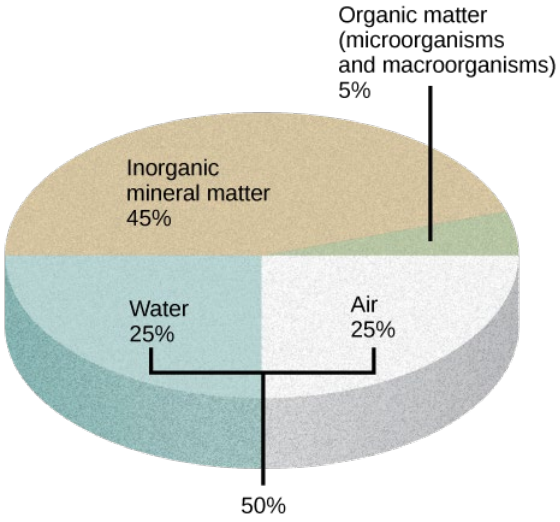
Biology 2e
Unit 6: Plant Structure and Function
Chapter 31: Soil and Plant Nutrition

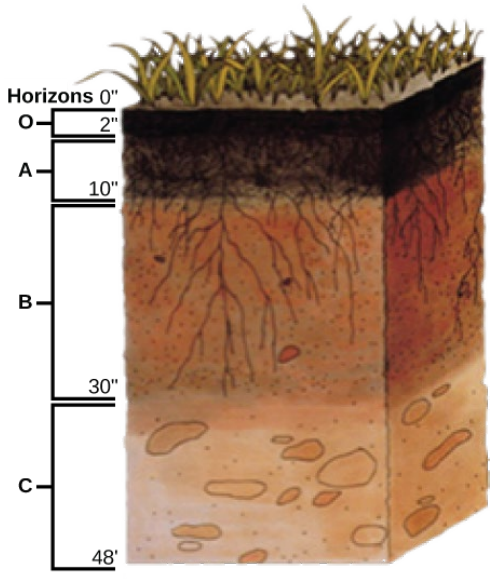
Visual Connection Questions

1. Soil compaction can result when soil is compressed by heavy machinery or even foot traffic. How might this compaction change the soil composition?



The air content of the soil decreases.

2. Which horizon is considered the topsoil, and which is considered the subsoil?



The A horizon is the topsoil, and the B horizon is subsoil.

3. Farmers often rotate corn (a cereal crop) and soy beans (a legume) planting a field with each crop in alternate seasons. What advantage might this crop rotation confer?

(a) (b) (c)

Soybeans are able to fix nitrogen in their roots, which are not harvested at the end of the growing season. The belowground nitrogen can be used in the next season by the corn.

Review Questions

4. For an element to be regarded as essential, all of the following criteria must be met, except:
c. The element is inorganic.

5. The nutrient that is part of carbohydrates, proteins, and nucleic acids, and that forms biomolecules, is _____.
b. carbon

6. Most _____ are necessary for enzyme function.
a. micronutrients

7. What is the main water source for land plants?
b. soil

8. Which factors affect soil quality?
d. all of the above (chemical composition, history of the soil, presence of living organisms and topography)

9. Soil particles that are 0.1 to 2 mm in diameter are called _____.
a. sand

10. A soil consists of layers called _____ that taken together are called a _____.
b. horizons : soil profile

11. What is the term used to describe the solid rock that lies beneath the soil?
b. bedrock

12. Which process produces an inorganic compound that plants can easily use?
b. nitrogen fixation

13. Through mycorrhization, a plant obtains important nutrients such as _____.
a. phosphorus, zinc, and copper

14. What term describes a plant that requires nutrition from a living host plant?
a. parasite

15. What is the term for the symbiotic association between fungi and cyanobacteria?
a. lichen

Critical Thinking Questions

16. What type of plant problems result from nitrogen and calcium deficiencies?
Deficiencies in these nutrients could result in stunted growth, slow growth, and chlorosis.

17. Research the life of Jan Baptista van Helmont. What did the van Helmont experiment show?
van Helmont showed that plants do not consume soil, which is correct. He also thought that plant growth and increased weight resulted from the intake of water, a conclusion that has since been disproven.

18. List two essential macronutrients and two essential micronutrients.
Answers may vary. Essential macronutrients include carbon, hydrogen, oxygen, nitrogen, phosphorus, potassium, calcium, magnesium, and sulfur. Essential micronutrients include iron, manganese, boron, molybdenum, copper, zinc, chlorine, nickel, cobalt, sodium, and silicon.

19. Describe the main differences between a mineral soil and an organic soil.
A mineral soil forms from the weathering of rocks; it is inorganic material. An organic soil is formed from sedimentation; it mostly consists of humus.

20. Name and briefly explain the factors that affect soil formation.
Parent material, climate, topography, biological factors, and time affect soil formation. Parent material is the material in which soils form. Climate describes how temperature, moisture, and wind cause different patterns of weathering, influencing the characteristics of the soil. Topography affects the characteristics and fertility of a soil. Biological factors include the presence of living organisms that greatly affect soil formation. Processes such as freezing and thawing may produce cracks in rocks; plant roots can penetrate these crevices and produce more fragmentation. Time affects soil because soil develops over long periods.

21. Describe how topography influences the characteristics and fertility of a soil.
Topography affects water runoff, which strips away parent material and affects plant growth. Steeps soils are more prone to erosion and may be thinner than soils that are on level surfaces.

22. Why is biological nitrogen fixation an environmentally friendly way of fertilizing plants?
Because it is natural and does not require use of a nonrenewable resource, such as natural gas.

23. What is the main difference, from an energy point of view, between photosynthesis and biological nitrogen fixation?

Photosynthesis harvests and stores energy, whereas biological nitrogen fixation requires energy.

24. Why is a root nodule a nutritional adaptation of a plant?

A nodule results from the symbiosis between a plant and bacterium. Within nodules, the process of nitrogen fixation allows the plant to obtain nitrogen from the air.