic. You can see this property in Nickel and Cobalt coins. Other materials like plastic, wood etc. are not attracted towards a magnet and they are called non-magnetic materials.

3. TRANSPARENCY

ACTIVITY 9

Materials required-Two glasses, water, stone, white paper lightly coated with oil.

Try to read the words on your book by putting on it, an empty glass, a glass full of water, a stone and then a white paper lightly coated with oil. Repeat this activity with other materials and complete the table given below.

TABLE 3.8

S.NO.	THINGS	TRANSPARENT/OPAQUE/TRANSLUCENT
1.	An empty glass	_____
2.	A glass filled with water	_____
3.	A stone	_____
4.	A white paper lightly wet with oil	_____
5.	_____	_____
6.	_____	_____

Materials through which we can see clearly like glass are called transparent materials. Those materials through which we cannot see are called opaque. Examples are wood, stone, wall etc. Those materials through which we can partially see are called translucent materials, like paper lightly coated with oil, transparent plastic, etc. Make a list of transparent translucent and opaque materials found in your surrounding.

ANSWER THESE

1. Name one transparent solid and one such liquid.
2. List the differences between transparent, opaque and translucent materials.

3. Pick up the appropriate words from the list and fill in the blanks.

   Soluble, insoluble, miscible, immiscible

   1. Blue vitriol can be dissolved uniformly in water, thus it is _____ in water.
   2. On mixing oil and water two separate layers are formed as these two liquids are _____.
   3. Coal is _____in water.
   4. Orange juice is _____ in water.

4. Classify the following materials according to their magnetic properties.

   Wood, glass, scissors, safety pin, pencil, aluminium wire

4. CONDUCTIVITY

You must have seen hot metallic utensils removed from fire with the help of cloth. Generally, handles of pressure cookers, pans etc. are made of wood or Bakelite plastic. Let us try to find the reason for this.

ACTIVITY 10

Materials required- Metallic pot/ beaker, water, a wooden stick, a metallic spoon, hot plate.

Take hot water in a beaker. Put a wooden stick and a metallic spoon in this (fig.3.5). After two minutes, touch the parts of the stick and the spoon, which are out of water. Which feels hotter?

Metallic spoon will be hotter as heat travels faster from one end to the other in metals. Thus, metals are called good conductors of heat. Materials like wood do not allow heat to pass through them, they are called bad conductors of heat.

Air is also a bad conductor of heat that is why in winter we wear one cloth over

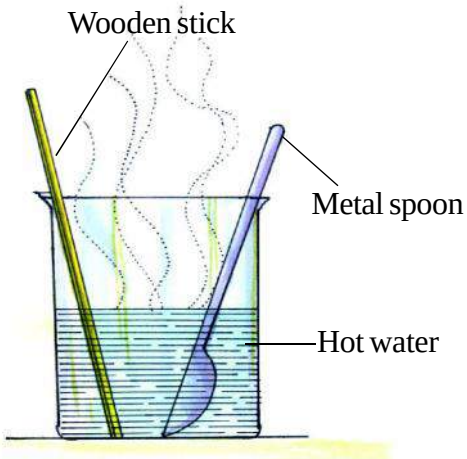


Figure 3.5 Good and bad conductors of heat

the other to keep ourselves warm. The air present between the layers of cloth does not allow the warmth of our body to go out, as air is a bad conductor of heat.

ELECTRICAL CONDUCTIVITY

Have you ever tried to remove the plastic covering over an electrical wire? You will find thin wires of copper inside it. These wires are good conductors of electricity thus they are used in the distribution of electricity. The outer covering made from plastic is a bad conductor of electricity.

ACTIVITY 11

Materials required- A cell of a torch , a one-metre long electrical wire and a torch bulb.

Remove plastic covering from both the ends of the electrical wire. Attach one side of the wire with the point on the metallic part of the bulb, while the other side of the wire is attached to the lower side of the cell as shown in fig. 3.6. Attach the lower side point of the bulb to the upper side point of the cell. The bulb lights up. The reason is that the metal in the wire is a good conductor of electricity. Insert a folded paper in between bulb and the cell. What happens? Paper is poor (bad) conductor of electricity and hence the bulb cannot be lighted. Repeat the activity by using other materials in place of paper like wooden piece, cloth and metallic coin.

Where does a torch get electricity from? Electricity to the bulb in torch is provided by the electric cell. Have you ever carefully looked at an electric cell? It has a small metal cap on one side and a metal disc on the other side. There is a (+) and a (-) sign on the electric cell. The metal cap is the positive terminal and the metal disc is the negative terminal of the cell. An electric cell produces electricity from the chemicals stored inside it.

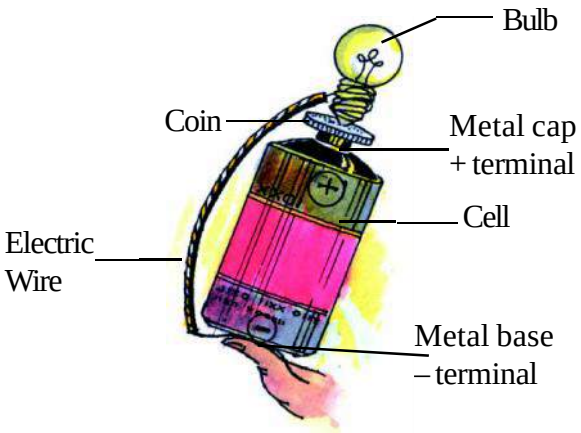


Figure 3.6 Electrical Conductivity

You have taken a torch bulb in activity-11. On observing this bulb of the torch carefully; you will find a thin wire in the middle of the glass bulb. This thin wire is called the filament; the filament is fixed between two thicker wires. One of these thick wires is connected to the metal case at the base of the bulb and the other thick wire is connected to the metal tip at the centre of the base. The base of the bulb and the metal tip of the base forms the two terminals of the bulb (fig. 3.7 a and b)

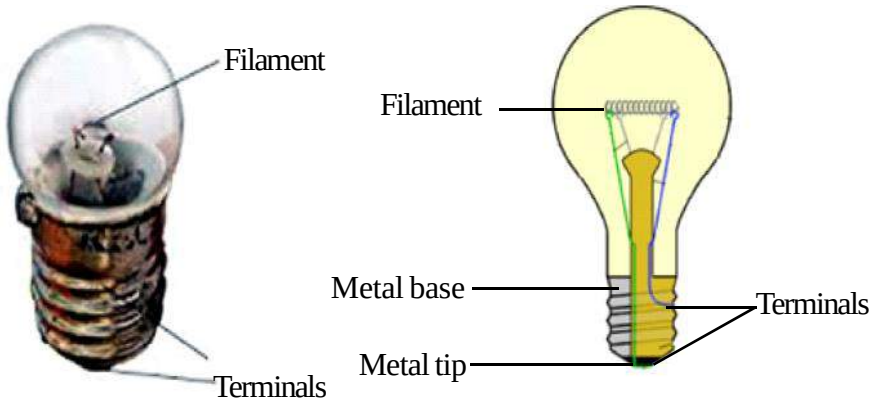


Fig. 3.7 Bulb of a torch

In activity-11, you have also connected the two terminals of the electric cell to the two terminals of the bulb (one terminal of electric cell is connected through wire to the metal case at the base of the bulb and other one connected to the metal tip at the centre of the base). Such an arrangement is an example of an electric circuit. It shows the entire path of electric current between the two terminals of the electric cell. In an electric circuit the direction of current is taken to be from (+) terminal to (-) terminal of the electric cell.

Pure water is a poor conductor of electricity. In the presence of dissolved salts however it become a good conductor of electricity. Thus, you should not touch electrical appliances with wet hands.

Those materials through which electricity can pass are called good conductors while those that do not allow electricity to pass are called poor conductors.

5. DIFFUSION

What happens when you light an incense stick in a room? After some time the scented fumes mix in the air and are spread in the room uniformly. This happens due to diffusion.

ACTIVITY 12

Materials required-Glass, water, ink, dropper

Take water in a glass. With the help of a dropper add 1-2 drops of blue ink in it. We observe that slowly blue ink mixes in water and makes it blue. This is due to diffusion of blue ink in water.

Any solid, liquid or gas when it tries to get distributed uniformly in another gas or liquid it is called diffusion.

Solubility, Magnetic property, Transparency, Heat and Electrical Conductivity and Diffusion are some of the properties, which are used to classify matter. We would study this more in the next chapter.

ANSWER THESE

1. While working with electricity why is it recommended that we wear gloves?
2. If the following materials are kept in between the cell and the bulb of a torch, what will happen-

   Aluminium foil, Rubber sheet, Paper, Coin
3. How can we smell the food being cooked in the kitchen?
4. Labourers working near a hot furnace are advised not to wear metallic-framed spectacles. Why?

WE HAVE LEARNT

- All things are made up of matter.
- Matter has weight and occupies space.
- There are three states of matter- solid, liquid and gas.
- Solids have a definite shape and they occupy space.
- Liquids do not have a definite shape but they occupy space.
- Gases do not have a definite shape and occupy the entire space, which is available.
- Those materials, which get dissolved in water, are called miscible, while those, which cannot be dissolved in water are called immiscible in water.

- Those materials through which we can see clearly are called transparent, those through which we cannot see are called opaque and those through which we can see faintly are called translucent.
- The materials which let the heat pass through them are called good conductors of heat while those that do not, are called bad conductors of heat.
- Those materials that let the electrical current pass through them are called good conductors of electricity while those that do not, pass easily are called poor conductors of electricity.
- Those materials that are attracted towards magnet are called magnetic while those that are not, are called non-magnetic materials.
- The normal tendency of a liquid or gas to spread uniformly within other solid, liquid or gas is called diffusion.
- An electric cell has two terminals; one is positive (+) and the other is negative (-) terminal.

EXERCISE

1. Select the correct answers;

a) What is the state of water vapour

1. Solid 2. Liquid

3. Gas 4. None of the above

b) Which of the following material is in soluble in water-

1. Washing soda 2. Sand

3. Salt 4. Blue vitriol

c) Which of the following is not magnetic-

1. Iron 2. Gold

3. Nickel 4. Cobalt

d) Which of the following is a good conductor of electricity-

1. Wood 2. Bakelite

3. Plastic 4. Copper

e) We can smell perfume in all corners of a room, while the bottle is kept in one corner. This is called -

1. Solubility 2. Diffusion

3. Conductivity 4. Insolubility

2. Fill in the blanks-

a) All matter occupies _____and has_____.

b) Dry leaves are _____ conductors of electricity.

c) We can clearly see through a glass, thus it is _____.

d) We can smell a stack of garbage even at a distance because gas is _____ in air.

e) We wear sweaters in winters because air present in between sweater and cloth is a _____ conductor of heat.

3. Answer the following questions:

1) A glass full of milk is heavier compared to an empty glass. Why?

2) Air is matter. Explain by giving an experiment?

3) Water is a transparent matter, give experimental evidence.

4) Explain why all electrical wires are covered with a plastic material?

5) A glass of steel with hot tea is difficult to hold as compared to a bone-china cup. Why?

6) Handles of cooking utensils are made of wood or plastic. Why?

7) Pure water is a bad conductor of electricity while salty water is a good conductor of electricity. Explain by giving reasons.

8) Would the bulb glow in the circuit shown in figure 3.8? Explain giving reason.

Fig.3.8

THINGS TO DO

1. Collect the things around you and classify them according to their state. Also write the name of the material they are made of. You can take the help of your family members and teachers for this.

S.No.	NAME	STATE	MATERIAL

2. Classify the above mentioned things according to the characters given below:

S.No.	Transparency	Diffusion in air	Solubility in water	Magnetic property	Thermal Conductivity	Electrical Conductivity

3. Imagine there were no electric supply in your home for a month. How would that affect your day to day activities and others in your family? Also when the electric supply is resumed, what measures will you take to stop misuse of electricity?
4. With the help of your teacher make "electric torch" in groups.

4 SEPARATION OF MATTER

In summer, we take a mixture of lemon- juice and sugar in water to quench our thirst. This lemon - juice, sugar and water form a mixture. Similarly, in case of acute stomach disorder doctors advise us to drink mixture of sugar and salt in water. This mixture is termed as ORS. There are many more examples of mixtures, which include solids, liquids and gases. Like the smoke coming out of a motor vehicle is a mixture of many gases. The substances, which form a mixture, are called constituents of a mixture. Seawater is also a mixture, whose constituents are the substances dissolved in it.

Make the table given below in your note- book, and complete it by adding names of other mixtures.

TABLE 4.1

S.NO	MIXTURE	CONSTITUENTS
1.	Air	Oxygen, Nitrogen, Dust particles
2.	Wheat taken from field	----------
3.	Pond water	----------
4.	Soil	----------
5.	----------	----------
6.	----------	----------

In the above examples we have seen that when two or more substances are mixed in a medium, they form a mixture. The characteristics of a mixture are dependent on the characteristics of its individual constituents. In our daily life, we see that before we use a material, we need to separate the more useful and less useful components of the material.

Make the table given below in your note-book and add more examples to understand it.

TABLE 4.2

S.NO	EXAMPLE	USEFUL PART	LESS USEFUL PART	METHOD OF SEPARATION
1.	Rice	Rice	Hay, small stones	Hand-picking, sieving
2.	Tea with tea leaves	----------	----------	----------
3.	Wheat	----------	----------	----------
4.	----------	----------	----------	----------
5.	----------	----------	----------	----------

Thus we have seen that by using one or more method of separation, we can separate various constituents of a mixture. This is called Separation.

4.1 Why do we need separation?

1. To remove the non-useful components: The smoke coming out of a chimney is treated in such a way to remove unburnt carbon and ash particles so that air pollution can be reduced . Also, in water treatment plants insoluble impurities and micro organisms are removed from water to make it drinkable.
2. To obtain a useful product: Sea water is evaporated to get common salt. Salt is used extensively in our kitchens and industries.
3. To obtain pure material: Pure sugar crystals are obtained from sugarcane juice, whereas the impurities remain in the juice.

ANSWER THESE

1. What do you understand by the term mixture?
2. What is separation?
3. Why do we need to separate substances?

4.2 Methods of separation

To separate components from a mixture we need to know the characteristics of its components. To separate the components from a mixture, a particular characteristic of one of the component is used. A characteristic which is not present in the other components. Now, let us understand some of the methods of separation.

1. Hand-picking— How do you separate the small stones from pulses and rice. When the impurity in the mixture is of a different shape, it can be separated by picking up by hand. This is called handpicking.

2. Sieving- Wheat flour is layered on a sieve, the impurities being bigger in size stay on the sieve while fine flour passes through the small holes on the sieve. This method is known as sieving.

The same technique is used at construction sites to separate pebbles and stones from fine sand. The stones present in the sand stay on the sieve while the sand passes through it.

(a) Sieving

(b) Sand Sieving

Fig 4.1

Sieving the flour removes the useful bran from flour. Thus we should not sieve the flour before kneading.

3. Winnowing and Threshing – You must have seen farmers in the field, removing the grain seeds from bundles of stalks. A farmer stands on an elevated platform, and slowly slides the mixture of grain seeds and stalks. Since grains are heavier , they fall straight on the ground. While the stalks being lighter fall at a little distance away. In this way we see two heaps, one of stalks and other of grain. This method is known as Winnowing.

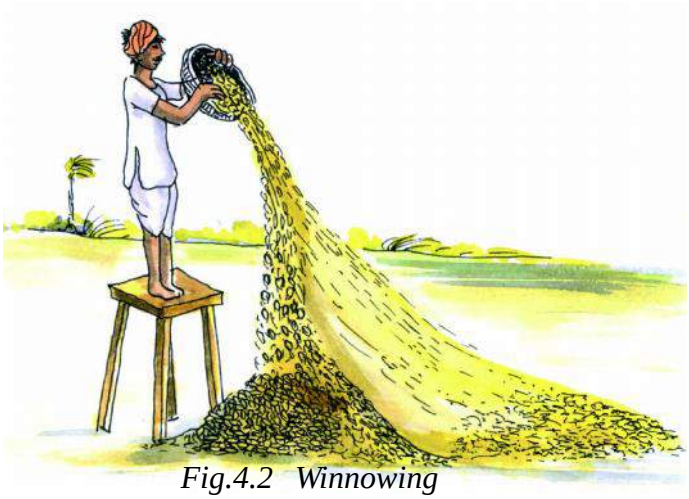


Fig.4.2 Winnowing

Similarly, stalks with grains are beaten to separate the light and heavy components. The lightest stalk fall in front and the heavier grains are separated. This method is known as **threshing.**

4. Magnetic separation

ACTIVITY 1

Materials required: Sand, iron fillings, magnet, paper

Spread the mixture of sand and iron fillings on a piece of paper. Now bring a magnet near this mixture. What do you observe? Iron fillings are attracted towards the magnet and hence get separated. Repeat this activity till the iron fillings are entirely separated from the sand. Sand remains on the paper. This method is known as **magnetic separation.**

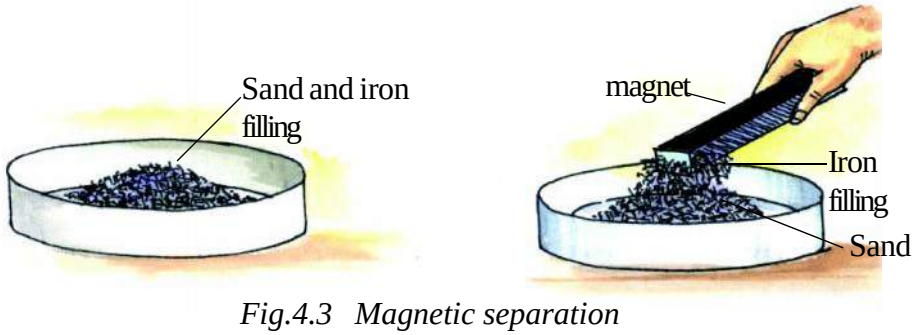


Fig.4.3 Magnetic separation

In industries, iron pieces are separated from other materials by this method(figure 4.4)

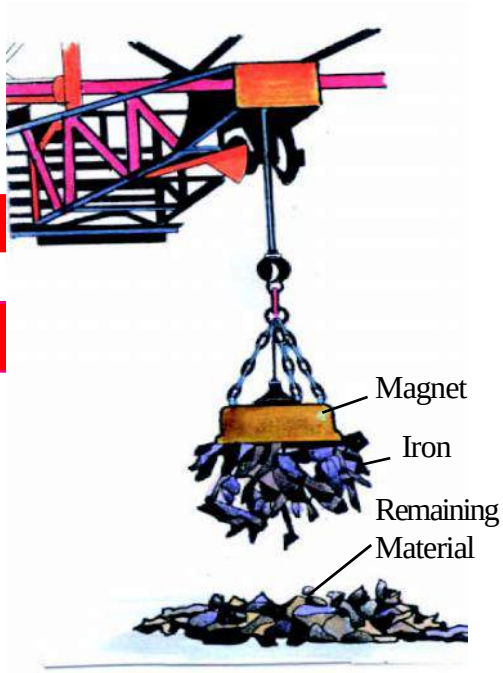


Fig.4.4 Separation of iron pieces by using electrical magnet

5. Decantation

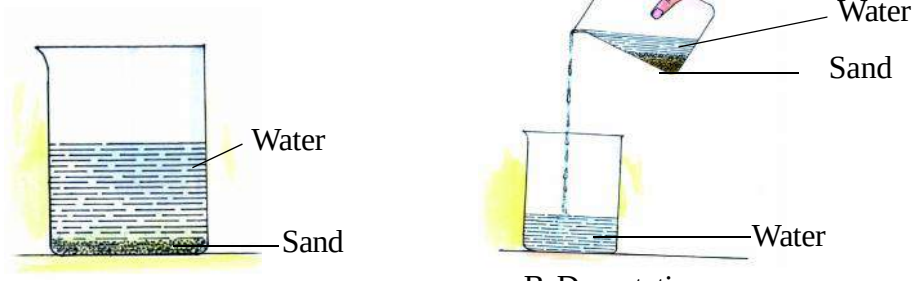
ACTIVITY 2

Materials required: Two beakers, glass rod, water, sand.

Take a mixture of water and sand in a beaker. Mix it well using a glass rod. Now leave it undisturbed for sometime. Observe. What do you see?

Sand settles down in the beaker as it is heavier. This is called **Sedimentation.**(figure 4.5A). Remove the water in the upper layer and pour it in a

beaker in such a way that the sand settled at the bottom does not move. This method is known as **Decantation.** By using this method we have separated insoluble sand (a solid) from water (liquid) (figure 4.5B)



A. Sedimentation B. Decantation

Figure 4.5

ACTIVITY 3

Materials Required- A beaker, separating funnel, stand, glass rod, oil and water

Take equal quantity of oil and water in a beaker. Mix well with a glass rod. Leave it undisturbed for sometime. Observe the beaker carefully. Do oil and water mix with each other? Both the liquids make separate layers. Can you separate the two by decanting?

To separate two immiscible liquids we use a separating funnel. Keep this mixture in a separating funnel and leave it for sometime. Water settles as the lower layer while oil settles as the upper layer. Open the stop cock at the base of the funnel and collect the heavier layer of water in a beaker. In this way two immiscible liquids can be separated. (figure 4.6)

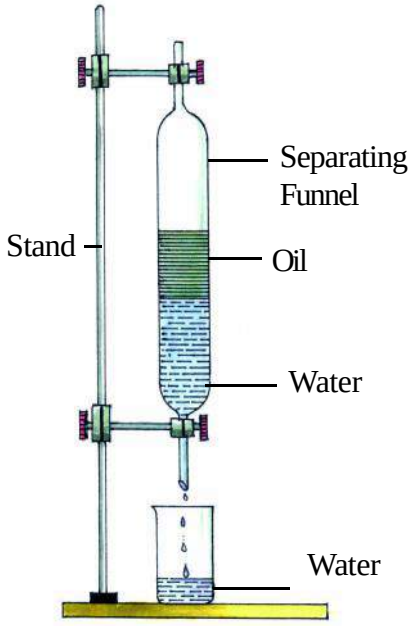


Figure 4.6 Separation by a separating funnel

6. Loading

ACTIVITY 4

Materials required- Two beakers, impure water, piece of alum

Fill half a beaker with impure water. Tie a piece of alum with a thread and put it in water while holding the other end of the thread. Now remove the alum and leave the beaker undisturbed for sometime. After 5-6 hrs you will see that impure water gets cleaned because the impure particles present in water become heavier due to alum and they settle down at the base of the beaker. This process is known as **loading**. Now decant the clean water into a beaker. (figure 4.7)

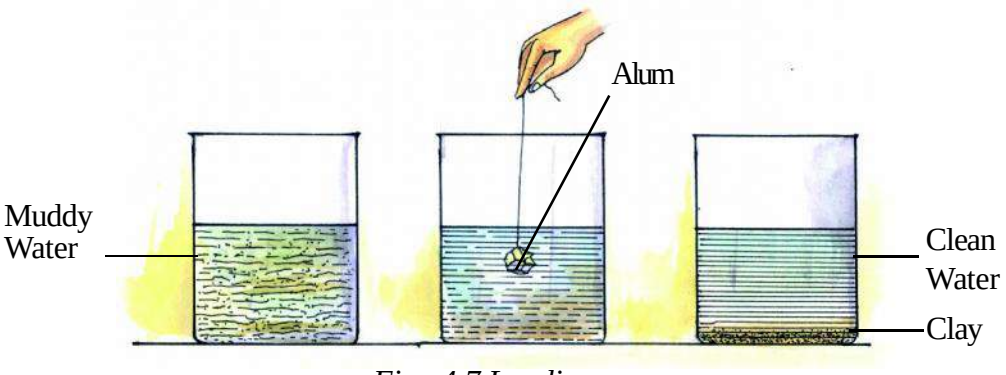


Fig. 4.7 Loading

ANSWER THESE

1. Which method is used to separate pieces of iron from coal in coal mines?
2. How will you separate kerosene oil mixed in water? Explain by giving diagrams.
3. Give two examples from your daily life where you use decantation for separating substances.
4. Name the property of the constituents which is used to separate the following mixtures.

   a) Wheat and hay b) Iron fillings and sand

   c) Coconut oil and water d) Flour and bran

7. Centrifugation

Tie a stone with a thick thread. Now hold the other end of the thread and revolve the stone fast over your head. You would feel your hand being trigged as if the stone is being pulled out of your hand towards opposite direction.

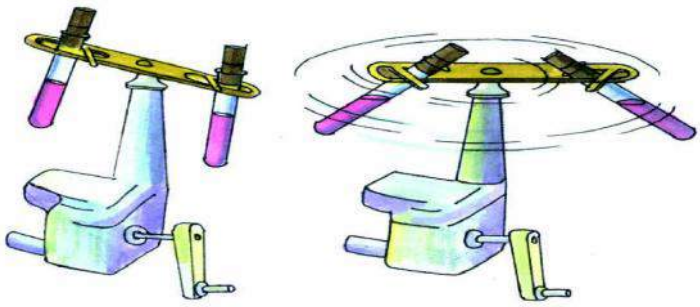


Fig 4.8 Hand driven centrifugation machine

If you leave the thread or it gets broken, what will happen? Which direction would the stone fly out? Take a small plastic bottle and fill it with muddy water. Close it with a cork so that water does not spill. Now tie the bottle with a thread and revolve it in the same way as the stone. What will happen to the mud particles? They are not attached to any thread so they would move towards the base of the bottle and settle. We can now decant the water and separate it from mud.

This process of separation is called Centrifugation. This method of sepalation is used in laboratories (fig.4.9) industries and also in separating cream from milk.

8. Filtration

ACTIVITY 5

Materials required- beaker. Glass rod, funnel, filter paper, stand, a mug and impure water.

Take a filter paper. Fold it twice to make a cone (fig 4.9A) Fix it inside the funnel as shown in fig 4.9B. Wet the filter paper and fix the funnel on the stand as shown in fig 4.9C. Pour impure water into the funnel with the help of a glass rod. Collect the filtered water in a mug. Mud particles and other insoluble impurities will remain on the filter paper. By using this method we can separate insoluble solid particles from liquids. This method is known as filtration.

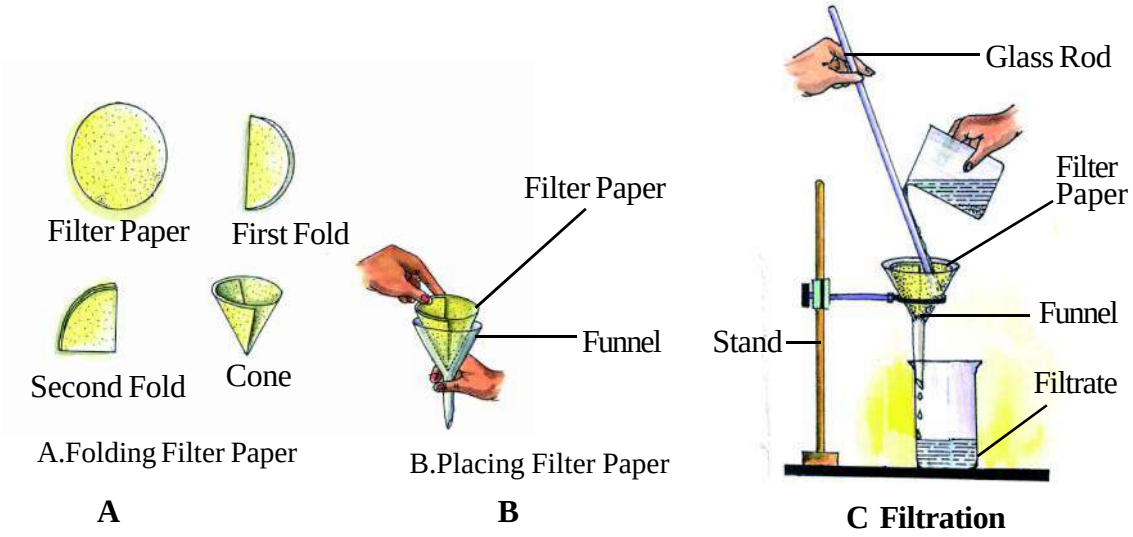


Figure 4.9

Filtration method plays an important role in industry. Generally water filters are used to clean water at home. In these filters, water is passed through a ceramic candle. In this process, solid impurities are stopped on the candle and potable water is collected in the lower part of the filter. (figure 4.10A)

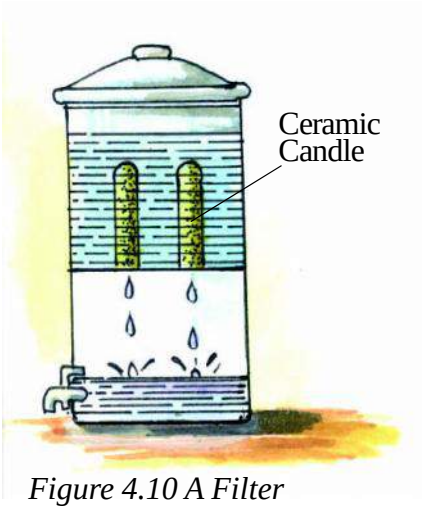


Figure 4.10 A Filter

In big cities, drinking water is distributed by water purification plants. In these plants (Fig 4.10B), impurities are separated from water by using methods of sedimentation, decantation, loading and filtration. Also harmful organisms are removed by treating the water with chlorine. Water obtained in this way is distributed as drinking water at homes.

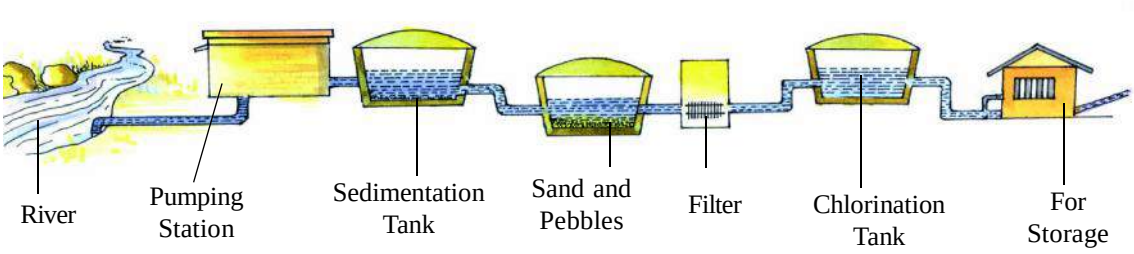


Figure 4.10(B) Method to clean water in big cities

In big cities, water coming out of drains is filtered by using large metal filters. Solid impurities are separated by this method. We should never throw polythene bags and household garbage in the drains.

9. Evaporation

ACTIVITY 6

Materials required- Porcelain bowl, tripod stand, wire gauge, spirit lamp, spoon , salt and water.

Take water in a bowl, add one spoon of salt and mix well. Put the bowl on a wire gauge over a tripod stand. Now heat it using a spirit lamp. While heating, stir the solution with the help of a spoon. Heat till all the water in the bowl disappears in the form of vapour. The substance left in the bowl is salt (fig. 4.11). To separate a miscible solute from solvent by evaporating the solvent is called evaportion.

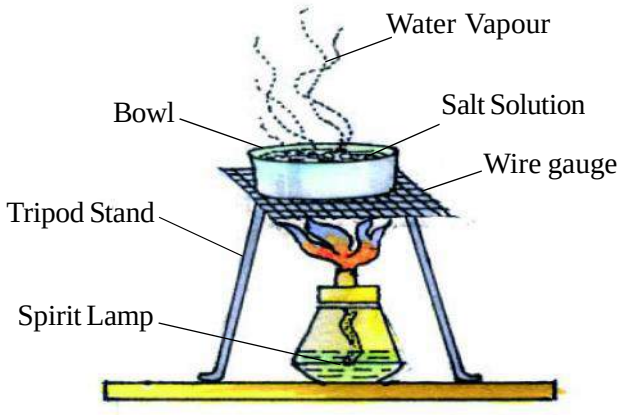


Fig 4.11 Evaporation of water to obtain common salt

Common salt is obtained from seawater in large scale by using this method. At the time of high tide, seawater gets collected in small cubicals. This water is evaporated in the sun and salt remains in the cubical.

10. Crystallization

ACTIVITY 7

Materials required: Beaker, glass rod, tripod stand, wire gauze, spirit lamp, copper sulphate (Blue vitriol), filter paper and water

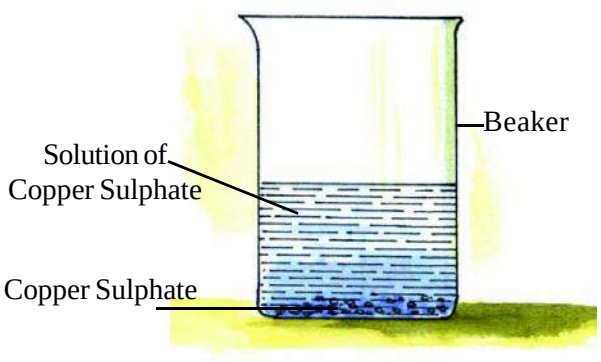


Fig. 4.12 Copper sulphate crystallization

Fill one fourth of the beaker with water. Add copper sulphate slowly and mix with a glass rod. Heat the solution and add more copper sulphate. Keep on dissolving copper sulphate till the solution becomes saturated and no more copper sulphate can be dissolved. Filter this hot solution through a filter paper to remove impurities. Now let it cool slowly. After some time you would see pure copper sulphate crystals at the base of the beaker. This process is known as Crystallization.

11. Distillation

Water is evaporated from rivers, streams, oceans, etc. This water vapour rises up as it is lighter; it gets cooled and changes into small droplets thereby forming clouds. These droplets condense and change into bigger droplets and come back to the earth in the form of rain. This is called water cycle. In this process water is distilled. Let us understand this by an activity

ACTIVITY 8

Materials required: Conical flask, glass tube bent at two right angles, cork, test tube, tripod stand, spirit lamp, beaker, salt solution, ice.

Arrange the apparatus according to fig.4.13 and put the salt solution in the conical flask and heat it. Water vapour, which come out, moves into the glass tube and is collected in a test

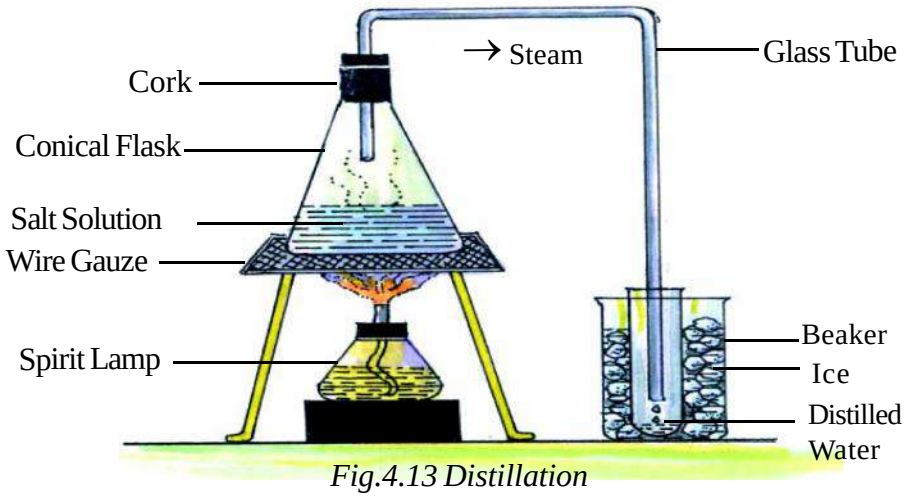


Fig.4.13 Distillation

tube kept in ice. When water vapour comes in contact with the ice-cold walls of test tube, it changes into small droplets of water. Salt is left in the conical flask. Changing of water to water vapour is called evaporation and changing of water vapour back to water is called condensation.

Thus, we can say that distillation is the result of both evaporation and condensation . By using this method we can separate solute and solvent from a solution.

12. Sublimation

ACTIVITY 9

Materials required: Porcelain bowl, spirit lamp, glass funnel, tripod stand, wire gauze, cotton, common salt, and ammonium chloride

Mix common salt and ammonium chloride in the porcelain bowl. Keep an inverted funnel over this mixture. Close the open end of the funnel with cotton and heat. White fumes will rise from the mixture.

Now stop heating. After some time vapours of ammonium chloride will settle on the inner side of the funnel on cooling and common salt will be left in the bowl (fig.4.14).

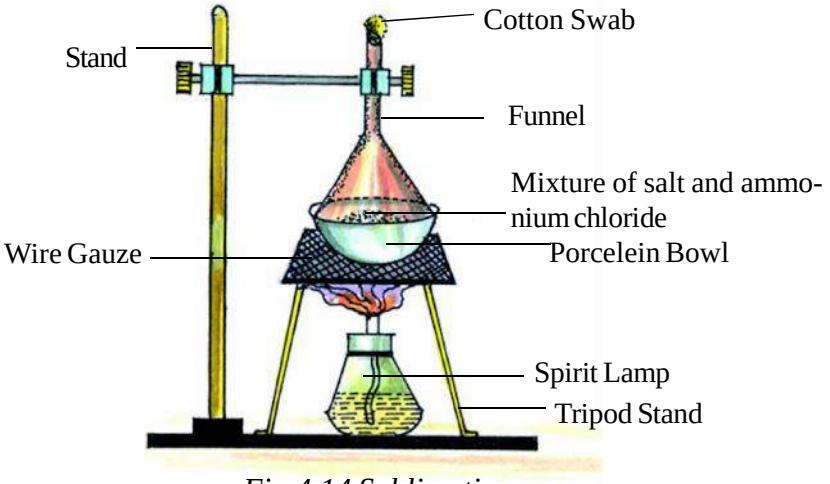


Fig.4.14 Sublimation

Normally substances like ice, wax etc. turn from solid to liquid on heating and then from liquid to gas. But in the above example, you have seen that ammonium chloride on heating turns to the gaseous state without showing the liquid state. On cooling also it again comes to solid state without showing the liquid state. This process is called sublimation. Camphor, iodine, naphthalene balls also show sublimation property

$$\text{Ammonium chloride(solid)} \underset{\text{On Cooling}}{\overset{\text{On heating}}{\rightleftharpoons}} \text{Ammonium chloride (gas)}$$

4.3 Using more than one method for separation

Till now we have separated a mixture of two substances by using any one method of separation. If a solution contains more than two substances, then more than two methods are used to separate these substances. Let us separate iron fillings, sand and salt mixture

ACTIVITY 10

Materials required: Magnet, two beakers, glass rod, paper, funnel, filter paper, iron fillings, sand, salt and water

Spread the mixture of iron fillings, sand and salt on a paper. Bring a magnet close to this mixture repeatedly. Separate the material which gets attracted to the magnet. What is this substance? Now, take rest of the mixture and dissolve it in water in a beaker. After some time filter this solution by using a filter paper on a funnel. Sand will be stopped on a filter paper. Evaporate or distill the rest of the solution to obtain salt.

Thus, we have used magnetic separation, filtration and evaporation to separate substances from a mixture.

WE HAVE LEARNT

- A mixture may have two or more than two substances in any quantity.
- A mixture has characters of its constituents, on the basis of which, they are separated.
- The separation of components of a mixture is done to remove unwanted constituents, and to obtain useful and pure substance.
- Constituents of a mixture can be separated by using one or more than one method of separation.
- To separate constituents from a mixture following methods can be used- Handpicking, sieving, winnowing, threshing, magnetic separation, decantation, loading, centrifugation, filtration, evaporation, crystallization, distillation and sublimation.

EXERCISE

1. Choose the correct answer

1. Which of the following mixtures can be separated by hand picking -

   i. Common salt and sand ii. Saw – dust and iron fillings

   iii. Rice and stone iv. Camphor and sand

2. Which method is used when we wash a pulse to clean it -

   i. Threshing ii. Hand Picking

   iii. Sieving iv. Decantation

3. Which method is used for separating a mixture of Iron and coal dust. -

   ii. Evaporation iii. Threshing

   iv. Magnetic separation v. Decantation

4. Which method is used to separate a mixture of Iodine and common salt?

   i. Threshing ii. Hand Picking

   iii. Sieving iv. Decantation

2. Match the following

a.	Separation of ammonium chloride and sand	Magnetic separation
b.	Mixing alum in muddy water	By separating funnel
c.	Revolving a mixture at high speed	Evaporation
d.	Groundnut oil and water	Loading
e.	Sand and iron fillings	Centrifugation
f.	Common salts dissolved in water.	Sublimation

3. Fill in the blanks

a. …….. method is used to separate iron filling from heap of garabage.

b. Two immiscible liquids can be separated with the help of…….. method.

c. Flour and bran can be separated by……..method.

d. ……. method is used to separate wheat from straw.

e. We can see the sky clearly after the rains because dust particles…… with the rain droplets and come to earth.

4. Answer the following question

a. How will you separate a mixture of naphthalene and sand?

b. Suggest a method to separate, a mixture of coconut oil and water.

c. How will you separate alum from alum solution?

5. In the following mixtures which property can be used for the separation of its component -

a. Salt and chalk powder

b. Rice and straw

c. Iodine and coal

d. Iron fillings and saw dust

e. Sand and rice

6. How do you obtain salt from seawater?

7. What is criterion for the selection of method to separate the components from a mixture?

8. Write four methods used to purify river water to obtain drinking water by the water purification plant.

9. Explain distillation with help of diagram.

THINGS TO DO

1. From things around you, give examples of various mixtures and try to understand how you can separate the components of these mixtures.
2. Try to know from your elders the methods that were used in their time to clean water. Write your information according to the following points,
   a. Diagram of traditional method
   b. Substances mixed in water.
   c. Reason to add the particular substance.
3. Request your principal to arrange a educational tour to a city where water treatment (purification) plant is established. Understand the working of that plant and note down the information in your notebook.

5. CHANGES AROUND US

Change is the law of nature. If we look around us we will find that things continuously change. The temperature changes from morning to evening, the day into night and night into day, the drying of wet clothes, the growing of plants, the rusting of iron are examples of changes around us. We have become so accustomed to these changes that we even fail to notice them.

Observe the changes that occur around you in your daily life and record them in your notebook in Table 5.1.

TABLE 5.1

S. No.	Area of change	Changes seen
1.	Kitchen	Cooking of food
2.	Pond	----------
3.	Field	----------
4.	Weather	----------

If we look at Table 5.1, we can see that in the changes recorded, some things are similar while some other things are dissimilar. To understand them further we will need to classify them.

5.1 Fast and Slow changes

ACTIVITY 1

Materials Required – A Matchbox, Iron filings, cloth piece, water.

Strike a matchstick and note the during which the matchstick remains lighted. Write it in the table below.

Wrap iron filings in a cloth and soak them in water. Then place these in an airy place. Note the time taken for the iron filings to rust and write in the table below.

TABLE 5.2

S. No.	Name of Activity or Experience	Time taken for the activity
1.	Burning of match stick	
2.	Rusting of iron filings	

Those changes that take a long time to complete are known as slow changes, whereas those changes which take very little time to complete are known as fast changes.

Copy the table given below in your notebook and on the basis of the time taken for the change, classify the changes as slow or fast.

TABLE 5.3

S. No.	Example	Slow / Fast Change	Cause of Change
1.	Germination of seeds	----------	----------
2.	Lighting the electric bulb	----------	----------
3.	Making curd from milk	----------	----------
4.	Curdling of milk	----------	----------
5.	Growth of hair	----------	----------
6.	Bursting of crackers	----------	----------
7.	Lightening	----------	----------

We can modify the pace at which changes occur according to our need. Rusting of iron is a slow change. Sometimes this change can cause a lot of damage. We try to prevent rusting. For this, we can apply coats of zinc or paint on objects made of iron. This coat protects the iron from exposure to air and water and prevents it from rusting.

When we store foodgrains for a long time they get infested by insects. This results in the wastage of foodgrains. This wastage can be reduced if we place insecticide tablets wrapped in a cloth with the foodgrains. This will protect the food grains for a longer time.

5.2 Reversible and Irreversible changes

ACTIVITY 2

Materials required – Tea kettle, source of heating, water, plate

Take some water in the tea kettle and heat it. On heating, water is converted to vapour. If we place a plate in front of the emerging vapours then the steam condenses to form water again. (Figure 5.1).

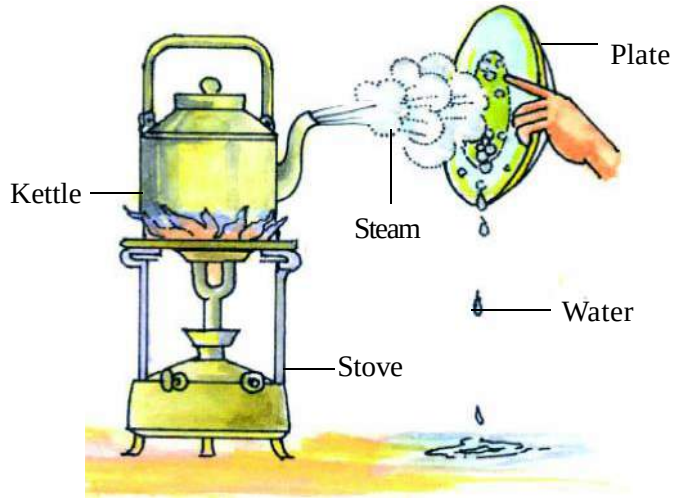


Figure 5.1: Reversible change

When we stretch out a rubber band or a cycle tube it expands but on release it regains its original shape.

In Activity 2 we saw that when we remove the cause for change (heating or stretching) the change occurs in the reverse direction.

$$\text{Water} \underset{\text{Cooling}}{\overset{\text{Heating}}{\rightleftharpoons}} \text{Vapour (steam)}$$

"The changes that can happen in the opposite directions as well are known as reversible changes." These changes are temporary.

The smoke emitted by burning paper and the ash formed cannot be used to regenerate paper. Similarly, cooked food cannot be changed to the raw form again.

"The changes that cannot be reversed are known as irreversible changes." Irreversible changes are generally permanent in nature.

Classify the following examples of changes and list them in your notebook-

TABLE 5.4

S. No.	Example	Reversible / Irreversible change	Cause of changes
1	Falling of fruits from trees	----------	----------
2	Stretching of rubber	----------	----------
3	Melting of wax	----------	----------
4	Formation of ice from water	----------	----------
5	Growth of plant from seed	----------	----------
6	Growth of our nails	----------	----------
7	Lighting of a bulb	----------	----------

5.3 Cyclic (Periodic) and Acyclic (Non periodic) changes

Look carefully at the minute and second hands of the clock. The seconds needle or hand take 60 seconds to come back to the initial position. It continues to move at the same speed. In the same way the minute hand also comes back to the initial position after 60 minutes and continues moving at its own unchanging speed.

In the same way night and day, low and high tide, new moon and full moon etc. occur after regular time intervals. The "changes that repeatedly occur after a regular time interval are known as periodic changes."

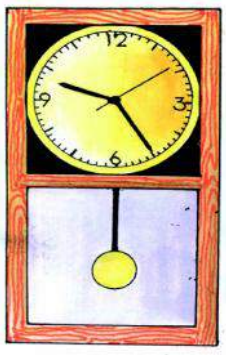


Fig 5.2 Cyclic change

You must have seen ripened fruits fall from trees. Does the fruit fall after a fixed time period? Can you predict the time of fall of the next fruit?

The recurrence of events such as movement of rocks and shifting of mountains, cyclone or floods cannot be predicted.

Therefore "changes which do not occur after a fixed time period are known as non periodic changes."

Classify the following as periodic or non periodic changes and write them in you notebook.

TABLE 5.5

S. No.	Example	Periodic / non periodic changes	Reason
1	Rising of the sun		
2	Railway accident		
3	Tides in the sea		
4	Sneezing		
5	Occurrence of day and night		
6	Change of Seasons		
7	Cyclones		

5.4 Desirable and Undesirable changes

There are some changes that are natural and some other changes that are effected by human beings for their own use, for example conversion of milk into yoghurt, cooking food, formation of manure from cow-dung, growing of fruit-trees, blooming of flowers etc. Hence the changes that are useful to us and give us pleasure are called desirable changes.

There are changes which are destructive, painful, and not useful to humans. They are known as undesirable changes. Decay of food, breaking of a glass plate, flooding of the river, rusting of parts of the machine, explosion, burning etc. are examples of undesirable changes.

There are some changes that are desirable from one point of view but may become undesirable from another point of view.

We can see this from the following table –

TABLE 5.6

S. No.	Example	One point of view	Another point of view
1	Rusting of iron	Undesirable	Desirable for mineral cycling in nature, Ecological imbalance
2	Manufacturing silk	Desirable	Ecological imbalance, loss of silk worm undesirable
3	Manufacturing things from animal skins	Desirable	Killing animals for their skins is causing ecological imbalance, hence undesirable.
4	Manufacturing plastic items	Since light and useful it is desirable	Plastic is not bio degradable, hence undesirable
5	Flood in the river	Loss of life and material hence undesirable	Increase in fertility of soil after floods, desirable.

Curdling of milk is otherwise an undesirable change but it is desirable when we want to make cottage cheese, paneer from milk. If we do not heat the milk properly then there is an increase in the level of microbes and the milk is spoiled. Nowadays, to prevent spoiling of milk a special technique is used. The milk is heated to a high and a desired temperature and then cooled immediately. In this method the microbes that spoil the milk die and the milk is pasteurised. This process is known as pasteurisation. This method was first used by a scientist in France, Louis Pasteur.

Classify the following examples as desirable or undesirable changes and write them down in your notebook –

TABLE 5.7

No.	Example	Desirable / Undesirable changes	Reason
1	Occurrence of rain		
2	Cutting trees in the forest		
3	Changing the course of the river to build dams		
4	Formation of manure from cow-dung		
5	Contamination of food		
6	Increase in the population of the fishes		
7	Release of smoke from industries		

5.5 Physical and Chemical Changes

If a big chalkpiece breaks the pieces are smaller in size. But they do not differ in colour or appearance. We can use these chalk pieces in the same way as we use a bigger chalk. Similarly, when we write on the black board chalk-dust keeps falling. If we collect this dust and mix it with a little water and dry it then we can reuse it as chalk. During this process the chalkpiece changed its external shape but no new product was formed.

We know that if we keep ice in the open then due to the higher temperature in the environment the ice melts and forms water. When water is heated it turns into water-vapour (figure 5.3). In this example water changes its state but no new substance is formed.

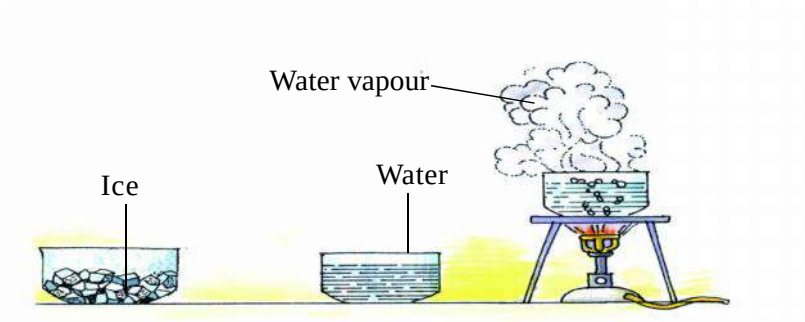


Figure 5.3: Physical change

"Changes in which no new substance is formed are known as physical changes."

A few examples of physical changes are tearing of paper, mixing of salt with water, sublimation of ammonium chloride etc..

Characteristics of physical changes are –

1. There is change in physical properties like colour, shape, size and state.
2. No new substance is formed.
3. The characteristic properties of the substance are not changed.

Come, let us see a few more examples. These can be the formation of ash after burning of wood, formation of curd from milk, rusting of iron, digestion of food etc. You will note that in all these examples the characteristics of the substances formed (products) after the reaction are different from the characteristics of the initial substance used (reactants). Also these reactions are irreversible.

ACTIVITY 3

Materials required – Conical flask or plastic bottle, washing soda, lemon juice, candle and match sticks.

Take a conical flask and add one spoon of washing soda and some water to it. Stir this mixture till the washing soda dissolves completely. Now add lemon juice into this mixture. You will see that gas comes out in the form of bubbles. Now hold a burning match stick or candle at the mouth of the flask. You will see that the candle or the match stick blows out because the gas released in the form of bubbles is Carbon dioxide which does not support burning.

Now carefully observe the mixture in the flask, you will see that it is different from what it was before. The washing soda and lemon juice have reacted with each other. This has resulted in the formation of Carbon dioxide and other products. We cannot regain the washing soda or lemon juice from this mixture – this is an irreversible change.

In the above examples new products were formed due to chemical reactions.

Therefore, 'changes where new products are formed are known as Chemical changes'.

ACTIVITY 4

Materials required – A plastic bottle with a cap, phenolphthalein solution, washing soda, water, boiled rice, cotton, test tube, urea.

Take some boiled rice in the bottle and add just enough water such that the rice is immersed in it. Add some urea to this. Now tie some cotton to both ends of a piece of thread and dip them in an alkaline phenolphthalein mixture. Place them in such a way that one end is in the bottle and the other outside. Now close the lid tightly. Keep this for two to three days. On the fourth day you

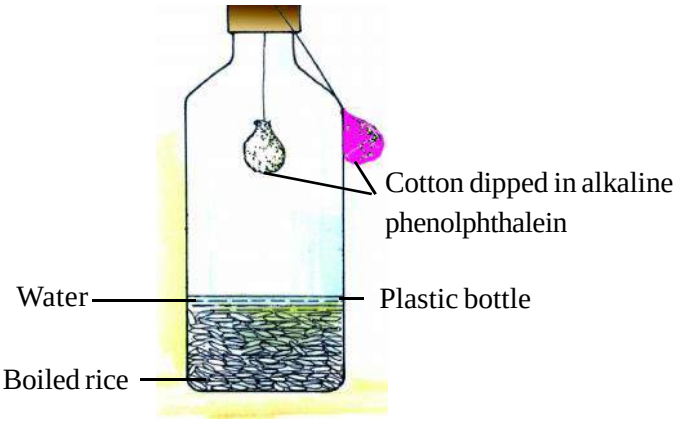


Figure 5.4 : Chemical change

will see that the pink cotton inside the bottle has become colourless, while the cotton outside is pink, as it was before.

To prepare alkaline phenolphthalein, take phenolphthalein and add a bit of washing soda, the solution turns pink in colour.

The colour change inside the bottle shows that a new product (Carbon dioxide) was formed from the rice kept inside the bottle. This turned the pink cotton colourless. In this way if we keep the cooked rice immersed in water for few days then the rice decays, this is called fermentation.

The break down of complex carbon compounds to simpler compounds in the presence of enzymes is called fermentation. This is a chemical reaction.

Characteristics of chemical reactions

1. Chemical reactions occurs between reactants.
2. New products are formed.
3. The characteristics of the reactants and the products are different.
4. Most of the chemical changes are irreversible.

Identify the following as Physical or Chemical changes and write in your notebook.

TABLE 5.8

S. No.	Example	Physical / Chemical change	Reason for your answer
1	Dissolving sugar in water for preparation of 'sherbat'		
2	Preparing lime for white-washing of the walls		
3	Igniting the gas for cooking		
4	Cooking of pulses		
5	Drying of clothes		
6	Manufacture of soap from vegetable oils		

Classify examples given in Table 5.8 into reversible or irreversible changes and answer the following questions-

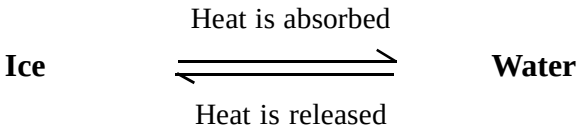
(a) Are all chemical changes irreversible?

(b) Are all physical changes reversible?

We see that generally physical changes can be reversible. Find the examples of chemical changes which are reversible.

5.2 Energy is utilised during change

In a physical change heat can be absorbed or released. For example, formation of water from ice and ice from water.



In chemical reactions also heat is either absorbed or released, for example in the formation of Nitric oxide heat is absorbed. If water is poured on lime stone heat is released. Hence in all physical and chemical changes either heat is released or absorbed.

WE HAVE LEARNT

- A lot of changes occur around us daily.
- Changes can be classified, for example as slow or fast, as reversible or irreversible, as cyclic or non-cyclic, as desirable or undesirable and as physical and chemical changes.
- Those changes which take a short time period are known as fast changes while those changes that take a longer time to be completed are known as slow changes.
- If the changed products can be brought back to their original form then it is known as a reversible change. If the changed product cannot be brought back to the original form then the change is an irreversible change.
- Those changes which occur after a fixed time period are known as **periodic** changes, while those changes which do not have a fixed time period of occurrence are known as **non-periodic** changes.
- No new product is formed in a physical change, while in chemical changes new products are formed.
- In Physical and Chemical changes heat can be released or absorbed.

EXERCISE

1. Classify the following changes as slow or fast, reversible or irreversible, desirable or undesirable, cyclic or acyclic, physical or chemical changes –

1. Formation of phases of moon
   _____,
   _____,
   _____,
2. Lightening in the sky
   _____
   _____
   _____
3. Formation of natural gas from cow dung
   _____,
   _____,
   _____,
4. Combustion of petrol in a vehicle
   _____
   _____
   _____
5. Formation of curd from milk
   _____,
   _____,
   _____,

2. Fill in the blanks with the words physical or chemical –

1. Digestion of food is a _____change.
2. Formation of water from ice is a _____change.
3. Curdling of milk is a _____change.
4. Melting of wax of a candle is a _____ change whereas its burning is a _____change.

3. Match items in Column A with appropriate item in Column B

Column A	Column B
Occurrence of earthquake	Periodic change
Sprouting of seeds	Chemical change
Melting of wax	Slow change
Occurrence of day and night	Physical change
Bursting of crackers	Non-periodic change

4. Answer the following questions –

1. Explain whether the melting of 'kulfi' is a physical change or a chemical change.
2. Write with reasons what kind of a change evaporation of water is.
3. What is the kind of change that occurs when there is discolouration of the walls? State the reasons.

4. How is Pasteurisation done? What are the benefits?
5. State with examples how the same changes under different situations can be desirable or undesirable.
6. State with examples the role of energy in bringing about changes.
7. What is the kind of change that occurs during leaf fall in autumn? Explain.
8. Write down any cyclic changes that may occur in your body.

5. Write down the reasons for the following –

1. Cooked food is kept in the refrigerator.
2. Salt is kept in an airtight box during rainy season.
3. Ripening of guava is a chemical change.
4. A coat of tin is put on iron sheets before making a box.
5. Rotation of fan is a cyclic change.

THINGS TO DO

1. Observe the changes that occur around you and write in your notebook as per the classification given in the table.

S. No.	Changes observed	Type of change	Type	Reason
1		Slow / Fast Reversible/ Irreversible Cyclic/Acyclic Desirable/ Undesirable Physical / Chemical		
2		Slow / Fast Reversible/ Irreversible Cyclic/Acyclic Desirable/ Undesirable Physical / Chemical		

2. Based on your imagination prepare a list of possible future changes in the field of science.

S.No.	Changes
1	
2	
3	
4	

3. Collect articles on undesired changes occuring in the world. Discuss on their causes and the various measuses to control these changes.

6. MEASUREMENT

6.1 Introduction

In our daily life we use rough estimates all the time– to decide the quantity of sugar to put in tea, the quantity of salt while cooking, the time taken to reach school, the time for which the new tube of toothpaste will last etc. This rough estimates works well where-ever accurate measurement is not necessary.

But we also see that the tailor measures and marks the cloth before stitching the shirt, pant, kurta etc. The bell in the school is rung after checking the time on the clock. The shopkeeper sells vegetables, fruit, foodgrains etc. after weighing them. The doctor while examining the patient suffering from fever first checks the body temperature by using a thermometer. Why is all this done? Actually to get accurate information measurement is important. Without measuring it would not be possible to find the accurate length, area, volume, weight or temperature. On the basis of estimates the answer may often be inaccurate.

In figure 6.1 we see that the segment CD appears longer than segment AB, but if you measure with a scale you will find that they are of the same length.

Fig. 6.1

In the same way in figure 6.2 the volume of water in the two vessels is the same, but it can appear to be different to our eyes. In other words, to get the correct information it is essential to measure the volume.

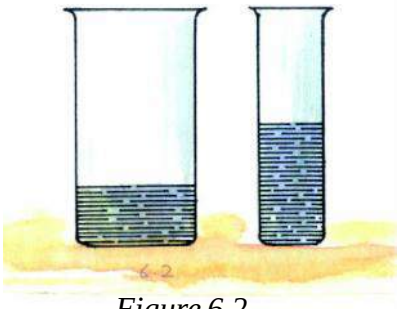


Figure 6.2

Length, area, volume, weight, time, temperature and other measures are known as Physical measures.

In this chapter we will learn some methods to measure the length, volume, weight, time and temperature.

6.2 What does measurement mean

To find out the quantity of an unknown measure we compare it with a known quantity of a similar kind of entity. The known fixed quantity of the measure used for comparison is known as the unit of measurement. In each measurement one part is a numerical value. The second part is its unit of measurment. If we consider a table of 2 metre (2 m) length, in this 2 is the numerical value and metre is the unit of length. Similarly, if any student weighs 35 kilogram then 35 is its numerical value and kilogram is the unit of weight.

ACTIVITY 1

Write down the numerical values and units in the table give below –

TABLE 6.1

S. No.	Physical measure	Measurement	Numerical value	Unit
1	Length	4 metre	----------	-------
2	Weight	50 kilogram	----------	-------
3	Time	5 minute	----------	-------
4	Temperature	100 kelvin	----------	-------

When writing the result of any measurement the numerical value and the unit should be mentioned.

6.3 The need for units of measurement

Many things can be used to compare with as a unit. In earlier times people measured length using different parts of the body like foot, hand-span, arm length, width of four fingers etc. as units. But there are differences in the lengths of these body parts of people hence, these can not be used as units.

ACTIVITY 2

Measure the length of your classroom using your foot steps and write the measure in your notebook. Now you ask your friends to measure the length of the room in the same way and fill it in your notebook.

TABLE 6.2

S. No.	Name of the student	Length of the classroom(number of steps)
1.	----------	----------
2	----------	----------
3	----------	----------
4	----------	----------

Are all measurements the same? If they are not the same then why are they not the same? Your foot-steps and those of your friends may have different lengths. Hence, you would get different values for the length of the classroom. Hence, it is not correct to use parts of the human body as the unit of measurement. Similarly, we cannot use bowls or cups to measure the volume of milk.

For uniformity it is essential to have the same units for a measure. This is the reason that for buying or selling in markets the same units are used. Any unit that is accepted as a standard for measurent by a group of people becomes a standard for that group. Standard units represent a fixed quantity which when measured whenever, wherever and by whomsoever will give the same result.

ANSWER THESE

1. Why can not the length of a hand-span be considered as a standard unit of measurement?
2. Give examples of any three measures used in daily life.
3. While selling rice what measure of quantity is used by the shopkeeper?
4. Which two things need to be specified while measuring any quantity?

Story of the scale – How new, how old

Many years ago people used their hand-span, foot and fist to measure lengths, but there were problems since the lengths of hand-spans, feet or fists of different people varied according to their body sizes. Therefore people developed a fixed length as the standard unit and divided it into smaller parts. Then people started measuring length and distance with it. This was the early version of the scale. People made scales using a fixed length of metal or wood. But it was not specific enough. In some places they took the distance between the nose of the king and the tip of his index finger as one yard. They divided this one yard into three parts and considered each part to be one foot. For long distances, two hundred and twenty yards was considered to be one furlong and eight furlongs as one mile. In this way different standards were formed. Everything was working fine, until countries started to trade with each other. Due to different standards there was great inconvenience in trade and there was also a danger of fights occurring due to this. Hence a country named France came forward. France decided that a fixed length of a bar of special metal will be considered as a metre. The metre was further divided into hundred parts and each part was called a centimetre. One centimetre was divided into 10 equal parts called millimetre and in this way the standard had got a permanent form. Though, even now at different places various measuring units are used, the metre is considered as the international unit for length.

Following systems are used to measure the length, mass and time-

Systems of measurement-

• **C.G.S. System: -** In this system length is measured in centimeter, mass in gram and time in second.

• **F.P.S. System: -** In this System length is measured in foot, mass in pound and time in second.

• **M.K.S. System: -** In this system length is measured in metre, mass in kilogram and time in second.

6.4 International System of units (SI)

In order to bring uniformity all the scientists of the world agreed to use a standard set of units for different measures. This widely accepted system is known as 'International System of units'. In brief it is known as SI system. Under this system the following units have been accepted for measurement of various physical measures –

Table 6.3

S. No.	Measure	Unit	Sign
1.	Length	metre	m
2.	Weight	kilogram	kg
3.	Time	second	s
4.	Temperature	kelvin	K

We commonly use degree celsius as the unit for temperature ($^{\circ}$C).

6.5 International units and their symbols

1. The units of measures are written using small English alphabet. For example – metre is denoted by m, kilogram denoted by kg and second by s.
2. The units which have been named after the scientist are written in capital letters. For example – kelvin is denoted by K, degree celsius by ^{0}C.
3. No full stop is used after a unit name, for example metre is denoted as m not "m." But if it appears at the end of the sentence then full stop can be used.
4. The sign is always used in the singular form and not as plural. For example, if the length of any material is 10 metre then we write it as 10 m not 10 ms.
5. While writing in the full form the units are always written in small alphabets example – kelvin, metre, celsius etc

6.6 Division and Multiplication of Units

We know that the metre is the unit of length. The length and breadth of a playground is measured in metres. Similarly, the height of a building can be measured in metres. Suppose you have to measure the length of your book. The length of the book is much less than a metre. It is convenient to write such lengths in smaller units. The smaller measure is said to be a factor of the standard measure. Centimetre is a factor of the metre.

1 metre (m) = 100 centimetre (cm)

1 metre (m) = 10 decimetre (dm)

1 decimetre (dm) = 10 centimetre (cm)

1 centimetre (cm) = 10 millimetre (mm)

Now consider that you have to measure the distance between two countries. It is inconvenient to measure this distance using metres. It will be convenient if we have a measure bigger than the metre. A unit that is bigger than the standard unit is said to be its multiple.

1 kilometre (km) = 1000 metre (m)

kilometre is a multiple of a metre.

In a similar way the weight is measured as gram (g) and milligram (mg). They are factors of kilogram.

1 kilogram (kg) = 1000 gram (g)

1 gram (g) = 1000 milligram (mg)

Heavy materials like wood, coal etc. are weighed in multiples of kilogram like quintal, tonne etc.

1 quintal = 100 kilogram

1 tonne = 10 quintal = 1000 kilogram

Factors and Multiples of the units of length, weight and time

Length

10 millimetre (mm)	=	1 centimetre (cm)
10 centimetre (cm)	=	1 decimetre (dm)
10 decimetre (dm)	=	1 metre (m)
1000 metre (m)	=	1 kilometre (km)

Weight

1000 milligram (mg)	=	1 gram (g)
1000 gram (g)	=	1 kilogram (kg)
100 kilogram (kg)	=	1 quintal
10 quintal	=	1000 kilogram (kg)
	=	1 metric tonne

Time

60 second (s)	=	1 minute (min)
60 minute (min)	=	1 hour (h)
24 hours (h)	=	1 day
365 days	=	1 year
10 years	=	1 decade
10 decades	=	100 years
	=	1 century

ANSWER THESE

1. What is the SI unit for length?
2. What is the SI unit for time
3. kilogram is the SI unit for which measure?
4. How many kilograms are there in one quintal?
5. How many hours are there in one day?
6. How many seconds are there in an hour?

7. What unit of length will you use to show the distance between Raipur and Bilaspur?

8. What unit of length will you use to show the thickness of a two rupee coin?

6.7 Measurement of length

In our daily life we use various devices like measuring tape, metre rod, metre scale etc. for measuring length. To measure the length of a material an appropriate device should be used. For example, to measure the width of the trunk of a tree or measure the chest of a person, measuring tape is the most useful, not the metre scale. To measure the length of a pencil we use metre scale or the scale in the geometry box.

The length of the scale in the geometry box is 15 cm. Each one cm is divided into 10 equal parts. In this way each part is 1/10 cm = 0.1 cm or 1mm. This is the minimum length that can be measured by using this scale. This minimum measure is said to be the least count of the scale. While using a measuring equipment it is necessary to know its least count.

While measuring the length of any line the scale is placed in such a way that any mark of the scale is at the start of the line. The measure on the scale of the other end of the line is noted. The difference between these two numbers is the length of the line. In Figure 6.3, one end of the line AB is at 1.1 cm and the other is at 4 cm. Therefore, the length of AB = 4.0 – 1.1 = 2.9 cm.

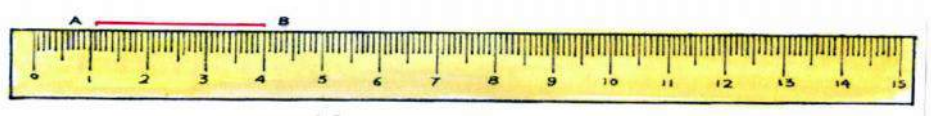
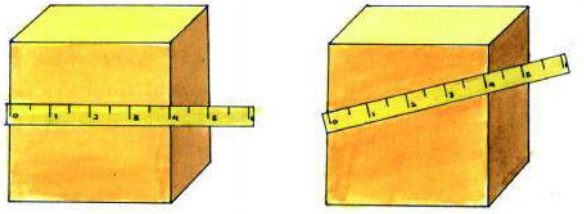


Figure 6.3 Measuring the length of a line using a scale.

The following precautions should be taken while measuring with a scale –

1. The scale should be kept very close to the object and parallel to the length being measured.

2. Sometimes the edges of the scale wear away. Also repeated use of a scale may result in scraping or breaking of the scale. Sometimes the zero mark is not clearly visible. In such a situation another convenient mark should be chosen. At one end of the object the 1.0 cm mark can be



(a) Correct *(b) Wrong*

Figure 6.4 The correct position of the scale while measuring a length

placed. In such a case to measure the length of the object the reading at this end is subtracted from the reading at the other end. In Figure 6.5 the first value is 1.0 cm and the second is 5.5 cm, the length of the material is 5.5 – 1.0 = 4.5 cm.

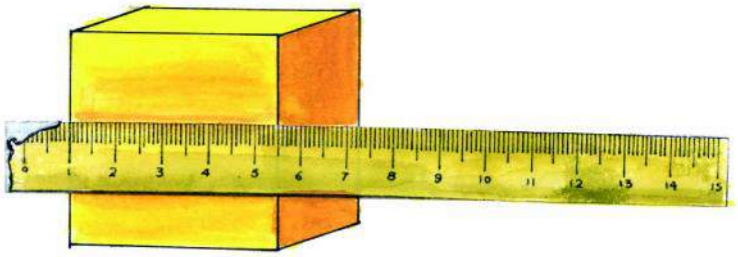


Figure 6.5 The correct position to use when the scale is broken.

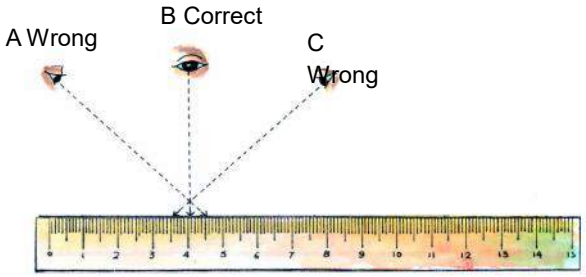


Fig. 6.6 The correct position of the eyes to read the value on the scale

3. The right method to measure with a scale is to keep the eye perpendicular to the point being observed. In the Figure 6.6 the position B of the eye is correct. Position A and C are wrong.

ACTIVITY 3

Let us now see how to measure the length of an arc AB. (Fig. 6.7). For this tie a knot at one end of the thread. Place this on one end of the arc 'A' and press it with the left hand thumb, stretch the thread and place a small portion of it on the line till it seems apparently straight. Press this end with the right hand thumb. Now bring your left hand thumb to take the place of the right hand thumb, again place a small part of some more thread over the remaining portion of the arc till it appears straight. Continue in this way till the thread has covered the entire arc till B. Mark

the point on the thread which reaches B. Measure the distance between the knot and the mark with the help of a metre scale by placing the thread on it. This is the length of the arc AB.

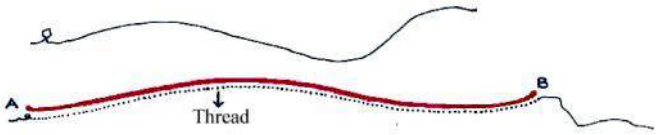


Figure 6.7 Measuring the length of an arc

ANSWER THESE

1. What device will be used to measure the waist of any person?
2. Write two precautions to be taken while measuring with a metre scale.
3. One edge of the scale is broken. The broken edge is marked 1.4 cm. How will you use this scale to measure the length of your pencil?
4. How will you measure the circumference of the circle with the help of a thread?

6.8 Measurement of Volume

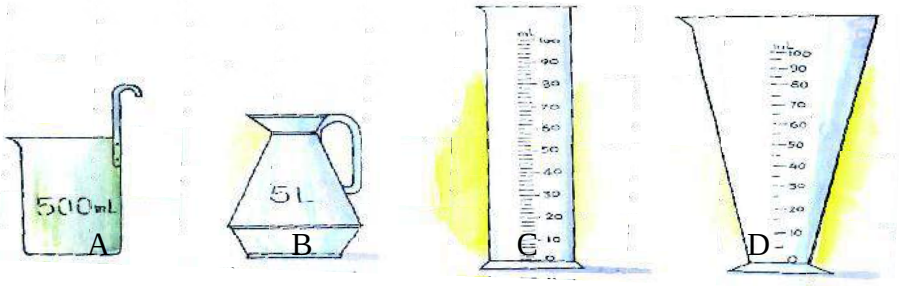
We see chairs, tables and books etc. in our classroom. Apart from the length and breadth these objects either have depth or height or thickness. These objects also occupy a fixed space. The amount of space occupied by a material is known as its volume. The SI unit for volume is cubic metre or metre ^{3}.

Volume of liquids

Liquids like water, milk, oil, diesel, petrol, kerosene are measured by their volume. The volume of liquids is measured in litres (L) . The factor of a litre is millilitre (mL).

1L = 1000 mL

1 mL = ^{3}1 cm



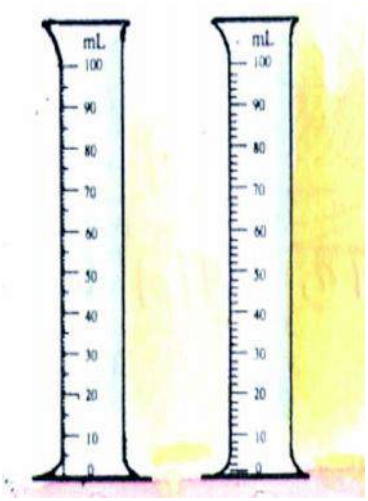
The volume of liquid required to fill a vessel completely is known as its capacity. In reality the capacity of any vessel is its internal volume. Many different types of vessels and apparatus are used to measure the volume of liquids. (Figure 6.8)

The containers shown in figure 6.8 (a) and (b) are used to measure milk, kerosene, oil etc. figure 6.8 c shows a measuring cylinder. This is used in laboratories to measure the volume of liquids. In figure 6.8 d a measuring cup that is used by doctors and by chemists to measure volume of medicines is shown. All these measuring vessels have markings that depict the volume when filled uptil that point, hence we can directly measure volume by using these.

Measurement of the volume of liquids using a measuring cylinder

ACTIVITY 4

The volume of any liquid can be measured easily by using a measuring cylinder. A cylinder has millimetre markings on the outer surface. First find out the volume represented by the smallest division on the cylinder. In the measuring cylinder figure 6.9 (a) there is one division showing two parts between 10 mL and 20 mL Hence one part measures 5 mL (figure 6.9 a). In cylinder b there are 5 parts between 10 mL and 20 mL. Hence the smallest part measures 2mL figure 6.9 (b).



(a) (b)

Figure. 6.9 Measuring cylinder

Place the measuring cylinder on a flat surface like the table, then pour some water into it. You will find that the surface of water is somewhat curved. In the case of water it is pulled downwards from the centre (figure 6.10 a). While noting the level of water the eyes should be at the same level as the lower portion of the curve. This is the volume of the water in the cylinder.

When we take mercury in a measuring cylinder to measure its volume, the upper surface is raised (fig. 6.10 b). In this case keep the eyes level with the upper part of the curve and note the reading.

ACTIVITY 5

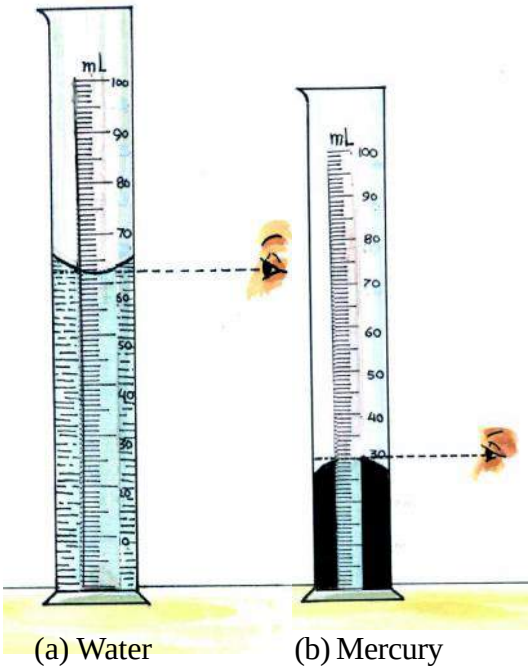


Fig. 6.10 The right position for the eyes while reading a measuring cylinde

Let us now find out how much one litre is. Take a cubical vessel in your laboratory such that each arm measures 10 cm. Take one half litre (500 ml) measuring vessel from a person who sells milk. Use this measuring vessel to completely fill the cubical vessel. You will be required to pour the completely filled measuring vessel twice. From this we say that the cubical vessel contains one litre of water.

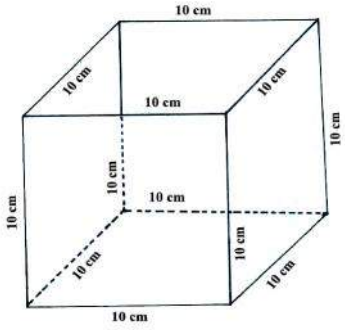


Figure 6.11 Relationship between litre and cubic centimetre

Volume of the one litre vessel = 10 cm × 10 cm × 10 cm

$$1\ L = 1000\ cm^3$$

$$1000\ mL = 1000\ cm^3$$

$$1\ mL = 1\ cm^3$$

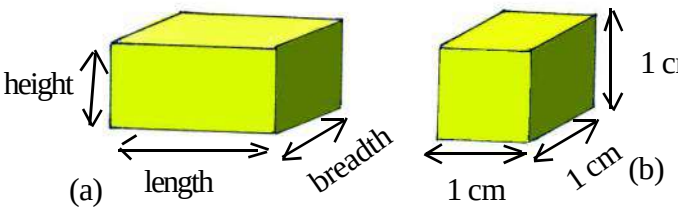


Figure 6.12 A Cuboid and a Cube

The volume of any regular solid cuboid shaped object like the matchbox or a book can be determined using the following formula –

Volume of cuboid = length × breadth × height

If the length, breadth and height of a cuboid are equal then that cuboid is a cube(fig 6.12 b)

Volume of cube = length × length × length = length^3

ACTIVITY 6

Measure the volumes of the objects listed below and write them in the table –

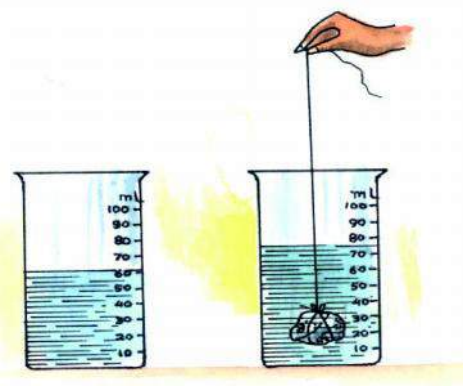
Table 6.4 Measurement of the volume of cuboids

S.No.	Object	Length (a) cm	Breadth (b) cm	Height (c) cm	Volume (a×b×c)cm^3
1	Textbook of Science	---------	---------	---------	---------
2	Geometry box	---------	---------	---------	---------
3	Brick	---------	---------	---------	---------
4	Matchbox	---------	---------	---------	---------

Measuring volumes of irregularly shaped objects

ACTIVITY 7

Take a measuring cylinder. Pour some water into it and note the level of water (Figure 6.13 a). Now take an irregular solid object (piece of stone). Tie it with a thread and very carefully dip it in to the water in the measuring cylinder. What do you see? The level of water rises up. Note the new level of the water. The difference between the two levels is the volume of the stone (figure 6.13 b).



(a) (b)

Figure 6.13 Measuring the volume of irregular shaped objects

ANSWER THESE

1. What do you understand by the volume of any object?
2. What is the SI unit of volume?
3. Which unit is used to represent the volume of liquids?
4. How many cubic centimetres are there in a litre?
5. Give the name of any equipment used in the laboratory to measure volume.

6.9 Measurement of Mass

From our experience we know that two handfuls of sand together are heavier than one handful. This is so because two handfuls of sand have more matter than one handful of sand. Those objects that are heavier also have more mass because the amount of substance in them is more. In this way mass is the measure of the quantity of the substance in any object.

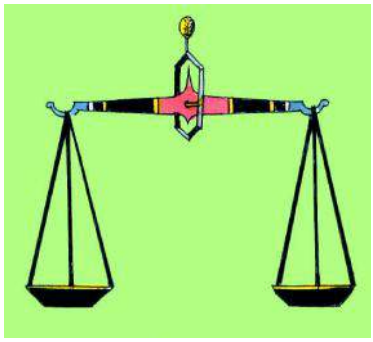


Figure 6.14
Beam balance

In order to measure the mass of an object we compare it with a standard mass. The SI unit of mass is kilogram. A beam-balance is generally used to measure mass (Figure 6.14).

This balance has a metal beam. This beam is balanced on a support at its mid point. The beam can move freely on the support. Two pans are placed at equal distances from the point of support. We keep the object to be weighed on any one pan and the weight measures in the other.

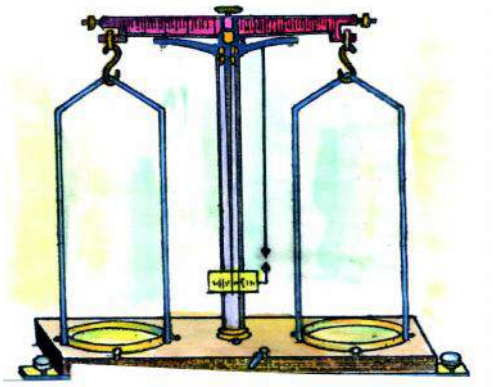


Figure 6.15 Physical balance

Figure 6.16 Electronic balance

We have seen that the local shopkeepers use a common beam-balance. Do goldsmiths or pharmacists use similar beam-balances? No, as exact measurement of mass cannot be made using a normal beam-balance. To measure mass accurately the use of a physical or a chemical balance is better (figure 6.15). These balances can measure mass accurately up to one tenth of a milligram.

With technological advancement an electronic balance has been made, this can accurately measure upto one part from one lakh divisions of a gram (figure 6.16).

6.10 Measurement of time

In our daily lives it is very important to keep track of time. For example, to travel in a bus or a train, it is important to reach the station on time. Similarly, we have to reach the school on time.

We measure time with the help of clocks, but there was a time when there were no clocks. At that time people used naturally occurring periodic events to know time. One such event was the occurrence of day and night. Nowadays, we have divided our days into smaller intervals. These intervals are hours, minutes and seconds.

Sun dial

In olden days sundial was used to measure time. It had a dial plate. On this plate a triangular metal piece was placed in a perpendicular or upright position. The plate was kept within the south-west direction. The shadow of the triangular piece fell on the dial plate. At different times of the day the shadow of the piece was formed at different parts/ corners of the plate. This helped to determine the time of the day. Such ancient clocks can still be seen at Jantar – Mantar in Delhi and Jaipur. The Jantar-Mantar in Jaipur was built by Maharaj Jaisingh II. The time shown by these dials was more or less correct but these dials could not be used after sunset. (figure 6.17)

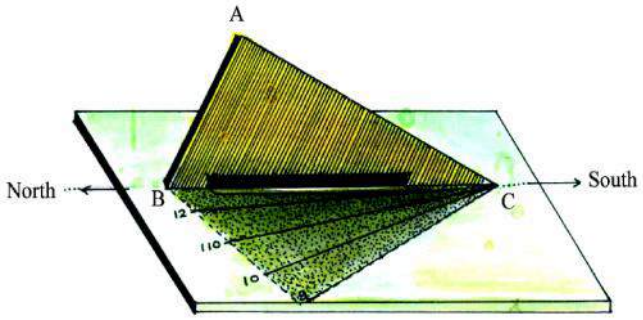


Figure 6.17 Sun dial

Hour glass

In olden days there was another device called an hourglass to measure time. In an hourglass two vessels were joined together through a minute pore. (figure 6.18) The sand

from the upper vessel slowly falls in to the lower vessel in a fixed duration of time. This duration can be used to measure time.

Figure 6.18 Hour glass

Pendulum Clock

Figure 6.19 Pendulum clock

Modern clocks also use periodic events i.e. events that repeat in a fixed duration of time. The pendulum clock is a good example of this where the periodic event can be seen (Figure 6.19).

Stop clock

Sometimes we need to measure time intervals very accurately, for example the time taken for finishing a 100 metre race or time to complete a swimming race. Such events are timed using a stop clock (figure 6.20). Stop clock can be switched on or off as desired. These clocks are normally used to measure time in a laboratory or in racing competitions.

Figure 6.20 Stop clock

Digital Clock

In many clocks nowadays the traditional hour, minute or second hands are not seen. These clocks known as digital clocks which show the time in numeric figures. (figure 6.21)

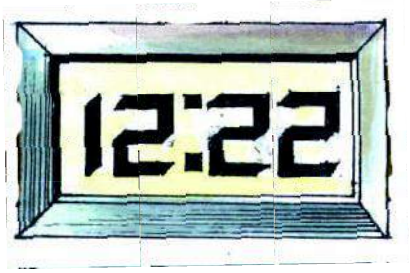


Figure 6.21 Digital watch

ANSWER THESE

1. What is mass?
2. Which balance is used to measure small weights accurately?
3. Write down the names of two clocks used in olden days.
4. Write the names of two cities where ancient sundial is still present.
5. Which clock is used to measure time in a race?
6. What is the name of the clock that can be switched on and off as desired.

MAHARAJA SAWAI JAISINGH II

Maharaja Jaisingh II was a great Indian astronomer, mathematician and vastu kala expert of his time. He was born in the year 1686. In his youth he had great interest in astronomy. Once he was asked "How far are the stars and moon from here?" He was not able to give an answer. His search of an answer to this question led him to become a famous mathematician and astronomer. He built four Jantar-Mantars (Observatories) in Delhi, Jaipur, Benares and Ujjain.In Sanskrit the meaning of Jantar- Mantar means instruments and formula. Those people who were interested in studying astronomy could visit his observatories. He was keen that this science be popularized. The Maharaja himself designed the three main instruments in Jantar-Mantar – " Samrat instrument, Ram instrument and Jaiprakash". The Samrat instrument is a big sundial which can be used to measure time as well as the distance to the sun. The Ram instrument is used to measure accurately the distances to the stars while Jaiprakash is used to determine the position of astronomical bodies at any given time.

6.11 Measuring temperature

The temperature on a cold day is lower than that on a hot day. What do we understand by the word 'temperature'? The measure of heat in an object or how hot or cold a material is said to be the temperature of the object. The temperature of ice is much less than that of boiling

water. We use a thermometre to measure temperature. Generally we use degree celsius (°C) as a unit for temperature.

The SI unit of temperature is kelvin (K).

The relationship between the celsius and kelvin scale is as below –

$t°C = (273 + t)$ K

For example $40°C = (273 + 40)$ K $= 313$ K.

$100°C = (273 + 100)$ K $= 373$ K.

Ordinary Thermometer

In figure 6.22 we can see an ordinary thermometer. The thermometer has a thick walled glass tube with a uniform thin tube inside. This tube is called the capillary. On one end of this tube a thin walled bulb is present, while the other end is closed. The bulb of the thermometer is filled with mercury. The outer surface of the capillary tube is marked in °C.

An increase in temperature causes the mercury in the bulb to expand and move up in to the capillary to form a bright line. As the temperature increases the length of the line also increases. As the temperature decreases the mercury contracts. Hence, the length of the bright line decreases. In this way the increase or decrease in the bright line represents the increase or decrease in the temperature.

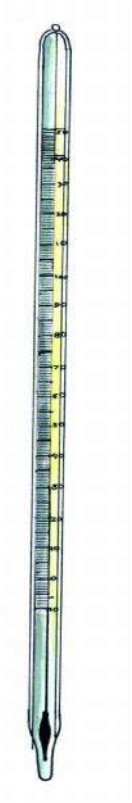


Figure 6.22 Ordinary thermometer

Clinical thermometer

Figure 6.23 Clinical thermometer

Figure 6.24 Maximum - Minimum thermometer

This thermometer is used to measure the temperature of the human body. It is similar to the ordinary thermometer; the only difference is that near the bulb the capillary is curved. This gives an advantage as though this the mercury rises easily with increase in temperature but does not easily flow back into the bulb. Hence it is easy to remove the thermometer from the patients' body and take the reading.

In order to reuse the clinical thermometer it should first be washed and shaken vigorously to bring the mercury that has risen back into the bulb.

A healthy human body has a temperature of 37°C or 98.6°F. Hence a clinical thermometer has markings between 35°C to 42°C.

Maximum-Minimum Thermometer

Figure 6.24 shows a Maximum - Minimum thermometer that can be used to measure the maximum and minimum temperatures of a place.

ACTIVITY 8

Let us take a clinical thermometer and find the temperature of our body. For this take a clinical thermometer and check carefully whether the mercury level is below 35 °C. If it is not so then carefully shake the thermometer once or twice so that the mercury comes to or below 35°C. Now keep the thermometer under your tongue carefully. After approximately one minute remove the thermometer and note the reading. This reading is the current temperature of your body.

ANSWER THESE

1. What is temperature? What is the commonly used unit for this?
2. What is the SI unit for temperature?
3. Which liquid is used in the thermometer?
4. What is the use of a clinical thermometer?
5. What is the temperature of a healthy human body?
6. How is the ordinary thermometer different from the clinical thermometer?

6.12 The Role of the Department of Weights and Measures

In our country the responsibility of safeguarding the standard units is with the New Delhi based National Physical Laboratory. A copy of the standard metre, standard kilogram and standard form of time has been kept here. The metre rod or kilogram weights available in the market are based on these units.

You would have heard of the pip-pip …..sound before the broadcast of news in our Akashwani channel. This signal is indicative of the correct time; this is provided by the National Physical Laboratory, New Delhi.

The Government of India's Department of Weights and Measures ensures that the metre rods, balances, weights etc used in the market are as per the standards.

When you buy cloth, pipe and other materials that are sold as per length, first confirm if the metre rod is proper. In a correct metre rod you find the sign (← →) at both ends as well as the seal of the Department of Weights and Measures, as given in the picture below (figure 6.25)

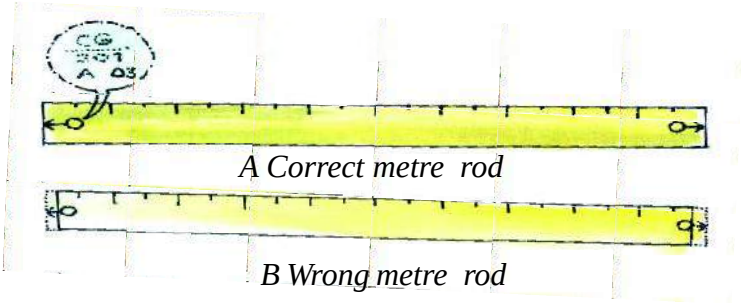


Figure 6.25 Correct and wrong metre rod

Whenever you buy anything by weight you must make sure that the weights and balance being used is correct. At the central point of the beam balance there should be the seal of the Department of Weights and Measures.

Similarly a correct weight will have its value written on it. At the bottom there is a hole which has a little bit of lead filled in it. This is to keep the weight of the measure correct. On this the seal of the Department of Weights and Measures is present. If the seal is not present then the weight may measure higher or lower in quantity.

In India all the shopkeepers should follow the directions of the Department of Weights and Measures and get their metre rods, weights and balances certified every year.

WE HAVE LEARNT

- Our senses cannot estimate measurements of an object accurately.
- Anything that can be measured is a quantity.
- To maintain uniformity it is essential to have a standard unit.
- The meaning of measurement is to compare an unknown quantity with a similar kind of known quantity.
- To measure any quantity two aspects are important – one is the unit and the second its numeric value.
- All scientists in the world use the International System of unit - SI.

- The SI unit of length is metre, of weight is kilogram, of time is second, of volume is cubic metre and of temperature is kelvin.
- The commonly used unit to measure temperature is degree celsius.
- In order to define the measures of quantity conveniently we use the multiples or factors of the unit.
- The device used to measure the length depends on the object to be measured.
- The amount of space occupied by any object is known as its volume.
- The volume of liquid is measured in litres.
- Different apparatus/vessels are used to measure volume.
- The capacity of any vessel is its internal volume.
- The weight of an object is the measure of the amount of matter in it.
- To measure smaller weights physical / chemical balances are used.
- Those events that occur repeatedly after a fixed interval of time are used to measure time.
- To measure smaller time intervals we use stop clocks (laboratory and games).
- The temperature of the object tells how hot or cold it is.
- The capillary of a clinical thermometer is sharply curved and narrow at a point.
- The temperature of a healthy human body is 37°C.
- The Government of India's Weights and Measures Department sees to it that the weights, balances and measuring instruments being used in the market are as per standards.
- In the accurate weights and weighing instruments there is the seal of the Department of Weights and Measures.
- The National Physical Laboratory, New Delhi safeguards the standard units in India.

EXERCISE

1. Choose the right option for every question

1. Measurement is a process to –
   a. change b. calculate
   c. compare d. explain the difference
2. For a measure to be complete it should have a -
   a. numeric value b. unit
   c. unit and numeric value d. none of the above
3. The SI unit of length is -
   a. metre b. centimetre
   c. millimetre d. kilometre
4. The SI unit of temperature is -
   a. kelvin b. celsius
   c. fahrenheit d. none of the above
5. The temperature of a healthy human body is -
   a. 96 °C b. 37.0 K
   c. 40.0 K d. 37.0 °C

2. Fill in the blanks

1. One tonne has _____ kilograms.
2. One kilometre has _____ metres.
3. The clinical thermometer measures temperature between _____ and _____.
4. The goldsmith uses _____balance.
5. The length of the field is measured using_____.

3. Match the following

A	B
Unit of length	second
Unit of mass	cubic metre
Unit of time	kelvin
Unit of temperature	kilogram
Unit of volume	metre

4. Answer the following questions

1. What is a physical quantity? Give three examples.
2. What are the two most important things to mention when writing the result of a measurement?
3. Write the following lengths in descending order-
   kilometre, millimetre, metre, centimetre
4. Place the following masses in ascending order
   Quintal, tonne, milligram, kilogram, gram
5. How is stop clock different from an ordinary clock?
6. In India who has the responsibility to ensure the availability of the correct instruments for measurements?
7. How will you know whether the metre rod used by the cloth trader is correct or not?
8. How will you know whether the weights and balance used to measure weight is correct or not?
9. Draw the picture of an ordinary thermometer.
10. The smallest division of a measuring cylinder is 1.0 ml Water is poured in it such that the water level reaches the 35 mark. When we put a stone into the water now the level reaches the 56 mark. What is the volume of the stone?
11. Each of the following shows a measure. Find out what is wrong with the way they are written and correct them.
    1. The pencil is 15 cm. long.
    2. The temperature of water is 300 k.
    3. The bag has 40 Kg rice.
    4. The volume of water in the drum is 100 l.
    5. Neeraj swims 100 m distance in 10 Sec.

THINGS TO DO

1. Divide the class into groups and ask them to measure the length of the room as well as the black board and discuss the result.

2. Measure the height and weight of any five of your friends and write it on a card. encourage them to fill the card every month.

3. Let us measure the height of the tallest tree that is situated at a distance.

i. First look around and identify the tallest tree around you.

ii. Now ask your friend to stand near the tree.

iii. Move backwards while holding a scale (or rod) vertically upright in your right hand. Hold out your hand in front of you such that the top of the rod is in line with the top of the tree. Place your thumb at the place on the scale where it is in line with the bottom of the tree.

Figure 6.26. Measuring the height of the tree

iv. Now without moving the thumb from its position on the scale, rotate the scale into an horizontal position. Ask your friend to move side ways to a point where the top of the rod appears to be in line with the feet of you friend.

v. In this position measure the distance between the tree and your friend, this is the height of the tree.

Now take a scale, a straight rod or a pencil. With the help of any of these you can measure heights of tall buildings, the height of the water tank and trees around your school.

4. a. The tap valves in homes or on the roads sometimes become loose and water starts flowing from them. Collect the water flowing from such a tap in one minute or one hour and measure it using a measuring vessel. Calculate the volumes for other time periods and fill values as required in the table below –

S. No.	S.No. of tap	Water collected				
		In 1 minute	In 1 hour	In 1 day	In 1 month	In 1 year
1						
2						

b. Discuss the measures to stop this flow with your teachers and write about it to the municipal bodies.

5. Ask your grand parents / uncles / aunts about the units they used in their times to measure weight and length. Discuss about these in the class.

7. CHARACTERISTICS AND CLASSIFICATION OF LIVING ORGANISMS

There are large numbers of things around us. For example, trees, plants, chairs, tables, dogs, cows, stones, houses, birds etc. Are these things similar or there are differences that can be seen among them? Copy Table 7.1 in your notebook and fill it. If the mentioned properties are found in the examples mentioned (✓) them or else mark them (×).

Table 7.1

S.No	Object	Characteristics				Conclusion
		Respire	Grow	Have Food	Produce similar things	Living / Non-living
1.	Plant & tree					
2	Chair					
3.	Table					
4.	Dog					
5.	Cow					
6.	Stone					
7.	House					
8.	Bird					

You see that the things that have the above-mentioned properties are called living, while those that do not have these properties are called non-living.

7.1 Characteristics of Living

1. Respiration

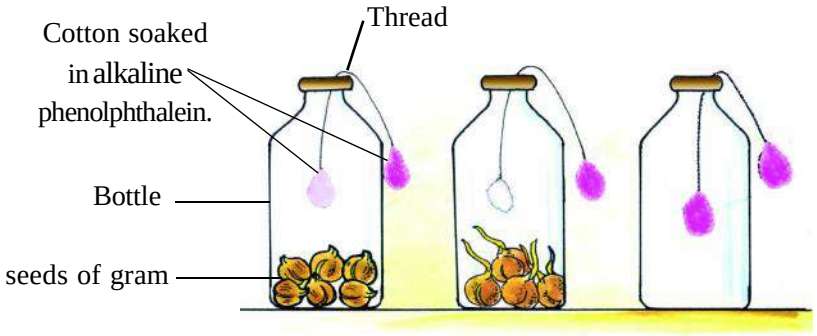
All living beings take in oxygen and give out carbon dioxide gas during the breathing process.

ACTIVITY 1

Materials Required- three bottles with caps, cotton, thread, dried seeds of gram, sprouted seeds of gram, phenolphthalein solution, caustic soda.

When caustic soda is mixed in the phenolphthalein solution, it turns pink. This pink solution again turns colourless when it comes into contact with carbon dioxide.

Take three bottles with caps, label them A, B and C. Put dried gram seeds in bottle A, sprouted (Germinated) seeds of grams in bottle B and keep the bottle C empty. Take three pieces of a thread of length about 20-30 cm. Attach cotton soaked in alkaline phenolphthalein at both ends of the three threads. Insert these three threads in each of the bottles such that one end is inside the bottle, while the other end remains outside the bottles. Close all three bottles tightly with lids. After about 30 minutes you will observe that -



(a) Dried seeds (b) Germinated seeds (c) Empty bottle
Figure 7.1 Breathing in seeds

(1) As compared to bottle A, the cotton immersed in bottle B, has turned colourless faster.

(2) On observing the cotton immersed inside bottle C, and those cotton which are outside bottle A, B and C, we learn that due to the lesser amount of corboon dioxide in the atmosphere outside there has been no change in their colour.

From this experiment, we learn that living beings respire. The rate of respiration is slow in the dried seeds while the respiratory rate is more in the sprouted seeds.

2. Nutrition

How do you feel if you do not get food on some day? Similarly, what will happen if a plant in a flowerpot is kept without water in darkness for five-six days? If you do not get food your body becomes weak and you are not able to do a lot of running around. Similarly the leaves of the plant in the flowerpot slowly turns yellow because in the absence of light and water food is not produced in the plant.

Do animals produce their own food? In the chapter 'Our Environment' you learnt that animals cannot synthesize their food like green plants. Animals get their food by eating plants or other animals. Therefore, all living beings need nutrition.

3. Excretion

There are certain substances produced inside the body of living beings that are harmful for the body and these need to be removed from the body. These harmful substances are known as waste and the process of taking these out of the body is known as excretion. Animals excrete solid waste (faeces), urine, sweat and carbon dioxide. Plants also excrete carbon dioxide and water vapour. Some plants excrete gum as waste material.

4. Movement

You walk to move from one place to another. In a similar manner other animals also walk, fly or swim to move from one place to another. This is known as mobility. Bigger plant and trees are stationary at one place, but in these also the stems move towards light, while the roots move in the direction opposite to light.

ACTIVITY 2

Materials Required- Potted plant, A cardboard box with a hole

As shown in figure 7.2, place the potted plant inside a cardboard box with a hole. Place this in the sunlight. After three-four days you will observe that the stem of the plant has turned towards the sunlight (hole). From this activity we learn that there is motion in plants.

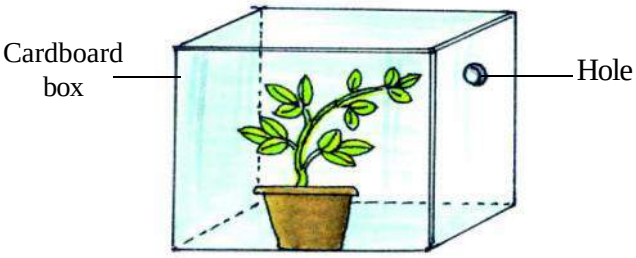


Figure 7.2 Plants move towards light.

5. Sensitivity

When we call a cow by showing her bread or grass, she walks towards us. How do you feel when you see your favourite dish? Your mouth starts watering. What happens when your hand comes near the flame of a burning candle? You remove your hand at once. These actions are due to sensitivity.

There is sensitivity in plants too. For example, the flowers of lotus open when the sun rises and close at sunset, and the leaves of tamarind and the *Kachnar* plants close at night. These

two examples show that plants are sensitive to light. The leaves of touch-me-not plant close on touch showing their sensitivity to contact.

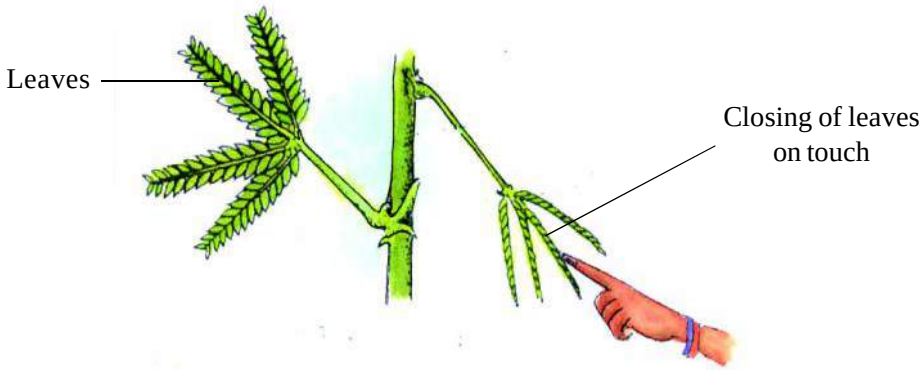


Figure 7.3 Sensitivity of the touch-me-not plant

ACTIVITY 3

Materials Required – a bottle with a wide mouth, cotton, black paper, Earthworm

Wrap half portion of the bottle with black paper in such a way that the paper can be moved back and forth. Place a earthworm inside this bottle and close the mouth of the bottle with cotton. Now place the bottle in sunlight.

After some time you will find that the earthworm moves to that portion of the bottle that is wrapped with black paper.

The earthworm is sensitive to light. It moves towards darkness.

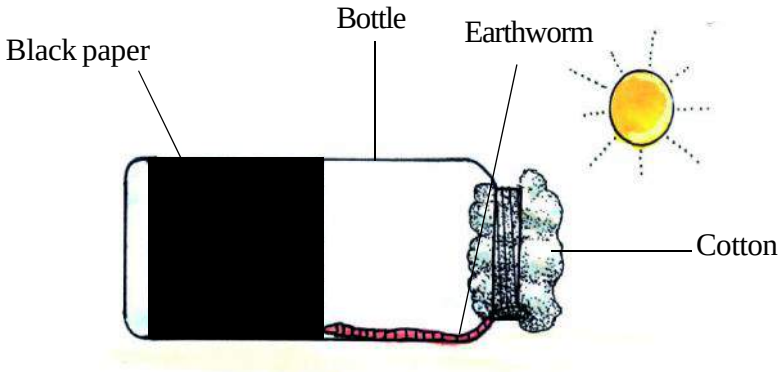


Figure 7.4 Sensitivity in an Earthworm

6. Growth

You have seen that there is an increase in the height of the offsprings of all animals. In the same way plants also grow. Animals grow up to a fixed age, while plants grow throughout their life.

7. Cellular Structure

Just as a house is made up of small bricks, the body of all animals and plants are made up of small cells. The structure of cells can be observed under a microscope.

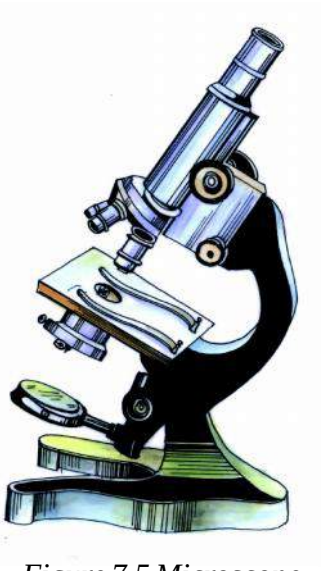


Figure 7.5 Microscope

8. Reproduction

All living beings reproduce offsprings of the same kind as them. This is known as reproduction. For example, cats have kittens, and chickens come out of hens' eggs. Plants produce seeds and new plants grow out of seeds.

9. Fixed Lifespan

All living things are alive for a fixed time after birth and after this period, they die. This fixed time is known as the life span of a living being. Different living beings have different life spans. This life span can vary from a few days to many years (figure. 7.6).

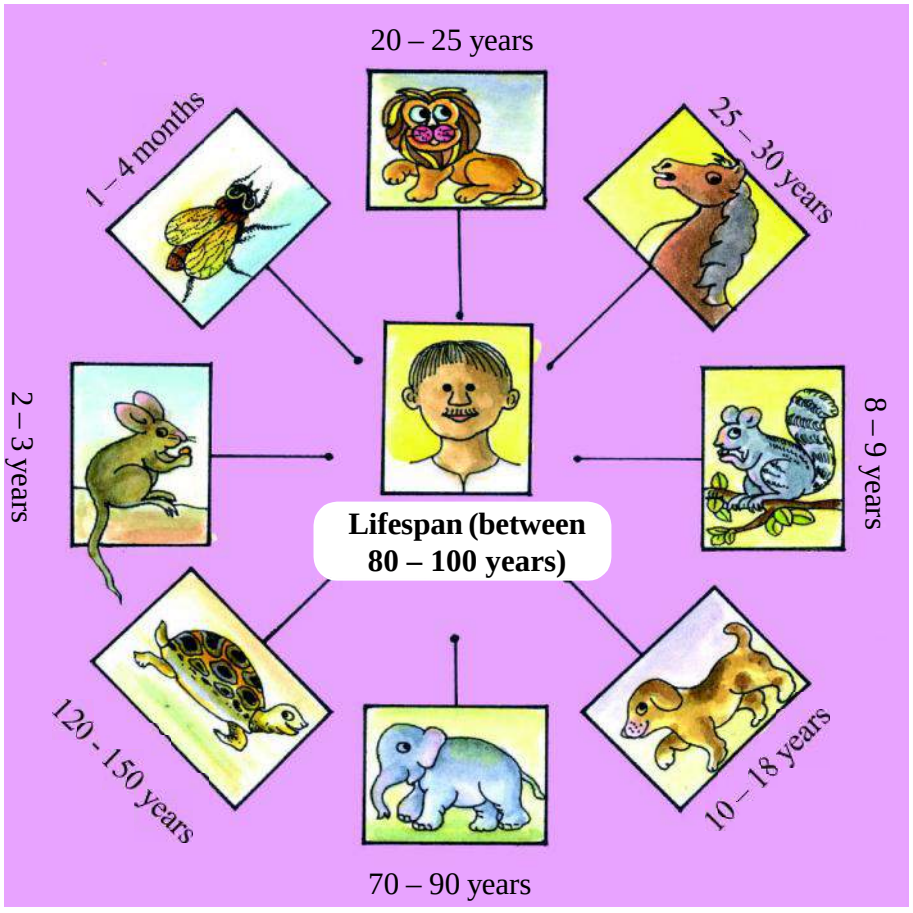


Figure 7.6 Lifespan of some living organisms

ANSWER THESE

1. Fill in the blanks-

1. The touch-me-not plant is _____ to touch.
2. Gum is a _____material of plants.
3. In respiration, plants take in _____ and give out _____ .
4. Growing out of plants from seeds shows the characteristic of _____ in living beings.
5. Animals expel _____ materials during excretion.

2. Match the following-

	A	**B**
1.	Growth	having food
2.	Reproduction	expelling of wastes from body
3.	Nutrition	increase in the size of the body
4.	Excretion	exclaim on hearing an explosion
5.	Sensitivity	production of the same kind of living being

3. Classify the following into living and non-living

Motor, Peacock, Nightingale, Car, Tap, Mongoose, Fan, Earthworm, Insects, Balloon, Aeroplane, a sapling of Mango, Wheat, Science textbook, Seed, Egg

4. Explain the following characteristics of the living-

(a) Respiration (b) Excretion (c) Reproduction (d) Nutrition

Try the following –

1. Take the pink solution of phenolphthalein in a glass. Blow your breath into it. Observe the change in the solution.
2. Observe a Sunflower in the morning and evening and note the changes that you see.

7.2 Similarities in living Organisms

There are certain basic similarities among all living organisms, be it plants or animals. The bodies of all living things are made up of cells. Different life activities like mobility, reproduction, growth, nutrition etc. function similarly in all living beings. In spite of these basic similarities, there are certain differences among them as well. These arise due to the environment they live in. For example, for the animals on land, motion is through legs, while motion for living beings of water like fish is due to fins, where as in birds, motion is due to wings.

7.3 Variety in Living organisms

1. Variation in shape of the living organisms

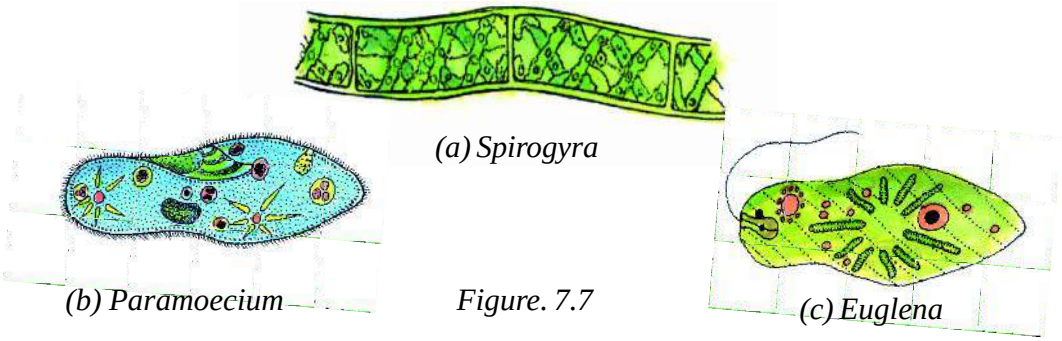
Observe insects at your home and in your surrounding or the weevil found in grains. These living beings are visible to us. Can there be organisms smaller than these?

ACTIVITY 4

Materials Required - water from a pond, a glass slide, a microscope

Procedure – Take a drop of water from the pond on the glass slide and observe it under the microscope. What do you see?

Observation – Some organisms are seen moving in the drop of water, these are microscopic organisms such as *Spirogyra, Paramoecium, Euglena*, etc. (fig. 7.7 a, b, c respectively) that are found in water.



(a) Spirogyra

(b) Paramoecium

(c) Euglena

Figure. 7.7

Elephant is a big animal. But do you know that the blue whale is an animal much-much bigger than the elephant? The weight of the blue whale is equal to that of thirty adult elephants. The flowers of certain plants are very small while those of some other plants are very big. Similarly the seeds of some plants are of the size of dust particles while those of some plants are very big. Which plant that you have seen has the biggest flower? And which plant has the biggest seed?

2. Variation in mode of nutrition

In the chapter on environment you learnt that plants are autotrophic – they photosynthesize. Those plants that do not make their own food take it from other plants – like *Amarbel* (Dodder, Figure 7.8 a). They are called parasites. Some plants depend on dead and decaying matter for food

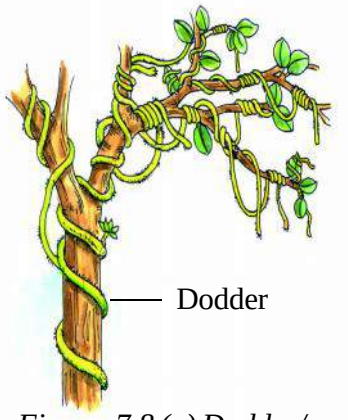


Figure. 7.8 (a) Dodder/ Cuscutta

– they are called saprophytes, like mushrooms (Figure 7.8 b) and bread mould etc. Some plants are autotrophic but they also digest insects – they are called insectivorous plants e.g. pitcher plant (Figure 7.8 c). Other living organisms are herbivorous, carnivorous or omnivorous. We see that there is a lot of variation in the mode of nutrition of various living organisms.

Figure 7.8 (b) Mushroom

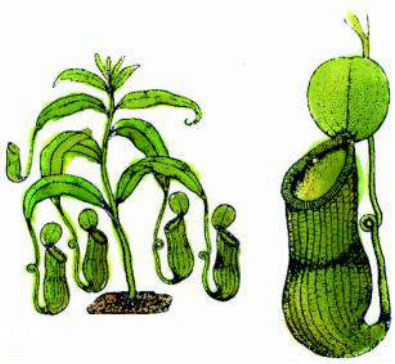


Figure 7.8 (c) Pitcher plant

3. Variation based on habitat

Living organisms have been categorized on basis of whether they live on basis, water or in a desert.

(a) Terrestrial plants and animals

Those living organisms that live on land are called terrestrial plants and animals – Roses, Human beings, Horses, Lions, Cows, Goats, Neem, Banyan, Mango etc. are examples of these.

(b) Aquatic animals and plants

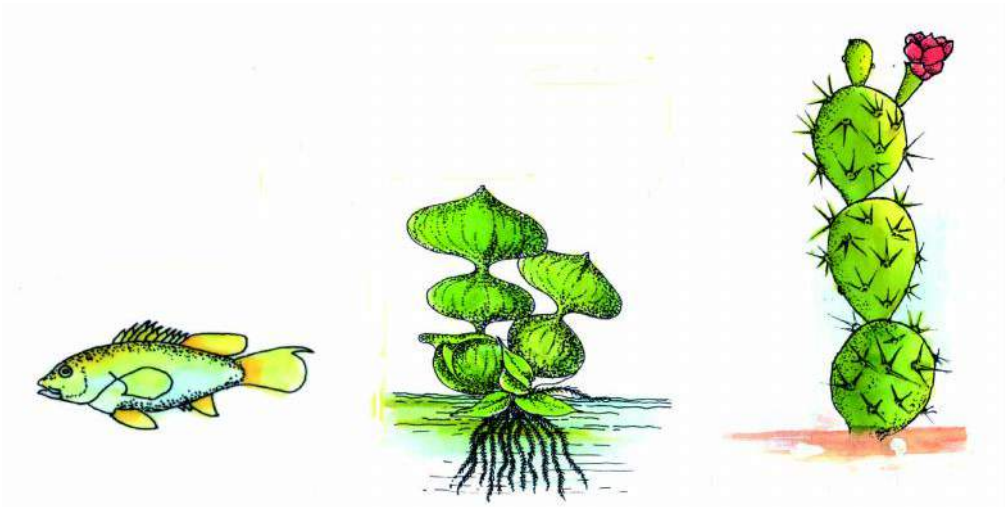
Animals and plants that are found living in water are called aquatic organisms e.g. fishes, Lotus. Aquatic animals like the fish are boat-shaped (figure 7.9 a) while others have webbed feet like frogs and ducks.

The stems and roots of water plants have air cavities that help them float in water e.g. water hyacinth (figure 7.8 b). Make a list of the aquatic plants and animals found in the nearby ponds and draw diagram of it.

Some animals live in water as well as on land – they are called amphibians e.g. frogs, crocodile, tortoise.

(c) Xerophytic plants and animals

Plants found in deserts are called Xerophytes while animals found in the desert are desert-animals. The animals and plants of the deserts have special adaptations like the cushioned hoofs of the camel. The stem of the *Opuntia* cactus is thick and succulent and the leaves are modified into spines (Figure 7.9 c). Discuss about other xerophytic plants and animals with your friends in the class and draw their diagrams.



(a) Fish *(b) Water hyacinth* *(c) Opuntia cactus*

Figure 7.9 Variation based on habitat

ANSWER THESE

1. **Draw a well labeled diagram of any xerophytic or aquatic plant known to you.**
2. **Match the following:**

(i)	Dodder	(i)	Herbivore
(ii)	Mushroom	(ii)	Aquatic
(iii)	Water hyacinth	(iii)	Saprophytes
(iv)	Rabbit	(iv)	Parasite

7.4 Need for Classification

There is a great variation in the organisms found in our surroundings. They show broad and specific structural differences. It is difficult to study each organism individually. If we classify similar organisms into one category then by studying about any one member of the category we would get broad information about the other member. Hence, classification is carried out for making our study of organism easier.

7.5 Classification of living organisms

All living organisms are classified into two categories: 1. Plants 2. Animals

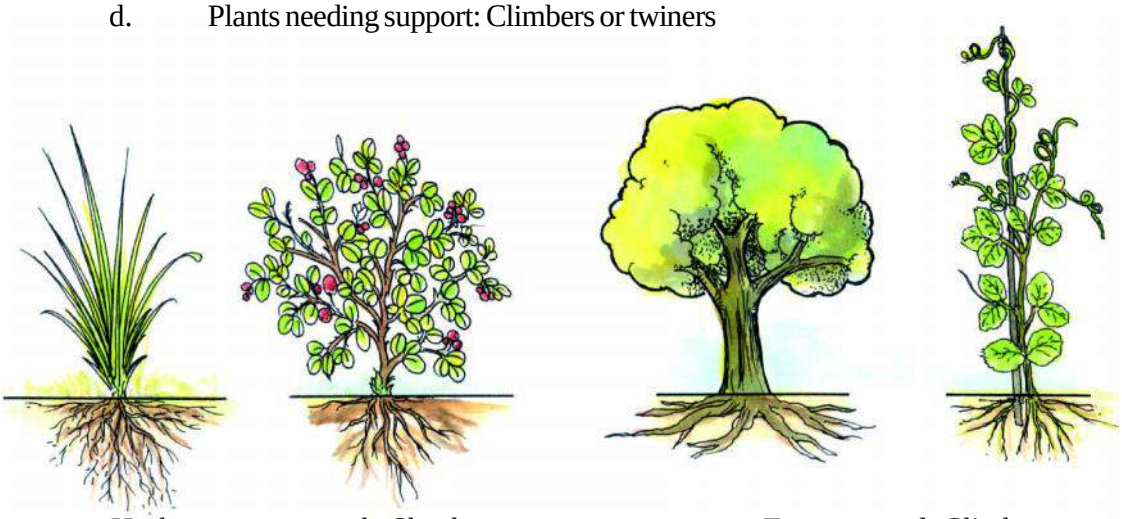
(1) Classification of plants: Plants are classified based on size, type of stem and life-span. They are classified into four types:

a. Herbs

b. Shrubs

c. Trees

d. Plants needing support: Climbers or twiners



a. Herb *b. Shrub* *c. Tree* *d. Climber*

Figure 7.10

a. Herbs – These are small plants that have a soft green stem. They may have a lifespan of less than a year. They are called Annuals e.g. coriander, wheat, rice.

b. Shrubs – Shrubs have a medium height and the stems are relatively hard. They live for more than a year and are called perennial plants e.g. rose, *besharam*, *ber.*

c. Trees – These are tall and large plants. Their stems are thick and hard. The trees are perennials e.g. mango, banyan, *peepal*, neem.

d. Plants needing support: The climbers or twiners have long stems that are weak. Hence they climb using some support. They could be annual, biennial or perennial e.g. peas, bottle gourd, pumpkin, bougainvillea.

ACTIVITY 5

Observe some plants found around you and fill in their characteristics in the Table 7.2 copied in your notebook.

TABLE 7.2

S. No	Name of plant	Nature of Stem				Growth of stem	Height of plant	Life-span	Type of plant
		Thick/ Thin	Brown/ green	Soft/ hard	With branches/ Without branches	Vertical/ along the ground/ Needs support	Low/ medium/ tall	Annual/ biennial /perennial	Herb/ shrub/ tree
1	Mustard								
2	Rose								
3	Mango								
4	Pumpkin								
5									
6									
7									
8									
9									
10									

Another basis of classification of plants

You classified plants based on their size, nature of stem and life-span. Plants can also be classified based on their mode of nutrition. In this very lesson you have read about the variation in nutrition among plants. For classification on the basis of nutrition copy this Table 7.3 in your notebook and complete it.

TABLE 7.3

S.No.	Name of plant	Can make their own food (Autotroph)	Get their food from dead and decaying matter (Saprophytes)	Get their food from living plants (Parasites)
1	Mango	----------	----------	----------
2	Water hyacinth	----------	----------	----------
3	Dodder	----------	----------	----------
4	----------	----------	----------	----------
5	----------	----------	----------	----------

2. Classification of Animals

We have classified plants based on two parameters. Similarly animals can also be classified based on different characteristics. We will now classify animals depending on whether they have the spinal cord or not.

Based on the following points we can know which animals have the Vertebral column

1. From below the head of an organism a long bone extends to below the waist. This is called the vertebral column or backbone (figure 7.11).
2. Those animals that have fore and hind limbs have the Vertebral column. You can feel the vertebral column by feeling the back with your hands.
3. Those animals that have a tail also have the Vertebral column.
4. The animals that have bones in any part of their body always have vertebrae.The animals that have a vertebral column are called vertebrates e.g. fish, lizard, bird, frog, human being etc. The vertebral column is made of several small bones, these are called vertebrae. The animals that do not have the vertebral column are called invertebrates e.g. centipede, earthworm, snail, leech, scorpion, crab, lobster.

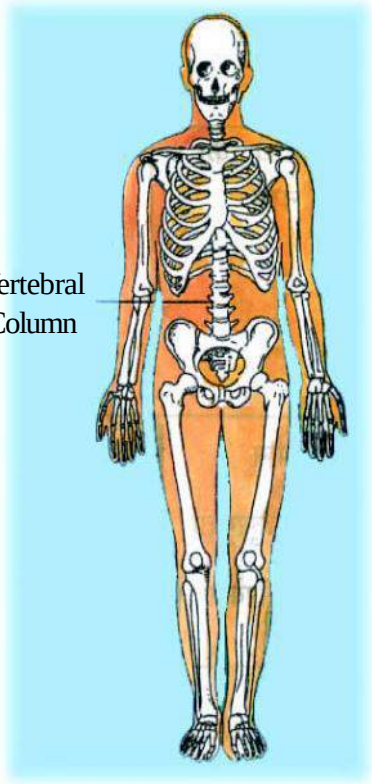


Figure 7.11 Human Skeleton

5. Animals that are segmented do not have a Vertebral Column e.g. earthworm.

Some animals are shown in Figure 7.12. Classify them as invertebrates and vertebrates and list them in Table 7.4 copied into your notebook.

TABLE 7.4

S.No.	Name of animals	Invertebrate/ Vertebrate	Reason
1	Earthworm	Invertebrate	Does not have vertebral column
2	Frog	Vertebrate	The body has fore and hind limbs
3	----------	----------	----------
4	----------	----------	----------
5	----------	----------	----------

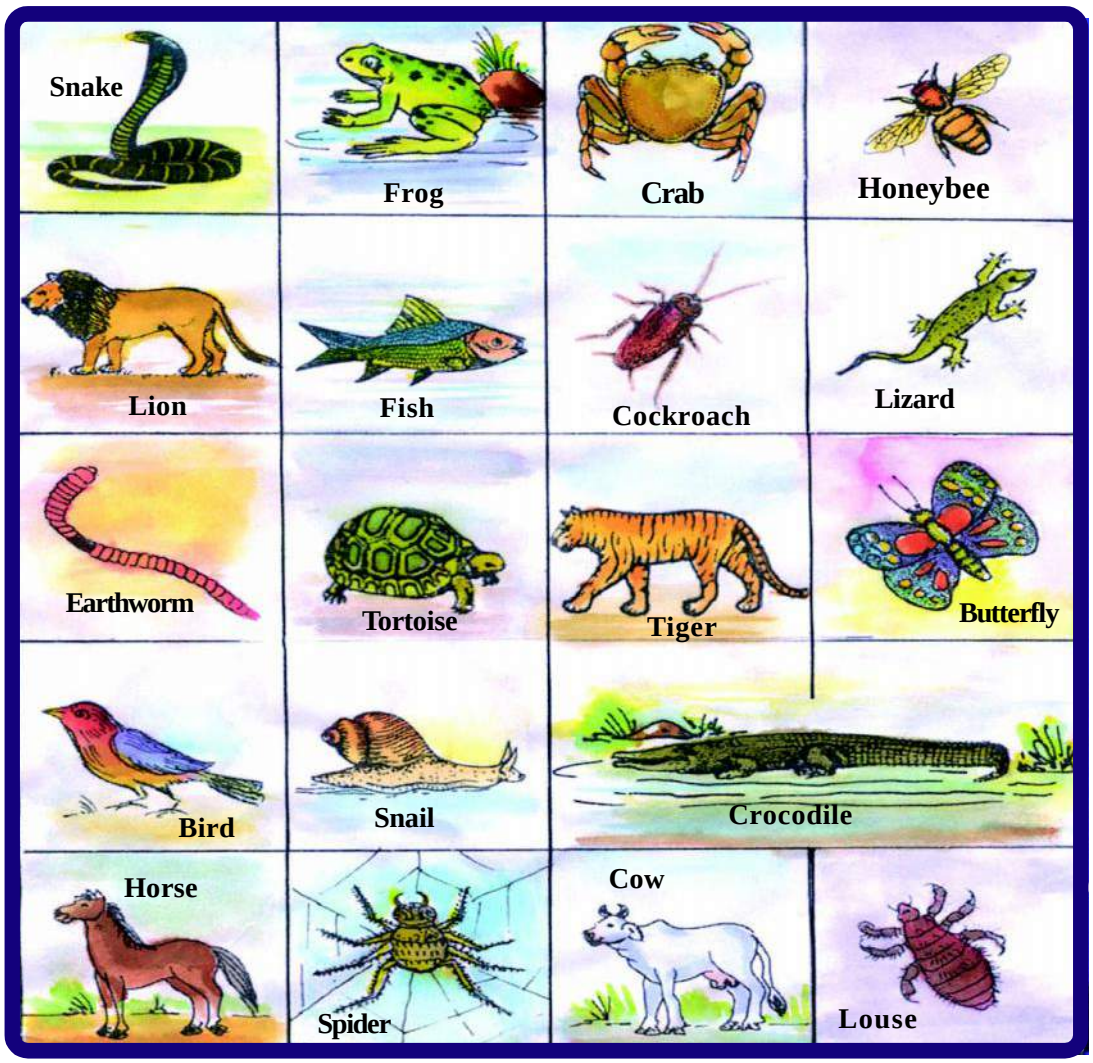


Figure 7.12

Now classify the vertebrates as per directions given –

1. Fishes — a. live in water. b. Lay eggs.
2. Animals like Frogs — a. Are found living both on land and water
   b. Lay eggs. c. Do not have scales.
3. Snake-like animals — a. Body covered with scales.
   b. Lay eggs
4. Birds — a. The body is covered with feathers
   b. Lay eggs
5. Mammals — a. Body covered with hair
   b. Give birth to young ones

This classification can be shown through a flow chart also.

Table 7.5

Animals

Invertebrates

Vertebrates

- Aquatic and egg-laying eg. Fish
- Aquatic as well as terrestrial, mainly terrestrial, egg-laying e.g. frog
- Body covered with scales, egg-laying, ————————
- Body covered with feathers, egg-laying ————————
- Body covered with hair, give birth to young ones, ————————-

Make Table 7.5 in your notebook and write the names of the animals shown in Figure 7.12 based on their characteristics in the right place as examples. For example the name of fish and frog is already written.

7.6 Scientific names of living organisms

Plants and animals have different names in different languages e.g. the mango is called aam in Hindi, mangaya in Tamil, aamdi in Gujrati, manga in Malayalam, aama in Chattisgarhi and amba in Marathi. Similarly the panther is called tendua in Hindi, shivangi in Kannada and chirudhai in Tamil.

It is necessary that for research any one organism should have only one name all over the world. The swedish scientist Carolus Linnaeus (1707 – 1778) started a naming system where each living organism was given a scientific name. The scientific name has two parts – the first name is the Genus and the other is the Species e.g. the mango is called *Mangifera indica* where *Mangifera* is the genus and *indica* is the species name. Similarly the scientific name of panther is *Panthera pardus*. Here *Panthera* is the genus name and *pardus* is the species name. In each Genes there can be several related species like the tiger (*Panthera tigris*) and lion (*Panthera leo*) are also the members of the Genus *Panthera*. From this we come to know that the tiger, lion and the panther are very similar and are related to each other. Similarly the scientific name of human beings is *Homo sapiens*, the frog is *Rana tigrina*, the rose is *Rosa indica* and the rat *is Ratus ratus*.

State bird of Chattisgarh:	- *Pahari Mynah*
Scientific name:	- *Gracula religiosa peninsularis*
State animal of Chattisgarh	- *Bison*
Scientific name	- *Bubalus-Bubalis*

Figure 7.13 Pahari mynah

Figure 7.14: Bison

ANSWER THESE

1. Based on the characteristics write the examples of animals
    1. Invertebrate
    2. Vertebrate, aquatic, egg-laying animals
    3. Vertebrate, terrestrial, egg-laying
    4. Vertebrate, amphibian animal
2. Match the following

	A		B
1	Cow	1	Vertebrate, terrestrial, egg laying
2	Pigeon	2	Vertebrate, aquatic, egg lying
3	Earthworm	3	Vertebrate, terrestrial, giving birth to young ones
4	Fish	4	Invertebrates

3. Look at the plants around you and give two examples each of the following: herb, shrub, tree, and climber.

7.7 Importance of plants and animals

We are dependent on plants and animals for several things. Let us see their importance in our lives.

A Importance of Plants

We have the following benefits from plants:

1	As food	Wheat, maize, pulses, sugar, oil
2	As spices	Mustard, coriander, ani seeds *(saunf)* turmeric, cumin seeds *(jeera)*, fenugreek seeds *(methi)*
3	As medicines	Basil *(Tulsi)*, belladonna, Cinchona
4	As beverages	Tea, coffee

5	As fibre	Cotton, jute, linen
6	As fuel	Wood
7	In paper industry	Bamboo
8	In industries	Resin, rubber (tyre, tubes)
9	For purification of the environment	Purification of air by plants
10	As oil	Castor, peanut, *amla*, *neem*

B Importance of Animals

1	As food	Milk, ghee, meat, eggs, butter
2	For transport	Horse, camel, donkey, elephant
3	In leather industry	Skin of dead animals
4	To get wool	From sheep and yak
5	Honey, wax	From honeybee

WE HAVE LEARNT

- We have several thing around us that can be classified as living and non-living.
- The living, breathe, eat, excrete, move, grow, reproduce and they are sensitive.
- Based on size the plants can be classified as herbs, shrubs, trees and climbers.
- Animals are classified as invertebrates and vertebrates.
- Animals and plants show variation based on habitat and mode of nutrition.
- All plants and animals have a scientific name.
- We are dependent on plants for many things. Plants give us food like wheat, rice, pulses, spices, oils, vegetables etc. From animals we get milk, ghee, butter, eggs, curd, wool, fibre etc.
- Animals help us in transport and in carrying loads.

EXERCISE

1. Classify the following as living and nonliving:

   house, air, human being, peacock, tortoise, mongoose, water, cloud, soil, plant, mango, papaya, gram, well, tap, motor, cycle, fan

2. Explain the following characteristics of the living:

   1. sensitivity
   2. growth

3. Give two examples each of herbivores, carnivores and omnivores
4. Give names of parasites, saprophytes and insectivorous plants.
5. Give the scientific names of the state bird and state animal of Chhattisgarh.
6. What is the average lifespan of human beings and elephants respectively?
7. Give the names of some medicinal and food plants. Also write the uses of animals to human beings.
8. What will happen if a plant is placed without being watered in the dark for seven days?
9. The motor vehicle moves, it uses fuel as food and it excretes smoke, yet it is called non-living. Give reasons.
10. Tick the correct statements (✓) and rewrite the wrong statements to make them correct.
    1. The gum is an excretory product of a plant.
    2. The mushroom is a parasite
    3. The rat is an omnivorous animal
    4. Micro-organisms are observed using a microscope
    5. The animals that do not have a spinal chord are called invertebrates
    6. Bamboo is used in the paper industry
    7. The snake is an invertebrate animal

THINGS TO DO

1. Make a list of animals found in the garden, pond, homes, forest and the zoo and classify them based on the following points:
    a. Size – very small, small, big, very big
    b. Habitat – terrestrial, aquatic, amphibious, aerial
    c. Food – herbivore, carnivore, omnivore
2. Make a collection of articles and photographs containing interesting information and uses of plants and animals.
3. Observe the plants found in your surroundings and classify them as herbs, shrubs, trees and climbers. Discuss on what basis you classified them, with your friends in your class.
4. Till now you have answered the questions and divide the class into groups and prepare questions based on this chapter and ask questions to the other groups with the help of the teacher and friends find the answer.

8. STRUCTURE AND FUNCTIONS OF LIVING ORGANISMS – I

You have learnt that in the body of a living organisms several processes take place. Plants and animals have different parts or organs for different functions.

In this chapter we will study the various parts of the plants and their functions.

Parts of the plants and their functions

Look carefully at figure 8.1. This shows the various parts of the plant. It would be good if you uproot a plant, bring it to class and with the help of the figure identify various parts of the plant. The parts of a plant are roots, stem, leaves and flowers. The roots are parts of a system called the root-system. These are usually found within the soil while the stems, branches, leaves and flowers that constitute the shoot-system are above the ground.

Are any seeds shown in the figure? But we know that the life of the plants starts from seeds. Hence, let us also start our study with seeds.

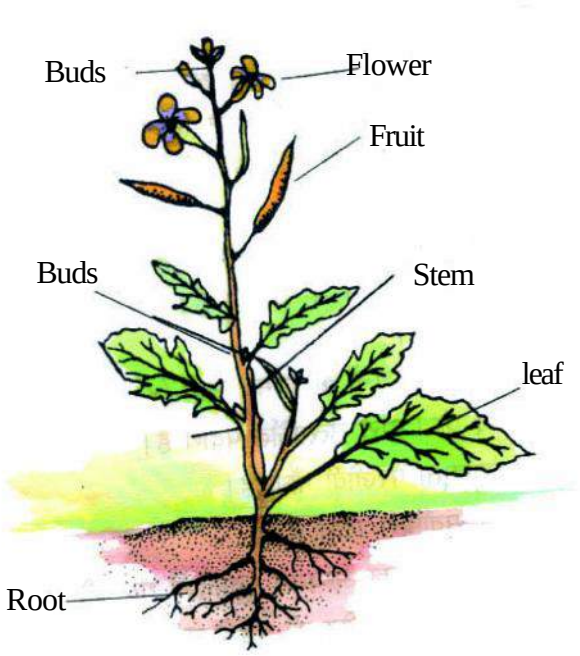


Figure 8.1 Parts of a plant

8.1 Structure of Seeds

ACTIVITY 1

You will have to collect 8 – 10 different types of seeds for this activity. Copy the Table 8.1 in your notebook. Observe the seeds and fill in the table.

TABLE 8.1

S. No.	Name of Seed	Colour of seed	Shape of seeds	Whether the surface of seed is smooth or rough	Any other special feature
1.	Gram	Reddish-brown	Round	Rough	_____
2.	Peas	Green	Round	Smooth	_____
3.	_____	_____	_____	_____	_____
4.	_____	_____	_____	_____	_____
5.	_____	_____	_____	_____	_____

Now draw pictures of the seeds in your notebook.

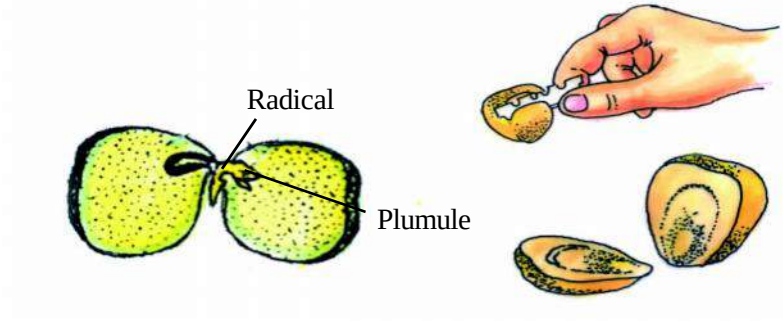
ACTIVITY 2

Soak some seeds of gram, peas, maize etc in water. Observe the soaked seeds the next day. To germinate the seeds, place the soaked seeds in a plate and cover with a wet and thick cloth. Observe it everyday and write information in the following table:

TABLE 8.2

S.No.	Name of Seed	Observation		
		First Day	Second Day	Third Day
1.	Peas	Seeds swollen	Can see white germinated part	Can see white and green germinated part clearly
2.	Maize	_____	_____	_____
3.	_____	_____	_____	_____
4.	_____	_____	_____	_____
5.	_____	_____	_____	_____

Now try and remove the skin of the germinated seeds and compare the internal structure of seed with the Figure 8.2. If the skin comes off easily press the seeds gently between your thumb and forefinger to split the seed.



(a) Pea *(b) Maize*

Figure 8.2 Internal structure of the seed

ANSWER THESE

1. Which takes longer time to germinate - seeds of peas or maize?
2. Write the names of those seeds in which the skins separate easily.
3. Write the names of those seeds in which the skins do not separate easily.
4. Draw pictures and label the structures seen inside the germinated seeds seeds in which there are two cotyledons are called dicotyledonous seeds e.g. peas, gram etc.

Seeds in which there is only one cotyledon are called monocotyledonous seeds e.g. Maize, Wheat etc.

ACTIVITY 3

Take moist soil in a glass tumbler. Place some germinating seeds in the tumbler such that you can see the parts that come out after germination through the sides. Observe these germinating seeds daily.

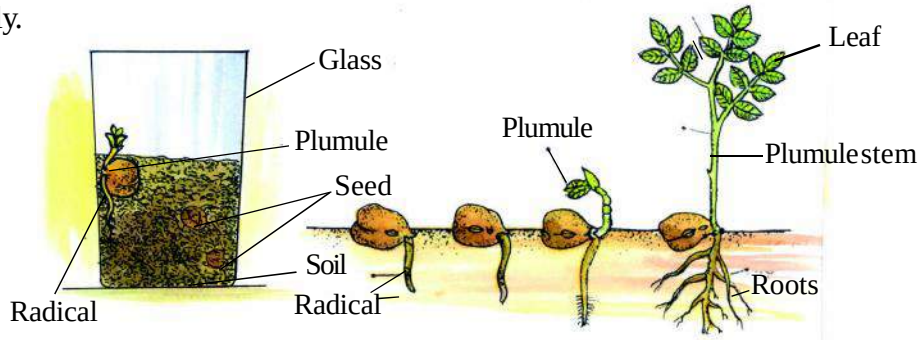


Figure 8.3 (a) Germination of seeds in a glass tumbler (b) Germination in gram

You observed that the white part that grows out of the germinating seed grows towards the soil – this is called the radical and it grows to form the roots. Similarly the green part growing out of the germinated seed grows upwards – this is called the plumule and it develops into the shoot system. The stem, leaves, flowers, fruits and seeds comprise the shoot system.

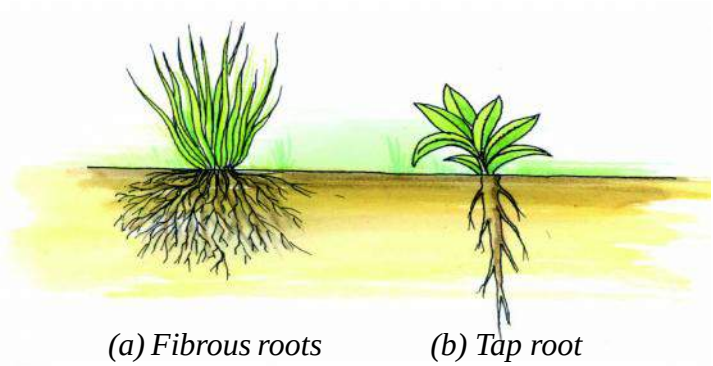
Hence the plants have two systems – the root system within the soil and the shoot system above the ground (Figure 8.1)

8.2 The Root System

The radical that grows out of monocotyledonous plants like wheat and maize stops growing after a certain length and the tip then branches into a fibre like structures. Hence, they are called fibrous roots (Figure 8.4 b). In the dicotyledonous plants like gram and peas the radical continues to grow and branches arise from it. These are called tap roots (Figure 8.4 a)

Hence roots are of two types –

1. Fibrous root
2. Tap root



(a) Fibrous roots *(b) Tap root*

Figure 8.4 Types of Roots

ACTIVITY 4

All students should go with their teacher on an excursion to some place where different types of plants grow. Remember to take some necessary things like a notebook, pen, blade or knife, bag, newspaper etc. with you.

During the trip observe all plants and trees carefully. Uproot small plants and place them between the sheets of a newspaper. As far as possible collect only plants that grow wild and grasses. If you need to collect plants from a field or garden follow instructions given by your teacher. As you collect plants note their names. In case you do not know the names of the plants label them a, b, c etc. After you return from your excursion or trip carefully observe all the plants you have collected. Copy Table 8.3 in your notebook and complete it.

TABLE 8.3

S. No.	Name of plant	Type of root	Type of seed Monocotyledonous/Dicotyledonous
1.	Peas	Tap	Dicotyledonous
2.			
3.			
4.			
5.			

Functions of the roots

You may have noticed that you need to exert some force to uproot the plants. This is because the roots hold the soil firmly together due to which the plant stand erect in the soil. This is one function of the roots. Let us do an activity to learn about another function.

ACTIVITY 5

Take a tumbler filled with water. Now put some red ink in the water to colour it. Carefully uproot a plant having a soft stem. Clean its roots with water. Now stand this plant in the coloured water and place the tumbler in the sun. Observe the plant after two hours.

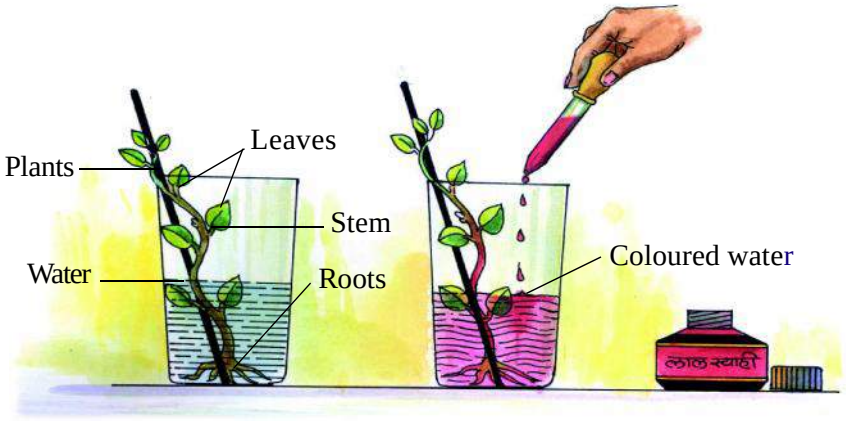


Figure 8.5 Absorption of water and mineral salts by roots

You will see that the coloured water has reached the leaves. Why did this happen?

The roots take up water and mineral salts and transport it to various parts of the plant. This process of taking up water and salts by roots is called absorption.

8.3 The Shoot System

You have learnt that stem, leaves, flowers fruits and seeds together constitute the shoot system.

Stem

In Chapter 7 you have learnt about herbs, shrubs, trees and climbers and about the special features of their stems.

You may have seen that leaves and branches arise from particular positions on the stem called nodes. The part between two nodes is called the inter-node. Maize, bamboo and sugarcane have nodes that are distinct and form swollen joints (Figure 8.6).

Now go on an excursion and try to recognize the nodes and internodes on different plants.

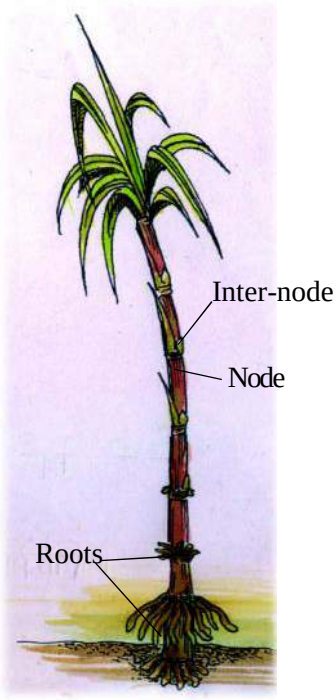


Figure 8.6 Plant of Sugarcane

Functions of the Stem

1. The stems help the plant to stand erect.
2. The stem bears leaves, flowers and fruits.
3. In Activity 5 you saw that the red coloured water that was absorbed by the roots reaches the leaves and flowers through the stem. Thus it is clear that the water and mineral salts absorbed by the root are transported by the stem to various parts.
4. The stem also transports the food synthesized by the leaves to various parts of the plant.

Structure and Functions of the Leaves

ACTIVITY 6

Observe the leaves collected during the excursion and fill in the details after copying the following table in your notebook.

Table 8.4

S.No.	Name of leaf	Shape	Colour	Margin	Surface	Tip
1.	Peepal	Heart shaped	Green	without any cut	Smooth	Pointed
2.						
3.						
4.						

ANSWER THESE

1. What is the colour of most of the leaves?
2. What is the difference between the two surfaces of the leaves?
3. Are the upper surfaces of all leaves similar?
4. How do the margins of the leaves differ?
5. Draw pictures of the leaves you have collected.

The leaf is an important part of the plant. You have seen that it is usually green in colour. The leaf is green due to a green pigment called chlorophyll. The leaves synthesize food with the help of chlorophyll. This process is called photosynthesis.

ACTIVITY 7

Place a leaf between two sheets of your notebook with the rough surface on top. Now gently rub a pencil or a crayon on the sheet over the leaf. Slowly the shape of the leaf will emerge on the paper and become distinct. Take rubbings of leaves of different shapes and size.

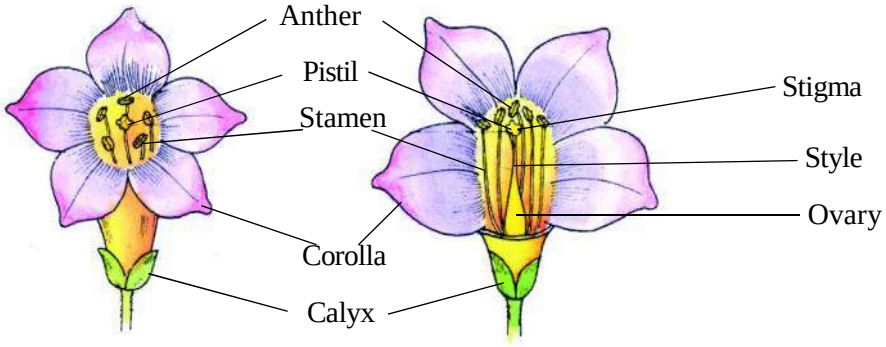
Flower

The flower is the reproductive organ of the plant. You would have seen many flowers of different types. Are all flowers similar? In what ways do flowers differ from each other?

ACTIVITY 8

Take flowers of *Dhatura* or *Besharam* and study their various parts. The outermost green whorl is called the calyx (Figure 8.7 a). It protects the flower before it opens. The coloured whorl seen inside the calyx is called the corolla. This attracts the insects like butterflies.

Separate the whorls carefully. Surrounding the central portion you will see several structures with swollen tips. These are called stamens. The swollen tips of the stamens are the anthers, which contain very tiny pollen grains. The stamens are the male parts of the flower. On removing the stamens the vase-like structure seen in the middle is the pistil (Figure 8.7 b). This is the female part of the flower.



(a) Flower *(b) Vertical section of the Flower*

Figure 8.7 Parts of a flower.

The swollen basal portion of the pistil is the ovary. The elongated neck above the ovary is the style. On top of the style is the stigma. The ovary develops into the fruit. Cut a flower with a blade, study its structure and compare it with the Figure 8.7 b.

Such flowers which have both stamen and pistil in them are called bisexual flowers. The flowers which have either pistil or stamen are called unisexual flowers.

Fruit

The ovary of the flower gets converted into the fruit. You may have eaten fruits like mango, tamarind, *ber*, papaya and seen their seeds. The seeds give rise to the new plant. The seeds store food for the baby plants.

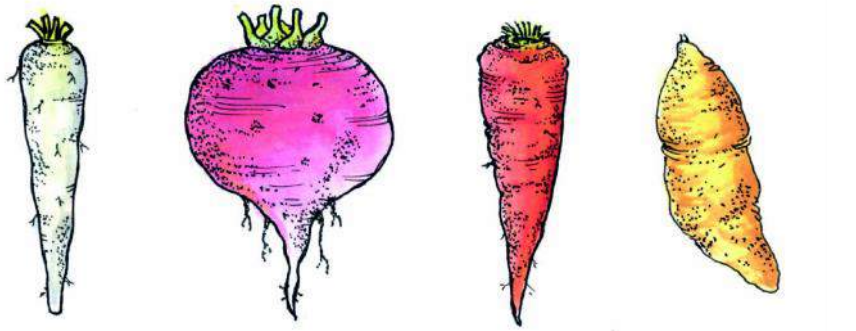
8.4 Modifications in Plants

Sometimes some parts of the plant have to carry out functions other than the ones that they normally do. The parts that do a separate function also look different from what they look like normally. Such parts are called modified parts. The roots, stems and leaves may be modified in different plants.

Modifications of roots

ACTIVITY 9

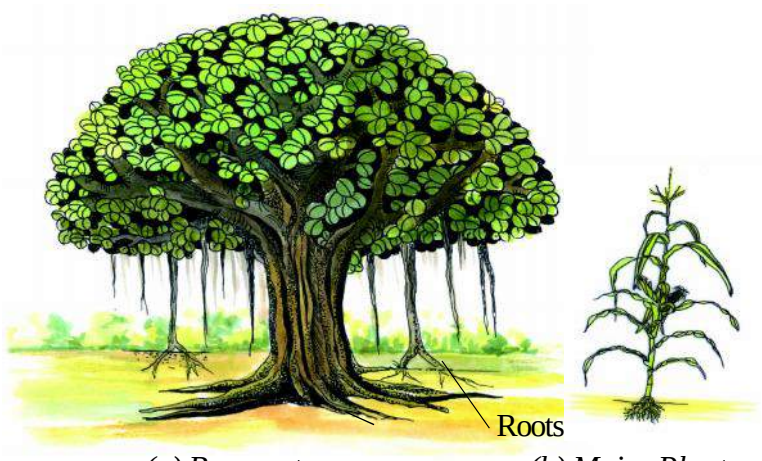
Look at radishes, carrots, turnips and sweet potatoes carefully. Do they look different from other roots? All these roots store food and hence they get swollen and their shapes change.



(a) Radish *(b) Turnip* *(c) Carrots* *(d) Sweet Potato*

Figure 8.8 Modifications of Roots.

You may have seen rope-like roots arising from the branches of Banyan. These roots enter the soil and give support to the branches. (Figure 8.9 a). Similarly the lower part of the stems of sugarcane, maize and *Kewra* gives out roots that give support to the plant.



(a) Banyan tree *(b) Maize Plant*

Figure 8.9

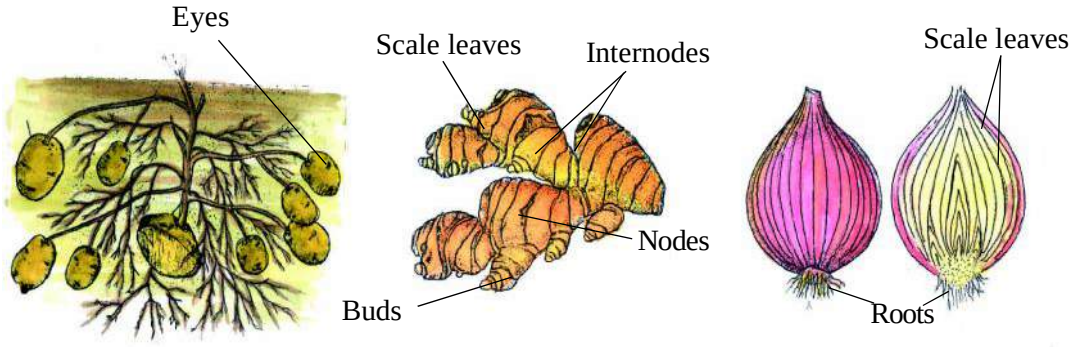
Modifications of stem

In some plants stems perform functions other than what they normally do. Such stems are said to be modified stems.

ACTIVITY 10

With the help of a hand lens look carefully at the pits (eyes) seen on the surface of the potato tuber (Figure 8.10). What do you see in them? You will see buds inside them. Similarly carefully observe ginger, Colocasia *(arbi)*, and an onion cut vertically. With the help of the Figure 8.10 identify the node, the inter node and buds in these.

Though these are found inside the soil they are not roots but are modified stems. They are stems since they have nodes, internodes, buds and scale leaves. None of these are found in roots. These stems store food.



(a) Potato *(b) Ginger* *(c) Onion*

Figure 8.10 Modifications of the stem

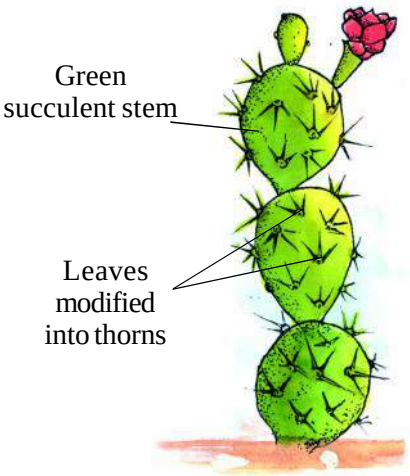


Figure 8.11 Opuntia

Look at figure 8.11 of the Opuntia [Cactus] carefully. These grow in areas with water scarcity. What is the structure and colour of its stem? Can you see any leaves on it?

Actually this is a modified stem. It is green, swollen succulent and it stores water. The leaves are modified into thorns which protect the plant. Find other such similar plants around you and discuss about it's similarities among your friends.

You may have seen creepers of pumpkin, gourd, bottle gourd, cucumber and the grape vine. Look at the creeper of the bottle gourd in Figure 8.12. Can you see small structures on the stem? What is special about their shape? These thread-like spiral structures are called tendrils. When the stems are weak and cannot bear the

weight of the plant, then the tendrils wind around any thing near them and help the plant to climb up.

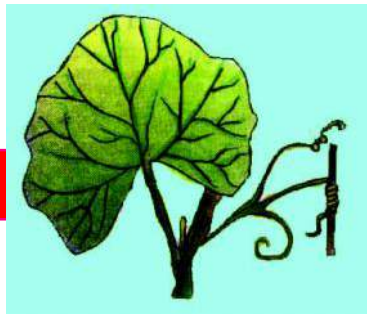


Figure 8.12 Creeper of the Bottle Gourd

ANSWER THESE

1. Why do stems and roots get modified?
2. Give the differences between fibrous and tap roots.
3. Give the names of any three modified stems and any three modified roots that you eat.
4. Identify which of these are roots, which are stems and write them in your notebook.
   Radish, Potato, Ginger, Sweet Potato, Carrot, Onion,

Modifications of Leaves

Look at the pea plant in Figure 8.13. Can you see anything special about its leaves? How are the leaves helping the plant stay erect? Like the stem and the roots the leaves can also get modified to perform some special purposes. The upper part of the leaves in peas gets modified into tendrils and help the plants climb.

You have seen that the leaves of cactus get modified into thorns, that protect the plants.

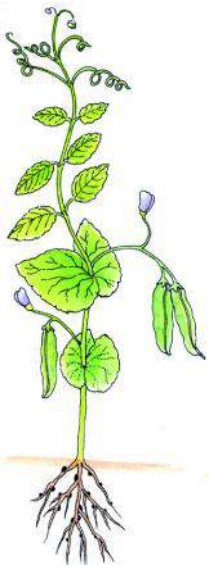


Figure 8.13 A Pea plant

WE HAVE LEARNT

- There are two main systems in the plant. The root system and the shoot system.
- Modified roots store food and give support to plants.
- Modified stems can manufacture and store food.
- Leaves manufacture food for the plant.
- Flower is the reproductive organ of the plant.
- Seeds are inside the fruits.
- Seeds germinate and make new plants.

EXERCISE

1. Choose the correct option

1. The ovary develops into –

   a. Seed b. Fruit

   c. Stem d. Tendril

2. Internodes are found on-

   a. Root b. Stem

   c. Flower d. Leaf

3. Fibrous roots are found in –

   a. Basil *(Tulsi)* b. Grass

   c. Peas d. Beans

4. An example of modified root is –

   a. Radish b. Potato

   c. Ginger d. Colocasia *(Arbi)*

5. In the centre of the flower is found –

   a. The pistil b. The stamens

   c. The calyx d. The corolla

2. Fill in the blanks –

1. The potato is an example of a modified _____.
2. The flowers are the _____ organ of the plant.
3. The leaves are green due to the presence of _____ in them.
4. The dicotyledonous plants have _____ roots.
5. The root in sugar cane perform the function of _____.

3. Answer these –

1. Draw diagrams of any one plant and label its parts.
2. Which system does the radical develop into?

3. Give the characteristics of the Opuntia.
4. Give examples of two plants that have stem tendrils.
5. Draw a labelled diagram of a flower.
6. Differentiate between the monocotyledonous and dicotyledonous plant.

THINGS TO DO

1. Collect the plants like Opuntia, sugar cane, turnip, radish, onion, carrot, sweet potato etc. growing around you. Also collect their parts with the help of your teacher, preserve them as specimens in the biology laboratory and find out the following information about them –

   Name: Ginger

   Identification: Thick, succulent, scaly leaves, with nodes and inter nodes.

2. With the help of your friends collect different types of seeds and exhibit them in your class room.
3. For your collection file collect 15 different leaves and 10 different flowers. (Before putting them in the file, dry the leaves and flowers by placing them between some thick sheets and pressing them with some heavy weight like some stacked books). compare the file with your friends and find the difference and discuss on them.

9. STRUCTURE AND FUNCTIONS OF LIVING ORGANISMS – II

The Structure and Functions of the Human Body

You learnt about the various parts of the plants and their functions. Similarly man and other animals are also made up of various parts or organs. These together form the organ system. All the systems work together in coordinated way so that the body functions in a balanced manner; and is healthy. Come let study the various organ systems of the human body.

9.1 Digestive System

What will happen if you continue working for long without eating any food? Organisms need energy to carry out their normal activities. This energy is obtained from food.

There are specific organs in the human body for digestion and for the removal of the undigested food. Together these are called the Digestive System

Digestive system

Organs of the Digestive System

- Mouth
- Pharynx
- Oesophagus & Stomach
- Intestines
- Anal opening

Digestive Glands

- Salivary Glands
- Liver
- Pancreas

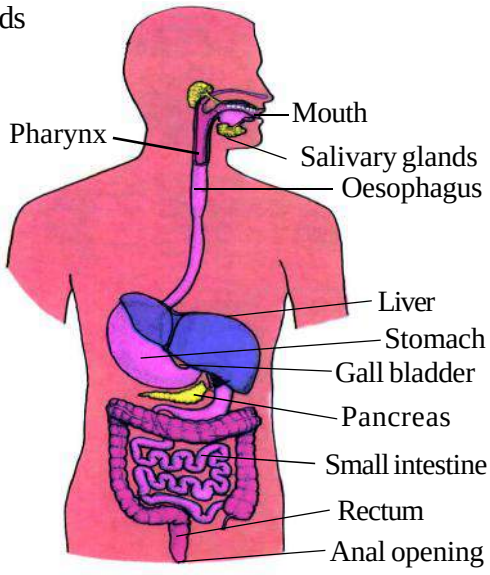


Figure 9.1 Digestive system of the human body

Study Figure 9.1 carefully and copy it in your notebook. The main organs of the Digestive system are mouth, pharynx, oesophagus, stomach, small intestine, large intestine, liver and pancreas. Taking in of food into the mouth is called ingestion. The salivary glands in the mouth secrete saliva. As food is chewed between the teeth it mixes with the saliva and becomes slimy. This food mixed with saliva moves

through the oesophagus to the stomach. Here the food is mixed with gastric juices from the stomach lining. The digestion of food starts. From the stomach the food moves to the small intestine where digestion is completed. The useful nutrients in the food are absorbed by the walls of the intestine. The undigested food is moved through the large intestine, and out through the anus.

- The process of breakdown of food into components that can be used by the body is called Digestion.
- The Alimentary Canal extends from the opening of the mouth to the anal opening.

ACTIVITY 1

Make groups of two students each among yourself. Ask your friend to open his/her mouth. Look carefully into the open mouth and compare the teeth seen in both the jaws with the ones shown in Figure 9.2.

Based on your observation fill in the following table after copying it in your notebook.

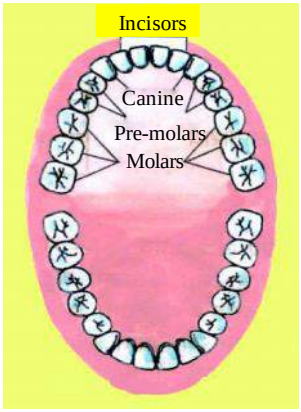


Figure 9.2 Different types of teeth

TABLE 9.1

S.No.	Shape	Work	Position	Total number	
				Upper jaw	Lower jaw
1.	Like chisel	Cutting	In front	Four	Four
2.	Pointed	Tearing shearing			
3.	Like a grinder *(Chakki)*	Grinding			
4.	Like a grinder	Grinding			

Do you know ?

1. Teeth come out twice in our life– the milk teeth and the permanent teeth.
2. Adults have 32 teeth.
3. There are four types of teeth.

The tongue has taste buds that can make out things that are sweet, salty, bitter and sour (Figure 9.3)

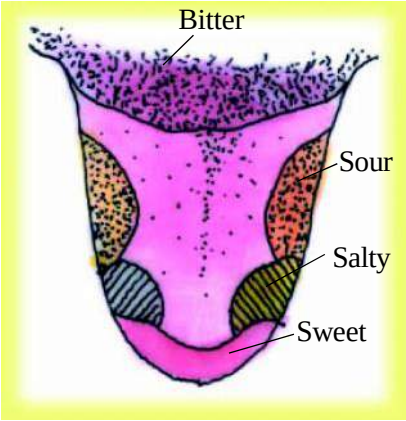


Figure 9.3 Taste buds areas of the Tongue

ANSWER THESE

1. What is the function of the salivary glands in the mouth?
2. Based on the shapes of teeth found in the human mouth write their fuctions.
3. Which are the tastes that we can differentiate with our tongue? Explain by drawing a picture in your notebook.
4. Write down the various organs of the Digestive system.

The story about the stomach with the hole

Till about 200 years ago scientists did not know what happened to food once it reached the stomach, since it was not possible to peep into the stomach. Then a surprising but interesting incident happened. In 1822 a soldier called Martin was hit by a bullet and brought to Dr Boman. He treated Martin and his wound was healed but an interesting thing happened – a hole was formed in the stomach. Through that hole it was possible to remove food from the stomach using a pipe. Martin did not suffer any problem due to the hole and he remained healthy.

Dr Boman continued to conduct experiments through the hole for nine long years to understand the process of digestion. He first removed the gastric juice from the stomach into a small bottle and put various food stuffs in it. He saw that the food stuff got dissolved in the gastric juice. He realized that there was a chemical reaction between the food and the gastric juice and that it could be carried out even outside the stomach.

You may have understood now that the digestive process is no magic.

9.2 The Circulatory System

You may have seen a wound bleeding when someone is hurt. The blood comes out because the blood vessels has been cut. Blood vessels are of two types : arteries and veins. The bluish-green tinge you see below the skin is due to the vessels called veins. They can be seen easily. The other type of vessels are located deeper and cannot be seen easily; they are the arteries. Veins carry blood from different parts of the body to the heart while arteries carry blood from the heart to various parts of the body. The heart is the main organ of the circulatory system. The blood brought in by the veins to the heart is taken to the lungs where it become oxygen-rich and is brought back to the heart. The oxygen-rich blood is taken by the arteries to various parts of the body. The network of capillaries joins the arteries and the veins.

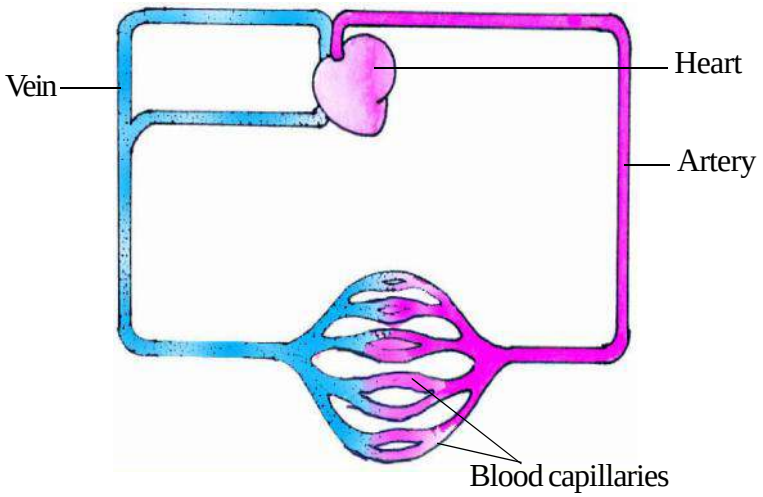


Figure 9.4 Circulatory system

Place your hand on your chest and feel for the beat – on which side of your body is it? The organ that is beating is the heart, situated a little towards the left of the centre within the rib cage. Hence the heart, arteries, veins and capillaries constitute the circulatory system.

The function of the circulatory system is to circulate useful substances to various parts of the body, and useless substances to the excretory organs through blood.

ACTIVITY 2

Take a glass or plastic funnel and attach a rubber tube to its stem (as shown in Figure 9.5 a). Put the open end of the tube to your ears. Then place the mouth of the funnel on your friends chest and listen carefully. Do you hear a sound of something beating? This is the heart beat of your friend. You can also feel for the pulse in your wrist and count the beats (Figure 9.5 b). Similarly count the number of heart beats per minute of your friends too. Also count the number of beats after running for a while and write the values in Table 9.2 made in your notebook.

(a) (b)

Figure 9.5 Counting the Heart Beat.

TABLE 9.2

S. No.	Name of student	Heart beat per minute	Heart beat per minute after running
1.			
2.			
3.			

ANSWER THESE

1. On an average how many times does the heart beat in any person?
2. Is the heart beat the same before and after running?

9.3 Respiratory System

When we breathe in (inhale) then oxygen also enters the lungs with air through the windpipe or trachea. When we exhale (breathe out) carbon dioxide comes out in the air along the same path (Figure 9.6). The blood carries oxygen from the lungs to all parts of the body and also brings carbon dioxide to the lungs.

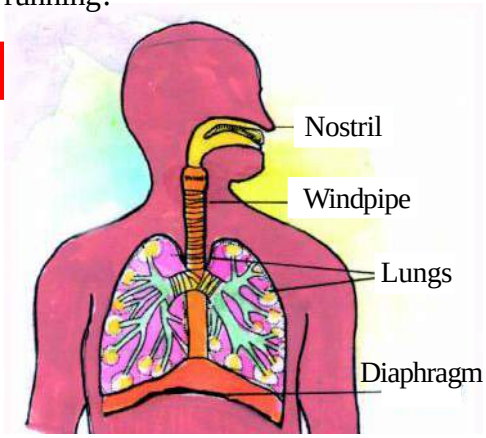


Figure 9.6 Human Respiratory System

Do you know?

- Inside the body between the abdomen and the chest there is a layer made of muscles which is called the diaphragm. It helps in the process of breathing.
- There is hair and sticky phlegm inside our nostrils that prevent dust and germs from entering our body.

ACTIVITY 3

Take a plastic bottle and cut its base as shown in Figure 9.7. Cut a balloon, stretch it and tie it at the cut end of the bottle. Fix a small balloon at one end of a glass tube or the plastic tube of a pen refill. Fix the tube in a cork as shown so that the other end is towards the outside of the bottle. Now pull the rubber sheet of the balloon downwards and push it inwards and note what happens to the balloon inside the bottle.

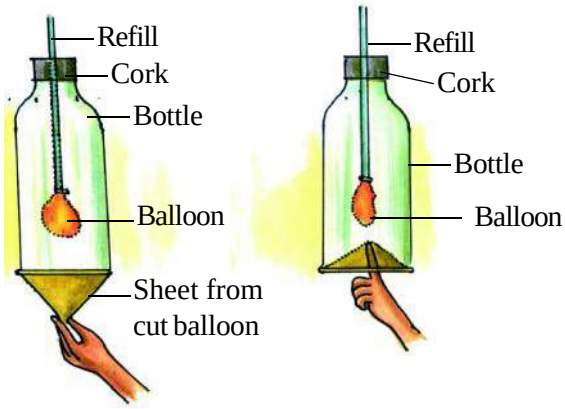


Figure 9.7 Role of Diaphragm in respiration

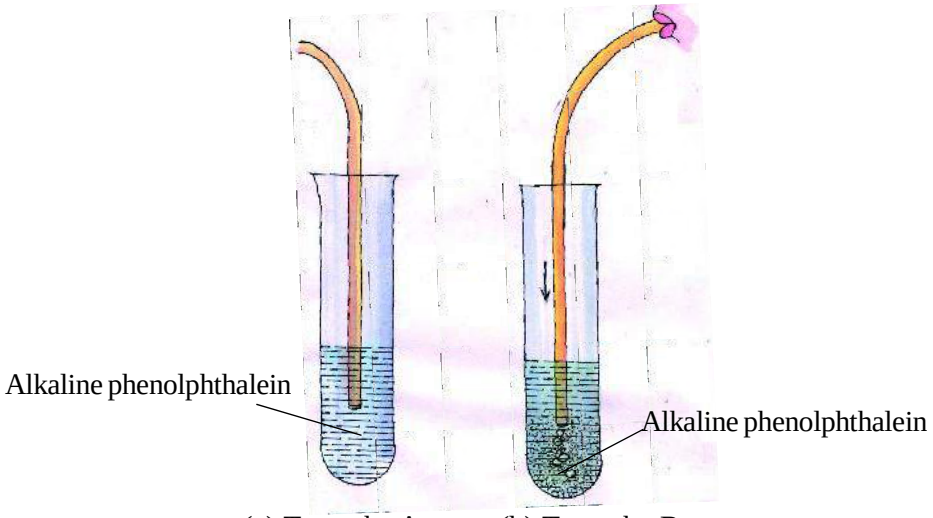
Now place your hand on your chest and take a deep breath. Breathe out after some time. Compare what happens in your body while breathing with what happened in the experiment given above, and understand what happens based on Table 9.3.

TABLE 9.3

S.No.	Experiment	Part of the body
1.	Outer mouth of the tube	Nose
2.	Long part of the tube	Trachea
3.	Balloon	One lung
4.	The cut balloon tied to the base	Diaphragm
5.	Bottle	Chest

ACTIVITY 4

Take some alkaline phenolphthalein in two test tubes. Label one 'A' and the other 'B'. Put either glass or plastic tubes in each test tube. Blow your breath into the tube in test tube 'B'. Write what happens in each tube in the Table 9.4, made in your notebook.



(a) Test tube A (b) Test tube B

Figure 9.8

TABLE 9.4

S.No.	Changes in the test tubes
1.	A
2.	B

The change that occurred in Test tube B was due to the carbon dioxide in the air breathed out.

ANSWER THESE

1. We should not breathe through our mouth, why?
2. How does oxygen reach all parts of the body?
3. Write the names of the main organs of the respiratory system.
4. Draw labelled diagram of the respiratory system.

9.4 Excretory System

Due to the many reactions in our bodies several poisonous substances or waste products are synthesized. The accumulation of these products can be dangerous for the body. The removal of these substances from the body is called excretion.

Our body gets rid of the waste products in several ways. The solid waste accumulated in the rectum is removed through the anal opening. Carbon dioxide (gas) through the lungs, and sweat (liquid) through our skin. Another waste product is the urine. To remove this the body has the urinary system. This system consists of a pair of kidneys, a pair of ureters, urinary bladder and urinary tube (figure 9.9).

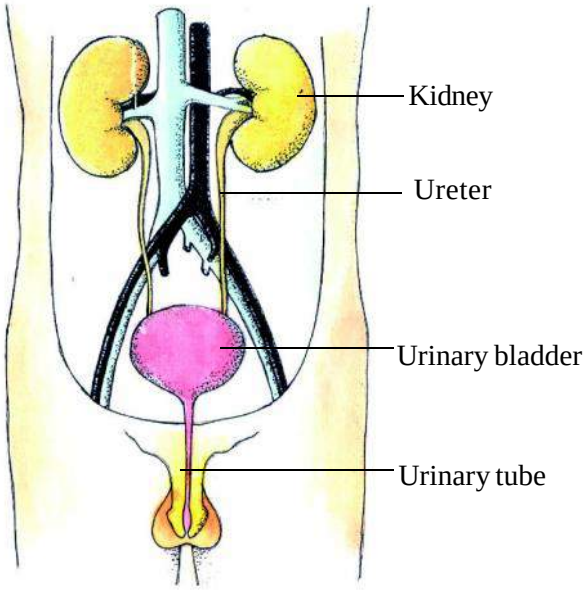


Figure 9.9 Human excretory system

The main function of the kidneys is to remove dangerous substances from the blood and synthesize urine.

ANSWER THESE

1. What will happen if the waste products are not removed from the body?
2. Which are the waste products that are removed from the body?
3. Name the various organs of the excretory system.
4. Draw a labelled diagram of the excretory system.

If all the organs of our body perform their functions properly then our body remains healthy Malfunctioning of any organ will make the body sick or unhealthy. In the same way if all the members of the society perform their duties properly then peace prevails in the society. Even one person in the group can cause havoc and disturb the peace of the society. so we must see to it that peace is maintained in the society.

9.5 Skeleton and joints

Press your fingers against hand and leg; do you get a feel of something hard pressing your figures? The hard structures are the bones. They provide a strong support to keep body straight. This frame work is known as skeleton (chapter 7 fig 7.11)

ACTIVITY 5

With the help of your friend tie a scale on your hand in such a manner that the elbow rests in the middle portion of the scale. Now try to bend your elbow. Are you able to bend it? Think why we cannot bend our elbow when it is tied but can easily bend it when it is not tied. Did you notice that we are able to bend or rotate our body in places where two bones of our body seem to be joined together-like elbow, shoulder or neck? These are called joints.

Main joints of our body are-

1. Ball and socket Joints: - This joint is found in shoulder, wrist and also in between hip and leg joints.
2. Hinge joints: - This is found in elbow and knee.

9.6 Nervous System

You have learnt that the digestive, circulatory, respiratory and the excretory systems are very closely related to each other. Imagine what would happen if these systems were not to function in coordination? If the digestive system did not digest food then how will food reach the blood? If oxygen was not made available by the respiratory system then how will the body get energy? Hence it is necessary for different parts to function in a coordinated manner. It is the function of the nervous system to maintain this coordination.

The main parts of the nervous system are –

1. Brain 2. Spinal cord 3. Nerves
4. Sensory organs

You read, you study, you play – you do all these activities according to your wish. The brain controls these activities.

We do some activities without thinking. If your foot were to fall on a thorn you would raise your foot instantly. You would do this as fast as a bulb would be lighted on switching it. These actions are controlled by the spinal cord and not the brain. Very fine thread-like structures come out from the brain and the spinal cord and go to all the sense organs and all other parts of the body. These are called nerves and they send information in both directions.

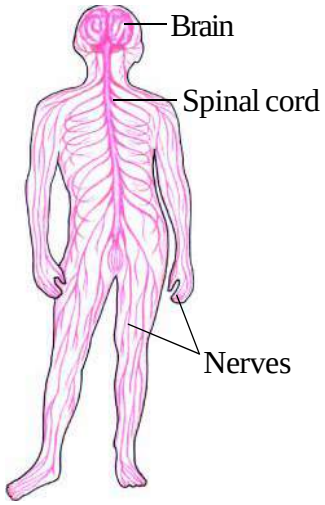


Figure 9.10 Human Nervous System

Sense Organs

You know that we can sense the presence of light with our eyes, the sound by the ears, smell by the nose, taste by tongue and touch by skin. Hence, eyes, nose, ears, tongue and skin are our sense organs.

ANSWER THESE

1. What are the thread –like structures that send information to and fro called?
2. Name the main parts of the nervous system and the various sense organs.
3. Draw neat well-labelled diagram of the nervous system.

9.7 Reproductive System

You have learnt that all living organism produce young ones similar to themselves through the process of reproduction. Chicks come out of hens eggs that grow up to become a hen or a cock. Some animals give birth to young ones like the dog, cat, human beings etc.

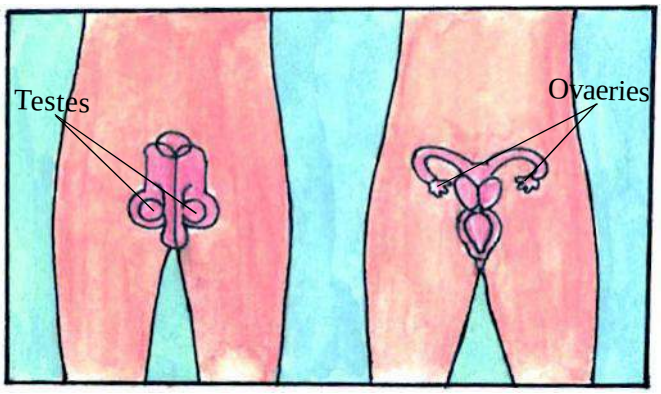


Figure 9.11 Human Reproductive Systems

In males the reproductive organ is the testes and in females it is the ovaries (Figure 9.11).

WE HAVE LEARNT

- Bodies of all organisms are made up of organ systems
- The main organ systems found in the human body are – digestive system, circulatory system, respiratory system, excretory system, nervous system and the reproductive system.
- The process of digestion involves ingestion of food, its digestion, absorption and removal of solid wastes.
- The digested food is absorbed by the small intestine.
- The process of inhalation of breath and its exhalation is carried out with the help of the lungs and the diaphragm.

- The function of the circulatory system is to carry useful substances through the blood to various parts of the body and carry waste substances to the excretory organs.
- The main organs of the circulatory system are the heart, the areteries, the veins and the blood capillaries.
- The main organs of the excretory system – kidneys, ureter, urinary bladder and the urinary tube.
- The organs of the nervous system are the brain, nerves, spinal cord and the sense organs.
- Involuntary actions are carried out by the spinal cord.
- All living organisms produce off springs like themselves through reproduction.
- The main organs of reproduction are the testes and the ovaries.

EXERCISE

1. Fill in the blank spaces —

1. We have _____ types of teeth.
2. The liquid waste that is excreted out is called _____.
3. The eyes are a type of _____ organ.
4. The _____ is the main organ of the circulatory system.
5. _____ is an example of an animal that gives birth to young ones.

2. Match the following:

1.	Saliva	Breathing
2.	Lungs	Reproduction
3.	Blood	Digestion
4.	Kidney	Circulation
5.	Testes	Excretion

6. Brain — Sense organ

7. Skin — Voluntary action

3. Choose the right answer and write:

1. Number of permanent teeth in human beings are –

   a. 20 b. 28 c. 30 d. 32

2. The vessels that takes blood from various organs to the heart are the–

   a. Arteries b. Capillaries c. Veins d. Nerves

3. The main organ of the Nervous system is –

   a. Brain b. Heart c. Kidney d. Skin

4. Which organ separates the waste products by filteration from the blood and forms urine –

   a. Lungs b. Stomach c. Heart d. Kidney

5. The following is not a sense organ –

   a. Eye b. Teeth c. Tongue d. ear

4. Write answers for the following questions –

a. Which are the organs of the respiratory system?

b. What does the diaphragm do during breathing?

c. Draw a diagram of the human Alimentary Canal?

d. Why is it necessary to have the excretion process?

e. Through which system do substances move around in the body?

f. What is reproduction?

THINGS TO DO

1. Draw a well labelled diagram of the various parts of the human body as well as its different systems. Colour them and use the charts to decorate your classroom.

2. Collect pictures and interesting articles about the human body and the body systems. Paste them in your scrap book.

10. MOTION, FORCE AND PRESSURE

10.1 What is motion?

If we look at various objects in our daily life we find that some objects are at rest and some are in motion. For example, a house, or an electric pole is at rest while a flying bird, a sprinter and a swimming fish etc are in motion. What difference do you notice between objects in these two states? You will see that for stationary objects there is no change in position with time but there is a change in position with time for those bodies that are in motion. Sometimes a body appears stationary due to its very slow speed of its motion. For example, the change in the position of the hour arm of a clock is very slow, therefore state of motion can be known after observing it for a long time. In this way it can be said that we should conclude whether a body is stationary or in motion only after observing it carefully for a long time.

Figure 10.1 Some objects in the state of motion and rest.

In the table given below write the names of five objects that are in the state of rest and five that are in motion.

TABLE 10.1

S. No.	Bodies in rest	Bodies in motion
1	----------	----------
2	----------	----------
3	----------	----------
4	----------	----------
5	----------	----------

10.2 Types of motion

1. Motion in a straight line

Let us observe the following examples- the motion of a sprinter in a 100 meters race, the motion of a fruit falling from a tree, the motion of a bullet fired from a gun, the speed of a carom coin or that of the striker before it strikes the board in a game of carom, the speed of soldiers doing march-past.

The motion, which is in a straight line, is known as straight-line motion.

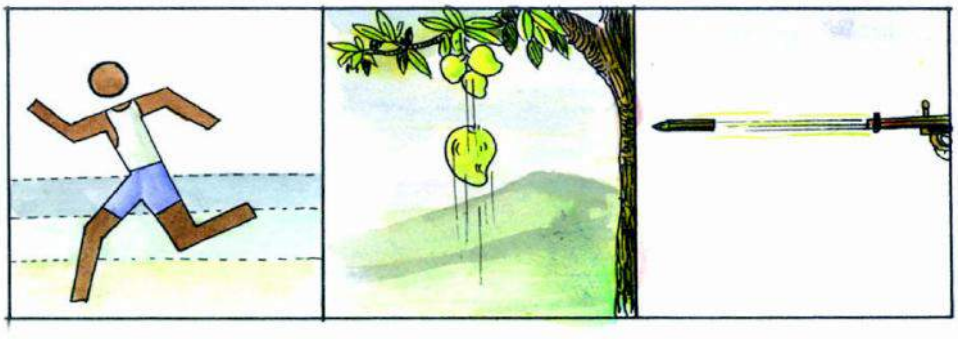


Figure 10.2 Examples of straight-line motion.

2. Circular Motion

Let us look at the bodies moving in a circular path. An oxen moving the pressmill (Kolhu), a stone tied to a string being whirled around, a child sitting in a merry go round etc are moving in a circular path around a centre. These are examples of circular motion.

Figure 10.3 Examples of Circular Motion

3. Rotational Motion

Observe a rotating top. What kind of motion is the top undergoing? The motion of the top is known as rotational motion (fig. 10.4).

Figure 10.4 Rotating Top

In rotational motion the whole body rotates about its own axis. The potter's wheel, a spinning top, a fan in motion and the motion of the earth on its own axis are examples of rotational motion. In spinning motion the object moves around its own axis whereas in revolving motion the object moves around an axis outside the object. For example, the motion of the fan is spinning motion while the motion of a point on the blades of a fan is revolving motion.

Identify the kind of motion being shown by the various objects given in table 10.2

TABLE 10.2

S. No.	Name of objects	Kind of motion (Circular/Rotational)
1.	The tip of the needle of a clock	----------
2.	The needle of a clock	----------
3.	A fan going around	----------
4.	A point on the blade on a rotating fan	----------
5.	The potter's wheel	----------
6.	The wheels of a bullock cart	----------
7.	The earth going around in its orbit	----------
8.	A spinning top	----------
9.	A child sitting on a merry go round	----------
10.	A motorcyclist going around in a circular cage in a circus.	----------

4. Oscillatory Motion

ACTIVITY 1

Take a one-metre long string. Attach a small stone at one end and hang the other end from a pivot. Pull the stone to a side and then leave it. Observe what happens? The piece of stone starts to move back and forth periodically across the central position. This kind of motion is known as oscillatory motion (Fig. 10.5 a).

There are many examples of this motion, a child swinging on a swing, the motion of a bob suspended from a spring, the motion of the pendulum in a wall clock, the motion of a bell hung in a temple etc.(Fig-10.5 b).

(a) Motion of a stone suspended from a pivot. (b) The motion of a bell hung in a temple

Figure 10.5 Oscillation

The oscillatory motion of a piece of stone (pendulum) completes its one oscillation by moving from its mean position 'O' to right extreme position 'A' then from 'A' to left extreme position 'B' and finally from 'B' to mean position 'O'. The time taken by the pendulum to complete one oscillation is called its time period. Again we can calculate the time taken for one oscillation (time period) by calculating the time taken for 20 complete oscillations.

5. Periodic and Non-periodic Motion

You must have seen a sprinter running on a circular track and also the motion of the second's needle in a clock. What is the difference in their motion? While going around a circular track, the sprinter takes different time to complete the round because sometimes he runs fast and sometimes he is slower. But the second's needle takes exactly one second each time it completes one round. This means it repeats its motion after a fixed interval of time. The motion of the second's needle of the clock is periodic while the motion of the sprinter is non-periodic. The

motion of earth around the sun, the motion of pendulum of the clock, the motion of a mass on the spring etc are periodic while the to and fro motion of hands and legs, our heart beat, motion of our lungs during breathing etc. are examples of non-periodic motion.

The motion, which repeats itself in a fixed interval of time, is called periodic motion and the motion, which takes different intervals of time to repeat itself, is called non-periodic motion.

Many motions at the same time

There are many instances in which an object executes more than one kind of motion. For example-

1. Motion of a cycle

In this, the forward motion of the cycle is a straight-line motion; the motion of pedal and the wheel is rotational while the motion of cycle's rim is circular.

2. Sewing Machine

The motion of the handle is circular and the motion of the needle is oscillatory.

ANSWER THESE

1. What do you understand by the state of rest and motion?
2. What kind of motion does a stone released from a catapult show?
3. What kind of motion does the wheel of a car in motion show?
4. The motion of the needle of a clock is not oscillatory, but is periodic. Explain?
5. Write down the different kinds of motion and give one example for each of them?

10.3 Speed

You save time when you travel by bus, cycle or a scooter to go to a school ten kilometre away from your home instead of going on foot. It can also be said that going on foot is slow motion, while the motion of a cycle, scooter or bus is much faster in comparison. To compare these we find out the distance travelled in a unit time, this is known as speed.

$$\text{Speed} = \frac{\text{Distance travelled}}{\text{Time taken}}$$

If you complete 500 metre in 50 second then,

$$\text{Speed} = \frac{500 \text{ metre}}{50 \text{ second}} = 10 \text{ metre/second}$$

The SI unit of speed is meter/second.

10.4 Uniform and Non uniform motion

Observe the figures 10.6 (a) and 10.6 (b) carefully and tell the difference between the motion of the car and the aeroplane.

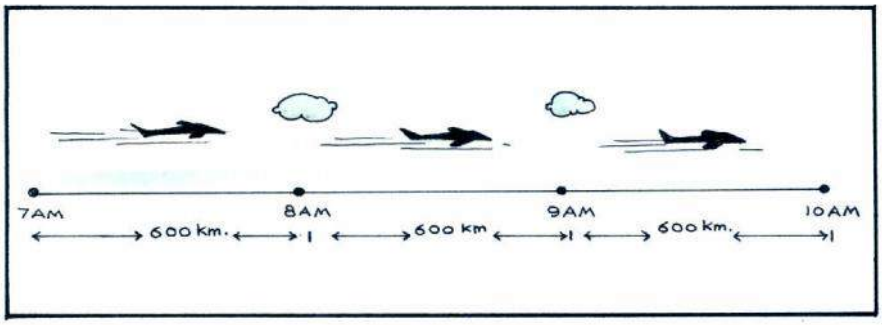


Figure 10.6 (a) Uniform motion

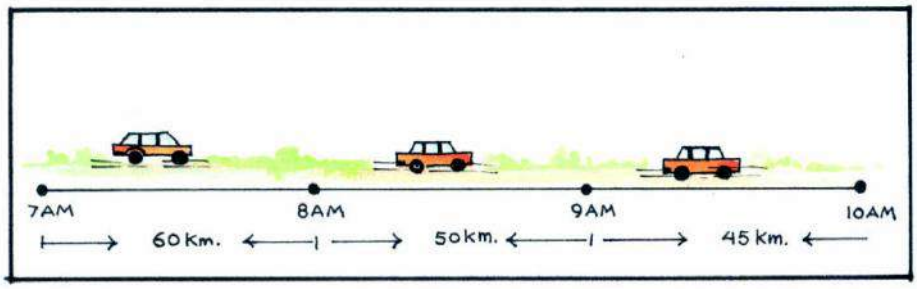


Figure 10.6 (b) Non-uniform motion

The aeroplane is travelling the same distance in each hour while the car is travelling different distances each hour. The motion of the aeroplane is uniform and the motion of the car is non-uniform.

If an object travels equal distances in equal intervals of time then it is called uniform motion. On the contrary if an object travels unequal distances in equal intervals of time then it is called non uniform motion.

ANSWER THESE

1. What is the SI unit of speed?
2. Explain the difference between uniform and non-uniform motion?
3. A cyclist travels a distance of 100 metre in 10 second. Another cyclist covers a distance of 300 metre in 25 second. Which cyclist has more speed?
4. If the speed of a train is 80 kilometre per hour, then find out the distance covered by the train in one minute?

10.5. Force

What do you do to move a heavy trunk and to open or close a door? You either pull it or push it. In the same way, to move objects in daily life one has to either pull or push them. The action of pulling or pushing is known as force.

The SI unit of force is Newton. Which has been named after the famous scientist Isaac Newton. This unit is labeled as 'N'.

10.5.1 Effect of Force

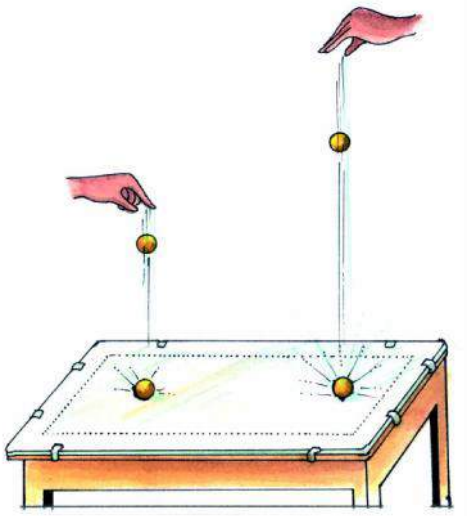
1. Change in Speed

If you want to move a football from a state of rest, what will you do? Without doubt you will apply force. A force also has to be applied to change the speed of a moving ball. If a force is applied in the direction of the motion of the body then its speed increases. The speed decreases if the force is applied in a direction opposite to the motion. Due to this reason one applies more force on the pedal to increase the speed of the cycle and to stop it one uses brakes that apply a force opposite to the direction of the motion.

A fruit falls down after being separated from the tree. Which force is responsible for it? The earth pulls every thing towards itself, this force is known as 'force of gravitation'. This gravitational force is the weight of that body.

ACTIVITY 2

Drop a glass marble from a height of 50 cm on a table and listen to the sound of collision between the table and the glass marble. Listen to the sound of collision again when the same glass marble is dropped from a height of 100 cm (fig.10.7). This sound is more than in the previous case because the glass marble requires more time to fall from more greater height and as a result there is a greater increase in its speed due to the action of gravitational force for a longer time.



Picture 10.7 Change in speed because of force

Isaac Newton

Isaac Newton was a famous physicist and mathematician. His contribution to science and technology has made him one of the greatest scientists of modern times. One day he was sitting under an apple tree in a garden. Accidentally an apple fell on his head. Newton started thinking, why did the apple fall down? Why did it not go upward? Is it due to the attraction of the earth? What is this force of attraction? When this force can effect an apple, why does it not affect the moon. These questions in the mind of Newton led to the Universal Law of Gravitation.

2. Change in the direction of motion

What happens when a goalkeeper pushes a ball coming to his direction in a game of football? The direction of motion of the football is changed (fig. 10.8). In the same way one has seen the change in the direction of motion of the ball, when the bat hits it. Therefore the direction of motion can be changed on the application of force.

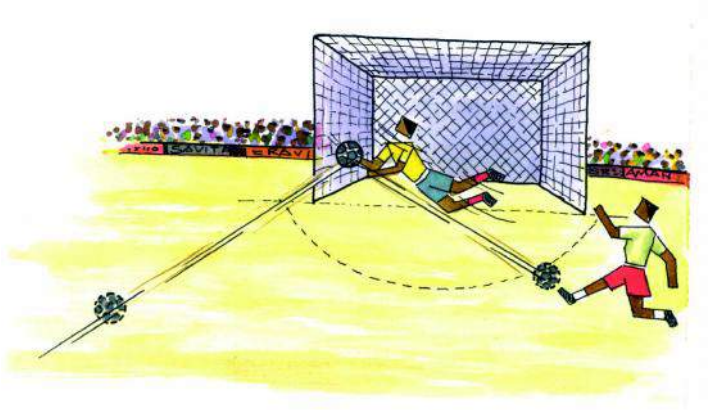


Figure 10.8 Change in the direction of motion by force.

3. Change in shape and size

Take a rubber ball and press it. Observe the changes. The ball is compressed and its shape changes. In the same way you have seen that small rounded moulds of kneaded flour turns into thin chapati on rolling them. These all are possible due to the action of force. Therefore, force can change the shape or size of the object. Shown below in figure 10.9 are examples of change in shape or size of some objects.

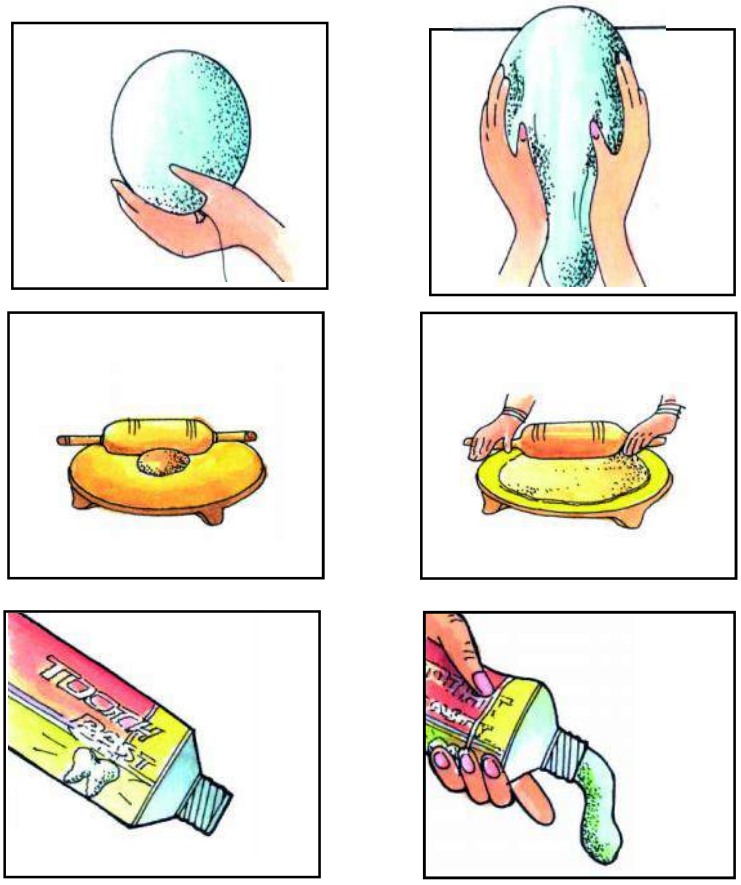


Figure 10.9 Change in shape or size of objects due to force

ANSWER THESE

1. What is the SI unit of force?
2. What is the effect on the motion of a ball when a player in cricket hits it with a bat?
3. What happens to the speed of a moving train when brakes are applied?
4. What happens to the shape of a tube of cream when it is pressed?
5. List five objects which changes shape when a force is applied on them?

10.6 Kinds of force

Different forces can be classified as follows -

1. Mechanical force

A force is required to pull, push or lift an object. Humans or animals apply this force by their muscles, this is known as a mechanical force. The force involved in pulling of bullock carts by bullocks, hitting an object by a hammer, lifting a bucket full of water, compressing a rubber ball in hand etc are examples of mechanical force. Contact forces - In this type of force, it is necessary for the object to come in contact with the body. Therefore it is known as contact force.

2. Force of gravitation

Throw a piece of stone upwards. You will see that after some time the stone comes back. Why does this happen? This is due to the force of gravitation of the earth. The flow of water down an incline and falling of objects to earth from heights are due to the force of gravitation applied on them by the earth. The attractive force between any two bodies in the universe is known as force of gravity. Due to this force the earth goes round the sun and the moon goes round the earth.

3. Magnetic force

ACTIVITY 3

Put some iron fillings on the table. Bring a magnet near them. See what happens? The iron filings are attracted towards the magnet and get glued to it (Fig.10.10 a). Besides iron, objects made of nickel and cobalt too are attracted towards the magnet. Such substances are known as magnetic substances.

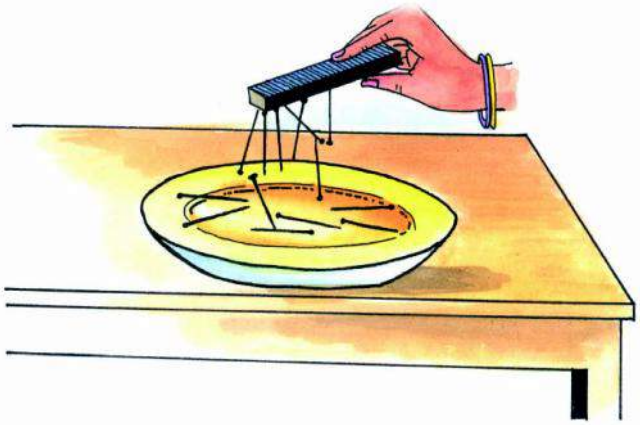


Figure 10.10 (a) A magnet attracting iron nails

ACTIVITY 4

Take two bar magnets. Place one of them on the table. Bring one end of the other bar magnet to any one end of the bar magnet on the table. Now bring the same end of the second magnet near the other end of the bar magnet on the table. Observe what happens.In one situation attraction takes place while repulsion is seen in the other.

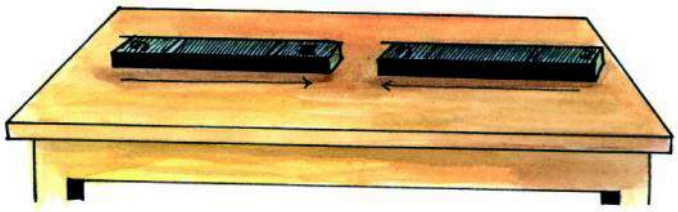


Figure 10.10 (b) Magnetic Force

The attractive and repulsive force applied by the magnet is known as the magnetic force.

Non contact forces - Contact of the body with the object is not necessary like in gravitational and magnetic force, so these forces are known as noncontact forces .

4. Electrostatic force

ACTIVITY 5

Comb dry hair using a plastic comb and bring it near small pieces of paper. You will see that the comb is attracting paper pieces. In the same way if a glass rod wiped with a piece of silk is brought near small pieces of paper, it attracts paper pieces too.

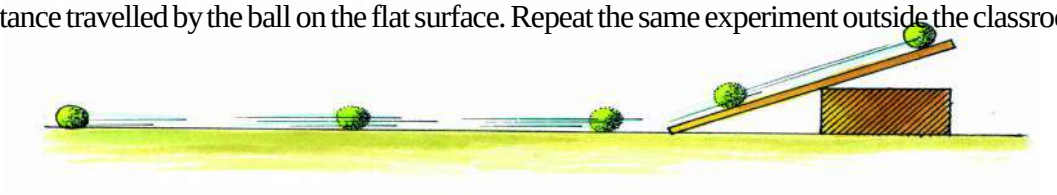
Have you ever wondered, why does this happen? This is because of rubbing, charge develops in objects or you can say that bodies get charged and start to attract small objects. In the same way put some grains of mustard in a plastic plate. Now if they are left free on the plate after rubbing them, they try to move away from each other but try to remain glued to the plastic plate. This force of attraction or repulsion is known as the electrostatic force.

5. Frictional Force

ACTIVITY 6

Take a plank of wood. Support it with the help of a brick (Fig. 10.11).

Now place a small ball on the upper portion of the plank and release it. Measure the distance travelled by the ball on the flat surface. Repeat the same experiment outside the classroom



(a) Smooth surface

(b) Rough surface

Figure 10.11 Frictional Force

in a field. Is the distance travelled by the body, in both cases the same? You will find that the distances are different in the two cases.

In fact due to the roughness of the surface of the ball and the ground, a retarding force acts opposite to the motion of the ball. This retarding force is known as the force of friction. If the surface is smooth the frictional force is less. Due to friction, the sole of shoes, components of machines or the wheels of vehicles get worn out. On the other hand, there are advantages of the frictional force also. It is due to friction that we are able to walk on the surface of the earth, light a match stick, make ropes and write with a pen or pencil on paper.

In table 10.3 fill in the type of force applicable in each of the actions

TABLE 10.3

S. No.	Actions	Name of force
1.	Lifting a sack full of rice grains	----------
2.	Water falling from a stream	----------
3.	Body hair standing up after rubbing with a mosquito net	----------
4.	Separation of iron pieces from waste using a magnet	----------
5.	The wearing of wheels of a vehicle	----------
6.	Striking the ball with a bat in cricket	----------
7.	Rubbing of palms	----------
8.	Water falling in a bucket	----------

ANSWER THESE

1. List any five examples of force.
2. Give three examples of electrostatic force.
3. Why does the tyre of a cycle wear out?

10.7. Pressure

Using a sharp tipped pin we may pierce a large number of paper kept together, but it is not easy to pierce the same using a blunt pin. Why is this so? In the first case the area of the tip of pin is small. Therefore the action of force is on a small area. In the second case the area of the tip of the pin is more. Therefore the action of force is on a larger area. It is clear that, when the area is small the action of force is felt more strongly. The action of force is measured as pressure.

The force applied on a unit area is known as pressure.

The SI unit of pressure is Newton/metre^2, which is denoted as N/m^2.

This unit is known as Pascal (Pa). 1000 times of this is known as kilo Pascal (kPa).

Let's do a related activity.

ACTIVITY 7

Take two soft wooden boards. Place two nails between them, and apply force as shown in the figure 10.12. You will observe that the nail A penetrates the board above it, while nail B penetrates the board below it. Why did it happens, discuss it in the class

Fig. 10.12. The action of pressure

10.8 Pressure on fluids

The substances that flow are called fluids. Gases and liquids are both fluids. The air in the atmosphere exerts pressure on all sides. The pressure exerted by the atmosphere is known as atmospheric pressure. This pressure is about 100 kilo pascal (100 kPa).

ACTIVITY 8

Take an airtight container made up of thin sheets. Open the lid and fill it with water partially. Heat it such that the water boils and the container is filled up with water vapour. Now replace the lid and let it cool. You will observe that the container gets compressed from all sides. What is the reason for this? Before heating, the air inside and outside the container was exerting an equal pressure on the walls of the container. After boiling the vapour took up the space of the air. On cooling most of the vapour changed into water. As a result the pressure inside the container became less than the atmospheric pressure. Therefore, the container was pressed inside and got squashed.

The amount of air decreases as we go upwards in the atmosphere. Due to this the atmospheric pressure decreases. This is the reason, why a person feels restless on the top of a

high mountain. Sometimes blood also oozes out from the nose. On the surface of earth the blood flowing in our veins, exerts a pressure on the walls of the veins, that is equal to the atmospheric pressure. On reaching heights the atmospheric pressure decreases but blood pressure increases. Blood oozes out of the veins because the pressure exerted by the blood makes the veins burst.

10.9 Pressure of liquids

A liquid exerts pressure on the walls and the surface of the container in which it is placed. This pressure on the walls increases with depth.

ACTIVITY 9

Take a container made of tin. Use a nail to make a hole in its wall. Now fill the container with water. Water oozes out of the hole. Put your finger on the hole. Observe what happens? You will feel a force being exerted on your finger. (fig.10.13).

Now fill the hole on the wall of container by wax and make a hole on the bottom of the container. Fill the container with water again. Water starts to ooze from the hole. Put your finger

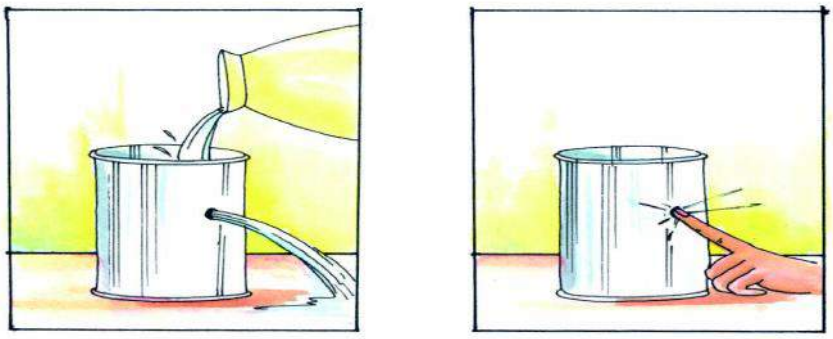


Fig. 10.13. Pressure of a liquid.

on this hole. You will again feel a force on your finger. This shows that the pressure of liquid is exerted in all directions.

ACTIVITY 10

Take a U tube having an arm length of approximately 30 cm. As shown in figure 10.14, place this tube on a wooden plank. Fill some water in the tube. You will see that water remains at the same level in both arms of the U tube. Attach a 20 centimetre rubber tube to one arm of the U tube. Slowly blow some air into the rubber tube. You will see that the water level in that

arm of the U tube, into which air is blown, goes down due to increase in pressure from the air blown in. Now using the rubber tube suck some air out of the tube slowly. Why does the level of air in that arm of the U tube rise? This experiment shows the principle of working of a manometer (pressure gauge). This manometer is an instrument that is used to measure pressure differences.

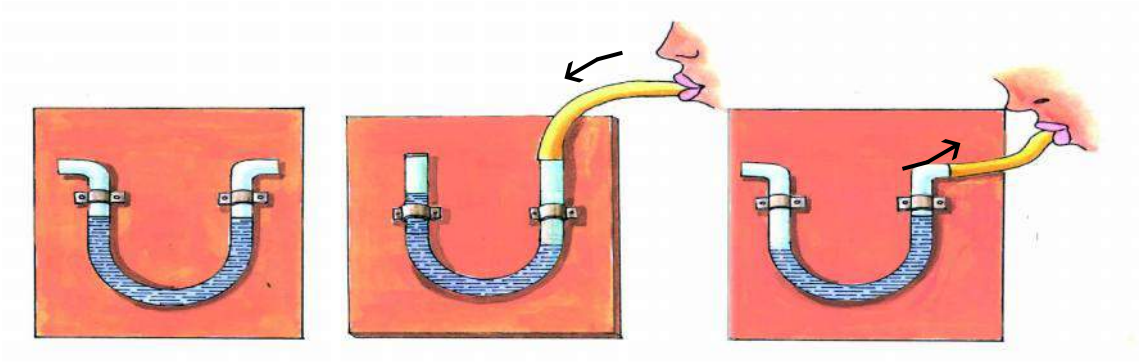


Fig. 10.14 Principle of a manometer

Water exerts pressure inside the sea. As we move to greater depths inside the sea, the pressure increases. This is the reason for divers who go deep inside the sea to wear special suits.

A barometer measures atmospheric pressure. A fixed pressure is maintained in the tyres of vehicles. An instrument, which measures tyre pressure, is used in shops that fill air and fix punctures of tyres.

The air pressure required in tyres of some vehicles is as follows.

Scooter	-	140-170 kPa
Car	-	110-190 kPa
Truck	-	450-530 kPa
Atmospheric Pressure	-	100 kPa

ANSWER THESE

1. What is the relation between force and pressure?
2. What is motion in a straight line ? Give examples.
3. What is the SI unit of pressure?
4. What is the effect of increase in height on atmospheric pressure?
5. Which instrument is used for measuring pressure?

WE HAVE LEARNT

- Objects around us can be in a state of rest or motion.
- Motion can be straight-line, circular, rotational, oscillatory, periodic or non-periodic.
- A straight-line motion can be uniform or non-uniform
- The distance traversed by a body or an object in unit time is called its speed.
- The SI unit of speed is metre/second.
- The push or pull applied to any body is called force
- The speed of a body can be changed by the application of a force.
- Using force can change the shape and size of a body.
- The SI unit of force is Newton.
- Force can be classified into mechanical, gravitational, magnetic, electrostatic and frictional force.
- The force exerted on a unit area is called pressure.
- Fluids (liquids and gases) also exert pressure.
- The SI unit of pressure is Newton/metre^2
- Atmospheric pressure is measured using an ordinary barometer.
- A fluid exerts pressure in all directions. The pressure increases with depth.

EXERCISE

1. Choose the correct alternative —

1. A motion which repeats itself in a fixed interval of time is known as

   a. non-periodic motion b. periodic motion

   c. rotational motion d. straight-line motion

2. When a force is applied opposite to the direction of motion of a moving object, its speed-

   a. increases b. increase or decrease

   c. decreases d. no change

3. The force of attraction between any two bodies is known as -

a. electrostatic force b. magnetic force

c. gravitational force d. mechanical force

4. Which force is responsible for walking -

a. magnetic force b. Electric force

c. mechanical force d. frictional force

5. At what level would a swimmer experience more pressure-

a. three-fourth depth b. half depth

c. on the lower surface d. on the upper surface.

2. Match the following

A	B
1. Force	pascal
2. An electric pole	metre/second
3. Pressure	newton
4. Speed	body in motion
5. A flying bird	a static object.

3. Fill up the blanks with appropriate words/phrases -

1. Force is either push or _____ .
2. Newton/metre^2 is the unit of _____ .
3. The earth pulls a body thrown from a height towards itself due to the _____ force.
4. _____ force is responsible for wearing out of cycle tyres.
5. 1 atmospheric pressure = _____ kilo pascal.

4. Answer the following questions -

1. Which kind of force do the animals use during running?
2. What is the speed of the hour needle of a wall clock?

3. What kind of motion do the legs of a tailor show while he is sewing clothes on a machine?
4. Shatabdi express traverses 1350 km in 15 hours. Compute the speed of the Shatabdi express?
5. Spikes are put on the soles of the shoes of the players and the sprinters. Why?
6. An air filled balloon, on being rubbed with dried hair sticks to a wall. Why?
7. While wearing or taking out clothes made of terylene during dry weather our body hair stand erect. Which force is responsible for this?
8. Which force is utilized during chewing of food?
9. Why do divers wear special kind of suits?
10. Why is it difficult to cut fruits using a blunt knife?

THINGS TO DO

1. Observe different activities in your daily life and complete the table shown below.

S. No.	Event	Force that is acting	The effect of force
1.	A rolling ball	Frictional force	Ball comes to rest
2.			
3.			
4.			

11. WORK, ENERGY AND MACHINES

In daily life various meanings are assigned to the word 'work'. Let us discuss these statements. "By writing *Geetanjali* Rabindranath Tagore did an unparalleled work" or "I work in a factory". The meaning assigned to the word –work in the above sentences, cannot be taken as the meaning of work in the language of science. The meaning of work is to apply a force on a body and move it from one point to another or to displace it. A person applies force on a cart and takes the sacks filled with grains on the cart from one place to another. In this process the person performs work.

If there is no displacement in the cart, after the application of force, then it will mean that the cart-puller has not done any work. Therefore, it is clear that for work displacement on application of force is necessary.

11.1 Work and Energy

A person carrying a sack full of potatoes up the stairs is doing work. The amount of work done by the person not only depends on the weight of potato sack, but also upon the height to which he carries the weight. The amount of work done in putting this sack full of potatoes from the surface to a table 1 metre high will be double the work done in putting the same sack on a stool half a metre high. In the same way the amount of work done in lifting a 20 kg sack to 1 metre will be double the work done in lifting a 10 kg to the same height. Thus, we see that both force and displacement are involved in the calculation of work. In fact "The amount of work done on a body is the product of the force applied and the displacement produced in the body in the direction of the force applied". Thus

Work done by the body = Force × distance travelled in the direction of the force

In **System International (SI)** the unit of work is Joule. It is denoted by **J.**

If 110 Newton force is applied to a body to make it move to 9 metres then

Work = 110 N $\times$ 9 m

Work = 990 Newton metre

Work = 990 Joules

We feel tired after playing or working for a long time. If we don't take food on some day, then there is a decrease in the capacity of the body to do work. After taking food, this capacity again increases. Why is that? In fact intake of food provides energy, due to which the capacity to do work increases. The ability to do work is known as energy. The SI unit of energy is also Joule the same as work.

11.2 Different kinds of energy

All the changes we see around us in our daily life, involve work due to different kinds of energy. In these not only is work performed but there is also conversion of energy from one form to another. Let us study different kinds of energy.

ACTIVITY 1

Support a wooden plank on a stack of books to make an inclined plane. Place a matchbox near the foot of the inclined plane roll down. Now place a torch cell at different heights of the inclined plane (A, B, C) and allow it to roll down (Fig. 11.1). The cell rolls down the plane and pushes the matchbox to a certain distance. You will notice that when the cell rolls from a greater height, it displaces the matchbox to a greater distance. Therefore, there is an increase in the stored energy of a body on an increase in height.

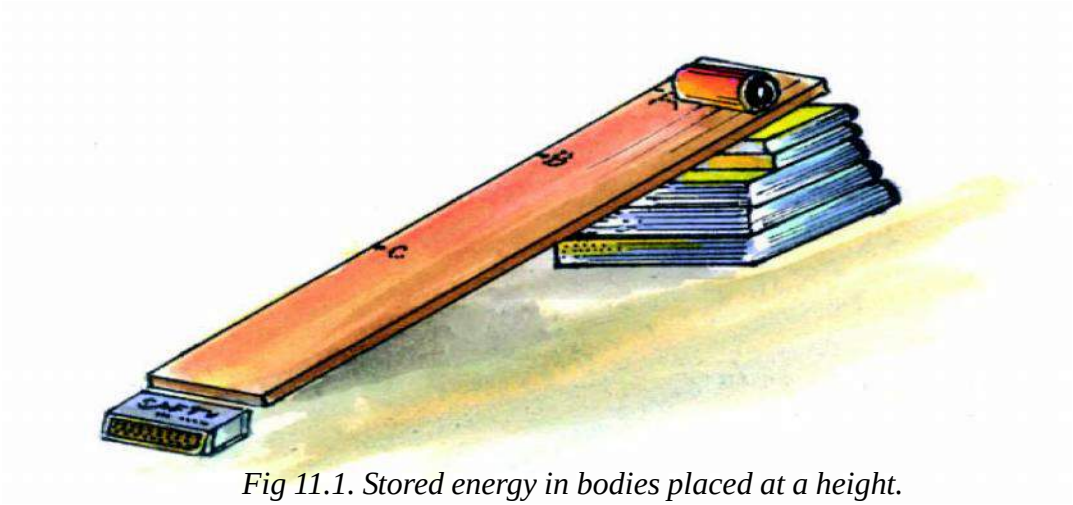


Fig 11.1. Stored energy in bodies placed at a height.

1. Mechanical Energy

The energy in a body by virtue of its position or its motion is known as the mechanical energy of the body. In a game of carom a fast moving striker spreads the coins (gotties), the flowing water of a river causes rocks to move, strong gust of wind blows a boat with sails. In all these the work has been performed due to kinetic energy.

"The energy in a body by virtue of its motion is known as the kinetic energy of the body"

If a brick is placed on a piece of earthen pot, then it does not have enough energy to break the piece of the pot. But, if the same brick falls on the same piece of earthen pot from a

height, then it breaks the piece of earthen pot into a large number of pieces and these pieces scatter in many directions. In the same way the extended rubber of a catapult can throw a stone to a great distance. In these examples, the brick on an height and the stone on an extended catapult posses potential energy.

"The energy in a body by virtue of its position is known as the potential energy of the body".

The total mechanical energy of a body is the sum of its potential and kinetic energy.

Total mechanical energy of the body = Kinetic energy of the body + Potential energy of the body

An aeroplane in flight posseses both kinetic and potential energies. The sum of both these kinds of energy is the total mechanical energy of the aeroplane.

2. Chemical energy

The energy stored in fuel-wood, coal, diesel, petrol, cooking gas is known as chemical energy. The chemical energy stored in a torch cell produces electrical energy, which lights up the bulb. Whatever we take in our meals, the chemical energy stored in food transforms into our muscular energy that provides us energy to do work.

3. Thermal energy

Heat is a form of energy; therefore it also has ability to do work. For example the lid of a kettle rises when water is boiled in the kettle. Heat converts water into steam. The lid moves due to the energy of the steam. James Watt had used this principle to invent the steam engine. In this example, heat energy has been converted to mechanical energy. In the same way, by rubbing two stones or rubbing the two palms one can convert mechanical energy into thermal energy.

4. Light energy

Light is also a form of energy, due to which we are able to see things around us. We have seen many objects emitting light on being heated. Light causes a chemical change in a photographic film. By using a photocell, light energy can be converted into electrical energy. In hilly regions where it is not possible to transmit electricity, photocell can be used to obtain electrical energy from solar energy. This kind of cell is known as solar cell. These kinds of cells are used as source of electricity in satellites.

5. Sound energy

Sound is also a kind of energy. Sound is produced by vibration of bodies. When the bell of your school is rung, on touching it one can notice that it is vibrating. This vibration produces vibrations in the air and the vibrating air causes the same vibration in our eardrums. In the end, these vibrations send signals to the brain through the nerves. This causes the sensation of sound. Thus sound is a kind of energy, which has the ability to cause motion in the particles of the medium and the eardrums. This is the reason why some times the windows and doors of building etc. start to vibrate and rattle when there is a loud sound from the thundering of clouds or crackers.

6. Electric energy

In our daily life electrical energy is used the most often. Different equipments or machines can be used to convert electric energy into different kinds of energy. Electric heater, electric bulb or tube and electric press, converts electrical energy into heat and light energy. The equipment which converts electric energy into sound energy is - electric bell, motor horn, siren of a factory etc. Some equipment which transforms electric energy into kinetic energy is– electric engine, flourmill, fodder cutting machines etc. An electric lift and an electric pump convert electric energy to potential energy. While radio converts electric energy into sound energy, a television converts electric energy into sound as well as light energies. These examples clearly bring out the importance of electric energy.

ANSWER THESE

1. What is work according to science?
2. Write two situations where no work is done even if a force is applied.
3. The units of work and energy are the same. Why?
4. Write two examples each of work done by heat energy, mechanical energy and electric energy.
5. Compute the work done if a five newton force is applied to move a table by two metres.

11.3 Energy conservation

Energy can neither be created nor destroyed. Energy can be converted from one form to another. This is known as principle of energy conservation. The scientist Hehlmoltz formulated this principle. If all kinds of energies are considered then the sum of all energy in the universe remains a constant. The conversion of solar energy is shown in Figure 11.2.

Fig. 11.2 Energy Conservation

Let us consider certain situations of our daily life: -

When a candle is lit, then the chemical energy stored in it transforms into light and heat energy.

When we climb stairs, we carry our weight to a certain height. The energy required for doing this comes from the stored chemical energy (food) in our body, which is converted into potential energy during the climb.

In hydropower stations, the water of rivers is collected in large dams at great heights. The potential energy of water is converted to kinetic energy when it falls from such heights. The falling water provides mechanical energy to the turbine placed in its path, which further converts into the electric energy of the generator. The whole process can be understood as follows.

Potential energy of the water in the dam → Kinetic energy of the flowing water → Mechanical energy of the turbine → Electric energy of the generator.

Conversion of form of energy also utilises energy in ways that are not useful. For example when a bulb is lit, while light is useful, energy is wasted in the form of heat. In the same way when work is being performed by instruments, a part of energy given to the machine is converted into sound and heat energy due to friction between different parts of the machine. This is also loss of energy. Efforts are being made in science and technology to reduce this wasteful expenditure of energy so that most of the energy fed into instruments may be utilized in doing useful work. This is the reason why oil or grease is put in parts of a cycle to reduce friction. Putting oil lubricates moving parts of electric pump, sewing machine, bullock cart and other machines.

Table 11.1

Name the kind of energy that is converted to another kind of energy in the various instruments mentioned in the table below?

S. No.	Name of instrument	Transformation	
		Energy converts from	Energy converts to
1.	Electric Iron (Press)	----------	----------
2.	Dynamo	----------	----------
3.	Photocell	----------	----------
4.	Electric Pump	----------	----------
5.	A winded clock	----------	----------
6.	Cell	----------	----------
7.	Catapult	----------	----------
8.	Hydroelectric plant	----------	----------

11.4 Machines

We perform work when we push, pull or lift an object. Force is required to do work. There is certain work, that can be done by applying less amount of force. Work like opening the lid of a soft drink bottle, loading a drum full of oil on a truck, changing the wheels of a truck are not easy jobs. To do this type of work we make use of machines. It is necessary to understand here that these machines do not do work by themselves. Energy must be provided to obtain work from these machines. With the help of machines work can be done easily.

Simple machines

We use different kind of machines in our daily life, in which knife, screws, forceps, pulley are important.

Some examples of simple machines are shown in figure 11.3.

Fig. 11.3 Some simple machines

We also use some complex machines in our daily life. These machines are made up of two or more simple machines. For example, cycle, sewing machine, tractor etc (fig.11.4).

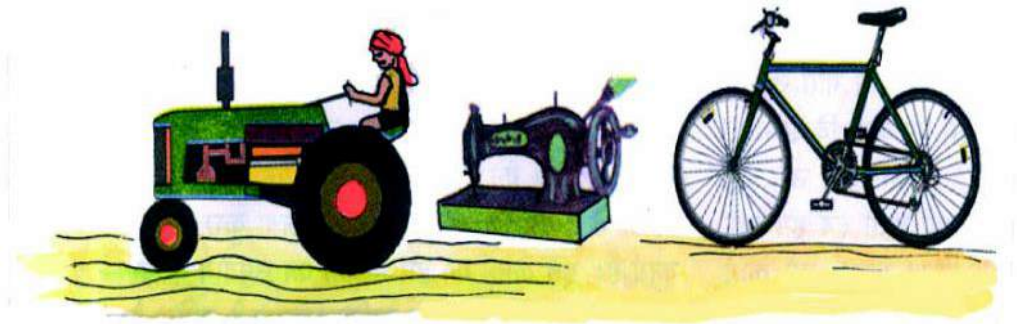


Fig. 11.4 Some complex machines

Machines are used for the following purposes-

1. To apply force at a convenient point
2. To change the direction of force in the desired manner
3. To lift a heavy weight by the application of smaller force.
4. To increase the speed.

"Elements or machines that can increase the effect of force or change the direction of force or do both are simple machines". Simple machines are of six kinds (Fig. 11.5)

1. Lever 2. Inclined Plane
3. Wedge 4. Screw
5. Pulley
6. Wheel and axle

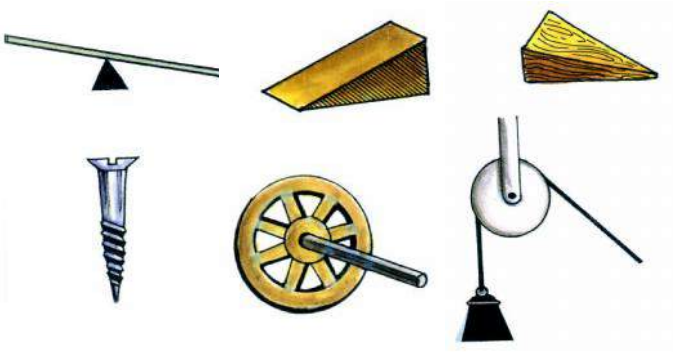


Fig. 11.5 Six types of simple machines

1. Lever

Which of the methods shown in the figure below (Fig. 11.6 a, b) is more appropriate for lifting or removing a weight?

(a) (b)

Fig 11.6 Two methods of lifting weight

According to figure 11.6 (a) three persons are required to lift and invert the box, while according to figure 11.6 (b) by using a strong rod or spade and a support only one person can lift and invert the box alone. Here the strong rod or spade is a lever.

In the same way if the lid of a box is tightly fixed, how will you remove the lid? Figure 11.7 shows removal of the lid by using a spoon. Here the spoon acts as a lever.

Fig. 11.7 Spoon in the form of a lever

A lever is a straight or curved rod, which can be supported at a convenient point and can move independently around that point. This point is known as fulcrum. The object that is required to be lifted is known as weight or load. The force, which is applied on the lever, is known as effort (Aayas). In figure 11.8 Fulcrum, weight or load and effort (Aayas) are denoted by F, L and E respectively.

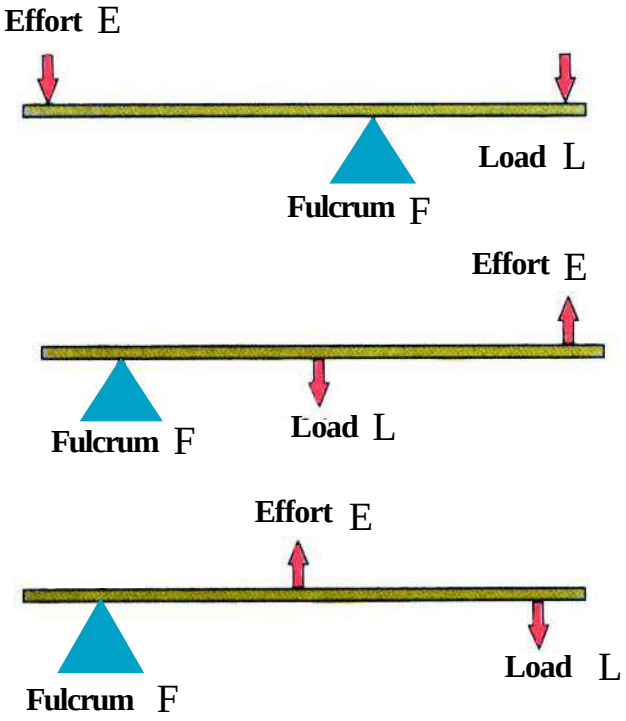


Fig. 11.8 Three kinds of lever

Kinds of lever

There are three kinds of lever. They are shown in figure 11.8.

Lever of the First kind.

In this kind of lever the fulcrum is in between the load and the effort (aayas). Examples- scissors, plier, sea-saw (Fig. 11.9 a, b, c).

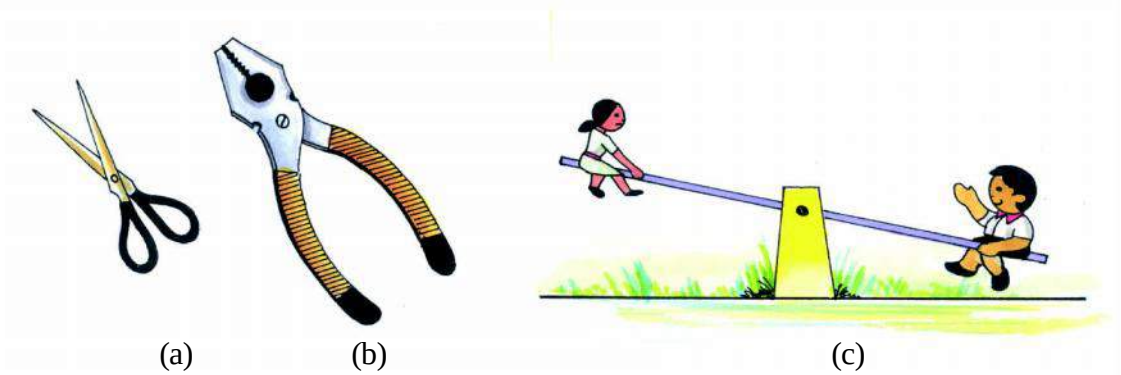


Fig. 11.9 Lever of the First kind

Lever of the Second kind

In this kind of lever the load is in between the fulcrum and the effort (aayas). Examples- cart, betel-nut cutter (sarotta), bottle opener of cold drink bottles etc (Fig. 11.10).

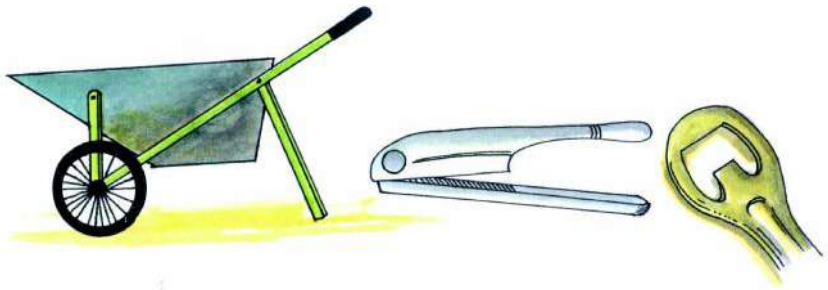


Fig. 11.10 Lever of the Second kind

Lever of the Third kind

In this kind of lever the effort (aayas) is in between the load and the fulcrum. Examples- forceps, fishing rod, spade etc (Fig. 11.11).

Fig. 11.11 Lever of the Third kind

ARCHIMEDES

Archimedes was a great Greek scientist and mathematician. He was born in Sicily in 287 B.C. He became world famous for his work in geometry and mechanics. His knowledge about lever, pulley, wheel and axle helped the Greek army in their war against the Romans. He had realized the power of lever and had said that if he is given a place away from earth in space where he can stand, and then using a lever he can remove the

earth from its position. He sprayed big boulders on the enemy's army by using lever supported against a wall. He caused lot of trouble for the enemy when he collected solar energy using concave mirrors and burnt their submarines. Archimedes discovered the principle of floatation and examined the purity of the gold in the crown of his friend who was also the king of Sicily.

ACTIVITY 2

Let us perform an activity to understand the principle of the lever of first kind. Suspend a 50 cm long scale using a thread from its mid point such that the scale is balanced horizontally. In the balanced position, the point where the thread is tied is the fulcrum. Now with a help of a small polythene and thread suspend a 20 gm weight to the left of fulcrum at a distance of 20 cm (Fig. 11.12).

On the opposite side i.e., on the right side suspend with the help of small polythene and thread a 20 gm weight such that the scale is again balanced. Note the distance on the scale.

Fig. 11.12 Principle of Lever of the first kind.

Now repeat this experiment twice by suspending at a distance of 20 cm on the left of fulcrum weights of 10 g and 5 g and suspending the 20 g weight on the right arm such that each time the scale is balanced. Note down your observations. Did you conclude the following-

Weight on the left of the fulcrum × distance of the weight from the fulcrum = Weight on the right of the fulcrum × distance of the weight from the fulcrum

You saw that to balance a 20 g weight kept near the fulcrum the lighter weight needs to be kept further away from the fulcrum. In the same way to balance a sea saw the heavier object needs to be kept near the fulcrum.

2. Inclined Plane

You must have seen many times an incline is made to raise a scooter or a truck to a height. A sliding board is used to raise a drum full of oil on to a truck or bullock cart (Fig. 11.13). The sliding board used here is known as an inclined plane. An incline plane is a strong and smooth plain plank which is placed making an angle with the horizontal.

a. Lifting straight *b. Raising using an inclined plane*

Fig. 11.13 Two methods to lift a drum full of oil on a truck

Which of the methods given in figures 11.13 (a) and (b) is appropriate to lift an oil filled drum on to a truck? Heavier objects, which are difficult to be lifted, can be easily raised using an inclined plane. The curvaceous roads in hilly region and the ramps to carry patients in hospitals are also examples of inclined planes (Fig. 11.14).

Fig. 11.14 (a) The curvy roads on hills

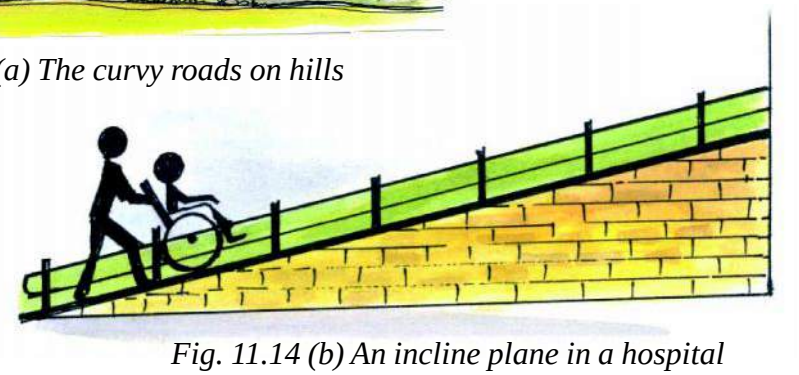


Fig. 11.14 (b) An incline plane in a hospital

ACTIVITY 3

Make use of books or bricks to raise up and make an incline plane from a sturdy board. Weigh a block of wood using a spring balance. Place the block of wood on the incline plane, suspend it with the hook of the spring balance and pull it upwards as shown in Fig. 11.15 and note the reading on scale of the spring balance scale.

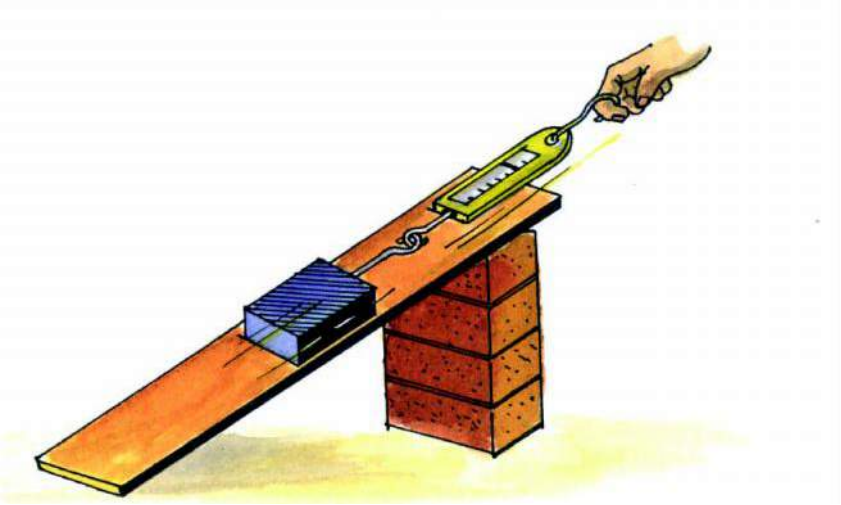


Fig. 11.15. Use of inclined plane

Repeat this experiment for different angles of the inclined plane and note the reading each time. To change the amount of angle, the height of the raised head of the inclined plane from the surface needs to be changed.

Table 11.2

S.No.	Height of the raised head of the inclined plane from the surface (in cm)	Weight of the block when suspended straight from the spring balance (in g)	Weight of the block when pulled by the spring balance on the inclined plane (in g)
1.			
2.			
3.			

On the basis of the above table answer the following-

1. Is the amount of force required to pull the weight upwards for all angles of the inclined plane the same?
2. When compared to the amount of force required to lift it straight upward, the force required to raise the object upwards using an inclined plane is smaller or larger?
3. How is the force required to raise the object upward using an inclined plane related to the angle of the inclined plane?

3. Wedge

This is a piece of wood or metal whose one head is wide while the other is pointed or sharp. This is used for cutting, tearing or separating two things glued to each other. Knife, axe, chisel needle etc are examples of wedge. In fact a wedge is made up of two inclined planes. The sharper the wedge the easier it is to cut or tear. Some examples of wedge are given in Fig. 11.16.

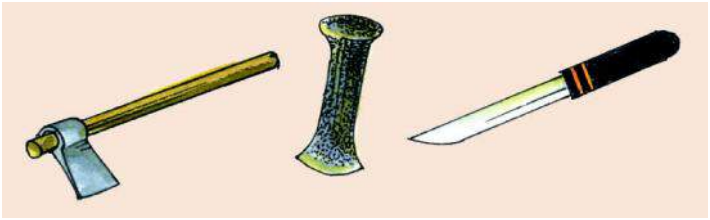


Figure 11.16 Examples of Wedge

4. Screw

You must have used nut and bolts. The bolt moves ahead by rotating on the nut. In the same way while opening and closing your pen for changing the refill. A screw is an inclined plane wound around a cylindrical pin. The jack used to lift vehicles is also a screw or a circular inclined plane. By using the screw single person can lift a vehicle.

ACTIVITY 4

Let us perform an experiment to relate an inclined plane to a screw. Cut a paper into a right angled triangle as shown in the figure (Fig. 11.17 a). The hypotenuse appears like an inclined plane, which is placed over the base and the perpendicular. Place a cylindrical pencil along the perpendicular side of the paper (Fig. 11.17 b). Now roll the paper on the pencil. You will observe that the paper makes a continuous spiral line over the pencil (Fig. 11.17 c). The pencil with paper wound on it is a model of a screw.

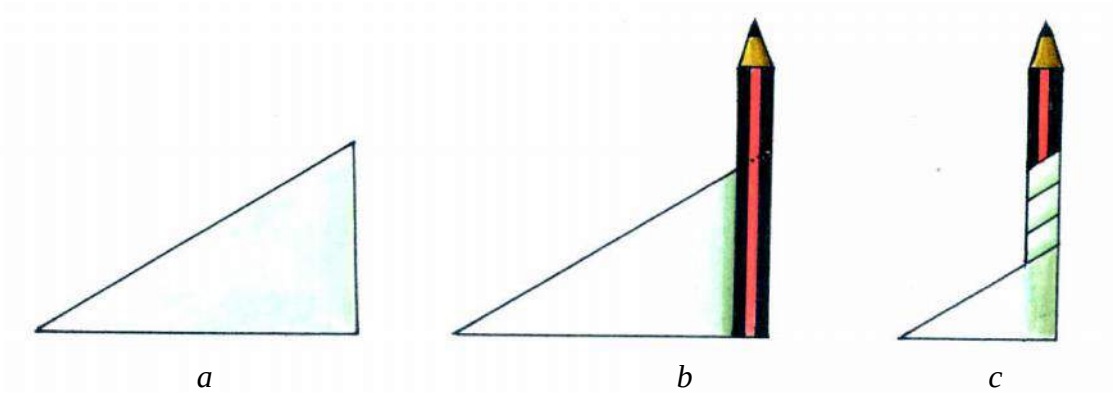


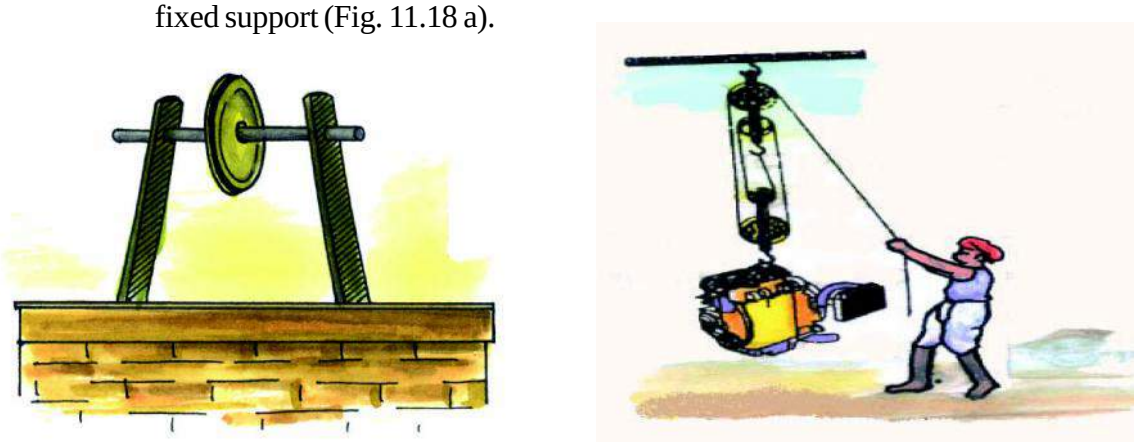
Fig. 11.17. Construction of the screw using an incline plane.

The spiral lines on the screw are known as threads and the distance between two successive threads is known as thread interval (Fig. 11.17 c). On moving the screw once it covers a distance equal to the thread interval. The amount of force required to displace a body by a distance through a screw is less than that required while displacing it straight.

5. Pulley

You must have seen the use of a pulley while taking out water from a well. This is a simple machine which changes the direction of applied force and makes our work easier. A pulley has the following parts: -

1. A circular disc or wheel made of wood or metal in whose circumference grooves have been made to place ropes.
2. Axle or nail on which the disc rotates.
3. A frame on which both ends of the axle are fixed. This frame is suspended from a fixed support (Fig. 11.18 a).



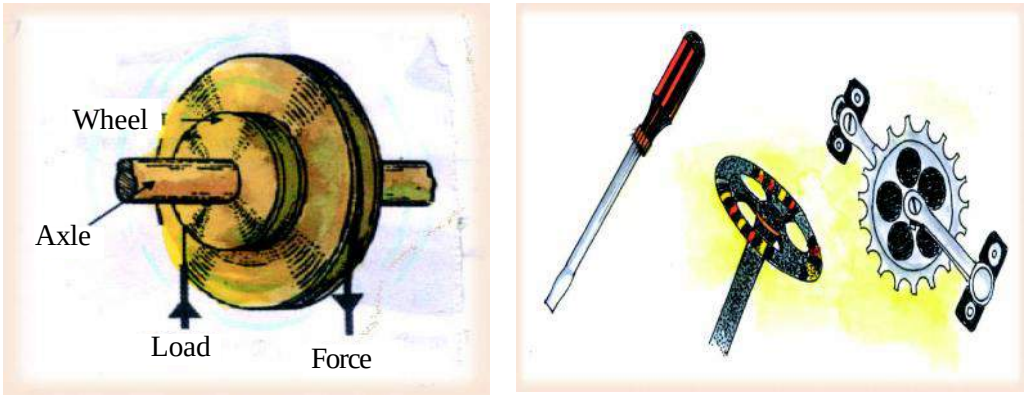
a. A single pulley *b. System of pulleys*

Fig. 11.18 Pulleys

In fig. 11.18 b a system of four pulleys is illustrated. This clarifies the principle of a crane and how it is able to lift heavy objects. Commonly a crane uses more than one pulley. This is a technological application of the principle of pulley.

7. Wheel and axle

A wheel and an axle are cylindrical pins of different diameters, which rotate together on a fixed axes. (Fig. 11.19 a). A screw driver, steering of a motor car, a cycle's pedal etc. are examples of wheel and axle (Fig. 11.19 b) .



a. Wheel and axle *b. Examples of wheel and axle*

Fig. 11.19

ANSWER THESE

1. Why are machines used?
2. What are the different kinds of levers, give two examples of each.
3. Why are pulleys used?
4. Explain what do you mean by an inclined plane ? Give two examples from daily life.

WE HAVE LEARNT

- The product of force and the distance travelled in the direction of force is known as work.
- The ability to do work is known as energy.

- The unit of work and energy in SI is Joule.
- The energy in a body by virtue of motion is known as the kinetic energy of the body.
- The energy in a body by virtue of its position is known as the potential energy of the body.
- The sum of kinetic energy and potential energy of a body is known as the total mechanical energy of the body.
- Mechanical energy, heat energy, light energy, chemical energy, sound energy and electric energy are all different forms of energy.
- Energy can be transformed from one form to another.
- Energy can neither be created nor destroyed. It can only be transformed from one form to another. This is known as principle of energy conservation.
- Machines make our work easier.
- Machines can be classified into two classes-simple machines and complex machines.
- Complex machines are made up of two or more simple machines.
- The force applied on the machine is known as effort and the weight lifted by the machine is known as load.
- Simple machines are of six kinds. 1. Lever 2. Inclined plane 3. Wedge 4. Screw 5. Pulley 6. Wheel and axle.
- A lever is a straight or curved rod, which can be supported at a convenient point and can move freely around that point. This point is known as the fulcrum.
- Levers are of three kinds-First, second and the third kind.
- In the lever of first kind the fulcrum is in between the load and the effort. Examples-scissors, plier, sea-saw.
- In the lever of second kind the load is in between the fulcrum and the effort. Examples-cart, beetle nut (sarotta), cutter bottle opener of cold drink bottles etc.
- In the lever of third kind the effort is in between the load and the fulcrum. Examples-forceps, fishing rod, spade etc.
- An incline plane is a strong and smooth plank, which is placed making an angle with the horizontal. Example - The wooden plank used to raise heavy objects on a truck.
- A wedge is a piece of wood or metal whose one head is wide while the other is pointed or sharp. Example- knife, nail (chisel) etc.
- Wedge is made up of two inclined planes.
- A screw is an inclined plane wound around a cylindrical pin. Example Jack, screw.
- Pulley is a simple machine, that is used to change the direction of the force.
- Wheels as well as axle are cylindrical pins of different diameters, which rotates together on a fixed axes.

EXERCISE

1. Choose the correct alternative

1. Is a simple machine-
   a. cycle b. tractor
   c. forceps d. sewing machine.
2. A scissor is a lever of which kind?
   a. first b. second
   c. third d. none of these.
3. Which of the following work, machines cannot do?
   a. Apply force at a convenient point b. Increase the speed
   c. Change the direction of force d. Produce energy
4. Joule is a unit of-
   a. Work b. Energy
   c. Work as well as energy d. Neither of work nor of energy.
5. Petroleum products have energy in the form of -
   a. Chemical energy b. Electric energy
   c. Light energy d. Sound energy.

2. Fill in the blanks: -

1. Tractor is a _____ machine.
2. Fulcrum is in the middle for levers of the _____ kind.
3. In the lever of the second kind, _____is in between the fulcrum and effort.
4. The spade used to lift garbage is a lever of the _____ kind.
5. The use of planks to lift drums on a truck is an example of _____.
6. In the extended rubber of a catapult _____ energy is stored.

3. Answer the following questions : -

1. What is a machine?
2. What is known as a lever?
3. How are fulcrum, load and effort placed in different kinds of levers?
4. What is work? Write the units of work.
5. If a body moves a distance of 12 metres on applying a force of 125 newton, compute the amount of work done.
6. Define energy. What is the relation between work and energy?
7. Write five types of energy. Give examples of each.

4. Give reasons for the following: -

1. The roads of hills are curvy.
2. It is easier to take out water from a well by using a pulley.
5. A heavy box is required to be raised to the terrace of a house-

a. Can you use a pulley/ roller/ inclined plane?

b. What kind of energy is required to do this task?

THINGS TO DO

1. To know your energy related habits, mark the sign of (√) in the appropriate option against the given statements. Complete the table and self evaluate.

S. No.	Energy related habits	Always do	Do it sometimes	Never do it	Reasons behind it
1.	If nobody is inside the room switch off the bulb, tube and fans while leaving the room				
2.	If nobody is inside the classroom switch off the bulb and the fans.				
3.	Close the refrigerator door quickly.				
4.	While cooking food at home cover the utensil with a lid.				
5.	Prefer reading in lighted area during day time instead of lighting a bulb in a dark room.				
6.	Prefer solar energy (solar cooker and solar heater) over other kinds of energy for warming water for preparing food and bathing.				
7.	During TV viewing or doing other things family members sit in one room so that there is less consumption of electricity.				
8.	Bulbs and tubes are wiped clean so that maximum light can be used.				
	Total Marks				

On the basis of above mentioned activity and the given classification below evaluate yourself –

2 marks for the answer - always do
1 marks for the answer - do it some times
0 marks for the answer - never do it

Marks obtained	Class	Marks obtained	Class
14-16	Best	08-10	average
11-13	Good	05-07	poor
		00-04	very poor

12. LIGHT

When we enter a dark room even with our eyes open, we are not able to see any object, but when the bulb lights up we are able to see the objects in the room. This means we need light to make things visible. When the light scattered from an object enters our eyes, only then we are able to see the object.

12.1 Sources of Light

An object, which emits light, is called a light source. Light sources that we get in nature are known as 'Natural Sources' while those that are made by us are known as 'Man-Made' or 'Artificial sources'. Let us consider the sources from which we get light. Make table 12.1 in your notebook and complete it.

TABLE - 12.1

S. No.	Natural Sources	Artificial Sources
1.	.....	.....
2.	.....	.....
3.	.....	.....

12.2 Does light travel in a straight line?

ACTIVITY 1

Materials required :– A candle, a match box, straw or folded paper to make a straight pipe.

Light a candle and put one end of the straw in front of the flame of the candle (fig.12.2). Now, look at the flame from the other side of the straw. Are you able to see the flame? Now, bend the straw gently (Fig. 12.2). Try to see the flame of the candle again. Can you see the flame in this situation also? Why is it so?

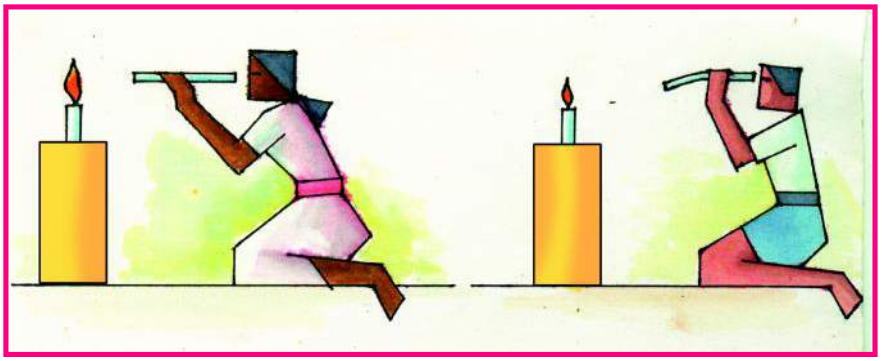


Fig. 12.1 Light moves in a straight line

Fig. 12.2 Light moves in a straight line

ACTIVITY 1

Materials required :– A candle, a long needle, three empty match boxes, four wooden blocks.

First of all take out the inner cases of the match boxes with a needle, pierce each in the middle so as to form a round hole in it. (Fig. 12.3).

Fix these match boxes (with inner case) with the help of wooden blocks, as shown in fig 12.4. Take care that the inner cases of match boxes are not at the same height, keep them at slightly different levels - a little up or down. Now try to see the candle through the hole from the other side. Are you able to see the flame?

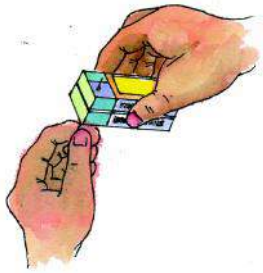


Fig. 12.3

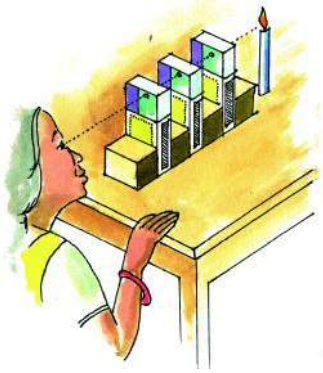


Fig. 12.4

Now, put the inner cases of the match boxes at the same height so that the three holes lie in a straight line. For confirmation gently pass the needle through the holes and check. Now, try to see the flame of the candle from the other side again (fig.12.4)?

What conclusion can you draw from the two activities? Does light travel in a straight line?

Now, you might be curious to know how fast does light travel. Speed of light in air is very high. It is nearly three lakh kilometres per second. Due to this high speed we are not able to notice the time-difference between switching on of a light bulb and seeing its light on the walls. Light takes about 8 minutes to travel from the sun to the Earth.

ANSWER THESE

1. When are we able to see an object?
2. Name any four man-made sources of light.
3. Give an example of an insect that emits light.
4. If sunlight takes 8 minutes to reach the earth (and the speed of light is 3 lakh kilometres per second) calculate the distance of the sun from the earth.

Formation of Shadows :-

ACTIVITY 3

Material required :- Torch, key

Throw the light of the torch on a wall such that it makes a lighted patch. Now, put a key between the torch and the wall. The shadow of the key is formed on the wall. This means if we put an opaque object in the path of light its rays are blocked and do not reach the other side. An un-lighted region is produced on the screen (wall). This region is called the shadow of the object.

ACTIVITY 4

Materials required :-

Light a candle in a dark room. Hold both the hands in ways according to Fig. 12.5 and form different figures. It would be better to make the shadow on a white-washed wall or a screen. Ask your friends to identify the different figures made by the shadow of the hands. To make the play of shadows more interesting you can also produce sounds of the animals whose shapes are formed.

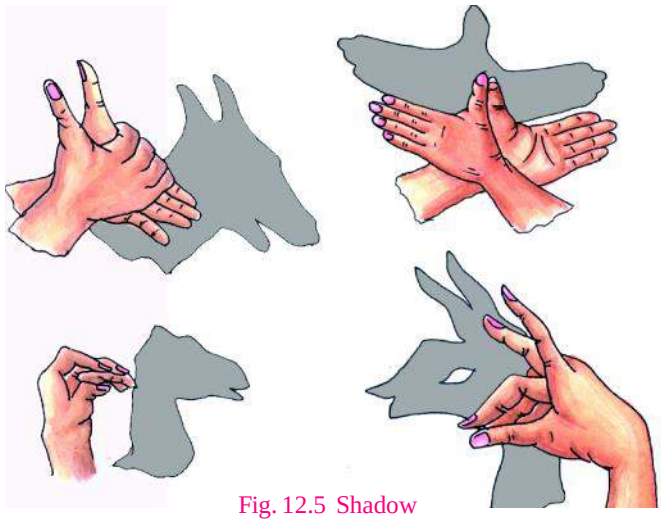


Fig. 12.5 Shadow

ACTIVITY 5

Materials required :– One rod, measuring tape.

At 8 o'clock in the morning put up a rod perpendicular to the ground in an open space near your school or near your house. The place should get full sunlight throughout the day. Mark the tip of the shadow on the ground. Using a measuring tape measure the distance from the base of the rod to the mark. Repeat this experiment at 12 o'clock at 2 p.m. and at 5 o'clock in the evening. Note the results and answer the following questions-

(1) When was the length of the shadow the maximum?

(2) When was the length of shadow the minimum?

(3) On which factors do the length and position of the shadow depend?

12.4 Umbra and Penumbra

In fig. 12.6, S is a big source of light and an object AB is placed between the source S and the screen P. Since no ray reaches the CD portion of the screen therefore there is complete darkness in that

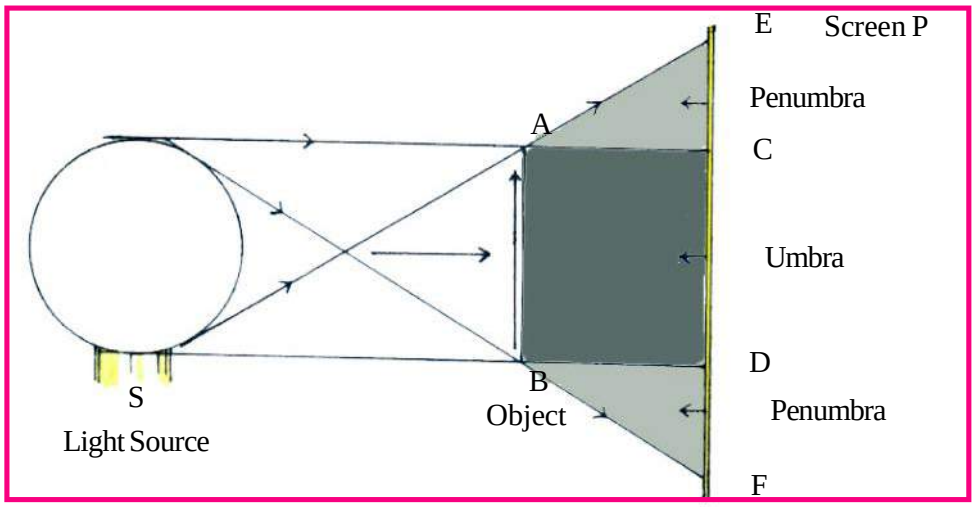


Fig. 12.6 Formation of Umbra and Penumbra

region. This region is called umbra. However, some rays are able to reach the CE and DF regions so a diffused shadow is formed in these regions. These regions are called penumbra. (Fig. 12.6)

12.5 Eclipse

We notice the shadow of several objects on the surface of the earth everyday. Likewise the shadows of earth, moon and other planets are formed somewhere in space. We can see the shadows only when they fall on a screen. We cannot see the shadows of birds on the earth, if they fly very high becuase the shadow in formed at sufficient height in space so that even penumbra does not fall on earth. But if they fly at low altitudes their shadow can be seen on the surface of the earth.

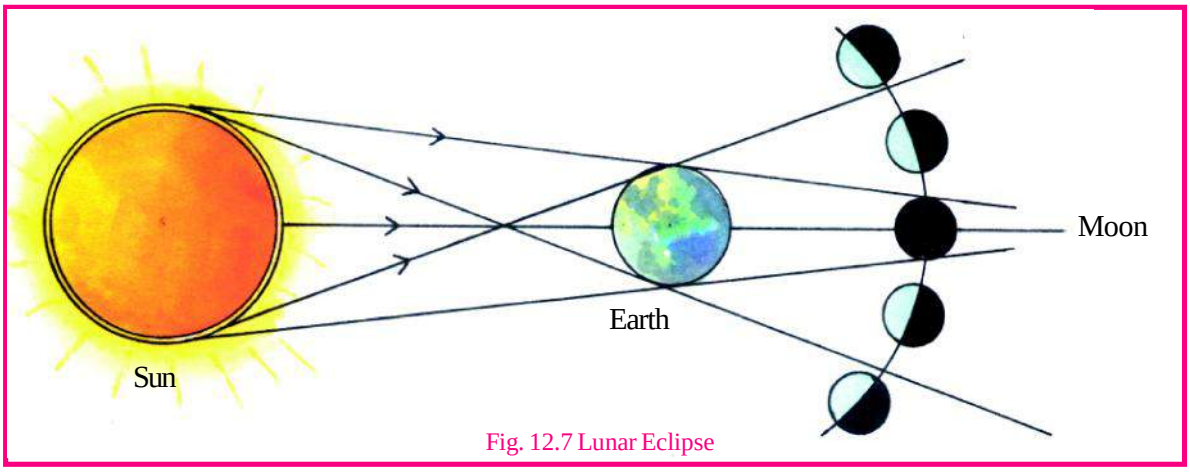


Fig. 12.7 Lunar Eclipse

On a full – moon night (Poornima) the earth is in between the sun and the moon. Sometimes when these three are in a straight line in the same plane then the moon passes through the umbra made by the earth (fig. 12.7). In this position, we cannot see the part of the moon, that lies in the umbra from any position on the earth. This phenomenon is called the lunar eclipse.

When the moon enters the umbra completely and is not visible from the earth, then we have the total lunar eclipse. When the moon passes only partially through the umbra cast by the earth then it is called a partial lunar eclipse.

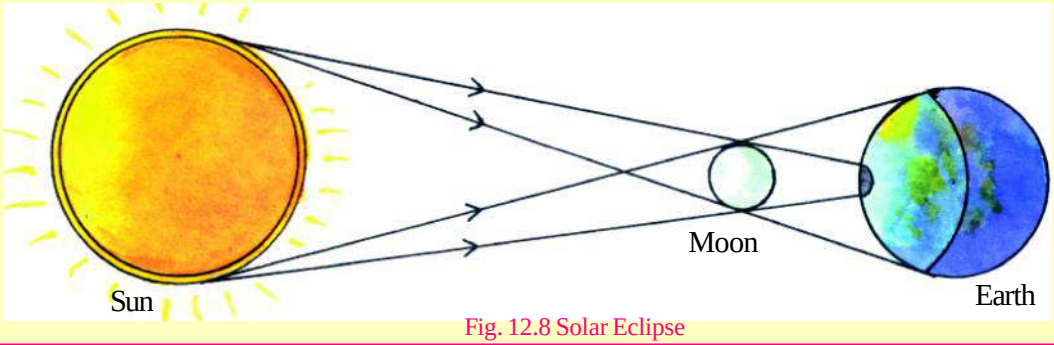


Fig. 12.8 Solar Eclipse

On a no moon (amavasya) day, the moon lies in between the earth and the sun. Sometimes, their centres may lie in the same plane on the same straight line. This event occurs only on certain no-moon days, and not on all no-moon days. As the size of the moon is small compared to that of earth, the moon's shadow falls only on a limited region of the earth. In these regions on the Earth, SOLAR ECLIPSE occurs (fig. 12.8)

The small region of the earth which is in the umbra of moon and where sunlight is completely blocked has TOTAL SOLAR ECLIPSE. The region where you can see the sun partially, has partial solar eclipse.

Both lunar and solar eclipses are natural events and when they occur you must look at them, using appropriate devices. It is dangerous to view the solar eclipse with naked eyes. It is always safe to observe a solar eclipse by looking at the image of the Sun on a screen. To obtain the image, you can punch a neat circular hole in a piece of cardboard and place it perpendicular to the sun rays. You can get an image of the eclipsed sun through this pinhole on a screen or on a wall. It is safe to view this image with naked eyes, keeping your back to the sun. Eclipse can also be seen on live telecast made by Doordarshan.

12.6 Reflection of Light

You know that light travels along a straight line. Can we change the direction or path of light? Think, what happens when light falls on a polished or shiny surface?

Moon

We all use mirrors at home. Since the surface of mirror is shiny, it changes the path of light when it falls on it. Due to the change of direction of light we can see our face in the mirror.

Earth

So, we can say that when a ray of light falls on a shiny surface, direction of light changes. This phenomenon is called reflection of light. Think why are you able to see your face in still water? The surface of water can also act as a mirror and can change the direction of light.

Sun

ACTIVITY 6

Material Required:- Two strips of plane mirror, black and white paper, gum and blade

Take a plane mirror. Wrap a piece of black paper having three slits on it as shown in fig.12.9 a. Put the white paper on a plane surface chosen at such a place where there is both light and shadow. Keep the mirror (having slits) in your hand in such a way that the slits are towards the sun. Place another plane mirror in the path of these rays. Ensure that the rays coming from the slits are falling on the mirror (fig.12.9 b).

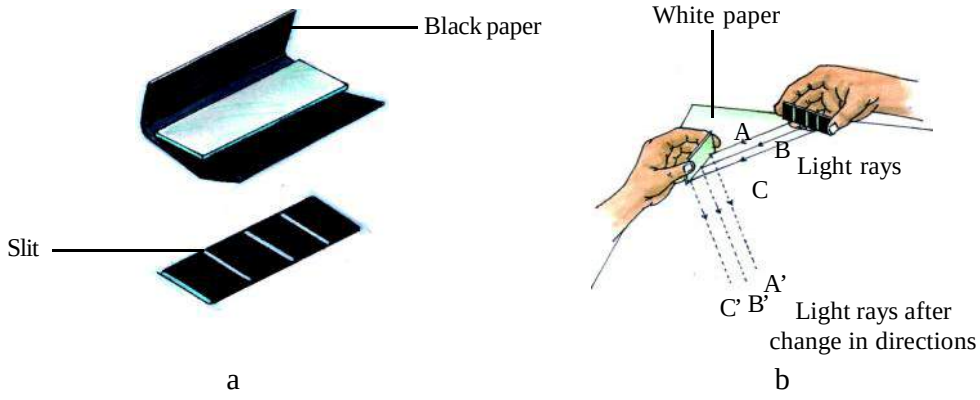


Fig.12.9. Reflection of Light

What do you see? Does the mirror change the direction of light falling on it? This activity shows that when a ray of light falls on a shiny surface, direction of light is changed. This is known as reflection of light.

ANSWER THESE

1. State the difference between umbra and penumbra.
2. Why do total and partial lunar eclipses occur?
3. Why does lunar eclipse not occur on every full-moon day?
4. State the precautions to be taken for viewing partial or total solar eclipses.
5. Which type of surface is necessary for the phenomenon of reflection?

WE HAVE LEARNT

- An object, that has its own light and gives it out, is called a source of light. Sources of light are natural as well as man-made.
- To see objects we need light. This light scatters from the objects and reaches our eyes. This makes the objects visible to us.
- Light travels in a straight line
- Speed of light is 300,000 km/sec
- By placing, opaque objects in the path of light, the path of light is blocked. The Region, where no light can reach is called umbra and where light reaches partially is called perumbra.
- Eclipses of the Moon and the Sun occur due to the shadows cast by the Earth and Moon respectively.
- When a ray of light falls on a shiny surface, direction of light is changed. This is known as reflection of light.

EXERCISE

1. Choose the correct option-

I. Time taken by light to travel from the Sun to the Earth is

(a) 5 minutes (b) 6 minutes (c) 7 minutes (d) 8 minutes

II. When moon passes through the middle of the umbra of the earth then

(a) Total lunar eclipse occurs (b) Partial lunar eclipse occurs

(c) Solar eclipse occurs (d) None of these

III. When the sun is at the top of the head, then the length of the shadow of a man will be –

(a) Maximum (b) Minimum (c) Twice the height of man (d) None of these

2. Fill in the blanks –

1. An object, which has its own light, is called _____.
2. Light travels in a _____ line.
3. Eclipses of the Moon and the Sun occur due to the shadows cast by the Earth and _____ respectively.
4. Change in direction of light rays by a shiny surface is known as ---------- of light.

3. Short answer questions –

1. Name any four light sources.
2. How does light travel from one point to the other?
3. Explain the following using ray-diagrams-

(i) Lunar Eclipse (ii) Solar Eclipse

4. Calculate the time taken by light to travel from the Moon to the Earth, if the distance between them is 4,00,000 kms.

5. Explain by experiment that light travel in a straight line ?

6. If the moon becomes bigger in size what will be its effect on solar eclipse ?

THINGS TO DO

1. Make your own pinhole camera -

Take two old post cards and fold them in the form of a tubes such that the radius of one tube is less than the other, and the former can be fitted into the later easily. Use gum to make the tubes. Paste black paper on one side of the tube with the smaller radius. Make a neat pin hole in the middle of the black paper. Exactly in the same manner paste a white paper on one side of the other tube, apply some oil on this paper so that it becomes translucent.

Place the tube having black paper inside the other tube. Your pinhole camera is ready with butter / oil paper acting as a screen.

Light a candle and keep it in front of the pinhole of the camera and look at the screen carefully. What do you observe? Move the outer tube forward and backward and observe the image of lighted candle in every position, see the effect of this movement on the image.

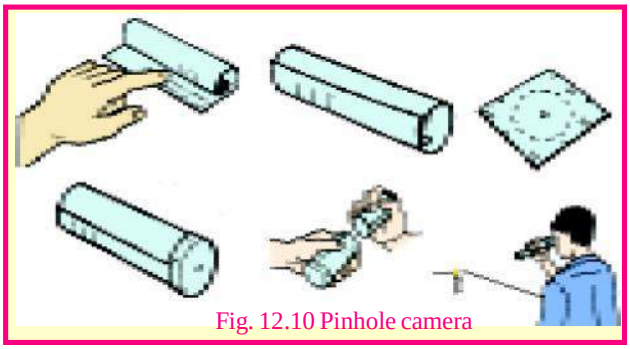


Fig. 12.10 Pinhole camera

Now see brightly lit objects like trees, house etc. using the camera.

2. With the help of posters, charts, models or plays explain the concept of solar and lunar eclipse to the community.

3. Make your own periscope

Materials required: - Empty incense sticks box (agarbatti), two plane mirror strips, candle, blade, match box, scale, and gum.

Close the agarbatti box on both the sides. On both the corners of the box make a square with side equal to the breadth of the box (fig.12.11a). Join the diagonals of both squares. Make a cut with the help of blade along the diagonals having thickness equal to thickness of mirror and place the mirror strips such that the shining sides are facing each other (fig. 12.11b).Ensure that the mirror strips are parallel to each other. On both sides of the strip drop melted wax using a lighted candle, such that, the strips stick to the box and are fixed. To stick them we can also use gum laden paper.

Now cut out two windows in the box as shown in fig. 12.11c. Ensure that the windows made in the narrow side strip of the box are facing the silvery side of the mirrors. They should also be at the same height, so that reflected light from one reaches the other. Now your 'periscope' is ready, you can use it to see objects on the other side of the wall. For this put window-1 of periscope above the wall and use the window-2 to see the objects opposite to the window-1 (fig. 12.11d). Periscope is used to see the ships on the surface of the sea from submarines.

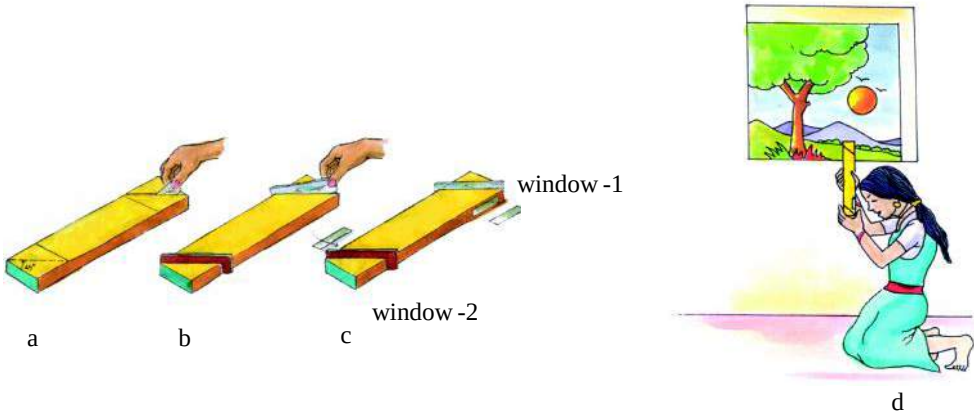


Fig 12.12 a b c d Periscope

13. MAGNETISM

13.1

Magnet has been an object of mystery to man from ages. For years scientists have been trying to find how a magnet could attract objects of iron from a distance. You must also have played many games with a magnet and tried to know about its qualities. There is an interesting story about the discovery of the magnet.

Some two thousand years ago, in a small village called Mangnesia in Asia minor (Turkey), there lived a shepherd named Magnus. He used to take his goats and sheep to the hills for grazing. He had a stick with iron attached to the ends. Once he was sitting near a waterfall, where his sheep were grazing. When he lifted his stick to call back his sheep, he found some black stones attached to the iron ends. To know more about these stones, he dug the earth and found some mysterious stones (iron ore), which had the quality to attract iron towards them. This ore got to be called magnetite. It was found that when this stone was taken in form of a rock and suspended by a string it came to rest in the north –south direction. So this came to be known as 'leading stone' or 'lode stone'(directing). About 2500 years ago people in Greece used to show some miracles with this stone. We also have proof that in the 12th century, in China, the Chinese used to rub needles with this stone and suspend it on a string to find the north-south direction(fig.-13.1). This proves that the Chinese had knowledge of making iron ,magnetic with the help of lode-stone.

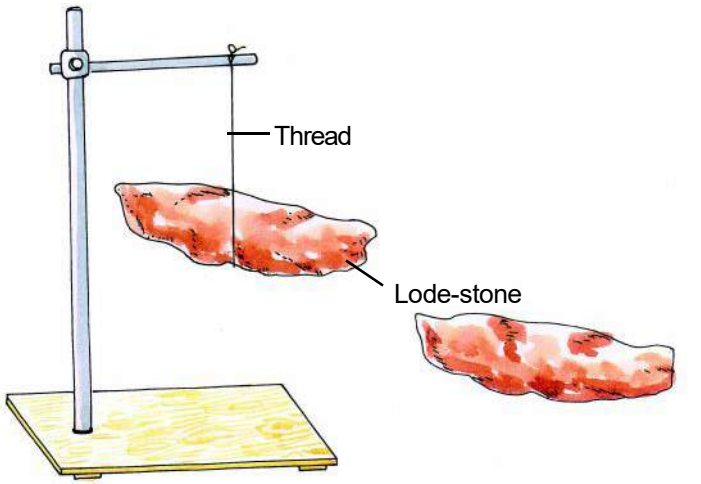


Fig 13.1 Freely suspended lodestone

You know that magnet is that which can attract iron towards it. This property of magnet is called Magnetism.

13.2 Natural and Artificial Magnets

In the earth the natural ore of iron 'Magnetite' is the only form of natural magnet, which is an oxide of iron (Fe_3O_4). Some other rocks, ores and meteorites also have magnetic properties.

1. In natural magnets the measure of magnetism is very less. They are not powerful .
2. Their shapes are irregular.
3. They are less stable and are very fragile.

So these are less used in practical purposes.

Artificial Magnets

Some metals and alloys are such that they can be made into powerful magnets by artificial methods. These are called artificial magnets. Powerful magnets are made from steel or cobalt-steel or nickel-steel or aluminum- nickel- cobalt alloy (Alnico). Their magnetism remains for longer time. Now a days magnets of different shapes and sizes, which are powerful and permanent are made and used widely.

Artificial magnets are named as per their shapes.

1. Bar Magnet or Rod Magnet :- These are in shape of cuboids or cylinders.(fig 13.2a)

2. Horse-shoe shaped Magnet:- These are bar magnets bend in shape of a horse shoe.(fig 13.2b)

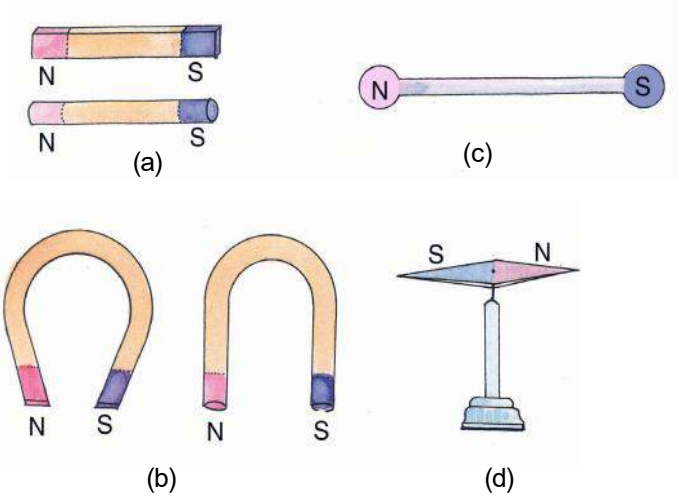


Fig 13.2 Different types of artificial magnet

3. U-shaped Magnet :-When rod magnets are bend in U form, they are called U-Magnets.(fig 13.2b)

4. Spherical Magnet:- These are in form of a long rod with spheres at its ends.(fig 13.2c)

5. Magnetic Needle :- These are flat and thin pieces made of steel which is broad at the centre and tapering towards the ends. At the mid centre they are attached to a pointed nail on a stand, so that they can move freely horizontally.(fig 13.2d)

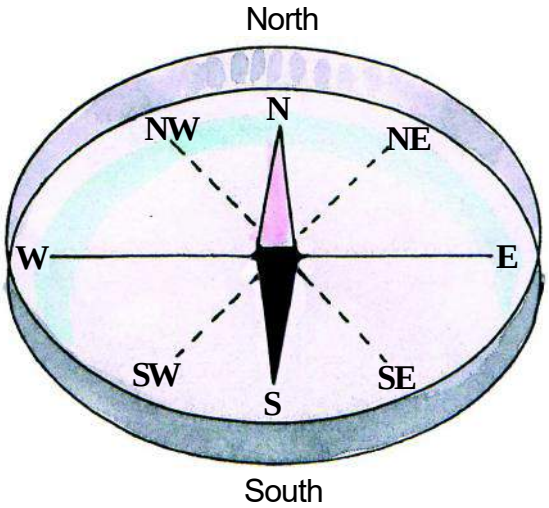


Fig 13.3 Magnetic compass

6. Magnetic Compass:- These are magnetic needles packed in boxes which have transparent plates on the upper side. Both ends of the magnetic needle are marked N and S.(fig 13.3). these are mainly used in aircrafts and ships to know the direction.

13.3 Magnetic and Non-magnetic Substances

Magnetic Substances

Those substances which can be attracted by a magnet or which can be converted to a magnet is known as a magnetic substance. Iron ,cobalt ,nickel and their alloys are examples of magnetic substances.

Non-magnetic Substances

Those substances which are not attracted by a magnet or which cannot be made into a magnet even by artificial methods is known as non-magnetic substances. Copper, Aluminium, Sulphur, Carbon, Cotton, wood, paper, rubber, glass etc are the examples of non-magnetic substances.

Let us identify magnetic and non-magnetic substances by activity :-

ACTIVITY 1

Materials required :- materials collected as pieces of wood, rubber, plastic, glass, nickel, cobalt, iron, steel materials, salt, sugar and a powerful magnet.

Place all these objects on a wooden table covered with a paper. Place all the articles on this table some distance away from each other. Now bring a powerful magnet near all the articles one by one. Observe the effect of magnet on each of the articles. Draw the table 13.1 in your copy and fill in the details.

TABLE NO 13.1

S.No.	Name of the object	Attracted by the magnet or not	Magnetic/ Non magnetic
1 .	plastic straw	no	non magnetic
2 .	blade (Iron)	yes	magnetic
3 .	_____	_____	_____
4.	_____	_____	_____

Answer These

1. What are magnets?
2. Why are artificial magnets more useful than natural magnets?
3. What are magnetic and non-magnetic substances?
4. Why is magnetite called a lode stone?

13.4 Properties of a Magnet

From the above experiment we have seen that magnet attracts some objects made of magnetic materials towards itself. Let us know about the properties of magnet through some experiments.

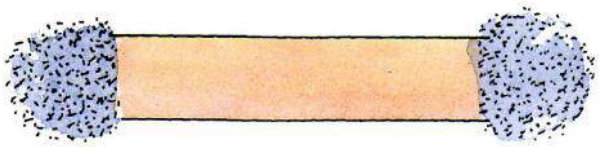
Property No. 1 Magnetic poles / Attraction Property

ACTIVITY 2

Materials required :- bar magnet, white paper, and iron powder.

Scatter the iron powder all over the white paper. Now bring a powerful magnet and turn it over the iron powder. What do you find? The iron powder is mostly attached to the ends of the bar magnet.

And towards the middle there is no piece attached.(fig13.4). This proves that the magnetic power is concentrated towards the ends. These are called the 'poles'. Attraction of the magnetic substances by a magnet is known as attraction property of the magnet.



(a)

(b)

Fig 13.4 Poles of a magnet

Property No 2 Directional Property of Magnet :

ACTIVITY 3

Materials required :- wooden stand , bar magnet and a string.

From the wooden stand, suspend a bar magnet with a string tied at its middle(centre of gravity) freely. On which direction does the magnet come to rest? The direction is north- south (fig 13.5).

Now rotate this magnet with your hand and leave it. At which direction does it settle now? After some time it again comes to rest in north- south direction. So we can say that a freely suspended magnet always comes to rest in the north- south direction. This is known as directional property of the magnet. The end of the magnet pointing towards the north is called its North Pole and which points south is the South Pole of the magnet.

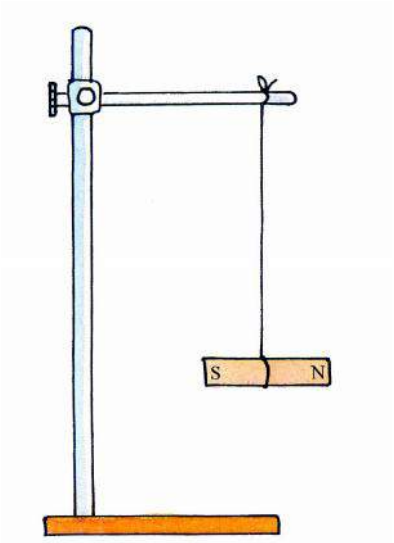


Fig 13.5

Property No 3 Attraction and Repulsion

ACTIVITY 4

Materials required :- wooden stand, two magnetic needles.

Two magnetic needles to be placed such that there is no movement. Find their north and south poles and mark them. Now place one magnet in your hand and bring its poles near the magnetic needles, one after the other (fig 13.6) and write your finding in the given table copied in your notebook.

Table 13.2

S.No.	Poles Brought Near		Observation	
	Magnetic Needle	Other magnet	Attraction	Repulsion
1	north	north	———	yes
2.	south	north	———	———
3.	north	south	———	———
4.	south	south	———	———

From the above observations we can say that

1. There is repulsion between similar poles.(north-north ; south-south)

2. There is attraction between dissimilar poles that is north – south.

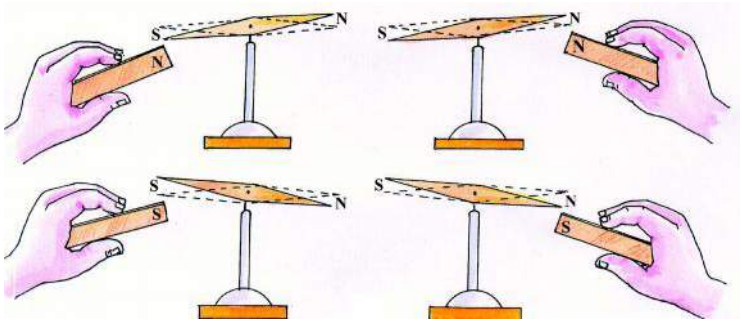


Fig 13.6 Magnetic attraction & repulsion

ACTIVITY 5

Materials required :- two magnets and an iron rod.

To differentiate between a magnet and an iron rod. Take another magnet and bring it near both the ends of both the magnet and the rod. If there is attraction to both the ends then it is an iron rod, and if is attracted to one end and is repelled by the other end then it is a magnet. So we can say that repulsion identifies a magnet.

ANSWER THESE

1. What do you mean by poles of a magnet?

2. What do you mean by the directional property of a magnet ?

3. Write the laws of attraction and repulsion between the poles of a magnet ?

4. How will you identify a magnet and a magnetic substance?

Property No. 4 Opposite poles are present in pairs

When we cut a bar magnet into two pieces, we cannot obtain the two poles separately. That is, if we cut any bar magnet into two halves, then the two halves will have north pole and south pole. And if you

again cut the two halves you will get the four pieces each having a north pole and south pole.(fig 13.7). In this way if we cut a magnet into any number of pieces each will have the two poles. This proves that the smallest particle of any magnet, which is the atom, itself is a complete magnet, with one end as north pole and the other end as south pole.

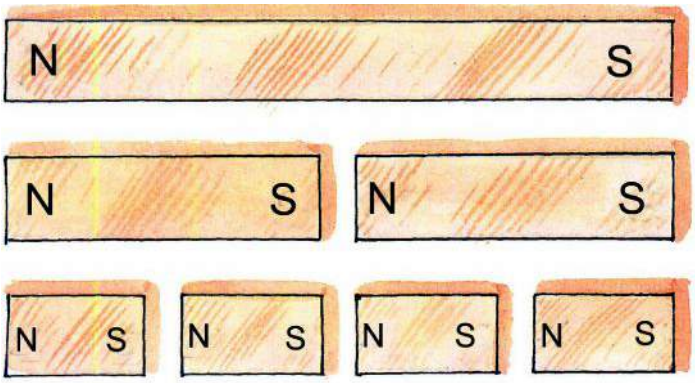


Fig 13.7 Divided pieces of a magnet each having the two poles

Property no. 5 Magnetic Induction

ACTIVITY 6

Materials required :- a powerful magnet, iron nails.

Bring a nail to one end of the magnet. It gets attached to that end. Now bring another nail near the first nail, at its free end. Does it get attached? In this way, the nails are attached to the free end and form a chain. (fig 13.8) If the magnet is powerful this chain will be longer and each nail acts as a magnet.

Now pull the first nail away from the magnet. If it is not in contact but near the magnet, then also the chain remains. But when the first nail is removed far away then all the nails fall off.(fig 13.8b). Why does it happen?

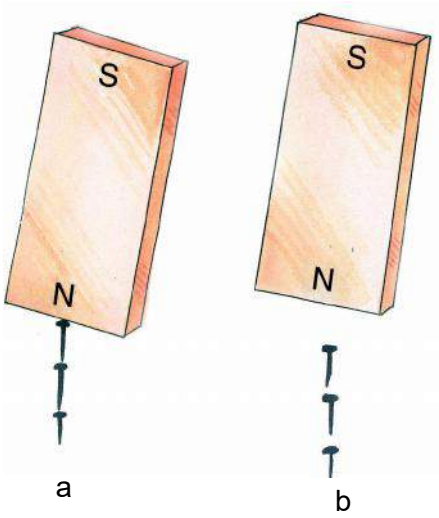


Fig 13.8 Magnetic induction

When a magnetic substance is kept near a magnet, it acquires the property of a temporary magnet and on removing the magnet its property of magnetism is lost. This process is called magnetic induction .That magnet which caused induction is called inducting magnet. From the above experiment we can say that

1. When an inducing magnet is brought near a magnetic substance, that end of the substance acquires the opposite pole and its other end has the same pole.

2. The power of magnetism depends on the power of the inducing magnet.

3. The quality or power of the induced magnetism is more at the poles and becomes less as we move towards the centre.

It is also seen that the magnetic effect is felt only upto some area around the magnet. This area is known as **magnetic field**.

Property No 6 Transforming a Magnetic Substance to a Magnet

ACTIVITY 7

Materials required: - A long bar of soft iron and a powerful magnet.

Place the iron bar on a wooden table. Now take the magnet and rub it over the bar with its north pole from one end to other as shown in the figure. Now pull away the magnet and again repeat it from the starting end of the iron bar. (fig13.9) Repeat this a number of times. Note that during all this repetitions , neither the pole of the bar magnet nor the direction of the magnet change.

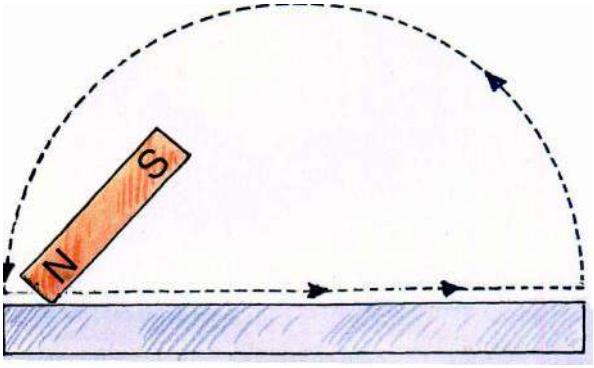


Fig.13.9Transforming a magnetic substance to a Maganet

Now test the iron bar for its magnetism by bringing another magnet near its ends. You will find that the starting end of the iron bar is the north pole and the other end is the south pole.

Property No. 7 Effect of Magnet through a Non-magnetic Substance.

ACTIVITY 8

Materials required :- one powerful magnet , drawing paper and some iron powder.

Place the sheet of drawing paper and spread the iron powder over it. At first, move the magnet. Repeat, by keeping wood or other non-magnetic materials between the iron powder and the magnet. What does the movement of iron powder with the magnet prove?

Can you prove from this experiment that the magnetic effect passes through non-magnetic substances?

Property No 8 Loss of Magnetic Effect due to Careless Handling and Storage

ACTIVITY 9

Materials required:- a powerful magnet, iron rod, hammer, and iron powder.

Insert the iron rod in the iron powder. You will find that the powder does not stick to the rod. Now place the rod on a wooden table and rub it with a magnet,(as shown in activity 7) to make it a magnet. Now insert the rod in the iron powder, you will find that some pieces of the powder has stuck to the rod.

This means that the iron rod has gained some magnetic property. Now beat the rod with a hammer many times to flatten it. Again insert this into the iron powder. The iron powder does not stick. What does this prove?

It is also seen that when weak magnets are carelessly left for a long period of time, or when it is heated,or beaten ,then its magnetic power is lost.

So it is proved that if proper care is not taken in storing or handling, then the magnetic power may be lost.

13.4 Magnetic Protector

From the above activities it can be noted that for a loss of magnetic power, the causes are:-

1. Beating or hitting a magnet
2. Heating a magnet.
3. Keeping the two similar poles of two magnet near to each other.
4. Improper storage.

So we must take property care that the magnetic power of a magnet is not lost.

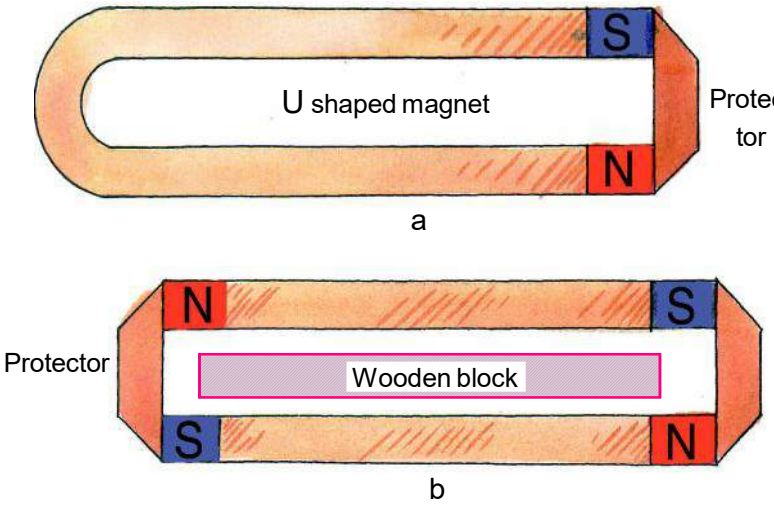


Fig 13.10 Magnetic protetor

To protect a magnet from losing its magnetic property , a rod of soft iron is placed on the poles of a horse-shoe magnet.(fig 13.10a)

In the same way to store bar magnets, two bar magnets are placed with their dissimilar poles near and a wooden piece is kept in between them. At their ends pieces of soft iron is kept (fig 13.10b). The soft iron bands or pieces are called magnetic protectors, because when they are placed on the magnet, the magnet does not lose its power.

Soft iron is used as a magnetic protector because its magnetic domains gets aligned quite easily on coming in contact with any magnet. This alignment is formed in such a way that a circle is formed and the alignment of the magnetic domain of the magnet is not disturbed.

13.5 Earth as a Magnet

Have you ever imagined why a freely suspended magnet comes to stay in the north-south direction?

The earth itself behaves as a magnet. The magnetic north lies near the geographical south of the earth and its magnetic south lies near the geographical north. The line joining the geographical north and south makes an angle of 17^0 to the line joining the magnetic north and south.(fig 13.11). We know that the opposite poles attract each other. That is why any freely suspended magnet's north pole always points to the geographical north(where the earth's magnetic south is situated). It is seen that if an iron is buried in the earth for some days, it becomes a magnet and its end which has pointed towards the geographical north becomes its north pole.

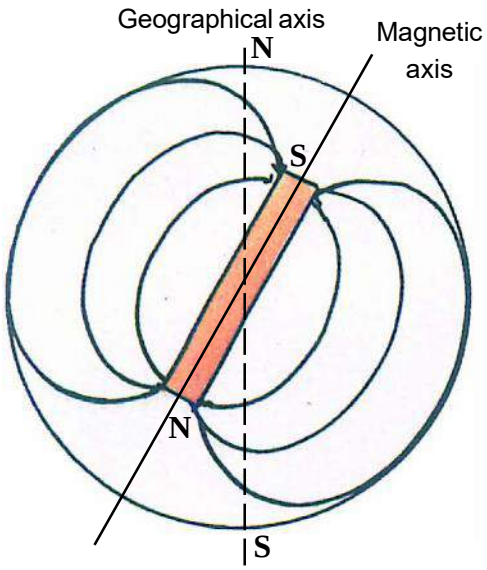


Fig 13.11 Earth as a magnet

Human beings do not feel the earth's magnetic effect but birds and animals can feel it. It is said that the migratory birds find their way by using the magnetic field of the earth.

13.6 Uses of a Magnet

There are many uses of magnet in our day to day life. Some of which are given below.

1. Magnets are used in bulletin boards, magnetic toys, stickers(placed on iron almirahs), electric bell, electric generator or dynamo, television, loudspeaker etc.
2. Usually the doctor uses a magnet to extract minute iron pieces from the patient's eye.
3. Iron ore is extracted from mixed ores by using a magnet.
4. The main use of magnet is to make magnetic compass which is used in aeroplanes and ships to know direction.
5. To lift very heavy iron blocks, cranes are fitted with magnet.

ANSWER THESE

1. For which purpose ship navigators use the magnetic compass?
2. From which material is magnet protector made of ?
3. How can the magnetic properties of a magnet be lost?
4. Write any two uses of magnet.

WE HAVE LEARNT

- Magnet attract iron and materials made of iron towards it.
- Substances which can be attracted towards a magnet or which can be made a magnet are known as magnetic substances. Those which are not attracted towards a magnet or which can not be made into a magnet are known as non-magnetic substances.
- Magnets found in nature in free state are called natural magnets and those which are artificially made are called artificial magnets.
- In a magnet the maximum power is towards its ends which are called poles.
- A magnet freely suspended from its centre of gravity always comes to rest in the north-south direction. The end which points the north is its north pole and that which points south is its south pole.
- Similar poles of the magnet repel each other and dissimilar poles are attracted.
- Poles of a magnet are always present in pairs of opposite poles. Never can a pole be separately obtained.
- When a iron bar is kept near a magnet it obtains the property of a magnet. This is known as magnetic induction.
- The effect of magnet is also felt through non-magnetic materials.
- If a magnet is beaten or hit with a hammer, its magnetism is lost.
- To protect a magnet, pieces of soft iron is used. It is called a magnetic protector.
- Magnetic compass is used by navigators and aircraft pilots to know the direction.
- Earth acts as a magnet itself. Its magnetic north pole points the geographical south and its south pole points geographical north.
- Magnets are used in generators, telephone, television, loud speaker, magnetic toys, and for magnetic therapy etc.

EXERCISE

1. Name these :-

1. The place from where the word ‘magnet’ has come .
2. When a nonmagnetic substance is brought near a magnet it obtains the property of a magnet.
3. Magnets which are found free in nature.
4. The alloy from which powerful magnets are made.
5. The portion of the magnet where maximum magnetic power is felt.
6. The piece of soft iron which protect a magnet.

2. Choose the correct answer :-

1. This is a natural magnet;
   (a) magnetic needle (b) bar magnet
   (c) lode stone (d) soft iron
2. This is a magnetic substance :-
   (a) glass (b) cotton
   (c) rubber (d) iron
3. Permanent magnet are made from :-
   (a) iron (b) nickel
   (c) cobalt (d) alnico
4. Magnetic north of a magnet :-
   (a) attracts other north pole. (b) repels other north pole.
   (c) repels other south pole (d) sometimes attract and sometimes repels south pole
5. Magnetic power of a magnet is :-
   (a) maximum at the poles (b) minimum at the mid point
   (c) both the above statement are correct (d) its same allover

3. Answer the following questions :-

1. Give two examples each of magnetic and non-magnetic materials.
2. Why are artificial magnets used more than natural magnets?
3. Explain in brief, the method how a needle can be made into magnet.
4. What is done to preserve the magnetic power of a magnet ?
5. Write two important properties of a magnet.
6. Write the uses of a magnet.
7. "Repulsion is the proper identification of a magnet". Prove it.
8. "Earth is a magnet". Justity.
9. Two bar magnets are usually kept in pairs. In the given figure 13.12 E and F are pieces of two metals;
   (1) Name the metal E and F
   (2) Explain the use of E and F
   (3) Mark the poles of the other magnet.
   (4) Name the black part in the middle.

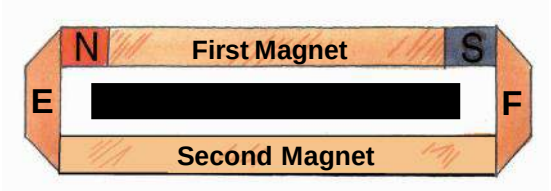


Fig 13.12

10. Suppose you have two iron rods, and one of them is a magnet. How will you identify it ?

14. FIBRE TO FABRIC: PLANT FIBRE

14.1 In ancient times people used to protect themselves from heat, cold and rain by using the bark and big leaves of trees, or animal skins and furs. Gradually they learnt to weave twigs and grass into mats and baskets. In the same way, animal fleece or hair was twisted together into long strands and were then woven into fabrics.

In those days, stitching was not known. People simply draped the fabrics around different parts of their body. With the invention of the sewing needle, people started stitching fabrics to make clothes. Stitched clothes have gone through many variations since this invention. Think of some un-stitched clothes we use even today. Make a list of these clothes.

14.2 Varieties in Fabrics -

Do you think the clothes that we use are made up of the same fibres/ thread or do they have any variety? Come let us do an activity to understand it.

ACTIVITY 1

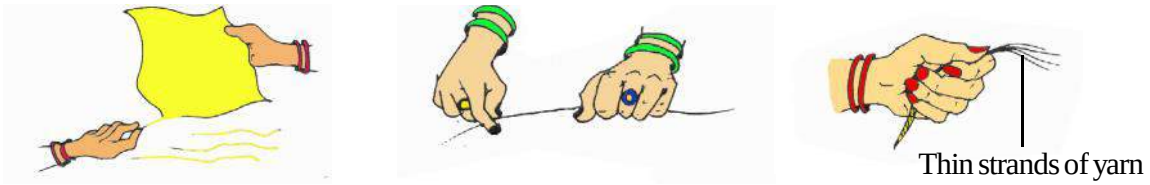
Materials required: Fabric cuttings, pen for labeling

Visit a nearby tailoring shop. Collect cuttings of fabrics leftover after stitching. Feel and touch each piece of fabric. Is the feel of all fabrics same? Now, try to label some of the fabrics as cotton, silk, wool or synthetic with the help of tailor. Now, look at it closely. What do you notice? Can you see the weave?

ACTIVITY 2

Materials required: piece of cotton fabric, needle

Select a piece of cotton fabric. Now, try to find a loose thread or yarn at one of the edges and pull it out. If no loose yarns are visible, you can gently pull one out with a pin or needle (fig.14.1a).



a b c

Fig.14.1 Yarn split up into thin strands

We find that a fabric is made up of yarns arranged together. What are these yarns made of?

ACTIVITY 3

You might have observed something similar when you try to thread a needle. Many a times, the end of the thread is separated into a few thin strands. This makes it difficult to pass the thread through the eye

of the needle. The thin strands that we see are made up of still thinner strands called fibres. Fabrics made up of yarns are further made up of fibres. Where do these fibres come from?

The fibres of some fabrics such as cotton, jute, silk and wool are obtained from plants and animals. These are called natural fibres. Cotton and jute are examples of fibres obtained from plants. These are called plant fibres. Wool and silk fibres are obtained from animals. These are called animal fibres. Wool is obtained from the fleece of sheep or goat. It is also obtained from the hair of rabbits, yak and camels. Silk fiber is drawn from the cocoon of silkworm.

For thousands of years natural fibres were used. But since last hundred years chemical substances, are also used to make fibres, these are called synthetic fibres. Some examples of synthetic fibres are polyester, nylon and acrylic.

What type of clothes should we wear during different seasons like summer and rainy season and why?

14.3 Some plant fibres -

These fibres are obtained from plants. These fibres are obtained from different plants, so their names are also according to the respective plants. Main plant fibres are-

1. Cotton - The fruits of the cotton plant (cotton balls) are about the size of a lemon. After maturing the balls burst open and the seeds covered with cotton fibres can be seen.

2. Silk Cotton- Kapok - The fibres of silk cotton are also obtained from pods as cotton. Kapok pods ripen after the flower withers off. On ripening they burst out and strands of fibres come out. These fibres do not have natural cohesion in them, because of which they cannot be drawn into threads. But these fibres are glossy like silk and of high quality. These are used for making mats and bedsheets.

3. Jute-

The fibres obtained from jute plants are commonly called 'taat'. Jute plant needs moisture and warmth. Jute plant grows to about 12-15 feet high. The plants are cut after their flowers wither off. The stem is soaked in water for days and decayed. The outer bark gets decayed and can be removed and from the rest, soft yellow coloured glossy fibres are obtained. Sacks, carpets and mats are made from jute.

4. Coconut Fibres (Coir)

These are found outside the coconut shell. It is used in the making of ropes and mattresses.

ANSWER THESE

1. What do you understand by natural fibres?
2. Write the names of the fibres which are obtained from the plant.
3. Name the fibre used to make sacks or gunny bags to keep the grains and mats (tat patti) you sit on.

14.4 Manufacture of Clothes

14.4.1 Spinning of Thread (Katai)

Fibres are the basic unit of any cloth. The first step of cloth manufacture from fibre is obtaining thread. Earlier the thread was spun by hands only. After the invention of hand spindle or takli and spinning wheel (charkha fig. 14.2) we could save time and the labour. Industrial revolution brought a new era to the

manufacture of cloth. Different machines were there for obtaining the fibres, cleaning them, making yarns from them and finally making clothes from these yarns.

Fig. 14.2 Charkha

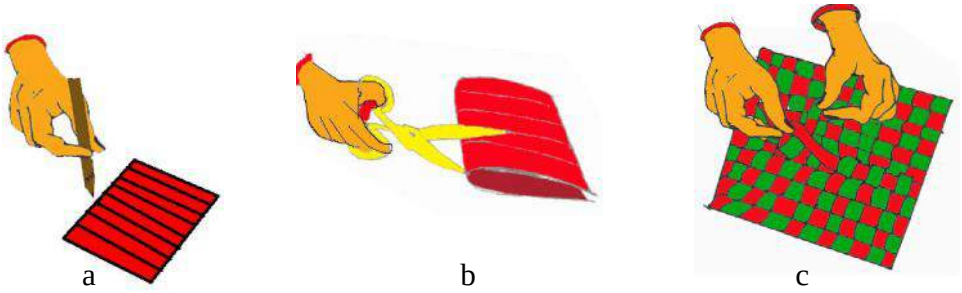
The process of making yarn from fibres is called spinning. This is the first step in making of clothes. After this the yarn is ready for weaving clothes.

14.4.2 Weaving on Looms

ACTIVITY 4

Material required - Two sheets of colour paper, scissors, pencil

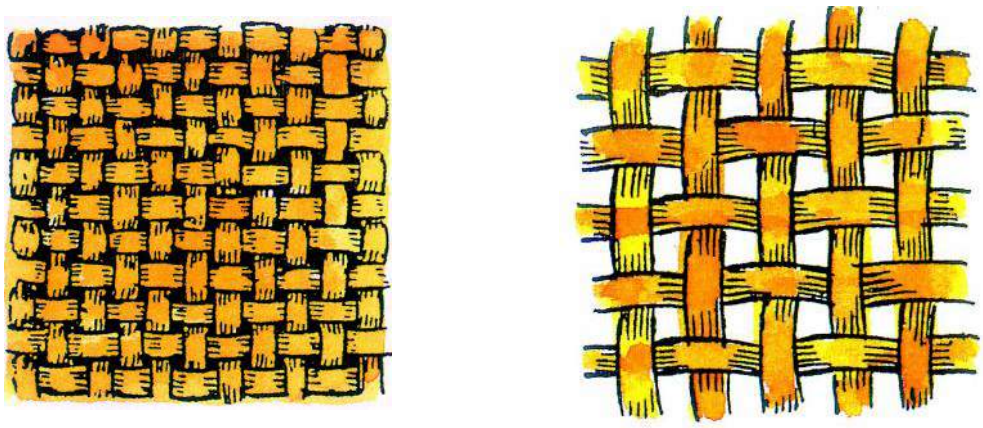
Take two sheets of paper of different colours. Cut square pieces of length and width equal to 30 cm from each sheet. Now, fold both the sheets into half. On the sheets draw lines as shown in the (fig. 14.3 a). Cut thin strips along the line drawn on the first sheet, also cut the second sheet carefully along the lines drawn, leaving a border of one inch along the edges and then unfold (fig. 14.3 b). This sheet will form the base of the mat. Weave the thin strips one by one through the cuts in the second sheet of paper as shown in (fig. 14.3 c)



a b c

Fig. 14.3 Shows the pattern after weaving all the strips.

According to activity-4 two sets of yarns are woven to make fabric (fig. 14.4). The yarns are much thinner than our paper strips. Fabrics (cloth) are made from yarns, which in turn are made from fibres. So fibres are the basic unit of cloth. Weaving of fabric is done on looms. The looms are either hand operated or power operated.



a. Compact Weaving **b. Loose Weaving**

Fig. 14.4 Simple Weaving

A cloth is weaved by intersecting the longitudinal threads, with the transverse thread. For this many methods are used. The main method is by using the loom. Mostly all the clothes are made by this method. For making a cloth the threads are placed from both sides, Weaving is done by interlacing the longitudinal threads, the warp i.e. "that which is thrown across", with the transverse threads, the weft i.e. "that which is woven".

With the invention of the handloom, weaving has become simple. Now a days cloth manufacturing is done in large scale by motorized looms in factories. In a simple weave, if you look at a cloth from one side, you will find the first warp thread over the weft thread, the second below and the third again above, the fourth below. In this way the pattern continues. Similar pattern is on the other side also.

14.4.3 Knitting with needles-

Along with weaving, knitting is also an important method of making the cloth. You must have used sweaters, jerseys, cardigans, baniyans etc. These are knitted clothes. Such clothes have the ability to stretch and shrink as per requirement. They stretch and shrink and get adjusted to fit the body. So these clothes are useful in the field of sports. Come, let's do an interesting activity to understand this.

ACTIVITY 5

Materials required: - A weaved cloth like a cotton handkerchief and a knitted cloth like cotton socks.

Try to pull both the clothes horizontally and vertically.

Now write the answers to the following questions in your copy -

1. Which of these clothes stretches more?
2. Does this cloth retain its shape after it is being stretched?

Now observe each of the cloth minutely with the help of hand lens and see how the threads are arranged. (Fig. 14.5)

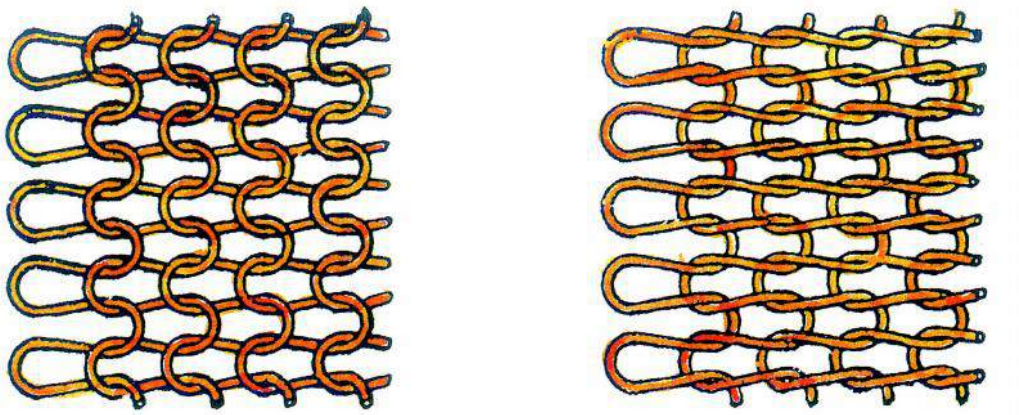


Fig. 14.5 Knitting from both side

Weaved cloth have the warp and weft threads at right angles to each other. So if they are pulled horizontally or vertically, they don't change. But the knitted cloth is made by interlocking loops of one or more yarns. Loops can stretch in all directions, so when the cloth is pulled vertically the loop stretches up and downwards and shrink horizontally. In the same way when it is pulled horizontally its length decreases and it stretches to the sides. The knitted clothes have the characteristic property of stretching and shrinking. So they fit properly and are comfortable to wear.

ANSWER THESE

1. What is the process of getting yarn from fibre known as?
2. What do you know about warp and weft?
3. What is the difference between knitting with needles and weaving on looms?
4. Observe any stretchable cloth with a lens and draw its pattern.

WE HAVE LEARNT

- There are different kinds of clothes (or fabrics) such as cotton, silk, wool and polyester.
- Natural fibres are obtained from plant- trees, animals and worms.
- Natural fibres are of two types - plant fibres and animal fibres.
- Plant fibres are obtained from cotton, coconut, jute etc.
- Silk, wool etc are obtained from animals.
- Man has made artificial fibres by chemical process. These are called synthetic fibres.
- Yarns are made from fibres by spinning.
- Yarns are weaved on looms to make cloth.
- Knitting using needles is also an important method of making cloth.
- Knitted cloths have the ability to stretch and shrink as required.

EXERCISE -

1. Identify the true and false statements. Correct the false statements and write them in your notebook -

(a) Mostly jute is used to make carpets and rugs.

(b) Yarn is made from fibres.

(c) Jute is the outer part of coconut.

(d) Silk yarn is obtained from the stem of a plant.

(e) Polyester is a natural fibre.

2. Fill in the blanks -

(a) Coir is obtained from.....plant.

(b) Making of yarns from fibres is known as .....

(c) Natural fibres are obtained from ..... and .....

(d) Nylon is a ..... fibre.

3. Answer the following questions -

(a) How do you obtain jute yarn?

(b) What are the characteristics of knitted cloth?

(c) Name two items made from coconut fibres.

(d) Explain the process of obtaining yarns from fibres.

(e) How do you select clothes according to the seasons? Explain.

THINGS TO DO

You can do an activity under the guidance of your teacher or parents to identify the fibre of any cloth. Pull out six to eight strands of threads from a cloth. Hold one end of the thread with forceps and bring the other end over a burning candle. Does the thread shrink away from the flame? Does the thread melt or burn? Is there any smell when it is burnt?

If it is a cotton cloth, it will burn but will not shrink or melt. Burning cotton gives out a smell of burning paper. Silk fibre shrinks away from the flame and burn but does not melt. It gives out a smell of burning flesh. Woolen fibres also shrink and burn but do not melt. They give out a strong smell of burning hair. Artificial fibres burn, shrink and also melt, they give out a smell of burning plastic.

15. WASTE AND ITS MANAGEMENT

Have you ever considered what happens to the garbage that is thrown out of our homes everyday? Where does it go? If it accumulates continuously for many days, what will happen? Is a pile of garbage, mosquitoes, flies, diseases and environmental pollution related?

The garbage, that comes out of our homes, consists of waste materials like peels of fruits and vegetables, pieces of paper, polythene bags, dust etc. These are not useful to us. So we throw these waste materials in dustbins in our homes. In the same way the garbage from factories, hotels, markets, and hospitals is thrown at dumping areas. However, this is not always done and as a result we see piles of garbage around us everywhere.

You must have noticed that during monsoons the piles of garbage stink and there is an increase in the number of mosquitoes and flies. One of the chief problems during monsoons is the contamination of water due to the garbage. During monsoons a large population in the urban centres suffer from diarrhoea, jaundice and skin diseases. Therefore, necessary steps are required to solve this problem.

The state capital, Raipur produces approximately 300 tons of garbage every day. According to one estimate an individual disposes off approximately 350 gram of garbage everyday. You can well estimate how much waste is generated from just the households of your village/city

Figure 15.1 Garbage house

Imagine the magnitude of the problem of waste when the waste of the household, waste from factories and markets etc. of the entire country is added.

Make a list of different waste materials coming out from various places in table 15.1

TABLE 15.1

Place	Waste which comes out
Home	_____, _____, _____, _____
school	_____, _____, _____, _____
Vegetable market	_____, _____, _____, _____
Hotel	_____, _____, _____, _____
Hospital	_____, _____, _____, _____
Factory	_____, _____, _____, _____

It is commonly seen that people throw waste materials here and there. This causes environmental pollution. The harmful effects of these waste materials can be enumerated as follows.

1. Pollution of air, water and land
2. Bad effect on health.
3. Destruction of the beauty of the environment.

Today, all cities and villages are facing the problem of waste management (disposal). Therefore, there is a need to think of such methods of waste disposal, that do not harm the environment and keep the city/village neat and clean. Think, how you would help the community in waste disposal.

Some substances thrown with the garbage, are easily decomposable. For example, peels of fruits and vegetables, paper, cardboard etc., these are known as biodegradable substances. However plastic, metals, glass, cement etc. neither decompose naturally nor decay very slowly. These are known as non –biodegradable.

Lets perform an activity to find out the time required for the decomposition of substances found in the garbage.

ACTIVITY 1

Materials Required: - Peels of fruits and vegetables, pieces of glass, plastic bags, pieces of paper and cardboard, four big pots and spade.

Dig 4 cubical pits with length, width and height 1 foot each. Dig these in places where observations can be made easily or you can take four big pots and label them 1, 2, 3, and 4 respectively.

As given in table 15.2, place different kinds of things in each of these and then fill them up with earth. Sprinkle some water over them. After two weeks dig each of these pits and observe the things, which you had put in. Observe their state of decomposition carefully. After observation bury them with earth again and put some water over them. Repeat the above process after four and six weeks and note your observations in the table 15.2.

TABLE 15.2

Pit/Pot No.	Buried substances	State After two weeks	State After four weeks	State After six weeks
1.	Peels of fruits and vegetables	----------	----------	----------
2.	Glass pieces	----------	----------	----------
3.	Polythene bags	----------	----------	----------
4.	Cardboard and paper pieces	----------	----------	----------

You see that some materials decompose, while others do not. You can now segregate the daily wastes into these two groups and perform their disposal.

1. **Wet and easily perishable substances -** Everyday our house generates wet garbage. This comprises of leftover food, flowers, wastes from fruits and vegetables, leaves and other wet wastes. Leave them in a pit after covering them with earth. After about a month they turn into a fertilizer. This is compost manure, which consists of essential nutrition for plants. This manure increases the water absorbing ability of the soil and also disposes off the garbage.

It is suggested to use more and more of natural manure, like cow dung, organic manure (vermi compost) etc in fields.

Earthworm Manure: Vermi Compost

Biodegradable waste is decomposed by earthworm. Earthworm decomposes all the decaying waste material present in the soil and it's excreta is called organic manure. It is also called vermi compost. Nitrogen, phosphorous and potassium is present in large amount in it.

Earthworms help not only in keeping the environment clean but also in disposing garbage and providing us organic manure. So they are farmers' friend and useful for environment.

2. **Dry Waste: -** This group comprises of paper aluminum etc., which can be again utilized after recycling. Recycling has a major role in the waste management.

What do you use to carry things purchased from the market? Look around and make a list of things made of plastic. You can take the help of the picture 15.2 given below.

Figure 15.2 Various Plastic objects

You know, plastic has become a part of our life. There are a lot of advantages of plastics, but we are also facing difficulties due to plastics. Everybody uses plastics and throws them in the garbage. Discuss in your class, how it is harmful. You will see -

1. Often plastic bags collect in drains and clog them.
2. Many animals like cows, dogs etc swallow plastics along with the garbage. These can get stuck in their intestines and may cause their death.
3. When plastics collect in soil, they stop the flow of water.
4. All the plastics, while heating and burning releases harmful gases. These gases cause different types of health problems. Never burn things made of plastics. This is because; while burning they cause a lot of air pollution.

You must have understood the harmful effects of plastics and realized that plastics should not be used. Lets see what can be done to minimize their use-

- Ask shopkeepers to use paper bags instead of plastic bags.
- Use cloth or jute bags to carry things.
- Avoid using glasses, bowls, spoons, plate etc. made of plastics.
- Sell plastic materials to the waste collector (kabaadiwaala), so that it may be recycled.
- Do not throw plastic bags on the streets, in drains and at other public places.

Increase in waste materials causes a lot of inconvenience. Let us see the other methods used in the management of waste.

Reusing

You must have seen some waste products that are renewed.

Make a list of things, which you have thrown in the garbage bin, just think how these can be utilized again. For example, empty bottles and boxes can again be used to keep things. Some pens, bags, papers written on one side can be used again. In this way you can dispose off some of the wastes.

Recycling

You must have seen many people collecting plastic bags from the garbage bins and from the streets. You must have also seen kabadiwalas buying old newspapers, bottles, metals and things made of plastics from your homes. They re-sell these things after collecting them and they are transformed to new things after some processes. This process helps in the management of wastes, and simultaneously provides employment to the illiterate and the jobless.

Recycling is the process that uses scientific method on waste substances like metals, plastics, glass and rubber to make them reusable. A part from this there are waste which are useful in other form. For example After removing the grain the barn is the waste but is used to extract oil or used as cattle food.

Recycling of paper -

You will require pieces of old newspapers, magazines, used envelops, note books or any other paper. Do not use shiny, plastic-coated paper. You will also need a frame fitted with a wire mesh or a net. You can also use a large sized sieve in place of a frame.

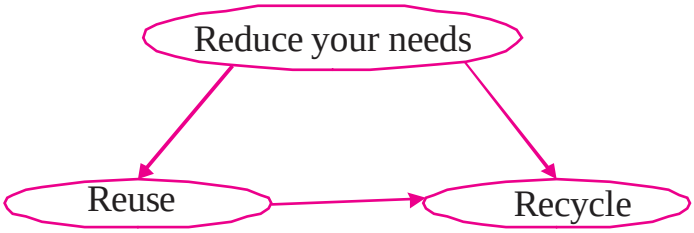
Tear the paper into small pieces. Put them in a tub or a bucket and pour water in it. Let the pieces of paper remain submerged in water for a day. Make a thick paste of paper by pounding it.

Spread the wet paste on the wire mesh fixed to the frame. Pat it gently to make the thickness of layer of the paste as uniform as possible. Wait till water drains off. If required spread an old cloth or a sheet of newspaper on the paste to let it soak up the extra water.

Now carefully remove the layer of paste from the frame, spread it on a sheet of newspaper in the sun. Keep the corners of the newspaper sheet pressed by putting some weights so that these do not curl up.

You can add pieces of dry leaves or flower petals or pieces of coloured paper in the paste before spreading it to get coloured paper. It would help us to get a recycled paper with beautiful patterns on it.

Can we recycle everything?



In table 15.3 names of some waste products are given. Try to find the use of these waste products with the help of your friends and family members.

Table 15. 3

S. N.	Waste Products	Uses
1.	Cow dung and urine of animals	
2.	Oil cakes of mustard and other oil seeds	
3.	Husk of wheat	

WE HAVE LEARNT

- Improper management of waste has become a danger for the environment and is a serious problem for human.
- Waste material causes pollution of air, water and land.
- Substances, that are naturally and easily decomposable naturally, are called biodegradable.
- Those substances, which are not easily decomposable are called non-biodegradable.
- Dry and wet wastes are managed in different ways.
- Things made of plastic can be better managed by their reutilization and recycling.
- Earthworms eat rotten food materials present in the soil and excrete them as organic manure. This is called vermi compost.

EXERCISE

1. What can be the reasons for the water of a pond being unfit for consumption?
2. What will be the condition of dumping area if the volume of garbage keeps on increasing?
3. List the harmful effects of the use of plastics in articles of daily use.
4. Explain the meaning of recycling.
5. Why earthworms are known as farmers' friends?

THINGS TO DO

1. With the help of your teacher, make groups of 6 students. Each group would visit a alloted area and to survey on the following points.
   (a) Number of handpumps and their usabilety.
   (b) The condition of the drainage.
   (c) The system of waste disposal in homes.
   (d) The arragement for the waste disposal from small industries or farms etc.

Make a report of your survey and discuss about it in the class and clarify the problems with the help of the community.

2. Make two garbage bins for your school. Paste a green paper on one and a blue paper on the other. On the green bin enumerate the name of biodegradable and on the blue one enumerate the name of non-biodegradable substances. Manage and dispose of the waste of these bins properly, when they get filled up.

16. HEALTH AND HYGIENE

A healthy person is one who is both physically and mentally fit. For us to remain mentally and physically fit, it is important that we know our body parts and their functioning. If our environment is not clean and we do not take care to keep our body clean then we will fall ill. Good habits, a balanced diet and a balanced life style will not only influence our personal health, but also that of whole community.

Health is influenced by factors internal to our body as well as external factors. Internal factors include improper functioning of internal organs like heart, lungs, kidneys etc. External factors include unbalanced diet, disease causing microorganisms, bad habits and environmental pollution.

16.1 Diet for Good Health

The food we normally eat in a day is our diet. For growth and maintenance of good heath, our diet should have all the nutrients that our body needs, in right quantities. No nutrient should be in excess quantity or less than enough in quantity. A diet containing all nutrient foods in right amounts is called a balanced diet. The balanced diet has components called carbohydrates, proteins, fats, minerals and vitamins (Figure 16.1). Their classification is done on the basis of the requirements of the body .

a. **Carbohydrates:** energy giving foods
b. **Fats:** energy giving foods
c. **Proteins:** body-building foods
d. **Minerals and Vitamins:** foods that protect the body

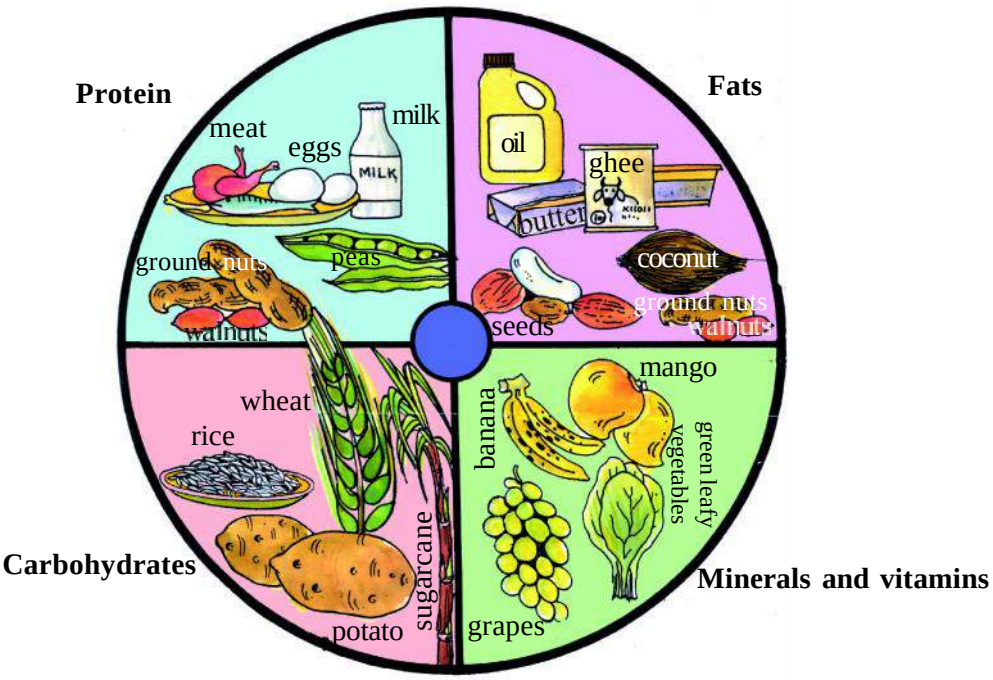


Figure 16.1 Different types of foods

The diet should also contain a good amount of roughage and water. Such a diet is called a balanced diet. Do you think that people of all ages need the same type of diet? Do you also think that what we need for a balanced diet would depend on the amount of physical work that we do?

Prepare a chart of whatever you eat over a period of week. Compare your list with other students of your class. Check whether all the nutrients for a balanced diet are present in your meals.

It is not necessary that a person getting enough food gets all nutrients in right proportion. The person may lack some or the other nutrient. Deficiency of one or more nutrients can cause disease or disorders in our body. Diseases that occur due to lack of nutrients over a long period are called deficiency diseases.

16.2 Some diseases/disorders caused by deficiency of vitamins and minerals.

Some diseases/disorders caused by deficiency of vitamins and minerals are as follows

Vitamin / Minerals	Deficiency disease/disorder	Characteristics	Sources
Vitamin A	Night blindness	Poor vision, loss of vision in darkness, sometimes complete loss of vision	Fish oil, Carrots, Pumpkin
Vitamin B1	Beriberi	Weak muscles and very little energy to work	Green leafy vegetables,gram, tomato, soya bean, coconut,egg
Vitamin C	Scurvy	Bleeding gums, wounds take longer time to heal	Lemon, citrus fruits, chilli, amla
Vitamin D	Rickets	Bones become soft and bent	Butter, egg, fish, sunlight
Calcium	Bone and tooth decay	Weak bones, tooth decay	Milk, curd, banana etc.
Iodine	Goiter	Glands in the neck appear swollen, mental disability in children.	Iodized salt.
Iron	Anemia	Weakness	Maize, spinach

Besides a balanced diet, for remaining healthy, it is also necessary that we keep our body's hygiene, and are regular with our habits and also exercise regularly. We should also keep our home, neighbourhood, village and town clean. You will learn about these things through the game 'Snake and Ladder'.

You probably know how to play 'Snake and Ladder'. This book has a pull-out paper having the game – take it out from the book. You can play the game in school or even at home. The game can be played in groups of four. In case you do not have dice then you can take three seeds of tamarind and split them – your dice are ready. You can use buttons, seeds or pebbles as counters for each team. Continue the game till buttons or counters of all players reach 'home' or in the box numbered 100. The moment any child's button reaches 100, s/he will be out of the game but s/he will continue to sit in her/his place.

ANSWER THESE

Write right/wrong against these statements –

1. There should be no standing water in the ground, near taps, wells and in our homes.
2. We should dirty our houses, schools and public toilets.
3. We should spit only on roads and walls.
4. We should put peels of vegetables and fruits in plastic bags before throwing them.
5. The dining area should be kept clean.
6. We should delay taking the sick person to the hospital.
7. Loud speakers should be used at full volume.
8. Plants and trees should be cut.
9. We should not urinate outside our homes or on the streets.

16.3 Health check up and Vaccination

We come to know about some disease in our body through medical examination. If we are regular in these examinations we will know about a disease in time and get timely treatment.

Vaccination is also a valuable method of controlling diseases. Children are vaccinated with B.C.G, D.P.T and Polio vaccines. This develops resistance in them against these life-threatening diseases and prevents them from being infected.

WE HAVE LEARNT

- A healthy person is both physically and mentally fit.
- We should take a balanced diet, i.e. a diet that contains proper quantities of carbohydrates, proteins, fats, minerals and vitamins. Lack of nutrients over a long period of time cause deficiency diseases.

- Important factors for a healthy body – balanced diet, clean water, fresh air, hygienic body, exercise, rest and not taking any addictive substances like alcohol, tobacco etc.
- Keeping oneself hygienic and free of disease is being healthy.
- For good personal health it is necessary to have-
  1. Regular bowel habits, bathing, proper exercises, rest and sufficient sleep.
  2. Regular cleaning of teeth and gums.
  3. Proper care of eyes.
  4 Regular cleaning of ears and nose and regular check-up.
  5. Proper care and cleaning of the hair for its healthy look.
  6. Regular cleaning and trimming of nails.
  7. Proper cleaning of the hand before meals and after using the toilets with soap or fresh ash.
- For a healthy community it is necessary to – put garbage in bins, prevent stagnation of water, proper use of community toilets, not spitting on walls and on the streets, disposing garbage properly, preventing pollution, having health education and having a proper arrangement for treatment.

Why use the Toilets ?

The main source of disease germs are the faeces. One gram of faeces has about 1 crore virus, 10 lakhs of bacteria and 1000 parasites and their eggs. The germs in the faeces are so small that they can not be seen by naked eye. To protect ourselves from these germs of the faeces, the best form is the use of toilets. We can be free from the diseases only if hundred percent people use the toilets. Even if one person doesnot use the toilet and excrete in the open then the possibility of diseases remain same as if cent percent have not used the toilets. There fore all must use the toilets.

EXERCISE

1. Match correctly:

	A	B
1.	Protein	Lungs
2.	Tobacco chewing	Body-building
3.	Part affected by smoking	Protection of the body
4.	Minerals and vitamins	Care for the body
5.	Personal health	Mouth cancer

2. Choose the correct alternative :

i. Found in large quantities in rice, potato and sugar

a. Vitamins b. Proteins

c. Carbohydrates d. Minerals

ii. Diarrhoea occurs due to

a. drinking infected water b. over-eating

c. drinking clean water d. eating salads

iii. Breathing problems may occur due to

a. Soil pollution b. Air pollution

c. Water pollution d. Noise pollution

iv. Vaccination for which disease involves taking an oral dose of the vaccine:

a. Malaria b. Diarrhoea

c. Cold d. Polio

v. Disposal of garbage should be:

a. packed in plastic bags

b. thrown on the streets

c. thrown outside the houses

d. segregated and if possible some materials recycled.

3. Fill in the blanks with correct option.

(a) Lack of vitamin A causes…….disease (night blindness/ scurvy)

(b) We get …… from sour fruits. (vitamin D / vitamin C)

(c) …… is the energy giving food. (dal / rice)

(d) Body building food is …… (ground nut / banana)

(e) For good health …… is needed. (balanced diet/ narcotic drugs)

4. Write answers to these questions:

i. Why is there a need to have a balanced diet?

ii. Why should fruits and vegetables be washed before use?

iii. Why should food and water be kept covered?

iv. Why is health education necessary?

v. What all should be kept in mind to keep healthy?

vi. Why are toilets necessary at our homes and schools ?

vii. What is vaccination?

viii. How do bad habits affect health?

ix. What should we do to keep the community healthy?

x. Write what you understand by personal and community health?

xi. Why is it necessary to wash hands before meals ?

xii. Why must not we drink unclean water ?

THINGS TO DO

1. How can food materials lying uncovered in the market-places harm us? Organize discussions on this periodically.
2. Collect articles written about the diseases caused by water pollution from newspapers, magazines etc. Also collect material on prevention of such diseases. Paste these in your project – notebook and discuss it with the community
3. Copy the given vaccination schedule on a chart paper and put it up in your class room and also at the public square of your locatity. Encourage people in your family and neighbourhood to get all small children vaccinated at proper times.

Vaccination Schedule

Age of the Child	Vaccination	Disease
At birth	B.C.G.	Tuberculosis
At 6 weeks	D.P.T. , polio drops - 1	Diptheria, Whooping cough, tetanus and polio
At two and a half months	D.P.T. , polio drops - 2	Diptheria, Whooping cough, tetanus and polio
At three and half months	D.P.T. , polio drops - 3	Diptheria, Whooping cough, tetanus and polio
At nine months	Measles	Chicken pox, measles
At one and half years	Polio Booster - 1	Polio
At 5 years	Polio Booster - 2	Polio

4. Make a list of nutrients present in the food of animals wandering near your surroundings.

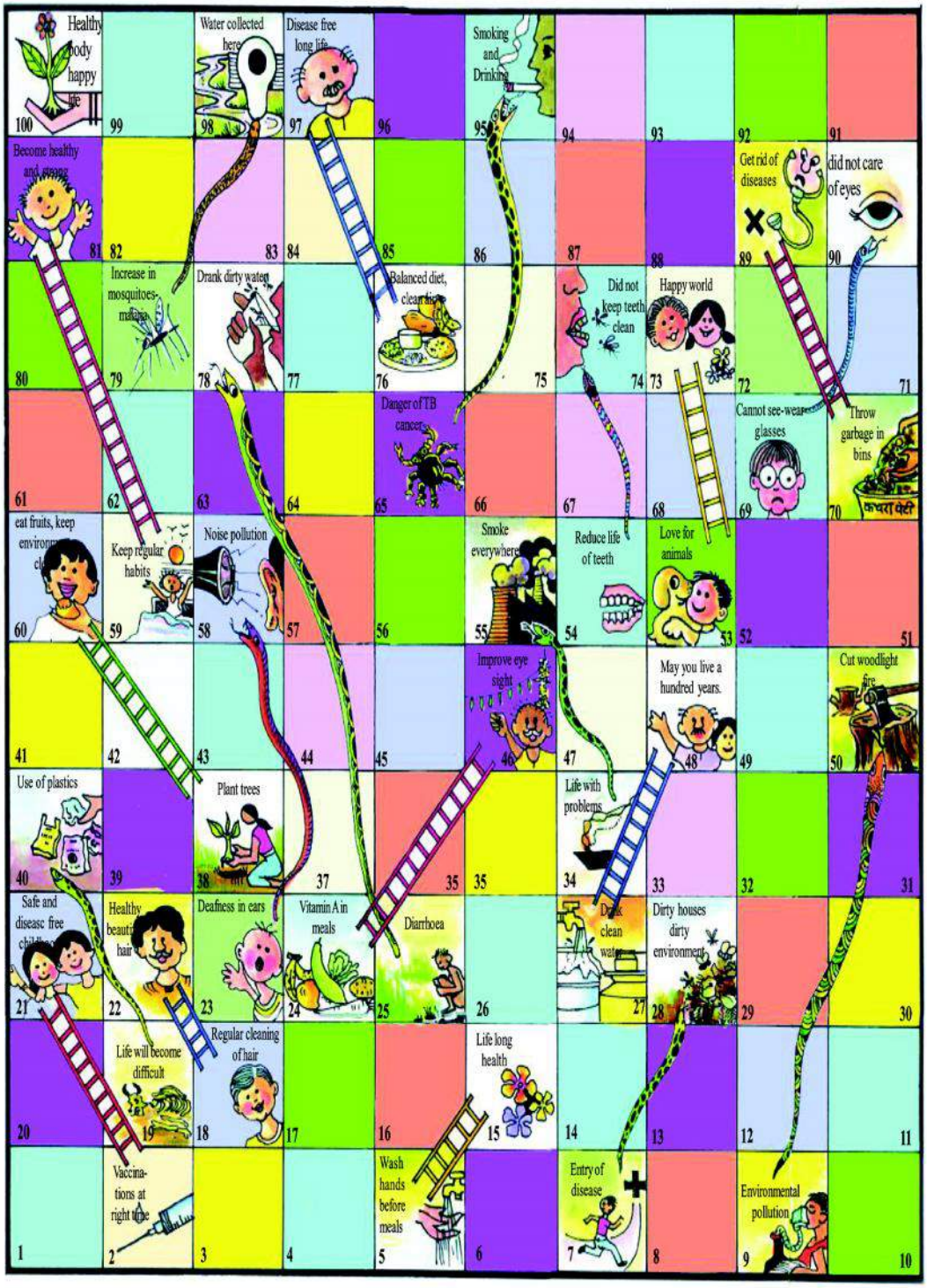
S.No.	Name of Animal	Food material	Nutrients
1	Cow	Grass, husk, jaggery and khali etc.	Carbohydrate, fat
2	Dog	----------	----------
3	----------	----------	----------
4	----------	----------	----------

Discuss about the balanced diet of animals from the information gathered by other students of your class-

5. Make a balance diet chart for a 12 year old child. The diet chart should include all the food items which are not costly and found easily in your local area.

6. In your house what will you do to stop wastage of food? Make a plan with your family members and friends and apply it.

SNAKE & LADDER



Facts related to the game

2. Vaccination at the right time 21. Safe and disease-free chidhood

. diseases like polio, cholera, small pox can be prevented by vaccination.

. The government has a national vaccination programme.

. All children up to 5 years should be given preventive vaccination.

5. Wash hands before meals - 15. life long health

. You may fall ill if you cook or eat food with dirty hands.

. Wash your hands with soap before meals and after using the toilet.

18. regular cleaning of hair - 22 healthy beautiful hair

. Hair should be cleand and combed regularly

. Dirty hair result in deandruff and lice infestaion. This causes itching and hair fall.

24. Vitamin A in meals- improves eye- sight

. Spinach, milk, butter, cabbage, carrots, mangoes are rich in Vitamin A

. Lack of Vitamin A can cause night-blindness.

27. Drink clean water - 48 may you live a hundred years.

. Water for drinking should be kept in a clean vessel and kept covered.

. Water for drinking should be cleaned by boiling, filtering or by adding chemicals.

. Drinking dirty water may cause infection in the stomach, vomiting, diarrhoea or jaundice.

28. Drity house, dirty environment - 7 Entry or disease

. There are grems in dirty places

. Flies pick up germs from dirty places and carry them to the food they sit on.

38. Plant trees - 60 eat fruits, keep environment clean

. Trees keep the air fresh

. Plants prevent tunoff of soil and make it fertile.

40. Use of Plastic - 19 life will become difficult

. Plastic does not disintegrate

. Burning of plastics releases poisonous gases

. When animals eat plastics then there is a danger of their dying.

50. Cut wood-light fire - 9 environmental pollution

. Cutting trees increases environmental pollution. The soil becomes bere and the animals and birds have no places to live in.

53. Love for animals - 73 happy world

. Different kinds of living organisms help maintain balance in nature.

55. Smoke everywhere - 47 Life difficult

. The smoke that comes out vehicles, factories and stoves is harmful for heatlh.

. Smoke has a bad effect on the nose, throat, wind pipe and lungs.

58. Noise pollution - deafness

. Loud noise leads to pollution.

. Very loud noise can cause the membrane in ear to tear and cause permanet deafness.

59. Keep regular habits - 81 become healthy and strong

. Early to bed and early to rise, makes man healthy and wise.

. One should be regular in one's bowel habits, keep teeth and hair clean and bathe regularly.

. One should follow a regular schedule in taking exercise, eating meals and studies.

70. Throw grabage in bins - 89 get rid of diseases

. It is easier to remove garbage and dispose it off if collected in garbage bins.

. Flies, mosquitoes etc. cannot sit on covered garbage.

74. did not keep teeth clean - 54 reduce life of teeth

. One should brush ones teeth and massage the gums before going to bed at nigth and in morning on waking up. If cleanliness is not maintained then it may cause teeth decay and the mouth could give a foul odour.

76. balanced diet, clean air - 97 disease free long life

. The diet for children between the ages 10 and tweleve should include two cups of cooked cereal, half a cup of cooked lentils *(dal)*, 2 cups of milk, green vegetables and seasonal fruits.

78. drank dirty water - 25 diarrhoea

. Areas around wells, handpums, community taps etc should not be dirty.

. There are germs in dirt and mixed with water can cause diarrhoea, vomiting etc.

90. did not take care of eyes - 69 cannot see without glasses

. one should wash ones eyes with clean fresh water early in the morning.

. Protect eyes from very strong light.

95. intake of drugs - 65 risk of T.B. and cancer

. the use of bidi, cigarette and tobacco causes diseases pertaining to mouth, nose, throat, trachea and lungs.

. the substance 'nicotin' which is found in tobacco is very harmful for the body.

98. Water collected here - 79 increase in mosquitoes - malaria

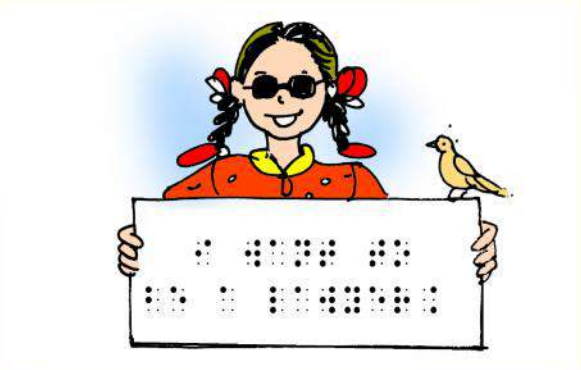
. Do not allow drains and gutters near your home to fill up with dirt and water.

. Keep the bathrooms and toiletes clean.

100. Healthy body - happy life

. For a healthy body you will have to develop regular and healthy habits.

Braille An Introduction



Do you know what is written here?

It is: I want to be a lawyer.

Like devnaagri and Gurumukhi etc. Braille is also a script. Braille script is used by Blind persons to read and write. Braille was invented by Louis Braille in 1829. Braille script is based on six dots. These six dots are referred as the Braille cell. Each cell comprises of one Braille character. To write Braille script Blind person uses Stylus and Braille slate. Braille slate consist essentially of two metal or plastic plates hinged together to permit a sheet of paper to be inserted between the two plates. While writing on a Braille sheet (drawing sheet) it is to be written from right to left and then reverse the normal numbering of the Braille cell. Blind person reads these raised (embossed) dots with the help of their finger tip.

Braille cell

Total 63 combinations are possible using these 6 dots.
Some combinatios given below:

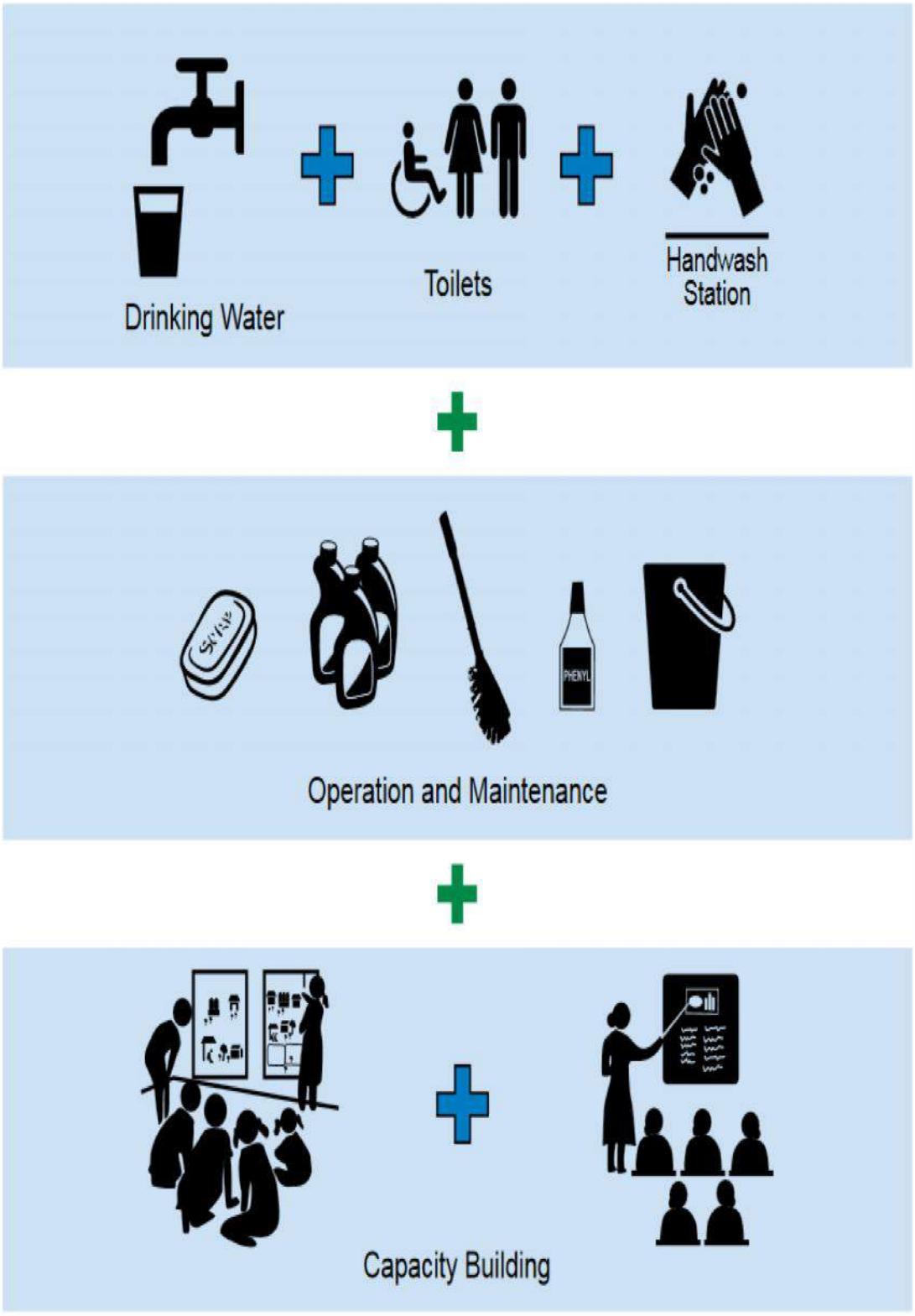
Braille Chart

a	b	c	d	e	f	g	h	i	j
k	l	m	n	o	p	q	r	s	t
u	v	w	x	y	z				

A Number sign (⠼) is used before the alphabets 'a' to 'j' to convert them to numbers.

1	2	3	4	5	6	7	8	9	0

A Minimum Swachh Vidyalaya Package



स्वच्छता– एक आदत है।

(स्वच्छ भारत, स्वच्छ विद्यालय)

Everyone must be his own scavenger.

M. K. Gandhi

प्रत्येक को अपना कूड़ा–करकट, स्वयं साफ करना चाहिए।

–महात्मा गांधी

राज्य स्वच्छ भारत मिशन
छत्तीसगढ़ शासन