

AGRI-SCIENCE III

Agricultural Mechanics

Overview

Agri-Science III students will focus on those areas of interest they have developed over the previous two years and concentrate on developing skills more specific to those areas of interest. All Agri-Science curriculum is aligned with the national Agriculture, Food, and Natural Resources (AFNR) standards.

Agribusiness Systems (ABS)—the study of business principles, including management, marketing and finance, and their application to enterprises engaged in Agriculture, Food and Natural Resources

Agricultural Mechanics/Power, Structural and Technical Systems (PST)—the study of agricultural equipment, power systems, alternative fuel sources and precision technology, as well as woodworking, metalworking, welding and project planning for agricultural structures

Animal Science/Animal Systems (AS)—the study of animal systems, including life processes, health, nutrition, genetics, management and processing, through the study of small animals, aquaculture, livestock, dairy, horses and/or poultry

Environmental Service Systems (ESS)—the study of systems, instruments and technology used in waste management and their influence on the environment

Food Products and Processing Systems (FPP)—the study of product development, quality assurance, food safety, production, sales and service, regulation and compliance, and food service within the food science industry

Natural Resource Systems (NRS)—the study of the management of soil, water, wildlife, forests and air as natural resources

Horticulture/Plant Systems (PS)—the study of plant life cycles, classifications, functions, structures, reproduction, media and nutrients, as well as growth and cultural practices, through the study of crops, turf grass, trees and shrubs and/or ornamental plants

Note that the AFNR standards pathways do not indicate aquaculture as an independent pathway. Aquaculture standards are drawn from various pathways, most notably Animal Systems.

Students are expected to follow a specific course of study related to their career interests and goals that will prepare them for further study after high school or direct entry into the workplace. Some students may elect to pursue study in two diverse areas. Course selection is developed with the assistance of the SAE advisors and classroom teachers.

Agri-Science III students will continue to have opportunities to further develop leadership skills through participation in the FFA. Students at this stage are encouraged to participate in FFA Career Development Events (CDEs) in order to further develop skills.

Agri-Science III agricultural mechanics students study the physical science and engineering principles which govern the design, construction, operation and maintenance of equipment and technical systems used in agriculture and related fields. Topics include: internal combustion engines, mechanical power transmission, fluid power, environmental control and the biological and horticultural principles which govern the use and maintenance of equipment used to support living systems. Opportunities for practical application of lessons learned are given in the engine lab, shop, greenhouse and school landscape.

Units
Energy and the Environment
Small Engines
Machine Design
Landscape Equipment

Title: Agri-Science II Supervised Agricultural Experience (SAE)

Unit Overview: SAE is a vital aspect of agricultural education. As part of Agri-Science I & II students have explored their options and developed work experience programs suitable for young students exploring agriculture as a career. Students have learned how to keep records and the best methods for documenting their day to day work as well as their progress. By the end of Agri-Science II students have developed and implemented a clear plan for supervised work experience relating to their interests and career goals.

Agri-Science III students are expected to demonstrate increased responsibility and new learning relative to their SAEs. Through advanced SAE work, students may be more involved in starting and operating their own businesses or taking employment in agriculturally-related enterprises. It is strongly recommended that students apply for local and state FFA proficiency awards as well as the FFA State Degree.

SAE advisors work with individual students, parents, work-site mentors, and employers to ensure student activities are appropriate, meet student needs, and are in compliance with state labor laws. All students work with their SAE advisors to complete the Universal Structured Work-Based Learning Plan. In addition, some students must complete the Connecticut Department of Labor forms LED 75-1 (Workplace Learning Experiences for Minor Students in Hazardous Occupations) or the LED 31-23 (Workplace Learning Experiences for Minor Students Ages 14 or 15 in Non-Hazardous Occupations), or Unpaid Work Experience forms.

Suggested Time: On-going

Ledyard High School Expectations for Student Learning:

Read and write critically and effectively for a variety of purposes
Speak clearly and communicate ideas accurately in a variety of settings
Demonstrate critical thinking skills

Agriculture, Food, and Natural Resources Standards:

- CS.01.01.07.c** Evaluate actions taken and make appropriate modifications to personal goals.
- CS.01.03.02.c.** Create a plan of action to complete a task based on a conceptualized idea
- CS.01.06.03.c** Use problem solving strategies to solve a professional or personal issue
- CS.01.06.05.c** Implement a plan to develop new knowledge and skills related to professional and personal aspirations
- CS.02.03.03.c.** Demonstrate employability skills for a specific career
- CS.03.01.01.b.** Select the appropriate form of technical and business writing or communication for a specific situation.

CS.03.02.03.b. Practice ethical behaviors.

CS.07.04.01.c. Apply general workplace safety precautions/procedures.

CS.08.01.01.c. Use tools and equipment appropriately to complete a specific task.

ABS.03.01.01.a Maintain production and agri-business records

Common Core State Standards

RST.11-12.4 Determine the meaning of words and phrases as they are used in text, including analyzing how an author uses and refines the meaning of a key term over the course of a text

WHST.11-12.1.e Provide a concluding statement or section that follows from or supports the argument presented.

WHST.11-12.2a Introduce a topic and organize complex ideas, concepts, and information so that each new element builds on that which precedes it to create a unified whole; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension

WHST.11-12.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience

MP 6 Attend to precision

Objectives	Required Activities/ Suggested Activities	AFNR Standards/CCSS
Implement planned improvements to enhance or improve work experience program	<ul style="list-style-type: none"> • Develop and expand work experience activities/projects in line with career goals • Write SMART goals for SAE improvement over the year 	CS.01.01.07.c CS.01.03.02.c CS.01.06.03.c CS.01.06.05.c CS.02.03.03.c. ABS.03.01.01.a RST.11-12.4 WHST.11-12.4
Accurately (or independently) complete appropriate work experience forms utilizing AFNR standards	<ul style="list-style-type: none"> • Identify key skills necessary to complete the Structured Work-Based Learning Form using AFNR standards • Complete appropriate CT Departments of Labor and Education forms for student work experience independently 	CS.01.06.05.c CS.02.03.03.b. CS.03.01.01.b. WHST.9-10.4
Demonstrate effective and appropriate work skills	<ul style="list-style-type: none"> • Work safely and effectively • Document safe handling of equipment, plants, 	CS.01.06.03.c CS.02.03.03.c.

	<ul style="list-style-type: none"> and animals • Demonstrate appropriate workplace skills such as time management, interpersonal skills, organization, communication, technology and tool use, and problem solving 	CS.01.06.05.c CS.03.02.03.b. CS.07.04.01.c. CS.08.01.01.c. ABS.03.01.01.a RST.11-12.4 WHST.11-12.4
Develop and maintain clear records	<ul style="list-style-type: none"> • Document time spent in activities, skills learned, income, and expenses • Keep all SAE records in a well-organized binder • Provide evidence of work using photographs, videos, and journals • Meet with SAE advisor weekly during the school year and at least once during the summer • Set up/organize appointments with SAE advisor and employer/supervisor/parent 	CS.02.03.03.c. CS.03.01.01.b. ABS.03.01.01.a RST.11-12.4 WHST.11-12.1.e WHST.11-12.2a WHST.11-12.4

Vocabulary

- 501(c)(3)
- Entrepreneurship
- Hazardous Occupations
- Liability
- Non-Profit Entity
- Paid Placement
- Structured Work-Based Learning Plan
- Volunteer
- Worker's Compensation
- Work-site Mentor

Assessments:

- Weekly record checks
- Monthly and annual summaries
- On-site visits by advisor in coordination with parent/supervisor/employer
- SAE rubrics

Resources/Materials:

- AFNR Standards
- Binder and record sheets
- SDE/SDOL employment forms

Title: Small Engines

Unit Overview:

This unit provides an introduction to the theory and operation of 2- and 4-stroke internal combustion engines.

Suggested Time: One quarter

Ledyard High School Expectations for Student Learning:

Read and write critically and effectively for a variety of purposes
Speak clearly and communicate ideas accurately in a variety of settings.
Employ problem-solving skills effectively.
Employ effective research and study skills
Demonstrate critical thinking skills.

Agriculture, Food, and Natural Resources Standards:

- CS.01.01.01.c.** Work independently and in group settings to accomplish a task.
- CS.06.02.01.c.** Educate other workers to improve health, safety, and environmental performance in a safe manner.
- CS.07.01.01.b.** Use appropriate personal protective equipment for a given task.
- CS.07.04.01.c.** Apply general workplace safety precautions/procedures.
- CS.07.04.02.a.** Handle chemicals and equipment in a safe and appropriate manner.
- CS.07.04.02.b.** Maintain AFNR facilities to promote health and safety.
- CS.08.01.01.c.** Use tools and equipment appropriately to complete a specific task.
- CS.08.01.02.b.** Demonstrate appropriate operation, storage, and maintenance techniques for tools and equipment.
- PST.01.03.01.a.** Identify and demonstrate safe use and maintenance of measurement and layout tools.
- PST.01.03.01.b.** Select, maintain and use hand and power tools in service, construction and fabrication.
- PST.02.01.02.a.** Service filtration systems and maintain fluid levels on power units and equipment.
- PST.02.02.02.b.** Demonstrate safe practices and regulations in the operation of power units and equipment.
- PST.03.01.01.a.** Identify components and systems of internal combustion engines.
- PST.03.01.01.b.** Utilize technical manuals and computer-based diagnostics in engine analysis and repair.
- PST.03.01.02.a.** Describe the operation of internal combustion engines by types of fuel used.
- PST.03.01.02.b.** Analyze and troubleshoot internal combustion engines.

Common Core State Standards:

- WHST.11-12.2** Use precise language, domain-specific vocabulary and techniques such as metaphor, simile, and analogy to manage the complexity of the topic; convey a knowledgeable stance in a style that responds to the discipline and context as well as to the expertise of likely readers.
- WHST 11-12.4** Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose and audience
- RST 11-12.4** Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11-12 texts and topics.
- SL.11.-12.4** Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.
- MP1** Make sense of problems and persevere in solving them.
- MP2** Reason abstractly and quantitatively.
- MP4** Model with mathematics.
- MP5** Use appropriate tools strategically.
- MP6** Attend to precision

Objectives	Required Activities/ Suggested Activities	AFNR Standards/CCSS
Work safely and efficiently with engines.	<ul style="list-style-type: none"> • Maintain a clean and safe shop environment. • Demonstrate procedures for maintaining a safe shop such as cleaning equipment and surroundings as well as determining and eliminating potential workplace hazards. • Describe the causes, symptoms and appropriate response to CO exposure. 	CS.06.02.01.a CS.07.01.01.b CS.07.04.01.c. CS.07.04.02.a. CS.07.04.02.b. CS.08.01.02.b CS.08.02.01.a PST.02.02.02.b. SL 11.-12.4
Explain the operation of internal combustion engines, differentiating between diesel, 4-stroke spark and 2-stroke spark ignition engines.	<ul style="list-style-type: none"> • Describe each step in the diesel, 2-stroke and 4-stroke cycles. • Develop a dramatization that summarizes the events of a specified engine cycle. • Specify a type and size of engine for the design of a piece of agricultural or natural resource equipment, providing rational for the 	CS.01.01.01.c. PST.03.01.01.a. PST.03.01.02.a SL 11.-12.4

	decision based on general characteristics of the engine.	
Describe the role of lubricants, coolants, and fuel in the operation of gas engines.	<ul style="list-style-type: none"> Using manufacturer's specifications, add engine oil to a 4-stroke engine. Mix gasoline with 2-stroke oil according to specifications. Analyze case studies of engine troubles due to the absence, inappropriate type, contamination or breakdown of lubricating oil. Perform calculations of gasoline octane rating. 	CS.07.01.01.b. CS.07.04.01.c. CS.07.04.02.a. PST.02.01.02.a. PST.03.01.01.b. RST 11-12.4 SL.11.-12.4 MP4 MP5 MP6
Identify the components of small engines and describe their functions	<ul style="list-style-type: none"> Disassemble and reassemble a small engine, returning it to operating condition. Maintain a journal of activities. Develop a catalog of engine components with pictures, diagrams and descriptions of key components. Mount an engine on an appropriate base, evaluate it for compression, spark and presence of fuel and lubricant. Start the engine and adjust it for smooth operation. 	CS.01.01.01.c. PST.01.03.01.a. PST.01.03.01.b. PST.02.02.02.b. PST.03.01.01.a. PST.03.01.01.b. PST.03.01.02.a. PST.03.01.02.b. RST 11-12.4 WHST.11-12.2 WHST 11-12.4
Identify and select tools used in the repair and maintenance of small engines	<ul style="list-style-type: none"> Demonstrate the use of vane and click-type torque wrenches to tighten a fastener to a specified torque. Select appropriate tools and sizes to disassemble and reassemble a small engine. 	CS.08.01.01.c. CS.08.01.02.b. PST.01.03.01.a. PST.01.03.01.b. RST 11-12.4
Perform precision measurements of engine components to determine service requirements.	<ul style="list-style-type: none"> Use printed diagrams of Vernier micrometer readings to practice reading Vernier micrometers. Measure the crankpin journal of an engine and 	CS.08.01.01.c. CS.08.01.02.b. PST.01.03.01.a. PST.03.01.01.b.

	<p>compare to the published data.</p> <ul style="list-style-type: none"> • Measure the bore and stroke of an engine to calculate the engine displacement and determine wear. • Use a <i>feeler gauge</i> to measure valve clearance and ring gaps. • Measure and adjust the spark gap of a spark plug using a <i>feeler gauge</i> or <i>gapping tool</i>. 	<p>RST 11-12.4 MP4 MP5 MP6</p>
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Italicized items indicate technology use

Vocabulary:

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| <ul style="list-style-type: none"> • Air Filter • Bore • Bottom dead center • Breather • Camshaft • Carbon Monoxide • Carburetor • Compression • Compression Ignition • Crankcase • Crankshaft • Crankshaft throw • Cylinder • Diesel Ignition | <ul style="list-style-type: none"> • Exhaust • External Combustion Engine • Fire Triangle • Flywheel • Head gasket • Heat engine • Intake • Internal Combustion Engine • Magneto • Mechanical governor • Muffler • Oil slinger • Piston • Piston displacement | <ul style="list-style-type: none"> • Piston ring • Pneumatic governor • Power Stroke • Reed valve • Reject size • Solid-State Ignition System • Spark gap • Spark Ignition Engine • Spark plug • Stoichiometric • Stroke • Top dead center • Valve |
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Assessments:

- Written quizzes and tests
- Skill assessments
- Catalog assessment
- Restoration of engine to operation with associated rubric

Resources/Materials:

- Agricultural Mechanics: Fundamentals and Applications, Delmar, multiple editions
- Small Gas Engines, Goodheart-Willcox
- Small Engines, American Technical Publishers
- Online Octane Calculator at <http://www.csgnetwork.com/octaneratecalc.html>
- Briggs and Stratton Repair Manual for Single Cylinder 4-Cycle Engines, multiple editions as appropriate to the engine.
- How to Read a Vernier Micrometer <http://www.linnbenton.edu/auto/day/mike/vernier.html>

Title: Energy and the Environment

Unit Overview:

Energy and Environment provides students with an understanding of how energy is measured, transformed and used. Emphasis is given to the application of these principles to environmental control in agricultural systems.

Suggested Time: One quarter

Ledyard High School Expectations for Student Learning:

Read and write critically and effectively for a variety of purposes
Speak clearly and communicate ideas accurately in a variety of settings.
Employ problem-solving skills effectively.
Employ effective research and study skills
Demonstrate critical thinking skills.

Agriculture, Food, and Natural Resources Standards:

- CS.06.02.01.a.** Use proper safety practices/personal protective equipment.
- CS.07.01.01.b.** Use appropriate personal protective equipment for a given task.
- CS.07.04.01.c.** Apply general workplace safety precautions/procedures.
- CS.07.04.02.a.** Handle chemicals and equipment in a safe and appropriate manner.
- CS.07.04.02.b.** Maintain AFNR facilities to promote health and safety.
- CS.08.01.01.c.** Use tools and equipment appropriately to complete a specific task.
- CS.08.01.02.b.** Demonstrate appropriate operation, storage, and maintenance techniques for tools and equipment.
- CS.11.02.01.b.** Implement an experimental design to test a formulated hypothesis.
- PST.01.03.01.a.** Identify and demonstrate safe use and maintenance of measurement and layout tools.
- PST.01.01.01.a** Identify renewable and nonrenewable energy sources and pathways of delivery.
- PST.03.02.01.a** Identify and describes applications of simple machines in power systems
- PST.03.02.02.a** Calculate mechanical advantage in mechanical systems.
- PST.03.02.03.a.** Identify power transfer principles, including those using friction, gears and fluids.
- PST.03.04.01.a** Apply the meaning and measurement of electricity, including amperage, voltage and wattage.
- PST.03.05.01.a** Identify principles of heat and temperature measurement
- PST.03.06.01.a** Identify and describe principles of motion, including speed, velocity and acceleration
- PST.03.06.02.a** Identify principles of force on acceleration including friction and gravity

PST.04.01.01.b. Develop plans and sketches using drafting equipment and computer programs.

PST.04.04.04.a. Calculate efficiencies gained through insulation.

Common Core State Standards:

WHST.11-12.2 Use precise language, domain-specific vocabulary and techniques such as metaphor, simile, and analogy to manage the complexity of the topic; convey a knowledgeable stance in a style that responds to the discipline and context as well as to the expertise of likely readers.

WHST 11-12.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose and audience

RST 11-12.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11-12 texts and topics.

SL.11.-12.4 Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.

MP1 Make sense of problems and persevere in solving them.

MP2 Reason abstractly and quantitatively.

MP4 Model with mathematics.

MP5 Use appropriate tools strategically.

MP6 Attend to precision.

Objectives	Required Activities/ Suggested Activities	AFNR Standards/CCSS
Work safely and efficiently in a shop.	<ul style="list-style-type: none"> • Maintain a clean and safe shop environment. • Demonstrate procedures for maintaining a safe shop such as cleaning equipment and surroundings as well as determining and eliminating potential workplace hazards. 	CS.06.02.01.a CS.07.01.01.b CS.07.04.01.c. CS.07.04.02.a. CS.07.04.02.b. CS.08.01.02.b
Identify forms of energy and convert between their measures in conventional and SI units.	<ul style="list-style-type: none"> • Classify forms of energy released by various sources. • Use tables of equivalent values to perform conversions between units of work and energy. 	PST.03.02.03.a PST.03.04.01.a PST.03.05.01.a PST.03.06.01.a RST 11-12.4 SL.11.-12.4

Identify and relate force, work and power	<ul style="list-style-type: none"> Analyze real and simulated mechanical systems for force, work and power. Compete in a human power activity such as lifting a weight on a string by winding the string around a piece of broom handle. Students calculate rate of work produced by members of their team. 	PST.03.04.01.a PST.03.05.01.a PST.03.06.01.a RST 11-12.4 MP4 MP6
Identify and analyze applications of simple machines in power systems.	<ul style="list-style-type: none"> Analyze the performance of simple machines such as levers or a chain hoist using weights and spring scales. Identify and classify applications of levers in everyday life. 	PST.01.03.01.a. PST.03.02.01.a PST.03.02.02.a MP4 MP6
Calculate and relate potential, kinetic and total mechanical energy of objects at rest and in motion.	<ul style="list-style-type: none"> Use online resources such as the Energy Skate Park to visualize and quantify energy conversions in mechanical systems Construct a simple machine that converts potential energy to kinetic energy and measure its performance. 	PST.01.03.01.a. PST.03.06.01.a PST.03.06.02.a MP4 MP6
Calculate system efficiencies	<ul style="list-style-type: none"> Calculate the efficiency of a simple machine that converts potential energy to kinetic energy. Use a Prony brake or dynamometer to determine the efficiency of a small engine or electric motor. 	CS.01.01.01.c. PST.01.03.01.a. MP4 MP5 MP6
Describe and quantify heat losses from a structure by conduction, leakage and radiation	<ul style="list-style-type: none"> Design and perform an experiment to investigate the factors which affect rate of heat exchange by conduction. Construct a structure such as a low hoop house or animal housing and predict its performance based on heat loss equations. Calculate the size of a heating unit needed to maintain temperature in a structure. Calculate heat savings resulting from changes in covering materials on a structure or components of the structure such as windows. 	CS.08.01.01.c. CS.11.02.01.b. PST.04.04.04.a. RST 11-12.4 WHST.11-12.2 WHST 11-12.4 MP1 MP2 MP4 MP5 MP6

Prepare clear, concise technical reports that include text, figures and tables.	<ul style="list-style-type: none"> • Write-up the experiment to investigate the factors which affect rate of heat exchange 	CS.08.01.01.c. CS.08.01.02.b. PST.01.03.01.a. PST.03.01.01.b. PST.04.01.01.b. RST 11-12.4 WHST.11-12.2 WHST 11-12.4
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Italicized items indicate technology use

Vocabulary:

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|--|---|--|
| <ul style="list-style-type: none"> • BTU • Gravitational constant • Horsepower • Kilowatt-hour • Kinetic energy | <ul style="list-style-type: none"> • Latent heat • Perpetual motion machine • Potential energy • R-value • Sensible heat | <ul style="list-style-type: none"> • Slug • Specific heat • Specific heat of vaporization |
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Assessments:

- Written quizzes and tests
- Lab reports

Resources/Materials:

- Energy Skate Park online or download version from <http://phet.colorado.edu/en/simulation/energy-skate-park>
- Dynamics section of any physics textbook.
- Energy Skate Park at <http://phet.colorado.edu/en/simulation/energy-skate-park>
- Agricultural Mechanics: Fundamentals and Applications. Cooper. Delmar, multiple editions.
- Midwest Plan Service Structures and Environment Handbook, multiple editions.
- Everyday Sketching and Drafting, Glachino and Beukama (LHS Ag-Sci Library)
- Software with simple drawing capability such as Microsoft PowerPoint or Word or Google Sketchup.
- Spring scales to measure force of pull; scale or balance to weigh projectiles

Title: Power and Controls

Unit Overview:

The Power and Controls unit familiarizes students with systems for generation, transmission and control of mechanical energy. Emphasis is given to belt, gear, pneumatic and hydraulic systems.

Suggested Time: One quarter

Ledyard High School Expectations for Student Learning:

Read and write critically and effectively for a variety of purposes
Speak clearly and communicate ideas accurately in a variety of settings.
Employ problem-solving skills effectively.
Employ effective research and study skills
Demonstrate critical thinking skills.

Agriculture, Food, and Natural Resources Standards:

- CS.06.02.01.a.** Use proper safety practices/personal protective equipment.
- CS.07.01.01.b.** Use appropriate personal protective equipment for a given task.
- CS.07.04.01.c.** Apply general workplace safety precautions/procedures.
- CS.07.04.02.a.** Handle chemicals and equipment in a safe and appropriate manner.
- CS.07.04.02.b.** Maintain AFNR facilities to promote health and safety.
- CS.08.01.01.c.** Use tools and equipment appropriately to complete a specific task.
- CS.08.01.02.b.** Demonstrate appropriate operation, storage, and maintenance techniques for tools and equipment.
- PST.03.02.01.a** Identify and describes applications of simple machines in power systems
- PST.03.02.02.a** Calculate mechanical advantage in mechanical systems.
- PST.03.02.03.a.** Identify power transfer principles, including those using friction, gears and fluids.
- PST.03.03.01.a.** Describe features, benefits and applications of common types of hydraulic and pneumatic systems.
- PST.03.03.01.b.** Describe principles of hydraulic and pneumatic system operation.
- PST.03.03.02.a.** Apply hydrostatic and hydrodynamic principles in hydraulics and pneumatics, including Archimedes' principle and Pascal's law.
- PST.03.03.02.b.** Identify major components of hydraulic and pneumatic systems and describe their use.
- PST.03.03.03.a.** Evaluate hydraulic and pneumatic system functionality.
- PST.03.03.03.b.** Identify hydraulic and pneumatic system fittings and ports.

PST.04.01.01.b. Develop plans and sketches using drafting equipment and computer programs.

Common Core State Standards:

- WHST.11.-12.2** Use precise language, domain-specific vocabulary and techniques such as metaphor, simile, and analogy to manage the complexity of the topic; convey a knowledgeable stance in a style that responds to the discipline and context as well as to the expertise of likely readers.
- WHST 11.-12.4** Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose and audience
- RST 11.-12.4** Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11-12 texts and topics.
- SL.11-12.4** Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.
- MP1** Make sense of problems and persevere in solving them.
- MP2** Reason abstractly and quantitatively.
- MP4** Model with mathematics.
- MP5** Use appropriate tools strategically.
- MP6** Attend to precision

Objectives	Required Activities/ Suggested Activities	AFNR Standards/CCSS
Work safely and efficiently in a shop.	<ul style="list-style-type: none"> • Maintain a clean and safe shop environment. • Demonstrate procedures for maintaining a safe shop such as cleaning equipment and surroundings as well as determining and eliminating potential workplace hazards. 	CS.06.02.01.a CS.07.01.01.b CS.07.04.01.c. CS.07.04.02.a. CS.07.04.02.b. CS.08.01.02.b. CS.08.01.01.c.
Predict the performance of gear trains or ganged pulleys.	<ul style="list-style-type: none"> • Calculate mechanical advantage and rates of rotation for simple and ganged gear and pulley systems. • Analyze performance of actual pulley systems 	PST.03.02.01.a PST.03.02.02.a PST.03.02.03.a. MP 4

	and quantify losses from friction and slippage.	
State and demonstrate the basic principles of hydraulics and pneumatics.	<ul style="list-style-type: none"> Construct a simple device which uses medical syringes as either pneumatic or hydraulic cylinders. Use the device to perform a task such as lifting or moving a small object. Analyze the performance of a bottle jack. Sketch the jack, showing the levers and hydraulic cylinders that contribute to the total mechanical advantage. Construct working hydraulic systems and analyze their performance. 	PST.03.02.02.a PST.03.02.03.a PST.03.03.01.a. PST.03.03.01.b. PST.03.03.02.a. SL 11.-12.4 WHST 11.-12.4 MP4
Calculate static head in hydraulic systems and determine dynamic head and head losses	<ul style="list-style-type: none"> Construct a manometer and use it to measure pressure in static and dynamic hydraulic systems. Measure dynamic performance of an aquarium water pump and graph the pump performance curve. Construct a hydraulic device and evaluate its performance. 	PST.03.03.02.a. PST.04.01.01.b. RST 11.-12.4 SL 11.-12.4 WHST 11.-12.2 WHST 11.-12.4 MP4 MP5 MP6
Calculate the power requirements for hydraulic and pneumatic systems.	<ul style="list-style-type: none"> Use published tables of friction losses to size a pump for an aquaculture or irrigation system. 	PST.03.03.03.a. RST 11.-12.4 SL 11.-12.4 WHST 11.-12.2 WHST 11.-12.4 MP4 MP6
Identify and describe the function of components of hydraulic and pneumatic systems.	<ul style="list-style-type: none"> Construct low-pressure equivalents of hydraulic components Read a basic schematic diagram of a hydraulic system, identifying the application of the system and individual components. Diagram the layout of the hydraulic 	PST.03.03.02.b. PST.03.03.03.a. PST.03.03.03.b. PST.04.01.01.b. RST 11.-12.4 WHST 11.-12.4

	components of a <i>farm tractor</i> . <ul style="list-style-type: none"> • Repack and install a hydraulic cylinder • Construct a hydraulic lift or other project using a <i>hydraulic pump</i> and cylinder. 	
Prepare clear, concise technical reports that include text, figures and tables.	<ul style="list-style-type: none"> • Write-up the procedure used to measure performance of a pump. • Document the construction of a hydraulically controlled robotic arm. 	CS.08.01.01.c. CS.08.01.02.b. PST.01.03.01.a. PST.03.01.01.b. PST.04.01.01.b. RST 11-12.4 WHST.11-12.2 WHST 11-12.4 MP2 MP4 MP6

Italicized items indicate technology use

Vocabulary:

- | | | |
|--|---|---|
| <ul style="list-style-type: none"> • Accumulator • Block and Tackle • Chain hoist • Check valve • Closed-Center System • Cylinder • Double-Acting Cylinder • Dynamic Head • Hydraulic | <ul style="list-style-type: none"> • Idler • Open –Center System • Pitch • Pneumatic • Positive Displacement • Pump • Reservoir • Single-Acting Cylinder • Specific heat | <ul style="list-style-type: none"> • Spool Valve • Sprocket • Spur Gear • Static Head • Torque • Transition • Vee Belt |
|--|---|---|

Assessments:

- Written quizzes and tests
- Project and Lab reports

Resources/Materials:

- VEX Robotics Curriculum at <http://curriculum.vexrobotics.com/home> - Units 7-10
- Hydraulics, John Deere Fundamentals of Service Series (LHS Ag-Sci library)
- Agricultural Power and Machinery, Jacobs and Harrell, McGraw-Hill.
- Medical syringes of various sizes and 3/16 nylon air hose for hydraulic robots.
- Hydraulic components and lines appropriate to projects
- Hydraulic trainer with pump, controls, actuators and gauges.

Title: Landscape Equipment

Unit Overview:

This unit is an introduction to the equipment used in landscape construction and maintenance. The unit is intended to allow students with a horticulture or landscape design background to become familiar with equipment principles applicable to these areas, while providing those with strong mechanical skills opportunities to expand their skills as well as to explore the connections between machinery and the landscape.

Suggested Time: One quarter

Ledyard High School Expectations for Student Learning:

Read and write critically and effectively for a variety of purposes
Speak clearly and communicate ideas accurately in a variety of settings.
Employ problem-solving skills effectively.
Employ effective research and study skills
Demonstrate critical thinking skills.

Agriculture, Food, and Natural Resources Standards:

- ABS.04.01.02.b** Use accounting information to estimate the cost of goods sold and margins on the goods
- ABS.05.01.04.a** Calculate percentages, ratios, and related business applications
- CS.06.02.01.a.** Use proper safety practices/personal protective equipment.
- CS.07.01.01.b.** Use appropriate personal protective equipment for a given task.
- CS.07.04.01.c.** Apply general workplace safety precautions/procedures.
- CS.07.04.02.a.** Handle chemicals and equipment in a safe and appropriate manner.
- CS.08.01.01.c.** Use tools and equipment appropriately to complete a specific task.
- CS.08.01.02.b.** Demonstrate appropriate operation, storage, and maintenance techniques for tools and equipment.
- ESS.06.02.01.a.** Demonstrate proper use and maintenance of hand tools.
- ESS.06.02.01.b.** Operate equipment and machinery in accordance with manufacturers' instructions and OSHA standards, specifically addressing personal protective equipment and proper machine guarding.
- ESS.06.02.01.c.** Demonstrate proper preventive maintenance techniques and set up a mock preventive maintenance schedule.
- PS.02.03.01.b.** Describe nutrient deficiency symptoms and recognize environmental causes of nutrient deficiencies.
- PS.02.03.04.b.** Calculate the amount of fertilizer to be applied and calibrate equipment to apply the prescribed amount of fertilizer.
- PS.03.01.02.a.** Demonstrate sowing techniques and provide favorable conditions for seed germination.

- PS.03.02.05.b** Demonstrate proper techniques to control and manage plant growth through mechanical, cultural or chemical means
- PS.03.03.01.b.** Identify major local weeds, insect pests and infectious and noninfectious plant diseases.
- PS.03.03.03.a.** Describe pest control strategies associated with integrated pest management.
- PS.03.03.04.b.** Explain procedures for the safe handling, use and storage of pesticides.
- PST.01.02.01.b.** Classify lubricants by SAE viscosity and API service classifications.
- PST.01.02.01.c.** Select, use and dispose of lubricants.
- PST.01.03.01.b.** Select, maintain and use hand and power tools in service, construction and fabrication.
- PST.02.01.01.a.** Identify and schedule power unit and equipment lubrication.
- PST.02.01.02.a.** Service filtration systems and maintain fluid levels on power units and equipment.
- PST.02.01.02.b.** Adjust equipment, including belts and drives, chains and sprockets, and maintain fluid conveyance components, such as hoses, lines and nozzles.
- PST.02.02.01.a.** Identify power unit and equipment controls and instruments, along with their functions.
- PST.02.02.01.b.** Perform start-up and shut-down procedures on power units and equipment as specified in technical manuals.
- PST.02.02.02.b.** Demonstrate safe practices and regulations in the operation of power units and equipment.
- PST.03.01.01.a.** Identify components and systems of internal combustion engines.
- PST.03.01.01.b.** Utilize technical manuals and computer-based diagnostics in engine analysis and repair.
- PST.03.01.02.b.** Analyze and troubleshoot internal combustion engines.
- PST.05.02.02.c.** Troubleshoot electrical system performance problems.

Common Core State Standards:

- WHST 11.-12.2** Use precise language, domain-specific vocabulary and techniques such as metaphor, simile, and analogy to manage the complexity of the topic; convey a knowledgeable stance in a style that responds to the discipline and context as well as to the expertise of likely readers.
- WHST 11.-12.4** Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose and audience
- RST 11.-12.4** Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11-12 texts and topics.
- SL 11.-12.4** Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.
- MP1** Make sense of problems and persevere in solving them.
- MP2** Reason abstractly and quantitatively.
- MP4** Model with mathematics.
- MP5** Use appropriate tools strategically.
- MP6** Attend to precision

Objectives	Required Activities/ Suggested Activities	AFNR Standards/CCSS
Work safely and effectively in the shop and in the field.	<ul style="list-style-type: none"> • Maintain a clean and safe work environment. • Demonstrate procedures for maintaining a safe working environment • Identify hazards inherent to working in the shop and in the field 	CS.06.02.01.a CS.07.01.01.b CS.07.04.01.c. CS.07.04.02.a. CS.08.01.01.c. CS.08.01.02.b ESS.06.02.01.b. PS.03.03.04.b.
Maintain hand tools key to working in agriculture.	<ul style="list-style-type: none"> • Clean, sharpen and lubricate hand tools. 	CS.07.04.01.c. ESS.06.02.01.a.
Maintain power equipment including push mowers, rider mowers and string trimmers.	<ul style="list-style-type: none"> • Clean and perform routine maintenance tasks to prepare landscape equipment for the season or for storage. • Develop a preventive maintenance schedule for a tractor or rider lawnmower based on manufacturers recommendations and good practice. • Mix 2-stroke oil and gasoline according to manufacturers' recommendations. • Calibrate a spreader or boom sprayer 	ESS.06.02.01.c. PS.02.03.04.b. PST.01.03.01.b. PST.01.02.01.b. PST.01.02.01.c. PST.02.01.01.a PST.02.01.02.a. PST.02.01.02.b. WHST 11-12.2 WHST 11-12.4 RST 11-12.4 MP2 MP4 MP6
Diagnose and correct fuel and spark problems in gasoline-powered equipment.	<ul style="list-style-type: none"> • Analyze case studies of engine performance problems and determine the likely cause of the problem. • Diagnose and correct fuel and spark problems in power equipment such as push mowers and string trimmers. • Analyze the water content of gasoline and 	PST.02.02.01.a. PST.02.02.01.b. PST.02.02.02.b. PST.03.01.01.a. PST.03.01.01.b. PST.03.01.02.b. RST 11-12.4

	recommend appropriate actions.	SL 11.-12.4 WHST.11-12.2 WHST 11-12.4 MP4 MP6
Diagnose and correct electrical system problems in power equipment.	<ul style="list-style-type: none"> • Diagram the electrical system of a rider mower. • Use a <i>multimeter</i> or <i>battery tester</i> to evaluate the condition of a storage battery • Demonstrate procedures for safely charging a vehicle battery 	PST.02.02.01.a. PST.05.02.02.c. MP5 MP6
Estimate the time, labor, equipment and materials required to service a property and estimate charges to the client.	<ul style="list-style-type: none"> • Determine the time, labor, equipment and materials required to service a property and estimate charges to the client. • Interview the owner of a landscaping business. Collect information on the methods used to maintain property and determine fees. 	ABS.05.01.04.a SL 11.-12.4 WHST.11-12.2 WHST 11-12.4 MP4 MP6
Demonstrate procedures for establishing and maintaining turf.	<ul style="list-style-type: none"> • Determine the best type of grass mixture for a specific purpose • Prepare land, seed and maintain turf • Demonstrate the proper procedures for cutting a lawn with a push or rider mower. • Apply lime or fertilizer to turf. 	ABS.04.01.02.b PS.02.03.01.b PS.03.01.02.a. PS.03.02.05.b PS.03.03.03.a. PS.03.03.04.b. RST 11-12.4 MP4 MP6
Demonstrate procedures for pruning trees and ornamental shrubs	<ul style="list-style-type: none"> • Identify the various reasons for pruning • Discriminate between pruning and shearing and describe when each would be used • Demonstrate proper pruning techniques on landscape trees and shrubs 	CS.06.02.01.a. CS.07.01.01.b. CS.07.04.01.c PS.03.02.05.b PS.03.03.03.a. SL 11.-12.4

Italicized items indicate technology use

Vocabulary:

- Alternator
- Collar
- Compression
- Cool-season Grasses
- Heading
- Heat Stroke
- Hypothermia
- Irrigation
- Leader/Lead Branch
- Plugging
- Scaffold Branch
- Seeding
- Sod
- Sprigging
- Sucker
- Thatch
- Thinning
- Turf
- Warm-season Grasses
- Water Sprout
- Winterize

Assessments:

- Written quizzes and tests
- Lab reports

Resources/Materials:

- Agricultural Mechanics: Fundamentals and Applications. Cooper. Delmar, multiple editions
- Briggs and Stratton, Tecumseh and other repair manuals stored in the engine room or online.
- HOSTA Curriculum materials found at <http://extension.psu.edu/business/aq-safety/youth-safety>, 1/2015
- Iowa Western Horticulture course materials found at <https://sites.google.com/a/w-harrison.k12.ia.us/whagdepartment/horticulture>, 1/2015
- North American Guidelines for Children's Agricultural Tasks (NAGCAT) found at <http://www.nagcat.org/nagcat/> 1/2015
- Ornamental Horticulture, Ingels, Delmar
- OSHA Landscape Hazards and Solutions materials found at <https://www.osha.gov/SLTC/landscaping/hazards.html>, 1/2015
- Pruning Techniques; Brooklyn Botanic Garden Record. Cook. Sterling Pub (Brooklyn Botanical Garden),
- Replacement parts such as head gaskets, crankcase gaskets, and governor springs, as-needed.
- Shop tools, Oil, Gasoline and grease for engines
- Small Engine Repair Made Easy, Ramsey. Publications International
- Small Gas Engines. Roth. Goodheart-Wilcox.
- Turfgrass extension information found at <http://plantscience.psu.edu/research/centers/turf/extension>, 1/2015
- Working in Horticulture. Richardson and Moore. McGraw-Hill, 1980