



Earth Science

Rocks, Minerals, and Soil

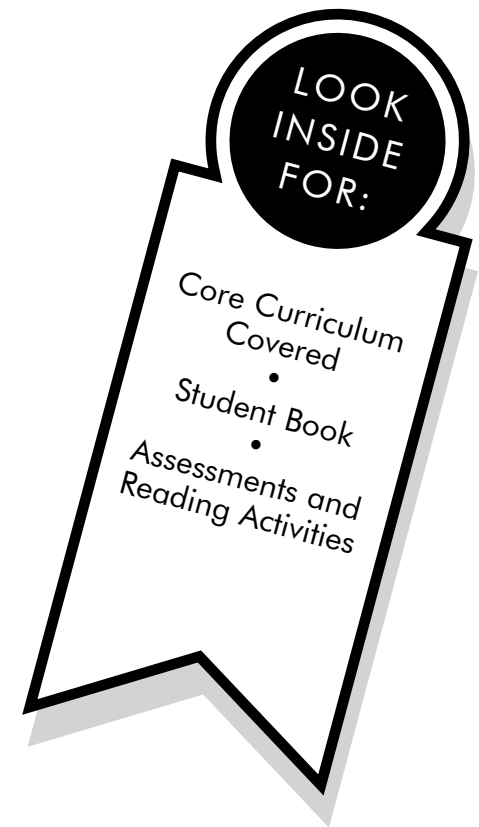
Advanced Level

What Is Soil?

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What Is Soil?

What materials make up the Earth?

CORE CURRICULUM STATEMENTS

Many of the phenomena that we observe on Earth involve interactions among components of air, water, and land.

Erosion and deposition result from the interaction among air, water, and land.

- interaction between air and water breaks down earth materials
- pieces of earth material may be moved by air, water, wind, and gravity
- pieces of earth material will settle or deposit on land or in the water in different places
- soil is composed of broken-down pieces of living and nonliving earth material

Nonliving things can be human-created or naturally occurring.



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Student Book

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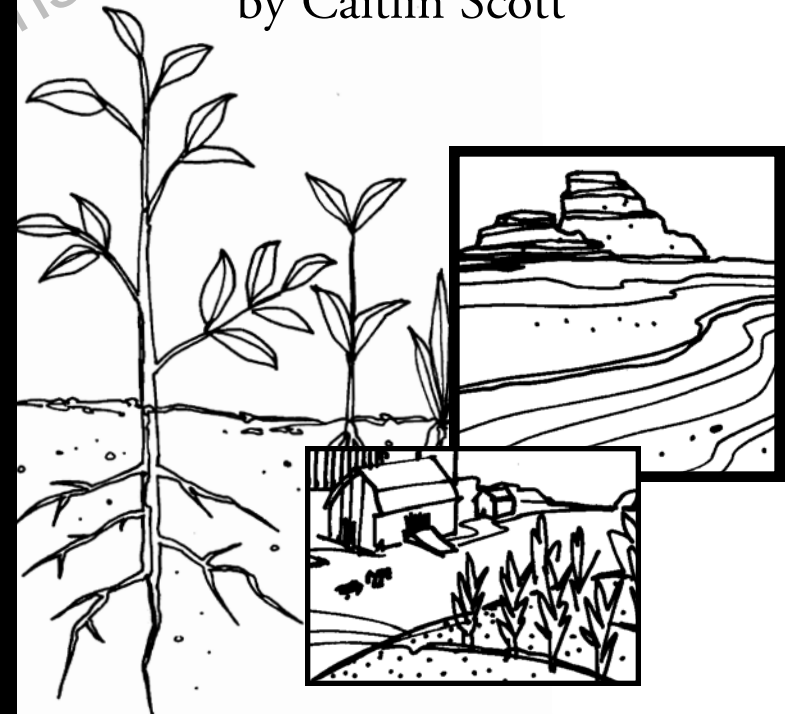


Earth Science

Rocks, Minerals, and Soil

What Is Soil?

by Caitlin Scott





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– Predict –

*What do you think you will
learn from reading this book?*

What Is Soil?

Look closely at soil. You'll notice that it has a lot of different things in it. Soil is made up of living, once-living, and nonliving things. Sometimes it is dark and crumbly, but other times you can see pebbles, gravel, or rocks in it.

Sometimes you might discover living creatures in the soil, like ants, earthworms, moles, or beetles. In fact, over 100 million small animals such as insects and worms may inhabit one acre of rich soil.

Other times you might notice dead plants, insects, and animals in the soil. These dead plants and animals **decay**, or break down, and become part of the soil.

decay: to rot or break down

Most soil also has some water in it. Very muddy soil has lots of water. Dry, crumbly, or sandy soil doesn't have much water at all. The amount of water in the soil is closely linked with the climate and other characteristics of the region.

Most soil also has air in it. Some soil seems soft and breaks apart easily because it has a lot of air in it. Other soil seems hard and isn't easy to break up. This soil doesn't have a lot of air in it.

The amount of water in the soil is one thing that can affect the amount of air in the soil. Very wet soil, such as in a wetland, probably has very little air. The composition of the soil affects the plants and the animals that can live there.

– Investigate –

Go outside and dig up a handful of soil.

Describe the composition of the soil.

Weathering

Soil is made of rocks; dead insects, animals, and plants; water; and air. How do these things get into the soil? They become soil in two ways: weathering and decomposition.

You might think rocks last forever, and most do last a long time. But, over thousands of years, rocks slowly wear away.

This **natural** process of wearing away is called weathering. It happens so slowly, we cannot see it happening. Wind, water, and ice are all forces that cause weathering.

Imagine rocks on the top of a mountain or on the bank of a river. Strong winds whip by the rocks, rain beats down on the rocks, and ice forms on the rocks. All these forces slowly break up the rock. Often the pieces that break off are very tiny. These pieces become soil. This process can take more than 500 years to form one inch of topsoil.

natural: not caused by people

Decomposition

What happens when you leave something in the refrigerator too long? It slowly rots, becoming moldy, soft, and slimy. After a while, it may turn a dark color like soil. That's because it is becoming soil. This is called decomposition.

To decompose is to rot. You know that food decomposes. Other things do, too. Wood decomposes. Paper decomposes. In fact, all plants and animals eventually die and decompose. This renews our soil.

When things decompose, they use water and air. They also need microbes. **Microbes** are tiny organisms. They convert organic matter into useful soil. Fungi, such as mushrooms, and insects also help material decompose.

microbes: very small living things

Soil Types

Our planet contains many different types of soil. Is the soil on the playground at your school different from the soil near your home? What about the soil on a beach or on a farm? What about the desert?

Soil scientists, who study soil, usually have a college degree in science. They may work outside collecting soil samples, or they may work in a lab examining these soil samples.

Soil scientists have several ways of naming different soils. This helps them know which soils are best for growing different types of plants. Naming soils also helps them tell people what to add to their soil to make it better

One way soil scientists name different soils is by the size of the particles in the soil. Clay has the smallest particles, sand has the largest **particles**, and silt has medium size particles.

Clay

Have you used clay in an art class? If so, you have worked with the type of soil we call clay. The small particles in clay have a regular shape. These particles can pack so tightly together that it is difficult for water and air to get through. Once water is in clay, the clay holds it inside.

If a soil is pure clay, most plants do not grow well in it. This is because it is difficult for the roots to grow and push through in the tightly packed soil. Air and water also have a hard time reaching the plant's roots.

particles: small pieces

Sand

The particles in sand are large and have an irregular shape. Because of this shape, sand particles don't pack together very well. In addition, sand has a lot of trapped air between the particles. As a result, water moves through loose sand quickly. Plants that need a lot of water don't grow well in sand because rain water moves away from the plant too quickly. Plants such as cactuses survive in sandy soils because they are able to store large amounts of water quickly.

Silt

Silt has medium size particles, which are **irregular** like the particles in sand. But, silt particles are often coated with clay. This makes them act a little bit like sand and a little bit like clay. Soil near rivers often contains a lot of silt.

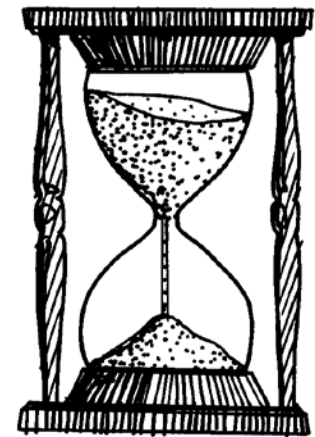
irregular: not shaped the same

How can you determine how much clay, sand, and silt is in your soil? First, pick up a handful of soil and squeeze hard. Soils with high clay contents form a solid lump, but sandy soils stay loose. Silt will be somewhat lumpy but not a solid lump.

Next, wet the soil and rub it gently between your fingertips. Clay feels slippery when wet, while sand feels rough.

Finally, for an exact answer, send your soil to a soil scientist, who can test your soil.

Sand is loosely packed, so it flows through an hourglass easily. If an hourglass were filled with tightly packed clay, what would happen?



– Describe –

What are the characteristics of different types of soil?

Loam

Most soil isn't just all clay, all sand, or all silt. Instead, most soil is a combination of the three. A combination that is equal parts sand, clay, and silt is called loam. Most plants grow extremely well in loam.

Humus

In this book, you've read about the size of the particles in soil. What about the decomposing plant and animal material in soil? This decomposing material is called humus. Humus breaks down readily in the soil, releasing **nutrients** that plants need for growth. Soils with lots of humus are called rich soils, while soils with very little humus are called lean.

nutrients: things needed by people, plants, and animals to stay healthy



A beach, a farm, a desert, and a river each have different types of soil. What is the soil likely to be like in each place? Will the soil be sand, silt, or clay? How much humus might be in it?

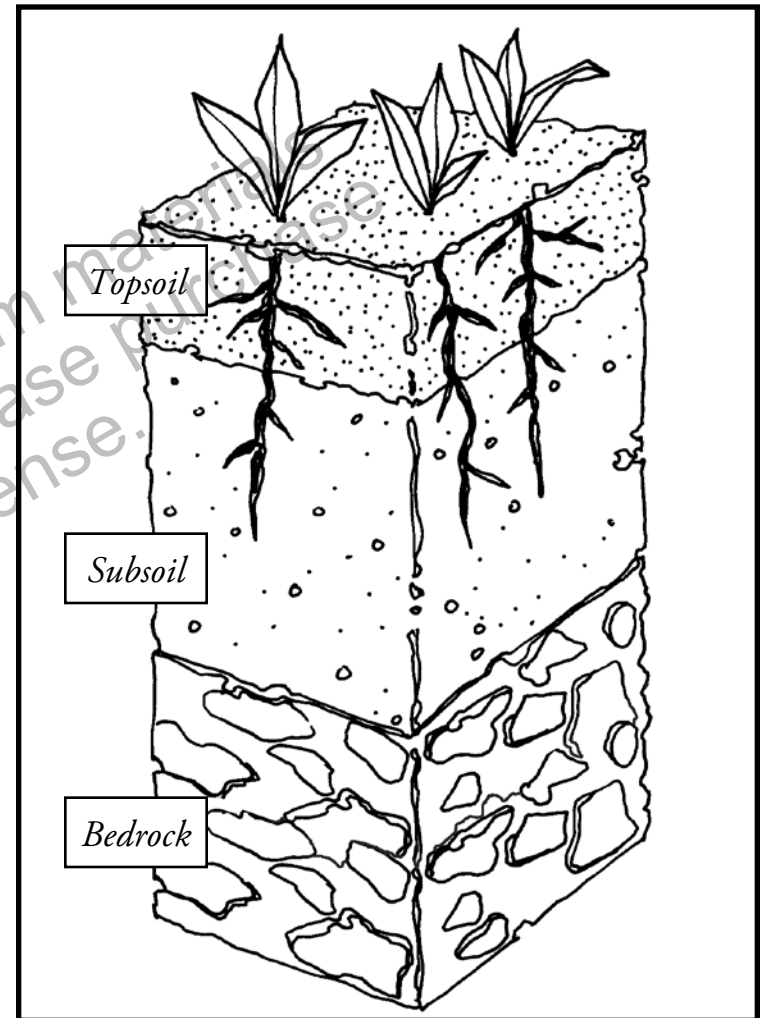
Soil Layers

Have you ever driven on a road that cuts into a hillside or through a mountain? If so, you may have seen layers in the soil beside the road.

Why does soil have these layers? Soil is made of rocks and decomposing insects, animals, and plants. Water flows through the soil creating layers of these materials. Heavier rocks often settle to the bottom.

Most soil has three layers: topsoil, subsoil, and bedrock. But, not all soil has all these layers. For example, when a house is built, the topsoil is scraped away and only the subsoil and bedrock remain.

Layers of Soil



*Soil has several layers. Topsoil is on top.
Subsoil is underneath.
Bedrock is the bottom layer.*

Topsoil

Topsoil is the very top layer of soil where plants grow. It is made mostly of decomposing plants and animals, such as insects, which is why the soil is a dark color. In fact, the darker the color the more plants and insects are decomposing. This dark, rich soil is often very good for growing plants.

When you buy a bag of dirt in a garden store, you are typically buying topsoil. You can use this soil for a potted plant. Sometimes people also put this soil in an outdoor garden and mix it with the existing soil. Adding topsoil can make this layer thicker and richer. This can help plants grow better.

– Experiment –

Go outside and dig down about three inches into the soil. Investigate the properties of the soil and record your observations.

Subsoil

The subsoil is underneath the topsoil. The dead plants and animals in this layer are fully decomposed. This layer often has a lot of clay and iron in it. Sometimes it is a rusty, red color due to the iron. Most of the time, the subsoil is lighter in color than the topsoil, and it is also usually a little harder. Plants don't grow very well in this layer, but people can add nutrients to make this layer better for plants.

Bedrock

Bedrock is the very bottom layer of the soil. As its name suggests, bedrock is mostly rock. The rock might be broken up by weathering, or it might be a flat layer of rock. It is very hard, so plant roots don't grow easily in this layer.

– Review –

How do the three layers of soil differ?

Glossary

decay—to rot or break down

irregular—not shaped the same

microbes—very small living things

nutrients—things needed by people, plants, and animals to stay healthy

particles—small pieces

To Find Out More . . .

Want to learn more about soil?

Try these books

Soil (True Books: Natural Resources) by Christin Ditchfield. Children's Press, 2003.

Soil (Early Bird Earth Science) by Sally Walker. Lerner Publications, 2006.

Access these Web sites

Just for Kids: Soil Biological Communities
<http://www.blm.gov/nstc/soil/Kids/index.html>

Natural Resources Conservation Service:
Tidbits for Teachers and Students
<http://www.nrcs.usda.gov/feature/education/>

Write for more information

U.S. Bureau of Land Management
Office of Public Affairs
1849 C Street, Room 406-LS
Washington, DC 20240

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Advanced Level

Assessments

What Is Soil?

Print pages 18–20 of this PDF for the assessments.

Check Understanding

Shade the circle next to the correct answer.

1. Plants grow well in rich soils. Rich soils contain a lot of
 - Ⓐ silt
 - Ⓑ bedrock
 - Ⓒ layers
 - Ⓓ humus
2. Why don't more plants grow in the desert?
 - Ⓐ The sand particles have a regular shape.
 - Ⓑ The sand does not pack tightly together.
 - Ⓒ Water moves through sand too quickly.
 - Ⓓ Plants and animals do not decompose there.

3. What do materials need in order to decompose?
 - Ⓐ water, air, and microbes
 - Ⓑ air, soil, and insects
 - Ⓒ soil, microbes, and nutrients
 - Ⓓ nutrients, water, and insects

Note that question 4 has only three choices.

4. Weathering is best described as
 - Ⓑ the breaking down of once-living things
 - Ⓒ the rapid flow of water through soil
 - Ⓓ the wearing away of rock over time

Check Understanding

Shade the circle next to the correct answer or write your answer on the lines provided.

5. Most soil has three layers. Complete the chart by identifying each layer based on its characteristics.

Characteristics	Layer
made mostly of decomposing plants and animals; dark in color	
made mostly of rock; plant roots do not grow easily	
usually contains a lot of clay and iron; may be rusty or red in color	

6. Identify the **three** forces that cause weathering.

- (1) _____
- (2) _____
- (3) _____

7. A soil combination that is equal parts sand, clay, and silt is called

- (A) humus
- (B) loam
- (C) topsoil
- (D) subsoil

Assessment Scoring Guidelines

1. Answer D is correct.
2. Answer C is correct.
3. Answer A is correct.
4. Answer D is correct.

5.

Characteristics	Layer
made mostly of decomposing plants and animals; dark in color	topsoil
made mostly of rock; plant roots do not grow easily	bedrock
usually contains a lot of clay and iron; may be rusty or red in color	subsoil

6. Water, wind, ice

7. Answer B is correct.

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Advanced Level

English Language Arts Activities

What Is Soil?

Print pages 22–26 of this PDF for the reading activities.

Summarize

TRY THE SKILL

To summarize means to briefly retell something. Summarizing can help you remember what you have read.

Here is a paragraph from *What Is Soil?* How would you say the same thing more briefly?

Look closely at soil. You'll notice that it has a lot of different things in it. Soil is made up of living, once-living, and nonliving things. Sometimes it is dark and crumbly, but other times you can see pebbles, gravel, or rocks in it.

Is this a good summary?

Some soil is dark and crumbly.

No, it is too specific.

Is this a good summary?

Soil is made up of many different things.

Yes, it tells the main idea of the paragraph.

Read the passage from *What Is Soil?* Then write a summary.

Most soil isn't just all clay, all sand, or all silt. Instead, most soil is a combination of the three. A combination that is equal parts sand, clay, and silt is called loam. Most plants grow extremely well in loam.

Read for a Purpose

TRY THE SKILL

Authors have different purposes for writing. Readers have different purposes for reading. Sometimes people read to understand something better. Sometimes they read to solve problems. Sometimes they read to be entertained.

Read this passage from *What Is Soil?*

Why does soil have these layers? Soil is made of rocks and decomposing insects, animals, and plants. Water flows through the soil creating layers of these materials. Heavier rocks often settle to the bottom.

Why might the author write this?

To explain why soil has layers.

Who might want to read this?

Someone who wants to learn more about soil and its layers.

Read the passages from *What Is Soil?* and answer the questions.

When you buy a bag of dirt in a garden store, you are typically buying topsoil. You can use this soil for a potted plant. Sometimes people also put this soil in an outdoor garden and mix it with the existing soil. Adding topsoil can make this layer thicker and richer. This can help plants grow better.

1. Why might the author write this?
 - (A) To help people improve their topsoil.
 - (B) To tell people about topsoil.
 - (C) To entertain people with topsoil.
2. Who might want to read this?

Use the Table of Contents

TRY THE SKILL

A table of contents tells you where to find information in a book. Chapter headings tell what a chapter is about. Subheadings tell about the information in a chapter.

Read the beginning of the table of contents from *What Is Soil?*

Chapter 1:

What is Soil?	4
Weathering	6
Decomposition	7

Chapter 2:

Soil Types	8
Clay	9
Sand	10
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Humus	12
Loam	12

Read the beginning of the table of contents. Then, answer the questions.

1. What chapter would give information about decomposition? _____
2. What page would give information about silt? _____
3. What chapter would give information about clay? _____
4. What would be another good title for chapter 1?
Ⓐ Why Does Soil Have Layers?
Ⓑ Where Can We Find Soil?
Ⓒ Where Does Soil Come From?

Determine Steps in Directions

TRY THE SKILL

In good directions, each step is clear and complete. You can make your directions clear by using words such as *first*, *then*, *next*, and *finally*.

Read this passage from *What Is Soil?* Then restate the steps clearly.

How can you determine how much clay, sand, and silt is in your soil? First, pick up a handful of soil and squeeze hard. Soils with high clay contents form a solid lump, but sandy soils stay loose. Silt will be somewhat lumpy but not a solid lump.

Next, wet the soil and rub it gently between your fingertips. Clay feels slippery when wet, while sand feels rough.

Finally, for an exact answer, send your soil to a soil scientist, who can test your soil.

Write the steps clearly, using the words *first*, *next*, and *finally*.

Step 1	
Step 2	
Step 3	

Answer Key

Summarize

Most soil is a combination of sand, silt, and clay.

Read for a Purpose

1. A
2. Someone interested in gardening

Use the Table of Contents

1. Chapter 1
2. Page 10
3. Chapter 2
4. C

Determine Steps in Directions

Step 1: First, pick up a handful of soil and squeeze hard.

Step 2: Then, wet the soil and rub it gently between your fingertips.

Step 3: Finally, send your soil to a soil scientist, who can test your soil.