**TDC, 1st Year, 2nd Sem, Paper-2026**

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**SOIL COMPOSITION AND HORIZON**

**Soil Composition**

Soil is one of the most important elements of an ecosystem, and it contains both biotic and abiotic factors. The composition of abiotic factors is particularly important as it can impact the biotic factors, such as what kinds of plants can grow in an ecosystem.

Soil contains air, water, and minerals as well as plant and animal matter, both living and dead. These soil components fall into two categories. In the first category are biotic factors—all the living and once-living things in soil, such as plants and insects. The second category consists of abiotic factors, which include all non-living things—for example, minerals, water, and air. The most common minerals found in soil that support plant growth are phosphorus, and potassium and also, nitrogen gas. Other, less common minerals include calcium, magnesium, and sulphur. The biotic and abiotic factors in the soil are what make up the soil’s composition.

Soil composition is a mix of soil ingredients that varies from place to place. The Natural Resources Conservation Service (NRCS)—part of the U.S. Department of Agriculture—has compiled soil maps and data for 95 percent of the United States. The NRCS has found that each state has a “state soil” with a unique soil “recipe” that is specific to that state. These differing soils are the reason why there is such a wide variety of crops grown in the United States.

Soil scientists conduct various tests on soils to learn about their composition. Soil testing can identify the amounts of biotic and abiotic factors in the soil. The results of these tests can also reveal if the soil has too much of a specific mineral or if it needs more nutrients to support plants. Scientists also measure other factors, such as the amount of water in the soil and how it varies over time—for instance, is the soil unusually wet or dry? The tests can also identify contaminants and heavy metal in the soil and determine the soil’s nitrogen content and pH level (acidity or alkalinity). All of these measurements can be used to determine the soil’s health. Soil is composed of biotic -living and once-living things, like plants and insects and abiotic materials - non- living factors, like minerals, water, and air.

**Soil horizons**

Soils differ widely in their properties because of geologic and climatic variation over distance and time. Even a simple property, such as the soil thickness, can range from a few centimetres to many metres, depending on the intensity and duration of weathering, episodes of soil deposition and erosion, and the patterns of landscape evolution. Nevertheless, in spite of this variability, soils have a unique structural characteristic that distinguishes them from mere earth materials and serves as a basis for their classification: a vertical sequence of layers produced by the combined actions of percolating waters and living organisms.

These layers are called horizons, and the full vertical sequence of horizons constitutes the soil profile (see the figure). Soil horizons are defined by features that reflect soil-forming processes. For instance, the uppermost soil layer (not including surface litter) is termed the A horizon. This is a weathered layer that contains an accumulation of humus (decomposed, dark-coloured, carbon-rich matter) and microbial biomass that is mixed with small-grained minerals to form aggregate structures.

Below A lies the B horizon. In mature soils this layer is characterized by an accumulation of clay (small particles less than 0.002 mm [0.00008 inch] in diameter) that has either been deposited out of percolating waters or precipitated by chemical processes involving dissolved products of weathering. Clay endows B horizons with an array of diverse structural features (blocks, columns, and prisms) formed from small clay particles that can be linked together in various configurations as the horizon evolves.

Below the A and B horizons is the C horizon, a zone of little or no humus accumulation or soil structure development. The C horizon often is composed of unconsolidated parent material from which the A and B horizons have formed. It lacks the characteristic features of the A and B horizons and may be either relatively un-weathered or deeply weathered. At some depth below the A, B, and C horizons lies consolidated rock, which makes up the R horizon.

These simple letter designations are supplemented in two ways (see the table of soil horizon letter designations). First, two additional horizons are defined. Litter and decomposed organic matter (for example, plant and animal remains) that typically lie exposed on the land surface above the A horizon are given the designation O horizon, whereas the layer immediately below an A horizon that has been extensively leached (that is, slowly washed of certain contents by the action of percolating water) is given the separate designation E horizon, or zone of eluviation (from Latin ex, “out,” and lavere, “to wash”). The development of E horizons is favoured by high rainfall and sandy parent material, two factors that help to ensure extensive water percolation. The solid particles lost through leaching are deposited in the B horizon, which then can be regarded as a zone of illuviation (from Latin il, “in,” and lavere)

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| Soil horizon letter designations |
| Base symbols for surface horizons |
| O | organic horizon containing litter and decomposed organic matter |
| A | mineral horizon darkened by humus accumulation |
| Base symbols for subsurface horizons |
| E | mineral horizon lighter in colour than an A or O horizon and depleted in clay minerals |
| AB or EB | transitional horizon more like A or E than B |
| BA or BE | transitional horizon more like B than A or E |
| B | accumulated clay and humus below the A or E horizon |
| BC or CB | transitional horizon from B to C |
| C | unconsolidated earth material below the A or B horizon |
| R | consolidated rock |
| Suffixes added for special features of horizons |
| a | highly decomposed organic matter |
| b | buried horizon |
| c | concretions or hard nodules (iron, aluminum, manganese, or titanium) |
| e | organic matter of intermediate decomposition |
| f | frozen soil |
| g | gray colour with strong mottling and poor drainage |
| h | accumulation of organic matter |
| i | slightly decomposed organic matter |
| k | accumulation of carbonate |
| m | cementation or induration |
| n | accumulation of sodium |
| o | accumulation of oxides of iron and aluminum |
| p | plowing or other anthropogenic disturbance |
| q | accumulation of silica |
| r | weathered or soft bedrock |
| s | accumulation of metal oxides and organic matter |
| t | accumulation of clay |
| v | plinthite (hard iron-enriched subsoil material) |
| w | development of colour or structure |
| x | fragipan character (high-density, brittle) |
| y | accumulation of gypsum |
| z | accumulation of salts |

The combined A, E, B horizon sequence is called the solum (Latin: “floor”). The solum is the true seat of soil-forming processes and is the principal habitat for soil organisms. (Transitional layers, having intermediate properties, are designated with the two letters of the [adjacent](https://www.merriam-webster.com/dictionary/adjacent) horizons.)

The second enhancement to soil horizon [nomenclature](https://www.britannica.com/science/nomenclature) (also shown in the table) is the use of lowercase suffixes to designate special features that are important to soil development. The most common of these suffixes are applied to B horizons: *g* to denote mottling caused by waterlogging, *h* to denote the alluvial accumulation of humus, *k* to denote [carbonate mineral](https://www.britannica.com/science/carbonate-mineral) precipitates, *o* to denote residual metal oxides, *s* to denote the alluvial accumulation of metal oxides and humus, and *t* to denote the accumulation of clay.