

# Water Treatment for Human Consumption

How is water processed so it is safe to drink?

## Overview

Students review each step of the water-treatment process used to make water potable and analyze the order in which the steps occur.

For the complete activity with media resources, visit:

<http://education.nationalgeographic.org/activity/water-treatment-human-consumption/>

## Directions

### 1. Engage students in a preliminary discussion about where water comes from.

Ask students where they get their water at home. Answers will probably include faucets and hoses. Then, ask students where they think that water originally comes from and how it arrived at their homes. Have a few students call out answers, and then follow up on those answers with the questions below.

*Ask: Does anyone get water straight from a lake or river? Why or why not? What are some potential issues with getting water straight from an open body of water?*

Answers should include health concerns, convenience, etc. Prompt students with questions about what sorts of things are found in open bodies of water (runoff, animals, chemicals, bacteria, etc.)

### 2. Explain that many things must happen to some water before it is safe for people to use.

Explain that most water must go through a process that makes it **potable**, or safe for drinking. This process is called the **water-treatment process**. Tell students that they are going to learn all of the steps in the water-treatment process, and then they will need to analyze them in order to figure out which order the steps are in.

### 3. Introduce the steps in the water-treatment process.

Write each of the steps on the board. Write them in a jumbled list. For example: filtration, disinfection, sedimentation, and coagulation. The correct order is: coagulation, sedimentation, filtration, and disinfection. Make sure to leave room in between each term to write the students' guesses and the

actual definition under each step.

#### **4. Brainstorm meanings of water-treatment process terminology.**

Ask students what they think each term means and write down their definitions under the terms on the board. Encourage guesses and creativity. To prompt guesses, break the words down and ask what they think each part of the word means (i.e. highlight the following: coagulation, sedimentation, filtration, and disinfection). When you have discussed all the terms, ask for student volunteers who want to help reveal the actual definitions. Pass a copy of the Definitions of Steps in the Water-Treatment Process handout to the student volunteers. Have the volunteers read the definitions aloud. Write the definitions on the board while the volunteers are reading them aloud. Make sure that students understand the vocabulary used in these descriptions. Encourage students to making drawings of each of the steps in the process.

#### **5. Determine the steps in the water-treatment process.**

Write each of the steps on a piece of paper using large print. Select four new volunteers from the class. Have them come to the front of the room and hand each of them one of the four steps. Have them line up and introduce themselves to the rest of the class as their respective step in the water-treatment process, asking them to describe what happens in that step in their own words. The steps should not be in the correct order when you hand them out to the volunteers at the front of the room.

Have the class direct the volunteers where to stand so that they are in the proper order of steps in the water-treatment process. Ask students to make recommendations. If a student needs help, refer him or her to the definitions on the board. Make sure to ask why a student makes a particular suggestion—don't let students shout out suggestions without support for their ideas.

Once students are in the correct order, stop the discussion. Ask five student volunteers to recap what they have learned so far. Have four of the student volunteers cover one step each and say, in their own words, what happens during that step of the water-treatment process. Have the remaining volunteer describe the order of the steps.

#### **6. Explore different orders and brainstorm why these orders wouldn't work.**

Ask the four student volunteers to organize into the following order: coagulation, disinfection, sedimentation, and filtration.

Ask all students whether the order above would work to make water potable. Then, as a class, discuss *why* the steps have to go in a certain order.

#### **7. Conclude the activity by explaining the final step in the water-treatment process.**

Finally, bring the activity full circle by explaining the final step of the water-treatment process. Explain

that the EPA (Environmental Protection Agency) adds storage at the end of the water treatment process. Water is placed in a closed tank or reservoir in order for additional disinfection to take place. The water then flows through pipes to homes and businesses in the community.

## Tip

In Steps 3 and 5, it's important to not provide the steps of the water-treatment process to students in the correct order, as they will need to use reasoning skills later on in the activity to identify the correct process.

## Informal Assessment

Throughout the activity, assess student engagement based on amount and quality of participation. When students are determining the order of the water-treatment steps, assess answers based on students' inclusion of evidence, or why they made that particular suggestion.

## Extending the Learning

Encourage students to think about how water is, or is not, treated in other places around the world. If students are studying a particular region, culture, or society as part of a social studies or history class, have students ask their social studies or history teachers the questions below and write a paragraph with the information they've gathered. Then, engage students in a 10-15 minute discussion about their findings.

*Ask: What bodies of water exist near the area of the world? How do people in this location or society bring water to their homes? Do they treat this water to make it safe for drinking? If not, why not? Does everyone in this society or area of the world have access to this treatment process? Why or why not?*

## Objectives

### Subjects & Disciplines

#### Language Arts

- Vocabulary

#### Science

- Earth science

### Learning Objectives

Students will:

- Explore the process through which water is treated to become potable
- Identify the steps in the water-treatment process
- Discuss why it is important that the steps in the water-treatment process occur in a certain order

### Teaching Approach

- Learning-for-use

### Teaching Methods

- Discussions

- Information organization

## Skills Summary

This activity targets the following skills:

- Science and Engineering Practices
  - Asking questions (for science) and defining problems (for engineering)

## National Standards, Principles, and Practices

### National Geography Standards

- **Standard 14:**

How human actions modify the physical environment

- **Standard 15:**

How physical systems affect human systems

### National Science Education Standards

- **(5-8) Standard F-2:**

Populations, resources, and environments

## Preparation

### What You'll Need

#### Materials You Provide

- Chalk
- Markers
- Whiteboard, chalkboard, or chart paper

#### Physical Space

- Classroom

#### Grouping

- Large-group learning

#### Resources Provided: Handouts & Worksheets

- [Water Treatment Process Teacher Guide](#)

## Background & Vocabulary

### Background Information

Before people can safely use water, it must be found, treated, and transported to households. Water that is safe for drinking is called **potable** water. The treatment piece of this process is called the **water-treatment process**. The water-treatment process involves four steps, in this order:

coagulation, sedimentation, filtration, and disinfection.

The purpose of **coagulation** is to create dirt clumps that are heavy enough to sink, which is important for the next step in the process. Alum and other chemicals are added to the water, forming “floc”—tiny, sticky particles. Dirt in the water sticks to these particles, forming clumps.

As water travels through a tank, gravity causes the clumps of dirt to fall to the bottom. The dirt is removed from the water because the water continues to flow, while the dirt remains at the bottom of the tank. The removal of the dirt is called **sedimentation**.

**Filtration** is the process of passing a liquid or gas through a porous article or mass (paper, membrane, sand, etc.) to separate out a solution (when some matter is dissolved in something else).

**Disinfection** is the use of chemical and/or other means like UV radiation to kill potentially harmful microorganisms and pathogens in the water.

**Storage** is the final step of the water-treatment process. The EPA adds storage at the end of the water treatment process. Water is placed in a closed tank or reservoir in order for additional disinfection to take place. The water then flows through pipes to homes and businesses in the community.

This resource was developed for Geography Awareness Week 2010. Each third week of November, students, families, and community members focus on the importance of geography through events, lessons, games, and challenges; and often meet with policymakers and business leaders. Visit the [Geography Awareness Week](#) website to find out more about this program.

## Prior Knowledge

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## Recommended Prior Activities

- None

## Vocabulary

Term	Part of Speech	Definition
<b>coagulation</b>	<i>noun</i>	process of changing from a liquid to a thickened or semi-solid mass.
<b>disinfect</b>	<i>verb</i>	to clean and remove harmful microorganisms.
<b>filtration</b>	<i>noun</i>	process of separating solid material from liquids or gases.
<b>potable</b>	<i>adjective</i>	suitable for drinking.

<b>Term</b>	<b>Part of Speech</b>	<b>Definition</b>
<b>sedimentation</b>	<i>noun</i>	process of accumulating small solid deposits.
<b>wastewater</b>	<i>noun</i>	water that has been used for washing, flushing, or industry.
<b>water treatment plant</b>	<i>noun</i>	facility that purifies water for drinking, hygiene, and other uses.

## **For Further Exploration**

### **Video**

- [How Do We Clean Water?](#)

### **Websites**

- [NGS Kids Network: Water](#)
- [National Geographic Freshwater Initiative](#)
- [EPA's Water Treatment Process](#)



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