

Unit 5: Carbon, Photosynthesis, & Respiration

Unit Summary: This unit focuses on the carbon cycle, with specific emphasis on the exchange of carbon dioxide within plants. Students will grow plants and monitor carbon dioxide production and consumption. Readings provide insight into the storage capabilities of the soil and biomass in relation to carbon.

Teaching Time: It is anticipated that this unit and its related activities will take a minimum of five 50-minute class periods to complete. Depending on the number of readings utilized, this could be longer. The activities for this unit do take longer to complete and will require from several days to a full month of plant growth to complete. It is recommended that the activities be started two to three weeks prior to the unit starting so the plants are mature enough to provide the results needed for students to visually see the effects of the cycle.

Audience: 9-12 Science & Agriculture Students

Unit's placement in the overall course: This unit is designed to be taught as part of a sequence with one unit covering the carbon cycle and the second unit covering the nitrogen cycle. Both units complement each other. While these units can stand alone, they are included as an essential knowledge set needed to understand the complex science underlying climate change. Carbon dioxide and nitrous oxides are two of the most culpable gasses in the storage of heat in the atmosphere, and both are produced in high quantities in the agricultural production of plants and livestock.

Goals: The major goals of this unit are for students to be able to explain that growth is the result of plants net uptake of carbon dioxide, and that carbon dioxide production exceeds the levels plants can convert to oxygen. Lab activities will also help students see the potential impacts of carbon dioxide fertilization.

Description of the unit: The unit contains one PowerPoint and two lab activities and multiple readings. Readings are found in the accompanying compressed file and additional readings are referred to in the notes sections of the presentation. Teacher notes are supplied with most slides to help guide class discussion. Activity documents are embedded in the PPT, located on the last slides.

Using this unit: Within the PowerPoint for this unit are hidden slides. On these slides are embedded Microsoft Word Documents. These documents provide the additional resources needed to deliver this unit. A standards document is provided which includes the relevant Next Generation Science Standards, Common Core State Standards for Math and ELA, and Agriculture, Food, & Natural Resources Standards. The standards included may be only introduced through this curriculum, and the teacher will need to decide the level at which they want to augment the provided instruction in relation to these standards. Readings associated with the unit are in a separate zipped PDF file. This document includes all the readings in one zipped file so teachers can select those readings most appropriate for their classrooms.

Related Readings for Meeting CCSS in ELA: These readings are not overly technical, however teachers reported some difficulty using them with students on IEP's. To accommodate these students it is recommended teachers choose a portion of the readings and run it through an application like <http://www.rewordify.com> which can adjust the reading levels as needed.

Required Supplies:

CO₂ Fertilization of Wheat: (5 weeks of growth time required)

- 2 One-gallon Containers (Recommended: Rubbermaid 6 Qt. Clear Square Food Storage Container-FG630600CLR) with lids
- 2 Milk Jugs
- Small container (+/- 8 oz.)
- Wheat seeds (Recommend soaking overnight)
- Alka-Seltzer Tablets
- OPTIONAL:
 - CO₂ Sensor
 - O₂ Sensor

Photosynthesis vs. Respiration & CO₂ Levels (*Plants will need to be about 2" tall to get better results, lab works great as a follow up to the CO₂ Fertilization lab using the plants grown in that experiment.*)

- CO₂ Sensor
- 2 One-gallon Chambers
- Temperature Probe
- Vernier Interface Cable, CBL, or LabQuest
- Vernier Logger Lite
- Wheat Seeds (berries)
- Empty milk cartons