



Department of Ecosystem Science and Management

Youth

Groundwater as Part of the Water Cycle

- **Keywords:** groundwater, water cycle, aquifer
- **Grade Level:** ninth grade
- **Total Time for Lesson:** two 55-minute periods
- **Setting:** classroom

Materials Needed

- potted plant with a large plastic bag
- 2-liter clear soda bottle with the bottom cut off to make a tall funnel
- beaker
- ring stand and ring
- sand, gravel, small pieces of limestone
- copies of *Groundwater, A Primer for Pennsylvanians* [<http://palwv.org/wren/pubs/primer.html>]

Concepts to be Covered

- Groundwater is filtered through earth and rock to supply clean water to streams and aquifers. We depend on this water resource to sustain life.
- The water cycle recharges groundwater.

Goals for the Lesson

- Students will understand the effects of soils and rocks on filtering groundwater.
- Students will expand their concept of the water cycle to include groundwater, transpiration, aquifers, and the water table.
- Students will consider sources of contamination in the water cycle.

Teaching Model: Explore - Focus - Reflect

State Standards Addressed: Environment and Ecology (4.1.10.B)

Procedures

Activity 1

- Cover the potted plant, or part of it, a few hours before class or overnight.
- Make sure you cover just the plant and tie the bag shut around the stem.
- The plant should be thoroughly watered. Moisture from transpiration will collect inside the bag.
- Use this as an opener to the water cycle and to explain transpiration.
- Ask the students where this fits in their understanding of the water cycle.

Activity 2

- Pack the 2-liter funnel starting at the top with a 2 cm organic layer blending into a 3 to 4 cm of sand and clay mixture.
- Do not put in too much clay or it will trap the water to be filtered.
- Then add layer of sand clay and limestone the size of a pea 2-3 cm deep, blending to a layer of all limestone.
- Have a jar with about 500 mL of water with sediments (fine soil runoff) in it.
- Shake the jar and tell the students that this represents our streams and runoff after a heavy rain. Have a student test the pH. (You may want to add some vinegar or other acid to make it slightly acidic.)
- Pour the runoff through the filter column catching the water in a clear jar or beaker. Test the pH again.
- Depending on your layer and size of limestone, you may see a small increase in pH as the water filters through. If it does not change, point out to the students that there is a greater amount of limestone in the bedrock in the Ridge and Valley area of Pennsylvania than in the filter column.
- Discuss the clarity of the water.
- Ask the students to compare the two demonstrations with the picture of the water cycle on page one of the [Groundwater \[http://palwv.org/wren/pubs/primer.html\]](http://palwv.org/wren/pubs/primer.html) booklet.
- In their notebooks have them draw three columns and record concepts from the picture

under the appropriate heading. This is a good way to have them analyze the picture information in closer detail and recognize more components of the hydrologic cycle.

Answer Key

Evaporation Condensation Precipitation

Rivers	Water vapor	Rain
Lakes	Clouds	Hail
Streams		Snow
Ocean		Runoff
Transpiration		Groundwater*
		Infiltration*
		Percolation*

*These are hard to place. Discuss their answers.

Activity 3

- Divide the students into eight to ten teams.
- Assign each team a section or page in the booklet.
- Give each team an index card. On one side they are to summarize their page in on more than three main points to explain to the class. On the other side they are to write the vocabulary, if any, and definitions.
- Collect the cards at the end of class for tomorrow's presentations. You may grade the cards if you wish. T
- he next day have students present their section to the class.
- Have the class look at the information in the booklet as being presented.
- Help clear up any concepts.

Evaluation

As an evaluation, have the students write a half-page to a page about a concept they learned and how it impacts their lives. They may use the booklet and their notebooks to do this.

Examples:

- How do we depend on groundwater?
- What is regulated by law to protect our ground water?

- Describe aquifers.

Reference

Stevens, Edith. *Groundwater: A Primer for Pennsylvanians*. [<http://palwv.org/wren/pubs/primer.html>] League of Women Voters of Pennsylvania Citizen Education Fund, 226 Forster St., Harrisburg, PA 17102 and Penn State Cooperative Extension, 112 Armsby Building, University Park, PA 16802

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