

Lesson Planning Tool for Climate Change

Title of Lesson: Ocean Acidification

Grade Level: 7-8

Subject: Life Science and Earth Science

Source(s) of the lesson:

Do now- <http://mass.pbslearningmedia.org/resource/tdc02.sci.life.eco.ccycle/carbon-cycle-diagram/>

Activity-http://www.blueworldtv.com/images/uploads/lesson-plans/Lesson_plan_webisode41Acidification.pdf

Background-<http://www.neaq.org/learn/climate-change-education-resources/climate-change-ocean/> and http://ocean.si.edu/sites/default/files/lesson_plan/additional_files/Sea%20Surface%20Temperature%20and%20Coral%20Bleaching.pdf

Essential Question(s):

How do oceans become acidic?

Massachusetts Curriculum Frameworks Science Standards:

7 LS 2-3 Develop a model to describe that matter and energy are transferred among living and nonliving parts of an ecosystem and that both matter and energy are conserved through these processes.

8 ESS 3-5 Examine and interpret data to describe the role that human activities have played in causing the rise in global temperatures over the past century.

Content Objectives	Practice Objectives	Language Objectives
To demonstrate how pH in water is lowered with the addition of CO ₂ .	2) Modeling	I can communicate the effects that extra atmospheric carbon will have on oceans.
Demonstrate the effects of a lower pH on the calcium carbonate exoskeletons or shells of marine animals.	3) Plan and carry out investigations	

Important Vocabulary:

Tier 1 marine, seawater, freshwater **Tier 2** acid, base, pH, coral reef, diversity, habitat **Tier 3** acidification, compound, molecule, calcium carbonate, ecosystem, bleaching, exoskeleton

Advanced alkaline, symbiosis, ions

Materials Needed:

Activator- Rubber glove (thick), Freezer, Bowl, Whipped cream, Green sprinkles

Activity- water, an aquarium pH test kit (the liquid drops not the strips), beaker or clear plastic cup, crushed coral or seashells or chalk, drinking straw

Other Resources: (websites, videos, books, etc.)

Student Ocean clean-up Volunteer day at Castle Island 9/17/16

<http://www.mass.gov/eea/docs/czm/coastsweep/lists/boston-harbor.pdf>

Webhunt-

http://ocean.si.edu/sites/default/files/lesson_plan/additional_files/Impact%20of%20a%20Changing%20Climate%20on%20Coral%20Reefs.pdf

Carbon Cycle game (similar to Water Cycle game in Foss *Weather and Water* unit)

http://oceanservice.noaa.gov/education/pd/climate/teachingclimate/carbon_cycle_game.pdf

Coral Bleaching <https://www.hhmi.org/biointeractive/coral-bleaching-activity>

Background Information for Teacher:

Coral reefs are among the most amazing of ecosystems on our planet. Although found as solitary forms through 400 million years of geological history, the fossil record shows that corals evolved into modern reef-building organisms within the past 25 million years. Over those millions of years, coral reefs have evolved into the rainforests of the sea –a place of great biological diversity that is home to thousands of species that are found no where else. In fact, coral reefs are the most complex, species-rich, and productive of marine ecosystems (<http://www.photolib.noaa.gov/reef/>).

Because corals are attached, taking root to the seafloor, people often think they are plants. Because many corals have hardened surfaces, they are sometimes mistaken as being rocks. However, unlike plants, corals do not make their own food using photosynthesis. And, unlike rocks, corals are very much alive. Corals are, in fact, animals.

What we often call “a coral” is actually made up of hundreds or thousands of individual invertebrate animals called polyps. The polyp uses calcium carbonate (limestone) from seawater to build a hard, cup-shaped skeleton. This skeleton protects the soft, delicate body of the polyp.

Each polyp has a stomach that opens at one end, which is surrounded by tentacles. The tentacles capture food by stinging it, similar to a jellyfish. Some corals use algae to get food; the coral gets food from the algae and the algae use the coral. This is called a “symbiotic” relationship (<http://oceanexplorer.noaa.gov/facts/coral-animal.html>).

Background Information the Student Needs to Access the Lesson:

Students should be familiar with the carbon cycle (photosynthesis and respiration) and some familiarity with what climate change is and how fossils fuels burned by humans is disrupting the natural cycle. Suggested that this lesson be done after Investigation 7 from the Foss *Weather and Water* unit, where students learn about the Water cycle.

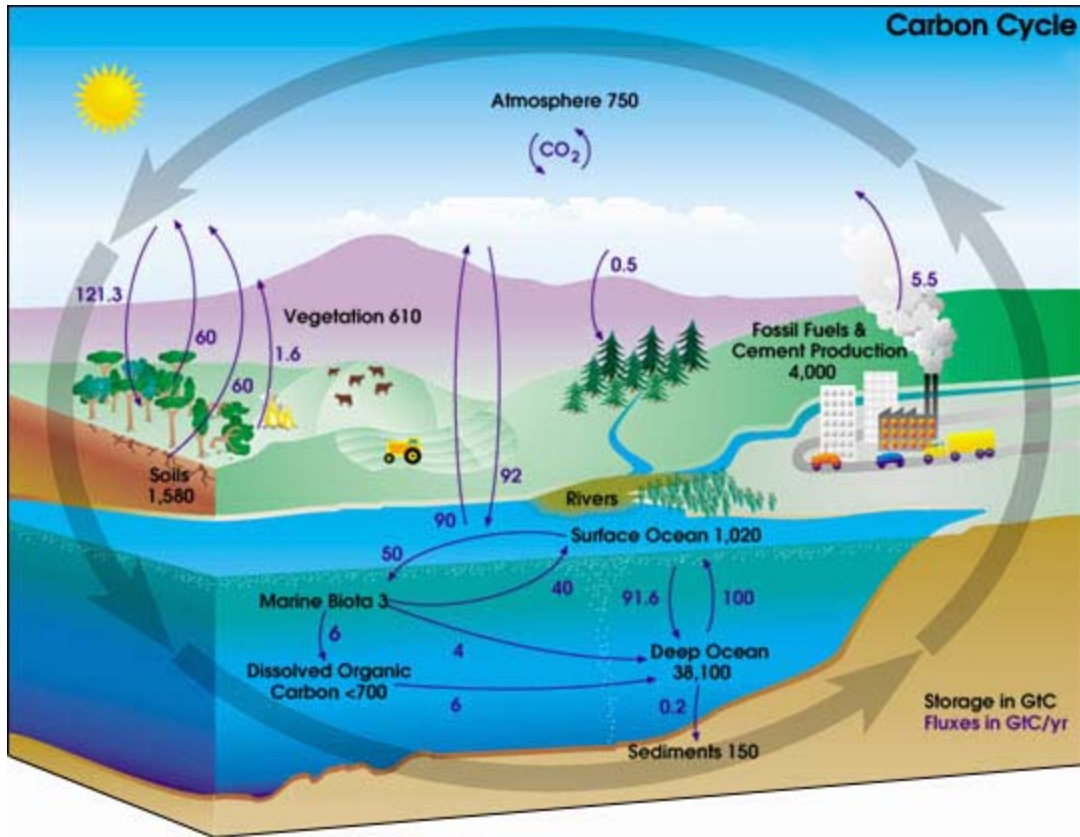
Lesson Structure

Lesson Launch	Carbon Cycle Diagram and questions
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(Do Now)	
Background Instruction (pre-activity)	<p>Coral Bleaching activator- Show students pictures of corals. Ask what they know about it- what it is made of, where it is found, what the largest one in the world is etc. Have a student write the list on the board. Then pull out the frozen glove and do teacher demonstration. Have students diagram the demonstration and what each part represents; Ask students what it represents and why it's occurring.</p> <p>Audiovisual- New England Aquarium <i>Coral Breakup- A Tragic Love Story</i> https://www.youtube.com/watch?v=GuuRj7f51VU&feature=youtu.be with student sheet http://www.neaq.org/wp-content/uploads/2016/06/LEARN_3-7_BI_coral_student.pdf</p> <p>Reading- ck12.org In the Acid Sea http://www.ck12.org/calculus/Logarithmic-Differentiation/rwa/In-the-Acid-Sea/</p> <p>Advanced- Coral Bleaching on https://www.hhmi.org/biointeractive/coral-bleaching</p>
Activity	<p>Ocean Acidification part 2 on page 8- http://www.blueworldtv.com/images/uploads/lesson-plans/Lesson_plan_webisode41Acidification.pdf</p>
Discussion/ Debrief	<ol style="list-style-type: none"> 1) Ocean Acidification part 3- Discussion and Follow up questions http://www.blueworldtv.com/images/uploads/lesson-plans/Lesson_plan_webisode41Acidification.pdf 2) Ocean Acidification Data Analysis activity- the Station ALOHA curve
Formative Assessment	<ol style="list-style-type: none"> 1) From the Bow Seat contest- students create art, poetry, prose, or film on ocean awareness, In addition, students are required to write a reflection of their work. 2) 3-2-1 Three things learned; 2 things that were really interesting; 1 thing still questioning

Notes:

Do Now-



- What are some of the contributors to atmospheric CO₂?
- How is some of the CO₂ removed from the atmosphere?
- What are some of the carbon sinks in the environment?
- Human activities are increasing the amount of CO₂ in the atmosphere. How might this affect the carbon cycle?

Coral Bleaching Activator- (teacher demonstration)

Materials Rubber glove (thick) Freezer Bowl Whipped cream Green sprinkles

Procedure

1. Fill the glove with water and tie the end shut. Place in freezer overnight or until completely frozen.
2. Remove the rubber glove. Place hand upright in bowl.
3. Carefully place whipped cream over the palm and back of hand. Avoid getting any on the fingers or thumb.
4. Add sprinkles to the topping.
5. Have students observe what happens as the ice melts. (The sprinkles should fall off, leaving a white polyp behind.)

Key

Frozen hand = coral polyp

Fingers = tentacles

Bowl = limestone cup

Whipped cream = limestone skeleton

Sprinkles = zooxanthellae