



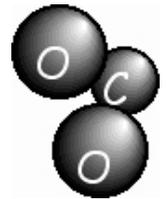
Black Earth Creek & Limnology Minifacts & Analysis Sheet 6

Carbon Dioxide Amounts in Water

Information on Carbon Dioxide Amounts & Water Quality

1. What is it?

Carbon dioxide is a poisonous gas. A molecule of carbon dioxide is made up of 1 part carbon and 2 parts oxygen. Therefore, its chemical formula is CO_2 .



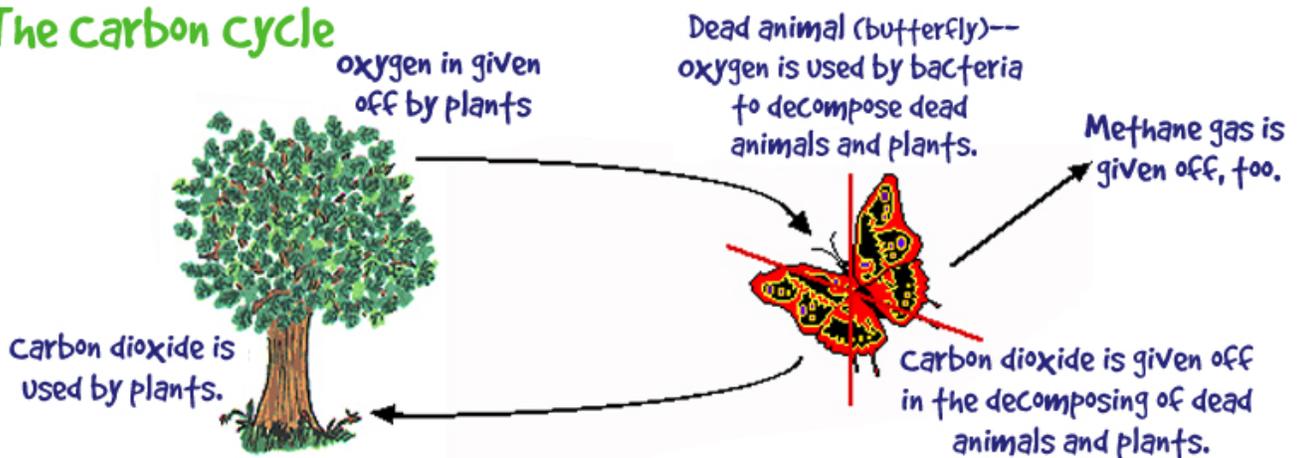
2. Where is it found?

- A. In our atmosphere. About .03% of our air is carbon dioxide.
- B. In solution, (mixed in) the water of lakes, ponds, streams and oceans.

3. Where does it come from?

- A. It is produced by almost all living organisms (both plant and animal).
- B. It is given off, (exhaled) into the air every time we breathe.
- C. Even organisms without lungs or gills release carbon dioxide into the environment. This includes insects, plants, bacteria, etc.
- D. Plants give off carbon dioxide mostly at night.
- E. All aquatic organisms release this gas into the water. Some of it bubbles to the surface, some of it dissolves (mixes in) with the water, but most of the carbon dioxide found in the water is produced by organisms (bacteria mostly) that carry on decomposition of dead material.

4. The carbon cycle



5. Carbon Dioxide and Plants -- a nest relationship!

- A. Most of the plant material in an aquatic environment is made up of algae.
- B. During daylight all plants use carbon dioxide and give off oxygen. This process is called **photosynthesis** – it requires light.
- C. At night, the opposite is true. Plants use oxygen and give off carbon dioxide. This process is called **respiration**.
- D. All dead plants will use up a lot of oxygen and give off a lot of carbon dioxide as they rot and decay.

6. Carbon Dioxide and Animals - another exciting relationship!

- A. All animals use oxygen and give off carbon dioxide.
- B. Dead animals continue to use oxygen and give off carbon dioxide as they rot and decay.

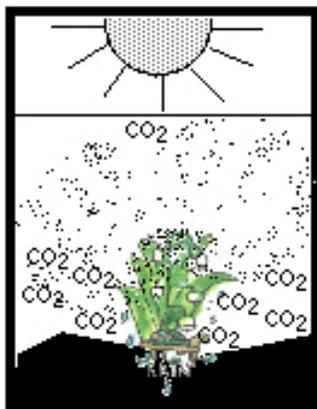
7. Carbon Dioxide and other chemical factors?

- A. Because oxygen is used up as carbon dioxide is produced, the quantities of these gases are usually opposite in quantities. This means if there is a high carbon dioxide amount there is going to be a low oxygen amount.
- B. High levels of carbon dioxide will make the pH more acidic.

8. Other important facts about Carbon Dioxide.

- A. A high level of carbon dioxide usually indicates that there is a lot of dead material undergoing decomposition. This may occur naturally, but could be the result of different types of water pollution or water treatment.
- B. The carbon dioxide in a lake is not constant; it changes. On the next page are some diagrams and explanation of some of those changes and fluctuations that occur in the amounts of carbon dioxide.

1. **Top / bottom** - Dead organisms usually sink. As a result, the carbon dioxide level caused by their decomposition is usually greater near the bottom of the lake.



2. **Day / Night** - The carbon dioxide level will be greater at night because plants will be using oxygen and producing carbon dioxide at the time.
3. **Spring / Fall** - The carbon dioxide level will be greater in the fall as a result of dead algae plants and animals that have died over the winter and are now decaying.
4. **New / Old** - In terms of succession, an older lake will have more carbon dioxide because of more decay due to more organisms.

9. When as Carbon Dioxide a limiting factor?

- A. Carbon dioxide is a poisonous gas to most animals.
- B. Levels of 30 ppm (parts per million) are harmful to most organisms.
- C. Levels greater than 35 ppm are considered limiting to all aquatic organisms.
- D. The chart below shows the **Average Carbon Dioxide Amounts** at a good freshwater pond.
- E. As shown in the chart below, the amounts of carbon dioxide that are available to plants changes during the day. It also changes during this time if the pH changes.
- F. The next chart below that is showing the **Tolerance of Different Organisms** to carbon dioxide.

Average Carbon Dioxide Amounts	
Time of Day	ppm
6 am	23
9 am	16
12 pm	9
3 pm	6
6 pm	3

Organisms Groups	Tolerance to CO₂
Game fish group	Very low amounts
Pan fish group	Medium to Low amounts
Rough fish group	Medium to High amounts
Macroinvertebrates Insect young – nymphs	Medium to Low amounts
Macroinvertebrates Insect young – larva	Medium to High amounts
Bacteria	High amounts