



**What is the real cost of cleaning?  
An integrated unit of work that  
involves a study of the costs, both  
financial and environmental, of  
using household cleaning products.  
Science and Financial Literacy for SEA\*ACT**

An integrated unit for students in Later Childhood, combining essential content from the ACT Department of Education and Training curriculum framework *Every Chance to Learn Essential Learning Achievements 20 and 24*.

**Janet Elliot and Katheryn Elliot.  
2008**



# *What is the real cost of cleaning?*



**An Integrated Unit of Work.  
Later Childhood Band of Development.**

by Janet Elliot and Kathryn Van Duren.

## What is the real cost of cleaning?

Level - Later Childhood Band of Development.

*What is the real cost of cleaning?* is an integrated unit of work that involves a study of the cost, both financial and environmental, of cleaning products. It uses the 5E's model and supports the essential Learning Achievements 20 – The student acts for an environmentally sustainable future- and 24 – The student makes informed choices about money and finance- of the ACT DET Curriculum Framework *Every Chance to Learn*. It gives students many opportunities to learn that environmental and human health considerations, along with monetary cost, safety and effectiveness, need to be a part of purchasing practices

People have a variety of cleaning products in their homes. They can impact on health and the environment.

Some cleaners may be 'brown', containing chemicals that can be toxic. The chemicals found in most 'brown' cleaners can be damaging to the environment. They may contain chemicals associated with human health issues (e.g. eye, skin and respiratory irritation). In concentrated form, some are classified as hazardous, creating potential handling, storage, and disposal issues for users.

Some cleaners may claim to be 'green' which claim to be better for the environment. They may claim to be biodegradability, low in toxicity, low in volatile organic compound (VOC) content, packaging friendly and/or have a low life cycle energy use.

Some cleaners may be 'home made', using natural ingredients, prepared from safer and more gentle alternative chemicals.

### Background Teacher Information.

A chemical is anything that has a mass and takes up space. Therefore everything and everyone is made up of chemicals. Toxic chemicals are substances that are potentially dangerous to the environment, including to humans.

#### Chemicals in cleaning.

We all use chemicals to clean our homes. They are important to the maintenance of a clean and healthy environment. Cleaning products are made from various chemicals, some of which may be deleterious to the environment.



For an **environmentally sustainable future**, we must meet the needs of current generations without compromising the needs of future generations. We need to live within the limits of what the environment can sustain and understand the interactions between economies, society and the environment. We need to make **informed choices** about our use of **money**. We need to consider sustainability and social responsibility in purchasing decisions. We need to use products that minimize the impact on the environment at each phase of the life cycle - production, supply, use and disposal. Consumer choice has a significant impact on the market. Through purchasing environmentally friendly products, consumers can make a big difference to the environment.

The production, supply, use and disposal of products can all impact adversely on the environment. Production impacts on the environment through the operation of factories – possible pollution, generation of waste and energy and water consumption. Transporting materials to production site and goods to point of sale entails vehicle emissions. Disposal of waste materials such as containers, used cleaning equipment and wash water can impact on the environment as they may end up in the environment where chemicals can kill or reduce micro-organisms.

Retail outlets sell many products that claim to be environmentally friendly – safe, recyclable, degradable, ozone friendly. But are they what they claim to be? Add to this the fact that most products do not exist on a simple continuum from 'green' to 'brown' because their impact may vary at different stages of their life cycle. For example, recyclable containers may be more resource intensive to manufacture. Environmentally and economically friendly products are less polluting to manufacture, less likely to cause injury if ingested, less expensive than toxic cleaners, packaged to reduce waste, not polluting indoors and simple and effective to use.

Sustainable products represent value for money in real dollar terms when life-cycle costs such as energy and water use, production of waste, packaging, durability (such as cleaning equipment) re-use and recyclability and disposal costs are also sustainable. Reducing consumption reduces both direct and indirect impacts on the environment. In assessing the sustainability of available purchases, consider the product information to determine potential environmental impacts, interpret the information and compare brands and alternative cleaners.

Some chemicals used in 'brown' cleaning products are;

**Phosphorus**, used in detergents to soften hard water, suspend dirt in the water once removed and increase the alkalinity of the cleaner. It can cause an imbalance in aquatic ecosystems such as algal blooms which choke waterways and strip oxygen out of the water.

**Fluorescers**, added to laundry detergents to increase the whiteness, but not necessarily the cleanliness, of the material.

**Surfactants**, which act as a wetting agent to enhance the power of detergents.

**Solvents** are used to help distribute a cleaner across a surface such as a floor. There are many types such as organic, chlorinated and hydrocarbon solvents. These may contaminate soil, water and create hazardous fumes.

**Dyes and deodorizers**, added to make a product look and smell good. They do not add to the cleaning power but may cause allergic reactions.

**Ammonia hydroxide**, a solution of ammonia in water. It is both caustic and hazardous and can irritate the lining of airways, causing them to become inflamed.

**Chlorine**, a powerful oxidant. It can cause choking and poisoning. It is used in bleaching and disinfectants. It can irritate the lining of airways, causing them to become inflamed.

**Sodium hydroxide**, a strongly alkaline compound that is used in soaps and detergents and as a drain cleaner. It irritates the lining of airways, causing them to become inflamed.

**Bleach**, or sodium hypochlorite. The chlorine used to make bleach is highly toxic and bleach itself is acutely toxic to fish.

**Hydrochloric acid**, sodium acid sulfate in toilet cleaners can burn skin and cause vomiting. It is very dangerous if swallowed, as it will burn the stomach. Splashed in the eyes can result in eye damage.

Some chemicals used in ‘home made’ green cleaners are;

**Baking soda** or **sodium hydrogen carbonate**, a chemical compound, a white crystalline or granular powder.

**Borax\*** is naturally occurring compound made of boron, sodium, oxygen and water. Borax is a very good cleaner, especially for laundry. **\*Students are not to handle borax**

**Cornstarch** or corn flour, the starch of the maize grain, commonly known as corn.

**Lemon juice**, from lemons.

**Salt**, sodium chloride, a white crystalline solid.

**Soap**, oil based, not detergent based, Soap, is made from acidic oils (such as oils of palm, coconut, olive and palm kernel) and an alkaline solution.

**Steel wool**, an abrasive material composed of long steel fibers of varying degrees of fineness that are matted together. The coarser grades are used to remove paint and other finishes, the finer grades for polishing or smoothing a finished surface. Steel wool is much used in kitchens for cleaning and polishing metals, especially aluminum utensils.

**TSP - trisodium phosphate**, a mixture of soda ash and phosphoric acid. **It is toxic if swallowed** but it is used for tasks which otherwise require more caustic and poisonous chemicals to clear drains and old paint.

**Washing soda**, or sodium carbonate. It occurs naturally in arid regions. It is found in the form of deposits on locations where lakes evaporate. It is believed to have erupted from volcanoes in the past.

**White vinegar, fermented wine.** Vinegar was discovered quite by accident when a cask of wine, past its time, fermented and turned sour. Today, pure White Vinegar, the most common and widely used vinegar, is primarily made from the alcohol derived from corn.

There are things that we can do to reduce the impact of cleaning on the environment and human health. **The best solution to the problem of environmental damage is prevention.** We can become more informed about the environmental impacts of cleaning products we buy and aim to purchase only sustainable products. We can change the way we clean our homes and work environments and we can use cleaning products that are more environmentally friendly. We can find safer alternatives for the most toxic cleaners and find more sustainable products. We can become readers of ingredient labels. We can reduce the amount of cleaning and still keep homes and work places clean and we can reduce the amount of cleaner we use. We can create safer home environments. We can use better cleaning equipment – vacuum cleaners, micro-fibre cleaning cloths – to reduce our use of cleaners. We can use safer ingredients for cleaning, such as soap, baking soda, vinegar, and lemon juice. We can reuse and recycle waste goods and materials.

-  SAFETY. Common household cleaners and chemicals are used in this unit of work. Working with chemicals can lead to dangerous situations with reactions (e.g. vinegar and baking soda in a closed container) or toxic fumes (e.g. bleach and ammonia based cleaners can give off toxic fumes). Use well ventilated areas and advise students that the products are not to be tasted or smelt. For safety concerns, refer to safety guidelines for your Department of Education.
-  ALERT: Using some essential oils during pregnancy is not recommended. If it is an issue, seek advice from experts.

## Learning Achievements addressed in this Unit of Work.

<b>Learning Achievement 20 – The student acts for an environmentally sustainable future.</b>	<b>Learning Achievement 24 – The student makes informed choices about money and finance.</b>
<p>Focus</p> <ul style="list-style-type: none"> <li>• To develop students’ capacity to understand and contribute to an environmentally sustainable future.</li> <li>• Acting for a sustainable future means knowing about developing ways to meet current human needs so as not to diminish the quality of the environment or reduce the capacity of future generations to meet their needs.</li> </ul>	<p>Focus.</p> <ul style="list-style-type: none"> <li>• Consumer and financial literacy – the application of knowledge, understandings, skills and values in consumer and financial context and the related decisions that impact on self, others , the community and the environment.</li> <li>• Develop the capacity of the students to take personal responsibility for making consumer choices and manage their own finances.</li> <li>• Prepare students to make informed choices about money and finances as they arise in life situations.</li> </ul>
<p>Three aspects to the ELA.</p> <ul style="list-style-type: none"> <li>• learning about the environment ecosystems the impact of people on the environment.</li> <li>• learning in the environment hands on investigation, collecting data, analysing data, identification and discussion of problems and opportunities research ways to improve management of environment contribute to practical solutions.</li> <li>• learning for the environment appreciate the intrinsic value of the environment and need to act as custodians *understand imperatives for global action for sustainable future *envisage possible future – identify positive ways to act for environmentally sustainable future.</li> </ul>	<p>Four aspects of the ELA.</p> <p>Knowledge and understanding about-</p> <ul style="list-style-type: none"> <li>• The nature and forms of money and how money is used.</li> <li>• Income, spending, saving and investment.</li> <li>• Types of financial transactions and roles of financial institutions.</li> <li>• Consequences of different consumer and financial choices</li> <li>• Value for money</li> <li>• Consumer rights and responsibilities</li> <li>• Responsible borrowing and lending.</li> <li>• Risks associated with impulse buying, credit and gambling.</li> </ul> <p>Skills</p> <ul style="list-style-type: none"> <li>• In budgeting and in accessing, analysing and applying consumer and financial information.</li> </ul> <p>Enterprise.</p> <ul style="list-style-type: none"> <li>• In using initiative, building financial capacity and managing risk.</li> </ul> <p>Care and responsibility</p> <ul style="list-style-type: none"> <li>• In making consumer and financial decisions, considering consequences and behaving ethically in financial dealings.</li> </ul>

<p><b>Attitudes and values.</b> Students have the opportunity to</p> <ul style="list-style-type: none"> <li>• appreciate the need to preserve the environment</li> <li>• appreciate their responsibility as a consumer and citizen, to conserve and manage environmental resources for future generations.</li> </ul>	<p><b>Attitudes and values.</b> Students have the opportunity to:-</p> <ul style="list-style-type: none"> <li>• develop a willingness to take personal responsibility for spending decisions.</li> <li>• develop an attitude of being assertive and ethical as a consumer</li> <li>• appreciate the need for individual and social responsibilities as a consumer</li> <li>• value honesty and integrity in financial dealings</li> <li>• develop a disposition to plan for the future</li> <li>• develop an attitude of enterprise and initiative</li> <li>• develop a positive attitude towards supporting charitable work.</li> </ul>
<p><b>Relevant links with other ELA/s</b> Learning about and learning in the environment links to :</p> <ul style="list-style-type: none"> <li>• The student understands and applies the inquiry process.</li> <li>• The student understands and applies scientific knowledge</li> <li>• The student understands world issues and events.</li> </ul> <p>Learning for the environment links to:</p> <ul style="list-style-type: none"> <li>• The student makes considered decisions</li> <li>• The student acts with integrity and regard for others</li> <li>• The student makes informed choices about money and finance</li> </ul>	<p><b>Relevant Links with other ELA's.</b> The ELA links to:-</p> <ul style="list-style-type: none"> <li>• The student makes considered decisions</li> <li>• The student will act with integrity and regard for others</li> <li>• The student understands and applies number.</li> </ul>
<p><b>Outcomes – Markers of Progress.</b> They describe some interrelationships between parts of the natural cycles and systems. Students investigate and describe the impact of human activity on familiar environments and identify what they can do to care for the local environment.</p>	<p><b>Outcomes – Markers of Progress.</b> Students know that purchasing involves making choices in relation to their needs and wants, prices and value for money.</p>

**Learning Achievement 20 – The student acts for an environmentally sustainable future.  
Later Childhood Band of Development**

Sections relevant to this unit of work:-

In the later childhood band of development, students have opportunities to understand and learn about;

20. LC. 1.	Natural cycles and systems in the environment
20. LC. 3.	Some effects of human action on natural environments
20. LC. 5.	The preservation of natural environments ...
20. LC. 6.	How to protect the environment requires that people work as citizens and consumers and participate in appropriate action as environmental stewards or in other civic action to effect positive change
20. LC. 9.	Investigate how their actions contribute to sustainability of resources and local environments
20. LC. 10.	Explore probable and preferred futures in relation to environmental issues familiar to them and discuss actions needed to make preferred futures happen

**Learning Achievement 24 – The student makes informed choices about money and finance.  
Later Childhood Band of Development**

Sections relevant to this unit of work:-

In the later childhood band of development, students have opportunities to understand and learn about;

24. LC. 3.	Factors to consider when making purchasing decisions(e.g. needs, wants, function, cost, quality, income, savings)
24. LC. 4.	The influences of advertising and peers on purchasing choices
24. LC. 5.	Basic consumer rights and responsibilities (e.g. people have the right to receive goods that meet health and safety standards and people have the responsibility to pay on time and repay borrowings)
24. LC. 9.	Reflect on their own needs and wants in relation to spending priorities and choices (e.g. explore clear and not so clear differences between needs and wants).
24. LC. 11.	Compare goods and services (e.g. functions, features and prices) and make judgments about value for money
24. LC 12.	Identify and use information on product labeling (e.g. amount, ingredients, health and safety information) and sales receipts (e.g. price charged, warranty)

### **5E's model.**

The **5Es model** is based on the idea that learners learn best when they are engaged in working out explanations. It derives from the constructivist learning theory which argues that learners actively construct knowledge and meaning from an interaction of their beliefs, understandings (prior knowledge) and experiences.

The 5E's model was developed by Roger Bybee. (1997). Using this model, a learner's existing ideas are considered and the students are engaged in examining new information, reconciling alternative conceptions and re-integrating new knowledge to build ever better understandings.

The phases of the 5E's model are based on Bybee's model. It provides structure for a sequence of learning experiences.

Element.	Focus
ENGAGE	To engage the student To access prior learning To stimulate thinking on the topic and find out what students want to know.
EXPLORE	To provide hands on experiences of the topic. To explore aspects of the topic. To give students time to think, investigate and collect information
EXPLAIN	To analyze explorations. To clarify understanding. To modify ideas through reflection.
ELABORATE	To expand and consolidate student thinking To apply the learning in a real situation through a student planned investigation.
EVALUATE	Provide opportunities for students to reflect on their learning, new understandings and their working scientifically skills. To assess student understandings of the topic concepts. To assess student skills.

## Overview of the Unit.

<b>Phase of the 5E's model.</b>	<b>Lesson</b>	<b>Content.</b>
Engage	1 Sessions 1 and 2.	Survey form to ascertain prior knowledge. Article to inform ideas about reactions to cleaners.
Explore	2 Sessions 1 - 5	Cleaning items with home made cleaners. Comparing ingredients and costs of a 'brown', 'green' and 'home made' cleaner.
Explain	3 Sessions 1 – 2.	Game to heighten awareness of environmental issues of toxic chemicals Raise awareness of the environmental pollution through germination experiments.
Elaborate	4	The students are supported to conduct an investigation of the cost (monetary and environmental) and the effectiveness of a 'brown' a 'green' and a 'homemade' disinfectant.
Evaluate.	5 Sessions 1 - 2	Survey, the same as used in the Engage Phase. Poster or PowerPoint presentation recording the three types of cleaners studied, recording the advantages, disadvantages and monetary and environmental costs of each.

## ENGAGE

To engage the student

To access prior learning

To stimulate thinking on the topic and find out what students want to know.

### **Content.**

Survey form to ascertain prior knowledge.

Article, “Spray and wipe and wheeze” (or some similar, relevant article) to inform ideas about reactions to cleaners.

### **Assessment.**

Assessment is an ongoing process of gathering and using evidence of student achievement. The survey undertaken in this phases provides assessment information about the students’ prior knowledge.

### **Materials.**

Worksheet 1. Survey form per student.

Worksheet 2. “Spray and wipe and wheeze” by Peter Lavelle for each group.

Integrated Unit Journal for each student.

### **Lesson/s steps.**

1. Distribute the Everyday Chemicals Survey to each student. Explain that the survey will give the teacher information about the student’s opinions and what they know about chemicals.
2. Students independently complete the survey.  
Questions 1,2,3 and 6 ask for individual opinions. Questions 4 and 5 are factual and the answer is ‘Agree’. Question 7 is designed to get the students thinking about pollution. Any of the items can produce pollution – either in manufacture, use or disposal.
3. Lead a discussion about the items listed in question 7 and ascertain the students’ understanding of the fact that all the items are made of chemicals.
4. Ask the students to name (or find out) household cleaners that are used in their home, or discuss the types of cleaners used at home – surface cleaners, toilet cleaners, bath and basin cleaners etc.
5. Introduce the article, “Spray and wipe and wheeze” by Peter Lavelle (worksheet 2) and have the students read it.
6. Divide the students into cooperative learning groups and ask each student to paste the article into their Integrated Unit book and to record their ideas about the scientific study carried out about sprays and asthma, what causes the asthma and steps that can reduce the risk.
7. Discuss the idea that all cleaners are chemicals and they can have an effect on people and the environment. People need to make decisions about what chemicals they buy, use and understand how the decisions are made.
8. Introduce a notice board for articles, advertisements, pictures about house cleaning chemicals. Discuss where these can be found, e.g. daily newspaper, magazines.
9. Begin an ‘Information Bank’ section in Integrated Unit Journal that can include words and visual representations (such as photos, diagrams, drawings, symbols and signs) that will aid vocabulary acquisition and understanding.

## Everyday Chemicals.

## Worksheet 1.

(based on the survey from “Everyday Chemicals, The Regents of the University of California, 1990).

### Individual Survey. YOUR opinions and ideas.

Please tick the boxes that best describes your opinion.

Statement	Agree	Not sure	Disagree
1. Chemicals have helped to improve the health of people.			
2. Chemicals have helped to improve our environment.			
3. Chemicals and their uses have helped to improve my life.			
4. Everything I eat or drink is made up of chemicals.			
5. Safety precautions are necessary when using chemicals around the house.			

6. Which of the following items contain chemicals?

bike	household cleaners	ipod
skateboard	camera	CD

7. Which of the following items do you use on a daily basis?

television	household cleaners	car (as passenger)
books	chair	Fruit juice

8. Which of the following items do you think add to the pollution of the environment?

mobile phone	household cleaners	car (as passenger)
diet soft drink	computer	diet soft drink

## ABC Health and Wellbeing

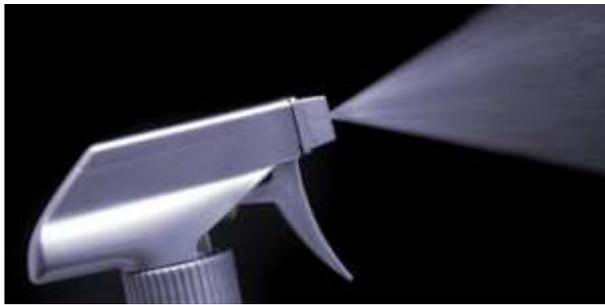
### The Pulse

# Spray and wipe and wheeze

by [Peter Lavelle](#)

Household spray cleaning products, even used only occasionally, can trigger asthma, say European researchers.

Published 01/11/2007



[Image source: iStockphoto]

Is your home full of bright shiny surfaces and gleaming tiles? Are your granite kitchen benches doused daily with a fine spray, and your designer chairs bathed in a weekly lather of foam?

Well, it might explain why you're gasping for breath.

Using spray home-cleaning products, even occasionally, may raise the risk of getting asthma symptoms, say European researchers.

Our lungs – intended by evolution to breathe pure, fresh unadulterated air – are sensitive and quick to react to modern 21st century pollutants in the air.

These substances irritate the airways, causing them to narrow, restricting the flow of air in and out of the lungs, and causing breathlessness and tightness in the chest.

There's a long list of these 'triggers': dust mites, pollens, animal hair, smoke, air pollutants; and to this list we can now aerosol chemical cleaners.

Researchers from 10 European countries did a study of more than 3,500 people who cleaned their homes regularly (most were women). They were part of a larger study of asthma in the EU called the European Community Respiratory Health Survey. Over a nine-year period, researchers quizzed them about their use of one or more of 15 cleaning products, did lung function tests and quizzed them to see if they developed signs of asthma: that is, if they reported wheezing, were diagnosed by doctors as having asthma or put on asthma treatment.

The researchers calculated that using cleaning sprays just once a week raised the risk of wheeze by 40 per cent. The more often sprays were used, and the greater the number of different sprays used, the greater the likelihood

of symptoms. Those who used sprays more than four times a week were twice as likely to see a doctor and be diagnosed with asthma than those who didn't use sprays.

The sprays more likely to cause symptoms were glass-cleaning, furniture, and air-refreshing sprays.

How do these products cause wheezing? They contain chemicals like ammonia, chlorine and sodium hydroxide, which directly irritate the lining of airways, causing them to become inflamed.

## **Wheezing in kids**

Past studies have also shown a correlation between spray cleaners and asthma. A 2004 study of 14,000 children aged three and under found that exposure to household cleaning products like bleach, aerosols, carpet and window cleaners doubled the risk of asthma in homes where they were used frequently compared to homes where they were used only sparingly.

Allergy specialists believe that a child who develops wheezing after exposure to spray cleaners is at a higher risk of having asthma later in life. It's more likely in a person with a tendency to asthma anyway – where the child has other allergic conditions like eczema, or it runs in the family (for example a parent has asthma).

Over the past two decades our use of these cleaning products has skyrocketed. We're encouraged by aggressive marketing to maintain a pristine, antiseptic, germ-free home. Over the last two decades the incidence of asthma has risen too, although the increasing use of cleaning agents and other chemicals in the home may not be the only reason.

Still, it makes sense to be aware of the association. So if you've noticed yourself wheezing when you clean, if you're asthmatic, and/or you have a child who wheezes or has allergies:

- clean with open doors and windows
- use liquid or solid (that is, non-spray) cleaners instead of aerosols
- wear a mask when cleaning
- put the child in another room
- use non-toxic cleaning alternatives: solutions of vinegar, salt and baking soda (bicarb) make good cleaners.

And let those designer chairs accumulate a little dust now and then.

<http://www.abc.net.au/health/thepulse/stories/2007/11/01/2078330.htm>

## EXPLORE

To provide hands on experiences of the topic.

To explore aspects of the topic.

To give students time to think, investigate and collect information

### **Content.**

Cleaning items with home made cleaners.

Comparing ingredients and costs of a 'brown', a 'green' and a 'home made' cleaner.

### **Assessment.**

Integrated Unit Book entries.

Tables in sessions 4 and 5.

### **Materials.**

#### **Session 1. Cleaning Silver.**

A tarnished piece of silver

A pan or dish large enough to completely immerse the silver in

Aluminum foil to cover the bottom of the pan

Enough water to fill the pan

A vessel in which to heat the water

Kitchen mitts with which to handle the heated water vessel

Baking soda, about 1 cup per 2 litres of water.

#### **Session 2. Cleaning copper coins.**

Disposable gloves for each student

Coins – old 1 and 2 cent coins (or other copper items such as pieces of copper pipe)

Vinegar (which is diluted acetic acid) (1/4 cup)

Salt (1 teaspoon)

Plastic cups

Water

Plastic measuring spoons.

Paper towel.

#### **Session 3. Stainless Steel and odor Removal.**

Per group;

Stainless steel 'soap'

Onion

Procedure – Worksheet 3.

#### **Session 4. Comparing cleaning ingredients and cost.**

Disposable gloves for each student.

A collection of three cleaners per group, one 'brown', one 'green' and one a 'home made cleaner' for one cleaning job, e.g. cleaning the shower. Sufficient sets for the number of cooperative learning groups that will be working.

See Worksheet 8 for recipes for home cleaners. Prepare those you wish to compare with commercial products.

Visit a supermarket or web site to determine the cost of cleaners, 'brown' and 'green'.

### **Lessons.**

#### **Session 1.**

1. Review the ideas that all cleaners are chemicals, that they can have an effect on humans and

their environment and that people need to make decisions about what chemicals they buy and use and understand how the decisions are made.

2. Explain that the students are going to be engaged in a number of 'cleaning' activities with 'home made' cleaners, cleaners formulated simply and using natural ingredients. The first activity will be done by the teacher as it involved hot water.

### 3. Cleaning Silver.

Discuss the fact that the bright, shiny surface of silver darkens and becomes less shiny. This happens because silver a chemical reaction with sulfur-containing substances in the the students that we can use chemistry to remove the reaction, and make the silver shiny again.

Line the bottom of the pan with aluminum foil. Set the silver top of the aluminum foil. Make sure the silver touches the In a separate pan, eat the water to boiling. Remove it from and place it in a sink. To the hot water, add about 1/3 cup of soda for each litre of water. The mixture will froth a bit and over; this is why you put it in the sink.

Pour the hot baking soda and water mixture into the pan, and completely cover the silver.

Invite the students to view the reaction -almost immediately, will begin to disappear. As a class, discuss what has



gradually undergoes air. Advise tarnishing

object on aluminum. the heat baking may spill

the tarnish happened.



**Explanation:** When silver tarnishes, it combines with sulfur and forms silver sulfide. Silver sulfide is black. When a thin coating of silver sulfide forms on the surface of silver, it darkens the silver. The silver can be returned to its former luster by removing the silver sulfide coating from the surface.

The picture shows tarnish removed from right half of the goblet.

### Session 2.

#### 4. Cleaning copper coins.

Explain that the students will be working in cooperative learning groups, with the manager collecting equipment, the director making sure the task gets done and the speaker, the only group member to approach the teacher to speak. Managers need to collect a procedure sheet (Worksheet 3) a container of salt and of vinegar, a plastic cup, a plastic measuring spoon, several sheets of paper towel and several copper coins.

5. Students follow the procedure.

6. As a class discuss what has happened.

#### **Explanation.**

Copper coins get dull over time because the copper in the coins slowly reacts with air to form copper oxide. Pure copper metal is bright and shiny, but the oxide is dull and greenish.

When you place the copper coins in the salt and vinegar solution, the acetic acid from the vinegar dissolves the copper oxide, leaving behind shiny clean coins.

The copper from the copper oxide stays in the liquid.

(You could use other acids instead of vinegar, such as lemon juice).



### Session 3.

#### 7. Stainless Steel and odor Removal.

Explain that the students will be working in cooperative learning groups to test if stainless steel ‘soap’ removed odors from hands. One household tip for removing odors from fish, onions, or garlic from your hands is to rub your hands with stainless steel. Does it work?

The manager will collect equipment, the director ensures the task gets done and the speaker, the only group member to approach the teacher to speak. Managers need to collect a procedure sheet (Worksheet 4), an onion, a stainless steel soap (available at National Geographic shops and Questacon shop).

8. Students follow the procedure.

9. As a class discuss what has happened.

**Explanation. Speculation on how it works**

The sulfur from the onion/garlic/fish would be attracted to and bind with one or more of the metals in stainless steel. Formation of such compounds is what makes stainless steel stainless. Onions and garlic contain amino acid sulfoxides, which form sulfuric acids, which then form a volatile gas (propanethiol S-oxide), which forms sulfuric acid upon exposure to water. These compounds are responsible for burning your eyes while cutting onions and also for their smell. If the sulfur compounds bind to the steel, then the odor is removed from your fingers.

**Session 4.**

**10. Comparing cleaner ingredients and cost.**

Explain to the students that they are going to work in cooperative learning groups to find out some information on ingredients and their effects on health and the environment, of some household cleaners. NOTE: Many products have minimal information about their ingredients and students may have to visit websites such as <http://www.ec.gc.ca/substances/ese/eng/psap/psl2-1.cfm> and [www.scorecard.org](http://www.scorecard.org) and then, under Health Hazards on the menu on the left hand side of the screen, click on Chemical Profiles. The teacher may prefer to obtain this information before the lesson. The managers will select one product at a time for their group to analyse. Using the table, Worksheet 5, they will record their findings. Discuss that a table is used to organize information into an easily understood format where we can compare information. Worksheet 6 will provide information on the chemicals. Worksheet 7 provides information about cleaning chemicals and their health impacts. Managers need to collect three copies of Worksheet 5 (one each for manager, speaker and director) and one each of Worksheet 6 and Worksheet 7 and a product to analyse – more than one if time permits. Set the students to work.

11. Students return to the class group and share their findings.

**Session 5.**

12. Explain to the students that, in cooperative learning groups, they are going to take a group of cleaners, one ‘brown’, one ‘green’ and one a ‘home made cleaner’ for one cleaning job, e.g. window cleaner, toilet bowl cleaner, disinfectant, drain cleaner, oven cleaner, all purpose cleaner, bath and tile cleaner, mould and mildew cleaner, silver cleaner, and create a table to display the ingredients of each. Remind them that a table is used to organize information into an easily understood format where we can compare information. In their Integrated Unit Book, they will need to rule up a table with three columns, four rows, a row for headings (‘Brown’ cleaner, ‘Green’ cleaner and ‘Home made’ cleaner), a row for name of cleaner, a row for monetary cost and a row for information on ingredients.

It will also need a title. e.g.

**Ingredients in Cleaners used for shower and bath cleaning.**

'Brown' cleaner	'Green' cleaner	'Home made' cleaner.
Name:	Name:	Name:
Price:	Price:	Price:
Ingredients;	Ingredients;	Ingredients;

Set of multi-purpose cleaners, 'brown', 'green', and 'home made'.



Set of silver cleaners.

Set of bathroom/shower/bath cleaners



Washing up detergents, 'brown' and 'green'.

The students will need a copy of Worksheet 6, Chemicals in Cleaners, Worksheet 7, Hazardous chemicals in household cleaners, Worksheet 8, Home Made Cleaning Products and a 'Prices at December 2008 sheet (or pricing information supplied by the teacher).

11. Managers collect materials, - three products, one 'brown', one 'green' and one a 'home made' cleaner for one cleaning job. All members of the group draw up a table in the Integrated Learning Unit Book and fill in the table with information on the products.

12. Students return to the class group and each cooperative learning group reports on its findings. The discussion should involve the differences between brown, green and home made cleaners and the implications

of what they have found out about the chemicals used in various cleaners. One objective of the discussion is to have the students realize that there may be more than the purchasing cost – there may be an environmental cost.

13. Review the notice board re articles, advertisements, pictures about house cleaning chemicals that was established in Lesson 1.

14. Review the ‘Information Bank’ section in Integrated Unit Journal, introduced in Lesson 1, and add information.

**Materials.**

Disposable gloves for each student

Coins – copper. Old 1 and 2 cent coins. Or copper items such as pieces of copper pipe

Vinegar (which is diluted acetic acid) (1/4 cup)

Salt (1 teaspoon)

Plastic cups

Water

Plastic measuring spoons.

Paper towel.

1. Put on gloves
2. Mix 1 teaspoon of salt with  $\frac{1}{4}$  cup of vinegar. Stir to dissolve the salt.
3. Dip a coin in half way and hold it there for about 20 seconds. Remove it. Observe it.
4. Place some coins in the liquid.
5. Leave for 5 minutes.
6. Remove coins, rinse and dry.



## Stainless Steel and odor Removal. Procedure sheet.

## Worksheet 4.

One household tip for removing odors from fish, onions, or garlic from your hands is to rub your hands with stainless steel.

Does stainless steel remove odors?

**TEST.**

### In your groups.

Have one person rub their hands in cut up onion.

Others in the group smell the hands to see if they have onion odor.

The onion hands person, wash your hands (for at least 30 seconds) using the stainless steel 'soap'.

Group members now check for onion odor.

Is the odor still there? Do you think it will remove the odor?

Did it work? Why do you think it had that result?



<p><b>Name of the product.</b></p>	
<p><b>List of ingredients.</b></p>	
<p><b>Potential problems with the ingredients.</b></p>	
<p><b>Potential impact on human health and/or the environment.</b></p>	
<p><b>Safer alternative product?</b></p>	

Some chemicals used in 'brown' cleaning products are;

**Phosphorus** used in detergents to soften hard water, suspend dirt in the water once removed and increase the alkalinity of the cleaner. It can cause an imbalance in aquatic ecosystems such as algal blooms which choke waterways and strip oxygen out of the water.

**Fluorescers**, added to laundry detergents to increase the whiteness, but not necessarily the cleanliness, of the material.

**Surfactants** which act as a wetting agent to enhance the power of detergents.

**Solvents** are used to help distribute a cleaner across a surface such a floor. There are many types such as organic, chlorinated and hydrocarbon solvents. These may contaminate soil, water and create hazardous fumes.

**Dyes and deodorizers**, added to make a product look and smell good. They do not add to the cleaning power.

**Ammonia** hydroxide, a solution of ammonia in water. It is both caustic and hazardous and can irritate the lining of airways, causing them to become inflamed.

**Chlorine**, a powerful oxidant. It can cause choking and poisonous. It is used in bleaching and disinfectants. It can irritate the lining of airways, causing them to become inflamed.

**Sodium hydroxide**, a strongly alkaline compound that is used in soaps and detergents and as a drain cleaner. It irritates the lining of airways, causing them to become inflamed.

**Bleach**, or sodium hypochlorite. The chlorine used to make bleach is highly toxic and bleach itself is acutely toxic to fish.

**Hydrochloric acid**, sodium acid sulfate in toilet cleaners can burn skin and cause vomiting. It is very dangerous if swallowed, as it will burn the stomach. Splashed in the eyes can result in eye damage.

Some chemicals used in 'home made' green cleaners are;

**Baking soda** or **sodium hydrogen carbonate**, a chemical compound, a white crystalline or granular powder.

**Borax\*** is naturally occurring compound made of boron, sodium, oxygen and water, borax is a great cleaner, especially for laundry. **\*Students are not to handle borax.**

**Cornstarch** or corn flour, the starch of the maize grain, commonly known as corn.

**Lemon juice**, from lemons.

**Salt**, sodium chloride, a white crystalline solid.

**Soap**, oil based, not detergent based. Soap is made from acidic oils (such as oils of palm, coconut, olive and palm kernel) and an alkaline solution. Unscented soaps are more commonly used.

**Steel wool**, an abrasive material composed of long steel fibers of varying degrees of fineness that are matted together. The coarser grades are used to remove paint and other finishes, the finer grades for polishing or smoothing a finished surface. Steel wool is much used in kitchens for cleaning and polishing metals, especially aluminum utensils.

**TSP - trisodium phosphate**, a mixture of soda ash and phosphoric acid. It is toxic if swallowed but it is used for tasks which otherwise require more caustic and poisonous chemicals to clear drains and old paint.

**Washing soda**, or sodium carbonate. It occurs naturally in arid regions. It is found in the form of deposits on locations where lakes evaporate. It is believed to have erupted from volcanoes in the past.

**White vinegar, fermented wine.** Vinegar was discovered quite by accident when a cask of wine, past its time, fermented and turned sour. Today, pure White Vinegar, the most common and widely used vinegar, is primarily made from the alcohol derived from corn.

**Essential oils** such as lavender, tea tree and eucalyptus.

## Hazardous chemicals in household cleaners.

**Worksheet 7.**

Sourced from the US National Institute for Occupational Safety and health (NIOSH)  
- [Pocket Guide to Chemical Hazards](#)

Listed below are some toxins found in common cleaning products. Following this is a list of these toxins and the health issues they can cause.

<b>Product</b>	<b>Common toxic ingredients</b>
dishwashing liquid	naphtha, chloro-ortho-phenylphenol, diethanolamine, petroleum-based surfactants (dishwashing liquids are a leading cause of poisonings in small children)
automatic dishwashing detergent	phosphates (trisodium phosphate, aluminum phosphate, etc), chlorines
furniture polish	naphtha
Drain cleaner	trichloroethylene
disinfectants	naphtha, formaldehyde
laundry Detergent	ethyl acetate
toilet Bowl Cleaner	naphtha
mould & mildew cleaner	formaldehyde
air fresheners	naphthalene, formaldehyde
carpet & upholstery shampoo	naphthalene, trichloroethylene, perchlorethylene

Some of the effects of these chemicals on your health

<b>Chemical toxin</b>	<b>Health issue.</b>
naphtha, naphthalene	damages eyes, skin, respiratory system, central nervous system, liver, kidneys
diethanolamine	damages eyes, skin, respiratory system
chlorine	damages eyes, skin, respiratory system
sodium hydroxide	damages eyes, skin, respiratory system
boric oxide	Damages eyes, skin, respiratory system
trichloroethylene	damages eyes, skin, respiratory system, heart, liver, kidneys, central nervous system; can cause liver & kidney cancer
benzene	damages eyes, skin, respiratory system, blood, central nervous system, bone marrow; can cause leukemia
dichloroethylene	damages eyes, skin, respiratory system, central nervous system, liver, kidneys; can cause liver & kidney tumors
formaldehyde	damages eyes, respiratory system; can cause nasal cancer
perchlorethylene	damages skin, liver
polychlorinated biphenyls (PCBs)	damages skin, eyes, liver, reproductive system; can cause cancer of the pituitary gland & liver, leukemia
ethyl acetate	damages eyes, skin, respiratory system

**Resources.**

<http://www.naturalstrategies.com.au/goods/Use-non-toxic-cleaners/use-non-toxic-cleaners>

**Rider, Kimberley. The Healthy Home Workbook. Easy Steps to Eco-Friendly Living. Chronicle Books LLC. 2006.**

**Fox, Maxine. Holistic Home. The Homemaker's Guide to health and Happiness. Findhorn Press. 200**

Although these ingredients are of an organic origin they can not all be used with complete impunity. Always be careful with some essential oils and with borax\*. Keep them away from your eyes and certainly keep them away from small children and pets. **\*Students are not to handle borax.**

Very few substances are needed to clean our houses safely. The basic cleaning kit needs only:

Vinegar

Baking soda

Cornstarch

Castile soap

Lemon juice

Vinegar

Good quality essential oils

**Vinegar** contains approximately 5 percent acetic acid – making it a mild acid. It can dissolve mineral deposits, grease, remove traces of soap, remove mildew or wax build-up, polish some metals, and deodorize. It can be used to clean brick or stone. It is normally mixed with water before use.

**Baking soda** is sodium bicarbonate. It is a naturally occurring material, present in most organic life forms. It can neutralize acid, scrub shiny materials without scratching, deodorize, and extinguish oil fires. Like vinegar, baking soda has three major attributes that make it indispensable: it is non-toxic, multi-purpose and cheap to purchase.

**Cornstarch.** Cornstarch is made from corn and can be used to clean windows, polish furniture, shampoo carpets and rugs and to starch clothes.

**Castille Soap.** Castille soap is a traditional soap made predominantly from olive oil. It is mild but effective and can be used in the laundry, bathroom, and kitchen.

**Borax\***. Borax is sodium borate. It is a naturally occurring mineral compound best known as a laundry booster and water softener. It is also an excellent multi-purpose household cleaner.

**\*Students are not to handle borax.**

**Lemon Juice.** Lemon juice contains citric acid. It is useful as a deodorizer and can be used to clean glass and remove stains from aluminium, clothes and porcelain. It is a mild bleach if used with sunlight.

### Specific Applications

<p><b>General purpose cleaner.</b> Vinegar and salt mixture or 4 tablespoons of baking powder dissolved in 1 litre of warm water.</p>	<p><b>Remove onion odor from hands.</b> Rub vinegar on hands before and after slicing onion.</p>
<p><b>Disinfectant.</b> 1. Soap and hot water. 3. A strong infusion of thyme leaves. 4. Lemon juice, lavender, pine and tea tree.</p>	<p><b>Air Freshener – deodorizer.</b> 1. Use indoor plants. 2. Use a potpourri of naturally fragrant plant materials such as lavender. Every so often, add a few drops of an essential oil.</p>
<p><b>Window cleaner.</b> Do not wash when window is in sunlight. 1. Use a vinegar and water solution. 2. Use a cornstarch, vinegar and water solution. 3. Use lemon juice and water. Wipe with a newspaper.</p>	
<p><b>Basic Laundry Liquid for Top-Loaders</b> (makes 30 gms) 2 tablespoons glycerin 1 cup washing soda 1 cup bi-carb 2 cups warm water 10 drops essential oil of choice Combine all ingredients in a heavy plastic container, such as an old ice cream container, and mix well. Depending on the load size and dirtiness, use a quarter of a cup to half a cup.</p>	<p><b>Fabric Softeners</b> Add 1/4 cup of baking soda to wash cycle add a 1/4 cup of white vinegar to rinse.</p> <p><b>Or.</b> Add vinegar to a load as a fabric softener. Vinegar will also reduce soap residue and break up grease and oil, and is a natural bleach.</p>
<p><b>Hard-Water Washing Powder for Top-Loaders.</b> Normal washing powders cannot work as efficiently with hard water. In this formula, vinegar and borax are used to soften the water. 1 cup soap flakes 1 cup washing soda 1/2 cup <b>borax*</b> 2 cups vinegar 10 drops essential oil of choice. Combine the soap, washing soda and borax in a heavy plastic container and mix well. Combine the vinegar and essential oil in a separate container or bottle. Use half a cup of soap mixture for a load and add half a cup of vinegar mixture during the rinse cycle. <b>*Note: Students are not to handle borax – a B class chemical</b></p>	

<p><b>Floor cleaner and polish.</b> A few drops of vinegar in clean water to remove soap traces. Wooden floor – a thin coat of equal parts light oil and vinegar and rub in well. For stone and tile floors, 1 cup of vinegar in 1 litre of water, rinse with clear water.</p>	<p><b>Citrus Floor Cleaner</b> 3-4 litres hot water 2 tablespoons pure liquid soap 15 drops sweet orange essential oil 8 drops lemon essential oil or 1/2 cup lemon juice Combine in a bucket and mop. No rinsing is necessary.</p>
<p><b>Greasy, dirty floor cleaner</b> 3-4 litres hot water 2 tablespoons of pure soap flakes 1 cup vinegar 20 drops of eucalyptus, tea tree or peppermint essential oil Combine ingredients and mop the floor. Rinsing is not necessary.</p>	<p><b>Wall Cleaner.</b> This formula will safely clean painted walls and wallpaper (provided it is washable wallpaper). 1 cup water 1/2 cup vinegar 6 drops of your favourite citrus essential oil Combine all ingredients in a spray bottle. Shake before each use. Lightly spray where needed and wipe clean with a damp cloth.</p>
<p><b>Toilet bowl cleaner.</b> Mix baking soda and vinegar or borax* and lemon juice.  <b>Note: students are not to handle borax.</b></p>	<p><b>Tile and bath cleaner.</b></p> <ol style="list-style-type: none"> <li>1. Rub in baking soda with a damp cloth and rinse. or</li> <li>2. Wipe with vinegar, then with baking powder as a scourer. or</li> <li>3. Use diluted eucalyptus.</li> </ol>
<p><b>Home made dishwashing blend</b> 1 litre - Liquid Castile soap 24 drops - lemon essential oil 10 drops - mandarin essential oil 8 drops - citrus seed extract Mix in a plastic squirt bottle and shake before each use. Change the blend of essential oils (and seed extracts) to suit your fancy.  When washing greasy dishes add half a cup of vinegar or lemon juice to the wash.</p>	<p><b>Sink cleaner</b> 1/4 cup baking soda (bi-carb) 1/2 cup vinegar 3 drops lavender, rosemary, or any citrus essential oil. Mix all ingredients. Rinse sink with hot water, wash with sink cleaner, rinse again with hot water. Probably using half this mixture would be adequate.</p>
<p><b>Microwave cleaner (oven cleaner).</b> This recipe is capable of <b>cleaning an oven:</b> you just need some hot water and soapy suds as well. 1/4 cup bi-carb soda 1 teaspoon vinegar Thyme or lemon essential oil (optional). Mix into a paste and apply to all areas of microwave with a cloth or sponge. Wipe and rinse well, leave the door open to dry in the air. Wash the microwave's glass plate with the dishes. For tough spots, use 1 tsp washing soda mixed with 2 tbsp distilled white vinegar, one cup of vegetable-based detergent and two cups of hot water.</p>	<p><b>Oven cleaning.</b> Sprinkle baking soda onto a moist surface and scrub with steel wool.</p>

<p><b>Herbal Degreaser.</b> Useful for greasy stove tops, floor patches or BBQs. Use the dishwashing blend and add hot water plus a few drops of rosemary, lavender, or citrus essential oil.</p>	<p><b>The refrigerator.</b> For odor control, place a piece of charcoal in the fridge.</p>
<p><b>Whitening Scouring Powder .</b> The combination of borax* and citrus peel kills germs and removes stains. 1 cup Bi Carb 2 teaspoons cream of tartar 1/8 cup borax 1/4 cup grated lemon, orange or grapefruit peel. The amount of grated peel you add is optional. You could add some citrus or rosemary essential oil as an alternative. Combine all ingredients in a plastic container, shake and sprinkle over the area to be scrubbed, then rinse. <b>*Students are not to handle borax</b></p>	
<p><b>Mould and Mildew Prevention Formula</b> 2 cups water 8-10 drops of citrus seed extract 2 teaspoons tea tree essential oil 4 drops juniper essential oil Combine all ingredients in a spray bottle. Spray and leave on affected areas to rest for a few hours, then wipe off. Respray and leave without rinsing.</p>	<p><b>Metal Cleaning.</b> <b>Cleaning silver.</b> Boil two-three inches of water in a shallow pan with 1 teaspoon of salt, 1 teaspoon of bi-carb and a sheet of aluminium foil. Totally submerge silver and boil for 2-3 minutes more. Remove silver from the pan and wipe away tarnish with a clean cotton cloth. Repeat if necessary. <b>Cleaning aluminium.</b> Use a solution of cream of tartar and water. <b>Cleaning brass.</b> Polish with a soft cloth dipped in a solution of lemon and baking powder or vinegar and salt. <b>Cleaning copper.</b> Boil the article in a pot of water with 1 tablespoon of salt and a cup of vinegar or a mixture of salt, vinegar, baking soda, lemon juice and cream of tartar. <b>Cleaning pewter.</b> Use a paste made of salt, vinegar and flour. <b>Cleaning stainless steel.</b> Clean with undiluted vinegar. <b>Cleaning chrome.</b> Polish with apple cider vinegar.</p>

To determine cleaner prices, visit a supermarket and record them or use websites to determine current prices, e.g. <http://grocery.bestpricedirectory.com.au/> and <http://www.grocerychoice.gov.au/>

<b>'Brown' cleaner</b>	<b>'Green' cleaner</b>	<b>'Homemade' cleaner</b>
<b>Dishwashing.</b> Palmolive liquid. 500ml \$2.98	Earth Choice. 1 litre \$1.99	
<b>Drain cleaner.</b> Draino 500g \$11.23	Earth Friendly Products. Earth Enzymes Drain Opener. 1kg. \$8.50	
<b>Toilet Cleaners.</b> Duck Double Action. 500ml. \$3.29	Earth Choice. 750ml \$7.50	Cleaning Vinegar. 2 litres. \$2.34. Lemon juice. 500ml. \$1.79
<b>Air Freshener</b> Glen 20 disinfectant 175g. \$4.19		Essential oil and water. Lavender, Tea Tree. etc
<b>Multi Purpose</b> Woolies. 500ml \$3.19	Earth Choice, Natural Clear. 600ml \$2.80 Orange Power. Multi- purpose cleaner. 750ml. \$4.18	Bicarbonate of soda.  Vinegar. 2 litres. \$2.34.
<b>Shower cleaner</b> Windex Shower Cleaner Trigger Pack 750ml \$4.89	Orange Power Shower Bath & Tile Cleaner Trigger 750ml \$5.41	Baking soda.  Vinegar. 2 litres. \$2.34.
<b>Silver Polish</b> Silvo Silver Polish 250 ml \$7.71		Vinegar. 2 litres. \$2.34 and bicarbonate of soda
<b>Window cleaners</b> Windex 500ml \$4.07	Greenie Goods Concentrate. 500ml \$9.67	Vinegar. 2 litres. \$2.34.

<b>Wood cleaner.</b> Pledge Clean and revitaliser for wood. 500ml \$4.49	Earth Friendly Everyday all natural furniture polish. 600grams. \$3.10	Lemon juice (500ml for \$1.79) and olive oil. Vinegar. 2 litres. \$2.34.
<b>Greasy cleaner.</b> Ajax Professional Ultra Kitchen Degreaser. 500ml \$5.77		
<b>Floor cleaner</b> Pine Clean Floors. 750ml \$4.05	Green Natural Bathroom Cleaner 500 ml. \$ 4.49	Cleaning Vinegar. 2 litres \$2.34
<b>Disinfectant</b> Pine Clean Disinfectant. 500ml \$2.38		
<b>Cleaning Mould.</b> Selley's Mould Killer. 500ml \$4.93 Coles Smart Buy Mould Killer Trigger 500ml \$3.21	Greenie Goods. Concentrate 1 litre \$19.90	
<b>Wool wash.</b> Home Brand Wool Wash 1.25Litres. \$1.98	Earth Choice 1 litre. \$1.97	

## EXPLAIN

To clarify understanding

To modify ideas through reflection

### **Content.**

Game to heighten awareness of environmental issues of toxic chemicals

Raise awareness of the environmental pollution through germination experiments.

### **Assessment.**

Integrated Unit Book entries, including conclusion to investigation.

### **Materials.**

#### **Session 1.**

##### **For the game,**

One enlarged copy of Ecosystem World.

White paper squares and coloured paper squares (or pipe cleaner pieces or dry beans — two-thirds of them white, one-third coloured). 30 pieces per student is recommended.

20 paper or plastic bags

Coloured arm ties or something to identify three groups – grizzly bears, salmon (approximately three times as many as grizzly bears) and herring (twice as many as salmons).

A large open space such as a gym, hallway or playing field.

#### **Session 2.**

##### **Materials.**

Cleaner 1, a 'brown' cleaner. Cleaner 2, a 'green' cleaner. Cleaner 3, a 'homemade' cleaner. e.g. general purpose cleaners, one 'brown' one 'green' and one homemade - vinegar and salt mixture.

4 teaspoons.

Test tubes or narrow glasses/jars, plastic cups.

Seeds (e.g. alfalfa)

Stop watch.

Shallow container.

Worksheet 9.

### **Lesson steps.**

#### **Session 1.**

1. Discuss the findings of the last session regarding cleaning chemicals and the environment and health costs associated with them.

2. As a class group read the information on Worksheet 8, about bio-accumulation. Read through the key ideas.

Source:

Toxic chemicals in the home and in the environment.

A Learning Resource Guide for Students and Teachers. January, 2007. Labour Environmental Alliance Society

1203–207 West Hastings St. Vancouver, BC V6B 1H7

Tel: 604-669-1921 Fax: 604-696-9627 E-mail: info@leas.ca

[www.leas.ca](http://www.leas.ca)

2. Explain to the students that, as a class, they are going to play, "Toxic chemicals in the home and in the environment". (Worksheet 9). It is a game about chemicals that get into the environment and impact on wild life. Read through the key ideas, key words, materials and the procedure.

Source of the game: - Toxic chemicals in the home and in the environment.

A Learning Resource Guide for Students and Teachers. January, 2007

Labour Environmental Alliance Society

1203-207 West Hastings St. Vancouver, BC V6B 1H7

Tel: 604-669-1921 Fax: 604-696-9627 E-mail: info@leas.ca

[www.leas.ca](http://www.leas.ca)

4. As a class, play the game.

5. Review the notice board re articles, advertisements, pictures about house cleaning chemicals that was established in Lesson 1.

6. Review the "Information Bank" section in Integrated Unit Journal, introduced in Lesson 1, and add information.

## **Ecosystem Earth: Grizzlies, salmon and human interconnections.**

*Through participation in an active game as predator and prey, students will understand the interconnections within an ecosystem and how introduced chemicals can migrate and bio-accumulate.*

### **Key ideas**

- The planet is a complex, interconnected eco-system
- Persistent chemicals do not disappear once they have left our homes and work spaces. Everything in nature goes somewhere.

### **Key words**

**Ecology** - The study of plants and animals in relation to their environment, showing the interconnectedness of activities. The whole earth can be considered as a large ecological unit.

**Ecosystem** - The system formed by the interaction of all living organisms, plants, animals, bacteria etc with the physical and chemical factors of their environment

**Food chain** - The successive links that connect the largest animal predators and those below them that they prey on. For example, orcas eat salmon, which eat herring which eat tiny shrimp and so on.

**Bio-accumulation** -The term to describe how toxic chemicals may become more concentrated in the bodies of animals, the higher up the food chain they are.

**Persistent Pollutant** - A toxin that doesn't readily break down in the environment

**POPS** (Persistent Organic Pollutants) - The most toxic of persistent pollutants, as identified by a United Nations convention. They are called organic because they contain carbon, which is usually combined with other elements, such as chlorine and hydrogen.

### **Materials**

White paper squares and coloured paper squares (or pipe cleaner pieces or dry beans — two-thirds of them white, one-third coloured). 30 pieces per student is recommended.

20 paper or plastic bags. At this stage do not mention the significance of the colours.

Coloured arm ties or something to identify three groups – grizzly bears, salmon (approximately three times as many as grizzly bears) and herring (twice as many as salmons).

A large open space such as a gym, hallway or playing field.

### **Procedure**

1. Tell the students that this is an activity about food chains and ecosystems (if they are unfamiliar with the terms, clarify definitions). Divide the students into three groups: in a class of 30, choose three grizzly bears, nine salmon and eighteen herring (work with approximately three times as many salmon as bears and three times as many herring as salmon). Label the three groups with coloured arm ties so they can be easily identified.
2. Hand each herring a small bag to represent it's "stomach".
3. Distribute the white and coloured paper squares (or whatever material you used) around in a large open space.
4. Give the students their instructions:  
The herring are the first to go looking for food: paper squares represent tiny shrimp they love to eat. The salmon and bears are to sit quietly on the sidelines watching their "prey." After 30 seconds, at a given signal, the salmon are allowed to hunt their prey, and try and tag the herring. Each time a herring is tagged, it must give its bag of food to the salmon and move to the sidelines. The amount

of hunting time (15 to 60 seconds) will depend on the size of open area you have. Watch to see that each salmon has caught at least one herring.

5. The next time period is time for the bears to hunt for their food, the salmon. The same rules apply. Herring still alive may hunt for shrimp, salmon may hunt for herring and bears are trying to catch the salmon. If a bear catches a salmon, it gets the food bag(s) and the salmon goes to the sidelines. At the end of the time period, have all students sit in a circle, bringing whatever food bags they have caught.

6. Have the “dead” students identify themselves, and tally up the count. Then have the salmon and bears empty their food bags out and count the total number of white food pieces and coloured food pieces.

7. Inform students that there are chemicals in the environment (POPs and other persistent toxins) that entered through the water system. They were taken up by the shrimp that are represented by multi-coloured food pieces. All herring that were not eaten by salmon are considered dead if they have any coloured food pieces in their bags. Any salmon for which half or more of their food supply was multi-coloured would also be considered dead. The bears who have consumed multi-coloured food would not die at this time, but they may not be able to reproduce successfully next year due to hormonal problems the chemicals have caused.

8. Discuss the activity with the students, asking them to give examples of how toxins enter an ecosystem, and other effects chemicals can have.

*(Activity adapted from “Deadly Links,” a project WILD activity. Western regional Educational Council 1995 and Canadian Wildlife Federation.)*

## **Session 2.**

To determine the toxicity of a ‘brown’, a ‘green’ and a ‘household’ cleaner.

1. Discuss information the students have gained about what cleaning chemicals go down the drain, and re-enter the natural environment. Discuss monetary and environmental costs.

2. Everyday, thousands of litres of household chemicals are flushed down our drains. Ask the students to give their ideas about how this may adversely affect plant life. Discuss the fact that there is an increasing use of grey water to water our gardens and that there is a need to know which cleaning chemicals are safe to use and which are harmful to plant life, let alone the effect on humans using these gardens.

3. Ask the students to think of ways that we could test whether or not cleaning chemicals are a problem to plant life. Explain that they are going to work in cooperative learning groups to carry out a germination test to determine the toxicity of three cleaning agents, one ‘brown’, one ‘green’ and one ‘homemade’, to seeds – plant life.

4. Read through an enlarged copy of Worksheet 9, Germination Test, drawing the students’ attention to the equipment used and the steps taken. Discuss fair testing and the use of a control container. Emphasize the need to change only one thing – the cleaning product being used, and the growth or not of the seeds, and to keep all other factors, such as the quantity of liquid used, the same.

5. Assign manager, director and speaker roles. Ask the managers to collect team equipment and a copy of Worksheet 9.

After the teams have set up their investigations and cleaned up equipment used, recall them to the class group. Set them to record in their Integrated Unit book, the investigation they have just carried out.

6. Revisit the investigation after a week. Reform the same cooperative learning groups that set up the investigations. Have each student in the group record their observations on a copy of Worksheet 10 and paste it in the Integrated Unit book. Then they are to write a concluding comment about what they learnt of the toxicity of the three cleaners.

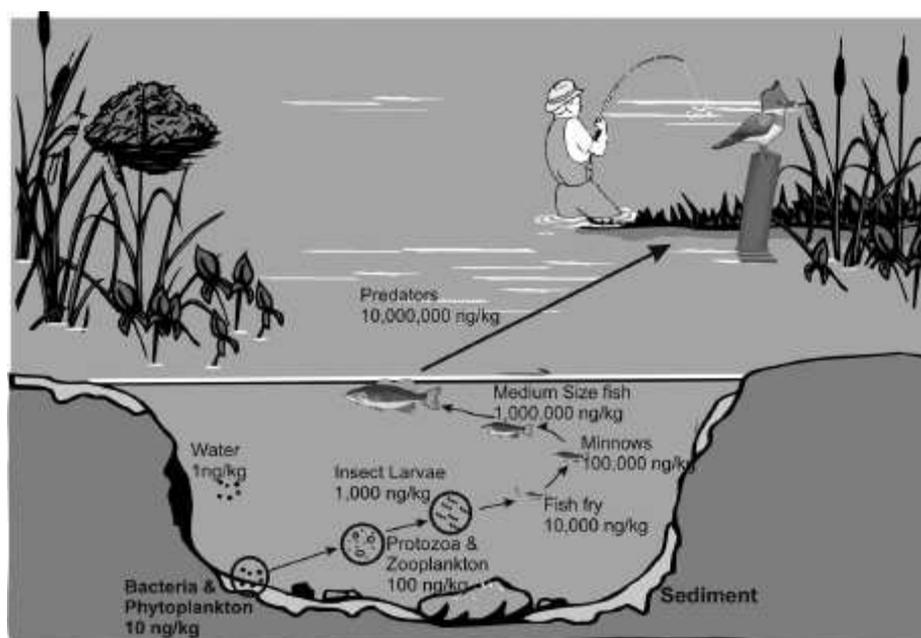
7. As a class, discuss the results of the investigation.

8. Review the notice board re articles, advertisements, pictures about house cleaning chemicals that was established in Lesson 1.

9. Review the 'Information Bank' section in Integrated Unit Journal, introduced in Lesson 1, and add information.

An ecosystem is a community of living things that interacts with each other and with their environment (soil, water etc.). Humans are all part of ecosystems, and depend on them for their survival. Humans also have an impact on ecosystems in many ways, including adding chemicals such as pesticides, herbicides, fertilizers, detergents and plastics. Many of these chemicals are long lasting, and end up going where they are not wanted. For example, a pesticide containing a persistent toxin may be sprayed onto a crop, and be washed by rains into streams, rivers and oceans. Persistent toxins may also leach out of old computer parts dumped in a landfill and make their way through groundwater into rivers and streams. There may only be small amounts of toxins in the water but the amounts become more concentrated as they are passed up the food chain. First, tiny organisms absorb the toxins from the water. Those organisms are then eaten by tiny shrimp, which are in turn are eaten by salmon, which are then eaten by bears and humans. The amount of toxins in the tiny organisms is multiplied by the number eaten by each shrimp and multiplied again as the shrimp and salmon are in turn eaten by animals higher up the food chain. This process is called bio-accumulation.

People and other animals become the concentrators of these chemicals, because they do not pass out of their bodies. Over time, the amounts of toxic chemicals in their bodies may increase as they continue to eat animals that have been exposed to toxins. The illustration below shows how small concentrations of toxins in the water and soil become magnified as they move up the food chain. The example used here is mercury, but the principle is the same for other persistent toxins.



Source -Toxic chemicals in the home and in the environment.  
 A Learning Resource Guide for Students and Teachers. January, 2007  
 Labour Environmental Alliance Society  
 1203-207 West Hastings St. Vancouver, BC V6B 1H7  
 Tel: 604-669-1921 Fax: 604-696-9627 E-mail: info@leas.ca  
[www.leas.ca](http://www.leas.ca)

## Germination test.

## Worksheet 9.

### Aim.

To determine the toxicity, to seeds, of a 'brown', a 'green' and a 'household' cleaner.

### Materials.

Cleaners 1,2 and 3. Cleaner 1, a 'brown'. Cleaner, cleaner 2, a 'green' cleaner. Cleaner 3, a 'homemade' cleaner. e.g. general purpose cleaners, one 'brown' one 'green' and one homemade - vinegar and salt mixture.

4 (5ml) teaspoons.

4 test tubes/narrow glasses, plastic cups.

Fast growing seeds (e.g. alfalfa)

Stop watch.

Shallow container.

### Procedure.

Use a clean measuring spoon for each.

Prepare 5 ml of cleaning agent 1 and 5 ml of water in container 1. Label it.

Prepare 5 ml of cleaning agent 2 and 5 ml of water in container 2. Label it.

Prepare 5 ml of cleaning agent 3 and 5 ml of water in container 3. Label it.

Control container, 10 ml water. Label it container 4. Germination of this sample will indicate that the seeds are viable.

Place seeds in each container.

Shake each container for one minute. Use the stop watch to ensure accuracy and fair testing procedure.

Drain the liquid from each container and lay the containers on their sides in a shallow container.

Place the container in a warm, light place. If the seeds are drying out, spray with tap water.

Observe for signs of germination over the next week.

Fill in the table below after one week.

<b>Mixtures shaken for one minute and rested for 5 minutes.</b>	<b>Results. After one week.</b>
5 ml of cleaning agent 1 and 5 ml of water in container 1 plus seeds. Container drained and left on side.	
5 ml of cleaning agent 2 and 5 ml of water in container 2 plus seeds. Container drained and left on side.	
5 ml of cleaning agent 3 and 5 ml of water in test tube 3 plus seeds. Container drained and left on side.	
10 ml of water in container 4. Container drained and left on side.	

## ELABORATE

To expand and consolidate student thinking

To apply the learning in a real situation through a student planned investigation

**Content.** The students are supported to conduct an investigation of the cost (monetary and environmental) and the effectiveness of a 'brown' a 'green' and a 'homemade' disinfectant.

### Assessment.

Evidence that they can plan and carry out an investigation with an awareness of fair testing.

Accuracy of observation.

Explanation of results.

### Materials.

- 4 cotton buds per group
- Three disinfectants per group, one 'brown' one 'green' and one 'homemade' (one of the following - ½ cup borax\* in a litre of hot water, strong infusion of thyme leaves, or lemon juice, lavender oil, pine or tea tree oil. **\*Students are not to handle borax**)
- 4 agar plates per group (to acquire, or make, see notes below). **MAY NEED TO PREPARE, SO MAKE TIME AVAILABLE.** An agar plate is a sterile Petri dish that contains agar plus nutrients, and is used to culture bacteria or fungi.

### Recipe for agar plates.

Materials.

- 4 envelopes of plain gelatin
- 4 cups cold water
- 8 teaspoons of sugar
- 4 teaspoons of vegemite
- 25 – 30 sterilized Petri dishes or small, lidded jars, such as baby food jars.

Measuring spoons.

**Procedure** – makes 25 – 30 plates.

1. In a saucepan, mix 4 envelopes of plain gelatin with 4 cups of water, 8 teaspoons of sugar and 4 teaspoons of sugar.

Bring slowly to the boil, stirring occasionally.

Cool slightly and fill 1/3 to ½ fill the sterilized Petri dishes with the hot gelatin solution.

Cool until the gelatin is solid. Refrigerate.

Do not touch the surface of the gelatin. Put the lids on.

Use this medium within 2 to 3 days.



**SAFETY.** Explain to the students the safety issues in using agar plates and growing cultures, emphasizing the absolute need for sealed Petri dishes and teacher disposal of the dishes.

### **Important teacher information.**

You can buy commercially produced agar plates. Your local high school is usually a good source and they may be willing to donate or sell some plates. Or you can make your own. Refrigerate the plates when you get them.

**BE AWARE OF THE POTENTIAL DANGER OF GROWING CULTURES AND OF DISPOSAL METHODS.**

Once the dishes have been taped shut, **THEY MUST NOT BE REOPENED.** Microorganisms that grow should be disposed of before disposal of the plates. Your local high school may do this for you or sterilize them in a pressure cooker, or bleach the plates (saturate the plates with a 1 in 5 mix of household bleach and water and let the plates soak overnight). The plates can be incinerated if that facility is available. **DO NOT** just throw the used plates in a bin.

**Lesson. Effectiveness of disinfectants for cleaning and bacteria control with consideration of cost, monetary and environmental.**

1. Explain to the students that they are going to compare the effectiveness for cleaning, bacteria control and monetary and environmental cost effectiveness of disinfectants, a 'brown', a 'green' and a 'homemade'. To do so, they will use agar plates. They will select something to clean, such as student seating, tables, floor of bag area etc.



Student seating



Student desks.



Bag area floor.

2. Discuss the safety procedures in growing cultures emphasis that **NO CONTAMINATED PLATES ARE TO BE OPENED**. Go through the 'Prepare the plates' sheet and the 'Science Investigation' sheet with the students. Discuss fair testing, that there is a variable that is changed, variables that remain the same and observations to record. Form them into cooperative learning groups and set them to work. As per Worksheet 10, each group of students will swab the dirty surface, clean a surface with each of their disinfectants (3 in all), swab the cleaned surface and prepare and seal each agar plate.

Calculate the monetary cost of the **same amount** of each of the cleaners.

3. Students complete the plate preparation and page one of the Science Investigation report. They regroup as a class. Discuss how the groups will observe and record what is happening over the next week.

4. Make daily observations. Record what is happening.

5. After approximately one week, the students will finalize their Science Investigation sheet, recording results, monetary costs and environmental costs.

6. As a class, discuss the findings.

7. Review the notice board re articles, advertisements, pictures about house cleaning chemicals that was established in Lesson 1.

6. Review the 'Information Bank' section in Integrated Unit Journal, introduced in Lesson 1, and add information

**Preparing the plates.**

**Worksheet 10.**

## Materials:

- 3 pairs of gloves for each group.
- 4 swab or cotton buds per group.
- permanent marker to label the plates beforehand.
- 4 agar plates per group. Label the bottom, NOT THE TOP of the plates. Label one, 'uncleaned surface', one 'brown' cleaner, one 'green' cleaner and one, 'homemade' cleaner. Put the date on each.
- Soap for hand washing.
- 5% bleach solution for teacher to clean the work area when finished.

Put gloves on. Inoculate the agar plates by streaking.

1. Rub a swab over the unclean surface (the control plate) then rub it back and forth a number of times in the Petrie plate – see diagram and picture. Have the teacher seal each Petri dish with sticking tape. Place the Petri dish upside down.



Picture from –  
<http://www.madsci.org/~lynn/micro/techniques/streaking/>

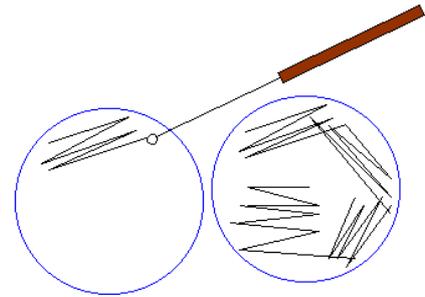


Diagram from  
<http://en.wikibooks.org/wiki/>

2. Clean part of the surface with the 'brown' disinfectant. Rub a swab over the 'brown' disinfected surface, then rub it back and forth a number of times in the Petrie plate. Have the teacher seal the Petrie dish. Place the Petri dish upside down.

3. Clean part of the surface with the 'green' disinfectant. Rub a swab over the 'green' disinfected surface, then rub it back and forth a number of times in the Petrie plate. Have the teacher seal the Petrie dish. Place the Petri dish upside down.

4. Clean part of the surface with the 'homemade' disinfectant. Rub a swab over the 'homemade' disinfected surface, then rub it back and forth a number of times in the Petrie plate. Have the teacher seal the Petrie dish. Place the Petri dish upside down.

NOTE. Agar plates are incubated upside down because;

1. There may be air contaminants in the incubator and it will be more difficult for them to get into the plates, and then move up to the agar plate because gravity is working against this movement.
2. Sometimes you will see a bit of water condensation on the top of the agar plate. If the plate is upside down, the water will not run into the agar.

5. Place the team's Petrie dishes together in a warm place. Check each day for growth. Students record daily observations in their Integrated Unit book. The draw a labeled diagram for each Petrie dish in their Integrated Unit book.

Name ..... Date .....

**Planning the investigation.**

**We will investigate,**  
the effectiveness of disinfectants for cleaning and bacteria control with consideration of cost, both monetary and environmental.

**Our hypothesis.**

What do we think will happen? Why do we think that?



We will **change** this factor.

Factors that we will **keep the same** to make it a fair test ...

We will **observe....**

**The equipment we will use is .....**

- 3 pairs of gloves
- 4 swab or cotton buds
- permanent marker to label our plates beforehand.
- 4 agar plates, labeled on the bottom, NOT THE TOP of the plates. We will label one, unclean surface, one 'brown' cleaner, one 'green' cleaner and one, 'household' cleaner. Put the date on each.

**Record (dated) of observations.**

Use Integrated Unit book if you need more space.

What did your results show you about the hypothesis that you were investigating?

Did any of the disinfectants have an environmental cost?

Monetary cost of brown disinfectant -

Monetary cost of green disinfectant -

Monetary cost of homemade disinfectant -

## EVALUATE

Provide opportunities for students to reflect on their learning, new understandings and their working scientifically skills

To assess student understandings of the topic concepts

To assess student skills

### **Content.**

Survey, the same as used in the Engage Phase.

Poster, or PowerPoint presentation, recording the three types of cleaners studied, recording the advantages, disadvantages and monetary and environmental costs of each.

### **Assessment.**

Survey.

Poster/PowerPoint presentation.

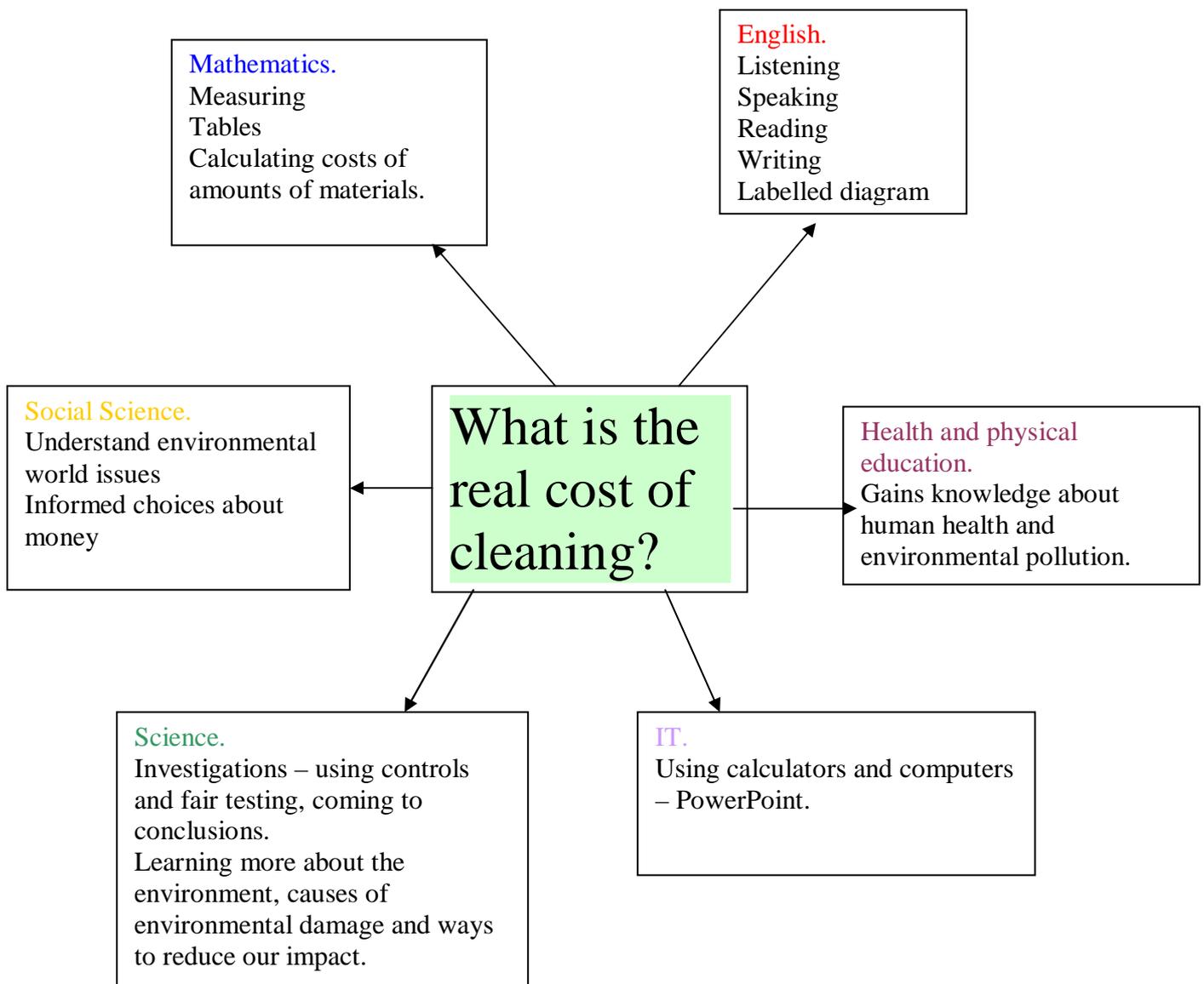
### **Materials.**

Survey form per student.

PowerPoint, or cardboard sheet for each student.

### **Lesson.**

1. Revisit the initial survey and re-do. Have the students compare their final with their initial survey responses. Discuss any changes of opinion.
2. Explain that the Unit assessment for each students will be a PowerPoint (or poster) that records advantages and disadvantages of using each of the three types of cleaners and the environmental cost and the monetary cost of each. They will record their conclusions about the best cleaners to use and why, in their Integrated Unit book.
3. Review the notice board re articles, advertisements, pictures about house cleaning chemicals that was established in Lesson 1.
4. Review the ‘Information Bank’ section in Integrated Unit Journal, introduced in Lesson 1, and add information.



**Other ELA's that** students have opportunities to understand and learn about when working through this Unit.

1. The student uses a range of strategies to think and learn.
2. The student understands and applies the inquiry process.
3. The student makes considered decisions.
4. The student acts with integrity and regard for others.
5. The student contributes to group effectiveness.
6. The student uses Information and Communication Technologies effectively.
8. The student listens and speaks with purpose and effect.
9. The student reads effectively.
10. The student writes effectively.
12. The student takes action to promote health.
16. The student understands and applies number.
17. The student chooses and uses measures.
18. The student recognises and represents patterns and relationships.
19. The student understands and applies scientific knowledge.

## **Resources.**

Clarke A, Porter H, Quested H and Thomas P. Living Organic. Easy steps to an organic lifestyle. Sourcebooks Inc. 2001.

Every Chance to Learn. Curriculum Framework for ACT Schools. Preschool – Year 10.

Fox, Maxine. Holistic Home. The Homemaker's Guide to health and Happiness. Findhorn Press. 200

Rider, Kimberley. The Healthy Home Workbook. Easy Steps to Eco-Friendly Living. Chronicle Books LLC. 2006.

Robin Thurman and Dr. Robert Thurman. (November 1994) "Testing Kitchen Chemicals" Investigating. Australian Primary and Junior Science Journal. Volume 10. Number 4. 11 – 13.

[www.greengoods.nsw.gov.au](http://www.greengoods.nsw.gov.au).

<http://www.abc.net.au/health/thepulse/stories/2007/11/01/2078330.htm>

<http://www.consumer.vic.gov.au>

<http://www.naturalstrategies.com.au/goods/Use-non-toxic-cleaners/use-non-toxic-cleaners>