



Drexel-SDP GK-12 ACTIVITY

Science

Environmental Science and Ecosystems

Water Filters and Watersheds

Grade Level _6_ (_5_-_6_)

Time Required: 3 Class Periods

Group Size: Whole Class

Expendable Cost per Group: \$10

Summary

Students are learning about environmental science and ecosystems in the standard SDP curriculum. To augment this with an appreciation for our water supply, treatment, and pollution, students will construct a simple “from-the-earth” water filter and notice its benefits and inefficiencies. The class will discuss ways to improve upon its performance. Students will then build an aquafier to identify groundwater supplies and discuss watersheds, particularly as they relate to the filtration issues previously discussed. Finally, students will construct a model “water cycle.”

Engineering Connection

Students construct models of real-world water processes to gain insight into a) how our water supply is treated and b) how we pollute and abuse that supply. Broader impacts include environmental and water care awareness.

Keywords

Water, filter, aquafier, environment, ecosystem, pollution

Educational Standards

- Science:
 - 3.5.7D: Explain the behavior and impact of the earth’s water systems
 - 3.5.10D: Assess the value of water as a resource

Learning Objectives

After this lesson, students should be able to:

- Describe commonly used water filtration systems and their purpose
- Assess the effectiveness of a water filter and suggest methods of improvement
- Identify sources of water, including watersheds and ground-wells
- Describe the water cycle with examples

Materials List

- 2-liter soda bottle cut in half
- napkins or paper towels
- oil
- food coloring
- pieces of paper
- tiny pieces of styrofoam
- plastic tub
- plastic cup
- measuring cup
- cling wrap
- aquarium gravel
- sand
- soil
- modeling clay
- marbles
- clean water

Procedure

Water filter

1. Put the top half of the soda bottle upside-down (like a funnel) inside the bottom half. The top half will be where you build your filter; the bottom half will hold the filtered water.
2. Layer the filter materials inside the top half of the bottle. Think about what each material might remove from the dirty water and in what order you should layer the materials. For an added challenge, use only two of materials to build your filter.
3. Pour the dirty water through the filter. What does the filtered water look like?
4. Take the filter apart and look at the different layers. Can you tell what each material removed from the water?
5. Wipe the bottle clean and try again. Try putting materials in different layers or using different amounts of materials.

Aquifer

Background

Many communities obtain their drinking water from underground sources called **aquifers**. Water suppliers or utility officials often drill wells through soil and rock into aquifers for the ground water contained therein to supply the public with drinking water. Home owners who cannot obtain their drinking water from a public water supply, will have their own private wells drilled on their property. Unfortunately, ground water can become contaminated by harmful chemicals, such as lawn care products and household cleaners

that were used or disposed of improperly, and any number of other pollutants, that can enter the soil and rock, polluting the aquifer and eventually the well. Such contamination can pose a significant threat to human health. The measures that must be taken by well owners and water plant operators to either protect or clean up contaminated aquifers are quite often costly.

Note: This demonstration should follow a class discussion on potential sources of pollution to drinking water supplies.

Objectives

To illustrate how water is stored in an aquifer, how ground water can become contaminated, and how this contamination ends up in a drinking water well. Ultimately, students should get a clear understanding of how careless use and disposal of harmful contaminants above the ground can potentially end up in the drinking water below the ground. This particular experiment can be done by each student at their work station.

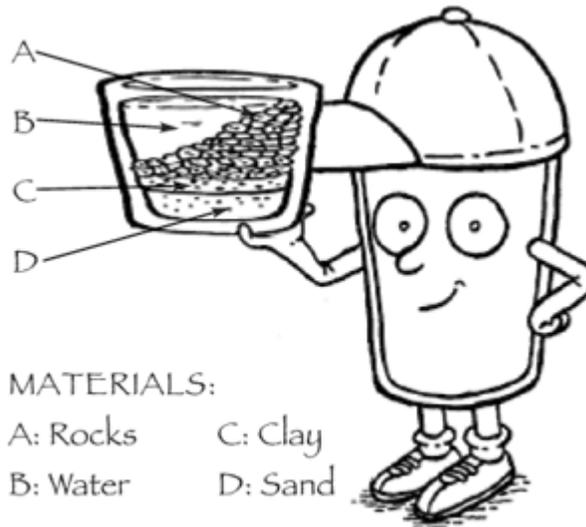
Procedure

1. Pour 1/4" of white sand in the bottom of each cup completely covering the bottom of the container. Pour water into the sand, wetting it completely (there should be no standing water on top of sand). Let students see how the water is absorbed in the sand, but remains around the sand particles as it is stored in the ground and ultimately forming part of the aquifer.
2. Have each student flatten the modeling clay (like a pancake) and cover 1/2 of the sand with the clay (have each student press the clay to one side of the container to seal off that side). The clay represents a "confining layer" that keeps water from passing through it. Pour a small amount of water onto the clay. Let the students see how the water remains on top of the clay, only flowing into the sand below in areas not covered by the clay.
3. Use the aquarium rocks to form the next layer of earth. Place the rocks over the sand and clay, covering the entire container. To one side of the cup, have students slope the rocks, forming a high hill and a valley (see Thirstin's illustration). Explain to students that these layers represent some of the many layers contained in the earth's surface. Now pour water into your aquifer until the water in the valley is even with your hill. Students will see the water stored around the rocks. Explain that these rocks are porous, allowing storage of water within the pores and openings between them. They will also notice a "surface" supply of water (a small lake) has formed. This will give them a view of both the ground and surface water supplies which can be used for drinking water purposes.
4. Use the food coloring and put a few drops on top of the rock hill as close to the inside wall of the cup as possible. As an example, explain to students that often old wells are used to dispose of farm chemicals, trash, and used motor oil. This practice can show up in the ground water and their drinking water. They will see that the color spreads not only through the rocks, but also to the surface water and into the white sand at the bottom of their cup. This is one way pollution can spread throughout the aquifer over time.

Follow up

Discuss with students other activities that could pollute their aquifer. Assign students the task of locating activities around the school or their own homes that could pollute their drinking water sources if not properly maintained. Allow students to drain off the water in their cups and carry home their container to refill with water and show their parents surface and ground water and how the food coloring illustrates pollution activity above their aquifer can affect all water. Students should discuss with parents what steps they can take as a household to prevent water pollution. steps they can take as a household to prevent water pollution.

Figure 1 -
http://www.epa.gov/ogwdw000/kids/grades_k-3_thirstin_builds_an_aquifer.html



Water Cycle

Instructions for Making a Mini Solar Still



1. Add one or two litres of soil or sand to the plastic tub – if making more than one still, add the same amount of soil or sand is used in each. You should also ensure the soil has a consistent and uniform moisture content.



2. Position the plastic cup in the centre of the tub, partially submerged in the soil for stability.



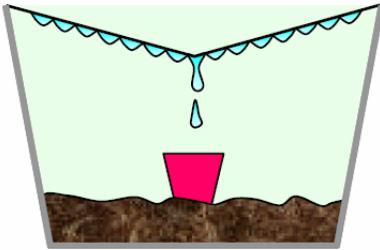
3. For a large tub such as this one, add 2 cups of water to the soil or sand. For smaller tubs (eg ice cream containers) add $\frac{1}{2}$ to 1 cup of water. Sprinkle the water evenly over the soil.



4. Seal the tub with cling wrap and tape. Add a pebble or large marble directly above the cup forming a depression for the water droplets to roll down.



5. Place the solar still in a still and sunny location (it may pay to check with groundsman to find the best position – wind can cause the cling wrap to flap about so that the droplets miss the cup).



- * Ensure the cup is directly under the pebble or marble – on sunny days exceeding 25⁰C, the still should collect more than half a cup of water in approximately 3 to 4 hours.

Figure 2- http://www.abc.net.au/science/surfingscientist/pdf/lesson_plan09.pdf

References

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Owner

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