Louisiana Public Broadcasting

ENVIRO•TACKLE BOX™

Teacher's Guide

Module 1: Science in the Personal & Social Perspetives

Exercise: The Motion Potion
Water: From the Earth for You
You & Me & UV
At Your Own Risk
A Biofilm's Bio

ENVIRO•TACKLE BOX™

Module 1

Science in the Personal & Social Perspectives

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Enviro•Tacklebox™

Module 1

Science in the Personal & Social Perspectives

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Exercise: The Motion Potion

ACTIVITY GUIDE

EXERCISE: THE MOTION POTION

Background Information

Children in the United States are steadily becoming less fit and more overweight due to increasingly sedentary lifestyles. A recent survey done by the International Life Sciences Institute shows that fewer than one out of four children in grades 4 through 12 get vigorous physical activity daily. Video games have replaced backyard games; television has replaced bike-riding and roller-skating; and high-fat fast foods have replaced family meals at the dinner table. Indeed, our lifestyles now dictate that we rush from one activity to the next, but unfortunately we do this rushing while sitting in a car. We even drive-through to get our meals, and often eat in such a hurry that no attention is paid to what was consumed. Surveys of middle school students show that very few consume any fruits or vegetables on a given day, and even fewer participate in regular exercise. Therefore, students need to be motivated and encouraged to make regular physical activity an integral part of their "*personal health environment.*"

Physical fitness is:

- a composite of intellectual, emotional, social, and physical well-being.
- comprised of muscular strength and endurance, cardiovascular endurance, and flexibility
- a state of cardiovascular health that enables a person to exercise large muscle groups for long periods of time.

A "*personal health environment*" consists of all the lifestyle factors which influence physical, emotional, and social health. These factors can include diet, exercise, stress, and external environmental influences such as smog, excessive heat or cold, or allergens. In order to maintain a positive balance in a "*personal health environment*," it is essential to learn about the behavior, attitudes, and activities which will improve the overall quality of life. Indeed, research has shown that prevention is the most effective weapon against infectious disease; maintaining a healthy balance in all areas of our personal health environment is the key to this prevention.

Physical fitness is one way to keep the body balanced and to reduce the threat from environmental hazards. A regular exercise program that becomes a habit now will affect the body in the future as well as today. Although many teenagers may think that serious illness, disease, or even death are far removed from their current situation, the habits they develop now can ensure that they maintain wellness in the future. Establishing a strong personal health environment now by reducing stress, maintaining a healthy diet, and exercising regularly will lead to a long, healthy and happy life in the years to come.

EXERCISE: THE MOTION POTION

Lesson 1 Activity: Building Blocks for a Healthy Body

Introduction:

The Motion Potion video will be used as a starting point for a discussion of the components of physical fitness and the necessity to keep physically fit at any age. Students will create a chart showing each component and discuss how these fit into their own lifestyles.

National Science Education Standards:

Content Standard F: Science in Personal and Social Perspectives
Personal Health

Concepts & Principles:

- Regular exercise is important to the maintenance and improvement of a healthy personal environment.
- Benefits of physical fitness include maintaining healthy weight, having energy and strength, strong heart/lung systems, and improved mental health.

Objectives:

- To determine the effect of regular physical activity on an individual's health.
- To list components that contribute to physical fitness and identify activities to develop these components.

Cross-Curricular Connections:

Physical Education:

- Identify how performance in sports/activitites improves with a greater fitness level.

Language Arts:

- Write a description of one of the chosen activities and tell how it helps improve fitness and why it might be an enjoyable activity.

Art:

- Design a title for a fitness chart and draw pictures of activities that can't be found in magazines.

Process Skills:

Communicating	Classifying	Inferring
Modeling	Graphing	

Lesson 1 Activity: Building Blocks for a Healthy Body

Lesson Description:

After watching the video, students will discuss the benefits of regular exercise on health. Using books, Internet sites, and interviews with health professionals, students will develop a list of components that contribute to physical fitness and some activities which develop these components.

Materials:

In quantities appropriate for class size:
markers, colored pencils, or crayons
chart paper
sports/lifestyle magazines
glue or tape
scissors

Suggested Time Frame:

One 45 minute class period.

Procedure:

1. Begin the lesson by having students brainstorm the benefits of physical activity on personal health and develop a concept map or a simple list of these benefits.

2. Watch the video and instruct students to focus on the benefits and personal satisfaction of participating in a regular exercise program.

3. Discuss the three components of physical fitness:
   - Stamina or cardiovascular endurance
   - Muscular strength
   - Flexibility

4. Use the components listed in number 3 above as headings for a three columned chart drawn on large paper. Students can look through magazines to find pictures which illustrate each component and attach them to the chart. If unable to find suitable pictures, they may draw or describe their suggested activity. Each group will then share its chart with the class, and a master list of suggested activities will be developed.

Suggested Discussion Questions:

- What are some activities that include more than one component of physical fitness?
- How could you incorporate some of these activities into your life now?
- Why is exercise important?
- What physical activities do you like/dislike? Why?

- If there is an activity that you do not currently enjoy, what would you change to make it more appealing?

Further Investigations:

- Keep the chart that has been developed, and add new activities as they are discovered.
- Talk to coaches, athletes, or personal trainers about the kinds of activities they recommend for each component.

Career Opportunities:

Aerobics Instructor
Physical Therapist
Exercise Physiologist
Kinesiologist
Athletic Trainer
Sports Coach

Assessment Procedures:

- Check each group's chart to see that all categories have been addressed with appropriate activities.
- Students should write in science journals about their plans to include fitness in their lives.

Additional Resources:

Aerobics and Fitness Association of America (AFAA)
15250 Ventura Blvd., Suite 200
Sherman Oaks, CA 91403
800-445-5950

Amateur Athletic Union of the United States (AAU)
3400 W. 86th St., P.O. Box 68207
Indianapolis, Ind. 46268
(317) 872-2900

American Alliance for Health, Physical Education, Recreation and Dance (AAHPERD)
1900 Association Dr., Reston, VA 22091
(703) 476-3400

American Running and Fitness Association (ARFA)
4405 E. West Highway, Suite 405,
Bethesda, MD 20814
800-776-ARFA

National Handicapped Sports
451 Hungerford Dr., Suite 100
Rockville, MD 20850
800-966-4NHS

National Strength and Conditioning Association
P.O. Box 38909
Colorado Springs, CO 80934
(719) 632-6722

President's Council on Physical Fitness and Sports
701 Pennsylvania Ave. N.W., Suite 250
Washington, D.C. 20004
(202) 272-3421

Women's Sports Foundation (WSF)
342 Eisenhower Park,
East Meadow, N. Y. 11554
800-227-3988

EXERCISE: THE MOTION POTION

Lesson 2 Activity: Fitness Trail

Introduction:

Early adolescents often don't see the need for physical activity in their lives. This lesson is designed to help these students see that not only is fitness necessary for a healthy life, but it can also be fun when designed to meet individual needs.

National Science Education Standards:

Content Standard F: Science in Personal and Social Perspectives
Personal Health

Concepts & Principles:

- Personal exercise is the key to physical fitness.
- Maintaining a state of physical fitness helps overcome environmental risk factors by building the body's immune system.
- Moderate exercise has been shown to reduce the risk of infection.

Objectives:

- Design and implement a fitness trail which incorporates all components of physical fitness.
- Develop a fitness plan that meets individual needs.

Cross-Curricular Connections:

Math:

- Measuring distances on fitness trail
- Calculating heart rate
- Graphing of individual progress

Language Arts:

- Writing fitness plans
- Keeping exercise logs
- Writing directions for each station on trail

Art:

- Planning a fitness trail
- Designing signs for each station on trail

Process Skills:

Communicating	Measuring	Collecting & Interpreting Data
Inferring	Modeling	Graphing

Lesson 2 Activity: Fitness Trail

Lesson Description:

Working in teams, students will design a fitness trail which incorporates warm-up, aerobic, and cool-down phases. Each student will develop an individualized fitness plan and monitor his or her progress through the use of an exercise log.

Materials:

In quantities appropriate for class size:
tape measure
markers or paint
stop watches
jump ropes
aerobic steps
balls
wooden stakes and boards for signs to mark trail

Suggested Time Frame:

Several 45 minute class periods.

Procedure:

1. Using a playground, open field, or other area, students will work in teams to design a fitness trail which includes stations for warm-up, aerobic, and cool-down activities. The trail should also include activities which develop each of the three components of physical fitness. Separate trails can also be designed for each component. Each team will be given a section of the trail to design, with one team member serving as a liaison to coordinate activities with the other sections.
    - Classrooms which are technologically capable may submit their trail designs to the EnviroTacklebox™ web site (www.envirotacklebox.org) for feedback and response by other classes.

2. Students will develop their own personal fitness plans which will include the three components of physical fitness. Begin by listing the physical activities each student enjoys, then discuss frequency of exercise, length of exercise time, and intensity of exercise. Students can then keep a log for one week to analyze their current level of physical activity, and analyze it to make adjustments as necessary. Students will describe their own personal health environments and list ways that they can be improved. Once a month, students should refer back to this description to monitor their progress toward maintaining a healthy balance in their lives.

Suggested Discussion Questions:

- Why are warm-up and cool-down exercises important?

- Why do some people choose not to participate in physical activities even though they know the health benefits? How can you encourage these individuals to be more active?

Lesson 2 Activity: Fitness Trail

- Why is it important to develop all three fitness components?
- How does exercise affect your heart rate?
- How can being physically fit reduce your risk from environmental hazards?
- What changes do you need to make to your personal health environment?

Further Investigations:

- Continue to monitor your personal fitness level through use of an exercise log.
- Make periodic changes to activities on the fitness trail to maintain high level of interest.
- Beautify the trail by planting flowers, shrubs, or trees along the path if possible.
- Visit other fitness trails from schools around the country by way of the website.

Career Opportunities

Aerobics Instructor
Physical Therapist
Exercise Physiologist
Kinesiologist
Athletic Trainer
Sports Coach

Assessment Procedures:

- Exercise log
- Group evaluation of project effort
- Self-evaluation of "before" and "after" fitness levels
- Performance Assessment: Design missing sections of a hypothetical fitness trail based on the three components of physical fitness.

Additional Resources:

Aerobics and Fitness Association of America (AFAA)
15250 Ventura Blvd., Suite 200
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800-445-5950

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Water: From the Earth for You

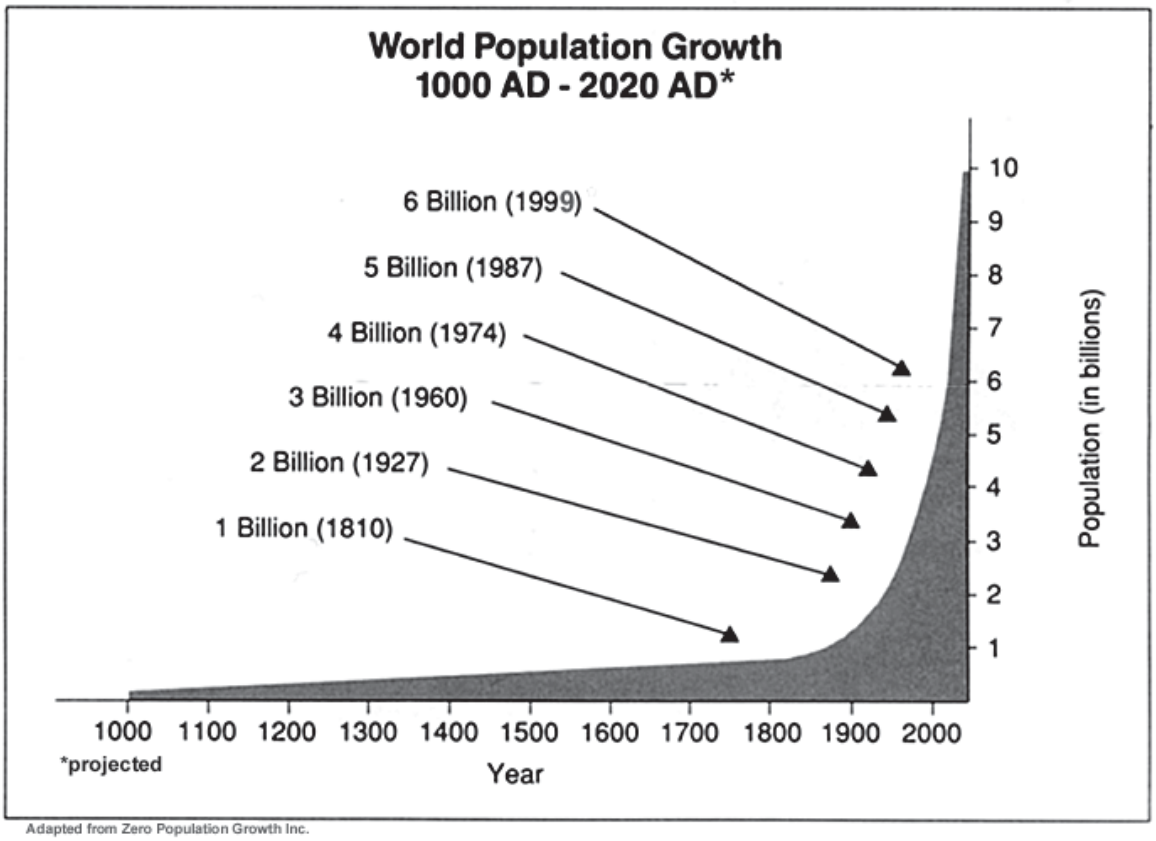
ACTIVITY GUIDE

WATER:
FROM THE EARTH FOR YOU

Background Information

The Effect of Population Density on Personal Health

"If current predictions of population growth prove accurate and patterns of human activity on the planet remain unchanged, science and technology may not be able to prevent either irreversible degradation of the environment or continued poverty for much of the world." This statement, written in a 1992 status report issued jointly by the U.S. National Academy of Sciences and the Royal Society of London, reflects the concerns the scientific community has for the future of our planet if the set course remains the same. Clearly, technology is not considered to be the panacea that will block all negative consequences of degrading the environment. While nature, when given the opportunity, will recover and overcome much of the damage done, there is a limit to which it is capable of rebounding.



Adapted from Zero Population Growth Inc.

Population Density

Issues that surround population growth and how to control its progress are complicated and involve societal mores, religious beliefs and economic factors. During the past 300 years, the world's population has grown at an exponential rate. Six billion people live on the planet today. As illustrated by the graph, there were only two billion people in 1930, but by 1960, just 30 years later, there were three billion. In 1975, only 15 years later, the population reached four billion. In the 12 years between 1975 and 1987, it grew to five billion. Projections indicate that the population may hit the ten billion mark by 2020.

Degradation of the Environment

While humans have always impacted the environment in the quest to improve their quality of life, the scale and rate of changes made during the past 50 years have had profound effects. Declining fish catches, falling water tables, progressive depletion of the ozone layer, eutrophication, and fresh water scarcity are all indications that the environment is undergoing significant change due to industrialization and population growth. Societal demands and an increase in population have stretched or exceeded the carrying capacity of many ecosystems.

The United States: Population Density and Resource Management

How is the environment affected, especially in urban areas, as the United States continues to grow by 2.5 million people annually? Cities have had to devise methods to efficiently and effectively manage resource availability and consumption as well as the disposal of various kinds of waste. At present, heavily populated areas are undergoing significant changes.

The increase in population in the United States in certain areas has placed a strain on one of our most important resources—water. Although the United States enjoys a plentiful renewable water supply, averaging almost 10,000 cubic meters per person per year, sometimes regional demands for water exceed the water supply. For example, the U.S. population is not evenly distributed throughout the country, as 46% of the population in the United States live in or near coastal regions.

Safe Drinking Water and Health

There is no such thing as naturally pure water. As the "universal solvent," water dissolves more substances than any other liquid. In nature, all water contains some impurities. As water flows in streams, sits in lakes, and filters through layers of soil and rock in the ground, it dissolves and/or absorbs many of the substances with which it comes into contact. Some of these substances are harmless. In fact, some people prefer mineral water because they feel that minerals give it an appealing taste or health benefit. However, at certain levels minerals, just like man-made chemicals, are considered contaminants and can make drinking water unpalatable or even unsafe.

The sources of contaminants might be your neighborhood or your own home, or they might be many miles away at the purification plant. Surface water (collected from a river or lake) can become contaminated by industrial wastes, farm runoff, storm water runoff, acid deposition and human and animal wastes. Although some natural cleansing may take place

when water is exposed to sunlight and certain microorganisms, intervention to restore the water quality usually takes place at the water treatment facility before it is sent to residents within a municipality. Surface water accounts for approximately 56% of water used for domestic purposes.

Groundwater, while somewhat better protected because it is collected from deep within the earth, is also subject to contamination. Leaking underground storage tanks, careless disposal of household hazardous wastes, leachate from landfills and septic tanks, agricultural chemicals and waste can adversely affect the quality of groundwater. Some natural cleansing occurs as the water moves through the various soil and rock layers. However, when groundwater becomes contaminated, it is usually more costly and difficult to restore its quality than it is to restore the quality of surface water. Groundwater sources supply about 44% of all water used for domestic purposes in the United States.

When chemicals and microorganisms contaminate the water supply, there is always a potential risk to the health of both humans and other living things. Certain cancers, birth defects, nervous system disorders and circulatory problems have all been linked to some of the chemicals that may contaminate drinking water. The EPA has set safety standards for more than 80 contaminants that may occur in drinking water and pose a risk to human health. These contaminants are placed into two groups according to the health effects that they may cause. Acute effects occur within hours or days of the time that a person consumes a contaminant. An example of such an acute effect was the 1993 outbreak of cryptosporidiosis in Milwaukee where over 400,000 people became ill from the city's drinking water. Chronic effects occur after people consume a contaminant for many years in amounts that exceed safe levels. The drinking water contaminants that can have chronic effects are chemicals (such as solvents and pesticides), radionuclides (such as radium), and minerals (such as arsenic). Examples of chronic effects of drinking water contaminants are cancer, liver or kidney problems, or reproductive difficulties.

Status of Drinking Water in the U.S. Today

The United States has one of the safest water supplies in the world. However, national statistics don't tell you specifically about the quality and safety of the water coming out of your tap. That's because drinking water quality varies from place to place, depending on the condition of the water source from which it is drawn and the treatment it receives. The U.S. Environmental Protection Agency sets maximum levels of a contaminant in drinking water at a level at which no known or anticipated adverse affect on health of persons would occur, and which allows for an adequate margin of safety (check the EPA website for more information).

Lesson 1 Activity: Ugh! We DRINK This Stuff?

Introduction:

Do you know where the water you drink comes from? Some people drink surface water every day! How do water treatment plants clean up water that comes from these areas so people can use it?

National Science Education Standards:

Content Standard F: Science in Personal and Social Perspectives:
Population, Resources, and Environments

Concepts & Principles:

- Many people drink treated surface water.
- Surface water is cleaned of particulate matter and purified before it is considered safe to drink.

Objective:

- To understand the processes involved in the cleansing and purifying of surface water.

Cross-Curricular Connections:

Mathematics:
- Measurement of materials

Social Studies:
- Surface water usage by individuals

Language Arts:
- Communicating information through research
- Discussing various water treatment procedures
- Journaling to record student trials
- Completing data sheet

Art:
- Drawing a model of a filtering system.

Process Skills:

Observing	Communicating	Comparing
Organizing	Inferring	

Lesson Description:

Students model the steps used by water treatment plants to clean and purify water.

Lesson 1 Activity: Ugh! We DRINK This Stuff?

Materials:

Per Student
Data Collection Journal
Ugh! We DRINK this Stuff? recording sheet
Per Group
1 two-liter plastic bottle with cap
1 funnel
2 two-liter plastic bottles prepared as indicated
craft stick
15 grams (1 1/2 tablespoons) powdered alum
1 liter pond or river water (if not available, add a half cup dirt to the water to approximate surface water)
ruler
800 ml fine sand
800 ml course sand
400 ml pebbles
50 ml charcoal (rinsed)
goggles
latex gloves
water treatment tablets (optional)
5 cm x 5 cm flexible nylon screen
rubber band
permanent marker
clock with a second hand/stopwatch
Per Class
1 knife for teacher-use

SAFETY NOTE: It should be recognized that river or pond water may contain contaminants that can be a cause for concern. Proper handling of these water samples should be emphasized at all times.

Suggested Time Frame:

Two 45-minute sessions

Procedure:

1. Each group of students prepares the bottles following these directions:

A. Remove the cap from one bottle. Turn it upside down. Using a ruler and a marker, measure 11 cm from the tabletop and mark 2 dots on opposites sides of the bottle. Place the rubber band around the bottle at the dots and draw a ring around the bottle. Mark this bottle with the letters HT (Holding Tank) as illustrated.

1A.

B. Following the same procedure, mark the second bottle as in step 1, but measure this line 26 cm from the tabletop and mark the bottle with the letters FS (Filter System).

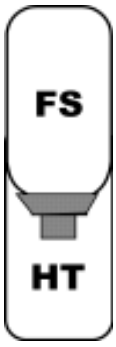
1B.

C. The teacher will use a knife to puncture each bottle at the marked rings.

D. The students will use regular school scissors to cut the bottles all around the rings. Remove the small sections and set aside.

2. Using a funnel, pour one liter of the river water into the remaining uncut bottle.
3. Observe and record the appearance of the water and any odors that may be present.
4. Cap the bottle and shake the contents for one minute. Pour the water into the bottle marked HT and continue aerating the water by pouring it from the HT bottle to the FS bottle (with the cap in place) and back at least 10 times, ending with the water in the HT bottle.
5. Observe and record any noticeable changes in the odor or appearance of the water.
6. Measure and pour the alum into the water and stir well with a spoon or craft stick for 5 minutes. After an initial observation (0 min.) record the results of this action at 5 minute intervals for 15 minutes with the bottle remaining absolutely still.

11.



7. While monitoring is taking place, prepare the FS bottle: remove the cap and place the screen over the end of the bottle and secure it with a rubber band.
8. Each group discusses how the materials provided can be used to construct a filtering system and records the proposed plan on the group data sheet.
9. Each group constructs a filter system according to their plan and draws the model on the data sheet and in individual journals.
10. Pour the water in the HT bottle into the uncut bottle using a funnel, being careful not to add any of the sediment that has settled in the bottom. Rinse the HT bottle with clean water.
11. Place the FS bottle over the HT bottle and pour the water slowly through the filter system. Observe and record results.

Suggested Discussion Questions:

- Why do you think students were asked to shake the water and pour it back and forth? Did you notice any changes in the way the water looked or smelled after this procedure? What could have caused these changes? (*This is the aeration process that adds oxygen to the water and allows trapped gasses in the water to escape.*)

- What did the alum do to the water? Did you notice any changes? (*The alum causes coagulation to occur. Particulate matter became chemically attracted to each other into floc (particulates) and caused the matter to sink to the bottom as sediment. The remaining water is then free of much of the suspended solid pieces of superfluous matter.*)

- How did the water look and smell after dripping through the FS bottle? What step in the H_2O treatment process did this represent? (*This is the filtration step and further cleanses the water of any additional particulate matter. It also simulates what happens to ground-water as it travels through rock and sand layers*).

- Compare the water filtered through each system. Which system was able to get the water the cleanest? What do you think made the difference? If you could change your system to make it clean the water better, what would you do? (*Answers will vary.*)

- Compare the filtered water with a sample of the initial river water. Is the clearer water safe to drink? Why or why not? (*To ensure that water is safe for human consumption, water treatment plants add chlorine gas to kill any remaining bacteria that could cause health problems.*)
- If you have chemical tablets to make water potable, have the students add these now. In an emergency, such as a natural disaster, you can add 1 teaspoon of liquid chlorine bleach to 5 gallons of water to make it potable. Discuss when individuals may need to use different techniques to make H_2O safe. i.e., anytime public water is threatened, or when access to public water is limited. *(a serious storm that may have damaged water lines, camping, hiking, during war times, etc.)*
- If the water you drink comes from aquifers, does it have to go through a similar treatment process?

Further Investigations:

- Investigate the safety issues surrounding the use of personal water wells.
- Ask a water treatment plant representative to visit the class and discuss where the local water source is located and how the water is treated to make it safe for human consumption.
- Research the health issues surrounding poorly treated water.
- Find out what the purpose of using charcoal is. Why do we use it in aquarium filters?
- Take a field trip to a water treatment plant.
- Research water borne diseases or pollutants that contaminate water and how they may affect the health of people and animals. For example, fish tend to store mercury in their bodies. How might this affect the health of consumers?
- Find out which diseases are most common and how they can be controlled, since more children die worldwide from water-borne diseases than from a lack of food.

Career Opportunities:

Health Sanitarian
Chemical Engineer
Civil Engineer
Environmental Engineer
Chemist
Epidemiologist

Assessment Procedures:

- Design a method for treating water that is different from the one described in the Procedure section of this guide.
- Use a notebook assessment that incorporates the data collected by the students.
- Present each group's filtering system to the local Water Quality Board for inspection and approval.

Additional Resources:

Chiras, Daniel. 1992. *Lessons from Nature: Learning to Live Sustainably on the Earth.* Washington, DC: Island Press.

Heinze-Fry, Jane. 1995. *Instructor's Manual for Miller's Environmental Science: Working with the Earth.* Boston: Wadsworth Publishing Company.

Murphy, Elaine. 1994. *World Population: Toward the Next Century.* Washington, DC: Population Reference Bureau.

Postel, Sandra. 1994. *Toward a New 'Eco'-nomics.* World-Watch 3 (5).

Scullard, Anne & Pamela Wasserman. 1994. *Counting On People.* Washington, DC: Zero Population Growth.

http://www.epa.gov/ogwdw

Lesson 1 Activity: Ugh! We DRINK This Stuff?

Group Members:_____ Date:_____

1.Describe the appearance and odor of the river water sample. _____

_____

_____

_____

2. Cap the bottle. Shake the water for one minute. Pour the water back and forth at least 10 times between the FS bottle (with cap in place) and the HT bottle, ending with the water in the HT bottle. Describe any changes in appearance or odor. _____

_____

_____

_____

3. Measure 15 grams alum, pour it into the water and stir continuously for five minutes. Stop stirring and record the appearance of the water in the chart below. Keep the bottle absolutely still and record the appearance at 5 minute intervals for 15 minutes.

INTERVAL (min.)	Appearance
0	
5	
10	
15	

4. Discuss and plan the process you will use to construct a filtering system. Include the amount of each material you will use. Draw your completed model in the box.

_____

_____

_____

_____

_____

5. Describe the water after it has filtered through the model. How does it compare to the water of other groups?

_____

_____

_____

_____

Lesson 2 Activity: OK...Just Whose Water Is It, Anyway?

Introduction:

To whom does water belong? Does everyone deserve to have access to clean, safe water?

National Science Education Standards:

Content Standard F: Science in Personal and Social Perspectives:
Population, Resources, and Environments

Concepts & Principles:

- Everyone should have access to clean, safe drinking water.
- There are many issues and many different perspectives to consider when determining water usage.

Objectives:

- To recognize that each person has a right to clean, safe drinking water. To understand that changes in behavior may be necessary when considering water usage.
- To realize that water usage issues are so important and complex that they demand consideration of all perspectives.

Cross-Curricular Connections:

Language Arts:
- oral communication
- speech making

Process Skills:

Communicating	Organizing	Modeling
Inferring	Analyzing	Investigating

Lesson Description:

A land parcel of 1000 acres of prime, water-rich real estate is for sale in an area that routinely experiences water shortages. Offers to purchase the land have come from all sectors of the community. Many of the offers are very lucrative, but the city council will ultimately determine what restrictions may be placed on the land use. A hearing is set and the council will decide the fate of the land after considering the issues and perspectives of all involved.

Materials:

Per Group
Chart paper or poster
Markers
Per Class
Overhead transparency detailing problem

Lesson 2 Activity: OK...Just Whose Water Is It, Anyway?

Task cards assigning at least two students to a particular group to represent:

- Water Conservation District Representatives
- Mayor and Executive Assistant
- Native American Tribal Members
- Nature Conservancy Board Members
- Owners of Adjoining Property
- Petroleum Company Plant Manager and Consultant
- Farmer and Agricultural Representative
- Recreational Park Developers
- Judge
- Jurors

Suggested Time Frame:

Two to four 45-minute sessions

Procedure:

1. Provide the description of the problem to the class and discuss "water rights issues."
2. Introduce group categories and allow students to choose which group they would prefer to represent (blank cards are available for additional groups that students may feel are appropriate) and distribute task cards. Note: The judge and jurors receive a copy of each card as evidence to assist them in making an equitable decision as to who gets possession of the water.
3. Each group discusses their task and prepares to state its case and make convincing arguments.
4. Each group chooses a creative name for itself and graphically represents its principal arguments on a chart for use during its presentation.
5. Each group presents its side of the issue, giving as many reasons as possible why it should be chosen to control the water.
6. The jurors discuss the issues and forward their decision to the judge, who then informs the participants.

Further Investigations:

- Investigate local concerns where land use may affect the water supply. Consider agricultural, industrial, recreational and municipal concerns.
- Research areas in the United States or other countries where water rights have become a primary issue for residents, i.e. Los Angeles, California, or the land adjoining the Nile River.

Career Opportunities:

Public Servant
Chemical/Civil/Environmental Engineer
Executive Director of Non-Profit Organization

Lesson 2 Activity: OK...Just Whose Water Is It, Anyway?

Assessment Procedures:

- Performance during debate
- Journal responses

Additional Resources:

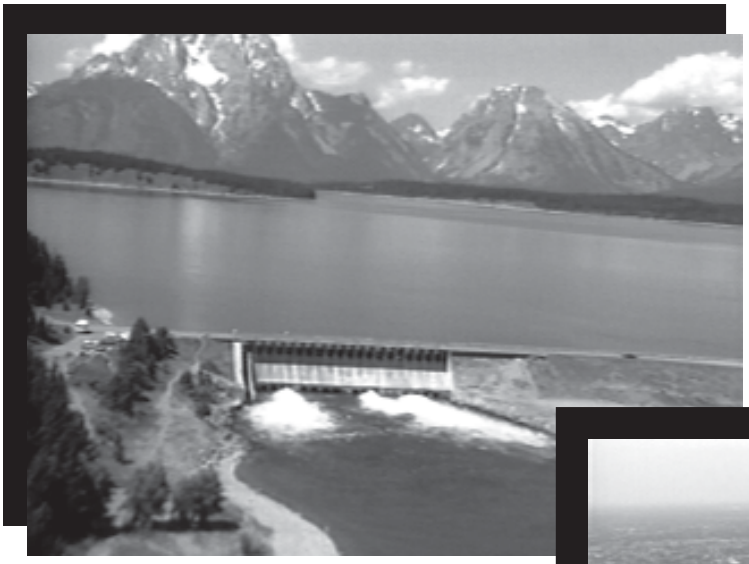
Chiras, Daniel. 1992. *Lessons from Nature: Learning to Live Sustainably on the Earth.* Washington, DC: Island Press.

Heinze-Fry, Jane. 1995. *Instructor's Manual for Miller's Environmental Science: Working with the Earth.* Boston: Wadsworth Publishing Company.

Murphy, Elaine. 1994. *World Population: Toward the Next Century.* Washington, DC: Population Reference Bureau.

Postel, Sandra. 1994. *Toward a New 'Eco'-nomics.* World-Watch 3 (5).

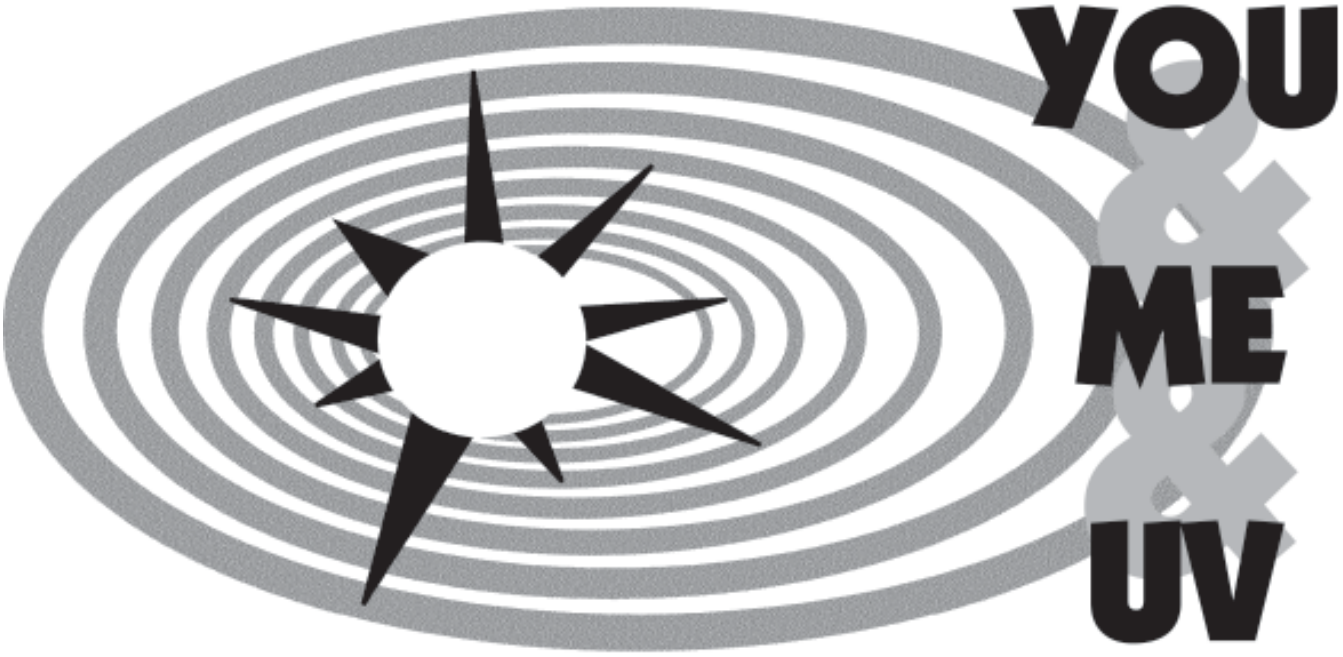
Scullard, Anne & Pamela Wasserman. 1994. *Counting On People.* Washington, DC: Zero Population Growth.



Water Conservation District Representatives You believe that water is the most valuable resource we have and must be carefully managed. You travel all over the area and know what's best for this community.	**Mayor and Executive Assistant** You, the mayor, have recused yourself from leading the meeting so you and your assistant can speak in favor of industrial development. The project will bring in much needed funds to upgrade roads, improve schools, and provide local assistance to the elderly.	**Native American Tribal Members** At present your tribe is using the water to irrigate your crops and provide water to you and your animals. You and your families depend on the water to live. Your lifestyle will change dramatically if any development occurs. You will have to move from your ancestral home.	**Nature Conservancy Board Members** Your group wants to buy the land to ensure it will not be developed. You plan on allowing environmental and educational groups to visit the land but will keep it as it is.
Owners of Adjoining Property You bought property in this area because of its quiet, scenic beauty. You and your neighbors believe that any development will devalue your property and affect your lifestyle adversely.	**Petroleum Company Plant Manager and Consultant** Your company is in financial trouble and you believe developing this land will keep you in business and provide goods and services to thousands of people. This new venture will provide 300 new jobs for local residents and ensure that the company continues to operate for those 500 people currently on payroll.	**Farmer and Agricultural Representative** Rich, fertile land with a stable water source makes this location ideal for farming and you can make it happen. Thousands of people can be fed if this land is used for farming. The farmer plans on hiring 100 people to run the machinery.	**Recreational Park Developers** You envision water slides, wave pools, and everyone having a blast at your park. You would provide about 50 jobs after construction and generate lots of taxes that will go to the local community.
	Mayor Pro-Tem You are in charge of the meeting because the mayor has recused himself so he can speak about the issues. You have several friends who live in the subdivision next to the land and you are strongly opposed to developing it for any purpose.	**City Council** You have to listen carefully to all the arguments and determine which group would be best suited to use the land. It is up to you to weigh all the evidence and make a decision that is in the best interests of everyone in your district.	

You & Me & UV

ACTIVITY GUIDE



Background Information

Knowledge of ultraviolet (UV) radiation is coupled with an understanding of the electromagnetic spectrum. Electromagnetic radiation is a wave of energy traveling at the speed of light. Electromagnetic waves can be characterized by the following two features that can be measured:

1. Wavelength is the distance between crests or the successive highest points of a wave.

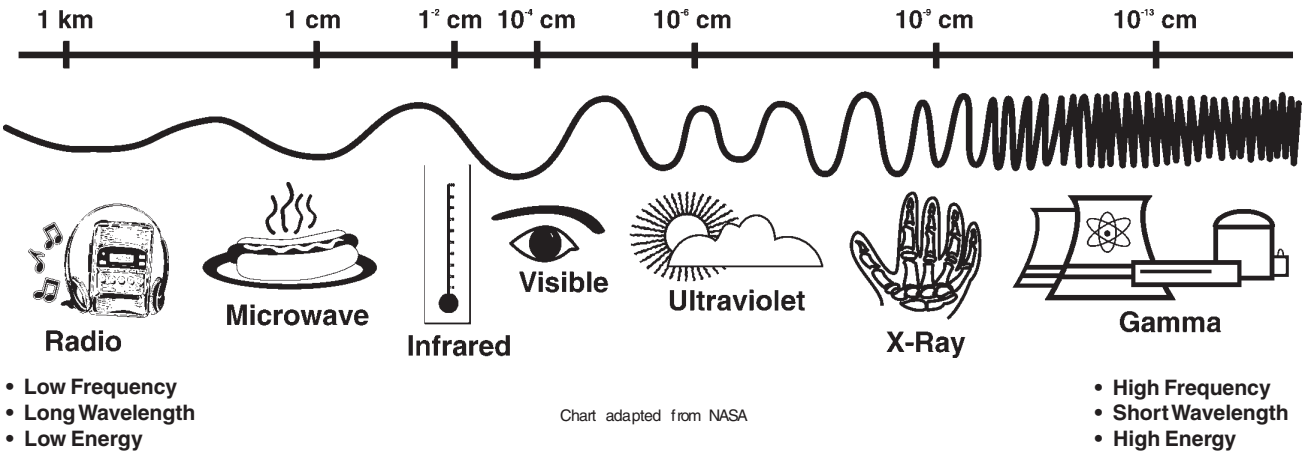
- Wavelengths in the electromagnetic spectrum range from 10^{8} to 10^{-16} meters
- The visible band of electromagnetic radiation is between 400 to 700 nannometers (A nannometer is abbreviated as "nm" and is equal to one billionth of a meter or 10^{-9} meter.)
- Ultraviolet radiation is in the electromagnetic spectrum range of 100 and 400 nm.

2. Frequency is the number of wave crests that pass a given point per second and is usually expressed as "cycles per second" or Hertz (Hz).

- The frequencies of electromagnetic radiation range from 10 Hz to 10^{24} Hz.
- Ultraviolet radiation has frequencies between 10^{15} to 10^{17} Hz.

Looking at the electromagnetic spectrum chart on the next page, you will find UV radiation between visible light and X-rays. In terms of energy, the higher the frequency, the higher the energy; therefore, UV radiation is on the higher energy end of the electromagnetic spectrum.

The Electromagnetic Spectrum

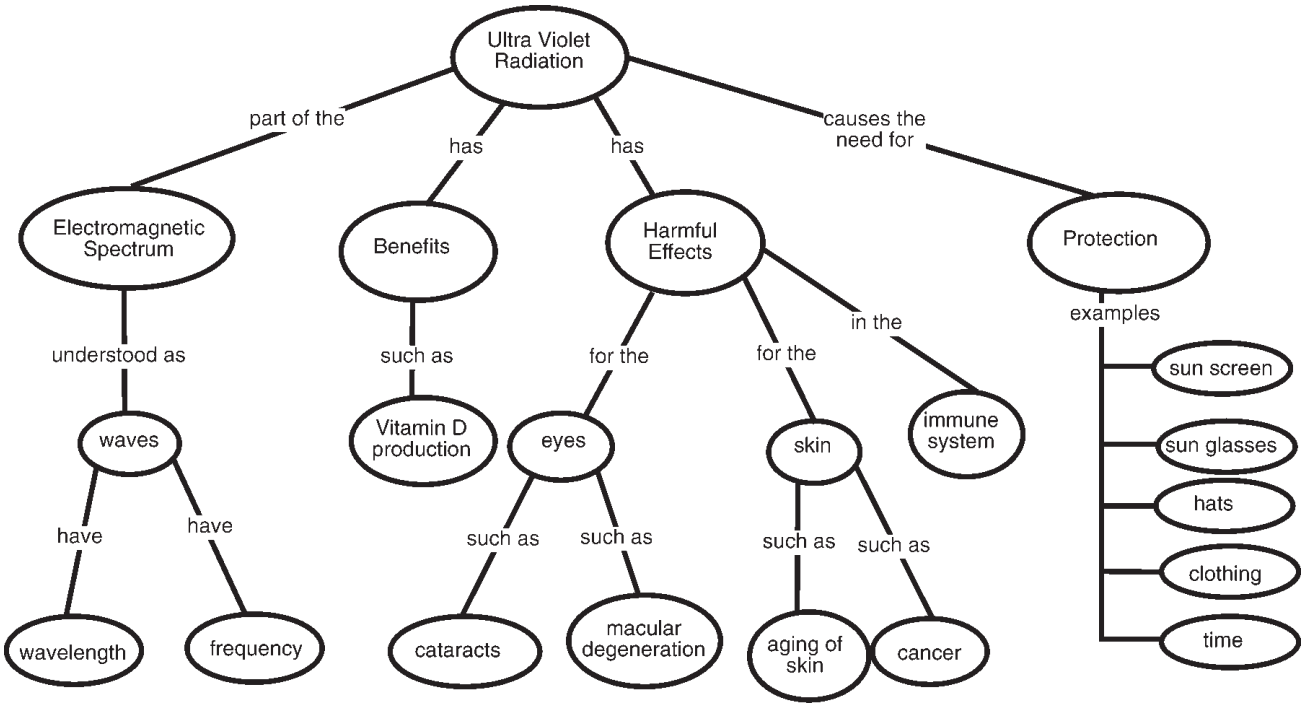


There are three types of UV radiation identified within the 100 to 400 nm range. They are:

- UV A - 330-400 nm - causes aging, wrinkling, and loss of elasticity of skin
- UV B - 290-330 nm - causes the greatest risk of skin cancer
- UV C - 100-290 nm - very destructive to tissues, however most is absorbed by the Earth's atmosphere before reaching ground level

While sunlight is generally the primary energy source for food production by plants, it is also necessary for the human body to produce vitamin D. However, prolonged and direct exposure to the sun means more exposure to damaging UV radiation. Students need to take responsibility for assessing their UV risk and act accordingly for themselves and others for whom they may be responsible (such as a younger sibling or a child whom they babysit.)

Ultraviolet Radiation Concept Map



Lesson 1 Activity: UV Beads

Introduction:

There are various methods of detecting UV radiation. One such method involves a chemical substance embedded into plastic beads that will change color when exposed to UV radiation. Students will use these indicator beads to test the effectiveness of various sun screens and sun glasses in filtering UV radiation.

National Science Education Standards:

Content Standard F, Grades 5-8 Science in Personal and Social Perspectives
Personal and Community Health

Concepts & Principles:

- Exposure to solar radiation, including harmful UV, varies in intensity over the course of a day.
- Students can apply scientific information to their daily decision making processes.

Objectives:

- To understand that solar radiation can be harmful.
- To recognize the time of day that sun exposure is more direct and intense.
- To recognize preventive measures that can be taken to reduce the risks associated with exposure to solar radiation.

Cross-Curricular Connections:

History:
- How other cultures and civilizations viewed the sun (for example, Ra)

Economics:
- The costs of UV protection and prevention
- The health costs associated with UV damage

Sociology:
- High risk lifestyles (occupations and recreation)

Math:
- Calculating the UV Index

Arts:
- How artists depict strong light and shadowing effects (chiaroscuro)

Language Arts:
- Mythology associated with the sun

Science:
- Global change research
- Cancer research

Lesson 1 Activity: UV Beads

Process Skills:

Observing	Communicating	Predicting
Controlling Variables	Hypothesizing	Experimenting

Lesson Description:

Students will test various UV blocks, such as sunglasses and sunscreens (including a range of SPF numbers), using UV beads.

Materials:

In quantities appropriate for class size:

UV Beads that turn white to purple. Available from:
Educational Innovations, Inc., 151 River Rd., Cos Cob, CT 06807
1-888-912-7474
http://www.teacherresource.com
various sunscreens with SPF 5, 10, 15, 20
sunglasses (cheap dimestore type and a pair with UV protection)
polaroid camera (optional)
plastic wrap
string
student journals

Procedure:

1. Distribute 30 UV beads to each cooperative group.
2. Ask each group to take the beads outside and observe what happens.
3. Return to the classroom and let the beads return to a white color.
4. Share conclusions.
5. Students should design and carry out investigations using materials such as sunscreens or sunglasses that claim to shield out UV radiation.

Suggested Discussion Questions:

- Besides the specially made beads used in this experiment, what else can be used as a UV detector?
- Why does your skin turn dark after exposure to UV?
- Visit a nursery and locate a number of plants with instructions to grow in indirect light. Why would a plant grow better in indirect sunlight than direct sunlight? If you have a yard or patio, where would you place such a plant? Why? Why not in other locations?
- Can you explain how it is possible to get a sunburn on a cloudy day? Can you design a test to measure UV on a cloudy day?
- UV radiation is used to sterilize instruments and even to sterilize water. How does UV act as a sterilizing agent?
- How could UV beads be used to warn people about excessive UV exposure?

Lesson 1 Activity: UV Beads

Further Investigations:

- Demonstrate photo-oxidation of various materials such as plastics, auto paint etc.
- Students can use light meters to test the intensity of light in direct sun, in the shade, or over a reflective surface, such as sand or concrete.
- Investigate industrial products that are used to prevent photo damage to signs and awnings.

Career Opportunities:

Dermatologist
Ophthalmologist
Resort Worker
Landscape Architect
Meteorologist
Environmental Specialist
Commercial Fisherman
Forester

Assessment Procedures:

- Collect the sunburn index and weather map from a newspaper over a period of several days. (You will need a range of high, moderate, and low). Have students record sun burn indices and cloud cover. Allow students to offer explanations for this correlation.

- A family is planning a vacation at the beach, even though everyone got sunburned on the first day of last year's vacation! They want to spend as much time as possible swimming, collecting seashells, or just relaxing on the beach. The family also wants to see several movies, visit the local museums, and shop at the nearby outlet mall. Plan this family's schedule so that they can spend as much time on the beach as is safely possible and also do the other things they wish to do. Remember to consider the impact of direct and prolonged exposure as you devise the family's activity schedule.

Additional Resources:

http://www.epa.gov/ozone/uvindex/ucover.html
This site is one of the best sites for information about UV. It also has excellent links. Learn about the EPA's Sunwise School Program. Find out what the UV index is and how it is calculated. This site provides important information on health effects of overexposure to the sun as well as actions for sun protection including sun protection for children.

http://www.who.ch/inf/fs/fact133.html
This site is maintained by the World Health Organization. This site provides an explanation of UV radiation, major health concerns (skin, eye, and immune system), health costs, and protective measures.

Additional Resources:

http://www.weather.com/weather/maps/boat-n-beach/uvmap_440x275.html
This Weather Channel site provides a forecast of the UV index for the U.S.

http://www3.accuwx.com/getwxbin/uvus**?**
This is another site that forecasts the UV index for the U.S.

http://www.cancer.org
This is the American Cancer Society's home page that has a search function. There are several sites about UV radiation within the ACS's web site. Don't forget to take "The Ways of the Ray's Quiz" and find out how to order fact sheets.

http://www.eyenet.org/public/pi/eye_health/safety/uv_faq.html
http://www.eyenet.org/public/pi/eye_health/safety/sunglasses_faq.html
These pages include information on the ocular hazards of UV exposure and information on what to look for when purchasing sunglasses. These two pages are maintained by the American Academy of Ophthalmology.

http://ericir.syr.edu
Search ERIC for information and lessons on UV radiation.

Lesson 2 Activity: Solar Oven

Introduction:

It is possible to capture and concentrate solar radiation and use it for cooking. The simple device that does this is called a **solar oven**. Students will experiment with designing a solar oven and determine which design is the most efficient.

National Science Education Standards

Content Standard F, Grades 5-8: Science in Personal and Social Perspectives:
Personal and Community Health

Concepts:

- Solar radiation can useful as well as harmful.
- Students can apply scientific information to their daily decision making processes.

Objectives:

- To understand that solar radiation can be useful.
- To recognize the time of the day that sun exposure is more direct and intense.

Cross- Curricular Connections:

History:
- How other cultures and civilizations viewed the sun (for example, Ra)

Math:
- The understanding of wavelengths and cycles

Arts:
- How artists depict strong light and shadowing effects

Language Arts:
- Mythology associated with the sun

Science:
- Global change research

Process Skills:

Observing	Communicating	Measuring
Predicting	Hypothesizing	Experimenting

Lesson Description:

Given materials such as cardboard, duct tape, aluminum foil etc., students will construct a solar oven.

Lesson 2 Activity: Solar Oven

Materials:

cardboard boxes or
6 - 12 inch square pieces of cardboard per group
1 roll of aluminum foil per group
1 roll of duct tape per group
1 ball of twine or string
10 long bamboo skewers
hot dogs
meat thermometer
student journals

Procedure:

1. Students working in cooperative groups will design a solar oven.
2 Using the materials provided, each group will construct an oven and test it. Suggested foods to cook include hot dogs, muffins and precut crescent rolls.
3. Students should keep journal entries throughout the activity noting what did and did not work. Changes in the design should be explained. Encourage students to include why they think their design will work and explain why it did or did not work.
4. Instruct the students to write comments relevant to how the sun's energy can be helpful and harmful.

Note: If students fail to construct a functioning solar oven or if they become too frustrated, show them models or pictures of solar ovens. Also, consider the availability of sunshine. If you live in an area that has persistent cloud cover, this activity may not work for you.

Suggested Discussion Questions:

- Make a line drawing to illustrate the path that solar radiation travels into the solar oven and then draw the path of the reflected solar radiation. Use this drawing to locate the hottest spot in the solar oven.

- Because cooking with solar radiation is simple and cheap, many countries use this method. Why don't we use solar ovens for our daily cooking in North America?

- Describe the similarities and differences between a solar oven and a greenhouse.

- Ask the groups to share their explanations as to why solar ovens must track the sun.

Further Investigations:

- Explore the promise of solar radiation as a factor in reducing human demand on non-renewable resources.
- Have students investigate why the length of a shadow will vary at different latitudes at the same time. This is a great Internet activity for sharing data with schools across the country or globe.

Lesson 2 Activity: Solar Oven

- References to the sun and sunshine are common in our culture. We find sunshine used in many expressions and songs. For example, someone who is very cheery may be called "Sunshine." Have students make a list of expressions and songs that refer to the sun.

Career Opportunities:

Dermatologist
Oncologist
Resort Worker
Landscape Architect
Earth Scientist
Environmental Specialist
Commercial Fisherman
Forester

Assessment Procedures:

- Students should keep a neat and accurate record of their plans for:
  1) constructing a solar oven - including predictions
  2) testing of the oven - thoughtful testing and record keeping
  3) drawing conclusions - why something did or did not work

  A teacher-developed rubric for each area should be designed.

- Students should be able to explain how solar radiation is reflected and concentrated in the oven, either verbally or in writing.

- Students should be able to determine the hot spot in the oven through measurements.

Additional Resources:

http://www.epa.gov/ozone/uvindex/ucover.html
This site is one of the best sites for information about UV and has excellent links. Learn about the EPA's Sunwise School Program. Find out what the UV index is and how it is calculated. This site provides important information on health effects of overexposure to the sun as well as actions for sun protection, including sun protection for children.

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http://www.eyenet.org/public/pi/eye_health/safety/uv_faq.html
http://www.eyenet.org/public/pi/eye_health/safety/sunglasses_faq.html
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http://ericir.syr.edu
Search ERIC for information and lessons on UV radiation.

At Your Own Risk

ACTIVITY GUIDE

At Your Own RISK

Background Information

Each day in countless ways every individual encounters a variety of hazards. We bounce down two stairs at a time…forget to rinse the grapes off before they go into the lunch bag…travel to school or work, sometimes driving too fast because even as the day begins, we are already behind.

An event is a hazard if it can result in injury, suffering, disease or death, damage to personal or public property, or deterioration or destruction of environmental elements. The probability of the occurrence of such an event is referred to as the risk. Many of the risks that we encounter are natural and uncontrollable by individuals. However, people make decisions or select daily activities, they need to be aware of how to address the risks that may arise. This process is called risk assessment and can only be properly completed if there is a fairness in handling the facts and an understanding of the consequences of one's choices. These consequences may impact both our own health and the Earth's ecological components.

Risk assessment done appropriately involves several different steps.

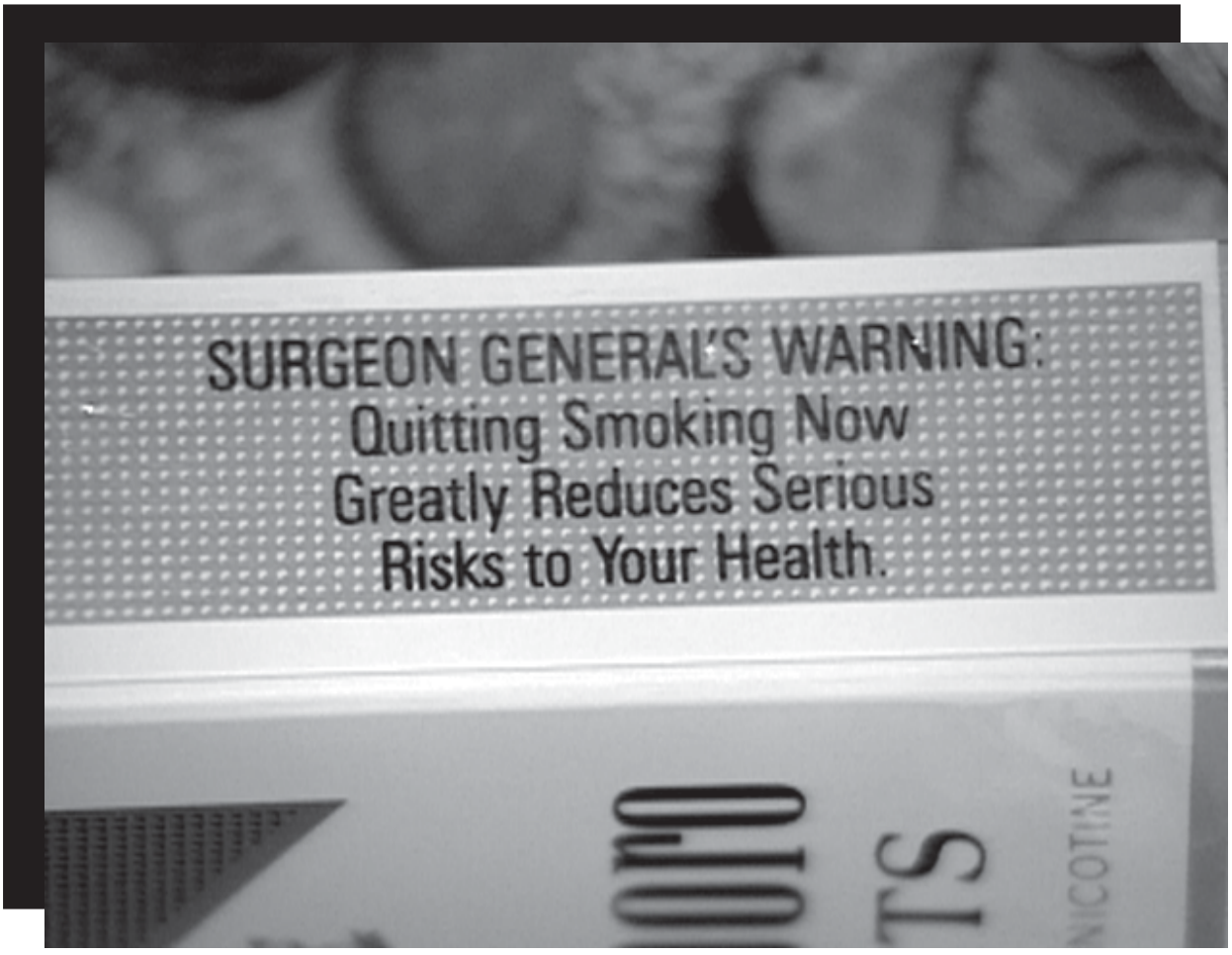
1. The situation as it presents a risk must be identified.
2. Data must be used to evaluate the event.
3. The probability of the result occurring must be determined. In some cases past information can be used to assist in this work, but so many new products are becoming available, it is often necessary to use estimated values.
4. The consequences must be characterized.

It is always essential to balance facts with perception before making a decision. For example, a news story may report on a new study that claims some hazard to our health. In reality, while there is often an emotional presentation of death rates associated with a hazard, people are not dying all around us; in fact, our life expectancy keeps increasing. It is impractical to expect a risk-free life.

Young people are told how good physical recreation and sports activities are for their health, but it is imperative that they take the proper precautions to avoid injury. Participating in a recreational activity requires decisions about using proper equipment and being physically prepared. Children need to be made aware of personal responsibility in making choices. Should they ride a bike without a helmet? Often it is their choice if mom and dad are out of sight. The odds of avoiding injury are much

better if they wear a helmet. So why might they take the risk and not wear one? *(They may not be aware of the risks. Often they just jump on the bike and go off without a thought of falling. Or, they may know the risks but prefer to go without a helmet because the cost of looking foolish in the eyes of their peers outweighs the risk in their mind.)*

Most professional athletes take the time to use the proper equipment and to train for their sport properly. They cannot risk an injury that would put them out of the game. However, each year there is is at least one high profile injury like that suffered by Mike Utley on the football field or Christopher Reeve during an equestrian event. Teenagers don't want to be sidelined by an injury either. How do students find out the risks or dangers of a particular activity? There are sports medicine and training facilities around the country that can provide help. Many sporting goods stores have qualified staff who can provide information about the proper use of equipment. Teens should be adequately prepared before they begin a recreational or sports activity. For example, almost all physical activity requires some form of warmup exercises and many sports require helmets, pads, gloves or life jackets.



Lesson 1 Activity: This is Your Life!

Introduction:

Students arrive in the classroom today with a wide range of personal experiences. Some bring direct experiences with family or friends with serious health problems or may have known the trauma of losing a home and/or a car to a flood or hurricane, while others in this age group have yet to be exposed to varied negative aspects of daily life.

National Science Education Standards:

Content Standard F: Science in Personal and Social Perspectives
Risks and Benefits

Concepts & Principles:

- Daily activities and the decisions they demand may bring an individual into a variety of different hazardous situations.
- "Students should understand the risks associated with natural hazards (fires, floods, tornadoes, hurricanes, earthquakes, and volcanic eruptions), with chemical hazards (pollutants in air, water, soil, and food, with biological hazards (pollen, viruses, bacterial, and parasites), social hazards (occupational safety and transportation), and with personal hazards (smoking, dieting, and drinking)." National Science Education Standards. 1996

Objectives:

- To identify areas of risk in the students' lives.
- To explore the areas of daily risk and how different people approach them.

Cross-Curricular Connections:

Language Arts
- Written report of daily events and verbal dialogue in cooperative groups/class discussion

Health
- Identification of practices that secure safe conditions

Science
- Observation of events, sequence and order

Process Skills:

Classifying	Communicating	Estimating
Predicting	Interpreting	

Lesson 1 Activity: This is Your Life!

Lesson Description:

After students have identified areas, locations, or events of risk in the community and ranked them according to their "known vs. unknown" and "controllable vs. uncontrollable" characteristics, they will keep a one-day diary identifying and recording their personal experiences.

Materials:

Student Diary Sheet
flip chart paper (butcher paper)
markers

Procedure:

1. Open class with a discussion of several newspaper articles that describe some risky or hazardous event, such as: car accidents, new safety reports, restaurant worker applies Heimlich maneuver to save customer, etc.
2. To heighten student awareness of everyday activities that may have risks attached to them, arrange a Gallery Walk. For the Gallery Walk identify familiar settings such as home, school, playground and list these on separate sheets of flip chart paper (see list below). Set these sheets around the classroom or yard to establish stations. Each cooperative group will rotate from station to station in order interact at each location.
3. For each topic listed, the group must decide on one item to include that may be considered a hazard and thus provide a risk to them or to someone else. Topics already listed should not be repeated.

Teacher's Note: *Because student groups may not repeat the ideas of other groups, it may be necessary to extend the time at each station for the last 2 or 3 locations.*

4. Following the completion of the student work on the Gallery Walk, each group should take the sheet from their last station and prepare a class presentation that incorporates the ideas listed. All students should participate in the discussion. A second large piece of paper may be used to prepare a ranking of the responses on the sheet or items could be numbered before presentation.
5. Distribute the Student Diary Sheets and instruct the students to clearly mark any occurrence of risk in the next 24 hours.
6. In class the following day, cooperative groups should compare their diaries with one another and freely dialogue to express what each person recorded.
7. Individual awareness should be noted and rankings compared. After the groups have met, a full class discussion should follow.

Examples of Topics for a Gallery Walk and Typical Student Responses:

Around My Home
Crack in the sidewalk or driveway
Leaving items on the floor
Unlocked gun cabinets

At School
Running in the halls
Opening my locker into someone
Wet floors

Lesson 1 Activity: This is Your Life!

While Traveling
School bus behavior
Children not in car seats
Ice on the road/fog

During Sports
Not wearing a batting helmet
Having enough life preservers
Swimming without lifeguards

While at Play
Roller Blading in the street
Smoking

In Our Community
Missing corner stop sign
People who dump trash
Street Flooding
Brownfields

Teacher's Note: *This is not a complete list of all possible categories. Teachers should freely substitute more relevant topics, if needed. Answers will vary.*

Suggested Discussion Questions:

- What does the term risk mean to each student?
- Are all risks hazardous or harmful? Explain.
- What daily activities are risky? Why are they considered risky?
- Do we think of these risks before undertaking the events that we consider risky?
- Why are some people willing to take a job that others see as too hazardous?
- Do you ever consider possible outcomes before deciding to do something?
- Describe a risk you have taken.

Further Investigations:

- Have students' family members keep a 24 hour diary on their activities.
- Invite a group of parents to discuss the risks in various careers.
- Research the differences between the natural hazards found in your students' geographic area and those typical of another region of the country. Identify the reasons why people chose to live in "risky" areas.
- Investigate the kinds of insurance that are recommended in different careers and the costs invloved.
- Have cooperative groups select different car models and research insurance rates based on age of the driver, car model and color.
- Complete a class average of the rankings of common diary items or use the student data to wrap up discussion on the assignment.

Lesson 1 Activity: This is Your Life!

Career Opportunities:

Actuarial Scientist
Legislator
Public Health Worker
Safety Supervisor
Engineer
Athletic Trainer
Construction Worker
Athletic Trainer

Assessment Procedures:

- Individual participation will be monitored as the students are working.
- The oral reports by each group following the Gallery Walk may be evaluated.
- The student diaries will be part of the assessment process.

Additional Resources:

PLT, Exploring Environmental Issues: Focus on Risk, 1998 American Forest Foundation, Washington DC

Ross, John. 1999. *The Polar Bear Strategy: Reflections on Risk in Modern Life*. Washington DC: Perseus Books

Ross, John. "Risk: Where Do the Real Dangers Lie?" *Smithsonian* 26, no. 8 (November 1995): 42-53

Leiss, William, and Christian Chociolko. *Risk and Responsibility*. Montreal: McGill-Queen's University Press, 1994

Wilson, Richard, and E.A.C. Crouch. "Risk Assessment and Comparisons: An Introduction." In Economics of the Environment, edited by Robert Dorfman and Nancy S. Dorfman. New York: W W Norton & Co. 1993

Society for Risk Analysis
http://www.sra.org

United States Environmental Protection Agency
http://www.epa.gov/ORD/Risk

Lesson 1 Activity: This is Your Life!

Student 24 Hour Risk Diary

Name: _____ Date: _____

Time	Event	Risk Rank 1 (low) - 5 (high) UK	K	UC	C
Example 7:00 am	Not properly seated on the bus		4		5

1

UK: Unknown to the exposed, new risk, effect delayed

K: Known to those exposed, effects immediate, risks known to science

2

UC: Uncontrollable, involuntary, risk not easily reduced, dreaded, risk to future health

C: Controllable, voluntary, risk decreasing- easily reduced, low risk to future health

Lesson 2 Activity: How Risky Is It?

Introduction:

Physical recreation and sports activities are events in which teenagers have the most control when it comes to risk decision-making. It is important to determine how risky an activity is and what students can do to prevent injury to themselves, their teammates or opponents.

National Science Education Standards:

Content Standard F: Science in Personal and Social Perspectives
Risks and Benefits

Concepts & Principles:

- Often the things that seem most natural to us in our daily experiences have the greatest hidden risks to our overall well being.
- "Important personal and social decisions are based on perceptions of benefits and risks." National Science Education Standards. 1996

Objectives:

- To develop an awareness of some risks that are commonplace.
- To recognize the importance of observation and attention to detail to prevent injury or illness

Cross-Curricular Connections:

Physical Education
- Identification of the importance of personal fitness

Language Arts
- Communicating information, completing data sheet

Science
- Identification of safety concerns and proper equipment

Process Skills:

Communicating	Modeling	Inferring
Applying	Identifying Variables	

Lesson Description:

Using the proposed field trip scenario, students will be given the opportunity to look closely at activities that are part of their lives and to identify the hazards associated with these activities. Some students may have had a family member or friend injured during a physical activity. While the student may not choose that field trip option he/she should be able to share personal insights during the discussion section.

Lesson 2 Activity: How Risky Is It?

Materials:

Student Activity Sheet
flip chart paper
markers

Procedure:

1. Provide a brief lead-in to a two day trip to a sports training center *(perhaps the trip was won by one of the students or donated by a local sports hero).*

2. Individual Reflection: Each student will select two activities in which to participate. Appropriate time should be given for the individuals to make their selections without discussing, with their friends, which activities to pick. They should then consider any risks or dangers they might encounter when participating in this activity and make a simple list to complete item 1 on the student activity sheet. At the same time they should be thinking of the remedies and solutions to list for question 2.

3. Small Group Exchange: After a period of time is allowed for individuals to develop their lists, have the students work in small groups according to the activity selected for Day 1. Provide each group with markers and flip chart paper. Have them select a recorder for the risks and one for the safeguards and work together to combine their individual lists into one general list to be posted and presented to the whole class.

4. Have the students separate into groups according to their Day 2 activity selections and repeat the exchange process.

5. Class Presentations: Select one activity and have the Day 1 group report on their two lists. Ask the Day 2 group with that activity what differences they might have and solicit class response for further things that might have been identified.

6. Continue for the other available activities until each group has been given the opportunity to report and share their work.

Suggested Discussion Questions:

At the start:

- What activities are most enjoyed by students? What sports have the highest percentage of student participation? Do we select activities to be engaged in competition or for other reasons?

Following the student exercise:

- Did anyone not select an activity due to fear of injury? Why? Are there any greater risks to professional athletes in this sport?

Further Investigations:

- Research the number of injuries identified per year with each of the listed activities. Special attention should be paid to injuries to teenagers. Students may expand their study to other activities such as rodeo events.
- Invite a guest speaker to address the class on spinal chord injuries. Research well-known injury cases and the public and private reaction to them *(example - Christopher Reeve's fall while horseback riding.)*
- Students may select one of their two activities and determine the cost of having the proper equipment or report on any new developments in equipment for that sport.

Career Opportunities:

Sports Medicine
Athletic Trainer
Equipment Designer
Statistician
Actuarial Scientist
Physical Therapist
Insurance Agent

Assessment Procedures:

- Individual sheets completed by the students.
- Group work and reports
- Evaluate student responses to given scenarios, such as:
  a) they are offered a ride in the back of an open pick up truck.
  b) though an unlicensed driver, a friend gives them a chance to drive a car.

Additional Resources:

PLT, Exploring Environmental Issues: Focus on Risk, 1998 American Forest Foundation, Washington DC

Ross, John. 1999. *The Polar Bear Strategy: Reflections on Risk in Modern Life*. Washington DC: Perseus Books

Ross, John. "Risk: Where Do the Real Dangers Lie?" *Smithsonian* 26, no. 8 (November 1995): 42-53

Leiss, William, and Christian Chociolko. *Risk and Responsibility*. Montreal: McGill-Queen's University Press, 1994

Wilson, Richard, and E.A.C. Crouch. "Risk Assessment and Comparisons: An Introduction." In Economics of the Environment, edited by Robert Dorfman and Nancy S. Dorfman. New York: W W Norton & Co. 1993

Society for Risk Analysis
http://www.sra.org

United States Environmental Protection Agency
http://www.epa.gov/ORD/Risk

Lesson 2 Activity: How Risky Is It?

Name: _____ Date: _____

How Risky Is It?

Your class will be attending a two day field trip to the Dream Team Sports Ranch. While there each student will select a different activity. The program offers instruction in each activity so you do not have to pick something you have already learned how to do.

You may select:

aerobic exercise	archery	baseball
boxing	canoeing	diving
football	gymnastics	horseback riding
lacrosse	soccer	softball
swimming	volleyball	water skiing

Day 1. Activity Selected:_____

1. List as many points as you can to identify what might be harmful during your participation in this activity.

_____

_____

_____

2. What safeguards should be in place to reduce any hazards during this time?

_____

_____

_____

Day 2. Activity Selected:_____

1. List as many points as you can to identify what might be harmful during your participation in this activity.

_____

_____

_____

2. What safeguards should be in place to reduce any hazards during this time?

_____

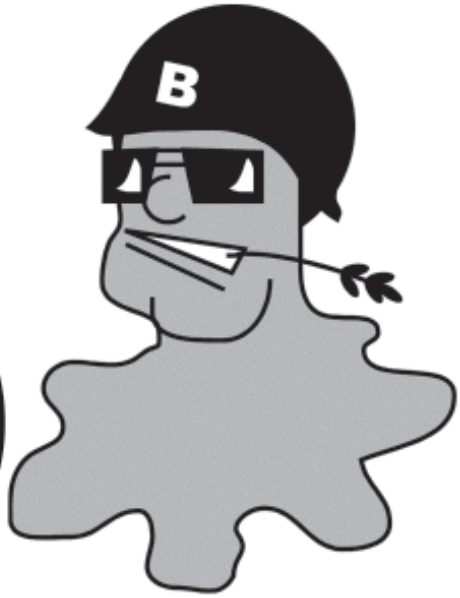
_____

_____

A Biofilm's Bio

ACTIVITY GUIDE

A BIOFILM'S BIO



Background Information

The term biofilm is so new to science that it may not yet appear in your textbook. A biofilm is a layer consisting of various combinations of many different organisms, (frequently, bacteria.) The common factor among these organisms is that they grow together in an aqueous (water) environment attached (adhered) to a solid surface, or substrate, forming a film.

Living together, the members of the biofilm form a community of individual organisms of different species. Biofilms can form on almost any surface that is submerged in nonsterile water. The organisms of the community cooperate and interact with each other and the local environment. These complex relationships form a small ecosystem. Microbiologists have traditionally studied microorganisms grown in pure culture as a single species. In the natural world, microorganisms often grow as biofilms of more than one species.

Biofilm formation has evolved as an adaptation by the individual members of the community as they struggle to survive. The microorganisms within the biofilm produce a sticky glue-like material, or polysaccharide, that attaches them to the substrate. This material makes a biofilm slimy. Once attached, the bacteria interacting as a dynamic system compete with other organisms for nutrients found at the interface where the substrate and water meet.

Biofilm formation also serves a protective function for the members of its community. Microorganisms on the inside of the biofilm are often safe from predators, antibiotics, and biocides.

Think of a biofilm as a sort of "microenvironment" or "microhabitat" that gives its living inhabitants a survival advantage.

Dental plaque was among the first groups of biofilms to be studied. Teeth provide a hard surface on which biofilms can attach themselves. Saliva and the remains of food we eat are both sources of nutrients for the bacteria that contribute to the formation of dental plaque and associated peridontal diseases.

Biofilms are found everywhere, including such extreme environments as the hot springs of Yellowstone National Park and the glaciers of the Antarctic. They can corrode pipes and the hulls of ships and contaminate processed foods. Biofilms grow on the porcelain surface of toilet bowls, wood siding, shower tiles, plastics, and wooden cutting boards. Biofilms are everywhere!

Because biofilms can also grow on surfaces inside other organisms they can potentially grow on anything that is inserted into the body. This includes such medical devices as catheters used for antibiotic therapy and chemotherapy, blood transfusions, and intravenous feedings. They can also grow on body implants and prosthetic devices and within the tissue of the upper respiratory tract, the gastrointestinal tract (GI), or the urinary tract. Biofilms also grow on contact lenses, mascara brushes, eye care solutions, and artificial fingernails.

Not all biofilms are harmful. Some biofilms are part of the normal flora inside our bodies and others help our bodies produce vitamins. In various ecosystems, biofilms are part of the food chain, facilitating the decomposition of dead organisms and the recycling of nutrients.

Biofilms are also used in the field of biotechnology. Two examples include the addition of certain biofilms in cattle feed to prevent disease, and their use to break down toxic wastes in the water purification process. A new research area known as bioprospecting has developed from the use of biofilms in biotechnology.

A BIOFILM'S BIO

Lesson 1 Activity: Technology Tackling Biofilms

Introduction:

During this activity students will use their knowledge of biofilms to design a model of a new toothbrush to tackle dental biofilms.

National Science Education Standards:

Content Standard F: Science in Personal and Social Perspectives:
Science and Technology in Society

Concepts & Principles:

- Scientists and engineers help design and implement technology that affects the quality of life.
- The process of designing and implementing technology is sequential.

Objectives:

- To control dental plaque, students will design a toothbrush, implement the proposed design, evaluate the product, and communicate the process of the technological design.
- To model how scientists and engineers collaborate to accomplish a goal, students will work together.

Cross-Curricular Connections:

Math:
- Drawing to scale, measuring
- Estimating

Language Arts:
- Writing and communicating orally
- Labeling

Arts:
- Designing
- Drawing
- Constructing graphic organizers

Health:
- Understanding dental plaque

Process Skills:

Communicating	Problem Solving	Inferring
Predicting	Analyzing	Modeling

Lesson 1 Activity: Technology Tackling Biofilms

Lesson Description:

The goal of this activity is to design, construct, and evaluate a model of a better toothbrush aimed at controlling dental plaque caused by biofilms. Students also work collaboratively in a group to model a research and design team.

Materials:

Per Group

several different types of toothbrushes to illustrate tooth brush technology currently in use *(Local dentists may donate these.)*

drawing paper

rulers

various materials provided by students with which to make their toothbrushes

Suggested Time Frame:

Three 45 minute class periods

Procedure:

Session 1

1. Use the background information to introduce the concept of biofilms and their role in dental plaque formation. Show the video on biofilms. Start and stop the video during class discussion, as needed, paying particular attention to the segment on dental biofilms. (*Use the National Science Education Standards to guide a class discussion of science and technology*) Identify present day technological solutions to the problem of dental plaque caused by biofilms.
2. Present student teams of 3-4 students with the challenge of designing a better toothbrush to control biofilms that cause dental plaque. Give clear instructions for the procedures which the students are expected to follow and the criteria for design and implementation of their product. *(As an alternative, students may brainstorm and develop the criteria together.)* Students should be provided with an assessment rubric, timeline, and team worksheet to be filled out and returned at the completion of the activity.

Session 2

1. Student teams organize their groups, assign responsibilities, and select a name for their research team.
2. Each team brainstorms ideas to design and implement a model of a better toothbrush. Factors to consider include the nature of biofilms, the projected users of the toothbrush, cost, materials, safety, ease of use, limitations, benefits, and unintended consequences.
3. The criteria for the design:
   a. Type and size of paper to draw the design on as stipulated by the teacher (example: 1/2 sheet of poster paper).
   b. Type of media to use as stipulated by the teacher (example: pen and ink, colored pencils, markers).
   c. Drawing should be to scale.
   d. Components should be clearly labeled.
   e. Product should be named.

Session 3

1. Research teams implement the proposed design by making a scale model.
2. The criteria for the new toothbrush:
    a. Original and creative idea
    b. Practical application (Will it work?)
    c. Materials to be used to construct the actual toothbrush (Are they practical and cost-effective?)
    d. Cost to the consumer
    e. Environmentally friendly packaging
    f. Aesthetics of design (How attractive is it?)
    g. Ease of use by the consumer
    h. Suitability for the need
    i. How will it be tested prior to marketing?
3. Evaluate the completed product and make necessary modifications.
4. Communicate the process of technological design through a graphic organizer such as a Vee diagram, concept map, or flow diagram (Novak and Gowin, 1984). It should describe and analyze the product and identify the stages of problem identification, solution design, implementation, and evaluation.

Session 4

1. Research teams present their products to the class.
2. Students conduct a peer evaluation of the pros and cons of each product and provide feedback to the research teams.

Suggested Discussion Questions:

Research Team Brainstorming. During ongoing assessment observe intercommunication among the team members and note the quality of their questions. Sample questions include:

- What are the benefits, limitations, and unintended consequences of using a toothbrush?
- What are some limitations of the toothbrush designs currently being used to remove bacterial biofilms from your teeth?
- How long should one keep a toothbrush before throwing it away? Why?
- What about the materials that a toothbrush is made of? Have you ever used a metal one? Why not?

Further Investigations:

- Students select other types of technology used to improve personal health and research their benefits and limitations.
- Student teams of four may be interested in participating in **The Bayer/NSF Award for Community Innovation**. Sixth, seventh, and eight graders employ teamwork, science and technology to solve community problems. Teams work under the guidance of an adult coach and 10 teams are selected as national finalists. Check out http://www.nsf.gov/bayer-nsf-award.htm

- Students design an advertisement for their product. This could be for print, radio, TV, a bumper sticker, etc.
- Students could also prepare a verbal presentation to convince a company to market their product.

Career Opportunities:

Dentist
Dental Hygienist
Microbiologist
Research Scientist
Marketing
Engineering
Graphic Design Artist
Public Relations Expert

Assessment Procedures:

- Ongoing social interaction skills may be assessed through peer and teacher evaluations.
- Teacher assessment of the design should be done prior to construction of the product model.
- Peer and teacher evaluation of the class presentation of the final products should be conducted. The products may also be displayed for parents, faculty and school visitors to view.
- Students can also reflect on their experience through journal writing.

Additional Resources:

American Society of Microbiology
(Images of Biofilms)
http://www.asmusa.org

Brock, T. D. (1994). *Life at high temperatures.* Yellowstone National Park,WY:Yellowstone Association for Natural Science, History & Education, Inc.

Lappin-Scott, H. M. & Costerton, J. W. (1995). *Microbial Biofilms.* Cambridge: Cambridge University Press.

Maryland Sea Grant Education
www.mdsg.umd.edu/MDSG/Education/biofilm/resource.htm

Montana State University Center for Biofilm Engineering
http://www.erc.montana.edu

National Research Council. (1996). *National Science Education Standards.* Washington, D.C.: National Academy Press.

National Dental Association
http://www.nda.com

NASA Spacelink
http://spacelink.nasa.gov/NASA.Projects/Human.Exploration.and.Development.of.Space/

NASA Spin-off Technology
http://www.sti.nasa.gov/tto/spinoff1998/html.htm

Novak, J.D. & Gowin, D. B. (1984). *Learning How to Learn*. New York: Cambridge University Press.

Lesson 1 Activity: Technology Tackling Biofilms

RECORD SHEET
ACTIVITY: Technology Tackling Biofilms

RESEARCH TEAM NAME: _____ Date _____

TEAM MEMBERS AND JOBS: _____

Personal Health Problem: _____

Product materials: _____

Estimated cost to the consumer: _____

Benefits to the user: _____

_____

The limitations of our product are: _____

_____

Any unintended consequences: _____

_____

Our product will be packaged in an environmentally friendly way by: _____

_____

How will you make it available to people in both developed and under-developed countries? _____

_____

Our product has been tested in the following way: _____

_____

Are there any ethical issues involved in its testing? _____

_____

Problems we had in designing and building our product were: _____

_____

The main reason we believe our product will be successful is because: _____

_____

Lesson 2 Activity: Interactive Historical Vignettes

Introduction:

In this activity students will write and present Interactive Historical Technological Vignettes (IHVs) and develop an understanding of the contributions made by people of different cultures to science and technology. They will also learn about the relationships between science, technology, and society.

National Science Education Standards:

Content Standard F: Science in Personal and Social Perspectives
Science and Technology in Society

Concepts & Principles:

- The contributions of people from different cultures have enabled science and technology to progress throughout history.
- Society influences the development of technology.

Objectives:

- To understand that science and technology have advanced throughout history because of the contributions of people of different cultures.
- To understand the relationship between science, technology, and society.

Cross-Curricular Connections:

Social Studies:
- Historical contributions and the influence of culture on science and technology
- Use of a timeline to record events
- Social and ethical issues

Language Arts:
- Written and oral communication
- Research
- Interviewing
- Documenting sources

Math:
- Metric measuring
- Use of scale measurements
- Sequencing

Arts:
- Drawing and illustrating

Process Skills:

Measuring to Scale Inferring Predicting Evaluating

Lesson 2 Activity: Interactive Historical Vignettes

Lesson Description:

Students will select and research the history of a scientific process or technology of interest to them. They should relate the individual and cultural contributions to the advancement of their selection on an historical time line. Following the methods of Wandersee and Roach, 1997, they will write and present their vignettes to the class.

Materials:

Per Student

Library and/or Internet access for researching the topic

Character mask:

1) Photocopy of technology and/or scientist/engineer who helped develop the process or technology
2) 3' x 3' stiff piece of corrugated cardboard (or foam board from an art supply store) on which an enlarged photocopy of a drawing or photograph of the technology and/or head and shoulders of the scientist/engineer is glued. *(Copy shops can enlarge a photocopy to this size.)*
3) Small eye, nose, and mouth openings can be cut out of the board so that the presenter can see, breathe, and talk during the presentation. *(The presenter will be behind the mask.)*
4) Handles should be attached to the back of the board for the presenter to hold.
5) Students may decide to add costume elements such as a labcoat, wig, or stethoscope to make the mask 3D.
6) Colored index card for drawing or a photocopy of the technology product are also needed. If a science process is studied, the process is succinctly described on the card.

*Used with permission. (Wandersee & Roach, 1997)

Per Classroom

meter stick

white accounting tape

4" x 6" colored index cards *(a different color should be used to represent each decade of your timeline.)*

tape that is safe to use on the wall

colored markers

Suggested Time Frame:

Three 45 minute class periods

Session 1: Teacher introduction. Students determine units of measurement and tape up the timeline and index cards.

Session 2: Students may conduct their research, construct character masks, plan and practice presentations during class or as homework.

Session 3: Each presentation and discussion should last 10 - 15 minutes.

Lesson 2 Activity: Interactive Historical Vignettes

Procedure:

Session 1

1. Lead a class discussion of students' prior knowledge about science, technology and society in order to develop a timeline.

2. Assign time periods to be included in the timeline and select colors for identification. For example, 1700 - 2000. Yellow (1700), Blue (1800), Pink (1900), Purple (2000)

3. Measure the wall on which you will tape the timeline and determine the scale to be used. For example, 5cm = 10 years.

4. Tape the white accounting tape to the wall for the timeline. Place a card with the date above the timeline where each decade begins as shown in the diagram below. Other historical events can be placed above the timeline. Students will place their science/technology cards below the timeline. Example:

5. Students select a scientific or technological event or object to research. Some suggested biofilm-focused topics include:
   a. microscope used to observe microorganisms: 1674, Anton von Leeuwenhoek (German)
   b. development of the electron microscope: 1940
   c. invention of the ice box (refrigeration of food): 1876
   d. development of freezing as a method for preserving food: 1917, Clarence Birdseye (American)
   e. discovery that germs cause disease: 1860, Louis Pasteur (French)
   f. discovery of penicillin: 1928, Alexander Fleming (British)
   g. germ theory of disease: 1876, Robert Koch (German)
   h. smallpox vaccination: late 1790s, Edward Jenner (British)
   i. development of chemotherapy: 1908, Paul Ehrlich (German)
   j. early biofilm research: 1972, Bill Costerton (Canadian)
   k. biotechnologically grown insulin: 1981 (USA)
   l. high speed dental drill: 1947 (USA)
   m. using sterile rubber gloves in surgery: 1890, William Stewart Halstead (American)
   n. bioremediation to clean up *Exxon Valdez* oil spill: (1989)

Lesson 2 Activity: Interactive Historical Vignettes

Procedure:

Session 2

1. Students research their assigned topics. They choose one pivotal event in the life of the scientist, one historical event that influenced their topic, and one way their topic influenced society. Complete the student report sheet.

   Example: E. Metchnikoff (Russian)

   Pivotal Event: One day in 1887 while looking at starfish larva under a microscope, Metchnikoff suddenly got the idea that became the basis for his phagocyte theory. He stuck a rose thorn into the larva and it was immediately surrounded by mobile cells trying to ingest the thorn and protect the larva.

   Historical Event: Louis Pasteur was the head of the new Pasteur Institute in Paris, France where research on disease was conducted.

   Influence on Society: Metchnikoff's ideas caused an intellectual war between German and French researchers that resulted in our first understanding of how the immune system works. He was awarded a Nobel Prize in 1908.

2. Students glue a photocopy of the technology or summarize the science process on a color-coded index card.

3. Students construct character masks and prepare interactive historical vignettes following adaptation of the IHV format:
   a. introduction to the scientist and the technology or scientific process
   b. context and basis for the pivotal event
   c. choicepoint and sample options
   d. final outcome of the incident
   e. influence of an historical societal event on the technology or science process
   f. influence of the technology or science process on society

4. Students write the final vignette in docudrama style, with a total presentation time of no more than 5 minutes. *(allow up to 10 additional minutes for discussion)*

Session 3

1. Students present the first three parts of the vignette in docudrama style. Next, they stop the presentation and allow students to decide *(independently)* what choice they think the scientist in the vignette eventually made. Conclude by telling the rest of the story including items 5 and 6.

2. Class discussion follows in order to provide an overview of the topic.

3. Students tape their index cards to the appropriate space on the timeline.

Lesson 2 Activity: Interactive Historical Vignettes

Suggested Discussion Questions:

- How do their childhood, education, cultural background, and personal experiences influence scientists?
- Under what conditions did the scientist work?
- Does there appear to be a code of conduct that scientists follow?
- Can there be risks involved when new technologies are produced?

Further Investigations:

- Write a science fiction short story predicting future biofilm technology.
- Illustrate or write about important world historical events that were occurring when one of the timeline technologies was developed. Encourage students to discuss how these events influenced the development of this technology.
- Write a news release or present an oral announcement that would be aimed at citizens who lived at that time in history and would discuss the new technology and its predicted benefits.

Career Opportunities:

Microbiologist
Food Scientist
Engineer
Graphic Design Artist
Architect
Environmental Engineer
Patent Attorney
Astronaut
House Keeper
Welder
Painter

Assessment Procedures:

- Illustrations and oral presentations may be evaluated using a rubric.
- The timeline may be used as an assessment tool.
- Students can construct a concept map of the events on the timeline showing how they are related to each other.

Additional Resources:

Center for Biofilm Engineering
http://www.erc.montana.edu

Desowitz, D. (1987). *The Thorn in the Starfish: The Immune System and How it Works.* New York: W. W. Norton & Company.

Murphy, A. & Perrella, J. (1993).Overview and Brief History of Biotechnology. 1993 Woodrow Wilson Biology Institute.

NASA
http://www.hq.nasa.gov/office/codef/education/online.html

NASA
http://spacelink.nasa.gov/NASA.Projects/Human.Exploration.and.Development.of.Space/

National Research Council. (1990). *National Science Education Standards*. Washington, D C: National Academy Press

Wandersee, J.H. & Roach, L. M. (1997). Interactive historical vignettes. In J. J. Mintzes, J. H. Wandersee, & J. D. Novak (Eds.), *Teaching Science for Understanding: A Human Constructivist View* (pp. 281-306). San Diego, CA: Academic Press.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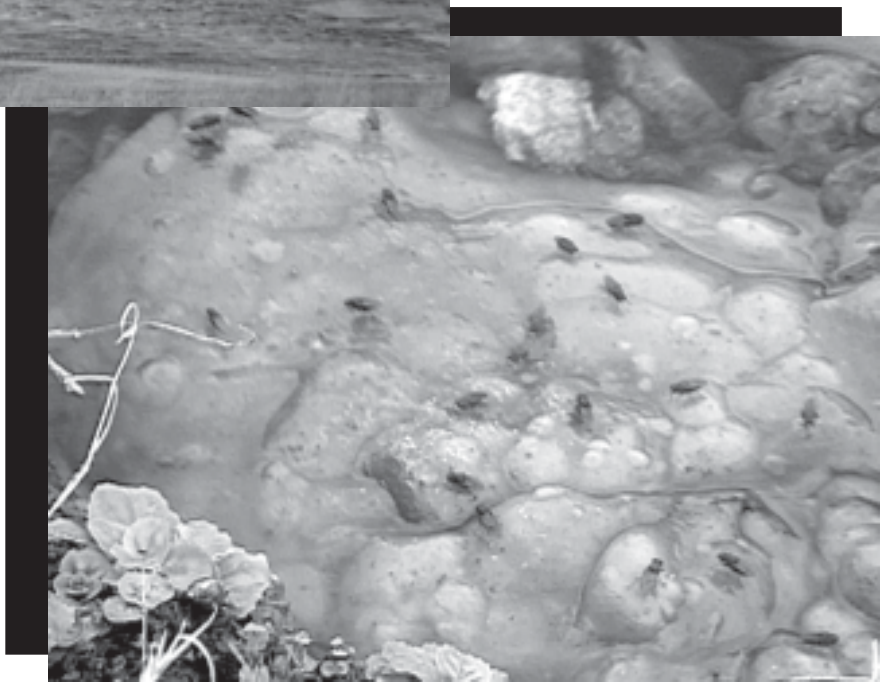

Lesson 2 Activity: Interactive Historical Vignettes

Science, Technology, and Society:
Interactive Historical Vignettes

Name _____ Date _____ Period _____

My topic is _____

My scientist is _____

Facts about this topic:

When and where was it developed? _____

Describe other historical events that occurred at this same time. _____

_____

_____

What problem did it attempt to solve for society? _____

_____

_____

Describe how it was developed. _____

_____

_____

What culture contributed to its development? _____

Describe the personal life of one scientist involved in the development and any pivotal point in his life.

_____

_____

_____

_____

Was this individual honored for this achievement? _____

_____

Explain how society influenced this development. _____

_____

_____

_____

Lesson 2 Activity: Interactive Historical Vignettes

Did this technology solve the problem? Explain _____

_____

_____

Did this technology lead to other inventions? Explain. _____

_____

_____

Describe the current benefits of this technology to society. _____

_____

_____

Is this technology available to all people around the globe? Why or why not? _____

_____

_____

_____

Describe any unforeseen consequences of this technology. _____

_____

_____

_____

Describe any improvements that you think should be made. _____

_____

_____

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