LaMotte

# SOIL TEXTURE Lab

CODE 5966

A unit of the LaMotte Classroom Studies Series

# TABLE OF CONTENTS



WARNING! This set contains chemicals that may be harmful if misused. Read cautions on individual containers carefully. Not to be used by children except under adult supervision

# KIT CONTENTS

| Quantity | Contents | Order Code |
|---|---|---|
| 60 mL | *Texture Dispersing Reagent | *5644WT-H |
| 300 g | Soil Texture Sample | 25723-JAR |
| 5 | Soil Separation Tubes | 0763 |
| 5 | Plastic Ruler | 0170 |
| 1 | Manual | ----- |

*WARNING: Reagents marked with a * are considered to be potential health hazards. To view or print a Material Safety Data Sheet (MSDS) for these reagents see MSDS CD or www.lamotte.com. To obtain a printed copy, contact LaMotte by email, phone or fax.

To order individual reagents or test kit components, use the specified code number in the list above. To order a complete refill for the kit, use code number R-5966.

# SAFETY

**1** Follow the instructions. Read to the end of each procedure before starting the actual work. Measure samples and reagents accurately. Add the reagents in the order stated in the instructions. Observe the waiting times, when specified, for maximum color development.


**2** Read reagent labels and Material Safety Data Sheets when supplied. Avoid contact between reagents and the skin and eyes. Additional information for all LaMotte reagents is available in the United States, Canada, Puerto Rico, and the US Virgin Islands from Chem-Tel by calling 1-800-255-3924. For other areas, call 813-248-0585 collect to contact Chem-Tel's International access number. Each reagent can be identified by the four digit number listed on the upper left corner of the reagent label, in the contents list and in the test procedures. Each reagent can be identified by the four digit number listed in the upper left-hand corner of the reagent label, in the contents list and in the test procedures.


**3** Cap reagent bottles after use to avoid contamination. Do not interchange caps. Store reagents in a cool, dry place.

**4** Rinse test tubes and caps thoroughly in clean tap water after each use. Allow them to dry before putting them away.

**5** Store equipment and reagents out of the reach of very young children.

**6** Wear eye protection during the demonstrations. Wash hands after performing the experiments. When using materials not contained in this kit, be sure to follow the safety instructions on the container.

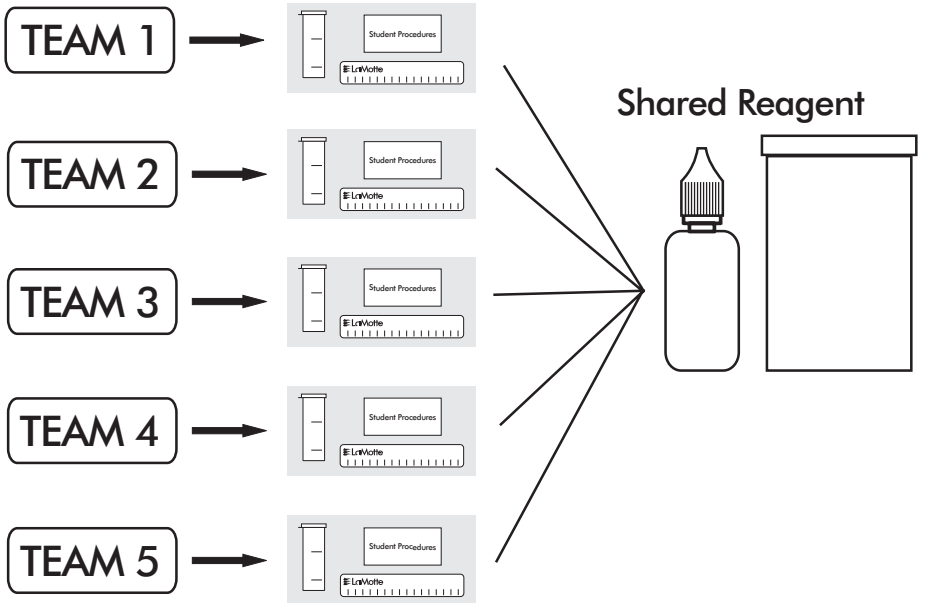
## After Testing

The solution from reacted samples can be poured down the drain with lots of running water. Discard soil samples in the trash.

# ORGANIZING THE TEAMS

Divide the group into 5 teams. Test tubes and apparatus are included for 5 teams to do a complete set of demonstrations at one time. There are enough reagents for the 5 teams to do 5 demonstrations each, or a total of 25 demonstrations. The teams will share one set of reagents.

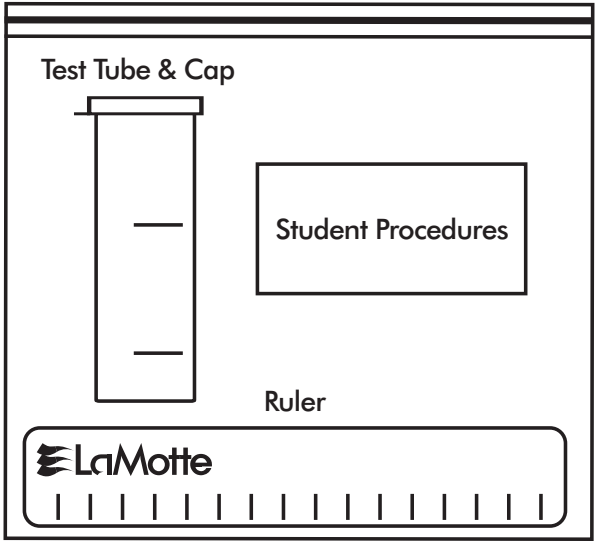
## Apparatus for One Demonstration



A set of items for each team can be collected ahead of time and packaged in a zipper-top bag. Each team will need:

| | | |
|---|---|---|
| 1 | Soil Separation Tube | 0763 |
| 1 | Plastic Ruler | 0170 |
| 1 | Student Procedures | ----- |

## For each team:



# INTRODUCTION

The soil that covers the surface of the Earth has taken millions of years to create. It is the natural covering of the Earth and supports most plant life. Soil is created when rocks and vegetation are broken down into tiny pieces by natural forces in a process called weathering. Weathering disintegrates rock by rain, erosion, freezing and thawing, and the slow movement of plant roots.

Soil is a mixture of many things but the majority of them are mineral particles. The mineral particles that form the soil are determined by the composition of the rocks in the area that were broken down. The size and amount of the particles affects how easily both water and air can pass through the soil and reach the roots of plants.

Sand particles are the largest. Because they are so big, there are lots of air spaces between the sand grains, so water passes quickly through the soil before the plants can absorb it. Water poured from a bucket into a hole in the sand at the beach or in a sandbox will disappear quickly.

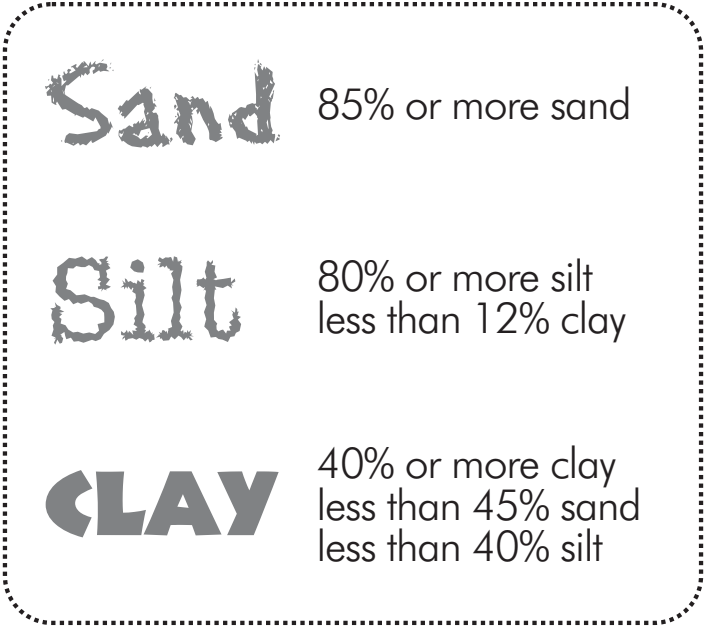
Silt particles are smaller than sand particles. Because they are smaller, there is less room between them and water can't move as quickly through the soil. The water is trapped for a longer time next to the plant roots and they can absorb it. Silt particles help hold soil together and reduce erosion.

Clay particles are the smallest. They can be packed close together so the spaces for water to pass through the soil are very small. Soils with some clay particles are able to store water and nutrients, which can be used by growing plants for a long time. But soils with too much clay are very dense and heavy. This makes it difficult for water and plant roots to push through the soil. Clay particles also help hold soil together and reduce erosion.

Besides mineral particles, soil texture is also influenced by the amount of decomposed organic matter that the soil contains. As organic matter breaks down, plant nutrients are released into the soil. Organic matter acts like a sponge to hold water and nutrients in the soil. Manure, compost, fallen leaves and decomposing plant and animal material, add organic matter to soil. Bacteria, fungi, protozoa, small animals, earthworms and ants live in the soil and break down organic matter into nutrients that are used by

plants. Organic matter also makes the soil fluffy. In fluffier soil, it is easier for plants to spread their roots and grow.

Soil scientists measure the amount of the mineral particles - clay, sand and silt - in soil to assign a soil classification.



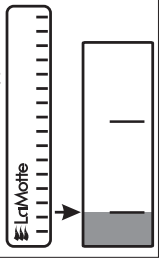
# Determining Soil Texture

**1**

Fill a Soil Separation tube (0763) to the 10 mL line with the Soil Texture Sample (25723-JAR). Gently tap the tube after each portion is added to pack the soil down and eliminate air spaces.

**2**

Place the plastic ruler (0170) next to the tube. Measure the total height of the soil. This is **Reading A**.

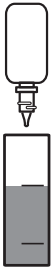



**3**

Add tap water until the tube is filled to the 40 mL line.

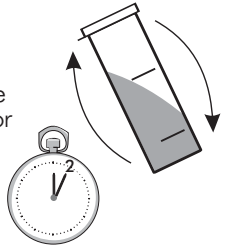
**4**

Hold the bottle vertically and add 10 drops of *Texture Dispersing Reagent (5644).



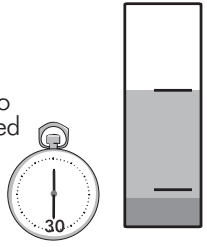
**5**

Cap the tube and shake for 2 minutes.



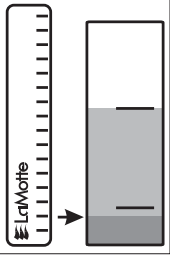

**6**

Allow the tube to stand undisturbed for 30 seconds.




**7**

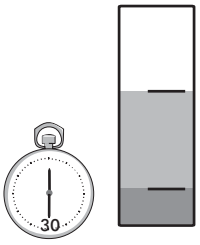
Place the plastic ruler (0170) next to the tube. Measure the height of the particles that have settled. This is the sand portion of the soil. This is **Reading B**.




$$\% \text{ Sand} = \frac{\text{Reading B} \times 100}{\text{Reading A}}$$

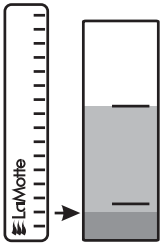
**8**

Allow the tube to stand undisturbed for 30 minutes.




**9**

Use the ruler to measure the total height of the particles that have settled. This is the sand portion plus the silt portion of the soil. This is **Reading C**.




**10**

Use **Reading B** and **Reading C** to determine the silt portion of the soil.

$$\% \text{ Silt} = \frac{(\text{Reading C} - \text{Reading B}) \times 100}{\text{Reading A}}$$

**11**

Subtract the Percent Sand and the Percent Silt from 100%. This is the Percent Clay.

$$\% \text{ Clay} = 100\% - \% \text{ Sand} - \% \text{ Silt}$$

## For Example:

| | |
|---|---|
| Initial amount of soil: | Reading A = 1.35 cm |
| After 30 seconds: | Reading B = 0.80 cm |
| After 30 minutes: | Reading C = 1.30 cm |

$$\% \text{ Sand} = \frac{0.80 \text{ cm} \times 100}{1.35 \text{ cm}} = 59\%$$

$$\% \text{ Silt} = \frac{(1.30 \text{ cm} - 0.80 \text{ cm}) \times 100}{1.35 \text{ cm}} = 37\%$$

$$\% \text{ Clay} = 100\% - 59\% - 37\% = 4\%$$

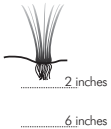
# ADDITIONAL EXPERIMENTS

If it is not necessary to do 25 demonstrations, the remaining reagents can be used to perform additional experiments. Try one or more of the following.

## Collecting Soil Samples

### Soil Sampling Tips

Take the soil sample from the root area of the plants that grow there. When sampling a lawn, take samples from the upper 2 or 3 inches of soil. When sampling a garden or farm crops, take the sample from the upper 6 to 8 inches of soil.



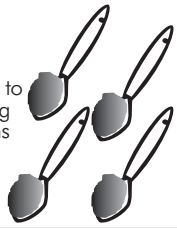

When testing a large area, take samples from several locations and mix them together to form a representative sample.

Use a clean trowel or knife to collect the samples.

Do not touch the soil with your hands unless it is necessary.

**1** Clean the area of leaves and plants.

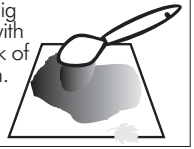
**2** Collect 4 to 5 heaping teaspoons of soil.



**3** Spread the soil on a clean piece of plastic or paper to dry. Allow the soil to dry for several hours or overnight. Do not bake the soil to dry.

**4** Remove leaves, stones, roots and other foreign matter.

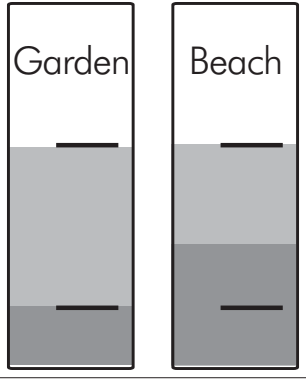
**5** Crush big lumps with the back of a spoon.



# Additional Experiments

**Test Your Own Soil Samples**

If only Steps 1,2 and 3 are followed in the procedure and the tubes are allowed to stand undisturbed until all the particles have settled from the solution, a good, visual comparison can be made between different soils. Sometimes it is necessary to let the tube stand for several days for the clay particles to settle.




**Get Your Hands Dirty**

The way that soil feels is another way to determine soil texture.

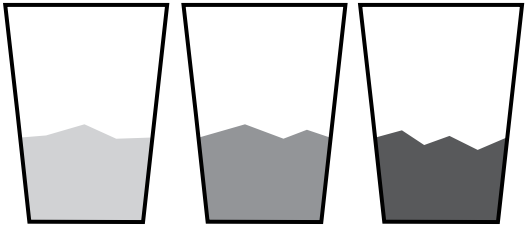
1. Spread a soil sample out on a piece of paper.
2. Pick out any leaves, stones or sticks.
3. Use the back of a spoon to crush any lumps that are bigger than a pea.
4. Wet your clean index finger by dunking it into a cup of water.
5. Rub a little bit of soil from the sample between your wet index finger and thumb.
6. How does the soil feel?

| | |
|---|---|
| **sand particles** | feel grainy or gritty |
| **silt particles** | feel smooth or silky, like powder or flour |
| **clay particles** | feel sticky and can be squeezed into a little dirtball between your fingers. |

# Additional Experiments

**All Dirt is Different**

Collect soils from different spots in your area. Put them in clear plastic cups and compare the texture, color, and how they absorb water.



**What Color is Your Soil?**

Soil color can tell you the kind of soil that you have.

| | |
|---|---|
| **Dark brown or black** | rich in nutrients and organic matter |
| **Gray** | has a lot of clay or is waterlogged |
| **Light brown or white** | has more sand |
| **Red or orange** | shows that iron in the soil has reacted with air or water |

# GLOSSARY

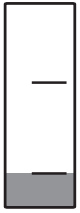
| | |
|---|---|
| **Absorb** | To take a substance into the physical structure of a liquid or solid without chemical reaction. |
| **Clay** | The smallest particle size in soil; has the tendency to become sticky or greasy to the touch when wet. When clay becomes dry it is extremely hard and brick-like. |
| **Organic matter** | The fraction of soil which results from the decomposition of plant and animal matter through the action of microorganisms. Organic matter in soils can be increased by the addition of manure, compost, and peat moss. Soils which are rich in organic matter have a high water holding capacity and are usually well aerated. |
| **Sand** | Small rock fragments that make up the mineral portion of the soil. Sands represent the largest particle size in textural classification and are formed through erosion of native rock material. |
| **Silt** | A type of soil that falls in size between sand and clay. It is usually found in combination with one of the other of these soil fractions. |
| **Texture** | The relative amounts of sand, silt, and clay in a soil determine the structural components or texture of the soil. |
| **Weathering** | Worn, disintegrated, or changed by the action of the elements; wind, rain, sleet, snow, freezing, thawing, can all be responsible for breaking up rocks to form smaller particles. |

## Student Procedure • Determining Soil Texture

Make a copy for each team.

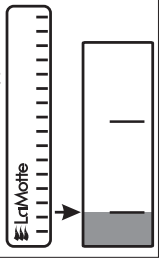
**1**

Fill a Soil Separation tube (0763) to the 10 mL line with the Soil Texture Sample (25723-JAR). Gently tap the tube after each portion is added to pack the soil down and eliminate air spaces.



**2**

Place the plastic ruler (0170) next to the tube. Measure the total height of the soil. This is **Reading A**.

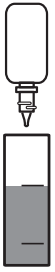



**3**

Add tap water until the tube is filled to the 40 mL line.

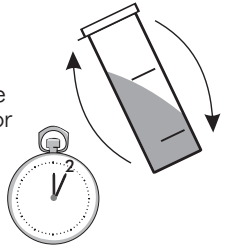
**4**

Hold the bottle vertically and add 10 drops of *Texture Dispersing Reagent (5644).



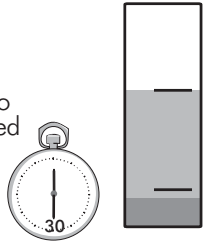
**5**

Cap the tube and shake for 2 minutes.




**6**

Allow the tube to stand undisturbed for 30 seconds.

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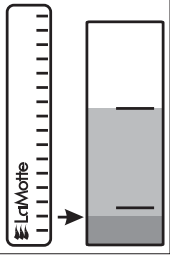



$$\% \text{ Sand} = \frac{\text{Reading B} \times 100}{\text{Reading A}}$$

Result _____

## Student Procedure • Determining Soil Texture

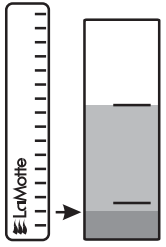
Make a copy for each team.

**8**

Allow the tube to stand undisturbed for 30 minutes.


**9**

Use the ruler to measure the total height of the particles that have settled. This is the sand portion plus the silt portion of the soil. This is **Reading C**.




**10**

Use **Reading B** and **Reading C** to determine the silt portion of the soil.

$$\% \text{ Silt} = \frac{(\text{Reading C} - \text{Reading B}) \times 100}{\text{Reading A}}$$

Result

**11**

Subtract the Percent Sand and the Percent Silt from 100%. This is the Percent Clay.

$$\% \text{ Clay} = 100\% - \% \text{ Sand} - \% \text{ Silt}$$

Result

### For Example:

| | |
|---|---|
| Initial amount of soil: | Reading A = 1.35 cm |
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$$\% \text{ Clay} = 100\% - 59\% - 37\% = 4\%$$

# REAGENT COMPOSITION

- Texture Dispersing Reagent (5644) contains a flocculating agent that facilitates the settling of the soil particles at a known rate.
- Soil Texture Sample (25723-JAR) is a natural soil sample.

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