

Lesson Title: Cleaning Up

Ohio Standards Connection:

Standard(s): Earth Science

Benchmark(s): (grades 3-5)

Indicator(s):

Grade(5): 5. Explain how the supply of many non-renewable resources is limited and can be extended through reducing, reusing and recycling but cannot be extended indefinitely.

Investigate ways Earth's renewable resources (e.g., fresh water, air, wildlife and trees) can be maintained.

Benchmark(s): (grades 6-8) C. Describe the interactions of matter and energy throughout the lithosphere, hydrosphere and atmosphere (e.g. water cycle, weather and pollution).

Indicator(s):

Grade(7) 1. Explain the biogeochemical cycles which move materials between the lithosphere (land), hydrosphere (water) and atmosphere (air).

2. Explain that Earth's capacity to absorb and recycle materials naturally (e.g., smoke, smog and sewage) change the environmental quality depending on the length of time involved (e.g., global warming).

Lesson Summary: The student will identify ways to prevent surface water pollution and simulate the removal of pollutants from water by filtration.

Estimated Duration: Class Period

Background: For years people believed that materials dumped into water supplies would decompose or be diluted to the point that they were virtually harmless. It has been shown that unlimited and unmonitored dumping of wastes can be very harmful to water supplies.

The vast quantities of industrial and human wastes produced must first be treated, either physically or chemically, before they are allowed to re-enter lakes, streams, rivers, and oceans. Bodies of water cannot clean themselves as fast as people pollute them — so people must try to keep pollution out of water.

Instructional Procedures:

ADVANCE PREPARATION

A. Preparation of Materials: Use large diameter clear straws or clear tubing for this activity. Cut the straws in half. Finely crush the charcoal. Pour food coloring into small dropper bottles. Activated charcoal may be purchased wherever aquarium supplies are

sold; you may buy capsules of activated charcoal at the pharmacy. If activated charcoal is not available use regular charcoal, but crush it very fine before using it.

B. Wide clear plastic tubing may be used in place of large-diameter straws.

C. Provide a spoon and small paper cup for the Organizer to obtain the charcoal. The entire class can share one small bottle of food coloring. At the end of the period, the straws, cotton and charcoal should be placed in solid waste receptacles. Water and food coloring may be flushed down the drain. Cups and droppers should be rinsed.

D. An alternative approach to doing the activity is to do it as a teacher demonstration for lower grades.

Use a large piece of clear plastic tubing or a buret borrowed from a high school chemistry teacher.

E. Make copies of the student sheets. (You may prefer to make transparencies of “Water Pollution Solution” and “Plant’s Pond.”)

I. Setting the stage

A. Tell the students a story about a boy or girl whose room is really messy. Describe in comical details how dirty the room is and what a big job it will be to clean it up. Then ask the students what the owner should do. Keep probing until someone suggests that he/she should not let the room get so dirty; keeping it neat is less work than a big cleaning job.

B. Tell the students that water pollution has become one of the most serious environmental problems facing the United States as well as countries around the world. Industry, government, cities, and towns have spent billions of dollars on research and treatment plants to try to reduce water pollution. Three chief sources of water pollution are: industrial (factories) wastes, municipal (city) wastes (sewage), and agricultural (farm) chemicals and wastes. Oil spills are another source of pollution. This activity will help you realize how hard it is to clean up polluted water.

II. Activity

A. Ask the students to think of ways we could clean polluted water. Write their answers on the board. Direct their responses to the idea of filtering. Tell them they are going to work in teams to investigate filtering.

B. Divide the class into teams of at least five. Each group will have an organizer, investigator, manager, recorder, and reporter.

1. Have students draw numbers for the following roles:

- a. Investigator - manipulates materials
- b. Organizer - gathers and organizes materials, directs the cleanup
- c. Manager - helps investigator, keeps time, makes sure safe procedures are followed, performs calculations, and encourages the team
- d. Recorder - writes down the team’s observations and answers to questions, and makes drawings as needed
- e. Reporter - shares the team’s results and conclusions with the class.

2. Give each student a copy of “Trying to Make It Clean and Clear.”

3. Remind the students to use a very tiny piece of cotton to plug the straw. If the cotton is too dense, the water will not pass through the straw.

4. Tell the students to hold the dropper at an angle when dropping colored water into the straw.
5. Instruct the students to collect water filtered through cotton in cup B, and water filtered through cotton and charcoal in cup C.

C. Ask the designated student(s) in each team the questions below.

1. Manager, Recorder: How does the color of the water in cup B compare with that in cup C? (The water in cup B will still be colored, while the water in cup C will be clear.)
2. Investigator, Recorder: What could account for any difference in color? (Since the only difference between the two setups was the charcoal, the charcoal must have removed color from the water.)
3. Reporter: How do your results compare with those of your classmates? (NOTE: Results should be alike.)

D. Discuss with the students how the experiment they did relates to cleaning up pollution.

1. Does filtering work (at least for some kinds of pollutants)? (yes)
2. What if you had a whole lake full of polluted water? Would filtering it be practical? (no)
3. What might you do to clean the whole lake? (Accept all answers, asking for their reasons.)
4. Some pollutants cannot be filtered out of water. How might you clean water polluted with unfilterable pollutants? (Accept all answers; ask for reasons.)
5. Remind the students of the messy room story. What can we conclude about cleaning up pollution? (It is better to prevent pollution than to have to clean it up.)

E. Demonstrate that pollution does not “just disappear.”

1. Set aside several cups having various amounts of food coloring in small quantities of water.
2. Make sure that one is so dilute that the color is not readily observable.
3. Let them sit for a couple of days or until the water evaporates. Let the students observe the residue left when the water evaporated.
4. Put a drop or two of water into each cup to reconstitute the food coloring. They will see that the “pollution” remains, even though the water comes and goes.
5. Discuss with the students that even if people clean up water pollution, they still must do something with the pollutants. This is a very difficult problem.

III. Follow-Up

Have the students complete the “Water Pollution Solution” student sheet. The answers are:

1. F
2. no,
3. charcoal,
4. F,
5. cotton and charcoal,
6. F,

7. fish,
8. F,
9. prevention,
10. (answers will vary).

IV. Extensions

A. Take a field trip to a wastewater plant. Tour the treatment facility. Have the students develop a list of questions to ask about the plant beforehand.

B. Hold a debate about an environmental issue, such as uses of pesticides, sewage treatment, or thermal pollution. Each issue has pros and cons. Allow students time to research the point of view they are to represent on Life depends on water website <http://www.wviz.org/edsvcs/Water/> . Establish debate rules and procedures before beginning.

RESOURCES

Cohen, M. R., T. M. Cooney, and C. M. Hawthorne, Discover Science, Scott, Foresman and Company, Glenview, Illinois, 1991.

Mallinson, G. G., J. B. Mallinson, Linda Froschauer, and J. A. Harris, Science Horizons, Silver Burdette & Ginn, Morristown, New Jersey, 1991.

Materials and Resources:

- cotton balls
- toothpicks
- clear plastic straws (large) or tubing
- activated charcoal
- water
- plastic cups
- spoons
- food coloring
- eyedroppers
- scissors
- metric rulers
- student sheets (included)

Vocabulary:

cooling pond: a pond where hot water from factories and power plants is stored until it is the same temperature as nearby bodies of water.

diluted: reduced in strength.

industrial pond: a pond used to hold dirty water until it is clean enough to be put into a nearby body of water.

pollution: contaminants

TRYING TO MAKE IT CLEAN AND CLEAR

1. Investigator: Pull a small piece of cotton from a cotton ball. With a toothpick or paper clip, stuff this piece into one end of each of the two straws. In one straw pour a layer of charcoal 1 cm high. The charcoal should be above the cotton.
2. Manager: Fill a plastic cup; cup A, 1/3 full of water. Add 1 drop of food coloring. With the eyedropper, mix the food coloring and water thoroughly.
3. Investigator, Manager: Using the eyedropper, add colored water to the straw that has only cotton in one end. Catch the water dripping from the straw in cup B.
4. Investigator: Repeat step 3, using the straw with charcoal and cotton. Collect the water in cup C.
5. Manager: Compare the water color in cup B with that in cup C.
6. Recorder: Record the results.

WATER POLLUTION SOLUTION

Answer these questions by filling in the blank or circling the correct answer.

1. T F It will be very easy to clean up water pollution.
2. Our experiment showed that we can filter some pollution out of water. Is this always possible? yes no
3. We used cotton and _____ to filter the water.
4. T F It is impossible to clean up water pollution.
5. Which worked better? just cotton cotton and charcoal
6. T F Pollution will disappear if we wait long enough.
7. Which of these is not a source of water pollution?
 factories cities farms fish oil spills
- 8 T F There is nothing we can do to prevent pollution.
9. What is the very best solution to pollution?
10. This is a thinking question. What would you do to clean up water pollution if you were in charge of protecting the environment?