BASIC SCIENCE

Part - 2

Standard VII

Government of Kerala
Department of Education

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

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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 help you understand higher levels of scientific concepts, a window opening to the recesses of the living and the physical worlds. In this journey, you will realise that several instances of day-to-day life are wonders of science. You can partake of the joys of novel experiments and of 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, the need for self-decisions and marching ahead is 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. J. Prasad
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

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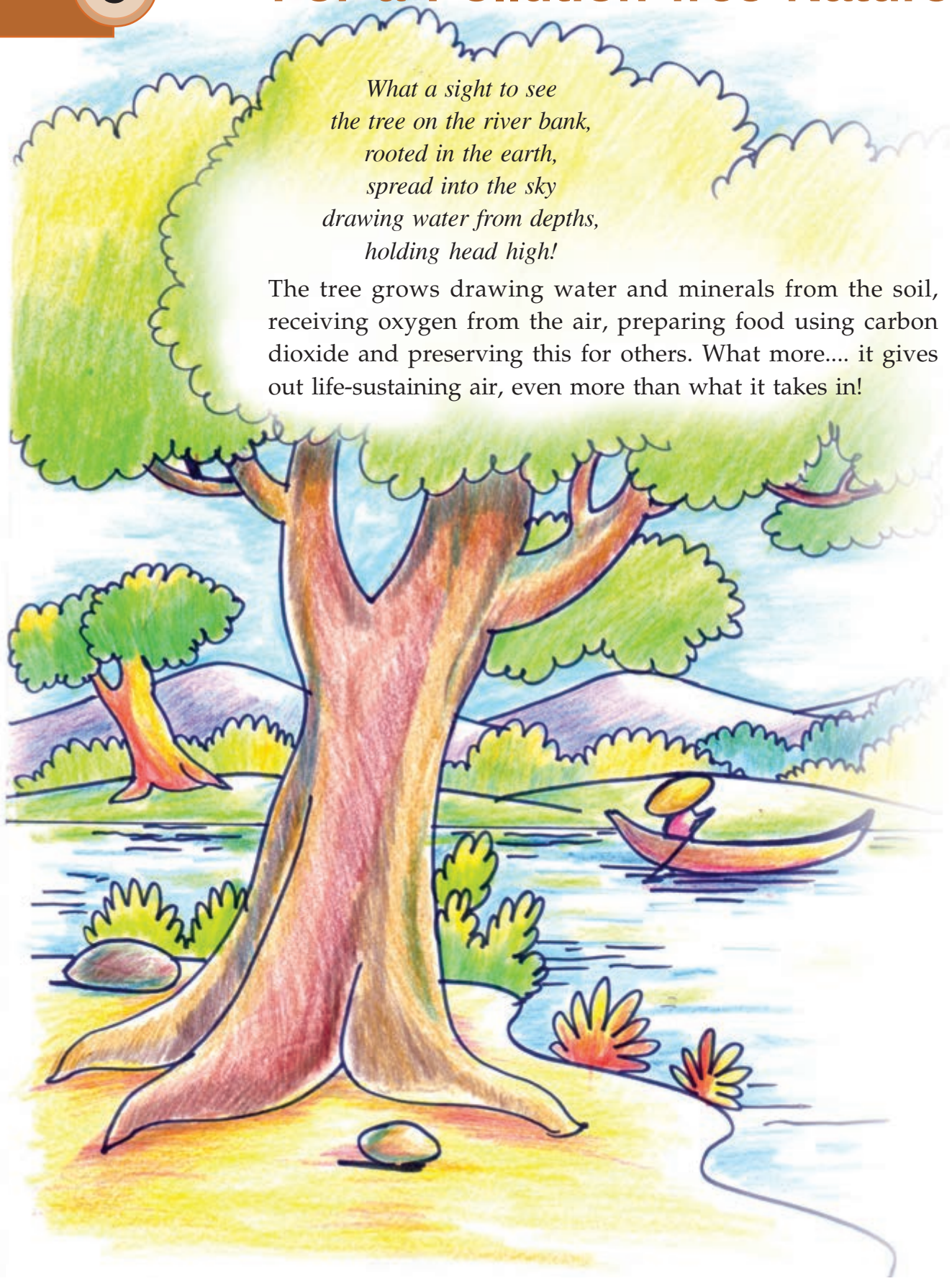
6 For a Pollution free Nature

What a sight to see
the tree on the river bank,
rooted in the earth,
spread into the sky
drawing water from depths,
holding head high!

The tree grows drawing water and minerals from the soil, receiving oxygen from the air, preparing food using carbon dioxide and preserving this for others. What more.... it gives out life-sustaining air, even more than what it takes in!



Soil, water and air are essential for the existence of a tree. How do other living beings make use of them?

Complete the table.

Creature	Air	Soil	Water
Fish	Breathe the oxygen in water	Water bodies exist in the soil	Live in water
Birds			
Insects			
Aquatic plants			
Human beings			

All living beings depend on factors
like soil, air and water directly or indirectly.

Didn't you understand the importance of factors like soil, air and water? What peculiarities of the soil are you aware of?

Soil observation

Is the soil around us the same everywhere? Collect samples of soil from different places and examine. Which are these places?

- Paddy field
- Garden
- Places from where soil has been removed for construction purposes

What should be observed?

- Colour
- Size of grains of soil
- Other particles

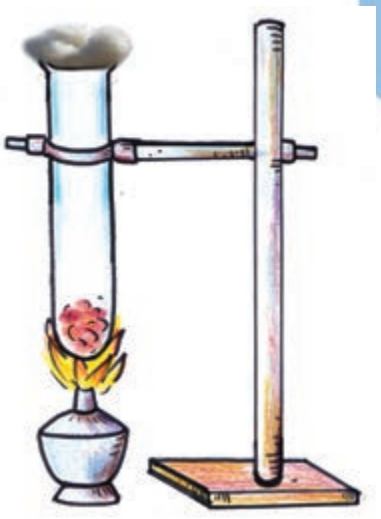
Tabulate the results of the observation in the science diary.

Take a jar half filled with garden soil. Fill the jar fully with water and stir well using a stick. Keep the jar aside for a while. Observe the jar after the top water layer becomes clear.

Don't you see large granules, organic matter and mud getting separated?

Draw the picture and record your observation in your science diary. Note down your findings too.

Moisture in soil



Does soil contain water? Collect soil upto a quarter of a boiling tube from the school premises. Close the boiling tube with a piece of cotton. Heat it for some time using a spirit lamp. After cooling, observe the inner wall of the boiling tube. What do you observe?

Repeat the experiment using soil collected from different places.

Consider the following factors when you observe:

- Do you see any trace of water on the inner wall of the boiling tube?
- Does the water content differ in different types of soil?

Write down the experiment note in the science diary.

Water absorption capacity of soil

Try doing the following activities.

Collect separately some sand, soil from a paddy field and soil from your yard and dry them.

Fold a filter paper into a cone and place it in the funnel in a beaker. Measure out half a cup of sand into the funnel. Arrange separate beakers and funnels in a similar manner with soil from the paddy field and yard. Using a dropper add water drop by drop into the three funnels. Make sure that the soil gets wet thoroughly. Do not forget to record the number of water drops added to each funnel. Continue adding water till the first drop of water drips from the funnel into the beaker.

Type of soil	Number of water drops added

- From which type of soil did water drip out first?
- Which one absorbed the maximum amount of water?

Write down the experiment note in your science diary.

Examine different types of soil in the surroundings of your house in the same manner, using glass tumbler, cloth and perforated coconut shell. Do not forget to present your findings in the classroom.

Organic content of the soil

What happens to the organic residue that reaches the soil?

As you know, organic matter gets decomposed in soil by the action of microorganisms like bacteria and fungi in the soil.

- How can organic content in soil be identified?
- What will be the colour of the soil with high organic content?

Examine the top soil and the deep soil collected from the same area. Is there any difference in colour?

Take equal quantities of sand, red soil and the soil from an area full of trees in three different test tubes. Pour a little hydrogen peroxide to each test tube.

- Which test tube produced the highest effervescence?
- Which soil has the highest organic content? Why?

Hydrogen peroxide

The effervescence is due to the oxygen that evolves during the dissociation of hydrogen peroxide. Hydrogen peroxide dissociates faster in soil with high organic content.

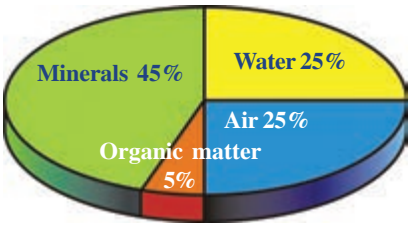
Availability of water, differences in the rate of evaporation, the capacity to retain water and differences in organic content are the reasons for the variation in the water content in different types of soil.

It takes many years for the formation of the top soil which is rich in organic content. The top soil is approximately one foot thick. The deep soil has lower organic content than the top soil.

Didn't you realize that top soil is important? What are the situations leading to the loss of top soil?

Soil with Life

Soil is the basis of the existence of all living creatures. Soil in all areas is not the same. Soil contains air, water, minerals and organic matter. Soil with high organic content is suitable for agriculture and has high water absorption capacity. The water absorption capacity is less for sand due to its lower organic content. Soil contains microorganisms such as fungi and bacteria. They decompose organic matter and thus improve the fertility of soil.



Components of soil suitable for agriculture

Haven't you seen top soil rich in organic content being washed away by rain water?

From which type of land does the soil get washed away?

Soil erosion

Soil erosion occurs mostly during the monsoon season. The roots of trees prevent soil from being washed away. Soil erosion will be greater in places with no trees and plants. The possibility is greater in slope land as well.

What are the different methods to be adopted to prevent soil erosion?

Does soil erode from the premises of your home or school? If so, what can be done to prevent it?

What the soil refuses

Don't we throw away many things to the soil after use? Some of them decompose into the soil. Non degradable substances bring about changes in the natural structure of soil. What are the activities we do that harm the soil like this?

Plastic is non degradable. It remains in the soil for long without degrading. It prevents the seeping of water into the soil and thus prevents the growth of roots.

Chemical pesticides

Chemical pesticides destroy not only harmful insects which destroy crops but also harmless microorganisms. Chemical fertilizers increase the amount of certain components in the soil. Chemicals cause the destruction of earthworms and other microorganisms found in the soil.

- Are your school premises garbage free?
- What can be done for garbage disposal?
  - Sorting garbage by type and disposing them.
  - Making biofertilizers using organic waste.
  - Controlling the use of plastics, reusing them.

Discuss the importance of disposing wastes formed in every institution and house at the origin itself.

Conserving water sources

Do you think waste reaches only the soil?

- Are the water sources such as ponds, rivers and streams in your locality polluted?
- What are the types of pollutants that reach these sources?

Examine the pictures given below:

The lamenting sewage...!

We used to bathe in this brook when we were children. It was full of water round the year. We used the water for all purposes except drinking. Gradually, the number of houses in the locality increased. The number of hotels and other commercial institutions also increased proportionately. Sewage and other waste from them reached the brook. After some time, waste increased enormously. Now people from even distant places deposit waste matter in this brook. It has been transformed into a foul-smelling cesspool due to the deposit of waste and dirty water. Will the brook ever get back its past glory?

Shouldn't we protect water sources from getting polluted? Prepare an action plan to keep the water sources in your locality pollution free.

The amount of pure water available to us is only a small percent of the total water on the earth.

Water source	Percentage
Sea water	96.50
Ice caps	1.73
Ground water	1.69
Atmosphere	0.001
Lakes	0.001
Other bodies	0.078

What are the fresh water sources in your locality?

Can the water obtained from all sources be used for drinking?

Collect samples of water from different water sources in your locality. Observe their peculiar properties and tabulate them in your science diary as given below.

Water quality

The quality of water is determined on the basis of the purpose for which it is used. The highest quality is required for drinking water. Water contains various minerals, oxygen, microorganisms and insoluble impurities. The variation in their levels influences the quality of water. Pure water is neutral. That is, its pH is 7. Water with pH value between 6.5 and 7.5 is used as drinking water.

Characteristics	Water Sources			
	Well	Pond	River	Brook
Colour				
Odour				
Turbidity				
Insoluble impurities (found by filtering using filter paper)				
pH value				

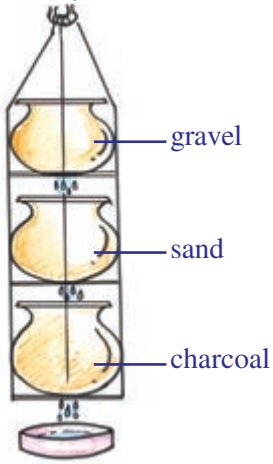
Diseases that spread through drinking water

Diseases spread through water when the disease causing microorganisms grow in water used for drinking. Mixing up of excreta and other pollutants with drinking water is one reason for the pollution of drinking water. The presence of the bacteria *E coli,* which reach water through excreta causes the disease diarrhoea. Typhoid, cholera, dysentery and jaundice are some of the other diseases that spread through drinking water.

What are the methods by which we can purify polluted drinking water?

Water purification

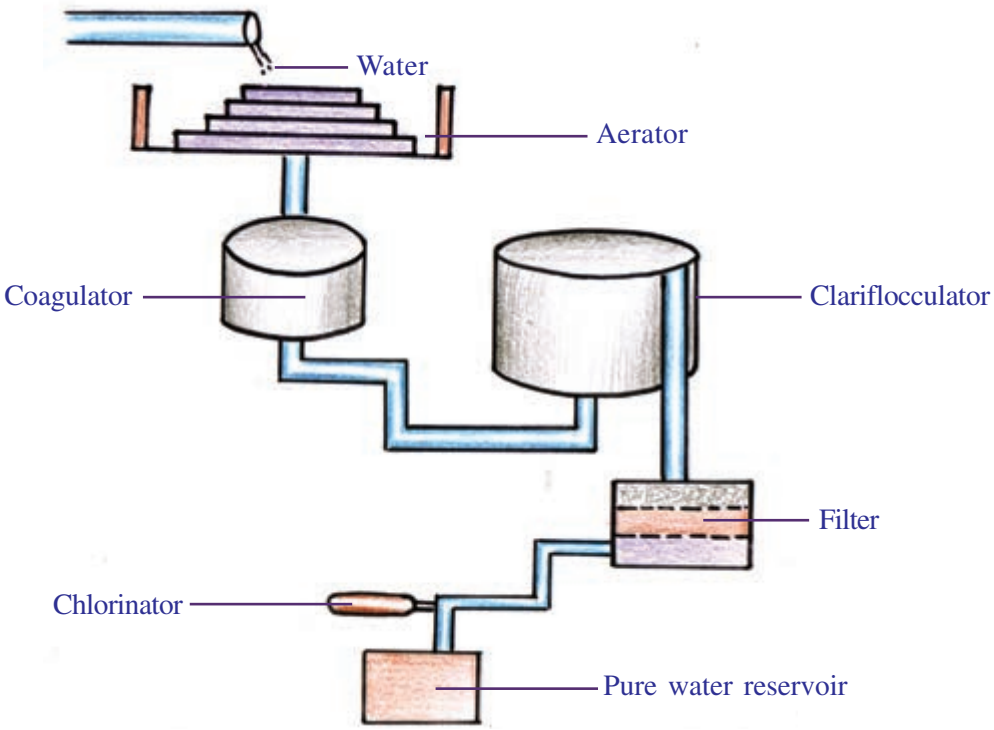
You have been familiarized with the conventional methods of purification of water in your locality. Which are they?



Are these methods enough for water purification when water is used in large quantities?

Let us familiarize ourselves with a few modern methods.

Water treatment plant



Given below are the important steps in the process of water purification in a water treatment plant.

Step 1	Aeration - The process of mixing water with air. Thus the amount of oxygen in the water increases.
Step 2	Coagulation – This is an important step in the process of water purification in a water treatment plant. This enables the sedimentation of solid matter present in water. Alum is added for this. When alum is added the pH value of water decreases. Lime is added to regulate the pH value.
Step 3	Clariflocculation – After the solid waste settles, the clear water is fed into filters.
Step 4	Filtration – Impurities which do not get settled are removed by the filter. Fine sand and gravel are used respectively in the upper and lower portions of the filter unit.
Step 5	Chlorination – Chlorine gas or bleaching powder is mixed with it to sterilize the filtered water,
Step 6	Storage – After purification, water is stored in a water reservoir.

See how many purification steps take place before drinking water reaches your public tap! Is it right to use this water for other purposes?

Have you noticed water being wasted from public taps?

Make a notice or poster to spread the message that drinking water should be used with care.

Water purifiers used to purify water at home have a filter unit and facilities to let ultra violet rays to pass through. Ultra violet rays are used instead of chlorine treatment.

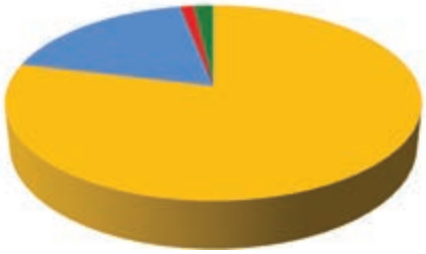
Do you agree with the statement seen on the board? Note down your opinion in the science diary.

Haven't you seen health workers sprinkling bleaching powder into wells to prevent contagious diseases. Why?

Air pollution

Air is as important as soil and water. Can we imagine a situation without air?

What are the components of atmospheric air?



Nitrogen - 78 %
Oxygen - 20.9%
Carbon dioxide - 0.03%
Others - 1.07%

Edubuntu - School Resource
See 'anthareekshavayuvile ghadakangal'.

What happens if the amount of any of the components increases or decreases?

Observe the pictures.

Gases like carbon dioxide and carbon monoxide and smoke containing other chemicals reach air. How does it affect the atmosphere?

Air is said to be polluted when there is any change in the normal amount of any of the components of air or when foreign substances mix with air. Increased rate of pollution creates many health problems.

Examine the table including the other situations in which air gets polluted.

Gas	Source	Harm
Carbon monoxide	Smoke from automobiles	This combines with haemoglobin in the human body and forms carboxy haemoglobin. This reduces the oxygen absorption capacity of blood.
Carbon dioxide	When wood and coal burn	Causes global warming
Sulphur dioxide	From factories	Causes irritation to eyes, lung cancer and asthma.
Oxides of nitrogen	From automobiles and factories	Causes acid rain.

What other steps can be taken to reduce air pollution? Discuss and record them in your science diary.

Edubuntu - School Resource
see - 'Vayumalineekaranam'

The growing city

Listen to what the people of a fast-developing city have to say.

I have been working here for the last five years. The number of vehicles is increasing day by day. Air pollution is also on the rise. Very often, I suffer from intense cough. My doctor says this is due to increased inhalation of smoke from motor vehicles.

This city has many facilities which are not available in other cities. Cooking gas is supplied directly through pipelines. We don't have to wait for the gas cylinder to be replaced. There are big malls where rice, vegetables and other provisions are available.

We strive to serve this city to the best of our ability. It is indeed a very difficult job. The population increases every year. But the facilities cannot be increased proportionately. From where can we get enough pure water for the residents in the city? Where can we dispose the waste produced by the people? People might now feel that this is not a problem. But 'tomorrow', it will definitely be a big problem.

This city is dying. The young generation believes that this is the best city in the country. They haven't seen the old city. Apartments have been constructed by filling many water bodies. Trees have been cut down to construct buildings and roads.

This city is really wonderful. Here, the standard of living is very high. I won't get such a high salary elsewhere. Public conveyances, shopping centres, schools and places for entertainments - all really great! This city is very lively.

Towards a Green future : Centre for Environment Education
Malayalam translation - 'Harithabhaviyilekku'

Didn't you notice the opinions of different people living in the same locality?

Everyone needs facilities. Every new facility brings forth its own problems. The amount of waste also increases with the increase in population.

- Shouldn't physical facilities increase?
- Does the increase in the number of vehicles increase the rate of air pollution? Do they pollute soil and water in any way?
- Aren't unpolluted air, water and soil the right of all living beings?
- Don't we need a mode of development that protects air, water and soil?

Analyse these ideas and conduct a seminar in your school on the topic 'Sustainable Development'.

While preparing the paper for the seminar, do not forget to include practical suggestions too in the report.

- Planting of trees.
- Use of public conveyance
- Obeying rules of pollution control.
- Disposal of waste at the origin itself.
- Avoid throwing electronic goods and plastics away after use.

Significant learning outcomes

The learner can

- explain how factors like soil, water and air are important for the existence of living beings.
- identify the natural components of soil, water and air.
- identify situations in which air, water and soil get polluted, and suggest remedies.
- carry out experiments accurately and precisely, to identify the natural components and properties of soil
- engage in awareness campaigns for the conservation of soil, air and water.
- engage in planting trees and other activities for the conservation of nature.

Let us assess

1. In which of the following water samples should lime be added?

   a. pH 7 b. pH 5
   c. pH 9 d. pH 8

2. When water is poured into a perforated coconut shell filled with gravel, water drops come out through the hole of the coconut shell quickly. What inference can be arrived at from this?

   a. Organic content in soil is high.
   b. Water absorbing capacity of soil is low.
   c. Water absorbing capacity of soil is high.
   d. The soil is suitable for cultivation.

3 What are the circumstances that cause an increase in the amount of carbon dioxide in the air?

4 What are the precautions to be taken to prevent the spread of diseases through water?

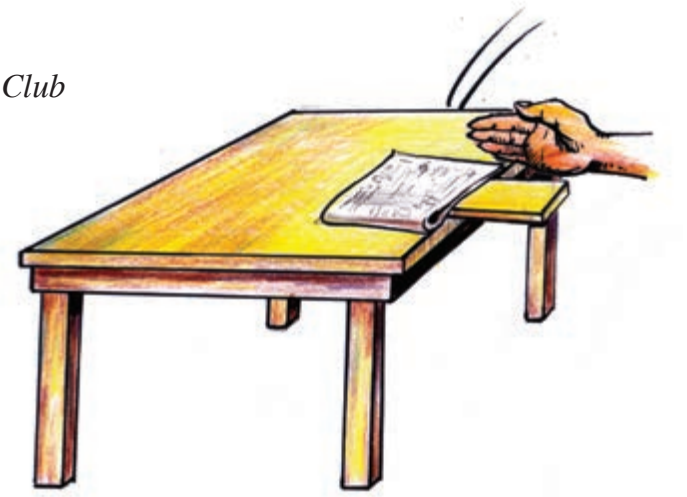
Extended activities

1. Construct a model of a water treatment plant using cardboard box and PVC pipes. For more information -

   Harithabhaviyilekku, Jalam (Kerala Water Authority)

7 Pressure in Liquids and Gases

The teacher who came to inaugurate the Science Club began with an experiment.



He placed a wide wooden ruler on a table, some part of it projecting out. A newspaper, folded eight times, was placed on it. He then asked a boy to press quickly on the free end of the ruler with his hand. The boy did so and the paper fell down.

Then he unfolded the same paper and placed it over the ruler on the table. He asked the boy to quickly press on the ruler again. He could neither raise the paper nor make it fall down.

Let us also do this experiment.

Isn't the weight of the paper the same when it is folded and unfolded?

- Why couldn't the paper be lifted up when unfolded?
- What force is effected so that the paper could not be raised?

Discuss your findings in the class.

You may know certain properties of air. Air is present all around us. Air requires space. Air possesses weight. Atmospheric air exerts force on the paper.

Forward...backward

Remove the needle of a syringe and observe the working of the piston pulling it back and pushing it in. When the pushed in piston is pulled back, atmospheric air rushes into the barrel of the syringe. When the piston is pushed in, the air that entered the barrel moves out.

Now try some other experiments using the syringe.

- After pushing the piston into the syringe, close the open end of the syringe with your finger. Then pull the piston back quickly and release it.

Don't you see the piston moving fast into the barrel? Can you explain its reason?

- After keeping the piston pulled back, close the open end of the syringe with a finger. Now, push the piston in and release it.

In which direction does the piston move now?

What is the reason for this movement?

Don't we apply force when we push in and pull out the piston? But when we released the hand, the piston moved inwards in the first case, and outwards in the second case. What was the force applied on the piston?

Write down the inferences made from observing the two experiments in your science diary.

Pressure of Gas

You have found that air can exert force. The force exerted by gas per unit area of the surface is called the pressure of gas. The force exerted per unit area by atmospheric air is called atmospheric pressure.

Based on the concept of atmospheric pressure, the experiments you have done can be explained as follows.

- When the piston is pulled back keeping the open end of the syringe closed, the pressure inside the barrel decreases. In order to equalize the pressure, the air from outside exerts force on the piston. Hence the piston moves inwards.
- When the piston is pushed in keeping the open end of the syringe closed, the air inside gets compressed. The pressure of this air is greater than that of the air outside. The pressure of air inside the barrel pushes the piston outwards.

Now, based on the concept of atmospheric pressure, try to explain the experiments done keeping the paper folded and unfolded on the table.

The balloon in the bottle

Pour hot water into a glass bottle of more than half a litre capacity. Blow air into a balloon and remove the air from it. Repeat it two or three times.

Pour out the hot water from the bottle and fix the balloon at the mouth of the bottle immediately. Allow the bottle to cool. What will happen to the balloon?

Record the result of your observation.

The air inside the bottle from which hot water is removed is hot and expands. When the bottle cools, the air inside the bottle also cools.

- Now, which is higher - air pressure inside the bottle or outside it?

Write down in your science diary the reason for the inflation of the balloon into the bottle.

Pressure of gas in daily life

Sometimes we need to transfer liquid from a vessel kept at a higher level to another vessel. Haven't you seen the use of tubes for such cases?

Can you transfer water from a bucket to another vessel using a plastic tube?

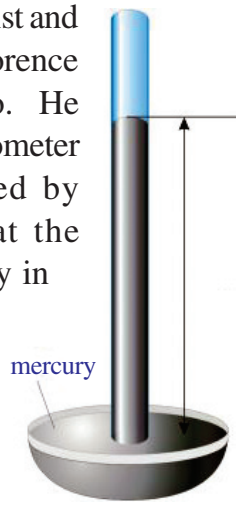
Immerse one end of the tube in the water in a bucket and keep the other free end in a small vessel as shown in the figure.

- Does water flow down?
- Why doesn't water enter the tube?

Barometer

Torricelli

Barometer is a device used to measure atmospheric pressure. There are different types of barometers. It was a scientist named Torricelli who first made a barometer and measured atmospheric pressure. Evangelista Torricelli was born in Italy on 15th October 1608. He was a physicist and mathematician. He went to Florence in 1641 to work with Galileo. He formulated the principle of barometer using mercury, as suggested by Galileo. He discovered that the change in the level of mercury in the tube is due to the change in atmospheric pressure. Accordingly he made a barometer in 1644.



Mercury Barometer

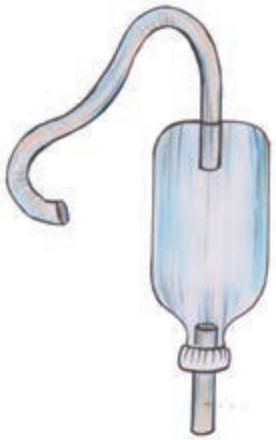
Suck the air out of the tube with your mouth and place it in the smaller vessel. What happens now? Explain.

What if the bucket contains kerosene instead of water? Is it safe to suck out air using the mouth? Let us make a simple apparatus for such needs.

Siphon making

Materials required : 1½ metre long plastic pipe, a small plastic bottle.

Method of construction: Cut a 10 cm long piece from the plastic pipe. Make a small hole at the bottom and on the lid of the plastic bottle. Fix the long pipe through the hole at the bottom and the small pipe through the hole in the lid so that the bottle is airtight.



Working : Immerse the end of the long pipe in the water in a bucket placed at a height. Keeping the small pipe in another vessel, gently press and release the bottle two or three times. You can see water flowing from the bucket to the lower vessel.

How does this happen?

A portion of the air inside the bottle moves out when the bottle is pressed. The pressure inside the bottle decreases when the bottle is pressed and released. Water rushes through the pipe due to the atmospheric pressure experienced on the surface of the water in the bucket. Water flows out continuously too.

Siphon is a device that works on the basis of atmospheric pressure. There are other devices like this which work on the basis of atmospheric pressure. See some examples. Try these devices and write down the method of their working in the science diary.

Device	Figure	Method of working
Syringe		
Straw		
Dropper		

Some activities are given below.

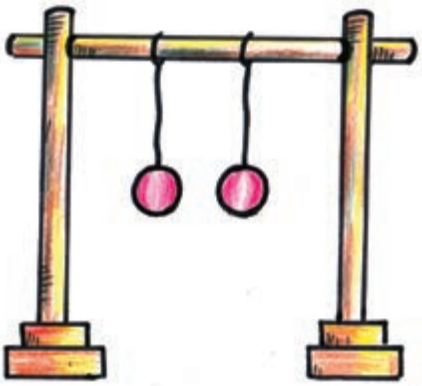
- Fill a glass tumbler with water. Close its mouth with a paper card and invert it. Does water flow out?
- Fix a vacuum hook on a mirror and pull it backwards.

Remember to write down in your science diary the results and inferences of the experiments done.

Coming close... moving apart

Suspend two identical plastic balls on strings as shown in the figure. What happens when you blow air between the balls? Note down your guess.

Do the experiment and write down the results of your observation. Explain the reasons too.



When air is blown between the balls, the air between the balls moves faster. As a result the pressure of air between the balls decreases. As the pressure of air around the balls is comparatively higher, the balls are pushed closer to each other.

Try the experiments given below and explain the reason.

Can you insert a paper ball into a bottle?

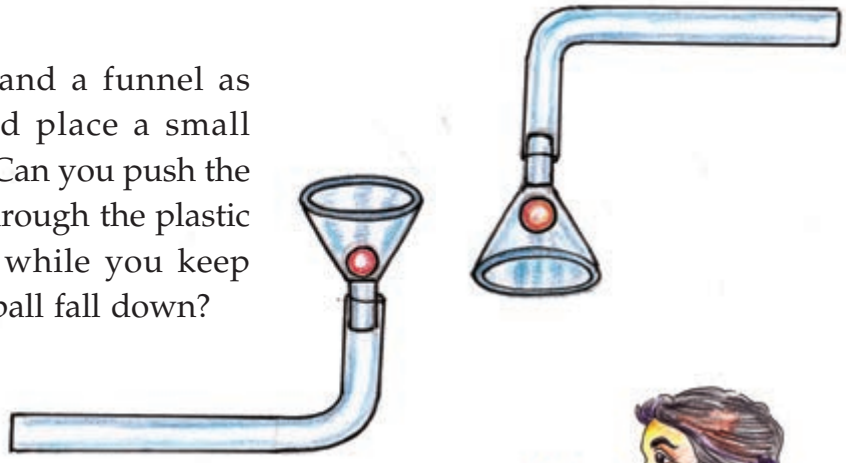
Place a piece of paper crumpled into a small ball at the mouth of a bottle with a narrow neck. Blow air strongly through one side of the mouth of the bottle as shown in the figure. What is your observation? What happens to the paper ball?

Blowing a paper up!

Cut a piece of paper 20 cm long and 3 cm wide. Hold the paper piece close to your lower lip and blow air over it. What happens to the paper?

Ball in a funnel

Arrange a plastic pipe and a funnel as shown in the figure and place a small plastic ball in the funnel. Can you push the ball out by blowing air through the plastic pipe? Invert the funnel while you keep blowing in air. Does the ball fall down?



Can you put out the flame?

Place a lighted candle on a table.

Try to blow air onto the flame using a funnel. Does the flame extinguish?

Tabulate the observation results of these experiments.

Experiment	Observation result	Explanation
Paper ball		
Blowing a paper up		
Ball in the funnel		
Can a candle be put out by blowing air through a funnel?	The candle flame is not put out. The flame comes close to the funnel	The flame moves closer because the pressure there reduces when air moves out fast.

Do you find any peculiarity in common in all these experiments?

Pressure of air reduces when it moves fast. This principle was explained by a scientist named Bernoulli. Hence it is called Bernoulli's Principle.

Bernoulli

This principle is utilised in the take off of aeroplanes and in aerodynamic structures of motor cars.

Liquid pressure

Can liquids also exert pressure as air does?

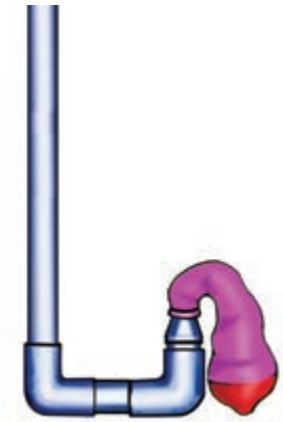
Try this experiment. Tie a polythene bag firmly on your hand and immerse it in a bucket of water as shown in the figure.

Explain the result of the observation.

Don't you feel the polythene bag sticking to the hand?

What force presses the bag to your hand?

The filling balloon



Materials required: Three pieces of one inch PVC pipe in the lengths of 50 cm, 5 cm and 5 cm, two elbows and a reducer.

Arrange these materials as shown in the figure. Fill the smaller pipe with water and fix a balloon there.

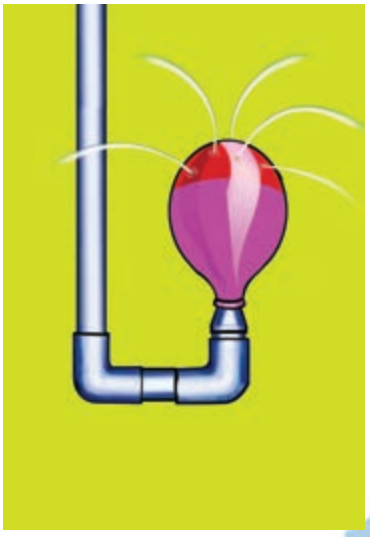
Now pour water through the free end and observe the change taking place in the balloon.

The pressure exerted by a liquid is called liquid pressure.

The polythene bag sticks to the hand because water exerts pressure on all sides of the polythene bag.

The reason for the inflation of the balloon fixed to the PVC pipe is also due to the pressure exerted by water.

Pressure everywhere



Do liquids exert pressure in all directions?

Activity 1

Fill air in a balloon and fix pieces of cellotape at different parts of the balloon.

Make small holes using a needle on the balloon at the portions where the pieces of cellotape are fixed. Repeat the experiment done earlier using this balloon.

- Does water gush out in all directions?
- What inference do you arrive at from this?

Activity 2

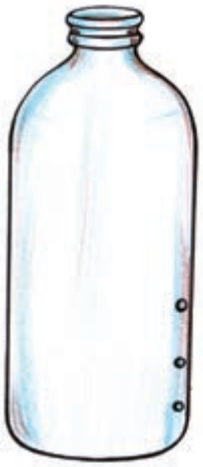
Make a few small holes of the same size around a plastic bottle, 3 cm from the bottom. Pour water into the bottle.

Observe water flowing out through the holes.

What are the peculiarities of the water flowing out?

From these experiments you might have understood that liquids exert pressure in all directions.

Depth and pressure



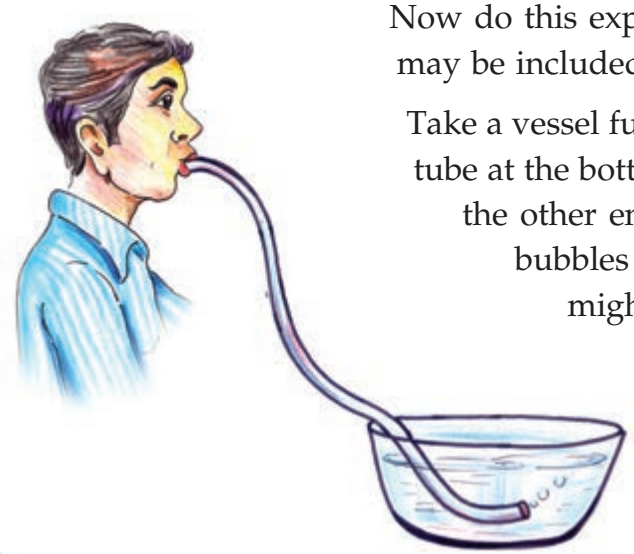
Haven't you learnt that liquids exert pressure in all directions? Is the pressure same at all parts of the liquid? Let us do an experiment to find this.

Make 3 holes in equal distance from each other upwards from the bottom of a long plastic bottle. Fill the bottle with water keeping the holes closed. Observe the flow of water coming out.

- Does the water coming out through all the holes fall at the same distance?
- What is the change in liquid pressure towards the bottom?
- Is there any change in the flow of water when its level in the bottle falls?

Didn't you understand that liquid pressure increases with the increase in depth?

Rising air bubble



Now do this experiment. Your observation and inference may be included in the science diary.

Take a vessel full of water. Keep one end of a thin plastic tube at the bottom of the vessel. Blow air gently through the other end. Is there any change in the size of the bubbles rising from the bottom to the top? What might be the reason?

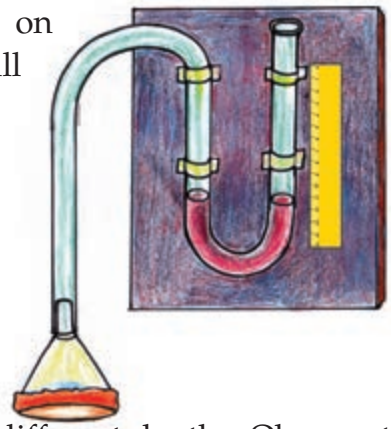
- Can you explain the reason for providing wider basements while constructing dams?

Pressure gauge

Pressure gauge is a device used to measure liquid pressure. Let us try to make a pressure gauge.

Materials required: Transparent plastic tube (about 1½ metre long), funnel, balloon, wooden board, clamp, ruler.

Method of construction: Fix a plastic tube in 'U' shape on a wooden board using clamps. Fill water in the 'U' portion. Make a diaphragm using balloon on the wider portion of a funnel.



Fix the funnel at the free end of the tube as shown in the figure. Fix the ruler on the board.

Method of working: Take a bucket full of water. Hold the funnel in the water at different depths. Observe the change in the level of water in the tube and write it down in the table.

Position of funnel	Level of water in the tube (cm)
At the surface of water	
At the middle of water in the bucket	
At the bottom of water in the bucket.	

Analyse the table: What are the inferences you can arrive at?

Take the same quantity of different liquids and compare the pressure exerted by them.

Can the pressure exerted by gases be measured using this device? Try the experiment using an inflated balloon instead of a funnel.

Significant learning outcomes

The learner can

- explain concepts such as gaseous pressure, liquid pressure and atmospheric pressure.
- analyse the working of devices which utilise pressure.
- plan experiments related to pressure and carry them out with precision and accuracy.

- construct and use devices related to pressure.
- recognise situations in which gas pressure, liquid pressure and atmospheric pressure are used in daily life.

Let us assess

1. Find the situation that helps us to understand that gas exerts pressure in all directions

   (a) Drinking water using a straw

   (b) Blowing air into a balloon

   (c) Blowing of wind

   (d) Rising up of steam

2. It was not possible to drink water using a straw with a hole on its side. Why?

   a. Water flows out through the hole in the straw.

   b. Air pressure inside the straw increases.

   c. Air moves out through the hole in the straw.

   d. Air pressure inside the straw does not decrease.

3. Why do sea-divers wear special costume?
4. Haven't you seen an injection needle fixed at the top of a drip bottle when a drip is administered to patients in hospitals? Why?
5. Haven't you noticed sheets, tiles etc. fixed on the roofs of buildings rising up when a strong wind blows? Why does this happen?

Extended activities

1. You have done the experiment in which a glass tumbler completely filled with water and covered by a paper card is held in an inverted position. Try this experiment changing the amount of water in the glass. Remember to do these experiments changing the size of the paper card used to cover the glass tumbler and holding the glass tumbler in an inclined position.

8 Breath and Blood of Life

Anumol's swimming lessons

"I will never forget the day I went with my father to learn swimming. Lying in my father's hands, I moved my hands and legs in a rhythm, trying to swim. Quite unexpectedly my head sunk down for a moment and water rushed into my mouth and nose. I could not breathe for some time. Oh, what a horrible experience it was!"

Did you listen to Anumol's experience? We can't live without breathing even a minute, can we?

Now let us try to hold our breath. Who can hold breath for longer time?

After a certain period, we tend to breathe involuntarily. Doesn't it mean that we cannot live without air?

We breathe about 20,000 times a day. We may not be aware of it. How many times do you breathe in one minute? Try to find out.

Breathing

What happens when we breathe?

Inhale deeply. Don't you feel air moving inwards?

Now keep your palm below your nose and slowly release the air. What do you feel now?

The process of inhaling air is called inspiration and the process of exhaling air is called expiration

Movement of the ribs

Now keep your palms on both sides of your ribs and breathe deeply.

What change occurs to the rib cage while inhaling and exhaling?

Record it in the science diary.

While inhaling	While exhaling
Rib cage expands	.....

Do other familiar organisms also breathe this way? Observe the movement of their ribs and write down the findings.

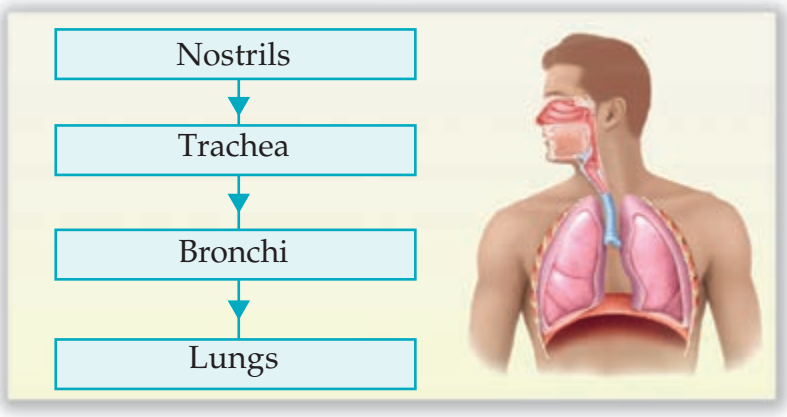
What have you learnt from the observation?

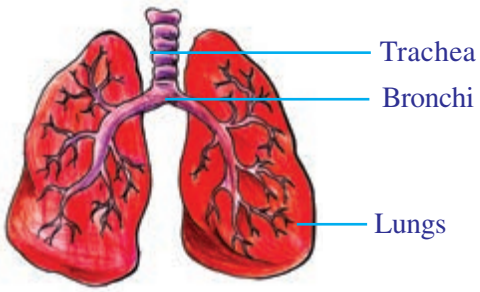
Where does the air we take in during inspiration go?

Let's familiarize ourselves with the parts through which inhaled air passes.

Respiratory system in humans

A pair of lungs is the main respiratory organ in human beings. Lungs are situated in the thorax inside the rib cage. How does air reach here? What are the organs involved in this process?





Structure of the lungs

The nose, trachea, bronchi and lungs are parts of the human respiratory system. The trachea is like a long pipe. Bronchi are the branches of the trachea. The wall of the trachea is strengthened by C-shaped rings of cartilage. Lungs are like sponge. There are many air sacs in them. The right lung is slightly larger than the left lung.

During respiration

Haven't you understood the parts of the respiratory system and the peculiarities of the lungs?

Let us see how the air that enters the nose reaches the lungs. You know that the lungs are like sponge. When the lungs expand, air enters it. When the lungs contract, the air moves out. Since the lungs do not possess muscles, they cannot expand or contract on their own. If so, how does the movement of the lungs become possible?

There are certain mechanisms in our body that enable the expansion and contraction of lungs.

Let us construct a model to understand the working of the lungs.

Constructing a model of lungs

Materials: Y-shaped tube, a large balloon, two small balloons, a one litre plastic bottle, cork.

Method of construction: Cut the plastic bottle to half its size.

Fix two small balloons at both ends of the Y-tube. Make a small hole in the cork and fix the Y-tube through the hole as shown in the picture.

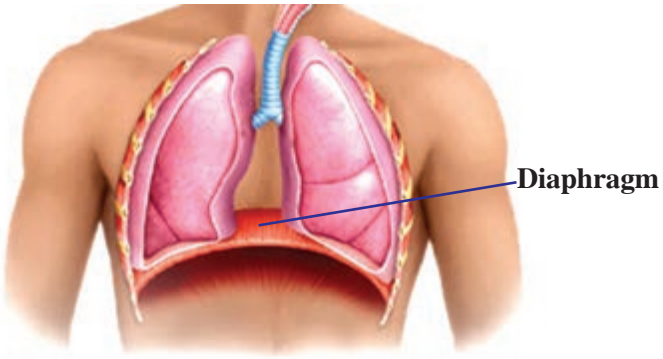
Cut the large balloon into two halves and fix one half tightly around the open part of the bottle.

Method of working: Hold the balloon at the middle and pull it slowly downwards as seen in the picture. Observe the change in the balloons inside the bottle. Now leave the balloon free. What change do you observe?

- Why do the two balloons inside the bottle expand when the tightly tied balloon is pulled downwards?
- Why do the balloons in the bottle contract when the balloon is left free?

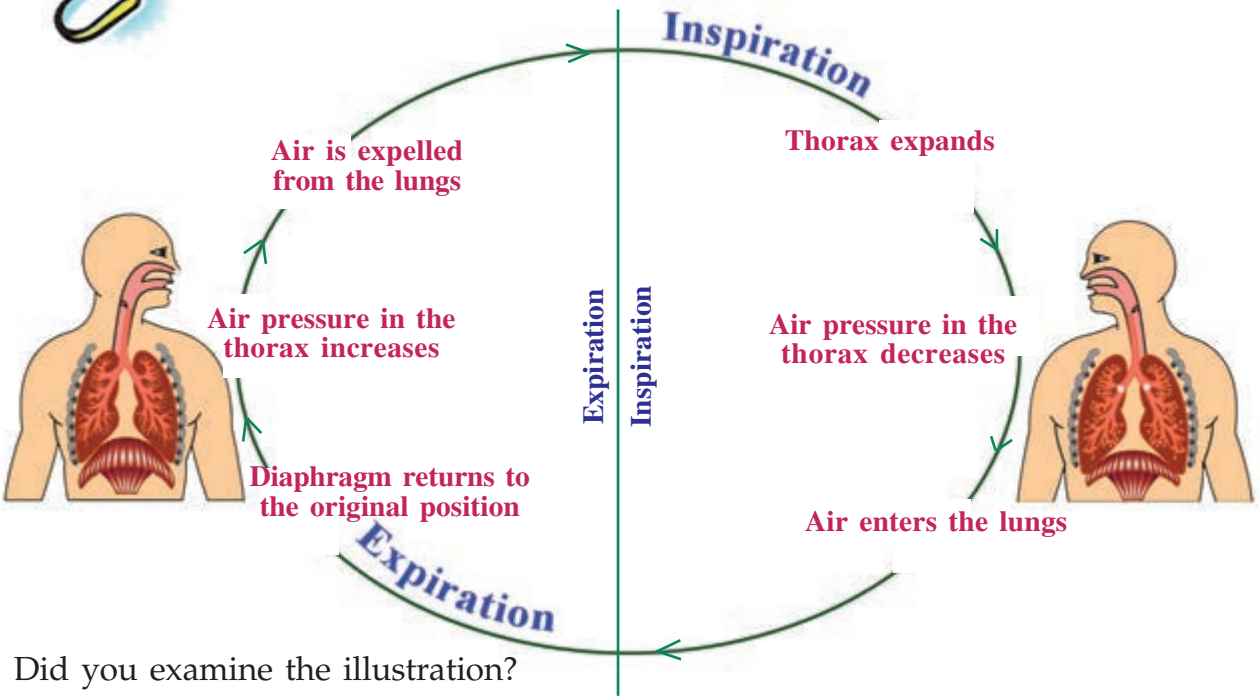
The expansion and contraction of the lungs is almost like this. Similar to the balloon tied firmly at the base of the bottle, there is a part called 'diaphragm' in our body to control the expansion and contraction of the lungs.

The expansion and contraction of the lungs is made possible by a layer of muscles at the base of the thorax called diaphragm and by the muscles attached to the ribs.



Didn't you read the description of the diaphragm? Observe the picture:

Edubuntu - School Resource see 'swasanaprakriya manushyanil'.



Did you examine the illustration?

Can you now explain the expansion and contraction of the lungs?

Analyse the table given below.

Inhaled air	Quantity (in percentage)
Oxygen	21
Carbon dioxide	0.04
Nitrogen	78
Water vapour	0.96

Exhaled air	Quantity (in percentage)
Oxygen	15
Carbon dioxide	4
Nitrogen	78
Water vapour	3

- What are the components that vary in quantity in inhaled and exhaled air?
- What are the components expelled through respiration?

Do the following activities to find out whether exhaled air contains water vapour and carbon dioxide.

Activity 1

Exhale air onto a mirror. Don't you see something like mist on the mirror? This is water vapour formed by the cooling of exhaled air on the mirror.

Activity 2

Fill two beakers upto half with clear lime water. Blow into one beaker with a straw. Pass atmospheric air repeatedly into the other beaker using a dropper. Observe the colour change in both the beakers.

Milky colour

Lime water is calcium hydroxide. When carbon dioxide is passed through clear lime water, calcium carbonate is formed. The clear lime water turns milky in colour.

Haven't you understood the reason why clear lime water turns milky?

When the windpipe is blocked

At times, when food or other substances enter the trachea, our breathing gets blocked. In such situations, if immediate first aid is not given, life may be in danger.

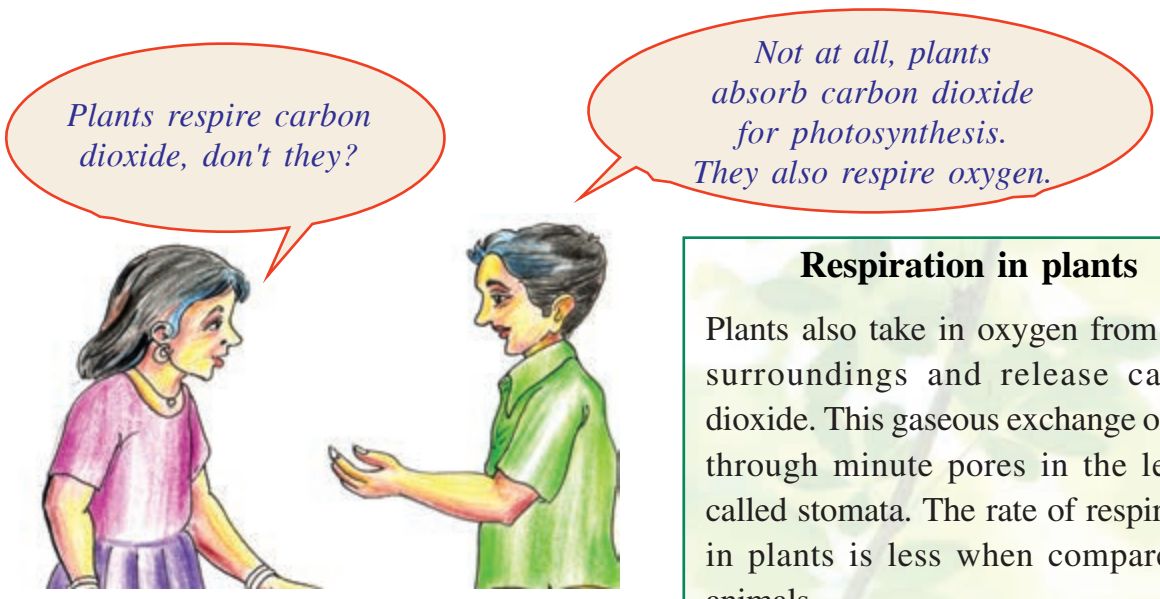
Hold around the abdomen of the person from behind. Fold one palm and place it below the ribs. Keep the other palm on top of it and press quickly.

In infants

Place the child facing downward in the lap and tap strongly between the shoulder bones.

Diversity in respiration

 **Amoeba**	There is no specific respiratory organ in amoeba which is a unicellular organism. Air diffuses in and out through its cell membrane.
 **Earthworm**	The respiratory organ of the earthworm is its moist skin. This is why earthworms are always seen in moist soil alone.
 **Insects**	Rows of small openings can be seen on the sides of the body of all insects. A network of tubules seen attached to them is the respiratory organ in insects.
 **Fish**	Gills are the respiratory organ of fish. When water is taken into the mouth which passes through the gills, the oxygen in the water gets transferred into the blood. Haven't you seen the fish in aquariums open their mouth and take water frequently? What could be the reason? Certain fish have the mechanism to inhale atmospheric air directly, besides breathing using gills. This is only a temporary mechanism. So they can't live on land for a long time. Fish like cat fish (*mushi*), snake head fish (*varaal*), eel etc. have this ability.
 **Amphibian**	They can respire through lungs when they are on land and through skin when they are in water.



Respiration in plants

Plants also take in oxygen from their surroundings and release carbon dioxide. This gaseous exchange occurs through minute pores in the leaves called stomata. The rate of respiration in plants is less when compared to animals.

Edubuntu - School Resource See 'vathakavinimayam sasyangalil.'

Didn't you listen to the argument between Sunu and Vinu?

What is your opinion?

Do plants breathe?

What are the gases exchanged during respiration in plants?

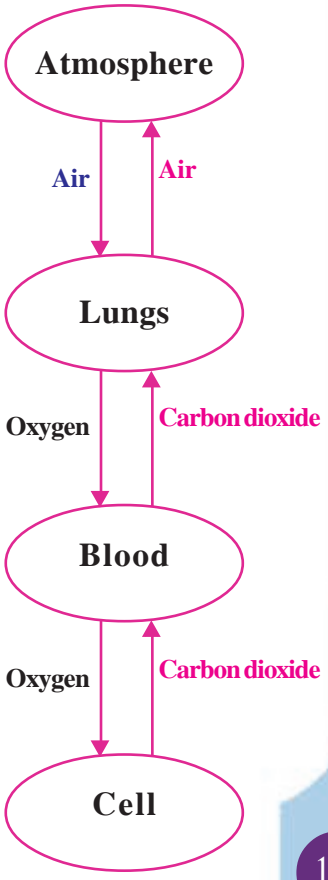
Didn't you understand that all organisms respire?

Respiration is the process by which organisms take in oxygen from the surroundings and release carbon dioxide.

Inhaled air into the blood

What happens to the oxygen that reaches the lungs? Haven't you learnt that respiration is the exchange of gases? This gaseous exchange has three stages. We have so far discussed the first of these stages. Observe the given illustration. How does the oxygen that enters the lungs reach the cells and the carbon dioxide formed in the cells reach the lungs?

Haven't you understood from the illustration that it is the blood that carries oxygen to all cells and receives carbon dioxide from the cells and carries it to the lungs? You have also learnt earlier that digested food components from the small intestine are carried to the cells by the blood.



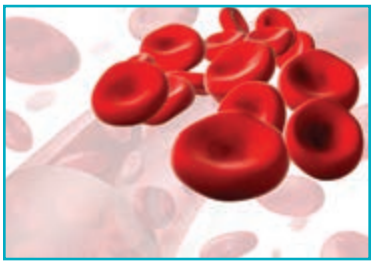
It is oxygen that breaks up food components reaching the cell to release energy.

You have understood that blood carries oxygen and nutrients. What are the other substances transported through blood?

Can you explain why certain medicines, glucose etc. are injected into the blood?

- Do all organisms have blood?
- Is the colour of blood in all organisms red?

In human blood

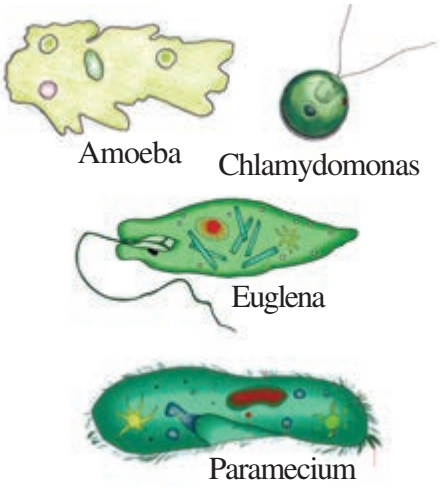


Isn't the human blood red in colour? This is due to the presence of a pigment in blood called haemoglobin. It is a compound of iron and protein. Haemoglobin plays a part in carrying oxygen and carbon dioxide.

In other organisms

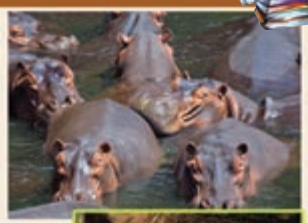
Transportation of substances in insects takes place through the fluid filled in their body cavities. Since haemoglobin is absent, it is not red in colour; nor does it have specific tubes to flow through.

There is no need of a separate mechanism to transport substances in unicellular organisms. The medium of transport is cytoplasm.



Blood is not present in all organisms. But all organisms have a mechanism for transporting oxygen and nutrients.

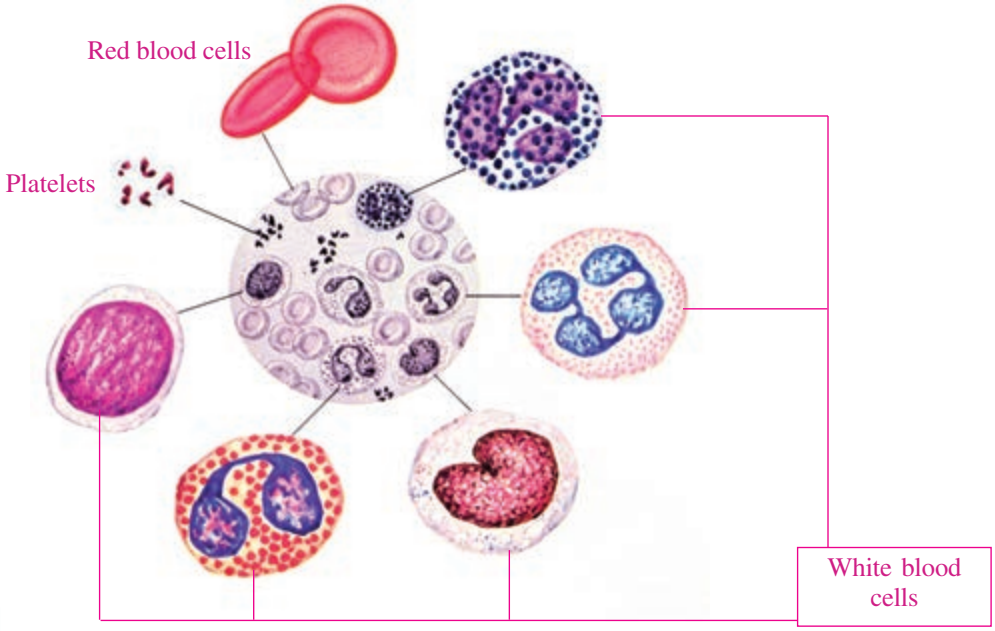
Blood sweat



The hippopotamus is known as an organism which has red sweat. The red drops secreted to the outside of the skin is called blood sweat. But it is neither blood nor sweat. It is a secretion released by glands situated just below the skin to destroy pathogens.

Let us observe blood cells

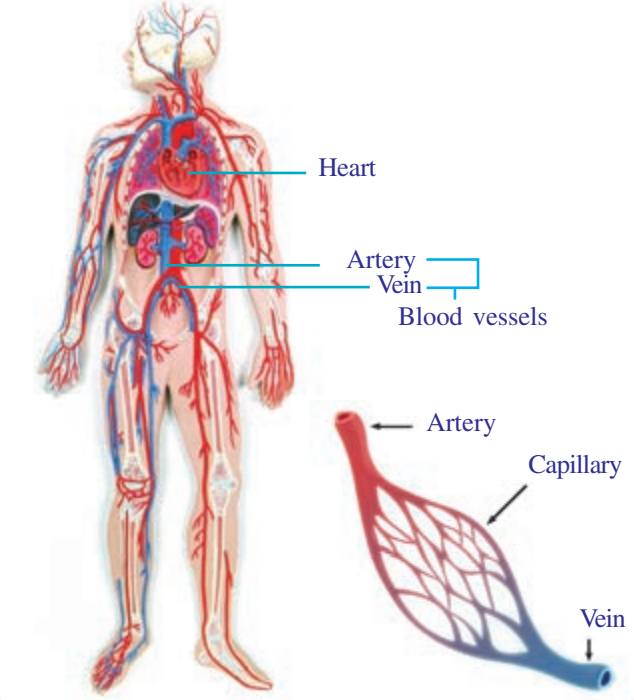
Observe a slide of blood cells through the microscope. Identify the different types of cells with the help of the chart given below.



Edubuntu - School Resource see 'Rakthakosa nireekshanam'

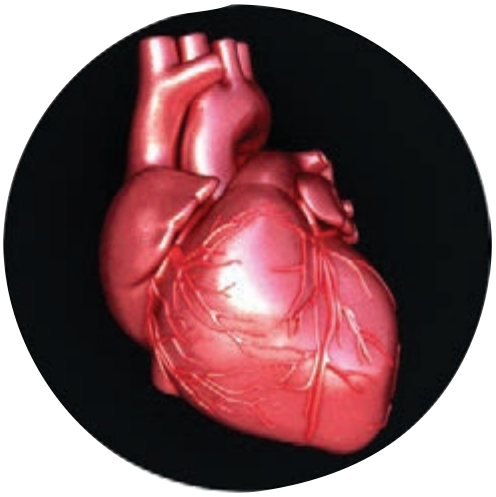
Blood is composed of cells like the red blood cells, white blood cells, platelets and the fluid part called plasma. White blood cells are of five types. More than 90 percent of plasma is water.

Blood circulation



How does blood reach all parts of the body? Observe the picture. Blood circulation is the transportation of blood from the heart to all parts of the body and from all parts of the body to the heart. What are the parts included in the blood circulatory system?

The blood circulatory system includes the heart, blood vessels and blood. The human body has three kinds of blood vessels- the arteries, veins and capillaries.



The human heart

Heart is the centre of the blood circulatory system. The heart pumps blood to all parts of the body. What are the peculiarities of the human heart?

- size of one's fist
- protected inside the thorax by ribs
- lungs on either sides
- covered with a double membrane called pericardium
- contains four chambers

Do all organisms have a heart?

Does the heart of all organisms have four chambers? Haven't you seen the device in the picture?

What is this device?

What is its use?

Let us also make a device like this.

Five pairs of lateral heart

Thirteen chambered heart

Two chambered heart

Three chambered heart

Four chambered heart

Four chambered heart

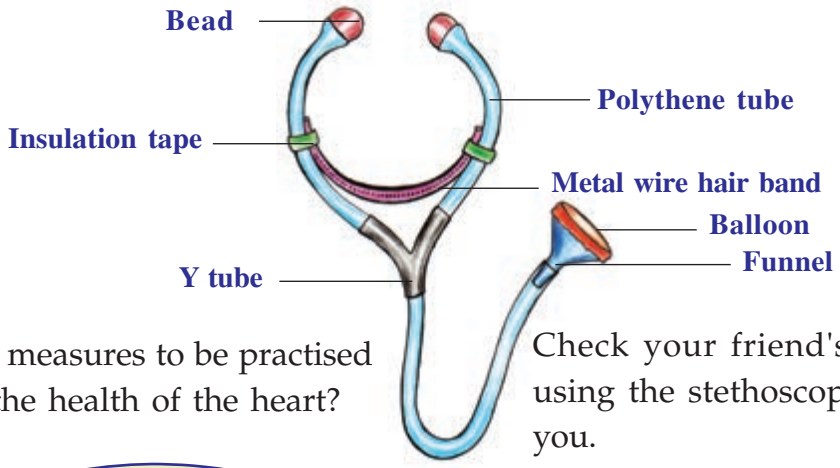
Rene Laennec

The stethoscope is a device used to know heart beat. It was first made by the scientist Rene Laennec.

Let us make a stethoscope

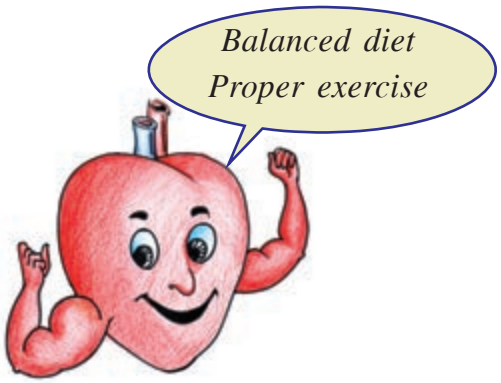
Materials required:

Polythene tube, 'Y' tube, beads, balloon, funnel, steel tongue cleaner /metal wire hair band, insulation tape.



What are the measures to be practised to maintain the health of the heart?

Check your friend's heartbeat using the stethoscope made by you.



Rhythm of the heart

The heart of a human embryo begins to beat from the day it turns 22 days old. The heartbeat stops only with death. The heart normally beats 72 times per minute. Smoking and alcoholism adversely affect the working of the heart. Food with excess fat also affect the health of the heart.

What do you have to say to those who ruin their health through unhealthy lifestyles? Prepare a poster and exhibit it in your class.

When wounded

Blood flows out from the blood vessels when a wound occurs. This blood flow must be stopped first.

- Clean the wound with pure water.
- Press and hold the wound tightly.
- If the wound is on the hand, lift the hand up.
- If the blood flow does not stop, cover the wound with a clean cloth or bandage.
- Provide medical assistance, if needed.

Significant learning outcomes

The learner can

- identify respiration as an important metabolic process, tabulate the parts of the respiratory system and explain the process of respiration.
- make a model of lungs and explain its working.
- identify and use the first aid needed when the wind pipe is blocked or when one is wounded.
- identify and explain the role of blood in the transportation of substances in the body.
- identify preliminary information related to the importance and working of the heart.
- use microscope to observe blood cells.
- identify and classify blood cells.
- formulate methods for creating awareness by realising the habits to be practised in maintaining the health of the heart.

Let us assess

1. Which of the following is not a part of the breathing process?
   a. Air pressure in the lungs increases
   b. Air sacs expand
   c. The diaphragm lowers
   d. The thorax contracts
2. Which of the following is done first while giving first aid to a person whose trachea gets blocked?
   a. Give water to drink
   b. Sprinkle water on the face
   c. Make him/her sit on a chair
   d. Remove the block
3. Arrange in order the illustration of the parts of the human respiratory system.

Nostril → Lungs → Trachea → Bronchi

Extended activities

1. Make models of the lungs and the heart with suitable materials like thermocol, sponge etc.
2. Watch videos explaining processes like respiration and blood circulation.

9

Paths of Heat Flow

City	Maximum temperature	Minimum temperature
Thiruvananthapuram	26°C	22°C
Kochi	26°C	23°C
Palakkad	28°C	23°C
Kozhikode	26°C	22°C

The temperatures recorded during a day in some cities, telecast in the news, have been given here.

- Which cities recorded the lowest temperature?
- At what time might have the lowest temperature been recorded?

You know that light and electricity are forms of energy. Similarly, heat is also a form of energy.

Is it during night or day that you feel hotter? Why?

We get heat along with light from the sun. The sun is a source of heat just as it is a source of light.

There are many situations in our daily life where we make use of heat. What are they?

What are the sources of heat in the situations given below?

Situation	Receives heat from
Cooking	
Ironing	
Drying articles	
Melting metals	

While heating

Introduce a steel spoon with water to the flame of a spirit lamp.

- Doesn't water get heated?
- Does the spoon get heated?

Didn't the spoon receive heat from the flame of the spirit lamp?

- Where did water get heat from?

Spirit lamp flame → heat → spoon → heat → water

The flow of heat from one place to another is termed heat transmission.

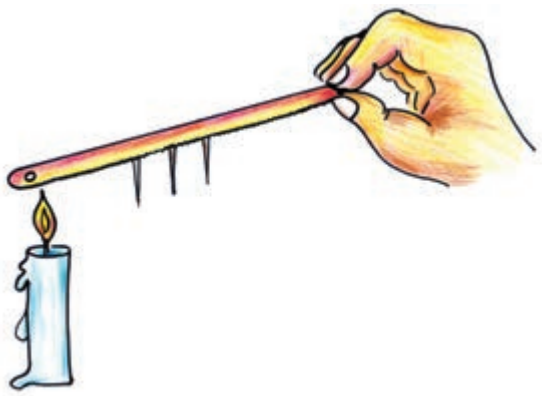
Try these activities. Fold a long piece of paper thick, burn it on a candle flame.

Show an iron rod to a candle flame.

In which situation did you experience heat? Why?

Repeat the experiment using an aluminium rod, a piece of wood, copper rod, rib of coconut leaf etc. Which are the materials that allowed heat to pass through?

Heat transmission - different modes



Fix pins on a hacksaw blade at equal distances using wax. Heat one end of the blade using a candle flame as shown in the figure.

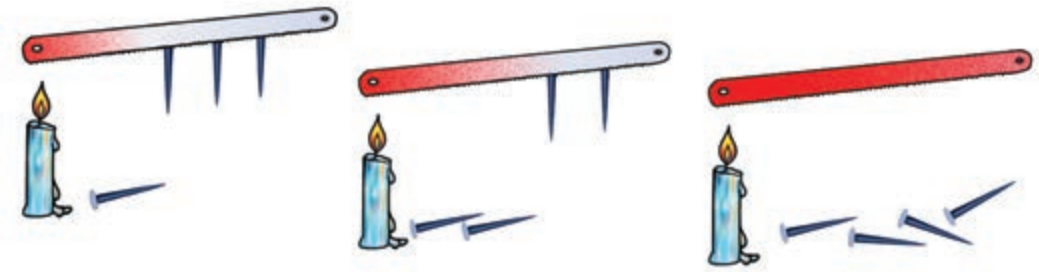
What is your observation?

- Did the pins fall down simultaneously?
- Which pin fell down first?

- Which pin fell down last?
- Why do the pins fall in a regular order?

Conduction

You know that all substances are made up of molecules. Molecules in solids are closely packed. When one end of a hacksaw blade is heated, the molecules at that end receive heat and transfer the heat to the neighbouring molecules. Here there is no actual change in the position of the molecules. This method of transmission of heat is called conduction.



Observe the figure. The pins fell down one by one when the heat was conducted from the heated end of the hacksaw blade to the other end.

The substances that conduct heat very well are termed good conductors and those which do not are termed poor conductors

Edubuntu - School Resource see 'chaalanam'

Heat some materials known to you and classify them into good conductors and poor conductors.

Good Conductors	Poor conductors

- The handle of the pressure cooker and nonstick vessels are made of substances like bakelite. Can you explain the reason?

Examine the handle of household articles like the electric iron, frying pan etc. Do you find any such peculiarities?

Do all conductors conduct heat at the same rate?

Transmission of heat in metals

Take three metal rods made of copper, iron and aluminium of the same length and thickness, and arrange them on wooden blocks as shown in the figure. Instead of rods you can use sheets of copper, iron and aluminium of the same size available in the school lab as well.

Edubuntu - School Resource
see 'lohangalude chaalanakshamatha'

Fix a pin using wax at one end of each metal rod. Heat with a spirit lamp the point where the rods meet in such a way that they receive equal quantity of heat.

- What did you observe?
- Did all the pins fall down at the same time?
- From which metal did the pin fall down first? From which metals did the pins fall secondly and thirdly?

All good conductors do not transmit heat at the same rate. Write down the metals iron, copper and aluminium in the order of their rate of conducting heat.

Transmission of heat in liquids

You have understood about heat transfer in solids. Let us see how heat is transferred in liquids.

Fill three- fourth of a round bottomed flask with water. Take a few crystals of potassium permanganate in an aluminium foil and pack it firmly. Make a hole in it with a pin and keep it immersed in water. Heat the flask using a spirit lamp. Observe the changes inside the flask.

- To which side does the water containing dissolved potassium permanganate move, on heating?
- Subsequently in which direction does this water move?

On heating, water gets heated and rises upwards and cold water moves down to that place. Isn't it clear that heat transfer takes place in water due to the movement of the heated water molecules?

Convection

Convection is the process by which heat transfer takes place by the actual movement of molecules.

How does heat transfer take place in gases?

Path of smoke

Materials required: shuttlecock container, incense stick and candle. Open the shuttlecock container at both ends. Make a small pencil-thick hole at a height of 8 cm on one side.

Fix a lighted candle on a table and place the container in such a way that the candle is inside the container. The hole pierced in the container should be towards the bottom of the container.

Bring a glowing incense stick near the hole on the side. Observe the direction of the flow of smoke.

- In which direction does smoke from the incense stick flow?

Place your palm at the top of the container. Don't you feel hot?

- What do you understand from this?

When the air inside the container gets heated and moves upwards, cool air flows to that part through the hole. Along with this, smoke from the incense stick also enters. As in the case of liquid, here too heat is transferred from one place to another through the actual movement of particles. It is mainly by convection that heat transfer takes place in liquids and gases.

From the sun

Haven't you now understood that a medium is required for heat transfer by conduction and convection?

At the same time, the heat from the sun reaches the earth through space even though there is no medium. How does this happen?

Don't you experience heat when you stand near a lighted firewood oven? If heat should reach us by conduction, there should be a good conductor between the oven and us. When the firewood burns, the heated air moves only up.

This means, it is neither by convection that the heat reaches us. Still we experience heat. This shows that heat transfer is possible without the presence of a medium as well.

Radiation

Radiation is the method of heat transmission without the help of a medium. A smooth surface reflects radiant heat.

Look at certain instances where heat is transferred by radiation.

- Heat reaching down from a glowing electric bulb.
- Hatching egg in an incubator.
- We experience heat while basking near the fireplace.

Let us consolidate as follows the ideas related to heat transfer that we have gathered.

Conduction	Convection	Radiation
The mode of heat transfer from one end of a material to the other without the actual movement of the molecules	The mode of heat transfer by the actual movement of molecules in liquids and gases.	The mode of heat transfer from one place to another without the help of a medium.

Without losing heat

- A steel glass containing hot tea is kept open on a table. Won't the tea become cold after some time? What are the ways in which the tea loses heat?
- Which mode of heat transfer is controlled when the glass is covered with a paper?

Hot food becomes cold after some time.

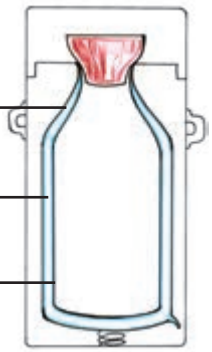
Food can be kept hot for a long time if we can minimise heat transfer by conduction, convection and radiation.

What are the devices we use for this?

Edubuntu - School Resource see 'choodaarathirikkaanulla vazhikal'.

The food and drinks stored in such devices remain hot for a long time. How is the heat loss due to conduction, convection and radiation controlled here?

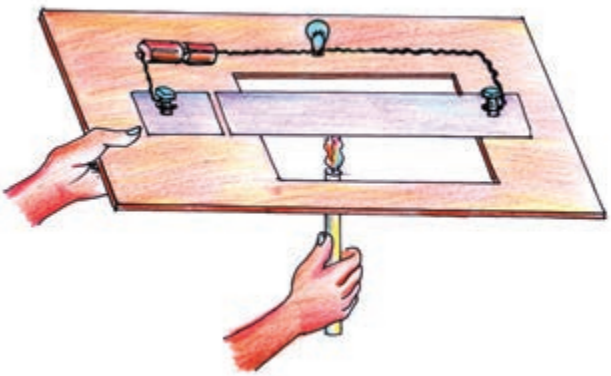
Parts of a thermoflask	Use
Glass vessel and lid	
The vacuum between double walls	
Inner surface coated with silver salts	



Examine the arrangements in casserole, thermal cooker etc. to retain heat. Record your findings in the science diary.

Thermal expansion in solids

What are the changes that happen when a solid is heated? Let us do an experiment. Cut off the middle portion of a cardboard sheet. Fix two aluminium plates using cycle screws on the cardboard sheet as shown in the figure. Connect these plates to a battery and a bulb using wires. Heat the aluminium plate using a lighted candle.



What do you observe?

- Why does the bulb glow?
- Why do the sheets come into contact with each other on heating?

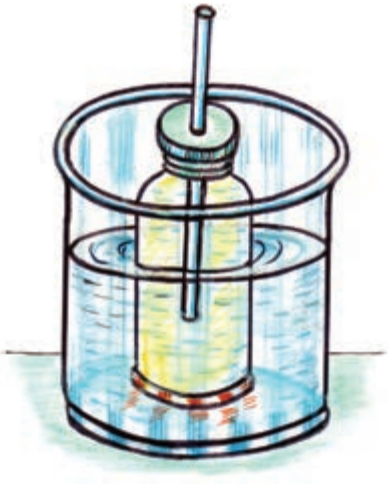
The aluminium sheets get heated up and expand. The circuit is completed and the bulb glows.

Put out the flame and allow the sheets to cool. What do you observe now? Why does the bulb stop glowing?

Solids expand on heating.
On losing heat, they contract.

Do liquids too expand on heating?

Thermal expansion in liquids



Take a big injection bottle filled with coloured water. Make a small hole in its rubber lid. Remove the metallic portion of an empty pen - refill and fix it into the hole. Keep this bottle partially immersed in a vessel containing hot water.

- Why does the coloured water come out of the injection bottle?

Remove the bottle from hot water and let it cool for some time.

- Is there any change in the liquid level in the refill?

Record the inferences made from your observations in your science diary.

Liquids expand on heating;
They contract on cooling.

Measuring temperature

The laboratory thermometer and clinical thermometer work on the basis of the ability of liquids to expand and contract. Let us familiarize ourselves with these two types of thermometers.

The bulb at the end of the thermometer contains mercury. There is a narrow vacuum tube adjacent to the bulb. Measurements are marked on the tube.

Place the clinical thermometer at the nook of your elbow and check your body temperature. Won't you record the temperature?

- Examine the expansion and contraction of mercury in a laboratory thermometer by dipping it first in hot water and then in cold water.

Write down the working principle of the thermometer in your science diary.

Clinical thermometer

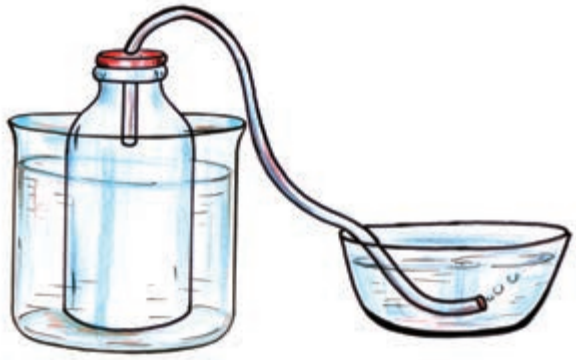
Laboratory thermometer

Thermometers

- Unlike the laboratory thermometer, there is a narrow portion above the mercury bulb in a clinical thermometer.
- Clinical thermometer is designed only to measure body temperature.
- Laboratory thermometer is used to measure temperatures below 200° C.

Thermal expansion in gases

Fix a plastic tube in the lid of an injection bottle. Immerse the free end of the tube in water taken in a vessel. Keep the bottle partially immersed in hot water.



- What did you observe?
- Why do bubbles come out through water?

Gases expand on heating
and contract on cooling.

Thermal expansion in daily life

Some situations in daily life are given below. Explain them on the basis of thermal expansion.

- Air holes are made near the ceiling in rooms.
- Long bridges are constructed as different spans.
- Hot water is poured in order to separate two glass plates that are stuck together.

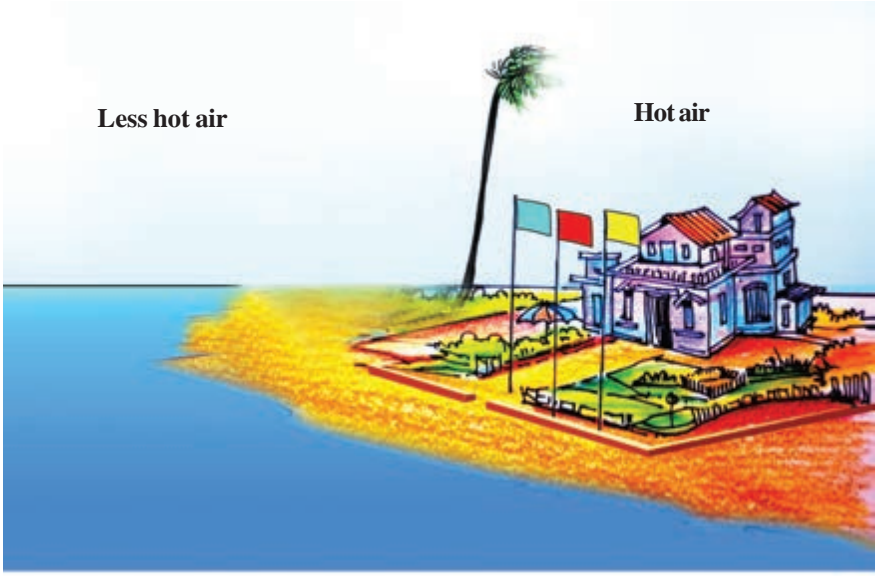
Wind

Observe the picture. Does the wind blow to the land or to the sea?

Wind blows from sea to land during the day.

What is the reason for this?

Sea breeze



- Which is hotter during day time - the air above sea or the air above land?
- Where does the heated air move to?
- State the direction of the wind by observing the direction in which the flag waves.

Don't sea and land get heat from the sun alike? But their ability to absorb heat is different. During day time, land gets heated fast by the heat of the sun, while sea water gets heated slowly. The air above land gets heated and rises up. The less heated air from sea rushes to the land at this time. This is sea breeze.

Land breeze

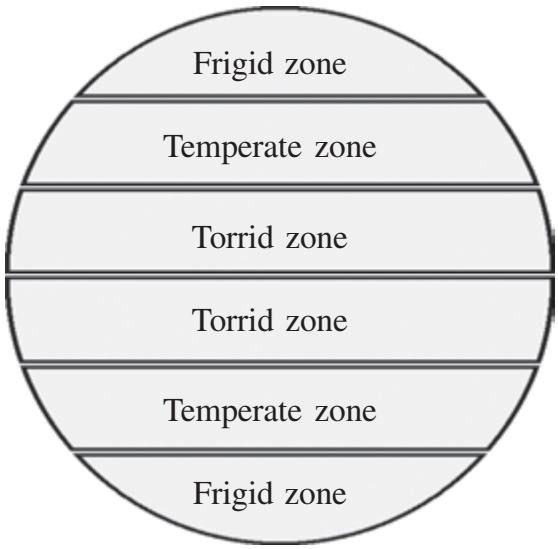
- Which is hotter at night - the air above land or the air above sea?
- In which direction does the wind blow then?

Land gets cooled faster at night. Sea gets cooled slowly. Hence the air above sea will expand more than the air above land and rise up. Then the air above the land will blow to the sea. This is land breeze.

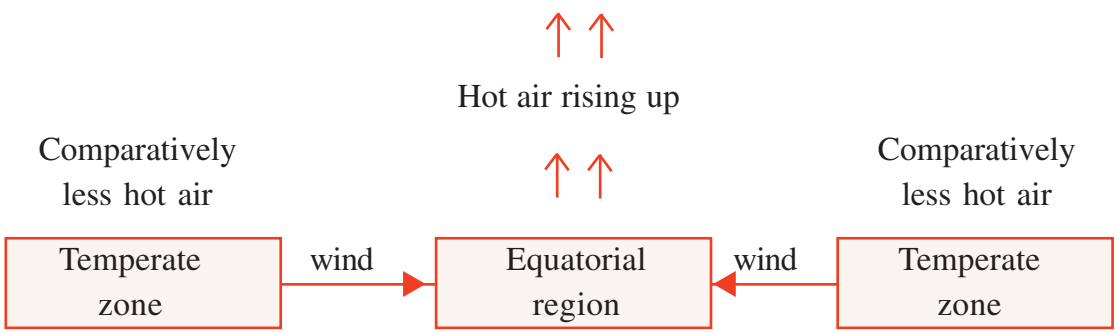
Does wind blow only from the land to the sea and from the sea to the land? Is the direction of wind the same always?

Direction of wind

Don't you know that the rays of the sun fall vertically mostly on the equatorial region? These regions are hotter.



When the rays of the sun fall vertically on the equatorial region



- Why does the wind blow from north and south to the equatorial region?
- How does the wind become useful to us?

Isn't it the wind that brings rain clouds? Doesn't the wind play a vital role in regulating the temperature of a region?

Does the ordinary wind bring any harm? What about a storm or a cyclone?

Haven't you seen in newspapers the news and pictures of the calamities caused by the wind?

What are the damages caused by wind? Try to write them down.

Wind and rain

- It is dangerous to stand under a tall tree when there is heavy rain and strong wind. Why?
- Why are special weather forecast warnings given to fishermen?

Monsoon rain

It is in the months of May, June and July that the sun rays fall most vertically above India. The atmospheric air gets heated up and expands at that time. During this time, water vapour-laden winds from the high pressure areas in the Indian ocean blow towards India. This causes monsoon rain. Sudden expansions and contractions in the air cause strong winds. Storms, cyclones etc. generally cause huge losses.

When there is strong wind, rain and lightning...

- Do not stand under tall and isolated trees.
- If you are travelling, stop and take shelter in a safe place.
- Take precaution foreseeing the chance of electric cables breaking and falling down.
- Do not stay inside weak buildings
- If you happen to be in a lake, get to the shore immediately and take shelter in a safe place.

Discuss with your friends the precautions to be taken to escape the dangers of wind and rain and note them down in the science diary.

Significant learning outcomes

The learner can

- explain with examples the methods of heat transfer namely conduction, convection and radiation.
- classify materials into good conductors and poor conductors.
- explain the working of devices that can prevent heat transfer.
- understand thermal expansion and find examples from daily life.
- explain how thermal expansion causes changes in climatic conditions.
- perform experiments on heat transfer and thermal expansion, with precision and accuracy.
- plan experiments on heat transfer and thermal expansion and construct devices related to these concepts.
- understand the dangers of natural calamities and take necessary precautions.

Let us assess

1) At which place is land breeze and sea breeze felt strongly?

   A. High Land

   B. Mid Land

   C. Coastal areas

   D. Coastal areas and high land

2) At noon, water in the deeper areas of a pond is cooler than that at the top. Why?

A. The pond is shallow.

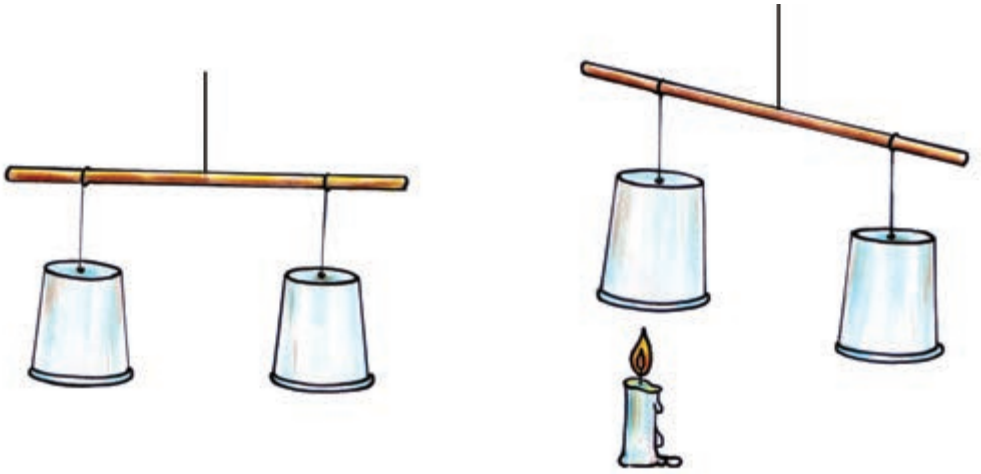
B. The heat that reaches the bottom is transmitted to soil.

C. Sun rays do not pass through water.

D. Water does not transmit heat from top to bottom.

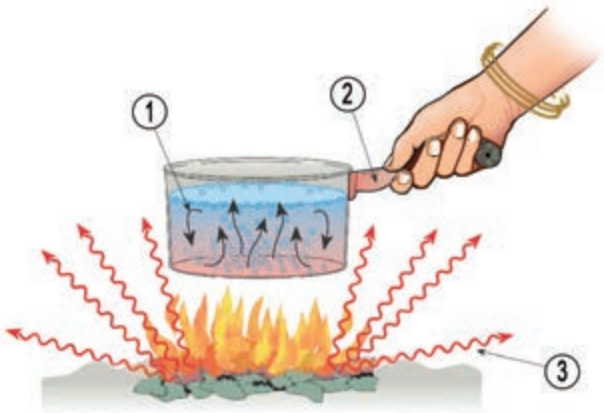
3) Hold your palm above and on the sides of a candle flame. Where do you experience more heat? Why?

4) Observe the figures



What change did you observe on placing a lighted candle below a cup? Why?

5)



Didn't you observe the figure? Which are the ways in which heat is transferred? Record your answer in the numbered positions.

Extended activities

1. Can you make an ice box using chalk box, thermocol and white enamel paint? Explain how it prevents heat transfer into the ice box and note down in the science diary.
2. Take two identical glass tumblers. Cut off an X ray sheet of the size of a post card and make two small holes side by side in the middle. Take some hot water in a glass and add some colour to it. Cover the other glass in which cold water is taken using the X ray sheet. Keep it inverted above the glass with hot water. Arrange the X ray sheet in such a way that the holes come in between the glasses. Write down the observations and inferences in the science diary.

10

Safety in food too

Hope you listened to what Manikutty told the bird.

Do you get mangoes round the year in your house?

Which are the months in which mangoes are available in plenty? What are the different ways in which they are preserved for use in other seasons?

Haven't you tasted mango pickles and salted mango?

Have you noticed other varieties of fruit and food substances preserved like this?

Mango

Mango is the king of fruits. How many varieties of tasty mangoes we get! The mango is a storehouse of fibre and vitamins. It is useful for healthy eyes and skin. It is said that eating mangoes improves immunity.

Without getting stale...

Look at the given pictures. How is each variety of food stored without getting stale?

Gooseberry in salt solution

Mango in salt solution

Cherry in sugar solution

Dried grapes

Mulakukondattam

Chilly pepper

- Are cherries and gooseberries preserved in the same solution?
- What are the ways in which the food substances given above are preserved?

Remember to classify them on the basis of the method of preservation and write them down in your science diary.

Expand the table adding more examples.

Mode of preservation		
In salt solution	**In sugar solution**	**By drying**
• Gooseberry • •	• Cherry • •	• Chilly • •

When dried

Will the rice stored in a jute sack get spoilt if some water happens to fall on it? Why?

What should be done to prevent wet rice from getting spoilt? What about drying it well?

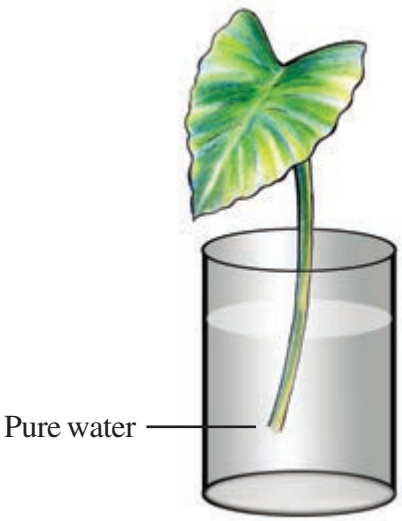
Certain food items when dried well do not get decayed. What could be the reason?

The action of microorganisms takes place under humid conditions and appropriate temperature.

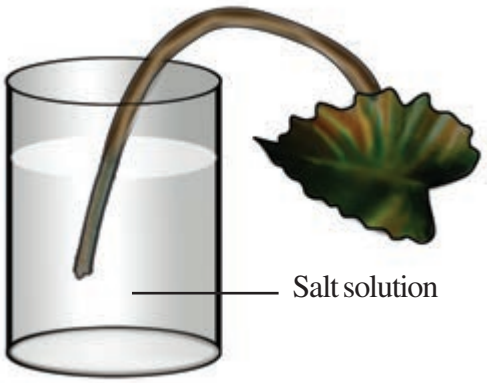
When salted...

We preserve a lot of food substances using salt. Why don't food substances decay when salt is used?

Let us do an activity.



Take two beakers. Fill one beaker with pure water and the other with concentrated salt solution. Take two taro leaves with their stems intact and place one each in the beakers. Examine after some time.



What happened to the taro leaf kept in the beaker containing salt solution?

What would be the reason for this change?

In salt solution

When the stem of taro leaf is kept immersed in salt solution, the water in the stem cells flows into the salt solution. As a result, the stem cells of the taro leaf shrink and the stem withers. When food substances are kept in salt solution, the salt draws the water content not only from the food substances but also from the microorganisms present in the food. Microorganisms are destroyed when water in the cytoplasm is lost. The same process takes place when substances are kept in sugar solution. This is why food substances kept in concentrated solutions of salt and sugar do not decay.

- Why does the tender mango kept in salt solution shrink?

Food substances are kept in refrigerators to prevent decay. They do not get decayed because the microorganisms in food are inactive at a very low temperature.

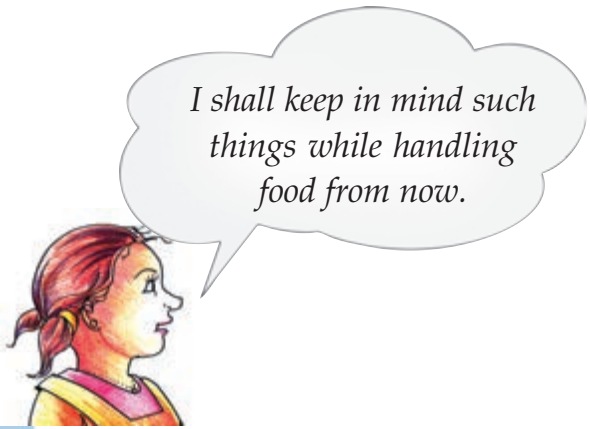
What would happen if food substances are taken and kept outside the refrigerator? The microorganisms become active again. As a result, food substances turn stale.

How does food get decayed?

Food gets decayed mainly due to the decomposition activities of bacteria, fungi etc. Most microorganisms are generally destroyed at a high temperature. At a very low temperature, the micro organisms become inactive.

The growth of certain bacteria, virus and fungi in food substances causes food borne diseases. The World Health Organisation has proposed five safety measures to prevent this.

- Clean the food substances thoroughly before cooking.
- Store cooked and uncooked items separately.
- Cook food substances in the appropriate manner.
- Store food substances at safe temperature.
- Use pure water and pure raw materials.



Greatness of the Jackfruit

Nutrients (in 100 g Jackfruit)	Quantity
Carbohydrate	23.5 g
Protein	1.72 g
Fat	0.64 g
Vitamin C	0.0137 g
Vitamin E	0.00034 g
Sodium	0.003 g
Calcium	0.034 g
Potassium	0.303 g
Iron	0.0006 g
Magnesium	0.037 g
Manganese	0.000197 g

National Nutrient Data Base

Do you know the other methods we use to prevent the decay of food?

We can make use of the papaya fruit available in plenty to prepare squash, jam, pickle etc.

Pasteurisation

This is a method of preserving milk. Milk is heated at 70° C for 15 to 30 seconds and quickly cooled to 10° C. The cell membrane of the microorganisms in the milk ruptures due to the sudden change in temperature. Thus they are destroyed. This method of preserving liquid food substances was developed by the French scientist Louis Pasteur. Hence this method is called Pasteurisation.

Louis Pasteur was a scientist who contributed much to the field of science.

Collect more information about him and prepare a note.

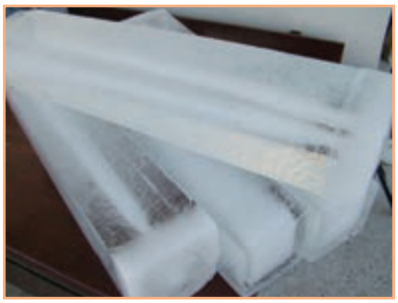
Pineapple Jam

Take a kilogram of pineapple, remove the outer skin and clean well. Grind the cleaned pineapple well and cook it till it thickens. Then add 500 g sugar and stir for 10 minutes. After it cools, add a spoon of lemon juice. The pineapple jam is ready.

Louis Pasteur

From the sea to the kitchen

Sea fish is an important part of the Kerala cuisine. The boats which go for deep sea fishing reach the shore several days later. It takes many more days to transport fish to other places. How is the fish preserved for so many days?



Large freezers are used for preserving fish and meat on an industrial basis. You might have seen ice blocks in boxes of fish when they are taken out of freezers for sale.

Ammonium chloride is added for obtaining low temperature and for fast solidification while making ice. Ammonium chloride is harmful to our intestine. Hence fish should be washed thoroughly in water as soon as it is bought.

Pesticides are sprayed on fruits, vegetables and spices to prevent the attack of insects and pests. You know that pesticides that reach inside the human body can cause serious health problems? How can this be prevented?

- Do you wash fruits and vegetables thoroughly before using them?
- Do you wash cardamom, cumin and mustard?

Just as fruits, vegetables and grains should be used after washing. These spices should also be used after washing and drying.

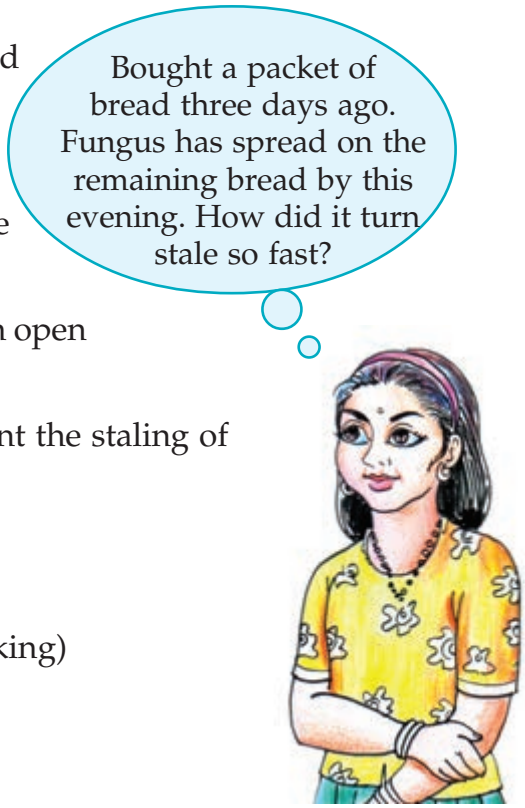
Airtight

Take out a piece of bread from a packet and examine it after two days, using a hand lens.

What do you notice?

The spores which form this fungus reached the bread through air.

Now you might have understood why bread in an open packet turns stale fast.



What are the precautions to be adopted to prevent the staling of packed food?

- Airtight packing
  eg: biscuit, bread etc.
- Packing after evacuating air (Vacuum packing)
  eg: Almonds (Badam), Cashewnuts etc.
- Sterilised after packing
  eg: Tinned food articles

Tinned Food

Haven't you noticed how safely the ghee, jam, pickles etc. that we buy from shops are stored in bottles?

Food substances can be preserved for a long period of time if microorganisms are prevented from entering them.

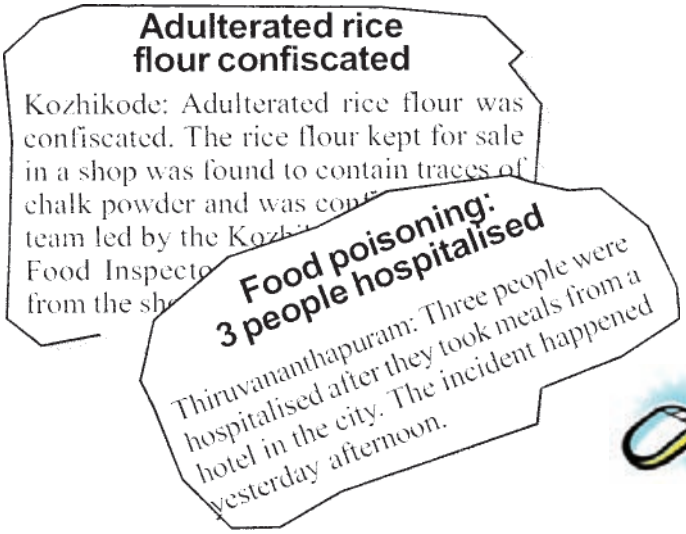
Edubuntu - School Resource see "Bhakshya Samskaranam"

Won't you include more food varieties and the methods of their preservation in your science diary?

Preservatives

Preservatives are substances added to food items to preserve them for a long time. Salt solution, sugar solution, oil, vinegar etc. are commonly used traditional preservatives. Apart from these, synthetic chemicals are also used. Eg: sodium benzoate, potassium sulphate.

Adulteration



Edubuntu - School Resource see 'Bhakshanathil Cherkkunna Mayam'

Did you notice these news reports?

Adulteration is adding to food items cheap and low quality materials that resemble food substances. Adding water or rice soup to milk is adulteration. Mixing brick powder with chilly powder and mixing powdered tamarind seed coat with coffee powder are also adulteration. The removal of quality components from a substance can also be considered as adulteration.

Adulterating food in this way can lead to several health problems.

Look at a few examples.

Food substance	Adulterant	Possible disorder/ disease
Pepper	Dry papaya seed, mineral oil coating	Stomach getting upset, Liver disease
Dal	Kesari dal	Paralysis
Milk	Water, Starch	Quality reduction
Chilli powder	Brick powder	Stomach -Liver related diseases
Sugar	Chalk powder, semolina, fine sand	Stomach -Liver related diseases
Tea	Artificial colour	Stomach diseases

Knowing by sight and smell

Closely examine the curry powder and food grains commonly used at home. Compare homemade powders with purchased curry powders. What are the methods we can use for comparison?

- Colour can be compared by spreading the powder on sheets of paper.
- Take water in two glass tumblers. Put the powders to be compared in each tumbler and stir well. The difference in sedimentation and colour can be thus examined.
- A hand lens can be used to examine them.

The quality of milk

What are the different substances mixed with milk?

- Addition of water
- Addition of starch for thickening

How do we find out the quantity of water added to milk? Haven't you seen the lactometer used in milk societies?

Examine the lactometer in your school lab.

How can we find out whether milk is adulterated with water? Do this activity.

Take three boiling tubes. Fill three fourth of one of them with milk, the second one with the same amount of pure water and the third one with equal amount of milk and water. Immerse the lactometer first in pure water, then in milk and finally in the mixture of milk and water. Record the reading.

In which boiling tube does the lactometer remain at the highest level?

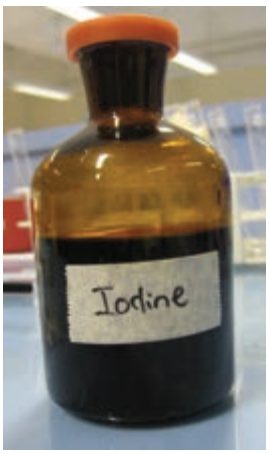
In which did it remain the lowest? What change do you notice in the lactometer in the boiling tube containing the mixture of milk and water?

We too can make a lactometer!

Take a long straw, fold the bottom end a little and tie with a string. Put small metal balls inside the straw. Sand may also be used instead of metal balls. Place it in water and try to balance it. If it does not stand steady, add one or two more metal balls into the straw so that it stands steady. Now the instrument is ready. Repeat the experiment done earlier using this lactometer. While dipping it in each of the boiling tubes, mark the liquid level on the straw using marker pens of different colours. Record the observations in the science diary. Repeat these activities changing the proportion of milk and water in the mixtures.

How can starch be detected if it is added to milk? Let us perform an experiment.

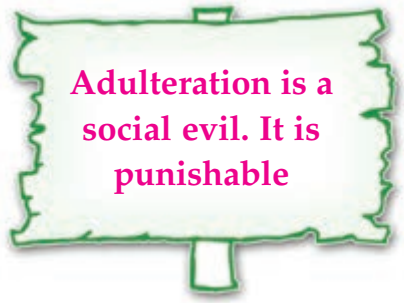
Iodine test



Take 5ml milk in a test tube and add two or three drops of iodine solution into it. What change do you observe? If the solution turns dark blue, it can be inferred that a lot of starch is mixed. Test the milk used at home this way.

Adulteration of food substances is a social evil. Collecting more information on adulteration from newspapers and magazines, prepare a project report and present the findings in a seminar. Remember to include details of food substances, adulterants mixed with them and the method of detecting such substances etc., in the presentation.

Prepare poster, notice etc. against adulteration and present them in the science club.



Food Safety and Standard Act 2006

This Act, which gives directions for taking necessary precaution to ensure the quality and safety of food substances came into effect in 2006. This was modified in 2011. Violating the Food Safety Act and related rules is punishable.

Enticing Colours

Don't shape and colour make food substances look more attractive? Many chemicals are used to impart colour. Artificial chemicals should not be added to impart colour to any food substance that is cooked and used. Such chemicals are usually added to bakery items. Addition of these substances above the permissible limit and their continuous use can affect the functioning of the liver and kidney.

Discuss whether artificial colours should be added to food substances.

Chemicals allowed to be used in permissible measure

Colour	Chemical
Red	Carmoisine, Erythrosine, Ponsi 4R
Yellow	Tartrazine, Sunset Yellow
Blue	Indigo carmine, Brilliant blue
Green	Fast green

Quality of food substances

How can you ensure the quality of food substances?

The quality of food substances is tested by an agency named Food Safety and Standards Authority of India (FSSAI) .

AGMARK : This emblem shows that the quality of food substances like grains and fruits, and partially processed food stuffs like vermicelli, is ensured.

Have you noticed other signs like this? Examine the packets or tins of food substances and find out.

Won't you remember to buy packed food substances of good quality in future?

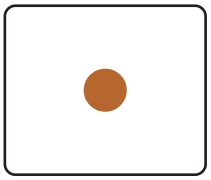
Information provided on the Packet

Have you noticed the details recorded on packets of food substances?

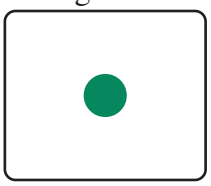
Try to read them with the help of a hand lens.

- Are there signs indicating quality?
- Are the packing date and expiry date indicated?
- Are the proportions of ingredients indicated?
- Are the names of manufacturers and Maximum Retail Price (MRP) given?
- Are there signs indicating the use of vegetarian - non vegetarian substances?

Non-vegetarian



Vegetarian



Write down in the science diary the various aspects to be considered for selecting articles of good quality.

Significant learning outcomes

The learner can:

- explain the necessity of preserving food substances
- realise that food substances turn stale by the action of microorganisms
- suggest the methods to preserve food substances by identifying situations where microorganisms cannot act.
- explain how the chemicals added to food substances adversely affect the human body.
- realise that adulteration is a social evil, and plan out activities against adulteration.
- select products of good quality.
- get involved in activities to detect adulterants in food substances and construct devices for this purpose oneself.

Let us assess

1. Why are the wounds on the body washed with salt solution?

   a. To remove the water content in the wound

   b. For blood clotting

   c. To destroy germs

   d. To relieve pain

2. Coconuts are broken and dried for *copra*. Why?

   a. To remove water content

   b. For colour

   c. For coconut oil

   d. To provide fragrance to coconut oil

3. A small amount of chilly powder is put into water to find whether it is adulterated with brick powder. Why?

   a. Both brick powder and chilly powder are red in colour

   b. Chilly powder dissolves in water

   c. Brick powder is heavier than chilly powder

   d. Brick powder dissolves in water

4. "Gargling your throat with warm salt solution for sometime will help relieve throat pain". This is Amal's opinion. Can you give an explanation for this suggestion.

Extended activities

1. Which are the fruits in our surroundings that go wasted without use? Prepare and execute a plan to identify such fruits and preserve them.
2. Collect the information recorded on various packets of biscuits and note them down in the science diary.