

Name: _____

Quiz (14pts)	
Completeness (20pts)	
GRADE:	



APES

Date: _____

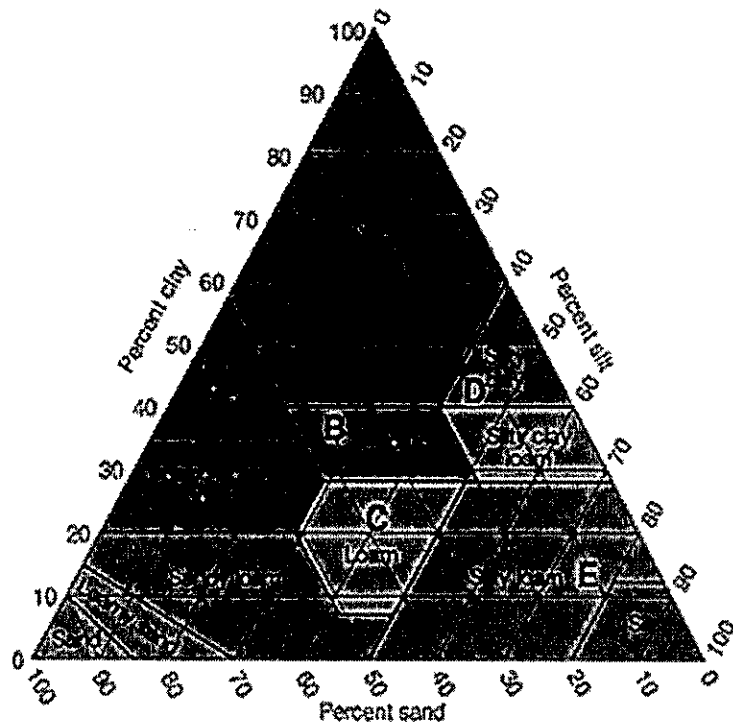
Lab: SOIL ANALYSIS

Introduction:

Soil consists of rock particles, water, dissolved chemical substances, decaying organic matter, and a large assortment of microorganisms, roots, and insects. Soil constitutes an important type of ecological community. In these labs, you will explore the physical and chemical makeup of a soil sample.

Through the process of **weathering**, rocks are weathered into fine particles of **clay** (<0.002 mm in diameter), **silt** (0.002 to 0.05 mm), and **sand** (0.5 to 1.0 mm). The relative amounts of the different sizes of particles control two very important properties of soil; *its fertility and its ability to hold water.*

****Soil fertility** is measured by the amount of **nutrients** available for plant growth. These nutrients in soils are usually found in the form of *positively charged ions*, such as sodium, calcium, and potassium. Since the tiny particles of clay often have a negative charge, the positive ions attach to the clay particles. The larger particles of silt and sand do not have this negative charge. *Therefore, soils with more clay tend to be more fertile.***



A. Soil Texture Triangle

1. Examine Figure 1, which shows the classes of soil textures based on their percentage proportions.
2. Determine the name and percent composition of points B, C, D, and E.

B is _____ and has _____% clay, _____% silt, & _____% sand.

C is _____ and has _____% clay, _____% silt, & _____% sand.

D is _____ and has _____% clay, _____% silt, & _____% sand.

E is _____ and has _____% clay, _____% silt, & _____% sand.

PART 1- FIELD (OUTSIDE) SOIL TESTS

Procedure:

B. Soil Permeability/Infiltration/Percolation Test

1. Obtain a permeability cylinder from your teacher.
2. Using a hammer and block of wood drive the cylinder into the ground leaving about an inch of the cylinder exposed at the surface. Use a ruler to make sure it is as close to an inch as possible.
3. Pour water to the top of the cylinder careful not overflow it. Start the timer as soon as you are done pouring. Let it run for as long as possible if it hits an hour stop.
4. Measure how much the water has dropped and the time it took to drop that amount
5. Record it in the table below:

Data Table 1: Infiltration Data Chart

Amount Water Level Dropped in inches	Time it Took to Drop That Amount

6. Calculate how much the water will drop in a 1 hour (60 minutes). Show your work in the space provided below.

7. Classify the rate using the infiltration chart below

Classification	Infiltration Rate (inches/hour)
Very Slow	Less than 0.06
Slow	0.06 to 0.2
Moderately Slow	0.2 to 0.6
Moderate	0.6 to 2.0
Moderately Rapid	2.0 to 6.0
Rapid	6.0 to 20.0
Very Rapid	Greater than 20.0

8. How would you classify the infiltration rate of the soil you tested based on your calculations?

C. Qualitative Soil Test – Ribbon Test

1. Using the flow chart called “Estimating Soil Texture” (Figure 2) perform the ribbon test to determine the texture of your soil sample.
2. Refer to the soil triangle on page 1 to determine approximate percentages of sand, silt, and clay for your sample.
3. Record all results in Data Table 2.

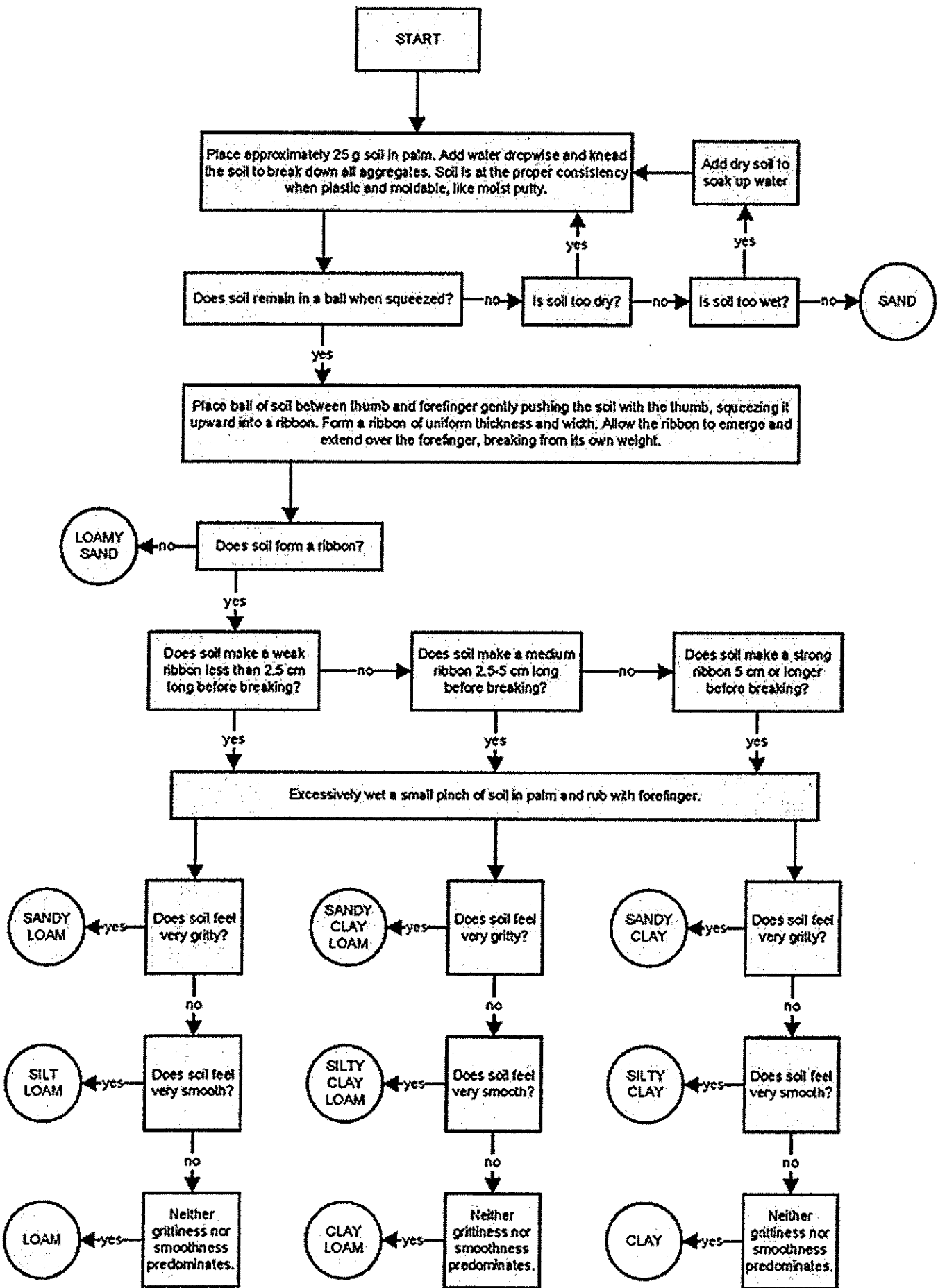


Figure 2 - Estimating Soil Texture (Ribbon Test)

Data Table 2: Ribbon test observations

Note: Refer to the soil triangle on page 1 to determine approximate percentages of sand, silt, and clay for your sample.

Description of where you found your soil sample. (What horizon?)	
Percentage of Sand	
Percentage of Silt	
Percentage of Clay	
What type of soil is this based on the soil ribbon test?	

D. Soil Horizons

1. Observe the soil profile closely. Use nails to mark the different soil horizons. Using a ruler measure the depth of each horizon and record it in your data table.
2. Next take a sample from the horizon of your choosing to test in lab. Make sure you remove any twigs and pebbles. Use a soil sieve if one is provided.

Data Table 3: Soil Horizons Depth

Depth of O Horizon	Depth of A Horizon	Depth of B Horizon
Observations and Descriptions of Layer (color, organisms, etc.)	Observations and Descriptions of Layer (color, organisms, etc.)	Observations and Descriptions of Layer (color, organisms, etc.)

PART 2- CLASSROOM SOIL TESTS

E. Quantitative Soil Test

1. In a graduated cylinder, place **40 to 50 mL** of your soil sample. Tap the bottom of the tube *gently* against your hand to pack soil and eliminate any large air pockets. Add more soil if necessary.
2. Add tap water **SLOWLY** to the level of threads in the container
3. Now tightly cover, using parafilm, to seal it and shake the whole apparatus until the soil and water completely mix to make a free-moving slurry. Be sure to break up any lumps in the soil. Do this for at least one minute.
4. Place the cylinder **LABELED** on the table and let it sit overnight.
5. When the soil has settled out there should be three reasonably distinct layers of sand, silt, and clay.
6. Measure the volume of each layer and divide each layer by the total volume using the formula below. Multiply your answer by 100 to get a percentage. Record your results in Data Table 4.

Calculate the percentages of each soil sample using the following formula:

$$(Amount\ of\ Sand/Silt/Clay)/(Total\ Amount\ of\ Soil) \times 100 = \% \text{ of sample}$$

7. To check your calculations, add the percentage of sand, silt, and clay. The total percentages should add up to 100.
8. Use the Soil Triangle to determine the name of your soil type. Record the name in the chart.
9. **Do the percentages from your qualitative & quantitative tests match?**

Data Table 4: Quantitative Soil Test

Note: Refer to the soil triangle on page 1 to determine approximate percentages of sand, silt, and clay for your sample.

Height of all 3 segments (not including any extra water) together	
Percentages of Sand	
Percentages of Silt	
Percentages of Clay	
What type of soil is this?	

F. Soil Nutrient and pH Test

Procedure:

1. Follow the guidelines in your packet to perform the following tests on your sample:
 - i. Nitrate-Nitrogen test
 - ii. pH test
 - iii. Phosphorus test
- b. Record all results on Data Table 5.

Data Table 5: Chemical Composition of Soil

Description of where you found your soil sample. (What horizon?)	
Nitrate-Nitrogen Test	
pH Test	
Phosphorous Test	

Lab Questions:

1. What is the importance of having a soil with a pH close to neutral?
2. Discuss the role of nitrogen in promoting plant growth. (think nitrogen cycle and why it is important)
3. If the rate of top soil for a temperate deciduous forest (where you live and this soil was samples) is 1in/225 years, how long would it take for this soil horizon to develop?

Depth in inches of the A horizon you measured = _____

Number of years to develop = _____
4. What problems can occur in a soil that has:
 - a. Too much sand?
 - b. Too much clay?
5. Based on the results of ALL of your tests what conclusion would you reach about the fertility of you soil sample? Support your answer with data obtained from the tests you performed.

Name: _____

APES

Lab Quiz: Soil Analysis

Date: _____

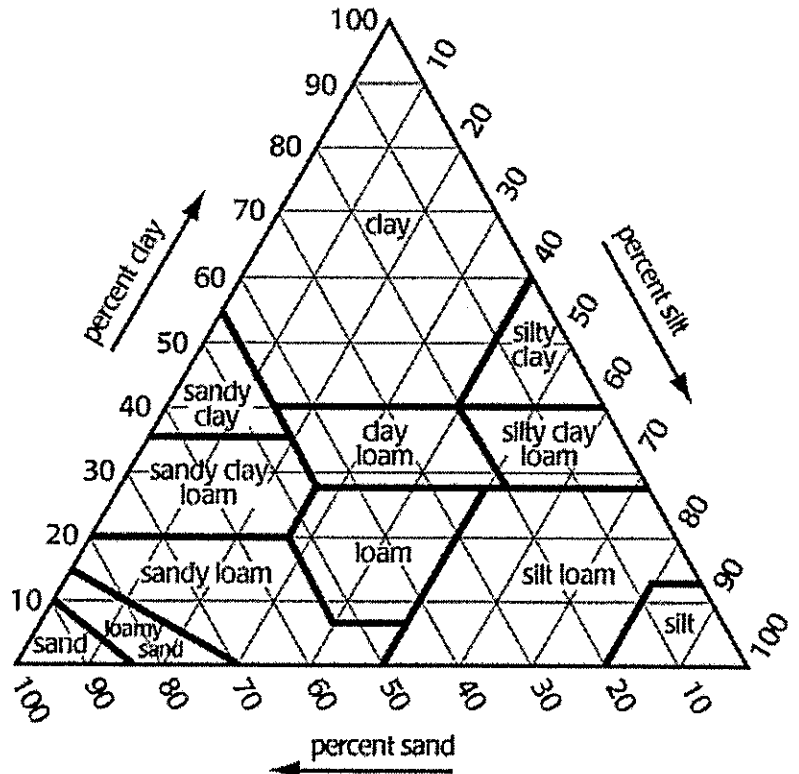
1. Use the soil triangle to determine the type of soils with the following particle sizes

a. 20% silt, 10% clay, 70% sand (1 point)

b. 30% sand, 10% clay, 60% silt (1 point)

c. 60% clay, 10% sand, 30% silt (1 point)

d. 40% sand, 10% silt, 50% clay (1 point)



2. If you were a farmer in the Midwest what type of soil would you want (use the soil triangle to name the soil)? Describe what properties you would want this soil to exhibit. (2 points)



3. **Draw and label** an idealized soil profile from O – C. List and **briefly describe** each layer that is represented in an ideal soil profile (4 points)



4. As soils form, distinct layers known as horizons develop over time. One of these is the A horizon. (2 points)
- i. **Identify** one specific biotic component of the A horizon.

- ii. **Identify** one abiotic component of the A horizon.

5. **Explain** the difference between eluviation and illuviation? Be sure to include the layers they each occur in. (2 points)

