Activity Title: Build Your Own Water Filter

Recommended Grades

Kindergarten, Grade 1, Grade 2, Grade 3, Grade 4, Grade 5, Grade 6

Curriculum Connections

Matter
- K – properties of objects
- 2 – combine materials to create an object for a purpose
- 3 – processed vs unprocessed materials
- 4 – waste management, gravity

Energy
- 4 – forces act without contact - gravity
- 5 – nonrenewable resources (oil)
- 6 – factors that influence selection of energy resources

Earth Systems
- K – examine and describe environments
- 1 – caring/respect for nature
- 2 – bodies of water
- 3 – human activities change Earth
- 4 – caring for water sources

Living Systems
- 1 – humans can help plants/animals by respecting environments
- 2 – human behaviours can affect plants/animals
- 3 – minimizing disturbances to plants/animals

Computer Science
- K – interpret instructions
- 1 – instructions need a specific order

Scientific Methods
- 1 – ask questions, make predictions

Time

Approx. 10 minutes to build, 30-45 minutes to filter

Skills Focused On

• Critical Thinking • Hypothesizing	• Problem-solving • Observation

Materials Needed

- Pop/soda bottles, cut into halves
- Sand - fine and coarse
- Gravel - small and big
- Elastic bands and coffee filters
- A glass of muddy or dirty water to be filtered
- *Optional:* Activated Charcoal
    - **WARNING** - activated charcoal is a very fine powder which can get in eyes or be inhaled. The Safety Data Sheet for activated charcoal recommends handling with gloves and eye protection. A mask is optional but a good choice for additional protection.
    - Only an adult should use the activated charcoal.

Though it is best to have materials of varying coarseness, if you do not have the four recommended materials (fine and coarse sand, big and small gravel), a filter can still be made with fewer materials.

Sand and gravel can be purchased in small quantities at craft and hobby stores. For larger quantities, Home Depot, and Canadian Tire are good choices.

Background Information

There are lots of activities which humans do which can make water dirty or polluted. It is very important that we find ways to clean water, so that humans and animals can safely drink it, and fish have a clean place to live.

Remediation is when we treat something in the environment that has been polluted, kind of like how you take a remedy when you are sick. For example, we use lots of water to extract oil from the ground, which leaves behind unclean water that we call tailing ponds. Scientists are studying the best way to clean tailing ponds water so it is drinkable again.

One material we use to clean water is called activated charcoal. Activated charcoal is charcoal which has been treated with oxygen, which opens millions of tiny holes that we can't see. These holes make it great for filtering. But there are other materials that we can use to filter water, too – like sand and gravel.

In this experiment, you will learn how to build your own water filter using materials you can find at home and in craft stores.

Experimental Steps

1. Cut your pop bottles into halves (get an adult to help you).
2. Cover the nozzle of the pop bottle with the coffee filter, then secure it with the elastic.

3. *Optional:* If you have activated charcoal, use it as your first layer, filling about ⅕ of the funnel (the top half of your pop bottle). You can also make two filters, one with charcoal and one without, to compare them. If you don't have activated charcoal, skip to step 4.
4. Add fine sand to your funnel, filling it about ¼ of the way.
5. Add coarse sand to your funnel, filling it another ¼ so it is halfway full.
6. Add small gravel to your funnel, filling it another ¼ so it is ¾ full.
7. Add coarse gravel as your final layer. Fill the funnel to the top.
8. Put the funnel nozzle-side down inside of the bottom half of your pop bottle. This will catch the water after it is filtered.
9. Pour the dirty water into your funnel(s). Watch what happens!

Even if your filtered water looks good enough to drink, do NOT drink it. There could still be contaminants which are too small to see with your eyes.

Note: If you only have sand, or only gravel, your filter will still work, just not as well. Try experimenting to see what makes your water cleanest!

Discussion/Experimental Extensions

Why do you think we put the coarse gravel on top, and the fine sand on bottom? Would the filter still work as well if we reversed the order of our materials? Why or why not? (Try it to confirm your hypothesis!)

What are all the different layers for? Would our filter still work if we only used fine sand, and not gravel? Do you think it would take more time to filter, or less? Try making a filter with only fine sand, and a filter with only coarse gravel, then timing them to see which one cleans the water fastest.

If you made two filters (one with activated charcoal and one without), which worked better? Why do you think that is?

Additional Resources

Dirty to Clean, It's Time to Build Your Own Water Filter experimental video produced by Future Energy Systems - provides background information and instructions for experiment: https://youtu.be/EuPh_qwoF4Y?feature=shared.

Learn more about Future Energy Systems (https://www.futureenergysystems.ca/) and access more learning content, including storytimes, lab tours, ask an experts and more (https://www.futureenergysystems.ca/engage/learning https://www.youtube.com/channel/UCJr8N9KyFJ6d-t36TPtUlwg).