

Activity 4.1.2 Extracting Air**Purpose**

Just like with any living organism, plant roots need oxygen to survive. How is this possible when plant roots are grown underground? It all depends upon porosity which are pores filled with air or water in the soil structure. Air is one of the four components that make up soil.

The size and number of pores are dependent upon a number of factors including mineral size, organic matter and compaction of the soil. Smaller pores will have the capability of holding water for a longer time, while larger pores allow water to flow freely through. Soils with a larger proportion of clay, which are very small in size, will have more small pores for holding water than soils with a larger proportion of sand. See Figure 1.

Organic matter, such as roots, breaks up the soil and provides additional space for air and water. Soils with more porosity are better suited for sustaining plant life. Since soil is filled with pores ranging in all sizes, the pores are hard to see with the naked eye.

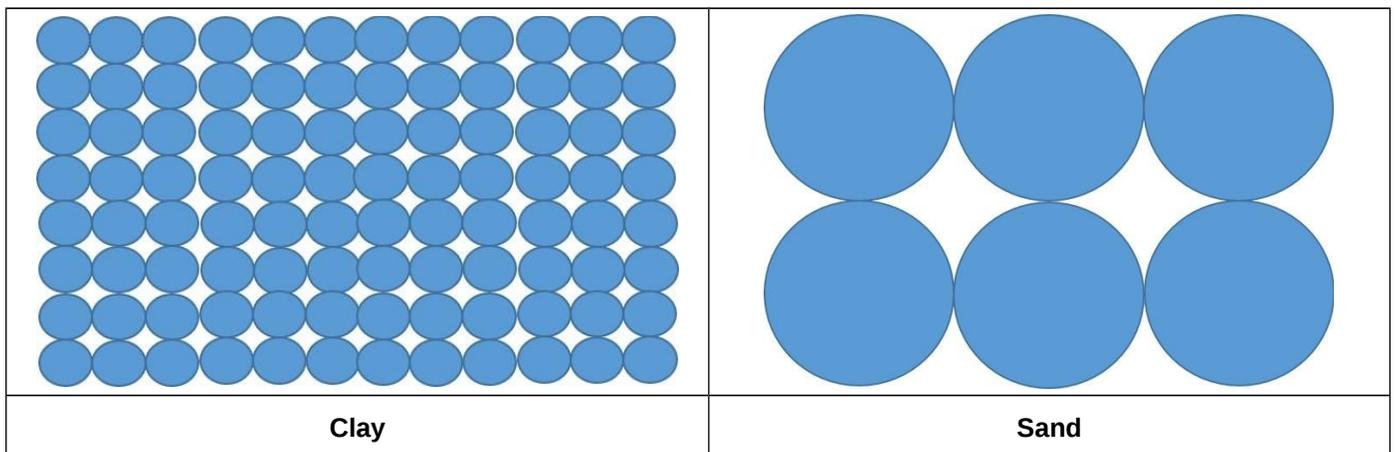


Figure 1. Mineral Pore Space

What factors affect soil porosity?

Materials**Per pair of students:**

- Two clods of soil
- Polyurethane spray can
- Laboratory tape
- Permanent marker
- 2 600ml beakers
- Stopwatch
- Water
- Paper towels

Per student:

- *Agriscience Notebook*
- Pencil

Procedure

Work with a partner to compare the porosity in two different soils.

Part One – Apply Sealant

Take two clods of soil, one from sample A and one from sample B. Make sure both samples are approximately the same size. Be sure the clods fit easily in the beaker. If either one does not, carefully break a small portion away to allow it to fit in the beaker.

Coat both samples with an even coat of polyurethane and set aside to dry. Drying time will require 5 – 10 minutes. While the clods are drying, complete Part Two.

Part Two – Observations and Prediction

1. Observe the features of each clod of soil. Look for organic matter, mineral size, and evidence of compaction.
2. Record the description of each clod in Table 1 of *Activity 4.1.2 Student Worksheet*.
3. Work with your partner to agree upon a prediction for the porosity of the each sample.
4. In the box provided on the student worksheet, formulate and write down a prediction as to which soil sample will have the most pore space. Record your prediction as a complete sentence.

Part Three – Conduct the Experiment

1. Use a permanent marker and laboratory tape to label one 600ml beaker “A” and the other “B”.
2. Pour 375ml of water into each of the 600ml breakers.
3. Once the polyurethane is dry, you and your partner will gently place each clod into the corresponding beakers at the same time. NOTE: Start the stopwatch at the moment the soil is placed into water.
4. Observe the bubbles that emerge from each clod. Record your observations in Table 3 for the time intervals listed. Important observations should be made including how fast and how many bubbles each clod is producing, and when a sample stops bubbling. Each partner will need to be responsible for one of the clods. But, each partner should observe the other clod when possible.

Part Four – Analysis and Clean Up

After recording your observations, answer the analysis questions on the student worksheet. Then dispose of the water and soil, clean and return the equipment, and clean up your workstation according to your teacher’s directions.

Conclusion

1. Why do you think organic matter affects the amount of pore space in soil?
2. What are some recommendations you would make for increasing porosity in soils?

Activity 4.1.2 Student Worksheet

Table 1. Clod Observations

Sample A	Sample B
soil from the field spray painted white	soil from the pile spray painted black

Table 2. Prediction

The water will soak into the soil and break it off releasing air bubbles
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Table 3. Data Observations

Observations	Sample A	Sample B
:30 check	air bubbles coming out clod of dirt	when put in many bubbles came up over 40
1:00 check	small dirt particles falling off	bubbles slowly coming up some sitting under water on the clod
1:30 check	soil soaking up water causing more dirt particles to fall off	lots of small bubbles sitting on top of soil
2:00 check	bigger chunks falling off	clump of bubbles in the middle on top of water
2:30 check	nothing happened except more air bubbles coming out	bubbles pushing soil around to show up on top of it
3:00 check	more particles falling off	very slowly bubbles floating up
3:30 check	air bubbles coming out of dirt	bubbles not moving at all
4:00 check	dirt is splitting because water being soaked up	soil completely loose with bubbles not moving
4:30 check	nothing happening	very tiny bubbles floating to top
5:00 check	nothing happening	little bits of soil floated to top with tiny bubbles

Analysis Questions

- What do you believe the bubbles represent in the soil?

the air in the pore space of the soil

- Explain why you believe your prediction was or was not correct about pore space between the two soil samples.

it was not correct because we never said how the water pushes the air out of the pore spaces

- What do you believe caused the difference in pore space between the two samples?

As the water soaked into the soil it slowly pushed the air out of the pores by filling it with the water