

Delaware Science Coalition



Promoting Scientific Literacy for All Students

Grade 2 Soils Unit Template



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Preface: This unit has been created as a model for teachers in their designing or redesigning of course curricula. It is by no means intended to be inclusive; rather it is meant to be a springboard for teacher thought and creativity. The information we have included represents one possibility for developing a unit based on the Delaware content standards and the Understanding by Design framework and philosophy.

Unit Summary:

In this unit, students investigate the chief components of soil—sand, clay, and humus—and explore the relationship between soil and plant growth. Early in the unit, they create their own compost bags. This activity enables them to observe the decomposition of organic materials over time. Students observe and read about earthworms to learn about their connection to plant roots and soil. The students also conduct tests that enable them to observe and compare such properties of soil as odor, appearance, and texture. Phenomena such as settling, water content, and soil consistency are also explored. These observations are then related to plant growth, as students plant cucumber seeds in a clear plastic tube. By observing root growth, students learn about the role of roots in keeping the plant anchored and upright. In a final activity, students apply what they have learned to investigate a sample of local garden soil.

Stage 1: Desired Results **Delaware Science Content Standards**

Delaware Science Content Standards

This course focuses on the Delaware Science Content Standards and Grade Level Expectations in Standards 1, 2 and 5 found on the following web site: http://www.doe.k12.de.us/programs/ci/content_areas/science.shtml

Standard 1- Nature and Application of Science and Technology

Understanding and Abilities of Scientific Inquiry

Students should know and be able to:

1. Understand that: Scientific investigations, whether conducted by students or scientists, involve asking a question about the natural world.
 - Be able to: Generate questions and predictions using observations and exploration about the natural world.
3. Understand that: The purpose of accurate observations and data collection is to provide evidence. Scientists use tools to enhance their senses in order to obtain more evidence.
 - Be able to: Collect data using observations, simple tools and equipment. Record data in tables, charts, and bar graphs. Compare data with others to examine and question results.

4. Understand that: Scientists use observations from investigations and knowledge that is already known to develop an explanation.
 - Be able to: Construct a simple explanation by analyzing observational data. Revise the explanation when given new evidence or information gained from other resources or from further investigation.
5. Understand that: The purpose of communicating with others is to share evidence and conclusions. Scientists communicate the results of their investigations to others.
 - Be able to: Share simple plans, data, and explanations with an audience and justify the results using the evidence from the investigation.
6. Understand that: The use of mathematics, reading, writing, and technology are important in conducting scientific inquiries.
 - Be able to: Use mathematics, reading, writing, and technology when conducting an investigation and communicating the results.

Standard 2: Materials and Their Properties

Properties and Structure of Materials

Students should know that:

1. Materials can be described and classified according to the following physical properties: size, shape, mass, texture, color, and material composition. Students can observe materials' physical properties by using tools that include rulers, balances, thermometers and hand lenses.

Standard 5: Earth's Dynamic Systems

Components of Earth

Students should know that:

1. Components of Earth's system include minerals, rocks, soil, water and air. These materials can be observed, sorted and/or classified based on their physical properties.

Students should be able to:

- Observe and identify basic components of soil. Use the senses to observe and then describe the physical properties of soil components.

3. Sand, clay and humus have distinct physical properties and are components of soils.

Students should be able to:

- Conduct simple tests to identify the three basic components of soil (sand, clay, humus) and to compare and contrast the properties of each of the components.
- Record and organize the results of soil tests and explain these results through writing, drawing, and discussion.

4. A soil's composition varies from environment to environment.

Students should be able to:

- Reflect on the test results and predict how plants will grow in different soil components. Apply this knowledge to describe how the properties of each soil component contribute to an appropriate soil mixture in growing plants.

5. Soil type can be identified by testing for grain size and composition.

- Use worms to enhance decomposition of plant material in composting. Explain how composting is an effective method to recycle plants and other discarded organic matter.

Technology and Applications

Students should know that:

1. Earth materials can be observed and described using simple tools (e.g., hand lens and balances).

Students should be able to:

- Select and use appropriate instruments (e.g., hand lens/magnifier, droppers, funnels, filter paper, sieves) to analyze soil samples.

Big Ideas

- Observation and Evidence (to identify soil characteristics)
- Reasoning and Explanation (of observations to support predictions about soil composition and water retention)
- Investigation (variables that affect plant growth and humus production)
- Process Skills (assembling laboratory materials to investigate the properties of different soils)
- Properties of Materials (particle size within soil samples and effects of porosity on water retention)
- Controlling experiments (items being investigated must be directly related to soil composition)
- Comparison of data and observations to support predictions on a large scale (not just individual results)
- Data Organization to visually represent/communicate results (graphing)
- Applying learned concepts and skills to analyze unfamiliar soil samples.
- Communicate conclusions through writing, drawing and discussion.

Unit Enduring Understandings

Students will understand that...

1. Tools and senses are used to ask questions, make predictions, observe, describe, and communicate results about the physical properties of soil.
2. Plant growth and water retention can be affected by soil composition.
3. Living organisms can affect soil composition. Example: worms ingest plant material and their excretions are part of the soil called humus.

Unit Essential Question(s)

1. How do worms enhance the decomposition of plant material in composting?
2. What simple tests can be conducted to identify the three basic components of soil (sand, clay, humus)?
3. How can the components of soil be compared/contrasted?
4. How can soil composition affect water retention and plant growth?
5. What tools or technology can you use to analyze soil samples?

Knowledge & Skills

Knowledge:

- Soil contains particles of different sizes
- Soil may contain animals, plants, and their remains
- Over time, dead plants decompose and become part of soil
- Composting-especially with worms-is an effective way to recycle old plants and other discarded organic matter.
- Sand, clay, and humus are three of the basic components in soil
- Every soil component has unique properties that can be identified using simple tests
- Different soils absorb water at different rates
- Many factors, including soil, affect plant and root growth.

Skills:

- Generate questions and predictions using observations and exploration about the natural world.
- Generate and follow simple plans using systematic observations to explore questions and predictions.
- Collect data using observations, simple tools and equipment. Record data in tables, charts, and bar graphs. Compare data with others to examine and question results.
- Construct a simple explanation by analyzing observational data. Revise the explanation when given new evidence or information gained from other resources or from further investigation.
- Share simple plans, data, and explanations with an audience and justify the results using the evidence from the investigation.
- Use mathematics, reading, writing, and technology when conducting an investigation and communicating the results.
- Observe and identify basic components of soil. Use the senses to observe and then describe the physical properties of soil components.
- Conduct simple tests to identify the three basic components of soil (sand, clay, humus) and to compare and contrast the properties of each of the components.
- Interpret test results (touch and roll, smear, settling, ability to absorb and retain water) and draw conclusions about a soil's components.
- Record and organize the results of soil tests and explain these results through writing, drawing, and discussion.

- Reflect on the test results and predict how plants will grow in different soil components. Apply this knowledge to describe how the properties of each soil component contribute to an appropriate soil mixture in growing plants.
- Use worms to enhance decomposition of plant material in composting. Explain how composting is an effective method to recycle plants and other discarded organic matter.
- Select and use appropriate instruments (e.g., hand lens/magnifier, droppers, funnels, filter paper, sieves) to analyze soil samples.
- Investigate how natural composting recycles plants and other discarded organic matter. Recognize the importance of this process to the environment.

Stage 2: Assessment Evidence

Suggested Performance Task(s)

Soils assessment for Grade Two can be found at:

http://www.doe.k12.de.us/programs/sci_assess/default.shtml

Key Transfer Ideas:

1. Soil is composed of living and non-living material.
2. Humus is decaying organic matter.
3. Every soil component has unique properties that can be identified using simple tests.
4. Sand, clay and humus have identifiable properties.
5. Living things affect the soil in which they live.

Students are expected to:

1. Observe soil samples and record observations.
2. Identify characteristics of humus.
3. Select appropriate tools to conduct tests on soil samples.
4. Explain how sand, clay and humus help plants to grow.
5. Examine a local soil sample and determine its components.
6. Explain how living organisms help in decomposing organic matter.

Rubrics/checklists for Performance Tasks

Soils rubrics for Grade Two can be found at:

http://www.doe.k12.de.us/programs/sci_assess/default.shtml

Other Evidence

Formative Assessment:

- Lesson 8 in Teacher's Manual

Stage 3: Learning Plan

Key learning events needed to achieve unit goals

Resource; STC *Soils*, National Science Resource Center, Washington, DC

Lesson 1: What Is in Soil?

In this lesson, students predict what they may find in a sample of garden soil. Students collect qualitative data regarding their garden soil by observing the sample with a hand lens and record their data for later discussion.

Lesson 2: Where Do Dead Plants Go?

Students investigate the role of living organisms in soil production by creating a compost container with worms and observing changes to decaying plant matter over time. A compost container without worms (control) is also created to allow comparison.

Lesson 3: Introducing Sand, Clay, and Humus

Students examine sand, clay and humus using their senses of touch, smell and hearing. Hand lenses are used to extend their sense of sight to allow observation of very small particles within soil. Students record their observations through writing and drawing.

Lesson 4: When Soils Get Wet

Soil samples are moistened and examined using the senses of touch and sight. Samples are observed and compared to the dry samples investigated in earlier lessons.

Lesson 5: More About Wet Soils

Students conduct a smear test on sand, clay and humus and record their results. After conducting the test, the resulting smudges are compared. Students also observe changes in the clay balls created in activity 4 that were allowed to dry overnight. The dried clay balls are crushed and students discuss changes that occur when water is added to the material. After making these observations; practical, every day uses of the materials are discussed.

Lesson 6: How Quickly Do Soils Settle in Water?

In this lesson, students predict what will happen when they separate soil components by settling. After discussing their predictions, students place a small sample of soil in a test tube with water and mix the combination. Time passes without students agitating the tube, and the resulting layering is recorded through words and pictures.

Lesson 7: More Settling a Few Days Later

Test tubes from lesson 6 are allowed to sit for a number of days and students observe how suspended materials settle over time. At this time, students are also directed to observe and record changes occurring in the compost containers.

Lesson 8: What is Your Mystery Mixture?

Students are given an unfamiliar mixture of soil and are instructed to use the testing methods learned and practiced in lessons 1-7 to investigate the composition of their mystery soil.

Lesson 9: Growing Plants in Different Soils

In this investigation, students predict which type of soil will be most hospitable for nurturing cucumber plants. After developing their hypotheses, students plant their seeds in sand, clay, humus and a combination of each (local soil). A log is created to record observations over time as each plant begins to develop.

Lesson 10: Why Do Plants Have Roots in Soils?

The role of roots in plant structure is investigated as students plant seeds in clear tubes filled with sand, clay and humus respectively. Each plant is watered regularly and monitored for growth. Observations of plant development continue through lesson 16. During this span of time, students are also observing changes that have occurred in their compost containers since their previous observations.

Lesson 11: Can Soil Hold Water?

This investigation leads students to discover that when a given amount of water is added to humus, less water drains from the sample than what was originally added. This illustration of soil retention is related to what happens when rain soaks into the ground.

Lesson 12: How Water Moves Through Sand and Clay

The investigation in lesson eleven is extended as students measure the amounts of water that drain through equal amounts of sand and clay. Observations are recorded and students work to relate their findings to the effects of rain on soil.

Lesson 13: Opening the Compost Bags

Students observe the difference in plant matter decay in the compost container including worms versus the compost container lacking worms. Students review their earlier predictions and discuss their current findings. Using their findings, students brainstorm the best methods of composting in real world applications.

Lesson 14 and 15: Exploring Your Local Soil and More about Your Local Soil

These lessons are excluded from the instructional unit and are used as the end of the unit assessment.

Students review previous soil tests and their results. Then a local soil sample is presented to students who predict what might be in their sample. The sample is then investigated to determine what components are present.

Lesson 16: What is Your Local Soil?

In this lesson, students compare and record plant growth in sand, clay, humus and local soil. A classroom chart is **created to visually represent plant growth in various samples and from this collection of data, students conclude which soil is best suited to support cucumber plant growth.**

Resources & Teaching Tips

- Have You Seen Sand or Clay Today? (Lesson 5)
- Earthworm: Nature's Plow (Lesson 10)
- Anita's Amazing Compost Pile (Lesson 13)

Lesson 2:

- Consider using a clear, solid container (Glad or 2L soda bottle) instead of Ziploc bags. Use one extra set up as an experimental control for the entire class. Stress that humus is material that was once living, but is now dead.

Lesson 3:

- Observe Record Sheet 3A one at a time with all five senses. Begin with sand, then clay, and then humus.

Lessons 4 and 5:

- Consider combining lessons 4 and 5 if access to water is not readily available. Allow time for students to wash hands at end of lesson. Having a source of water for these lessons is essential. Consider using buckets, milk containers, etc. Have extra paper towels and newspaper available.

Lesson 6:

- Be sure to stress to students to use the test tube without the two open ends. Model and have students show you which end is up on the test tube. Show students how to place the red caps on the test tube tightly and hold the cap with their thumb while shaking.

Lessons 9 and 10:

- Consider combining lessons 9 and 10. Use four clear, plastic cups so that students can observe what is happening both above and below ground. Of the four cups, one should have sand, one soil, one clay, and one a local soil sample. Consider using groups of four students rather than two and give all four samples to each group.

Lesson 11:

- Revise worksheet 12-A so that it is specific to humus. Doing this encourages students to write and record as they work through the investigation.

Lesson 13:

- Wait at least 4-6 weeks before opening the containers or bags.

Lessons 14 and 15:

- These lessons are the DE Coalition Summative Assessment and may be skipped if the Coalition Summative Assessment is given in its entirety.

General Tip:

- Worms are part of the unit due to their jobs with soil, however the focus of the unit is soil not worms.