



Lesson 1: Build an Aquifer

Objective: To learn about groundwater properties by building your own aquifer and conducting experiments.

Background Information

An aquifer is basically a storage container for groundwater that is made up of different sediments. These various sediments can store different amounts of groundwater within the aquifer. The amount of water that it can hold is dependent on the *porosity* and the *permeability* of the sediment.

Porosity is the amount of water that a material can hold in the spaces between its pores, while *permeability* is the material's ability to pass water through these pores. Therefore, an aquifer that has high permeability, like sandstone, will be able to hold more water, than materials that have a lower porosity and permeability.

Directions

You will build your own aquifers and investigate which sediments hold more water (rocks or sand). Students in your class will use either sand or rocks to build their models. You will use a ruler to measure the height of your water table and compare it to the height of water in other sediments.

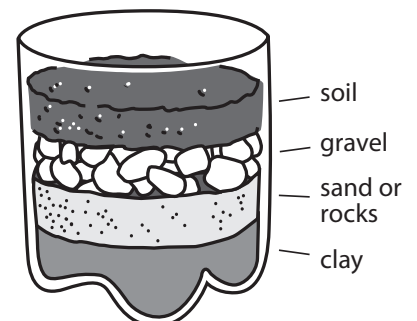
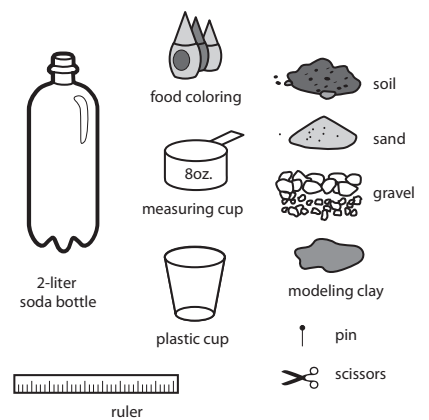
Building Directions

1. Take a pin and use it to make many holes in the bottom of a cup. This cup will later be filled with water and used to simulate rain over your recharge area.
2. Cut the top off the soda bottle and remove the base (leaving 5 inches from the bottom).
3. Flatten modeling clay and place it in the bottom of the soda bottle. Make sure that you use the same amount of clay for each container. This represents the impermeable layer that stops water from continuing to flow deeper under the surface.
4. Pour one cup of rocks into one soda bottle and pour one cup of sand into another soda bottle to form the bottom layer. Note: You can choose different types of sediment to fill the bottom layer of your aquifer and have your class predict which sediments hold more water.
5. Pour one cup of gravel on top of the rocks or sand.
6. Pour one cup of soil on top of the gravel.



Materials:

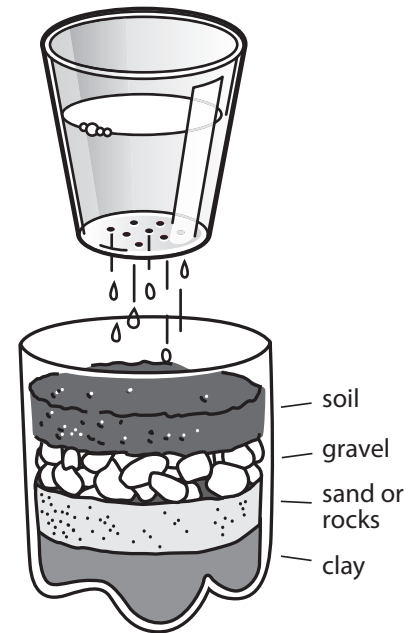
- One, 2 Liter Soda Bottle
- Plastic Cup
- 1 Cup of each:
 - soil, gravel, 1" rocks, sand
- Pin
- Modeling Clay
- Water
- Labels
- 1 Bottle of Food Coloring
- 1 Pair of Scissors
- 1 Ruler
- One 8 Ounce Cup



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Testing Directions

1. Create a hypothesis that addresses whether gravel will hold more or less water than sand.
2. Explain each layer to the students using the definitions given in the background information section. Have students label different areas of the aquifer that include the: impermeable layer, saturated zone, unsaturated zone, and surface. Refer to *Diving Deeper: Concepts & Vocabulary* for more information.
3. Pour a measured amount of water (example: 8 ounces) into the cup with holes and create rain over the top soil layer of the bottle. Have your students point out the water table as it rises with rain. Have the students observe and measure the height of the water table (from the bottom of the soda bottle to the top of the water table). Record their results (the height of the water table) on the board (rock vs. sand).
4. Since equal amounts of sediment and water were added in this experiment, then the only variable is the type of sediment added to the different containers. This means that the height of the water table is dependent on the type of sediment in each container. The container with with the shortest water table height contains sediment that is capable of holding more water. This sediment takes up less space and must have a higher porosity or permeability than the container with the other type of sediment.



Conclusion

- Discuss the results of the experiment and the validity of the hypothesis.
- Ask the students how porosity and permeability affect the amount of water that can be stored in an aquifer.
- Encourage the students to brainstorm further experiments that they can conduct to determine if porosity or permeability is more influential in groundwater storage.
- Discuss the importance of groundwater and how people use it.
- In addition, you may choose to create another experiment and ask your students to predict where the pollution will go when you add it to the top soil layer of your container and rain falls down from the sky. You can easily conduct this additional experiment by placing a drop of food coloring that symbolizes pollution in your container and then pour water to simulate rain.

This is a great activity to introduce ways that we can limit nonpoint source pollution and conserve groundwater.

