



Plants - The Food Making Specialists

Unit Summary

In this unit students learn about plants as the ultimate source of food for all living organisms. This unit explains how plants make food through the process of photosynthesis.

Using hands-on activities, students visualize where photosynthesis occurs and investigate how sunlight affects photosynthesis and the production of starch in plants.

Students also research on farming practices that enhance the photosynthetic process resulting to increased food production. Going through the unit, they will recognize the importance of photosynthesis in the environment.

The unit demonstrates how technology can be utilized to enhance students' learning. Students use technology to document and analyze data and results of their investigations. The unit illustrates how technology can be used to communicate results of student investigations to other students and how it may be used to solicit feedback on their work.

At a Glance

Grade Level: 8 (2nd year high school)

Subject(s): Science

Time Needed: 7 class meetings (each meeting is 60 minutes)

Things You Need

[Standards](#)

[Resources](#)

Curriculum-Framing Questions

- **Essential Question**
Why are plants special?
- **Unit Questions**
What can plants do?
What has photosynthesis got to do with farming?
Why should I plant a tree?
- **Content Questions**
How do plants make food?
How do farmers help plants produce more food?
Why is photosynthesis important to the environment?

Instructional Procedures

Implementation Plan (DOC 56.5KB): (Three weeks before: Preliminaries)

- Reserve use of computers, still camera, digital camera or digital video camera.
- Look for possible sources of *Hydrilla* and different potted plants.
- Survey for area where to place *Hydrilla* and potted plants for the investigations.
- Sign out equipment for documenting investigations.
- Reserve use of laboratory equipment and apparatuses.
- Procure *Hydrilla* and potted plants and place them close to the laboratory room.
- Four days prior to the activity on *Testing for the Presence of Starch*, keep some potted plants in the dark as under the table, or cover them with black cloth.

First Meeting

1. The unit begins with the teacher asking students "*Why they think plants are special?*". Students' answers will be recorded and used later as they learn about the process of photosynthesis occurring in plants. At this time, teacher will also orient students on the requirements of the unit. He/She will also present to them the rubrics that will be used in evaluating their outputs.
2. The teacher will then mention that plants and other chlorophyll-bearing organisms provide food (energy) for practically all organisms. This process of food-making is known as photosynthesis. Students will then be informed that they will perform several investigations to help them understand how the process of photosynthesis occurs in plants.
3. The students will then be asked if they have an idea where photosynthesis occurs.

4. The class will be divided into groups. The teacher may distribute the students with computers at home among the groups.
5. Students will complete the "[Laboratory Investigation Report](#)" (DOC 37.5KB) to record what they have learned. They will also take photomicrographs of the chloroplasts that they will use in their [website](#) (PDF 368KB).
6. Students can start planning and preparing for their output.

Note: Prior to the development of the student website, teacher will distribute the guide on [How to Save a Picture for the Web](#) (DOC 25KB). For schools with limited number of computers in a computer laboratory, teacher will instruct students to [sign up](#) (DOC 38.5KB) on the schedules in using of computers. Let students sign out laboratory equipment and apparatus.

Second Meeting

1. The teacher will now mention that the process of photosynthesis requires the following raw materials: carbon dioxide, water and light energy. When all of these raw materials are present, photosynthesis takes place and the product of this process is a kind of sugar called glucose. Excess glucose is converted into starch and is stored in leaves and in other parts of the plant. Oxygen is a by-product of photosynthesis and it is released to the atmosphere.
2. Students will then perform the activity *Testing the Leaf for the Presence of Starch*. In this activity students take pictures of their outputs and complete the "[Laboratory Investigation Report](#)" (DOC 37.5KB). The pictures will be later posted in their unit website.

Third Meeting

1. Students perform the activity on *Light and Oxygen Bubbles* to enable them to see the effect of the amount of light on the rate of photosynthesis. During this activity, students collect data and take pictures and, if possible, video footages of air bubbles released from *Hydrilla* leaves. Students will use a spreadsheet program (Microsoft Excel*) to process the data that they have gathered during the investigation. They will construct a graph showing the relationship between the [amount of illumination and the rate of photosynthesis](#) (XLS 29.5KB). They again complete a "[Laboratory Investigation Report](#)" (DOC 37.5KB).
2. The teacher now holds a participative discussion of photosynthesis. The observations made in the three activities will now enable the students to make an operational definition of photosynthesis. The teacher will then use a [Microsoft PowerPoint* presentation](#) (PPT 879KB) to summarize the process of photosynthesis. The following information will be included in the presentation – raw materials needed for photosynthesis, chloroplast ultrastructure, light-dependent and light-independent reactions that occur during photosynthesis.

Fourth Meeting

1. The teacher will now discuss the concept that farming practices done to increase harvest actually enhance the process of photosynthesis. He/she will describe each farming practice and explain how it enhances photosynthesis. Students will prepare a [presentation](#) (PPT 275KB) on their learning, further reading and research about the topic. The student outputs will be evaluated by group. The teacher will give an assignment to read about the importance of photosynthesis to the environment. Advanced students and those with computers at home may be asked to gather information from the Internet to be shared in class.

Fifth Meeting

1. The teacher will now challenge students to explain why photosynthesis is important to the environment. Based on what they have learned so far from the activities, lecture-discussions, and by researching on the Internet, students will come up with answers. They will then organize a campaign (e.g., to plant more trees) using a [brochure](#) (PDF 190KB) that will be distributed to other students and the community.

Sixth Meeting

1. The class will be given time to complete their final outputs.

Seventh Meeting

1. The last meeting will be spent on presenting students' outputs. The teacher can give an optional assignment for students.

Implementation Plan (DOC 56.5KB): (Within one week after implementation: Post-implementation)

- Let students acknowledge help of groupmates in making the outputs.
- Congratulate class for doing good job and exerting effort to be able to come up with the required outputs.
- Make arrangements for printing of brochure after checking and editing it.
- Send/distribute brochures to other classes, schools or to the community.
- Teachers and students return borrowed equipment and laboratory apparatuses.

Prerequisite Skills

The unit requires that students already know the following:

1. Identify and describe cell structures,
2. Prepare a wet mount for observation under the microscope, and
3. Construct a graph or translate data gathered into a graph.

In addition, they should already possess computer skills in:

1. Microsoft PowerPoint*, Microsoft Publisher*, and Microsoft Excel*
2. Internet inquiry

In Communication Arts, students should already know how to develop a brochure.

Differentiated Instruction

Resource Student

- Limit student projects to presentation and brochure. Concentrate on hands-on activities like laboratory work, where they investigate the photosynthetic process. Showing students a video material on photosynthesis will also help students imagine the photosynthetic process.

Gifted Student

- The gifted students may be challenged to design an activity to investigate how much CO₂ is needed by a leaf say, per minute. Understanding how much CO₂ is consumed will enable students to quantify the effect of photosynthesis on reducing global warming.

For Schools Located in Agricultural Areas

- Students can visit a local farm to observe actual farming practices. They may also hold a Question-and-Answer session with local farmers to learn more about how they optimize food production in plants. Before the farm visit, students brainstorm on questions to ask the farmers. To help students maximize the experience, the teacher can provide them with a "Farm Visit Guide".

Student Assessment

Assessment of student learning will be conducted by the teacher and peers through their final outputs. The teacher will evaluate students' presentation and website by group. He/she will use the following rubrics to evaluate the outputs of each group:

- [Rubric for website](#) (DOC 53.5KB)
- [Rubric for brochure](#) (DOC 45KB)
- [Rubric for presentation](#) (DOC 60.5KB)

To guide students, the teacher should also present these rubrics to students before students develop the required outputs.

The "[Laboratory Investigation Report](#)" (DOC 37.5KB) will also help the teacher evaluate their website as she can verify data and results and see for herself the details of the procedures they employed. Peers will be involved in the evaluation of the students' brochure. Here, each student's final score will be the average of their peer and teacher evaluation.

To synthesize what the students have learned, the teacher may opt to give students an assignment asking them to write an essay about why plants are special. The essay should include the following information:

- *How plants make their food?*
- *How certain farming practices enhance photosynthesis to produce more food? and*
- *Why photosynthesis is important to the environment?*

Students may add drawings or diagrams to help illustrate their thoughts and ideas.

Key Word Search

- Life energy
- Photosynthesis
- Chloroplasts
- Food-making in plants
- Plants
- Biology
- Science
- Photosynthetic process

Credits

Ma. Dulcelina Sebastian and Rodolfo Treyes are staff of UP NISMED who participated in the Intel® Teach Program Training last March 2003. They developed this unit plan idea as a team, during the training and enhanced their work after the training. This is the enhanced version of their training output.

Note: The hyperlinked support documents are not part of the PDF. They can be downloaded and printed individually.

Designing Effective Projects: Plants - The Food Making Specialists

Content Standards and Objectives

Targeted Philippine Basic Education Curriculum Competencies

Philippine Secondary Learning Competencies

Biology

Second Year High School

Life Energy

1. Understand how organisms obtain energy.
 - a. Describe the cell part involved in obtaining energy.
 - b. Describe the energy location and function of chlorophyll pigments.
 - c. State the requirements of photosynthesis.
 - d. Explain light and dark reactions of photosynthesis.
 - e. Identify the characteristics of plants that make them efficient producers.
 - f. Analyze the role of green plants as energy supplier to the ecosystem.
 - g. Give scientific explanations behind farming practices.

Student Objectives/Learning Outcomes

In this unit, students will be able to

1. explain the process of photosynthesis.
 - a. identify the cell parts involved in the process of photosynthesis.
 - b. observe chloroplasts under the microscope.
 - c. explain the functions of cell structures in the photosynthetic process.
 - d. identify the raw materials needed in photosynthesis.
 - e. identify the products of photosynthesis.
 - f. analyze the effect of light on the rate of photosynthesis.
 - g. test for the presence of the product of photosynthesis.
2. relate concepts of photosynthesis to farming practices.
3. illustrate how the photosynthetic process helps reduce global warming.

Designing Effective Projects: Plants - The Food Making Specialists

Resources

Materials and Resources

Printed Materials

Books

1. Carale, L. R., Galvez, E. R. and Reyes, R. L. (1999). *Science and Technology for a Better Life: Biology*. (3rd ed.). Makati City: Diwa Scholastic Press Inc.
2. Department of Education, Culture and Sports. Instructional Materials Development Center. (1990). *Science and Technology II*. (1st ed.) Quezon City: Author.
3. Science and Mathematics Education Manpower Development Project (SMEMDP). (1998). *Sourcebook on Practical Work for Teacher Trainers: High School Biology*. (Vol. 1). Quezon City: Author.
4. Science and Mathematics Education Manpower Development Project (SMEMDP). (2000). *Sourcebook on Practical Work for Teacher Trainers: High School Biology*. (Vol. 2). Quezon City: Author.

Supplies

- Paper
- Pencil
- Test tubes
- Test tube racks
- Timer or watch with second hand
- Metric ruler
- Hydrilla plant
- Glass slide
- Cover slip
- Dropper
- Beaker with water
- Compound microscope
- Potted plants
- Iodine solution
- Bleaching solution
- Hammer
- Forceps
- Petri dish or plastic saucers
- 2 vinyl tiles (10 by 15 cm)
- 2 filter papers

Internet Resources

- AQUASTAT: FAO's Information System on Water and Agriculture
http://www.fao.org/ag/AGL/AGLW/aquastat/water_use/index4.stm*
- The web page gives detailed information about photosynthesis.
<http://www.emc.maricopa.edu/faculty/farabee/BIOBK/BioBookPS.html>*
- The web page gives detailed information about the structure of chloroplast and the interactions occurring in them.
<http://www.ftexploring.com/photosyn/chloroplast.html>*

Technology – Hardware

- Camera
- Computer(s)
- Digital Camera
- Internet Connection
- Printer
- Projection System
- Scanner
- Video Camera
- Other: Compound Microscope

Technology – Software

- Database/Spreadsheet
- Webpage Development
- Image Processing
- Encyclopedia on CD-ROM
- Multimedia
- Web Processing
- Web Browser
- Desktop Publishing