Lesson Plans are provided to help organize an existing curriculum, allowing the teacher to spend more time on hands-on activities that meet key classroom learning objectives and improve student achievement. The Lesson Plans will aid the teacher in integrating LaMotte test kits and equipment into classroom activities that meet National Science Education Standards.
Concept/Topic
Introduction to pH and demonstration of a simple test procedure.

Time Requirement
one class/lab period

Subject Area(s)
Chemistry, Environmental Science, Biology

General Goals
1. The students will gain a basic understanding of pH in water.

Specific Objectives
1. Students will be able to explain the importance of pH in aquatic ecosystems and industrial processes.
2. Students will be able to explain the pH scale.
3. Students will be able describe the correlation between the acid and base added to the sample during the experiment and conditions that affect natural water.
4. Students will be able to follow instructions and work together as a team.
5. Students will be able to make observations.
6. Students will be able to collect and analyze data, and draw a conclusion.

Materials, Required

<table>
<thead>
<tr>
<th>Order Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5964</td>
<td>Classroom Studies, pH of Water Lab</td>
</tr>
<tr>
<td>2-2146</td>
<td>Safety Goggles</td>
</tr>
<tr>
<td>2-2234</td>
<td>Gloves</td>
</tr>
<tr>
<td></td>
<td>Timer/clock</td>
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<tr>
<td></td>
<td>Water sample (tap, aquarium etc)</td>
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</tbody>
</table>
Anticipatory Set (Lead-In)

The pH of a substance is a measurement that indicates whether the substance is acidic, neutral or basic. pH is measured on a scale which ranges from 0 to 14. A pH of 7 is considered neutral. Substances with a pH below 7 are acidic and those with a pH above 7 are basic, or alkaline.

Many factors contribute to the pH of water, including the quantity of plant and animal life, the rocks and minerals the water is exposed to, and the pH of substances that flow or are dumped into the water. Natural water that is used by factories and then returned to the source can make the pH of the water either increase or decrease. Changes in pH are harmful to many organisms. Some aquatic organisms may die if the pH is even slightly out of the optimal range.

pH regulation is also important in water used for industrial or household purposes. Low pH causes corrosion of metal pipes and fixtures. On the other hand, if the pH of the water is too high, deposits, known as scale, can clog pipes and ruin equipment.

Preparation

Read the manual to become familiar with the text and test procedures. Prepare and package a set of items for each of the 5 teams. Decide how to divide the students into 5 teams. Make a copy of the Student Procedures for each team.
Step-By-Step Procedures

1. Divide students into 5 groups.
2. Present the Introduction lecture material.
3. Pass out a set of bagged items to each team.
4. Have members of each team decide on duties of each member. For example, instruction reader, reagent adder, mixer, timekeeper, result recorder etc.
5. Read instructions aloud, one step at time, as students perform the Making The Sample Acidic procedure.
6. Read instructions aloud, one step at time, as students perform the Making The Sample Basic procedure.
7. Discuss students' results.

Plan for Independent Practice

Have students review additional information on pH on websites included in the Resources section. Have students read and become familiar with Student Procedures.

Closure (Reflect Anticipatory Set)

The pH test is one of the most important and frequent tests done on water. In natural waters, a large or abrupt change in pH can upset an entire ecosystem. Organisms that are unable to adapt or leave may die. In household and industrial situations, water with and improper pH can corrode pipes or clog equipment.
Assessment Based on Objectives
Have students:
- list factors that influence pH levels in water.
- describe the pH scale.
- explain how water pH is affected by acid rain, soil pH, algae and aquatic vegetation, and industrial use.

Adaptations (For Students With Learning Disabilities)
- Provide written and verbal instructions for test procedures.
- Provide a copy of lecture material.
- Give students a copy of the Student Procedures ahead of time so they may become familiar with the instructions.

Extensions (For Gifted Students)
- Have students draw a pH scale using the color chart as a reference.
- Have students follow suggestions in the manual for Additional Experiments.
- Have students use terms in the Glossary to create a pH crossword puzzle.

Possible Connections To Other Subjects:
- Social studies - land use and urbanization

Resources:

**Literature**
The Groundwater Federation
EPA Office of Groundwater and Drinking Water
www.epa.gov/OGWDW/kids/
American Waterworks Association
www.awwa.org/bluethumb/activitieskid.htm

**Methods**
Standard Methods for the Examination of Water and Waste Water
www.standardmethods.org

**Equipment**
LaMotte Company
www.lamotte.com
Review and order additional equipment
### National Science Content Standards Addressed

**A  Science as Inquiry**  
All students should develop:  
- Abilities necessary to do scientific inquiry  
- Understanding about scientific inquiry

**C  Life Science**  
All students should develop understanding of:  
- Structure and function in living systems  
- Regulation and behavior  
- Population and ecosystems  
- Diversity and adaptations in organisms

**D  Earth and Space Science**  
All students should develop understanding of:  
- Structure of the Earth system

**E  Science and Technology**  
All students should develop:  
- Abilities of technological design

**F  Science in Personal and Social Perspectives**  
All students should develop understanding of:  
- Natural Hazards

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**Resources**  
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