

STEM Challenge: Clean Dirty Water (Building a Water Filtration System)

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Suggested time: 50 minutes

Grade: 3-5

Overview

Students will learn the process water goes through to make it safe for humans. They will learn about the common places we get our drinking water and become familiar with the process of filtering out the harmful components. At the end of this lesson students should understand the importance of cleaning water and basic concepts for filtering harmful objects from water.

Vocabulary

Bacteria

Filtration

Disease - *in particular, cholera which is found in polluted water*

Pollution

Salt water

Fresh water

Melt water

Glacier

Groundwater

Hydrosphere

Particles

Objective

- Understand why it is important to have clean drinking water.
- Understand where we get our drinking water from.

- Know the basics of filtering water.

Next Generation Science Standards

LS4 D Biodiversity and Humans

PS1-6. Asking Questions

LS1-4. Developing and Using Models

Required Project Materials

(amount varies depending on class size)

Containers:

- 1 Pop bottles (2-liter) cut in half for each group
- 1 medium containers for access water per group
- 3 Large containers of Dirty water
- Beads or foam particles
- Dirt
- Sprinkles
- Food coloring (preferably different colors for each dirty water container)
- Vinegar
- Baking Soda
- Dish soap
- etc.

Filtration items:

- Rocks
- Sand
- Cheesecloth
- Tissue
- Coffee Filter
- Netting
- Cotton Balls
- Active Charcoal

Worksheets:

- *Results* - url <https://www.authorea.com/375910/MVKYtkLRRrdIPFTJDcj9cA>
- *Debrief* - url https://www.authorea.com/375909/sQutwf2yWTyVSw1GRdJr_A

Props:

Small bottle of filtered water (1 for each student)

Clean-up/Misc. items:

- Paper towel
- Rubber bands
- Tape
- Scissors
- Pens/Pencils/Markers
- 1 clear measuring cup per group
- Paper or Plastic cups (for filtration items)
- Something to scoop the dirty water in the measuring cup
- 6 test tubes per group

Multimedia Resources

- Video on Earth Water [<https://www.youtube.com/watch?v=oaQCiwzjnCM>]
- Importance of water to the Body [https://www.usgs.gov/special-topic/water-science-school/science/water-you-water-and-human-body?qt-science_center_objects=0#qt-science_center_objects and <https://www.livescience.com/32320-how-long-can-a-person-survive-without-water.html>]
- A projector and laptop or digital TV (to display video content)
- All Earth's Water [Image]
- Water Fix! [<https://www.youtube.com/watch?v=UYROQW9IDIg>]

Optimal Multimedia Resources

Before the Lesson/ Background Information

- Think over what questions kids might have related to the water filtration process.
- Think of real world problems - ie. the Flint, MI water crisis - Has any students (or their family) been impacted by this? This may be worth discussing with the class.
- Work on building your own filtration system to bring to the class.
- Good resource - Review link for good information on Safe Drinking water <https://www.koshland-science-museum.org/water/new/en/Overview/Quantity.html>
- Label the 3 sources of “dirty water” something creative like different locations from earth (or from different planets!) to make it more interesting.

The Lesson

Part 1 - Clean Water Discussion (20 minutes)

1. Intro: Give every student their own personal bottle of drinking water and as a group do a toast to a great learning experience :-)
2. Discuss: Why is it important to have clean drinking water?
 - Humans need clean water for health and hygiene, in fact we need water to stay alive.

- It is estimated that the average person can last somewhere between 2 and 7 days without water (but there are several factors to this like temperature and the person's current hydration level). Estimated 60% to 70% of our body is made up of water [Show related Image on Screen]
- Talk about diseases like cholera, and how harmful objects that get into the water.

Video (04:15): The Basics of Freshwater link: <https://www.youtube.com/watch?v=oaQCiwzjnCM>

- Fresh vs Salt water
- Glaciers - meltwater
- Springs and wells - Groundwater
- Rivers and streams - Surface Freshwater
- Where does it go before we can drink it?
- Discuss.

Part 2 - Build Your Own Water Filtration Machine (30 Minutes)

1. Separate into groups (size of 2 - 4)
2. Play Video (05:28) Water Fix! link <https://www.youtube.com/watch?v=UYROQW9IDIg>
3. **Introduce Challenge: Clean Earth's Water**
 - Review the basic structure of the Water Filtration system (the 2-liter pop bottle) **Note:** The structure of the water filtration system starts with the 2-liter bottle that is cut in half. The base of the bottle is the "water tank" that the filtered water flows into. The narrow top half of the bottle is where the students design the filter by arranging the 3 items they picked out of 8 items to choose from. The thought is that the material covered in the first part of the lesson and the preliminary test conducted by the students on each individual item prepares them to design a practical solutions with the materials they selected.
 - Pick one dirty water source from the 3 labeled containers
 - Pick (3) filtration items
 - Test and evaluate each item by itself
 - Use [worksheet - Results] to organize materials and document results
 - Review data and build your production filtration system. Students will organize all three filter items into the funnel half of pop bottle
 - Test finished product and document the results on the "Results" worksheet.
 - Redesign: allow for an iteration of the final product where students can swap out one filtration item in an attempt to improve their results.
4. Debrief [see Debrief worksheet]
 - After Final Build results are done, ask each group what happened to the dirty water as they poured it their filtration systems? Is that what they expected to happen? Explain.
 - In what ways do they think the filter can be more effective?
 - Once sufficiently clean, how many glasses of water can their filter tank hold - remember we cut a 2-liter bottle in approx. one half? How many containers would they need to produce enough clean water for one days worth of recommended drinking (64 oz)?
5. Explain that this was just a STEM project that solved a major human need.