School Recycling Club SHIP

(Supporting Home Instruction Program)

Lesson Plan 7

Grade Level:	7-8
Lesson:	II— The Routes of Household Hazardous Waste - Toxicity: A Relative Term
Source:	*Teaching Toxics*
Activity/Craft:	Edible Aquifers (https://www.groundwater.org/kids/getinvolved/girlscouts/leader_resources/edible_aquifer_video.html
Video Link:	Can Sea Water Desalination Save the World? (https://www.youtube.com/watch?v=bfr82RB72U8)
Game Link:	Water Cycle Crossword (http://groundwaterorg.presencehost.net/file_download/inline/d3e42b14-5000-4bae-ba9a-663b2367576d)

Lesson Matrix Grades 4-6
Teaching Toxics

Lesson	Concept	Objective	Common Core Alignments		Skills
7-8 **What's Hazardous in the Home?**	Products containing hazardous substances are commonly found in the home.	• Become familiar with types and quantities of hazardous products in the home • Conduct an inventory of hazardous products	**Grade 7** CC.L.7.6 CC.RI.7.7 CC.SL.7.2 CC.W.7.1 CC.7.NS.3	**Grade 8** CC.L.8.6 CC.RI.8.8 CC.SL.8.2 CC.SL.8.4 CC.W.8.1	• Analyzing • Evaluating • Gathering data • Interpreting
7-8 **Hazardous Characteristics**	A substance is considered hazardous if it is corrosive, reactive, flammable or toxic.	• Become familiar with characteristics of a hazardous substance • Perform a series of experiments	**Grade 7** CC.RST.6-8.4 CC.SL.7.1 CC.W.7.7 CC.WHST.6-8.2	**Grade 8** CC.RST.6-8.4 CC.SL.8.1 CC.W.8.9 CC.WHST.6-8.2	• Carrying out investigations • Collaborating • Communicating solutions • Observing
7-8 **Pondering Percolation**	Soil characteristics influence how substances move in the environment.	• Observe how fast water moves through different soil types	**Grade 7** CC.RST.6-8.3 CC.SL.7.2 CC.W.7.2	**Grade 8** CC.RST.6-8.3 CC.SL.8.2 CC.W.8.2	• Carrying out investigations • Explaining • Hypothesizing • Observing
7-8 **Toxicity: A Relative Term**	The toxicity of a chemical is determined by its concentration, its amount and the individual characteristics of the person exposed to it.	• Become familiar with what determines toxicity • Perform a series of experiments	**Grade 7** CC.L.7.6 CC.RST.6-8.3 CC.W.7.9 CC.7.RP.3 CC.7.SP.4	**Grade 8** CC.L.8.6 CC.RST.6-8.3 CC.W.8.9 CC.8.EE.2 CC.8.SP.1	• Carrying out investigations • Explaining • Hypothesizing • Observing
7-8 **The Battle of Baking Soda**	Purchasing decisions are based on personal values.	• Compare toxic and non-toxic cleaning products • Examine the factors that influence how people choose cleaning products	**Grade 7** CC.SL.7.4 CC.W.7.1 CC.W.7.10 CC.7.NS.2	**Grade 8** CC.SL.8.4 CC.W.8.1 CC.W.8.10 CC.8.EE.2	• Analyzing • Communicating solutions • Gathering information • Observing

7-8: Toxicity: A Relative Term

Subjects

Health, Science, Language Art, Mathematics

Skills

Carrying out investigations, explaining, hypothesizing, observing

Materials

Per student group:
Eight lima bean plants, bottle of vinegar, pH testing paper, container large enough to hold three liters, three 200 ml beakers, ruler

Time

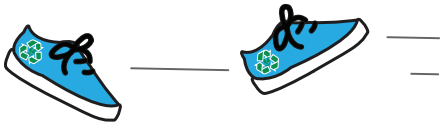
These experiments take approximately two to three weeks; about two class periods for set up, observation and discussion

Vocabulary

Absorption, inhalation, ingestion, risk assessment, ppm/ppb (parts per million/ billion), equivalent, analogy

Related *Teaching Toxics* Activities

K - 3 Prevention is the Best Medicine
4 - 6 Accidents Don't Have to Happen



Concept

The toxicity of a chemical is determined by its concentration, its amount and the individual characteristics of the person exposed to it.

Objective

Students will become familiar with what determines toxicity by performing a series of experiments.

Background *See Information Section, pages 124-127.*

Something that is toxic is capable of harming living things. Congress has defined a toxic substance as a chemical or mixture of chemicals whose manufacture, processing, distribution, use or disposal may present an unreasonable risk to the health of people or the environment Unreasonable risk is an ambiguous term. It is often a value judgment that decides what is unreasonable.

Many factors determine how harmful a toxic substance is to an organism. Toxicity is largely determined by its concentration and the dose (amount) taken. Some materials may be toxic in minute quantities (such as dioxins). Others, such as table salt, need to be taken in large quantities to have any toxic effects on an organism. An individual's characteristics influence the toxic effects of a substance. These characteristics include: genetic factors, lifestyle choices (smoking, alcohol consumption), gender (women accumulate more fat-soluble toxins in their bodies than men), age (the very old and the very young are more susceptible to the effects of toxic substances) and allergic sensitivity (many individuals experience an allergic reaction to some toxic chemicals even in low amounts and concentrations).

Procedures and Activities

Introduction to Toxics

- Ask student groups to predict what they think influences a toxic substance's effect on our bodies. List the main things that influence toxicity: concentration, amount and the characteristics of the individual exposed.
- Explain to students that some of the same hazardous substances used in industry are used in household products. However, when these substances are used in household products they are in lower concentrations and smaller amounts.

Common Core Alignments

GRADE 7

CC.L.7.6
Language:
Vocabulary Acquisition & Use

CC.RST.6-8.3
Reading in Science & Technical Subjects:
Key Ideas & Details
CC.W.7.9
Writing:
Research to Build & Present Knowledge

CC.7.RP.3
Mathematics:
Ratios & Proportions

CC.7.SP.4
Mathematics:
Statistics & Probability

GRADE 8

CC.L.8.6
Language:
Vocabulary Acquisition & Use

CC.RST.6-8.3
Reading in Science & Technical Subjects:
Key Ideas & Details

CC.W.8.9
Writing:
Research to Build & Present Knowledge

CC.8.EE.2
Mathematics:
Expressions & Equations

CC.8.SP.1
Mathematics:
Statistics & Probability

Note: These experiments take approximately two to three weeks.

Toxicity and Concentration
(Experiment Concentrating on Toxicity)
Teacher preparation: (Per small group) germinate eight lima bean seeds in containers with soil and water, as needed, until plants grow to 3" - 5" in height. At this point the experiment is ready to begin.

- Students will water four plants with different concentrations of vinegar-water solution to determine how different concentrations affect plant growth. See the student sheet on the following page.
- After the experiment is finished, discuss the following questions.
    - Were your predictions correct?
    - Which solution has the greatest amount of vinegar in it?
    - Which solution was the most toxic to plants?

Toxicity and Amount
(Experiment How Much is Too Much?)
- In this experiment students will water four plants with different amounts of the same concentration of vinegar-water solution. See the student sheet on the following page for detailed instructions.
- After the experiment, discuss with the class the following questions.
    - Were your predictions correct?
    - Based on your experiments, how would you define toxic?
    - Do you know of any products in your home that are toxic to humans and animals?
    - What is the difference between amount and concentration?

Toxicity and Individual Differences

- Ask the class, "Are all people affected the same way if they are exposed to a toxic substance?"
    - In small groups, have students list all the differences between (1) an infant and a 60 year-old person; (2) a smoker and a nonsmoker; (3) a person with a life history of kidney problems and a person with healthy kidneys. Note: Remind students that the kidneys help the body to detoxify substances that have been absorbed in the blood.
- Ask the small groups to decide who is most likely to be affected by toxic substances and to give their reasons for their choices.
- Have the groups report their discussion to the class.

Problems in Determining Toxicity

- Based on their experience, have students write a paper on why it is difficult to determine if something is toxic.

Extensions

How Small is Small?

- Discuss the information in the box below with the class.

> One part per million means that for every million parts of a solution or mixture, there is one part of the substance being measured. Scientists use parts per million (ppm) to describe the amount of a toxic substance which can be safely taken into the human body. When we say something has a concentration of one ppm, picture one inch in a distance of 15¾ miles; or one minute over a span of two years.

STUDENT WORKSHEET

Toxicity and Concentration

Concentrating on Toxicity
In this experiment, you will determine how different vinegar-water concentrations affect plant growth and appearance. You will prepare three different concentrations of a vinegar-water solution. Vinegar is an acid, which means it has a low pH. The lower the pH of the solution, the more vinegar is in the solution.

Instructions:

1. Prepare three different concentrations of vinegar and water (150 ml of each solution), pH 4, pH 5 and pH 6. Use pH test paper to determine when the solution has reached the desired pH. A fourth container will hold pure water (pH 7) .
2. Label each container with its pH value and assign a plant to a particular pH. One plant will receive only pure water.
3. Each day for three weeks, give each plant 10 ml of its vinegar-water solution.

Questions:

- What is the purpose of giving one plant water only?
- What are your predictions about what will happen to the plants?

Plant Growth Observation Chart

	Plant 1	**Plant 2**	**Plant 3**	**Plant 4** (pure water)
Week 1: Height				
Color				
Other Observations				
Week 2: Height				
Color				
Other Observations				
Week 3: Height				
Color				
Other Observations				

- On graph paper, plot a graph that shows the effects of the vinegar-water solutions on plant growth.

STUDENT WORKSHEET

Toxicity and Amount

How Much is Too Much?

In this experiment your group will decide if amount determines how toxic a substance is. You will prepare one vinegar-water solution and water three plants with different amounts of this solution.

Instructions:

1. Prepare three liters of vinegar-water solution with pH 4.
2. You have four plants. One plant will receive pure water. The other three plants will receive different amounts of the vinegar-water solution.
3. Decide how much solution each of the three plants will receive and label each plant with the amount
4. Water the plants every three days for nine days.
5. Record your observations below. Indicate each day you watered the plants.

Question:

- What are your predictions about what will happen to the plants?

Observations:

	Plant 1	**Plant 2**	**Plant 3**	**Plant 4** (pure water)
Amount Given				
Day 1				
Day 2				
Day 3				
Day 4				
Day 5				
Day 6				
Day 7				
Day 8				
Day 9				