

# WATER FILTER

The water we drink comes from lakes, rivers and underground aquifers but is filtered, cleaned and treated before it gets to us. The wastewater we create is also filtered, cleaned and treated before being returned to the environment. Make some "dirty" water and use different filtration techniques to see how clean it can get.

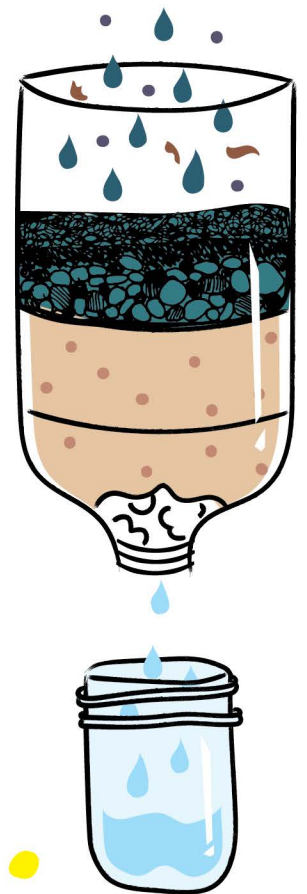


## MATERIALS

- Plastic beverage bottle (1-liter or 20-ounce bottle is best)
- Jar or vase that the plastic bottle fits into
- Pitcher or other container
- Sand
- Gravel
- Cotton balls
- Cooking oil
- Napkins or paper towels
- Scissors
- Spoon
- Measuring cup
- Soil
- Water

## INSTRUCTIONS

With help from an adult, cut the bottom inch off the plastic beverage bottle and remove it. Turn the bottle upside down and place it in a jar or vase to hold it upright while you build the filter. Make the bottom layer of your filter by adding cotton balls in the tapered end, packing them tightly in the bottom third of the bottle. Add a little water to the cotton balls to help them stay packed and in place. Next, add the sand to the filter—make the sand layer about three inches thick. Finally, add a one-inch gravel layer, being sure to leave an inch of space above the gravel. Pour one cup of clean water through the filter to wet the sand and cotton. Discard the water that comes out of the filter.



Make "dirty" water by filling a pitcher or container with about one liter of water. Add one cup of soil and stir thoroughly. Add a few drops of cooking oil and mix well. Now your water is ready to be filtered!

Slowly pour your dirty water in the filter one cup at a time. Wait until there is no standing water on top of the gravel before adding the next cup. Watch what happens as it comes in contact with each layer of the filter. What do you notice? What does the water that drips out of the bottom of the filter look like? What do you think each layer is removing?

The water that comes out of your filter should be clearer and cleaner than it started, but it has not been treated for bacteria and is not safe to drink. Use this water for something like watering your plants.



## WHAT'S HAPPENING?

Water filters are used to remove impurities and solid particles from water to clean it. As the dirty water moves through the filter, each layer removes a different size or type of particle while letting the water molecules pass through. Once the water reaches the bottom, the filter has caught the debris and leaves clean, clear water. Each layer has a special job. The top gravel layer filters larger sediment and debris, like trash, rocks and leaves. The sand layer filters fine impurities and organisms and can even help remove some bacteria and parasites. The cotton balls help remove any remaining contamination (like oil) that passed through the sand layer.

## TIPS

The flow rate (or speed) of the water as it passes through the filter is important. The more time the dirty water is in contact with the filter layers, the more impurities can be removed. So pour the dirty water into the filter slowly.

## EXTENSIONS

Experiment by modifying your filter layers. Try using two types of sand, such as a fine-grained sand and a coarse-grained sand. Add the finer sand first, on top of the cotton ball layer, and place the coarse-grained sand on the fine-grained sand. Make another filter using only two layers—you pick which ones to try! What's different? Does the water come out of the filter any clearer? Does the water travel through the filter faster?

## LEARN MORE

Chicago's Jardine Water Purification Plant is one of the largest in the world and provides almost one billion gallons of water a day to the city and suburbs. The plant uses filter screens and chemicals in addition to gravel and sand to make safe drinking water.

## RECOMMENDED READING

*You Wouldn't Want to Live Without Clean Water!* by Roger Canavan

*Maker Lab Outdoors—25 Super Cool Projects: Build, Invent, Create, Discover*, by Jack Challoner