



Water, Water, Everywhere

**This lesson is modified from [www. ScienceHouse.com](http://www.ScienceHouse.com)*

We often take for granted that our water will be clean. In this lesson, students will gain an appreciation for the methods used to keep water sources clean.

HYPOTHESIS:

Many different methods for cleaning wastewater exist, and several types must be used to rid water of certain contaminants.

Primary Learning Outcome:

Students will be able to describe processes used for cleaning wastewater.

- *How does water cleaned in the water cycle compare to how it is cleaned in a modern water treatment facility?*
- *What nontoxic methods can be used to clean water?*

Assessed GPS:

SCSh1. Students will evaluate the importance of curiosity, honesty, openness, and skepticism in science.

- a. Exhibit the above traits in their own scientific activities.
- b. Recognize that different explanations often can be given for the same evidence.
- c. Explain that further understanding of scientific problems relies on the design and execution of new experiments which may reinforce or weaken opposing explanations.

SCSh3. Students will identify and investigate problems scientifically.

- a. Suggest reasonable hypotheses for identified problems.
- c. Collect, organize and record appropriate data.
- d. Graphically compare and analyze data points and/or summary statistics.

SCSh4. Students use tools and instruments for observing, measuring, and manipulating scientific equipment and materials.

- a. Develop and use systematic procedures for recording and organizing information.
- b. Use technology to produce tables and graphs.

SCSh6. Students will communicate scientific investigations and information clearly.

- a. Write clear, coherent laboratory reports related to scientific investigations.
- b. Write clear, coherent accounts of current scientific issues, including possible alternative interpretations of the data.
- c. Use data as evidence to support scientific arguments and claims in written or oral presentations.
- d. Participate in group discussions of scientific investigation and current scientific issues.

SCSh9. Students will enhance reading in all curriculum areas by:

- Read technical texts related to various subject areas.
 - Respond to a variety of texts in multiple modes of discourse.
 - Relate messages and themes from one subject area to messages and themes in another area.
 - Recognize the features of disciplinary texts.
- c. Building vocabulary knowledge
- Demonstrate an understanding of contextual vocabulary in various subjects.
 - Use content vocabulary in writing and speaking.
 - Explore understanding of new words found in subject area texts.
- d. Establishing context
- Determine strategies for finding content and contextual meaning for unknown words

SB4. Students will assess the dependence of all organisms on one another and the flow of energy and matter within their ecosystems.

- a. Investigate the relationships among organisms, populations, communities, ecosystems, and biomes.
- d. Assess and explain human activities that influence and modify the environment such as global warming, population growth, pesticide use, and water and power consumption.

Total Duration:

- **30 minute lecture** (Discuss water pollution in the U.S., the need for waste water treatment, and processes used in contemporary waste water treatment)
- **1 hour lab**
- **30 minutes discussion**

Materials and Equipment:

- water
- safety goggles
- a gallon-sized container with wide mouth
- small plastic cups (100 mL)

Wastewater materials:

- coffee grounds
- salt
- vegetable oil
- soil
- soap
- food scraps
- vinegar

Possible water cleaning materials:

- screens for use as filters
- coffee filters

- bleach
- alum
- bowls or cups
- straws or pipettes
- spoons
- baking soda
- cornstarch
- pebbles
- sand

Possible testing materials:

- pH paper
- brown paper bag
- waxed paper

Procedures:

Step One

Involve students in making wastewater by acting out the attached scenario.

Step Two

Shake up the wastewater and distribute the water in small cups to each student group. Each group should record initial observations of the water, i.e., appearance, odor, etc. They should be instructed to NEVER taste the water.

Step Three

Using the materials provided, have students clean the water. They should not use more than about 2 mL of bleach, alum, or baking soda.

Step Four

Each group should detail the methods employed to clean the water with a brief explanation of each. The class should decide based on the water's appearance which group was most successful at cleaning the water.

Assessment:

Students should take extensive notes to be kept in a laboratory notebook. Students can be quizzed or tested over the vocabulary and background material.

Lab reports detailing what methods were used to clean the water and why should be included. Students should also comment on the effectiveness of the methods they used.

Lesson Materials to be Attached:

- Background information
- Student group planning sheet

Extension:

This lesson can be extended in a number of ways, all involving water quality and/or water pollution. For example, various non-toxic test kits are now on the market, and these could be used to test actual stream water for certain chemicals. Water from people's homes can be tested for hardness, etc. Students should always be instructed as to the relevance of each test.

Water, Water, Everywhere Background

Invite students to role-play in the following reading. Allow them to mix their contaminant into the large 'wastewater' container.

“DOWN THE DRAIN”

Featuring Eric, Stan, Kenny, and Eric's mother

Eric awoke early Saturday morning ready for a day of fun and adventure. Before the fun could begin, though, he had to do his chores. Eric hated doing chores, and often found creative ways of shortening the time he spent working. That particular morning, his job was to wash the breakfast dishes. He noticed that his mother had forgotten to remove the used coffee filter from the filter basket. As Eric was removing it, he spilled the coffee grounds into the sink. “Great,” thought Eric sarcastically. “What a mess!” But then he had an idea. Rather than use a paper towel to clean the sink, he simply rinsed all the grounds down the drain. * ***The student playing Eric should dump coffee grounds into the wastewater container.***

Eric glumly proceeded with his dishwashing. He noticed that his little brother had not bothered to rid his plate of all his scrambled eggs. “What a pain,” grumbled Eric, “but no problem for me!” He then remembered his solution for the spilled coffee grounds and rinsed the remaining scrambled eggs down the drain. * ***The student playing Eric should dump food scraps into the wastewater container.***

Later that morning, Eric's little brother, Stan, was outside playing. A rambunctious 4 year old, Stan's favorite activity was making mud pies and bothering Eric and his friends. After an enthusiastic pie-making session, Stan decided he was ready for a snack. He ran into the house and beseeched his mother, “Mom, can I have a snack? I'm starving!!!” Their mother replied as she so often did, with, “Not until you wash your hands.” So Stan proceeded to wash his hands, scraping off the delightful mud and rinsing it down the drain. * ***The student playing Stan should dump soil and soap into the wastewater container.***

Eric's father, Kenny, spent the afternoon washing his car. Kenny was fastidious, and would not be satisfied until every inch of the car was sparkling. He had heard that one of the best ways to achieve a clean, streak-free shine on glass surfaces was to clean with vinegar. He didn't want to bring the entire bottle of vinegar outside, so he poured some into a cup. When he finished washing the car, he went back into the house and washed his hands. * ***The student playing Kenny should dump soap into the wastewater container.***

Although Kenny enjoyed having his car spotless, his neatness did not extend into his home. After he finished with the car, he left the cup of vinegar on the kitchen counter. Eric soon entered the house, very thirsty after a day of play with his friends, Timmy and Kyle. He noticed the cup of clear liquid on the counter and hastily took a drink. “Gross!” exclaimed Eric. Not knowing what the horrible tasting substance was, and not caring either, he emptied the cup into the sink. * ***The student playing Eric should dump vinegar into the wastewater container.***

That evening, Eric's mother was preparing a lovely dinner of pasta and marinara. She always used plenty of oil in her pasta to ensure that the noodles did not stick to each other. When the noodles were cooked thoroughly, she poured the water and pasta into a colander in the sink. * *The student playing Mom should dump oil into the wastewater container.*

Water, Water, Everywhere Planning Sheet

Cleaning Strategy Used	Description of Water	Comments about Efficacy

