

HOUSEHOLD HAZARDOUS WASTE

An interdisciplinary curriculum recommended for grades 4-6



PRODUCT
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Sustainable Solutions to Protect Our Environment

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Introduction

This curriculum is designed as an inquiry-based hands-on approach to teaching 4th -6th grade students about household hazardous waste, also known as HHW. Educators are encouraged to adapt the following units to fit a breadth of educational opportunities for example, after school programs, Earth Day events, community outreach programs, the possibilities are endless.

Why is it Important to teach students about hazardous household products?

Most students that participate in recycling programs at home or at school are already familiar with the principles of “reduce, reuse, recycle.” However, not all students know of the special case that is household hazardous waste (HHW). Most household hazardous wastes can be recycled, although not with regular curbside recycling programs. All household hazardous wastes must be discarded separately and with care from household trash and recycling. The trace amount of hazardous chemicals found in everyday products, such as electronics and CFL bulbs, can accumulate when these products are dumped in massive quantities to landfills.

If improperly discarded, common household products can have long-term deleterious effects to health and the environment. Household hazardous waste contain certain chemical substances that have potentially dangerous characteristics such as ignitability and toxicity which persist long after the product has been discarded. Proper handling of these products can reduce or eliminate these potential risks. Hence, individuals, families and communities must learn how to safely manage these common household products. The first step to action is education.

What can my students do?

This curriculum has plenty of room for student leadership and involvement. Most of the products discussed in these units—such as electronics, pharmaceuticals, and motor oil—are familiar to children. Awareness of these products and their proper handling can significantly change the habits of a household. Expand this awareness across several households- and a whole community can improve its HHW handling and take strides towards being responsible consumers. Students can feel empowered knowing that they can be an agent of change. They can apply what they learned in the classroom to help address problems that may exist in their school or community.

Encourage your students to take the initiative. Ask thought-provoking questions. Provide opportunities for service-learning projects. Information is included at the end of the curriculum about how students can start their own “Green Kids Club”. This type of youth-led environmental club can be started by students at any school or community organization. For more information about starting a “Green Kids Coalition” at your school or community please refer to Page 24.

Household Hazardous Wastes: A Lesson Overview

The curriculum is divided into 5 units, each unit requiring about 45 minutes (or one class period). However, the activities and units are flexible and can be expanded or condensed as needed. Every unit is further divided into 6 components:

- **OBJECTIVE:** Units begin with a clear object or learning goal that can be used to evaluate students' prior understanding of the subject matter.
- **KEY WORDS:** This section introduces new vocabulary words relevant to that unit, providing examples when necessary.
- **BACKGROUND/ PREPARATION:** Some units include a section with basic information to prepare students and teachers for the activity.
- **ACTIVITIES:** Each unit has 2-4 activities with critical-thinking questions that allow students to make meaningful reflections and observations throughout the activity. Some units include worksheets to complement the activity.
- **DISCUSSION:** This component provides open-ended questions and additional information to help students relate the topic and activity to their own household, and their community. Teachers and students can use the discussion topics to provoke ideas for future service-learning projects.
- **SOURCES AND BACKGROUND READING FOR TEACHERS AND STUDENTS:** Lists links to websites and additional reading materials that can be integrated into each unit.

Each unit explores the following questions:

1. What makes up household waste?
2. Where does "stuff" come from, and what happens to it after it's been disposed?
3. How can pollutants or harmful chemicals move through the environment?
4. What is household hazardous waste (HHW) and how can it affect our health and local environment?
5. What can be done to minimize the impact of hazardous household products?

The appendix contains worksheets and graphics that supplement the unit lessons. For more information about how hazardous waste is being managed in your community, contact your local department of public works. For more general information about certain products, visit www.earth911.com.

UNIT 1: What is Garbage?

OBJECTIVE

- Identify the different materials that make up household trash
- Understand how these materials are managed once they are discarded (thrown away, recycled, composted, or reused)

KEY WORDS

Compost – A mixture of decaying organic material that can be used as fertilizer.

Corrosive – A material that can wear away or destroy another substance. Some corrosive materials can eat through metal, burn skin on contact or give off vapors that burn the eyes. For example: household bleach.

Environmental sustainability – The conservation of an ecological balance by avoiding depletion of natural resources.

Ignitable – Something that can easily be set on fire. For example: Paints and furniture polish.

Household hazardous waste (HHW) – Any product that contains properties that are dangerous or potentially harmful to human health or the environment. Leftover household products that contain corrosive, toxic, ignitable, or reactive ingredients are considered to be HHW.

Reactive – A material that can explode or create a gas when combined with other chemicals. For example: ammonia and bleach create dangerous fumes when combined.

Reduce – The first approach to minimizing waste by buying and using only what we need. For example, you can reduce the amount of Styrofoam cups being used by using reusable plastic cups instead.

Reuse – The second approach to minimizing waste by using an object again. For example, instead of throwing away an unwanted t-shirt, you can hand it down to a sibling or donate it to charity.

Recycle – The third approach to minimizing waste by converting waste into usable raw materials. For example, a recycled plastic bottle is converted back into.

Toxic – A substance or material that can poison people, animals, or other organisms. For example: antifreeze.

Waste Management – The collection, transport, processing, recycling or disposal, and monitoring of waste materials.

MATERIALS

- Five different containers per group
- A set of the following five labels per group:
 - Reuse/Donate
 - Recycle
 - HHW (household hazardous waste)
 - Compost
 - Trash
- Saved contents of classroom trash from the previous 24 hours AND/OR At least 10 different “waste” items for each bin. (For example: glass jar for “reuse”, aluminum can for “recycle”, old cell phone or batteries for “HHW”, banana peel for “compost,” a used paper towel or Styrofoam for “other”),
- Sealed containers of various household cleaning products
- “Know Your Waste” Worksheet
- “HHW Home Survey” Worksheet
- Stickers
- Video of Loop Scoops: *Garbage* <<http://pbskids.org/loopscoops/garbage.html>>

BACKGROUND AND PREPARATION

In 2010, the US produced 250 million ton of waste, recycling and composting. In other words, each American creates approximately 4 pounds of waste a day or 1,620 pounds of waste each year and on average recycles just 550 pounds of that annual total. The average US household produces 20 pounds of household hazardous waste each year. This amounts to 530,000 tons (1,060,000,000 lbs) each year.

1. Does 4 pounds per person seem like a lot or a little bit of waste? Ask students to think about what threw away in the trash this morning and have them consider where it will end up in a week.
2. What does “garbage” mean? Ask students to share their definitions of garbage and come up with a classroom definition of “garbage”.
3. What do students do with something they no longer need or want? What happens to trash after it gets taken “away”? Where does it all go?

ACTIVITY I

1. Assign the students in groups of 3-5. Have each group set up a work station by providing them with five bins and dividing the trash content equally among the groups.
2. Inform the students that they have 3 minutes to separate all the trash into the 5 different containers. Allow students to be creative in how they choose to classify each object.
3. Once the time has passed ask a representative from each group to explain how they separated their trash. At this point show the students the short video, Loop Scoops: *Garbage* <<http://pbskids.org/loopscoops/garbage.html>> Ask students why different objects were categorized in different piles. Continue the discussion by asking if they noticed anything in their trash pile that wasn’t present in Oliver’s trash pile (for example household hazardous wastes).

AROUND YOUR HOME

- Automotive waste (antifreeze, motor oil, gasoline)
- Batteries
- Cleaning products (degreasers, drain openers, furniture polishes etc)
- Electronics
- Mercury-containing products (thermometers, thermostats, fluorescent lights)
- Paints and solvents
- Pesticides
- Pharmaceuticals
- Gas Cylinders

ACTIVITY III (Take home project)

Hand out the HHW Survey and parent letter. Under parental guidance, students will use the worksheet to take a survey of HHW in their home.

1. On these worksheets, students will record the location, the name of product, purpose of product and its “hazard indicator” (Caution, Warning, Danger Poison).
2. Once all students have completed the survey, make a tally of:
 - The total number of household hazardous products
 - The total number by type (“caution, warning, danger, poison”)
 - The total amount found in each section of their home
3. Make a bar graph to illustrate the quantity of household hazardous products per location and per type of hazardous product.

DISCUSSION

1. Where does the garbage truck take your trash?
2. What are the challenges of responsible household hazardous waste disposal?
3. What are some reasons all hazardous products are not managed safely now?
4. How can we reduce the amount of hazardous substances being disposed in the first place?
5. What options does your town, city, or county have for safe and responsible HHW disposal? Where can you find out?

SOURCES AND BACKGROUND READING FOR TEACHERS

“Garbage.” Teachers’ Domain. (2010)

<<http://www.teachersdomain.org/resource/lpsc10.sci.life.garbage/>>

Environmental Protection Agency. Hazardous Substances and Hazardous Waste Fact Flash.

<http://www.epa.gov/superfund/students/clas_act/haz-ed/ff_01.htm>

SOURCES AND BACKGROUND READING FOR STUDENTS

Gail Gibbons. *Recycle!: A Handbook for Kids*. (1996)

Lara Bergen. *Don’t Throw That Away!* (2009)

Nuria Roca. *The Three R’s: Reuse, Reduce, Recycle*. (2007)

Paul Showers and Randy Chewning. *Where Does the Garbage Go?* (1994)

UNIT 2: Why Do We Recycle?

OBJECTIVE

- Explore how materials move throughout our economy.
- Understand how recycling helps ensure valuable, usable materials do not go to waste.

KEY WORDS

Carbon footprint – A measure of the total amount of carbon dioxide (CO₂) and methane (CH₄) emissions of an individual, community, business, system or activity.

Compost – A mixture of decaying organic material that can be used as fertilizer.

Household hazardous waste (HHW) – Any product that contains properties that are dangerous or potentially harmful to human health or the environment. Leftover household products that contain corrosive, toxic, ignitable, or reactive ingredients are considered to be HHW.

Nonrenewable resource – A natural resource which cannot be grown or regenerated at the same rate as it is being consumed at. (For example: fossil fuels, coal, minerals, and some fresh water aquifers)

Product lifecycle – The phases of a product's lifecycle, from the time it is raw materials, through production, transportation, retail, use to the time it is no longer useable.

Product stewardship – An approach where everyone involved in the lifecycle of a product assumes responsibility to reduce its environmental, health, and safety impacts.

Recycle – The third approach to minimizing waste by converting waste into usable raw materials. For example, a recycled plastic bottle is converted back into.

Reduce – The first approach to minimizing waste by buying and using only what we need. For example, you can reduce the amount of Styrofoam cups being used by using reusable plastic cups instead.

Renewable resource – A natural resource that can be replaced or regenerated with time, as part of the natural environment. (For example: wind power, solar power or geothermal energy).

Reuse – The second approach to minimizing waste by using an object again. For example, instead of throwing away an unwanted t-shirt, you can hand it down to a sibling or donate it to charity.

Supply Chain – The network or people, technology, resources, and information involved in bringing a product or service to a consumer. It includes every step taken to deliver the final product to your hands, such as the extracting the raw materials and natural resources, building, transporting and selling the product.

MATERIALS

- Paper, pencils, drawing paper
- A picture or representation of a peanut butter sandwich, apple, carrot sticks and a pudding cup
- An old computer or other electronic product such as a radio or walkman
- Map of the world <www.eduplace.com/ss/maps/pdf/world_country.pdf>

- Ruler
- Video: Loop Scoops *Electronic Gadgets*: <<http://pbskids.org/loopscoops/electronics.html>>
- Website: SourceMap: A typical laptop < <http://sourcemap.com/view/744#stop-60>>

ACTIVITY I

1. Ask students to think of something they brought to school today (a jacket, notebook, lunch box etc). Have them write down as many materials they can name that went into making that item. If they have a hard time coming up with materials, walk them through a simple example such as a water bottle or spiral bound notebook. Deconstruct the water bottle, from the plastic bottle and cap, the water, and the label. The plastic is derived from petroleum; the label can be made of paper, while the water can come from a natural spring or groundwater.
2. Allow several students to share their answers, and list their responses on a board where everybody can see. Have students identify what natural resources were used to produce each material listed on the board. For example, notebook paper comes from a tree. Bread comes from wheat. Trees and wheat need water and soil to grow.
3. Ask if anybody knows the location where these materials may have been produced. Students could check the tags on their shirts or backpacks to see where they were produced. Whose item traveled the longest to reach the classroom? How did those materials travel from one place to another? Add “fuel” or “energy” to the list written on the board. If applicable, include the type of energy used to produce or transport that item (fossil fuel, electricity).
4. Remind students of the differences between renewable and nonrenewable materials. Are the materials listed on the board made of renewable or nonrenewable materials? As students answer, write the appropriate answer for each material. What would happen if we run out of the nonrenewable materials, for example plastic? Which products will be affected?
5. Of the materials listed on the board, which are recyclable and which are not? Where do the non-recyclables go at their end of use? What will happen if we thrown products made of nonrenewable resources ‘away’ and don’t recycle them? (Note: Some products may be made of mixed materials that can be difficult to recycle; however, one solution to this some companies have adopted is to redesign their products so they can be more easily broken apart and recycled)

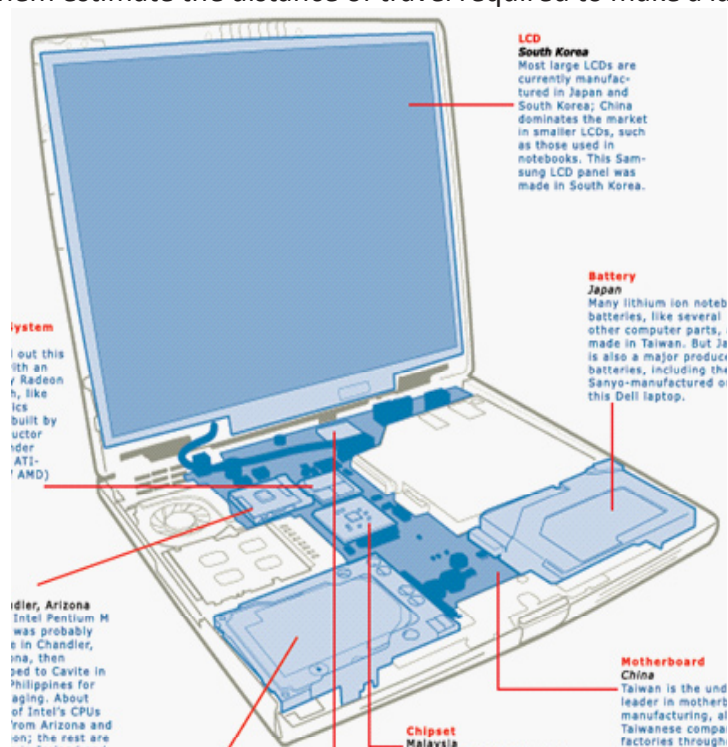
ACTIVITY II

1. Explain that all man-made products have a lifecycle. It might be useful to link the idea of a “product lifecycle” with the lifecycle of a living creature, such as a frog. Ask your students to come up with a class definition for “product lifecycle.”
2. Ask students where they think their lunch came from. Before their food reached the grocery store or the cafeteria, where did it originate from? A farm, an orchard, a bakery, a factory or from all four? Go even deeper, what other resources went into making that food? Fruits and vegetables grow from soil, but they required sun, water, nutrients and fertilizer to grow. They also needed to be shipped to the grocery store, refrigerated, put in a shopping bag, transported home, stored in the student’s refrigerator etc. Manufactured products such as chips or pudding list their ingredients on the package, which may help students identify a larger number of ingredients. The packaging should also be counted, for example plastic packaging was likely made from petroleum.
3. Hand out drawing paper and materials. Instruct students to make a diagram of the lifecycle for each item in their lunch box. To make a lifecycle, students should list all the ingredients and materials that make up an item in their lunch box. If something is made of different ingredients, (i.e. pudding) make sure to take into account each ingredient and the packaging materials as well.

4. Have all students construct another supply chain for one food (for example bread). Have the students assemble each material and ingredient in sequential order so the students understand all of the steps taken to produce that item. Challenge students include following in their diagram:
 - Fertilizers or animal feed (if applicable)
 - Sunlight
 - Water
 - Transportation and fuel
 - Distances traveled
 - Packaging (If applicable)
 - Retail
 - Labor
5. Students should also incorporate the waste management portion on their product lifecycle diagram. To complete the diagram, have them highlight the supply chain, product use, and waste management portion of the cycle. Which materials can be recycled or reused at the end of product life (ex: water bottles, containers, composted food)?

ACTIVITY III

1. Show Loop Scoops: *Electronic Gadgets* Video: <<http://pbskids.org/loopscoops/electronics.html>>
2. Most electronics contain valuable metals that can be recovered. What are ways we can recover these materials? Many people may not know that electronics can be recycled to recover precious metals (such as gold) and other raw materials. It is also important to recycle electronics to ensure that toxic components, such as mercury and lead do not end up in the environment. Some manufacturers take back their products for repairs or recycling.
3. Ask student volunteers to share what their family does after they no longer use an electronic device.
4. Show the students the following diagram of the inside of a computer (found on Page 31 of the appendix). How many parts do the students think it's made of? What are some of the materials it is made out of? Have them estimate the distance of travel required to make a laptop. Write these estimates on a board.



Source: http://www.pcmag.com/image_popup/0,1740,jid=167271,00.asp

5. All computers have similar components:
 - Case (Magnesium alloys, aluminum, plastic)
 - Display (silicone)
 - Battery (lithium ion)
 - Motherboard (copper, gold, silver, palladium)
 - Microprocessors (silicon, made of quartz and carbon, glass, copper, epoxy)
6. Of all these components, the motherboard bears the greatest carbon footprint. Ask students to brainstorm why this might be so. Motherboards are process-intensive, rather than material-intensive to manufacture meaning they take a lot of energy to manufacture even though they are very small and do not have a large mass. The extraction process of raw materials such as gold is responsible for the greater carbon footprint of its components.

ACTIVITY IV

1. Show Website: SourceMap: A typical laptop. Allow students to explore the map before asking the following questions:
 - How many different raw materials are necessary to create a laptop?
 - Where do most of the raw materials come from? Where do most of the raw materials go?
 - Where does most of product assembly take place?
2. Have students identify the key locations in the laptop supply chain on a map. Use a ruler and the scale on the map to estimate the distance between the key locations. Add the distance between these locations to estimate the total distance required to manufacture a laptop.
3. Is the actual distance greater or less than what students estimated? How much do you travel in one day? In one week? In one month?

DISCUSSION

1. We all know where our food goes after lunch, but what about all those pieces we didn't eat? Where do the scraps go?
2. What happens to the food thrown in the compost pile? Why might it be better to put food scraps into a compost pile rather than the trash?
3. What factors and resources are involved in the supply chain of the following: A cell phone, a text book, a pair of shoes?
4. How can the supply chain be restructured to minimize the amount of natural resources required to produce a product and total waste produced? Remember to consider each step in the supply chain.

SOURCES AND BACKGROUND READING FOR TEACHERS

S. O'Connell and M. Stutz, Product Carbon Footprint (PCF) Assessment of Dell Laptop- Results and Recommendations. 2010.

Tweney, Dylan. What's inside your laptop? *PC Magazine*. (2007)
<<http://www.pcmag.com/article2/0,2817,2102889,00.asp>>

SOURCES AND BACKGROUND READING FOR STUDENTS

Jen Green and Mike Gordon. Why Should I Recycle? (2005)

Alison Inches. The Adventures of a Plastic Bottle: A Story About Recycling. (2009)
-- The Adventures of an Aluminum Can: A story About Recycling. (2009)

UNIT 3- Keep Our Water Clean!

OBJECTIVE

- Identify different common household products that should be managed separately from the household trash.
- Discover how improper disposal of certain hazardous products can lead to water pollution.
- Explore how water can transport different substances, such as pollutants, through the environment.

KEY WORDS

Aquifer – The underground layer of rock, sand, or gravel from which groundwater can be extracted for use and drinking.

Capillary action – The ability of a liquid to flow in a narrow space on its own due to surface tension and adhesive forces between the liquid and the narrow space. For example, when water moves through a sponge or paper towel.

Groundwater – Water held underground in the soil or crevices in rock.. Groundwater makes up 20% of the world’s fresh water supply and many people get their drinking water from groundwater.

Leaching – Occurs when a liquid extracts a substance or material after passing through or over matter. For example, water extracts and carries chemicals and minerals as it passes over a riverbed.

Pollution – The introduction of a contaminant (also known as a “pollutant”) into a natural environment, causing disruption to the ecosystem. For example, sea turtles can confuse plastic bags floating in their marine environment for food.

Stewardship – The responsible management of a resource.

Water Table – The upper “surface” of groundwater, below which aquifers can be found.

MATERIALS

- Food dye
- Water
- Cup or mug
- Celery stalks
- Absorbent paper (like a paper towel or a coffee filter)
- Scissors
- Black washable (water-based) markers and color washable markers
- Ruler
- Large (16 oz or greater) clear plastic cup or glass
- Small (8oz) clear plastic cup. This cup should be small enough to fit in the larger one.
- Soil, Sand, Pebbles
- Brightly colored fruit drink or “jello” powder
- Masking tape
- “Water Underground” graphic (Appendix: Page 33)
- Sketch paper and supplies

BACKGROUND AND PREPARATION

Capillary action is the mechanism which allows liquids to travel through a narrow passage. Capillary action is possible because of adhesion and surface tension in water – which basically means water is “sticky.” Water molecules are attracted to each other and can also be attracted to other types of substances (not unlike a magnet). Capillary action is a phenomenon that can be found anywhere you look, from the blood in your veins to the water in plant cells. In this experiment, students will explore ways water can travel through different mediums.

Before beginning the first activity, explain the procedures to the students and then have students create a hypothesis on what they expect will occur when water touches the paper.

ACTIVITY I

1. Ask students what they think most people do with the common products in their house that contain hazardous materials (or household hazardous waste).
2. Have them reflect what their families, friends or neighbors might do after they no longer use a product with hazardous materials, such as a computer or old medications. Some possible answers could be:
 - Dumping in the trash
 - Washing down a storm drain
 - Pouring down the sink or toilet
 - Dumping on the ground or in a backyard
 - Recycling
 - Reusing (i.e. pass it on to a friend or neighbor)
 - Taking to a HHW collection site.
3. Assign some of these scenarios to groups of students and pass out drawing paper and pencils for each group.
4. Each group will draw the path they think HHW will take for each disposal option. Will the hazardous materials stay where it was dumped or will it move through the environment? If the latter, how will the hazardous components (or pollutants) be transported? Rain? Wind? Bus? Truck? (in the case of actual products that are recycled)
5. Have the groups share their diagrams with the class.

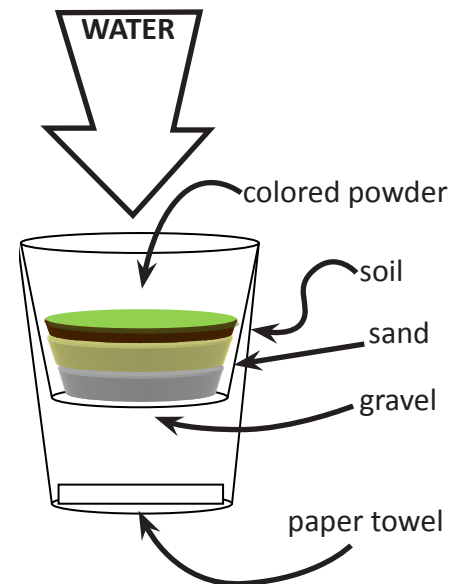
ACTIVITY II

1. Cut the absorbent paper into strips, about 2 inches wide and 5 inches long.
2. Draw one horizontal line with the black marker about 1 inch from the bottom of the strip. Repeat this step as many times as desired using a colored marker, making sure to use one color per strip.
3. Pour just enough water in the cup to cover the bottom.
4. Carefully place the paper strip into water in the mug (with the end with the black lines near the water but be careful not to let the black or colored marks touch the water). The water will then wick slowly up the absorbent paper.
5. Watch as the water travels up the strip of paper and record any observations.
6. How many colors do you see? Do you see more colors on the strip that had the black marking or on the strip with the colored markings?
7. The ink in washable markers is often made of colored pigments and water. When water travels up the paper, it brings some of the pigments with it. Black ink is made of a combination of different colored pigments that separate as water passes through. The distance each pigment travels varies

on the size of the pigment and its level of attraction to the paper. Similarly when water travels through the ground it picks up and transports different substances, just as the ink is dispersed across the paper. Pollutants disposed of in one location can be easily transported and dispersed across ecosystems. Plants root systems can take up or absorb contaminants in the water just like dry paper absorbs the water below it.

ACTIVITY III

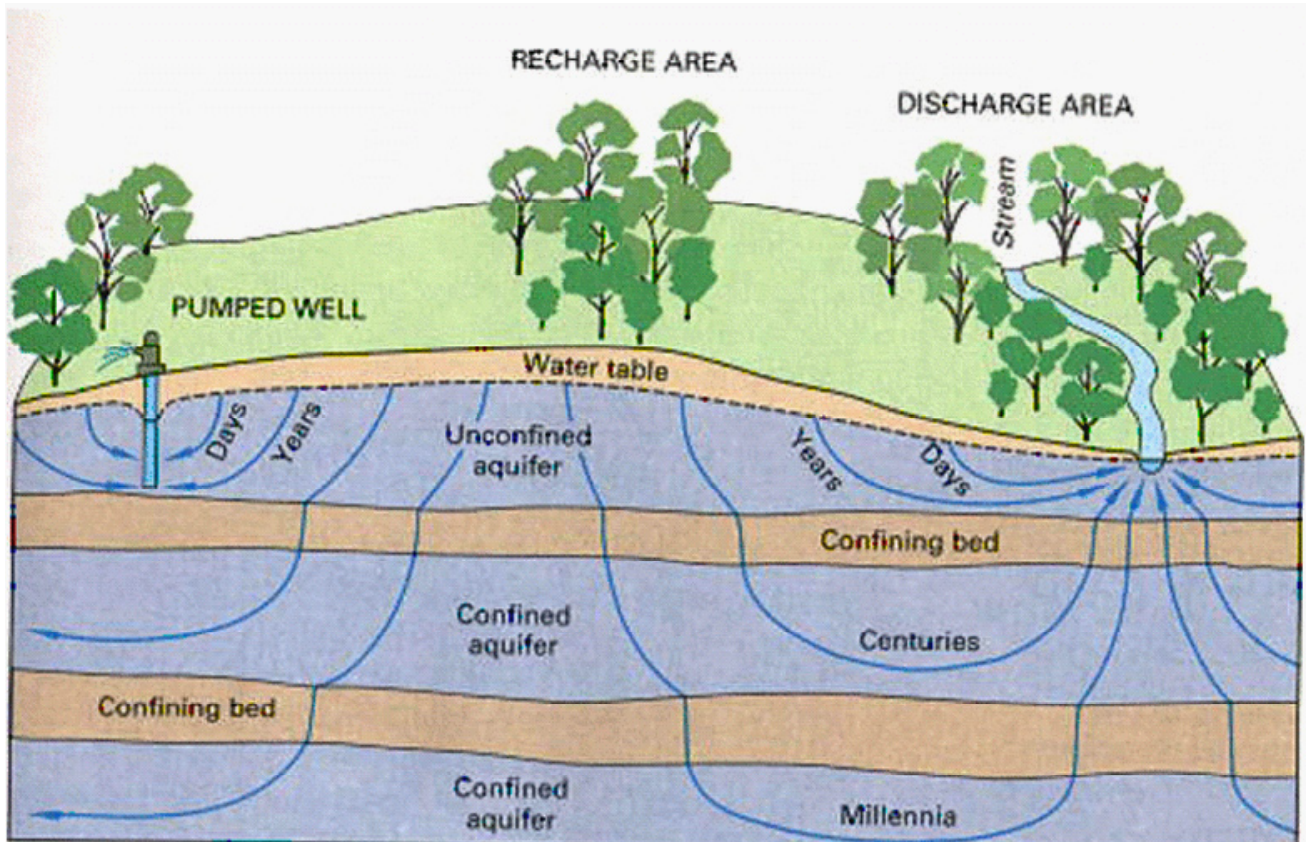
1. Explain that this activity models how pollutants can travel through the soil. Use the diagrams on page 36 of the appendix for reference.
2. Use a knife to cut an “X” into the bottom of a small clear plastic cup. The “X” should be just large enough for water to drip but not so large as to allow small particles to pass through.
3. Make a 1-inch layer of gravel at the bottom of the small cup. Explain that the gravel represents the groundwater aquifer. Add a 1-inch layer of sand on top of the gravel. The sand represents the water table. Cover the sand with a thin layer of dry soil and then sprinkle enough fruit drink powder to cover the soil.
4. Line the bottom of a large clear cup with absorbent paper (preferably white paper towels or coffee filters which will show colors).
5. Place the smaller cup inside the larger one, allowing about 2-inches of space at the bottom of the larger cup. If necessary use masking tape to secure the rims together.
6. Very slowly pour a cup of water into the smaller cup. Watch as the water drains through the layers. Does the water that pools at the bottom of the larger cup look the same as the water that was poured in the smaller cup? What do you think happens to substances that enter the soil?
7. This second activity demonstrated how even dry pollutants can become a source of water pollution. Just as water pulled drink powder through soil layers in the demo, rain can carry surface pollutants through soil. Over time, these pollutants can end up in our groundwater supply.



Adapted from: "Groundwater Leaching Activity," Developed by: David Stobaugh, Warren County Extension Agent for 4-H/Youth Development. University of Kentucky College of Agriculture. Cooperative State Research, Education, and Extension Service

DISCUSSION

1. Take a look at the image on page 15 (also found on Page 36 of the appendix.) How long does it take water to reach the deepest aquifer? How long does it take for water to reach the middle confined and unconfined aquifer?
2. Do you think aquifers are a renewable or nonrenewable resource?
3. What are some examples of good water stewardship?
4. Where do pollutants come from and how can we minimize the amount of pollutants in our water?
5. Who should be responsible for cleaning pollutants in our water?



SOURCES AND BACKGROUND READING FOR TEACHERS

Environmental Protection Agency. Surf your Watershed.
 <<http://cfpub.epa.gov/surf/locate/index.cfm>>

Environmental Protection Agency: Drinking Water- Consumer Information.
 <<http://water.epa.gov/drink/info/index.cfm>>

Environmental Protection Agency. What You Can do [About Water pollution] Resources.
 <<http://water.epa.gov/action>>

SOURCES AND BACKGROUND READING FOR STUDENTS

Environmental Protection Agency. Water Education Games and Activities for Kids.
 <http://water.epa.gov/learn/kids/drinkingwater/kids_4-8.cfm?>

Arthur Dorros. *Follow the Water from Brook to Ocean*. (1993)

Sandra Chisholm DeYonge. *Spring Waters, Gathering Places*. (2000)

Stan and Jan Berenstain . *The Berenstain Bears don't Pollute (Anymore)*. (1991)

UNIT 4- How does HHW move through our environment?

OBJECTIVE

- Identify the main types of common household hazardous wastes (HHW),
- Simulate how different hazardous substances can travel through the environment.

KEY WORDS

Household hazardous waste (HHW) – Any waste that contains properties that are dangerous or potentially harmful to human health or the environment. The EPA defines HHW as “leftover household products that contain corrosive, toxic, ignitable, or reactive ingredients.”

Pharmaceuticals – Prescription and over-the-counter medications.

Pesticide – A substance used to kill pests or other organisms harmful to plants or animals.

Solute – A substance dissolved in a solvent, (For example: salt)

Solution – A substance consisting of two or more substances evenly mixed together (ex: saltwater)

Solvent – A substance able to dissolve solvents (ex: water)

MATERIALS

- Room-temperature water
- Mugs or clear glass jars
- Oil
- Corn syrup
- Red food coloring
- Soil
- Clear 2L soda bottle
- Scissors
- Old nylon stockings or wire mesh to serve as a filter
- Sugar cubes
- Two pitcher water filters

BACKGROUND AND PREPARATION

A full day before this lesson, place a stalk of celery in a jar with about $\frac{1}{4}$ cup of water tinted with red food coloring. This will allow time for the celery to absorb the food coloring.

Many everyday products can contain components that can be hazardous if they are discarded with everyday trash. Most manufactured products today are made of materials that must be handled with care and disposed of responsibly so they do not pollute our soils and water.

Today’s activities focus on motor oil, pesticides and pharmaceutical waste; however, many other products can enter and travel through the environment in a similar manner. Water is an excellent solvent for many different substances and water can carry and deposit substances across a great distance. Life is especially vulnerable to being exposed to contaminated water, as plants, animals and people use water every day to survive.

ACTIVITY I

As a review of Lesson 1: Give students 100 seconds to write everything that comes to mind when they think of the words “hazardous waste.”

After students share their results, ask them the following questions:

1. How can you tell if something is hazardous?
 - Household items that produce HHW have a warning label or specific instructions for use and disposal on the container.
 - Other items – such as electronics – do not carry a warning label but should still be managed separately from the household trash.
2. Where can you find hazardous products in your home? (Remind students of their take-home HHW survey.)
3. How can somebody become exposed to hazardous waste?
 - Exposure can occur through skin or eye contact, inhalation, or ingestion of a hazardous product.
 - Long-term exposure can also result from drinking contaminated water or eating fish, or other foods that have been exposed to the pollutant.
4. Where do you think you can discard hazardous waste?
 - Most municipalities hold HHW collection days for residents to dispose of their HHW. Then the materials are transported to separate facilities to be managed with extra environmental controls.

ACTIVITY II- Pharmaceutical/ Pesticide Simulation

1. Have one cup of water ready in glass jars.
2. Challenge students to see how many sugar cubes they can dissolve in one cup of water, ensuring that they carefully dissolve each sugar cube one by one. In this experiment, the sugar is the solute, and the water is the solvent. How many sugar cubes could you dissolve in one cup of water? Is water an effective solvent?
3. Create a hypothesis: will the water filter remove the sugar from the sugar-water solution?
4. Pour each cup of the sugar-water solution into the pitcher filter.
5. While the water drips through the filter, explain that the sugar can represent both pesticides and improperly-disposed of pharmaceutical waste. Explain how these chemical wastes can enter drinking water supplies when pharmaceutical waste is flushed down the drain or when pesticides are sprayed on crops.
6. Use the diagram on page 34 of the appendix to trace the different ways pharmaceutical waste can enter water sources. During this time, pour cups of filtered water for each student to taste.
7. Was the filter effective in removing the dissolved sugar from the water? Why or why not?

NOTE: The filter may be unsuitable for future use as sugar particles may remain in the filter after this activity.

ACTIVITY III - Motor Oil Simulation

1. Cut off the top portion of the soda-bottle to make a wide-mouth bottle.
2. Poke holes along the bottom of the soda bottle.
3. Create a 2-3” layer of pebbles or gravel on the bottom of the soda bottle. This will represent the groundwater aquifer
4. Cover the layer of pebbles with the nylon stocking or wire mesh. This will keep the soil from sifting

into the pebbles.

5. Add 2 cups of soil on top of the nylon stocking. This represents the layer of soil in the earth.
6. Add no more than 3 drops of food coloring to the corn syrup. If necessary add water to the corn syrup to imitate the viscosity of motor oil. Pour a quarter cup of “motor oil” over the soil.
7. Sprinkle water over the soil and write down all observations.
8. How does “motor oil” move through the system after water enters the soil? What do you see entering the groundwater?

DISCUSSION

1. Present the celery stalk to students. Explain how the dye represents pollutants in the plant’s

Adapted from the California Integrated Waste Management Board: “Closing the Loop: Exploring Integrated Waste Management and Resource Conservation.” 4–6 Module, Unit 4:Lesson 3.

water source. How can pollutants enter our food systems?

2. What happens to HHW that is improperly disposed of or accidentally spilled on land or in water?
3. Who or what can be affected by contamination?
4. How can we avoid letting pollutants found in hazardous household products from affecting our environment?
5. Who is responsible for cleaning up the hazardous substances that leak into the environment: consumers, producers, towns or cities?

SOURCES AND BACKGROUND READING FOR TEACHERS

Environmental Protection Agency: Household Hazardous Waste.

<<http://www.epa.gov/osw/conserves/materials/hhw.htm>>

Environmental Protection Agency List of Household Hazardous Waste Publications (in English and Spanish) <http://www.epa.gov/osw/inforesources/pubs/hw_waste.htm>

“What’s in your water? An Overview of the Dangers of Pharmaceutical Waste” An environmental education lesson plan for highschool students presented by the Tennessee Solid Waste Education Project. <<http://www-tnswep.ra.utk.edu/PharmWasteHSLessonPlan.pdf>>

SOURCES AND BACKGROUND READING FOR STUDENTS

Bill Peet. *The Wump World*. (1981).

C. Vance Cast. *Where Does Pollution Come From?* (1994).

National Wildlife Federation. *Pollution: Problems and Solutions*. (1998).

UNIT 5- Taking Action, One Step Forward.

Time consideration: 2 class periods

OBJECTIVE

- Learn where to find out about local and national HHW collection programs.
- Research local HHW drop-off locations.
- Explore safer alternatives to hazardous household products.

KEY WORDS

Anthropogenic – Resulting from the influence of human beings on nature. For example, humans can cause habitat loss and affect the local biodiversity when clearing land for construction

MATERIALS

- Poster or large construction paper
- Markers, crayons, other coloring tools
- Old magazines and glue for collages (optional)
- Writing paper (note book or journal)
- Commercial glass or window cleaner
- Rubber gloves
- Paper towel
- Goggles
- Measuring cups, measuring spoons, vinegar, baking soda, water, towels, and coffee filters
- A glass surface, such as a window or mirror
- Internet connection

BACKGROUND AND PREPARATION

After discovering how improperly disposed HHW can adversely affect human health and the environment, what can we do with HHW? Fortunately, nearly every county has a location that collects hazardous waste. Learn where and when your county collects HHW and find out what types of products are acceptable for collection. For certain products, such as electronics, you can even host a collection drive. Some retailers may already have drop-off boxes for electronic products. Visit www.earth911.com, an excellent online resource to find a local collection location for almost any product.

In addition to proper waste disposal, another strategy to minimize the amount potential pollution from HHW is to reduce the amount of hazardous products you purchase. Always buy the least toxic product when possible, using the hazard label as a guide (caution, warning, danger, poison). Some simple substitutions, such as using baking soda and vinegar as a drain cleaner, can be just as effective as the commercial products.

AROUND YOUR HOME

- Automotive waste (antifreeze, motor oil, gasoline)
- Batteries
- Cleaning products (degreasers, drain openers, furniture polishes etc)
- Electronics
- Mercury-containing products (thermometers, thermostats, fluorescent lights)
- Paints and solvents
- Pesticides
- Pharmaceuticals
- Propane cylinders

ACTIVITY I

1. Have students work in groups of 3-4. Each group should choose one type of HHW listed below.
2. Using the poster paper, markers, magazine cut-outs, and the internet as an additional research tool, each group will create an informative poster about safe disposal of that product.
3. Each poster should include the following information in their posters:
 - Examples of product and its main ingredients.
 - Type(s) of hazard (Reactive, Toxic, Corrosive, Ignitable) and
 - Best disposal method and where to take it in their community.
4. Once completed, groups can present their poster to the class. During presentations, students in the audience should listen to the presenters and fill out the To Dump or Not To Dump Worksheet. Since not all types of HHW may be covered during class time, students can complete the chart at home.

ACTIVITY II

1. Students will use the scientific method to determine the effectiveness of alternative cleaning products. Before beginning this experiment have students read the label on the window cleaner and write down its ingredients, its intended use, hazard category (corrosive, ignitable, reactive, toxic) and signal words (caution, warning, danger, poison).
2. Remind students of the scientific method. Students should be keeping an accurate record throughout the experiment. Students can fill out the “Finding A Solution” worksheet as they proceed with the experiment. The worksheet can also be a guide if students will be working on a lab report.

Purpose or Research Question

The purpose states the goal and reason for the experiment. What are we trying to learn from this experiment? An example for this experiment could be, “To Assess the effectiveness of a natural homemade glass cleaning mixture (vinegar and water) relative to commercial glass cleaners.”

Hypothesis

The hypothesis states your educated guess or prediction of the results. What do you expect will be the answer to your purpose or research question? An example of a hypothesis could be, “The natural homemade glass cleaning mixture does not clean as effectively as the commercial glass cleaner.”

Materials

Lists all the materials used in this experiment, including the brand name of relevant products.

Procedure

The procedure details every step taken to execute the experiment. Illustrations or pictures can be included to supplement the procedure. This experiment will have three variables and a constant. Students will write down the procedures in their worksheet:

Variable One

1. Mix $\frac{1}{4}$ cup vinegar + 1 quart water in glass jar.
2. Apply one tablespoon of the natural glass cleaning mixture to the glass surface.
3. Clean a 12"x12" section of glass with a paper towel.
4. Clean the glass thoroughly for approximately 30 seconds.

Variable Two

1. Mix $\frac{1}{4}$ cup vinegar + $\frac{3}{4}$ cup water in glass jar.
2. Apply one tablespoon of the natural glass cleaning mixture to the glass surface.
3. Clean a 12"x12" section of glass with a paper towel.
4. Clean the glass for approximately 1 minute.

Variable three

1. Apply one tablespoon of commercial class cleaner to the glass surface.
2. Clean a 12"x12" section of glass with a paper towel.
3. Clean the glass for approximately 30 seconds.

Constant

1. Apply one tablespoon of tap water to the glass surface.
2. Clean a 12"x12" section of glass with a paper towel.
3. Clean the glass thoroughly for approximately 30 seconds.

Observations, Data, Results

This step is written as statements to interpret the results of the experiment. Clearly labeled illustrations or pictures can be included in the data. State any variable in the experiment. Did the water-to-vinegar ratio affect the cleaning properties of the natural cleaners? Was there an observable variable that may have affected the outcome of the experiment? An example of the results could be "Variables one, two, and three cleaned the glass more effectively than the control."

Discussion and Conclusion

Summarize the results of the experiment and state the answer to your research question. Did the data support your hypothesis or not at all? Propose why the results may have been different from or the same as your hypothesis. State any possible sources of errors.

Adapted from "Substitute for Safety" by the Tehama County Sanitary Landfill Agency; Educational Portfolio 2011.

ACTIVITY III

1. Have students write a recipe book for alternative cleaning products for their family, friends, or neighbors. The following is a list of recommended substitutes for commercial cleaning products.
2. ALWAYS test each substitute on a small concealed area before use.

All-Purpose Cleaner

Mix together:

1 tsp. liquid soap (castile, peppermint), 1 tsp. borax, Squeeze of lemon, 1 qt. warm water

OR

$\frac{1}{4}$ cup baking soda, $\frac{1}{2}$ cup borax, $\frac{1}{2}$ cup vinegar, 1 gal. water

For surfaces that need scouring, try moist salt or baking soda and a green scouring pad.

Oven Cleaner

Mix together:

$\frac{1}{4}$ cup baking soda, 2 tbsp. salt, hot water, as needed to make a paste.

Let paste sit for 5 minutes. Caution: Keep off wires/heating elements.

Window Cleaner

Mix together:

$\frac{1}{4}$ cup vinegar, 1 qt. warm water

OR

2 tbsp. borax, 3 cups water

Rub dry with newspaper to avoid streaking.

Disinfectant

Mix together:

$\frac{1}{4}$ cup borax

$\frac{1}{2}$ gal. hot water

OR 2 tbsp. liquid soap (castile, peppermint), 2 tsp. borax, 1 qt. warm water

Spray on oven and wait 20 minutes, then clean. For tough stains, scrub with very fine steel wool and baking soda.

Drain Cleaner

Pour together: ½ cup borax in drain followed by 2 cups boiling water

OR

¼ cup baking soda down the drain, followed by ½ cup vinegar. Cover drain and let sit for 15 minutes. Follow with 2 quarts boiling water.

Air Fresheners

- Find source of odors and eliminate them;
- Keep house and closets clean and well-ventilated;
- Grow lots of house plants;
- To freshen up a room, add two drops of vanilla extract or peppermint oil to a cotton ball and set inside a cup or bowl OR simmer: Cinnamon sticks, Orange peel, cloves, Water;

To absorb odors, place 2 to 4 tbsp. baking soda or vinegar in small bowls in refrigerator and around the house and pour ½ cup baking soda in the bottom of trash cans.

Carpet and Upholstery Spot Cleaning Foam

Mix together: ¼ cups vegetable oil-based liquid soap

3 tbsp. (or more) water

Whip ingredients in bowl with egg beater. Rub foam into problem areas of the rug. Rinse well with water.

Furniture Polish (Wood Surfaces)

Rub toothpaste on wood furniture to remove water marks.

Polish wood with 2 tsp. lemon oil and 1 pint mineral oil in spray bottle. Spray, rub in and wipe clean.

- Mix two parts olive oil to one part lemon juice. After rubbing the mixture in, let stand for several hours and then polish with a soft, dry cloth.

- Melt 1 tbsp. carnauba wax into two pints mineral oil. Use sparingly and rub hard.

Copper Cleaner

Rub lightly with fine table salt dampened with vinegar and lemon juice.

OR

Use a plumber's "snake" and boiling water.

Toilet Bowls

Pour: ¼ cups baking soda into bowl and drizzle with vinegar. Let sit for ½ hour. Scrub and flush. Add borax for stains.

Mildew Remover

Dissolve together: ½ c, vinegar

½ cups borax in warm water.

Apply with sponge or spray bottle.

Ceramic Tiles

Mix together: ¼ cups vinegar, 1 gal. warm water

Basin, Tub, and Tile

Mix together: ½ cups baking soda, 2-3 tbsp. liquid soap (castile, peppermint)

Garbage Disposal: Grind ice and lemon or orange juice in the disposal.

Rug and Upholstery Cleaner

Sprinkle corn meal, baking soda or cornstarch on dry rugs and vacuum. Use club soda or soap-based rug shampoo.

Floors

Mix together:

½ cups white vinegar

1 gal warm water

Silver Polish

Heat 1 qt. warm water, 1 tsp. baking soda, 1 tsp. salt, a small piece of aluminum foil. Drop silver in hot water. Remove silver object and wipe with cloth to remove tarnish.

OR

Rub toothpaste on silver, let it dry and rinse off.

Chrome

Rubbing alcohol, with hot water. Also try white flour in a damp rag.

Brass

Equal parts salt and flour, with a little vinegar.

Adapted from “Substitute for Safety” by the Tehama County Sanitary Landfill Agency; Educational Portfolio 2011.

DISCLAIMER: All alternative cleaning products should be used at your own risk. PSI does not assume any responsibility for their results. Do not mix household cleaning products together. Search online for additional alternative cleaners using key words such as “green cleaning” or “chemical-free cleaning.”

DISCUSSION

1. In addition to making changes in the types of products with hazardous substances your family purchases, what else can you do to reduce the amount of hazardous material that are released into the environment?
2. How is proper hazardous waste handling an example of good stewardship?
3. What can manufacturers do to help you reduce the amount of hazardous substances in the environment? What about retailers?
4. What other anthropogenic factors might be reduced if consumers, manufacturers and retailers make changes to a product’s lifecycle? (Remember to consider all man-made products: food, clothing, electronics, etc)

SOURCES AND BACKGROUND READING FOR TEACHERS

Activities for Teaching about Hazardous Materials in the Home by RW Howe
<www.eric.ed.gov/ERICWebPortal/recordDetail?accno=ED326381> 1989.

Local Hazardous Waste Management in King County Curriculum Guides
<<http://www.lhwmp.org/home/educators/curriculumguides.aspx>>

North Carolina Cooperative Extension Service: Hazardous Household Products
<http://www.bae.ncsu.edu/programs/extension/publicat/wqwm/he368_1.html>

“Sure, your home is clean... but is it safe for your family?” October 2006.
<<http://www.epa.gov/osw/conserves/materials/pubs/hhw-safe.htm>>

SOURCES AND BACKGROUND READING FOR STUDENTS

Dr. Seuss. *The Lorax*. (1971)

Alison Inches and Viviana Garofoli. *I Can Save the Earth!* (2008)

TAKING ACTION- BEYOND THE CLASSROOM

Making “real-world” connections is a key element to understanding the topics covered in this curriculum. The following are just a few ideas for teachers, school administrators and other adult mentors who wish to empower students to make a positive contribution in their school and communities.

START A CLUB

If your school does not have an environmental club, help your students start one! A club helps students develop valuable leadership, communication, and team-building skills. While the club should be driven by students, teachers and adults have a significant role to play as a club advisor and an educator. Guide interested students through the steps of starting a new club:

1. Determine the purpose and goals of the club.
2. Recruit students who are interested in getting involved and understand the club’s goals.
3. Contact your school administration for support or permission to start a club.
4. Establish when and where to have regular meetings and have an agenda for each meeting.
5. Assign specific roles and tasks for students who want to take different levels of engagement. For example, the “president” and “volunteer” might have different levels of engagement in the club.
6. Set timeframes for specific goals or events.
7. Most important: Announce the club to the student body! Have events that promote your club and encourage more students to participate in your cause. Highly visible projects can help build support.

CREATE A SERVICE-LEARNING PROJECT

A service learning projects connects lessons learned in the classroom with community service and hands-on experience. In a service-learning project, students develop their sense of civic engagement and responsibility, as well as enhance their critical-thinking skills and self-esteem. Service-learning projects are similar to community service projects. However, service-learning projects have an integrated educational component that meets specific learning goals.

For Example:

Community service project: students collect litter from a local urban park.

Service learning project: students collect litter from a local urban park and analyze their findings. They learn the different types of litter, sources of litter and potential hazards from the litter they collected. Students then share their findings with their community.

For more information and inspiration for service-learning projects, visit www.servicelearning.org. To download a free k-12 service-learning toolkit, visit:
http://www.servicelearning.org/filemanager/download/8542_K-12_SL_Toolkit_UPDATED.pdf

Start a Green Kids Club in Your School!

(in six easy steps!)

You learned how hazardous waste can affect your community, health and environment, and now you want to do something about it. Great! One way to take action is by starting a club in your school. Join the Green Kids Club in making a difference...one school at a time!!

1. No One is an Island

You can't run a club on your own! Find a group of friends or classmates who are interested in what you're doing. You will also need to find a teacher or an adult who could be your advisor. Your advisor is an important member of your club and could help your club connect with other helpful adults or outside organizations. Let's not forget that your advisor can drive....

2. Mission: Possible

Determine the mission of your club. Even though the Green Kids Club is an environmental student club, each individual club can have its own mission or purpose. Will your club focus on household hazardous waste in your community, or will it address recycling in your school?

3. Tell it like it Is

Have you rallied the troops? Good. It's now time to face the school administration. Different schools might have different regulations for new clubs. Find out what you need to do to get your school's permission to start a new club. Having a mission, an advisor, and a group of students to support your cause already puts your club at an advantage.

4. Meet and Greet

Now that you have your school's permission, it's time to get the ball rolling. Decide with your club members when, where, and how often your club will meet. It's important to have regular meetings to discuss how your club will achieve its goals. Meetings are also great opportunities for others to join your club.

5. Follow the Leaders

Talk to your club members to see if they are interested in assigning specific roles. For example, somebody who likes to write might be in charge of taking notes during the meeting. Somebody who likes to draw might be in charge of making posters. Everybody has a unique talent or interest that they can contribute to the club.

6. Make a Plan and Spread the Word

Now is the time to put your plans to action. Is your club doing an electronics collection event for your community or will you raise awareness about hazardous waste in your school? Establish a timeframe or schedule to help members know what needs to get done to reach your mission. Share what your club is working on with students, friends, and families. You might be surprised who would be willing to help out! The more support your club gets, the more successful it will be.

Green Kids Club Go!

Tackling Hazardous Waste in Your Community

How can you teach your community about household hazardous waste? There are many ways you can approach this challenge. One way is by creating a public outreach and education project in your community. The project might seem daunting and you might start off with a lot of questions. For example:

- How much does your community *already* know about household hazardous waste?
- If your town has a hazardous waste collection point, how much material does it receive on a regular basis?
- How do local businesses participate in minimizing the amount of discarded hazardous substances?

Gathering data is the first step to finding answers. Have an adult help you take a survey around your neighborhood. The answers your neighbors give will help you and the Green Kids Club gauge how much the community understands about household hazardous waste. This information can be very helpful in answering some key questions and will be useful in developing strategies for community outreach. You might even be surprised with the answers you may find!

Some Tips

- Have an adult accompany you when you take your survey
- Start each survey with: “Hello, I’m a student from [name of your school]. Do you have a minute to fill out a short survey for a school project?”
- Remember to say “thank you” and “good bye”
- Don’t forget to smile!



APPENDIX

The following contain worksheets, images, and other materials relevant to this curriculum.

Unit 1: Know Your Waste Worksheet.....	28
Unit 1: Hazardous Waste In Your Home Parent Letter.....	29
Unit 1: Hazardous Waste In Your Home Survey.....	30
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Unit 5: To Dump or Not to Dump Worksheet.....	35
Unit 5: Finding The Solution Worksheet.....	36

Hazardous Waste In Your Home

Dear Parent or Guardian,

Your child has been learning about products that may contain properties that are dangerous or potentially harmful to human health or the environment. These products, such as kitchen or bathroom cleaners, electronics, pharmaceuticals, and motor oil, can be found anywhere in your home. The assigned home survey will help students find these types of products and identify their specific hazard level and hazard category. Please supervise your child as she or he follows the activity. All of the products you and your child may find should be used and disposed with great care.

The following are some tips you can do right now to support your child and provide educational opportunities at home:

- Use a sticker to label the products you and your child find. This will allow your household to learn which everyday products should be treated with care.
- NEVER pour hazardous products down the toilet, sink, storm drains or onto the ground.
- Reduce the amount of hazardous products you buy. Always look for the least toxic product, avoiding those with the labels “Caution”, “Warning”, “Danger” or “Poison”. Purchase the smallest container when necessary to avoid having any leftover.
- Most municipalities hold hazardous waste collection events. Contact your township to learn about your waste disposal options for household hazardous waste and other questionable items.

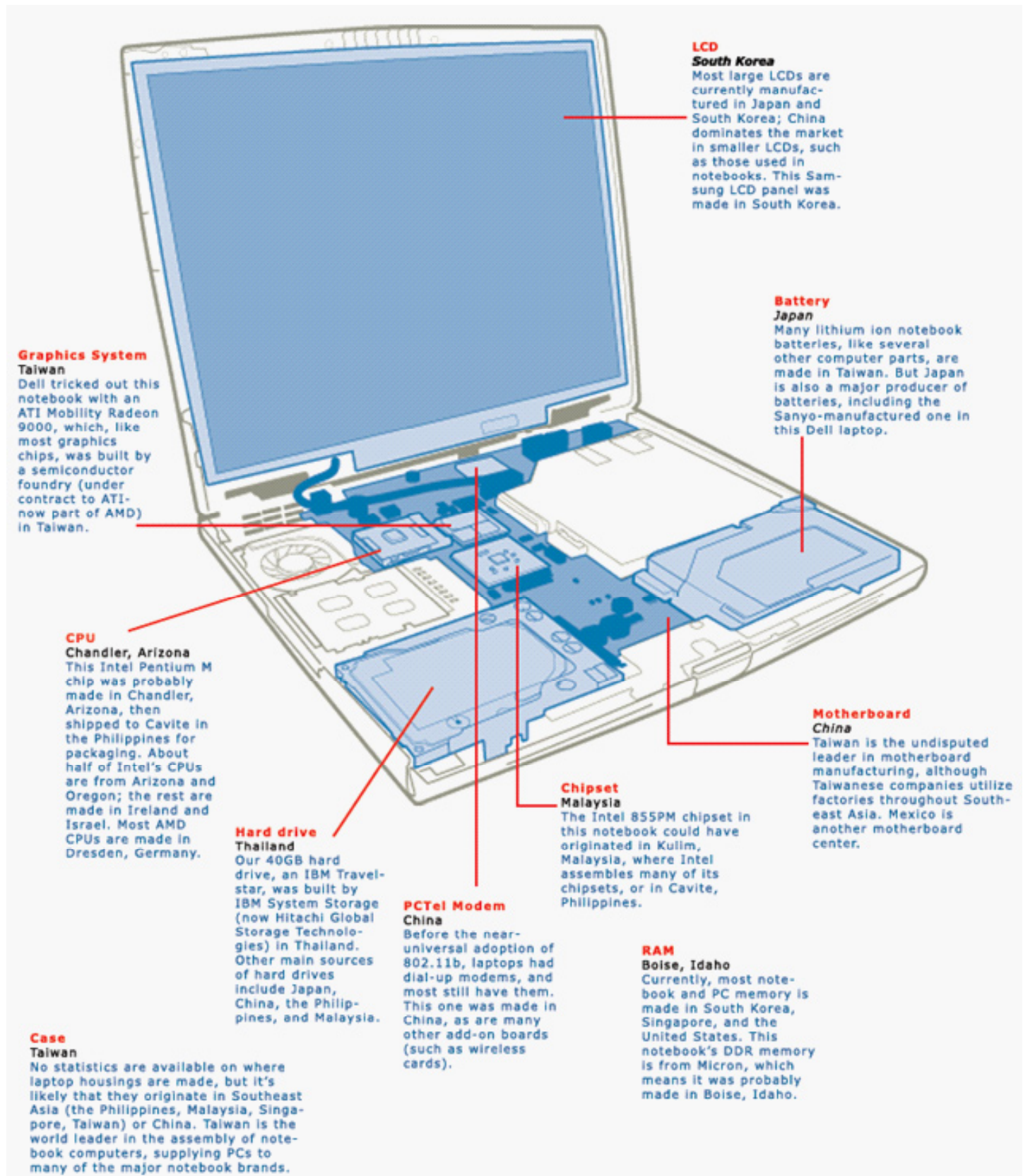
As the unit progresses, your child will learn how certain products can affect the environment and what she or he can do to minimize the amount of hazardous substances that may end up in your community. Ask your child what you can do to get involved!

COMMONLY USED HAZARDOUS HOUSEHOLD PRODUCTS

- Automotive waste (antifreeze, motor oil, gasoline)
- Batteries
- Cleaning products (degreasers, drain openers, furniture polishes etc)
- Electronics
- Mercury-containing products (thermometers, thermostats, fluorescent lights)
- Paints and solvents
- Pesticides
- Pharmaceuticals
- Petroleum cylinders

Name:
Date:

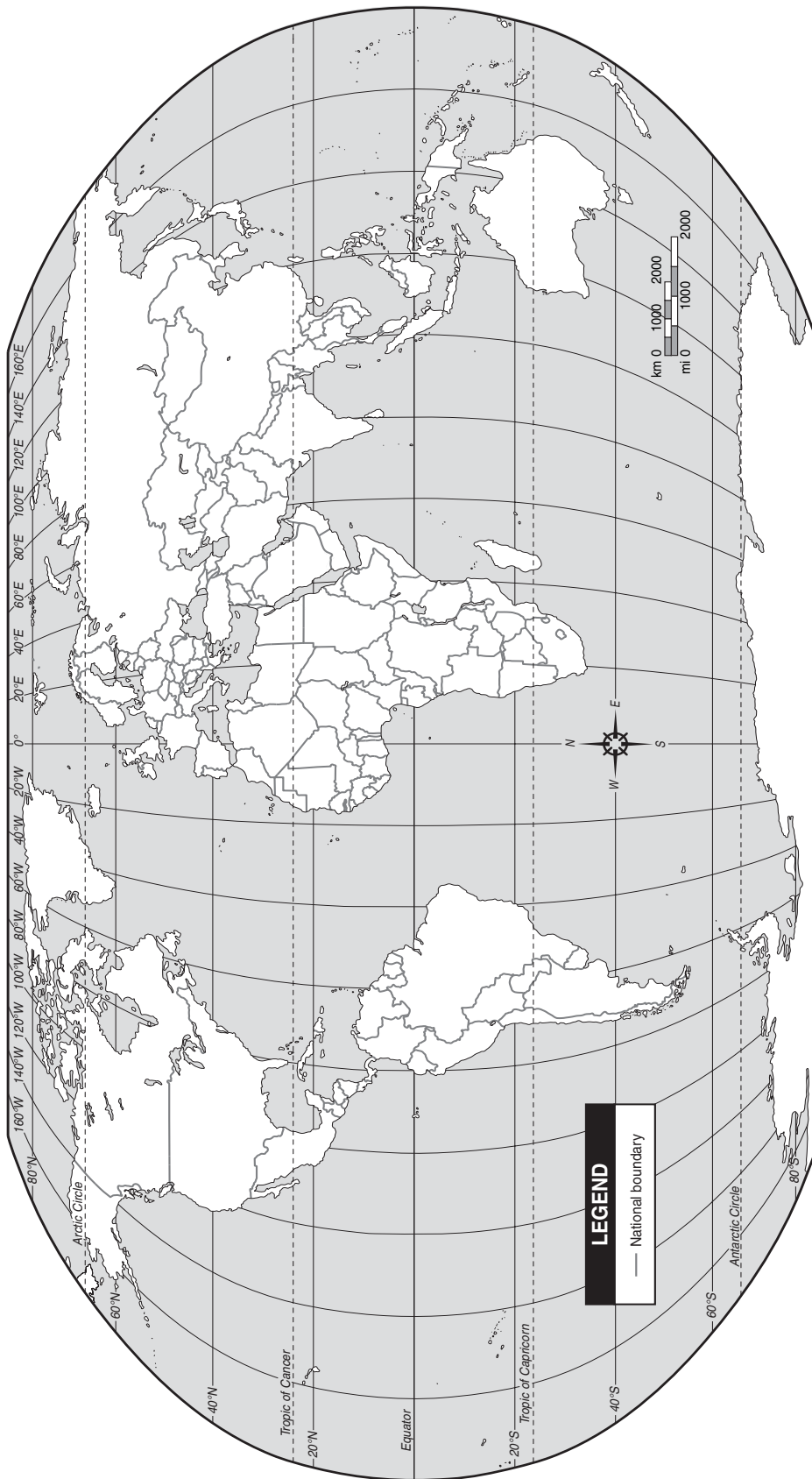
What's Inside Your Laptop?



source: http://www.pcmag.com/image_popup/0,1740,iid=167271,00.asp

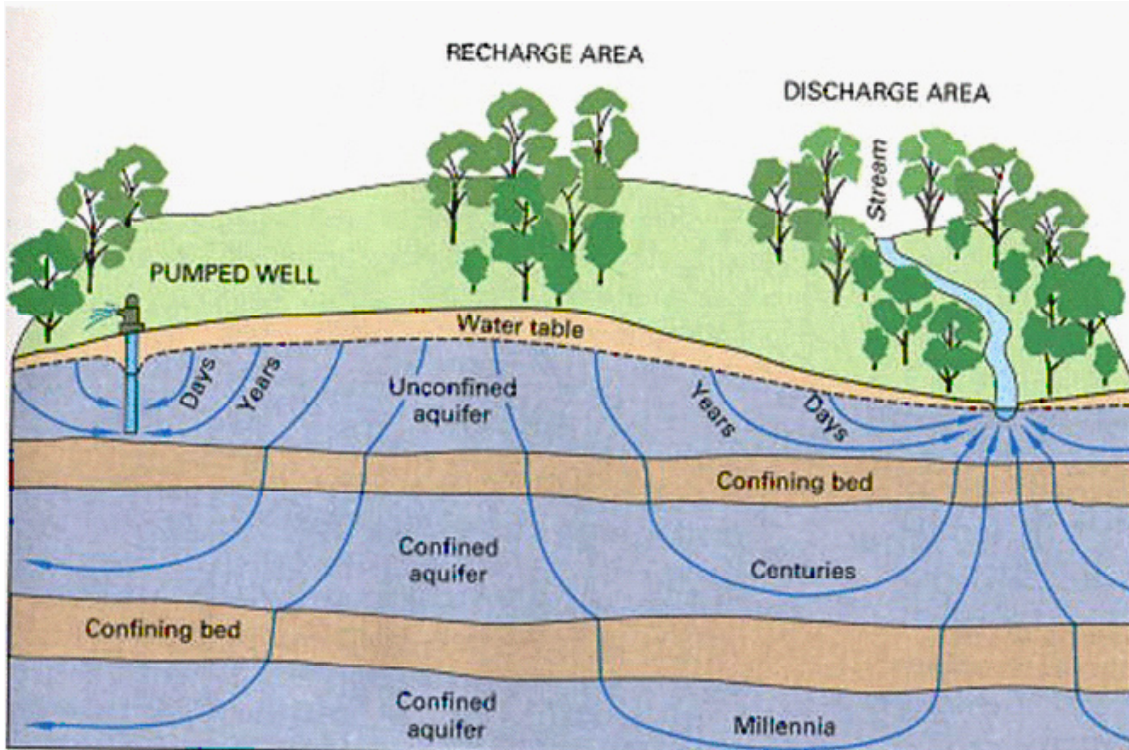
Name: _____
Date: _____

World: Political

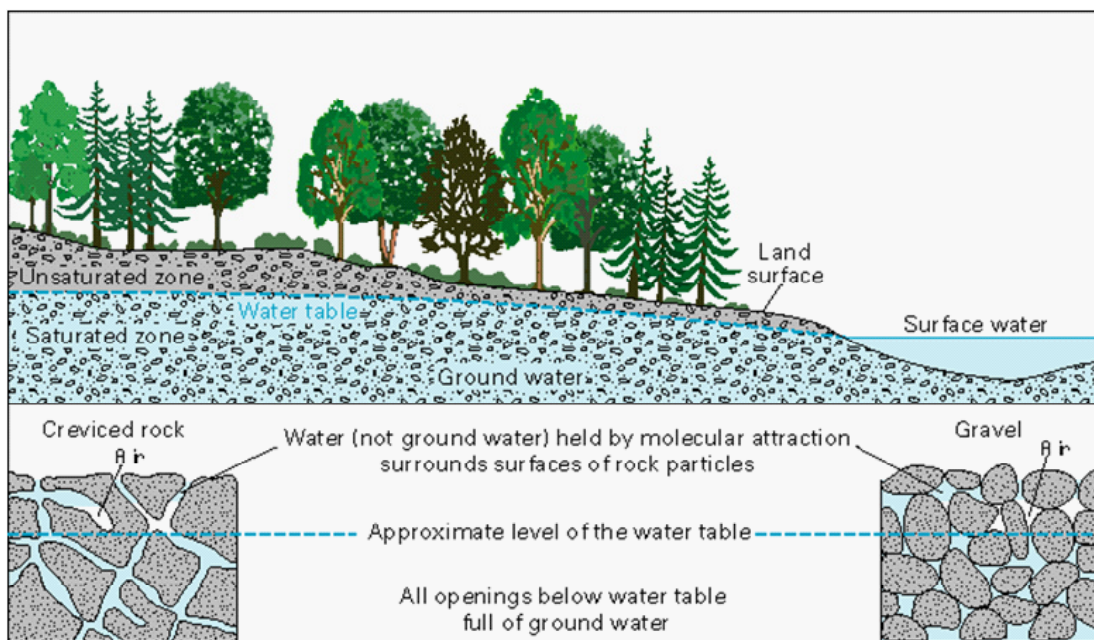


Water Underground

Name:
Date:



source: http://en.wikipedia.org/wiki/File:Groundwater_flow.png



source: ga.water.usgs.gov/edu/earthgwaquifer.html

Name:

Date:

To Dump or Not to Dump?

Taking household hazardous waste to a community collection site is the safest and most environmentally-friendly way to dispose of harmful chemicals. Use your town's website to research your options for each of the following different types of HHW. Other useful websites to help you search for safe disposal options are:

www.earth911.com and www.call2recycle.org

	Potential Hazard	Examples	Where Can I Take it?
Batteries	<i>Can contain toxic materials like cadmium</i>	Car batteries, single-use batteries (AAA, AA, button batteries), rechargeable	<i>According to Call2Recycle.org, the closest collection site is the electronics store located on 123 Green St.</i>
Household Cleaning Products		Ammonia, furniture polish, Pool cleaners	
Electronics		Computers, MP3 players, cell phones, TV's	
Liquid Car Wastes		Gasoline, antifreeze, motor oil	
Mercury-Containing Wastes		Thermostats, thermometers, CFLs and other fluorescent light bulbs	
Paints or Solvents		Paint, Paint thinners	
Pesticides		Rat Poison, Insect control	
Pharmaceuticals		Over-the counter and prescription medicines	
Propane Cylinders		Gas grills	

Finding A Solution

Name:

Date:

There are a number of safe and easy-to-make alternatives to many common hazardous household products. You will be using the scientific method to test which cleaner is best at getting glass squeaky clean: the natural homemade mixture or the commercial glass cleaner? The scientific method is a logical process used to answer questions through observation and experimentation. Here's your chance to be a scientist!

Purpose / Research Question

The purpose states the goal for the experiment. What are we trying to learn from this experiment?

Hypothesis

The hypothesis states your educated guess or prediction. What do you expect will be the answer to your research question?

Materials

List all the materials used in this experiment, including the brand name of relevant products.

Procedure

The procedure details every step taken to execute the experiment. Be specific in your writing so that others can repeat your experiment. Imagine you are writing a recipe for somebody else to follow. Illustrations or pictures can be included. This experiment will have three *variables* and one *constant*:

Variable 1: 	Variable 2:
Variable 3: 	Constant:

Observations, Data, Results

This step interprets the results of the experiment. Clearly labeled pictures can be included in the data. Did the water-to-vinegar ratio affect the cleaning properties of the natural cleaners (in other words did more vinegar lead to cleaner glass)? Was there an observable external variable that may have affected the outcome of the experiment?

Discussion and Conclusion

Summarize the results of the experiment and state the answer to your research question. Did the data support your hypothesis or not at all? Propose why the results may have been different from or the same as your hypothesis. State any possible sources of errors.

Acknowledgements

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- LOOP SCOOPS, WGBH, Teachers' Domain
- US Environmental Protection Agency
- US Geological Survey
- Tehama County Sanitary Landfill Agency
-

Additional support for this project is provided by the USDA.

About the Product Stewardship Institute

The Product Stewardship Institute (PSI) is a national non-profit membership-based organization located in Boston, Massachusetts. PSI works with state and local government agencies to partner with manufacturers, retailers, environmental groups, federal agencies, and other key stakeholders to reduce the health and environmental impacts of consumer products. PSI takes a unique product stewardship approach to solving waste management problems by encouraging product design changes and mediating stakeholder dialogues.

In accordance with Federal law and U.S. Department of Agriculture policy, the Product Stewardship Institute, Inc. is prohibited from discriminating on the basis of race, color, national origin, age, disability, religion, sex, and familial status. (Not all prohibited bases apply to all programs).

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