BASIC SCIENCE

Part - 1

Standard VII

Government of Kerala
Department of Education

State Council of Educational Research and Training (SCERT), KERALA
2016

KT-3/1 Basic Sci 7(E) Vol-I

The National Anthem

Jana-gana-mana adhinayaka, jaya he
Bharatha-bhagya-vidhata.
Punjab-Sindh-Gujarat-Maratha
Dravida-Utkala-Banga
Vindhya-Himachala-Yamuna-Ganga
Uchchala-Jaladhi-taranga
Tava subha name jage,
Tava subha asisa mage,
Gahe tava jaya gatha.
Jana-gana-mangala-dayaka jaya he
Bharatha-bhagya-vidhata.
Jaya he, jaya he, jaya he,
Jaya jaya jaya, jaya he!

PLEDGE

India is my country. All Indians are my brothers and sisters.

I love my country, and I am proud of its rich and varied heritage. I shall always strive to be worthy of it.

I shall give respect to my parents, teachers and all elders and treat everyone with courtesy.

I pledge my devotion to my country and my people. In their well-being and prosperity alone lies my happiness.

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Dear children,

This is your Basic Science textbook; a guide to prepare you scale higher levels of scientific concepts; a window opening avenues to the recesses of the living and the physical worlds. Traversing this journey, you will realize that several instances of day-to-day life are wonders of science. You can partake of the joys of novel experiments and making instruments. The views and plans formulated through discussions in the classroom can be taken out to society, at large.

There are thought arousing queries and guiding pathways in this textbook. Along with indicators about the destination to be reached, contexts of taking self decisions and advancing forward are also provided. A few glances, a few curiosities, beyond the concepts comprehended, are laid bare. There are indicators for club activities. I urge you to also explore ICT possibilities for clarifying facts that you don't have direct access to. You can move forward discussing the information obtained, with the help of teachers. You will definitely reach your goal.

Regards,

Dr.P.A.Fathima
Director, SCERT

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CONTENT

Certain icons are used in this textbook for convenience

For further reading
(Evaluation not required)

ICT possibilities for making concepts clear

Significant learning outcomes

Let us assess

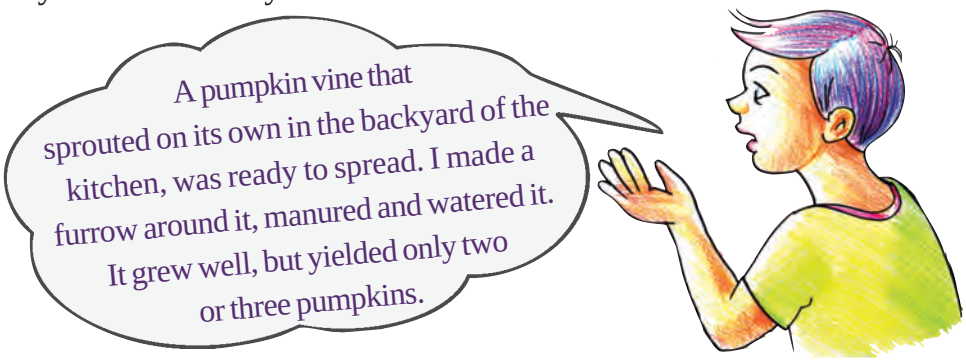
Extended activities

1 Reaping Gold From Soil

See how happily these children maintain their vegetable garden. Don't you think their minds also blossom and yield when each plant blossoms and yields?

Do you maintain the vegetable garden in your school this way?

Does it yield well always?



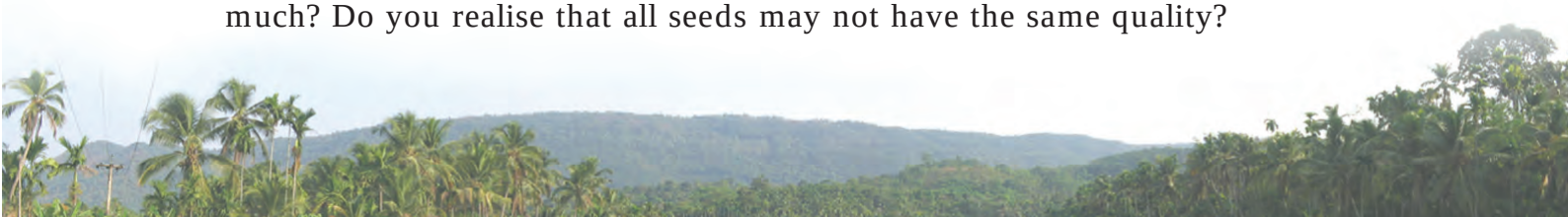
Did you listen to what Babu said? Why, do you think, the plant did not produce more fruits?

Nurturing alone is not enough to get more yield. There are other factors to be considered too.

- Fertile soil
- Favourable climate
- Quality seeds and planting materials

Seed quality...

A single plant yields plenty of seeds. Are all seeds suitable for farming? Why, do you think, the pumpkin that grew in the kitchen yard did not produce much? Do you realise that all seeds may not have the same quality?



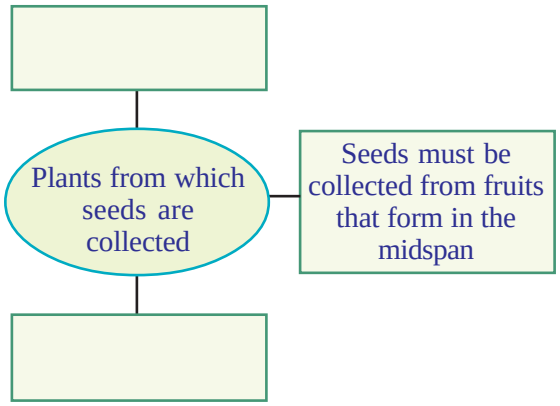
What are the factors to be considered while selecting seeds from a plant?

Observe these pictures. Note the differences.

- Which has more yield?
- Can seeds be collected from a diseased plant?
- Have you noticed that fruits are formed in a plant at different stages of its life? Which stage is suitable for collecting seeds - the first formed, mid formed or those formed at the end of its growing stage?

Try to write down the qualities essential for a plant from which seeds are collected.

There may be many crops cultivated in your locality. Observe how any two or three varieties of seeds are collected and stored and note it down in your science diary.



Sowing and sprouting

It is easy to select good quality seeds from plants like lady's finger and pea. How will you select quality seeds from plants that have smaller seeds than the above?

In the case of brinjal, good seedlings are transplanted after sowing and sprouting seeds.

Can you find more examples for seedlings that are transplanted and seedlings that are not? Classify them and write down in the science diary.

Stem cutting

Aren't you familiar with plants that germinate from seeds and those that sprout from other parts?

The formation of seedlings from seeds is by sexual reproduction. The formation of new plantlets from parts like root, stem and leaf is called vegetative propagation.

Tapioca and sweet potato are cultivated by planting stem cuttings. Find out more examples for plants formed through sexual reproduction and vegetative propagation.

Sexual reproduction	Vegetative propagation

Is a new guava plant produced usually by planting its stem cutting?

What is the method to produce a new plant with all the qualities of the parent plant?

What will happen if we plant after sprouting roots on the branches of the parent plant?

Try these activities.

Layering

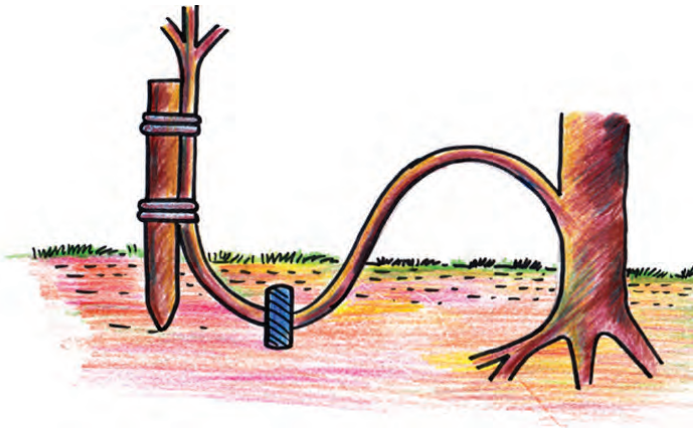
- Select a branch of the plant from which sapling is to be produced. The branch must be pencil thick. The branches from the main stem are better. Peel off one centimetre of bark from the stem in a circular shape.

- Cover the peeled off part with a slightly moistened mixture of coconut fibre, soil and sawdust.
- Cover it with a polythene sheet. Tie both ends with jute twine. Wet it with enough water to retain moisture.

- Numerous roots will sprout within two months. Cut the branch and plant it in a pot, till it is ready to be transplanted in the soil.

Take care to plant the sapling in a suitable place.

Layering is effective in plants like jasmine *(pichi, mulla)*, rose, hibiscus, cashew and sapota. Layering is also done on branches that grow close to the soil, by bending the middle of the branch into the soil.



Let us examine some information related to layering:

- Most of the plants can be grown this way.
- Plants formed from layering do not have as much life span as plants formed from seed germination. They will be of smaller size too.
- They have qualities of the parent plant.
- If layering is done on diseased plants, new plantlets will also be infected.
- Flowering and fruiting of such plants are faster than those in plants formed from seeds.
- Through this method, we can produce more saplings within a short period.
- Layered plants do not possess the taproot system.
- They require more care.

With the help of the information given above, write down in your science diary the merits and demerits of plantlets produced through layering.

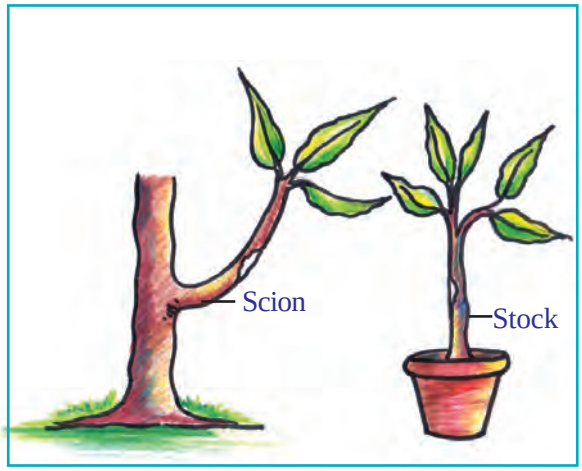
Grafting

Grafting is another method used to produce superior quality plantlets. This method is practised from ancient times. Superior quality plantlets are produced by joining the stems of two plants of the same species.

The rooted plant selected for grafting is called stock and the branch selected for grafting is called scion.

Branches of mango trees like neelam, malgova etc. can be grafted to the plantlets of indigenous mango trees. Here, the plantlet of the indigenous mango tree is the stock and the branch of malgova is the scion.

Let us try this activity.



Peel off the bark from the facing sides of both the stock and scion in 3 ½ cm length.

Bring the peeled off portions of stock and scion in contact with each other. Wrap them together firmly with a jute twine.

Cover it with a wax cloth or a plastic tape. After one month, cut partially the stock above the covered area and the scion below.

Wait for one more month and cut and detach the part completely. When it attains proper growth, it can be replanted in a more suitable place. Remove any new branches sprouting on the stock.

Graft the branch of any other variety of mango tree on the sapling of an indigenous variety of mango tree and write the procedure in your science diary.

Can you think of any other method by which good quality saplings can be produced?

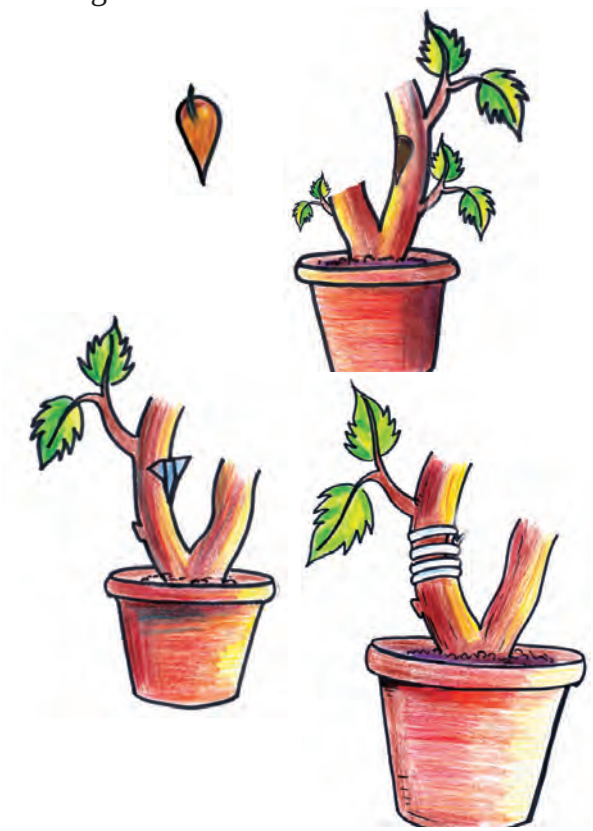
Budding

In this method, a bud is grafted, instead of grafting a branch to another plant. This method can be used to produce flowers of different colours in the same

plant. Buds of other varieties can be grown on indigenous varieties.

See how budding is done.

- Cut off the bud from a quality plant.
- Make a 'T' shaped cut on the plant on which the bud is to be grafted and leave the bark open.
- Insert the bud into the 'T' shaped cut on the bark.
- Wrap it in such a way that the bud is exposed.
- Cut off the upper part of the stock when the bud attains proper growth.



Try to graft the bud of a red rose plant on to a white rose plant. A bud of a superior rose variety may be grafted to a native rose variety too. Write down the activities sequentially in your science diary.

Now we are familiar with different methods to produce superior varieties of plantlets. Examine the information given in the table below and answer the following questions.

Crop

Variety 1	Variety 2
Long life span	Short life span
Low yield	High yield
Active growth in our soil	Poor growth in our soil
High resistance to disease	Low resistance to disease
Needs less nurturing	Needs more nurturing

- Examine the peculiarities of the two varieties. What are the methods that can be adopted to produce good saplings with the qualities of both the varieties?
- Which variety can be selected as stock and which one as scion?
- What would be the qualities of the plant formed by combining the two varieties?

Combining qualities

We have seen so far how plants of the same kind, but with different qualities, are combined together to form good quality sapling. What other methods can be used to produce better seeds?

Examine the pictures and notes given below

West-coast tall

Tall variety

- 20 – 30 metre high
- Yields in 6 – 10 years
- Life span of 80 – 100 years
- Green-coloured coconut

Major varieties: West-coast tall, East coast tall, Lakshadweep ordinary (Lacadive ordinary).

Chavakkad orange

Dwarf variety

- 8-10 metre high
- Yields in 4 – 5 years
- Life span of 30 – 35 years
- Yellow, orange, brown coloured coconut

Major varieties: Chavakkad orange (chowghat orange), Chavakkad green, Gangabondam.

Find out the advantages and disadvantages of tall and dwarf varieties and write them down.

What will be the qualities of a new seed produced by combining tall and dwarf varieties (tall × dwarf)?

Hybridisation

Hybridisation is the method of producing new seeds through artificial pollination between plants of the same species but of different characteristics. Seeds formed in this manner may combine advantages, disadvantages and mixed qualities of both the parent plants. Seeds with desired qualities are selected from these.

Edubuntu - School Resource - See 'vargasankaranam'

Hybrid variety coconut tree


Chandrasankara

Let us familiarise ourselves with certain hybrid varieties of coconut.

- ***Chandralaksha*** - *Lakshadweep ordinary × Chavakkad orange (T×D)*
- ***Chandrasankara*** - *Chavakkad orange × West coast tall (D×T)*
- ***Lakshaganga*** - *Lakshadweep ordinary × Gangabondam (T×D)*

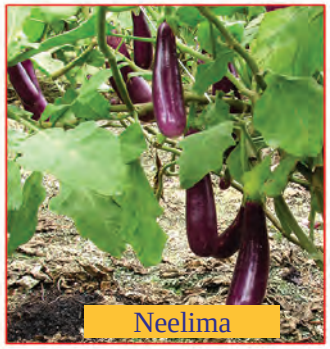
Good quality seeds of paddy, vegetables etc., have also been developed in this manner. Let us familiarise ourselves with some of these seeds.

Paddy	Pea	Green chilly	Lady's finger	Brinjal	Tomato
Pavithra, Hraswa Annapoorna	Lola, Malika, Bhagya-lakshmi Jyothika	Ujjwala Jwalamukhi Anugraha	Kiran, Arka Anamika Salkeerti	Surya, Swetha Haritha Neelima	Mukthi Anagha Akshaya

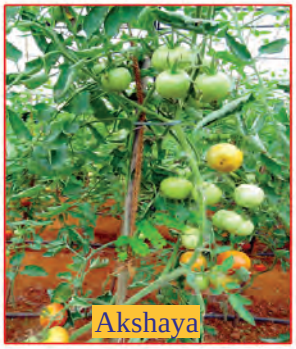

Pavithra


Salkeerti


Jyothika
Vellayani Jyothika


Neelima


Anugraha


Akshaya

Many research activities are being conducted in Kerala to produce such superior varieties of seeds.

Agricultural Research Institutes

What should be made possible in the agricultural sector?

- High yield
- Quick yield
- Resistance to infections
- Lower nurturing costs
- Availability of quality seeds / planting materials

Priyanka : a new leap in yield

Mannuthi : Priyanka, a new bitter gourd variety, is making new leaps in productivity. This variety was developed by the Kerala Agricultural University. It is a seed variety that grows well in the climatic conditions of Kerala.

Agricultural Research Institutes function to fulfil these needs. Is there any Agricultural Research Institute in your locality? Have you visited any such institutions?

Some of the Agricultural Research Institutes in our State

- Kerala Agricultural University (KAU) – Mannuthi, Thrissur
- Central Tuber Crops Research Institute (CTCRI) –Sreekaryam, Thiruvananthapuram
- Indian Institute of Spices Research (IISR) – Kozhikode
- Rubber Research Institute of India (RRII) – Kottayam
- Central Plantation Crops Research Institute (CPCRI) – Kasaragode
- Regional Research Centres of Kerala Agricultural University

Tissue Culture

Tissue culture is the process of producing a new generation from a cell or tissue of a plant. Plantlets with all parental qualities can be developed through this technology. This technology is effectively practised in plants like plantain, pepper, cardamom, pineapple etc. The peculiarity of this technology is that hundreds of plantlets with the same qualities of parent plant can be produced from a plant. The video of conducting tissue culture in the laboratory is available. Observe the different steps.

Kerala Agricultural University

It is through the Krishi Bhavan that seed varieties and planting materials developed by research institutes are brought to farmers. What are the other services that we get from the Krishi Bhavan? Prepare a report after visiting a Krishi Bhavan or collecting the information from the Agriculture Officer.

Plant diversity

We have so far discussed modern methods of preparing quality planting materials. Even if we use quality planting materials, the yield may not be good if the soil is not fertile. Good quality soil ensures the health of a plant.

What is the benefit of depositing plant debris in the field after cultivation?

The nutrients provided by one kind of plant debris is not the same supplied by another. The more diverse the plant debris that decomposes in the soil, the higher the fertility of the soil.

Let us observe some of the methods followed by farmers to ensure maximum diversity in agriculture.

Intercrop-Short term crops cultivated among the main crop in such a way that they do not harm the main crop are called intercrops. They help in maintaining soil fertility.

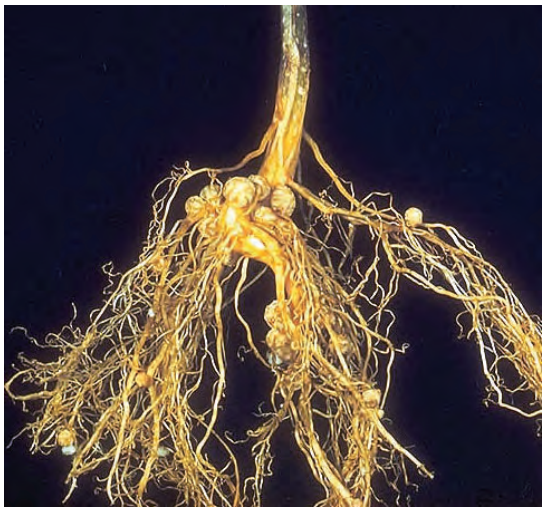
- Which are the intercrops cultivated in coconut fields? Observe and write them down in your science diary.

Crop rotation-Cultivating a different crop instead of the crop cultivated earlier is called crop rotation. Haven't you noticed the cultivation of pea, black gram etc at intervals in paddy fields?

- Does the cultivation of different crops bring about any increase in soil fertility?

Leguminous plants

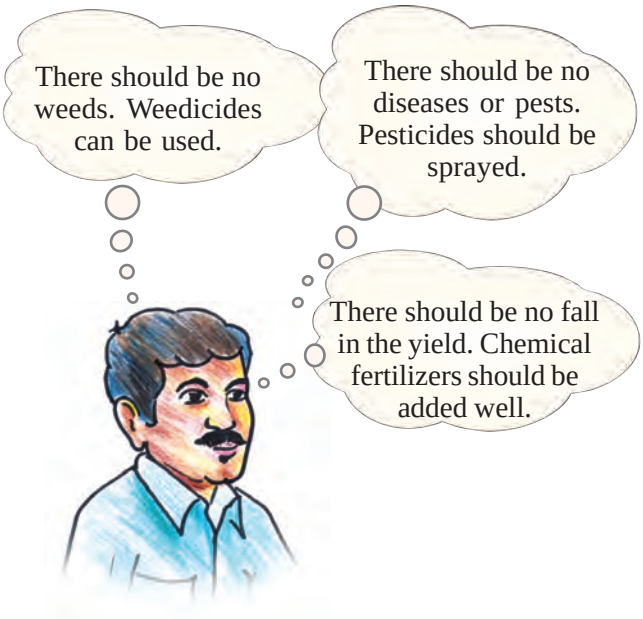
Nitrogen is an essential element for plant growth. Plants cannot absorb atmospheric nitrogen directly, but they absorb the nitrate salts dissolved in water. Some of the bacteria can convert atmospheric nitrogen to nitrate. Rhizobium is one such bacterium. They live in the roots of plants like pea, mimosa (touch–me–not), common terphrosia (kozhinjil), horse gram and black gram and absorb atmospheric nitrogen. When these plants decay, the plant nutrients are added to the soil.



- Observe the roots of leguminous plants. Don't you see nodules on their roots?
- What are the benefits of cultivating leguminous plants?

Crop management

Look at the thoughts of a farmer about improving yield.

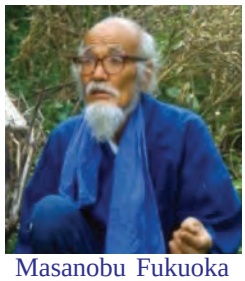


Are the decisions of the farmer beneficial? Discuss.

What kind of decisions should the farmer take? Shouldn't we promote the use of fertilizers and pesticides that are not harmful to nature? Examine the information given below.

What Fukuoka says

For man's survival we should return to nature. It is man who is destroying forests, the springs and the fertility of the earth. Such environmental destruction should be stopped if all living organisms including man are to be saved. Bio-fertilizers are an elixir to the soil deadened by the use of chemical fertilizers. They catalyse life and retain the fertility of the soil. Our aim should be to make land cultivable rather than a desert.



Masanobu Fukuoka
Researcher in Organic Farming
Japan

Biopesticides

Tobacco decoction : Cut 1 kg tobacco into small pieces. Soak them in 15 litre of water for one day. Filter this and dissolve 100 g scraped bar soap in it by stirring well. Tobacco pesticide is ready. Dilute this by adding double the quantity of water and then spray on plants.

Neem Cake : Adding neem cake, castor cake etc to the soil helps to control worms that attack roots.

Neem oil emulsion: Dissolve 60 g soap in ½ litre water. Mix it with one litre of neem oil and stir well. Dilute it with 10 litre water and spray on plants.

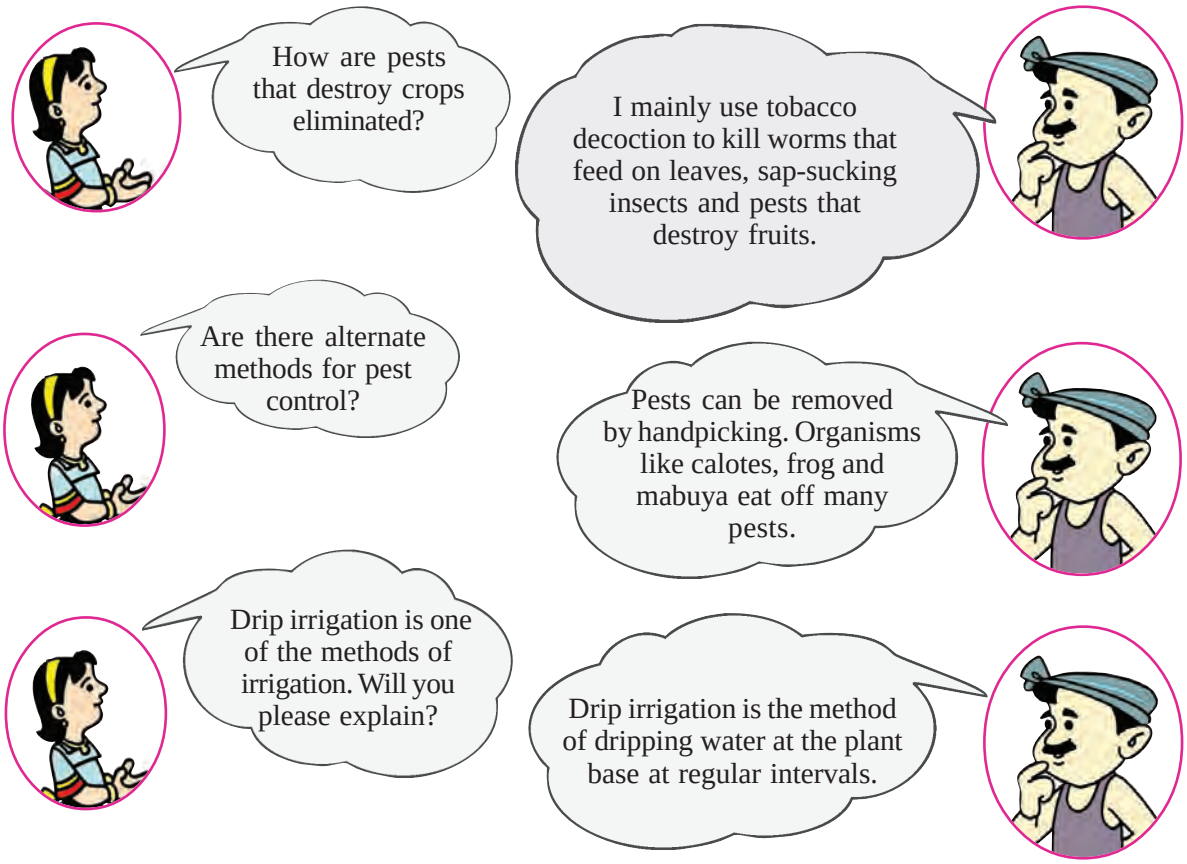
Biofertilizers

- Cow dung
- Green manure
- Compost manure
- Fish manure
- Poultry droppings
- Goat droppings
- Bone meal

Discuss the importance of making it a habit to use biofertilizers and biopesticides. Prepare biopesticides and apply it in the school vegetable garden. Record the method of their preparation, materials used and the mode of application in your science diary. Conduct a seminar on this topic and present your ideas.

Let us conduct an interview

Look at certain excerpts from an interview conducted by Beena with a farmer, for collecting information on agriculture.



Do you still have more questions to ask?

After discussing with your friends, prepare a questionnaire to interview a farmer or Agriculture officer. Don't forget to write the information gathered from the interview in your science diary.

Do we cultivate only food crops? Which other crops do we cultivate?


Floriculture


Tea plantation


Ornamental plant cultivation

Cotton

Cotton is an important fibre crop cultivated in India. The cotton and the seeds are separated from mature cotton balls. Thread is obtained from cotton. Cotton seed is used as cattle feed. The oil obtained from cotton seeds is used for industrial purposes.

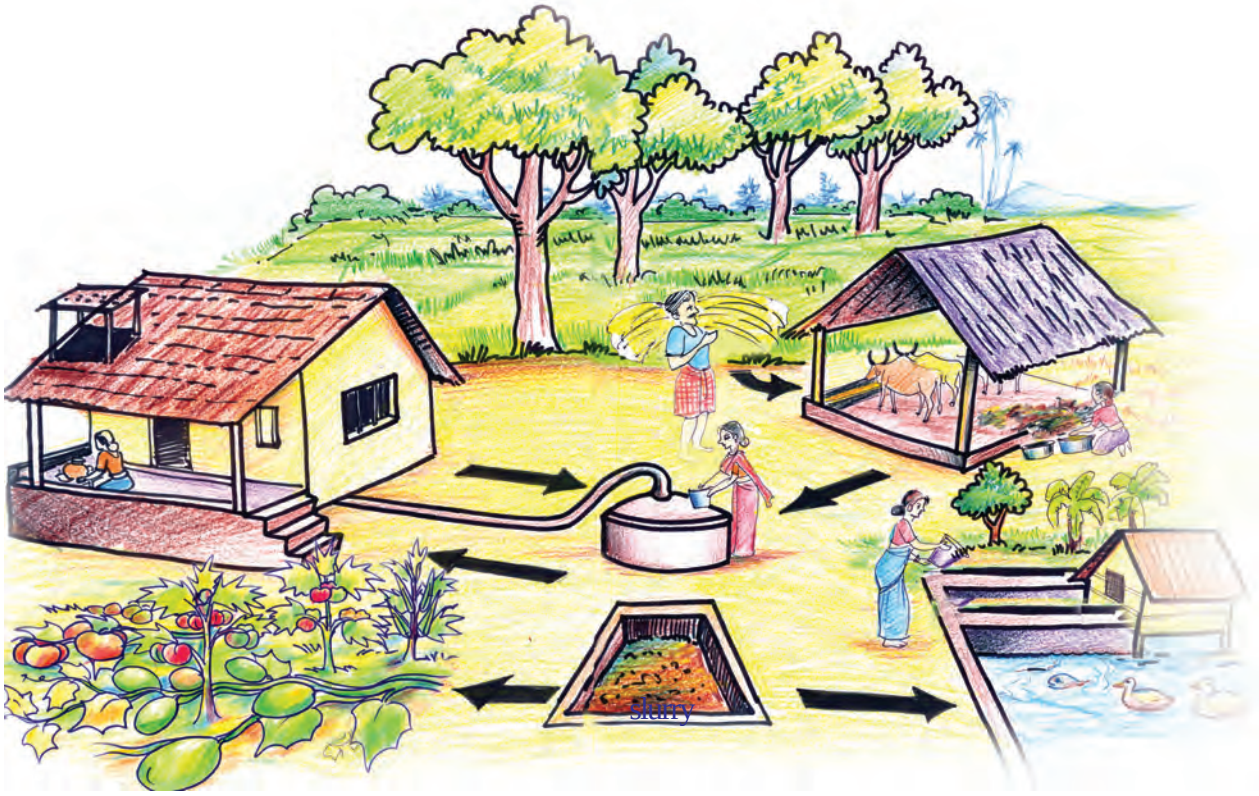
Jute

India is the largest producer of jute in the world. Jute fibre is obtained from the stem of jute plant. Jute sheaves are first soaked in water for retting. They are then beaten to separate the fibres. Sack thread is made of jute fibre.

Coir

Coconut husk is soaked in water. This is beaten to separate fibres. These fibres are woven to make different types of coir products.

Integrated farming



Did you notice the picture?

- How are cattle rearing and paddy cultivation related?
- How are the organic wastes from homes and agricultural fields utilised?
- What can be the use of slurry formed after the production of bio-gas?
- What is the advantage of integrating more than one field of agriculture?

Note the advantage of placing the duck coop above the fish pond. The left over food of the duck will be available to the fish. Moreover, droppings of ducks will promote the growth of aquatic plants. Aquatic plants are food for fish. At the same time, insects, algae, snail and small frogs in the pond will become food for the ducks.

Agriculture and cattle rearing

Agriculture and cattle rearing are integrated farming methods in Kerala that existed traditionally. Cows and buffaloes can be reared along with paddy cultivation. Fodder grass can be cultivated in coconut fields and rubber plantations. The straw obtained from paddy cultivation, the bran obtained from husking paddy grains etc. can be given to cattle as fodder. Goats, ducks, hens etc. can be reared in coconut fields.

Find out other similar possibilities. Write in your science diary how the areas are related to one another. Prepare an agriculture album collecting news reports, pictures etc.

Significant learning outcomes

The learner can

- practice activities like layering, grafting and budding.
- explain how quality seeds can be produced through hybridisation.
- provide suggestions related to crop management.
- explain the importance of organic farming.
- prepare biopesticides.
- identify the ways of agriculture that adversely affect the soil, and suggest remedial measures.
- scientifically nurture vegetable gardens at home and school.
- identify the possibilities of integrated farming.

Let us assess

1. Which of the following activities increases the fertility of soil?
   a. Repeating the same cultivation.
   b. Leaving agricultural remains on soil.
   c. Burning agricultural remains after drying
   d. Removing agricultural remains and cleaning the land.
2. Which of the following statements is true of grafted mango tree?
   - Has greater life span.
   - Requires less nurturing.
   - Yields in a short span of time.
   - Has high disease resistance.
3. Formulate inferences based on the table and record your opinion.

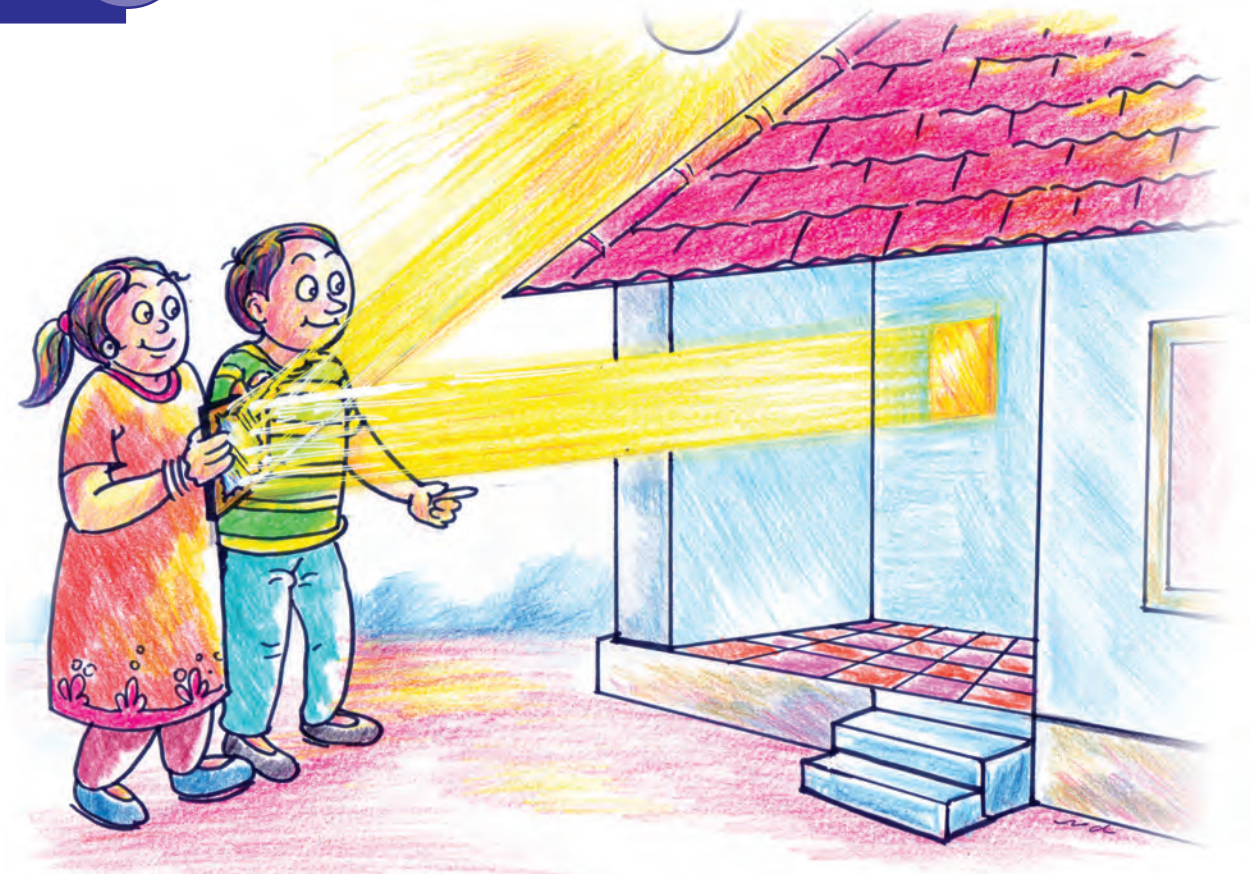
Biofertilizer	Chemical fertilizer
Not harmful to soil	Destroys soil composition
Can be prepared at home	Can be prepared only on industrial basis
Less expensive, required in large quantity	Required in less quantity
Mixes slowly with soil	Mixes quickly with soil
Cannot be provided as a specific salt	Can be provided as a specific salt

Extended activities

1. How can red flowers be obtained from a hibiscus plant that produces white flowers?
2. Visit a nearby plant nursery. Are there plantlets produced through budding, tissue culture etc.? Are there plantlets produced through any other method? Tabulate the information collected.

For more information – *Kayika Pravardhanam Sasyangalil* (Kerala Bhasha Institute), *Krishipadam* – R.Heli, *Harithakeralam* CD, Agriculture Magazines, *Mattupavile Krishi* (Kerala Bhasha Institute), One Straw Revolution (Fukuoka)

2 Wonders of Visible Light

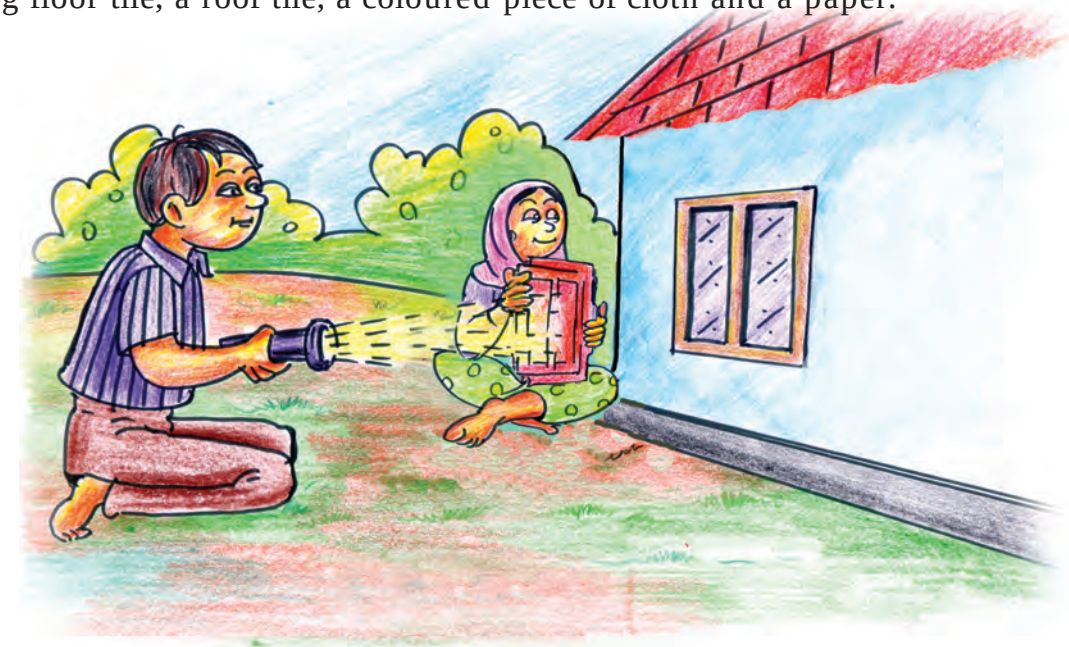


Did you observe the picture? Didn't you notice light being directed into the house using a mirror?

What other objects can be used instead of a mirror?

Let us do an experiment to find out.

Materials required: a torch, a new steel plate, an aluminium vessel, a cardboard, a shining floor tile, a roof tile, a coloured piece of cloth and a paper.



Direct light from the torch on to each of these objects. Tabulate the observed results in your science diary.

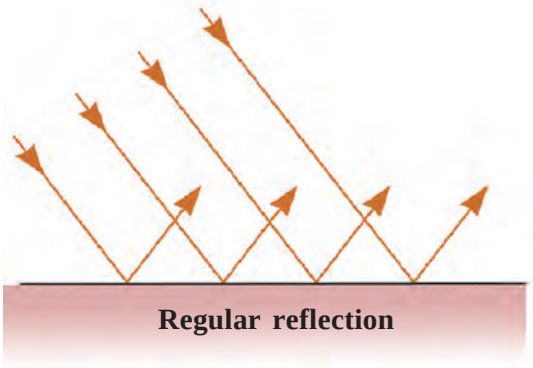
Sl. No.	Object	Observed result
1	New steel plate	reflects light very well
2		
3		

Reflection of light is the return of light that falls on a surface.

Which of the objects reflected light well? What is the peculiarity of their surfaces? Note it down in your science diary.

The surface matters

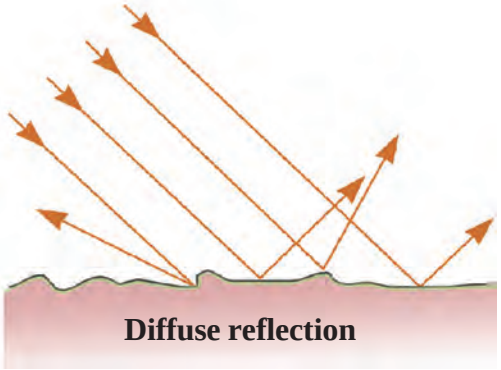
What happens when light falls on a surface? Look at the figure.



Regular reflection

When light falls on a mirror, steel plate, smooth floor tile etc., it is reflected regularly. This is known as regular reflection. Mirrors are surfaces which reflect light regularly.

How does the light reflect when it falls on cardboard, roof tile, cloth etc.?

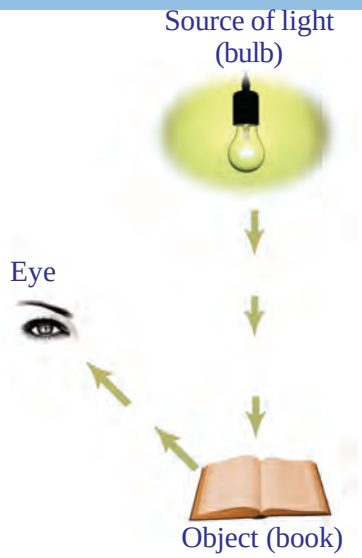


Diffuse reflection

When light falls on rough surfaces, it is reflected irregularly. This is diffuse reflection.

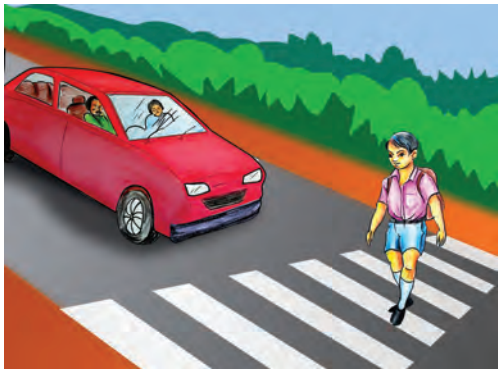
Light and sight

How do we see objects? Can we see objects in a dark room? Examine the illustration. Look at the path of light indicated by arrows.



We see an object when the light falling on the object is reflected into our eyes.

Can you mark the path of light in the following pictures?



How does the driver see the boy crossing the road during daytime?

How is the dog seen when torch is lighted?

Does the light reflected from our face reach our eyes? What method do we use to see our own face?

Plane mirror

Examine the surface of a mirror we use. What are the peculiarities of its surface?

A mirror with a plane surface is called a plane mirror.

Now, what if we look at a steel plate or an aluminium plate instead of a mirror? How does the face appear? Note it down in your science diary.

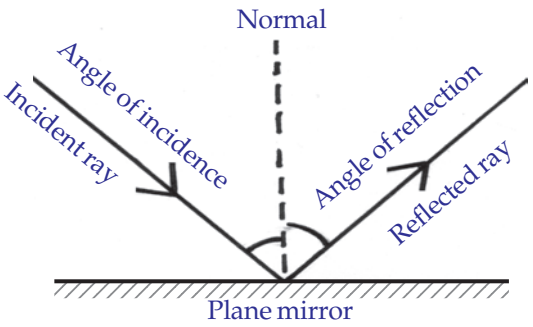
Can you find out the direction in which the light falling on a surface would get reflected?

When light is reflected

Try out the activity shown in the picture.

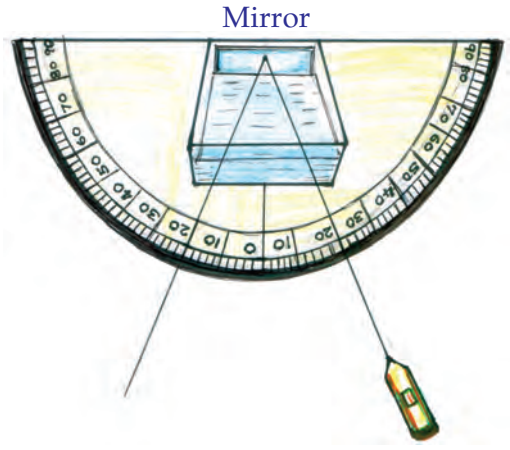
When you do this experiment, minimise the light in the classroom as much as possible. What happened when the light fell on the mirror placed on the table?

Repeat the activity by directing light on to the mirror from different directions. Do you see the light rays that move towards the mirror and those that are reflected from it? Try to draw the figure. The ray falling on the mirror is called incident ray and the ray reflected from it is the reflected ray.



The line drawn perpendicular to the mirror at the point of incidence is called the normal. The angle between the incident ray and the normal is the angle of incidence and the angle between the reflected ray and the normal is the angle of reflection.

Arrange an apparatus as shown in the figure.



- Fix a small mirror on any one of the inner sides of a transparent vessel.
- Cut out the shape of a protractor on a chart paper and mark the angles.
- Place the vessel on the chart paper.
- Take water in the vessel. Add a few drops of milk or soap solution to it. This is to see the path of light clearly.
- Place a laser torch at an angle, and focus its light beam on the mirror. The light reflected from the mirror can be seen.

Note : Take care that the light from the laser torch does not fall on your eyes.

The angle of incidence and the angle of reflection can be determined by observing the arranged paper protractor.

Repeat the experiment changing the angle of incidence and tabulate the results.

Angle of incidence	Angle of reflection
• 30°	
•	
•	

Analyse the table.

Now, isn't it clear that the angles of incidence and reflection are always equal?

Edubuntu - School Resource, see *'Pathana Prathipathana Kon'*

While looking in a mirror

Standing in front of a plane mirror, raise your left hand. Which hand of your image is raised? Lower the left hand and raise the right hand.

What change occurs to the image?

Doesn't our right side appear left and our left side appear right in the image? Such a shift of the lateral side of the images in the opposite direction is called lateral inversion.

Look at the picture. What could be the reason for writing AMBULANCE in that way? Hold the picture in front of a plane mirror and try to read ƎNAJUBMA through the mirror. What do you notice? Won't the driver of a vehicle moving in front read it as 'AMBULANCE' by looking through the rear view mirror? Now don't you understand the reason for writing it like that ?

What are the other properties of the image formed by a plane mirror? Try out this activity.

Place a mirror perpendicularly on a table. Hold different objects like pen, watch etc. in front of the mirror. Observe the image.

Is the size of the object and the image the same?

Keeping a scale in front of the mirror, place these objects at different positions and observe.

Does the distance of the image change when the distance of the object from the mirror is increased?

The properties of the image formed by a plane mirror may be summarised as follows:

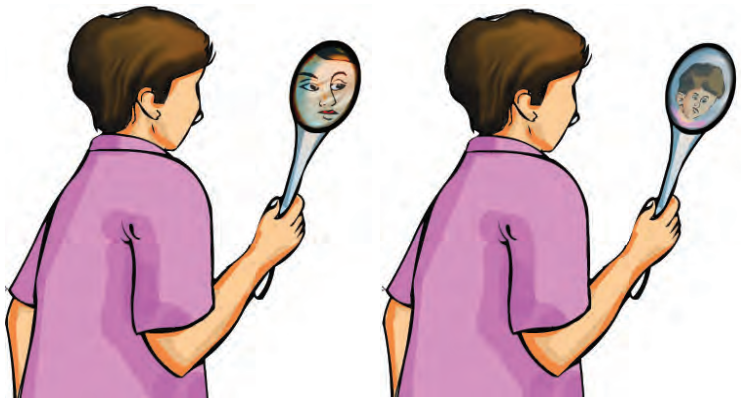
- The size of the image will be the same as that of the object.
- The distance between the image and the mirror is equal to the distance between the object and the mirror.
- The image will undergo lateral inversion.

Aranmula Mirror

The Aranmula Mirror is made with an alloy of special composition. This mirror gives a clearer image than ordinary mirrors do.

Images of different types

We have familiarised ourselves with plane mirrors. Is the image formed in a plane mirror the same as the one in a flat steel ladle?

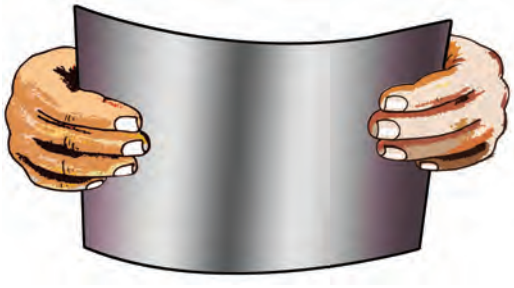


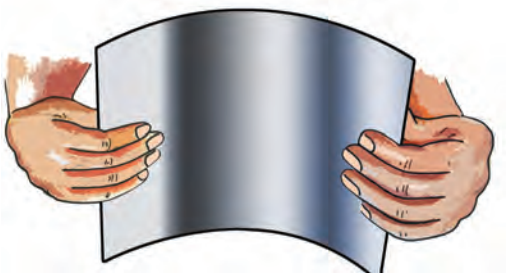
Is there any difference between the images formed on the inner and the outer surfaces of a steel ladle?

Let us make a mirror with silver paper used for decoration.

- Paste a silver paper without folds on a postcard size chart paper.
- Keep it under a heavy book and allow it to dry.
- Observe the image of your face on the sheet.
- Observe the image keeping the sheet slightly bent forward.
- Observe the change in the image when the sheet is bent slightly backward.

Tabulate the observations.

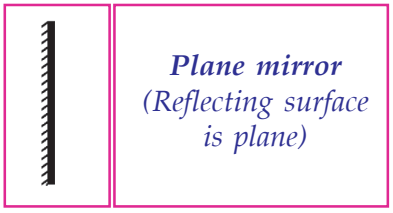




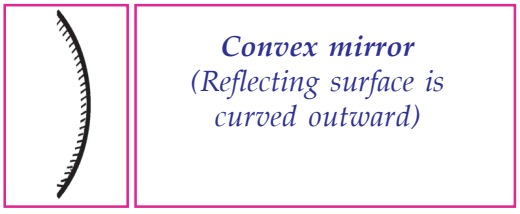
Shape of the sheet	Properties of the image
Plane	
Bent forward	
Bent backward	

Spherical mirrors

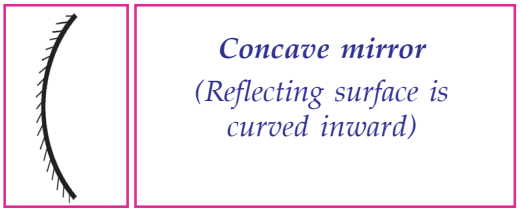
Haven't you noticed mirrors in vehicles? How does the surface of these mirrors appear? Examine the mirrors in your science laboratory. Find out the peculiarities by touching their surfaces and note them down.



Plane mirror
(Reflecting surface is plane)



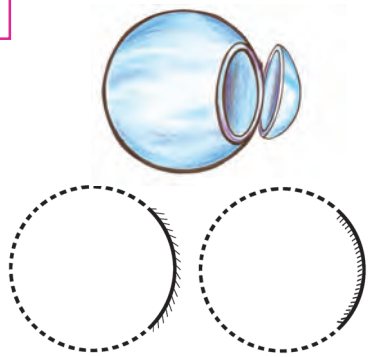
Convex mirror
(Reflecting surface is curved outward)



Concave mirror
(Reflecting surface is curved inward)

How does the surface of each mirror differ?

Cut out a small portion from a plastic ball as shown in the figure. Isn't the shape of the cut portion similar to the shape of mirrors you have been familiarised with? Since such mirrors are parts of spheres, they are called spherical mirrors.



Formation of image

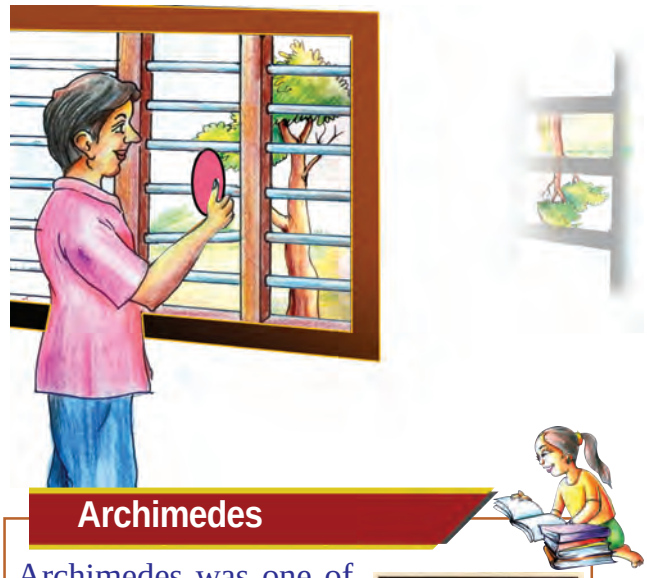
Hold a concave mirror in front of a distant object and direct the reflected light towards a wall or a white screen. Move the mirror forward or backward till the image becomes clear.

Hope you will observe the peculiarities of the image.

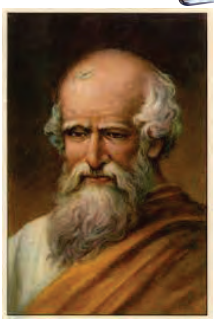
Repeat this experiment using a convex mirror.

Do the same experiment using a plane mirror. Which mirror is capable of making the image fall on the screen?

The image which can be caught on a screen is called real image and the image which is formed inside the mirror, but cannot be caught on a screen is called virtual image. A real image can be formed using a concave mirror.



Archimedes



Archimedes was one of the famous scientists in ancient Greece. He is believed to have lived from BC 287 to 212. He made many unparalleled discoveries and inventions in Physics and Astronomy besides Mathematics. During BC 214-212, when the Roman soldiers attacked his town Syracuse, it is said that he burnt their ships focusing sunrays on them using a large concave mirror!

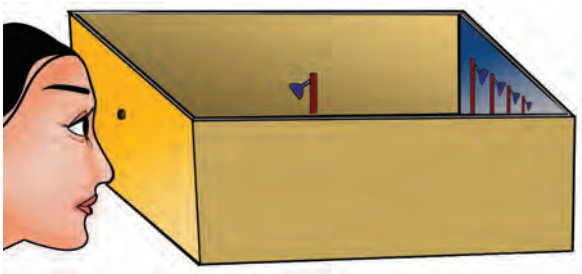
Wonder world of mirrors

Many fanciful objects can be made using mirrors. Try making them.

A royal road in a chalk box

Fix two plane mirrors on the opposite sides of a chalk box with their reflecting surfaces facing each other.

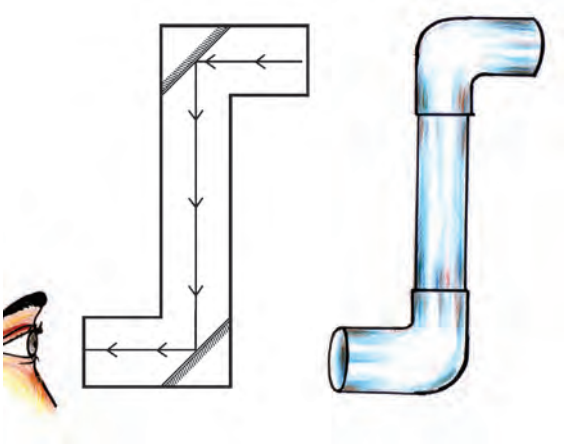
Draw a road on the bottom side of the chalk box, between the mirrors, and arrange a model street light on one side. Make a small hole on one side of the chalk box and then scrape off a little of the mercury coating from the mirror on that side. Look inside the box through this hole.



Kaleidoscope

Fix three rectangular plane mirrors of equal size with a cello tape, as shown in the figure. Put a few pieces of bangle or colour paper inside it and fix a glass paper at either end. Look inside through one end. Rotate the kaleidoscope slowly while viewing. Wow!

Periscope



Arrange a cardboard as shown in the figure and fix two plane mirrors inside it. This is a periscope. What is the use of this apparatus? A periscope can also be made using a PVC pipe instead of cardboard. In the apparatus, make provision for free rotation at the elbow joint at the bottom. You can use this periscope to view the sights around.

Can you make other similar interesting objects or devices using mirrors? Try. Do not forget to write down in your science diary how they are made.

Try to understand from the table some of the uses and peculiarities of different mirrors.

Mirror	Use	Peculiarity
Convex mirror	• Used by drivers to see the vehicles behind (rear view mirror) •	• Diminished image of the object is obtained; wide field of view. •
Concave mirror	• Shaving mirror • Reflector in torch •	• Ability to form enlarged image • Ability to reflect light as a parallel beam
Plane mirror	• To see our face • To make Kaleidoscope •	• Image the same size as that of the object • Multiple reflection •

The broken pencil

Look at a pencil placed obliquely in a glass of water. Doesn't it appear broken? What is the reason for this?

Let us try another activity.

The reappearing coin

- Place a coin on a plate kept on a table.
- Ask your friend to walk backwards, looking at the coin.
- Ask him to stop at the position when the coin disappears from sight.
- Pour water in small quantities into the plate.
- Can your friend see the coin again?

What is the reason for the reappearance of the coin?

The light reflected from the coin travels through water and air to reach our eyes.

What happened before pouring water?

The light travelled only through air to reach our eye. 'Walk backwards till the coin disappears' means walking backwards till the reflected light rays from the coin do not reach our eyes.

What happens when water is poured into the plate?

Light rays travelling from air to water and from water to air undergo slight deviation. Thus the light rays reflected from the coin reach our eyes, thus making it reappear.

Hope it is now clear to you why the coin appears a little raised and why it reappears.

> When light travels from one medium to another, its path undergoes a deviation. This phenomenon of light is called refraction.

Now, isn't it possible to explain why the pencil placed in a glass of water appears broken?

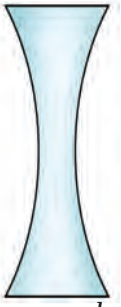
The world of lenses

We have now learnt about different types of mirrors. All of them reflect light. Now, let us see a few other objects which allow light to pass through them. Examine the collection of lenses given. Are all lenses alike? Classify them according to their differences.

Lens with a thick central portion and a thin edge is called convex lens and lens with a thin central portion and thick edges is called concave lens.

See how the lenses are illustrated.

convex lens

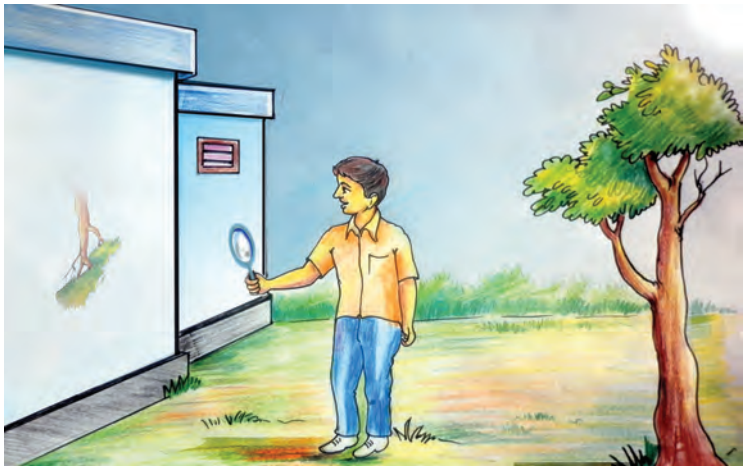


concave lens

Let us do some experiments using lenses.

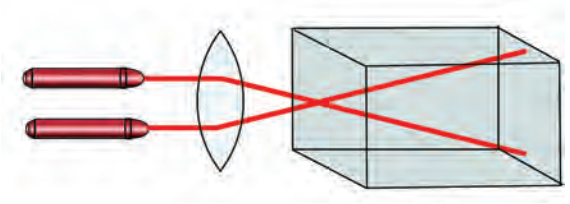
Distant sights can be seen

Hold a convex lens against a distant object and try to capture the image on a wall. Try increasing and decreasing the distance between the lens and the wall. Don't you get a clear image? What type of image is obtained?



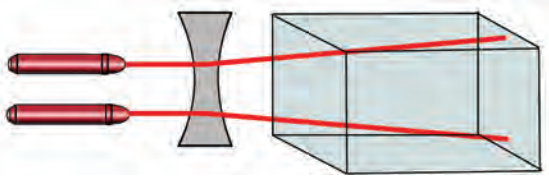
Repeat the experiment using a concave lens. Can the image be captured on the wall? Record the observation of both the experiments in your science diary.

When light falls on a lens



What happens to the light rays passing through a lens? Let us do an experiment.

Take some water in a transparent vessel. Add some milk or soap to the water to make the path of light rays clearer. Send light beams into the water using two laser torches. You can see the light travelling in a straight line. Now place a convex lens in the path of light outside the vessel but close to it.



What change has taken place in the path of light?

Now replace the convex lens with a concave lens and observe. Is there any change in the path of light now?

A convex lens brings the light rays passing through it close to each other (converges).
A concave lens separates the light rays passing through it (diverges).

Uses of lenses

- We use different types of spectacles to rectify defects of vision. Different types of lenses are used in them.
- To see tiny letters and objects in a bigger size, we use hand lens. This is a convex lens. Convex lens is used in equipment like microscope, telescope, camera and projector.

What are the other equipment in which we use lenses?

Find out and write them down in your science diary.

Beauty of the rainbow

You might have seen a rainbow. What are the colours in the rainbow? Why not create the colours of the rainbow in the class?

Take water in a flat vessel and place it under direct sunlight near a wall.

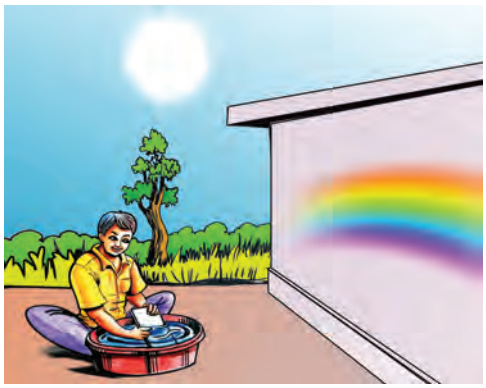
Place obliquely a plane mirror in the water to reflect the sunlight on the wall. Place a thermocol

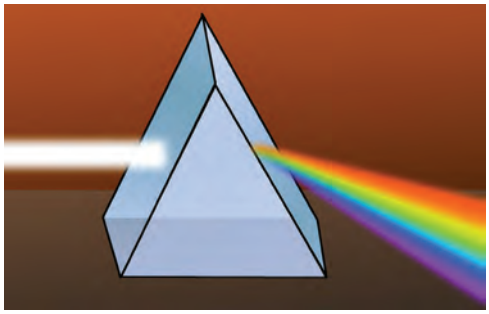
sheet or white paper where the light from the vessel falls, if the wall is not white.

Don't you see beautiful colours on the wall? What is the reason for it?

There must be a glass prism in your school laboratory. Let us do an activity using a prism.

Take a plane mirror and a black paper of the same size. Make a hole, as big as a coin, in the paper. Paste the paper on the plane mirror. Hold the plane mirror upto sunlight and reflect the light on the wall. Place the prism in the path of reflected light near the wall. Light should fall obliquely on the rectangular face of the prism. Light emerges through the other rectangular face and falls on the wall. Now try to change the position of the prism.





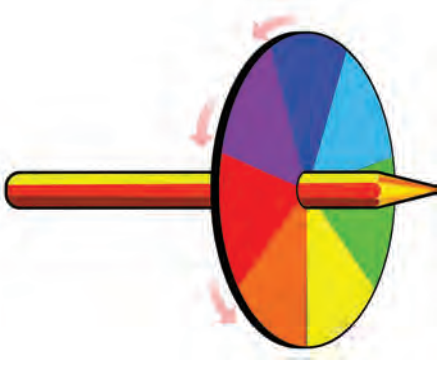
What do we see on the wall?

Sunlight is white light. White light consists of seven colours. Violet, indigo, blue, green, yellow, orange and red are the colours. When light is passed through a prism it splits into its component colours. The phenomenon of the splitting up of white light into its component colours is dispersion. It occurs because different colours in white light undergo different extents of refraction.

You may have now understood that the rainbow is a colour phenomenon that occurs when sunlight passes through water droplets in the atmosphere.

Let us make a colour disc

Take a discarded CD and mark seven equal sections as shown in the figure. You may either paint the seven colours of a rainbow on it in its order or paste coloured papers. Rotate the disc fast, inserting a pencil in the hole of the CD. Which colour do you see now? Haven't you now understood that when the component colours of light are combined, white light is obtained.



You have now done different experiments using mirrors, lenses, prisms etc. Certain peculiarities of light make all these experiments interesting. You can try more interesting experiments with additional materials.

Present your interesting experiments in the science club. A magazine on 'Light' may be brought forth combining experiments and figures.

Significant learning outcomes

The learner can

- explain with examples the changes in reflection when light falls on different surfaces.
- explain, on the basis of reflection, how we see objects.
- find out the properties and uses of different types of mirrors and lenses.
- explain the concepts of reflection, refraction and dispersion of light.
- plan experiments related to the properties of light.
- do experiments using prism, mirror and lens with accuracy and precision.
- make devices using mirrors.

Let us assess

1. Which of the following is not relevant to a plane mirror?

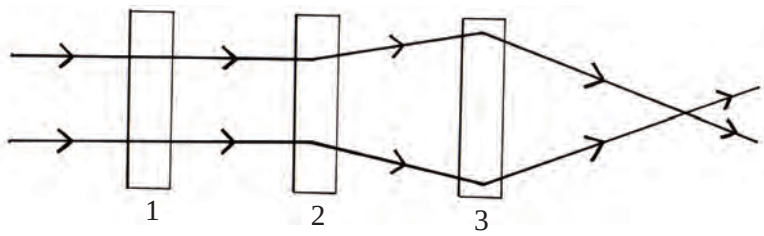
   (a) Causes dispersion of light

   (b) Reflects light

   (c) Produces lateral inversion

   (d) Produces virtual image

2. Three transparent objects are arranged in the path of a light beam. Which is the correct statement about them?



(a)	1. glass sheet	2. concave lens	3. convex lens
(b)	1. concave lens	2. convex lens	3. glass sheet
(c)	1. convex lens	2. glass sheet	3. concave lens
(d)	1. concave lens	2. glass sheet	3. convex lens

3. Rewrite arranging the second and the third columns suitably to match the first column.

Reflection	lens	see objects
Refraction	opaque object	see face
Dispersion	mirror	rainbow is formed
Image	prism	used in microscope

4. Is the actual position of a fish in water the same as the position at which it appears to us? Why?

5. In which of the following do we see images more clearly - new steel vessel or a used one? Why?

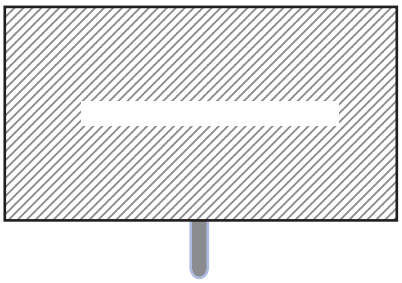
Extended activities

1. Try to capture the image of distant objects on a screen using different convex lenses. Is the image obtained when all lenses are held at the same distance? Find the difference.

2. We have seen that, while using a prism, sunlight undergoes dispersion and is split into its component colours. Try to let the component colours pass through another prism and observe. Write down the results of your observation and the inference.

3. Haven't we learned how to capture rainbow colours on a wall using a mirror?

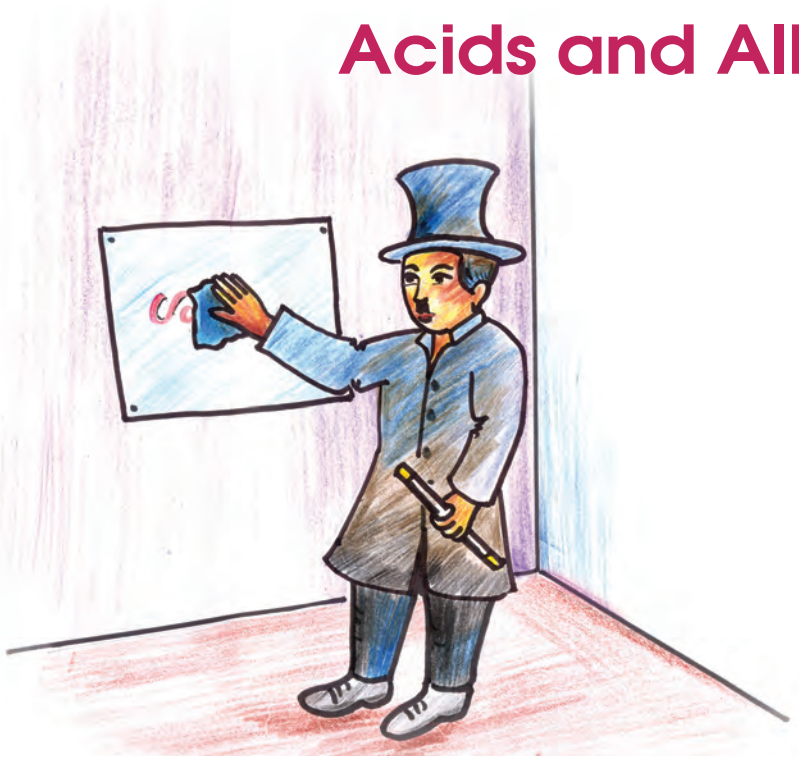
   What will happen if you can separate each colour from this rainbow?



As shown in the figure, prepare a mirror strip by sticking black insulation tape on all sides. Fix a handle to it. Hold this arrangement in the path of the rainbow colours captured on the wall. Don't you see a spectacular vision on the other side? Aren't you able to make each colour of your choice fall on your notebook or on your body using this apparatus?

3

Acids and Alkalis



2013 October 14

I went for a magic show yesterday. The magician fixed a white paper on a board. Then he slowly rubbed the board with a hand kerchief. What a wonder! Red letters started appearing on the board.

(from Shahana's diary)

Didn't you read the diary? How did the red letters appear on the board? Does the magician have any extra ordinary power?

The plant on which flowers appear

Let us do this activity. Keep a small amount of lemon juice, a white paper, two or three hibiscus flowers and a small piece of cloth ready.

Draw the picture of a plant on the white paper. Draw flower petals with lemon juice on the plant. Draw them with a stick dipped in lemon juice. When it gets dried, a plant without flowers can only be seen. Rub hibiscus flowers thoroughly on a piece of cloth. Now the magic can be started.

Fix the white paper with the picture on a board. Rub the portion of flowers in the picture gently with the cloth already rubbed with hibiscus flowers. Didn't you see flowers appearing in the picture? Remember to use a magic wand while performing the magic show.

Did you surprise your friends with your magic show?

What could be the reason for the appearance of red flowers on the plant?

Rub a hibiscus flower on a piece of paper. Pour one or two drops of lemon juice on it. Did you notice the colour change?

Which of the substances we commonly use have this property?

Conduct an experiment with hibiscus paper on buttermilk, water, coconut oil, vinegar, soap solution, sugar solution, salt solution, tamarind water and milk.

Repeat the above experiments, using blue litmus paper, instead of hibiscus paper.

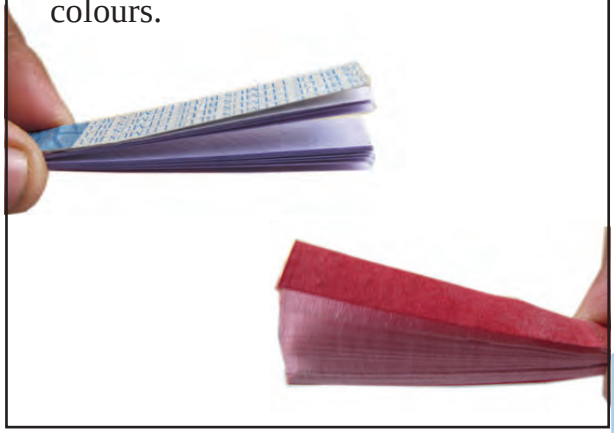
- Which are the liquids that turned the hibiscus paper red?
- Did you notice that the liquids that turned hibiscus flower paper red generally have a sour taste?

Hibiscus Paper

Rub thoroughly a hibiscus flower on both sides of a piece of white paper. Remove all traces of flower sticking on it after it is dried. Using scissors, cut the paper into long and narrow strips. This can be called Hibiscus paper.

Litmus Paper

In laboratories, litmus paper is commonly used instead of hibiscus paper. They are available in red and blue colours.



Acid

Lemon juice, buttermilk, tamarind, vinegar etc. contain certain acids. Litmus paper is red in acid. All acids have sour taste. Acids present in food substances are weak. Hydrochloric acid, nitric acid, sulphuric acid, etc. which are used in the laboratory are strong acids.

Let's look at some of the acids contained in certain food substances of daily use.

Food Substance	Acid present
Buttermilk	Lactic acid
Vinegar	Acetic acid
Tamarind	Tartaric acid
Lemon	Citric acid
Apple	Malic acid

Acids and metals

We have looked at some of the characteristics of acids. Now, let us do a few more activities. Take a little dilute hydrochloric acid in a test tube and put a piece of zinc into it.

What do you see?

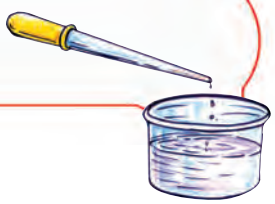
Close the mouth of the test tube with the thumb for some time. Hold a lighted match stick at the mouth of the test tube, and remove the thumb. What has happened?

Do not forget to record the experiments conducted and the observations made in your science diary.

Edubuntu - School Resource - see the portion *'Acidum Lohangalum'*

While handling chemicals…

- Do not taste.
- Do not touch.
- Do not smell.
- Do not let it fall on the body.
- Use a dropper while transferring acid from bottle.
- While diluting an acid, pour small quantities of acid slowly into water taken in a beaker, and stir well.
- Use a holder to hold a test tube.



Let's make a hydrogen balloon

When dilute hydrochloric acid reacts with zinc, hydrogen is produced. Hydrogen is inflammable. Hydrogen gas evolves from the test tube and burns with a low noise when lighted.

Do the same experiment using dilute sulphuric acid and metals like zinc, magnesium and aluminium. Record the observations in your science diary.

- Have you noticed the bottle and its stopper, used to store acid in the laboratory? Why are metal stoppers not used?
- The pickles we commonly use are acidic in nature. Are they stored in metal containers?

We use many substances of acidic nature at home. Haven't you learned that acids react with metals? Therefore, metal containers are not used to store food substances containing tamarind, buttermilk, vinegar and lemon juice. Some of the substances produced by the reaction of metal with acid can cause health problems.

Is an aluminium vessel or an earthen pot more suitable for preparing food containing butter milk?

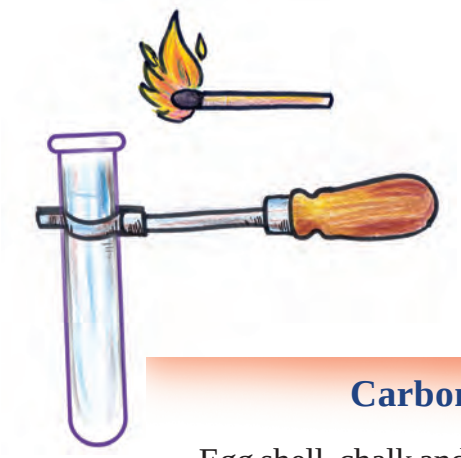
Henry Cavendish (1731-1810)

Henry Cavendish

It was discovered as early as in the 16th century that an inflammable gas is produced when some metals react with acids. This gas was first identified by the British scientist, Henry Cavendish. It was Lavoisier who named this gas as hydrogen. The meaning of the word hydrogen is 'water producing.'

Egg shell in acid

Take dilute sulphuric acid in a test tube and add pieces of egg shell into it. Bring a lighted match stick above the test tube. What happens?



Carbonate

Egg shell, chalk and marble contain calcium carbonate. When acids react with carbonates, carbon dioxide is produced. Carbon dioxide is a gas which extinguishes fire.

Edubuntu - School Resource
see the part '*acidum Carbonettukalum*'

Do more experiments using chalk and marble pieces with dilute acids.

Record the experiment notes in your science diary.

We can also make a fire extinguisher

Materials required: Vinegar, baking soda, plastic bottle, plastic tube and candle.

Fix a tube airtight in the cap of a plastic bottle. Fill vinegar upto half of the bottle. Pack some baking soda in a paper and suspend it from the tube at the opening of the bottle, above the level of vinegar. Take care that the packet of baking soda does not fall into vinegar. Close the bottle properly.

Shake the bottle thoroughly and allow baking soda to fall into vinegar. Direct the gas coming from the bottle towards a lighted candle. What do you see?

You know that vinegar is acetic acid. Baking soda is sodium bicarbonate. When they react carbon dioxide is formed. The fire extinguisher works on this principle. Include the experiment notes in your science diary.

General properties of acids

You have done a few experiments using different substances and acids. Can you state the general properties of acids on the basis of the following hints?

- colour of litmus in acid
- taste
- reaction with metals
- reaction with carbonates

Magic of the Egg

Place an egg in a beaker. Fill the beaker full with vinegar. The egg rises to the surface and then sinks. This action keeps on repeating. Carbonate in the egg shell reacts with acid and carbon dioxide is formed. The egg ascends because carbon dioxide adheres in the form of bubbles to the surface of the egg. When the egg reaches the surface, carbon dioxide escapes and the egg descends.

When ants bite

When ants bite, a small amount of formic acid enters our body. This is why it pains.

Red hibiscus paper

We have already prepared the hibiscus flower paper. Note that they are all blue in colour. We need papers in red colour too. What do we do? Dip the hibiscus papers in any acidic solution and then dry them. Haven't we got red papers now?

Now let us do some experiments using red hibiscus papers and red litmus papers. You can dip red hibiscus paper and red litmus paper in water, buttermilk, vinegar, soap solution, lime water, salt solution, sugar solution, milk and clear ash suspension, and observe what happens.

- Which are the liquids in which red hibiscus paper turns blue?
- Which are the liquids in which red litmus paper turns blue?

Using the above examine the alkalis available in the laboratory.

- Calcium hydroxide (lime water)
- Sodium hydroxide solution (caustic soda)
- Potassium hydroxide solution (caustic potash)
- Ammonium hydroxide solution (liquor ammonia dissolved in water)

Alkali

Substances like lime water which turn red litmus blue are called alkalis. They have a bitter taste and are slimy.

To identify alkali

So far we have used a hibiscus paper and litmus paper to distinguish between acid and alkali. Can other parts of plants be used for this purpose? Conduct a project work and prepare a report. Activities mentioned below may help you in doing the project.

Just as you prepared hibiscus paper, you can prepare similar papers by rubbing different substances on white paper. What are the substances that can be used?

- turmeric
- mango leaf
- rose
- beetroot
- carrot
-
-

Edubuntu - School Resource - see the part *'litmus nirmanam'*

Check whether each of these papers shows different colours in dilute acid and alkali.

Record the experiments and observations in your science diary.

Substance	Colour in acid	Colour in alkali

- What are the substances that can be used to distinguish between acids and alkalis?
- What could be the reason for red colour appearing on clothes when the turmeric stain on them is washed with soap?

Indicators

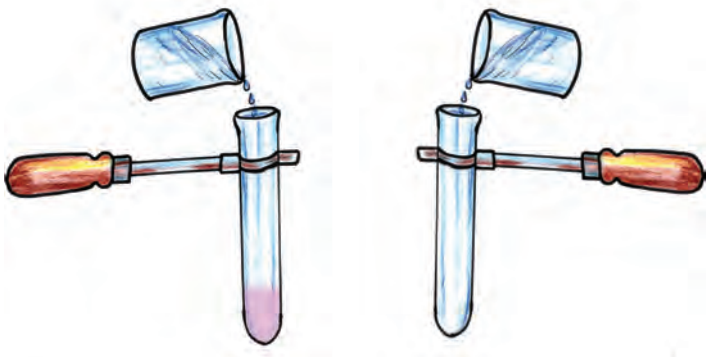
Indicators are substances that help us to distinguish between acids and alkalis through colour change. Parts of plants like turmeric, hibiscus, beetroot etc can be used as indicators. Litmus paper is an indicator used in the laboratory.

Indicators in the laboratory

Besides litmus, what other indicators are used in the laboratory?

Take small quantities of caustic soda solution and vinegar in two separate test tubes. Add two drops of phenolphthalein to each test tube. Do you see any colour change?

- Can phenolphthalein be used as an indicator to distinguish between acid and alkali?



Repeat the experiment using methyl orange instead of phenolphthalein.

Record the findings in your science diary.

See the table given below:

Substance used	Colour in acid	Colour in alkali
Blue litmus paper	Red	Blue
Chilly powder	Pale red	Pale red
Red litmus paper	Red	Blue
Hibiscus paper (blue)	Red	Blue
Phenolphthalein	Colourless	Pink
White paper	White	White
Carbon powder	Black	Black
Methyl orange	Pale pink	Pale yellow
Liquid blue	Blue	Blue
Turmeric	Yellow	Red

- What are the substances that can be used as indicators to identify acid?
- What are the indicators that can be used to identify alkali?

Haven't you learned to do many activities with acidic and alkaline substances and indicators? You can perform magic in the science club. Use only harmless chemicals. Take necessary precautions after discussing with your teachers.

Universal indicator

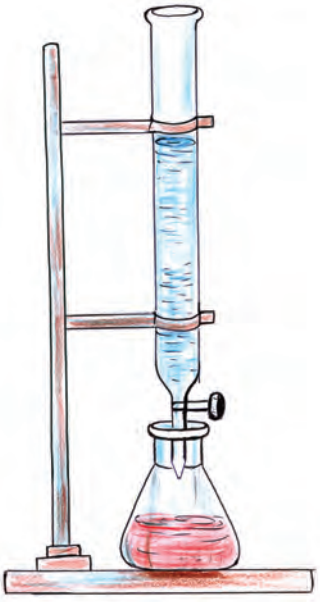
Universal Indicator is a mixture of different indicators. Depending on the strength of the acidic or the alkaline nature of solution, universal indicator gives different colours. These colours can be compared with the colour chart affixed outside the bottle.

When acid and alkali mix together

What happens when dilute solutions of hydrochloric acid and caustic soda are mixed together?

A certain procedure is followed for doing such experiments in the laboratory.

Take dilute hydrochloric acid in a burette. Add 20 ml caustic soda solution into a conical flask using a pipette. Add two drops of phenolphthalein into the flask and stir well. Place the conical flask below the stopcock of the burette. Open the stopcock slowly and add the acid, drop by drop, into the conical flask while swirling it continuously.



Close the stopcock when the colour of alkali in the conical flask just disappears. Examine whether the colourless solution in the conical flask is acidic or alkaline, using both red and blue litmus papers.

Neutralisation

When definite amounts of acid and alkali are mixed, their acidic and alkaline natures are lost and salt and water are formed. This is called neutralisation.

Acid + Alkali → Salt +Water

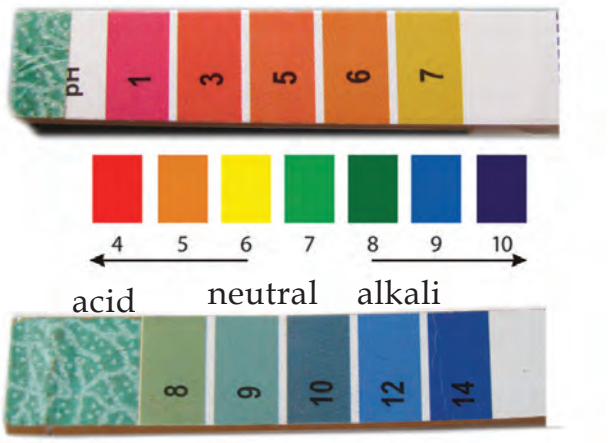
When hydrochloric acid and sodium hydroxide (caustic soda) are combined, sodium chloride (common salt) and water are formed.

Why are indicators like phenolphthalein used while conducting neutralisation reactions?

When acid and alkali combine together, both of them lose their properties. Soil in Kerala is generally acidic in nature. Do you understand now why lime, which is alkaline, is added to soil?

pH value

pH paper is used to examine whether a substance is acidic or alkaline. If pH value is 7, it indicates a neutral substance. It means the substance is neither acidic nor alkaline. The pH value of pure water is 7. When pH value is greater than 7, the substance is alkaline and when it is less than 7, it is acidic. A colour chart marked with pH values is available along with a pH paper. The colour change produced when a pH paper is dipped in a solution is compared with the colour chart to find whether the solution is acidic or alkaline in nature.



Let us find the pH of soil

Take a glass and fill it half with soil. Pour water till the soil is immersed completely and stir well. Tilt the glass and collect the oozing water. When the water clears, dip a pH paper into it. Compare the colour change of the pH paper with the colour chart and find the pH of the soil.

- You can find the instances when acids and alkalis are used in daily life.

Acidity

Acid is produced in the stomach to support the digestion of food. At times, when food is not taken properly or when enough water is not consumed and unhealthy food habits are followed, the amount of acid increases in the stomach. This is called *acidity*. Doctors prescribe medicines containing alkali to overcome this.

Edubuntu - School Resource see portion "pH scale"

Acid	Use
Vinegar	Pickles and other food substances.
Citric acid	Food preservation and in soft drinks
Nitric acid and sulphuric acid	Manufacture of chemical fertilizers, paints, dyes etc.
Sulphuric acid	Automobile battery
Tannic acid	Production of ink and leather.

Alkali

- Manufacture of soap
- Manufacture of detergents and ceramic materials
- Industrial purposes
- Purification of water.

Edubuntu - School Resource – see portion *'acidukalude upayogangal'*

Let us make soap

Materials required: Sodium hydroxide (caustic soda)- 180 g, Coconut oil- 1 kg, Water -350 ml, Sodium silicate- 100 g, Stone powder (talcum powder)- 100 g.

Procedure

Dissolve caustic soda in water taken in a steel vessel. Heat is liberated when caustic soda dissolves in water. It takes 3-4 hours for the solution to get cooled. When the solution cools, pour it slowly into coconut oil taken in a plastic or steel vessel and stir it. Add stone powder and sodium silicate. This is to increase the hardness and quantity of soap. Stir well till the mixture solidifies. Perfumes and dyes may be added for fragrance and attractive colour. Pour the above mixture into moulds. In three to four days, the mixture becomes soap. The soap taken from moulds should be used only after two weeks.

What are the advantages of making soap ourselves?

Try and make soap in your school under the auspices of the science club?

Edubuntu - School Resource
see *'soap nirmanam'*

Significant learning outcomes

The learner can

- cite examples of acids and alkalis by finding their characteristics.
- find out and use the indicators that help in identifying acids and alkalis.
- explain the reaction of acids with metals and carbonates.
- distinguish the acidic and alkaline nature of substances used in daily life.
- handle chemicals carefully.
- recognise instances of daily life in which neutralisation is made use of.
- make soap.

Let us assess

1. The pH values of different soil samples are given. Which of the soils should be treated with lime?

   (a) 7 (c) 8

   (b) 5 (d) 9

2. When a magician rubbed white paper with a kerchief, red letters appeared. Which of the following materials might have been used by him?

   (a) Vinegar, turmeric

   (b) Lime water , phenolphthalein

   (c) Soap, hibiscus juice

   (d) Methyl orange, sulphuric acid

3. Classify the substances in the following table

Substance	Colour of red litmus	Colour of blue litmus
A	Blue	Blue
B	Red	Red
C	Red	Red
D	Red	Blue
E	Blue	Blue
F	Red	Blue

4 When buttermilk spills on a marble floor, a stain appears after some time. Why?

Extended activities

1 Examine the fruits and vegetables used at home and classify them as acidic or alkaline.

2 Are there other flowers that can be used as indicators like the hibiscus? Examine.

4 Through the Alimentary Canal

Sensing the smell of a plantain, Pathumma's goat made her appearance before me. I peeled off the skin and ate the plantain. Seeing me eating something, Umma's refugee cats too appeared there. The hens, trotting under Umma's care, also came. I gave the peel of the plantain to Pathumma's goat. The goat stood there expecting more.

***('Pathummayude aadu'* - Vaikom Muhammad Basheer)**

- Why is the peeled skin of plantain given to the goat, and not to the cat or hens?
- What are the various types of food that goats eat?
- Other organisms in the surroundings also take food. Observe the picture.

- Do all of them eat the same food?
- What is the diversity seen in the mode of procuring food? Complete the table given below and note it down in your science diary.

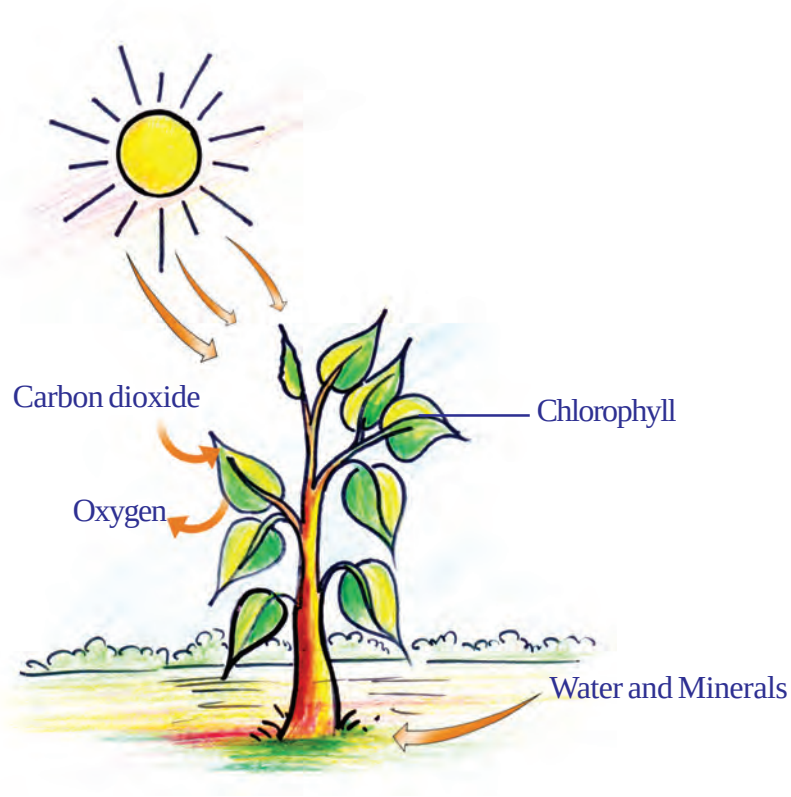
Organisms and food

Organism	Food	Mode of feeding
Caterpillar	Leaf	Nibbles

Edubuntu - School Resource – see the portion *"Jeevikalum Paristhithiyum"*

Nutrition

All organisms need food. The food and the mode of procuring it differ from organism to organism. The process of intake and utilization of food by organisms is called nutrition. Plants are also organisms. Don't they also require food?



Don't you know which process is indicated in the picture?

- What are the factors required for photosynthesis?
- Which is the gas received by plants during photosynthesis?
- Which is the gas given out?

Green plants do not depend on other organisms for food. They synthesise their own food. Hence they are called autotrophs. On the other hand, there are organisms which are unable to synthesise their own food and therefore depend on other organisms for food. They are called heterotrophs.

For food

Haven't you learnt earlier about parasitic plants, saprophytes etc.? Observe the pictures given below.

Sandalwood tree
During the initial stages of growth, it takes water and minerals from the roots of other plants

Monotropa
It takes food from decayed organic remains.

Loranthus
For water and minerals, it depends on the plant on which it lives.

Cuscuta
For food, it depends on the plant on which it lives

Classify the plants indicated in the pictures and note them down in the given table.

Total parasite	
Partial parasite	
Saprotroph (Saprophyte)	

What may be the reason for the drying up of the branch on which loranthus grows?

You know how organisms like mushrooms which belong to the group of fungi obtain food. In which group will you include them in the above table?

Inside and outside

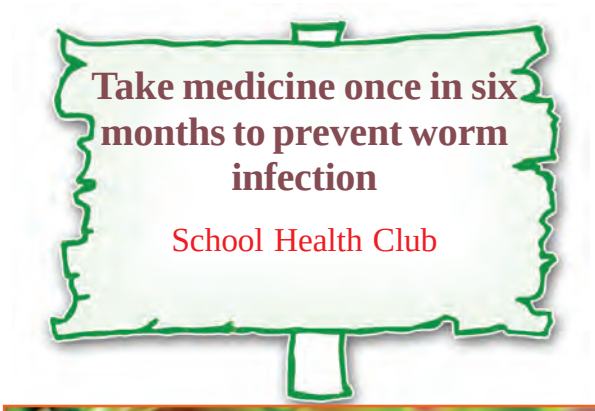
There are parasites among animals too. Which are they?

Louse

Worms

Flea

Louse and flea are external parasites. But worm is an internal parasite. Do parasites harm the health of organisms in which they live?



Predators of the plant world

Don't you know the factors on which plants depend for the synthesis of their own food? Look at these plants.

They are known as insectivorous plants. They are given this name because they catch insects. Photosynthesis takes place in these plants too. Then why do they catch insects?


Venus fly trap


Sundew plant


Pitcher plant

Edubuntu - School Resource See the portion 'sundew chedi'

Elements like carbon, hydrogen, phosphorus, nitrogen, sulphur, calcium and iron are required for plants in large quantities. You know that certain bacteria present in the soil (Azotobacter, Nitrobacter) convert atmospheric nitrogen into nitrates. These bacteria may not be present in soil with high acidity. Plants which grow in such soil do not get nitrogen. It is to overcome this situation that such plants acquire the ability to catch insects. They obtain the required nitrogen through the digestion of the body of these insects.

Food in humans

The energy required for life activities is obtained from food. Let us examine the changes that food undergoes within our body.

Food first reaches the mouth, doesn't it?

What change does the food undergo inside the mouth? What role do lips, teeth and tongue play in this? Observe the changes on your own while having food and write down your observations.

mouth lips tongue teeth

Digestion of food starts from the mouth. The digestive enzymes in the saliva enable this process.

Tooth

Tooth is the hardest part of the human body. Nevertheless, it is easily prone to damage if not given proper care.

Why does the tooth, which does not decay even when buried for long in the earth, decay easily inside the mouth?

Let us do a simple experiment.

As you know, marble is a hard material. Put a few small pieces of marble in dilute hydrochloric acid. Examine after a while. What changes do we observe in the marble pieces?

Acid reacts with marble and dissolves it.

Tooth decay

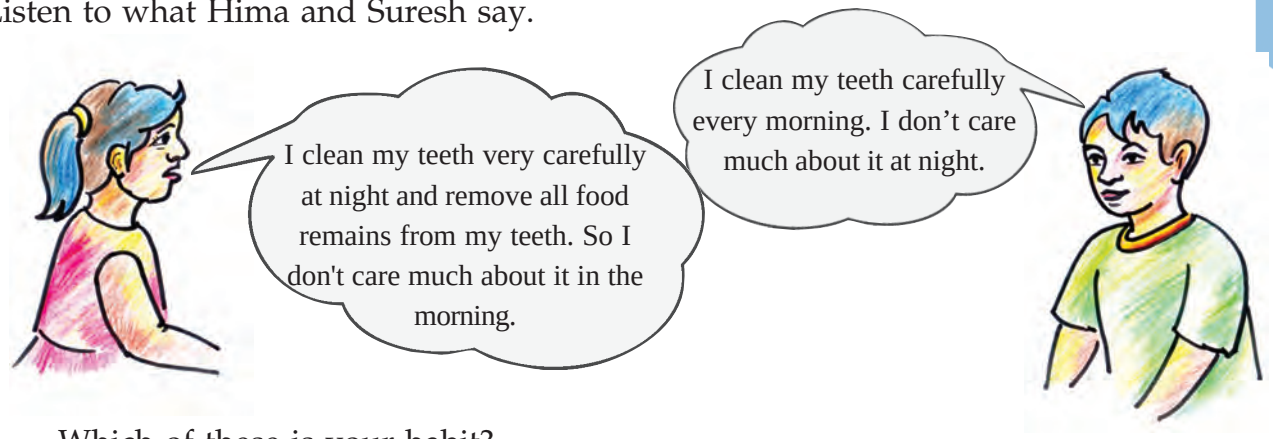
Enamel is the outermost layer of teeth. It is the hardest material in the human body. It is not easy to destroy enamel. The enamel, which is a calcium compound, reacts with acid and gets destroyed in the same way a marble reacts with hydrochloric acid.

- How does acid come into contact with teeth?

When food remains stuck to teeth, bacteria feed on them. As a result, lactic acid is produced, which causes the destruction of enamel. Sweet foodstuff accelerates bacterial activity.

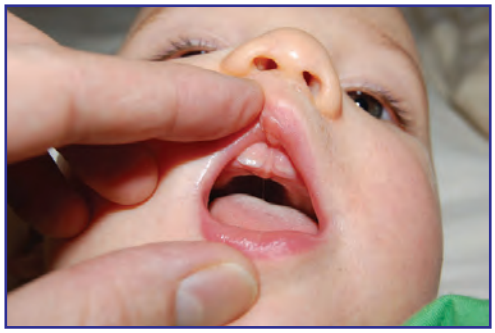
Do you now realise the importance of cleaning your teeth after food?

Listen to what Hima and Suresh say.



- Which of these is your habit?
- Which habit should be practised for the health of teeth? Why?

Milk teeth



Do you have a little brother or sister?

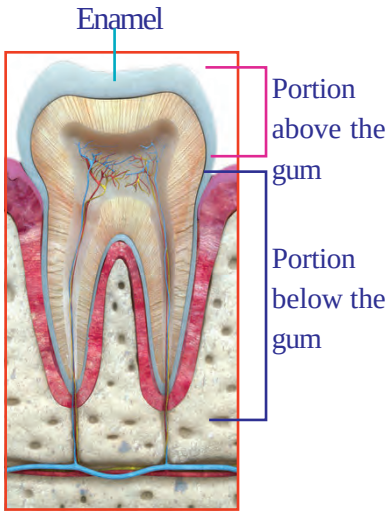
Have you noticed teeth sprouting in the mouth of small children?

At which age do teeth sprout in children?

- How many teeth do you have? Let us count.
- Do all the teeth, which sprouted first, remain even now?

It is at the age of approximately six months that teeth start sprouting. These teeth are known as milk teeth. Ten teeth each would appear on the upper and lower rows.

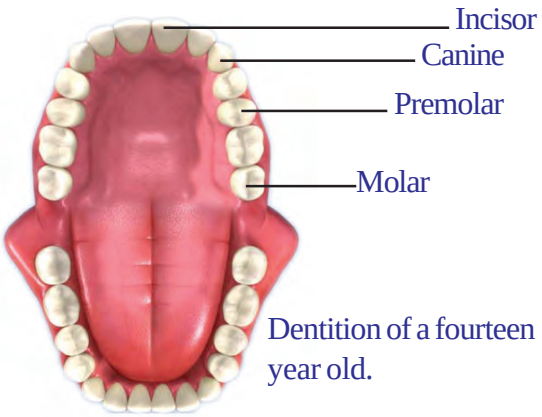
The milk teeth start falling from the age of six. Permanent teeth are those which appear after that. If any of them breaks or falls off, a new one will never take its place. Those which grow last are the molars at the end of the gum.



To chew and grind

- Are all our teeth similar?
- Is there any difference in the use of each of them?

Examine the details and the table given below and note them down in your science diary.



Dentition of a fourteen year old.

Incisor

- Eight teeth in the front-four above and four below.
- Helps to bite and cut.

Premolar

- Eight teeth next to canines on both sides above and below.
- Helps to chew and grind.

Canine

- Four teeth near the incisors on both sides above and below.
- Helps to tear off foodstuff.

Molar

- Twelve teeth next to premolars above and below.
- Helps to grind and crush.

Premolars and molars are generally called molar teeth.

A total of thirty two teeth are seen in adults.

Are the teeth of other animals similar to ours? Look at the pictures given below.

How is the shape of their teeth related to their food habit?

Carnivores have canine teeth which can tear off food. But herbivores have teeth that help in cutting, chewing and grinding food.

The Journey of food

- Where does the food, chewed and ground in the mouth, move to ? Trace the path of food and write it down.

I was sitting very happily in a vessel. Unexpectedly I got trapped in a mouth. I was pressed and squeezed even before I could enter the mouth. And what to say about my story in the mouth! How cruelly the teeth treated me. And when I tried to escape, the tongue threw me again before the teeth.

What happened to the idli next? Where all did the idli reach?

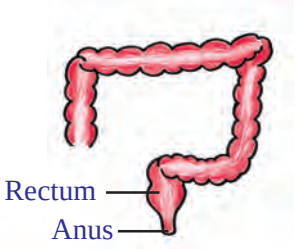
Analyse the details given below.

Stomach

Food reaches the stomach from the mouth through the oesophagus. It is the wave-like movement of the oesophagus which enables this. This is called peristalsis. Due to the movement of the stomach wall, food is rendered paste-like inside the stomach. The digestive enzymes produced by the stomach digests food chemically too.

Small intestine

Small intestine is about six metre long. Digestion of food is completed here. The nutrients in the digested food are absorbed into the blood.



Large intestine

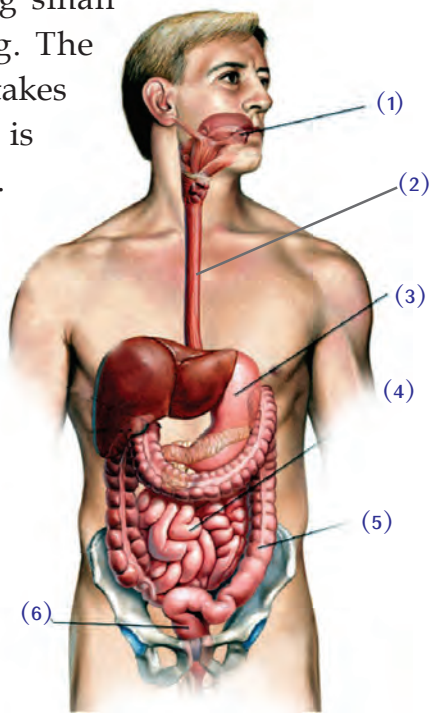
Large intestine is the broader intestine following small intestine and is about one and a half metre long. The absorption of water containing minerals and salts takes place here. What remains after that is the faeces. It is stored in the rectum and expelled through the anus.

Edubuntu - School Resource
see the portion 'Digestive system'

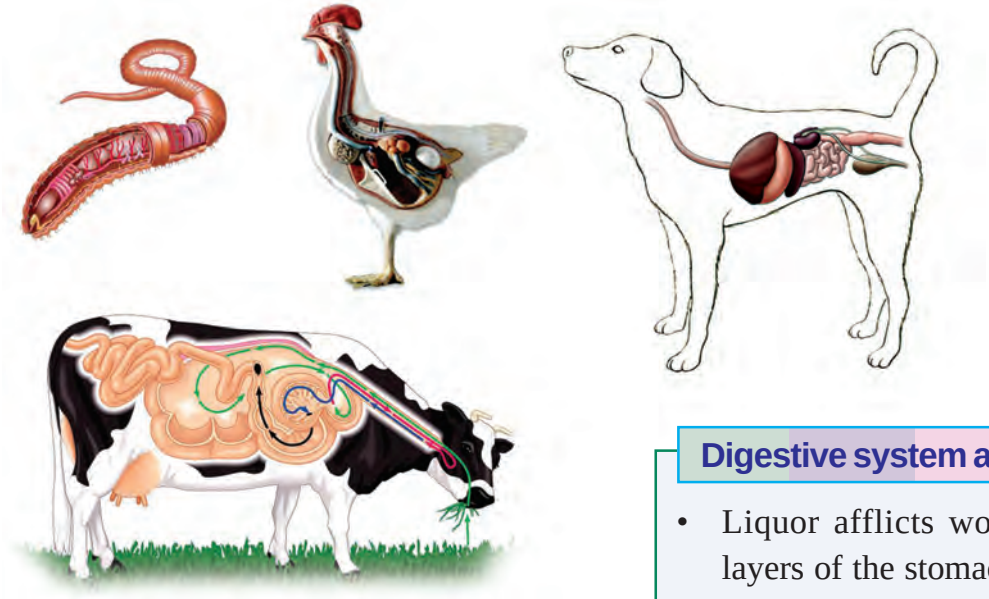
Now, complete the 'Journey of Idli' adding necessary information.

Digestive system

Hope you are now familiar with the parts of the digestive system. Look at the picture and label the parts marked in it.



Look at the pictures of the digestive systems of some organisms.

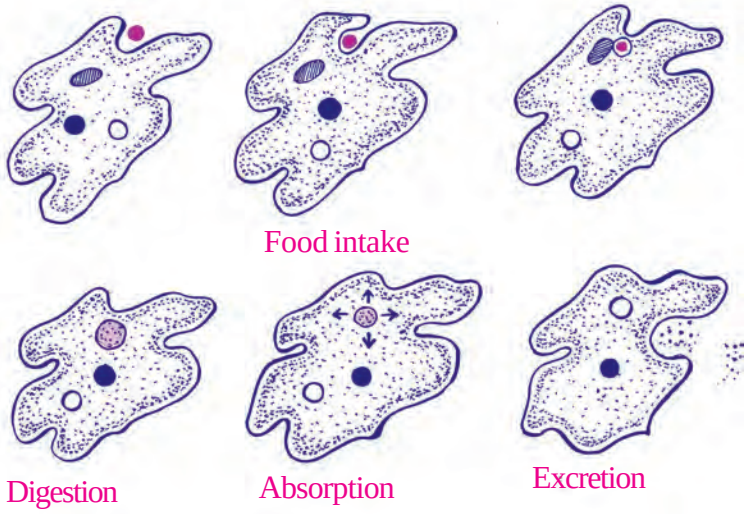


Digestive system and alcoholism

- Liquor afflicts wounds on the soft layers of the stomach. This results in ulcer.
- Excessive alcoholism causes liver cirrhosis.
- Liquor causes cancer in the mouth, oesophagus, liver and large intestine.

Nutrition in amoeba

How many different types of organisms are there around us! Don't all the organisms receive and utilize food from the environment? See the illustration of the process of nutrition in amoeba, a unicellular organism.



Edubuntu - School Resource - See portion on *'Ekakosa jeevikal'*

What are the different stages in the process of nutrition in amoeba? Complete the flowchart.

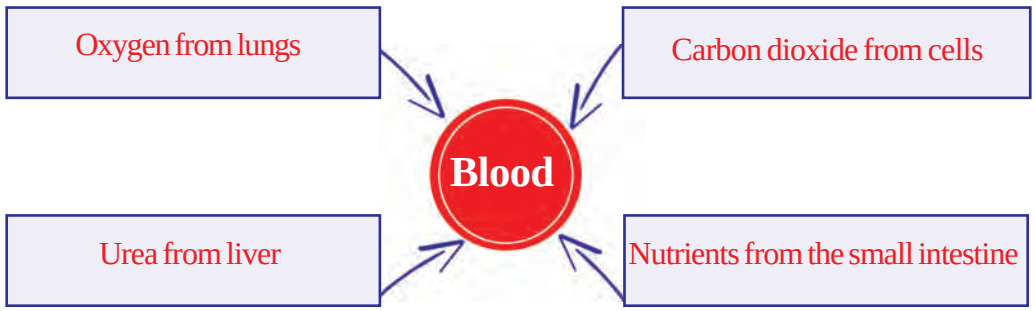
Stages in the process of nutrition

The first stage in the process of nutrition is ingestion. Digestion is the process in which the organic factors present in the food are broken down to simple components that can be absorbed by the body. The process of the digested food being received into the body is absorption. Assimilation is the process in which absorbed components become part of the body. The byproducts of metabolic reactions which are not useful to the body are eliminated through the process called excretion.

Complete the flowchart, adding the stage of assimilation.

Expelling waste

Look at the illustration:

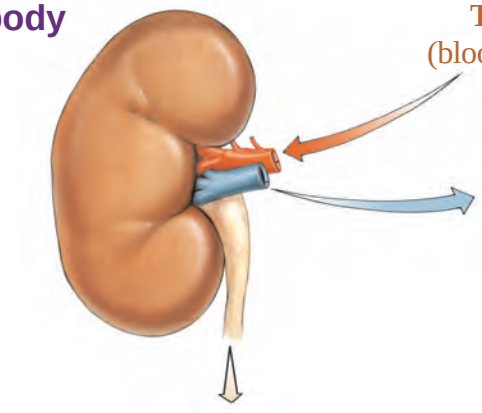


- Which are the components reaching blood?
- Which among these are required for the body?
- How are the unwanted substances eliminated?

Carbon dioxide is eliminated through respiration.

The urea that reaches the blood is not necessary for the body. Let us see how this is expelled.

Filters in the body



The blood vessel that reaches the kidney
(blood along with urea, water and other components in greater quantities)

The blood vessel that leaves the kidney
(blood along with water, urea and other components in lesser quantities)

Ureter (Urea + water + other components)

Examine the components of both the blood vessel that reaches the kidney and that which leaves the kidney. What difference do you see?

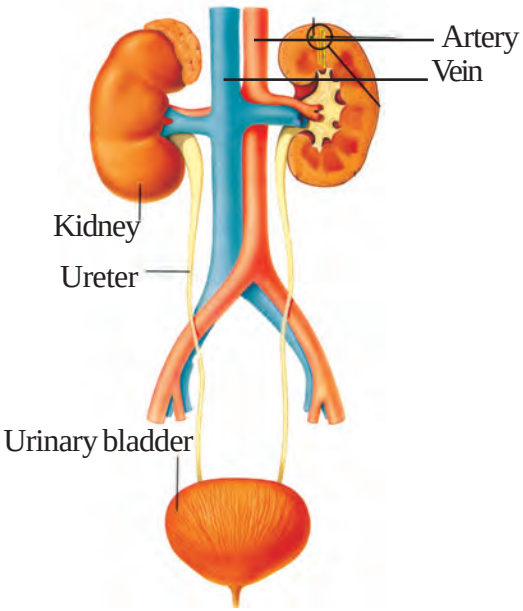
Can you tell what the function of the kidney is?

During summer, more water is lost through skin. Hence there would be less water and more salt in urine. Urine in this season would be slightly more yellowish in colour.

Excretion through skin

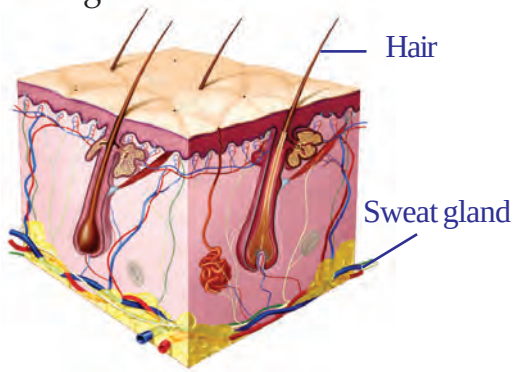
Kidney

Kidney is the major excretory organ in the body. Excess urea, water and salts in the blood are filtered and expelled in the form of urine. In order to facilitate this process, children should drink at least one and a half litre and adults should drink three litre of water daily. Urine contains 96% water.



When do you sweat profusely?

What all are expelled from the body through sweat?



Not passing urine when required, not drinking enough water, not maintaining hygiene etc. will cause urinary diseases.

Sweat and other wastes are expelled through the minute pores of the skin. They accumulate on the skin. Hence the skin has to be cleaned.

Do you now understand the importance of carefully cleaning all body parts while bathing?

- Is it proper to prevent sweat?

Sweat

Sweat is produced by sweat glands in the skin. Excess water and salts in the body are eliminated through sweat. Sweating helps to regulate and maintain our body temperature. The condition of excessive loss of water and salts from the body is called dehydration.

Excretion in plants

As in the animal body, wastes are formed in the body of plants too. Observe the methods plants adopt to eliminate these.

- Waste materials are stored in the bark which later gets detached.
- Waste materials are expelled as exudates from the them.

Food and hygiene

Until now, we have been discussing how food that is taken into the body is utilized and eliminated. Proper food habits are to be practised in order to facilitate the smooth functioning of organs in the digestive system and the excretory organs like kidney, skin etc. Frequent food intake, excess food intake, insufficient food intake, excluding vegetables and leafy vegetables from food etc. may cause several health problems. Won't you write out healthy food and hygienic habits in charts and display them in the class?

Significant learning outcomes

The learner can

- explain the different stages in the process of nutrition.
- explain with examples the importance of photosynthesis.
- identify and explain the parts of the digestive system and its functioning.
- identify the importance of dental care and practise it.
- identify the diverse mechanisms adopted by the body to eliminate wastes.
- understand the importance of maintaining body hygiene and practise it.

Let us assess

1. Food is to be thoroughly chewed and ground while eating. Why?

   (a) To feel the taste of food

   (b) To give exercise to teeth

   (c) To facilitate digestion

   (d) To mix hydrochloric acid in food

2. The levels of Oxygen and Carbon dioxide are maintained constant in the atmosphere

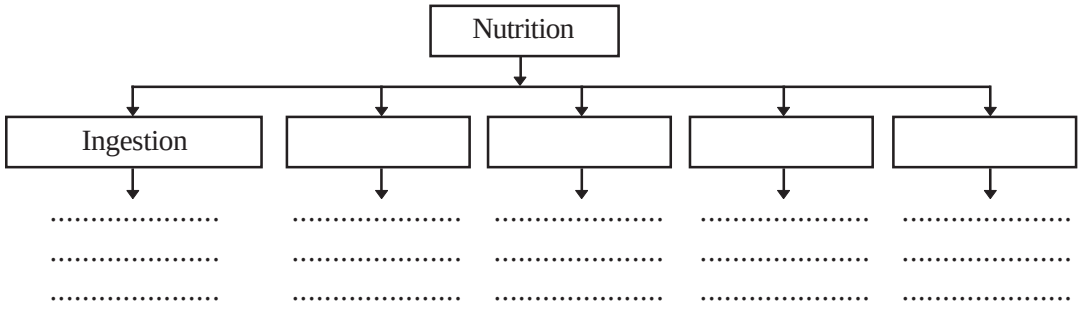
   a. Due to respiration by animals

   b. Due to photosynthesis by plants

   c. Due to the processes of respiration and photosynthesis

   d. Due to decrease in plant population

3. Complete the flow chart adding the different stages, related organs and functions of the process of nutrition.



Extended activities

1. Prepare and display anti-drug messages in school.

2. Prepare a table classifying traditional and modern substances used for cleaning the skin and the teeth.

5 When Current Flows

On waking up in the morning, I turned the tap on to brush my teeth. No water . . . I was about to switch on the motor when I remembered that there was no power supply yesterday since a tree had fallen on the line. I heard my mom cursing the power failure as she was unable to grind the soaked rice in the mixie to prepare breakfast. My father and I helped her in completing the urgent work.

How difficult it is to manage a day without power supply!

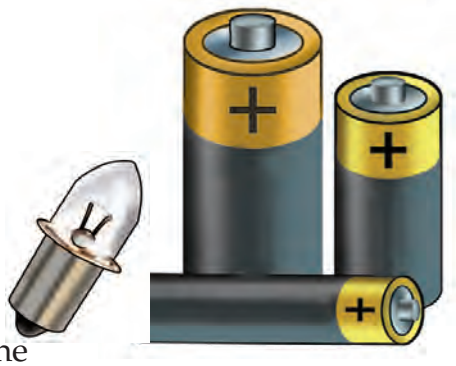
Didn't you listen to what Raju said?

What are the problems that you face at home on a day when there is no power supply?

Write them down.

Isn't it true that a world without electricity cannot be even imagined today?

How the torch bulb glows...



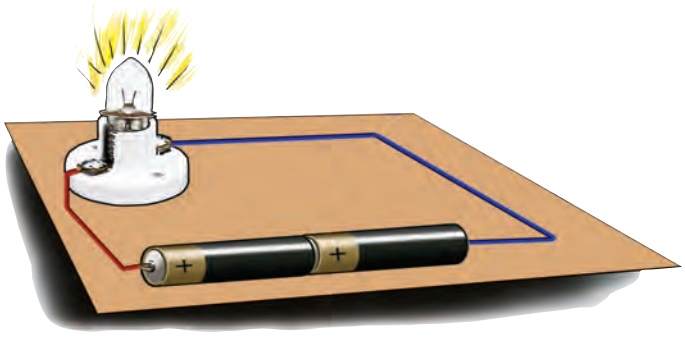
Prepare an arrangement to light a bulb using two torch cells, one torch bulb and two pieces of copper wires.

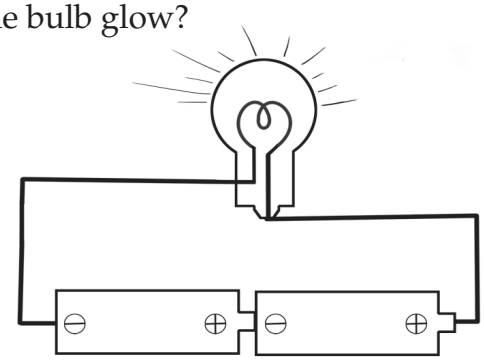
Light the bulb. This arrangement is an electric circuit.

Observe the diagram of the circuit. A path is prepared for current to flow from one terminal to the other terminal of the torch cells through a copper wire and a bulb. The bulb glows when the circuit is complete.

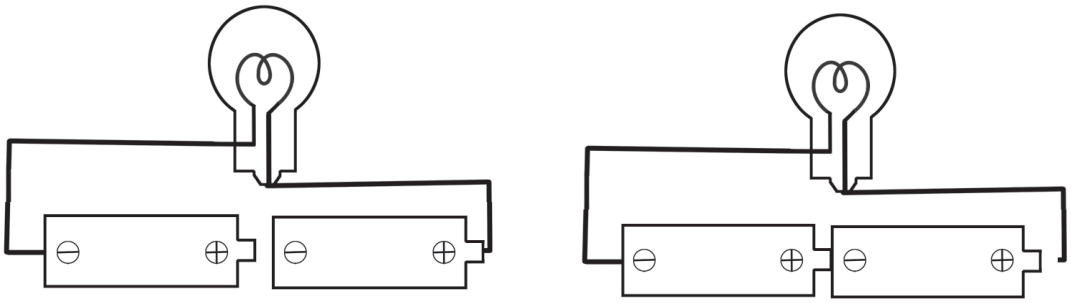
Such a circuit is called a closed circuit.

Now, disconnect any part of the circuit. Does the bulb glow?





Now, disconnect any part of the circuit. Does the bulb glow?

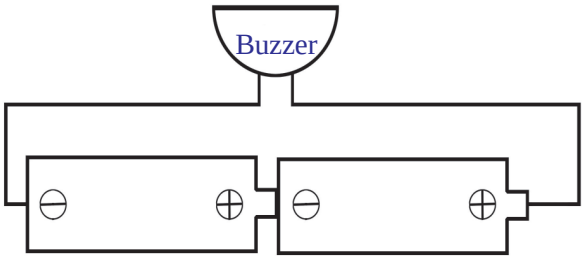


In such situations the circuit is said to be an open circuit. The bulb does not glow then.

- Have you observed what happens to a bulb when it fuses? Is the circuit closed or open then?

Beep ..... Beep....

Complete the circuit by replacing the bulb with a buzzer. Doesn't the buzzer work? Observe the illustration of the circuit of this arrangement.



Now complete the circuit replacing the buzzer with a mini motor and make it work.

Illustrate how this circuit is arranged.

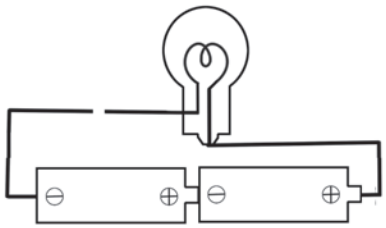
Haven't you familiarised yourself with three electric circuits? Try to write down the components in each circuit after examining all the three.

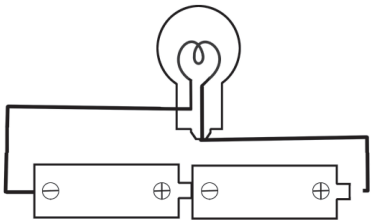
	Source of electricity	Electric device	The wire used for connection
Circuit 1	Torch cells	bulb	copper
Circuit 2			
Circuit 3			

Which of these components are similar?

- Source of electricity
- Device that uses electricity
- Wire that conducts electricity

You might have now understood the components of an electric circuit. Some electric circuits are given below. None of the bulbs in these circuits is glowing. Identify its reason and note it down.





Copper wires were used to conduct electricity in all the circuits we have seen. Do all substances conduct electricity? Let's find out.

For current to flow

Make an arrangement as shown below and try to complete the circuit using different materials. Which materials made the bulb glow?

Edubuntu - School Resource- See the portion 'Circuit construction kit.'

Material used for the experiment	Bulb glows/ does not glow	Current is conducted/ not conducted
Nail		
Piece of paper		
Block of wood		
Steel spoon		
Plastic wire		
Rubber band		
Tin sheet		

Substances that conduct electricity are called conductors and those which do not conduct electricity are called insulators.

Do this activity using more materials and expand the table. Write them down in your science diary.

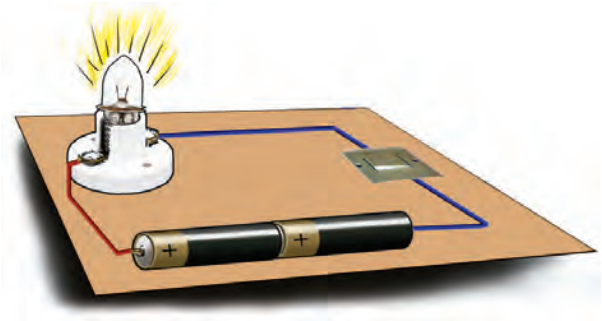
Let's use symbols

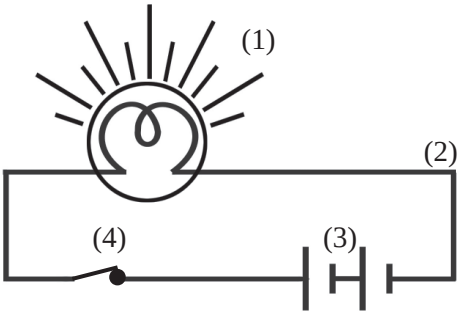
In all the circuits we have seen so far, figures of the source of electricity and the device were drawn. Isn't this very difficult?

Wouldn't it be easier to give symbols to each of them while drawing circuits? Try to understand the symbol of each by observing the table below:

Electric cell		
Battery		
Bulb		
Glowing bulb		
Switch in the 'on' mode		
Switch in the 'off' mode		
Buzzer		
Fuse		
Conducting wire		

Draw the circuits you have seen earlier using these symbols.





Note down in your science diary what 1,2,3 and 4 in the given circuit indicate.

Is the circuit closed or open? What change should be made in the circuit to show it as an open circuit?

A switch is a device used to make a circuit work only when necessary.

Different types of wires

Which are the conducting wires usually used in circuits?

Different types of wires

Multistranded wire

Laminated wire

Service wire

Non-insulated wire

Different types of switches

ordinary switch

bell switch

two-way switch

press button switch

D P switch

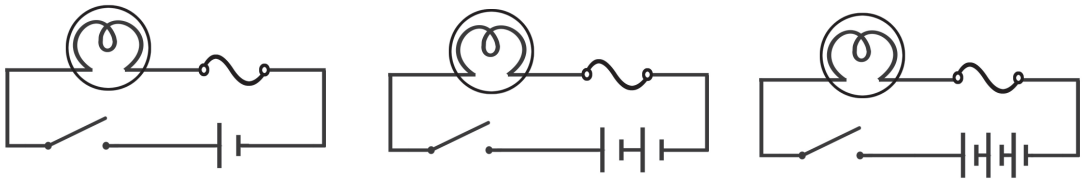
You might have seen lines carrying electricity and also the wires that carry electricity from electric posts to houses. Find out the peculiarities of such conducting wires and write them down in your science diary.

Safety fuse

Hope you have got an idea of some simple electric circuits.

Isn't it very essential to operate devices making sure of the safety of the electrical circuits through which current flows? Safety fuse is one such device used in circuits.

Let's do an activity



Operate the electric circuits arranging them as shown in the figures. As you know, the fuse is a very thin wire. Doesn't the bulb glow now?

What do you observe when the circuit is operated using more cells? Doesn't the fuse wire get burnt off throwing the circuit open?

The fuse wire gets heated when current flows through it. It was the flow of excess current that burnt off the thin fuse wire.

Safety fuse is a device used in circuits as a precaution to protect the circuit and electric devices from damage caused by the flow of excess current.

Observe the circuits in your house and find out where fuses are used. Haven't you understood the importance of the safety fuse?

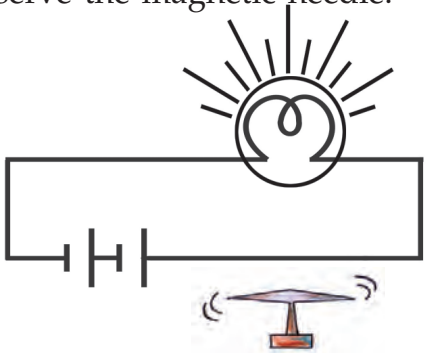
A special type of thin wire is used in the safety fuse. What could be the reason for this?

MCB
(Miniature Circuit Breaker)

Nowadays MCB is used instead of safety fuse in houses. This device breaks a circuit whenever there is an excessive flow of current.

Magnet and electricity

Arrange an electric circuit and keep it switched off. Bring a pivoted magnetic needle just below the copper wire. Observe the direction of the magnetic needle. Now switch on the circuit and observe the magnetic needle.



What do you see? Observe the magnetic needle after switching off the circuit. Don't you see the needle returning to its original position? Now repeat the experiment after placing the magnetic needle above and also

on the sides of the copper wire. What do you observe? Bring another magnet near the pivoted magnetic needle. Does it move instantly? Hope you have understood that a magnetic field is formed around a current-carrying conductor.

Enter the activities and observations in your science diary.

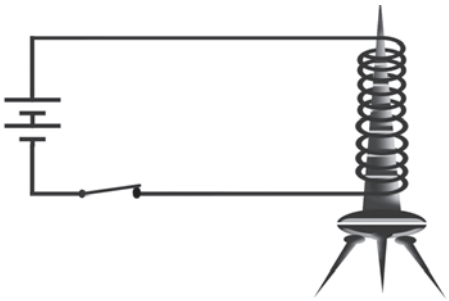
Christian Oersted

Christian Oersted

The scientist Christian Oersted discovered that a magnetic field is produced around a current-carrying conductor. Electromagnets are made by utilising the relationship between electricity and magnetism.

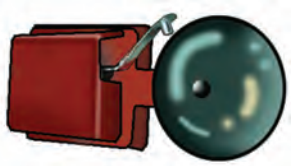
Let's make an electromagnet

Take an insulated copper wire of 75 cm length. Wind it closely over an iron nail from one end to the other. Remove the insulation from both ends of the wire and connect them to a battery. Bring some pins near the nail. What do you see? Here the nail become a magnet temporarily.



There are many devices that make use of electromagnets.

Electric fan



Electric bell

Electric motor

Find out more examples.

Domestic electricity

From where do we get the electricity needed to operate the electric devices in our homes?

Did you notice the newspaper report?

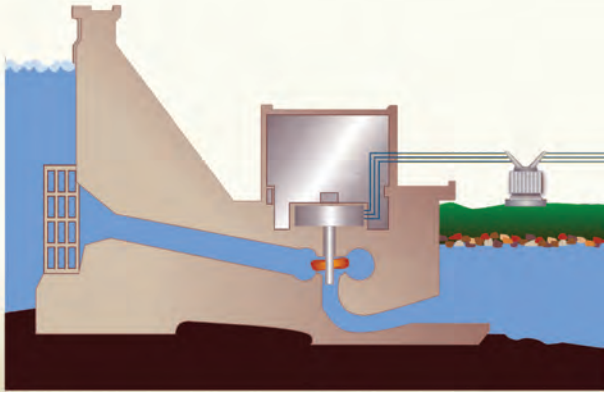
Water level in the dam goes down: Load-shedding likely

Thiruvananthapuram: Load-shedding is likely in the state due to steep fall in water levels in the dams.

What is the relation between the availability of rain and load-shedding?

Hydroelectric power station

Electricity is produced making use of the energy of the water stored in dams. The water stored at a height in a dam is made to flow through penstock pipes to reach the turbine installed at a very low level. The turbine rotates using the energy of flowing water. It makes the generator work and generates electricity. There are arrangements to control the flow of water as per our requirement of electricity.



Observe the picture of a hydroelectric power station. How does the electricity generated at a power station reach our homes?

Never waste electricity!

We know the importance of electricity as the most used form of energy. The regulation of power supply in the form of load-shedding and power cut is imposed when the demand for electricity increases while its production does not. How do we face this challenge? Don't you think we need to use the available electricity judiciously and avoid situations of wasting it?

Given below are certain situations when electricity is wasted. Do such situations arise in your house?

- Bulb and fan switched on even when there is no one in the room.
- TV switched on even when there is no one to watch it.
- Bulbs switched on even during day time.
- Refrigerator left open.

Find out more such situations and add them to the list.

While selecting electric appliances

Star symbols are marked on electric appliances. The number of stars on them indicates the energy efficiency of the device. See that you select electric devices with more number of stars.

What steps can we take to avoid wastage of electricity in such situations?

In the science club, present your suggestions for reducing the consumption of electricity. Remember to prepare pamphlets and posters as well.

Electric shock

You may know that the electricity used at home is more powerful than what you get from a torch cell. Electricity can cause accidents if not used carefully and may even lead to death. Here are some situations leading to an electric shock:

- Operating a switch with a wet hand.
- Removing plug pins when the switch is on.
- Using wires without insulation
- Changing bulb when the switch is on.
-

When you get electric shock

What immediate action should we take to save a person who gets electric shock?

The first thing to do is to cut off the electric connection. For this, either switch off the electric supply or remove the fuse. In case this is not possible, push away the affected person using materials which do not conduct electricity. The person should be taken to the nearest hospital immediately if the shock is severe. Give artificial respiration, if necessary. Warm the body up by massaging softly. If the heart beat ceases, immediately place your palms one over the other on the person's chest and start pressing down and then release. Continue this process until the heart starts beating on its own.

So far, we have discussed the arrangements for the flow of electricity. Idukki power station is the biggest hydroelectric power station in Kerala. We also use the electricity produced in other power stations. Do you know which are the other power stations in Kerala? Collect information regarding them and note them down in your science diary. Imagine an electric circuit that spreads all over Kerala. Isn't it amazing?

Significant learning outcomes

The learner can

- make an electric circuit using torch cells, bulb, switch etc.
- classify substances into conductors and insulators.
- draw electric circuits using symbols.
- make an electromagnet.
- identify a safety fuse and explain its function.
- identify the instances of wastage of electricity and also suggest and implement methods to avoid such situations.
- identify the first aid to be given to a person who gets an electric shock and apply them when required.

Let us assess

1) Though an electric circuit was made using a torch cell, a bulb and a copper wire, the bulb didn't glow. What may be the reason?
   a) The torch cell may be connected in a reverse order.
   b) The copper wire does not touch the cell.
   c) The copper wire is longer than required.
   d) The hand is placed on the torch cell.

2) From an experiment, it was found that copper, aluminium, iron, steel etc. are conductors of electricity. From this, we understand that
   a) Heavy materials are conductors.
   b) All materials are conductors.
   c) Metals are insulators.
   d) Metals are conductors.

3) Is it during the summer or the monsoon season that load-shedding is normally implemented in Kerala? Why?

4) What safety precautions should be taken while handling an electric iron?

Extended activities

1) List out the electric devices used in your home. Examine which of them have star markings.

2) Haven't you seen an electricity bill? What is the information recorded in it? Examine two or three consecutive bills and find out the difference of amount in them. Implement activities to reduce consumption of electricity.