



Soil and Water Relationships

From this lesson, students will gain an understanding of soil and water relationships. Students will investigate water holding capacity and porosity of soil and how soils of different textures differ in these areas.

Primary Learning Outcomes

What is water holding capacity? What is porosity? How do these characteristics affect soil in an environmental and agricultural setting?

Assessed GPS Standards

General

SCSh1. Students will evaluate the importance of curiosity, honesty, openness, and skepticism in science.

SCSh2. Students will use standard safety practices for all classroom laboratory and field investigations.

SCSh3. Students will identify and investigate problems scientifically.

SCSh4. Students will use tools and instruments for observing, measuring, and manipulating scientific equipment and materials.

SCSh6. Students will communicate scientific investigations and information clearly.

SCSh8. Students will understand important features of the process of scientific inquiry.

SCSh9. Students will enhance reading in all curriculum areas

Physical Science

SPS6. Students will investigate the properties of solutions.

Biology

SB4. Students will assess the dependence of all organisms on one another and the flow of energy and matter within their ecosystems.

Procedures/Activities

Step 1 – Duration: 25 minutes

Discussion with students to lay foundation for day's activities. Discussion to include definition of **porosity** and **water holding capacity**. Discussion should also include a brief overview of the laboratory activity to include how we will measure the aforementioned variables.

Step 1 – Duration: 45 minutes

Laboratory activity by students to determine the water holding capacity and porosity of different soil samples. Soil samples can be altered prior to class by adding either ground kitty litter (clay) or children's play sand to soil samples to show differences. (It is a nice tie-in to run this activity concurrently with the soil texture activity so that students can see the relationship between soil texture (% clay, silt, and sand) and porosity and water holding capacity. Another way of approaching this is to assign a soil type to each lab group so that they can run all of the analysis on the same soil type.) The activity is as follows:

1. Place a sample of dry soil in a Buchner funnel equipped with filter paper (make sure filter paper is wet before putting soil in filter) set up on a ring stand. Make sure the funnel is plugged with a non-absorbent material prior to placing the soil in the funnel. Also, measure and record the volume of the soil prior to placing in the funnel.
2. Add water to the soil in the funnel slowly until the surface glistens. Record the amount of water added.
3. Determine the total percent porosity of the medium by dividing the volume of the water added in step 2 by the volume of soil in the funnel from step 1. Multiply by 100 to determine total porosity.
4. Remove the plug from the funnel and collect all the water that drains from the funnel. Record the volume of water drained from the funnel.
5. To calculate the percent air space in the soil, divide the amount of water drained from the bucket in step 4 by the volume of soil from step 1. Multiply by 100 to determine the percentage of air space in the soil.
6. To determine the percent water holding capacity subtract the percent air space (step 5) from the total percent porosity (step 3). This figure is the percent water holding capacity of the soil.

Another area of interest might be to have one group of students investigate these variables on potting soil to compare with field soil. The water holding capacity of field soil should be around 25%, while an artificial growing media should be somewhere between 30 and 50%. Have the students explain why this might be the case and why it is important for artificial growing media to hold water better.

Step 3 – Duration: 20 minutes

Discussion with students of results of laboratory exercise. Discussion should include the results from all groups and why values are different for different soil types.



Materials and Equipment

1. Soil samples of differing textures
2. Potting soil
3. Moderately sized funnels with non-absorbent plug
4. Ring stand
5. Graduated cylinder

Total Duration

1 hour 30 minutes

Assessment

Students will be assessed according to their participation in lab as well as a written lab report to be turned in. Students will also be tested on the concepts covered in the laboratory and discussion.