

# Foundations of Agriculture, Food, and Natural Resources

8006 36 weeks

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## Acknowledgments

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Virginia Department of Education

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## Course Description

**Suggested Grade Level:** 9 or 10

This course develops a foundation in each of the career pathways in agriculture, food, and natural resources (AFNR), including the global scope of agriculture; concepts in plant, animal, and food science; natural resources and environmental systems; agricultural skills and safety in power, structural, and technical systems; and agribusiness.

*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.

8006	Tasks/Competencies
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<input checked="" type="checkbox"/>	Identify the role of supervised agricultural experiences (SAEs) in agricultural education.
<input checked="" type="checkbox"/>	Participate in an SAE.
<input checked="" type="checkbox"/>	Identify the benefits and responsibilities of FFA membership.
<input checked="" type="checkbox"/>	Describe leadership characteristics and opportunities as they relate to agriculture and FFA.
<input type="checkbox"/>	Apply for an FFA degree and/or an agricultural proficiency award.
<input checked="" type="checkbox"/>	Explore career opportunities related to AFNR.
<input checked="" type="checkbox"/>	Identify Virginia's major agricultural commodities and products by region.
<input checked="" type="checkbox"/>	Examine the history of agriculture in Virginia, the United States, and globally.
<input checked="" type="checkbox"/>	Examine the relationship of science and technology to agriculture.
<input checked="" type="checkbox"/>	Analyze the effects of agriculture on the local, state, national, and global economy.
<input checked="" type="checkbox"/>	Explain the future of AFNR.
<input checked="" type="checkbox"/>	Identify local, state, and federal stakeholders relevant to AFNR.
<input checked="" type="checkbox"/>	Examine agricultural issues related to population, food, energy, and the environment.
<input checked="" type="checkbox"/>	Define terms associated with plant science.
<input checked="" type="checkbox"/>	Describe the influence of biotechnology on AFNR.
<input checked="" type="checkbox"/>	Explain the functions of major plant parts.
<input checked="" type="checkbox"/>	Explain the process of photosynthesis and cellular respiration in plants.
<input checked="" type="checkbox"/>	Describe the relationship among temperature, light, air, soil/substrate, water, and nutrients required for plant growth.
<input checked="" type="checkbox"/>	Propagate plants through sexual and asexual reproduction.
<input checked="" type="checkbox"/>	Grow plants.
<input checked="" type="checkbox"/>	Research a current issue in AFNR using the scientific method.
<input checked="" type="checkbox"/>	Describe the types of plants that are being developed using biotechnology.
<input checked="" type="checkbox"/>	Define terms related to animal species.
<input checked="" type="checkbox"/>	Identify production stages and goals for selected industries.
<input checked="" type="checkbox"/>	Identify basic body systems of livestock, poultry, and specialty animals.

<input checked="" type="radio"/>	Explain animal nutrition and feeding practices.
<input checked="" type="radio"/>	Differentiate between the signs of good health and illness in animals.
<input checked="" type="radio"/>	Describe the responsibilities of the animal industry regarding animal care and welfare.
<input type="radio"/>	Identify types of aquaculture systems.
<input type="radio"/>	Identify types of aquatic animals and the systems used to rear them.
<input type="radio"/>	Identify management interventions, infrastructure, and support technologies used in aquaculture production.
<input checked="" type="radio"/>	Identify types of facilities used in agricultural production.
<input checked="" type="radio"/>	Explain the process of constructing agricultural facilities.
<input checked="" type="radio"/>	Identify equipment and facilities required for an aquaculture production facility.
<input checked="" type="radio"/>	Define terms associated with the food industry.
<input checked="" type="radio"/>	Identify agricultural commodities.
<input checked="" type="radio"/>	Examine guidelines for food labels.
<input checked="" type="radio"/>	Interpret food packaging and nutrition facts labels.
<input checked="" type="radio"/>	Describe the steps involved in the processing of plant and animal food products.
<input checked="" type="radio"/>	Explain the role that food science plays in ensuring a nutritious, safe, and abundant food supply.
<input checked="" type="radio"/>	Describe methods of food preservation.
<input checked="" type="radio"/>	Perform a method of food preservation.
<input checked="" type="radio"/>	Identify the four steps to food safety and the potential sources of food contamination.
<input checked="" type="radio"/>	List the procedures for the safe handling of foods.
<input checked="" type="radio"/>	Design a food product.
<input checked="" type="radio"/>	Describe categories of natural resources.
<input checked="" type="radio"/>	Define terms associated with natural resources management.
<input checked="" type="radio"/>	Explain the relationship between natural resources management and the environment.
<input checked="" type="radio"/>	Identify natural resource BMPs and conservation practices used in agriculture to protect the environment.
<input checked="" type="radio"/>	Identify major forest trees in Virginia and their uses.

<input checked="" type="radio"/>	Explain the need for safety in agricultural mechanics.
<input checked="" type="radio"/>	Demonstrate safe practices in the agricultural mechanics lab/workshop.
<input checked="" type="radio"/>	Identify marked safety areas.
<input checked="" type="radio"/>	Identify the location and use of eyewash stations.
<input checked="" type="radio"/>	Identify the location of the posted evacuation routes.
<input checked="" type="radio"/>	Demonstrate knowledge of SDS.
<input type="radio"/>	Demonstrate the use of chemicals.
<input checked="" type="radio"/>	Demonstrate the use of standard and metric hand tools.
<input checked="" type="radio"/>	Demonstrate standard measurement techniques in agricultural mechanics.
<input checked="" type="radio"/>	Demonstrate the use of precision standard and metric measuring tools.
<input checked="" type="radio"/>	Demonstrate the use of protective clothing and equipment.
<input type="radio"/>	Demonstrate use of fire protection equipment.
<input checked="" type="radio"/>	Demonstrate the use of hand tools, portable power tools, and equipment.
<input checked="" type="radio"/>	Demonstrate basic woodworking skills.
<input checked="" type="radio"/>	Identify various metal fabrication technologies.
<input checked="" type="radio"/>	Explain the principles of arc welding.
<input checked="" type="radio"/>	Identify arc welding tools, equipment, and supplies.
<input type="radio"/>	Perform arc welding.
<input checked="" type="radio"/>	Create an agricultural project.
<input checked="" type="radio"/>	Explain basic principles of agricultural economics.
<input checked="" type="radio"/>	Identify the components of a business and financial plan.
<input checked="" type="radio"/>	Identify financial management tools used in an agricultural business.
<input checked="" type="radio"/>	Describe how the four Ps of marketing are used to develop a successful marketing strategy for an agricultural product or service.
<input checked="" type="radio"/>	Define terms associated with banking and business operations.
<input checked="" type="radio"/>	Develop a personal financial plan, including a budget.

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?

## Exploring the Agriculture Industry

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## Task Number 44

### Explore career opportunities related to AFNR.

#### Definition

Exploration should include

- listing possible agricultural careers related to this course
- conducting a career interest survey and exploring a career of choice
- determining the education and experience required
- exploring job opportunities, salaries, and benefits
- describing career pathways in the AFNR Career Cluster.

Many websites offer career exploration resources, including the Virginia Department of Education's [Career Planning Guide](#), [Virginia Education Wizard](#), and the National FFA's [Ag Explorer](#).

#### Process/Skill Questions

- What are some local career opportunities in each of the agricultural career pathways?
- What are some global career opportunities?
- What level of education is required for different careers in each of the agricultural career pathways?
- What are the potential salaries and opportunities for advancement in different careers in AFNR?
- What AFNR careers are available through government agencies?
- How would an individual begin to start his/her own agricultural business?
- How will these careers evolve in the future?
- What is the career outlook for AFNR?

## Task Number 45

### Identify Virginia's major agricultural commodities and products by region.

#### Definition

Identification should include

- the difference between *commodity* and *product*
- the five physiographic regions in Virginia (i.e., Coastal Plain, Piedmont, Blue Ridge, Valley and Ridge, and Appalachian Plateau)
- the major agricultural commodities and products associated with each region.

#### Process/Skill Questions

- What are some current trends in agriculture?
- How have agricultural commodities and products changed in different regions?
- How do natural conditions affect the products that are produced?

- What programs are available to promote Virginia commodities and products?

## Task Number 46

### Examine the history of agriculture in Virginia, the United States, and globally.

#### Definition

Examination should include the history of

- plant and animal domestication
- land resources
- transportation systems
- markets
- technology
- inventions
- the role of geography in agriculture.

#### Process/Skill Questions

- What are the most significant inventions in agriculture?
- Who are individuals who played a significant role in shaping the agricultural revolution? What were their contributions to mechanization, food safety, food preservation, food transport, and the Green Revolution?
- How have cultural and political changes affected the Virginia agriculture industry?
- How have land, transportation, markets, and ingenuity affected agricultural production in Virginia?

## Task Number 47

### Examine the relationship of science and technology to agriculture.

#### Definition

Examination should include

- the definition of *agriculture*—the production, processing, marketing, distribution, financing, and development of agricultural commodities and resources including food, fuel, fiber, wood products, natural resources, horticulture, and other plant and animal products/resources
- the definition of *technology*
- how science and technology have evolved over the years
- problems that drive the development of technologies that are used in agriculture
- cybersecurity
- the role of biotechnology in the plant sciences, animal sciences, food, and natural resources management industries
- innovations (e.g., precision agriculture, genetics, Global Positioning System [GPS], global navigation satellite systems [GNSS], livestock and crop telemetry, vertical farming, biofuels, food packaging)

- the Green Revolution
- legislation.

### **Process/Skill Questions**

- How has technology affected the field of agriculture over time?
- How have genetically modified plant products affected society?
- What types of animals are used in biotechnology research?
- How are swine used in the production of human hemoglobin?
- How have transgenic animals affected animal production?
- How is biotechnology in food science affecting global food supplies?
- How are microbes used in the bioremediation process?
- How are plants used to prevent crop run-off in lakes and rivers?

## **Task Number 48**

### **Analyze the effects of agriculture on the local, state, national, and global economy.**

#### **Definition**

Analysis should include

- defining *import* and *export*
- identifying Virginia's major agricultural imports and exports to other states and other countries
- describing the role of geography in AFNR
- identifying states and countries that receive Virginia's agricultural exports
- identifying where various fibers and foods are produced and processed locally, in Virginia, nationally, and globally
- describing how the export/import trade affects the local, state, national, and global economy
- reviewing global trade relationships and how they affect the agriculture industry in Virginia
- understanding commodity and product pricing.

### **Process/Skill Questions**

- What are the five major agricultural commodities that are imported to Virginia and the United States?
- What are the five major agricultural commodities that are exported?
- How do agricultural products in the community affect the local economy?
- Where does the locality rank in agricultural commodities production in the state and in the nation?
- How have the effects of agricultural production evolved in the locality?
- How do global trade relationships affect prices of agricultural commodities and products in Virginia and in the rest of the country?

## **Task Number 49**

### **Explain the future of AFNR.**

## Definition

Explanation should include

- factors that determine the future of AFNR
  - population growth
  - consumer demands
  - sustainability
- technological advances in engineering, biotechnology, and information systems.

## Process/Skill Questions

- What trends in food consumption have influenced agricultural production?
- How has the ability to preserve food influenced population growth?

## Task Number 50

### Identify local, state, and federal stakeholders relevant to AFNR.

#### Definition

Identification should include explaining the purpose, history, mission, and jurisdiction of

- federal agencies
  - U.S. Forest Service
  - U.S. Department of Agriculture (USDA)
  - Food and Drug Administration (FDA)
  - Environmental Protection Agency (EPA)
  - Natural Resources Conservation Service (NRCS)
- state agencies
  - Department of Environmental Quality (DEQ)
  - Virginia Department of Agriculture and Consumer Services (VDACS)
  - Department of Forestry
  - Department of Game and Inland Fisheries (DGIF)
  - Virginia Cooperative Extension
- local stakeholders
  - agricultural research and extension centers
  - American Farm Bureau Federation
  - commodity associations
  - land grant universities, agricultural colleges, and other educational institutions.

#### Process/Skill Questions

- How can one find one's local cooperative extension agent?
- How many cooperative extension stations are in Virginia?
- What is the role of cooperative extension in Virginia?
- What resources do these agencies provide for local residents?
- How have legislation and regulations governing ANFR evolved?

- How are organically produced foods regulated and certified?
- What major changes have occurred in the food processing industry? What specific legislation has affected food safety?

## Task Number 51

### Examine agricultural issues related to population, food, energy, and the environment.

#### Definition

Examination should include exploration of issues such as

- population growth
- the use of animals for service, companionship, work, and food
- food production (e.g., genetically modified organisms [GMOs], organics)
- energy production
- environmental concerns (e.g., fracking, climate change, deforestation, water resources, pollutants, soil degradation, waste, legislation)
- technology concerns
- food security vs. food insecurity
- food deserts
- food sovereignty
- agroecology
- traceability
- consumer perception
- advocacy.

Teacher resources: [U.S. Food Sovereignty Alliance](#); [Food Security, Food Justice, or Food Sovereignty?](#), Food First

#### Process/Skill Questions

- What are the roles of service animals?
- How do people use animals in a work role?
- How did the domestication of animals contribute to advancements in societies?
- Which crops have approved GMOs? Which ones are approved for human or animal consumption (i.e., food or feed) or alternative uses?
- What controversies are related to current food production methods? What are potential solutions to these conflicts?
- How does a farmer's production decisions affect commodities and products?
- How does food sovereignty affect agricultural production?
- How does agroecology affect economic and social factors related to agriculture?

## Investigating Basic Scientific Skills and Principles of Plant Science

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## Task Number 52

### Define terms associated with plant science.

#### Definition

Definitions may include

- *angiosperms*
- *annual*
- *biennial*
- *cotyledon*
- *dicot*
- *dormancy*
- *fertilization*
- *ferns*
- *germination*
- *gymnosperms*
- *juvenile growth*
- *maturity*
- *monocot*
- *perennial*
- *pest*
- *photoperiod*
- *phototropism*
- *pollination*
- *reproductive phase*
- *vegetative phase.*

#### Process/Skill Questions

- Why is it important to use correct terminology?
- What are the similarities and differences between monocot and dicot plants?
- How do annual, biennial, and perennial plants differ?
- What are the signs that a plant has reached maturity?
- How can one force dormancy in a plant?
- What are the signs that a plant has reached dormancy?

## Task Number 53

### Describe the influence of biotechnology on AFNR.

#### Definition

Description should include

- definition of *biotechnology*
- explanation of the way natural and artificial selection has changed today's plants and animals
- traditional and modern biotechnology
- genetic engineering
- GMOs
- reproductive biotechnology (e.g., artificial insemination, cloning, embryo transfer)
- transgenic animals (risks vs. benefits).

### **Process/Skill Questions**

- What are some of the benefits associated with GMOs?
- What are some of the risks associated with GMOs?
- What are transgenic animals, and how are they used?
- How can biotechnology help reduce environmental pollution?

## **Task Number 54**

### **Explain the functions of major plant parts.**

#### **Definition**

Explanation should include the functions of the

- leaf
- stem
- roots
- flower
  - incomplete vs. complete
  - imperfect vs. perfect
- seed
- fruit.

### **Process/Skill Questions**

- What role does each part of the plant play in the life and health of the plant?
- What could happen to a plant if it were missing one or more parts?
- What products come from flowers?
- What are the basic components of all seeds?
- What are some seeds that are not safe to eat?
- What are the basic reproductive structures of a flower?
- What parts of the plant do humans consume?
- What are the differences between fruits and vegetables (botanical vs. culinary)?

## **Task Number 55**

# **Explain the process of photosynthesis and cellular respiration in plants.**

## **Definition**

Explanation should include

- the chemical equations for photosynthesis and cellular respiration
- the relationship between photosynthesis and cellular respiration
- plant anatomy and physiology as it relates to the chemical processes.

## **Process/Skill Questions**

- What inputs must exist for photosynthesis to occur?
- What steps occur in the process of photosynthesis?
- What parts of the plant are involved in photosynthesis?
- What are the steps of cellular respiration?
- What parts of the plant are involved in cellular respiration?
- What are the products of cellular respiration?

## **Task Number 56**

# **Describe the relationship among temperature, light, air, soil/substrate, water, and nutrients required for plant growth.**

## **Definition**

Description should include the roles of

- optimal growing temperature and USDA plant hardiness zones
- natural and artificial light
- gas exchange
- soil components and physical properties (e.g., soil triangle, soil horizons)
- growing media/substrate
- organic vs. inorganic fertilizer
- water quantity and quality
- macronutrients and micronutrients, deficiencies, and toxicity.

## **Process/Skill Questions**

- How does photoperiod affect plants?
- How does soil fertility affect plant production?
- What are the soil horizons?
- What are the different growing media for plants?
- What would happen to a plant if one of the growing requirements were lacking?
- How does the USDA plant hardiness zone affect what can be grown locally?
- What are the symptoms of nutrient deficiency?

- How can a nutrient deficiency be treated?
- What environmental factors can cause negative plant performance?

## **Task Number 57**

### **Propagate plants through sexual and asexual reproduction.**

#### **Definition**

Propagation should include

- sexual
- asexual (e.g., using cuttings, division, separation, and/or layering).

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

- Why do certain asexual propagation methods not apply to all plants?
  - What is the difference between division and separation?
  - Why is rooting hormone used in asexual propagation?
  - What are the advantages and disadvantages of sexual propagation? Asexual propagation?
  - When should seedlings be transplanted into larger containers?
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## **Task Number 58**

### **Grow plants.**

#### **Definition**

Growing plants may include

- selecting the type of plant to grow
- preparing the soil/substrate or hydroponic unit
- sowing seeds or transplanting seedlings
- controlling weeds
- identifying and controlling pests (e.g., using Integrated Pest Management [IPM])
- applying fertilizers
- irrigating by hand or through an irrigation system
- pruning or thinning
- harvesting fruits or vegetables.

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

- What are the advantages of using mulches?
- What types of mulches are appropriate for various plants?
- What are the watering requirements for various plants?

- What are some methods of pest control?
- How are fertilizers applied?
- What is the purpose of pruning?
- What is the difference between growing plants hydroponically and traditionally?

## **Task Number 59**

### **Research a current issue in AFNR using the scientific method.**

#### **Definition**

Research should include

- identifying the problem
- formulating a hypothesis
- conducting an experiment to test the hypothesis
- collecting and analyzing data
- reaching a conclusion.

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

- How can the scientific method be used to research problems in agricultural production, processing, marketing and distribution?

## **Task Number 60**

### **Describe the types of plants that are being developed using biotechnology.**

#### **Definition**

Description should include the use of biotechnology in

- production of forages (e.g., grasses, legumes), ornamentals, grain crops, fruits, vegetables, or products derived from them
- technologies used to develop pathogen resistance, plant-made products, phytoremediation, water use efficiency, nitrogen use efficiency, and quality traits
- pharming.

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

- What are the differences among transgenic, biotech, genetically modified (GM) and genetically engineered (GE) crops?
- What are the most widely grown biotech crops, and how have they been modified?
- How is bioremediation useful?
- What are different types of ornamental crops?
- What are some significant uses of legumes?

- What are some of the goals of genetic engineering in plant science?
- How are genetically engineered products assessed for safety and environmental risk?
- How can using biotechnology reduce the environmental impact of the food system, increase agricultural production efficiency, and enhance the nutritive value of food?

# Investigating Basic Scientific Skills and Principles in Animal Science

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## Task Number 61

### Define terms related to animal species.

#### Definition

Definition should include terms referring to the age, gender, and reproductive status of animal species and terms such as

- *bovine*
- *ovine*
- *caprine*
- *equine*
- *porcine*
- *avian*.

#### Process/Skill Questions

- Why is it important to learn and use correct terminology for animal species and conditions?
- What resources can one use to find definitions for unfamiliar terminology?

## Task Number 62

### Identify production stages and goals for selected industries.

#### Definition

Identification should include ideal market weights, ages, rates of gain, and production rates for species such as

- dairy cattle
- beef cattle
- poultry (e.g., broilers, turkeys, layers)
- sheep
- goats

- swine
- equine.

### **Process/Skill Questions**

- How are equine production goals different from those of livestock?
- How do producers determine that animals are ready for market?
- What is the purpose of each industry?
- How do production goals differ between dairy and beef?
- How does each industry contribute to the economy?
- What are the different subcategories of equine production?

## **Task Number 63**

### **Identify basic body systems of livestock, poultry, and specialty animals.**

#### **Definition**

Identification should include the

- digestive system (e.g., ruminant, nonruminant, pseudo-ruminant, hindgut fermenters)
- circulatory system
- lymphatic system/immune system
- respiratory system
- muscular system
- skeletal system
- nervous system
- endocrine system
- integumentary system/exocrine system
- reproductive system
- renal system/urinary system.

### **Process/Skill Questions**

- What are the parts of the male and female reproductive systems?
- What are the three types of muscle tissue? What are the basic characteristics of each?
- What are the functions of the respiratory system?
- How does each component of the digestive system assist in the digestion process?
- How are waste products removed from the body? What systems are involved?
- What are the consequences when waste is not effectively removed from the body?
- What are examples of animals with different digestive tracts?

## **Task Number 64**

### **Explain animal nutrition and feeding practices.**

## Definition

Explanation should include

- defining *ration*
- identifying the basic nutrients and their functions in maintaining animal health
- analyzing and selecting feed, based on ingredients and nutritional content
- identifying the nutritional requirements of different species
- identifying feeding and supplemental feeding practices based on growth stage and purpose.

## Process/Skill Questions

- What are possible sources of the basic required nutrients?
- What disorders may develop if nutrient requirements are not met?
- What are symptoms of toxicity and/or nutritional deficiencies?
- What techniques are used to formulate rations?
- Why is water such an important part of an animal's diet?
- Why is it important to feed animals quality feed?
- How do feeding practices differ in organic and conventional production systems?
- What is the veterinary feed directive, and how does it affect feed choices?

## Task Number 65

### **Differentiate between the signs of good health and illness in animals.**

#### Definition

Differentiation may include

- identifying signs of healthy animals
- describing animal diseases, the symptoms of each disease, how they are contracted and/or transmitted, and how to prevent and/or treat them
- identifying common parasites and related prevention and treatment methods
- explaining basic vaccination concepts, techniques, and the factors involved in vaccination schedules.

#### Process/Skill Questions

- What animal behaviors indicate stress or poor health? Why is it important to understand animal behavior?
- What facility maintenance procedures can be put in place to keep animals healthy?
- Why is it important to understand how diseases can be transmitted from animal to animal?
- What are the most common diseases and parasites among domestic animals in the local area?
- How effective are common preventive measures against diseases?
- How effective are parasite control products? What strategies improve the efficacy of these products?
- How has the development of vaccine protocols affected overall animal health?
- Why is a vaccination schedule important to an animal's health? What factors should be considered in establishing a vaccination schedule for an animal?
- What is the purpose of the withdrawal period?

## **Task Number 66**

**Describe the responsibilities of the animal industry regarding animal care and welfare.**

### **Definition**

Description should include

- livestock vs. companion animals
- basic animal needs (e.g., water, feed, shelter, space, preventive care) and strategies to meet those needs
- misconceptions about animal production
- regulatory agencies for animals (e.g., Animal and Plant Health Inspection Service [APHIS])
- policies, regulations, and laws for selected industries.

### **Process/Skill Questions**

- What is animal welfare?
- What are animal rights?
- Why should people employed in the animal production industry be concerned about animal rights and animal welfare?
- What are the basic needs for domestic animals?
- How have organizations like the Humane Society of the United States (HSUS) and People for the Ethical Treatment of Animals (PETA) influenced regulations in the animal industry?
- How does media influence public perception?

## **Task Number 67**

**Identify types of aquaculture systems.**

### **Definition**

Identification should include

- water-based (e.g., cages, pens, inshore/offshore)
- land-based (e.g., rainfed ponds, irrigated or flow-through systems, tanks, raceways)
- recycling (e.g., high-control enclosed systems, containment structures)
- integrated farming (e.g., livestock-fish, agriculture and fish dual-use, irrigation ponds).

### **Process/Skill Questions**

- What factors determine the type of aquaculture system used?
- What are the benefits of using indoor systems vs. outdoor systems?
- What are the differences between marine and freshwater aquaculture?

## **Task Number 68**

## Identify types of aquatic animals and the systems used to rear them.

### Definition

Identification should include

- fish—ponds, polishing ponds, integrated pond systems
- seaweeds and macrophytes—floating/suspended culture, onshore pond/tank culture
- mollusks—bottom, pole, rack, raft, long-line systems, culture-based fisheries
- crustaceans—pond, tank, raceway, culture-based fisheries
- other minor invertebrates (e.g., echinoderms, coelenterates, seahorses)—tanks, ponds, culture-based fisheries.

### Process/Skill Questions

- How does marine aquaculture support commercial fisheries and restore habitat and at-risk species?
- How does aquaculture contribute to increased food production and reduce pressure on aquatic animal resources?
- What is *sustainable aquaculture*?
- What environment, community, business, and farm management practices need to be adopted to ensure sustainability in aquaculture production?

## Task Number 69

### Identify management interventions, infrastructure, and support technologies used in aquaculture production.

#### Definition

Identification should include

- seed supply
- stocking
- handling
- feeding
- controlling
- monitoring (e.g., water quality, water temperature, aeration, dissolved oxygen, wastewater, filtration, disposal, mechanical systems)
- sorting
- treating
- harvesting
- processing
- prophylactic measures (e.g., disease and pest control).

### Process/Skill Questions

- Why is water quality monitoring essential in aquaculture production?

- How does water temperature affect production and feed efficiency?
- What are the advantages and disadvantages of indoor vs. outdoor production facilities?

## **Task Number 70**

### **Identify types of facilities used in agricultural production.**

#### **Definition**

Identification should include facilities used for

- plant growth
- animal housing
- animal birthing
- milking and storage
- crop storage and processing
- animal feed storage
- mechanical shops
- equipment storage
- waste storage and processing.

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

- What structural components need to be considered when designing a poultry facility?
- What structural components need to be considered when designing a dairy facility?

## **Task Number 71**

### **Explain the process of constructing agricultural facilities.**

#### **Definition**

Explanation should include

- securing permits and inspection
- site preparation
- footings
- foundation
- framing
- roofing
- finishing.

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

- What are prefabricated components, and why are they used?
- Why are permits required for the construction of agricultural facilities?

## Task Number 72

### Identify equipment and facilities required for an aquaculture production facility.

#### Definition

Identification should include

- outdoor facilities
- indoor facilities
- water supply and filtration systems
- environmental control systems
- waste management systems
- electrical service
- heating and cooling systems
- structures for feeding and housing aquacultural animals.

#### Process/Skill Questions

- What type of flooring should be considered in an indoor aquaculture facility?
- How is water quality maintained in an aquaculture facility?
- What factors need to be taken into consideration when designing access for transport and harvesting of an aquacultural crop?

## Investigating Basic Scientific Skills and Principles in Food Products and Processing

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## Task Number 73

### Define terms associated with the food industry.

#### Definition

Defining terms may include

- *biosecurity*
- *farm-to-table*
- *food packaging*
- *food preparation*
- *food preservation*
- *food processing*

- *food safety*
- *food waste*
- *genetics*
- *Good Agricultural Practices (GAP)*
- *niche market*
- *organically produced foods*
- *sustainability*
- *plant-based diets (e.g., vegetarian vs. vegan)*
- *product development*
- *traceability.*

### **Process/Skill Questions**

- Why is it important to know and understand terms related to the food science industry?
- Where can one find definitions for terms associated with the food science industry?
- What are local, state, and national trends related to the food industry?
- How do cultural and religious backgrounds affect food production and consumption?

## **Task Number 74**

### **Identify agricultural commodities.**

#### **Definition**

Identification should include

- examining a variety of animal and plant raw products
- listing alternative sources of nutrition (e.g., plant-based vs. animal-based)
- aligning them to the food groups and to the USDA dietary guidelines
- evaluating nutritional requirements based on age, gender, activity level, and chronic disease.

### **Process/Skill Questions**

- What food byproducts are produced from agricultural commodities?
- What are the five food groups?
- How have dietary guidelines evolved?
- What are alternative sources of nutrition related to the USDA dietary guidelines?
- How can one determine one's own nutritional needs?

## **Task Number 75**

### **Examine guidelines for food labels.**

#### **Definition**

Examination should include

- current label requirements
- current trends in diets
- government-mandated vs. voluntary labels
  - safety inspection vs. grading
- government agencies that regulate labeling
- the role of consumers (e.g., labels, regulations, marketing)
- food defect action levels.

Teacher resource: [Food Defect Action Levels](#), FDA

### Process/Skill Questions

- Why are some plant-based beverages labeled as milk?
- How do food labels influence consumer decision-making?
- How are foods labeled as vegan, vegetarian, kosher, halal, organic, and non-GMO? What are the requirements for each?
- How do consumers influence labeling regulations?
- How do international food labeling requirements differ?

## Task Number 76

### Interpret food packaging and nutrition facts labels.

#### Definition

Interpretation should include

- examining a variety of nutrition facts labels
  - nutrition information (e.g., nutrients, amount of each nutrient, percentage of minimum daily requirement for each nutrient)
  - serving size and number of servings per package
- packaging labels
  - ingredients
  - allergens
  - expiration, sell-by, best-by, use-by, and freeze-by dates
  - preparation instructions
  - storage instructions.

Teacher resource: [Compliance FAQs: Packaging and Labeling in the US](#), National Institute of Standards and Technology (NIST); [The Difference between “Use-By,” “Sell-By,” and “Best-By” Dates](#), Institute of Food Technologists (IFT)

### Process/Skill Questions

- Who benefits from information on nutrition facts labels?
- Which products are required to have nutrition facts labels?
- Which major allergens are required to be identified?
- Why are footnotes not required on all packages?

- What is the difference between best-by, sell-by, use-by, freeze-by, and expiration dates?
- Why does the federal government change its requirements for nutrition facts labels?
- How can a consumer evaluate a nutrition facts label in relation to his/her own nutritional needs?

## Task Number 77

### **Describe the steps involved in the processing of plant and animal food products.**

#### **Definition**

Description could include

- GAP
- harvesting
- storage
- cleaning
- portioning
- preservation
- packaging
- special procedures such as milk handling and animal slaughter
- consideration for the types of fruits, vegetables, and/or grain crops chosen and the type of process used (e.g., whole, canned, sliced) for plant products.

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

- What are the different procedures for processing fruits?
- What are the different procedures for processing vegetables?
- What determines which procedure will be used for processing a specific food item?
- What is *humane slaughter*?
- How have technology and mechanization changed the process of animal slaughter?
- Which steps in processing apply only to plant food products?
- How do international processing guidelines differ?

## Task Number 78

### **Explain the role that food science plays in ensuring a nutritious, safe, and abundant food supply.**

#### **Definition**

Explanation should include

- food safety
- food availability
- sustainability

- nutrition
- special foods.

Teacher resources: [World Without Food Science](#) and [K-12 Food Science Classroom Resources](#), IFT

### **Process/Skill Questions**

- What is the role of food scientists in ensuring a safe and abundant food supply?
- What types of technologies are used to prevent food contamination?
- What is food fortification, and how has it helped eliminate dietary deficiencies within the human population?
- What are special foods, which populations do they support, and what unique nutritional needs are satisfied by these foods?

## **Task Number 79**

### **Describe methods of food preservation.**

#### **Definition**

Description should include

- methods such as canning, freezing, fermenting, freeze-drying, pasteurization, dehydration, curing, smoking, and drying
- packaging of preserved foods
- preservative additives
- scientific principles that determine safe methods of food preservation
- the history of food preservation
- cottage industry regulations.

### **Process/Skill Questions**

- What are the benefits and disadvantages of preserving foods?
- What are the environmental benefits of preserving foods?
- What are the different methods of curing and drying meat?
- How has technology affected food preservation methods?
- What is the difference in nutritional value of preserved vs. fresh food?
- How does pasteurization extend the shelf-life of foods?

## **Task Number 80**

### **Perform a method of food preservation.**

#### **Definition**

Performance could include

- canning
- freezing
- food fermentation (e.g., pickling)
- freeze-drying
- pasteurization
- dehydration
- curing
- smoking
- drying.

### **Process/Skill Questions**

- What are the consequences of improperly canning foods?
- What equipment and tools make preserving foods easier?
- Why is it important to label and date preserved foods?
- Why is it important to know the chemical composition of foods before applying a preservation method?

## **Task Number 81**

### **Identify the four steps to food safety and the potential sources of food contamination.**

#### **Definition**

Identification should include explaining

- the four steps to food safety
  - clean—wash hands and kitchen surfaces often
  - separate—do not cross-contaminate
  - cook—to the correct temperature
  - chill—refrigerate promptly
- sources of food contamination
  - raw materials and ingredients
  - food handlers and machinery
  - packaging material
  - pets and wild animals
  - insects
  - rodents
  - garbage and sewage
  - soil
  - water and its sources or containers.

### **Process/Skill Questions**

- What are the source points of food contamination?
- What are the three foodborne pathogens that contaminate meat, raw vegetables, eggs, and milk?
- What government agencies regulate food products?
- Which pathogens are responsible for foodborne illnesses?

- What is *cross-contamination*? How can it be prevented?
- What temperature is recommended for food refrigeration to ensure food safety? What is the danger zone?

## Task Number 82

### List the procedures for the safe handling of foods.

#### Definition

List should include

- hazard analysis and critical control points (HACCP)
- time and temperature danger zones for different foods
- cooking temperatures
- holding temperatures
- personal hygiene guidelines (e.g., handwashing procedures; use of clothing, hair nets, gloves)
- cross-contamination and cross-contact prevention
- procedures for the selection, acquisition, inspection, storage, and transportation of food
- procedures for cleaning and sanitation
- following current regulations (e.g., FDA Food Code).

Teacher resource: [ServSafe](#)

#### Process/Skill Questions

- What are the hazards to be considered when handling food items?
- Why should frozen foods, once thawed, not be frozen again?
- What preventive measures can be taken to ensure safe food consumption?
- Why is it important to follow personal hygiene guidelines?
- What illnesses might be contracted due to cross-contamination or improper food handling procedures?
- What food safety certifications can one acquire?
- What are the differences between the FDA Food Code recommendations and the USDA recommendations for proper cooking temperatures?

## Task Number 83

### Design a food product.

#### Definition

Design may be applied to the creation of a new food product or the improvement of an existing one and could include elements such as

- rationale
- ingredients
- production and processing

- marketing
- nutritional components
- packaging and labeling.

### **Process/Skill Questions**

- Why do companies develop new products?
  - Who is the target audience for the food product?
  - What government agencies would regulate the food product?
  - What marketing techniques would one employ to get the food product into the market?
  - How can one implement this project as an SAE?
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# **Investigating Basic Scientific Skills and Principles in Natural Resources Management**

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## **Task Number 84**

### **Describe categories of natural resources.**

#### **Definition**

Description should include

- biotic vs. abiotic
- renewable vs. nonrenewable
- metallic vs. non-metallic
- exhaustible vs. inexhaustible
- stock
- alternative energy sources (e.g., solar, wind, hydro, anaerobic digestion).

### **Process/Skill Questions**

- What are some natural resources in the local area?
- How do natural resources affect everyday life?
- What are the major local environmental issues associated with natural resources?
- How can one bring awareness to and/or address local environmental issues in the community?
- What are the major global environmental issues associated with natural resources?

## **Task Number 85**

# Define terms associated with natural resources management.

## Definition

Defining terms could include

- *abiotic and biotic factors*
- *adaptation*
- *agroforestry*
- *alternative energy*
- *best management practices (BMPs)*
- *biodiversity*
- *biome*
- *communities*
- *competition*
- *conservation*
- *distribution*
- *dominant species*
- *ecology*
- *ecosystem*
- *emigration*
- *exhaustible and inexhaustible natural resources*
- *food web*
- *fossil fuels*
- *habitat*
- *immigration*
- *minerals*
- *mortality*
- *niche*
- *population and population density*
- *predation*
- *preservation*
- *natural selection*
- *silviculture*
- *species diversity*
- *succession*
- *sustainability*
- *water cycle*
- *watershed.*

Teacher resource: [\*Biodiversity and Ecosystem Services in Agroecosystem\*](#), Food Institute, University of Berkeley

## Process/Skill Questions

- What is the difference between renewable and nonrenewable resources?
- What factors affect the water cycle?
- Why is biodiversity important?
- What are the components of a food web?

- What are some natural resources management practices that promote sustainability?
- What ecological principles are used when planning natural resource management?
- What is the local watershed?

## **Task Number 86**

### **Explain the relationship between natural resources management and the environment.**

#### **Definition**

Explanation should include

- ecosystems management
- soil health and availability
- water conservation
- habitat management
- overpopulation
- pollution (point and nonpoint)
- forest management
- wildfires
- exotic and invasive species
- endangered species
- climate change
- extreme weather conditions
- recreational use of natural resources.

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

- What are some things people can do to conserve natural resources?
- How are wildlife and fish affected when natural resources are mismanaged?
- How does overpopulation affect ecosystems?
- What local and state entities are involved in natural resources management?
- What responsibility does society have regarding resource management?
- What is the relationship between soil health and natural resource management?
- How is soil health determined? What factors contribute to soil health?

## **Task Number 87**

### **Identify natural resource BMPs and conservation practices used in agriculture to protect the environment.**

#### **Definition**

Identification should include

- definition of *BMPs*
- laws and regulations related to natural resources management
- specific strategies for natural resources management (e.g., riparian buffers, wetland restoration, hunting regulations, field borders, livestock exclusion, reforestation, storm water retention, controlling invasive species, protecting endangered species, BMPs for forest harvesting)
- threats to the soil (e.g., erosion, salinization, compaction)
- ground and surface water contamination
- pest management
- waste management
- contour tillage
- crop covers
- crop residue
- grassed waterways
- irrigation systems
- no-till programs
- water and sediment control basins.

### Process/Skill Questions

- How can understanding key influences/laws shape the management and harvesting of natural resources?
- What is the purpose of reintroduction or relocation of wildlife?
- What are some examples of BMPs used in the local community?
- Why do hunting regulations vary throughout the state?
- What is a conservation easement?
- What are common methods of waste disposal?

## Task Number 88

### Identify major forest trees in Virginia and their uses.

#### Definition

Identification should include

- differentiating between hardwood vs. softwood trees
- listing tree species native to Virginia according to bark, leaf, bud, and fruit
- describing their uses
- calculating volume in board feet
- determining volume and value of a tree/timber
- listing forestry tools and equipment
- interpreting topographical maps.

Teacher resources: [Virginia Tech Dendrology](#), [National FFA Forestry CDE](#)

### Process/Skill Questions

- What are the differences among tree species according to bark structure?
- What are the differences among tree species according to leaf shape?

- What are the differences among tree species according to fruit?
- How is a Biltmore stick used?
- What are the steps in calculating volume board feet of lumber and the market value of a tree?

# Demonstrating the Use of Agriscience Tools, Equipment, and Instruments in Power, Structural, and Technical Systems

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## Task Number 89

### Explain the need for safety in agricultural mechanics.

#### Definition

Explanation should include the need for

- safety rules for the use of tools and equipment
- fire safety
- lab safety
- chemical safety
- electrical safety
- weather safety
  - heatstroke
  - heat exhaustion
  - heat cramps
  - frostbite
  - hypothermia
- safe lifting techniques
- personal protective equipment (PPE)
  - eye
  - hearing
  - respiratory
  - clothing and shoes
- first aid.

#### Process/Skill Questions

- What problems might occur if safety rules are not followed?
- What guidelines help prevent accidents?
- What chemicals might one come into contact within this class?
- What are some examples of PPE and the proper use of each?
- What are some possible hazards in a laboratory environment?

- What do the colors in the safety color system represent?

## **Task Number 90**

### **Demonstrate safe practices in the agricultural mechanics lab/workshop.**

#### **Definition**

Demonstration must include

- passing written tests with 100% accuracy on
  - general lab/workshop safety
  - safety and operating procedures for all tools, equipment, and machinery
  - the major parts of all tools, equipment, and machinery
- passing a proficiency/performance test with 100% accuracy for all tools, equipment, and machinery
- following manufacturer's instructions and reviewing safety manuals, when applicable
- following all safety guidelines and procedures when using tools, equipment, and machinery in the agricultural mechanics lab/workshop
- selecting appropriate PPE for the operation of concern
- following the safety standards and regulations of the EPA, Occupational Safety and Health Administration (OSHA), the Equipment and Engine Training Council (EETC) Education Committee, and safety data sheets (SDS).

Teacher resource: [Laboratory Safety Resources](#), Virginia Tech

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

- Why is it important to have every student achieve 100 percent on the state/local safety test?
- What are some examples of basic housekeeping standards?
- What are the different categories of tools?
- What are the various safety hazards associated with each tool group?
- What are some common safety rules with power equipment?

## **Task Number 91**

### **Identify marked safety areas.**

#### **Definition**

Identification should include describing and translating signage and special markings (e.g., floor paint) that identify work and caution areas.

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

- What are the different types of work zones?
- How can one determine whether additional safety equipment or clothing is needed to enter a safety area?

- How are walkways identified in the lab/workshop area?

## **Task Number 92**

### **Identify the location and use of eyewash stations.**

#### **Definition**

Identification should include describing the signage and operating procedures for the unit.

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

- What is the color of the sign that signifies an eyewash station?
- When should one use an eyewash station?
- What safety equipment provides additional eye protection?

## **Task Number 93**

### **Identify the location of the posted evacuation routes.**

#### **Definition**

Identification should include

- events that could trigger an evacuation
- the location and interpretation of the posted evacuation route
- the destination and procedures for evacuation.

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

- What route should be followed in the event of an evacuation?
- Where is the evacuation route posted?
- Why is it important to establish a meeting place in the case of an evacuation?

## **Task Number 94**

### **Demonstrate knowledge of SDS.**

#### **Definition**

Demonstration should include identifying

- the location of the sheets within the agricultural mechanics lab/workshop and the purpose they serve
- the administration's (ownership's) responsibility for workers' health and safety
- laws/regulations and practices affecting workers' health and safety
- health and safety hazards

- health and safety programs and the responsibility for environmental stewardship
- environmental laws, regulations, and practices
- sustainability initiatives.

### **Process/Skill Questions**

- What environmental concerns should an industry address?
- What environmentally friendly practices and resources are available to an industry?
- What methods can be used to motivate employees to become involved in effective health, safety, and environmental practices?

## **Task Number 95**

### **Demonstrate the use of chemicals.**

#### **Definition**

Demonstration should include the different types of solvents, soaps, cleaning solutions, fuel, oils, greases, specialty additives, and gases.

Demonstration should also emphasize the correct use, the hazards, and the precautions associated with each, in accordance with manufacturers' instructions and government regulations.

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

- Why is it important to read the manufacturer's directions when using chemicals?
  - What may be the effects of using chemicals incorrectly?
  - Where should chemicals be stored within the lab/workshop?
- 

## **Task Number 96**

### **Demonstrate the use of standard and metric hand tools.**

#### **Definition**

Demonstration should include the various types of hand tools (including specialty tools, fasteners, and measuring tools) used in agricultural mechanics.

Demonstration should emphasize the correct use, the hazards, the precautions, and the maintenance procedures associated with each, in accordance with manufacturer's instructions and government regulations. Hand tools should include

- common end wrenches
- various socket set components
- various wrenches

- various screwdrivers
- various styles of pliers
- various hammers
- various punches and chisels
- specialty cutting tools (e.g., hack saw, tubing cutter, hand reamer, file)
- specialty electrical system tools (e.g., volt/ohmmeter, dwell/tachometer, continuity light, timing light, remote starter switch)
- battery specialty tools (e.g., cable puller, terminal and post cleaner, battery lifting or carrying strap)
- lubrication specialty tools (e.g., transmission funnel, oil filter-removing tool, grease gun)
- other miscellaneous specialty tools (e.g., air nozzles, C-clamp, puller set, pressure gauge, screw extractor).

### **Process/Skill Questions**

- Why is it important to use the proper tool for each job?
- When a wrench is used, why should it always be pulled toward the body?
- Why is it necessary to keep hand tools clean and free of grease?

## **Task Number 97**

### **Demonstrate standard measurement techniques in agricultural mechanics.**

#### **Definition**

Demonstration may include

- defining terminology related to measurement (e.g., weight, area, mass, length, volume, temperature, etc.)
- listing common measurement tools (e.g., caliper, tape, ruler, squares)
- selecting and using measurement tools
- identifying common units of measurement
- using the U.S. Customary system and the metric system
- conducting measuring exercises (i.e., reading a ruler to within 1mm and to within 1/16 inch)
- calculating volume and area
- calculating board feet
- using conversion factors (e.g., fractions to decimals, pints to quarts, feet to meters)
- using calculations of basic decimals and fractions.

Teacher resource: [The Ruler Game](#)

### **Process/Skill Questions**

- For what purposes are measurement techniques used in agricultural mechanics?
- Why is it important to be able to use conversion factors?
- What are various consequences of not measuring correctly?
- How does one determine which measurement to use?

## **Task Number 98**

### **Demonstrate the use of precision standard and metric measuring tools.**

#### **Definition**

Demonstration should include micrometers, dial indicators, torque wrenches, and other manufacturers' specialty tools.

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

- How does heat affect the micrometer?
  - Why are standard and quality tools necessary when repairing agricultural machinery and equipment?
  - What is *torque*? Why is proper torque important?
- 

## **Task Number 99**

### **Demonstrate the use of protective clothing and equipment.**

#### **Definition**

Demonstration should include using the types of protective clothing and equipment needed (e.g., protection of the eyes, respiratory system, auditory functions, feet, hands, and body) and grooming/hygiene (e.g., precautions related to hair length; loose clothing/jewelry; greasy hands, shoes, or clothing; dirty or scratched eye protection).

Demonstration should include the correct use, the hazards, and the precautions associated with each, in accordance with manufacturer's instructions and government regulations concerning hazardous material and lab safety.

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

- What hazards exist due to loose-fitting clothing or long hair?
- When is it advisable to use goggles in an agricultural mechanics lab/workshop?
- Why are closed-toe shoes required in the agricultural mechanics labs/workshops?

## **Task Number 100**

### **Demonstrate use of fire protection equipment.**

#### **Definition**

Demonstration should include

- explaining the different types of fires encountered in the agricultural science and mechanics field (Class A, B, C, and D)
- identifying the appropriate types of extinguishers to use with each fire
- explaining the hazards and the precautions associated with each
- explaining fire emergency procedures that follow government regulations and instructor's guidelines.

### **Process/Skill Questions**

- What are the different types of fire extinguishers?
- What procedure should students follow in case of an emergency or accident?

## **Task Number 101**

### **Demonstrate the use of hand tools, portable power tools, and equipment.**

#### **Definition**

Demonstration could include using various types of tools, equipment, and machinery used in the agricultural mechanics field, ensuring the correct use, recognizing the hazards and the precautions associated with each, in accordance with manufacturer's specifications and instructor's guidelines.

- portable power tools (e.g., power drills, jigsaws, circular saws, routers, grinders, sanders, etc.)
- arc welding equipment and plasma cutters
- gas welding equipment
- stationary power tools and equipment (e.g., table saws, band saws, miter saws, radial arm saws, grinders, drill press, lathes, planers, jointers, etc.)
- pneumatic equipment (e.g., tire machine, pneumatic jack)
- hydraulic equipment (e.g., floor jack, lift rack, hydraulic press, engine hoist)
- electrical equipment (e.g., bench grinder, drill press, battery testers and chargers).

### **Process/Skill Questions**

- What are unsafe uses of air compressors in the agricultural lab/workshop?
- What is the safest way to hold a part in a vise?
- When is the cleaning tank used?

## **Task Number 102**

### **Demonstrate basic woodworking skills.**

#### **Definition**

Demonstration should include

- following safety procedures for woodworking
- following measurement procedures.

Demonstration could also include

- selecting and using hand tools
- selecting and using power tools
- selecting and using stationary tools and machinery
- constructing a selected woodworking project using a set of plans, including a bill of materials.

### **Process/Skill Questions**

- How can woodworking be used in agriculture?
- Why should one learn and follow safety procedures while woodworking?
- Why does one need a bill of materials before starting a woodworking project?
- What should be included in a bill of materials?
- How is the cost of the project calculated?

## **Task Number 103**

### **Identify various metal fabrication technologies.**

#### **Definition**

Identification should include

- arc welding
- gas welding
- tungsten inert gas (TIG)
- metal inert gas (MIG)
- plasma cutter
- computer numerical control (CNC).

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

- What determines the type of welding process one should use?
  - What are the advantages and disadvantages of each type of welding process?
- 

## **Task Number 104**

### **Explain the principles of arc welding.**

#### **Definition**

Explanation should include

- different types of arc welding
- the steps involved in the arc-welding process
- the three properties of metals
- the effects welding has on metal properties
- electrical principles involved in arc welding.

### **Process/Skill Questions**

- What are safety precautions an arc welder must observe?
- Why is the ground connection important in arc welding?
- What are some arc welding applications in agriculture?
- What is the difference between MIG, TIG, and shielded metal arc welding (SMAW)?
- What is the difference between alternating current (AC) and direct current (DC) arc welding?

## **Task Number 105**

### **Identify arc welding tools, equipment, and supplies.**

#### **Definition**

Identification should include

- arc welding tools
- material selection for arc welding
- arc welding equipment
- arc welding supplies
- PPE
- explanation of their uses.

### **Process/Skill Questions**

- What PPE is required for arc welding?
- What safety precautions should be used when arc welding or approaching someone who is arc welding?
- Why is ventilation equipment needed for arc welding?
- What environmental conditions would be hazardous for welding?

## **Task Number 106**

### **Perform arc welding.**

#### **Definition**

Performance should include

- demonstrating the safe use of arc-welding equipment

- wearing PPE
- setting up materials and equipment
- following welding safety procedures
- selecting equipment necessary for welding
- applying and maintaining proper grounding methods
- selecting the proper electrode
- striking an arc and running a bead
- demonstrating single-pass fillet welds
- evaluating the quality of the weld.

### **Process/Skill Questions**

- What are examples of situations where welding is necessary?
  - What is the importance of grounding electrical circuits in arc welding?
  - What are the procedures to take when an electrode sticks to the material?
  - What are the different bead patterns?
  - What are the two techniques of striking an arc?
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## **Task Number 107**

### **Create an agricultural project.**

#### **Definition**

Creation should include

- designing the project
- identifying a bill of materials and calculating the cost of production
- planning (e.g., computer-aided design [CAD], outline, cut list)
- producing the project
- calculating profit
- finishing the project.

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

- Why is it important to plan a project?
- What is the purpose of the project?
- How does the availability of materials affect the design?
- How does technology affect the completion of the project?
- What are some alternative ways to create the project if certain tools were not available?

## **Demonstrating Skills in Agribusiness**

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## Task Number 108

### Explain basic principles of agricultural economics.

#### Definition

Explanation may include

- assets and liabilities
- break-even point
- cost-benefit analysis
- efficiency
- law of demand
- law of supply
- marketing
- opportunity cost
- principle
- return on investment
- risk analysis
- scarcity
- surplus.

Teacher resources: [Virginia State FFA Degree](#), [National FFA Agricultural Proficiency Awards](#)

#### Process/Skill Questions

- How does the interaction between consumers and producers determine the prices of goods and services?
- In what way is opportunity cost induced by scarcity and by the need to make choices?
- How is efficiency assessed?

## Task Number 109

### Identify the components of a business and financial plan.

#### Definition

Identification should include the

- components of a business plan
  - executive summary
  - company description
  - products and/or services
  - market analysis
  - strategy and implementation
  - organization and management
  - financial plan and projections
- components of a financial plan

- sales forecasting
- expense outlay
- statement of financial position
- cash flow projection
- break-even analysis
- operations plan.

### **Process/Skill Questions**

- Why is the executive summary important?
- What are the components of a financial plan, and how can they be used to secure funding for a new business?
- What are the advantages of creating a business plan?

## **Task Number 110**

**Identify financial management tools used in an agricultural business.**

### **Definition**

Identification should include

- cash flow statement
- balance sheet
  - assets
  - liabilities
  - ownership equity
- income statement
  - revenue
  - expenses
  - profits/losses.

### **Process/Skill Questions**

- Why is it important to have a business plan?
- Why is it important to analyze one's return on investment?
- How are financial statements used to make business decisions?
- What is the purpose of a balance sheet? Income statement? Cash flow statement?

## **Task Number 111**

**Describe how the four Ps of marketing are used to develop a successful marketing strategy for an agricultural product or service.**

### **Definition**

Description should include

- product (any good or service offered to the target market)
- place (distribution)
- price (payment and method)
- promotion (methods of communication).

### **Process/Skill Questions**

- What are the four Ps of marketing? Why is “people” sometimes called the fifth P of marketing?
- What questions should be considered regarding the target market in order to create a successful marketing mix?
- What are some emerging trends in marketing?
- What is a niche market?
- How are locally grown products marketed to consumers?

## **Task Number 112**

### **Define terms associated with banking and business operations.**

#### **Definition**

Defining terms may include

- *balance sheet*
- *cash flow*
- *checking account*
- *checks*
- *credit*
- *credit cards*
- *disclosure statements*
- *fees (e.g., overdraft, monthly maintenance, stop-payment)*
- *interest*
- *interest rates*
- *inventory*
- *investments*
- *loans*
- *money orders*
- *net vs. gross*
- *safe deposit boxes*
- *savings accounts*
- *taxes (e.g., income, real estate, personal property, W-2, W-4).*

### **Process/Skill Questions**

- What is the difference between a checking account and a savings account?
- How and when does an individual establish credit?
- How does one write a check and balance a checkbook?

- What is the purpose of a safety deposit box?
- What is the difference between a credit card and a debit card?
- What is the process for applying for a loan?
- What is the difference between a balance sheet and a cash flow statement?
- How has technology affected how businesses keep up with their finances?

## Task Number 113

### Develop a personal financial plan, including a budget.

#### Definition

Development should include

- a short statement of short- and long-term goals (e.g., pursuing postsecondary opportunities, acquiring assets)
- a plan for managing one’s money over a short-term period
- a plan for managing one’s money over a long-term period (i.e., retirement)
- a budget allowing for discretionary income and taking into consideration cost-of-living increases.

#### Process/Skill Questions

- What items fall into the short-term budget category? Long-term budget category?
- What is the difference between gross and net income?
- What resources are available to help one prepare a personal budget?
- What is discretionary income?
- What are some resources that provide financial advice?

## SOL Correlation by Task

39	Identify the role of supervised agricultural experiences (SAEs) in agricultural education.	English: 9.3, 9.5, 10.3, 10.5
40	Participate in an SAE.	English: 9.5, 9.8, 10.5, 10.8
41	Identify the benefits and responsibilities of FFA membership.	English: 9.5, 9.6, 9.7, 9.8, 10.5, 10.6, 10.7, 10.8
42	Describe leadership characteristics and opportunities as they relate to agriculture and FFA.	English: 9.5, 10.5  History and Social Science: VUS.8, VUS.9, VUS.10, VUS.11, WHII.8, WHII.10, WHII.11
43	Apply for an FFA degree and/or an agricultural proficiency award.	English: 9.5, 10.5
44	Explore career opportunities related to AFNR.	English: 9.5, 9.6, 9.7, 9.8, 10.5, 10.6, 10.7, 10.8
45	Identify Virginia's major agricultural commodities and products by region.	English: 9.5, 10.5  Science: ES.5

46	Examine the history of agriculture in Virginia, the United States, and globally.	English: 9.5, 10.5 History and Social Science: WG.4, WG.14, WG.16, WHI.2, WHI.3
47	Examine the relationship of science and technology to agriculture.	English: 9.3, 9.5, 10.3, 10.5 History and Social Science: VUS.14, WG.17, WHI.2, WHI.3, WHII.14 Science: BIO.7
48	Analyze the effects of agriculture on the local, state, national, and global economy.	English: 9.3, 9.5, 10.3, 10.5 History and Social Science: VUS.14, WG.17, WHII.14
49	Explain the future of AFNR.	English: 9.5, 10.5 History and Social Science: WG.14, WHII.8
50	Identify local, state, and federal stakeholders relevant to AFNR.	English: 9.5, 10.5 History and Social Science: VUS.13, VUS.14
51	Examine agricultural issues related to population, food, energy, and the environment.	English: 9.5, 10.5 History and Social Science: VUS.14, WG.14, WG.17, WHII.14 Science: BIO.8
52	Define terms associated with plant science.	English: 9.3, 10.3 Science: BIO.4
53	Describe the influence of biotechnology on AFNR.	English: 9.3, 9.5, 10.3, 10.5 History and Social Science: VUS.14, WG.17, WHII.14 Science: BIO.5
54	Explain the functions of major plant parts.	English: 9.5, 10.5 Science: BIO.4
55	Explain the process of photosynthesis and cellular respiration in plants.	English: 9.5, 10.5 Science: BIO.2
56	Describe the relationship among temperature, light, air, soil/substrate, water, and nutrients required for plant growth.	English: 9.5, 10.5
57	Propagate plants through sexual and asexual reproduction.	
58	Grow plants.	History and Social Science: WHI.2, WHI.3

59	Research a current issue in AFNR using the scientific method.	English: 9.5, 9.8, 10.5, 10.8  History and Social Science: WHII.4  Mathematics: AFDA.8, PS.1*, PS.2*, PS.10*  Science: BIO.1
60	Describe the types of plants that are being developed using biotechnology.	English: 9.5, 10.5  History and Social Science: VUS.14, WG.17, WHII.14
61	Define terms related to animal species.	English: 9.3, 10.3
62	Identify production stages and goals for selected industries.	English: 9.5, 10.5
63	Identify basic body systems of livestock, poultry, and specialty animals.	English: 9.5, 10.5  Science: BIO.4
64	Explain animal nutrition and feeding practices.	English: 9.3, 9.5, 10.3, 10.5
65	Differentiate between the signs of good health and illness in animals.	English: 9.5, 10.5
66	Describe the responsibilities of the animal industry regarding animal care and welfare.	English: 9.5, 10.5
67	Identify types of aquaculture systems.	English: 9.5, 10.5
68	Identify types of aquatic animals and the systems used to rear them.	English: 9.5, 10.5
69	Identify management interventions, infrastructure, and support technologies used in aquaculture production.	English: 9.5, 10.5
70	Identify types of facilities used in agricultural production.	English: 9.5, 10.5
71	Explain the process of constructing agricultural facilities.	English: 9.5, 10.5
72	Identify equipment and facilities required for an aquaculture production facility.	English: 9.5, 10.5
73	Define terms associated with the food industry.	English: 9.3, 10.3  History and Social Science: VUS.14, WG.17, WHII.14
74	Identify agricultural commodities.	English: 9.5, 10.5  History and Social Science: VUS.13, VUS.14
75	Examine guidelines for food labels.	English: 9.5, 10.5  History and Social Science: VUS.13, VUS.14
76	Interpret food packaging and nutrition facts labels.	English: 9.5, 9.8, 10.5, 10.8
77	Describe the steps involved in the processing of plant and animal food products.	English: 9.5, 10.5
78	Explain the role that food science plays in ensuring a nutritious, safe, and abundant food supply.	English: 9.5, 10.5

79	Describe methods of food preservation.	English: 9.5, 10.5 History and Social Science: WHI.2, WHI.3
80	Perform a method of food preservation.	History and Social Science: WHI.2, WHI.3
81	Identify the four steps to food safety and the potential sources of food contamination.	English: 9.5, 10.5
82	List the procedures for the safe handling of foods.	English: 9.5, 9.6, 9.7, 10.5, 10.6, 10.7 History and Social Science: VUS.13, VUS.14
83	Design a food product.	
84	Describe categories of natural resources.	English: 9.5, 10.5 History and Social Science: WG.4 Science: ES.6
85	Define terms associated with natural resources management.	English: 9.3, 10.3 History and Social Science: WG.4 Science: BIO.8
86	Explain the relationship between natural resources management and the environment.	English: 9.5, 10.5 History and Social Science: WG.4 Science: BIO.8, ES.6
87	Identify natural resource BMPs and conservation practices used in agriculture to protect the environment.	English: 9.5, 10.5 History and Social Science: WG.4
88	Identify major forest trees in Virginia and their uses.	Mathematics: A.1, A.4 Science: ES.1
89	Explain the need for safety in agricultural mechanics.	English: 9.5, 10.5 History and Social Science: VUS.8, WHII.8
90	Demonstrate safe practices in the agricultural mechanics lab/workshop.	English: 9.5, 9.6, 9.8, 10.5, 10.6, 10.8 History and Social Science: VUS.8, WHII.8 Science: CH.1
91	Identify marked safety areas.	English: 9.5, 10.5 History and Social Science: VUS.8, WHII.8
92	Identify the location and use of eyewash stations.	English: 9.5, 10.5

		History and Social Science: VUS.8, WHII.8
93	Identify the location of the posted evacuation routes.	English: 9.5, 10.5  History and Social Science: VUS.8, WHII.8
94	Demonstrate knowledge of SDS.	English: 9.5, 10.5  History and Social Science: VUS.8, WHII.8  Science: CH.1
95	Demonstrate the use of chemicals.	
96	Demonstrate the use of standard and metric hand tools.	History and Social Science: WHI.2, WHI.3
97	Demonstrate standard measurement techniques in agricultural mechanics.	English: 9.3, 9.5, 10.3, 10.5  Mathematics: A.1, A.4
98	Demonstrate the use of precision standard and metric measuring tools.	
99	Demonstrate the use of protective clothing and equipment.	History and Social Science: VUS.8, WHII.8
100	Demonstrate use of fire protection equipment.	History and Social Science: VUS.8, WHII.8
101	Demonstrate the use of hand tools, portable power tools, and equipment.	History and Social Science: WHI.2, WHI.3
102	Demonstrate basic woodworking skills.	English: 9.5, 10.5  History and Social Science: WHI.2, WHI.3
103	Identify various metal fabrication technologies.	
104	Explain the principles of arc welding.	English: 9.5, 10.5
105	Identify arc welding tools, equipment, and supplies.	
106	Perform arc welding.	
107	Create an agricultural project.	English: 9.1, 9.5, 9.6, 10.1, 10.5, 10.6  Mathematics: A.1, A.4
108	Explain basic principles of agricultural economics.	English: 9.5, 10.5
109	Identify the components of a business and financial plan.	English: 9.5, 10.5
110	Identify financial management tools used in an agricultural business.	
111	Describe how the four Ps of marketing are used to develop a successful marketing strategy for an agricultural product or service.	English: 9.5, 10.5
112	Define terms associated with banking and business operations.	English: 9.3, 10.3  History and Social Science: VUS.10, WHII.10, WHII.11
113	Develop a personal financial plan, including a budget.	English: 9.1, 9.5, 10.1, 10.5

# 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

- College and Work Readiness Assessment (CWRA+)
- Customer Service Specialist (CSS) Examination
- 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)
- Biotechnology Foundations in Agricultural and Environmental Science (8085/36 weeks)
- Food Science and Dietetics (8239/36 weeks)
- Introduction to Animal Systems (8008/36 weeks)
- Introduction to Natural Resources and Ecology Systems (8040/36 weeks)
- Introduction to Plant Systems (8007/36 weeks)
- Introduction to Power, Structural, and Technical Systems (8016/36 weeks)
- Small Engine Repair (8082/36 weeks)

<b>Career Cluster: Agriculture, Food and Natural Resources</b>	
<b>Pathway</b>	<b>Occupations</b>
<b>Agribusiness Systems</b>	<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>Sales Manager</b>
<b>Animal Systems</b>	<b>Agricultural Products Sales Representative</b> <b>Animal Breeder, Husbandry</b> <b>Animal Geneticist</b> <b>Animal Nutritionist</b> <b>Animal Scientist</b> <b>Aquacultural Manager</b> <b>Poultry Manager</b> <b>Veterinarian</b> <b>Veterinary Technician</b>
<b>Environmental Service Systems</b>	<b>Agricultural Products Sales Representative</b> <b>Environmental Compliance Inspector</b> <b>Environmental Sampling and Analysis Technician</b>

<b>Career Cluster: Agriculture, Food and Natural Resources</b>	
<b>Pathway</b>	<b>Occupations</b>
	<b>Hazardous Materials Handler</b> <b>Secondary School Teacher</b> <b>Toxicologist</b> <b>Turf Farmer</b> <b>Water Conservationist</b>
<b>Food Products and Processing Systems</b>	<b>Biochemist</b> <b>Food Scientist</b>
<b>Natural Resources Systems</b>	<b>Ecologist</b> <b>Fish and Game Officer</b> <b>Fisheries Technician</b> <b>Forest Manager, Forester</b> <b>Forest Technician</b> <b>Logging Equipment Operator</b> <b>Microbiologist</b> <b>Outdoor Recreation Guide</b> <b>Park Manager</b> <b>Park Technician</b> <b>Range Technician</b> <b>Wildlife Manager</b>
<b>Plant Systems</b>	<b>Agricultural Products Sales Representative</b> <b>Botanist</b> <b>Certified Crop Advisor</b> <b>Crop Grower</b> <b>Custom Harvester</b> <b>Farm, Ranch Manager</b> <b>Farmer/Rancher</b> <b>Floral Designer</b> <b>Floral Shop Manager</b> <b>Forest Geneticist</b> <b>Golf Course Superintendent</b> <b>Nursery and Greenhouse Manager</b> <b>Ornamental Horticulturist</b> <b>Plant Breeder/ Geneticist</b> <b>Secondary School Teacher</b> <b>Soil and Plant Scientist</b> <b>Tree Surgeon</b> <b>Turf Farmer</b>
<b>Power, Structural, and Technical Systems</b>	<b>Agricultural Engineer</b> <b>Agricultural Equipment Operator</b> <b>Agricultural Equipment Parts Manager</b> <b>Agricultural Equipment Parts Salesperson</b> <b>Machinist</b> <b>Parts Manager</b> <b>Welder</b>