Soil

Soil, its Importance and Characteristics

Did you know that it takes a thousand years to form a one-inch thick layer of soil?

We find soil all around us. **What is soil? What are its components? How is soil formed? What are the different layers of soil?**

Let us explore the answers to the above questions.

Activity

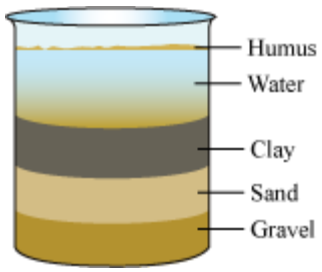
Dig a pit in a suitable area using a spade. Collect a sample of soil from this pit and mix it with water in a glass jar. Stir well and then allow the contents to settle. Observe the components.

What do you see?

Organisms such as ants and earthworms, decaying leaves, plant roots, small pebbles, rock particles, etc. are commonly observed.

You will also see soil particles of varied colours and sizes. These settle down at different regions in the glass jar. The larger and heavier particles settle at the bottom of the glass while the finer soil particles form the top layer. Soil particles of intermediate size form the middle layer. These are the components of the soil.

Decaying leaves and dead organisms form the Humus.



How is soil formed?

Soil is formed by a process called weathering. The process of weathering occurs as a result of the action of wind, water, or climatic changes.

Weathering is the process that breaks down large rocks into smaller pieces. These small pieces of rocks form soil by mixing with decaying plants and animal parts.

Thus, is soil uniform throughout? Let us find out

Dig a deep pit vertically into the ground. What do you observe? **Is the appearance of the soil same as you go deeper into the pit?**

No. As we dig deeper, the nature of the soil changes in terms of its colour, contents, texture, chemical composition etc. Thus, different regions or layers of soil can be observed.

What are the constituents of soil?

Soil is a mixture. Thus, soil contains a variety of materials, which can support life on earth. The following are some major components of soil:

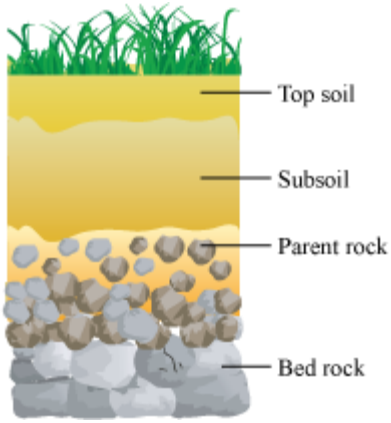
- **Soil is enriched with various minerals** such as iron, copper, phosphorus, potassium, etc.
- **Soil also contains organic materials**. The dead and decayed living organisms constitute the organic part of the soil. This is called humus. It is an important factor to decide the quality of the soil. Humus causes the soil to become more porous. This helps in allowing air and water to penetrate deep into the soil.
- **Various microorganisms are also a part of soil**. Majority of this includes various forms of bacteria.

The type of soil is decided by the average size of the particles found in it. The presence of mineral nutrients in a soil depends upon the rock from which it is formed.

Soil profile

The vertical section of soil from the surface down to bedrocks, showing different horizons, is called soil profile. The soil profile shows three layers one above another.

1. **A-horizon** − A-horizon consists of the topmost layer of the soil that contains minerals, nutrients, and humus in addition to the soil particles. It is also known as topsoil. It is the most fertile part of the soil, which is rich in humus and has good water holding capacity.
2. **B-horizon −** It lies below A-zone and is called subsoil. It consists of sand, silt, and clay. It is hard and compact and is rich in minerals such as iron oxide.
3. **C-horizon −** It lies under subsoil and has parent rocks. The layer of large solid rocks, called the bedrock lies below this layer. It is an impermeable layer over which rain water collects and forms the base of the water table.

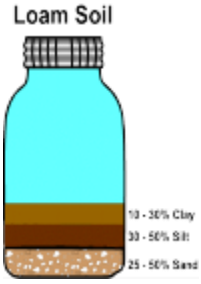


Types of soil

Observe the soil in a garden and the soil near a beach. Now, look closely at the soil in agricultural lands. **Do they all appear similar?**

No, they are not. Soils can be classified into different types based on their composition, size of soil particles, and other properties.

Let us study the characteristics and properties of soils and classify them into different types.



Collect soil samples from different places, mix with water in a glass and allow it to settle.

We find that the larger and heavier particles settle at the bottom of the glass and the smaller, fine particles form the top-most layer. The particles that are intermediate in size form the middle layer.

Based on this activity, we can divide the soil into different types

- **Large sized particles called sandy soil**
- **Fine particles called clayey soil**
- **A mixture of large and small sized particles called loamy soil**

We find sandy soil at the bottom layer, clayey soil at the top layer and loamy soil in between these two layers.

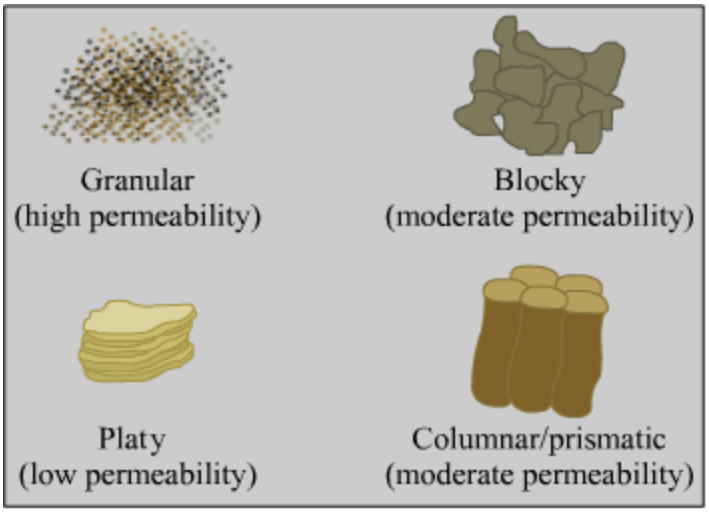
Particle size is an important characteristic that determines the property of the soil. The following table shows the properties of soils based on the size of soil particles

Soil type	Particle type	Properties
Sandy	Large	Loosely packed, with large air spaces. Water soaks into it easily. Thus it is dry, light and airy
Clayey	Fine, small	Tightly packed with no air spaces. This type of soil is heavy and holds more water
Loamy / silt	A mixture of large and small particles	Holds water, contains humus

Based on the colour and its constituents, soil can also be classified into four types:

- **Red soil:** It is found mainly in South India. An iron oxide present in the soil gives it a red colour. It has particles of clayey and sandy soil. Coffee, tea, cardamom etc. are grown in this type of soil.
- **Black soil:** This type of soil is found in northern part of Karnataka and is the most suitable soil for the agriculture. Black soil contains a greater amount of decomposed constituents of organic substances which give it a black colour. It contains more moisture. This soil is suitable for the crops of cotton, groundnut, sugarcane and tobacco etc.
- **Laterite soil:** This type of soil usually red or reddish yellow in colour and looks like a honeycomb. It is usually found in the area where there is heavy rainfall and contains less amount of calcium. This soil becomes dug and bricks when the moisture content present in it reduces to a reasonable quantity.
- **Alluvial soil:** The soil found near the beaches and on the river bank is known as alluvial soil.

How does soil occur in nature?



The shapes of particles present in the soil decide the structure of the soil. Various forms are:
Granular: This type of soil structure is commonly found on surfaces where roots have been growing. This structure is highly permeable.
Platy: This structure is found where soil is compact. In this, thin and flat plates of soil lie horizontally. It has low permeability.
Columnar: This structure is observed in areas of arid climates. It has vertical columns of soil that have salt cap at the top. It has moderate permeability.
Blocky: This structure has irregular blocks with sharp corners. This structure also has moderate
permeability.

Do you know how a good soil structure is helpful?

The soil fertility depends on the structure of soil. A good soil structure will allow easy movement of air and water within the soil.
This will impart growth in the roots of plant and also reduces soil erosion.

Some more uses:

- **Plant conservation**: Soil helps plants to grow well as it is the primary nutrient base for the plants.
- **Water conservation**: Soil helps in the binding of water and as a result helps in water conservation.
- **Construction**: Soil is an important part of the building process. Soil compaction is a process of increasing soil density which is done to improve the load support.

- **Plasticity**: The property of soil to acquire any required shape is known as plasticity. This property of soil is used for making many decorative articles.

More about soils

Sandy soils are found on the beaches and deserts.

Loamy soils are found in the river beds. It contains humus and its capacity to hold water is ideal for growth of plants

Clayey soil is wet, moist and can be moulded into different shapes. This makes it very useful in making different objects.

Can you think of some products that are made from soil?

Let us understand how soil property influences the type of products created from it

Clay is fine and smooth and can be moulded into any shape. It is therefore suitable for making toys, statues, artistic items etc. Loamy soils consist of larger sized soil particles, thereby making it porous. As a result of this property, they are used to make bricks.

China clay: It is white in colour and suitable for making crockery, jars, tiles etc.

The soil used in constructing statues and idols is ***Shadu*** *soil*.

The red colour soil used decorative items and pots is known as **Terracotta** soil.

Can soil be used as a beauty product?

Multani soil is used in cosmetics and it is highly beneficial for skin. It is light in colour.

Did you know that the porous property makes *surahi* and *kalla* a good utensil for storing water as it helps to keep the water cool?

Is there any way to find out the nutrient content in a soil sample?

Soil testing enables us to find out the characteristics and composition of the soil. Soil

testing helps in determining the need for any additional fertilizers. A sample of soil is taken and is tested for its various characteristics. Few tests are ph and electrical conductivity tests.

Causes of deteriorating soil fertility:

- ph imbalance of soil
- soil erosion and loss of water
- decreasing soil's organic content
- excessive use of pesticides and insecticides degrade the soil quality

Percolation And Absorption Properties Of Soil

Soils have various qualities that are based on its particle size and other components.

Some of the important properties of soil are as follows.

- Rate of percolation of water
- Rate of absorption of water
- Moisture content

Let us explore each property.

Water percolation rate of the soil refers to the rate of the movement of water through the soil as it passes through the small holes or spaces between the particles of the soil.

Sanjana fills two columns or cans, about 20 cm long, with soil. One contains clayey soil and the other contains sandy type of soil. She pours water into each of these columns.

She observes that the water seeps into the sandy soil column quickly, but the clayey soil does not absorb water easily. This phenomenon is called percolation of water.

Why is this difference observed?

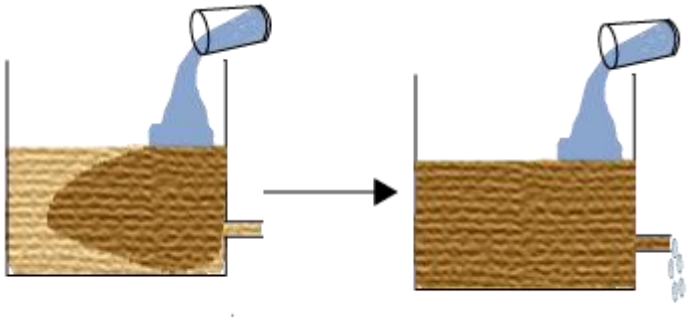
This is observed because the rate of percolation of water is different for different soil types. It is calculated using the following formula.

Percolation rate = Amount of water (ml)/Percolation time (min)

How is percolation different from absorption? Let us find out.

***Water absorption rate of the soil is defined as the capacity of the soil to take in water from the surface or surrounding areas*.**

Let us find out if all soil types absorb water equally.



Sanjana pours water into the container containing soil, as illustrated. She counts the number of glasses she pours into it. She continues to pour until water starts to drip from the tap below.

When this activity is repeated with different soil types, it is found that the amount of water that the soil can hold is different for each type. The time taken for the water to drip down from the container is also different for each soil type.

When the soil is sandy, the amount of water that drips out is large. The time taken for the water to flow out is also less. On the other hand, when this activity is conducted with clayey soil, the amount of water that drips out is lesser in comparison to sandy soil. The time taken is also more when compared to sandy soil.

Do you know why?

This is because sandy soil contains soil particles that are large and loosely packed. This creates air spaces between them. The water seeps into it much faster than the other soil types. Clayey soil, on the other hand, contains fine soil particles that stick to each other. Its ability to retain water is much higher than that of the other soil types.

We can calculate the water absorption percent of soil by using the following formula.

(U-V) 100 / 50

Here,

50 g of soil is utilized.

U represents initial volume of water in the container.

V represents final volume of water drip down from the container.

Thus, clayey soil holds more water. This water content is the **moisture content of the soil or the amount of water that the soil can hold. Different soils have differing moisture-carrying capacities.**

In summer, we observe the soil shimmering. This is caused by the release of moisture from the soil as a result of intense heating of the soil. **Do all soils contain equal amount of moisture? Let us find out with the help of the following animation.**

Soils and Suitable Crops

Ramu's agricultural land has a clayey soil. He grows sugarcane on his farm but reaps a low yield.

After incurring a loss, he decides to change his crop from sugarcane to wheat. This time, the crop yield is high and he earns a profit.

Sukhvinder's agricultural land has a clayey soil and he plants cotton. He reaps low quality cotton. He changes from cultivating cotton to gram. He earns a larger profit this time as a result of a good yield.

Do you know why sugarcane and cotton when grown in clayey soil, produced a low yield, while wheat and gram, when grown in the same clayey soil, produced a high yield?

This is because different crops are best suited for specific types of soils.

The following table shows the different crop types and the corresponding suitable soil type.

Crop name	Suitable soil type
Wheat	Clayey
Grams	Clayey
Paddy	Clayey with organic matter (humus)
Lentils (masoor)	Loamy
Cotton	Loamy
Sugarcane	Loamy

Different soil types vary in their properties such as water holding capacity, ability to retain moisture, quantity of organic matter etc. Different crops have different requirements and therefore grow best only in the specific type of soil.

Interesting Fact:

Soil quality is one of the factors that determine the yield. You will be surprised to know that in India, the quantity of rice produced is 1756 kg per hectare, where as, in North Korea, it is 5475 kg per hectare!

Components of Soil and Preparation of Soil for Cultivation

Soil is made up of small particles of different sizes. Dead plants and animal parts are decomposed by soil organisms. This decomposition process releases various nutrients

in soil. These nutrients are absorbed by plants as they are important for the growth of a plant.

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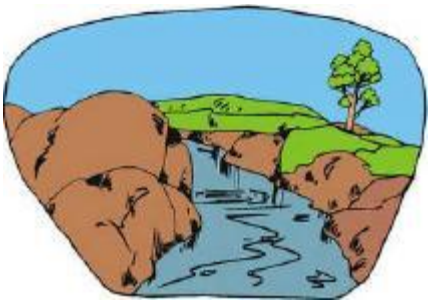
Types of Soils Found In India

Type of soil	Regions	Crops grown
Red soil	Kerala, Karnataka, Tamil Nadu and Orissa	Wheat, rice, sugarcane, cotton, pulses
Black soil	Maharashtra, MP, Gujarat	Cotton, sugarcane
Alluvial soil	Punjab, Haryana, UP, Bihar	Highly fertile. Wheat, rice, sugarcane
Desert soil	Desert areas like Rajasthan	Thin vegetation cover since it is less fertile
Mountain soil	Himalayan region and N-E India	
Laterite soil	Tamil Nadu, Orissa, Andhra Pradesh, P, Assam	Tea, coffee, coconut

Soil is essential for a plant's growth. Hence, preparation of soil is the first step of growing a crop.

Soil Erosion

Have you noticed that rainwater carries mud along with it when it flows? Rivers too carry the soil during their course. When moving rapidly over the surface of the land, these rivers wash away the topsoil. This washing away of the valuable topsoil is called erosion.



Erosion occurs not only because of water but also by the action of wind and ice.

Erosion destroys agricultural lands as the nutrients are washed away along with the soil. Therefore, it is important to prevent soil erosion.

The roots of plants hold the soil together and reduce erosion. They also help in indirectly preventing erosion by reducing the force of rainfall before it falls to the ground. **The cutting of trees and deforestation increases the rate of erosion**. Thus, plants and trees play an important role in preventing erosion.

An area that does not have any vegetation or plants is more prone to erosion. This is the reason why deserts face a lot of erosion.

Therefore, afforestation (planting of trees) and prevention of the cutting of trees are two important measures to help control soil erosion.

With the help of the following animation, let us observe how plants help prevent erosion.