THE WASHINGTON STATE BOARD OF EDUCATION

A high-quality education system that prepares all students for college, career, and life.

Title:	**Career and Technical Education Course Equivalency Frameworks—Consideration of Approval**	
As related to:	☐ **Goal One:** Develop and support policies to close the achievement and opportunity gaps. ☐ **Goal Two:** Develop comprehensive accountability, recognition, and supports for students, schools, and districts.	☒ **Goal Three:** Ensure that every student has the opportunity to meet career and college ready standards. ☐ **Goal Four:** Provide effective oversight of the K-12 system. ☐ **Other**
Relevant to Board roles:	☐ Policy leadership ☒ System oversight ☐ Advocacy	☐ Communication ☐ Convening and facilitating
Policy considerations / Key questions:	The Board will review the Career and Technical Education (CTE) course equivalency list and frameworks and consider approving statewide course equivalencies. Key questions include: • Does the process for developing the course equivalencies and frameworks support strong incorporation of math, science and CTE standards? • From the perspective of non-content-experts, do the CTE standards and the core content standards appear to mesh well into a single course? • Is the course likely to help students meet both academic and career goals?	
Relevant to business item:	The Board will consider approval of new course equivalencies in Agricultural Power and Technology, and Viticulture.	
Materials included in packet:	Memo and CTE course equivalency frameworks. Presentation by staff from the Office of the Superintendent of Public Instruction is in additional materials.	
Synopsis:	E2SSB 6552, passed in 2014, increased the responsibility of districts to provide students access to CTE course equivalencies in science and math. The bill directed the State Board of Education (SBE) to review a list of equivalent CTE courses developed by the Office of the Superintendent of Public Instruction (OSPI), provide an opportunity for public comment, and approve the list. In May 2015 the Board approved 21 statewide CTE equivalency frameworks, and in May 2016, approved an additional 11. At this meeting, the Board will consider approval of two additional statewide CTE course equivalencies.	

CAREER AND TECHNICAL EDUCATION COURSE EQUIVALENCY FRAMEWORKS—CONSIDERATION OF APPROVAL

Policy Considerations

Career and Technical Education (CTE) course equivalencies are CTE courses identified as aligning with both professional and technical career standards and academic core subject area learning standards. CTE courses recognized as equivalent to core subject area courses may meet both an CTE/occupational education graduation requirement and a core subject area requirement. Such courses allow for a "two-for-one" policy, wherein students meet two graduation requirements while earning one credit in one course. Course equivalencies allow important flexibility to students in CTE programs, such as most programs at skill centers, consisting of multi-course sequences leading to a professional technical certificate.

Senate Bill 6552, passed in 2014, expanded the responsibility of districts to provide access to CTE course equivalencies and established statewide course equivalencies in science and math. The bill directed the Office of the Superintendent of Public Instruction to develop course frameworks from a list of CTE courses equivalent to core math and science subject graduation requirements. The bill further directed that:

> The office shall submit the list of equivalent career and technical courses and their curriculum frameworks to the state board of education for review, an opportunity for public comment, and approval.

In May 2015, the SBE approved 21 CTE course equivalency frameworks and the Board approved an additional 11 equivalencies in May 2016. Frameworks considered for approved by the Board this year would be the third group of statewide CTE course equivalency frameworks.

At the May 2017 Board meeting, the Board will:

- Receive an update on the development of new CTE course equivalency frameworks.
- Hear from representatives from the Office of the Superintendent of Public Instruction and content specialists involved in developing and reviewing the frameworks.
- Consider approving two new CTE course equivalency frameworks in Agricultural Power and Technology and in Viticulture.

The language in the bill authorizing the SBE to approve course equivalencies does not provide any criteria or basis for approval, however, one stated purpose for the Board's involvement is to provide an opportunity for public comment. By providing time on the agenda at the Board's public meeting for discussing the equivalencies and through the public comment time scheduled during the meeting, the Board is meeting the legislative directive to provide an opportunity for public comment. Notice of the opportunity for public comment on the course equivalencies was sent to SBE distribution lists, which includes superintendents, school board members, education professional associations, and others.

Without any stipulated basis in law for approval of course equivalencies, what criteria for approval should the Board apply? The staff recommendation is that the review should focus on broad questions:

- From the perspective of non-content experts, do the CTE standards and the core content standards appear to mesh well into a single course?
- Is the course likely to help students meet both academic and career goals?
- Is the course framework logically presented and understandable for an educator, student, parent or member of the public?

In addition, staff recommends that the Board examine the process that was used to develop and review the frameworks. OSPI staff will present on the process at the meeting. Key questions about the process include:

- Does the process for developing the course equivalencies and frameworks support strong incorporation of math, science and CTE standards?
- Have the proposed CTE course equivalencies undergone appropriate review by both core and CTE content experts to assure a sufficient commitment and fidelity to math, science and CTE standards to meet graduation requirements?

Background

CTE course equivalencies have been recognized and encouraged by the Legislature since 2006 (SHB 2973, Chapter 113, Laws of 2006). RCW 28A.230.097 requires that each "high school or school district board of directors shall adopt course equivalencies for career and technical high school courses offered to students in high schools and skill centers."

An SBE legislative priority for 2014 was to expand CTE math and science course equivalencies, so the Board strongly supported the actions of the Legislature to expand math and science course equivalencies in Senate Bill 6552 passed that year. The bill increased the opportunities for students to access course equivalencies by mandating that in addition to any locally established course equivalencies, each district offer at least one math or science equivalency from the approved list of statewide equivalencies:

> School district boards of directors must provide high school students with the opportunity to access at least one career and technical education course that is considered equivalent to a mathematics course or at least one career and technical education course that is considered equivalent to a science course as determined by the office of the superintendent of public instruction and the state board of education in RCW 28A.700.070. Students may access such courses at high schools, interdistrict cooperatives, skill centers or branch or satellite skill centers, or through online learning or applicable running start vocational courses. (RCW 28A.230.010.)

A waiver from the requirement to offer at least one of the courses from the approved list of statewide equivalencies is available to districts with fewer than 2,000 students. The SBE adopted rules on this waiver in July 2014 (WAC 180-18-100).

CTE programs and courses are characterized by:

- Alignment with proven workforce needs.
- Alignment with industry standards.
- Advisory committees of industry representatives.
- Teachers with substantial work experience in their teaching assignment.
- A curriculum framework: a document that describes the state core content standards, industry standards, and leadership and employability skills associated with the course. Frameworks are reviewed annually by program advisory committees and by OSPI program supervisors.

Action

At the May 2017 meeting the Board will hear from OSPI Career and Technical Education staff and educators who were involved with developing the course equivalencies.

If you have questions regarding this memo, please contact Linda Drake at Linda.drake@k12.wa.us.

Statewide Framework Document for: 010201

Standards may be added to this document prior to submission, but may not be removed for the framework to meet state credit equivalency requirements. Performance assessments may be developed at the local level. In order to earn state approval, performance assessments must be submitted within this framework. **This course is eligible for 1 credit of laboratory science.** The Washington State Science Standards performance expectations for high school blend core ideas (Disciplinary Core Ideas, or DCIs) with scientific and engineering practices (SEPs) and crosscutting concepts (CCCs) to support students in developing usable knowledge that can be applied across the science disciplines. These courses are to be taught in a three-dimensional manner. The details about each performance expectation can be found at Next Generation Science Standards and the supporting evidence statements can be found under Resources. Science standards identified within the Aligned Washington State Standards sections do not connote a one-to-one correspondence, but indicate where opportunities for building student knowledge and understanding of science are strongest. This is consistent with the knowledge that science learning is a progression and builds over time.

Agricultural Power and Technology

Course Title: Agricultural Power and Technology		**Total Framework Hours: 180**
CIP Code: 010201	☒**Exploratory** ☐**Preparatory**	**Date Last Modified: 4.10.2017**
Career Cluster: Agriculture, Food and Natural Resources		**Cluster Pathway: Power, Structural, and Technical Systems**
Eligible for Equivalent Credit in: ☐ **Math** ☒ **Science**		**Total Number of Units: 7**

Course Overview

Summary:
The focus of Agricultural Power and Technology (APT) is to expose students to mechanics, power, technology, and career options in the world of agriculture. Students participating in the APT course will have experiences in various mechanical and engineering concepts with exciting hands-on activities, projects, and problems. Student's experiences will involve the study of energy, tool operation and safety, material properties, machine operation, and structural components. Students will acquire the basic skills to operate, repair, engineer, and design agricultural tools and equipment. Throughout the course, students will apply the engineering principles to the construction of machines and structures.

Students will explore projects and problems similar to those that a mechanic, technician, or engineer may face in their respective careers. In addition, students will understand specific connections between science, math, and technical skills applied to Supervised Agricultural Experiences and FFA components that play an important role developing an informed agricultural education student. Students will investigate, experiment, and learn about documenting a project, solving problems, and communicating their solutions to their peers and members of the professional community.

The Agricultural Power and Technology course includes; Shop Safety, Tool Operation, Material Selection and Uses, Fabrication, Energy and Power Production, Machine Components and Design, Agricultural Structures, Engineering, Technical Applications of Math and Science

As with all agriculture courses, instruction and assessment in the Supervised Agriculture Experience (SAE) is a requirement. The Supervised Agriculture Experience includes placing a student in a position where he or she will learn the practices of entrepreneurship and the fundamentals of research and experimentation in the agricultural field. Participants in the SAE will conduct exploratory projects with the purpose of learning about and improving practices in their surroundings.

SAE.01. This course will include instruction in and Student involvement in Supervised Agriculture Experience Projects (SAE).

Unit 1: Introduction to Ag, Power, and Tech	Total Learning Hours for Unit: 15

Unit Summary:

Competencies include:

1.1.1 Organization and record keeping are important to success in agricultural mechanics.
1.1.2 The agricultural industry uses power and technology to produce food, fiber, and fuel that are essential for everyday life.
1.1.3. Power and technology increase the efficiency of agriculture, food, and natural resource production.
1.1.4 People in agricultural power and technology use the engineering design process to increase agricultural productivity and solve problems.
1.2.1 Many forms of potential and kinetic energy are used in agriculture to complete tasks or work.
1.2.2 Machines in agriculture are designed to harness energy to perform work.
1.2.3 Work and power calculations are used to determine efficiencies in agricultural systems.
1.2.4 Communication and writing skills complement the operation of mechanical equipment used in agricultural power and technology careers.

Performance Assessments:

Performance assessments on the following topics may be developed at the local level. In order to earn approval at the state level, performance assessments must be submitted within this framework.

It is expected that students will:

- Develop and keep an Agriscience Notebook to record and store information.
- Research systems in power and technology and explain how they are applied in agriculture
- Use mathematical and computation thinking to calculate and compare the efficiency of different tools
- Obtain, evaluate, and communicate information about how an entrepreneur in agricultural mechanics uses the engineering process to improve production of food, fiber, and fuel.
- Design a prototype using the engineering design process to solve a problem.
- Obtain, evaluate, and communicate the types of energy used and managed in agriculture.
- Make a device to convert wind energy into mechanical energy
- Use mathematical and computation thinking to calculate the work completed by a machine.
- Use mathematical and computation thinking to calculate and compare power in English and SI units.
- Obtain, evaluate, and communicate information needed for a technical manual for machines that use different forms of energy.

Leadership Alignment:

Students will access and evaluate information to research systems in power and technology and the agricultural applications.
Students will reason effectively to design a prototype specifically purposed to solve a problem.

Industry Standards and Competencies

Agriculture, Food, and Natural Resources (AFNR) Standards:

CRP.02. Apply appropriate academic and technical skills.
CRP.03. Attend to personal health and financial well-being.
CRP.04. Communicate clearly, effectively and with reason.
CRP.05. Consider the environmental, social and economic impacts of decisions.
CRP.08. Utilize critical thinking to make sense of problems and persevere in solving them.
CS.02. Evaluate the nature and scope of the Agriculture, Food & Natural Resources Career Cluster and the role of agriculture, food and natural resources (AFNR) in society and the economy.
PST.01. Apply physical science principles and engineering applications to solve problems and improve performance in AFNR power, structural and technical systems.

Aligned Washington State Standards:

Washington Science Standards (Next Generation Science Standards):

HS-PS2-3. Apply scientific and engineering ideas to design, evaluate, and refine a device that minimizes the force on a macroscopic object during a collision.
HS-PS2-5. Plan and conduct an investigation to provide evidence that an electric current can produce a magnetic field and that a changing magnetic field can produce an electric current.
HS-PS3-1. Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known.
HS-PS3-2. Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles (objects) and energy associated with the relative position of particles (objects).
HS-PS3-3. Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.
HS-PS3-4. Plan and conduct an investigation to provide evidence that the transfer of thermal energy when two components of different temperature are combined within a closed system results in a more uniform energy distribution among the components in the system (second law of thermodynamics).
HS-ETS1-4. Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.

Additional Science and Engineering Practices (SEPs), Disciplinary Core Ideas (DCIs), and Crosscutting Concepts (CCCs):

The local level must list one or more projects to be completed in this unit that will cumulatively address all of the following additional SEPs, DCIs, and CCCs.

Specific Project Title(s): MUST BE ADDED AT LOCAL LEVEL

Science and Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
Asking Questions and Defining Problems	PS3.A. Definitions of Energy	Patterns
Developing and Using Models	PS3.B. Conservation of Energy and Energy Transfer	Cause and Effect: Mechanism and Prediction
Planning and Carrying Out Investigations	PS3.D. Energy in Chemical Processes and Everyday Life	Systems and System Models
Using Mathematics and Computational Thinking	ETS1.A. Defining and Delimiting Engineering Problems	Energy and Matter: Flows, Cycles, and Conservation
Constructing Explanations and Designing Solutions	ETS1.B. Developing Possible Solutions	
Obtaining, Evaluating, and Communicating Information		
Analyzing and Interpreting Data		

Unit 2: Safety and Measurement	Total Learning Hours for Unit: 15

Unit Summary:

Competencies include:
2.1.1 Site-specific safety policies and procedures are in place for agricultural mechanic shops and labs
2.1.2 Safety must be planned and systematic for effective identification and lean management strategies in a laboratory or shop.
2.1.3 Personal protective equipment is the last line of defense against injury.
2.1.4 The purpose of first aid is to treat injuries or accidents in order to sustain life until professional medical attention can be received.
2.2.1 Tools are designed for specific applications.
2.2.2 The function of tools and machines will affect how they are operated.
2.2.3 Operating procedures for machines and tools keep the operator/by-standers safe and the machine or tool in good working order.
2.3.1 Precise and accurate measurements are important for fabrication of materials.
2.3.2. Technical measurements are expressed in different forms and units.
2.3.3 Estimation is used for completing a project or activity.
2.3.4 Technical application of the Pythagorean Theorem can be used to determine if a corner is square.
2.3.5 Areas are calculated using mathematical formulas.

Performance Assessments:

Performance assessments on the following topics may be developed at the local level. In order to earn approval at the state level, performance assessments must be submitted within this framework.

It is expected that students will:

- Identify workplace hazards and the causes for accidents.
- Develop a standard set of safety requirements for an agricultural shop.
- Assess a shop to determine if safety standards are being met and make recommendations for changes.
- Identify types of Personal Protective Equipment (PPE) and their uses in the shop.
- Prepare an emergency first aid booklet.
- Select correct hand tools for a specific job.
- Identify the components of a power tool and determine any hazards present by using a safety evaluation form
- Write an operating procedure for using a power tool safely.
- Compare precise and accurate measurements using a combination square and caliper.
- Computational thinking and accurate measurement requires the conversion between fractions and decimals.
- Use pacing to estimate the distance between two points.
- Use the Pythagorean Theorem to determine if a structure is square and square a wall corner using a 3-4-5 triangle.
- Use mathematical formulas to measure an area of land.

Leadership Alignment:

Students will reason effectively to determine hazards, establish safety procedures, and select appropriate PPE for needs in the agricultural shop setting.
Students will work independently to select the correct tools for the appropriate tasks.

Students will communicate clearly to create an operating procedure for power related equipment.

Industry Standards and Competencies

Agriculture, Food, and Natural Resources (AFNR) Standards:
CRP.01. Act as a responsible and contributing citizen and employee.
CRP.02. Apply appropriate academic and technical skills.
CRP.04. Communicate clearly, effectively and with reason.
CRP.06. Demonstrate creativity and innovation.
CRP.08. Utilize critical thinking to make sense of problems and persevere in solving them.
CRP.11. Use technology to enhance productivity.
CS.01. Analyze how issues, trends, technologies and public policies impact systems in the Agriculture, Food & Natural Resources Career Cluster.
CS.03. Examine and summarize the importance of health, safety and environmental management systems in AFNR workplaces.
PST.01. Apply physical science principles and engineering applications to solve problems and improve performance in AFNR power, structural and technical systems.
PST.02. Operate and maintain AFNR mechanical equipment and power systems.

Aligned Washington State Standards

Washington Science Standards (Next Generation Science Standards):

Specific Project Title(s): MUST BE ADDED AT LOCAL LEVEL

Science and Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
Asking Questions and Defining Problems	PS3.B. Conservation of Energy and Energy Transfer	Patterns
Developing and Using Models	PS3.C. Relationship Between Energy and Forces	Cause and Effect: Mechanism and Prediction
Analyzing and Interpreting Data	ETS1.C. Optimizing the Design Solution	Systems and System Models
Using Mathematics and Computational Thinking		

Unit 3: Material Properties | Total Learning Hours for Unit: 25

Unit Summary:
Competencies include:
3.1.1 Metals used in agriculture can be classified using physical properties.
3.1.2 Chemical properties of metal will determine how it reacts with other metals in the environment.
3.1.3 The structure and function of metal will determine its service life and applications.
3.1.4 Metals will physically change based upon environmental factors.
3.2.1 Wood is selected based upon their physical and mechanical properties.
3.2.2 Environmental factors determine the type of wood used for a project.
3.2.3 Plastics used in agriculture are designed for a specific purpose.
3.2.4 The chemical makeup of plastics will determine their mechanical properties.
3.3.1 Fluids cool and lubricate agricultural machines and equipment.

3.3.2 Solutions need to be mixed with the correct proportions to function correctly.
3.3.3 Temperature can change the physical properties of fluids.
3.3.4 Machines use gases, such as air, to produce power.
3.4.1 Water and land are material that are mechanically managed and conserved.
3.4.2 Slope has an impact on the mechanics and design of materials.
3.4.3 The strength of concrete is dependent upon proper mixing and curing of materials.
3.4.4 Volume calculations and proportions are used for properly mixing concrete.

Performance Assessments:
Performance assessments on the following topics may be developed at the local level. In order to earn approval at the state level, performance assessments must be submitted within this framework.

It is expected that students will:

- Plan and conduct an investigation to classify metals based upon their physical properties.
- Construct an explanation of how metals chemically react in certain environmental conditions.
- Construct an explanation of how metals react with each other.
- Compare and contrast tensile strength, ductility, brittleness, and hardness of common metals used in agriculture.
- Use mathematics and computational thinking to measure the thermal conductivity and thermal expansion of different metals.
- Conduct an investigation to determine the effect of heat treating various metals to compare physical changes.
- Conduct an investigation to determine the relationship between density and tensile strength of species of wood.
- Plan and conduct an investigation to test the effect moisture has on the dimensional stability of different wood species.
- Plan and conduct an investigation to identify different types of plastics and their uses.
- Synthesize plastics to investigate the resulting mechanical properties.
- Plan and conduct an investigation to determine how lubrication can reduce the friction produced in a machine.
- Prepare solutions of water and antifreeze and compare their physical properties.
- Use mathematics and computational thinking to calculate the viscosity of different oils at varying temperatures.
- Observe and demonstrate the relationship between airflow and air pressure.
- Construct a windmill using Bernoulli's Principle as a basis for design.
- Measure the relationship between slope and velocity of water and observe management techniques to control erosion on sloped land.
- Use mathematics and computational thinking to calculate the slope of land between two points using surveying equipment.
- Obtain information through an investigation to observe the chemical and physical changes of concrete.
- Plan and conduct an investigation to test the compression strength of different mixtures of concrete.
- Using mathematical and computation thinking, complete mathematical calculations to mix concrete using proportions and volume calculations.

Leadership Alignment:
Students will think creatively and use and manage information to plan and conduct investigations related to metals, woods, and mechanical properties.
Students will produce results through completion of student investigation projects.

Industry Standards and Competencies

Agriculture, Food, and Natural Resources (AFNR) Standards:
CRP.02. Apply appropriate academic and technical skills.
CRP.04. Communicate clearly, effectively and with reason.
CRP.06. Demonstrate creativity and innovation.
CRP.11. Use technology to enhance productivity.
CS.03. Examine and summarize the importance of health, safety and environmental management systems in AFNR workplaces.
PST.01. Apply physical science principles and engineering applications to solve problems and improve performance in AFNR power, structural and technical systems.

PST.02. Operate and maintain AFNR mechanical equipment and power systems.
PST.03. Service and repair AFNR mechanical equipment and power systems.
PST.04. Plan, build and maintain AFNR structures.

Aligned Washington State Standards

Washington Science Standards (Next Generation Science Standards):
HS-PS1-2. Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties.
HS-PS1-3. Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles.
HS-PS1-4. Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy
HS-PS1-5. Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs.
HS-PS1-6. Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium
HS-PS1-7. Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.

Additional Science and Engineering Practices (SEPs), Disciplinary Core Ideas (DCIs), and Crosscutting Concepts (CCCs):
The local level must list one or more projects to be completed in this unit that will cumulatively address all of the following additional SEPs, DCIs, and CCCs.

Specific Project Title(s): MUST BE ADDED AT LOCAL LEVEL

Science and Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
Asking Questions and Defining Problems	PS1.A. Structure and Properties of Matter	Patterns
Developing and Using Models	PS1.B. Chemical Reactions	Cause and Effect: Mechanism and Prediction
Analyzing and Interpreting Data	PS2.B. Types of Interactions	Systems and System Models
Using Mathematics and Computational Thinking	PS3.D. Energy in Chemical Processes and Everyday Life	Scale, Proportion, and Quantity
Planning and Carrying Out Investigations	ETS1.A. Defining and Delimiting Engineering Problems	Energy and Matter: Flows, Cycles, and Conservation
Constructing Explanations and Designing Solutions	ETS1.B. Developing Possible Solutions	Structure and Function
Engaging in Argument from Evidence	ETS1.C. Optimizing the Design Solution	Stability and Change
Obtaining, Evaluating, and Communicating Information		

Unit 4: Fabrication	Total Learning Hours for Unit: 30

Unit Summary:
Competencies include:
4.1.1 Construct and design accurate plans and scaled drawings that are essential for project success.
4.1.2 A bill of materials accounts for all items needed to complete a project and assists in determining the budget.
4.2.1 A variety of tools are used to process bulk materials into useable parts.
4.2.2 Proper measurements and efficient use of materials are essential when manufacturing useable parts.
4.2.3 Quality products are produced by following procedural steps.
4.3.1 Torque is a factor considered when fastening material together.
4.3.2 Fasteners are selected based upon strength and durability when joining machine and structural parts.
4.3.3 A variety of welding processes are used to fuse metal.
4.3.4 Metals are welded together for a strong fit using a combination of materials.
4.3.4 Fabrication involves forming and fastening multiple types of materials together to make a useable product.

Performance Assessments:
Performance assessments on the following topics may be developed at the local level. In order to earn approval at the state level, performance assessments must be submitted within this framework.

It is expected that students will:

- Design a floor plan of a shop to scale.
- Draft isometric and orthographic depictions of three-dimensional objects.
- Complete a bill of materials for the construction of a fabricated project.
- Identify by name and describe the functionality the different types of cutting tools and blades.
- Fabricate a nut and bolt with a tap and die.
- Using mathematics and computational thinking demonstrate how the kerf must be considered when cutting material.
- Develop and write a detailed procedure to cut pieces of metal.
- Ask questions to understand the effect of torque on fastener performance.
- Carry out an investigation to test the strength and durability of different fasteners and determine and define where they should be used.
- Obtain, evaluate, and communicate basic techniques for different welding processes.
- Ask questions and define problems when identifying materials, consumables, and processes used to various metal.
- Construct explanations and design solutions for creating and selecting a welding electrode for a specific job.
- Fabricate a doorstop using concrete, metal, and wood.

Leadership Alignment:
Students will use systems thinking to determine the cost of materials for a designed project.
Students will collaborate with others and work creatively with others while designing and completing projects.

Industry Standards and Competencies

Agriculture, Food, and Natural Resources (AFNR) Standards:
CRP.02. Apply appropriate academic and technical skills.
CRP.04. Communicate clearly, effectively and with reason.
CRP.06. Demonstrate creativity and innovation.
PST.01. Apply physical science principles and engineering applications to solve problems and improve performance in AFNR power, structural and technical systems.

PST.02. Operate and maintain AFNR mechanical equipment and power systems.
PST.03. Service and repair AFNR mechanical equipment and power systems.
PST.04. Plan, build and maintain AFNR structures.

Aligned Washington State Standards:

Washington Science Standards (Next Generation Science Standards):
HS-PS2-3. Apply scientific and engineering ideas to design, evaluate, and refine a device that minimizes the force on a macroscopic object during a collision.
HS-PS3-3. Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.
HS-LS4-6. Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.
HS-ETS1-4. Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.

Additional Science and Engineering Practices (SEPs), Disciplinary Core Ideas (DCIs), and Crosscutting Concepts (CCCs):
The local level must list one or more projects to be completed in this unit that will cumulatively address all of the following additional SEPs, DCIs, and CCCs.

Specific Project Title(s): MUST BE ADDED AT LOCAL LEVEL

Science and Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
Asking Questions and Defining Problems	ETS1.A. Defining and Delimiting Engineering Problems	Patterns
Developing and Using Models	ETS1.B. Developing Possible Solutions	Cause and Effect: Mechanism and Prediction
Analyzing and Interpreting Data	ETS1.C. Optimizing the Design Solution	Systems and System Models
Using Mathematics and Computational Thinking		Structure and Function
Planning and Carrying Out Investigations		Energy and Matter: Flows, Cycles, and Conservation
Constructing Explanations and Designing Solutions		Structure and Function
Engaging in Argument from Evidence		
Obtaining, Evaluating, and Communicating Information		

Unit 5: Energy	Total Learning Hours for Unit: 40

Unit Summary:

Competencies include:

5.1.1 Chemical reactions release and absorb thermal energy.
5.1.2 Electrical energy can be harnessed and transferred through chemical reactions.
5.1.3 Chemical energy can be converted into mechanical movement.
5.1.4 Agriculture is a producer of renewable forms of fuel.
5.1.5 Fossil and bio–fuels release energy and chemical bi-products when they combust.
5.1.6 Many factors influence the choice of an energy source.
5.2.1 Electricity must flow in a complete loop from the source and to the source with no breaks for a circuit to operate correctly.
5.2.2 The relationship between amps, volts, and ohms can be defined using Ohm's Law.
5.2.3 Two types of electrical circuits used in agriculture are series and parallel.
5.2.4 The use of electricity requires a knowledge and understanding of relationships between voltage, current, and resistance.
5.2.5 Circuits are designed to provide electrical power for a specific job or application.
5.3.1 Electromagnetic fields are a source of mechanical energy used to produce rotational movement.
5.3.2 Mechanical energy can be converted into electrical power.
5.3.3 The force produced in a fluid power system is measured using Pascal's Law.
5.3.4 Controlled movements of fluids under pressure produce mechanical energy.

Performance Assessments:

Performance assessments on the following topics may be developed at the local level. In order to earn approval at the state level, performance assessments must be submitted within this framework.

It is expected that students will:

- Design and construct a hand warmer using elements that chemically react.
- Plan and carry out an investigation to create a wet cell battery to power an electric motor.
- Design and construct a steam engine that propels a boat and explain the transfer of energy.
- Design and construct ethanol from agricultural products.
- Develop and test a model to demonstrate the combustion of hydrocarbons and ethanol.
- Obtain, evaluate and communicate the advantages and disadvantages of renewable and nonrenewable fuels.
- Analyze and interpret data to measure the energy output of renewable and nonrenewable fuels.
- Develop and construct a complete electrical circuit.
- Obtain and evaluate information to distinguish between an open and closed circuit.
- Using mathematical and computational thinking to determine amps, volts, and ohms in a circuit using Ohm's Law.
- Construct a parallel and series circuit to show the effects on Ohm's Law.
- Analyze and communicate how a resistor affects the electrical current in circuit.
- Design, construct, and test an electrical circuit that meets certain specifications.
- Construct an electric motor and identify the parts and their functions.
- Generate electrical energy with a windmill and evaluate factors optimize the power produced.
- Using mathematics and computational thinking to determine the force of fluids under pressure.
- Planning and carrying out an investigation to create a hydraulic lift that can perform a specified amount of work.

Leadership Alignment:

Students will manage projects, and produce results in designing and constructing a steam engine.

Students will work creatively with others and solve problems to distinguish between open and closed circuits.

Industry Standards and Competencies

Agriculture, Food, and Natural Resources (AFNR) Standards:
CRP.02. Apply appropriate academic and technical skills.
CRP.04. Communicate clearly, effectively and with reason.
CRP.05. Consider the environmental, social and economic impacts of decisions.
CRP.08. Utilize critical thinking to make sense of problems and persevere in solving them.
CS.01. Analyze how issues, trends, technologies and public policies impact systems in the Agriculture, Food & Natural Resources Career Cluster.
CS.06. Analyze the interaction among AFNR systems in the production, processing and management of food, fiber and fuel and the sustainable use of natural resources.
PST.01. Apply physical science principles and engineering applications to solve problems and improve performance in AFNR power, structural and technical systems.
PST.03. Service and repair AFNR mechanical equipment and power systems.

Aligned Washington State Standards

Washington Science Standards (Next Generation Science Standards):
HS-PS1-1. Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms
HS-PS1-2. Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties.
HS-PS1-3. Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles.
HS-PS1-4. Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy.
HS-PS1-5. Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs.
HS-PS1-6. Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium
HS-PS1-7. Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.
HS-PS2-3. Apply scientific and engineering ideas to design, evaluate, and refine a device that minimizes the force on a macroscopic object during a collision.*
HS-PS2-4. Use mathematical representations of Newton's Law of Gravitation and Coulomb's Law to describe and predict the gravitational and electrostatic forces between objects.

Additional Science and Engineering Practices (SEPs), Disciplinary Core Ideas (DCIs), and Crosscutting Concepts (CCCs):
The local level must list one or more projects to be completed in this unit that will cumulatively address all of the following additional SEPs, DCIs, and CCCs.

Specific Project Title(s): MUST BE ADDED AT LOCAL LEVEL

Science and Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
Asking Questions and Defining Problems	PS1.A. Structure and Properties of Matter	Patterns
Developing and Using Models	PS1.B. Chemical Reactions	Cause and Effect: Mechanism and Prediction
Analyzing and Interpreting Data	PS2.B. Types of Interactions	Systems and System Models
Using Mathematics and Computational Thinking	PS3.A. Definitions of Energy	Stability and Change

Planning and Carrying Out Investigations	PS3.B. Conservation of Energy and Energy Transfer	Energy and Matter: Flows, Cycles, and Conservation
Constructing Explanations and Designing Solutions	PS3.C. Relationship Between Energy and Forces	Scale, Proportion, Quantity
Engaging in Argument from Evidence	PS3.D. Energy in Chemical Processes and Everyday Life	
Obtaining, Evaluating, and Communicating Information	ETS1.A. Defining and Delimiting Engineering Problems	
	ETS1.B. Developing Possible Solutions	
	ETS1.C. Optimizing the Design Solution	

Unit 6: Machines and Structures	**Total Learning Hours for Unit: 30**

Unit Summary:

Competencies include:

6.1.1 Agricultural machines consist of one or more simple machines that produce linear and/or rotational movement.
6.1.2 Simple machines provide a mechanical advantage.
6.1.3 The amount of work to operate a machine will be greater than the work done by the machine.
6.1.4 The power and speed of a machine is dependent upon proper design.
6.2.1 Technical reading involves interpreting and applying information from manuals, schematics, diagnostic tools, and measuring tools.
6.2.2 Preventive maintenance requires a systematic periodic schedule.
6.2.3 Troubleshooting includes identifying the problem, researching solutions, and applying the possible solutions.
6.2.4 Machines are calibrated to perform at specific efficiencies.
6.3.1 Requirements of a project need to abide by code, laws, or rules governing such project.
6.3.2 Structures provide a controlled environment to protect agricultural commodities and equipment.
6.3.3 Agricultural structures contain joints and assemblies that withstand multiple types of forces.
6.3.4Agricultural structures need to be well planned, to meet a specific need or purpose.

Performance Assessments:

Performance assessments on the following topics may be developed at the local level. In order to earn approval at the state level, performance assessments must be submitted within this framework.

It is expected that students will:

- Analyze and interpret the simple machines and types of motions found in agricultural equipment.
- Using mathematics and computational thinking measure the mechanical advantage of different classes of levers and identify where levers are used in agriculture.
- Using mathematics and computational thinking, calculate the efficiency of work completed by a pulley system to lift an object.
- Use ratios to calculate speed and torque of multiple systems of gears.

- Read and obtain information from an operation manual.
- Design a maintenance schedule for a small engine using a technical manual.
- Develop and use a model flow chart for solving a problem for a machine and analyze the model for troubleshooting.
- Calibrate a water pump to perform a task at a specific rate.
- Design a model of a windmill that produces electricity used to pump water at a specified rate.
- Obtain, evaluate, and communicate codes and laws for constructing an agricultural structure.
- Analyze and interpret data about the insulating properties of building materials.
- Design and evaluate test truss designs for strength.
- Define a plan for constructing an agricultural building with a specific purpose.

Leadership Alignment:
Students will implement innovations while designing and calibrating a water pump to perform a specific task.
Students will interacting effectively with others and working in diverse teams while working in pairs and small groups to complete unit projects.

Industry Standards and Competencies

Agriculture, Food, and Natural Resources (AFNR) Standards:
CRP.02. Apply appropriate academic and technical skills.
CRP.04. Communicate clearly, effectively and with reason.
CRP.05. Consider the environmental, social and economic impacts of decisions.
CRP.06. Demonstrate creativity and innovation.
CRP.08. Utilize critical thinking to make sense of problems and persevere in solving them.
CS.01. Analyze how issues, trends, technologies and public policies impact systems in the Agriculture, Food & Natural Resources Career Cluster.
CS.03. Examine and summarize the importance of health, safety and environmental management systems in AFNR workplaces.
CS.06. Analyze the interaction among AFNR systems in the production, processing and management of food, fiber and fuel and the sustainable use of natural resources.
PST.01. Apply physical science principles and engineering applications to solve problems and improve performance in AFNR power, structural and technical systems.
PST.02. Operate and maintain AFNR mechanical equipment and power systems.
PST.03. Service and repair AFNR mechanical equipment and power systems.
PST.04. Plan, build and maintain AFNR structures.
PST.05. Use control, monitoring, geospatial and other technologies in AFNR
power, structural and technical systems.

Aligned Washington State Standards

Washington Science Standards (Next Generation Science Standards):
HS-PS3-1. Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known.
HS-PS3-2. Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles (objects) and energy associated with the relative position of particles (objects).
HS-PS3-3. Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.
HS-PS3-4. Plan and conduct an investigation to provide evidence that the transfer of thermal energy when two components of different temperature are combined within a closed system results in a more uniform energy distribution among the components in the system (second law of thermodynamics).
HS-PS3-5. Develop and use a model of two objects interacting through electric or magnetic fields to illustrate the forces between objects and the changes in energy of the objects due to the interaction.
HS-LS2-7. Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.
HS-LS4-6. Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.

Additional Science and Engineering Practices (SEPs), Disciplinary Core Ideas (DCIs), and Crosscutting Concepts (CCCs):
The local level must list one or more projects to be completed in this unit that will cumulatively address all of the following additional SEPs, DCIs, and CCCs.

Specific Project Title(s): MUST BE ADDED AT LOCAL LEVEL

Science and Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
Asking Questions and Defining Problems	PS3.A. Definitions of Energy	Patterns
Developing and Using Models	PS3.B. Conservation of Energy and Energy Transfer	Cause and Effect: Mechanism and Prediction
Analyzing and Interpreting Data	PS3.C. Relationship Between Energy and Forces	Systems and System Models
Using Mathematics and Computational Thinking	ETS1.A. Defining and Delimiting Engineering Problems	Structure and Function
Planning and Carrying Out Investigations	ETS1.B. Developing Possible Solutions	Energy and Matter: Flows, Cycles, and Conservation
Constructing Explanations and Designing Solutions	ETS1.C. Optimizing the Design Solution	Scale, Proportion, Quantity
Obtaining, Evaluating, and Communicating Information		

Unit 7: Mechanical Applications	Total Learning Hours for Unit: 25

Unit Summary:
Competencies include:
7.1.1 Communication and writing skills complement the operation of mechanical equipment used in agricultural power and technology careers.
7.1.2 Careers in agricultural mechanics require the application of technical skill combined with material knowledge.
7.1.3 Agricultural mechanics design and calibrate equipment to produce food, fiber, and fuel.

Performance Assessments:
Performance assessments on the following topics may be developed at the local level. In order to earn approval at the state level, performance assessments must be submitted within this framework.

It is expected that students will:

- Complete a final draft of a technical manual for chosen tools and share the operational information about the tools with the class.
- Students will identify technical skills, careers, and knowledge needed in mechanical systems.
- Asking questions about needs and defining problems to design a planter/seeder/drill that meets the needs of a specific crop.

Leadership Alignment:
Students will implement innovations while designing a planter to address specifications for crop production.
Students will create media products while finalized the technical manual cumulative course project.

Industry Standards and Competencies

Agriculture, Food, and Natural Resources (AFNR) Standards:
CRP.04. Communicate clearly, effectively and with reason.
CRP.05. Consider the environmental, social and economic impacts of decisions.
CRP.06. Demonstrate creativity and innovation.
CRP.08. Utilize critical thinking to make sense of problems and persevere in solving them.
CRP.10. Plan education and career path aligned to personal goals.
CS.05. Describe career opportunities and means to achieve those opportunities in each of the Agriculture, Food & Natural Resources career pathways.
PST.01. Apply physical science principles and engineering applications to solve problems and improve performance in AFNR power, structural and technical systems.

Aligned Washington State Standards

Washington Science Standards (Next Generation Science Standards):
Additional Science and Engineering Practices (SEPs), Disciplinary Core Ideas (DCIs), and Crosscutting Concepts (CCCs):
The local level must list one or more projects to be completed in this unit that will cumulatively address all of the following additional SEPs, DCIs, and CCCs.

Specific Project Title(s): MUST BE ADDED AT LOCAL LEVEL

Science and Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
Asking Questions and Defining Problems	ETS1.A. Defining and Delimiting Engineering Problems	Systems and System Models
Developing and Using Models	ETS1.B. Developing Possible Solutions	

Planning and Carrying Out Investigations		
Constructing Explanations and Designing Solutions		
Obtaining, Evaluating, and Communicating Information		

21st Century Skills		
Students will demonstrate in this course:		
LEARNING & INNOVATION **Creativity and Innovation** ☐Think Creatively ☐Work Creatively with Others ☒Implement Innovations **Critical Thinking and Problem Solving** ☒Reason Effectively ☒Use Systems Thinking ☒Make Judgments and Decisions ☒Solve Problems **Communication and Collaboration** ☒Communicate Clearly ☒Collaborate with Others	**INFORMATION, MEDIA & TECHNOLOGY SKILLS** **Information Literacy** ☒Access and Evaluate Information ☒Use and Manage Information **Media Literacy** ☒Analyze Media ☒Create Media Products **Information, Communications and Technology (ICT Literacy)** ☒Apply Technology Effectively	**LIFE & CAREER SKILLS** **Flexibility and Adaptability** ☒Adapt to Change ☒Be Flexible **Initiative and Self-Direction** ☒Manage Goals and Time ☒Work Independently ☒Be Self-Directed Learners **Social and Cross-Cultural** ☒Interact Effectively with Others ☒Work Effectively in Diverse Teams **Productivity and Accountability** ☒Manage Projects ☒Produce Results **Leadership and Responsibility** ☐Guide and Lead Others ☒Be Responsible to Others

Statewide Framework Document for: 010309 Viticulture

Standards may be added to this document prior to submission, but may not be removed from the framework to meet state credit equivalency requirements. Performance assessments may be developed at the local level. In order to earn state approval, performance assessments must be submitted within this framework. **This course is eligible for 1 credit of laboratory science.** The Washington State Science Standards performance expectations for high school blend core ideas (Disciplinary Core Ideas, or DCIs) with scientific and engineering practices (SEPs) and crosscutting concepts (CCCs) to support students in developing usable knowledge that can be applied across the science disciplines. These courses are to be taught in a three-dimensional manner. The details about each performance expectation can be found at Next Generation Science Standards, and the supporting evidence statements can be found under Resources. Science standards identified within the Aligned Washington State Standards sections do not connote a one-to-one correspondence, but indicate where opportunities for building student knowledge and understanding of science are strongest. This is consistent with the knowledge that science learning is a progression and builds over time.

Viticulture

Course Title: Introduction to Viticulture	**Total Framework Hours: 180**
CIP Code: 010309 ☒ **Exploratory** ☐ **Preparatory**	**Date Last Modified: 2/23/2017**
Career Cluster: Agriculture, Food, and Natural Resources	**Cluster Pathway: Plant Systems**
Eligible for Equivalent Credit in: ☐ **Math** ☒ **Science**	**Total Number of Units: 8**

Course Overview

Summary:

A program that focuses on the application of scientific and agribusiness principles to the production and agribusiness of grape growing. Includes instruction in grapes of the world; grape production; plant biology; chemistry; food science, safety, and packaging; soil science; vineyard and pest management; and marketing and business management.

As with all agriculture courses, instruction and assessment in the Supervised Agriculture Experience (SAE) is a requirement. The Supervised Agriculture Experience includes placing a student in a position where he or she will learn the practices of entrepreneurship and the fundamentals of research and experimentation in the agricultural field. Participants in the SAE will conduct exploratory projects with the purpose of learning about and improving practices in their surroundings.
SAE.01. This course will include instruction in and Student involvement in Supervised Agriculture Experience Projects (SAE).

Unit 1: Introduction to Viticulture	Total Learning Hours for Unit: 20

Unit Summary:
This unit will introduce students to the history, purpose, science, and supply and demand of grape production, consumption, and processing.

Competencies may include:

- Asking questions by observing worldwide/US/WA production and consumption
- Obtain, evaluate and communicate information utilizing basic supply and demand principles.
- Identifying the species origin
- Varieties in Washington – traditional or historic context
- History of the vine from Mesopotamia to modern day.

Performance Assessments:
Performance assessments on the following topics may be developed at the local level. In order to earn approval at the state level, performance assessments must be submitted within this framework.

It is expected that students will demonstrate understanding by:

- Obtaining, evaluating, and communicating information by critically reading scientific and technical information related to grape production and basic supply and demand principles.
- Communicate scientific information related to species origin and varieties grown in Washington through an oral or written presentation.
- Viticulture Summative Project: comprehensive course long project: research varieties in Washington to determine preferred varietals.

Leadership Alignment:

Students will reason effectively and work independently to investigate the historical and current context of grape production.

Industry Standards and Competencies

Agriculture, Food, and Natural Resources (AFNR) Standards:

ABS 01.01.a Examine and provide examples of microeconomic principles related to decisions about AFNR business inputs and outputs (e.g., supply, demand and equilibrium, elasticity, diminishing returns, opportunity cost, etc.).
PS.02.01.02.b Identify and describe important plants to agricultural and ornamental plant systems by common names.
PS.02.01.02.c Identify and describe important plants to agricultural and ornamental plant systems by scientific names.

Aligned Washington State Standards

Washington State Science Learning Standards (Next Generation Science Standards):

HS-ESS3-1. Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.

HS-ESS3-5. Analyze geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth systems
HS-LS1-2. Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.
HS-LS4-4. Construct an explanation based on evidence for how natural selection leads to adaptation of populations.

Unit 2: Soil Science	**Total Learning Hours for Unit: 30**

Unit Summary:
This unit will investigate the role of the climate, soil, geography and other factors that affect grape production.
Competencies include:

- American Viticultural Area
- Soil types and effects on variety choice
- Soil fertility
- Soil characteristics: water capacity and structure
- Soil chemistry and pH
- Irrigation
- Water management (natural water and irrigation)
- Topography and aspect – elevation
- Microclimates and Mesoclimates
- Growing Degree Days (GDD): heat units
- Water cycle
- Technology

Performance Assessments:
Performance assessments on the following topics may be developed at the local level. In order to earn approval at the state level, performance assessments must be submitted within this framework.

It is expected that students will:

- Conduct an investigation to determine soil texture by feel, soil permeability to determine relationships between particle size and rate of water filtration.
- Demonstrate the principles of water holding capacity and represent differences between test substances with data.
- Conduct an investigation to determine soil pH and explain the effects of pH on grape production.
- Conduct an experiment providing evidence for the role of organic matter related to water holding capacity of the soil.
- Obtain, evaluate, and communicate scientific and technical information related to microclimates and mesoclimates, and the effect of heat units and weather related factors on grape production.
- Describe the water cycle
- Compare, and evaluate the differences in American Viticultural Areas (AVAs)
- Use mathematics and computational thinking to analyze and interpret data collected through soil science investigations.
- Evaluate the ability of specific geographic locations to produce grapes based upon factors including topography, GDD, climate, and soil characteristics.
- Viticulture Summative Project: comprehensive course long project: propose and defend site selection of vineyard based on soil chemistry and characteristics.

Leadership Alignment:

Students will think creatively, access and evaluate information, and interact effectively with others to conduct investigations related to soil science.
Students will access and evaluate information to determine proposed site selection of vineyards.

Industry Standards and Competencies

Agriculture, Food, and Natural Resources (AFNR) Standards:

ESS.03.02.01.b Use a soil survey to determine the land capability classes for different parcels of land in an area.
ESS.03.02.03.a Examine and explain how the physical qualities of the soil influence the infiltration and percolation of water.
ESS.03.02.03.b Assess the physical qualities of the soil that determine its potential for filtration of groundwater supplies and likelihood for flooding.
ESS.03.03.01.b Analyze the soil chemistry of a sample.
ESS.03.01.01.a Examine and summarize how chemistry affects soil structure and function (e.g., pH, cation-exchange capacity, filtration capability, flooding likelihood, etc.).
ESS.03.01.01.b. Differentiate how components of the atmosphere (e.g., weather systems and patterns, structure of the atmosphere, etc.) affect environmental service systems.
ESS.03.01.01.c Utilize meteorological data to assess the impact of atmospheric conditions on environmental service systems.
ESS.01.02.01.a Identify basic laboratory equipment and explain their uses.
ESS.01.01.01.a Identify sample types and sampling techniques used to collect laboratory and field data.
ESS.01.01.01.b Determine the appropriate sampling techniques needed to generate data.
ESS.01.01.01.c Collect and prepare sample measurements using appropriate data collection techniques.
ESS.05.01.01.b Apply surveying and mapping principles to a situation involving environmental service systems and identify and explain the use of equipment for surveying and mapping.
NRS.03.02.01.b Assess harvesting methods in regards to their economic value, environmental impact, and other factors.
NRS.01.03.01.a Classify different kinds of biogeochemical cycles and the role they play in natural resources systems.
NRS.01.03.01.b Assess the role that the atmosphere plays in the regulation of biogeochemical cycles.
NRS.01.03.01.c Evaluate and make recommendations to lessen the impact of human activity on the ability of the atmosphere to regulate biogeochemical cycles.
PS.01.02. Prepare and manage growing media for use in plant systems.
PS.01.02.01.a. Identify the major components of growing media and describe how growing media support plant growth.
PS.01.02.01.b. Describe the physical and chemical characteristics of growing media and explain the influence they have on plant growth.
PS.01.02.01.c. Formulate and prepare growing media for specific plants or crops.
PS.01.02.02.a. Identify the categories of soil water.
PS.01.02.02.b. Discuss how soil drainage and water-holding capacity can be improved.
PS.01.02.02.c. Determine the hydraulic conductivity for soil and how the results influence irrigation practices.
PS.01.03.06.a Summarize the impact of environmental factors on nutrient availability (e.g., moisture, temperature, pH, etc.).
PS.01.01.03.a Identify and summarize the effects of water quality on plant growth, (e.g., pH, dissolved solids, etc.).
PS.01.03.03. b Interpret laboratory analyses of soil and tissue samples
NRS.03.02.01.a. Summarize how to use maps and technologies to identify directions and land features, calculate actual distance and determine the elevations of points.
NRS.03.02.01.b. Apply cartographic skills and tools and technologies (e.g., land surveys, geographic coordinate systems, etc.) to locate natural resources.

Aligned Washington State Standards

Washington State Science Learning Standards (Next Generation Science Standards):

HS-ESS2-2. Analyze geoscience data to make the claim that one change to Earth's surface can create feedbacks that cause changes to other Earth systems.

HS-ESS2-3.Develop a model based on evidence of Earth's interior to describe the cycling of matter by thermal convection
HS-ESS2-5. Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.
HS-ESS2-6. Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere.
HS-ESS2-7. Construct an argument based on evidence about the simultaneous coevolution of Earth's systems and life on Earth.
HS-ESS3-1.Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.
HS-ESS3-2. Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.*
HS-ESS3-3. Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity.
HS-ESS3-4. Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.*
HS-PS1-1.Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms
HS-PS1-2. Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties.
HS-LS2-3. Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions.
HS-LS2-6. Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem.
HS-LS2-7. Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.*

Unit 3: Plant Biology and Chemistry	Total Learning Hours for Unit: 35

Unit Summary:
This unit will investigate the fundamental principles of plant biology and chemistry through studying structure, physiology, and plant development
Competencies include:

- Classification
- Scientific name – family/genus/species/variety/clone/rootstock
- Vitis vinifera vs. Vitis labrusca
- Varieties in Washington
- Photosynthesis
- Transpiration
- Respiration
- Parts, functions, processes of plant
- Pollination
- Parts of a flower/berry development
- Components and products of the fruit
- Carbon cycle

Performance Assessments:
Performance assessments on the following topics may be developed at the local level. In order to earn approval at the state level, performance assessments must be submitted within this framework.

It is expected that students will:

- Obtain, evaluate, and communicate information to compare vitis vinifera and vitis labrusca.
- Identify and describe the parts and functions of the flower/berry, and plant as it relates to fruit production
- Design and carry out an investigation to monitor the rates of photosynthesis, transpiration, and respiration
- Compare and contrast the effects of various biochemical cycles on plant development
- Develop and use a model that proves pollination leads to fruit bearing plants
- Viticulture Summative Project: comprehensive course long project: students will analyze and include information related to plant physiology and plant development demonstrating an understanding of components, structure, and function as it relates to plant biology and chemistry.

Leadership Alignment:

Students will apply technology effectively to research the difference between Vitis vinifera and Vitis labrusca. Students will collaborate with others to design and build a model to demonstrate the effects of pollination.

Industry Standards and Competencies

Agriculture, Food, and Natural Resources (AFNR) Standards:

PS.02.01.01.a. Identify and summarize systems used to classify plants based on specific characteristics.
PS.02.01.01.c. Classify agricultural and ornamental plants according to the hierarchical classification system
PS.02.01.02.a. Describe the morphological characteristics used to identify agricultural and herbaceous plants (e.g., life cycles, growth habit, plant use and as monocotyledons or dicotyledons, woody, herbaceous, etc.).
PS.02.01.02.b. Identify and describe important plants to agricultural and ornamental plant systems by common names.
PS.02.01.02.c. Identify and describe important plants to agricultural and ornamental

PS.02.03.01.a. Summarize the importance of photosynthesis to plant life on earth and the process of photosynthesis, including the types (c3, c4, Cam), its stages (e.g., light-dependent and light independent reactions), and its products and byproducts.
PS.02.03.01.b. Apply knowledge of photosynthesis to analyze how various environmental factors will affect the rate of photosynthesis.
PS.02.03.01.c. Evaluate the impact of photosynthesis and the factors that affect it on plant management, culture and production problems.
PS.02.02.06.a. Identify and summarize the functions and components of seeds and fruit.
PS.02.02.06.b. Analyze and categorize the major types of seeds and fruit.
PS.02.02.06.c. Evaluate the impact of different seed and fruit structures to plant culture and use.
PS.02.02.05.a. Identify and summarize the components of a flower, the functions of a flower and the functions of flower components.
PS.02.02.04.b. Analyze how leaves capture light energy and summarize the exchange of gases.
PS.02.03.02.a. Summarize the stages of cellular respiration including their products and byproducts.
PS.02.03.02.b. Analyze the factors that affect cellular respiration processes and rate in a crop production setting.
PS.02.03.02.c. Evaluate the impact of plant respiration on plant growth, crop management and post-harvest handling decisions.
PS.02.02.02.a. Identify and summarize the components, the types and the functions of plant roots.
PS.02.02.03.a. Identify and summarize the components and the functions of plant stems.

Aligned Washington State Standards

Washington State Science Learning Standards (Next Generation Science Standards):

HS-LS1-1. Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins that carry out the essential functions of life through systems of specialized cells.
HS-LS1-2. Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.
HS-LS1-3. Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.
HS-LS1-5. Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy.
HS-LS1-6. Construct and revise an explanation based on evidence for how carbon, hydrogen, and oxygen from sugar molecules may combine with other elements to form amino acids and/or other large carbon-based molecules.
HS-LS1-7. Use a model to illustrate that cellular respiration is a chemical process whereby the bonds of food molecules and oxygen molecules are broken and the bonds in new compounds are formed resulting in a net transfer of energy.
HS-ESS2-5. Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.
HS-ESS2-6. Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere.
HS-ETS1-2. Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
HS-ETS1-3. Evaluate a solution to a complex real-world problem based on prioritized criteria and tradeoffs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts.
HS-LS1-4. Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms.
HS-LS1-5. Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy.
HS-LS2-5. Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere.

Unit 4: Integrated Pest and Disease Management	Total Learning Hours for Unit: 25

Unit Summary:
This unit will establish how to systematically manage vineyards in relation to pests and diseases in ways that are cost-effective, sustainable, and environmentally worthwhile for long term vineyard, grape, human and community health.
Competencies include:

- Common Diseases
- Common pests
- IPM strategies
- Health and safety regulations
- Biodiversity and species impact
- Sustainable Alternatives and practices
- Biocontrol
- Cropping systems
- Pesticide/herbicide certification regulations and trainings (PPE)

Performance Assessments:
Performance assessments on the following topics may be developed at the local level. In order to earn approval at the state level, performance assessments must be submitted within this framework.

It is expected that students will:

- Identify common diseases and pests that affect plant production
- Describe life cycles of common pests and plants
- Analyze questions and define problems in determining common diseases, pests, and the effects on plant production and IPM strategies to combat those negative impacts.
- Construct explanations and design solutions in determining the best practices to utilize based upon values of the production.
- Engage in arguments about selection of pest and disease management options with a focus on biodiversity, health, and safety regulations.
- Engage in arguments from evidence on the effectiveness and costs of alternative practices.
- Develop a successful model for the safe use and application of pesticides and herbicides.
- Viticulture Summative Project: comprehensive course long project: students will analyze and interpret the pest management and disease management strategies selected for their vineyard plan.

Leadership Alignment:

Students will work effectively and respectfully in diverse teams in order to create management plans for controlling pests and diseases.
Students will monitor, define, and prioritize their investigations and research regarding pesticides (chemical) and organic (natural) prevention methods.
Students will use systems thinking and make judgements and decisions when determining personal application for IPM and disease management.

Industry Standards and Competencies

Agriculture, Food, and Natural Resources (AFNR) Standards:

PS.03.03.01.a. Identify and categorize plant pests, diseases and disorders.
PS.03.03.01.b. Identify and analyze major local weeds, insect pests and infectious and noninfectious plant diseases.

PS.03.03.01.c. Devise solutions for plant pests, diseases and disorders.
PS.03.03.02.a. Diagram the life cycle of major plant pests and diseases.
PS.03.03.02.b. Predict pest and disease problems based on environmental conditions and life cycles.
PS.03.03.03.a. Identify and summarize pest control strategies associated with integrated pest management and the importance of determining economic threshold.
PS.03.03.03.b. Demonstrate pesticide formulations including organic and synthetic active ingredients and selection of pesticide to control specific pest.
PS.03.03.04.a. Distinguish between risks and benefits associated with the materials and methods used in plant pest management.
PS.03.03.04.b. Examine and apply procedures for the safe handling, use and storage of pesticides including personal protective equipment and reentry interval.
PS.03.03.04.c. Evaluate environmental and consumer concerns regarding pest management strategies.
PS.03.04.01.a. Compare and contrast the alignment of different production systems (conventional and organic) with USDA sustainable practices criteria.
PS.03.04.02.b. Compare and contrast the impact on greenhouse gas, carbon footprint of the national/international production system with local/regional production system markets.
NRS.01.01.03.b. Analyze how biodiversity develops through evolution, natural selection and adaptation; explain the importance of biodiversity to ecosystem function and availability of natural resources.
NRS.01.01.03.c. Evaluate biodiversity in ecosystems and devise strategies to enhance the function of an ecosystem and the availability of natural resources by increasing the level of biodiversity

Aligned Washington State Standards

Washington State Science Learning Standards (Next Generation Science Standards):

HS-LS2-1. Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales.
HS-LS2-2. Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.
HS-LS3-3. Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population
HS-LS4-3. Apply concepts of statistics and probability to support explanations that organisms with an advantageous heritable trait tend to increase in proportion to organisms lacking this trait.
HS-LS4-4. Construct an explanation based on evidence for how natural selection leads to adaptation of populations
HS-LS4-5. Evaluate the evidence supporting claims that changes in environmental conditions may result in: (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.
HS-LS4-6. Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.*
HS-ESS3-3. Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity
HS-ESS3-4. Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.*
HS-ETS1-1.Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.
HS-ETS1-3.Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.

Unit 5: Vineyard Design and Management	Total Learning Hours for Unit: 25

Unit Summary:
This unit will establish how design principles and management strategies affect the success of a vineyard including vine training, pruning, and harvesting methods and canopy and vineyard management.
Competencies include:

- Determining conditions necessary for vineyard site selection: climate, topography and soil preparation
- Frost protection
- Water cycle
- Row and vine spacings and calculating layout
- Types of trellis and training systems
- Engineering design (load calculation)
- Pruning types
- Irrigation
- Life cycle of the vine and nutrient needs
- Canopy management guidelines and techniques
- Cover crops and ground cover
- Principles and effects of pruning
- Soil fertility
- Steps to planting a new vineyard
- Nursery production – selection of vines
- Pest and disease management
- Permitting and regulations
- Hygiene
- Equipment needs

Performance Assessments:
Performance assessments on the following topics may be developed at the local level. In order to earn approval at the state level, performance assessments must be submitted within this framework.

It is expected that students will:

- Ask questions and define problems when determining the best management methods in relation to pruning and harvesting.
- Use mathematics and computational thinking to determine row and vine spacing and calculating layout when designing a vineyard.
- Construct explanations and design solutions when determining constraints, which affect the potential design layout of a vineyard.
- Plan and carry out an investigation to determine the effects of soil fertility on site selection.
- Develop an irrigation model that includes water usage calculations, output expectations, and maximizes water efficiency.
- Viticulture Summative Project: comprehensive course long project: students will create initial design of vineyards and include decisions based upon evidence and reasoning when determining initial design and management techniques.

Leadership Alignment:
Students will make judgements and decisions, use and manage information, and produce results in evaluating and selecting design and management decisions for their vineyard projects.

Industry Standards and Competencies

Agriculture, Food, and Natural Resources (AFNR) Standards

ESS.03.02.01.b Use a soil survey to determine the land capability classes for different parcels of land in an area.
ESS.03.02.03.a Examine and explain how the physical qualities of the soil influence the infiltration and percolation of water.
ESS.03.02.03.b Assess the physical qualities of the soil that determine its potential for filtration of groundwater supplies and likelihood for flooding.
ESS.03.03.01.b Analyze the soil chemistry of a sample.
ESS.03.01.01.a Examine and summarize how chemistry affects soil structure and function (e.g., pH, cation-exchange capacity, filtration capability, flooding likelihood, etc.).
ESS.03.01.01.b. Differentiate how components of the atmosphere (e.g., weather systems and patterns, structure of the atmosphere, etc.) affect environmental service systems.
ESS.03.01.01.c Utilize meteorological data to assess the impact of atmospheric conditions on environmental service systems.
PS.01.02.02.a. Identify the categories of soil water.
PS.01.02.02.b. Discuss how soil drainage and water-holding capacity can be improved.
PS.01.02.02.c. Determine the hydraulic conductivity for soil and how the results influence irrigation practices.
PS.01.03.06.a Summarize the impact of environmental factors on nutrient availability (e.g., moisture, temperature, pH, etc.).
PS.01.01.03.a Identify and summarize the effects of water quality on plant growth, (e.g., pH, dissolved solids, etc.).
PS.01.03.03. b Interpret laboratory analyses of soil and tissue samples
PS.01.01.02.a. Identify and summarize the effects of air and temperature on plant metabolism and growth.
PS.01.01.02.b. Determine the optimal air and temperature conditions for plant growth.
PS.01.02.02.c. Determine the hydraulic conductivity for soil and how the results influence irrigation practices
PS.01.03.01.a. Identify the essential nutrients for plant growth and development and their major functions (e.g., nitrogen, phosphorous, potassium, etc.).
PS.01.03.02.a. Discuss the influence of pH and cation exchange capacity on the availability of nutrients.
PS.01.03.02.b. Contrast pH and cation exchange capacity between mineral soil and soilless growing media.
PS.01.03.02.c. Adjust the pH of growing media for specific plants or crops.
PS.01.03.05.a. Research and summarize production methods focused on soil management (e.g., crop rotation, companion planting, cover crops, etc.).
PS.01.03.06.b. Assess and describe the impact environmental factors have on a crop.
PS.03.01.01.b. Examine and apply the process of plant pollination and/or fertilization.
PS.03.01.03.a. Summarize optimal conditions for asexual propagation and demonstrate techniques used to propagate plants by cuttings, division, separation, layering, budding and grafting.
PS.03.02.02.a. List and summarize the reasons for preparing growing media before planting.
PS.03.02.02.b. Prepare soil and growing media for planting with the addition of amendments.
PS.03.02.02.c. Analyze how mechanical planting equipment performs soil preparation and seed placement.
PS.03.02.04.c. Prepare and implement a plant production schedule based on predicted environmental conditions and desired market target (e.g., having plants ready to market on a specific day such as Mother's Day, organic production, low maintenance landscape plants, etc.).
PS.03.02.05.a. Summarize the stages of plant growth and the reasons for controlling plant growth.
PS.03.02.05.b. Demonstrate proper techniques to control and manage plant growth through mechanical, cultural or chemical means.
PS.03.02.05.c. Prepare plant production schedules utilizing plant growth knowledge to get plants to their optimal growth stage at a given time.
PS.04.01.01.a. Identify and categorize plants by their purpose (e.g., floral plants, landscape plants, house plants, etc.).
PS.04.01.01.b. Demonstrate proper use of plants in their environment (e.g., focal and filler plants in floriculture, heat tolerant and shade plants in a landscape design, etc.).
PS.04.01.01.c. Install plants according to a design plan that uses the proper plants based on the situation and environment.
PS.04.01.02.a. Summarize the applications of design in agriculture and ornamental plant systems.
PS.04.01.02.b. Create a design utilizing plants in their proper environments.
PST.04.03.04.a. Compare and contrast the characteristics of materials used in plumbing and water systems (e.g., copper, PVC, PEX, etc.).

PST.04.03.04.b. Calculate the cost of a water system in an AFNR structure (e.g., copper, PVC, etc.).
PST.05.02.02.a. Differentiate between the purpose of electrical sensors and controls used in AFNR power, structural and technical systems.
PST.05.02.02.b. Interpret maintenance schedules for electrical control systems used in AFNR power, structural and technical systems.
PST.05.02.02.c. Troubleshoot electrical control system performance problems found in AFNR power, structural and technical systems.
PST.05.02.01.a. Examine and categorize electrical control system components used in AFNR systems (e.g., transistors, relays, HVAC, logic controllers, etc.).
PST.05.02.01.b. Analyze schematic drawings for electrical control systems used in AFNR systems.
PST.05.02.01.c. Design schematic drawings for electrical control systems used in AFNR systems.
PST.05.02.03.a. Research and summarize the importance of AFNR power, structural and technical control systems using programmable logic controllers (PLC) and/or other computer-based systems.
PST.05.02.03.b. Assess the functions of AFNR power, structural and technical control systems using programmable logic controllers (PLC) in agricultural production and manufacturing.
PST.05.02.03.c. Develop and implement AFNR power, structural and technical control systems using programmable logic controllers (PLC) and/or other computer-based systems.

Aligned Washington State Standards

Washington State Science Learning Standards (Next Generation Science Standards):

HS-ESS2-4.Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate.
HS-ESS2-5.Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.
HS-ESS2-6.Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere.
HS-ESS3-2.Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.*
HS-ESS3-3.Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity
HS-ESS3-4.Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.*
HS-PS3-1.Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known.
HS-LS1-5. Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy.
HS-LS1-6. Construct and revise an explanation based on evidence for how carbon, hydrogen, and oxygen from sugar molecules may combine with other elements to form amino acids and/or other large carbon-based molecules.
HS-LS1-7. Use a model to illustrate that cellular respiration is a chemical process whereby the bonds of food molecules and oxygen molecules are broken and the bonds in new compounds are formed resulting in a net transfer of energy.
HS-LS3-1. Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring.
HS-LS3-2. Make and defend a claim based on evidence that inheritable genetic variations may result from: (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors.
HS-LS4-2. Construct an explanation based on evidence that the process of evolution primarily results from four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment.
HS-LS4-6. Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.*
HS-ETS1-1.Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.
HS-ETS1-3.Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.

Unit 6: Food Science Safety and Processing	Total Learning Hours for Unit: 20

Unit Summary:
This unit will highlight the importance of food science safety principles when making decisions related to the growing, producing, and processing of plants and products.
Competencies include:

- Plant patents and vineyard management
- Safety procedures and regulations
- Human health impacts
- Harvest – indicators leading to harvest
- Global gap
- ISO5000- International Food Standards
- Labor law and regulations H2A
- Accident prevention
- SDS
- Job Hazard Analysis
- Lab Safety
- Equipment and Technology
- Basic lab tests – PH, residual sugar
- Processing regulations
- Shelf life
- Product assurance
- Nutraceuticals: by-products being repurposed

Performance Assessments:
Performance assessments on the following topics may be developed at the local level. In order to earn approval at the state level, performance assessments must be submitted within this framework.

It is expected that students will:

- Analyze plant indicators including sugar content to determine proper harvest times
- Plan and carry out investigations to determine pH, residual sugar, and practice lab safety protocols throughout investigation.
- Identify and communicate safety needs, human health impacts, and job hazards related to the production and processing of grapes.
- Analyze and interpret factors to determine quality and yield grades.
- Viticulture Summative Project: comprehensive course long project: Students will create a flowchart that describes the planting, harvest, processing, storage, transportation, and delivery of the end plant product.

Leadership Alignment:

Students will be self-directed learners when collecting information related to safety needs for processing of grapes.
Students will be responsible to others as they collaboratively complete pH and residual sugar investigations.

Industry Standards and Competencies

Agriculture, Food, and Natural Resources (AFNR) Standards:

FPP.01.01.01.a. Research and summarize the purposes and objectives of safety programs in food products and processing facilities (e.g., Sanitation Standard Operating Procedures (SSOP); Good Manufacturing Practices (GMP); worker safety, etc.).
FPP.01.01.01.b. Analyze and document attributes and procedures of current safety programs in food products and processing facilities.
FPP.01.02.02.a. Research and summarize procedures of safe handling protocols (e.g., Hazard Analysis and Critical Control Points Plan (HACCP); Critical Control Point procedures (CCP); Good Agricultural Practices Plan (GAP), etc.).
FPP.01.02.02.b. Construct plans that ensure implementation of safe handling procedures on food products.
FPP.01.02.01.a. Examine and identify contamination hazards associated with food products and processing (e.g., physical, chemical and biological).
FPP.01.02.01.b. Outline procedures to eliminate possible contamination hazards associated with food products and processing.
FPP.01.02.01.c. Identify sources of contamination in food products and/or processing facilities and develop ways to eliminate contamination.
FPP.01.03.01.a. Identify and summarize purposes of food storage procedures (e.g., first in/first out, temperature regulation, monitoring, etc.).
FPP.01.03.01.b. Analyze characteristics of food products and determine appropriate storage procedures.
FPP.01.03.01.c. Prepare plans that ensure implementation of proper food storage procedures.
FPP.02.02.01.a. Examine and describe the basic chemical makeup of different types of food.
FPP.02.02.01.b. Explain how the chemical and physical properties of foods influence nutritional value and eating quality.
FPP.02.02.01.c. Design and conduct experiments to determine the chemical and physical properties of food products.
FPP.02.02.03.a. Research and summarize the application of biochemistry in the development of new food products (e.g., value added food products, genetically engineered food products, etc.).
FPP.02.02.03.b. Analyze how food products and processing facilities use biochemistry concepts to develop new food products.
FPP.03.01.01.a. Summarize characteristics of quality and yield grades of food products.
FPP.03.01.01.b. Analyze factors that affect quality and yield grades of food products.
FPP.03.01.01.c. Outline procedures to assign quality and yield grades to food products according to industry standards.
FPP.03.01.02.a. Summarize procedures to select raw food products based on yield grades and quality grades.
FPP.03.01.02.b. Assemble procedures to perform quality-control inspections of raw food products for processing.
FPP.03.01.02.c. Develop, apply and evaluate care and handling procedures to maintain original food quality and yield.
FPP.03.02.01.a. Identify and explain English and metric measurements used in the food products and processing industry.
FPP.03.02.01.b. Compare weights and measurements of products and perform conversions between units of measure.
FPP.03.02.02.b. Outline appropriate methods and prepare foods for sale and distribution for different markets.
FPP.04.01.01.a. Research and summarize examples of policy and legislation that affect food products and processing systems in the United States and around the world (e.g., labeling, GMOs, biosecurity, food system policy, dietary guidelines, etc.).

Aligned Washington State Standards

Washington State Science Learning Standards (Next Generation Science Standards):

HS-PS1-1. Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.
HS-PS1-2. Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties.
HS-LS2-7. Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.*
HS-LS1-6. Construct and revise an explanation based on evidence for how carbon, hydrogen, and oxygen from sugar molecules may combine with other elements to form amino acids and/or other large carbon-based molecules.
HS-LS4-6. Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.*

HS-ETS1-3. Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.

Unit 7: Agribusiness of Grape Production	Total Learning Hours for Unit: 13

Unit Summary:
This unit will investigate the business, economics, and marketing principles that influence decision making for the production, harvesting, and marketing of grapes.

Competencies include:

- Economics –principles of economics of scale
- Costs to Produce/ROI
- Cash flow
- Developing a business plan (including business principles – mission/vision/branding)
- Regulatory processes
- Credit/loan
- Workers safety/comp/regulations/availability
- Distribution channels- direct to consumer/clubs/wholesale/retail
- Story – branding – contracting
- Supply/demand – price point determination

Performance Assessments:
Performance assessments on the following topics may be developed at the local level. In order to earn approval at the state level, performance assessments must be submitted within this framework.

It is expected that students will:

- Analyze the grape supply to determine demand, price point, and potential distribution channels.
- Ask questions and define problems related to regulatory processes that may affect costs and profit related to production.
- Construct explanations and define solutions in determining major issues related to production, and select management decisions with these constraints in mind.
- Engage in argument from evidence when defending business and management decisions based upon cost and environmental impact.
- Viticulture Summative Project: comprehensive course long project: Students will develop a business plan including a company name, mission, vision, and a justification for management decisions based on business principles and environmental impacts.

Leadership Alignment:

Students will make judgements and decisions, access and evaluate information, and create media products while developing their business plan taking into consideration financial and environmental impacts of their decisions. Students will think creatively and implement innovations while creating their business plan.

Industry Standards and Competencies

Agriculture, Food, and Natural Resources (AFNR) Standards:

ABS.01.01.01.a. Examine and provide examples of microeconomic principles related to decisions about AFNR business inputs and outputs (e.g., supply, demand and equilibrium, elasticity, diminishing returns, opportunity cost, etc.).
ABS.01.01.02.a. Examine and provide examples of macroeconomic principles related to AFNR businesses (e.g., Gross Domestic Product, inflation, capital accounts, unemployment rate, etc.).

ABS.01.01.02.b. Analyze and describe the relationship between AFNR business and industry outputs and domestic and global macroeconomic trends (e.g., Gross Domestic Product, national income, rate of growth, price levels, etc.).
ABS.01.01.02.c. Analyze the impact of the current macroeconomic environment on decisions related to AFNR businesses.
ABS.01.02.01.a. Read and interpret statements of purpose (e.g., vision, mission statement, charter, etc.).
ABS.01.02.02.a. Identify the meaning and importance of goals and objectives in AFNR business enterprises
ABS.02.02.01.a. Compare and contrast the different types of financial reports (e.g., income statements, cash flow statements, equity statements, etc.) and their frequency of use (e.g., daily, weekly, monthly, quarterly, annual) for monitoring AFNR business performance.
ABS.03.02.01.a. Research and summarize the characteristics of different types of credit instruments available to AFNR businesses (e.g., lines of credit, operating notes, alternative sources of capital, etc.).
ABS.03.02.01.b. Analyze AFNR business needs to determine the necessity of loans for business operation..
ABS.04.01.01.a. Describe the meaning, importance and economic impact of entrepreneurship on the AFNR industry and larger economy.
ABS.04.01.01.b. Classify the characteristics of successful entrepreneurs in AFNR businesses.
ABS.04.01.01.c. Demonstrate the application of entrepreneurial skills to conceptualize an AFNR business (e.g., idea generation, opportunity analysis, risk assessment, etc.).
ABS.04.01.03.a. Research and describe the components to include in a business plan for an AFNR business.
ABS.04.01.03.b. Analyze the information needed and strategies to obtain the information to complete an AFNR business plan (e.g., SMART goals and objectives, needs assessment, cash flow projection, etc.).
ABS.04.01.03.c. Prepare a business plan for an AFNR business.
CS.02.01.02.a. Identify and examine economic data related to AFNR systems (e.g., commodity markets, food marketing, food and nutritional assistance programs, etc.).
CS.02.01.02.b. Analyze and interpret a set of economic data and explain how it impacts an AFNR system.
CS.03.03. Apply health and safety practices to AFNR workplaces.
CS.03.03.04.a. Examine and categorize the risk level of contamination or injury as associated with AFNR tasks in the workplace.

Aligned Washington State Standards

Washington State Science Learning Standards (Next Generation Science Standards):

HS-ETS1-1. Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.
HS-ETS1-3. Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.

Unit 8: Marketing and Packaging | Total Learning Hours for Unit: 12

Unit Summary:
This unit will develop student's understanding of marketing strategies and encourage innovation and creativity as communication principles including marketing strategies, packaging decisions, and labeling and finishing decisions are made in relation to bringing a product to market.
Competencies include:

- Cork/screw top selection "Finishing"
- Packaging selection
- Labeling
- SWOT analysis/Analysis of market
- Introduction to Market
- Media/Press

- Mass Communications –
- Employee relations
- Branding
- Business sustainability
- Competencies include:

Performance Assessments:
Performance assessments on the following topics may be developed at the local level. In order to earn approval at the state level, performance assessments must be submitted within this framework.

It is expected that students will:

- Analyze market trends and data to establish a market niche for your product
- Engage in a discussion citing evidence about the sustainability of the viticulture industry.
- Communicate product qualities and brand recognition for a defined target audience.
- Obtain, evaluate, and communicate information by completing a SWOT analysis for the product.
- Viticulture Summative Project: comprehensive course long project: Students will develop a model package, design a label, and create an initial marketing plan.

Leadership Alignment:
Students will be self-directed learners, think creatively, and reason effectively to complete market analysis.
Students will solve problems, use and manage information and communicate clearly, to determine the sustainability of their business, marketing plan, and the viticulture industry at large.
Students will interact effectively with others, work creatively with others, and implement innovations while developing model packaging and marketing plans.

Industry Standards and Competencies

Agriculture, Food, and Natural Resources (AFNR) Standards:

FPP.02.03.01.a. Examine and explain the importance of food labeling to the consumer.
FPP.02.03.01.b. Examine, interpret and explain the meaning of required components on a food label.
FPP.02.03.01.c. Determine a strategy to prepare and label foods according to the established standards of regulatory agencies.
FPP.02.03.02.a. Research and summarize relevant factors in planning and developing a new food product (e.g., regulation, creativity, economics, etc.).
FPP.02.03.02.b. Determine consumer preference and market potential for a new food product using a variety of methods (e.g., double-blind testing, etc.).
FPP.02.03.02.c. Design new food products that meet a variety of goals (e.g., consumer preferences, market, nutritional needs, regulatory requirements, etc.).
ABS.05.01.01.b. Analyze and describe the role of trade and price in the market structure as it relates to AFNR businesses.
ABS.05.01.02.a. Research and summarize different forms of market competition found in AFNR businesses (e.g., direct competitors, indirect competitors, replacement competitors, etc).
ABS.05.03.01.a. Identify and explain marketing principles used in AFNR businesses (e.g.,4 P's-product, place, price, promotion; attention, interest, desire, action, etc.).
ABS.05.03.01.b. Assess and select appropriate alternative marketing strategies (e.g. value-adding, branding, niche marketing, etc.). for AFNR businesses using established marketing principles
ABS.05.03.02.a. Research and categorize different strategies used in marketing programs for AFNR businesses (e.g., Internet, direct to customer, social media, etc.).

ABS.05.03.02.b. Compare and contrast the strategies of marketing for products and services used in AFNR businesses (e.g., direct marketing, commodities, etc.).
ABS.05.03.03.a. Research and summarize the purpose, components and process to develop marketing plans for AFNR businesses.

Aligned Washington State Standards

Washington State Science Learning Standards (Next Generation Science Standards):

HS-ETS1-1. Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.
HS-ETS1-3. Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.

21st Century Skills

Students will demonstrate in this course:

LEARNING & INNOVATION

Creativity and Innovation
☒Think Creatively
☒Work Creatively with Others
☒Implement Innovations

Critical Thinking and Problem Solving
☒Reason Effectively
☒Use Systems Thinking
☒Make Judgments and Decisions
☒Solve Problems

Communication and Collaboration
☒Communicate Clearly
☒Collaborate with Others

INFORMATION, MEDIA & TECHNOLOGY SKILLS

Information Literacy
☒Access and Evaluate Information
☒Use and Manage Information

Media Literacy
☐Analyze Media
☒Create Media Products

Information, Communications and Technology (ICT Literacy)
☒Apply Technology Effectively

LIFE & CAREER SKILLS

Flexibility and Adaptability
☐Adapt to Change
☐Be Flexible

Initiative and Self-Direction
☐Manage Goals and Time
☒Work Independently
☒Be Self-Directed Learners

Social and Cross-Cultural
☒Interact Effectively with Others
☒Work Effectively in Diverse Teams

Productivity and Accountability
☐Manage Projects
☒Produce Results

Leadership and Responsibility
☐Guide and Lead Others
☒Be Responsible to Others

CTE Course Equivalencies 2017 Update

REBECCA WALLACE

EXECUTIVE DIRECTOR OF CAREER AND TECHNICAL EDUCATION

Current Implementation of ESSB 6552 Available Frameworks

Credit Type	Math Equivalency	Science Equivalency	Combination (Sci/Math/ELA)
Number of Frameworks	11	20	5

Program Area	STEM	Agriculture	Business & Marketing	Family & Consumer Science	Health Sciences	Skills & Technical Sciences
Number of Frameworks	4	11	4	4	3	10

2017 proposed frameworks:
Agricultural Power and Technology (PST)
Viticulture (PS)

Development of Proposed Frameworks

Identify Need → Draft Frameworks → Technical Working Groups → Refine and Evaluation → Finalize

Agricultural Power and Technology

- Previously unrepresented cluster pathway (Power, Structural and Technical Systems)
- School district requested review for non-shop based agricultural mechanics course
- Draft created and reviewed by technical working group (6 total: 3 Science/3 CTE)
- Amended framework sent to science/CTE experts for review electronically
- OSPI final review by Learning and Teaching and CTE staff

Development of Proposed Frameworks

Identify Need → Draft Frameworks → Technical Working Groups → Refine and Evaluation → Finalize

Viticulture

- CIP code established within Washington in 2016 based on industry growth and need
- School district worked with community colleges and industry to determine potential articulation agreements with strong science alignment.
- Draft outline created and reviewed by technical working group (Admin/Science/College/CTE)
- Technical working group aligns science and industry standards (CTE/Science)
- Amended framework sent to science/CTE experts for review electronically
- OSPI final review by Learning and Teaching and CTE staff

Agricultural Power and Technology

Agricultural Power and Technology designed to prepare students for the wide array of career opportunities in agricultural engineering. Students are immersed in inquiry-based exercises that tie in the math and science of agricultural mechanics and engineering.

Units of Instruction/Hours	
Introduction to Ag, Power, and Tech (15)	Safety and Measurement (15)
Material Properties (25)	Fabrication (30)
Energy (40)	Machines and Structures (30)
Mechanical Applications (25)	

Agricultural Power and Technology

Washington State Science Learning Standards	AFNR Industry Standards
Physical Science (PS) PS1-1, PS1-2, PS1-3, PS1-4, PS1-5, PS1-6, PS1-7 PS2-3, PS2-4, PS2-5, PS3-1, PS3-2, PS3-3, PS3-4, PS4-5	• Power, Structure, Technical Systems (PST) • Career Ready Practices (CRP) • Cluster Skills (CS)
Engineering Design (ETS) ETS1-4	
Life Science (LS) LS2-7, LS4-6	

Viticulture

A program that focuses on the application of scientific and agribusiness principles to the production and agribusiness of grape growing; heavily rooted in the application of plant and soil science.

Units of Instruction/Hours	
Introduction to Viticulture (20)	Integrated Pest and Disease Management (25)
Soil Science (30)	Vineyard Design and Management (25)
Plant Biology and Chemistry (35)	Food Science and Safety (20)
Agribusiness of Grape Production (13)	Marketing and Packaging (12)

Viticulture

Washington State Science Learning Standards	AFNR Industry Standards
LS1-1, LS1-2, LS1-3, LS1-4, LS1-5, LS1-6, LS1-7 LS2-1, LS2-2, LS2-3, LS2-5, LS2-6, LS2-7 LS3-1, LS3-2, LS3-3 LS4-2, LS4-3, LS4-4. LS4-5, LS4-6	• Natural Resource Systems (NRS) • Environmental Service Systems (ESS) • Plant Systems (PS) • Agribusiness Systems (ABS) • Food Products and Processing Systems (FPP) • Power, Structural, Technical Systems (PST) • Cluster Skills (CS)
ESS2-2, ESS2-3, ESS2-4, ESS2-5, ESS2-6, ESS2-7 ESS3-1, ESS3-2, ESS3-3, ESS3-4, ESS3-5	
PS1-1, PS1-2 PS3-1	
ETS1-1, ETS1-2, ETS1-3	

Leading Questions

Do the frameworks describe coherent courses that makes sense for both science graduation requirements and the CTE program requirements?

These courses have been designed to meet science and/or occupational education credit requirements. The achieved goal was to create a course that had rigorous and intentional alignment of science standards with alignment to industry required standards, creating a positive experience for students to experience science in a way that connects to the world around them.

The viticulture course includes Earth and Space, chemistry, physics, and biology concepts applied in a contemporary course.

The nature of understanding science through application in plant systems, specifically through the lens of viticulture, should peak interest into multiple potential student career interest areas and post- secondary opportunities

The agricultural technology course focuses on the science and engineering behind the application of agricultural applications, and moves this science based experience out of a traditional shop setting. There is a need for students to connect their understanding of engineering and technology to the need within the agricultural industry and abroad. There are additional opportunities to include computer science application development as well. This further supports connections beyond the classroom, and beyond the initial classroom setting.

Leading Questions

How will the courses based on these frameworks help students meet both academic and career goals?

Students engaging in these courses will be able to design a pathway of study which is rigorous, relevant, and in many cases, community based. Many smaller communities would like to have the opportunity for their children to remain in their home communities by providing important job opportunities.

The proposed courses integrate leadership and employability practices, science standards, industry standards, and student learning experiences that will make intentional connections across academic areas and real-world applications.

Both courses require instruction, and student involvement, in Supervised Agricultural Experience Projects (SAE). These student learning experiences are diverse in choice, and encourage the student to make connections outside of the regular class time.

By increasing student exposure to the variety of occupational opportunities through agriculture, science, and the many cross-sections of applications, students may learn of career opportunities they'd never considered.

"I have reviewed both frameworks and find that the WSSLS that have been identified for unit, in each framework, are appropriate. The "marriage" between the WSSLS and the CTE standards are exactly the kind of intended outcome we had when we wrote the NGSS. I so applaud you for seizing this opportunity to create learning experiences that can be far more meaningful for students – which really ends up attending to the issue of equitable access to science for all kids."

Dr. Craig Gabler, NGSS Writer

Educator Perspective

Questions ?

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