

Teacher Package

Science and Technology Exemplar Task Grade 3

Teacher Package

Title: Soils in the Environment

Time Requirements: 335 minutes (over several class periods)

Introductory activities

- Pre-task 1:30 minutes
- Pre-task 2:60 minutes
- Pre-task 3:30 minutes

Exemplar task

- Part A: 45 minutes (excluding time for separation)
- Part B: 120 minutes (a whole morning or afternoon)
- Part C: 25 minutes
- Part D: 25 minutes

Description of the Task

Students are given a soil sample to determine whether it would be useful for growing plants in a garden. Students will separate the soil sample into piles, develop experiments, and make recommendations. Student responses will be recorded in a "Soil Booklet".

Students will complete the worksheets provided in this package and submit selected worksheets for assessment.

Scenario and Instructions for Students

Students should be presented with the following scenario and set of instructions:

Our class has been studying soils. You have learned different information about soils that could be helpful to others. The Kindergarten class wants to plant a flower garden and needs your help to decide if the soil they have chosen is appropriate for their garden. You will experiment with this soil sample and give advice to the Kindergarten class about its usefulness.

Curriculum Expectations Addressed in the Task

Note that the codes that follow the expectations relate to the Ministry of Education's *Curriculum Unit Planner* (CD-ROM).

Students will:

1. demonstrate an understanding of the similarities and differences between various soils and the effects of moving water on soils (3s96);
2. investigate the components of various soils, and describe the effects of moving water on these soils (3s97);
3. recognize the dependence of humans and other living things on soil and recognize its importance as a source of materials for making useful objects (3s98);
4. describe through experimentation how soil can be separated into its different components (e.g., sieving, sedimentation) (3s104);
5. ask questions about organisms and events in the outdoor environment and identify needs of organisms that arise from these events, and explore possible answers to these questions and ways of meeting these needs (e.g., investigate the different effects produced when water is sprayed on and poured on exposed soil, asphalt, and grass) (3s105);
6. plan investigations to answer some of these questions or find ways of meeting these needs, and explain the steps involved (3s106);
7. use appropriate vocabulary in describing their investigations, explorations, and observations (e.g., use terms such as *clay*, *sand*, and *pebbles* to describe the earth materials in soil) (3s107);
8. record relevant observations, findings, and measurements, using written language, charts, and drawings (e.g., create a tally chart to record the water absorption of different earth materials) (3s108);
9. communicate the procedures and results of investigations for specific purposes and to specific audiences, using drawings, demonstrations, simple media works, and oral and written descriptions (e.g., record what happens when soil and water are shaken together in a container; prepare a display comparing the composition of soils from different locations) (3s109);
10. demonstrate awareness of the importance of recycling organic materials in soils (e.g., explain the purpose of a compost heap; explain the reason why it is useful to leave grass clippings on the lawn) (3s111);
11. recognize the importance of understanding different types of soil and their characteristics (e.g., enables people to determine which crops can be grown in a particular area; enables gardeners and farmers to improve plant growth) (3s112).

“Big Ideas”

Based on the expectations being assessed, the following “big ideas” have been identified for this task:

- The composition of soil determines its capacity to sustain life.
- Different soils have different uses.
- Humans contribute in both helpful and harmful ways to the makeup of soil.
- Soils provide animals and plants with shelter and nourishment.

Teacher Instructions**Prior Knowledge and Skills Required**

Before attempting the exemplar task, students should have had experience with the following:

- the topic “Soils in the Environment” from the Earth and Space Systems strand
- the topic “Plants” from the Life Systems strand
- separating soils and analysing the components by carefully examining the characteristics (smell, colour, texture, compaction, malleability, cohesion, permeability, and absorption) of each component
- examining the characteristics of each component (sand; small pebbles; clay; organic matter, including humus) using a variety of experiments such as the following (all described in Pre-task 2): absorption experiment, permeability experiment, compaction experiment, malleability experiment, and cohesion experiment

The Rubric

The rubric* provided with this exemplar task is to be used to assess students’ work. The rubric is based on the achievement levels outlined on page 13 of *The Ontario Curriculum, Grades 1-8: Science and Technology, 1998*.

Introduce the task-specific rubric to students at least one day before administering the task. Copy the rubric for students or create a transparency to use with the class. You may find it useful to rephrase the rubric for students to help them in their work.

Review the elements of the rubric with students to ensure that they understand the criteria and the descriptions for achievement at each level. Allow ample class time for a thorough reading and discussion of the assessment criteria outlined in the rubric.

Accommodations

Accommodations that are normally provided in the regular classroom for students with special needs should be provided in the administration of the exemplar task.

Classroom Set-up

- Students will work independently at their desks for the exemplar task.
- Each student must have access to water.
- Tables or groups of desks could be used as the centres for Pre-task 2.
- Set up the classroom as you normally would for a science and technology task allowing space for students to experiment.

Materials Needed

Note: The listed materials are required both for the pre-tasks and for the exemplar task.

- a soil sample in a plastic sandwich bag for each student (All soil samples should include all of the components of soil: sand, small pebbles, clay, and organic matter – dead plant and animal material, such as peat moss or humus. You can obtain soil samples and/or the components of soil from the schoolyard or from around the school, if appropriate, or you can purchase soil at a local nursery.)
- 150 mL vials or clear containers with lids (one per student)
- graduated cylinders or plastic measuring cups for water (ideally, one per student)
- large coffee filters (one per student)
- funnels (one per student for use with coffee filters)
- student booklets (photocopies from appendices)
- magnifying lenses (ideally, one per student)
- plastic containers (e.g., 500 mL yogurt or margarine containers; one per student)

Safety Considerations

- Some students may have allergies to some of the materials being used (e.g., to moulds). These students should be provided with sterile soil to work with (available from garden centres).
- When students make their observations by looking at, feeling, and smelling the soil, ensure that they do not taste the soil.
- Ensure that students wash their hands after working with the soil.
- Use plastic containers rather than glass to avoid accidents.

Task Instructions**Introductory Activities**

The pre-tasks are intended to ensure that students have the prior knowledge required to complete the task. The purpose of Pre-task 1 is to introduce the exemplar task, review the elements of the rubric, and allow time for students to ask questions for clarification.

Pre-task 1: Introduction of Student Scenario

1. Read the student scenario to the class.
2. Discuss the scenario as a class and ensure that all students understand the task.

*The rubric is reproduced on pages 14–15 of this document.

3. As a class, review the methods of separating soil. Tell students that they will use the water method to separate their soil.
4. Review with students the observations that could be made from separating soil. Focus the discussion on the specific soil components and whether they would help the growth of a plant (e.g., How does clay affect the growth of a plant?).

Pre-task 2: Soil Activities

1. Prepare five soil centres with a container of soil (e.g., a yogurt or margarine container) at each centre for student use. (The composition of the soil should be the same at every centre to ensure a fair test.) The containers of soil are to stay at the centres, with students rotating from one centre to another. *Note:* Throughout the tasks, check the soil supplies at the centres to ensure there is enough soil to allow every student to perform the experiments.
2. Distribute the soil booklets and have students examine the contents of the booklets.
3. Explain to students what they will do at each centre. Have them refer to the directions provided on the first page of the Student Package (see Appendix 1: Experiments).
4. Direct students' attention to the "Soil Activities Sheet" (see Appendix 2). Highlight that it is important for them to record observations while they are doing the experiments.
5. At their first centre, students are to make and record observations about their soil sample using three senses (look, feel, smell). *Note:* Have students use a magnifying lens to aid them in their observations.
6. Ask students to visit all the centres in rotation and complete the five experiments (absorption, permeability, compaction, malleability, cohesion), recording their observations.
7. As a class, discuss the observations associated with each experiment and the importance of these observations to students' tasks. Record the ideas on chart paper for students' use during the exemplar task.

Pre-task 3: Soil and Plant Growth

1. As a class, review the importance of the experiments completed in Pre-task 2.
2. Brainstorm the qualities of soils needed to grow plants effectively.
3. Discuss and list what can be added to soils to improve the growth of plants (e.g., vegetable food scraps and organic fertilizers).
4. Brainstorm and record the ways humans help or harm soil.
5. As a class, review all vocabulary associated with soil, recording students' answers on chart paper.

Exemplar Task

For the completion of this task, each student will need his or her own soil sample, which should combine all soil components. The amount of each component is not as important as having all of the components present in each student's sample. Students' samples can be distributed in plastic sandwich bags. The samples do not need to be identical in amount or have the same ratio of the soil components.

The completed student worksheets "Soils Booklet, Part A", "Soils Booklet: Super Science Sheets, Part B" (1–3 copies), "A Soil Report to the Kindergarten Class, Part C", and "What have I learned?, Part D" (see Appendices 3–6) are to be submitted for marking.

Part A: Separating the Soil

1. Review the scenario with students.
2. Remind students that they will each be working independently, and review the student rubric with them.
3. Give each student a piece of paper and ask students to fold their papers into quarters and then unfold the paper on their desks.
4. Distribute a soil sample to each student. (Samples have previously been placed in plastic sandwich bags.)
5. Have students put their soil samples into five piles on the paper, placing one pile in each quarter and the fifth pile in the middle. Have students ensure that the piles are almost equal.
6. Have students use three of their senses (look, feel, smell) to make qualitative observations of the middle pile, recording the observations in their booklets (see item 1 of Appendix 3). Have students use magnifying lenses to help them in their observations.
7. Give each student a small (150 mL) vial (or clear plastic container) and ask him or her to put one pile of soil into the vial.
8. Tell students to separate their soil using their vial and water. They can do this by letting the vial sit until the water is clear and the soil is at the bottom of the vial. (The length of time this takes may vary depending on the composition of the soil.)
9. Direct students to make observations and draw labelled diagrams for their separations in their booklets (see item 2 of Appendix 3).
10. Have students complete item 3 of the worksheet reproduced in Appendix 3: "What experiments will you do to learn more about your soil?" (Students can choose to do one, two, or three experiments.)
11. Once students have completed this part of the task, ask them to place the leftover soil from the experiments in plastic bags and label these with their names. They will need their samples for the next part of the task.
12. Collect students' booklets.

Part B: Experimenting With Soil

1. Tell students that they will be experimenting with their soil samples and making observations in the “Super Science Sheets” in their “Soils Booklet”. Read and discuss the worksheets, ensuring that students understand them. *Note:* There are three copies of the “Super Science Sheets” in each “Soils Booklet”. Each student can choose to do one to three experiments, recording each on a separate sheet.
2. Have students plan their experiments using the top part of the worksheets, “Planning the Experiment”.
3. Then give each student a piece of paper and ask him or her to fold it into quarters and then unfold it on the desk.
4. Distribute soil samples to students.
5. Have each student spread his or her soil into five piles on the paper, placing one pile in each quarter and the fifth pile in the middle. Ensure that the piles are almost equal.
6. While students are completing their experiments (students should refer to Appendix 1), they should record their observations and explain what they have learned about the soil samples on the bottom part of their worksheets, using the “Observations” checklist to ensure that they have remembered everything.
7. Collect students’ booklets and any remaining soil. Students will no longer require soil after completing this part of the task.

Part C: A Soil Report for the Kindergarten Class

1. Read over the worksheet “A Soil Report to the Kindergarten Class” (see Appendix 5) with the class. Students are to use the worksheet to make recommendations and suggestions to the Kindergarten class about the soil sample.
2. Have students complete their worksheets and then collect them.

Part D: What Have I Learned?

1. Discuss the worksheet “What have I learned?” (see Appendix 6) with students.
2. Ask students to apply their understanding of soil to explain what kind of soil would be best for their own gardens.
3. Collect the worksheets when completed.

Appendix 1: Pre-task 2**Experiments****Centre 1: Absorption**

- Use a 500 mL/454 g yogurt cup with a hole in the bottom.
- Put one vial of soil into the cup.
- Cover the hole with a finger.
- Pour 50 mL of water into the cup.
- Let the soil sit for two minutes.
- Place the cup over a graduated cylinder (or measuring cup) and remove your finger, allowing the water to flow through the cup into the graduated cylinder (or measuring cup).
- Measure the amount of water in the graduated cylinder.

Centre 2: Permeability

- Put a large coffee filter in a funnel.
- Place one vial of soil in the filter.
- Place the funnel over a graduated cylinder (or measuring cup).
- Pour 50 mL of water over your soil.
- Measure the amount of water in the graduated cylinder (or measuring cup) after you have let the soil sit for two minutes.

Centre 3: Compaction

- Put one vial of soil in a container (e.g., a 500 mL/454 g yogurt or margarine container).
- Try to push a thick marker into the soil.
- Make observations on how easy it was to push the marker through the soil.

Centre 4: Malleability

- Place one vial of soil in a container (e.g., a 500 mL/454 g yogurt or margarine container).
- Add water to the soil in small amounts until it is moist enough to shape.
- Place the moistened soil in your hands and try to shape it.
- Make observations on how easy it was to shape.

Centre 5: Cohesion

- Take a handful of soil and squeeze it.
- Observe how well the soil stays together.
- Add water to moisten the soil.
- Take a handful of moistened soil and squeeze it.
- Observe how well the moistened soil stays together.

Appendix 2: Pre-task 2

Soil Activities Sheet

While completing the soil activities, fill in your observations in the chart below. Use numbers, pictures, and words for your observations.

Activity	Observations and Measurements
Senses (look, feel, smell)	
1. Absorption	
2. Permeability	
3. Compaction	
4. Malleability	
5. Cohesion	

Appendix 3

Soils Booklet Part A

1. Use your senses (look, smell, and feel) to make observations about your soil sample. You can use numbers, pictures, and words to describe the soil.

Look	
Feel	
Smell	

2. After separating your soil, draw a **labelled** diagram to show what your soil looks like in the vial.

3. What experiments will you do to learn more about your soil?

Appendix 4

Soils Booklet: Super Science Sheets Part B

Planning the Experiment

Name the Experiment	
Why did you choose this experiment?	
Materials	
List the steps to do the experiment. (Use pictures, numbers, and words.)	

Doing and Recording

Observations Did you use: <input type="checkbox"/> numbers <input type="checkbox"/> pictures <input type="checkbox"/> words Are you done?	
What have you learned about the soil sample?	

Appendix 5

A Soil Report to the Kindergarten Class
Part C

1. Do you think the kindergarten class should use your soil sample?

2. Explain the reasons for your decision. Remember to list as many reasons as you can, using numbers, pictures, and words.

Appendix 6

What have I learned?
Part D

1. Describe the best kind of soil you would use in your garden. You can use pictures, numbers, and words.

2. How would people in your community improve the soil for growing their plants?
