Module 6: Ocean Water Chemistry
Topic 4 Content: Dissolved Gases Notes

There are three main types of dissolved gases in seawater: carbon dioxide, nitrogen, and oxygen. Oxygen and carbon dioxide are involved in everyday life functions such as respiration and photosynthesis. Nitrogen is necessary for the basic life functions of most organisms. Let's begin our examination of the dissolved gases by taking a closer look at oxygen.

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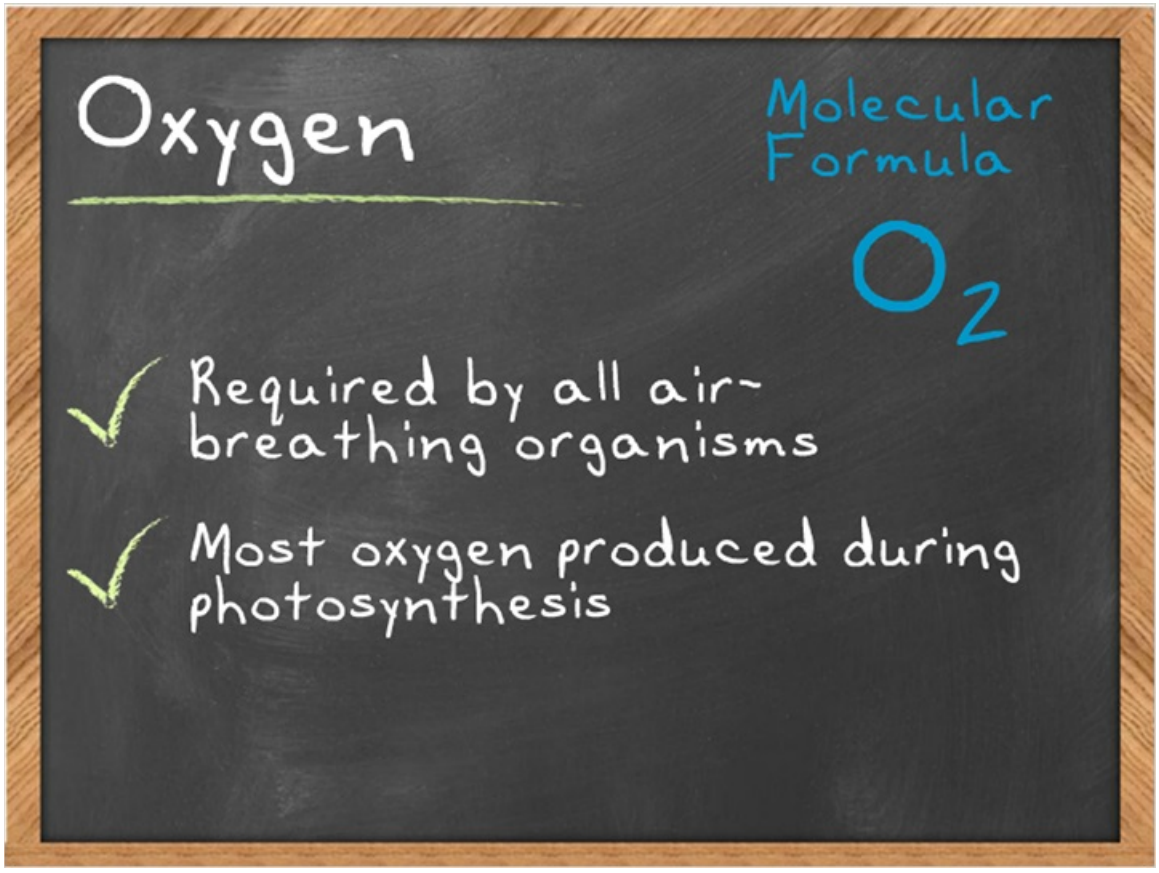
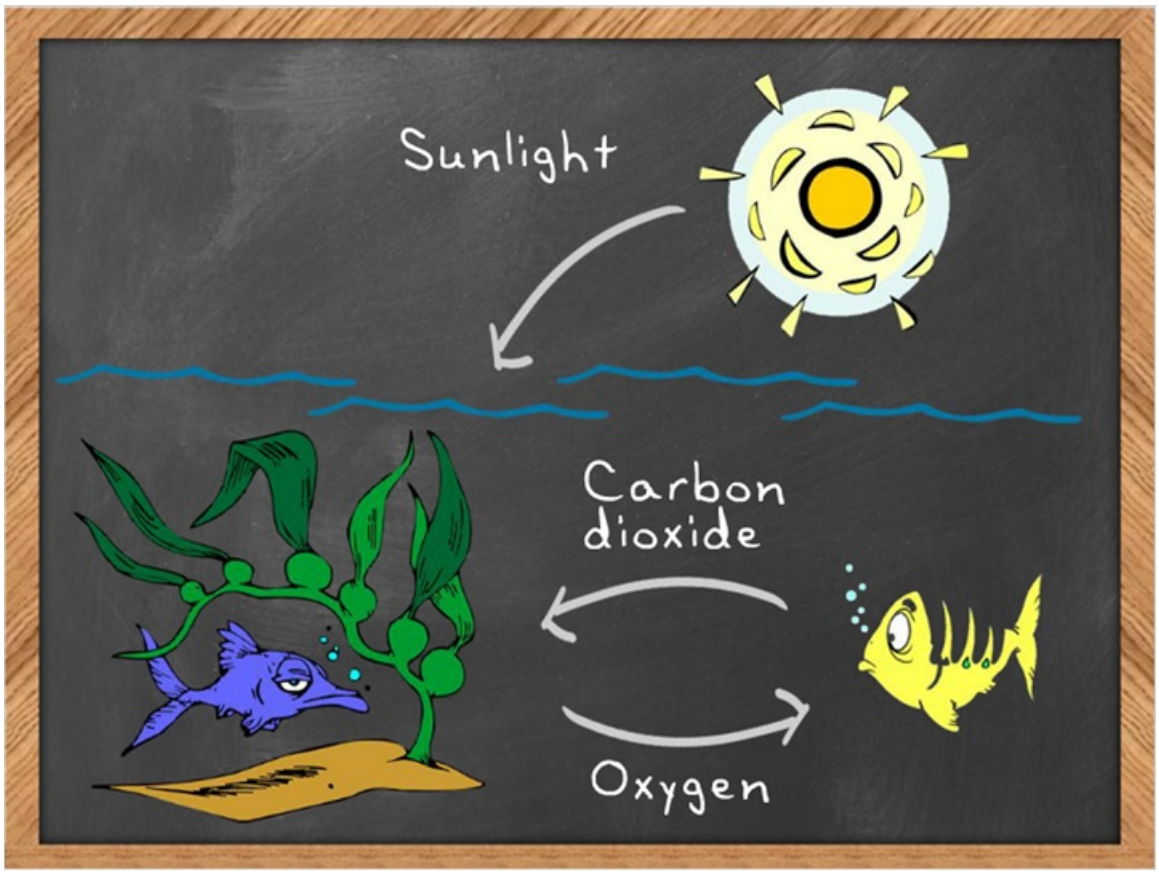


All air-breathing organisms, and most animal life in the ocean, require oxygen to survive. The molecular formula for oxygen is pronounced O_2. Most of the oxygen in existence is a result of photosynthesis.



In fact, marine plants and algae produce much of the Earth's oxygen supply. How do they do it? Let's find out! Photosynthesis is the process through which plants make their own food by combining carbon dioxide and energy from the Sun. Marine plants and algae obtain dissolved carbon dioxide from the water. While producing food, marine plants and algae expel oxygen into the water as a byproduct. This oxygen mixes with the seawater providing the dissolved oxygen necessary for other marine organisms.

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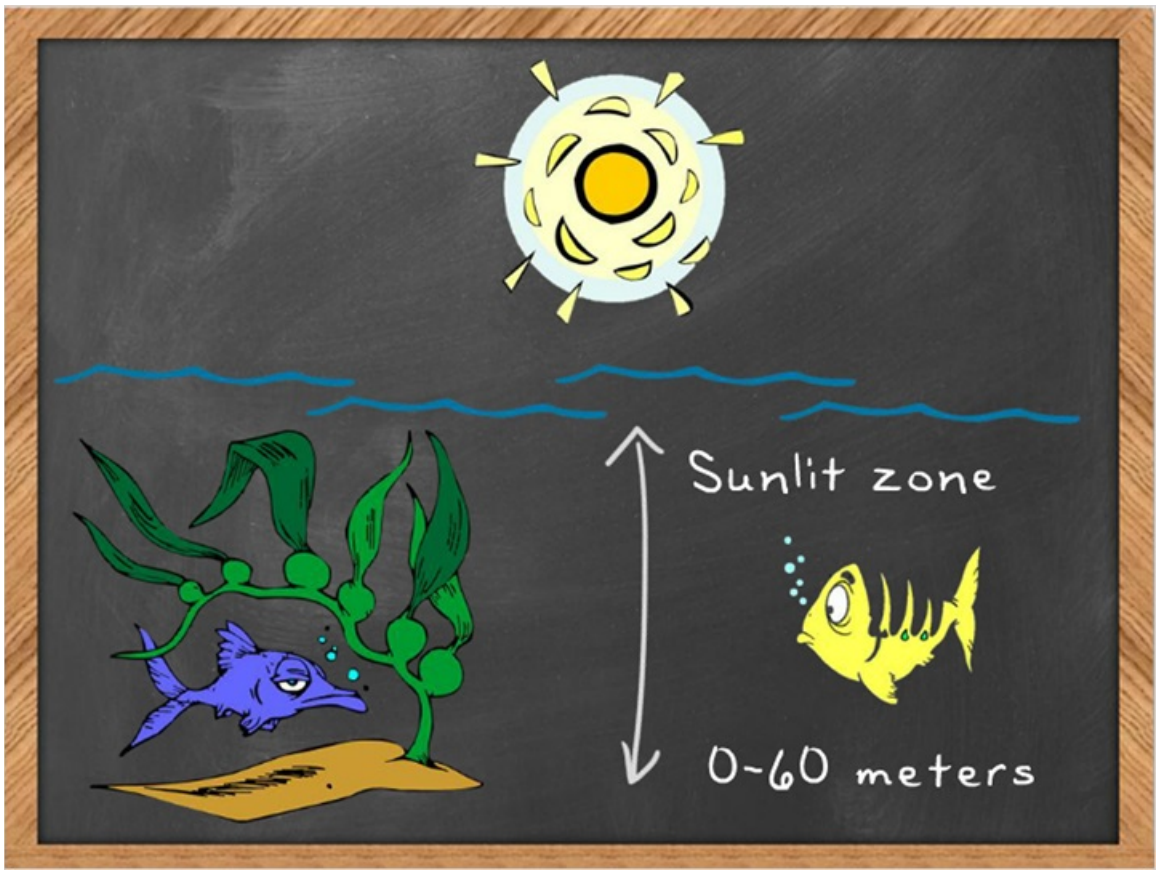
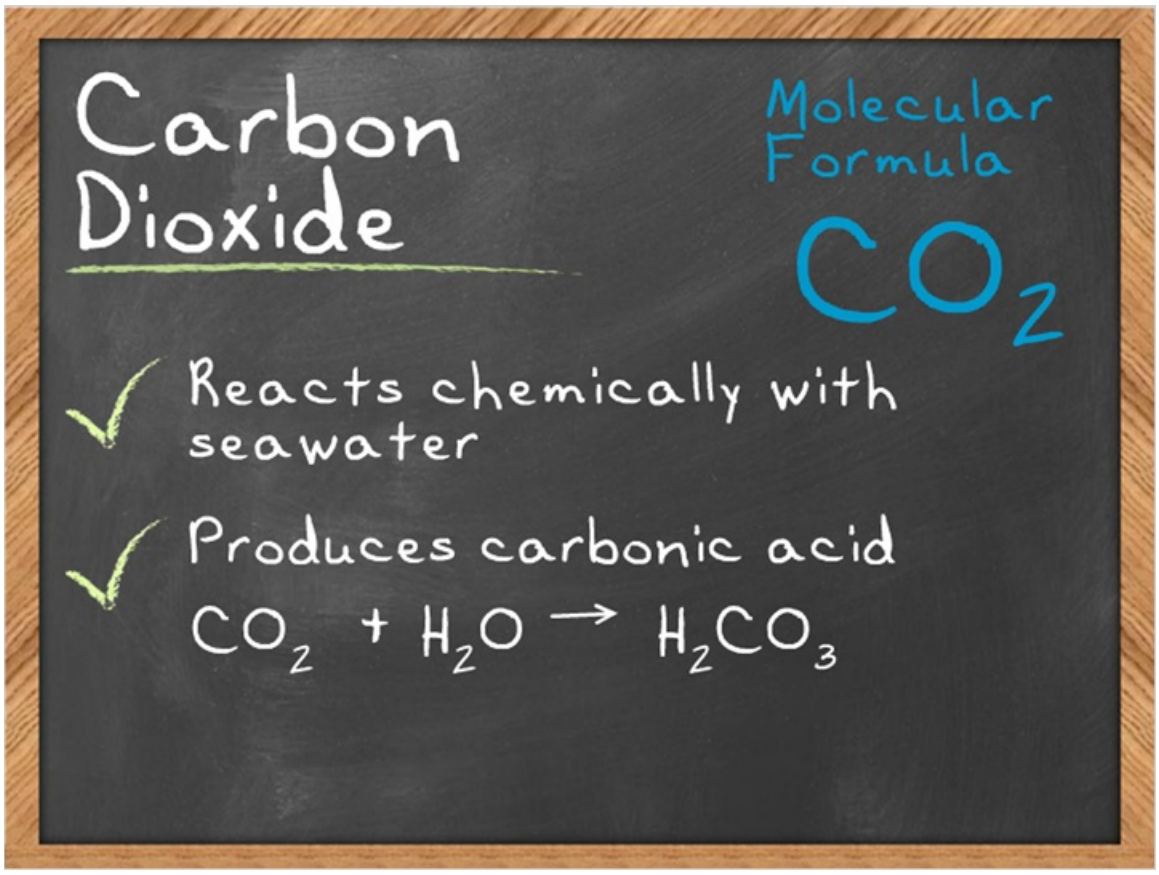
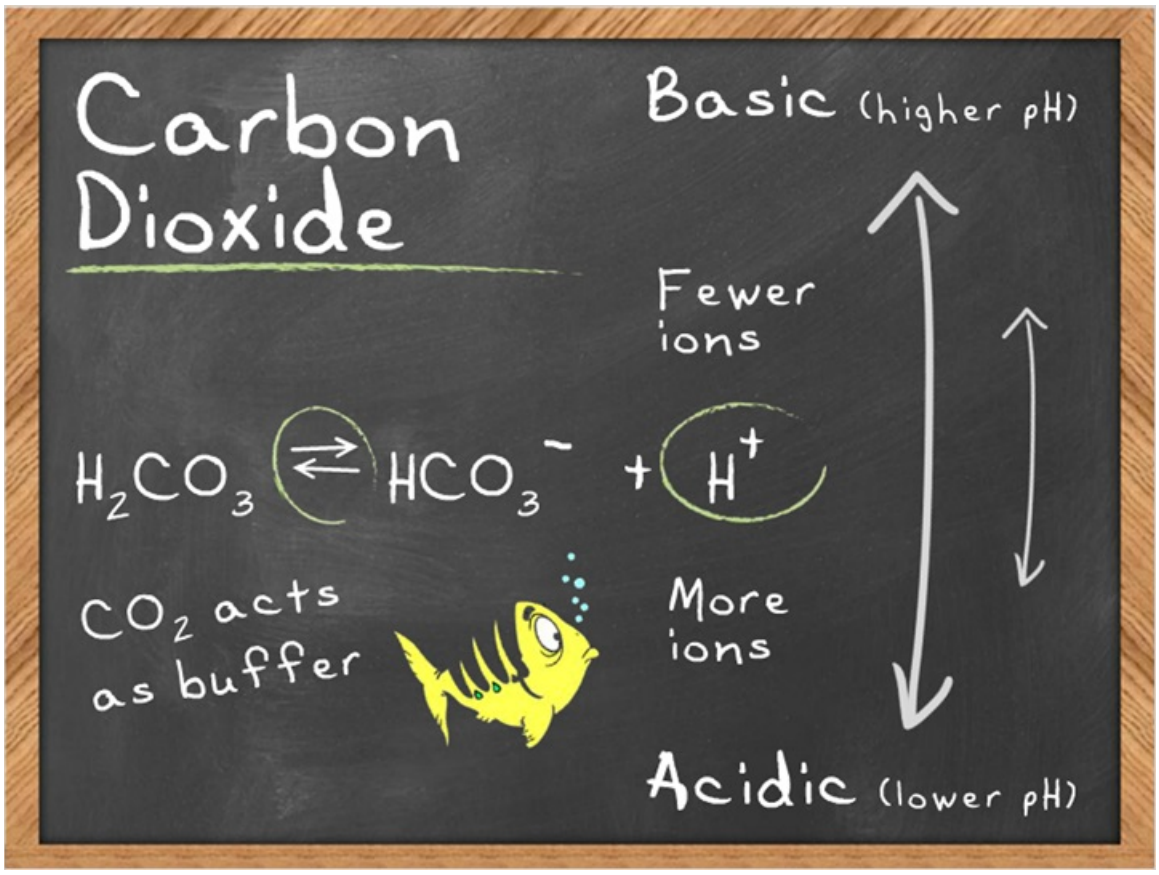


Remember that photosynthesis requires sunlight to make food. Photosynthetic organisms – those which rely on sunlight to produce energy – all live within the top 0-60 meters of the ocean. This narrow range, called the sunlit zone, is the depth to which sunlight penetrates, and it contains the highest levels of dissolved oxygen. Oxygen is also added to seawater by diffusing from the atmosphere.



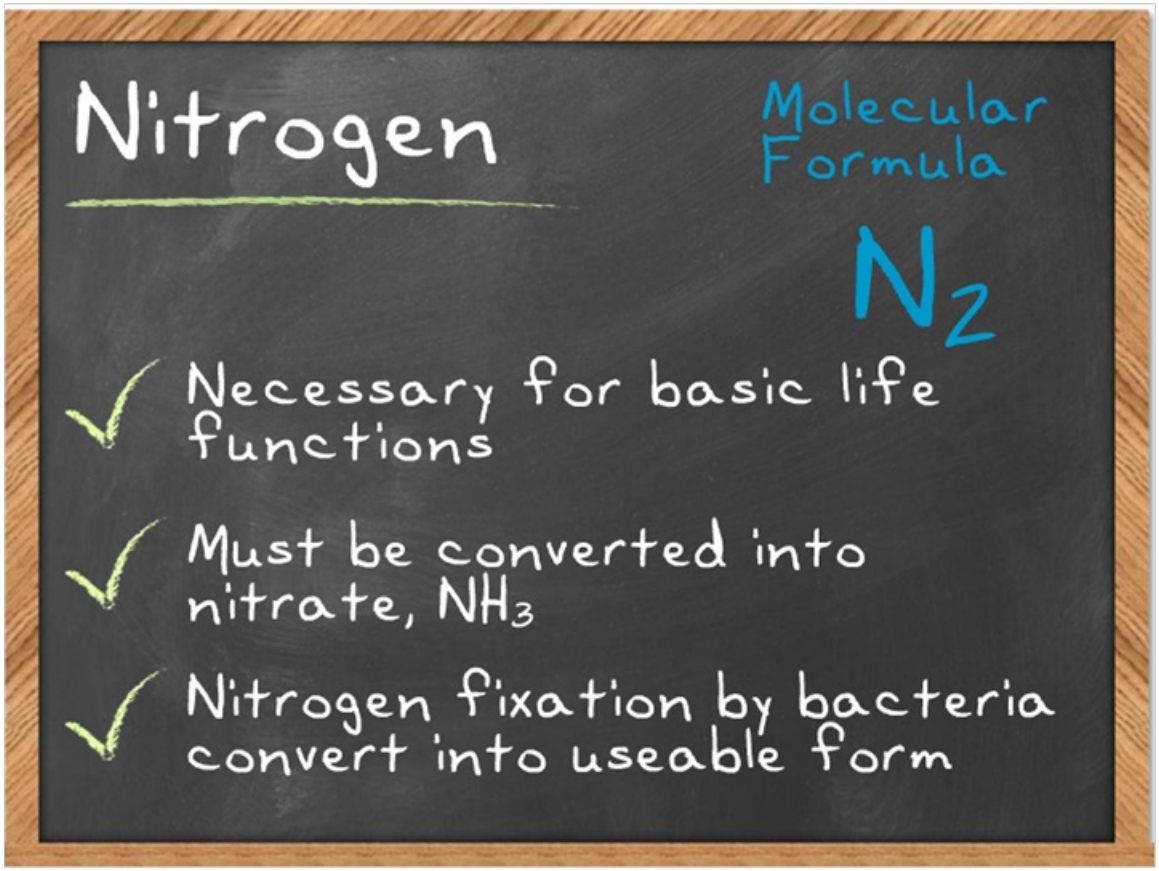
Carbon dioxide is another important gas found in seawater. The molecular formula for carbon dioxide is pronounced CO_2. Carbon dioxide differs from oxygen in that it reacts chemically with seawater. When carbon dioxide enters the water, it forms a new molecule called carbonic acid, represented by the molecular formula pronounced H_2CO_3.



On its own, pure water has a pH of 7. It is said to be neutral, neither acidic or basic. Typically, seawater has a pH of 8.1, making it slightly basic. As shown in this chemical reaction, carbonic acid breaks apart, or dissociates, into two parts: a bicarbonate ion and a hydrogen ion. This reaction is reversible so it can add or remove hydrogen ions.

The amount of hydrogen ions in seawater determines whether it is acidic or basic. More hydrogen ions increases the acidity of seawater. Fewer hydrogen ions make the seawater more basic. As acidity increases, the pH goes down. As acidity decreases, the pH goes up. Large fluctuations in pH are harmful to ocean life.

However, a buffer limits the change in pH level. Carbon dioxide acts as a buffer because the dissociation of carbon dioxide in seawater is reversible. This is helps provide a more stable environment for ocean life.



Nitrogen is necessary for the basic life functions of most organisms. The molecular formula for nitrogen is pronounced N_2. Unfortunately, most organisms cannot use nitrogen in its atmospheric form. Instead, nitrogen must be changed, or fixed, into a usable form, such as nitrate.

Many organisms are capable of nitrogen fixation, or converting the atmospheric form of nitrogen into a usable form for other organisms. There are a few ocean dwellers that are capable of nitrogen fixation including a few types of bacteria.