

Unit C: Traits of Soil

Lesson 2: Calculating Density of Soil

Student Learning Objectives: Instruction in this lesson should result in the students achieving the following objectives:

1. Understand the importance of calculating soil density
2. Identify the steps in finding the density of soil

Recommended Teaching Time: 3 Hours

Recommended Resources: The following resources may be useful in teaching this lesson

- A PowerPoint has been provided

List of Equipment, Tools, Supplies, and Facilities:

Writing surface
PowerPoint Projector
PowerPoint Slides
Transparency Masters
3 buckets with soil
.71 liters of water

Terms: The following terms are presented in this lesson (shown in italics and on PowerPoint Slide 2)

- Permeability
- Soil density

Interest Approach: Use an interest approach that will prepare the students for the lesson. Teachers often develop approaches for their unique class and student situations. A possible approach is included here.

Using 3 different buckets fill one up with very loose soil. Take a second bucket and pack the soil in a little bit. With the third bucket pack the soil in as tight as possible. Tilt the buckets at a small angle. Inform the students that you have 3 buckets of soil one filled with very loose soil, another bucket with soil that has been slightly packed and the third bucket with very tightly packed soil. Ask the students what will happen to the soil in each bucket as you pour .24 liters of water over the soil. After all the students have had the opportunity to respond pour one cup of water over each bucket of soil and have the students observe what happens. Ask the students to share with each other what they observed.

The water should filter through the loose bucket of soil and the lightly packed bucket of soil. The water should run out of the tightly packed bucket of soil and not filter through the soil. After discussing the results of this demonstration, begin discussion of Objective 1.

Summary of Content and Teaching Strategies

Objective 1: Understand the importance of calculating soil density

(PowerPoint Slide 3)

- I. A. **Soil density** is found by identifying the amount of pore space lost in a set area.
1. Soil density is most commonly 1.75 grams per centimeter
 2. Soil density can be above 1.75 grams per centimeter, but the soil will lose productivity and have drainage problems due to how dense the soil is.
- B. Different textures are more susceptible to soil density. **Permeability** is also affected by how dense the soil is. Permeability will decrease with higher soil density and increase with lower soil density.
1. Sandy, Loamy Sand, and Sandy Loam do not have a problem with soil density.
 2. Silt, Silt Loam, Loam, Sandy Clay Loam, Clay Loam, and Silty Clay Loam are more common to have soil density problems.
 3. Clay, Sandy Clay, and Silty Clay can have the worst problems with soil density.

Explain how soil density is affected. Begin with dense till, something that occurs naturally as well as other things that occur by humans. Have students split into groups and make a list. The first list will be ways that soil density increases naturally. Then make a second list of ways that soil density increases due to humans. Then make a full list of all the ideas together as a class.

Objective 2: Identify the steps in finding the density of soil.

(PowerPoint Slide 4)

- II. A. Soil density is found by doing a mechanical analysis:
1. Take a soil sample and weigh it in grams.
 2. Take the sample and bake it in an oven to dry the sample.
 3. Bake the sample at 350 degrees for 3 hours.
 4. Take the sample out and let it cool off.
 5. Measure the weight of the soil sample in grams.
 6. Measure the sample size in centimeters.
 7. Divide the dry weight (cook weight) by the centimeters and that will be your density.

Take students outside to collect a soil sample. Follow the directions listed above to find the soil density of the soil sample. Use LS: 2-1 Soil Density Lab Sheet to

record the information gathered. As you wait for the oven to finish drying the soil have the students complete the problems on WS: 2-1 Solving for Density. There are ten different problems for them to complete. Have them work on this individually.

(PowerPoint Slide 5)

Review/Summary: Have students describe in a paragraph why soil density is important and why we should keep an eye on soil density. Then give them a set of problems to solve what the soil density is.

Application: Take soil samples and follow the procedure listed above to find the soil density of different soil samples.

Evaluation: A sample test has been provided.

Answers to Sample Test:

Part One: Matching

1=e, 2=d, 3=a, 4=b, 5=f, 6=c

Part Two: Completion

1. permeability
2. bake
3. do not/ doesn't
4. good
5. worst

Part Three: Short Answer

1. a. Sandy, Loamy Sand, Sandy Loam
b. Silt, Silt Loam, Loam, Sandy Clay Loam, Clay Loam, Silty Clay Loam
c. Clay, Sandy Clay, Silty Clay
2. deep tillage, less travel over soil, deep rooted plants
3. take a soil sample and weigh in grams
Take sample and bake in oven
Bake at 350 for 3 hours
Let sample cool
Measure weight in grams
Measure sample size in grams
Divide dry weight by centimeters

Test

Unit C Lesson 2: Calculating Density of Soil

Part One: Matching

Instructions. Match the term with the correct response. Write the letter of the term by the definition.

- | | |
|-------------------------|------------------|
| a. soil density | d. permeability |
| b. grams per centimeter | e. soil textures |
| c. 3 hours | f. dry weight |

_____ 1. Different types of these can be either more or less susceptible to soil density.

_____ 2. This is affected by being slowed down with higher density in soils.

_____ 3. The loss of pore space in a certain area.

_____ 4. Soil density is measured with this.

_____ 5. Use this weight to find soil density.

_____ 6. Bake your soil for this long before you find the soil density.

Part Two: Completion

Instructions. Complete the following statements.

1. The ease with which water may pass through the soil is referred to as

_____.

2. _____ the soil for 3 hours at 350 degrees to find the dry weight.

3. Sandy, Loamy Sand, and Sandy Loam _____ have a problem with soil density.
4. 1.75 grams per centimeter or less is a _____ soil density.
5. Clay, Sandy Clay, and Silty Clay have the _____ problems with soil density.

Part Three: Short Answer

Instructions. Use the space provided to answer the following questions.

1. Name the soil textures that are found under each category
 - a. no problem with soil density—
 - b. some problems with soil density—
 - c. worst problems with soil density—
2. List three ways to prevent soil density?
3. Describe the steps in finding soil density.

Solving for Density

Find the density of the problems listed below.

1. Dry weight: 350 grams
Size: 225 centimeters

2. Dry weight: 188 grams
Size: 68 centimeters

3. Dry weight: 1210 grams
Size: 1000 centimeters

4. Dry weight: 314 grams
Size: 250 centimeters

5. Dry weight: 788 grams
Size: 500 centimeters

6. Dry weight: 436 grams
Size: 400 centimeters

7. Dry weight: 89 grams
Size: 40 centimeters

8. Dry weight: 375 grams
Size: 175 centimeters

9. Dry weight: 612 grams
Size: 500 centimeters

10. Dry weight: 1750 grams
Size: 1237 centimeters

Solving for Density

1. 1.56
2. 2.76
3. 1.21
4. 1.26
5. 1.58
6. 1.09
7. 2.23
8. 2.14
9. 1.22
10. 1.41