

Florida's Water Resources Module

Lesson 2: Groundwater Pollution

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2005-2006

Purpose/ Overall Objective:

The behavior of pollutants in the groundwater environment will be explored with an emphasis on Florida's water resources. The concepts of natural resources, groundwater aquifers, pumping wells, and groundwater pollutants will be introduced. Then, each class will perform an inquiry-based laboratory experiment to determine the behavior of different pollutants based on their density. Follow-up includes what was observed, density calculations, as well as applications to Florida Department of Environmental Protection's Underground Storage Tank and Drycleaner Programs.

Materials List:

1. Powerpoint lecture, slide dialogue for teacher.
2. Handouts of Powerpoint lecture for students.
3. Large Bottles of Salad Oil and Molasses.
4. Small clear plastic cups.
5. Printed out laboratory worksheet for students.
6. Large clear plastic cups .
7. Calculators.

Title: Groundwater Pollution Lab

Key Questions : What is the density of different liquids?
What happens to different liquids in groundwater?

Science Subjects : Earth Sciences, Chemistry, Groundwater Hydrology, Hydrogeology, Environmental Science, Environmental Engineering, Mathematics.

Grade Level : 5th - 7th Grade

Science Concepts : Earth Sciences, Chemistry, Groundwater Hydrology, Hydrogeology, Environmental Science, Environmental Engineering, Mathematics.

Overall Time Estimate : 1-1/2 to 2 hours.

Learning Styles : Visual, Auditory, & Kinesthetic.

Sunshine State Standards:

SCA 1.3.1, SCC 2.3.7, SCD 1.3.3, SCD 2.3.1, SCD 2.3.2, SCG 1.3.2, SCG 1.3.4, SCG 2.3.1, SCG 2.3.2, SCG 2.3.3, SCG 2.3.4, SCH 1.3.4

Lesson Summary :

Through a combination of powerpoint lecture and laboratory experience, the concepts of groundwater resources, groundwater pollution, and liquid density will be explored.

Vocabulary :

Resource - a supply of material that we draw upon when needed

Natural Resource - Anything found in a nature that is valuable to humans for survival; includes land, soil, air, water, minerals, trees & plants

Groundwater - fresh water below the ground surface

Aquifer - Sand, gravel, or rock capable of storing water below the surface of the land

Water Table - The level below ground where soil and rock are saturated with water

Well - a pipe dug deep into the ground to extract groundwater

Density - mass divided by volume; the amount of material in something divided by the space it takes up.

Gasoline Spill - low density liquid that floats on water

Industrial Solvent Spill - high density liquids that sink in water

Student Learning Objectives:

The students will understand:

1. What is a resource?
2. What is natural resource?
3. Where is most of the usable fresh water on earth?
4. What is groundwater?
5. What is an aquifer?
6. What is the water table?
7. Why are there wells?
8. How does density determine the fate of pollutants in groundwater?
9. What happens when a underground gasoline tank leaks?
10. What happens when a dry cleaner spills its solvent?

The student will be able to:

1. Use a balance and determine mass of a liquid.
2. Calculate the density of each liquid.
3. Predict the behavior of a liquid in water based on its density.
4. Understand how this relates to gasoline and industrial solvent spills.

Background Information:

In progress

Advanced Preparation:

It will be essential to read the background information and review the powerpoint slides and dialogue before the teaching this lesson. Gather the materials. You will need to printout the worksheet for the students. Feel free to allow student questions about the topic during the presentation.

Procedure:

1. Classroom Lecture is presented in powerpoint format - 20-30 minutes.
2. Follow up discussion of Density calculation and what it means - 10 minutes.
3. Pass out laboratory handout and go over what is expected of the students - 5 minutes.
3. Break the students into groups of 2 or three and distribute the materials.
4. Have the students mass each of the given 25mL liquid samples - 5 minutes.
5. Using calculators, have the students determine the density of each liquid and make predictions of how they will behave in water - 15 minutes.
6. Complete the experiment and document their observations -10 minutes.
7. Compare results to predictions, describe the role of density in the behavior of the liquids in water - 10 minutes.
8. Make the connection to gasoline and industrial solvent spills in groundwater - 5 minutes.
9. Review Density calculations and have the students volunteer to come up to the board and show their calculations - 15 minutes.
10. After gathering all the classes data, you can then demonstrate central tendency of the density calculations, by teaching the average (mean), for an additional math lesson - 15 minutes.

Discussion Questions:

Additional teacher facilitated discussions can revolve around local pollution problems that affect water resources. Have students describe the role of density in pollutant behavior in groundwater. Ask them to suggest ways that we can reduce our groundwater pollution.

Assessment:

Grading the Lab worksheet will allow the teacher to judge the attention and effort of each student. On a quiz or test, supplemental or bonus questions can revolve around the key concepts of groundwater resources, potential groundwater pollution problems, and the role of density in pollutant behavior in water.

Extensions:

The ABC's of Superfund

<http://www.epa.gov/superfund/kids/alphabet/a.htm>

Darby Duck and the Aquatic Crusaders

<http://www.epa.gov/OWOW/NPS/kids/DARBY.HTM>

What is Groundwater?

<http://www.groundwater.org/kc/whatis.html>

Groundwater Protection: Kids Style!

http://www.groundwater.org/kc/kidsprotect_2.html

Resources:

Gainesville Regional Utilities

Water Supply

<http://www.gru.com/YourHome/ProductsServices/WaterWastewater/water.jsp>

History of Gainesville Water Since 1891

<http://www.gru.com/OurEnvironment/WaterQuality/historywater.jsp>

US Geological Survey

Water Science for Schools

<http://ga.water.usgs.gov/edu/>

Aquifer Basics

<http://capp.water.usgs.gov/aquiferBasics/index.html>

Groundwater

http://capp.water.usgs.gov/GIP/gw_gip/index.html

Alachua County, FL Dept. of Environmental Protection:

Groundwater

http://environment.alachua.fl.us/Natural_Resources/Water_Quality/Groundwater/water_quality_groundwater_page.htm

Floridan Aquifer

http://environment.alachua.fl.us/Natural_Resources/Water_Quality/groundwater/water_quality_groundwater_page2.htm

Groundwater Pollution:

Alachua County, FL Underground Storage Tank Program

http://environment.alachua.fl.us/Pollution_Prevention/petroleum/petrol_mainpage.htm

Florida DEP Petroleum Cleanup Program

<http://www.dep.state.fl.us/waste/categories/pcp/default.htm>

Florida DEP Dry Cleaner Solvent Cleanup Program

<http://www.dep.state.fl.us/waste/categories/drycleaning/default.htm>

State Coalition of Dry Cleaners

<http://www.drycleancoalition.org/>

Organizations:

The Groundwater Foundation

<http://www.groundwater.org/>

National Ground Water Association

<http://www.ngwa.org/>

Florida Ground Water Association

<http://www.fgwa.org/>

American Water Resources Association

<http://www.awra.org/>

Florida Section of AWRA

<http://www.awraflorida.org/>

References:

Contaminants in the Subsurface, 2005. National Research Council. National Academies Press.

Applied Hydrogeology, 2000. C.W. Fetter. Prentice Hall; 4th Ed.

Physical and Chemical Hydrogeology,

Contaminant Hydrogeology, 1998. C.W. Fetter. Prentice Hall; 2nd Ed.