Glencoe Science

Chapter Resources

Weathering and Soil

Includes:

Reproducible Student Pages

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- ✔ Chapter Review

HANDS-ON ACTIVITIES

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- ✔ Laboratory Activities
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- ✔ Teacher Guide and Answers

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Reproducible Student Pages

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Hands-On Activities

TRY AT HOME Mini LAB

Observing the Formation of Rust

Procedure

1. Place some **steel wool** in a **glass jar** with 1 cm of **water**.
2. Observe for several days.

Data and Observations

Days	What does the steel wool look like?
Day 1	
Day 2	
Day 3	
Day 4	
Day 5	

Analysis

1. What changes occurred?

2. What caused the changes?

3. How are these changes related to weathering?

Mini LAB

Comparing Components of Soil

Procedure

1. Collect a sample of **soil.**
2. Observe it closely with a **magnifying lens**.

Data and Observations

	Description of soil sample
Kinds of particles	
Remains of organisms	
Other components	
Differences from other soil samples	
Similarities to other soil samples	

Analysis

1. Describe the different particles found in your sample. Did you find any remains of once-living organisms?

2. Compare and contrast your sample with those other students have collected.

Soil Texture

Lab Preview

Directions: *Answer these questions before you begin the Lab.*

1. What is the safety symbol of the goggles telling you?

2. Read through the experiment. Why should the soil be moist before making a ribbon?

Soils have different amounts of different sizes of particles. When you determine how much sand, silt, and clay a soil contains, you describe the soil's texture. In this lab, you will learn a simple way to estimate soil texture.

Real-World Question

What is the texture of your soil?

Goals

- **Estimate** soil texture by making a ribbon.

Materials

soil sample (100 g)
water bottle

Safety Precautions

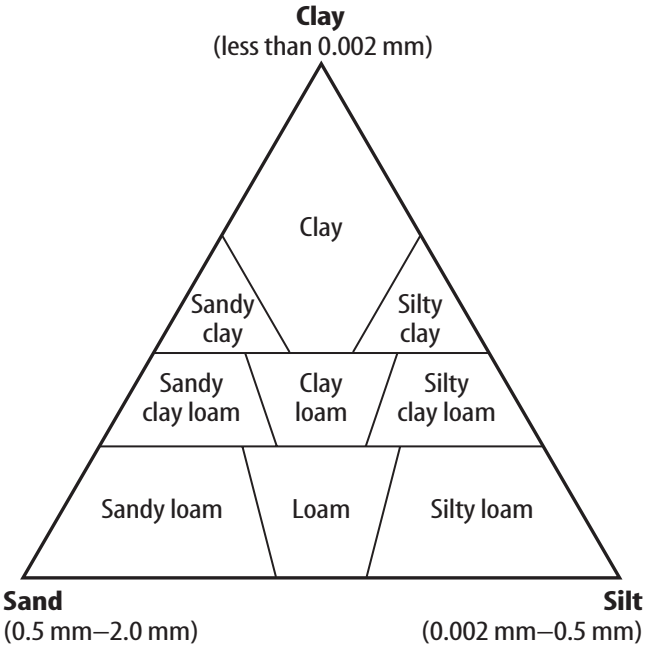
Procedure

1. Take some soil and make it into a ball. Work the soil with your fingers. Slowly add water to the soil until it is moist.

2. After your ball of soil is moist, try to form a long, thin ribbon of soil. Use the following descriptions to categorize your soil:
   a. If you can form a long, thin ribbon, you have a clay soil.
   b. If you formed a long ribbon but it breaks easily, you have a clay loam soil.
   c. If you had difficulty forming a long ribbon, you have loam soil.

3. Now make your soil classification more detailed by selecting one of these descriptions:
   a. If the soil feels smooth, add the word *silty* to your soil name.
   b. If the soil feels slightly gritty, don't add any word to your soil name.
   c. If the soil feels very gritty, add the word *sandy* before your soil name.

LAB (continued)



Conclude and Apply

1. Which texture class name did you assign to your soil?

2. Find your soil texture class name on the triangle above. Notice that the corners of the triangle are labeled *sand*, *silt*, and *clay*.

3. Is your soil texture class close to one of the three corners or near the middle of the diagram? If your soil texture class is close to a corner, which one?

4. Does your soil contain mostly sand, silt, or clay, or does it have nearly equal amounts of each? *Hint: If your soil name is close to a corner, it has mostly that size of sediment. If your soil name is in the middle of the triangle, it has nearly equal amounts of each sediment size.*

Design Your Own

Weathering Chalk

Lab Preview

Directions: *Answer these questions before you begin the Lab.*

1. Look at the chalk samples for this lab. What do you think could change these rocks?

2. What effects could these factors have on the chalk?

Chalk is a type of limestone made of the shells of microscopic organisms. The famous White Cliffs of Dover, England, are made up of chalk. This lab will help you understand how chalk can be chemically weathered.

Real-World Question

How can you simulate the chemical weathering of chalk?

Form a Hypothesis

How do you think acidity, surface area, and temperature affect the rate of chemical weathering of chalk? What happens to chalk in water? What happens to chalk in acid (vinegar)? How will the size of the chalk pieces affect the rate of weathering? What will happen if you heat the acid? Make hypotheses to support your ideas.

Possible Materials

equal-sized pieces of chalk (6)
small beakers (2)
metric ruler
water
white vinegar (100 mL)
hot plate
computer probe for temperature
**thermometer*
**alternate materials*

Goals

- **Design** experiments to evaluate the effects of acidity, surface area, and temperature on the rate of chemical weathering of chalk.
- **Describe** factors that affect chemical weathering.
- **Explain** how the chemical weathering of chalk is similar to the chemical weathering of rocks.

Safety Precautions

Wear safety goggles when pouring vinegar. Be careful when using a hot plate and heated solutions. **WARNING:** *If mixing liquids, always add acid to water.*

Test Your Hypothesis

Make a Plan

1. **Develop** hypotheses about the effects of acidity, surface area, and temperature on the rate of chemical weathering.
2. **Decide** how to test your first hypothesis. List the steps needed to test the hypothesis.
3. Repeat step 2 for your other two hypotheses.
4. **Design** data tables on separate sheets of paper. Make one for acidity, one for surface area, and one for temperature.

LAB (continued)

5. **Identify** what remains constant in your experiment and what varies. Change only one variable in each procedure.
6. **Summarize** your data in a graph. Decide from reading the **Science Skill Handbook** which type of graph to use.

Follow Your Plan

1. Make sure your teacher approves your plan before you start.
2. Carry out the three experiments as planned.
3. While you are conducting the experiments, record your observations on separate sheets of paper and complete the data tables.
4. Graph your data to show how each variable affected the rate of weathering.

Analyze Your Data

1. **Analyze** your graph to find out which substance—water or acid—weathered the chalk more quickly. Was your hypothesis supported by your data?

2. **Infer** from your data whether the amount of surface area makes a difference in the rate of chemical weathering. Explain.

Conclude and Apply

1. **Explain** how the chalk was chemically weathered.

2. How does heat affect the rate of chemical weathering?

3. What does this imply about weathering in the tropics and in polar regions?

Communicating Your Data

Compare your results with those of your classmates. How were your data similar? How were they different? **For more help, refer to the Science Skill Handbook.**

LAB 1 Laboratory Activity

Chemical Weathering

Rocks are mixtures of minerals that are either elements or chemical compounds. Chemical weathering is the chemical reaction of these minerals with carbon dioxide, water, oxygen, or other substances at Earth's surface. For example, in minerals containing iron, the iron reacts with oxygen in the air and moisture to form rust. Rotted plant material combines with water to form humic acids that cause chemical weathering.

Strategy

You will cause a chemical reaction between a copper strip and combined salt and vinegar at room temperature.

You will observe a chemical reaction between iron and atmospheric oxygen and moisture.

Materials

copper strip (dirty)
pie pan (disposable)
graduated cylinder
salt
vinegar (white)
iron (II) sulfate, $FeSO_4$
water
beaker

Procedure

1. For the first activity, place a copper strip in the pie pan and place 5 mL salt on the strip.
2. Carefully pour 30 mL of vinegar over the copper. Record your observations in Table 1.
3. Wash the salt and vinegar off the copper. **WARNING:** *The material formed is an acid. Avoid contact with skin and clothing.*
4. For a separate activity, mix 5 g of iron (II) sulfate in 50 mL of water. **WARNING :** *Iron(II) sulfate is poisonous. Avoid contact with skin.* Record the color of the solution and any other observations in Table 1.
5. Let both the beaker and the copper stand undisturbed overnight.
6. Next day, observe the beaker and the copper. Record your observations in Table 1.

Data and Observations

Table 1

	Start	Next day
1. Copper strip		
2. Beaker $FeSO_4$		

Laboratory Activity 1 (continued)

Questions and Conclusions

1. What happened to the copper when you poured the vinegar over the salt?

2. Is cleaning copper a chemical or physical process?

3. Explain what happens to the clean copper left in the air overnight.

4. Why does this reaction follow the cleaning of the copper?

5. Explain what you observed in the beaker of $FeSO_4$.

6. Is this a physical or chemical change?

7. Explain the rust-colored stains you see on some rocks.

8. How might a soil layer protect rock from chemical weathering?

Strategy Check

_____ Can you observe chemical reactions at Earth's surface?

_____ Can you demonstrate that chemical reactions can occur at room temperature?

LAB 2 Laboratory Activity

Soil Infiltration by Groundwater

Whether rainwater enters the soil or runs off the surface depends on many factors. One of the most important factors is the type of soil. Also, the rate at which rainwater enters the soil determines whether or not flooding occurs and whether or not septic tanks can be installed safely in a given region. If liquid from the tanks flows outward faster than the soil can absorb it, no filtering action occurs, and sewage reaches the surface and contaminates the area.

This laboratory activity is one of the tests that engineers use to decide if septic tanks are acceptable for a given area. Engineers make the test directly in the ground, sinking the can as far as possible. You may perform the test in the same way, or you may construct a simulated soil sequence and do your testing in the classroom.

Strategy

You will measure the rate at which water filters through soil.
You will plot the rate of infiltration against time.
You will compare various materials to see which are most suitable for filtering groundwater.

Materials

can opener
juice can (large)
cheesecloth (30 cm × 30 cm)
tape (masking)
dishpan or sink
2 pencils
beaker (500 mL)
gravel (500 mL)
slab clay
fine sand (500 mL)
soil (500 mL)
cardboard (thin)
scissors
plastic bucket
water
pointed stick (30 cm long)
pen (felt-tip)
watch with second hand
metric ruler
graph paper

Procedure

1. With the can opener, cut out both ends of the can. Place the cheesecloth across the bottom of the can and fasten it with tape.
2. Place the can in the dishpan, cloth side down. Raise the can slightly by resting it on the two pencils.
3. Do not fill the can more than half full. Place a layer of gravel in the bottom of the can. Place a layer of clay on the layer of gravel. Place a layer of sand on top of the clay. Place a thick layer of soil on top of the sand.
4. Make a cardboard cover for the can. Cut a small hole (about the diameter of the pointed stick) in the cardboard cover. Cut a small portion from one side of the cover. Through this hole, you will be able to observe the water level.
5. Fill the rest of the can with water. Place the cover over the top of the can.
6. After about one minute, insert the pointed stick into the can through the small hole until it just touches the top of the water. With the felt-tip pen, draw a line on the stick where it intersects the side of the can.
7. Mark the water depth on the stick every 60 seconds until the soil appears above the water. Determine the various water depths by measuring from the point of the stick to the first mark, second mark, and so on. Record your data in Table 1.

Laboratory Activity 2 (continued)

Data and Observations

Table 1

Time (min)	Water depth (cm)	Time (min)	Water depth (cm)

Graph your data on a sheet of graph paper using the vertical axis for depth of water (cm) and the horizontal axis for time (min).

Questions and Conclusions

1. Is the rate of infiltration constant? Explain.

_____

_____

2. Would the rate of infiltration be faster in wet soil or dry soil? Why?

_____

_____

3. Which layer infiltrates most slowly? Explain how you got your answer.

_____

_____

4. Which layer is most likely to allow the water to move through it too rapidly to be a good filter? Explain how you could design an experiment to find out.

_____

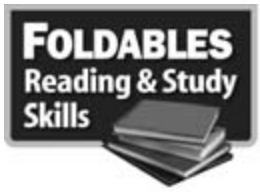
_____

Strategy Check

_____ Can you measure the rate at which water filters through soil?

_____ Can you make a graph that shows the rate of infiltration?

_____ Can you compare various materials to see which is suitable for filtering groundwater?



Weathering and Soil

Directions: *Use this page to label your Foldable at the beginning of the chapter.*

weathering

mechanical weathering

ice wedging

chemical weathering

oxidation

climate

soil

humus

horizon

soil profile

litter

leaching

no-till farming

contour farming

terracing

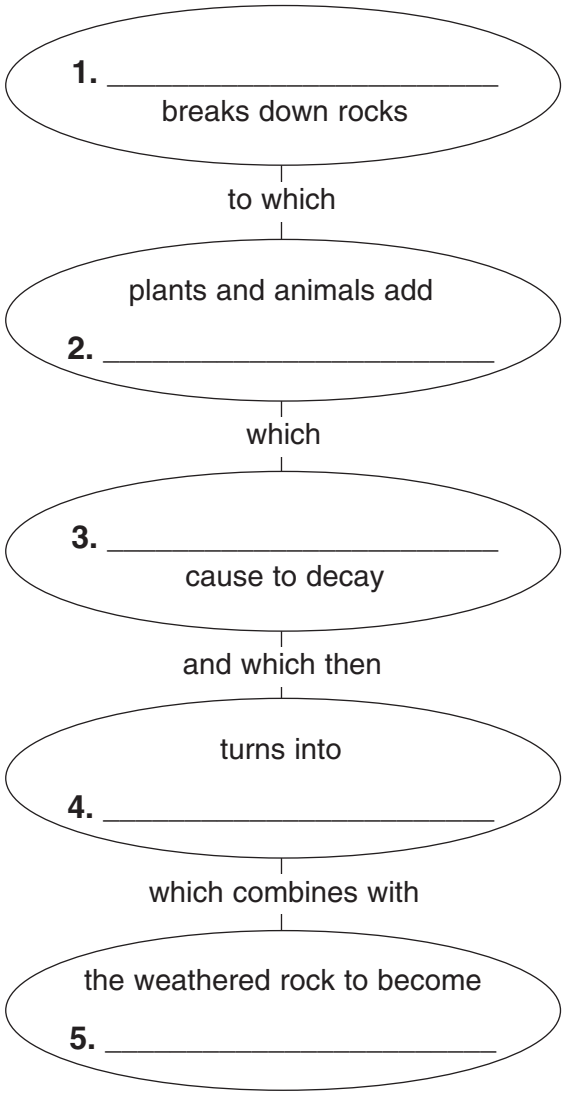
Meeting Individual Needs

Directed Reading for Content Mastery

Overview Weathering and Soil

Directions: *Complete the concept map using the terms listed below.*

weathering **humus** **soil**
organic matter **fungi and bacteria**



Directions: *Write* **T** *if the statement is true; write* **F** *if the statement is false.*

_____ **6.** Soil is eroded when it is moved from the place where it formed.

_____ **7.** Erosion is much more common in areas with lots of vegetation.

_____ **8.** Increased use of farmland has led to more rapid soil erosion.

_____ **9.** Terracing is one recent method of stopping erosion.

_____ **10.** No-till farming helps reduce soil erosion.

Name Date Class

Directed Reading for Content Mastery

Section 1 ▪ Weathering

Directions: *Complete the following paragraph using the terms listed below.*

roots	**ice wedging**	**moisture**	**oxygen**	**carbonic acid**
chemical	**oxidation**	**tropical**	**minerals**	**calcite**
climate	**deserts**	**mechanical**	**cracks**	**rock**

Weathering is the surface processes that work to break down **1.** _____. There are two main types of weathering. **2.** _____ weathering occurs when rocks are broken apart by physical processes. When water enters cracks in rocks and freezes, expanding and breaking the rock apart, it is called **3.** _____. In another type of mechanical weathering, plant **4.** _____ seeking water and nutrients sometimes grow into **5.** _____ in the rock and break the rock apart. **6.** _____ weathering occurs when chemical reactions dissolve the **7.** _____ in rocks or change them into different minerals. When water mixes with carbon dioxide gas in the air or soil, a weak acid, called **8.** _____, forms. This acid dissolves minerals, such as **9.** _____. When minerals containing iron are exposed to water and the **10.** _____ in air, the iron may form a new mineral that is like rust. This process is called **11.** _____. The rate of mechanical and chemical weathering is affected by **12.** _____. Chemical weathering occurs more quickly in **13.** _____ areas such as parts of South America. In **14.** _____, chemical weathering is slower due to lack of **15.** _____.

Meeting Individual Needs

Directed Reading for Content Mastery

Section 2 ▪ The Nature of Soil
Section 3 ▪ Soil Erosion

Directions: *Use the following terms to fill in the blanks below.*

soil	**humus**	**water**	**horizons**	**below**
topsoil	**bottom**	**top**	**soil profile**	**leaching**

1. _____ is a mixture of weathered rock, decayed organic matter, mineral fragments, water, and air.

2. Decaying organic matter is called _____.

3. Due to weathering, different layers, or _____, of soil form.

4. The different layers of soil make up a _____.

5. The *A* horizon is the _____ layer of soil and is also known as _____.

6. The *B* horizon is the layer _____ the *A* horizon.

7. The *C* horizon is the _____ layer in a soil profile; it consists of partly weathered rock.

8. _____ seeping downward through the horizons dissolves and carries minerals into lower horizons by the process of _____.

Directions: *Match the descriptions in Column I with the terms in Column II. Write the letter of the correct term in the blank at the left.*

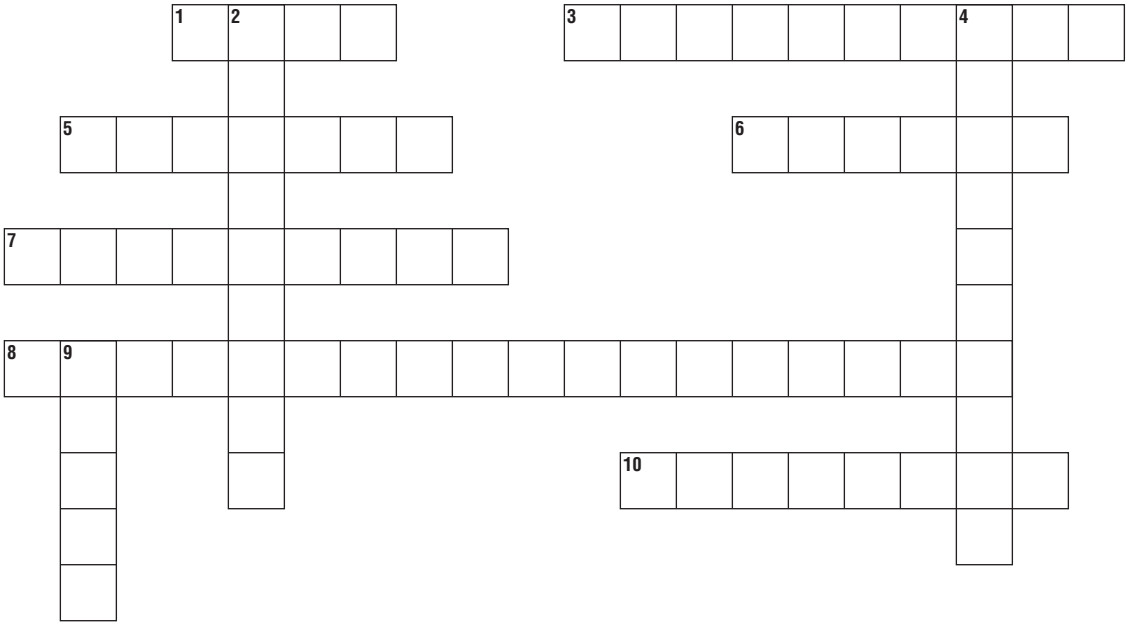
Column I	Column II
_____ **9.** practice of leaving plant stalks in the field	**a.** plowing
_____ **10.** mechanical turning and loosening of the soil	**b.** overgrazing
_____ **11.** planting along the natural shape of slopes of the land	**c.** forest harvesting
_____ **12.** building level areas into the sides of steep hills to grow crops	**d.** contour farming
_____ **13.** animals grazing until almost no ground cover remains	**e.** no-till farming
_____ **14.** removing forests and exposing the soil	**f.** terracing

Meeting Individual Needs

Directed Reading for Content Mastery

Key Terms
Weathering and Soil

Directions: *Use the clues below to complete the crossword puzzle.*



Across

1. Mixture of weathered rock, decayed organic matter, mineral fragments, water, and air

3. Surface processes that break down rock

5. A layer in the soil profile

6. Organic material such as leaves and twigs that may be changed to humus by decomposing organisms

7. Method of building level-topped areas onto the sides of steep hills or mountains so that crops can be grown

8. When chemical reactions dissolve the minerals in rocks or change them into different minerals

10. Removal of minerals that have been dissolved in water

Down

2. Occurs when materials containing iron are exposed to oxygen and water

4. When water breaks rocks apart by entering cracks and freezing, then thawing

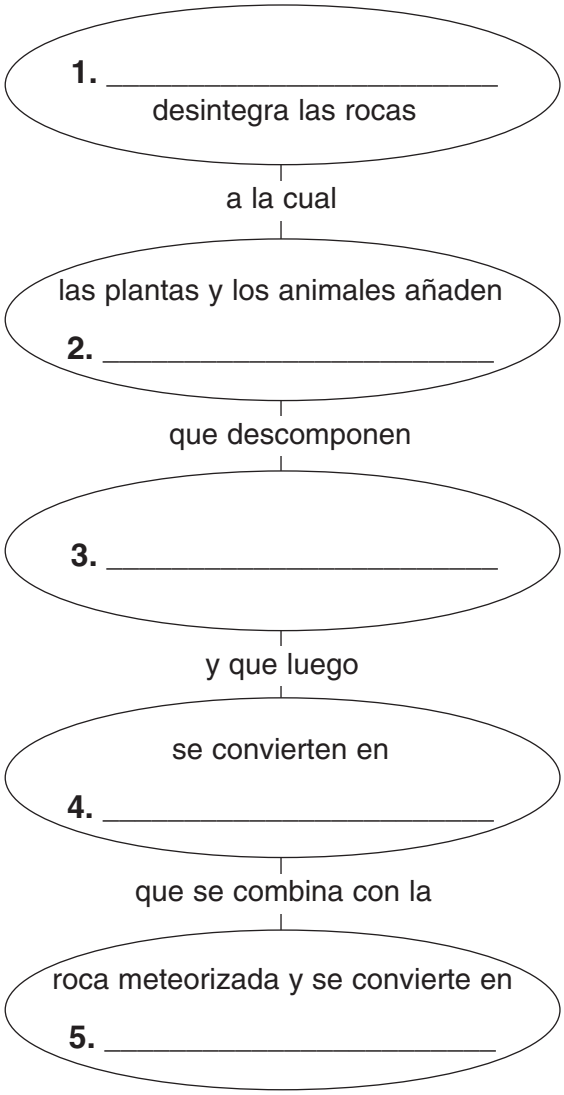
9. Decayed organic matter that turns into a dark-colored material

Lectura dirigida para Dominio del contenido

Sinopsis Meteorización y suelo

Instrucciones: *Completa el mapa de conceptos usando los siguientes términos.*

meteorización **humus** **suelo**
materia orgánica **hongos y bacterias**



Instrucciones: *Escribe* **V** *si el enunciado es verdadero; escribe* **F** *si el enunciado es falso.*

_____ **6.** El suelo sufre erosión cuando es trasladado del lugar donde se forma.

_____ **7.** La erosión es mucho más común en áreas con mucha vegetación.

_____ **8.** El uso excesivo de los terrenos de cultivo ha conducido a una erosión rápida del suelo.

_____ **9.** La construcción de terrazas es un método reciente para detener la erosión.

_____ **10.** La técnica de cultivo no-till ayuda a reducir la erosión del suelo.

Satisface las necesidades individuales

Lectura dirigida para Dominio del contenidio

Sección 1 ▪ Meteorización

Instrucciones: *Completa el párrafo con los siguientes términos.*

raíces	**grietas debido al hielo**	**humedad**	**oxígeno**	**ácido carbónico**
químico	**oxidación**	**tropical**	**minerales**	**calcita**
clima	**desiertos**	**mecánica**	**grietas**	**roca**

La meteorización es el proceso superficial que desintegra **1.** _____. Hay dos tipos principales de meteorización. La meteorización **2.** _____ocurre cuando las rocas son desintegradas por procesos físicos. El proceso en que el agua penetra en las grietas, se congela, se expande y quiebra la roca se llama **3.** _____. En otro tipo de meteorización mecánica, cuando las **4.** _____ de las plantas buscan agua y nutrientes, a veces crecen dentro de las **5.** _____de las rocas y las desintegran. La meteorización **6.** _____ocurre cuando las reacciones químicas disuelven los **7.** _____en las rocas o los cambian a minerales diferentes. Cuando el agua se mezcla con el dióxido de carbono en el aire o el suelo, se forma un ácido débil llamado **8.** _____. Este ácido puede disolver minerales como el(la) **9.** _____. Cuando los minerales que contienen hierro se exponen al agua y al **10.** _____del aire, el hierro puede formar un material nuevo parecido a la herrumbre. Este proceso se llama **11.** _____. El **12.** _____ afecta la tasa de meteorización mecánica y química. La meteorización química ocurre más rápidamente en áreas **13.** _____ como parte de Sudamérica. En los(las) **14.** _____, la meteorización química es más lenta debido a la falta de **15.** _____.

Lectura dirigida para Dominio del contenidio

Sección 2 ▪ Naturaleza del suelo
Sección 3 ▪ Erosión del suelo

Instrucciones: *Usa los siguientes términos para llenar los espacios en blanco.*

suelo	**humus**	**agua**	**horizontes**	**debajo**
suelo arable	**al fondo de**	**más arriba**	**perfil del suelo**	**lixiviación**

1. El(La) _____es una mezcla de roca meteorizada, materia orgánica en descomposición, fragmentos minerales, agua y aire.
2. La materia orgánica en descomposición se llama _____.
3. Como resultado de la meteorización, se forman diferentes capas o _____ en el suelo.
4. Las diferentes capas del suelo forman un(a) _____.
5. El horizonte A es la capa de suelo de _____ y se conoce también como _____.
6. El horizonte B es la capa que está _____ del horizonte A.
7. El horizonte C es la capa del _____ en un perfil de suelo; consiste de roca parcialmente meteorizada.
8. El proceso que ocurre cuando el _____ se escurre a través de los horizontes y transporta minerales a los horizontes de más abajo se llama _____.

Instrucciones: *Coordina la descripción de la Columna I con el término correcto de la Columna II. Escribe la letra de la respuesta correcta en el espacio en blanco.*

Columna I

_____ **9.** práctica en que se dejan los tallos de las plantas en los campos de cultivo

_____ **10.** revolver y esponjear mecánicamente el suelo

_____ **11.** sembrar siguiendo el contorno natural de las pendientes del terreno

_____ **12.** áreas planas que se construyen en los lados de las colinas de declive fuerte para el cultivo

_____ **13.** apacentamiento del ganado hasta que casi no queda cobertura en el suelo

_____ **14.** tala de bosques y exposición del suelo

Columna II

a. arado

b. pastoreo excesivo

c. tala de bosques

d. sembrado de contorno

e. técnica no-till

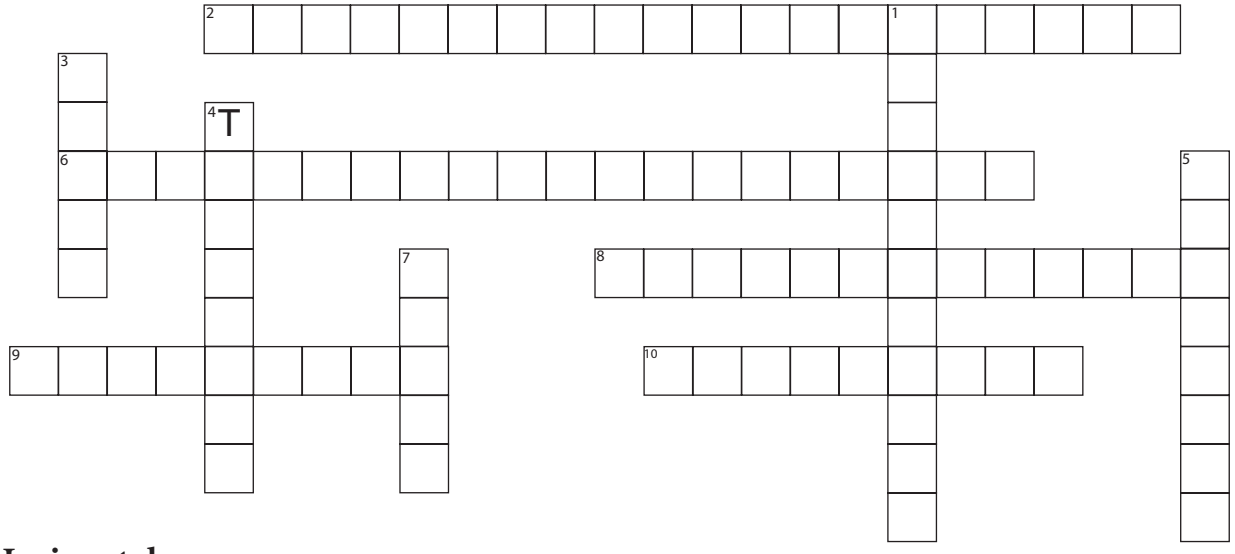
f. terrazas

Satisface las necesidades individuales

Lectura dirigida para Dominio del contenidio

Términos claves Meteorización y suelo

Instrucciones: *Usa las claves para completar el crucigrama.*



Horizontales

2. Cuando el agua rompe las rocas cuando penetra en las grietas, se congela y luego se descongela

6. Cuando las reacciones químicas disuelven minerales de las rocas o los cambian a minerales diferentes

8. Proceso superficial que desintegra las rocas

9. Una de las capas en un perfil del suelo

10. Ocurre cuando los materiales que contienen hierro entran en contacto con el aire y el agua

Verticales

1. Eliminación de minerales que han sido disueltos en el agua

3. Materia orgánica en descomposición que se vuelve de color oscuro

4. Estructuras aplanadas en las pendientes de las colinas que permiten la siembra de cultivos

5. Materia orgánica como hojas y ramitas finas que los microorganismos pueden convertir en humus

7. Mezcla de roca meteorizada, materia orgánica descompuesta, fragmentos de minerales, agua y aire

Satisface las necesidades individuales

Name Date Class

SECTION 1 Reinforcement

Weathering

Weathering includes mechanical weathering and chemical weathering. Mechanical weathering occurs when rocks are broken apart by physical processes but the chemical makeup of the rock stays the same. Chemical weathering occurs when chemical reactions dissolve the minerals in rocks or change them into different minerals.

Directions: *Identify each statement below as an example of mechanical or chemical weathering. Write* **M** *for mechanical or* **C** *for chemical in the blank at the left.*

_____ **1.** the wedging of tree roots along natural joints in granite

_____ **2.** limestone dissolved by carbonic acid

_____ **3.** the oxidation of minerals that contain iron

_____ **4.** animal burrows dug in rock that let in water and air

_____ **5.** repeated freezing and thawing of water that cracks rock

_____ **6.** the action of water, salt, and air on car fenders

_____ **7.** acids from plants roots that break up rocks

_____ **8.** formation of potholes in streets during severe winters

_____ **9.** raised sections of sidewalk along tree-lined streets

_____ **10.** a small rock falling from a cliff

_____ **11.** feldspar mixing with water and producing clay minerals

_____ **12.** halite in rocks dissolving in water

_____ **13.** decaying plants dissolving minerals in rocks

_____ **14.** tree roots cracking the concrete foundation of a house

_____ **15.** iron lawn furniture rusting outside

_____ **16.** more rapid in tropical climates

_____ **17.** carbonic acid weathering limestone

_____ **18.** leaves decaying in the forest

Name Date Class

SECTION 2 Reinforcement

The Nature of Soil

Directions: *Answer the following questions on the lines provided. Study the diagram of a soil profile to answer questions 1–5.*

1. Which soil layer contains the most humus?

2. How far into the soil do plant roots grow?

3. Where in this soil profile is organic matter broken down?

4. Where in this soil profile is solid rock being weathered into soil?

5. What is the name of the process by which water carries dissolved minerals from the upper horizons down to the lower levels?

6. Why does the color of soil affect soil temperature?

7. Why are earthworms, frost, and rodents beneficial to soil?

8. What factors help determine the type of soil, such as the thickness of the layers and their composition?

9. Choose a factor from Question 6 and explain how it can affect the soil in an area.

Meeting Individual Needs

Name Date Class

SECTION 3 Reinforcement

Soil Erosion

Directions: *Unscramble the terms in italics to complete the sentences below. Write the terms on the lines provided.*

_____ **1.** *gonPliw* mechanically turns and loosens the soil to grow crops.

_____ **2.** When soil is moved from the place where it formed, the process is called *sieroon.*

_____ **3.** There is no plowing and plant stalks are left in the field in *li-toln gimnarf.*

_____ **4.** In *artericeng,* flat-topped areas are built into the sides of steep hills and mountains to grow crops.

_____ **5.** In dry regions where sheep and cattle eat the grasses, *reggianvorz* increases soil erosion.

_____ **6.** Each year, clearing thousands of square kilometers of *nair setrof* destroys soil in the tropics.

Directions: *Answer the following questions on the lines provided.*

7. What can be done to reduce erosion at construction sites?

8. What effect does overgrazing have on topsoil?

9. Why shouldn't more land be cleared for farming and grazing as old land is worn out?

10. Why do people need soil?

11. What can farmers do to reduce soil erosion?

Meeting Individual Needs

SECTION 1 Enrichment

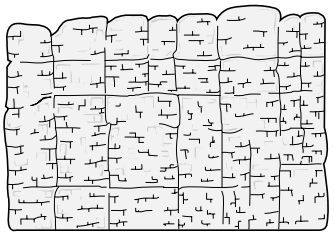
The Forming of Tors

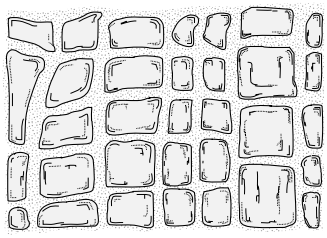
From afar, they resemble a family of huge robots standing in a field. Even as you get closer, they look like statues made of stone. Up close, you can see that they are rocks of different sizes stacked upon one another. This kind of landform is called a tor. Tors are usually formed by the weathering of granite.

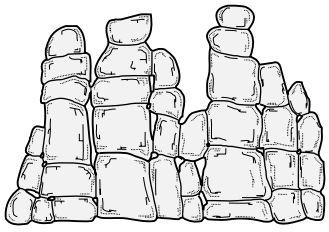
Tor Formation

These blocks of granite once formed a solid wall. Cracks in the rocks and spaces between the rocks (even though they were small) allowed water to seep in and begin the weathering process. In some cases, the acidic water dissolved the minerals in the rocks and wore the edges of the rocks away. In other cases, the water seeped between the rocks and then froze and thawed, which caused pieces of the rocks to crumble and split. And sometimes the minerals in the rocks absorbed the water, expanded, and split the rocks. The pieces that weathered eventually fell to the ground. The rocks that were closest together and the smaller rocks broke down first. What remained were large blocks of granite resting upon each other.

Sometimes the blocks look like figures, huddled together in a group. Sometimes they form a rocky mound. Usually the tors are no higher than 4.5 meters. They are found in different parts of the world—for example, England, Tanzania, and New Zealand.







Directions: *Remember that there are two kinds of weathering, mechanical and chemical, and that sometimes both kinds occur together. Below, fill in the action involved in forming tors that matches the type of weathering listed.*

Types of weathering	Action
1. Chemical and mechanical	
2. Chemical	
3. Mechanical	

4. Do you think there is any difference in height between the original rock formation and the tor? Explain your answer.

Meeting Individual Needs

SECTION 2 Enrichment

Analyzing Soil

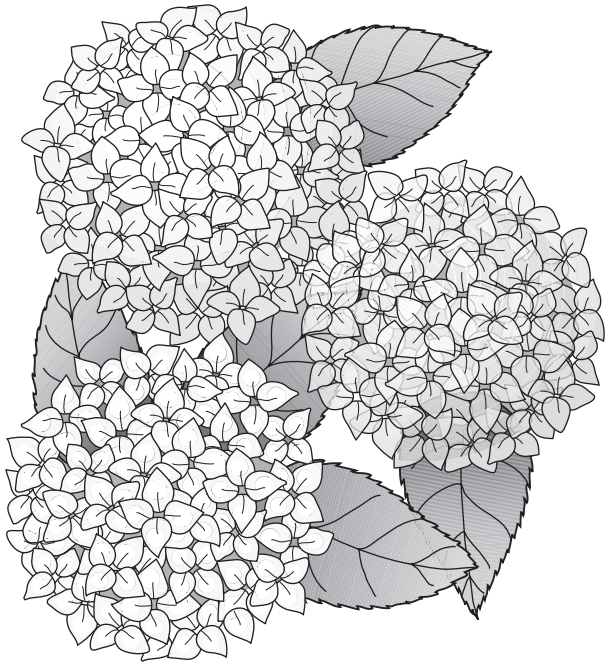
The hydrangea is a bush with snowball-like flowers. When a certain kind of hydrangea grows on the East Coast, the flowers are blue. When that same kind of hydrangea grows in the Midwest, the flowers are pink. What causes the flowers to be two different colors? The answer is the soil. In much of the East Coast the soil is acidic. In the Midwest, some of the soil is alkaline—it has more calcium than acidic soil does.

Some plants grow best in fairly acidic soil—blueberries, cranberries, and pineapples, for example. Other plants, such as cotton and alfalfa, need a soil that is neutral—neither acidic nor alkaline. Most plants do well in a mildly acidic soil.

Soil pH Ranges

Material can be added to soil to make it the right acidity for the crop to be grown. To know what and how much material to add, the soil has to be tested. Samples of soil are analyzed by a machine to measure the pH, or how acidic or alkaline the soil is. Soil that has a pH between 0 and 7 is acidic; the lower the number, the more acidic the soil. Soil that has a pH of 7 is neutral. Soil with a pH between 7 and 14 is alkaline; the higher the number, the more alkaline the soil. Actually, in nature, soils don't seem to reach the extremes of 0 and 14. They range between about 3.5 and 11.

If the soil needs to be more alkaline, then lime—a chalky material (not the fruit) containing calcium—is added to the soil. If the soil needs to be made more acidic, sulfur can be added to the soil. Most of the time, the soil needs to be more alkaline rather than more acidic.



1. How would you classify a soil that has a pH of 8? _____

2. Suppose a soil has a pH of 5.5, but the crop to be grown does best in a soil with a pH of 6. What would you do?

_____

3. If a hydrangea has flowers that are part pink and part blue, in what kind of soil would you suspect it was planted?

_____

4. Why is it important for a farmer to know the pH of soil?

_____

_____

Meeting Individual Needs

SECTION 3 Enrichment

No-Till Farming

Our image of a farmer is often that of a person plowing fields of rich, dark earth in the springtime. But that image simply doesn't fit some farmers. These farmers practice a method of farming called no-till farming. In no-till farming, the farmer drives a machine that makes slits in the ground, spreads fertilizer, and plants the seeds. Sometimes the farmer does this all in one operation. Sometimes the farmer plants the seeds in a separate operation. What the farmer does NOT do is plow the soil.

When the crop has been harvested, the remains of the plants are left on the field. They act as a covering called a mulch. The mulch helps to prevent the loss of soil, a major advantage of the no-till method. The mulch prevents the loss of as much as 90 to 95 percent of the soil that would normally be blown or washed away in a plowed field. The mulch also allows the farmer to plant on hillsides without causing excessive soil loss.

The no-till method has other advantages as well. It helps keep the ground moist; it requires fewer machines than the plowing method; and, in comparison to the plowing method, the farmer spends less time planting crops.

The no-till method is well suited to crops such as corn, which have large seeds, but it doesn't work as well with plants such as tomatoes, which have tiny seeds. Another disadvantage is an increase in the amount of weeds and the large quantity of weed killer required to kill those weeds.

1. In the no-till method, farmers often spread fertilizer over the remains of the old crop. How do you think the fertilizer gets into the ground?

2. Who do you think uses more fertilizer—a no-till farmer or a farmer who uses the traditional plowing method? Why?

3. What are some advantages of using less farm machinery in planting?

4. Why is using a large quantity of weed killer a disadvantage?

Name Date Class

Note-taking Worksheet

Weathering and Soil

Section 1 Weathering

A. Effects of **weathering**—surface processes break down rock into small particles called _____.

B. _____ _____—physical processes break rocks into fragments with the same chemical makeup and characteristics as the original rock.

1. Plant _____ and burrowing _____ cause mechanical weathering.

2. ___ _____—water enters cracks and freezes and expands, breaking rocks apart.

3. Small pieces of rock have more _____ area than larger pieces of rock and weather faster.

C. _____ _____—chemical reactions dissolve minerals in rocks or change them into different minerals.

1. Carbonic _____, formed from carbon dioxide gas and water, and plant acids can react with minerals to weather rock.

2. _____—chemical process that occurs when iron is exposed to oxygen in the air

D. Effects of _____—pattern of weather that occurs over time.

1. Mechanical weathering is more rapid than chemical weathering in _____ climates.

2. Chemical weathering is more rapid than mechanical weathering in _____, _____ climates.

3. Rock type can affect _____ of weathering.

Section 2 The Nature of Soil

A. Formation of **soil**—can take _____ of years

1. _____ is a mixture of weathered rock, decayed organic matter, mineral fragments, water, and air.

2. Formation is influenced by _____, _____, types of _____, types of _____, and length of _____ that rock has been weathering.

B. _____ of soil—the ingredients that make up soil

1. Clay, silt, and sand are small particles of _____.

2. Decaying, dark-colored plant and animal material is called _____.

3. Small spaces between soil particles may be filled with _____ or _____.

Meeting Individual Needs

Note-taking Worksheet (continued)

C. Soil Profile—made up of different _____ of soil

1. **Horizon** A—___ soil layer
   - **a.** May be covered with organic _____ that may turn into humus
   - **b.** Fertile layer with more _____ and less _____ and mineral particles than other soil horizons
   - **c.** Soil color can affect soil _____.
   - **d.** Soil _____ and _____ are important in determining seed germination.
2. Horizon B—_____ soil layer
   - **a.** Contains less _____ and is lighter in color than A horizon
   - **b.** Minerals travel from A horizon to B horizon in a process called _____.
3. Horizon C—_____ soil layer
   - **a.** Has very little _____ matter and is not strongly affected by leaching
   - **b.** Contains rock—the _____ material of the soil
4. Soil structure can be _____, _____, _____ and _____.
   - **a.** _____ are clumps in the structure of soil.
   - **b.** Pore space affects a plant's ability to _____ _____.
   - **c.** Earthworms, frost, and _____ mix the soil providing good porosity and movement for _____ and _____.

D. Soil Types—_____ in different places

1. Different regions have different _____ that affect soil development.
2. _____ rock material affects soil formation and type of _____ that grows in a region.
3. Soil _____ controls many chemical and biological activities taking place in soil.
4. _____ affects soil development because the longer the weathering has occurred, the less the soil resembles the parent rock.
5. Soil on steep _____ develops poorly.

Note-taking Worksheet (continued)

Section 3 Soil Erosion

A. Soil _____ or loss is important because plants do not grow as well when topsoil is lost.

B. Causes and effects of soil erosion—Many human activities disturb the natural _____ between soil production and soil erosion.

1. _____ _____—increased farming removes the plant cover, leaving soils open to wind and water erosion.

2. _____ _____—removes forest which increases erosion and particularly damages tropical rain forest soil

3. _____ results when animals graze until almost all ground cover disappears.

4. _____ _____ can damage the environment when soil erosion is severe.

C. Preventing soil erosion—Soil must be _____.

1. Manage crops

a. Farmers plant _____ _____ of trees to break the force of the wind.

b. Bare soil can be _____ with decaying plants to hold soil in place.

c. Farmers can _____ _____ on vegetation instead of plowing it under.

d. With _____-_____ farming, plant stalks are left in the field to provide cover for soil.

2. Reduce erosion on slopes

a. _____ farming reduces soil erosion by planting along the contours of slopes.

b. _____ creates steep-sided flat areas for crops on the sides of hills and mountains.

3. Reduce erosion of exposed soil

a. _____ is sprayed onto bare soil to reduce wind erosion

b. Topsoil is replaced and _____ are planted.

c. _____ flow can be controlled in strip mines.

d. After mining, the land can be _____.

Assessment

Name Date Class

Chapter Review

Weathering and Soil

Part A. Vocabulary Review

Directions: *Write the term that matches each description below on the spaces provided. The letters in the boxes form words that answers question 12.*

1. all the horizons of a soil
2. each layer in a soil profile
3. type of weathering that occurs when reactions dissolve the minerals in rocks
4. a mixture of weathered rock, decayed organic matter, mineral fragments, water, and air
5. ice breaking apart a rock
6. when materials containing iron are exposed to water and oxygen
7. leaves, twigs, and organic matter that may be changed to humus
8. decayed organic matter that turns into a dark-colored material
9. the removal of minerals that have been dissolved in water
10. weathering that occurs when rocks are broken apart by physical processes
11. surface processes that work to break down rock

1. ___ ___ ___ ___ ___ ☐ ___ ___ ___ ___ ___
2. ___ ☐ ___ ___ ___ ___ ___
3. ___ ___ ___ ___ ___ ☐ ___ ___
   K
4. ☐ ___ ___ ___
5. ___ ___ ___ ___ ☐ ___ ___ ___ ___ ___
6. ___ ___ ___ ☐ ___ ___ ___ ___ ___
7. ___ ☐ ___ ___ ___ ___
8. ___ ___ ☐ ___ ___
9. ___ ☐ ___ ___ ___ ___ ___ ___
10. ___ ___ ___ ___ ___ ☐ ___ ___ ___ ___
11. ___ ___ ___ ☐ ___ ___ ___ ___ ___ ___
    S

12. What does weathering create? _____

Chapter Review (continued)

Part B. Concept Review

Directions: *Answer the following questions on the lines provided.*

1. How does climate affect the rate of weathering of rocks?

2. List five factors that affect the type of soil in a particular area.

3. What would happen to life on Earth if there were no soil?

4. What farming activities have contributed to soil loss? How can farmers prevent this loss?

5. Describe each of the three soil layers in a soil profile.

Transparency Activities

Name Date Class

SECTION 1 Section Focus Transparency Activity

Going, Going . . .

Can you read this inscription? The effects of weathering have greatly reduced your chances of doing so. This stone is in Kempton Cemetery in Columbus, Ohio.

1. **How do you think this marker originally appeared? Can you read any of the inscription today?**
2. **What steps might be taken to preserve the writing that remains?**

Name Date Class

SECTION 2 Section Focus Transparency Activity

More Than Just Dirt

You probably see the material shown here every day, but you may not even notice it. You may only think about it when it makes your room or clothes dirty, but soil is also a valuable resource.

1. **What components of soil can you identify in this picture?**
2. **How is the worm involved with the soil?**
3. **Why isn't soil the same everywhere?**

Name Date Class

SECTION 3 Section Focus Transparency Activity

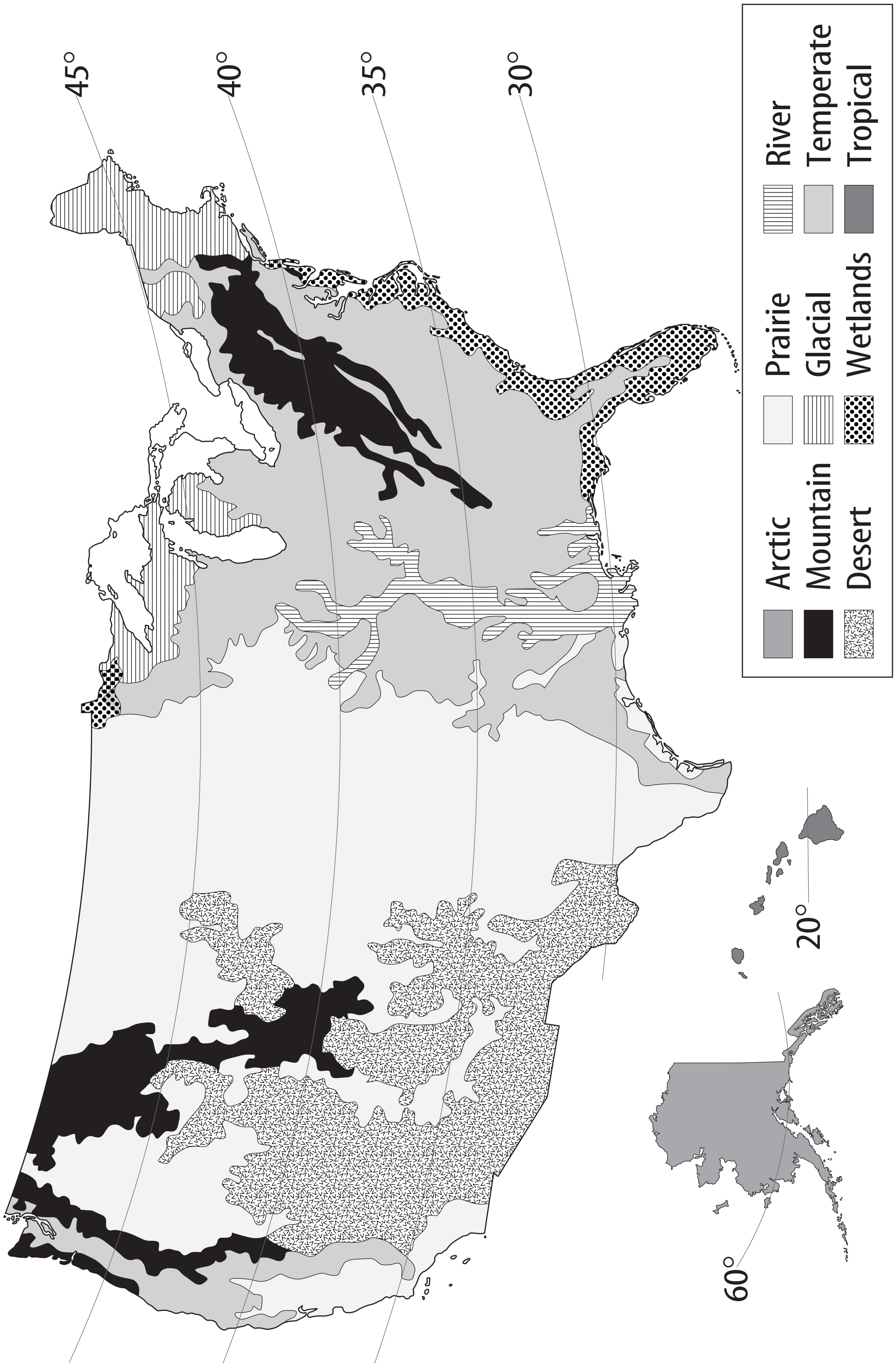
Blowing in the Wind

During the 1930s, catastrophic "black blizzards" were experienced in many states of the southern Great Plains. One storm carried over 300 million tons of dirt all the way to the east coast.

1. **What is occurring in this picture?**
2. **Why is the loss of topsoil harmful?**
3. **What steps have been taken to prevent such serious dust storms from happening today?**

SECTION 2 Teaching Transparency Activity

Types of Soil



Teaching Transparency Activity (continued)

1. What is soil and what is it made of?

2. What affects the formation of soil?

3. How many types of soil are there in the United States?

4. Describe what you would find in prairie, temperate, and desert soils.

5. What is leaching?

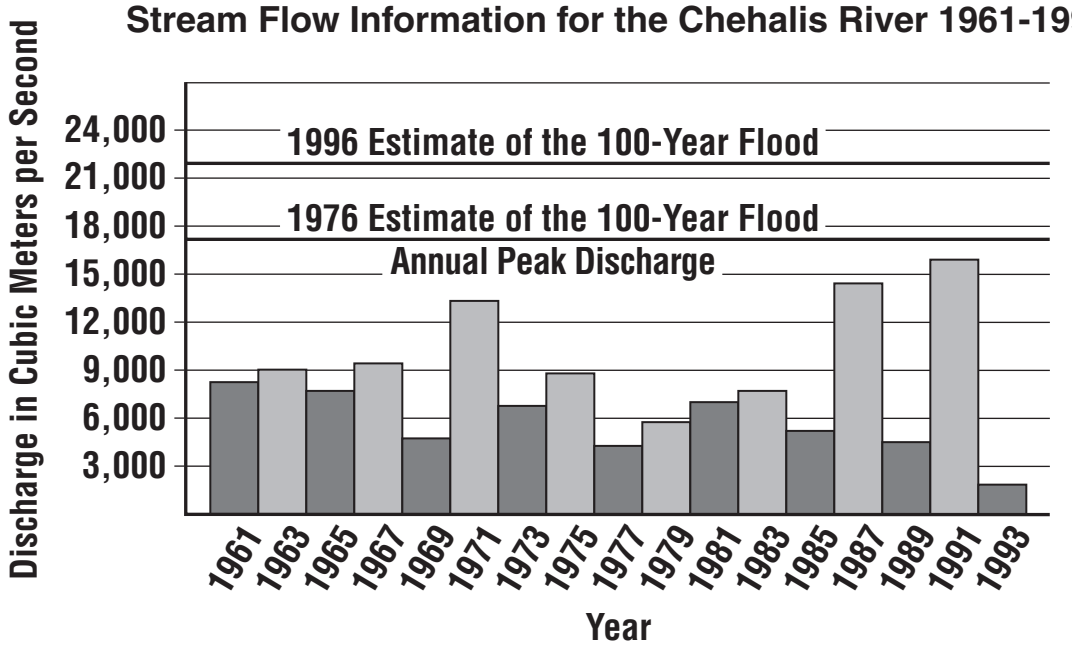
6. What type of soil do you have in your area?

Name Date Class

Assessment Transparency Activity

Weathering and Soil

Directions: *Carefully review the graph and answer the following questions.*



1. According to the graph, the year which experienced the second highest amount of annual peak discharge was ___.

A 1990
B 1991
C 1972
D 1987

2. According to the information in the graph, all of the following decades had at least one year in which the annual peak discharge was over 12,000 cubic meters per second EXCEPT ___.

F 1960s
G 1970s
H 1980s
J 1990s

3. According to the information in the graph, which decade experienced both the lowest and highest amounts of annual peak discharge?

A 1960s
B 1970s
C 1980s
D 1990s