



## Module #4

### Calculating Water Quality Index

*Adapted and excerpted from Field Manual for Water Quality Monitoring: An Environmental Education Program for Schools by Mark M. Mitchell and William B. Stapp*

#### Materials

small water sample bottle and rod sampler if needed  
(constructed from a series of metal rods that can be extended and rubber tubing that holds a sample bottle)

test tubes

gloves

dropper

Wide Range Indicator Solution

Wide Range pH Comparator

Testing materials can be purchased as individual test kits from Hach or LaMotte. pH tests also are available in Multiple Water Quality Test kits from these manufacturers as well. The materials and instructions that follow are based on a LaMotte test kit using a wide range method. If you use the Hach kit or another testing method, please follow the directions you receive with your test kit.

#### BACKGROUND INFORMATION

*from <http://www.h2ou.com/h2wtrqual.htm> a subsite of hach.com*

The balance of positive hydrogen ions (H<sup>+</sup>) and negative hydroxide ions (OH<sup>-</sup>) in water determines how acidic or basic the water is. Notice the '+' and '-' in the chemical symbols above. They indicate that these chemical forms are 'ions' — they have a positive or negative electrical charge. This means the molecule in question is either missing an electron or has an extra electron. Since electrons have a negative charge, an extra one in the OH molecule makes it OH<sup>-</sup>, and a missing one in the H molecule gives it a "missing-minus" charge — in other words, positive — and makes it H<sup>+</sup>. When analysts measure pH, they are determining the balance between these ions.

The pH scale ranges from 0 (high concentration of positive hydrogen ions, strongly acidic) to 14 (high concentration of negative hydroxide ions, strongly basic). In pure water, the concentration of positive hydrogen ions is in equilibrium with the concentration of negative

hydroxide ions, and the pH measures exactly 7.

In a lake or pond, the water's pH is affected by its age and the chemicals discharged by communities and industries. Most lakes are basic (alkaline) when they are first formed and become more acidic with time due to the build-up of organic materials. As organic substances decay, carbon dioxide (CO<sub>2</sub>) forms and combines with water to produce a weak acid, called "carbonic" acid — the same stuff that's in carbonated soft drinks. Large amounts of carbonic acid lower water's pH.

Most fish can tolerate pH values of about 5.0 to 9.0, but serious anglers look for waters between pH 6.5 and 8.2. The vast majority of American rivers, lakes and streams fall within this range, though acid rain has compromised many bodies of water in our environment.



#### A. pH Sampling Procedure

Like the sample collected for the dissolved oxygen test, the water sample for the pH test should be collected away from the river bank and below the surface. If possible, use an extension rod sampler. The sample must be measured immediately because changes in temperature can affect the pH value. If pH must be measured later, the sample should be placed on ice and measured as soon as possible.

If the pH of the same water sample is tested more than once, the most common pH value (the mode) should be reported, not the average value.

#### B. pH Testing Procedure

1. Rinse each test tube with the water sample. Gloves should be worn to avoid skin contact with the water.
2. Fill the tube to the 5 ml line with sample water.
3. While holding dropper bottle vertically, add 10 drops of Wide Range Indicator Solution.
4. Cap and invert several times to mix.
5. Insert the tube into the Wide Range pH Comparator. Hold the comparator up to a light source. Match the



sample color to a color standard.

6. Record the pH value.
7. Wash your hands.

### C. pH Calculating the Results

After the test is completed and the results are recorded, the Water Quality Index (WQI) for the body of water can be computed. To formulate a WQI, you must first compute a Q- value for the results you obtained. The Q-values of all nine tests will be used together to determine the health of the river or lake.

See Water Quality Index (Module 10). To compute the Q-value for the pH test, follow these steps:

1. Find the weighting curve chart (below);
2. Locate your test result on the bottom (horizontal or “x” axis) of the chart;
3. Interpolate the Q-value for your test result using the following steps;
4. From your test result value on the horizontal (“x”) axis of the chart, draw a vertical line up until it intersects the weighting curve line;
5. From this point of intersection, draw a horizontal line to the left hand side (the vertical or “y” axis) of the chart;
6. Where this horizontal line intersects the vertical (“y”) axis of the chart, read off the value. This is the Q-value for this test; it should be recorded in Column B on the WQI chart on the Calculating Water Quality Index (Module 10)

The Q-value for each test should then be multiplied by the weighting factor listed in the chart on the Water Quality Index page. Record the product of this calculation in Column D of the chart.

