

Super-Eco, the Environmentally Friendly Store

Supermarket shelves are crammed with products that make people's lives easier. Countertop sprays, toilet-bowl disinfectants, window-cleaning solvents, and countless other household products save precious time and energy by doing their jobs quickly and with a minimum of effort. However, using these products without strictly following their safety guidelines can be hazardous. The waste from these products also may release hazardous chemicals into the environment.

You have just been hired by Super-Eco, a startup company that wants to build supermarket chain stores across the country. The supermarket will specialize in selling environmentally safe consumer products. Your expertise in chemical research is required to develop products that could be used to replace the more hazardous products on the shelves of most supermarkets. If you and the other scientists on the team can develop enough alternative products, the company will continue forward with its plans.

OBJECTIVES

Survey several commercial products and record information about their hazardous properties.

Experiment to find the effectiveness of alternative, less hazardous products.

Predict whether Super-Eco will be a successful startup business.

MATERIALS

- cleaning buckets
- cleaning gloves, rubber
- cleaning products: toilet-bowl cleaner, laundry detergent, bleach, laundry stain remover, window cleaner, furniture polish, all-purpose cleaner
- ingredients for alternative cleansers: white vinegar, lemon juice, cut lemon, baking soda, washing soda, ammonia, chalk, borax, cream of tartar, olive oil
- measuring cups
- measuring spoons
- metal or nylon scouring pads
- mixing bowl
- mixing spoon
- newspaper
- paper towels
- photocopied labels from caustic cleaning products such as oven cleaner and drain cleaner
- sponges
- spray bottles



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Procedure**PART I—MAKE OBSERVATIONS**

1. Work with a partner. Examine the label for each of the following products: toilet-bowl cleaner, oven cleaner, laundry detergent, bleach, laundry stain remover, drain cleaner, window cleaner, and furniture polish. **CAUTION: Some chemicals may have leaked or there may be harmful residue on the outside of the containers. Do not inhale any fumes or mix any of the products together.**
2. On a sheet of paper, record the following data about each product:
 - name of product
 - presence of warning labels, such as *Caution*, *Warning*, and/or *Danger*
 - hazardous characteristics: toxic, flammable, explosive, caustic, and/or irritant
 - summary of precautions for using or disposing of the product.
3. Now decide which of the products are most hazardous. The product is hazardous if the product label uses the words *Caution*, *Warning*, or *Danger*. Hazardous substances usually have at least one of the following labels:
 - toxic/poisonous—long-term effects may include cancer or birth defects
 - flammable—can ignite easily
 - explosive—can explode if exposed to shock, heat, or pressure
 - irritant—can cause skin, eye, or other irritations and inflammation on contact
4. With your partner, choose one of the household cleaners you examined. What is the name of the product? What hazards are associated with home use of the product?

5. What is the product typically used for? Choose one of the soiled household items to which your product applies. Identify the cleaning issues associated with the item (e.g., grease, mold, stains, bacteria). Record the cleaning issues below.

6. Your job is to find out if you can clean the item with an alternative cleaning agent that is less hazardous and cleans as well or nearly as well as the standard consumer product that you have chosen. You might use one of the recipes for safer alternative cleaners in the table on the next page or find other recipes in the library. Identify the recipe you plan to use.

Super-Eco, the Environmentally Friendly Store *continued***RECIPES FOR ALTERNATIVE CLEANERS**

Drain opener	Pour 1 cup baking soda into drain, then add $\frac{1}{2}$ cup warm white vinegar. Cover drain for 1 min. Rinse with cold water.	Porcelain cleaner	Rub on Paste of borax and lemon juice. Let sit for 2 hrs. Scrub with nylon scrubber and baking soda paste or cream of tartar paste.
Window cleaner	Mix $\frac{1}{4}$ cup white vinegar in 1 qt. water spray on, and wipe with dry newspaper.	Laundry stain remover	To remove grease: rub chalk into the affected area let sit for 15 min., then wash. To remove soil from whites: soak item in baking soda and water solution.
Oven cleaner	Fill spray bottle with equal parts ammonia and water. Spray on, close door, and let set 15 min. Wipe off.	Wood furniture polish	Mix 2 tbsp. olive oil and 1 tbsp. white vinegar and slowly stir into 1 qt. water. Apply to wood and rub with cloth rag.

PART II—WRITE A HYPOTHESIS

7. How effective do you think the alternative cleaning product will be? Write a hypothesis that states your ideas.

PART III—DESIGN AN EXPERIMENT

8. You must plan and implement an experiment that will test your hypothesis. Variables other than the actual cleaning product might affect the cleaning process. List those variables. Be sure to account for the variables when you write your procedure.

9. Write your experimental procedure on a separate sheet of paper. Remember to consider the following as you write your procedure. What criteria will you use to compare the cleaning power of the cleaner? How will you measure the criteria? How will you record your observations and results? What safety cautions are necessary?

10. Have your teacher approve your plans. Then perform your experiment.

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Analysis

- 1. Examining Data** Compare the standard consumer product with your alternative cleanser. What are the advantages of your alternative product, in terms of avoiding health hazards?

- 2. Analyzing Data** Compare the amount of mechanical force you had to use to obtain cleaning results from each cleaner.

- 3. Analyzing Results** In your opinion, which cleaner worked better? Give reasons for your opinion.

- 4. Analyzing Results** Did your results support your hypothesis? Explain.

Conclusions

- 5. Drawing Conclusions** Review the data on all the products tested by the class. Does it look like Super-Eco could have a product line that will draw consumers to their stores? On a separate sheet of paper, write a summary to Super-Eco that states your opinion. Be sure to include experimental data to support your opinion.

Extension

- 1. Research and Communications** Research ways to reduce your use of hazardous chemical cleaning products in your home. Write your ideas and have them available for a class discussion.