Activity 5. Inquiry on the factors that influence the intensity of photosynthesis

Activity 5a. Using computer models to explore the factors controlling photosynthesis (effects of light intensity and wavelength on the rate of photosynthesis)

In this simulation, you will stimulate two variables: light intensity and light wavelength. The amount of ATP produced will change depending upon the set parameters. The simulation "Johnson Explorations: Photosynthesis" is located at
http://www.mhhe.com/biosci/genbio/biolink/j_explorations/ch09expl.htm

Your report must include the following sections:

1. Propose a hypothesis to answer to the posed research question.

2. Provide a rationale to your hypothesis (Why do you think that?)

3. Define independent and control variables.

4. Data: Include data tables to your report. The tables must show clearly trends resulting from changes of intensity and changes of wavelength. Multiple data tables would probably be best here.

4. A graph showing how the percentage of ATP changed (Y axis) as a result of changes in wavelength and intensity (X axis). Two graphs would be best here. You may use Microsoft Excel to make your graphs, or use a spread sheet or graphing program of your choice.

5. Conclusion: Use your data to answer the experimental question. Offer an explanation of the results, taking into account the principles of photosynthesis and the light reaction.

Activity 5b. Using digital sensors and data logger to explore the factors controlling photosynthesis (effects of light intensity and wavelength, temperature and on the rate of photosynthesis)

In this experiment, you will

- Plan and carry out an experiment on factors controlling photosynthesis.
- Explore the effect of at least one condition (light intensity, wavelength or temperature, plant) on the rate of photosynthesis.
- Use an O_2 Gas Sensor to measure concentrations of oxygen gas.
- Use a CO_2 Gas Sensor to measure concentrations of carbon dioxide gas.

Your report must contain the following sections

1. Propose a hypothesis to answer the research question.
2. Provide a rationale to your hypothesis (Why do you think that?).
3. The list of materials.
4. Define independent and controlling variables.
5. Procedure: (Write a detailed account of how you will set up your experiment).
   Notes: (Write down any events that occurred during the lab set up that may affect your results).
6. Data: Construct a data chart that contains observations and results.
7. Compare your results to one other group's results. Make sure that you understand their procedure.
8. Conclusion: Write a conclusion that discusses what your results in your data chart mean. Also analyse your hypothesis and discuss future experiments that may be done to get a further understanding of the question.

NB: In this experiment, two parallel reactions, photosynthesis and cell respiration, take place simultaneously in the chamber. However, in light conditions, the first process is more intensive than the other, and therefore, we are able to control variables that influence the rate of photosynthesis.

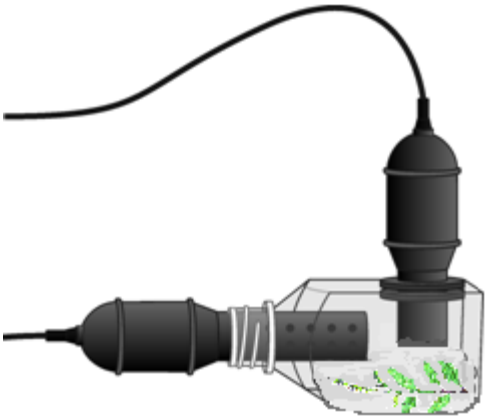

Figure x

Digital data logger
CO_2 gas sensor
O_2 Gas Sensor
250 mL respiration chamber

Plant material

ice cubes
1 L beaker
thermometer
lamp with adjustable light intensity
coloured films

1. Connect the CO_2 Gas Sensor to the data logger Channel 1 and the O_2 Gas Sensor to Channel

3. Obtain ~25 g plant material and put it into the respiration chamber.

5. Insert the CO_2 and O_2 sensors into the neck of the respiration chamber (Figure 1).

6. Wait four minutes for readings to stabilise, then begin collecting data

7. Record your data into the table whether manually or, depending on your technical equipment, by the data logger itself.

(Compile graphs of CO_2 concentration vs. time; O_2 concentration vs time)

7. When data collection has finished, remove sensors from the respiration chamber.