Two ways to test for DO

Using the LaMotte Winkler-Titration Test Kit

1) **Rinse** sample bottle 3 times with the water you want to test.

2) Obtain an air-tight sample by holding sample bottle under water. Slowly allow the water to fill the bottle. Cap the bottle underwater and remove from water.

3) Uncap sample bottle, making sure the plastic cone from the cap stays inside the cap. This plastic cone makes room for the chemicals that you are about to add. Please keep the plastic cone inside the cap at all times).

4) Add **8 drops** of **Manganous Sulfate Solution** (pinkish solution) and **8 drops** of **Alkaline Potassium Iodide Azide Solution** (same size bottle, clear solution).

5) Cap the sample bottle and mix by inverting several times. A precipitate will form.

6) Place bottle in an undisturbed area and allow precipitate to settle below the shoulder of the bottle. (Approximately 5 minutes).

7) Add **8 drops** of **sulfuric acid** (clear solution with red cap).

8) Cap and gently shake until precipitate is completely dissolved.

9) Fill titration tube (glass bottle and cap with hole in top) to the 20 ml mark.

10) Fill the direct reading titrator (syringe) with **Sodium Thiosulfate**. When filling the direct reading titrator, the upper stopper should be even with the zero mark. Make sure that there are no air bubbles in the titrator.

11) Insert the direct reading titrator into the center hole of the titration tube cap.

12) Add **one drop** of **Sodium Thiosulfate** and gently swirl the tube. Continue one drop at a time until the yellow-brown color is reduced to a very faint yellow. "Very faint" is subjective. It is helpful to hold the sample up against your sample bottle to determine the "faintness" of the color).

13) Remove the titration tube cap, being careful not to disturb the plunger.

14) Add **8 drops** of the **Starch Indicator Solution** and gently swirl.

15) Replace the titration tube cap.

16) Continue adding **one drop** of **Sodium Thiosulfate** and swirling until the blue solution turns clear.

17) Read the test results where the plunger tip meets the scale. Record as **ppm** (parts per million) dissolved oxygen.

Using the LaMotte Oxygen in Water Test Kit

1) **Rinse** sample bottle 3 times with the water you will be testing then fill the vial to overflowing with the water to be tested.

2) Add **two Dissolved Oxygen Tablets** and cap. The water will overflow the vial. Make sure there are no air bubbles in the sample.

4) Gently invert until the tablets have dissolved.

5) Wait 5 minutes for full color development.

6) Facing a source of natural light, hold the vial flat against the white section of the ColoRuler. Match the sample color to a color standard. Record the oxygen level as zero, low, or high.

What is Dissolved OXYGEN ?

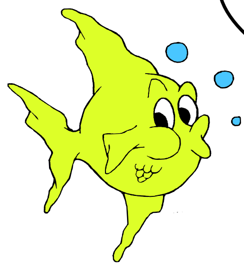
O_2

Activity booklet created by:

NJ Sea Grant Consortium

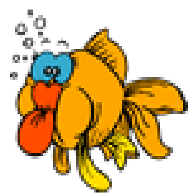
njseagrant.org

NAME: ______________________



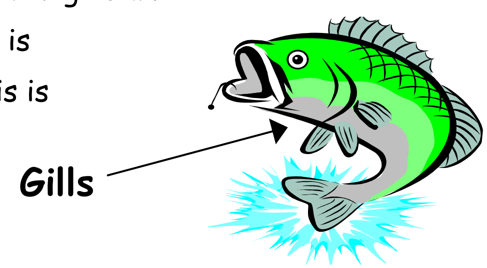
What is Dissolved Oxygen?

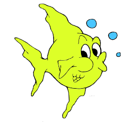
Take a deep breath... aahhh… you just took in air molecules that contain a lot of oxygen gas, also known as O_2. Sure, there are other gases and elements we breathe in, but oxygen is the most important. Us humans, just like all living creatures, need to breathe. Like other animals that live on land, we take oxygen from the air to live. Every time we take a breath our lungs take in air and extract from it the oxygen our body needs. The cells in our body need oxygen to function. Without oxygen we could not live.



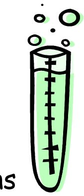
When we go underwater we cannot breathe because there is no air available for us. Yet fish breathe. Did you ever wonder how a fish breathes underwater if there is no air? How do fish survive? What about other aquatic creatures?

Even though we cannot use it for breathing, there is oxygen or O_2 in water. Most fish, and other aquatic creatures, have gills. Gills are similar to our lungs, except they take in and extract oxygen out of water. Fish pump water over their gills and the oxygen that is in the water is transferred to their cells. This is how they breathe!

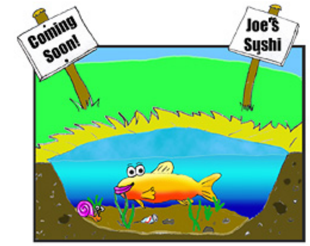




Testing for Dissolved Oxygen

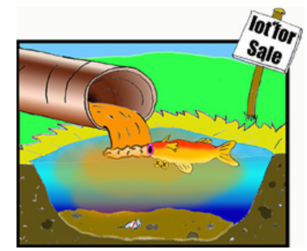


When scientists test for dissolved oxygen they use special kits that measure dissolved oxygen in ppm- parts per million. ppm means that for every 1 million parts of water some of those parts are oxygen molecules. Scientists use this scale (ppm) to measure dissolved oxygen because there are normally only from 1 to 18 molecules of oxygen for every 1 million molecules of water.



DO above 5ppm

Waters with DO levels of 5-14 ppm are considered healthy ecosystems capable of supporting many different kinds of aquatic life. DO levels can change in small amounts during the day due to factors such as wind or temperature. This is normal.



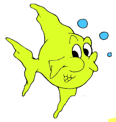
DO below 5ppm

When DO levels dip down to 3-4 ppm, aquatic life becomes stressed. If oxygen levels drop below 3 ppm even the hardiest of organisms cannot live. Large fluctuations of DO are also stressful to life underwater. Low levels, fluctuating levels or the absence of DO is often a sign that pollution is getting into the water.

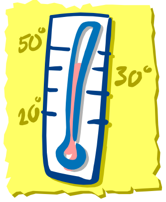
On the opposite end of the spectrum, if oxygen levels go over 14 ppm, the oxygen molecules will form harmful gas bubbles inside an animal's blood vessels causing "gas bubble disease." This is deadly to most aquatic creatures. Luckily, this is very rare.

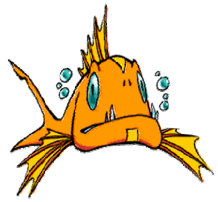
Scientists use several terms to describe the varying DO levels found in aquatic ecosystems throughout the year:

- **Healthy Water** generally contains at least 5ppm of dissolved oxygen.
- **Hypoxia** occurs when water contains low levels of dissolved oxygen (2ppm – 4ppm).
- ***Anoxia*** occurs when water contains very little or no oxygen (0-1ppm)



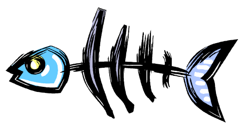
What can affect Dissolved Oxygen?





Temperature: Oxygen is a gas and gases are more soluble in cooler temperatures than warm temperatures, so cold water can hold more DO molecules!

Respiration: All aquatic plants and animals use up DO in the water to breathe (respire). Even though plants photosynthesize and produce DO during daylight hours, they use up oxygen at night.



Decomposition: The bacteria that decomposes dead and decaying materials uses DO to break those things down into simpler things. This causing DO levels in the water to drop. This often happens when excess nutrients enter a body of water initially causing too much algae growth. As the overabundant algae decays it uses up a lot of DO.

QUESTIONS

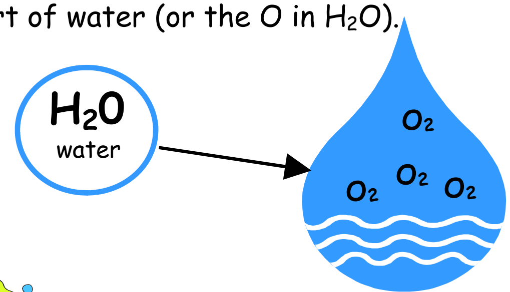
1. Does warm water hold more or less DO than cold water?

2. Plants only put oxygen in the water, they never use up oxygen. True or False?

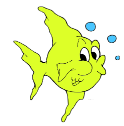
3. Would DO levels change if too many fish were put in a fish tank?

4. If a rainstorm washes the extra fertilizer used on your garden into the nearby lake causing an algae bloom, what could happen to DO levels in the lake?

The oxygen that is in water is known as **Dissolved Oxygen (O_2)**. It is important for you to know that the Dissolved Oxygen or the O_2 molecule is different than the oxygen molecule that is a part of water (or the O in H_2O).

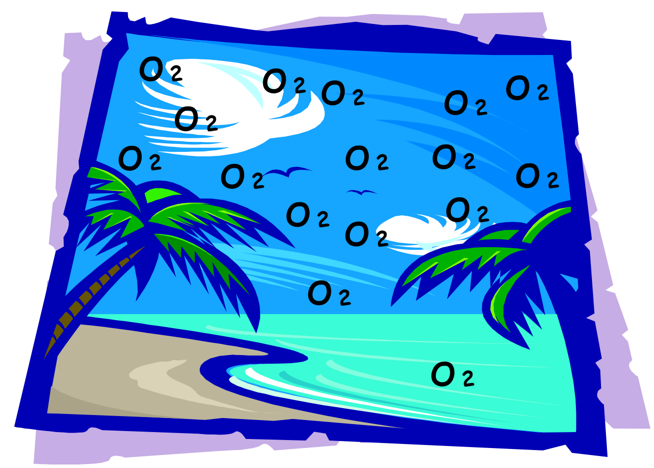


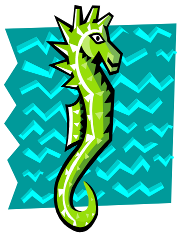
Inside the H_20 molecules are microscopic dissolved oxygen (O_2) gas molecules. Aquatic animals use O_2 molecules to breathe.



Why Dissolved Oxygen so Important

Keeping track of how much dissolved oxygen is in the water is extremely important! Unfortunately for fish, there is much less dissolved oxygen in water than in air. In the air, 1 out of 5 molecules are oxygen molecules available for respiration (breathing). In water, there might only be 1 out of 200,000 molecules that are oxygen molecules available for respiration! Any minor change in the amount of dissolved oxygen in the water can have drastic effects on the lives of aquatic creatures!





It is also important to know the amount of dissolved oxygen molecules in the water because this can determine what life can live there. Some creatures like bass or seahorses require more dissolved oxygen than other animals like snails or eels.

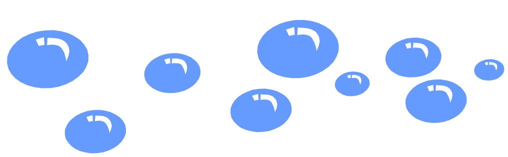
QUESTIONS

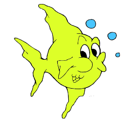
1. How do aquatic creatures breathe oxygen in the water?

2. Can animals use the oxygen found in H_2O to breathe?

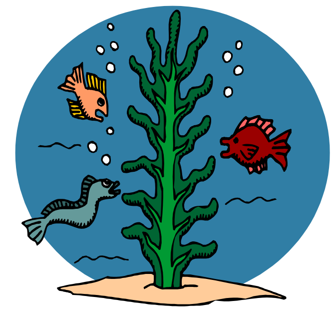
3. Is there more oxygen found in the air or in water?

4. What can dissolved oxygen tell us about the amount of life that could be found in the water?





How does Dissolved Oxygen (DO) get into Water?



The Growth of Plants: DO is released into the water mostly through photosynthesis. As plants take in carbon dioxide, they excrete oxygen that aquatic creatures use to breathe.

Water Turbulence: DO can enter water as it mixes with oxygen rich air. Waterfalls, rapids and waves all add DO to water. Winds blowing over a body of water help DO enter the water too.

QUESTIONS

1. If there were many underwater plants in the water would there be more dissolved oxygen in the water as well?

2. Would dissolved oxygen be able to enter the water better in a calm, sheltered area or in a unsheltered, windy area?

3. If there was a drought, a waterfall could stop flowing. What do you think would happen to dissolved oxygen levels in the area around the waterfall during a drought?