SCIENCE

STANDARD SEVEN

TERM I

சின்னஞ்சிறு குருவி போலே நீ
திரிந்து பறந்துவா பாப்பா
வண்ணப் பறவைகளைக் கண்டு நீ
மனதில் மகிழ்ச்சி கொள்ளு பாப்பா

கொத்தித் திரியும் அந்தக் கோழி – அதைக்
கூட்டி விளையாடு பாப்பா
எத்தித் திருடும் அந்தக் காக்காய் – அதற்கு
இரக்கப்பட வேணுமடி பாப்பா

வண்டி இழுக்கும் நல்ல குதிரை – நெல்லு
வயலில் உழுது வரும் மாடு
அண்டிப் பிழைக்கும் நம்மை ஆடு – இதை
ஆதரிக்க வேணுமடி பாப்பா

வாலைக் குழைத்து வரும் நாய்தான்– அது
மனிதர்க்குத் தோழனடி பாப்பா

–மகாகவி பாரதியார்

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Chandra, while preparing for a competition, came across the above Bharathiar's poetry. She was astonished and admired that how Bharathiar loved animals and presented their characters in sweet and short evergreen lines. She ran to her mother to show the poem.

Amazed by her daughter's interest, Chandra's mother told her that since time immemorial man coexisted with birds and animals. Everyday from dawn to dusk man's life is influenced by animals. He woke up listening to the call of birds. He had to depend on animals for food, clothing, transport, fuel etc. The buzzing of bees was his first music and the dance of the peacock was his first entertainment. Dogs and cats were his first playmates.

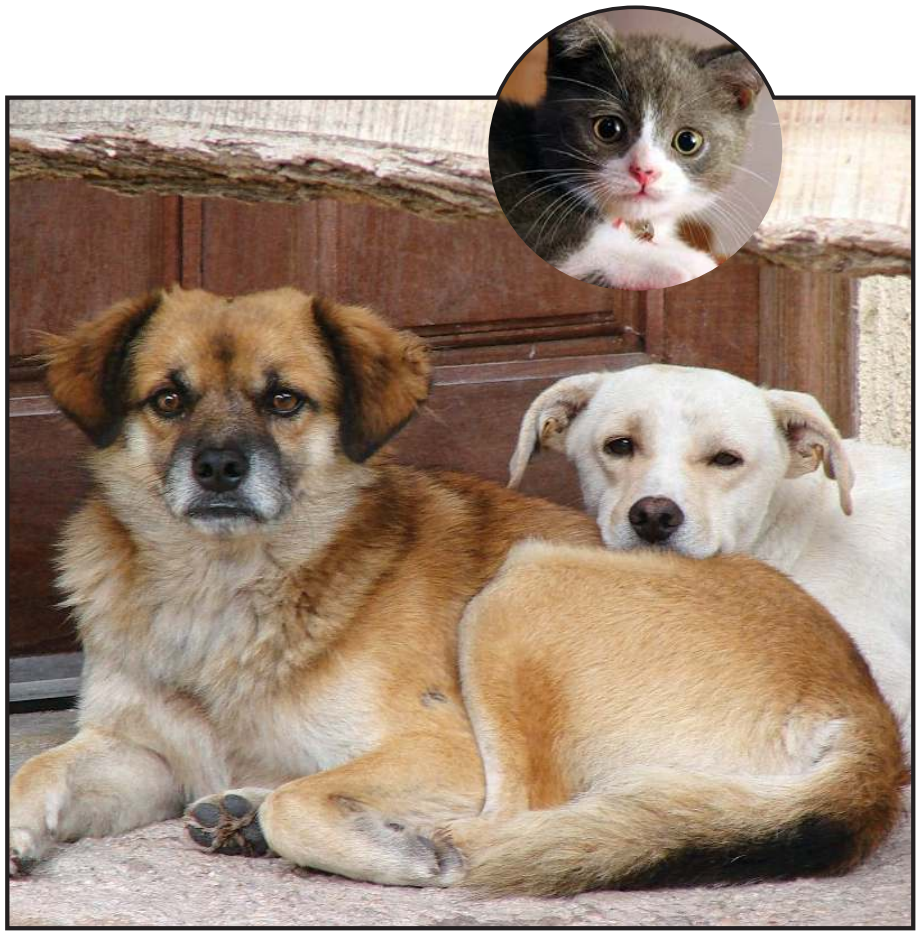

Fig 1.1 Pet animals

ACTIVITY - 1.1

Children, do you have a pet animal? Shall we write down what we do when our pet is.....

a) hungry.....

b) feeling hot or cold .....

c) teased by someone .....

d) hurt .....

The life on this planet Earth is sustained by plants and animals. With the development of knowledge and technology, man's dependance on animals for economic purpose increased. The balance in nature will be upset if the relationship between human and animals deteriorates.

ACTIVITY - 1.2

Children, shall we fill in the blank spaces?

Name of the Animal	Why do we keep them?
1. Dog	.....
2.	gives milk
3.	pulls cart
4. Ox	.....
5. Hen	.....
6. Fish	.....
7.	we love it
8. Honey bee	.....

Fig 1.2 (a) Jersey

Fig 1.2 (b) Kangeyam

1.1. USES OF ANIMALS

Animals and their products are of great use to man. Based on the utility of animals, they are classified into three groups

1. Food yielding animals

Animals are reared for milk, eggs and meat. Breeds of cows are mainly raised for milk eg. Jersey . Certain breeds of goat are reared for milk and meat. Honey bees give us honey. Fishes are a good source of protein.

Fig 1.3 Llama

2. Fibre yielding animals

Animals such as sheep, Llama and goat provide us fur. The fur is processed into wool. Silk moth gives us silk fibre.

3. Draught animals

Animals which are used for ploughing and transporting are called draught animals. Bullock(kangeyam), Ox, horse, elephant, donkey, etc are employed in farm activities and transport.

MORE TO KNOW

Some cows produce around 16 litres of milk a day or 6000 litres a year.

ACTIVITY - 1.3

Observe the care taken by milkman on the cow in the shed and the care taken by your family on your pet animal. List down your observations.

Sl.No.	Dog	Cow
1.		
2.		
3.		
4.		

Fig 1.4 Honey Comb

Fig 1.5 Milk

Fig 1.6 Silk

1.2. ANIMAL PRODUCTS

Animals provide us a variety of products like wool, silk, milk, honey, meat, leather, pearl, egg, lac and so on. Let us learn about some.

1. Wool: Wool is obtained from hairs on the bodies of animals such as sheep, llama and goat. It is used to make sweaters, shawls, blankets, socks, hand gloves etc.
2. Meat: Animals such as goat, sheep, pig, poultry birds, prawn, crab etc. yield flesh as food.
3. Silk: Silk is obtained from silkworm and it is used for making silk clothes.
4. Leather: The skin of animals such as goat, sheep, and cattle is used for manufacturing leather goods(bags, shoes, purses, suitcases, belts).
5. Pearl : Pearl is a valuable gem obtained from pearl oysters and is used in making ornaments.
6. Lac : Some insects secrete a resin like substance called lac. It is used for making paints, varnish, printing inks and cosmetics.
7. Milk: Animals like cows, buffaloes and goats give milk as food.
8. Honey: Honey is obtained from honey bees. It is consumed along with food and used in the preparation of certain medicines.
9. Egg: Poultry birds such as hen, duck, goose and turkey give us eggs as food.

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MORE TO KNOW

In 2004 December 26th, some tribes that live in the forests of Andaman islands noticed the animals behaving in a different manner. They guessed some danger. So they moved to a safer part of the island. Soon after their move the islands were hit by Tsunami, but the people were saved.

1.3. ANIMAL FIBRES

One day Selvan saw his grandmother wearing a shawl and his mother asked him

Fig 1.7 Sheep

to wear a sweater. He was curious to know why they should wear these clothes? His mother said that woollen clothes trap air and act as bad conductor of heat or cold . Hence they keep us warm during winter.

Wool

Wool is a thick coat of hairy fibres(fleece) obtained from sheep, goat, yak and other animals. It is composed of a protein called keratin. Several breeds of sheep are reared in our country that yield different kinds of wool. The skin of sheep has two types of hair.

a) Coarse beard hair and b) Fine soft under hair.

MORE TO KNOW

Australian scientists have invented a way of removing wool from Sheep without shearing. The new wool harvest technology is called Bioclip.

ACTIVITY - 1.4

Let us collect pictures of animals that produce wool and paste them in the scrapbook.

Normally fine hairs provide the fibres for making wool. **Yak wool** is common in Tibet and Ladakh. **Angora wool** is obtained from Angora goats which are found in Jammu and Kashmir. The wool from Angora goat is called as “Mohair”. The underhair of Kashmiri goat (Pashmina) is woven into fine shawl. It is very soft and expensive.

Processing of wool

There are many steps involved in processing the fur into wool. The process of cutting off the woollen fleece of sheep with a thin layer of skin is called **shearing**.

The wool is used to manufacture sweaters, shawls, blankets, hand gloves etc.

Silk

Silk is also a natural animal fibre. Silk worm secretes the silk fibre. The best known type of silk is obtained from the cocoon of larvae of mulberry silkworm. Silk fabric was first developed in ancient China.

Uses of Silk

Silk is used for making silk clothes, parachutes, insulation coils for telephone and wireless receivers.

MORE TO KNOW

Pure silk is one of the finest natural fibres and is said to be the **“queen of fibres”**

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1.4. SERICULTURE

Selvan and Valli attended a marriage function. They noticed that some of the women were wearing colourful sarees. Selvan asked his mother, why those sarees are shining?. His mother told him that those sarees are made of silk.

The rearing of silk worms for obtaining silk is called **Sericulture**. It is a very old occupation in India. The silk fibre is obtained from the cocoon of the silk moth. There are varieties of silk moths and the silk they yield is different in texture.

The types of silk are

1. **Mulberry silk**
2. **Tassar silk**
3. **Eri silk**
4. **Muga silk**

The most common silk is mulberry silk. Mulberry silk is superior in quality because it is soft, lustrous and creamy white in colour. It is secreted by the silk producing glands of silkworm.

Steps of preparing silk fibre.

1. A female silk moth lays hundreds of eggs at a time.
2. The eggs are kept under hygienic conditions and under suitable temperature.
3. When the eggs hatch into larvae, they are fed on mulberry leaves.
4. After 25 to 30 days of feeding, they spin a protective case around them called cocoons.
5. The cocoons are dipped in hot water and the silk fibres are separated.
6. The process of taking out threads from the cocoon is called **Reeling**.
7. The thread is woven into silk cloth.

MORE TO KNOW

It is believed that silk was first dicovered in China by the Empress Si Ling Chi

India is the world's second largest producer of Silk.

Kancheepuram, Siruvanthadu, Thirubhuvanam and Arani are famous for silk in Tamil Nadu.

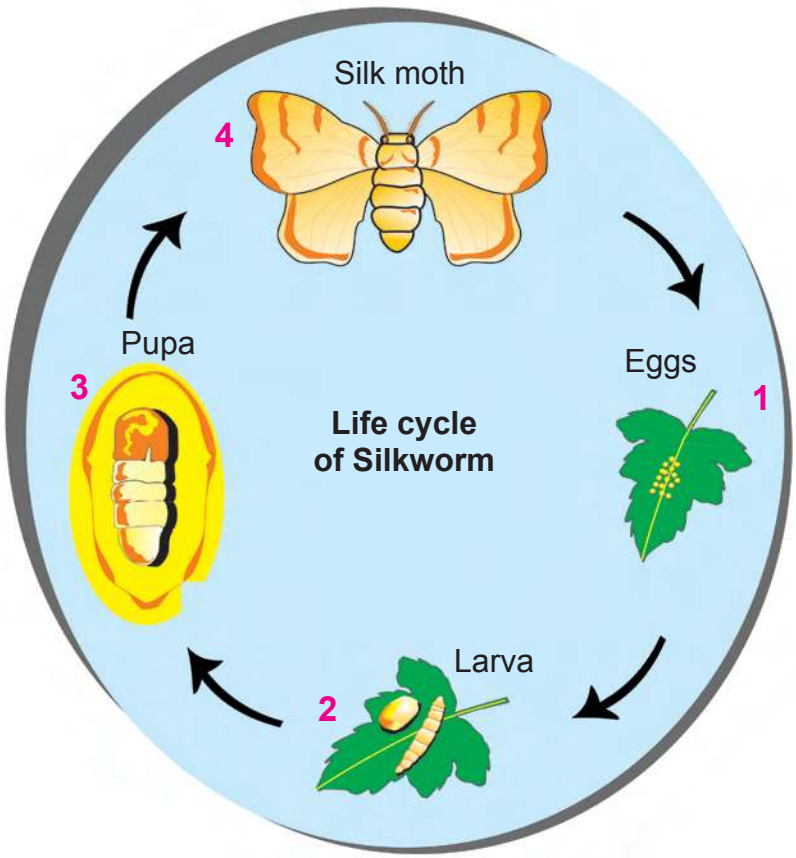


Fig 1.8 Life cycle of Silkworm

ACTIVITY - 1.5

Let us mark the places in the map of Tamil Nadu where silk is produced and woven into fibres and clothes.


Fig 1.9 Queen bee


Fig 1.10 Drone bee

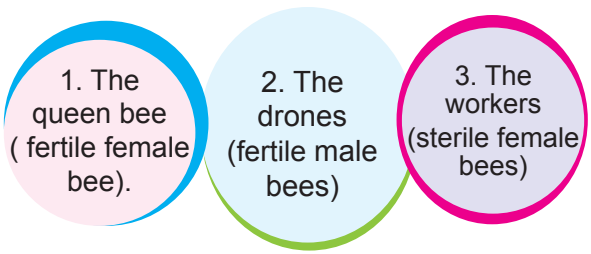

Fig 1.11 Worker bee

1.5. APICULTURE

I am used in cakes.
I am found in sweets.
I am used in medicines.
I am manufatured by bees.
Can you guess who am I?
Yes, I am **HONEY**.

Where do bees live?

Honey bees live in beehives. A beehive consists of numerous small compartments called honey combs. Bees live in colonies. There are three kinds of bees in a beehive. They are



There is only one queen bee in a beehive. The work of the queen bee is to lay eggs. There are a few hundreds of male bees which help in reproduction. The worker bees are thousands in number. They perform various functions.

Honey is used as food. It is used in the preparation of certain medicines in Siddha, Ayurveda and Unani. Bees also produce wax, which is used for making candles. Some Indian varieties of bees are

1. Rock bee (*Apis dorsata*)
2. Little bee (*Apis florea*) and
3. Indian bee (*Apis indica*)

MORE TO KNOW

Composition of Honey.

Sugar	-	75%
Water	-	17%
Minerals	-	8%

Nowadays, bee-keeping is practised to produce more honey.The rearing of honey bees to produce honey in large scale is known as **apiculture.** A well known Italian breed called *Apis mellifera* is the best for bee-keeping because it has high honey collecting capacity and it does not sting much.

ACTIVITY - 1.6

Shall we check if the honey is pure or not?

1. Let us take a glass of water.
2. Add a drop of honey to it.
3. If the drop of honey reaches the bottom without dissolving, then the honey is pure.
4. If the drop of honey dissolves before reaching the bottom then the honey is impure.

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Fig 1.12 Poultry farm

1.6. POULTRY

Selvan and Valli eagerly wait for lunch everyday. They get an egg with their midday meal in school. Selvan wants to know from where they get huge amount of eggs.

Valli said that they get the eggs from poultry.

The rearing of hens and other fowls to produce eggs and flesh is called **Poultry farming**. Several kinds of birds like hen, duck, turkey, goose etc.. are reared for the production of eggs and flesh. The place where the fowls are reared is called **Poultry farm**.

Fig 1.13 Broiler Egg - Country Egg

Namakkal district in Tamil nadu is famous for poultry industry.

In our country, hen is the most favourite domestic bird. Poultry keeping has developed into a very big industry. Some varieties of hens are reared for the production of eggs only. Such hens are called **layers.** There are some varieties of hens grown for flesh. They are called **broilers**.

The poultry house should be well lighted and well ventilated. The common poultry feed is grains and lots of fresh water. Hens that hatch eggs are called **Broody hens**. They sit on eggs and keep them warm. This is known as **incubation**. The eggs hatch after 21 days.

Expand TAPCO - Tamil Nadu Poultry Development Corporation.

Silver Revolution

The massive step taken in India to increase egg production by adopting enlightened practices of poultry is called Silver Revolution.

ACTIVITY-1.7

1. Take a broiler egg and a country egg. Differentiate these two eggs.
2. Try making penguins out of egg shells and eye drop filler caps.

ACTIVITY-1.8

We can distinguish a fresh egg from a rotten one by putting them in a bowl of water.

The fresh egg will sink. But the rotten one will float.

1.7. ANIMALPROTECTIONANDMAINTENANCE

Ever since human beings appeared on the earth, they have been living with animals. Plants and animals are dependent on each other. We have to protect them to maintain the balance in nature because our own survival depends on this.

Domestic animals can be cared by

1. Providing animals with good feed and clean drinking water to keep them fit and healthy.
2. Providing shelters that are clean, airy and well lighted .
3. Protecting them from diseases

MORE TO KNOW

Some of the famous wildlife sanctuaries in Tamil Nadu are Vedanthangal, Mudumalai, Mundanthurai, Kalakadu and Kodiakarai.

Care of Wildlife

As people use more and more land to cultivate crops, graze cattle, build houses and factories, animals and plants are being forced out of existence. Poaching, pollution and use of excess pesticides have killed so many plants and animals. Some have been completely wiped out from the earth. If an animal no longer exists, it is said to be extinct. If they are in danger of becoming extinct, they are said to be **endangered**. Wildlife protection and maintenance is called **wildlife conservation**.

Some of the conservation measures are :

1. setting up of National Parks and Wildlife Sanctuaries.
2. stringent action against poaching.
3. discouraging deforestation.

Wildlife and forest are the wealth and pride of a country. So it is our moral duty to protect the plants and animals. We can protect our animals by

1.Not harming any animal or plant.
2. Growing trees that provide home to birds and insects.
3. Not buying animal products that are banned. eg. Tusk

MORE TO KNOW

Blue Cross is a registered animal welfare society. It helps to find homes for uncared animals and promote animal protection.

ACTIVITY-1.9

Collect different types of animal eggs. Display in the classroom.

Hen, duck, lizard, crow, turkey.

Varaiadu - The state animal of Tamil Nadu

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EVALUATION

1. PICK OUT THE CORRECT ANSWER :-

1. Fibres obtained from an insect _____
   (Wool / Silk)
2. _____ is reared in a poultry farm.
   (Buffalo / Hen)
3. There is only one_____ bee in a bee hive.
   (queen / drone)
4. After incubation, the hen's egg hatch in _____days.
   (21 / 31)
5. A sheep has a coat of wool for _____
   (man / itself)

2. The following jumbled words denote the stages in the life cycle of a silkworm. Could you write the correct sequence.

THOM, GEGS, VARAL, APPU

MOTH -> _____ -> _____ -> _____

3. On the way home you notice a goat with a broken leg. You feel sad and want to help it. Write down the things you would do.

a) _____

b) _____

c) _____

4. Complete the chart given below by observing the following animals in your surrounding.

crow, cow, lizard,donkey,goat, horse, housefly, ant, monkey, butterfly, mosquito, dog, cat.

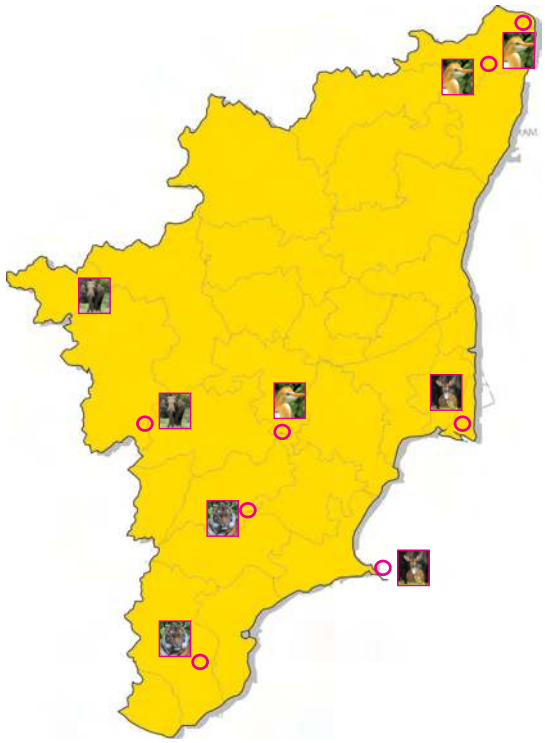
Sl.No.	Animal	Sound it makes	Food it eats	Where it lives	Relationship with man
1.	dog	wow, wow	rice, meat	kennel	friend, guard
2.					
3.					
4.					
5.					

5. In the given map of Tamilnadu some famous wildlife sanctuaries are marked.

(a) Name the places.

(b) Find out the animals / birds which are found there.

(c) Mark your place of residence and find the name of the sanctuary near your home.



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Places of scientific importance for visit

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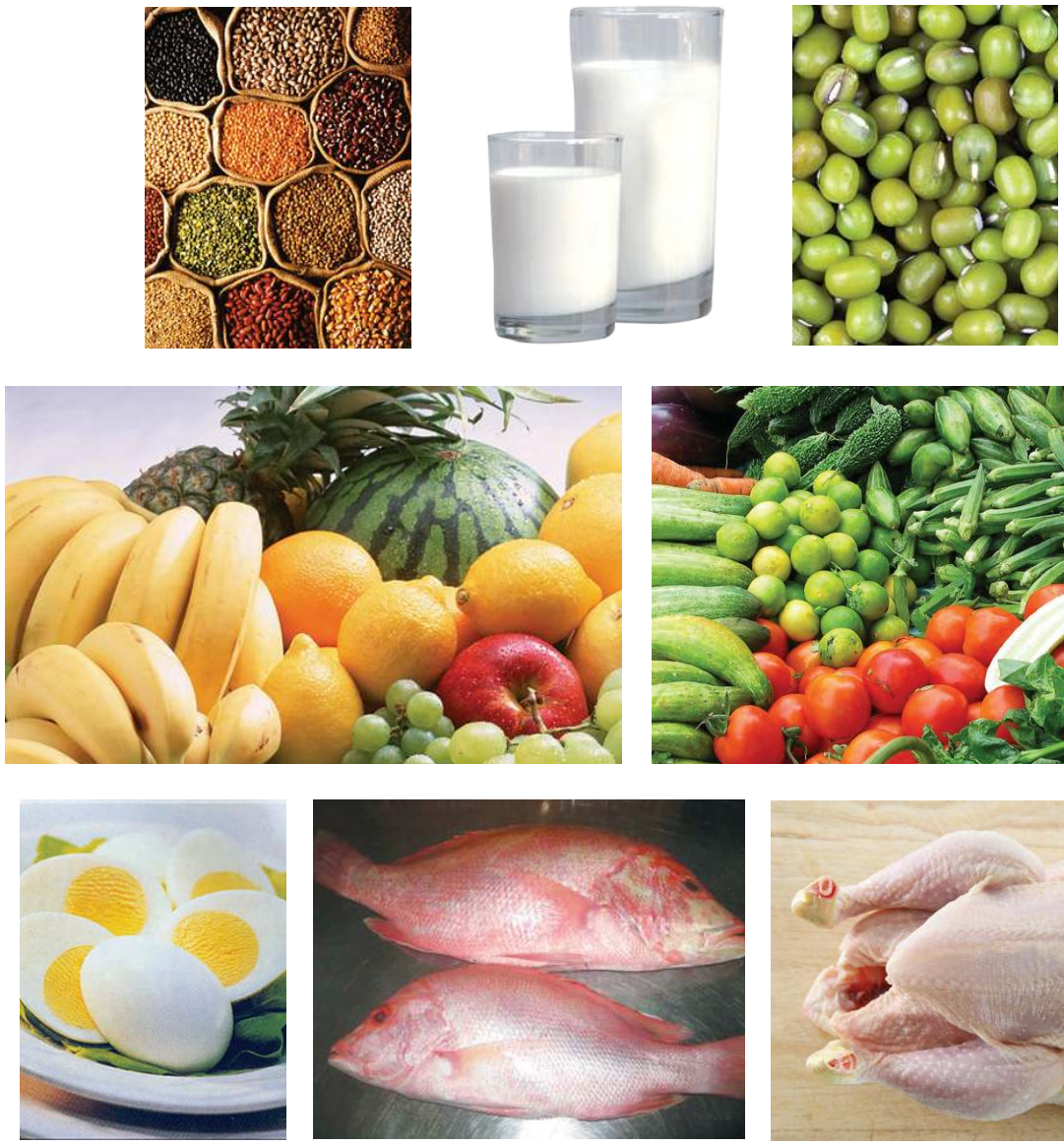


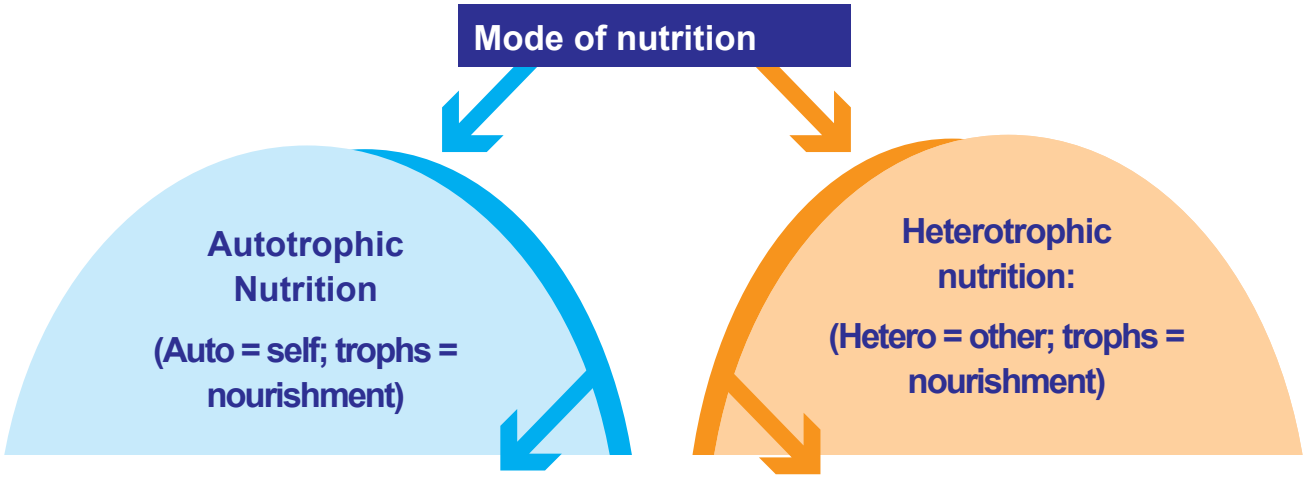
Fig 2.1. Nutritious food

Food is a basic necessity for all living organisms to survive. It is because food provides energy to all living organisms to do their life activities. Food also helps them to grow and build their bodies. How do living organisms obtain their food? Green plants can make their own food by using sunlight, water and carbon dioxide. Animals cannot make their own food. They depend on plants directly or indirectly for their food. The mode of taking food by an organism and utilizing it by the body is called **nutrition**.

2.1. MODES OF NUTRITION IN PLANTS

There are two modes of nutrition in organisms. They are autotrophic and heterotrophic nutrition.

2.2. AUTOTROPHIC & HETEROTROPHIC NUTRITION



Green plants are the only organisms which can synthesize food for themselves and also provide food for other organisms including us. The mode of nutrition in which organisms make their own food is called **Autotrophic Nutrition** and such organisms are called **autotrophs**.

eg. Green plants.

Non-green plants and most animals (like us) take in readymade food from plants and other animals. The mode of nutrition in which organisms depend on others for their food is called **Heterotrophic Nutrition** and those organisms are called **heterotrophs**. eg. All animals, including human beings.

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2.2.1. PHOTOSYNTHESIS

Dear children, we shall be surprised if we could peep inside a leaf and find that sunlight comes into a leaf through the leaf's surface. Inside, the leaves also have a wonderful green substance called **chlorophyll**.

At the same time air comes into the leaf through tiny openings named **stomata** and water moves up from roots below.

Fig 2.2 Leaf - (inset) Stomata

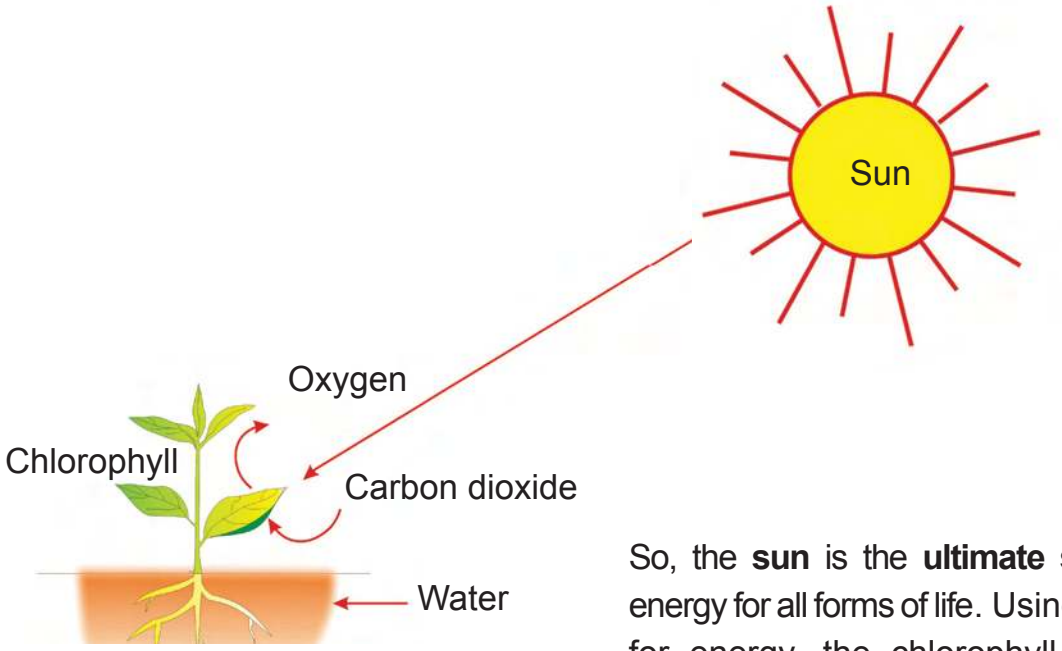

Fig 2.3. Photosynthesis chart

Imagine what would happen if there is no sun? In the absence of the sun, there would be no photosynthesis. Hence, there would not be any food. In the absence of food, life would be impossible on earth.

So, the **sun** is the **ultimate source** of energy for all forms of life. Using sunlight for energy, the chlorophyll changes water and carbon dioxide into food for the plant.

The process of preparing food with the help of water, carbon dioxide, sunlight and chlorophyll in plants is called **photosynthesis**.

Photosynthesis can be represented by the equation given below

$$\text{Water} + \text{Carbon dioxide} \xrightarrow[\text{Chlorophyll}]{\text{Sunlight}} \text{Starch} + \text{Oxygen}$$

There are some leaves of plants which show different colours other than green. Can they do photosynthesis? Yes, they can. The huge amount of red, brown and other pigments eclipse the green colour.

ACTIVITY 2.1

When the weather is sunny, let us put a steel bowl on a patch of grass. Leave the bowl for 5 days. No peeking! Lift the bowl and look at the grass. How is it different from the grass exposed to sunlight?

Fig 2.4 Leaves of various colours

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2.2.2. OTHERMODESOFNUTRITION IN PLANTS

There are some non-green plants which cannot prepare their own food. They take readymade food prepared by other plants. They follow heterotrophic nutrition. They may be **saprophytes**, **parasites**, **insectivorous** plants etc.

ACTIVITY 2.2

Let us take a piece of bread. Moisten it and leave it for a few days. We can see the cotton like mass growing on it. What is it?

Fig 2.5 Bread mould

Saprophytes

Sometimes we see umbrella-like structures growing on decaying matter on the road side during the rainy season. What are they? How do they get their nutrients?

These organisms are called **fungi**. They grow on dead organic matter. They produce digestive enzymes on the dead matter and change it into simple nutrients. They absorb the nutrients in dissolved form (solution) and utilize it. Such a mode of nutrition is called **saprotrophytic** nutrition and those plants are called **saprotrophytes**.

eg: mushroom, bread mould.

Fig 2.6 Mushroom

Parasites

Shall we look at the picture 2.7 carefully. we can see yellow coloured tubular structures coiling around the stem of a tree. This is a plant called **cuscuta**. It cannot synthesize food. As it lacks chlorophyll, it depends on the tree on which it is climbing for food. The plant which provides food is called **host** and the plant which consumes it is called **parasite**.

Fig 2.7. Parasite cuscuta (Sadathari)

venus fly trap
(Insect entering)

venus fly trap
(Insect trapped)

Fig 2.8. Nepenthes (pitcher plant)

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Insectivorous Plants

We know that many insects eat plants, but we shall be surprised to know that some plants eat insects.

Let us observe the picture 2.8 of venus fly trap, pitcher plant. They need to eat insects because their soil does not have certain nutrients like nitrogen for them to grow.

Symbiotic Plants

There is yet another mode of nutrition in which two different types of organisms live together and mutually help each other for nutrition. Lichens are organisms that consist of a fungus and alga. The algae gives food to the fungus and the fungus absorbs water and minerals and gives to algae. Here, both the organisms help mutually. The phenomenon by which two different organisms live together for mutual help is called **symbiosis.** The organisms are called **symbionts.**

Fig 2.9. Lichens

2.3. NUTRITION IN ANIMALS:

Let us observe machines like a car, bus or a train etc. How do they work? They get energy to do work from fuels. Our body is also a machine. We get energy from the food that we eat. Food contains not only energy but also the raw materials needed for body's growth, maintenance and repair. Mostly animals take in solid food. This mode of nutrition is called **holozoic nutrition**.

Fig 2.10 Ingestion

Nutrition includes five steps

1. Ingestion

The process of taking food into the body is called **ingestion**. The mode of intake of food differs in different organisms. eg: Butterflies and bees suck the nectar of the flowers. Snakes (Python) and frogs swallow their food. Aquatic animals (Blue Whale) filter feed.

2. Digestion

The process of breaking down of complex food into simple food with the help of enzymes is called **digestion**.

3. Absorption

The process by which the digested food passes into the villi of the wall of the intestine is called **absorption**.

4. Assimilation

The ways in which the absorbed food is utilized in cells is called **assimilation**.

5. Egestion

The removal of undigested food through anus is called **egestion**.

2.4. NUTRITION IN AMOEBA

Amoeba is a unicellular organism. It lives in the stagnant water bodies. It feeds on microscopic organisms. Though amoeba is a one-cell animal, it takes in solid food through its body surface. So the mode of nutrition is holozoic. Whenever the food touches the body surface of amoeba, it engulfs the food with the help of pseudopodia (false feet) and forms the food vacuole. The food is digested with the help of enzymes inside the food vacuole. The digested food reaches the entire cell by diffusion. Amoeba uses the food for getting energy, making proteins for growth, etc. The undigested food is thrown out of the body through its body surfaces.

2.5. HUMAN DIGESTIVE SYSTEM

Think of any food that you like, a sweet, a fruit etc. Let us find out what happens to it when eaten. It passes through the digestive system. This system is made up of mouth, oesophagus, stomach, small intestine, large intestine and anus.

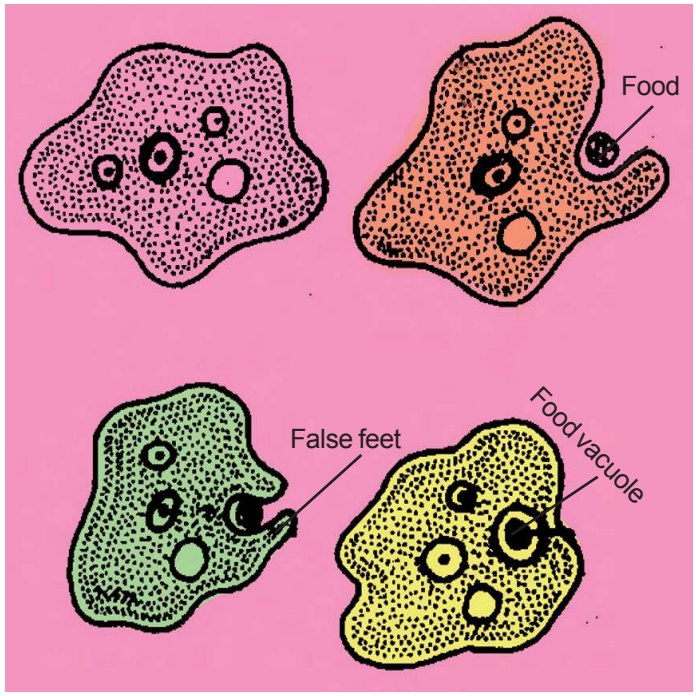

Fig 2.11 Ingestion of food in Amoeba

Mouth

We ingest the food into mouth cavity through mouth. Mouth cavity contains teeth, tongue and salivary glands.

Teeth

Teeth help us to cut the food into small pieces, chew and grind it.

Salivary Glands

There are three pairs of salivary glands in our mouth. These glands secrete a watery fluid called saliva. It makes the food wet so that we can easily swallow it. It contains an enzyme called amylase which helps in the digestion of starch

Tongue

The tongue is an organ of taste. It helps to mix the food with saliva and make it wet. It also helps in rolling and pushing the food while swallowing.

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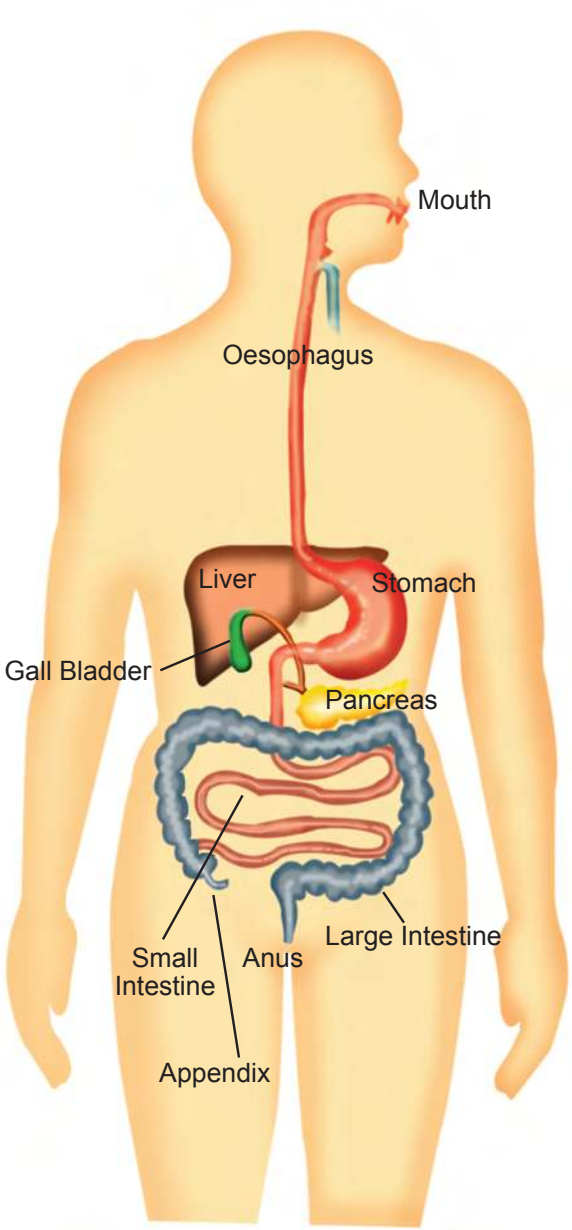


Fig 2.12. Digestive System of man

MORE TO KNOW

Food takes an average of 24 hours to pass all the way through the digestive system.

Oesophagus

It is a tube which connects the mouth and stomach. It is also known as food pipe. It helps to pass the food from the mouth to the stomach.

Stomach

Stomach is a bag-like structure where the food is further digested. The food is churned. Stomach secretes digestive juice called gastric juice which helps to digest food.

Small Intestine

It is a very long tube and is about 7 metre in length. Here the food is mixed with bile juice, pancreatic juice and intestinal juice. These juices help in completing the digestion.

At the end of digestion, carbohydrates are broken down into glucose and fructose, proteins into amino acids and fats into fatty acids and glycerol. This digested food is absorbed by the villi in the small intestine.

Large Intestine

It is about 1.5 metre in length and helps in absorbing water. It is the place for temporary storage of undigested food. Digestion does not take place here.

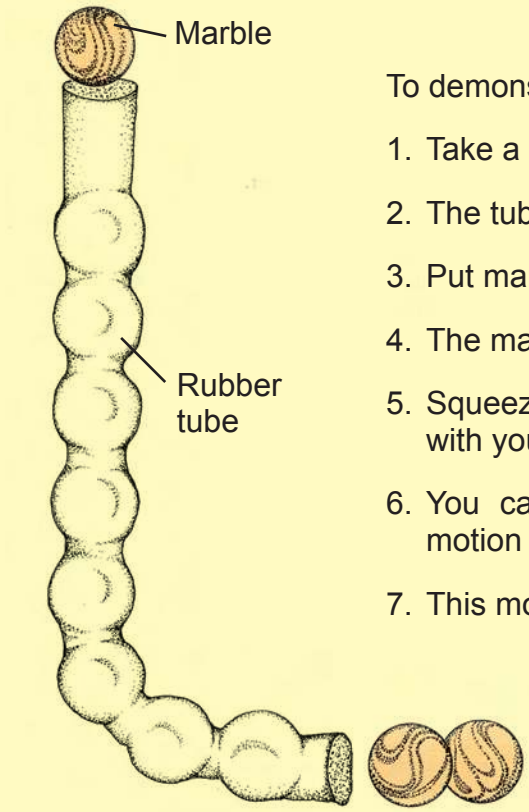
Anus

The undigested food (faecal matter) is eliminated through anus and the process is called egestion.

Let us find out how the food moves in our digestive system.

Food in the digestive system moves from the oesophagus to the anus by rhythmic contraction and expansion of the wall of the digestive system. This movement is called **peristalsis**.

ACTIVITY 2.3



To demonstrate peristalsis.

1. Take a rubber tube and wet it inside.
2. The tube represents the food pipe.
3. Put many marbles into the tube.
4. The marbles represent food.
5. Squeeze the rubber tube from the top with your hand in a forward direction.
6. You can observe a kind of wave-like motion in the rubber tube.
7. This movement represents peristalsis.

SCIENCE

2.5.1. TYPES OF TEETH

We all have two sets of teeth in our life time. The first set of teeth grows when a baby is about one year old. This set of teeth is called **milk teeth**. They are twenty in number. Milk teeth stay in a child up to the age of seven to eight years. When the milk teeth fall off, a new set of teeth grow. They are called **permanent teeth**. They are thirty-two in number. Of these, sixteen are in the upper jaw and sixteen are in the lower jaw. All the teeth in our mouth are not the same. There are four types of teeth. They are **incisors, canines, premolars** and **molars**.

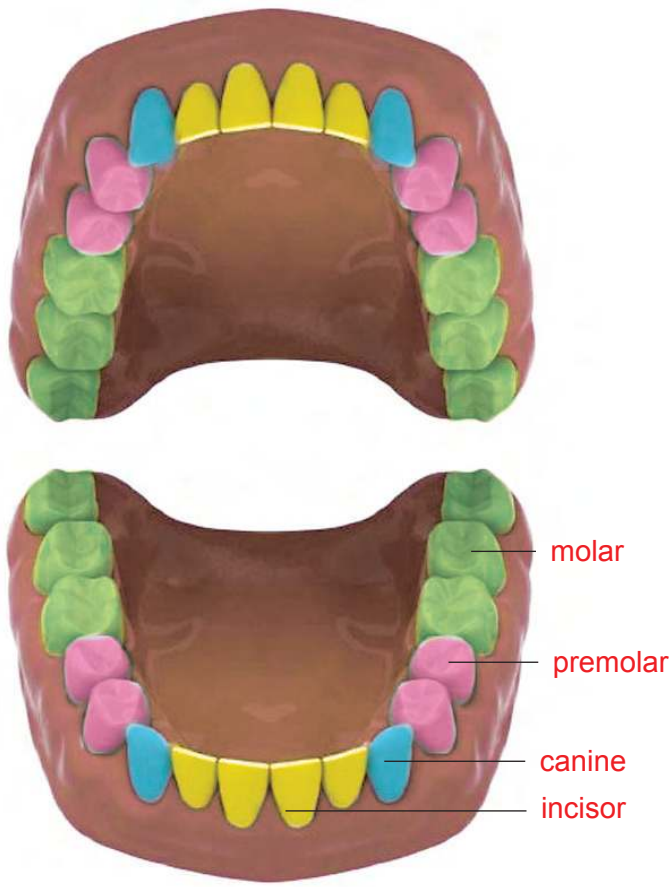


Fig 2.13. Types of Teeth

Incisors: These are chisel shaped teeth at the front of the mouth. They are eight in number. Four are present in each jaw. These are used for biting the food.

Canines: These are sharp and pointed teeth. They are four in number and two are present in each jaw. Canines are used for cutting and tearing of food.

Premolars: These are large teeth behind canines on each side. They have large surface. They are eight in number and four are present in each jaw. They help in chewing and grinding the food.

Molars: These are very large teeth present just behind the premolars. They have more surface area than premolars. They are used for chewing and grinding of food like premolars. They are twelve in number and six are present in each jaw.

Tooth Care

Permanent teeth serve for life time. They are not replaced like the milk teeth. Hence, great care should be taken for keeping the teeth clean.

The enamel in the teeth of children is much thinner than on the teeth of adults. So, teeth of children are more liable to decay than those of adults. Children should avoid very cold or very hot food. They should brush twice a day. Teeth should not be rubbed with hard things like brick powder.

ACTIVITY 2.4

Let us take any fruit. Enjoy eating it. Now find out.

Function	Teeth
Biting	
Tearing and cutting	
Chewing and grinding	

"Valli... are there animals without teeth?"

"Yes Selva, Bluewhale, the largest mammal does not have teeth.

MORE TO KNOW

Interesting facts about teeth in other animals.

1. Birds have no teeth.
2. Rats have continuously growing teeth.
3. The tusks of elephants are actually incisors that have become very long.
4. Very few adult humans have all the 32 teeth.

2.6. RUMINANTS

Shall we observe some grass eating animals such as goat, cow and buffalo. They keep on chewing even when they are not eating or at rest. They have an interesting digestive system. In fact they eat grass hurriedly and swallow quickly and store it in the first chamber of the stomach called **rumen**.

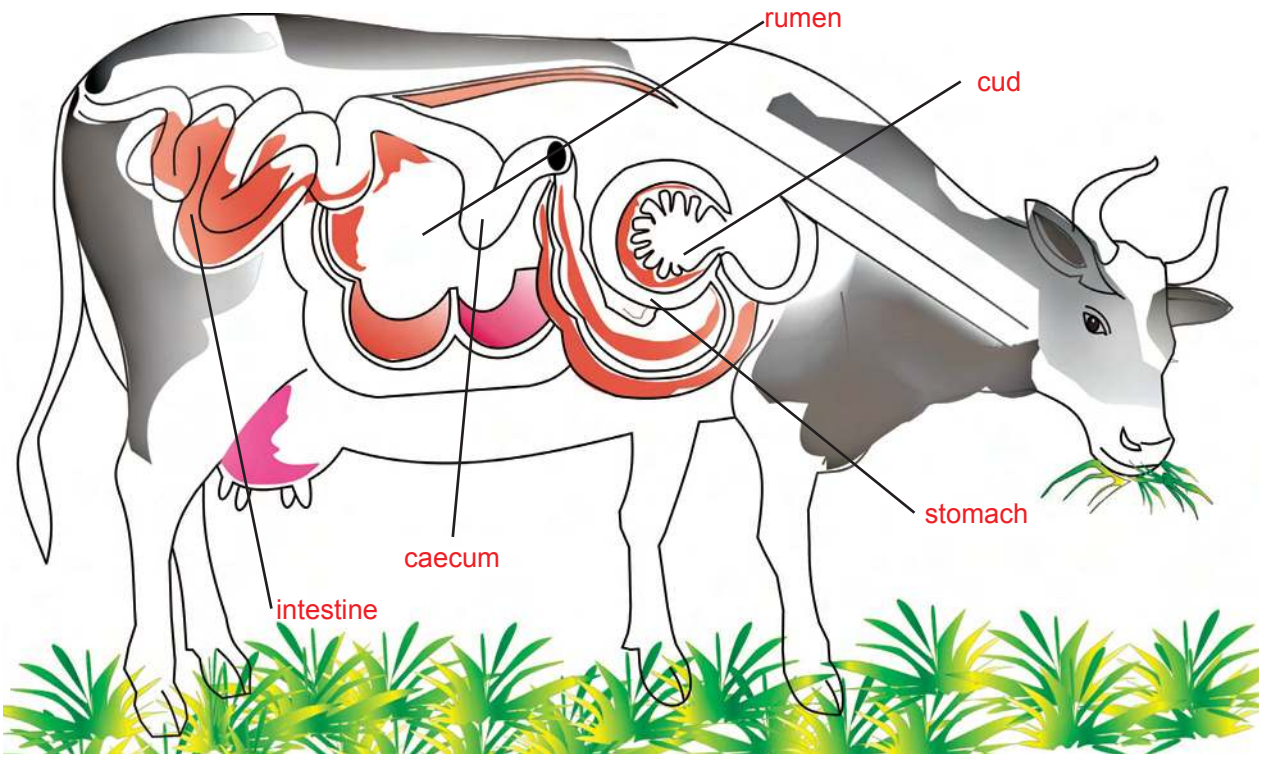


Fig 2.14 Ruminant - Cow

In the rumen, the grass is fermented with the help of certain bacteria and the partially digested grass is called cud. Later, the cud is brought back to the mouth in small quantities and the animal chews it. The process of chewing the cud is called **rumination**. Animals which chew the cud are called **ruminants**.

Grass is rich in cellulose which is a kind of carbohydrate. Herbivorous animals can digest it. The other animals and humans cannot digest cellulose. There is a sac-like structure called caecum between the small and large intestine in ruminants. This sac contains some bacteria which produce an enzyme called cellulase which digest the cellulose.

ACTIVITY 2.5

From the given list of animals, shall we find out the ruminants and the non-ruminants:

Bison, deer, horse, camel, rabbit, and donkey.

MORE TO KNOW

A Cow makes 40,000 to 60,000 jaw movements per day while it keeps on chewing and rechewing.

SCIENCE

EVALUATION

1. From the given list of living things list out the autotrophs and heterotrophs.

grass, snake, neem tree, man, mushroom, amoeba, mango tree, cabbage, cow, sunflower.

S.No.	AUTOTROPHS	HETEROTROPHS
1.		
2.		
3.		
4.		

2. Fill in the boxes with the given words to complete the equation for photosynthesis.

water, starch, oxygen, sunlight, carbon dioxide, chlorophyll.

3. Given below is a list of food items with their constituents. In the table given below write the names of the food that you took yesterday and tick the constituents in it.

Idli	Carbohydrates, proteins
Dosai	Carbohydrates, proteins
Sambar	Protein, vitamin, minerals, fat
Rice	Carbohydrates
Egg	Protein, fat
Channa sundal	Protein
Vegetable poriyal	Vitamins, minerals
Vadai, milk	Fat, protein
Fish	Protein
Millet (Kambu/Cholam)	Carbohydrates
Greens	Vitamins, minerals

Could you find out the nutrient missing in your diet.

	Food you took	Carbo hydrate	Protein	Fat	Vitamin	Mineral
Breakfast						
Lunch						
Snacks						
Dinner						

4. Observe the teeth of your family members. Count the teeth and record below.

S.No	Family member	Jaws	Incisors	Canines	Premolars	Molars
1.	Father	U				
		L				
2.	Mother	U				
		L				
3.	Self	U				
		L				
4.	Brother	U				
		L				
5.	Sister	U				
		L				
6.		U				
		L				

Dental formula of human being =I $\frac{2}{2}$; C $\frac{1}{1}$; PM $\frac{2}{2}$; M $\frac{3}{3}$ x2 = 32

5. Look at the diagram, find out the teeth and list its use in human being.

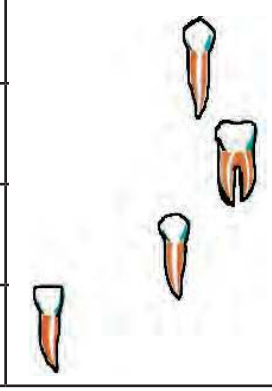
S.No	Picture of teeth	Name of the teeth	Uses
1.			
2.			
3.			
4.			

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Fig 3.1 Vegetables

Mani and Mythli are helping their mother in the kitchen.

Mother : Children, will you help me to make a fresh vegetable salad?

Mani : Sure Amma. We will be glad to help you.

Mother : Choose some vegetables that you want from the basket.

Mani and Mythli selected tomato, spinach, cabbage, groundnut, cucumber, green peas, carrot and beetroot.

Shall we classify them?

Roots	Leaves	Fruits	Seeds

The Children made a tasty salad with the different parts of the plant.

3.1. CHARACTERISTICSOFLIVING THINGS

Things that have life are called living things.

eg. Plants and animals.

Things that do not have life are called non-living things.

eg. Rock, book.

Among living things, some are plants and some are animals. Now the question is, how do living things differ from non-living things?

Living things show the following characteristics, whereas non-living things do not.

All living things

- need food,
- respire to convert food into energy.
- grow at certain stages of life.
- respond to their surroundings.
- live for a definite span of time.
- reproduce their own kind.
- are made up of cells.

3.2 HABITAT - VARIOUS HABITATS OF PLANTS

Children, shall we go for a walk around our school and make a list of different plants and animals there. We see different varieties of plants around us. All plants are well adjusted to the place where they live. The living place of a plant provides food, shelter and suitable climate to survive and reproduce successfully. Such a place of living is called a habitat. Plants live in different habitats such as water, land, desert, hills and so on.

WARMING (1909) classified the plants into three types on the basis of their water requirement. They are

1. Hydrophytes
2. Mesophytes
3. Xerophytes

1. Hydrophytes

Hydrophytes means water plants

(Hydro = Water, and Phytes = Plants).

These plants live in the water of ponds, lakes and rivers. Plants which live in water are called hydrophytes. They are divided into three types:

a) Free-floating hydrophytes

These plants float freely on the water surface.

eg. Water hyacinth (Agayatamarai)

Fig 3.2 Water hyacinth (Agayathamarai)

b) Attached floating hydrophytes

These plants are fixed at the bottom of the pond and the leaves float on the surface of the water.

eg. Water-lily (alli), Lotus.

Fig 3.3 Water-lily

c) Submerged hydrophytes

These plants are rooted in the mud and remain under- water.

eg. Vallisneria

Adaptations of Hydrophytes

1. Root system is poorly developed. In some cases roots are even absent.

2. Stem is thick, short and spongy with air spaces to float in water.

Fig 3.4 Vallisneria

3. Leaves have a waxy-coat that prevents their decay in excess water.

2. Mesophytes

These plants grow in places with moderate water supply. They cannot grow in places with too much of water or too little water. Most of the crop plants are mesophytes.

eg. Wheat, maize, sunflower, mango, neem.

Fig 3.5 Sunflower (Surya kanthi)

Adaptations of mesophytes

1. They have well developed root system.
2. Leaves are usually large and broad.

3. Xerophytes

Xerophytes means desert plants:

(Xero = Desert and Phytes = Plants)

SCIENCE

Plants which grow in dry areas (deserts) are called Xerophytes. The plant body is adapted to cope with the water scarcity, high temperature, strong winds, etc.

eg. Opuntia (chappathikalli).

Fig 3.6. Opuntia (chappathikalli)

ADAPTATIONS OF XEROPHYTES:

1. They have long roots which go deep into the ground so as to absorb water.
2. In Opuntia, the stem is thick, flat and green and does the function of photosynthesis.
3. Leaves are reduced or modified into spines to prevent the loss of water from their surface.

3.3. HERBS, SHRUBS AND TREES

"Valli... the walk around the campus was very interesting wasn't it?"

"Yes Selva, did you notice that all plants are not of the same size".

"You are correct valli".

Flowering plants can be grouped based on their size of stem.

They are herbs, shrubs and trees.

1.Herbs

- Small plants with soft and green stems are called herbs.
- They are non-woody plants and do not grow more than one metre in height.

eg. Radish, wheat, paddy, sunflower.

Fig 3.7 Paddy

2.Shrubs

- The medium sized plants with a thin but hard and woody stem are called shrubs.
- They do not have a clear main stem.
- They tend to branch and become bushy.

eg. Rose, jasmine, croton, Tulsi, lemon.

3.Trees

- Tall and big plants with a distinct hard and woody stem are called trees.

- The main stem is called trunk which gives out branches and leaves.

eg. Neem, mango, teak, coconut, banyan.

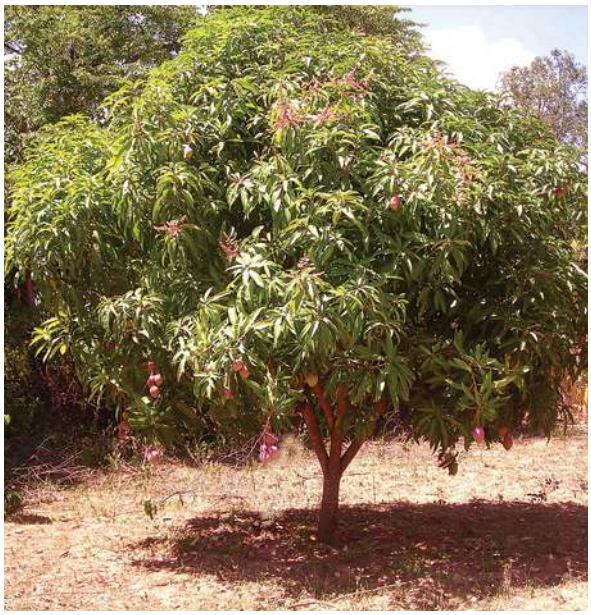


Fig 3.8 Mango tree

3.4. PARTS OF A PLANT

Shall we recollect the salad that Mani and Mythili made. It was made with different parts of the plant.

A typical flowering plant consists of two main systems, viz. Root System (underground part), and Shoot System (aerial part). The root System consists of main root and its lateral branches. The Shoot System has a stem, branches and leaves. The flowering plant produces flowers, fruits and seeds at maturity. Root, stem and leaves are called vegetative parts of a plant as they do not take part in reproduction. Flowers, fruits and seeds are reproductive parts of a plant as they take part in reproduction.

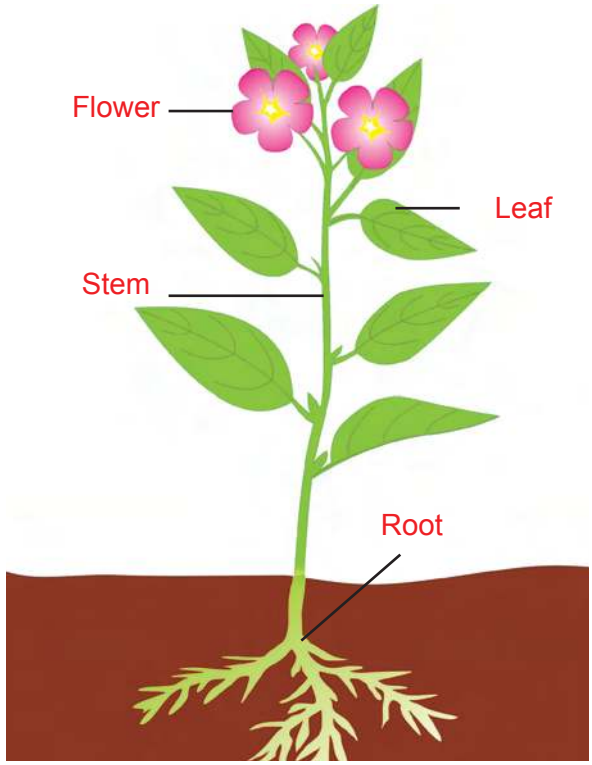


Fig 3.9 Parts of a plant

3.4.1. ROOTS, STEM, LEAVES AND FLOWERS

Root system

The part of the plant which grows under the soil is called Root System. It usually develops from the radicle of embryo. It is the descending part of the plant. It grows away from sunlight. It does not have chlorophyll. Nodes and Inter-nodes are absent. It does not bear leaves or buds. Root system is broadly classified in two types. They are

1. Tap root system
2. Adventitious root system

ACTIVITY 3.1

Let us take a jar and fill it with water. Place an onion in the neck of the jar and its base in the water. Observe the onion roots.

SCIENCE

1. Tap Root System

The radicle of the embryo grows deep into the soil and becomes the primary root (tap root). This root gives rise to lateral roots such as secondary roots and tertiary roots. Generally dicot plants have tap root system.

eg. Mango, neem, carrot, radish, etc.

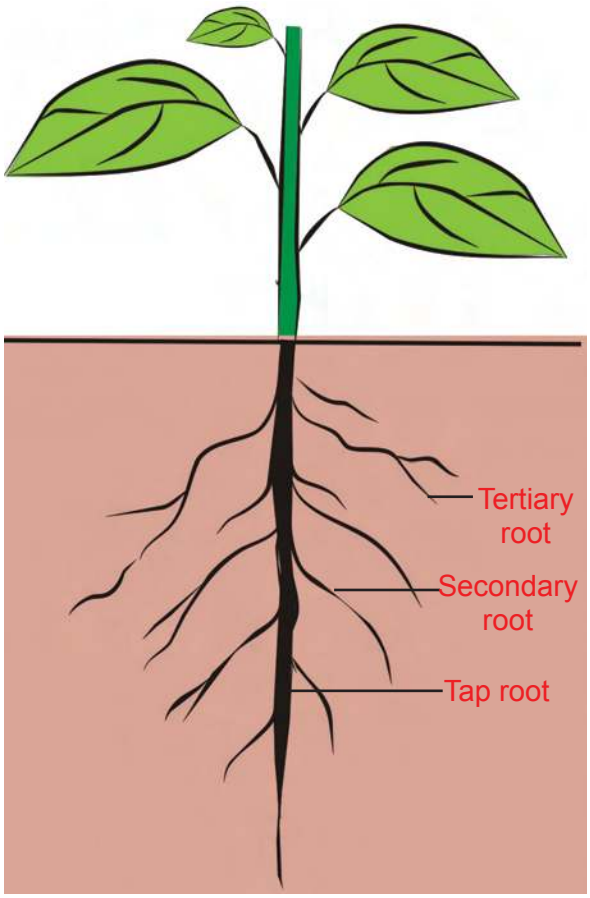


Fig 3.10 Tap Root

2. Adventitious Root System

Roots that grow from any part of the plant other than the radicle are called adventitious roots. These roots arise in cluster which are thin and uniform in size. As these roots arise in cluster, they are also called as fibrous roots. Most monocot plants show adventitious roots.

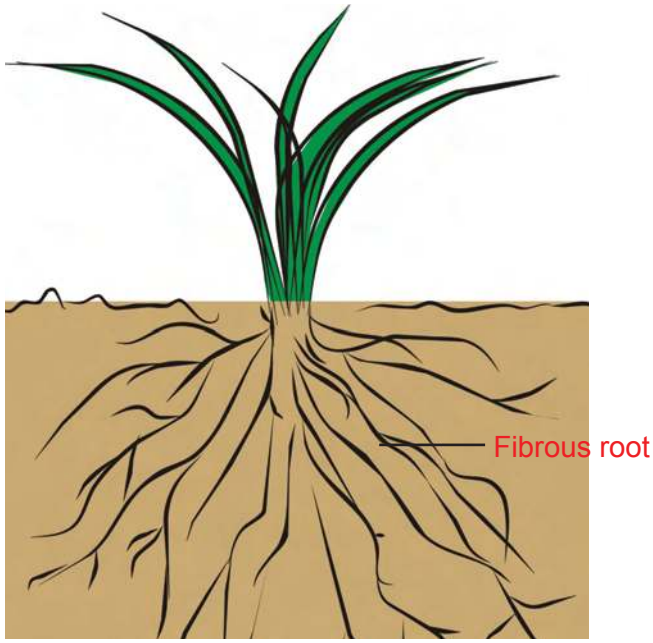


Fig 3.11 Adventitious Root

eg. Rice, grass, maize, bamboo.

Normal functions of roots

1. Roots absorb water and minerals from the soil and transport to the stem.
2. Roots fix the plant firmly to the soil.

Shoot system

The part of the plant which grows above the ground is called shoot system. It develops from the plumule of the embryo. Stem is the ascending part of the plant axis. It grows towards the sunlight. The shoot consists of main stem with branches,nodes, inter-nodes, leaves, buds, flowers and fruits. Young stems are green and old stems are brown in colour. The place from where the leaf arises is known as node. The distance between the two successive nodes is called inter-node . It bears buds either in the axils of leaves or at the tip of the stem.

Normal functions of stem

1. Support: The stem holds the branches, leaves, flowers and fruits.

2. Conduction: The stem transports water and minerals from roots to the upper parts. It also transports the prepared food from leaves to other parts.

ACTIVITY 3.2

Children, it is very interesting to help our mother in the kitchen, and next time when you clean greens (Keerai), try to observe the various parts of the plant.

Leaf

Leaf is a thin, broad, flat and green part of the plant. The leaf consists of three main parts. They are leaf blade (leaf lamina), leaf stalk (Petiole) and leaf base.

Leaf blade (leaf lamina):

It is the expanded part of the leaf which is green in colour. It has a midrib (a main vein) in the centre of the leaf blade. The midrib has branches on either side which are called veins.

Petiole

The stalk of the leaf is called petiole. It connects the lamina to the stem.

Leaf base

The basal part of the leaf with which it is attached to the stem is called leaf base. The leaf base may bear two small lateral leaf-like structures called stipules.

Normal functions of leaf

1. Synthesis of Food: Leaves produce food by photosynthesis.

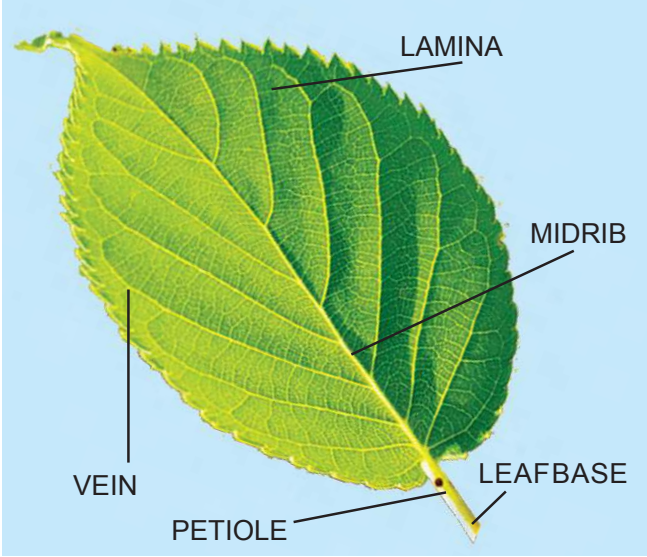


Fig 3.12. Leaf

2. Exchange of Gases: Leaves exchange gases through stomata. Plants take in carbon dioxide and give out oxygen during photosynthesis. They take in oxygen and give out carbon dioxide during respiration. This is called exchange of gases in plants.

3. Transpiration: The loss of excess water from the leaf in the form of water vapour through stomata is called transpiration.

Fig 3.13 Transpiration

SCIENCE

ACTIVITY 3.3

Let us cover a leaf of a potted plant with a transparent polythene bag. Observe it after few hours. We will find water droplets in the polythene bag. This proves transpiration in leaves.

Flower

Flower is called the reproductive part of a plant because it helps in sexual reproduction. The flower changes into fruit after pollination and fertilization. Like leaves, flowers also have stalk. The stalk of a flower is called pedicel. There are stalk less flowers also.

eg. Banana.

Parts of a typical flower

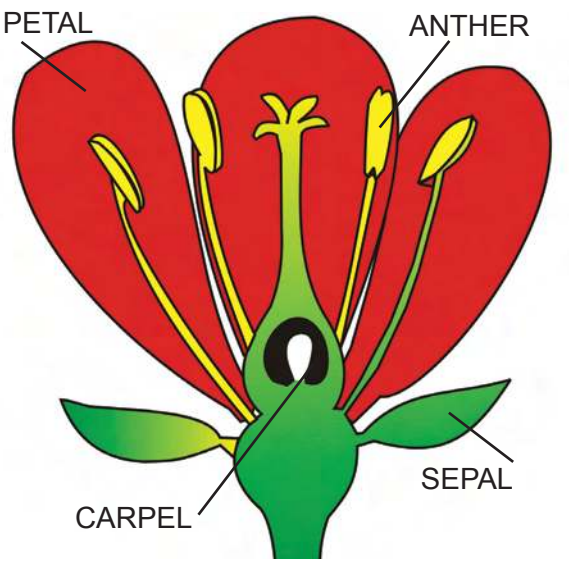


Fig 3.14 Parts of a flower

A flower has four parts, viz. Calyx, Corolla, Androecium and Gynoecium.

Calyx: The green, leaf like parts in the outermost circle of a flower are called sepals. They protect the flower when it is a bud.

Corolla: The brightly coloured parts of a flower are called Petals. They are the second part of the flower. They can be of different colours, shapes and sizes.

Androecium: The stamen is the third part of a flower. It is the male part of the flower. Each stamen consists of a stalk called filament and a bag like structure on the top of filament called anther. Anther forms pollen grains which are the male gametes.

Gynoecium: It is the inner most part of the flower. It is the female part of a flower. A carpel has three parts. The upper part of the carpel is the stigma. The middle part is called style. The lower swollen part is called ovary. Ovary contains ovule which has the egg (female gamete).

Uses of a Flower

Flowers are used to make perfumes, medicines and for ornamental purposes.

Fig 3.15 Kurinji

MORE TO KNOW

Kurinji is a rare flower that blooms once in 12 years. It is endemic (found only) to Tamilnadu. The Nilgiris which literally means the "blue mountains" gets its name from the purplish blue flowers of Neelakurinji. The last blooming season was in 2006.

1. When is the next blooming season?

2. How old will you be then?

3.5. MODIFICATIONS OF ROOT, STEM AND LEAVES

Root, stem and leaf have their normal functions as mentioned earlier. In addition to the normal functions, some of the roots, stems and leaves change their shape and structure to do extra functions.

Modifications of Tap Root:

1. Storage Roots:

The tap root becomes thick and fleshy due to storage of food materials. Based on the shape of the root, they are

a) Conical: The root is broad at the apex and gradually tapers towards the base like a cone.

eg: Carrot

b) Fusiform: When the root is swollen in the middle and tapers gradually towards both the ends like a spindle, it is called fusiform.

eg: Radish.

c) Napiform: When the root is swollen at the apex coming almost spherical and tapers suddenly towards the base give a top-like appearance, it is called napiform.

eg: Turnip, beetroot.

Fig 3.16 Carrot

Fig 3.17 Radish (Mullangi)

Fig 3.18 Beetroot

SCIENCE

2. Respiratory Roots

Plants which grow in saline swamps near the sea shore develop numerous upright aerial roots called respiratory roots. They help in breathing.

eg. Avicennia (vellai alayatri)

It is found at Pitchavaram in Tamilnadu.

Fig 3.19 Avicennia (vellai alayatri)

Modifications of Adventitious Roots

1. Storage Roots

a) Tuberous Roots: Some of the adventitious roots store food and become swollen without any definite shape.

eg. Sweet Potato (chakravalli kizhangu).

b) Fasciculated Roots: The swollen tuberous roots occurring in clusters are called fasciculated roots.

eg. Dahlia.

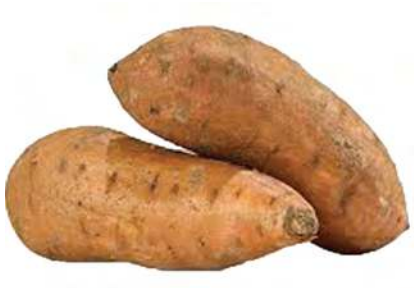


Fig 3.20. Sweet potato (chakravalli kizhangu)

2. Supporting Roots

a) Prop Roots: A number of roots are produced from aerial branches. These roots grow vertically downward and fix into the ground. These roots act as pillars and give additional support to the main plant. Such roots are called prop roots.

eg. Banyan.

b) Stilt Roots: Plants with delicate stems develop short and thick supporting roots from the basal part of the stem. They fix to the ground and give support.Such roots are called stilt root.

eg. Maize, sugarcane

Fig 3.21 Sugarcane (Karumbu)

Fig 3.22 Banyan (Aala maram)

MORE TO KNOW

The big banyan tree in the Indian Botanical Garden near Kolkata has produced over 900 such prop roots from its branches. Its age is more than 200 years and its diameter is well over 360 metre .

3. Parasitic Roots

Roots of parasitic plants penetrate into the host tissue to absorb nourishment. Such roots are called parasitic roots.

eg. Cuscuta

Fig 3.23 Cuscuta

Fig 3.24 Vanda

4. Epiphytic Roots

There are some plants which grow on the branches of other trees for only shelter and not for food. These plants grow some roots which hang freely in the air and velamen tissue in these roots absorb moisture. Such roots are called epiphytic roots.

eg. Vanda (orchid)

Modifications of stem

In addition to the normal functions of stem, the stem also performs certain special functions in some plants. In such cases, either the complete plant or a part of the stem is modified to do those special functions. Such stems are called modified stems.

1. Underground Stem Modifications

Stem of some plants remain underground and do the function of storage. They are of different types.

a) Tuber: It is modified underground stem which develops by swelling of tip of stem. It stores a large amount of food.

eg. Potato.

Fig 3.25. Potato (Urulai kilangu)

ACTIVITY 3.4

Go to your kitchen, collect some vegetables. Make a list of the vegetables that are modified roots and stems

Fig 3.26 Ginger (Inji)

b) Rhizome: These are thickened stem that grow horizontally under the soil.

eg. Ginger.

SCIENCE

2. Sub-Aerial Modifications of Stem

This modification is meant for vegetative propagation. In some plants, branches are weak and they lie horizontal on the ground or may become buried in top soil. Aerial branches and adventitious roots develop at nodes. These are called as Creepers.

The Creepers are of two types.

(a) Runners: eg. Grass, Pumpkin

(b) Stolons: eg. Strawberry.

Fig 3.29 Bougainvillea (Kakitha Poo)

Fig 3.30 Passion flower

Fig 3.27.Grass

Fig 3.28 Strawberry

3. Aerial Stem Modifications

Normally buds develop into branches or flowers. In some plants, the buds undergo modification for definite purpose. Some of the aerial stem modifications are:

a) Stem Tendril: In some plants , the axillary bud is modified into tendril, which helps the plant to coil around a support.

eg. Passion flower, snake gourd.

b) Thorn: In some plants, the axillary bud is modified into thorn for protection.

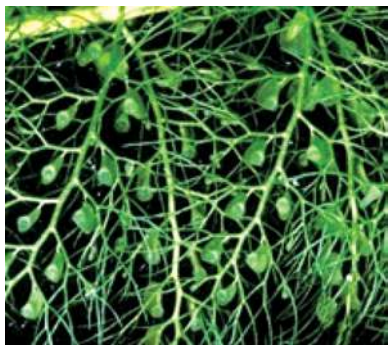
eg. Bougainvillea.

c) Phylloclade: In some xerophytes, the leaves are reduced to spines. The function of the leaves is taken over by the stem which is green and flat. Such a stem is called Phylloclade.

eg. Opuntia

Fig 3.31 Nepenthes

Pea (Pattani)



Utricularia Fig 3.32

MORE TO KNOW

The Amazon Water Lilly bears leaves measuring upto 7 feet in diameter and flowers between 12 and 16 inches.

MODIFICATIONS OF LEAF:

In some plants, the leaf is modified as under:

a) Leaf Tendril: In some plants, the leaf is modified into slender, wiry coiled structure, known as tendril. They help in climbing.

eg. Pea

b) Leaf-Spine: In opuntia, the leaves are reduced to spines. They are protective in function and prevent transpiration.

eg. Opuntia.

c) Pitcher: In some plants, the leaves are modified into pitcher to trap insects to fulfill their nitrogen deficiency.

eg. Nepenthes.

d) Bladder: In some plants, the leaf is modified into a bladder, to trap insects.

eg. Utricularia. (Bladder-wort)

SCIENCE

3.6. KINDS OF STEM

Stems of flowering plants attain diverse forms in order to perform their various functions. Based on the texture, stems of plants are grouped under three broad categories.

1) Reduced Stems: In some plants, the stem is reduced to small disc. Nodes and inter-nodes are absent in the disc.

eg. Radish, carrot, turnip, onion.

2) Erect Stems: Most of the flowering plants possess upright erect woody stems.

eg. Bamboo, banyan, eucalyptus, coconut

Fig 3.33 Onion

3) Weak Stems: There are thin, soft and delicate stems which cannot stand erect without support. They are two types.

1. Upright Weak Stems: They may be twiners or climbers

a) Twiners: The stems are long, slender, flexible and very sensitive. They coil around an upright support without any special structure.

eg. bean.

b) Climbers: They climb up the support with some clinging structures

eg. Betelvine (vetrilai), pepper (Milagu).

2. Prostrate Weak Stems: These stems spread over the ground. They may be trailers or creepers.

eg. Tridax (vettukaya poondu).

Fig 3.34 Tridax

Fig 3.35 Bean (Avarai)

3.7. MOVEMENTS IN PLANTS

Plants generally do not move from place to place like animals. But the parts of the plant show growth movements in response to some stimuli like sunlight, water, soil, etc. Therefore, the tendency of the plant parts to grow towards or away from the direction of stimuli is called tropism.

MORE TO KNOW

J.C.Bose, an Indian Botanist invented Crescograph which showed that plants have feelings. He was awarded nobel prize for his invention.

1.Tropism

There are three types of tropism.

a) Phototropism: The tendency of the plant parts to grow either towards or away from the direction of sunlight, is called phototropism.

Fig 3.36 Phototropism

Stem grows towards the sunlight. So, stem is positively phototropic. Root grows away from the sunlight. So, root is negatively phototropic.

b) Geotropism: Roots tend to grow towards the soil or gravity. This

is called geotropism. Root is positively geotropic and stem is negatively geotropic.

c) Hydrotropism: The roots tends to grow towards the direction of water, whereas stem does not. So, root is positively hydrotropic and stem is negatively hydrotropic.

Fig 3.37 Geotropism

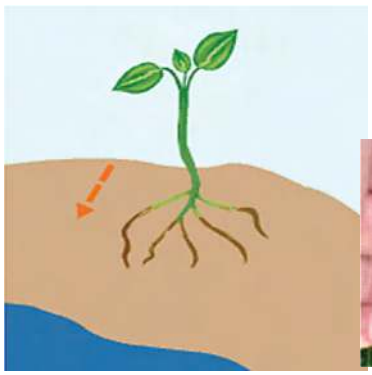


Fig 3.38 Hydrotropism

Nastic movement

2. Nastic movement

The plant Mimosa - Touch Me Not (Thotta surungi) is sensitive to touch. When the plant is touched, the leaves fold. The folding of leaves in Mimosa is not due to growth. It is an irregular movement and it is called nastic movement.

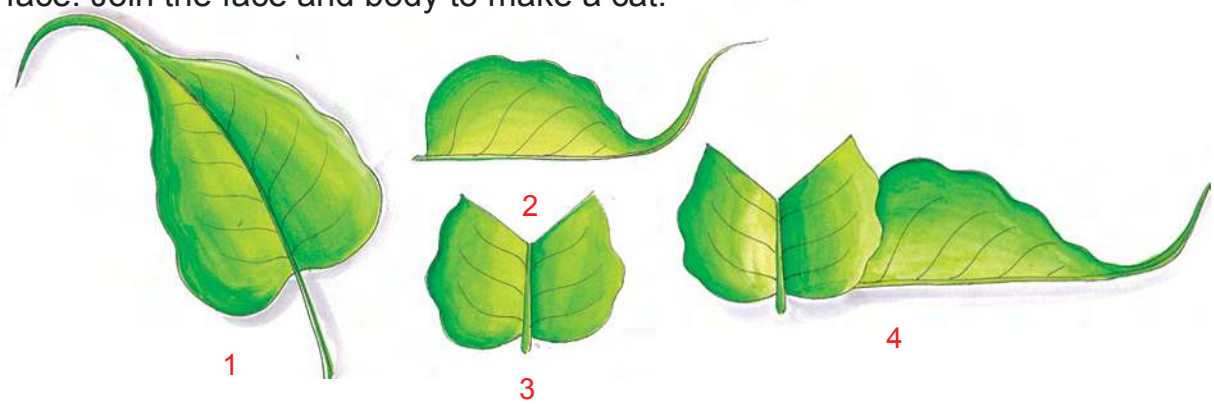
3.8. OBSERVATION OF PLANTS AND TREES

1. Recording data and drawings

Children, we are planning to go for a trekking during the holidays to the hills or the forest area which is nearer to our school. We shall observe the types of plants present over there. Collect different kinds of leaves, flowers, seeds, etc. We shall place the leaves and flowers that we have collected between the pages of our used old notebooks, after drying, paste them in a scrapbook.

2. Let us make

Children, let us make animals with leaves. Collect some leaves of peepul tree (Ficus tree). Tear along the midrib to make the body of a cat. Tear V shape for face. Join the face and body to make a cat.



Try to make elephant, deer, tortoise, peacock with different leaves.

EVALUATION

1. Pick out the correct answer:-

   a. Absorption of water is a function of _____ system. (Shoot / root)

   b. Thulasi is an example of a _____ (herb / shrub)

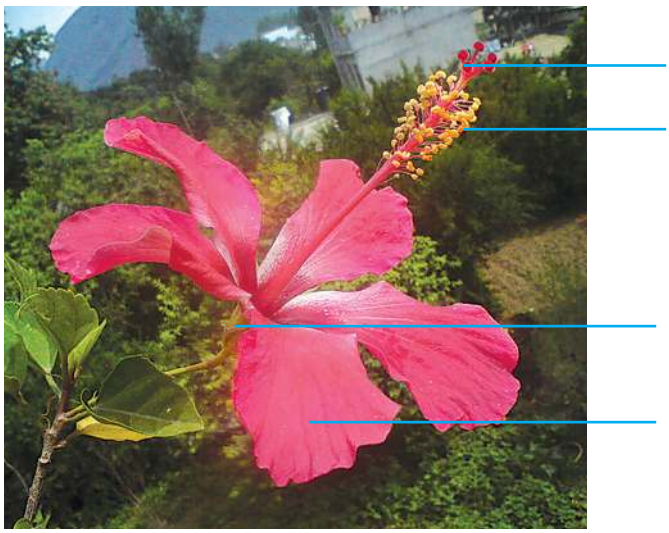
   c. The stalk of a leaf is called _____ (stipule / petiole)

   d. _____ protects the flower when it is a bud. (calyx / corolla)

   e. Movement of plant towards _____ is called phototropism. (Water / light)

2. The diagram of a flower is given below. Label the following parts.

   a) sepal b) petal c) stamen d) stigma



3. The jumbled words below are the various movements of a plant. Write the correct word.

   a. SICTAN = NASTIC

   b. PSIMORTOEG = _____

   c. PISOMTRORDHY = _____

   d. SIMPTROOOTHP = _____

4. The answers to the following are found in the word grid below. Find the answers and fill in the blanks.

   a. I am a hydrophyte _____

   b. I am a herb _____

   c. I grow in desert _____

   d. I am a tree _____

e. I produce food in the plant _____

f. I am a fusiform root _____

g. I am a tuber _____

h. I am a climber _____

i. Touch-me not _____

j. I am a flower endemic to Tamil Nadu _____

P	K	U	R	I	N	J	I	O	P
O	Z	Y	R	E	P	P	E	P	Q
T	T	R	A	D	I	S	H	P	T
A	E	O	P	U	N	T	I	A	Q
T	A	L	E	A	F	X	W	D	R
O	K	M	I	M	O	S	A	D	A
W	A	T	E	R	L	I	L	Y	A

5. Match the following.

1. Vallisneria	-	Sugarcane
2. Stomata	-	Opuntia
3. Stilt root	-	Pepper
4. Phylloclade	-	Submerged hydrophyte
5. Climber	-	Transpiration

SCIENCE

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Fig 4.1 All animals

Inba and Valli are going to their uncle's house in their village. Their uncle takes them around his farm. They see number of animals neatly kept in coops and paddocks. They asked their uncle how he had arranged them. Uncle replied that he classified them according to their kind, the food they eat etc. There are many varieties of living things in the world. Are they also arranged in a similar way?.

Yes, we call the arrangement as classification.

There is great diversity among living organisms found on the planet earth. They differ in their size, shape, habitat, mode of nutrition and other ways of life. The biodiversity of the earth is enormous.

We call such a variety among living organisms as biodiversity. Even though there is such a variety and diversity among them, the living organisms show a lot of similarities and common features so that they can be arranged into many groups. In order to understand and study them systematically, these living organisms mainly the plants and animals are grouped under different categories.

The system of sorting living organisms into various groups based on similarities and dissimilarities is called classification.

4.1. NEED FOR CLASSIFICATION

It is not possible for anyone to study all the organisms. But if they are grouped in some convenient way, the study would become easier. Classification allows us to understand diversity better.

Necessity for classification

1. Classification helps us to identify the living organisms easily.
2. It helps us to learn about different kinds of plants and animals, their features, similarities and differences.
3. It enables us to understand how complex organisms evolve from simple ones.

ACTIVITY 4.1

Shall we name some common vegetables and find out if they have any other name...

S. No.	Common name	Other name
1.	Brinjal	Egg plant
2.		
3.		
4.		

4.2. THE FIVE KINGDOM CLASSIFICATION

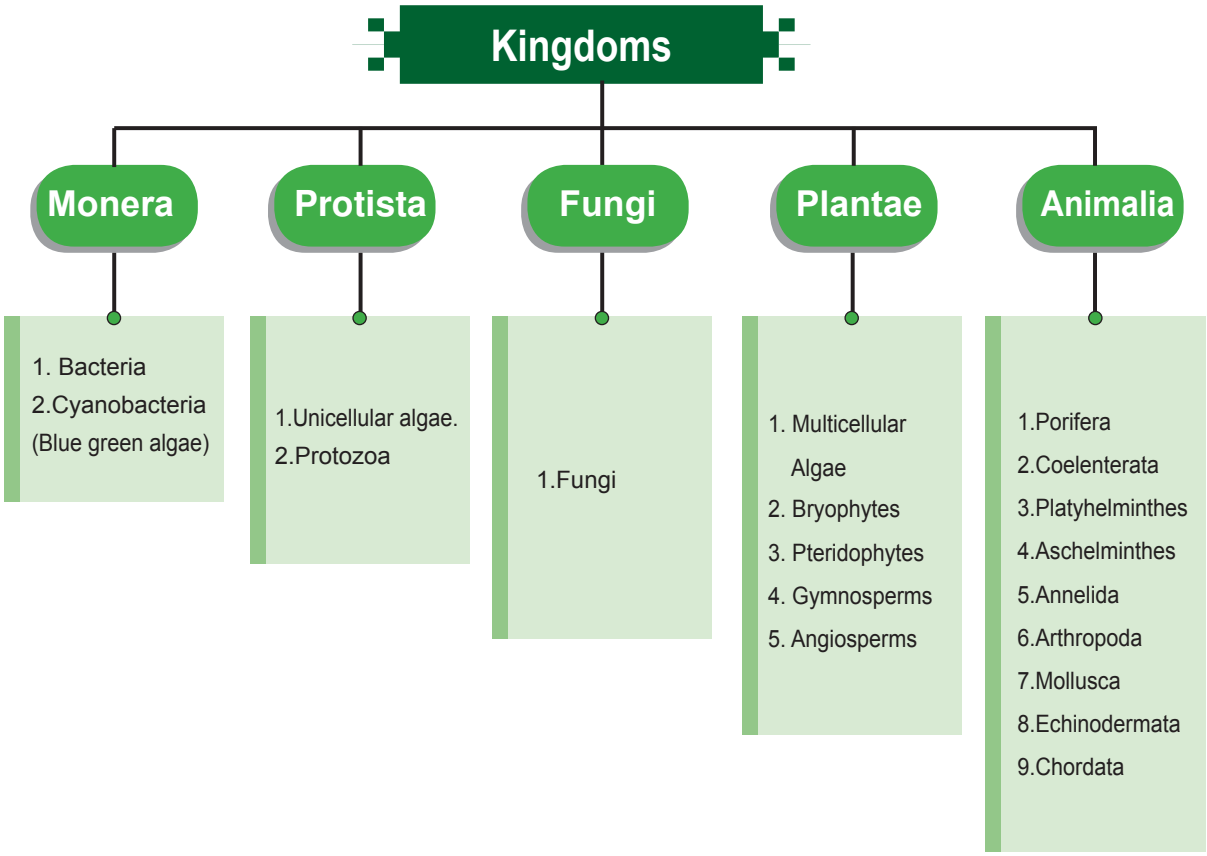
Robert Harding Whittaker (1920–1980)

R.H.Whittaker (1920–1980) was an American plant ecologist. He was the first to propose the five kingdom classification of the world's biota, based on their evolutionary relationships. In 1969 he classified the organisms into five kingdoms. This classification has been accepted by all scientists.

MORE TO KNOW

About 9,000 species are identified under Kingdom Monera. The number of species in Kingdom Protista is about 59,950. The number of species under Fungi is about 100,000. The number of species identified under the Kingdom Plantae is about 289,640. The total number of species identified under Animalia is about 1,170,000.

The Five Kingdoms are Monera, Protista, Fungi, Plantae and Animalia.



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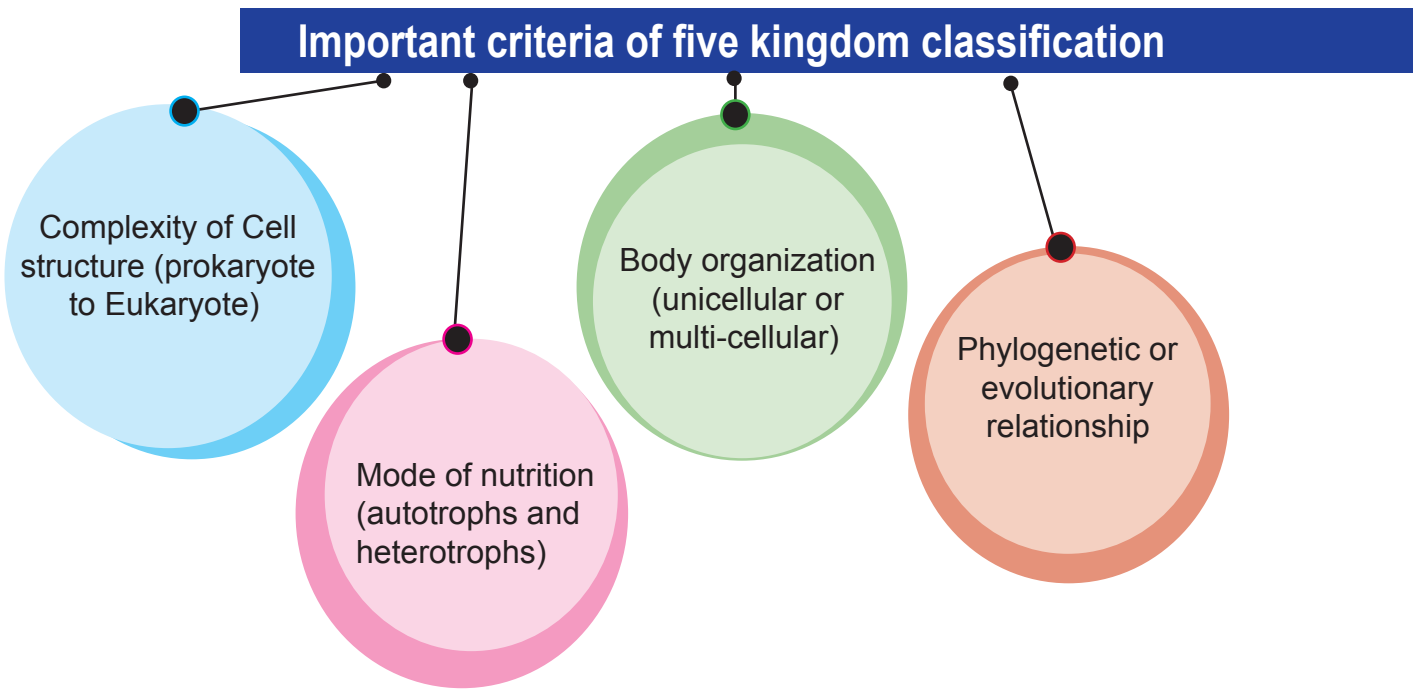
This classification takes into account the following important criteria.



4.2.1. KINGDOM OF MONERA

General features

- The kingdom Monera comprises all bacteria and the cyanobacteria.
- They are Primitive unicellular. (single cell organisms).
- They do not have a true nucleus (prokaryotic).
- Their mode of nutrition is autotrophic or heterotrophic.
- They cause diseases like diphtheria, pneumonia, tuberculosis, leprosy etc.
- They are also used in manufacture of antibiotics to cure many diseases.

ACTIVITY 4.2

Children, shall we find out what converts milk into curd, ferments idli batter, causes disease like cholera, and produces medicines

Yes, the organism is bacteria.

Discovery of Bacteria

In 1675 Anton Von Leewvenhoek, a Dutch scientist, discovered bacteria. He called the bacteria as 'animalcules'. Anton Von Leewvenhoek is called as the father of bacteriology. Bacteria are considered as the first formed organisms in the world.

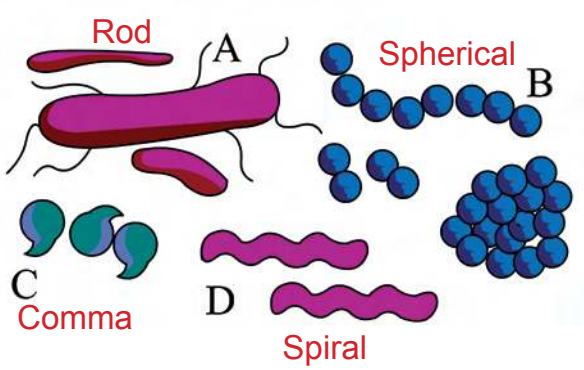


Fig 4.2 Bacteria shapes

Shape of Bacteria

The shape of bacteria varies in different species.The important shapes are

(A) rod
(B) spherical
(C) comma
(D) spiral.

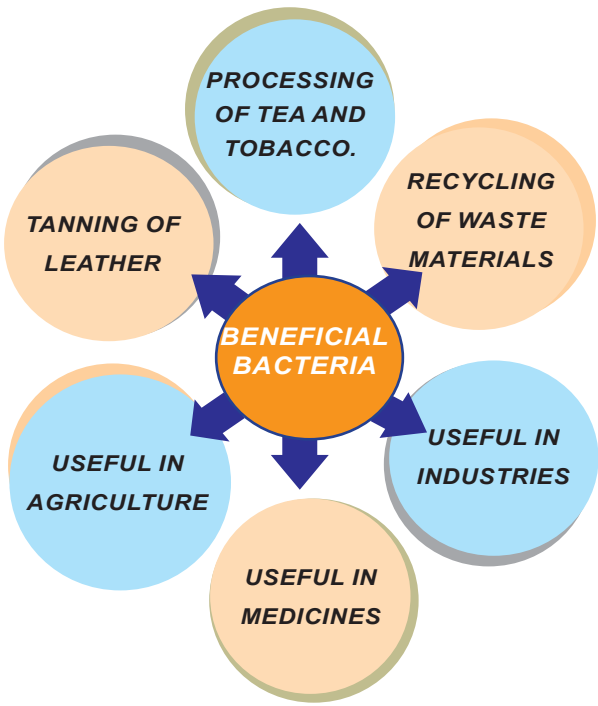
ACTIVITY 4.3

Children, shall we keep a drop of curd on clean glass slide and observe under microscope. We can see rod shaped Lacto bacillus.

MORE TO KNOW

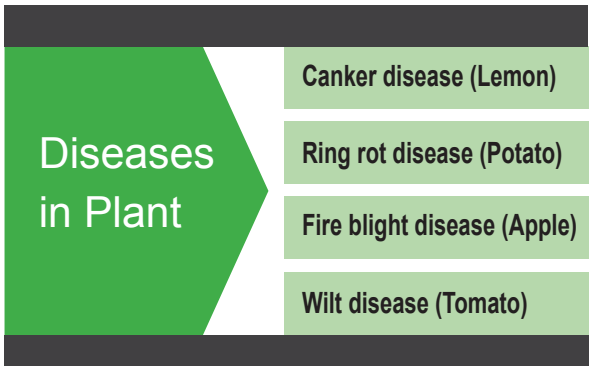
The average human gut contains about 1kg of bacteria. Their presence is essential for normal health.

Beneficial bacteria



Harmful Bacteria

Bacteria cause many diseases in plants and human beings.



4.2.2. KINGDOM OF PROTISTA

General features

- The kingdom Protista includes unicellular eukaryotes.
- Animals and plants of Protista live in sea as well as in fresh water.
- Some are parasites. Though they are single celled they have the capacity of performing all the body activities.
- They have nucleus enclosed by a nuclear membrane (eukaryotic).
- Some of them posses chloroplast and make their food by photosynthesis. e.g.Euglena

There are two main groups of protista.

1. Plant like protista which are photosynthetic are commonly called microalgae. They can seen only under a microscope. They occur as single cells or filaments or colonies. eg. Chlamydomonas, Volvox etc. Algae are autotrophs.
2. Animal like Protista are often called Protozoans. Protozoans include Amoeba and Paramoecium like animals. The Paramoecium, which consists of cilia, belongs to class Ciliata. Amoeba which consists of pseudopodia belongs to class Sarcodina. All unicellular plants are collectively called phytoplanktons and unicellular animals as zooplanktons.

Euglena, a protozoan possesses chloroplast and make their food by photosynthesis.It has two modes of nutrition. In the presence of sunlight it is autotrophic and in the absence of sunlight it is heterotrophic. This mode of nutrition is known as myxotrophic and hence they form a border line between plants and animals.

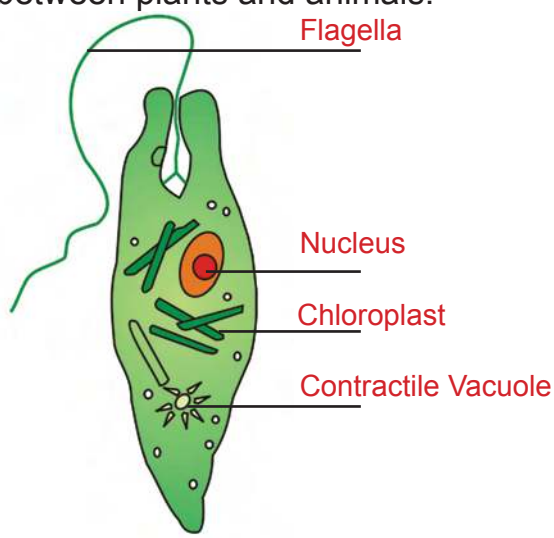


Fig 4.3 Euglena

SCIENCE

4.2.3. KINGDOM OF FUNGI

General features

This kingdom Fungi includes Yeast, Moulds, Mushrooms (Kaalaan), Toadstools, Puffballs and Penicillium

- Fungi are eukaryotic and mostly multicellular. The body is made up of filamentous hyphae.
- Their mode of nutrition is heterotrophic (obtain their nutrients from other organisms) since they lack the green pigment chlorophyll.
- They have cell walls, made of a tough complex sugar called chitin.
- Fungi act either as decomposers (decay-causing organisms) or as parasites(live in other organisms) in nature.
- Mould fungi grows on stale bread, cheese, fruit or other food.

Fig 4.4. Mushroom (Kaalaan)

Penicillium is a fungus. It lacks chlorophyll. It lives as saprophyte. The body consists of filamentous structures. The antibiotic penicillin is extracted from it. The

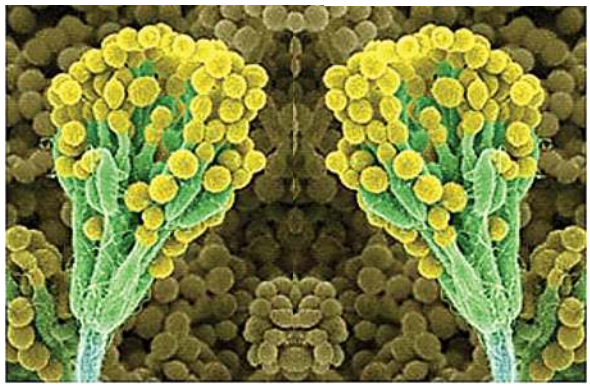


Fig 4.5 Penicillium

Penicillin is also known as **"the queen of drugs"**.

Yeast is an unicellular organism and oval in shape. It is a saprophytic fungus. It is useful for the preparation of alcohol by fermentation process. Conversion of sugar solution into alcohol with the release of carbon dioxide by yeast is called fermentation. It is also used in bakery.

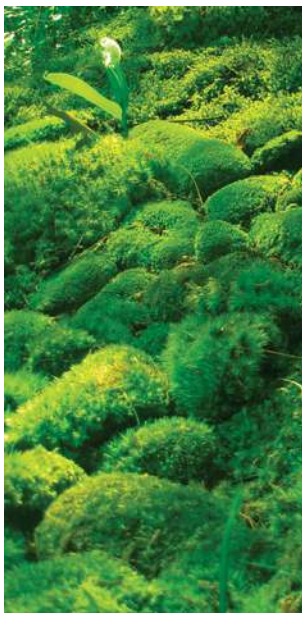
ACTIVITY 4.4

Let us mix the yeast powder with the sugar solution. After a few days you can see the formation of whitish layer on the surface of the extract. When it is observed under the microscope, yeasts can be seen.

MORE TO KNOW

Children, some fungi are extremely poisonous. Never touch or eat wild fungi without the advice of elders.

4.2.4. KINGDOM OF PLANTAE



Moss

Ferns (perani)

Pinus

Sunflower (Suryakanthi)

Fig 4.6.

General features

Kingdom Plantae includes all multicellular plants of land and water.

1. Algae (Multicellular)
   eg. Laminaria, Spirogyra, Chara
2. Bryophytes
   eg. Riccia, Moss
3. Pteridophytes
   eg. Ferns
4. Gymnosperms
   eg. Cycas, Pinus
5. Angiosperms
   eg. Grass, Coconut Mango, Neem (veppa maram)

- Plantae are multicellular eukaryotes.
- The plant cells have an outside cell wall that contain cellulose.
- They show various modes of nutrition. Most of them are autotrophs since they have chlorophyll.
- Some plants are heterotrophs. **eg. Cuscuta is a parasite.**
- Nepenthes and Drosera are insectivorous plants.

MORE TO KNOW

Kingdom Plantae includes

Bryophyta - 24,000 species

Pteridophyta - 10,000 species

Gymnosperms - 640 species

Angiosperms - 255,000 species

SCIENCE

4.2.5 KINGDOM OF ANIMALIA

General features

- This kingdom includes all multicellular eukaryotic animals.
- All animals show heterotrophic mode of nutrition. They directly or indirectly depend on plants for their basic requirements particularly the food.
- They form the consumers of an ecosystem.
- The cells have plasma membrane.
- They have contractibility of the muscle cells.
- They have well developed, controlled and coordinated mechanisms.
- They can transmit impulses due to the presence of nerve cells
- Some groups of animals are parasites e.g. tapeworms and roundworms.

Most members of the animal kingdom can move from place to place. However, some animals, such as adult sponges and corals are permanently attached to a surface.

Kingdom Animalia includes the following phyla

S.N	PHYLUM	CHARACTERS	EXAMPLES
1.	Porifera	Pore bearers	**eg. Sponges**
2.	Coelenterata	Common body cavity and digestive cavity	**eg. Hydra, Jelly fish**
3.	Platyhelminthes	Flatworms	**eg. Tape worm (Taenia)**
4.	Aschelminthes	Thread-like worms	**eg. Round worm (Ascaris)**
5.	Annelida	Body is segmented	**eg. Nereis, Earthworm**
6.	Arthropoda (insect group)	Have jointed legs	**eg. Centepede, Cockroach, Scorpion**
7.	Mollusca	Soft bodied with shells	**eg. Snail, Octopus, Sepia.**
8.	Echinodermata	Spiny skinned	**eg. Star fish, Sea-cucumber.**
9.	Chordata	Have backbone	**eg. Fish, Frog, Man.**

MORE TO KNOW

Tamil Nadu ranks first among all states in the country to have endemic animals.

4.3.BINOMIALNOMENCLATURE

History of classification

Aristotle categorized organisms into plants and animals.

- Hippocrates, the Father of Medicine, listed organisms with medicinal value.
- Aristotle and Theophrastus classified the plants and animals on the basis of their form and habitat.
- John Ray introduced the term species.
- Carolus Linnaeus organized a simple naming system for plants. So, he is known as Father of Taxonomy. He developed the Binomial System of nomenclature, which is the current scientific system of naming the species.

Necessity for Binomial Nomenclature

In the earlier period, organisms were referred by their common names. Since common names or vernacular names were in the local languages, they differed at different places resulting in total confusion. They were not universally applicable.

Carolus Linnaeus (1707-1778)

In order to avoid this confusion, a scientific system of naming organism which is universally followed was evolved. So Linnaeus devised a system of naming animals and plants with two names. This is called binomial nomenclature.

Basic Principles of Binomial Nomenclature

1. Scientific names must be either Latin or Latinized.
2. The name of the genus begins with a capital letter.
3. The name of the species begins with a small letter.
4. When printed, the scientific name is given in italics.
5. When written by hand, name should be underlined.

SCIENCE

ACTIVITY 4.5

Shall we observe some plants and animals and find their binomials.

ZOOLOGICAL NAME		BOTANICAL NAME	
Cockroach (Karapan Poochi)	*Periplaneta americana*	Hibiscus (Chemparuthi)	*Hibiscus rosasinensis*
Housefly (Ee)	*Musca domestica*	Tomato (Thakkali)	*Lycopersicon esculentum*
Frog (Thavalai)	*Rana hexadactyla*	Potato (Urulai)	*Solanum tuberosum*
Pigeon (Pura)	*Columba livia*	Mango (Maankai)	*Mangifera indica*
Man (Manithan)	*Homo sapiens*	Rice (Nel)	*Oryza sativa*

EVALUATION

1. Pick out the correct answer:-

a) The five kingdom system of classification was proposed by _____
(R.H.Whittaker / Carl Linnaeus)

b) Kingdom Monera includes _____ organisms.
(multicellular / unicellular)

c) The queen of drugs is _____
(yeast / penicillin)

d) Plant cells have it. Animal cells do not have it. What is it? _____
(Nucleus / cell wall)

e) Oryza sativa is a binomial of _____
(rice / wheat)

2. Place the following animals in their phylum.

tapeworm, sponges, hydra, ascaris, scorpion, human, snail, starfish, earthworm.

Tapeworm - Platyhelminthes

a) _____- _____ e) _____- _____

b) _____- _____ f) _____- _____

c) _____- _____ g) _____- _____

d) _____- _____ h) _____- _____

3. Some beneficial and harmful effects of bacteria are given below. Write (B) for BENEFICIAL and (H) for HARMFUL.

a) Leprosy - Beneficial / Harmful ☐

b) Ring rot of potato - Beneficial / Harmful ☐

c) Recyciling of waste - Beneficial / Harmful ☐

d) Tuberculosis in man - Beneficial / Harmful ☐

e) Tanning of leather - Beneficial / Harmful ☐

f) Wilt of tomato - Beneficial / Harmful ☐

g) Processing of tea - Beneficial / Harmful ☐

4. Draw different shapes of bacteria.

5. Euglena possesses chloroplast. In the absence of sunlight it is heterotrophic. In which kingdom will you place it? Animal or plant?

6. Find out the names of the following in as many languages as you can with help of your teachers and parents.

1. Lion 2. Mango 3. Dog 4. Potato 5. Hibiscus 6. Groundnut






Sl.No	English Name	Tamil Name	Binomial Name
1.	Lion	Singam	Panthera leo
2.	Mango		
3.	Dog		
4.	Potato		
5.	Hibiscus		
6.	Groundnut		

SCIENCE

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We are surrounded by a number of objects. eg : iron, wood, water, air etc. We do not see air but we feel its presence. All these things occupy space and have mass. In the **World of Science, matter is anything that has mass and occupies space.** There are different kinds of matter. Here, we learn about matter based on its physical properties.

ACTIVITY 5.1

Look at your surroundings, observe and write the objects around you.

In your house	1..... 2..... 3.....
In the playground	1..... 2..... 3.....
In your classroom	1..... 2..... 3.....

SCIENCE

5.1. PHYSICAL NATURE OF MATTER

Let us perform an activity to learn about the nature of matter.

ACTIVITY 5.2

Let us take a small piece of chalk and powder it. We can see that the chalk powder consists of small particles. These particles are responsible for the formation of matter (chalk). **Matter is made up of tiny particles** known as atoms and molecules. Molecules are made up of atoms. Molecules and atoms are the building blocks of matter.

MORE TO KNOW

The size of the atoms and molecules of matter is very small, almost beyond our imagination. It is measured in nanometres (1nm = 10^{-9}m).

Fig.5.1-Chalk piece

Fig.5.2-Chalk powder

5.2. CHARACTERISTICS OF PARTICLES OF MATTER

ACTIVITY 5.3

- Take some water in a beaker.
- Mark the level of water. Add some sugar to the water and stir well.
- Do you observe any change in the water level?
- What does the solution taste like?
- What happened to the sugar?
- How did it disappear?

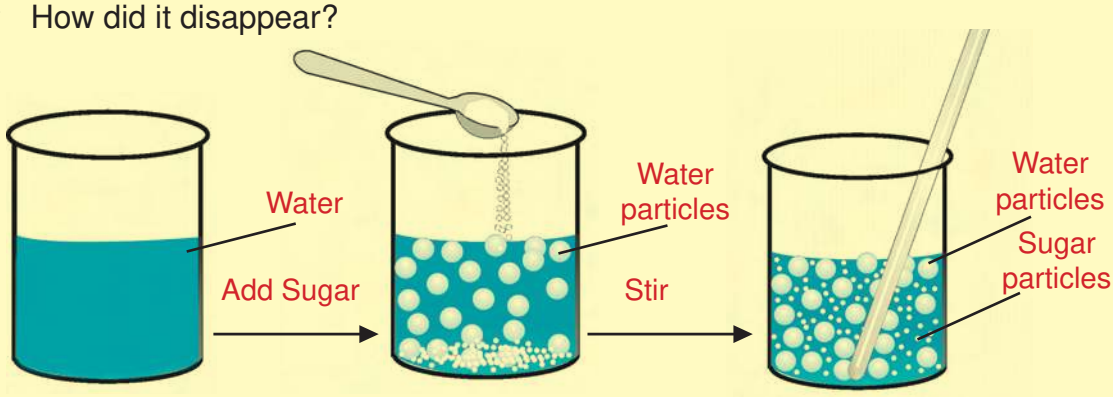


Fig.5.3-Particles of water and sugar are magnified million times.

From the above activity you can notice that there is no change in the water level but the taste is sweet. It indicates that the sugar is completely dissolved in water. When you dissolve sugar in water, the molecules of sugar occupy the space between molecules of water and get uniformly distributed in water. It is understood **that there exists a space between the molecules in matter.**

ACTIVITY 5.4

- Take some water in a beaker.
- Add a drop of blue ink slowly and carefully into the beaker.
- Leave it undisturbed in your classroom.
- Record your observation.

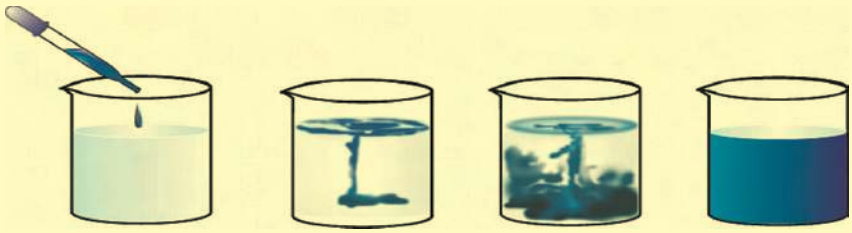


Fig.5.4-Diffusion of ink in water

From the above activity you can understand that **the molecules of matter continuously move and mix with each other.**

SCIENCE

ACTIVITY 5.5

- Open a water tap.
- Try to break the stream of water with your fingers.
- Are you able to break the stream of water?
- What could be the reason behind the stream of water remaining together?

Fig.5.5-Stream of water remains together

The above activity shows that **molecules of matter have force of attraction between them.** This force binds the molecules together. Force of attraction between the molecules (Inter molecular forces) varies from one kind of matter to another. The structure and properties of matter – whether they are hard or soft, coloured or transparent, liquid or gas- depends on the way in which the atoms and molecules are arranged.

SCIENCE

5.3. STATES OF MATTER

Matter can exist in three physical states, i.e., solid, liquid and gas.

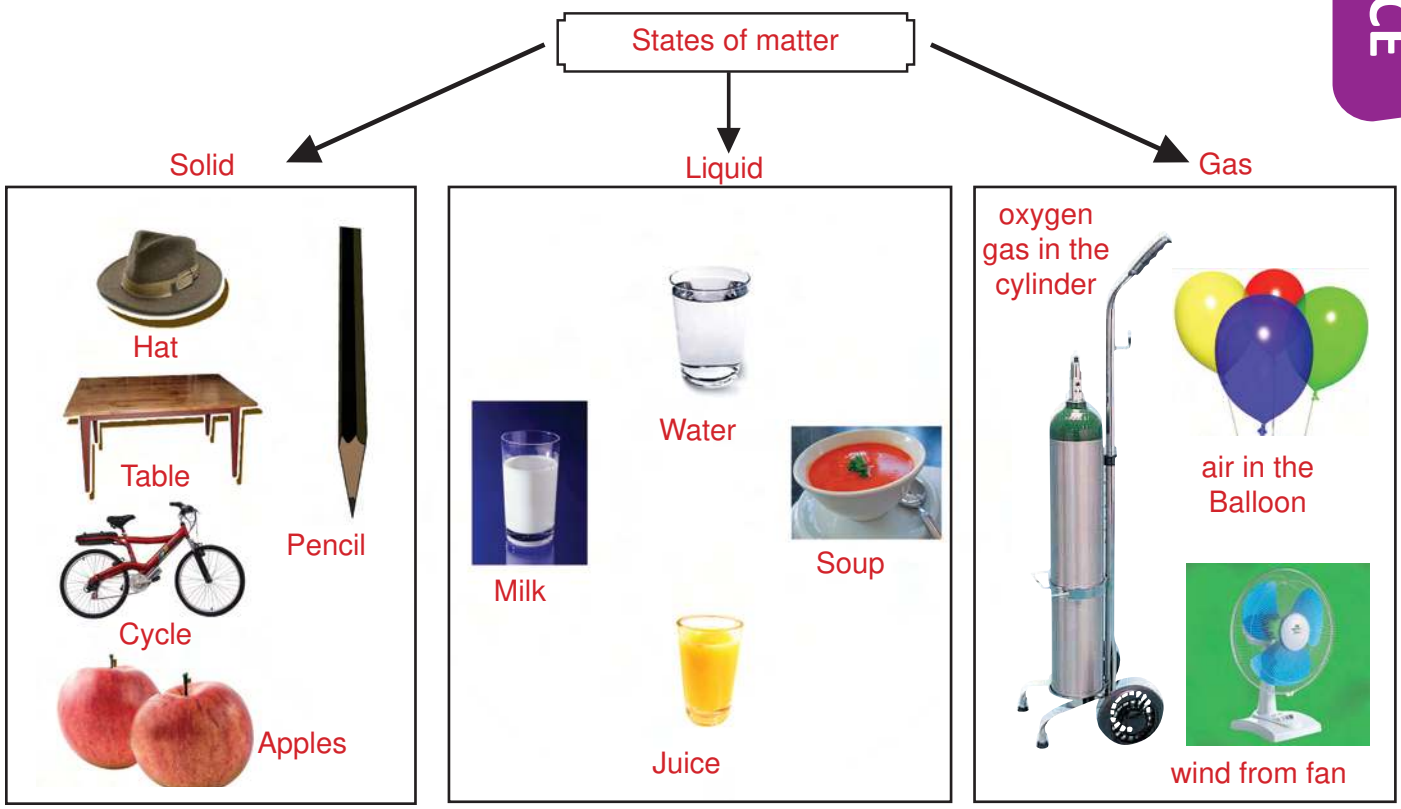


Fig.5.6-States of matter

Solid

Solids are characterized by definite shape, size and volume. In solids, the molecules are very closely arranged because the force of attraction between the molecules is very strong. They are incompressible. The following figures 5.7(a & b) are a few examples to show that matter exists in the solid state. Fig (5.8) shows how molecules are closely arranged in solids.

5.7.(a)

5.7.(b)

Fig. 5.7- Examples of matter in solid state

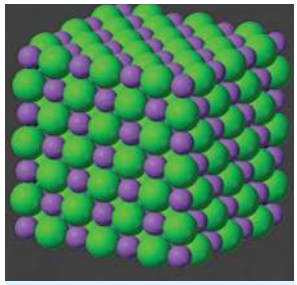


Fig.5.8
Close arrangement of molecules in solid

SCIENCE

TO THINK...

Sponge is also a solid. Yet we are able to compress it. Why? Sponge has minute holes in which air is trapped. When we press it, the air is expelled and we are able to compress it.Solids may break under force. It is difficult to change their shape as they are highly incompressible.

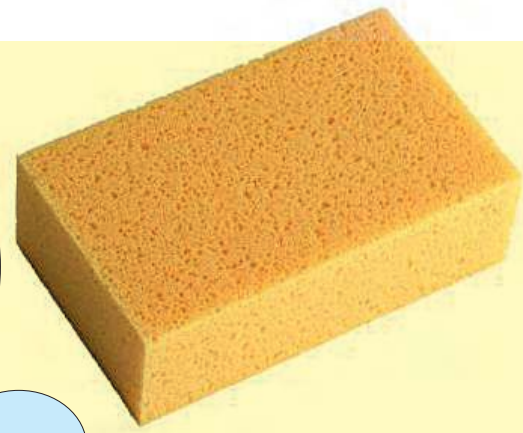


Fig. 5.9. Sponge

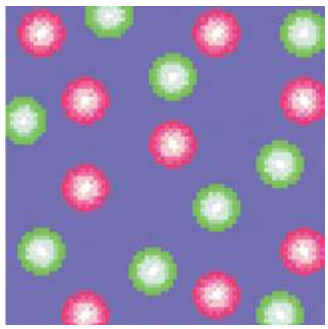


Fig.5.10
Plasma State

MORE TO KNOW

Matter exists in two more states.

Fourth State of Matter -Plasma- super heated gaseous State.

Fifth State of Matter - 'Bose-Einstein condensate' – super cooled Solids.

Liquid

Liquids occupy definite volume but have no definite shape. It takes the shape of the container as shown in fig 5.11. Do you know why? The inter molecular force of attraction between the molecules in a liquid is less when compared to solids and these molecules are loosely packed. This allows the liquid to change its shape easily. They are negligibly compressible. A few examples for matter that exist in liquid state are water, oil, juice etc. From the fig 5.12 you can also see how the molecules are loosely arranged in liquids.

Fig. 5.11. Liquid takes the shape of the container

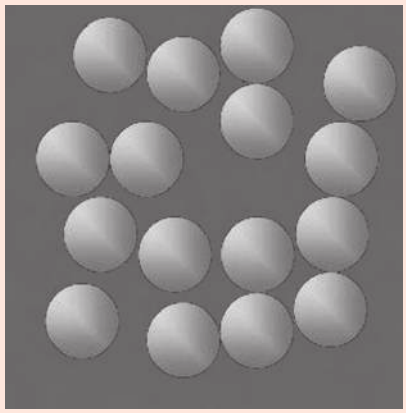


Fig 5.12. Loose arrangement of molecules in liquid

Gas

The atoms or molecules of matter that always occupies the whole of the space in which they are contained is called a **gas**, as shown in Fig 5.13 . It neither occupies a definite volume nor possesses a definite shape. The inter molecular force of attraction between the molecules of a gas is negligibly small, because the molecules are very loosely packed as in Fig 5.14 . The molecules are distributed at random throughout the whole volume of the container. Gases are highly compressible when compared to solids and liquids. Gases will expand to fill the space of the container. The Liquefied Petroleum Gas (LPG) cylinder that we get in our home for cooking and the oxygen supplied to hospitals in cylinders are compressed gases. These days Compressed Natural Gas (CNG) too, is used as fuel in vehicles. In Delhi, CNG gas is used as a fuel in buses.

Fig 5.13.
Gas filled balloon

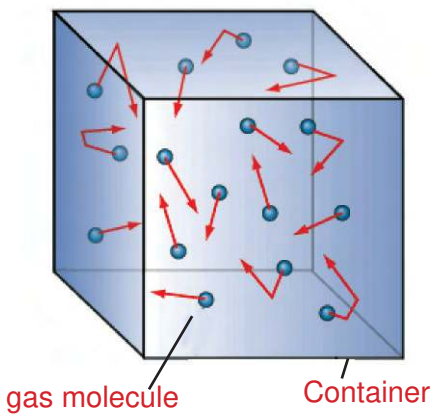


Fig5.14. Very loose arrangement of molecules in gas

SCIENCE

ACTIVITY 5.6

Take a cork ball and press it. Do you find any change in the size or shape. No,it cannot be compressed. You know well that solids are incompressible.

Let us compare the compressibility of liquids and gases using an activity.

Take two hypodermic syringes and label them 1 and 2.

1. Plaster the nozzle and seal it with a cork.
2. Remove the piston (Plunger) from the syringes.
3. Fill syringe-1 with water.
4. Do not add anything in syringe 2 (still it contains air).
5. Insert the piston back into the syringes. You may apply some Vaseline on the piston before inserting them into the syringes for smooth movement.

Now try to compress by pushing the piston in each syringe. In the case of water (liquid) in syringe1 the piston moves just a little. But in the case of air in syringe2, the piston can be pushed completely.

This shows liquids can be compressed slightly, while gases can be compressed easily.

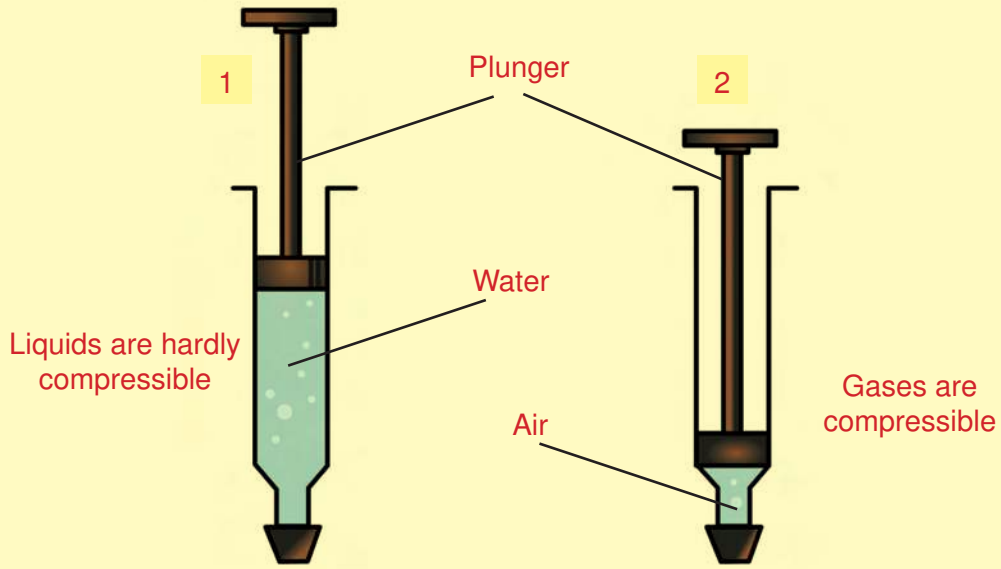


Fig. 5.15. Effect of pressure on liquid and air

MORE TO KNOW

Why does the smell of hot cooked food spread out easily?

Here the particles of the aroma of food mix with the particles of air in the kitchen and spread out from the kitchen very easily. This is due to

(i) The free particles or molecules of gas in aroma and air.

(ii) The high speed of the gaseous particles or molecules.

(iii) The large space between them.

So gases diffuse much faster than solids and liquids.

Properties of Solid, Liquid and Gas :

Table 5.1

S.No	SOLID	LIQUID	GAS
1	Have definite shape and volume	Have definite volume but no definite shape	Have neither definite shape nor definite volume
2	Cannot flow	Can flow from higher level to lower level	Can flow very easily and quickly in all directions
3	Intermolecular space is minimum	Intermolecular space is moderate	Intermolecular space is maximum
4	Intermolecular forces are maximum	Intermolecular forces are less than solid	Intermolecular forces are negligible
5	They are incompressible	They are compressible to an extent	They are easily compressible

5.4 EFFECT OF TEMPERATURE ON SOLID, LIQUID AND GAS

Can you change the state of matter? i.e., from solid to liquid or from liquid to gas.

Let us perform an activity to understand the effect of temperature on matter.

ACTIVITY 5.7

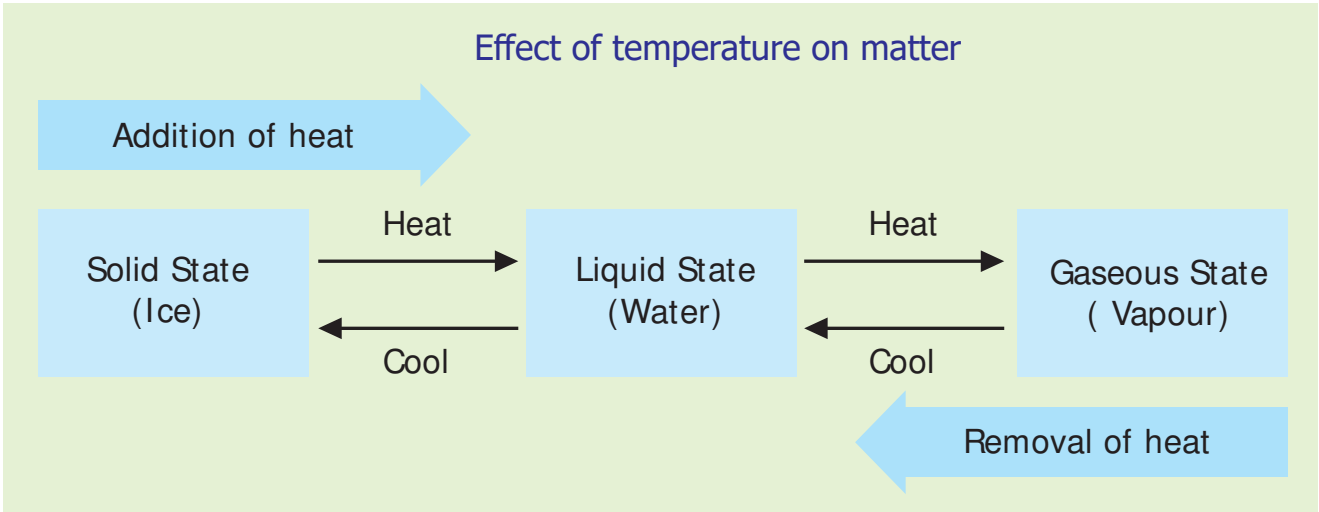
Take some ice cubes in a container, heat the container and observe the changes.

Ice (Solid)

Water (Liquid)

Vapour (Gas)

Fig. 5.16. Effect of temperature on matter.



SCIENCE

On varying the temperature, you can notice that matter will change from one state to another. For example ice (solid) in the container, on heating, becomes water (liquid) and on further heating, it changes into water vapour(gas).

Water can exist as three states of matter.

- Solid, as ice.
- Liquid, as water
- Gas, as water vapour.

What happens to the particles of matter during the change of states? How does this change of state take place? Don't we need answers to these questions?

On increasing the temperature of solids, the kinetic energy of the particles (molecules/atoms) increases. Due to the increase in kinetic energy, the particles start vibrating with greater speed. The energy supplied by heat overcomes the forces of attraction between the particles. The particles leave their fixed positions and start moving more freely. A stage is reached when the solid melts and is converted into a liquid. The temperature at which a solid melts to become a liquid is called its **melting point. The melting point of ice is 0° C**

When we supply heat energy to water, the particles (molecules or atoms) start moving even faster. At a certain temperature, a point is reached when the particles have enough energy to break free from the forces of attraction between each other. At this temperature the liquid starts changing into gas. The temperature at which a liquid starts boiling is known as its **boiling point.** The boiling point of water is 100° **C**

Particles from the bulk of the liquid gain enough energy to change to the vapour state. So, we infer that one state of matter can be changed into another state by varying the temperature.

THINK AND ANSWER

Does coconut oil solidify during the winter season?

ACTIVITY 5.8

Magesh is interested in classifying the different states of matter shown in the box below. Shall we help Magesh to classify the objects below, depending on its state. Put the appropriate objects in the given table (Table 5.2).


Stone


Smoke from incense sticks


Water


Petrol


Oxygen inside the Cylinder


Iron Rod


Honey


Ice Cubes


Milk


Balloon

Table 5.2

Solid	Liquid	Gas

ACTIVITY 5.9

To check whether all solids change their state at the same temperature.

- Take ice, butter and wax.
- Put the ice into the pan. Heat it until the ice changes into water. Use the thermometer to measure the temperature at which it changes the state
- Continue this process for butter and wax.
- Note down the temperature at which the solid state is converted into liquid state in the following table.

Table 5.3

S.No.	Solids	Temperature (^{0}C)
1.	Ice	
2.	Butter	
3.	Wax	

EVALUATION

1. Materials which are very familiar to Raveena are given below. Help her to classify them into solids, liquids and gas.

   bricks, kerosene, milk, coconut oil, air, book, table, oxygen, carbon dioxide

2. Give reason for the following observation.

   a) We can smell the jasmine flower while we are sitting several metres away.

   b) The level of water remains the same when a pinch of salt is dissolved in it.

3. Gas can be compressed into a smaller volume but a solid cannot be. Could you explain. Why?

4. Match the following:

a)	Liquid on heating	-	liquid
b)	Solid	-	easily compressible
c)	Atoms and molecules	-	becomes vapour
d)	Milk	-	cannot flow
e)	Gas	-	building blocks of matter

5. Choose the correct one from the answers given in bracket:

   a) The only substance which exists in all the three states of matter is _____ (water, stone, glass)

   b) The matter which has a negligible intermolecular space is_____ (solid, liquid, gas)

   c) 1 Nanometer is equal to _____

   (10^{-10}m, 10^{-9}m, 10^{-12}m)

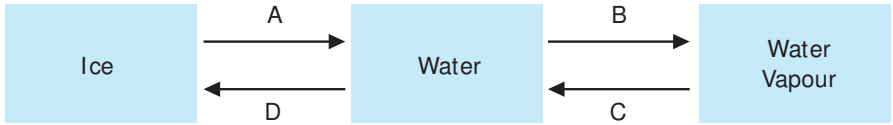
6. Fill in the blanks:

   a) The force of attraction between the particles in gas is _____ (less / more) than that of a solid.

   b) _____ (Solid / Liquid) state has definite volume, but no definite shape.

7. Mohan went to a shop to buy milk. He took his bicycle to go to the shop. He saw that the air in the cycle tube was a very little. He took it to the cycle shop. The cycle mechanic used a compressor pump to inflate the cycle tube. Mohan had a doubt. “How does the compressor works?”. Help Mohan to find the answer.

8. On varying the temperature, you can notice the process that matter will change from one state to another. Name the process A, B, C and D.



9. Solids are incompressible. Sponge is also a solid. We are able to compress it. Could you explain. Why?

PROJECT

Collect 5 or 6 different types of used 1 litre water bottles. Take a bucket of water. Fill the bottles with water fully. Based on your observation, answer the following questions.

a) Does the volume remain the same?

b) Does the shape of the liquid remain same?

1 Litre 1 Litre 1 Litre 1 Litre 1 Litre

FURTHER REFERENCE

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2. Introductory Chemistry - M Katyal, Oxford University press, New Delhi

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http://chemistry . about.com/od/everyday chemistry.in.everyday-life htm

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Places of scientific importance for visit:

Birla Planetorium, Guindy, Chennai.

SCIENCE

Fig. 6.1.

Arun and his father went to see a plot of land they wanted to buy. The owner of the land gave the size of the plot in square feet. Arun's father asked the owner to give the size of the plot in square metre. Arun knew that length is measured in metre. He was confused with the terms square metre and square feet. Let us help him to understand.

The measure of a surface is known as area. **Area is the extent of plane surface occupied.** The area of the plot of land is derived by multiplying the length and breadth.

Area = length x breadth

The unit of area will be

metre x metre = (metre) ^{2} read as square metre and written as m^2.

6.1. DERIVED QUANTITIES

You have already studied the fundamental quantities (length, mass and time) in the sixth standard. Quantities got by the multiplication or division of fundamental physical quantities are called **derived quantities**.

Area is a **derived quantity** as we obtain area from the fundamental physical quantity - length.

Volume and **density** are some other **derived quantities.**

One square metre is the area enclosed inside a square of side 1m.

Other units of measurement

The area of a surface is $10m^2$ means that it is equivalent to 10 squares each of side of 1m

Breadth, height, depth, distance, thickness, radius, diameter are all different measures of length.

Sl.No.	Unit of length	Unit of area
1.	centimetre (cm)	square centimetre (cm^2)
2.	millimetre (mm)	square millimetre (mm^2)
3.	feet (ft)	square feet (ft^2)

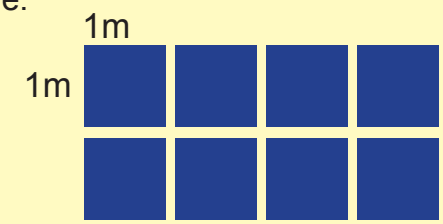
Area of agricultural fields is measured in acre and hectare

1 Acre = 4047 m^2 = 100 cent

1 hectare = 2.47 acre

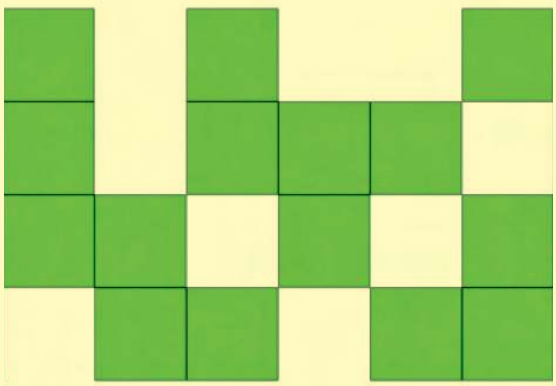
ACTIVITY 6.1

Let us find the area of the given figure.



ACTIVITY 6.2

Let us find the area of the given figure (coloured portion) in cm^2 and mm^2. The side of each small square is 1cm.



ACTIVITY 6.3

Name the unit convenient to measure the area of these surfaces we see in everyday life [mm^2, cm^2, m^2, ft^2, acre].

Sl. No.	Surface	Unit of area
1	Teacher's table top	
2	Black board	
3	Science text book	
4	Measuring scale	
5	Eraser	
6	Class room	
7	Play ground	
8	Agricultural land	

MORE TO KNOW

A metre is much longer than a foot. Do you know how many feet make a metre?

1 metre = 3.28 feet

So, 1 m^2 = 10.76 ft^2

SELF CHECK

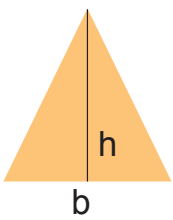
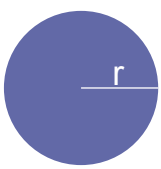
1cm^2 = ---------- mm^2

1 m^2 = ---------- cm^2

REMEMBER

Even though the area is given in square metre, the surface need not be square in shape.

The surfaces need not be a rectangle or square always. We use the following formulae to calculate the area of some regular objects. (i.e.) objects which have definite geometric shape.

S.No.	Shape	Figure	Area	Formula
1.	Square		length x length	l^2
2.	Rectangle		length x breadth	l b
3.	Triangle		½ x base x height	$\frac{1}{2}$ bh
4.	Circle		π x radius x radius	πr^2 $\pi = \frac{22}{7}$ or 3.14

Let us try the method of measuring the area of irregular objects (i.e) objects which do not have regular geometric shape .

We can use a graph sheet to measure their area.

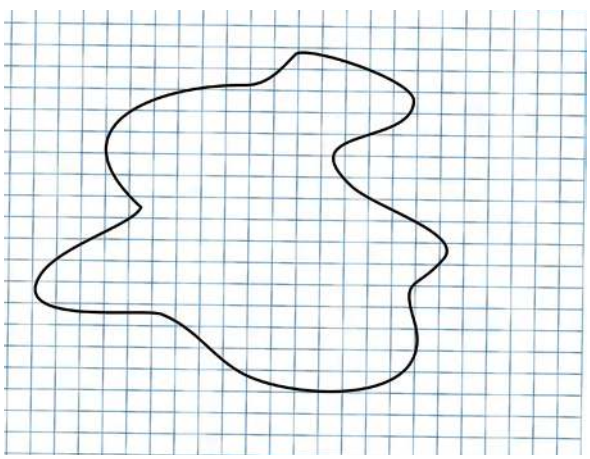


Fig. 6.2.

ACTIVITY 6.4

- Take a graph sheet and draw a square of any size in it and find its area in square millimetre (mm^2) and in square centimetre (cm^2).
- Repeat the activity by drawing a rectangle.
- Verify your answer by using the formula.

SCIENCE

ACTIVITY 6.5

Let us take an object having irregular shape like a broken glass or a broken tile and measure its area.

Follow the steps given below:

1) Place the object on a graph sheet and draw the outline (like shown in figure 6.2).
2) Count the number of small squares enclosed within the outline. If more than half a square is inside the boundary, count it as one otherwise neglect it.
3) Each small square of the graph sheet has a side of 1mm or area $1mm^2$.
4) Area of the irregular object = Number of squares counted X 1 mm^2

The area of the irregular object } = ------mm^2.
= ------ cm^2.

EXPERIMENT

1) Repeat the procedure to find the area of a leaf.
2) Draw squares of the area of one square metre and one square foot. Compare the two areas.

TO THINK

How would you find the surface area of

(a) a banana and

(b) your palm?

Volume

Kumar's family lives in a small house. They have no cupboard to keep their clothes. Kumar asked his father to buy a cupboard. His father refused to buy it as the cupboard would occupy much space in the house.

The space occupied by a body is called its volume.

ACTIVITY 6.6

Shall we observe the following figures of the objects and get an idea about their size and volume?

Bicycle

Nail

Pen

Motorcycle

Chair

Bench

Bus

From your observation, name the objects in increasing order of size and answer the following questions.

1) Which object is the smallest and which is the biggest in size?

2) Which object occupies the minimum space and which the maximum space?

3) What do you infer from the above?

[Objects of smaller size occupy less volume and objects of larger size occupy more volume]

Shall we calculate the volume of regular objects ?

Volume of some regular objects is obtained by multiplying the base area by their height.

Volume = base area x height

Can you tell the unit with which volume is measured?

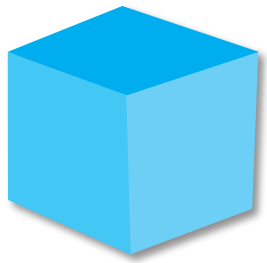
It is, $m^2 \times m = m^3$ which is known as cubic metre.

The volume may also be expressed with different units depending upon the unit of measurement.

Unit of length	Unit of volume
milli metre (mm)	cubic millimetre (mm^3)
centimetre (cm)	cubic centimetre (cm^3)

The volume of an object is $10m^3$ means that it is equivalent to 10 cubes each of side 1m.

One cubic metre is the volume of a cube of side 1m.

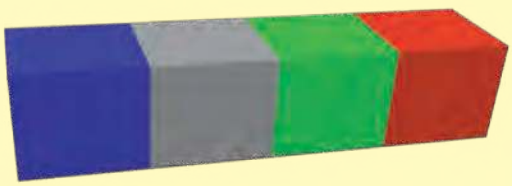


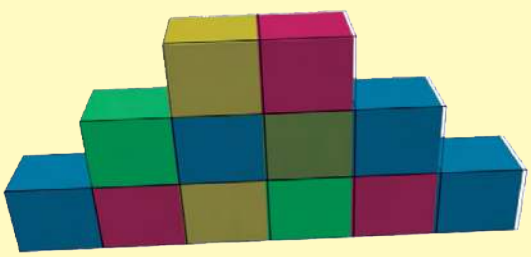
$1m^3$

ACTIVITY 6.7

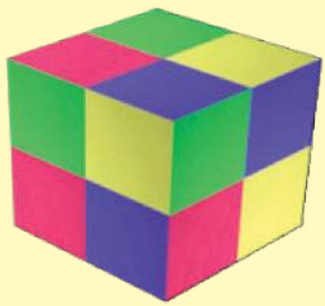
Let us calculate the volume of the objects shown below:

The side of each small cube is 1 cm in length.





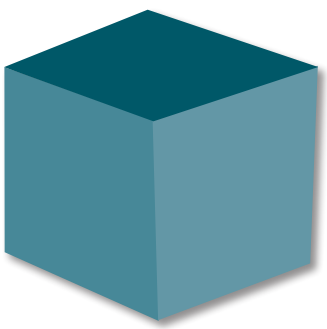
ACTIVITY 6.8



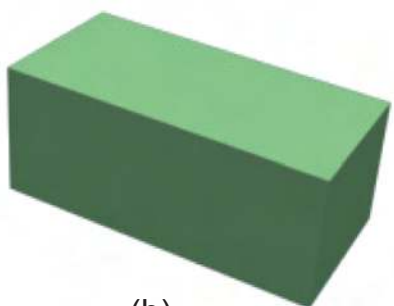
1. How many small cubes make the big cube shown in the picture ?

2. If the side of each small cube is 1 cm in length, find the total volume of the big cube.

Using the concepts discussed so far, try to write the names of the given shapes and the formula for calculating their volume.



(a)



(b)

(c)

Measuring liquids

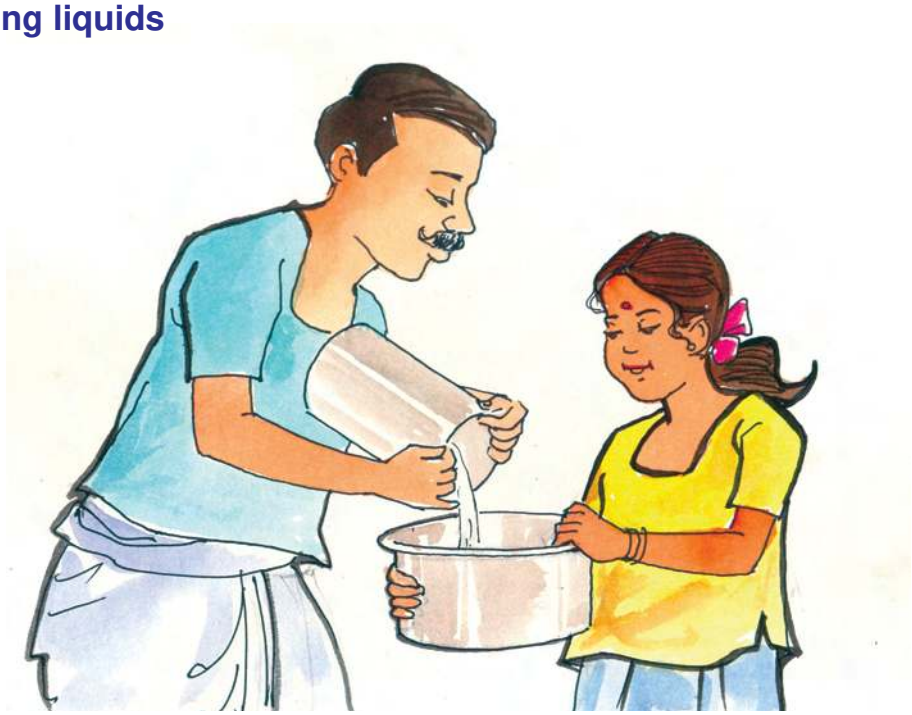


Fig. 6.3

Your mother asks you to get milk from the milkman. When you buy milk from the milkman, he will give it to you in litres (i.e) volume of liquid is measured in litres.

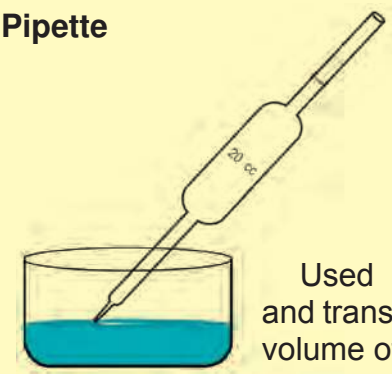
What is the meaning of 1 litre?

1 litre = 1000 cm^3.

One cubic centimetre is otherwise known as 1 millilitre written as ml.

What are the different instruments used to measure the volume of liquids?

Pipette



Used to measure and transfer a definite volume of liquid.

Fig 6.4

Measuring cylinder

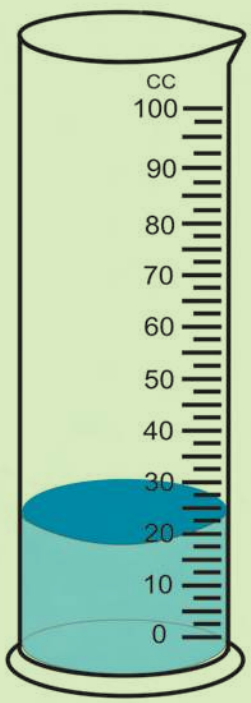


Fig 6.5

Used to measure the volume of liquid.

SCIENCE

SCIENCE

Burette

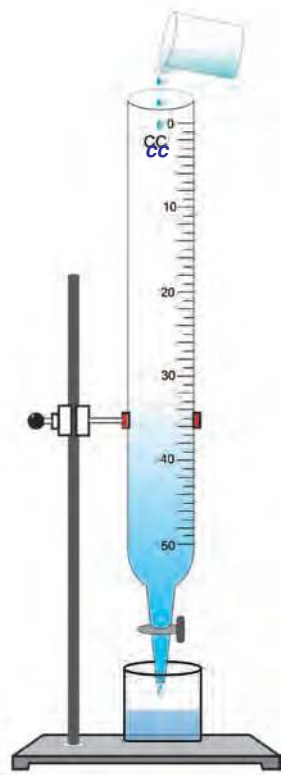


Fig 6.6

Used to make a small fixed volume of liquid to flow.

Measuring flask

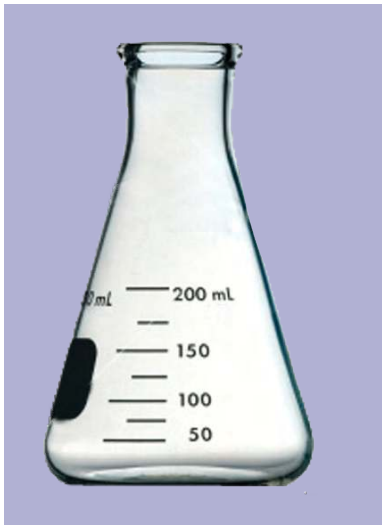
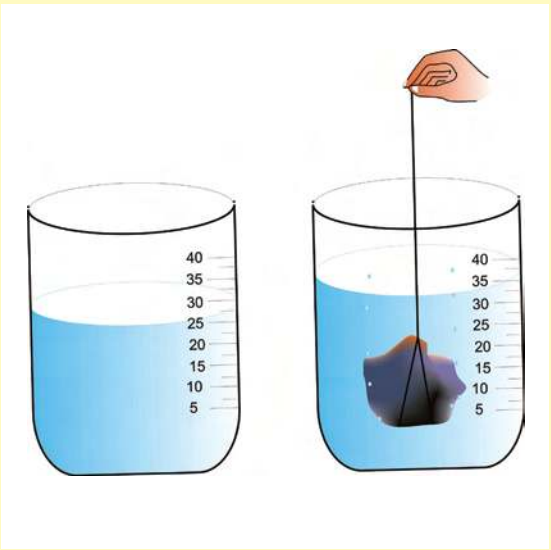


Fig 6.7

Designed to hold a fixed volume.

ACTIVITY 6.9



Let us find the volume of a stone using a measuring cylinder.

Follow the steps given below.

1) Pour water in the measuring cylinder up to a certain level.
2) Note the initial level of water.
3) Tie the stone by means of a thread.
4) Lower the stone into the water so that it is completely immersed without touching the sides.
5) Note the final level of water.
6) The difference between the final and initial levels gives the volume of the stone.

MORE TO KNOW

How will you express volume of water stored in a dam or reservoir?

In thousand million cubic feet (tMc).

Density

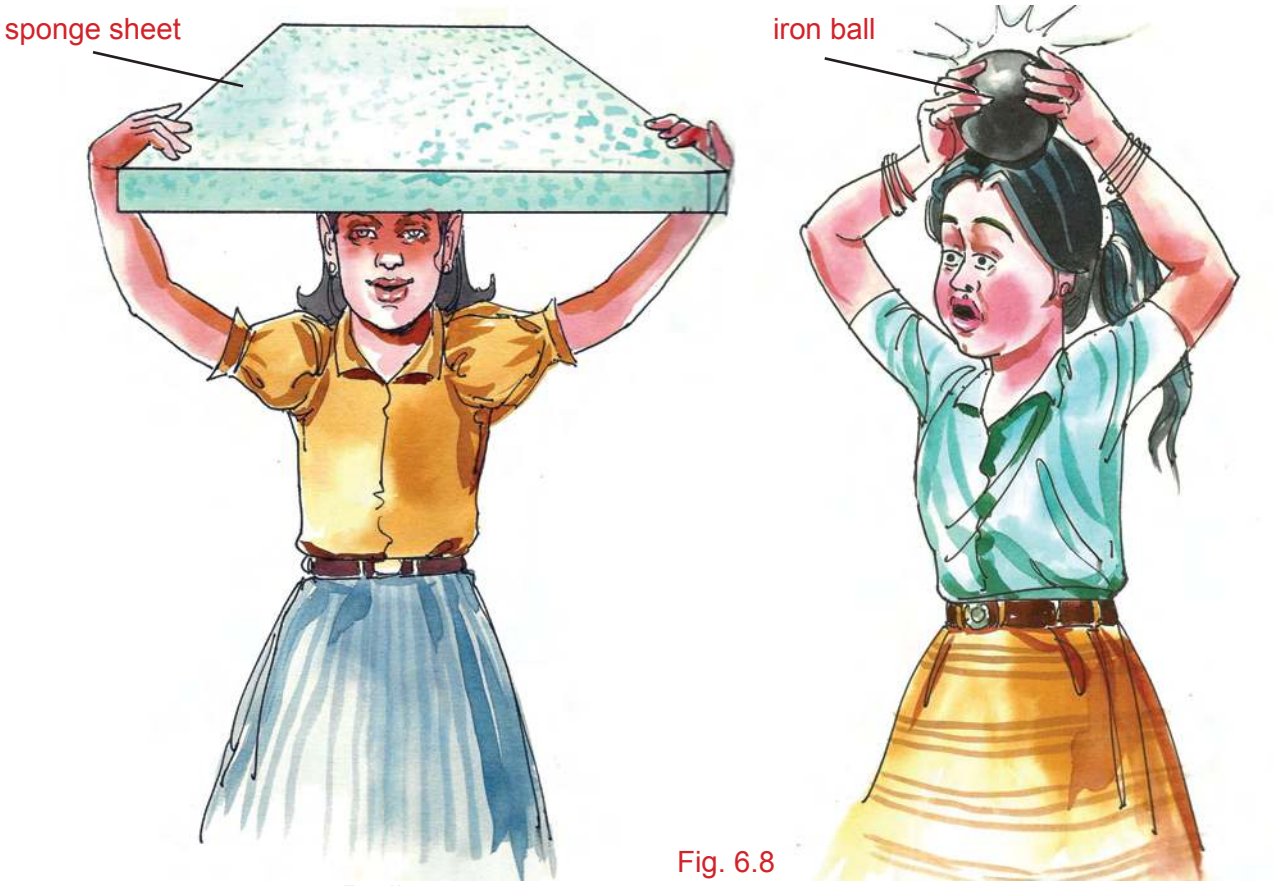


Fig. 6.8

Have a look at the pictures. Who is happier ? Radha or Seetha ?

Definitely Seetha will not be happy as her load (iron ball) is heavier, while Radha will be happy as her load (sponge sheet) is lighter.

The lightness or heaviness of a body is due to density. If more mass is packed into the same volume, it has greater density. So, the iron ball will have more mass than the sponge of same size. Therefore iron has more density.

Density is the mass of unit volume of the substance.

$$\text{Density} = \frac{\text{mass}}{\text{volume}}$$

The SI unit of density is kg /m^3.

ACTIVITY 6.10

Let us take three balls (spheres) of the same size but made of different materials like cork (cricket ball), iron (shot put) and rubber (bouncing ball) Hold them separately in your hand. Arrange them according to the descending order of their mass.

1.

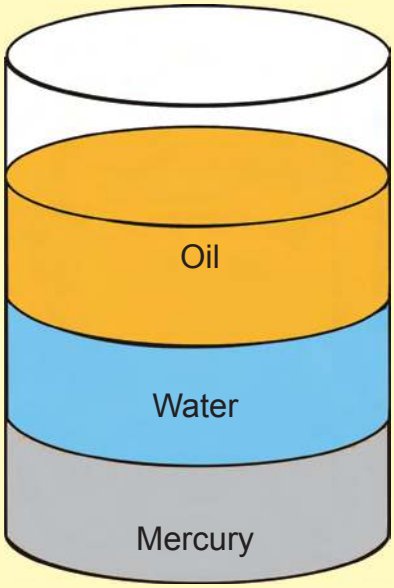
2.

3.

We see that the iron ball has more mass when compared to cork and rubber. It shows that iron has greater density.

SCIENCE

ACTIVITY 6.11



Observe the diagram

Let us identify the following :

(i) The liquid denser than water is _____

(ii) The liquid lighter than water is _____

If a substance is lighter than water, it will float; but if it is heavier than water, it will sink.

MORE TO KNOW

The density of water is 1000 kg/m^3. This means that water filled in a tank of length 1m, breadth 1m and height 1m, has a mass of 1000kg.

If the same tank is filled with mercury it will have a mass of 13,600 kg. So mercury is 13.6 times denser than water.

SELF CHECK

1) Density of steel is 7800 kg/m^3. Will it float or sink in mercury?

2) Give the mass of water contained in a tank of length 5m, breadth 3m and height 2m.

TO THINK

A balloon filled with air does not fly whereas a balloon filled with helium gas can fly. Why?

Hot air balloon

Why does this hot air balloon fly?

6.2. MEASUREMENT OF TIME

Why do we need to measure time?

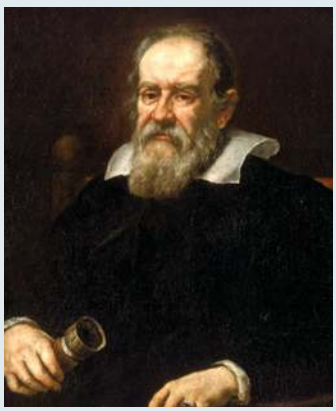
We need to measure time for many reasons –to know when to go to school, when to take food, when to watch TV and when to sleep . The earlier clocks like the sundial , water clock and hour glass were not very accurate. There was the need to have more accurate and precise instruments . The earliest pendulum clocks which had weights and a swinging pendulum satisfied this need.

Simple pendulum

Fig 6.9. swing

Have you been on a swing? The back and forth motion of the swing is an example of oscillatory motion. You can observe the same in pendulum clocks, which work on the principle of the simple pendulum.

A story is told of Galileo. He went to a church in Pisa (in Italy). He noticed that a lamp suspended from the roof by a long chain was swinging periodically. Using his pulse beats he found that the time of swing of the lamp remained constant even as the swinging decreased. His keen observation made him understand the importance of the constant time of the swing.



Galileo (1564-1642)

A simple pendulum is a small metallic ball (bob) suspended from a rigid stand by an inelastic thread. When the bob is pulled gently to one side and released, it moves to and fro. One complete to and fro motion is called one **oscillation.** i.e. from one end (extreme) to the other end and back. The time taken to complete one oscillation is called **time period**.

The distance between the point of suspension and the centre of the bob is called **length of the pendulum**.

Amplitude is the distance upto which the bob is pulled from the position of rest.

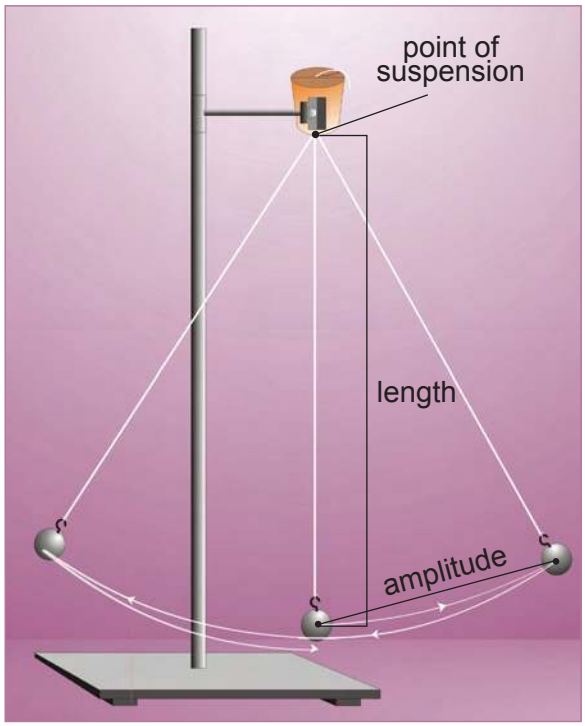


Fig 6.10. Simple pendulum

Before his death in 1642. He made plans for the construction of a pendulum clock; but the first successful pendulum clock was constructed by the Dutch scientist Christian Huygens only in 1657.

SCIENCE

ACTIVITY 6.12

1. Set up a simple pendulum in your class room with a thread of length 60cm.
2. Set the bob into oscillations
3. Note the time taken for 20 oscillations in seconds, using a stop clock.
4. Time period = Time for one oscillation = $\frac{\text{time taken for 20 oscillations}}{20}$

EXPERIMENT

Repeat the above experiment using

(i) bobs of different sizes without changing length of the pendulum.

(ii) threads of length of 80 cm and 100cm.

(iii) various amplitudes.

Do you notice any change in the time period?

In the first and third cases you will find no change in the time period

But in the second case the time period increases with increase in length. So we infer that **time period of a simple pendulum depends on the length of the pendulum and is independent of mass of the bob and the amplitude.**

SCIENCE

6.3. ASTRONOMICAL DISTANCES

Meera and Sundar were very excited as their uncle had joined ISRO (Indian Space Research Organisation). They were eagerly anticipating a visit to his new work place to see rockets and satellites. Let us listen to a conversation between Meera, Sundar and their uncle.

Meera : Uncle, will you become an astronaut?

Uncle : No, Meera, I will be joining a team responsible for the launch of rockets.

Sundar : Rockets shoot up many thousands of kilometre in the sky, don't they?

Uncle : Yes, indeed they do. These rockets send satellites into orbits and spacecraft on their journey into outer space. A spacecraft travels lakhs and lakhs of kilometres in space. Don't you feel that to measure such long distances unique units of measurement are required?

Meera & Sundar : What are these units? Do tell us!

Uncle : Now you see, to measure very long distances like the distance of the sun, other stars and different planets from the earth we use convenient units like **astronomical unit** and **light year**.

Astronomical Unit is the average distance between the earth and the sun.

1 Astronomical Unit = 149.6 million kilometre (14.96 crore km).

$1\ AU = 1.496 \times 10^{11}\ m$

Light year is the distance travelled by light in vacuum in one year.

1 Light year = 9.46×10^{12} km (9,46,000 crore kilometres). (or)

1 Light year = 9.46×10^{15} m

MORE TO KNOW

Light travels distance of 3 lakh km in one second.

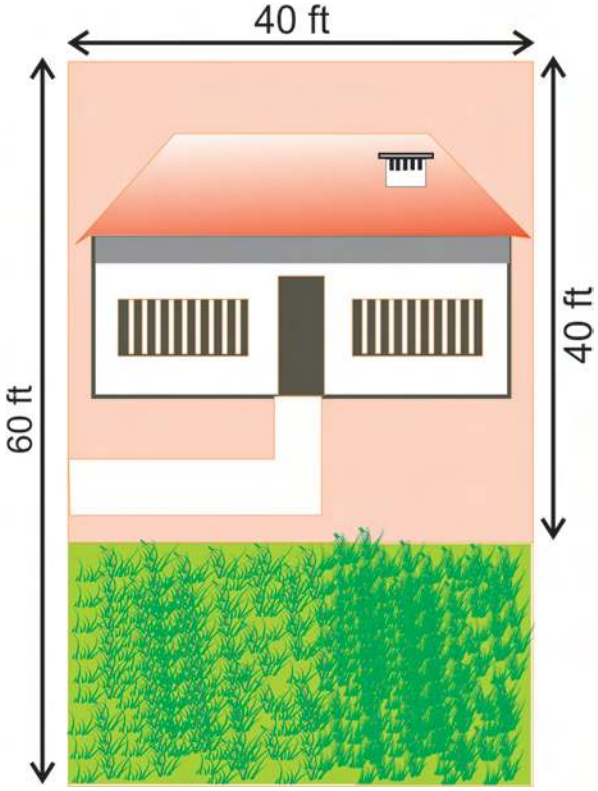
Imagine this boy is travelling at the speed of light . He can travel around the world seven and a half times in one second. He would take eight minute, and twenty seconds to reach the earth from the sun . A racing car travelling at 1,000 kilometres per hour would take 17 years to complete the same journey.

SCIENCE

SCIENCE

EVALUATION

1. Anand's father had a rectangular plot of length 60 feet and breadth 40 feet. He built a house in the plot and in the remaining area he planted a garden as shown.

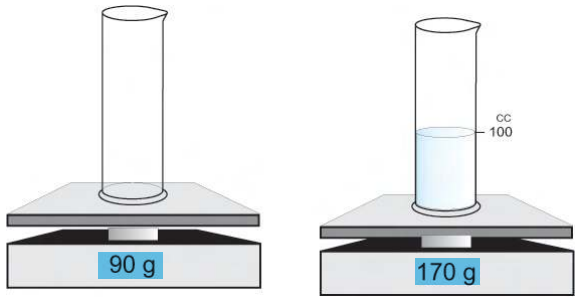


Can you help Anand to find out the area of his garden.

2. 'Density is the lightness or heaviness of a substance.

Kamala wanted to know whether water or coconut oil had lesser density. Her sister Mala asked her to bring a cup of water and some coconut oil. How did Mala clear Kamala's doubt?

3. Observe the given picture and note

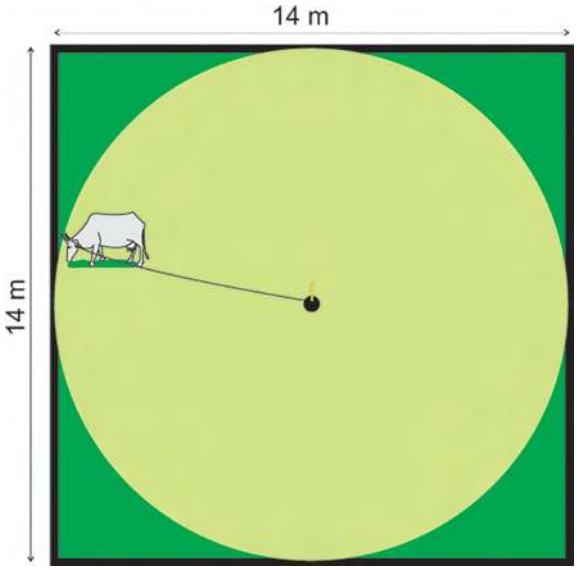


(i) Mass of the liquid ---------- gm

(ii) Volume of the liquid ---------- cc

(iii) Density of the liquid ---------- g/cc

4. Kandasamy, a farmer had a fenced square shaped field in which he allowed his cow to graze. He tied his cow to a stake at the centre of the plot by a rope of length 7 m.



Kandasamy's son, Raju was amused to see that the cow grazed over a large circle of grass but left grass at the corners untouched. How could Raju find out the area of the land not grazed by the cow?

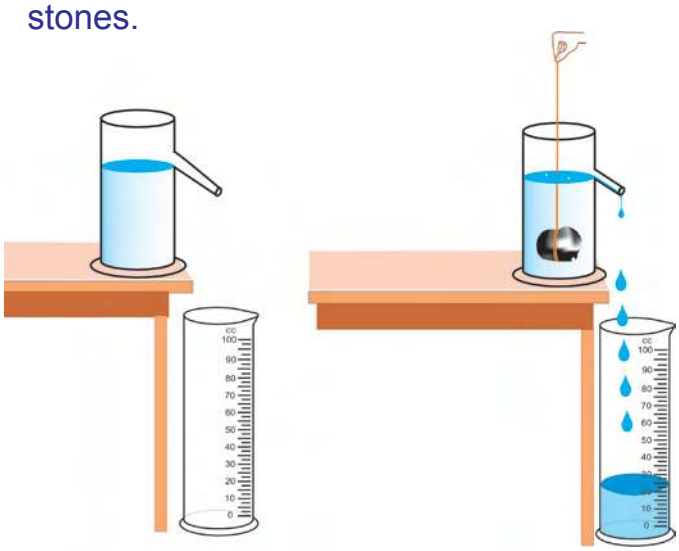
PROJECTS

1. Take a vessel with water and a 25ml graduated beaker. Distribute the water by giving 100ml, 125ml, 175 ml and 200 ml respectively to each of your four friends with the help of the beaker. How many times did you use the beaker for each friend?

2. Use a stop clock and determine how many times the following activities can be repeated in a span of one minute.

S.No.	Activity	Number of repetitions in one minute.
1.	Your friend inhales and exhales	
2.	The heart beat of your friend	
3.	blinking of eyes by your friend	

3. Using an overflow jar and a measuring cylinder find the volume of different stones.



Record Your observations:

Stone	Volume
1.	
2.	
3.	

SCIENCE

FURTHER REFERENCE

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1. Frame work of Science - Paddy Gannon, Oxford University Press, New Delhi

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7.1. SPEED

Two of the most exciting events in any sports meet is the 100m dash and 4x100m relay. Though all athletes run the same distance, the athlete who runs the distance in the shortest time will be the winner. In other words, the athlete who has the highest speed or is the fastest will win.

The most obvious feature of an object in motion is speed. It is a measure of how fast or slow an object is moving.

Fig 7.1

MORE TO KNOW

Usain Bolt won the 100m in 9.63 seconds and 200 m in 19.23 seconds at the London Olympics in 2012. He also won the 4 x 100 m relay along with his team mates. His high speed made the media call him **'Lightning Bolt'**.

ACTIVITY 7.1

Let us observe a car, a cycle and a bullock-cart as they move on the road. Which of these takes the shortest time to cover a certain distance?

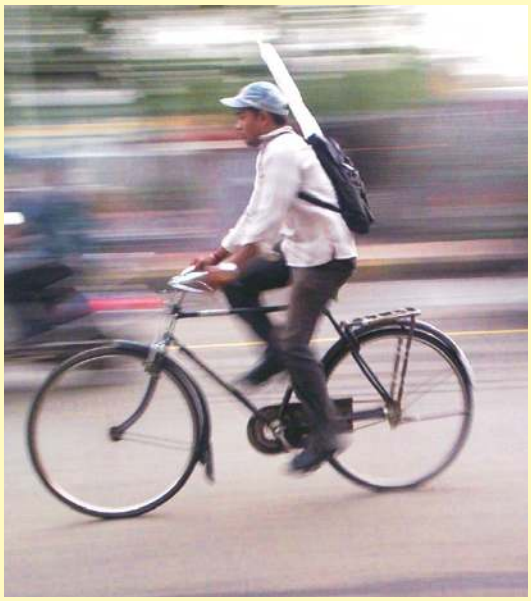
The car is the fastest as it takes least time. The bullock-cart is the slowest as it takes longest time. The cycle moves at a speed between that of the car and the bullock-cart.

A fast moving object has high speed and a slow moving object has slow speed.

Now, what about an aeroplane?

Car

Bullock cart



Cycle

SCIENCE

7.2. WHAT IS SPEED?

Speed of a body is the distance travelled by the body in one second.

$$\text{SPEED} = \frac{\text{DISTANCE TRAVELLED}}{\text{TIME TAKEN}}$$

Distance travelled is measured in metre and time in second

Therefore, the unit of speed is metre / second . [m / s].

It can also be expressed in kilometre / hour [km / h]

What do you mean by saying the speed of a car is 50 km/h?

It means that the car travels a distance of 50 km in one hour.

1 km = 1000m and
1 hour = 60x60 s =3600 s

$$\text{So, 1 km/h} = \frac{1000\text{ m}}{3600\text{ s}}$$

$$= \frac{5}{18}\text{ m/s}$$

Example :

a) $2\text{ km/h} = 2 \times \frac{5}{18}\text{ m/s}$

b) $3\text{ km/h} = 3 \times \frac{5}{18}\text{ m/s}$

If you know the speed of an object, you can find out the distance covered by it in a given time. All you have to do is to multiply the speed and time.

Distance covered = Speed x Time

ACTIVITY 7.2

Let us give a cricket ball to a group of four friends and ask each of them to throw the cricket ball from a given point. Mark the point up to which each of them throws the ball. Measure the distance thrown and discuss the speed of the ball.

SELF CHECK

a) 36 km/h = ——— m/s

b) 72 km/h = ——— m/s

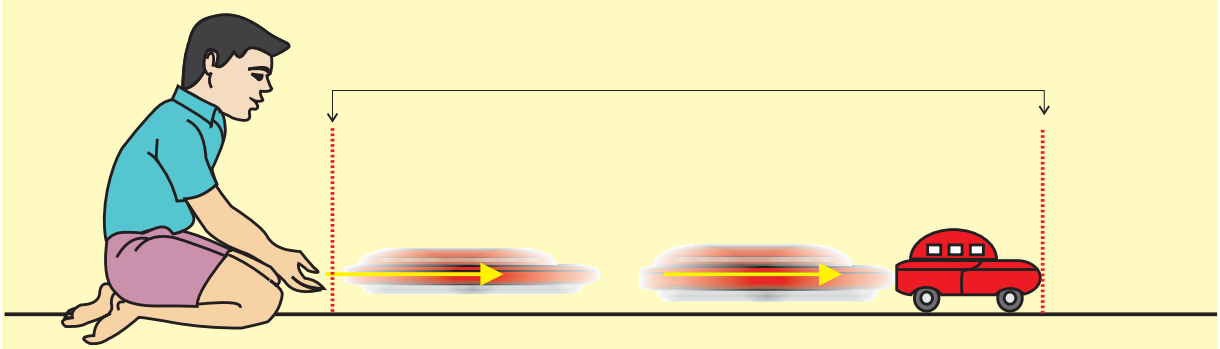
c) 180 km/h = ——— m/s

d) 15m/s = ——— km / h

e) 25m/s = ——— km / h

f) 35m/s = ——— km/ h

ACTIVITY 7.3



Let us organise a toy car race to understand the concept of speed. Divide the class into 5 groups. Draw a line at the starting point .

One from each group should roll the toy car along the ground. Another should note the time taken by the car from the instant the car crosses the line to the instant it stops. Measure the distance. Calculate the speed of each car and record it.

S.No	Group	Distance travelled by the car	Time taken	Speed
1	I			
2	II			
3	III			
4	IV			
5	V			

Find

1) Which group is the fastest?

2) Which group is the slowest?

Variable Speed

The speed of a bus during a journey may vary. When the bus is nearing a bus stop, its speed decreases.

On the highways the bus travels with greater speed. But in a city or town it travels with less speed due to heavy traffic.

The bus has different speeds at different time intervals. So we say that it has **variable speed.**

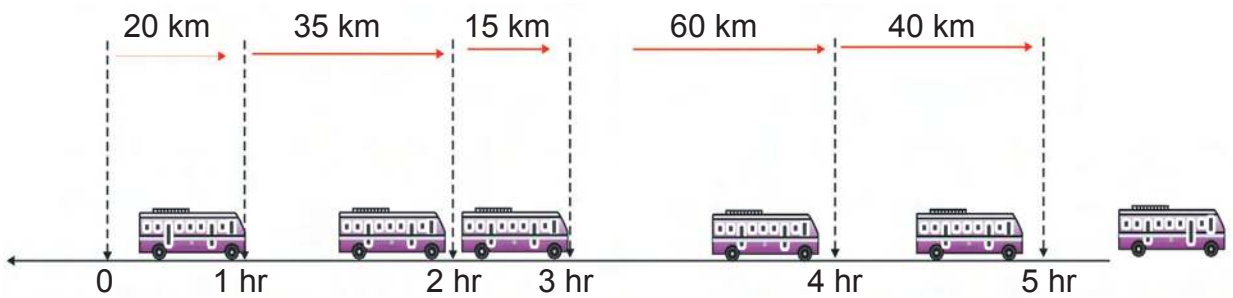


Fig 7.2. Variable speed

For such bodies, we can calculate the average speed:

$$\text{Average speed} = \frac{\text{Total distance travelled}}{\text{Total time taken}}$$

If a body moves with the same speed at all times we say that it has **uniform speed.**

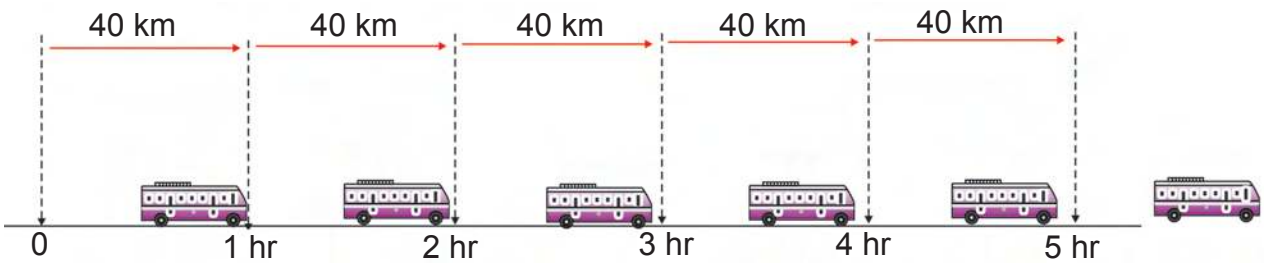


Fig 7.3. Uniform speed

Graphical representation

Have you seen a graph shown on your television screen while watching a cricket match?

It gives you an idea of the runs scored and also compares the performances of two teams.

Why is graphical representation used?

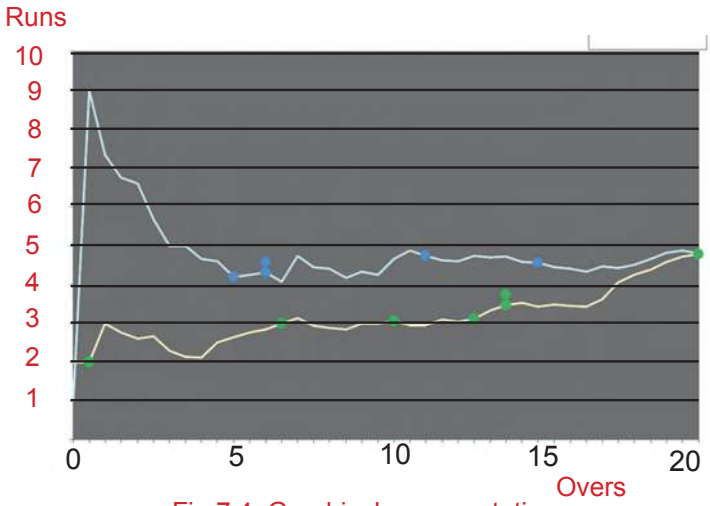


Fig 7.4. Graphical representation

When you are given a set of numbers which are relative to one another, it may not give you a clear idea of the relationship between them.

If the same numbers are represented on a graph, it gives a beautiful visual representation and a clearer idea of the relation.

Hence, change of distance with time may be represented by a distance - time graph.

Science today

Have you noticed a meter fitted in the front of a scooter or a motorcycle?

Such meters can be found on the dashboard of cars, buses etc,. This meter has provision to measure both speed and distance. One of the meters has km/h written. This is a **speedometer**. It gives the speed of the vehicle every instant in km/h. There is another meter also which measures the total distance covered by the vehicle in metre. This is called an **Odometer**.

Speedometer with odometer

7.3. DISTANCE – TIME GRAPH

Rajesh was travelling with his father in their car from Erode to Coimbatore. He kept himself busy by noting the distance travelled by the car every 5 minutes.

This is what he noted in the first 30 minutes.

S.No	Time in minutes	Distance in km
1	0	0
2	5	5
3	10	10
4	15	15
5	20	20
6	25	25
7	30	30

You can make a graphical representation of his observations:

Follow these simple steps.

Taking axes and scale:

Take a graph sheet and draw two lines perpendicular to each other.

Mark the horizontal line as OX(x-axis) and the vertical line as OY (y-axis).

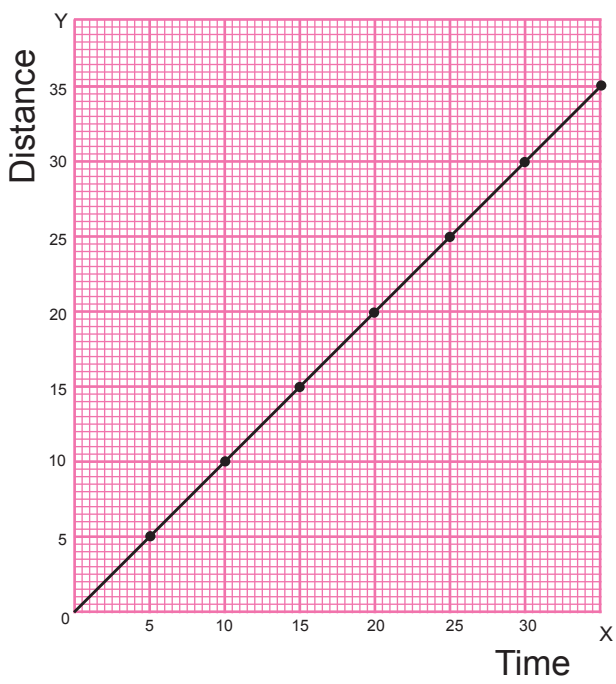


Fig 7.5. Distance Time Graph

Time is taken on the X-axis and distance on the Y-axis.

Choose scales to represent distance and time.

For example, the scales could be

X-axis : 1 cm = 5 minutes

Y-axis : 1 cm = 5 km

Plotting the graph :

Mark the values on the axes for time and distance according to the scales you have chosen.

According to the values noted, mark the points on the graph sheet. Join the points. You will get a straight line.

For uniform speed, the distance time graph is always a straight line.

For variable speed, it could be of any shape.

SCIENCE

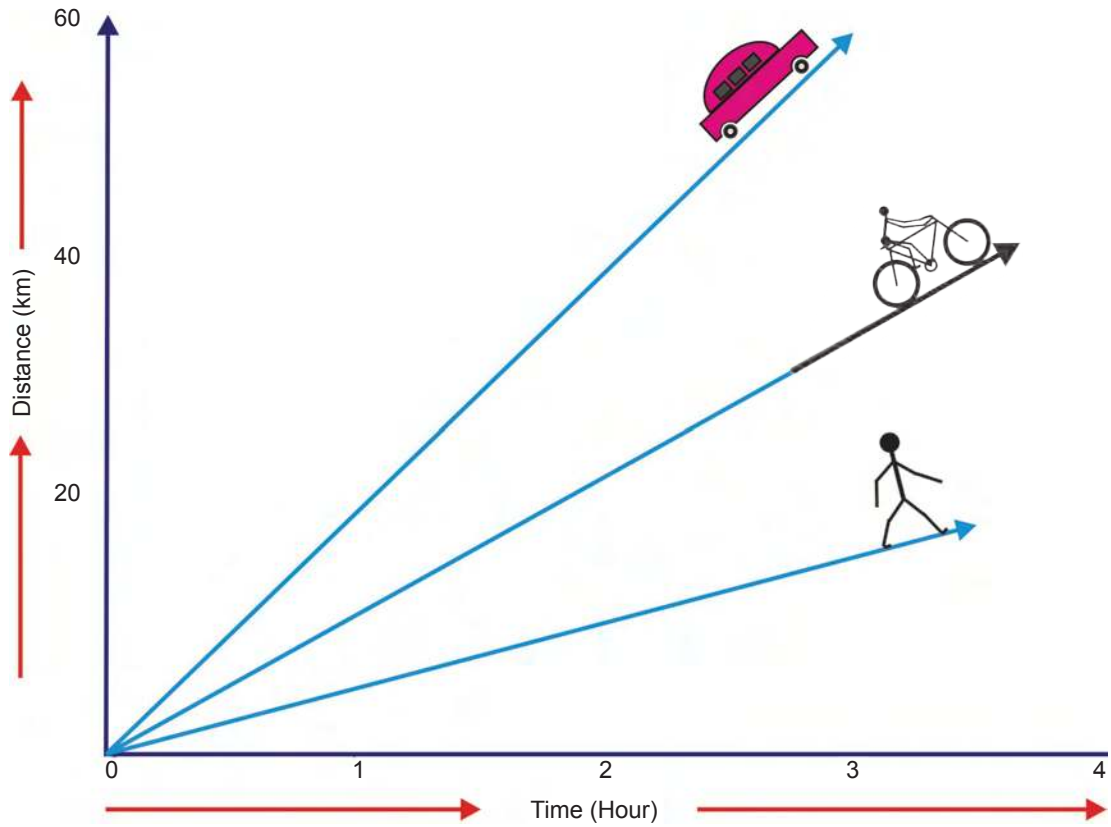


Fig 7.6

Greater the speed, steeper will be the graph.

ACTIVITY 7.4

Three cars, A, B and C travel from Madurai to Salem. The time taken and the distance covered are given in the table below.

S.No	Time taken in hours	Distance travelled in km		
		Car A	Car B	Car C
1	1	20	50	40
2	2	40	100	80
3	3	60	150	120
4	4	80	200	160
5	5	100	250	200

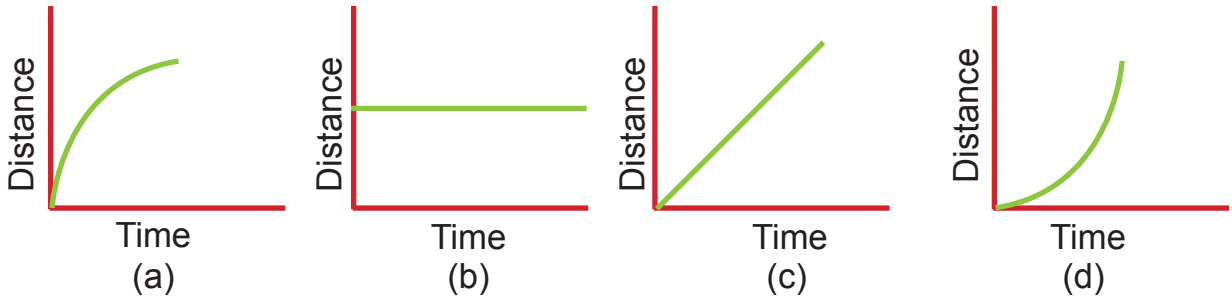
Plot the distance-time graph for the three cars in the same graph sheet.

a) What do you infer?

b) Which car had the maximum speed?

SELF CHECK

What do the following graphs represent?



(a) and (d) represent variable speed. (b) represents an object at rest.

(c) represents uniform speed.

7.4. VELOCITY

Every day when you go to school from your house,you could take path 1 or path 2 or path 3. Do these paths have the same distance? No, the distance is not the same; it varies with the path taken.

Imagine that you travel from your house to school in a straight line.

Fig 7.7.

This will be the shortest distance among them, called **displacement**. In the picture, it is represented by a dotted line.

Displacement is the shortest distance between two points in a particular direction.

Fig 7.8 Anemometer

MORE TO KNOW

Anemometer is a device used for measuring wind speed. It has aluminium cups which turn on a spindle. As the wind speed increases the cups rotate faster.

SCIENCE

Velocity is the displacement of a body in one second.

$$\text{VELOCITY} = \frac{\text{DISPLACEMENT}}{\text{TIME TAKEN}}$$

Its unit is m / s.

Velocity is nothing but speed in a definite direction.

7.5. ACCELERATION

Do you ride a bicycle to school? If you are late, what would you do?

Obviously, you would pedal faster to reach school on time. In other words, you would increase your velocity or accelerate.

So, acceleration is the measure of change in velocity.

Acceleration is the change of velocity in one second.

$$\text{Acceleration} = \frac{\text{Change in velocity}}{\text{Time taken}}$$

Its unit is m / s^2.

If a car has an acceleration of 5 m/s^2 every second its velocity increases by 5 m/s.

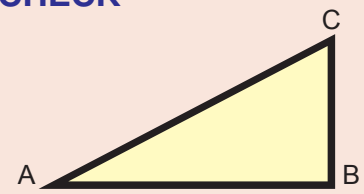
If the velocity of a moving body decreases, we say that it has negative acceleration or retardation or deceleration.

Example : A train slows down to stop at a station.

Acceleration due to gravity

Let us see what happens when a ball is thrown up vertically?

SELF CHECK



Suresh walks from point A to B and then from B to C.

a) What is the distance he has travelled?

b) What is the displacement?

As the ball rises, its velocity gradually decreases till it becomes zero ie., the body is decelarated. When the ball falls down its velocity gradually increases ie., it is accelerated.

The decelaration or acceleration is due to the earth's gravitational force. It is known as acceleration due to gravity. It has an average value of 9.8 m/s^2 on the surface of the earth and is represented as g.

$g=9.8 m/s^2$

This means that the velocity of a body decreases by 9.8 m/s every second when it is thrown up and the velocity increases by 9.8 m/s every second when it falls down.

To Think

A marble and a big stone are dropped simultaneously from a particular height. Which will reach the ground first?

7.6. SCIENCE TODAY - ADVENTURE SPORTS

Have you ever dreamed of flying like a bird or gazed up at flying birds and longed to join them.

1. Hang gliding

Hang-gliding is a sport in which a pilot flies a light un-motorized aircraft called a hang glider launched by foot.

Most modern hang-gliders are made of aluminium alloy. The pilot is safe when fastened to a harness suspended from the frame of the glider.

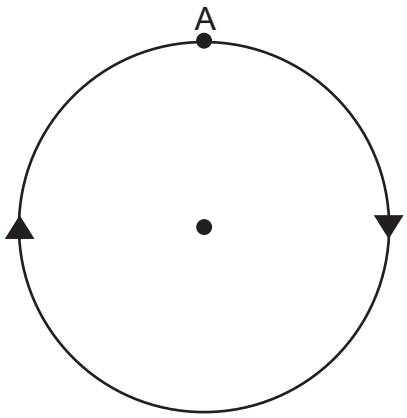
2. Paragliding

Paragliding is the latest aero sport. A paraglider is a non-motorised, foot launched inflatable wing, easy to transport, launch and land. It is basically a parachute made of special nylon or polyester fabric. The pilot is clipped to a harness in a comfortable sitting position. A paraglider is much lighter than a hangglider and easier to operate.

Yelagiri in Vellore district of Tamil Nadu is a hill station with gentle slopes ideal for paragliding. Tamil Nadu Tourism holds a paragliding festival at Yelagiri in August- September every year.

EVALUATION

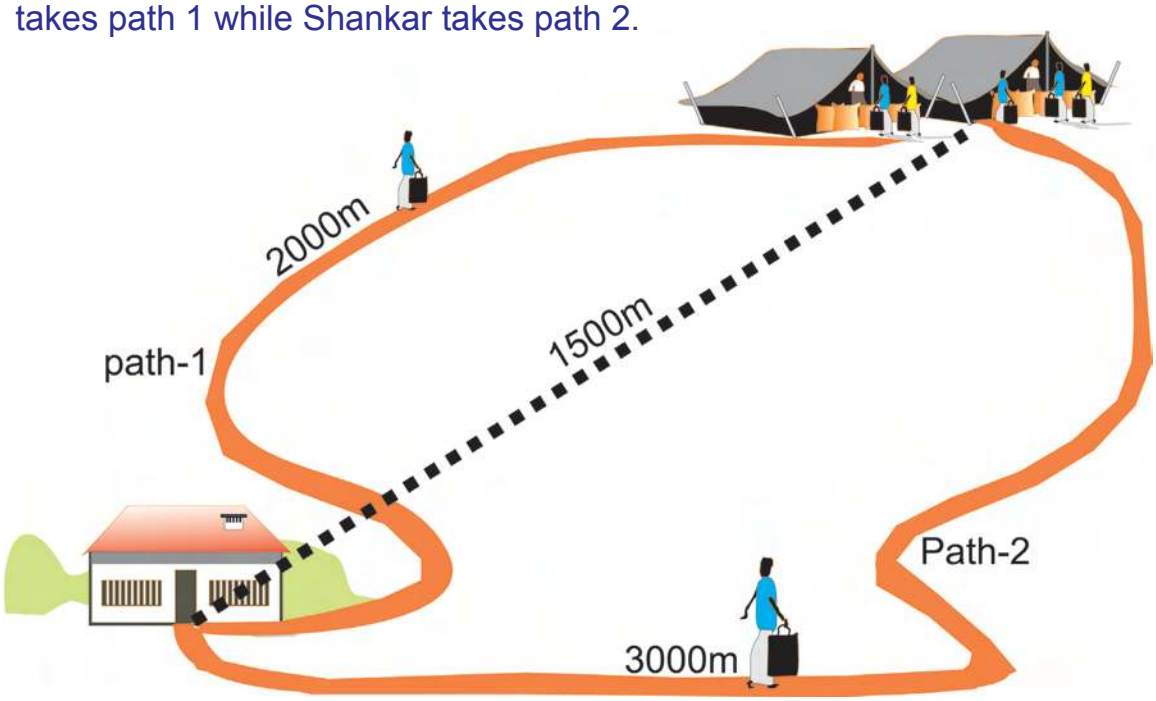
1. Selvi goes for a morning walk in the park near her house. She starts from point 'A', walks a circular path of radius 7m and returns to the same point 'A'.



(i) What is her displacement?

(ii) Find the distance she has walked.

2. Mani and Shankar walk from their home to the market in 20 minutes, Mani takes path 1 while Shankar takes path 2.



(i) What are their speed?

(ii) What is their velocity?

(iii) What do you infer?

3. Raju is travelling in a train moving at a speed of 72 km/h. In order to stop the train, the driver decreases the speed. The rate of decrease in speed of the moving body is known as deceleration or retardation.

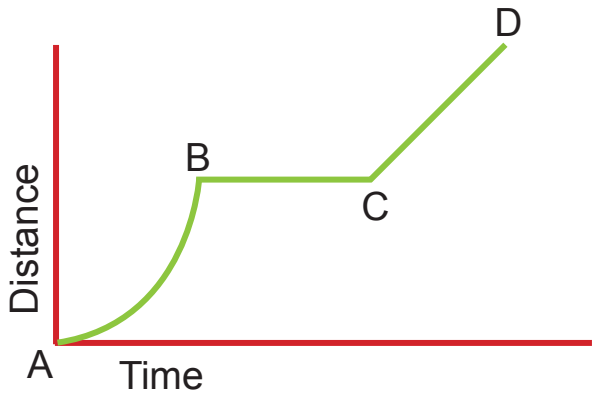
If the deceleration of the train is 10m/s^2, how much time will it take to come to a stop?

4. The given graph depicts the motion of a bus. Interpret the motion the bus.

a) AB represents _____

b) BC represents _____

c) CD represents _____



PROJECTS

1. Take a graph sheet. Draw a distance – time graph with the data given below.

Time (minute)	10	15	20	25	30
Distance (km)	10	20	30	40	50

2. Conduct a race and find who is the fastest among your friends. Make 4 friends run a distance of 50 m one by one and note the time taken by each. Complete the given table.

S.No.	Name of the friend	Time taken (second)	Speed (m/s)
1. 2. 3. 4.			

SCIENCE

FURTHER REFERENCE

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Webliography:

http://www.sciencemadeeasy.com

'I can, I did'

Student's Activity Record

Subject :

Sl. No.	Date	Lesson No.	Topic of the Lesson	Activities	Remarks