

Greenhouse Operation and Management

Curriculum Guide: *Greenhouse Operation and Management*

Unit: I. The Greenhouse Industry

Unit Objective:

Students will demonstrate an understanding of the requirements of a position in the greenhouse industry by researching the position and presenting their findings on a poster that will be displayed in class.

Show-Me Standards: 4.8, CA6

References:

Area businesses, the newspaper, or the local phone book

CAFNR Career Services. University of Missouri. Accessed December 3, 2003, from <http://cafnr.missouri.edu/Students/CareerServices/default.asp>.

Division of Workforce Development. Missouri Department of Economic Development. Accessed December 3, 2003, from <http://www.ded.mo.gov/employment/workforcedevelopment/>.

Greenhouse Operation and Management. University of Missouri-Columbia, Instructional Materials Laboratory, 2002.

Missouri Occupational information Coordinating Committee. Accessed December 3, 2003, from <http://www.moicc.net/>.

Monster.com (job search engine). Accessed December 3, 2003, from <http://www.monster.com/>.

Occupational Outlook Handbook. U.S. Department of Labor. Bureau of Labor and Statistics. Accessed February 3, 2004, from <http://www.bls.gov/oco/home.htm>.

University of Missouri-Career Center. Accessed December 3, 2003, from <http://www.career.missouri.edu/>.

Students will use additional outside sources to complete this activity.

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Instructional Strategies/Activities:

- Students will engage in study questions in lessons 1 and 2.
- Students will complete AS 1.4, Greenhouse Careers: Which One? How to Succeed?; and AS 1.5, Getting Involved in the Greenhouse Industry.
- Additional activities that relate to the unit objective can be found under the heading “Other Activities and Strategies” in the following location:
p. 29.

Performance-Based Assessment:

Students will work individually to research one profession listed in TM 1.4 in lesson 2 of the unit. Areas to examine include, but are not limited to, educational requirements, pay scale, responsibilities, and duties. Students will present their findings on a poster that will be displayed in class.

Assessment will be based on the content and presentation of the poster. Spelling, grammar, punctuation, and capitalization will also be factors in the assessment.

Unit I—The Greenhouse Industry Instructor Guide

The instructor should assign the performance-based assessment activity at the beginning of the unit. Students will work toward completing the activity as they progress through the unit lessons. The assessment activity will be due at the completion of the unit.

1. Have each student select a greenhouse operation position listed on TM 1.4 in lesson 2 of the unit and determine the job requirements for that position.
 - a. If preferred, assign each student a greenhouse operation position to ensure that a variety of positions are researched and represented on the posters.
 - b. Provide students with other position choices if additional positions are needed due to class size or interests.
2. Have students find information on the following requirements.
 - Education
 - Pay scale
 - Responsibilities
 - Duties
 - Any other information that is relevant to the position
3. Students should use a variety of sources to find information, such as books, the Internet, journals, magazines, and job ads.
 - a. Several useful Internet resources are listed in the references section of this assessment activity.
 - b. Students must submit a complete bibliography of their sources along with their posters.
4. Have students present their information on a poster. Display completed posters in class. NOTE: The information on the posters could be used for material for quizzes or exams.
5. The final assessment will be based on the overall content and presentation of the poster. Spelling, grammar, punctuation, and capitalization will also be factors in the assessment.

Unit I—The Greenhouse Industry Student Handout

1. Select a greenhouse operation position listed on TM 1.4 in lesson 2 of the unit and determine the job requirements for that position.
2. Find information on the following job requirements.
 - Education
 - Pay scale
 - Responsibilities
 - Duties
 - Any other information that is relevant to the position
3. Use a variety of sources to find information, such as books, the Internet, journals, magazines, and job ads. You must submit a complete bibliography of your sources along with your poster.
4. Present your findings on a poster, which will be displayed in class.
5. Your final assessment score will be based on the overall content and presentation of your poster. Spelling, grammar, punctuation, and capitalization will also be factors in the assessment.

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Unit I—The Greenhouse Industry Scoring Guide

Name _____

Assessment Area	Criteria	0 Points	1 Point	2 Points	3 Points	4 Points	Weight	Total
Content of Poster	Information is complete and facts are accurate	Failed	Poor	Fair	Good	Excellent	X 15	
Presentation of Poster	Well organized, neat, and easy to follow	Failed	Poor	Fair	Good	Excellent	X 7.5	
Technical Considerations	Spelling, grammar, punctuation, and capitalization are correct	Failed	Poor	Fair	Good	Excellent	X 2.5	
TOTAL								

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Final Assessment Total _____/100 pts.

Comments:

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Unit: II. Growing Structures

Unit Objective:

Students will demonstrate an understanding of greenhouse structures by making an oral presentation in which they will propose a repair or improvement to the school's greenhouse and provide specifics on the materials and costs involved.

Show-Me Standards: 1.1, CA1

References:

Biondo, R. J. *Greenhouse Production*. Pearson Prentice Hall, 2004.

Greenhouse Operation and Management. University of Missouri-Columbia, Instructional Materials Laboratory, 2002.

Hummert International. Accessed December 3, 2003, from <http://www.hummert.com/>.

Stuppy, Inc. Accessed December 3, 2003, from <http://www.stuppy.com/>.

Students will use additional outside sources to complete this activity.

Instructional Strategies/Activities:

- Students will engage in study questions in lessons 1 through 3.
- Students will complete AS 2.1, Plan Your Own: Part I; and AS 2.2, Plan Your Own: Part II.
- Additional activities that relate to the unit objective can be found under the headings "Other Activity and Strategy" and "Unit II Activity" in the following locations: p. 47, p. 74, and pp. 92-93.

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Performance-Based Assessment:

Students will be given the scenario that the department's instructors want to make repairs or improvements to the school's greenhouse. Students will work individually or in groups to develop a plan to present to the school board (classmates) to convince the board that the greenhouse needs these changes. They will present their plan in the form of a 5-minute sales pitch that will include a visual aid, such as a diagram of the proposed changes and where in the greenhouse they will be made, a list of materials, and a price sheet that provides the overall cost.

Assessment will be based on the overall content and presentation of the plan.

Unit II—Growing Structures Instructor Guide

The instructor should assign the performance-based assessment activity at the beginning of the unit. Students will work toward completing the activity as they progress through the unit lessons. The assessment activity will be due at the completion of the unit.

1. Present the following scenario to the students: The department's instructors want to get approval from the school board to make repairs or improvements to the school's greenhouse.
2. Have students evaluate the greenhouse to determine what repairs or improvements to make or suggest changes for students to consider, such as replacing a gravel floor with a cement floor or installing an overhead sprinkler system.
3. Have students work individually or in groups to develop a plan that will convince the school board that the changes should be made.
4. Students may use material in the unit and will need to use additional outside sources to prepare their plan.
 - a. Several resources are listed in the references section of this assessment activity that contain information on greenhouse structure options, materials, and costs.
 - b. Students must provide a complete bibliography of their sources along with their presentation.
5. Have students present their plan to the school board (classmates) in the form of a sales pitch. Presentations should be 5 minutes long.
 - a. The presentation will include the following elements:
 - Visual aid, such as a diagram of the proposed changes (This should show where in the greenhouse the changes will be made and include a picture of the materials, if possible.)
 - List of materials needed to make the improvement or repair
 - Price sheet displaying the total cost
 - b. For example, if the student proposes installing an overhead sprinkler system, the presentation should include a picture of the system, where it would be installed in the greenhouse, a list of the materials required, and a price sheet that provides the total cost.
6. Remind students who are working in groups that all members must participate in the presentation in some way.

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7. The final assessment will be based on the overall content and the presentation of the plan.
8. **ADDITIONAL ACTIVITY:** For further review, an additional unit-level activity, *Greenhouse Portfolio*, is included on pp. 92–93 of the *Instructor Guide*. For this activity, students will work in groups to assemble a portfolio that includes information about all the structural and internal mechanisms needed to build a new commercial greenhouse. Students will then give their portfolio to the instructor and receive another group's portfolio to critique using questions included in the activity. Answers will vary.

Unit II—Growing Structures Student Handout

1. Consider the following scenario: The department’s instructors want to get approval from the school board to make repairs or improvements to the school’s greenhouse.
2. Your instructor may suggest repairs or improvements or may instruct you to evaluate the greenhouse and decide what repair or improvement is needed most.
3. Develop a presentation that will convince the school board that the changes should be made.
4. You may use material in the unit and will need to use additional outside sources to prepare your presentation. You must provide a complete bibliography of your sources along with your presentation.
5. Present your plan to the school board (classmates) in the form of a sales pitch. Presentations should be 5 minutes long.
 - a. The presentation will include the following elements:
 - Visual aid, such as a diagram of the proposed changes (This should show where in the greenhouse the changes will be made and include a picture of the materials, if possible.)
 - List of materials needed to make the improvement or repair
 - Price sheet displaying the total cost
 - b. For example, if you were proposing to install an overhead sprinkler system, the presentation should include a picture of the system, where it would be installed in the greenhouse, a list of the materials required, and a price sheet that provides the total cost.
6. If you are working in a group, be sure that all group members participate in the presentation in some way.
7. Your final assessment score will be based on the overall content and the presentation of your plan.

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Unit II—Growing Structures Scoring Guide

Name _____

Assessment Area	Criteria	0 Points	1 Point	2 Points	3 Points	4 Points	Weight	Total
Content of Plan	<ul style="list-style-type: none"> <input type="checkbox"/> Includes all required elements <input type="checkbox"/> Facts are accurate <input type="checkbox"/> Visual elements emphasize and clarify key points <input type="checkbox"/> Well organized 	0 criteria met	1 criterion met	2 criteria met	3 criteria met	All 4 criteria met	X 17.5	
Presentation of Plan	<ul style="list-style-type: none"> <input type="checkbox"/> Holds audience interest <input type="checkbox"/> Speaks clearly and uses correct grammar <input type="checkbox"/> Speaks in a persuasive manner <input type="checkbox"/> Maintains good posture 	0 criteria met	1 criterion met	2 criteria met	3 criteria met	All 4 criteria met	X 7.5	
TOTAL								

Final Assessment Total _____/100 pts.

Comments:

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Curriculum Guide: *Greenhouse Operation and Management*

Unit: III. Plant Science Basics

Unit Objective:

Students will demonstrate an understanding of plant science by creating a plant collection in which plants will be identified and labeled as to the type of root, leaf shape, leaf margin, leaf attachment, and venation.

Show-Me Standards: 1.3, SC3

References:

Greenhouse Operation and Management. University of Missouri-Columbia, Instructional Materials Laboratory, 2002.

Horticulture Publications. MU Extension. University of Missouri-Columbia. Accessed February 6, 2004, from <http://muextension.missouri.edu/explore/agguides/hort/index.htm>.

The National Arbor Day Foundation. Accessed December 11, 2003, from <http://www.arborday.org/>.

Plants of Missouri. Missouri Department of Conservation. Accessed December 11, 2003, from <http://www.conservation.state.mo.us/>.

Reiley, H. E., & Shry, C. L., Jr. *Introductory Horticulture*, 6th ed., Delmar Learning, 2000.

Instructional Strategies/Activities:

- Students will engage in study questions in lessons 1 through 3.
- Students will complete AS 3.2, Stem Poster; AS 3.3, Leaf Poster; AS 3.4, Identifying Monocot and Dicot Plants; AS 3.6, Plant Pictionary: Part I; and AS 3.7, Plant Pictionary: Part II.
- Additional activities that relate to the unit objective can be found under the heading "Other Activities and Strategies" in the following location: p. 161.

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Performance-Based Assessment:

Each student will create a plant collection that includes two types of roots, six types of leaf shapes, four types of leaf margins, four types of leaf attachments, and two types of venation. For examples of these plant types and shapes, students can refer to lesson 1 in the unit. Students will mount each specimen to a piece of paper in some manner. Each root or leaf should be labeled as to the category and the sample it represents (e.g., type of leaf shape, oval).

Assessment will be based on the overall content and presentation of the plant collection.

Unit III—Plant Science Basics Instructor Guide

The instructor should assign the performance-based assessment activity at the beginning of the unit. Students will work toward completing the activity as they progress through the unit lessons. The assessment activity will be due at the completion of the unit.

1. Students will work individually to collect plant specimens that represent the following categories:
 - Two types of roots
 - Six types of leaf shapes
 - Four types of leaf margins
 - Four types of leaf attachments
 - Two types of venation
2. Students can refer to lesson 1 in the unit to find examples of the different categories.
3. Have students create a plant collection from their specimens.
 - a. Students will mount each specimen to a piece of paper in some manner.
 - b. Each specimen will be labeled as to the category and sample it represents (e.g., type of leaf shape, oval).
4. The final assessment will be based on the overall content and presentation of the collection.

Unit III—Plant Science Basics Student Handout

1. You will work individually to collect plant specimens that represent the following categories:
 - Two types of roots
 - Six types of leaf shapes
 - Four types of leaf margins
 - Four types of leaf attachments
 - Two types of venation
2. You can refer to lesson 1 in the unit to find examples of the different categories.
3. Create a plant collection from your specimens.
 - a. Mount each specimen to a piece of paper in some manner.
 - b. Label each specimen as to the category and sample it represents (e.g., type of leaf shape, oval).
4. Your final assessment score will be based on the overall content and presentation of your collection.

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**Unit III—Plant Science Basics
Scoring Guide**

Name _____

Assessment Area	Criteria	0 Points	1 Point	2 Points	3 Points	4 Points	Weight	Total
Content of Collection	All the required mounts are present	Failed	Poor	Fair	Good	Excellent	X 5	
	Mounts are labeled correctly	Failed	Poor	Fair	Good	Excellent	X 5	
Presentation of Collection	Mounts are well organized and neat	Failed	Poor	Fair	Good	Excellent	X 15	
TOTAL								

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Final Assessment Total _____/100 pts.

Comments:

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Curriculum Guide: *Greenhouse Operation and Management*

Unit: IV. Plant Growth

Unit Objective:

Students will demonstrate an understanding of the basic plant processes of germination and photosynthesis by conducting a seed germination experiment and writing a summary of their findings.

Show-Me Standards: 1.8, SC7

References:

Greenhouse Operation and Management. University of Missouri-Columbia, Instructional Materials Laboratory, 2002.

The National Arbor Day Foundation. Accessed December 11, 2003, from <http://www.arborday.org/>.

Reiley, H. E., & Shry, C. L., Jr. *Introductory Horticulture*, 6th ed., Delmar Learning, 2000.

Instructional Strategies/Activities:

- Students will engage in study questions in lessons 1 through 5.
- Students will complete AS 4.2, Effects of Light on Plants; AS 4.5, Growing Media and Containers; and AS 4.8, Over-, Under-, and Proper Watering.
- Additional activities that relate to the unit objective can be found under the headings “Other Activities and Strategies” and “Unit IV Activity” in the following locations: p. 180, p. 203, and p. 279.

Performance-Based Assessment:

Students will work individually to conduct a seed germination experiment comparing the differences in growth patterns based on the variable to which the seeds are exposed. Each student will plant and care for approximately 10 seeds (e.g., corn or beans) to the instructor’s specifications. Students will examine the plants each class period and record the differences (i.e., the height and appearance of the plant) in a chart that they design. Before the students plant their seeds, they must hypothesize what will happen to their seeds. At the end of the experiment, students will write a short summary of their findings.

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Assessment will be based on the overall content and presentation of the chart and summary. Spelling, grammar, punctuation, and capitalization will also be factors in the assessment.

Unit IV—Plant Growth Instructor Guide

The instructor should assign the performance-based assessment activity at the beginning of the unit. Students will work toward completing the activity as they progress through the unit lessons. The assessment activity will be due at the completion of the unit.

1. Students will work individually to conduct a seed germination experiment comparing the differences in growth patterns based on the variable to which the plant seeds are exposed.
2. Give each student specifications (a variable) for planting or caring for his or her seeds. Variables may include, but are not limited to, the following:
 - Light (different light strengths or light colors)
 - Media type
 - Moisture levels
 - Fertilizer (amount or type)
 - pH
 - Seed depth
3. Before the students plant their seeds, have them hypothesize what will happen to their seeds based on their given variable. For example, they should address whether the plants will grow well or poorly and if the plants will have root system problems.
4. Provide each student approximately 10 seeds (e.g., corn or beans). Have the students plant the seeds according to specifications and care for them.
5. Have students develop a chart to record their plants' activity.
 - a. The chart will include a space at the top for writing the hypothesis before the experiment begins.
 - b. Students will examine their plants and record activity (e.g., the height and appearance of the plant) every day that they are in the classroom.
6. At the end of the experiment, each student will write a short summary that presents his or her findings and evaluates how the hypothesis held up. The summary should at least cover the following topics:
 - General performance of the plants
 - What the variable was
 - What the initial hypothesis was and how it changed (if applicable)
 - Summary of the care given to the plants

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7. The final assessment will be based on the overall content and presentation of the chart and summary. Spelling, grammar, punctuation, and capitalization will also be factors in the assessment.

8. **ADDITIONAL ACTIVITY:** For further review, an additional unit-level activity, Plant Portfolio, is included on p. 279 of the *Greenhouse Operation and Management* Instructor Guide. For this activity, students create a portfolio of the plants they grew at the beginning of unit I. They are asked to provide basic information and specific greenhouse needs for the plants in their portfolio. See the activity for additional directions and details. Answers will vary.

Unit IV—Plant Growth Student Handout

1. You will work individually to conduct a seed germination experiment comparing the differences in growth patterns based on the variable to which your plant seeds are exposed.
2. Your instructor will give you a variable (e.g., different light strength or color, media type, moisture level, fertilizer amount or type, etc.) for planting or caring for your seeds.
3. Before planting your seeds, hypothesize what will happen to your seeds based on the given variable. For example, address whether the plants will grow well or poorly and if the plants will have root system problems.
4. You will plant approximately 10 seeds (e.g., corn or beans) according to specifications and care for them.
5. You will develop a chart to record your plants' activity.
 - a. The chart will include a space at the top for writing your hypothesis before the experiment begins.
 - b. Each day you are in the classroom, you will examine your plants and record the activity (e.g., the height and appearance of the plant).
6. At the end of the experiment, you will write a short summary that presents your findings and evaluates how your hypothesis held up. The summary should at least cover the following topics:
 - General performance of the plants
 - What your variable was
 - What your initial hypothesis was and how it changed (if applicable)
 - Summary of the care you gave to the plants
7. Your final assessment score will be based on the overall content and presentation of the chart and summary. Spelling, grammar, punctuation, and capitalization will also be factors in the assessment.

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Unit IV—Plant Growth Scoring Guide

Name _____

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Assessment Area	Criteria	0 Points	1 Point	2 Points	3 Points	4 Points	Weight	Total
Chart	<input type="checkbox"/> All entries were made and are complete <input type="checkbox"/> Information is accurate <input type="checkbox"/> Easy to read and understand <input type="checkbox"/> Well organized	0 criteria met	1 criterion met	2 criteria met	3 criteria met	All 4 criteria met	X 15	
Summary	<input type="checkbox"/> Contains all elements required <input type="checkbox"/> Information is complete <input type="checkbox"/> Conclusions are valid <input type="checkbox"/> Well organized	0 criteria met	1 criterion met	2 criteria met	3 criteria met	All 4 criteria met	X 7.5	
Technical Considerations	<input type="checkbox"/> Spelling <input type="checkbox"/> Grammar <input type="checkbox"/> Punctuation <input type="checkbox"/> Capitalization	0 criteria met	1 criterion met	2 criteria met	3 criteria met	All 4 criteria met	X 2.5	
TOTAL								

Final Assessment Total _____/100 pts.

Comments:

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Curriculum Guide: *Greenhouse Operation and Management*

Unit: V. Plant Propagation

Unit Objective:

Students will apply principles of plant propagation by properly propagating a plant and describing the process in written form.

Show-Me Standards: 2.1, CA1

References:

Greenhouse Operation and Management. University of Missouri-Columbia, Instructional Materials Laboratory, 2002.

Reiley, H. E., & Shry, C. L., Jr. *Introductory Horticulture*, 6th ed., Delmar Learning, 2000.

Instructional Strategies/Activities:

- Students will engage in study questions in lessons 1 and 2.
- Students will complete AS 5.1, Transplanting a Seedling; AS 5.2, Asexual Propagation; and AS 5.3, Budding and Tissue Culture.
- Additional activities that relate to the unit objective can be found under the heading “Other Activity and Strategy” in the following locations: p. 287 and p. 302.

Performance-Based Assessment:

Each student will propagate a plant from the school’s greenhouse. After propagating the plant, students will write a procedure that will include the method used, materials required, and steps for the propagation method. Students will give the instructor the plant cutting sample along with the written procedure.

Assessment will be based on the overall content of the written procedure and the quality of the propagated plant specimen. Spelling, grammar, punctuation, and capitalization will also be factors in the assessment.

Unit V—Plant Propagation Instructor Guide

The instructor should assign the performance-based assessment activity at the beginning of the unit. Students will work toward completing the activity as they progress through the unit lessons. The assessment activity will be due at the completion of the unit.

1. Have each student propagate a plant from the school's greenhouse. Students should use plants already in the greenhouse to prevent pest transfer.
 - a. Students may need to share a plant if there are not enough plants available.
 - b. Be sure to provide different types of plants so that a variety of propagating techniques are represented.
2. Have students determine the correct propagation method, propagate their plant, and write a procedure for the method they used. The written procedure will cover the following topics:
 - Statement of the method used
 - List of the materials needed
 - Steps for the propagation method
3. Have students turn in the planted cutting and written procedure.
4. The final assessment will be based on the content of the written procedure and the quality of the propagated plant specimen. Spelling, grammar, punctuation, and capitalization will also be factors in the assessment.

Unit V—Plant Propagation Student Handout

1. Your instructor will provide a plant from your school's greenhouse for you to propagate.
2. Determine the correct propagation method, propagate your plant, and write a procedure for the method you used. The written procedure should cover the following topics:
 - Statement of the method used
 - List of the materials needed
 - Steps for the propagation method
3. Turn the planted cutting and written procedure in to the instructor.
4. Your final assessment score will be based on the content of the written procedure and the quality of the propagated plant specimen. Spelling, grammar, punctuation, and capitalization will also be factors in the assessment.

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Unit V—Plant Propagation Scoring Guide

Name _____

Assessment Area	Criteria	0 Points	1 Point	2 Points	3 Points	4 Points	Weight	Total
Procedure	<input type="checkbox"/> Includes all required elements <input type="checkbox"/> Content is accurate <input type="checkbox"/> Information is complete <input type="checkbox"/> Well organized	0 criteria met	1 criterion met	2 criteria met	3 criteria met	All 4 criteria met	X 15	
Propagated Plant	<input type="checkbox"/> Correct method was used <input type="checkbox"/> Propagated correct portion of plant <input type="checkbox"/> Plant watered properly <input type="checkbox"/> Plant is in good health	0 criteria met	1 criterion met	2 criteria met	3 criteria met	All 4 criteria met	X 7.5	
Technical Considerations (Procedure)	<input type="checkbox"/> Spelling <input type="checkbox"/> Grammar <input type="checkbox"/> Punctuation <input type="checkbox"/> Capitalization	0 criteria met	1 criterion met	2 criteria met	3 criteria met	All 4 criteria met	X 2.5	
TOTAL								

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Final Assessment Total _____/100 pts.

Comments:

Greenhouse Operation and Management

Curriculum Guide: *Greenhouse Operation and Management*

Unit: VI. Plant Health

Unit Objective:

Students will demonstrate an understanding of a plant pest and disease by writing a report on each that describes the pest and disease and identifies the control method.

Show-Me Standards: 1.4, SC3

References:

Greenhouse Operation and Management. University of Missouri-Columbia, Instructional Materials Laboratory, 2002.

Insects and Diseases Publications. MU Extension. University of Missouri-Columbia. Accessed February 9, 2004, from <http://muextension.missouri.edu/explore/agguides/pests/index.htm>.

McKinley, M. (Ed.). *Home Gardener's Problem Solver*. Ortho Books, 2001.

"Nursery/Landscaping." *Missouri CDE Handbook*. Accessed November 3, 2003, from <http://dese.mo.gov/divcareered/AG/CDE/Nursery-Landscape.pdf>.

Plant Diseases Library. Kansas State Research and Extension. Accessed February 9, 2004, from <http://www.oznet.ksu.edu/library/plant2/>.

Plant Industries Division. Missouri Department of Agriculture. Accessed February 9, 2004, from <http://www.mda.mo.gov/WhoWeAre/i7.htm>.

Students may use additional outside sources to complete this activity.

Instructional Strategies/Activities:

- Students will engage in study questions in lessons 1 through 3.
- Students will complete AS 6.1, Path of Destruction Part I: Insects and Arachnids; A.S 6.2, Path of Destruction Part II: Other Pests and Diseases; AS 6.3, Applied Pest Management; and AS 6.4, Integrated Pest Management.

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- Additional activities that relate to the unit objective can be found under the heading “Other Activities and Strategies” in the following locations: p. 327, p. 361 (1, 2), and p. 378 (1, 2, 3).

Performance-Based Assessment:

Students will be assigned one plant pest and one plant disease. They will write a report on each that includes the effects the pest or disease has on the plant, warning signs the plant might exhibit to indicate the presence of the pest or disease, and a listing of any recommended treatments and their application methods. Students should include a picture with each report that illustrates the pest or disease. The reports also can be used to educate future students.

Assessment will be based on the overall content and presentation of the reports. Spelling, grammar, punctuation, and capitalization will also be factors in the assessment.

Unit VI—Plant Health Instructor Guide

The instructor should assign the performance-based assessment activity at the beginning of the unit. Students will work toward completing the activity as they progress through the unit lessons. The assessment activity will be due at the completion of the unit.

1. Assign each student one plant pest and one plant disease.
2. Have students write a report about the pest and another report about the disease. Reports should address the following topics:
 - Effects of the pest or disease on the plant
 - Warning signs the plant might exhibit to indicate the presence of the pest or disease
 - Recommended treatments and their application methods
3. Have students include pictures that illustrate the pest and disease.
4. Students may use material found in the unit or discussed in class as well as additional outside sources to complete their reports.
5. Students may not use the source material word for word and must provide a complete bibliography of their sources along with their reports.
6. The final assessment will be based on the overall content and presentation of the reports. Spelling, grammar, punctuation, and capitalization will also be factors in the assessment.
7. ADDITIONAL ACTIVITIES:
 - a. Have students examine the school's greenhouse for evidence of pests and diseases. Use their findings as the basis for a class discussion. Topics could include the following:
 - Was there evidence of pests or diseases?
 - What was the evidence?
 - What was the cause?
 - What treatment would you recommend?
 - If you did not find evidence of pests or diseases, what management methods were being used to keep the plants free of pests and diseases?
 - b. Use pictures from students' reports as illustrations for a class discussion about pests and diseases or as flash cards for a matching activity or review.

Unit VI—Plant Health Student Handout

1. The instructor will assign you one plant pest and one plant disease.
2. Write a report about the pest and another report about the disease. Reports should address the following topics:
 - Effects of the pest or disease on the plant
 - Warning signs the plant might exhibit to indicate the presence of the pest or disease
 - Recommended treatments and their application methods
3. Be sure to included pictures that illustrate the pest and disease.
4. You may use material found in the unit or discussed in class as well as additional outside sources to complete your reports.
5. You may not use the source material word for word and must provide a complete bibliography of your sources along with your reports.
6. Your final assessment score will be based on the overall content and presentation of your reports. Spelling, grammar, punctuation, and capitalization will also be factors in the assessment.

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**Unit VI—Plant Health
Scoring Guide**

Name _____

Assessment Area	Criteria	0 Points	1 Point	2 Points	3 Points	4 Points	Weight	Total
Pest Report	<input type="checkbox"/> Covers all required topics <input type="checkbox"/> Content is complete <input type="checkbox"/> Information is accurate <input type="checkbox"/> Picture clearly illustrates the pest	0 criteria met	1 criterion met	2 criteria met	3 criteria met	All 4 criteria met	X 11.25	
Disease Report	<input type="checkbox"/> Covers all required topics <input type="checkbox"/> Content is complete <input type="checkbox"/> Information is accurate <input type="checkbox"/> Picture clearly illustrates the disease	0 criteria met	1 criterion met	2 criteria met	3 criteria met	All 4 criteria met	X 11.25	
Technical Considerations	<input type="checkbox"/> Spelling <input type="checkbox"/> Grammar <input type="checkbox"/> Punctuation <input type="checkbox"/> Capitalization	0 criteria met	1 criterion met	2 criteria met	3 criteria met	All 4 criteria met	X 2.5	
TOTAL								

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Final Assessment Total _____/100 pts.

Comments:

Greenhouse Operation and Management

Curriculum Guide: *Greenhouse Operation and Management*

Unit: VII. Greenhouse Business Management

Unit Objective:

Students will apply principles of greenhouse business management by generating a cost analysis and marketing plan for a greenhouse.

Show-Me Standards: 1.8, MA1

References:

Ball Seed Company. Accessed February 18, 2004, from <http://www.ballseed.com/>.

Commercial seed and plant catalogs

"Economics and Marketing." *The Texas Poinsettia Producers Guide*. Accessed February 19, 2004, from <http://aggie-horticulture.tamu.edu/greenhouse/nursery/guides/poinsettia/econ.html>.

Greenhouse Operation and Management. University of Missouri-Columbia, Instructional Materials Laboratory, 2002.

Hummert International. Accessed December 3, 2003, from <http://www.hummert.com/>.

Poinsettias. UK Cooperative Extension Service, University of Kentucky College of Agriculture. Accessed February 19, 2004, from <http://www.uky.edu/Ag/NewCrops/introsheets/poinsettiaintro.pdf>.

Stuppy, Inc. Accessed December 3, 2003, from <http://www.stuppy.com/>.

Students will use additional outside sources to complete this activity.

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Instructional Strategies/Activities:

- Students will engage in study questions in lessons 1 and 2.
- Students will complete AS 7.1, Selecting Commercial Crops and Devising a Growing Schedule; AS 7.2, Cost Analysis of a Commercial Crop; AS 7.3, Plant Care After Harvest and During Marketing; and AS 7.4, Creating a Marketing Plan.
- Additional activities that relate to the unit objective can be found under the headings “Other Activities and Strategies” and “Unit VII Activity” in the following locations: p. 400 (1) and pp. 425–427.

Performance-Based Assessment:

Each student will generate a cost analysis and marketing plan for a greenhouse. The student handout includes a scenario, or the instructor may change the activity to reflect the facts and figures from the school’s greenhouse, if desired.

Assessment will be based on the overall thoroughness and accuracy of the cost analysis and marketing plan.

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The instructor should assign the performance-based assessment activity at the beginning of the unit. Students will work toward completing the activity as they progress through the unit lessons. The assessment activity will be due at the completion of the unit.

1. Have each student devise a cost analysis and marketing plan for a greenhouse.
2. The student handout includes a scenario that can be used for the performance-based assessment activity, or it can be adapted, if preferred. In the scenario, students will grow poinsettias to sell during the Christmas season. They must decide on a spring season plan to alternate with their poinsettia crop.
3. For the cost analysis portion of the activity, students must calculate the fixed costs related to the greenhouse, determine variable/operating costs, and answer key questions about overall cost and profit.
4. For the marketing plan portion, they must devise a yearlong marketing plan for the greenhouse based on their cost analysis. The plan must address the following topics.
 - Market timing based on growing season
 - Target customers
 - Advertising and display costs that stay within their budget
 - Spring season crops to provide efficient year-round bench use
 - Seasonal or holiday promotions to increase sales
5. Students may use material found in the unit or discussed in class as well as additional outside material to complete this activity. Students must provide a complete list of their sources along with their completed handout.
6. Have students turn in their completed handout.
 - a. For the activity as it is currently written, the average cost per week per square foot is \$.023.
 - b. Answers to parts B, C, and D will vary.
7. The final assessment score will be based on the overall thoroughness and accuracy of the cost analysis and marketing plan.

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8. **ADDITIONAL ACTIVITY:** For further review, an additional unit-level activity, *Designing a Garden*, is included on pp. 425–427 of the *Instructor Guide*. For this activity, students must design a garden, create a cost analysis and growth schedule for the project, and present their plan to the class. See the activity for additional directions and details. Answers will vary.

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Unit VII—Greenhouse Business Management Student Handout

Name _____

Cost Analysis and Marketing Plan

Objective: Generate a cost analysis and marketing plan for a greenhouse.

Directions: You are planning to sell poinsettias for the Christmas season. Use the following scenario. Show all of your work.

Your greenhouse has 4,000 sq ft of bench space. Assume your crop consists of 750 poinsettia plugs grown in 6-inch pots. The production time for the crop is 15 weeks. Your utilities for the year are \$1,800 and labor costs are \$1,200 for the year.

Part A – Fixed Costs*

Depreciation:	\$1,500
Interest on Investment:	$\$30,000 \times 6\%$ opportunity cost = _____
Repairs & Maintenance:	\$550
Taxes:	$\$30,000 \times 32\%$ (commercial rate) $\times \$5.20/\100 assessed value = _____
Insurance:	\$500
Total fixed costs:	\$ _____

Average cost per week per square foot = total fixed costs/52 weeks per year/square foot bench space

Average cost per week per square foot = _____

*Estimates for the purpose of this exercise only

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Directions: Once you have determined your fixed costs, determine the variable/operating costs for your crop. Use the Internet, commercial catalogs, and other sources to fill in the blanks below and then answer the key questions that follow. List all of the sources you used to locate your information in the space provided.

Part B – Variable/Operating Costs

Plugs:	
Royalty/Plug:	
Transportation/Plug:	
Soiless Media:	
Containers:	
Fertilizer:	
Care Tags:	
Commission:	
Advertising/Mailing/Paper/Copying:	
Subtotals:	
Death Loss or Unsalable (5% of subtotal):	
Totals:	

Part C – Key Questions

1. What are the total costs for the crop?
2. What is the total cost per plant?

3. What is the net profit for the plant?
4. At what sale price could you sell the plants and still make a profit?

Sources:

Part D – Marketing Plan

Directions: On separate paper, describe a yearlong marketing plan for your greenhouse based on your cost analysis. Be sure to address the following topics.

- Indicate when you will start your poinsettia crop, when you will have plants ready to sell, and how long you expect your selling period to be.
- Who are the target customers for your poinsettias?
- How do you plan to attract customers? Your advertising and display expenses must stay within the budget you established in your cost analysis.
- Describe a spring season plan to alternate with your poinsettia crop. For your spring season plan, choose 15 plants you will grow, determine their growing season, and indicate when you would start your spring plants.
- What seasonal or holiday promotions will you use to increase sales?

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Name _____

Assessment Area	Criteria	0 Points	1 Point	2 Points	3 Points	4 Points	Weight	Total
Fixed Costs	<ul style="list-style-type: none"> <input type="checkbox"/> Calculations are accurate for interest, taxes, fixed costs, and cost per week per square foot <input type="checkbox"/> Shows all work 	Failed	Poor	Fair	Good	Excellent	X 2.5	
Variable/ Operating Costs and Key Questions	<ul style="list-style-type: none"> <input type="checkbox"/> Includes all necessary operating costs <input type="checkbox"/> Costs are reasonable for the crop and scenario <input type="checkbox"/> Correctly answers key questions <input type="checkbox"/> Includes sources 	Failed	Poor	Fair	Good	Excellent	X 10	
Marketing Plan	<ul style="list-style-type: none"> <input type="checkbox"/> Includes a workable marketing plan for poinsettia crop <input type="checkbox"/> Identifies target customers <input type="checkbox"/> Includes a workable spring season plan and identifies 15 spring plants <input type="checkbox"/> Includes an advertising plan and special promotions <input type="checkbox"/> Spelling, grammar, and punctuation are correct 	Failed	Poor	Fair	Good	Excellent	X 12.5	
TOTAL								

Final Assessment Total _____/100 pts.

Comments:

