NOTES

Objectives:

- Understand that soil is composed of inorganic and organic solid material, water, and air.
- Investigate the properties of the inorganic solid components of soil: sand, silt, and clay.
- Recognize that varying proportions of sand, silt, and clay in a soil impact the soil's ability to hold and transmit water.
- Experimentally determine the soil texture of a local soil sample.
- Determine the chemical composition of a local soil sample for pH, nitrate, phosphorus, and potassium levels.
- Analyze a given soil's ability to support crops such as corn, soybeans, wheat, and oats.
- Provide recommendations for amending a given soil to support the needs of various crop plants.

Background Information

Most middle-school students don't actively think about the importance of soil unless they are told to wash the "dirt" from their hands or clothes. However, without soil, agriculture as we know it would cease to exist. Soil provides the structure and nutrients necessary for farmers to grow food, fuel, and fiber. Containing air, water, organic (derived from living matter) and inorganic material, soil is considered one of the most important mineral resources of a nation. According to the United States Geological Survey, entire civilizations have prospered or declined based upon the productivity of the soils in their regions. As a human race, we are dependent upon soil and other earth resources.

Soil texture determines the availability of water in the soil, its **permeability** (ability to transmit fluid through pores), **bulk density** (weight per volume), and infiltration rates (how fast water can enter the soil). As such, the texture of the soil influences land use and agricultural management practices. Three major particles – sand, silt, and clay – are produced by the weathering process of inorganic material.

Sand Silt Clay

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Sand constitutes the largest of the particles and increases the permeability of soil and its ability to move water through the soil. However, it does not retain water or other nutrients well. Silt, on the other hand, has the ability to pull water up from a water table due to its high capillary action. Clay is the smallest of the three particles and has a very high water-holding capacity. Clay is also the particle which contributes the most to the nutrient movement between the soil and the plant's roots. However, clay soils can be very difficult for farmers to work with, and their water-holding ability can make it difficult for a plant's roots to penetrate into the clay soil. A combination of the three particles in relatively equal proportions is referred to as a **loam** soil. This type of soil incorporates the best properties of all three components while minimizing the negative aspects of each individual component. Loamy soils often drain well, yet retain moisture and are nutrient rich.

Relative sizes of soil particles

Sand: $0.05mm \leq x < 2.0mm$

Silt: $0.002mm \leq x < 0.05mm$

Clay: $x < 0.002mm$

Soil texture is often considered a "permanent" characteristic of soil that is hard to change. However, adding organic material to the soil can improve its texture. Compost, leaf mold, humus and decaying crop plant waste can add organic material to a soil.

The chemical composition of soils also plays a major role in the agricultural productivity of the soil. **Soil pH** is a measure of the acidity of a soil. Most minerals and other nutrients are more soluble in acidic soils than in soils that are more neutral or alkaline. However, soils that are too acidic can also pose problems ranging from poor nutrient uptake to increased soil toxicity to such metals as aluminum and manganese. For soils that are too acidic, lime can be added to increase the pH level.

Soil macronutrients are essential to maximizing yield of crop plants. Determining the amounts of **nitrogen**, **phosphorus**, and **potassium** in a sample of soil is essential in managing fertilizer application location, times, and rates. Soils that are high in essential macronutrients need little or no additional supplementation. However, soils that are deficient in one or more of the nutrients need supplementation through fertilization. Other management practices that contribute to soil fertility include crop rotation, tillage, water management, and insect/weed control.

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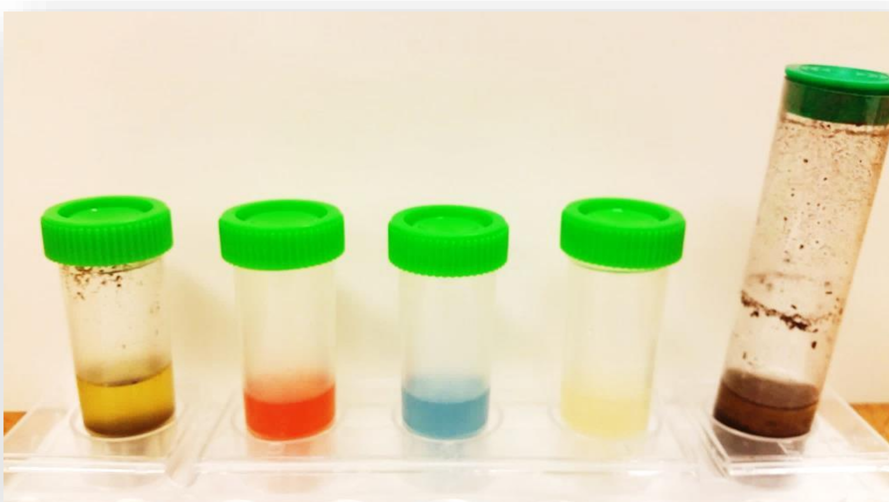
Inquiry Overview

In this unit, students will explore soil texture and soil fertility and will use the information they obtain to recommend which crops could be grown in a certain soil and identify management practices which could enhance the soil's ability to produce these crops.

In the first activity, students will explore properties of the three main components of soil: sand, silt, and clay. Then, using a locally-obtained soil sample they will determine the texture of the soil by measuring the amount of sand, silt, and clay in the sample. They will use the USDA soil textural triangle to classify the soil's texture and will decide on its ability to grow various Illinois' crops.

Next, students will use the soil sample to test the acidity of the soil as well as the amount of the macronutrients nitrogen, phosphorus, and potassium that are present in the sample. Based upon the results of their testing, students will develop a recommendation to present to the National Resources Conservation Service (NRCS) regarding potential crop production and soil management practices in their area.



NOTES

Activities

Activity 1: Don't Call it Dirt!

Objectives:

- Understand that soil is composed of inorganic and organic solid material, water, and air.
- Investigate the properties of the inorganic solid components of soil: sand, silt, and clay.
- Recognize that varying proportions of sand, silt, and clay in a soil impact the soil's ability to hold and transmit water.
- Experimentally determine the soil texture of a local soil sample.

Standards:

NGSS Science and Engineering Practices: SEP3, SEP4, SEP5
Common Core State Standards Mathematics: 6.RP.A.3.c
Common Core State Standards ELA/Literacy: 6-8.RST.3, 6-8.SL.1

***Estimated Time*:**

- **5 Minutes – Background information**
- **25 Minutes – Soil Components Activity**
- **20 Minutes – Sample Composition Identification**
- **10 Minutes – Debrief**

Don't Call it Dirt! Materials:

for the class:
- Measuring spoon set

for each team of 3:
- Soil Component Template
- Small Cup of Water
- Disposable Pipette
- ¼ tsp sample of clay, silt, and sand
- 25 mL soil sample in paper cup (school)
- Wax paper
- 100 mL graduated cylinder
- ½ tsp alum
- Distilled water
- Ruler
- Dowel Rod

for each student:
- Student Pages
- Computer with Internet

Advanced Preparation:

Prior to this lesson, you will need to obtain a soil sample. It is recommended that you obtain a sample from as close to the school as possible for student analysis. You will need about 3 cups of prepared soil.

To prepare the soil, dig about 2 inches below the grass root line. Then dig down from 2 to 6 inches below the root line and obtain a sample of about 4 cups. Spread the sample out onto wax paper to dry and remove any large stones, twigs, leaves, or other material. Once the soil has dried, pulverize it using a rolling pin or mallet into small aggregate pieces. If desired, you may pass soil through a screen or sieve. Store soil in a container with lid until ready to use.

Suggested Inquiry Approach:

Determine prior to the start of the activity where student teams of three will go in the classroom to pick up their materials. If there is no sink in the classroom, provide a bucket or large 1 liter container of water so that student teams are able to fill a graduated cylinder and a small paper cup.

Group students into teams of two or three. Then, pass out student pages. Ask a volunteer to read the background information and problem statement to the class. If desired, ask students what they think the words in bold print might mean and ask teams to work together to form a definition.

Provide students with a 100 mL graduated cylinder, 25 mL soil sample, dowel stir rod, and ruler. Let students know where the Alum, water, and measuring spoons are located, and direct students to carefully follow Steps 1 through 4 of their procedure. Allow soil to settle for at least 30 minutes.

Meanwhile, students will need to be provided with a Soil Component Template, sheet of wax paper, a small paper cup of water, and disposable pipette. Show students where they can bring their template covered with wax paper on which to place their sand, silt, and clay samples. Allow students adequate time to work through Steps 5 through 8 on their student pages.

As student teams reach Step 9, they will need you to provide a sheet of soil properties for sand, silt, and clay. Students should cut out the properties and place them below the appropriate component of sand, silt, or clay. Allow students to complete Steps 9 and 10, and then reconvene the class for discussion.

Ask teams to share their sorted properties of sand, silt, and clay as well as their justification for declaring it a property of sand, silt, or clay. Students should rely on their observations to support their decision. If there is disagreement among teams for a particular property, allow the teams to respectfully debate, again using justification, for why they believe the way they do.

After all properties of sand, silt, and clay have been sorted, ask students to share their ideas on how to use the soil textural triangle to classify soils and to provide their compositions that they believe are "ideal" for growing crops in Illinois.

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Advanced Preparation:

Soil Component Templates will also need to be cut apart prior to completing this activity.

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Note:

Clay may not settle out in a sufficient quantity for students to measure in 30 minutes. If possible, keep the soil samples in the graduated cylinders for 1 week and review the calculations again prior to the next activity.

Next, direct students to carefully retrieve their soil columns that are "settling" in the graduated cylinders. The first layer to settle will be the sand layer. This is the value that the students measured after about 1 minute of settling time. After 30 minutes, most of the silt will have settled out of suspension and some of the clay. If students have taken a measurement of the total height of the column of soil before mixing, they can subtract the sand and the silt to find the height of the clay layer. However, sometimes the addition of water will cause the soil sample to swell somewhat, and the heights will appear greater than the initial height. If this happens, ask students to estimate the amount of clay that they believe is in the sample. They can check their work the following week after the clay has had sufficient time to settle. The material that is floating on the top of the sample, if any, will be organic material (mainly humus). Students will check their work with the teacher and may need assistance with their percent calculations.

Students will be working with the USDA (United States Department of Agriculture) Soil Textural Triangle. To use the triangle, follow the steps below:

1. First, look at the orientation of the percentages on the sides of the triangle. Sand is along the bottom and increases from right to left. Clay is along the left side of the triangle and increases from bottom to top. Silt is along the right edge of the triangle and increases from top to bottom.

2. On the chart, the percentages of sand, silt, and clay at each intersection point will add up to 100%.

3. To classify a soil sample, you will determine the amount of clay in the sample and then draw a horizontal line through the triangle from left to right.

4. Next, determine the amount of silt in the sample along the right scale and draw a line going down diagonally to the left.

5. Determine the amount of sand in the sample along the bottom scale and draw a line going up diagonally to the left.

6. Mark the point of intersection.

To classify a soil sample, you find the intersection of the three lines that correspond to the three proportions. On the chart, all of the percentages will add up to 100%.

The example below is for a soil that is 20% clay, 40 % silt, and 40% sand. Note that the intersection of this soil composition is classified as loam.

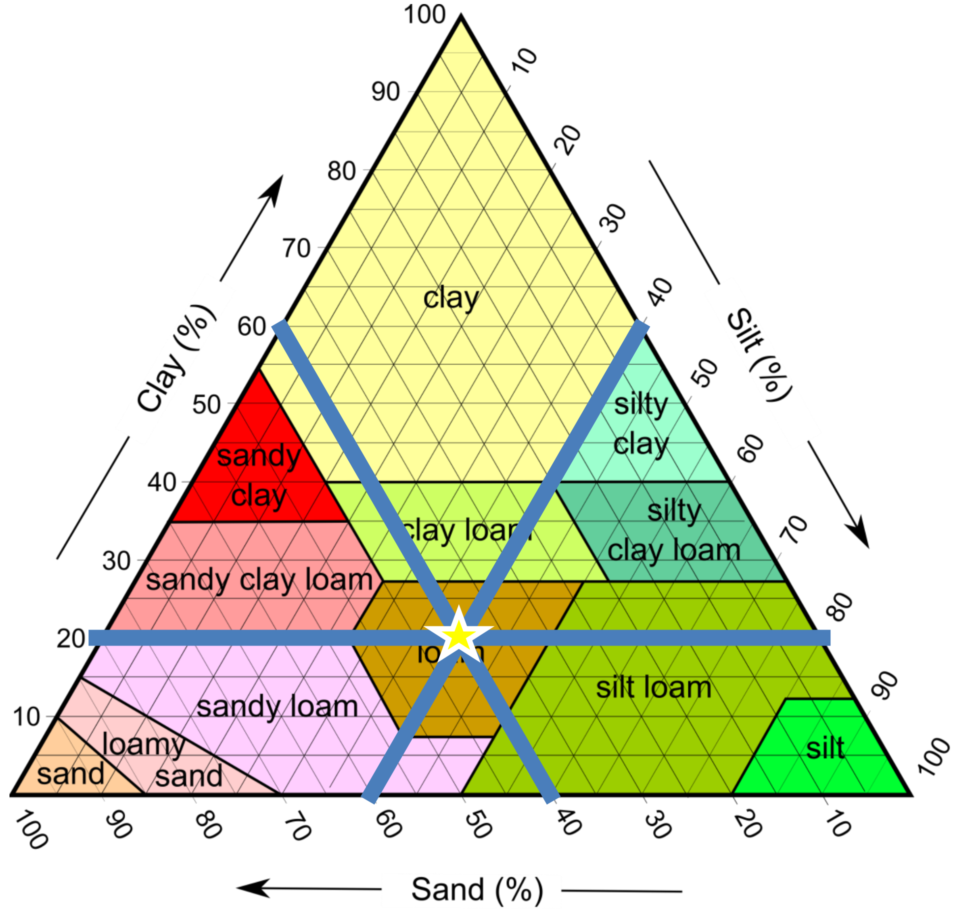

Image courtesy: https://commons.wikimedia.org/wiki/File:SoilTexture_USDA.png

If students will be keeping their soil columns intact for a week, carefully move them to a location where they will not be disturbed. Students should dispose of their sand, silt, and clay samples and clean up their areas.

Debrief Activity 1:

- ***How accurate do you believe your calculations are for your soil sample's composition of sand, silt, and clay? How might you improve your accuracy?***
- ***What do you think loam means on the textural triangle?***
- ***Which soil classifications would Illinois' crop plant prefer? Why do you think this is a desirable combination of sand, silt, and clay?***
- ***How does your soil sample compare to the "desirable" soil type?***
- ***What might we do to improve the texture of the soil?***

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A YouTube video at https://www.youtube.com/watch?v=4hW59WZ0EQI provides an explanation of how to use the Soil Textural Triangle.

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Activity 2: Managing Soil Fertility

Objectives:

- Determine the chemical composition of a local soil sample for pH, nitrate, phosphorus, and potassium levels.
- Analyze a given soil's ability to support crops such as corn, soybeans, wheat, and oats.
- Provide recommendations for amending a given soil to support the needs of various crop plants.

Standards:

NGSS Science and Engineering Practices: MS-ESS3-3, SEP3, SEP4, SEP6, SEP8
Common Core State Standards ELA/Literacy: 6-8.W.9, 6-8.SL.1, 6-8.SL.4, 6-8.RST.3

***Estimated Time*:**

- **10 minutes – Introductory discussion**
- **50 Minutes – Soil Chemical Tests**
- **35 Minutes – Research and Proposals**
- **25 Minutes – Presentation and Debrief**

Managing Soil Fertility Materials:

for the class:
- Measuring spoon set

for each team of 3:
- 30 mL graduated cup
- Soil sample
- Teaspoon
- 4 – conical tubes with lids
- 1 tube with snap-on lid
- 1 – each TesTabs for:
  pH
  Nitrogen
  Phosphorus
  Potassium
- 2 – Floc-Ex TesTabs
- Distilled water
- Disposable Pipette
- pH soil color chart
- NPK soil color chart
- Safety Gloves
- Safety Goggles

for each student:
- Student Pages
- Computer with Internet Access

Advanced Preparation:

Prior to the activity, be sure to cut apart the TesTabs tablets and place into labeled containers or placed on top of an index card or other piece of paper labeled with the type of TesTab. Once they are cut apart, it is difficult to tell the names of the tablets marked on the foil. Plant Characteristic Cards may also be cut apart if desired.

Also, you will need to prepare soil. If you have completed Activity 1, there should be enough soil remaining. Otherwise, you will need to prepare about 1 cup of soil according to the instructions in the ***Advanced Preparation*** section of Activity 1.

Determine where materials will be located in the classroom for this activity prior to beginning the activity. Be sure to use distilled water as directed for all chemical tests.

SAFETY NOTE: **Students should wear goggles and gloves whenever handling any chemical reagent in this activity. Although LaMotte TesTabs are designed for use in middle school, please read all provided SDS sheets prior to using any unknown chemical reagent.**

Suggested Inquiry Approach:

Students should be grouped into teams of three for this activity. Pass out student pages and ask one student to volunteer to read aloud the information in the gray box at the top of the student pages and to also read to the class the problem statement. Students initially will be performing four soil tests:

- pH test for Soil Acidity
- Nitrogen (Nitrate -N) Test
- Phosphorus (P) Test
- Potassium (K) Test

Refer to the unit on **Nutrient Management** for additional information on the macronutrients nitrogen, phosphorus, and potassium.

Next, indicate to the students where to find their materials and stress to them the importance of using good safety procedures when handling the chemical reagents. As they proceed through testing their soil sample for pH level, nitrogen level, phosphate level, and potassium level, encourage students to carefully read the procedures for each test and to use the checkboxes to keep track of their progress. If desired, students may use some masking tape and a marker to label their conical tubes or may use the other side of their Soil Component Template to place each conical tubes on its properly labeled circle.

As they complete each test, it is important to remind student teams to analyze the results of the test using the appropriate charts and to view the information on the Plant Characteristic Cards to determine how the test result can impact a particular crop.

Students will then gather all of their findings from both the soil texture test and the chemical tests (be sure to use the same soil for both activities!). Students will be acting as consultants for the National Resources Conservation Service. They will now generate a recommendation for which crops could grow in the soil and/or what steps need to be taken to prepare the soil to grow crops. Students should focus on choosing management practices that would enhance the soil's productivity without endangering the environment. Students may research soil management practices on the internet if computers are available.

NOTES

Some websites that may be useful for student research are as follows:

- http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/mgnt/
- http://extension.cropsciences.illinois.edu/handbook/pdfs/chapter08.pdf
- http://soilquality.org/management/soil_management_practices.html
- http://www.soil-net.com/dev/page.cfm?pageid=secondary_intro&loginas=anon_secondary

Allow teams about 35 minutes for research and to prepare their recommendations. Then, have each team share their recommendations with the class. Following presentations, debrief the activity using the suggested questions in the section below.

** Please remove tape and rinse and dry conical tubes prior to returning to the kit. Reagents may be poured down the drain (soil from pH test can be discarded). Be sure to flush drain with water after disposing of reagents. **

Debrief Activity 2:

- ***Which soils would need to have more frequent irrigation and fertilization treatments? Why?***
- ***If soils that have a high percentage of clay are slow to drain, what management practices could a farmer use to help their fields more adequately drain? Why would proper drainage be necessary?***
- ***What other characteristics of soils might be necessary to analyze to make more informed decisions?***
- ***If a soil is not "ideal" for growing a particular crop, should a farmer still try to produce it? Justify your thoughts.***

Background Information: Without soil, the agricultural industry as we know it would not exist. Soil is essential in providing physical support, water, and nutrients to crop plants. Soil is composed of **inorganic** materials such as sand, silt, and clay, **organic** materials, water, and air. The proportion of sand, silt, and clay in a soil determines its **texture**. Soil texture and its associated pore space control many other properties of the soil. In this activity, you will investigate samples of sand, silt, and clay to observe their relative properties and will then hypothesize the combination that would provide an "ideal" soil for growing Illinois crops of corn, soybean, wheat, or oats. Next, you will investigate how to classify soil by texture and apply your knowledge to determine the soil texture of a sample of soil in your area.

Problem: What soil composition is "ideal" for producing Illinois crops?

Materials per team:

- Soil Component Template
- 1 – Disposable Pipette
- Wax paper
- 100 mL graduated cylinder
- 75 mL distilled water
- Paper towels
- Small Cup of Water
- ¼ teaspoon samples of sand, silt and clay
- ½ teaspoon Alum
- Dowel stir rod
- 25 mL soil sample in paper cup

Procedure:

1. Using the 100 mL graduated cylinder, fill the cylinder to the 25 mL line with a sample of soil provided by your teacher. Using a ruler, record the height of the soil column (in mm). _______ Empty the soil sample into a paper cup.

2. Fill the cylinder with distilled water to the 50 mL line, and gently pour the soil sample into the cylinder. Stir with the dowel stir rod.

3. Fill the cylinder with distilled water to the 100 mL line. Take a piece of wax paper and place over the end of the cylinder. Using your hand to cover the wax paper and the end of the cylinder, turn the cylinder upside down several times to thoroughly mix the soil and water and/or use the stir rod.

4. Add ½ teaspoon of Alum and gently invert the cylinder to mix. Be sure to place wax paper and your hand over the cylinder. Set the cylinder down to rest for one minute and record the height (in mm) of the layer that forms along the bottom using a ruler. __________
   What do you think the layer is? ____________________

5. Do not move or disturb the cylinder for at least 30 minutes.

6. Now, you will receive a Soil Component Template from your teacher. Place the template underneath a sheet of wax paper. You will be scooping ¼ teaspoon samples of sand, silt, and clay onto the appropriate circles on the template. Make sure that all of the sample material is contained within the appropriately labeled circle.

7. Using a hand lens, investigate each material and record your observations in the space below. You may touch each material with your hands, but be sure to keep each material separate at this time.

Sand	Silt	Clay

8. Make sure that all of your sample materials are contained within their proper circular areas. Then, take a disposable pipette and fill it with 3 mL of water. Drop the water from the pipette onto the sample of sand. Repeat with 3 mL of water for both the silt and clay samples. Record your observations below:

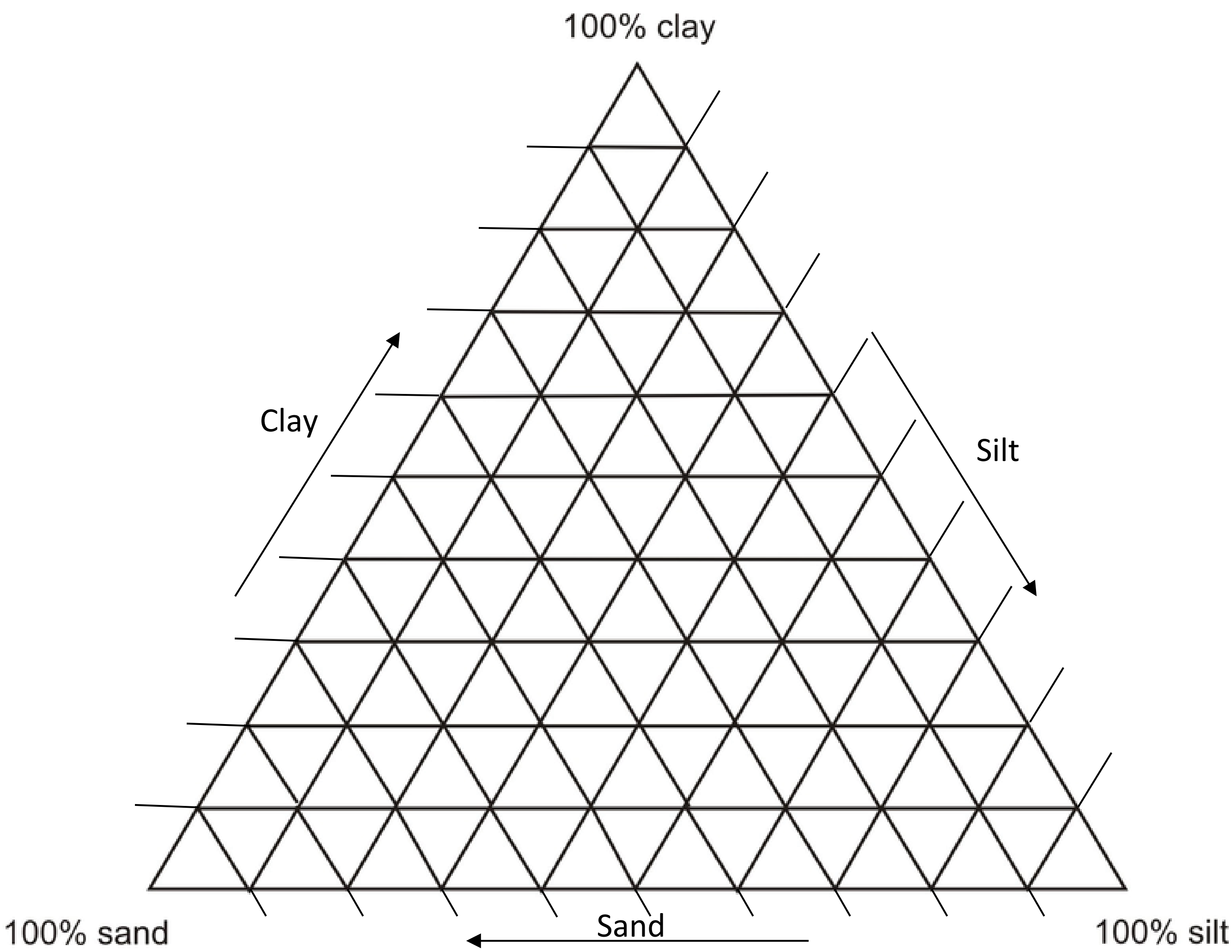
Sand	Silt	Clay

9. Using the pipette, mix the water into each of the separate samples within their circle. Then, tilt the template forward and record your observations below:

Sand	Silt	Clay

9. Your teacher will provide your team with a set of properties of sand, silt, and clay. Cut out each of the individual properties and place below the circle template for sand, silt, and clay. Use your observations to guide you and be prepared to discuss your choices with the class.

10. The **texture** of a soil is determined by measuring the proportion of soil that is sand, silt, and clay. A special graphic display known as a **soil textural triangle** is used to graph the percent of a soil sample that is sand, silt, and clay. Investigate the triangle below and determine with your team how you might use the triangle to graph how much sand, silt, and clay are in a sample of soil. Then, mark on the triangle the composition of sand, silt, and clay that your team thinks would be "ideal" for growing crops such as corn, soybeans, wheat, or oats in Illinois. Justify your choice.



11. Now, carefully examine your soil sample in the graduated cylinder that has been resting undisturbed for at least 30 minutes. Your sample has separated into different layers.

Based upon the properties of each of the different particles, which particle would fall to the bottom of the cylinder? ______________

Which particle would be in the middle layer? ______________

Which particle would be on top of the middle layer? _________________

Why might the water be cloudy?

Is there any material that is floating on top of the surface of the water in the cylinder? _______ What might that material be?

Check your ideas with your teacher before moving on!!!

12. Calculate the relative percentage of each of the soil samples by taking the height of each individual layer and dividing it by the total height of the column of soil.

$$\frac{height\ of\ sand}{total\ height\ of\ soil} \times 100 = \_\_\_\_\_\_ \%\ sand$$

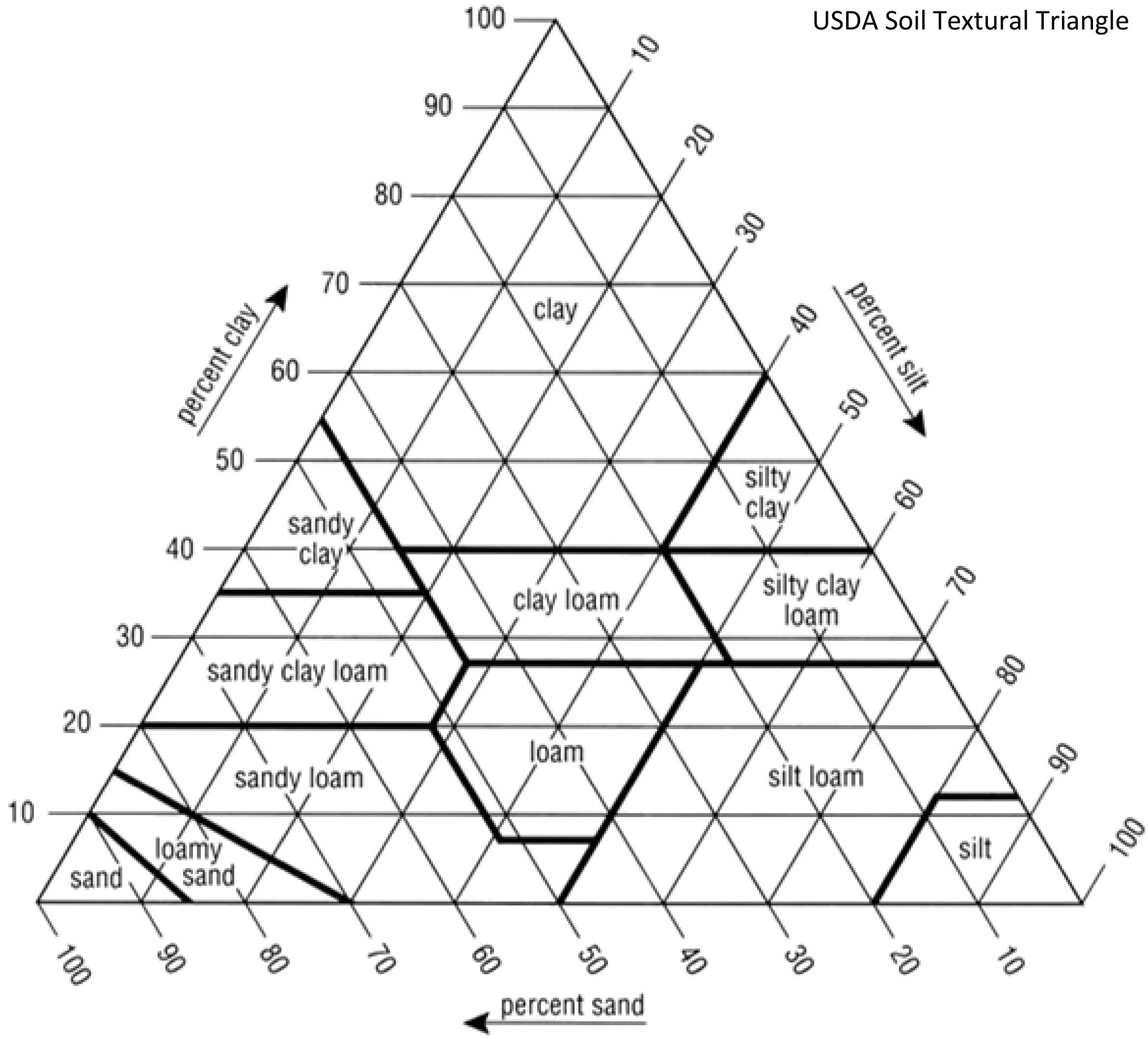
$$\frac{height\ of\ silt}{total\ height\ of\ soil} \times 100 = \_\_\_\_\_\_ \%\ silt$$

$$\frac{height\ of\ clay}{total\ height\ of\ soil} \times 100 = \_\_\_\_\_\_ \%\ clay$$

http://www.isa-arbor.com/education/onlineresources/CDDemos/triangle.swf is a website that provides a tutorial on how to use the USDA Soil Textural Triangle shown on the next page. http://soils4teachers.org/physical-properties provides additional information.

13. Record your percentage data on the soil triangle below to identify the soil texture as determined by the United States Department of Agriculture (USDA).

USDA Soil Textural Triangle



14. What do you think the word "loam" means on the triangle?

15. Most Illinois crops prefer soils that retain nutrients and hold water while still allowing the water to flow through the soil. Based on these requirements, which soil types would Illinois crop plants prefer?

How does this match your earlier prediction?

Your team has been contracted by the Natural Resources Conservation Service (NRCS) to conduct a soil survey on the area around your school. The NRCS is interested if the soil in your location would support the growth of crops such as corn, wheat, soybeans, or oats. You will prepare a recommendation based upon analysis of both the texture and various chemical properties of the soil for the suitability of the soil to produce crops. If reasonable, your recommendation may contain strategies for preparing the soil to grow one or more of these crop types in an economic and sustainable manner.

Problem: What are the properties and characteristics of a soil that make it suitable for various crops?

Materials:

- 4 – 30 mL conical tubes with caps
- 1 – snap-seal vial with lid
- 2 – disposable pipettes
- 1 – pH and NPK color chart (each)
- 1 ¼ teaspoons – soil sample
- Small paper cups
- Paper towels
- Safety Goggles
- TesTabs chemical test tablets:
  1 – pH TesTab
  1 – Nitrate WR *TesTab*
  1 – Phosphorus *TesTab*
  1 – Potassium *TesTab*
  2 – Floc-Ex tablets
- Distilled water
- 30 mL graduated cup
- Plant Characteristic Cards
- Safety Gloves

Procedure:

1. You will be working in a team of three for this activity. From your teacher, obtain the materials listed above. Note that you will be dividing the soil sample into two paper cups. In one paper cup, place **1 teaspoon** of the soil sample and in the other paper cup place **¼ teaspoon** of the soil sample.

2. Be sure to wear your **safety goggles** and **gloves** before handling any of the *TesTab* chemical reagents. Read each procedure for testing the soil sample for a given property carefully before proceeding!

pH Test for Soil Acidity

- ☐ Take one conical tube and fill to the 10 mL line with distilled water.
- ☐ Add 1 Soil pH *TesTab*
- ☐ Add your ¼ teaspoon sample of soil carefully to the conical tube.
- ☐ Cap the tube tightly.
- ☐ Mix thoroughly by inverting the conical tube 10 times.
- ☐ Stand the conical tube upright on the table and let the soil settle to the bottom of the conical tube for about 1 minute.
- ☐ Using the soil pH color chart, hold the conical tube against the white portion of the card. Match the color of the liquid above the soil sample to a color on the chart.

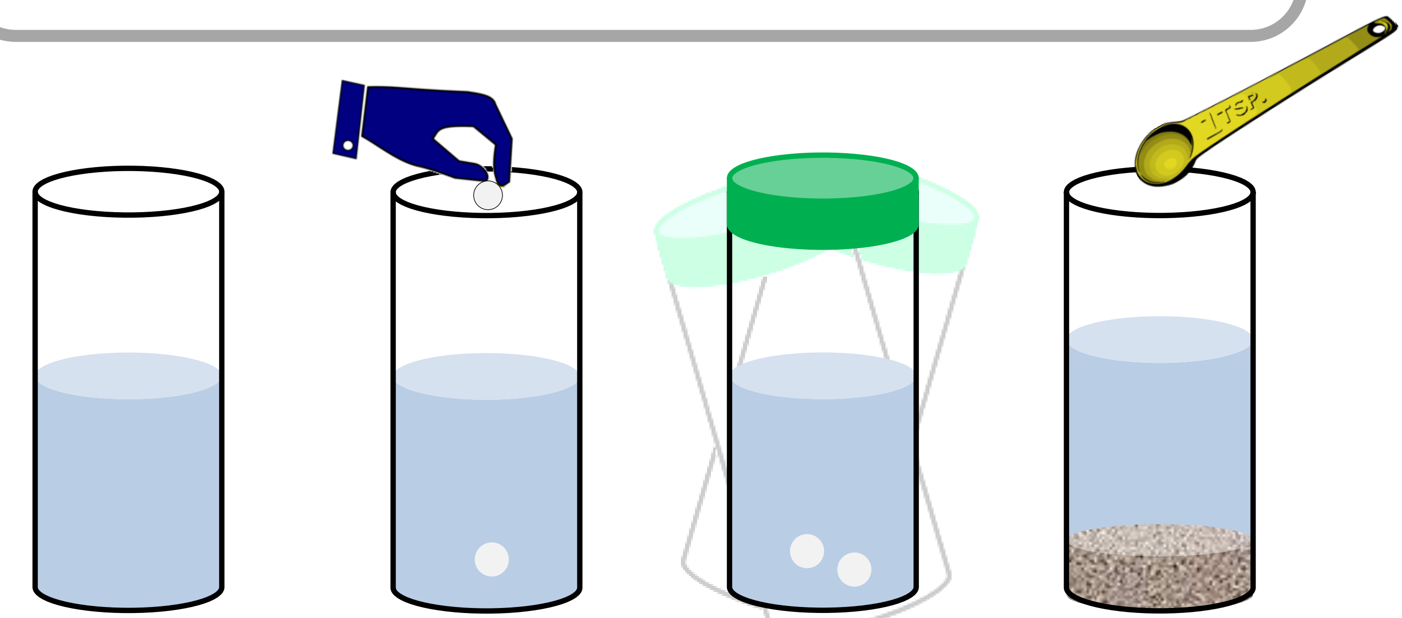
The pH of my soil sample is ______

In the space below, analyze the results of your pH test for soil acidity. You may use the <u>Plant Characteristic Cards</u> for information on the pH needs of various Illinois crop plants. Also, consider how you might "amend" the soil to provide a proper pH range for your desired crop plant.

In a previous unit you learned about the macronutrients Nitrogen, Phosphorus, and Potassium and their importance to various crop plants. You will now be testing your soil sample for the presence of these vital nutrients. For all three tests, you will be using the same solution generated using the following process:

Soil Extraction Solution

- ☐ Fill the snap-seal vial with 30 mL of distilled water. (Measure using your graduated cup.)
- ☐ Be sure to have your safety goggles and safety gloves on!
- ☐ Add **two** Floc-Ex tablets to the tube.
- ☐ Snap the cap on the tube and mix until the tablets have disintegrated.
- ☐ Now, remove the cap and carefully pour in your 1 teaspoon sample of soil.
- ☐ Re-cap the tube and shake to mix for one minute.
- ☐ Place the tube on the table and let stand undisturbed until the soil settles out to the bottom of the tube.
- ☐ The clear solution above the soil is what you will be using to conduct tests for Nitrogen (Nitrate), Phosphorus, and Potassium.



Fill with 30 mL distilled water | **Add two Floc-Ex tablets** | **Cap and shake until tablets dissolve** | **Add 1 tsp soil, cap and mix for 1 minute**

Nitrogen (Nitrate - N) Test

- ☐ Use the disposable pipette to transfer 10 mL of the clear solution above the soil to a conical tube.
- ☐ Add 1 Nitrate WR *TesTab*.
- ☐ Note: When conducting the Nitrogen test, do not expose the solution to outside UV light!!
- ☐ Cap the tube tightly.
- ☐ Mix thoroughly by inverting and shaking the conical tube for two minutes until the tablet has disintegrated.
- ☐ Stand the conical tube upright on the table and wait 5 minutes for the color to develop.
- ☐ Using the NPK soil color chart, hold the conical tube against the white portion of the card. Match the color of the liquid to its closest match on the Nitrogen portion of the color chart (the pinks).
- ☐ Use the following code: L = low M = moderate H = high

The amount of Nitrogen in my soil sample is ______

In the space below, analyze the results of your nitrate test. You may use the <u>Plant Characteristic Cards</u> for information on the nitrogen needs of various Illinois crop plants. Also, consider how you might "amend" the soil to provide the proper nitrogen needs for your desired crop plant.

Phosphorus (P) Test

- ☐ Use the disposable pipette to transfer **25 drops** of the clear solution above the soil to a conical tube.
- ☐ Using a clean pipette, fill the conical tube to the 10 mL line with distilled water.
- ☐ Add one Phosphorus *TesTab* to the conical tube.
- ☐ Cap the tube tightly.
- ☐ Mix thoroughly until the tablet has disintegrated.
- ☐ Stand the conical tube upright on the table and wait 5 minutes for the color to develop.
- ☐ Using the NPK soil color chart, hold the conical tube against the white portion of the card. Match the color of the liquid to its closest match on the Phosphorus portion of the color chart (the blues).
- ☐ Use the following code: L = low M = moderate H = high

The amount of Phosphorus in my soil sample is _______

In the space below, analyze the results of your phosphorus test. You may use the <u>Plant Characteristic Cards</u> for information on the phosphorus needs of various Illinois crop plants. Also, consider how you might "amend" the soil to provide the proper phosphorus needs for your desired crop plant.

Potassium (K) Test

- ☐ Use the disposable pipette to transfer 10 mL of the clear solution above the soil to a conical tube.
- ☐ Add 1 Potassium *TesTab*.
- ☐ Cap the tube tightly.
- ☐ Mix thoroughly until the tablet has disintegrated.
- ☐ Using the NPK soil color chart, hold the conical tube against the black (left) side of the Potassium portion of the color chart.
- ☐ You will be observing the **cloudiness** of the solution by comparing it to the shaded boxes in the right column. If the solution is clear, or not cloudy, what would be the result? ______ What if it was so cloudy you couldn't see through it at all? ____
- ☐ Use the following code: L = low M = moderate H = high

The amount of Potassium in my soil sample is ______

In the space below, analyze the results of your potassium test. You may use the <u>Plant Characteristic Cards</u> for information on the potassium needs of various Illinois crop plants. Also, consider how you might "amend" the soil to provide the proper potassium needs for your desired crop plant.

Your team will now gather all of your findings from the soil chemical tests and texture test. You will prepare a recommendation for Illinois' farmers in your local area to be presented to the NRCS. Indicate which crops you believe could be successfully grown in your area. Indicate how the soil might be improved both physically and chemically, if necessary. Also, outline any required management practices that your team feels would improve the production of any crops planted in the local soil.

Discussion Questions:

1.) Which soils would need to have more frequent irrigation and fertilization treatments?

Why?

2.) If soils that have a high percentage of clay are slow to drain, what management practice could a farmer use to help their fields more adequately drain?

Why would proper drainage be necessary?

3.) What other characteristics of soils might be necessary to analyze to make more informed decisions?

4.) If a soil is not "ideal" for growing a particular crop, should a farmer still try to produce it? Justify your thoughts.