

# BIOLOGY

## Structure and Function of Biological Molecules

Project Code: B-c.0

### SUBMERGED AQUATIC VEGETATION (SAV) & LIGHT

Design, conduct, and evaluate an investigation to determine an effect of light on the rate of photosynthesis. The investigation should be controlled and include a hypothesis, procedure, data, research, and a conclusion.



# STUDENT PROJECT

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Student Name

Sample Draft  
2008



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**PROJECT TASK**

Design, conduct, and evaluate an investigation to determine an effect of light on the rate of photosynthesis. The investigation should be controlled and include a hypothesis, procedure, data, research, and a conclusion.

Submit the completed project to your Project Monitor by the agreed upon date. (*See Student Planner and Agreement Form.*)

**DIRECTIONS**

1. Read the Scenario on the next page.
2. Read through the Project Steps on the next page.
3. Review the categories in the Project Scoring Criteria on page 5 and discuss this information with the Project Monitor.
4. Determine a timeline for completing the project with your Project Monitor. (*See Student Planner and Agreement Form.*)
5. The Project Monitor and student will specify dates for each CHECK POINT listed in the Project Steps. After the Project Monitor and student meet on the specified date, both must initial the CHECK POINT.
6. Complete the Project Steps.
7. Submit all completed project documents (*see Project Completion Requirements*) to your Project Monitor by the agreed upon due date.

**PROJECT COMPLETION REQUIREMENTS**

The completed project should include the components listed below.

1. Testable hypothesis
2. List of materials
3. Lab procedure
4. Independent and dependent variables clearly identified
5. Data table
6. Evidence that the laboratory investigation was conducted by the student
  - Data obtained during the laboratory investigation
  - Electronic image of the laboratory setup
7. Data analysis
8. Annotated bibliography
9. Confirmation, modification, or rejection of the hypothesis
10. Communication of conclusion statements

The completed project must be submitted to the Project Monitor in the required format(s). (*Students will be given information about required formats by the Project Monitor in advance.*)



## Scenario

Students on a biology field experience observe that there is less submerged aquatic vegetation (SAV) in a bay compared to their last visit. They also observe that the water appears cloudier. Several students pose the question, "Is there a relationship between the cloudiness of the bay water and the reduced number of plants?"

## Project Steps

1. Write a testable hypothesis related to the students' question. (*See Category 1 in the Scoring Criteria.*)
2. List the materials needed for an investigation that would test the hypothesis. (*See Category 1 in the Scoring Criteria.*)
3. Write a procedure for your proposed investigation. (*See Category 1 in the Scoring Criteria.*)

**CHECK POINT**      **Date** \_\_\_\_\_      **Student/Monitor Initials** \_\_\_\_\_/\_\_\_\_\_

4. Identify and explain the following for your investigation: (*See Category 1 in the Scoring Criteria.*)
  - Independent variable;
  - Dependent variable;
  - Safety precautions and equipment.
5. Design a data table for the data you will collect in this investigation. (*See Category 2 in the Scoring Criteria.*)
6. Conduct the investigation. Record all data and observations. (*See Category 1 and Category 2 in the Scoring Criteria.*)

**CHECK POINT**      **Date** \_\_\_\_\_      **Student/Monitor Initials** \_\_\_\_\_/\_\_\_\_\_

7. Analyze the data that you recorded during the investigation. (*See Category 1, Category 2, Category 3, Category 4, and Category 5 in the Scoring Criteria.*)



## Project Steps (continued)

8. Research information related to the effects of environmental factors on the survival of submerged aquatic vegetation. Construct an annotated bibliography with at least five reputable references used in your research. *(See Category 2, Category 3, Category 4, and Category 5 in the Scoring Criteria.)*

CHECK POINT      Date \_\_\_\_\_      Student/Monitor Initials \_\_\_\_/\_\_\_\_

9. Use your data and research to confirm, modify, or reject your hypothesis. *(See Category 1, Category 2, Category 3, and Category 5 in the Scoring Criteria.)*

10. Develop and communicate conclusions using presentation software or appropriate technology. *(See Category 2, Category 3, Category 4, and Category 5 in the Scoring Criteria.)*

FINAL CHECK POINT      Date \_\_\_\_\_      Student/Monitor Initials \_\_\_\_/\_\_\_\_

*Submit all completed project documents to your Project Monitor.*



## PROJECT SCORING CRITERIA

## Overview

In order to satisfactorily complete this project, the student must:

- Demonstrate understanding of twenty (20) Indicators of Learning.
- Demonstrate understanding of at least one (1) indicator within each category.

## Category 1: Science Ideas and Investigative Approaches

A student must attempt to address all indicators appropriate to the project task. A student must demonstrate understanding of at least one (1) indicator in this category but may demonstrate an understanding of a maximum of four (4) indicators.

## Progress

Check\*  Indicators of Learning

- Modify or affirm scientific ideas according to accumulated evidence.
- Formulate a working hypothesis.
- Test a working hypothesis.
- Select appropriate instruments and materials to conduct an investigation.
- Identify appropriate methods for conducting an investigation (independent and dependent variables, proper controls, repeat trials, appropriate sample size, etc.).
- Use relationships discovered in the lab to explain phenomena observed outside the laboratory.

## Category 2: Data Collection and Analysis

A student must attempt to address all indicators appropriate to the project task. A student must demonstrate understanding of at least one (1) indicator in this category but may demonstrate an understanding of a maximum of four (4) indicators.

## Progress

Check\*  Indicators of Learning

- Develop and demonstrate skills using lab and field equipment to perform investigative techniques.
- Recognize safe laboratory procedures.
- Organize data appropriately using techniques such as tables, graphs, and webs (for graphs: axes labeled with appropriate quantities, appropriate units on axes, axes labeled with appropriate intervals, independent and dependent variables on correct axes, appropriate title).
- Analyze data to make predictions, decisions, or draw conclusions.
- Describe trends revealed by data.
- Use analyzed data to confirm, modify, or reject a hypothesis.

*\* Progress checks do not indicate approval of student work.*



**Category 3: Communicating Science**

A student must attempt to address all indicators appropriate to the project task. A student must demonstrate understanding of at least one (1) indicator in this category but may demonstrate an understanding of a maximum of four (4) indicators.

**Progress****Check\*  Indicators of Learning**

- Explain scientific concepts and processes through drawing, writing, and/or oral communication.
- Use computers and/or graphing calculators to produce the visual materials (tables, graphs, and spreadsheets) that will be used for communicating results.
- Use tables, graphs, and displays to support arguments and claims in both written and oral communication.
- Create and/or interpret graphics (scale drawings, photographs, digital images, field of view, etc.).
- Read a technical selection and interpret it appropriately.
- Communicate conclusions derived through a synthesis of ideas.

**Category 4: Science, Mathematics, and Technology**

A student must attempt to address all indicators appropriate to the project task. A student must demonstrate understanding of at least one (1) indicator in this category but may demonstrate an understanding of a maximum of two (2) indicators.

**Progress****Check\*  Indicators of Learning**

- Use ratio and proportion in appropriate situations to solve problems.
- Use computers and/or graphing calculators to perform calculations for tables, graphs, or spreadsheets.
- Manipulate quantities and/or numerical values in algebraic equations.
- Judge the reasonableness of an answer.
- Investigate career possibilities in the various areas of science.
- Identify and evaluate the impact of scientific ideas and/or advancements in technology on society.

*\* Progress checks do not indicate approval of student work.*



**Category 5: Concepts of Biology**

A student must attempt to address all indicators appropriate to the project task. A student must demonstrate understanding of at least one (1) indicator in this category but may demonstrate an understanding of a maximum of ten (10) indicators.

**3.1.1 The student will be able to describe the unique characteristics of chemical substances and macromolecules utilized by living systems.****Progress****Check\*  Indicators of Learning**

- Water (inorganic molecule, polarity, density, and solvent properties)
- Carbohydrates (organic molecule; monosaccharides are building blocks; supplier of energy and dietary fiber; structural component of cells: cell wall, cellulose)

**3.1.2 The student will be able to discuss factors involved in the regulation of chemical activity as part of a homeostatic mechanism.****Progress****Check  Indicators of Learning**

- Osmosis (predicting water flow across a membrane based on a cell's environment, explain role in living systems)
- Temperature (effect upon enzyme activity and metabolic rate)
- pH (pH scale: relative values for acids and bases; effect on living systems: cellular, organismal)

**3.1.3 The student will be able to compare the transfer and use of matter and energy in photosynthetic and non-photosynthetic organisms.****Progress****Check\*  Indicators of Learning**

- Photosynthesis (energy conversion: light)
- Photosynthesis (energy conversion: chemical)
- Photosynthesis (basic molecules involved: carbon dioxide)
- Photosynthesis (basic molecules involved: water)
- Photosynthesis (basic molecules involved: sugar)
- Photosynthesis (basic molecules involved: oxygen)
- Carbon cycle (movement of carbon between living systems and the environment, cyclic relationship between photosynthesis and respiration)
- Cellular respiration (distinctions between aerobic and anaerobic, energy released, use of oxygen, basic molecules involved in aerobic)
- ATP (energy carrier molecule)

*\* Progress checks do not indicate approval of student work.*



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### Category 6: Miscellaneous

Students may have addressed project steps in more depth or in ways that are not anticipated. The G/E/I\* and Indicator statement should be added to the table below to document additional indicators that the student has addressed. The student may demonstrate an understanding of a maximum of two (2) indicators in this category.

#### Progress

Check\*     G/E/I\*    Indicators of Learning

Check* <input checked="" type="checkbox"/>	G/E/I*	Indicators of Learning
<input type="checkbox"/>		
<input type="checkbox"/>		

\* G/E/I - Content Area Core Goal/Expectation/Indicator

*\* Progress checks do not indicate approval of student work.*





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