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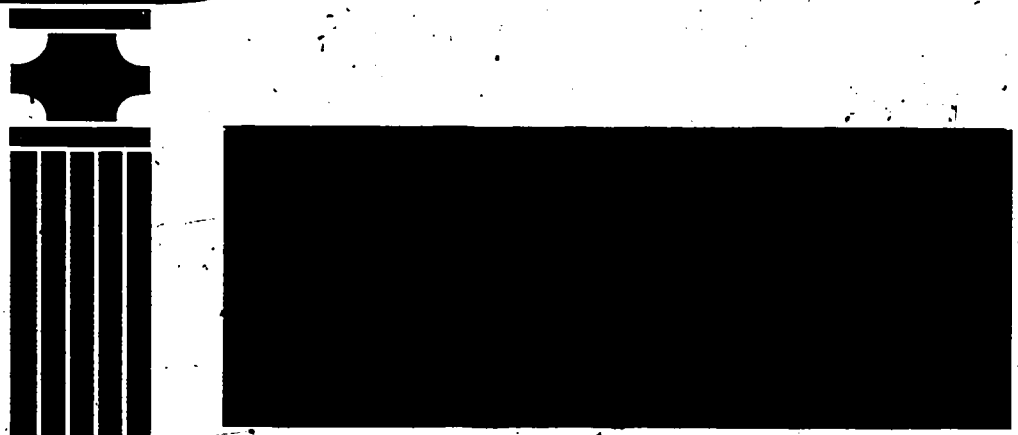
ABSTRACT

This publication has been designed for use by teachers wishing to incorporate consumer education activities into their science program. Each activity is classified by grade level most appropriate for use, area of consumer education involved, specific topic, and consumer education concept involved. Activities are designated as suitable for grades 4-6, 7-9, and 10-12 although some can be adapted for use at different grade levels. Within each grade level grouping, activities are classified as relating to the consumer and the environment, foods, advertising, tools, health, clothing, product testing, or natural resources. For those activities not developed specifically for this publication, the original source of the activity is identified. (PEB)

SCIENCE EDUCATION INFORMATION REPORT



THE ERIC SCIENCE, MATHEMATICS AND ENVIRONMENTAL EDUCATION CLEARINGHOUSE
in cooperation with
Center for Science and Mathematics Education
The Ohio State University

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SELECTED SCIENCE ACTIVITIES

in

CONSUMER DECISION MAKING

ERIC Clearinghouse for Science,
Mathematics and Environmental Education
College of Education
The Ohio State University
1200 Chambers Road
Columbus, Ohio 43212

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SCIENCE EDUCATION INFORMATION REPORTS

Science Education Information Reports are issued to analyze and summarize information related to the teaching and learning of science education. It is hoped that these publications will provide information for personnel involved in development, ideas for teachers, and indications of trends in science education.

Your comments and suggestions for this series are invited.

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INTRODUCTION

This book contains many science education activities related to consumer decision making. Each activity has been classified by the editors according to the most appropriate grade level, the area of consumer education involved, the specific topic, and the consumer education concept considered. It should be noted that the activities have been classified for grades 4-12, but some potentially can be adapted for other grades.

It is hoped that the teachers who use these materials will recognize that the classification statements and statements of purpose serve only as guides in selecting appropriate activities and should not be viewed as fixed structures.

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GRADE LEVEL 4-6

PURPOSE: To provide information on the effect of chemicals dissolved in water on the freezing and boiling points of water.

LEVEL: 4-6
7-9

AREA: The Consumer and the Environment

TOPIC: Chemicals that Affect the Freezing and Boiling Points

CONCEPT: Dissolving materials in water alters the boiling and freezing points of water.

REFERENCE: "Salt on Winter Roads." John A. Miller, Science and Children, January-February, 1974, pp. 23-24.

ACTIVITY: Chemicals are used in a number of ways to affect the freezing and boiling points of water. Many students do not understand how these chemicals work. The following activity suggests how students can predict the effects of various substances and then test to determine if they are right or wrong. Other items can be added if they desire.

Other factors that should be considered for consumer use could also be discussed. Does the material cause corrosion of metal? Will it affect concrete or blacktop? Why isn't methyl alcohol used very frequently as an additive to water in car engines? Why don't all alcohols work the same when added to water? Why don't all salts work the same when added to water?

SALT ON WINTER ROADS

Every winter in the colder climates we may see salt being put on roads and sidewalks. Even the young school children know that table salt, which has the chemical name sodium chloride, causes the ice to melt,* but few people know what actually happens to the temperature when salt is placed on ice. Does the temperature increase, decrease, or remain the same? This question leads to an exciting investigation in which the pupil can attempt to predict results from adding chemicals to ice and then testing for actual results. Furthermore the study provides the scientific background behind the technology of winterizing an automobile, preparing the roads for safer winter driving, or making homemade ice cream.

To determine if the temperature of ice is increased, decreased, or remains the same when a chemical is added, the pupil must first know what happens to the temperature of pure ice when it melts. Therefore, in the first activity, a group of students measured the melting point

*Table salt causes the phenomenon at temperatures equal to or above $0^{\circ}F$.

of ice in a paper cup. Prior to making the measurement the class predicted what the results would be. The children knew that the melting point of ice and therefore the freezing point of water is 32°F or 0°C (Celsius) but several, when asked, thought that the temperature would rise as the ice continued to melt. Their measurements soon proved them wrong. If the ice is stirred no temperature change occurs until all the ice melts. If a good quality mercury thermometer is used the temperature can be expected to be very close to 0°C or 32°F. However, if a cheaper inaccurate thermometer, costing 35 to 50 cents, is used, the thermometer may read several degrees high or low. In either case the temperature will remain constant and even a possibly inaccurate thermometer is sufficient for the remainder of the experiment.

In the second activity each student was given a sheet (Figure 1) with three columns. In column A there was a list of chemicals with the information on water solubility given under each chemical. The list included the following solids:

1. sodium chloride (table salt), soluble in water
2. calcium chloride, soluble in water
3. calcium carbonate (limestone or chalk), insoluble in water
4. calcium phosphate, insoluble in water

and liquids:

5. methyl alcohol (wood alcohol), soluble in water
6. ethylene glycol, soluble in water
7. kerosene or equivalent, insoluble in water
8. mineral oil, insoluble in water

In column B the student predicted what he thought would happen to the temperature of ice on addition of the chemical as compared to the temperature of pure ice. To facilitate the students recording their predictions in column B, the three statements:

1. higher
2. lower
3. about the same

were included for each chemical listed in column A. In each case the students were required to give their prediction prior to doing the measurement. After making the prediction the students were given paper or plastic cups partially filled with ice and a liberal amount of the chemical (1-3 teaspoons per cup). Each student recorded his results in column C which is identical to column B. After the class completed a measurement we discussed the results and the use of the phenomena illustrated.

DATA SHEET

The melting point of pure ice is ____.

	Column A	Column B	Column C
	Chemical to be added to ice.	Your prediction on the effect of adding the chemical on the melting point of ice.	Results of adding chemical on the melting point of ice.
1.	sodium chloride (table salt) soluble in water	higher lower about the same	higher lower about the same

FIGURE 1: Example of data sheet given the student for the second activity.

In the classroom, ice is at a constant temperature of 32°F (0°C) since the room temperature is above the melting point. However, addition of the salt causes a depression in melting point until the ice finds itself at the new melting point. On a cold winter day the phenomenon of decreased melting point, caused by adding salt to ice, is used. The salt is put on the icy sidewalk. This promptly lowers the melting point of the ice temperature below that of the surroundings and therefore the ice begins to melt. This use of salt to cause melting of ice on sidewalks is only effective at 0°F or temperatures above 0°F. The next aspect of this topic will explain the reason for the limitation.

The zero point or temperature on the Fahrenheit scale is also based on the fact that table salt when put on ice causes a melting point decrease. At one point in history the coldest temperature man could obtain in the laboratory was found to be a salt-ice mixture. The temperature obtained for the mixture was used by Fahrenheit to designate the zero point on his temperature scale.

The addition of sodium chloride in the form of rock salt to ice also provides the low temperature needed for making homemade ice cream.

In the portion of the activity involving the use of calcium chloride the students find that the results are identical to those obtained with table salt. It should be noted that in most regions calcium chloride rather than sodium chloride is the salt put in the sand which is used on roads in winter. The solids, calcium carbonate and calcium phosphate, which are water insoluble cause no change in the melting point of ice. This result is true of all water insoluble substances including the two liquids kerosene and mineral oil, which were included in the second activity. The water soluble liquid, methyl alcohol, was the first antifreeze used in automobile radiators because it lowers the freezing point of water. Today, ethylene glycol rather than methyl alcohol is

used and the methyl alcohol serves only as a gas line antifreeze. In actual practice, spirit duplicating fluid can be substituted for methyl alcohol, and commercial antifreeze rather than pure ethylene glycol may be used in the second activity.

At the conclusion of the activity the students formed two hypotheses. Only chemicals soluble in water cause a decrease in the melting point of ice and no chemical tested can cause an increase in the melting point of ice. These hypotheses were in direct contradiction to the first predictions most students made during the activity. Most of the fourth and fifth graders in the class tended in the early stages of the activity to predict that the chemicals would cause increase in the melting point of ice, for after all, they knew that salt causes the ice to melt in the winter.

If desired the experiment could be extended by having the children examine the effect of chemicals on the normal boiling point of water which is 212°F or 100°C at sea level. The student would find that water insoluble substances including both liquids and solids have no effect on the boiling point, whereas water soluble solids cause the boiling point to rise. However, water soluble liquids can cause two types of effects. If a water soluble liquid has a lower boiling point than that of water, the boiling of water will be decreased. Methyl alcohol falls in this category of liquids. The opposite effect is illustrated by using ethylene glycol, which has a boiling point higher than that of water and causes the boiling point of the water to rise.

PURPOSE: Illustrate effects of different products (detergents) on a controlled environment.

LEVEL: 4-6
7-9

AREA: The Consumer and the Environment

TOPIC: Effect of Detergents on Plant Life

CONCEPT: Consumer decision making - environmental factors

REFERENCE: Multidisciplinary Activities for Environmental Learning. June S. Wilson, Genesee Intermediate School District, Flint, Michigan, July, 1973.

ACTIVITY: Materials: pond plants such as duckweed, etc.; three or more equal sized glass jars (one quart or larger) with the same amount of gravel and water in each; samples of several different detergents.

Note: Most detergents (for laundry and dishwasher) are caustic and can cause skin irritations and damage to eyes.

Procedure: Set up identical aquaria. Be sure to place the same amount of water and gravel in each, as well as the same number of plants (no animals). Place each in the same window so all get the same light. Add one teaspoon of each detergent to different jars. Leave one jar untreated as a control.

Examine the aquaria daily and note plant life changes. Keep a diary of observations. After three or four days, add another teaspoon of detergent. Compare with the control and with each other. Continue the process for four or five weeks, making daily observations.

PURPOSE: To have the students establish certain priorities in buying, with the focus on environmental effects.

LEVEL: 4-6
7-9

AREA: The Consumer and the Environment

TOPIC: Effects of Various Products on the Environment

CONCEPT: Consumer decision making - environmental factors

ACTIVITY: After some background on pollution and ecology, discuss the use of different products and their effects on the environment. Such things as returnable bottles as opposed to non-returnables, biodegradable detergents versus non-biodegradables, recyclable packaging and non-recyclable containers, could be discussed.

Have the students identify reasons why the environment should be a factor when making a purchase.

Have them also discuss other factors to look for when purchasing. Have each student establish a list of priorities for purchasing.

PURPOSE: To show the savings that can be made through home gardening. (Could easily be tied in with a botany unit.)

LEVEL: 4-6
7-9
10-12

AREA: Foods

TOPIC: Home Gardening

CONCEPT: Consumer decision making - food marketing

ACTIVITY: Materials: Various containers (cut-off plastic milk jugs would work well); rich soil; vegetable plants or seeds; watering containers.

Procedure: Divide the students into groups. Give each group a container, soil, and a watering container. Then distribute different plants or seeds to each group. Let the students plant the seeds or plants according to instructions.

After plants have reached maturity and vegetables are fully developed, have the students figure cost per vegetable (per weight unit; e.g. kg. or lb.), including soil (if it was purchased), fertilizers added (if any), container (if purchased), and cost of plant or packet of seeds.

Then, using a newspaper ad, or by a trip to a supermarket, figure the cost per vegetable if it were purchased. Compare. Was the savings worth the effort? How would the savings add up over a long period of time for a whole family? Would the plant's vegetables develop sooner if you started with plants rather than with seeds? If the answer is yes, is the time saved (as compared to seeds) worth the extra expense?

Great care will need to be taken to select plants that will grow and produce in the classroom. Probably very few will prosper in this environment. If gardening is done outdoors, winter weather will probably limit gardening to early fall or late spring. In this case quick growing crops like radishes, leaf lettuce, and spinach should be grown so that the students actually do see the produce.

PURPOSE: To compare the cost and nutritional value of the ready-to-eat breakfast foods to that of the more simple types.

LEVEL: 4-6

AREA: Foods

TOPIC: Breakfasts

CONCEPT: Consumer decision making - product comparisons

REFERENCE: Teaching Activities in Environmental Education, Vol. III, 1975. John H. Wheatley and Herbert L. Coon, Columbus, Ohio: ERIC/SMEAC.

ACTIVITY: Develop on the chalkboard a master list of ready-to-eat breakfast foods commonly eaten by class members. Have children bring in empty containers (with prices on them).

Have two or three small groups of students take the list to different large supermarkets and identify the ones available for sale. Add to the list any additional cereals available in the supermarket that students had not identified.

Classify the breakfast foods according to major ingredients. Calculate cost per ounce or gram. Compare costs with a simple standard cereal such as regular rolled oats. Compare nutrition between the two. Is there any reason for one to be more expensive than the other?

Ask the class to explain why there has been a very large growth during the past 30 years in the number and variety of breakfast foods available. Does it cost a large company more to make a large variety of breakfast foods than if it made fewer? Why or why not?

Advertising prizes inside and special offers are a major factor in the buying of "ready-to-eat breakfast foods" and should be discussed here also.

PURPOSE: Introduce students to basic information on function, daily requirements, caloric values, and primary sources of nutrients.

LEVEL: 4-6
7-9

AREA: Foods

TOPIC: Nutrients

CONCEPT: Consumer decision making - nutritional and dietary value

REFERENCE: Teaching Personal Economics in the Home Economics Curriculum. Joint Council on Economic Education, New York, N.Y., 1971.

ACTIVITY: Freedom of choice enables individuals and families to select food that maximizes satisfaction of nutritional requirements and tastes within the limits of their availability and the income that can be used for food purchases.

Divide the class into groups and have each group represent a nutrient (i.e., fat, protein, carbohydrates, vitamins--such as A, C, D, B-complex--and minerals--such as calcium and iron). Have each group gather information on function, daily requirements, caloric values (only applicable to protein, fat, carbohydrates), and primary sources of nutrients. Also determine expensive, moderate, and inexpensive nutrient sources. This information can be presented in skit form, role playing, or other ways in which visual aids are incorporated.

Possible problems and discussion topics:

1. Survey the family level of satisfaction for expensive and inexpensive sources of nutrients. Do families have expensive food tastes? If they do, what budgeting problems does this present? What are some ways in which these problems can be solved? Demonstrate the preparation of recipes showing the way less expensive foods can be incorporated in the diet.

2. What are some factors which influence the cost of foods? (High prices, due to demand exceeding supply; food items having "prestige", being out of season; select cut or style; inflation.)

3. Emphasis should be placed (at both these levels) on each student's own personal nutrition, particularly such things as:

   breakfast -- do they eat it or not
   lunch -- school lunch vs. packing (and what to pack)
   after school snacks

4. Note should be made of nutrient labels which are now found on many food products. Discussion should include the usefulness of the information contained on them.

PURPOSE: Introduce students to a variety of food choices and factors to be considered in decision making.

LEVEL: 4-6
7-9
10-12

AREA: Foods

TOPIC: Variations in One Type of Product

CONCEPT: Consumer decision making - product comparisons

REFERENCE: Teaching Personal Economics in the Home Economics Curriculum. Joint Council on Economic Education, New York, N.Y., 1971.

ACTIVITY: Introduce students to a variety of product choices which they must make with just one food type by preparing four types of orange juice drink to be tasted and compared by students. Use either fresh oranges, frozen concentrate, canned juice, or powdered concentrate.

Keep juices in opaque containers to prevent light oxidation which results in very bad off flavors.

Activities and Discussion:

1. Use a score card to compare flavor, nutritive value, color, cost and preparation time.

2. Locate information (labels) which will enable students to compare the nutritive value of the products under consideration. Discuss nutritive value of fruit juice in the diet.

PURPOSE: To compare costs, nutritional value, and caloric count of different breakfast meals.

LEVEL: 4-6
7-9

AREA: Foods

TOPIC: Breakfasts

CONCEPT: Consumer decision making - nutritional and dietary value.

REFERENCE: "Activities for Consumer Economics." William D. Rader, Instructor, January, 1974, p. 63.

ACTIVITY: Involve the class in making a comparative study of breakfast products—cereals, pastries, eggs, pancakes, quick breakfast items, etc. Have them investigate costs per suggested serving, the caloric count, and the nutritional value. Suggest some pupils make a comparative chart of the number of calories per serving. Others can figure cost, adding an amount for sugar (if needed), fruit, and milk. Another group may compare and chart nutrients in various breakfast meals.

PURPOSE: To learn about food additives and the reasons for their use.

LEVEL: 4-6
7-9
10-12

AREA: Foods

TOPIC: Food Additives

CONCEPT: Consumer decision making - food additives

REFERENCE: Consumer and Homemaking 3-4, Manual for Career Education, James C. Stewart, Comp. Knox County Schools, Knoxville, Tenn.

ACTIVITY: Collect several different food labels for each student or group of students. Have them study the labels to see what additives have been added to the food. Assign each student or group a different additive to research as to reason for use, effectiveness, etc. (The type of product in which the additive was used could be a hint for further research.) A demonstration or class report could be used to show findings.

PURPOSE: To test the advertised "good points" of products and see if the advertising is accurate.

LEVEL: 4-6
7-9

AREA: Advertising

TOPIC: Accuracy in Advertising

CONCEPT: The effects of advertising on consumer decision making.

ACTIVITY: Have the students collect magazine and newspaper ads for things such as clothing, toys, games, etc. After each student has two or three, have them classify the type of item, cost, and most important buying point(s) stressed in the advertisement.

With the information collected, two things may be done:

1. Ask if anyone's family has tried the products. Did they hold up? Were they as good as advertised? etc.

2. Obtain a few products and have the class test them for the points stressed in the advertisement. Did they meet the advertised specifications?

PURPOSE: To learn the following:

1. There are many kinds of mallets and hammers.
2. Hammers are shaped for their jobs.
3. Some materials used in hammers are steel, wood and rubber.
4. Handles are attached in different ways depending on strength needed.

LEVEL: 4-6

AREA: Tools

TOPIC: Hammers

CONCEPT: Consumer decision making - tool selection

REFERENCE: Science: Grade 6. Curriculum Bulletin, 1971-72 Series #6, New York City Board of Education, Brooklyn, N.Y. Bureau of Curriculum Development.

ACTIVITY: Let students examine all kinds of hammers and mallets. Have them use the tools to hammer nails into wood and also to remove nails. Test the magnetized head of the upholsterer's hammer. Compare weights of hammers. Have students suggest possible uses for each tool.

Students should examine the handles on the hammers. They should check to see how the handles are attached to the heads. Observe the materials in the hammer heads and handles and relate the material to the use of this tool.

How to Use the Tool Safely:

1. Use the proper hammer for the job.
2. Use the hammer that is appropriate for your strength.
3. Do not use a hammer with a loose handle.
4. When nailing, hit gently at first, holding the hammer near the head with one hand, and holding the nail with the other until the nail is started. Then, take your hand away from the nail, hold the hammer close to the end, and continue nailing.

PURPOSE: To learn:

1. Scissors and shears are used to cut various materials.
2. Scissors and shears have different uses; the right tool should be used for the job.

LEVEL: 4-6

AREA: Tools

TOPIC: Scissors and Shears

CONCEPT: Consumer decision making - tool selection

REFERENCE: Science: Grade 6. Curriculum Bulletin, 1971-72 Series #6, New York City Board of Education, Brooklyn, N.Y., Bureau of Curriculum Development.

ACTIVITY: Let the students examine a collection of scissors and shears. Ask the students for what purposes they use scissors or shears. Experiment by attempting to cut sheet metal with an old pair of scissors and then with shears. Have the students relate the shape and size of the tools to their uses.

How to Use the Tool Safely:

1. Always offer the handles of scissors when they are given to someone.
2. Do not put scissors in your pockets.
3. Do not use scissors for prying since the blade might snap off.
4. Do not run with scissors in your hands.

PURPOSE: To learn:

1. Wrenches are made in many sizes and shapes. Some are adjustable.

2. A long-handled wrench can tighten better than a short-handled wrench.

LEVEL: 4-6

AREA: Tools

TOPIC: Wrenches

CONCEPT: Consumer decision making - tool selection

REFERENCE: Science: Grade 6. Curriculum Bulletin, 1971-72 Series #6, New York City Board of Education, Brooklyn, N.Y. Bureau of Curriculum Development.

ACTIVITY: Have students tell where they've seen wrenches used. Identify many kinds of wrenches and associate the shape of each wrench to its use. Have the students examine different kinds of wrenches and then use one to tighten a large nut or bolt holding two pieces of wood together.

How to Use the Tool Safely:

1. Use the proper wrench for the job.

2. Use the correct sized wrench, to prevent slipping.

3. Do not tighten a nut on a bolt too hard; you may strip the threads.

PURPOSE: To learn:

1. Knives have different shapes for different jobs.

2. Knives should be stored safely.

LEVEL: 4-6

AREA: Tools

TOPIC: Knives

CONCEPT: Consumer decision making - tool selection

REFERENCE: Science: Grade 6. Curriculum Bulletin, 1971-72 Series #6, New York City Board of Education, Brooklyn, N.Y. Bureau of Curriculum Development.

ACTIVITY: Have students discuss the various uses of knives and other tools with sharp edges. Have them list the jobs done by each tool. Have them discuss the care needed to keep each tool in good condition. (At this point the teacher may want to demonstrate the various sharpening methods.)

How to Use the Tool Safely:

1. When you cut with a knife, watch your fingers and cut away from yourself.

2. Do not keep open knives or other sharp things in your pockets.

3. Do not use knives as screwdrivers or for prying.

PURPOSE: To learn:

1. A saw has tiny teeth with sharp edges to cut wood or metal when the saw is moved.

2. The teeth work best when used in only one direction.

3. Different saws do different jobs. Some cut wood, some metal. Some cut straight lines, others are better for curves.

LEVEL: 4-6

AREA: Tools

TOPIC: Saws

CONCEPT: Consumer decision making - tool selection

REFERENCE: Science: Grade 6. Curriculum Bulletin, 1971-72 Series #6, New York City Board of Education, Brooklyn, N.Y. Bureau of Curriculum Development.

ACTIVITY: Let the students examine many kinds of handsaws: crosscut saws, ripsaws, hacksaws, and coping saws. (Use pictures for younger grades.) Have them examine the teeth and note the sharp cutting edge. They also examine the blades and note the varying lengths and the sizes and shapes of the teeth. The teacher may demonstrate a coping saw cutting a thin piece of wood. The students should notice it cuts best in only one direction. The students may also compare the cutting action of a saw with that of a knife, and consider the advantages of the saw. They may also compare a coping saw to a hacksaw in cutting aluminum or copper tubing.

How to Use the Tool Safely:

1. Hold work firmly when sawing.

2. Keep fingers out of the way.

3. Store saws carefully.

4. Use the proper saw for the job.

PURPOSE: To learn the following:

1. Pliers do many jobs: pick up, grab, twist, cut.
2. When the handles of the pliers open, the jaws open; when the handles close, the jaws close.
3. Pliers hold tighter than fingers alone.
4. Pliers do different jobs, and the right pliers should be used for each job.

LEVEL: 4-6

AREA: Tools

TOPIC: Pliers

CONCEPT: Consumer decision making - tool selection

REFERENCE: Science: Grade 6. Curriculum Bulletin, 1971-72 Series #6, New York City Board of Education, Brooklyn, N.Y. Bureau of Curriculum Development.

ACTIVITY: The students may bring an assortment of pliers from home and tell how they are used. In class, they experiment with the pliers by picking up objects, holding things tight, tightening bolts, and snipping wires. In this way, the students become familiar with all kinds of pliers and relate the shape of the tool to its use.

How to Use the Tool Safely:

1. Be sure the object held in the pliers is secure so it won't slip out and the student's fingers get pinched by the jaws.
2. Be certain any wire which is to be snipped is not connected to any source of electricity.

PURPOSE: Provide a method for making shampoo inexpensively.

LEVEL: 4-6
7-9
10-12

AREA: Health

TOPIC: Making Your Own Shampoo

ACTIVITY: A good shampoo cleans hair and scalp gently. It should remove some oils, but still leave some oil. You can make your own shampoo for less money than the store-bought type. You can also modify the shampoo by changing the proportions of the ingredients. Increase the soap for cleansing, herbs for conditioning, and oil for fragrance.

Materials

1 1/2 - 2 oz. of herbs, such as rosemary, chamomille
12 oz. of water (distilled or soft water works best)
1 oz. of castile soap
One or two drops of a good essential oil (rosemary, lavender, etc.)

Procedure: Place the water and herbs in a pot that is not metal. Boil, then cover and simmer for 4-6 minutes. Turn the heat off and steep the herbs for 15-20 minutes. Pour the material through a fine strainer and save the strained liquid. Add the soap and stir until the soap is blended. Add the fragrance.

Note: An "acid" rinse is recommended after using this shampoo. It will remove the soap particles that often remain in your hair after shampooing. An acid rinse can be made by placing 1 tablespoon of apple cider vinegar in a quart of water (plus some fragrance).

PURPOSE: To demonstrate the relationship between prescription and non-prescription drugs.

LEVEL: 4-6
7-9
10-12

AREA: Health

TOPIC: Drugs

CONCEPT: Consumer protection as related to drugs.

REFERENCE: Consumer and Homemaking 5-6 Manual for Career Education. Knox County Schools, Knoxville, Tennessee.

ACTIVITY: After the development of some background information, the class should discuss the taking of prescription and non-prescription drugs and their effects on the body. Why are prescription drugs classified as such? Non-prescription?

Discuss:

1. Storage of medicines.

2. Disposal of unused or old medicines.

3. Protection of young children.

4. Poison control centers.

Encourage students to inventory their own homes (with parents' aid and approval) for safety, etc. of medicines and for possible disposal of old or unused ones.

PURPOSE: To see what kinds of materials stand up best to different factors.

LEVEL: 4-6

AREA: Clothing

TOPIC: Types of Fabric

CONCEPT: Consumer decision making - product comparisons

REFERENCE: Consumer and Homemaking 3-4 Manual for Career Education. James C. Stewart, Comp., Knox County Schools, Knoxville, Tennessee.

ACTIVITY: Take several samples of material used in clothing, such as wool, cotton, and synthetics. Examine carefully for such things as flaws, thin spots, etc. Expose to heat, light, moisture, dryness, darkness, etc. Re-examine and determine what effects the different variables have on the fabric. Are there differences between the fabric in relationship to the effect of the different variables?

Examine the clothing labels for care instructions.

PURPOSE: To make students aware of ways of conserving energy in the home.

LEVEL: - 4-6
7-9

AREA: Natural Resources

TOPIC: Conservation of Electricity

CONCEPT: Consumer conservation of energy.

REFERENCE: Toth, N. June, Cikach, F.S., and Frankovits, N.D., Maple Heights City School District Environmental Education Program, Final Report. Maple Heights, Ohio, June 30, 1977, p. 6.

ACTIVITY: Are You Saving on Use of Electricity?

Listed below are ways to save on several uses of electricity. Have students check at home whether they conserve on each item. If yes, score 2; if partial, score 1; if no, score 0.

Total the scores on each item for the class and determine the mean. Which items need most attention for further conservation?

Here are seven ways to save on your home electric bill:

1. Lighting: Larger bulbs are more efficient. Lighting represents 20% of electricity used in the home. You can enjoy more illumination while saving because larger size incandescent light bulbs are more efficient. You can get more light from several large bulbs than from twice as many small bulbs.

2. Electric Range: Approximately 80% of cooking is done on top of range and only about 20% in the oven. To save electricity, use the right size cooking utensils and when boiling water heat only amount needed. Aluminum utensils with bright shiny exteriors are best.

3. Oven: Use it to full advantage. When preheating oven, set control at the temperature needed to cook. Arrange oven racks before turning on oven. Use the full oven capacity when possible. Don't open oven door to peek in, use lights inside.

4. Electric Air Conditioners - Hands off Thermostat: Set the thermostat at a comfortable level and leave it there. Frequent resetting impairs efficient operation. Do not use a window fan when using air conditioner; open windows will admit humidity and warm air. Keep window shades closed on the sunny side of the house. Clean or replace air conditioner filters about once a month.

Do not place any lamp, TV, or other heat producing device within three feet of indoor thermostat. Have system checked each year. Be sure that no room air registers, either supply or return, are obstructed by drapes or furniture.

5. The best recommendation for your Heating System is insulation in the home. Proper insulation should be in the ceilings. Storm windows or double glazed windows will also reduce heat loss considerably. All outdoor entrances should be equipped with storm doors. Weatherstripping around doors and windows also helps insulate your home.

6. Refrigerator: Help keep it cool. If your refrigerator is not self defrosting, be sure to defrost it whenever the cooling coils accumulate more than 1/4 inch of ice.

7. Points about appliances: Clothes Dryer - do not overload or put in too small a load. Be sure clothes dryers are vented to the outdoors to eliminate added heat and moisture. Dishwasher - Do not use after every meal, wash only full loads.

GRADE LEVEL 7 - 9

PURPOSE: To provide information on the effect of chemicals dissolved in water on the freezing and boiling points of water.

LEVEL: 4-6
7-9

AREA: The Consumer and the Environment

TOPIC: Chemicals that Affect the Freezing and Boiling Points

CONCEPT: Dissolving materials in water alters the boiling and freezing points of water.

REFERENCE: "Salt on Winter Roads." John A. Miller, Science and Children, January-February, 1974, pp. 23-24.

ACTIVITY: Chemicals are used in a number of ways to affect the freezing and boiling points of water. Many students do not understand how these chemicals work. The following activity suggests how students can predict the effects of various substances and then test to determine if they are right or wrong. Other items can be added if they desire.

Other factors that should be considered for consumer use could also be discussed. Does the material cause corrosion of metal? Will it affect concrete or blacktop? Why isn't methyl alcohol used very frequently as an additive to water in car engines? Why don't all alcohols work the same when added to water? Why don't all salts work the same when added to water?

SALT ON WINTER ROADS

Every winter in the colder climates we may see salt being put on roads and sidewalks. Even the young school children know that table salt, which has the chemical name sodium chloride, causes the ice to melt,* but few people know what actually happens to the temperature when salt is placed on ice. Does the temperature increase, decrease, or remain the same? This question leads to an exciting investigation in which the pupil can attempt to predict results from adding chemicals to ice and then testing for actual results. Furthermore the study provides the scientific background behind the technology of winterizing an automobile, preparing the roads for safer winter driving, or making homemade ice cream.

To determine if the temperature of ice is increased, decreased, or remains the same when a chemical is added, the pupil must first know what happens to the temperature of pure ice when it melts. Therefore, in the first activity, a group of students measured the melting point

*Table salt causes the phenomenon at temperatures equal to or above $0^{\circ}F$.

of ice in a paper cup. Prior to making the measurement the class predicted what the results would be. The children knew that the melting point of ice and therefore the freezing point of water is 32°F or 0°C (Celsius) but several, when asked, thought that the temperature would rise as the ice continued to melt. Their measurements soon proved them wrong. If the ice is stirred no temperature change occurs until all the ice melts. If a good quality mercury thermometer is used the temperature can be expected to be very close to 0°C or 32°F. However, if a cheaper inaccurate thermometer, costing 35 to 50 cents, is used, the thermometer may read several degrees high or low. In either case the temperature will remain constant and even a possibly inaccurate thermometer is sufficient for the remainder of the experiment.

In the second activity each student was given a sheet (Figure 1) with three columns. In column A there was a list of chemicals with the information on water solubility given under each chemical. The list included the following solids:

1. sodium chloride (table salt), soluble in water
2. calcium chloride, soluble in water
3. calcium carbonate (limestone or chalk), insoluble in water
4. calcium phosphate, insoluble in water

and liquids:

5. methyl alcohol (wood alcohol), soluble in water
6. ethylene glycol, soluble in water
7. kerosene or equivalent, insoluble in water
8. mineral oil, insoluble in water.

In column B the student predicted what he thought would happen to the temperature of ice on addition of the chemical as compared to the temperature of pure ice. To facilitate the students recording their predictions in column B, the three statements:

1. higher
2. lower
3. about the same

were included for each chemical listed in column A. In each case the students were required to give their prediction prior to doing the measurement. After making the prediction the students were given paper or plastic cups partially filled with ice and a liberal amount of the chemical (1-3 teaspoons per cup). Each student recorded his results in column C which is identical to column B. After the class completed a measurement we discussed the results and the use of the phenomena illustrated.

DATA SHEET

The melting point of pure ice is ____.

Column A	Column B	Column C
Chemical to be added to ice.	Your prediction on the effect of adding the chemical on the melting point of ice.	Results of adding chemical on the melting point of ice.
1. sodium chloride (table salt) soluble in water	higher lower about the same	higher lower about the same

FIGURE 1: Example of data sheet given the student for the second activity.

In the classroom, ice is at a constant temperature of 32°F (0°C) since the room temperature is above the melting point. However, addition of the salt causes a depression in melting point until the ice finds itself at the new melting point. On a cold winter day the phenomenon of decreased melting point, caused by adding salt to ice, is used. The salt is put on the icy sidewalk. This promptly lowers the melting point of the ice temperature below that of the surroundings and therefore the ice begins to melt. This use of salt to cause melting of ice on sidewalks is only effective at 0°F or temperatures above 0°F. The next aspect of this topic will explain the reason for the limitation.

The zero point or temperature on the Fahrenheit scale is also based on the fact that table salt when put on ice causes a melting point decrease. At one point in history the coldest temperature man could obtain in the laboratory was found to be a salt-ice mixture. The temperature obtained for the mixture was used by Fahrenheit to designate the zero point on his temperature scale.

The addition of sodium chloride in the form of rock salt to ice also provides the low temperature needed for making homemade ice cream.

In the portion of the activity involving the use of calcium chloride the students find that the results are identical to those obtained with table salt. It should be noted that in most regions calcium chloride rather than sodium chloride is the salt put in the sand which is used on roads in winter. The solids, calcium carbonate and calcium phosphate, which are water insoluble cause no change in the melting point of ice. This result is true of all water insoluble substances including the two liquids kerosene and mineral oil, which were included in the second activity. The water soluble liquid, methyl alcohol, was the first antifreeze used in automobile radiators because it lowers the freezing point of water. Today, ethylene glycol rather than methyl alcohol is

used and the methyl alcohol serves only as a gas line antifreeze. In actual practice, spirit duplicating fluid can be substituted for methyl alcohol, and commercial antifreeze rather than pure ethylene glycol may be used in the second activity.

At the conclusion of the activity the students formed two hypotheses. Only chemicals soluble in water cause a decrease in the melting point of ice and no chemical tested can cause an increase in the melting point of ice. These hypotheses were in direct contradiction to the first predictions most students made during the activity. Most of the fourth and fifth graders in the class tended in the early stages of the activity to predict that the chemicals would cause increase in the melting point of ice, for after all, they knew that salt causes the ice to melt in the winter.

If desired the experiment could be extended by having the children examine the effect of chemicals on the normal boiling point of water which is 212°F or 100°C at sea level. The student would find that water insoluble substances including both liquids and solids have no effect on the boiling point, whereas water soluble solids cause the boiling point to rise. However, water soluble liquids can cause two types of effects. If a water soluble liquid has a lower boiling point than that of water, the boiling of water will be decreased. Methyl alcohol falls in this category of liquids. The opposite effect is illustrated by using ethylene glycol, which has a boiling point higher than that of water and causes the boiling point of the water to rise.

PURPOSE: Illustrate effects of different products (detergents) on a controlled environment.

LEVEL: 4-6
7-9

AREA: The Consumer and the Environment

TOPIC: Effect of Detergents on Plant Life

CONCEPT: Consumer decision making - environmental factors

REFERENCE: Multidisciplinary Activities for Environmental Learning. June S. Wilson, Genesee Intermediate School District, Flint, Michigan, July, 1973.

ACTIVITY: Materials: pond plants such as duckweed, etc.; three or more equal sized glass jars (one quart or larger) with the same amount of gravel and water in each; samples of several different detergents.

Note: Most detergents (for laundry and dishwasher) are caustic and can cause skin irritations and damage to eyes.

Procedure: Set up identical aquaria. Be sure to place the same amount of water and gravel in each, as well as the same number of plants (no animals). Place each in the same window so all get the same light. Add one teaspoon of each detergent to different jars. Leave one jar untreated as a control.

Examine the aquaria daily and note plant life changes. Keep a diary of observations. After three or four days, add another teaspoon of detergent. Compare with the control and with each other. Continue the process for four or five weeks, making daily observations.

PURPOSE: To have the students establish certain priorities in buying, with the focus on environmental effects.

LEVEL: 4-6
7-9

AREA: The Consumer and the Environment

TOPIC: Effects of Various Products on the Environment

CONCEPT: Consumer decision making - environmental factors

ACTIVITY: After some background on pollution and ecology, discuss the use of different products and their effects on the environment. Such things as returnable bottles as opposed to non-returnables, biodegradable detergents versus non-biodegradables, recyclable packaging and non-recyclable containers, could be discussed.

Have the students identify reasons why the environment should be a factor when making a purchase.

Have them also discuss other factors to look for when purchasing. Have each student establish a list of priorities for purchasing.

PURPOSE: Illustrate effects of selected chemicals commonly used in detergents on a controlled environment.

LEVEL: 7-9

AREA: The Consumer and the Environment

TOPIC: Effect of Selected Chemicals Used in Detergents on Plant Life

CONCEPT: Consumer decision making - environmental factors

REFERENCE: Multidisciplinary Activities for Environmental Learning. June S. Wilson, Genesee Intermediate School District, Flint, Michigan, July, 1973.

ACTIVITY: Materials: pond plants (duckweed, etc.); three equal sized glass jars (one quart or larger) with the same amount of water and gravel in each; one teaspoon solid potassium phosphate; one teaspoon solid sodium carbonate.

Note: Most detergents contain chemicals which are caustic and can cause skin irritations and damage to eyes.

Procedure: Set up three identical aquaria. Be sure to place the same amount of water (half quart or more) and gravel in each, as well as the same number of plants (no animals). Place each in the window so that all get the same light. Add 1/2 teaspoon ammonium nitrate to one jar. Add 1/2 teaspoon potassium phosphate to the second. Do not add any chemical to the third jar, as it will be the control.

Examine the aquaria daily to note changes in plant life. Keep a diary of all observations. After three or four days, add another 1/2 teaspoon of each chemical. Compare the two aquaria with the control. Describe the differences that you see after four or five weeks.

PURPOSE: To investigate the effects of pesticides on the environment.

LEVEL: 7-9

AREA: The Consumer and the Environment

TOPIC: Pesticides

CONCEPT: Consumer decision making - environmental factors.

REFERENCE: "Exploring Pesticide Pollution." Thomas J. Rillo, Science Activities, March/April, 1974, pp. 22-31.

ACTIVITY: After some background on pesticides:

Have students make up index cards with the names of chlorinated hydrocarbon pesticides printed on them. Do the same for organo-phosphates. Instruct the students to visit garden centers, hardware stores, and other businesses dealing in the sale of pesticides. Have them check the active ingredients on pesticide labels. Ask them to list the number of times each chemical compound is listed for each pesticide. Data should be tabulated, and a list of harmful pesticides developed.

Note: Pesticides are poisons and the teacher should take great care in cautioning students about the dangers involved and in discussing the actions of these and similar chemicals.

PURPOSE: To show the savings that can be made through home gardening. (Could easily be tied in with a botany unit.)

LEVEL: 4-6
7-9
10-12

AREA: Foods

TOPIC: Home Gardening

CONCEPT: Consumer decision making - food marketing

ACTIVITY: Materials: Various containers (cut-off plastic milk jugs would work well); rich soil; vegetable plants or seeds; watering containers.

Procedure: Divide the students into groups. Give each group a container, soil, and a watering container. Then distribute different plants or seeds to each group. Let the students plant the seeds or plants according to instructions.

After plants have reached maturity and vegetables are fully developed, have the students figure cost per vegetable (per weight unit; e.g. kg. or lb.), including soil (if it was purchased), fertilizers added (if any), container (if purchased), and cost of plant or packet of seeds.

Then, using a newspaper ad, or by a trip to a supermarket, figure the cost per vegetable if it were purchased. Compare. Was the savings worth the effort? How would the savings add up over a long period of time for a whole family? Would the plant's vegetables develop sooner if you started with plants rather than with seeds? If the answer is yes, is the time saved (as compared to seeds) worth the extra expense?

Great care will need to be taken to select plants that will grow and produce in the classroom. Probably very few will prosper in this environment. If gardening is done outdoors, winter weather will probably limit gardening to early fall or late spring. In this case quick growing crops like radishes, leaf lettuce, and spinach should be grown so that the students actually do see the produce.

PURPOSE: Introduce students to basic information on function, daily requirements, caloric values, and primary sources of nutrients.

LEVEL: 4-6
7-9

AREA: Foods

TOPIC: Nutrients

CONCEPT: Consumer decision making - nutritional and dietary value

REFERENCE: Teaching Personal Economics in the Home Economics Curriculum. Joint Council on Economic Education; New York, N.Y., 1971.

ACTIVITY: Freedom of choice enables individuals and families to select food that maximizes satisfaction of nutritional requirements and tastes within the limits of their availability and the income that can be used for food purchases.

Divide the class into groups and have each group represent a nutrient (i.e., fat, protein, carbohydrates, vitamins--such as A, C, D, B-complex--and minerals--such as calcium and iron). Have each group gather information on function, daily requirements, caloric values (only applicable to protein, fat, carbohydrates), and primary sources of nutrients. Also determine expensive, moderate, and inexpensive nutrient sources. This information can be presented in skit form, role playing, or other ways in which visual aids are incorporated.

Possible problems and discussion topics:

1. Survey the family level of satisfaction for expensive and inexpensive sources of nutrients. Do families have expensive food tastes? If they do, what budgeting problems does this present? What are some ways in which these problems can be solved? Demonstrate the preparation of recipes showing the way less expensive foods can be incorporated in the diet.

2. What are some factors which influence the cost of foods? (High prices, due to demand exceeding supply; food items having "prestige", being out of season; select cut or style; inflation.)

3. Emphasis should be placed (at both these levels) on each student's own personal nutrition, particularly such things as:

   breakfast -- do they eat it or not
   lunch -- school lunch vs. packing (and what to pack)
   after school snacks

4. Note should be made of nutrient labels which are now found on many food products. Discussion should include the usefulness of the information contained on them.

PURPOSE: Introduce students to a variety of food choices and factors to be considered in decision making.

LEVEL: 4-6
7-9
10-12

AREA: Foods

TOPIC: Variations in One Type of Product

CONCEPT: Consumer decision making - product comparisons

REFERENCE: Teaching Personal Economics in the Home Economics Curriculum. Joint Council on Economic Education, New York, N.Y., 1971.

ACTIVITY: Introduce students to a variety of product choices which they must make with just one food type by preparing four types of orange juice drink to be tasted and compared by students. Use either fresh oranges, frozen concentrate, canned juice, or powdered concentrate.

Keep juices in opaque containers to prevent light oxidation which results in very bad off flavors.

Activities and Discussion:

1. Use a score card to compare flavor, nutritive value, color, cost and preparation time.

2. Locate information (labels) which will enable students to compare the nutritive value of the products under consideration. Discuss nutritive value of fruit juice in the diet.

PURPOSE: To compare costs, nutritional value, and caloric count of different breakfast meals.

LEVEL: 4-6
7-9

AREA: Foods

TOPIC: Breakfasts

CONCEPT: Consumer decision making - nutritional and dietary value.

REFERENCE: "Activities for Consumer Economics." William D. Rader, Instructor, January, 1974, p. 63.

ACTIVITY: Involve the class in making a comparative study of breakfast products--cereals, pastries, eggs, pancakes, quick breakfast items, etc. Have them investigate costs per suggested serving, the caloric count, and the nutritional value. Suggest some pupils make a comparative chart of the number of calories per serving. Others can figure cost, adding an amount for sugar (if needed), fruit, and milk. Another group may compare and chart nutrients in various breakfast meals.

PURPOSE: To learn about food additives and the reasons for their use.

LEVEL: 4-6
7-9
10-12

AREA: Foods

TOPIC: Food Additives

CONCEPT: Consumer decision making - food additives

REFERENCE: Consumer and Homemaking 3-4, Manual for Career Education, James C. Stewart, Comp. Knox County Schools, Knoxville, Tenn.

ACTIVITY: Collect several different food labels for each student or group of students. Have them study the labels to see what additives have been added to the food. Assign each student or group a different additive to research as to reason for use, effectiveness, etc. (The type of product in which the additive was used could be a hint for further research.) A demonstration or class report could be used to show findings.

PURPOSE: To show that different fruits and vegetables must be preserved in different ways to maintain nutritional and dietary values.

LEVEL: 7-9

AREA: Foods

TOPIC: Effects of Freezing on Fruits and Vegetables

CONCEPT: Consumer decision making - nutrition.

REFERENCE: Consumer and Homemaking 5-6. Manual for Career Education. Knox County Schools, Knoxville, Tennessee.

ACTIVITY: After some background development, let the class discuss ways of freezing different fruits and vegetables. The discussion should include reasons for using each method. The class also could test various methods of freezing (e.g. quick freezing vs. slow freezing) as a part of background development.

Investigate the effects of freezing on different fruits (e.g. apples, peaches, bananas, oranges) and vegetables (e.g. beans, spinach, tomatoes, carrots, lettuce, radishes).

Other methods to consider:
blanching (and the reason for it) vs. no blanching
cooking food first vs. freezing raw

PURPOSE: To figure the nutritional value of different restaurant meals and relate this to cost.

LEVEL: 7-9

AREA: Foods

TOPIC: Nutrition in Restaurants

CONCEPT: Consumer decision making - nutritional and dietary value.

REFERENCE: Consumer and Homemaking: Grade 7. Cluster I. Olivia H. Calhoun, Washington, D.C., 1972.

ACTIVITY: Obtain the morning and evening menu from a few restaurants. Using a calorie guide, have the students figure the number of calories provided in a continental-type breakfast, featured breakfast, special breakfast, special lunch, special dinner, and regular lunches and dinners. The student is then to determine the best nutritional value of meals, using a reference book, the home economics teacher, or the school lunch program's dietician. Compare the costs with nutritional value to come up with a "best buy."

PURPOSE: Have students critically evaluate information on food products in terms of health standards, costs, etc.

LEVEL: 7-9
10-12

AREA: Foods

TOPIC: Nutrition of Disadvantaged People

CONCEPT: Consumer decision making - nutritional and dietary value

REFERENCE: Teaching Personal Economics in the Home Economics Curriculum. Joint Council on Economic Education, New York, N.Y., 1971.

ACTIVITY: Lower-income families are aided by measures which redistribute national income. This is done principally through public aid programs, transfer payments and supplemental food programs.

Read newspaper and magazine articles about the current nutritional status of people in Appalachia and other depressed areas of the country, or obtain information about low income people in the local geographical area from a social welfare worker, county extension agent, or public health worker.

Possible problem and discussion topics are:

1. What types of diets do these people have? What are some of the inadequacies in their diets? Identify some of the factors which might be responsible for the inadequate diets. (Limited industry and agriculture to sustain local economy; income limited due to low salaries and/or unemployment; limited education prevents employment, mobility, and basic health knowledge.)

2. There is evidence that people with inadequate diets have a greater frequency of illness compared to others with more adequate diets. What are the costs to them personally? What does people's poor health status cost the economy of the country? (Cost of labor in relation to output would increase, welfare expenditures of the government would be increased.)

3. Is there evidence that people in higher income brackets might also have nutritionally inadequate diets? (Research has indicated that people in higher income brackets have inadequate nutrition, but people in the lower income brackets more frequently have nutritional inadequacies.)

4. Consider the effect that television advertising (e.g. potato chips, pop, beer, ready-made dishes, baking mixes) has on these people in relation to what they want to or ought to buy.

PURPOSE: Have students critically evaluate information on food products in terms of health standards, costs, etc.

LEVEL: 7-9
10-12

AREA: Foods

TOPIC: Health Foods and Supplements

CONCEPT: Consumer decision making - nutritional and dietary value

REFERENCE: Teaching Personal Economics in the Home Economics Curriculum. Joint Council on Economic Education, New York, N.Y., 1971.

ACTIVITY: Advertising and labels of food products can be a source of valuable information when determining how to spend the food dollar.

Claims for "health foods" and "food supplements" should be critically evaluated in terms of health standards as well as the Opportunity Cost of choosing other foods.

Exhibit some examples of health foods and locate advertisements in magazines and newspapers, and on TV which make food claims dealing with pills, specially-grown or processed foods, and food supplements.

Possible discussion questions and activities:

1. Analyze the statement and claims about these foods to determine whether they represent half-truths, incomplete facts, misinformation, or superstitions and/or analyze the following claims: "melts away fat as you continue to eat foods you enjoy," "gives you that exhilerating feeling," "keeps you from the depths of fatigue," "prevents that bogged down feeling.".

2. What are the "real costs" of these foods and/or pills to the consumer? (Expensive--health may suffer due to omissions from the diet.)

3. Research the amount of money Americans spend annually on food fads and report to the class. Are the sales of health foods important to the American economy? (Depending on the amount of sales they might be quite important.)

4. Who benefits from the sales of health foods?

5. What protection does the consumer have against fraudulant health food products and claims? (Buying from reliable merchants; obtaining information from consumer-

sponsored agencies and from professional associations; an protection by government through the Federal Food and Drug Administration.)

6. What would be the effect on the cost, availability, and quality of food grown without the use of pesticides, fertilizers and industry processing?

PURPOSE: Introduce students to nutritional value of various foods and relate this to consumer decision making.

LEVEL: 7-9
10-12

AREA: Foods

TOPIC: Meal Planning: Considering the Needs of Different Family Members.

CONCEPT: Consumer decision making - nutritional and dietary value

REFERENCE: Teaching Personal Economics in the Home Economics Curriculum. Joint Council on Economic Education, New York, N.Y., 1971.

ACTIVITY: After students have gained familiarity with recommended daily dietary allowances, food nutrients, and meal planning guidelines, present the following menu pattern:

MENU*

Broiled Chicken (3oz.)
Baked Idaho Potato — Whole Green Beans
Sliced Tomatoes (3 sl.) with Mayonnaise — Dinner Rolls (1 roll) and Butter
Apple Pie (3" serving)
Milk (8 oz.)

*Indicate prices per serving. Use frozen green beans, brown-and-serve rolls, and ready-made pie.

Have students, in groups or individually, make the following modifications:

1. Assume you have a limited budget but want to maintain approximately the same nutritional value, modify the above-mentioned menu so this can be accomplished.

2. Assume you are celebrating and have a liberal budget for this meal; maintain approximately the same nutritive value and modify the above-mentioned menu.

3. Assume you are the parent of a 16-year old boy who is participating in a high school athletic program. His coach suggests he eat a high protein diet. Modify the above-mentioned family menu to meet his needs.

4. Discuss the use of this menu for an infant. What modifications might be needed? Consider cost and convenience of this menu vs. baby food.

In each of the cases above have the students:

a. Compute the cost of the modified menu and compare this to the estimated cost of the basic menu given. What differences are there? Identify some factors which may be responsible for this difference (refer to newspapers and magazine articles for economic conditions).

b. Identify sources of information available to the homemaker in this community which would be helpful in making wise consumer decisions in food selection. (Newspapers, magazines, local radio or television, shopping guide programs, company home demonstration agent.)

c. Which of the foods in the menus seem to represent the largest proportion of the food dollar? Have these particular foods increased in price within the past year? Have other food groups increased proportionately in price also? What action might the consumer take in order to show concern and/or displeasure with the current market conditions?

PURPOSE: To test the advertised "good points" of products and see if the advertising is accurate.

LEVEL: 4-6
7-9

AREA: Advertising

TOPIC: Accuracy in Advertising

CONCEPT: The effects of advertising on consumer decision making.

ACTIVITY: Have the students collect magazine and newspaper ads for things such as clothing, toys, games, etc. After each student has two or three, have them classify the type of item, cost, and most important buying point(s) stressed in the advertisement.

With the information collected, two things may be done:

1. Ask if anyone's family has tried the products. Did they hold up? Were they as good as advertised? etc.

2. Obtain a few products and have the class test them for the points stressed in the advertisement. Did they meet the advertised specifications?

PURPOSE: To test the accuracy of "scientific claims" in advertising.

LEVEL: 7-9
10-12

AREA: Advertising

TOPIC: Accuracy in Advertising

CONCEPT: The effects of advertising on consumer decision making

REFERENCE: "Experiment Through Advertising." Gerald H. Krockover. Science and Children, January/February, 1973, pp. 28-29.

ACTIVITY: Collect advertising that involves experiments conducted in a scientific manner. Have the students identify as many variables as possible which could affect the outcome. Once these are listed, gather materials and have the students test the product, keeping variables in mind. After data are gathered, graph or chart results. Compare class results to advertisement results. What variables did the manufacturer use? What variables did he neglect to use?

PURPOSE: Provide a method for making shampoo inexpensively.

LEVEL: 4-6
7-9
10-12

AREA: Health

TOPIC: Making Your Own Shampoo

ACTIVITY: A good shampoo cleans hair and scalp gently. It should remove some oils, but still leave some oil. You can make your own shampoo for less money than the store-bought type. You can also modify the shampoo by changing the proportions of the ingredients. Increase the soap for cleansing, herbs for conditioning, and oil for fragrance.

Materials

1 1/2 - 2 oz. of herbs, such as rosemary, chamomille
12 oz. of water (distilled or soft water works best)
1 oz. of castile soap
One or two drops of a good essential oil (rosemary, lavender, etc.)

Procedure: Place the water and herbs in a pot that is not metal. Boil, then cover and simmer for 4-6 minutes. Turn the heat off and steep the herbs for 15-20 minutes. Pour the material through a fine strainer and save the strained liquid. Add the soap and stir until the soap is blended. Add the fragrance.

Note: An "acid" rinse is recommended after using this shampoo. It will remove the soap particles that often remain in your hair after shampooing. An acid rinse can be made by placing 1 tablespoon of apple cider vinegar in a quart of water (plus some fragrance).

PURPOSE: To demonstrate the relationship between prescription and non-prescription drugs.

LEVEL: 4-6
7-9
10-12

AREA: Health

TOPIC: Drugs

CONCEPT: Consumer protection as related to drugs.

REFERENCE: Consumer and Homemaking 5-6 Manual for Career Education. Knox County Schools, Knoxville, Tennessee.

ACTIVITY: After the development of some background information, the class should discuss the taking of prescription and non-prescription drugs and their effects on the body. Why are prescription drugs classified as such? Non-prescription?

Discuss:

1. Storage of medicines.

2. Disposal of unused or old medicines.

3. Protection of young children.

4. Poison control centers.

Encourage students to inventory their own homes (with parents' aid and approval) for safety, etc. of medicines and for possible disposal of old or unused ones.

PURPOSE: To provide information for making decisions regarding over-the-counter medicines.

LEVEL: 7-9
10-12

AREA: Health

TOPIC: Relief from Symptoms of the Common Cold

CONCEPT: Sources of information with respect to consumer decision making - drugs.

REFERENCE: Hecht, Annabel. "The Common Cold: Relief But No Cure." FDA Consumer, September 1976. (HEW Publication FDA 77-3029)

ACTIVITY: Read the following article. Based on the information presented, have each student select five non-prescription cold remedies and comment on the statements made on the package, on the type of relief inferred, and on the ingredients included.

THE COMMON COLD: RELIEF BUT NO CURE

After reviewing the ingredients that go into thousands of nonprescription drug products, an FDA advisory panel has concluded that a number of them will relieve cold symptoms but there is still no cure for one of mankind's most familiar maladies. The panel studied some 90 active ingredients that are used in cough, cold, and related products and gave its views on the safety and effectiveness of each one.

by Annabel Hecht

Had you lived in ancient Rome you might have sipped a broth made by soaking Allium cepa--an onion--in warm water to relieve the symptoms of the common cold. In Colonial America you might have relied on pennyroyal tea or an herbal concoction made from such unmedicinal sounding plants as sage, hyssop, yarrow, black cohosh, buckthorn, coltsfoot, goldenseal, cubeb berries, or bloodroot. In grandma's time, lemon and honey was a favorite recipe, or in extreme cases, a hot toddy laced with rum--the amount of same determined by the age of the drinker.

Today, if you don't have an old reliable remedy to fall back on, you might take one of literally thousands of drug preparations available without prescription. Some contain ingredients reminiscent of the folk medicine of the past; others are formulated with sophisticated chemical creations. Old or new, simple or sophisticated, many of these remedies will relieve some of the familiar cold symptoms, such as stopped-up nose or hacking cough. But not a single one of these products--on which Americans spend an estimated $700 million a year--will prevent, cure, or even shorten the course of the common cold.

So says a panel of non-Government experts called on by the Food and Drug Administration to study the safety, the effectiveness, and the accuracy of claims made on the labels of some 50,000 cold, cough, allergy, bronchodilator, and antiasthmatic drug products. The Panel is one of 17 set up by FDA to examine all nonprescription (over-the-counter) drugs marketed in the United States. The project, mandated by a 1962 Amendment to the Food, Drug, and Cosmetic Act which requires that all drugs be proven effective as well as safe, will eventually lead to the establishment of definitive Federal standards on ingredients and labeling claims for all nonprescription drugs.

The Panel indicated that proper use of nonprescription drugs can be effective in relieving cough, sinus congestion, runny nose, and some of the other symptoms associated with colds, allergies, or asthma. But it made clear that although these products may relieve certain symptoms they will not cure any of these conditions.

One aspect of this class of drugs that concerned the Panel was the relative scarcity of single ingredient products on the market. This is particularly true of cough and cold remedies. The common cold is a self-limiting respiratory infection which lasts from one to two weeks. It usually starts with a sore throat, sneezing, and runny nose. After a few days, the nose becomes stopped up and the eyes become watery. This is followed by lethargy, aches and pains, and sometimes a slight fever. Cough may occur in the later stages. Often these symptoms do not occur at the same time. Nevertheless, almost 90 percent of cough and cold products now available contain a combination of ingredients intended to relieve a number of different symptoms. Only 46 of the cough-cold products examined by the Panel consisted of a single active ingredient.

The Panel said it is "irrational" to take a combination product unless each of the ingredients is necessary to relieve the patient's particular symptoms. Moreover, because of variations in individual reactions to drugs, fixed combination may not be suitable for some people. Consumers need more choice in selecting the appropriate treatment for their symptoms, the Panel said, and recommended that all products to relieve cough and cold symptoms be available in both combination and single ingredient form.

Another area of concern to the Panel was labeling of cough and cold remedies. It said labeling for these products "tends to be overly complicated, vague, unsupported by scientific evidence, and in some cases, misleading." The Panel called for an end to claims that one product is superior to, stronger than, or contains more active ingredients than another, or is specially formulated. Under its recommendations such words as "cold medicine," "cold formula," or "for the relief of colds" would be banned from drug labels. Such claims suggest the product will cure a cold when the best it can do is relieve specific symptoms, the Panel said.

-Antihistamines, a class of drugs used to relieve sneezing and watery and itchy eyes, usually associated with hay fever and other allergies.

Each ingredient reviewed was placed in one of three categories:

Category I--Generally recognized safe and effective and not mislabeled.

Category II--Not generally recognized as safe and effective or mislabeled. Such ingredients and labeling claims will be removed from products within six months after FDA issues its final regulation on cough, cold, and related nonprescription drug products.

Category III--Available data insufficient to permit final classification at this time. The Panel recommended that when FDA issues its final regulations ingredients which are placed in this category be permitted to remain on the market for a stipulated length of time if the manufacturer immediately begins tests to satisfy the questions raised by the Panel.

Lucky is the cold victim who has only an annoying tickle in his throat or a stuffed up nose. The Panel found 7 ingredients both safe and effective as cough suppressants and 14 safe and effective as nasal decongestants. It recommended that one of the cough suppressants and four of the nasal decongestants which are not available only in dosage levels that require a prescription be made available in effective dosages that could be sold without a prescription.

Not so fortunate is the person whose cough is "nonproductive" or produces only small amounts of thick phlegm. Not one ingredient was found by the Panel to be both safe and effective as an expectorant. Similarly, the Panel found no ingredient both safe and effective as an anticholinergic to relieve watery secretions of nose and eyes.

Fifteen of the ingredients it studied are not generally recognized as safe and effective for cough and cold symptoms and should be taken off the market, the Panel reported. One of these is chloroform, which FDA already has banned on the basis of evidence that high doses of it can cause cancer in test animals.

A wide array of ingredients--52 all told--were considered by the Panel to be safe enough, but further proof of their effectiveness in relieving coughs and stuffy or runny noses is needed. Scattered throughout the list are names reminiscent of patent medicines and home remedies of the past: cod liver oil, slippery elm, cedar leaf oil, horehound, camphor, menthol, and oil from the koala bear's favorite food, eucalyptus leaves. The Panel recommended that these familiar remedies--as well as the rest of the 52 whose effectiveness it questioned--be permitted to stay on the market for from three to five years if their manufacturers undertake further tests to prove (or disprove) that grandma knew all along what was good for the sniffles.

As for the labeling of cough and cold remedies, the Panel recommended that cough suppressants be permitted to claim that they temporarily relieve coughs due to minor throat irritation, help to quiet the cough reflex, or help you to cough less. But the labels should warn that a cough may be a sign of a serious condition and that a physician should be consulted if it lasts more than one week. The Panel also recommended a warning that cough suppressants should not be used for persistent or chronic coughs such as occur with smoking, asthma, and emphysema. In such cases, coughing is essential to rid the bronchial airways of mucus and other secretaions. Cough suppressant labels should not refer to lung or chest conditions, the Panel said, nor should they claim the product works by soothing the bronchial passages.

The Panel said expectorant labels should be permitted to claim that the product helps loosen phlegm or rid passageways of bothersome mucus, but it called for a warning against taking expectorants for persistent chronic cough associated with smoking, asthma, or emphysema, or if there are excessive secretions, except under the advice of a physician.

Labels on anticholinergics could promise temporary relief of watery nasal discharge, or runny nose or watering of the eyes, but such statements as "clears nasal passages" or "opens airways" would not be permitted under the Panel's recommendations. Consumers should be warned not to take anticholinergics if they have asthma, glaucoma, or difficulty in urinating, the Panel said.

Topical nasal decongestants, those applied directly in the nose, present a unique problem. These drugs help clear up stuffy noses by constricting enlarged blood vessels in the nasal passage. But if they are used for too long a time or too frequently they can have the opposite effect and actually enlarge, rather than constrict, the blood vessels. Therefore, the Panel recommended that labeling for topical nasal decongestants warn users not to exceed the recommended dosage and not to use the product for more than three days. If symptoms persist, a physician should be consulted.

Oral nasal decongestant labels should warn against use by persons suffering from high blood pressure, heart disease, diabetes, or thyroid disease unless under a physician's supervision, the Panel said. And products that are inhaled should carry the caution statement: "Not for use by mouth."

Approximately six million people in this country suffer from asthma, a disease marked by wheezing, coughing, and shortness of breath. Many of these people use nonprescription drugs called bronchodilators to help them breathe more easily, and the Panel found 12 ingredients safe and effective for this purpose. Five of them are now available only by prescription, and the Panel proposed that they be changed to over-the-counter status.

One of the most distressing symptoms of the common cold is sore throat and many nonprescription drug products claim to provide relief for this condition. The Panel noted, however, that sore throat can be due to serious infection which would not be treated by self-medication. It recommended that labels on cough, cold, and related nonprescription drugs limit their claimed effectiveness to "minor throat irritation" and should advise consumers to seek medical help for serious throat problems.

Time-released formulations also came under the scrutiny of the panel, which found advantages and disadvantages in this type of medication. Obviously it is easier to take one pill instead of two or three, especially at night, but variations in the rate at which ingredients dissolve, differences in individual patient reactions, and even technical flaws in the manufacturing process could mean that the medicine could be absorbed erratically or possibly all at one time. Therefore, the Panel recommended that a four-year period be allowed for industry, in cooperation with FDA, to develop suitable tests for the standardization of all nonprescription timed-release cough-cold products and that timed-release claims not be permitted in labeling unless such claims have been documented.

Children represent a substantial portion of the consumers of cough and cold remedies, yet the Panel found that information on how these drugs affect them is "negligible or non-existent." Lacking definitive data, the Panel sought the advice of a group of experts on pediatric drug therapy in developing the following recommendations: the dose for children 6 through 11 should be half the adult dose, and for youngsters 2 through 5 it should be one quarter of the adult dose. Asthma and cough preparations should not be taken by children 2 through 5 in any amount except on the advice of a physician. Any product with an alcoholic content of more than 10 percent is not for children under 6, the Panel noted.

As for infants up to 2 years of age, the Panel said dosage should be determined by a physician and the labels on nonprescription drug products should make this clear. Labels should never carry a recommended dose for these youngsters unless the product has been demonstrated to be safe for them, the Panel said.

In reviewing all cough, cold, allergy, bronchodilator, and anti-asthmatic nonprescription drug products the Panel studied some 90 active ingredients. These ingredients were divided into six groups (plus a miscellaneous classification):

-Antitussives, which are cough suppresants.
-Expectorants, which help bring up mucus in the bronchial airways so it can be spit out.
-Bronchodilators, which enlarge the bronchial passages to make it easier for people with asthma to breathe.
-Anticholingerics, which dry up watery secretions in the nose and eyes.
-Nasal decongestants, which open up the nasal passages.

Because of variations in the way the body breaks down the two types of drugs most often used as bronchodilators, the Panel said that single ingredient preparations are more effective and safer to use than combination products. It also cautioned that bronchodilators not be used unless a diagnosis of asthma has been made and then only under the supervision of a physician.

Because bronchodilators can have adverse effects on the circulatory and central nervous systems, they should carry labels warning against use by persons suffering from high blood pressure, heart disease, thyroid disease, diabetes, or enlargement of the prostate gland, the Panel said. Labeling also should warn the patient to seek help immediately if symptoms are not relieved in one hour--or in 20 minutes in the case of epinephrine taken by an inhaler. Bronchodilator labels should be permitted to claim that the product is for temporary relief or symptomatic control of bronchial asthma only, the Panel recommended, and there should be no suggestion that it will relieve hay fever or have any effect on the nasal passages.

The relief of hay fever should be left to the antihistamines, the Panel indicated. It found 11 ingredients from this class of drugs safe and effective for relieving the symptoms of allergic rhinitis, or hay fever. Four of these are now available by prescription only, but the Panel recommended that they be approved for over-the-counter sale. Two antihistamines now used in hay fever products require further testing to demonstrate their effectiveness, the Panel said.

Although the antihistamines that are rated safe and effective have a low potential for side effects and toxicity they may cause drowsiness, the Panel pointed out, and it said this fact should be made known on the label. The label also should include a warning against use by people who have asthma, glaucoma, or enlargement of the prostate gland unless under the supervision of a physician.

Acceptable label claims for antihistamines should be that they are for the temporary relief of runny nose, sneezing, itching of the nose or throat, and itchy and watery eyes as may occur in hay fever, but not for the relief of nasal symptoms, such as stopped up nose, nasal stuffiness, or clogged up nose, the Panel said.

Although antihistamines are widely used in the treatment of common cold symptoms, the Panel said there is "little valid evidence" that they are effective for this purpose. Claims that antihistamines are effective for cold symptoms have not been substantiated by appropriate research, the Panel said, but it suggested ways these drugs could be tested for the common cold.

The Panel considered a number of ingredients which are often found in nonprescription cough-cold preparations, but which did not fall within the six main categories under review. These included antihistamines added to some cough-cold products as a sedative or sleep-aid. The Panel questioned the validity of adding an antihistamine to a cough or cold

preparation for purposes of sedation and recommended that such combinations be taken off the market. But it said combinations that include an antihistamine "for restful sleep" should be allowed to stay on the market provided testing is undertaken by the manufacturer to establish an effective dose.

The Panel also called for additional testing to prove the effectiveness of caffeine, which is added to some cough-cold products to counteract drowsiness caused by other ingredients, and phenobarbital, which is added to offset central nervous system stimulants.

Label claims that vitamins, when used either alone or in combination with other products, are effective as cold preventives or cures should not be permitted, the Panel said. But the Panel added that manufacturers should be allowed to use vitamin C in cold products for three years if they want to do so in an effort to demonstrate its effectiveness, on the condition that no claims are made about the vitamin C.

The Panel's report, the culmination of three years of study of this vast array of ingredients, is advisory in nature. It was published by FDA in the Federal Register to allow for comments from industry and consumers. After reviewing the report and the comments on it, FDA will issue final standards for acceptable ingredients and labeling claims for cough, cold, and related over-the-counter drug products. As a result, many products may have to be reformulated and labeling and advertising claims may have to be changed, a process which may take place even before the final standards are issued.

Cough and Cold Remedies

The Panel found that the following ingredients are generally recognized as safe and effective and are not mislabeled:

Antitussives (cough suppressants)

Codeine
Codeine alkaloid
Codeine phosphate
Codeine sulfate
Dextromethorphan
Dextromethorphan hydrobromide
Diphenhydramine hydrochloride

Expectorants

none

Anticholinergics

none

Nasal Decongestants

Ephedrine
Ephedrine hydrochloride
Ephedrine sulfate
Racephedrine hydrochloride
Naphazoline hydrochloride (topical)
Oxymetazoline hydrochloride (topical)
Phenylephrine hydrochloride (oral/topical)
Phenylpropanolamine bitartrate (oral)
Phenylpropanolamine hydrochloride (oral)
Phenylpropanolamine maleate (oral)
Propylhexedrine (inhalant)
Pseudoephedrine hydrochloride (oral)
Pseudoephedrine sulfate (oral)
Xylometazoline hydrochloride (topical)

The Panel found that the following ingredients are not generally recognized as safe and effective or are mislabeled.

Antitussives

Hydrocodone bitartrate
Oil of turpentine (oral)

Anticholinergics

Atropa belladonna (inhalant)
Datura stramonia (inhalant)

Nasal Decongestants

Mustard oil (topical/inhalant)
Oil of turpentine (oral)

Expectorants

Antimony potassium tartrate
Calcium iodide anhydrous
Chloroform
Hydriodic acid syrup
Iodized lime
Ipecac fliudextract
Potassium iodide
Squill
Squill extract
Oil of Turpentine (oral)

The Panel found that there are insufficient data to classify the following ingredients. It recommended that these ingredients be permitted to remain on the market from three to five years if their manufacturers immediately begin tests to answer the questions raised by the Panel.

Antitussives

Beechwood creosote
Camphor (topical/inhalant)
Caramiphen edisylate
Carbetapentane citrate
Cod liver oil
Elm bark
Ethylmorphine hydrochloride
Eucalyptol/eucalyptus oil
(topical/inhalant)
Horehound (horehound fluidextract)
Menthol/peppermint oil
(topical/inhalant)
Noscapine
(noscapine hydrochloride)
Oil of turpentine
(topical/inhalant)
Thymol

Anticholinergics

Atropine sulfate (oral)
Atropine (d, dl hyoscyamine)
(oral)
Scopolamine (l-hyoscine) (oral)

Expectorants

Ammonium chloride
Beechwood creosote
Camphor (topical/inhalant)
Compound tincture of benzoin
(inhalant)
Compound white pine compound
Glyceryl guaiacolate
Ipecac Syrup
Menthol/peppermint oil
(topical/inhalant)
Oil of turpentine
(topical/inhalant)
Eucalyptol/eucalyptus oil
(topical/inhalant
Extract white pine compound
Pine tar
Potassium guaiacol sulfonate
Sodium citrate
Syrup of pine tar
Terpin hydrate
Terpin hydrate elixir
Tincture of benzoin (inhalant)
Tolu
Tolu balsam
Tolu balsam tincture
White pine

Nasal Decongestants

Beechwood creosote
Bornyl acetate (topical)
Camphor (topical/inhalant)
Cedar leaf oil (topical)
1-Desoxyephedrine (inhalant)
Ephedrine (oral)
Eucalyptol/eucalyptus oil
(topical/inhalant)
Menthol/peppermint oil
(topical/inhalant)
Oil of turpentine (topical/inhalant)
Phenylpropanolamine hydrochloride
(topical)
Racephedrine hydrochloride (oral)
Thenyldiamine hydrochloride (topical)
Thymol (inhalant)
Ephedrine hydrochloride (oral
Ephedrine sulfate (oral)

Allergy Remedies (Antihistamines)

The Panel found that the following ingredients are generally recognized as safe and effective and are not mislabeled.

Brompheniramine maleate
Chlorpheniramine maleate
Diphenhydramine hydrochloride
Doxylamine succinate
Methapyrilene fumarate
Methapyrilene hydrochloride
Phenindamine tartrate
Pheniramine maleate
Promethazine hydrochloride
Pyrilamine maleate
Thonzylamine hydrochloride

The Panel found that there are insufficient data to classify the following ingredients. It recommended that they be permitted to remain on the market for three years if their manufacturers immediately begin tests to answer the questions raised by the Panel.

Phenyltoloxamine citrate
Thenyldiamine hydrochloride (oral)

Asthma Remedies (bronchodilators)

The Panel found that the following ingredients are generally recognized as safe and effective and are not mislabeled.

Ephedrine
Ephedrine hydrochloride
Ephedrine sulfate
Racephedrine hydrochloride
Epinephrine
Epinephrine bitartrate
Epinephrine hydrochloride (racemic)
Methoxyphenamine hydrochloride
Aminophylline
Theophylline anhydrous
Theophylline calcium salicylate
Theophylline sodium glycinate

The Panel found that the following ingredients are not generally recognized as safe and effective or are mislabeled.

Atropa belladonna (inhalant)
Datura stramonia (inhalant)
Pseudoephedrine hydrochloride
Pseudoephedrine sulfate

The Panel found that there are insufficient data to classify the following ingredient. It recommended that this ingredient be permitted to remain on the market for three years if the manufacturer immediately begins tests to answer the questions raised by the Panel.

Euphorbia pilulifera

PURPOSE: To have students become aware of the relationship between trade names and cost.

LEVEL: 7-9
10-12

AREA: Health

TOPIC: Drugs

CONCEPT: Sources of information with relationship to consumer decision making - drug, cost comparison

ACTIVITY: After some background on the comparison of generic and trade name drugs, invite one or more pharmacists to discuss this matter with the class. Ask the pharmacist(s), to the extent possible, to concentrate on drugs commonly used by the consumer.

PURPOSE: To have students become aware of the wide range of information available to consumers.

LEVEL: 7-9
10-12

AREA: Health

TOPIC: Drugs

CONCEPT: Sources of information with relationship to consumer decision making - drugs

REFERENCE: "Drugs". Science Activities, John Paul Eddy, February, 1972, pp. 42-45.

ACTIVITY: Over a two-week period, have the students collect all articles from popular magazines and newspapers dealing with drugs. These can be posted on a bulletin board, placed in a scrap-book, or displayed in another manner. Students should be made aware of differences in "authority" of information.

PURPOSE: To find out where certain drugs originate and how this relates to cost.

LEVEL: 7-9
10-12

AREA: Health

TOPIC: Drugs

CONCEPT: Factors which affect cost of drugs

REFERENCE: "Drugs." Science Activities, John Paul Eddy, February, 1972, pp. 42-45.

ACTIVITY: Have the students make or take ready-made world maps and mark the major drug producing countries, the drug(s) produced in each, and research the manufacturing of the drug. Have students look for relationships between origin of production and such factors as cost, amount of processing, etc.

PURPOSE: Obtain information on the effects of drugs and relate this to consumer decision making.

LEVEL: 7-9
10-12

AREA: Health

TOPIC: Drugs

CONCEPT: Biological effects of drugs in relationship to consumer decision making.

REFERENCE: "Drugs." John Paul Eddy, Science Activities, February, 1972, pp. 42-45.

ACTIVITY: Have students search the library to get information on how different drugs affect the human body. Compare the results and report on the findings to the class.

Consider use, storage and disposal of drug items.

PURPOSE: To provide information for making decisions regarding medical care.

LEVEL: 7-9
10-12

AREA: Health

TOPIC: Medical Care

CONCEPT: Consumer decision making - medical care

REFERENCE: Suggested Guidelines for Consumer Education - K-12. The President's Committee on Consumer Interests, Washington, D.C., November, 1970.

ACTIVITY: After some background on medical care, have a doctor, nurse, or hospital administrator discuss with the class basic factors involved in choosing a doctor, hospital, or medical care in general.

PURPOSE: To provide information on the action of shampoos.

LEVEL: 7-9
10-12

AREA: Health

TOPIC: Shampoo

CONCEPT: Sources of information with respect to consumer decision making.

REFERENCE: "And Now a Word About Your Shampoo." FDA Consumer, Harold C. Hopkins, HEW Publication No. (FDA) 76-5002, March 1975.

ACTIVITY: 1. Have each student comment on what they now use for washing their hair. Do they like it; what do they believe it is supposed to do; have they had any problems with it?

2. Have the students read the attached article. If they haven't had chemistry, they may need some assistance with some of the terminology. Encourage them to use a dictionary, and if you don't know the words have a chemistry teacher or another science teacher explain any terms they don't understand.

3. After reading the article have the students write a report on the product they currently use and one other product.

4. Make a list of those products reviewed and spend a class period or two discussing the various products.

AND NOW A WORD ABOUT YOUR SHAMPOO

One of the most interesting distinctions that can be made between synthetic detergent shampoo, used to cleanse the hair, and toilet soap, used to cleanse the rest of the body, is that the former is considered under the law to be a cosmetic and the latter is not.

Both may contain fragrances, oils, and other substances, and these may "be rubbed, poured, sprinkled, or sprayed on, introduced into, or otherwise applied to the human body or any part thereof for cleansing, beautifying, promoting attractiveness, or altering the appearance," which is the way the Food, Drug, and Cosmetic Act of 1938 defines a cosmetic. But the same law specifically excludes soap from this definition of a cosmetic and it is thus exempt from FDA regulation.

In 1938 the cleansing agent in most if not all shampoo was soap, so the shampoos of that era were not covered by the law. Today, the cleansing agent in most shampoo is a synthetic detergent rather than soap. And because shampoo containing a synthetic detergent falls within the legal definition of a cosmetic, most of the products that dominate today's shampoo market are so classified.

Synthetic detergents may have been a cloud no bigger than your hand in the late 1930's, but when they did come, they swept through the cleansing business like a hurricane. It didn't take the cosmetics people long to discover that these synthetic chemicals had properties especially desirable in a shampoo and that other properties could be incorporated to make them even more desirable. These properties--and their effects--probably are familiar to every television viewer.

Can you imagine watching your favorite TV show, or anyone else's, without a leading nymph loping in slow motion across grassy glades under a bouncing, billowing halo of feminine glory while an off-screen voice archly insists that it could be you if you'd buy you know what? Street construction crews and pedestrians paralyzed as their mass masculinity is sideswiped by a silken-tressed sylph out on the avenue for her morning undulation? Elevator passengers elevated and blind dates struck dumb by a radiant-maned creature close enough for comfort? Acres of skin, scalp, and smirks emerging from showers with secrets that refuse to keep? A gossamer-topped tot dreamily enduring the camera's gaze while her gossamer-topped look-alike mother hums to her, one gathers, of the magic bottle they share? Or a bit of good news for blondes, brunettes, and redheads who weren't born that way?

Depending on your ability to remember brand names, you can have hair so clean it squeaks, possess tresses that can't tangle or tousle, get back something you had as a tyke, own a product you can't lose or spill or break in the shower or tub, or let the potroast burn and the housework slide if you know your way to the right shelf at the drugstore. For paying your money and making your choice, the right one, you can have hair with body, smoothness, softness, sheen, lustre, highlights, fragrance, and manageability, locks that stay locked come hail, high wind, or humidity.

While these matters could be of concern to the Federal Trade Commission in its monitoring of advertising for claims that may be false or misleading, they are not within FDA's regulatory domain. FDA's authority under the Food, Drug, and Cosmetic (FDA) Act to regulate synthetic detergent shampoos, along with other cosmetics, falls considerably short of the comprehensive kind of jurisdiction the Act authorizes for regulation of foods and drugs. The maker of a cosmetic is not required, as is the sponsor of a new drug, to obtain FDA approval before marketing to assure that the product is safe and effective. And cosmetics makers, unlike food processors, are not required to obtain FDA clearance to use new additives (except for color additives) in their products.

A shampoo, however, whose label claims that it can alter bodily functions--such as correcting and preventing conditions that produce dandruff--automatically becomes a drug and subject to either the over-the-counter drug monographs now being developed by FDA or the "New Drug" requirements of the FDC Act. When these claims are made for a new drug, either prescription or over-the-counter, safety and efficacy must be proved to FDA's satisfaction. The over-the-counter drug monographs will list permitted drug ingredients, those generally recognized by experts as safe and effective.

The law does hold the manufacturer of a synthetic detergent shampoo or other cosmetic solely responsible for safety in its use. He is expected to use ingredients about which there have been no questions of safety, and to perform adequate studies with test animals and humans for new ingredients or combinations to make sure his product is safe to use before he puts it on the market. FDA must trust that the manufacturer has fulfilled his responsibility when he offers a new product. Should adverse reactions occur, FDA urges the consumer to notify the manufacturer and the Division of Cosmetics Technology, Bureau of Foods, FDA, 200 C St., S.W., Washington, D.C. 20204, or any FDA office around the country. The manufacturer is also urged to provide FDA any information learned from consumers about adverse reactions, and FDA provides preprinted forms for more convenient reporting. Such reports are a signal for FDA to look into the matter and, where necessary, take regulatory action under the FDC Act, which prohibits the marketing of misbranded products, those which have false or misleading labeling or other violations of labeling requirements, or those that contain a harmful substance.

The advent of synthetic detergents in the past few decades has, of course, revolutionized cleansing and cleaning chores, whether household, industrial, automotive, or cosmetic. Synthetic detergents are classified as anionic, cationic, nonionic, or amphoteric, depending on the way the ions behave in water. To some degree, all have the capacity to break down the resistance barrier between the water and the dirt, oil, or other material on the surface to be cleaned, and allow the material to be rinsed away. Synthetic detergent shampoos sold for adults are usually of the anionic type; for babies and children, of the amphoteric type, or amphoteric mixed with the anionic type. Cationic synthetic detergents are not usually included in shampoos as detergent agents.

The major advantage of synthetic detergents over soap in shampoos is their efficient functioning in hard water. Soap, an alkali salt of fatty acids, works well in removing dirt and grease from surfaces, but in hard water, which contains a relatively high amount of calcium in solution, the calcium reacts with the soap to form deposits of a gummy material called "soap scum." The familiar ring in the bathtub is composed of these deposits, to which dirt and other undissolved matter in the water may adhere. Such scum can form on the hair during shampooing with soap and hard water, dulling its lustre and making it difficult to comb unless rinsed with some substance that will redissolve

the scum. Soap's foaming and cleansing action is reduced according to the degree of hardness of the water. Synthetic detergents do not react with the calcium in the water and scum deposits do not form, even in the hardest water, though the detergent or cleansing action may itself vary depending on the kind of synthetic detergent used and the kind of foreign material to be removed.

Many synthetic detergents of various types have been formulated by chemists into shampoos, and some have been combined with soaps in shampoos.

FDA has been especially concerned about use of the stronger synthetic detergents in shampoos. Shampoos containing cationics as germicides and nonionics as cleansing agents have been found capable of causing severe eye irritation and occasionally permanent eye injury. Those containing mixtures of cationic and nonionic synthetic detergents have a high potential for permanent eye injury, and reputable manufacturers generally avoid marketing them. Some synthetic detergent shampoos also have been found through consumer experience to cause allergenic skin reactions in some users, although the number has been low considering the millions of packages of synthetic detergent-based shampoos sold.

When soap was still the thing for hairwashing, the scum that formed to dull the hair's lustre was often reduced or eliminated by following up with a rinse of such acidic substances as vinegar and lemon juice. The belief still persists among some consumers that vinegar and lemon juice are needed, even when a synthetic detergent shampoo is used. But such shampoos generally don't require the use of these substances because no scum forms, nor is the extensive lather normally expected from soap necessary for many synthetic detergents to perform an adequate cleansing job. The combination of soap with secret recipes and ritual that the Gibson Girl, the Flapper and Vamp, the "It" and "Oomph" girls thought guaranteed them enchanting tresses would curl the lips of today's more sophisticated consumers, who have a wide choice of shampoos or other commercial hair products labeled to perform specific cosmetic functions.

In some synthetic detergent shampoos there are newly developed additives called conditioners, which enable the user to forget the hundred brushstrokes of the past and still have enough hair lustre and sheen in sunlight to dazzle a doorpost. There are conditioners to give hair the appearance or feel of softness; to create or enhance lustre and sheen; to impart smoothness and lubricity to the touch and make combing or brushing easier; to give the hair "body," or somewhat more bulk, for special hair configurations or coiffeurs; to add "texture," the appearance of stronger strands or vibrancy; and to retain "set," that is, control frizziness or "flyaway" resulting from excessive dryness, static electricity, and other causes, and allow the hair to be kept several hours in a desired position.

Shampoos have came a long way since the days when their cosmetic functions were confined pretty much to cleansing and scenting the hair.

The consumer now learns, not far past toddling, that shampoos perform other magic. The consumer's obvious desire for a shampoo that will perform additional cosmetic functions traditionally done by rinses or other applications after shampooing has affected both the aim and the claims of the shampoo maker. The big difficulty in achieving this aim is that if a shampoo is unusually effective for one function, it may be correspondingly less so for another. For this and other reasons, many shampoos under development may go back to the laboratory instead of into the marketplace. Most of the problems are related in some degree to the cleansing effectiveness of the synthetic detergent.

Can one shampoo product perform several cosmetic functions as well as after-shampoo conditioner rinses? The answer is probably not, but manufacturers continue seeking to develop shampoos that perform as many as possible. The biggest rub is the synthetic detergent. The more thoroughly it removes dirt and other unwanted material, the more likely it is to irritate the scalp, strip off hair dyes and tints put on by the consumer at some effort and expense, remove the natural oil left on the hair from the hair gland secretions, or neutralize the intended effects of some conditioning ingredients in the shampoo.

Among conditioners that have been used in shampoos to produce various cosmetic effects are eggs, proteinaceous substances of protein derivatives, glycerin or propylene glycol, and ethyl alcohol. The manufacturer's difficult objective is to produce a shampoo that cleanses effectively, yet is mild enough to have minumum effect on desirable characteristics, either natural or produced by conditioners in the shampoo.

When egg is included in a shampoo, FDA regulations permit the word "egg" to be used in the name, as "egg shampoo," only if there is the equivalent of one whole egg for each "shampooing" in the container; egg may be mentioned on the label by such statements as "shampoo with egg" or "contains egg" only if egg constitutes at least 2 percent of the product.

It should be understood that protein materials used in shampoos, or for that matter any other conditioning ingredients, cannot feed the hair roots to make the hair "alive," since hair is dead tissue.

The conditioners in shampoos are not normally adequate to conceal damage to hair that may result from use of chemicals such as dyes, bleaches, waving or straightening mixtures, or from intense heat used to curl or straighten the hair strands. Special conditioners usually are needed after shampooing to mask such damage.

Shampoos labeled for use on normal, dry, or oily hair are formulated by controlling the strength or amount of the synthetic detergent, whose "defatting" action removes oil from the hair, and of the conditioning additives that alleviate or offset this action.

How a shampoo looks, its viscosity, its clarity or opacity, its color, how it smells when being applied, how it feels to the touch, the amount of lather it produces, its packaging, and whether it is liquid, cream, gel, or paste, all may affect the consumer's choice of a product and thus are considered by the manufacturer along with performance when the product is being developed, priced, and marketed.

One purpose of shampooing is to remove dandruff--small flakes of dead skin that shed from the scalp. When dandruff is shed from the scalp in scales larger than normal, it becomes unsightly, either in the hair itself or when it falls and clings to the outer clothing. Shampooing can help alleviate this problem. A medicated shampoo labeled for dandruff control would be the best choice if flaking is very heavy.

A medicated shampoo, whether prescribed or sold over the counter, contains drug ingredients specific for alleviating or eliminating certain conditions, such as those that result in excessive dandruff. As such it is a drug, not a cosmetic, and the manufacturer is required either to market it in accord with FDA's over-the-counter drug monographs being developed or, if a new drug, to demonstrate to FDA before marketing that it is safe as well as effective in performing the claims made for it on the label.

Some shampoos are labeled for babies and young children, whose hair does not commonly receive frequent deposits of hair sprays or other hair products. Baby shampoos usually are made from the amphoteric synthetic detergents, some of which are comparatively stingless and nonirritating, and these shampoos do not normally contain such added ingredients as perfumes, which may irritate the eyes. Most baby shampoos are formulated by the manufacturers to have minimum irritation potential.

Because of the number of consumer complaints FDA has received about eye injuries, the Agency is considering proposal of a regulation to require certain warning statements in shampoo labeling. Depending on the results of laboratory animal tests to be established in the regulation, manufacturers would be required to display a particular warning in labeling. The regulation would also specify the kinds of ingredients or combinations of them that FDA considers to be too dangerous for use in shampoos.

PURPOSE: To test the effectiveness of different insecticides.

LEVEL: 7-9
10-12

AREA: Product Testing

TOPIC: Insecticides

CONCEPT: Consumer decision making - product comparison

REFERENCE: "Inyestigating Insecticides." Science Activities, James E. Murphy, May, 1972, pp. 30-32.

ACTIVITY: Materials: 10-12 mosquito larvae; 1 stereoscopic microscope; 1 petri dish or similar glass dish; 1 pipette or medicine dropper; several kinds of household spray insecticides; safety glasses; adequate ventilation.

Procedure: Several days before the day on which the experiment is planned, ask students to bring spray insecticides used at home. The mosquito larvae should also be on hand a few days ahead of time so the students may observe them and become familiar with their structure, function, and behavior. After making their observations, they should give a brief summary of the parts and principles in operation for circulation, respiration, digestion, movements, and sensation. A list of the differences between various larvae should also be compiled.

Next, let the students design the experiment(s) they will use to observe the effect of the insecticides on the larvae. Variables such as the amount of insecticide and time period should be kept in mind. Also, control groups should be used as a basis for comparison. Before the experiments begin, the procedure should be reviewed in class to see the soundness of each student's approach in light of the points mentioned above.

During the experiment, have the students work in twos, one observing the larvae through a stereomicroscope, and the other recording time and applying the insecticide. The insecticide should be applied only for a second or two, and the students should be cautioned against its potency. The activity should be performed in a well ventilated area. Students should wear safety glasses.

Data obtained in the activity, information on the insecticide labels, and any other pertinent information can be used in arriving at comparisons.

PURPOSE: To test phosphate content of fertilizers and/or detergents in relationship to what brands are least harmful to the water supply.

LEVEL: 7-9
10-12

AREA: Product testing

TOPIC: Phosphates in Fertilizers and Detergents

CONCEPT: Consumer decision making - environmental factors

REFERENCE: "Phosphate - Some Studies of How It Affects Our Water." Science Teacher, Ann. L. Abeles, February, 1972, pp. 53-56.

ACTIVITY: Materials: One phosphate test kit (LaMotte or Hach) which will measure 10-50 ppm. phosphate; 500 ml. distilled water; one 100 ml. graduated cylinder; a few grams fertilizer or detergent; two 150 ml. beakers; two stirring rods; one balance capable of weighing to tenths of a gram; one marking pencil or labels; one 1 ml. pipette; two 100 ml. volumetric flasks.

Procedure:

1. Dissolve 1 gram of detergent or fertilizer in 100 ml. distilled water, or dissolve in a volumetric flask and dilute with 100 ml. distilled water. Label this "first dilution."

2. Pipette 1 ml. of the first dilution into another volumetric flask and dilute to 100 ml. with distilled water, or put the 1 ml. in one of the beakers and add 99 ml. of distilled water. Label this "second dilution."

3. Follow directions for phosphate analysis included with the test kit. The analysis will give the ppm. phosphate in the second dilution.

4. Calculate the concentration of phosphate in the first dilution and in the detergent or fertilizer as follows:

   a. Since the second dilution was made by diluting the first solution, 1 to 100, the concentration of the first dilution is 100 times what was measured with the kit.

   b. The first dilution was made by dissolving 1 gram of sample in 100 ml. water, so again the concentration of phosphate in the sample is 100 times greater than the concentration of the first dilution.

Repeat with other samples and compare results.

PURPOSE: Compare actual soap content in different brands.

LEVEL: 7-9
10-12

AREA: Product Testing

TOPIC: Soaps

CONCEPT: Consumer decision making - product comparisons

REFERENCE: Consumer Education: A Model of an Interdisciplinary K-12 Curriculum Approach to Consumer Education Processes. C. Raymond Anderson and L. M. Bongiovanni, Mass. State Dept. of Ed., Boston, April, 1974.

ACTIVITY: After discussing water as a cleaning agent and also the composition of soap, take samples of different brands. Weigh each, then heat to remove any water. Reweigh. Determine volume before and after heating to determine density. This will aid in determining those brands which contain large quantities of air. Record data on a chart and determine the amount and cost of the water you buy with the soap. Decide which brands are the best buy based on your results and rank accordingly.

PURPOSE: To see if there are performance differences between expensive alkaline batteries and less expensive batteries.

LEVEL: 7-9
10-12

AREA: Product Testing

TOPIC: Dry Cell Batteries

CONCEPT: Consumer decision making - product comparisons

REFERENCE: "The Business Department Studies Science" Science Activities, Roger M. Records, July/August, 1974, pp. 6-8.

ACTIVITY: Materials: Shoe box, solar cell, flashlight, ammeter, batteries to be tested.

Procedure: Obtain two new batteries of the same brand. In the shoe box, attach the solar cell to one end. Place the flashlight in the bottom of the box so that the light is centered on the solar cell. Connect the solar cell to the ammeter.

As the batteries wear out, the light will dim and the current reading on the ammeter will drop off. When batteries are worn out, figure cost per hour and compare.

PURPOSE: To compare the effectiveness of phosphate detergents, non-phosphate detergents, and soaps.

LEVEL: 7-9
10-12

AREA: Product Testing

TOPIC: Detergents and Soaps

CONCEPT: Consumer decision making - product comparisons

REFERENCE: Soaps, Detergents, and the Environment.... The Soap and Detergent Association; 475 Park Ave. South; New York, N.Y. 10016. Problems with Current Phosphate Replacement Materials. Federal Trade Commission Hearing, April 26, 1971.

ACTIVITY: Divide the students into five lab teams. Give each team one-4" x 4" square of soiled fabric and 2 quart jars filled with hot water. To one of the jars of hot water:

Team #1 adds I Tbsp. phosphate detergent
Team #2 adds 1 Tbsp. soap
Team #3 adds 1 Tbsp. soap and 1 Tbsp. washing soda
Team #4 adds 1 Tbsp. non-phosphate detergent
Team #5 adds nothing to the water (control)

After each team adds their particular soap or detergent to the water, agitate the jar. Add the square of fabric. Cap the jar and shake for a given period of time. Remove the fabric and place in the other jar. Cap, and agitate to rinse.

Compare cleanliness of the fabric swatches. The experiment could then be run again, using a different type of material for fabric swatch, and again compare the results.

PURPOSE: To make students aware of ways of conserving energy in the home.

LEVEL: 4-6
7-9

AREA: Natural Resources

TOPIC: Conservation of Electricity

CONCEPT: Consumer conservation of energy.

REFERENCE: Toth, N. June, Cikach, F.S., and Frankovits, N.D., Maple Heights City School District Environmental Education Program, Final Report. Maple Heights, Ohio, June 30, 1977, p. 6.

ACTIVITY: Are You Saving on Use of Electricity?

Listed below are ways to save on several uses of electricity. Have students check at home whether they conserve on each item. If yes, score 2; if partial, score 1; if no, score 0.

Total the scores on each item for the class and determine the mean. Which items need most attention for further conservation?

Here are seven ways to save on your home electric bill:

1. Lighting: Larger bulbs are more efficient. Lighting represents 20% of electricity used in the home. You can enjoy more illumination while saving because larger size incandescent light bulbs are more efficient. You can get more light from several large bulbs than from twice as many small bulbs.

2. Electric Range: Approximately 80% of cooking is done on top of range and only about 20% in the oven. To save electricity, use the right size cooking utensils and when boiling water heat only amount needed. Aluminum utensils with bright shiny exteriors are best.

3. Oven: Use it to full advantage. When preheating oven, set control at the temperature needed to cook. Arrange oven racks before turning on oven. Use the full oven capacity when possible. Don't open oven door to peek in, use lights inside.

4. Electric Air Conditioners - Hands off Thermostat: Set the thermostat at a comfortable level and leave it there. Frequent resetting impairs efficient operation. Do not use a window fan when using air conditioner; open windows will admit humidity and warm air. Keep window shades closed on the sunny side of the house. Clean or replace air conditioner filters about once a month.

Do not place any lamp, TV, or other heat producing device within three feet of indoor thermostat. Have system checked each year. Be sure that no room air registers, either supply or return, are obstructed by drapes or furniture.

5. The best recommendation for your Heating System is insulation in the home. Proper insulation should be in the ceilings. Storm windows or double glazed windows will also reduce heat loss considerably. All outdoor entrances should be equipped with storm doors. Weatherstripping around doors and windows also helps insulate your home.

6. Refrigerator: Help keep it cool. If your refrigerator is not self defrosting, be sure to defrost it whenever the cooling coils accumulate more than 1/4 inch of ice.

7. Points about appliances: Clothes Dryer - do not overload or put in too small a load. Be sure clothes dryers are vented to the outdoors to eliminate added heat and moisture. Dishwasher - Do not use after every meal, wash only full loads.

PURPOSE: To learn to read an electric meter and to show the savings that come from [illegible] electrical use.

LEVEL: 7-9
10-12

AREA: Natural Resources

TOPIC: [illegible]ctric Meters

CONCEPT: [illegible]ergy use and cost

ACTIVITY: After some background on reading electric meters, this "homework" activity can be done.

Have the students keep track of the amount of electricity used for a period of time, such as one week. Then have them figure cost using information gathered from the electric company. The following week, have them ask their family to conserve energy by shutting off unnecessary lights, keeping air-conditioning or heating to a comfortable minimum, using the oven for several things at a time instead of heating it up separately every time, etc. Record amount used and again figure cost and savings over the last period. Recognition can be given to students demonstrating the savings of energy. The activity can also include gas or other energy sources.

Note: Power company public relations personnel would probably be able to provide or suggest a resource person.

PURPOSE: To investigate variables influencing gasoline consumption.

LEVEL: 7-9
10-12

AREA: Natural Resources

TOPIC: Conserving Gasoline in Automobile Travel

CONCEPT: Consumer decision making - factors in automobile travel.

ACTIVITY: Gasoline is currently produced from oil, a natural resource that cannot be replenished. It is also becoming more expensive as world supply decreases. There are a number of variables that influence the mileage a car can obtain. Some of these variables relate to the physical characteristics of the car, some to the area in which the car is driven, and others to driving practices of the driver.

Listed below are some of the variables. These variables can be refined by consulting Consumer Reports or a similar publication to make a scale for each variable, from the most economical equipment, from the most effective driving practice to the least effective driving practice.

1. Equipment Variables

   a. The weight of the car and the size of the engine have the most effect on gasoline mileage. A car that weighs 4,800 - 5,200 lbs. will use about twice the amount of fuel as will a car of 2,400 to 2,600 lbs.

   b. An automatic transmission normally reduces the gas mileage (compared to a manual transmission).

   c. Optional equipment, such as air conditioners and and other items, reduce gas mileage by added weight and also by operations.

   d. Radial tires will increase gas mileage over bias-ply tires. Savings vary with the type of car, type of tire, and driving conditions.

   e. A properly tuned car will usually obtain at least 5 - 8% better mileage.

2. Driving Practices

   a. The rate of acceleration is an important variable in gasoline consumption. Moderate acceleration will usually save 10-20% over rapid acceleration.

b. Gasoline mileage is usually at a maximum between 35 and 40 m.p.h. with no rapid or extensive speed changes.

c. Extensive changing of speed (fast to slow and slow to fast) decreases gas mileage.

d. Use of the brake and driving in low gear ranges decreases gas mileage.

e. Warm-up or idling the engine increases the consumption of gasoline. The amount used varies with the type and size of the engine. Substantial savings can be obtained by reducing idling in a car with a large engine.

3. Driving Conditions

a. Stop and go driving (city) increases gasoline consumption.

b. Short trips increase gasoline consumption.

c. Hilly or mountainous terrain increases gasoline consumption.

PURPOSE: To investigate various factors related to the use of wood for heating.

LEVEL: 7-9
10-12

AREA: Natural Resources

TOPIC: Heating Fuels

CONCEPT: Consumer decision making - comparison of fuel costs.

REFERENCE: Toth, N. June, Cikach, F. S., and Frankovits, N. D., Maple Heights City School District Environmental Education Programs, Final Report. Maple Heights, Ohio, June 30, 1977, pp. 1-4.

ACTIVITY: Many people are converting from other fuels to wood to heat their homes or heating parts of their homes with wood fuel.

Table 1 gives the approximate weight and heating value per cord of different woods, both green and air-dried.

TABLE 1

SPECIES	WEIGHT		AVAILABLE HEAT	
	GREEN	AIR-DRIED	GREEN	AIR-DRIED
	Pounds	Pounds	Million BTU	Million BTU
Ash	3,840	3,440	16.5	20.0
Aspen	3,440	2,160	10.3	12.5
Beech, American	4,320	3,760	17.3	21.8
Birch, yellow	4,560	3,680	17.3	21.3
Elm, American	4,320	2,960	14.3	17.2
Maple, red	4,000	3,200	15.0	18.6
Maple, sugar	4,480	3,680	18.4	21.3
Oak, red	5,120	3,680	17.9	21.3
Oak, white	5,040	3,920	19.2	22.7
Pine, eastern white	2,880	2,080	12.1	13.3

Air-dried means with 20 percent moisture in terms of oven-dry weight, or 16.7 percent in terms of total air-dried weight. One BTU (British Thermal Unit) is the amount of heat required to raise the temperature of one pound of water 1°F. Available heat equals calorific value, minus loss due to moisture, minus loss due to water vapor formed, minus loss in heat carried away in dry chimney gas. Flue temperature 450°F., no excess air. (Data supplied by Forest Products Laboratory, Madison, Wis.)

Table 2 shows the relationship between species, pounds per cord, usable fuel value per cord and the price per cord equivalent to oil at 42¢ per gallon. Keep in mind that this table was computed using 65% oil burner efficiency and a stove efficiency of 50%. Furnace efficiencies typically range between 50-75% while wood stove efficiencies range from 15% for a fireplace up to 85% for air tight stoves under optimum conditions.

TABLE 2

SPECIES	AVERAGE DENSITY lbs/cord 20% Moisture CONTENT	POTENTIAL USABLE FUEL VALUE PER CORD (BTUs)	PRICE/CORD @50% EFFICIENCY EQUIVALENT TO OIL AT 42¢/gallon
White Oak	4,400	30,800,000	$71.14
Sugar Maple	4,000	28,000,000	$68.61
American Beech	4,000	28,000,000	$64.68
Red Oak	3,900	27,300,000	$63.06
Yellow Birch	3,800	26,600,000	$61.44
White Ash	3,700	25,900,000	$59.83
American Elm	3,400	23,800,000	$54.97
Red Maple	3,400	23,800,000	$54.97
Paper Birch	3,400	23,800,000	$54.97
Douglas Fir	2,900	21,400,000	$49.43
Eastern White Pine	2,200	15,800,000	$36.49

Activity 1: Stove Design

Homemakers are turning to wood for heat as the price of heating oil goes up. Problems have arisen, however, in the transition from oil heat to wood heat due to the lack of homeowner experience with the convenient and safe methods of cutting, splitting and burning wood. In this activity, you will be thinking of ways to improve stove efficiency, wood burning convenience and stove safety.

Part 1 - Stove Design

Design, using proper drafting techniques, a wood burning stove that incorporates the following features:

a. inexpensive materials
b. ease of construction
c. durability
d. heat output control
e. minimum creosote buildup in flue
f. ease of operation
g. beauty
h. safety in operation
i. efficiency

Make a drawing of your design. Outline how your stove satisfies each of these design features. Optional: list construction materials and their cost. List construction procedure.

Part 2 - Wood Burning Convenience

List ten ways to make wood heat more convenient. (i.e., decrease the number of times the wood is handled, combine storage and drying facilities) List and describe specific tools and facilities that would make the handling and burning of wood easier. (i.e., house modifications such as enlarged basement openings, attached wood sheds, etc.) Optional: sketch one or more of your ideas.

Part 3 - Safety

Insurance rates for homeowners who burn wood in space heaters are higher than for homeowners who burn oil. The higher rates are in part due to the number of improperly installed and poorly operated stoves which cause house fires. Call your local fire inspector and find out what safety precautions are necessary for installing and operating a wood stove.

Activity 2: Cost of Using Wood Fuel

Part 1 - Comparison of Wood Fuels to Other Fuels

Use the data in Table 1 to calculate the cost of the most common green and air-dry wood in your area to (1) coal, (2) fuel oil, (3) piped gas, (4) bottled gas, and (5) electricity.

Part 2 - Comparison of Cost of Green Wood to Cost of Air-Dried Wood

Use the data in Table 1 to determine a reasonable difference to expect in the cost of a cord of green wood compared to the cost of a cord of air-dried wood.

PURPOSE: To investigate rates of consumption of various resources.

LEVEL: 7-9
10-12

AREA: Natural Resources

TOPIC: Consumption of Natural Resources

CONCEPT: Relationship of rate of use of resources to community factors.

NOTE: Figures cited are average of those reviewed. They are neither the high nor the low figures.

ACTIVITY: Presented are a series of activities that can be used to focus on the problems of consumption and use of resources. Suggested questions will be applied to most activities, but you should consistently raise at least these questions:

1. Is the resource renewable (wood vs. oil)?;
2. Can the "waste" be recycled (newspapers)?;
3. Can the "waste" be re-used or used in some other way (motor oil)?; and
4. Can the use be reduced by changes in technology or methodology (wastewater reduction)?

To meet the needs of the average U.S. community approximately 140-160 gallons of clean water are needed per person per day.

1. Use the population of your community to determine the amount of water that would be needed by an average water system:
   a. each day
   b. each week
   c. each month
   d. each year.
2. Consult the water department in your town, city, or rural area. Determine the average use in your community per day. It your use higher or lower than the "average"? Why do you believe it is higher or lower?
3. What are the major users of water in your community? How could their use of clean water be reduced?

Americans use a large number of metal cans each year. While figures vary, it is estimated that over 35,000,000,000 cans were used in 1975. This represents an extensive use of metal, energy, and money.

1. Keep a record for one week.

   a. How many cans does your family use?
   b. How many cans did your family use per person for that week?
   c. What % of the cans were recycled (compared to those that were thrown away)?

2. Is recycling of cans done in your community? If no, discuss how such an effort might be started. If yes, discuss the process in class.

3. Compare the costs of items in throw-away bottles (non-returnable), returnable bottles and cans. Discuss the data and whether the pricing structure encourages or discourages conservation.

During 1974 it is estimated that United States service stations disposed of over 450,000,000 gallons of used oil. Disposal of used oil can be both a waste of natural resources and an environmental problem.

1. Check with service stations in your community to determine how they dispose of motor oil wastes.

   a. Are they dumped?
      1. In the sewer system?
      2. Outside -- into a ground or water deposit area?
      3. If yes, to either of the above, what are the potential hazards to the community?

   b. Are they recycled?
      1. For re-use as a motor oil?
      2. For chemicals?
      3. For use as a fuel?
      4. For use as a road binder?
      5. Other?

   c. If the oil is not reused, try to determine why.

   d. If the oil is re-used, consider how the oil might be better used from the standpoint of wise use of natural resources.

PURPOSE: To investigate ways of reducing water consumption in the home.

LEVEL: 7-9
10-12

AREA: Natural Resources

TOPIC: Water Conservation

CONCEPT: Consumer decision making - reduction of water usage and associated cost

REFERENCE: "Water Conservation and Wasteflow Reduction in the Home." Special Circular 184. William Sharpe, The Pennsylvania State University, College of Agriculture, Extension Service and The Institute for Research on Land and Water Resources, University Park, Pennsylvania.

ACTIVITY: Read the attached article and compare costs for your family with the estimated costs in the article.

For most of us water is never more than a few steps away. The opening of a faucet, the press of a button, or the turn of a cap is all that is necessary to quench our thirst. This closeness of water to our daily activities tells us that 1) water is relatively abundant and 2) it is vital to our existence.

In spite of its importance, all of us take water for granted. We are unconcerned with the source of water flowing from the tap or how the water has been treated before arriving at our homes. As long as we have water in unlimited supply and of obviously good quality, we are satisfied.

As pollution of our water resources increases, the degree of treatment required to improve the quality of this water to the point where it is acceptable for home use also increases. Elaborate and expensive water treatment facilities are becoming necessary in many areas of the country. True, the fight against water pollution has resulted in cleaner water in many areas, but nationally we are still polluting more than is being cleaned up. In many areas ground water supplies for individual homes are becoming polluted. These people are unable to afford expensive individual water treatment devices; consequently, they are faced with the grim prospect of buying drinking water and having it hauled to their homes.

When one adds to pollution the fact of increasing water demands, the situation does not look any better. The average use of water per person has risen from 115 gallons per day in 1920 to 150 gallons in 1960. This upward trend appears to be continuing. In addition, new households are being formed at the rate of 2 million per year with an

expected increase to 3 million per year by 1980. This translates to an increased water usage rate of 623 million gallons per day in 1971 over 1970, and a projected rate of increase of 915 million gallons per day in 1980 over 1979. Total water consumption for domestic use will increase by 7 billion gallons per day in the nine years between 1971 and 1980.

Most of the water that comes into our homes is used to remove wastes. Washing clothes, dishes and ourselves, plus flushing the toilet and washing the car account for most of the water used in the home. Drinking and cooking are really insignificant uses of water compared to the amount we use for waste removal. The following chart is an example of how water is used by a typical American family of four.

Use	Gallons Used per Day
1. Dishwashing	15
2. Cooking, drinking	12
3. Utility sink (washing hands, etc.)	5
4. Laundry	35
5. Bathing	80
6. Bathroom sink	8
7. Toilet	100
	255

Several things are apparent from the chart. Toilet water usage is the largest of any of the items on the list. It accounts for more water than all other categories combined with the exception of bathing. Next to bathing, the most water is used for doing the laundry.

Now let us look at what happens to this 255 gallons of water after it has been used in the home and leaves as wastewater. Let us assume that the drains from the home are connected to a sewer line. These sewer lines run under the streets of the town to the sewage treatment plant. Wastewater usually flows in these pipes by gravity; consequently, they are called gravity sewers. In older towns storm drains are connected to this system so that rainwater also goes to the sewage treatment plant. During periods of high rainfall much of the flow must be diverted around the treatment plant and into streams because the plants cannot handle the increased volume of wastes. Newer wastewater collection systems separate storm water into storm sewers and wastewater into sanitary sewers.

There are basically two types of sewage treatment, primary and secondary. Most new plants are required to have both of these treatments. Some of the most modern plants have a third type of treatment known as tertiary. During primary treatment, solid materials are removed from the

wastewater. This is done by first passing the wastewater through a series of screens. The screens remove the larger floating objects. From there the waste water passes into a grit chamber which allows sand and small stones to settle out. The wastewater then moves out of the grit chamber into a sedimentation tank where the smallest particles suspended in the wastewater settle to the bottom, producing a black, oily appearing sludge. Finally the wastewater is chlorinated. If secondary treatment follows primary treatment, chlorination is the last step in the secondary treatment process.

Secondary treatment removes up to 90 percent of the organic matter contained in the wastewater after primary treatment. If not removed, this organic matter would rob the receiving streams of oxygen. The two types of secondary treatment used most widely are the trickling filter and activated sludge methods. The trickling filter consists simply of a bed of stones varying in depth from three to ten feet, through which waste water is trickled. The stones are colonized by bacteria which feed on the organic matter in the wastewater as it passes over them. In this way most of the organic matter is removed from the wastewater. Pipes at the bottom of these stone beds carry off the cleaner water to be chlorinated and released to the receiving stream.

The activated sludge process uses a different means to accomplish the same end as the trickling filter. The work of the bacteria is speeded up by the addition of air and sludge, laden with bacteria, to the wastewater. This is done in an aeration tank. After several hours in the aeration tank the wastewater is conveyed to a sedimentation tank where solid materials settle out. The wastewater is then chlorinated and released to the receiving stream, while the sludge is conveyed back into the aeration tanks for reuse.

After primary and secondary treatment the wastewater still contains nutrient materials such as nitrogen and phosphorus which may cause problems of over-fertilization in receiving streams. To cope with this problem various tertiary treatments are being developed. One of the most promising of these involves the application of secondary treated wastewater to land through a spray-irrigation system. The vegetation and soil material act as a "living filter" to remove these nutrient materials which are then available as plant fertilizer. Alternatives to spray-irrigation involve mechanical removal of nitrogen from wastewater by a system that copies natural processes. Lower volumes of sewage result in a better primary and secondary treatment.

Other sewage disposal systems are widely used. Two such systems are lagoons and septic tanks. A septic tank is simply a concrete tank into which wastes from an individual home flow. In the tank solids settle to the bottom and bacteria begin to break down some of the organic matter. The overflow from the septic tank flows into an underground drainage field where soil organisms complete the breakdown of the sewage. Unfortunately, septic tanks work well only on soil that can accept the septic tank overflow at an adequate rate. Generally, the less water moving through this type of system the better.

Lagoons are often used as a less expensive way to treat sewage from small communities. They consist of an oxidation pond or ponds in which the sewage is broken down by bacteria. Oxygen is supplied by the air, and sunlight supplies energy to help in the treatment process. The volume of wastes is especially critical in lagoons. This treatment process is slow; consequently, wastewater must be retained in the system for several days or more depending on conditions at the lagoon.

Water Conservation

As we have seen, it takes a lot of effort and expense to keep an adequate supply of good water flowing from the taps in our homes and to dispose of the wastewater that results from home water use. It should be obvious that the less water we use, the less effort and expense is required to supply us with water. Similarly, the less water we use, the smaller the volume of wastewater produced and the less it costs to treat it. Where sewage treatment plants are already overloaded, a reduction in wastewater volume would lessen pollution significantly by improving waste treatment.

The conservation of water used in the home, unlike other efforts to conserve electrical energy and save heating oil, does not require a change in life style or personal habits. Unlike expensive auto emission control equipment, the simplest water conservation measures cost only a few cents, and even the more expensive ones easily pay for themselves over time. All of these measures will actually save you money. Almost all the devices are designed to save water while resulting in a minimum of inconvenience to the water consumer. The water conservation measures we are about to discuss actually make life a little easier and a little cheaper.

WATER-USING APPLIANCES

Automatic Washers -- The most common water-using home appliance is the automatic washer. Its convenience and labor saving value to the housewife have been tremendous. Unfortunately, automatic washers use much more water than the old wringer-style washer. Water consumption by automatic washers ranges from 20 to 30 gallons per wash load, the exact figure varying according to habits of the user and the type of washer. Washers with suds savers use less water by providing for the reuse of wash water for a second wash load.

Water savings may also be achieved by automatic washers that allow the amount of water used to be adjusted for load size. This feature enables the housewife to use less water for smaller loads of clothes. If a washer does not have this feature, water can still be saved by washing only when there are enough soiled clothes to make a full load.

Automatic Dishwashers -- The automatic dishwasher has done much to relieve the housewife of this unpleasant mealtime chore; however, dishwashers use water extravagantly, between 13 and 19 gallons of water per day. If dishwashers are loaded to capacity for each use, worthwhile water savings can be obtained.

It should be noted that following the above procedur[illegible]ave water also saves energy by limiting hot water use in autom[illegible]washers and dishwashers (it takes energy to heat water).

WATER-SAVING DEVICES

Faucet Aerators -- Faucet aerators are already in wide use. Faucets with aerators provide a nice even flow and reduce splashing. By mixing water with air they reduce the amount of water flowi[illegible]from a faucet. The air added to the water as it leaves the faucet makes a stream of air and water. This gives the illusion that more water is flowing from the tap than actually is. When water is left running to wash something, as in rinsing dishes or washing one's hands, less water is actually used.

Faucet aerators are easy to install and quite inexpensive. The following table gives cost estimates for the faucet aerator:

COST EXTIMATES FOR A FOUR MEMBER FAMILY

Material cost 2 aerators @ $1.50	$3.00
Labor cost 1/6 hr. (non-professional)	0
Total installation cost	3.00
Expected life (15 years)	
Cost per year	.20
Maintenance and power saved per year	0
Cost of water saved per year	
2 gpd (365 day/yr) X $.42/1000 gal.	.31
Cost of power saved per year	
(½) (2gpd) (365 day/yr) X $.44/1000 gal.	.24
Cost of sewage saved per year	
2 gpd (365 day/yr) X $.44/1000 gal.	.32
Total savings per year	.87
Net savings per year $.87 - $.20	.67
Water saved per day -- 2 gallons	

Spray Taps -- Spray taps are one of the latest developments in water-saving devices. These taps are actually mini-showers designed for use in lavatory sinks and wash basins. Water is sprayed from the tap rather than issuing forth in a single stream as is the case with conventional faucets. The spray allows for faster washing and rinsing with less water use as a consequence. When such devices are conbined with thermostatic mixing valves water savings of up to 90 percent are claimed by the manufacturer. The saving of hot water is especially significant, since it results in a saving of energy as well.

Flow Control Devices -- These are used to limit the rate of flow from shower heads and faucets. These devices are usually nothing more than valves that fit into the supply lines for faucets or showers. Flow is usually limited to 2.5 gallons per minute from faucets and 3 gallons per minute from showers. Normal flow from showers varies between 5 to 15 gallons per minute. Water savings of 50 to 70 percent are claimed for flow-limiting shower heads and up to 50 percent for faucets. Assuming average shower usage, more than 2,000 gallons of water may be saved per person per year. A similar type of device is the thermostatic mixing valve. These valves permit mixing of hot and cold water to preset temperatures. Water issues from the tap at this temperature. In this manner water is not wasted while its temperature is being adjusted by manipulating the hot and cold water faucets.

Substantial savings can be achieved with flow-limiting devices in shower heads. The following table estimates their savings.

COST ESTIMATES FOR A FOUR MEMBER FAMILY

Material cost flow control shower head @ $15.00	$15.00
Labor cost 2 hr. @ $7.50/hr.	15.00
Total installation cost	30.00
Expected life (15 years)	
Cost per year	2.00
Maintenance and power cost per year	0
Cost of water saved per year	3.70
Cost of power saved per year	4.40
Cost of sewage saved per year	3.90
Total savings per year	12.00
Net savings per year	10.00
Water saved per day -- 24 gallons	

Improved Float Assemblies -- Float assemblies of improved design are now available at most hardware stores. These are easily installed in most conventional water closets and sell for about four or five dollars. Water savings are achieved using these devices by adjusting them to maintain a lower water level in the toilet reservoir. Some manufacturers also claim that their devices facilitate the detection of leaks. Flushing efficiency is not impaired when water levels are lowered using one of these devices.

Shallow Trap Toilets -- Shallow trap toilets are now being manufactured in this country. They are required by local plumbing codes in some areas of the East. The principal feature of this type of toilet is a smaller water reservoir than that of a conventional toilet. These toilets use only 3½ gallons per flush as compared to 5 or 6 gallons for a standard toilet. This amounts to a savings of 7½ gallons per day for the

average person. Shallow trap toilets are operated the same way as conventional toilets and are no different in appearance. The following table compares costs and savings of shallow trap toilets.

COST ESTIMATES FOR A FOUR MEMBER FAMILY

Material cost (1 shallow trap water closet) @$70.20	$ 70.20
Labor cost 4 hrs. @ $7.50/hr.	30.00
Total installation cost	100.20
Expected life (20 years)	
Cost per year	5.01
Maintenance and power cost per year	0
Cost of water saved per year	4.60
Cost of power saved per year	0
Cost of sewage saved per year	4.80
Total savings per year	9.40
Net savings per year	4.39
Water saved per day -- 30 gallons	

Flush Valves -- Flush valves are widely used in office and other commercial buildings. They do not require a reservoir as do conventional household toilets. The flush valve automatically delivers the required volume of water to flush the toilet with no excess to be wasted. Water flow ceases when flushing is completed. Flush valves are especially adapted to installation as a two cycle system in which two volumes of water are utilized for flushing, one for feces and a smaller one for urine. This is made possible by installing two valves in parallel in the water line. A disadvantage of flush valves is that they require larger water supply lines than are standard in most homes; however, this would not preclude their use.

Initial costs of flush valves would be higher than any of the devices that we have thus far looked at, but cost reductions in water and sewage would offset these costs in the long run. The following table analyzes these costs:

COST ESTIMATES FOR A FOUR MEMBER FAMILY

	1 Valve	2 Valves
Material cost 1 or 2 flush valves $40 ea., piping $20	$60.00	$100.00
Labor cost 5-6 hr. @ $7.50/hr.	37.50	45.00
Total installation cost	97.50	145.00
Expected life (15 years)		
Cost per year	6.50	9.65
Maintenance and power cost per year	.75	1.50

COST ESTIMATES FOR A FOUR MEMBER FAMILY
(Continued)

	1 Valve	2 Valves
Cost of water saved per year	4.60	7.05
Cost of power saved per year	0	0
Cost of sewage saved per year	4.80	7.40
Total savings per year	9.40	14.45
Net savings	2.15	3.30
Water saved per day: 1 valve - 30 gallons, 2 valves - 62 gallons.		

Siphon-Jet Toilets -- Siphon-jet toilets are so called because when flushed, water is siphoned from the toilet reservoir rather than emptied by gravity flow. Such a design permits smaller volumes of water to be utilized in flushing the toilet bowl. Toilets of this type have been used in Britain for many years and are now available in this country. Water use for U.S. models is reported by the manufacturer to be one third of that for his conventional models.

An improvement to this toilet that is finding wide acceptance in Britain is the two cycle siphon-jet toilet. The difference between this toilet and the standard siphon toilet is that there are two separate flush cycles, one for urine and one for feces. The solid waste flush cycle uses 2.5 gallons per flush while the liquid waste cycle uses only 1.25 gallons per flush. The flush cycles are initiated by a short, sharp pull on the flush handle for the smaller amount of water, and a longer, more persistant pull for the larger amount of water. When these figures are compared to the 5 to 6 gallons of water used to flush our standard toilets, the tremendous potential water savings is obvious. Unfortunately, these toilets are not as yet being manufactured in the United States.

By combining several of the water saving devices that have been discussed an even greater total saving of water can be obtained. For instance, if a shallow trap toilet reservoir, a flow control shower head, and two faucet aerators are installed in a single home, the cost estimates would be as in the following table.

COST ESTIMATES FOR A FOUR MEMBER FAMILY

Material cost	1 shallow trap res. @ $70.20 1 flow control shower @ $15 2 aerators @ $1.50	$ 88.20
Labor cost 6 hr. @ $7.50/hr.		45.00
Total installation cost		133.20
Expected life (15 years)		
Cost per year		6.45
Maintenance and power cost per year		0
Cost of water saved per year		8.10
Cost of power saved per year		4.37
Cost of sewage saved per year		8.62
Total savings per year		21.09
Net savings per year		14.64
Water saved per day -- 56 gallons		

Recycling Wastewater -- The recycling of resources is a popular concept that has wide implications in resource conservation. Recycling has a definite place in home water use. Various methods such as distillation, freezing, reverse osmosis, electrodialysis, and refinements to processes already in use such as oxidation, chemical-mechanical removal, and filtration show promise. All of these methods currently have severe limitations which prevent their widespread adoption. In most cases such treatment is simply too expensive.

Recent studies have shown that wastewater from sink, bathtub, and laundry drains is satisfactory for reuse in toilet flushing without treatment other than simple filtering. Wastewater from these drains can be stored in a tank connected to the toilet reservoir. In this manner most of the water usually required for toilet flushing can be saved. A system of this type has been in operation at the Grand Canyon for many years. Staining agents and bacteria may pose problems with this type of reuse. Color and murkiness will normally also be present to a degree. This may be objectionable to some people. Recycling of water to flush toilets is already in use in some water-short areas of the country. Below is a cost estimates table for a home with a wastewater recycling system for toilet flushing.

COST ESTIMATES FOR A FOUR MEMBER FAMILY

Material cost tanks and piping @ $95	$235.00
pump and filter @ $140	
Labor cost 12 hrs. @ $7.50/hr.	90.00
Total installation cost	325.00
Expected life 10 years (main components)	
Cost per year	32.50
Maintenance and power cost per year	3.65
Cost of water saved per year	16.10
Cost of power saved per year	0
Cost of sewage saved per year	15.30
Total savings per year	31.40
Net savings per year	4.75
Water saved per day -- 100 gallons	

Vacuum System -- In this system a vacuum pump removes wastes from the toilet and transports them to a holding tank from which they are fed into the sewer line. Such a system uses a mere 10 percent of the water required by the standard flush toilet. This type of system is too expensive for installation in individual homes but it appears to be attractive where many toilets can be joined to a central vacuum system as in hotels or housing developments. The effects that vacuum systems will have on conventional sewage treatment facilities is not known.

Many devices are available to conserve water, reduce wasteflow, and save energy in the home. Most of these devices are inexpensive and relatively easy to install. Over the long run these devices will save you money on fuel, electric, sewage and water bills, at no inconvenience to you. If water-saving devices are adopted on a community-wide basis, millions of gallons of water can be saved. These savings may buy more time for planners, delay the need for expensive water and wastewater treatment expansion, improve water quality by lessening the load on sewage treatment and septic tank systems, and help conserve our valuable energy resources. The result will be a cleaner environment for everyone.

GRADE LEVEL 10-12

106

PURPOSE: To show the savings that can be made through home gardening. (Could easily be tied in with a botany unit.)

LEVEL: 4-6
7-9
10-12

AREA: Foods

TOPIC: Home Gardening

CONCEPT: Consumer decision making - food marketing

ACTIVITY: Materials: Various containers (cut-off plastic milk jugs would work well); rich soil; vegetable plants or seeds; watering containers.

Procedure: Divide the students into groups. Give each group a container, soil, and a watering container. Then distribute different plants or seeds to each group. Let the students plant the seeds or plants according to instructions.

After plants have reached maturity and vegetables are fully developed, have the students figure cost per vegetable (per weight unit; e.g. kg. or lb.), including soil (if it was purchased), fertilizers added (if any), container (if purchased), and cost of plant or packet of seeds.

Then, using a newspaper ad, or by a trip to a supermarket, figure the cost per vegetable if it were purchased. Compare. Was the savings worth the effort? How would the savings add up over a long period of time for a whole family? Would the plant's vegetables develop sooner if you started with plants rather than with seeds? If the answer is yes, is the time saved (as compared to seeds) worth the extra expense?

Great care will need to be taken to select plants that will grow and produce in the classroom. Probably very few will prosper in this environment. If gardening is done outdoors, winter weather will probably limit gardening to early fall or late spring. In this case quick growing crops like radishes, leaf lettuce, and spinach should be grown so that the students actually do see the produce.

PURPOSE: Introduce students to a variety of food choices and factors to be considered in decision making.

LEVEL: 4-6
7-9
10-12

AREA: Foods

TOPIC: Variations in One Type of Product

CONCEPT: Consumer decision making - product comparisons

REFERENCE: Teaching Personal Economics in the Home Economics Curriculum. Joint Council on Economic Education, New York, N.Y., 1971.

ACTIVITY: Introduce students to a variety of product choices which they must make with just one food type by preparing four types of orange juice drink to be tasted and compared by students. Use either fresh oranges, frozen concentrate, canned juice, or powdered concentrate.

Keep juices in opaque containers to prevent light oxidation which results in very bad off flavors.

Activities and Discussion:

1. Use a score card to compare flavor, nutritive value, color, cost and preparation time.

2. Locate information (labels) which will enable students to compare the nutritive value of the products under consideration. Discuss nutritive value of fruit juice in the diet.

PURPOSE: To learn about food additives and the reasons for their use.

LEVEL: 4-6
7-9
10-12

AREA: Foods

TOPIC: Food Additives

CONCEPT: Consumer decision making - food additives

REFERENCE: Consumer and Homemaking 3-4, Manual for Career Education, James C. Stewart, Comp. Knox County Schools, Knoxville, Tenn.

ACTIVITY: Collect several different food labels for each student or group of students. Have them study the labels to see what additives have been added to the food. Assign each student or group a different additive to research as to reason for use, effectiveness, etc. (The type of product in which the additive was used could be a hint for further research.) A demonstration or class report could be used to show findings.

PURPOSE: Have students critically evaluate information on food products in terms of health standards, costs, etc.

LEVEL: 7-9
10-12

AREA: Foods

TOPIC: Nutrition of Disadvantaged People

CONCEPT: Consumer decision making - nutritional and dietary value

REFERENCE: Teaching Personal Economics in the Home Economics Curriculum. Joint Council on Economic Education, New York, N.Y., 1971.

ACTIVITY: Lower-income families are aided by measures which redistribute national income. This is done principally through public aid programs, transfer payments and supplemental food programs.

Read newspaper and magazine articles about the current nutritional status of people in Appalachia and other depressed areas of the country, or obtain information about low income people in the local geographical area from a social welfare worker, county extension agent, or public health worker.

Possible problem and discussion topics are:

1. What types of diets do these people have? What are some of the inadequacies in their diets? Identify some of the factors which might be responsible for the inadequate diets. (Limited industry and agriculture to sustain local economy; income limited due to low salaries and/or unemployment; limited education prevents employment, mobility, and basic health knowledge.)

2. There is evidence that people with inadequate diets have a greater frequency of illness compared to others with more adequate diets. What are the costs to them personally? What does people's poor health status cost the economy of the country? (Cost of labor in relation to output would increase, welfare expenditures of the government would be increased.)

3. Is there evidence that people in higher income brackets might also have nutritionally inadequate diets? (Research has indicated that people in higher income brackets have inadequate nutrition, but people in the lower income brackets more frequently have nutritional inadequacies.)

4. Consider the effects that television advertising (e.g. potato chips, pop, beer, ready-made dishes, baking mixes) has on these people in relation to what they want to or ought to buy.

PURPOSE: Have students critically evaluate information on food products in terms of health standards, costs, etc.

LEVEL: 7-9
10-12

AREA: Foods

TOPIC: Health Foods and Supplements

CONCEPT: Consumer decision making - nutritional and dietary value

REFERENCE: Teaching Personal Economics in the Home Economics Curriculum. Joint Council on Economic Education, New York, N.Y., 1971.

ACTIVITY: Advertising and labels of food products can be a source of valuable information when determining how to spend the food dollar.

Claims for "health foods" and "food supplements" should be critically evaluated in terms of health standards as well as the Opportunity Cost of choosing other foods.

Exhibit some examples of health foods and locate advertisements in magazines and newspapers, and on TV which make food claims dealing with pills, specially-grown or processed foods, and food supplements.

Possible discussion questions and activities:

1. Analyze the statement and claims about these foods to determine whether they represent half-truths, incomplete facts, misinformation, or superstitions and/or analyze the following claims: "melts away fat as you continue to eat foods you enjoy," "gives you that exhilerating feeling," "keeps you from the depths of fatigue," "prevents that bogged down feeling."

2. What are the "real costs" of these foods and/or pills to the consumer? (Expensive--health may suffer due to omissions from the diet.)

3. Research the amount of money Americans spend annually on food fads and report to the class. Are the sales of health foods important to the American economy? (Depending on the amount of sales they might be quite important.)

4. Who benefits from the sales of health foods?

5. What protection does the consumer have against fraudulant health food products and claims? (Buying from reliable merchants; obtaining information from consumer-

sponsored agencies and from professional associations; an protection by government through the Federal Food and Drug Administration.)

6. What would be the effect on the cost, availability, and quality of food grown without the use of pesticides, fertilizers and industry processing?

PURPOSE: Introduce students to nutritional value of various foods and relate this to consumer decision making.

LEVEL: 7-9
10-12

AREA: Foods

TOPIC: Meal Planning: Considering the Needs of Different Family Members.

CONCEPT: Consumer decision making - nutritional and dietary value

REFERENCE: Teaching Personal Economics in the Home Economics Curriculum. Joint Council on Economic Education, New York, N.Y., 1971.

ACTIVITY: After students have gained familiarity with recommended daily dietary allowances, food nutrients, and meal planning guidelines, present the following menu pattern:

MENU*

Broiled Chicken (3oz.)
Baked Idaho Potato — Whole Green Beans
Sliced Tomatoes (3 sl.) with Mayonnaise — Dinner Rolls (1 roll) and Butter
Apple Pie (3" serving)
Milk (8 oz.)

*Indicate prices per serving. Use frozen green beans, brown-and-serve rolls, and ready-made pie.

Have students, in groups or individually, make the following modifications:

1. Assume you have a limited budget but want to maintain approximately the same nutritional value, modify the above-mentioned menu so this can be accomplished.

2. Assume you are celebrating and have a liberal budget for this meal; maintain approximately the same nutritive value and modify the above-mentioned menu.

3. Assume you are the parent of a 16-year old boy who is participating in a high school athletic program. His coach suggests he eat a high protein diet. Modify the above-mentioned family menu to meet his needs.

4. Discuss the use of this menu for an infant. What modifications might be needed? Consider cost and convenience of this menu vs. baby food.

In each of the cases above have the students:

a. Compute the cost of the modified menu and compare this to the estimated cost of the basic menu given. What differences are there? Identify some factors which may be responsible for this difference (refer to newspapers and magazine articles for economic conditions).

b. Identify sources of information available to the homemaker in this community which would be helpful in making wise consumer decisions in food selection. (Newspapers, magazines, local radio or television, shopping guide programs, company home demonstration agent.)

c. Which of the foods in the menus seem to represent the largest proportion of the food dollar? Have these particular foods increased in price within the past year? Have other food groups increased proportionately in price also? What action might the consumer take in order to show concern and/or displeasure with the current market conditions?

PURPOSE: To test the accuracy of "scientific claims" in advertising.

LEVEL: 7-9
10-12

AREA: Advertising

TOPIC: Accuracy in Advertising

CONCEPT: The effects of advertising on consumer decision making

REFERENCE: "Experiment Through Advertising." Gerald H. Krockover. Science and Children, January/February, 1973, pp. 28-29.

ACTIVITY: Collect advertising that involves experiments conducted in a scientific manner. Have the students identify as many variables as possible which could affect the outcome. Once these are listed, gather materials and have the students test the product, keeping variables in mind. After data are gathered, graph or chart results. Compare class results to advertisement results. What variables did the manufacturer use? What variables did he neglect to use?

PURPOSE: Provide a method for making shampoo inexpensively.

LEVEL: 4-6
7-9
10-12

AREA: Health

TOPIC: Making Your Own Shampoo

ACTIVITY: A good shampoo cleans hair and scalp gently. It should remove some oils, but still leave some oil. You can make your own shampoo for less money than the store-bought type. You can also modify the shampoo by changing the proportions of the ingredients. Increase the soap for cleansing, herbs for conditioning, and oil for fragrance.

Materials

1 1/2 - 2 oz. of herbs, such as rosemary, chamomille
12 oz. of water (distilled or soft water works best)
1 oz. of castile soap
One or two drops of a good essential oil (rosemary, lavender, etc.)

Procedure: Place the water and herbs in a pot that is not metal. Boil, then cover and simmer for 4-6 minutes. Turn the heat off and steep the herbs for 15-20 minutes. Pour the material through a fine strainer and save the strained liquid. Add the soap and stir until the soap is blended. Add the fragrance.

Note: An "acid" rinse is recommended after using this shampoo. It will remove the soap particles that often remain in your hair after shampooing. An acid rinse can be made by placing 1 tablespoon of apple cider vinegar in a quart of water (plus some fragrance).

PURPOSE: To demonstrate the relationship between prescription and non-prescription drugs.

LEVEL: 4-6
7-9
10-12

AREA: Health

TOPIC: Drugs

CONCEPT: Consumer protection as related to drugs.

REFERENCE: Consumer and Homemaking 5-6 Manual for Career Education. Knox County Schools, Knoxville, Tennessee.

ACTIVITY: After the development of some background information, the class should discuss the taking of prescription and non-prescription drugs and their effects on the body. Why are prescription drugs classified as such? Non-prescription?

Discuss:

1. Storage of medicines.
2. Disposal of unused or old medicines.
3. Protection of young children.
4. Poison control centers.

Encourage students to inventory their own homes (with parents' aid and approval) for safety, etc. of medicines and for possible disposal of old or unused ones.

PURPOSE: To provide information for making decisions regarding over-the-counter medicines.

LEVEL: 7-9
10-12

AREA: Health

TOPIC: Relief from Symptoms of the Common Cold

CONCEPT: Sources of information with respect to consumer decision making - drugs.

REFERENCE: Hecht, Annabel. "The Common Cold: Relief But No Cure." FDA Consumer, September 1976. (HEW Publication FDA 77-3029)

ACTIVITY: Read the following article. Based on the information presented, have each student select five non-prescription cold remedies and comment on the statements made on the package, on the type of relief inferred, and on the ingredients included.

THE COMMON COLD: RELIEF BUT NO CURE

After reviewing the ingredients that go into thousands of nonprescription drug products, an FDA advisory panel has concluded that a number of them will relieve cold symptoms but there is still no cure for one of mankind's most familiar maladies. The panel studied some 90 active ingredients that are used in cough, cold, and related products and gave its views on the safety and effectiveness of each one.

by Annabel Hecht

Had you lived in ancient Rome you might have sipped a broth made by soaking Allium cepa--an onion--in warm water to relieve the symptoms of the common cold. In Colonial America you might have relied on pennyroyal tea or an herbal concoction made from such unmedicinal sounding plants as sage, hyssop, yarrow, black cohosh, buckthorn, coltsfoot, goldenseal, cubeb berries, or bloodroot. In grandma's time, lemon and honey was a favorite recipe, or in extreme cases, a hot toddy laced with rum--the amount of same determined by the age of the drinker.

Today, if you don't have an old reliable remedy to fall back on, you might take one of literally thousands of drug preparations available without prescription. Some contain ingredients reminiscent of the folk medicine of the past; others are formulated with sophisticated chemical creations. Old or new, simple or sophisticated, many of these remedies will relieve some of the familiar cold symptoms, such as stopped-up nose or hacking cough. But not a single one of these products--on which Americans spend an estimated $700 million a year--will prevent, cure, or even shorten the course of the common cold.

So says a panel of non-Government experts called on by the Food and Drug Administration to study the safety, the effectiveness, and the accuracy of claims made on the labels of some 50,000 cold, cough, allergy, bronchodilator, and antiasthmatic drug products. The Panel is one of 17 set up by FDA to examine all nonprescription (over-the-counter) drugs marketed in the United States. The project, mandated by a 1962 Amendment to the Food, Drug, and Cosmetic Act which requires that all drugs be proven effective as well as safe, will eventually lead to the establishment of definitive Federal standards on ingredients and labeling claims for all nonprescription drugs.

The Panel indicated that proper use of nonprescription drugs can be effective in relieving cough, sinus congestion, runny nose, and some of the other symptoms associated with colds, allergies, or asthma. But it made clear that although these products may relieve certain symptoms they will not cure any of these conditions.

One aspect of this class of drugs that concerned the Panel was the relative scarcity of single ingredient products on the market. This is particularly true of cough and cold remedies. The common cold is a self-limiting respiratory infection which lasts from one to two weeks. It usually starts with a sore throat, sneezing, and runny nose. After a few days, the nose becomes stopped up and the eyes become watery. This is followed by lethargy, aches and pains, and sometimes a slight fever. Cough may occur in the later stages. Often these symptoms do not occur at the same time. Nevertheless, almost 90 percent of cough and cold products now available contain a combination of ingredients intended to relieve a number of different symptoms. Only 46 of the cough-cold products examined by the Panel consisted of a single active ingredient.

The Panel said it is "irrational" to take a combination product unless each of the ingredients is necessary to relieve the patient's particular symptoms. Moreover, because of variations in individual reactions to drugs, fixed combination may not be suitable for some people. Consumers need more choice in selecting the appropriate treatment for their symptoms, the Panel said, and recommended that all products to relieve cough and cold symptoms be available in both combination and single ingredient form.

Another area of concern to the Panel was labeling of cough and cold remedies. It said labeling for these products "tends to be overly complicated, vague, unsupported by scientific evidence, and in some cases, misleading." The Panel called for an end to claims that one product is superior to, stronger than, or contains more active ingredients than another, or is specially formulated. Under its recommendations such words as "cold medicine," "cold formula," or "for the relief of colds" would be banned from drug labels. Such claims suggest the product will cure a cold when the best it can do is relieve specific symptoms, the Panel said.

-Antihistamines, a class of drugs used to relieve sneezing and watery and itchy eyes, usually associated with hay fever and other allergies.

Each ingredient reviewed was placed in one of three categories:

Category I--Generally recognized safe and effective and not mislabeled.

Category II--Not generally recognized as safe and effective or mislabeled. Such ingredients and labeling claims will be removed from products within six months after FDA issues its final regulation on cough, cold, and related nonprescription drug products.

Category III--Available data insufficient to permit final classification at this time. The Panel recommended that when FDA issues its final regulations ingredients which are placed in this category be permitted to remain on the market for a stipulated length of time if the manufacturer immediately begins tests to satisfy the questions raised by the Panel.

Lucky is the cold victim who has only an annoying tickle in his throat or a stuffed up nose. The Panel found 7 ingredients both safe and effective as cough suppressants and 14 safe and effective as nasal decongestants. It recommended that one of the cough suppressants and four of the nasal decongestants which are not available only in dosage levels that require a prescription be made available in effective dosages that could be sold without a prescription.

Not so fortunate is the person whose cough is "nonproductive" or produces only small amounts of thick phlegm. Not one ingredient was found by the Panel to be both safe and effective as an expectorant. Similarly, the Panel found no ingredient both safe and effective as an anticholinergic to relieve watery secretions of nose and eyes.

Fifteen of the ingredients it studied are not generally recognized as safe and effective for cough and cold symptoms and should be taken off the market, the Panel reported. One of these is chloroform, which FDA already has banned on the basis of evidence that high doses of it can cause cancer in test animals.

A wide array of ingredients--52 all told--were considered by the Panel to be safe enough, but further proof of their effectiveness in relieving coughs and stuffy or runny noses is needed. Scattered throughout the list are names reminiscent of patent medicines and home remedies of the past: cod liver oil, slippery elm, cedar leaf oil, horehound, camphor, menthol, and oil from the koala bear's favorite food, eucalyptus leaves. The Panel recommended that these familiar remedies--as well as the rest of the 52 whose effectiveness it questioned--be permitted to stay on the market for from three to five years if their manufacturers undertake further tests to prove (or disprove) that grandma knew all along what was good for the sniffles.

As for the labeling of cough and cold remedies, the Panel recommended that cough suppressants be permitted to claim that they temporarily relieve coughs due to minor throat irritation, help to quiet the cough reflex, or help you to cough less. But the labels should warn that a cough may be a sign of a serious condition and that a physician should be consulted if it lasts more than one week. The Panel also recommended a warning that cough suppressants should not be used for persistent or chronic coughs such as occur with smoking, asthma, and emphysema. In such cases, coughing is essential to rid the bronchial airways of mucus and other secretaions. Cough suppressant labels should not refer to lung or chest conditions, the Panel said, nor should they claim the product works by soothing the bronchial passages.

The Panel said expectorant labels should be permitted to claim that the product helps loosen phlegm or rid passageways of bothersome mucus, but it called for a warning against taking expectorants for persistent chronic cough associated with smoking, asthma, or emphysema, or if there are excessive secretions, except under the advice of a physician.

Labels on anticholinergics could promise temporary relief of watery nasal discharge, or runny nose or watering of the eyes, but such statements as "clears nasal passages" or "opens airways" would not be permitted under the Panel's recommendations. Consumers should be warned not to take anticholinergics if they have asthma, glaucoma, or difficulty in urinating, the Panel said.

Topical nasal decongestants, those applied directly in the nose, present a unique problem. These drugs help clear up stuffy noses by constricting enlarged blood vessels in the nasal passage. But if they are used for too long a time or too frequently they can have the opposite effect and actually enlarge, rather than constrict, the blood vessels. Therefore, the Panel recommended that labeling for topical nasal decongestants warn users not to exceed the recommended dosage and not to use the product for more than three days. If symptoms persist, a physician should be consulted.

Oral nasal decongestant labels should warn against use by persons suffering from high blood pressure, heart disease, diabetes, or thyroid disease unless under a physician's supervision, the Panel said. And products that are inhaled should carry the caution statement: "Not for use by mouth."

Approximately six million people in this country suffer from asthma, a disease marked by wheezing, coughing, and shortness of breath. Many of these people use nonprescription drugs called bronchodilators to help them breathe more easily, and the Panel found 12 ingredients safe and effective for this purpose. Five of them are now available only by prescription, and the Panel proposed that they be changed to over-the-counter status.

One of the most distressing symptoms of the common cold is sore throat and many nonprescription drug products claim to provide relief for this condition. The Panel noted, however, that sore throat can be due to serious infection which would not be treated by self-medication. It recommended that labels on cough, cold, and related nonprescription drugs limit their claimed effectiveness to "minor throat irritation" and should advise consumers to seek medical help for serious throat problems.

Time-released formulations also came under the scrutiny of the panel, which found advantages and disadvantages in this type of medication. Obviously it is easier to take one pill instead of two or three, especially at night, but variations in the rate at which ingredients dissolve, differences in individual patient reactions, and even technical flaws in the manufacturing process could mean that the medicine could be absorbed erratically or possibly all at one time. Therefore, the Panel recommended that a four-year period be allowed for industry, in cooperation with FDA, to develop suitable tests for the standardization of all nonprescription timed-release cough-cold products and that timed-release claims not be permitted in labeling unless such claims have been documented.

Children represent a substantial portion of the consumers of cough and cold remedies, yet the Panel found that information on how these drugs affect them is "negligible or non-existent." Lacking definitive data, the Panel sought the advice of a group of experts on pediatric drug therapy in developing the following recommendations: the dose for children 6 through 11 should be half the adult dose, and for youngsters 2 through 5 it should be one quarter of the adult dose. Asthma and cough preparations should not be taken by children 2 through 5 in any amount except on the advice of a physician. Any product with an alcoholic content of more than 10 percent is not for children under 6, the Panel noted.

As for infants up to 2 years of age, the Panel said dosage should be determined by a physician and the labels on nonprescription drug products should make this clear. Labels should never carry a recommended dose for these youngsters unless the product has been demonstrated to be safe for them, the Panel said.

In reviewing all cough, cold, allergy, bronchodilator, and anti-asthmatic nonprescription drug products the Panel studied some 90 active ingredients. These ingredients were divided into six groups (plus a miscellaneous classification):

-Antitussives, which are cough suppresants.
-Expectorants, which help bring up mucus in the bronchial airways so it can be spit out.
-Bronchodilators, which enlarge the bronchial passages to make it easier for people with asthma to breathe.
-Anticholingerics, which dry up watery secretions in the nose and eyes.
-Nasal decongestants, which open up the nasal passages.

Because of variations in the way the body breaks down the two types of drugs most often used as bronchodilators, the Panel said that single ingredient preparations are more effective and safer to use than combination products. It also cautioned that bronchodilators not be used unless a diagnosis of asthma has been made and then only under the supervision of a physician.

Because bronchodilators can have adverse effects on the circulatory and central nervous systems, they should carry labels warning against use by persons suffering from high blood pressure, heart disease, thyroid disease, diabetes, or enlargement of the prostate gland, the Panel said. Labeling also should warn the patient to seek help immediately if symptoms are not relieved in one hour--or in 20 minutes in the case of epinephrine taken by an inhaler. Bronchodilator labels should be permitted to claim that the product is for temporary relief or symptomatic control of bronchial asthma only, the Panel recommended, and there should be no suggestion that it will relieve hay fever or have any effect on the nasal passages.

The relief of hay fever should be left to the antihistamines, the Panel indicated. It found 11 ingredients from this class of drugs safe and effective for relieving the symptoms of allergic rhinitis, or hay fever. Four of these are now available by prescription only, but the Panel recommended that they be approved for over-the-counter sale. Two antihistamines now used in hay fever products require further testing to demonstrate their effectiveness, the Panel said.

Although the antihistamines that are rated safe and effective have a low potential for side effects and toxicity they may cause drowsiness, the Panel pointed out, and it said this fact should be made known on the label. The label also should include a warning against use by people who have asthma, glaucoma, or enlargement of the prostate gland unless under the supervision of a physician.

Acceptable label claims for antihistamines should be that they are for the temporary relief of runny nose, sneezing, itching of the nose or throat, and itchy and watery eyes as may occur in hay fever, but not for the relief of nasal symptoms, such as stopped up nose, nasal stuffiness, or clogged up nose, the Panel said.

Although antihistamines are widely used in the treatment of common cold symptoms, the Panel said there is "little valid evidence" that they are effective for this purpose. Claims that antihistamines are effective for cold symptoms have not been substantiated by appropriate research, the Panel said, but it suggested ways these drugs could be tested for the common cold.

The Panel considered a number of ingredients which are often found in nonprescription cough-cold preparations, but which did not fall within the six main categories under review. These included antihistamines added to some cough-cold products as a sedative or sleep-aid. The Panel questioned the validity of adding an antihistamine to a cough or cold

preparation for purposes of sedation and recommended that such combinations be taken off the market. But it said combinations that include an antihistamine "for restful sleep" should be allowed to stay on the market provided testing is undertaken by the manufacturer to establish an effective dose.

The Panel also called for additional testing to prove the effectiveness of caffeine, which is added to some cough-cold products to counteract drowsiness caused by other ingredients, and phenobarbital, which is added to offset central nervous system stimulants.

Label claims that vitamins, when used either alone or in combination with other products, are effective as cold preventives or cures should not be permitted, the Panel said. But the Panel added that manufacturers should be allowed to use vitamin C in cold products for three years if they want to do so in an effort to demonstrate its effectiveness, on the condition that no claims are made about the vitamin C.

The Panel's report, the culmination of three years of study of this vast array of ingredients, is advisory in nature. It was published by FDA in the Federal Register to allow for comments from industry and consumers. After reviewing the report and the comments on it, FDA will issue final standards for acceptable ingredients and labeling claims for cough, cold, and related over-the-counter drug products. As a result, many products may have to be reformulated and labeling and advertising claims may have to be changed, a process which may take place even before the final standards are issued.

Cough and Cold Remedies

The Panel found that the following ingredients are generally recognized as safe and effective and are not mislabeled.

Antitussives (cough suppressants)

Codeine
Codeine alkaloid
Codeine phosphate
Codeine sulfate
Dextromethorphan
Dextromethorphan hydrobromide
Diphenhydramine hydrochloride

Expectorants

none

Anticholinergics

none

Nasal Decongestants

Ephedrine
Ephedrine hydrochloride
Ephedrine sulfate
Racephedrine hydrochloride
Naphazoline hydrochloride (topical)
Oxymetazoline hydrochloride (topical)
Phenylephrine hydrochloride (oral/topical)
Phenylpropanolamine bitartrate (oral)
Phenylpropanolamine hydrochloride (oral)
Phenylpropanolamine maleate (oral)
Propylhexedrine (inhalant)
Pseudoephedrine hydrochloride (oral)
Pseudoephedrine sulfate (oral)
Xylometazoline hydrochloride (topical)

The Panel found that the following ingredients are not generally recognized as safe and effective or are mislabeled.

Antitussives

Hydrocodone bitartrate
Oil of turpentine (oral)

Anticholinergics

Atropa belladonna (inhalant)
Datura stramonia (inhalant)

Nasal Decongestants

Mustard oil (topical/inhalant)
Oil of turpentine (oral)

Expectorants

Antimony potassium tartrate
Calcium iodide anhydrous
Chloroform
Hydriodic acid syrup
Iodized lime
Ipecac fliudextract
Potassium iodide
Squill
Squill extract
Oil of Turpentine (oral)

The Panel found that there are insufficient data to classify the following ingredients. It recommended that these ingredients be permitted to remain on the market from three to five years if their manufacturers immediately begin tests to answer the questions raised by the Panel.

Antitussives

Beechwood creosote
Camphor (topical/inhalant)
Caramiphen edisylate
Carbetapentane citrate
Cod liver oil
Elm bark
Ethylmorphine hydrochloride
Eucalyptol/eucalyptus oil (topical/inhalant)
Horehound (horehound fluidextract)
Menthol/peppermint oil (topical/inhalant)
Noscapine (noscapine hydrochloride)
Oil of turpentine (topical/inhalant)
Thymol

Anticholinergics

Atropine sulfate (oral)
Atropine (d, dl hyoscyamine) (oral)
Scopolamine (l-hyoscine) (oral)

Nasal Decongestants

Beechwood creosote
Bornyl acetate (topical)
Camphor (topical/inhalant)
Cedar leaf oil (topical)
l-Desoxyephedrine (inhalant)
Ephedrine (oral)
Eucalyptol/eucalyptus oil (topical/inhalant)
Menthol/peppermint oil (topical/inhalant)
Oil of turpentine (topical/inhalant)
Phenylpropanolamine hydrochloride (topical)
Racephedrine hydrochloride (oral)
Thenyldiamine hydrochloride (topical)
Thymol (inhalant)
Ephedrine hydrochloride (oral
Ephedrine sulfate (oral)

Expectorants

Ammonium chloride
Beechwood creosote
Camphor (topical/inhalant)
Compound tincture of benzoin (inhalant)
Compound white pine compound
Glyceryl guaiacolate
Ipecac Syrup
Menthol/peppermint oil (topical/inhalant)
Oil of turpentine (topical/inhalant)
Eucalyptol/eucalyptus oil (topical/inhalant
Extract white pine compound
Pine tar
Potassium guaiacol sulfonate
Sodium citrate
Syrup of pine tar
Terpin hydrate
Terpin hydrate elixir
Tincture of benzoin (inhalant)
Tolu
Tolu balsam
Tolu balsam tincture
White pine

Allergy Remedies (Antihistamines)

The Panel found that the following ingredients are generally recognized as safe and effective and are not mislabeled.

Brompheniramine maleate
Chlorpheniramine maleate
Diphenhydramine hydrochloride
Doxylamine succinate
Methapyrilene fumarate
Methapyrilene hydrochloride
Phenindamine tartrate
Pheniramine maleate
Promethazine hydrochloride
Pyrilamine maleate
Thonzylamine hydrochloride

The Panel found that there are insufficient data to classify the following ingredients. It recommended that they be permitted to remain on the market for three years if their manufacturers immediately begin tests to answer the questions raised by the Panel.

Phenyltoloxamine citrate
Thenyldiamine hydrochloride (oral)

Asthma Remedies (bronchodilators)

The Panel found that the following ingredients are generally recognized as safe and effective and are not mislabeled.

Ephedrine
Ephedrine hydrochloride
Ephedrine sulfate
Racephedrine hydrochloride
Epinephrine
Epinephrine bitartrate
Epinephrine hydrochloride (racemic)
Methoxyphenamine hydrochloride
Aminophylline
Theophylline anhydrous
Theophylline calcium salicylate
Theophylline sodium glycinate

The Panel found that the following ingredients are not generally recognized as safe and effective or are mislabeled.

Atropa belladonna (inhalant)
Datura stramonia (inhalant)
Pseudoephedrine hydrochloride
Pseudoephedrine sulfate

The Panel found that there are insufficient data to classify the following ingredient. It recommended that this ingredient be permitted to remain on the market for three years if the manufacturer immediately begins tests to answer the questions raised by the Panel.

Euphorbia pilulifera

PURPOSE: To have students become aware of the relationship between trade names and cost.

LEVEL: 7-9
10-12

AREA: Health

TOPIC: Drugs

CONCEPT: Sources of information with relationship to consumer decision making - drug cost comparison

ACTIVITY: After some background on the comparison of generic and trade name drugs, invite one or more pharmacists to discuss this matter with the class. Ask the pharmacist(s), to the extent possible, to concentrate on drugs commonly used by the consumer.

PURPOSE: To have students become aware of the wide range of information available to consumers.

LEVEL: 7-9
10-12

AREA: Health

TOPIC: Drugs

CONCEPT: Sources of information with relationship to consumer decision making - drugs

REFERENCE: "Drugs". Science Activities, John Paul Eddy, February, 1972, pp. 42-45.

ACTIVITY: Over a two-week period, have the students collect all articles from popular magazines and newspapers dealing with drugs. These can be posted on a bulletin board, placed in a scrap-book, or displayed in another manner. Students should be made aware of differences in "authority" of information.

PURPOSE: To find out where certain drugs originate and how this relates to cost.

LEVEL: 7-9
10-12

AREA: Health

TOPIC: Drugs

CONCEPT: Factors which affect cost of drugs

REFERENCE: "Drugs." Science Activities, John Paul Eddy, February, 1972, pp. 42-45.

ACTIVITY: Have the students make or take ready-made world maps and mark the major drug producing countries, the drug(s) produced in each, and research the manufacturing of the drug. Have students look for relationships between origin of production and such factors as cost, amount of processing, etc.

PURPOSE: Obtain information on the effects of drugs and relate this to consumer decision making.

LEVEL: 7-9
10-12

AREA: Health

TOPIC: Drugs

CONCEPT: Biological effects of drugs in relationship to consumer decision making.

REFERENCE: "Drugs." John Paul Eddy, Science Activities, February, 1972, pp. 42-45.

ACTIVITY: Have students search the library to get information on how different drugs affect the human body. Compare the results and report on the findings to the class.

Consider use, storage and disposal of drug items.

PURPOSE: Prepare a slide-lecture demonstration which relates the effects of drugs to consumer decision making.

LEVEL: 10-12

AREA: Health

TOPIC: Drugs

CONCEPT: Biological effects of drugs in relationship to consumer decision making

REFERENCE: "Drugs." Science Activities, John Paul Eddy, February, 1972, pp. 42-45.

ACTIVITY: Have the students prepare a slide-lecture demonstration describing selected characteristics of drugs commonly used by consumers. Included should be pictures of various drugs in the making, if the class has access to a drug manufacturing firm. If you have a nearby college that is willing to help, you could construct slides showing some biochemical diagrams and chemical reactions of certain drugs. Content should be selected to show the effects of drugs on the human (to the extent possible) and the reasons for each effect.

This presentation may then be shown to other science classes, to other high school and junior high students, depending upon the appropriateness of the content.

If there is sufficient time and interest, the class might repeat this procedure, gathering information about illegal drugs and their use.

PURPOSE: To provide information for making decisions regarding medical care.

LEVEL: 7-9
10-12

AREA: Health

TOPIC: Medical Care

CONCEPT: Consumer decision making - medical care

REFERENCE: Suggested Guidelines for Consumer Education - K-12. The President's Committee on Consumer Interests, Washington, D.C., November, 1970.

ACTIVITY: After some background on medical care, have a doctor, nurse, or hospital administrator discuss with the class basic factors involved in choosing a doctor, hospital, or medical care in general.

PURPOSE: To provide information on the action of shampoos.

LEVEL: 7-9
10-12

AREA: Health

TOPIC: Shampoo

CONCEPT: Sources of information with respect to consumer decision making.

REFERENCE: "And Now a Word About Your Shampoo." FDA Consumer, Harold C. Hopkins, HEW Publication No. (FDA) 76-5002, March 1975.

ACTIVITY:

1. Have each student comment on what they now use for washing their hair. Do they like it; what do they believe it is supposed to do; have they had any problems with it?

2. Have the students read the attached article. If they have not had chemistry, they may need some assistance with some of the terminology. Encourage them to use a dictionary, and if you don't know the words have a chemistry teacher or another science teacher explain any terms they don't understand.

3. After reading the article have the students write a report on the product they currently use and one other product.

4. Make a list of those products reviewed and spend a class period or two discussing the various products.

AND NOW A WORD ABOUT YOUR SHAMPOO

One of the most interesting distinctions that can be made between synthetic detergent shampoo, used to cleanse the hair, and toilet soap, used to cleanse the rest of the body, is that the former is considered under the law to be a cosmetic and the latter is not.

Both may contain fragrances, oils, and other substances, and these may "be rubbed, poured, sprinkled, or sprayed on, introduced into, or otherwise applied to the human body or any part thereof for cleansing, beautifying, promoting attractiveness, or altering the appearance," which is the way the Food, Drug, and Cosmetic Act of 1938 defines a cosmetic. But the same law specifically excludes soap from this definition of a cosmetic and it is thus exempt from FDA regulation.

In 1938, the cleansing agent in most if not all shampoo was soap, so the shampoos of that era were not covered by the law. Today, the cleansing agent in most shampoo is a synthetic detergent rather than soap. And because shampoo containing a synthetic detergent falls within the legal definition of a cosmetic, most of the products that dominate today's shampoo market are so classified.

Synthetic detergents may have been a cloud no bigger than your hand in the late 1930's, but when they did come, they swept through the cleansing business like a hurricane. It didn't take the cosmetics people long to discover that these synthetic chemicals had properties especially desirable in a shampoo and that other properties could be incorporated to make them even more desirable. These properties--and their effects--probably are familiar to every television viewer.

Can you imagine watching your favorite TV show, or anyone else's, without at least one nymph loping in slow motion across grassy glades under a bouncing, billowing halo of feminine glory while an off-screen voice archly insists that it could be you if you'd buy you know what? Street construction crews and pedestrians paralyzed as their mass masculinity is sideswiped by a silken-tressed sylph out on the avenue for her morning undulation? Elevator passengers elevated and blind dates struck dumb by a radiant-maned creature close enough for comfort? Acres of skin, scalp, and smirks emerging from showers with secrets that refuse to keep? A gossamer-topped tot dreamily enduring the camera's gaze while her gossamer-topped look-alike mother hums to her, one gathers, of the magic bottle they share? Or a bit of good news for blondes, brunettes, and redheads who weren't born that way?

Depending on your ability to remember brand names, you can have hair so clean it squeaks, possess tresses that can't tangle or tousle, get back something you had as a tyke, own a product you can't lose or spill or break in the shower or tub, or let the potroast burn and the housework slide if you know your way to the right shelf at the drugstore. For paying your money and making your choice, the right one, you can have hair with body, smoothness, softness, sheen, lustre, highlights, fragrance, and manageability, locks that stay locked come hail, high wind, or humidity.

While these matters could be of concern to the Federal Trade Commission in its monitoring of advertising for claims that may be false or misleading, they are not within FDA's regulatory domain. FDA's authority under the Food, Drug, and Cosmetic (FDA) Act to regulate synthetic detergent shampoos, along with other cosmetics, falls considerably short of the comprehensive kind of jurisdiction the Act authorizes for regulation of foods and drugs. The maker of a cosmetic is not required, as is the sponsor of a new drug, to obtain FDA approval before marketing to assure that the product is safe and effective. And cosmetics makers, unlike food processors, are not required to obtain FDA clearance to use new additives (except for color additives) in their products.

A shampoo, however, whose label claims that it can alter bodily functions--such as correcting and preventing conditions that produce dandruff--automatically becomes a drug and subject to either the over-the-counter drug monographs now being developed by FDA or the "New Drug" requirements of the FDC Act. When these claims are made for a new drug, either prescription or over-the-counter, safety and efficacy must be proved to FDA's satisfaction. The over-the-counter drug monographs will list permitted drug ingredients, those generally recognized by experts as safe and effective.

The law does hold the manufacturer of a synthetic detergent shampoo or other cosmetic solely responsible for safety in its use. He is expected to use ingredients about which there have been no questions of safety, and to perform adequate studies with test animals and humans for new ingredients or combinations to make sure his product is safe to use before he puts it on the market. FDA must trust that the manufacturer has fulfilled his responsibility when he offers a new product. Should adverse reactions occur, FDA urges the consumer to notify the manufacturer and the Division of Cosmetics Technology, Bureau of Foods, FDA, 200 C St., S.W., Washington, D.C. 20204, or any FDA office around the country. The manufacturer is also urged to provide FDA any information learned from consumers about adverse reactions and FDA provides preprinted forms for more convenient reporting. Such reports are a signal for FDA to look into the matter and, where necessary, take regulatory action under the FDC Act, which prohibits the marketing of misbranded products, those which have false or misleading labeling or other violations of labeling requirements, or those that contain a harmful substance.

The advent of synthetic detergents in the past few decades has, of course, revolutionized cleansing and cleaning chores, whether household, industrial, automotive, or cosmetic. Synthetic detergents are classified as anionic, cationic, nonionic, or amphoteric, depending on the way the ions behave in water. To some degree, all have the capacity to break down the resistance barrier between the water and the dirt, oil, or other material on the surface to be cleaned, and allow the material to be rinsed away. Synthetic detergent shampoos sold for adults are usually of the anionic type; for babies and children, of the amphoteric type, or amphoteric mixed with the anionic type. Cationic synthetic detergents are not usually included in shampoos as detergent agents.

The major advantage of synthetic detergents over soap in shampoos is their efficient functioning in hard water. Soap, an alkali salt of fatty acids, works well in removing dirt and grease from surfaces, but in hard water, which contains a relatively high amount of calcium in solution, the calcium reacts with the soap to form deposits of a gummy material called "soap scum." The familiar ring in the bathtub is composed of these deposits, to which dirt and other undissolved matter in the water may adhere. Such scum can form on the hair during shampooing with soap and hard water, dulling its lustre and making it difficult to comb unless rinsed with some substance that will redissolve

the scum. Soap's foaming and cleansing action is reduced according to the degree of hardness of the water. Synthetic detergents do not react with the calcium in the water and scum deposits do not form, even in the hardest water, though the detergent or cleansing action may itself vary depending on the kind of synthetic detergent used and the kind of foreign material to be removed.

Many synthetic detergents of various types have been formulated by chemists into shampoos, and some have been combined with soaps in shampoos.

FDA has been especially concerned about use of the stronger synthetic detergents in shampoos. Shampoos containing cationics as germicides and nonionics as cleansing agents have been found capable of causing severe eye irritation and occasionally permanent eye injury. Those containing mixtures of cationic and nonionic synthetic detergents have a high potential for permanent eye injury, and reputable manufacturers generally avoid marketing them. Some synthetic detergent shampoos also have been found through consumer experience to cause allergenic skin reactions in some users, although the number has been low considering the millions of packages of synthetic detergent-based shampoos sold.

When soap was still the thing for hairwashing, the scum that formed to dull the hair's lustre was often reduced or eliminated by following up with a rinse of such acidic substances as vinegar and lemon juice. The belief still persists among some consumers that vinegar and lemon juice are needed, even when a synthetic detergent shampoo is used. But such shampoos generally don't require the use of these substances because no scum forms, nor is the extensive lather normally expected from soap necessary for many synthetic detergents to perform an adequate cleansing job. The combination of soap with secret recipes and ritual that the Gibson Girl, the Flapper and Vamp, the "It" and "Oomph" girls thought guaranteed them enchanting tresses would curl the lips of today's more sophisticated consumers, who have a wide choice of shampoos or other commercial hair products labeled to perform specific cosmetic functions.

In some synthetic detergent shampoos there are newly developed additives called conditioners, which enable the user to forget the hundred brushstrokes of the past and still have enough hair lustre and sheen in sunlight to dazzle a doorpost. There are conditioners to give hair the appearance or feel of softness; to create or enhance lustre and sheen; to impart smoothness and lubricity to the touch and make combing or brushing easier; to give the hair "body," or somewhat more bulk, for special hair configurations or coiffeurs; to add "texture," the appearance of stronger strands or vibrancy; and to retain "set," that is, control frizziness or "flyaway" resulting from excessive dryness, static electricity, and other causes, and allow the hair to be kept several hours in a desired position.

Shampoos have came a long way since the days when their cosmetic functions were confined pretty much to cleansing and scenting the hair.

The consumer now learns, not far past toddling, that shampoos perform other magic. The consumer's obvious desire for a shampoo that will perform additional cosmetic functions traditionally done by rinses or other applications after shampooing has affected both the aim and the claims of the shampoo maker. The big difficulty in achieving this aim is that if a shampoo is unusually effective for one function, it may be correspondingly less so for another. For this and other reasons, many shampoos under development may go back to the laboratory instead of into the marketplace. Most of the problems are related in some degree to the cleansing effectiveness of the synthetic detergent.

Can one shampoo product perform several cosmetic functions as well as after-shampoo conditioner rinses? The answer is probably not, but manufacturers continue seeking to develop shampoos that perform as many as possible. The biggest rub is the synthetic detergent. The more thoroughly it removes dirt and other unwanted material, the more likely it is to irritate the scalp, strip off hair dyes and tints put on by the consumer at some effort and expense, remove the natural oil left on the hair from the hair gland secretions, or neutralize the intended effects of some conditioning ingredients in the shampoo.

Among conditioners that have been used in shampoos to produce various cosmetic effects are eggs, proteinaceous substances or protein derivatives, glycerin or propylene glycol, and ethyl alcohol. The manufacturer's difficult objective is to produce a shampoo that cleanses effectively, yet is mild enough to have minumum effect on desirable characteristics, either natural or produced by conditioners in the shampoo.

When egg is included in a shampoo, FDA regulations permit the word "egg" to be used in the name, as "egg shampoo," only if there is the equivalent of one whole egg for each "shampooing" in the container; egg may be mentioned on the label by such statements as "shampoo with egg" or "contains egg" only if egg constitutes at least 2 percent of the product.

It should be understood that protein materials used in shampoos, or for that matter any other conditioning ingredients, cannot feed the hair roots to make the hair "alive," since hair is dead tissue.

The conditioners in shampoos are not normally adequate to conceal damage to hair that may result from use of chemicals such as dyes, bleaches, waving or straightening mixtures, or from intense heat used to curl or straighten the hair strands. Special conditioners usually are needed after shampooing to mask such damage.

Shampoos labeled for use on normal, dry, or oily hair are formulated by controlling the strength or amount of the synthetic detergent, whose "defatting" action removes oil from the hair, and of the conditioning additives that alleviate or offset this action.

How a shampoo looks, its viscosity, its clarity or opacity, its color, how it smells when being applied, how it feels to the touch, the amount of lather it produces, its packaging, and whether it is liquid, cream, gel, or paste, all may affect the consumer's choice of a product and thus are considered by the manufacturer along with performance when the product is being developed, priced, and marketed.

One purpose of shampooing is to remove dandruff--small flakes of dead skin that shed from the scalp. When dandruff is shed from the scalp in scales larger than normal, it becomes unsightly, either in the hair itself or when it falls and clings to the outer clothing. Shampooing can help alleviate this problem. A medicated shampoo labeled for dandruff control would be the best choice if flaking is very heavy.

A medicated shampoo, whether prescribed or sold over the counter, contains drug ingredients specific for alleviating or eliminating certain conditions, such as those that result in excessive dandruff. As such it is a drug, not a cosmetic, and the manufacturer is required either to market it in accord with FDA's over-the-counter drug monographs being developed or, if a new drug, to demonstrate to FDA before marketing that it is safe as well as effective in performing the claims made for it on the label.

Some shampoos are labeled for babies and young children, whose hair does not commonly receive frequent deposits of hair sprays or other hair products. Baby shampoos usually are made from the amphoteric synthetic detergents, some of which are comparatively stingless and nonirritating, and these shampoos do not normally contain such added ingredients as perfumes, which may irritate the eyes. Most baby shampoos are formulated by the manufacturers to have minimum irritation potential.

Because of the number of consumer complaints FDA has received about eye injuries, the Agency is considering proposal of a regulation to require certain warning statements in shampoo labeling. Depending on the results of laboratory animal tests to be established in the regulation, manufacturers would be required to display a particular warning in labeling. The regulation would also specify the kinds of ingredients or combinations of them that FDA considers to be too dangerous for use in shampoos.

PURPOSE: To provide information on the effects of the pH factor in shampoo.

LEVEL: 10-12

AREA: Health

TOPIC: The pH of Hair Shampoo

CONCEPT: Relationship of pH to hair cleansing, hair conditioning, and ecological balance of the scalp.

REFERENCE: "The pH of Hair Shampoos." John J. Griffin, Robert F. Corcoran, and Kenn K. Akana, Journal of Chemical Education, Vol. 54, No. 9, Sept. 1977, pp. 553-554.

ACTIVITY: Attached is an activity related to pH of hair shampoos. The discussion presents the procedures used, data obtained, and how pH ranges affect hair. Your data may be the same or different depending on the amount chemicals used in the shampoo and the technique you use for determining pH. You may also want to consult the Consumer Reports to obtain their latest data.

This can be a class activity or a project for a group of students.

THE PH OF HAIR SHAMPOOS

During recent years the topic of pH has been introduced into commercial hair shampoo advertisements. Claims of pH control not only improving the cleansing of hair but also making hair shinier, bouncier, and stronger are found in these advertisements.

Following a discussion and laboratory assignment in measuring pH by different conventional techniques, the topic of pH effects in hair shampoos developed in a Freshman Science class at Hull High School. The following questions were generated by the students. What pH's would be found in hair shampoos? What effect would the pH factor have on cleansing hair? What pH would be good for a hair shampoo? In response to these questions the students were invited on an assigned day to bring in different hair shampoos and related toiletries for pH determination.

Measurements of the pH of the various shampoos and rinses were then repeated under controlled conditions as part of a Junior class project.

Experimental

All pH measurements were made with a Chemtrix, Type 40E, pH meter, using a Broadly James combination electrode with the toiletries in a thermostated water bath at 25.5 ± 0.5°C. The reproducibility of this

pH system was > ±0.1 pH units on the non-expanded scale when used in the pH range of 2.2 to 9.2. The meter was calibrated before and during use by standard buffer solutions. Dilutions were made by adding 10 ml. of each toiletry to 90 ml. of distilled water.

The toiletries reported in this study were purchased between June, 1975 and May, 1976.

Results

The pH values for the more popular brands of shampoos, both concentrated and dilute, are reported in Table 1. The corresponding measurements for the creme rinses and conditioners are reported in Table 2. Slightly over half of the shampoos tested were on the acid side of the pH scale. The pH range was from 3.3 - 8.7. All of the creme rinses and conditioners tested were acidic with a pH range of 2.6 to 4.8.

Discussion

The Relevance of pH in Hair Cleansing

The cleansing power of a shampoo generally refers to the ability of a shampoo to remove grease, dirt, and foreign matter from the hair and scalp. Grease originates in the hair as sebum, a substance composed primarily of glycerides (50%), waxes (20%), squalene (10%), and fatty acids (5%). These substances are secreted by the sebacious glands into the hair follicle cell. Sebum moves by capillary action up the shaft of the hair and gives the hair luster and pliability. Over-secretions and assumulated secretaions can cause hair to have a greasy appearance. The cleansing power of a shampoo is primarily characterized by the detergent used in the shampoo.

A detergent molecule is composed of two functional groups: the polar or hydrophilic group and the nonpolar or hydrophobic group. The function of the polar group is twofold: to attach itself to the hair so as to aid in displacing the grease from the hair and to maintain the detergent's solubility in water. The nonpolar group's function is to aid in displacing the grease as well as assisting in the emulsification of the grease. Whether the pH of a shampoo is high or low does not indicate the cleansing power of the shampoo. Hair shampoos are adjusted to a pH which among other things is compatible to the nature of the detergents within the shampoo.

A good shampoo should not remove all oils from the hair and scalp. This promotes ideal conditions for scalp diseases. Human skin has a natural acid layer on its surface with a pH between 3.0 and 5.0. This acid layer is caused by the lactic acid-lactate buffer pair secreted in the eccrine sweat and the fatty acids produced by the sebacious glands. The fatty acids within this layer inhibit the growth of certain bacteria, especially streptococci. In addition, unsaturated fatty acids, especially those having an odd number of carbon atoms, afford a natural protection against fungus infections such as ringworm. Undecylinic acid, for example, is used in "medicated" shampoos.

Creme Rinse and/or Conditioner	pH	pH after dilution
Wella Balsam Instant Conditioner	2.6	3.5
Plasticare pH Balanced Conditioner	2.7	3.1
Clairol, Long & Silky Conditioner	2.8	3.3
Clairol, Long & Silky Extra Body Conditioner	2.9	3.3
Alberto Balsam Conditioner	2.9	3.5
Harrison Lemon Creme Rinse	3.0	3.0
Earth Born Creme Rinse, Avocado	3.0	3.1
Herbal Essence Creme Rinse & Conditioner	3.0	3.3
Tame Conditioner (dry hair)	3.0	3.6
Tame pH Controlled Creme Rinse	3.2	3.6
Lemon Up Creme Rinse	4.3	4.2
Breck Creme Rinse	4.3	4.8

Table 2. pH of Creme Rinses and Conditioners

The Relevance of pH in Damaging Hair

Hair consists of groups of amino acids interconnected forming long polypeptide chains. The polypeptide chains are kept in a fixed position relative to parallel polypeptide chains through intermolecular bonding from side chain amino acids. The side chain amino acids constitute approximately 50% of the weight of hair keratin.

The side chain bonding consists of the following types

1) hydrogen bonding, especially that between adjacent amide and carbonyl groups

$$C = O \cdots H - N$$

2) an acid group from one side chain interacting with a basic group on a parallel protein forming a salt bridge

$$- COO^- \ldots +NH_3 -$$

3) cystine disulfide bonds linking adjacent polypeptides

$$- CH_2 - S - S - CH_2 -$$

In water the hydrogen bonds are reversibly broken; this accounts for the ease in manipulating wet hair. In strong acid solutions, pH of 1-2, both the hydrogen bonds and salt links are broken, but the hair is able to maintain its integrity through the disulfide bonding. In the

isoelectric region for hair (approximate pH 4-6) the normal charge distribution remains unchanged and hair is least swollen and has its maximum wet strength. At a pH of 12, all three bonds are broken with a subsequent dissolution of hair. Commercially available depilatories, such as "Neet" and "Nair" contain strong alkaline ingredients. At 25°C.; the pH values for "Neet" and "Nair" are 11.5 and 11.9, respectively.

Robinson has indicated that shampoos of relatively low alkalinity, pH of 8.5, can produce damage to hair cells in the form of split ends. This is particularly true for long hair which has been subjected to repeated shampoo treatments over a two-year period at a typical shower temperature of 40°C. A cumulative effect reduces the disulfide bond content to the extent that splitting occurs. Cuticular erosion is readily visible on these ends.

The Relevance of pH for Hair Conditioning Agents

In hair there are approximately 1.5 times as many acidic amino acid side chains available for interaction with basic amino side chains from adjacent polypeptides. This means that when salt bonds form between an acid carboxylate group on one polypeptide and a base (ammonium) group on a parallel polypeptide, there will still be a large number of excess acid side chains. These are normally neutralized by ammonium, sodium, or other available cations, but can be selectively exchanged by making available (as in certain toiletries) a high concentration of a particular cation, or by the addition of a cation with some surface activity.

The addition of polyethylenimines which become positively charged at a pH of 4 to a shampoo of similar pH results in its uptake on hair, especially damaged hair, and reportedly improves compatibility and manageability. Other cationic materials can also condition the hair by reducing electrostatic attraction.

Laden and Finklestein using dye solutions demonstrated that the rate and exteht of sorption of dye in hair could be modified by changing the pH of the system from which sorption occurs. The sorption of collagen derived peptides on peroxide damaged hair has been demonstrated to be an equilibrium phenomenon governed by the pH of the peptide solution.

The pH of Children's Shampoos

Shampoos manufactured for use on infants and children should be formulated to avoid skin and eye irritation as well as eye sting. Eye sting can be minimized by the use of shampoos buffered to a pH close to that found in eye tears. Solutions entering the conjunctival sac with a pH above 7.8 or below 6.6 will produce unpleasant sensations. Extended studies have indicated the pH of lacriminal fluid to be approximately equal to that of blood with a pH of 7.4.

Eye irritations can be produced by one or more ingredients within the shampoo. Consumer Reports chemists found that several commercially available hair shampoos caused iris and cornea tissue irritations to rabbits used as test animals.

Conclusions

The pH of shampoos and hair conditioners has been shown to be important not only for cleansing hair, but also in terms of improving and enhancing qualities of hair, minimizing irritations to the eyes, and stabilizing the ecological balance of the scalp.

Commercial advertisements have effectively stimulated students to explore beyond the classroom to find a relationship between the concept of pH and its use in a practical and applied sense.

Acknowledgment

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PURPOSE: To test the effectiveness of different insecticides.

LEVEL: 7-9
10-12

AREA: Product Testing

TOPIC: Insecticides

CONCEPT: Consumer decision making - product comparison

REFERENCE: "Investigating Insecticides." Science Activities, James E. Murphy, May, 1972, pp. 30-32.

ACTIVITY: Materials: 10-12 mosquito larvae; 1 stereoscopic microscope; 1 petri dish or similar glass dish; 1 pipette or medicine dropper; several kinds of household spray insecticides; safety glasses; adequate ventilation.

Procedure: Several days before the day on which the experiment is planned, ask students to bring spray insecticides used at home. The mosquito larvae should also be on hand a few days ahead of time so the students may observe them and become familiar with their structure, function, and behavior. After making their observations, they should give a brief summary of the parts and principles in operation for circulation, respiration, digestion, movements, and sensation. A list of the differences between various larvae should also be compiled.

Next, let the students design the experiment(s) they will use to observe the effect of the insecticides on the larvae. Variables such as the amount of insecticide and time period should be kept in mind. Also, control groups should be used as a basis for comparison. Before the experiments begin, the procedure should be reviewed in class to see the soundness of each student's approach in light of the points mentioned above.

During the experiment, have the students work in twos, one observing the larvae through a stereomicroscope, and the other recording time and applying the insecticide. The insecticide should be applied only for a second or two, and the students should be cautioned against its potency. The activity should be performed in a well ventilated area. Students should wear safety glasses.

Data obtained in the activity, information on the insecticide labels, and any other pertinent information can be used in arriving at comparisons.

PURPOSE: To test phosphate content of fertilizers and/or detergents in relationship to what brands are least harmful to the water supply.

LEVEL: 7-9
10-12

AREA: Product testing

TOPIC: Phosphates in Fertilizers and Detergents

CONCEPT: Consumer decision making - environmental factors

REFERENCE: "Phosphate - Some Studies of How It Affects Our Water." Science Teacher, Ann. L. Abeles, February, 1972, pp. 53-56.

ACTIVITY: Materials: One phosphate test kit (LaMotte or Hach) which will measure 10-50 ppm. phosphate; 500 ml. distilled water; one 100 ml. graduated cylinder; a few grams fertilizer or detergent; two 150 ml. beakers; two stirring rods; one balance capable of weighing to tenths of a gram; one marking pencil or labels; one 1 ml. pipette; two 100 ml. volumetric flasks.

Procedure:

1. Dissolve 1 gram of detergent or fertilizer in 100 ml. distilled water, or dissolve in a volumetric flask and dilute with 100 ml. distilled water. Label this "first dilution."

2. Pipette 1 ml. of the first dilution into another volumetric flask and dilute to 100 ml. with distilled water, or put the 1 ml. in one of the beakers and add 99 ml. of distilled water. Label this "second dilution."

3. Follow directions for phosphate analysis included with the test kit. The analysis will give the ppm. phosphate in the second dilution.

4. Calculate the concentration of phosphate in the first dilution and in the detergent or fertilizer as follows:

   a. Since the second dilution was made by diluting the first solution, 1 to 100, the concentration of the first dilution is 100 times what was measured with the kit.

   b. The first dilution was made by dissolving 1 gram of sample in 100 ml. water, so again the concentration of phosphate in the sample is 100 times greater than the concentration of the first dilution.

Repeat with other samples and compare results.

PURPOSE: Compare actual soap content in different brands.

LEVEL: 7-9
10-12

AREA: Product Testing

TOPIC: Soaps

CONCEPT: Consumer decision making - product comparisons

REFERENCE: Consumer Education: A Model of an Interdisciplinary K-12 Curriculum Approach to Consumer Education Processes. C. Raymond Anderson and L. M. Bongiovanni, Mass. State Dept. of Ed., Boston, April, 1974.

ACTIVITY: After discussing water as a cleaning agent and also the composition of soap, take samples of different brands. Weigh each, then heat to remove any water. Reweigh. Determine volume before and after heating to determine density. This will aid in determining those brands which contain large quantities of air. Record data on a chart and determine the amount and cost of the water you buy with the soap. Decide which brands are the best buy based on your results and rank accordingly.

PURPOSE: To see if there are performance differences between expensive alkaline batteries and less expensive batteries.

LEVEL: 7-9
10-12

AREA: Product Testing

TOPIC: Dry Cell Batteries

CONCEPT: Consumer decision making - product comparisons

REFERENCE: "The Business Department Studies Science." Science Activities, Roger M. Records, July/August, 1974, pp. 6-8.

ACTIVITY: Materials: Shoe box, solar cell, flashlight, ammeter, batteries to be tested.

Procedure: Obtain two new batteries of the same brand. In the shoe box, attach the solar cell to one end. Place the flashlight in the bottom of the box so that the light is centered on the solar cell. Connect the solar cell to the ammeter.

As the batteries wear out, the light will dim and the current reading on the ammeter will drop off. When batteries are worn out, figure cost per hour and compare.

PURPOSE: To compare the effectiveness of phosphate detergents, non-phosphate detergents, and soaps.

LEVEL: 7-9
10-12

AREA: Product Testing

TOPIC: Detergents and Soaps

CONCEPT: Consumer decision making - product comparisons

REFERENCE: Soaps, Detergents, and the Environment.... The Soap and Detergent Association; 475 Park Ave. South; New York, N.Y. 10016. Problems with Current Phosphate Replacement Materials. Federal Trade Commission Hearing, April 26, 1971.

ACTIVITY: Divide the students into five lab teams. Give each team one 4" x 4" square of soiled fabric and 2 quart jars filled with hot water. To one of the jars of hot water:

Team #1 adds 1 Tbsp. phosphate detergent
Team #2 adds 1 Tbsp. soap
Team #3 adds 1 Tbsp. soap and 1 Tbsp. washing soda
Team #4 adds 1 Tbsp. non-phosphate detergent
Team #5 adds nothing to the water (control)

After each team adds their particular soap or detergent to the water, agitate the jar. Add the square of fabric. Cap the jar and shake for a given period of time. Remove the fabric and place in the other jar. Cap, and agitate to rinse.

Compare cleanliness of the fabric swatches. The experiment could then be run again, using a different type of material for fabric swatch, and again compare the results.

PURPOSE: To provide a technique for detecting the presence of lead in objects and products commonly in use.

LEVEL: 10-12

AREA: Product testing

TOPIC: Testing for Lead in Consumer Products

CONCEPT: Consumer decision making - potential contaminants

REFERENCE: Toth, M. Jane, Cikach, F. S., and Frankovits, N. D., Maple Heights City School District Environmental Education Program, Final Report, Maple Heights, Ohio, June 30, 1977, p. W-2.

ACTIVITY: Put your sample in a test tube with a few cubic centimeters of 0.1M acetic acid. Slowly heat the mixture to boiling over your Bunsen burner. (If you are testing a piece of pottery, heat the acetic acid to boiling first. Then carefully rinse the acetic acid around the inside of the pottery and pour it back into your test tube.) Cool the test tube and its contents in running water from the tap. Add 1 cm^3 dithizone solution. Stopper the test tube with a cork and shake it vigorously for 10 seconds. Run a known positive by placing 1 cm^3 lead nitrate solution, $Pb(NO_3)_2$, and 1 cm^3 dithizone in a second tube. Shake this tube. Run a control, using distilled water and dithizone. Record your results. Compare your results with those of other members of the class. Was there lead in your sample?

LEAD TESTS (RESULTS)

Description of Test Object	Acetic Acid Time	Positive Results (Lead)	Negative Results (No Lead)

PURPOSE: To test the effectiveness of different antacids, using a simulated stomach.

LEVEL: 10-12

AREA: Product Testing

TOPIC: Antacids

CONCEPT: Consumer decision making - product comparisons

REFERENCE: "Excess Stomach Acid Treatment - A Chemistry Laboratory Project." Science Teacher, Bob Graham, December, 1973, p. 48, Idea #22.

ACTIVITY: A simulated stomach is made of a 250 ml. Erlenmeyer flask to which 5 ml. of 2 M HCl acid are added with a pipette. The acid is fairly concentrated to react rapidly. Various medications (Tums, Rolaids, Milk of Magnesia tablets, etc.) are tested individually and separately by adding a tablet to the acid and allowing the reaction to subside. Tablets may be tested on a per tablet basis or a "prescribed dosage" basis.

The residual acid is then titrated using 0.25 M NaOH and phenolphthalein indicator. A titration of the 2 M HCl acid is run so that the efficacy of each medication can be assessed in terms of 0.25 M NaOH.

The data should be suitably presented on a bar graph, and the results discussed.

PURPOSE: To compare the quantity of vitamin C in various fruit drinks by determining the amount of the vitamin in each.

LEVEL: 10-12

AREA: Product Testing

TOPIC: Vitamin C in Juice Drink

CONCEPT: Consumer decision making - product comparisons

ACTIVITY:

Ascorbic acid reduces the oxidation-reduction indicator dye, 2, 6-dichloroindophenol to a colorless solution. At the end point, excess unreduced dye is rose pink in acid solution. The vitamin is extracted and titrated in the presence of phosphoric acid - acetic acid or metaphosphoric acid - acetic acid - sulfuric acid solution to maintain proper acidity for the reaction and to avoid autoxidation of acid at high pH.

Reagents

Extracting Solutions. 1. Metaphosphoric acid - acid stabilizing extracting solutions. Dissolve, with shaking, 15 g glacial HPO_3 pellets or freshly pulverized stick HPO_3 in 40 ml of HOAc and 200 ml of H_2O; dilute to about 500 ml, and filter rapidly through fluted paper into a small glass-stoppered bottle. (HPO_3 slowly changes to H_3PO_4, but if stored in refrigerator, the solution remains satisfactory for 7-10 days.)

2. Metaphosphoric acid - acetic acid - sulfuric acid solution. Proceed as in (1), but use 0.3 N H_2SO_4 in place of H_2O.

Ascorbic Acid Standard Solution. Accurately weigh 50 mg of USP ascorbic acid reference standard that has been stored in a desiccator away from direct sunlight. Transfer to a 50 ml volumetric flask; dilute to volume immediately before use with HPO_3-HOAc solution (1 ml = 1 mg ascorbic acid).

Indophenol Standard Solution. Dissolve 50 mg of 2,6-dichloroindophenol Na salt (Eastman No. 3463) that has been stored in a disiccator over soda lime, in 50 ml of H_2O to which has been added 42 mg of $NaHCO_3$; shake vigorously, and when the dye dissolves, dilute to 200 ml with H_2O. Filter through fluted paper into amber glass-stoppered bottle. Keep stoppered, out of direct sunlight, and store in refrigerator. (Decomposition products that make end point indistinct occur in some batches of dry indophenol and also develop with time in stock solution. Add 5.0 mg of extracting solution containing excess ascorbic acid to 15 ml of dye reagent. If reduced solution is not practically colorless, discard, and prepare new stock solution. If dry dye is at fault, obtain new specimen).

Transfer three 2.0 ml aliquots of the ascorbic acid standard solution to each of three 50 ml Erlenmeyer flasks containing 5.0 ml of HPO_3-HOAc solution. Titrate rapidly with the indophenol solution from a 50 ml burette until light, but distinct, rose-pink persists at least 5 seconds. (Each titration should require about 15 ml of the indophenol solution and titrations should check within 0.1 ml.) Similarly, titrate 3 blanks composed of 7.0 ml of the HPO_3-HOAc solution plus a volume of H_2O approximately equivalent to the volume of indophenol solution used in direct titrations. After subtracting average blanks (usually about 0.1 ml) from standardizing titrations, calculate and express the concentration of the indophenol solution as milligrams ascorbic acid equivalent to 1.0 ml of reagent. Standardize indophenol solution daily with freshly prepared standard ascorbic acid solution.

Thymol Blue pH Indicator--0.04%. Dissolve 0.1 g of indicator by triturating in agate mortar with 10.75 ml of 0.02 N NaOH and dilute to 250 ml with H_2O. Transition range: 1.2 red-2.8 yellow. Fisher Catalog No. 5-985-B, or equivalent, is suitable.

Preliminary Tests for Appreciable Quantity of Basic Substances

Grind a representative sample or express contents from a capsule and add ca 25 ml of HPO_3-HOAc solution. Test pH by placing a drop of thymol blue indicator on pestle or by using spot plate. (pH > 1.2 indicates appreciable quantities of basic substances.) For liquid preparations, dilute representative sample approximately twofold with HPO_3-HOAc solution, before testing with indicator.

Preparation of Sample Assay Solution

For Dry Materials Containing No Appreciable Quantity of Basic Substances. Pulverize sample by gentle grinding, add HPO_3-HOAc solution and titrate until sample is in suspension. Dilute with HPO_3-HOAc solution to measured volume. Designate this volume as V ml.

(Use approximately 10 ml of extracting solution per gram of dry sample. Final solution should contain 10-100 mg of ascorbic acid per 100 ml.)

For Dry Materials Containing Appreciable Quantities of Basic Substances. Pulverize sample by gentle grinding, add HPO_3-HOAc-H_2SO_4 solution to adjust pH to ca 1.2, and triturate until sample is in suspension. Dilute with HPO_3-HOAc solution to measured volume. Designate this volume as V ml.

(Use ca 10 ml of extracting solution per gram of dry sample. Final solution should contain 10-100 mg of ascorbic acid per 100 ml.)

For Liquid Materials. Take quantity of sample containing ca 100 mg of ascorbic acid. If appreciabel quantities of basic substances are present, adjust the pH to ca 1.2 with HPO_3-HOAc-H_2SO_4 solution. Dilute with HPO_3-HOAc solution to measured volume containing 10-100 mg of ascorbic acid per 100 ml. Designate this volume as V ml.

For Fruit and Vegetable Juices. Prepare the juice by mixing thoroughly by shaking to insure uniform sample, and filter through absorbent cotton or rapid paper. Prepare fresh juices by pressing well-pulped fruit and filtering. Express juice of citrus fruits by one of the common devices used for squeezing oranges or lemons, and filter. Add aliquots of at least 100 ml of prepared juice to equal volumes of HPO_3-HOAc solution. Designate total volume as V ml. Mix, and filter through rapid folded paper (Eaton-Kikeman No. 195, 18.5 cm, or equivalent).

Determination

Titrate three sample aliquots each containing about 2 mg of ascorbic acid, and make blank determinations for correction of titrations as explained for liquid materials using proper volumes of HPO_3-HOAc solution and H_2O. If approximately 2 mg of ascorbic acid are contained in sample aliquot with volume less than 7 ml, add HPO_3-HOAc solution to give 7 ml for titration.

$$\text{mg ascorbic acid per g, tablet, ml, etc.} = (A - B) \times (F/E) \times (V/X)$$

where A is the average milliliters for sample titration, B the average milliliters for sample blank titration, F the milligrams of ascorbic acid equivalent to 1.0 ml of indophenol standard solution, E the number of grams, tablets, milliliters, etc., assayed, V the initial assay solution volume, and X the volume sample aliquot titrated.

PURPOSE: To investigate variables influencing gasoline consumption.

LEVEL: 7-9
10-12

AREA: Natural Resources

TOPIC: Conserving Gasoline in Automobile Travel

CONCEPT: Consumer decision making - factors in automobile travel.

ACTIVITY: Gasoline is currently produced from oil, a natural resource that cannot be replenished. It is also becoming more expensive as world supply decreases. There are a number of variables that influence the mileage a car can obtain. Some of these variables relate to the physical characteristics of the car, some to the area in which the car is driven, and others to driving practices of the driver.

Listed below are some of the variables. These variables can be refined by consulting Consumer Reports or a similar publication to make a scale for each variable--from the most economical equipment, from the most effective driving practice to the least effective driving practice.

1. Equipment Variables

   a. The weight of the car and the size of the engine have the most effect on gasoline mileage. A car that weighs 4,800 - 5,200 lbs. will use about twice the amount of fuel as will a car of 2,400 to 2,600 lbs.

   b. An automatic transmission normally reduces the gas mileage (compared to a manual transmission).

   c. Optional equipment, such as air conditioners and and other items, reduce gas mileage by added weight and also by operations.

   d. Radial tires will increase gas mileage over bias-ply tires. Savings vary with the type of car, type of tire, and driving conditions.

   e. A properly tuned car will usually obtain at least 5 - 8% better mileage.

2. Driving Practices

   a. The rate of acceleration is an important variable in gasoline consumption. Moderate acceleration will usually save 10-20% over rapid acceleration.

b. Gasoline mileage is usually at a maximum between 35 and 40 m.p.h. with no rapid or extensive speed changes.

c. Extensive changing of speed (fast to slow and slow to fast) decreases gas mileage.

d. Use of the brake and driving in low gear ranges decreases gas mileage.

e. Warm-up or idling the engine increases the consumption of gasoline. The amount used varies with the type and size of the engine. Substantial savings can be obtained by reducing idling in a car with a large engine.

3. Driving Conditions

a. Stop and go driving (city) increases gasoline consumption.

b. Short trips increase gasoline consumption.

c. Hilly or mountainous terrain increases gasoline consumption.

PURPOSE: To learn to read an electric meter and to show the savings that come from wise electrical use.

LEVEL: 7-9
10-12

AREA: Natural Resources

TOPIC: Electric Meters

CONCEPT: Energy use and cost

ACTIVITY: After some background on reading electric meters, this "homework" activity can be done:

Have the students keep track of the amount of electricity used for a period of time, such as one week. Then have them figure cost using information gathered from the electric company. The following week, have them ask their family to conserve energy by shutting off unnecessary lights, keeping air-conditioning or heating to a comfortable minimum, using the oven for several things at a time instead of heating it up separately every time, etc. Record amount used and again figure cost and savings over the last period. Recognition can be given to students demonstrating the savings of energy. The activity can also include gas or other energy sources.

Note: Power company public relations personnel would probably be able to provide or suggest a resource person.

PURPOSE: To investigate various factors related to the use of wood for heating.

LEVEL: 7-9
10-12

AREA: Natural Resources

TOPIC: Heating Fuels

CONCEPT: Consumer decision making - comparison of fuel costs.

REFERENCE: Toth, N. June, Cikach, F. S., and Frankovits, N. D.; Maple Heights City School District Environmental Education Programs, Final Report. Maple Heights, Ohio, June 30, 1977, pp. 1-4.

ACTIVITY: Many people are converting from other fuels to wood to heat their homes or heating parts of their homes with wood fuel.

Table 1 gives the approximate weight and heating value per cord of different woods, both green and air-dried.

TABLE 1

SPECIES	WEIGHT		AVAILABLE HEAT	
	GREEN	AIR-DRIED	GREEN	AIR-DRIED
	Pounds	Pounds	Million BTU	Million BTU
Ash	3,840	3,440	16.5	20.0
Aspen	3,440	2,160	10.3	12.5
Beech, American	4,320	3,760	17.3	21.8
Birch, yellow	4,560	3,680	17.3	21.3
Elm, American	4,320	2,960	14.3	17.2
Maple, red	4,000	3,200	15.0	18.6
Maple, sugar	4,480	3,680	18.4	21.3
Oak, red	5,120	3,680	17.9	21.3
Oak, white	5,040	3,920	19.2	22.7
Pine, eastern white	2,880	2,080	12.1	13.3

Air-dried means with 20 percent moisture in terms of oven-dry weight, or 16.7 percent in terms of total air-dried weight. One BTU (British Thermal Unit) is the amount of heat required to raise the temperature of one pound of water 1°F. Available heat equals calorific value, minus loss due to moisture, minus loss due to water vapor formed, minus loss in heat carried away in dry chimney gas. Flue temperature 450°F., no excess air. (Data supplied by Forest Products Laboratory, Madison, Wis.)

Table 2 shows the relationship between species, pounds per cord, usable fuel value per cord and the price per cord equivalent to oil at 42¢ per gallon. Keep in mind that this table was computed using 65% oil burner efficiency and a stove efficiency of 50%. Furnace efficiencies typically range between 50-75% while wood stove efficiencies range from 15% for a fireplace up to 85% for air tight stoves under optimum conditions.

TABLE 2

SPECIES	AVERAGE DENSITY lbs/cord 20% Moisture CONTENT	POTENTIAL USABLE FUEL VALUE PER CORD (BTUs)	PRICE/CORD @50% EFFICIENCY EQUIVALENT TO OIL AT 42¢/gallon
White Oak	4,400	30,800,000	$71.14
Sugar Maple	4,000	28,000,000	$68.61
American Beech	4,000	28,000,000	$64.68
Red Oak	3,900	27,300,000	$63.06
Yellow Birch	3,800	26,600,000	$61.44
White Ash	3,700	25,900,000	$59.83
American Elm	3,400	23,800,000	$54.97
Red Maple	3,400	23,800,000	$54.97
Paper Birch	3,400	23,800,000	$54.97
Douglas Fir	2,900	21,400,000	$49.43
Eastern White Pine	2,200	15,800,000	$36.49

Activity 1: Stove Design

Homemakers are turning to wood for heat as the price of heating oil goes up. Problems have arisen, however, in the transition from oil heat to wood heat due to the lack of homeowner experience with the convenient and safe methods of cutting, splitting and burning wood. In this activity, you will be thinking of ways to improve stove efficiency, wood burning convenience and stove safety.

Part 1 - Stove Design

Design, using proper drafting techniques, a wood burning stove that incorporates the following features:

a. inexpensive materials
b. ease of construction
c. durability
d. heat output control
e. minimum creosote buildup in flue
f. ease of operation
g. beauty
h. safety in operation
i. efficiency

Make a drawing of your design. Outline how your stove satisfies each of these design features. Optional: list construction materials and their cost. List construction procedure.

Part 2 - Wood Burning Convenience

List ten ways to make wood heat more convenient. (i.e., decrease the number of times the wood is handled, combine storage and drying facilities) List and describe specific tools and facilities that would make the handling and burning of wood easier. (i.e., house modifications such as enlarged basement openings, attached wood sheds, etc.) Optional: sketch one or more of your ideas.

Part 3 - Safety

Insurance rates for homeowners who burn wood in space heaters are higher than for homeowners who burn oil. The higher rates are in part due to the number of improperly installed and poorly operated stoves which cause house fires. Call your local fire inspector and find out what safety precautions are necessary for installing and operating a wood stove.

Activity 2: Cost of Using Wood Fuel

Part 1 - Comparison of Wood Fuels to Other Fuels

Use the data in Table 1 to calculate the cost of the most common green and air-dry wood in your area to (1) coal, (2) fuel oil, (3) piped gas, (4) bottled gas, and (5) electricity.

Part 2 - Comparison of Cost of Green Wood to Cost of Air-Dried Wood

Use the data in Table 1 to determine a reasonable difference to expect in the cost of a cord of green wood compared to the cost of a cord of air-dried wood.

PURPOSE: To investigate rates of consumption of various resources.

LEVEL: 7-9
10-12

AREA: Natural Resources

TOPIC: Consumption of Natural Resources

CONCEPT: Relationship of rate of use of resources to community factors.

NOTE: Figures cited are average of those reviewed. They are neither the high nor the low figures.

ACTIVITY: Presented are a series of activities that can be used to focus on the problems of consumption and use of resources. Suggested questions will be applied to most activities, but you should consistently raise at least these questions:

1. Is the resource renewable (wood vs. oil)?;
2. Can the "waste" be recycled (newspapers)?;
3. Can the "waste" be re-used or used in some other way (motor oil)?; and
4. Can the use be reduced by changes in technology or methodology (wastewater reduction)?

To meet the needs of the average U.S. community approximately 140-160 gallons of clean water are needed per person per day.

1. Use the population of your community to determine the amount of water that would be needed by an average water system:

   a. each day
   b. each week
   c. each month
   d. each year.

2. Consult the water department in your town, city, or rural area. Determine the average use in your community per day. It your use higher or lower than the "average"? Why do you believe it is higher or lower?

3. What are the major users of water in your community? How could their use of clean water be reduced?

Americans use a large number of metal cans each year. While figures vary, it is estimated that over 35,000,000,000 cans were used in 1975. This represents an extensive use of metal, energy, and money.

1. Keep a record for one week.

   a. How many cans does your family use?
   b. How many cans did your family use per person for that week?
   c. What % of the cans were recycled (compared to those that were thrown away)?

2. Is recycling of cans done in your community? If no, discuss how such an effort might be started. If yes, discuss the process in class.

3. Compare the costs of items in throw-away bottles (non-returnable), returnable bottles and cans. Discuss the data and whether the pricing structure encourages or discourages conservation.

During 1974 it is estimated that United States service stations disposed of over 450,000,000 gallons of used oil. Disposal of used oil can be both a waste of natural resources and an environmental problem.

1. Check with service stations in your community to determine how they dispose of motor oil wastes.

   a. Are they dumped?
      1. In the sewer system?
      2. Outside - into a ground or water deposit area?
      3. If yes, to either of the above, what are the potential hazards to the community?

   b. Are they recycled?
      1. For re-use as a motor oil?
      2. For chemicals?
      3. For use as a fuel?
      4. For use as a road binder?
      5. Other?

   c. If the oil is not reused, try to determine why.

   d. If the oil is re-used, consider how the oil might be better used from the standpoint of wise use of natural resources.

PURPOSE: To investigate ways of reducing water consumption in the home.

LEVEL: 7-9
10-12

AREA: Natural Resources

TOPIC: Water Conservation

CONCEPT: Consumer decision making - reduction of water usage and associated cost

REFERENCE: "Water Conservation and Wasteflow Reduction in the Home." Special Circular 184. William Sharpe, The Pennsylvania State University, College of Agriculture, Extension Service and The Institute for Research on Land and Water Resources, University Park, Pennsylvania.

ACTIVITY: Read the attached article and compare costs for your family with the estimated costs in the article.

For most of us water is never more than a few steps away. The opening of a faucet, the press of a button, or the turn of a cap is all that is necessary to quench our thirst. This closeness of water to our daily activities tells us that 1) water is relatively abundant and 2) it is vital to our existence.

In spite of its importance, all of us take water for granted. We are unconcerned with the source of water flowing from the tap or how the water has been treated before arriving at our homes. As long as we have water in unlimited supply and of obviously good quality, we are satisfied.

As pollution of our water resources increases, the degree of treatment required to improve the quality of this water to the point where it is acceptable for home use also increases. Elaborate and expensive water treatment facilities are becoming necessary in many areas of the country. True, the fight against water pollution has resulted in cleaner water in many areas, but nationally we are still polluting more than is being cleaned up. In many areas ground water supplies for individual homes are becoming polluted. These people are unable to afford expensive individual water treatment devices; consequently, they are faced with the grim prospect of buying drinking water and having it hauled to their homes.

When one adds to pollution the fact of increasing water demands, the situation does not look any better. The average use of water per person has risen from 115 gallons per day in 1920 to 150 gallons in 1960. This upward trend appears to be continuing. In addition, new households are being formed at the rate of 2 million per year with an

expected increase to 3 million per year by 1980. This translates to an increased water usage rate of 623 million gallons per day in 1971 over 1970, and a projected rate of increase of 915 million gallons per day in 1980 over 1979. Total water consumption for domestic use will increase by 7 billion gallons per day in the nine years between 1971 and 1980.

Most of the water that comes into our homes is used to remove wastes. Washing clothes, dishes and ourselves, plus flushing the toilet and washing the car account for most of the water used in the home. Drinking and cooking are really insignificant uses of water compared to the amount we use for waste removal. The following chart is an example of how water is used by a typical American family of four.

Use	Gallons Used per Day
1. Dishwashing	15
2. Cooking, drinking	12
3. Utility sink (washing hands, etc.)	5
4. Laundry	35
5. Bathing	80
6. Bathroom sink	8
7. Toilet	100
	255

Several things are apparent from the chart. Toilet water usage is the largest of any of the items on the list. It accounts for more water than all other categories combined with the exception of bathing. Next to bathing, the most water is used for doing the laundry.

Now let us look at what happens to this 255 gallons of water after it has been used in the home and leaves as wastewater. Let us assume that the drains from the home are connected to a sewer line. These sewer lines run under the streets of the town to the sewage treatment plant. Wastewater usually flows in these pipes by gravity, consequently, they are called gravity sewers. In older towns storm drains are connected to this system so that rainwater also goes to the sewage treatment plant. During periods of high rainfall much of the flow must be diverted around the treatment plant and into streams because the plants cannot handle the increased volume of wastes. Newer wastewater collection systems separate storm water into storm sewers and wastewater into sanitary sewers.

There are basically two types of sewage treatment, primary and secondary. Most new plants are required to have both of these treatments. Some of the most modern plants have a third type of treatment known as tertiary. During primary treatment, solid materials are removed from the

wastewater. This is done by first passing the wastewater through a series of screens. The screens remove the larger floating objects. From there the waste water passes into a grit chamber which allows sand and small stones to settle out. The wastewater then moves out of the grit chamber into a sedimentation tank where the smallest particles suspended in the wastewater settle to the bottom, producing a black, oily appearing sludge. Finally the wastewater is chlorinated. If secondary treatment follows primary treatment, chlorination is the last step in the secondary treatment process.

Secondary treatment removes up to 90 percent of the organic matter contained in the wastewater after primary treatment. If not removed, this organic matter would rob the receiving streams of oxygen. The two types of secondary treatment used most widely are the trickling filter and activated sludge methods. The trickling filter consists simply of a bed of stones varying in depth from three to ten feet through which waste water is trickled. The stones are colonized by bacteria which feed on the organic matter in the wastewater as it passes over them. In this way most of the organic matter is removed from the wastewater. Pipes at the bottom of these stone beds carry off the cleaner water to be chlorinated and released to the receiving stream.

The activated sludge process uses a different means to accomplish the same end as the trickling filter. The work of the bacteria is speeded up by the addition of air and sludge, laden with bacteria, to the wastewater. This is done in an aeration tank. After several hours in the aeration tank the wastewater is conveyed to a sedimentation tank where solid materials settle out. The wastewater is then chlorinated and released to the receiving stream, while the sludge is conveyed back into the aeration tanks for reuse.

After primary and secondary treatment the wastewater still contains nutrient materials such as nitrogen and phosphorus which may cause problems of over-fertilization in receiving streams. To cope with this problem various tertiary treatments are being developed. One of the most promising of these involves the application of secondary treated wastewater to land through a spray-irrigation system. The vegetation and soil material act as a "living filter" to remove these nutrient materials which are then available as plant fertilizer. Alternatives to spray-irrigation involve mechanical removal of nitrogen from wastewater by a system that copies natural processes. Lower volumes of sewage result in a better primary and secondary treatment.

Other sewage disposal systems are widely used. Two such systems are lagoons and septic tanks. A septic tank is simply a concrete tank into which wastes from an individual home flow. In the tank solids settle to the bottom and bacteria begin to break down some of the organic matter. The overflow from the septic tank flows into an underground drainage field where soil organisms complete the breakdown of the sewage. Unfortunately, septic tanks work well only on soil that can accept the septic tank overflow at an adequate rate. Generally, the less water moving through this type of system the better.

Lagoons are often used as a less expensive way to treat sewage from small communities. They consist of an oxidation pond or ponds in which the sewage is broken down by bacteria. Oxygen is supplied by the air, and sunlight supplies energy to help in the treatment process. The volume of wastes is especially critical in lagoons. This treatment process is slow; consequently, wastewater must be retained in the system for several days or more depending on conditions at the lagoon.

Water Conservation

As we have seen, it takes a lot of effort and expense to keep an adequate supply of good water flowing from the taps in our homes and to dispose of the wastewater that results from home water use. It should be obvious that the less water we use, the less effort and expense is required to supply us with water. Similarly, the less water we use, the smaller the volume of wastewater produced and the less it costs to treat it. Where sewage treatment plants are already overloaded, a reduction in wastewater volume would lessen pollution significantly by improving waste treatment.

The conservation of water used in the home, unlike other efforts to conserve electrical energy and save heating oil, does not require a change in life style or personal habits. Unlike expensive auto emission control equipment, the simplest water conservation measures cost only a few cents, and even the more expensive ones easily pay for themselves over time. All of these measures will actually save you money. Almost all the devices are designed to save water while resulting in a minimum of inconvenience to the water consumer. The water conservation measures we are about to discuss actually make life a little easier and a little cheaper.

WATER-USING APPLIANCES

Automatic Washers -- The most common water-using home appliance is the automatic washer. Its convenience and labor saving value to the housewife have been tremendous. Unfortunately, automatic washers use much more water than the old wringer-style washer. Water consumption by automatic washers ranges from 20 to 30 gallons per wash load, the exact figure varying according to habits of the user and the type of washer. Washers with suds savers use less water by providing for the reuse of wash water for a second wash load.

Water savings may also be achieved by automatic washers that allow the amount of water used to be adjusted for load size. This feature enables the housewife to use less water for smaller loads of clothes. If a washer does not have this feature, water can still be saved by washing only when there are enough soiled clothes to make a full load.

Automatic Dishwashers -- The automatic dishwasher has done much to relieve the housewife of this unpleasant mealtime chore; however, dishwashers use water extravagantly, between 13 and 19 gallons of water per day. If dishwashers are loaded to capacity for each use, worthwhile water savings can be obtained.

It should be noted that following the above procedures to save water also saves energy by limiting hot water use in automatic washers and dishwashers (it takes energy to heat water).

WATER-SAVING DEVICES

Faucet Aerators -- Faucet aerators are already in wide use. Faucets with aerators provide a nice even flow and reduce splashing. By mixing water with air they reduce the amount of water flowing from a faucet. The air added to the water as it leaves the faucet makes a stream of air and water. This gives the illusion that more water is flowing from the tap than actually is. When water is left running to wash something, as in rinsing dishes or washing one's hands, less water is actually used.

Faucet aerators are easy to install and quite inexpensive. The following table gives cost estimates for the faucet aerator:

COST EXTIMATES FOR A FOUR MEMBER FAMILY

Material cost 2 aerators @ $1.50	$3.00
Labor cost 1/6 hr. (non-professional)	0
Total installation cost	3.00
Expected life (15 years)	
Cost per year	.20
Maintenance and power saved per year	0
Cost of water saved per year	
2 gpd (365 day/yr) X $.42/1000 gal.	.31
Cost of power saved per year	
(½) (2gpd) (365 day/yr) X $.44/1000 gal.	.24
Cost of sewage saved per year	
2 gpd (365 day/yr) X $.44/1000 gal.	.32
Total savings per year	.87
Net savings per year $.87 - $.20	.67
Water saved per day -- 2 gallons	

Spray Taps -- Spray taps are one of the latest developments in water-saving devices. These taps are actually mini-showers designed for use in lavatory sinks and wash basins. Water is sprayed from the tap rather than issuing forth in a single stream as is the case with conventional faucets. The spray allows for faster washing and rinsing with less water use as a consequence. When such devices are conbined with thermostatic mixing valves water savings of up to 90 percent are claimed by the manufacturer. The saving of hot water is especially significant, since it results in a saving of energy as well.

Flow Control Devices -- These are used to limit the rate of flow from shower heads and faucets. These devices are usually nothing more than valves that fit into the supply lines for faucets or showers. Flow is usually limited to 2.5 gallons per minute from faucets and 3 gallons per minute from showers. Normal flow from showers varies between 5 to 15 gallons per minute. Water savings of 50 to 70 percent are claimed for flow-limiting shower heads and up to 50 percent for faucets. Assuming average shower usage, more than 2,000 gallons of water may be saved per person per year. A similar type of device is the thermostatic mixing valve. These valves permit mixing of hot and cold water to preset temperatures. Water issues from the tap at this temperature. In this manner water is not wasted while its temperature is being adjusted by manipulating the hot and cold water faucets.

Substantial savings can be achieved with flow-limiting devices in shower heads. The following table estimates their savings.

COST ESTIMATES FOR A FOUR MEMBER FAMILY

Material cost flow control shower head @ $15.00	$15.00
Labor cost 2 hr. @ $7.50/hr.	15.00
Total installation cost	30.00
Expected life (15 years)	
Cost per year	2.00
Maintenance and power cost per year	0
Cost of water saved per year	3.70
Cost of power saved per year	4.40
Cost of sewage saved per year	3.90
Total savings per year	12.00
Net savings per year	10.00
Water saved per day -- 24 gallons	

Improved Float Assemblies -- Float assemblies of improved design are now available at most hardware stores. These are easily installed in most conventional water closets and sell for about four or five dollars. Water savings are achieved using these devices by adjusting them to maintain a lower water level in the toilet reservoir. Some manufacturers also claim that their devices facilitate the detection of leaks. Flushing efficiency is not impaired when water levels are lowered using one of these devices.

Shallow Trap Toilets -- Shallow trap toilets are now being manufactured in this country. They are required by local plumbing codes in some areas of the East. The principal feature of this type of toilet is a smaller water reservoir than that of a conventional toilet. These toilets use only 3½ gallons per flush as compared to 5 or 6 gallons for a standard toilet. This amounts to a savings of 7½ gallons per day for the

average person. Shallow trap toilets are operated the same way as conventional toilets and are no different in appearance. The following table compares costs and savings of shallow trap toilets.

COST ESTIMATES FOR A FOUR MEMBER FAMILY

Material cost (1 shallow trap water closet) @$70.20	$ 70.20
Labor cost 4 hrs. @ $7.50/hr.	30.00
Total installation cost	100.20
Expected life (20 years)	
Cost per year	5.01
Maintenance and power cost per year	0
Cost of water saved per year	4.60
Cost of power saved per year	0
Cost of sewage saved per year	4.80
Total savings per year	9.40
Net savings per year	4.39
Water saved per day -- 30 gallons	

Flush Valves -- Flush valves are widely used in office and other commercial buildings. They do not require a reservoir as do conventional household toilets. The flush valve automatically delivers the required volume of water to flush the toilet with no excess to be wasted. Water flow ceases when flushing is completed. Flush valves are especially adapted to installation as a two cycle system in which two volumes of water are utilized for flushing, one for feces and a smaller one for urine. This is made possible by installing two valves in parallel in the water line. A disadvantage of flush valves is that they require larger water supply lines than are standard in most homes; however, this would not preclude their use.

Initial costs of flush valves would be higher than any of the devices that we have thus far looked at, but cost reductions in water and sewage would offset these costs in the long run. The following table analyzes these costs.

COST ESTIMATES FOR A FOUR MEMBER FAMILY

	1 Valve	2 Valves
Material cost 1 or 2 flush valves $40 ea. piping $20	$60.00	$100.00
Labor cost 5-6 hr. @ $7.50/hr.	37.50	45.00
Total installation cost	97.50	145.00
Expected life (15 years)		
Cost per year	6.50	9.65
Maintenance and power cost per year	.75	1.50

COST ESTIMATES FOR A FOUR MEMBER FAMILY
(Continued)

	1 Valve	2 Valves
Cost of water saved per year	4.60	7.05
Cost of power saved per year	0	0
Cost of sewage saved per year	4.80	7.40
Total savings per year	9.40	14.45
Net savings	2.15	3.30
Water saved per day: 1 valve - 30 gallons, 2 valves) - 62 gallons,		

Siphon-Jet Toilets -- Siphon-jet toilets are so called because when flushed, water is siphoned from the toilet reservoir rather than emptied by gravity flow. Such a design permits smaller volumes of water to be utilized in flushing the toilet bowl. Toilets of this type have been used in Britain for many years and are now available in this country. Water use for U.S. models is reported by the manufacturer to be one third of that for his conventional models.

An improvement to this toilet that is finding wide acceptance in Britain is the two cycle siphon-jet toilet. The difference between this toilet and the standard siphon toilet is that there are two separate flush cycles, one for urine and one for feces. The solid waste flush cycle uses 2.5 gallons per flush while the liquid waste cycle uses only 1.25 gallons per flush. The flush cycles are initiated by a short, sharp pull on the flush handle for the smaller amount of water, and a longer, more persistant pull for the larger amount of water. When these figures are compared to the 5 to 6 gallons of water used to flush our standard toilets, the tremendous potential water savings is obvious. Unfortunately, these toilets are not as yet being manufactured in the United States.

By combining several of the water saving devices that have been discussed an even greater total saving of water can be obtained. For instance, if a shallow trap toilet reservoir, a flow control shower head, and two faucet aerators are installed in a single home, the cost estimates would be as in the following table.

COST ESTIMATES FOR A FOUR MEMBER FAMILY

Material cost	1 shallow trap res. @ $70.20	$ 88.20
	1 flow control shower @ $15	
	2 aerators @ $ 1.50	
Labor cost 6 hr. @ $7.50/hr.		45.00
Total installation cost		133.20
Expected life (15 years)		
Cost per year		6.45
Maintenance and power cost per year		0
Cost of water saved per year		8.10
Cost of power saved per year		4.37
Cost of sewage saved per year		8.62
Total savings per year		21.09
Net savings per year		14.64
Water saved per day -- 56 gallons		

Recycling Wastewater -- The recycling of resources is a popular concept that has wide implications in resource conservation. Recycling has a definite place in home water use. Various methods such as distillation, freezing, reverse osmosis, electrodialysis, and refinements to processes already in use such as oxidation, chemical-mechanical removal, and filtration show promise. All of these methods currently have severe limitations which prevent their widespread adoption. In most cases such treatment is simply too expensive.

Recent studies have shown that wastewater from sink, bathtub, and laundry drains is satisfactory for reuse in toilet flushing without treatment other than simple filtering. Wastewater from these drains can be stored in a tank connected to the toilet reservoir. In this manner most of the water usually required for toilet flushing can be saved. A system of this type has been in operation at the Grand Canyon for many years. Staining agents and bacteria may pose problems with this type of reuse. Color and murkiness will normally also be present to a degree. This may be objectionable to some people. Recycling of water to flush toilets is already in use in some water-short areas of the country. Below is a cost estimates table for a home with a wastewater recycling system for toilet flushing.

COST ESTIMATES FOR A FOUR MEMBER FAMILY

Material cost tanks and piping @ $95 pump and filter @ $140	$235.00
Labor cost 12 hrs. @ $7.50/hr.	90.00
Total installation cost	325.00
Expected life 10 years (main components)	
Cost per year	32.50
Maintenance and power cost per year	3.65
Cost of water saved per year	16.10
Cost of power saved per year	0
Cost of sewage saved per year	15.30
Total savings per year	31.40
Net savings per year	4.75
Water saved per day -- 100 gallons	

Vacuum System -- In this system a vacuum pump removes wastes from the toilet and transports them to a holding tank from which they are fed into the sewer line. Such a system uses a mere 10 percent of the water required by the standard flush toilet. This type of system is too expensive for installation in individual homes but it appears to be attractive where many toilets can be joined to a central vacuum system as in hotels or housing developments. The effects that vacuum systems will have on conventional sewage treatment facilities is not known.

Many devices are available to conserve water, reduce wasteflow, and save energy in the home. Most of these devices are inexpensive and relatively easy to install. Over the long run these devices will save you money on fuel, electric, sewage and water bills, at no inconvenience to you. If water-saving devices are adopted on a community-wide basis, millions of gallons of water can be saved. These savings may buy more time for planners, delay the need for expensive water and wastewater treatment expansion, improve water quality by lessening the load on sewage treatment and septic tank systems, and help conserve our valuable energy resources. The result will be a cleaner environment for everyone.