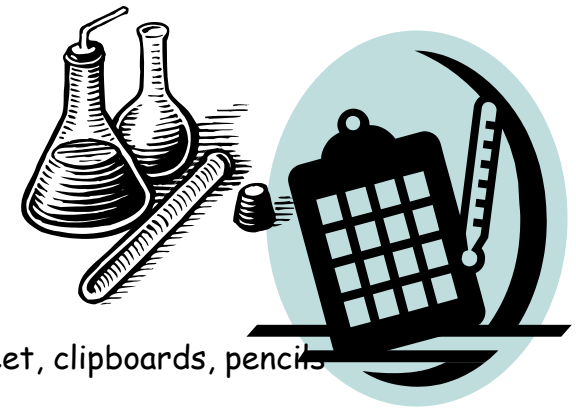

Water Quality Monitoring

Grade Level: 4th through 12th
Subject: Science, Math
Duration: 45 Minutes
Materials: LaMotte Water Quality Kits, Data sheet, clipboards, pencils

Benchmarks

Learn what a watershed is and its importance to the protection of our water SC.4.L.17.4, SC.7.L.17.1, SC.7.L.17.2, SC.7.L.17.3, SC.912.L.17.2, SC.912.L.17.3, SC.912.L.17.7, SC.912.L.17.19, SC.912.L.17.20

Determine the types and sources of pollution and how humans are polluting our water SC.4.L.17.4, SC.7.L.17.1, SC.7.L.17.2, SC.7.L.17.3,

SC.912.L.17.2, SC.912.L.17.3, SC.912.L.17.7, SC.912.L.17.19, SC.912.L.17.20

Learn the importance of collecting data, multiple trials and using this data to analyze the results to determine water quality SC.4.N.1.1, SC.4.N.1.5, SC.4.N.1.6, SC.5.N.1.1, SC.5.N.1.5, SC.5.N.1.6, SC.5.N.2.2, SC.6.N.1.1, SC.6.N.1.5, SC.6.N.1.6,

SC.7.N.1.1, SC.7.N.1.5, SC.7.N.1.6, SC.8.N.1.1, SC.8.N.1.5, SC.8.N.1.6,

SC.912.N.1.1, SC.912.N.1.3, SC.912.N.1.6, SC.912.N.1.7, SC.912.N.2.2

Overview: This water quality monitoring activity will use LaMotte Kits measuring temperature, pH, dissolved oxygen, turbidity and salinity (optional nitrate & phosphate). Finally students will analyze the results of the tests to determine the quality of the water.

Objectives: With this activity students will focus on the impact of human activities on water quality. They will determine what makes water of good or poor quality, gain scientific field experience while collecting water samples and test to evaluate and determine the quality of water sampled.

Background:

The quality of water can change as it flows over the land. These changes in water quality may be due to natural factors or human activities. When water is degraded to a point that affects its use for a particular purpose, it has become polluted. Water pollution originates from two very different sources: point sources and non-point sources. Point source pollution comes from a discrete source such as a pipe, ditch or wastewater treatment plant. Non-point source means that the pollution comes from a broad area, such as a large field that has been covered with fertilizer or pesticides. Excessive application of fertilizer or pesticides on lawns and gardens (such as various

"chem.-lawn" companies promote) can create non-point sources. People who use fertilizers and pesticides must read labels to ensure that they are applying the materials properly.

Water quality testing determines whether water is healthy enough for the aquatic animals to live and reproduce. Knowledge of the water quality within your watershed provides understanding about human activities and our role in the ecological processes. Typically, tests for water quality identify several indicators that can be used to determine the health of a watershed and waterways. Key indicators include dissolved oxygen, pH, temperature, turbidity, nitrates and phosphates. A glossary of key terms follows:

Dissolved oxygen measures the presence of oxygen gas molecules in water. These oxygen molecules keep organisms living, sustain species reproduction, and support many chemical processes that occur in water. Water that maintains high dissolved oxygen levels is generally considered environmentally healthy; although saltwater, warm water, and water at high altitudes can contain less dissolved oxygen and still be part of a health-sustaining ecosystem.

Sources: from atmosphere and photosynthesis of plants. Oxygen is absorbed in water by direct diffusion and by surface-water mixing.

Effects and Hazards: Low dissolved oxygen levels stress fish and other aquatic organisms.

pH measures the acidity of a solution as an "index" of the amount of hydrogen ions present in a substance and affects many chemical and biological processes. Sources: Acidity increases due to mine draining, industrial waste, and acid rain.

- pH is measured on a scale of 0-14, with a neutral pH at 7
- A pH less than 7 is an acid, with more hydrogen ions
- A pH greater than 7 is basic (or alkaline) and has more hydroxide ions
- Most natural water has a pH value between 5.0 and 8.5. Rainwater 5.5 and 6.0
- Salt water has a pH between 8.0 and 8.5
- Most aquatic animals prefer a range of 6.5 to 8.0

Temperature measures the degree of heat in the water which affects the rate of many of the waterways' biological and chemical processes and the amount of dissolved oxygen. Sources: Air temperature, the amount of runoff, the temperature of water running into the waterway, amount of sunlight, and water cloudiness.
Effects and Hazards: Temperature affects the rate of photosynthesis and decomposition in plants. High temperatures may be a sign of thermal pollution from industrial sites as warm temperatures will hold less oxygen then cooler temperatures.

Turbidity is the clarity of the water. Clear water has a low turbidity while murky water has a high turbidity.
Sources: Small particles suspended in water such as algae, clay, microorganisms, silt, organic chemicals, decaying vegetation, or chemical wastes.
Effects and Hazards: Turbidity can interfere with the process of disinfecting water. Particles may absorb or bond with toxic substances and prevent their removal during treatment.

Nitrate and phosphate are important nutrient for plants and animals.

Sources: Human and animal waste, agricultural and industrial runoff

Effects and Hazards: Excess nutrients can cause the plants to overgrow and cause a bloom. When the plants die, the bacteria decompose them. The increase in bacterial activity will cause the dissolved oxygen to decrease.

Suggested Procedure:

1. Begin the activity by collecting a sample the water in a large bucket. Have students work in groups of 2-4 with a LaMotte Kit and data sheet to share.
2. Have students collect a full LaMotte sample jar from your sample, or from the water body.
3. Use their skills of observation to complete the field notes on the top of the data chart
4. The first test will be **temperature.** Hold the thermometer on the edge read the temperature which will be the number that is green on the thermometer. Record this in degrees Celsius.
5. Place the thermometer 4 inches below the surface of the water. Wait 1 minute and record the number that is green on the thermometer.
6. Dissolved oxygen should be conducted first. The next 4 tests can be conducted in any order but note the times needed for the color to develop.

Dissolved oxygen.

1. Submerge the small tube into the water making sure it is completed filled with no air bubbles.
2. Drop two dissolved oxygen TesTabs into the tube. Water will overflow when the tablets are added. Secure the cap. Mix by inverting the tube over and over until the tablets have disappeared. Wait 5 minutes as it will take that long for the color to develop. Compare the color of the sample to the dissolved oxygen color on the chart. Record in ppm (parts per million).

3. Using the % Saturation Chart find the water temperature on the left side of the chart. Move across the row to the amount of dissolved oxygen in ppm. Record the % saturation. **Percent Saturation** is the amount of **oxygen** dissolved in the **water** sample compared to the maximum amount that could be present at the same temperature.

Phosphate

1. Fill one of the longer test tubes to the 10ml line with a sample of the water.
2. Add 1 Phosphorus TesTab to the test tube. Cap and invert until the tablet is dissolved.
3. Wait 5 minutes for the color to develop .
4. Compare the color of the sample to the Phosphate color chart. Record in ppm. If there is no blue color record 0.

Nitrate

1. Fill another test tube to the 5ml line with the sample.
2. Add 1 Nitrate TesTab to the test tube. Place the test tube into the protective sleeve as the UV light will affect the results.
3. Cap and mix by inverting until the sample.
4. Wait 5 minutes and remove the test tube from the sleeve.
5. Compare the color of the sample to the Nitrate color chart. Record in ppm. If there is no color change or it is yellow, record 0.

pH

1. Fill the last test tube to the 10ml line with the water sample. Add 1 pH TesTab
2. Cap and invert until the tablet has dissolved. This will happen quickly
3. Compare the color of the sample to the pH color chart. Record the pH.

Turbidity

1. At the bottom of the sample jar there is a small circular object. This is called a secchi disk.
2. Hold the Turbidity Chart on the top edge of the jar. Do not put it in the water. Looking down into the jar compare the appearance of the secchi disk in the jar to the chart. Record in JTU (Jackson Turbidity Units)

7. Students will analyze the water quality of the water based on these parameters.

Dissolved oxygen: Percent saturation

91%- 100% = excellent 7ppm – 12 ppm
71%-90% = good = 5 – 6 ppm
51%-70% = fair = 4 ppm
Below 50% = poor = at 3 ppm fish will be stressed - 2 ppm will not support fish

Phosphate:

1 ppm = excellent
2 ppm = good
4 ppm = fair

Nitrate:

Less than 5 = good or excellent
5 ppm = fair
20 or greater ppm = poor

pH

pH of 4,5,9 or 10 = poor
pH of 6.5 and 8 = good
pH of 7 = excellent

Turbidity

0 JTU = excellent
0 – 40 JTU = good
40 – 100 JTU = fair
Greater than 100 JTU = poor

Additional resources:

Fred the Fish http://www.scilitlinks.org/fredthefish.htm

Vocabulary:

- Watershed
- Pollution
- Nonpoint source pollution
- Point source pollution
- Estuary
- Vertebrate
- Invertebrate
- Exoskeleton
- Endoskeleton
- Bivalve and Univalve
- Food chain and food web
- Mutualism,
- Predation
- Parasitism
- Competition
- Commensalism

From: Low Cost Water Monitoring Kit, LaMotte Company, Chestertown, Maryland