Agricultural Fabrication and Emerging Technologies

8019 36 weeks

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Course Description

Suggested Grade Level: 10 or 11

Students will receive instruction in metal fabrication, including cutting, welding, and cold metalworking processes, for agricultural applications. The course will also include the investigation of emerging technologies used within the field of agriculture. Leadership and career skills will be incorporated throughout.

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

8019	Tasks/Competencies	
⊕	Identify the role of supervised agricultural experiences (SAEs) in agricultural education.	
⊕	Participate in an SAE.	
⊕	Identify the benefits and responsibilities of FFA membership.	
⊕	Describe leadership characteristics and opportunities as they relate to agriculture and FFA.	
○	Apply for an FFA degree and/or an agricultural proficiency award.	
⊕	Identify safety procedures and equipment necessary in agricultural fabrication and emerging technologies.	
⊕	Apply laboratory safety instructions.	
⊕	Explain emergency first-aid procedures.	
⊕	Identify the classifications of fires and the methods used to extinguish them.	
⊕	Demonstrate lifting and carrying techniques.	
⊕	Report injuries.	
⊕	Pass safety exam.	
⊕	Describe scientific principles related to electricity.	
⊕	Apply electrical terminology and measurement.	
○	Explain the electrical service system from generation to residential distribution.	
⊕	Follow safe practices in SMAW operations.	
⊕	Identify types of electrodes, rods, and fluxes.	
⊕	Prepare equipment and materials for SMAW operations.	
⊕	Demonstrate machine setup for SMAW operations.	
⊕	Demonstrate SMAW operations.	

○	Test welds for quality and strength of joint as outlined by American Welding Society (AWS) standards.	
⊕	Follow safe practices in oxy-fuel gas welding and cutting.	
⊕	Set up gas welding and cutting equipment.	
⊕	Demonstrate oxy-fuel welding.	
⊕	Braze weld mild steel.	
⊕	Cut mild steel with an oxy-fuel cutting torch.	
⊕	Prepare equipment and materials for GMAW operations.	
⊕	Demonstrate GMAW operations.	
⊕	Describe the procedures for welding aluminum.	
○	Demonstrate the ability to weld aluminum.	
⊕	Describe GTAW operation procedures.	
○	Prepare equipment and materials for GTAW operations.	
○	Demonstrate the ability to perform GTAW operations.	
⊕	Describe safe operation of a plasma-arc cutting system.	
⊕	Describe the components of a plasma-arc cutting system.	
○	Demonstrate the ability to set up equipment for a plasma-arc cutting task.	
○	Demonstrate the ability to operate plasma-arc cutting equipment.	
⊕	Identify metals.	
⊕	Describe the procedures for shaping, hardening, and tempering common tools.	
⊕	Select soldering equipment and tools.	
○	Prepare metals for soft-soldering.	
○	Demonstrate soldering skills.	
⊕	Identify safe practices for metal striking and machine tools.	
⊕	Identify metalworking hand tools by type and use.	

⊕	Drill holes in metal.	
⊕	Determine tap drill sizes.	
⊕	Cut threads with tap and die.	
⊕	Use files and saws.	
⊕	Identify safe practices for tool reconditioning.	
⊕	Sharpen common tools.	
○	Repair tools.	
⊕	Describe technologies used in precision agricultural management.	
○	Define site-specific application technology and its benefits.	
○	Define remote sensing and its applications.	
⊕	Describe the various types of positioning equipment.	
○	Describe the importance of developing and using maps in agricultural management.	
⊕	Describe the procedure for operating a global positioning system (GPS) receiver.	
○	Demonstrate the ability to collect data and apply that data in developing a map.	
○	Describe how GPS data is used in agricultural management.	
○	Describe the purpose and uses of variable-rate technology.	
○	Develop a precision-management plan.	
⊕	Research the applications for laser technology in agriculture.	
○	Demonstrate the ability to use laser technology in agriculture.	

Legend: ⊕Essential ○Non-essential ⊖Omitted

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. 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).

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
Virginia SAE Record Book

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

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?

Orienting Students to Agricultural Machinery and Equipment Safety and Operation

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Task Number 44

Identify safety procedures and equipment necessary in agricultural fabrication and emerging technologies.

Definition

Identification should include but is not limited to

- safety hazards
- personal protective equipment (PPE)
- Occupational Safety and Health Administration (OSHA) color codes for marking physical hazards
- procedures for verification that all equipment is in acceptable operating condition, according to OSHA standards
- procedures for application of appropriate safety devices (e.g., guards in place, tool rests adjusted).

Process/Skill Questions

- What personal protective equipment (PPE) is necessary in agricultural fabrication?
- What are the standard color codes for laboratory safety?
- How would you describe the procedures required to ensure equipment is in good operating condition?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PST.01.02. Apply physical science and engineering principles to design, implement, and improve safe and efficient mechanical systems in AFNR situations.

PST.02.02. Operate machinery and equipment while observing all safety precautions in AFNR settings.

Task Number 45

Apply laboratory safety instructions.

Definition

Application should include following laboratory safety guidelines, including proper handling of tools, materials, and chemicals.

Process/Skill Questions

- Why is a clean, organized mechanics laboratory important?
- What is the purpose and function of OSHA safety standards?
- What are the potential dangers of working in a laboratory?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PST.01.02. Apply physical science and engineering principles to design, implement, and improve safe and efficient mechanical systems in AFNR situations.

PST.02.02. Operate machinery and equipment while observing all safety precautions in AFNR settings.

Task Number 46

Explain emergency first-aid procedures.

Definition

Identification should include first-aid procedures for accidents involving

- bodily fluids
- electrical injuries

- eye injuries
- falls
- burns

according to current first-aid procedures and school policies.

Process/Skill Questions

- What are the steps that should be followed in the event of an accident?
- Why is cardiopulmonary resuscitation (CPR) important?
- Why is it important to be certified to administer first aid?
- What are the three different classifications (degrees) of burns?
- What are the four basic classifications of fire extinguishers?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PST.02.02. Operate machinery and equipment while observing all safety precautions in AFNR settings.

Task Number 47

Identify the classifications of fires and the methods used to extinguish them.

Definition

Identification should include the classifications of fires (A, B, C, and D), causes and prevention of fires, types of extinguishers, and the procedure for using a fire extinguisher, in accordance with government regulations and instructor's guidelines.

Process/Skill Questions

- Why do fires have different classifications, and what are they?
- What is the fire triangle?
- What are the three requirements for a fire?
- Why is it important to know the classification of a fire when trying to extinguish it?
- Why and how often should fire extinguishers be inspected?
- What are the classifications of fire extinguishers?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PST.01.02. Apply physical science and engineering principles to design, implement, and improve safe and efficient mechanical systems in AFNR situations.

PST.02.02. Operate machinery and equipment while observing all safety precautions in AFNR settings.

Task Number 48

Demonstrate lifting and carrying techniques.

Definition

Demonstration involves lifting and carrying materials and equipment based on the principles of

- lifting with legs
- keeping back straight
- holding load close to the body
- securing help when necessary

in accordance with government regulations and instructor's guidelines.

Process/Skill Questions

- What are common injuries associated with improper lifting techniques?
- What can one do to prevent back injuries?
- How does proper positioning of the body affect proper technique?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PST.01.02. Apply physical science and engineering principles to design, implement, and improve safe and efficient mechanical systems in AFNR situations.

Task Number 49

Report injuries.

Definition

Report should consist of an immediate oral statement of the job-related or non-job-related injury to the instructor or supervisor, and may be followed by a written confirmation reporting the date, extent of injury, and circumstances of the accident.

Process/Skill Questions

- Why is it important to report all injuries?
- What are common reporting procedures?
- Why is it important to report an injury promptly, before leaving the job site?
- What are the key components of an injury report?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PST.01.02. Apply physical science and engineering principles to design, implement, and improve safe and efficient mechanical systems in AFNR situations.

PST.02.02. Operate machinery and equipment while observing all safety precautions in AFNR settings.

Task Number 50

Pass safety exam.

Definition

Assessment should measure participation in safety training programs, including attending safety meetings and completing periodic demonstration of knowledge and skills gained from program topics (e.g., interpretation of Safety Data Sheets [SDS]). A perfect score is required, and a copy of the exam will be kept on file.

Process/Skill Questions

- How often should one participate in safety training programs? Why?
- How does insurance impact the requirement of continuous retraining for safety?
- What is workers' compensation?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PST.01.02. Apply physical science and engineering principles to design, implement, and improve safe and efficient mechanical systems in AFNR situations.

Demonstrating Skills in Electricity

Task Number 51

Describe scientific principles related to electricity.

Definition

Description should include

- basic atomic structure (i.e., electrons), as it relates to electricity
- the differences among conductors, insulators, and semiconductors
- amperage (current), including its unit of measure and symbol
- voltage, including its unit of measure and symbol
- wattage
- electrical resistance, including its unit of measure and symbol.

Process/Skill Questions

- Who is credited with discovering the law of charges?
- According to the law of charges, how should objects with similar charges behave with each other?
- What is meant by the term *amperage*? What letter symbol is used to represent current?
- What is meant by the term *volt*? What letter symbol is used to represent voltage?
- What is meant by the term *resistance*? What letter symbol is used to represent resistance?
- How does resistance affect the movement of free electrons?
- What are the mathematical relationships of Ohm's law?
- What are the mathematical relationships of Watt's law?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PST.03.02. Service electrical systems and components of mechanical equipment and power systems using a variety of troubleshooting and/or diagnostic methods.

Task Number 52

Apply electrical terminology and measurement.

Definition

Application should include the terms *watts*, *amps*, *volts*, *ohms*, and other terminology and measures, according to the National Electrical Code.

Process/Skill Questions

- How would you describe the relationship among watts, amps, volts, and ohms?
- How would you explain the interrelationship of current, voltage, and resistance?
- What are potential and electromotive forces?
- How would you calculate for the unknown, using Ohm's law?
- How would you calculate for the unknown, using Watt's law?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PST.03.02. Service electrical systems and components of mechanical equipment and power systems using a variety of troubleshooting and/or diagnostic methods.

Task Number 53

Explain the electrical service system from generation to residential distribution.

Definition

Description should include

- sources of power generation
- types of power plants
- methods of electrical distribution
- functions of transformers.

Process/Skill Questions

- What are the sources of electricity?

- What components are necessary to complete the circuit from generation to distribution? How would you describe each component?
- What is the purpose and function of a transformer?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PST.03.02. Service electrical systems and components of mechanical equipment and power systems using a variety of troubleshooting and/or diagnostic methods.

Performing Shielded Metal Arc Welding (SMAW) Operations

Task Number 54

Follow safe practices in SMAW operations.

Definition

Following safe practices should include

- listing and using safety equipment
- describing and wearing proper clothing for SMAW operations
- avoiding hazards (e.g., electrical hazards, heat, light, fumes)
- demonstrating the proper procedures for SMAW operations.

Process/Skill Questions

- What are the hazards associated with SMAW operations? What PPE would address each of these hazards, and how?
- What is the purpose of a welding helmet?
- What shade lenses should be used for arc welding up to the 250 amp rating?
- What is meant by the term *flash* in welding?
- Why should synthetic fibers not be worn while welding?
- Why is it important to remove flammable materials and fumes from the work area?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PST.01.03. Apply physical science principles to metal fabrication using a variety of welding and cutting processes (e.g., SMAW, GMAW, GTAW, fuel-oxygen and plasma arc torch, etc.).

Task Number 55

Identify types of electrodes, rods, and fluxes.

Definition

Identification may include

- basic applications for the following general production rods:
  - E6010
  - E6011
  - E6013
  - E7014
  - E7018
  - E7024
- explanation of the classification by the American Welding Society (AWS) classification system for welding rods.

Process/Skill Questions

- What does the term *tensile strength* mean?
- What number(s) reveal(s) the tensile strength of a weld made by an electrode (in thousands of pounds per square inch)?
- Which number represents the welding positions? What is the number for each position?
- What does the final number of the electrode indicate?
- Why are there multiple types of rods available?
- Which electrodes require direct current with reverse polarity?
- Which electrodes can be welded with an alternating current machine?
- What materials are used in the flux coating of an electrode?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PST.01.03. Apply physical science principles to metal fabrication using a variety of welding and cutting processes (e.g., SMAW, GMAW, GTAW, fuel-oxygen and plasma arc torch, etc.).

Task Number 56

Prepare equipment and materials for SMAW operations.

Definition

Preparation should include

- inspecting welding leads and electrode holders for safety
- ensuring that material is properly grounded
- getting metal ready by filing, grinding, removing paint, or using a wire brush
- inspecting electrodes.

Process/Skill Questions

- Why is metal preparation important to ensure a good weld?
- How does the electrode selection affect the way the metal is prepared?
- How can frayed welding leads be a hazard?
- How do you properly store welding supplies, including electrodes?
- How can you determine if you will be able to perform a weld with your welder, or if you should select another machine?
- Why do you have to clean metal to ensure a proper ground?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PST.01.03. Apply physical science principles to metal fabrication using a variety of welding and cutting processes (e.g., SMAW, GMAW, GTAW, fuel-oxygen and plasma arc torch, etc.).

Task Number 57

Demonstrate machine setup for SMAW operations.

Definition

Demonstration should include selecting the appropriate polarity and amperage for the metal (i.e., type, thickness) and electrode (i.e., type, diameter).

Process/Skill Questions

- How is machine setup affected by the type of metal you are welding? By the thickness of the metal? By the purpose of your weld (e.g., new construction vs. repair)?
- How do you determine which electrode is best suited for your weld?
- What national system is in place for determining electrode type?
- How does changing the amperage affect the weld?
- How does changing the polarity affect the weld?
- When should you change the amperage and polarity on the machine?
- What is the difference between DC+ and DC-?
- Where can you find the recommended settings for the polarity and amperage for various types of steel?
- How does the diameter of the electrode affect the appearance of the bead?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PST.01.03. Apply physical science principles to metal fabrication using a variety of welding and cutting processes (e.g., SMAW, GMAW, GTAW, fuel-oxygen and plasma arc torch, etc.).

Task Number 58

Demonstrate SMAW operations.

Definition

Demonstration should include

- stringer bead welding
- groove welding
- fillet welding
- out-of-position welding

with various electrodes.

Process/Skill Questions

- What are the characteristics of a proper weld?
- What are the basic operating procedures to produce a proper SMAW bead?
- What determines the rate of travel when performing SMAW operations?
- What is undercutting?
- What does excessive spatter indicate when performing SMAW operations?

- When might a fillet weld be used?
- How do you determine if an electrode is suitable for out-of-position welding?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PST.01.03. Apply physical science principles to metal fabrication using a variety of welding and cutting processes (e.g., SMAW, GMAW, GTAW, fuel-oxygen and plasma arc torch, etc.).

Task Number 59

Test welds for quality and strength of joint as outlined by American Welding Society (AWS) standards.

Definition

Testing should include nondestructive examination, nondestructive testing, or destructive testing techniques (e.g., bend test).

Note: Additional guidelines can be found in AWS SENSE Program guidelines.

Process/Skill Questions

- When is weld testing required?
- What are some techniques for inspecting welds?
- How do you determine which testing technique to use?
- How do you perform a bend test on a groove weld?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PST.01.03. Apply physical science principles to metal fabrication using a variety of welding and cutting processes (e.g., SMAW, GMAW, GTAW, fuel-oxygen and plasma arc torch, etc.).

Performing Oxy-fuel Welding and Cutting

Task Number 60

Follow safe practices in oxy-fuel gas welding and cutting.

Definition

Following safe practices should include

- identification of cylinders, parts, and torch assembly
- proper use of PPE
- proper selection and correct use of hand tools.

Process/Skill Questions

- Why is it important to follow safety procedures when using equipment?
- How are the hazards associated with oxy-fuel welding and cutting different from those associated with electrical welding processes?
- What safety equipment should you wear when using a gas welder?
- How is PPE used in order to address the hazards associated with oxy-fuel processes?
- How would you identify components used on oxygen and fuel-gas cylinders and related equipment?
- Why is it important to report any damage or broken equipment to the instructor?
- Why do reactive (flammable) gases have an odor?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PST.01.03. Apply physical science principles to metal fabrication using a variety of welding and cutting processes (e.g., SMAW, GMAW, GTAW, fuel-oxygen and plasma arc torch, etc.).

Task Number 61

Set up gas welding and cutting equipment.

Definition

Setup should include

- storing, handling, and installing high-pressure gas cylinders
- assembling regulators, hoses, and torch
- setting line pressure in the correct order
- performing a leak test.

Process/Skill Questions

- Why do fuel and oxygen hoses have different types of threads?
- What safety precautions should be followed when assembling gas welding and cutting equipment to the cylinders?
- What is the procedure for performing a leak test on welding and cutting equipment?
- How do you determine the tip size for performing a welding operation?
- What is the procedure for determining and setting line pressures?
- At what PSI does acetylene become unstable?
- What is the proper order of adjusting gauges and line pressures?
- What is the procedure for cleaning the welding tip?
- What is the proper order of the steps for shutting down line pressures and disengaging the gauges?
- What could happen if the wrong type of regulator is used when performing gas welding and cutting operations?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PST.01.03. Apply physical science principles to metal fabrication using a variety of welding and cutting processes (e.g., SMAW, GMAW, GTAW, fuel-oxygen and plasma arc torch, etc.).

Task Number 62

Demonstrate oxy-fuel welding.

Definition

Demonstration should include

- fusion welding without a filler rod
- fusion welding with a filler rod.

Process/Skill Questions

- What are the characteristics of a good weld?
- What corrections should be made if a poor weld is produced?

- How can you determine if the metal is hot enough for proper fusion?
- How can you determine if the fillet is large enough to provide sufficient strength to the joint?
- What happens to your fusion if your torch tip is the wrong size?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PST.01.03. Apply physical science principles to metal fabrication using a variety of welding and cutting processes (e.g., SMAW, GMAW, GTAW, fuel-oxygen and plasma arc torch, etc.).

Task Number 63

Braze weld mild steel.

Definition

Braze welding should include

- cleaning the metals to be joined
- ensuring proper fit and clearance
- fluxing the welding area
- assembling the metal to be brazed
- lighting and adjusting the heat source to a neutral flame, following all safety precautions
- heating and brazing the filler metal
- cleaning the newly brazed joint.

Process/Skill Questions

- What is the purpose of braze welding?
- What safety precautions should be followed when braze welding?
- Why is clean metal critical for good adhesion when braze welding?
- What are methods to determine the quality of the braze weld?
- What corrections can be made if the quality of the weld is not sufficient?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PST.01.03. Apply physical science principles to metal fabrication using a variety of welding and cutting processes (e.g., SMAW, GMAW, GTAW, fuel-oxygen and plasma arc torch, etc.).

Task Number 64

Cut mild steel with an oxy-fuel cutting torch.

Definition

Cutting should include

- using various cutting techniques
- examining cut surfaces for proper results
- shutting down equipment.

Process/Skill Questions

- What are some commonly used fuels when using a cutting torch?
- What are some uses for the oxy-fuel cutting torch?
- Why is it important to always perform a leak test before using the oxy-fuel torch?
- What types of metal can you cut with the oxy-fuel torch?
- How do you determine proper operating line pressures for the oxy-fuel torch when cutting metal of a specific thickness?
- How can you prevent hot molten from blowing back into your torch tip?
- How should the cut surface look after a successful cut?
- What are some characteristics of the kerf of a properly cut piece of metal?
- How do you identify mistakes on the cut surface?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PST.01.03. Apply physical science principles to metal fabrication using a variety of welding and cutting processes (e.g., SMAW, GMAW, GTAW, fuel-oxygen and plasma arc torch, etc.).

Performing Gas Metal Arc Welding (GMAW) Operations

Task Number 65

Prepare equipment and materials for GMAW operations.

Definition

Preparation should include

- storing, handling, and installing high-pressure gas cylinders
- determining the welder type, electrode, wire type, diameter, and gas to be used
- setting up welding equipment
- adjusting the welder for proper electrode stick-out, voltage, polarity, flow rate, and wire-feed speed required for the material being welded
- determining work clamp (ground) location and attaching.

Process/Skill Questions

- How is GMAW wire classified?
- Why is GMAW wire copper in color?
- What is the line pressure for gas shielding when welding steel?
- What resources are available to determine voltage and wire-feed speed?
- When you increase voltage, what else will need to be increased? Why?
- What is the proper gun angle to the metal when performing GMAW operations?
- What are common problems to look for if the wire does not feed properly?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PST.01.03. Apply physical science principles to metal fabrication using a variety of welding and cutting processes (e.g., SMAW, GMAW, GTAW, fuel-oxygen and plasma arc torch, etc.).

Task Number 66

Demonstrate GMAW operations.

Definition

Demonstration should include

- stringer bead welding
- groove welding

- fillet welding
- out-of-position welding.

Process/Skill Questions

- How do you select the appropriate wire and burn angle when performing GMAW operations?
- How does the wire feed speed affect your weld?
- What is the difference between pushing and pulling the spool gun?
- Should you push or pull the weld? Why?
- What are the characteristics of a proper weld?
- What corrections can be made if the quality of a weld is not good?
- How should a proper weld sound while welding?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PST.01.03. Apply physical science principles to metal fabrication using a variety of welding and cutting processes (e.g., SMAW, GMAW, GTAW, fuel-oxygen and plasma arc torch, etc.).

Task Number 67

Describe the procedures for welding aluminum.

Definition

Description should include procedures for

- determining the welder type, electrode, wire type, diameter, and gas to be used
- setting up welding equipment
- adjusting the welder for proper electrode stick-out, voltage, polarity, flow rate, and wire-feed speed required for the material being welded
- cleaning aluminum oxide surface
- determining work clamp (ground) location and attaching.

Process/Skill Questions

- What are the alternative methods for cutting aluminum?
- What types of welders are used for welding aluminum?
- What shielding gas would you use for performing GMAW operations on aluminum?
- What polarity is needed to weld aluminum?
- Why is a separate spool gun usually required for welding aluminum?

- How is the aluminum oxide surface removed?
- Why is it important to clean aluminum thoroughly before welding?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PST.01.03. Apply physical science principles to metal fabrication using a variety of welding and cutting processes (e.g., SMAW, GMAW, GTAW, fuel-oxygen and plasma arc torch, etc.).

Task Number 68

Demonstrate the ability to weld aluminum.

Definition

Demonstration should include

- stringer bead welding
- groove welding
- fillet welding.

Process/Skill Questions

- What are the alternative methods for cutting aluminum?
- What types of welders are used for welding aluminum?
- What shielding gas would you select when performing GMAW operations on aluminum?
- What are the potential effects of not properly cleaning your base metal?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PST.01.03. Apply physical science principles to metal fabrication using a variety of welding and cutting processes (e.g., SMAW, GMAW, GTAW, fuel-oxygen and plasma arc torch, etc.).

Performing Gas Tungsten Arc Welding (GTAW) Operations

Task Number 69

Describe GTAW operation procedures.

Definition

Description should include procedures for

- storing, handling, and installing high-pressure gas cylinders
- setting up equipment and materials
- selecting the current
- selecting the shielding gas
- selecting the shielding gas flow rate
- selecting and preparing a tungsten electrode
- selecting the torch nozzle
- selecting the filler metal
- preparing the metal for welding
- starting the arc
- using welding techniques
- shutting down the equipment.

Process/Skill Questions

- What are some methods for starting the arc when performing GTAW operations?
- What are the steps for preparing metal for GTAW operations?
- What resources are available to determine the appropriate current, polarity, shielding gas, shielding gas flow rate, tungsten electrode, torch nozzle, and filler metal?
- What is the shape of a properly prepared tungsten electrode?
- Why is GTAW considered to be the most precise welding operation?
- How are GMAW and GTAW similar? Different?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PST.01.03. Apply physical science principles to metal fabrication using a variety of welding and cutting processes (e.g., SMAW, GMAW, GTAW, fuel-oxygen and plasma arc torch, etc.).

Task Number 70

Prepare equipment and materials for GTAW operations.

Definition

Preparation should include equipment and materials such as

- power source
- shielding gas supply
- shielding gas regulator
- gas flowmeter
- shielding gas hoses and fittings
- electrode lead, workpiece lead, hoses
- welding torch
- tungsten electrodes
- welding rods.

Process/Skill Questions

- What are the safety precautions that should be followed when preparing equipment and materials for GTAW operations?
- What types of power sources can be used for GTAW operations?
- Why do some systems use water in the welder?
- What types of metal are typically welded using GTAW?
- How do you determine what type of tungsten is used for a given weld?
- What does a clean welding surface look like?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PST.01.03. Apply physical science principles to metal fabrication using a variety of welding and cutting processes (e.g., SMAW, GMAW, GTAW, fuel-oxygen and plasma arc torch, etc.).

Task Number 71

Demonstrate the ability to perform GTAW operations.

Definition

Demonstration should include

- stringer bead welding

- groove welding
- fillet welding.

Process/Skill Questions

- What are similarities and differences among SMAW, GMAW, and GTAW operations?
- What safety precautions should be taken when welding?
- How can you tell if your base metal is heated to a molten state?
- What might happen if you add filler rod before your base metal is heated to a molten state?
- What are some different types of weld positions, and where are they most beneficial?
- How can the size of a weld be manipulated?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PST.01.03. Apply physical science principles to metal fabrication using a variety of welding and cutting processes (e.g., SMAW, GMAW, GTAW, fuel-oxygen and plasma arc torch, etc.).

Performing Plasma-arc Cutting Operations

Task Number 72

Describe safe operation of a plasma-arc cutting system.

Definition

Description should include procedures for

- using PPE in the operation of the plasma-arc cutting system
- setting up the system
- preparing to cut
- making cuts
- shutting down the system.

Process/Skill Questions

- What safety precautions should be taken before using a plasma-arc cutting system? During? After?
- What hazards are associated with plasma-arc cutting?
- What type of eye protection is required when using the plasma-arc cutting system?
- How does each piece of PPE protect you from the hazards of plasma-arc cutting?
- Along with electricity, what else is used to operate the plasma-arc cutter?
- What is the procedure for shutting down a plasma-arc cutting system?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PST.01.03. Apply physical science principles to metal fabrication using a variety of welding and cutting processes (e.g., SMAW, GMAW, GTAW, fuel-oxygen and plasma arc torch, etc.).

Task Number 73

Describe the components of a plasma-arc cutting system.

Definition

Description should include

- power supply
- torch
- supply of gas or gases and regulator(s)
- safety equipment.

Process/Skill Questions

- What is the function of the torch in a plasma-arc cutting system?
- What safety equipment is required when using a plasma-arc cutting system?
- What gases can be used when operating a plasma-arc cutting systems?
- What does a defective component look like?
- What parts of a plasma cutter are disposable and must be replaced occasionally?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PST.01.03. Apply physical science principles to metal fabrication using a variety of welding and cutting processes (e.g., SMAW, GMAW, GTAW, fuel-oxygen and plasma arc torch, etc.).

Task Number 74

Demonstrate the ability to set up equipment for a plasma-arc cutting task.

Definition

Demonstration should include

- assembling components, including setting correct air compressor pressure and shielding, as it pertains to metal thickness
- selecting amperage or machine setting
- setting grounding on power source
- installing torch head parts
- applying principles of plasma-arc cutting operation.

Process/Skill Questions

- What resources are available to determine amperage and air pressure?
- What steps should be followed when setting up the equipment for a plasma-arc cutting task?
- Why is placement of the ground wire critical in plasma-arc cutting?
- What determines the power output settings for a plasma-arc cutter?
- How is travel speed determined when using a plasma-arc cutter?
- What factors affect travel speed when using a plasma-arc cutter?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PST.01.03. Apply physical science principles to metal fabrication using a variety of welding and cutting processes (e.g., SMAW, GMAW, GTAW, fuel-oxygen and plasma arc torch, etc.).

Task Number 75

Demonstrate the ability to operate plasma-arc cutting equipment.

Definition

Demonstration should include

- using various cutting techniques
- examining cut surfaces
- shutting down equipment.

Process/Skill Questions

- What are the various ways to cut metal? Why are there so many?
- Why is it important to always perform a leak test before using a torch?
- What types of metal can be cut with the plasma cutter?
- What mistakes can be evident on a cut surface?
- How can you cut straight edges?
- How does metal cut with a plasma-arc cutter compare to metal cut with an oxy-fuel torch?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PST.01.03. Apply physical science principles to metal fabrication using a variety of welding and cutting processes (e.g., SMAW, GMAW, GTAW, fuel-oxygen and plasma arc torch, etc.).

Performing Hot Metalworking Operations

Task Number 76

Identify metals.

Definition

Identification should include metals commonly used in the agriculture industry and their characteristics. Characteristics may include

- ferrous vs. non-ferrous
- hardness
- malleability
- ductility.

Process/Skill Questions

- What types of metal are commonly used in the agriculture industry?
- How do you determine metal type?
- How can a magnet and grinder help you identify metal type?
- What are methods to determine if a metal is ferrous?
- What are methods to determine metal hardness?
- What are some common solder alloys?
- Why is soft-soldering the preferred method for joining some metals, but not others?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PST.01.03. Apply physical science principles to metal fabrication using a variety of welding and cutting processes (e.g., SMAW, GMAW, GTAW, fuel-oxygen and plasma arc torch, etc.).

Task Number 77

Describe the procedures for shaping, hardening, and tempering common tools.

Definition

Description should include

- heating techniques when working with metal
- cooling techniques when working with hot metal
- necessary tools and equipment for shaping, hardening, and tempering common tools.

Process/Skill Questions

- Why is tempering necessary?
- What tools are necessary for shaping metal?
- What are some methods for determining metal temperature? Explain.
- How is metal surface color associated with various heating techniques?
- What are some methods for shaping metal?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PST.01.03. Apply physical science principles to metal fabrication using a variety of welding and cutting processes (e.g., SMAW, GMAW, GTAW, fuel-oxygen and plasma arc torch, etc.).

Task Number 78

Select soldering equipment and tools.

Definition

Selection should include

- PPE
- fuel type
- torch assembly
- friction lighter
- solder
- fluxes.

Process/Skill Questions

- Which equipment and tools are commonly associated with soldering?
- How do you determine the appropriate equipment for a soldering task?
- Why is flux necessary when soft-soldering?
- How does soldering differ from brazing? How is it similar?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PST.01.03. Apply physical science principles to metal fabrication using a variety of welding and cutting processes (e.g., SMAW, GMAW, GTAW, fuel-oxygen and plasma arc torch, etc.).

Task Number 79

Prepare metals for soft-soldering.

Definition

Preparation should include

- cleaning the metal, using a mechanical process (e.g., wire brush, wire wheel, grinder, sander)
- using chemicals to remove any impurities.

Process/Skill Questions

- How do you determine which mechanical process to use when cleaning metal?
- What safety precautions should be followed when preparing metal for soldering?
- What are fluxes?
- How should metal be prepared for soldering?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PST.01.03. Apply physical science principles to metal fabrication using a variety of welding and cutting processes (e.g., SMAW, GMAW, GTAW, fuel-oxygen and plasma arc torch, etc.).

Task Number 80

Demonstrate soldering skills.

Definition

Demonstration should include

- obtaining and preparing the necessary materials
- using specified soldering technique(s)
- shutting down equipment.

Process/Skill Questions

- How are soldering skills similar to welding skills? How are they different?
- What risks are associated with using lead solder?
- How is soldering equipment stored when not in use?
- What characteristics should you look for when inspecting a soldered joint?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PST.01.03. Apply physical science principles to metal fabrication using a variety of welding and cutting processes (e.g., SMAW, GMAW, GTAW, fuel-oxygen and plasma arc torch, etc.).

Performing Cold Metalworking Operations

Task Number 81

Identify safe practices for metal striking and machine tools.

Definition

Identification should include

- PPE (e.g., safety glasses, gloves, face shield)
- tool-care and tool-fitting procedures.

Process/Skill Questions

- How is the proper angle to sharpen a specific tool determined?
- What parts of the body need to be protected when using striking tools?
- What safety equipment is needed when using striking tools?
- What is the potential result of using a dull tool? Will striking or machining fix the problem? Why, or why not?
- What are common injuries sustained while metal striking and/or using machine tools? How can they be avoided?
- What causes a mushroomed top on a chisel?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PST.01.02. Apply physical science and engineering principles to design, implement, and improve safe and efficient mechanical systems in AFNR situations.

Task Number 82

Identify metalworking hand tools by type and use.

Definition

Identification may include striking, turning, and cutting tools.

Process/Skill Questions

- What are some of the most common metalworking hand tools?
- What are some less common metalworking hand tools?
- What metalworking tools are associated with cutting?
- Which tools are better for light or fine work? Why?
- Which tools are better for heavy or coarse work? Why?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PST.01.02. Apply physical science and engineering principles to design, implement, and improve safe and efficient mechanical systems in AFNR situations.

Task Number 83

Drill holes in metal.

Definition

Drilling holes should include

- measuring and marking metal for drilling
- center punching metal
- selecting the correct bit
- selecting and applying necessary cooling lubricants.

Process/Skill Questions

- How do you lay out a hole to be drilled?
- What are the different types of drill bit shanks?
- What determines the size of the bit to use when drilling a hole in metal?
- What is the purpose of center-punch marking before drilling?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PST.01.02. Apply physical science and engineering principles to design, implement, and improve safe and efficient mechanical systems in AFNR situations.

Task Number 84

Determine tap drill sizes.

Definition

Determination should include

- use of a tap and drill chart
- the type of threads (e.g., NPT, NF, NC, metric).

Process/Skill Questions

- How is a tap and drill chart used?
- Why are there different types of taps?
- What determines the type of threads that are needed?
- Why is the size of drill important for getting good threads?
- What are the differences among NPT, NF, NC, and metric?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PST.01.02. Apply physical science and engineering principles to design, implement, and improve safe and efficient mechanical systems in AFNR situations.

Task Number 85

Cut threads with tap and die.

Definition

Cutting threads should include using various tap and die handles and types of metal.

Process/Skill Questions

- Why is it important to bevel the end of the rod?

- What is the purpose of lubricant when cutting threads?
- What determines if the treads are long enough?
- Why is it important to hold the diestock/tap wrench level when cutting threads?
- What is crossthreading?
- What happens if you do not back up regularly as you thread?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PST.01.02. Apply physical science and engineering principles to design, implement, and improve safe and efficient mechanical systems in AFNR situations.

Task Number 86

Use files and saws.

Definition

Use should include

- identifying types of files and saws
- handling files and saws
- cleaning files (e.g., with a file card and brush)
- selecting sawing and filing techniques.

Process/Skill Questions

- What is the difference between a single- and double-cut file?
- What determines the type of file to use for a specific operation?
- What types of saws can be used to cut metal?
- What factors determine which sawing or filing technique should be used?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PST.01.02. Apply physical science and engineering principles to design, implement, and improve safe and efficient mechanical systems in AFNR situations.

Demonstrating Tool Reconditioning

Task Number 87

Identify safe practices for tool reconditioning.

Definition

Identification should include

- protective equipment
- procedures for handling sharp instruments
- types of portable and bench grinders
- procedures for the safe use of grinders
- importance of inspecting and adjusting the tool rest on a bench grinder.

Process/Skill Questions

- What precautions should be taken when using keen edge tools and grinders?
- What PPE should be used when reconditioning tools?
- What injuries may occur during tool-reconditioning activities? How can they be avoided?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PST.01.02. Apply physical science and engineering principles to design, implement, and improve safe and efficient mechanical systems in AFNR situations.

Task Number 88

Sharpen common tools.

Definition

Sharpening should include identification of proper shapes and angles of tools (e.g., chisels, punches, drill bits).

Process/Skill Questions

- What are the advantages of keeping tools sharp?

- Which is more dangerous, a sharp tool or a dull tool? Explain.
- What tools can be used to sharpen other tools?
- Why does cutting angle affect the function of a tool?
- What angles are common to drill bits?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PST.01.02. Apply physical science and engineering principles to design, implement, and improve safe and efficient mechanical systems in AFNR situations.

Task Number 89

Repair tools.

Definition

Repairing tools should include

- determining when to repair vs. replace
- identifying hazards related to tools
- replacing, maintaining, or repairing handles
- reshaping tools (e.g., hammer heads, chisel ends, striking surfaces).

Process/Skill Questions

- Why is important to be able to repair and maintain tools?
- What factors are used to determine if a tool needs to be repaired or replaced?
- What are the procedures for refitting a mushroomed head of a cold chisel or other cutting tool?
- What can be applied to wooden handles when they become dry and cracked? Why?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PST.01.02. Apply physical science and engineering principles to design, implement, and improve safe and efficient mechanical systems in AFNR situations.

Understanding Precision Agricultural Management

Task Number 90

Describe technologies used in precision agricultural management.

Definition

Description should include

- new technologies in land mapping
- global positioning system (GPS)
- self-steering systems on farm machinery
- computer-guided systems
- remotely operated equipment (e.g., drones).

Process/Skill Questions

- What new precision technologies are available in agriculture production that were not available five years ago?
- What does GPS stand for, and how does it acquire its signal?
- How is GPS being used with robotics in the agriculture industry?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PST.05.03. Apply geospatial technologies to solve problems and increase the efficiency of AFNR systems.

Task Number 91

Define site-specific application technology and its benefits.

Definition

Definition should include

- types of application equipment
- purpose of application
- benefits of application.

Process/Skill Questions

- What is an example of site-specific application equipment used in agriculture? How does it work?
- What are some benefits of site-specific application equipment for an agricultural field?
- How can site-specific application reduce the use of fertilizer or chemicals?
- What are the environmental benefits of site-specific application?

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The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PST.05.03. Apply geospatial technologies to solve problems and increase the efficiency of AFNR systems.

Task Number 92

Define remote sensing and its applications.

Definition

Definition should include

- types of sensing equipment
- types of data collected
- application of data collected.

Process/Skill Questions

- What is an example of data collected from remote-sensing equipment? How is that data used?
- What are some benefits of gathering data from remote-sensing equipment?
- How can remote sensing be used in sustainable agriculture?
- Why is remote sensing valuable to producers?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PST.05.03. Apply geospatial technologies to solve problems and increase the efficiency of AFNR systems.

Task Number 93

Describe the various types of positioning equipment.

Definition

Definition should include

- types of GPS equipment
- types of position-correction systems
- types of computer software (e.g., ArcGIS).

Process/Skill Questions

- What is your experience is using GPS? For what purposes have you used it?
- What is an example of computer software that is used in agricultural applications? For what purpose(s) is it used?
- What level of accuracy is needed in GPS equipment for agricultural applications?
- How do position-correction systems work?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PST.05.03. Apply geospatial technologies to solve problems and increase the efficiency of AFNR systems.

Task Number 94

Describe the importance of developing and using maps in agricultural management.

Definition

Description should include

- types of agriculture-related maps (e.g., yield, soil, scouting)
- purposes of agriculture-related maps.

Process/Skill Questions

- Where can maps for agricultural systems be found?
- Why do maps require legends?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PST.05.03. Apply geospatial technologies to solve problems and increase the efficiency of AFNR systems.

Task Number 95

Describe the procedure for operating a global positioning system (GPS) receiver.

Definition

Description should include how to use a handheld or vehicle-mounted GPS unit to plot points, measure distances, and calculate area.

Process/Skill Questions

- What are the steps to determine the area of a field, using GPS?
- How has precision technology helped make production agriculture more efficient?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PST.05.03. Apply geospatial technologies to solve problems and increase the efficiency of AFNR systems.

Task Number 96

Demonstrate the ability to collect data and apply that data in developing a map.

Definition

Demonstration should include

- plotting points
- determining distance
- calculating area, using specific given points at a location.

Process/Skill Questions

- What is the procedure for developing a map of a given area?
- How is area calculated?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PST.05.03. Apply geospatial technologies to solve problems and increase the efficiency of AFNR systems.

Task Number 97

Describe how GPS data is used in agricultural management.

Definition

Description should include

- examples of computer software used with GPS data
- geographic information systems (GIS)
- examples of agriculture-related maps (e.g., yield, soil, scouting).

Process/Skill Questions

- What types of decisions are made using GPS data?
- How can the use of GPS data save money in agricultural management?

- What is an example of an agricultural map that would be used when applying fertilizers to a field?
- How can GIS be used outside of agriculture?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PST.05.03. Apply geospatial technologies to solve problems and increase the efficiency of AFNR systems.

Task Number 98

Describe the purpose and uses of variable-rate technology.

Definition

Description should include

- types of products applied
- types of application equipment
- methods of rate calculation.

Process/Skill Questions

- When applying product to a field, why should only the necessary amount be used?
- How can variable-rate technology affect the environment?
- What are some products that are applied at a variable rate?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PST.05.03. Apply geospatial technologies to solve problems and increase the efficiency of AFNR systems.

Task Number 99

Develop a precision-management plan.

Definition

Developing a plan should include

- purpose and goal of the plan
- resources required
- technologies used
- steps for implementation.

Process/Skill Questions

- What are the main components of a precision-management plan?
- What are the steps in creating a precision-management plan?
- How can a precision-management plan affect production costs?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PST.05.03. Apply geospatial technologies to solve problems and increase the efficiency of AFNR systems.

Utilizing Laser Technologies in Agriculture

Task Number 100

Research the applications for laser technology in agriculture.

Definition

Research should include

- types of lasers (e.g., cutting, sensing)
- uses of lasers in agriculture
- safety concerns associated with the use of lasers.

Process/Skill Questions

- What is a laser?
- Why is important to take safety precautions when operating lasers?
- What can lasers do that normal light cannot?

- How are lasers used in everyday life?
- Where are lasers used in agriculture? How are they used?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PST.05.01. Apply computer and other technologies (e.g., robotics, CNC, UAS, etc.) to solve problems and increase the efficiency of AFNR systems.

Task Number 101

Demonstrate the ability to use laser technology in agriculture.

Definition

Demonstration should include

- selection of an appropriate laser
- setup and calibration of equipment
- operation of equipment
- analysis of results.

Process/Skill Questions

- How would you go about selecting the appropriate laser for a job?
- Why is it important to calibrate and properly locate a laser?
- When might lasers be unsafe? Explain.
- What level of accuracy can be expected with laser measurement?

The National Council for Agricultural Education: Agriculture, Food and Natural Resources Content Standards

PST.05.01. Apply computer and other technologies (e.g., robotics, CNC, UAS, etc.) to solve problems and increase the efficiency of AFNR systems.

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
40	Participate in an SAE.	English: 10.5, 10.8, 11.5, 11.8
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
42	Describe leadership characteristics and opportunities as they relate to agriculture and FFA.	English: 10.5, 11.5 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: 10.5, 11.5
44	Identify safety procedures and equipment necessary in agricultural fabrication and emerging technologies.	English: 10.5, 11.5 History and Social Science: GOVT.8
45	Apply laboratory safety instructions.	History and Social Science: GOVT.16
46	Explain emergency first-aid procedures.	English: 10.5, 11.5
47	Identify the classifications of fires and the methods used to extinguish them.	English: 10.5, 11.5
48	Demonstrate lifting and carrying techniques.	
49	Report injuries.	
50	Pass safety exam.	
51	Describe scientific principles related to electricity.	English: 10.5, 11.5 Science: PH.11
52	Apply electrical terminology and measurement.	Science: PH.11
53	Explain the electrical service system from generation to residential distribution.	
54	Follow safe practices in SMAW operations.	
55	Identify types of electrodes, rods, and fluxes.	
56	Prepare equipment and materials for SMAW operations.	
57	Demonstrate machine setup for SMAW operations.	
58	Demonstrate SMAW operations.	
59	Test welds for quality and strength of joint as outlined by American Welding Society (AWS) standards.	
60	Follow safe practices in oxy-fuel gas welding and cutting.	
61	Set up gas welding and cutting equipment.	
62	Demonstrate oxy-fuel welding.	
63	Braze weld mild steel.	
64	Cut mild steel with an oxy-fuel cutting torch.	

65	Prepare equipment and materials for GMAW operations.	
66	Demonstrate GMAW operations.	
67	Describe the procedures for welding aluminum.	
68	Demonstrate the ability to weld aluminum.	
69	Describe GTAW operation procedures.	
70	Prepare equipment and materials for GTAW operations.	
71	Demonstrate the ability to perform GTAW operations.	
72	Describe safe operation of a plasma-arc cutting system.	English: 10.5, 11.5
73	Describe the components of a plasma-arc cutting system.	English: 10.5, 11.5
74	Demonstrate the ability to set up equipment for a plasma-arc cutting task.	
75	Demonstrate the ability to operate plasma-arc cutting equipment.	
76	Identify metals.	Science: ES.4
77	Describe the procedures for shaping, hardening, and tempering common tools.	
78	Select soldering equipment and tools.	
79	Prepare metals for soft-soldering.	
80	Demonstrate soldering skills.	
81	Identify safe practices for metal striking and machine tools.	English: 10.5, 11.5
82	Identify metalworking hand tools by type and use.	English: 10.5, 11.5
83	Drill holes in metal.	
84	Determine tap drill sizes.	
85	Cut threads with tap and die.	
86	Use files and saws.	
87	Identify safe practices for tool reconditioning.	English: 10.5, 11.5
88	Sharpen common tools.	
89	Repair tools.	
90	Describe technologies used in precision agricultural management.	English: 10.5, 11.5 History and Social Science: VUS.14, WG.1, WG.2, WHII.14
91	Define site-specific application technology and its benefits.	English: 10.3, 10.5, 11.3, 11.5 History and Social Science: VUS.14, WG.1, WG.2, WHII.14

92	Define remote sensing and its applications.	English: 10.3, 10.5, 11.3, 11.5 History and Social Science: VUS.14, WG.1, WG.2, WHII.14
93	Describe the various types of positioning equipment.	English: 10.3, 10.5, 11.3, 11.5 History and Social Science: VUS.14, WG.1, WG.2, WHII.14
94	Describe the importance of developing and using maps in agricultural management.	English: 10.5, 11.5 History and Social Science: WG.1, WG.2
95	Describe the procedure for operating a global positioning system (GPS) receiver.	English: 10.5, 11.5 History and Social Science: WG.1, WG.2 Mathematics: G.3
96	Demonstrate the ability to collect data and apply that data in developing a map.	History and Social Science: WG.1 Mathematics: A.9, G.3
97	Describe how GPS data is used in agricultural management.	English: 10.5, 11.5 History and Social Science: VUS.14, WG.1, WG.2, WHII.14
98	Describe the purpose and uses of variable-rate technology.	English: 10.5, 11.5 History and Social Science: VUS.14, WG.1, WG.2, WHII.14
99	Develop a precision-management plan.	English: 10.5, 11.5 History and Social Science: WG.1, WG.2, WG.4
100	Research the applications for laser technology in agriculture.	English: 10.5, 10.8, 11.5, 11.8 History and Social Science: VUS.14, WHII.14
101	Demonstrate the ability to use laser technology in agriculture.	History and Social Science: VUS.14, WHII.14

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.

The following leadership development events are available for this course:

- Agricultural Issues
- Employment Skills
- Extemporaneous Public Speaking
- Parliamentary Procedure
- Prepared Public Speaking

The following career development events are available for this course:

- Agricultural Technology and Mechanical Systems
- Environmental & Natural Resources
- Forestry
- Nursery/Landscape

Green Building Infusion Units

The Green Building Infusion Unit (GBIU) was designed to encourage teachers to infuse instructional units on green building knowledge and skills into designated CTE courses. The infusion unit is not mandatory, and, as such, the tasks/competencies are marked as "optional," to be taught at the instructor's discretion.

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

- Agriculture Mechanics Assessment
- College and Work Readiness Assessment (CWRA+)
- Customer Service Specialist (CSS) Examination
- Flux Core Arc Welding (FCAW) Examination
- Gas Metal Arc Welding Examination
- Gas Tungsten Arc Welding (GTAW) Examination
- National Career Readiness Certificate Assessment
- SENSE Training Program Certification Examination (Level 1, Entry-Level Welder)
- Shielded Metal Arc Welding (SMAW) Examination
- Welding Assessment
- Welding Examination
- 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)
- Agricultural Power Systems (8018/36 weeks)
- Agricultural Power Systems, Advanced (8020/36 weeks)
- Agricultural Structural Systems (8017/36 weeks)
- Applied Agricultural Concepts (8073/36 weeks)
- Applied Agricultural Concepts (8072/18 weeks)
- Introduction to Power, Structural, and Technical Systems (8016/36 weeks)
- Livestock Production Management (8012/36 weeks)
- Small Engine Repair (8021/18 weeks)
- Small Engine Repair (8082/36 weeks)

Career Cluster: Agriculture, Food and Natural Resources	
Pathway	**Occupations**
Agribusiness Systems	**Agricultural Products Sales Representative** **Farm Products Purchasing Agent and Buyer** **Farm, Ranch Manager** **Farmer/Rancher** **Feed, Farm Supply Store Sales Manager** **Sales Manager**
Animal Systems	**Agricultural Products Sales Representative**

Career Cluster: Agriculture, Food and Natural Resources	
Pathway	**Occupations**
	Animal Breeder, Husbandry **Aquacultural Manager** **Poultry Manager**
Environmental Service Systems	**Agricultural Products Sales Representative** **Environmental Compliance Inspector** **Environmental Sampling and Analysis Technician** **Hazardous Materials Handler** **Recycling Coordinator** **Secondary School Teacher** **Toxicologist** **Turf Farmer** **Water Conservationist**
Natural Resources Systems	**Forest Manager, Forester** **Forest Technician** **Geological Technician** **Logging Equipment Operator** **Park Manager** **Park Technician** **Range Technician**
Plant Systems	**Agricultural Products Sales Representative** **Crop Grower** **Custom Harvester** **Farm, Ranch Manager** **Farmer/Rancher** **Golf Course Superintendent** **Machine Setter, Operator** **Nursery and Greenhouse Manager** **Ornamental Horticulturist** **Secondary School Teacher** **Tree Surgeon** **Turf Farmer**
Power, Structural, and Technical Systems	**Agricultural Engineer** **Agricultural Equipment Operator** **Agricultural Equipment Parts Manager** **Agricultural Equipment Parts Salesperson** **Machinist** **Parts Manager** **Welder**

Career Cluster: Science, Technology, Engineering and Mathematics	
Pathway	**Occupations**
Engineering and Technology	**Agricultural Engineer** **Architect** **Assembler** **Civil Engineer** **Civil Engineering Technician** **Commercial and Industrial Designer** **Electrical Drafter**

Career Cluster: Science, Technology, Engineering and Mathematics	
Pathway	**Occupations**
	Electrical Engineer **Electrical Engineering Technician** **Electro-Mechanical Technician** **Environmental Engineer** **Industrial Engineer** **Industrial Engineering Technician** **Landscape Architect** **Machine Setter, Operator** **Manufacturing Systems Engineer** **Marine Engineer** **Materials Engineer** **Mechanical Drafter** **Mechanical Engineer** **Mechanical Engineering Technician** **Stockroom, Warehouse, or Storage Yard Stock Clerk** **Technical Writer**