AM 12



CODE 5849

LaMotte

THE TESTAB® WATER INVESTIGATION KIT

The TesTab® Water Investigation Kit...

is an easy-to-use, modular test kit designed to investigate water quality and pollution. Individual test modules allow teams of students to perform tests using safe and simple TesTab® reagents. Modules contain TesTabs® and equipment to conduct 100 tests for each factor. The Monitor's Handbook contains all the information needed to set up a water quality monitoring program and interpret the results.



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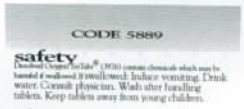
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GUIDELINES FOR TESTING...

1



Read the safety information on the label of each module. These labels provide very specific first aid and chemical information. Read the entire manual before performing any tests.

2

Be sure that students understand the danger of treating reagents casually or endangering others through "horseplay".

3



Wear safety goggles.

4

Wash hands after performing water quality tests. Avoid placing hands in contact with eyes or mouth.

5

Follow the general safety guidelines for your school.

6 Ensure a safe experience by using the following:

- Safety goggles for each student
- Clean pail or bucket for washing hands
- Jug of clean water for washing hands
- Soap (biodegradable if possible)
- Towels
- Waste container for chemical waste
- Plastic gloves
- Eye wash bottle
- First aid kit

7

Note which test procedures require distilled or deionized water.

AFTER TESTING

Most reacted samples can be disposed of by flushing down the drain with excess water. While in the field, reacted samples can be poured together into a waste container for later disposal. The Chloride TesTabs® (3885) contain silver which is considered to be an EPA characteristic waste in large quantities. Waste solutions containing no more than 2 Chloride TesTabs® per liter can be flushed down the drain with excess water. If a large number of chloride tests are to be performed, keep a separate waste container for the chloride test waste and dispose of it as hazardous waste.

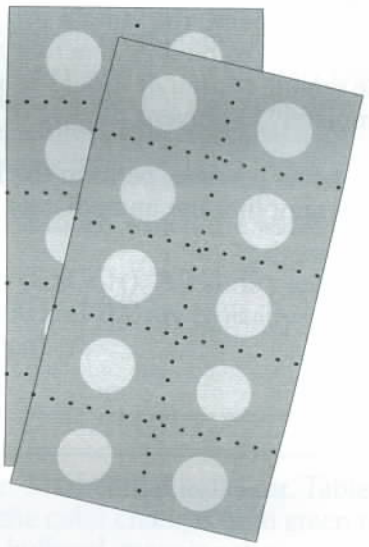
DILUTIONS

If a test reaction is darker than the darkest standard on the color chart, the sample concentration is greater than the range of the test module. Mix equal parts of the water sample and distilled water. Follow the test procedure with the diluted sample. Multiply the test result by 2.

NOTE: This dilution method cannot be used with the pH or Dissolved Oxygen/BOD tests.

SAFETY...

The TesTab® reagents used in this kit are designed with safety in mind. The single-use, foil packaged TesTabs® are easy to dispense. Store TesTabs® in a cool, dry place and only open the foil when ready to use the tablet. A single tablet, either alone or reacted with a sample, is not a health hazard. However, TesTabs® should not be ingested. Additional emergency information on all LaMotte TesTabs® is available 24 hours a day from the Poison Control Center listed in the front of your phone book. Each tablet can be identified by the 4-digit code number referenced in the test procedure.



SAFETY NOTE: Wear eye protection during experiments. Wash hands after performing experiments. Follow all safety rules and guidelines provided by your school or organization regarding laboratory and outdoor activities.



COLLECTING A WATER SAMPLE...

It is a good idea to collect several samples from each test site. For best results, test all samples as soon as possible or within one hour of collection.



Collect the water sample in a clean, plastic or glass container with a cap. In general, the sample should be handled in such a way as to prevent changes due to biological activity, physical variations, or chemical reactions. The sample container should be rinsed with sample water and filled completely to prevent the loss of dissolved gases.

Whenever possible, perform the Dissolved Oxygen and BOD procedures at the sampling site immediately.



TEST PROCEDURES...

ALKALINITY • MODULE 5893

Alkalinity refers to the ability of water to neutralize acids as they are added to or created in the aquatic ecosystem. This neutralization process is called buffering, and is critical to maintaining proper pH levels. A healthy, productive freshwater lake has a pH of about 8. Natural pH buffers, primarily carbonates and bicarbonates, help to maintain the pH at this level and to prevent drastic pH fluctuations. A temporary loss of buffering capacity can permit the pH to drop to levels that are harmful to aquatic life. For example, an entire season of acidic precipitation can be stored in the form of snow and ice, so areas which receive a lot of snow melt in the spring are especially susceptible to seasonal loss of buffering capacity.

Buffering materials in the water are produced by leaching of the rocks and soil through which the water flows.

Alkalinity is usually expressed as parts per million (ppm) of calcium carbonate ($CaCO_3$). Alkalinity levels of 100 to 200 ppm will stabilize the pH level in a body of water. Levels between 20 and 200 are typically found in freshwater, while sea water generally has alkalinity levels from 100 to 125 ppm.

REACTION

ALK TesTabs® (3920) contain a known amount of acid and Bromcresol Green-Methyl Red indicator. Tablets are added until the pH of the sample drops to a specific level indicated when the color changes from green to pink. If a lot of acid is required to change the sample pH, the sample is highly buffered, meaning that it has a high alkalinity. If very little acid is required to change the sample pH, the sample is weakly buffered and has a low alkalinity.

PROCEDURE

1



Fill the test tube (0788) to the 100 mL line.

2



Add Alk TesTabs® (3920), one at a time, until the color of the solution changes from green to pink and matches the Alkalinity Color Chart (5893-CC). Make sure to mix until each tablet has totally disintegrated before adding the next tablet.

3

$$\frac{\text{\# of tablets}}{\text{alkalinity}} \times 40$$

Multiply the number of tablets used by 40.

4

Record the result as **ppm Total Alkalinity**.

AMMONIA • MODULE 5894

Ammonia is present in variable amounts in many surface and ground waters. The primary sources of ammonia in water are bacterial decomposition of organic waste and excretions of aquatic animals. Ammonia serves as a source of nitrogen, which is used as a nutrient for the growth of aquatic plants.

Ammonia exists in water as two forms, un-ionized (NH_3) and ionized (NH_4). Un-ionized ammonia is toxic to fish while the ionized form is non-toxic, except at extremely high levels. The relative proportions of each form present are regulated by pH and temperature.

Ammonia is usually present in low quantities (less than 1 ppm) in non-polluted, well-oxygenated waters, but may reach levels of 5 to 10 ppm in areas with low dissolved oxygen and large amounts of decaying organic materials.

REACTION

Ammonia #1 TesTabs® (3968) and Ammonia #2 TesTabs® (3969) contain lithium hypochlorite and sodium salicylate. Ammonia reacts with salicylate at high pH in the presence of a chlorine donor and an iron catalyst to form an indophenol dye in proportion to the amount of ammonia in the sample.

PROCEDURE

1. 
Fill the test tube (0106) to the 5 mL line.

2. 
Add one Ammonia #1 TesTab® (3968).

3. 
Cap the tube & mix until the tablet has disintegrated.

4. 
Add one Ammonia #2 TesTab® (3969).

5. 
Cap the tube & mix until the tablet has disintegrated.

6. 
Wait 5 minutes.

7. 

Compare the color of the sample to the Ammonia Color Chart (5894-CC). Record result as **ppm Ammonia**.

CHLORIDE • MODULE 5895

Chloride is one of the major anions found in water and sewage. The presence of chlorides in large amounts may be due to the natural process of water passing through salt formations in the earth, or it may be evidence of the intrusion of sea water or pollution from industrial or domestic wastes. Chloride gives water a salty taste.

Drinking water standards recommend a maximum chloride concentration of 250 ppm.

Salinity is an important water quality measurement that is related to chloride. It is the total of all salts dissolved in water. The salt content of water affects the distribution of plant and animal life in an aquatic system, based on the amount of salt they can tolerate. Salinity can be calculated from chloride concentrations, and is usually expressed as parts-per-thousand (ppt), ranging from 0 ppt in freshwater, up to 35 ppt in sea water.

REACTION

Chloride TesTabs® (3885) contain silver nitrate which reacts with chloride to form silver chloride. Silver chloride in water creates a turbid solution.

PROCEDURE

FRESHWATER

1. Fill the test tube (0106) to the 10 mL line.



2. Add one Chloride TesTab® (3885).



3. Cap the tube & mix gently until the tablet has disintegrated.



4. Place the tube over the left-hand column of black squares on the Freshwater Chloride Color Chart (5895-CC).



5. Compare the appearance of the squares through the tube to the squares in the right-hand column. Record the result as **ppm Chloride**.



Sample should be at room temperature.

Salt Water on next page....

SALT WATER

1 Use the pipet (30444) to add 6 drops of the sample water to the large round tube (0788).



2 Fill the tube to the 100 mL line with distilled or deionized water.



3 Fill the test tube (0106) to the 10 mL line with the diluted sample from Step 2.



4 Add one Chloride TesTab® (3885). Cap tube and mix until the tablet has disintegrated.



5 Place the tube over the left-hand column of black squares on the Salt Water Chloride Color Chart (5895-CC2).



6 Compare the appearance of the squares through the tube to the squares in the right-hand column.



7 Multiply the test results by 400. Record the result as **ppm Chloride.**

Sample should be at room temperature.

To convert ppm Chloride to ppt Salinity:

$$\text{ppt Salinity} = (0.001805 \times \text{ppm Chloride}) + 0.03$$

CHLORINE • MODULE 5896

Chlorine is not present in natural waters, and is found only as a result of chlorination of a water supply. It is widely used for sterilization and disinfection in municipal water supplies, swimming pools and spas, food and beverage processing, and in medical facilities such as dialysis units.

Swimming pools generally have a chlorine concentration of 1 to 3 ppm, while levels in drinking water are maintained below 0.5 ppm. High levels of chlorine can be harmful or fatal to plants and fish.

REACTION

Chlorine DPD #4R TesTabs® (6899) contain diethyl-p-phenylenediamine (DPD). When chlorine oxidizes DPD, a pink color is formed in proportion to the chlorine concentration.

PROCEDURE

1. Fill the test tube (0106) to the 5 mL line.



2. Add one Chlorine DPD #4R TesTab® (6899).



3. Cap the tube and mix until the tablet has disintegrated.



4. Compare the color of the sample to the Chlorine Color Chart (5896-CC). Record the result as **ppm Total Chlorine**.



CHROMIUM • MODULE 5897

Chromium compounds may be found in natural waters in trace amounts ranging from 0.003 to 0.040 ppm. It may also be present in water containing waste from industrial processes such as metal plating, or in overflow waters from large air conditioning units, where chromium is frequently added to cooling water to control corrosion. Chromium is one of a class of heavy metals sometimes found in the bottom mud of polluted bodies of water. It is considered to be a toxic chemical. Certain shellfish are capable of concentrating this element, endangering the health of consumer organisms, human or animal.

Chromium levels over 0.5 ppm are evidence of pollution from untreated or incompletely treated waste.

REACTION

Chromium TesTabs® (3889) contain 1,5-diphenylcarbohydrazide. Chromium reacts with 1,5-diphenylcarbohydrazide under acidic conditions to form a red-purple color in proportion to the amount of chromium present.

PROCEDURE

1. 
   Fill the test tube (0106) to the 10 mL line.
2. 
   Add one Chromium TesTab® (3889).
3. 
   Cap the tube & mix until the tablet has disintegrated.
4. 
   Wait 3 minutes.
5. 

   Compare the color of the sample to the Chromium Color Chart (5897-CC). Record result as **ppm Chromium**.

COPPER • MODULE 5898

Copper is usually found only in small amounts (less than 1 ppm) in natural waters. Elevated amounts may be due to industrial effluents or corrosion of pipes and fittings. Copper is also added to swimming pool and aquarium water to control algae and bacteria. Concentrations of 1.0 ppm or higher may give water a bitter taste, and may cause staining and discoloration.

The copper content of drinking water is generally below 0.03 ppm, but occasionally ranges up to 0.6 ppm in some areas.

REACTION

Copper TesTabs® (3701) contain Zincon. Zincon chelates with copper to produce a blue color. Zincon is orange in solution when no copper is present.

PROCEDURE

1. Fill the test tube (0106) to the 10 mL line.



2. Add one Copper HR TesTab® (3701).



3. Cap the tube and mix until the tablet has disintegrated.



4. Compare the color of the sample to the Copper Color Chart (5898-CC). Record the result as **ppm**



DISSOLVED OXYGEN/BIOCHEMICAL OXYGEN DEMAND • MODULE 588

Fish, invertebrates, plants, and aerobic bacteria all require oxygen for respiration. Oxygen dissolves readily into water from the atmosphere until the water is saturated. Once dissolved in water the oxygen diffuses very slowly, and distribution depends upon the movement of the aerated water. Oxygen is also produced by aquati plants, algae, and phytoplankton as a by-product of photosynthesis.

Aquatic organisms require different amounts of dissolved oxygen. Dissolved oxygen levels below 3 ppm are stressful to most aquatic organisms. Dissolved oxygen levels below 2 or 1 ppm will not support fish. Levels of to 6 ppm are usually required for the growth and activity of aquatic organisms.

REACTION

Dissolved Oxygen TesTabs® (3976) contain sodium citrate and 2,4-diaminophenol dihydrochloride. Dissolved Oxygen, in a solution buffered by sodium citrate, oxidizes a proportionate amount of 2,4-diaminophenol dihydrochloride to produce a colored solution.

PROCEDURE

1. 
Fill a small test tube (0125) to overflowing with sample water.

2. 
Add two Dissolved Oxygen TesTabs® (3976) to the test tube.

3. 
Cap the tube. Be sure no air bubbles are in the sample.

4. 
Mix by inverting until the tablets have disintegrated (about 4 minutes).

5. 
Wait 5 minutes.

6. 

Compare the color of the sample to the Dissolved Oxygen Color Chart (6663). Record the result as **ppm Dissolved Oxygen.**

BIOCHEMICAL OXYGEN DEMAND (BOD 5 -DAY)

Biochemical Oxygen Demand (BOD) is a measure of the quantity of dissolved oxygen used by bacteria as they break down organic wastes. In slow moving and polluted waters, much of the available dissolved oxygen is consumed by bacteria, robbing other aquatic organisms of the dissolved oxygen needed to live.

PROCEDURE

1



Fill a small test tube (0125) to overflowing with sample water.

2



Cap and wrap the tube with aluminum foil and store it in a dark place at room temperature for 5 days.

3



Unwrap the tube. Add two Dissolved Oxygen TesTabs® (3976) to the test tube.

4



Cap the tube. Be sure no air bubbles are in the sample.

5



Mix by inverting until the tablets have disintegrated (about 4 minutes).

6



Wait 5 minutes.

7



Compare the color of the sample to the BOD Color Chart (5889-CC). The difference between the Dissolved Oxygen result and the BOD result is the Biochemical Oxygen Demand. Record the result as **ppm BOD**.

$$\text{BOD} = \underset{\textit{(original sample)}}{\text{ppm Dissolved Oxygen}} - \underset{\textit{(after 5 days)}}{\text{ppm Dissolved Oxygen}}$$

HARDNESS • MODULE 5899

Hardness refers primarily to the amount of calcium and magnesium ions in water. Other ions contribute to hardness also, but are usually present in insignificant amounts. Calcium and magnesium enter the water mainly by the leaching of rocks and soil. Calcium is an important component of aquatic plant cell walls and also the shells and bones of many aquatic organisms. Magnesium is an essential nutrient and is a component of chlorophyll.

Hardness is usually expressed as parts per million (ppm) of calcium carbonate ($CaCO_3$). These results can be expressed as calcium or magnesium by multiplying by 0.4 for calcium and 0.24 for magnesium.

Waters with calcium levels of 10 ppm or less can support only sparse plant and animal life. Levels of 25 ppm or more are typical of waters having excessive levels of plant nutrients, and may contribute to excessive algae growth. Typical levels of magnesium in freshwater range from 5 to 50 ppm. Sea water contains high levels of both calcium and magnesium. Typical sea water contains 400 ppm calcium and 1350 ppm magnesium, which adds up to a total hardness of above 6625 ppm.

Water with a low level of hardness is generally referred to as "soft", while water with a high level of hardness is described as "hard". Hard water can cause problems in home and industrial water systems, including scaly deposits in plumbing and appliances, and decreased cleaning action of soaps and detergents. Water with total hardness from 0 to 60 ppm is soft, from 60 to 120 ppm is medium hard, from 120 to 180 ppm is hard, and above 180 ppm is considered very hard.

REACTION

Hardness T TesTabs® (6917) contain Eriochrome Black T indicator which is blue in pure water. If calcium or magnesium ions are present, they combine with the indicator to form a red complex. The TesTabs® also contain EDTA (ethylenediaminetetraacetic acid). EDTA is a chelant which pulls the calcium and magnesium away from the red colored complex. The EDTA is added in known amounts until all of the calcium and magnesium have been chelated away from the complex and the indicator returns to the blue color. The amount of EDTA required to cause the color change is a direct indication of the amount of calcium and magnesium in the sample.

Procedure on next page....

PROCEDURE

FRESHWATER

1. Fill the test tube (0788) to the 50 mL line.



2. Add Hardness T TesTabs® (6917), one at a time, until the color of the solution changes from red to blue and matches the Freshwater Hardness Color Chart (5899-CC). Make sure to mix until each tablet has totally disintegrated before adding the next tablet.



3. $\frac{\text{\# of tablets x 40}}{\text{hardness}}$

Multiply the number of tablets used by 40.

4. Record the result as **ppm Total Hardness.**

SALT WATER

1. Fill the test tube (0106) to the 5 mL line.



2. Pour this sample into the large round tube (0788) and dilute to the 50 mL line with distilled or deionized water.



3. Add Hardness T TesTabs® (6917) one at a time until the color of the solution changes from red to blue and matches the Salt Water Hardness Color chart (5899-CC2). Make sure to mix until each tablet has totally disintegrated before adding the next tablet.



4. $\frac{\text{\# of tablets x 800}}{\text{hardness}}$

Multiply the number of tablets used by 800.

5. Record the result as **ppm Total Hardness.**

IRON • MODULE 5900

Iron is present in most natural waters, and is an important nutrient for many organisms. Soil and rocks provide the most common sources of iron in water. Industrial waste, such as acid mine drainage, can contribute to elevated levels. Concentrations can vary from trace amounts (0.1 ppm) up to several parts per million. Large amounts of iron in the water will cause problems such as orange stains on porcelain fixtures and laundry, and may cause undesirable taste and color in drinking water and beverages.

Iron concentrations should not exceed 0.2 ppm for domestic use, and for some industrial applications, not even trace amounts can be tolerated.

REACTION

Total Iron TesTabs® (2792) contain bipyridyl. Ferric iron is reduced to ferrous iron and subsequently forms a colored complex with bipyridyl for a quantitative measure of total iron.

PROCEDURE

1. 
Fill the test tube (0106) to the 5 mL line.

2. 
Add one Total Iron TesTab® (2792).

3. 
Cap the tube & mix until the tablet has disintegrated.

4. 

Wait 5 minutes.

5. 

Compare the color of the sample to the Iron Color Chart (5900-CC). Record result as **ppm Iron**.

NITRATE • MODULE 5891

Nitrogen is a nutrient that acts as a fertilizer for aquatic plants. When nitrogen levels are high, excessive plant and algae growth creates water quality problems. Nitrogen enters the water from human and animal waste, decomposing organic matter, and lawn and crop fertilizer run-off. Nitrogen occurs in water as Nitrate (NO_3), Nitrite (NO_2), and Ammonia (NH_3).

Unpolluted waters usually have a nitrate level below 4 ppm. Nitrate levels above 40 ppm are considered unsafe for drinking water.

REACTION

Nitrate #1 TesTabs® (2799) contain sulfamic acid which destroys any nitrite that will give a positive interference. Nitrate #2 TesTabs® (NN-3703) contain zinc, which reduces the nitrate to nitrite, and chromotropic acid which reacts with the nitrite to form a pink color.

PROCEDURE

1. 
Fill the test tube (0106) to the 5 mL line.

2. 
Add one Nitrate #1 TesTab® (2799).

3. 
Cap the tube & mix until the tablet has disintegrated.

4. 
Add one Nitrate #2 CTA TesTab® (NN-3703).

5. 
Cap the tube & mix until the tablet has disintegrated.

6. 
Wait 5 minutes.

7. 

Compare the color of sample to the Nitrate Color Chart (5891-CC). Record the result as **ppm Nitrate**.

pH • MODULE 5890

The pH test is one of the most common analyses in water testing. pH is a measurement of the activity of hydrogen ions in a water sample. The pH scale ranges from 0 to 14. Water samples with a pH below 7.0 are considered acidic, those above 7.0 are basic, with 7.0 considered neutral.

A pH range of 6.5 to 8.2 is optimal for most aquatic organisms. Rapidly growing algae and vegetation remove carbon dioxide (CO_2) from the water during photosynthesis. This can result in a significant increase in pH.

Most natural waters have pH values from 5.0 to 8.5. Acidic, freshly fallen rain water may have a pH of 5.5 to 6.0. Alkaline soils and minerals can raise the pH to 8.0 to 8.5. Sea water usually has a pH value close to 8.0.

REACTION

pH Wide Range TesTabs® (6459) contain mixed pH indicators which are sensitive to pH and undergo specific color changes with variation in pH.

PROCEDURE

1. Fill the test tube (0106) to the 10 mL line.



2. Add one pH Wide Range TesTab® (6459).



3. Cap the tube and mix until the tablet has disintegrated.



4. Compare the color of the sample to the pH Color Chart (5890-CC). Record the result as **pH**.



PHOSPHATE • MODULE 5892

Phosphorus is a nutrient that acts as a fertilizer for aquatic plants. When nutrient levels are high, excessive plant and algae growth creates water quality problems. Phosphorus occurs in natural waters in the form of phosphate (PO_4). Over half of the phosphates in lakes, streams, and rivers come from detergents.

Phosphate levels higher than 0.03 ppm contribute to increased plant growth.

REACTION

Phosphorus TesTabs® (5422) contain ammonium molybdate which reacts with phosphorus to form a phosphomolybdate complex. This is reduced to a blue complex by ascorbic acid.

PROCEDURE

1. 
Fill the test tube (0106) to the 5 mL line.

2. 
Add one Phosphorus TesTab® (5422).

3. 
Cap the tube & mix until the tablet has disintegrated.

4. 

Wait 5 minutes.

5. 

Compare the color of the sample to the Phosphate Color Chart (5892-CC). Record result as **ppm Phosphate**.

TEST RESULTS

Photocopy for use

Name _____ Date _____

Sampling Site _____ Sample # _____

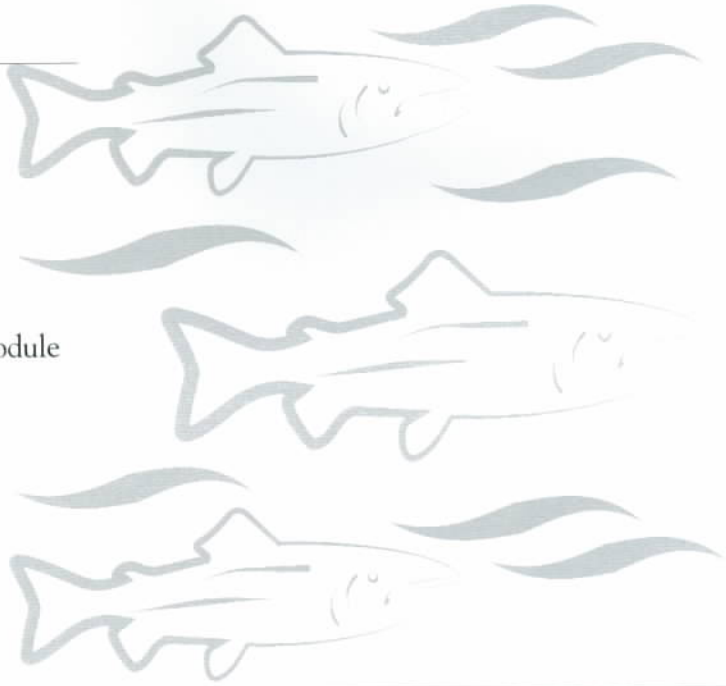
FACTOR	RESULT
Alkalinity	
Ammonia	
Chloride	
Chlorine	
Chromium	
Copper	
Dissolved Oxygen	
BOD	
Hardness	
Iron	
Nitrate	
pH	
Phosphate	

ORDERING INFORMATION

THE TESTAB® WATER INVESTIGATION KIT **MODEL AM-12 • CODE 5849**

Test modules available separately.

CODE	DESCRIPTION
5893	Alkalinity Module
5894	Ammonia Module
5895	Chloride Module
5896	Chlorine Module
5897	Chromium Module
5898	Copper Module
5889	Dissolved Oxygen/BOD Module
5899	Hardness Module
5900	Iron Module
5891	Nitrate Module
5890	pH Module
5892	Phosphate Module
1507	The Monitor's Handbook



HOW TO ORDER



phone
800-344-3100
410-778-3100



fax
410-778-6394



write
PO Box 329
Chestertown, MD 21620



website
http://www.lamotte.com



LaMotte

P.O. Box 329 • Chestertown • Maryland • 21620
800-344-3100 • 410-778-3100
Visit us on the web at www.lamotte.com

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