GRADE LEVEL: ELEMENTARY THROUGH HIGH SCHOOL

Everyday Engineering: STEM@Home

Activity: Water Pollution Clean Up

INTRODUCE THIS:

Civil engineers are very concerned about water quality. They devise systems for taking water from rivers, underground reservoirs, and even the ocean to provide water for drinking, irrigation, and flushing toilets. They also figure out how to clean the water after it's been used so people and animals downstream have safe water to drink and use.

WATCH THIS:

Quenching a Thirsty World: Water Engineering https://youtu.be/YGZOK6H7OZ4. See how civil engineers can take wastewater and purify it so that it can be consumed.

Water Wishes: Engineering for Those in Need https://youtu.be/4VnPo_0ATgE. University students design a water system for a needy community in Peru.

MATERIALS:

Part 1: Polluted water

Bowl

Items to pollute the water: dry grass, potting soil, toilet paper, fishing line, plastic pieces, detergent, paper. Use your imagination!

Part 2: Filtration system:

Cups or recycled bottles

Items to filter/clean the water which could include: cotton balls, coffee filters, spoons, funnels, strainers, cloth, paper towels, kitty litter, sand, rocks, marbles, charcoal from the grill. You might need to pre-rinse items like kitty litter, rocks, and charcoal to remove tiny pieces that could actually add to the dirt in the water.

DO THIS:

Part 1: Make some polluted water by mixing water and several pollutants in a bowl. The exact proportions aren't important.

You might want to make more of a personal connection by telling a simple story as each pollutant is added to the water. For example, talk about people flushing toilet paper, a farmer plowing a field that allows dirt into a stream, or picnickers who leave behind trash as you add each item.

Part 2: Design a way to clean the water using materials from around the house Engineers need to sequence water treatment. They may start with scooping out large items and disposing of them as trash. Then they can move on to removing smaller pollutants.

Design a filter system that removes as much of the pollutants as possible. Hint—it will take several layers of filters to do the best job. You might want to figure out how to remove bigger pieces at the start of the system so that they don't block the entire filter.

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If you have a large, 2-liter bottle you may be able to assemble your filter in one system. If you have small cups or bottles you can design a system where you treat the water one step at a time, pouring the results from one step into the next.

What can be scooped out? What needs to be filtered?

Try a couple different systems. You can use 2-3 items per system.

TALK ABOUT THIS:

Did anything clog your filter? Is there a step you can add to prevent this?
Could you reuse your water treatment system? If you couldn't, do you think this is a problem? Would real water treatment systems need to be reused? Can you redesign it so that it can be reused?
Would you drink the water after it's been cleaned? Why or why not? What additional steps would it take to make you feel the water was safe to drink? Even if you are able to get the water to look clean there may be microscopic pollutants in it, so don't drink it!

WANT MORE CHALLENGE?

Sometimes we can see the pollutant, but sometimes we can't. Some common pollutants that get into water include oils and acids. You may have heard of oil spills that occur when ships carrying oil spring a leak. Acids and other chemicals get into water from factory waste.

You can add to the challenge by adding an acid to the water such as vinegar and lemon juice. When you add them to the water it might not be visible to the naked eye. That's why engineers use chemical indicators that change color in the presence of acids and bases. The activity Colorful Chemistry has more information about measuring acids in water using red cabbage juice as an indicator. You can neutralize excess acid by adding a base such as baking soda.

Can you figure out how to test for and neutralize acids in your treatment system?

Oil and water generally don't mix. Oil floats on top of the water, and one way of removing it is to skim it off the surface. Can you design a skimmer that would work to remove oil?

WANT TO GO FURTHER?

This activity and over 65 others were developed in support of the award-winning documentary *Dream Big: Engineering Our World*. This version has been adapted to showcase how to do it at home.

For more in-depth coverage download the Water Pollution Cleanup activity from the *Dream Big: Engineering Our World* website: http://discovere.org/dreambig/activities. There you will find discussion questions for younger as well as older children, relevant vocabulary, and more.

Dream Big: Engineering Our World is available on Netflix and Vimeo.

The free library of over 65 activities and webisodes can be found at discovere.org/dreambig.