

Category V Life Science Examples

Guiding student interpretation and reasoning

Material B

Consider the bolded part of the benchmark 5E6-8#1:

Food provides the molecules that serve as fuel and building material for all organisms.

Plants use the energy from light to make sugars from carbon dioxide and water.

This food can be used immediately or stored for later use. Organisms that eat plants break down the plant structures to produce the materials and energy they need to survive. Then they are consumed by other organisms. (American Association for the Advancement of Science, 1993)

After reading the text (p. **2s**), students are asked to respond to six questions (p. **3s** and p. **39t**). Questions 1-5 are directly relevant to this benchmark. They may help students focus on important ideas in the text. However, they are not likely to help students make sense of the text. For example, they do not encourage students to make connections between the ideas presented in the text and their *own* ideas. Moreover, students are never asked to relate the ideas in the text to experiences with phenomena that follow (for example, leaves from plants kept in the dark have little starch compared with leaves from plants that have been in the bright light).

Green machines

1. Modern farming uses many different sorts of machinery. But the most important machines are growing in the fields, the "green machines."

2. Plants make their own food. They do this by a process called photosynthesis. Photosynthesis occurs mostly in the leaves, but also in other green parts of a plant.

3. Plants need light to give them energy for photosynthesis. Leaves have a large surface area to catch a lot of light.

4. Leaves contain a chemical called chlorophyll. This is a green pigment that gives leaves their color. Chlorophyll absorbs energy from sunlight for photosynthesis.

5. During photosynthesis, plants combine carbon dioxide with water to make carbohydrates. The carbon dioxide gas comes from the air and enters the plant through openings in the leaves.

6. The water comes from the soil, enters the plant through the roots, and is drawn up to the leaves. Plants use the carbohydrates (sugars) produced by photosynthesis as food for growth and development.

7. During photosynthesis, plants also release oxygen into the air. This is a by-product of photosynthesis.

8. All the plant material available for harvesting is the product of photosynthesis. It is all produced by green machines.

Photosynthesis

Use the information on the previous page to answer the following questions.

1. What are the starting materials for photosynthesis?
2. What are the products of photosynthesis?
3. Write a word equation that summarizes the process of photosynthesis?
4. Where do plants get the energy required to carry out photosynthesis?
5. Why is chlorophyll important to photosynthesis?
6. If green plants did not photosynthesize, what would happen to:
 - The amount of oxygen in the atmosphere?
 - The amount of carbon dioxide in the atmosphere?
 - Our food supply?

Food for plants and animals

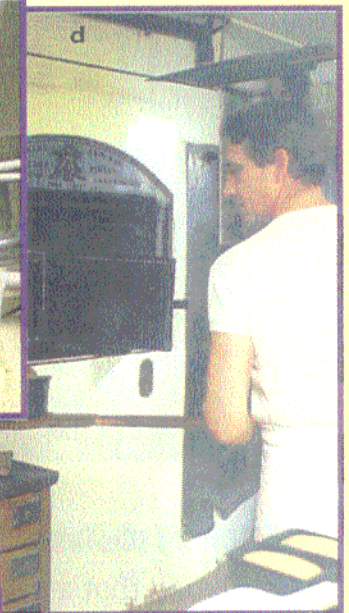
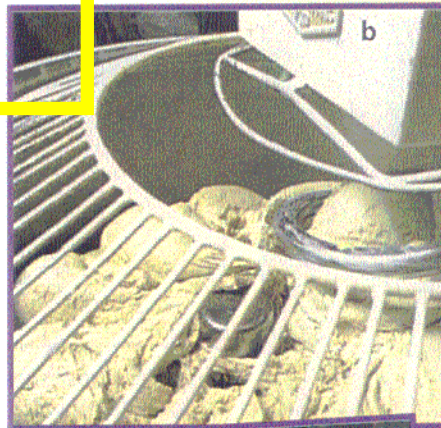


Plants make their own food by photosynthesis. We use food made by plants as food for ourselves. We either eat plant material, or feed it to animals and then eat animal products. A large variety of plants are grown as food for humans or for animals.

Wheat

Directly or indirectly, plants provide all our food by photosynthesis. One of the most important food plants is wheat. The pictures here show different stages in the production of bread from wheat.

- Explain what is happening in each picture (a-d).
- Draw a flow chart to show how bread is made from wheat.



Text application
50 minutes**Student Book pages 2-3**
Green Machines

Students may be familiar with the idea that light is important to plants. For example, if a tent is left standing on a field for several days, the grass underneath will wilt and become very pale. The picture story on Student Book page 2 introduces the idea of leaves as "machines," with the plants as busy factories, making food.

Caption 2: Oxygen is also released in photosynthesis. (It will be discussed in caption 7.)

Caption 6: Water and carbohydrates move up and down special tubes called veins, which consist of xylem and phloem cells.

Caption 7: Oxygen is listed as a by-product of photosynthesis because food is the main product.

Caption 8: Plant parts not harvested may also serve as food for other creatures in the environment.

Students work in small groups, discussing the information on Student Book page 2 and completing the tasks suggested on page 3.

Displaying data
30 minutes**Student Book page 3**
Green Machines

As an example of our dependency on plants for food, students follow pictures on Student Book page 3 to compile a flow chart showing the stages in making bread from wheat.

Answers to Student Book page 3:

1. Carbon dioxide, water.
2. Carbohydrates, oxygen.
3. Carbon dioxide + water \rightarrow carbohydrates + oxygen.
4. From light.
5. Chlorophyll absorbs energy from sunlight for photosynthesis.
6.
 - Oxygen would decrease.
 - Carbon dioxide would increase.
 - Food supply would be decreased.
- (I) a. Harvesting wheat.
b. Making dough from flour.
c. Baking the bread.
d. Removing bread from the oven.
- (I) Make flour from wheat \rightarrow use flour to make bread dough \rightarrow bake bread in oven.

Lab work 1
50 minutes**Student Sheet 1a**
Light and Photosynthesis

Most students will follow the logic of the tests in this lesson more easily if they are done in succession. However, this and the next activity may be done simultaneously by having some groups of students working with leaves from the plants described in the requirements for this lesson. A discussion to share results with the entire class is then necessary.