

ACKNOWLEDGMENTS

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About the Teaching & Learning Collaborative

TLC is a non-profit organization whose mission is to improve science and mathematics education. It is a coalition of school districts, organizations, businesses and government agencies with whom we collaborate to design and carry out our work. The TLC works at a variety of levels, from the classroom to the state level, to ensure that all students have access to quality education in science and mathematics.

Currently, our work is focused in three areas:

- Professional development in science and mathematics for grades K-12 educators
- Special initiatives
- Tailored contracted professional services

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EARTH'S RESOURCES - SOIL

TEACHER INFORMATION

TEACHER INFORMATION

CENTER SUMMARY

Students discover the composition of soil by investigating its four components and reading information.

TEACHER DIRECTIONS FOR SETTING UP THE CENTER

Materials

The following materials are for one station set up. To accommodate more students, multiple stations can be used.

Task A

- 1, 8 oz. clear plastic cup per group of students to hold the soil
- 1 bucket of soil. Soil from a field, woods or school yard is best (do not use potting soil). Each group will need about 1 cup of soil.
- Newspaper to cover work area and/or tray or box lid
- 1 large sheet of white paper (11 x 17) or comparable size of chart paper.
- Hand lens
- Bug box or other container to hold and observe live “critters”
- Tweezers
- Disposable gloves or small plastic baggies
- Wet wipes or damp paper towels
- 1 copy **per student** of the Student Packet
- 1 copy of Task Cards

Task B—additional materials

- 1 spoon
- 1 cup per group of students to hold water (same amount as soil)
- Pitcher of water (or you may want to have the water in a container with a lid to minimize spills).
- 2 buckets for waste water and soil
- Dry paper towels for spills and clean-up
- 1 copy of the Task Card

SETTING UP ONE CENTER

- Make 1 copy **per student** of the Student Packet.
- Make 1 copy of the Answer Key. Make this accessible to students but hidden from view. Optional: Laminate each answer sheet and glue/place each in a file folder marked "Check Your Understanding #1 or #2."
- The Answer Key/Rubric for the final "Check Your Understanding #3" which is graded by the teacher is at the end of the Teacher Information section.
- Make 1 copy of each Task Card. Optional: Laminate each card and/or glue each to a file folder or other stiff material to make it stand up.
- Cover work area with newspaper and/or use a tray or a box lid to help contain the soil.
- Fill a clear plastic cup with 250 ml of soil (approximately 8 oz.). Do not use potting soil. If possible, dig up soil from a garden, forest, field or other location for "rich" soil. Use the top 4-5 inches of soil. Note: Procure enough soil for each student/team of students to have at least 250 ml (about 1 cup).
- Add the large white paper, hand lens, bug box, tweezers, disposable gloves/small plastic baggies, and wet wipes/damp paper towels to the work area.
- Have the spoon, cup of water, waste bucket and towels readily available for Task B.

CONTENT REVIEWED

Soil is the topmost layer of the Earth's surface and it is vital to the health and well-being of all living things. Most of our food, clothing, medicine and other materials we make come directly or indirectly from soil. Soil is comprised of both biotic (living) and abiotic (non-living) components functioning as an ecosystem.

While soil varies around the world, the abiotic composition of soil on average is 45 percent minerals (pieces or particles of rocks, stones, gravel, sand, silt and clay), 25 percent air (fills the spaces/pores around the particles), 25 percent water (also fills pores/spaces; varies depending on the amount of rain and the water-holding capacity of a soil), and 5 percent organic material (plants and animals that are dead and decomposing; products of plants and animals like berries, excrement or tunnels).

PREREQUISITE SKILLS

Students need to know to hold the hand lens close to their eye (but not touching) and to move their head and the hand holding the hand lens toward the object they want to view until the object comes into focus. A hand lens is optically related to a microscope. So just like a microscope, the viewer's eye should be close to one side of the lens and the object will be close to the other side of the lens. It is also important to have good light and to try

to avoid casting a shadow over the object to be viewed. It may take some practice. Students can start by putting their free hand in front of the lens and moving back and forth until they see a sharp image.

VOCABULARY

Decomposed plants and animals: Pieces of dead plants and animals that have been digested by other organisms (decomposers).

Mineral: A nonliving, solid natural material that has a crystal form and its own set of properties.

Organic materials: Materials that are or were living.

Products of plants and animals: Something that comes from or is made by a plant or animal.

Rocks: A solid mixture of minerals that was formed in Earth's crust.

Soil: A material made of tiny pieces of rock, minerals, and decayed plants and animals.

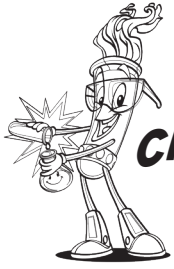
Weathering: The breaking down or wearing away of rock by forces such as moving water, plant roots, or freezing and thawing.

REFERENCES

Kaufman, D. G., & Franz, C. M. (2000). *The Biosphere: Protecting Our Global Environment, 4th edition*. Dubuque, Iowa: Kendall/Hunt Publishing Company.

National Science Teachers Association. (2001). *Dig-in! Hands-on Soil Investigations*. Arlington, VA: NSTA Press.

Proujan, C., Martin, S., & Knowles, M. (2005). *ScienceSaurus: A student handbook*. Wilmington, MA: Great Source Education Group.



ANSWER KEY

CHECK YOUR UNDERSTANDING #3 - TEACHER GRADES RUBRIC

Score	Explanation
4	<p>The student names and describes the other two parts that compose soil:</p> <ul style="list-style-type: none"> • Rocks and Minerals: Descriptions: Tiny pieces of rocks and minerals that are broken down from larger rocks and minerals; may mention weathering or weathered rocks. • Organic Materials: Descriptions: decomposed plants and animals; products from plants and animals; living plants and animals.
3	Includes 3 of the above.
2	Includes 2 of the above.
1	Includes 1 of the above.
0	Includes none of the above.

EARTH'S RESOURCES - SOIL

STUDENT TASK CARDS

EARTH'S RESOURCES - SOIL

TASK CARD A

I can observe and describe the composition of soil.



Task A Directions

Put on a pair of gloves (or use a plastic baggie) to keep your hands clean. Pour an 8 oz. cup of soil (250 ml) onto the large sheet of white paper. Use the tweezers and your fingers to sort through the soil. Separate the parts of soil into 3 categories:



1. **Rocks and Minerals** (tiny pieces of rocks and minerals that came from larger rocks and minerals)
2. **Once-Living Organic Material** (decomposed plants and animals; products of plants and animals)
3. **Living Organic Material** (living plants and animals).
4. Fill out the "Data Sheet" in your Student Packet. Describe and draw what you observe.

EARTH'S RESOURCES - SOIL

TASK CARD B

I can observe and describe the composition of soil.



Task B Directions

1. After observing your soil, spoon or pour the soil back into the cup.
2. Answer questions 1 and 2 in your Student Packet.
3. Then, slowly pour the cup of water (250 ml) into the cup of soil until the soil is completely covered with about 2 centimeters (cm) of water. Did you see anything that told you what the water was taking the place of in the soil?
4. Carefully observe what happens while pouring and after pouring the water.
5. Answer question 3.



EARTH'S RESOURCES - SOIL

**STUDENT
PACKET**

STUDENT PACKET

TASK A



Follow the directions on Task Card A and complete the Data Sheet below, describing what you observe about soil. You may also draw what you observe.

Data Sheet: What Makes Up Soil?

Rocks and Minerals (tiny pieces of rocks and minerals that came from larger rocks and minerals)	Once-Living Organic Material (decomposed plants and animals; products of plants and animals)	Living Organic Material (living plants and animals; products of plants and animals)



Complete Task Card B.



Follow the directions on Task Card B.

1. What do you predict will happen to the **soil** when you slowly pour water into the cup until it is covered with 2 cm of water? Explain your answer.
2. What do you predict will happen to the water? Explain your answer.



Continue to follow the directions on Task Card B.

3. What happened when you poured the water into the cup of soil? Explain your answer. How could it go into the cup when the cup was filled with soil?



Complete "Check Your Understanding #1."



CHECK YOUR UNDERSTANDING #1

Answer the following question and check your answer.

1. What is composed of pieces of rocks and minerals, plants and animals (both living and decomposed), water and air? (Circle your answer)
 - A. Dirt
 - B. Organic materials
 - C. Non-living materials
 - D. Soil



***OTIS SAYS: CHECK YOUR
ANSWER WITH THE
ANSWER KEY!***



Read this page before moving on.

MORE ABOUT SOIL

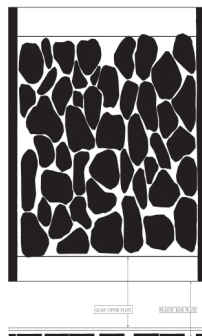
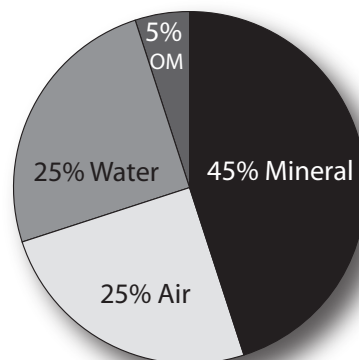
Got soil? Or do you just call it dirt? Dirt is soil that is out of place—under your fingernails or on the kitchen floor.

We could not live without this thin layer of material that surrounds our earth. We grow our food in soil. We build our homes and highways on it. Plants and animals, including us, get important nutrients from it. We are completely dependent on soil! Just think of all the things you have used today that grew from soil—your cotton shirt, favorite cereal, wooden chair, even your science book!

Soil is exciting! Let's take a closer look.

What is the composition of soil? Soil has four parts:

- Tiny pieces of rocks and minerals (45%)
- Air (25%)
- Water (25%)
- Organic material (OM) (5%)



The tiny pieces of rocks and the minerals come from larger rocks that have been weathered (the breaking down of rock). These tiny pieces of rock are different sizes and shapes. Some may be like pebbles or gravel and others as fine as dust.

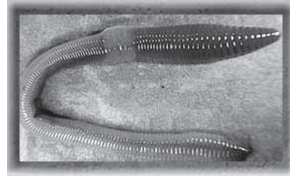
Because of these differences, they do not fit tightly together. The space, or pores, between the pieces is filled with air and water. Both of these are important for healthy soil.

This space is also filled with organic material. Organic material includes plants and animals that are dead and decomposing as well as products of plants

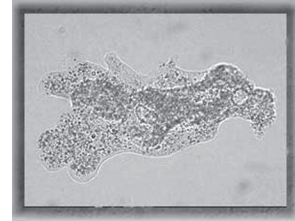
and animals such as berries, poop and tunnels. It also includes living plants and animals. Some are so small you need a microscope to see them. Others are the size of your hand. One tablespoon of soil can be home to 1,000,000 bacteria. Here are just a few of the things that live and die in our soil.



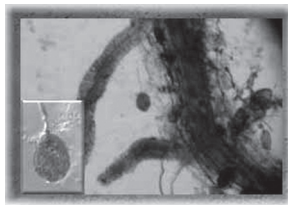
Beetle Mite



Night Crawler



Amoeba



Root Fungus



Eastern Mole



Complete the Vocabulary Words on the next page.

VOCABULARY



For each of the following words, write a definition and give an example or drawing.

Soil	
Definition	Drawing or Give an Example
Decomposed Plants and Animals	
Definition	Drawing or Give an Example
Mineral	
Definition	Drawing or Give an Example
Organic Material	
Definition	Drawing or Give an Example



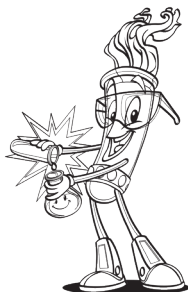
Check your answers and then complete "Check Your Understanding #2."

CHECK YOUR UNDERSTANDING #2

Answer the following question and check your answer.

Soil is composed of four (4) parts. Which makes up the biggest part?

- A. Rocks and minerals
- B. Decomposed plants and animals
- C. Bacteria
- D. Water



***CHECK YOUR ANSWER
WITH THE ANSWER KEY!***

CHECK YOUR UNDERSTANDING #3

Read the following and write your answer in the box on the next page.



It is a beautiful, warm spring day. Tanya is helping her grandmother plant vegetables in her garden. Her grandmother is explaining the importance of having healthy soil if you want to grow healthy plants. She has dug up a handful of soil from her garden so that Tanya can observe the composition of the soil in her garden.

Soil is composed of four parts. Two of these are air and water.

In the box on the next page, name the other two parts of soil. For each, describe what Tanya saw as she observed the soil in her grandmother's garden.
(4 points)



Go to Next Page

CHECK YOUR UNDERSTANDING #3, CONTINUED

Soil is composed of four parts. Two of these are air and water.
In the box below, name the other two parts of soil. For each, describe what Tanya saw as she observed the soil in her grandmother's garden. (4 points)



***HAVE YOUR TEACHER
CHECK THIS ANSWER!***

EARTH'S RESOURCES - SOIL

ANSWER KEY



ANSWER KEY

CHECK YOUR UNDERSTANDING #1

Question: *What is composed of pieces of rocks and minerals, plants and animals (both living and decomposed), water and air?*

Responses:

A. Dirt

If you chose A, you may have been thinking of the word that many people use when they really mean soil. Dirt is soil that is out of place. If you track mud (wet soil) into the house, you may get yelled at for making the floor dirty.

B. Organic materials

If you chose B, you may have been thinking of one important part of soil. Organic materials are plants and animals that live in the soil or have died and are decomposing in the soil.

C. Non-living materials

If you chose C, you may have been thinking of one important part of soil. Pieces of rocks and minerals are non-living materials found in soil.

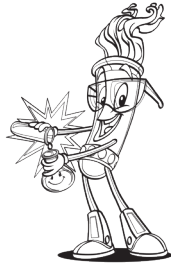
D. Soil

This is the correct answer.

The composition of soil includes: 1) pieces of rocks and minerals; 2) plants and animals that are living and plants and animals that are decomposed; 3) air; and 4) water.



Flask says: Go back to your Student Packet!



ANSWER KEY

VOCABULARY

Soil	
<p>Definition</p> <p>A material made of tiny pieces of rock, minerals, and decayed plants and animals.</p>	<p>Drawing or Give an Example</p>
Decomposed Plants and Animals	
<p>Definition</p> <p>Pieces of dead plants and animals that have been digested by other organisms (decomposers).</p>	<p>Drawing or Give an Example</p>
Mineral	
<p>Definition</p> <p>A nonliving, solid natural material that has a crystal form and its own set of properties.</p>	<p>Drawing or Give an Example</p>
Organic Material	
<p>Definition</p> <p>Materials that are or were living.</p>	<p>Drawing or Give an Example</p>



Go back to your Student Packet!



ANSWER KEY

CHECK YOUR UNDERSTANDING #2

Question: *Soil is composed of four (4) parts. Which makes up the biggest part?*

Responses:

- A. Rocks and minerals - This is the correct answer.**
Small rocks, pebbles, pieces of rock and minerals make up 45% of soil.
- B. Organic material - this is not correct.
Organic materials are living and non-living plants and animals. Organic materials only make up 5% of soil.
- C. Bacteria - this is not correct.
Bacteria are part of the organic material in soil. Even though there are billions of bacteria in soil they are microscopic in size and only make up a small part of the organic material in soil.
- D. Water - this is not correct.
Water fills the pores, or small spaces, around the rocks and minerals that are in soil. Water makes up 25% of soil.



Go back to your Student Packet and complete "Check Your Understanding #3."

NOTES

[illegible]

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[illegible]

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[illegible]