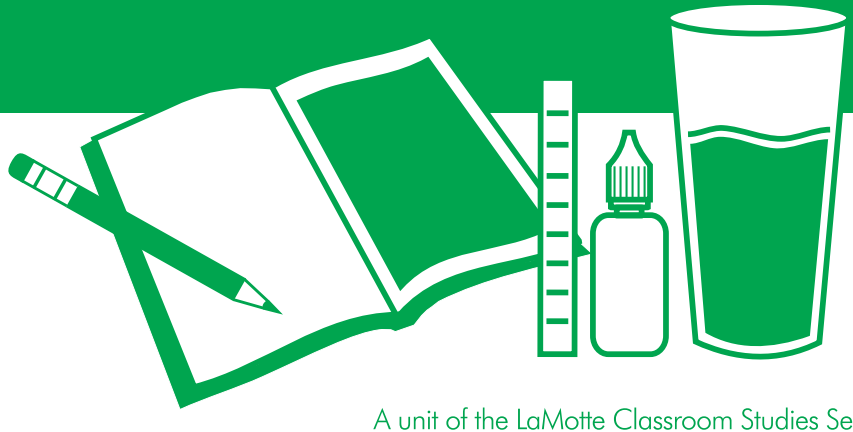
LaMotte

DISSOLVED OXYGEN IN WATER

Lab



CODE 5963

A unit of the LaMotte Classroom Studies Series

TABLE OF CONTENTS

WARNING! This set contains chemicals that may be harmful if misused. Read cautions on individual containers carefully. Not to be used by children except under adult supervision

KIT CONTENTS

QUANTITY	CONTENTS	ORDER CODE
50	Dissolved Oxygen TesTabs	3976A-H
5	Vials, glass, w/caps	0125
5	Color Chart	5963-CC
1	Manual	-----

*WARNING: Reagents marked with an * are considered to be potential health hazards. To view or print a Safety Data Sheet (SDS) for these reagents go to www.lamotte.com. Search for the four digit reagent code number listed on the reagent label, in the contents list or in the test procedures. Omit any letter that follows or precedes the four digit code number. For example, if the code is 4450WT-H, search 4450. To obtain a printed copy, contact LaMotte by email, phone or fax.

Emergency information for all LaMotte reagents is available from Chem-Tel (US, 1-800-255-3924) (International, call collect, 813-248-0585).

To order individual reagents or test kit components, use the specified code number in the list above. To order a complete refill for the kit, use code number R-5963.

SAFETY

1 Follow the instructions. Read to the end of each procedure before starting the actual work. Measure samples and reagents accurately. Add the reagents in the order stated in the instructions. Observe the waiting times, when specified, for maximum color development.

2 Read reagent labels and Safety Data Sheets when supplied. Avoid contact between reagents and the skin and eyes. Additional information for all LaMotte reagents is available in the United States, Canada, Puerto Rico, and the US Virgin Islands from Chem-Tel by calling 1-800-255-3924. For other areas, call 813-248-0585 collect to contact Chem-Tel's International access number. Each reagent can be identified by the four digit number listed on the the reagent label, in the contents list and in the test procedures.

3 Cap reagent bottles after use to avoid contamination. Do not interchange caps. Store reagents in a cool, dry place.

4 Rinse test tubes and caps thoroughly in clean tap water after each use. Allow them to dry before putting them away.

5 Store equipment and reagents out of the reach of very young children.

6

Wear eye protection during the demonstrations. Wash hands after performing the experiments. When using materials not contained in this kit, be sure to follow the safety instructions on the container.

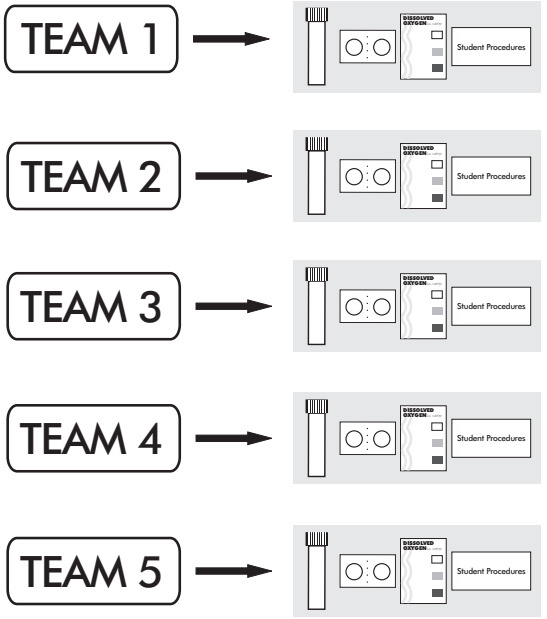
After Testing

All reacted samples can be poured down the drain with lots of running water.

ORGANIZING THE TEAMS

Divide the group into 5 teams. Test tubes and apparatus are included for 5 teams to do a complete set of demonstrations at one time. There are enough reagents for the 5 teams to do 5 demonstrations each, or a total of 25 demonstrations.

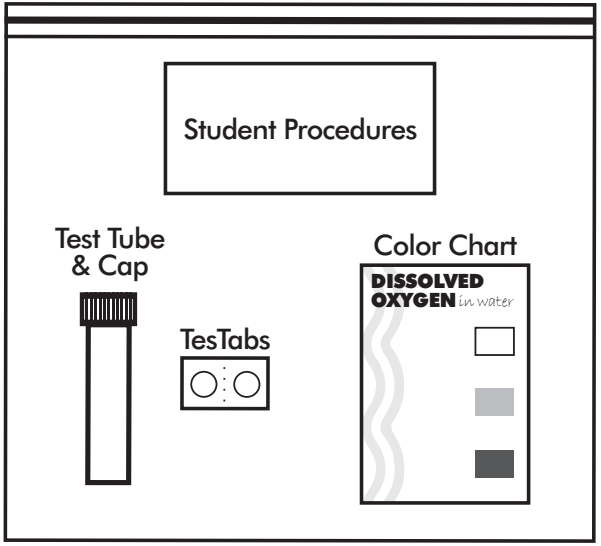
Apparatus for One Demonstration

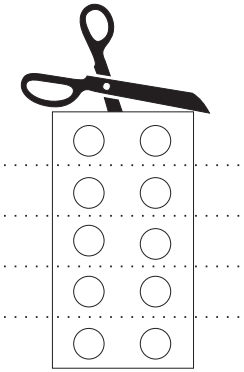


A set of items for each team can be collected ahead of time and packaged in a zipper-top bag. Each team will need:

2	Dissolved Oxygen TesTabs	3976A
1	Vial, glass, w/cap	0125
1	Color Chart	5963-CC
1	Student Procedures	-----

For each team:





TesTabs

TesTabs are supplied in strips of ten tablets. Before class, cut the TesTabs as shown at left and place in zipper-top bags with other apparatus for each group. Do not break the foil sealed pocket around each TesTab until ready to use.

INTRODUCTION

Almost all types of water have some oxygen dissolved in them. Oxygen generally enters the water in two ways: from contact with the atmosphere and from aquatic plants.

Oxygen dissolves directly into water from the air at the surface of the water. Because more of the water's surface is exposed to the air in a tumbling mountain stream or a windswept, wave-covered lake, the water can absorb more oxygen than a calm, smooth body of water.

Dissolved oxygen is so important to the health of fish that aquarium owners and fish farmers often use mechanical methods to add oxygen to the water. They pump air through the water and use bubblers, diffusers or air stones to produce many small bubbles, increasing the amount of surface area for contact between the air and water. The rising bubbles also move and mix the water, allowing more water to contact air at the surface, increasing dissolved oxygen levels.

Aquatic plants, including algae, increase dissolved oxygen levels in water. During photosynthesis, plants use carbon dioxide from the water and energy from the sunlight to produce oxygen. On a sunny day, bubbles of oxygen can be seen on the leaves of aquatic plants. Since photosynthesis requires light, plants don't produce oxygen during the night but respire and remove a small amount of oxygen from the water which slightly decreases oxygen levels.

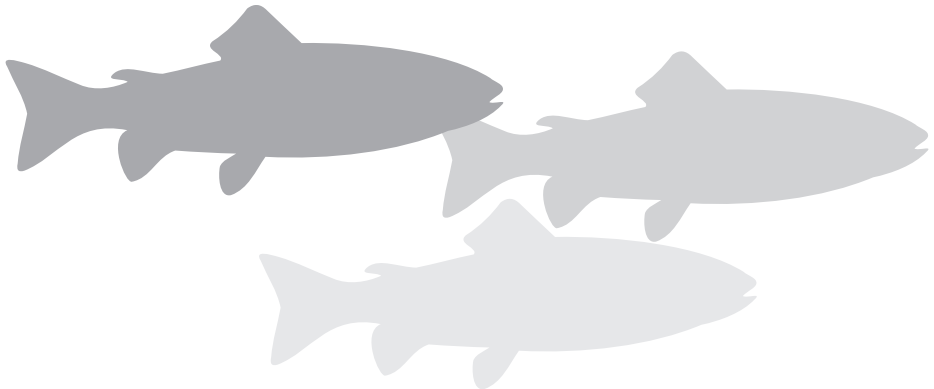
Dissolved oxygen levels change according to the time of day, the temperature and the weather. Water can hold more oxygen at low temperatures. Fish, like trout, may seek cold, deep pockets of oxygenated water. Salinity and altitude also limit the amount of oxygen that can be dissolved in water. Fresh water can hold more oxygen than salt water and the greater the atmospheric pressure the more oxygen the water will hold.

ppm (parts per million) is a unit of concentration for very dilute solutions. It is a way of expressing how much of something is in a solution. Parts per million is very similar to percent. 1% is one part per hundred. 1 ppm is one part per million. In water testing, ppm is also called milligrams per liter (mg/L).

Once in the water system, oxygen is used by the aquatic life. Oxygen is also consumed when organic material such as human or animal waste, improperly treated wastewater or plant debris decomposes in water. Bacteria use oxygen to chemically change the organic matter and break it down. This is called the Biological Oxygen Demand. Some aquatic systems may undergo such a large amount of decay of plant and animal material that no oxygen remains for the living organisms.

In natural water, a high dissolved oxygen level is a sign of a healthy ecosystem. Low dissolved oxygen levels are often a sign of pollution. The amount of oxygen required varies according to species and stage of life. Concentrations of 5 to 6 ppm are usually required for growth and activity of a diverse population. Dissolved oxygen levels below 3 ppm are stressful to most aquatic organisms and levels below 2 ppm will not support fish. Fish and other animals that can move will leave areas with low dissolved oxygen and go to areas with higher levels. Those that cannot move or are trapped may die if oxygen levels become too low.

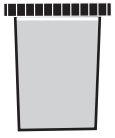
High levels of oxygen are not desirable in water used in industry. Rust occurs when oxygen comes into contact with iron. As a result, even tiny amounts of dissolved oxygen contribute to corrosion in boilers and hot water heating systems. To prevent damage to these systems, chemicals called oxygen scavengers are added to absorb the oxygen from the water.



How To Take Water Samples

1

Test samples for dissolved oxygen as soon as they are collected.

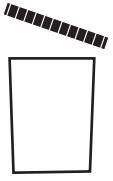


2

If the sample is not going to be tested immediately, the container should be filled until it overflows, and then capped. This procedure eliminates the possibility of getting air bubbles in the sample.

3

Use a clean glass or plastic container.

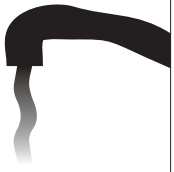


4

The water sample should be representative of the source. A natural water sample should be free of any foreign matter, such as aquatic plants and sediment from the bottom.

5

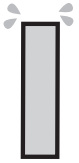
If the sample is taken from a tap, it is important to let the water run for several minutes before the sample is taken.



Testing for Dissolved Oxygen

1

Fill a vial (0125) to overflowing with a water sample. Use tap or natural water.

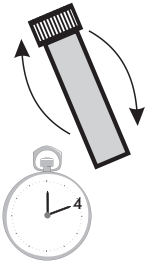


2

Add two Dissolved Oxygen Testabs (3976A). Cap the vial. Water will overflow from the vial. Make sure there are no air bubbles in the sample.

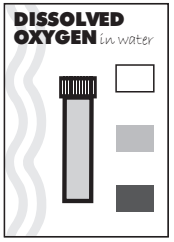
3

Invert the tube to mix the sample until the tablets have disintegrated. This may take 3 to 4 minutes.



4

Hold the vial against the white area of the Dissolved Oxygen Color Chart (5963-CC). Match the reaction color to the color chart. Record the result as ppm dissolved oxygen.



ADDITIONAL EXPERIMENTS

If it is not necessary to do 25 demonstrations, the remaining reagents can be used to perform additional experiments. Try one or more of the following:

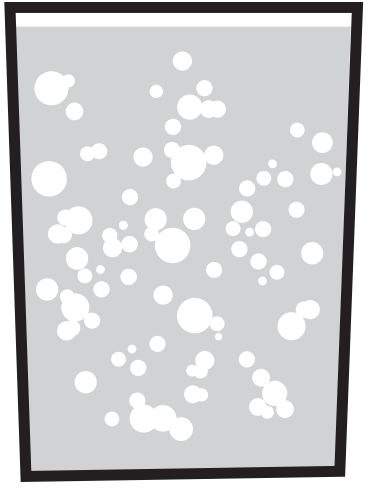
Biochemical Oxygen Demand

1. Fill two vials (0125) with water from a stream or a pond.
2. Immediately test the first vial for dissolved oxygen as described in the test procedure.
3. Wrap the second vial with aluminum foil. Store the vial in a dark drawer or closet for 5 days.
4. After 5 days, run the dissolved oxygen test on the aluminum foil covered vial. (Take the foil off before you run the test).

The difference in the dissolved oxygen level between the uncovered vial and the covered vial is the biochemical oxygen demand of the water sample. The biochemical oxygen demand (BOD) is the amount of oxygen required for the biodegredation, or decomposition, of the organic matter in the water. High BOD levels may be an indication of pollution.

High Dissolved Oxygen Sample

Use an aquarium bubbler to aerate a sample in a container. Aerate for 15 minutes for every 500 mL of water.



Additional Experiments

Low Dissolved Oxygen Sample

Boil water vigorously for 10 minutes. Place a canning jar in the sink. A canning jar must be used. Boiling water may shatter a regular glass jar. Pour the boiling water into the jar and seal it immediately. Make sure that there is no air space at the top of the jar. Allow the sample to cool to room temperature overnight. Open the jar the next day and test it immediately.

Dissolved Oxygen Requirements

Research different types of aquatic plants and animals and make a list based on their dissolved oxygen requirements.

GLOSSARY

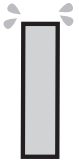
Aerate	To combine with air.
Algae	Usually aquatic plants of cellular structure which do not have leaves, roots, flowers or seeds. All algae have chlorophyll which is used to convert solar energy (sunlight) into chemical energy.
Aquatic	Living or growing in a water environment.
Corrosion	The deterioration of metal parts which are slowly eaten away by oxidation or rusting. Corrosion usually occurs when oxygen comes into contact with metal surfaces.
Decompose	To undergo chemical breakdown, rot.
Dissolved oxygen	The amount of oxygen dissolved in water.
Diffuser	A devise for deflecting air from an outlet in various directions.
Ecosystem	A self-supporting system of interacting organisms and their environment.
Organic matter	Usually refers to living or dead plant and animal matter.

scavenger	A chemically active substance that removes oxygen.
Oxidation	Chemical change caused by oxygen reacting with the substance.
Photosynthesis	The process by which green plants convert solar energy (sunlight) into chemical energy.
Pollution	The act of making naturally occurring substances, such as air and water, unclean or impure.
Waste	An unwanted by-product.
Wastewater	Water that has been used, as in a manufacturing process.

Student Procedure • Dissolved Oxygen

1

Fill a vial (0125) to overflowing with a water sample. Use tap or natural water.



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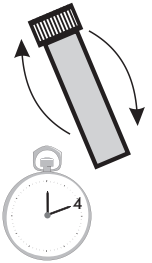

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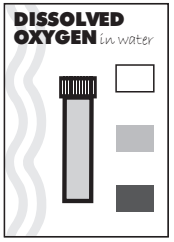

REAGENT COMPOSITION

- Sodium citrate buffer is combined with 2,4 Diaminophenol dihydrochloride in the Dissolved Oxygen Testabs (3976A). Oxygen in the buffered sample oxidizes the 2,4 Diaminophenol dihydrochloride to produce a colored solution.

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