

Name: _____ Date: _____ Period: _____

DISSOLVED OXYGEN AND PRIMARY PRODUCTIVITY SIMULATION

Go to http://www.phschool.com/science/biology_place/labbench/lab12/intro.html.

Follow the directions in the simulation. Answer the questions below as you move through the experiment.

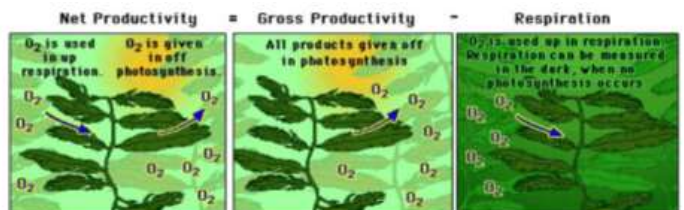
Ideal Conditions for Maximum Dissolved Oxygen

1. Describe the effect each of the following factors has on the availability of oxygen and explain why.
 - a. Temperature:
 - b. Light & Photosynthesis:
 - c. Decomposition & Respiration:
 - d. Mixing & Turbulence:
 - e. Salinity:

Primary Productivity

2. Define the following terms in your own words.
 - a. Primary productivity =
 - b. Gross productivity =
 - c. Net productivity =
3. Why do we use dissolved oxygen as a measure of productivity? Does productivity include more than oxygen?

4. Use the diagrams to explain the following:



- a. How does putting a sample of pond water and algae/freshwater plants in the light enable us to measure gross productivity?
 - b. How does putting a sample of pond water and algae/freshwater plants in the dark enable us to measure respiration?
 - c. How does subtracting the two indirectly measure net productivity?
5. Write a hypothesis about how you predict the amount of light will affect gross productivity.

Measuring Primary Productivity

6. The equation for photosynthesis is:
7. Describe two alternative methods to measuring primary productivity other than the rate of O₂ production.
- a.
 - b.

Dissolved Oxygen and Temperature (Use the nomograph on the screen to answer Questions 10 and 11)

8. What is the percent oxygen saturation for a water sample at 10°C that has 7 mg O₂/l?

9. What is the percent oxygen saturation for a water sample at 25°C that has 7 mg O₂/l?

A Model of Productivity as a Function of Depth in a Lake

10. What is the purpose of the varying amounts of screen wrapped around the bottles of algal water?

11. Use the “Closer look” icons to see a visualization of what is happening at the molecular level in the algae. Summarize the rates of photosynthesis and respiration in each bottle:
- Bottle wrapped in foil =
 - Bottle without any covering =

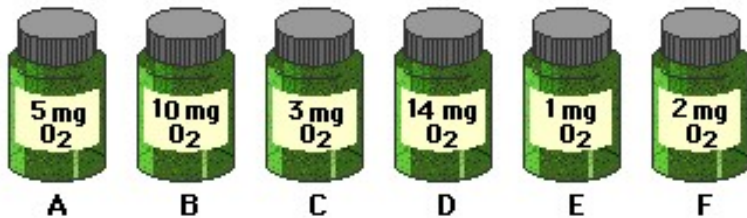
Analysis of Results

12. Summarize how to solve for each of the processes below:

- Respiration rate
- Gross productivity
- Net productivity

13. Answer the sample problem using the table below. Graph the results following the axes on the screen on your own paper.

Initial oxygen reading for water = 4 mg O₂/L



% Light	Bottle Letter	Gross Productivity % Light Bottle O ₂ mg – Dark Bottle O ₂ mg	Net Productivity % Light Bottle O ₂ mg – Initial Bottle O ₂ mg
0%			
2%			
10%			
25%			
65%			
100%			

Summary Questions

14. So, now explain why the fish in the aquarium (on the LabBench Web site) above the radiator died.

15. Would you expect the dissolved oxygen levels in water sampled from a stream entering a lake to be higher or lower than the dissolved oxygen levels in water sampled from the lake itself? Explain.

16. Would you expect the dissolved oxygen levels in water sampled from a lake at 7AM to be higher or lower than the dissolved oxygen levels in water sampled at 5PM? Explain.

17. One of the major sources of water pollution is the runoff from fertilizer used in agriculture and on suburban lawns as well as golf courses. In particular, the nitrogen and phosphorus nutrients in the fertilizer creates problems in the streams and ponds into which they flow. They cause *algal blooms* and *eutrophication* in lakes.
 - a. Why do nitrogen and phosphorus promote a lot of plant/algal growth?

 - b. What is meant by algal bloom? (Look it up!)

 - c. What problems do algal blooms cause in ponds & lakes? Why are a lot more producers not a good thing? (Look it up!)

 - d. What is meant by eutrophication? (Look it up!)

18. At what depth—shallow or deep—will there be more primary productivity in a pond or a lake? Explain.