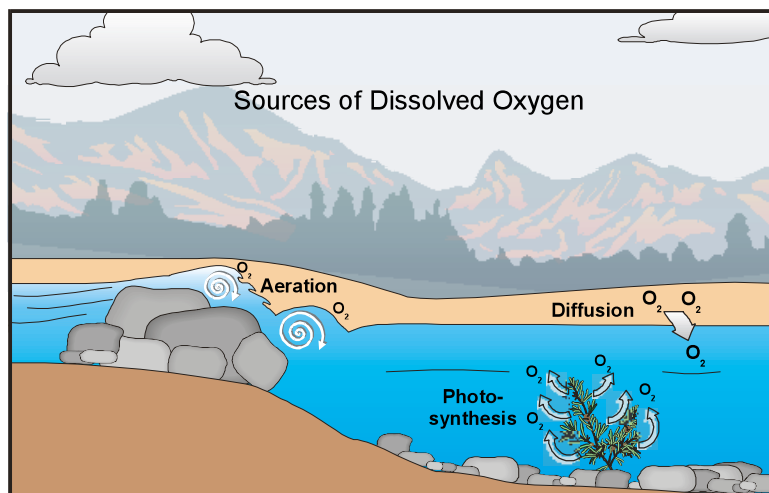
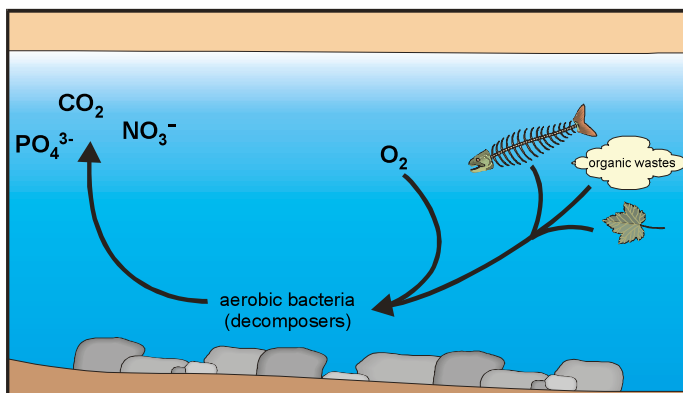


PRELIMINARY ACTIVITY FOR Biochemical Oxygen Demand

Oxygen available to aquatic organisms is found in the form of *dissolved oxygen*. Oxygen gas is dissolved in a stream through aeration, diffusion from the atmosphere, and photosynthesis of aquatic plants and algae. Plants and animals in the stream consume oxygen in order to produce energy through respiration. In a healthy stream, oxygen is replenished faster than it is used by aquatic organisms. In some streams, aerobic bacteria decompose such a large volume of organic material that oxygen is depleted from the stream faster than it can be replaced. The resulting decrease in dissolved oxygen is known as the *Biochemical Oxygen Demand* (BOD).



When it rains, organic material found in the soil is transported in the rainwater to streams and rivers. Additional organic material accumulates in the stream when aquatic organisms die. Bacteria and other microorganisms decompose this organic material. In a healthy body of water, this process has only a slight impact on dissolved oxygen levels. It serves to release vital



nutrients, such as nitrates and phosphates, which stimulate algae and aquatic plant growth. If the amount of decomposing organic material is too high, dissolved oxygen levels can be severely reduced. In a body of water with large amounts of decaying organic material the dissolved oxygen levels may drop by 90%—this would represent a high BOD. In a mountain stream with low levels of decaying organic material, the dissolved oxygen levels may drop by only 10% or 20%—a low BOD.

Organic materials, such as leaves, fallen trees, fish carcasses, and animal waste, end up in the water naturally and are important in the recycling of nutrients throughout the ecosystem. Organic materials that enter the water as a result of human impact can be considered sources of pollution.

BOD levels are dependent on the body of water being tested. Shallow, slow-moving waters, such as ponds and wetlands, will often have large amounts of organic material in the water and high BOD levels. A water sample from a pond could have an initial dissolved oxygen reading of 9.5 mg/L. After the five-day incubation period, the dissolved oxygen could be down to 1 mg/L resulting in a high BOD level of 8.5 mg/L. In contrast, a water sample collected from a cold

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mountain stream with an initial dissolved oxygen reading of 11 mg/L may have decreased to 9 mg/L after incubation, resulting in a BOD of only 2 mg/L. Use Table 1 as a rough guide for the data you gather¹.

BOD Level (mg/L)	Status
1–2 mg/L	Clean water with little organic waste.
3–5 mg/L	Moderately clean water with some organic waste.
6–9 mg/L	Lots of organic material and many bacteria.
>10 mg/L	Very poor water quality. Large amounts of organic material in the water.

Generally, steps in BOD testing are:

- Initial DO is measured on site.
- Five water samples are collected.
- Beginning 24 hours later, a sample is tested for dissolved oxygen every 24 hours for five days.
- If, before the fifth day, the dissolved oxygen concentration falls below 4 mg/L, oxygen is added to the remaining samples by aeration.
- The BOD value is the sum of the DO changes for all five bottles.

In the Preliminary Activity, you will gain experience using a Dissolved Oxygen Probe as you determine the DO level of a water sample provided by your teacher.

After completing the Preliminary Activity, you will first use reference sources to find out more about BOD before you choose and investigate a researchable question dealing with BOD. Some topics to consider in your reference search are:

- Biochemical Oxygen Demand (BOD)
- dissolved oxygen
- water pollution
- eutrophication

PROCEDURE

1. Prepare the Dissolved Oxygen Probe for use following instructions from your teacher. Place the probe in a beaker filled with about 100 mL of distilled water.
2. Connect the Dissolved Oxygen Probe to the interface and open the data-collection program. Allow the probe to stay in the water for about 5 minutes as the probe warms up.

¹ Table 1 is from the Student Watershed Research Project manual, 3rd Edition 1996.

3. Collect DO data.
 - a. Place the tip of the probe into the water sample being tested. Submerge the probe tip to a depth of 4–6 cm.
 - b. Start data collection. Gently stir the probe in the water sample. **Note:** It is important to keep stirring until you have finished collecting data.
 - c. Continue stirring and data collection until the readings have been relatively stable (stable to the nearest 0.2 mg/L) for about 30 seconds, then stop data collection.
 - d. Select the stable region of your graph, then display Statistics for that region. Note and record the mean value for that region as the DO of the water sample.

QUESTIONS

1. What was the DO of the water sample you tested in the Preliminary Activity?

2. How is DO level related to the water quality of a stream?

3. List three factors that contribute to high BOD levels.

4. Identify a local body of water that may have a high BOD. What causes you to think that it has a high BOD?

5. List at least one researchable question for this experiment.