

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

WASTEWATER, Level 1

ACTIVITY 1 – The Three States of Water — Day 1 and 2

Teacher Note: This activity is intended to build student awareness of the different forms of water: liquid, solid (ice), and vapor.

ACTIVITY 2 – Characteristics of Water (Self Explanatory) All statements listed are TRUE

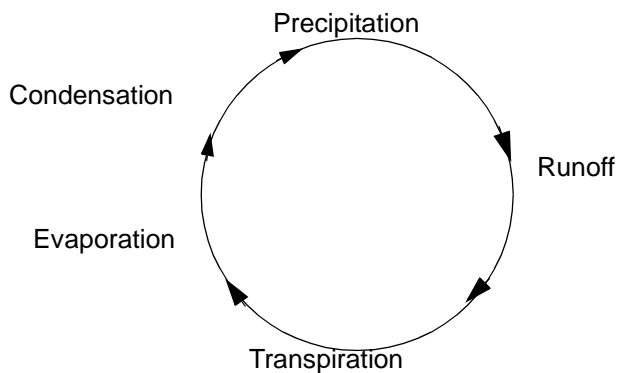
ACTIVITY 3 – Water Words Crossword

ANSWERS:

ACROSS: 1. Runoff 2. Clouds 5. Oceans 6. Solid 9. Evaporation 10. Rain 11. Lakes

DOWN: 1 Rivers 3. Liquid 4. Snow 6. Stream 7. Water 8. Vapor

ACTIVITY 4 – Water Cycle



ACTIVITY 5 – Water Cycle Words

Word	Definition
Evaporation	The sun heats the water. The water becomes vapor that rises into the atmosphere.
Condensation	Water vapor condense to form clouds. When the clouds cool, the vapor becomes liquid.
Precipitation	Liquid is heavier than vapor. Gravity pulls the liquid down to earth as rain or snow.
Runoff	When rain reaches earth it flows across the land into lakes, stream and oceans.
Transpiration	Plants take in water, then “breathe” the water out as vapor.

ACTIVITY 6 – Puzzle

ANSWER: THE THREE STATES OF WATER ARE SOLID, LIQUID AND GAS (VAPOR).

ACTIVITY 7 – Sewer Pipe Maze (self explanatory)

ACTIVITY 8 – Averages

Teacher Note: With the information presented about average water use (160 gallons per person per day), some students may have not yet grasped the concept of averages. This exercise is intended to build on the concept of averaging.

The activity can be summed up with a classroom discussion of “ Why do you think we would want to lower the average number of gallons of water used by a person? The “take away” message is that we all can do things to reduce our water use, thereby preserving our LIMITED water resources. The puzzle in Activity 9 reinforces this message.

ACTIVITY 9 – Puzzle

ANSWER: LESS THAN ONE PERCENT OF FRESH WATER IS AVAILABLE FOR PEOPLE, PLANTS AND ANIMALS TO USE.

(Note: Most of the water on earth is salt water or frozen in our glaciers and ice caps.)

ACTIVITY 10 – Puzzle

ANSWER: WASTEWATER TREATMENT PLANTS CLEAN WATER. IS IT EASIER TO CLEAN YOUR DESK OR THE ENTIRE SCHOOL ROOM?

(Note: The message here is that if we do not “dirty” water by wasting it, we do not have as much water to clean at the wastewater plant, i.e. It is easier to clean a little of something than a lot of something!)

ACTIVITY 11 – Ways to Use Less Water

Teacher Note: The students have just completed two other cryptograms in the previous activities. This exercise gives them a chance to create their own.

ACTIVITY 12 -- Labels

Teacher Note: This exercise has been added to raise student awareness of hazardous substances in their homes and schools. This activity will be further developed later in the curriculum to teach students that (in many cases) “dumping it down the drain” does not get rid of a hazardous substance.

ACTIVITY 13 and 14 – Wastewater Words and Wastewater Treatment

Teacher Note: This exercise will challenge students with unique vocabulary words and unknown wastewater treatment processes. The words that they write in Activity 13 can be cut apart and arranged in proper order on another sheet of paper.

ACTIVITY 15 – It’s Us!

Teacher Note: This exercise will help the student identify improper disposal of hazardous wastes.

ACTIVITY 16 – It's Just A Little Bit

Teacher Note: The intent of this exercise is to give students an understanding that what they do individually can appear to have little or no effect (on the environment), but when they all do the same thing, the result is compounded.

ACTIVITY 17 – Puzzle

ANSWER: *INDIVIDUAL ACTIONS CAN HAVE A BIG IMPACT ON TOXIC POLLUTION.*

EXPERIMENT – Chlorine

Answers to Questions posed:

1. “Good Part of using chlorine” – Kills bacteria in the water to prevent human disease
“Bad Part of using chlorine” – Chlorine can be toxic to fish and other aquatic organisms
2. HIGHER LEVELS of chlorine would be necessary in a swimming pool. Many people in a pool can bring disease causing bacteria into the water. Thus, a high level of chlorine needs to be used.

Chlorine Testing Log Sheet

1. Color of test strip should be between white and purple, That color will correspond with a given ppm (parts per million of chlorine) that is given on the test strip bottle.
 - If the level is above 0.5 mg/L (ppm) there is “disinfecting ability.”
 - Chlorine is very toxic to fish, so if the result indicated any chlorine, it is probably toxic to fish.
2. If additional test strips are available, other liquids can be tested for fun.

EXPERIMENT – Nitrate / Nitrite (Self Explanatory)

Answers to Questions posed:

1. Self Explanatory – “Test Yes” should have a nitrate result of approximately 10 ppm (mg/L) nitrate
2. Testing other water sources for nitrates – Most likely, drinking water will NOT have any nitrates in it. (That’s why we provide the Test Yes!” chemistry.) However, if you live in a rural area, you may want to check the water flow away from an agricultural field to see if any of the nitrogen fertilizers being used in the field showing up in the water.
3. Eutrophication
4. Basic concepts in the short essay should include eutrophication and methemoglobinemia (blue baby syndrome)

EXPERIMENT – Phosphate

Answers to Questions posed:

1. Self Explanatory – “Test Yes” should have a phosphate result of approximately 15 ppm (mg/L)
2. We measured “ortho” phosphate
3. “Meta” forms are used for treating boiler waters (in industrial plants) and in detergents
4. “Ortho” forms are produced by natural processes and are found in wastewater.
5. “Organically bound” phosphates are important in nature and also may result from the breakdown of organic pesticides which contain phosphates
6. MAN-MADE SOURCES: Fertilizers, cleaning compounds, industrial processes; pesticides
NATURAL SOURCES: Rocks and soils; solid or liquid wastes (from animals)

Thank you! Good luck to you in your study of water!