Name: _____ Class: _____ Date: _____ ID: A

Weathering, Erosion and Soil Short Study Guide

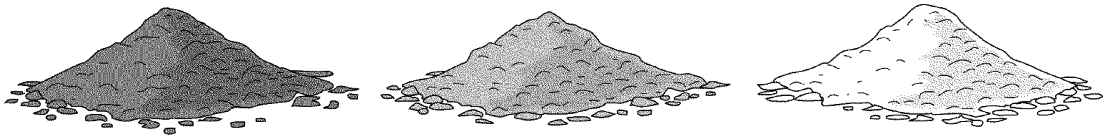
Multiple Choice
Identify the letter of the choice that best completes the statement or answers the question.

____ 1. Most of the weathering of Cleopatra's Needle is caused by ____.
a. hydrolysis
b. chemical weathering
c. oxidation
d. frost wedging

____ 2. Which of the following has the potential for the most erosion?
a. water flowing across a flatland
b. wind blowing materials in the air, against the force of gravity
c. wind blowing materials down a slope
d. water flowing down a steep slope

____ 3. What is one source of organic matter in soil?
a. acid precipitation
b. dead fungi, bacteria, and protozoa
c. weathered topsoil
d. eroding bedrock

____ 4. Of the three soil samples shown below, Sample 1, the darkest and richest, would be found in ____ of a typical soil profile.


Sample 1 Sample 2 Sample 3

a. horizon A
b. horizon B
c. horizon C
d. the hardpan

____ 5. Which of the following characteristics of water can be responsible for mechanical weathering?
a. Water flows downstream under gravity.
b. Water expands when it freezes.
c. Water combines with atmospheric gases to form acid rain.
d. Water reacts with and can dissolve many kinds of minerals.

____ 6. Which of the following statements is NOT true of soil?
a. It is a loose covering of broken rock particles and decaying organic matter.
b. There is one kind of soil in the United States.
c. Living organisms add nutrients to it.
d. It takes a long time to form.

____ 7. Which of the following happens when a river enters a large body of water?
a. The river water slows down and deposits large amounts of sediments.
b. The river water increases its speed and carries out gully erosion.
c. The river water flows over the delta, causing exfoliation.
d. The river water erodes the shoreline and deposits barrier islands.

____ 8. The color of a soil ____.
   a. is a reliable indicator of its fertility
   b. is always dark brown or black
   c. is not dependent on the amount of humus
   d. is determined by its composition and climate

____ 9. Which of the following statements is NOT true of soils in sloped areas?
   a. Smaller particles remain on the slopes, while coarser particles move downslope.
   b. Soils on slopes tend to be infertile.
   c. Valley soils are usually thick.
   d. South-facing slopes have somewhat thicker soils than slopes facing other directions.

____ 10. There can be no stream erosion or glacial erosion without ____.
   a. gravity
   b. hydrolysis
   c. wind
   d. deposition

Matching

Match each item with the correct definition below.

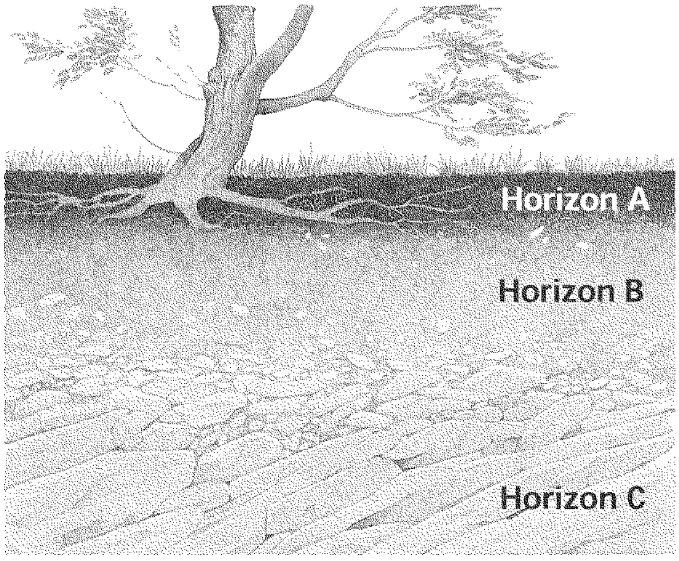
a. residual soil
b. transported soil
c. exfoliation
d. oxidation
e. hydrolysis
f. soil
g. soil profile
h. chemical weathering
i. frost wedging

____ 11. A vertical sequence of soil layers
____ 12. The chemical reaction of oxygen with other substances
____ 13. Soil that has been moved to a location away from its parent bedrock
____ 14. Soil located above its parent material
____ 15. The process by which outer layers of a rock are stripped away

Short Answer

16. What is the difference between weathering and erosion?
17. What is acid precipitation and how does it affect the weathering process?
18. Give an example of how animals, including humans, affect the erosional process.
19. Describe how soils form layers.

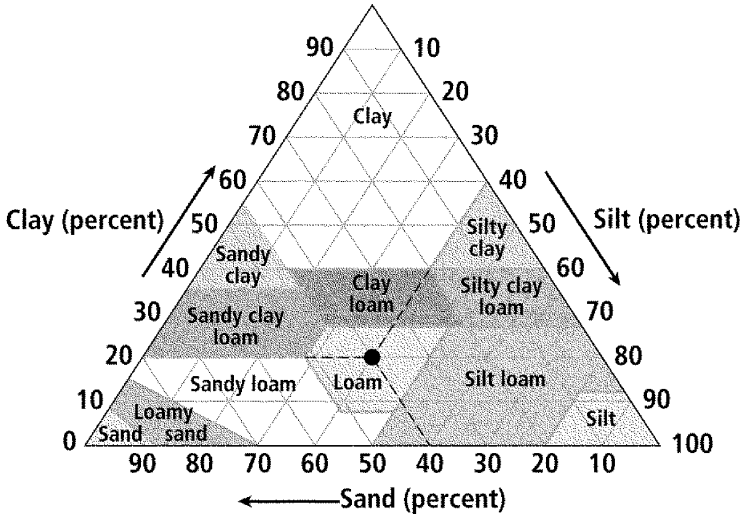
20. Below is a picture of a soil profile. Compare the characteristics of soil in Horizon A with soil in Horizon B.



21. How does climate influence the rate of weathering of earth materials?

22. Describe how soil forms.

Study the diagram. Then answer the following questions.



23. What property of soil does the diagram illustrate?

24. Name the three sizes of soil particles, from largest to smallest.

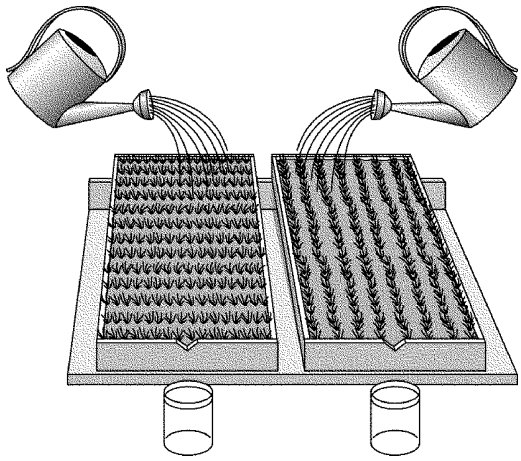
25. In general, soil drainage is determined by particle size: the larger the particle size, the better the drainage. Compare the drainage of sand, sandy clay, and clay soils.

Problem

A golf course designer, who is about to build a championship golf course, has come to you with a problem. He tells you that parts of his developing course cannot grow grass and tend to flood. After testing the soil, you decide that the reason it drains poorly and doesn't retain adequate moisture is because it has too much nonporous clay. You tell him that by adding soil conditioners, the new soil will improve its drainage and retain more water. You mention that water retention is important because water supplies are low in the hot summer months, and grasses need water to stay green. Improved drainage will also allow more rainfall to be soaked into the soil, thus lessening runoff and water erosion.

You develop a simple setup to test various soil combinations for drainage and water retention. You will add dry soil, which was heated to expel all moisture, to a beaker. The beaker has a drain hole in the bottom to allow the drainage of excess water to a measuring cylinder. You add 200 ml of water to the beakers with the various soil combinations. After one hour, you then reweigh the soil and measure the drainage water.

The clay is the unsuitable soil from the golf course. Humus and sand were picked up from a local nursery, and soils A and B are higher priced synthetic soils produced by a chemical company. Most of the soil combinations drained in less than 30 minutes. When the drain time is greater than 60 minutes, this indicates poor drainage and some of the water will remain on top of the soil, where it either evaporates or runs off. All water weights are given in grams. One gram of water is approximately equal to one milliliter.



	Clay	Clay + Humus	Clay + Sand	Clay + Soil A	Clay + Soil B
Dry soil weight	600 g	600 g	600 g	600 g	600 g
Water added	200 g	200 g	200 g	200 g	200 g
Wet soil weight	690 g	730 g	640 g	730 g	760 g
Water drainage	20 g	70 g	160 g	70 g	35 g
Time to drain	>60 min	30 min	20 min	30 min	>60 min

26. The water added to the dry soil should equal the weight of the wet soil plus the drainage weight. If it doesn't, it's because some of the water evaporated or ran off. Using the data from the chart provided above, complete the table below by indicating the amount of water that either evaporated or ran off.

	Clay	Clay + Humus	Clay + Sand	Clay + Soil A	Clay + Soil B
Water evaporated/runoff					

27. Compare the use of sand and humus as far as their ability to retain water and improve drainage.

28. How does Soil A and B compare to humus as far as their ability to retain water and improve drainage.

29. Why do you suppose clay has such a high evaporation rate?

30. What soil combination would you recommend to the golf course designer? What are some other factors that might influence the selection of the best soil conditioner?

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Answer Section

MULTIPLE CHOICE

1. B
2. D
3. B
4. A
5. B
6. B
7. A
8. D
9. A
10. A

MATCHING

11. G
12. D
13. B
14. A
15. C

SHORT ANSWER

16. Weathering is the process that involves the breaking down and changing of rocks and material on or near the Earth's surface. Erosion is the removal and movement of weathered materials from one location to another.
17. Acid precipitation is produced when sulfur dioxide and nitrogen oxides emissions combine with oxygen and water in the atmosphere to form sulfuric acid and nitric acid. These two acids can dissolve certain materials like limestone, which results in chemical weathering.
18. Many animals that burrow move surface material from one location to another. Humans excavate areas and move soil from one area to another.
19. Small pieces of weathered bedrock break off and rest on top of the parent rock layer. The pieces of rock continue to weather and the smaller pieces, along with living and dead organisms, form the top layer. Larger pieces form the underlying layers. Rainwater carries dissolved mineral to the lower layers of the soil.
20. Horizon A is the surface layer containing topsoil, which is usually dark-colored and rich in humus. Horizon B is the subsoil, is less-developed than Horizon A soil, and often contains soluble minerals that have been washed out from the topsoil. Horizon B soil may be red or brown in color due to the presence of iron oxides.

21. The interaction between temperature and precipitation has a great effect on rates of weathering. Chemical weathering occurs most readily in warm climates where rainfall is abundant and vegetation is lush. In contrast, physical weathering occurs most readily in cool, dry climates where water freezes and thaws.
22. Soil formation begins when weathering breaks bedrock into smaller and smaller pieces. Over time, tiny organisms living in the weathered material add nutrients to form soil. The processes of weathering and nutrient addition continue, and soil texture improves. As soil continues to develop, soil horizons form.
23. soil texture
24. clay, silt, sand
25. Since sand has the largest percentage of large particle sizes, it should drain the best. Clay has the largest percentage of small particle sizes, so it should drain the worst. Sandy clay has a mixture of particle sizes, so it should drain somewhere between clay and sand.

PROBLEM

26. Clay = 90, Clay + Humus = 0, Clay + Sand = 0, Clay + Soil A = 10, Clay + Soil B = 5
27. Sand in a soil will increase the drainage rate substantially, and also increase the water retention by a small amount. Humus not only increases the drainage rate of the soil, but also adds an organic component that retains a lot of moisture.
28. Soil A has the same drainage and water retention as humus. Soil B has more water retention than humus, but does not drain as well.
29. Clay soil has small particle sizes that compact easily. Once compacted, it does not allow the easy penetration of water. The water that cannot enter the soil usually evaporates or runs off.
30. The soil that has the best combinations of water retention and drainage is the clay/humus mixture and the clay/Soil A mixture. Answers may vary. The availability of either soil conditioner, its cost, and the long term effects of synthetic soil might be factors that would influence a decision.