Clear into the Classroom LESSON PLAN

Water Filtration Demonstration

DEMONSTRATION:

What is the best way to filter water that is not yet purified for drinking?

Begin with discussion of **water quality** and where local water comes from. Do we drink it directly from puddles and lakes? From the ocean? Perhaps students know that there are people in the world whose water is unsafe for drinking, yet they must drink it. What could be some results of this? How can we make water safe for drinking?

This demonstration will be done in small groups and is taken from the website http://tryscience.org/nld/handson2.html. There is an interactive animation showing the optimal ways to filter water. VOLUNTEERS WILL BE NECESSARY TO HELP THE SMALL GROUPS, ESPECIALLY WITH CUTTING THE PLASTIC BOTTLES.

MATERIALS per team:

Half- or one-liter plastic bottle, box cutter, sand, coffee filter, activated carbon (from a pet store), plastic cups, food coloring.

WATER FILTER CONSTRUCTION:

1. Using a scissor or a box cutter, **volunteer** will cut the top off a half- or one-liter plastic soda bottle, about 3/4 the way up from the base of the bottle.
2. Create a "materials" table with sand, rocks, activated carbon, and coffee filters.
3. Now divide students into design teams to gather one of each of the following materials: a 1/2 cup of sand, a 1/2 cup of activated carbon, a 1/2 cup of rocks/gravel, string, coffee filter, and plastic bottle pieces.
4. Next, instruct students to create the main structure of their filter. Invert the top plastic bottle piece to form a funnel into the remaining bottle, which will now serve as a reservoir or basin for water to collect. The top portion will act as a funnel for filtering your sample water.
5. Using a coffee filter, instruct students to place this in their makeshift funnel top portion. Now have each team construct layers that will make up their filter.
6. Talk to students about their material choices and how each media—sand, carbon and rock—are different "particle sizes" and will therefore influence the kind of filter created. Tell each team to discuss which layering techniques they will use for their filters: sand first? Or rocks first? Encourage students to begin laying down their first layers and have a team member record which particles they placed and in which order.
7. Once each group of student has their filters completed, experiment with how effective the designs are.
8. In the plastic cups, create some "mock wastewater" to use for your experiment. Add a little bit of food color, some glitter, or a bit of soil.
9. Now line up each team's water filter. Help students slowly trickle this mock "wastewater" through their filter to see how effective their designs turned out to be. Use a stopwatch to see how fast water trickles through and compare the reservoirs to see how effectively materials were filtered out. Be sure that the team recorder writes down the speed of the water trickling through the filtration materials.
   See notes below.

EXTENSION:

Determine the **water quality** of the samples. Use a simple **Water Quality** Testing kit available at any science education supply store to gauge **water quality** parameters such as pH, turbidity, dissolved oxygen levels, and measure of chlorine. Set up a **water quality** testing station with pipettes and 10 mL test tubes. Instruct students to pour 10 mL of their sample wastewater into their test tubes. Using water quality indicator tablets (again available at any science education store), measure major parameters.

Note: A good result will be a water filter that slowly lets water pass through with larger particles gathered on top and smaller particles caught in the lower levels of the filter system. **Most of the food color should be filtered out and the water should look relatively clear.** If impossible to test for water quality, take a photo of each substance once it has finished passing through the filtration system. Post on a display next to a photo of the team's filtration system. Display should have the recorder's notations on order of materials used and length of time to pass through the filtration materials.

Discussion: should we drink this water? Why or why not? What else is needed? Explain that most modern wastewater treatment systems use similar methods comprised of a large screen to filter large items, then brought down to holding tanks where solids and liquids are separated.
Solids are dried and sent to a landfill, and the remaining liquids are pushed through membranes and other media to extract finer particles.

FIELD TRIP:

Visit a local water treatment plant.