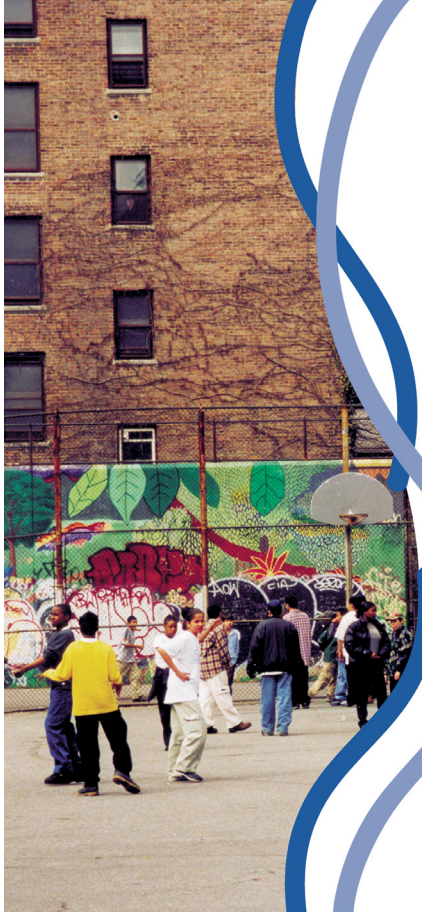

# URBAN WATER

## test kit

LaMotte

CODE 5918

# URBAN WATER QUALITY TEST KIT

The lifestyle of youth in the city often does not include involvement in outdoor activities or contact with nature. They may feel that environmental issues are not a part of their world and should not concern them when, actually, urban environmental issues involving water, are all around them.

Clean water is carried in underground pipes from a water treatment plant to millions of people for millions of uses. Sewage is taken away in another network of underground pipes to a sewage treatment plant and may eventually be discharged into a nearby river. Rain water gushes over sidewalks and down gutters, washing pollutants, trash, and everything in its path into storm drain systems. Toxic chemicals and waste from industrial areas leach into reservoirs, rivers and wells where cities and communities get their drinking water.

Everyone who lives in a city has the opportunity and the responsibility to insure that they will have enough safe water for the future.

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 Includes:

| Quantity | Description | Code |
|---|---|---|
| 5 | Coliform Tablets in a tube | 4890 |
| 10 | Chlorine DPD #4R TesTabs | 6899A |
| 10 | Copper HR TesTabs | 3701A |
| 20 | Dissolved Oxygen TesTabs | 3976A |
| 50 | *Hardness T TesTabs | 6917A |
| 10 | *Total Iron TesTabs | 2792A |
| 10 | *Nitrate CTA TesTabs | 3703A |
| 10 | Wide Range pH TesTabs | 6459A |
| 10 | Phosphorus TesTabs | 5422A |
| 1 | Thermometer, 0-12°C | 31821 |
| 1 | Thermometer, 14-40°C | 31822 |
| 1 | Vials, glass | 0125 |
| 6 | Test tubes, plastic, w/caps | 0106 |
| 2 | Protective Sleeve | 0106-FP |
| 1 | Test tube, plastic, large, w/cap | 0788 |
| 1 | Color chart | 5918-CC |

**Potential Health Hazard. Read SDS at www.lamotte.com. See page 8*

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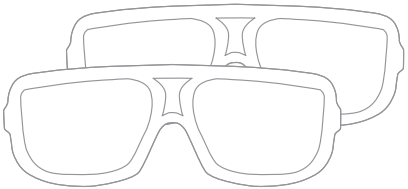
# GUIDELINES FOR TESTING



- Read all safety information. These labels provide very specific first aid and chemical information. Read the entire manual before performing any tests.
- Be sure that students understand the danger of treating reagents casually or endangering others through "horseplay".
- Wear safety goggles.
- Wash hands after performing water quality tests. Avoid placing hands in contact with eyes or mouth.
- Follow the general safety guidelines for your school.
- Note which test procedures require distilled or deionized water.

Ensure a safe experience by using the following:

| **In the Classroom:** | **In the Field add:** |
|---|---|
| Safety goggles for each student | Clean pail or bucket for washing hands |
| Sink for washing hands | Plastic gloves |
| Soap (biodegradable if possible) | Jug of clean water for washing hands |
| Towels | Container for chemical waste |
| Eye wash bottle | First aid kit |

## AFTER TESTING

Reacted samples, except for those for the coliform test, 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.

## 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.

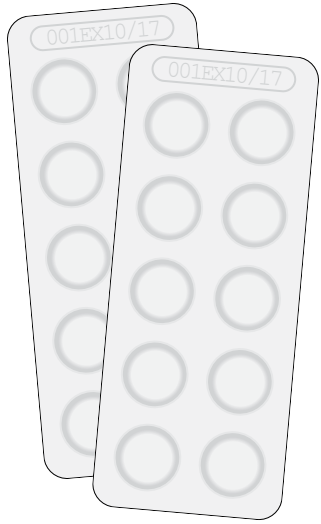
**NOTE:** This dilution method cannot be used with the pH or Dissolved Oxygen tests.

# SAFETY

*Reagent is a potential health hazard.
**READ SDS:** lamotte.com
**Emergency information:**
Chem-Tel USA 1-800-255-3924
Int'l, call collect, 813-248-0585


The TesTabs® 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. TesTabs® should not be ingested.

**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.

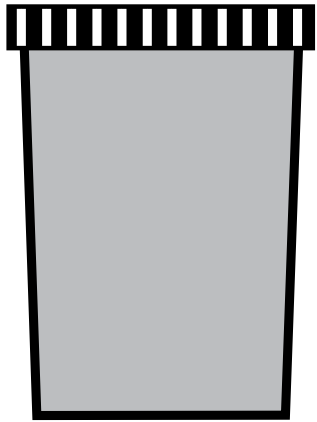


## COLLECTING A WATER SAMPLE

It is a good idea to collect several samples from each test site. All test procedures can be performed on natural water and tap water. 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 procedure at the sampling site immediately.



# TEST PROCEDURES

## Bacteria

Coliform bacteria are generally harmless bacteria that live naturally in the intestines of warm-blooded animals, including humans, and help the body function. Coliform bacteria are abundant in human and animal feces but do not usually occur elsewhere. Even though coliform bacteria itself may not make you sick, they are often found with other types of bacteria that are harmful. For this reason, coliform bacteria are used as an indicator of sewage or fecal contamination.

Water supplies can become contaminated with coliform bacteria when sewer lines become damaged or rainwater washes pet waste into storm sewer systems. Coliform bacteria is introduced to water in lakes, ponds and puddles by animals that live in the area, like birds and small mammals.

The sewage systems of some cities discharge sewage directly into local rivers. A person who swims in water with high levels of coliform bacteria could get sick from swallowing the water or from the bacteria entering their body through cuts or scrapes on their skin.

Even if test results are negative for coliform bacteria, water samples should be tested by a professional lab before the water is considered to be safe.

# Taking Water Samples

Sample collection technique is important for the bacteria test. To avoid contamination, do not remove the tablet from the test tube and do not touch the inner surfaces of the test tubes, caps, or sample container.

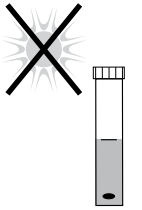
# Coliform Procedure

**1** Pour the sample into the large test tube with the tablet until it is filled to the 10 mL line. Don't worry if you overfill or under fill a little.

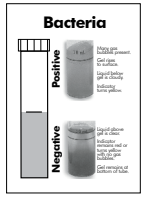
**2** Replace the cap on the test tube.

**3** Stand the tube upright, with the tablet flat on the bottom of the tube.

**4** Incubate by storing the tube upright, at room temperature, out of direct sunlight, for 48 hours. Store the tube where the temperature will be fairly constant and between 70° to 80°F (21° to 27°C). Do not disturb, handle, or shake tube during the incubation period.



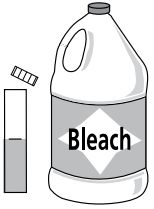
**5** Compare the appearance of the tube to the coliform color chart.



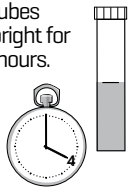

Note: This method is a screening test for total coliform bacteria. It will detect many forms of coliform bacteria, includint fecal coliform bacteria. A positive test result does not necessarily indicate fecal contamination.

# Disposal of Coliform Reactions

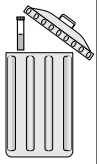
**1** One tube at a time, remove the cap and add approximately 1 mL (1/3 tsp or 20 drops) of household chlorine bleach and immediately recap.




**2** Let the tubes stand upright for about 4 hours.




**3** Dispose of the closed tubes in the trash. Do not open tubes.



## Chlorine

Water for cities and communities is usually disinfected. Even water that comes from clean sources, like reservoirs and deep wells, is commonly disinfected to make sure it is safe to drink. Chlorine levels can be easily measured so it is the disinfectant that is used most in municipal water supplies because chlorine is not found naturally in water, it is added to drinking water at the water treatment plant to kill disease producing bacteria.

Chlorine levels in tap water are safe for humans but will kill other small organisms like fish. Water straight from the tap should never be used to fill an aquarium until the chlorine has been removed.

Drinking water usually has less than 0.5 ppm of chlorine in it. If too much chlorine is added, the water will smell and taste bad. Laundry bleach has 15,000 times as much chlorine as drinking water.

Chlorine is also used to keep swimming pools clean. Swimming pools generally have a chlorine concentration of about 1 ppm. Swimmers eyes can be irritated when high levels of chlorine combine with dirt in a swimming pool.

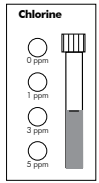
# Chlorine Procedure

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

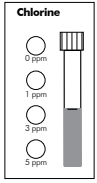
**2** Add one Chlorine DPD #4R TesTab (6899A).

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

**4** Hold the tube against the white area of the color chart.




**5** Compare the color of the sample to the chlorine color chart. Record the result as ppm total chlorine.




**ppm**

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).

## Copper

Only small amounts of copper are found in natural water. Large amounts are found in drinking water when acidic water dissolves the inside surfaces of copper pipes and copper fittings. Acid rain can damage copper statues, roofs and architectural ornamentation in the same way, leaving blue-green stains on sidewalks and buildings. People who have a lot of copper in their tap water may have the same type of blue-green stains in their bathtubs and sinks.

Because copper kills bacteria, it is sometimes used in aquariums to treat fish with diseases. It is also used in swimming pools and ponds to kill algae.

The concentration of copper in drinking water is usually below 0.03 ppm but may be as high as 0.6 ppm in some areas. Concentrations of 1.0 ppm or higher will make water taste bitter.

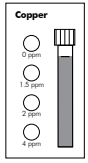
# Copper Procedure

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

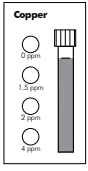
**2** Add one Copper HR TesTab (3701A).

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

**4** Hold the tube against the white area of the color chart.




**5** Compare the color of the sample to the copper color chart. Record the result as ppm copper.



## Dissolved Oxygen

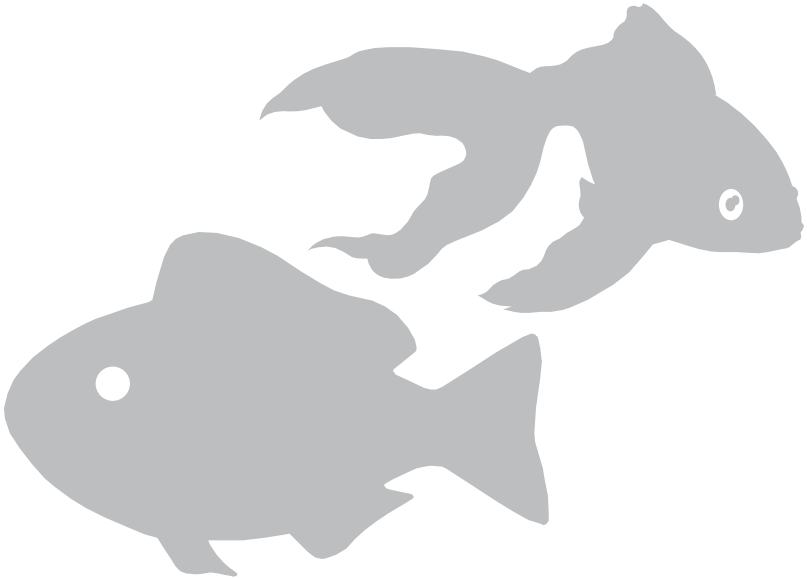
The presence of oxygen in natural water is a healthy sign. The absence of oxygen can be a sign of severe pollution. Aquatic plants and animals need oxygen to survive so it is essential to the health of rivers and lakes. Some fish, like trout, require high levels of dissolved oxygen to live. Other fish, such as carp and catfish, flourish in conditions of low dissolved oxygen. Aquatic organisms can be indicators of dissolved oxygen levels.

Most dissolved oxygen enters water from the atmosphere. In nature, waves and wind whip up the water and mix it with oxygen in the air. In aquariums, bubblers and diffusers do the same thing but on a smaller scale. In water treatment plants, water is often sprayed into the air like a fountain to add more oxygen to the water. Aquatic plants add oxygen to water during photosynthesis.

Dissolved oxygen in rivers is reduced by the build-up of organic waste. Organic waste can enter rivers as sewage or urban runoff, including run-off from over-fertilized lawns, and from discharge from food processing plants, meat packing houses and other industrial sources.

While dissolved oxygen is desirable in natural water, it is not wanted in air conditioning and hot water heating systems. Even tiny amounts of oxygen in these systems will allow rust to occur when the oxygen comes into contact with iron. To prevent damage, chemicals are added to the system to absorb the oxygen and prolong the life of the system.

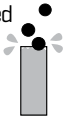
Aquatic organisms require different amounts of dissolved oxygen. Levels of 5 ppm are usually required for the growth and activity of aquatic organisms. Dissolved oxygen levels below 3 ppm are stressful to most aquatic organisms. Dissolved oxygen levels below 2 ppm will not support fish. Animals that can move will leave areas of low dissolved oxygen.



# Dissolved Oxygen Procedure

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

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

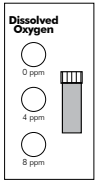


**3** Cap the tube. Be sure no air bubbles are in the sample.

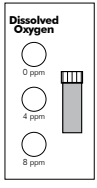
**4** Mix by inverting until the tablets have disintegrated (about 4 minutes).

**5** Wait 5 minutes.


**6** Hold the tube against the white area of the color chart.




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



## Hardness

Hardness is a measure of the amount of calcium and magnesium in water. Calcium and magnesium are minerals that dissolve in water as the water flows past underground rocks. Rocks like sandstone and limestone, which contain large amounts of calcium and magnesium, dissolve easily and produce hardness in water.

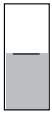
Water with a lot of calcium and magnesium is called “hard”. Hard water leaves mineral deposits in pipes, heaters, and appliances. These deposits clog pipe openings and reduce the flow of water. Hard water reduces the amount of sudsing from soap, detergents and shampoo and can leave a film on clean dishes, clothes and hair. The white deposits on cooking pots and coffee makers left behind when water is boiled away can be caused by hard water.

Water with little or no dissolved minerals is called “soft”. Rain water and melted snow are good examples of soft water. Soft water is very good at dissolving things. If water is too soft it can dissolve the walls of plaster swimming pools and metal surfaces of industrial systems. Soft water will make loads of suds with soap, detergent or shampoo and the suds may seem difficult to rinse off.

The hardness of water may range from zero ppm to hundreds of parts per million. Water is called soft if the hardness level is from 0 to about 50 ppm. Water with a hardness level above 50 ppm is called hard.

# Hardness Procedure

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



**2** Add *Hardness T TesTabs® (6917A), one at a time, until the color of the solution changes from red to blue and matches the hardness color chart. Make sure to mix until each tablet has totally disintegrated before adding the next tablet.

**3** Multiply the number of tablets used by 40.

# of tablet
x 40
_____
hardness

**4** Record the result as ppm total hardness.

# Iron

Iron is naturally found in most ground water and is an important nutrient for plants. Plants with normally green leaves will have yellow leaves if they are not getting enough iron. Iron is an important nutrient for people too and we can get it from eating green vegetables.

Water with a lot of iron will leave an orange stain where the water drips into a bathtub or sink. Iron can also leave rusty stains on clothes and dishes. A lot of iron will make water an ugly color and give it a bad taste.

Sometimes objects made from iron react with oxygen in the air to form rust. Acid rain can make things rust even faster and can cause damage to metal buildings, bridges, cars, machines and statues. Salt water from ocean spray or from salt used on icy surfaces in the winter, can also speed up the corrosion of metals.

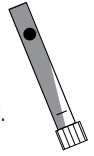
The concentration of iron in tap water should not be greater than 0.2 ppm.

# Iron Procedure

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

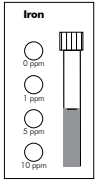
**2** Add one *Total Iron TesTab (2792A).

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

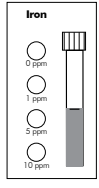


**4** Wait 5 minutes.


**5** Hold the tube against the white area of the color chart.




**6** Compare the color of the sample to the Iron Color Chart. Record result as ppm Iron.



## Nitrate

Nitrate is one of the main ingredient in fertilizer and is used to increase production of healthy, green grass and plants. If more fertilizer is applied than can be used by the plants, the extra nitrate is washed out of the soil and into nearby rivers when it rains. Too much nitrate can make algae grow out of control and upset the ecological balance of the river. Nitrate can also trickle down through the soil and into the groundwater and can contaminate the wells where some cities get their drinking water.

Nitrate can enter water from leaking sewage systems, animal wastes and discharge from car exhaust.

It is important to monitor nitrate in drinking water because high levels of nitrate can poison babies under six months old. It makes them unable to get enough oxygen and they will turn blue and may suffocate.

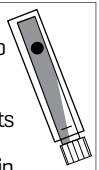
Unpolluted water usually has a nitrate level below 4 ppm. Nitrate levels above 40 ppm are considered unsafe for drinking water.

# Nitrate Procedure

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

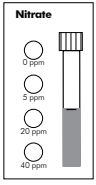
**2** Add one *Nitrate CTA TesTab (3703A). Immediately slide the tube into the Protective Sleeve (0106-FP).

**3** Cap the tube & mix for two minutes to disintegrate the tablet. Bits of material may remain in the sample.

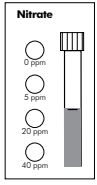


**4** Wait 5 minutes for the red color to develop. Remove the tube from the Protective Sleeve.


**5** Hold the tube against the white area of the nitrate color chart.




**6** Compare the color of the sample to the color chart. Record the result as ppm nitrate.




Note: Nitrate CTA TesTabs (3703A) are sensitive to UV light. The Protective Sleeve (0106-FP) will protect the reaction from UV light. If testing indoors, there is no need to use the Protective Sleeve in this procedure.

# pH

A pH value tells us how acidic or basic things are. It is measured on a scale which ranges from 0 to 14. Battery acid is very acidic with a pH of almost zero. Bleach is very basic with a pH of 12.6. The neutral pH, pH 7, is at the middle of the scale. It is neither acidic nor basic. Distilled water has a pH of 7 because there is nothing dissolved in it.

Water with a low pH causes corrosion of metal pipes and fixtures and may result in high iron, copper and lead levels in drinking water. To prevent this from happening, operators of water systems adjust the pH of drinking water to be slightly basic.

Normal rain, sleet and snow, may have a pH as low as 6. Acid rain and snow are formed when moisture in the atmosphere combines with pollutants from automobile and coal-fired power plant emissions. The areas hardest hit by acid rain are those downwind of urban and industrial areas. Acid rain, with a pH of less than 6, damages buildings, statues, forests, rivers and streams.

The pH of water is critical to aquatic life. Most organisms are used to living in water with a specific pH and may die if pH levels change even slightly. A range of pH 6.5 to 8.2 is optimum for most organisms.

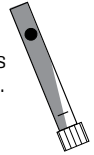
Tap water can have a pH that is acidic or basic.

# pH Procedure

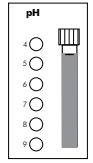
**1** Fill the test tube (0106) to the 10 mL line.

**2** Add one pH Wide Range TesTab (6459A).

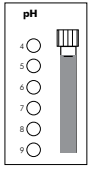
**3** Cap the tube and mix until the tablet has disintegrated.



**4** Hold the tube against the white area of the color chart.




**5** Compare the color of the sample to the pH color chart. Record the result as pH.



# Phosphate

Phosphate is usually found in natural water and is a necessary element for plants and animals. Phosphate naturally enters water from plant and animal by-products and remains.

Phosphate is a nutrient that acts as a fertilizer for aquatic plants. When nutrient levels are too high, plants and algae grow out of control and create water quality problems. When large amounts of plants die and rot, oxygen levels drop and the area may eventually become an unfit habitat for the fish, animals and insects that used to live there. Algae and aquatic plants can also clog the intake pipes and equipment of industries that use natural water to cool their equipment.

Phosphate in water can come from human waste, animal waste and industrial waste. Storm sewers sometimes have illegal connections to sanitary sewers. Rain and melting snow flowing into storm drains then carry sewage directly into waterways, bypassing the treatment plant. Detergent in household sewage is a large source of phosphate. Over half of the phosphate in lakes, streams and rivers comes from detergents. Phosphate can also enter waterways when animal waste or detergent from washing cars flows into storm drains.

Even sewage that has been treated at a wastewater treatment plant and is purposefully or accidentally dumped into a river may contain phosphate. Sewage effluent should not have more than 1 ppm phosphate but many old wastewater treatment plants cannot meet this standard.

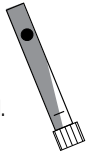
Phosphate levels higher than 0.03 ppm contribute to increased plant growth.

# Phosphate Procedure

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

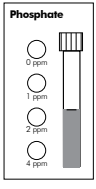
**2** Add one Phosphorus TesTab (5422A).

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

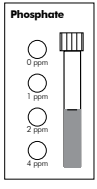


**4** Wait 5 minutes.


**5** Hold the tube against the white area of the color chart.




**6** Compare the color of the sample to the phosphate color chart. Record result as ppm phosphate.



## Temperature

The largest impact that people have on the temperature of water is thermal pollution. Thermal pollution is caused when warm water is added to a waterway. Thermal pollution occurs in built up areas where buildings, parking lots, and sidewalks trap heat and warm up the rainwater that runs off of them. The warm water runs into storm drains and into local waterways. The temperature of river water is also increases when some industries and power plants use water to cool machinery and then return the warm water back to the river.

The temperature of a river will decrease when cool underground water or snow melt join the river. Overhanging trees and vegetation shade the river from the sun and also keep it cool.

Water temperature is one factor in determining which species may or may not be present. Most aquatic organisms have adapted to survive within a specific water temperature range and many organisms cannot tolerate extremes of heat or cold. Temperature affects the feeding, reproduction, and metabolism of aquatic animals. Fish larvae and eggs usually are more sensitive to temperature than adult fish. Temperature also affects oxygen levels in water.

Warm water holds less oxygen than cool water and directly affects the amount of oxygen that is available to aquatic organisms.

# Temperature Procedure

**1**

Place the thermometer below the water surface for one minute.


**2**


Remove the thermometer from the water. Read the temperature and record the results as degrees Celsius.

## Hints:

- the sample should be in a clear container so the thermometer can be read when the reading stabilizes.
- keep the thermometer in the water until a constant reading is attained.
- If you are measuring the temperature of a stream or river, measure the temperature at the site where other water quality tests are being performed. Then repeat the test approximately one mile upstream as soon as possible. The difference in the two readings is the temperature change.

# TEST RESULTS FORM

| Factor | Result |
|---|---|
| Bacteria | |
| Chlorine | |
| Copper | |
| Dissolved Oxygen | |
| Hardness | |
| Iron | |
| Nitrate | |
| pH | |
| Phosphate | |
| Temperature | |

## Test Site

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