

## 2.2) INSTRUCTOR’S GUIDE TO DOSE-RESPONSE TO CARBON DIOXIDE

**Overview:** Make sure there is enough airspace in the sealed bottles so that the cultures get thoroughly mixed when you shake the bottles. Nutrient-rich water is prepared by adding the recommended dose of plant food to de-chlorinated tap water (usually between 1/2 and 1 teaspoon per gallon). Based on the procedure involving chlorophyll extraction, the following readings were obtained in one class:

**Sample Results**

CO <sub>2</sub> saturation level	Absorbance reading
Atmospheric (control)	0.17
25% CO <sub>2</sub> saturated	0.94
50% CO <sub>2</sub> saturated	1.08
100% CO <sub>2</sub> saturated	0.52*

\*Note that 100% carbon dioxide saturation did not result in the highest concentration of algae. This possibly can be attributed to the effect of dissolved carbon dioxide on pH (a very low pH can inhibit algae growth).

**Answers to Questions:** 1) Answers may vary. Usually 2-3 weeks. 2) This prevents the algae from permanently settling to the bottom. 3) The plant food insures that these nutrients are not limiting. Plant food is chemical fertilizer. 4) The CO<sub>2</sub> is the limiting nutrient. You know this because it shows a dose-response pattern. 5) Answers may vary. 6) Extremely high CO<sub>2</sub> concentrations inhibit algae growth, possibly due to the low pH. 7) Harvesting phytoplankton from the water for their oil is not yet cost effective. 8) Installing this technology on small moving CO<sub>2</sub> sources like motor vehicles is unrealistic. 9) Too little CO<sub>2</sub> will inevitably result in less photosynthesis.

**Logistics:** The basic preparations can easily be done over a 40-minute lab period. This is a long-term lab that may not produce measurable differences for as long as three weeks, so do not leave it for the last two weeks of classes.

**Degree of Difficulty:** 1—This lab requires very little skill or experience.

**Materials:** Four 500-mL clear plastic bottles (discarded drinking-water bottles are best); two liters of nutrient-rich water (dechlorinated water to which the recommended amounts of plant food have been added); two 1-liter containers; two 250-mL flasks; two rubber stoppers (for the flasks); two effervescent antacid tablets (for carbon dioxide production); a 50-mL test tube (for the effervescent solution); a rubber stopper connected to plastic tubing (for gas collection from the effervescent reaction); a 1-liter water sample from an algae culture or a hypereutrophic pond; and a turbidity testing kit.