

Science Lessons for Grades 6-8

“Coastal and Urban Water Quality Testing”

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Discipline: Chemical water quality testing, Environmental toxicology, Water use and regulation

Grade: 6 to 8

Standards

UPC.2, UPC.3, UPC.A.1, UPC.A.2, UPC.B.1, UPC.D.1, UPC.E.2, UPC.F.2, UPC.F.5

Sunshine State Standards

• Strand D: Processes that Shape the Earth

Standard 2: The student understands the need for protection of the natural systems on Earth.

Benchmark SC.D.2.3.1: The student understands that the quality of life is relevant to personal experience.

Benchmark SC.D.2.3.2: The student knows the positive and negative consequences of human action on the Earth's systems.

• Strand G: How Living Things Interact with Their Environment

Standard 2: The student understands the consequences of using limited natural resources.

Benchmark SC.G.2.3.4: The student understands that humans are a part of an ecosystem and their activities may deliberately or inadvertently alter the equilibrium in ecosystems.

Purpose/Goals

To examine water as a vital resource. Many people world wide live without clean water and many major cities are in short supply of available water, but water is often taken for granted. This lesson will examine why water is so important, the many uses of water, water pollution, and water quality policy and regulation. The lesson will include a water quality video, a hands-on activity to determine pollutants in local water samples, a power point presentation and lecture and assessment and home learning activities.

Students will:

- Explain the importance of water is to living things.
- Identify major steps of the water cycle.
- Identify types and sources of pollution.
- Identify human intervention in natural water flow.
- Examine local coastal and urban water for pollutants.
- Explain water quality policy and regulation.

Common misconceptions include:

- There is an unlimited supply of clean water
- Water pollution is mostly large, visible debris (trash)
- Personal water use does not affect 'the big picture.'
- Decisions made about water quality and water use are 'out of the public's hands.'

Pre-requisites include:

- General knowledge of the water cycle
- General knowledge that large concentration of nutrients or minerals can damage an ecosystem.

Preparation

1. Water Works® Water Quality School Test Kit – ordered from Ward's Scientific Supply
2. Water samples – Miami River, Miami Harbor, Brownsville Middle School tap water, distilled water, bottled water, fish tank water, tap water from home. (500ml water samples gathered by the teacher several days previous to the lab.)
3. Guided notes handout
4. Power point presentation handout (for ESE/ELL students)
5. Water Quality Testing lab activity guide sheet.
6. Home learning

- a. Water Use at Home
- b. Water Use Worldwide

Multimedia/Technology Materials/Websites:

1. "After the Storm" video, produced by The Weather Channel and The Environmental Protection Agency. Available at <http://www.epa.gov/weatherchannel/>
2. Water Quality power point presentation, created by Joelle Verhagen and Nexer Palacios.
3. Water Quality Jeopardy review (power point format), content created by Joelle Verhagen and Nexer Palacios.

"After the Storm" video, produced by The Weather Channel and The Environmental Protection Agency. Available at <http://www.epa.gov/weatherchannel/>

Description:

Engage:

1. Hold up a beaker of water. Ask what it is, where it comes from and why it's a vital resource?
 - a. Why is water so important?
 - b. What are some of the daily uses of water?
 - c. What are some large scale uses of water (i.e. agriculture)?
 - d. Where does all that water come from?
 - e. 70% of the Earth is covered by water but less than 1% is available for us to use. We need to take care of the water available to us and other living organisms.

Explore:

1. Hold up a beaker with muddy water and one with clear water.
 - a. Ask which one is clean.
 - b. If students say the clear water, ask if they would drink it.
 - c. If they respond yes, tell them it is Miami River water.
 - d. If you knew this is Miami River water would drink it now?
 - e. How do you know if your water is safe to drink?
 - f. Is all pollution visible?
 - g. Explain that water pollution isn't always visible. Microorganisms, pesticides, fertilizers, and heavy metals are not visible but in large concentrations are toxic to humans and other organisms.
 - h. Explain how we are going to test for non-visible, non-living factors in local water samples.

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 - e. 70% of the Earth is covered by water but less than 1% is available for us to use. We need to take care of the water available to us and other living organisms.
2. Show "After the Storm" video. Students will write down important terms or words they don't understand while they watch the video (see guided notes, included.)
3. After we watch the video, go over any of the vocabulary and concepts the students have plus the following:
 - a. Watershed
 - b. Water cycle
 - c. Usable water
 - d. Point source pollution
 - e. Non-point source pollution
 - f. Managing water resources
 - g. People without access to clean water
 - h. Water regulation
 - i. EPA – Environmental Protection Agency

Students will provide the words and the teacher will write and define them on the board (guided notes provided for ELL and ESE students.) We will discuss the terms in how they relate to the video and water quality.

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2. Water quality testing activity (procedure included.) Students will get into groups of four and choose one of the 7 available water samples. The students will test their water sample for nine different factors.
 3. Once the students have completed the data for their sample they will compile data on the computer overhead (data table included.) We will discuss the different factors tested, and examine the levels of these factors in each sample.
 4. The following questions will be addressed in a class discussion.
 - a. If the river water "looks" clean from our testing, does that mean it's ok to drink?
 - b. Would you drink it?
 - c. What other pollutants might be in the river or harbor water and where might these pollutants come from?
 5. Students will be directed to complete the analysis question at the end of the lab activity.

Explain:

1. Power point presentation on water cycle, sources of water pollution, human intervention on water flow and the effects on ecosystems (everglades), and water management (EPA.)
2. Students will use notes handout (guided notes included) to assist in taking notes on the presentation
 - a. Label a simplified water cycle with students.
 - b. Concept map of the types and sources of water pollution.
 - c. Concept map on water regulation and the EPA.
3. Look back at the compiled results of tested water samples. Examine the provided color chart card to compare the data to the EPA recommendations for each of the factors. Identify which factors are within or outside of EPA recommendations, and discuss why factors may be high. For example, if chlorine is found in the tap water we will identify if it is within EPA recommendations and why it is in the water to begin with. Analysis of the data will be student led where each group will come up and discuss the results from their water sample.
4. Power point Jeopardy review game (included) – students will review the lesson by playing Jeopardy.

Assessment

1. Pre-lesson assessment by evaluating the students' knowledge of the vocabulary and concepts in the water quality video.
2. Formative evaluation of individual lab groups during the lab activity by discussion and probing questions.
3. Formative evaluation of notes and concept maps by asking students to explain what they have written.
4. Power point Jeopardy review game at the end of the lesson (included).
5. Water use homework (included.)
6. Extra credit homework involving water use worldwide (included)

Follow-Up Activities

Community Project

1. Students can research the water quality in their community as a Science, Technology and Society project. Topics could include local water quality standards, sources of local pollution, sources of drinking water, waste water treatment, etc. Students will
 - design and build as a way to find a solution to a real problem or
 - investigate and improve by reading, personal interviews and site visits.

Expand:

1. Provided enough time, students will use Palm Handheld computers with attached pH probe to obtain a digital pH reading. Instructions for using the Palm Handheld are on back of the Lab Guidesheet handout.
2. Students will have a more in depth look at the water cycle including water storage, evaporation, transpiration, sublimation, condensation, precipitation, and infiltration. Students will draw a more complex water cycle diagram indicating where in the cycle water contaminants can occur, for instance ground water run-off, acid rain, factories, etc.
3. In depth look at the factors that were tested including free and total chlorine, iron, copper, nitrate, nitrite, pH, alkalinity, and hardness. Students will learn what these factors are, where they might come from and what concentration of these factors are considered toxic.