

Substitute for Safety!

Grade: 4

State Standards:

Grade: 4; Science 6: a-f, Investigation and Experimentation, Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other three strands, students should develop their own questions and perform investigations.

Grade: 4; Math: 1.0 Students organize, represent, and interpret numerical and categorical data and clearly communicate their findings.

Preparation Time: 25 minutes

Activity Time: 2 hours

Key Words: household hazardous waste

OBJECTIVE

Students will be able to accurately describe household hazardous and nonhazardous cleaning chemicals. Students will have an understanding of household hazardous waste disposal in landfills.

MATERIALS

Recipe book supplies: Copy of handouts, tape, scissors, colored pencils or markers to make recipe books, ten pieces of paper per student, and newspapers or magazines for cutouts. Have the students bring in a jar from home. Safe substitute supplies: measuring cups, measuring spoons, vinegar, baking soda, water, towels, and coffee filters.

BACKGROUND

According to national estimates, each home contains from three to eight gallons of hazardous materials in kitchens, bathrooms, garages, and basements. Throwing these items in the garbage can threaten the safety of people, animals, and the environment. The most effective way to reduce the quantity of hazardous waste pollution is to reduce the quantity of household hazardous wastes we produce. The highest risk cleaning products are associated with cancer, reproductive disorders, poisonous ingredients, skin and eye irritation, or respiratory ailments. These products, when used, can also pollute local water resources, harming fish, plants and wildlife. The U.S. Environmental Protection Agency (EPA) ranks indoor air quality among the top five environmental risks and links it, in part, to cleaning product exposure. The average janitor uses an estimated 28 gallons of chemicals per year. This lesson informs students of the common nonhazardous substitutes available to use in place of more expensive and environmentally hazardous chemicals.

- Household hazardous waste accounts for only 2% of residential waste, but causes the majority of pollution problems associated with landfills.
- Garbage collectors and landfill workers can be injured by exploding aerosol cans, splashing chemicals, or poisonous fumes created by mixed chemicals. Chemical reactions can also cause fires in garbage collection trucks.
- Some household hazardous waste can be recycled or used as an energy saving fuel.

- Acids from toilet bowl cleaners may cause burns to the skin and possibly blindness.
- Traditional glass cleaners contain a form of glycol ethers known to be a skin absorbing poison.
- Some household cleaning products can create a respiratory hazard when used in poorly ventilated areas.
- Some cleaning agents contain chemical substances that can harm the earth's protective ozone layer or toxic chemicals that are persistent in the environment and do not degrade easily.

PROCEDURE

Review with students the meaning of the term “household hazardous waste” and have them give examples, such as pesticides, motor oil, household cleansers, and paint, etc. Hazardous wastes can be either solid, liquid, or gas, and improperly disposing of them can harm the air, water, or soil.

Pass out the handout, “Safe Substitutes” to each student. Many hazardous products we purchase in stores are not always more effective than nonhazardous products and may even harm us or the environment.

Compare these recipes to store bought examples of these products and have students read the label and discuss how the store bought version may contain chemicals that are more toxic and must be used as directed by the label. Note that these product labels may contain the label warning words: Caution, Warning, or Danger.

Instruct students to accurately measure out ingredients and properly label their jars according to the glass cleaner recipe. Have students write and decorate a “recipe book” for the safe substitutes to household hazardous products and share with their families and friends. Let students take turns cleaning with a non-toxic glass cleaner that you have made as a class or for the class.

Homework: Conduct a test of certain cleaning products to their suggested “safe substitute” alternative to compare their effectiveness. Have students record and evaluate their results using the Scientific Process.

Guideline for Scientific Process:

1. **Problem, Purpose, or Research Question:** The problem or research question is the single most important part of the scientific method. Every part of your project is done to answer this question. The research question is sometimes formed as a statement and is called the "Problem" or "Problem Statement." What is your goal or what idea are you trying to test? What is the scientific question that you are trying to answer? Answer: To assess the efficacy of natural glass cleaning products (vinegar and water) relative to common commercial glass cleaners (Windex) for home use.

2. **Hypothesis:** The hypothesis is an "educated guess," formed as a statement that you propose to be the answer to the research question. Explain how you think your project can demonstrate your purpose. You should try to state the results you are predicting in measurable terms. Not always will your conclusion match your hypothesis. Answer: Natural glass cleaning products (vinegar and water) will have the same cleaning characteristics as commercial glass cleaners (Windex).
3. **Materials:** List all supplies and equipment used in conducting your research or experiment. Your list of materials should include all of the ingredients of the procedure. Water, paper towels, glass to be cleaned, vinegar, and store bought Windex
4. **Procedure:** The procedure is a somewhat detailed, step - by - step description of how you conducted your experiment. Be clear about the variables vs. your controls. Be specific about how you measure results to prove or disprove your hypothesis. Your procedure should be like a recipe whereby another person should easily be able to follow it. Photos depicting the steps are good to have on your display board.

Variable One

Step One: Mix ¼ c. vinegar + 1 quart *cold* water in glass jar

Step Two: Using the natural glass cleaning mixture, apply one tablespoon to the glass surface

Step Three: Using a paper towel clean a 12"x12" section of glass

Step Four: Clean the glass for approximately 1 minute

Variable Two

Step One: Mix ¼ c. vinegar + 1 quart *warm* water in glass jar

Step Two: Using the natural glass cleaning mixture, apply one tablespoon to the glass surface

Step Three: Using a paper towel clean a 12"x12" section of glass

Step Four: Clean the glass for approximately 1 minute.

Variable three

Step One: Using Windex apply one tablespoon to the glass surface

Step Two: Using paper towel clean a 12"x12" section of glass

Step Three: Clean the glass for approximately 1 minute

Constant

Step One: Using tap water apply one tablespoon to the glass surface

Step Two: Using a paper towel clean a 12"x12" section of glass

Step Three: Clean the glass for approximately 1 minute

5. **Observations, Data, Results:** The results are usually in the form of a statement that explains or interprets the data. Results can be in the form of raw data, graphs, general summarization of what your data is telling you. Photos can also be used here. Answer Examples: "Variables One and Two were both effective in cleaning the glass and showed little difference between the two. Variables One, Two, and Three showed equal measures of cleanliness. Variables; One, Two, and Three cleaned the glass more effectively than the Control. Temperature is the independent variable, the consequent cleanliness is not dependent on the variable temperature."

6. **Conclusion:** The conclusion is a summary of the research and the results of the experiment. This is where you answer your problem or research question. You make a statement of whether your data supported your hypothesis or not. You may have data that supported part of your hypothesis and not another part. You may also have data that did not support your hypothesis at all. In this case, you may explain why the results were different. The efficacy of natural glass cleaning products (vinegar and water) relative to common commercial glass cleaners (Windex) for home use is the same and is supported by my testing procedures used.

Teacher Note: Students should graph results on the blackboard for comparison of variables and procedure techniques.

ASSESSMENT

Households often discard many common items such as cleaners, paint, oils, and pesticides that contain hazardous components. Leftover portions of these products are called household hazardous waste (HHW). These products, if mishandled can be dangerous. Special precautions need to be in place when a landfill accepts HHW for disposal.

Safe Substitutes

All Purpose Cleaner

Mix together:

1 tsp. liquid soap (castile, peppermint)

1 tsp. borax

Squeeze of lemon

1 qt. warm water

OR

¼ c. baking soda

½ c. borax

½ c. vinegar

1 gal. water

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

Window Cleaner

Mix together:

1/4c. vinegar

1 qt. warm water

OR

2 tbsp. borax

3 c. water

Rub dry with newspaper to avoid streaking.

Disinfectant

Mix together:

¼ c. borax

½ gal. hot water

Kitchen/Bathroom Cleaners

Oven Cleaner

Mix together: ¼ c. 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.

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 c. borax in drain followed by
2 c. boiling water

OR

¼ c baking soda down the drain, followed by
½ c. vinegar

Cover drain and let sit for 15 minutes. Follow with 2 qts. boiling water.

OR

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

Toilet Bowls

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

Air Fresheners

Commercial fresheners work by masking smells, coating nasal passages and deadening nerves to diminish sense of smell. Instead:

- 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.

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.

Ceramic Tiles

Mix together: ¼ c. vinegar

1 gal. warm water

Basin, Tub, and Tile

Mix together: ½ c. baking soda

2-3 tbsp. liquid soap (castile, peppermint)

Garbage Disposal Freshener

Grind ice and lemon or orange juice in the disposal.

Mildew Remover

Dissolve together: ½ c. vinegar

½ c. borax in warm water.

Apply with sponge or spray bottle.

Rugs/Floors

Rug and Upholstery Cleaner

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

Carpet and Upholstery Spot Cleaning Foam

Mix together: ¼ c. 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.

Floors

Mix together: ½ c. white vinegar

1 gal warm water

Polishing with skim milk after floor is dry will make the floor glow!

Furniture

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.

Metal Polishes

Silver Polish

Soak: 1 qt. warm water

1 tsp. baking soda

1 tsp. salt

small piece of aluminum foil

OR

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

Copper Cleaner

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

Chrome

Rubbing alcohol, or a small amount of ammonia with hot water. Also try white flour in a damp rag.

Brass

Equal parts salt and flour, with a little vinegar.

Dear Parent:

Your child has recently been learning about products in the home that are potentially dangerous to people, wildlife and the environment if used or disposed of improperly. The following worksheet has some tips for dealing with chemicals in your home and will help you and your child identify products that should be used and disposed with care.

Safe Use and Disposal Tips

- Always buy the least toxic product necessary to do the job. Avoid products with the words CAUTION, WARNING, DANGER, or FLAMMABLE on the label.
- Buy the smallest container necessary to accomplish your task to avoid having left-overs.
- Follow the instructions carefully and try to use up the product as intended or give left over's to someone else who can use it.
- Never pour hazardous products into the sink, storm drains, or onto the ground.
- Don't mix hazardous chemicals or store them in unlabeled containers.
- Do take hazardous chemicals and cleaners to a household hazardous waste collection center or special collection event.
- Do take used motor oil to a service station or authorized dealers for recycling.
- Contact your local solid waste official, the Tehama County / Red Bluff Sanitary Landfill Agency to find out how to properly dispose of Hazardous Waste and any other questionable materials.