

GRADE 8: WATER SYSTEMS BOOKLET

TO THE TEACHER

Welcome! This booklet has been designed to help teachers enhance the educational value and enjoyment of the 'Water Systems' workshop. We recommend that workshop visits coincide with classroom studies of water systems. This collection of activities has been designed to meet several expectations of the Grade Eight Science Curriculum. Our pre-visit activities have been designed to help students gain a foundation to help them more thoroughly understand what they will experience during the workshop. Additionally, follow-up activities have been provided to help students synthesize their observations and experiences. Most of the activities include working in cooperative groups, hands-on elements or provide a variety of choices in order to accommodate the needs of diverse learners. We hope you find this information useful and easy to incorporate into your classroom. Enjoy!

SCIENCE CONNECTIONS

Strand: Earth and Space Systems

Topic: Water Systems

Specific Expectations Met:

Understanding Basic Concepts

- ◆ identify the various states of water on the earth's surface and the conditions under which they exist
- ◆ describe the distribution and circulation of water on the earth

Developing Skills of Inquiry, Design, and Communication

- ◆ formulate questions about and identify needs arising from events relating to the earth's water, and explore possible answers to these questions and ways of meeting these needs

Relating Science and Technology to the World Outside the School

- ◆ evaluate human use of water and the economic and environmental effects of that use
- ◆ analyse factors that affect the productivity and distribution of animal species in marine and fresh water environments

AGENDA

Please note that the order or location of some of these activities may change due to construction, weather or animal health concerns.

10:00	Welcome to the zoo and outline of agenda. Introduction to the water cycle. Discussion of animal adaptations to aquatic habitats. Demonstration of human impact on aquatic ecosystems.
11:00	Tour Wetlands area. Investigation of human impacts on freshwater systems.
12:00	Lunch. Please have everyone bring a lunch. <u>There will be no opportunity to go to the restaurant</u>
12:30	Definition of wetland habitats. Discussion of positive roles of wetlands and methods of wetland conservation.
1:00	Tour of freshwater and marine habitats in Australasian and Americas pavilions.
1:50	Certificate presentation and close of program

PRE-VISIT ACTIVITIES

1. WATER WEBS

Individually, in pairs, in small groups, or as a class construct concept maps related to the subject of water. Encourage students to think laterally and include all ideas they feel are related to water. Students should be encouraged to include visual representations of their ideas. Teachers can ensure that some key ideas to be covered later are included (i.e., water as a part of the climate, physical forms of water, water as a resource, human impact on water). Use the summary and vocabulary list included in this package as a guide to important concepts to be included. Have students present their ideas in a visual format. This activity will serve as a diagnostic assessment of students' prior conceptions of the importance of water.

FOLLOW UP ACTIVITIES

1. DATA TABULATION AND DISPLAY

Collect the water chemistry test results recorded by the students during the workshop. Have students analyse their data. Individually, or in pairs, students can make comparisons of recorded values between different ponds. Students should be encouraged to draw conclusions about possible correlations between recorded values (eg. temperature vs. dissolved Oxygen, pH vs. phosphates). Data analyses can be presented in a variety of graphical or visual formats (eg. bar graphs, pie charts).

Feeling Bold?

Follow up the water testing at the Zoo with further water testing at a local wetland. Compare your test results with those taken at the Zoo. Take measurements weekly over a lengthy period. Have students record the seasonal changes in the water.

Tying It All Together

Mathematics Strand: Measurement

- demonstrate a verbal and written understanding of and ability to apply accurate measurement and estimation strategies that relate to their environment

Mathematics Strand: Data Management and Probability

- systematically collect, organize, and analyse primary data
- interpret displays of data and present the information using mathematical terms
- evaluate data and draw conclusions from the analysis of data

How To Assess

- Presentation is organized and accurately displays measurements
- Students worked cooperatively within pairs
- Analysis draws unique and convincing conclusions about data

2. SOIL ABSORPTION EXPERIMENT

(adapted from an activity found in [Wetlands](#) by Pamela Hickman)

In small groups, have students select a type of soil (eg. potting soil, playground dirt, sand, leaf litter) to test. Fasten cheesecloth to the ends of large funnels and fill the funnels with one of the selected soil types. Place each funnel over a large jar. Have each groups of students pour 250 mL of water into their funnel. Have students record the time it takes for the water to filter through their soil as well as the volume of water retained by the soil. Have each student write a brief report on the physical properties of their chosen soil compared to other soils tested in class.

Feeling Bold?

Have students test a variety of soil types. Have the students compare the absorption and filtration rates of each. Have the students try to develop a mixture of soil that will produce the highest and lowest filtration and absorption rates.

Tying It All Together

Mathematics Strand: Measurement

- demonstrate a verbal and written understanding of and ability to apply accurate measurement and estimation strategies that relate to their environment

Mathematics Strand: Data Management and Probability

- systematically collect, organize, and analyse primary data
- evaluate data and draw conclusions from the analysis of data

Language Strand: Writing

- communicate ideas and information for a variety of purposes and to specific audiences, using forms appropriate for their purpose and features appropriate to their form

3. NUTRIENTS AND AQUARIA

(adapted from an activity found in [Investigating Aquatic Ecosystems](#) by William Andrews)

In small groups, have students build an aquatic ecosystem. Weight the bottom of a wide-mouth jar or a cut-off 2L soda bottle with sand. Fill the aquarium with pond water and stock it with a few snails and freshwater plants. Very small guppies can even be added. Ecosystems should maintain themselves well if placed in indirect sunlight and kept from over- or underheating. Once they are established, have students experiment with their ecosystems by adding nutrients. Commercial fertilizer, manure, even food scraps can be added to ecosystems in very small amounts. Have the students observe the effects of added nutrients in their ecosystems. Each student can then compose a report, in paragraph form, of the effects of added nutrients to aquatic ecosystems. Students should be encouraged to draw general conclusions about the impact of human nutrient addition to natural waterways and wetlands.

Tying It All Together

Language Strand: Writing

- organize information and ideas creatively as well as logically, using paragraph structures appropriate for their purpose

4. STREAM TABLE

Create a model of a natural waterway right in your classroom. Attach an outlet tube to a large, rectangular pan (a hamper sized plastic container will work). Elevate the end of the pan opposite the outlet tube using books or scraps of wood. Fill the upper half of the pan with a mixture of sand and rocks materials to a depth of 4-5 cm. Add water to the lower half of the pan to create a pool. Flow water into the upper part of the pan using a garden hose. Adjust the flow of water so that it creates a channel through the rocks and sand down to the pool. Have the students observe the path of the water as it cuts through the “land” and how it reaches the pool. Experiment by changing the angle of the pan, the rock material used, and the flow rate of the water. Have students experiment by adding dams or diverting the flow of the “river.” Initiate a class discussion on the physical effects of water as it moves over land. Discuss as well how humans impact on the flow of water for our own purposes.

Tying It All Together

Language Strand: Oral and Visual Communication

- provide clear answers to questions and well-constructed explanations or instructions in classroom work
- listen attentively to organize and classify information and to clarify thinking
- demonstrate the ability to concentrate by identifying main points and staying on topic

5. MODEL WATERSHED

Working in small groups, students can create individual watersheds and investigate how precipitation and pollution drains through them. In small rectangular pans, have students create a model of at least two separate watersheds using modeling clay. Building a mountain in the middle of the pan will allow students to create drainage basins on opposite sides of the mountain. When the clay has hardened, have the students “rain” on their models using a watering can. Students can observe how water drains separately into different watersheds. Have students experiment with adding a surface pollutant (eg. tea leaves or confetti) to either watershed and observing where the pollutants end up. Have students modify their water shed by adding wetlands made of turf. Students can see how wetlands can filter out pollutants. Have the students present their wetland models and findings to the class in a presentation.

Feeling Bold?

As a class, try building a scale model of a real watershed. Using topographical map measurements of a local watershed, create a large and accurate model of the watershed. Try to include as many real features and buildings as possible. Experiment with the impact of adding or removing wetlands to this model in order to make decisions about management of the watershed.

Tying It All Together

The Arts Strand: Visual Arts

- produce two-and three-dimensional works of art that communicate a variety of ideas for specific purposes and to specific audiences, using a variety of art forms
- describe, in their plan for a work of art, the main idea they wish to communicate and the artistic decisions they have made to support that decision

SUMMARY

The following is a summary of the major concepts covered in the workshop.

Water as a Resource

Water cycles continually through the environment. Available freshwater comprises a very small proportion of the water on Earth. Human impact on water can have a huge effect on wildlife and human life. Chemical testing and continual monitoring are means to determine the degree of impact humans have on water resources. Individual citizens can take personal responsibility for conservation of water and aquatic ecosystems.

Wetlands

Freshwater wetlands exist in five different types: marsh, swamp, fen, bog, and ephemeral wetland. Wetlands serve several important functions ecologically including: flood protection, water purification, and habitat for endangered species.

Animal Adaptations to Water

Many different types of animals inhabit aquatic ecosystems. Evidence of animal habitation in a wetland includes: nests, scat, and tracks. Freshwater and saltwater animals have different adaptations to their specific environments.

VOCABULARY

biomagnification	the buildup of a toxic substance as it moves through the levels of a food chain.
bloom	a rapid increase in the algal population in an aquatic ecosystem.
condensation	the process of a substance changing from a gas to a liquid.
conservation	methods employed to reduce demands for a resource and therefore increase supplies.
dissolved Oxygen	gaseous oxygen that is found dissolved in water.
eutrophication	a process by which an excess of nutrients in an aquatic ecosystem leads to a proliferation of plant life and a reduction in available oxygen.
evaporation	the process of a substance changing from a liquid to a gas, slowly and over a wide range of temperatures.
groundwater	water that lies beneath the surface of the Earth.
nitrate	a salt of nitric acid (NO_3^-), an essential nutrient and commonly occurring pollutant
pH	a measurement of the concentration of hydrogen ions (H^+) per unit volume: used to determine the degree of acidity and alkalinity of solutions.
phosphate	a salt of phosphoric acid (PO_4^-), an essential nutrient and commonly occurring pollutant
pollution	substances that contaminate natural environments.
potable	water suitable for human consumption.

precipitation	water that falls to the earth in solid or liquid form (eg. rain, sleet, hail, snow).
transpiration	the evaporation of water from the surface of a plant.
vitamins	help control body growth and functions
water cycle	the movement of water through different locations and physical forms.
wetland	an area of land that is partly covered by water for some part of the year.

RESOURCE LIST

S – student friendly resource: T – teacher appropriate resource

Books

[Investigating Aquatic Ecosystems](#). 1987. by W. Andrews (S & T)

A fully detailed program of study. Contains activities, lecture ideas, assignments and long-term projects.

[Wetlands](#). 1993. by P. Hickman (S)

Primarily aimed at younger students, but contains a variety of activities that could easily be adapted.

[WOW! The Wonders of Wetlands](#). 1995. by A.S. Kesselheim, B.. Slottery, S.H. Higgins, and M.R. Schilling (T)

A complete educator's guide to wetlands education. Contains activities suitable for a range of ages from pre-school to secondary. Also contains detailed background information.

Websites

www.ec.gc.ca/education (T)

The Environment Canada website. Contains a variety of links to environmental websites including many sites related to water .

www.ene.gov.on.ca (T)

The Ontario Ministry of the Environment website. Focuses mainly on Acts and Regulations, but contains downloadable documents on monitoring, pollution, and rehabilitation programs.

vathena.arc.nasa.gov/curric/land/wetland/index.html (S & T)

NASA's wetland education site. Aimed a wide range of student ages, but contains many activity ideas.

www.environmentalsustainability.info/water (T)

Links to current environmental headlines and hundreds of ecologically related websites.

ga.water.usgs.gov/edu (S & T)

USGS water education website. Lots of information and activities, including quizzes and games.

www.cwra.org (T)

Canadian Water Resources Association website. Comprehensive links to water related groups and organizations.

www.epa.gov/safewater/kids (S & T)

U.S. Environmental Protection Agency website. Contains activities related to water sorted by grade level.