



## Filter in a Bottle

Most untreated, unfiltered surface water contains bacteria and other organisms that can cause disease. Purification is necessary for safe, healthy drinking water. Purification requires the use of a filter and some chemicals. Chemicals will NOT be used in this experiment. However, two of the chemicals Aquarion uses at the filtration plant are chlorine and fluoride. Aquarion uses chlorine at the end of the filtering process to kill off bacteria that might still be in the water. Fluoride is added for the protection of teeth, as recommended by dentists.

### KEY VOCABULARY:

**Conservation** is the protection, preservation, management, or restoration of wildlife and natural resources, such as forests, soil, and water.

To **disinfect** is to cleanse, so as to destroy or prevent the growth of disease-carrying microorganisms.

A **filter** is a porous material through which a liquid or gas is passed in order to separate the fluid from suspended matter. It can also be a device containing such a material, especially one used to extract impurities from air or water.

**Filtration** is the process of filtering or the mechanical separation of a liquid from the undissolved particles floating in it. Undissolved means retaining a solid form, as in, "undissolved sugar in the bottom of the cup."

A **medium** (plural: media) is an intervening substance through which something else is transmitted or carried on.

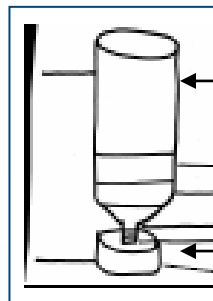
An **organism** is an individual form of life, such as a plant, animal, bacterium, protist, or fungus. It can also be a body made up of organs, organelles, or other parts that work together to carry on the various processes of life.

### MATERIALS:

- 2-liter plastic soda bottle with the bottom cut off (see diagram on next page)
- Screening
- 1 tablespoon charcoal (aquarium stock is best)  
*This can make the water look grey. Only use it if you have a significant amount of time to refilter the water.*
- Container for dirty water
- Plastic bags to cover work area
- Materials to make the water dirty (twigs, leaves, paper, salt, soil)
- 3/4 - 1 cup sand
- 3/4 - 1 cup pebbles (gravel used in fish tanks)
- Rubber bands

## MAIN FOCUS:

This activity aims to demonstrate how a water filter works and the importance of filtering and disinfecting drinking water.



Cut bottle here

Save bottle bottom  
to use as basin

## PROCEDURE:

Emphasize the time it takes to clean the water and the difference in the amount of water you start and end with in the filtering process. Discuss the additional amount of energy needed to filter water in a filtration plant if the water is extremely polluted. If unchecked, polluted water may not be possible to clean completely. We must conserve water, as well prevent pollution, in order to ensure enough safe, clean drinking water for the future.

1. Have a container with clear tap water ready.
2. Discuss how water gets polluted with things like leaves, soil from erosion, pieces of animals, road salts, etc. As the class discusses various items, add some of the following to the tap water: soil, twigs, feathers, small rocks, salt, shredded paper (be creative but do not add food coloring).
3. Shake the water with the debris until it is well-mixed together. Ask: What is the problem with this water? (It is polluted.) What can we do about it? (Clean it.) How can we clean it?

Discuss what a filter is, what a medium is, and how the process works at a filtration plant. If you have the video “Wonders of Water” at your school, you may want to show it prior to this lesson.

4. Explain to the class that you will now create a filter. Cut the bottle as depicted in the diagram above and retain both portions of the 2-liter bottle.
5. Remove the cap from the bottle and put nylon screen over the outside of the opening. Fasten it with elastic bands.

Discuss the media you are about to use. Remember that you are assembling the filter in the opposite order than that in which the unclean water will filter through it.

6. Pour in a layer of charcoal. This media is used to take out some small particles and to reduce odor and taste issues.
7. Pour in a layer of sand on top of the charcoal. This media is finer than the charcoal and is used to trap the very fine particles in the unclean water.
8. Pour in a layer of gravel. This media will trap the bigger particles between the spaces.

## **PROCEDURE (continued):**

When the dirty water pours through the filter, you will see each of these layers change. The space between the gravel will become filled with larger particles from the dirty water. The sand will get wet (a darker color will indicate that the water is being absorbed) and soil will be trapped between the sand. These are the small particles from the unclean water. The charcoal may also have items trapped and will appear darker as the water travels through it, but mostly works to reduce odor issues.

9. Make sure you place the filter over a basin (use the bottom of the bottle or another container/cup) so the filtered water will be caught as it is drained through the various media.
10. Take a full glass of the dirty mixture. Be sure a little of everything gets into the glass. If necessary, scoop some dirt into the cup. Be sure to show everyone the dirty water. Do NOT drink this water. It has not been disinfected for drinking!
11. Observe the water as it passes through the filtering process. Is the water coming through the filter media cleaner than when it entered? If so, why? How much came out? Is it safe to drink? Why not?

## **TOPICS FOR FURTHER DISCUSSION:**

1. What are the possible uses for non-potable water?
2. What are some human requirements for safe, purified water (such as drinking, cooking, bathing, swimming, brushing teeth, food preparation)?
3. Discuss reasons for water conservation even though we can filter water.
4. Discuss why this water should NOT be consumed.

Name \_\_\_\_\_

Date \_\_\_\_\_

PROBLEM:

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HYPOTHESIS:

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PROCEDURE:

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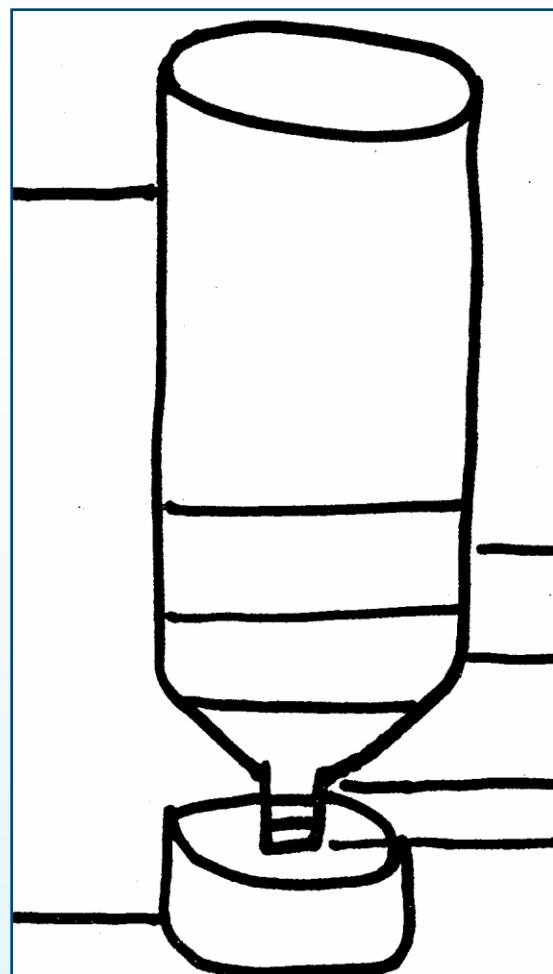
OBSERVATIONS:

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CONCLUSION:

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