Name: ______________________________________ Period: ____________ Date: ____________

Soil Analysis

(Physical and Chemical Properties of Soil)

(7.2.6)

(NS 2, 3, 5, 7, 11, DP 1, 2, 4, 5, 10)

FOCUS: How do scientists study and describe soil?

OVERVIEW:

Soil Physical and Chemical Properties

http://www.nrcs.usda.gov/wps/portal/nrcs/detail/nj/home/?cid=nrcs141p2_018993

Soil Properties (that will be covered in this class):

1. Soil *physical* properties
    a) soil horizons
    b) soil color
    c) soil texture
2. Soil *chemical* properties
    a) soil pH
    b) nutrients

The properties of soil tell scientists how it formed. The different properties are also important to know for growing food and other plants.

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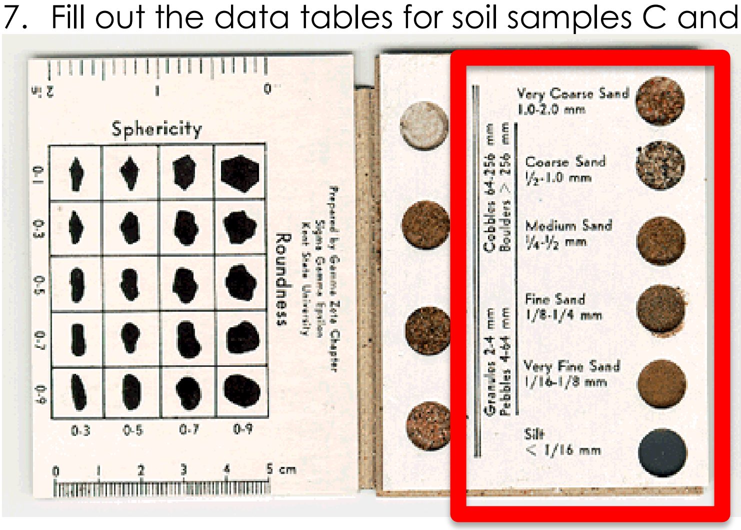
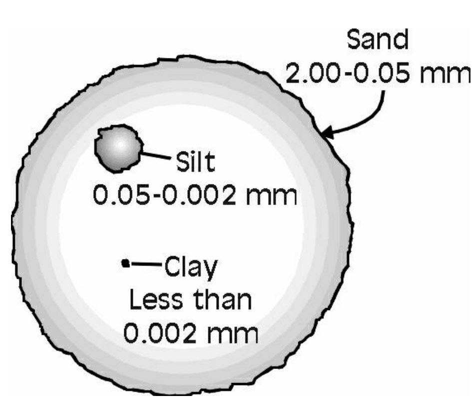
STATION 1 – Sediment Sorting

(Texture – Physical Property)

1. Make sure the soil sieve is stacked in the correct order, with "1" on the top.
2. Make sure the soil sample is DRY.
3. Pour in the entire soil sample.
4. With a hand on the bottom and a hand on the top part, shake the sieve.
5. After about a minute of shaking, open up each section, ONE AT A TIME. Do this over the bin that the soil was stored in.
6. Use the grain size chart to determine what size sediment is in each section. You can compare by looking AND feeling the each section and then COMPARING it to the grain size chart. Use the part of the grain size chart that is highlighted in **RED**.
7. Fill out the data tables for soil samples C and D.

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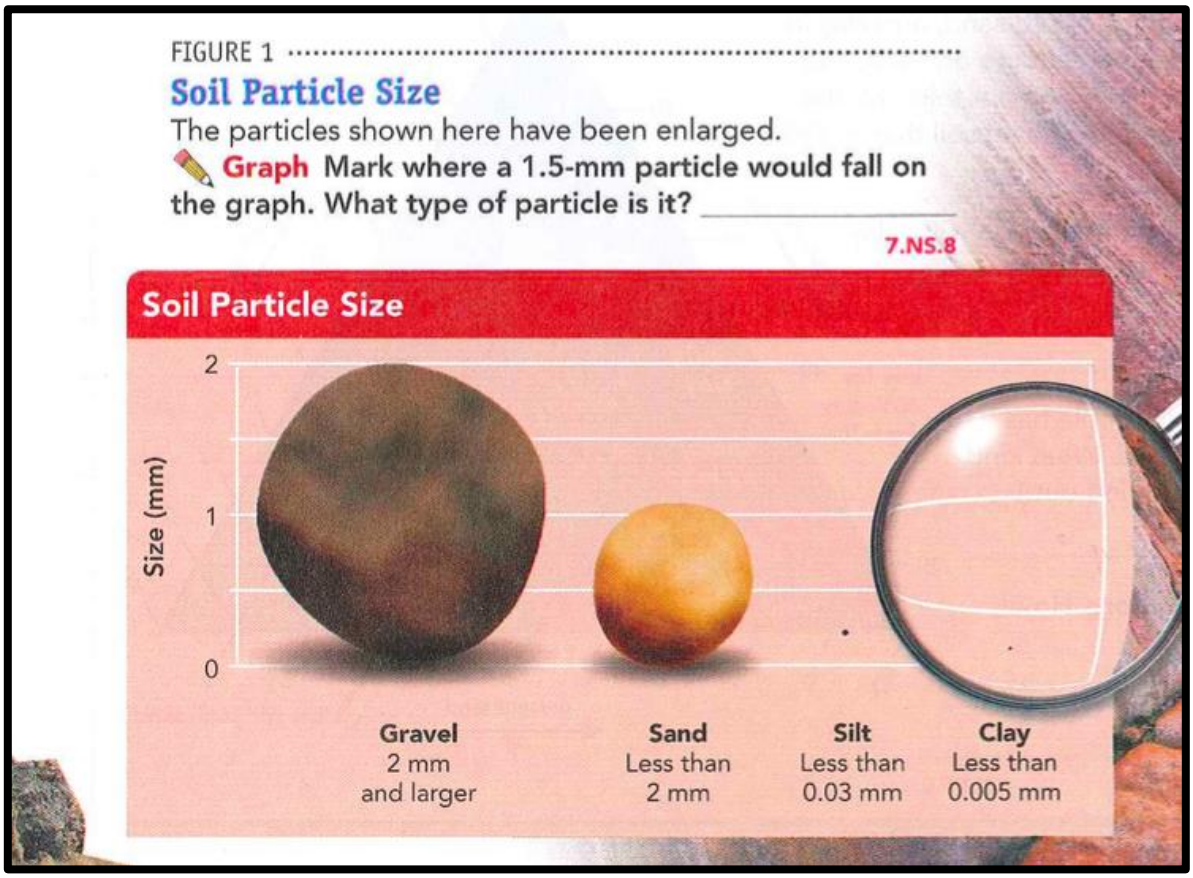
Soil Sample C		
Sieve number	Sediment Name (Qualitative)	Sediment Size (Quantitative)
1		
2		
3		
4		

Soil Sample D		
Sieve number	Sediment Name (Qualitative)	Sediment Size (Quantitative)
1		
2		
3		
4		



STATION 2 – Soil Texture and Plant Growth

Soil Composition **Soil is a mixture of rock particles, minerals, decayed organic material, water, and air.** One of the main ingredients of soil comes from bedrock. **Bedrock** is the solid layer of rock beneath the soil. Once bedrock is exposed to air, water, and living things, it gradually weathers into smaller and smaller particles that are the most common components of soil.

The particles of rock in soil are classified by size as gravel, sand, silt, and clay. **Figure 1** shows the relative sizes of these particles. Together, gravel, sand, silt, and clay make up the portion of soil that comes from weathered rock.

Soil Texture Sandy soil feels coarse and grainy, but soil with lots of clay feels smooth and silky. These differences are differences in texture. Soil texture depends on the size of the soil particles.

Soil texture is important for plant growth. Soil that is mostly clay may hold too much water and not enough air. In contrast, sandy soil loses water quickly. Plants may die for lack of air or water. Soil that is made up of about equal parts of clay, sand, and silt is called **loam.** Loam is the best soil for growing most plants.

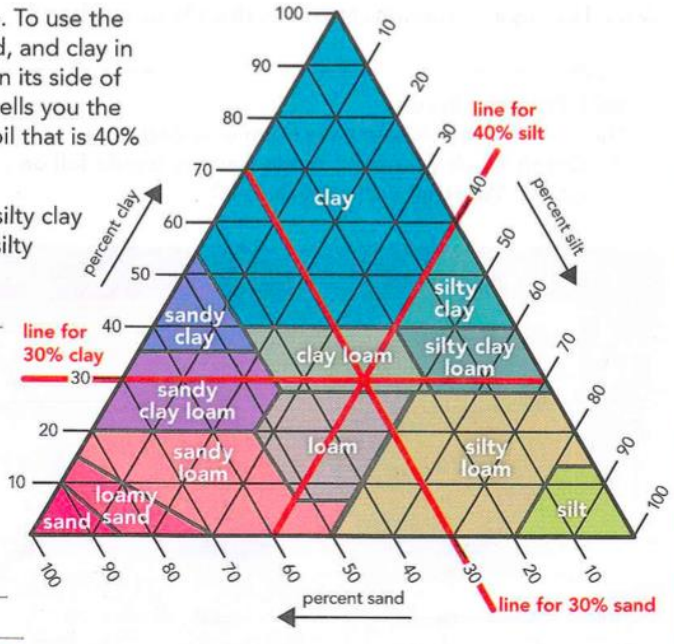
Based on texture only, why is LOAM best for growing plants? Use the text above to cite evidence for your answer. _____

_____

_____

apply it!

This diagram is called the soil texture triangle. To use the triangle, first find the percentages of silt, sand, and clay in a soil sample. Then locate each percentage on its side of the triangle. The point where the lines meet tells you the type of soil. (This example shows clay loam soil that is 40% silt, 30% clay, and 30% sand.)



1 Interpret Diagrams What percentage of silty clay loam is silt? (*Hint:* Look at the corners of the silty clay loam area.)

_____

2 Interpret Diagrams A soil sample has 20% silt, 10% clay, and 70% sand. What kind of soil is it? (*Hint:* Draw lines to find out.)

_____

3 Form Operational Definitions How would you define silty clay soil?

_____

_____

7.NS.8

Pick THREE samples below to determine the texture of. Use the soil texture triangle to evaluate each sample.

Sample #1	Sample #2	Sample #3	Sample #4	Sample #5
65% sand 20% silt 15% clay	30% sand 10% silt 60% clay	35% sand 55% silt 10% clay	25% sand 50% silt 25% clay	50% sand 10% silt 40% clay
Texture:	Texture:	Texture:	Texture:	Texture:

STATION 3 – Soil Color

(Color – Physical AND Chemical Property)

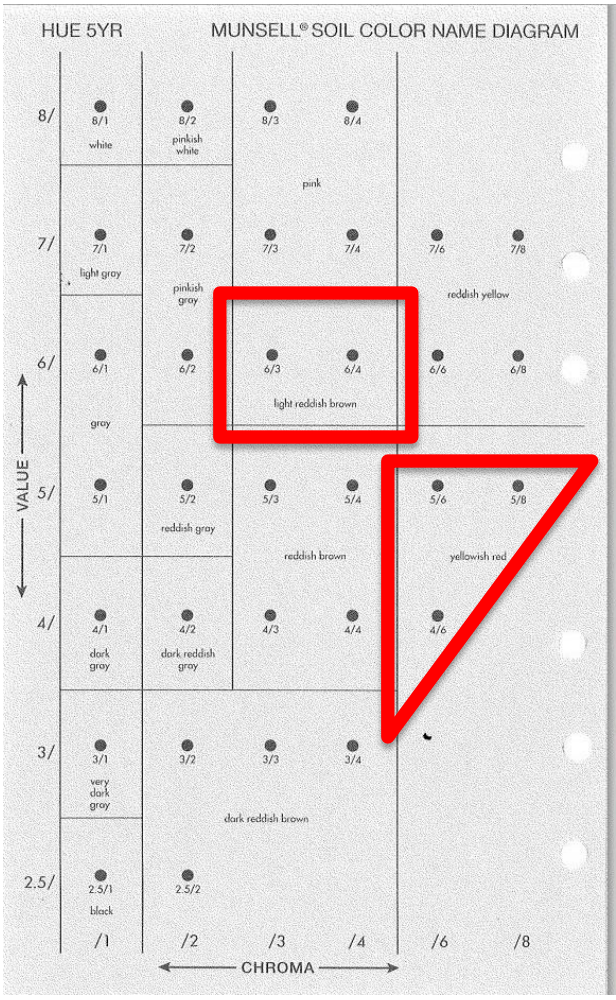
BACKGROUND:

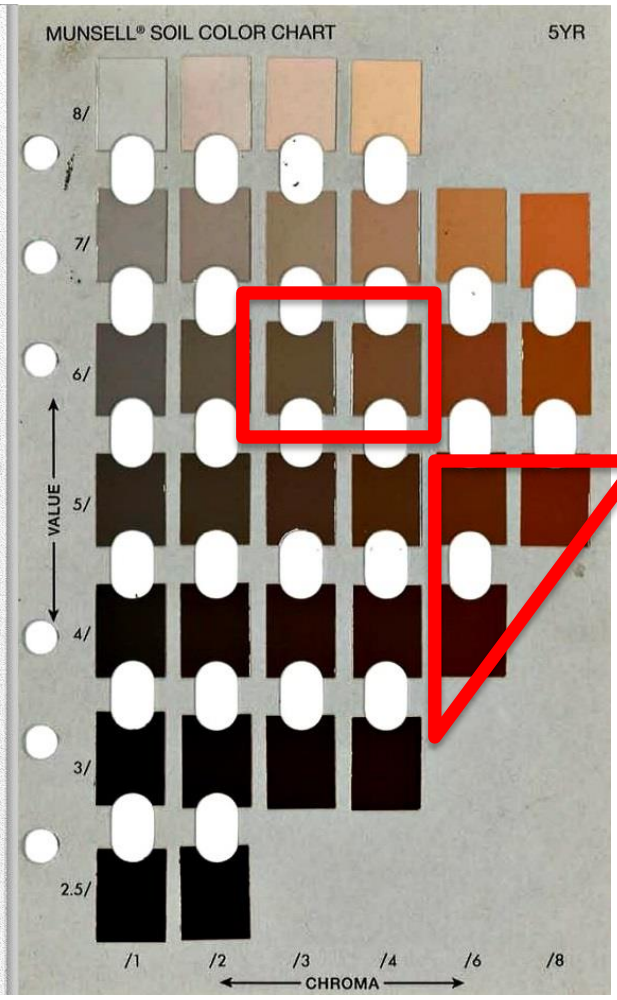
Soil color is typically described using some form of color reference chart, such as the ***Munsell Color Chart***. Using the Munsell system, color is described in reference to the color's "hue", "value", and "chroma."

a. **Hue** describes the **specific color of soil**. This is where in the color spectrum the soil color exists, which for soils includes the colors **yellow, red, blue, green, purple and gray**.
b. **Value** describes how **light or dark** the color of soil is.
c. **Chroma** indicates how intense the color of soil is. You could think of this as the strength of the color, such as the intensity.

In a Munsell notation, the color is **written in the order hue-value-chroma**. The color "5YR 4/3" is an example of a Munsell notation, where 5YR is the hue, 4 is the value, and 3 is the chroma.

1. Take one sample at a time.
2. Flip through the Munsell pages and find the best matching "chip." There are holes next to each color so you can see the soil right next to the color chip.
3. Once you have found the color, find the exact same spot on the page next to it. This spot will give you a color name.
4. There are also numbers. They refer to value and chroma.
5. Record these observations and include pictures.





Soil Sample	Picture of Soil and Munsell Chip	Soil Color Name (Hue) (Qualitative)	Soil Color Value (Quantitative)	Soil Color Chroma (Quantitative)
A				
B				

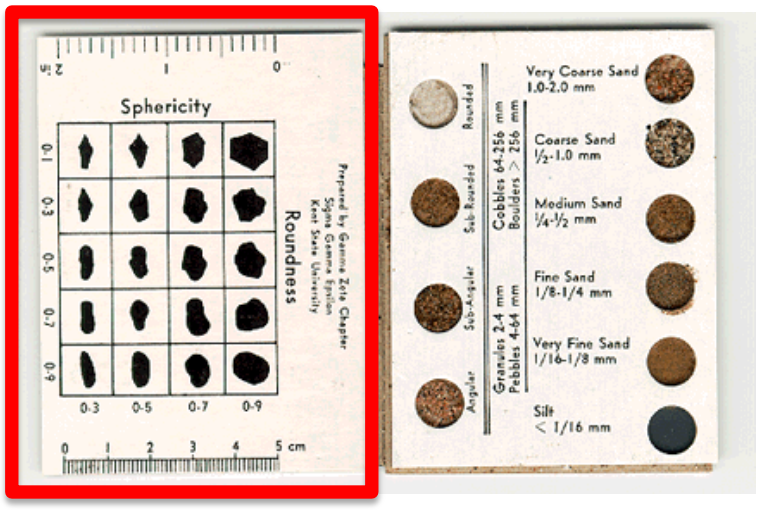
* If you have extra time, use the Internet to research what color can tell a scientist about soil. Give examples and insert pictures to help clarify your explanation.

STATION 4 – Soil Chemistry
(pH and Nutrients – Chemical Property)

1. **Read ALL directions and SAFTEY information first**. They are enlarged copies from the actual testing kits.
   - The most important parts have been highlighted.
2. **Start by picking ONE test to complete**. (If you have time, you can complete a second test.)
3. Follow the directions specific to the test you are completing.
4. Record your results in the data table below.

Test Completed (circle)	Resulting Color (Qualitative)	Resulting Number (Quantitative)	What does this mean for the soil? (Use the sheets provided to help explain.)
• nitrogen (N) • phosphorus (P) • potassium/ potash (K) • pH (how acidic/basic the soil is)			
• nitrogen (N) • phosphorus (P) • potassium/ potash (K) • pH (how acidic/basic the soil is)			

STATION 5 - Take a Closer Look
(Soil Composition – organic and inorganic materials)



1. Use the dissection scopes to examine the soil.
2. Examine the soil for evidence of rock weathering. Pick out any sediment you find.
3. Use the grain size chart to determine how "rounded" the sediments are. Use the part boxed in red.
4. Take a picture and include it in the data table below.
5. Examine the soil for evidence of organic matter. Pick out any plant, insect or animal parts you find.
6. Take a picture and include it in the data table below.

(Station 5 continued)

Sample F	Describe: Roundness? _____ Sphericity? _____	Picture:
	Describe: Organic Matter Observed	
Sample G	Describe: Roundness? _____ Sphericity? _____	Picture:
	Describe: Organic Matter Observed	

Answer the following by circling the correct bold word:

The rounder or more spherical the sediment, the **less/more** weathered the rock is.

Explain your answer.

STATION 6

Soil Texture
(Texture – physical property)

1. Examine the flow chart.
2. Locate the PINK box labeled "start" in the upper left hand corner.
3. Follow the directions in each box. Begin with one soil sample. If you have time, you can analyze the texture of a second sample.
4. When you complete the directions, follow the arrow that describes the soil sample.
5. You have successfully determined the soil texture when you get to a lighter pink box.
6. In that box is a name for the soil. There is also a letter, which goes with a texture classification. The key for this in the upper right hand corner.

(Station 6 continued.)

Soil Sample H	This soil is called: _____.	Its texture classification is (circle one) C/MC/M/F.	Evidence from the flow chart that proves this is:
Soil Sample I	This soil is called: _____.	Its texture classification is (circle one) C/MC/M/F.	Evidence from the flow chart that proves this is:

(Station H is on the next page.)

STATION H:
Soil Horizons and Living Organisms in Soil
(Texture, Color, and Composition)

***CAUTION* These samples are FRAGILE and may break easily. DO NOT pick them up. Be VERY careful when examining them.**

Below is a map of RCMS and the surrounding areas. Each sample location is marked on the map and its location described below.

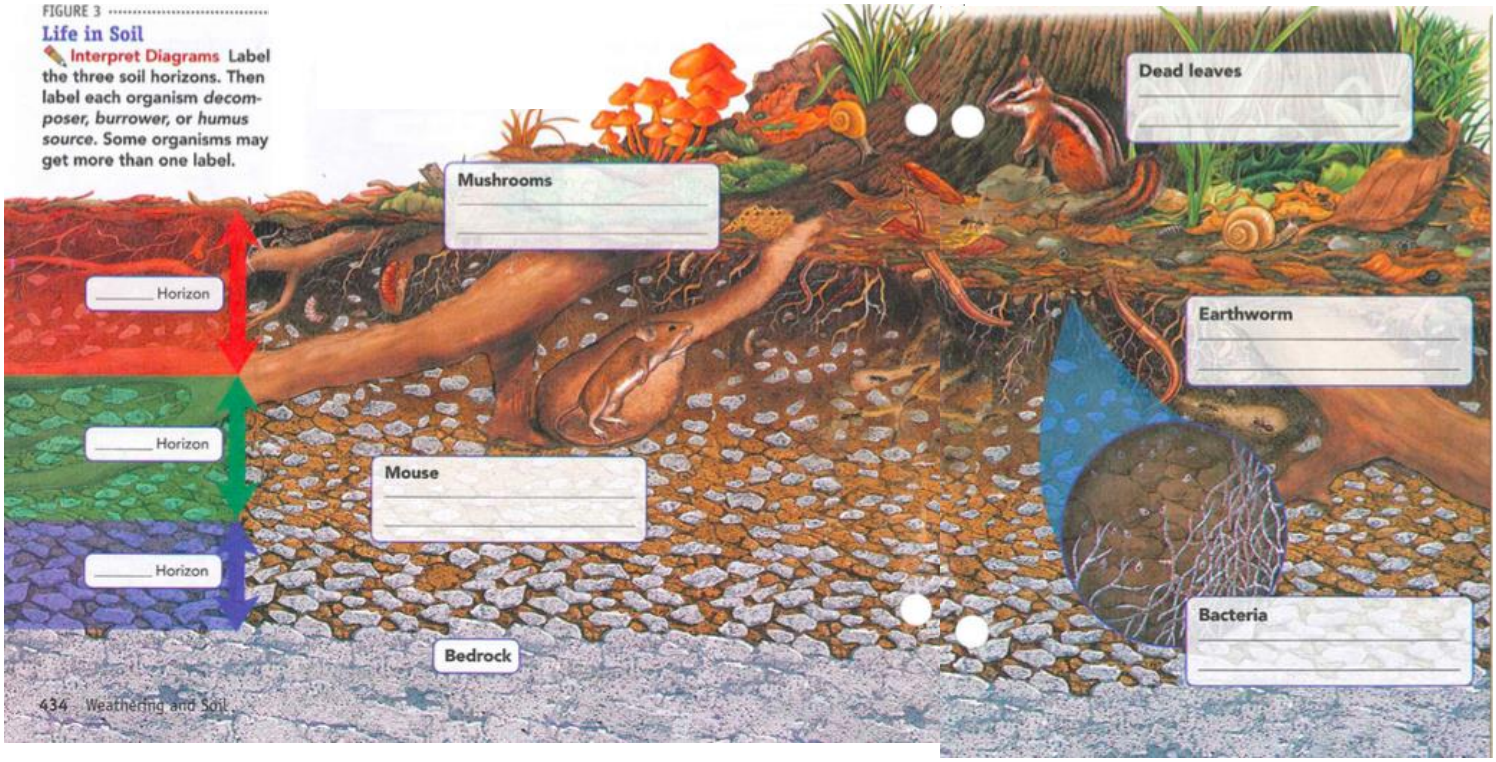
TOPSOIL SAMPLE LOCATIONS:
Period 1: Near the edge of the "wetlands" in the outdoor lab.
Period 2: On the edge of the creek's bank in the outdoor lab.
Period 6: Near the edge of the outdoor lab, under the arborvitae and evergreen trees.
Period 7: At the very edge of the chain-link fence behind the bleachers.
Period 8: (a) A the top of the "hill" in the yard between Van Rensselaer and RCMS.
Period 8: (b) Between the soccer filed and the driveway behind RCMS.

Based on what you observe and each samples location, which samples have the most organic matter? Why?

How would you compare the color of the samples with more organic matter to those with less organic matter?

Complete FIGURE 3 below.
a. Label the three soil horizons.
b. Label each organism as:
    i. Decomposer
    ii. Burrower
    iii. Humus source

* Some organism may have more than one label.



List the organisms (from the picture above) that contribute to soil in more than one way. Explain your reasoning behind labeling them this way.