Water Detectives

Purpose

To help students understand that some substances can be identified safely with your senses. For other substances we may need tools to help us identify them.

Overview

Students will try to identify mystery substances in the water.

Student Outcomes

Students will learn to use their senses to make observations and explain why sometimes you need extra tools to expand your senses.

Science Concepts

Earth and Space Science
Water is a solvent.

Physical Science
Objects have observable properties.

Scientific Inquiry Abilities

Develop explanations using observations.
Recognize and analyze alternative explanations.
Communicate procedures and explanations.
Use instruments to gather data.

Time

One class period

Level

All

Materials and Tools

For each team of 4-5 students:
4 clear plastic cups
4 spoons or straws
Marker to number cups
Distilled or tap water
Water Detectives Work Sheet
"Pollutants" for the water which represent all of the senses. Any safe, nontoxic food can be used, such as:
Sight: drop of yellow food coloring or coffee, carbonated water
Touch: baking soda, clear syrup
Smell: vinegar, lemon/orange juice
Hearing: carbonated water

Preparation

Number the cups for each station from 1 to 5.

Copy the *Water Detective Work Sheet* for each group.

Provide a work station with 4 cups of distilled or tap water with small amounts of a 'pollutant' mixed into 4 of the cups.

Lay out spoons or straws for dipping water from the cups.

Prerequisites

None

Background

In the hydrologic cycle, moving water (precipitation, surface water, groundwater) constantly erodes the continents. Part of the eroded material is transported by rivers to oceans, both as suspended solids (e.g. sand, clays, and silts) and dissolved substances (e.g. salts). These can be considered as natural pollutants and can vary from dissolved limestone (calcium carbonate) to dissolved minerals that contain heavy metals such as lead, cadmium, and zinc. Other substances are introduced into the hydrologic system through human activity. Oil, sewage, and chemical fertilizers and pesticides are examples. Once these materials are in the water, all forms of life using that water are subject to the effects of these substances. At the completion of the water cycle, the water evaporates, often leaving the particles it carried behind.

Scientists have developed tests to see if various substances, whether harmful or beneficial, naturally occurring or not, are found in water. These tests involve the use of tools to measure substances or properties that humans can not sense directly.

What to Do and How to Do It

Discuss with students how they use their senses to detect things in their environment. Discuss the advantages and limitations of each of the senses. Questions students may want to think about:

How do we use our eyes to detect danger? When does our sense of sight not work very well? *(when something is out of vision range, in the dark, or so small that it cannot be seen by the human eye...)*

How do we use our ears to detect danger? When do our ears not work very well? *(things that make no sound, when we do not listen or pay attention...)*

How do we use our sense of smell to detect danger? When does it not work very well? *(some things are odorless, when we have a cold...)*

How do we use our sense of touch to detect danger? When does it not work very well? *(when an object is far away, when touching might be dangerous...)*

Hold up a cup of water from one of the stations. Explain what the cup contains (water plus what known substances). Ask students which senses would be most useful for finding out if the water was unaltered tap water (intended for drinking)? Consider the advantages and disadvantages of using each of your senses.

Discuss proper lab procedures for testing substances with your senses.

Doing the Experiment

Explain to students that 4 of the 5 cups contain a mystery food that will be considered a 'pollutant' in the water. You may want to show students the boxes of 'mystery food' which have been put in the water (salt, baking soda, etc.).

Students are to detect which cups contain mystery pollutants and which cup has just water by using their senses. Use the *Water Detectives Work Sheet* to have students record their data.

Ask students what other ways might be used to find out what was in water. Introduce the idea of how we use tools and ask for examples of how we use tools to help our senses. For example, they may think of smoke detectors, microscopes, hearing aids, etc.

Introduce students to pH paper as a tool for sensing water. Have students use pH paper to test their cups of water. What can the pH paper detect?

Extensions of the Basic Learning Activity

Introduce students to pH paper as a tool for testing water. Have students use pH paper to test their cups of water. What can the pH paper detect?

Challenge students to devise their own tests for detecting what is in the water. Examples:

- Shake the water
- Add other substances that might react with things in the water (vinegar)
- Freeze, boil, or evaporate the water
- Test the density
- Look for refraction
- Conduct electricity through the water

Discuss how the GLOBE *Hydrology Protocols* use some of these principals to collect water data.

Student Assessment

Ask students to

- List several substances they might find in the water at their Hydrology Site
- Explain why instruments are sometimes needed to detect substances
- Guess (hypothesize) how various substances might affect things living in the water
- Explain how each sense is good for examining different kinds of materials

Water Detectives Work Sheet

*Name:*_____

Cup	Look 	Listen 	Smell 	Feel 	pH Test
1 one					
2 two					
3 three					
4 four					

1. Look at the cups. Put an X next to the cups that do not look like water.

2. Listen to the cups. Put an X next to the cups that do not sound like water.

3. Smell the cups. Put an X next to the cups that do not smell like water.

4. Feel water dipped from the cups. Put an X next to the cups that do not feel like water.

Which cup has ONLY water? _____