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 soil phosphorus and demonstration of a simple test procedure.

Time Requirement: 
One class/lab period

General Goals: 
The students will gain a basic understanding of soil phosphorus.

Specific Objectives: 
1. Students will be able to list sources of phosphorus in soil.
2. Students will be able to explain how phosphorus is removed from the soil and used by plants.
3. Students will be able list the symptoms of insufficient or excess phosphorus.
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>
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</thead>
<tbody>
<tr>
<td>5969</td>
<td>Classroom Studies, Phosphorus in Soil Lab</td>
</tr>
<tr>
<td>2-2146</td>
<td>Safety Goggles</td>
</tr>
<tr>
<td>2-2234</td>
<td>Gloves</td>
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<tr>
<td></td>
<td>Timer/Clock</td>
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</tbody>
</table>
### Materials, Optional:

<table>
<thead>
<tr>
<th>Order Code</th>
<th>Description</th>
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<tbody>
<tr>
<td></td>
<td>Soil Samples</td>
</tr>
<tr>
<td>5425</td>
<td>Topsoil Tour</td>
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<tr>
<td>5913</td>
<td>Nitty Gritty Soil Science Kit</td>
</tr>
<tr>
<td>5679</td>
<td>Garden Guide Kit</td>
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</tbody>
</table>

### Anticipatory Set (Lead-In):

Plants need air, light, water and nutrients to grow. Some of the nutrients used by plants are found in the upper soil layers of the Earth. Phosphorus is one of the most important nutrients.

Phosphorus dissolves in the water in the soil and then plants absorb it through their roots. The phosphorus solution travels up from the roots and up the stem. When the phosphorus gets to the leaves, it enables the plant to take energy from sunlight and make food for the plant in a process called photosynthesis.

Phosphorus is necessary for hardy growth and it encourages root development, increases resistance to disease and increases the total yield of crops. Phosphorus is especially important for crops such as beets, potatoes, carrots, and radishes because they are root crops.

Plants that don’t get enough phosphorus have spindly, weak stems and a poor root system. They have difficulty producing seeds, flowers, and fruits. Farmers and gardeners add fertilizer to their fields and gardens to replace phosphorus. Commercial phosphorus fertilizer is obtained by mining phosphorus ores from the earth.

### 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 the 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 Testing Soil for Phosphorus procedure.
6. Discuss students' results.

Plan for Independent Practice:
Have students review additional information on soil on websites included in the Resources section. Have students read and become familiar with Student Procedures.

Closure (Reflect Anticipatory Set):
The proper amount of phosphorus in soil is needed to produce healthy plants. Large amounts of phosphorus can affect the environment. High levels of phosphorus in lakes, rivers and streams can cause excessive algae growth. Phosphorus pollution can affect drinking water and aquatic life and animal life living in and around the waterway. Soil tests are done to determine soil phosphorus levels.

Assessment Based on Objectives:
Have students:

- list two root crops that would be influenced by the amount of phosphorus in the soil.
- explain how phosphorus travels through the plant from the roots and is turned into food by photosynthesis.
- describe the visible symptoms of a plant that has too little or too much phosphorus in the soil.
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 diagram of photosynthesis.
- Have students follow suggestions in the manual for Additional Experiments.
- Have students use terms in the Glossary to create a phosphorus in soil crossword puzzle.

Possible Connections To Other Subjects:

Social studies—land use and urbanization

Resources:

**Literature**

NASA Soil Science Education
http://ltpwww.gsfc.nasa.gov/globe/
Sci4kids
www.ars.usda.gov/is/kids/soil/soilintro.htm

National Gardening Association
www.kidsgardening.com

**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:
   • Population and ecosystems

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