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 water hardness and demonstration of simple water test procedures.

**Time Requirement:**
One class/lab period

**Subject Area(s):**
Chemistry, Environmental Science, Mathematics

**General Goals:**
The students will gain a basic understanding of water hardness.

**Specific Objectives:**
1. Students will be able to explain the origin of hardness in water.
2. Students will be able to explain the difference between hard and soft water and the consequences of each one.
3. Students will be able to follow instructions and work together as a team.
4. Students will be able to make observations.
5. 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>5962</td>
<td>Classroom Studies, Water Treatment 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>
</tr>
</tbody>
</table>
Anticipatory Set (Lead-In):

Hardness is a measurement of the amount of calcium and magnesium in water. Calcium and magnesium are minerals that get into water when rocks above and below ground dissolve.

Water with a large concentration of calcium and magnesium is called “hard”. Hard water leaves deposits of calcium and magnesium in pipes, heaters, and appliances. Hard water also decreases the ability of detergents and soaps to clean and make suds. Industrial and drinking water systems must be monitored and treated so that hard water does not ruin pipes and equipment.

Water with a low level of hardness is called “soft”. When soft water contacts surfaces containing calcium and magnesium, such as plaster swimming pool walls, it dissolves the plaster and may damage the surface. Industrial and drinking water systems must also be monitored and treated so soft water does not dissolve metal surfaces.

A water softener removes calcium and magnesium from hard water, making it softer.

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.

Materials, Optional:

<table>
<thead>
<tr>
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<th>Description</th>
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</thead>
<tbody>
<tr>
<td>3608</td>
<td>Tapwater Tour</td>
</tr>
<tr>
<td>5914</td>
<td>Funky Faucet Sink Science Kit</td>
</tr>
<tr>
<td>3-5879</td>
<td>Hardness Science Project Kit</td>
</tr>
</tbody>
</table>
Step-By-Step Procedures:

1. Divide students into 5 groups.
2. Present the Introduction and Hard Water 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 Determine the Hardness of a Hard Water Sample procedure.
6. Present Soft Water lecture material.
7. Read instructions aloud, one step at time, as students perform the Soften Water with Ion Exchange Resin procedure.
8. Discuss students' results.

Plan for Independent Practice:

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

Closure (Reflect Anticipatory Set):

Water hardness is important to homeowners, members of industry and the environment. Very high or low levels of hardness can ruin expensive equipment or make water unsuitable for aquatic life.

Assessment Based on Objectives:

Have students:

- describe where water hardness comes from.
- explain the difference between hard and soft water.
- describe how hard and soft water affects household plumbing fixtures and everyday activities.
- list evidence from their own homes that would lead them to believe that their water has hard, soft or moderate water hardness.
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 follow suggestions in the manual for Additional Experiments.
- Schedule a classroom visit from a local water conditioning company (for example, The Culligan Man).
- Have students use terms in the Glossary to create a water hardness crossword puzzle.

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

Resources:

**Literature**
EPA Drinking Water for Kids
[www.epa.gov/OGWDW/kids](http://www.epa.gov/OGWDW/kids) games, activities and other stuff

**Methods**
Standard Methods for the Examination of Water and Waste Water
[www.standardmethods.org](http://www.standardmethods.org) Details of test methodology

**Equipment**
LaMotte Company
[www.lamotte.com](http://www.lamotte.com) Review and order additional equipment

**EPA Water Treatment Cycle**
[www.epa.gov/OGWDW/kids/treat](http://www.epa.gov/OGWDW/kids/treat) information and games about water treatment
National Science Content Standards Addressed

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

B  Physical Science
   All students should develop understanding of:
   • Properties and changes in matter

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:
   • Personal health

Resources
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