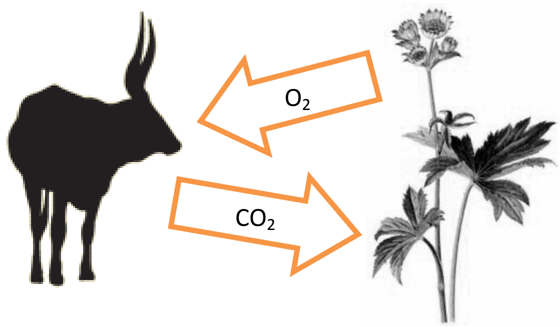
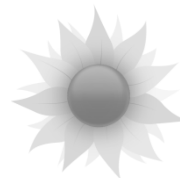
Oxygen Underwater

What is Oxygen?
Oxygen is essential to all life. All living things—plants, animals, and microorganisms—need oxygen in order to break down organic molecules (such as carbohydrates and fats) to get energy.

We call this process ***Respiration***.

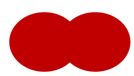




Photosynthesis is the source of the oxygen.

Only organisms that can engage in photosynthesis (such as green plants) can produce oxygen. In photosynthesis, plants use light energy to make organic molecules, which can be used as an energy source later. Oxygen is the "waste product" of photosynthesis.

Oxygen is found in many common molecules, including water (H_2O) and carbon dioxide (CO_2). But the form of oxygen we need constantly is pure oxygen (O_2), a gas. It consists of two oxygen atoms joined together:



Oxygen in the Atmosphere and Under Water
Those of us who live on land seldom need to worry about having enough oxygen. Oxygen gas makes up about 20% of the earth's atmosphere, so unless you are climbing a high mountain or working deep in a mine, there is usually enough oxygen around you to keep you alive—although when you're exercising strenuously, it doesn't always feel that way!

http://www.streetsblog.org/2006/11/22/sacrificing-central-park-to-appease-the-traffic-gods/

But if you live under water, it's a very different story. Oxygen molecules can dissolve in water, and we refer to this as "dissolved oxygen" or "DO". But dissolved oxygen is only present in very small amounts.

Imagine just one oxygen molecule surrounded by 100,000 water molecules. This represents a DO concentration of only one part in 100,000 –or it can be expressed as 10 parts per million. Yet 10 parts per million, or 10 mg/L, is an excellent level of dissolved oxygen and is plenty for the needs of fish and other aquatic animals. With their gills and other adaptations they can easily extract such small amounts of DO from water. But when DO levels dip below 5 mg/L, many species struggle to survive. Still, some organisms are able to live at lower DO levels than others, so the amount of DO in water often determines exactly which species can live in a particular aquatic environment.

How does Dissolved Oxygen get into the water?

The main way water picks up dissolved oxygen is when water mixes with air. Fast currents, waterfalls, waves, bubbles, even raindrops falling through the atmosphere bring oxygen and water together.

This explains why streams, with flowing water, usually have higher levels of DO than lakes, where the water barely moves.

http://www.publicdomainpictures.net/viewimage.php?image=11863&picture=waterfall

Plants in the water are also an important source of dissolved oxygen as they carry out photosynthesis. Aquatic plants may be microscopic such as tiny plankton, or they may be macroscopic (visible without magnification). Like plants on land, they can only produce oxygen during daylight. During the night, plants use oxygen and perform respiration until the light returns the next day.

What Removes Dissolved Oxygen from Water?

Dissolved oxygen is absorbed by living things as they carry out respiration. They take up oxygen and release carbon dioxide in its place.

http://sharon-taxonomy2009-p3.wikispaces.com/Bacteria

Bacteria can rapidly deplete dissolved oxygen from waterways as they decompose organic matter. When human activities cause large amounts of organic matter to enter waterways, decomposition by bacteria can lower DO to far below the levels fish and other aquatic life need to survive. These conditions are called "anoxic" (without oxygen), and places where this occurs are often called "*dead zones*". In recent years, dead zones have appeared in lakes, in estuaries and inland bays, and in coastal areas around the world.

There are several other factors that can lower the ability of water to hold dissolved oxygen. We will look at some of them in later activities.