

Surface to Groundwater Interaction, Filtration and Usage

Created and delivered by **Matthew G. Averill**, Geophysics PhD candidate
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Lab 2: Water Filtration Competition

Lesson Vocabulary

Contamination, contaminate, contaminant, filter, purification

Materials Required

Plastic bottles

Scissors

“Contaminated” water

Screening

Rubber bands

Filtration materials - be creative, but these can include soil, clay, sand, gravel, marbles, potting soil, cotton balls, metal scrap, woodchips, sawdust, packing peanuts, charcoal, coffee filters, vegetation (such as shredded lettuce)

Preparation

Before the first class, prepare at least one of the bottles that will be used to build the filtration chamber. Cut the bottom off the bottle. Remove the cap and cover the opening with screening to keep the filtration materials inside. Attach the screen tightly with a rubber band. Gather filtration materials. Prepare “contaminated” water.

Safety Information

Depending on material used for “contamination” of water, it may be necessary to use prior purification materials, such as iodine tablets. Students should be instructed to avoid ingestion of any of the materials. If food coloring is used, clothing should be protected.

Engagement Technique

A review of contamination and how it can be carried in our groundwater can be demonstrated using the groundwater flow models. Additionally, the affects of groundwater contamination may be shown as a PowerPoint presentation.

Exploration

Step 1: Before the first class, prepare at least one of the bottles that will be used to build the filtration chamber. Cut the bottom off the bottle. Remove the cap and cover the opening with screening to keep the filtration materials inside. Attach the screen tightly with a rubber band.

Step 2: Instruct each team of students (~4-5 teams per class) to design an idea for a filtration system. Show them the sample filtration chamber you made so they can see how it will work. Each design can use any three of the filtration materials, and use them in any order. Do not tell the students what is in the

The

polluted water. Because results will vary with the materials available and the different possible designs, let the students know that there may not be a single best plan. Also, show them the **competition rubric**, so students can see that they will be evaluated on both water quality and speed of water through the system.

Step 3: Students should design their filtration systems. Designs should include a short paragraph describing why they used the materials they did and how they chose the order. Each team hands in the design to the teacher.

Step 4: One at a time the teams discuss in front of the class the details of their design. (The designs should be collected by the teacher to avoid students modifying their plans based on the ideas of others. However, the teams may want to refer to their plans when they present to the class.)

Step 7: Student teams should build their filtration systems. Instruct students to clean up any spills immediately.

Step 8: Each team will pour 150 mL "polluted" water through their filtration systems and collect the water in another beaker. Teams should time how long it takes from the time water is first poured into the system until the time 150 ml of water comes out the other end. This time should be recorded.

Step 9: Test 150 ml of water collected through each filtration system against the pollution level in the extra 150 ml sample that was unfiltered.

Explanation

Students must provide a detailed description of their filter design and explain why they used their specific materials.

Elaboration, Extension

Students can research what physical filtration methods are used in the municipal water in their area.

Evaluation

Students are evaluated on filtration system design, description, building, and testing; quality of their filtration system; ability to answer follow-up questions.

Peer Review

The lesson plan will be observed by and reviewed by both co-teachers at the participating middle school as well as the GK-12 program manager.

Water Filtration Competition Procedure

Materials:

- plastic bottles
- scissors
- "Contaminated" water and/or other solutions to be filtered
- filtration materials
 coffee filters, screening, sand, pebbles, charcoal, etc.
- screening
- rubber bands

Procedures:

You will design, evaluate, build, and test water filtration systems.

Design.

These systems will be built within plastic bottles like the one your teacher has as a sample. The bottom will be cut off, and a screen will prevent the small opening from spilling filtration materials. Your system will include 3 of the filtration materials provided to you.

You will not know what is in the contaminated water until after your system is constructed.

Your design should consist of a short paragraph describing why you used the materials you did, and how the order was chosen. Hand in the design to your teacher.

Build.

Cut the bottom off of your plastic bottle.

Remove the cap, and cover the opening with screen. Use a rubber band to tightly attach the screen.

Create your filtration system just as you designed.

Test.

Before pouring the polluted sample through your filter, be prepared to 1) start timing to see how long it takes to produce 150 ml, and 2) collect the water flowing through your system.

Evaluate your sample based on the teacher's directions.

Follow-up.

Complete the follow-up sheets.

Names: _____

Date: _____

Water Filtration Competition

Pre-test questions:

Description of Design: Provide a detailed description of your filter design, including: Filtering materials used, why you used each material, how you layered your materials and what you expect to happen. This description will be used to determine a winner of the competition.

Names: _____

Date: _____

Water Filtration Competition

Post-experiment questions:

How long did it take to filter the water? _____seconds

Which group's filter worked the best for:

Rio Grande water _____

Colored salt water _____

Which material worked best for filtering? _____

What would you do differently next time?