You have decided to plant an azalea bush in a bare spot in your yard. You dig an appropriate hole and plant the bush. Despite sufficient rain and sun, the bush dies. You try again with another one with the same results. You know that the soil you put in the hole with the bush is good and that you have supplemented with plant fertilizer. You see that there is water standing for a while in your yard after it rains. There is no evidence of damaging pests. What could the problem be? Take an educated guess and write your idea here.

Let’s Explore!

Activity 1

In a previous activity you determined that weathering and erosion can produce Earth materials of varied sizes. Today we will investigate some of the properties of these differently sized materials with respect to water flow and water storage. This area of study is called hydrology. Let’s begin with some hydrology terminology.

**Pore space** is the space between particles in a sample. It can be filled with air or water depending on the conditions.

How could you measure pore space in a sample of Earth material?

**Permeability** is the ability of a material to allow the passage of a fluid (usually water) through its pore space. It is related to flow rate of water through the material.

What could you do to measure permeability?

**Water retention** is a measure of the amount of water that is trapped in a sample of Earth material. This water may adhere to the surface of the particles or be absorbed by the materials.

How are water retention and permeability related?
1. Examine the samples of three different sized Earth materials provided by the instructor. In the boxes below draw a cross-section of the materials indicating the relative pore space.

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2. **Before you investigate, let’s make some predictions based on how the samples look.**

   Prediction 1: Which size of particle will have the greatest pore space? Why?
   
   __________________________________________________________________________
   __________________________________________________________________________

   Prediction 2: Which size of particle will retain the most water when water is allowed to drain? Why?
   
   __________________________________________________________________________
   __________________________________________________________________________

   Prediction 3: Which size of particle will allow water to pass through the fastest? Why?
   
   __________________________________________________________________________
   __________________________________________________________________________

3.a. Obtain a water sports bottle that has the bottom removed. Be sure it has a cap that is completely open and that there is section of latex on the cap and a pinch clamp available. There should be a cheesecloth or mesh screen under the cap.

3.b. Place the inverted bottle in a beaker to support it. Choose one of the Earth materials and fill the sports bottle to the **LOWER** black line. Carefully tap the side of the bottle to pack the material. Add more material and repeat until the level reaches the black line when packed.
c. Fill a 100 mL graduated cylinder with water to the 100 mL mark. Make sure that the pinch clamp has sealed the bottom of the latex on the bottle. Add water to the bottle until the materials are just covered with water. Tap the side of the bottle to remove any air bubbles and add more water if necessary until the material is just covered again when the bottle is upright. Record the volume of water needed to cover the material in the data table near the end of this activity. What hydrologic property are you measuring?

d. Carefully open the pinch clamp on the bottle and allow the water to drain and collect in a beaker. Close the pinch clamp again. Record the volume that drained and calculate the amount of water that is retained in the Earth material. Record the value in the data table.

e. With the bottle closed, add water back into the sports bottle until it reaches the UPPER black line. Get a timer or locate a clock with a second hand. Open the clamp and record the amount of time it takes for the water to drain through the material to the lower black line. This flow rate is a measure of the permeability.

f. Empty the Earth material into a drying tray labeled for that specific material, rinse and dry the bottle. Repeat steps b-e with a different sized material.

g. Repeat steps b-f with the last Earth material.

4. Ask your instructor to show you a sample of clay before proceeding.

5. a. Graph the result for pore space and particle size on the graph provided on the Data/Results pages. Be sure to label the graph and the axes. Use equal spacings for the material sizes even though the particles sizes do not change in set increments. What type of graph would be useful for your data?

b. Generate a graph for water retention and particle size and one for flow time and particle size.

c. Generate bar graphs for these data sets using Excel on the computers in the lab. Ask the instructor to show you how to use Excel if you are not already familiar with Excel.

Continue on to the conclusions on the next page…

6. Look at each of your predictions from Section 2. Were you correct? Respond why or
why not using your data and observations.

Prediction 1

Prediction 2

Prediction 3

7. Think back about the problem of your dying azalea bush. Could the Earth materials that surrounded the bush (beyond the hole you dug) have been a factor in its survival? Explain.
# DATA AND RESULTS

## Data and Results Table

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## Graphs

![Graphs](image-url)