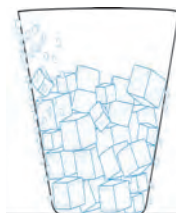


9. Heat



Observe and discuss.

What are the causes of what you see happening in the pictures below? Write in the boxes.



9.1 Various events



Try this.

Rub your palms against each other and put them on your cheeks. What do you feel?

We come to know some properties of heat energy from the examples in the pictures and the above activity. The sun's heat has many effects and uses. How does the solar heat reach the earth? Why does the heat in the water heated to boiling slowly decrease once it is taken off the flame? Where does this heat go? The moisture in the air cools down due to the ice cubes in the glass and collects on the outside of the glass. A thermometer is used to measure the temperature of a substance. We have already studied the changes in the state of matter, caused by heat.

Transfer of heat



Can you tell ?

1. Why does the *halwai* wrap up cloth around the end of his slotted spoon while stirring the boiling milk in his large *kadhai*?
2. Why do we hold a steel glass in a handkerchief while drinking hot milk from it?
What are other examples of this kind? Make a note of them.

When we take a hot object in the vicinity of a cold one, the cold object becomes warm and the hot one becomes cooler. From this, we can infer that heat is transferred from a hot body to a cold body.

Transfer of heat means the flow of heat from one place to another.



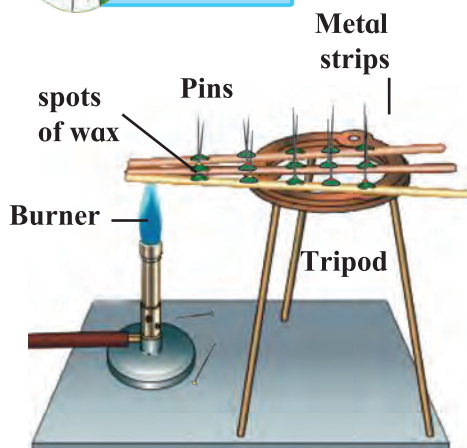
Use your brain power!

Why do we wear woollen clothes in winter?

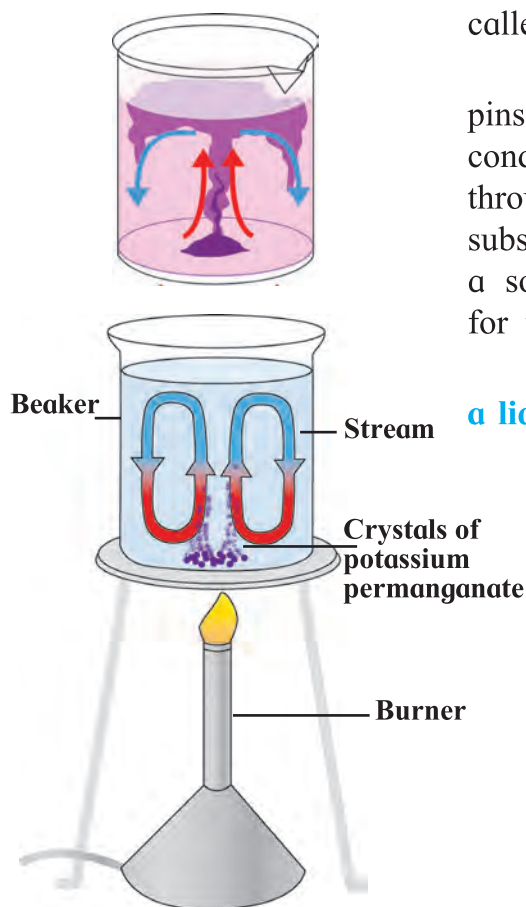
Modes of heat transfer : Conduction, convection and radiation



Try this.



9.2 Conduction of heat



9.3 Convection of heat

Convection can occur in liquid and gaseous substances. Convection needs a medium.

Apparatus : Bars of stainless steel, aluminium and copper, a candle, a burner, pins, etc.

Procedure : Take stainless steel (or iron), copper and aluminium bars, each about 30 cm long and having the same shape. Apply wax spots with the help of candle at a distances of 2 cm from each other on all the three bars. Stick a pin in each of these spots so that it is upright. Now insert the ends of all three bars into a flame at the same time. Observe for a while.

What do you see? From which bar do the pins start falling first? Why?

Pins fall starting from the end near the burner. It means that transfer of heat takes place from the hot end of the bar to the cold end. This transfer of heat from the hot part of an object to the cold part, is called **conduction** of heat.

The pins on the copper bar start falling first. The pins on the steel bar fall comparatively late. Heat is conducted quickly through copper. Conduction of heat through a substance depends on the property of that substance. That conduction of heat takes place through a solid substance, shows that a medium is required for the conduction of heat.

How does the transfer of heat take place through a liquid?

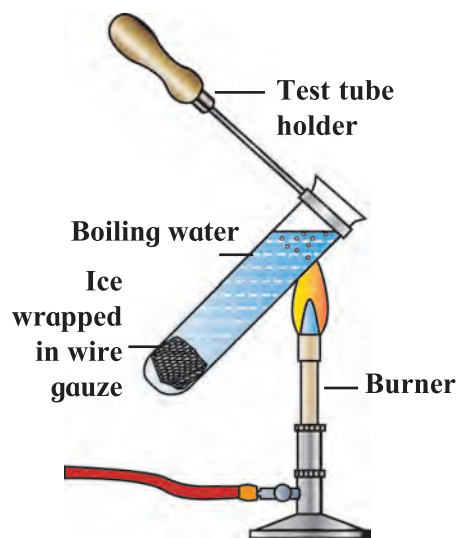
Apparatus : a beaker, potassium permanganate crystals, a burner, water, etc.

Procedure : Take some water in a beaker. Heat the beaker slowly on a gas burner. Drop a few crystals of potassium permanganate into the water. Now watch the water in the beaker carefully. What do you see?

You will see streams of water going upwards and coming back to the bottom. Due to the potassium permanganate, these magenta coloured streams can be identified easily. When heating begins, the water near the bottom becomes warm and its density decreases. As a result, it moves upwards and is replaced by cold water coming from above. In this manner, heat is transferred by means of currents, called convection currents. This process is called **convection of heat**.

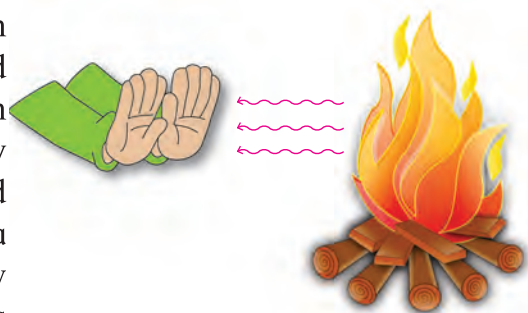
Apparatus : a test tube, a piece of ice, wire gauze, a burner, a candle, etc.

Procedure : Take some water in a test tube. Wrap a piece of ice in a wire gauze and drop it in the test tube. It will sink to the bottom. Now, using a test tube holder, hold the test tube at a slant, as shown in the figure. Heat the upper part of test tube. Stop heating when the water starts boiling. Observe the piece of ice at the bottom. The heat does not reach the bottom even though the upper part is heated. How does this happen? The density of water decreases due to heating. Therefore, it cannot sink and the process of convection does not occur.



9.4 The relation between density and convection

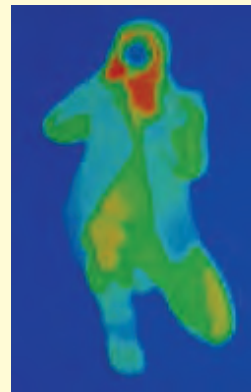
Procedure : Light a candle and stand it upright. Hold your hands on its two sides at some distance from the candle. Bring them closer. What do you feel? Have you warmed yourself near a bonfire or in the morning sun in winter? The sun is millions of kilometres away from us. There is no air between the sun and the earth and the earth's atmosphere is only a thin layer of air close to the earth. Then, how does the heat of the sun reach us? This heat is transferred in the absence of any medium. The



9.5 Radiation

transfer of heat that takes place in this way, without a medium, is called radiation. In the two examples above, heat reaches us mainly by **radiation**.

A wonder of science : Radiation of heat takes place from many objects in nature such as trees, mountains, stones and roads. A camera has been developed which uses these radiations to make our surroundings visible at night. It is called an infrared camera. Using this camera, it is possible to keep a watch on the movements of the enemy during the night.



When heat rays fall on an object, a part of the heat is absorbed by the object and a part of it is reflected. The ability of a substance to absorb heat radiation depends on its colour and also its intrinsic properties.



Let's try this.

Apparatus : Two aluminium tins of the same size, two small glasses, water, thermometers, black paint, etc.

Procedure : Paint the outer surface of one tin with black paint, and let it dry. Then in both tins, place one glass, each filled with water at the same temperature. Cover the tins with lids. Keep them in the sun for two hours. Now measure the temperature of the water in the glasses in the two tins. What is the reason for the difference in the temperature?

Good and bad conductors of heat

Place a steel spoon, a copper strip or rod, a divider from your compass box, a pencil and a plastic ruler in a glass beaker. Pour hot water (heated upto 60°C - 70°C) into the beaker. Wait for a while. Then touch the outer end of each of the objects. Record your observations in the table below.

Object	How hot is the outer end ? (very hot, hot, warm, as cool as the atmosphere)

What inference will you draw from this?

Some substances are good conductors of heat while some are bad conductors of heat. Heat is easily conducted through a copper strip or pot, but not through plastic or wood.

We can hold a glass tumbler or china cup full of hot tea easily in our hand, but not so a steel or copper cup if the same tea is poured into them.



Use your brain power!

Why do we use white clothes in summer and dark or black clothes in winter?

Expansion and contraction of a solid substance due to heat

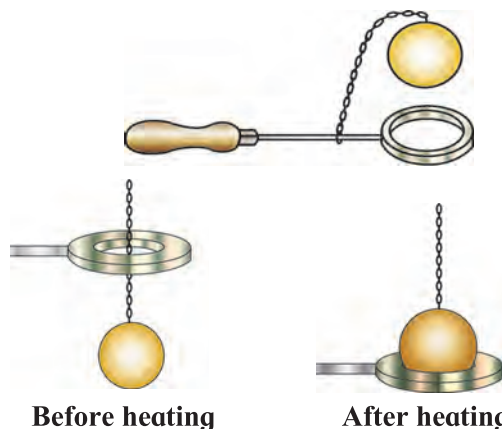


Let's try this.

Apparatus : a metal ring, a metal ball, a burner, etc.

Activity 1 : Take a metal ring and metal ball of such size that the ball just passes through the ring. Heat the ball and check whether it passes through the ring. Now let the ball cool down, and check whether it passes through the ring.

The above experiment tells us that metals expand on heating and contract on cooling. Solids expand due to heat and come back to the original state if heat is removed. However, the extent to which different solids expand is different.



9.6 Expansion and contraction of a solid substance



Use your brain power!

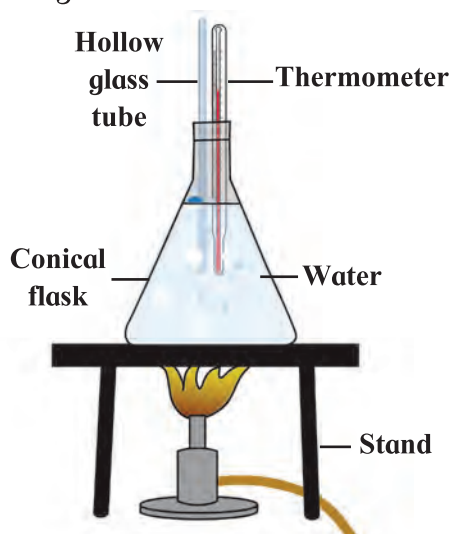
Why is there a gap at the joints of rails and of cement concrete bridges?

Expansion and contraction of liquids due to heat

Apparatus : 500 ml conical flask, two-holed rubber stopper, glass tube, measuring ruler, thermometer, stand, wire gauze, burner, graph paper, etc.

Procedure : Fill the conical flask completely with water. Insert the glass tube and the thermometer in the two holes of the stopper and fit it to the conical flask. Heat the water and with the help of the ruler, record the water level in the glass tube after every 2°C rise in temperature. Take about 10 readings. Observe what happens when heating is stopped. Draw a graph to show the change in water level as the temperature rises.

When a liquid is heated the distances between its particles increase and its volume too increases. This is called the expansion of liquids. When its temperature falls, the liquid contracts.



9.7 Expansion and contraction of a liquid



Use your brain power!

Why is mercury or alcohol used in a thermometer?

Expansion and contraction of gases due to heat

Apparatus : Glass bottle, balloon, hot water, etc.

Procedure : Fix a balloon on the mouth of a glass bottle. Hold this bottle in hot water. What happens?

The volume of a gas increases on heating. This is called expansion of the gas. On the other hand on removing heat, the volume of the gas decreases. This is called contraction of the gas.

Thermos flask (Dewar Flask)

You might have seen a thermos flask used for keeping tea, coffee, milk, etc. hot or a sherbet cold for a long time. What is its structure and how does it function?

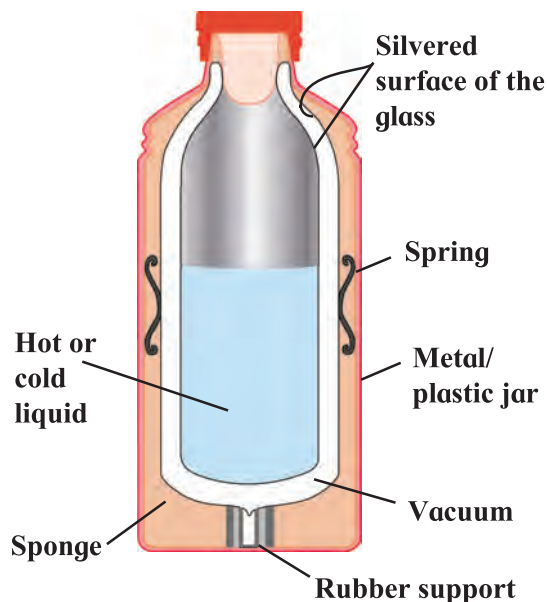
This is a double-walled flask. It consists of two glass tubes, one inside the other with the gap between them sealed. The surfaces of both the tubes are made shiny by a silver coating. The air between the two tubes is removed to create a vacuum. There is a protective jar of metal or plastic outside the tubes. For the protection of the flask, pieces of sponge or rubber are fixed between the outer jar and the flask.

Great Scientists

Sir James Dewar was a Scottish scientist. He made the first thermos flask in 1892. That is why it is called Dewar flask. Even today, a Dewar flask is used for keeping a substance cold or hot.



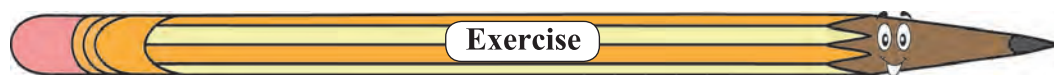
Function of the thermos flask : When a hot substance is placed in a thermos flask, the heat going out gets reflected due to the shining surface of the inner tube. Hence, heat is not radiated. Neither conduction nor convection of the heat occurs because of the vacuum. As a result, heat is not transferred to the outer cooler region and is retained inside for a long time. Still, a little heat is lost from around the lid and by a small amount of conduction through the glass. Therefore, the hot substance does not remain as hot after two or three hours.



Find out.

What is meant by thermoware?

9.8 Thermos flask



1. Fill in the blanks with the proper word from the brackets.

(radiation, white, conduction, blue, convection, bad conductor, good conductor, black, reflection)

- Maximum heat is absorbed by a coloured object.
- of heat does not require a medium.
- Conduction of heat takes place through a substance.
- The shining surface in a thermos flask decreases the outgoing heat by
- Cooking utensils are made from metals due to their property of
- The earth receives heat from the sun by

2. What will absorb heat?

Steel spoon, wooden board, glass vessel, iron griddle (*tava*), glass, wooden spoon, plastic plate, soil, water, wax

3. Write answers to the following questions.

- How does a fever get lowered by putting a cold compress on the forehead of a patient?

- Why are the houses in Rajasthan painted white?
- What are the modes of heat transfer?
- Explain which mode of heat transfer causes sea breezes and land breezes.
- Why is the outer coat of the penguins of Antarctica black?
- Why are heaters fitted near the floor and air conditioners, near the ceiling of a room?

4. Give scientific reasons.

- An ordinary glass bottle cracks when boiling water is poured into it, but a borosil glass bottle does not.
- The telephone wires which sag in summer become straight in winter.
- Dew drops form on the grass, in winter.
- In winter, why does an iron pillar feel colder than a wooden pole?

Project :

Make a note of the various examples of heat transfer seen in day-to-day life.



10. Disaster Management



Observe and discuss.



10.1 Various news items about disasters



Can you tell ?

1. Is it possible to prevent the loss of life caused by lightning?
2. What should be done to prevent the bunds on a farm from getting washed away in the rainy season?
3. Why do we experience water-scarcity?

We have studied two types of disasters, namely, manmade and natural disasters. Into which categories do the disasters shown in the news items above, fall?

We can prevent certain disasters, while it is necessary to take precautions in the case of some other disasters. Natural and manmade disasters are related to each other.

Natural disasters such as famine, lightning strikes, cloudbursts, storms, etc. occur due to changes in the weather. There is the possibility of loss of life and damage to property in such natural calamities. Who is to be held responsible for that? What can we do to deal with these losses?

Famine

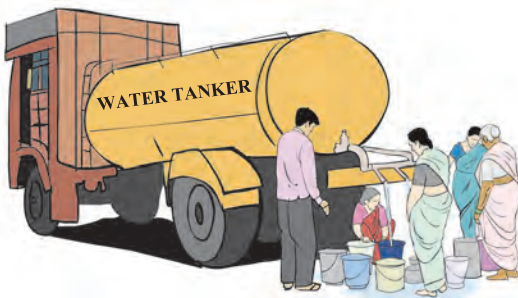
The condition that arises due to long term and severe scarcity of foodgrains and water is

10.2 Famine, water scarcity

called famine. Famines can be very severe. Although the main cause of famine is natural phenomena, yet a famine condition is created by some human activities besides some natural events.

Think.

What would happen if no food were grown during one whole year?



Causes of famine

Drought, heavy rains and flood, crops getting washed away or damaged in the flood, environmental changes such as temperature change, storms, cold waves or fog, damage of crops by animals like mice and rats, attack of pests, locusts or diseases of crops, a natural calamity like earthquake, etc. are some of the causes of famine. Of these, drought is the main cause. Man-made causes of famine include war, internal unrest, absence of transport routes, uncontrolled population growth, etc.

There are records of loss of life caused by severe famines in various parts of the world. Asia has turned out to be the most famine affected continent of the world. A majority of the famines occurred in drought prone and flood affected regions. Among the most dreadful famines that have occurred in the world, are the famines that affected India and China.

Are we responsible for famine?

1. Water shortage is increasing as the balance between rainfall and population is disturbed.

2. Though there has been a very high rise in the production of foodgrains as a result of the green revolution, the balance of the environment has been lost due to use of chemical fertilizers, pesticides and weedicides.

3. Unlimited lifting of water.

4. Erosion of land.

5. Misuse of water.



In the Past...

Famines are not a new phenomenon. The problems of drinking water, food, and fodder for animals date back to historic times. Chhatrapati Shivaji Maharaj and Chhatrapati Shahu Maharaj implemented many schemes to overcome the famines of their time. Their water supply and water storage schemes are ideal even in today's circumstances. You too can make schemes like these to face future crises and disasters, which will be of use not only in your own life in the future, but also for society at large.

Malik Ambar implemented a canal scheme for drinking water in Aurangabad. It exists even today. Collect more information about it.

What can we do to ease the severity of a famine?

1. Planned usage of water and reuse of water.

2. Proper planning of water conservation and harvesting at the local level.

3. Large scale plantation of trees and prevention of deforestation.

4. Making appropriate changes in plans, taking into account the weather forecasts.

Large scale tree plantation – No famine, no land erosion!

Compose a variety of such slogans and use them during Environment Awareness Rallies.

Cloudburst



Can you tell ?

What causes rain ?



Do you know ?

Sometimes the water coming down from rain clouds does not reach the land in the form of rain. Instead, due to very high temperature near the land, it vapourizes and goes back into the same clouds. As a result the amount of vapour in those clouds becomes very high. Due to rapid condensation, it rains suddenly over a specific and small region at a rate of 100 mm per hour or more. This is known as a cloudburst.

A cloudburst occurred at Leh (Ladakh) on 6th August 2010. The cloudburst that occurred in Mumbai on 26th August 2005 was extraordinary and unforgettable. On that day it rained about 950 mm, that is, 37 inches, in 8 to 10 hours, and the entire city of Mumbai was waterlogged and flooded.



Use your brain power !

Why shouldn't we wait at the foothill while it is raining heavily?

Flood



Let's recall.

What is meant by flood? What are the effects of flood?

We have already learnt about floods and the effects of floods. Collect information about the floods that have occurred at various places in Maharashtra in the last few years.



Protective measures in view of floods

1. Construction of small dams in mountainous regions
2. Construction of percolation tanks
3. Making river beds flat
4. Cultivation of new forests
5. Connecting rivers

Government of India established the National Flood Commission in 1976. The Commission has made special efforts towards the control of floods. A plan regarding flood control is kept ready from national level to village level. Large scale damage of property and loss of life can be avoided because of this plan.

Lightning



Can you tell ?

1. Have you seen a flash of lightning in the sky? When?
2. What causes lightning?

You have learnt about generation of electric charge and lightning strikes in the lesson on static electricity. In this lesson we shall learn something more about lightning and the measures for protection from it.

Wonderful things to know!

Lightning temperature more intense than the sun

Not all lightning strikes the ground. In fact, about 95% of the lightning flashes are limited to the sky. Only 5% of lightning reaches the ground. Lightning can be generated within one cloud, between two clouds or between a cloud and the ground. About forty lightning flashes occur per second in the atmosphere. The temperature generated by lightning is higher than that of the sun. Due to this high temperature, the air under high pressure expands suddenly and a loud crashing sound is heard.



Do you know?

Lightning strikes open ground maximum times

The world's mortality rate due to lightning is low. However, survivors of lightning strikes suffer long term effects. Immediate treatment of lightning affected persons can save their life. A study of places struck with lightning show that it happens more on open ground than under a tree or near water. Mishaps have occurred most often when a person is at a high place or near a tall object.

What precautions will you take during thunder storms?

1. Do not stand on open ground or below a tree.
Do not go to a high location or climb a tree.
2. Do not stand near an electric pole, a telephone pole, a tower, etc.
3. Do not lean on wired fences around a farm, a compound, a garden or a house.
4. If you are on a two-wheeler, a bicycle, a tractor or a boat, get off immediately and go to a safe place.
5. Do not gather all together in one place.
6. Take care to keep a distance of 15 feet between any two persons.
7. Do not use plugged in electrical appliances. Do not use a mobile or telephone.
8. Stand on dry wood, a plastic sheet, sack or jute cloth or dry leaves.
9. Keeping your feet together support yourself on the soles of your feet placing your hands on your knees and crouch low.
10. Swimmers or fishermen should immediately come out of the water.
11. A pucca house is the safest place. Find out if there is a lightning conductor on any tall building near your house. If necessary get a lightning conductor fitted on your house.

My friend, the internet!

Visit the website www.ndma.gov.in and compile information about disasters and disaster management.

Volcano

A volcano is a natural event or phenomenon. The interior of the earth is very hot. Movement of hot substances continuously occur from the interior towards the surface of the earth. As a result, sometimes the solid, liquid and gaseous substances below the earth's crust are pushed towards the crust. When these substances come out of the earth's crust in an eruption and start flowing, it is called a volcano.



10.3 Volcano

What are the effects of a volcano?

1. The chemical substances such as lava, vapour, hot mud, sulphur, etc. get collected on the surface of the earth and thereby mountains and hills are created.
2. The atmosphere gets polluted due to the ash and gases ejected by the volcano.
3. Often, it rains as a result of a volcanic eruption.
4. Temperature rises due to hot gases.
5. Forests and settlements get buried under the hot mud.

Volcanoes erupt in the sea as they do on land. The same substances that come out during the eruption of a volcano on the land are ejected during the eruption of a volcano in the sea. Some islands are created due to the eruption of volcanoes in the sea.

It is not possible to prevent the eruption of a volcano, to stop it after it erupts or to control it. However, by means of science and technology, it is possible to predict an eruption and to take immediate steps for disaster management.

Tsunami



Let's recall.

1. What is an earthquake?
2. What will happen if an earthquake and volcanic eruption occur at the bottom of the sea?

As on land, earthquakes and volcanic eruptions occur at the bottom of the sea, too. If an earthquake occurs at the bottom of ocean, the energy released pushes the water upwards. As a result of this, a peculiar type of waves are formed. These waves are not very high near the source, but they start spreading very fast to long distances. The velocity of these waves is 800 to 900 kilometre per hour. When they reach a coastal area, their velocity is reduced, but their height is found to have increased tremendously, even to about 30 metres.



10.4 Tsunami

Such a wave, generated by an earthquake or volcano occurring on the ocean floor, is called a 'tsunami'. 'Tsunami' is a Japanese word which means 'harbour wave'.

Destructive effects of tsunami

1. Buildings and other constructions are destroyed.
2. There is large scale loss of life and financial loss.
3. Boats and ships near the coast get damaged.
4. Trees get uprooted. Landslides take place on a large scale.
5. Changes take place in the original land near the coast giving rise to swamps.
6. Traffic obstructions arise.
7. The business/industry related to the sea are adversely affected and normal day-to-day life is disrupted.
8. Large scale damage is caused to harbours.

Precautionary measures

When a tsunami wave is formed due to an earthquake on the sea floor, it is necessary that an immediate estimate is made of its progress and a warning of the danger is issued to the people in the coastal area. For this purpose, an artificial geostationary satellite is of great use.

Storms



Let's recall.

What gives rise to a storm?
What are their effects?

We have already learnt about the formation of storms and their effects. Suppose, you are caught in a storm. What will you do to keep yourself safe?



Try this.

1. Regularly cut down trees or branches that are likely to fall and cause damage.
2. If you are outside, take shelter in a safer place.
3. If you are away from home, inform your close relatives and friends about your exact location.
4. At home, shut the valves of gas regulators and turn off the electric supply.
5. Make telephone calls to warn your relatives and friends about the probable danger. Tell them to go to a safer place.
6. Give temporary shelter to people who are far away from their homes.

Note: Refer to the lesson on 'Winds' in the Std VII in the Geography textbook and read the part about storms.

National Institutions

United Nations established a standing international organisation (UNDP) in 1965. About 177 nations from all over the world are members of the the UNDP. One of the main functions of this organization is to send equipment, financial aid and also volunteers to the place of the distater. In addition, international medical teams and groups of other experts are also sent.

13th October
International Day for
Disaster Reduction

Techno-support

With the help of your teacher prepare a power point presentation on 'Effects of Natural Calamities and Measures for their Management' and present it in the class.



1. Find the odd man out.

- (a) Famine, earthquake, cloudburst, railway accident.
- (b) Drought, heavy rains, storm, tsunami.
- (c) Lava, hot mud, ash, locusts.
- (d) Washing away of crops, attack of pests on crops, volcano, singeing of crops

2. What are the remedial measures for the following calamities?

- (a) Famine
- (b) Lightning strike
- (c) Storm
- (d) Cloudburst

3. True or false? Give reasons for your answer.

- (a) Information about a forthcoming storm is to be kept secret.
- (b) You should not swim when there is lightning in the sky.
- (c) It is possible to prevent the eruption of a volcano.
- (d) Heavy rains result in famine.

4. Write answers to the following questions in your own words.

- (a) What is a tsunami? What gives rise to a tsunami?
- (b) What is a cloudburst?
- (c) Explain the effects of a volcano.
- (d) What are the measures to prevent loss of life due to lightning?

5. What measures have been taken to deal with calamities such as floods and landslides under the disaster management programme in Maharashtra?

6. With reference to disaster management what are the things in your house that you will check?

Project :

- 1. With the help of the internet, collect information about the places where a calamity has occurred.
- 2. Collect information from the internet about how cyclonic storms are named.



11. Cell Structure and Micro-organisms



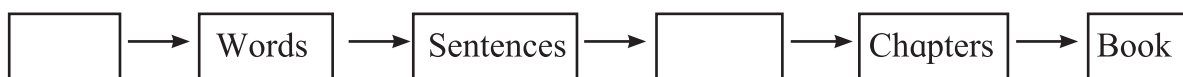
Let's recall.

What is the name of the minute components of which the body of a living organism is made? Is the number of these smallest units the same in the bodies of all living organisms?

Cell

We have learnt that cellular organization is the primary characteristic of all living organisms and that the cell is the fundamental structural and functional unit of living organisms.

Complete the flow chart:

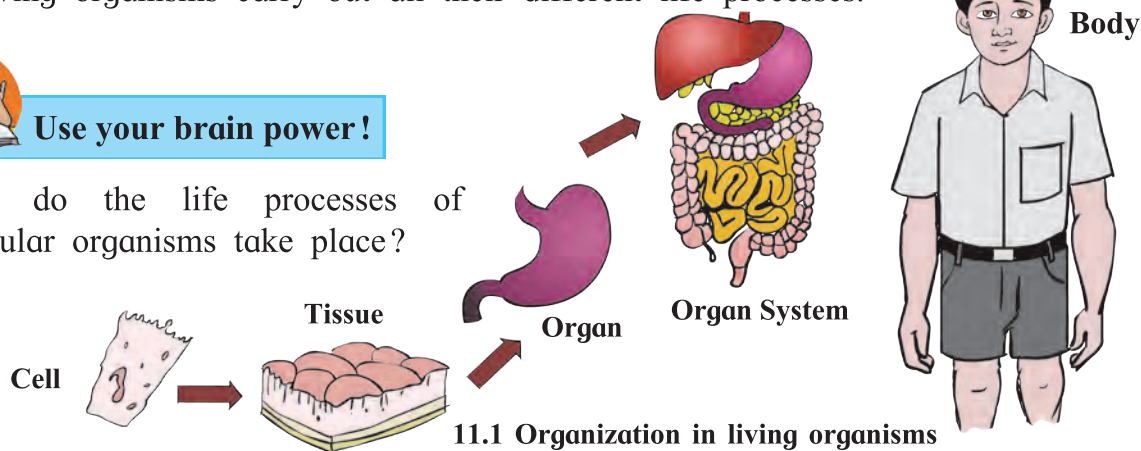


We see the structural organization of a book in the above flow chart. Similarly, there are organizational levels in living organisms, too. These are : cells, tissues, organs, organ systems, organism. Cells form the basis of the structure and function of all living organisms. It is only with the help of cells that living organisms carry out all their different life processes.



Use your brain power!

Where do the life processes of unicellular organisms take place?



11.1 Organization in living organisms

Great Scientists



In 1665, a scientist, Robert Hooke observed a thin section of cork under a microscope. In this section, he saw hexagonal compartments like those of a bee-hive. He named those compartments 'cells'. This term is derived from the Latin word '*cella*' which means 'small room'.



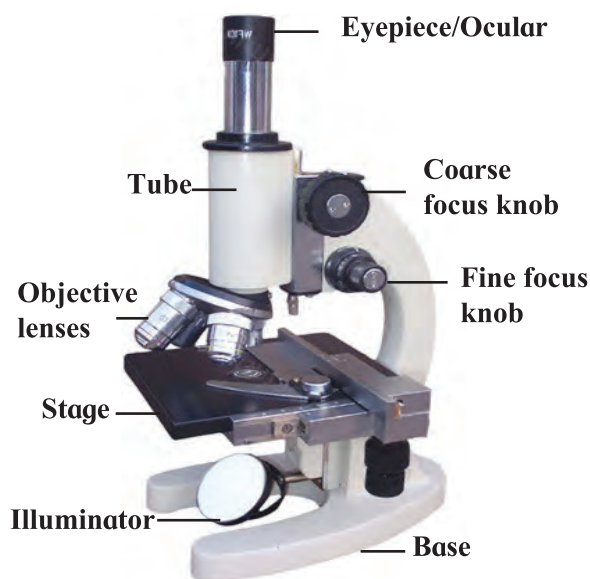
In 1838, the two scientists M. J. Schleiden and Theodore Schwann formulated a theory about cellular structure which stated, 'All the living organisms are made up of cells and the cell is the fundamental component of living organisms'. In 1885, Rudolph Virchow stated that all cells are formed from pre-existing cells.



Measurement and observation of cells

In 1673, Anton van Leeuwenhoek assembled various lenses to construct a microscope. He was the first to observe live bacterial and protozoan cells under the microscope.

Cells are extremely minute in size. We cannot see cells with the naked eye. Micrometre and nanometre are the units used for measuring their sizes. The compound microscope is used for observing cells. An object on a glass slide magnified many times by the lenses of this microscope.



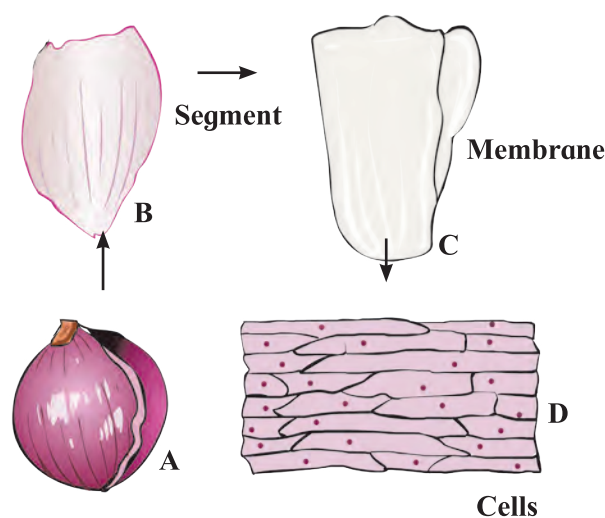
11.2 Compound microscope

1 centimetre = millimetres, 1 millimetre = 1000 micrometres,
1 micrometre (or micron) = 1000 nanometres



Let's try this.

Take a piece/segment of onion and carefully separate the thin skin from its concave surface with the help of forceps. Place the membrane on a glass slide and put a drop of water on it. (Take care that the membrane does not get folded while placing on the slide). Put a drop of a dilute solution of iodine or eosin over it and observe under the 10X objective of the compound microscope. Don't forget to put a cover-slip over the onion skin on the slide before placing it under the microscope.



11.3 Onion cells seen under a compound microscope

In the same way, observe the cells from various parts of plants like leaves, bark, root tips, etc. Do you remember that last year you had observed the amoeba and paramecium that are found in water?



Can you tell ?

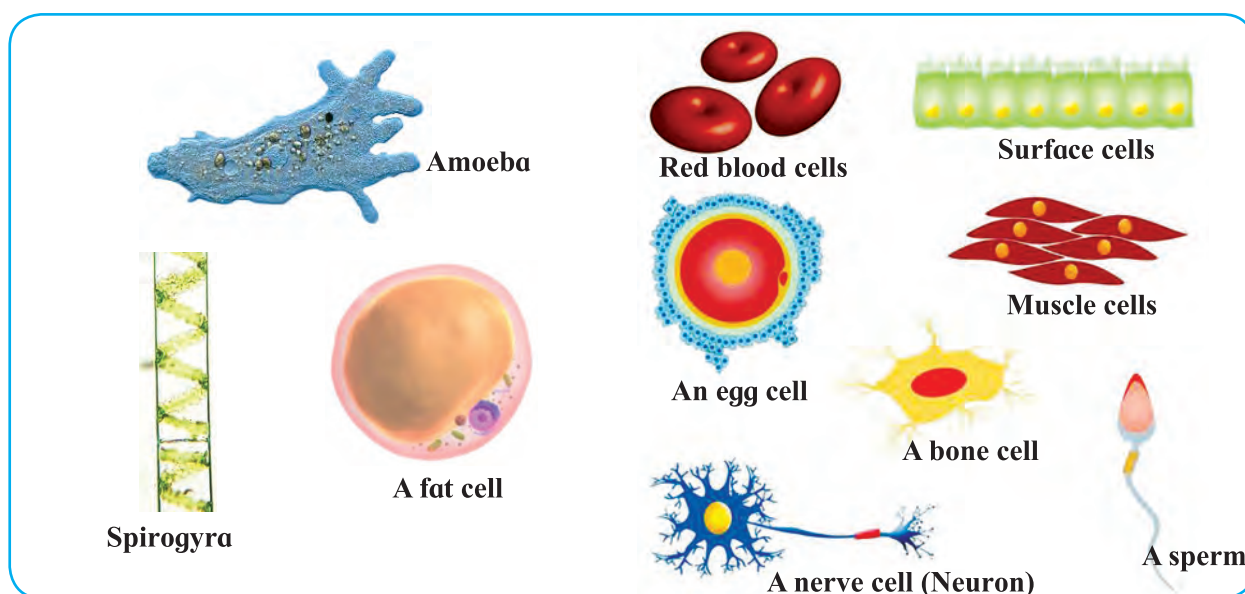
Are the cells that you observed, all alike? What is their structure? What are their shapes?

Books, my friends!

Collect interesting information about cells, from the reference books in the school library. For example, the largest cell, smallest cell, etc.

Cell size

There is great variation in the shapes of cells. Their shapes are mainly related to their function. Observe the cells of different shapes shown below.



11.4 Various cells

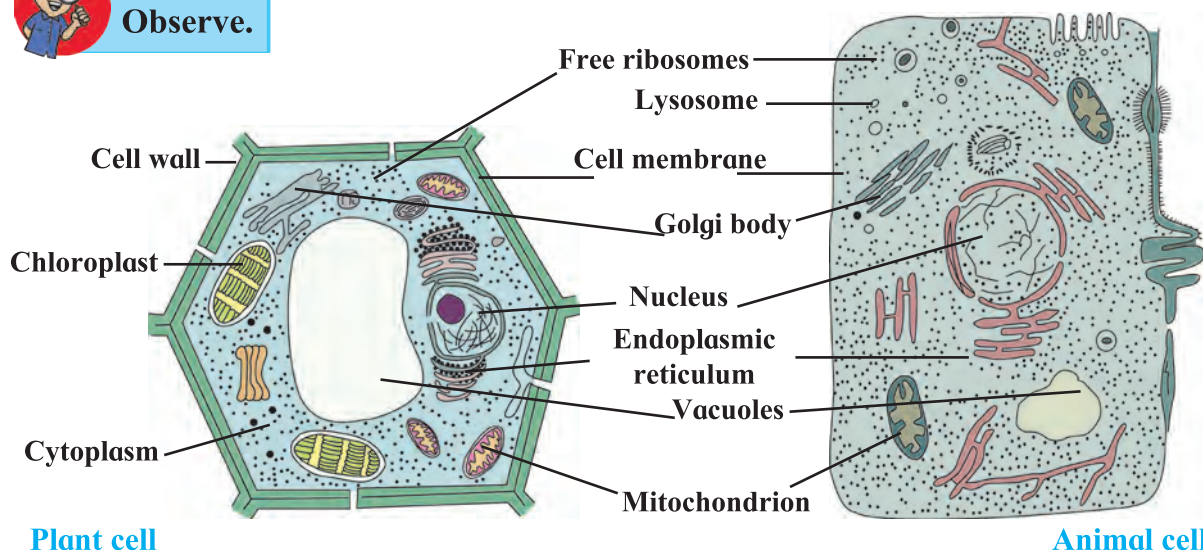
Cells are of many different shapes e.g. circular, rod-shaped, columnar, spiral, oval, rectangular, etc.

Each cell contains various components for carrying out the life-processes of the living organism. These components are called organelles. These organelles are studied in detail with the help of the electron microscope which can magnify images up to (2×10^9) two billion times their actual size.

There are two main types of cells - animal cells and plant cells. These cells consist of various types of membrane-bound cell organelles. Plant cells have a definite shape due to the presence of the cell wall around them. Besides, unlike animal cells, plant cells contain single large vacuole. All these cells are known as eukaryotic cells.



Observe.



11.5 Cells as seen under the electron microscope

The cell has four main parts - the cell wall, cell membrane, cytoplasm and cell organelles.

- (a) **Cell wall** : The cell wall is the outermost covering of a cell. It is present only in plant cells.
- (b) **Plasma membrane** : The plasma membrane, also called the cell membrane, is a kind of thin covering. It is extremely delicate and flexible. It is the outermost covering of animal cells.
- (c) **Cytoplasm** : The liquid part in the cell, present around the nucleus is called cytoplasm. It occupies the space between the plasma membrane and nucleus. Cell organelles are scattered in the cytoplasm.
- (d) **Cell organelles** : These mainly include the nucleus, endoplasmic reticulum, Golgi bodies, lysosomes, mitochondria, vacuoles, plastids, etc. Plant cells contain chloroplasts.

Which are the common components of plant and animal cells? Which are the different ones?

The nucleus is the most important organelle of the cell. There is a porous double membrane around it. The nucleus controls all functions of the cell. The endoplasmic reticulum is a sprawling net-like organelle. Its function is to make necessary changes in the proteins produced by ribosomes and send them to the Golgi bodies. Golgi bodies are made up of several flat sacs. Their function is the proper distribution of proteins. Mitochondria and plastids are organelles with double outer coverings. As mitochondria produce energy, they are called the powerhouses of the cell. The chloroplasts in plant cells carry out the function of photosynthesis. Vacuoles help to throw out waste products of the cell. Vacuoles in animal cells are small whereas there is only one large vacuole in a plant cell.



Use your brain power!

1. How do the cells acquire definite shapes?
2. How are cells protected?
3. What are the needs of cells?

Micro-organisms



Let's recall.

1. What is meant by micro-organisms?
2. Categorise the following organisms into two groups, according to size - amoeba, paramecium, euglena, snail, elephant, pigeon, worms.

We have learnt that there are countless living organisms on the earth. Of these, the organisms which cannot be seen with our eyes but can only be observed under a microscope are called **micro-organisms**.

Occurrence of micro-organisms

Micro-organisms are present all around us in the air, water, soil, food, sewage, garbage as well as in the bodies of plants and animals, including humans. Some micro-organisms are solitary, that is, they live singly, e.g. amoeba, paramecium, whereas some live in colonies. Some micro-organisms live on the remains of dead plants and animals.

Observation and measurement of micro-organisms



Try this.

1. Keep a moistened piece of bread or bhakari in a closed box. Observe it after 3-4 days using a magnifying lens.

2. Observe a drop of muddy water or water from a stagnant puddle, under the compound microscope.

3. Take a drop of yoghurt or buttermilk on a glass slide and observe it under a compound microscope.

In your notebook, draw sketches of the microbes you observe.



Use your brain power!

Can the point of a needle accommodate micro-organisms?

Nature of micro-organisms

Among the sketches you have drawn, do you find any of the micro-organisms you see below? What inferences can you draw about their sizes?



11.7 A variety of microbes



Do you know?

We cannot see objects smaller than 100 micrometres in size, with our eyes. So, we make glass slides of the micro-organisms and observe them under a compound microscope. However, if a magnification of 1000 $\times$ proves to be insufficient, then, we need to use an electron microscope to observe those micro-organisms.

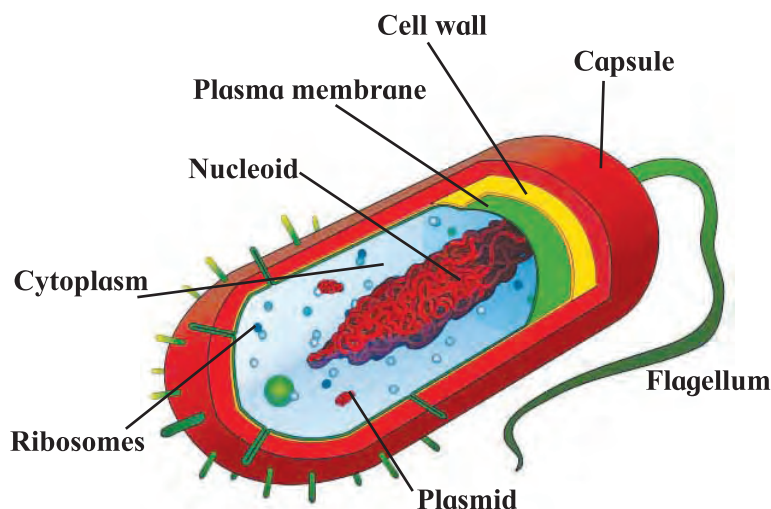
Sizes of some microbes :

- Paramoecium : about 100 micrometres
- Bacteria of typhoid: 1 to 3 micrometres
- Polio virus: 28 nanometres

Microbes measure less than 100 micrometres.

Even in these minute organisms, their organelles carry out all life-process within the single cell.

Some micro-organisms like the fungus that grows on bread or strands of algae in ponds are multi-cellular. However, most micro-organisms such as bacteria and viruses are unicellular. They have a somewhat different cellular structure. They do not have the membrane-bound organelles found in eukaryotic cells. The plasma membrane, cytoplasm and nucleoid are their only components. Such cells are called prokaryotic cells.



11.6 Prokaryotic cell

National Institutions

National Center for Cell Science (NCCS), Pune, is an institute involved in research in the field of cell science (cytology), biotechnology, etc.

Web address:

www.nccs.res.in

Growth of micro-organisms

Each micro-organism needs a specific environment for growth and reproduction. Many microbes need oxygen for their growth whereas some microbes can grow without oxygen. Some micro-organisms survive even in extreme and adverse conditions like the ocean floor, ice in polar regions, hot water springs, etc. During adverse conditions, micro-organisms form a thick covering around themselves and stop their life-processes. On return of favourable conditions, they come out of the protective covering and continue their life processes.

Where do the micro-organisms grow?

Medium : Soil, water, decaying matter, etc.

Temperature : 25° - 37°.

Nutrition : specific nutrients, e.g. algae-chlorophyll, oxygen.

Atmosphere : Moist, humid, warm

According to shape, and life-processes, micro-organisms are classified as algae, fungi, protozoa, bacteria and viruses.

Useful micro-organisms



Try this.

Take two earthen pots half filled with soil and mark them 'A' and 'B'. Mix some waste material like garden waste, dung, fruit peel, vegetable stalks, paper scrap, etc. with the soil in pot 'A'.

Mix things like pieces of glass, scrap metal, plastic bags, etc. with the soil in pot 'B'. Keep both pots at the same spot in the garden and observe them after 3 to 4 weeks.

**Can you tell ?**

Did the garbage in pot 'B' remain unchanged?

Where did the garbage in pot 'A' disappear? Why?

Microbes present in soil, dung, etc. decompose the garbage to obtain food material. As a result, garbage is soon converted into manure of the best quality and our surroundings are kept clean. As in the case of garbage, for proper sewage disposal, too, microbes are released into the sewage so as to help in the quick decomposition of the organic compounds in it.

**Use your brain power!**

Why should dry and wet waste be collected separately?

**Can you tell ?**

Observe the roots of the pea, bean and fenugreek plants. What could be the functions of the nodules on their roots?

We have seen that some micro-organisms present in the soil and those in the root nodules of leguminous plants convert atmospheric nitrogen into its compounds. These nitrogenous compounds help to increase soil fertility and thereby the protein content of the pulses grown in that soil.

Project : Visit the garbage depot near your village/city. Find out the reason for burying the garbage in the large pits there?

**Let's recall.**

What does your mother do to make yoghurt from milk?

If a few drops of yoghurt or buttermilk are mixed with lukewarm milk and it is kept at that temperature for 8-10 hours, microbes present in the drops of yoghurt quickly multiply and the milk gets converted into yoghurt. Microbes are thus useful for producing milk products like butter, buttermilk, cheese, *paneer*, etc.

Fermentation

The chemical process of conversion of one type of carbon compound into another type of carbon compound by the action of micro-organisms is called fermentation. Heat is generated in this process and carbon dioxide and some other gases are released. These gases cause an increase in volume, e.g. bread dough and idli batter are seen to 'rise'. The process of fermentation is used for making yoghurt from milk, producing alcohol from grains and fruits, bread from flour as well as in the production of acetic acid, citric acid, lactic acid, vitamins, antibiotics, etc.

**Use your brain power!**

1. Why is yoghurt mixed in the batter or dough for making *rava-idli*, *bhature*, *naan*?
2. How do preparations like yoghurt, idli, dosa become easy to digest?

If microbes are allowed to grow in batter, dough, fruit juices, etc., they break down these substances producing new compounds as they grow and multiply in them. This microbial process is used in the production of various common foodstuffs.

Books, my friends!

Who discovered the process of fermentation?



Sometimes, when you are ill, the doctor prescribes capsules or injections of medicines like penicillin. These types of medicines destroy the pathogens and retard their growth. They are called antibiotics. Antibiotics are produced with the help of specific microbes.

Diseases like tuberculosis, typhoid, cholera, etc. which were previously considered incurable, have now come under control because of antibiotics.

Domestic animals too can be protected from various diseases by mixing antibiotics with their food. Plant diseases can also be controlled with the help of antibiotics.



Always remember –

Though antibiotics are useful for curing certain diseases, they can be harmful if used without consulting a physician. Hence, a course of antibiotics should be completed strictly following the doctor's prescription. In fact, we should not take any medicines on our own to treat ailments like body-aches, headaches, common colds, etc.



Find out.

Why are infants vaccinated according to a fixed time schedule?

What is a vaccine?

A vaccine is produced in a laboratory with the help of microbes, that gives immunity against a particular disease. If we have been vaccinated against any disease, our immunity i.e. resistance to that disease, increases, so that the possibility of contracting that disease is greatly reduced.

Microbes are also used in processes like tanning of skin, production of ropes and strings from agave. Some microbes use oil for their growth. Such microbes are used to clear a layer of oil floating on the surface of an ocean or lake formed due to a leak or a spill i.e. to clear an oil slick.

Farm waste, human urine and faeces, wet garbage, etc. is collected and used in a biogas plant to produce biogas and fertilizer.

Harmful micro-organisms



Let's recall.

What happens to the sweetmeat or bread forgotten in a lunch-box for three or four days?

If jars of pickles, jams (*murabba*), etc. are opened after a long time, a round layer of white scum or black particles may appear to have formed on the surface. In summer, milk and meat get spoilt quickly. Fungus grows quickly on moist and stale food. What do we do with such spoilt food? Why?

Food poisoning

As they use foodstuffs for their own nutrition, some microbes release toxic materials (enterotoxins), into the food. Such toxins spoil the food. Eating such spoiled food can cause loose motions and vomiting.



Use your brain power!

1. How will you know that a foodstuff is spoilt?
2. What precautions will you take while purchasing food? Why?
3. Why do food poisoning incidents occur during marriage or other community feasts?

Pathogens : Disease-producing micro-organisms

Pathogens may be present in water bodies contaminated with sewage and dirt from the surroundings, in food left uncovered in unhygienic conditions with houseflies sitting on it, etc. If such contaminated food or water is consumed, we may fall ill with diseases of the alimentary canal, like amoebiasis, typhoid, cholera, hepatitis, gastro, etc. Pathogens are released in the air when a person having an infection of the respiratory tract sneezes or coughs. A healthy person may get infected with such pathogens on breathing in the same air and contract diseases like common cold, cough, diphtheria, pneumonia, tuberculosis, etc.

Mosquitoes reproduce in places like heaps of garbage, drains, stagnant water, etc. Microbes that cause diseases like malaria, dengue, elephantiasis, yellow fever, chikungunya, Zika fever, etc. gain entry into the human body through the bite of a female mosquito.

Make sure to check -

1. Is the water tank and the water in it, clean?
2. Are the water tanks and toilets in the school, clean?
3. Is the water that accumulates in pots, tyres, cans, etc. around the house drained promptly?
4. Are the water storage containers cleaned regularly?



Always remember –

1. Eat fresh and properly covered food.
2. Drink boiled water.
3. Hold a handkerchief over your mouth and nose when you cough or sneeze.
4. Don't allow garbage and water to accumulate around your house.

Swachha Bharat Abhiyan

Almost 80% of all diseases occur due to uncleanness. Keeping our surroundings clean, avoiding litter and disposing garbage properly, avoiding defecation in the open are some easy ways to stop the spread of diseases.

The Swachha Bharat Abhiyan is a national movement started several years ago to increase awareness about public hygiene along with habits of personal hygiene. Let us participate in this movement by starting a cleanliness drive in our school and neighbourhood.



Find out.

Which diseases do micro-organisms cause in plants and animals?



Do you know?

What exactly happens when we have fever?

The body temperature of a healthy human being is about 37° C. If micro-organisms enter our body, our immune system starts acting and body temperature rises. This destroys the micro-organisms. The site of an injury also feels warm for the same reason.



Use your brain power!

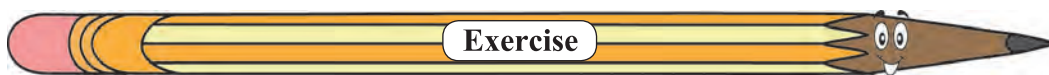
What is the correlation between the normal body temperature of humans which is 37°C and the optimum temperature for the growth of micro-organisms, 15°C to 35°C ?



Can you tell ?

1. What happens if clothes remain damp in the rainy season?
2. What are the black or white spots sometimes seen on gunny bags?
3. Why are leather articles like purses, wallets, belts, footwear always polished before storing away?
4. What is the powdery material found on old currency notes or old rubber or paper?

All the materials mentioned above i.e. gunny bags, cotton clothes, paper, rubber, etc. are plant products and leather is an animal product. In a humid atmosphere, fungi and some other micro-organisms grow on these articles and spoil or damage them.



1. Answer the following questions.

- (a) What is a 'cell'?
- (b) Name the different organelles in a cell?
- (c) What are micro-organisms?
- (d) Which are the different types of micro-organisms?

2. Fill in the blanks with the proper word.

- (a) The organelle called the is present in plant cells only.
- (b) Garbage is converted into by micro-organisms.
- (c) In the cell, photosynthesis is carried out with the help of
- (d) An electron microscope is necessary for the study of

3. What is difference between us?

- (a) Plant cell and animal cell.
- (b) Prokaryotic cell and eukaryotic cell.

4. Sketch and describe in your own words, the plant cell and animal cell.

5. Explain the uses and the harmful effects of micro-organisms.

6. Give reasons.

- (a) Diseases spread on a large scale during periods of heavy rainfall and floods.
- (b) There is a possibility of food poisoning if we eat stale food.
- (c) Soil is turned over during tilling.
- (d) Fungus grows quickly in moist or humid conditions.
- (e) A refrigerator is used in almost every home.
- (f) Bread 'rises' during baking.
- (g) Fodder is soaked in water before offering to cattle.

7. When will you use a simple microscope and when, a compound microscope? Explain in detail how you will use them.

Project : Visit a bakery in your area, collect information about the process of manufacture of their products and make one of them at home.



12. The Muscular System and Digestive System in Human Beings



Let's recall.

1. What is meant by 'organ system'?
2. How are the bones in our body joined to each other?

Muscular system



Try this.



Close your fist tightly and bend your arm at the elbow. Now feel the upper part of this arm with the fingers of your other hand. What did you experience?

Did you feel the hardness in the upper arm ? This fleshy part consists of muscle. Muscles contract and relax as different parts of our body move. Muscles give our body a specific shape and posture.

Muscles are bundles of fibres that can contract and relax as required.

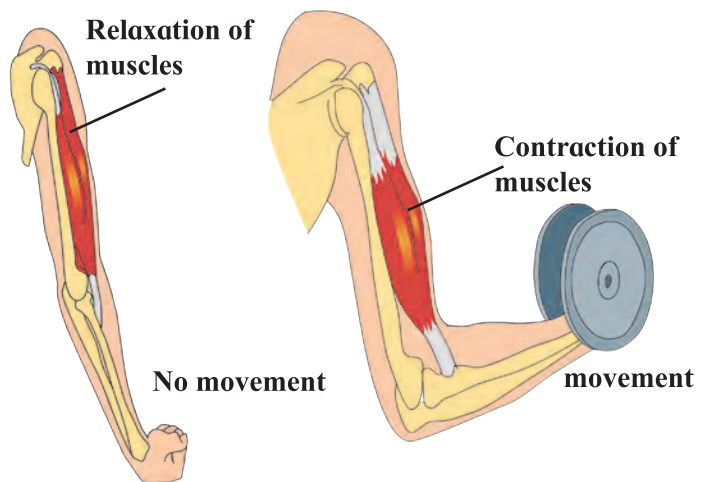


Can you tell ?

What is the mutual relationship between muscles and bones?

Muscles are firmly attached to bones by means of tendons. When muscles contract, there is movement at the joint and the bones move either nearer to or away from each other.

The action of muscles is necessary for all kinds of movements – from the small movements of eyelids to those that demand great strength as when chopping wood with an axe. We use muscles for various movements like talking, laughing, walking, jumping, throwing, etc.



12.1 Contraction of muscles



Use your brain power!

Which parts of our body are made up only of muscles?



Do you know ?

There are more than 600 muscles in the human body. Muscles contribute almost 40% of the weight of a healthy adult human body. There are about 30 muscles in the human face. Our eyes, mouth and nose are encircled by small muscles. Expressions like happiness, sadness, fear are expressed by the movements of these muscles of the face.



Can you tell ?

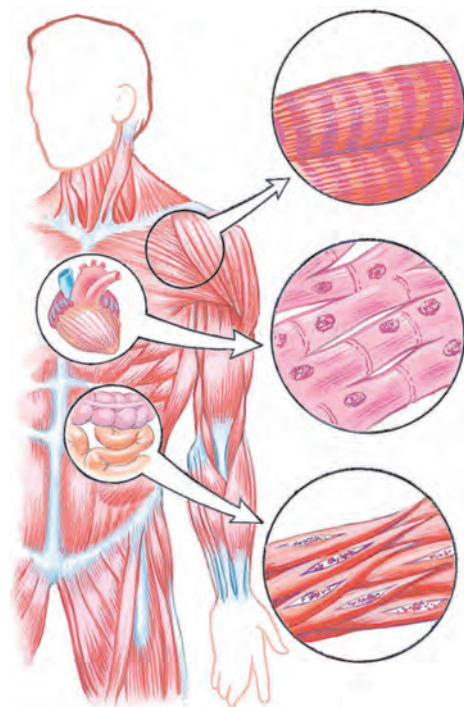
Are the muscles of the different organs in our body identical?

1. Voluntary muscles : Working with our hands, walking, eating, etc. are functions that depend upon our will. Muscles used in these actions are called **voluntary muscles**. For example, muscles in our arms and legs are voluntary muscles.

2. Involuntary muscles : Various processes like breathing, blood circulation, digestion are vital functions, i.e., they are essential for life. They do not depend upon our will. The muscles of organs which carry out these involuntary functions are called **involuntary muscles**. Functions of organs like the stomach, intestine, heart are carried out in their own fixed manner by involuntary muscles.

Which organs in our body have voluntary muscles and which ones have involuntary muscles? Find out and make a list of each type.

Types of muscles



12.2 Muscles in the human body

1. Skeletal muscles : The two ends of each of these muscles are attached to two different bones. Examples of such muscles are muscles of the arms and legs. Their movements are voluntary. They are also responsible for holding the bones of the skeleton together and giving shape to our body.

2. Heart or cardiac muscles : These muscles bring about the contraction and relaxation (beating) of the heart. Their movement is involuntary. Cardiac muscles cause our heart to relax and contract continuously at a rate of about 70 times per minute.

3. Smooth muscles : These muscles are present in the internal organs other than the heart. For example, muscles of the stomach, intestine, blood vessels, uterus, etc. Their movements are involuntary and slow. Various vital functions of our body, of which we remain quite unaware, are carried out by these special muscles.



Can you tell ?

How do muscles perform their functions ?



Try this.

1. Hold your arm straight at the elbow (i.e. 180°) without closing your fist.
2. Bend the arm at the elbow through 90° .
3. Touch the shoulder with your fingers on same side.

Muscles of which part of your arm contracted and relaxed during the above three actions ?

Muscles in our body always work in groups. When some muscles contract, other muscles of the same group, relax. This is how muscles help in the proper performance of the various functions of our body.

The muscle on the front of the bone in our upper arm is called the biceps. The muscle at the back is called the **triceps**.



Use your brain power !

What would happen if :

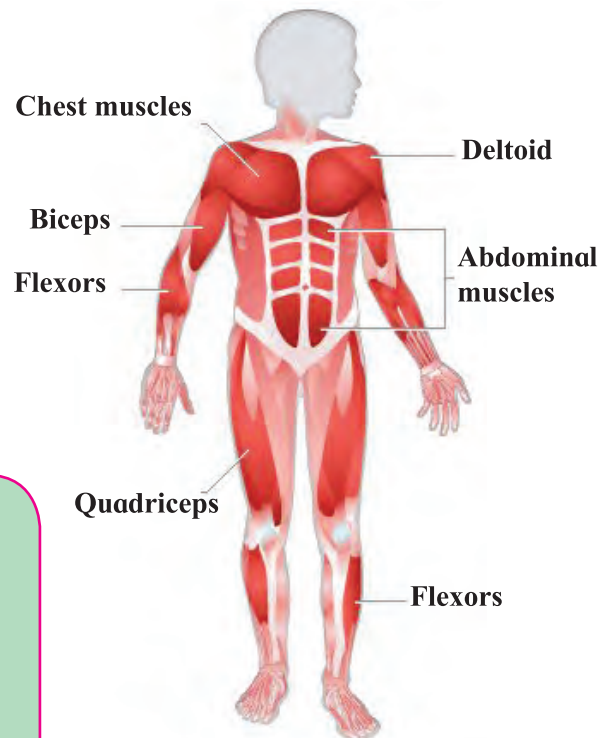
1. The cardiac muscles do not move.
2. Food enters the stomach and the stomach muscles do not move.



Always remember -

Muscles of our body must be strong and efficient. Our diet must include proteins and carbohydrates in sufficient quantity for the proper growth and repair of muscles. We must get regular exercise. It makes the muscles strong. We must sit with a straight back, and not with the back hunched or bent. Otherwise, gradually, changes occur in the structure of the vertebrae. Muscles in the shoulder and back begin to hurt. Disorders of the vertebral column may also arise.

During exercise, movements of the heart muscles become more rapid. Breathing, too, becomes faster, ensuring a sufficient supply of oxygen and nutrients to various parts of the body.



12.3 Muscles in different parts of the body



Do you know ?

The study of muscles is called myology. Contraction is the basic property of muscles. The largest muscle of our body is in the thigh. The smallest muscle is attached to a bone in the ear, called the stapes.

Digestive system



Let's recall.

1. What happens to the food we eat, inside our body?
2. Does this food mix as it is with the blood?

Conversion of food into a soluble form and its absorption into the blood is called digestion.

The digestive system consists of the alimentary canal and digestive glands. The total length of alimentary canal is about 9 metres. Its main parts are the mouth, pharynx, oesophagus, stomach, small intestine, large intestine, rectum and anus. The salivary glands, liver and pancreas are the digestive glands connected to the alimentary canal.

Different organs of the digestive system systematically perform the function of digestion. There are different stages in the process of digestion of food and at each stage there is a different organ of the digestive system which performs its specific role. Let us study the structure and function of each organ of the digestive system.

Teeth

The process of digestion begins with the function of the teeth in the mouth. There are four types of teeth, namely, incisors, canines, pre-molars and molars. Each type of tooth has a specific function. Each tooth is covered by a hard substance called enamel. Enamel is made of a calcium salt.

Saliva contains an enzyme called ptyalin or salivary amylase. Ptyalin converts starch into a sugar called maltose.

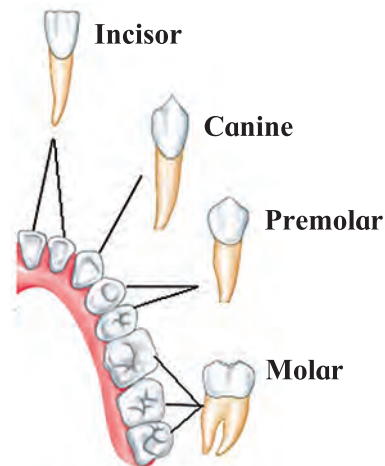
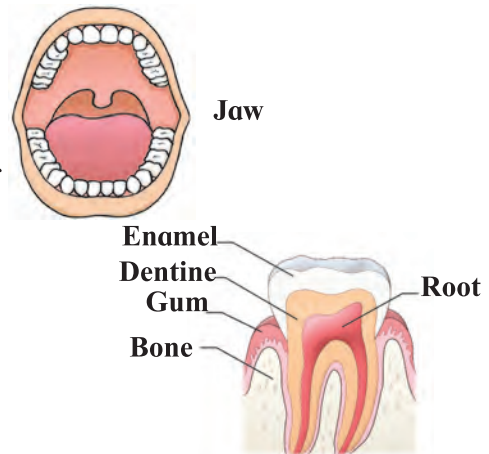


Use your brain power!

During digestion, does all the food that we have eaten get converted into useful, nutritive substances?

My friend, the internet!

Collect information about the various organ-systems from the websites www.livescience.com and www.innerbody.com



12.4 Teeth

Learn a new word

Enzymes are substances secreted in the body of an organism, which bring about specific chemical reactions. They act as catalysts. Digestive enzymes of the digestive system bring about changes in the food materials. Metabolic processes are impossible without enzymes. Enzymes are a specific type of proteins. They are most active at normal body temperature.

Mouth : Digestion of food begins in the mouth. Food is chewed with the help of teeth into very small pieces.

Pharynx/Throat : The oesophagus and trachea open into the pharynx.

Liver : The liver is the largest gland in the body. It has a rich supply of blood. Its main function is storage of glucose. The gall bladder is situated below the liver. It stores the bile, the digestive juice secreted by the liver. When bile is carried into the small intestine, it mixes with the food there and helps in the digestion of fats. Bile contains bile salts.

Small intestine : The small intestine is about 6m long. Most of the digestion and absorption of food takes place here. Three different digestive juices are mixed with the food in the small intestine. Absorption into the blood, of nutrients obtained by the digestion of food, also occurs in the small intestine.

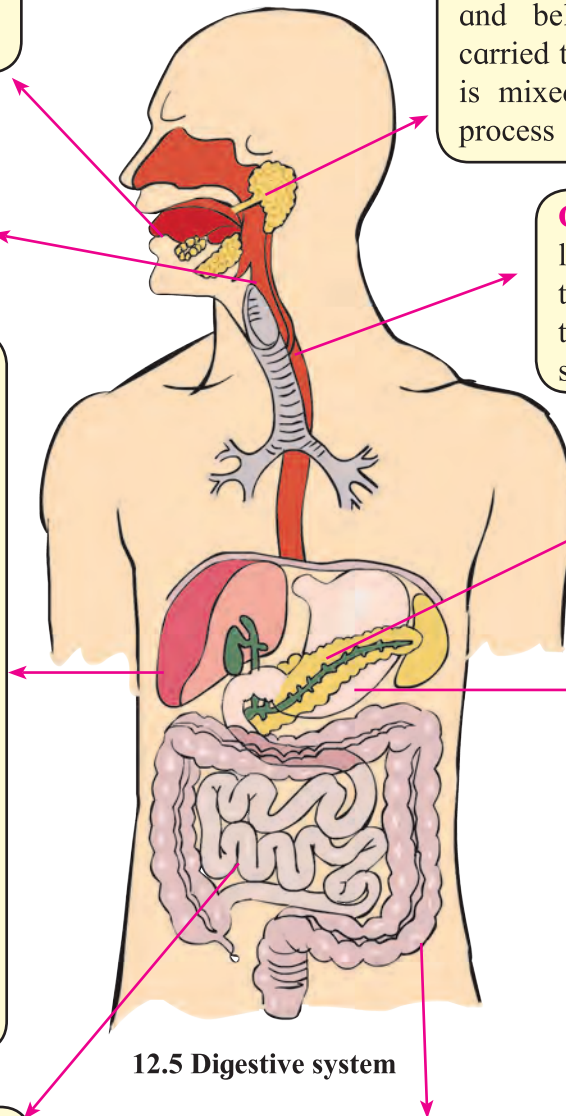
Large intestine : The large intestine is about 1.5m long. Only water is absorbed in the large intestine. A small part called the 'appendix' is attached to the first part of large intestine. Undigested remains of the food digested in the small intestine enter the large intestine. Undigested material is thrown out of the body through the anus.

Salivary glands : Saliva is produced in the salivary glands in the mouth cavity, located in front of the ears, near the pharynx and below the tongue. It is carried to the mouth via ducts. It is mixed with food during the process of chewing.

Oesophagus : It is a tube leading from the pharynx to the stomach. It pushes the food towards the stomach.

Pancreas : The pancreas secretes the pancreatic juice that contains various enzymes.

Stomach : The large sac-like part of the alimentary canal is called the stomach. The gastric glands of stomach secrete gastric juice. Food that has entered stomach is churned. Three components of gastric juice, namely, hydrochloric acid, pepsin and mucus are mixed with food here and it becomes acidic. Mainly proteins are digested in the stomach. Due to the churning and the action of gastric juice, food becomes a semi-solid slurry which is slowly pushed into the small intestine.



12.5 Digestive system

Important Glands of the Digestive System, their Secretions and Functions

Organ	Gland	Secretion	Functions
Mouth	Salivary gland	Saliva : Ptyalin	Conversion of starch into maltose.
Stomach	Gastric wall	Gastric juice Hydrochloric Acid Pepsin Mucous	To make the food acidic. Breakdown of proteins. To protect the inner lining of the stomach from hydrochloric acid.
	Liver	Bile	To make food alkaline. To convert large fat particles into small ones (emulsification of fats).
	Pancreas	Pancreatic juice Trypsin Lipase Amylase	To convert proteins into amino acids. To convert fats into fatty acids and glycerol. To convert complex carbohydrates into simple sugars.
Small intestine		Intestinal juice	To convert proteins into amino acids. To convert complex carbohydrates into glucose. To convert fats into fatty acids and glycerol.

Are we putting our health at risk?

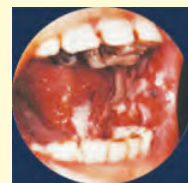
Physical health is extremely important in personality development. When all our organ systems function properly, we say that we are in good health. However, harmful habits like smoking, chewing of tobacco, drinking alcohol affect our health adversely.

Effects of tobacco, alcohol, smoking, on the digestive system

If we consume any tobacco products, the mouth, pharynx, alimentary canal and other organs of the digestive system cannot function properly. It causes problems like vomiting, nausea, and headache. Besides, tobacco particles stick to teeth, gums and skin of the mouth cavity and slowly cause injury to those parts resulting in their dysfunction. This causes swelling of the gums and pain when moving the jaws. The pharynx and intestine become inflamed and the condition further progresses into cancer leading to death.

My Role

- Making pictures and slogans against tobacco consumption, smoking, drinking alcohol, etc. and displaying them in the classroom and the neighbourhood. Keeping a watch on whether one's surroundings are tobacco-free.
- Composing an oath against addiction and taking the oath in the class and also during assembly.
- Making parents and teachers aware of such instances in the neighbourhood.



**31st May is World No Tobacco Day and
7th April is World Health Day.**



1. Fill in the blanks with the right word from the brackets.

- (a) The process of digestion starts from the (stomach / mouth)
- (b) Eyelids have muscles (voluntary / involuntary) .
- (c) is not a function of the muscular system. (Production of blood cells / Performing movements)
- (d) Muscles of the heart are (ordinary muscles / cardiac muscles)
- (e) Pushing forward the food that has been chewed is the function of the (stomach / oesophagus).

2. Find a match for me.

- | Group 'A' | Group 'B' |
|----------------------------------|--|
| (1) Cardiac muscles | (a) always function in pairs. |
| (2) Are brought about by muscles | (b) we never feel tired. |
| (3) Pepsin | (c) uncontrolled and painful contraction of muscles. |
| (4) Cramps | (d) chewing movements of jaws. |
| (5) Skeletal muscles | (e) enzyme of the gastric juice. |

3. Who is telling a lie?

- | Organ | Statement |
|--------------|--|
| 1. Tongue | My taste-buds can tell only a sweet taste. |
| 2. Liver | I am the largest gland in the body. |

3. Large intestine I am 7.5 meter long.

4. Appendix Digestion is impossible without me.

5. Lung I play an important role in excretion.

4. Give reasons.

- (1) Food becomes acidic in the stomach.
- (2) Cardiac muscles are said to be involuntary muscles.
- (3) Intoxicating substances should not be consumed.
- (4) Your muscles should be strong and efficient.

5. Answer the following.

- (a) How many types of muscles are there? Which are those types?
- (b) What causes the problem of acidity? What is its effect on the body?
- (c) Name the different types of teeth. What is the function of each type?

6. Sketch and label a diagram of the digestive system and describe it in your own words.

Project :

1. Make charts about maintaining good health.
2. Design a powerpoint presentation about the digestive system and present it in the class.



13. Changes – Physical and Chemical



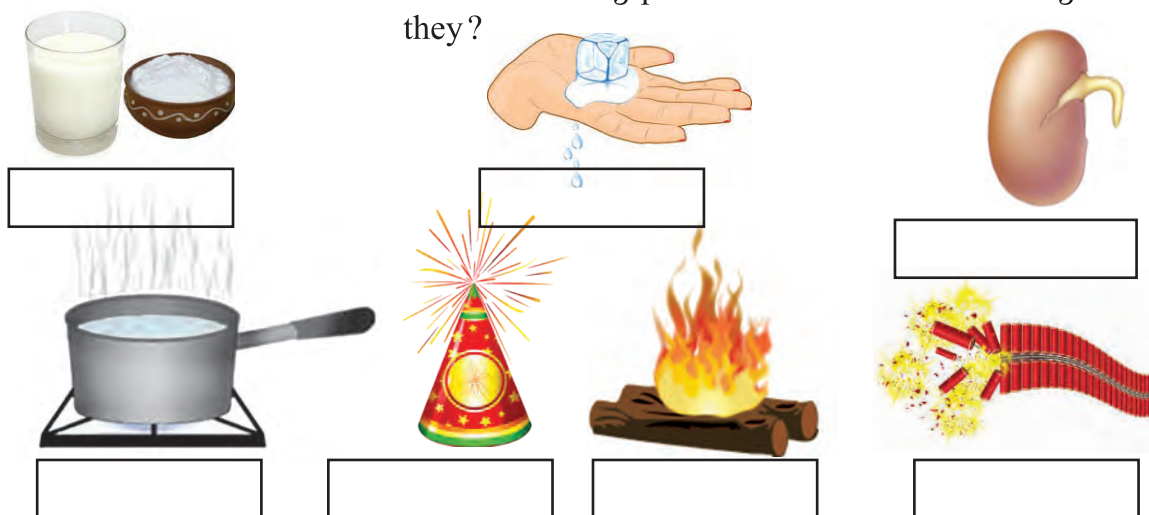
Let's recall.

1. What are the causes of the changes occurring in our surroundings?
2. What is meant by man-made changes? Which are these changes?



Observe and discuss.

What changes have taken place in the materials seen in the following pictures? What kind of changes are they?



13.1 Various changes

Which points will you consider while classifying the following changes into two groups – a fruit falling from a tree, rusting of iron, raining, lighting an electric bulb, cutting vegetables?



Can you tell?

Which of the above changes have occurred of their own accord or naturally?

We have previously studied some examples of changes. Changes like the ripening of a fruit, spoiling of milk occur naturally. These are called **natural changes**. Can you think of other examples of such natural changes?

What changes have you seen taking place in the materials in your surrounding?

Let us learn about changes in greater detail in this lesson.



Can you tell?

We see many man-made materials in our day-to-day life. For what purposes are they produced?

Many changes such as sharpening a pencil, baking bread, cooking food are useful to us and these are, therefore, called **useful changes**. The changes that are not useful or changes that do us harm are called **harmful changes**.



Use your brain power!

1. What kind of change is the falling of a tree in a storm?
2. What kind of change is the conversion of milk into yoghurt?

Think about it.

Can you now classify the natural and man-made changes you have listed as useful and harmful changes ? So far, we have studied certain types of changes. What can you tell about two of these, namely, bursting of a balloon and ripening of a fruit, from the point of view of their duration i.e. the time they take to happen?

The duration of the bursting of a balloon is far shorter than that of the ripening of a fruit. Changes that take place in a short period of time are called **fast/quick changes**. While changes that take place over a long period of time are called **slow changes**.



Use your brain power !

Give some examples of fast and slow changes that occur in your surroundings.

Have some fun !

Apparatus : Pieces of glass bangles, a candle, a matchbox, etc.

Procedure : Hold a piece of glass bangle in the candle flame supporting it with your fingers. Take care to heat the piece in the middle keeping its two ends outside the flame. Observe it as the middle gets heated and becomes soft. It bends due to the finger-pressure on its ends. In this way, bring the two ends together and let the piece cool.

A *toran* can be made by linking such pieces with each other. Make such *torans* of different patterns and colours and decorate your class and home.



Can you tell ?

1. You made a link from the glass piece. How will you change the shape of the link to give it its original shape ?
2. How will you restore the original candle after melting one ?

Melting some wax and obtaining the original solid wax again is something that we can do repeatedly. The changes that can occur in a forward and reverse direction again and again are called **reversible changes**. A ripe mango, however, cannot be transformed back into a raw mango. Wood cannot be obtained from the ash formed on burning the wood.



Use your brain power !

What is meant by irreversible change?
Give some examples.



Can you tell ?

1. What comes after daytime?
2. What is the next stage after sunrise?
3. What comes after a high tide in the sea?
4. A bird sitting on a tree flies away.
5. Flooding
6. A meteor streaking across the sky.

On considering the above examples, we find that some changes occur again and again after a definite interval of time. Such changes are called **periodic changes**. On the other hand, it cannot be said for sure when certain changes will recur after one occurrence. Even if they recur, the time interval is not fixed. Such changes are called **non-periodic changes**.



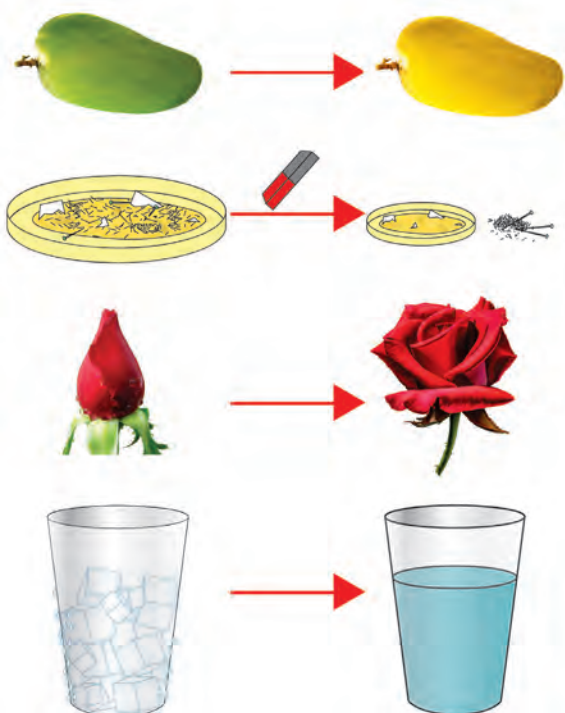
Use your brain power!

1. Which type of change is the change of seasons from summer to rains to winter?
2. Which hands of a clock show periodic changes from 6.00 am to 6.00 pm? How many times?



Observe.

1. Which of the changes shown in the picture alongside are temporary?



2. Which of the changes are permanent?
3. In which of the changes did the original matter undergo a change?
4. In which, did the original matter remain unchanged?
5. In which of the changes was a new substance with a new property formed?

In some of the above examples of changes, the properties of the original substances remain the same, that is, their composition remains unchanged. No new substance is formed. Such a change is called a **physical change**.

The change due to which one substance is transformed into another substance having new and different properties is called a **chemical change**.

13.2 Various chemical and physical changes



Let's recall.

1. What processes occur during the change of state of matter?
2. What happens when water is taken in a bowl and heated?

The process of formation of vapour from a liquid is called evaporation. Drying of clothes, formation of salt from seawater are possible due to evaporation. We have studied some processes that are a part of the water-cycle. Which are these processes? Do the original properties of water change during those processes? Previously, we have learnt about the processes of dissolving, boiling, melting. They are all examples of physical change.



Use your brain power!

Which of the following are physical changes and which are chemical – making a table from wood, burning wood, breaking of a glass object, ripening of a tomato, rusting of iron?



Try this.

Apparatus : Evaporating dish, sugar, burner, tripod, etc.

Procedure : Take some sugar in an evaporating dish. Place the dish on a tripod and heat it. Observe the changes taking place in the sugar. Stop heating when a blackish substance is seen at the bottom of the evaporating dish. What kind of change does the above process bring about?

Corrosion

When an iron article rusts, a reddish brown layer forms on it. A greenish layer is seen to form on a copper article. This process is called corrosion of metals. Things become weak due to corrosion. Corrosion is caused by oxygen, moisture, vapours of chemicals in the air.



Always remember –

While classifying changes we take into account only one criterion at a time. However, a number of different criteria can be applied to the same change.



Do you know?

Iron articles are given a thin coat of zinc to prevent corrosion. This is called galvanization. Copper and brass articles are coated with tin. This is called tinning.

In this age of technology, a new process called powder coating has been developed. Coats of various colours are applied on metals like iron and aluminium. They prevent corrosion of the metal.



1. Distinguish between the following.

- (a) Physical change and chemical change
- (b) Periodic change and non-periodic change
- (c) Natural change and man-made change

2. Under which different types can the following changes be classified?

- (a) Conversion of milk into yoghurt.
- (b) Bursting of a cracker.
- (c) Occurrence of an earthquake.
- (d) Revolution of the earth around the sun.
- (e) Stretching of a spring.

3. Give reasons.

- (a) While purchasing canned food, its expiry date should be checked.
- (b) An iron article should be given a coat of paint.
- (c) A wooden article should be polished.
- (d) Copper and brass utensils should be tinned.
- (e) A dry handkerchief gets wet at once on dipping in water, but it takes long for a wet handkerchief to dry.

4. What will you take into account while identifying the following?

- (a) A physical change in a substance.
- (b) A chemical change in a substance.

5. Read the paragraph and note down the various types of changes it mentions.

It was nearing six o'clock in the evening. The sun was setting. A breeze was blowing. Leaves on the tree were shaking. Sahil was sitting in the courtyard, rolling balls of wet soil and shaping them into various toys. Then he felt hungry and went into the house. Mother made a dough from wheat flour and fried purees. While eating hot purees, his attention was drawn outside the window. It had started raining. There was lightning, too. Sahil was enjoying his dinner in the dim light.

Project :

Visit a place where work like powder coating, spray painting is done. Make a note of the information you obtain.

