

# BOTANY, PLANT PHYSIOLOGY AND PLANT GROWTH

## Lesson 8: ENVIRONMENTAL FACTORS

### I. LESSON DESCRIPTION

Students study a reading assignment on environmental factors affecting the three basic physiologic processes of plants, and then complete a three-part exercise with the aid of the assignment. *Estimated time requirement for this lesson is 25 minutes.*

**Curriculum Standards:** Minnesota Academic Standards in Science, Minnesota Department of Education, 5-24-10, Grades 9-12:

- 9.4.1.2.4 “Explain the function and importance of cell organelles for prokaryotic and/or eukaryotic cells as related to the basic cell processes of respiration, photosynthesis, protein synthesis and cell reproduction.”
- 9.4.1.1.1 “Explain how cell processes are influenced by internal and external factors, such as pH and temperature, and how cells and organisms respond to changes in their environment to maintain homeostasis.”

National Agriculture, Food and Natural Resources (AFNR) Career Cluster Content Standards, National Council for Agricultural Education, 2009:

- Plant Systems (PS):
    - PS.02.01.01.a. Describe the qualities of light that affect plant growth.
    - PS.02.01.02.a. Describe the effects air, temperature and water have on plant metabolism and growth.
- PS.02.01.02.b. Determine the optimal air, temperature and water conditions for plant growth.

*Light, temperature, and water affect the three basic physiological processes of plants.*

**Student Learning Objectives:** After completing this class, students will be able to explain the effects of three environmental factors on plant functions:

- (1) light
- (2) temperature
- (3) water

**Instructional Methods:** Reading Assignment, Exercise.

## II. LESSON PLAN

### Introduction

Legend:

Text in normal face - Represents teacher's words.

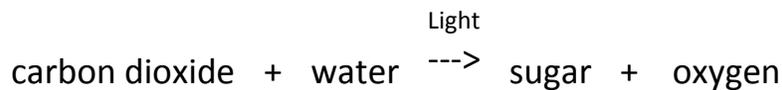
*Text in italic face - Represents suggestions for the teacher.*

#### Interest Approach:

- Let's bring back to mind the three basic functions from the physiology lesson,  
(1) Photosynthesis, or production of food  
(2) Respiration, or consumption of food, and  
(3) Transpiration, or water movement through the plant.

QUESTION: Specifically, what is the equation for photosynthesis? (*Write the equation on the chalkboard for reference during this lesson.*)

ANSWER:



QUESTION: And what is the equation for respiration? (*Write on the chalkboard.*)

ANSWER:



QUESTION: Look closely at the components of these equations, and tell me what ways will the environmental conditions surrounding a plant affect photosynthesis, respiration, and transpiration?

ANTICIPATED RESPONSES: *Responses can include ideas such as, more photosynthesis occurs on sunny days than cloudy days, plants wilt in a drought period, plant growth slows down during cooler days in fall. Let the dialog continue for about 3 minutes, until you see the students begin to appreciate the value of ideal conditions, and the variety of scenarios that may spell stress or decline of a plant. If dialog is not active, you can stimulate the discussion with more specific questions rising out of this lesson, or by recalling specific elements of the equations for photosynthesis and respiration.*

- Having analyzed how basic plant processes work in ideal situations, you can consider in this lesson how certain environmental conditions maintain or degrade those ideal situations.

**Relevancy:**

- In this lesson we'll learn how light, temperature, and water affect the three basic plant processes.

**Learning Objectives:**

- After attending this class, you will be able to:
  - (1) cite examples of light quantity, light quality, and light duration,
  - (2) state the effect of temperature on plant growth and flower formation, and
  - (3) relate the importance of water to photosynthesis, respiration, and transpiration.
- Now let's move into a study session on these factors.

**Instructional Methods****Reading Assignment:** 10 minutes estimated

- Distribute to each student a copy of the reading assignment, 08\_Environmental Factors\_Reading.pdf.*
- Please study this handout. You'll have 10 minutes.

**Exercise:** 5 minutes estimated

- Distribute to each student a copy of the exercise, 08\_Environmental Factors\_Task.pdf.*
- Please complete this exercise; you can refer to the reading assignment. You'll have 5 minutes.
- Then discuss their responses.*

**Conclusion**

- You can see in broad terms the many ways that light, temperature, and water can cause a plant to thrive or to decline.
- That understanding will help the nursery grower/professional or landscaper to assess, in specific terms, the varying states of health of any given plant.
- In the next lesson, we'll continue to learn how additional factors affect the plant health – factors related to plant nutrition.

## OPTIONAL ACTIVITIES

- Assign a research project for the students to locate specific instructions that growers use to bring chrysanthemums or poinsettias into bloom at specific times of the year.
- Study the growth rings on a cross-section of tree trunk, either in a photograph or a real slice of trunk. Distinguish between thick and lean growth rings, indicating a year where environmental conditions were not so favorable.
- Take the students on a walk outdoors to find plants that enjoy ideal conditions regarding light, temperature, and water. At the same time keep your eyes open for plants that are not doing so well, and discuss the possibility that the plant's needs are not being met for light, temperature, or water. For example, if a plant looks spindly under a shade tree, then you can guess that the plant requires more sun. Look for plants that may be suffering from excess heat, possibly reflected light from a building or sidewalk. If the weather has been dry, then you're likely to run across some good examples of wilt.
- Research the chill hour requirements of various varieties of fruit. Chill hours are the number of hours where winter temperatures are above 32 and below 45 degrees Fahrenheit.

## OPTIONAL RESOURCES

### Books:

- *Biology of Plants*, Seventh Edition (December 17, 2004), by Peter H. Raven, Ray F. Evert, Susan E. Eichhorn. Publisher: W. H. Freeman; Hardcover: 944 pages. ISBN: 0716710072  
- Comprehensive book on botany.

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