

Teacher's Guide

Objective and Background of the "Just Add Water" Classroom Science Kits:

This kit is intended to be an easy-to-use way to teach students about water and the importance of water in their lives, while providing the student with an enjoyable learning experience.

You can use the curriculum two different ways:

1. As an interactive computer teaching tool

Students can view the curriculum on a computer, much in the same way that one would view an Internet website.

2. If you prefer, the entire curriculum can be printed out and photocopied. Adobe Acrobat (available free over the Internet) is required to print out this curriculum.

The curriculum is not divided into specific units but may be customized to fit your teaching schedule.

What is included in the kit?

In each kit, you will find the following:

Hach Water Quality Test Strips — Water Quality test strips are the ideal way for students to learn about water quality without complicated procedures or extensive equipment. They are effective, inexpensive, easy-to-use, and safe. Just dip the strip into water, watch for the color development and compare to the color chart on the side of the bottle.

Curriculum on Diskette — The kit includes a curriculum on a 3.5" diskette. This diskette is readable by either MAC (Apple) or PC formats using any web browser, such as Netscape Navigator™ or Microsoft Internet Explorer™. If you do not have a web browser, contact your computer system administrator who probably can install a copy for you. Web browsers are readily available for free over the Internet, or can be purchased from most computer software stores.

TestYES!™ Positive Result Chemistry — In many cases, water testing for specific water quality parameters yields a "negative result", meaning nothing happens. While this may be good in "real life", it's not so fun if you (and your students) want something to happen! For this reason, we have included *TestYES!™*, Positive Result Chemistry, which will guarantee that your test strip will give a positive response.

Pre-paid Response Card — Return this card to get more information about Hach and our products.

How many students can use the kit?

Each kit contains enough test strips to complete 50 tests of each water quality test. If you like, each student can get their own test strip, or you can break the class into small groups, thereby serving more students.

How do I get more test strips or *TestYES!™* Positive Result Chemistry?

The test strips and *TestYES!™* Positive Result Chemistry and Hach Test Strips are easily replaceable by calling leading science education distributors or Hach Company.

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Tell me about the *TestYES!*TM Positive Result Chemistry

What is it?

The chemistry is a specially formulated blend of chemistries that will guarantee that your students will get a positive result when the test strip is dipped in water. This will add interest and excitement to the students' learning experience.

How do I use it?

Add one PermaChemTM foil "powder pillow" to about a quart (or about one liter) of water. Distilled or deionized water is ideal, but regular tap water may be used.

Please note: because chlorine is unstable, it will dissipate over time. However, the mixed *TestYES*TM solution will give a positive result for at least three hours after mixing.

Safety

Is it safe?

Safety was key to the development of this kit. However, any chemical can be harmful if not handled properly. Please read the following precautions carefully:

*TestYES!*TM Positive Result Chemistry

In Powder Form:

In powder form, the *TestYES!*TM positive result chemistry is an oxidizer and may cause eye, skin, and respiratory tract irritation. It should be used only under adult supervision.

In case of contact with eyes or skin — Flush your eyes or skin with water for 15 minutes.

In case of ingestion — Give large quantities of water and call a physician.

In case of inhalation — Remove to fresh air

When mixed with water:

When mixed with water, the *TestYES!*TM Positive Result Chemistry becomes relatively benign. The only effect anticipated is some slight eye irritation if it comes in contact with eyes. Do not ingest the mixed solution.

Note: It is always wise to wear safety goggles when handling any chemicals.

How do I dispose of excess waste?

Dispose of the mixed *TestYES!*TM chemistry by pouring it down the drain while running the tap. Throw the test strips in the trash.

Who is Hach Company?

A brief history of our company...

An enterprising husband and wife team, Clifford and Kathryn Hach, started Hach Chemical Company in 1947, in Ames, Iowa, USA. Originally a producer of known samples for analytical testing in college classrooms, the company began to grow after developing a simplified titration method for measuring hardness in drinking water.

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Over time, Hach Chemical Company focused on supplying products and chemicals needed for water quality analysis. Clifford Hach and his team of researchers developed methods for testing everything from acidity to zinc. Electronic analytical instruments, such as colorimeters and turbidimeters, were developed in the 1950s to "bring analytical chemistry out of the laboratory and put it in the workplace and into the hands of the general public."

In 1980, the company name was changed to "Hach Company" to reflect Hach's place as a supplier of laboratory and process instruments, portable laboratories, and test kits, as well as analytical chemicals.

Today Hach Company has facilities in Ames, Iowa, and in Loveland, Colorado, USA. The Loveland facility houses corporate headquarters, research and development laboratories and instrument manufacturing operations. A plastics division and technical training center are also located in Loveland. About 540 employees work in Loveland.

The Iowa facility continues to manufacture and package chemical reagents, and assemble test kits. Sophisticated electronic information systems enable employees to pick, pack, and ship hundreds of orders throughout the world every day.

Today Hach Company is an international presence in the water quality market with offices and representatives around the world. Increasing involvement in the education market is bringing Hach "back to our roots" in science education.

Teachers Guide - Answer Sheet and Teaching Suggestions

PONDS AND STREAMS, Level 2

ACTIVITY 1 - Water Cycle Crossword Puzzle

■ ANSWERS:

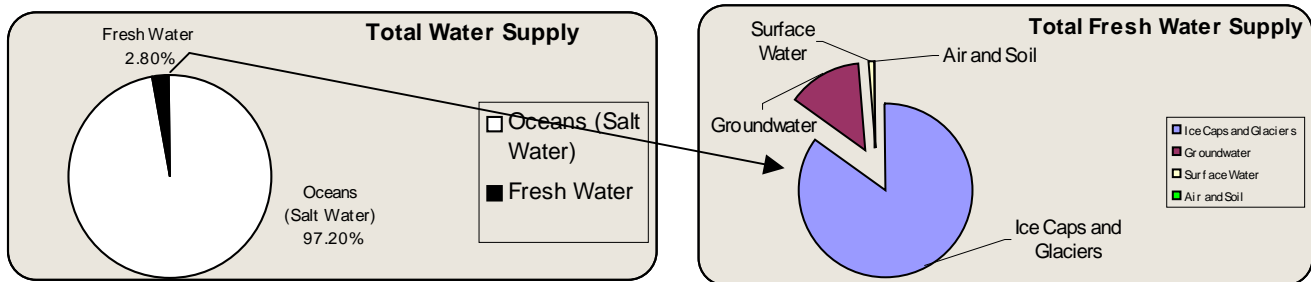
ACROSS: 2) rivers 6) runoff 9) precipitation 10) vapor 11) liquid 13) rain

DOWN: 1) snow 3) evaporation 4) transpiration 5) condensation 7) cyclic 8) spring 12) ice

ACTIVITY 2 - Mapping your watershed (Self Explanatory)

If you have access to the internet, the United States Environmental Protection Agency has an outstanding watershed website: <http://www.epa.gov/surf>.

ACTIVITY 3 – Charting - (Charts should look something like the below pie charts)



ACTIVITY 4 – Find the Hidden Pollution

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| V | N | M | I | P | O | W | F | D | T | C | P | V | C |
| A | R | G | J | K | L | O | P | M | Q | H | Q | U | I |
| R | A | D | I | O | A | C | T | I | V | E | M | N | K |
| N | E | D | R | R | V | S | E | D | I | M | E | N | T |
| U | S | X | D | G | C | V | Q | W | A | I | S | D | T |
| T | W | S | X | A | Z | A | E | Q | T | C | U | K | L |
| R | M | N | R | N | X | V | B | H | E | A | T | Y | P |
| I | B | N | M | I | A | S | D | F | G | L | H | J | K |
| E | P | O | R | C | M | N | B | V | C | X | X | Z | A |
| N | P | O | L | K | I | M | J | U | Y | H | N | B | T |
| T | M | N | B | V | C | X | Z | D | F | G | H | J | K |

ACTIVITY 5 – What's in the Water? - Categories of Non Point Source Pollution

■ ANSWERS:

Sources of Pollution: B;A;C;D

Causes of Pollution: A;B;D;C

ACTIVITY 6 – Water Properties Crossword Puzzle

■ ANSWERS:

ACROSS: 2. alkaline 5. dissolves 6. pH 7. neutral 8. tension

DOWN: 1. water 3. acid 4. molecule

ACTIVITY 7 – Acid Rain Crossword Puzzle

■ ANSWERS:

ACROSS: 1. NPS 5. sulfur oxides 7. rural 8. acid 9. conservation

DOWN: 2. pure 3. nitrogen 4. nitric 5. sulfuric 6. urban

ACTIVITY 8 - Investigating Labels (Self Explanatory)

ACTIVITY 9 – Looking for More Information – Research

Teacher tip: This activity is intended to inspire the student to further study an aspect of water quality. The example given is nitrate, which can cause human health problems. Perhaps each student (or group of students) can study a different water quality parameter.

Specifically in terms of nitrate, here is some fundamental background information for classroom discussion:

Nitrate is a major ingredient of farm fertilizer and is necessary for crop production. When it rains, varying nitrate amounts wash from farmland into nearby waterways. Nitrates stimulate the growth of plankton and water weeds that provide food for fish. This may increase the fish population. However, if algae grow too wildly, oxygen levels will be reduced and fish will die.

Nitrates also may get into waterways from lawn fertilizer run-off, leaking septic tanks and cesspools, manure from farm livestock, animals wastes (including fish and birds), and discharges from car exhausts. In nature, they generally are formed by the action of bacteria on ammonia and nitrogen-containing compounds.

Nitrites are relatively short-lived because they're quickly converted to nitrates by bacteria. Even though they don't exist for very long in the environment, nitrites produce a serious illness (brown blood disease) in fish. Nitrites also react directly with hemoglobin in the human blood to produce methemoglobin, which destroys the ability of blood cells to transport oxygen. This condition is especially serious in babies under three months of age as it causes a condition known as methemoglobinemia. Many babies have been seriously poisoned by well water containing more than 10 mg/L of nitrate-nitrogen.

Because nitrates may be reduced to toxic nitrites in the human intestine, the US Public Health Service established 10 mg/L of nitrate-nitrogen as the maximum contamination level allowed in public drinking water. Water with nitrite levels exceeding 1.0 mg/L should not be used for feeding babies. Nitrite concentrations in drinking water seldom exceed 0.1 mg/L.

Effects of nitrates and nitrites on fish and aquatic life

Nitrate-nitrogen levels below 90 mg/L and nitrite levels below 0.5 mg/L seem to have no effect on warm-water fish, but salmon and other cold-water fish are more sensitive. The recommended nitrite minimum for salmon is 0.06 mg/L.

ACTIVITY 10 – Acids and Plants

This experiment takes several days, but allows students to see first hand the effects of pH (acids) on plant growth. It can help the student understand the actual effects of acid rain.

ACTIVITY 11 – The pH of Water

This activity is intended to encourage additional testing and comparison of various water sources. Use your (and your students') imagination. If additional test strips are needed, they are available through selected science education suppliers and/or Hach Company at a nominal price.

ACTIVITIES 12,13,14 – Testing the claims, Nitrate and Phosphate Testing

Teacher Tip: These experiments can produce extremely variable results depending on the materials being tested. Be sure to try this prior to teaching it in class—If the results are beyond the range of the test strips (too high), you can dilute the solution with water. This experiment or process can help students realize the (small) size of a milligram per liter or ppm.