

Flint River GREEN: Phosphates



MATERIALS	<p>LaMotte Phosphate Test Kit</p> <p>Lab Phosphate Bottle (labeled)</p> <p>Water Sample Collection Bottle (can be an empty water bottle rinsed)</p> <p>Gloves</p> <p>Safety Goggles</p> <p>Cooler</p> <p>Stopwatch or Timer</p>	VOCABULARY	<p>Phosphorous</p> <p>Phosphate</p> <p>Orthophosphate</p> <p>Total Phosphate (TP)</p> <p>Algal Blooms</p> <p>Harmful Algal Blooms (HAB)</p> <p>Saginaw Bay Watershed</p>
------------------	---	-------------------	--

WATER QUALITY STANDARDS	<p><u>DRINKING WATER:</u></p> <p>There are no drinking water standards for phosphorous, total phosphates, or orthophosphate.</p>	<p><u>SURFACE WATER (Total Phosphates):</u></p> <ul style="list-style-type: none"> • Within a lake or reservoir: ≤ 0.025 mg/L • Streams that discharge into lake or reservoir: ≤ 0.05 mg/L • Streams not flowing into lake or reservoir: ≤ 0.1 mg/L
--------------------------------	--	--

WHAT DOES THIS TEST MEASURE?	<p>Phosphorous is an element that makes up about 12% of the earth’s crust. It is an important plant nutrient that helps with root and flower development. Too much phosphorous contributes to eutrophication. Phosphorous is found in many forms. The tests you will use require an understanding of a few of these: <u>Phosphorous</u> almost always occurs in water in the form of various phosphates. These are broken into three groups: orthophosphates, condensed phosphates, and organically bound phosphates. Together, these three groups determine Total Phosphates (TP). Orthophosphates are easily tested for and help to estimate the amount of phosphorus available for algae and plant growth because it is the form most often used by plants and animals. Water quality professionals generally speak about phosphorous by referring to total phosphates. Testing for total phosphates is complex, so you will send samples to a lab for this result.</p>
-------------------------------------	--

LOOK FOR THESE CAUSES	<p><u>EVIDENCE FOR DECREASES IN PHOSPHATES?</u></p> <ul style="list-style-type: none"> • Is runoff controlled/slowed? • Are riparian areas maintained and healthy? • Look for sustainable agricultural practices. • Are residents using fertilizers w/o phosphates • Are leaves/grasses kept out of storm drains? • Is erosion controlled at construction sites? 	<p><u>EVIDENCE FOR INCREASES IN PHOSPHATES?</u></p> <ul style="list-style-type: none"> • Is there soil erosion? • Are there excess fertilizers reaching the stream? • Is there excess manure from pets, farms, and wildlife? Is there sewage entering the stream? • Is there decomposing plant material? • Are there detergents entering the stream?
------------------------------	--	---

CONNECTING CONCEPTS	<ul style="list-style-type: none"> • A bag of fertilizer is labeled with three numbers. The middle number indicates how much phosphorous is available for plants. A 100 pound bag of 12-10-10 fertilizer contains 10 pounds of phosphorous for plants. • Like nitrogen, excess phosphorous causes extra plant growth. When those plants die, they decompose. Decomposition uses up oxygen which affects how much oxygen is available for organisms in the water. • Too much phosphorous can lead to algal blooms. These can be toxic or contain toxic bacteria that are harmful to humans and animals. Lake Erie is noted for recent harmful algal blooms affecting drinking water. • The Saginaw Bay Watershed geography is similar to the Western Lake Erie Basin and faces similar issues.
----------------------------	--

WEB LINKS	<ul style="list-style-type: none"> • Video (2 min) - Nutrient Pollution. EPA. https://www.epa.gov/nutrientpollution/problem • Video (6 min.)—Lake Erie Algal Blooms: http://lakeeriealgae.com/ • Fact Sheet—Saginaw Bay Muck: http://www.miseagrant.umich.edu/saginawbaymuck/files/2014/07/14-721-Saginaw-Bay-Beach-Muck-rev2.pdf • Website—Harmful Algal Blooms in the Great Lakes: http://www.miseagrant.umich.edu/explore/coastal-communities/harmful-algal-blooms-in-the-great-lakes/
------------------	--

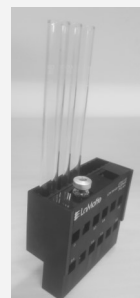
THIS PROCEDURE REQUIRES MULTIPLE TESTS. The first is to collect a sample to send to the lab to test for Total Phosphates (which cannot be done at the stream). The results from the lab are the only results that should be included in your final WQI score. The Phosphate test kit that you will do at the stream only tests for Orthophosphates. Orthophosphates can help you begin to analyze your data while you wait for Total Phosphate results (which could be up to two weeks). **NOTE:** Orthophosphates do not have a Q-Value Chart.

1. Check to be sure everyone is wearing gloves and goggles.
2. Inventory the supplies in your Phosphate test kit and check to be sure you have a treated lab phosphate bottle and a water sample collection bottle *in addition* to your LaMotte Test Kit.
3. Enter the stream with a water collection bottle (an empty water bottle will work), wearing gloves and waders or boots following standard water sample collection procedures.
4. Fill your water sample collection bottle following standard water sample collection procedures.
5. **Total Phosphate Lab Sample:** Carefully remove the lid to the lab sample bottle (which is treated with sulfuric acid!) and pour your water sample *from* your collection bottle *to* the lab sample bottle. You may need to collect additional sample water to fill the lab bottle. Do not dip the lab bottle in the stream!
6. Check to be sure the lab label is filled out with your school, teacher name, site name, time and date then place in cooler to be delivered to the lab later.
7. **Student Lab Sample:** Determine which Phosphate kit you are using before proceeding: **(A.) Low Range Phosphate Kit with Axial Reader (3121-01)** uses a Comparator with square holes which slides into an Axial Reader. **(B.) Low Range Phosphate Kit with color bar (3121-02)** uses a Comparator Viewer with round holes and a color bar that slides in and out of the viewer. Follow the instructions that correspond to your test kit.

Kit A.) Low Range Phosphate Kit with Axial Reader (3121-01):



- a. Fill a test tube to the 10 mL line with water from the collection bottle.
- b. Use a 1.0 mL pipet to add 1.0 mL of Phosphate Acid Reagent to the test tube.
- c. Cap and mix gently.
- d. Use the 0.1 g spoon to add 0.1 g of Phosphate Reducing Reagent.
- e. Cap and mix until dissolved. Wait 5 minutes.
- f. Position the Comparator inside the Axial Reader so the mirror inside faces you.
- g. Insert the Comparator with the numbers on the Comparator also facing you.
- h. Insert the water ampule into the left, square hole in the Comparator (between 0 and 0.2).
- i. Insert the sample test tube into the Axial Reader directly behind the water ampule.
- j. Fill the remaining two test tubes to the 10 mL line with untreated sample water and insert them into the Axial Reader on either side of the treated sample.
- k. Slide the Axial Reader upward until the top of it is level with the top of the Comparator.
- k. Your test kit should now look like the photo on the right. Hold and tilt the test so that sunlight is directed down the treated sample to the mirror.
- l. Begin by viewing your treated sample through the top, left, unlabeled window of the Comparator.
- m. If your sample color is darker than the surrounding color standards, move your axial reader down to view your sample through the bottom, left, unlabeled window of the Comparator.
- n. If your sample color is darker than these surrounding color standards, move the distilled water ampule and all three test tubes to the right side of the comparator and repeat the process, starting at the top.
- o. Record your result as ppm Orthophosphate which is equal to mg/L **Orthophosphate:** _____ mg/L



KIT B.) Low Range Phosphate Kit with color bar (3121-02):



- Fill a test tube to the 10 mL line with water from the collection bottle.
- Use a 1.0 mL pipet to add 1.0 mL of Phosphate Acid Reagent to the test tube.
- Cap and mix gently.
- Use the 0.1 g spoon to add 0.1 g of Phosphate Reducing Reagent.
- Cap and mix until dissolved. Wait 5 minutes.
- While waiting, position the color slide bar into Insert test tube into the Comparator Viewer.
- Insert the treated sample into the hole directly above the color slide bar in the Comparator Viewer.
- Fill a second test tube to the 10 mL line with untreated sample water from the collection bottle.
- Place this tube in the other hole (directly behind the test tube containing the treated sample).
- Position the comparator so that light shines down through the test tubes. Tilt the comparator until you see the color standards and sample illuminated. (You will be comparing the standard to the color *projected* on the screen within the Comparator and not the actual sample in the tube).
- Match the color of the reaction to the closest color standards by sliding the color slide bar while looking at the projection (within the top, square hole of the Comparator) and stopping when the projected color appears to match the color standard in view.
- Read the numerical result from the color slide bar and record your result as ppm Orthophosphate which is equal to mg/L **Orthophosphate: _____ mg/L**

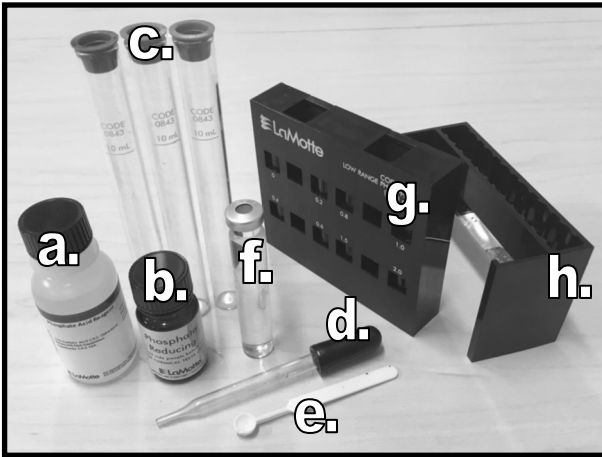


Clean Up and Analysis:

- Dispose of your samples and rinse the test tubes into the hazardous waste container.
- Your Orthophosphate value from the LaMotte test is a good estimate of Total Phosphates. You should begin analyzing your data using the Orthophosphate reading while you wait for Total Phosphate results from the lab (which could be 2 weeks). **NOTE:** *You can expect your Total Phosphate result to be at least the amount that you recorded for orthophosphates. It will likely be slightly higher; potentially up to 4 times higher.*
- Use your results to calculate a Q-Value on the Total Phosphate (TP) Chart: **Q-Value: _____**
- Check the Q-Value by entering your **Total Phosphate** data at <http://www.flintrivergreen.org/add-info/add-data/>. Teachers: be sure to enter the GM Total Phosphate Score when submitting your data online.

WHAT TO WATCH OUT FOR

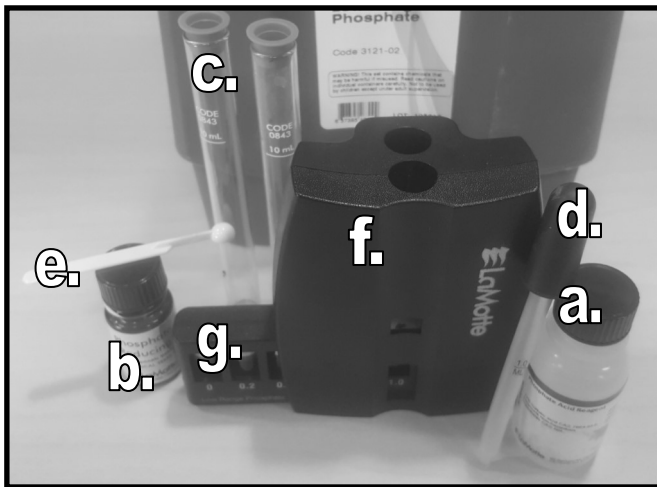
- Add chemical to a test tube and not the water collection bottle.
- Be sure to wait the full five minutes!
- Be sure to use only **Total Phosphates** on the Q-value graph. The **Orthophosphates** cannot be converted to Total Phosphates and there is no Q-Value chart for Orthophosphates.
- When entering your field data on the WQI data sheet, be sure to enter the result you received from the lab and NOT your orthophosphate result.
- While waiting for your lab results, you can still use Orthophosphate results to analyze your data, just keep in mind that your Total Phosphate will likely be slightly higher.
- When preparing your lab sample, be sure to pour water *into* the bottle and keep in a cooler always!
- When using Kit A, carefully follow the instructions for how to use the Axial Reader.
- When using Kit B, be sure to compare the color standards through the test tubes and not from the side of the Comparator.



Kit A: Axial Reader Phosphate Kit

Contents

- a. Phosphate Acid Reagent - [V-6282-G]
- b. Phosphate Reducing Agent - [V-6283-C]
- c. (x3) Test Tubes, 10mL, glass, w/caps - [0843]
- d. Pipet, 1.0mL, plastic - [0354]
- e. Spoon, 0.1g, plastic - [0699]
- f. Distilled Water Ampoule, 5mL - [2748]
- g. Phosphate Comparator, 0.0-2.0ppm - [3122]
- h. Axial Reader - [2071]



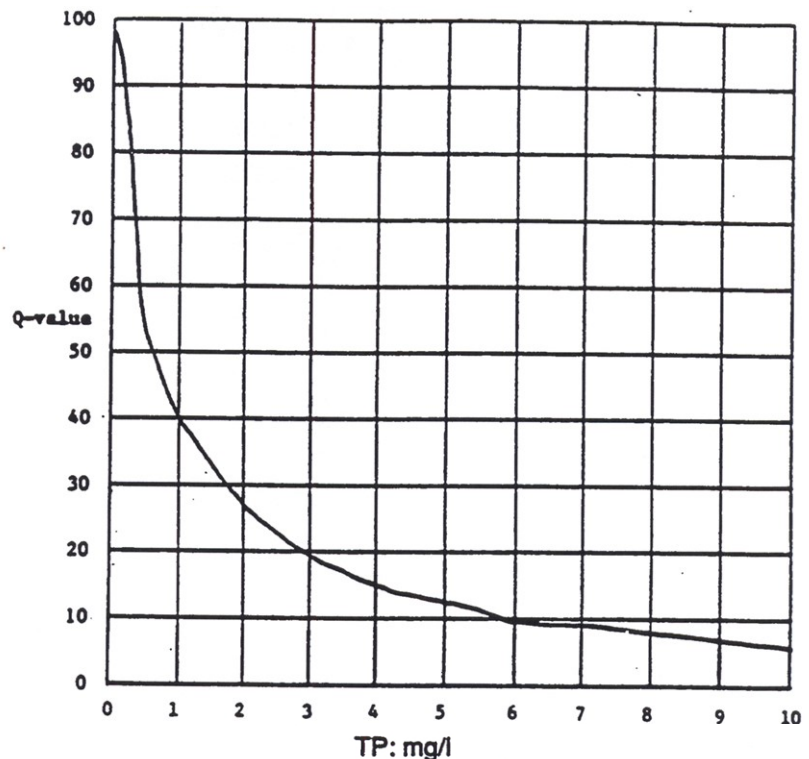
Kit B: Low Range Comparator Phosphate Kit

Contents

- a. Phosphate Acid Reagent - [V-6282-G]
- b. Phosphate Reducing Agent - [V-6283-C]
- c. (x2) Test Tube, 10.0mL, glass, w/cap - [0843]
- d. Pipet, 1.0mL, plastic - [0354]
- e. Spoon, 0.1g, plastic - [0699]
- f. Low Range Comparator Viewer - [1102]
- g. Phosphate low Range Comparator Bar 0.0-2.0ppm - [3122-01]

Total Phosphate Q-Value Chart

*Note: Use GM Lab Score to calculate



Note: if T-PO₄ > 10.0. Q=2.0