

Unit B: Tree Growth and Development

Lesson 2: Understanding the Growth and Decline of Forest Trees

Student Learning Objectives: Instruction in this lesson should result in students achieving the following objectives:

1. Explain the processes of photosynthesis, respiration, and transpiration.
2. Explain how trees reproduce.

Recommended Teaching Time: 1.5 hours

Recommended Resources: The following resources may be useful in teaching this lesson:

- A PowerPoint has also been developed with use of this lesson plan
- <http://mff.dsisd.net/Environment/TreePhys.htm>
- http://www.arboretum.harvard.edu/programs/tree_basics.swf
- <http://maple.dnr.cornell.edu/kids/reproduction.htm>
- <http://www.newton.dep.anl.gov/askasci/bio99/bio99643.htm>

List of Equipment, Tools, Supplies, and Facilities

Writing surface
PowerPoint Projector
PowerPoint slides
Transparency Masters
Student Worksheet
Tree Seeds

Terms: The following terms are presented in this lesson (shown in bold italics and on PowerPoint Slide #2):

- Chloroplasts
- Chlorophyll
- Layering
- Ovules
- Photosynthesis
- Respiration
- Stomata
- Suckering
- Transpiration
- Xylem

Interest Approach: Use an interest approach that will prepare the students for the lesson. Teachers often develop approaches for their unique class and student situations. A possible approach is included here.

On the board write the question, “From where do we get our energy to live?” Ask for student responses. Some possible responses would be food, nutrients, etc. Then ask how do plants get their energy. Point out that they can’t eat food like humans can. Lead discussion to objective one of the lesson.

Summary of Content and Teaching Strategies

Objective 1: Explain the processes of photosynthesis, respiration, and transpiration.

(PowerPoint Slide # 3)

I. Like any other type of plant, trees require several chemical processes to occur within the plant for survival. These reactions allow the plant to produce food, expel waste, and regulate plant temperature. Three of the most important reactions that occur within a tree are photosynthesis, respiration, and transpiration.

(PowerPoint Slide # 4)

A. Photosynthesis—**Photosynthesis** is a series of complex chemical reactions in which carbon dioxide from the air and water from the soil are converted into carbohydrates (starches and sugars), with oxygen as a by-product. Nutrients and water from the roots are carried to the leaves by the **xylem**.

(PowerPoint Slide # 5)

Inside each leaf are millions of chloroplasts containing chlorophyll. **Chlorophyll** is the green substance in the chloroplasts that reacts with sunlight. The **chloroplasts** convert radiant energy (sunlight) into chemical energy.

(PowerPoint Slide # 6)

The carbohydrates manufactured by the leaves are transported and used throughout the tree as the food materials for life support, growth, and reproduction.

(PowerPoint Slide # 7 shows the equation for respiration and PowerPoint Slide # 8 shows a cross section of a leaf.)

(PowerPoint Slide # 9)

B. Respiration—The process of consuming carbohydrates and oxygen to obtain energy for the biological processes of life support, growth and reproduction is called **respiration**. Although a growing tree uses oxygen in respiration, the amount of oxygen consumed is much less than the amount of oxygen produced in the separate process of photosynthesis.

(PowerPoint Slide # 10 shows the equation for respiration)

(PowerPoint Slide # 11)

C. Transpiration—The loss of water vapor in plants is called **transpiration**. This occurs as a product of the process of respiration. Most of the water vapor escapes through structures in the leaf called stomata, which are located on the underside of the leaf. The primary function of the **stomata** is to regulate the exchange of carbon dioxide and water vapor with the atmosphere.

****Use TM: B2–1, TM: B2–2, and TM: B2–3 or PowerPoint Slide #12, to aid in the discussion on this topic. Have students repeat the Photosynthesis chemical equation out loud together as a class. When they are all together have them repeat the**

Respiration equation in the same manner. Then pass out WS: B2-1. Have them complete this and then review the answers together as a class.

Objective 2: Explain how trees reproduce.

(PowerPoint Slide # 13)

II. There are two methods by which trees reproduce: seed reproduction and vegetative reproduction (sprouting, suckering, and layering).

A. Most trees reproduce by seed, but many can also reproduce vegetatively. Broad-leaved trees will usually sprout from cut stems, but most needle-leaved trees, or conifers, will not sprout.

(PowerPoint Slide # 14)

Suckering is the sending up of shoots from underground roots. **Layering** occurs when the lower branches of a tree touch the ground and the branch tips become covered by plant and leaf litter. A branch tip then develops roots extending into the soil and eventually a new tree grows from the branch tip.

(PowerPoint Slide # 15)

B. Seed reproduction is the most common method of reproduction utilized by trees. There is a series of stages that the tree goes through in the development of seeds. In broadleaved trees, seeds are produced when the fertilized **ovules**, which are found in the ovaries of the flower, ripen. In most instances, the fruit of broad-leaved trees matures one year from the time it was fertilized.

(PowerPoint Slide #16)

Seed production occurs differently in conifers. In these needle-leaved trees, the ovules are born naked on cone scales and are not enclosed in an ovary. At pollination time the female cone (containing the ovules) scales spread apart for a short period of time. At this same time, male cones produce pollen.

(PowerPoint Slide # 17)

It is hoped that when the scales of the female cone is spread apart that some of the pollen will fertilize the ovule. Upon ripening, the cone dries out, the scales come apart, and the winged seeds are dispersed by wind.

**** Ask students what tree seeds are popular in your area. Invite your students to bring examples of these seeds in and have a discussion. You could also bring in some seeds if needed.**

Review/Summary: Use the student learning objectives to summarize the lesson. Have students explain the content associated with each objective. Student responses can be used in determining which objectives need to be reviewed or taught from a different angle.

Application: Students will identify tree seeds around their area.

Evaluation: Use the following sample test to evaluate the students' comprehension of the material covered in this lesson.

Answers to Sample Test:

Part One: Matching

1. b
2. h;
3. d
4. g
5. a
6. f
7. e
8. c

Part Two: Completion

1. seed; vegetative
2. Broad; needle
3. respiration; photosynthesis

Test

Unit B Lesson 2: Understanding the Growth and Decline of Forest Trees

Part One: Matching

Instructions. Match the term with the correct response. Write the letter of the term by the definition.

- | | | |
|-------------------|-----------------|--------------|
| a. Respiration | d. Chloroplasts | g. Stomata |
| b. Photosynthesis | e. Ovules | h. Suckering |
| c. Transpiration | f. Chlorophyll | |

- _____ 1. A series of complex chemical reactions in which carbon dioxide from the air and water from the soil are converted into carbohydrates (starches and sugars), with oxygen as a by-product.
- _____ 2. The sending up of shoots from underground roots.
- _____ 3. Converts radiant energy (sunlight) into chemical energy.
- _____ 4. Regulates the exchange of carbon dioxide and water vapor with the atmosphere.
- _____ 5. The process of consuming carbohydrates and oxygen to obtain energy for the biological processes of life support, growth and reproduction.
- _____ 6. The green substance in the chloroplasts that reacts with sunlight.
- _____ 7. Found in the ovaries of the flower.
- _____ 8. The loss of water vapor in plants.

Part Two: Completion

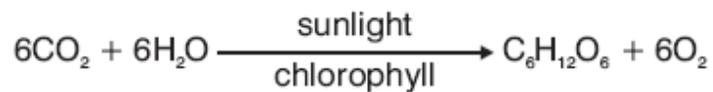
Instructions. Provide the word or words to complete the following statements.

1. There are two methods by which trees reproduce: _____ reproduction and _____ reproduction
2. _____-leaved trees will usually sprout from cut stems, but most _____-leaved trees will not sprout.
3. Although a growing tree uses oxygen in _____, the amount of oxygen consumed is much less than the amount of oxygen produced in the separate process of _____.

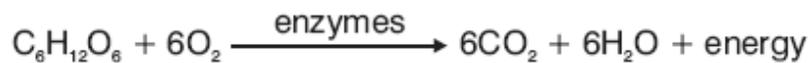
TM: B2-1

CHEMICAL EQUATION FOR PHOTOSYNTHESIS

◆ SIMPLE PHOTOSYNTHESIS EQUATION

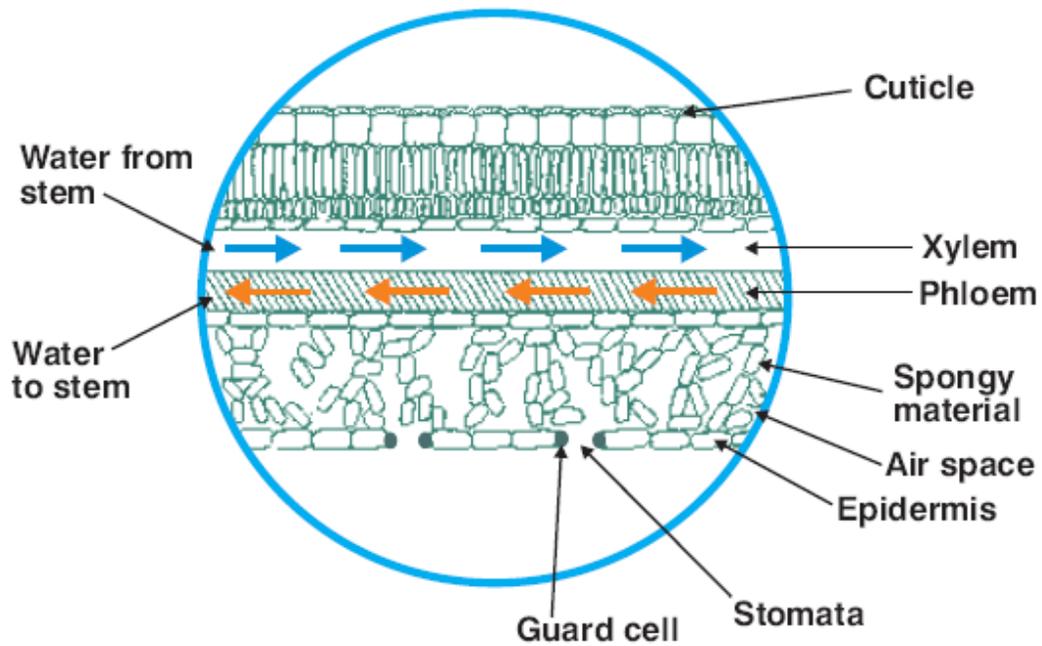


◆ CHEMICAL EQUATION FOR RESPIRATION



TM: B2-2

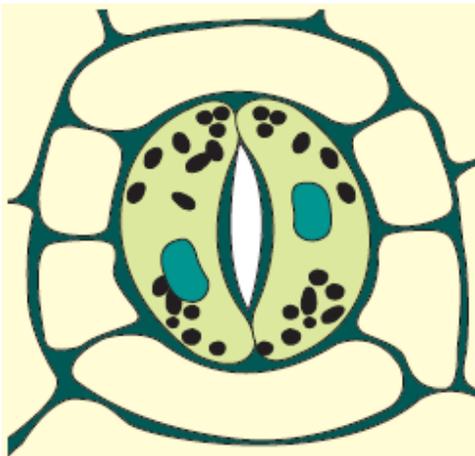
CROSS SECTION OF A LEAF



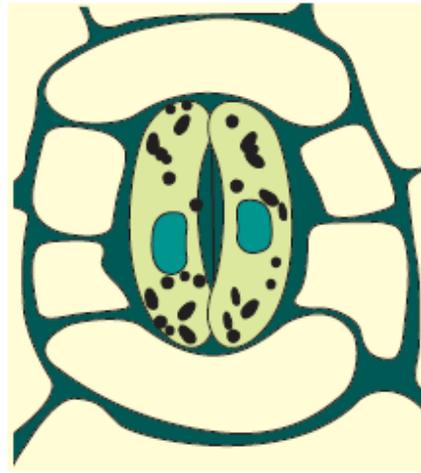
TM: B2-3

STOMATA

Stoma open



Stoma closed



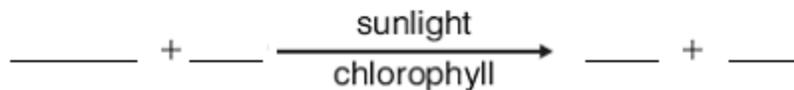
(Courtesy, Interstate Publishers, Inc.)

WS: B2-1

Directions: In the underlined blank spaces below, complete both equations

CHEMICAL EQUATION FOR PHOTOSYNTHESIS

◆ SIMPLE PHOTOSYNTHESIS EQUATION



◆ CHEMICAL EQUATION FOR RESPIRATION

