

LCM Lesson Plan: An Ecosystem's Limits of Tolerance

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Science Concept: Students will explore the effects of abiotic factors on an ecosystem.

Students will be able to measure and compare the pH of soil and water samples.

Students will be able to evaluate the pH of soil and water samples as an environmental limiting factor.

Knowledge and skills gained from this lesson would be applied to everyday science, as dangerous levels of pH are important indicators of the health of water and soil environments.

Content Standards:

- Science A9, A15, B1, B2, C2, D1, D2, D3.
- Math A3, A6, B6.

Cultural Standards:

- Students A1, A7, B3, D1, D5
- Educators A4,

<u>Gear Up #1: Fieldwork and K W L Chart:</u>	<u>Process Skills</u>	<u>Materials</u>
<p>A field work to the tundra, with an elder, to observe and to discuss local plants that of medicinal value. A review of the vocabulary, to address any misconceptions.</p> <p><u>Gear Up #2:</u> Students will use pH paper to determine the pH of common household solutions, such as ammonia, lemon juice, liquid detergent, shampoo, and vinegar.</p>	<ul style="list-style-type: none"><li>• Observing</li><li>• Inferring</li><li>• Interpreting data</li></ul>	<ul style="list-style-type: none"><li>• pH paper</li><li>• ammonia,</li><li>• lemon juice,</li><li>• liquid detergent,</li><li>• shampoo,</li><li>• vinegar</li><li>• local medicinal plants</li><li>• measuring cylinder</li></ul>

<p><u>Explore</u> Students will investigate pH as a limiting factor by measuring the pH of soil samples from different habitats (grassland, tree land and bare ground) their areas</p>	<ul style="list-style-type: none"> <li>• Observing</li> <li>• Measuring</li> <li>• Data Collection</li> <li>• Interpreting data</li> <li>• Estimating</li> <li>• Inferring</li> </ul>	<ul style="list-style-type: none"> <li>▪ Soil samples</li> <li>▪ Protective gloves,</li> <li>▪ measuring cylinder</li> <li>▪ pH paper</li> </ul>
<p><u>Generalize</u></p> <ol style="list-style-type: none"> <li>1. Which soil samples showed the highest pH?</li> <li>2. Did soils of different pH levels support different types of plants? Explain.</li> </ol>	<ul style="list-style-type: none"> <li>▪ Inferring</li> </ul>	
<p><u>Experiment</u> Students will measure the pH collected water samples, such as distilled water, ocean or saltwater, aquarium water, precipitation water, drinking water, and stream, pond or lake water.</p>	<ul style="list-style-type: none"> <li>▪ Observe</li> <li>▪ Investigating</li> <li>▪ Collecting data</li> <li>▪ Interpreting data</li> <li>▪ Inferring</li> <li>▪ Concluding</li> </ul>	<ul style="list-style-type: none"> <li>▪ Protective gloves,</li> <li>▪ measuring cylinder</li> <li>▪ pH paper</li> </ul>
<p><u>Interpret</u></p> <ol style="list-style-type: none"> <li>1. Students will compare the pH values for the water samples and summarize their</li> </ol>	<ul style="list-style-type: none"> <li>▪ Communicating</li> <li>▪ Interpreting data</li> </ul>	

<p>observations</p> <p>2. Students will be required to share results from the experiment and interpret them.</p>	<ul style="list-style-type: none"> <li>▪ Inferring</li> <li>▪ Concluding</li> </ul>	
<p><u>Apply/Assess</u></p> <ol style="list-style-type: none"> <li>1. How do the pH values of the water samples compare?</li> <li>2. Which of the water samples tested provides the greatest limiting factor for fish?</li> <li>3. Students will be challenged to use pH paper to determine which body care products (lotion, shampoo, fragrances etc) are acidic, basic or neutral</li> <li>4. Give one example of how you would investigate pH data of your local environment, and use data from your investigation to infer what limits the type of organism found in which habitat.</li> </ol>	<ul style="list-style-type: none"> <li>▪ Investigating</li> <li>▪ Concluding</li> <li>▪ Predicting</li> </ul>	<p><u>Vocabulary</u></p> <ul style="list-style-type: none"> <li>▪ Abiotic factor</li> <li>▪ Biotic factor</li> <li>▪ Habitat</li> <li>▪ Ecosystem</li> <li>▪ pH</li> <li>▪ Acid</li> <li>▪ Base</li> <li>▪ Limiting factor</li> <li>▪ Biome</li> </ul>
<p><u>Extensions</u></p> <ol style="list-style-type: none"> <li>1. Go online to <a href="http://www.globe.gov">www.globe.gov</a> and observe the archival data of soil, atmospheric or hydrologic studies done in different parts of the world.</li> </ol>	<ul style="list-style-type: none"> <li>▪ Observing</li> <li>▪ Inferring</li> </ul>	<p><u>Material</u></p> <ul style="list-style-type: none"> <li>▪ Internet access</li> </ul>

<p>2. Compare your pH data with data from different world biomes.</p> <p>3. Infer how abiotic factors may determine or limit the kind of fauna and flora of different world biomes and ecosystems</p> <p>4. Inquire about how your school may become a globe school and report your findings to your peers and teacher.</p>	
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## SCORING GUIDE

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Parameter	Level 1	Level 2	Level 3	Level 4
<b>Gear-up</b>	Student does neither engage in any discussion with the elder nor measures the pH of any sample.	Student engages in a respectful discussion with the elder. But does not take any pH measurements.	Student engages in a respectful discussion with the elder. Correct pH measurements of some of the samples	Student engages in a respectful discussion with the elder. Correct pH measurements of all the samples.
<b>Explore</b>	Student does not collect, prepare, tests any soil sample.	Student collects, prepares, and tests some soil samples.	Student collects, prepares, and tests all soil samples.	Student collects, prepares, and tests all soil samples.

			Student records his or her data and observations but does not analyze the results, critically.	Student records his or her data and observations and analyses the results, critically.
<b>Generalize</b>	Students has no record of data and observations,	Based on data and observations, student correctly identifies the soil samples with the highest pH. No explanation of how soils of different pH levels support different types of plants.	Based on data and observations, student correctly identifies the soil samples with the highest pH. Poor explanation of how soils of different pH levels support different types of plants.	Based on data and observations, student correctly identifies the soil samples with the highest pH. Detailed explanation of how soils of different pH levels support different types of plants.
<b>Apply</b>	Student does not measure the pH of any body care product.	Student uses pH paper to measure some body care products (lotion, shampoo, fragrances etc) but incorrectly identifies products, as	Student uses pH paper to determine which body care products (lotion, shampoo, fragrances etc) are acidic, basic or neutral. But Student	Student uses pH paper to determine which body care products (lotion, shampoo, fragrances etc) are acidic, basic or neutral. Student

		acidic, basic or neutral.	does not investigate pH of his or her local environment.	investigates pH of his or her local environment, and uses data from such investigation to infer what limits the type of organism found in which habitat.
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**References:**

This lesson is adapted from the text:

*Glencoe's Biology Text: Biology; Dynamics of Life.*

*Glencoe's Biology Laboratory manual.*

*Chapter 3: Communities and Biomes*

*Chapter 6: The Chemistry of Life*