

# Argumentative Biology Detailed Lesson Plan Template

1. Title of the Lesson: The Use of the Synthesized Substances
2. Grade Level: 10
3. Subject: Biology

4. Duration: 8 hrs. ( 2 wks.)
5. Topic: 3

2. Objective(s): Students should be able to indicate the presence of the stored substances in the green plant.

## Stage 1: The Identification of a Problem and the Research Question

1.Introduction:	<ol style="list-style-type: none"><li>1. The lesson relates the nutrition process of the plants as photosynthesis to the source of the stored materials in the plants</li><li>2. The research questions:<ol style="list-style-type: none"><li>a) What is the relationship between the used organic materials and the materials that are produced or/and by plants?</li></ol></li></ol>
2. Context  Setting:	<ol style="list-style-type: none"><li>1- Provide students with the data set or observations that they will use to address the research question such as mounted slides of the phloem and the vacuoles in the green plants.</li><li>2- Explain that students will use the Toulmin argumentation framework to support their claims.</li></ol>
3. Instructions:	<p>Review the Toulmin model with the class:</p> <ul style="list-style-type: none"><li>▪ <b>Claim:</b> Green plants produce glucose as a product of photosynthesis, this organic matter will be used later after storage into starch during respiration.</li><li>▪ <b>Evidence:</b> After the application and experimentation, testing two plants by allowing: <b>Experiment:</b><ol style="list-style-type: none"><li>a- A control apparatus ( App A) that has a green plant doesn't undergo photosynthesis due to lack of a limiting factor (such as avoiding sunlight or having limewater to absorb carbon dioxide). App A was exposed to the limiting factors for 72 hours.</li><li>b- Another apparatus (App B) that has a green plant with all the available factors for photosynthesis, will have photosynthesis properly.</li></ol><b>Observation:</b><ol style="list-style-type: none"><li>a- Pick out two leaves from App A and App B respectively.</li><li>b- Treat these two leaves with hot water, cold water and then hot alcohol for decolorizing them by removing the green chlorophyll.</li><li>c- Add iodine on these two leaves and investigate the results.</li><li>d- The appearance of blue color on the leaves means that starch exists that will indicate the existence of glucose as photosynthesis product.</li><li>e- The brownish color of the leaf means that the plant couldn't make glucose due to the absence of photosynthesis such as App A.</li></ol></li></ul>

	<ul style="list-style-type: none"> <li>▪ <b>Warrant:</b> During photosynthesis, the green plant will synthesize glucose molecules that will be stored as starch. Plants need a way to store glucose for times when the plant survives without any of the limiting factors such as during night time or when the environmental factors are not available. Starch is considered as a long-term storage form because it is insoluble in water and inert that doesn't interfere in cellular processes.</li> <li>▪ <b>Backing: As a scientific background:</b> <ul style="list-style-type: none"> <li>a- Review the steps of the photosynthesis process with the diagrams from grade 9.</li> <li>b- Photosynthesis is a chemical reaction that converts carbon dioxide gas and water liquids to carbohydrates such as reducing sugar (glucose) and oxygen gas in the presence of sunlight and chlorophyll.</li> <li>c- The hydrolysis of Starch will require the existence of enzymatic reactions.</li> </ul> </li> <li>▪ <b>Rebuttal:</b> While it is true that glucose is stored as starch, some might argue that glucose can be stored as sucrose (non-reducing sugar) and transported in the vacuoles of the green plants to be transported to phloem later. However, starch is the primary storage form because it is more stable and is stored in specialized organelles (plastids such as amyloplast), which don't interfere with the plant's regular metabolic reactions (anabolic).</li> </ul>
<b>4. Group Activity:</b>	<p>Divide the students into small groups (3-4 students per group) to begin the inquiry activity.</p> <p>The activity is in the form of a printable paper with a question to answer:</p> <p><i>“You are given two apparatus A and B (as in the explanation), how do you think the presence of light and carbon dioxide affect the photosynthesis process and allow the glucose storage?”</i></p> <p>In pairs, discuss by using your prior knowledge to what you may observe in this experiment after treating with iodine test.”</p>
<b>5. Allocated time 50-60 minutes ( explanation) , 20 minutes for group work and discussion.</b>	

## Stage 2: The Generation of a Tentative Argument ( 3 hours- 180 minutes)

### Group Work:

Every group will investigate botanical experiment “Study Photosynthesis with the Floating Leaf Disk Assay”

1. Each group is provided with a **printed document**
2. Students use the Toulmin framework to develop a tentative argument:
  - **Claim:** the floating Leaf Disk Assay is an affective method for investigating photosynthesis by measuring the rate of oxygen production in green plants.
  - **Evidence:** The floating leaf disk phenomenon is based on the floating of the cut circular pieces in a solution when exposed to light and carbon dioxide (when all the factors are available). The first evidence is that the oxygen gas that is produced is the leading factor of raising these disks to the surface of the solution, thus the rate of oxygen production is the same as the rate of photosynthesis, thus if more oxygen is produced the more photosynthesis and glucose production occurs).
    - i. Thus, the students should notice the importance of this experiment as a quantitative method that ends up by graphical presentation of the results and allow analysis and conclusion based on this evidence.
    - ii. **Experimental Observation:** what is significant is the solution that the discs are emerged in it, this is a bicarbonate solution and exposed to light. The discs sink as photosynthesis occurs, the driving force is the production of oxygen.
    - iii. **Control apparatus:** this apparatus will have one limiting factor that avoids photosynthesis and thus the discs will sink rather than floating due to the absence of the driving force.
  - **Warrant:** The mentioned evidence of the occurrence of photosynthesis will indicate the importance of light and carbon dioxide as important factors for this process. Since we can't directly evident and prove the existence of photosynthesis, the easiest way is to wait for the oxygen collection and since it is collected in the air spaces, this will enable the discs to float.
  - **Backing: Scientific principle:** photosynthesis is a chemical process that is driven by the action of light solar energy. Oxygen is a by-product, and its release can be measuring also by the use of an indicator for photosynthetic activity. The floating leaf experiment can be a measurable vital way to track this oxygen production.
  - **Rebuttal:** Some people argue that this experiment is not a precise quantitative method for measuring photosynthesis because only oxygen is measured which is only one aspect rather than other products. Besides the surface area is ignored or the concentration of the bicarbonate concentration that will also are factors of the movement of discs.

### Teacher Support:

1. The teacher circulates around the lab, asking probing questions to guide students through the argumentation process (e.g., "What data supports your claim?" or "How do you know your evidence is reliable?").
2. Every group of students who are given the printables will be provided with rubric as well and time- table that will help them to work accordingly and to achieve the task on time.
3. The task accomplishment is fulfilled after the submission of the graphic paper that studies the rate of oxygen with passing time.

### Stage 3: The Argumentation Session ( 60 minutes)

#### 1.Presentation Format:

- In a round-robin format, one member of each group stays at their workstation to present their argument while other students rotate to different groups to critique the arguments.

#### 2.Peer Evaluation:

- As students present their arguments, others listen and provide constructive feedback based on the Toulmin model.
- The teacher can ask critical questions to encourage evaluation of evidence and reasoning (e.g., "Does this evidence fully support the claim?" or "What alternative explanations can you consider?").

#### 3.Revision of Arguments:

After the argumentation session, students return to their original groups and modify their tentative arguments based on peer feedback.

### Stage 4: A Reflective Discussion

**Time: 50-60 minutes**

#### 1. Whole-Class Discussion:

- The teacher will use the white board to stick the diagrams of the photosynthesis equation and the green photosynthetic leaf that has many in and out arrows for the reactants and products.
- The teacher also will start the discussion by writing the question on the board:

*How the light and carbon dioxide affect the rate of photosynthesis?*

#### 2. Reflection:

- Ask the students in groups to answer these questions as separate ideas.
- Allow the students to discuss ideas with each other.

### Stage 5: The Production of a Final Written Argument

**Time: 50-60 minutes**

#### 1. Final Argument Writing:

- Each student writes an individual final argument, using the Toulmin framework to organize their thoughts.
- Students should answer the following questions:
  - **Claim:** based on the experiment that you did with your friends, what can you conclude about the relationship of light and the concentration of carbon dioxide with respect to photosynthesis?
  - **Relevant evidence:** what is the available evident data that supports your conclusion of the relationship of light to photosynthesis?

- **A supported warrant:** Why does the collected data about oxygen concentration that is represented as the rate, support the conclusion of the effect of light factor on photosynthesis?
- **Backing from scientific principles:** What is your background information about other factors for photosynthesis that will also control the occurrence of photosynthesis?
- **Rebuttal:** How can we alter this process by changing other factors not only light?

## 2. Writing Prompt:

- Provide students with a prompt to guide their writing.

1. *The teacher will motivate her students to write a scientific argumentative paper that starts with the research question.*
2. *The teacher also will ask the students to support their claim with evidence from the data and explain why the evidence supports their conclusion.*
3. *The teacher will allow the students also to consider any counterarguments or conflicting evidence and address them in their argument.*
4. *The students are provided with rubrics and due dated of submission via email on the school platform.*

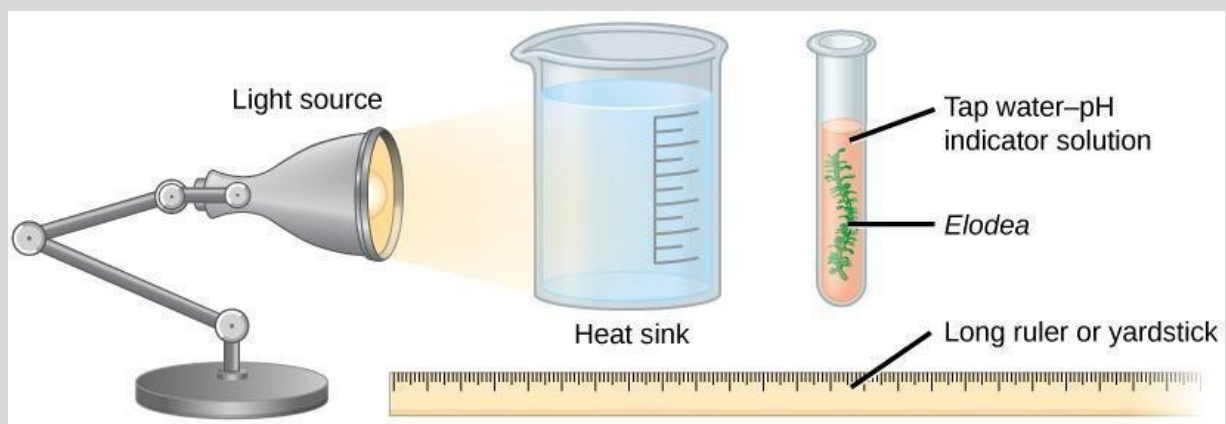
## 3. Submission: Grading will be based on the rubrics and on the sharp submission date.

## 8. Assessment- Graded Homework

### Reason:

Assessing students' arguments allows teachers to measure whether the lesson's objectives have been achieved and whether students can apply their learning to construct well-supported arguments.

**Assessment:** the students are given a similar experiment or investigation to solve:



## Title: Influence of Light Reaction on The Concentration of CO<sub>2</sub>

**1. The details of this experiment in the attached link:**

<https://louis.pressbooks.pub/generalbiology1lab/chapter/influence-of-the-light-reaction-on-the-concentration-of-co2/>

**2. After completing the lab, the student will be able to:**

- A. Measure the dependence of CO<sub>2</sub> fixation on the light-dependent reaction.
- B. Explain the chemical principles of pH indicators and the bicarbonate-CO<sub>2</sub> equilibrium.

**3. The students will be graded after answering one of the case scenario and **NOT** the three and submitting the answers of these three questions:**

- A- In an experiment, the water was first boiled, which drove out all of the existing gases. The water was then added to the test tube containing *Elodea*, which was then exposed immediately to light. The photosynthetic activity of the *Elodea* was then monitored but no photosynthetic activity was detected. How can you correct the situation by modifying the composition of the *Elodea* environment?
- B- Scientists report that the levels of carbon dioxide are rising in the atmosphere and driving climate change. Another observation is that the acidification of oceans is also a consequence of climate change. Can you explain what link may exist between the two phenomena and how it affects the marine ecosystem?
- C- Farmers report that planting corn plants too closely can stunt growth even when the plants are heavily fertilized and receive plenty of light. Furthermore, the effect seems to be reduced in recent years. What is the growth limiting factor under these conditions? What may be an explanation? How do plants respond to decreased availability of the limiting factor?

**Writing Quality:** Organization, clarity, and adherence to scientific argument conventions.

## 9. Extension/Reflection ( 60 minutes)

<b>Reason:</b>	<p><i>This part encourages students to reflect on the lesson and extend their learning. It might include homework, further reading, or a reflection on how the argumentative skills learned can apply to other areas of science or life.</i></p> <p><i>After the lesson, the teacher reflects on how effectively students engaged in the inquiry and argumentation process. Were students able to use evidence effectively to support their claims? Did they engage in meaningful critique of their peers' arguments? What improvements can be made for future lessons?</i></p> <p><b>Procedure:</b></p> <p><b>A- The teacher designed a questionnaire that the student will receive and answer it individually.</b></p> <p><b>B- The teacher may have an online virtual game that will help the students to challenge as two groups to test the student knowledge.</b></p> <p><b>C- The teacher may ask the students to write suggestions to write their feedback and reviews about their new experience in explain based on argumentation.</b></p>
----------------	--