<u>SOIL TEXTURE</u> – Refers to proportions of sand, silt and clay size particles. These proportions determine water infiltration rates, permeability rates, and water holding rates.

Using a soil texture triangle. You will need to read the attached explanation on how to interpret the soil texture diagram and THEN answer the following questions, using your triangle and your newfound knowledge.

<u>EXAMPLE</u>

Point A: Sandy Loam: <u>65% Sand _ 20% Silt _ 15% Clay</u>

Point B: ___________ ____%Sand ____% Silt ____% Clay

Point C: ___________ ____%Sand ____% Silt ____% Clay

Point D: ___________ ____%Sand ____% Silt ____% Clay

Point E: ___________ ____%Sand ____% Silt ____% Clay

Reading a Soil Triangle

Using the soil texture triangle, scientists have created classes which break the distribution of particle sizes (soil textures) into 12 categories: clay, sandy clay, silty clay, sandy clay loam, clay loam, silty clay loam, sand, loamy sand, sandy loam, loam, silt loam, silt.

The soil texture triangle is one of the tools that soil scientists use to visualize and understand the meaning of soil texture names. The textural triangle is a diagram which shows how each of these 12 textures is classified based on the percent of sand, silt, and clay in each. Note: these percentages are based on the USDA definition of sand and silt only.

Follow these steps to determine the textural class name of your soil sample:

1. Determine the percent sand of your sample and find that number on the bottom of the triangle. Note that the numbers read from right to left, not left to right. For example, if your sample is 65% sand, then you need to pick a point to the LEFT of the 60 mark.
2. Draw another line to correspond to the percent clay. Let's say you had 27% clay.

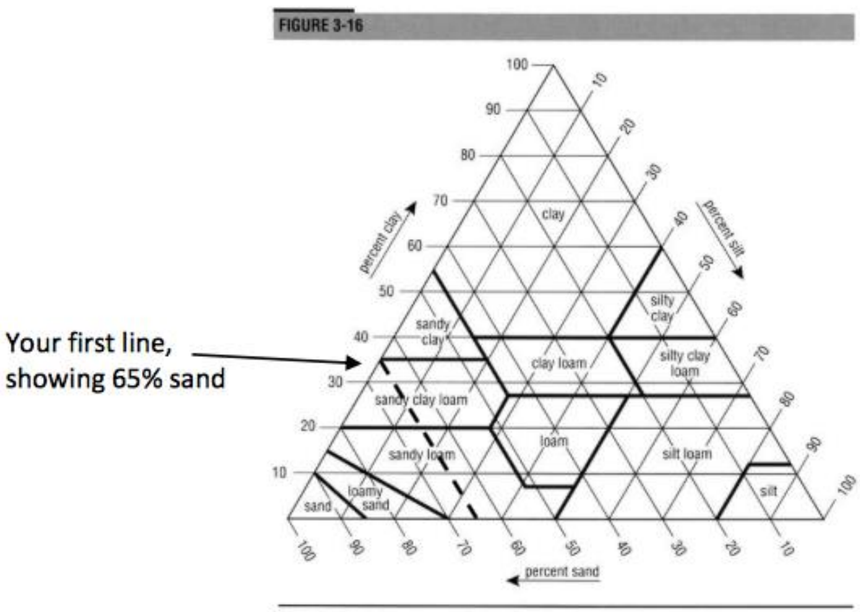
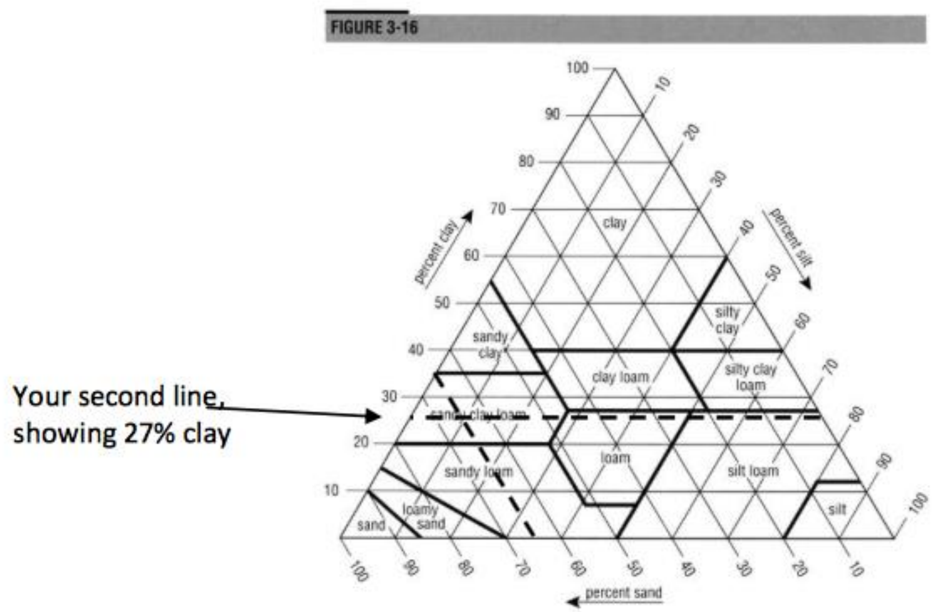
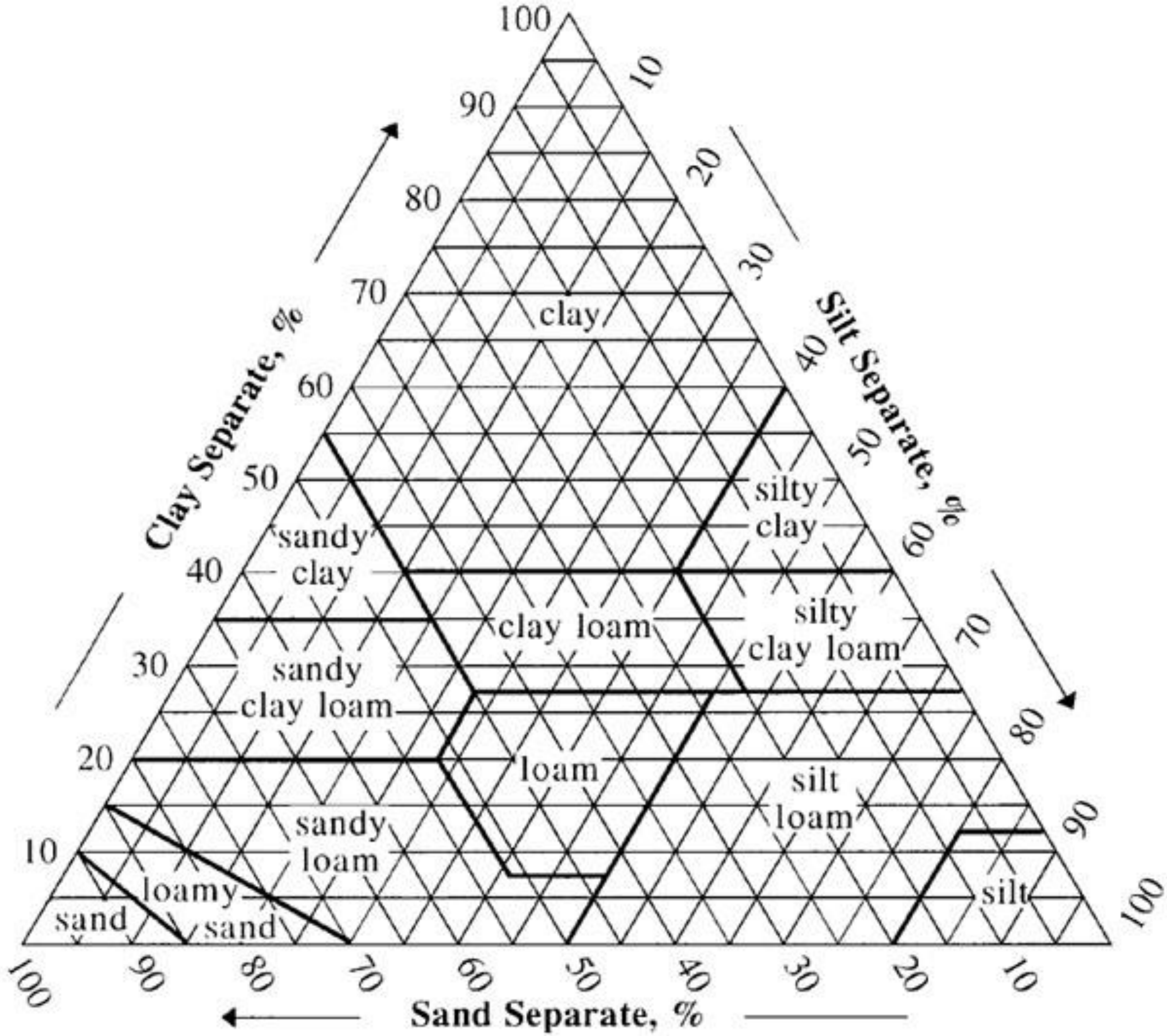


Chart showing the percentages of clay, silt, and sand in the basic textural classes.



3. Where the lines intersect should also indicate percent silt. On the graph above, you can see that it is about 8% silt.
4. Wherever your lines intersect indicates the soil type you have. In this situation, with 65% sand, 27% clay, and 8% silt, it is sandy clay loam.



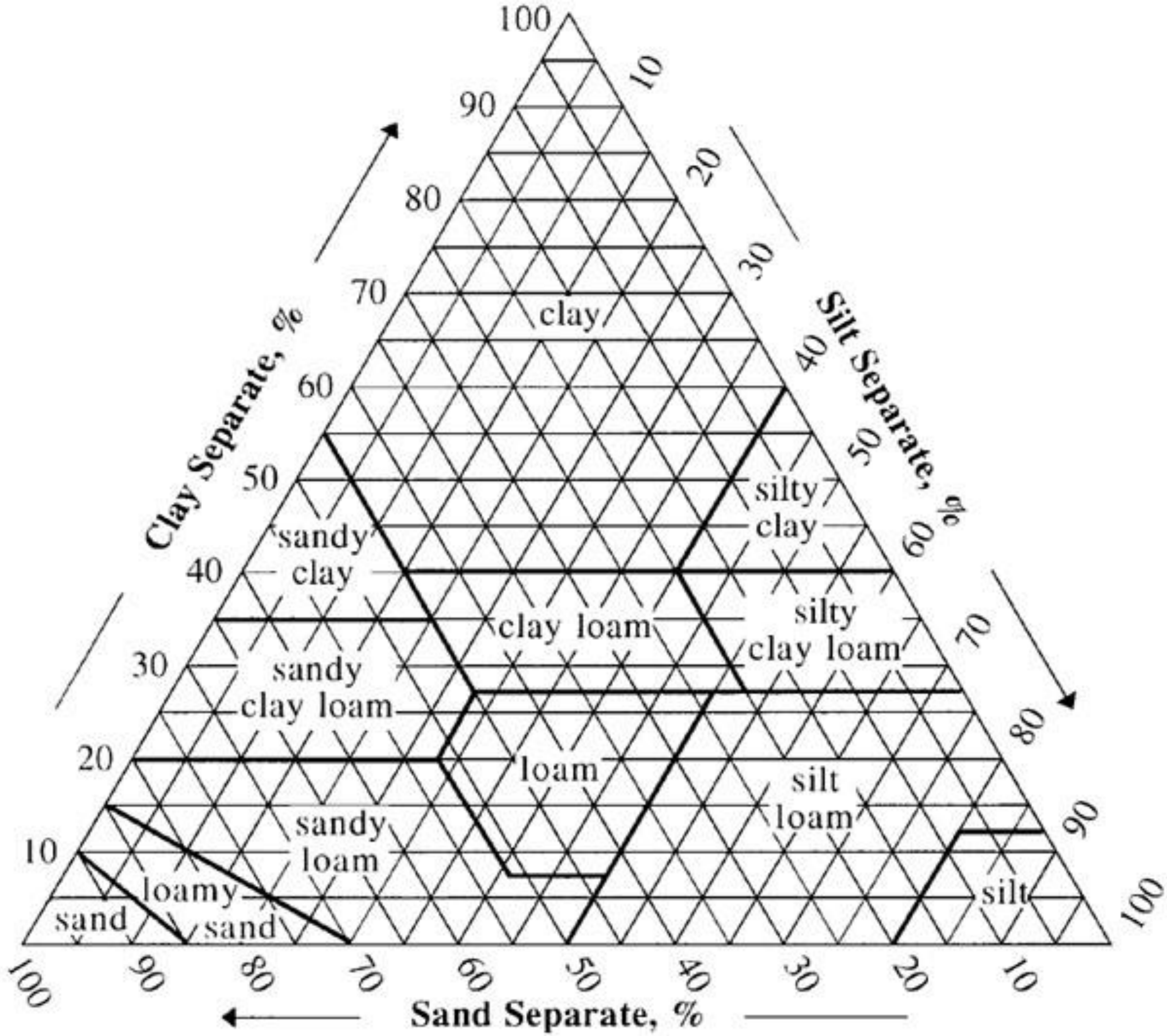
Clay Separate, %
Silt Separate, %
Sand Separate, %
100
90
80
70
60
50
40
30
20
10
clay
sandy clay
silty clay
clay loam
silty clay loam
sandy clay loam
loam
silt loam
sandy loam
loamy sand
sand
silt

Finding soil texture by fragmentation: This design is based on the principle that larger particles having a greater mass will settle out first. Sand (the largest particle) should settle out faster in a suspension than silt or clay. We can use this technique, called fragmentation, to find the general composition of our soil samples. **Sand** will usually settle in about 1 minute, **silt** settles in about 10 minutes, and any remaining particles still suspended after 10 minutes are **clay**. Organic material may float.

1. 50 mL of soil, added with water up to 100 mL mark, was shaken vigorously. The mixture was then allowed to settle over time.
2. After 1 minute, the sand settled to the bottom of the cylinder.
3. After 10 minutes, the silt particles had settled on top of the sand layer.
4. Identify the three layers in the graduated cylinder.
5. **Determine the volume of each layer (record):**
    a. **Layer A (Sand) Volume = _____ mL**
    b. **Layer B (Silt) Volume = _____ mL**
    c. **Layer C (Clay) Volume = _____ mL**
    d. **Total Volume = _____ mL**
6. It takes a long time for clay to settle out. If it hasn't complete settled, subtract your sand and silt measurement from ____ mL to determine your clay volume.
7. **Draw, label, and describe a diagram of the particles in the cylinder.**
8. **Why did the particles settle out this way?**
9. **Calculate the percentage of each component using the following equation:**

    $$\frac{\text{Amount of each component}}{\text{Total Volume of soil}} \times 100 = \%\ \text{Component}$$

10. **NOW identify the type of soil in your sample, using your % combinations of Particles and the soil triangle.**



Clay Separate, %
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sandy clay loam
loam
silt loam
sandy loam
loamy sand
sand
silt

<u>SOIL POROSITY</u>: The space between the particles is called the pore space. It determines the amount of water that a given volume of soil can hold. Porosity is the percentage of the total volume of soil that consists of pore space.

<u>PROCEDURES</u>:

1. The beaker was filled to the 100 mL mark with dry soil or sand.
2. A graduated cylinder was filled with <u>100 mL</u> of tap water.
3. **SLOWLY** the water from the graduated cylinder was poured into the soil sample in the beaker. Water was not added once the water level reached the top of the soil. <u>The soil had reached saturation and could not hold any more water.</u>
4. **How much water is now left in the graduated cylinder? _________mL**
5. **How much water was held in the pore spaces of the soil sample in the beaker? ______mL**
6. **Use these numbers to calculate the porosity of the soil sample:**

$$\textbf{Porosity} = \frac{\text{Vol of water added to the soil (mL)}}{\text{Initial volume of soil (mL)}} \times 100$$

Using the table below, determine the properties of each of the soil samples analyzed above.

Soil texture	Nutrient-holding capacity	Water- infiltration capacity	Water-holding capacity	Aeration	Workability
Clay	Good	Poor	Good	Poor	Poor
Silt	Medium	Medium	Medium	Medium	Medium
Sand	Poor	Good	Poor	Good	Good
Loam	Medium	Medium	Medium	Medium	Medium

<u>SOIL PERMEABILITY</u>: Soil permeability is the property of the soil pore system that allows fluid to flow. It is generally the pore sizes and connectivity—how well those pore spaces allow water to flow through the soil—that determines whether a soil has high or low permeability.

<u>PROCEDURES</u>:

1. Have one of the lab partners hold the cup with the soil above an empty beaker to catch the water as it drips through.
2. The other lab partner should measure out 50mL of water and slowly pour it on top of the soil.
3. Time for **<u>1 minute</u>** and then set the cup with the soil aside in the plastic cup provided. (Be careful where you place the cup. It will continue to drip water, so put it in a sink or over a cup or beaker.)
4. Pour the water collected in the beaker into a graduated cylinder to determine how much of the 50mL came through.
5. Record the amount in the following chart; repeat the procedure for the remaining two soil samples.

<u>DATA</u>:

	Soil Sample 1	**Soil Sample 2**	**Soil Sample 3**
Volume of Water (mL)			

<u>ANALYSIS</u>:

1. Which of the soil samples held more water and why?
2. Which soil sample has the best permeability?
3. Which soil sample would have the greatest porosity? Explain your reasoning.
4. Why would a farmer need to know the soil permeability of his land? Why is this important?

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SOIL HORIZONS:

- Soil Profile - A vertical section of the soil extending vertically through all its horizons and into the parent material.
- Soil Horizon - A layer of soil, approximately parallel to the surface, with properties that differ from the horizons above or below it – the properties (characteristics) are produced by soil forming processes.
- Soil Layer - A layer in the soil deposited by a geologic force (wind, water, glaciers, oceans, etc.) and not relating to soil forming process.

There are 3 primary soil horizons called master horizons. They are A, B, and C. These are part of a system for naming soil horizons in which each layer is identified by a code: O, A, E, B, C, and R. They will be discussed as follows:

1. "O" horizon. This is an organic layer made up of partially decayed plant and animal debris. It generally occurs in undisturbed soil such as in a forest.
2. "A" horizon. This is often referred to as ***topsoil*** and is the surface layer where organic matter accumulates. Over time, this layer loses clay, iron, and other materials due to leaching. This is called ***eluviation***. The A horizon provides the best environment for the growth of plant roots, microorganisms, and other life.
3. "E" horizon. This is the zone of greatest eluviation. Because the clay, chemicals, and organic matter are very leached, the color of the E horizon is very light. It usually occurs in sandy forest soils with high amounts of rainfall.
4. "B" horizon. This horizon is referred to as the ***subsoil***. It is often called the "zone of accumulation" since chemicals leached from the A and E horizons accumulate here. This accumulation is called ***illuviation***. The B horizon will have less organic matter and more clay than the A horizon. Together, the A, E, and B horizons are known as the ***solum***. This is where most of the plant roots grow.
5. "C" horizon. This horizon is referred to as the ***substratum***. It lacks the properties of the A and B horizons since it is influenced less by the soil forming processes. It is usually the parent material of the soil.
6. "R" horizon. This is the underlying bedrock, such as limestone, sandstone, or granite. It is found beneath the C horizon.

Answer the following questions:

1. Draw a soil profile and label each of the three major horizons.
   (use your packet)

2. Explain how each horizon is different from one another in terms of color and content.

3. Explain how "losses" might occur that will cause a change in the soil profile.

PRIMARY LAYERS OF A SOIL PROFILE