**Soil Infiltration**

**Topics:** Soil Composition, Water Resources

**Grade Level:** 9-12

**Summary:** Students know gardens need water grow, but here they explore the infiltration and water potential of garden soils. After measuring infiltration rates in the garden, students will observe the infiltration/runoff characteristics of soil cores taken around the school.

**Research Question:** How do garden soil types influence water infiltration rates? How does water from the watering can get to plant roots.

**Introduction/Pre-Lab:** Discuss the importance of water uptake for plants or the issue of water runoff or resource limitation.

\*Include pore space when talking about infiltration. Give three pictures as examples.

**Materials List:**

Coffee Can Without Bottom or Lid (can be marked at constant volume intervals)

Ruler

Stopwatch

Plastic cups with bottom removed and replaced with fine mesh

Variety of soil or material samples

Beaker or cup for water runoff

Colored Pencils

Clipboards

**Procedure:**

1. Obtain a metal coffee can and with the help of your teacher remove the bottom so it is open on both ends. Measure 2 inches from the bottom of the can and mark it with a sharpe. Do this in four places around the can.

2. Select an open area of soil in the garden big enough to place the coffee can on. Push the coffee can 2 inches into the soil, so the first mark is at the same level as the soil.

3. Start a timer as you begin to pour 1 Liter of water into the coffee can. Make sure not to overflow the coffee can or to let it go dry before you have poured out all the water. Stop the timer as soon as all of the water has disappeared.

4. Use a hand shovel or soil core to collect a soil sample near the coffee can and place it in a plastic cup.

5. Repeat steps 2, 3 and 4 in an area outside of the garden.

6. Back in the classroom and with the help of your teacher, carefully cut out a circle in the bottom of a two plastic cups. Try to make sure the holes are roughly the same size. Place a piece of mesh in between the two cups as you place one inside the other. It should look like this:

7. Fill your cup with either: garden soil, non-garden soil, gravel, small pebbles, sand, or a mix of these. Draw what your sample looks like.

8. Hold your cup over a sink or waterproof container. Start a timer as you begin to pour 100 ml of water into your cup. Stop the timer when water has stopped flowing from the bottom of the cup.

**Data Collection**

**Prediction:** Do you think water will infiltrate more quickly in the garden, or outside of the garden?

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**Observation**: Record one qualitative observation about the soil in the garden where you sampled.

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Record one qualitative observation about the soil outside of the garden where you sampled.

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**Data:**

Time for 1 Liter of Water to Infiltrate In the Garden: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Time for 1 Liter of Water to Infiltrate Outside of the Garden: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Hypothesis:** What type of soil (garden, non-garden, gravel, pebble, sand) would allow water to infiltrate the fastest?

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**Draw:** Please draw what your soil sample or mixture looks like below.



Soil Type or Mixture: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Data:**

Time for 100 ml to drain (s): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Conclusion/Post-Lab:** Graph coffee can infiltration over time. Graph differences in infiltration rates of soil/material examples. Extend to discuss the impact of soil/material type on plant growth or water uptake. Discuss your soil/material choice for the CHS garden compared to the CHS bioretention area.

1. What is infiltration? Why is it important to the garden and plants?

2. Question about pore space/permeability. Give three pictures similar to the background. Ask which would work best in the garden and why (use the word infiltration)

3. How do you think the infiltration time or rate would change if the soil was compacted? Would compacted soil allow plants to grow?

4. Work with other group members to complete the chart below. Make sure to get at least three different types of soil mixtures.

|  |  |
| --- | --- |
| **Soil Type or Mixture** | **Time to Infiltrate 100 ml** |
|  |  |
|  |  |
|  |  |
|  |  |

5. Describe how and when the plants in the garden receive water. Does someone water them or is there a rain barrel?

6. What type of soil mixture would you think is best for a garden? What would the infiltration rate of this soil type be? Would it be able to retain enough water or nutrients for the plants to grow?

**Modifications:**  *You can extend or differentiate this lesson by including these modifications:*

1. Have students observe the bioretention pond or rain garden in front of the MLK Performance center. Have students compare the infiltration rate and soil mixture. Ask them to construct a soil mixture and profile for their own bioretention pond.

2. If your students are limited by time or motor skill ability, you can prepare the coffee can and filter cups beforehand. You can also place masking tape around the edges of the cut metal to protect against cuts.

3. Students calculate the volume of the coffee can and the volume of each one-inch cross-section of the coffee can. Have students mark off additional one-inch segments of the coffee can. In the garden they will mark down the time it takes for the water to reach each one-inch mark. In the classroom the can create a graph representing infiltration over time.

4. Comparing the infiltration of different soils and materials in the classroom can be done as a demonstration.