Freshwater Pollution Lab

Connecticut Expected Performances: D.24: Explain how the accumulation of mercury, phosphates, and nitrates affects the quality of water and the organisms that live in rivers, lakes, and oceans.

Links to the Mission:

- Demonstrate proficiency in critical and creative thinking
- Utilize problem solving and reasoning strategies.

Background information:

Water pollution can come in many forms. Mercury, for example, is a pollutant released into the air by the combustion of coal for electricity, and may be transported from the air to soil and water by rain. The mercury in urban storm water sediment results in part from improperly discarded fluorescent lights, electrical switches, thermometers, other mercury-containing devices, and historical and ongoing industrial activities. As mercury is consumed by organisms at the bottom of the food chain, and in turn consumed by other heterotrophs, mercury makes it way up the food chain. The results of consuming too much mercury can be devastating. Impacts on cognitive thinking, memory, attention, language, and fine motor and visual spatial skills have been seen in children exposed to mercury in the womb.

Consider Figure 1 to the right, which shows the biomagnifications of mercury as it makes its way up the food chain.

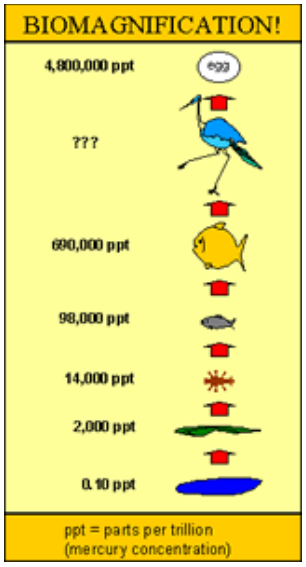

Figure 1

However, water pollution can result from seemingly less harmful sources than mercury. Plant fertilizer, for example, contains two very important molecules essential for plant growth: nitrates and phosphates. Nitrates and phosphates may be great for your plants, but when it

runs off into the sewers, the molecules eventually end up in a water supply. In the water, algae have a field day! They increase exponentially. The term used to refer to the situation in which too much algae grows in a lake is known as **eutrophication**. The problem with eutrophication is that when the algae begin to die off, bacteria within the lake decompose the algae. Yes, you guessed it……to decompose, they use cellular respiration. Obviously, the bacteria take in oxygen as a reactant and release carbon dioxide. The water, therefore, is robbed of oxygen. Fish and other aquatic organisms often die due to a lack of oxygen. This process is known as fish kill.

Objectives:

- To determine the level of nitrates, phosphates, and oxygen within given water samples.
- To determine, based on the levels of nitrates, phosphates, and oxygen, if water supplies are eutrophic.

More background information:

Nitrate: Nitrates accumulate for decaying vegetation, from the atmosphere, for fertilizer, animal excrement and sewage. Unpolluted water generally has an overall nitrate level less than 4 parts per million. Water with concentrations greater than 10 ppm may be unfit to drink.

Phosphate: Phosphate originates from fertilizer, wastewater from human, animal and plant residue, and from industrial wastewater. Phosphate levels greater than .03ppm may lead to eutrophication.

Dissolved oxygen: The concentration of dissolved oxygen is one of the most important indicators of overall aquatic health. Water with consistently high levels of dissolved oxygen (6 ppm) typically supports the most diverse biological communities. Water with dissolve oxygen concentrations below 3 ppm is extremely stressful to aquatic organisms.

Your Task: Pretend you are working for the Department of Environmental Protection. It is your job to determine the health of various bodies of water and thus determine if they are fit for aquatic life.

Make a hypothesis as to what will happen to the amount of dissolved oxygen as the levels of phosphates and/or nitrates increases.

_____
_____
_____

Procedure: Use the following tests for each of your water samples

A. Testing for Dissolved Oxygen

    1. Filled a dissolved oxygen test vial to overflowing with the fresh water sample.

    2. Add two dissolved oxygen TesTabs to the test tube

    3. Cap the tube and be sure that there are no air bubbles in the sample.

    4. Invert the tube and mix until the tablets have dissolved.

    5. Wait 5 minutes.

    6. Compare the color of the sample to the Dissolve Oxygen color chart.

B. Nitrate Test

    1. Fill the water sample tube to the 5 mL line with fresh water.

    2. Add one nitrate Wide Range TesTab to the tube

3. Cap the tube and mix until the table has dissolved.

4. Wait for 5 minutes

5. Compare the color of the sample to the Nitrate color comparison chart

C. Phosphate Test

1. Fill the water sample tube to the 5 mL line with fresh water

2. Add one Phosphorous TesTab to the tube

3. Cap the tube and mix until the tablet has dissolved

4. Wait 5 minutes

5. Compare the color of the sample to the Phosphate color comparison chart.

Factor			
Dissolved Oxygen			
Nitrates			
Phosphates			

Conclusion:

1. Which water sample was the control and WHY do you believe so?

2. Which water sample was determined to be the most eutrophic and WHY?

3. For the sample that was determined to be most eutrophic, hypothesize as to how nitrates and phosphates entered the water sample.

4. Was your experiment valid? Why or why not?

5. How will increased levels of nitrates and phosphates decrease the amount of oxygen in the water?