

Topic: Environmental Monitoring
Lesson Title: Environmental Monitoring Lab
Serial Dilutions
Grade Level: 6th - 8th Grade
Science Domain: Earth Science

Connecting to the Next Generation Science Standards

ESS2.A – EARTH'S MATERIALS AND SYSTEMS: All Earth processes are the result of energy flowing and matter cycling within and among the planet's systems. The energy that flows and the matter that cycles produce chemical and physical changes in Earth's materials and living organisms.

The materials/lessons/activities outlined below are intended to help students reach the Performance Expectations listed below.

Performance Expectations:

Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process.

Connections to Classroom Activity

Students: Students will model how the water cycle can be contaminated and cause chemical and physical changes in Earth's materials.

Science and Engineering Practices

- Using mathematics and computational thinking
- Constructing explanations (science)
- building models

- Students will use math and computational thinking to make a serial dilution to model how contaminants that are not visible are still affecting Earth's materials

Disciplinary Core Idea

ESS 2.A: Earth's Materials and Systems: All Earth processes are the result of energy flowing and matter cycling within and among the planet's systems. This energy is derived from the sun and Earth's hot interior. The energy that flows

- As the students learn about serial dilutions, they will apply that knowledge to the EPA regulations about contaminants. They will learn about Environmental monitoring at the Infinity Science Center, so they will be able to

and the matter that cycles produce chemical and physical changes in Earth's materials and living organisms.	transfer their knowledge of serial dilutions and acceptable levels of chemicals in the water supplies to understand how the water cycle can become contaminated.

Teacher Background Information
<p>The Environmental Monitoring area in the Infinity Science Center consists of six interactive computer stations, each providing a specific type of live data. This lesson focuses around water quality which is one of the areas of focus at the Science Center. Students can better understand how contaminants can affect Earth's water system and terrestrial system. When visiting the Infinity Science Center, students will see an exhibit in the Environmental Monitoring exhibit about water quality and what contaminates water. To better understand how those contaminants are measured, students can do this lesson on serial dilutions. By using math and computational analysis, students can better understand the regulations for acceptable levels of chemicals set forth by the Environmental Protection Agency (EPA). The lesson begins with a PowerPoint that describes the computations necessary to determine the parts per million or parts per billion. Then, students will use dye to make a model of a serial dilution that will show what a solution of water and black dye looks like in dilutions of one part per hundred, one part per thousand, one part per million, and one part per billion. Students will be able to associate their data collection with the monitoring that they saw while visiting the Infinity Science Center. Lastly, students will use the EPA website to determine chemicals that are monitored in Earth's waterways.</p>
<p>Statement of Learning Objective: ABCs – Audience, Behavior, Condition</p> <p>Students will make a serial dilution of black dye and water to model the levels that are acceptable for different chemicals that are monitored for water quality. Then, they will research different chemicals that are monitored at Infinity and by other organizations to insure water quality on Earth.</p>
<p>Common Learner Misconceptions:</p> <ol style="list-style-type: none"> 1. Lakes, rivers, and oceans are able to dilute all contaminants to an acceptable level on Earth. 2. Contaminants that are not visible are at safe levels for the water systems.

<p>Materials: (per group)</p> <ul style="list-style-type: none"> • black clothing dye • pipettes or droppers • white ice cube trays (well plates can be used if available) • toothpicks (for stirring) • paper towels • (2) 3-oz plastic cups • student lab sheets • goggles
<p>Vocabulary: solute, solution, solvent, serial dilution, concentration, dilution factor</p>
<p>Safety: Students should wear safety goggles during this lab to protect their eyes from splash from the dye solution.</p>
<p>Adaptations/Accommodations for Exceptional Students: Students may need support with the mathematics portion of this lesson. Extra individual help may be given, calculators may be used, or peer tutoring may be implemented to provide extra support.</p>
<p>Literacy Connections:</p> <ul style="list-style-type: none"> • Oceans by Seymour Simon • DK Eyewitness Books: Oceans by Miranda Macquitty • Scholastic Discover More: Ocean and Sea by Steve Parker

5E Instructional Process:

<p><u>Engage:</u> Activity What do you know about water pollution?</p> <ul style="list-style-type: none"> • Ask students to write in their science notebook about the questions below: <ol style="list-style-type: none"> 1. What is the source of pollution in our rivers, streams, and oceans? 2. How does a large volume of water affect that pollution? 3. Who regulates how much pollution can enter our waterways? • Lead a class discussion about the questions that students answered in their science notebooks to assess what they know about pollution.

- Then, show the PowerPoint, “Environmental Monitoring.”

Explore:

- Show students the materials for the serial dilution lab. Model how to use a pipette.
- Give students the Student Lab Sheet or have them draw the lab sheet in their science notebook.
- Review the procedure with students and answer any questions they may have.
- Remind students to wear goggles and to take care in not getting the solution on their clothes because it will stain.

Explain:

1. As a class, discuss the questions from the Student Lab Sheet.

Elaborate:**Activity – Writing**

1. Complete the lesson by asking students to do a 3-2-1. They should write three things they learned in this lesson. Two things they want to learn more about, and one thing that surprised them.

Evaluate:

1. Use the Answer Key for the Student Lab Sheet to assess students’ understanding of serial dilutions.
2. Evaluate what students write in their 3-2-1 writing assignment.