READING PRACTICE SETS

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RAINFOREST SOILS

TOEFL iBT

READING PRACTICE SET

Directions: Read the passage and answer the questions. Give yourself 18 minutes to complete this practice set.

RAINFOREST SOILS

1 On viewing the lush plant growth of a tropical rainforest, most people would conclude that the soil beneath it is rich in nutrients. **[A]** However, although rainforest soils are highly variable, they have in common the fact that abundant rainfall washes mineral nutrients out of them and into streams. **[B]** This process is known as leaching. **[C]** As a result of rain leaching, most tropical rainforest soils have low to very low mineral nutrient content, in dramatic contrast to mineral-rich grassland soils. **[D]** Tropical rainforest soils also often contain particular types of clays that, unlike the mineral-binding clays of temperate forest soils, do not bind mineral ions well. The dominant cation, i.e., an ion that has a positive electric charge, that is present in tropical soils is aluminum. However, plants do not require this element, and it is moderately toxic to a wide range of plants. Moreover, aluminum reduces the availability of phosphorus, an element that is in high demand by plants.

2 High moisture and temperatures speed the growth of soil microbes that decompose organic compounds. Thus, tropical soils typically contain far lower amounts of organic materials (humus) than do other forest or grassland soils. Since organic compounds help loosen compact clay soils, hold water, and bind mineral nutrients, the relative lack of organic materials in tropical soils is deleterious to plants. Plant roots cannot penetrate far into hard clay soils, and during dry periods, the soil cannot hold enough water to supply plant needs. Because the concentration of dark-colored organic materials is low in tropical soils, they are often colored red or yellow by the presence of iron, aluminum, and manganese oxides. When dry, these soils become rock hard. The famous Cambodian temples of Angkor Wat, which have survived for many centuries, were constructed from blocks of such hard rainforest soils.

3 Given such poor soils, how can lush tropical forests exist? The answer is that the forest's minerals are held in its living biomass – the trees and other plants and the animals. In contrast to grasslands, where a large proportion of plant biomass is produced underground, that of tropical forests is nearly all aboveground. Dead leaves, branches, and other plant parts, as well as the wastes and bodies of rainforest animals, barely reach the forest floor before they are rapidly decayed by abundant decomposers – bacteria and fungi. Minerals released by decay are quickly absorbed by multitudinous shallow, fine tree feeder roots and stored in plant tissues. Many tropical rainforest plants, like those in other forests, have mycorrhizal (fungus-root) partners whose delicate hyphae spread through great volumes of soil, from which they release and absorb minerals and ferry them back to the host plant in exchange for needed organic compounds. These fungal hyphae can absorb phosphorus that plant roots could not themselves obtain from the very dilute soil solutions, and can transfer mineral nutrients from one forest plant to another. Consequently, tropical rainforests typically have what are known as closed nutrient systems, in which minerals are handed off from one organism to another with little leaking through to the soil. When mineral nutrients do not spend much time in the soil, they cannot be leached into streams. Closed nutrient systems have evolved in response to the leaching effects of heavy tropical rainfall. Evidence for this conclusion is that nutrient systems are more open in the richest tropical soils and tightest in the poorest soils.

4 The growth of organisms is dependent on the availability of nutrients, none of which is more important than nitrogen. Although there is an abundant supply of nitrogen in Earth's atmosphere, it cannot be absorbed by plants unless it is "fixed," or combined chemically with other elements to form nitrogen compounds. Nitrogen-fixing bacteria help tropical rainforest plants cope with the poor soils there by supplying them with needed nitrogen. Many species of tropical rainforest trees belong to the legume family, which is known for associations of nitrogen-fixing bacteria within root nodules. In addition, cycads, which are tropical seed plants that resemble palms and ferns, produce special aboveground roots that harbor nitrogen-fixing cyanobacteria. By growing above the ground, the roots are exposed to sunlight, which the cyanobacteria require for growth. Nitrogen fixation by free-living bacteria in tropical soils is also beneficial.

1. According to paragraph 1, one reason that the relatively high levels of aluminum in rainforest soils present a problem for plants is that aluminum

   (A) reduces the mineral-binding capacity of soils
   (B) is somewhat toxic to plants
   (C) makes too much phosphorus available to plants
   (D) is present as a positively charged ion in tropical rainforest soils

2. According to paragraph 2, clay soils that contain relatively low amounts of organic materials have all of the following disadvantages for plants EXCEPT

   (A) poor water retention
   (B) poor root penetrability
   (C) few soil microbes
   (D) low levels of mineral nutrients

3. Paragraph 2 supports the idea that, as compared with rainforest soils, grassland soils

   (A) contain a greater variety of soil microbes
   (B) contain less organic material
   (C) are able to hold more water
   (D) are generally lighter colored

4. Why does the author mention Angkor Wat?

   (A) To show that rainforest soils are essentially the same today as they were many centuries ago
   (B) To make the point that rainforest soils have certain advantages over other types of soils
   (C) To illustrate how colorful rainforest soils can sometimes be
   (D) To emphasize how hard rainforest soils can become

5. According to paragraph 3, the main advantage of a closed nutrient system is that such a system

   (A) reduces the risk of minerals being lost through leaching
   (B) ensures that all organisms in the system receive an adequate supply of nutrients
   (C) increases the amount of nutrients that plant roots can absorb from soil solutions
   (D) increases the speed with which nutrients are returned to the soil

6. According to paragraph 4, why can getting enough nitrogen be a problem for plants?

   (A) Because most of Earth's nitrogen is located in the atmosphere
   (B) Because plants can use the nitrogen that they absorb only if they have previously absorbed certain other elements that are often scarce in poor soils
   (C) Because plants cannot absorb nitrogen that has not been chemically combined with other elements
   (D) Because plants have to compete with bacteria for available nitrogen in the soil

7. The word abundant in the passage is closest in meaning to

(A) valuable
(B) plentiful
(C) usable
(D) obvious

8. According to paragraph 4, in which of the following ways does having aboveground roots benefit cycads?

(A) By increasing the growth rate of cycads' roots through exposure to sunlight
(B) By increasing the supply of usable nitrogen available to cycads
(C) By reducing the amount of nitrogen cycads require
(D) By reducing cycads' dependence on nitrogen-fixing bacteria

9. Look at the four squares **[A-D]** that indicate where the following sentence could be added to the passage.

In many contexts – grasslands and most other types of forest, for example – that inference would be correct.

Where would the sentence best fit?

10. **Directions:** An introductory sentence for a brief summary of the passage is provided below. Complete the summary by selecting the **THREE** answer choices that express the most important ideas in the passage. Some sentences do not belong in the summary because they express ideas that are not presented in the passage or are minor ideas in the passage. **This question is worth 2 points.**

Even though tropical rainforest plants grow vigorously, the clay soils of tropical rainforests are very low in mineral nutrients.

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Answer Choices

(A) Clays with poor mineral-binding capacities plus low levels of organic compounds that result from rapid decomposition produce compacted soils that are highly vulnerable to rain leaching.
(B) Plants are able to tolerate the high levels of aluminum in tropical rainforest soils only because of bacteria and fungi that neutralize aluminum while absorbing and transferring phosphorus.
(C) Because water does not penetrate deep into tropical rainforest soils, most trees growing in such soils have shallow feeder roots that spread over large areas in search of adequate moisture.
(D) The delicate fungal hyphae that extend throughout most tropical rainforest soil help maintain soil quality by transferring excess nutrients from plant tissues back into the soil.
(E) Tropical rainforests have evolved closed nutrient systems, in which plants and their fungal partners transfer mineral nutrients among organisms with little leaching through to the soil.
(F) Nitrogen-fixing bacteria in the soil and within the roots and root nodules of many plants provide rainforest plants with the nitrogen needed to help compensate for poor soils.