

## Modeling the Chloroplast Teacher Preparation

In this assignment, students will design and construct a model of a plant chloroplast using textbooks or diagrams as reference. The three-dimensional model can be constructed on paper plates or ovals cut from poster board. Provide students with some introduction and explanation of the structure before they begin. It will also be helpful if students have previously studied the structure of the plasma membrane and the basic process of photosynthesis. The model should approximate the internal appearance as closely as possible with the materials provided. If studying respiration, the class may be divided, and half of the students assigned models of mitochondria. The models can also be retained and used for comparison to mitochondria in future chapters.

**MC.3.B.1-** *Compare and contrast the structure and function of mitochondria and chloroplasts.*

### Objectives:

#### Students will:

- Design and create a model of the internal structure of a chloroplast.
- Know the names of the parts of the chloroplast.
- Relate the internal structure of a chloroplast to its function.
- Write a fact-based account of a journey through a chloroplast from the viewpoint of a molecule or photon.

#### Materials:

- |  |  |
|--|--|
| • Paper plates (white or green)          | <b>Various green craft materials:</b>        |
| • Hot glue guns/sticks or craft glue     | Sponges, felt, foam sheets, plastic beads,   |
| • Scissors                               | buttons, paper, chenille stems,              |
| • Printed labels or index cards, markers | cardstock, cotton swabs, ribbon, bubble wrap |

#### Preparation Tips:

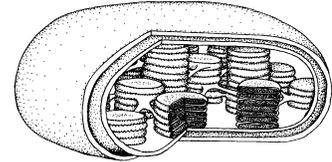
- Collect various materials throughout the year so you have enough for the assignment.
- You may wish to ask students to provide their own green materials, or divide materials you have on hand into zipper bags to discourage waste.
- An interesting variation is to have an activity, such as a review game, during which students can “earn” points or money with which to buy the materials. Provide them with basics and then assign prices to additional materials so they have to determine what they can afford to buy and use.
- **Safety-** Caution students on the proper use of scissors and hot glue guns.

Student Name \_\_\_\_\_ Date \_\_\_\_\_

## Modeling the Chloroplast

### Introduction:

Photosynthesis occurs in organelles called chloroplasts found within the cells of plant leaves, or other organisms such as protists. A basic knowledge of the structure of a chloroplast is important in understanding where the phases of photosynthesis occur. In this assignment, you will design and create a three-dimensional model of a chloroplast using materials provided by the teacher. As you choose materials for the construction, try to simulate the appearance of an actual chloroplast as closely as possible using diagrams as reference.



### Objectives:

- Design and create a model of the internal structure of a chloroplast.
- Know the names of the parts of the chloroplast.
- Relate the internal structure of a chloroplast to its function.
- Review the process of photosynthesis and write a fact-based account of a journey through a chloroplast from the viewpoint of a molecule or photon.

### Materials:

- Paper plate or oval cardboard base
- Glue
- Scissors
- Green craft materials
- Labels for internal structures, green markers
- Diagrams of chloroplasts and text

**Instructions:**      **Safety:** Use caution with scissors or hot-glue guns.

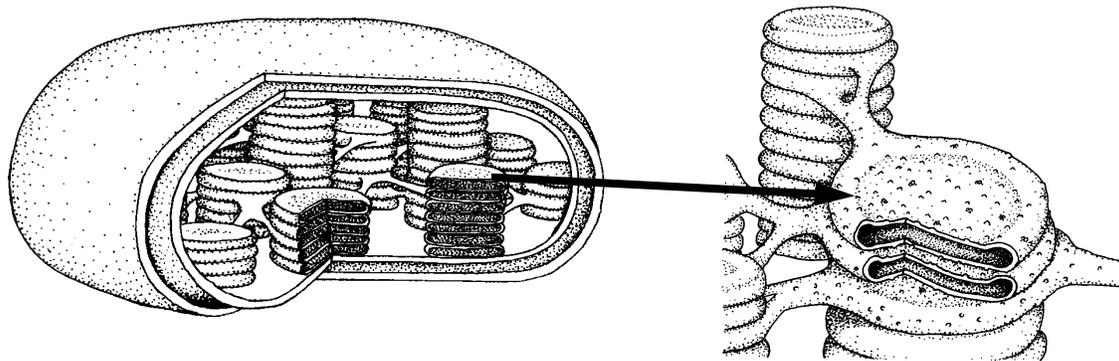


- Examine diagrams of the internal structure of a chloroplast in your text or other resources.
- Review the structure and function of all parts.

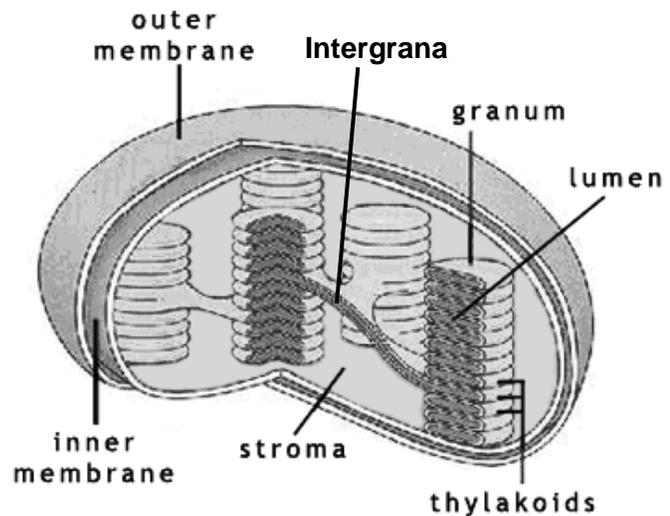
### Instructions (continued)

- Assemble your materials and decide how to best represent the structure in a three-dimensional way.
- Cut out and arrange the materials on the paper plate base.
- When you are satisfied with the appearance begin to glue items to the base.
- Make labels for each structure in the chloroplast or use those provided by the teacher.
- Glue the labels next to each structure.

### Chloroplast Diagrams



Use these diagrams as reference for structure. Label the inner structures as indicated by the teacher. You may also refer to your textbook.



**Reference:** Diagrams: [Helpsavetheclimate.com/photosynthesisBiodidac.bio.uottawa.ca](https://www.helpsavetheclimate.com/photosynthesisBiodidac.bio.uottawa.ca)

Name \_\_\_\_\_

Date \_\_\_\_\_

## Modeling the Chloroplast

### Questions:

1. Where are the chlorophyll molecules and other pigment molecules located in the chloroplast? How are these pigment molecules arranged?
2. What is the difference between the granum and a thylakoid?
3. Photosynthesis can be divided into two distinct phases. What are they called and where does each occur?
4. Write a balanced equation for photosynthesis and indicate the products and reactants. During what phase of photosynthesis are each of the reactants used?
5. Why is it incorrect to refer to part of photosynthesis as the "Dark Reactions"?

## Modeling the Chloroplast

### Key to Questions

1. Where are the chlorophyll molecules and other pigment molecules located in the chloroplast? How are these pigment molecules arranged?

***They are arranged in photosystems within the thylakoid membranes.***

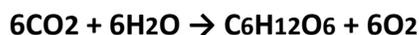
2. What is the difference between the granum and a thylakoid?

***A thylakoid is a single membranous sack and a granum is a stack of several thylakoids.***

3. Photosynthesis can be divided into two distinct phases. What are they called and where does each occur?

***The first phase of photosynthesis is the light dependent reactions and occurs in the thylakoid membrane. The second phase is the light independent reactions (Calvin Cycle) and occurs in the stroma of the chloroplast.***

4. Write a balanced equation for photosynthesis and indicate the products and reactants. During what phase of photosynthesis is each of the reactants used?



***Water is split during the light dependent phase, and carbon dioxide is utilized during the light independent phase.***

5. Why is it misleading to refer to part of photosynthesis as the “Dark Reactions”?

***The light independent reactions were at one time referred to as dark reactions because light is not required. Since they can occur during the day or at night it is misleading to call them the dark reactions.***

Name \_\_\_\_\_

Date \_\_\_\_\_

## RAFT Writing 1 - The Chloroplast

“RAFT” writing is a paper written from a viewpoint other than your own as a student, to someone other than your teacher. RAFT stands for Role, Audience, Format, and Topic.

- You will be writing about the structure of a chloroplast, from the viewpoint of a **photon of light** that has entered the chloroplast.
- Your audience will be other photons that have not yet entered the chloroplast.
- The format will be a descriptive trip through the chloroplast, relating what you as a photon “saw” and what happened to you or what you did.
- The paper should be creative and not a copy of source information. Include a title.
- Write it in your own words and be able to describe or explain the information using terminology you’ve learned.
- Review the process of photosynthesis before you begin.

Name \_\_\_\_\_

Date \_\_\_\_\_

## RAFT Writing 2 - The Chloroplast

“RAFT” writing is a paper written from a viewpoint other than your own as a student, to someone other than your teacher. RAFT stands for Role, Audience, Format, and Topic.

- You will be writing about the structure of a chloroplast from the viewpoint of a **water molecule** that has entered the chloroplast.
- Your audience will be other water molecules that have not yet entered the chloroplast.
- The format will be a descriptive trip through the chloroplast, relating what you as a water molecule “saw” and what happened to you or what you did.
- The paper should be creative and not a copy of source information. Include a title.
- Write it in your own words and be able to describe or explain the information using terminology you’ve learned.
- Review the process of photosynthesis before you begin.