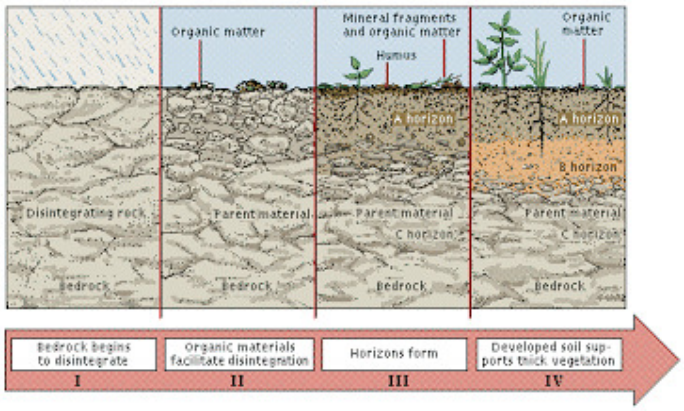
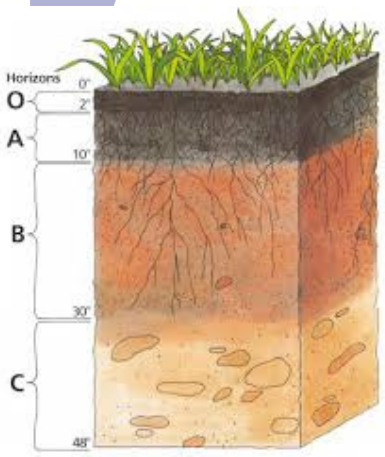
8th – Chemistry Soil I

- Soil is not just a layer of dirt and mud. It is actually filled with life. there are variety of insects, reptiles and other animals living right under our feet. Soil also provides nutrients required for plants to grow and thrive.
- All living organisms depend directly or indirectly on soil
- **Soil Formation**
- The uppermost layer of the Earth surface is called soil. It is usually composed of a thin layer of minerals which include sand, mud, and rock particles, and a layer of dead and decayed plant and animal remains called humus.
- Soil formation (see figure) is a slow, stepwise process. It takes thousands of years to form a layer of soil just a few centimetres thick. It is a result of continuous breaking down of rocks by a process called weathering.
- **Weathering** is the disintegration (breakdown) of rocks on the Earth surface caused by exposure to natural forces such as wind, water, frost, roots of plants, etc.
- Weathering is of two types: physical and chemical.
- **Physical Weathering**: In this process, rocks are broken down to form smaller pieces. It is a mechanical process and does not involve any change in the characteristics of the original rock. It may be caused by temperature differences, frost, growing roots of plants, movement of animals, etc.
- **Chemical Weathering**: It is a process in which existing minerals are broken down into new mineral components. In this process, the chemical nature of the rock changes. Water is one of the main agents of chemical weathering.
- The process of weathering can be divided into three stages:
- Stage I: Weathering, be it physical or chemical, causes large pieces of parent rock near the surface to disintegrate into smaller ones.
- Stage II: Smaller rocks continue to undergo weathering, thus allowing a very fine layer of rock particles to form at the surface of the Earth. Bacteria and other microorganisms break down plant and animal remains to add humus to it. This makes the soil fertile and rich in organic materials and minerals, which are vital to plant growth.
- Stage III: Minerals and salts seep deeper into the ground along with water to complete the formation of soil and make it favourable for plant growth.
- **Factors affecting soil formation**
- There are a number of factors which affect soil formation, namely, climate, characteristics of the parent rock, and slope of land. -



- Climate: Climatic factors or weathering forces such as temperature, rain, wind, etc., play an important role in loosening and breaking up rocks (physical weathering).
- Water in rock crevices expands when it freezes, hence, increasing the pressure and causing the rocks to crack. Rocks are also worn down by wind.

- Soil formation is fastest in hot, moist climates and slowest in cold, dry climates.
- In the warm and wet tropics, bacterial activity is high. As a result, soil in these areas have a rich content of humus.
- On the other hand, desert regions have very little vegetation and animal life, and so limited decaying material is available for the soil.
- The lack of rainfall leads to the formation of coarse-textured soil in dry and arid regions. In areas that experience severe winter, bacterial activity is very slow causing dead plant and animal matter to build up.
- Therefore, soil in such places forms very slowly. Thus, the rate of soil formation and the type of soil formed depends on the climate of a place.
- 2.Characteristics of the parent rock: The composition of the parent rock also determines the kind of soil formed. For example, if the parent rock is rich in calcium, the soil formed by its weathering would be rich in calcium, too.
- 3.Slope of land: The physical features of a place play an important role in the formation of soil. Hilly areas generally have a thin layer of soil because running water and wind tend to carry the soil down the slope.
- On flat plains, soil remains relatively undisturbed leading to the formation of a thick layer.
- **Soil Profile:** Due to the physical, chemical, and biological activities that take place during soil formation, well-developed layers of soil are formed, one below the other.
- Typically, four distinct soil layers can be seen. These layers are referred to as horizons.
- A vertical section of soil from the ground surface to the parent rock that shows the different layers of soil or the horizons is called soil profile. "A" horizon or topsoil is the uppermost layer of soil. It consists of fine particles. It is rich in humus and therefore dark in colour. It is soft, porous. and can hold water.
- "O" horizon lies just above the topsoil and is rich in organic matter.
- "B" horizon or subsoil is rich in minerals that seep down along with water. It also contains compactly packed fine particles of soil.
- "C" horizon contains partly weathered pieces of rock. It is usually characterized by cracks and crevices. It is very difficult to dig beyond this layer.
- "R horizon" or Bedrock is the lowermost layer and mainly consists of the parent rock. The properties of this rock greatly determine the composition of the soil.



- **Composition of soil:** The main constituents of soil are water, sand, clay, silt, pebbles, and humus. The table gives the particle size of some of these constituents. The differences in the proportion of these constituents leads to the formation of different kinds of soils.

• Particle	Diameter (in mm)
• Clay	• Less than 0.002
• Slit	• 0.002 - 0.05
• Sand	• 0.05 - 2.00
• Fine particle	• 2.00 - 5.00
• Medium particle	• 5.00 - 20.00
• Coarse pebble	• 20.00 - 75.00

- **Properties of Soil**
- Soil has special properties which determine different soil types.
- These properties are: (a) absorption of water in soil (b) moisture in the soil, and (c) percolation rate of water in soil.

1.Absorption of Water in Soil: The plants that grow in soil require water to grow. If the soil can hold water, the plants will grow well. If the soil does not hold water, the plants would need frequent watering or they would die.

- The amount of water a particular type of soil can absorb is its water absorption tendency.
- Higher the absorption of water by soil, higher is its availability to plants.

2.Moisture in the Soil: When you take a bit of soil and heat it in a test tube, you will see tiny droplets of water condensing near the mouth of the test tube.

- Soil contains some amount of water in the form of moisture. We can estimate the moisture content of the soil by the look and feel of it.
- Soil moisture helps to determine when it needs to be irrigated and how much water it needs.

3. Percolation Rate of Water in Soil: The rate at which water exits the soil is known as its percolation rate. Different soils have different percolation rates.

- For proper plant growth, it is important to check percolation rate of water in soil. In well-drained soil, water will pass rapidly after it is irrigated.
- On the other hand, soil with a poor percolation will hold too much water for too long a time. That can be harmful to plants.

- **Percolation Rate = Amount of water in (ml)/ Percolation time in (min)**
- Q Given a certain sample, it took 10 min for 500 ml, to percolate. Find the percolation rate. Answer:_____

What happens to water when it falls on cemented ground?

- Cemented ground is porous to some extent. But the porosity of a cemented floor is very low as compared to soil and, therefore, water absorption is very slow.
- Most of the water that falls on a cemented floor evaporates or runs off, and only a very small amount seeps through it.
- Cemented ceilings have to be specially treated to make them waterproof, otherwise waterlogging would result in seepage.

Types of soil: The difference in particle size of the various soil constituents gives rise to a property called texture. The easiest way to identify the type of soil is to take some, wet it, and roll it between your fingers.

- If it is very gritty and pale brown, then it is sandy.
- If it makes a shiny smooth coating on your fingers and is greyish-brown, then it is clayey.
- If it is flaky and dark, then it is loamy.

ABHYAS Academy, Behind Pragat Shiv Mandir, Near Govt. College, Nishat Cinema Road, Ambala Cantt.
Ph No. +91-171-2631595, 9416541198, e-Mail: anusethi1968@yahoo.com Website: www. abhyasonline.in

- Based on the proportion of sand, silt, clay, and humus present, soil can be sandy, clayey.

Sandy Soil	Clayey Soil	loamy Soil
• More than two-thirds of sandy soil is sand, and about one-tenth is clay. • It is made up of large particles with large air spaces. • Its porosity prevents retention of water. So it dries up very easily. • It is well suited for fruit and vegetable cultivation.	• More than two-thirds of clayey soil is clay. • It is made up of fine particles with small air spaces. • It retains moisture and becomes very sticky when wet. When dry, it becomes hard and forms deep cracks. To improve this soil, chalk can be added. • It is good for making pots.	• Loamy soil has sand and silt in equal amounts, about two-fifths each. One-fifth of loamy soil is clay. • It has high humus content. • It is porous and also holds moisture. • It is good for cultivation of crops and gardening.

ABHYAS Academy, Behind Pragat Shiv Mandir, Near Govt. College, Nishat Cinema Road, Ambala Cantt.
Ph No. +91-171-2631595, 9416541198, e-Mail: anusethi1968@yahoo.com Website: www. abhyasonline.in