



CENTRAL GULF OF MEXICO

COSEE THEMATIC TOPIC AREA:

Potential crossover between Physical Parameters and Marine Organisms and Habitats.

ACTIVITY TITLE:

CO₂ and YOU

AUTHORS:

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GRADE SUITABILITY:

Fifth through Seventh Grade

SCOPE:

Marine Biology/Oceanography/Earth Processes/Chemistry

SEQUENCE:

This activity should follow a discussion of human and plant interaction for the transfer of CO₂ to oxygen. Precede the activity with a Microsoft PowerPoint presentation.

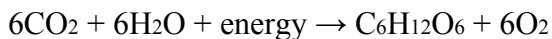
LENGTH OF TIME NEEDED:

Two classes of one hour each

BACKGROUND SUMMARY:

Do you know that you are a part of the **carbon cycle**? **Carbon dioxide** is a gas in our atmosphere that is used by plants for **photosynthesis** and is given off by living organisms – including you - during **respiration**. The **carbon cycle** is the process whereby carbon is transformed from carbon dioxide into plants on the land and in the ocean and eventually

returned back to the atmosphere. Plants on the land and in the ocean have **chlorophyll**, a pigment that gives them their green color and allows them to use the sun's energy for growth. Plants use the energy from the sun to convert carbon dioxide and water into sugar and oxygen in a process known as photosynthesis:



The opposite process, known as respiration, combines sugar and oxygen to form carbon dioxide and water:



The land and ocean biomes are both important in the carbon cycle. Each is responsible for about half of global photosynthetic production. We can see the impact of photosynthesis on levels of carbon dioxide in the atmosphere during different seasons of the year. Carbon dioxide levels are lower in the summer when plants, especially those on land, are actively growing. Inversely, such levels are higher in the winter when processes that give off carbon dioxide exceed those that take it up. The activities of people have perturbed the carbon cycle through the burning of **fossil fuels** such as coal, oil and gasoline. We know that carbon dioxide levels in the atmosphere are increasing based on long term measurements since 1957 and even before that by looking at bubbles trapped in ice core samples. There is growing concern that increasing levels of carbon dioxide will alter the Earth's climate in ways that are not yet fully understood. Increasing carbon dioxide can also lead to **ocean acidification**. So what does that mean? It is the increasing acidity or concentration of hydrogen ions that results when carbon dioxide dissolves in water. Ocean acidification may have serious consequences for some marine organisms and harm the marine ecosystems of which they are a part. Based on laboratory studies, it has been shown that coral and other marine organisms that produce calcium carbonate may be impaired by increasing ocean acidification.

OBJECTIVES:

Students will be able to:

- Define and utilize key vocabulary.
- Compare how photosynthesis and respiration relate to land and ocean biomes.
- Demonstrate the chemical reactions for photosynthesis and respiration.
- Demonstrate the processes involved with the carbon cycle.
- Graph how human activity has altered the carbon cycle and levels of CO₂ in the atmosphere.

MATERIALS:

- Diagram of carbon cycle,
- Styrofoam balls,
- Glitter,
- Glue,
- Stirrer straws,

- Tag board letters,
- Station markers,
- Card board dice,
- Graph paper and CO₂ increases over time handout, and
- Tempra paint.

SETTING:

Classroom

ACTIVITY DESCRIPTION:

- The students will watch a PowerPoint presentation over viewing photosynthesis, respiration and the carbon cycles. The PowerPoint will also highlight the impact of humans on the recent increases in carbon dioxide in the atmosphere.
- The students will design a tactile model of the processes for photosynthesis and respiration.
- Based on a modified game from Project Wet titled “Incredible Journey,” the students will apply knowledge of the carbon cycle by following the path of a carbon atom through the carbon cycle.
- The students will create a line graph demonstrating the increase in carbon dioxide in the atmosphere over time.

POSSIBLE EXTENSIONS:

- Show United Streaming video *The Cycle Series: The Carbon Cycle*.
- Research and create a terrarium to demonstrate land based example of the carbon cycle.
- Discuss the coral reef ecosystem and the possible impact of increased CO₂ and ocean acidification on the coral reef.
- The students will create coral reefs. For further information on the impact on ocean acidification, refer to www.ocean-acidification.net.
- Select given a selected year of carbon dioxide increases and determine mean, mode, range, and median of the data set.

TEACHER EVALUATION:

The teacher may utilize matching of terms to definitions to assess understanding of key terms. The teacher may also evaluate the students’ ability to label the processes of the carbon cycle. The teacher will check graphing of CO₂ increases over time.

OCEAN LITERACY: THE ESSENTIAL PRINCIPLES AND FUNDAMENTAL CONCEPTS OF OCEAN SCIENCES K-12:

(3) The ocean is a major influence on weather and climate.

- (f) The ocean dominates the Earth's carbon cycle. Half the primary productivity on Earth takes place in the sunlit layers of the ocean and the ocean absorbs roughly half of all carbon dioxide added to the atmosphere
- (4) The ocean makes Earth habitable
 (a) Most of the oxygen in the atmosphere originally came from the activities of photosynthetic organisms in the ocean.
- (5) The ocean supports a great diversity of life and ecosystems.
 (f) Ocean habitats are defined by environmental factors. Due to interactions of abiotic factors such as salinity, temperature, oxygen, pH, light nutrients, pressure, substrate and circulation, ocean life is not evenly distributed temporally or spatially, i.e., it is "patchy". Some regions of the ocean support more diverse and abundant life than anywhere on Earth, while much of the ocean is considered a desert.

NATIONAL SCIENCE EDUCATION STANDARDS:

Unifying Concepts and Processes
 Life Science
 Physical Science
 Personal and Social Perspectives

REFERENCES:

Castro, Peter and Huber Michael E. 2007. *Marine Biology*. McGraw Hill, New York. 460 pp.

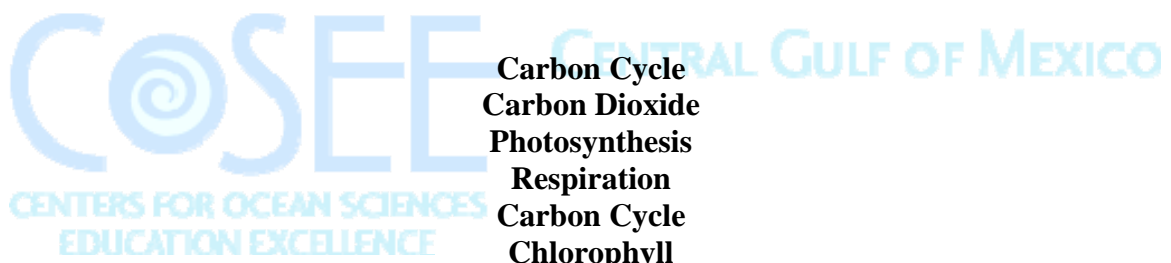
1995. *Project Wet*, "The Incredible Journey". The Watercourse and the Council of Environmental Education.

Lohrenz, Steven E. Department of Marine, presentation to MS COSEE:CGOM teachers, June 2008 titled *The Ocean's Role in Carbon Cycling and Climate Change*.

2008. *Science: A Closer Look* (5th grade text). McGraw Hill, New York. 690 pp.

Field,C.B.,Behrenfield,M.J.,Randerson,J.T.,Folkowski,P.,1998. Primary Production of the biosphere: integrating terrestrial and oceanic components. *Science*, 281:237-240.

KEY TERMS



Carbon Cycle
Carbon Dioxide
Photosynthesis
Respiration
Carbon Cycle
Chlorophyll
Fossil Fuels
Ocean Acidification