

15.1 Different types of soil

Soil, the topmost layer of the earth crust is one of the most important resources that we have been gifted from the nature. It plays a very important role to maintain life on the earth. The nature of soil is different from place to place on the earth.

Let us do Activity 15.1 to observe the nature of soil in different locations.



Activity 15.1

You will need:- Samples of soil taken from different locations (Close to a big tree, from a flower bed, from your compound, under a rock), a white sheet of paper, hand lens

Method:-

- Spread the soil sample on the white paper.
- Observe components of it using a hand lens.
- Take a sample of soil between thumb and forefinger and feel the texture of soil.
- Use the following table to record your observations.

Place where soil is collected	Observed components	Texture (soft/hard)	Other facts
1.			
2.			
3.			
4.			

Important : After doing this activity wash your hands well.



Figure 15.1
▲ Testing the texture of soil

You may have learnt from the Activity 15.1 that soil consists of different particles and their texture is also different.

Mineral particles in soil can be divided into 3 groups according to their size. They are sand, clay and silt. Clay contains very small particles with a soft texture. Sand particles are bigger than clay, with a hard texture. Silt is medium sized particles with a soft texture. You can learn the relative size of them referring to the Figure 15.2.

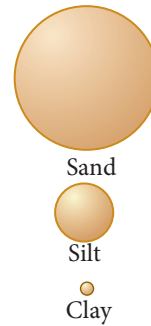


Figure 15.2 ▲ Relative size of different particles in the soil

There are three types of soil which can be identified according to the abundance of those particles in the soil. They are;

- Clay soil
- Sandy soil
- Loamy soil

Some features of those soil types are given in Table 15.1.

Table 15.1 ▼ Some features of soil types

Kind of soil	Nature of soil	Properties	Uses
Clay soil	<ul style="list-style-type: none"> ● Clay is more abundant ● Sticky 	<ul style="list-style-type: none"> ● Retain water and minerals ● Retention of air is less 	<ul style="list-style-type: none"> ● Used to make bricks, tiles and ceramics
Sandy soil	<ul style="list-style-type: none"> ● Sand is more abundant ● Particles are arranged loosely 	<ul style="list-style-type: none"> ● Retention of air high ● Retention of water is less 	<ul style="list-style-type: none"> ● Used in building industries ● Used to make glass items
Loamy soil	<ul style="list-style-type: none"> ● Contains sand, silt and clay ● Organic materials are abundant 	<ul style="list-style-type: none"> ● Water and air retained sufficiently ● Soil is rich in soil organisms and plant nutrients. 	<ul style="list-style-type: none"> ● Most suitable for agriculture

Loamy soil is more suitable for the growth of plants. Therefore, a flower pot should be filled with loamy soil.

Sieves are used to separate different sized particles in soil. These sieves are prepared in sets. The topmost sieve has biggest holes. The size of the holes decrease from top to bottom. A soil mixture is put into the topmost sieve and the set of sieve is shaken fast. Then, in each sieve, different sized soil particles remain.



Figure 15.3 ▲ Set of sieves



Activity 15.2

You will need :- A set of sieves, soil samples

Method :-

- Separate soil particles using different sized sieves
- Mix them in different ratios and form different types of soil

Sandy soil or clay soil can be converted to loamy soil by adding organic materials (decayed animal and plant parts) in suitable amounts.

15.2 Composition of soil



Activity 15.3

Separation of components in the soil

You will need :- A long polythene tube, threads, soil, water

Method:-

- Cut a polythene tube about 50 cm long and tie one end of it. Fill $\frac{3}{4}$ of the tube with water.
- Dig a hole in your school garden and take a sample of soil from it.
- Mix the soil sample with water.
- Then, add it to the water already present in the polythene bag and leave to settle.
- Now observe.
- You can observe the separation of components of soil as shown in Figure 15.4

Then, take a polythene tube of 1m long. Fill $\frac{3}{4}$ of it with water and put twice the amount of soil taken in the above activity into it

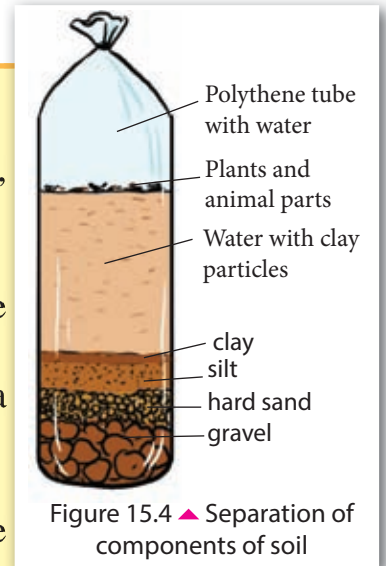


Figure 15.4 ▲ Separation of components of soil

Soil is a mixture of different components. Ratio of these mixtures are different in various types of soil. Figure 15.5 shows results of a study carried out on the composition of different types of soil.

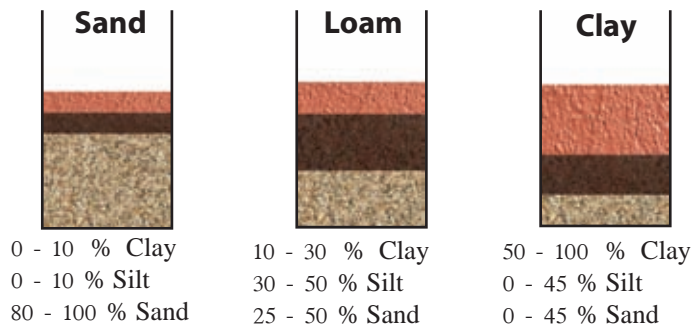


Figure 15.5 ▲ Composition of different types of soil

Components of soil can be listed as follows.

- Solid components
 - Soil minerals
 - Soil organic materials (humus)
- Soil air
- Soil water
- Soil organisms

Soil minerals

Solid components in soil such as clay, silt and sand are considered as soil minerals. When you study the composition of soil, you have studied about these particles.

Functions of soil minerals

- Minerals that is obtained from soil to plants are provided by soil minerals.
- Water and minerals are retained by the clay particles in soil.

Soil organic materials (Humus)

Decayed parts of animals and plants in soil are called soil organic materials.



Activity 15.4

By adding humus to sandy soil, the water retention capacity is increased. Plan an experiment that can be conducted in the school laboratory to find the accuracy of this statement.

Functions of soil organic materials (Humus)

- As a storage of nutrients needed for the growth of plants
- Increase the capacity of retaining air and soil
- Prevents the cracks in soil during dry seasons
- Increase retention of water in soil

You may have understood the mineral components and organic materials in soil through the above activities.

Soil air

What happens when a soil clod is put into a water beaker?

You can observe air bubbles emitting from the soil clod. It is clear that air in the soil is coming out as bubbles.

Let us do Activity 15.5 to prove that soil contains air.

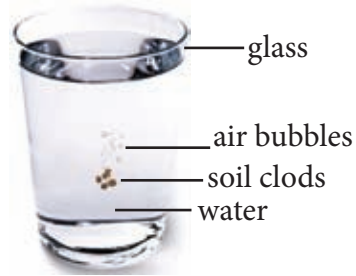


Figure 15.6 ▲ Releasing of water bubbles when a soil clod is put into water



Activity 15.5

You will need :- Two glass vessels of the same size, soil, water

Method :-

- Put soil into one vessel up to 4 cm.
- Put water into the other vessel up to 4 cm.
- Add water in the water vessel into the vessel with soil.
- Then, measure the height from the bottom to the water level.
- Repeat the above experiment using soil samples collected from different locations.

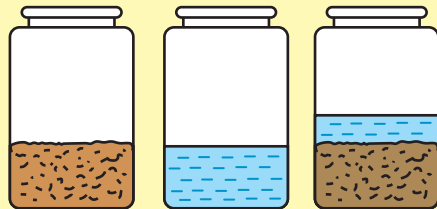


Figure 15.7 ▲ Learn about air in soil

When, water and soil are mixed the height to the water level appears to be less than 8 cm. Imagine the height after water and soil are mixed is 7 cm. We can assume that the height of 4 cm of soil contains about 1 cm of air. That means about $\frac{1}{4}$ of the volume of soil contains air. The soil air amount in different soil samples is different.

In the above activity water has moved into the space among soil particles. When, water moves into those spaces air present in them is released. Air which retains in soil particles is called soil air.

Functions of soil air

- Provides air needed for the respiration of soil organisms and plant roots
- Needs in germination of seeds
- Creates porosity in soil

Soil water

Though we think that soil is dry, there is water in it.

Let us do Activity 15.6 to identify that soil contain water.



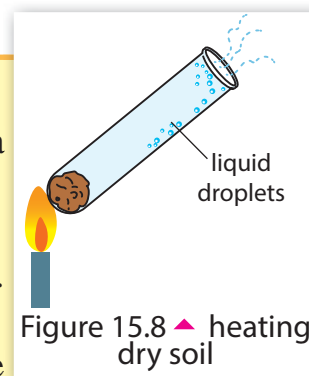
Activity 15.6

Let us prove that soil contains water

You will need :- A sample of dry soil, a test tube, a bunsen burner or a sprit lamp

Method :-

- Put the sample of soil into the test tube and heat it.
- Write down your observations.
- Identify whether the liquid droplets deposit on the walls of the test tube are water.



How can we identify that liquid droplets formed inside the test tube are water?

A blue colour chemical called **copper sulphate** is present in the laboratory. When it is heated, it turns **white**. White coloured **copper sulphate** is called anhydrous copper sulphate. When water is added to anhydrous copper sulphate it turns again into **blue** colour.

Functions of soil water

- Helps soil organisms to maintain their function.
- Helps plants to absorb nutrients from soil.
- Controls the temperature of soil
- As a raw material for the photosynthesis of plants

Soil organisms

Do the Activity 15.7 to identify organisms in soil.



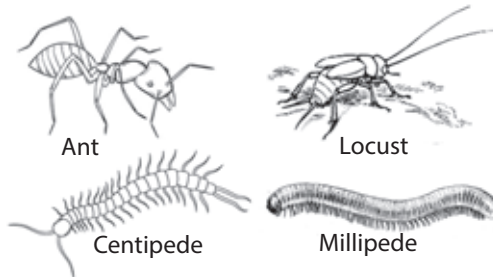
Activity 15.7

You will need :- Several soil samples taken from under a tree, a flower bed and under a large stone, a sheet of white paper

Method:-

- Spread each soil sample on the sheet of white paper. Observe soil organisms using a hand lens and draw them.

Several soil organisms observed by a student are given in Figure 15.9.



But organisms who are not visible to our naked eye also may be present in soil. They are called soil microorganisms.

Figure 15.9 ▲ line drawings of several soil organisms

Let us do Activity 15.8 to observe whether microorganisms are present in the soil.

Activity 15.8

You will need :- Two test tubes, milk, cotton, a soil sample

Method:- • Sterilize the two test tubes in boiling water (Microorganisms in them will be destroyed).

- Put equal amounts of boiled milk into the test tubes and let them cool.
- Take a soil sample and divide them into two equal portions.
- Take one sample and heat it for about five minutes keeping on a metal plate.
- Add heated soil sample to one test tube with milk and add the non-heated soil sample into the other test tube
- Fix cotton stoppers to both test tubes. Both test tubes will gain air but microorganisms cannot enter them.
- Observe the tube hourly.
- Record your observations.

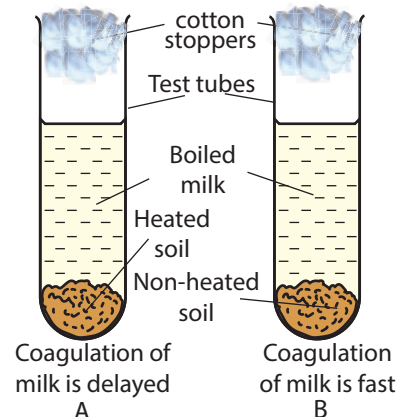


Figure 15.10 ▲ Observe whether microorganisms are present in the soil

Milk in the test tube with unheated soil will coagulate faster than the other one. Coagulation of milk is a microbial activity. Milk in the test tube with heated soil will coagulate slowly.

When cotton stoppers are fixed to the test tubes, air enters but not microorganisms. Accordingly, the above experiment shows that microorganisms are present in the soil.

The diagram given below shows the organisms who live in soil.



Figure 15.11 ▲ Different organisms who live in soil

Functions of soil organisms

- When earthworms dig holes, soil gets loosened and it gets air.
- Microorganisms like bacteria decay plants and dead bodies so that minerals get into soil.

Soil profile

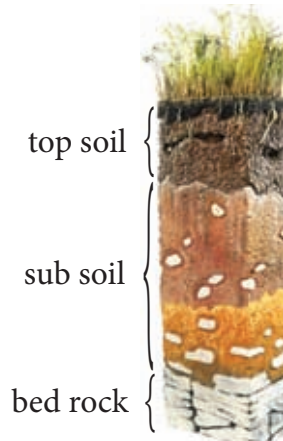


Assignment 15.1

Observe an occasion where earth is dug in a slope of a mountain using a backhoe loader. Identify the soil layers that can be seen.

A vertical section of the different layers of the soil from the earth crust is called soil profile. It spreads from top layer to the bed rock. There are mainly three layers that can be identified in the soil profile.

- Top soil
- Sub soil
- Bed rock



When moving from top to bottom in the soil profile, the size of the particles will gradually increase. The bottom of the profile is the bed rock. Sub soil is formed by weathering of bed rock and forming small particles. The top soil is formed by further weathering of the particles in the sub soil.

Roots of the most plants are spread in the top soil. But, roots of some large plants can penetrate in to the sub soil layer.

Figure 15.12 ▲ A soil profile
The soil profile is very important in studying about soil.



Activity 15.9

Let us make a model of a soil profile

You will need:- A set of soil sieves, cardboard, soil, glue

Method:-

- Dig a hole of 30 cm deep in your home garden and collect a soil sample from it.
- Separate the soil sample by using the set of sieves. (Follow the instructions from your teacher)
- Get a piece of cardboard (similar in size to a file cover) and separate it into three areas by drawing two horizontal lines.
- Paste the soil particles remaining in the second sieve from top to bottom on the lowest region on the cardboard.
- Then, paste the soil particles remaining in the second sieve from the top on the lower area.
- Paste the soil particles in the third sieve from the top.
- Paste the sieved soil particles from all the sieves on the topmost area.

Now you have created a model of a soil profile.

15.3 Soil erosion

What is the colour of water flowing above the soil during a rainy day? You have observed that the colour of water changes based on the fact of soil being covered with a covering or being exposed. The reason is that soil particles flow into another location with water. **Soil erosion is the removal of the top soil layer of a certain location by water, wind and animals.**



Figure 15.13 ▲ Sites of soil erosion

The most fertile part of soil is the top layer of soil. The removal of the top soil layer can happen in the following manner

- Top soil is washed away mainly by rain and flowing water.
- It is carried away by wind during the dry season as dust.
- Sand in coastal areas are washed away by sea waves.
- Soil erosion mainly occurs during agricultural and development activities.
- Removal of soil by legs, hoofs and horn of animals is also a type of soil erosion.

Soil erosion takes place often in lands with slopes. When there is no plant covering in such a land, soil erosion takes place fast.

Let us do Activity 15.10 to find it out.



Activity 15.10

Finding how the covering of earth affects soil erosion

You will need :- A tin with holes at the bottom, three large plastic bottles, three small plastic bottles, soil, grass clod, dried/decayed leaves

Method :-

- Cut three large bottles as shown in Figure 15.14. Remove their lids.
- Cut three small bottles as shown in the Figure. Do not remove the lids.
- Add the same type of soil in equal amounts to each large bottle. Then press them well.
- Plant the grass clod in one bottle and keep dried/decayed leaves on the surface of the other bottle. Keep the soil in the third bottle open.
- Make holes in small bottles and tie them to the mouth of the large bottles, as shown in the figure.
- Keep those bottles on the edge of the table in a manner that the bottom of the large bottles is little tilted up.
- After the grass grow well, pour water to the soil samples by using three taps. The speed of the flowing should be equal. Or else, pour equal amounts of water on to the soil samples in the same height. Use the tin with holes at the bottom to pour water.
- Observe the colour of water collected in small bottles.

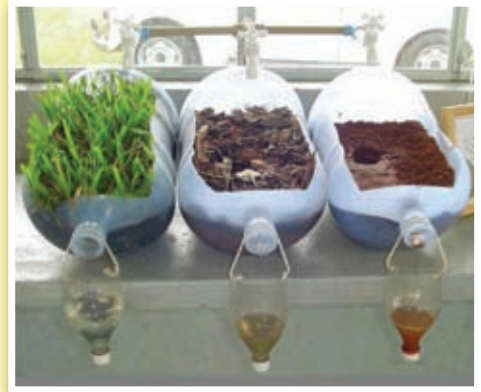


Figure 15.14 ▲ Comparing soil erosion

The water flowing from the open bottle is darker than the other two bottles. The water flowing from the bottle containing water with decaying dried leaves is less darker than the above. The water flowing from the grass grown bottle is the clearest.

This Activity reveals us when there is a cover on soil, soil erosion is less. Let us see the devices used to minimize soil erosion in a slopy land.

Following are the methods that can be applied to minimize the soil erosion in a land with slopes.

- Make stone ridges against the slope
- Make drains according to contours
- Cultivate according to the contour method
- Use cover crops with highly rooted plants
e.g. :- grow "savandera"/"vettivear"
- Prepare fields according to terraced system (for paddy cultivation)
- Use wind breakers



Make stone ridges against the slope



Make drains according to contours



Cultivate according to the contour method



Use cover crops with highly rooted plants



Prepare fields according to terraced system



Use wind breakers

Figure 15.15 ▲ Strategies used to minimize soil erosion

Substances like polythene, used batteries, chemical fertilizer and used electronic appliances pollute the environment.

Soil is one of the most valuable resource on earth. Therefore, it is our duty to protect it.



Assignment 15.2

Identify the locations in the school garden that have undergone soil erosion. Discuss the strategies that can be used to prevent soil erosion in these places. Make a report including these facts.



Summary

- The outermost layer of the earth crust is soil. Soil is important in different ways for the existence of plants and animals.
- The components of soil are minerals, water, air and soil organisms. There are various advantages of them to the soil.
- Soil is formed by weathering of bed rock due to various factors for a long period of time.
- Soil erosion is the removal of top soil layer of a particular location by water, wind or animals.
- Soil erosion takes place due to natural reasons as well as human activities.
- Soil conservation is essential for the existence of all life on Earth.

Exercise

01. Select the most suitable answer.

I. What is the type of soil most suitable for cultivation?

- 1) Clay soil 2) Sandy soil 3) Loamy soil 4) Gravel soil

II. A component /components of soil is/are

- 1) Air 2) Water 3) Minerals 4) All of the above

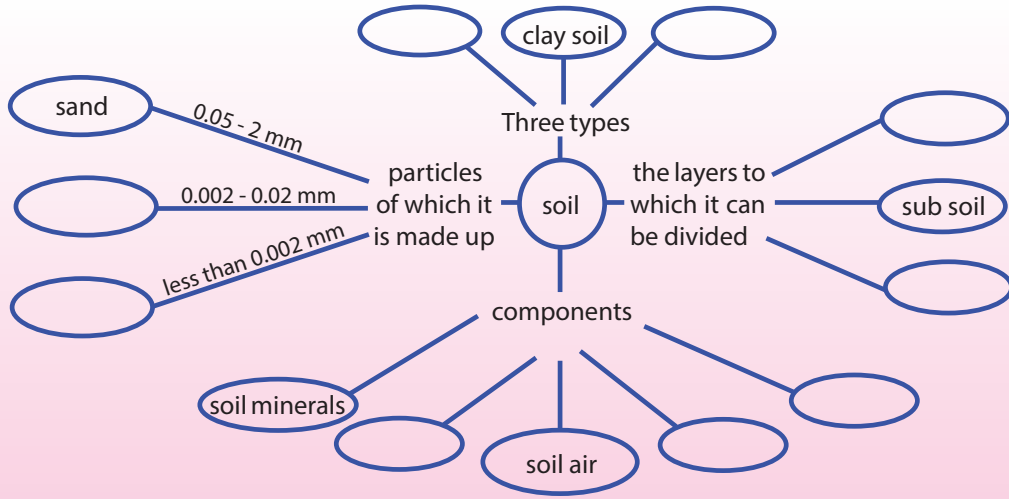
02. Fill in the blanks using the given words.

(Humus, clay, rocks, loamy soil, silt)

The most important part of the earth crust is soil. As a result of weathering, soil is formed. The amount of sand,..... and clay particles present in the soil is different from place to place. Soil is classified into three groups according to the composition of particles in the soil. They are clay soil, sandy soil and, The inorganic component which has the ability to retain water in the soil is, The organic material present in the soil is

03. Select words from the given list and complete the concept map.

(sandy soil, clay, soil organisms, outermost soil, soil water, organic materials, bed rock, sand, loamy soil, clay soil, silt, sub soil)



4) 'Earthworm is a friend of the farmer' explain the above idea with your own words.

5) List four activities used to prevent soil erosion.

Technical Terms

Sand soil	- வுரி ப஑	- மணல் மண்
Clay soil	- ஡ுரி ப஑	- களி மண்
Loamy soil	- லு஡ ப஑	- இருவாட்டி மண்
Silt	- ரு஡் ஡வ	- ஁டையல்
Soil sieve set	- ப஑் ப஑஡ுர் க஡ி஡ுலு	- மண் ஁ரிதட்டுத் து஁குதி
Top soil	- ஡஁பி஡ ப஑	- ஡ு஡ல்மண்
Sub soil	- ஁ப ப஑	- கீழ்மண்
Bed rock	- ஡வி ப஑	- தாய்ப்பா஡ு
Soil erosion	- ப஁஡ு ஡ு஁த஁	- மண்ணரிப்பு
Soil conservation	- ப஁஡ு ஑஁ர்஑஁஁஁	- மட்காப்பு
Soil texture	- ப஁஡ு ஡஁த஁	- மண்ணின் இ஁ழயமைப்பு
Soil air	- ப஁஡ு ஡ா஁த஁	- மண் வளி
Soil water	- ப஁஡ு ஑்ல஁	- மண் நீர்
Soil organisms	- ப஁஡ு ஑ீ஁஁	- மண் ஁ங்கிகள்