Black Earth Creek & Limnology Minifacts & Analysis

Sheet 4

Dissolved Oxygen in Water

Information on Available Amounts of Oxygen for Living Organisms

1. Some basic facts:

A. Cold water is heavier than warm water and sinks to the bottom of lakes. However, if water gets so cold that it turns to ice, it will float.
B. Cold water can hold much more dissolved oxygen than can warm water.
C. Oxygen is a gas. A molecule of oxygen is made up of two atoms, bonded (joined) together. Therefore, its chemical formula is O_2.
D. 21% of our atmosphere is oxygen. Oxygen is also found dissolved in water of lakes, ponds, streams and oceans.

In the Black Earth Creek unit we are primarily concerned with the amount of oxygen dissolved in water. This dissolved oxygen is frequently abbreviated as D.O.

2. How does oxygen get into the water, anyway?

A. Most oxygen enters the water and becomes dissolved, at the surface of lakes and streams. Wind, waves, rapids and riffle areas are responsible for most of the oxygen found in the water.
B. The rest of the oxygen enters the water through the by-product of photosynthesis from plants.
C. Algae and other plants add oxygen to the water during the daytime hours.

3. Process of Photosynthesis

A. Most dissolved oxygen added by plants comes from millions of microscopic green algae. The larger seaweed-type plants don't add much at all.
B. On the next page is an illustration showing a general description of **photosynthesis**.

4. Why is oxygen important?

A. Nearly all living organisms need oxygen to carry on life processes.
B. Terrestrial organisms usually are not concerned about the amount of oxygen available, there seems to be plenty available in our atmosphere.

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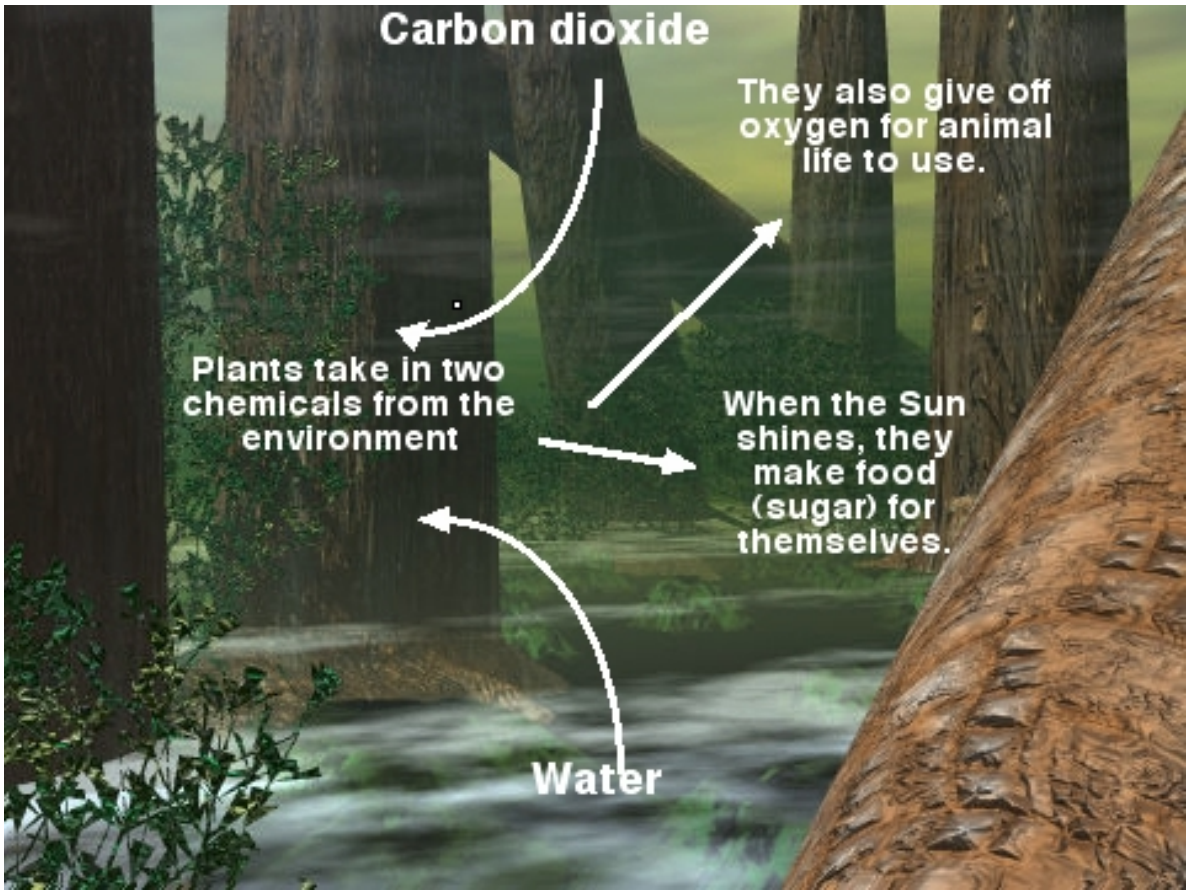
C. Aquatic organisms use gills, etc, to get their oxygen supply out of the dissolved oxygen found in the water in which they live. This dissolved oxygen can be in short supply and is often a limiting factor for populations of aquatic organisms.



5. How is dissolved oxygen used?

A. Decomposer bacteria use up 'tons' of dissolved oxygen in decaying dead plants and animals.
B. Sewage, metals, and other pollutants use up dissolved oxygen in the process of oxidation and respiration.
C. Fish and other aquatic organisms use up dissolved oxygen in the process of respiration.
D. Even aquatic plants use dissolved oxygen at night.

6. What effects do physical factors have on dissolved oxygen levels?

A. Lakes and ponds usually have their lowest oxygen levels in the early morning. Great quantities are used by plants and fish at night while none is being produced.
B. The highest levels of oxygen in the water is in early evening, after a full days production.
C. Lowest levels of oxygen are in late winter when there has been no production for along time, but much has been used up in respiration and decay.
D. Water temperature is very important in the amount of oxygen dissolved in the water. The colder the temperature of the water the more dissolved oxygen can be held in

the water. As water temperature increases its ability to hold dissolved oxygen decreases. Check the sheet called, **'Changes on Oxygen Sheet'** to see how much oxygen each temperature level can hold.

7. How much oxygen do aquatic organisms need?

A. The chart below gives you an idea of amounts of life can live in pond at different oxygen levels. The second chart shows the oxygen requirements of certain fish in order to sustain life.

Dissolved Oxygen Readings (in ppm)	
Below 5 ppm	**Very little life**
Above 5 ppm	**Large variety of life**

Type of Fish	Lowest Oxygen Level for Life	Type
Lake Trout	**8.3 ppm**	**Game fish**
Brown Trout	**7.8 ppm**	**Game fish**
Perch and Walleye	**6.4 pmm**	**Game fish**
Large and Smallmouth Bass	**5.1 ppm**	**Game fish**
Sunfish, Crappie	**4.7 ppm**	**Pan fish**
Bullheads, Carp, Suckers	**4.0 ppm**	**Rough fish**

Dissolved Oxygen: A good level of dissolved oxygen is essential for aquatic life.

Why is Dissolved Oxygen Important?

Dissolved oxygen analysis measures the amount of gaseous oxygen (O_2) dissolved in a water solution. Oxygen gets into water by diffusion from the surrounding air, by aeration (rapid movement), and as a waste product of photosynthesis.

When performing the dissolved oxygen test, only grab samples should be used, and the analysis should be performed immediately. Therefore, this is a field test that should be performed on site.

Environmental Impact:

If too Much -- Total dissolved gas concentrations in water should not exceed 110 percent. Concentrations above this level can be harmful to aquatic life. Fish in waters containing excessive dissolved gases may suffer from "gas bubble disease"; however, this is a very rare occurrence. The bubbles block the flow of blood through blood vessels causing death. External bubbles (emphysema) can also occur and be seen on fins, on skin and on other tissue. Aquatic invertebrates are also affected by gas bubble disease but at levels higher than those lethal to fish.

If too Little -- Adequate dissolved oxygen is necessary for good water quality. Oxygen is a necessary element to all forms of life. Natural stream purification processes require adequate oxygen levels in order to provide for aerobic life forms. As dissolved oxygen levels in water drop below 5.0 ppm, aquatic life is put under stress. The lower the concentration, the greater the stress. Oxygen levels that remain below 1-2 ppm for a few hours can result in large fish kills.