



Introduction to Supermarket Science Materials

What You Need:









Parent Helpers



How to Use These Materials

Supermarket Science Materials are organized into thematically linked sets with experiments and activities as well as background information that makes them easier to do. There are also a bunch of simple, fun art and writing projects. All of the activities can be done alone or in conjunction with other project sets. Choose activities that are developmentally appropriate for your children.

All Supermarket Science Materials are primarily geared toward students in elementary and secondary schools, as well as their parents and teachers, but can be expanded to higher grades. The activities are designed to advance the understanding of concepts of biology, ecology, geology, and sociology based on local resources like a backyard or a local grocery store. All of the materials in this set and others link the Core Curriculum Standards. Use these Standards to focus the activities to a particular grade level.

There are also LEARN, SHOW, USE, DO, and TEACH pages. LEARN pages are designed to be printed out and given to the kids. They contain explanations, stories, or diagrams. SHOW pages usually present interesting photographs or illustrations that demonstrate specific concepts. USE pages are created as supplemental materials for the activities and experiments. Animal Cards and Map Cards are examples of USE pages. And finally, the DO pages contain the actual activities and experiments—please print as many copies as you need and give them to your children. Please use the back of these pages as scrap and add additional pages as needed.

On some pages, there are icons of animals. For example, an activity about elephants might have an elephant icon next to it. These icons can be used as keys to link information between all of the Supermarket Science Materials.

Most DO pages have a What You Need list of items in the margin under the title of the activity. This is a quick reminder for what children should have while doing the activity. It might look something like a list on the right: Animal Stamps pages, Animal Cards pages, research books, pencil, scissors, glue, etc.

Some of the activities use of cards from the Supermarket Science Cards or Stamps USE pages. Creating taxonomies is part of the scientific process. Card games and activities allow kids an opportunity to practice this skill.

There are many activities which can be done on the importance of water. This set shows some possibilities. We encourage you to come up with others. Think of these activities as inspirational examples, jumping off points.

Summary

These activities and experiments focus on the chemistry and composition of water. What does it mean when we say the water is clean? Water can look crystal clear and still be deadly if consumed by people. Clean-looking water can be safe to drink but taste terrible. This course introduces students

to water contaminants and their sources. Students will learn about the *Nitrogen Cycle* and perform series of tests on water from various sources and on household liquids (e.g.: juice, vinegar, soap).

We hope that these materials will teach you something new and make this subject enjoyable to your children as well. For more activities and suggestions by teachers and parents on how to explore this material with kids, visit Supermarket Science web site at SupermarketScience.com.

Watershed illustration by EPA and GAO



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Introduction to Supermarket Science Water Materials



Words in red are vocabulary words. They are used in a word puzzle DO pages.

Main Ideas

Research

• Research is the basic tool of well-educated people. While engaging with Supermarket Science Activities, kids learn how to conduct and think about research in general and how to look up basic information about water in a library or the Internet. USGS is a good resource. To learn more about watersheds, please visit https://www.usgs.gov/special-topic/water-science-school/science/ watersheds-and-drainage-basins

Precision

- Each label, name, or word has a specific meaning that all scientists in the same field understand to mean exactly the same thing.
- Descriptions of objects and events need to be precise enough to limit misunderstanding or misinterpretation by the readers as much as possible.
- "Fuzzy thinking" is not allowed!

Logical Thinking

- There two pathways in science: deduction and induction. Deduction is a process that puts together bits of data and evidence to build a theory—it's bottom up reasoning. Induction is the process that starts with an idea and then looks for data and evidence to support it—it's top down reasoning.
- Logical reasoning is a formal way of thinking (usually deductive) where each successive thought is built upon the previous one; as long as each link is a chain of logical reasoning is true, the end conclusion is true.

Water Contaminants

- There are two types of water contaminants: biological and chemical.
- Contaminants can be introduced into water by people or through natural processes.
- Contaminants can be dangerous or benign.

Water Quality and Testing

- pH test kits provide a readily available and easily performed set of water tests that can be used in the classroom. pH test kits usually tests for: pH, hardness, buffering capacity, and Nitrate and Nitrite abundance.
- pH is a 14 point measure of liquid's acidity, with 7 being a neutral value.
- Hardness measures the amount of dissolved metals in the water.
- Buffering capacity measures the water's ability to resist changes in its pH as the result of addition of acidic or basic contaminants.
- Abundance of Nitrate and Nitrite measures the health of the Nitrogen Cycle of the water.
- Temperature is another easily measurable quality of water, but it is only useful if obtained on site (i.e. directly from a river or a pond).
- Clarity of water is an important but difficult to measure quality, especially in a classroom setting.

Water Treatment

- There is a limited amount of clean, fresh water—clean, fresh water is a natural resource and it needs to be conserved.
- Water has to undergo a treatment process before it is fit for human consumption. People designed and built water treatment, distillation, and desalinization plants to make water potable.





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What You Need to Conduct These Activities



pH tester



What You Need

E ach child will need a set of LEARN, SHOW, DO, and USE pages from this set of activities. Each group of children (students can work in pairs, small groups, or individually) will also need materials listed below.

For water filtration activity, you will need:

- Activated Carbon found in any aquarium supplies store or on Amazon.com
- An empty soda bottle with the bottom cut off
- Two cups of fine sand (sterilized by oven baking at 350°) and two cups of fine gravel (also sterilized)
- 3-4 cotton balls or cut-up old (but clean) cotton sock

Most of these activities require pH test kits or pH meter. You can purchase these at a hardware store, at a fish pet store, a medical equipment supplier, or at a gardening supply center. The cheapest pH paper will cost about \$3 for an entire class to do all of the activities once. pH meters can cost a lot more but can be used over and over again. These devices range from \$10 to over \$100.

You might want to discuss why these particular stores carry this item. The presence of blood in a liquid can be detected with a pH paper test, which is why it could be found at a medical supply store. Most pH kits include tests for water hardness. Water hardness—the amount of metals dissolved in the water—affects plumbing fixtures and so is an important diagnostic tool. Most hardware stores have some version of pH and water hardness tests. Gardeners use pH tests to determine the quality of the soil. When the soil is too acidic or too basic, some plants can't grow. A simple pH tests can explain why a particular plant is not thriving. And finally, most fish prefer water with neutral pH (that's pH=7).



When the water gets too acidic or too basic, fish die. All pet fish supply stores carry several types of pH testing and adjustment kits.

If you would like to make your own pH paper from red cabbage leaves and coffee filters, please consult the Supermarket Science Course on Acids and Bases that walks through the entire process in detail and provides additional experiments that you can do with your children. If you plan to use ready-made pH testing tools, you can skip that course.



Using red cabbage pH paper, 5th graders test house-hold liquids for acidity in front of their Science Buddies from 2nd grade.







Do More

Additional Fun with Water Chemistry

TEACH

Teaching writing, math, and reading is easier in a context rather than in isolation. Ask your children to write a short story about what they've learned or to draw an illustration or both. For example, is New York City tap water *kosher*? There are infinite number of ways of expanding these activities to meet the needs of different kids at different stages of their development. We hope teachers, parents, and students will make more activities using the materials found in these sets.

There are many experiments that can be done with pH test kits—so many liquids, so little time! Look around your home, classroom, lunch room, and students' lunch bags for interesting things to test. For example, you can compare the pH values of the different juices from the student lunches. Another interesting measurement is the water hardness. Different bottled water have different hardness. Compare the bottled water with tap water. You can also test rain water by collecting samples from puddles or by leaving jars outside in the rain. If you do rain water testing over the whole year, you might be able to plot the acidity of the rain water over time. These measurements will help children understand the concept of "acid rain" in a very direct way. And finally, consider collecting and testing the waters from local springs, rivers, lakes, and ponds. The kids can map the variation in acidity and hardness over a geographic area of their neighborhood.

Encourage your children to discuss the following questions:

- 1. What would happen if oceans become more acidic?
- 2. What's safer to drink: bottle water or tap water?

You'd be surprised how many other ideas your children will have after doing these activities. Please share those. For example, if your kids make their own connect the dots drawings, email them to us and we will post them. Such recognition would make children proud and encourage them to make more.



pH measures the concentration of hydrogen ions [H⁺] in a solution.

$pH = -log[H^+]$

A pH test paper is soaked in a chemical that will either absorb hydrogen ions or give them up, changing the color in the process. An acidic solution has many hydrogen ions. When pH paper is put into an acid, hydrogen ions will move from the acid onto the paper and change its color, indicating a low pH level (pH<7).

Bases react exactly the apposite. A basic solution will take hydrogen ions from the pH paper and change its color to indicate a high pH level (pH>7).



Students purify dirty water with a home-made filter.

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