



DOES THIS WATER TASTE FUNNY TO YOU?

The Office of Science Outreach

Does this water taste funny to you?

Place a check mark in the column which you think is the best source for drinking water.

Location/Country	Which can you drink?	
	Bottled H ₂ O	Tap H ₂ O
WITHIN THE U.S.		
Columbia, Missouri		
Los Angeles, California		
New York, New York		
Florida Keys		
OUTSIDE OF THE U.S.		
South Africa		
Paris, France		
London, England		
Hawaii		
Puerto Rico		
Berlin, Germany		
Cairo, Egypt		
Bangladesh, India		
Tokyo, Japan		
Montreal, Canada		

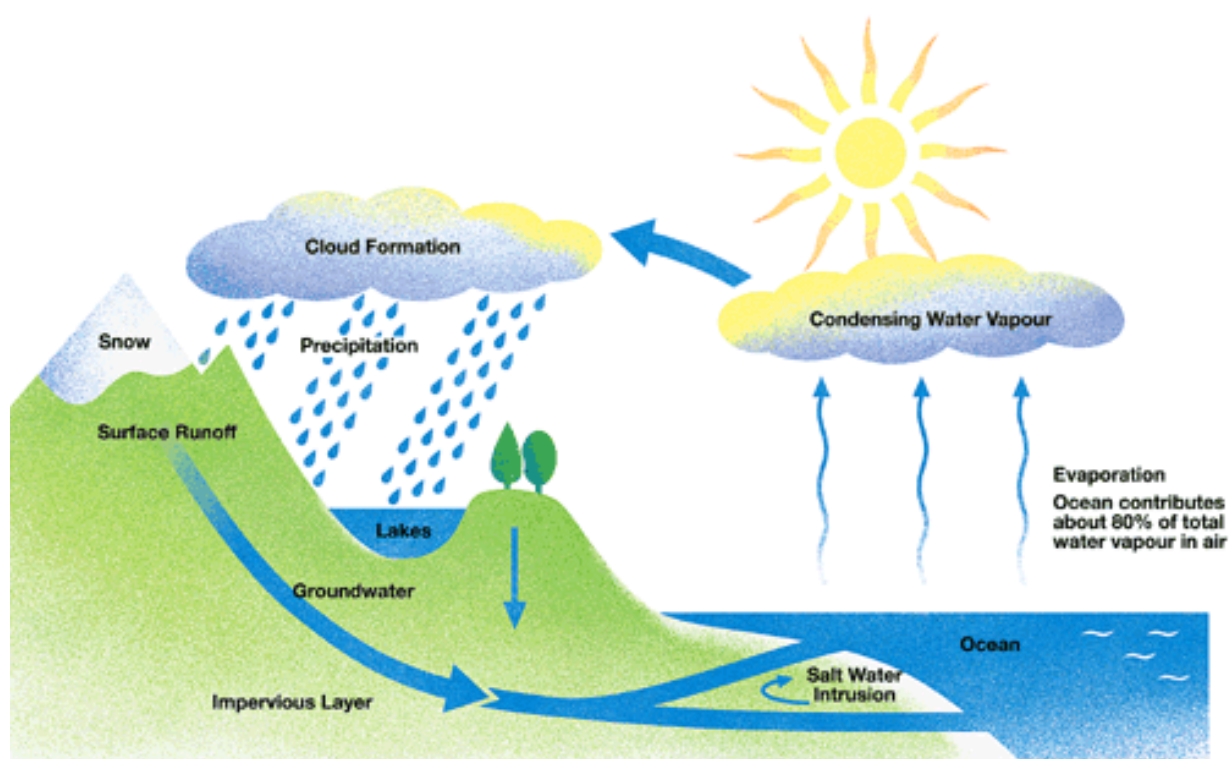
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Objective

Water is vital to the function of not only the environment, but also to our bodies. Students will create filtration systems and be able to describe the importance of purification methods in providing clean water to drink. They will be able to describe the differences between natural and mechanical filtration systems.

Background information

One pathway that water cycles throughout the globe (hydrologic cycle or water cycle) is that water evaporates into the atmosphere, falls to Earth's surface as precipitation, and flows to the sea, where it evaporates again (USGS website).



Without accessibility to clean and safe water, millions of people throughout the world will continue to live in impoverished and unhealthy conditions. Inadequate sanitation and access to potable water are among the biggest causes of child mortality. Clean water, or the lack of it, is one of the major reasons why five million children in Africa succumb annually to water borne illnesses (DST Program Planning and Development, 2009).

Wetlands are a significant element in the water cycle. They store vast quantities of water, and wetland vegetation contributes to the earth's water cycle through the process of evapotranspiration. Because of the intensity of their chemical and biological activity, wetlands are important to global vitality. They accept, break down, and make nutrient matter. They absorb heavy metals, filter out toxins, produce a massive food base, process nitrates, and release oxygen into the atmosphere while removing carbon

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dioxide and other greenhouse gases. Wetlands contribute to flood control, bank stabilization, pollution control, the recharge and discharge of ground water, and habitat for myriad plants and animals, including humans. They also act as storm buffers, sediment traps, and contribute to waste treatment. Wastewater created by humans must be treated before being released back into the environment (Wow! The Wonders of Wetlands).

Treatment plants utilize various water-purification methods, including biological treatment, during which microorganisms digest certain impurities. Several steps are required to purify water. Water can be filtered and purified naturally to some extent in wetlands. Many wetlands lie in depressions or basins in the land. When runoff collects there, it has a chance to stop and “rest” before it is slowly released to ground water or an adjacent waterway (Wow! The Wonders of Wetlands).

Materials

Group I – Mechanical Purification	Group II – Natural Filtration
2 liter bottle	1 clear pan (13”x9”)
25ml: gravel, sand, soil, salt	25ml: rocks, gravel, sand, soil, salt, crushed leaves, grass
Alum	2 quart jars
Stirring rod	Florist foam or sponges
Coffee filter	Books to tilt pans
Rubber band or masking tape	Watering can
Bleach	Food coloring (red)
2 quart jars of ‘polluted’ water	2 liter bottle
3 jars of water samples: Flat Branch Creek, tap water, bottled water	

Activity Source: Wow! The Wonders of Wetlands: An Educator’s Guide. 2003.

Engage

Begin by showing students jars containing water sampled from Flat Branch Creek, bottled water, and ordinary tap water. Where does our drinking water come from? How much water does the average American drink/use daily? Why do people need to drink water? Is water good for you or bad for you? What is the benefit of drinking water? What happens if you don’t drink water? What can happen if you don’t drink clean or filtered water? Give students the Drinkability chart and ask them to complete the chart.

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Explore

Break students into two groups. One will perform a manual filtration process and the other will perform the natural process. Which method do they predict will be more effective in purifying the water?

Which of the resulting treated water will be better for us?

Procedure:

Group 1 (Mechanical Filtration) – see handout

Step 1: Observe and record the first jar of polluted water's color and clarity. Describe the particles and their positions in the solution. This will be the control.

Step 2: Take the second jar of polluted water; add 0.5 grams of alum. Stir for 3-5 minutes. Aluminum hydroxide particles will develop as a demonstration of flocculation.

Step 3: Let the water settle for 10-15 minutes. Observe and record the water's color and clarity, and describe the position of the particles in the solution. This is the process of sedimentation.

Step 4: Cut the top off of a 2 liter bottle. Insert the coffee filter into the 2 liter bottle and secure with a rubber band (or masking tape). Carefully pour the water from step 3 through the filter. Do not stir the particles as you pour. Remove the coffee filter and set aside.

Step 5: Add one drop of bleach to the filtered sample and stir the solution. Observe the final sample and compare its appearance to the control. This demonstrates sterilization.

Step 6: Save final results, do not discard.

Group 2 (Natural Filtration) – see handout

Part A

Step 1: Ask what will happen when you pour water over the wetland model. Sprinkle some soil over wetland model, and slowly pour water over the wetland model. Students should observe and record what they see. Examine the runoff and the particles in it. What about the particles not in the runoff? (*Relates to filtration*)

Step 2: Reset the model, but remove the wetland area (sponges). Add more soil and pour water over the model again. Students should observe and record what they see. What is different about this scenario? (*Relates to flood control and soil erosion*)

Step 3: Reset the model a third time, replacing the wetland area and soil. This time use water that has red food coloring added to it. Pour this over the model. Students should observe and record what they see. What is different about the runoff in this scenario? (*Relates to pollution*)

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Part B

Step 1: In 2 glass containers layer rocks, gravel, sand, soil, and grass/leaves. Insert toothpicks so there are holes in the sand for leaching to occur.

Step 2: Pour muddy water into one container and 'polluted' water (water with red food coloring) into the other.

Step 3: Observe and record the process of water filtering at various levels. Observe and record characteristics of the water settling between the rock spaces in each container. (*Relates to natural filtration*).

Step 4: Save final results from both jars; do not discard.

Explain

Wetlands are important players in keeping our water clean and contribute to the water cycle globally. They play a role in flood control and waste control, and act as storm buffers, sediment traps, and pollution interceptors [*see diagram of water cycle for visual aid*]. Students will describe the difference between the processes of filtration and reflect back on these differences during the filtration activity. Each student group will then present their results to the other group. Groups will then discuss the differences between the two filtration systems (*see list of potential probing questions*).

Flood Control

Wetlands can act as protective natural sponges in capturing, storing, and slowly releasing water over a long period of time, reducing the impact of floods. Water stored in wetland soils is released steadily over weeks and months rather than in a sudden and uncontrolled pulse.

Storm Buffers

As storm buffers they dissipate more than half of the energy in waves; they slow erosion by holding soil in place with their roots; their stalks lessen the damage done by wind and waves; they trap sediments and increase wetland acreage over time.

Sediment Traps

Wetlands improve water quality by burying pesticides, residues and heavy metals within sediment layers. They slow water velocity, decreases water turbidity (muddiness) to let sunlight filter through to encourage growth of plants and organisms, adding more oxygen to the water. However, too much sediment can change the water temperature, and can be harmful to animals by clogging their gills and burying beneficial organisms.

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Pollution Interception

Pollutants reduce the oxygen level and plant production in water; it kills fish and harm habitats as well as having other harmful effects. As pollution interceptors, wetland plants take up and filter some pollutants found in water; while other pollutants settle into the sediment and are chemically reduced over time; and other pollutants are processed by bacteria.

Waste Treatment

Peat is an efficient filter, so are mangroves and salt marshes for removing some pollutants from water. Wetlands also slow waste water and removes harmful bacteria. High levels of beneficial bacterial activity within wetlands, breaks down and neutralizes waste.

Probing Questions

- Which system was better (more efficient) at removing solid materials from water?
- Which system was better at removing chemical materials from water?
- Is the taste of water affected by the purification process?
- What are some of the drawbacks and benefits of each filtration process?

Elaborate/Extend

Starting with natural process and then moving on to mechanical process; each group will share what they did and what they found in the two filtration processes (use jars from final results). Who has the cleaner water? What are the benefits and drawbacks in each process? Discuss the importance of having access to clean water for human health. Talk about things from the standpoint of having clean water not only in Columbia, Missouri but also in other countries.

Evaluate

Investigate how clean the water is in the various locations listed on the Drinkability chart. Can learn how different states or countries treat their water, and determine how much of the population has access to potable water.

For further information:

US Geological Survey site on Water Cycle

<http://ga.water.usgs.gov/edu/watercyclesummary.html>

Wow! The Wonders of Wetlands: An Educator's Guide. 2003.