CELEBRATE SOIL

Overview

Students will learn about Kansas's state soil Harney silt loam by determining soil type by texture, by applying knowledge through graphing the results, and by completing an assessment. They will use science by inquiry skills, data interpretive skills, math skills and social studies skills.

Suggested Grade Level:
4th-5th

Time:
Lesson 1 - Two, 40 minute class periods
Lesson 2 - 20 minutes

Subjects:
Earth and Space Science
Measurement and Data
Represent and Interpret Data
Geography

Objectives

1. Students will understand the percentage amounts of air, water, mineral matter, and organic matter in the average soil.
2. Students will label the three types of particles in soil mineral matter.
3. Students will identify loam.
4. Students will recognize the name of the Kansas' state soil.
5. Students will comprehend how Kansas' state soil was formed.
6. Students will know the general area of 26 counties in the state where the state soil is very abundant.
7. Students will use textures of mudpie and shape of mudpie and the Soil Textural Triangle to determine soil type in their samples.
8. Students will compare and contrast their sample types with their classmates and will compare results from activity 1 for plant growth.
9. Students will share the advantages and disadvantages of their soil types.

Background Information

Kansas' soil should be celebrated! It is a natural resource critical to the production of agricultural crops and livestock that are grown in Kansas. Soil provides food, filters water, helps clean the air, and provides a base to live and work on for all Kansans! Soil is the source of life.

There are over 300 orders or types of soil in Kansas. The average soil is made up of 25% water, 25% air, 45% mineral matter and 5% organic matter.

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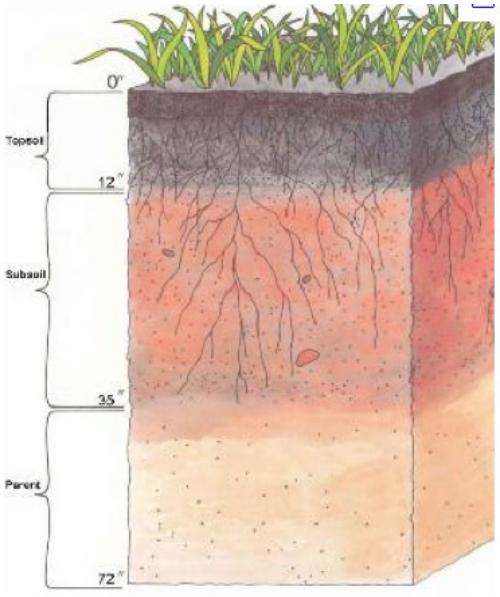
Background Information Continued

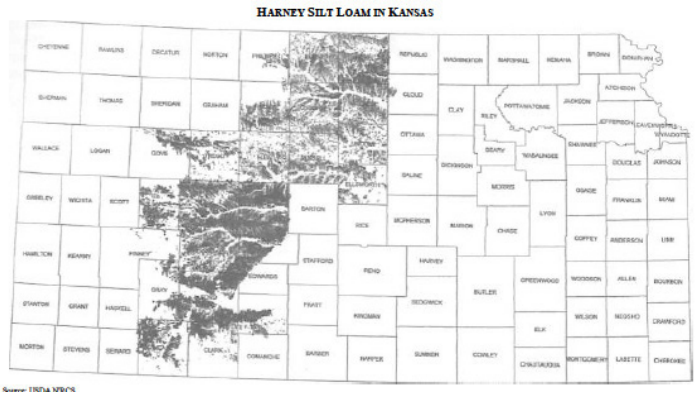
Soil is made up of three types of particles: sand, silt, and clay. Loam is the term used for a mixture of sand, silt, and clay. Sand is the largest of the particles, silt is the name for the medium-size particles, and clay is the smallest particle of the three. The most widespread soil type in Kansas is called Harney silt loam, and it covers almost 4 million acres in 26 counties. Harney silt loam was named Kansas' state soil on April 12, 1990, by then-Governor Mike Hayden. The soil's name means "people" in the native Wichita Indian language. This soil provides an ideal environment to raise irrigated and dryland crops in Kansas.



Harney Silt Loam Profile
Source: KS NRCS

Harney silt loam is a very deep soil formed in prairie grass regions over hundreds of years. Prairie soils are formed where grasses grow best; cold winters and warm summers. When the grass dies back in the cold winter, dried leaves and roots remain, and they act like mulch. The dried leaves and roots make organic matter as they decompose, which enriches the soil with nutrients. Plants are able to access this topsoil for nutrients. Harney silt loam is nearly level to moderately sloped, well-drained soil.

The "recipe" for Harney Silt Loam soil is: 12 inches of dark grayish-brown silt loam then 23 inches of subsoil with its two layers of grayish-brown, silty-clay loam and brown calcareous silty-clay loam. The parent layer is 35-70 inches below the surface and is calcareous silt loam. In the mixture, clay provides soil the ability to hold moisture. Sand helps the soil from becoming too compact, and it allows moisture to move readily through the soil profile. Soils that have a medium texture and relatively equal ratio of all particle sizes are ideal for Kansas crops. The mixture of silt loam can contain 10-50% of sand; 70-100% of silt; and 0-30% of clay. Therefore, a mixture of 70% silt, 15% sand and 15% clay would fall into the silt loam soil texture.



A Soil Textural Triangle is a tool that allows a person to look at percentages of sand, silt, and clay in soil to determine its type by texture.

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Lesson 1: Mudshake

Materials

- One quart-size canning jar with lid and rings (found in local discount or farm supply store)
- Marker
- Pitcher of water
- 2-cup liquid measuring cup
- One sharpshooter spade or trowel
- Measuring cup
- Wide funnel
- A 12” ruler
- Larger container (recycled ice cream bucket or recycled vegetable can from food service with sharp edges removed)
- Copies of Soil Textural Triangle
- Copies of Student Worksheet A: Mudshake

Procedures

1. Divide students into small groups, and give each group a glass canning jar.
2. Instruct the students to mark the halfway point (or two cup point) on the jar with a marker.
3. Have the students mark the full point (or four cup point on the jar) with a marker.
4. Demonstrate how to take a soil sample by digging straight down with sharpshooter spade or large hand trowel for 12 inches. Loosen the soil.
5. Assign soil collection points on the school grounds, such as school flower garden, school play ground, school soccer or football field to each group.
6. Have students take soils samples from their soil collection points.
7. Instruct students to put loose soil into an empty gallon container like a recycled ice cream bucket or large vegetable can.
8. Students should mix the soil.
9. Instruct students to reserve one to two cups of soil. Place the reserved soil in a quart-size re sealable plastic bag. With a marker, label the bag with the group members’ names. The soil will be used for Activity 2 - Mudpie.
10. Using a wide funnel, students will place two cups of soil into the jar, up to the halfway point.
11. Each group of students should return to the classroom with soil in their jars.
12. Each group should fill the remainder of the jar, up to the full point or four cup line, with water (should be about 2 cups). Students should record the exact amount of water used on Student Worksheet A: Mudshake.
13. Have students attach the canning ring and cap tightly and invert the jar over a plastic tub or trash can to check that it will not leak.
14. Instruct students to shake the jar for several minutes until all the soil and water are thoroughly mixed.
15. Students should set the jar on a level surface to let the particles settle out. Observations will be taken the next day. The water should turn clear in the top of the jar, and the soil particles should settle to the bottom in layers. If the water is still cloudy, the clay hasn’t fully settled out. It may take several hours or a day to separate.
16. The following day, the students should complete Student Worksheet A: Mudshake.

Lesson 2: Mudpie

Materials

Per group of students:

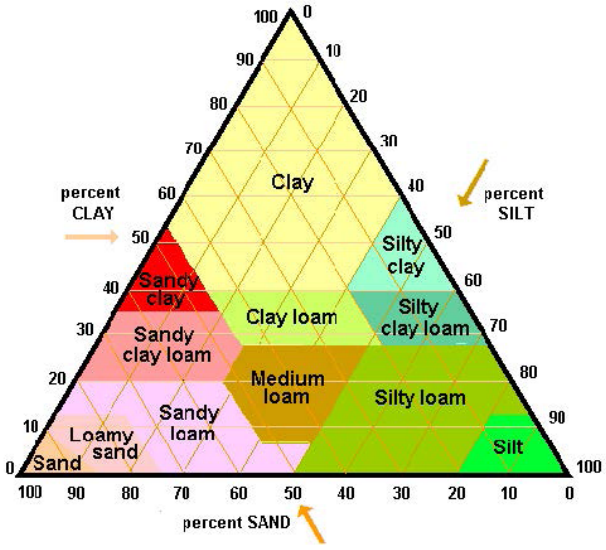
- One quart-size resealable plastic bag

Per class:

- Spray bottle with water
- Large tub

Procedures

1. This lab should be conducted outside or over a large tub to contain water.
2. Instruct students to take some soil from their resealable plastic bags and rub it between their thumbs and fingers.
3. Explain to the students that the grittier the soil feels, the more sand content there is in the soil. If the soil feels like flour or face powder, it contains a lot of silt.
4. Spray the soil in each student's palm with a small amount of water.
5. Encourage students to squeeze the "mudball." If the soil holds together and get stickier the more they work with it, it contains a lot of clay and silt. If the soil won't hold together, it contains more sand.
6. Spray some more soil with water and try to mold it into a snake form. If a long snake can be created, the soil contains more clay. If the "snake" can be squeezed into a thin ribbon between a thumb and index finger, the soil contains more silt.
7. Refer to the conclusions the students made regarding their soil types from the Soil Textural Triangle and discuss any similarities or differences.



Source: Idaho One Plan

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Conclusion Questions

1. What type of soil did your sample turn out to be according to your measurements and the Soil Textural Triangle?
2. Thinking about the percentages of sand, silt, and clay in your soil:
   a. Will your soil be a good place for plants to grow?
   b. Will it be able to hold water?
   c. Will it hold too much water?
   d. Will water run through it too quickly taking nutrients with it (leaching)?
3. Would the roots be able to move freely or be trapped as the plant grows?
4. Would there be enough pores in the soil structure to hold water, oxygen and nutrients or would it be easily compacted?
5. What are three main particles in soil?
   Sand, silt, and clay
6. What is loam?
   Loam is the term used for a mixture of sand, silt, and clay.
7. Why do you want a nearly equal mixture of sand, silt, and clay?
   Soils that have a medium texture and relatively equal ratio of particle sizes are ideal for Kansas crops because they all plant roots to easily grow and reach stored nutrients and water.
8. What percentage of mineral matter makes up average soil?
   45%
9. What percentage of water makes up average soil?
   25%
10. What percentage of air makes up average soil?
    25%
11. What percentage of organic matter makes up average soil?
    5%

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Vocabulary

Clay: the smallest-sized soil particles. Clay feels sticky when wet, and it holds water in place in the soil.

Loam: soil texture with moderate amounts of sand, silt, and clay.

Minerals: the inorganic particles in soils that are produced from rocks as they are weathered by temperature, wind, water, or natural disaster.

Nutrients: elements or compounds that nourish organisms and are essential for growth.

Organic matter: material that comes from decayed plants and animals. It always contains compounds of carbon and hydrogen.

Sand: the largest particles that make up soil texture. The large spaces around sand allow water to move through the soil to get to the roots. Sand feels gritty.

Silt: medium soil particles sized between sand and clay. Silt feels like face powder; smooth and silky.

Soil: the naturally occurring mixture of mineral, organic matter, water and air that occurs on the earth's surface.

Soil Textural Triangle: a tool that allows a person to look at percentages of sand, silt, and clay in soil to determine its type by texture.

Soil Texture: the relative proportions of sand, silt and clay particles.

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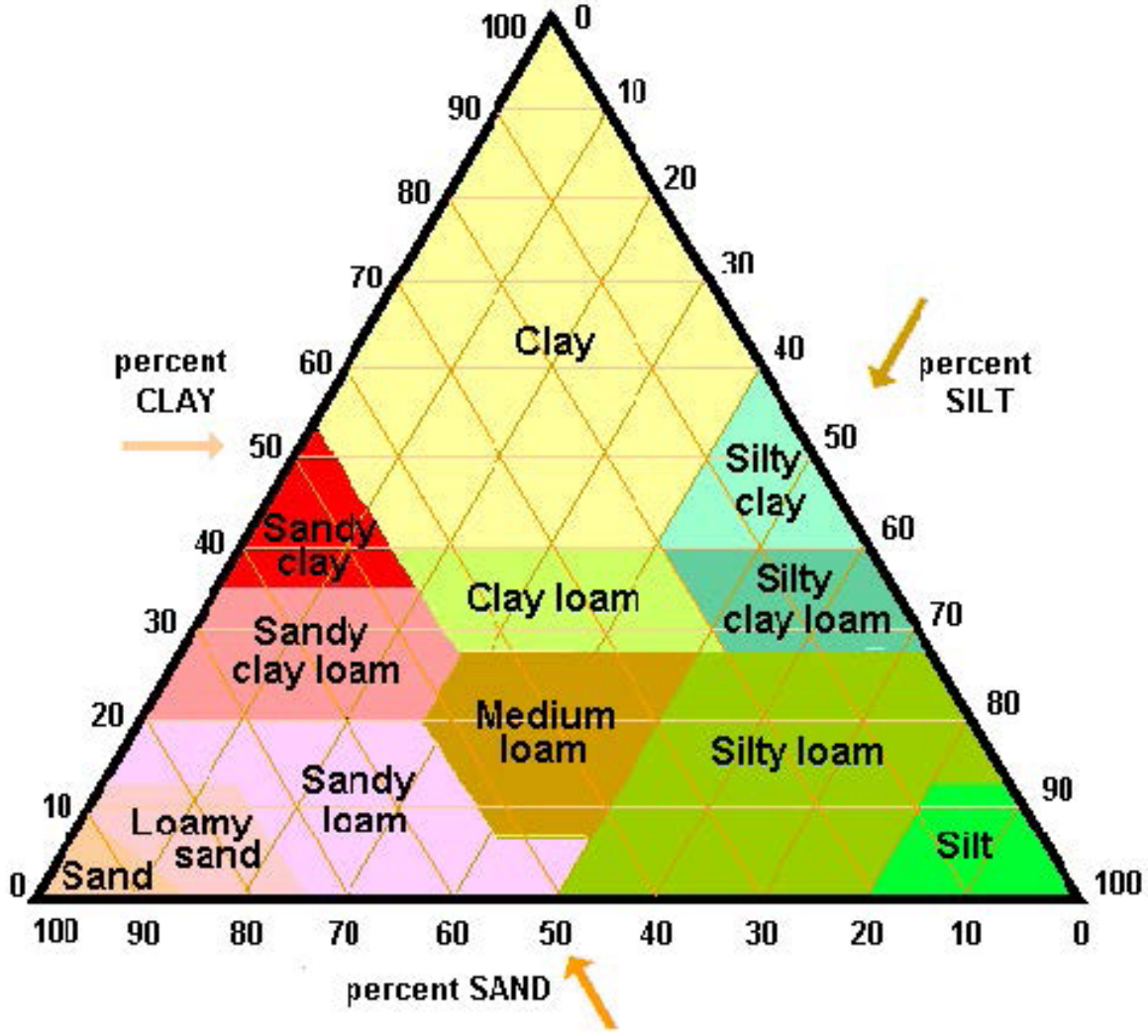
Soil Textural Triangle

A Soil Textural Triangle is a tool that allows a person to look at percentages of sand, silt, and clay in soil to determine its type by texture.



Student Worksheet A: Mudshake

Write answers on the blanks provided.

Day 1

How much soil was added to the jar?
How much water was added to the soil in the jar?

Day 2

Be very careful not to disturb or move your Mudshake. One student should hold the jar in place, and another student should take a ruler and measure the levels of particles.

1. Is there any intact organic matter (not decomposed yet) floating in the clear water, such as leaves or twigs? If so, estimate how much is there?

2. Measure the layers of the Mudshake.
    a. How many inches of your Mudshake are sand (or bottom layer)?
    b. How many inches of your Mudshake are silt (or middle layer)?
    c. How many inches of your Mudshake are clay (or top layer)?
    d. What is total number of inches of the layers?

3. Determine the percentage of sand, silt, and clay in your sample. Note: Take each layer and divide it by the total of all the measurements.
    a. Sand_____ % (sand measurement/total measurement)
        As a fraction_____
    b. Silt_____ % (silt measurement/total measurement)
        As a fraction_____
    c. Clay_____ % (clay measurement/total measurement)
        As a fraction_____

4. Look at Appendix B: Soils Textural Triangle to determine what type of soil was collected by finding the percentages of sand, silt, and clay to see where the lines intersect on the pyramid. This tool is helpful in deciding soil type using texture or particles.
Type of soil:_____

5. Create a circle or pie graph of the components of the soil you collected. Compare your graphs and results with your classmates.