

SOIL

19.1

Along with air and water, soil is also a basis of life. It is interminable with life in such a way that we cannot think of a life without it. All of you make a list of the different uses of soil and discuss about them in the class. Also discuss whether the soil used for different purposes is the same. Can any type of soil be used to make pictures and toys? Are all type of crops grown on the same type of soil?

Come we will try to know more about different types of soil. For this we will have to collect samples of soil from different places as fields, ponds, roadside, garden, grounds etc. Therefore when you read this chapter go on a tour to a nearby area of the school with your teacher.



Activity - 1

Before going on tour with your teacher's guidance, make groups of six students each. Take with you, some soil digging equipments as a pickaxe and plastic or metal bowls to carry the soil. For studying different properties of the soil, about 250 g of soil is needed. Decide which group will collect soil samples from which place. Soil samples must be collected on the same day when the activity is to be done. Place a label with the name of the place from where the sample of soil is collected.

Soil can be examined through out the year but it is better if the soil sample is collected during summer.

When collecting the soil sample from the selected area, the upper layer of carbonic compound which is not decayed as waste, stones, etc. should be removed but do not remove the soil. Now with the pickaxe dig a hole in V shape of about 15cm deep. Collect a layer of it carefully. (fig-19.1)

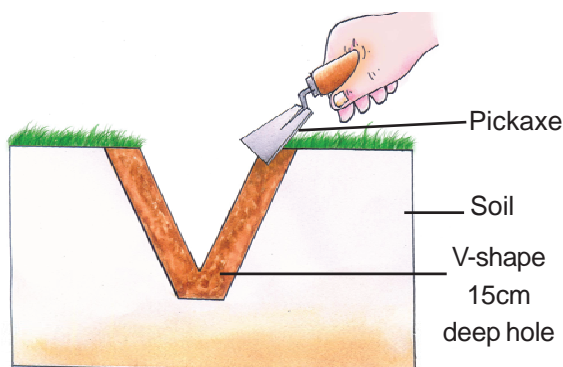


Fig 19.1 Collecting soil sample with pickaxe.

19.2 COMPOSITION OF SOIL

Let us perform an activity to know about the constituents of the soil.



Activity - 2

Materials Required- Soil, glass or beaker, spoon.

Fill three-fourth of the glass or beaker with water. Now add a portion of the collected sample of soil into it. Stir and mix with a spoon. Keep this glass or beaker aside without disturbing it for two hours. Now observe the different layers formed in the beaker. The

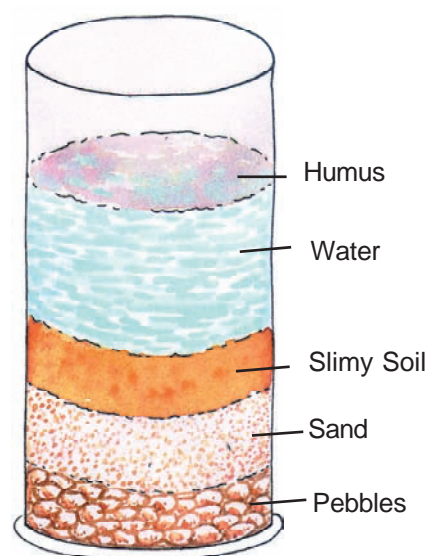


Fig 19.2 Composition of the Soil

effervescence produced in the soil is give to air present in the soil. (fig -19.2) and write them in the table (19.1) given below :



table 19.1

S.N.	Layers	Constituents of the layer	Colour
1.	First Layer (bottom)	pebbles	_____
2.	Second Layer	_____	_____
3.	Third Layer	_____	_____

You have seen that layers are formed of particles which are differently sized. The heaviest particles form the lowest bottom layer and the lightest particles like humas, dead decaying matter of plants and animals form the the upper most layer. Do the experiment with all the samples of soil collected by the other students of the class. Do you find any difference? Discuss it in the class.

19.3 SOIL - PROFILE

If we want to know about the profile of the soil, we have to go to a place where ground has been dug for the purpose of building road, bridge, well or the foundation of a house. In its depth we can see the different layer.(fig 19.3). We find each layers different in colour, compositon ,depth and chemical composition. These layers are called stratas. Now draw a picture of the cut portion of the ground. Also if you can , try to write the width, size of the particles and colour of each strata.

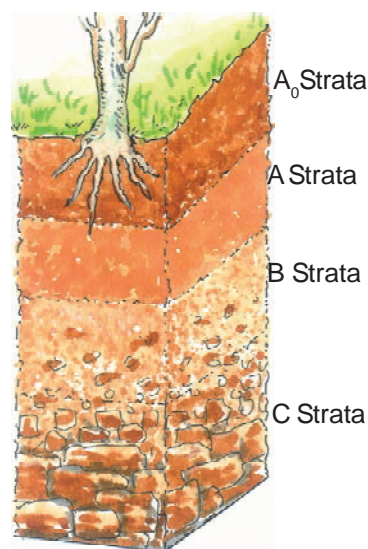


Fig 19.3 Profile of the Soil

You have seen that soil has different stratas. The main ones are:-

- A₀ Strata** — The topmost layer is called the Carbonic Strata. It is formed by the plants and other carbonic organisms present in the ground. In this strata the decomposition of the carbonic compounds goes on and so this strata has a dark colour.
- A Strata** — This lies below the A₀ strata. It is the living place of many organisms as earth-worms, fungi and bacteria. This strata is full of humus. It is soft, porous and retains much water.
- B Strata** — This strata is hard. Its colour is mild and has less carbonic compounds. Minerals are plenty in this strata.
- C Strata** — This strata contains small pieces of rocks. It has no humus but it does have minerals. Below this strata we find the rocks.

19.4 COMPONENTS OF THE SOIL.

There are four components of soil. They are air, water, minerals and carbonic compounds (humus).

These four components of soil are mixed so close together that it is difficult to separate them. Such soil where plants grow easily as per its volume has about 50% water and air. The rest 45% of minerals, and 5% is of carbonic compounds (humus).

The minerals of the soil comes from the rocks, from which the soil is formed. Some soil gives a distinct colour to the soil. For example soil rich in iron is red in colour. Humus is found on the topmost layer. This helps in providing nutrients to the plants and also helps in binding the soil particles together.

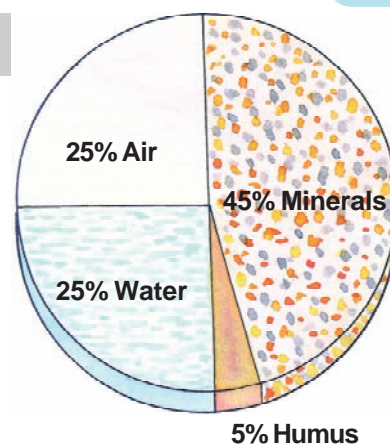


Fig 19.4 Components of Soil

POROSITY OF THE SOIL- Even though the particles of the soil are binded together, here are small vacant spaces in between them. They are called the pores. These pores are filled with air and water. It is due to these pores that soil has the quality of porosity. The porosity of the soil plays an important role for plants and animals.

- Plants and animals use air and water present in the pores of the soil.
- It is due to porosity that soil can retain water and air .
- Roots of the plants can grow properly only when there is sufficient porosity in the soil.
- There are different types of bacteria present in the pores which by their reactions enhance the fertility of the soil.

Now write in your copy why marshy soil is not good for the growth of the plants.



Answer these

1. Name the main components of the soil.
2. Draw a diagram of the soil profile.
3. Which strata of the soil contains the humus in the profile of the soil?
4. How does soil with porosity help in the growth of plants?

19.5 HOW IS SOIL FORMED

The shape of the soil which you see now ,was not so from the beginning. Let us see how the soil is formed. You can understand this by a simple activity. Rub two pieces of small stones with each other. You will get powder of the stones. In the same way the rocks of the earth, due to some physical, chemical and biological causes, break into small pieces or very minute particles. This is called weathering of rocks.

On the earth,flowing water, wind, temperature, volcanoes, earthquakes, and other physical processes cause the breaking up of the rocks.

The minerals present in the rocks are transformed by many chemical reactions. These make the rocks weak and break them. Come, let us see how biological factors help in the formation of soil. Bacteria , algae and many microbes, decompose dead plants and animals and wastes of food materials. This process forms a dark brown product. This combines with the soil and forms the main constituent of the soil

– the humus. The combination of the carbonic compounds (humus) with the soil is the last step of soil formation. Humus makes the soil fertile and plants are able to get nutrients continuously from the soil.

Therefore soil has a composition made of mineral and carbonic products having air, water, along with plants and animals. The minerals present in the rocks are transformed by a number of chemical reactions.

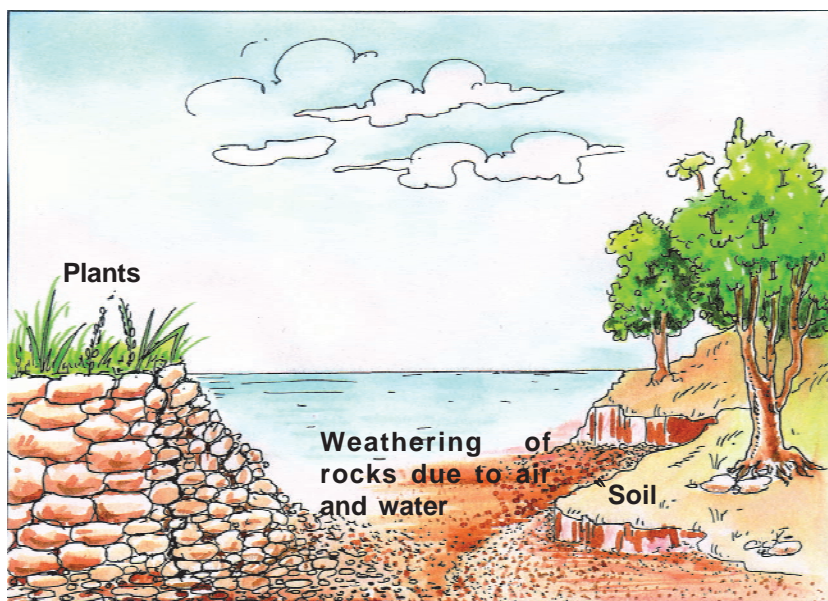


Fig 19.5 Formation of soil due to weathering of rocks

19.6 TYPES OF SOIL

In the activity you have seen the different layers having many different constituents.

Mainly there are four type of particles in the soil.

1. **Gravel or Pebbles** – The particles which are of the biggest in size settle down at the bottom. Their size are bigger than 2 mm.
2. **Sand** – The particles of size between 0.05mm and 2mm are called sand. They form the layer above the gravel.
3. **Silt** - The particles of size between 0.005mm and 0.05mm are called silt.
4. **Clay** – These particles are of the smallest size. It can only be seen under the microscope. Its size is less than 0.002mm and feels very slimy to touch.

Soil is made of these constituents. Different types of soil have different amount of these particles. The soil is classified according to the amount of particles present.

- A. **Sandy soil** – If the amount of bigger particles is more, then it is the sandy soil.
- B. **Slimy soil** – If the amount of minute particles are more, then it is called slimy soil.
- C. **Loamy soil** – The soil having equal amount of small (clay) and big (sand) particles, (fig 19.6) called loamy soil. Loamy soil is formed by sand, slimy soil and humus.

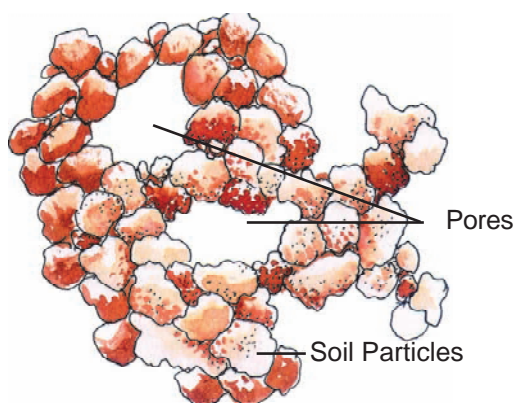


Fig 19.6 Structure of loamy soil

It contains small and big particles. Pores are also present in the soil. Therefore it can retain sufficient water and air. This is the best soil for the growth of the plants.

19.7 PROPERTIES OF THE SOIL

Now you have sufficient knowledge of soil. Let us see the characteristics of the samples of soil collected and write the observations in table 19.2, drawn in your copy.



Table - 19.2

S.	CHARACTERISTICS	OBSERVATIONS
1.	Colour	black/brown/blackish-brown/reddish-yellow/ —
2.	Odour	odorous/foul-smelling/odourless/ — — — —
3.	Feels on touch	minute/powder/lumpy/ — — — —
4.	When pressed between fingers	stiff/soft/crisp/sticky/ — — — —
5.	Seen with a lens (if needed)	— — — — —

One of the main property of soil is its ability to retain water. Come let us see which soil has the maximum ability to retain water.



Activity - 3

Materials Required: - 3 funnels, 3 measuring cylinders, glasses, slimy soil, sandy soil, and loamy soil (if not available, prepare by mixing equal quantity of slimy and sandy soil) filter paper, and cotton.

Fold the filter paper and place it in the funnel, put cotton on it. Put 50 g of slimy, sandy, loamy soil

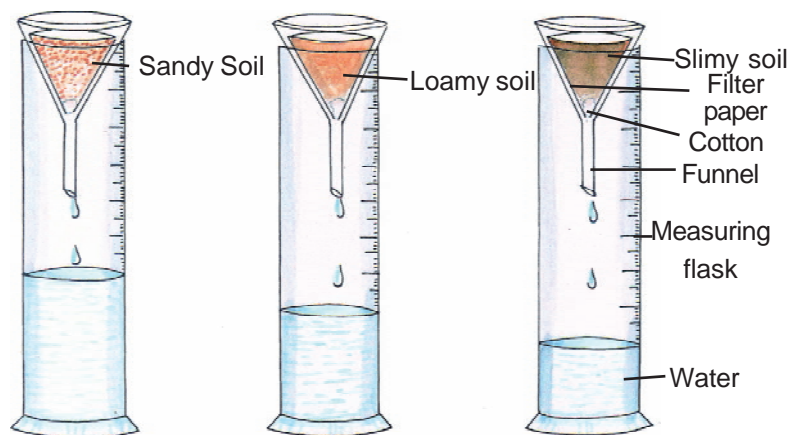


Fig 19.7 Water retaining property of soil

each in different funnels and place these funnels as shown in fig 19.7 on glasses or measuring cylinders.

Pour 50 mL water in each sample of the soil slowly on the upper surface. Do not pour the entire water at the same place. After sometime when the water-drops stop falling in the measuring cylinders, measure the quantity of the water collected in the cylinder. If you have used glasses for the activity then pour the water into the measuring

cylinder and measure it. This activity must not be done after the rains or after irrigation, it must be done only after 48 hours or the results may not be accurate.



Answer these

1. In which of the measuring cylinders is the maximum amount of water collected?

- From the observations, what can you conclude about the water retaining capacity of each of the soil samples?
- Which type of soil is suitable for the growth of plants and why?
- Which type of soil is not suitable for the growth of plants and why?
- The level of the water in the well increases even eight to ten days after the rains. Why?

Come, we will perform some other activities with the collected samples of soil.



Activity - 4

Materials required:- Test tube of hard glass, dry soil, heating apparatus, matches.

Take the soil in the test tube of hard glass and heat it. Do you find water drops on the walls of the test tube? If yes, from where did this water come? Now remove the soil to a plate. Compare this with the unheated soil and answer the following questions in your copy.

- Are both of the samples of soil same?
- Which qualities are enhanced in the soil by the presence of water in the soil?
- What is the importance of this quality for the plants?



Activity - 5

Materials required:- Two bottles with lids, cotton, thread, two samples of soil collected from different places (sand and soil from garden, farm or any other place near a waterbody) phenolphthalein, caustic soda and water.

Label the two bottles with lid as 'A' and 'B'. Put some damp soil in bottle 'A' and some sand in bottle 'B'.

Take two threads of about 20 to 30 cm length. Dip balls of cotton in alkaline phenolphthalein solution and tie them to the ends of the threads. Place one end of the thread (with the balls) inside and the other end (along with the ball) lies outside. Tighten the lids of the bottles.

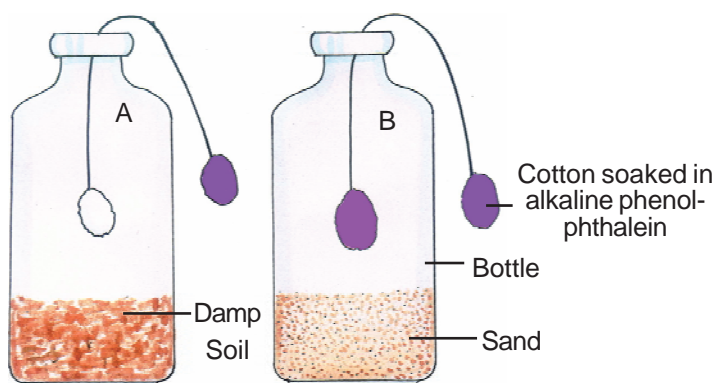


Fig 19.8 Microorganisms are present in the soil

After 4-5 hours observe the changes and answer the following questions :-

- Observe the colour of the cotton balls inside and outside the bottles.
- What are the changes in colour of the cotton balls in bottles 'A' and 'B'?
- What is the cause of the change in colour of the cotton ball inside bottle 'A'?

From this activity we can say that, there are micro-organisms in the soil which release carbon-dioxide through respiration.

19.8 SOIL AND CROPS

Different types of soils are found in different parts of India. The components of soil, determine the various types of vegetation and crops that might grow in any region.

- Clayey and loamy soils are both suitable for growing cereals like wheat, rice and gram. Such soils are good at retaining water. For lentils (masoor) and other pulses, loamy soils, which drain water easily, are required. For cotton, sandy loam or loam, which drain water easily and can hold plenty of air are more suitable.

- Crops such as wheat are grown in the fine clayey soil, because they are rich in humus and are very fertile. Find from your teachers, parents and farmers the type of soils and crops grown in your area. Enter the data in the following table 19.3 and note in your notebook.



Table -19.3

S.No.	Type of soil	Crop grown
1.	Clayey	Wheat
2.
3.



Answer these

1. What is weathering of rocks?
2. Name the different components of the soil?
3. In which type of soil will most of the rainwater flow away?
4. What will be the effect on the crops, if there is no porosity in the soil ?

19.9 SOIL EROSION



Activity - 6

Materials required:- Two small flowerpots or baskets, seeds of bengalgram, mustard or wheat and water.

Fill both the flowerpots or basket with garden soil. In one of them germinate some seeds. Donot sow seeds in the other pot. In six to seven days the plants in the first pot will grown more. Now tilt the pots such that soil washed away may be collected near the pot or in plates(fig 19.9). Now slowly pour equal amount of water in each flowerpot. Observe and find out from which pot less soil is washed of and why?

The roots of the plants hold fast the soil. Most of the nutrients in the soil is in its upper layer. Due to which the soil becomes fertile. Strong wind and rains wash away or erode this fertile layer. Loss or destruction of this upper fertile layer is known as soil erosion.

Due to soil erosion, there are losses other than destruction of the fertile layer. Soil eroded by wind and water get collected in ponds, rivers and lakes as silt. This lessens the depth of the water source and increases the danger of floods. Erosion of soil can also lessen the absorption of water by the ground which increases the dangers of droughts.

Now you can know how to stop soil erosion.

Human being with some of his activities has increased soil erosion. Deforestation, cutting of forests, over grazing, digging earth for construction, excessive agriculture, mining for man's selfish use (mining for gravels, sand, bricks and minerals) also increases the dangers of soil erosion.

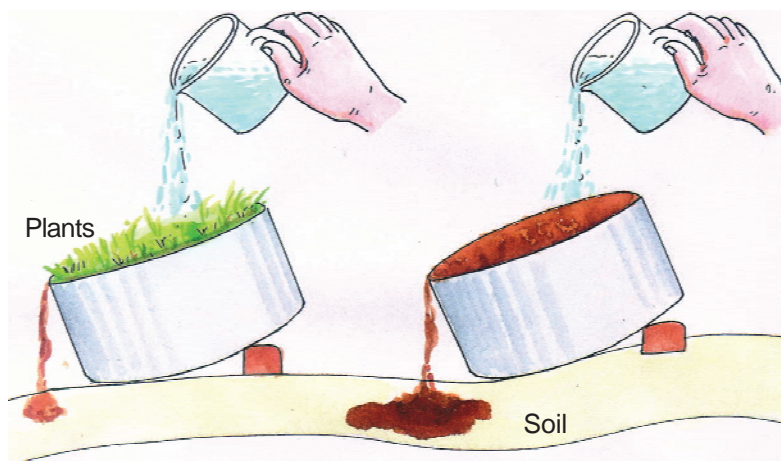


Fig 19.9 Plants stop soil erosion

19.9 SOIL A NATURAL RESOURCE

You all know that we get food, clothes, medicines, minerals, fuels, construction materials and fresh air directly or indirectly from the soil. It forms the foundation of houses buildings and roads. Many utensils and toys are made from this. It is the habitat of many organisms as bacteria fungus, insects, earthworms, snakes, rats etc and plants. It is difficult to amend its loss. This natural resource is being polluted by human activities so it is necessary to save or preserve this.

19.10 POLLUTION OF SOIL

As water and air, soil also gets polluted.



Activity - 7

From the dustbin of your house collect all the skins of fruits and vegetables and leftover food in one bag, waste papers in a second bag and all the plastics, glass pieces, and metal pieces in the third bag. Remove all these from the bags and bury them at three different places and mark them. After 8-10 days dig out all these and observe their state. What are the findings? Discuss them in your class.

You must have seen garbage heaped up at many places in your village, town or city, which has wastepapers, torn clothes, old leather bags and shoes etc. All that can be decomposed by micro-organisms or we can say they decay. These increases the quality of the soil.

But along with these, things which are made of metals, glass pieces, polythene bags, and things made of plastic as buckets, bottles, boxes etc are also there. Decomposition of these things by the micro-

organisms is very slow or even negligible. This is a cause of pollution and such waste products make the soil polluted.

Another major problem in the cities, as you all know is the disposal of the sewage. When all this sewage mixes with the soil, it closes the pores in the soil, and this hinders the propagation of air and water in the soil. In such a soil, plants cannot grow properly.

Mixing of the sewage with the soil creates one more problem, that is germs of many diseases as typhoid, diarrhoea, T.B. etc get mixed in the soil. Which makes it clear that such soil is the cause of the spread of these diseases. Even though agriculture is the basis of life, excessive spraying of the germicides and fungicides on the crops is a cause of soil pollution. Continuous excessive use of chemical fertilizers, and use of hard water for irrigation continuously, can also cause soil pollution. Waste product from the factories can also pollute the soil.

19.12 PRESERVATION OF SOIL

Soil is a renewable resource, although it develops slowly and by gradual weathering of rocks. You have seen that the formation of soil is not possible. Its formation is by nature. Therefore it must be used carefully, so that the soil is not destroyed.

- Plants and trees are the best protectors of soil. That part of soil which is covered by plants and trees are safe from erosion. So we must plant trees in lands where farming is not done.
- In the sloping hilly areas and mountainous areas, by terracing of the land or by making bunds on slopes between the fields of crops, soil can be preserved.
- All carbonic waste (cowdung, leaves, leftovers of crops, kitchen and market waste of vegetables and fruits) must be returned to the soil as biological manure.
- Discarded faeces, wasteproducts of factories must be disposed of very safely. So that the soil can be saved from their ill effect or pollution.
- Un-necessary cutting of trees in forests must be stopped.
- Pits dug for the extraction of minerals must be filled afterwards.

19.13 Soil Testing and Remediation

In agriculture, a soil test commonly refers to the analysis of a soil sample to determine nutrient content, composition and other characteristics such as the acidity or pH level, salinity, nutrient deficiency and the necessary remediation are taken accordingly.



Answer these

1. What is known as soil erosion?
2. Write three causes of soil pollution?
3. How will you preserve soil of your neighbourhood?
4. What is the effect of the cutting of trees, on soil?
5. Why is soil-testing necessary? Explain.



We have learnt

- Soil is also a basis of life as air and water.
- If you dig the earth deep you will find different layers. This is the profile of soil.
- Various physical, chemical and biological activities lead to the breaking of rocks into powder or dust, which when mixed with decaying, dead, organic matter (humus) forms the soil.
- There are mainly four types of constituents in soil;-gravel, sand, silt and clay.
- Loamy soil is a mixture of sand, clay and humus. This soil is much useful for the growth of plants.
- There are pores in between the particles of the soil , so that the soil becomes porous.
- Wheat and gram are grown in clayey and loamy soil while cotton is best grown in sandy loamy soil.
- Soil testing refers to the analysis of a soil sample and gives information about the quality of soil and its fertility.
- Loss of the upper fertile layer of the soil is called soil erosion.
- Along with strong wind, flowing water, cutting forests, excessive grazing and excessive ploughing for agriculture also adds to soil erosion.
- Waste products, sewage and excessive use of insecticide, fungicide, fertilizers may pollute the soil.
- Soil is a valuable natural resource.



Questions for practice

1. Fill in the blanks :-

1. The biggest particles of the soil is _____.
2. _____ soil has the maximum property of water retention.
3. Breaking up of rocks into small particles is called _____.
4. Loss of the upper fertile layer of the soil is called _____.
5. ----- soil is good for growing cotton.

2. Write true and false for the statements given below and also correct the false statements.

1. The soil with humus is not fertile.
2. Loamy soil has gravel and clay particles in it.
3. All types of soil have the same property of water retention.
4. Soil must be porous for a good crop.
5. Plants and trees increase soil erosion.

3. Answer the following questions.

1. How can you prove that soil has micro organisms in it?
2. How can you stop soil from being polluted ?
3. Explain the profile of soil of your area with a labelled diagram of it?
4. How will you test the capability of water retention in red sandy soil, red loamy soil and black soil found in Chhattisgarh?
5. What will happen if soil disappears from the earth?
6. Which type of soil is suitable for rice crop?



Do these also

1. Collect informations from potters of your village or city who make clay toys and utensils, about the types of soil they use.
2. Prepare fertilizer for plants of your house/school with your friends.

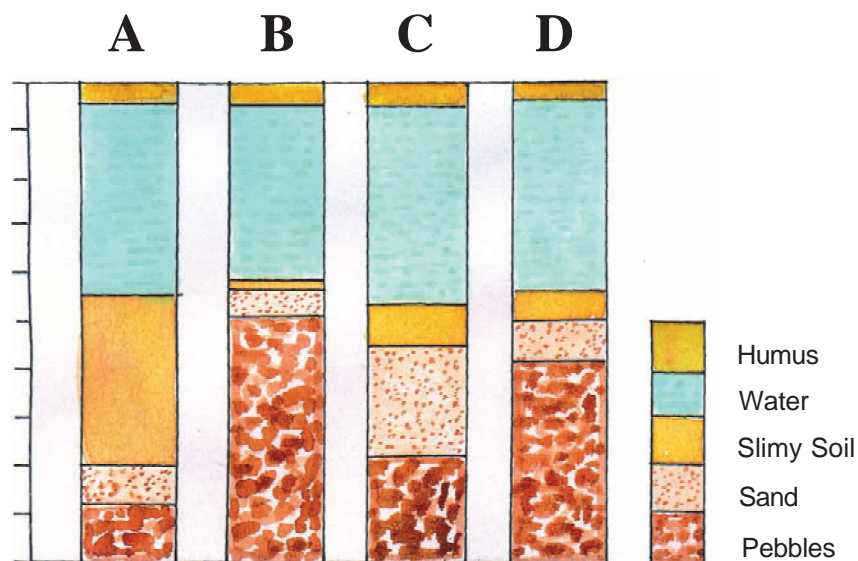


Fig 19.10 Sample of soil

3. Four equal quantities of soil samples were collected from four (A,B,C,D) places and equal amount of water was mixed in each and left for sometime. The results where as per fig.19.10.

Can you say -

1. Which soil has maximum humus?
2. Which soil has the least pebbles?
3. B sample has very less earthworms. Why?
4. Out of these which soil is a good garden soil?
5. How can you change the soil of the D sample to be a better soil ?
4. In which other fields the soil is used other than agriculture ? Is the soil type used is same for all the work areas. Discuss with your teacher.

