

Name \_\_\_\_\_

Date \_\_\_\_\_

## Water Quality Testing Data Sheet- Chemistry

Time of day: \_\_\_\_\_

Location: \_\_\_\_\_

Weather: \_\_\_\_\_

Past 2 days (precipitation events): \_\_\_\_\_

Air temperature: \_\_\_\_\_

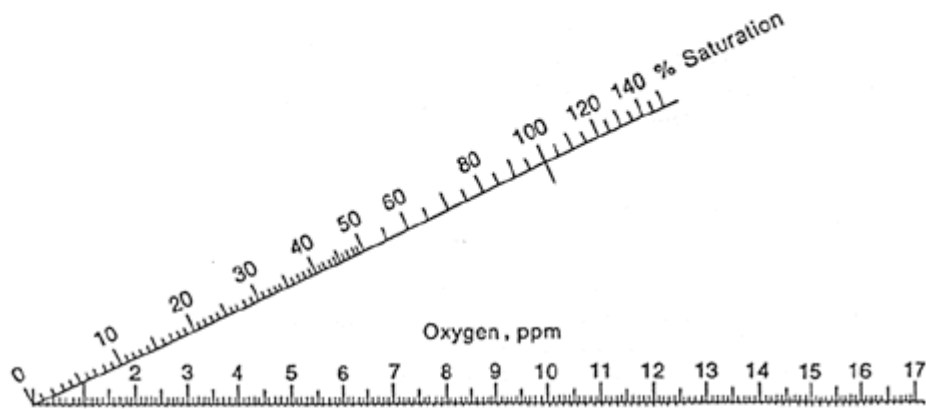
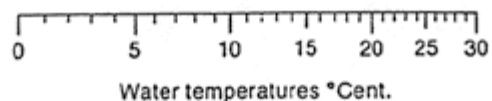
Observations of the river or stream (water movement, color, etc): \_\_\_\_\_

### Water Chemistry

Test	Equipment used (include brand, ie HACH, Lamotte, or type of equipment: probe, test kit)	Test 1	Test 2	Test 3	Average
Water Temperature					
Dissolved Oxygen (mg/L)					
% saturation					
pH					
Nitrate-Nitrogen (NO <sub>3</sub> <sup>-</sup> mg/L)					
Phosphate (PO <sub>4</sub> <sup>3-</sup> , mg/L)					
Turbidity					

Notes:

**Calculate percent saturation:** Find the parts per million (ppm) of oxygen on the lower line and the water temperature on the upper line. Use a straight edge to line up the two readings and record where the straight edge intersects the percent saturation line.



**A note about percent saturation:** It is possible to get more than 100% saturation. The sample can be supersaturated in an area where there are a lot of plants or algae on a sunny day (due to photosynthetic activity).

## Dissolved Oxygen

Oxygen is essential for many living things and for many of the chemical processes that happen in the water. There are two ways that dissolved oxygen enters water—either through photosynthesis by aquatic plants or through diffusion from the surrounding air. Oxygen is also consumed in the water through the respiration of aquatic animals and plants, decomposition of organic matter by microorganisms, and different chemical reactions. When more oxygen is consumed than produced, dissolved oxygen (DO) levels in the water decline. High, relatively stable dissolved oxygen levels are indicative of a healthy ecosystem, capable of supporting lots of different kinds of aquatic organisms. Organisms have adapted to the natural variation of DO in the water—it changes throughout the day, across the seasons, and even from one location within a water body to another. However, if DO reaches extreme levels, animals can become stressed. Low DO (called hypoxic) levels usually indicate pollution or some type of human-caused change, of which there are several major categories:

- organic waste in the form of sewage and animal manure
- nutrients from fertilizers and agricultural runoff
- changing the flow of the water through dams and water withdrawal
- removal of vegetation from stream banks—vegetation removal increases water temperature, thereby decreasing dissolved oxygen levels.

Natural processes also affect the dissolved oxygen levels:

- Warm water holds less dissolved oxygen than cold water.
- The lowest levels of DO usually occur in the morning, because photosynthesis stops at night while respiration continues.
- Water at higher altitudes holds less oxygen.
- Fast-moving water generally has more oxygen than still water, because the movement mixes the air into the water. However, if the water is very turbulent, it may hold too much oxygen, causing stress to the aquatic organisms.
- Water with lots of aquatic plants have higher levels of dissolved oxygen, since submerged plants produce oxygen through photosynthesis. Also, as mentioned above, too many plants will ultimately reduce the DO levels, because of either night-time oxygen use by plants or the decay process that consumes oxygen.

**For mg/L:**

**0-2 mg/L: not enough oxygen to support most animals**

**2-4 mg/L: only a few kinds of fish and insects can survive**

**4-7 mg/L: good for most kinds of pond animals**

**7-11 mg/L: very good for most stream fish**

**For percent saturation:**

**Below 60%: poor quality, bacteria may be consuming most of the DO**

**60-79%: acceptable for most stream animals**

**80-125%: excellent for most stream animals**

**125% or more: too high**

## **Nitrate**

Nitrogen is an essential nutrient for plants and animals, since it is a building block for the proteins that exist in living things. Forms that are common in the environment include **nitrate** ( $\text{NO}_3^-$ ), **nitrite** ( $\text{NO}_2^-$ ), and **ammonia** ( $\text{NH}_3$ ). We usually measure nitrate when we are testing water quality, because it is the most stable form of dissolved nitrogen in aquatic systems. Nitrate is found naturally in unpolluted streams and ponds due to the ongoing process of growth and decay and from low-level inputs from the terrestrial watersheds.

Clean water generally has less than 3 mg/L nitrate-nitrogen ( $\text{NO}_3^- - \text{N}$ ). High readings indicate pollution from fertilizer, sewage, or industrial waste. Sewage treatment plant effluent often has discharge with nitrate levels of 30 mg/L  $\text{NO}_3^- - \text{N}$ . For other classes of water (fishing, swimming water) the New York government requires there to be “none that will result in growths of algae, weeds, and slime that will impair uses.”

## **Phosphate**

Phosphorous (P) is also an essential nutrient for plants and animals. Phosphate ( $\text{PO}_4^{3-}$ ) is the most biologically available form of P and is rapidly taken up by organisms. Therefore, dissolved organic particles containing P are generally more abundant than  $\text{PO}_4^{3-}$  in aquatic ecosystems. Natural sources of phosphate include that gained from erosion or weathering from phosphate-rich rocks and the recycling of phosphorous from organic matter. In the Hudson, as in many rivers, particulate detritus delivered from tributaries is an important natural source of phosphorus. Phosphorus from these sources is primarily in the organic form. However, the Hudson also

receives a lot of P inputs from tributaries that receive treated sewage, which often contains a lot of the inorganic, bioavailable  $\text{PO}_4^{3-}$ . Because the form that is rapidly taken up,  $\text{PO}_4^{3-}$ , is in such short supply, phosphorus is often considered the "limiting factor" in freshwater ecosystems; this means that it is the factor that controls how much plant and animal growth can occur.

Clean water has low phosphate levels, usually between 0.01 and 0.03 mg/l of  $\text{PO}_4^{3-}$ . Readings higher than 0.3 mg/L indicate pollution from fertilizer, sewage, industrial waste or detergents, which tend to accelerate the eutrophication process. Waste water contains 5 - 30  $\mu\text{g/L}$  phosphate. According to federal law, drinking water must be less than 0.5  $\mu\text{g/L}$  phosphate.

## pH

pH, which literally stands for the 'power of hydrogen', is an important water quality component. Many fish and invertebrates are sensitive to high (above 9) and low (below 5) pH levels. At low pH levels, the bones of fish can become soft and their eggs may not hatch. Further, in acidic conditions, fish gills become clogged with mucus, making it difficult for the animals to get oxygen into their bloodstream. Air pollution can cause precipitation to have a lower than normal pH. The pH of unpolluted rain is about 5, while rain that has become acidic because of pollutants has a range from 3.5 - 4.5. This is called "acid rain." Other substances, like concrete or drain cleaner can cause the pH of water to be very high.

Water with a pH range from 6.5 - 8.6 is best for fish and most invertebrates. Most natural waters fall within this range. Exceptions include bog lakes, which often have a very low pH, some naturally eutrophic systems, and inland saline lakes which can have very high pH values. With few exceptions, water with a pH less than 5.0 or greater than 9.0 is harmful for aquatic life and is indicative of some kind of human input.