

# Horticulture Sciences

8034 36 weeks

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## Course Description

**Suggested Grade Level:** 10 or 11 or 12

This course prepares students for postsecondary educational career programs and entry-level positions in the horticulture industry. Instruction includes safety in the horticulture industry, the science of horticulture and nursery plant production, greenhouse operation and management, landscape design, and turf management. Through hands-on activities, students will identify and manage plant-growing substrates and propagate and grow horticultural plants in the greenhouse and land laboratory.

*As noted in [Superintendent's Memo #058-17 \(2-28-2017\)](#), this Career and Technical Education (CTE) course must maintain a maximum pupil-to-teacher ratio of 20 students to one teacher, due to safety regulations. The 2016-2018 biennial budget waiver of the teacher-to-pupil ratio staffing requirement does not apply.*

## Task Essentials Table

**Template material omitted:** General material used to introduce the task list has been omitted.

For the indicated course(s):

- Tasks/competencies designated by plus icons (+) in the left-hand column(s) are essential
- Tasks/competencies designated by empty-circle icons (○) are optional
- Tasks/competencies designated by minus icons (−) are omitted
- Tasks marked with an asterisk (\*) are sensitive.

8034	Tasks/Competencies
+	Identify the role of supervised agricultural experiences (SAEs) in agricultural education.
+	Participate in an SAE.

<input checked="" type="radio"/>	Identify the benefits and responsibilities of FFA membership.	
<input checked="" type="radio"/>	Describe leadership characteristics and opportunities as they relate to agriculture and FFA.	
<input type="radio"/>	Apply for an FFA degree and/or an agricultural proficiency award.	
<input checked="" type="radio"/>	Follow safety procedures in the horticulture industry.	
<input checked="" type="radio"/>	Outline the scope of the horticulture industry.	
<input checked="" type="radio"/>	Research career opportunities in the horticulture industry.	
<input checked="" type="radio"/>	Describe factors to consider when planning a greenhouse.	
<input checked="" type="radio"/>	Identify a variety of greenhouses, their components, and other protected structures.	
<input checked="" type="radio"/>	Identify a variety of greenhouse environmental controls.	
<input checked="" type="radio"/>	Describe procedures for greenhouse structural and equipment maintenance.	
<input checked="" type="radio"/>	Describe plant taxonomy.	
<input checked="" type="radio"/>	Analyze plant anatomy and physiology.	
<input checked="" type="radio"/>	Define the characteristics of soil and soilless substrates.	
<input checked="" type="radio"/>	Describe nutrition management practices.	
<input checked="" type="radio"/>	Compare irrigation system options.	
<input checked="" type="radio"/>	Describe how environmental factors affect plant growth.	
<input checked="" type="radio"/>	Describe plant propagation methods.	
<input checked="" type="radio"/>	Demonstrate plant propagation.	
<input checked="" type="radio"/>	Identify floriculture crops.	
<input checked="" type="radio"/>	Produce a floriculture crop.	
<input type="radio"/>	Design interior plantings.	
<input checked="" type="radio"/>	Design floral arrangements.	
<input checked="" type="radio"/>	Identify landscape plants.	
<input checked="" type="radio"/>	Design landscapes.	
<input type="radio"/>	Construct landscapes.	
<input checked="" type="radio"/>	Identify landscape maintenance tasks.	

<input checked="" type="radio"/>	Identify turfgrass species.	
<input checked="" type="radio"/>	Outline aspects of the turfgrass industry.	
<input type="radio"/>	Describe the procedures for establishing turf.	
<input type="radio"/>	Maintain turf.	
<input checked="" type="radio"/>	Identify plant pests.	
<input checked="" type="radio"/>	Interpret pesticide labels.	
<input checked="" type="radio"/>	Interpret safety data sheets (SDS).	
<input checked="" type="radio"/>	Identify safety issues in pest management.	
<input checked="" type="radio"/>	Identify pest management programs for horticulture crops.	
<input checked="" type="radio"/>	Explain the principles of Integrated Pest Management (IPM).	
<input checked="" type="radio"/>	Explain the differences between biotic and abiotic issues in pest management.	
<input checked="" type="radio"/>	Identify vegetable crops.	
<input checked="" type="radio"/>	Plan a vegetable garden site.	
<input checked="" type="radio"/>	Produce vegetables.	
<input checked="" type="radio"/>	Identify fruit and nut crops.	
<input checked="" type="radio"/>	Plan a fruit garden, orchard, nut tree nursery, or vineyard.	
<input type="radio"/>	Produce fruit crops.	
<input checked="" type="radio"/>	Describe additional horticultural methods used for flower, vegetable, and fruit production.	

Legend:  Essential  Non-essential  Omitted

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**Note: Competencies 39-43 have been added to ensure compliance with federal legislation: National FFA Organization's Federal Charter Amendments Act (Public Law 116-7, <https://www.congress.gov/116/plaws/publ7/PLAW-116publ7.pdf>). All inquiries may be sent to [cte@doe.virginia.gov](mailto:cte@doe.virginia.gov). Students are provided opportunities for leadership, personal growth, and career success. Instruction is delivered through three major components: classroom and laboratory instruction, supervised agricultural experience (SAE) program, and student leadership (FFA).**

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## Curriculum Framework

## Task Number 39

### Identify the role of supervised agricultural experiences (SAEs) in agricultural education.

#### Definition

Identification should include

- defining an SAE program as *an opportunity for students to consider multiple careers and occupations in the agriculture, food, and natural resources (AFNR) industries, learn expected workplace behavior, develop specific skills within an industry, and apply academic and occupational skills in the workplace or a simulated workplace environment*
- researching the Foundational SAE
  - career exploration and planning
  - personal financial planning and management
  - workplace safety
  - employability skills for college and career readiness
  - agricultural literacy
- researching the Immersion SAE
  - entrepreneurship/ownership
  - placement/internships
  - research (experimental, analytical, invention)
  - school business enterprises
  - service learning
- developing a plan to participate in an SAE, based on personal and career goals
- researching available awards and degrees, based on SAE participation.

Teacher resource: [SAE Resources](#), National Council for Agricultural Education

#### Process/Skill Questions

- What are examples of SAEs related to this course and in the AFNR industries?
- Where can a copy of the Virginia SAE Record Book be found?
- What is an Immersion SAE?
- How does a placement/internship SAE differ from an ownership/entrepreneurship SAE?
- How does an SAE provide relevant work experience and contribute to the development of critical thinking skills?
- How is the SAE an extended individualized instructional component of a student's Career Plan of Study?
- How can an SAE be used to provide evidence of student growth and participation in authentic, work-related tasks?
- What are the four types of SAEs?
- What are the advantages of participating in work-based learning experiences and projects?
- How does one choose an appropriate SAE in which to participate?

## Task Number 40

### Participate in an SAE.

#### Definition

Participation should include

- developing, completing, or continuing a plan to participate in an SAE as a work-based learning experience, based on personal and career goals
- documenting experience, connections, positions held, and competencies attained, using the *Virginia SAE Record Book*
- researching available awards and degrees, based on SAE participation.

Teacher resources:

[FFA SAE](#)

[The Agricultural Experience Tracker](#)

#### Process/Skill Questions

- What are the advantages of participating in work-based learning experiences and projects?
- How do SAEs help prepare students for the workforce?
- What are some examples of SAEs in AFNR?

## Exploring Leadership Opportunities through FFA

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## Task Number 41

### Identify the benefits and responsibilities of FFA membership.

#### Definition

Identification should include

- benefits
  - listing opportunities to participate in community improvement projects and career development events (CDEs) and leadership development events (LDEs)
  - exploring leadership development opportunities
- responsibilities
  - researching the responsibilities of FFA officers, committees, and members
  - locating resources that guide participation in FFA activities

- explaining the FFA Creed, Motto, Salute, and mission statement
- explaining the meaning of the FFA emblem, colors, and symbols
- explaining significant events and the history of the organization.

### **Process/Skill Questions**

- How does one become an FFA member?
- What is the FFA’s mission and how does it accomplish its mission?
- What are the benefits and responsibilities of FFA membership?
- What five FFA activities are available through the local chapter?
- What are some significant events in FFA history? How have these events shaped membership over time?
- What is the FFA program of activities (POA), and how is it used?

## **Task Number 42**

### **Describe leadership characteristics and opportunities as they relate to agriculture and FFA.**

#### **Definition**

Description should include

- examples of successful leaders
- types of leadership
  - autocratic
  - participative
  - laissez-faire
  - servant
  - followership
- positive leadership qualities and traits of successful leaders
- opportunities for participating in leadership activities in FFA
- demonstrating methods for conducting an effective meeting.

### **Process/Skill Questions**

- Who are some successful leaders in the agriculture industry?
- What qualities make a successful leader?
- What are leadership traits?
- What is the difference between positive and negative leadership?

## **Task Number 43**

### **Apply for an FFA degree and/or an agricultural proficiency award.**

#### **Definition**

Application should include

- identifying types of FFA degrees
  - Greenhand
  - Chapter
  - State
  - American
- identifying proficiency award areas
  - entrepreneurship
  - placement
  - combined
  - agriscience research
- exploring CDEs and LDEs related to this course
- identifying all SAE criteria to be eligible for the award
- identifying the type of award
- applying for an FFA award.

Teacher resource: [FFA Agricultural Proficiency Awards](#)

### **Process/Skill Questions**

- Where are the awards and their application criteria located?
- What are the benefits of winning an FFA award?
- What are the benefits and requirements of an FFA degree?
- What FFA awards are available?
- How does the FFA degree program reward FFA members in all phases of leadership, skills, and occupational development?
- What is the highest degree that can be conferred upon an FFA member at the national level?
- What are the requirements for a Greenhand FFA degree?

## **Gaining an Overview of the Horticulture Industry**

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### **Task Number 44**

**Follow safety procedures in the horticulture industry.**

#### **Definition**

Following safety procedures should include

- identifying safety hazards
  - physical
  - chemical
  - biological



- general safety
- ergonomic
- weather
- passing all required safety tests with 100% for tools, machinery, and equipment
- following all requirements related to wear and use of personal protective equipment (PPE)
- demonstrating industry-recommended safety procedures and guidelines when using chemicals, tools, machinery, equipment, and other supplies in the classroom, laboratory, greenhouse, and/or land lab
- examining the laws and regulations concerning safety in the horticulture industry
- explaining compliance to the Agricultural Worker Protection Standard (WPS).

Teacher resources: [Centers for Disease Control and Prevention \(CDC\)](#), [Occupational Safety and Health Administration \(OSHA\)](#), [United States Department of Labor \(DOL\)](#)

### Process/Skill Questions

- What clothing and equipment are required for personal safety in the horticulture industry?
- How do clothing and equipment help keep workers in the horticulture industry safe?
- What are the laws that address safety procedures in the horticulture industry?

## Task Number 45

### Outline the scope of the horticulture industry.

#### Definition

Outline should include

- defining *horticulture*
- botany
- landscaping
- interiorscapes
- nursery crops and production
- floriculture
- olericulture
- viticulture
- turfgrass
- pomology
- arboriculture
- specialty crops.

### Process/Skill Questions

- What are examples of outlets for horticultural products?
- How does technology affect the scope of the horticulture industry?
- What are the differences between edible and ornamental horticulture?
- How does social media affect the scope of the horticulture industry?

## Task Number 46

# Research career opportunities in the horticulture industry.

## Definition

Research should include

- identifying related Career Clusters and Pathways
- determining the education and experience required for specific careers
- examining the working conditions associated with specific jobs in the horticulture industry
- developing a plan to gain the necessary education and experience for a career in horticulture.

Teacher resource: [Turfgrass Degrees and Certificates](#), Penn State; [American Horticultural Society \(AHS\)](#); [The American Society of Horticultural Science \(ASHS\)](#); [International Society for Horticultural Science \(ISHS\)](#); [National Association of Landscape Professionals \(NALP\)](#)

## Process/Skill Questions

- What are examples of outlets for horticultural products?
- How does technology affect the scope of the horticulture industry?
- What are the differences between edible and ornamental horticulture?
- How does social media affect the scope of the horticulture industry?
- What are the careers related to this course? Which are possibilities in the locality?
- What are the working environments/conditions related to horticultural jobs?
- How can the level of education required for a specific career in horticulture be determined?
- Why is a career plan important?
- What types of careers in the biotechnology industry are related to horticulture?

# Selecting, Operating, and Maintaining Greenhouses

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## Task Number 47

**Describe factors to consider when planning a greenhouse.**

### Definition

Description should include

- site location
- drainage and soil quality
- nearby utilities
- road access
- market opportunities
- municipal laws, zoning laws, and other restrictions (e.g., Americans with Disabilities Act [ADA])

## Process/Skill Questions

- Why is site location important when selecting a greenhouse?
- What factors are important when considering marketing opportunities for the greenhouse crops being grown?

## Task Number 48

### Identify a variety of greenhouses, their components, and other protected structures.

#### Definition

Identification should include

- greenhouse structures
- cold frames
- high tunnels
- glazing materials
- fans
- louvers, shutters, and vents
- heating and cooling systems
- benches
- floors
- irrigation
- ADA compliance.

## Process/Skill Questions

- How can a grower determine the style of greenhouse to build, considering the various features of different styles of greenhouses?
- How does the geographic location influence the material chosen for the structures?
- What are the benefits of putting a gravel floor over a poured concrete floor?
- What are the major costs associated with greenhouses of different types?
- What considerations should be made for ADA compliance both for employees and for customers?

## Task Number 49

### Identify a variety of greenhouse environmental controls.

#### Definition

Identification should include devices and equipment used to maintain optimal growing conditions for plants involving

- lighting
- temperature

- irrigation
- ventilation.

### **Process/Skill Questions**

- How is light intensity manipulated?
- What is the difference between a short-day and a long-day plant?
- What is the cost comparison between light-emitting diode (LED) and high-intensity discharge (HID) lights?
- When is evaporative cooling a good option?
- What is the science behind DIF?
- Why might a minimum/maximum thermometer need to be reset? How is it done?
- What are the advantages of using a drip system rather than a mist system?
- Given a recommendation of parts-per-million of nitrogen, how are fertilizer formulas calculated?
- What are the advantages of using a portable fertilizer injector over a dedicated system?

## **Task Number 50**

### **Describe procedures for greenhouse structural and equipment maintenance.**

#### **Definition**

Description should include

- structural maintenance
- covering maintenance
- heating and cooling equipment maintenance
- irrigation equipment maintenance.

### **Process/Skill Questions**

- What types of maintenance procedures are required to ensure a greenhouse has a long and useful life?
- Why would a spreadsheet be helpful for planning routine greenhouse maintenance?
- What types of careers are related to greenhouse construction and maintenance?

## **Applying Science to Horticulture**

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## **Task Number 51**

### **Describe plant taxonomy.**

#### **Definition**

Description should include

- discussing the importance of scientific naming and classifications
- discussing the importance of the binomial system used in classifying plants
- differentiating among taxonomic levels (e.g., kingdom, phylum, class, order, family, genus, species)
- variety
- cultivar.

### **Process/Skill Questions**

- Why is scientific naming important to the horticulture industry?
- What characteristics make plants related?
- What is the difference between a variety and a cultivar?
- What are the limitations of common names for plants?
- What is a cultivar?

## **Task Number 52**

### **Analyze plant anatomy and physiology.**

#### **Definition**

Analysis should include

- naming and describing the function of the major parts of plants
- explaining how plant structure is used to identify plants
- identifying leaves by shape, arrangement, and margin
- explaining the difference between monocots and dicots
- explaining the processes of photosynthesis, respiration, and transpiration
- describing the processes of plant reproduction.

### **Process/Skill Questions**

- What are the main parts of a flowering plant?
- How does a plant photosynthesize?
- How is a plant keyed for identification?
- How do seeds develop?
- What is the difference between cross-pollination and self-pollination?
- What are the different shapes, margins, and vein arrangements found in leaves?
- How does water affect plant physiology?
- What element is created as a by-product of photosynthesis?

#### **English**

##### **10.5**

The student will read, interpret, analyze, and evaluate nonfiction texts.

- a. Analyze text features and organizational patterns to evaluate the meaning of texts.
- b. Recognize an author's intended audience and purpose for writing.
- c. Skim materials to develop an overview and locate information.
- d. Compare and contrast informational texts for intent and content.
- e. Interpret and use data and information in maps, charts, graphs, timelines, tables, and diagrams.
- f. Draw conclusions and make inferences on explicit and implied information using textual support as evidence.
- g. Analyze and synthesize information in order to solve problems, answer questions, and generate new knowledge.
- h. Analyze ideas within and between selections providing textual evidence.
- i. Summarize, paraphrase, and synthesize ideas, while maintaining meaning and a logical sequence of events, within and between texts.
- j. Use reading strategies throughout the reading process to monitor comprehension.

### **11.5**

The student will read, interpret, analyze, and evaluate a variety of nonfiction texts including employment documents and technical writing.

- a. Apply information from texts to clarify understanding of concepts.
- b. Read and correctly interpret an application for employment, workplace documents, or an application for college admission.
- c. Analyze technical writing for clarity.
- d. Paraphrase and synthesize ideas within and between texts.
- e. Draw conclusions and make inferences on explicit and implied information using textual support.
- f. Analyze multiple texts addressing the same topic to determine how authors reach similar or different conclusions.
- g. Analyze false premises, claims, counterclaims, and other evidence in persuasive writing.
- h. Recognize and analyze use of ambiguity, contradiction, paradox, irony, sarcasm, overstatement, and understatement in text.
- i. Generate and respond logically to literal, inferential, evaluative, synthesizing, and critical thinking questions about the text(s).

### **12.5**

The student will read, interpret, analyze, and evaluate a variety of nonfiction texts.

- a. Use critical thinking to generate and respond logically to literal, inferential, and evaluative questions about the text(s).
- b. Identify and synthesize resources to make decisions, complete tasks, and solve specific problems.
- c. Analyze multiple texts addressing the same topic to determine how authors reach similar or different conclusions.
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- e. Analyze false premises claims, counterclaims, and other evidence in persuasive writing.

## **Science**

### **BIO.2**

The student will investigate and understand the chemical and biochemical principles essential for life. Key concepts include

- a. water chemistry and its impact on life processes;
- b. the structure and function of macromolecules;
- c. the nature of enzymes; and
- d. the capture, storage, transformation, and flow of energy through the processes of photosynthesis and respiration.

#### **BIO.4**

The student will investigate and understand life functions of Archaea, Bacteria, and Eukarya. Key concepts include

- a. comparison of their metabolic activities;
  - b. maintenance of homeostasis;
  - c. how the structures and functions vary among and within the Eukarya kingdoms of protists, fungi, plants, and animals, including humans;
  - d. human health issues, human anatomy, and body systems;
  - e. how viruses compare with organisms; and
  - f. evidence supporting the germ theory of infectious disease.
- 

## **Task Number 53**

### **Define the characteristics of soil and soilless substrates.**

#### **Definition**

Definition should include

- the major components of a true soil
- soil classification
- soil texture
- the importance of soil sterilization
- the benefits of organic matter (e.g., compost practices)
- soil amendments and how they can improve soil
- components of soilless substrates
- chemical properties of soilless substrates and their effects on fertility
- physical properties of soilless substrates and their effects on drainage and/or water-holding capacity.

#### **Process/Skill Questions**

- What constitutes a living soil?
- How is soil classified?
- What common substrate components are used in plant production?
- How do the common components of substrates affect plant growth?
- What are the principles of building successful compost?

- What substrate amendments are useful for plant production?
- How does pH affect plant growth?
- How can pH be adjusted?
- How should soil be stored and preserved?
- How often should the soil of indoor plants be changed?

## **Task Number 54**

### **Describe nutrition management practices.**

#### **Definition**

Description should include

- macronutrients
- micronutrients
- essential nutritional elements
- organic and inorganic fertilizers
- sources of nutrients
- soluble salts in the soil
- deficiency and toxicity symptoms of the major nutrients
- overview of tools for nutrient analysis
- interpretation of soil test results and fertilizer recommendations
- methods of fertilizer application
  - applying granular and slow-release fertilizers
  - calibrating and using a fertilizer spreader.

#### **Process/Skill Questions**

- What elements are essential for plant growth?
- Why are fertilizers with many different formulations available?
- What are the benefits of using different formulations of fertilizers?
- Which major elements are necessary for healthy green plant growth?
- What information can be obtained from a soil test?
- What are the differences between granular and water-soluble fertilizers?
- Which organic fertilizers can be used in floriculture crop production?
- How can a grower determine a fertilizer schedule?
- How is a fertilizer analysis interpreted?
- What are the advantages of using pre-plant fertilizers?
- How do controlled-release fertilizers work?

## **Task Number 55**

### **Compare irrigation system options.**

#### **Definition**



Comparison should include

- hand watering
- overhead/sprinkler
- drip
- ebb and flow.

### **Process/Skill Questions**

- When should hand watering be used instead of overhead options?
- What are the advantages and disadvantages of hand watering?
- What are the advantages and disadvantages of an ebb and flow system?
- How do plant nutrient requirements affect irrigation system selection?

## **English**

### **10.5**

The student will read, interpret, analyze, and evaluate nonfiction texts.

- a. Analyze text features and organizational patterns to evaluate the meaning of texts.
- b. Recognize an author's intended audience and purpose for writing.
- c. Skim materials to develop an overview and locate information.
- d. Compare and contrast informational texts for intent and content.
- e. Interpret and use data and information in maps, charts, graphs, timelines, tables, and diagrams.
- f. Draw conclusions and make inferences on explicit and implied information using textual support as evidence.
- g. Analyze and synthesize information in order to solve problems, answer questions, and generate new knowledge.
- h. Analyze ideas within and between selections providing textual evidence.
- i. Summarize, paraphrase, and synthesize ideas, while maintaining meaning and a logical sequence of events, within and between texts.
- j. Use reading strategies throughout the reading process to monitor comprehension.

### **11.5**

The student will read, interpret, analyze, and evaluate a variety of nonfiction texts including employment documents and technical writing.

- a. Apply information from texts to clarify understanding of concepts.
- b. Read and correctly interpret an application for employment, workplace documents, or an application for college admission.
- c. Analyze technical writing for clarity.
- d. Paraphrase and synthesize ideas within and between texts.
- e. Draw conclusions and make inferences on explicit and implied information using textual support.
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- g. Analyze false premises, claims, counterclaims, and other evidence in persuasive writing.

- h. Recognize and analyze use of ambiguity, contradiction, paradox, irony, sarcasm, overstatement, and understatement in text.
- i. Generate and respond logically to literal, inferential, evaluative, synthesizing, and critical thinking questions about the text(s).

## 12.5

The student will read, interpret, analyze, and evaluate a variety of nonfiction texts.

- a. Use critical thinking to generate and respond logically to literal, inferential, and evaluative questions about the text(s).
  - b. Identify and synthesize resources to make decisions, complete tasks, and solve specific problems.
  - c. Analyze multiple texts addressing the same topic to determine how authors reach similar or different conclusions.
  - d. Recognize and analyze use of ambiguity, contradiction, paradox, irony, overstatement, and understatement in text.
  - e. Analyze false premises claims, counterclaims, and other evidence in persuasive writing.
- 

## Task Number 56

### Describe how environmental factors affect plant growth.

#### Definition

Description should include

- explaining abiotic factors
- explaining the impact of humidity
- explaining the function of CO<sub>2</sub>
- explaining the role of water in plant growth and development
- defining *temporary* and *permanent wilting points*
- identifying the impact of soil and air temperatures
- defining *crop minimum, maximum, and optimum temperatures*
- interpreting the plant hardiness zones
- explaining light quality and quantity
- defining *full-sun, part-sun, part-shade, and full-shade exposure*
- explaining photoperiodism
- explaining phototropism.

#### Process/Skill Questions

- What is the difference between light quality and intensity?
- What are the consequences of high- or low-humidity environments on plants?
- What is *xeriscaping*?
- What is *drought tolerance*?
- How do specific plants adapt to the climate/location where they live?

- What are the differences between biotic and abiotic factors that affect plant growth?

## Task Number 57

### Describe plant propagation methods.

#### Definition

Description could include

- differentiating between sexual and asexual methods of propagation
- conducting scarification and stratification treatments of seeds
- defining *enhanced seeds* and *pelleted seeds*
- identifying seed storage conditions
- identifying sources of seeds, including collection, seed banks, and commercial outlets
- contrasting direct and indirect seeding methods
- describing environmental conditions for germination
- identifying types of cuttings
- identifying hormone treatment of cuttings
- identifying environmental conditions for rooting of cuttings
- outlining propagation procedures by bulb, tuber, corm, rhizome, and tuberous root
- identifying plants suitable for propagation by division
- describing the requirements for successful grafting and budding
- defining *scion*, *compatibility*, *stock*, and *cambium*
- outlining the grafting and budding procedures
- describing plant care after grafting and budding procedures
- identifying plants that are commercially grafted and budded
- discussing the advantages and disadvantages of layering
- outlining layering procedures
- defining *micropropagation*
- plant patents and trademarks.

#### Process/Skill Questions

- Why are some plants reproduced sexually while other plants are reproduced asexually?
- How do growers determine whether to produce their own seedlings and liners or to purchase them?
- What method of seed storage will ensure the longevity of seeds?
- What determines the planting depth at which seeds should be sown?
- How is it determined whether seeds should be covered during propagation?
- How do commercially prepared rooting hormones improve propagation?
- What types of plants can be layered?
- What are the advantages and disadvantages of micropropagation?
- Why is it important to know whether a plant is patented?
- What are the rules or regulations regarding the propagation of patented plants?
- What are some careers related to plant propagation?

## Task Number 58

# Demonstrate plant propagation.

## Definition

Demonstration could include

- seed propagation techniques
- manipulating environmental conditions for the germination of seeds
- stem and leaf propagation techniques
- manipulating environmental conditions required for rooting cuttings
- layering and division propagation techniques
- grafting and budding propagation techniques
- tissue culture and micropropagation techniques.

## Process/Skill Questions

- Why do certain asexual propagation methods not apply to all plants?
- What is the difference between division and separation?
- At what stage should seedlings be transplanted into larger containers?
- How does the type of plant affect the method of propagation used?
- What are plant growth regulators, and how are they used in the propagation of plants?
- What are some careers related to tissue culture and micropropagation?

# Investigating the Floral Industry

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## Task Number 59

### Identify floriculture crops.

#### Definition

Identification should include

- developing a list of economically important crops from each category of floriculture crops, including
  - cut flowers
  - cut foliage
  - potted plants
  - garden plants (annuals and perennials)
  - interior plants
- discussing the characteristics of each species, including
  - uses of the plant
  - category
  - distinguishing growth characteristics
  - propagation methods

- economic value
- production method (indoor, outdoor, under protection)
- using artificial and dried specimens with photos or slides for identification.

### Process/Skill Questions

- Why is knowledge of common plant materials important in the horticulture industry?
- How do some floriculture crops overlap into two or more categories?

## Task Number 60

### Produce a floriculture crop.

#### Definition

Production could include

- comparing methods of producing floriculture crops indoors or under protection
- comparing methods of producing floriculture crops outdoors (e.g., field grown)
- describing the environmental requirements needed for optimal growth for the selected plant(s)
- sterilizing containers, tools, and planting areas
- potting cuttings for production
- interpreting and following a crop production schedule
- transplanting seedlings and plugs
- spacing plants for production
- describing the use of growth management (e.g., pinching, plant growth regulators [PGRs])
- marketing floriculture crops
- maintaining production records.

### Process/Skill Questions

- What is the importance of using clean substrates, pots, tools, and supplies?
- How can a grower sterilize materials?
- What is the purpose of pinching ornamental crops?
- How do cost and location affect the type of floriculture crop produced?

## Task Number 61

### Design interior plantings.

#### Definition

Design should include

- defining *interiorscape*
- identifying plants suited to interior planting
- measuring light with a light meter

- determining species suited to various light measurements
- listing methods of watering interior plants
- choosing containers for interior plants
- maintaining interior plants.

### **Process/Skill Questions**

- Why is knowledge of light and its measurement critical to the interior plantscape and to the landscape designer?
- How can interior plantings be watered and fertilized without disturbing the normal function of the space?
- What methods of grooming are acceptable for indoor plantings?
- What factors determine which types of plants should be chosen?

## **Task Number 62**

### **Design floral arrangements.**

#### **Definition**

Design could include

- identifying tools used to create floral arrangements
- identifying containers used to embellish floral arrangements
- identifying cut foliage, flowers, and plants
- identifying principles and elements of design
- constructing a bow
- designing and creating bouquets
- designing corsages and boutonnieres
- designing bud vases
- designing and constructing a wreath
- dressing a potted plant for sale
- designing and creating a centerpiece
- pricing merchandise.

### **Process/Skill Questions**

- What types of flowers are suited to air-drying?
- What is the difference among cost of merchandise, overhead, and profit?
- What are examples of color schemes used in flower arrangements?
- What are the principles of floral design?

## **Investigating the Landscaping Industry**

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## Task Number 63

### Identify landscape plants.

#### Definition

Identification could include

- listing species by landscape-use category (i.e., shade trees, large conifers, ornamental trees, large and small shrubs, groundcovers, vines, ornamental grasses, herbaceous perennials, annuals, bulbs)
- identifying the benefits of native plants
- identifying plants from live samples, photos, and slides
- visiting nurseries and arboreta.

#### Process/Skill Questions

- Under what conditions might groundcovers be a good choice?
- What are the disadvantages of using vines in a landscape?
- What characteristics must be considered when choosing plant species and cultivars for a landscape?
- How does location affect the types of plants selected?

## Task Number 64

### Design landscapes.

#### Definition

Design should include

- assessing the risk of using exotic invasive plants
- calculating the area of beds
- drawing to scale
- factoring in ecosystem services (e.g., biodiversity, conservation, nutrient recycling, flood regulation, water purification)
- applying the principles of design to landscaped areas
  - symmetrical and asymmetrical methods of achieving balance in the landscape
  - simplicity
  - focal point in a landscape design
  - the relationship between the principles of rhythm and line to the creation of shapes in a landscape design
  - the concepts of scale and proportion.

Design could also include

- connecting the site evaluation and client needs to a landscape design
- planning an outdoor room
- planning a planting bed.

## Process/Skill Questions

- Under what conditions might groundcovers be a good choice?
- What are the disadvantages of using vines in a landscape?
- What characteristics must be considered when choosing plant species and cultivars for a landscape?
- What are the major costs associated with designing a landscape?
- How does the location of the landscape affect the design?
- How does landscaping affect businesses?
- How does landscaping affect the value of a home?
- Why are exotic invasive plants and pests a cause for concern?
- What are ecosystem services and how do they affect the local, national, and global economy?

## Task Number 65

### Construct landscapes.

#### Definition

Construction could include

- site selection and preparation for selected plants included in the landscape design (e.g., annuals, biennials, perennials, bulbs, evergreens, deciduous, vines, groundcovers, aquatic plants, shrubs, grasses, rushes, sedges, cacti, succulents, tropicals)
- amending soil based on specific plant requirements
- determining the quantity of plants needed based on spacing requirements
- planting selected plants
- planting balled-and-burlapped trees and shrubs
- installing containerized landscape plants
- staking newly planted trees
- calculating the volume of mulch required to mulch a bed to proper depth.

## Process/Skill Questions

- How is the area of a bed(s) calculated?
- What steps may be followed to prepare a new bed for planting annuals?
- What formula can be used to determine the amount of soil amendment needed for a given area?
- How is the quantity of plants calculated, given specifications indicating a certain on-center spacing requirement for those plants?
- What are the differences between planting containerized plants and balled-and-burlapped plants?
- How should newly planted trees be staked?

## Task Number 66

### Identify landscape maintenance tasks.

#### Definition



Identification could include methods to perform the following tasks:

- Irrigate landscape plants.
- Measure landscape plants.
- Measure the caliper of landscape trees.
- Calculate fertilizer quantity and apply to plants.
- Pruning trees and shrubs.
- Cut back and comb ornamental grasses.
- Winterize landscapes.
- Keep grounds clean of trash and debris.
- Use hand/power tools to edge beds.
- Monitor/scout for exotic pests and diseases.

Teacher Resource: [The Green Industry Web Portal](#)

### Process/Skill Questions

- What are the standard measurements of nursery materials?
- How are trees measured?
- How are spreading shrubs measured?
- How are upright shrubs measured?
- What are methods of fertilizing landscape plants?
- What is the difference between thinning and heading-back?
- How, when, and why are perennials and grasses pruned?
- What are some common landscape winterization tasks?
- What are the ecological, economic, and aesthetic effects of exotic species?

## Investigating the Turf Grass Industry

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### Task Number 67

#### Identify turfgrass species.

##### Definition

Identification should include

- definition of *turfgrass*
- warm-season
- cool-season.

Teacher Resources: [Center for Turfgrass Science](#), Penn State, and [Turf and Garden Tips](#), Virginia Tech Turfgrass Team

## **Process/Skill Questions**

- Why is it important to be able to identify turfgrass species?
- How are pesticide management practices different for Kentucky bluegrass vs. a fine fescue?
- What are the differences between warm-season and cool-season grasses?
- How is vernalization used to identify turfgrass species?

## **Task Number 68**

### **Outline aspects of the turfgrass industry.**

#### **Definition**

Outline should include

- the benefits of establishing and maintaining lawns
- the key differences between commercial, sports, and residential services.

## **Process/Skill Questions**

- What are examples of commercial turf management?
- What are some environmental advantages of established turf areas?

## **Task Number 69**

### **Describe the procedures for establishing turf.**

#### **Definition**

Description could include a selection from the following tasks:

- Evaluate the reasons for establishing and maintaining lawns.
- Grade soil to improve drainage.
- Interpret turf seed labels.
- Discuss methods of turf establishment (e.g., sod, seed, sprigs)
- Calculate the area to determine the quantity of seed or sod required.

## **Process/Skill Questions**

- What are the advantages of using certified seed?
- What factors should the landscaper consider when determining the propagation method to use when establishing turf?
- What are the three functions of turf? What is an example of each?
- What are the advantages and disadvantages of various types of turf grasses?

## **Related Standards of Learning**

## English

### 10.5

The student will read, interpret, analyze, and evaluate nonfiction texts.

- a. Analyze text features and organizational patterns to evaluate the meaning of texts.
- b. Recognize an author's intended audience and purpose for writing.
- c. Skim materials to develop an overview and locate information.
- d. Compare and contrast informational texts for intent and content.
- e. Interpret and use data and information in maps, charts, graphs, timelines, tables, and diagrams.
- f. Draw conclusions and make inferences on explicit and implied information using textual support as evidence.
- g. Analyze and synthesize information in order to solve problems, answer questions, and generate new knowledge.
- h. Analyze ideas within and between selections providing textual evidence.
- i. Summarize, paraphrase, and synthesize ideas, while maintaining meaning and a logical sequence of events, within and between texts.
- j. Use reading strategies throughout the reading process to monitor comprehension.

### 11.5

The student will read, interpret, analyze, and evaluate a variety of nonfiction texts including employment documents and technical writing.

- a. Apply information from texts to clarify understanding of concepts.
- b. Read and correctly interpret an application for employment, workplace documents, or an application for college admission.
- c. Analyze technical writing for clarity.
- d. Paraphrase and synthesize ideas within and between texts.
- e. Draw conclusions and make inferences on explicit and implied information using textual support.
- f. Analyze multiple texts addressing the same topic to determine how authors reach similar or different conclusions.
- g. Analyze false premises, claims, counterclaims, and other evidence in persuasive writing.
- h. Recognize and analyze use of ambiguity, contradiction, paradox, irony, sarcasm, overstatement, and understatement in text.
- i. Generate and respond logically to literal, inferential, evaluative, synthesizing, and critical thinking questions about the text(s).

### 12.5

The student will read, interpret, analyze, and evaluate a variety of nonfiction texts.

- a. Use critical thinking to generate and respond logically to literal, inferential, and evaluative questions about the text(s).
- b. Identify and synthesize resources to make decisions, complete tasks, and solve specific problems.
- c. Analyze multiple texts addressing the same topic to determine how authors reach similar or different conclusions.
- d. Recognize and analyze use of ambiguity, contradiction, paradox, irony, overstatement, and understatement in text.
- e. Analyze false premises claims, counterclaims, and other evidence in persuasive writing.

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## Task Number 70

### Maintain turf.

#### Definition

Maintenance could include

- interpreting turf fertilizer analysis
- fertilizing a lawn
- applying lime to turf
- cutting turf with a rotary mower
- maintaining turf equipment
- troubleshooting turf problems
- renovating turf
- identifying damage from pests
- identifying weeds
- managing weeds
- identifying water/irrigation requirements.

Maintenance may also include reviewing the [Fertilizer Applicator Certification Training](#).

#### Process/Skill Questions

- What pests typically attack turf?
- How can a landscape contractor diagnose turf pest problems?
- What are the common diseases associated with turf?
- What methods of weed management are acceptable for various types of turf?
- What is urban nutrient management as it relates to residential, commercial, or sports turf?
- How does urban nutrient management relate to water quality and the Chesapeake Bay?

## Investigating Pest Management

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### Task Number 71

#### Identify plant pests.

#### Definition

Identification should include

- listing common plant pests
- classifying pests (e.g., insect, mite, rodent, weed, disease) and pest injury
- identifying key pests of particular plants.

### **Process/Skill Questions**

- What pests may become established in the greenhouse?
- What are the major categories of plant pests?
- Why is species selection important in pest management?

## **Task Number 72**

### **Interpret pesticide labels.**

#### **Definition**

Interpretation should include

- reading labels thoroughly and identifying
  - manufacturer
  - trade name
  - active ingredients
  - type of pesticide
  - signal words
  - formulation
  - EPA registration number
  - storage and disposal precautions
  - hazard statement
  - directions for use
  - net contents
- describing worker protection procedures under WPS regulations
- explaining the “label is the law” principle
- explaining types of toxicity and toxicity statements
- explaining safe practices while handling pesticides
- following personal protection procedures according to the directions found on pesticide labels.

### **Process/Skill Questions**

- What information can be found on a pesticide label?
- What do the different toxicity statements indicate?
- What safety measures must be followed when handling pesticides?

## **Task Number 73**

### **Interpret safety data sheets (SDS).**

#### **Definition**

Interpretation should include

- reading the SDS and categorizing information
- identifying key components in the layout of the SDS
- locating the SDS for all pesticides used.

### **Process/Skill Questions**

- Where are SDS located in school?
- What critical information can be found on the SDS?
- Why is it important to be able to quickly locate the SDS?
- Who should have access to the SDS?

## **Task Number 74**

### **Identify safety issues in pest management.**

#### **Definition**

Identification should include

- outlining WPS
- describing PPE
- investigating the uses of various types of respirators
- maintaining pesticide application equipment for safe operation
- maintaining pest-management records.

### **Process/Skill Questions**

- What is WPS?
- What are the varieties of respirators used?
- How should pesticide application equipment be maintained for safe operation?
- What are organic and traditional methods in pest management?

## **Task Number 75**

### **Identify pest management programs for horticulture crops.**

#### **Definition**

Identification should include

- scouting for pests
- managing pests by hand collection
- describing how to spray pesticides
- describing how to dust garden crops
- describing how to apply granular pesticides

- calculating, measuring, and describing how to mix pesticides, according to specifications
- managing weeds.

### **Process/Skill Questions**

- Why is it important to scout for pests?
- What are the methods for scouting?
- How are weeds in a greenhouse managed?
- What emerging technologies can assist with scouting?

## **Task Number 76**

### **Explain the principles of Integrated Pest Management (IPM).**

#### **Definition**

Explanation should include

- defining *IPM*
- defining *economic threshold* and *damage threshold*
- monitoring and scouting for pests
- discussing preventive measures for pest management (e.g., exclusion, cultivar or variety selection, sanitation)
- describing how pests may be managed with biological, cultural, mechanical, and/or chemical techniques
- classifying approaches as biological, cultural, mechanical, or chemical
- recording and assessing the effectiveness of management techniques.

### **Process/Skill Questions**

- What is the importance of IPM?
- What are some advantages of IPM over biological pest control?
- What common pests are typically managed without chemicals?
- How can IPM be used to control common greenhouse pests?

## **Task Number 77**

### **Explain the differences between biotic and abiotic issues in pest management.**

#### **Definition**

Explanation should include

- defining *abiotic disorder*
- defining *plant physiology*
- diagnosing plant problems based on environmental conditions.

## Process/Skill Questions

- What is an abiotic disorder?
- Why are abiotic disorders and diseases often confused?
- What is the difference between signs and symptoms when diagnosing plant problems?

# Investigating Fruit and Vegetable Production

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## Task Number 78

### Identify vegetable crops.

#### Definition

Identification should include

- defining *olericulture*
- composing a list of vegetables typically grown in the region
- identifying industry standards (i.e., proven varieties)
- organizing species according to edible parts of the plant
- dividing vegetables by season (i.e., cool/warm requirements)
- identifying perennial vegetable species
- identifying advantages and disadvantages of heirloom and hybrid varieties
- identifying ethnic, international, or culturally relevant crops.

## Process/Skill Questions

- What are common vegetable crops that may be grown in the region?
- What are the differences between cool-season and warm-season crops?
- When is the average last frost date for the region?
- When is the average first frost date for the region?
- How are perennial vegetable crops produced compared to common annual vegetable crops?
- What are some nontraditional or alternative international crops that can be grown in Virginia?

## Task Number 79

### Plan a vegetable garden site.

#### Definition

Planning should include

- site selection



- identifying methods of production (e.g., hydroponics, raised bed, in-ground, protected structures such as high tunnels)
- identifying cultural requirements of vegetable plants
- identifying nutrient requirements of selected plants
- interpreting days-to-maturity label
- sketching a garden plot
- devising a plan to rotate crops
- determining the fertilizer requirements of vegetable plants
- investigating average first and last frost dates for the region
- discussing the benefits of using cover crops
- differentiating between urban and rural considerations.

### **Process/Skill Questions**

- What are the major cultural requirements of vegetable crops?
- Why is crop rotation important when engaging in home gardening?
- How is crop succession beneficial to the home gardener?
- How might vegetable crops be fertilized?
- What are the benefits of using cover crops?
- What are some common cover crops that may be grown in the region?
- What are some concerns specific to urban vegetable gardening?

## **Task Number 80**

### **Produce vegetables.**

#### **Definition**

Production could include

- preparing the site (e.g., raised bed vs. in-ground, cultivation methods)
- improving the organic matter content of a garden site
- nutrient management
- comparing direct seeding to transplanting seedlings
- using cover crops
- providing protection
- weed management
- using appropriate irrigation methods
- identifying and managing garden pests
- harvesting vegetables
- using organic or sustainable gardening practices.

### **Process/Skill Questions**

- What are the advantages of purchasing young vegetable plants as opposed to direct seeding?
- What types of plants are typically direct-seeded? Transplanted?
- What are the advantages of using mulches in the vegetable garden?
- What types of mulches are appropriate for vegetable crops?

- How much water is needed for vegetable crops?
- What methods of pest management are appropriate for the home garden?
- How does mulch help manage the growth of weeds?
- What are pros and cons of conventional vs. organic gardening?

## **Task Number 81**

### **Identify fruit and nut crops.**

#### **Definition**

Identification should include

- defining *pomology*
- brambles
- tree fruits
- vine fruits
- the advantages and disadvantages of heirloom and hybrid varieties.

#### **Process/Skill Questions**

- What small fruits can be grown successfully in a home garden?
- What resources may be used to determine cultivar selection?
- What are the major cultural requirements of growing small fruits?

## **Task Number 82**

### **Plan a fruit garden, orchard, nut tree nursery, or vineyard.**

#### **Definition**

Planning should include

- designing a fruit planting
- determining varieties and spacing
- determining production scale.

#### **Process/Skill Questions**

- What is the benefit of planting bare-root plants?
- If planting apples, why is it important to identify the pollinating partners?
- What special soil considerations must be investigated when planning a fruit garden?
- How does the square-foot gardening method work?

## **Task Number 83**

# Produce fruit crops.

## Definition

Production could include

- developing a working fruit plot
- preparing soil with organic matter
- testing and adjusting the pH of soil, as necessary
- constructing a trellis system for brambles and grapes
- mulching strawberries
- managing weeds in fruit plantings
- identifying and managing pests
- testing soil to determine fertilizer requirements
- applying fertilizers
- irrigating fruit plantings
- thinning brambles
- pruning grapevines
- pruning blueberry plants
- harvesting fruits
- understanding pest and disease pressures.

## Process/Skill Questions

- What steps must be followed to plant bare-root fruit crops successfully?
- How are fruit plantings fertilized?
- How can a regular pruning schedule for specific fruit crops be developed?
- What practices mitigate against crop loss or damage due to pests?

## Task Number 84

### Describe additional horticultural methods used for flower, vegetable, and fruit production.

## Definition

Description could include

- hydroponic systems
- aquaponics systems
- vertical gardening systems
- urban gardening methods

## Process/Skill Questions

- How is the effluent used to provide nutrients to plants in an aquaponics system?
- Why would one choose to use a vertical gardening system?

- What types of produce are produced using hydroponic systems? Why?
- What types of hydroponic systems are there?

## SOL Correlation by Task

39	Identify the role of supervised agricultural experiences (SAEs) in agricultural education.	English: 10.3, 10.5, 11.3, 11.5, 12.3, 12.5
40	Participate in an SAE.	English: 10.5, 10.8, 11.5, 11.8, 12.5, 12.8
41	Identify the benefits and responsibilities of FFA membership.	English: 10.5, 10.6, 10.7, 10.8, 11.5, 11.6, 11.7, 11.8, 12.5, 12.6, 12.7, 12.8
42	Describe leadership characteristics and opportunities as they relate to agriculture and FFA.	English: 10.5, 11.5, 12.5  History and Social Science: VUS.8, VUS.9, VUS.10, VUS.11, WHIL.8, WHIL.10, WHIL.11
43	Apply for an FFA degree and/or an agricultural proficiency award.	English: 10.5, 11.5, 12.5
44	Follow safety procedures in the horticulture industry.	English: 10.5, 11.5, 12.5  History and Social Science: GOVT.16
45	Outline the scope of the horticulture industry.	English: 10.3, 10.6, 10.7, 11.3, 11.6, 11.7, 12.3, 12.6, 12.7
46	Research career opportunities in the horticulture industry.	English: 11.5, 11.8, 12.5, 12.8
47	Describe factors to consider when planning a greenhouse.	English: 10.5, 11.5, 12.5
48	Identify a variety of greenhouses, their components, and other protected structures.	English: 10.5, 11.5, 12.5  History and Social Science: GOVT.9, VUS.14
49	Identify a variety of greenhouse environmental controls.	English: 10.5, 11.5, 12.5
50	Describe procedures for greenhouse structural and equipment maintenance.	English: 10.5, 11.5, 12.5
51	Describe plant taxonomy.	English: 10.1, 10.5, 11.1, 11.5, 12.1, 12.5  Science: BIO.4
52	Analyze plant anatomy and physiology.	English: 10.5, 11.5, 12.5  Science: BIO.2, BIO.4
53	Define the characteristics of soil and soilless substrates.	English: 10.3, 10.5, 11.3, 11.5, 12.3, 12.8  Science: ES.8
54	Describe nutrition management practices.	English: 10.5, 11.5, 12.5  Science: BIO.2
55	Compare irrigation system options.	English: 10.5, 11.5, 12.5
56	Describe how environmental factors affect plant growth.	English: 10.3, 10.5, 11.3, 11.5, 12.3, 12.5  Science: BIO.2

57	Describe plant propagation methods.	English: 10.3, 10.5, 10.6, 10.7, 11.3, 11.5, 11.6, 11.7, 12.3, 12.5, 12.6, 12.7
58	Demonstrate plant propagation.	Science: BIO.1
59	Identify floriculture crops.	English: 10.1, 10.5, 11.1, 11.5, 12.1, 12.5
60	Produce a floriculture crop.	English: 10.5, 11.5, 12.5
61	Design interior plantings.	English: 10.3, 10.5, 11.3, 11.5, 12.3, 12.5
62	Design floral arrangements.	English: 10.5, 11.5, 12.5
63	Identify landscape plants.	English: 10.5, 10.6, 10.7, 11.5, 11.6, 11.7, 12.5, 12.6, 12.7
64	Design landscapes.	English: 10.5, 11.5, 12.5  Mathematics: A.1, A.4, G.3
65	Construct landscapes.	Mathematics: A.1, A.4, G.13
66	Identify landscape maintenance tasks.	English: 10.5, 11.5, 12.5
67	Identify turfgrass species.	English: 10.3, 10.5, 11.3, 11.5, 12.3, 12.5
68	Outline aspects of the turfgrass industry.	English: 10.6, 10.7, 11.6, 11.7, 12.6, 12.7
69	Describe the procedures for establishing turf.	English: 10.5, 11.5, 12.5
70	Maintain turf.	English: 10.5, 11.5, 12.5
71	Identify plant pests.	English: 10.5, 10.6, 11.5, 11.6, 12.5, 12.6
72	Interpret pesticide labels.	English: 10.5, 11.5, 12.5
73	Interpret safety data sheets (SDS).	English: 10.5, 11.5, 12.5  Science: CH.1
74	Identify safety issues in pest management.	English: 10.5, 11.5, 12.5
75	Identify pest management programs for horticulture crops.	English: 10.5, 11.5, 12.5  Mathematics: A.1, A.4
76	Explain the principles of Integrated Pest Management (IPM).	English: 10.3, 10.5, 11.3, 11.5, 12.3, 12.5
77	Explain the differences between biotic and abiotic issues in pest management.	English: 10.3, 10.5, 11.3, 11.5, 12.3, 12.5
78	Identify vegetable crops.	English: 10.3, 10.5, 11.3, 11.5, 12.3, 12.5  History and Social Science: WG.3, WG.4
79	Plan a vegetable garden site.	English: 10.5, 10.8, 11.5, 11.8, 12.5, 12.8
80	Produce vegetables.	English: 10.5, 11.5, 12.5  Science: BIO.1
81	Identify fruit and nut crops.	English: 10.3, 10.5, 11.3, 11.5, 12.3, 12.5
82	Plan a fruit garden, orchard, nut tree nursery, or vineyard.	English: 10.5, 11.5, 12.5
83	Produce fruit crops.	English: 10.5, 11.5, 12.5  Science: BIO.4
84	Describe additional horticultural methods used for flower, vegetable, and fruit production.	English: 10.5, 11.5, 12.5

## FFA Information

The National FFA is an organization dedicated to preparing members for leadership and careers in the science, business, and technology of agriculture. Local, state, and national activities and award programs provide opportunities to apply knowledge and skills acquired through agriculture education.

For additional information about the student organization, see the [National FFA website](#) and the [Virginia FFA Association website](#).

## **Entrepreneurship Infusion Units**

Entrepreneurship Infusion Units may be used to help students achieve additional, focused competencies and enhance the validated tasks/competencies related to identifying and starting a new business venture. Because the unit is a complement to certain designated courses and is not mandatory, all tasks/competencies are marked “optional.”

# Appendix: Credentials, Course Sequences, and Career Cluster Information

## Industry Credentials: Only apply to 36-week courses

- BASF Plant Science Certification Examination
- Chesapeake Bay Landscape Professional, Associate (CBLP-A) Examination
- College and Work Readiness Assessment (CWRA+)
- Customer Service Specialist (CSS) Examination
- Floriculture Assessment
- Floriculture: Greenhouse Assessment
- Greenhouse Operators Certification Examination
- Horticulture-Landscaping Assessment
- National Career Readiness Certificate Assessment
- Workplace Readiness Skills for the Commonwealth Examination

**Concentration sequences:** *A combination of this course and those below, equivalent to two 36-week courses, is a concentration sequence. Students wishing to complete a specialization may take additional courses based on their career pathways. A program completer is a student who has met the requirements for a CTE concentration sequence and all other requirements for high school graduation or an approved alternative education program.*

- Agricultural Business Fundamentals I (8022/36 weeks)
- Agricultural Business Management III (8026/36 weeks)
- Agricultural Business Operations II (8024/36 weeks)
- Applied Agricultural Concepts (8072/18 weeks)
- Applied Agricultural Concepts (8073/36 weeks)
- Biological Applications in Agriculture (8086/36 weeks)
- Biotechnology Applications in Agriculture (8087/36 weeks)
- Biotechnology Foundations in Agricultural and Environmental Science (8085/36 weeks)
- Floral Design I (8055/36 weeks)
- Floral Design II (8056/36 weeks)
- Floriculture (8038/36 weeks)
- Greenhouse Plant Production and Management (8035/36 weeks)
- Introduction to Plant Systems (8007/36 weeks)
- Landscaping I (8036/36 weeks)
- Landscaping II (8039/36 weeks)
- Operating the Farm Business (8014/36 weeks)
- Turfgrass Management (8051/36 weeks)
- Turfgrass Management, Advanced (8054/36 weeks)

Career Cluster: Agriculture, Food and Natural Resources	
Pathway	Occupations
Agribusiness Systems	<b>Agricultural Commodity Broker</b> <b>Agricultural Economist</b> <b>Agricultural Loan Officer</b> <b>Agricultural Products Sales Representative</b> <b>Farm Products Purchasing Agent and Buyer</b> <b>Farm, Ranch Manager</b> <b>Farmer/Rancher</b> <b>Feed, Farm Supply Store Sales Manager</b>

<b>Career Cluster: Agriculture, Food and Natural Resources</b>	
<b>Pathway</b>	<b>Occupations</b>
	<b>Sales Manager</b>
<b>Environmental Service Systems</b>	<b>Environmental Compliance Inspector Environmental Sampling and Analysis Technician Toxicologist Turf Farmer</b>
<b>Food Products and Processing Systems</b>	<b>Biochemist Food Scientist</b>
<b>Natural Resources Systems</b>	<b>Forest Manager, Forester Forest Technician Microbiologist</b>
<b>Plant Systems</b>	<b>Agricultural Products Sales Representative Botanist Certified Crop Advisor Crop Grower Custom Harvester Farm, Ranch Manager Farmer/Rancher Floral Designer Floral Shop Manager Forest Geneticist Nursery and Greenhouse Manager Ornamental Horticulturist Plant Breeder/ Geneticist Secondary School Teacher Soil and Plant Scientist Tree Surgeon Turf Farmer</b>

<b>Career Cluster: Science, Technology, Engineering and Mathematics</b>	
<b>Pathway</b>	<b>Occupations</b>
<b>Science and Mathematics</b>	<b>Biologist Botanist Chemist Microbiologists Plant Biologist Plant Breeder and Geneticist Plant Pathologist Research Chemist Secondary School Teacher Technical Writer Toxicologist</b>