

Agricultural Power Systems

8018 36 weeks

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Course Description

Suggested Grade Level: 10 or 11 or 12

Agricultural Power Systems prepares students for careers in agricultural machinery service. Areas of focus include engines, powertrains, and hydraulic, electrical, and fuel systems. Precision measurement, leadership, and career skills will be emphasized.

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

8018	Tasks/Competencies
<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"/>	Identify marked safety areas.
<input checked="" type="checkbox"/>	Identify the location and use of eye wash stations.
<input checked="" type="checkbox"/>	Identify the location of the posted evacuation routes.

<input checked="" type="radio"/>	Locate and demonstrate knowledge of safety data sheets (SDS).
<input checked="" type="radio"/>	Demonstrate the safe use of chemicals.
<input checked="" type="radio"/>	Demonstrate the safe use of standard and metric hand tools.
<input checked="" type="radio"/>	Demonstrate the safe use of power tools.
<input checked="" type="radio"/>	Demonstrate the safe use of precision standard and metric measuring tools.
<input checked="" type="radio"/>	Demonstrate the safe use of protective clothing and equipment.
<input checked="" type="radio"/>	Demonstrate the safe use of fire protection equipment.
<input checked="" type="radio"/>	Demonstrate the safe use of equipment.
<input checked="" type="radio"/>	Demonstrate safe practices in the agricultural mechanics lab/workshop.
<input checked="" type="radio"/>	Explain the basic operating principles of an internal combustion engine.
<input checked="" type="radio"/>	Explain the interrelationship of parts during each stroke for an internal combustion engine.
<input checked="" type="radio"/>	Explain the differences between a two-stroke and a four-stroke engine.
<input checked="" type="radio"/>	Explain the differences between gasoline and diesel engines.
<input type="radio"/>	Research alternative energies.
<input checked="" type="radio"/>	Analyze alternative energy sources.
<input checked="" type="radio"/>	Disassemble an engine.
<input checked="" type="radio"/>	Reassemble an engine.
<input checked="" type="radio"/>	Troubleshoot an engine.
<input checked="" type="radio"/>	Select repair parts.
<input checked="" type="radio"/>	Identify precision measuring tools.
<input checked="" type="radio"/>	Demonstrate the use of precision measuring tools.
<input checked="" type="radio"/>	Explain the function and operating principles of the powertrain and its components.
<input type="radio"/>	Remove powertrain components.
<input type="radio"/>	Disassemble powertrain components.
<input type="radio"/>	Rebuild powertrain components.
<input checked="" type="radio"/>	Identify the application of hydraulics in agriculture.

<input checked="" type="radio"/>	Explain the components of a hydraulic system.
<input checked="" type="radio"/>	Explain terminology and symbols of a hydraulic system.
<input type="radio"/>	Interpret hydraulic schematics.
<input type="radio"/>	Explain the difference between open and closed center systems and their advantages.
<input type="radio"/>	Replace hydraulic pumps, valves, cylinders, and hoses.
<input checked="" type="radio"/>	Explain the application of safety switches on agricultural machines.
<input checked="" type="radio"/>	Explain the application of electricity in agricultural equipment.
<input type="radio"/>	Troubleshoot and repair a safety system.
<input type="radio"/>	Troubleshoot and repair an operating system.
<input checked="" type="radio"/>	Troubleshoot and repair a charging system.
<input checked="" type="radio"/>	Describe the function and importance of controls and control circuits in the operation of electrical equipment.
<input type="radio"/>	Identify the characteristics of automated and non-automated control systems.
<input checked="" type="radio"/>	Describe safe use, storage, and disposal of fuels and lubricants.
<input checked="" type="radio"/>	Select fuels based on engine types.
<input checked="" type="radio"/>	Describe crankcase oil classifications and selection.
<input type="radio"/>	Select gear lubricant.
<input type="radio"/>	Select hydraulic fluids.
<input type="radio"/>	Select bearing grease.
<input checked="" type="radio"/>	Explain the different paint application methods.
<input type="radio"/>	Prepare equipment for painting.
<input type="radio"/>	Select and apply protective coatings.
<input type="radio"/>	Prepare steam and/or high-pressure washer.
<input type="radio"/>	Clean equipment with steam cleaner and/or high-pressure washer.

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).

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?

Applying Safety Practices in the Agricultural Mechanics Lab/Workshop

Task Number 44

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 do you know if additional safety equipment or clothing is needed to enter a safety area?
 - How are walkways identified in the lab/workshop area?
-

Task Number 45

Identify the location and use of eye wash 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 eye wash station?
 - When should you use an eye wash station?
 - What safety equipment provides additional eye protection?
-

Task Number 46

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 47

Locate and demonstrate knowledge of safety data sheets (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 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 48

Demonstrate the safe use of chemicals.

Definition

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

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?
- What is an SDS?

Task Number 49

Demonstrate the safe 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 manufacturers' 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 hand 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 50

Demonstrate the safe use of power tools.

Definition

Demonstration should include the various types of power tools (including pneumatic and electric tools) encountered in agricultural mechanics.

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

- air impact gun
- air hammer
- air ratchet

- air drill
- drop light
- electric drill
- electric grinder.

Process/Skill Questions

- What is the purpose of a dead man switch and/or kill switch on power tools? What is the purpose of an emergency stop (e-stop) or emergency power off (EPO) on power tools?
 - When should adjustments be made to power tools?
 - Why is training on the use of a power tool necessary before using it?
-

Task Number 51

Demonstrate the safe 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 52

Demonstrate the safe use of protective clothing and equipment.

Definition

Demonstration should include the types of protective clothing and equipment (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 manufacturers' 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?
 - Would it ever be necessary to wear ear protection in an agricultural mechanics lab/workshop?
 - Why are steel-toed boots and shoes worn in agricultural mechanics labs/workshops?
-

Task Number 53

Demonstrate the safe use of fire protection equipment.

Definition

Demonstration should include

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

Process/Skill Questions

- What are the different types of fire extinguishers?
 - Is the fire extinguisher in your lab/workshop appropriate for all types of fires? Explain.
 - What procedure should students follow in case of an emergency or accident?
-

Task Number 54

Demonstrate the safe use of equipment.

Definition

Demonstration should include the different types of equipment used in the agricultural mechanics field, along with the correct use, the hazards, and the precautions associated with each, in accordance with manufacturer's specifications and instructor's guidelines. Equipment should include

- 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 55

Demonstrate safe practices in the agricultural mechanics lab/workshop.

Definition

Demonstrating safe practices 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 personal protective equipment (PPE) for the operation of concern
- following the safety standards and regulations of the U.S. Environmental Protection Agency (EPA), Occupational Safety and Health Administration (OSHA), the Equipment and Engine Training Council (EETC) Education Committee, and Safety Data Sheets (SDS).

Process/Skill Questions

- What information should be sent with emergency responders to the hospital with the student if a chemical is splashed in an eye or wound?
- Are state and national safety standards followed in school labs/workshops? Explain.
- What agency requires labs/workshops and businesses to use the services of companies such as Safety Clean?
- What are the dangers of running an engine in a confined space without proper ventilation?
- Why is it important to achieve 100% accuracy on tests regarding safety and operating procedures before using tools, equipment, and machinery?

Identifying Fundamentals of Engines

Task Number 56

Explain the basic operating principles of an internal combustion engine.

Definition

Explanation should include what happens during intake, compression, power, and exhaust events in engines. It should also include listing the major parts of an engine and explaining their function(s).

Process/Skill Questions

- What are the three things engines need to run?
- How is compression achieved?

Task Number 57

Explain the interrelationship of parts during each stroke for an internal combustion engine.

Definition

Explanation should include description of the function, rotation, and position of internal and external parts of a two- and four-stroke engine.

Process/Skill Questions

- What internal parts are being used in each stroke?
- In what position are these parts?
- If a part is not in its correct position, how will this cause the engine to not run?

Task Number 58

Explain the differences between a two-stroke and a four-stroke engine.

Definition

Explanation should include comparing and contrasting the engines and listing the applications of each.

Process/Skill Questions

- How do engines differ on lubrication?
- What are the advantages and disadvantages of two-stroke engines? Four-stroke engines?
- What are some applications of each type?

Task Number 59

Explain the differences between gasoline and diesel engines.

Definition

Explanation should include comparing and contrasting the engines and paying special attention to how the fuel is ignited.

Process/Skill Questions

- What are the advantages and disadvantages of each type of engine?
- What are some applications of each type?

Task Number 60

Research alternative energies.

Definition

Research should include describing fuels currently in production and trends influencing the future.

Process/Skill Questions

- What are some alternative fuels being used today?
- What are the advantages and disadvantages of alternative fuels?
- What types of fuels will be available in the future?

Task Number 61

Analyze alternative energy sources.

Definition

Analysis should include

- geothermal energy
- solar energy
- nuclear power
- atom
- wind
- water
- biodiesel
- ethanol
- biomass
- methane

and should include structural and design components of each.

Process/Skill Questions

- What are available energy sources?
- How will alternative energy sources affect carburetion systems?
- What is the importance of alternative energy sources?
- How do alternative energy sources impact the environment?

Task Number 62

Disassemble an engine.

Definition

Disassembly should include

- using proper tools
- following procedures in a systematic plan
- inspecting parts.

Process/Skill Questions

- Why would you disassemble an engine?
- What tools are needed to do the job properly?
- What should you look for when inspecting the parts?
- What are some safety measures to take when disassembling an engine?

Task Number 63

Reassemble an engine.

Definition

Reassembly should include

- using proper tools
- following procedures in a systematic plan
- using torque of nuts and bolts
- using specifications
- using new parts, when needed.

Process/Skill Questions

- What tools are needed to do the job?
- Why are new parts needed when assembling an engine?
- Why do you need to torque nuts and bolts to industry specifications?

Task Number 64

Troubleshoot an engine.

Definition

Troubleshooting should include systematically diagnosing and correcting problems that prevent an engine from effectively running.

Process/Skill Questions

- Why do you troubleshoot an engine?
 - How and why do you check compression?
 - How do you safely check for spark?
 - How do you determine whether the engine is getting fuel?
-

Task Number 65

Select repair parts.

Definition

Selection should include using engine numbers to determine replacement part requirements.

Process/Skill Questions

- What sources are available to determine replacement part numbers?
 - What is the importance of using engine numbers to obtain replacement parts?
-
-

Using Precision Measurement Tools

Task Number 66

Identify precision measuring tools.

Definition

Identification should include the types, parts, and uses of

- calipers
- dividers
- straight edges
- telescoping gauges
- standard fixed gauges
- feeler gauges
- wire gauges
- micrometer
- dial indicators
- small hole gauges.

Process/Skill Questions

- Why are precision measuring tools used?
- What is the difference between using a caliper and a micrometer?

Task Number 67

Demonstrate the use of precision measuring tools.

Definition

Demonstration should include using tools in practical application such as equipment maintenance and/or repair.

Process/Skill Questions

- Why are certain locations measured on a part?
 - What are the two types of measuring systems? Which type is used more on agricultural machinery?
-
-

Identifying Fundamentals of Powertrains

Task Number 68

Explain the function and operating principles of the powertrain and its components.

Definition

Explanation should include

- the basic functions of powertrains, to include engines, clutches, transmissions, and final drives
- the operation of clutches
- the operation of transmissions
- the operation of final drives
- the operation of planetary gears
- the operation of inboard and outboard brakes.

Process/Skill Questions

- What does each part of the powertrain do?
- Why is it important to have the service manual for the equipment you are fixing?
- What are the different types of clutches?
- What are some typical clutch problems?
- How do the different types of transmissions work?
- Why is transmission fluid important? What is its purpose?
- Where is the final drive located? What is its purpose?
- How can final drives affect the output speed?
- How does each part work in conjunction with the other?
- Which part(s) would need to be changed to vary the output speed?
- Where are inboard brakes located? Where are outboard brakes located?
- What are the advantages and disadvantages of inboard brakes? Outboard brakes?

Task Number 69

Remove powertrain components.

Definition

Procedure should include systematically removing components using proper tools and safety.

Process/Skill Questions

- Why would you need to remove parts of the powertrain?
 - Why is it important to disconnect the battery cables before starting to work on the machinery?
-

Task Number 70

Disassemble powertrain components.

Definition

Procedure should include systematically disassembling components using safety, proper tools, and manuals.

Process/Skill Questions

- Why are manuals and proper procedures important in disassembly?
 - What tools should be used to disassemble the powertrain components?
-

Task Number 71

Rebuild powertrain components.

Definition

Procedure should include diagnosing condition of parts and reassembling to good working order using proper tools and safety.

Process/Skill Questions

- Why is measuring equipment important when rebuilding components?
 - Why is it important to follow repair manuals?
-
-

Identifying Fundamentals of Hydraulics

Task Number 72

Identify the application of hydraulics in agriculture.

Definition

Identification should include agricultural equipment and implements.

Process/Skill Questions

- Why is hydraulic power important for agricultural equipment?
- What are some examples of hydraulic equipment used on agricultural machinery?

Task Number 73

Explain the components of a hydraulic system.

Definition

Explanation should include

- motors
- cylinders
- pumps
- valves
- hoses
- oils.

Process/Skill Questions

- How does each of the parts work?
- When would you use the components?

Task Number 74

Explain terminology and symbols of a hydraulic system.

Definition

Explanation should include the terms and symbols used in the industry.

Process/Skill Questions

- Why does a technician need to learn to use symbols and understand terminology?
- What symbol is used to represent a line under pressure?

Task Number 75

Interpret hydraulic schematics.

Definition

Interpretation should include understanding drawing, using symbols, and using terminology.

Process/Skill Questions

- Why is reading schematics important?
- What symbol is used to represent the direction of flow of the hydraulic fluid?

Task Number 76

Explain the difference between open and closed center systems and their advantages.

Definition

Explanation should include the uses, functions, and advantages of each system.

Process/Skill Questions

- What is the difference between a closed and open system?
- Where are these systems used?

Task Number 77

Replace hydraulic pumps, valves, cylinders, and hoses.

Definition

Replacement should include

- using tools safely
- following manuals
- measuring and inspecting parts.

Process/Skill Questions

- Why is measuring equipment important when rebuilding components?
- Why is it important to follow repair manuals?
- Why is it important that repairs are done and properly inspected?

Understanding Agricultural Machinery Electrical Systems

Task Number 78

Explain the application of safety switches on agricultural machines.

Definition

Explanation should include listing locations of safety switches and describing what dangers they prevent.

Process/Skill Questions

- What equipment should have safety switches?
- What can the use of safety switches help to prevent?

Task Number 79

Explain the application of electricity in agricultural equipment.

Definition

Explanation should include listing the uses of electricity in agricultural equipment and examining how the electricity performs the operation.

Process/Skill Questions

- Why is electricity needed for certain applications on a piece of equipment?
- What are some safety precautions you should use when working with electricity?

Task Number 80

Troubleshoot and repair a safety system.

Definition

Troubleshooting should include using electrical schematics and multimeters to diagnose and repair.

Process/Skill Questions

- What is the best type of electrical measure to use for a given job?
- Why is it important to repair and keep a safety switch in service?

Task Number 81

Troubleshoot and repair an operating system.

Definition

Troubleshooting could include using electrical schematics and multimeters and other diagnostic tools to diagnose and repair

- starting systems
- charging systems
- ignition systems

and/or operating systems for diesel engines.

Process/Skill Questions

- How do you test a solenoid?
- What dangers can happen from bypassing starting safety switches?
- What is the purpose of the different key locations on a switch?

Task Number 82

Troubleshoot and repair a charging system.

Definition

Troubleshooting should include using electrical schematics and multimeters to diagnose and repair.

Process/Skill Questions

- How do you test an alternator?
- What does an alternator do?
- What does a regulator do?
- How do you read an amp gauge?

Identifying the Functions of Electrical Controls

Task Number 83

Describe the function and importance of controls and control circuits in the operation of electrical equipment.

Definition

Description should include identifying the types of controls and the purpose and use of each type.

Process/Skill Questions

- What are the types of electrical controls found on equipment?
- What safety precautions should be used when working on any electrical control circuit?

Task Number 84

Identify the characteristics of automated and non-automated control systems.

Definition

Identification should include the difference between the two types and the parts of the systems.

Process/Skill Questions

- What is the difference between an automated and non-automated control system?
 - When would an automated control system be used vs. a non-automated system?
 - How are global positioning systems integrated into electrical controls?
-
-

Selecting and Using Fuels and Lubricants

Task Number 85

Describe safe use, storage, and disposal of fuels and lubricants.

Definition

Description should include the types of fuels, the dangers of each, handling methods, and the types of storage.

Process/Skill Questions

- What are the three main types of fuel storage?
- Why is it important to use the proper type and color of portable cans?
- What are safety considerations for storing fuel?

Task Number 86

Select fuels based on engine types.

Definition

Selection should include gas, diesel, propane, and alternative fuels.

Process/Skill Questions

- What is the type of fuel used in an engine, given the ignition type?
 - What effect does temperature have on certain fuels?
-
-

Task Number 87

Describe crankcase oil classifications and selection.

Definition

Description should include Society of Automobile Engineers (SAE) grades, multi- and single-viscosity, quality ratings, additives, and synthetics. Selection should include looking up proper oils according to the engine manufacturer's specifications.

Process/Skill Questions

- Which oil would be best to use in a certain application given a geographic location and season of the year?
- Why are synthetic oils manufactured?
- What are additives? Why are they used?

Task Number 88

Select gear lubricant.

Definition

Selection should include quality, viscosity ratings, and synthetics.

Process/Skill Questions

- Why are there different viscosity ratings?
- Where would gear oil be used vs. motor or hydraulic oil?

Task Number 89

Select hydraulic fluids.

Definition

Selection should include types and qualities needed for the hydraulic system.

Process/Skill Questions

- Where can you find information about the type and quality of hydraulic fluid needed?
- What is the purpose of hydraulic oils?

Task Number 90

Select bearing grease.

Definition

Selection should include types, qualities, synthetics, marine, and dispensing methods.

Process/Skill Questions

- What are some methods to dispense grease?
 - How often should you regrease parts?
 - What is marine grease? When and where would it be used?
-
-

Applying Protective Coatings

Task Number 91

Explain the different paint application methods.

Definition

Explanation should include

- spray guns
- brushes
- rollers
- aerosols.

Process/Skill Questions

- Why are anticorrosive materials important when applying protective coatings?
- What safety measures should be taken when working with paint applications?

Task Number 92

Prepare equipment for painting.

Definition

Preparation should include

- cleaning
- sanding
- masking.

Process/Skill Questions

- What PPE is required for painting?
 - What is the best way to get perfectly straight lines?
 - What are the different methods used to clean the equipment?
-

Task Number 93

Select and apply protective coatings.

Definition

Selection should include

- knowledge of label reading
- types of paints, to include enamels and latexes
- type of application and safety (e.g., clothing, equipment, ventilation).

Applying should include

- thinning
- straining
- shaking
- stirring

of coatings and preparation of chosen equipment.

Process/Skill Questions

- Why are shaking and stirring needed for paints?
- What is the proper method for cleaning paint equipment?
- What safety practices are needed for a given application?

Task Number 94

Prepare steam and/or high-pressure washer.

Definition

Preparation should include

- safety with electricity, chemicals, and water
- set-up and take down.

Process/Skill Questions

- What PPE is required for steaming and high-pressure washing?
 - What are the advantages of using each method?
 - What is the difference between a steam cleaner and a pressure washer?
-

Task Number 95

Clean equipment with steam cleaner and/or high-pressure washer.

Definition

Procedure should include

- using safety with hot water, electricity, and hot parts
- covering critical parts
- disposing of runoff chemicals and grease.

Process/Skill Questions

- What are the best settings for the chosen machine?
 - What damage can happen with improper use?
 - Why is it important to correctly dispose of the runoff chemicals and grease?
-

SOL Correlation by Task

39	Identify the role of supervised agricultural experiences (SAEs) in agricultural education.	English: 10.3, 10.5, 11.3, 11.5, 12.3, 12.5
40	Participate in an SAE.	English: 10.5, 10.8, 11.5, 11.8, 12.5, 12.8
41	Identify the benefits and responsibilities of FFA membership.	English: 10.5, 10.6, 10.7, 10.8, 11.5, 11.6, 11.7, 11.8, 12.5, 12.6, 12.7, 12.8
42	Describe leadership characteristics and opportunities as they relate to agriculture and FFA.	English: 10.5, 11.5, 12.5 History and Social Science: VUS.8, VUS.9, VUS.10, VUS.11, WHII.8, WHII.10, WHII.11
43	Apply for an FFA degree and/or an agricultural proficiency award.	English: 10.5, 11.5, 12.5
44	Identify marked safety areas.	

45	Identify the location and use of eye wash stations.	
46	Identify the location of the posted evacuation routes.	
47	Locate and demonstrate knowledge of safety data sheets (SDS).	English: 10.5, 11.5, 12.5
48	Demonstrate the safe use of chemicals.	Science: CH.1
49	Demonstrate the safe use of standard and metric hand tools.	
50	Demonstrate the safe use of power tools.	
51	Demonstrate the safe use of precision standard and metric measuring tools.	
52	Demonstrate the safe use of protective clothing and equipment.	
53	Demonstrate the safe use of fire protection equipment.	
54	Demonstrate the safe use of equipment.	
55	Demonstrate safe practices in the agricultural mechanics lab/workshop.	English: 10.5, 11.5, 12.5 History and Social Science: GOVT.16 Science: CH.1
56	Explain the basic operating principles of an internal combustion engine.	English: 10.5, 11.5, 12.5
57	Explain the interrelationship of parts during each stroke for an internal combustion engine.	English: 10.5, 11.5, 12.5 Science: PH.5g, PH.6a
58	Explain the differences between a two-stroke and a four-stroke engine.	English: 10.5, 11.5, 12.5
59	Explain the differences between gasoline and diesel engines.	English: 10.5, 11.5, 12.5
60	Research alternative energies.	English: 10.5, 10.8, 11.5, 11.8, 12.5, 12.8 Science: PH.1a
61	Analyze alternative energy sources.	English: 10.5, 11.5, 12.5 Science: ES.6b, PH.7a
62	Disassemble an engine.	English: 10.5, 11.5, 12.5
63	Reassemble an engine.	English: 10.5, 11.5, 12.5
64	Troubleshoot an engine.	
65	Select repair parts.	
66	Identify precision measuring tools.	Science: PH.1b
67	Demonstrate the use of precision measuring tools.	
68	Explain the function and operating principles of the powertrain and its components.	English: 10.5, 11.5, 12.5 Mathematics: A.4 Science: PH.1a
69	Remove powertrain components.	
70	Disassemble powertrain components.	
71	Rebuild powertrain components.	
72	Identify the application of hydraulics in agriculture.	Science: PH.7a

73	Explain the components of a hydraulic system.	English: 10.5, 11.5, 12.5 Science: PH.4a
74	Explain terminology and symbols of a hydraulic system.	English: 10.3, 11.3, 12.3
75	Interpret hydraulic schematics.	English: 10.5, 11.5, 12.5
76	Explain the difference between open and closed center systems and their advantages.	English: 10.5, 11.5, 12.5 Science: PH.1a, PH.4a
77	Replace hydraulic pumps, valves, cylinders, and hoses.	English: 10.5, 11.5, 12.5
78	Explain the application of safety switches on agricultural machines.	English: 10.5, 11.5, 12.5
79	Explain the application of electricity in agricultural equipment.	English: 10.5, 11.5, 12.5 Science: PH.4a
80	Troubleshoot and repair a safety system.	Science: PH.11c
81	Troubleshoot and repair an operating system.	Science: PH.11c
82	Troubleshoot and repair a charging system.	Science: PH.11c
83	Describe the function and importance of controls and control circuits in the operation of electrical equipment.	English: 10.5, 11.5, 12.5 Science: PH.1a, PH.11c
84	Identify the characteristics of automated and non-automated control systems.	
85	Describe safe use, storage, and disposal of fuels and lubricants.	English: 10.5, 11.5, 12.5 Science: CH.1b
86	Select fuels based on engine types.	
87	Describe crankcase oil classifications and selection.	English: 10.5, 11.5, 12.5
88	Select gear lubricant.	
89	Select hydraulic fluids.	
90	Select bearing grease.	
91	Explain the different paint application methods.	English: 10.5, 11.5, 12.5
92	Prepare equipment for painting.	
93	Select and apply protective coatings.	English: 10.5, 11.5, 12.5 History and Social Science: GOVT.16
94	Prepare steam and/or high-pressure washer.	
95	Clean equipment with steam cleaner and/or high-pressure washer.	

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 Communications](#)
- [Agricultural Sales](#)
- [Agronomy](#)
- [Agricultural Technology & Mechanical Systems](#)
- [Dairy Cattle Evaluation and Management](#)
- [Environmental & Natural Resources](#)
- [Farm and Agribusiness Management](#)
- [Floriculture](#)
- [Food Science and Technology](#)
- [Forestry](#)
- [Horse Evaluation](#)
- [Marketing Plan](#)
- [Meats Evaluation and Technology](#)
- [Nursery/Landscape](#)
- [Poultry Evaluation](#)
- [Veterinary Science](#)

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
- EETC Technician Certification Tests
- National Career Readiness Certificate Assessment
- Power Equipment Technology Examination
- Small Engine Technology Assessment
- Workplace Readiness Skills for the Commonwealth Examination

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

- Agricultural Business Fundamentals I (8022/36 weeks)
- Agricultural Business Management III (8026/36 weeks)
- Agricultural Business Operations II (8024/36 weeks)
- Agricultural Fabrication and Emerging Technologies (8019/36 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)
- Energy and Power (8495/18 weeks)
- Introduction to Power, Structural, and Technical Systems (8016/36 weeks)
- Small Engine Repair (8082/36 weeks)
- Small Engine Repair (8021/18 weeks)

Career Cluster: Agriculture, Food and Natural Resources	
Pathway	Occupations
Power, Structural, and Technical Systems	Agricultural Engineer Agricultural Equipment Operator Agricultural Equipment Parts Manager Agricultural Equipment Parts Salesperson Machinist Parts Manager

Career Cluster: Architecture and Construction	
Pathway	Occupations
Design/Pre-Construction	Civil Engineer Mechanical Drafter Mechanical Engineer

Career Cluster: Architecture and Construction	
Pathway	Occupations
Maintenance and Operations	Electrician General Contractor

Career Cluster: Science, Technology, Engineering and Mathematics	
Pathway	Occupations
Engineering and Technology	Agricultural Engineer Electrical Engineer Electrical Engineering Technician Electro-Mechanical Technician Engineer Engineering Technician Industrial Engineer Industrial Engineering Technician Machine Setter, Operator Manufacturing Systems Engineer Marine Engineer Mechanical Engineer Mechanical Engineering Technician Power Systems Engineer