INQUIRY SKILLS MENU

○ Questioning	○ Planning	● Analyzing
○ Hypothesizing	● Conducting	● Evaluating
● Predicting	● Recording	● Communicating

Selecting Soil for a Sports Field

Baseball purists claim that artificial turf has ruined the game. The smooth carpet causes the ball to move too quickly across the infield following a bunt. Real grass slows the ball and makes for a more exciting running game. Baseball fields (and also football and soccer fields) require soil that drains quickly but provides maximum nutrients for a lush, even lawn. If you were choosing a location for a new baseball stadium, what kind of soil would be best (Figure 1)? Assume the new baseball stadium will be built in an area that experiences wide ranges of temperature and precipitation.

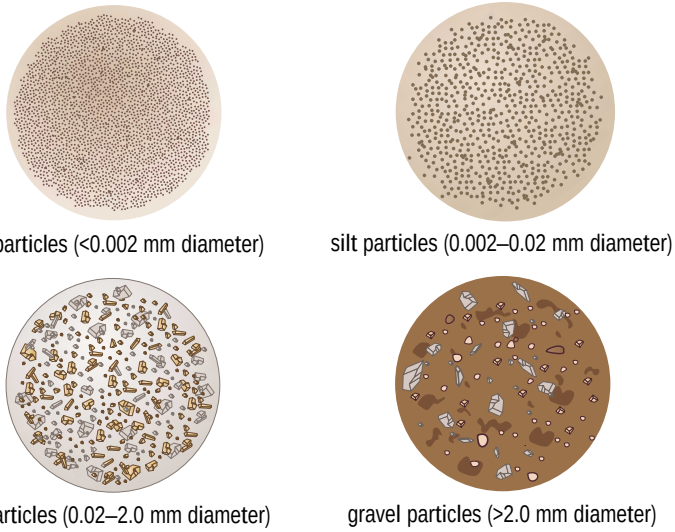

Figure 1

Soil is composed of rock particles of various sizes. Clay particles are the smallest, followed by silt, then sand, and finally gravel. Large particles have large spaces between them, which can be occupied by air or water. Small particles have much smaller spaces between them.

Question

Which soil sample would provide maximum drainage and still provide enough nutrients for the growth of a lush and even lawn?

Prediction

(a) Make a prediction about which of the soil samples would be best. Explain your prediction. (K3)

Design

In this investigation you will conduct tests that will help you rate each of four soil samples for qualities that provide maximum water drainage and support the growth of grass.

(b) To properly compare different samples of soil, make a list of variables that must be controlled throughout the experiment. (K4)

(c) Make a table to record your observations, measurements, and calculations.

Materials

- safety goggles
- apron and gloves
- 250 mL each of dry soil samples A, B, C, D
- 4 50-mL beakers or crucibles
- tablespoon
- white paper
- hand lens
- 4 plastic jars, with lids
- water
- 2 100-mL graduated cylinders
- balance
- weighing boat or filter paper
- hot plate
- beaker tongs

When using your nose to gather observations, wave your hand over the opening of the beaker to identify the odor. Never place your nose over the edge of the beaker and inhale.

Procedure

Part 1: Classifying Soil Particles

1. Obtain a level tablespoon of each soil sample and put it in a separate labeled beaker.
2. Compare the samples of soil using your nose, fingers, and eyes. Record your observations.
3. Place a few soil particles from each of the samples on a piece of white paper and examine them with a hand lens. Using Figure 1 as a reference, attempt to classify the soil particles in each sample. Record your observations in your table.

SKILLS HANDBOOK: (K3) Developing the Prediction and Hypothesis (K4) Creating the Design

Part 2: Viewing Soil Layers

4 Pour soil from sample A into a clear plastic jar until it is about ¼ full. Add water until the jar is ¾ full. Replace the lid and shake vigorously for 2 min. Leave the jar for 2 min or until its contents settle. Record your observations in a diagram.

(d) Are larger particles found near the top or bottom of the jar?

5 Repeat step 4 for Samples B, C, and D.

(e) Observe the results from other groups. Do all samples look the same?

Part 3: Measuring Soil Density

6 Using the tablespoon, put 20 mL of soil sample A in a 100-mL graduated cylinder.

7 Place the weighing boat or filter paper on the pan of your balance. Either determine its mass or press the tare button. Next pour the soil from the cylinder onto the boat or filter paper. Determine the mass of the sample. Record the mass in your table.

8 Using the measured mass and volume of the soil sample, calculate the density of soil sample A ($D = \frac{m}{v}$). Record your calculation in your table.

9 Repeat steps 6, 7, and 8 for soil samples B, C, and D.

Part 4: Measuring Air Content

10 Place 40 mL of soil sample A in a 100-mL graduated cylinder. Slowly add 40 mL of water. Observe how the water interacts with the soil.

(f) Did you notice any bubbles coming from the soil when the water was added? What does the presence of bubbles tell you?

(g) Measure the volume of the soil/water mixture. Calculate the volume of the air that was in the sample and record your calculation in your table. Repeat for samples B, C, and D.

Part 5: Measuring Humus Content

11 Put about four tablespoons of soil sample A into a small beaker or crucible. Using a balance, measure the mass of the beaker and soil sample. Record the mass of the beaker and soil sample in your table. Repeat for samples B, C, and D.

12 Ask your teacher to place the beakers on a hot plate for 4 min. Heating the soil will cause organic material in the soil to combust, forming gases that will rise out of the soil. Using beaker tongs, carefully remove the beakers from the hot plate. Allow the beakers to cool for 3 min, then measure the final mass of each beaker. Calculate the mass of the material (humus) that was lost during heating and record it in your table.

13 Clear your workspace and wash your hands thoroughly.

Analysis and Evaluation

(h) Peat and humus are made from decomposed plant matter. Which of your senses would provide the best clues for identifying these? Explain your answer.

(i) Which of the tests you conducted could be used to rate the drainage provided by each soil sample? Explain your answer.

(j) Which tests could be used to provide information about which soil would provide the best environment for the growth of a lawn? Explain your answer.

(k) According to your evidence, rate the four soil samples according to how appropriate they are for use in a sports field. Compare your answer to your prediction.

Understanding Concepts

1. Many plants grow best in soils that have large air spaces. Speculate about why this is the case.
2. Explain why it is more difficult to dig in clay than in sand.
3. Explain the dangers of burying toxic waste in a sandy area.

Reflecting

4. What other information would you need to gather before making a recommendation to a municipality or company that was planning to build a stadium with natural grass? Consider what other tests that you could run or experiments that you could perform.

Challenge

1 Compare the soil requirements of a baseball field with those of a golf course. What special soil qualities would be needed for a golf course in a warm, dry climate or a cold, wet climate?